Errata

Title & Document Type: 8557A Spectrum Analyzer Operating and Service Manual

Manual Part Number: 08557-90010

Revision Date: May 1975

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

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, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

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Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

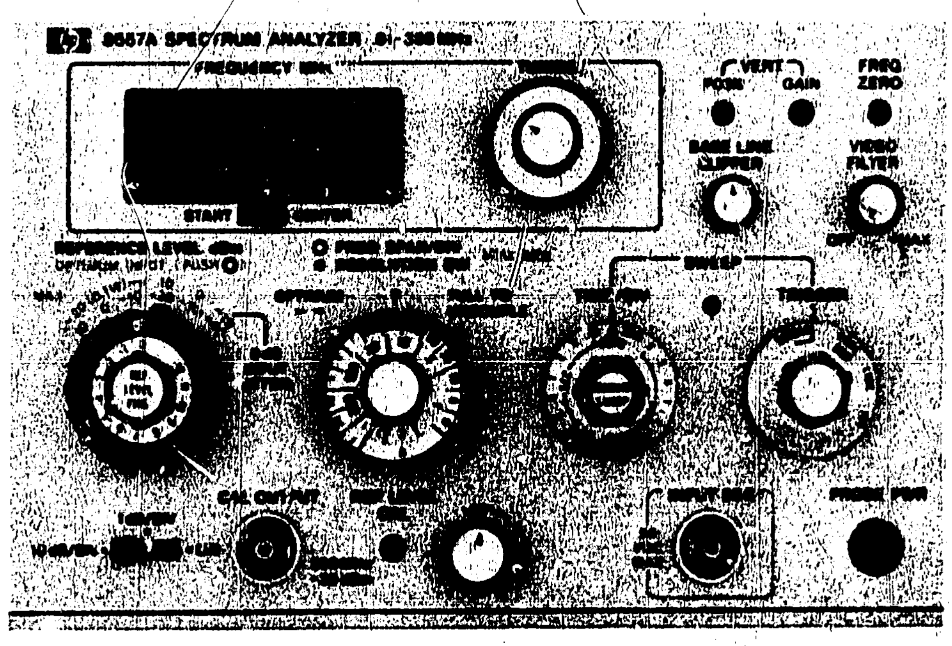
Agilent Technologies

HP 8557A

OPERATING AND SERVICE MANUAL

SPECTRUM ANALYZER
.01-350 MHz

8557A



HEWLETT hp PACKARD

HP 8557A

SAFETY

This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring apparatus," and has been supplied in safe condition. This is a Safety Class I instrument. To ensure safe operation and to keep the instrument safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section I for general safety considerations applicable to this instrument.

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facilities, or to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. Hewlett-Packard will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

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OPERATING AND SERVICE MANUAL

SPECTRUM ANALYZER .01–350 MHz 8557A

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1510A.

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

MANUAL PART NO. 08557-90010
Microfiche Part No. 08557-90011
Operating Information Supplement Part No. 08557-90012
Overall Schematic Part No. 08557-90013

Printed: MAY 1975

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ILLUSTRATIONS (Cont'd)

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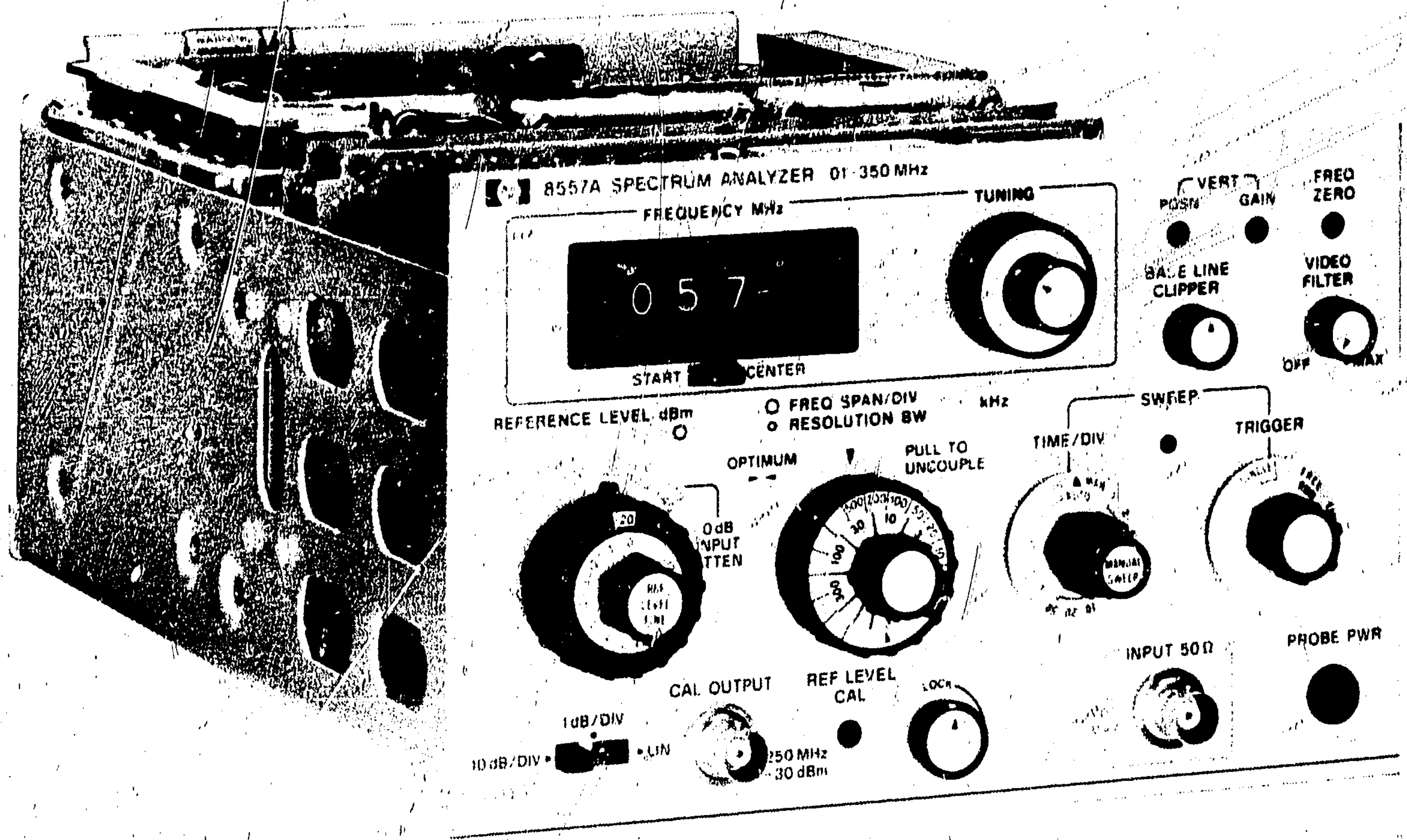

HP 8557A

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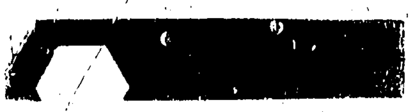

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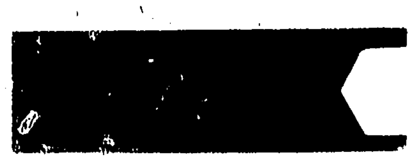

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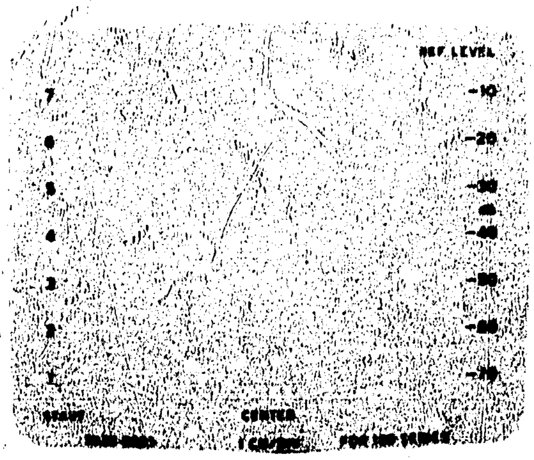

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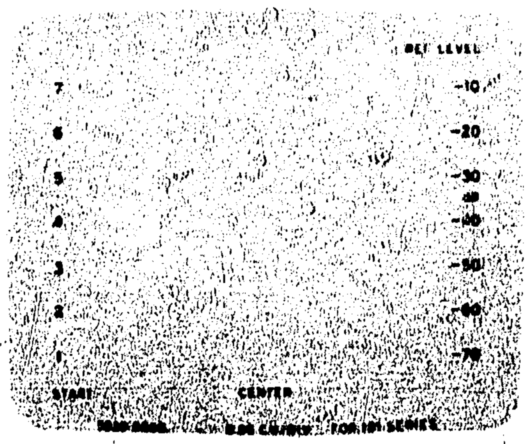

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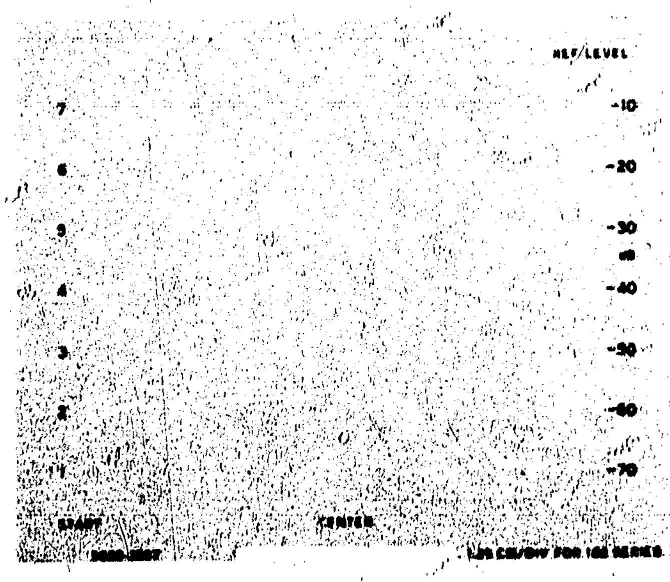


5020-8567

Figure 1-1. Model 8557A Spectrum Analyzer .01 — 350 MHz and Accessories

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test, adjust, and service the Hewlett-Packard Model 8557A Spectrum Analyzer, .01 — 350 MHz, hereafter referred to as spectrum analyzer. Figure 1-1 shows the 8557A Spectrum Analyzer and accessories supplied. For information concerning related equipment, such as the Hewlett-Packard Model 180-series Oscilloscope Mainframes, refer to the appropriate manual or manuals.

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

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

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

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

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

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

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

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

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

1-4. Packaged with this manual is an Operating Information Supplement. This supplement should stay with the instrument for use by the operator. Additional copies of the Operating Information Supplement may be ordered through your nearest Hewlett-Packard office. The part number is listed on the title page of this manual.

1-5. Also listed 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 x 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 Change supplement as well as all pertinent Service Notes.

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

1-7. SPECIFICATIONS

1-8. Specifications for the instrument are listed in Table 1-1. These are the performance standards the instrument is tested against. A list of typical operating characteristics is provided in Table 1-2. They are included as additional information only; they are not specifications.

1-9. SAFETY CONSIDERATIONS

1-10. General

1-11. This is an International Electrotechnical Commission Safety Class I instrument. This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring Apparatus," and has been supplied in safe condition.

Table 1-1. Model 8557A Spectrum Analyzer/180-Series Display Specifications (1 of 3)

SPECIFICATIONS

FREQUENCY

ACCURACY:

Frequency Range: 10 kHz to 350 MHz.

Frequency Display Span (on a 10-division CRT Horizontal axis):
12 calibrated spans from 5 kHz/div to 20 MHz/div in a 1, 2, 5 sequence. In "F" or full span, the analyzer displays the full 10 kHz to 350 MHz. In "0," the analyzer is a fixed-tuned receiver.

Accuracy:
Frequency error between any two points on the display is less than ±10% of the indicated frequency separation.

Digital Frequency Readout:
Indicates center frequency or start frequency of the frequency display span. In full span, the readout indicates the frequency at the marker.

Accuracy (after zeroing on the LO feedthrough):
±3 MHz + 10% of FREQUENCY SPAN PER DIVISION setting.

RESOLUTION:

Stability:

Residual FM: Less than 1 kHz peak-to-peak for time ⩽0.1 sec (video filter full clockwise, but not in detent).

Noise Sidebands: More than 75 dB below CW signal, 50 kHz or more away from signal with a 1 kHz resolution bandwidth and full video filtering.

Resolution:

Bandwidth Ranges: 3 dB resolution bandwidths of 1 kHz to 3 MHz in a 1, 3, 10 sequence. Resolution bandwidth may be coupled to frequency display span at a ratio of two display spans per resolution bandwidth.

Resolution Bandwidth Accuracy: Individual resolution bandwidth 3 dB points calibrated to ±20% (10° to 40° C).

Resolution Bandwidth Selectivity: 60 dB/3 dB resolution bandwidth ratio<15:1.

Video Filter: Post-detection low pass filter used to average displayed noise. Bandwidth variable from approximately 3X Resolution Bandwidth to approximately 0.01X Resolution Bandwidth. In the MAX position it provides a noise averaging filter with a bandwidth of approximately 1.5 Hz.

AMPLITUDE

RANGE:

Absolute Amplitude Calibration Range:

Log Calibration Range: From —117 dBm to +20 dBm in 10 dB steps. Reference level vernier, 0 to —12 dB continuously.

Log Display Ranges: 10 dB/div on a 70 dB display, and 1 dB/div on an 8 dB display.

Linear Display: From 2.2 microvolts (—100 dBm) full-scale to 2.24 volts (+20 dBm) full scale in 10 dB steps. Full-scale signals in linear translate to approximately full-scale signals in log.

Dynamic Range:

Average Noise Level: <—107 dBm with a 10 kHz resolution bandwidth (0 dB input attenuation) (1 to 350 MHz).

Spurious Responses: For input signal level ⩽ Optimum Input Level setting, all image and out-of-band mixing responses, harmonic and intermodulation distortion products are more than 70 dB below input signal level, 1 MHz to 350 MHz; 60 dB below, 20 kHz to 1 MHz.

Table 1-1. Model 8557A Spectrum Analyzer/180-Series Display Specifications (2 of 3)

Spurious Responses Due to 3rd Order Intermodulation Distortion: For two input signals 10 dB above Optimum Input Level Setting,[1] 3rd Order intermodulation distortion products are >70 dB below input signals, 1 to 350 MHz:>60 dB below, 10 kHz to 1 MHz (signal separation⩾50 kHz).

Residual Responses (no signal present at input): <−100 dBm with 0 dB input attenuation, 0.1 MHz to 350 MHz.

ACCURACY:

Amplitude Accuracy:

Frequency Response (Flatness): ±0.75 dB.

Switching Between Bandwidths (at 10° to 40°C), 0 to 90% relative humidity):

3 MHz to 300 kHz: ±0.5 dB.

3 MHz to 1 kHz: ±1.0 dB.

Reference Level Accuracy (at fixed center frequency, fixed resolution bandwidth): ±1.5 dB (includes input attenuator and IF gain accuracy. May be improved using IF or RF substitution techniques).

Amplitude Log Display: ±0.1 dB/dB but not more than ±1.5 dB over full 70 dB display range.

Calibrator:

Amplitude: −30 dBm ±1 dB.

Frequency: 250 MHz ±50 kHz, crystal controlled.

INPUT

Input Connector: Type BNC female.

Input Attenuator: 50 dB range.

Accuracy: ±0.5 dB per 10 dB step but not more than ±1.0 dB over full 50 dB range.

Maximum Input Levels:

AC or Peak: Peak or average power +20 dBm (3.16 Vac peak or 0.1 W) incident on analyzer. (MAX input markings on front panel indicate maximum input allowable for <1 dB gain compression or attenuator overload.)

DC: ±30 Vdc.

GENERAL

Power Requirements (including oscilloscope display): 115 or 230 volts 10%. 48 to 440 Hz less than 200 VA. Convection-cooled.

Weight:

Model 8557A Spectrum Analyzer:
Net, 10 lb (4.5 kg).

Model 182T Display:
Net, 27 lb (12.3 kg).

Model 180TR Display:
Net, 26 lb (11.8 kg).

Model 181T Display:
Net, 24 lb (10.9 kg).

Dimensions:

Model 182T Display Section:
12 5/16 inches high (including height of feet and top handle) x 7 15/16 inches wide x 19 5/8 inches deep (338.1 x 201.6 x 498.5 mm).

[1] Corresponds to two −30 dBm signals incident on input mixer.

Table 1-1. Model 8557A Spectrum Analyzer/180-Series Display Specifications (3 of 3)

Model 180TR Display Section:
5 7/32 inches high (including height of feet) x 16 3/4 inches wide x 21 3/8 inches deep (132.6 x 425 x 543 mm).

Model 181T Display Section:
12 inches high (including height of feet and top handle) x 7 7/8 inches wide x 21 1/4 inches deep (305 x 200 x 530 mm).

Table 1-2. Model 8557A/180-Series Supplemental Performance Characteristics (1 of 4)

PERFORMANCE CHARACTERISTICS

FREQUENCY

Center Frequency Zero:

Adjusts center frequency of display. CENTER FREQUENCY ZERO control may be used at 0 frequency or any other frequency up to 350 MHz to calibrate the center frequency reading of the Spectrum Analyzer.

Out-of Range Blanking:

CRT display is automatically blanked whenever the Spectrum Analyzer is swept or tuned approximately 10 MHz below 0 frequency or above 360 MHz.

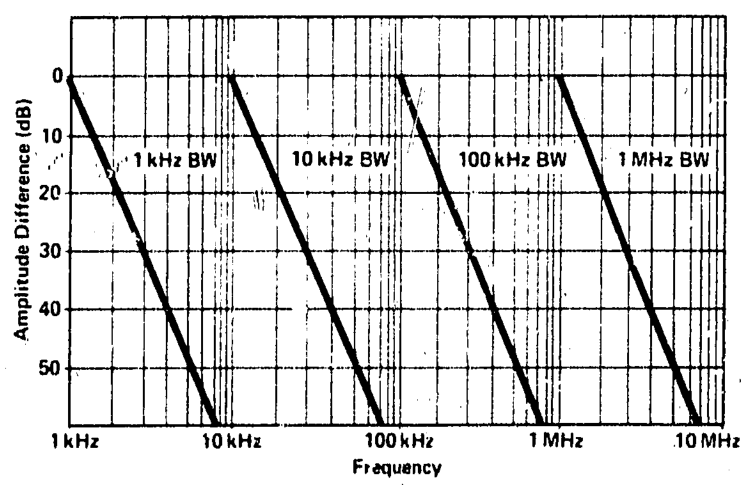
Long-Term Drift:

At fixed center frequency, after 2-hour warm-up:
20 kHz/10 min.

Temperature Drift: 50 kHz/°C.

Resolution:

The following illustration shows typical Spectrum Analyzer resolution using different IF bandwidths.

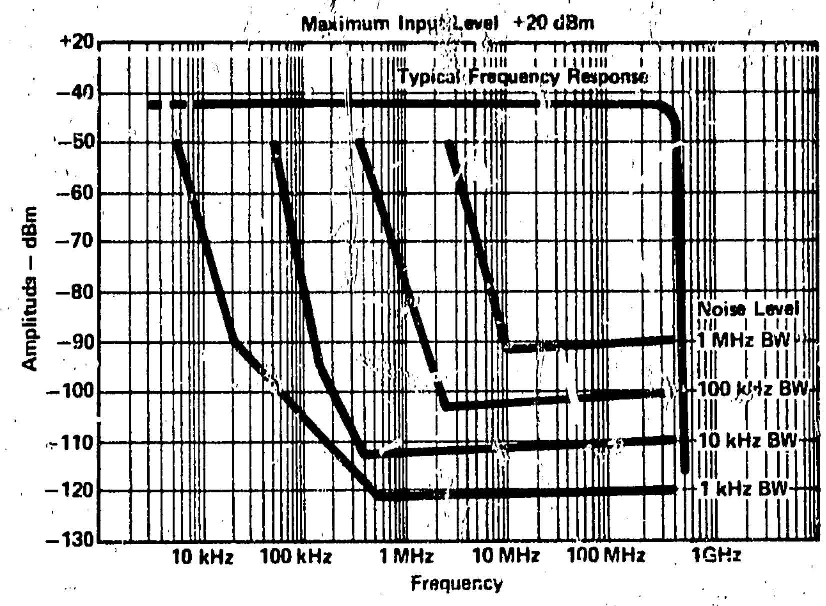


Typical spectrum analyzer resolution

AMPLITUDE

Frequency Response and Sensitivity:

Typical curves of Spectrum Analyzer sensitivity and frequency response versus input frequency are shown in the following illustration.



Average noise level vs. input frequency

Log Reference Level Calibration Range:

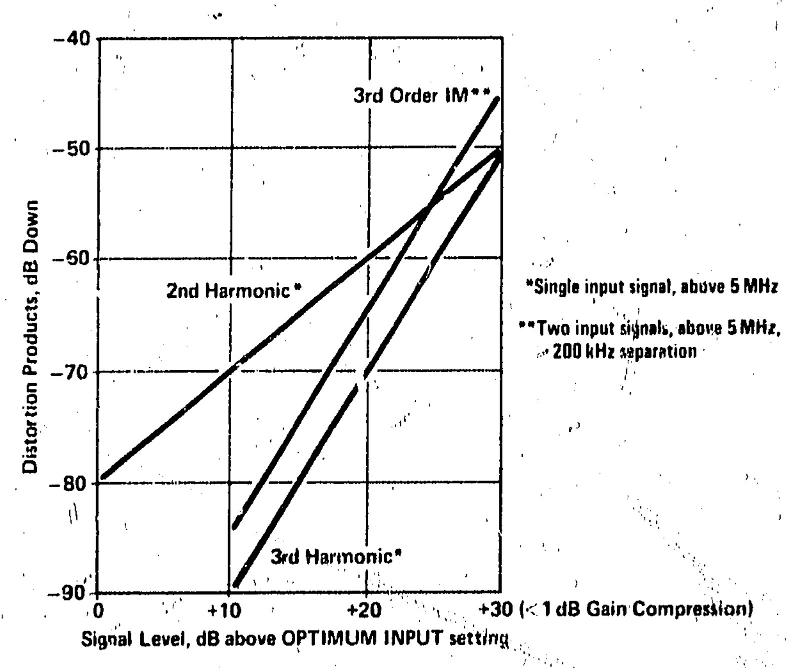
Calibrated for full scale (top graticule line) signals from −100 dBm to +20 dBm in 10 dB steps.[1]

Gain Compression:

For Signal Levels below MAX INPUT level setting, gain compression is less than 1 dB.

Distortion:

The following curves illustrate typical harmonic and third order intermodulation distortion.



Distortion vs. input frequency

[1]Maximum input to the analyzer must not exceed +20 dBm (0.1 watt) or damage may occur.

Table 1-2. Model 8557A/180-Series Supplemental Performance Characteristics (2 of 4)

INPUT

Input Impedance: 50 Ω nominal. Reflection coefficient 0.27 (1.74 SWR) for all Optimum Input Level settings except −40 dBm (0 dB Input Attenuation).

OUTPUT

Cal Output:
−30 dBm, 250 MHz.

Probe Power:
+15 V, −12.6 V: 150 mA max.
Powers 1120A, 1121A, 1123A, or 1124A high impedance probes.

NOTE

Oscilloscope display rear panel outputs refer to 180T-series displays and 180-series Opt. 807 displays only. For oscilloscope mainframes without Opt. 807, see Performance characteristics under GENERAL.

Horizontal Output:
(AUX D on oscilloscope display rear panel.) −5.0 to +5.0 V for 10 div CRT deflection, 5 kΩ output impedance.

Vertical Output:
(AUX A on oscilloscope display rear panel.) 0 to 0.8 V for 8-division deflection on CRT 50Ω output impedance.

Pen Lift/Blanking Output:
(AUX B on oscilloscope display rear panel.) 0 to 15 V (0 V pen down). Approximately 10 kΩ impedance when blanked. Compatible with HP 7004B, 70034B, 7005B, and 7035B X-Y RECORDERS.

21.4 MHz IF Output:
A 21.4 MHz output linearly related to the RF input to the analyzer. Bandwidth controlled by analyzer Resolution Bandwidth setting. Amplitude controlled by input attenuator. IF gain vernier, and first six IF step gain positions (−10 through −60 dBm Ref Level with 0 dB input attenuation). Output is approximately −10 dBm for full-scale signals on the CRT. (AUX C on oscilloscope display rear panel, 50Ω output impedance.)[1]

SWEEP

Sweep Time:
Auto: Sweep time is automatically controlled by Frequency Span, Resolution Bandwidth and Video Filter.

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

Calibrated Sweep Times: 16 internal sweep times from 0.1 ms/div to 10 sec/div in a 1, 2, 5 sequence For sweep times of 2 ms/div to 10 sec/div, the Spectrum Analyzer is operable in its normal swept-frequency mode. Faster sweeps are useful for analyzing modulation waveforms when the Spectrum Analyzer is being operated as a fixed-tuned receiver with 0 display span. Sweep times may be reduced to an effective 10 µsec/div by using the 180-series X10 horizontal magnifier.

Accuracy: ±10%

Sweep Trigger:
Internal: Sweep internally triggered by envelope of RF input signal (signal amplitude of 1.0 division peak-to-peak required on CRT display).

Line: Sweep triggered by power line frequency.

Free Run: Sweep triggered repetitively by internally generated ramp.

Single: Sweep triggered by front panel sweep trigger switch (spring return position).

[1]For the following serial prefixes only. (Earlier Option 807 mainframes must be modified by adding a 200pF capacitor across A7R3.) 180C, >1315A; 180D, >1314A; 181A, >1313A; 181AR, >1315A; 182C, >1311A.

Table 1-2. Model 8557A/180-Series Supplemental Performance Characteristics (3 of 4)

DISPLAY

Oscilloscope Display Sections:

180-Series Compatibility: The 8557A is compatible with all 180A, 180AR, 180C, 180D, 180F, 181A, 181AR, 182C, 184A, 184B, 180C Opt. 807, 180D Opt. 807, 181A Opt. 807, 181AR Opt. 807, and 182C Option 807 mainframes. It is operable with the 183A and 183B mainframes, but the display is limited to 6 divisions by the 6 division CRT.

180T-Series: The following 180-series oscilloscope displays are available which provides 4 non-buffered rear panel auxiliary outputs (for unattenuated vertical, horizontal, and penlight outputs) and P39 medium-persistence CRT phosphor (except with 181T, 181TR which provide variable persistence).[2]

180T	P39 phosphor
180TR	P39 phosphor
181T	P31 phosphor with variable persistence
181TR	P31 phosphor with variable persistence
182T	P39 phosphor

NOTE

See HP Service Notes 180A/AR/C/D-1, 181A/AR-7, and 182A-1 for information needed to modify standard displays to provide auxiliary outputs.

The following oscilloscope displays are recommended with the 8557A:

Large Screen (Model 182T):

Plug-ins: Accepts Model 8557A and 8558B Spectrum Analyzers. Model 8755 Swept Amplitude Analyzer and 1800-Series time domain plug-ins.

Cathode Ray Tube:

Type: Post-accelerator, 19 kV accelerating potential; aluminized P39 phosphor.

Graticule: 8 x 10 div internal graticule, 1 div = 1.29 cm. 5 subdivisions per major division.

Functions Used With Time Domain Plug-ins Only: Intensity modulation calibrator, and beam finder.

Rack Mount (Model 180TR Option 807):

Plug-ins: Same as 182T.

Cathode Ray Tube:

Type: Post-accelerator, 15 kV accelerating potential; aluminized P39 phosphor.

Graticule: 8 x 10 div internal graticule, 1 div = 1 cm. 5 subdivisions per major division.

Functions Used With Time Domain Plug-ins Only: Same as 182T.

Variable Persistence/Storage (Model 181T):

Plug-ins: Same as 182T.

Cathode Ray Tube:

Type: Post-accelerator storage tube; 8.5 kV accelerating potential; aluminized P31 phosphor.

Graticule: 8 x 10 div internal graticule 1 div = 0.95 cm, 5 subdivisions per major division.

Persistence:

Normal: Natural persistence of P31 phosphor (approx. 40 μs).

Variable: From <0.2 s to >1 min.

Storage Time:

Store Mode: >1 hr at reduced intensity.

View Mode: >1 min at normal intensity.

Functions Used With Time Domain Plug-ins Only: Same as 182T.

[2] See HP Service Notes 180A/AR/C/C-1, 181A/AR-7 and 182A-1 for information needed to modify standard displays to provide auxiliary outputs.

Table 1-2. Model 8557A/180-Series Supplemental Performance Characteristics (4 of 4)

GENERAL

CRT Baseline Clipper: Front panel control adjusts blanking of CRT trace baseline to allow more detailed analysis of low-repetition-rate signals and improved photographic records to be made.

EMI: Meets or exceeds MIL-I-6181D.

Temperature Range:
Operating 0° C to +55° C.
Storage −40° C to +75° C.

1-12. Operation

1-13. BEFORE APPLYING POWER, refer to SAFETY CONSIDERATIONS in Section I of the Operating and Service Manual for the Mainframe.

1-14. Service

1-15. Although the instrument has been designed in accordance with international safety standards, the information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. Service and adjustments should be performed only by qualified service personnel.

1-16. Adjustment or repair of the opened instrument with the ac power connected should be avoided as much as possible and, when inevitable, should be performed only by a skilled person who knows the hazard involved.

1-17. Capacitors inside the instrument may still be charged even though the instrument has been disconnected from its source of supply.

1-18. Whenever it is likely that the protection has been impaired, make the instrument inoperative and secure against it any unintended operation.

WARNING

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal is likely to make this instrument dangerous. Intentional interruption of the earth ground is prohibited.

Servicing this instrument often requires that you work with the instrument's protective covers removed and with ac power connected. Be very careful; the energy at many points in the instrument may, if contacted, cause personal injury.

CAUTION

BEFORE SWITCHING THIS INSTRUMENT ON, ensure that all devices connected to the instrument are connected to the protective earth ground.

1-19. INSTRUMENTS COVERED BY MANUAL

1-20. This instrument has a two-part serial number. The first four digits and the letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix as listed under SERIAL NUMBERS on the title page.

1-21. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes supplement that contains "change information" that documents the differences.

1-22. 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 Changes supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-23 For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-24. DESCRIPTION

1-25. The Model 8557A 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 Model 8557A is calibrated to measure signals from +20 dBm to −117 dBm over a frequency range of 0.01 MHz to 350 MHz. The complete measuring system includes the Model 8557A Spectrum Analyzer plugged into a Hewlett Packard 180-series oscilloscope mainframe.

1-26. The Model 8557A is designed for simplicity operation. Most measurements are made using only three controls, two for frequency and one for amplitude. The CENTER or START frequency of the display is shown on the front-panel mechanical readout.

1-27. OPTIONS

1-28. Option 001

1-29. The Model 8557A Option 001 provides the spectrum analyzer with a direct measurement capability in a 75 ohm system. The front-panel INPUT is a 75 ohm BNC connector. The Option 001 provides calibration in dBm from −110 dBm to +20 dBm in 10 dB steps. For manual changes to incorporate this option, see Appendix A.

1-30.Option 002

1-31. The Model 8557A Option 002 provides the spectrum analyzer with a direct measurement capability in a 75 ohm system. The front-panel INPUT is a 75 ohm BNC connector. The Option 002 provides calibration in dBmV from −63 dBmV to +70 dBmV in 10 dB steps. For manual changes to incorporate this option, see Appendix B.

1-32. ACCESSORIES SUPPLIED

1-33. Graticule overlays are supplied to provide the operator with greater ease of reading the information displayed. HP Part Number 5020-8565 is the overlay for 180-series oscilloscope mainframes, HP Part Number 5020-8566 is the overlay for 181-series oscilloscope mainframes, and HP Part Number 5020-8567 is the overlay for 182-series oscilloscope mainframes. For proper installation of graticule overlay, refer to Section II. Special Dial Drive wrenches, HP Part Numbers 08557-00017 and 08557-00018, are supplied to ease Dial Drive Assembly adjustments. All supplied accessories are shown in Figure 1-1.

1-34. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-35. Oscilloscope Display

1-36. The Hewlett-Packard Model 180T-series oscilloscope is used for the display and mainframe for the HP Model 8557A. To be completely compatible with the 8557A, the Model 180-series oscilloscope should have Option 807 installed. This provides the proper rear-panel auxilliary outputs for use with the 8557A Spectrum Analyzer. The rear-panel auxilliary output connectors are labeled AUX A, AUX B, AUX C, and AUX D. They provide Vertical Output, Pen Lift Output, 21.4 MHz IF Output, and Horizontal Output, respectively.

1-37. If the Hewlett-Packard 180-series oscilloscope does not have Option 807 installed, only the horizontal, vertical, and blanking outputs will be available at the mainframe's rear panel. These outputs will be attenuated and shifted in dc level. (See Supplemental Performance Characteristics Table 1-2 GENERAL.) In non-storage 180-series mainframes, the standard P31 CRT phosphor will not provide the long persistence of the Option 807 P7 phosphor. Modification Kit Number 00180-69503 may be used to provide the proper rear-panel auxilliary outputs for use with the 8557A Spectrum Analyzer. See Table 1-3.

1-38. EQUIPMENT AVAILABLE

1-39. Hewlett-Packard Model 1121A 500 MHz AC Probe

1-40. The HP Model 1121A active probe permits testing high-frequency circuits without significant loading effects. High input impedance is maintained by a field effect transistor (FET) circuit. The HP Model 8557A Spectrum Analyzer has a front panel PROBE PWR connector which permits the use of high impedance active probes such as the HP Model 1120A, HP Model 1121A, HP Model 1123A, or HP Model 1124A. The HP Model 1121A is preferred because of its low noise characteristics.

1-41. Hewlett-Packard 180-series Oscilloscope Modification Kit (Option 807 connections)

1-42. This Modification Kit (HP Part Number 00180-69503) provides the materials and information necessary to modify a standard HP 180-series oscilloscope. The modification provides installation of Option 807 rear-panel connections on the standard HP 180-series oscilloscope. See Table 1-3 for description of parts and HP part numbers contained in Modification Kit.

1-43. Service Equipment Available

1-44. Table 1-4 describes equipment available from Hewlett-Packard that provides convenience in aligning and troubleshooting the 8557A Spectrum Analyzer.

1-45. RECOMMENDED TEST EQUIPMENT

1-46. Table 1-5 lists all of the equipment required for performance testing, adjustments, troubleshooting, and repair of the Hewlett-Packard Model 8557A Spectrum Analyzer. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-3. Parts Included in Modification Kit 00180-69503

Quantity	Description	HP Part Number
1	Output Amplifier Assembly (Auxiliary Output Board)	00180-66548
1	Label	7120-3116
2	3/4 inch pieces of shrink tubing	0890-0720
1	Service Note	180A/AR-10, 180C/D-2, 181A/AR-8, 182A/C-1, or 184/B-1 (only one Service Note is included, depending on model number)

Table 1-4. Equipment Available for Servicing 8557A

Item	Required Features	Suggested Model
Board Puller	Two prongs to lift PC Boards	HP 03950-4001
*Extender Board	10 Pin, 20 Contacts	HP 5060-0256
*Extender Board	6 Pin, 12 Contacts	HP 5060-0257
*Extender Board	22 Pin, 44 Contacts	HP 5060-5990
Cable Assembly	Male BNC to Female Subminiature RF, 36 inches long	HP 11592-60001
Cable Assembly	Male Subminiature RF to Female Subminiature RF	HP 11592-60003
Adapter	Subminiature RF, Female on both ends	HP 1250-0827
Adapter	Subminiature RF, Male on both ends	HP 1250-1113
Extender Cable Assembly (See Figure 1-2)	32 Contact Male and Female connectors specially adapted to extend all of the inter-connections from the oscilloscope mainframe to the 8557A (or 8755A)	HP 5060-0303
Wrench	15/64 inch, Combination or open end	HP 8710-0946
Wrench	5/16 inch, Combination or open end	HP 8720-0015
Side Wrench	Special Dial Drive Adjustment Wrench	HP 08557-00017
End Wrench	Special Dial Drive Adjustment Wrench	HP 08557-00018

*Rubber bumpers (HP part number 0403-0115) should be installed in the center of both sides of extender board. The rubber bumpers prevent the extender board from shorting against the 8557A chassis when in use.

Table 1-5. Recommended Test Equipment (1 of 3).

Instrument	Critical Specifications	Recommended Model	Use*
Oscilloscope Mainframe	HP 180T Series or HP 180 Series with Option 807 and Variable Persistence	HP 181T	P, A, T
Oscilloscope	Time Base: 1ms/cm to 10 ms/cm Vertical Sensitivity: 1mV/cm to 20 volts/cm	HP180A/1801A/1820C	P, A, T
Electronic Counter	Frequency Range: 10MHz to 350 MHz Sensitivity: 100 mV Gate Time: 10μS (Time Base)	HP 5245L/5254C	P, A, T
Digital Voltmeter	Accuracy: ±(.05% Rdg ±1 digit)	HP 34740A/34702A	P, A, T
Power Meter	Power Range: −35 dBm to +20 dBm	HP 435A	P, A, T
Power Sensor	Frequency Range: 100 MHz to 350 MHz Maximum SWR: 1.1, 50 MHz to 350 MHz	HP 8481A	P, A, T
Amplifier	Frequency Range: 200 MHz to 350 MHz Gain: > 20 dB Impedance: 50Ω	HP 8447A	P, A, T
Signal Generator (2 required)	Frequency Range: 100 MHz to 350 MHz Drift: Less than 50 ppm (or 5 Hz, whichever is greater)	HP 8640B	P, A, T
Sweep Oscillator/ RF Unit	Frequency Range: 0.1 GHz to 2.0 GHz Maximum Leveled Power: > 6 mW	HP 8620A/86210A	P, A, T
Generator/Sweeper	Frequency Range: 100 kHz to 110 MHz Flatness: ±.25 dB over full range, ±0.1 dB over any 10 MHz portion (+10 dBm step or below)	HP 8601A	P, T
Comb Generator	Accuracy: 0.01%	HP 8406A	P, A, T
Test Oscillator	Frequency Range: 10 kHz to 10 MHz Output Impedance: 50Ω	HP 652A	P
Crystal Detector	Frequency Range: 10 MHz to 350 MHz Frequency Response: ±0.2 dB/octave to 2 GHz; ±0.5 dB overall	HP 423A	P, A, T
50 MHz LPF	Rejection: > 50 dB for signals above 50 MHz	Cir Q Tel FLT/2-50-5/50-3A/3B	P, A, T
300 MHz LPF	Rejection >50 dB for signals above 300 MHz	Telonic TLP 300-4AB	P, A, T

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

Table 1-5. Recommended Test Equipment (2 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
10 dB Attenuator (2 required)	Frequency Range: 10 kHz to 350 MHz Accuracy: ±0.5 dB	HP 8491A Option 010	P, T
20 dB Attenuator	Frequency Range: 10 kHz to 350 MHz Accuracy: ±0.5 dB	HP 8491A Option 020	P, T
Step Attenuator	Frequency Range: 20 MHz to 350 MHz Attenuation: 12 dB in 1-dB steps Accuracy: ±0.25 dB	HP 355C	P, A, T
Step Attenuator	Frequency Range: 20 MHz to 350 MHz Attenuation: 80 dB in 10-dB steps Calibrated at 30 MHz and 250 MHz by a Standards Lab Accuracy: ±0.01 dB ±0.02/10dB step at calibrated frequencies	HP 355D Option H82	P, A, T
Terminator	Impedance: 50 Ω	HP 11593A	P
Extender Cable Assembly	32 contact male and female connectors specially adapted to extend all of the interconnections from the oscilloscope mainframe to the 8557A	HP 5060-0303	A, T
BNC Cable, 6 inch	50Ω coaxial cable with male BNC connectors on both ends	HP 10502A	A, T
Adapter	GR male on one end, BNC female on other end	Pomona Electronics 1645	A, T
Adapter	BNC female on one end, aligator clips on other end	HP 8120-1292	A,T
Adapter	BNC jack to SMA plug	HP 1250-1200	T
Adapter (2 required)	Type N male on one end, BNC female on other end	HP 1250-0780	P, A, T
Adapter	Type N female on both ends	HP 1250-0777	A, T

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

Table 1-5. Recommended Test Equipment (3 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Adapter	Type N male on one end, subminiature RF male on other end	HP 1250-1023	A, T
Adapter	Subminiature RF, male on both ends	HP 1250-1113	A, T
Type N Tee	Two female connectors and one male connector	UG-107 B/U	P, A, T
BNC Tee	Two female connectors and one male connector	HP 1250-0781	P, A, T
Extender Board	6 pin, 12 contacts with 51.1Ω resistor between pin 1 and pin 5	HP 5060-0257 HP 0757-0394	A, T

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

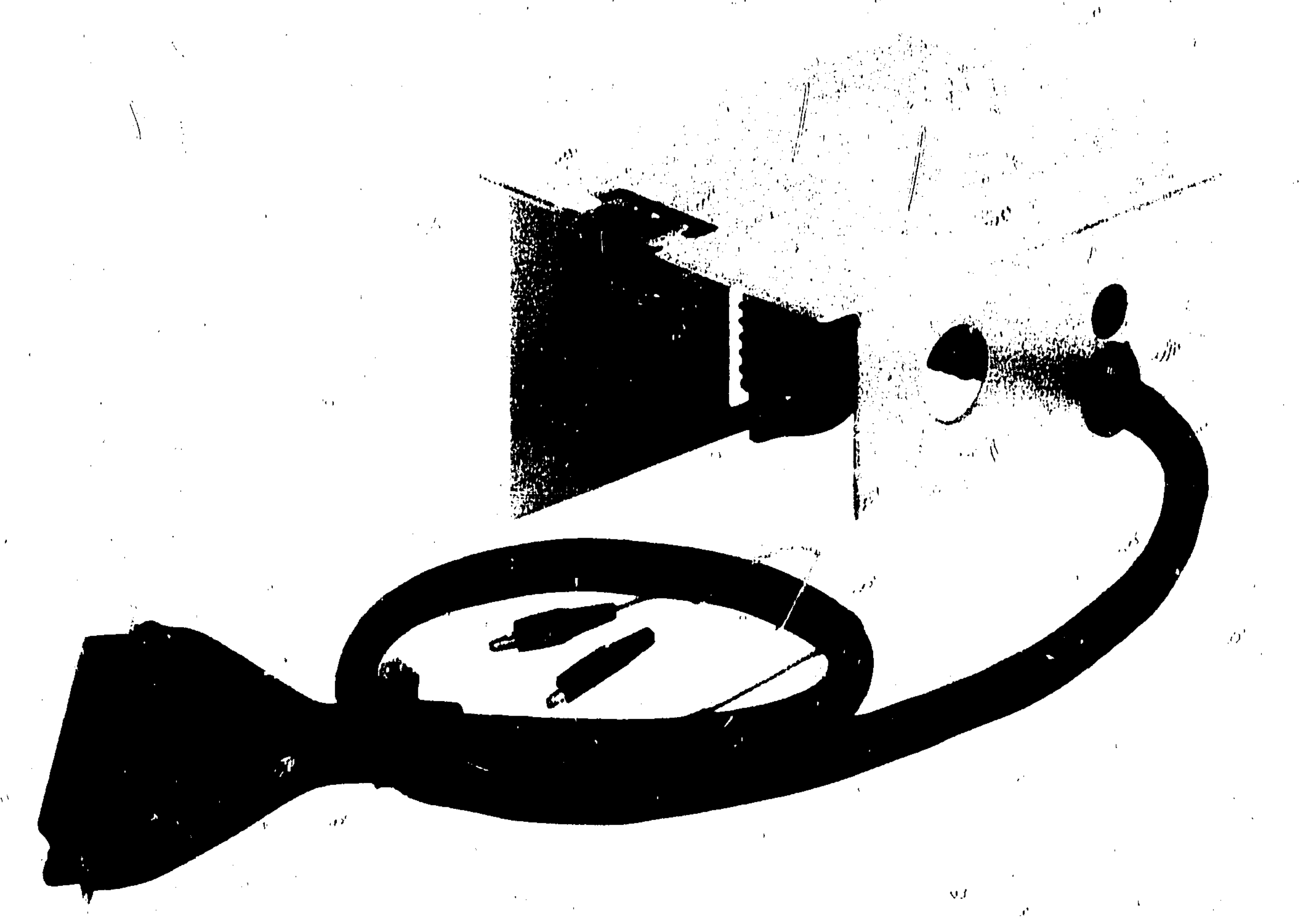


Figure 1-2. Extender Cable Assembly, HP Part Number 5060-0303

INSTALLATION

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section covers initial inspection, installation of the instrument into a mainframe, and storage and shipping requirements.

2-3. INITIAL INSPECTION

2-4. 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, and procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Installation

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

2-8. To install the Plug-in into the mainframe:

a. Set Model 180-series mainframe LINE switch to OFF.

b. Slide plug-in into place toward rear of compartment.

c. Turn the "latch" knob located at the center of the front panel clockwise until plug-in is held solidly in the mainframe.

2-9. To install the graticule overlay:

a. Select the proper overlay. HP Part Number 5020-8565 is for 180-series oscilloscope mainframes, HP Part Number 5020-8566 is for 181-series oscilloscope mainframes, and HP Part Number 5020-8567 is for 182-series oscilloscope mainframes.

b. For 180-series and 181-series mainframes, remove CRT bezel. Insert proper overlay and replace CRT bezel. The metallic mesh contrast filter may be used with the overlay.

c. For 182-series mainframes, grasp top portion of CRT bezel and pull straight up. Insert overlay and replace top portion of CRT bezel. The metallic mesh contrast filter or the light blue contrast filter may be used with the overlay.

2-10. Interconnections

2-11. When the Hewlett-Packard Model 8557A is properly installed in the HP Model 180-Series Oscilloscope, the interconnections are as shown in Table 2-1.

2-12. Operating Environment

2-13. Temperature. The instrument may be operated in temperatures from 0°C to +55°C.*

2-14. Humidity. The instrument may be operated in environments with humidity up to 95%.* However, the instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-15. Altitude. The instrument may be operated in altitudes up to 25,000 feet.

2-16. Modifications

2-17. Modification Kit Number 00180-69503 provides materials and information necessary to add Option 807 rear-panel connections on the standard HP 180-series oscilloscope. Refer to Table 1-3 in Section I. This modification is necessary only if all four rear-panel outputs are needed, but is not necessarily required to use the 8557A in a 180-series mainframe.

*Except as noted in Specifications, Table 1-1.

four rear-panel outputs are needed, but is not necessarily required to use the 8557A in a 180-series mainframe.

2-18. STORAGE AND SHIPMENT

2-19. Environment

2-20. The Instrument may be stored or shipped in environments within the following limits:

Temperature: −40°C to +75°C
Humidity: Up to 95%
Altitude: Up to 25,000 feet

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

2-21. Packaging

2-22. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-23. Other Packaging. The following general instructions should be used for re-packaging with commercially available materials:

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

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.

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

d. Seal the shipping container securely.

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

Table 2-1. 8557A *Mainframe Interconnections*

Pin on P1	Signal or Voltage
1	CRT HORIZ Adjustment Signal
2	GROUND from Mainframe (jumpered to Pin 8 of P1)
3	N.C.
4	N.C.
5	AUX D Horizontal Output to mainframe rear-panel (labelled EXT. RESET on 183A/B/C/D).
6	N.C.
7	N.C.
8	GROUND from mainframe (jumpered to Pin 2 of P1)
9	N.C.
10	N.C.
11	AUX D Horizontal Output to mainframe rear panel
12	AUX C 21.4 MHz IF Output to mainframe rear panel
13	AUX B Pen Lift/Blanking Output to mainframe rear panel
14	AUX A Vertical Output to mainframe rear panel
15	GROUND
16	N.C.
17	BLANKING
18	N.C.
19	GROUND from mainframe (jumpered to Pin 24 of P1)
20	N.C.
21	BEAM FINDER circuit
22	N.C.
23	N.C.
24	GROUND from mainframe (jumpered to Pin 19 of P1)
25	N.C.
26	N.C.
27	N.C.
28	−12.6 Vdc from mainframe
29	+15 Vdc from mainframe
30	+100 Vdc from mainframe
31	20 Vac from mainframe (Line sync.)
32	N.C.
W10P3 (2 contacts)	Vertical deflection to CRT

OPERATION

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section provides complete operating instructions for the 8557A Spectrum Analyzer. It also provides a brief description of oscilloscope-mainframe controls. For a detailed description of the oscilloscope mainframe, refer to its manual.

3-3. CONTROLS, INDICATORS, AND CONNECTORS

3-4. The Spectrum Analyzer is used with one of the 180-series oscilloscope mainframes. The 180-T series oscilloscope mainframes or 180-series with Option 807 have the correct rear-panel connections for spectrum analyzer horizontal, vertical, pen-lift, and IF outputs. Figure 3-1 shows the front-panel features of the 8557A Spectrum Analyzer. Figure 3-2 shows the rear-panel features of the oscilloscope mainframe and the rear-panel features of the spectrum analyzer. The rear panels of all 180-T series or Option 807, 180-series oscilloscope mainframes, are basically the same.

3-5. OPERATOR'S CHECKS

3-6. Upon receipt of the 8557A Spectrum Analyzer, or if the mainframe is changed, perform the operational adjustments listed in Figure 3-3. This procedure corrects for minor differences between units and ensures that the analyzer and mainframe are properly matched.

3-7. OPERATING CONSIDERATIONS

3-8. Control Grouping

3-9. The spectrum analyzer and oscilloscope 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.

3-10. **Display.** The display group consists of:

SWEEP TIME/DIV	VIDEO FILTER
SWEEP TRIGGER	BASELINE CLIPPER
VERT POS	HORIZONTAL POSITION
VERT GAIN	INTENSITY
MANUAL SWEEP	FOCUS
HORIZ GAIN (rear panel of 8557A)	TRACE ALIGN
	ASTIG

In addition, the variable persistence and storage controls on the HP 181T/TR fall into this category.

3-11. The display group enables the operator to calibrate the display and to select a variety of scan and display conditions. The controls are explained in Figure 3-3. 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.

3-12. **Frequency.** The frequency group consists of:

TUNING
RESOLUTION BW
FREQ SPAN/DIV

3-13. 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 1 MHz to 1 kHz will be automatically selected as the FREQ SPAN/DIV is narrowed from 100 MHz/DIV to 5 kHz/DIV. The FREQ SPAN/DIV control permits the operator to look at a spectrum that varies in width from zero to 1000 MHz. TUNING controls coarse and fine (coarse is larger knob) set the center frequency or starting frequency of the displayed spectrum. RESOLUTION BW control determines the resolution of the signals of the CRT.

3-14. **Amplitude.** The amplitude group consists of:

REFERENCE LEVEL dBm — OPTIMUM INPUT

REF LEVEL FINE
REF LEVEL CAL
10 dB/DIV – 1 dB/DIV – LIN

3-15. The amplitude group enables the operator to measure signal amplitude in units of either voltage or dBm. The REFERENCE LEVEL dBm – OPTIMUM INPUT knob controls two functions with one control knob. The amount of attenuation at the input attenuator is set by pushing in and turning the large knob. The square-black pointer indicates the OPTIMUM INPUT attenuation selected. Selecting –40 corresponds to 0 dB of input attenuation. When the large knob is pushed in and turned from –40 to the +10 position, attenuation is added in 10-dB steps. When the power level of the input signal being measured is equal to or less than the OPTIMUM INPUT setting, the signal level at the input mixer is equal to or less than –40 dBm. A signal level of –40 dBm or less at the input mixer assures the operator of at least 70 dB of spurious-free measurement range on the spectrum analyzer display. Turning the REFERENCE LEVEL dBm – OPTIMUM INPUT knob without pushing in, calibrates the top graticule line to the power level indicated in the REF LEVEL dBm window, provided the REF LEVEL CAL control has been properly adjusted. The REF LEVEL FINE control allows the operator to calibrate the top graticule line in 1/2 dB increments.

3-16. If the operator is only interested in measuring amplitude, the signal at the mixer can be as high as –10 dBm. (Signals above this level will compress.) Signal sources and signal generating equipment must not apply signal levels exceeding ±30 Vdc or 2.2 Vrms to the 8557A input. Options 001 and 002 maximum AC signal level is 5 Vrms. Maximum input power level must not exceed +20 dBm, or input attenuator burnout may result.

3-17. Variable Persistence and Storage Functions.

3-18. With the 181T/TR Oscilloscope Mainframe, the operator can set trace persistence for a bright, steady trace that does not flicker, even on the slow sweep required for narrow band analysis. The variable persistence also permits the display of low repetition rate pulses without flickering and, using the longest persistence, intermittent signals can be captured and displayed. The storage capability allows side-by-side comparision of changing signals.

3-19. Persistence and Intensity. These controls largely determine how long a written signal will be visible. Specifically, PERSISTENCE controls the rate at which a signal is erased and INTENSITY controls the trace brightness as the signal is written. With a given PERSISTENCE setting, the actual time of trace visibility can be increased by greater INTENSITY. Since the PERSISTENCE control sets the rate of erasing a written signal, it follows that a brighter trace will require more time to be erased. Conversely, a display of low intensity will disappear more rapidly. The same principle applies to a stored display of high and low intensity.

CAUTION

Excessive INTENSITY may damage the CRT storage mesh. The INTENSITY setting for any sweep speed should just eliminate trace blooming with minimum PERSISTENCE setting.

3-20. Storage. These controls select the storage mode in which the CRT functions. In ERASE mode, STORE, WRITE and MAX WRITE are disconnected and all written signals are removed from the CRT. The STORE selector disconnects the WRITE, MAX WRITE, and ERASE functions and implements signal retention at reduced intensity. In the STORE mode, PERSISTENCE and INTENSITY have no function.

3-21. Writing Speed. In the MAX WRITE mode, the CRT storage surface is primed to allow much faster writing on the storage surface. Since the erasing rate is decreased, the entire screen becomes illuminated more rapidly and the display is obscured. The effective persistence and storage times are thus considerably reduced.

3-22. Photographic Techniques

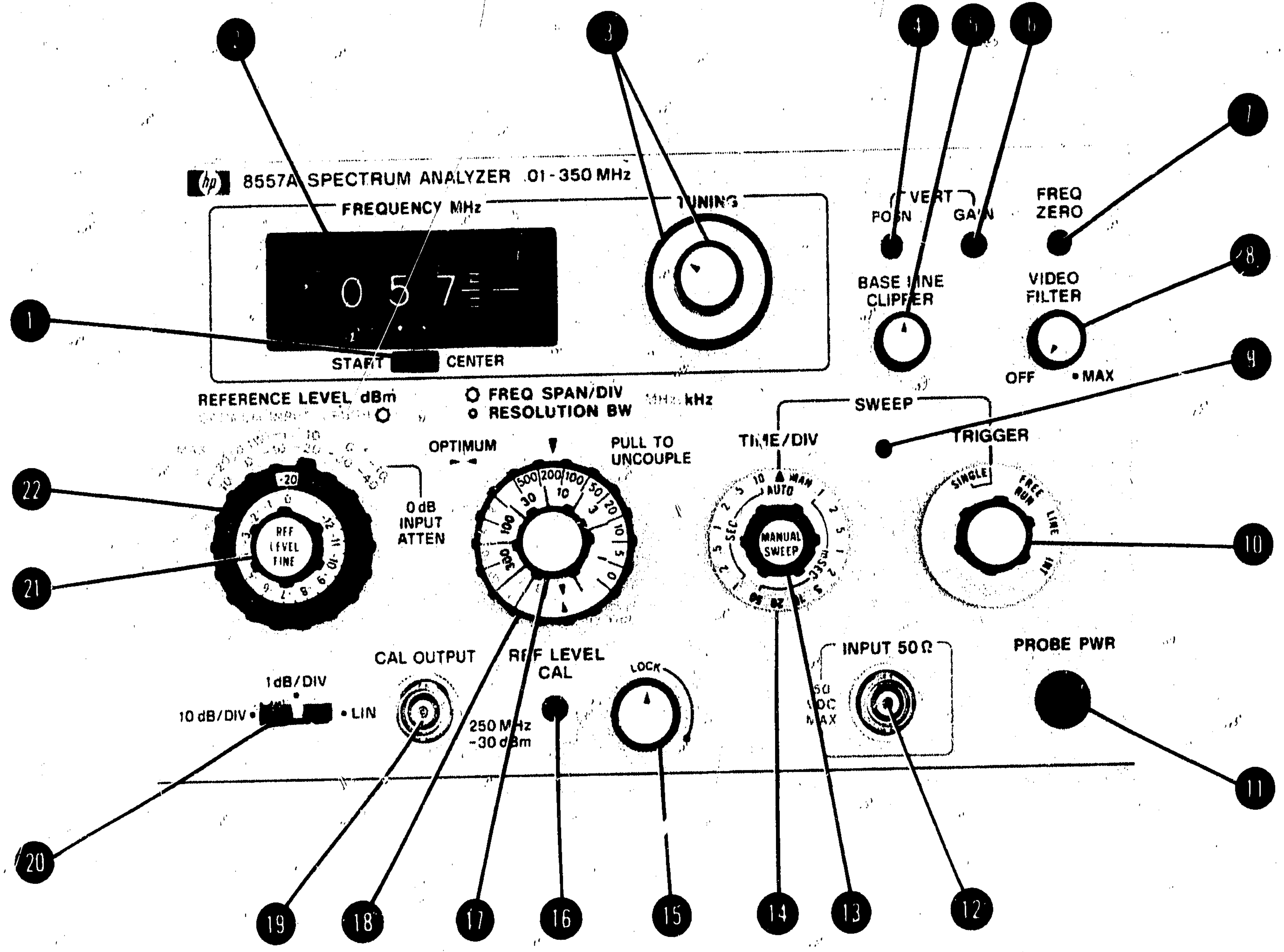
3-23. Excellent oscillographic photography is possible when the spectrum analyzer is used with proper optics and when proper techniques are employed. The HP Model 197A Oscilloscope Camera attaches directly to the analyzer's CRT bezel without adapters. The camera also has an Ultra-Violet light source that causes a uniform glow to the CRT phosphor. This gives the finished photograph a gray background that contrasts sharply with the white trace and the black graticule lines. Ultra-Violet illumination is normally used only when the CRT is of the non-storage and fixed persistence type. For a storage or variable persistence CRT Display Section, a uniform gray background is obtained by simply taking the photograph in STORE rather than in VIEW. (See Application Note AN150-5).

3-24. APPLICATIONS OF SPECTRUM ANALYSIS

3-25. Signal analysis in the frequency domain is recognized as a tremendous aid in the evaluation of circuits and systems. Frequency-domain techniques are logical, easy to use, and the results are easy to interpret. Some of the more important frequency-domain phenomena are: distortion of oscillators; frequency response, parasitic oscillations, and distortion characteristics of amplifiers; frequency parameters of networks and filters; and all types of modulation.

3-26. The 8557A Spectrum Analyzer is capable of analytically resolving almost any problem whose unknowns are amplitude and frequency; thus, over and above the general-purpose applications, the instrument is a powerful observation-and-measurement tool for surveillance, EMC, and systems work. To define each instrument application is beyond the scope of this manual. For further details, there are complete discussions of spectrum analyzer application in Application Notes 63A through 63E, 150A, and 150-1 through 150-5. These application notes are available from the nearest HP Sales and Service Office.

FRONT PANEL FEATURES



(1) **START — CENTER Switch.** This switch selects the frequency read on the FREQUENCY MHz indicator (2) to be the frequency at center of CRT with the switch in CENTER position, or the frequency at start of CRT with the switch in START position.

(2) **FREQUENCY MHz Indicator.** Provides mechanical readout of the frequency at center or start of CRT, depending on position of START — CENTER switch (1)

(3) **TUNING Control.** This control consists of two parts, a coarse-tuning control (larger diameter knob) and a fine-tuning control (smaller diameter knob). The TUNING control tunes the center frequency or start frequency of the spectrum displayed, depending on the position of the START — CENTER switch (1)

(4) **VERT POS Control.** This control adjusts the 8557A vertical driver to properly position the trace on the Oscilloscope.

(5) **BASE LINE CLIPPER Control.** This control blanks the lower part of the CRT baseline noise. Blanking function is useful to prevent blooming with a variable-persistence storage oscilloscope mainframe.

(6) **VERT GAIN Control.** This control adjusts the 8557A vertical driver for proper vertical calibration of the Spectrum Analyzer. It compensates for a difference in vertical gain of different oscilloscope mainframes.

(7) **FREQ ZERO Control.** This control adjusts the FREQUENCY MHz indicator (2) to zero when the TUNING control (3) has LO feedthrough centered. (START — CENTER switch (1) must

Figure 3-1. Front Panel Controls, Connectors, and Indicators (1 of 3)

FRONT PANEL FEATURES

be in center position.) The FREQ ZERO control may also be used to calibrate the center frequency anywhere in the frequency spectrum from 0 to 350 MHz.

(8) **VIDEO FILTER Control.** This control is a variable post detection video filter which smooths the display by averaging background noise. The MAX detent position (fully clockwise) selects a 1.5 Hz video filter and decreases AUTO sweep time for maximum noise averaging. The VIDEO FILTER control is one of the controls that determines sweep time when the SWEEP TIME/DIV control (14) is in the AUTO sweep mode.

(9) **SWEEP Indicator.** Lights for the duration of each sweep.

(10) **SWEEP TRIGGER Control.** Selects sweep trigger mode and single sweep. When in SINGLE sweep position, this control must be turned clockwise to initiate or to stop a sweep.

(11) **PROBE PWR Connector.** Supplies power for high impedance probes such as the HP Models 1120A, 1121A, 1123A, and 1124A. The HP Model 1124A Active Probe is preferred because of its low noise characteristics.

(12) **INPUT 50 Ω Connector.** 50 Ohm input for .01 to 350 MHz signals to be measured.

CAUTION

Maximum input signal to attenuator must not exceed +20 dBm (0.1W).

(13) **MANUAL SWEEP Control.** Controls sweep in MAN Position of SWEEP TIME/DIV control (14).

(14) **SWEEP TIME/DIV Control.** Controls sweep time in 0.1 mSEC to 10 SEC per division settings. MAN position permits manual sweep. In AUTO position the correct sweep time is controlled by FREQ SPAN/DIV control, (18) RESOLUTION BW control (17) and VIDEO FILTER Control (8) to maintain absolute amplitude calibration.

(15) **LOCK – Knob.** This knob pulls out for easier turning and to provide a handle for removing the analyzer from the oscilloscope mainframe. When the knob is turned to the LOCK position (fully clockwise) the 8557A is locked into the oscilloscope mainframe. When the knob is turned fully counterclockwise the 8557A is free to move in or out of the oscilloscope mainframe.

(16) **REF LEVEL CAL Control.** Calibrates display amplitude for absolute power measurements.

(17) **RESOLUTION BW Control.** This control selects resolution bandwidth from 1 kHz to 3 MHz. The blue numbers are MHz and the black numbers are in kHz. The RESOLUTION BW control is coupled with the FREQ SPAN/DIV control (18) unless pulled out. The RESOLUTION BW Control is one of the controls which determines sweep time when the SWEEP TIME/DIV control (14) is in the AUTO sweep mode.

(18) **FREQ SPAN/DIV Control.** This control selects the CRT horizontal frequency calibration. The blue numbers are MHz/Div and black numbers are kHz/Div calibrations. When in 0 position, the frequency is not swept (fixed tuned) and the signal appears at the same level across the entire display. The FREQ SPAN/DIV control is one of the controls which determines sweep time when the SWEEP TIME/DIV control (14) is in the AUTO sweep mode. Unless the FREQ SPAN/DIV control is pulled out, it is coupled with the RESOLUTION BW control. (17) When the controls are coupled and aligned in the optimum position, the optimum RESOLUTION BW is selected for each FREQUENCY SPAN/DIV.

Figure 3-1. Front Panel Controls, Connectors, and Indicators (2 of 3)

FRONT PANEL FEATURES

(19) CAL OUTPUT Connector. This BNC connector provides a 250 MHz signal at −30 dBm for calibration of the Spectrum Analyzer. A short cable with male BNC connectors should be used to feed the CAL OUTPUT signal into the INPUT 50Ω connector (12).

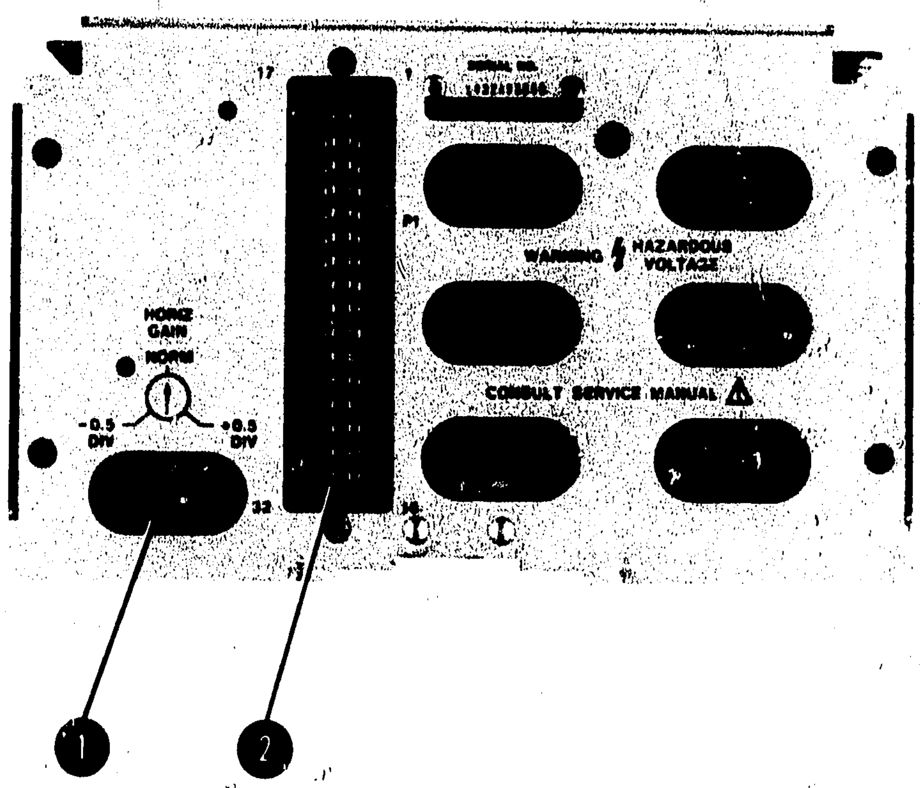
(20) 10 dB/DIV – 1 dB/DIV – LIN Switch. Selects log (1 dB/DIV or 10 dB/DIV) or linear display modes.

(21) REF LEVEL FINE Control. Provides continuous control of the analyzer's amplitude reference level. This control has a range of 0 dB to 12 dB and is calibrated in ½ dB increments. The REF LEVEL FINE control setting should be added to the setting displayed in the open window of the REFERENCE LEVEL dBm – OPTIMUM INPUT control (22). For example, if −30 is displayed in the open window and the REF LEVEL FINE control is set at −2, the actual reference level (top graticule line) is −32 dBm.

(22) REFERENCE LEVEL dBm – OPTIMUM INPUT Control. Controls display amplitude calibration. The number displayed in the open window indicates the dBm level of the CRT top graticule line with REF LEVEL FINE control (21) set at 0. Turn control to select desired amplitude calibration. The optimum and maximum input level selected is designated by the pointer behind the control. Push in control and turn to select input level range needed. Controls the Input Attenuator from 0 to 70 dB. The MAX input level (red) indicates maximum allowable input signal level for less than 1 dB gain compression. The OPTIMUM INPUT dBm level (blue) indicates maximum input level for greater than 70 dB spurious-free dynamic range.

Figure 3-1. Front Panel Controls, Connectors, and Indicators (3 of 3)

REAR PANEL FEATURES

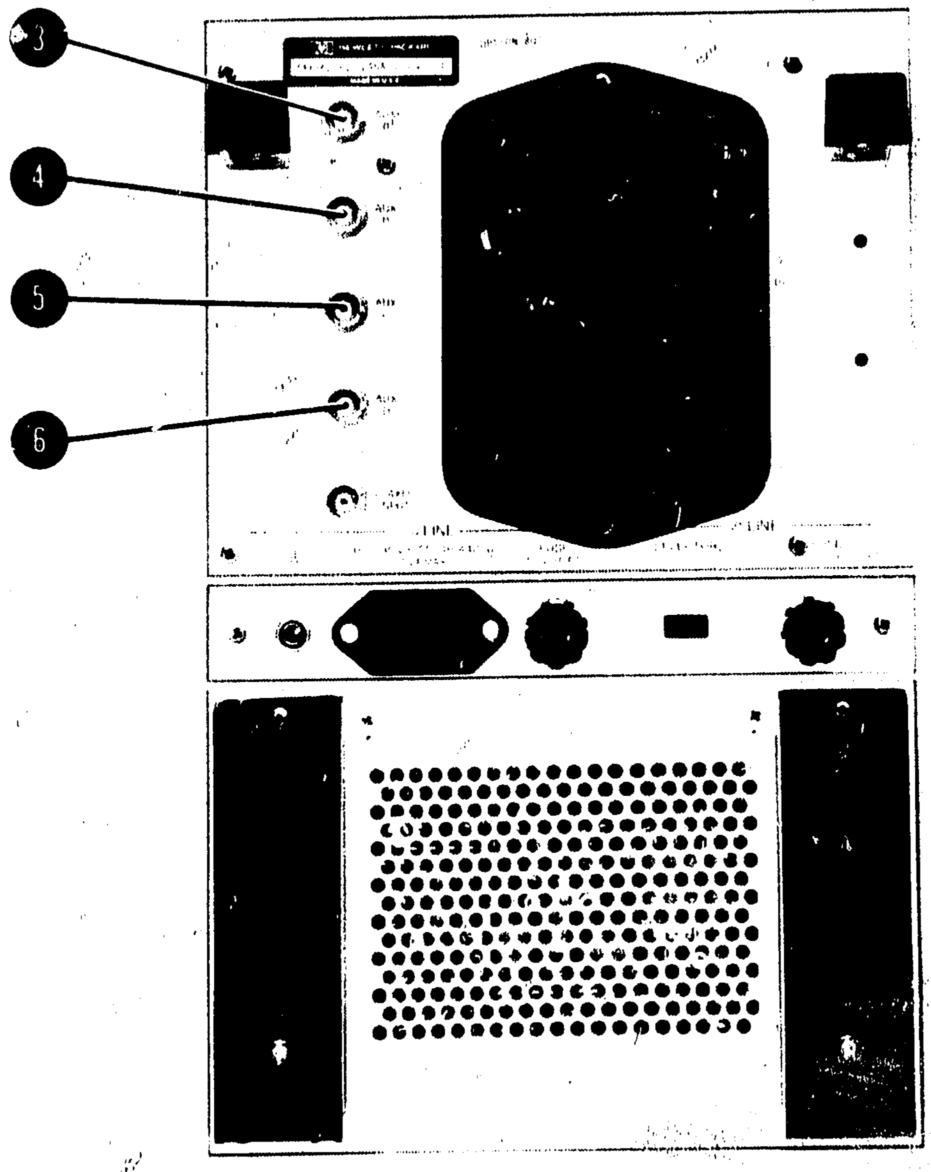


8557A Spectrum Analyzer Rear Panel

1. **HORIZ GAIN Control.** This control is used to adjust the horizontal gain for a full 10 divisions of horizontal deflection. Spectrum Analyzer must be removed to adjust this control. Adjustment is made to compensate for any difference in horizontal gain characteristics between different oscilloscope mainframes.
2. **P1 Connector.** Interconnects to oscilloscope mainframe.

Figure 3-2. Rear Panel Controls and Connectors (1 of 3)

REAR PANEL FEATURES



Oscilloscope Mainframe (182C) Rear Panel

Figure 3-2. Rear Panel Controls and Connectors (2 of 3)

REAR PANEL FEATURES

3 **AUX A Vertical Output (180T-Series or 180-Series Option 807).** Provides detected video output of 0 volts to 0.8 volts for eight divisions of CRT display deflection from oscilloscope mainframes with Option 807. The output impedance is 50 ohms. On oscilloscope mainframes without Option 807, the rear-panel MAIN GATE OUTPUT connector may be used to provide detected video output. The MAIN GATE OUTPUT is approximately +0.7 V to +1.0 V with a load greater than 600 Ohms. Output impedance is less than 100 Ohms.

4 **AUX B Pen Lift Blanking Output (180T-Series or 180-Series Option 807).** Provides a positive pulse from 0 volts to +15 volts. The zero volt level provides a pen-down signal and the +15 volt level provides a blanking signal with an impedance of approximately 10 k Ohms. This output signal is compatible with HP Models 7004B, 7005B, 7034B and 7035B X-Y Recorders. On oscilloscope mainframes without Option 807, the rear-panel DELAYED GATE OUTPUT may be used for blanking. The DELAYED GATE OUTPUT is approximately +0.7V to 3.1V (0.7V unblanked) with a load greater than 1500 Ohms. Output impedance is less than 100 Ohms.

CAUTION

DO NOT connect X-Y recorder to 180-Series DELAYED GATE OUTPUT or damage to the oscilloscope mainframe will result.

5 **AUX C 21.4 MHz IF Output (180 T-Series or 180-Series Option 807).** Provides 21.4 MHz IF output linearly related to the RF input to the Spectrum Analyzer. The bandwidth and amplitude are controlled by the Spectrum Analyzer front panel controls. The output impedance is 50 Ohms. This output is available only on oscilloscope mainframes with Option 807.

6 **AUX D Horizontal Output (180T-Series or 180-Series Option 807).** Provides a horizontal sweep voltage from −5 volts to +5 volts for 10 divisions of CRT display deflection. The output impedance is 5 K Ohms. On oscilloscope mainframes without Option 807, the rear-panel MAIN SWEEP OUTPUT may be used to provide a horizontal sweep voltage from approximately 1.5 V to +0.2 V with a load greater than 600 Ohms. Output impedance is less than 100 Ohms.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

WARNING

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

Figure 3-2. Rear Panel Controls and Connectors (3 of 3)

OPERATOR'S CHECK

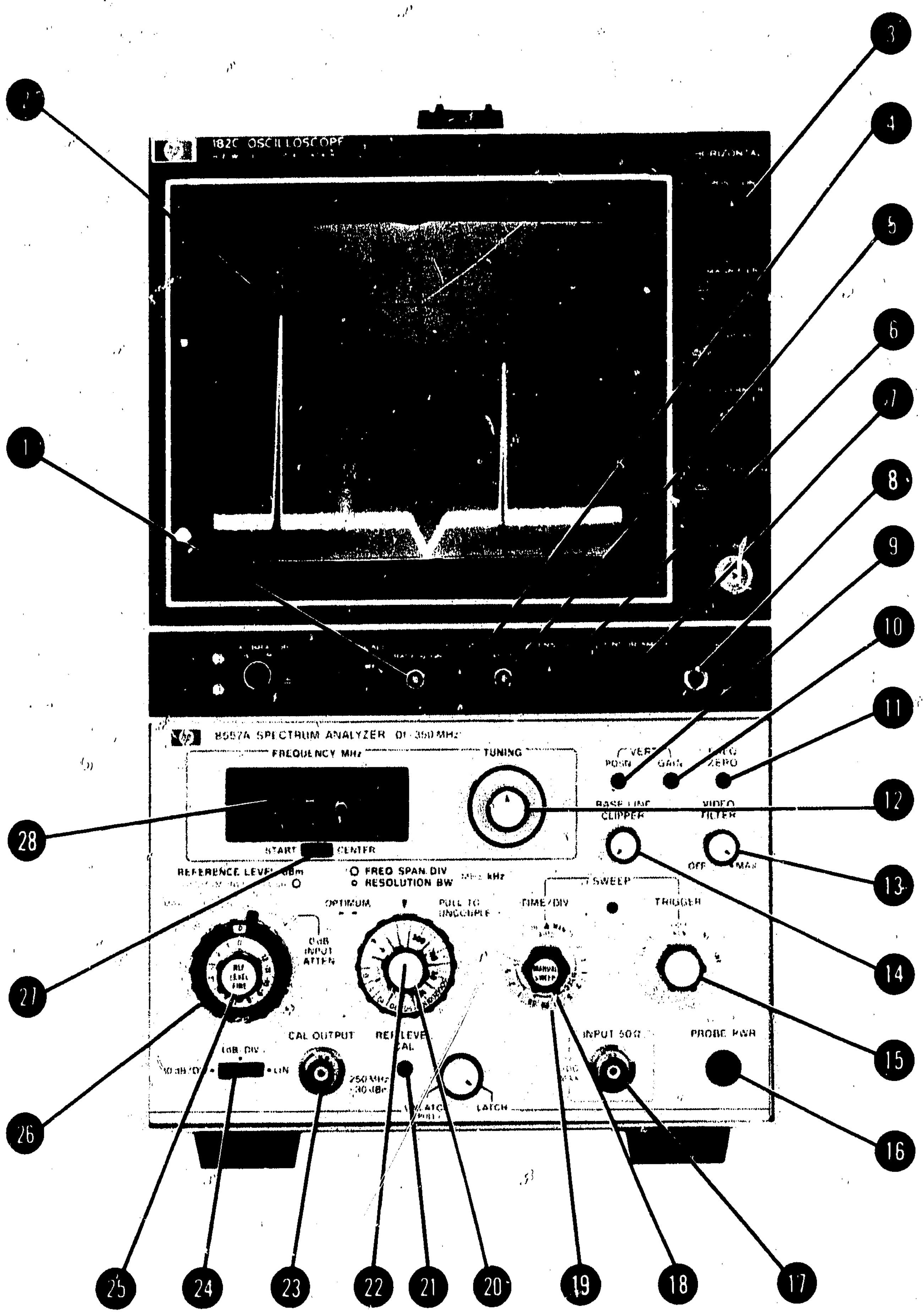
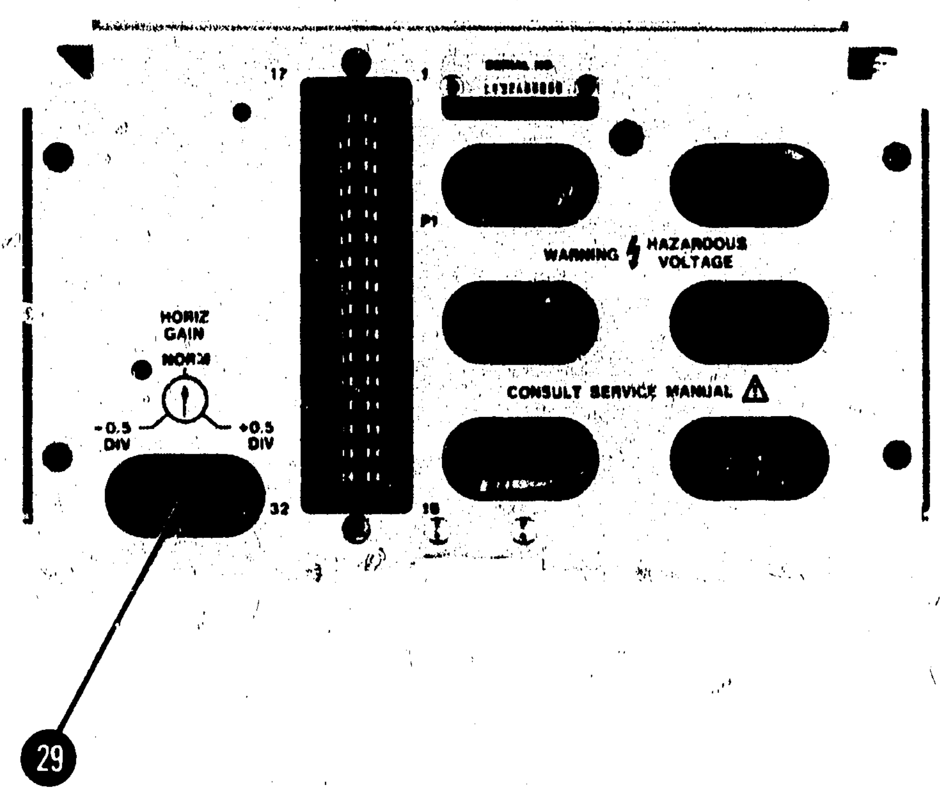


Figure 3-3. Operator's Check (1 of 4)

OPERATOR'S CHECK



1. Set oscilloscope mainframe 115/230 switch or check to see that POWER MODULE circuit card is installed correctly to correspond with available input voltage. The instrument is fused for 115-volts, 50/60 Hz operation; if 230-volt power is used, refer to the oscilloscope mainframe Service Manual for fuse replacement procedures.
2. Set mainframe LINE switch (8) to ON position. LINE indicator should be lit.
3. Turn BASELINE CLIPPER control (14) and VIDEO FILTER control (13) fully counterclockwise.
4. Set START-CENTER Switch (27) to START and FREQ SPAN/DIV control (22) to 10 MHz.
5. Push in REFERENCE LEVEL dBm — OPTIMUM INPUT control (26) and set OPTIMUM INPUT to −30 (10 dB of input attenuation). Release and turn fully counterclockwise (REFERENCE LEVEL dBm setting of 0).
6. Pull out on FREQ SPAN/DIV control (22) to uncouple RESOLUTION BW control (20) from the FREQ SPAN/DIV control.
7. Set RESOLUTION BW control (20) to either 300 kHz position and set 10 dB/DIV — 1 dB/DIV — LIN switch (24) to LIN.
8. Set the SWEEP TIME/DIV control (19) to MAN (manual position).
9. Turn the MANUAL SWEEP control (18) to center dot on horizontal axis of CRT DISPLAY (2).
10. Turn the VERT POSN control (9) until dot is 3 divisions above bottom graticule line.

Figure 3-3. Operator's Check (2 of 4)

OPERATOR'S CHECK

11. Adjust the FOCUS 4 and ASTIGMATISM 5 controls until combined effect produces smallest round dot possible.
12. Set SWEEP TIME/DIV control 19 to AUTO position and set SWEEP TRIGGER control 15 to FREE RUN position.
13. Adjust TRACE ALIGN control 1 until trace is aligned with horizontal line of graticule.
14. Set the HORIZONTAL POSITION control 3 to center the trace on the display.
15. Check that the trace begins at the first graticule line and ends at the last graticule line. If the trace is too long or too short, remove the Spectrum Analyzer from the oscilloscope mainframe and adjust the HORIZ GAIN control 29 to increase or decrease gain as marked on rear panel.
16. Readjust the HORIZONTAL POSITION Control 3 so trace begins at first line of graticule and ends at last graticule line.
17. Readjust the VERT POSN control 9 until trace aligns with bottom line of graticule at the center of the display. Set 10 dB/DIV — 1 dB/DIV — LIN switch 24 to 10 dB/DIV and turn VIDEO FILTER control 13 to 2 o'clock position.
18. Connect the CAL OUTPUT 23 (250 MHz - 30 dBm) signal to RF input (INPUT 50Ω connector 17).
19. Set the FREQ SPAN/DIV control 22 to 100 MHz and RESOLUTION BW control 20 to 1 MHz.
20. Place the START — CENTER switch 27 in the CENTER position.
21. Turn the REFERENCE LEVEL dBm control 26 (without pushing in) until 0 appears in the REF LEVEL dBm window.
22. Turn the TUNING control 12 to center the LO feedthrough signal on the center vertical graticule line (larger knob is coarse control, smaller knob is fine control). The 250 MHz calibrator signal from CAL OUTPUT will be 2.5 divisions to the right of the LO feedthrough.
23. Set the FREQ SPAN/DIV control 22 to 1 MHz and adjust TUNING control 12 for a FREQUENCY MHz indication of 000.0.
24. Turn the FREQ ZERO control 11 until LO feedthrough is centered on display. Mechanical frequency readout and display are now calibrated with the LO feedthrough at center graticule line.
25. Move the START — CENTER switch 27 to the START position. The LO feedthrough will move to the vertical graticule reference line (left side of display) which is now zero frequency. Return the switch to CENTER position.

Figure 3-3. Operator's Check (3 of 4)

OPERATOR'S CHECK

26. Turn the TUNING control (12) to center the 250 MHz calibrator signal. FREQUENCY MHz indicator should read 250 MHz ±3 MHz.

27. Turn the REFERENCE LEVEL dBm control (26) (without pushing in) until −20 appears in the REF LEVEL dBm window.

28. Set the 10 dB/DIV — 1 dB/DIV — LIN switch (24) to LIN.

29. Rotate the REF LEVEL FINE control (25) clockwise until signal is at the top graticule line.

30. Set the 10 dB/DIV — 1 dB/DIV — LIN Switch (24) to 10 dB/DIV. Adjust VERT GAIN (10) until signal is at the top graticule line.

31. Repeat steps 28 through 30 until signal is at the top graticule line in both LIN and 10 dB/DIV.

32. Turn the REFERENCE LEVEL dBm control (26) (without pushing in) until −30 appears in the REF LEVEL dBm window. Set REF LEVEL FINE control (25) to zero.

33. Set 10 dBm/DIV — 1 dB/DIV — LIN switch (24) to LIN and adjust REF LEVEL CAL control (21) to place signal at the top graticule line.

34. Spectrum Analyzer is now calibrated for absolute amplitude and frequency measurements.

35. Set the 10 dB/DIV — 1 dB/DIV — LIN switch (24) to 10 dB/DIV.

36. Set the RESOLUTION BW control (20) to the 30 kHz position to align optimum markings and push in to couple with the FREQ SPAN/DIV control (22).

37. Turn FREQ SPAN/DIV (22) and RESOLUTION BW (20) controls together and observe change in sweep time. Signal should not go out of calibration. Return control to the 100 MHz FREQ SPAN/DIV position.

38. Turn the VIDEO FILTER control (13) clockwise and observe the change in sweep time and video filtering. Turn the control fully clockwise (MAX detent) and observe maximum noise averaging. Signals will reduce to the baseline. Return the control to the fully counterclockwise position.

39. Turn SWEEP TIME/DIV control (19) through sweep times and observe changes in sweep time. Turn control to the AUTO position.

NOTE

The display will not be calibrated for sweep times greater than 2 mSEC/DIV.

Figure 3-3. Operator's Check (4 of 4)

GENERAL OPERATING PROCEDURE

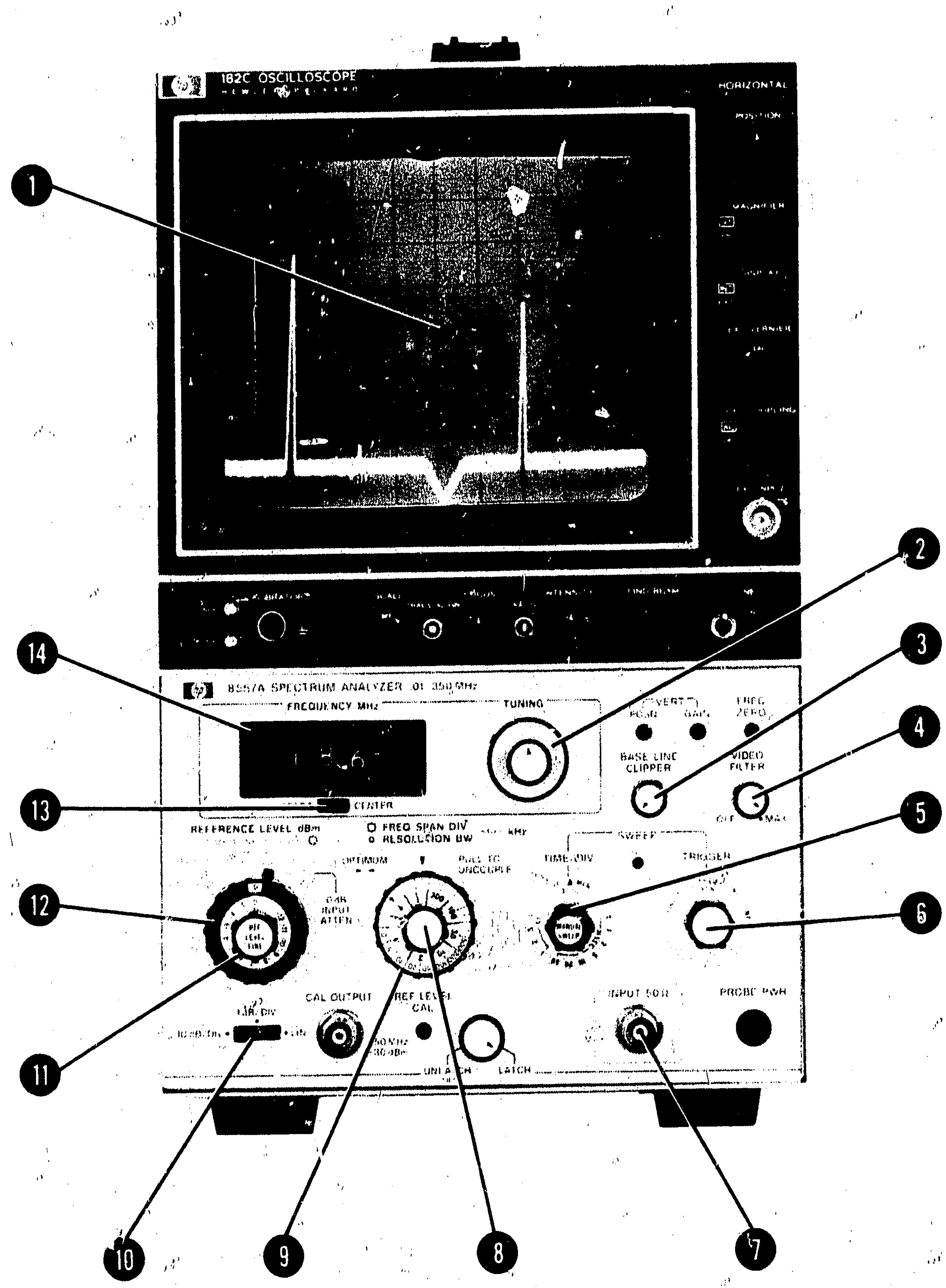


Figure 3-4. General Operating Procedure (1 of 3)

GENERAL OPERATING PROCEDURE

1. After 8557A Spectrum Analyzer has been calibrated to the oscilloscope mainframe, the 8557A becomes a three control instrument for most measurements.

2. The three controls, two for frequency and one for amplitude, control the frequency and amplitude displayed on the CRT. The TUNING control (2) and the FREQ SPAN/DIV control (9) coupled with the RESOLUTION BW control (8) determine the frequency displayed. The REFERENCE LEVEL dBm — OPTIMUM INPUT control determines the amplitude displayed.

3. Controls should be preset as follows:

BASELINE CLIPPER (3)	Fully counterclockwise
VIDEO FILTER (4)	OFF
SWEEP TIME/DIV (5)	AUTO
SWEEP TRIGGER (6)	FREE RUN
10 dB/DIV — 1 dB/DIV — LIN (10)	10 dB/DIV
REF LEVEL FINE (11)	Fully counterclockwise
START — CENTER (13)	CENTER
OPTIMUM INPUT (12)	0

NOTE

With the SWEEP TIME/DIV control (5) in AUTO, the sweep time changes as FREQ SPAN/DIV (9), RESOLUTION BW (8), and VIDEO FILTER (4) are changed. When the SWEEP TIME/DIV control is removed from the AUTO position, care must be taken to not have sweep time too fast for Spectrum Analyzer response, resulting in a loss of calibration.

4. Connect any unknown signal within the frequency range of .01 MHz to 350 MHz.

CAUTION

To avoid damage to the input attenuator and first mixer, RF signal level to the INPUT 50Ω connector (7) should not exceed +20 dBm, 2.2 Vrms, or ±30 Vdc.

5. Push in the REFERENCE LEVEL dBm — OPTIMUM INPUT control (12) and turn pointer to optimum input level for RF Input. If the level of RF Input is unknown, start with maximum input level setting (optimum input setting of +10 dBm) so the mixer will not be damaged. Release and turn the control so the signal amplitude is adequate for viewing.

6. Set the FREQ SPAN/DIV control (9) to 100 MHz. The RESOLUTION BW control (8) should be in optimum position 1 MHz. If not, uncouple and set to 1 MHz. Push in to couple.

Figure 3-4. General Operating Procedure (2 of 3)

GENERAL OPERATING PROCEDURE

7. Tune with the TUNING control ❷ (coarse and fine) to center signal of interest on CRT display. Read frequency on the FREQUENCY MHz indicator ⓮.

8. Use the REFERENCE LEVEL dBm — OPTIMUM INPUT control ⓬ to establish calibrated power level of top graticule reference line and amplitude of signal necessary to be viewed. Read power level of signal directly by adding power figure (dBm) displayed in window of REF LEVEL dBm to the difference between signal peak and top graticule reference line. (Example: When −30 is displayed in REF LEVEL dBm window and signal peak is at graticule line four divisions from the top graticule line (reference of display), then

$$\text{signal power level} = -30\text{ dBm} + (-40\text{ dB}) = -70\text{ dBm}$$

9. Set the FREQ SPAN/DIV control ❾ coupled with the RESOLUTION BW control ❽ to provide necessary spectrum detail.

10. Adjust the TUNING control ❷ (coarse and fine) as necessary to keep signal of interest centered on CRT.

11. The FREQ SPAN/DIV control ❾ and the RESOLUTION BW control ❽ may be uncoupled at any time to provide added spectrum detail.

Figure 3-4. General Operating Procedure (3 of 3)

PERFORMANCE CHECK

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the instrument's electrical performance using the specifications of Table 1-1 as the performance standards. Most of the tests can be performed without access to the interior of the instrument. A simpler operational test is included in Section III under Operator's Check.

4-3. EQUIPMENT REQUIRED

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

4-5. TEST RECORD

4-6. Results of the performance tests may be tabulated on the Test Record at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. Test results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

4-7. INSTRUMENTS TESTED

4-8. Since a 180-series Oscilloscope mainframe is required for operation of the Model 8557A 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 Model 8557A and the particular 180-series Oscilloscope mainframe used.

4-9. ABBREVIATED PERFORMANCE TEST

4-10. To assure that the Spectrum Analyzer is performing properly without testing all of the specifications listed in Table 1-1, the following procedure is suggested as an abbreviated performance test:

a. Perform Operator's Check in Section III, Figure 3-3.

b. Perform only the following Performance Tests:
   1. Paragraph 4-11, Frequency Display Span Accuracy Test.
   2. Paragraph 4-17, Average Noise Level Test.
   3. Paragraph 4-21, Amplitude Accuracy Switching Between Bandwidth Test.
   4. Paragraph 4-22, Input Attenuator Accuracy Test.
   5. Paragraph 4-25, Calibrator Accuracy Test.

PERFORMANCE TESTS

NOTE

Perform Operator's Check in Section III before proceding with Performance Tests. Allow at least 30 minutes warm-up time.

PERFORMANCE TESTS

4-11. FREQUENCY DISPLAY SPAN ACCURACY TEST

SPECIFICATIONS:

Twelve calibrated spans from 20 MHz/div to 5 kHz/div in a 1, 2, 5 sequence. In "F" or full span the analyzer displays the full 10 kHz to 350 MHz spectrum. In "0" the analyzer is a fixed-tuned receiver. Frequency error between any two points on the display is less than ±10% of the indicated frequency separation.

DESCRIPTION:

Wide span widths are checked by using the 100 MHz, 10 MHz and 1 MHz outputs from a comb generator. Narrow span widths are checked by using the output from a comb generator modulated by an audio oscillator. Since the comb generator produces frequency components separated by a precisely determined frequency interval, the resultant spectral lines displayed on the CRT are evenly spaced when no span error exists in the instrument. Thus, span error is the cumulative variance of distance among the spectral line intervals displayed across the CRT. The amount of span error is determined by comparing the distance of the first eight graticule divisions to the display distance of the corresponding spectral line intervals.

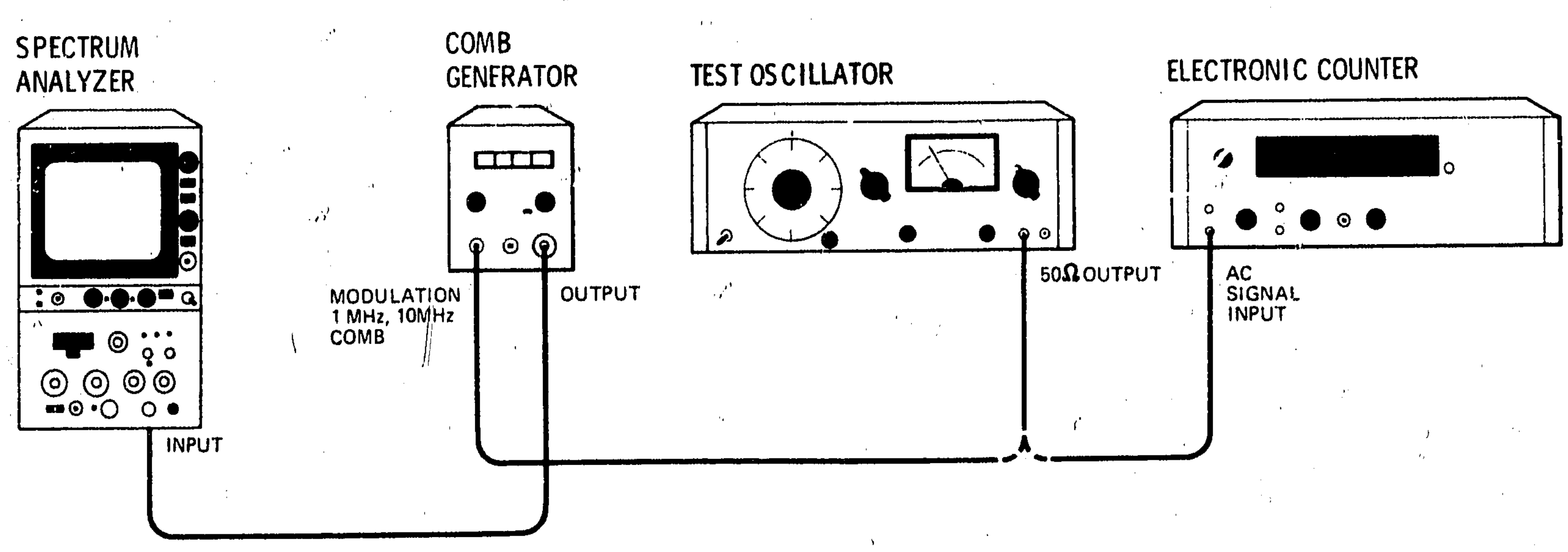


Figure 4-1. Frequency Display Span Accuracy Test Setup

EQUIPMENT:

Comb Generator .... HP 8406A
Electronic Counter .... HP 5245L
Audio Oscillator .... HP 652A

PERFORMANCE TESTS

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

PROCEDURE:

1. Set spectrum analyzer and comb generator controls as follows:

Spectrum Analyzer:

START — CENTER	CENTER
TUNING	175 MHz
FREQ SPAN/DIV	F
RESOLUTION BW	OPTIMUM
OPTIMUM INPUT	−40
REFERENCE LEVEL dBm	−20
10 dB/DIV — 1 dB/DIV — LIN	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	OFF

Comb Generator:

COMB FREQUENCY—MC	100 MC
INTERPOLATION AMPLITUDE—1 MC	OFF
OUTPUT AMPLITUDE	Fully clockwise

2. Connect equipment as shown in Figure 4-1.

3. The display should appear as shown in Figure 4-2, indicating correct full span operation. Note presence of tuning marker at center screen.

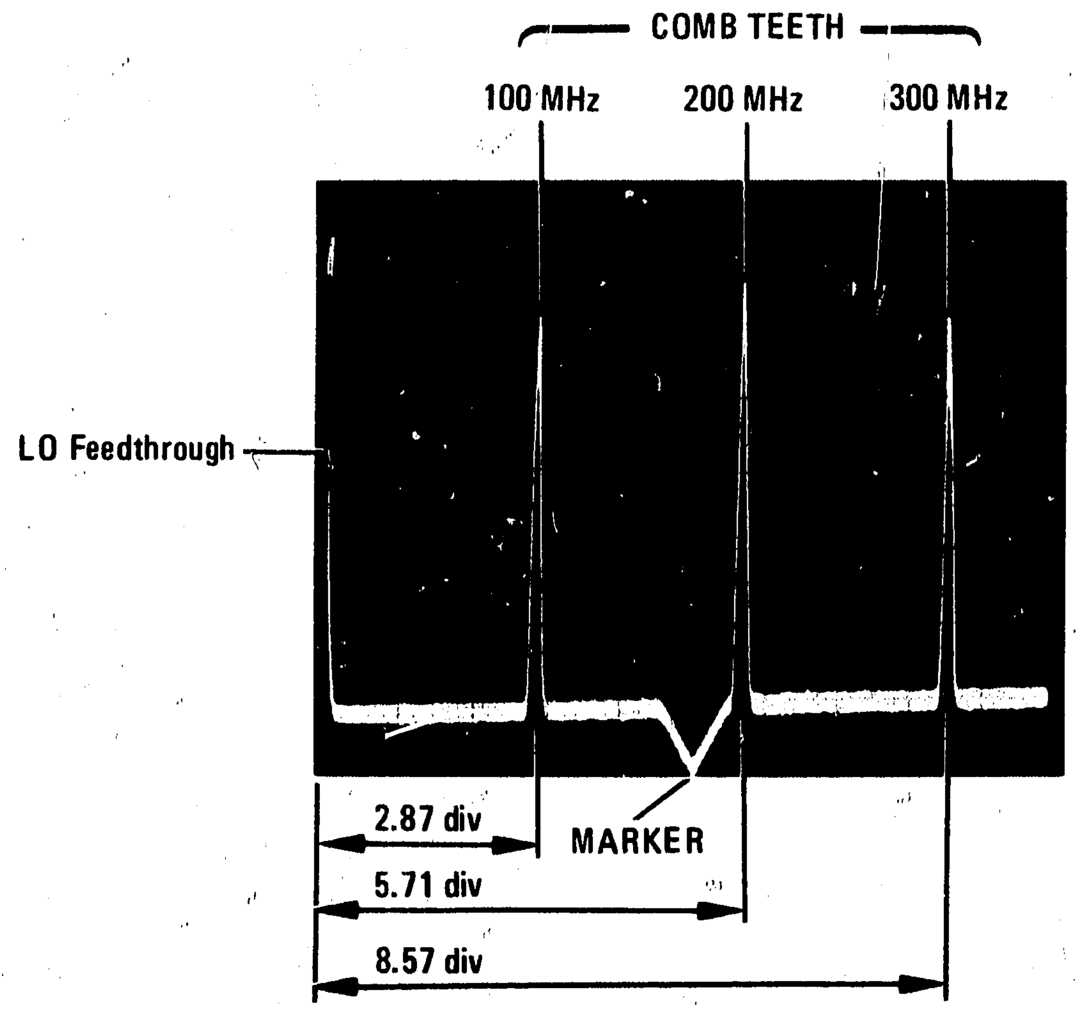


Figure 4-2. Full Span Display

PERFORMANCE TESTS

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

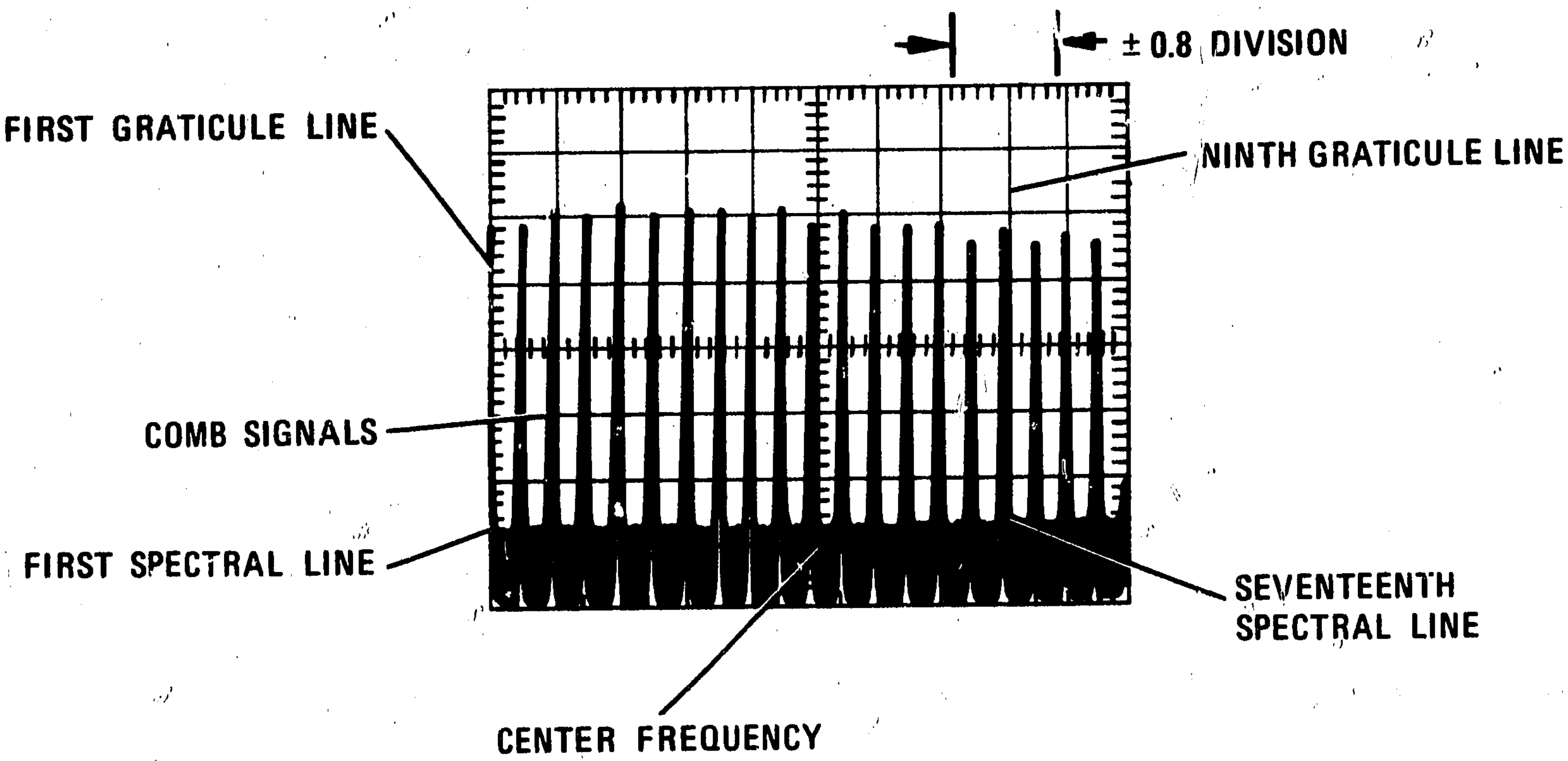


Figure 4-3. Frequency Display Span Accuracy Measurement

4. Set spectrum analyzer FREQ SPAN/DIV to 20 MHz, RESOLUTION BW to OPTIMUM, and comb generator to 10 MHz comb frequency. Adjust spectrum analyzer TUNING control to position one spectral line (from comb generator) at the first graticule line (far left) of display. Measure error between seventeenth spectral line and ninth graticule line. Error should be 0.8 division, maximum. (See Figure 4-3).

5. Set FREQ SPAN/DIV to 10 MHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line (from comb generator) at the first graticule line (far left) of display. Measure error between ninth spectral line and ninth graticule line. Error should be ±0.8 division, maximum.

6. Set FREQ SPAN/DIV to 5 MHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line at first graticule line. Measure error between fifth spectral line and ninth graticule line. Error should be ±0.8 division,maximum.

7. Set comb generator comb frequency for 1 MHz comb. Set spectrum analyzer FREQ SPAN/DIV to 2 MHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line at first graticule line. Measure error between seventeenth spectral line and ninth graticule line. Error should be ±0.8 division, maximum.

8. Set FREQ SPAN/DIV to 1 MHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line at first graticule line. Measure error between ninth spectral line and ninth graticule line. Error should be ±0.8 division, maximum.

9. Set FREQ SPAN/DIV to 500 kHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line at first graticule line. Measure error between fifth spectral line and ninth graticule line. Error should be ±0.8 division, maximum.

10. Set comb generator comb frequency for 10 MHz comb and turn interpolation control on. Connect audio oscillator output, set at 200 kHz, to modulate the comb generator. Set audio oscillator AMPLITUDE control for a clean 200 kHz comb on the 8557A display (approximately mid-position).

PERFORMANCE TESTS

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

NOTE

It may be necessary to readjust audio oscillator AMPLITUDE control and comb generator INTERPOLATION AMPLITUDE control to obtain desired presentation of comb.

Set spectrum analyzer FREQ SPAN/DIV to 200 kHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line at first graticule line. Measure error between ninth spectral line and ninth graticule line. Error should be ±0.8 division, maximum.

11. Using procedure of step 11, vary spectrum analyzer FREQ SPAN/DIV and audio oscillator output frequency in accordance with Table 4-1. Adjust spectrum analyzer TUNING control to position one spectral line at first graticule line. Measure the span error between the ninth spectral line and the ninth graticule line.

Table 4-1. Narrow Span Width Error Measurement

Spectrum Analyzer		Audio Oscillator Output Frequency[1]	Allowable Error (Max.)
FREQ SPAN/DIV	RESOLUTION BW		
100 kHz	OPTIMUM	100 kHz	±0.8 Division
50 kHz	OPTIMUM	50 kHz	±0.8 Division
20 kHz	OPTIMUM	20 kHz	±0.8 Division
10 kHz	OPTIMUM	10 kHz	±0.8 Division
5 kHz	OPTIMUM	5 kHz	±0.8 Division

[1] Check Audio Oscillator output frequency using an electronic counter. Frequency readout should be within ±0.5% of desired audio frequency.

4-12. DIGITAL FREQUENCY READOUT ACCURACY TEST

SPECIFICATION:

±3 MHz plus 10% of FREQ SPAN/ON setting

DESCRIPTION:

A comb generator is used to provide 1, 10, or 100 MHz frequency components that produce spectral lines on the CRT at 1, 10, or 100 MHz intervals, respectively. The spectrum analyzer TUNING control is adjusted until the desired test frequency is shown on the digital frequency readout. The readout error is determined by measuring the distance of the spectral line offset from the center graticule line.

PERFORMANCE TESTS

4-12. DIGITAL FREQUENCY READOUT ACCURACY TEST (Cont'd)

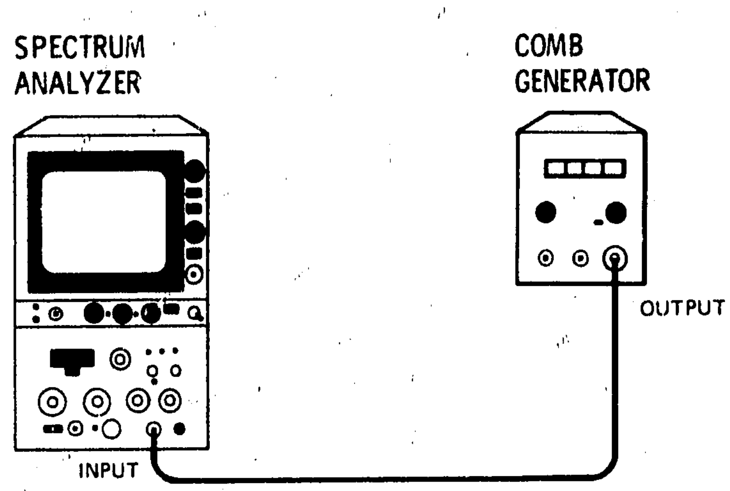


Figure 4-4. Digital Frequency Readout Accuracy Test Setup

EQUIPMENT:

Comb Generator .... HP 8406A

PROCEDURE:

1. Set spectrum analyzer controls as follows:

   START — CENTER .... CENTER
   FREQ SPAN/DIV .... 1 MHz
   RESOLUTION BW .... OPTIMUM
   OPTIMUM INPUT .... −40
   REFERENCE LEVEL dBm .... −20
   10 dB/DIV — 1 dB/DIV — LIN .... 10 dB/DIV
   SWEEP TIME/DIV .... AUTO
   SWEEP TRIGGER .... FREE RUN
   BASELINE CLIPPER .... Fully counterclockwise
   VIDEO FILTER .... OFF
   TUNING .... 0 MHz

2. Adjust FREQ ZERO potentiometer to position LO feed-through signal at center graticule line.

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

4. Set comb generator control as follows:

   COMB FREQUENCY — MC .... 10 MHz
   INTERPOLATION AMPLITUDE — 1 MC .... OFF
   OUTPUT AMPLITUDE .... Fully clockwise

5. Adjust spectrum analyzer TUNING control until digital frequency readout indicates 10.0 MHz. Comb generator spectral line, displayed on CRT readout, should be within 3.1 divisions (−3.10 MHz) to the left and 3.1 divisions to the right (+3.10 MHz) of the center graticule line.

6. Using procedure of step 5, adjust spectrum analyzer and comb generator controls in accordance with Table 4-2 to measure readout error.

4-12. DIGITAL FREQUENCY READOUT ACCURACY TEST (Cont'd)

Table 4-2. Digital Frequency Readout Error Measurement

SPECTRUM ANALYZER		COMB GENERATOR	SPECIFICATION (Spectral line limits referenced to center graticule line) (Divisions)	
FREQUENCY (MHz) Setting	FREQ SPAN/DIV Setting	COMB FREQUENCY-MC Setting (MHz)	MIN.	MAX.
20.0	1 MHz	10	−3.1	+3.1
40.0	1 MHz	10	−3.1	+3.1
60.0	1 MHz	10	−3.1	+3.1
80.0	1 MHz	10	−3.1	+3.1
100.0	1 MHz	10	−3.1	+3.1
120.0	1 MHz	10	−3.1	+3.1
140.0	1 MHz	10	−3.1	+3.1
160.0	1 MHz	10	−3.1	+3.1
180.0	1 MHz	10	−3.1	+3.1
200.0	1 MHz	10	−3.1	+3.1
220.0	1 MHz	10	−3.1	+3.1
240.0	1 MHz	10	−3.1	+3.1
260.0	1 MHz	10	−3.1	+3.1
280.0	1 MHz	10	−3.1	+3.1
300.0	1 MHz	10	−3.1	+3.1
320.0	1 MHz	10	−3.1	+3.1
340.0	1 MHz	10	−3.1	+3.1
350.0	1 MHz	10	−3.1	+3.1

4-13. RESIDUAL FM TEST

SPECIFICATION:

Less than 1 kHz peak-to-peak for time ≤0.1 sec (VIDEO FILTER control fully clockwise but not in MAX detent)

DESCRIPTION:

A comb generator is used to supply a 300 MHz signal to the spectrum analyzer. The spectrum analyzer is used as a fixed-tuned receiver by setting the FREQ SPAN/DIV to zero. The RESOLUTION BW is set to 10 kHz and the resultant frequency change (residual FM) near the 300 MHz signal is measured on the CRT display.

4-13. RESIDUAL FM TEST (Cont'd)

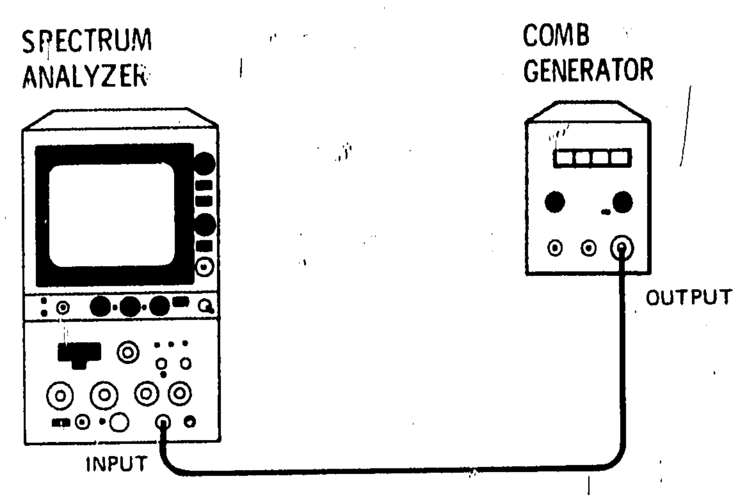


Figure 4-5. Residual FM Test Setup

EQUIPMENT:

Comb Generator	HP 8406A

PROCEDURE:

1. Set spectrum analyzer and comb generator controls as follows:

Spectrum Analyzer:

START — CENTER	CENTER
FREQ SPAN/DIV	200 kHz
RESOLUTION BW	10 kHz
OPTIMUM INPUT	−40
REFERENCE LEVEL dBm	−20
10 dB/DIV — 1 dB/DIV — LIN	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	OFF

Comb Generator:

COMB FREQUENCY — MC	100 MC
INTERPOLATION AMPLITUDE — 1 MC	OFF
OUTPUT AMPLITUDE	Full clockwise

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

4-13. RESIDUAL FM TEST (Cont'd)

NOTE

This test uses the slope of the 10 kHz bandwidth filter to demodulate the residual FM into AM. This can be easily seen at 5 kHz FREQ SPAN/DIV, 10 kHz BW, in LIN mode. Thus, a 1 kHz shift in frequency produces a 1 division shift in amplitude. (See Figure 4-6).

3. Adjust spectrum analyzer TUNING control to locate on CRT display the 300 MHz signal produced by comb generator output. Adjust REFERENCE LEVEL and REF LEVEL FINE controls to bring the signal to the top graticule line.

4. While keeping 300 MHz signal centered on CRT display, reduce FREQ SPAN/DIV to sero.

5. Set RESOLUTION BW to 10 kHz, SWEEP TIME/DIV to .1 sec., and VIDEO FILTER fully clockwise but not in the MAX detent.

6. Slightly readjust spectrum analyzer fine TUNING control until trace appears in upper half of graticule on CRT. Peak-to-peak variation of trace should not exceed one division vertical for each horizontal division. (See Figure 4-7)

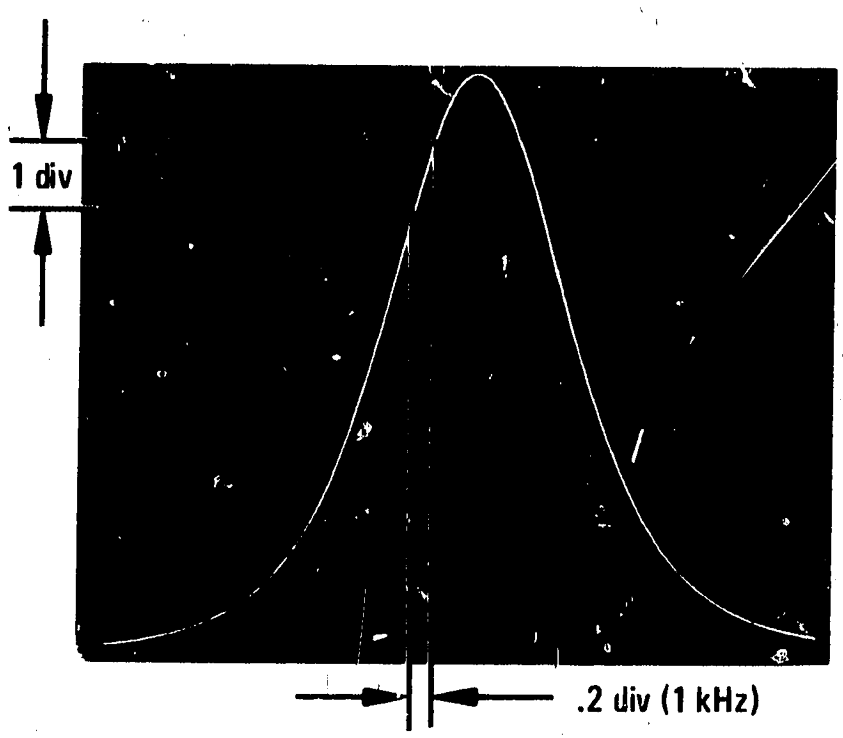


Figure 4-6. Residual FM to AM Conversion Display

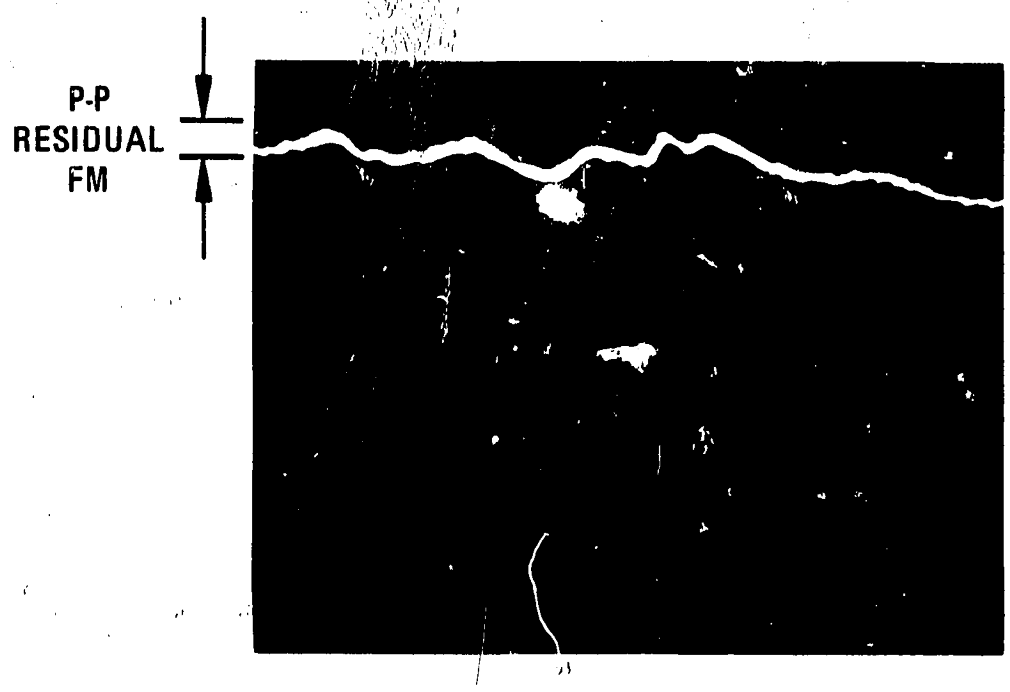


Figure 4-7. Residual FM Display

4-14. NOISE SIDEBANDS TEST

SPECIFICATION:

More than 75 dB below CW signal, 50 kHz or more away from signal with a 1 kHz resolution bandwidth and full video filter.

DESCRIPTION:

A stable 300 MHz signal is applied to the spectrum analyzer and displayed on the CRT. The amplitudes of noise-associated sidebands and unwanted responses near the signal are measured.

Model 8557A

Performance Tests

PERFORMANCE TESTS

4-14. NOISE SIDEBANDS TEST (Cont'd)

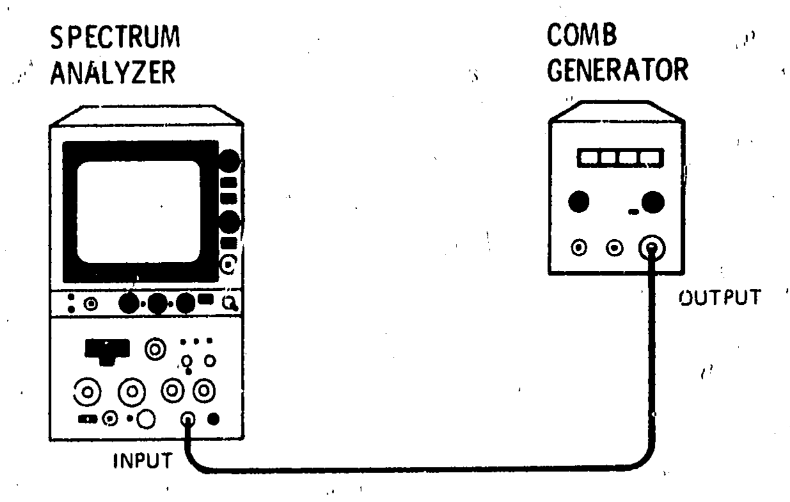


Figure 4-8. Noise Sidebands Test Setup

EQUIPMENT:

Comb Generator 8406A

PROCEDURE:

1. Set controls as follows:

Spectrum Analyzer:

START — CENTER .... CENTER
TUNING .... 300 MHz
FREQ SPAN/DIV .... 1 MHz
RESOLUTION BW .... 30 kHz
OPTIMUM INPUT .... −40
REFERENCE LEVEL dBm .... −20
10 dB/DIV — 1 dB/DIV — LIN .... 10 dB/DIV
SWEEP TIME/DIV .... AUTO
SWEEP TRIGGER .... FREE RUN
BASELINE CLIPPER .... Fully counterclockwise
VIDEO FILTER .... OFF

Comb Generator:

COMB FREQUENCY — MC .... 100 MC
INTERPOLATION AMPLITUDE — 1 MC .... OFF
OUTPUT AMPLITUDE .... Fully clockwise

2. Connect equipment as shown in Figure 4-8.

PERFORMANCE TESTS

4-14. NOISE SIDEBANDS TEST (Cont'd)

3. Adjust TUNING control as required to locate 300 MHz comb tooth on CRT.
4. Adjust REFERENCE LEVEL and REF LEVEL FINE controls as required to position top of 300 MHz signal on top graticule line; then increase REFERENCE LEVEL control by 10 dB (signal then 10 dBm off screen).
5. Decrease FREQ SPAN/DIV and RESOLUTION BW controls until FREQ SPAN/DIV is 20 kHz and RESOLUTION BW is 1 kHz.
6. Position signal at center of display. Set VIDEO FILTER control as required between center and fully clockwise position (not in MAX detent). Measure noise sidebands existing more than 2.5 divisions (50 kHz) from 300 MHz signal. Noise sidebands should be greater than 65 dB down from top graticule line (6.5 divisions), or 75 dB down from 300 MHz signal.

4-15. RESOLUTION BANDWIDTH ACCURACY TEST

SPECIFICATION:

Individual resolution bandwidth 3 dB points calibrated to ±20% (10°C −40°C).

DESCRIPTION:

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

$$\left[\frac{1}{1.41} \text{(voltage ratio)} = \frac{\text{X DIV}}{\text{7.1 DIV}} \therefore X = \frac{\text{7.1 DIV}}{1.41} = \text{5.0 DIV} \right]$$

This test is in two segments, 3 MHz to 100 kHz bandwidths, and 30 kHz to 1 kHz bandwidths.

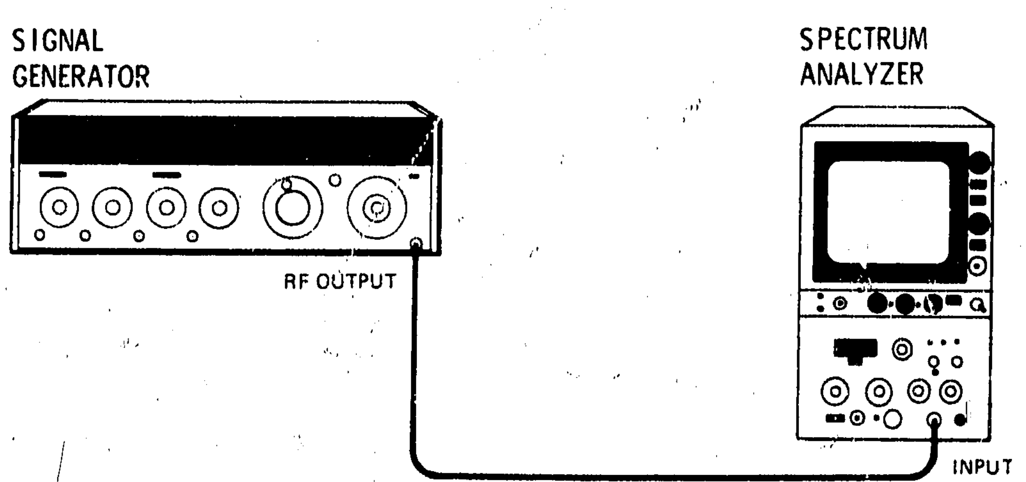


Figure 4-9. Resolution Bandwidth Accuracy Test Setup 100 kHz to 3 MHz

Model 8557A
Performance Tests

PERFORMANCE TESTS

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

EQUIPMENT:

Signal Generator (with counter)	HP 8640B
Extender Cable Assembly	HP 5060-0303
Adapter, Type N Female on both ends	HP 1250-0777
Adapter, Type N Male to subminiature RF Male	HP 1250-1023
Adapter, Type N Male to BNC Female (2 required)	HP 1250-0780

PROCEDURE:

1. Set controls as follows:

Spectrum Analyzer:

START — CENTER	CENTER
TUNING	10 MHz
FREQ SPAN/DIV	0
RESOLUTION BW	3 MHz
OPTIMUM INPUT	−20
REFERENCE LEVEL dBm	0
10 dB/DIV — dB/DIV — LIN	LIN
SWEEP TIME/DIV	5 mSEC
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	OFF

Signal Generator:

COUNTER MODE	INT
AM	OFF
FM	OFF
FREQUENCY TUNE	10 MHz
OUTPUT LEVEL	0 dBm

2. Connect equipment as shown in Figure 4-9.

3. Adjust spectrum analyzer TUNING control to locate peak of 10 MHz signal on CRT. Reduce signal generator output if necessary.

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

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

   ______ MHz

6. Tune signal generator frequency in opposite direction of Step 5 until trace peaks (7.1 divisions above graticule baseline) and then drops to 5 divisions above graticule baseline. Record frequency displayed on the 8640B.

   ______ MHz

Performance Tests Model 8557A

PERFORMANCE TESTS

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

7. The difference between results of Steps 5 and 6 is the measured resolution bandwidth at 3 dB points.

Min.	Actual	Max.
2.40 MHz	______	3.60 MHz

8. Set RESOLUTION BW control to 1 MHz, leaving FREQ SPAN/DIV control set to 0. Set signal generator to 10 MHz and repeat Steps 3 through 7.

Min.	Actual	Max.
800 kHz	______	1.20 MHz

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

Min.	Actual	Max
240 kHz	______	360 kHz

10. Set RESOLUTION BW control to 100 kHz, leaving FREQ SPAN/DIV control set to 0. Set signal generator to 10 MHz and repeat Steps 3 through 7.

Min.	Actual	Max.
80 kHz	______	120 kHz

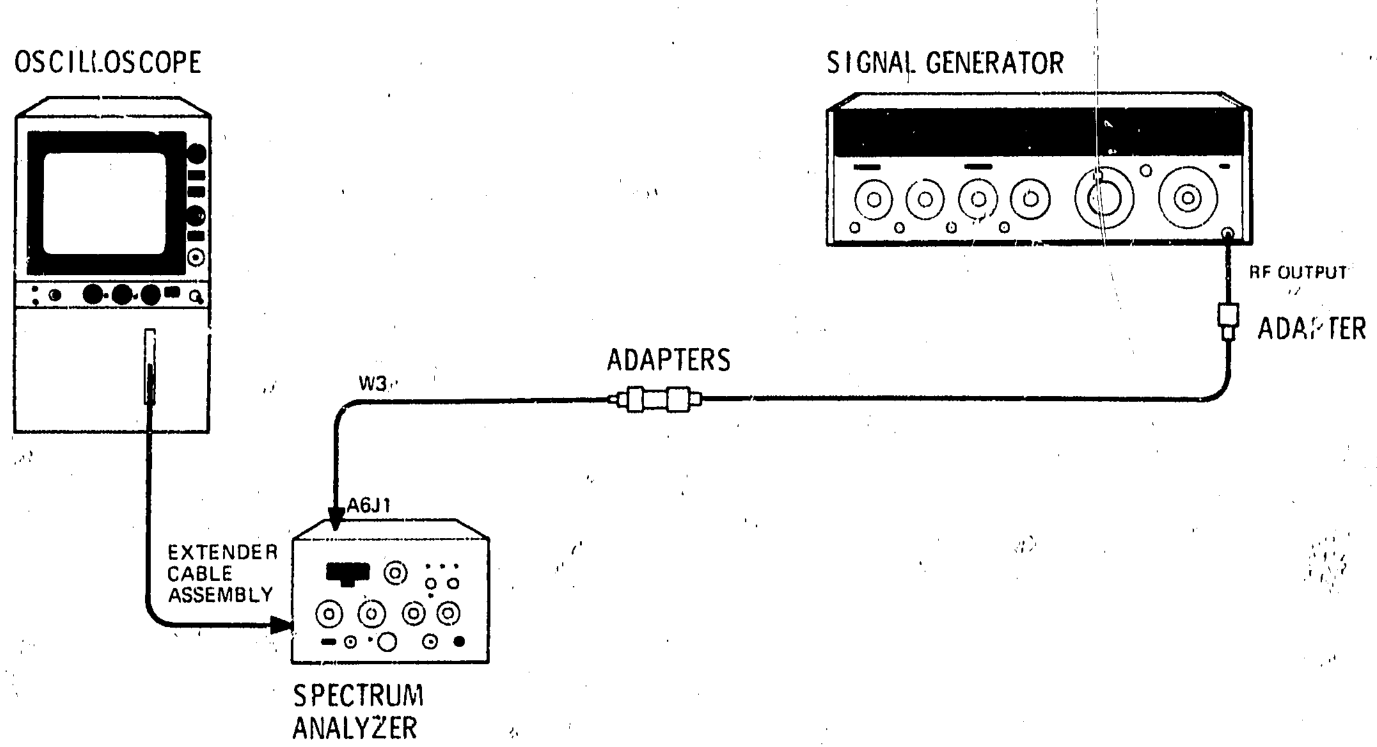


Figure 4-10. Resolution Bandwidth Accuracy Test Setup 1 kHz to 30 kHz

PERFORMANCE TESTS

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

WARNING

The following performance test requires the 8557A to be removed from the oscilloscope mainframe and connected through the extender cable assembly. Be very careful; the energy at some points in the instrument may, if contacted, cause personal injury. This test should be performed only by a skilled person who knows the hazard involved.

11. Set signal generator output level to approximately −32 dBm. Set frequency for a readout of 21.4 MHz.

12. Set RESOLUTION BW control to 30 kHz. FREQ SPAN/DIV should remain at 0.

13. Connect equipment as shown in Figure 4-10. Remove W3P1 from A5J2. Connect signal generator through adapter to W3P1 (21.4 MHz Preamp input).

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.

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

    ______MHz

16. Tune signal generator frequency in opposite direction of Step 15 until trace peaks and then drops to 5 divisions above graticule baseline. Record frequency displayed on the 8640B.

    ______MHz

17. The difference between results of Steps 15 and 16 is the measured resolution bandwidth at 3 dB points.

Min.	Actual	Max.
24 kHz	______	36 kHz

18. Set RESOLUTION BW control to 10 kHz, leaving FREQ SPAN/DIV controls to 0. Repeat Steps 14 through 17.

Min.	Actual	Max.
8 kHz	______	12 kHz

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

Min.	Actual	Max.
2.4 kHz	______	3.6 kHz

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

Min.	Actual	Max.
0.8 kHz	______	1.2 kHz

4-16. RESOLUTION BANDWIDTH SELECTIVITY TEST

SPECIFICATION:

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

PERFORMANCE TESTS

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

DESCRIPTION:

The 60 dB bandwidth is measured for all RESOLUTION BW control settings. The 60 dB to 3 dB resolution bandwidth ratio is then computed by dividing the 3 dB bandwidth values from the RESOLUTION BANDWIDTH ACCURACY TEST into the 60 dB Bandwidth values of this test for each RESOLUTION BW control setting. This test is in two segments, 1 kHz to 30 kHz, and 100 kHz to 3 MHz.

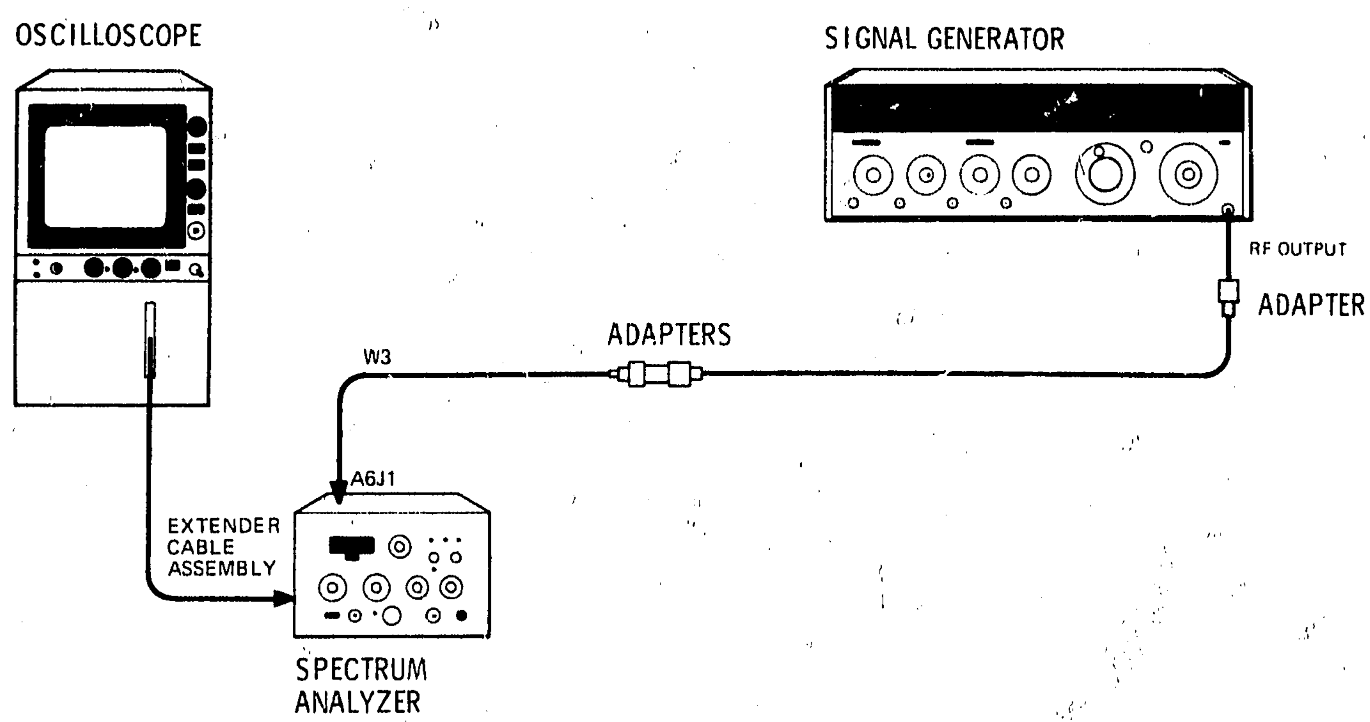


Figure 4-11. Resolution Bandwidth Selectivity Test Setup, 1 kHz to 30 kHz

WARNING

The following performance test requires the 8557A to be removed from the oscilloscope mainframe and connected through the extender cable assembly. Be very careful; the energy at some points in the instrument may, if contacted, cause personal injury. This test should be performed only by a skilled person who knows the hazard involved.

EQUIPMENT:

Signal Generator (with counter) .... HP 8640B
Extender Cable Assembly .... HP 5060-0303

PERFORMANCE TESTS

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

PROCEDURE:

1. Set controls as follows:

Spectrum Analzyer:

START — CENTER	CENTER
TUNING	50 MHz
FREQ SPAN/DIV	0
RESOLUTION BW	1 kHz
OPTIMUM INPUT	−40
REFERENCE LEVEL dBm	−10
10 dB/DIV — 1 dB/DIV — LIN	10 dB/DIV
SWEEP TIME/DIV	5 mSEC
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	Midrange

Signal Generator:

COUNTER MODE	INT
AM	OFF
FM	OFF
FREQUENCY TUNE	21.4 MHz
OUTPUT LEVEL	−22 dBm

2. Connect equipment as shown in Figure 4-11.
3. Adjust signal generator frequency until spectrum analyzer trace is at peak. Set signal generator output level to position trace at top graticule line.
4. Tune signal generator frequency until trace drops to two divisions above graticule baseline. Record the frequency displayed on the 8640B.

   ______MHz
5. Tune signal generator frequency in opposite direction of step 4 until trace peaks and then drops to 2 divisions above graticule baseline. Record the frequency displayed on the 8640B.

   ______MHz
6. The difference between results of steps 4 and 5 is the measured bandwidth at 60 dB points.

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

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

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

   ______kHz

PERFORMANCE TESTS

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

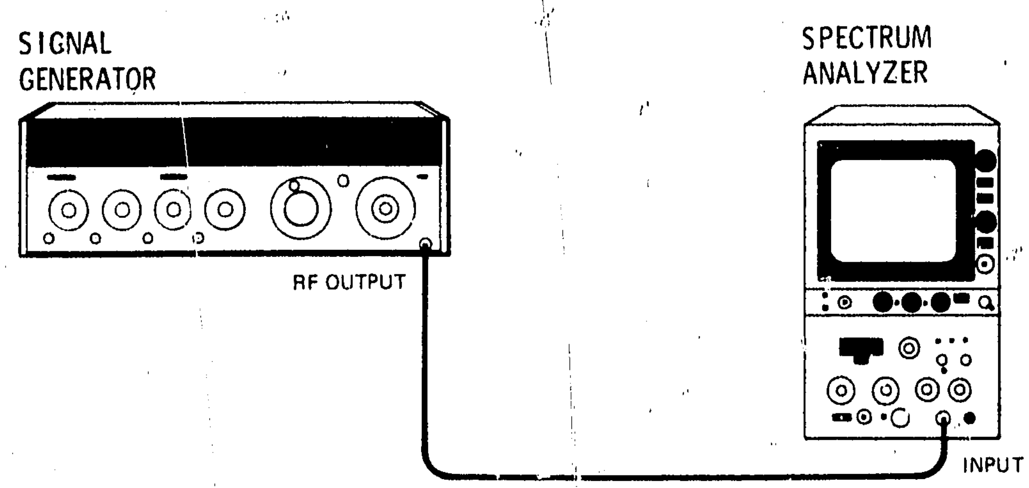


Figure 4-12. Resolution Bandwidth Selectivity Test Setup, 100 kHz to 3 MHz

10. Reconnect W3P1 to A5J2. Set oscilloscope line power to OFF and remove extender cable assembly. Plug 8557A into mainframe and set line power to ON. Set Signal Generator output level to 0 dBm. Set FREQUENCY TUNE control for readout of 50 MHz.

11. Set the spectrum analyzer OPTIMUM INPUT control to −40 and REFERENCE LEVEL dBm control to −10 dBm. Set RESOLUTION BW control to 100 kHz. FREQ SPAN/DIV should remain at 0.

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

13. Adjust spectrum analyzer TUNING control to locate peak of 50 MHz signal on CRT.

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 frequency displayed on the 8640B.
_____MHz

16. Tune signal generator frequency in opposite direction of step 15 until trace peaks and then drops to 2 divisions above graticule baseline. Record frequency displayed on the 8640B.
_____MHz

17. The difference between steps 15 and 16 is the measured bandwidth at 60 dB point
_____kHz

18. Set RESOLUTION BW control to 300 kHz leaving FREQ SPAN/DIV control set to 0. Repeat steps 13 through 17.
_____kHz

19. Set RESOLUTION BW control to 1 MHz leaving FREQ SPAN/DIV control set to 0. Repeat steps 13 through 17.
_____MHz

PERFORMANCE TESTS

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

20. Set RESOLUTION BW control to 3 MHz leaving FREQ SPAN/DIV control set to 0. Repeat steps 13 through 17.

_____MHz

21. Record the measured 3 dB bandwidths from Paragraph 4-15, steps 7 through 10 and steps 18 through 21 in Table 4-3.

22. Record the measured 60 dB bandwidths from Paragraph 4-16, steps 6 through 9 and steps 17 through 20 in Table 4-3.

Table 4-3. Resolution Bandwidth Selectivitiy

RESOLUTION BW Setting	MEASURED 3 dB BW	MEASURED 60 dB BW	Resolution Bandwidth Ratio (60 dB BW) (3 dB BW)
3 MHz	_____	_____	_____
1 MHz	_____	_____	_____
300 kHz	_____	_____	_____
100 kHz	_____	_____	_____
30 kHz	_____	_____	_____
10 kHz	_____	_____	_____
3 kHz	_____	_____	_____
1 kHz	_____	_____	_____

23. Compute Resolution Bandwidth Ratio for each RESOLUTION BW setting, dividing the measured 60 dB bandwidth by the measured 3 dB bandwidth for each setting. All ratios should be less than 15:1.

4-17. AVERAGE NOISE LEVEL TEST

SPECIFICATION:

Less than −107 dBm with a 10 kHz resolution bandwidth (0 dB input attenuation), 1 — 350 MHz.

DESCRIPTION:

Spectrum analyzer average noise level is checked by observing the average noise power level displayed on the CRT when no input signal is applied to the instrument. The test is performed using a 10 kHz resolution bandwidth setting.

PERFORMANCE TESTS

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

PROCEDURE:

1. Set Spectrum Analyzer controls as follows:

START — CENTER	CENTER
FREQ SPAN/DIV	200 kHz
RESOLUTION BW	10 kHz
OPTIMUM INPUT	−40
REFERENCE LEVEL dBm	−60
10 dB/DIV — 1 dB/DIV — LIN	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	Midrange

2. Tune down in frequency to the LO feedthrough; center the LO feedthrough on the lefthand graticule line (thus the center frequency is now 1MHz). Without retuning, set FREQ SPAN/DIV to 10 KHz, VIDEO FILTER to MAX (in detent). Observe the average noise level displayed on the CRT. The noise level should be less than −107 dBm. (See Figure 4-13.)

_______<−107 dBm

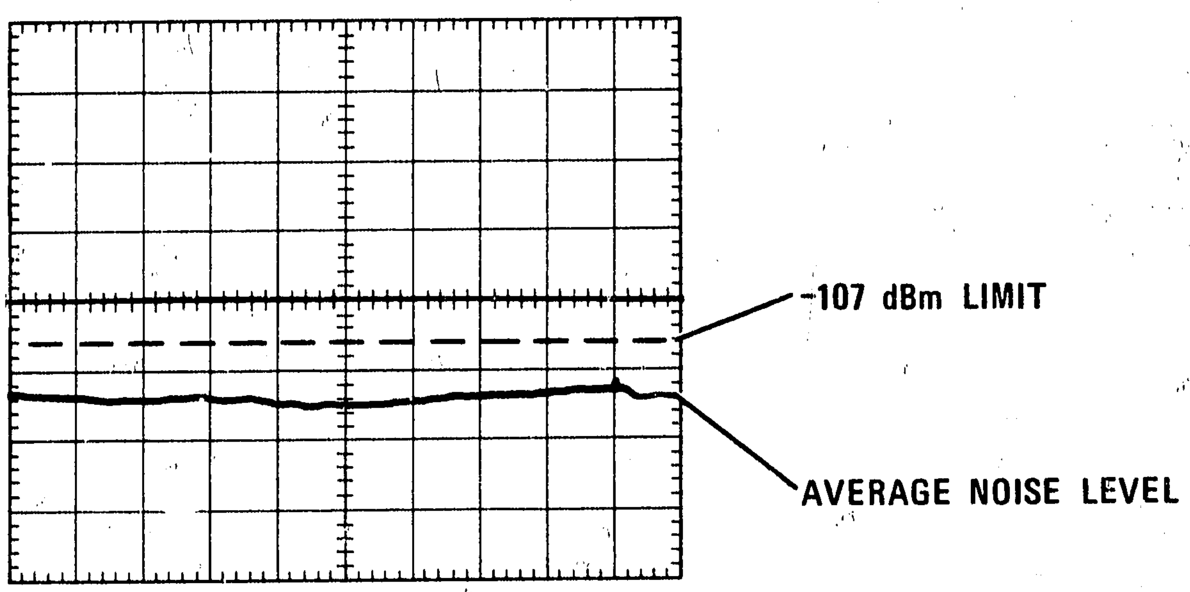


Figure 4-13. Average Noise Level Measurement

3. Slowly tune the spectrum analyzer to 350 MHz. The noise level should be less than −107 dBm at any frequency.

_______<−107 dBm

PERFORMANCE TESTS

4-18. SPURIOUS RESPONSES TEST

SPECIFICATION:

For input signal level ≤ Optimum Input level setting, all image and out-of-band mixing responses, harmonic and intermodulation distortion products are more than 70 dB below input signal level, 1 MHz to 350 MHz; 60 dB below, 20 kHz to 1 MHz. For two input signals 10 dB above Optimum Input level setting 3rd order intermodulation distortion products are >70 dB below the input signals, 1 —350 MHz; 60 dB below, 10 kHz to 1 MHz (signal separation ≥50 kHz).

DESCRIPTION:

Harmonic distortion is measured, using a signal source with a lowpass filter (LPF). The LPF is required to ensure that the signals measured are due to harmonic distortion in the Spectrum Analyzer, not the harmonic content of the Signal Generator.

Spurious responses due to image frequencies, out-of-band responses, and intermodulation distortion are measured by applying signals from two separate sources to the 8557A INPUT connector.

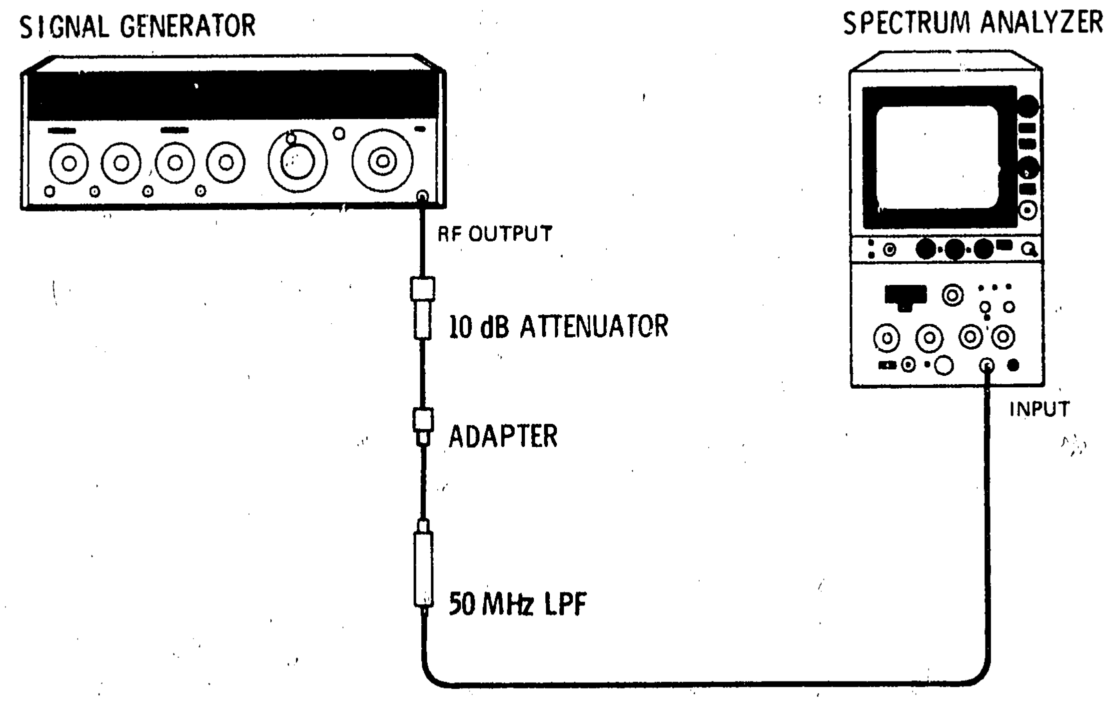


Figure 4-14. Harmonic Distortion Test Setup

PERFORMANCE TESTS

4-18. SPURIOUS RESPONSES TEST (Cont'd)

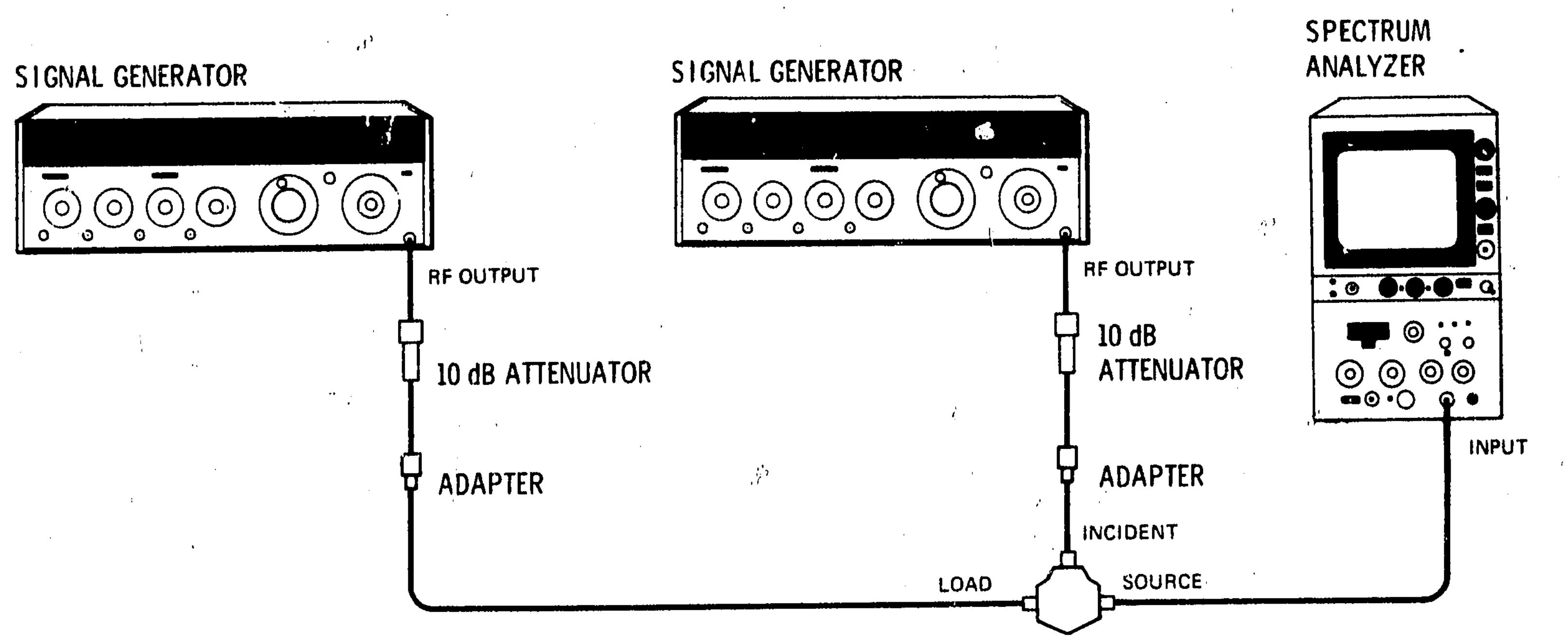


Figure 4-15. Intermodulation Distortion Test Setup

EQUIPMENT:

Signal Generator (2 required) . . . . HP 8640B
10 dB Attenuator (2 required) . . . . HP 8491A Option 010
50 MHz LPF . . . . Cir Q Tel FLT/2—50—5/50—3A/3B
BNC Tee . . . . HP 1250-0781
Adapter. Type N Male to BNC Female
(2 required). . . . . HP 1250-0780
Directional Bridge. . . . . HP 8721A

PROCEDURE:

Harmonic Distortion

1. Set the Spectrum Analyzer controls as follows:

START — CENTER . . . . CENTER
TUNING . . . . 50 MHz
FREQ SPAN/DIV . . . . 500 kHz
RESOLUTION BW . . . . 30 kHz
OPTIMUM INPUT . . . . −30
REFERENCE LEVEL dBm . . . . −30
10 dB/DIV — 1 dB/DIV — LIN . . . . 10 dB/DIV
SWEEP TIME/DIV . . . . AUTO
SWEEP TRIGGER . . . . FREE RUN
VIDEO FILTER . . . . Midrange

2. Connect equipment as shown in Figure 4-14.

PERFORMANCE TESTS

4-18. SPURIOUS RESPONSES TESTS (Cont'd)

3. Set signal generator frequency to 50 MHz and set output level at —20 dBm.
4. Tune signal generator frequency to center signal on spectrum analyzer display.
5. Adjust the signal generator output level for —30 dBm as displayed on the spectrum analyzer (top graticule line).
6. Increase signal generator output level by 20 dB.
7. Set 8557A TUNING control to approximately 100 MHz and identify second harmonic.
8. Center signal on the spectrum analyzer display and reduce spectrum analyzer RESOLUTION BW to 3 kHz and FREQ SPAN/DIV to 20 kHz keeping signal centered on display.
9. Reduce signal generator output level by 20 dB. Harmonics should be more than 70 dB below input signal (below first graticule line from bottom). (It may be necessary to increase video filtering slightly to make this measurement.)
10. Set 8557A RESOLUTION BW control to 30 kHz, and repeat step 6.
11. Set 8557A TUNING control to approximately 150 MHz and identify third harmonic.
12. Repeat steps 8 and 9.
13. Connect equipment as shown in Figure 4-15 and repeat step 1 setting TUNING control to 30 MHz rather than 50 MHz.
14. Set both signal generators for approximately 30 MHz output at −10 dBm.
15. Set 8557A REFERENCE LEVEL dBm control to —20. Tune the signal generator until signals are 2 divisions (1 MHz) apart and centered on the display.
16. Adjust the output levels of both signal generators for −20 dBm, as displayed on the spectrum analyzer.
17. Reduce spectrum analyzer RESOLUTION BW control to 3 kHz and check for third order intermodulation distortion products at approximately 3 divisions from center graticule line (both sides of center line). They should be more than 70 dB below both input signals (−90 dBm on spectrum analyzer display). See Figure 4-16.
18. Set 8557A TUNING control to approximately 1 MHz. Tune second order intermodulation distortion products ($f_2 - f_2$) at 1 MHz to center screen. Change OPTIMUM INPUT control to —20, REFERENCE LEVEL dBm control to —20, and reduce the output of both signal generators by 3 dB. Second order intermodulation distortion product should be more than 70 dB below the total applied signal, —90 dBm on the spectrum analyzer display. See Figure 4-16. Signal should be more than 70 dB below the input signals (—90 dBm on the spectrum analyzer display).

NOTE

If unable to locate intermodulation distortion product, increase the output level of one of the signal generators by 10 dB. Be sure to return the output level to its previous setting before making the actual measurement.

PERFORMANCE TESTS

4-18. SPURIOUS RESPONSES TESTS (Cont'd)

19. Set 8557A TUNING control to 60 MHz.

20. Check for second order intermodulation distortion product ($f_1 + f_2$) near center of display (between $2f_1$ and $2f_2$ signals). See Figure 4-16. Signal should be more than 70 dB below the input signals (−90 dBm on spectrum analyzer display).

NOTE

If unable to locate intermodulation distortion product, increase the output level of one of the signal generators by 10 dB. Be sure to return the output level to its previous setting before making the actual measurement.

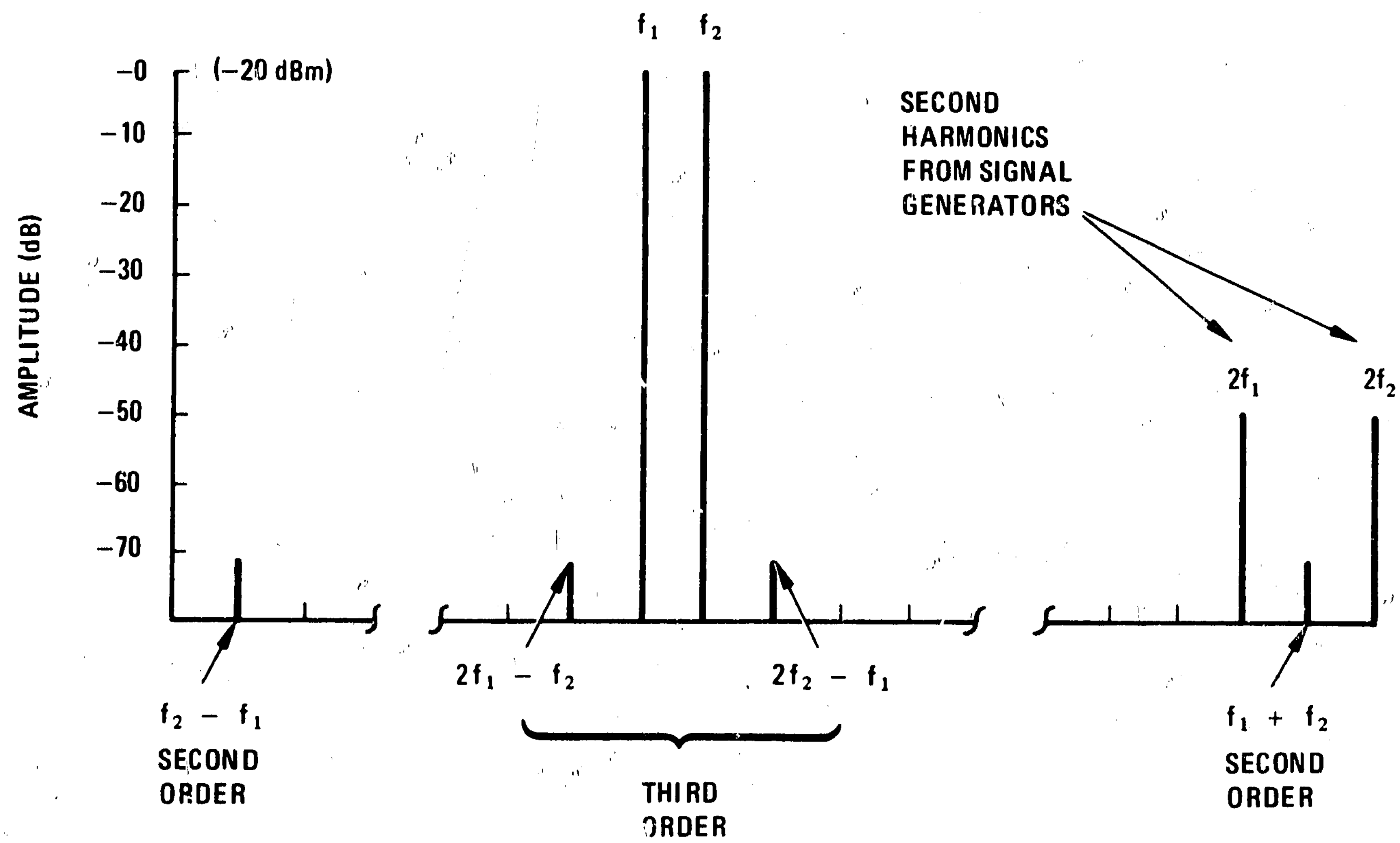


Figure 4-16. Intermodulation Distortion Products

21. Set 8557A TUNING to 30 MHz, RESOLUTION BW to 1 kHz, OPTIMUM INPUT to −30, and FREQ SPAN/DIV to 20 kHz. Tune the two signal generators until signals are 2.5 divisions apart (50 kHz separation), centered on the display.

22. Adjust the output levels of both signal generators for −20 dBm displayed on the spectrum analyzer. Third order intermodulation products should be more than 70 dB below input signals. (−90 dBm on signal generator display). See Fig. 4-16.

PERFORMANCE TESTS

4-18. SPURIOUS RESPONSES TEST (Cont'd)

23. Set Spectrum Analyzer controls as follows:

TUNING .... 0.9 MHz
FREQ SPAN/DIV .... 20 kHz
RESOLUTION BW .... 1 kHz

24. Tune the signal generators to approximately 900 kHz; continue tuning until the two signals are 2.5 divisions apart, centered on the display.

26. Change OPTIMUM INPUT to −20, REFERENCE LEVEL dBm to −20. Reduce signal generator output by 3 dB each. Tune the 8557A to 50 kHz (2.5 divisions above LO feedthru). Check for second order intermodulation distortion product ($f_2 - f_1$) at 50 kHz. Signal should be more than 60 dB below input signals (−80 dBm on Spectrum Analyzer display). See Figure 4-16. It may be necessary to adjust VIDEO FILTER to observe the signal.

27. Set 8557A TUNING control to 1.8 MHz and check for second order intermodulation distortion product ($f_1 - f_2$) near center of display (between $2f_1$ and $2f_2$ signals). See Figure 4-16. Signal should be more than 60 dB below the input signals (−80 dBm on spectrum analyzer display).

NOTE

If unable to locate intermodulation distortion product, increase the output level of one of the signal generators by 10 dB. Be sure to return the output level to its previous setting before making the actual measurement.

4-19. RESIDUAL RESPONSE TEST

SPECIFICATION:

< −100 dBm with 0 dB input attenuation, no signal present at input (0.1 — 350 MHz).

PERFORMANCE TESTS

4-19. RESIDUAL RESPONSE TEST (Cont'd)

DESCRIPTION:

The spectrum analyzer is tested for residual responses with no signal applied to the INPUT 50Ω connector. The input attenuation is set to 0 dB (−40 position of OPTIMUM INPUT control).

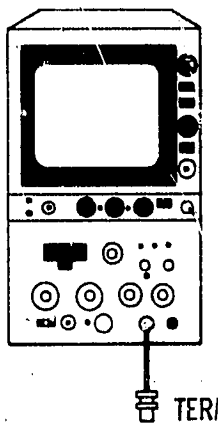


Figure 4-17. Residual Response Test Setup

EQUIPMENT:

Variable Persistence/Storage Oscilloscope .... HP 181A
50 Ohm Termination .... HP 11593A

PROCEDURE:

1. Set the spectrum analyzer controls as follows:

START — CENTER .... CENTER
FREQ SPAN/DIV .... F
RESOLUTION BW .... 30 kHz
OPTIMUM INPUT .... −40 (zero attenuation)
REFERENCE LEVEL dBm .... −50
REF LEVEL FINE 0
10 dB/DIV — 1 dB/DIV — LIN .... 10 dB/DIV
SWEEP TIME/DIV .... AUTO
SWEEP TRIGGER .... FREE RUN
VIDEO FILTER .... Fully clockwise
(not in MAX detent)

2. Terminate the 8557A INPUT 50Ω connector with a 50 ohm coaxial termination.

3. With variable persistence oscilloscope in NORM mode, set TUNING control fully counterclockwise (to move marker off screen). Set BASELINE CLIPPER control fully clockwise.

4. Set variable persistence oscilloscope to WRITE mode. Set PERSISTENCE control to MAX and INTENSITY control to approximately midrange.

PERFORMANCE TESTS

4-19. RESIDUAL RESPONSE TEST (Cont'd)

5. Set 8557A SWEEP TRIGGER control to SINGLE sweep mode and set RESOLUTION BW control to 30 kHz. Momentarily depress ERASE.

NOTE

When ERASE button is depressed, the 8557A sweep may be triggered. To stop the sweep, turn SWEEP TRIGGER control clockwise.

6. Turn SWEEP TRIGGER control clockwise to initiate the sweep.
7. Slowly turn BASELINE CLIPPER control until peaks of trace begin to appear on display. It may be necessary to increase baseline clipping slightly near end of sweep to reduce blooming. It may also be necessary to adjust the INTENSITY control to prevent blooming.
8. Trigger the sweep at least one more time and check for residual responses from 0.1 to 350 MHz. Note frequency of residual response with greatest amplitude.

_______ MHz

9. Set variable persistence oscilloscope to NORM mode. Set 8557A BASELINE CLIPPER control fully counterclockwise and set SWEEP TRIGGER control to FREE RUN.
10. Set 8557A FREQ SPAN/DIV to 20 kHz and set TUNING control to center the signal noted in step 8.
11. Narrow the FREQ SPAN/DIV and RESOLUTION BW, keeping signal centered with TUNING control. Reduce sweep speed, using SWEEP TIME/DIV control until signal level does not rise when sweep speed is further reduced. Residual response must be less than −100 dBm.

_______ <−100 dBm

4-20. FREQUENCY RESPONSE TEST

SPECIFICATION:

±0.75 (1.5 dB P-P Flatness)

DESCRIPTION:

A very flat signal source is applied to the INPUT of the spectrum analyzer. As the source is slowly tuned across the spectrum analyzer's frequency range, the display is observed for amplitude flatness versus frequency. This test is performed in two segments: 10 kHz to 7 MHz, and 7 MHz to 350 MHz.

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

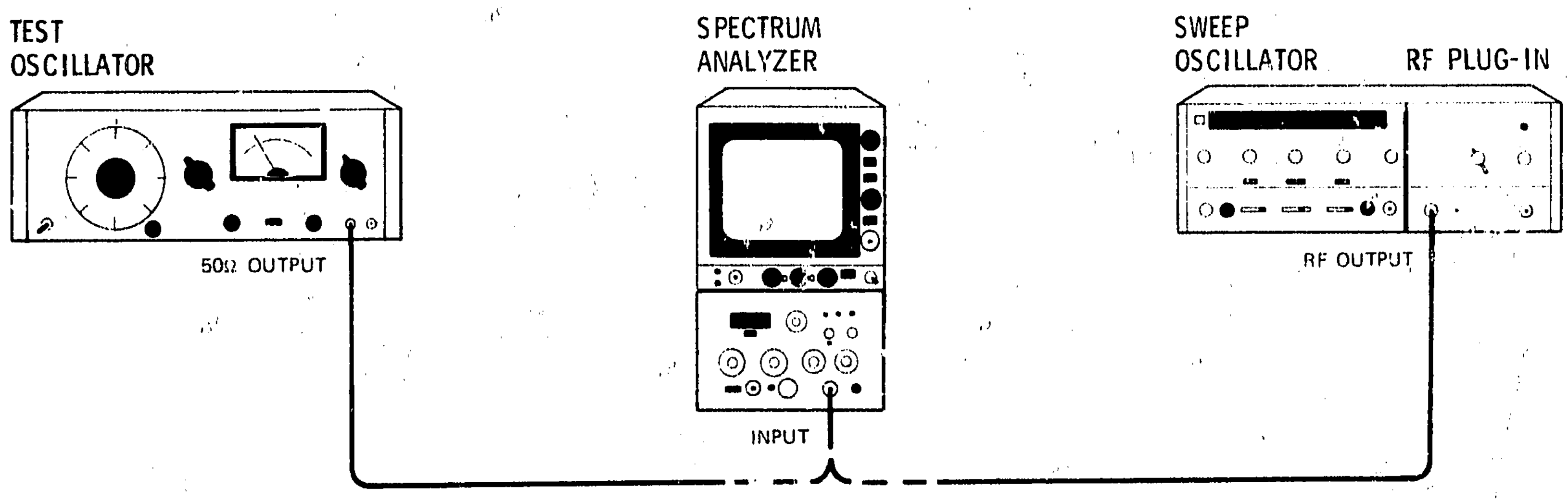


Figure 4-18. Frequency Response Test Setup.

EQUIPMENT:

Test Oscillator	HP 652A
Sweep Oscillator	HP 8620A
RF Plug-in	HP 86210A

PROCEDURE:

1. Set controls as follows:

Spectrum Analyzer:

START — CENTER	START
TUNING	.0 MHz
FREQ SPAN/DIV	.10 kHz
RESOLUTION BW	.1 kHz
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	0
REF LEVEL FINE	.0
10 dB/DIV — 1 dB/DIV — LIN	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	.OFF

PERFORMANCE CHECK CON'T

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

2. Adjust the spectrum analyzer TUNING to set the LO feedthru on the lefthand graticule line. During this test it may be necessary to slightly retune.

3. Connect the test oscillator 50Ω output to the 8557A input. Set the oscillator frequency to 10 kHz (X10K RANGE) and adjust amplitude to give full-screen display on the 8557A.

4. Switch the 8557A to 1 dB/DIV. Adjust REF LEVEL FINE CONTROL to give a signal 2 divisions down from the top graticule line on the display.

5. Slowly tune the test oscillator from 10 to 100 kHz, moving the displayed signal from the second to the last graticule line. It may be necessary to adjust the test oscillator amplitude vernier to maintain constant amplitude output. (Use the expand mode on output monitor). Note the maximum and minimum amplitude.

   Max_________div down Min__________div down

6. Note the signal level at 100 kHz.

7. Set 8557A FREQ SPAN/DIV control to 100 kHz RESOLUTION BW control to 10 kHz. Tune the Test Oscillator to 100 kHz (X100K RANGE). Readjust the REF LEVEL FINE control to give a signal display at the reference level noted in step 6.

8. Repeat step 5, except tune from 100 kHz to 1 MHz. Note maximum and minimum amplitude.

   Max_________div down Min__________div down

9. Note signal level at 1 MHz.

10. Set 8557A FREQ SPAN/DIV control to 1 MHz, RESOLUTION BW control to 30 kHz. Tune the Test Oscillator to 1 MHz (X1M RANGE). Readjust the REF LEVEL FINE control to give a signal display at the reference level noted in step 9.

11. Repeat step 5, except tune from 1 MHz to 7 MHz. Note maximum and minimum amplitudes.

    Max_________div down Min__________div down

12. Note signal level at 7 MHz.

13. Set 8557A FREQ SPAN/DIV control to F, RESOLUTION BW to 1 MHz, and TUNING full counterclockwise (to move the marker off screen). Connect the RF plug-in OUTPUT to the 8557A input.

14. Set the Sweep Oscillator to CW mode, tune to 7 MHz, and adjust its POWER LEVEL and the 8557A REF LEVEL FINE to give a signal display at the reference level noted in step 12. (Note: on full span, 7 MHz is 0.2 divisions from the left hand graticule line.) (It may be necessary to change OPTIMUM INPUT to −20.)

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

15. Slowly tune the Sweep Oscillator from 5 MHz to 350 MHz. Note the maximum and minimum amplitude.

Max_________div down Min__________div down

16. Select the absolute maximum from step 5, 8, 11, and 15. Select the absolute minimum from steps 5, 8, 11, and 15. The difference should be less than 1.5 divisions. (Note: If the difference exceeds 1.5 divisions, verify the flatness of the RF source with a power meter. With the RF source flatness deviations subtracted, the 8557A should have a flatness of less than 1.5 dB).

Frequency Response____________dB p-p.

4-21. AMPLITUDE ACCURACY SWITCHING BETWEEN BANDWIDTHS TEST

SPECIFICATION:

(At 10° to 40° C, 0 to 90% relative humidity)

3 MHz to 300 kHz: ± 0.5 dB
3 MHz to 1 kHz: ± 1.0 dB

DESCRIPTION:

The spectrum analyzer 250 MHz CAL OUTPUT signal is applied to the INPUT connector and displayed on the CRT. The peak of the displayed 250 MHz signal is centered on the CRT and adjusted for a vertical deflection of seven divisions. The amplitude variation of the 250 MHz signal is measured for each RESOLUTION BW control setting. The overall variation between RESOLUTION BW settings of 3 MHz to 300 kHz should be equal to or less than 1 dB (±0.5 dB). The overall variation between RESOLUTION BW settings of 3 MHz to 1 kHz should be equal to or less than 2 dB (±1.0 dB).

PROCEDURE:

1. Set spectrum analyzer controls as follows:

START — CENTER	CENTER
TUNING	250 MHz
FREQ SPAN/DIV	.1 MHz
RESOLUTION BW	3 MHz
OPTIMUM INPUT	−40
REFERENCE LEVEL dBm	−20
REF LEVEL FINE	−10
10 dB/DIV — 1 dB/DIV — LIN	1 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	OFF

PERFORMANCE TESTS

4-21. AMPLITUDE ACCURACY SWITCHING BETWEEN BANDWIDTHS TEST (Cont'd)

2. Connect spectrum analyzer CAL OUTPUT signal to INPUT 50Ω connector.

3. Set TUNING control, as required, to center 250 MHz signal on CRT.

4. Set REF LEVEL FINE control to position peak of 250 MHz signal seven divisions above graticule baseline.

5. Vary the RESOLUTION BW and FREQ SPAN/DIV controls in accordance with Table 4-4. Record the change in amplitude for each RESOLUTION BW setting. Changes in amplitude above reference level set in step 4 are positive (+). Changes below reference level are negative (−).

Table 4-4. Amplitude Accuracy Switching Between Bandwidths

RESOLUTION BW Setting	FREQ SPAN/DIV Setting	Change in Amplitude (dB)	Overall Variation Between 3 MHz and 300 kHz RESOLUTION BW Settings	Overall Variation Between 3 MHz and 1 kHz RESOLUTION BW Settings
3 MHz	1 MHz	0 (Ref.)	________	________
1 MHz	500 kHz	________		
300 kHz	100 kHz	________		
100 kHz	50 kHz	________		
30 kHz	10 kHz	________		
10 kHz	5 kHz	________		
3 kHz	5 kHz	________		
1 kHz	5 kHz	________		

6. To find the overall variation in Table 4-4, algebraically subtract the greatest negative change in amplitude from the greatest positive change in amplitude. If all changes in amplitude are of the same sign, the overall variation is the largest positive or largest negative change in amplitude. The overall variation between 3 MHz and 300 kHz RESOLUTION BW settings should be ≤ 1.0 dB (±0.5 dB). The overall variation between 3 MHz and 1 kHz RESOLUTION BW settings should be ≤ 2.0 dB (±1.0 dB).

PERFORMANCE TESTS

4-22. INPUT ATTENUATOR ACCURACY TEST

SPECIFICATION:

Accuracy ±0.5 dB for each 10 dB step but not more than ±1.0 dB over full 50 dB range.

DESCRIPTION:

The input attenuator accuracy is tested over its full 50 dB range using an RF substitution method. A step attenuator that has been calibrated by a Standards Laboratory at 30 MHz is used for substitution. The known error of the calibrated attenuator is taken into account when computing the 8557A input attenuator accuracy.

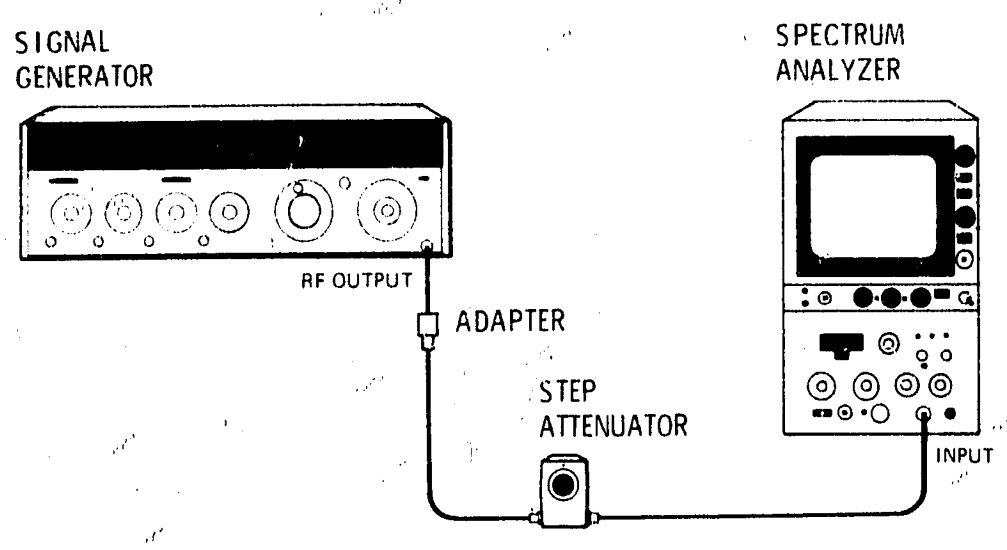


Figure 4-19. Input Attenuator Accuracy Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Step Attenuator	HP 355D Opt. H82
Adapter (1 required)	HP 1250-0780

PROCEDURE:

1. Set controls as follows:

Spectrum Analyzer:

START — CENTER	CENTER
TUNING	30 MHz
FREQ SPAN/DIV	200 kHz
RESOLUTION BW	30 kHz
OPTIMUM INPUT	+10
REFERENCE LEVEL dBm	0
10 dB/DIV — 1 dB/DIV — LIN	1 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	Midrange

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

Signal Generator
COUNTER MODE .... INT
AM .... OFF
FM .... OFF
FREQUENCY TUNE .... 30.0 MHz
OUTPUT LEVEL .... 0 dBm

2. Connect equipment as shown in Figure 4-19 with step attenuator set at 0 dB. Locate signal on CRT and adjust signal generator output level until trace is 6 divisions above graticule baseline.

3. Set the 8557A OPTIMUM INPUT control and step attenuator to settings indicated in Table 4-5. Record the deviation from the sixth division reference set in step 2 for each setting.

Table 4-5. Input Attenuator Accuracy

OPTIMUM INPUT Setting	Step Attenuator Setting (dB)	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)	Corrected Deviation (dB)
10	0	0 (Ref.)	Ref.	0 (Ref.)
0	10	________	________	________
10	20	________	________	________
20	30	________	________	________
−30	40	________	________	________
−40	50	________	________	________

* 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.

4. To compute the corrected deviation, add the step attenuator error of the deviation from 6th division for each setting. The corrected deviation should not exceed ±0.5 dB between any two adjacent settings of the input attenuator.

5. Record the maximum positive and the maximum negative corrected deviation values. The difference between these two values (total deviation) should not exceed 2.0 dB (± 1.0 dB).

________ dB Maximum Positive Corrected Deviation
________ dB Maximum Negative Corrected Deviation
________ dB Total Corrected Deviation

PERFORMANCE TESTS

4-23. REFERENCE LEVEL ACCURACY TEST

SPECIFICATION:

Reference Level Accuracy (at fixed center frequency, fixed resolution bandwidth): ± 1.5 dB (includes input attenuator and IF gain accuracy).

DESCRIPTION:

The reference level accuracy is tested over the range of 0 dBm to −90 dBm by checking the IF gain steps in 1 dB/DIV (Log) and in LIN. The resulting maximum deviation in each case is added to the maximum deviain input attenuation found in Paragraph 4-22. The total maximum error must be equal to or less than 3.0 dB (±1.5 dB).

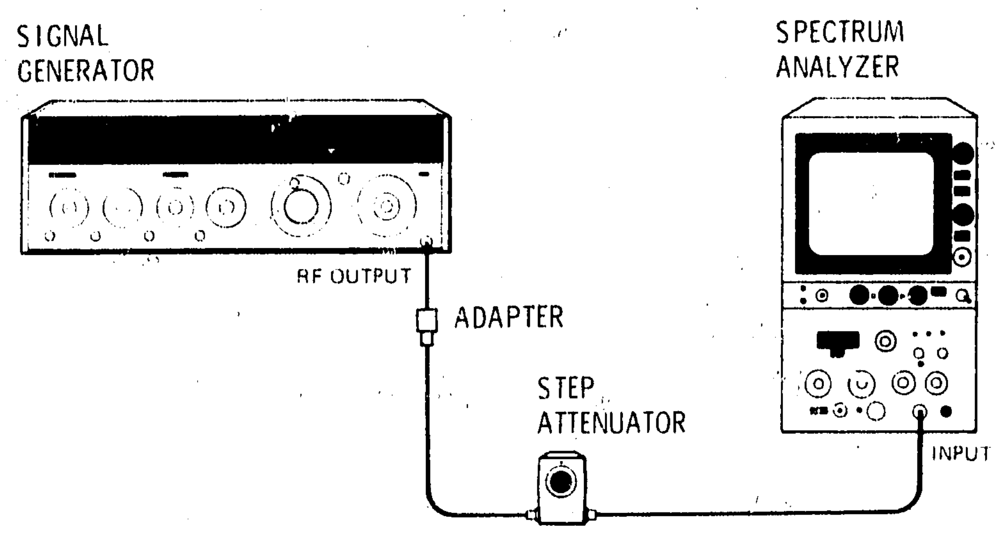


Figure 4-20. Reference Level Accuracy Test Setup

EQUIPMENT:

Signal Generator .... HP 8640B
Step Attenuator .... HP 355D Opt. H82
Adapter .... HP 1250-0780

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

PROCEDURE:

IF Gain Accuracy in Log Mode

1. Set controls as follows:

Spectrum Analyzer:

START — CENTER	CENTER
TUNING	30 MHz
FREQ SPAN/DIV	5 kHz
RESOLUTION BW	3 kHz
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	0
10 dB/DIV — 1 dB/DIV — LIN	1 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise
VIDEO FILTER	Midrange

Signal Generator:

COUNTER MODE	INT
AM	OFF
FM	OFF
FREQUENCY TUNE	30.0 MHz
OUTPUT LEVEL	0 dBm

2. Connect equipment as shown in Figure 4-20 with step attenuator set at 0 dB. Locate signal on CRT.

NOTE

If signal is difficult to locate, press RESOLUTION BW control to couple with FREQ SPAN/DIV control and turn the coupled controls clockwise until signal appears on display. Center the signal using TUNING control. Return controls to positions called out in step 1, adjusting TUNING control as necessary to keep signal centered.

3. Adjust signal generator output until trace is 6 divisions above graticule baseline. Set the 8557A REFERENCE LEVEL dBm control and step attenuator to settings indicated in Table 4-6. Record the deviation from the sixth division (reference set in step 2) for each setting.

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

Table 4-6. IF Gain Accuracy in Log Mode

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

* Attenuations > dial settings are positive (+). Attenuations < dial settings are negative (—). For example, 9.99 dB calibration for a 10 dB attenuator setting represents an error of -0.01 dB.

4. To compute the corrected deviation, add the step attenuator error to the deviation from 6th Division for each setting.

IF Gain Accuracy in Linear Mode

5. Set the spectrum analyzer 10 dB/DIV — 1 dB/DIV — LIN switch to LIN. Set REFERENCE LEVEL dBm control to 0 and set step attenuator to 0 dB. Adjust the signal generator output until trace is six divisions above graticule baseline.

6. Set the 8557A REFERENCE LEVEL dBm control and Step Attenuator to settings indicated in Table 4-7. Record the deviation from the sixth division (reference set in step 5) for each setting.

PERFORMANCE TESTS

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

Table 4-7. IF Gain Accuracy in Linear Mode

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

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

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

8. To compute the corrected deviation, add the step attenuator error to the deviation from 6th division in dB.

Reference Level Accuracy in Log Mode

9. Add the maximum positive corrected deviation recorded in Paragraph 4-22, step 5 to the maximum positive corrected deviation in Table 4-6.

______ dB

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

10. Add the maximum negative corrected deviation recorded in Paragraph 4-22, step 5 to the maximum negative corrected in Table 4-6.

_______dB

11. The difference between the result in step 9 and the result in step 10 should not exceed 3 dB (±1.5 dB Reference Level Accuracy, Log).

Max. Actual
3 dB _______dB

Reference Level Accuracy in Linear Mode

12. Add the maximum positive corrected deviation recorded in Paragraph 4-22, step 5 to the maximum positive corrected deviation in Table 4-7.

_______dB

13. Add the maximum negative corrected deviation recorded in Paragraph 4-22, step 5 to the maximum negative corrected deviation in Table 4-7.

_______dB

14. The difference between the result in step 12 and the result in step 13 should not exceed 3 dB (±1.5 dB Reference Level Accuracy, LIN).

Max. Actual
3 dB _______dB

Table 4-8. Conversion Table, Deviation in Linear Mode Deviation in dB

POSITIVE DEVIATIONS (Above 6th division from graticule baseline)		NEGATIVE DEVIATIONS (Below 6th division from graticule baseline)	
Divisions (Linear)	**Equivalent dB**	**Divisions (Linear)**	**Equivalent dB**
0	0	0	0
+ .1	+0.14	− .1	−0.15
+ .2	+0.28	− .2	−0.29
+ .3	+0.42	− .3	−0.45
+ .4	+0.56	− .4	−0.60
+ .5	+0.70	− .5	−0.76
+ .6	+0.82	− .6	−0.92
+ .7	+0.96	− .7	−1.08
+ .8	+1.09	− .8	−1.24
+ .9	+1.21	− .9	−1.41
+1.0	+1.34	−1.0	−1.58
+1.1	+1.46	−1.1	−1.76
+1.2	+1.58	−1.2	−1.94
+1.3	+1.70		
+1.4	+1.82		
+1.5	+1.94		

PERFORMANCE TESTS

4-24. AMPLITUDE LOG DISPLAY TEST

SPECIFICATION:

± 0.1 dB/dB but not more than ± 1.5 dB over full 70 dB display range.

DESCRIPTION:

The amplitude log display amplifier is tested by connecting a DVM to the rear-panel AUX A connector (vertical output) of the Option 807 oscilloscope mainframe. The widest analyzer bandwidth possible is selected so the signal appears as a straight horizontal line on the CRT display. The DVM is used to provide good resolution when checking for ±1 dB per 10 dB step (0.1 dB/dB).

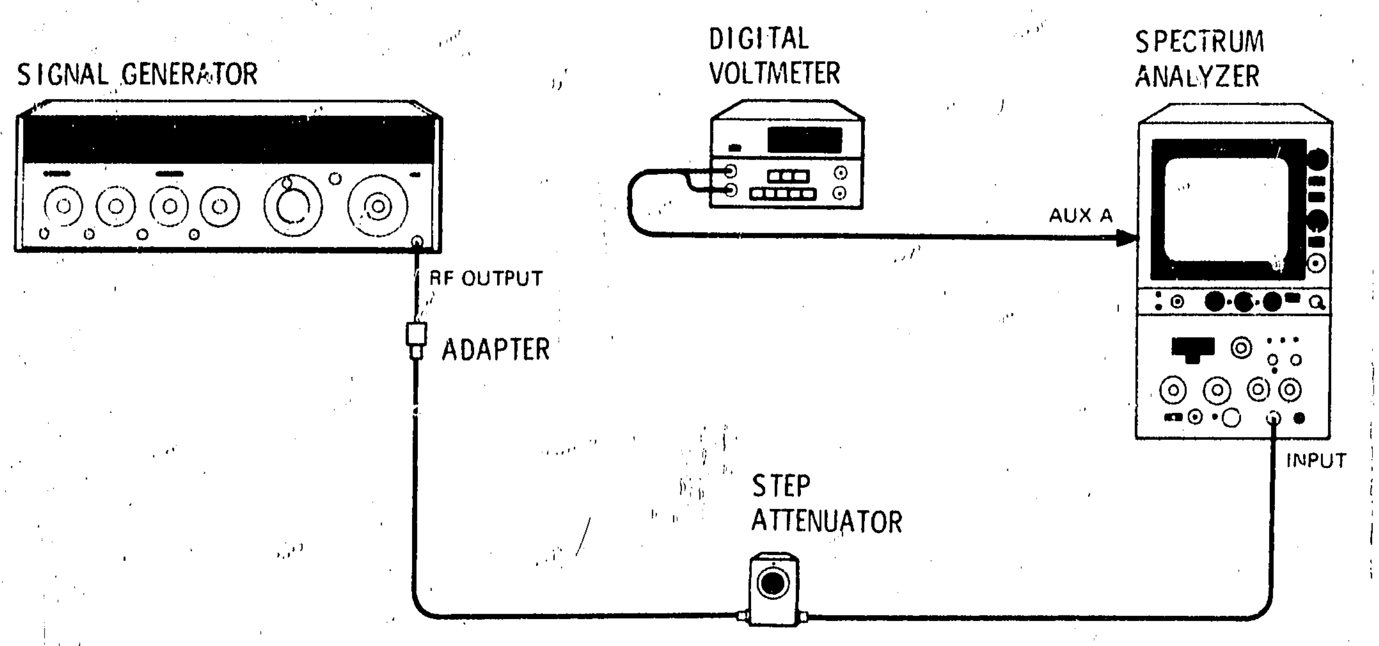


Figure 4-21. Amplitude Log Display Test Setup

EQUIPMENT:

Signal Generator .... HP 8640B
Digital Voltmeter .... HP 34740A/34702A
Step Attenuator .... HP 355D
Adapter, Type N Male to
BNC Female (1 required) .... HP 1250-0780

PERFORMANCE TESTS

4-24. AMPLITUDE LOG DISPLAY TEST (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:

   START — CENTER .... CENTER
   TUNING .... 30 MHz
   FREQ SPAN/DIV .... 500 kHz
   RESOLUTION BW .... 300 kHz
   OPTIMUM INPUT .... −30
   REFERENCE LEVEL dBm 0
   10 dB/DIV — 1 dB/DIV — LIN .... 10 dB/DIV
   SWEEP TIME/DIV .... AUTO
   SWEEP TRIGGER .... FREE RUN
   BASELINE CLIPPER .... Fully counterclockwise

2. Connect equipment as shown in Figure 4-21.

3. Tune signal generator to 30 MHz and set power output for approximately 0 dBm. Set HP355D to 0 dB.

4. Set spectrum analyzer TUNING control to center the signal on the CRT display.

5. Set the FREQ SPAN/DIV control to zero and RESOLUTION BW control to 100 kHz. Tune the signal generator frequency for maximum reading on DVM.

6. Set the signal generator output level so the DVM reads +800 mV. The trace should be approximately at the top graticule line.

7. Increase the attenuation of the HP 355D and record the DVM reading for each 10 dB step, up to 70 dB.

Table 4-9. Amplitude Log Display Error

Attenuator Setting (dB)	DVM Reading (mV)	AUX A Theoretical Reading (mV)	AUX A Theoretical Reading Subtracted from DVM Reading (mV)	Difference Between Adjacent Readings (mV)
0	+800 (Ref.)	+800	0	
10	______	+700	______	______
20	______	+600	______	______
30	______	+500	______	______
40	______	+400	______	______
50	______	+300	______	______
60	______	+200	______	______
70	______	+100	______	______

4-24. AMPLITUDE LOG DISPLAY TEST (Cont'd)

8. Having recorded the DVM readings for all of the attenuator settings from 0 to 70 dB, subtract the AUX A theoretical reading from the actual DVM reading in each case and record results in Table 4-9.

9. Subtract each converted reading (AUX A theoretical reading subtracted from DVM reading) from the previous converted reading. This subtraction must be performed algebraically. Record results in Table 4-9 (see Example 1).

Example 1

Attenuator Setting (dB)	DVM Reading (mV)	AUX A Theoretical Reading (mV)	AUX A Theoretical Reading Subtracted from DVM Reading (mV)	Difference Between Adjacent Readings (mV)
0	+800	+800	0	
10	+703	+700	+3	−3
20	+594	+600	−6	+9
30	+492	+500	−8	+2
40	+401	+400	+1	−9

10. The difference between adjacent readings (Table 4-9) should not exceed ± 10 mV (±0.1 dB/dB).

11. Note the highest positive value and highest negative value recorded under "AUX A Theoretical Reading Subtracted from DVM Reading." Add their absolute values (disregarding their signs). If all of the signs are negative or all of the signs are positive, subtract the lowest absolute value from the highest absolute value. (See Example 2). The sum or difference of the absolute values should not exceed 30 mV (±1.5 dB).

Example 2:

Observing table in Example 1, note that −8 mV is the highest negative value and +3 mV is the highest positive value. Their absolute values being 8 mV and 3 mV: 8 plus 3 = 11 mV (1.1 dB)

4-25. CALIBRATOR ACCURACY TEST

SPECIFICATION:

Amplitude: −30 dBm ±1 dB
Frequency: 250 MHz ±50 kHz, Crystal Controlled

DESCRIPTION:

The amplitude accuracy and frequency accuracy of the CAL OUTPUT signal are checked for −30 dBm ±1 dB and 250 MHz ±50 kHz, respectively.

PERFORMANCE TESTS

4-25. CALIBRATOR ACCURACY TEST (Cont'd)

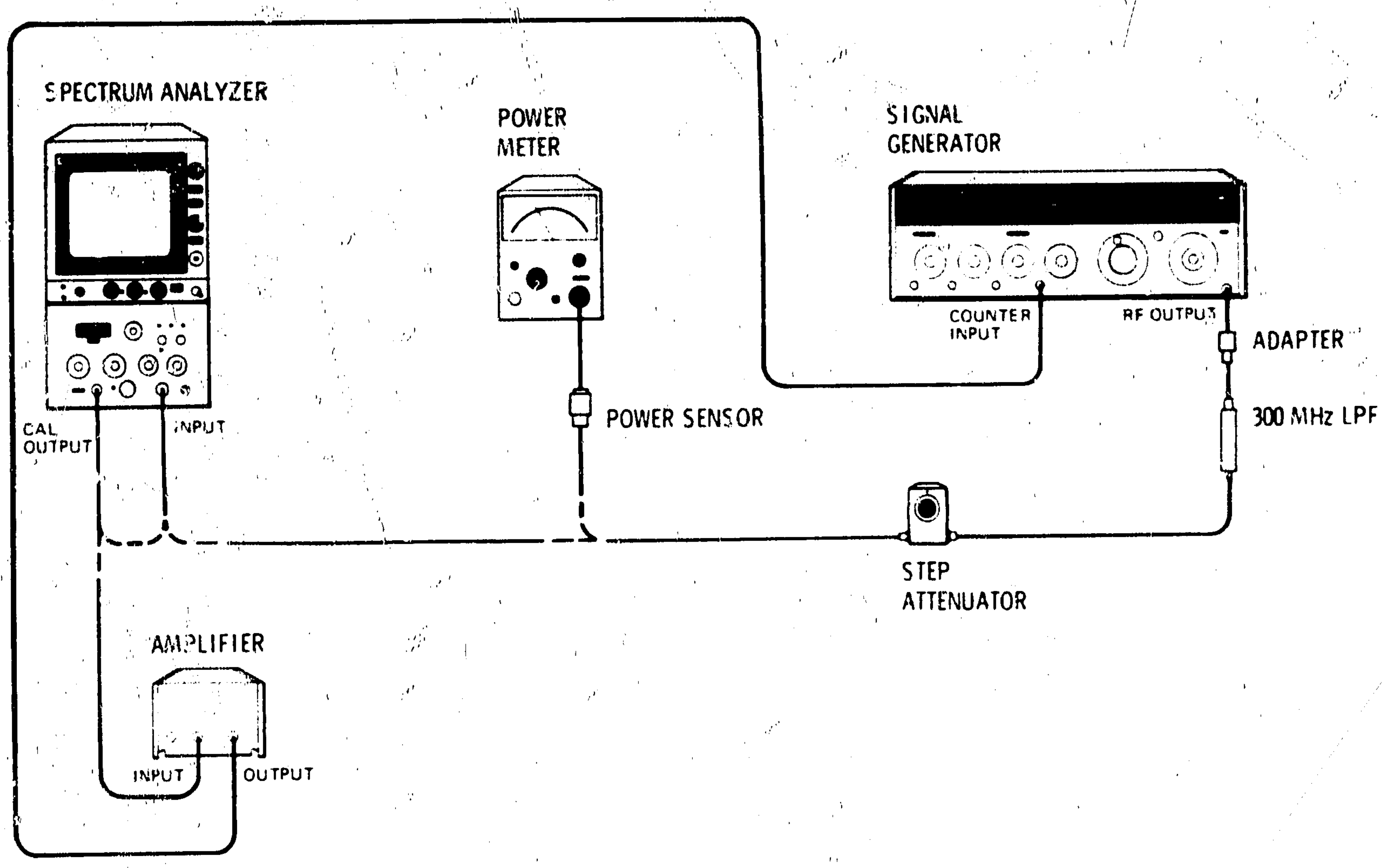


Figure 4-22. Calibrator Accuracy Test Setup

EQUIPMENT:

Amplifier	HP 8447A
Signal Generator	HP 8640B
Step Attenuator (Calibrated at 250 MHz)	HP 355D Opt. H82
Power Meter	HP 435A
Power Sensor	HP 8481A
300 MHz LPF	TELONIC TLP 300-4AB
Adapter, Type N Male to BNC Female	HP 1250-0780

1. Set spectrum analyzer controls as follow:

START — CENTER	CENTER
TUNING	250 MHz
FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	−20
10 dB/DIV — 1 dB/DIV — LIN	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	Fully counterclockwise

PERFORMANCE TESTS

4-25. CALIBRATOR ACCURACY TEST (Cont'd)

PROCEDURE:

2. Connect CAL OUTPUT to 8640B counter input connector through amplifier. Frequency counter should indicate 250 MHz ±50 kHz. (Use EXPAND X10 counter mode, EXT 0-550).

3. Set the signal generator frequency to 250MHz. Connect the output of the generator to the calibrated step attenuator.

4. Set the step attenuator to 10 dB and connect the power sensor and power meter to the attenuator as shown in Figure 4-22.

5. Set signal generator output power for a 1 mW full scale reading on the power meter. Leave signal generator set at this level.

6. Set the step attenuator to 40 dB and connect the −30 dBm reference (from signal generator through the step attenuator) to the 8557A INPUT 50Ω connector.

7. With the 10 dB/DIV—1 dB/DIV—LIN switch set to 10 dB/DIV, set TUNING control so signal is centered on CRT display. The peak amplitude of the reference signal should be one division down from the top graticule line.

8. Set the 10 dB/DIV — 1 dB/DIV — LIN switch to 1 dB/DIV and adjust the REF LEVEL FINE control so peak amplitude of the reference signal is on the seventh graticule line (one division down from top).

9. Disconnect the reference signal and connect the 8557A CAL OUTPUT to the INPUT 50Ω connector. Signal amplitude should be one division down from the top graticule line ± 1 division.

−31 dBm____________−29 dBm

Table 4-10. Performance Test Record

Hewlett-Packard
Model 8557A
Spectrum Analyzer 10 kHz -- 350 MHz
Serial No. ____________

Tested By ____________
Date ____________

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-11.	**Frequency Display Span Accuracy Test**			
	3. FULL SPAN	−0.3 div	______	+0.8 div
	4. 20 MHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	5. 10 MHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	6. 5 MHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	7. 2 MHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	8. 1 MHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	9. 500 kHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	10. 200 kHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	11. 100 kHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	50 kHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	20 kHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	10 kHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
	5 kHz FREQ SPAN/DIV	−0.8 div	______	+0.8 div
4-12.	**Digital Frequency Readout Accuracy Test**			
	5. 10.0 MHz	−3.1 div	______	+3.1 div
	6. 20.0 MHz	−3.1 div	______	+3.1 div
	40.0 MHz	−3.1 div	______	+3.1 div
	60.0 MHz	−3.1 div	______	+3.1 div
	80.0 MHz	−3.1 div	______	+3.1 div
	100.0 MHz	−3.1 div	______	+3.1 div
	120.0 MHz	−3.1 div	______	+3.1 div

Table 4-10. Performance Test Record (Cont'd)

Para. No.	Test Description	Results		
		Actual	**Min.**	**Max.**
4-12.	**Digital Frequency Readout Accuracy Test (Cont'd)**			
	140.0 MHz	−3.1 div	______	+3.1 div
	160.0 MHz	−3.1 div	______	+3.1 div
	180.0 MHz	−3.1 div	______	+3.1 div
	200 MHz	−3.1 div	______	+3.1 div
	220 MHz	−3.1 div	______	+3.1 div
	240 MHz	−3.1 div	______	+3.1 div
	260 MHz	−3.1 div	______	+3.1 div
	280 MHz	−3.1 div	______	+3.1 div
	300 MHz	−3.1 div	______	+3.1 div
	320 MHz	−3.1 div	______	+3.1 div
	340 MHz	−3.1 div	______	+3.1 div
	350 MHz	−3.1 div	______	+3.1 div
4-13.	**Residual FM Test**			
	6. Peak-to Peak Variation of Trace		______	1 div (1 kHz/0.1 sec)
4-14.	**Noise Sidebands Test**			
	6. Noise Sidebands		______	6.5 div. down (−75 dB)
4-15.	**Resolution Bandwidth Accuracy Test**			
	7. 3 MHz Resolution BW	2.40 MHz	______	3.60 MHz
	8. 1 MHz Resolution BW	800 kHz	______	1.20 MHz
	9. 300 kHz Resolution BW	240 kHz	______	360 kHz
	10. 100 kHz Resolution BW	80 kHz	______	120 kHz
	17. 30 kHz Resolution BW	24 kHz	______	36 kHz
	18. 10 kHz Resolution BW	8 kHz	______	12 kHz
	19. 3 kHz Resolution BW	2.4 kHz	______	3.6 kHz
	20. 1 kHz Resolution BW	0.8 kHz	______	1.2 kHz

Table 4-10. Performance Test Record (Cont'd)

Para. No.	Test Description	Results Min.	Results Actual	Results Max.
4-16.	**Resolution Bandwidth Selectivity Test**			
	23. 3 MHz Resolution BW Selectivity		______	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 Test**			
	2. Average Noise Level, 1 MHz		______	−107 dBm
	3. Average Noise Level 350 MHz		______	−107 dBm
4-18.	**Spurious Responses Test**			
	9. Harmonic Distortion			
	2nd harmonic	−70 dB	______	
	3rd harmonic	−70 dB	______	
	17. Third Order Intermodulation Distortion, 30 MHz input signals	−70 dB	______	
	18. Second Order Itermodulation Distortion, 30 MHz input signals ($f_2 - f_1$)	−70 dB	______	
	20. Second Order Intermodulation Distortion, 3 MHz input signals ($f_1 + f_2$)	−70 dB	______	
	25. Third Order Intermodulation Distortion, 0.9 MHz input signals	−60 dB	______	
	26. Second Order Intermodulation Distortion, 0.9 MHz input signals ($f_2 - f_1$)	−60 dB	______	

Table 4-10. Performance Test Record (Cont'd)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-18.	**Spurious Responses Test (Cont'd)** 27. Second Order Intermodulation Distortion, 0.9 MHz input signals ($f_1 + f_2$)	−60 dB	______	
4-19.	**Residual Responses Test** 11. Residual Responses .1 to 350 MHz		______	−100 dBm
4-20.	**Frequency Response Test** 16. Frequency Response 10 kHz to 350 MHz		______	1.5 dB p-p.
4-21.	**Amplitude Accuracy Switching Between Bandwidths Test** 6. 3 MHz to 300 kHz (overall variation) 3 MHz to 1 kHz (overall variation)	−0.5 dB −1.0 dB	______ ______	+0.5 dB +1.0 dB
4-22.	**Input Attenuator Accuracy Test** 4. Error Between Adjacent Settings 5. Error Over Full 50 dB Range		______ ______	±0.5 dB ±1.0 dB (2.0 dB p-p.)
4-23.	**Reference Level Accuracy Test** 11. Reference Level Accuracy in Log 14. Reference Level Accuracy in LIN		______ ______	±1.5 dB (3 dB) ±1.5 dB (3 dB)

Table 4-10. Performance Test Record (Cont'd)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-24.	**Amplitude Log Display Test**			
	10. Error Between Adjacent Readings		______	±1.0 dB (±10 mV)
	11. Error Over Full 70 dB Display Range		______	±1.5 dB (±15 mV)
4-25.	**Calibrator Accuracy Test**			
	2. CAL OUTPUT Frequency	249.950 MHz	______	250.050 MHz
	9. CAL OUTPUT Amplitude	−31 dBm	______	−29 dBm

ADJUSTMENTS

SECTION V
ADJUSTMENTS

5-1 INTRODUCTION

5-2. This section describes adjustments required to return the Spectrum Analyzer to peak operating condition when repairs are required. Table 5-1 lists all of the adjustments by adjustment name, reference designator, adjustment paragraph, service sheet number, and description. Included in this section are test setups, and check and adjustment procedures. Adjustment location photographs are contained in the last foldout in Section VIII.

5-3. Data taken during adjustments should be recorded in the spaces provided. Comparison of initial data with data taken during periodic adjustments assists in preventive maintenance and troubleshooting.

5-4. EQUIPMENT REQUIRED

5-5. Table 1-5 contains a tabular list of test equipment and test accessories required in the adjustment procedures. In addition, the table contains the required minimum specifications and a suggested manufacturers model number.

5-6. Blade Tuning Tools

5-7. For adjustments requiring a non-metallic tuning tool, use fiber tuning tool, HP part number 8710-0033. In situations not requiring non-metallic tuning tools, an ordinary small screwdriver or other suitable tool is sufficient. No matter what tool is used, never try to force any adjustment control in the analyzer. This is especially critical when tuning variable slug-tuned inductors, and variable capacitors.

5-8. Table 1-4, Equipment Available for Servicing 8557A contains a detailed description of service items. Items may be ordered separately.

5-9. Extender Cable Installation

5-10. Turn the front panel LOCK control fully counterclockwise. Pull the 8557A out of the oscilloscope mainframe.

5-11. Place the plate end of the HP 5060-0303 extender cable assembly in the oscilloscope mainframe so the extender cable assembly plug will mate with the oscilloscope mainframe jack. Guide the plate into the slotted side rail at the top of the plug-in compartment of the oscilloscope mainframe. Press firmly into place so the plug makes 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. Connect the orange and yellow leads from extender cable assembly to the small printed circuit board mounted on the 8557A left guide rail.

5-13. FACTORY SELECTED COMPONENTS

5-14. Table 5-2 contains a list of factory selected components by reference designation, schematic diagram location, and basis of selection. Factory selected components are designated by an asterisk (*) on the schematic diagrams in Section VIII.

5-15. RELATED ADJUSTMENTS

5-16. 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 repairing or replacing the circuit. The troubleshooting procedures and Table 5-3 specify the required adjustments.

WARNING

The adjustments in this section require the 8557A to be removed from the oscilloscope mainframe and connected through the extender cable assembly. Be very careful; the energy at some points in the instrument may, if contacted, cause personal injury. The adjustments in this section should be performed only by a skilled person who knows the hazard involved.

Table 5-1. Adjustable Components

Adjustment Name	Reference Designator	Adjustment Paragraph	Service Sheet	Description
L1, L2, L3 L4, L5	A2L1 thru A2L5	5-19	2	Adjust high frequency flatness and cutoff frequency of input lowpass filter.
1K BW	A3R1	5-21	9	Adjusts bandwidth between 3 dB points for RESOLUTION BW setting of 1 kHz.
30K BW	A3R2	5-21	9	Adjusts bandwidth between 3 dB points for RESOLUTION BW setting of 30 kHz.
100K BW	A3R3	5-21	9	Adjusts bandwidth between 3 dB points for RESOLUTION BW setting of 100 kHz.
1M BW	A3R4	5-21	9	Adjusts bandwidth between 3 dB points for RESOLUTION BW setting of 1 MHz.
2 MS	A3R5	5-25	8	Adjusts sweep ramp to calibrate 2 ms per division sweep time.
1 MS	A3R6	5-25	8	Adjusts sweep ramp to calibrate 1 ms per division sweep time.
+10 V	A3R7	5-25	8	Adjusts +10 volt supply. This adjustment must be performed while spectrum analyzer is still cold, during first five minutes after turn on.
+14	A4R6	5-17	11	Adjusts 14 volt supply to 14 volts
350 MHz	A4R13	5-17	11	Adjusts display to 350 MHz when digital readout reads 350 MHz.
350 BLANK	A4R41	5-17	11	Adjusts oversweep blanking for 10 MHz at 350 MHz.
0 BLANK	A4R42	5-17	11	Adjusts oversweep blanking for 10 MHz at 0 MHz.
OFFSET	A4R47	5-17	11	Adjusts offset current in shaping network.
0/40	A4R60	5-17	11	Adjusts shaping from 0 to 40 MHz.

Table 5-1. Adjustable Components (Cont'd)

Adjustment Name	Reference Designator	Adjustment Paragraph	Service Sheet	Description
40/80	A4R63	5-17	11	Adjusts shaping from 40 to 80 MHz.
80/120	A4R69	5-17	11	Adjusts shaping from 80 to 120 MHz.
120/160	A4R75	5-17	11	Adjusts shaping from 120 to 160 MHz.
160/200	A4R79	5-17	11	Adjusts shaping from 160 to 200 MHz.
200/240	A4R83	5-17	11	Adjusts shaping from 200 to 240 MHz.
240/280	A4R86	5-17	11	Adjusts shaping from 240 to 280 MHz.
280/320	A4R89	5-17	11	Adjusts shaping from 280 to 320 MHz.
320/350	A4R92	5-17	11	Adjusts shaping from 320 to 350 MHz.
BP1 BP2	A5C4 A5C6	5-18	3	Adjusts center frequency of 500 MHz bandpass filter for second LO.
BP3 BP4 BP5 BP6	A5C7 A5C5 A5C3 A5C2	5-18	3	Adjusts center frequency of 521.4 MHz bandpass filter for first IF.
FREQ ADJ	A5A1L3	5-18	3	Adjusts frequency of 250 MHz oscillator.
L6	A5A1L6	5-18	3	Adjusts center frequency of 500 MHz doubler.
CAL ADJ	A5A1R11	5-18	3	Adjusts amplitude of −30 dBm CAL OUTPUT signal.
SLOPE LO	A6R15	5-19	3	Compensates for input mixer frequency response 0 — 120 MHz.
SLOPE MID	A6R16	5-19	3	Compensates for input mixer frequency response 120 — 240 MHz.
SLOPE HI	A6R17	5-19	3	Compensates for input mixer frequency response 240 — 350 MHz.

Table 5-1. Adjustable Components (Cont'd)

Adjustment Name	Reference Designator	Adjustment Paragraph	Service Sheet	Description
CTR CTR	A7A2L1 A7A2L2	5-19	2	Adjusts center frequency of first IF bandpass, which slightly affects flatness between 0 and 120 MHz.
LC CNTR	A8C1	5-20	4	Adjusts centering of LC bandwidth filter to coincide with center of crystal bandwidth filter.
XTL SYM	A8C2	5-20	4	Adjusts symmetry of crystal bandwidth filter (in 30 kHz BW).
XTL CNTR	A8C3	5-20	4	Adjust centering and amplitude of crystal bandwidth filter (in 30 kHz BW). Affects adjustment of LC CNTR.
LC CNTR	A8C4	5-20	4	Adjusts centering of LC bandwidth filter to coincide with center of crystal bandwidth filter.
XTL SYM	A8C5	5-20	4	Adjusts symmetry of crystal bandwidth filter (in 30 kHz BW).
XTL CNTR	A8C6	5-20	4	Adjust centering and amplitude of crystal bandwidth filter (in 30 kHz BW). Affects adjustment of LC CNTR.
LC	A8R1	5-20	4	Adjusts feedback in LC circuit of bandpass filter.
XTL	A8R2	5-20 5-21	4	Adjusts feedback in crystal circuit of bandpass filter.
40 dB	A9R1	5-23	5	Adjusts 40 dB step gain.
20 dB	A9R2	5-23	5	Adjusts 20 dB step gain.
10 dB	A9R3	5-23	5	Adjusts 10 dB step gain.
GAIN	A9R4	5-22	5	Adjusts overall gain of S Gain Assembly.
0 dB	A9R5	5-23	5	Adjusts to calibrate 0 dB position of REF LEVEL FINE control.
—12 dB	A9R6	5-23	5	Adjusts to calibrate —12 dB position of REF LEVEL FINE control.

Table 5-1. Adjustable Components (Cont'd)

Adjustment Name	Reference Designator	Adjustment Paragraph	Service Sheet	Description
LC CNTR	A10C1	5-20	6	Adjusts centering of LC bandwidth filter to coincide with center of crystal bandwidth filter.
XTL SYM	A10C2	5-20	6	Adjusts symmetry of crystal bandwidth filter (in 30 kHz BW).
XTL CNTR	A10C3	5-20	6	Adjust centering and amplitude of crystal bandwidth filter (in 30 kHz BW). Affects adjustment of LC CNTR.
LC CNTR	A10C4	5-20	6	Adjusts centering of LC bandwidth filter to coincide with center of crystal bandwidth filter.
XTL SYM	A10C5	5-20	6	Adjusts symmetry of crystal bandwidth filter (in 30 kHz BW).
XTL CNTR	A10C6	5-20	6	Adjust centering and amplitude of crystal bandwidth filter (in 30 kHz BW). Affects adjustment of LC CNTR.
LC	A10R1	5-20	6	Adjusts feedback in LC circuit of bandpass filter.
XTL	A10R2	5-20 5-21	6	Adjusts feedback in crystal circuit of bandpass filter.
LOG GAIN	A11R1	5-24	7	Adjusts DC offset circuitry at output of Log Amplifier for 10 dB steps in Log.
LOG-LIN	A11R2	5-24	7	Adjusts for Log to linear full screen display translations.
LIN GAIN	A11R3	5-24	7	Adjusts Log Amplifier for 10 dB gain steps when in Linear. Affects adjustment of LOG/LIN.
1 dB OFFSET	A12R1	5-31	10	Adjusts for equal amplitude displayed in 10 dB/DIV and 1 dB/DIV for a given input.

Table 5-2. Factory Selected Components

COMPONENT	SERVICE SHEET	BASIS OF SELECTION
A3R55	8	Selected to properly set low end of sweep ramp (−5 volts).
A3R58	8	Selected to properly set high end of sweep ramp (+5 volts).
A3R74	9	Selected for 0 volts at A3TP8 with START − CENTER switch in START, 100 MHz/DIV, single scan mode (no sweep).
A3R110	9	Selected to optimize 300 kHz bandwidth.
A3R115	9	Selected to optimize 1 MHz bandwidth.
A3R116	9	Selected for optimum automatic sweep time with VIDEO FILTER on (but not in detent).
A4R46	11	Selected to properly set offset current in shaping network for first LO.
A4R61	11	Selected for first LO shaping from 0 to 40 MHz.
A4R64	11	Selected for first LO shaping from 40 to 80 MHz.
A4R67	11	Selected for first LO shaping from 0 to 40 MHz.
A4R70	11	Selected for first LO shaping from 80 to 120 MHz.
A4R73	11	Selected for first LO shaping from 40 to 80 MHz.
A4R76	11	Selected for first LO shaping from 120 to 160 MHz.
A4R77	11	Selected for first LO shaping from 80 to 120 MHz.
A4R80	11	Selected for first LO shaping from 120 to 160 MHz.
A4R81	11	Selected for first LO shaping from 160 to 200 MHz.
A4R84	11	Selected for first LO shaping from 200 to 240 MHz.
A4R87	11	Selected for first LO shaping from 240 to 280 MHz.
A4R90	11	Selected for first LO shaping from 280 to 320 MHz.
A4R93	11	Selected for first LO shaping from 320 to 350 MHz.
A4R97	11	Selected for first LO shaping close to 350 MHz.
A5A4C1	3	Selected for minimum conversion loss and distortion products.
A6R2	3	Selected for proper location of break points in slope compensation network.

Table 5-2. Factory Selected Components (Cont'd)

COMPONENT	SERVICE SHEET	BASIS OF SELECTION
A6C4	3	Selected to improve stability of 21.4 MHz preamp.
A6R5	3	Selected to set overall gain of RF front end.
A7A1C10	2	Selected for optimum stability of first LO.
A8R49	4	Selected to optimize 100 kHz bandwidth amplitude in second pole of A8 Bandwidth Filter.
A10R49	6	Selected to optimize 100 kHz bandwidth amplitude in second pole of A10 Bandwidth Filter.
A11R6	7	Selected for proper gain of Q3/Q4, Q5/Q6 IF gain stages in linear mode with −10V at IFG6 (Eighth IF gain step).
A11R8	7	Selected for best Log fidelity curve at 700mV and above (upper portion of Log curve).
A11R16	7	Selected for full screen translation from Log to linear mode.
A11R23	7	Selected for best Log fidelity curve at 700mV and above (opposite sense of A14R8).
A11R46	7	Selected for best Log Fidelity curve at 600 mV and above (upper portion of Log curve).
A11R65	7	Selected for best Log Fidelity at 500 mV.
A11R74	7	Selected for proper gain of Q9/Q10 IF gain stage in linear mode with −10 V at IFG4 (sixth IF gain step).
A11R82	7	Selected for best Log fidelity curve at 400mV and below (lower portion of Log curve).
A11R102	7	Selected for best Log fidelity curve at 300mV and below (lower portion of Log curve).
A11R119	7	Selected for best Log fidelity curve at 200mV and below (lower portion of Log curve).

Table 5-3. Related Adjustments

Assembly Changed or Repaired		Perform the Following Related Adjustments	Paragraph Number
A1	Front Panel	A9R5, A9R6	5-23
A1A3	Input Attenuator	A2L1, A2L2, A2L3, A2L4, A2L5, A6R15, A6R16 A6R17	5-19
A2	Input Low-pass Filter	A2L1, A2L2, A2L3, A2L4, A2L5, A6R15, A6R16, A6R17	5-19
A3	Sweep Generator	A3R1, A3R2, A3R3, A3R4, A3R5, A3R6, A3R7	5-21 5-25
A4	Frequency Control	A4R6, A4R13, A4R41, A4R42, A4R47, A4R60, A4R63, A4R69, A4R75, A4R79, A4R83, A4R86, A4R89, A4R92	5-17
A5	Second Converter	A5BP1, A5BP2, A5BP3, A5BP4, A5BP5, A5BP6, A5A1L2, A5A1L5, A5A1R11	5-18
A6	21.4 MHz Preamp	A6R15, A6R16, A6R17	5-19
A7A1	First LO	A2L1, A2L2, A2L3, A2L4, A3L5, A4R6, A4R13, A4R41, A4R42, A4R47, A4R60, A4R63, A4R69, A4R75, A4R79, A4R83, A4R86, A4R89, A4R92, A6R15, A6R16, A6R17, A7A1L1, A7A1L2	5-17 5-19
A7A2	First Mixer	A2L1, A2L2, A2L3, A2L4, A2L5, A6R15, A6R16 A6R17, A7A1L1, A7A1L2	5-19
A8 & A10*	Band-Width	A8C1, A8C2, A8C3, A8C4, A8C5, A8C6, A8R1, A8R2, A10C1, A10C2, A10C3, A10C4, A10C5, A10C6, A10R1, A10R2 A3R1, A3R2, A3R3, A3R4	5-20 5-21
A9	Step Gain	A9R1, A9R2, A9R3, A9R4, A9R5, A9R6,	5-22 5-23
A11	Log Amplifier	A11R1, A11R2, A11R3 A12R1	5-24 5-26
A12	Vertical Driver and Blanking	A12R1	5-26
A13	Mother Board	No related adjustments.	

*A8 and A10 Bandwidth Filter Assemblies contain a matched set of crystals. These two must be treated as a matched pair when replacement is necessary.

ADJUSTMENTS

5-17. FREQUENCY CONTROL ADJUSTMENTS

REFERENCE:

Service Sheet 11.

DESCRIPTION:

The +14.0 Vdc supply is adjusted and the −11.5 Vdc supply is checked. The shaping network for the First LO is adjusted to give the correct frequency readout. Oversweep blanking is adjusted.

EQUIPMENT:

Digital Voltmeter .... HP 34740A/34702A
Comb Generator .... HP 8406A
Oscilloscope (mainframe) .... HP 182C

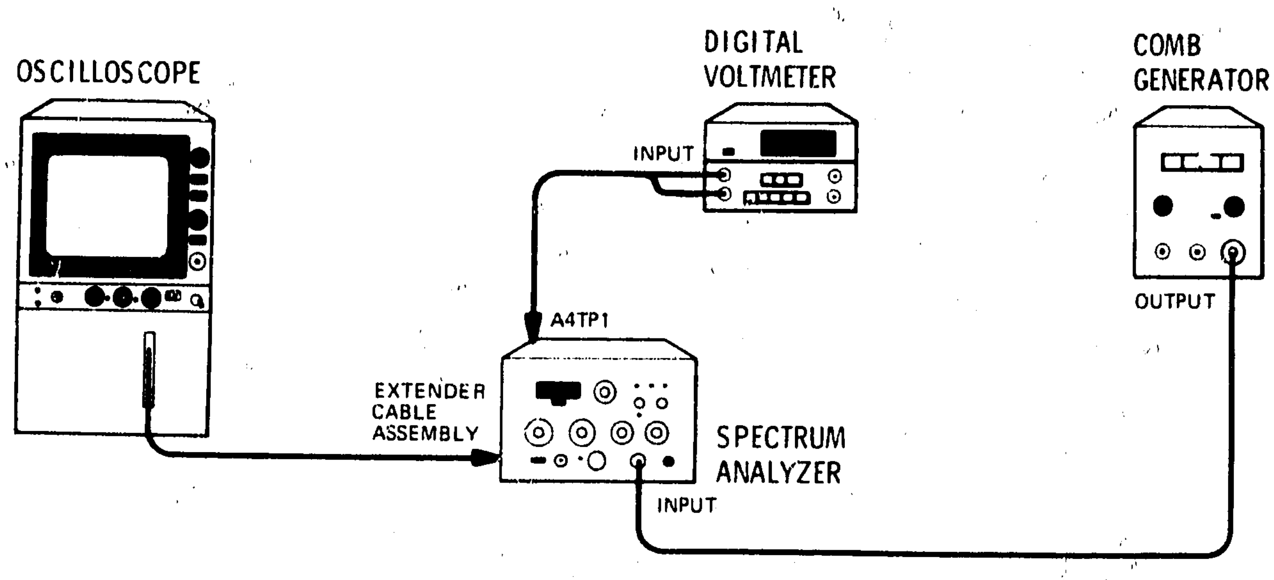


Figure 5-1. Frequency Control Adjustment Test Setup.

PROCEDURE:

1. Connect equipment as shown in Figure 5-1. Connect digital voltmeter to A4TP1.
2. Adjust +14 control A4R6 (if necessary) for digital voltmeter reading of +14.000 ±.010 Vdc.
3. Connect digital voltmeter to A4TP4.

ADJUSTMENTS

5-17. FREQUENCY CONTROL ADJUSTMENTS (Cont'd)

4. Set controls as follows:

8557A:

START — CENTER	CENTER
FREQUENCY SPAN/DIV	0
RESOLUTION BW	1 kHz, OPTIMUM
TIME/DIV	AUTO
TRIGGER	FREE RUN
VIDEO FILTER	Fully counterclockwise
10 dB — 1 dB — LIN	10 dB/DIV
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	0

5. Adjust 8557A TUNING control for a digital voltmeter reading of 0.100 ±.010 Vdc. Ensure that the spectrum analyzer display is exactly 10 divisions wide (if not, adjust 8557A rear panel HORIZ GAIN control). Adjust the oscilloscope HORIZONTAL POSITION control to center signal on display.

6. Without changing the TUNING controls, set FREQ SPAN/DIV control to 5 MHz and RESOLUTION BW control to 100 kHz.

7. Adjust OFFSET control A4R47 to align the 200 MHz comb tooth with the 10th graticule line (from the left side) (See Figure 4-3). It may be necessary to start with a larger FREQUENCY SPAN/DIV to bring the comb tooth on screen. The 200 MHz tooth can be identified by its amplitude in the full scan position. Do not adjust the tune controls.

NOTE

If the range of OFFSET control A4R47 is insufficient, select a new value of A4R46* as follows:

If OFFSET control A4R47 is fully clockwise, increase A4R46* by 10%.

If OFFSET control A4R47 is fully counterclockwise, decrease A4R46* by 10%.

Continue this process until the 200 MHz comb is on the 10th graticule line. (See Figure 4-3.)

8. Change the comb generator to a 10 MHz comb output. Adjust 160/200 control A4R70 to give an eight division spacing between the 160 MHz tooth and the 200 MHz tooth. Use OFFSET control A4R47 to keep the 200 MHz tooth on the tenth division. The fine TUNING control may be used to align the 200 MHz tooth exactly on the tenth division after A4R47 has it within 0.05 divisions. If the comb teeth are too are apart to be adjusted, decrease value of A4R81* by 30%. If the comb teeth are too close, increase value of A4R81* by 30%. Continue this process until there is an eight division spacing between the 160 MHz tooth and the 200 MHz tooth.

9. Adjust 8557A TUNING control to set the 200 MHz comb tooth on the second graticule line. Adjust 200/400 control A4R83 to set the 240 MHz tooth on the tenth graticule line. If the comb teeth are too far apart to be adjusted, increase value of A4R84* as necessary. If the correct spacing cannot be obtained with the value of A4R84* at 464K or less, remove A4R84* from the board.

ADJUSTMENTS

5-17. FREQUENCY CONTROL ADJUSTMENTS (Cont'd)

10. Repeat steps 8 and 9, increasing the frequency by 40 MHz at each step. Then return to 160 MHz on the 10th graticule line, and adjust 120/160 control A4R75 to set the 120 MHz comb tooth on the second graticule line. Decrease frequency in 40 MHz steps, continuing as above, with the following addition. If the comb teeth are too close together to be properly adjusted, increase the value of the appropriate resistor until it equals 196K. If even more compensation is needed, decrease the resistor called out for that purpose in Table 5-4. If this resistor is decreased, it will be necessary to return to the beginning (step 7) and make slight readjustments. Use Table 5-4 as a guide; see Note 1 with Table 5-4.

Table 5-4. Linearity Adjustment

Frequency of Comb Tooth on 2nd Graticule Line	Frequency of Comb Tooth on 10th Graticule Line	Linearity Adjustment	Primary Linearity Adjustment Range	Secondary Linearity Adjustment Range (Note 3)
160 MHz	200 MHz	160/200 (A4R79)	A4R81*	
200 MHz	240 MHz	200/240 (A4R83)	A4R84*	
240 MHz	280 MHz	240/280 (A4R86)	A4R87*	
280 MHz	320 MHz	280/320 (A4R89)	A4R90*	
320 MHz	350 MHz	320/350 (A4R92)	A4R93*	
120 MHz	160 MHz	120/100 (A4R75)	A4R76*	A4R80*
80 MHz	120 MHz	80/120 (A4R69)	A4R70*	A4R77*
40 MHz	80 MHz	40/80 (A4R63)	A4R64*	A4R73*
LO Feedthrough	40 MHz	0/40 (A4R60)	A4R61*	A4R67*

NOTES

1. At least one resistor of each pair (e.g. A4R76* and A4R80*) should be 196K.
2. The 350 MHz comb tooth is set on the eighth graticule line. If necessary, A4R97* can be changed to improve linearity between 320 MHz and 350 MHz.
3. This resistor is changed only if the matching Primary resistor has reached 196K and more adjustment range is needed.

11. Repeat the above procedure from step 4 through 10, until no adjustments are required.

12. Set 8557A FREQ SPAN/DIV control to 1 MHz. Adjust TUNING control for FREQUENCY indication of 000.0 MHz. Adjust 8557A front panel FREQ ZERO control to position LO feedthrough at center of screen, ±0.5 MHz (±0.5 div).

13. Set 8755A FREQ SPAN/DIV control to 5 MHz. Adjust 0 BLANK control A4R42 to blank the first three divisions (from left) of the display, leaving 2 divisions (10 MHz) of unblanked baseline to left of LO feedthrough.

14. Set FREQUENCY control to 350 MHz. Adjust 350 MHz control A4R13 to position 350 MHz comb tooth at center of screen, ±0.5 MHz (±0.5 div).

5-17. FREQUENCY CONTROL ADJUSTMENTS (Cont'd)

15. Adjust 350 BLANK control A4R41 to blank the last 3 (from left) divisions of the display, leaving 2 divisions (10 MHz) of unblanked baseline above the 350 MHz signal.

16. Set the center frequency to 0 MHz and check the centering of the LO feedthrough. If it is not within ±0.5 MHz, repeat steps 12 through 14 until no adjustment is necessary.

5-18. SECOND CONVERTER LO, CAL OUTPUT, AND BANDPASS ADJUSTMENT.

REFERENCE:

Service Sheet 3

DESCRIPTION:

The Second Converter is adjusted for maximum 250 MHz oscillator output, to set the Cal Output to −30 dBm, and to adjust symmetry and amplitude of its bandpass. Care of adjustments is taken to maintain low-distortion performance of the analyzer.

NOTE

The adjustments must be performed in the order shown and all adjustments must be performed, unless otherwise noted.

EQUIPMENT:

Signal Generator	HP 8640B
Power Meter	Hp 435A
Power Sensor	HP 8481A
10 dB Step Attenuator	HP 355D
Adapter, N-Male to BNC female	HP 1250-0780
Extender Cable Assembly	HP 5060-0303

PROCEDURE:

1. Set 8557A controls as follows:

START — CENTER	CENTER
TUNING	250 MHz
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	−20
10 dB/DIV — 1 dB/DIV — LIN	1 dB/DIV
FREQ SPAN/DIV	1 MHz
RESOLUTION BW	300 KHz
TIME/DIV	AUTO
TRIGGER	FREE RUN
BASE LINE CLIPPER	Fully counterclockwise
VIDEO FILTER	Fully counterclockwise
REF LEVEL FINE	−7 dB

ADJUSTMENTS

5-18. SECOND CONVERTER LO, CAL OUTPUT, AND BANDPASS ADJUSTMENT. (Cont'd)

2. Connect CAL OUTPUT to INPUT. Adjust TUNING control to position the trace at the center of the display. Adjust REF LEVEL FINE control for a display 5 divisions high.

3. Using an insulated tuning screwdriver, adjust FREQ ADJ control A5A1L3 (bottom of A5 Second Converter) for maximum display amplitude. Do not readjust this control without performing steps 4 through 12.

4. Connect equipment as shown in Figure 5-2, connecting thermistor mount to step attenuator. Set attenuator to 0 dB. Set signal generator frequency to 250.0 MHz.

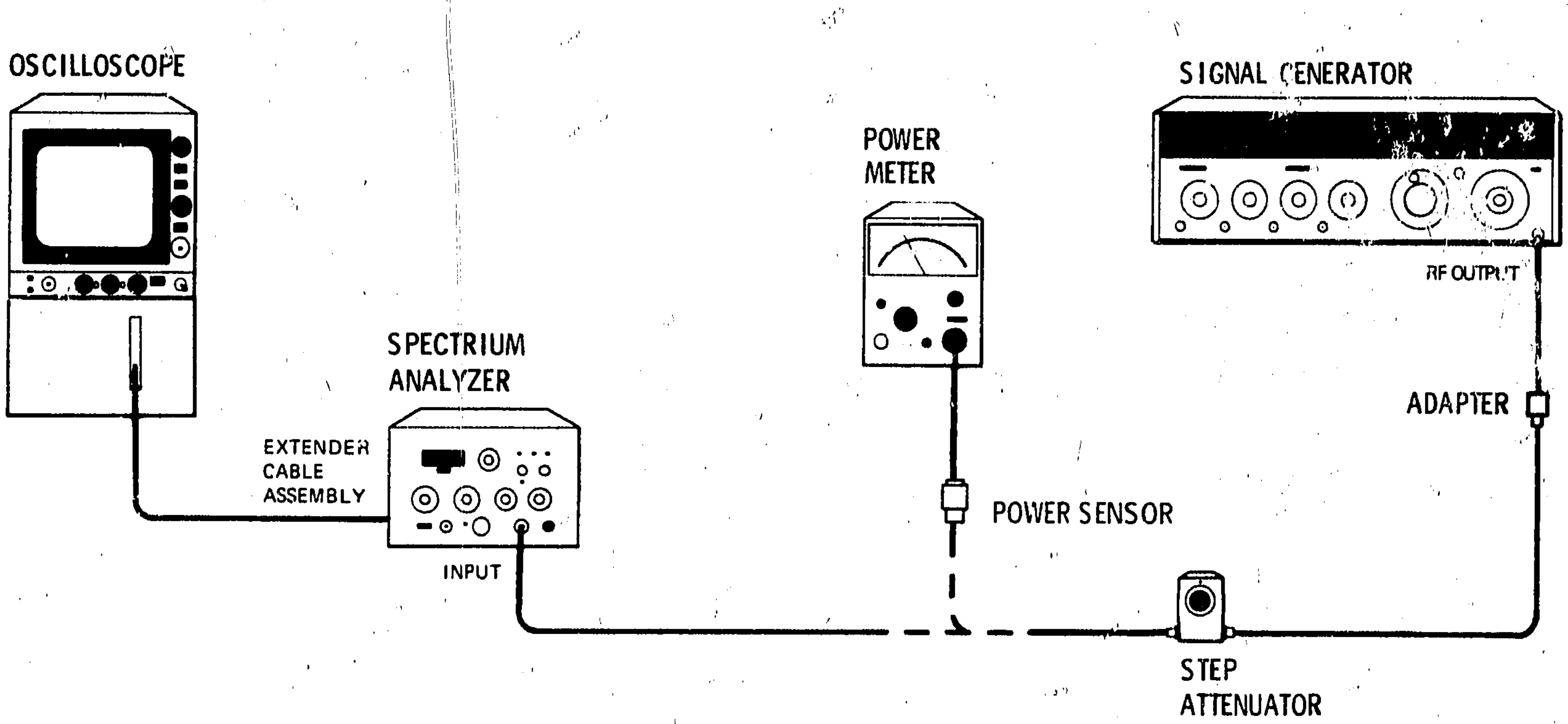


Figure 5-2. Second Converter Adjustment Test Setup

5. Adjust signal generator for 0 dBm ±0.05 dBm as indicated on power meter. Connect 8557A. Set attenuator to 30 dB attenuation.

6. Adjust REF LEVEL FINE control to give 7 division vertical reference.

7. Disconnect the attenuator and connect CAL OUTPUT to INPUT. Using an insulated tuning screwdriver, adjust CAL ADJ control A5A1R11 to give a vertical display of 7 divisions ±0.1 division.

NOTE

CAL ADJ control A5A1R11 has no interaction and may be adjusted any time.

8. Adjust A5A1L6, top side of Second Converter for maximum amplitude on display.

9. Set controls as follows:

REFERENCE LEVEL dBm	0
REF LEVEL FINE	0
10 dB/DIV — 1 dB/DIV — LIN	10 dB/DIV
FREQ SPAN/DIV	5 MHz
RESOLUTION BW	3 MHz

ADJUSTMENTS

5-18. SECOND CONVERTER LO, CAL OUTPUT, AND BANDPASS ADJUSTMENT. (Cont'd)

10. Connect signal generator through step attenuator to 8557A INPUT. Set attenuator to 0 dB.

11. Adjust BP1 control C4 and BP2 control C6 (Second Converter LO Bandpass Filters) and BP3 control C7, BP4 control C5, BP5 control C3, and BP6 control C2 (Second Converter IF Bandpass Filter) for maximum amplitude and symmetry of the 3 MHz bandwidth filter as shown on display. Repeat adjustments as necessary for optimum response. Tighten locknuts when adjustments are completed.

12. Turn VIDEO FILTER control to maximum clockwise without being in MAX detent position. Observe any spurious signals at 10.7 MHz (2.14 divisions) below the main signal. If a spurious signal is present, slightly adjust BP2 control C6 for minimum spurious amplitude. Spurious signal amplitude must be at least 70 dB below the main signal, taking care not to sacrifice 3 MHz bandwidth symmetry more than necessary.

NOTE

This adjustment must be performed last whenever the adjustments called for in steps 3, 8, and 11 are performed. Tighten the locknut securely when finished.

5-19. FLATNESS ADJUSTMENT, INCLUDING SLOPE COMPENSATION, INPUT LOW PASS FILTER, AND FIRST CONVERTER BANDPASS.

REFERENCE:

Service Sheet 2 and 3.

DESCRIPTION:

Slope compensation adjusts for changes in first converter conversion loss as a function of frequency, in three sections. Input low pass filter adjustments affect flatness above 250 MHz. First converter bandpass affects flatness below 100 MHz.

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86210A
Power Meter	HP 435A
Power Sensor	HP 8481A
Extender Cable Assembly	HP 5060-0303

PROCEDURE:

1. Set 8557A controls as follows:

OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	0
10 dB/DIV — 1 dB/DIV — LIN	1 dB/DIV
FREQ SPAN/DIV	F
RESOLUTION BW	3 MHz
TIME/DIV	AUTO
TRIGGER	FREE RUN
BASE LINE CLIPPER	Fully counterclockwise
VIDEO FILTER	Fully clockwise
TUNING	Fully counterclockwise

ADJUSTMENTS

5-19. FLATNESS ADJUSTMENT, INCLUDING SLOPE COMPENSATION, INPUT LOW PASS FILTER, AND FIRST CONVERTER BANDPASS. (Cont'd)

2. Connect equipment as shown in Figure 5-3, connecting thermistor mount to RF plug-in. Set RF power to −10 dBm.

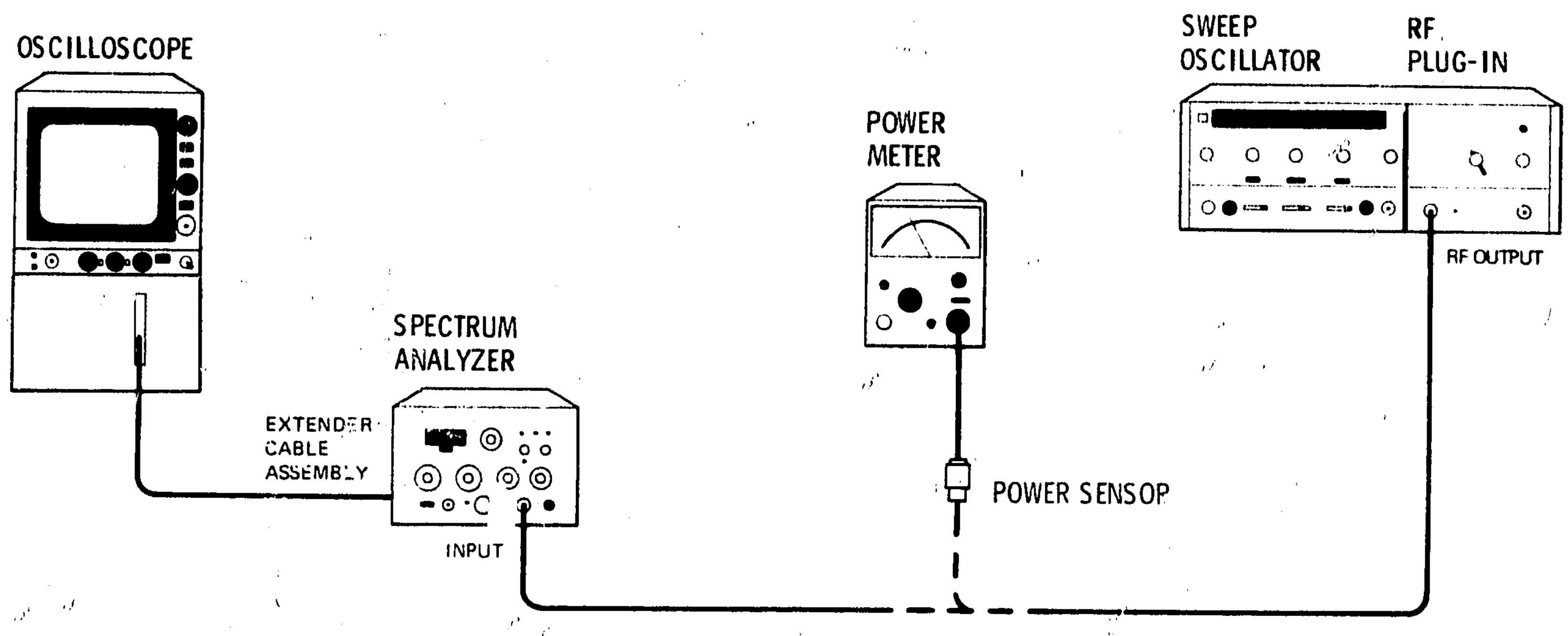


Figure 5-3. Flatness Adjustment Test Setup

3. Measure with power meter the flatness of the sweep oscillator from 10 MHz to 350 MHz to within ±0.25 dB. Note leveled flatness variations, and be prepared to subtract out flatness errors in subsequent steps, if required.

4. Connect output of RF plug-in to 8557A INPUT connector.

5. Use REF LEVEL FINE control (and OPTIMUM INPUT control if necessary) to place the trace on the screen. Manually tune the sweep oscillator over the range of 3 MHz to 350 MHz, and set the highest amplitude displayed to the 7th graticule line from the bottom.

6. Set sweep oscillator to automatic sweep mode and set sweep speed low enough to easily follow signal. Sweep the full range from 3 MHz to 350 MHz.

7. Adjust the A6 SLOPE compensation controls (LO, MID, HI) to increase or decrease the slope in one third of the full span range, while changing at most the level of the other two thirds. SLOPE LO control A6R15 affects the lowest frequencies, SLOPE MID control A6R16 affects the middle range, and SLOPE HI control A6R17 affects the high frequencies.

8. If the flatness of the low frequency portion of the band is still unsatisfactory, remove hole plugs on the side of A7 First Converter Assembly and adjust A7L1 and A7L2 Bandpass Filter adjustments, using insulated tuning screwdriver. A7L1 and A7L2 should be alternately adjusted for maximum signal level across the band, then slightly readjusted to improve flatness as required at the low frequency end of the band. The hole plugs must be replaced to prevent RF1 leakage into the first converter.

ADJUSTMENTS

5-19. FLATNESS ADJUSTMENT, INCLUDING SLOPE COMPENSATION, INPUT LOW PASS FILTER, AND FIRST CONVERTER BANDPASS. (Cont'd)

9. If the flatness of the high frequency portion of the band is still unsatisfactory, adjust A2L1, A2L2, A2L3, A2L4, and A2L5 input low pass filter adjustments accessible through the side panel. Use an insulated tuning screwdriver. Take care not to drive the brass tuning slugs out of the coil forms. Iterate these five adjustments and A5R17 SLOPE HI control to achieve optimum flatness at the high frequency end of the band.

10. Repeat steps 7, 8, and 9 until peak-to-peak flatness variation is less than 1.5 dB. If necessary, subtract out the unflatness of the RF plug-in measured in step 3.

11. If the A2 input low pass filter or A6R17 SLOPE HI control were adjusted, the following precautionary check should be made: The average noise level at 350 MHz as described in paragraph 4-17, step 3. If it is out of specifications, make further adjustments on A2 Input Low Pass Filter and A6R17 SLOPE HI control to bring it into a specification and maintain an overall peak-to-peak flatness of 1.5 dB.

5-20. LC AND CRYSTAL BANDWIDTH FILTER ADJUSTMENTS

REFERENCE:

Service Sheets 4 and 6.

DESCRIPTION:

The LC and crystal bandwidth filter circuits are adjusted for symmetry, centering, and peak. Three dB bandwidths are adjusted on A3 Sweep Generator Assembly in Paragraph 5-21.

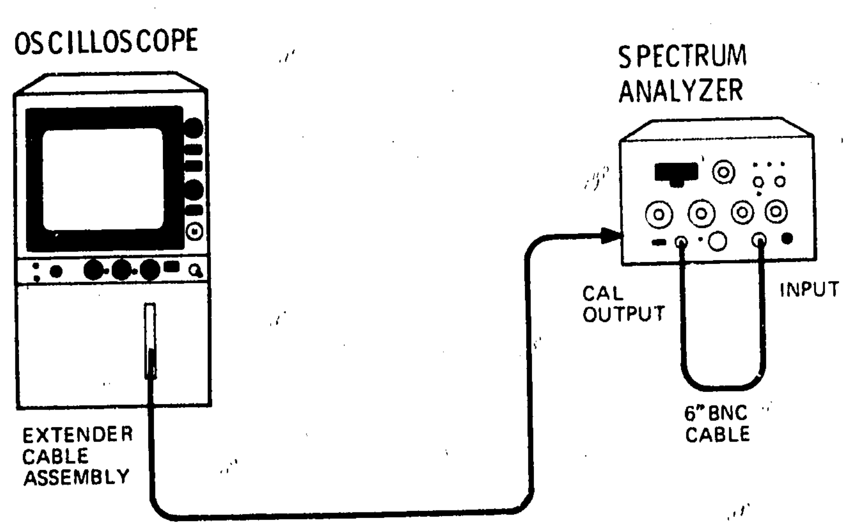


Figure 5-4. LC and Crystal Bandwidth Filter Adjustments Test Setup

ADJUSTMENTS

5-20. LC AND CRYSTAL BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

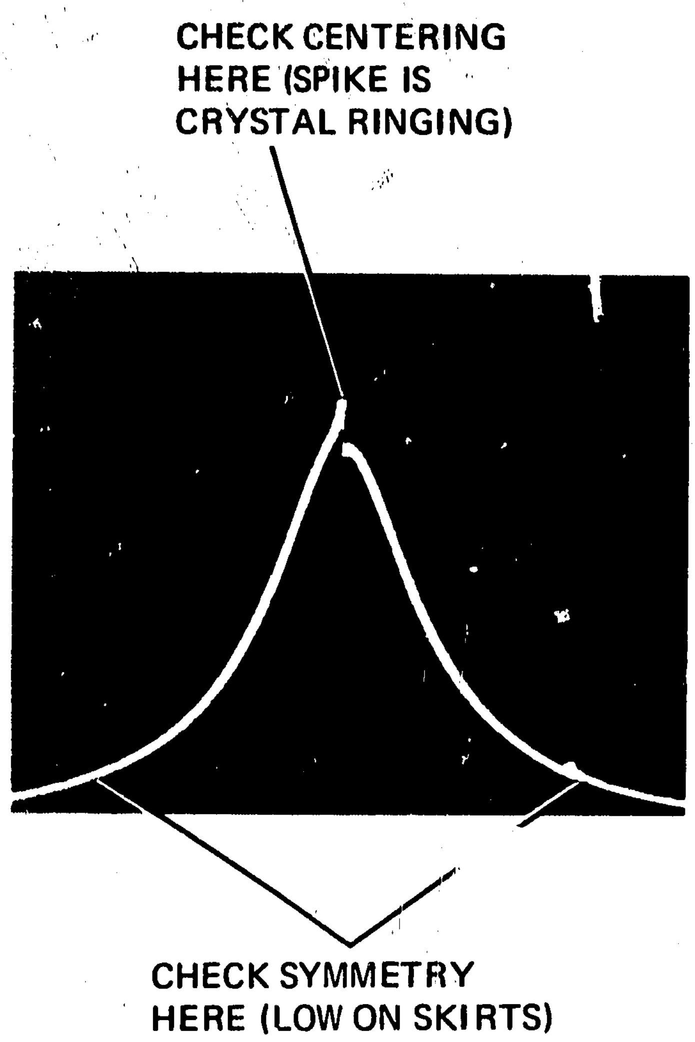


Figure 5-5. Crystal Symmetry and Crystal Centering Display

EQUIPMENT:

BNC Cable, 6 Inch .... HP 10502A

PROCEDURE:

1. Set spectrum analyzer controls as follows:

START — CENTER .... CENTER
TUNING .... 250 MHz
FREQ SPAN/DIV .... 20 kHz
RESOLUTION BW .... 30 kHz
OPTIMUM INPUT .... −40 (zero attenuation)
REFERENCE LEVEL dBm .... −20
10 dB/DIV — 1 dB/DIV — LIN .... LIN
SWEEP TIME/DIV .... 5 mSEC
SWEEP TRIGGER .... FREE RUN

2. Connect equipment as shown in Figure 5-4. Center signal with TUNING control. Using REF LEVEL FINE control, set signal near top graticule line.

NOTE

A non-metallic tuning tool is required for all adjustments except R1 and R2 on A8 and A10 bandwidth filter assemblies.

ADJUSTMENTS

5-20. LC AND CRYSTAL BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

3. Short to ground A8TP3, A8TP12, and A10TP3 through the holes in the assembly covers. Test points can be shorted to covers using midget copper alligator clips, HP Part Number 1400-0483.

4. Adjust A10C5 XTL SYM and A10C6 XTL CNTR adjustments for best symmetry and centering. Crystal center adjustment A10C6 is adjusted for minimum signal amplitude. (See Figure 5-5).

5. Remove short from A10TP3 and apply to A10TP12.

6. Adjust A10C2 XTL SYM and A10C3 XTL CNTR adjustments for best symmetry and centering. Crystal center adjustment A10C3 is adjusted for minimum signal amplitude. (See Figure 5-5.)

7. Remove short from A8TP12 and apply to A10TP3.

8. Adjust A8C5 XTL SYM and A8C6 XTL CNTR adjustments for best symmetry and centering. Crystal center adjustment A8C6 is adjusted for minimum signal amplitude. (See Figure 5-5.)

9. Remove short from A8TP3 and apply to A8TP12.

10. Adjust A8C2 XTL SYM and A8C3 XTL CNTR adjustments for best symmetry and centering. Crystal center adjustment A8C3 is adjusted for minimum signal amplitude. (See Figure 5-5.)

11. Change RESOLUTION BW to 100 kHz and FREQ SPAN/DIV to 200 kHz. Leave A8TP12, A10TP3 and A10TP12 shorted and adjust A8C1 LC CNTR adjustment to center signal to same center of display as for crystal centering. Switch RESOLUTION BW control back and forth several times between 30 kHz and 100 kHz settings while adjusting LC CNTR adjustment. This assures that the signal is in the same position on the display for the two different settings of the RESOLUTION BW control.

12. Remove short from A8TP12.

13. Adjust A8C4 LC CNTR adjustment to center signal to same center of display as crystal centering.

14. Remove short from A10TP3.

15. Adjust A10C1 LC CNTR adjustment to center signal to same center of display as crystal centering.

16. Remove short from A10TP12.

17. Adjust A10C4 LC CNTR adjustment to center signal to same center of display as crystal centering.

18. Set RESOLUTION BW to 3 MHz and short A10TP3 and A10TP12. Set signal level with REF LEVEL FINE for a maximum amplitude of seven divisions, one division below top graticule line.

19. Set RESOLUTION BW to 100 kHz and adjust A8R1 LC adjustment to position signal one division down from top graticule line.

20. Set RESOLUTION BW to 3 MHz and remove shorts from A10 assembly. Adjust signal level one division down from top graticule line.

21. Set RESOLUTION BW to 100 kHz and adjust A10R1 LC adjustment to position signal one division down from graticule line.

ADJUSTMENTS

5-20. LC AND CRYSTAL BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

22. Set FREQ SPAN/DIV to 5 kHz and RESOLUTION BW to 1 kHz. Set SWEEP TIME/DIV to 50 mSEC.
23. Short A8TP3 and A8TP12, and adjust A10R2 XTL adjustment to position signal one division down from top graticule line.
24. Remove shorts from A8 assembly.
25. Adjust A8R2 XTL adjustment to position signal one division down from top graticule line.
26. Set 10 dB/DIV — 1 dB/DIV — LIN switch to 1 dB/DIV. Set SWEEP TIME/DIV to 5 msec. Set RESOLUTION BW to 3 MHz. Using REF LEVEL FINE control, set signal amplitude at 7th division, one division below top graticule line.
27. Step through RESOLUTION BW 3 MHz to 1 kHz keeping signal centered with TUNING control. Signal amplitude shall not differ more than ±0.5 dB from 3 MHz reference to 300 kHz and ±1.0 dB from 3 MHz to 1 kHz.

5-21. THREE-dB BANDWIDTH ADJUSTMENT

REFERENCE:

Service sheet 9

DESCRIPTION:

Three-dB bandwidth for 30 kHz, 100 kHz, and 1 MHz RESOLUTION BW settings can be adjusted with an external signal or CAL OUTPUT. The analyzer does not have narrow enough FREQ SPAN/DIV to accurately adjust the 1 kHz RESOLUTION BW. The three-dB bandwidth for 1 kHz RESOLUTION BW is adjusted by injecting a stable 21.4 MHz signal into the 21.4 MHz preamplifier of the spectrum analyzer.

ADJUSTMENTS

5-21. THREE-dB BANDWIDTH ADJUSTMENT (Cont'd)

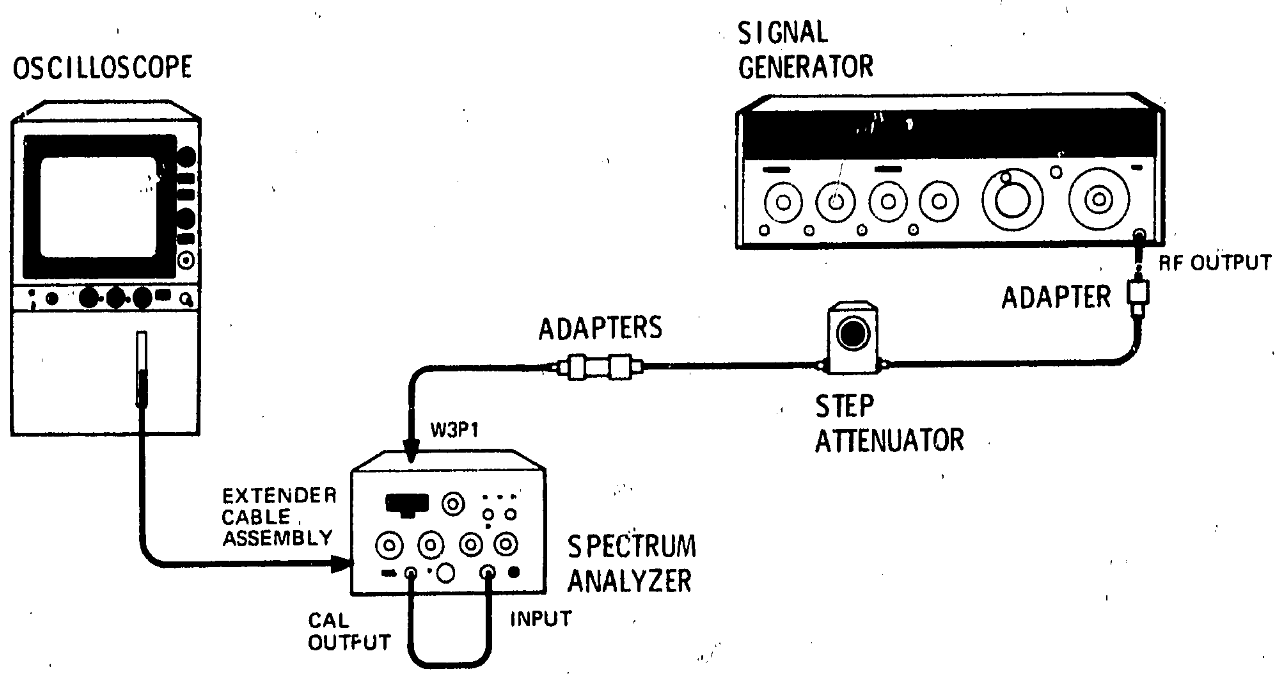


Figure 5-6. Three-dB Bandwidth Adjustment Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Step Attenuator	HP 355D
BNC Cable, 6 Inches	HP 10502A
Adapter, Type N Female on Both Ends	HP 1250-0777
Adapter, Type N to BNC (2 required)	HP 1250-0780
Adapter, Type N Male to Subminiature RF Male	HP 1250-1023

PROCEDURE:

1. Set spectrum analyzer controls as follows:

START — CENTER	CENTER
TUNING	250 MHz
FREQ SPAN/DIV	200 kHz
RESOLUTION BW	1 MHz
OPTIMUM INPUT	−40
REFERENCE LEVEL dBm	−20
10 dB/DIV 1 dB/DIV — LIN	LIN
SWEEP TIME/DIV	1 mSEC
SWEEP TRIGGER	FREE RUN
VIDEO FILTER	OFF

ADJUSTMENTS

5-21. THREE-dB BANDWIDTH ADJUSTMENT (Cont'd)

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 A3R4 1M BW adjustment for a 5 division wide signal at the 5th graticule line.
5. Change RESOLUTION BW to 100 kHz and FREQ SPAN/DIV to 20 kHz. With the REF LEVEL FINE control, set the signal level to 7.1 divisions.
6. Adjust A3R3 100K BW adjustment for a 5 division wide signal at the 5th graticule line.
7. Change RESOLUTION BW to 30 kHz and FREQ SPAN/DIV to 5 kHz. With the REF LEVEL FINE control, set the signal level at 7.1 divisions.
8. Adjust A3R2 30K BW adjustment for a 6 division wide signal at the 5th graticule line.
9. Remove W3P1 from A5J2. Connect signal generator through adapter to W3P1.
10. Tune signal generator to approximately 21.40 MHz.
11. Set 8557A RESOLUTION BW to 1 MHz. Tune signal generator to peak signal on oscilloscope display. Adjust the output level for a 7.1 division signal.
12. Set 8557A RESOLUTION BW to 1 kHz. Tune signal generator to peak signal on oscilloscope display.
13. Adjust A8R2 and A10R2 (crystal feedback adjustments) equally, if necessary for a 7.1 division signal.
14. Record the counter frequency and tune the signal generator 500 Hz below the center frequency recorded.
15. Adjust A3R1 1K BW adjustment to bring signal level to the 5th graticule line (3 divisions from the top graticule line).
16. Repeat steps 12 through 15 until the frequency change from center frequency at 7.1 divisions to the 3 dB point of the 5th graticule line is 500 Hz ±50 Hz.

ADJUSTMENTS

5-22. STEP GAIN ASSEMBLY RF GAIN ADJUSTMENT

REFERENCE:

Service Sheet 5

DESCRIPTION:

The RF gain (sensitivity) of the step Gain Assembly is adjusted by injecting a 21.4 MHz signal at XA6. The 21.4 MHz Preamplifier Assembly A6 is removed and replaced with a special extender board for applying the 21.4 MHz signal from the signal generator.

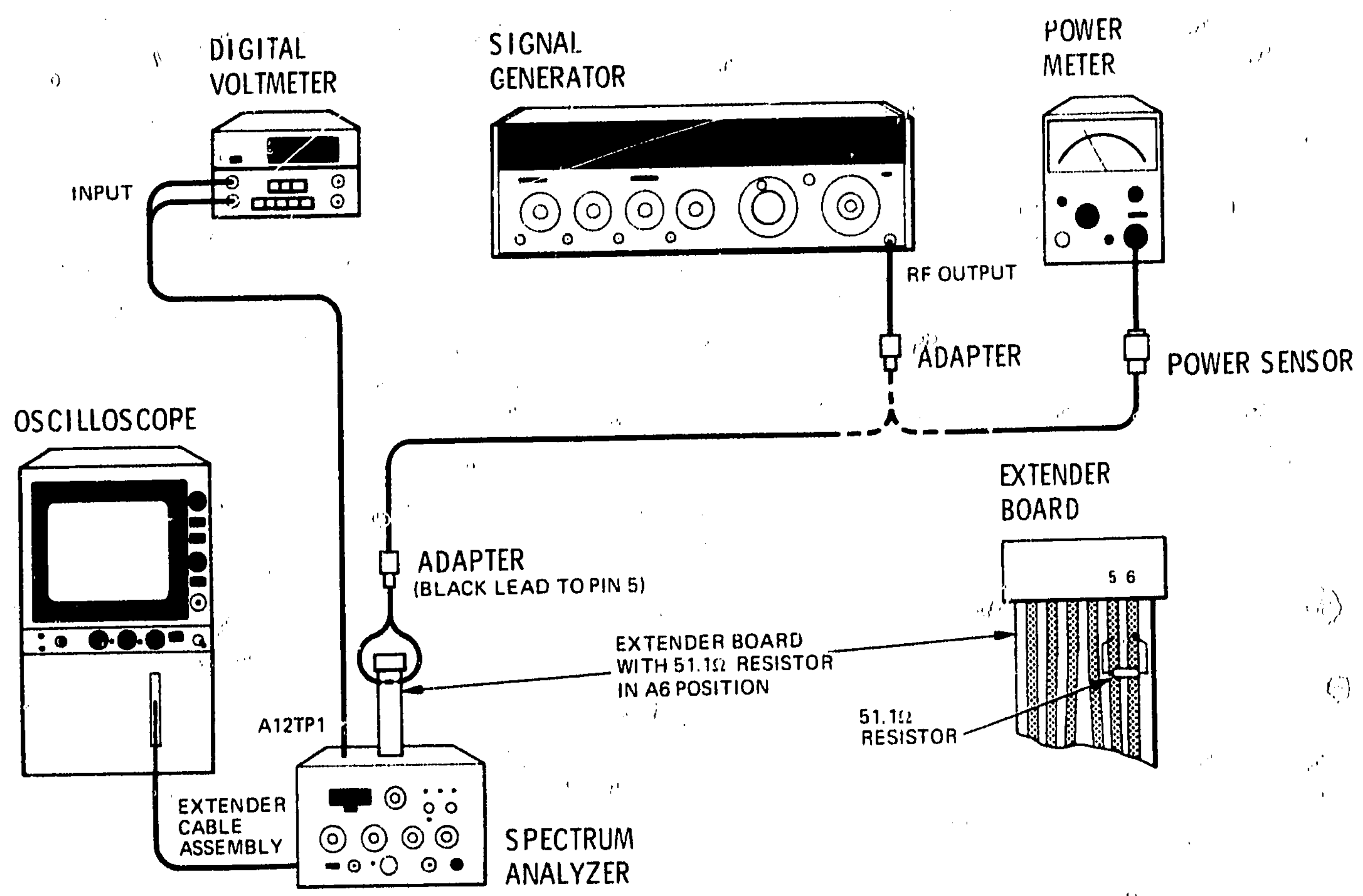


Figure 5-7. RF Gain Adjustment Test Setup

EQUIPMENT:

Signal Generator .... HP 8640B
Digital Voltmeter .... HP 34740A/34702A
Power Meter .... HP 435A
Power Sensor .... HP 8481A
Adapter, BNC Female to
Aligator Clips .... HP 8120-1292
Special Extender Board with 51.1 ohm resistor .... HP 5060-0257/0757-0394

NOTE

To make special extender board, solder 51.1 ohm resistor from pin 6 to pin 5 of standard extender board, HP part number 5060-0257. Leave resistor leads long for easy connection of clip leads.

ADJUSTMENTS

5-22. STEP GAIN ASSEMBLY RF GAIN ADJUSTMENT (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	0
REF LEVEL FINE	0
10 dB/DIV — 1 dB/DIV — LIN	LIN
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
VIDEO FILTER	OFF

2. Connect equipment as shown in Figure 5-7.
3. Set signal generator frequency to 21.4 MHz. Set output level for approximately −5 dBm.
4. Connect output of signal generator across 51.1 ohm resistor on special extender board using BNC to cliplead adapter. The red lead (center conductor) should be connected to pin 5 of extender board.
5. Set signal generator frequency for peak amplitude on oscilloscope display. Connect output of signal generator to power meter and set output level to −3 dBm. Reconnect signal generator output to clip-lead adapter.
6. Adjust A9R4 GAIN adjustment for signal one division from top graticule line. DVM should indicate +700 mV ±30 mV. Remove special extender board and replace A6 21.4 MHz Preamplifier Assembly.

5-23. STEP GAIN ADJUSTMENTS

REFERENCE:

Service Sheet 5

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.

ADJUSTMENTS

5-23. STEP GAIN ADJUSTMENTS (Cont'd)

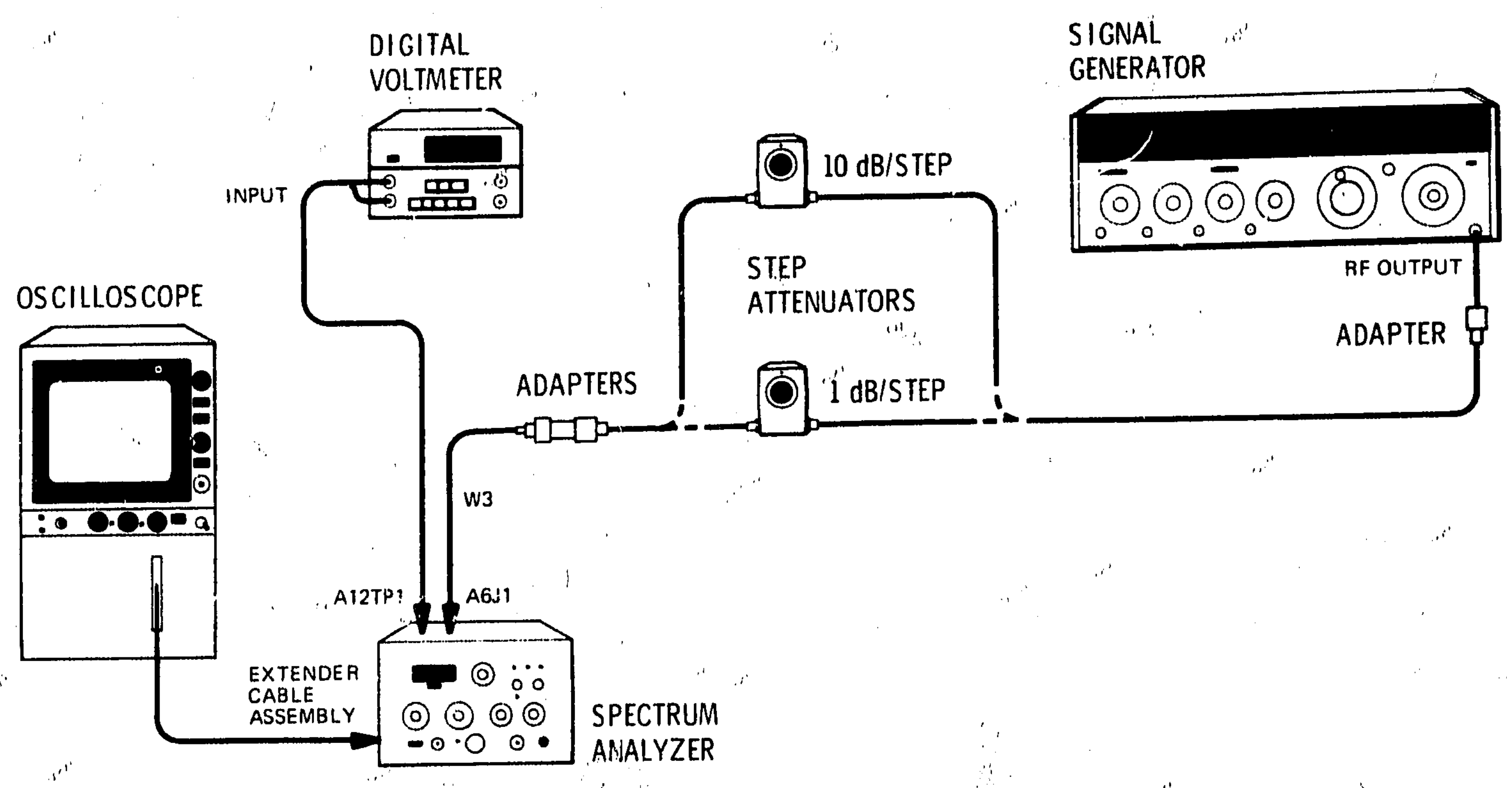


Figure 5-8. Step Amplifier Gain Adjustment Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Step Attenuator (1 dB/Step)	HP 355C
Step Attenuator (10 dB/Step)	HP 355D
Digital Voltmeter	HP 34740A/34702A
Adapter, Type N Female on Both Ends	HP 1250-0777
Adapter, Type N Male on One End, Subminiature RF Male on Other End	HP 1250-0781
Adapter, Type N Male on One End, BNC Female on Other End (2 required)	HP 1250-0780

PROCEDURE:

1. Set spectrum analyzer controls as follows:

FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	0
10 dB/DIV — 1 dB/DIV — LIN	1 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
VIDEO FILTER	OFF

ADJUSTMENTS

5-23. STEP GAIN ADJUSTMENTS (Cont'd)

2. Connect equipment as shown in Figure 5-8. Connect signal generator tuned to 21.4 MHz with approximately −25 dBm output to one side of a 1 dB/step attenuator. Connect attenuator output to A6J1 through adapters and W3. 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 reference.

4. Adjust A9R6 −12 dB adjustment until signal stops rising on display, then adjust A9R6 counterclockwise until signal drops approximately half 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 A9R5 0 dB adjustment for a signal level one division from the graticule line.

8. Set step attenuator to 12 dB and REF LEVEL FINE to −12. Signal level on display shall be ±0.1 division from the reference one division down from top graticule line. If signal level is out of limits, adjust A9R6 to the reference one division down from top graticule line.

9. Repeat steps 3 through 8 until signal level is within limits.

10. Check the REF LEVEL FINE control from 0 to −12 dBm, as shown in table below.

Table 5-5. REF LEVEL FINE Control Check

REF LEVEL FINE SETTING	STEP ATTENUATOR SETTING (dB)	DEVIATION FROM REFERENCE
0	0	Ref. —— mV (Ref.)
−1	1	±0.3 Div ±30 mV
−2	2	±0.3 Div ±30 mV
−3	3	±0.3 Div ±30 mV
−4	4	±0.3 Div ±30 mV
−5	5	±0.3 Div ±30 mV
−6	6	±0.3 Div ±30 mV
−7	7	±0.3 Div ±30 mV
−8	8	±0.3 Div ±30 mV
−9	9	±0.3 Div ±30 mV
−10	10	±0.3 Div ±30 mV
−11	11	±0.3 Div ±30 mV
−12	12	±0.3 Div ±30 mV

ADJUSTMENTS

5-23. STEP GAIN ADJUSTMENTS (Cont'd)

11. Replace 1 dB/step attenuator with 10 dB/step attenuator set to 0 dB. Set REF LEVEL FINE control to 0.
12. Connect cable from attenuator to A6J1 through adapters and W3.
13. Tune signal generator frequency for peak amplitude on the display (near 21.4 MHz). Set a reference at one division from top graticule line.
14. Set step attenuator to 10 dB and REFERENCE LEVEL dBm to −10.
15. Adjust A9R3 10 dB adjustment for signal level one division from top graticule line.
16. Set step attenuator to 20 dB and REFERENCE LEVEL dBm to −20.
17. Adjust A9R2 20 dBm adjustment for signal level one division from top graticule line.
18. Set attenuator to 40 dB and REFERENCE LEVEL dBm to −40.

NOTE

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

19. Adjust A9R1 40 dBm adjustment for signal level one division from top graticule line.
20. Check REFERENCE LEVEL dBm control form 0 to −50 as shown in table below:

Table 5-6. REFERENCE LEVEL Control Check

REFERENCE LEVEL dBm	ATTENUATOR (dB)	DEVIATION FROM REFERENCE
0	0	Reference
−10	10	±0.2 Div 20 mV
−20	20	±0.2 Div 20 mV
−30	30	±0.2 Div 20 mV
−40	40	±0.2 Div 20 mV
−50	50	±0.2 Div 20 mV

21. Reconnect W3P1 to A6J1.

ADJUSTMENTS

5-24. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENT.

REFERENCE:

Service Sheet 7

DESCRIPTION:

10 dB/DIV and LIN are adjusted for correct steps and full screen display translations.

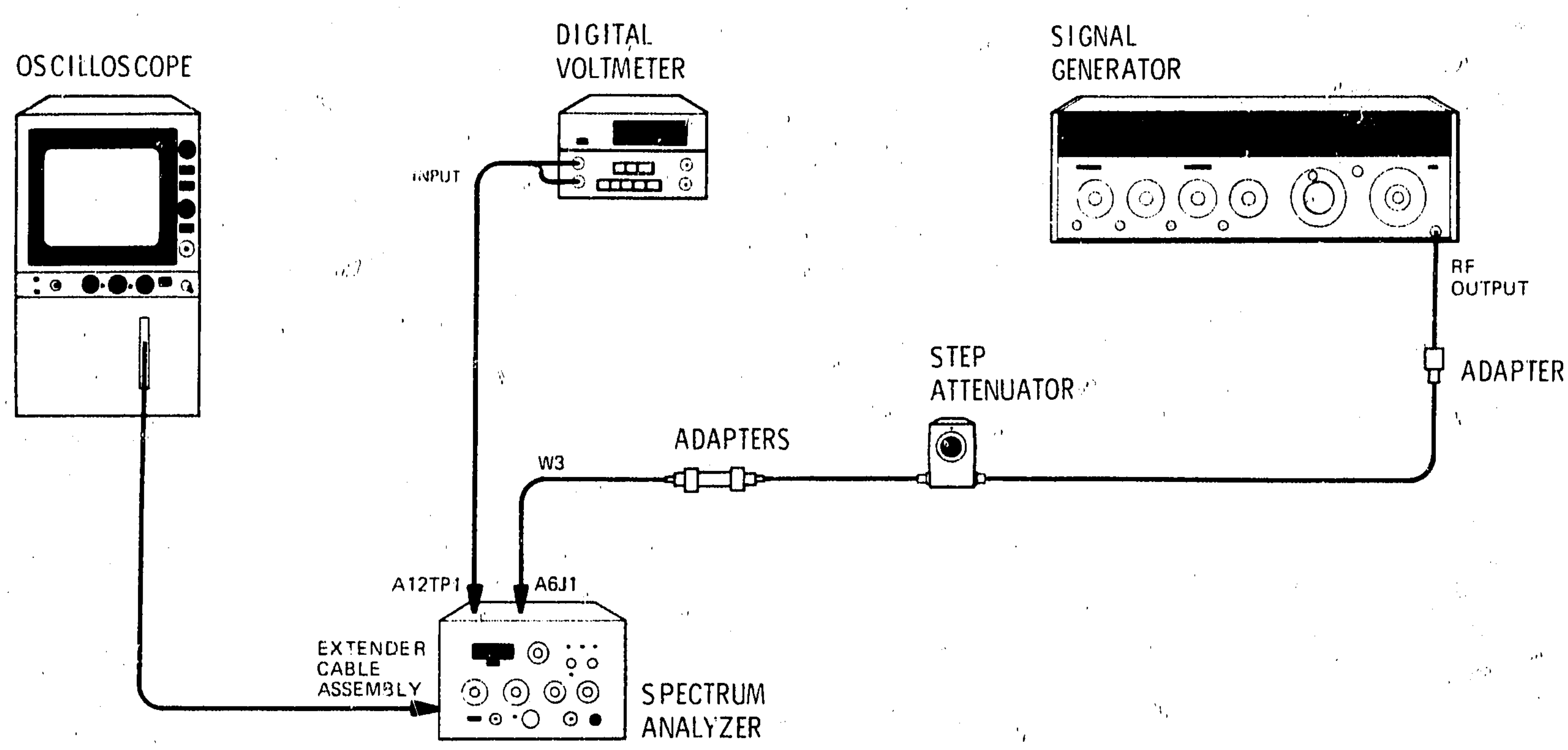


Figure 5-9. Log Amplifier Log and Linear Adjustments Test Setup

EQUIPMENT:

Signal Generator .... HP 8640B
Digital Voltmeter .... HP 34740A/34702A
Step Attenuator (10 db/step) .... HP 355D
Adapter, Type N Male on one end,
BNC Female on other end (2 required) .... HP 1250-0780
Adapter, Type N Female on Both Ends .... HP 1250-0777
Adapter, Type N Male on One End,
Subminiature RF Male on Other End .... HP 1250-1023

5-24. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENT (Cont'd)

PROCEDURE:

1. Set spectrum analyzer controls as follows:
   - FREQ SPAN/DIV .... 1 MHz
   - RESOLUTION BW .... 300 kHz
   - OPTIMUM INPUT .... −30
   - REFERENCE LEVEL dBm .... −50
   - REF LEVEL FINE .... Full counterclockwise
   - 10 dB/DIV — 1 dB/DIV — LIN .... LIN
   - SWEEP TIME/DIV .... AUTO
   - SWEEP TRIGGER .... FREE RUN

2. Connect equipment as shown in Figure 5-9. Set signal generator frequency to 21.4 MHz and output level to −30 dBm. Remove W3P1 from A5 Second Converter Assembly. Connect signal generator output through step attenuator and adapters to W3P1.

3. Set the TEST-NORM switch on Step Amplifier Assembly A9 to the TEST position. Tune signal generator frequency for maximum signal amplitude on oscilloscope display with step attenuator set at 0 dB.

4. Set output level of signal generator for a digital voltmeter reading of 700 mV with step attenuator set at 0 dB and REFERENCE LEVEL dBm control set to —50.

5. Set 8557A REFERENCE LEVEL dBm to —80 and set step attenuator (355D) to 30 dB. Observe digital voltmeter reading.

6. Adjust LIN GAIN adjustment A11R3 for a digital voltmeter reading of 700 mV.

7. Repeat steps 4, 5, and 6 until the DVM reading in step 5 is 700 mV ±2 mV.

8. Set 8557A REFERENCE LEVEL dBm to —50 and set step attenuator to 0 dB. Change REFERENCE LEVEL dBm and step attenuator settings as shown in Table 5-7. If DEVIATION FROM REFERENCE is not within the given limits, readjust LIN GAIN adjustment A11R3 for best fit.

Table 5-7. Linear Gain Adjustment Limits

REFERENCE LEVEL dBm	STEP ATTENUATOR SETTING (dB)	DEVIATION FROM REFERENCE
−50	0	Reference
−60	10	±0.2 DIV ±20 mV
−70	20	±0.2 DIV ±20 mV
−80	30	±0.2 DIV ±20 mV
−90	40	±0.3 DIV ±30 mV

5-24. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENT (Cont'd)

9. Set 8557A REFERENCE LEVEL dBm to 0 and disconnect signal generator from step attenuator. Record offset reading (DVM). The offset should be less than +30 mV.

_______ Offset

10. Reconnect signal generator as shown in Figure 5-9. Set 10 dB/DIV — dB/DIV — LIN switch to 10 dB/DIV and set step attenuator to 40 dB.

11. Set output level of signal generator for a digital voltmeter reading of 400 mV plus offset recorded in step 9 (Algebraic sum). (Example: If offset is −23 mV., set output level of signal generator for a DVM reading of 377 mV).

12. Set step attenuator to 0 dB. Digital voltmeter should indicate 800 mV, plus offset (algebraic sum) ±1 mV. If DVM reading is not within limits, adjust LOG-LIN adjustment A11R2 for a digital voltmeter reading of 800 mV, plus offset minus 50 percent of overshoot. [Example: If DVM indicates 767 mV and should be indicating 777 mV (−10 mV overshoot), adjust A11R2 for a DVM reading of 777 mV minus −5 mV (782 mV)

13. Repeat steps 10,11,and 12 until the digital voltmeter indicates 800 mV plus offset ±1 mV with no further adjustment of A11R2 in step 12.

14. Set the step attenuator to the positions shown in Table 5-8 and record DVM reading for each setting. Correct the DVM readings by algebraically adding the offset (recorded in step 9).

Table 5-8. Log Fidelity Check

STEP ATTENUATOR SETTING (dB)	DVM READING (mV)	DVM READING CORRECTED FOR OFFSET		
		Min. (mV)	Actual (mV)	Max. (mV)
0	______	799	______	801
10	______	697	______	703
20	______	596	______	604
30	______	496	______	504
40	______	395	______	405
50	______	294	______	306
60	______	193	______	207
70	______	92	______	108

15. Readjust A11R2 if necessary to meet the limits in Table 5-7.

16. Set step attenuator to 0 dB and set output level of signal generator for a digital voltmeter reading of 800 mV plus offset (recorded in step 9) ±1 mV.

17. Set 10 dB/DIV — 1 dB/DIV — LIN switch to LIN. The digital voltmeter should indicate the reading set in step 16 ±25 mV. If it does, go to step 19. If it does not, or if Log fidelity is not within limits, go to step 18 and select A11R16*.

5-24. LOG AMPLIFIER LOG AND LINEAR ADJUSTMENT (Cont'd)

NOTE

Log fidelity must be considered when selecting A11R16*. That is, if the DVM READING CORRECTED FOR OFFSET in Table 5-8 is greater than 100 mV for a STEP ATTENUATOR SETTING of 70 dB, A11R16* should be selected for a DVM reading greater than the reading set in step 16 if the READING CORRECTED FOR OFFSET is less than 100 mV, A11R16* should be selected for DVM reading less than the reading set in step 16. Decreasing A11R16* 10 percent will increase the DVM reading approximately 30 mV with 10 dB/DIV — 1 dB/DIV — LIN switch in the LIN position.

18. Select A11R16* to obtain an output in step 17 within ±25 mV of the reading set in step 16. Decreasing A11R16* 10 percent will increase the DVM reading approximately 30 mV in step 17.

19. Set output level of signal generator for a digital voltmeter reading of 800 mV plus offset (algebraic sum) ±101 mV.

20. Set 8557A 10 dB/DIV — 1 dB/DIV — LIN switch to 10 dB/DIV and adjust LOG LIN adjustment A11R2 for a digital voltmeter reading of 800 mV plus offset.

21. Repeat step 14 to recheck the Log fidelity.

22. Set the 8557A REFERENCE LEVEL dBm control to −50. Set the 10 dB/DIV — 1 dB/DIV — LIN switch to 1 dB/DIV.

23. Set the step attenuator to 0 dB and set output level of signal generator for a digital voltmeter reading of 700 mV (do not include offset).

24. Set the 8557A REFERENCE LEVEL dBm control to −90 and the step attenuator to 40 dB. Adjust LOG GAIN adjustment A11R1 for a digital voltmeter reading of 700 mV.

25. Change REFERENCE LEVEL dBm and step attenuator settings as shown in Table 5-9. Deviation from reference should not exceed the given limits.

26. Return TEST-NORM switch on A9 assembly to the NORM position.

Table 5-9. Log Gain Adjustment Limits

REFERENCE LEVEL dBm	STEP ATTENUATOR SETTING (dB)	DEVIATION FROM REFERENCE
−50	0	Reference
−60	10	±0.3 DIV ±30 mV
−70	20	±0.3 DIV ±30 mV
−80	30	±0.3 DIV ±30 mV
−90	40	±0.3 DIV ±30 mV

ADJUSTMENTS

5-25. SWEEP TIME PER DIVISION ADJUSTMENT

REFERENCE:

Service Sheet 8

DESCRIPTION:

Sweep time per division is adjusted for proper sweep time and "dead time".

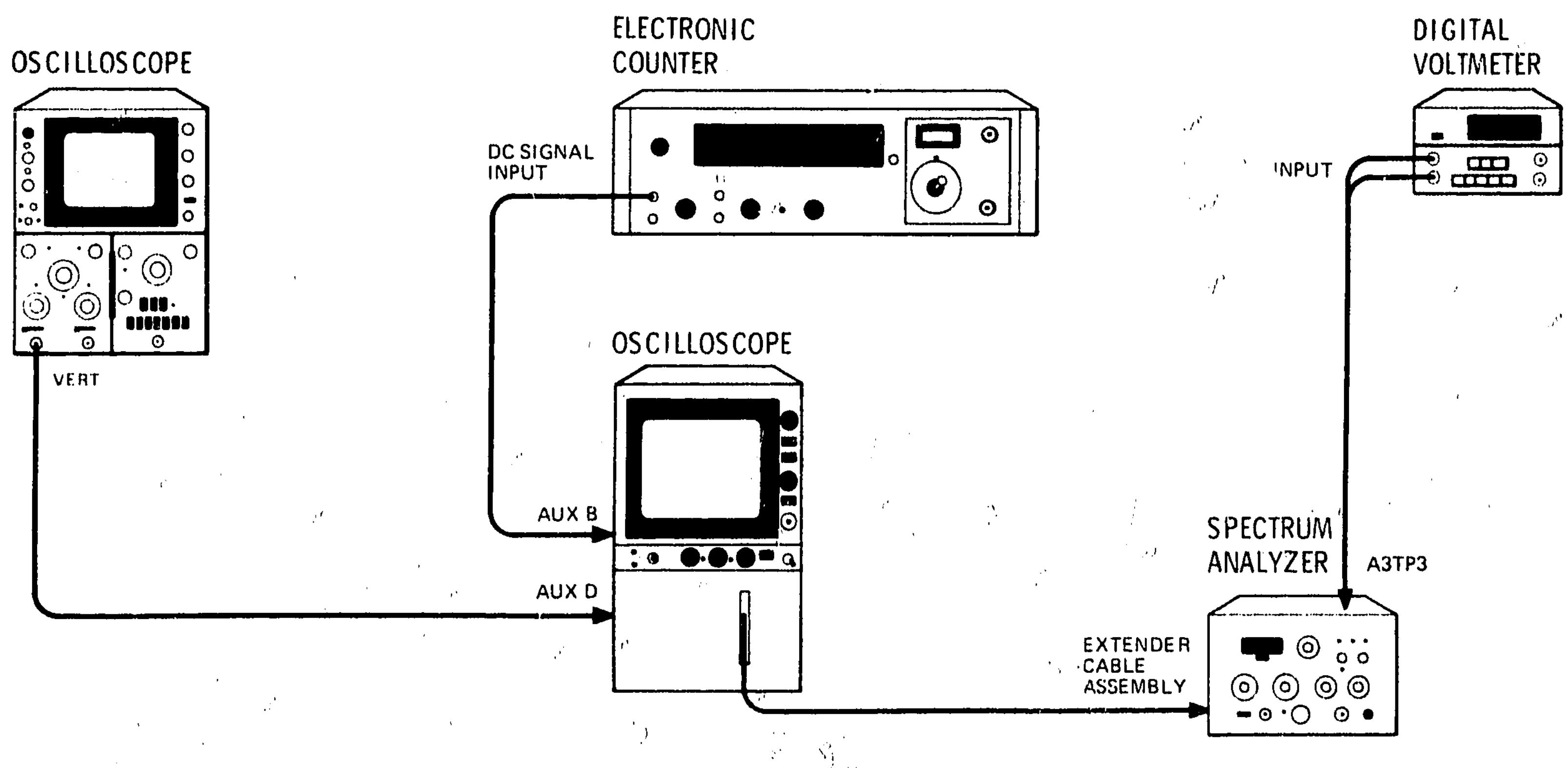


Figure 5-10. Sweep Time Per Division Adjustment Test Setup

EQUIPMENT:

Oscilloscope .... HP 180A/1801A/182C
Digital Voltmeter .... HP 34740A/34702A
Electronic Counter .... HP 5245L

PROCEDURE:

1. Connect equipment as shown in Figure 5-10. Connect oscilloscope to AUX D, HORIZONTAL OUTPUT, rear of 180-Series mainframe option 807, or to A12TP5 of 8557A. Connect digital voltmeter to A3TP3 (located to the left and below A3TP4.)

2. Adjust A3R7, +10 V adjustment, for 10 V ±0.02 V.

NOTE

The +10 V must be adjusted while analyzer is still cold, during first five minutes after turn on.

ADJUSTMENTS

5-25. SWEEP TIME PER DIVISION ADJUSTMENT (Cont'd)

3. Set spectrum analyzer controls as follows:
   SWEEP TIME/DIV .... 1 ms
   SWEEP TRIGGER .... FREE RUN

4. Check sweep amplitude for approximately a −5 V to +5 V ramp.

5. Adjust A3R6 1 MS adjustment for a 10 ms ramp time.

6. Set spectrum analyzer SWEEP TIME/DIV to 2 mSEC. Adjust A3R5 2 MS adjustment for a 20 ms ramp time.

7. Measure the dead time of sweep (time between falling edge and start of new range) on both 1 msec/div and 2 msec/div.

   _______ dead time, 1 msec/div
   _______ dead time, 2 msec/div

8. Connect electronic counter to AUX B PEN LIFT/BLANKING output, rear of 180-series mainframe Option 807, and set counter as follows:

   SENSITIVITY .... 1 V
   TIME BASE .... 10 μs
   FUNCTION PERIOD AVERAGE 1

9. Set SWEEP TIME/DIV to 1 mSEC. Electronic counter should read sweep time plus dead time of 10 ms + dead time + 0.05 ms. Adjust A3R6 if necessary to obtain this reading.

10. Set SWEEP TIME/DIV to 2 mSEC. Electronic counter should read sweep time plus dead time of 20 ms + dead time ±0.1 ms. Adjust A3R5 if necessary to obtain this reading.

11. Repeat steps 9 and 10 until the sweep time plus dead time for the 1 ms and 2 ms sweeps are correct.

    9.95 ms + dead time________10.05 ms + dead time

    19.90 ms + dead time________20.10 ms + dead time

5-26. 1 dB OFFSET ADJUSTMENT

REFERENCE:

Service Sheet 10

DESCRIPTION:

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

ADJUSTMENTS

5-26. 1 dB OFFSET ADJUSTMENT (Cont'd)

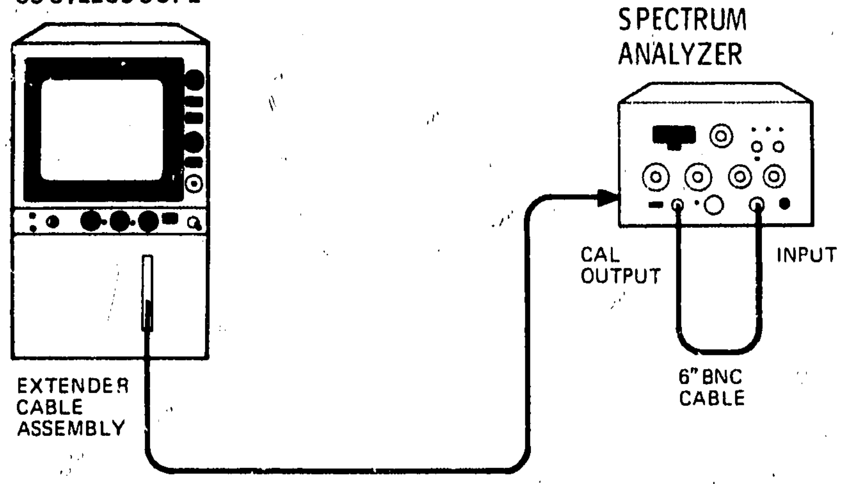


Figure 5-11. 1 dB Offset Adjustment Test Setup

EQUIPMENT:

6" BNC Cable .... HP 10502A

PROCEDURE:

1. Set Spectrum Analyzer controls as follows:

FREQ SPAN/DIV	1 MHz
RESOLUTION BW	1 MHz
OPTIMUM INPUT	−30
REFERENCE LEVEL dBm	−20
REF LEVEL FINE	Approximately −10
10 dB/DIV — 1 dB/DIV — LIN	LIN
SWEEP TIMEPDIV	AUTO
SWEEP TRIGGER	FREE RUN
FREQUENCY	250 MHz

2. Connect equipment as shown in Figure 5-11.

3. Set TUNING control to center the trace on the display. Set REF LEVEL FINE for a full-screen trace (signal at top graticule line).

4. Set 10 dB/DIV — 1 dB/DIV — LIN switch to 10 dB/DIV. Adjust VERT GAIN if necessary for full screen trace.

5. Repeat steps 3 and 4 until the trace is full screen in both LIN and 10 dB/DIV.

6. Set 10 dB/DIV — 1 dB/DIV — switch to 1 dB/DIV. Adjust A12R1 1 dB OFFSET adjustment for a trace 0.5 division down from top graticule line.

NOTE

1 dB/DIV will read approximately 0.5 dB (0.5 division) low when using Extender Cable assembly. Adjusting A12R1 1 dB OFFSET adjustment for a trace 0.5 division down from top graticule line should place signal at top graticule line when 8557A is properly installed in 180-series mainframe.

PARTS LIST

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 is a list of exchange assemblies and Table 6-2 lists abbreviations used in the parts list and throughout the manual. Table 6-3 lists all replaceable parts in reference designator order. Table 6-4 contains names and addresses that correspond to the manufacturer's code numbers.

6-3. EXCHANGE ASSEMBLIES

6-4. Table 6-1 lists assemblies within the instrument that may be replaced on an exchange basis, thus affording considerable cost savings. Exchange, factory-repaired and tested assemblies are available only on a trade-in basis, therefore the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number.

6-5. ABBREVIATIONS

6-6. Table 6-2 gives a list of abbreviations used in the parts list, schematics, and throughout the manual. In some cases, two forms of the abbreviation are given, one all capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-7. REPLACEABLE PARTS LIST

6-8. Table 6-3 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.

b. Chassis-mounted parts in alpha-numeric order by reference designation.

c. Miscellaneous parts.

d. Illustrated parts breakdown, if appropriate.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity (Qty) in the instrument.

c. The description of the part.

d. The typical manufacturer of the part in a five-digit code.

e. Manufacturer code number for the part.

The total quantity for each part is given only once —at the first appearance of the part number in the list.

6-9. ORDERING INSTRUCTIONS

6-10. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate quantity required, and address the order to the nearest Hewlett-Packard office.

6-11. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

Table 6-1. Assemblies Available for Module Exchange

Assembly	New Part No.	Exchange Part No.
A8/A10 Bandwidth Filters	08558-60011	08558-60066
A11 Log Amplifier	08558-60014	08558-60067
A3 Sweep Generator	08557-60003	08557-60049

*For module exchange procedure, see Paragraph 8-17.

Model 8557A

Replaceable Parts

Table 6-2. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

- A: assembly
- AT: attenuator; isolator; termination
- B: fan; motor
- BT: battery
- C: capacitor
- CP: coupler
- CR: diode; diode thyristor; varactor
- DC: directional coupler
- DL: delay line
- DS: annunciator; signaling device (audible or visual); lamp; LED
- E: miscellaneous electrical part
- F: fuse
- FL: filter
- H: hardware
- HY: circulator
- J: electrical connector (stationary portion); jack
- K: relay
- L: coil; inductor
- M: meter
- MP: miscellaneous mechanical part
- P: electrical connector (movable portion); plug
- Q: transistor: SCR; triode thyristor
- R: resistor
- RT: thermistor
- S: switch
- T: transformer
- TB: terminal board
- TC: thermocouple
- TP: test point
- U: integrated circuit; microcircuit
- V: electron tube
- VR: voltage regulator; breakdown diode
- W: cable; transmission path; wire
- X: socket
- Y: crystal unit (piezo-electric or quartz)
- Z: tuned cavity; tuned circuit

ABBREVIATIONS

- A: ampere
- ac: alternating current
- ACCESS: accessory
- ADJ: adjustment
- A/D: analog-to-digital
- AF: audio frequency
- AFC: automatic frequency control
- AGC: automatic gain control
- AL: aluminum
- ALC: automatic level control
- AM: amplitude modulation
- AMPL: amplifier
- APC: automatic phase control
- ASSY: assembly
- AUX: auxiliary
- avg: average
- AWG: American wire gauge
- BAL: balance
- BCD: binary coded decimal
- BD: board
- BE CU: beryllium copper
- BFO: beat frequency oscillator
- BH: binder head
- BKDN: breakdown
- BP: bandpass
- BPF: bandpass filter
- BRS: brass
- BWO: backward-wave oscillator
- CAL: calibrate
- ccw: counter-clockwise
- CER: ceramic
- CHAN: channel
- cm: centimeter
- CMO: cabinet mount only
- COAX: coaxial
- COEF: coefficient
- COM: common
- COMP: composition
- COMPL: complete
- CONN: connector
- CP: cadmium plate
- CRT: cathode-ray tube
- CTL: complementary transistor logic
- CW: continuous wave
- cw: clockwise
- cm: centimeter
- D/A: digital-to-analog
- dB: decibel
- dBm: decibel referred to 1 mW
- dc: direct current
- deg: degree (temperature interval or difference)
- °: degree (plane angle)
- °C: degree Celsius (centigrade)
- °F: degree Fahrenheit
- °K: degree Kelvin
- DEPC: deposited carbon
- DET: detector
- diam: diameter
- DIA: diameter (used in parts list)
- DIFF AMPL: differential amplifier
- div: division
- DPDT: double-pole, double-throw
- DR: drive
- DSB: double sideband
- DTL: diode transistor logic
- DVM: digital voltmeter
- ECL: emitter coupled logic
- EMF: electromotive force
- EDP: electronic data processing
- ELECT: electrolytic
- ENCAP: encapsulated
- EXT: external
- F: farad
- FET: field-effect transistor
- F/F: flip-flop
- FH: flat head
- FIL H: fillister head
- FM: frequency modulation
- FP: front panel
- FREQ: frequency
- FXD: fixed
- g: gram
- GE: germanium
- GHz: gigahertz
- GL: glass
- GRD: ground(ed)
- H: henry
- h: hour
- HET: heterodyne
- HEX: hexagonal
- HD: head
- HDW: hardware
- HF: high frequency
- HG: mercury
- HI: high
- HP: Hewlett-Packard
- HPF: high pass filter
- HR: hour (used in parts list)
- HV: high voltage
- Hz: Hertz
- IC: integrated circuit
- ID: inside diameter
- IF: intermediate frequency
- IMPG: impregnated
- in: inch
- INCD: incandescent
- INCL: include(s)
- INP: input
- INS: insulation
- INT: internal
- kg: kilogram
- kHz: kilohertz
- kΩ: kilohm
- kV: kilovolt
- lb: pound
- LC: inductance-capacitance
- LED: light-emitting diode
- LF: low frequency
- LG: long
- LH: left hand
- LIM: limit
- LIN: linear taper (used in parts list)
- lin: linear
- LK WASH: lock washer
- LO: low; local oscillator
- LOG: logrithmic taper (used in parts list)
- log: logrithm(ic)
- LPF: low pass filter
- LV: low voltage
- m: meter (distance)
- mA: milliampere
- MAX: maximum
- MΩ: megohm
- MEG: meg (10^6) (used in parts list)
- MET FLM: metal film
- MET OX: metallic oxide
- MF: medium frequency; microfarad (used in parts list)
- MFR: manufacturer
- mg: milligram
- MHz: megahertz
- mH: millihenry
- mho: mho
- MIN: minimum
- min: minute (time)
- ′: minute (plane angle)
- MINAT: minature
- mm: millimeter

NOTE

All abbreviations in the parts list will be in upper-case.

Table 6-2. Reference Designations and Abbreviations (2 of 2)

MOD	modulator
MOM	momentary
MOS	metal-oxide semiconductor
ms	millisecond
MTG	mounting
MTR	meter (indicating device)
mV	millivolt
mVac	millivolt, ac
mVdc	millivolt, dc
mVpk	millivolt, peak
mVp-p	millivolt, peak-to-peak
mVrms	millivolt, rms
mW	milliwatt
MUX	multiplex
MY	mylar
μA	microampere
μF	microfarad
μH	microhenry
μmho	micromho
μs	microsecond
μV	microvolt
μVac	microvolt, ac
μVdc	microvolt, dc
μVpk	microvolt, peak
μVp-p	microvolt, peak-to-peak
μVrms	microvolt, rms
μW	microwatt
nA	nanoampere
NC	no connection
N/C	normally closed
NE	neon
NEG	negative
nF	nanofarad
NI PL	nickel plate
N/O	normally open
NOM	nominal
NORM	normal
NPN	negative-positive-negative
NPO	negative-positive zero (zero temperature coefficient)
NRFR	not recommended for field replacement
NSR	not separately replaceable
ns	nanosecond
nW	nanowatt
OBD	order by description
OD	outside diameter
OH	oval head
OP AMPL	operational amplifier
OPT	option
OSC	oscillator
OX	oxide
oz	ounce
Ω	ohm
P	peak (used in parts list)
PAM	pulse-amplitude modulation
PC	printed circuit
PCM	pulse-code modulation; pulse-count modulation
PDM	pulse-duration modulation
pF	picofarad
PH BRZ	phosphor bronze
PHL	Phillips
PIN	positive-intrinsic-negative
PIV	peak inverse voltage
pk	peak
PL	phase lock
PLO	phase lock oscillator
PM	phase modulation
PNP	positive-negative-positive
P/O	part of
POLY	polystyrene
PORC	porcelain
POS	positive; position(s) (used in parts list)
POSN	position
POT	potentiometer
p-p	peak-to-peak
PP	peak-to-peak (used in parts list)
PPM	pulse-position modulation
PREAMPL	preamplifier
PRF	pulse-repetition frequency
PRR	pulse repetition rate
ps	picosecond
PT	point
PTM	pulse-time modulation
PWM	pulse-width modulation
PWV	peak working voltage
RC	resistance-capacitance
RECT	rectifier
REF	reference
REG	regulated
REPL	replaceable
RF	radio frequency
RFI	radio frequency interference
RH	round head; right hand
RLC	resistance-inductance-capacitance
RMO	rack mount only
rms	root-mean-square
RND	round
ROM	read-only memory
R&P	rack and panel
RWV	reverse working voltage
S	scattering parameter
s	second (time)
"	second (plane angle)
S-B	slow-blow (fuse) (used in parts list)
SCR	silicon controlled rectifier; screw
SE	selenium
SECT	sections
SEMICON	semiconductor
SHF	superhigh frequency
SI	silicon
SIL	silver
SL	slide
SNR	signal-to-noise ratio
SPDT	single-pole, double-throw
SPG	spring
SR	split ring
SPST	single-pole, single-throw
SSB	single sideband
SST	stainless steel
STL	steel
SQ	square
SWR	standing-wave ratio
SYNC	synchronize
T	timed (slow-blow fuse)
TA	tantalum
TC	temperature compensating
TD	time delay
TERM	terminal
TFT	thin-film transistor
TGL	toggle
THD	thread
THRU	through
TI	titanium
TOL	tolerance
TRIM	trimmer
TSTR	transistor
TTL	transistor-transistor logic
TV	television
TVI	television interference
TWT	traveling wave tube
U	micro (10^{-6}) (used in parts list)
UF	microfarad (used in parts list)
UHF	ultrahigh frequency
UNREG	unregulated
V	volt
VA	voltampere
Vac	volts, ac
VAR	variable
VCO	voltage-controlled oscillator
Vdc	volts, dc
VDCW	volts, dc, working (used in parts list)
V(F)	volts, filtered
VFO	variable-frequency oscillator
VHF	very-high frequency
Vpk	volts, peak
Vp-p	volts, peak-to-peak
Vrms	volts, rms
VSWR	voltage standing wave ratio
VTO	voltage-tuned oscillator
VTVM	vacuum-tube voltmeter
V(X)	volts, switched
W	watt
W/	with
WIV	working inverse voltage
WW	wirewound
W/O	without
YIG	yttrium-iron-garnet
Z_o	characteristic impedance

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	08557-60028	1	FRONT PANEL ASSY	28480	08557-60028
A1A1	08557-60027	1	DIAL DRIVE ASSY (SEE FIGURE 6-2)	28480	08557-60027
A1A2	08557-60026	1	SWITCH BOARD ASSY (SEE FIGURE 6-1)	28480	08557-60026
A1A2CR1	1901-0025	1	DIODE-GEN PRP 100V 200MA	28480	1901-0025
A1A2DS1	1990-0485	1	LED-VISIBLE GREEN	28480	1990-0485
A1A2R1	0757-0199	16	RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A1A2R2	2100-3340	1	RESISTOR-VAR 1K 20% CC	01121	TYPE W
A1A2R3	2100-2681	2	RESISTOR; VAR; TRMR; 5KOHM 10% MC	01121	FH 502U
A1A2R4	2100-3332	1	RESISTOR; VAR; TRMR; 10K OHM 5% MC	28480	2100-3332
A1A2R5	0757-0444	4	RESISTOR 12.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1212-F
A1A2R6	2100-1412	2	RESISTOR; VAR; TRMR; 500 OHM 20% MC	01121	FR501M
A1A2R7	2100-3331	2	RESISTOR-VAR 10K 20% WW	28480	2100-3331
A1A2R8	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A1A2R9	2100-2681		RESISTOR; VAR; TRMR; 5KOHM 10% MC	01121	FH 502U
A1A2R10	2100-3317	1	RESISTOR, VAR 2 X 50K+-20% 10CW LOG CC	28480	2100-3317
A1A2R11			P/O A1A2R10	01121	FR501M
A1A2R12	2100-0542		RESISTOR-VAR 10K 5% WW	28480	2100-0542
A1A2R13	0698-3439	6	RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-178R-F
A1A2S1			P/O A1A2R10		
A1A2S2	3101-1799	1	SWITCH-SL DP3T-NS .5A 125VAC/DC	79727	G-128-S-0029
A1A2VR1	1902-0064	1	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	04713	SZ 10939-146
A1A3	08557-60025	1	ATTENUATOR ASSY, INPUT	28480	08557-60025
A1A3C1	0160-3490	1	CAPACITOR-FXD 1UF +-20% 50WVDC CER	28480	0160-3490
A1A3R1	0698-5192	2	RESISTOR 61.11 OHM .25% .125W F TUBULAR	03888	PME55-1/8-T0-61R11-C
A1A3R2	0698-5196	2	RESISTOR 96.25 OHM .25% .125W F TUBULAR	03888	PME55-1/8-T0-96R25-C
A1A3R3	0727-0062	1	RESISTOR 247.5 OHM .5% .25W CF TUBULAR	91637	DC-1/4-19
A1A3R4	0698-5194	1	RESISTOR 71.15 OHM .25% .125W F TUBULAR	03888	PME55-1/8-T0-71R15-C
A1A3R5	0698-5192		RESISTOR 61.11 OHM .25% .125W F TUBULAR	03888	PME55-1/8-T0-61R11-C
A1A3R6	0698-5196		RESISTOR 96.25 OHM .25% .125W F TUBULAR	03888	PME55-1/8-T0-96R25-C
A1A3R7	0698-6668	2	RESISTOR 53.3 OHM .25% .125W F TUBULAR	19701	MF4C1/8-T0-53R3-C
A1A3R8	0727-0091	1	RESISTOR 790 OHM .5% .25W CF TUBULAR	91637	DC-1/4-18
A1A3R9	0698-6668		RESISTOR 53.3 OHM .25% .125W F TUBULAR	19701	MF4C1/8-T0-53R3-C
A2	08557-60001	1	BOARD ASSY, INPUT FILTER	28480	08557-60001
A2C1	0160-3872	5	CAPACITOR-FXD 2.2PF +-.25PF 200WVDC CER	28480	0160-3872
A2C2	0160-3873	6	CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A2C3	0160-2260	2	CAPACITOR-FXD 13PF +-5% 500WVDC CER 0+	28480	0160-2260
A2C4	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A2C5	0160-3874	2	CAPACITOR-FXD 10PF +-.5PF 200WVDC CER	28480	0160-3874
A2C6	0160-3874		CAPACITOR-FXD 10PF +-.5PF 200WVDC CER	28480	0160-3874
A2C7	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A2C8	0160-2260		CAPACITOR-FXD 13PF +-5% 500WVDC CER 0+	28480	0160-2260
A2C9	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A2C10	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200WVDC CER	28480	0160-3872
A2J1	1250-1220	2	CONNECTOR-RF SMC M PC	98291	50-051-0109
A2J2	1250-1220		CONNECTOR-RF SMC M PC	98291	50-051-0109
A2L1	08557-80003	5	COIL, INPUT FILTER	28480	08557-80003
A2L2	08557-80003		COIL, INPUT FILTER	28480	08557-80003
A2L3	08557-80003		COIL, INPUT FILTER	28480	08557-80003
A2L4	08557-80003		COIL, INPUT FILTER	28480	08557-80003
A2L5	08557-80003		COIL, INPUT FILTER	28480	08557-80003
A3	08557-60003	1	BOARD ASSY, SWEEP GENERATOR	28480	08557-60003
A3C1	0180-0197	12	CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3C2	0160-3009	1	CAPACITOR-FXD 982PF +-1% 100WVDC MICA	28480	0160-3009
A3C3	0160-3402	1	CAPACITOR-FXD 1UF +-5% 50WVDC MET POLYC	28480	0160-3402
A3C4	0160-3094	2	CAPACITOR-FXD .1UF +-10% 100WVDC CER	28480	0160-3094
A3C5	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3C6	0160-3466	2	CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3C7	0160-2150	1	CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-2150
A3C8	0160-3466		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3466
A3C9	0160-2257	1	CAPACITOR-FXD 10PF +-5% 500WVDC CER 0+	28480	0160-2257
A3C10	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3C11	0160-3456	3	CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3C12	0160-3456		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3C13	0170-0066	1	CAPACITOR-FXD .027UF +-10% 200WVDC POLYE	56289	292P27392
A3C14	0160-3459	20	CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A3C15	0140-0192	1	CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3C16	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A3C17	0160-3094		CAPACITOR-FXD .1UF +-10% 100WVDC CER	28480	0160-3094
A3C18	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3C19	0160-3456		CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3C20	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A3C21	0180-2205	1	CAPACITOR-FXD; .33UF+-10% 35VDC TA	56289	150D334X9035A2
A3C22	0180-1743	1	CAPACITOR-FXD; .1UF+-10% 35VDC TA-SOLID	56289	150D104X9035A2
A3C23	0160-0163	1	CAPACITOR-FXD .033UF +-10% 200WVDC POLYE	56289	292P33392
A3C24	0160-0161	3	CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A3C25	0160-0155	1	CAPACITOR-FXD 3300PF +-10% 200WVDC POLYE	56289	292P33292
A3C26	0160-0945	1	CAPACITOR-FXD 910PF +-5% 100WVDC MICA	28480	0160-0945
A3C27	0160-0134	1	CAPACITOR-FXD 220PF +-5% 300WVDC MICA	28480	0160-0134
A3C28	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3CR1	1901-0040	80	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR3	1901-0376	1	DIODE-GEN PRP 35V 50MA	28480	1901-0376
A3CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR5	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR6	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR7	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR8			NOT ASSIGNED		
A3CR9	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR10	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR11	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR12	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR13	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR14	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR15	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR16	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR17	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR18	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR19	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR20	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR21	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR22	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR23	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR24	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR25	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR26	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR27	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR28	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR29	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR30	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR31	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR32	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3Q1	1854-0071	37	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q2	1855-0082	9	TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A3Q3	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A3Q4	1853-0020	11	TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A3Q5	1853-0007	21	TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A3Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q7	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A3Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q10	1854-0404	13	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A3Q11	1855-0417	2	TRANSISTOR, FET		
A3Q12	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A3Q13	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q14	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q15	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q16	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q17	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q18	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q19	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q20	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q21	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q22	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q23	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q24	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q25	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A3Q26	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A3Q27	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A3Q28	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A3Q29	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A3Q30	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3Q31	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q32	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q33	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q34	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q35	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q36	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A3Q37	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q38	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q39	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q40	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q41	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q42	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q43	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q44	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A3Q45	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q46	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A3Q47	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q48	1855-0417		TRANSISTOR, FET		
A3Q49	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3R1	2100-3103	3	RESISTOR-VAR TRMR 10KOHM 10% C SIDE ADJ	32997	3006P-1-103
A3R2	2100-3165	2	RESISTOR-VAR TRMR 2MOHM 20% C SIDE ADJ	32997	3006P-1-205
A3R3	2100-3165		RESISTOR-VAR TRMR 2MOHM 20% C SIDE ADJ	32997	3006P-1-205
A3R4	2100-3103		RESISTOR-VAR TRMR 10KOHM 10% C SIDE ADJ	32997	3006P-1-103
A3R5	2100-3052	2	RESISTOR-VAR TRMR 50 OHM 20% C SIDE ADJ	32997	3006P-1-500
A3R6	2100-3109	3	RESISTOR-VAR TRMR 2KOHM 10% C SIDE ADJ	32997	3006P-1-202
A3R7	2100-3154	1	RESISTOR-VAR TRMR 1KOHM 10% C SIDE ADJ	32997	3006P-1-102
A3R8	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A3R9	0698-3161	1	RESISTOR 38.3K 1% .125W F TUBULAR	16299	C4-1/8-T0-3832-F
A3R10	0757-0279	24	RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A3R11	0698-3152	5	RESISTOR 3.48K 1% .125W F TUBULAR	16299	C4-1/8-T0-3481-F
A3R12	0757-0459	3	RESISTOR 56.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-5622-F
A3R13	0757-0442	51	RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A3R14	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A3R15	0698-3451	3	RESISTOR 133K 1% .125W F TUBULAR	16299	C4-1/8-T0-1333-F
A3R16	0757-0459		RESISTOR 56.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-5622-F
A3R17	0698-7421	3	RESISTOR 40K .25% .125W F TUBULAR	19701	MF4C1/8-T0-4002-C
A3R18	0698-3194	3	RESISTOR 20K .25% .125W F TUBULAR	03888	PME55-1/8-T2-2002-C
A3R19	0698-7794	8	RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-T0-1002-C
A3R20	0757-0444		RESISTOR 12.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1212-F
A3R21	0698-3457	4	RESISTOR 316K 1% .125W F TUBULAR	19701	MF4C1/8-T0-3163-F
A3R22	0698-3442	1	RESISTOR 237 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-237R-F
A3R23	0698-3446	2	RESISTOR 383 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-383R-F
A3R24	0698-3156	18	RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A3R25	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A3R26	0757-0289	14	RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A3R27	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A3R28	0757-0419	9	RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A3R29	0757-0458	2	RESISTOR 51.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F
A3R30	0757-0465	24	RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A3R31	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A3R32	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A3R33	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A3R34	0757-0464	1	RESISTOR 90.9K 1% .125W F TUBULAR	24546	C4-1/8-T0-9092-F
A3R35	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A3R36	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A3R37	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A3R38	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A3R39	0698-7794		RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-T0-1002-C
A3R40	0698-6501	1	RESISTOR 42.2K .25% .125W F TUBULAR	03888	PME55,T-2
A3R41	0698-7794		RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-T0-1002-C
A3R42	0757-0439	12	RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A3R43	0683-3355	2	RESISTOR 3.3M 5% .25W CC TUBULAR	01121	CB3355
A3R44	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A3R45	0757-0460	1	RESISTOR 61.9K 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A3R46	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A3R47	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A3R48	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A3R49	0698-3160	12	RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A3R50	0698-7794		RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-T0-1002-C
A3R51	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A3R52	0698-3260	4	RESISTOR 464K 1% .125W F TUBULAR	19701	MF4C1/8-T0-4643-F
A3R53	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A3R54	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A3R55*	0698-3155	1	RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
			*FACTORY SELECTED PART.TYPICAL VALUE SHOWN.		

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R56	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-TO-3162-F
A3R57	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R58*	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-101-F
A3R59	0757-0401	6	RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-101-F
A3R60	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A3R61	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A3R62	0683-6845	1	RESISTOR 680K 5% .25W CC TUBULAR	01121	CB6845
A3R63	0698-3457		RESISTOR 316K 1% .125W F TUBULAR	19701	MF4C1/8-TO-3163-F
A3R64	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R65	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-10R0-F
A3R66	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A3R67	0698-7794		RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-TO-1002-C
A3R68	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R69	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R70	0757-0459		RESISTOR 56.2K 1% .125W F TUBULAR	24546	C4-1/8-TO-5622-F
A3R71	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R72	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R73	0698-3153	5	RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-TO-3831-F
A3R74*	0698-3452		RESISTOR 147K 1% .125W F TUBULAR		
A3R75	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R76	0698-3243	1	RESISTOR 178K 1% .125W F TUBULAR	16299	C4-1/8-TO-1783-F
A3R77	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R78	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-TO-6811-F
A3R79	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R80	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R81	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R82	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R83	0698-3158	3	RESISTOR 23.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-2372-F
A3R84	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R85	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R86	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R87	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R88	0698-3451		RESISTOR 133K 1% .125W F TUBULAR	16299	C4-1/8-TO-1333-F
A3R89	0698-3451		RESISTOR 133K 1% .125W F TUBULAR	16299	C4-1/8-TO-1333-F
A3R90	0698-7794		RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-TO-1002-C
A3R91	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R92	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R93	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R94	0757-0461	2	RESISTOR 68.1K 1% .125W F TUBULAR	24546	C4-1/8-TO-6812-F
A3R95	0698-6502	1	RESISTOR 3.32K .25% .125W F TUBULAR	03888	PME55,T-2
A3R96	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-TO-3162-F
A3R97	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-TO-3161-F
A3R98	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R99	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A3R100	0698-7794		RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-TO-1002-C
A3R101	0698-6727	1	RESISTOR 1.13K .25% .125W F TUBULAR	19701	MF4C1/8-TO-1131-C
A3R102			NOT ASSIGNED		
A3R103	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R104	0698-7794		RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-TO-1002-C
A3R105	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R106	0683-1055	2	RESISTOR 1M 5% .25W CC TUBULAR	01121	CB1055
A3R107	0698-7421		RESISTOR 40K .25% .125W F TUBULAR	19701	MF4C1/8-TO-4002-C
A3R108			NOT ASSIGNED		
A3R109	0698-3457		RESISTOR 316K 1% .125W F TUBULAR	19701	MF4C1/8-TO-3163-F
A3R110*	0698-3243		RESISTOR 178K 1% .125W F TUBULAR	16299	C4-1/8-TO-1783-F
A3R111	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A3R112	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R113	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R114	0698-3194		RESISTOR 20K .25% .125W F TUBULAR	03888	PME55-1/8-T2-2002-C
A3R115*	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-TO-3162-F
A3R116*	0698-3161		RESISTOR 38.3K 1% .125W F TUBULAR	16299	C4-1/8-TO-3832F
A3R117	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R118	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R119	0698-7421		RESISTOR 40K .25% .125W F TUBULAR	19701	MF4C1/8-TO-4002-C
A3R120	0698-7412	1	RESISTOR 13.3K .25% .125W F TUBULAR	19701	MF4C1/8-TO-1332-C
A3R121	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R122	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R123	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R124	0698-3194		RESISTOR 20K .25% .125W F TUBULAR	03888	PME55-1/8-T2-2002-C
A3R125	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R126	0683-3355		RESISTOR 3.3M 5% .25W CC TUBULAR	01121	CB3355
A3R127	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A3R128	0757-0470	1	RESISTOR 162K 1% .125W F TUBULAR	24546	C4-1/8-TO-1623-F
A3R129	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A3R130	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-681R-F
A3R131	0683-3355		RESISTOR 3.3M 5% .25W CC TUBULAR	01121	CB3355
			*FACTORY SELECTED PART. TYPICAL VALUE SHOWN.		

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3U1	1820-0223	1	IC LIN LM301AH AMPLIFIER	27014	LM301AH
A3U2	1826-0092	5	IC LIN AMPLIFIER	04713	MC7812CP
A3U3	1826-0092		IC LIN AMPLIFIER	04713	MC7812CP
A3U4	1826-0013	8	IC LIN AMPLIFIER	28480	1826-0013
A3VR1	1902-0025	3	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A4	08557-60004	1	BOARD ASSY, FREQUENCY CONTROL	28480	08557-60004
A4C1	0180-1746	7	CAPACITOR-FXD: 15UF+-10% 20VDC TA-SOLID	56289	150D156X902082
A4C2	0160-3877	10	CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A4C3	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A4C4	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A4C5	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A4C6	0180-1746		CAPACITOR-FXD: 15UF+-10% 20VDC TA-SOLID	56289	150D156X902082
A4C7	0180-0197		CAPACITOR-FXD: 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4C8	0160-0161		CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A4C9	0180-1746		CAPACITOR-FXD: 15UF+-10% 20VDC TA-SOLID	56289	150D156X902082
A4C10	0180-0197		CAPACITOR-FXD: 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4C11	0180-1746		CAPACITOR-FXD: 15UF+-10% 20VDC TA-SOLID	56289	150D156X902082
A4C12	0160-3454	1	CAPACITOR-FXD 220PF +-10% 1000WVDC CER	28480	0160-3454
A4C13	0180-1746		CAPACITOR-FXD: 15UF+-10% 20VDC TA-SOLID	56289	150D156X902082
A4C14	0180-0269	1	CAPACITOR-FXD: 1UF+75-10% 150VDC AL	56289	30D105G150BA2
A4C15	0170-0040	1	CAPACITOR-FXD .047UF +-10% 200WVDC POLYE	56289	292P47392
A4C16	0180-0291	2	CAPACITOR-FXD: 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A4C17	0180-1746		CAPACITOR-FXD: 15UF+-10% 20VDC TA-SOLID	56289	150D156X902082
A4C18	0180-0116	1	CAPACITOR-FXD: 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A4C19	0180-0197		CAPACITOR-FXD: 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4CR1	1901-0159	6	DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A4CR2	1901-0159		DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A4CR3	1901-0159		DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A4CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR5	1901-0159		DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A4CR6	1901-0159		DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A4CR7	1901-0159		DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A4CR8	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR9	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR10	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR11	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR12	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR13	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR14	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR15	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR16	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR17	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR18	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR19	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR20	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR21	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR22	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR23	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR24	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR25	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR26	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR27	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR28	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR29	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR30	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR31	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR32	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4CR33	1901-0535		DIODE-SHOTTKY	28480	1901-0535
A4CR34	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A4L1	08558-80011	2	FILTER, COIL, BLUE	28480	08558-80011
A4L2	08558-80011		FILTER, COIL, BLUE	28480	08558-80011
A4Q1	1854-0475	4	TRANSISTOR NPN DUAL 200%-HFE 10MV-VBE	28480	1854-0475
A4Q2	1854-0475		TRANSISTOR NPN DUAL 200%-HFE 10MV-VBE	28480	1854-0475
A4Q3	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q4	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A4Q5	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A4Q6	1855-0052	1	TRANSISTOR; J-FET P-CHAN, D-MODE SI	07263	2N4360
A4Q7	1853-0322	1	TRANSISTOR PNP 2N2946A SI CHIP	01295	2N2946A
A4Q8	1855-0082		TRANSISTOR; J-FET P-CHAN, D-MODE SI	28480	1855-0082
A4Q9	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q10	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4Q11	1854-0039	3	TRANSISTOR NPN 2N3053 SI PD=1W	04713	2N3053
A4Q12	1853-0012	1	TRANSISTOR PNP 2N2904A SI CHIP	01295	2N2904A
A4Q13	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q14	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q15	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q16	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4R1	0698-3159	1	RESISTOR 26.1K 1% .125W F TUBULAR	16299	C4-1/8-TO-2612-F
A4R2	0698-3460	1	RESISTOR 422K 1% .125W F TUBULAR	19701	MF4C1/8-TO-4223-F
A4R3	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A4R4	0698-3155	10	RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-TO-4641-F
A4R5	0698-3439		RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-TO-178R-F
A4R6	2100-2852	3	RESISTOR-VAR TRMR 1KOHM 10% WW SIDE ADJ	32997	3005P-1-102
A4R7	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A4R8	0698-3449	3	RESISTOR 28.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-2872-F
A4R9	0698-3193	1	RESISTOR 10K .25% .125W F TUBULAR	19701	MF4C1/8-C-1002-C
A4R10	0698-6503	1	RESISTOR 101 OHM .25% .125W F TUBULAR	03888	PMF55,T-2
A4R11	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-6[illegible]R-F
A4R12	0757-0444		RESISTOR 12.1K 1% .125W F TUBULAR	24546	C4-1/8-TO[illegible]2-F
A4R13	2100-2852		RESISTOR-VAR TRMR 1KOHM 10% WW SIDE ADJ	32997	3005P-1[illegible]
A4R14	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1[illegible]-F
A4R15	0698-3154	2	RESISTOR 4.22K 1% .125W F TUBULAR	16299	C4-1/8-TO-4221-F
A4R16	0698-3447	2	RESISTOR 422 OHM 1% .125W F TUBULAR	16299	C4-1/8-TO-422R-F
A4R17	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A4R18	0698-7568	1	RESISTOR 6.19K .5% .125W F TUBULAR	19701	MF4C1/8-T2-6191-D
A4R19	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R20	0698-7796	1	RESISTOR 14.7K .25% .125W F TUBULAR	19701	MF4C1/8-TO-1472-C
A4R21	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-TO-6191-F
A4R22	0698-3439		RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-TO-178R-F
A4R23	0757-0438	8	RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-TO-5111-F
A4R24	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A4R25	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-681R-F
A4R26	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R27	0698-0085	7	RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-TO-2611-F
A4R28	0757-0441	2	RESISTOR 8.25K 1% .125W F TUBULAR	24546	C4-1/8-TO-8251-F
A4R29	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-TO-2611-F
A4R30	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-TO-2152-F
A4R31	0698-8025	1	RESISTOR 1.91K .25% .125W F TUBULAR	19701	MF4C1/8-T2-1911-C
A4R32	0698-3249	1	RESISTOR 2.53K .25% .125W F TUBULAR	19701	MF4C1/8-T2-2531-C
A4R33	0698-8038	1	RESISTOR 5.9K .25% .125W F TUBULAR	19701	MF4C1/8-T2-5901-C
A4R34	0698-6780	1	RESISTOR 5.62K .25% .125W F TUBULAR	19701	MF4C1/8-T2-5621-C
A4R35	0698-3453	1	RESISTOR 196K 1% .125W F TUBULAR	16299	C4-1/8-TO-1963-F
A4R36	0698-8038		RESISTOR 5.9K 1% .25W F TUBULAR	16299	C4-1/8-TO-5901-C
A4R37	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R38	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R39	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A4R40	0698-3449		RESISTOR 28.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-2872-F
A4R41	2100-1972	4	RESISTOR-VAR TRMR 20KOHM 10% WW SIDE ADJ	32997	3005P-1-203
A4R42	2100-1972		RESISTOR-VAR TRMR 20KOHM 10% WW SIDE ADJ	32997	3005P-1-203
A4R43	0698-3413	2	RESISTOR 13.3K 1% .5W F TUBULAR	19701	MF7C1/2-TO-1332-F
A4R44	0698-3447		RESISTOR 422 OHM 1% .125W F TUBULAR	16299	C4-1/8-TO-422R-F
A4R45	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R46*	0698-3154		RESISTOR 4.22K 1% .125W F TUBULAR	16299	C4-1/8-TO-4221-F
A4R47	2100-2852		RESISTOR-VAR TRMR 1KOHM 10% WW SIDE ADJ	32997	3005P-1-102
A4R48	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R49	0698-3413		RESISTOR 13.3K 1% .5W F TUBULAR	19701	MF7C1/2-TO-1332-F
A4R50	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-TO-5111-F
A4R51	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-TO-2152-F
A4R52	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-TO-2152-F
A4R53	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R54	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-TO-5111-F
A4R55	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-TO-5111-F
A4R56	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-TO-1472-F
A4R57	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-TO-5111-F
A4R58	0757-0424	5	RESISTOR 1.1K 1% .125W F TUBULAR	24546	C4-1/8-TO-1101-F
A4R59	0757-0278	1	RESISTOR 1.78K 1% .125W F TUBULAR	24546	C4-1/8-TO-1781-F
A4R60	2100-3162	3	RESISTOR-VAR TRMR 200KOHM 10% C SIDE ADJ	32997	3006P-1-204
A4R61*	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-TO-3162-F
A4R62	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R63	2100-3162		RESISTOR-VAR TRMR 200KOHM 10% C SIDE ADJ	32997	3006P-1-204
A4R64*	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-TO-3162-F
A4R65	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R66	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R67*	0698-3453		RESISTOR 196K 1% .125W F TUBULAR	16299	C4-1/8-TO-1963-F
A4R68	0757-0398	1	RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-75R0-F
A4R69	2100-3061	3	RESISTOR-VAR TRMR 500KOHM 10% C SIDE ADJ	32997	3006P-1-504
A4R70*	0757-0461		RESISTOR 68.1K 1% .125W F TUBULAR	24546	C4-1/8-TO-6812-F

*FACTORY SELECTED PART. TYPICAL VALUE SHOWN.

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R71	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R72	0698-3439		RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-TO-178R-F
A4R73*	0698-3453		RESISTOR 196K 1% .125W F TUBULAR	16299	C4-1/8-TO-1963-F
A4R74	0698-3152		RESISTOR 3.48K 1% .125W F TUBULAR	16299	C4-1/8-TO-3481-F
A4R75	2100-3061		RESISTOR-VAR TRMR 500KOHM 10% C SIDE ADJ	32997	3006P-1-504
A4R76*	0757-0461		RESISTOR 68.1K 1% .125W F TUBULAR	24546	C4-1/8-TO-6812-F
A4R77*	0698-3453		RESISTOR 196K 1% .125W F TUBULAR	16299	C4-1/8-TO-1963-F
A4R78	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R79	2100-1972		RESISTOR-VAR TRMR 20KOHM 10% WW SIDE ADJ	32997	3005P-1-203
A4R80	0698-3453		RESISTOR 196K 1% .125W F TUBULAR	16299	C4-1/8-TO-1963-F
A4R81*	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-TO-3162-F
A4R82	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R83	2100-3162		RESISTOR-VAR TRMR 200KOHM 10% C SIDE ADJ	32997	3006P-1-204
A4R84*	0698-3160		RESISTOR 31.6K 1%.125W F TUBULAR	16299	C4-1/8-TO-3162-F
A4R85	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R86	2100-3094	2	RESISTOR-VAR TRMR 100KOHM 10% C SIDE ADJ	32997	3006P-1-104
A4R87*	0757-0461		RESISTOR 68.1K 1% .125W F TUBULAR	24546	C4-1/8-TO-6812-F
A4R88	0757-0405		RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-162R-F
A4R89	2100-3054	2	RESISTOR-VAR TRMR 50KOHM 10% C SIDE ADJ	32997	3006P-1-503
A4R90*	0698-3450		RESISTOR 42.2K 1% .125W F TUBULAR	16299	C4-1/8-TO-4222-F
A4R91	0698-3438	4	RESISTOR 147 OHM 1% .125W F TUBULAR	16299	C4-1/8-TO-147R-F
A4R92	2100-1972		RESISTOR-VAR TRMR 20KOHM 10% WW SIDE ADJ	32997	3005P-1-203
A4R93*	0757-0442		RESISTOR 10.0K 1% .125W F TUBULAR	24546	C4-1/8-TO-1002-F
A4R94	0757-0424		RESISTOR 1.1K 1% .125W F TUBULAR	24546	C4-1/8-TO-1101-F
A4R95	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-TO-5111-F
A4R96	0757-0428	2	RESISTOR 1.62K 1% .125W F TUBULAR	24546	C4-1/8-TO-1621-F
A4R97*	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-TO-2152-F
A4R98	0757-0461		RESISTOR 68.1K 1% .125W F TUBULAR	24546	C4-1/8-TO-6812-F
A4R99	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-TO-1003-F
A4U1	1826-0013		IC LIN AMPLIFIER	28480	1826-0013
A4U2	1826-0013		IC LIN AMPLIFIER	28480	1826-0013
A4U3	1826-0092		IC LIN AMPLIFIER	04713	MC7812CP
A4U4	1826-0092		IC LIN AMPLIFIER	04713	MC7812CP
A4U5	1826-0013		IC LIN AMPLIFIER	28480	1826-0013
A4U6	1826-0013		IC LIN AMPLIFIER	28480	1826-0013
A4U7	1826-0013		IC LIN AMPLIFIER	28480	1826-0013
A4U8	1826-0013		IC LIN AMPLIFIER	28480	1826-0013
A4U9	1826-0013		IC LIN AMPLIFIER	28480	1826-0013
A4VR1	1902-0680	1	DIODE; ZENER; 6.2V VZ; .25W MAX PD	03877	1N827
A4VR2	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A5	08557-60005	1	CONVERTER ASSY, SECOND	28480	08557-60005
A5C1	0160-2437	1	CAPACITOR-FXD 5000PF +80-20% 200WVDC CER	28480	0160-2437
A5C2			PART OF A5, NOT SEPARATELY REPLACEABLE.		
A5C3			PART OF A5, NOT SEPARATELY REPLACEABLE.		
A5C4			PART OF A5, NOT SEPARATELY REPLACEABLE.		
A5C5			PART OF A5, NOT SEPARATELY REPLACEABLE.		
A5C6			PART OF A5, NOT SEPARATELY REPLACEABLE.		
A5C7			PART OF A5, NOT SEPARATELY REPLACEABLE.		
A5C8	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A5CR1	1901-1085	18	DIODE-SCHOTTKY	28480	1901-1085
A5FL1	9135-0002	1	FILTER; LINE 10A	28480	9135-0002
A5L1	08557-80006	3	COIL, IF RESON	28480	08557-80006
A5L2	08557-80007	2	COIL, LO RESON	28480	08557-80007
A5L3	08557-80006		COIL, IF RESON	28480	08557-80006
A5L4	08557-80006		COIL, IF RESON	28480	08557-80006
A5L5	08557-80007		COIL, LO RESON	28480	08557-80007
A5L6	08557-80006		COIL, IF RESON	28480	08557-80006
A5A1	08557-60021	1	BOARD ASSY, 500 MHZ LO	28480	08557-60021
A5A1C1	0160-3878	13	CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C2	0160-2252	1	CAPACITOR-FXD 6.2PF +-.25PF 500WVDC CER	28480	0160-2252
A5A1C3	0160-2249	1	CAPACITOR-FXD 4.7PF +-.25PF 500WVDC CER	28480	0160-2249
A5A1C4	0160-3876	1	CAPACITOR-FXD 47PF +-20% 200WVDC CER	28480	0160-3876
A5A1C5	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A5A1C6	0160-0570	2	CAPACITOR-FXD 220PF +-20% 100WVDC CER	28480	0160-0570
A5A1C7	0160-0570		CAPACITOR-FXD 220PF +-20% 100WVDC CER	28480	0160-0570
A5A1C8	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C9	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A5A1C10	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200WVDC CER	28480	0160-3872
A5A1C11	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C12	0160-2236	8	CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
			*FACTORY SELECTED PART.TYPICAL VALUE SHOWN.		

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A1L1	08557-80002	1	COIL, .075 UH	28480	08557-80002
A5A1L2	9100-2250	1	COIL, .180 UH	28480	9100-2250
A5A1L3	08557-80004		COIL, VARIABLE .055 UH	28480	08557-80004
A5A1L4	9100-2255	1	COIL, .47 UH	28480	9100-2248
A5A1L5	9100-2248	1	COIL, .12 UH	24226	10/120
A5A1L6	08557-80005		COIL, VARIABLE .035 UH	28480	08557-80005
A5A1Q1	1854-0345	8	TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A5A1Q2	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A5A1Q3	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A5A1R1	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A5A1R2	0698-7188	1	RESISTOR 10 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-10R-G
A5A1R3	0757-0420	8	RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A5A1R4	0757-0403	2	RESISTOR 121 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-121R-F
A5A1R5	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A5A1R6	0757-0424		RESISTOR 1.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1101-F
A5A1R7	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A5A1R8	0757-0276	1	RESISTOR 61.9 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A5A1R9	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A5A1R10	0698-3435	2	RESISTOR 38.3 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-38R3-F
A5A1R11	2100-3122	2	RESISTOR-VAR TRMR 500 OHM 10% C SIDE ADJ	32997	3006P-1-501
A5A1R12	0757-0379	4	RESISTOR 12.1 OHM 1% .125W F TUBULAR	19701	MF4C1/8-T0-12R1-F
A5A1R13	0698-3132	3	RESISTOR 261 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-2610-F
A5A1R14	0698-3435		RESISTOR 38.3 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-38R3-F
A5A1R15	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A5A1VR1	1902-3104	1	DIODE-ZNR 5.62V 5% DO-7 PD=.4W	04713	SZ 10939-110
A5A1VR2	1902-3171	1	DIODE-ZNR 11V 5% DO-7 PD=.4W TC=+.062%	04713	SZ 10939-194
A5A1Y1	0410-0588	1	CRYSTAL, 250 MHZ	28480	0410-0588
A5A2	08557-60020	1	BOARD ASSY, IF FILTER	28480	08557-60020
A5A2C1	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A5A2L1	9100-2250	1	COIL; FXD; MOLDED RF CHOKE; .18UH 10%	24226	10/180
A5A2L2	9100-0368	1	COIL; FXD; MOLDED RF CHOKE; .33UH 10%	24226	10/330
A5A2L3	9100-2255	1	COIL; FXD; MOLDED RF CHOKE; .47UH 10%	24226	10/470
A5A3	08557-60019	1	BOARD ASSY, LOW PASS FILTER	28480	08557-60019
A5A3C1	0160-4237	2	CAPACITOR-FXD 6.2PF +-10% 250WVDC MICA	72982	2930-000-6.2PF+-10
A5A3C2	0160-4238	4	CAPACITOR-FXD 10PF +-10% 250WVDC MICA	72982	2930-000-10PF+-10
A5A3C3	0160-4238		CAPACITOR-FXD 10PF +-10% 250WVDC MICA	72982	2930-000-10PF+-10
A5A3C4	0160-4238		CAPACITOR-FXD 10PF +-10% 250WVDC MICA	72982	2930-000-10PF+-10
A5A3C5	0160-4238		CAPACITOR-FXD 10PF +-10% 250WVDC MICA	72982	2930-000-10PF+-10
A5A3C6	0160-4237		CAPACITOR-FXD 6.2PF +-10% 250WVDC MICA	72982	2930-000-6.2PF+-10
A5A4	08557-60018	1	BOARD ASSY, 521.4 AMP	28480	08557-60018
A5A4C1*	0160-2265	1	CAPACITOR-FXD 22PF +-5% 500WVDC CER 0+	28480	0160-2265
A5A4C2	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A4C3	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A5A4C4	0150-0059	1	CAPACITOR-FXD 3.3PF +-.25PF 500WVDC CER	28480	0150-0059
A5A4C5	0160-3877		CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A5A4Q1	1854-0666	3	HP-21 TO-72 PKG		
A5A4Q2	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A5A4R1	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A5A4R2	0698-3441	1	RESISTOR 215 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-215R-F
A5A4R3	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A5A4R4	0757-0443	1	RESISTOR 11K 1% .125W F TUBULAR	24546	C4-1/8-T0-1102-F
A6	08557-60039	1	BOARD ASSY, 21.4 MHZ	28480	08557-60039
A6C1	0160-2055	107	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6C2	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A6C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6C4*	0160-3536	1	CAPACITOR-FXD 620PF +-5% 100WVDC MICA	28480	0160-3536
A6C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6C6	0160-4084	1	CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A6C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A6CR1	1901-0033	5	DIODE-GEN PRP 180V 200MA	28480	1901-0033
A6CR2	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A6CR3	1901-0639	2	DIODE-PIN 110V	28480	1901-0639
A6CR4	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A6CR5	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033

*FACTORY SELECTED PART.TYPICAL VALUE SHOWN.

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6CR6	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A6CR7	1901-0639		DIODE-PIN 110V	28480	1901-0639
A6E1	9170-0847				
A6L1	9140-0096	2	COIL; FXD; MOLDED RF CHOKE; 1UH 10%	24226	15/101
A6L2	9140-0112	1	COIL; FXD; MOLDED RF CHOKE; 4.7UH 10%	24226	15/471
A6L3	9140-0178	2	COIL; FXD; MOLDED RF CHOKE; 12UH 10%	24226	15/122
A6L4	9140-0178		COIL; FXD; MOLDED RF CHOKE; 12UH 10%	24226	15/122
A6L5	9140-0096		COIL; FXD; MOLDED RF CHOKE; 1UH 10%	24226	15/101
A6Q1	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A6Q2	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A6Q3	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A6Q4	1854-0247	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	28480	1854-0247
A6Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A6Q7	1854-0019	19	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6R1	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A6R2*	0757-0462		RESISTOR 75K 1% .125W F TUBULAR	24546	C4-1/8-T0-7502-F
A6R3	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A6R4	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A6R5*	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A6R6	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A6R7	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A6R8	0698-3438		RESISTOR 147 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-147R-F
A6R9	0683-0475	2	RESISTOR 4.7 OHM 5% .25W CC TUBULAR	01121	CB47G5
A6R10	0698-3446		RESISTOR 383 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-383R-F
A6R11	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A6R12	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A6R13	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A6R14	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A6R15	2100-2517	3	RESISTOR; VAR; TRMR; 50KOHM 10% C	19701	ET50X503
A6R16	2100-2517		RESISTOR; VAR; TRMR; 50KOHM 10% C	19701	ET50X503
A6R17	2100-2517		RESISTOR; VAR; TRMR; 50KOHM 10% C	19701	ET50X503
A6R18	0698-3132		RESISTOR 261 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-2610-F
A6R19	0698-3443		RESISTOR 287 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-287R-F
A6R20	0698-3132		RESISTOR 261 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-2610-F
A6R21	0698-3438		RESISTOR 147 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-147R-F
A6R22	0698-3439		RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-178R-F
A6R23	0757-0416	7	RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A6R24	0698-3152		RESISTOR 3.48K 1% .125W F TUBULAR	16299	C4-1/8-T0-3481-F
A6R25	0698-3157	6	RESISTOR 19.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-1962-F
A6R26	0698-3157		RESISTOR 19.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-1962-F
A6R27	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A6R28	0698-3158		RESISTOR 23.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-2372-F
A6R29	0757-0428		RESISTOR 1.62K 1% .125W F TUBULAR	24546	C4-1/8-T0-1621-F
A6R30	0698-3157		RESISTOR 19.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-1962-F
A6R31	0757-0418	2	RESISTOR 619 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-619R-F
A6VR1	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A6VR2	1902-3059	1	DIODE-ZNR 3.83V 5% DO-7 PD=.4W TC=	04713	SZ 10939-62
A7	08557-60007	1	ASSY, FIRST CONVERTER	28480	08557-60007
A7C1	0160-2604	4	CAPACITOR-FXD 1000PF +100-0% 300WVDC CER	01121	FW5N-1000 PF
A7C2	0160-2604		CAPACITOR-FXD 1000PF +100-0% 300WVDC CER	01121	FW5N-1000 PF
A7C3	0160-2604		CAPACITOR-FXD 1000PF +100-0% 300WVDC CER	01121	FW5N-1000 PF
A7C4	0160-2604		CAPACITOR-FXD 1000PF +100-0% 300WVDC CER	01121	FW5N-1000 PF
A7C5	0180-1735	1	CAPACITOR-FXD; .22UF+-10% 35VDC TA	56289	150D224X9035A2
A7MP1	08557-00021	1	GASKET, SILVER IMPREG SILICON	28480	08557-00021
A7A1	08557-60046	1	BOARD ASSY, FIRST LO	28480	08557-60046
A7A1C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C2	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C3	0160-2204	2	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A7A1C4	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A7A1C5	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C6	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C7	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C8	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C9	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C10*	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C11	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1C12	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A7A1CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A7A1CR2	0122-0078	1	DIO-VVC 2.2PF 5% C3/C25=4.5 MIN	04713	BB105B
A7A1CR3	1901-1068	3	DIODE-SCHOTTKY	28480	1901-1068
A7A1CR4	1901-1068		DIODE-SCHOTTKY	28480	1901-1068

*FACTORY SELECTED PART.TYPICAL VALUE SHOWN.

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7A1L1	9100-1610	3	COIL: FXD: MOLDED RF CHOKE: .15UH 20%	24226	15/150
A7A1L2	9100-1610		COIL: FXD: MOLDED RF CHOKE: .15UH 20%	24226	15/150
A7A1L3	9100-2247	3	COIL: FXD: MOLDED RF CHOKE: .1UH 10%	24226	10/100
A7A1L4	08557-00013	1	COIL, FXD .003 UH	28480	08557-00013
A7A1L5	08557-20038	1	COIL, FXD .02 UH	28480	08557-20038
A7A1L6			NOT ASSIGNED		
A7A1L7	9100-2247		COIL: FXD: MOLDED RF CHOKE: .1UH 10%	24226	10/100
A7A1L8	9100-1610		COIL: FXD: MOLDED RF CHOKE: .15UH 20%	24226	15/150
A7A1MP1	08557-20048	1	SHIELD; METAL CAN	28480	08557-20048
A7A1Q1	1854-0666		TRANSISTOR, HP-21 TO-72 PKG	28480	1854-0666
A7A1Q2	1854-0666		TRANSISTOR, HP-21 TO-72 PKG	28480	1854-0666
A7A1Q3	1853-0034	1	TRANSISTOR PNP SI CHIP TO-18, PD=360MW	28480	1853-0034
A7A1R1	0757-0462	1	RESISTOR 75K 1% .125W F TUBULAR	24546	C4-1/8-T0-7502-F
A7A1R2	0698-3150	3	RESISTOR 2.37K 1% .125W F TUBULAR	16299	C4-1/8-T0-2371-F
A7A1R3	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A7A1R4	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A7A1R5	0757-0394	3	RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-51R1-F
A7A1R6	0698-3150		RESISTOR 2.37K 1% .125W F TUBULAR	16299	C4-1/8-T0-2371-F
A7A1R7	0698-3150		RESISTOR 2.37K 1% .125W F TUBULAR	16299	C4-1/8-T0-2371-F
A7A1R8	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A7A1R9	0698-3437	1	RESISTOR 133 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-133R-F
A7A1R10	0698-3405	1	RESISTOR 422 OHM 1% .5W F TUBULAR	19701	MF7C1/2-T0-422R-F
A7A1R11	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A7A1R12	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A7A1R13	0757-0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-51R1-F
A7A1R14	0698-7188		RESISTOR 10 OHM 2% .05W F TUBULAR	24546	C3-1/8-TO-10R-G
A7A1R15	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-TO-10RJ-F
A7A2	08557-60047	1	BOARD ASSY, FIRST MIXER	28480	08557-60047
A7A2C1	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A7A2C2	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200WVDC CER	28480	0160-3872
A7A2C3	0150-0021	2	CAPACITOR-FXD .47PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A7A2C4	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200WVDC CER	28480	0160-3872
A7A2C5	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A7A2CR1	1901-0050	4	DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A7A2CR2	1901-0050		DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A7A2L1	08557-80001	2	COIL, INDUCTOR	28480	08557-80001
A7A2L2	08557-80001		COIL, INDUCTOR	28480	08557-80001
A7A2MP1	08557-20047	1	SHIELD; METAL CAN	28480	08557-20049
A7A2R1	0698-7227	2	RESISTOR 422 OHM 2% .05W F TUBULAR	24546	C3-1/8-T0-422R-G
A7A2R2	0698-7190	1	RESISTOR 12.1 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-12R1-G
A7A2R3	0698-7227		RESISTOR 422 OHM 2% .05W F TUBULAR	24546	C3-1/8-T0-422R-G
A7A2R4	0698-7224	2	RESISTOR 316 OHM 2% .05W F TUBULAR	24546	C3-1/8-T0-316R-G
A7A2R5	0698-7194	1	RESISTOR 17.8 OHM 2% .05W F TUBULAR	24546	C3-1/8-T00-17R8-G
A7A2R6	0698-7224		RESISTOR 316 OHM 2% .05W F TUBULAR	24546	C3-1/8-T0-316R-G
A7A2U1	0955-0062	1	MIXER, 1500 MHZ	28480	0955-0062
A8	08558-60011	1	ASSY, BANDWIDTH FILTER, NO. 2	28480	08558-60011
A8C1	0121-0479	4	CAPACITOR: VAR: TRMR: AIR: 1.7/11PF	74970	187-0106-195
A8C2	0121-0453	2	CAPACITOR: VAR: TRMR: AIR: 1.3/5.4PF	74970	187-0103-195
A8C3	0121-0479		CAPACITOR: VAR: TRMR: AIR: 1.7/11PF	74970	187-0106-195
A8C4	0121-0479		CAPACITOR: VAR: TRMR: AIR: 1.7/11PF	74970	187-0106-195
A8C5	0121-0453		CAPACITOR: VAR: TRMR: AIR: 1.3/5.4PF	74970	187-0103-195
A8C6	0121-0479		CAPACITOR: VAR: TRMR: AIR: 1.7/11PF	74970	187-0106-195
A8C7	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C8	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C10	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C11	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C12	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C13	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C14	0160-2255	6	CAPACITOR-FXD 8.2PF +-.25PF 500WVDC CER	28480	0160-2255
A8C15	0160-2255		CAPACITOR-FXD 8.2PF +-.25PF 500WVDC CER	28480	0160-2255
A8C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C20	0160-2208	2	CAPACITOR-FXD 330PF +-5% 300WVDC MICA	28480	0160-2208
A8C21	0160-3467	2	CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3467
A8C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C24	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A8C25	0160-3157	2	CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-3157
A8C26	0160-2253		CAPACITOR-FXD 6.8PF +-.25PF 500WVDC CER	28480	0160-2253
A8C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C28	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C29	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C30	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8C31	0160-2255		CAPACITOR-FXD 8.2PF +-.25PF 500WVDC CER	28480	0160-2255
A8C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C35	0160-3467		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3467
A8C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C38	0160-2208		CAPACITOR-FXD 330PF +-5% 300WVDC MICA	28480	0160-2208
A8C39	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A8C40	0160-3157		CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-3157
A8C41	0160-2253		CAPACITOR-FXD 6.8PF +-.25PF 500WVDC CER	28480	0160-2253
A8C42	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C43	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C44	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A8C45	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C46	0160-2255		CAPACITOR-FXD 8.2PF +-.25PF 500WVDC CER	28480	0160-2255
A8C47	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C48	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8C49	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A8CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A8CR2	1901-0047	7	DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR3	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR4	1901-1070	11	DIODE:PIN	28480	1901-1070
A8CR5	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A8CR6	1901-1070		DIODE:PIN	28480	1901-1070
A8CR7	1901-1070		DIODE:PIN	28480	1901-1070
A8CR8	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A8CR9	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR10	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A8CR11	1901-1070		DIODE:PIN	28480	1901-1070
A8CR12	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A8CR13	1901-1070		DIODE:PIN	28480	1901-1070
A8E1	9170-0029	7	CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A8E2	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A8E3	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A8L1	9100-1623	3	COIL; FXD; MOLDED RF CHOKE; 27UH 5%	24226	15/272
A8L2	9100-1619	12	COIL; FXD; MOLDED RF CHOKE; 6.8UH 10%	24226	15/681
A8L3	9100-1619		COIL; FXD; MOLDED RF CHOKE; 6.8UH 10%	24226	15/681
A8L4	9100-1623		COIL; FXD; MOLDED RF CHOKE; 27UH 5%	24226	15/272
A8L5	9100-1619		COIL; FXD; MOLDED RF CHOKE; 6.8UH 10%	24226	15/681
A8L6	9100-1619		COIL; FXD; MOLDED RF CHOKE; 6.8UH 10%	24226	15/681
A8L7	9100-1623		COIL; FXD; MOLDED RF CHOKE; 27UH 5%	24226	15/272
A8L8	9100-1619		COIL; FXD; MOLDED RF CHOKE; 6.8UH 10%	24226	15/681
A8Q1	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A8Q2	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8Q3	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A8Q4	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A8Q5	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A8Q6	1855-0081	2	TRANSISTOR; J-FET N-CHAN, D-MODE SI	01295	2N5245
A8Q7	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A8Q8	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8Q9	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A8Q10	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A8Q11	1855-0081		TRANSISTOR; J-FET N-CHAN, D-MODE SI	01295	2N5245
A8Q12	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A8Q13	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A8R1	2100-3094		RESISTOR-VAR TRMR 100KOHM 10% C SIDE ADJ	32997	3006P-1-104
A8R2	2100-3052		RESISTOR-VAR TRMR 50 OHM 20% C SIDE ADJ	32997	3006P-1-500
A8R3	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R4	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A8R5	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A8R6	0757-0440	7	RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R7	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A8R8	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A8R9	0698-3439		RESISTOR 178 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-178R-F
A8R10	0698-3432	1	RESISTOR 26.1 OHM 1% .125W F TUBULAR	03888	PME55-1/8-T0-26R1-F
A8R11	0757-0379		RESISTOR 12.1 OHM 1% .125W F TUBULAR	19701	MF4C1/8-T0-12R1-F
A8R12	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R13	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A8R14	0757-0440		RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R15	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A8R16	0757-0180	4	RESISTOR 31.6 OHM 1% .125W F TUBULAR	24546	C5-1/4-T0-31R6-F
A8R17	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A8R18	0757-0440		RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R19	0757-0417	3	RESISTOR 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F
A8R20	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R21	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A8R22	0698-0084	4	RESISTOR 2.15K 1% .125W F TUBULAR	16299	C4-1/8-T0-2151-F
A8R23	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A8R24	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A8R25	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A8R26	0757-0180		RESISTOR 31.6 OHM 1% .125W F TUBULAR	24546	C5-1/4-T0-31R6-F
A8R27	0698-3260		RESISTOR 464K 1% .125W F TUBULAR	19701	MF4C1/8-T0-4643-F
A8R28	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A8R29	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A8R30	0757-0379		RESISTOR 12.1 OHM 1% .125W F TUBULAR	19701	MF4C1/8-T0-12R1-F
A8R31	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R32	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A8R33	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A8R34	0757-0440		RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R35	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A8R36	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R37	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A8R38	0757-0440		RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R39	0757-0180		RESISTOR 31.6 OHM 1% .125W F TUBULAR	24546	C5-1/4-T0-31R6-F
A8R40	0757-0417		RESISTOR 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F
A8R41	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A8R42	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A8R43	0698-0084		RESISTOR 2.15K 1% .125W F TUBULAR	16299	C4-1/8-T0-2151-F
A8R44	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A8R45	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A8R46	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A8R47	0757-0180		RESISTOR 31.6 OHM 1% .125W F TUBULAR	24546	C5-1/4-T0-31R6-F
A8R48	0757-0379		RESISTOR 12.1 OHM 1% .125W F TUBULAR	19701	MF4C1/8-T0-12R1-F
A8R49	0698-0084		RESISTOR 2.15K 1% .125W F TUBULAR	16299	C4-1/8-T0-2151-F
A8R50	0698-3260		RESISTOR 464K 1% .125W F TUBULAR	19701	MF4C1/8-T0-4643-F
A8R51	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R52	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A8R53	0757-0419		RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A8R54	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R55	0757-0440		RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R56	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A8T1	08558-80008	2	TRANSFORMER	28480	08558-80008
A8T2	08558-80008		TRANSFORMER	28480	08558-80008
A8Y1	0410-0450	1	CRYSTAL, MATCHED SET OF 4, 21.4 MHZ (MATCHED SET OF FOUR, INCL A10Y1,Y2).	28480	0410-0450
A8Y2		1	(PART OF A8Y1)		
A9	08557-60009	1	BOARD ASSY, STEP GAIN	28480	08557-60009
A9C1	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C12	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A9C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C16	0160-3457	3	CAPACITOR-FXD 2000PF +-10% 250WVDC CER	28480	0160-3457
A9C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C18	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C19	0160-3457		CAPACITOR-FXD 2000PF +-10% 250WVDC CER	28480	0160-3457
A9C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C22	0160-3457		CAPACITOR-FXD 2000PF +-10% 250WVDC CER	28480	0160-3457
A9C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A9C24	0160-2199		CAPACITOR-FXD .01UF +-5% 300WVDC MICA	28480	0160-2199
A9C25	0160-2199		CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-2199
A9CR1	1901-0050		DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A9CR2	1901-0050		DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A9CR3	1901-1070		DIODE:PIN	28480	1901-1070
A9CR4	1901-1070		DIODE:PIN	28480	1901-1070
A9CR5	1901-1070		DIODE:PIN	28480	1901-1070

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9CR6	1901-1070		DIODE:PIN	28480	1901-1070
A9E1	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A9E2	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A9E3	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A9L1	9140-0179	10	COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L2	9140-0179		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L3	9140-0179		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L4	9140-0179		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L5	9140-0179		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L6	9140-0179		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L7	9140-0179		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L8	9140-0179		COIL; FXD; MOLDED RF CHOKE; 22UH 10%	24226	15/222
A9L9	9100-2260	1	COIL; FXD; MOLDED RF CHOKE; 1.8UH 10%	76493	9230-26
A9L10	9140-0158	1	COIL, FXD, MOLDED RF CHOKE, 1UH 10%	24226	10/101
A9Q1	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A9Q2	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A9Q3	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A9Q4	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A9Q5	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A9Q6	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A9Q7	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A9Q8	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A9Q9	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A9R1	2100-3056	3	RESISTOR-VAR TRMR 5KOHM 10% C SIDE ADJ	32997	3006P-1-502
A9R2	2100-3056		RESISTOR-VAR TRMR 5KOHM 10% C SIDE ADJ	32997	3006P-1-502
A9R3	2100-3054		RESISTOR-VAR TRMR 50KOHM 10% C SIDE ADJ	32997	3006P-1-503
A9R4	2100-3061		RESISTOR-VAR TRMR 500KOHM 10% C SIDE ADJ	32997	3006P-1-504
A9R5	2100-3103		RESISTOR-VAR TRMR 10KOHM 10% C SIDE ADJ	32997	3006P-1-103
A9R6	2100-3056		RESISTOR-VAR TRMR 5KOHM 10% C SIDE ADJ	32997	3006P-1-502
A9R7			NOT ASSIGNED		
A9R8	0757-0288	3	RESISTOR 9.09K 1% .125W F TUBULAR	19701	MF4C1/8-T0-9091-F
A9R9	0698-3457		RESISTOR 316K 1% .125W F TUBULAR	19701	MF4C1/8-T0-3163-F
A9R10	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A9R11	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A9R12	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A9R13	0757-0288		RESISTOR 9.09K 1% .125W F TUBULAR	19701	MF4C1/8-T0-9091-F
A9R14	0757-0395	4	RESISTOR 56.2 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-56R2-F
A9R15	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A9R16	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A9R17	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A9R18	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A9R19	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A9R20	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A9R21	0698-3162	3	RESISTOR 46.4K 1% .125W F TUBULAR	16299	C4-1/8-T0-4642-F
A9R22	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A9R23	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A9R24	0757-0395		RESISTOR 56.2 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-56R2-F
A9R25	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A9R26	0757-0417		RESISTOR 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F
A9R27	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A9R28	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A9R29	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A9R30	0757-0395		RESISTOR 56.2 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-56R2-F
A9R31	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A9R32	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A9R33	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A9R34	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A9R35	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A9R36	0757-0395		RESISTOR 56.2 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-56R2-F
A9R37	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A9R38	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A9R39	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A9R40	0698-3440	5	RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A9R41	0698-3162		RESISTOR 46.4K 1% .125W F TUBULAR	16299	C4-1/8-T0-4642-F
A9R42	0698-3162		RESISTOR 46.4K 1% .125W F TUBULAR	16299	C4-1/8-T0-4642-F
A9S1	3101-0973	1	SWITCH; SL; DPDT NS; .5A 125VAC/DC	79727	GF126-0018
A10			SAME AS A8, USE PREFIX A10		
A11	08558-60014	1	ASSY, LOG AMPLIFIER	28480	08558-60014
A11C1	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C2	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A11C3	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A11C4	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A11C5	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C7	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A11C8	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A11C9	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C10	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C11	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C12	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C13	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C14	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C15	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C16	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C17	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C18	0160-2234		CAPACITOR-FXD .51PF +-.25PF 500WVDC CER	28480	0160-2234
A11C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C20	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A11C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C26	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C27	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C28	0180-0228	1	CAPACITOR-FXD; 22UF+-10% 15VDC TA-SOLID	56289	150D226X9015B2
A11C29	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C30	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A11C31	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C32	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C33	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C34	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C35	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C36	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C37	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C38	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C39	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C40	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A11C41	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C42	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C43	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C44	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C45	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C46	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C47	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C48	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C49	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C50	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C51	0160-3459		CAPACITOR-FXD .02UF +-20% 100WVDC CER	28480	0160-3459
A11C52	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A11C53	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C54	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C55	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C56	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C57	0160-2256	1	CAPACITOR-FXD 9.1PF +-.25PF 500WVDC CER	28480	0160-2256
A11C58	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C59	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C60	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C61	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C62	0140-0195	1	CAPACITOR-FXD 130PF +-5% 300WVDC MICA	72136	DM15F131J0300WV1CR
A11C63	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C64	0160-2308	1	CAPACITOR-FXD 36PF +-5% 300WVDC MICA	28480	0160-2308
A11C65	0160-2240	1	CAPACITOR-FXD 2PF +-.25PF 500WVDC CER	28480	0160-2240
A11C66	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C67	0160-2236		CAPACITOR-FXD 1PF +-.25PF 500WVDC CER	28480	0160-2236
A11C68	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C69	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C70	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C71	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C72	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C73	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C74	0180-2206	1	CAPACITOR-FXD; 60UF+-10% 6VDC TA-SOLID	56289	150D606X9006B2
A11C75	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11C76	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A11CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR3	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR4	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR5	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11CR6	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A11CR7	1901-0047		DIODE-SWITCHING 10NS 20V 75MA	28480	1901-0047
A11CR8	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR9	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR10	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR11	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR12	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR13	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR14	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR15	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR16	1901-1070		DIODE:PIN	28480	1901-1070
A11CR17	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR18	1901-1070		DIODE:PIN	28480	1901-1070
A11CR19	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR20	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR21	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR22	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR23	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR24	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR25	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR26	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR27	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR28	1901-1085		DIODE-SCHOTTKY	28480	1901-1085
A11CR29	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR30	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR31	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11CR32	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A11E1	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A11L1	9100-1622	2	COIL: FXD: MOLDED RF CHOKE: 24UH 5%	24226	15/242
A11L2	9140-0105	2	COIL: FXD: MOLDED RF CHOKE: 8.2UH 10%	24226	15/821
A11L3	9100-1619		COIL: FXD: MOLDED RF CHOKE: 6.8UH 10%	24226	15/681
A11L4	9100-1619		COIL: FXD: MOLDED RF CHOKE: 6.8UH 10%	24226	15/681
A11L5	9100-1619		COIL: FXD: MOLDED RF CHOKE: 6.8UH 10%	24226	15/681
A11L6	9100-1619		COIL: FXD: MOLDED RF CHOKE: 6.8UH 10%	24226	15/681
A11L7	9100-1619		COIL: FXD: MOLDED RF CHOKE: 6.8UH 10%	24226	15/681
A11L8	9100-1619		COIL: FXD: MOLDED RF CHOKE: 6.8UH 10%	24226	15/681
A11L9	9100-1627	1	COIL: FXD: MOLDED RF CHOKE: 39UH 5%	24226	15/392
A11L10	9100-1629	1	COIL: FXD: MOLDED RF CHOKE: 47UH 5%	24226	15/472
A11L11	9100-1622		COIL: FXD: MOLDED RF CHOKE: 24UH 5%	24226	15/242
A11L12	9100-1619		COIL: FXD: MOLDED RF CHOKE: 6.8UH 10%	24226	15/681
A11L13	9140-0105		COIL: FXD: MOLDED RF CHOKE: 8.2UH 10%	24226	15/821
A11Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q2	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q3	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q4	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q5	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q6	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q7	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q8	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q9	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q10	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q11	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q12	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q13	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q14	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q15	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A11Q16	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A11Q17	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A11Q18	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A11Q19	1853-0015	1	TRANSISTOR PNP SI CHIP PD=200MW	28480	1853-0015
A11Q20	1854-0475		TRANSISTOR NPN DUAL 200%-HFE 10MV-VBE	28480	1854-0475
A11Q21	1854-0404		TRANSISTOR NPN SI TO-18 PD=3[illegible]W	28480	1854-0404
A11Q22	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A11Q23	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q24	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A11Q25	1854-0039		TRANSISTOR NPN 2N3053 SI PD=1W	04713	2N3053
A11R1	2100-3109		RESISTOR-VAR TRMR 2KOHM 10% C SIDE ADJ	32997	3006P-1-202
A11R2	2100-3161	1	RESISTOR-VAR TRMR 20KOHM 10% C SIDE ADJ	32997	3006P-1-203
A11R3	2100-3109		RESISTOR-VAR TRMR 2KOHM 10% C SIDE ADJ	32997	3006P-1-202
A11R4	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A11R5	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R6*	0757-0344	27	RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R7	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A11R8*	0757-0280	19	RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
			*FACTORY SELECTED PART. TYPICAL VALUE SHOWN.		

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R9	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A11R10	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A11R11	0757-0440		RESISTOR 7.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A11R12	0698-3157		RESISTOR 19.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-1962-F
A11R13	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R14	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A11R15	0698-3136	1	RESISTOR 17.8K 1% .125W F TUBULAR	16299	C4-1/8-T0-1782-F
A11R16*	0698-3443	2	RESISTOR 287 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-287R-F
A11R17	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A11R18			NOT ASSIGNED		
A11R19	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A11R20	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R21	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R22	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R23*	0698-3444	20	RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R24	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R25	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R26	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R27	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R28	0698-3449		RESISTOR 28.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-2872-F
A11R29	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A11R30	0698-3152		RESISTOR 3.48K 1% .125W F TUBULAR	16299	C4-1/8-T0-3481-F
A11R31	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R32	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R33	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R34	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R35	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R36	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R37	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A11R38	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R39	0698-3154		RESISTOR 4.22K 1% .125W F TUBULAR	16299	C4-1/8-T0-4221-F
A11R40	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A11R41	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R42	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R43	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R44	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A11R45	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A11R46*	0698-0083	2	RESISTOR 1.96K 1% .125W F TUBULAR	16299	C4-1/8-T0-1961-F
A11R47	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R48	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R49	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A11R50	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R51	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R52	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A11R53	0698-0083		RESISTOR 1.96K 1% .125W F TUBULAR	16299	C4-1/8-T0-1961-F
A11R54	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A11R55	0698-3151		RESISTOR 2.87K 1% .125W F TUBULAR	16299	C4-1/8-T0-2871-F
A11R56	0757-0458		RESISTOR 51.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F
A11R57	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R58	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R59	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A11R60	0698-3157		RESISTOR 19.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-1962-F
A11R61	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A11R62	0698-3152		RESISTOR 3.48K 1% .125W F TUBULAR	16299	C4-1/8-T0-3481-F
A11R63	0698-3157		RESISTOR 19.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-1962-F
A11R64	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R65*	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R66	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A11R67	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R68	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R69	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R70	0757-0463	1	RESISTOR 82.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-8252-F
A11R71	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R72	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R73	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R74*	0698-3152	2	RESISTOR 3.48K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A11R75	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A11R76	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R77	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A11R78	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R79	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R80	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F

*FACTORY SELECTED PART.TYPICAL VALUE SHOWN.

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11R81	0757-0403		RESISTOR 121 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-121R-F
A11R82*	0757-0290	12	RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R83	0757-0419		RESISTOR 619 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-619R-F
A11R84	0757-0402	1	RESISTOR 110 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-111-F
A11R85	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R86			NOT ASSIGNED		
A11R87	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R88	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A11R89	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R90	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R91	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A11R92	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R93	0757-0438		RESISTOR 5.11K 1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A11R94	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R95	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R96	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A11R97	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R98	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R99	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R100	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R101	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A11R102*	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R103	0757-0405	9	RESISTOR 162 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-162R-F
A11R104	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R105	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A11R106	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R107	0757-0288		RESISTOR 9.09K 1% .125W F TUBULAR	19701	MF4C1/8-T0-9091-F
A11R108	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A11R109	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R110	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R111	0698-3158		RESISTOR 23.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-2372-F
A11R112	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A11R113	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A11R114	0698-3160		RESISTOR 31.6K 1% .125W F TUBULAR	16299	C4-1/8-T0-3162-F
A11R115	0757-0346		RESISTOR 10 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A11R116	0757-0289		RESISTOR 13.3K 1% .125W F TUBULAR	19701	MF4C1/8-T0-1332-F
A11R117	0698-0085		RESISTOR 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A11R118	0757-0439		RESISTOR 6.81K 1% .125W F TUBULAR	24546	C4-1/8-T0-6811-F
A11R119*	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R120	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A11R121	0698-3438		RESISTOR 147 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-147R-F
A11R122	0757-0447	2	RESISTOR 16.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-1622-F
A11R123	0757-0447		RESISTOR 16.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-1622-F
A11R124	0757-0441		RESISTOR 8.25K 1% .125W F TUBULAR	24546	C4-1/8-T0-8251-F
A11R125	0698-3260		RESISTOR 464K 1% .125W F TUBULAR	19701	MF4C1/8-T0-4643-F
A11R126	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A11R127	0757-0421	1	RESISTOR 825 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-825R-F
A11R128	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11R129	0757-0290		RESISTOR 6.19K 1% .125W F TUBULAR	19701	MF4C1/8-T0-6191-F
A11U1	1826-0[illegible]2		IC LIN AMPLIFIER	04713	MC7812CP
A11VR1	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=	04713	SZ 10939-98
A11VR2	1902-0048	1	DIODE-ZNR 6.81V 5% DO-7 PD=.4W	28480	1902-0048
A11VR3	1902-0579	1	DIODE; ZENER; 5.11V VZ; 1W MAX PD	04713	SZ 11213-56
A12	08557-60012	1	BOARD ASSY, VERTICAL DRIVE	28480	08557-60012
A12C1	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A12C2	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A12C3	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A12C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A12C5	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A12C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A12CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR3	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A12CR5	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR6	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR7	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A12CR8	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040

*FACTORY SELECTED PART. TYPICAL VALUE SHOWN.

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12L1	9140-0179		COIL: FXD: MOLDED RF CHOKE: 22UH 10%	24226	15/222
A12L2	9140-0179		COIL: FXD: MOLDED RF CHOKE: 22UH 10%	24226	15/222
A12MP1	0380-0111	1	STANDOFF-RVT-ON KNRL .25-LG 6-32-THD	28480	0380-0111
A12Q1	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A12Q2	1854-0234	4	TRANSISTOR NPN 2N3440 SI PD=1W	02735	2N3440
A12Q3	1854-0234		TRANSISTOR NPN 2N3440 SI PD=1W	02735	2N3440
A12Q4	1854-0009	1	TRANSISTOR NPN 2N709 SI TO-18 PD=300MW	28480	1854-0009
A12Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q6	1854-0234		TRANSISTOR NPN 2N3440 SI PD=1W	02735	2N3440
A12Q7	1854-0234		TRANSISTOR NPN 2N3440 SI PD=1W	02735	2N3440
A12Q8	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A12Q9	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A12Q10	1854-0039		TRANSISTOR NPN 2N3053 SI PD=1W	04713	2N3053
A12Q11	1853-0050	2	TRANSISTOR PNP SI CHIP TO-18 PD=360MW	28480	1853-0050
A12Q12	1853-0050		TRANSISTOR PNP SI CHIP TO-18 PD=360MW	28480	1853-0050
A12Q13	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q14	1854-0475		TRANSISTOR NPN DUAL 200%-HFE 10MV-VBE	28480	1854-0475
A12Q15	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q16	1853-0007		TRANSISTOR PNP 2N3251 SI CHIP	04713	2N3251
A12Q17	1855-0049	1	TRANSISTOR; JFET;DUAL; N-CHAN D-MODE SI	28480	1855-0049
A12Q18	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12Q19	1855-0417	1	TRANSISTOR FET		1855-0417
A12Q20	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A12R1	2100-3123		RESISTOR-VAR TRMR 500 OHM 10% C SIDE ADJ	32997	3006P-1-501
A12R2	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A12R3	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A12R4	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A12R5	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A12R6			NOT ASSIGNED		
A12R7			NOT ASSIGNED		
A12R8			NOT ASSIGNED		
A12R9	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A12R10	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A12R11	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A12R12	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A12R13	0683-0475		RESISTOR 4.7 OHM 5% .25W CC TUBULAR	01121	CB47G5
A12R14	0757-0424		RESISTOR 1.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1101-F
A12R15			NOT ASSIGNED		
A12R16	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A12R17	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A12R18	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A12R19	0698-0084		RESISTOR 2.15K 1% .125W F TUBULAR	16299	C4-1/8-T0-2151-F
A12R20	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A12R21	0683-1055		RESISTOR 1M 5% .25W CC TUBULAR	01121	CB1055
A12R22	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A12R23	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A12R24	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A12R25	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A12R26	0698-3153		RESISTOR 3.83K 1% .125W F TUBULAR	16299	C4-1/8-T0-3831-F
A12R27	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A12R28	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A12R29	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A12R30	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A12R31	0757-0444		RESISTOR 12.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1212-F
A12R32	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A12R33	0757-0424		RESISTOR 1.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1101-F
A12R34	0698-3156		RESISTOR 14.7K 1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A12R35	0757-0279		RESISTOR 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A12R36	0757-0200	1	RESISTOR 5.62K 1% .125W F TUBULAR	24546	C4-1/8-T0-5621-F
A12R37	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A12R38	0757-0199		RESISTOR 21.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A12R39	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A12R40	0757-0394		RESISTOR 51.1 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-51R1-F
A12R41	0698-3155		RESISTOR 4.64K 1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A12R42	0757-0416		RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A12R43	0757-0442		RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A12R44	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A12R45	0757-0837	2	RESISTOR 8.25K 1% .5W F TUBULAR	19701	MF7C1/2-T0-8251-F
A12R46	0757-0844	2	RESISTOR 16.2K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1622-F
A12R47	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A12R48	0757-0420		RESISTOR 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A12R49	0757-0844		RESISTOR 16.2K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1622-F
A12R50	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F

Table 6-3. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12R51	0757-0837		RESISTOR 8.25K 1% .5W F TUBULAR	19701	MF7C1/2-T0-8251-F
A12R52	0698-3444		RESISTOR 316 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-316R-F
A12U1	1858-0032	1	IC LIN CA3146E TRANSISTOR ARRAY	02735	CA3146E
A12VR1	1902-0033	1	DIODE; ZENER; 6.2V VZ; .25W MAX PD	03877	1N823
A12VR2	1902-0202	1	DIODE; ZENER; 15V VZ; 1W MAX PD	04713	SZ11213-191
A12VR3	1902-0556	1	DIODE; ZENER; 20V VZ; 1W MAX PD	04713	SZ 11213-227
A13	08557-60041	1	BOARD ASSY, MOTHER	28480	08557-60041
A13C1	0160-2055		CAPACITOR-FXD .01 MFD +80-20% 100 WVDC CER	28480	0160-2055
A13J1	1251-0541	2	CONNECTOR; 34 CONT; MALE; RECTANGULAR	76381	3431-1002
A13J2	1251-0541		CONNECTOR; 34 CONT; MALE; RECTANGULAR	76381	3431-1002
A13R1	0757-0395		RESISTOR 56.2 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-56R2-F
A13R2	0757-0465		RESISTOR 100K 1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A13R3	0698-5368	1	RF 3740 OHM .25%	28480	0698-5368
A13R4	2100-1757		RESISTOR-VAR TRMR 500 OHM 5% WW TOP ADJ	GB027	CT-106-4
A13R5	0757-0444		RESISTOR 12.1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1212-F
A13R6	0698-3442		RESISTOR 237 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-237R-F
A13VR1	1902-0632	1	DIODE; ZENER; 17V V2; 5W MAX PD	04713	1N5354B
A13VR2	1902-0631	1	DIODE; ZENER; 14V V2; 5W MAX PD	04713	1N5351B
A13XA1			NOT ASSIGNED		
A13XA2			NOT ASSIGNED		
A13XA3	1251-1365	6	CONNECTOR; PC EDGE; 22 CONT; DIP SOLDER	71785	252-22-30-300
A13XA4	1251-1365		CONNECTOR; PC EDGE; 22 CONT; DIP SOLDER	71785	252-22-30-300
A13XA5			NOY ASSIGNED		
A13XA6	1251-0472	1	CONNECTOR; PC EDGE; 6 CONT; DIP SOLDER	71785	252-06-30-300
A13XA7	1251-2034	2	CONNECTOR; PC EDGE; 10 CONT; DIP SOLDER	71785	252-10-30-300
A13XA8	1251-1365		CONNECTOR; PC EDGE; 22 CONT; DIP SOLDER	71785	252-22-30-300
A13XA9	1251-1365		CONNECTOR; PC EDGE: 22 CONT; DIP SOLDER	71785	252-22-30-300
A13XA10	1251-1365		CONNECTOR; PC EDGE; 22 CONT; DIP SOLDER	71785	252-22-30-300
A13XA11	1251-1365		CONNECTOR; PC EDGE; 22 CONT; DIP SOLDER	71785	252-22-30-300
A13XA12	1251-2034		CONNECTOR; PC EDGE; 10 CONT; DIP SOLDER	71785	252-10-30-300
P1	1251-0136	1	CONNECTOR; 32 CONT; MALE; BLUE RIBBON	71785	26-4100-32P
W1	08557-60016	1	CABLE ASSY LPF	28480	08557-60016
W2	08557-60017	1	CABLE ASSY 1ST CONV	28480	08557-60017
W3	08557-60022	1	CABLE ASSY 2ND CONV	28480	08557-60022
W4	08557-60023	1	CABLE ASSY CAL OUT	28480	08557-60023
W5	08557-60024	1	CALBE ASSY RF IN	28480	08557-60024
W6	08557-60044	1	CABLE ASSY ATTEN	28480	08557-60044
W7	08557-60045	1	BOARD ASSY CONN VERT	28480	08557-60045

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			FRONT PANEL ASSEMBLY		
1	08558-00036	1	KNOB	28480	08558-00036
2	3030-0007	33	SCREW-SET 4-40 SMALL CUP PT HEX REC ALY	28480	3030-0007
3	0510-0089	1	RETAINER, RING, .188 DIA, CAD PLT BE CU	97464	3100-18-BC-CD
4	08558-00017	1	DISC, INDEX	28480	08558-00017
5	3050-0032	2	WASHER-FL MTLC NO. 10 .189 IN ID .312 IN	28480	3050-0032
6	08558-60050	1	KNOB, REF LEVEL	28480	08558-60050
7	3030-0022	10	SCREW-SET 6-32 SMALL CUP PT HEX REC ALY	28480	3030-0022
8	08558-20060	1	NUT	28480	08558-20060
9	08558-00018	1	POINTER, ATTENUATOR	28480	08558-00018
10	08558-00038	1	KNOB, DIAL, RESOLUTION	28480	08558-00038
11	08557-60029	1	KNOB, FREQUENCY	28480	08557-60029
12	00180-67402	1	KNOB, FINE TUNE	28480	00180-67402
13	08558-00043	1	KNOB, COARSE TUNING	28480	08558-00043
14	5040-4558	1	BEZEL	28480	5040-4558
15	2950-0043	7	NUT-HEX-DBL CHAM 3/8-32-THD .094-THK	73743	2X 28200
16	2190-0016	8	WASHER-LK INTL T .377 IN ID .507 IN OD	78189	1920-02
17	1410-0721	1	BUSHING: PANEL: 3/8-32 THD BRASS	28480	1410-0721
18	08558-40001	1	SLIDER, START-CENTER	28480	08558-40001
19	2200-0781	3	SCREW-MACH 4-40 PAN HD POZI REC SST-300	28480	2200-0781
20	08558-00019	1	DETENT, ATTENUATOR	28480	08558-00019
21	0380-0411	14	SPACER-RND .5-LG .114-ID .154-OD STL CD	76854	8980-432
22	08558-20047	4	BUSHING, PANEL	28480	08558-20047
23	08558-10051	1	SHAFT, REF LEVEL	28480	08558-10051
24	1410-0006	6	BALL BEARING TYPE, 0.1875" DIA	78707	GRADE 50 TYPE 440C
25	1460-0578	6	SPRING CPRSN-CYL .18-OD .312-LG MUW	28480	1460-0578
26	08558-20059	6	HUB, DRIVE	28480	08558-20059
27	1480-0367	1	PIN, DOWEL 303 SST	00000	OBD
28	1480-0059	10	PIN:SPRING 0.062" NOM. DIA	00000	OBD
29	08558-40011	1	ROTOR, ATTENUATOR DRIVE	28480	08558-40011
30	08558-40008	1	GEAR, 45 TEETH	28480	08558-40008
31	0510-0015		RETAINER, RING, .125 DIA, CAD PLT STL	79136	5133-12-S-MD-R
32	08557-60023	1	CABLE, CAL OUTPUT	28480	08557-60023
33	2200-0509	2	SCREW-MACH 4-40 PAN	28480	2200-0509
34	2200-0125	1	SCREW-MACH 4-40 PAN HD POZI REC SST-300	28480	2200-0125
35	08558-0024	2	DETENT, SWEEP TIME	28480	08558-0024
36	08558-20050	1	SHAFT, SWEEP WIDTH	28480	08558-20050
37	08558-20066	1	ROTOR, FREQUENCY SPAN	28480	08558-20066
38	08558-20089	1	BUSHING, SLOTTED	28480	08558-20089
39	1460-1376	1	SPRING TRSN-HAIRPIN .035-OD 1.476-LG	28480	1460-1376
40	08558-20088	1	GEAR, 20 TEETH	28480	08558-20088
41	0520-0139	2	SCREW-MACH 2-56 PAN HD POZI REC SST-300	28480	0520-0139
42	0380-0487	2	SPACER-RND .625-LG .086-ID .125-OD BRS	76854	15525-440
43	2190-0890	6	WASHER-LK HLCL NO. 2 .088 IN ID .172 IN	28480	2190-0890
44	0610-0002	8	NUT-HEX-DBL CHAM 2-56-THD .062-THK .188	28480	0610-0002
45	08558-20002	1	BOARD, FRONT SWITCH	28480	08558-20002
46	08558-40005	3	ROTOR, DOUBLE CONTACT	28480	08558-40005
47	3050-0017	3	WASHER-FL MTLC .26 IN ID .385 IN OD	28480	3050-0017
48	1460-0532	1	SPRING CPRSN-CONE .54-OD .45-LG MUW	28480	1460-0532
49	2200-0165	2	SCREW-MACH 4-40 82 DEG FL HD POZI REC	28480	2200-0165
50	08558-00020	1	DETENT, IF GAIN	28480	08558-00020
51	08558-20061	1	LOCKOUT, ROTATING	28480	08558-20061
52	08558-20062	1	LOCKOUT, FIXED	28480	08558-20062
53	08558-20052	1	SHAFT, FIXED	28480	08558-20052
54	2260-0002	15	NUT-HEX-DBL CHAM 4-40-THD .062-THK .188	28480	2260-0002
55	0380-0413	3	SPACER-RND 1.25-LG .114-ID .154-OD STL	76854	8980-480
56	08558-00022	1	CRANK, SLOTTED	28480	08558-00022
57	08558-20053	1	SHAFT, REF LEVEL, FINE	28480	08558-20053
58	1490-0841	1	COUPLER-RGD .127-ID .281-OD .375-L	28480	1490-0841
59	2950-0006	3	NUT-HEX-DBL CHAM 1/4-32-THD .094-THK	73734	9000
60	2190-0027	5	WASHER-LK INTL T NO. 1/4 .256 IN ID .478	78189	1914-00
61	08558-00021	1	PLATE, LEVEL POT	28480	08558-00021
62	2190-0019	10	WASHER-LK HLCL NO. 4 .115 IN ID .226 IN	28480	2190-0019
63	08558-20054	1	SHAFT, ATTENUATOR DRIVE	28480	08558-20054
64	1430-0036	2	GEAR MITER, 32 PITCH	71041	G462Y(MOD)
65	0890-0312	0.10 FT	TUBING HS .25 D/.131 RCVD .025 WALL	92194	FIT 221 - 1/4 IN.
66	08558-00027	1	BRACKET	28480	08558-00027
67	3050-0105	6	WASHER-FL MTLC NO. 4 .125 IN ID .281 IN	28480	3050-0105
68	08557-00005	1	BRACKET	28480	08557-00005
69	08558-20030		BOARD, REAR SWITCH	28480	08558-20030
70	2200-0143	2	SCREW-MACH 4-40 PAN HD POZI REC SST-300	28480	2200-0143
71	08558-40004	1	ROTOR, SINGLE CONTACT	28480	08558-40004
72	08558-00025	1	DETENT, BANDWIDTH	28480	08558-00025
73	2260-0001	2	NUT-HEX-DBL CHAM 4-40-THD .094-THK .25	28480	2260-0001
74	08558-20056	1	SHAFT, BANDWIDTH	28480	08558-20056

Figure 6-1. Front Panel Assembly, Parts Location (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
75	08558-20058	1	HUB, COUPLING	28480	08558-20058
76			NOT ASSIGNED		
77	3050-0124	2	WASHER-FL MTLC .13 IN ID .218 IN OD	28480	3050-0124
78	08558-20055	1	SHAFT, MANUAL SWEEP	28480	08558-20055
79	3050-0098	4	WASHER-FL MTLC NO. 2 .094 IN D .25 IN	80120	AN960 C2
80	0380-0063	1	SPACER	28480	0380-0063
81			NOT ASSIGNED		
82	08558-20049	1	SHAFT, SWEEP TIME	28480	08558-20049
83	2190-0390	1	WASHER-FL NM NO. 1/4 .26 IN ID .562 IN	73734	193204
84	08558-20048	1	SHAFT, SWEEP TRIGGER	28480	08558-20048
85	1460-0537	1	SPRING, TORSION 0.80" ID	91961	A-1460-0537-1
86	08558-00053	1	STOP ARM	28480	08558-00053
87	08558-00026	1	DETENT, SWEEP TRIGGER	28480	08558-00026
88	2200-0151	3	SCREW-MACH 4-40 PAN HD POZI REC SST-300	28480	2200-0151
89			NOT ASSIGNED		
90			NOT ASSIGNED		
91	2200-0155	1	SCREW-MACH 4-40 PAN HD POZI REC SST-300	28480	2200-0155
92	08557-60024	1	CABLE ASSY RF INPUT	28480	08557-60024
93	08558-20092		SHAFT, LATCH	28480	08558-20092
94	08557-00016	1	PANEL, FRONT	28480	08557-00018
95	2950-0072	1	NUT-HEX-DBL CHAM 1/4-32-THD .062-THK	82389	P-1975
96			NOT ASSIGNED		
97	00183-67407	2	KNOB	28480	00183-67407
98	0510-0045		RETAINER, RING, .188 DIA, CAD PLT STL	97464	1000-19-ST-CD
99	0590-0012	2	NUT-KNURLED R 15/32-32-THD .062-THK .6	04009	8991-3
100	08558-20093	1	KNOB, LATCH	28480	08558-20093
101	08558-00045	1	KNOB, DIAL, MANUAL SWEEP	28480	08558-00045
102	08558-00044	1	KNOB, SWEEP TIME	28480	08558-00044
103	5060-0467	1	CONNECTOR, MALE PROBE	28480	5060-0467
104			NOT ASSIGNED		
105	08558-00046	1	KNOB, TRIGGER SWITCH	28480	08558-00046

Figure 6-1. Front Panel Assembly, Parts Location (2 of 3)

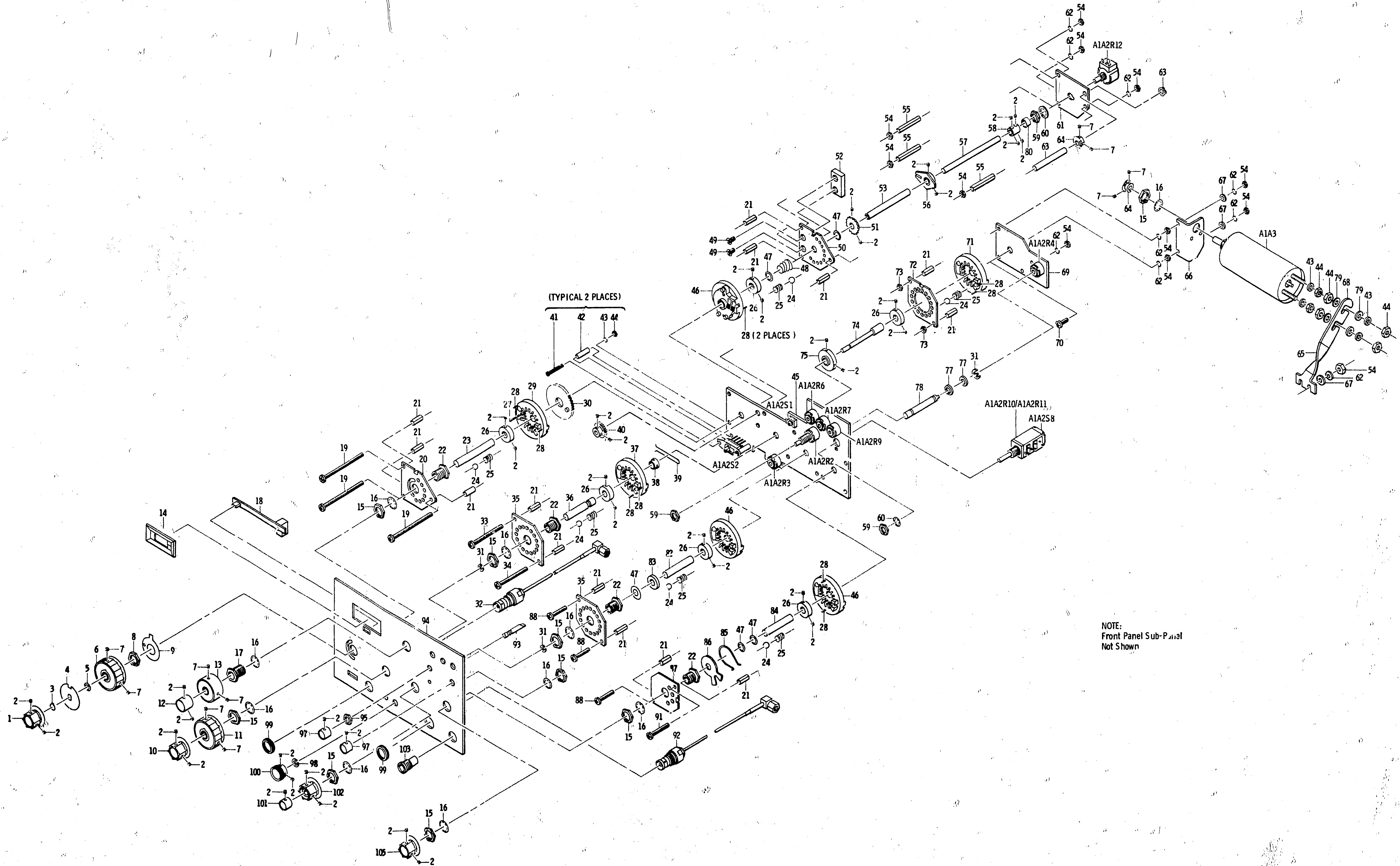


Figure 6-1. Front Panel Assembly, Parts Location (3 of 3)

PARTS
LIST
CON'T

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			DIAL DRIVE ASSEMBLY		
1	3050-0721	1	WASHER-SPR WAVY .368 IN ID .5 IN OD	28480	3050-0721
2	2950-0001	3	NUT-HEX-DBL CHAM 3/8-32-THD .094-THK .5	12697	20/4-13
3	08557-40002	1	CAM FOLLOWER	28480	08557-40002
4	1460-0023	1	SPRING CPRSN-CYL .384-OD .375-LG MUW	28480	1460-0023
5	1430-0555	2	GEAR SPUR 1.0 PD	28480	1430-0555
6	2420-0001	1	NUT-HEX-W/LKWR 6-32-THD .109-THK .312	28480	2420-0001
7	3050-0001	1	WASHER-FL MTLC NO. 0 .172 IN ID .375 IN	73734	NO. 1445
8	3050-0156	1	WASHER-FL MTLC NO. 12 .25 IN ID . IN	28480	3050-0156
9	00692-247	1	GEAR STOP	28480	00692-247
10	03580-23705	1	SHAFT LIMIT	28480	03580-23705
11	2100-1843	2	RESISTOR-VAR PREC 10K 5% WW	28480	2100-1843
12	3050-0086	1	WASHER-FL MTLC .406 IN ID .629 IN OD	28480	3050-0096
13	08557-20027	1	FRAME, DIAL DRIVE	28480	08557-20027
14	0510-0045	3	RETAINER, RING, .188 DIA, CAD PLT STL	97464	1000-18-ST-CD
15	1430-0556	1	GEAR LEVEL .250 PD	28480	1430-0556
16	2100-1843		RESISTOR-VAR PREC 10K 5% WW	28480	2100-1843
17	2360-0210	5	SCREW-MACH 6-32 82 DEG FL HD POZI REC	28480	2360-0210
18	2190-0016		WASHER-LK INTL T .377 IN ID .507 IN OD	78189	1920-02
19	3050-0032		WASHER-FL MTLC NO. 10 .189 IN ID .312 IN	28480	3050-0032
20	08557-20034	1	COUPLER	28480	08557-20034
21	08557-40001	1	CAM SPIRAL	28480	08557-40001
22	0510-0015	3	RETAINER, RING, .125 DIA, CAD PLT STL	79136	5133-12-S-MD-R
23	08557-20035	1	SHAFT, FINE TUNE	28480	08557-20035
24	08557-20030	1	GEAR BEVEL 1.0 PD	28480	08557-20030
25	08557-20031	1	SHAFT, PINION	28480	08557-20031
26	1430-0035	2	GEAR:PINION 22 PITCH 8 TEETH	18911	88-2219
27	1460-0298	1	SPRING CPRSN-CYL .088-OD .312-LG SST	28480	1460-0299
28	1480-0072	1	PIN:ROLL .062 DIA X .375 LG	72962	92-012-062-0375
29	1140-0008	1	COUNTING-DISPLAY, NUM WHL 1 DIGIT	99195	P/P-22F-JX
30	1140-0007	1	COUNTING-DISPLAY, NUM WHL	99195	G/G-22-J
31	1140-0009	1	COUNTING-DISPLAY, NUM WHL 50 GRAD	99195	G/G-28-K
32	08557-20033	1	FLY WEIGHT	28480	08557-20033
33	08557-20032	1	SHAFT, NUMBER WHEEL	28480	08557-20032
34	08557-20023	1	GEAR STOP MOD	28480	08557-20023
35	08557-20036	1	SHAFT, COARSE TUNE	28480	08557-20036
36	1410-0003	1	BUSHING, PANEL, 3/8-32 THD BRASS	28480	1410-0003
37	3030-0014	11	SCREW-SET 4-40 FLAT PT HEX REC ALY STL	28480	3030-0014
38	2190-0344	1	WASHER-SPR BLVL NO. 1/4-.26 IN ID .5 IN	70472	500-18

Figure 6-2. Dial Drive Assembly, Parts Location (1 of 2)

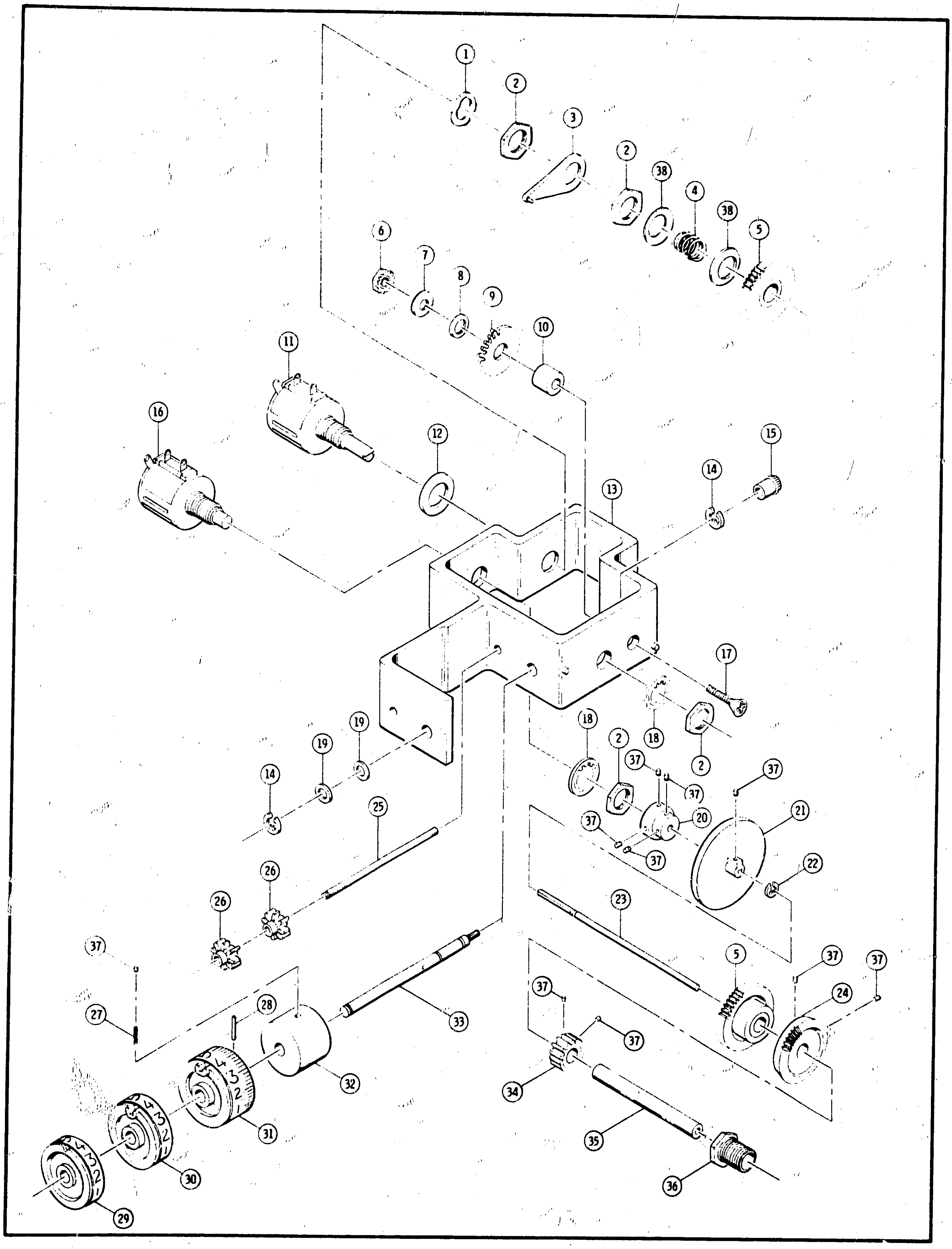


Figure 6-2. Dial Drive Assembly, Parts Location (2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CABINET PARTS		
1	08557-00002	1	PANEL,FRONT SUB	28480	08557-00002
2	08557-00003	1	GUSSET, LEFT	28480	08557-00003
3	08557-00004	1	GUSSET, RIGHT	28480	08557-00004
4	08558-00003	1	PANEL, REAR	28480	08558-00003
5	08558-20039	1	GUIDE, RAIL, LEFT	28480	08558-20039
6	08557-20052	1	GUIDE, RAIL, RIGHT	28480	08557-20052
7	08558-20037	1	EXTRUSION, END PLATE ENCLOSURE	28480	08558-20037
8	08558-20036	2	EXTRUSION, CCT ENCLOSURE, TAPPED	28480	08558-20036
9	08558-20087	2	EXTRUSION, CCT ENCLOSURE, PLAIN	28480	08558-20087
10	08558-20038	1	EXTRUSION, DIVIDER ENCLOSURE	28480	08558-20038
11	08558-40015	1	HOUSING, LATCH	28480	08558-40015
12	08558-20092	1	SHAFT, LATCH	28480	08558-20092
13	08557-00019	1	INSULATOR, BOTTOM GUIDE RAIL	28480	08557-00019
14	08558-20041	1	GUIDE RAIL, BOTTOM	28480	08558-20041
15	08557-60045	1	BOARD, VERTICAL OUTPUT CONNECTOR	28480	08557-60045
16	0624-0203	8	SCREW-TPG 4-40 82 DEG FL	28480	0624-0203
17	08557-20053	1	EXTRUSION, CCT ENCLOSURE. SHORT	28480	08557-20053
18	2200-0104	10	SCREW-MACH 4-40 82 DEG FL HD PCZI REC	28480	2200-0104
19	2360-0210	4	SCREW-MACH 6-32 82 DEG FL HD PCZI REC	28480	2360-0210
20	0624-0268	30	SCREW-TPG 4-24 PAN	28480	0624-0269
21	0624-0206	1	SCREW-TPG 6-32 PAN	28480	0624-0206
22	2200-0103	8	SCREW-MACH 4-40 PAN HD POZI REC SST-300	28480	2200-0103
23	2360-0115	1	SCREW-MACH 6-32 PAN HD POZI REC SST-300	28480	2360-0115
24	2200-0170	2	SCREW-MACH 4-40 82 DEG FL HD POZI REC	28480	2200-0170
25	0380-0022	2	SPACER-RND .375-LG .125 IG .188 OD STL	76854	3457-424
26	2260-0003	2	NUT-HEX-PLSTC LKG 4-40-THD .141-THK .25	72962	97NM40
28	2200-0164	2	SCREW-MACH 4-40 82 DEG FL HD POZI REC	28480	2200-0164
29	2200-0168	3	SCREW-MACH 4-40 82 DEG FL HD POZI REC	28480	2200-0168

Figure 6-3. Cabinet Parts (1 of 2)

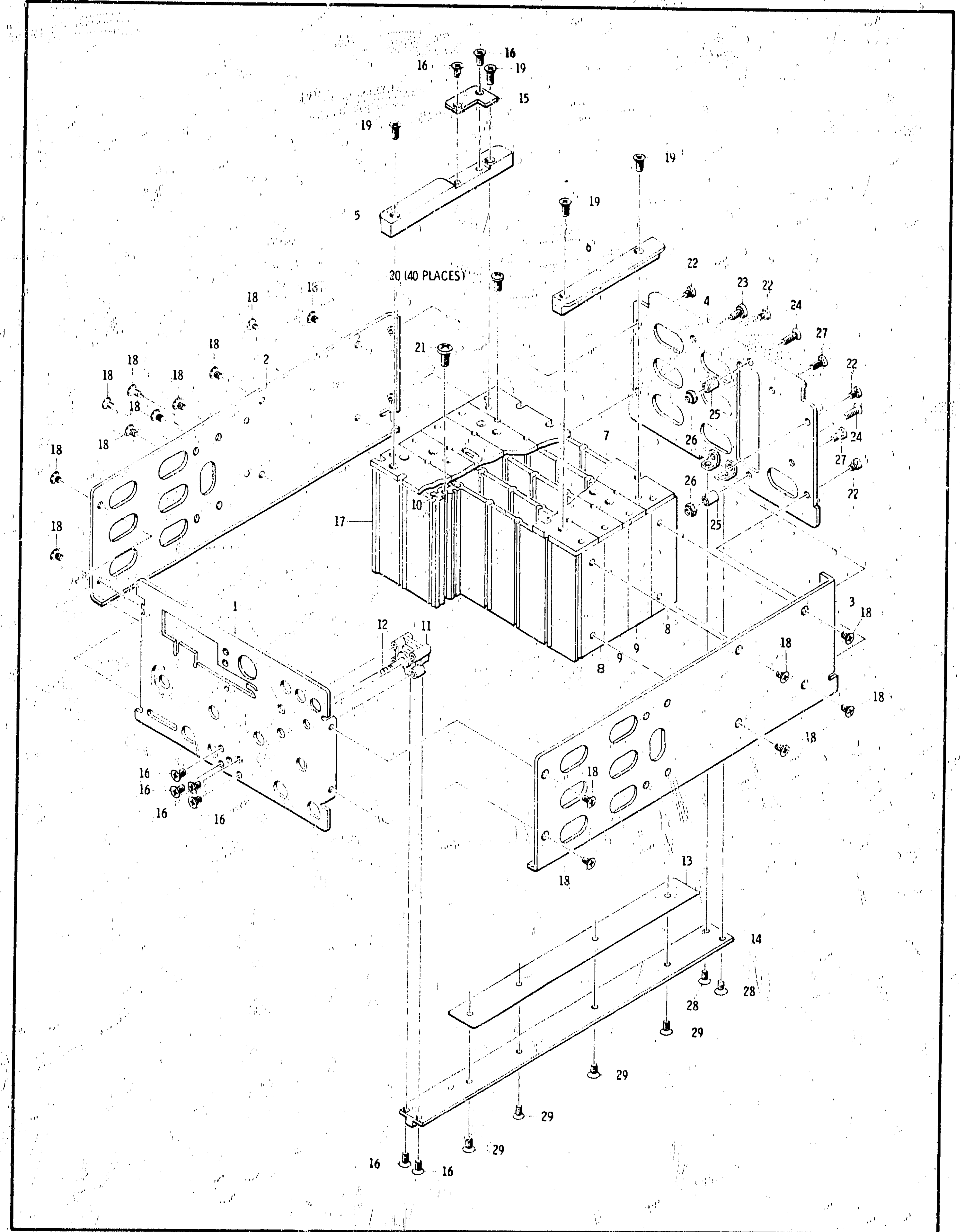


Figure 6-3. Cabinet Parts (2 of 2)

Table 6-4. Manufacturer's Code List

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
01121	ALLEN BRADLEY CO	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02114	FERROXCUBE CORP	SAUGERTIES NY	12477
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03877	TRANSITRON ELECTRONIC CORP	WAKEFIELD MA	01880
03888	PYROFILM CORP	WHIPPANY NJ	07981
04009	ARROW-HART INC	HARTFORD CT	06106
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
12697	CLAROSTAT MFG CO INC	DOVER NH	03820
16299	CORNING GL WK ELEC CMPNT DIV	RALEIGH NC	27604
18911	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS	BRADFORD PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
70472	ASSOCIATED SPRING CORP	BRISTOL CT	06010
71041	BOSTON GEAR WKS DIV OF NA ROCKWELL	QUINCY MA	02171
72136	ELECTRO MOTIVE MFG CO INC	WILLIMANTIC CT	06226
72962	ELASTIC STOP NUT DIV OF AMERACE	UNION NJ	07083
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE PA	16512
73734	FEDERAL SCREW PRODUCTS CO	CHICAGO IL	60618
73743	FISCHER SPECIAL MFG CO	CINCINNATI OH	45206
74970	JOHNSON E F CO	WASECA MN	56093
76493	BELL INDUSTRIES INC MILLER JW DIV	COMPTON CA	90224
76854	OAK IND INC SW DIV	CRYSTAL LAKE IL	60014
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN IL	60120
78767	TEK BEARING CO INC	NEW YORK NY	10013
79136	WALDES-KOHINOOR INC	LONG ISLAND CITY NY	11101
79727	C-W INDUSTRIES	WARMINSTER PA	18974
81073	GRAYHILL INC	LA GRANGE IL	60525
82389	SWITCHCRAFT INC	CHICAGO IL	60630
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601
91961	NAHM BROTHERS INC	OAKLAND CA	94604
97464	INDUSTRIAL RETAINING RING CO	IRVINGTON NJ	07111
98291	SEALECTRO CORP	MAMARONECK NY	10544
99195	THERMO ELECTRIC CO INC	SADDLE BROOK NJ	07662

BACK DATING MANUAL CHANGES

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information for adapting this manual to instruments for which the content does not apply directly.

7-3. To adapt this manual to your instrument, refer to Table 7-1 and make all of the manual changes listed opposite your instrument serial number. Perform these changes in the sequence listed.

7-4. If your instrument serial number is not listed on the title page of this manual, or in Table 7-1 below, it may be documented in a yellow MANUAL CHANGES supplement. For additional important information about serial number coverage, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes by Serial Number

Serial Prefix or No.	Make Manual Changes
1442A00111 thru 1442A00120	A
1442A00101 thru 1442A00110	A, B

7-5. MANUAL CHANGE INSTRUCTIONS

CHANGE A

Page 6-13, Table 6-3:
Add A7A1L6, HP Part Number 9100-2247, COIL:FIXED: MOLDED RF CHOKE: 0.1UH 10%
Delete A7A1R15
Change A8C26 to HP Part Number 0160-2255, CAPACITOR-FXD 8.2PF +— .25PF 500 WVDC CER

Page 6-14, Table 6-3:
Change A8C41 to HP Part Number 0160-2255, CAPACITOR FXD 8.2 PF +— .25PF 500 WVDC CER

Page 6-21, Table 6-3:
Delete part number for A12R16 and change description to NOT ASSIGNED

Page 6-23, Figure 6-1:
Delete Part Number for designator 80 and change description to NOT ASSIGNED

Page 6-24, Figure 6-2:
Change Reference Designator 4 to HP Part Number 1460-0019

Page 8-14, Figure 8-9, SERVICE SHEET 2:
Change A7A1R15, a 10 Ohm resistor to A7A1L6, a 0.1 UH COIL

Page 8-19, Figure 8-14, SERVICE SHEET 4:
Change A8C26 and A8C41 to 8.2PF

Page 8-23, Figure 8-18, SERVICE SHEET 6:
Change A10C26 and A10C41 to 8.2PF

Page 8-31, Figure 8-26, SERVICE SHEET 10:
Delete Resistor A12R16 and jumper across circuit

CHANGE B

Page 6-12, Table 6-3:
Change A7A1CR3 and A7A1CR4 to HP Part Number 1901-0535

SERVICE INFO

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for testing, troubleshooting, and repairing the HP Model 8557A Spectrum Analyzer.

8-3. ASSEMBLY SERVICE SHEETS

8-4. The schematics are arranged by service sheets. The service sheet numbers appear in the lower right-hand corner of the schematics (large number above assembly number). Included in the service sheet is the schematic as well as the component-parts location photo and schematic-level troubleshooting. A list of service sheets cross-referenced to assemblies is given in Table 8-1.

8-5. PRINCIPLES OF OPERATION

8-6. Detailed circuit description for each individual schematic diagram is placed on the facing left-hand foldout page. This places material needed for printed-circuit-level diagnosis in one location and allows easy correlation between function and specific circuit.

8-7. TROUBLESHOOTING

8-8. Troubleshooting is generally divided into two maintenance levels in this manual. The first is the assembly level, which isolates the cause of a malfunction to a circuit or assembly. A troubleshooting flow diagram provides a simple step-by-step procedure to identify the defective assembly.

8-9. The second maintenance level isolates the trouble to the component level. In getting to the component level, schematic diagrams are provided for each individual printed circuit board assembly. A detailed circuit description is provided to aid in troubleshooting down to the component level within the assembly.

Table 8-1. Service Sheet Cross-Reference

Service Sheet	Assembly Number	Schematic	Component Location
1		Troubleshooting Procedure	
2	A1A3, A2 A7	Figure 8-12 Figure 8-12 Figure 8-12	 Figure 8-10 Figure 8-11
3	A5 A6	Figure 8-15 Figure 8-15	Figure 8-13 Figure 8-14
4	A8	Figure 8-20	Figure 8-19
5	A9	Figure 8-24	Figure 8-23
6	A10	Figure 8-29	Figure 8-28
7	A11	Figure 8-32	Figure 8-31
8	A3	Figure 8-37	Figure 8-36
9	A3	Figure 8-41	Figure 8-40
10	A12	Figure 8-46	Figure 8-45
11	A4	Figure 8-50	Figure 8-49
12	A13	Figure 8-51	Figure 8-52

8-10. RECOMMENDED TEST EQUIPMENT

8-11. Test equipment and accessories required to maintain the instrument are listed in Table 1-3. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

8-12. REPAIR

8-13. Cleaning Switches

8-14. The cleaning agent to be used on the switches is isopropyl alcohol, HP Part No. 8600-0755. Spray the solvent into the switch and slide or rotate the switch back and forth. Repeat this procedure several times, continue to slide or rotate the switch back and forth until the solvent is evaporated.

8-15. Dial Drive Assembly Adjustment

8-16. This procedure is for adjusting the Dial Drive Assembly, shown in Figure 8-1. (Numbers in parenthesis refer to Figure 6-2.)

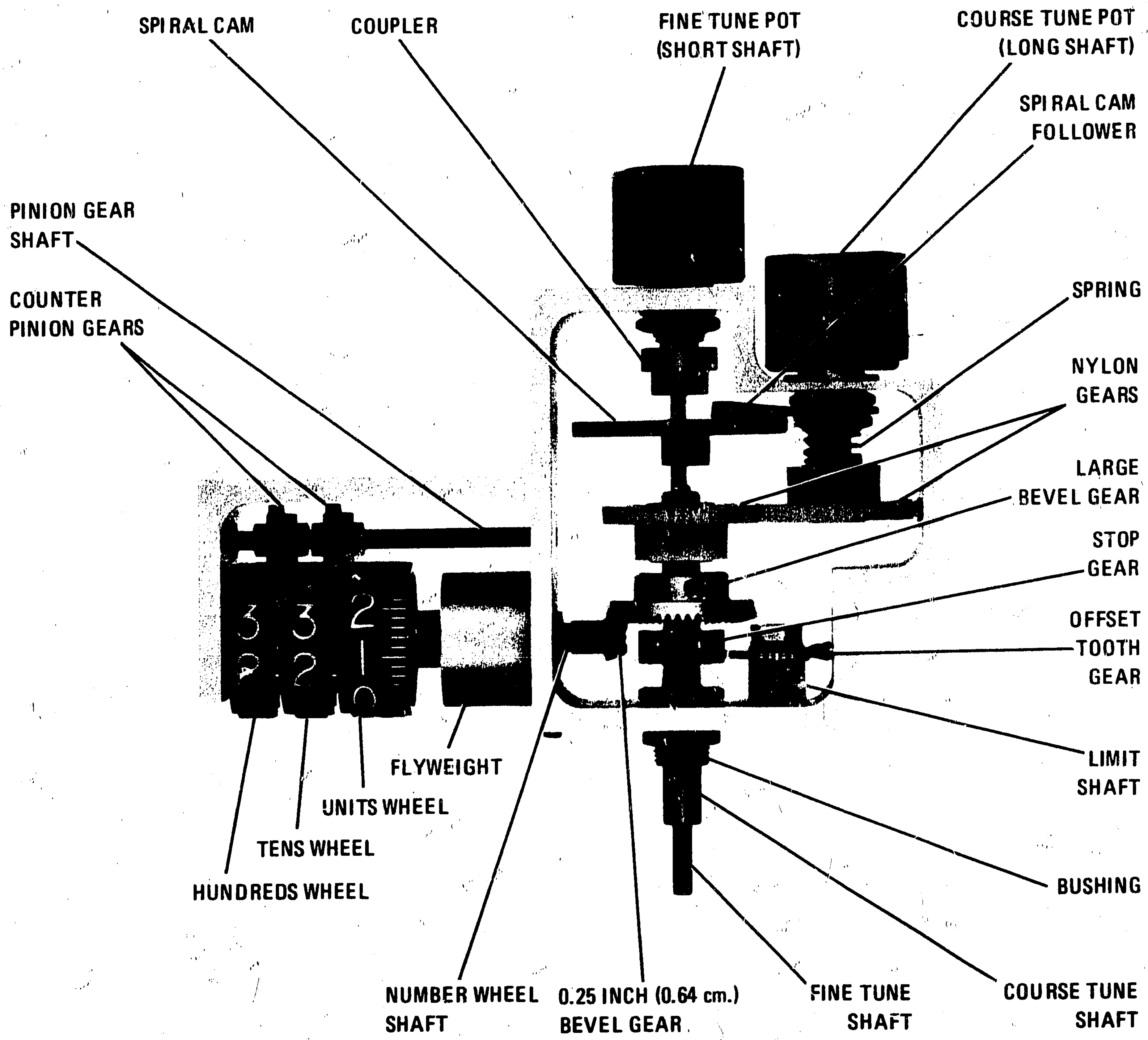


Figure 8-1. Dial Drive Assembly

a. Number Wheel and Pinion Shafts Assembly:

1. Preload setscrews (37) into bevel gear (24), stop gear (34), and coupler (20), and spiral cam (21).

2. Counter pinion gear shaft (25) should be partially inserted into left forward hole of dial frame (13). Slip the two counter pinion gears (26) on the pinion gear shaft. (Place half-tooth of each pinion gear toward the left.) Now press shaft into dial frame until knurling locks shaft into dial frame. Wipe a small amount of lubriplate on section of shaft where pinion gears will be operating.

3. Pressfit small 0.25 inch (0.64 cm) bevel geat (15) onto number wheel shaft (33) and add retaining ring (14) behind bevel gear (15), with rounded side away from bevel gear. When pressing bevel gear on shaft, be careful not to damage the gear.

4. Put a small amount of lubriplate on number-wheel shaft just behind and on the retaining ring. Insert number wheel shaft assembly through dial frame access hole on right side and approximately 0.5 inch (1.27 cm) into dial frame hole just forward of counter pinion gear shaft.

5. Place flyweight (32) onto shaft. Hold units wheel (31) in line with number wheel shaft and make sure indexing cog engages any one of the full teeth on the right pinion gear (the number 2 will be up). Push number wheel shaft through units wheel.

6. Before assembling the tens and hundreds wheels on number wheel shaft, apply a small amount of lubriplate to shaft hole of each number wheel.

7. Hold tens wheel (30) in line with number wheel shaft and make sure indexing cog engages any one of the full teeth on the left pinion gear (the number 2 will be up).

8. Push number wheel shaft until it is just through tens wheel. Put a small amount of lubriplate in shaft hole in dial frame. Hold hundreds (29) wheel in line with number wheel shaft so that the number 2 is in line with the number 2 on the tens and units number wheels. Then push shaft through hundreds wheel and into the hole in dial frame until the retaining ring seats on the dial frame.

9. Line up the hole in hub of units wheel with the hole in number wheel shaft and insert small steel pin (28).

10. Where number wheel shaft comes out of dial frame, add enough spacer washers (19), usually 2 or 3, until the end play of number wheel shaft, with a retaining ring in place is minimum and the shaft turns freely. One spacer too many will cause the shaft to bind.

11. Rotate flyweight so the hole is up. Drop spring (27) in hole then screw in 4-40 setscrew (37) until spring is fully compressed, then back off setscrew 1/8 to 1/4 turn. The flyweight must not be tight or locked to shaft, but should turn with the shaft.

b. Offset Tooth Gear Assembly:

1. Place bushing (36) through hole in front of dial frame, with threads to the front, then put on a lockwasher (18) and nut (2) and finger tighten.

2. Insert 0.625 inch (1.59 cm) long flat head 6-32 (17) screw into counter-sunk hole in front of dial frame and slip limit shaft (10) over screw. Apply small amount of lubriplate on shoulder of limit shaft and place offset tooth gear (9) on the shoulder of limit shaft with the offset teeth toward the rear of the dial frame. Again apply small amount of lubriplate on shoulder of limit shaft and place a spacer washer (8) over shoulder of limit shaft and on top of offset tooth gear. Put keeper washer (7) over screw, thread on and tighten locknut (6). Offset tooth gear must turn freely. If offset tooth gear does not turn freely, remove spacer washer (8).

c. Fine Tune Pot:

1. Put the Fine Tune Short Shaft Pot (16) through the left-hand hole in the rear of dial frame. Place a lockwasher (18) and nut (2) on shaft and lightly tighten. Push coupler (20) over shaft as far as is possible.

d. Coarse Tune Shaft Assembly:

1. Apply a small amount of lubriplate on coarse tune shaft (35).

2. Insert coarse tune shaft halfway through bushing and place stop gear (34) on shaft with setscrews toward back of dial frame. Push the coarse tune shaft in about one inch (2.54 cm) further and put on the brass bevel gear (24) and nylon gear (5).

e. Fine Tune Shaft Assembly:

1. Wipe a thin film of lubriplate on the fine tune shaft (23) and insert through coarse tune shaft until the spiral cam (21) can be put on. Then push the fine tune shaft into the coupler on the fine tune pot. Put a retaining ring (22) on fine tune shaft slot at rear face of the nylon gear.

f. Coarse Tune Pot Assembly:

1. Put a bearing washer (12) on the coarse tune long shafted pot (11). Apply a bead of lubriplate completely around the center hole of the washer.

2. Insert coarse tune pot shaft through the right-hand hole in the rear of dial frame. Apply lubriplate liberally to both sides of wavy washer (1) and place on pot. Put on pot nut (2) and tighten until the wavy washer is half to two thirds compressed.

3. Place spiral cam follower (3) over pot shaft with pin toward front of dial frame. Put on pot nut (2) and lightly tighten.

4. Orient pot solder lugs so that rear-most lug points to the right and is about 45 degrees below the horizontal. Orient cam follower straight up. Place open end wrench (08557-00018) over nut behind cam follower. Holding nut and pot stationary, tighten nut in front of cam follower with side wrench (08557-00017) until cam follower does not slip in relation to pot body.

5. Place belleville washer (38) over pot shaft with convex side away from pot. Then place spring (4) over pot shaft. Place the other belleville washer over pot shaft, convex side toward pot. Put nylon gear (5) on pot with hub to the rear of dial frame. Note pot shaft must be forced slightly to the left in order for the nylon gear to clear the dial frame radius.

g. Dial Driver Adjustment:

1. Before adjustment of the dial drive assembly, put the tuning knobs on to help make the adjustments easier.

2. After determining that the number wheel shaft turns freely, push the coarse tune shaft as far to the rear as possible. While holding this position, slip the large brass bevel gear forward until it just touches the small bevel gear on the number wheel shaft, and then back off the large bevel gear slightly. Note there should be approximately 0.005 to 0.010 inches (12.7 x 10^{-3} to 25.4 x 10^{-3} cm.) separation between the two gears with their teeth meshed. Lightly tighten the two setscrews in the large bevel gear.

3. Turn the coarse tune shaft until the number wheels read 3-6-8 across front. Adjust the stop gear so its right hand setscrew, seen from the top of dial frame, coincides with (hits) the left-hand offset tooth of the offset tooth gear.

4. Adjust the stop gear toward the front of the dial frame until the offset tooth hits the edge of the setscrew squarely. Important; lightly tighten the stop gear setscrew that points straight up. Turn coarse tune shaft counterclockwise one turn to verify that the offset gear straight teeth clear the stop gear setscrews by at least .010 inches (25.4 x 10^{-3} cm).

5. If the straight tooth clearance does not exist, loosen the setscrew on the stop gear and slip the gear about 0.010 inches (25.4 x 10^{-3} cm) to the rear. Retighten the setscrew lightly and recheck for straight tooth clearance of Step 4.

6. Now tighten both stop gear setscrews. Turn coarse tune shaft counerclockwise until it stops. The number wheels should read between 980 and 985. If not, repeat steps 2 through 5.

7. Turn fine tune shaft counterclockwise until the fine tune pot shaft stops turning. Then adjust the coupler position so that one of the two setscrews that seats on the fine

tune shaft is directly over the flat on the shaft. Tighten this setscrew until it just touches the shaft. The remaining setscrew should never be tightened.

8. Adjust spiral cam position forward or backward until grooved face of spiral cam is about in line with front face of spiral cam follower. Turn fine tune shaft CCW causing coupler to slip on fine tune pot shaft until the outside end of spiral cam groove is about 0.5 inch (1.27 cm) before point where spiral cam follower pin rides toward outside end of groove. Tighten both setscrews that seat onto the fine tune pot shaft. Turn fine tune shaft counterclockwise until it stops.

9. Rotate coarse tune pot body counterclockwise until the spiral cam follower pin hits outside of spiral cam. Spring (push back) follower and place the pin in outermost groove of spiral cam.

10. Adjust spiral cam position forward or backward until spiral cam follower pin is slightly spring loaded into spiral cam groove. Tighten spiral cam setscrew lightly.

11. Check coarse tune shaft end play by pushing shaft in. When coarse tune shaft is released, spiral cam follower should have enough spring tension to cause the large bevel gear to just touch the small bevel gear on the number wheel shaft. If the spiral cam follower does not have enough spring tension, turn fine tune shaft counterclockwise until shaft stops. Remove the spiral cam follower pin from groove and rotate coarse tune pot body to swing follower so it points straight up. Bend or flex the follower forward with your finger until it takes a slight set (or bend) forward. Return follower pin to cam groove. Repeat step 11 if necessary.

12. Rotate fine tune shaft clockwise until it stops. Spiral cam follower pin should not hit the end of the innermost spiral cam groove. Rotate fine tune shaft counterclockwise until it stops. Spiral cam follower pin should not hit the end of the outermost spiral cam groove.

h. Coarse Tune Pot Adjustment:

1. Push nylon gear on coarse tune pot shaft until spring is approximately half compressed. Tighten setscrew in nylon gear hub.

2. Adjust the nylon gear on the coarse tune shaft (not the gear just adjusted in Step 1) forward or backward until the two nylon gears mesh, but do not run tight. Tighten setscrew in nylon gear hub. Nylon gears may need to be adjusted so the gear faces are not completely aligned; if aligning gear faces causes the gears to run too tightly. The coarse tune shaft should now turn smoothly from stop to stop. The fine tune shaft should turn the number wheels smoothly and with no perceptible hesitation in number wheel movement.

i. Troubleshooting and Adjustment Notes:

1. If the coarse tune shaft does not turn smoothly, the fine tune control will probably not work properly.

2. If fine tune readout hesitates or slips, repeat the coarse tune pot adjustment after increasing spring compression slightly. Any damage to the brass bevel gears will also cause the fine tune readout to malfunction. In this case the bevel gears will need to be replaced.

3. If fine tune shaft binds at the same point each time it rotates 360 degrees, check for misalignment of fine tune pot and fine tune shaft. Loosen the nut on fine tune pot. Allow the pot to find its own center by holding the body of the pot and turning fine tune shaft several turns each way. Then retighten nut on fine tune pot. If binding still occurs, try loosening the coupler setscrew on the "flat" of fine tune shaft.

8-17. Module Exchange Program

8-18. This instrument may be quickly repaired by replacing a defective module with a restored-exchange module. To support the modular repair concept, Hewlett-Packard has set up a module exchange program.

8-19. The procedure for using the module exchange program is given in Figure 8-2. When you locate the defective module, order a replacement module through the nearest Hewlett-Packard sales office. The restored-exchange module will be sent immediately directly from a customer service replacement parts center. When you receive the exchange module, return the defective module in the same special carton in which the exchange module was received. DO NOT return a defective module to Hewlett-Packard until you receive the exchange module.

8-20. If you are not going to return the defective module to Hewlett-Packard, or if you are ordering a module for spare parts stock, etc., order a new module using the new module part number listed in Table 6-3.

8-21. The Hewlett-Packard module exchange program allows you to obtain a fully tested and guaranteed restored-exchange module at a reduced price. (The reduced price is contingent upon return of the defective module to Hewlett-Packard.)

The module exchange program described here is a fast, efficient, economical method of keeping your Hewlett-Packard instrument in service.

Locate defective module using troubleshooting procedures and service sheets in this manual.

↓

Is a replacement module on hand?

YES → Install the replacement module. Keep the defective module for return to HP.

↓ Order restored-exchange module from HP. Refer to the Replaceable Parts Section for part numbers.

↓ Put restored-exchange module in spares stock.

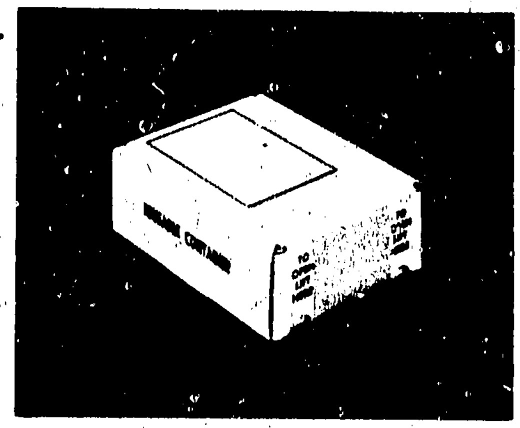
↓ Return defective module to HP.

NO ↓ Order restored-exchange module from HP. Refer to the Replaceable Parts Section for part numbers.

↓ Swap replacement module and defective module.

↓ Return defective module to HP.

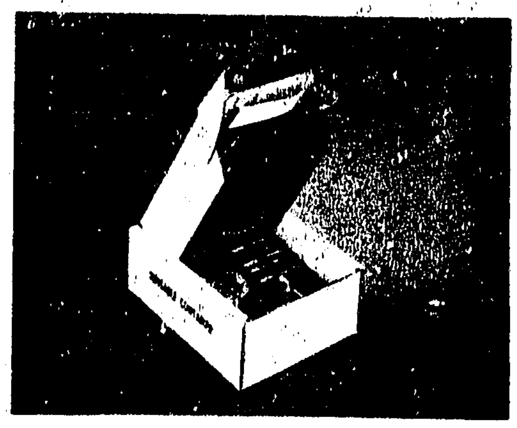
A.



Restored-exchange modules are shipped individually in boxes like this. In addition to the circuit module, the box contains:

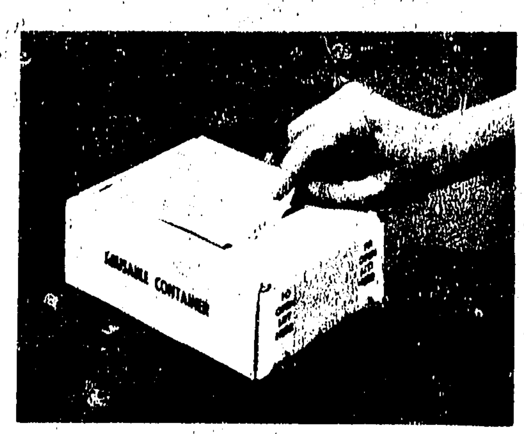
- Module repair report
- Return address label
- Tape for resealing box

B.



Open box carefully - it will be used to return defective module to HP. Complete repair report. Place it and defective module in box. Be sure to remove enclosed return address label.

C.



Seal box with tape provided. Inside U.S.A.* stick preprinted return address label over label already on box, and return box to HP. Outside U.S.A., do not use address label: instead, address box to the nearest HP office.

*HP pays postage on boxes mailed in U.S.A.

Figure 8-2. Module Exchange Procedure

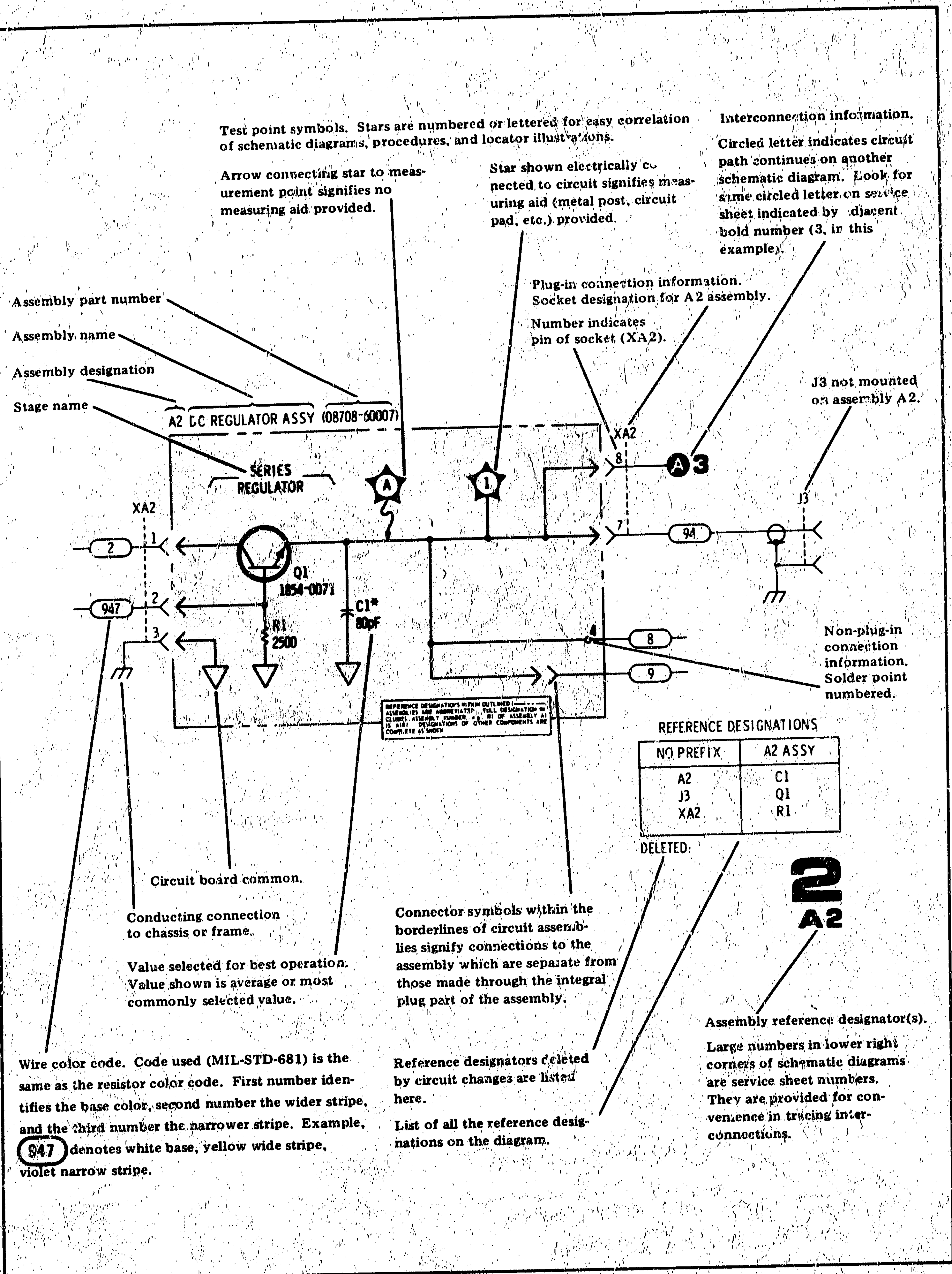


Figure 8-3. General Information on Schematic Diagrams

SCHEMATIC DIAGRAM NOTES

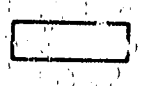
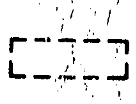
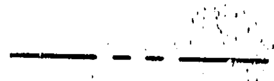
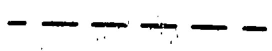
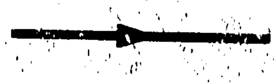
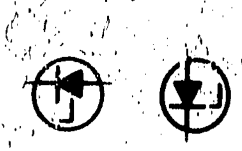
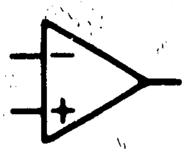
R, L, C	Resistance is in ohms, inductance is in microhenries, capacitance is in picofarads, unless otherwise noted.
P/O	Part of.
*	Asterisk denotes a factory-selected value. Value shown is typical.
O	Panel control.
	Screwdriver adjustment.
	Encloses front panel designation.
	Encloses rear panel designation.
	Circuit assembly borderline.
	Other assembly borderline.
	Heavy line with arrows indicates path and direction of main signal.
	Heavy dashed line with arrows indicates path and direction of main feedback.
	Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.
	Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number identifies the narrower stripe; e.g. (947) denotes white base, yellow wide stripe, violet narrow stripe.
	Number = Service Sheet number for off-page connection. Letter = off-page connection.
	Light-emitting diode (LED).
	Breakdown diode.
	PIN diode.
	Field effect transistor (FET) with N-type base.

Figure 8-4, Schematic Diagram Notes (1 of 2)

SCHEMATIC DIAGRAM NOTES (Cont'd)


Field effect transistor (FET) with P-type base.

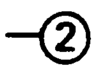

Operational amplifier (integrated circuit).


Test point location. Number denotes test point number.


Assembly ground.


Chassis ground.


Earth ground.



Common connection on same page.


Signal ground.


Indicates "WARNING: HAZARDOUS VOLTAGE ."


Refers serviceman or operator to CAUTIONS in Operating and Service Manual.

Figure 8-4. Schematic Diagram Notes (2 of 2)

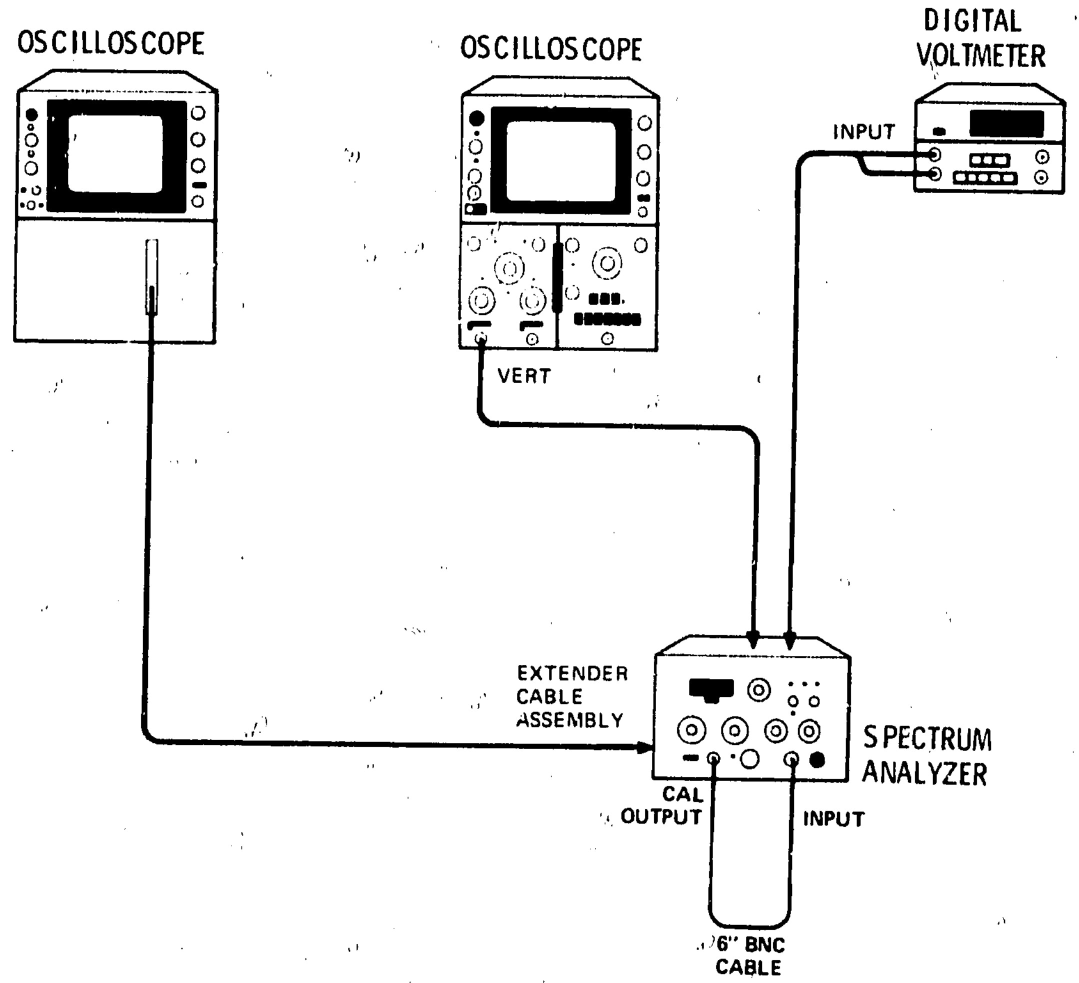
SCHEMATIC MEASUREMENT CONDITIONS

Voltages noted within circuits are ±10% tolerance.

Conditions for waveforms and dc voltages on schematics are as follows:

a. Connect equipment as shown below:
b. Set 8557A controls as follows:

START—CENTER	CENTER
TUNING	250 MHz
FREQ SPAN/DIV	1 MHz
RESOLUTION BW	300 kHz
OPTIMUM INPUT	—30
REFERENCE LEVEL dBm	—10
REF LEVEL FINE	0
10 dB/DIV — 1 dB/DIV — LIN	10 dB/DIV
SWEEP TIME/DIV	AUTO
SWEEP TRIGGER	FREE RUN
VIDEO FILTER	OFF
BASELINE CLIPPER	OFF



Test Setup for Waveforms and Voltages Shown on Schematics

EQUIPMENT:

Oscilloscope (with 10:1 probe)	HP 180A/1801A/1820C
Digital Voltmeter	HP 34740A/34702A
Extender Cable Assembly	HP 5060-0303

Figure 8-5. Schematic Measurement Conditions

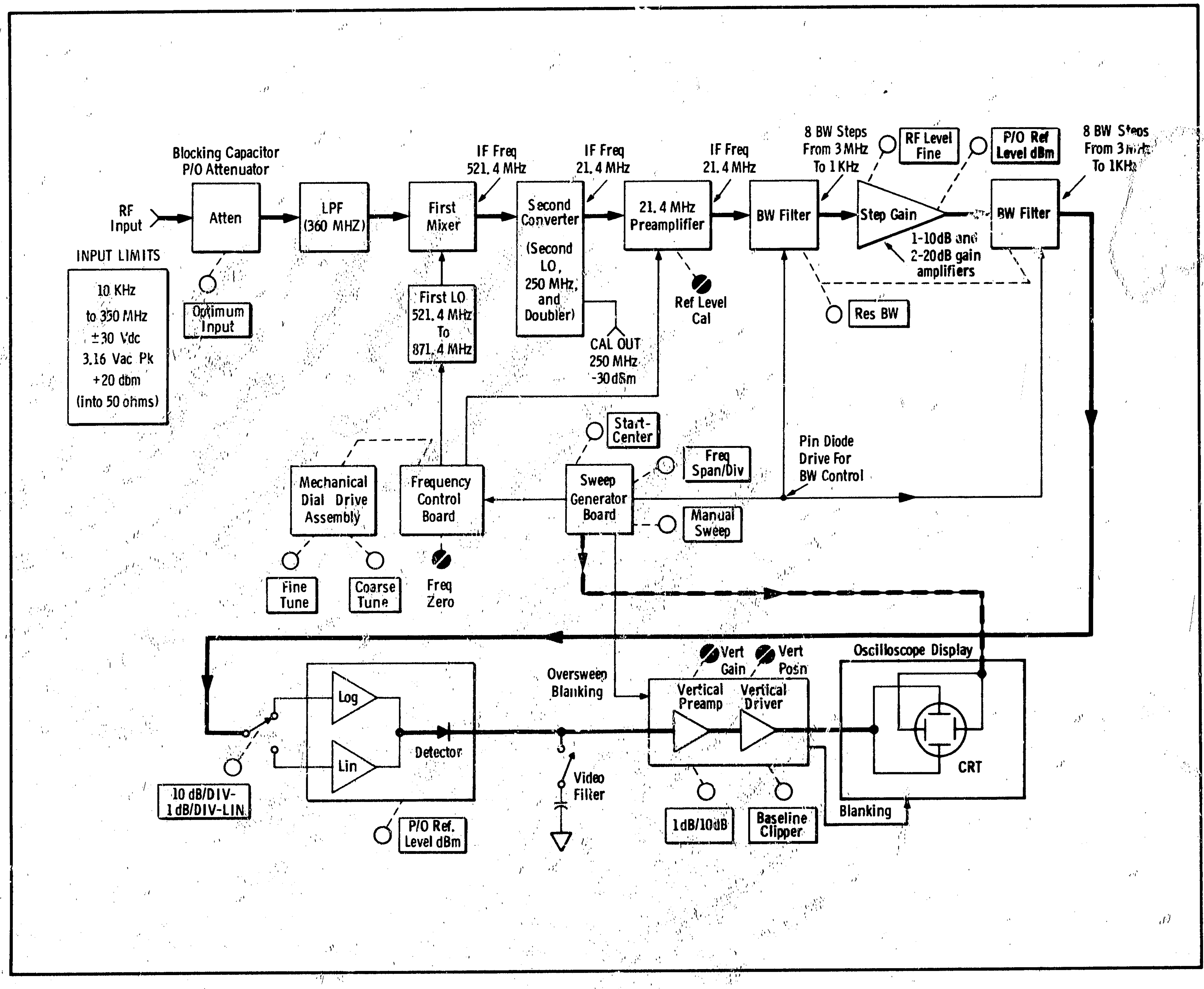
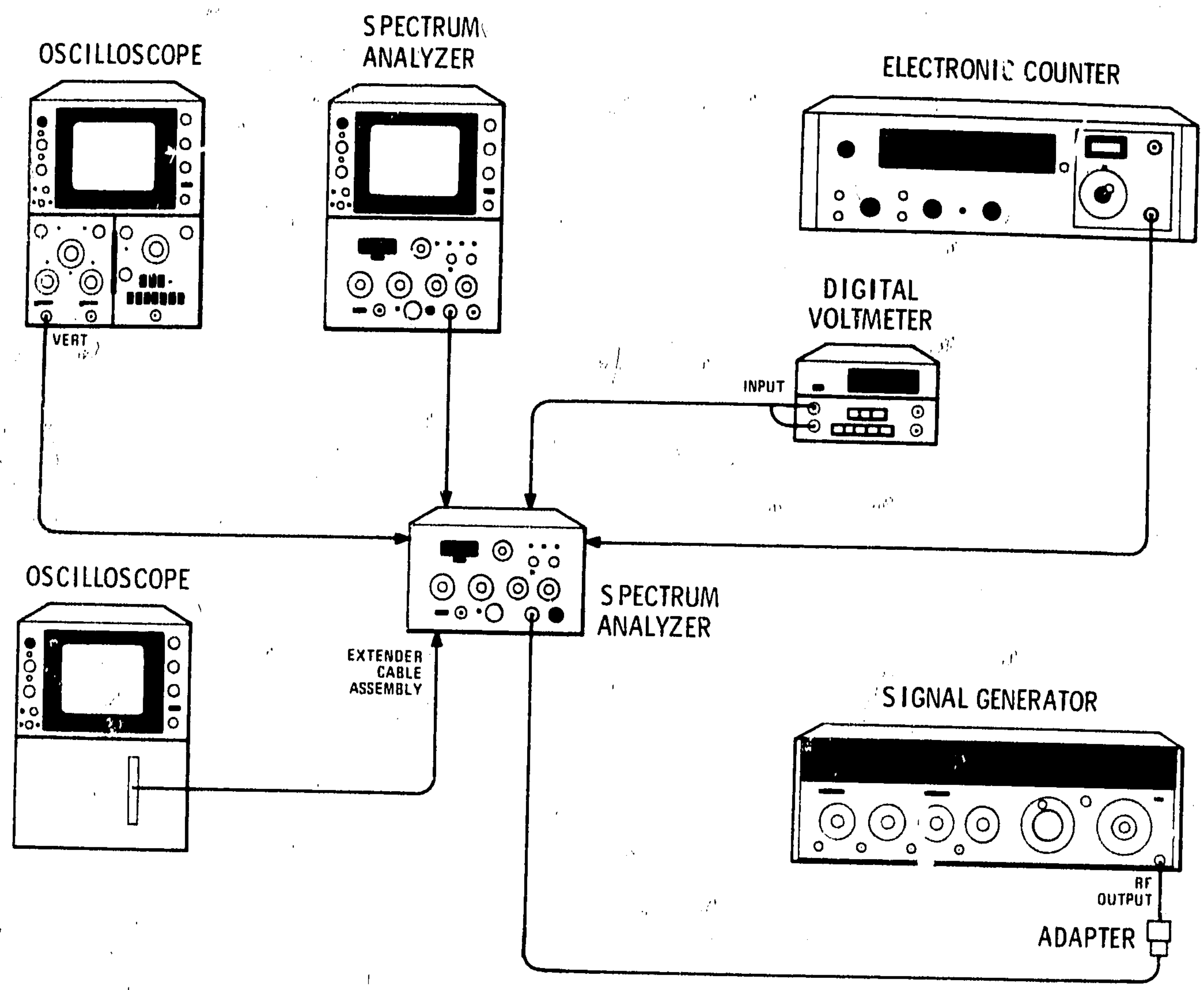


Figure 8-6. 8557A Simplified Block Diagram

Figure 8-7. Troubleshooting Block Diagram



EQUIPMENT:

Oscilloscope (with 10:1 probe)	HP 180A/1801A/1820C
Digital Voltmeter	HP 34740A/34702A
Signal Generator	HP 8640B
Extender Cable Assembly	HP 5060-0303
Spectrum Analyzer	HP 8558B/180T
Electronic Counter	HP 5245L/5254C
Adapter, Type N to BNC	HP 1250-0780

Figure 8-8. Troubleshooting Test Setup

Figure 8-9. Troubleshooting Procedure (1 of 4)

Figure 8-9. Troubleshooting Procedure (2 of 4)

Figure 8-9. Troubleshooting Procedure (3 of 4)

FROM SHEET 3

SHEET 4

RESOLUTION BW and FREQ SPAN/DIV (D)

FREQ SPAN/DIV . . . . 20 MHz
RESOLUTION BW . . . . 3 MHz
REF LEVEL FINE . . . . 0 dB
10 dB/DIV–
1 dB/DIV – LIN . . . . 10 dB/DIV

Alternately decrease RESOLUTION BW and FREQ SPAN/DIV control settings. Notice that as RESOLUTION BW is decreased, the noise level drops and the signal displayed becomes narrower; as FREQ SPAN/DIV is decreased the signal displayed becomes wider.

Couple FREQ SPAN/DIV and RESOLUTION BW controls in the OPTIMUM Position, and step FREQ SPAN/DIV from 20 MHz to 0 kHz setting.

Check that sweep time changes as necessary to keep a calibrated signal (no amplitude or frequency change).

INCORRECT SPAN/DIV → Connect scope to A3TP8 and ensure the sawtooth waveform amplitude decreases as SPAN/DIV is decreased.

- NO → Trouble is in A3 SWEEP GENERATOR. Refer to Service Sheet 9 for further troubleshooting.
- YES → Trouble is in A4 FREQUENCY CONTROL. Refer to Service Sheet 11 for further troubleshooting.

INCORRECT RESOLUTION BW → Place A3 SWEEP GENERATOR on extender board and check BW Control Voltages.

Resolution BW	Pin 30 (BW5)	Pin 31 (BW6)	Pin 32 (BW7)
3 MHz	+15V	–0.4V	+2.9V
1 MHz	+15V	–0.4V	+7.7V
300 kHz	+15V	–0.4V	+9.0V
100 kHz	+15V	–0.4V	+9.5V
30 kHz	+0.4V	+9V	+14.2V
10 kHz	+0.4V	+8.5V	+14.2V
3 kHz	+0.4V	+7.5V	+14.2V
1 kHz	+0.4V	+4.3V	+14.2V

- NO → Trouble is in A3 SWEEP GENERATOR or A1A2 RESOLUTION BW switch. Refer to Service Sheet 9 for further troubleshooting.
- YES ↓

10 dB/DIV –
1 dB/DIV – LIN . . . . 1 dB/DIV

Ground A8TP3 and A8TP12. Check the 3 dB bandwidth of signal displayed.

Resolution BW Switch Position	BW Displayed
3 MHz	4.42 MHz
1 MHz	1.48 MHz
300 kHz	442 kHz
100 kHz	148 kHz
30 kHz	44.2 kHz
10 kHz	14.8 kHz
3 kHz	4.42 kHz
1 kHz	1.48 kHz

- NO → Trouble is in A10 BANDWIDTH FILTER. Refer to Service Sheet 6 for further troubleshooting.
- YES → Trouble is in A8 BANDWIDTH FILTER. Refer to Service Sheet 4 for further troubleshooting.

INCORRECT SWEEP TIME → Check that sweep time increases as SWEEP TIME/DIV is stepped counterclockwise through the calibrated positions.

- NO → Trouble is in A3 SWEEP GENERATOR. Refer to Service Sheet 8 for further troubleshooting.
- YES → Trouble is in A3 SWEEP GENERATOR. Refer to Service Sheet 9 for further troubleshooting.

YES ↓

SWEEP TIME/DIV CONTROL

FREQ SPAN/DIV . . . . .1 MHz
RESOLUTION BW . . . . .1 MHz
SWEEP TIME/DIV . . . . MANUAL

Sweep trace with MANUAL SWEEP control and check that the trace sweeps the full ten divisions.

Step SWEEP TIME/DIV from .1 mSEC thru 10 SEC position. Notice that sweep times get progressively longer.

- NO → Trouble is in A3 SWEEP GENERATOR or A2 SWEEP TIME/DIV switch. Refer to Service Sheet 8 for further troubleshooting.
- YES ↓

SWEEP TRIGGER OPERATION

OPTIMUM INPUT . . . . -30
REFERENCE LEVEL dBm . . . . -30
SWEEP TIME/DIV . . . . .1 SEC
VIDEO FILTER . . . . .OFF
SWEEP TRIGGER . . . . SINGLE

Check that sweep does not trigger more than once for each time SINGLE SWEEP TRIGGER is selected.

Set SWEEP TRIGGER control to LINE position and observe sweep is triggering.

Center signal on CRT display and switch SWEEP TRIGGER control to INT.

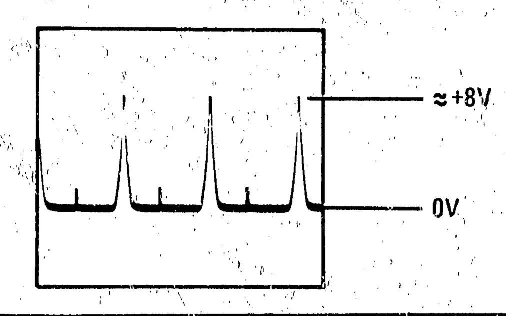
Adjust VIDEO FILTER control clockwise until sweep no longer triggers. The sweep should trigger on one division of baseline noise.

SINGLE TRIGGER → Trouble is in SINGLE TRIGGER circuit. Refer to Service Sheet 8 for further troubleshooting.

LINE TRIGGER → Check for 20 VAC at P1 pin 31 (30V P-P for 180 or 182 mainframe).

- NO → Trouble is in 180 Series Oscilloscope or Extender Cable Assembly.
- YES → Trouble is in LINE TRIGGER circuit. Refer to Service Sheet 8 for further troubleshooting.

INTERNAL TRIGGER → Connect scope to A12 pin 2 and check for presence of INTERNAL TRIGGER.



- NO → Trouble is in A12 VERTICAL DRIVER PREAMPLIFIER circuit. Refer to Service Sheet 10 for further troubleshooting.
- YES → Trouble is in INTERNAL TRIGGER circuit. Refer to SERVICE SHEET 8 for further troubleshooting.

YES ↓

BASELINE CLIPPER

SWEEP TRIGGER . . . . FREE RUN
SWEEP TIME/DIV . . . . .AUTO
VIDEO FILTER . . . . .OFF

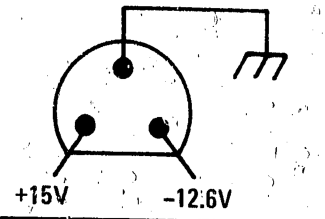
Turn BASELINE CLIPPER fully clockwise and check that the bottom two to four divisions of the display are blanked.

- NO → Trouble is in VERT/BASELINE COMPARATOR circuit. Refer to Service Sheet 10 for further troubleshooting.
- YES ↓

PROBE POWER

Measure PROBE POWER voltages as shown:

Front View



- NO → Refer to Service Sheet 2 for further troubleshooting.
- YES → Troubleshooting complete. Unit is operating normally.

Figure 8-9. Troubleshooting Procedure (4 of 4)

SERVICE SHEET 2

A1A3 INPUT ATTENUATOR, A2 INPUT LOW PASS FILTER, AND A7 FIRST CONVERTER ASSEMBLIES, CIRCUIT DESCRIPTION

General Description

The A1A3 Input Attenuator Assembly is a 50 ohm discrete-component resistive attenuator that provides 0 dB to 50 dB attenuation of the input signal in 10 dB steps. The input capacitor, mounted inside the attenuator housing, isolates the spectrum analyzer from dc voltages.

The A2 Input Low Pass Filter Assembly is a passive LC filter that provides out-of-band signal rejection (above 360 MHz).

Input signals flow through the attenuator and the filter into the A7 First Converter Assembly, made up by the A7A1 First LO Assembly and the A7A2 First Mixer Assembly. The A7A1 First LO Assembly is a one-transistor voltage-tuned-oscillator (VTO) utilizing a varactor diode and a one-transistor output amplifier. The A7A2 First Mixer Assembly consists of a Limiter to protect microcircuit Mixer U1, 2 dB Pad and 3 dB pad to improve impedance matches, and a 521.4 MHz Bandpass Filter.

Input Attenuator Assembly

The A1A3 Input Attenuator Assembly contains one each 10 dB, 20 dB, and 30 dB attenuation networks. These three-resistor precision Pi networks are switched in and out of circuit by the four-section rotary OPTIMUM INPUT switch A1A3S1 as necessary to produce 0 dB to 50 dB attenuation in 10 dB steps. Transmission line structure is used, making mechanical construction important to maintain 50 ohm impedance.

The Input Capacitor A1A3C1, is rated at 1.0µF, 50 Vdc to allow proper low-frequency input signal coupling and protection from dc levels up to ±50 Vdc.

Input Low Pass Filter Assembly

The A2 Input Low Pass Filter Assembly is an 11-pole LC filter that will pass signals up to 360 MHz. Variable inductors, A2L1 through A2L5, adjust the high frequency flatness and cut-off. Insertion loss is less than 1 dB up to 350 MHz. The filter board is soldered into a metal can to prevent stopband signals from passing through the filter in undesired modes.

First Converter Assembly

The A7 First Converter Assembly consists of the A7A1 First Local Oscillator (First LO), the A7A2 First Mixer Assemblies, and several board-mounted components.

The A7A1 First LO and A7A1 First Mixer Assemblies are mounted directly to the A7 First Converter Assembly circuit board. Individual metal cans are mounted over the LO and mixer assemblies to isolate the LO from the mixer. To ensure good shielding, a highly-conductive silver-impregnated silicone gasket is placed between the metal cans and the A7 circuit board.

NOTE

> Do not tighten nuts that hold the can on by more than one-half turn past where they touch the can, or cutting of the gasket may occur.

First Local Oscillator Assembly

The A7A1 First Local Oscillator (First LO) Assembly utilizes Q1 as a voltage-tuned oscillator in the frequency range of 521.4 MHz to 871.4 MHz.

The tank circuit of the First LO is made up of the inductance of L4, the capacitance of CR2, and stray circuit parasitics. Tuning the First LO is accomplished by applying the VTO Tune voltage from the A4 Frequency Control Assembly through temperature compensating diode CR1 to the cathode of varactor diode CR2. The VTO Tune voltage range, approximately +4 Vdc to +18 Vdc, corresponds to the First LO frequency range of 521.4 MHz to 871.4 MHz. Output Amplifier, Q2, provides load isolation and gain for the oscillator signal. The output of Q2 supplies the LO signal to the First Mixer and a sample of the First LO to A7J3, First LO Out connector.

First Mixer Assembly

The A7A2 First Mixer Assembly mixes the RF input signal and the First LO to produce the first IF signal, 521.4 MHz. Diodes CR1 and CR2 are shunts to ground at the input of the mixer assembly to protect the microcircuit mixer, U1, from high-level input signals. A 2 dB resistive pad is inserted between the input port of U1 and the Limiter diodes CR1 and CR2 to improve the impedance match between the A2 Input Low Pass Filter and microcircuit mixer U1. The RF input signal is mixed with the First LO by U1. The 521.4 MHz fundamental mixing product ($f_{LO} - f_{INPUT} = f_{IF} = 521.4$ MHz) at the output of Mixer U1 goes through a 3 dB resistive pad, to provide a good impedance match to the 521.4 MHz Bandpass Filter. CTR controls, L1 and L2, adjust center frequency of the bandpass filter. The 521.4 MHz signal from the bandpass filter is applied to the A5A4 521.4 MHz Amplifier Assembly (P/O A5 Second Converter).

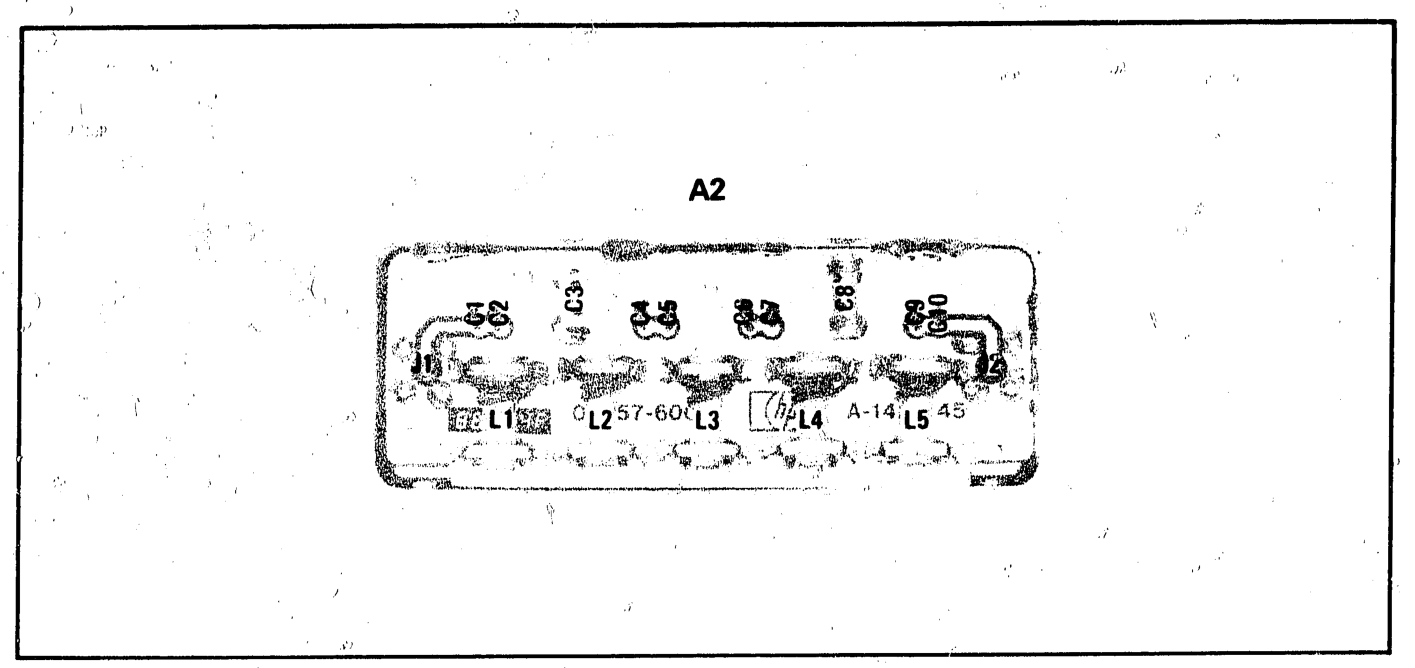


Figure 8-10. A2 Input Low Pass Filter Assembly, Component Locations

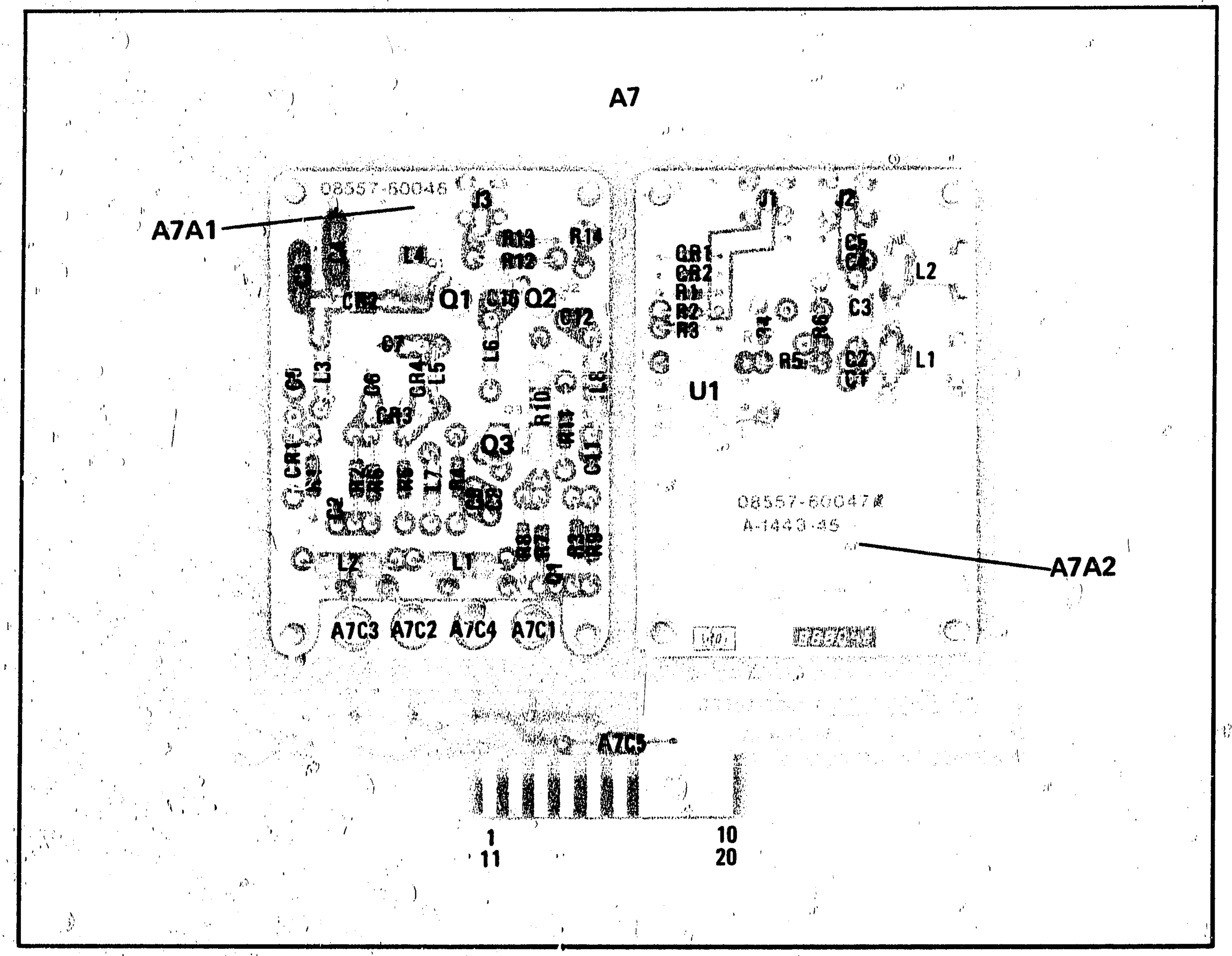


Figure 8-11. A7 First Converter Assembly, Component Locations

OPTIMUM INPUT	INPUT ATTEN
-40	0
-30	10
-20	20
-10	30
0	40
10	50
SWITCH SHOWN IN 10 dBm (60 dB ATTEN) POSITION	

REFERENCE DESIGNATIONS

NO PREFIX	A7
W1,2,5,6 W1P1 W1P2 W2P1 W5J1 W5P1 W6P1 W6P2	C1-5 J1-3 W1
	A7A1
	C1-13 CR1-4 L1-5,7,8 Q1-3 R1-15 TP1
A1A3	A7A2
C1 J1-2 R1-9 S1-1 - S1-4	C1-5 CR1-2 L1-2 R1-6 U1
A2	A13
C1-10 J1-2 L1-5	XA7

NOTES

1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENTS CONDITIONS.
2. PUSH IN REFERENCE LEVEL KNOB TO ENABLE S1 TO ROTATE.

REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

Figure 8-12. A1A3 Input Attenuator Assembly, A2 Input LPF and A7 First Converter Assembly, Schematic

SERVICE SHEET 3

A5 SECOND CONVERTER AND A6 21.4 MHz PREAMPLIFIER ASSEMBLIES, CIRCUIT DESCRIPTION

General Description

The A5 Second Converter Assembly contains the A5A1 500 MHz LO, (250 MHz oscillator and 500 MHz doubler), A5A2 IF Filter, A5A3 Low Pass Filter, A5A4 521.4 MHz Preamplifier Assemblies. Also included in the A5 Second Converter casting are helical-resonator 500 MHz Bandpass Filter (BPF) and 521.4 MHz Bandpass Filter (BPF). The A5 Second Converter Assembly converts the 521.4 MHz signal from the A7 First Converter Assembly down to 21.4 MHz.

The A6 21.4 MHz Preamplifier Assembly receives the 21.4 MHz signal from the A5 Second Converter and provides appropriate gain and impedance matching for optimum noise and distortion performance. The output is fed to the A8 Bandwidth Filter Assembly.

Second Converter Assembly

500 MHz LO Assembly

The A5A1 500 MHz LO Assembly consists of a one-transistor 250 MHz crystal-controlled oscillator. Transistor Q3 provides load isolation and gain for the oscillator and drives 500 MHz doubler transistor Q2. The output of Q2 is fed through the helical-resonator 500 MHz Bandpass Filter (BPF) and is inductively coupled to Mixer Diode CR1.

The 250 MHz oscillator also provides a 250 MHz, −30 dBm signal to the front-panel CAL OUTPUT connector for calibration of the spectrum analyzer.

521.4 MHz Preamplifier Assembly

The A5A4 521.4 MHz Preamplifier Assembly provides a broad-band fixed 12 dB of gain to the incoming 521.4 MHz signal from the First Converter. Transistor Q2 provides active bias for amplifier Q1. The output is fed to the A5A3 Low Pass Filter (LPF) Assembly.

Low Pass Filter Assembly

The A5A3 Low Pass Filter Assembly (LPF) is a passive 11-pole non-adjustable LC filter with a high frequency cut-off of 600 MHz. The filter is constructed to provide a stop band well into the microwave range (7—8 GHz) in order to reduce residual spurious responses. The maximum insertion loss of the LPF (at 521.4 MHz) is 1 dB. The output of the LPF is fed to the main image-rejection filter of the spectrum analyzer, the 521.4 MHz Bandpass Filter (BPF). The 521.4 MHz BPF is a 4-pole helical resonator that provides 9.5 MHz bandwidth and is adjusted for minimum insertion loss at 521.4 MHz by BP3—BP6. The output of the 521.4 MHz BPF is applied, along with the 500 MHz LO signal, to Mixer Diode CR1. The output of Mixer Diode CR1 is applied through L5 to the A5A2 IF Filter Assembly.

IF Filter Assembly

The A5A2 IF Filter Assembly is an LC filter that provides band-pass rejection of unwanted mixing products (signals other than 21.4 MHz). At the IF Frequency (21.4 MHz), the filter converts the impedance of mixer diode CR1 to 50 ohms.

21.4 MHz Preamplifier Assembly

The 21.4 MHz IF signal from the IF Filter Assembly is coupled through capacitor C5 to the base of Q4, a common emitter amplifier. The input impedance of the preamplifier is approximately eight ohms at 21.4 MHz. The mismatch to the previous stage (IF Filter Assembly) provides optimum noise performance for the system. The gains of Q4 stage is adjusted by factory selected resistor R5 which controls the amount of feedback. VR1 is a 10V zener diode that supplies Q4's collector to emitter voltage. The output of Q4 is fed to Q7, an emitter follower, whose output goes to PIN diodes CR3 and CR7 which adjust the 21.4 MHz Preamplifier gain. After the PIN diodes, the signal goes through coupling capacitor C10 to the A8 Bandpass Filter Assembly.

A voltage ramp proportional to frequency (Frequency Analog Voltage) is amplified by −1.0 by Q6 (unity inverting gain); R1 and R3 set the gain, R2 sets the DC offset. This inverted ramp is applied to the bases of Q1, Q2, and Q3 whose emitters are set at break points established by R20, R19, R18, respectively. During a full sweep (0—350 MHz) the ramp voltage at collector of Q6 starts down from approximately +13.6 volts and goes to approximately +7.0 volts at the end of the sweep. It first turns on Q3, drawing an increasing collector current determined by R15 and R12, until the inverted ramp reaches approximately +11.9 volts; at that point CR1 turns on and no increased current flows through Q3. Simultaneously at +11.9 volts, Q2 turns on with an increasing current set by R16 and R13, until the ramp voltage equals approximately +9.1 volts. Then CR2 turns on and Q2's current remains constant, while Q1 begins providing current set by R14 and R17. The currents from Q1, Q2, Q3 sum in R11 to make a voltage ramp with 3 different slopes, each slope independently setable. This ramp is applied to Q5 which controls the current to PIN diodes CR3 and CR7. The REF LEVEL CAL voltage is also summed in at this point. Components R20, R21, R22, VR2, CR4, CR5, CR6, R23, R24, R25 provide three break points to give a linear attenuation (dB) vs. voltage (volts) curve for PIN diodes CR3 and CR7.

◀ **A1A3 Input Attenuator Assembly**
A2 Input CPF
A7 First Converter Assembly
SERVICE SHEET 2

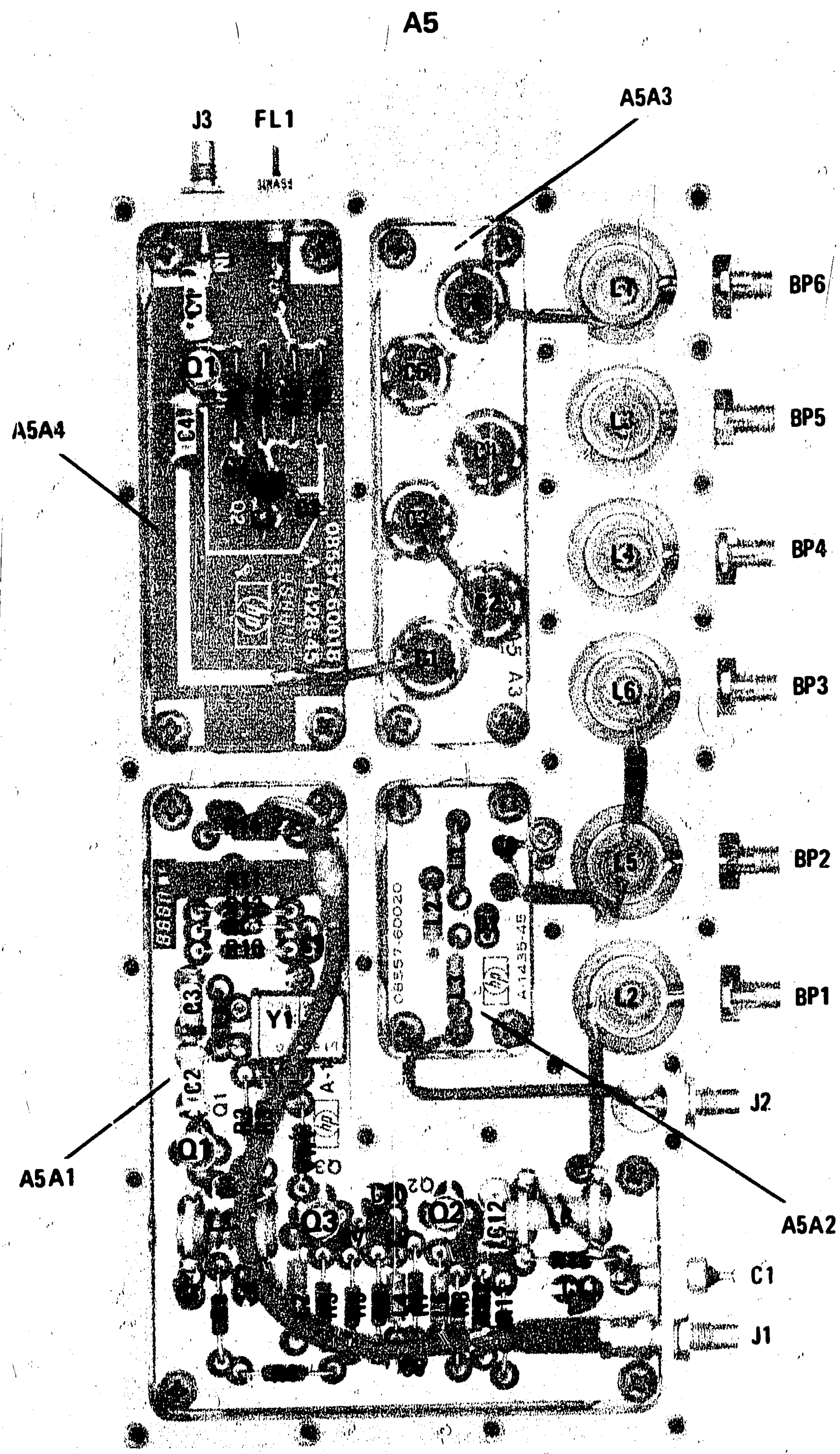


Figure 8-13. A5 Second Converter Assembly, Component Locations

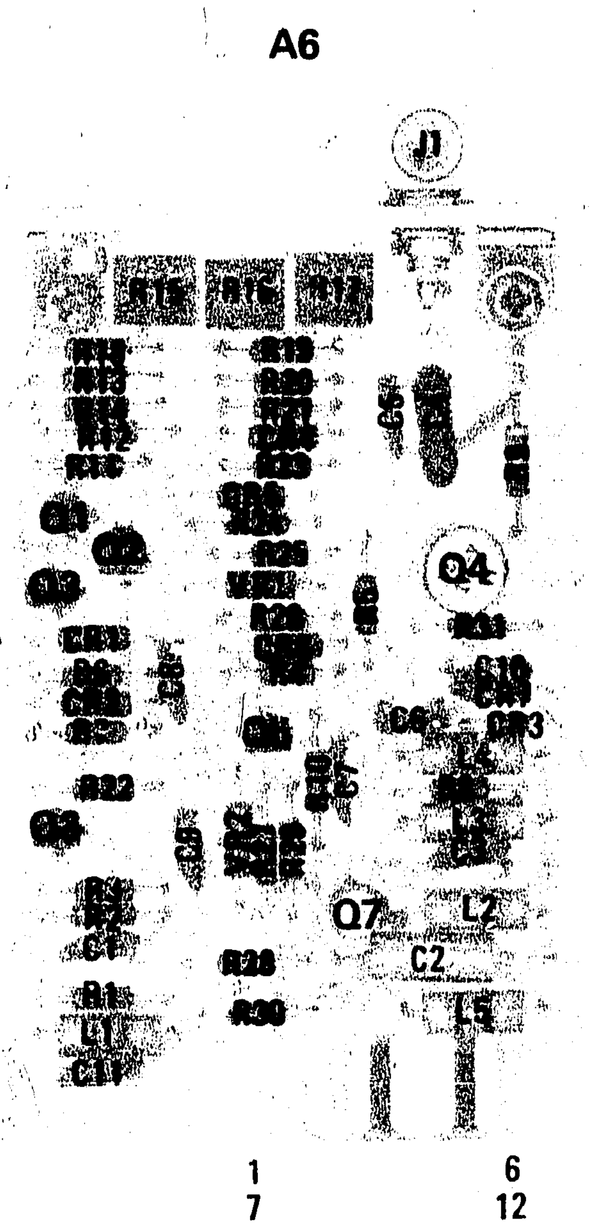
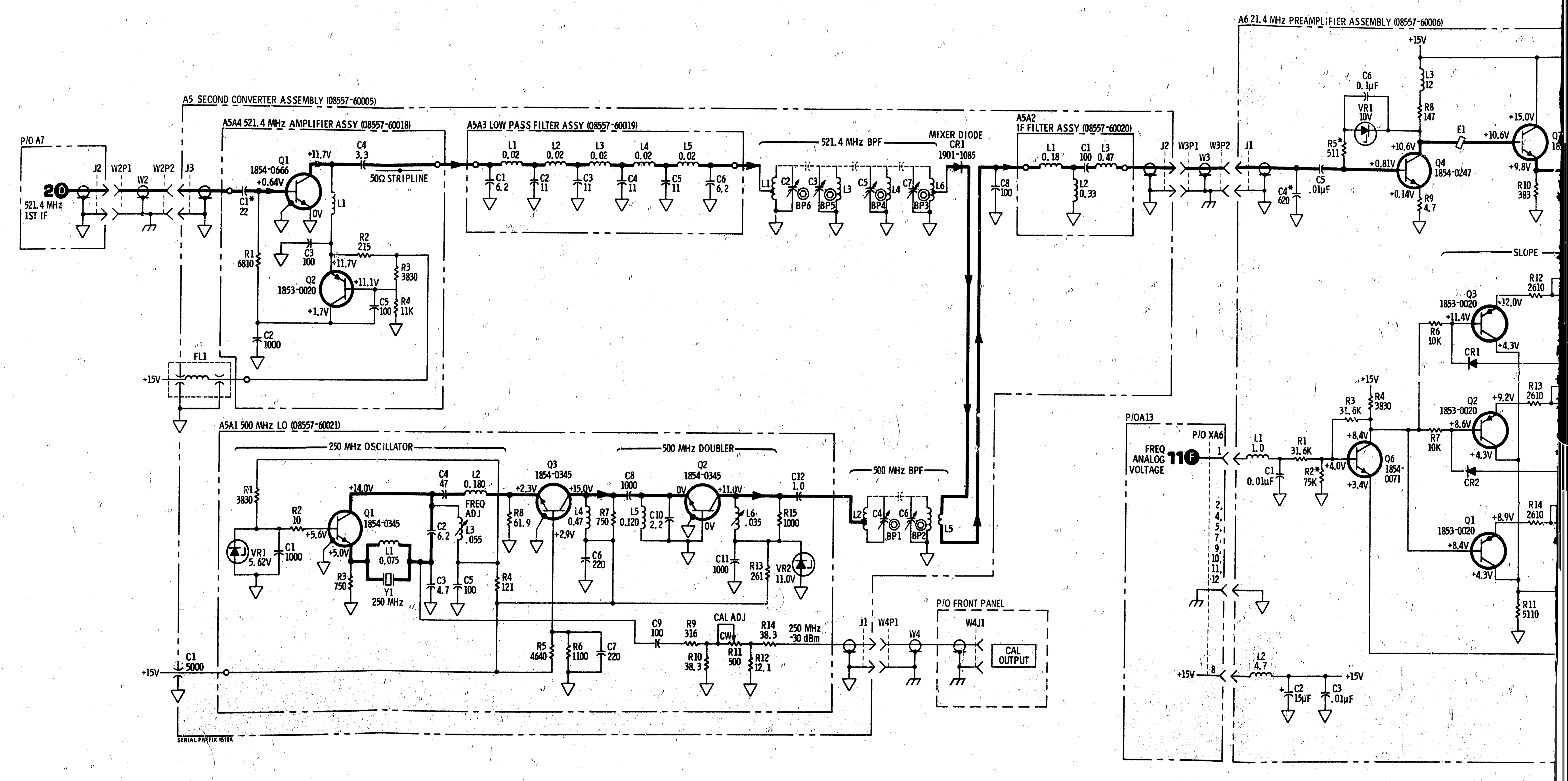
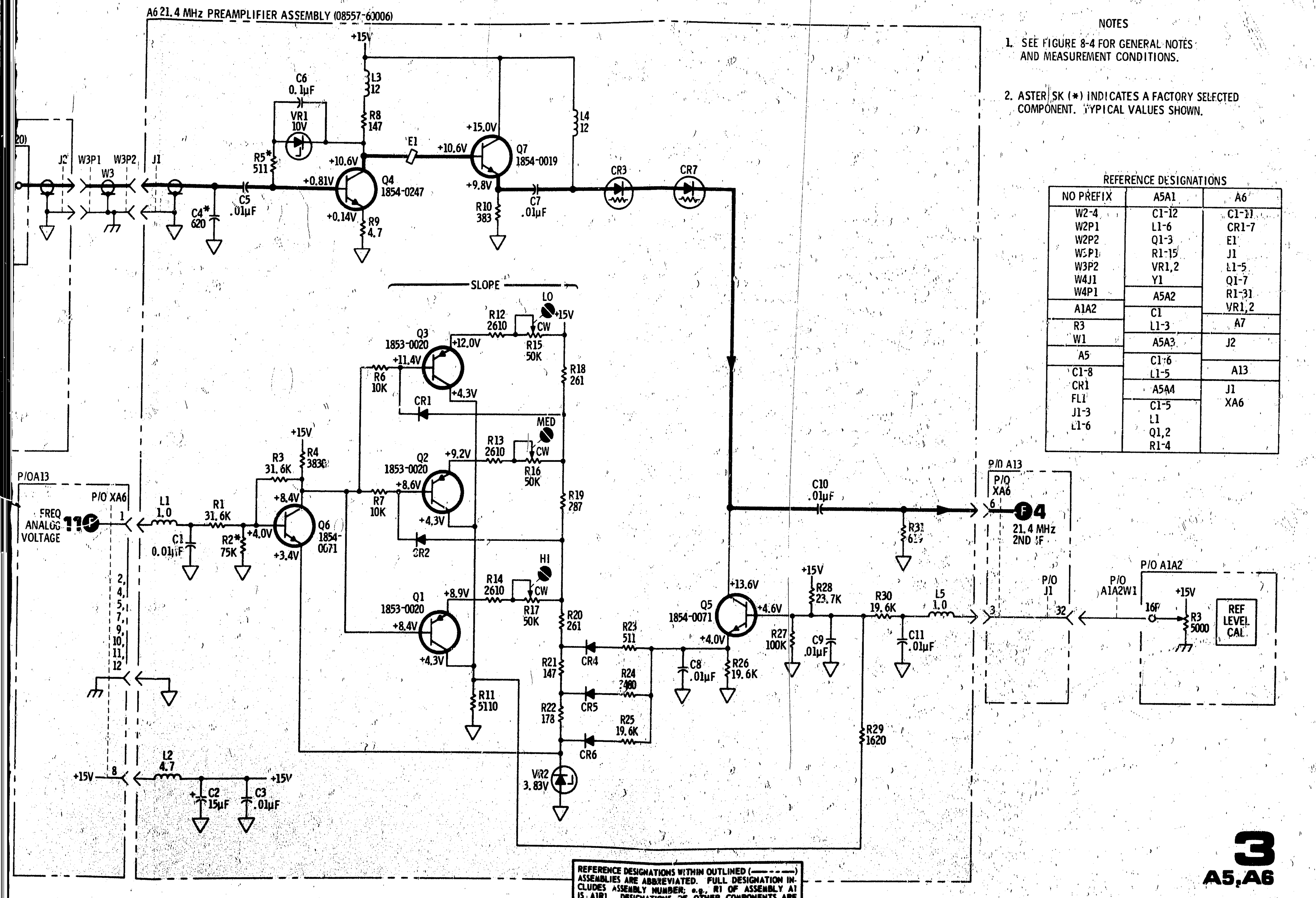


Figure 8-14. A6 21.4 MHz Preamplifier Assembly, Component Locations





NOTES

1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.

2. ASTERISK (*) INDICATES A FACTORY SELECTED COMPONENT. TYPICAL VALUES SHOWN.

REFERENCE DESIGNATIONS

NO PREFIX	A5A1	A6
W2-4 W2P1 W2P2 W3P1 W3P2 W4J1 W4P1	C1-12 L1-6 Q1-3 R1-15 VR1,2 Y1	C1-11 CR1-7 E1 J1 L1-5 Q1-7 R1-31 VR1,2
A1A2	A5A2	A7
R3 W1	C1 L1-3	J2
A5	A5A3	A13
C1-8 CR1 FL1 J1-3 L1-6	C1-6 L1-5	J1 XA6
	A5A4	
	C1-5 L1 Q1,2 R1-4	

REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

3
A5,A6

Figure 8-15. A5 and A6 Second Converter and 21.4 MHz Preamplifier, Schematic

A8 BANDWIDTH FILTER ASSEMBLY CIRCUIT DESCRIPTION

General Description

The Bandwidth Filter Assembly provides 10 dB of gain at 21.4 MHz with bandwidths from 3 MHz to 1 kHz. The front-panel RESOLUTION BW switch is used to select one of eight available bandwidth settings (3 MHz, 1 MHz, 300 kHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, and 1 kHz). The four narrower bandwidths (1 kHz through 30 kHz) are obtained from four synchronously-tuned crystal filters. The four wider bandwidths (100 kHz through 3 MHz) are obtained from four synchronously-tuned LC tank circuits. The four stages of bandwidth filters are on two identical printed circuit boards, A8 and A10. The four crystals on the bandwidth filter assemblies, A8Y1, A8Y2, A10Y1, and A10Y2 are a factory-selected matched set. If replacement of a bandwidth filter board becomes necessary, the new board is shipped with two crystals installed and two other crystals which must be used to replace the crystals on the other bandwidth filter board.

Amplifier

The input amplifier stage, Q2, Q3 and Q4, of A8 Bandwidth Filter Assembly provides 10 dB of gain in LC or XTL Mode to offset signal loss through the PIN diode attenuator on the A9 Step Gain Assembly. It can be treated as an operational amplifier as shown in Figure 8-16. Transistor Q3 provides base drive for Q2 with no signal gain due to the placement of C17 between the collector and the emitter of Q3. Transistor Q2 provides negative feedback to Q4. The formula for gain in this configuration is $Av = 1 + R_f/R_i$ where Av is voltage gain, R_f is feedback resistance and R_i is input resistance. Plugging the values shown in Figure 8-16 into this formula yields Av=1+(178+26.1+12.1)/100=3.16. A voltage gain of 3.16 represents a stage gain of 10 dB (dB = 20 log Av).

LC Bandwidth Filter

Using the table to the right of the schematic diagram, in LC mode with 3 MHz RESOLUTION BW, we find that BW5 (test point N) is at +15 volts (coming from the front-panel RESOLUTION BW control A1A2S5). The BW6 line (test point 0) is at –10 volts supplied by the a PIN drive buffer, A3U2A, and the BW7 line (test point P) is at +3.0 volts supplied by PIN drive buffer A3U2B. The +15 volts on the BW5 line applies a high positive potential at the anodes of CR1, CR2, CR3, and CR4 causing them to conduct. It also applies a positive voltage at the base of Q1 turning Q1 off. Diode CR1 supplies the proper collector current to Q2 (since Q1 is turned off). Diodes CR2, CR3, and CR4 drop about 0.6 volts each, placing the emitter of Q5 at approximately +13.2 volts. Since the base supply is at +10 volts, Q5 is now conducting at saturation. Thus, a relatively large current flows through CR2, CR3, and CR4 creating a signal path from ground through C22, CR2, CR3, CR4, and C23 back to ground. So we see that in the LC mode the crystal driver Q1 is turned off and crystal Y1 is effectively shorted through the path described above. The anode of CR5 is at about +10 volts (from the center tap of T1) and its cathode is at approximately +13.8V (+15V minus the voltage drops across CR2 and CR3). Thus CR5 is reverse biased and is not conducting. Looking back into CR5, the LC tank circuit sees only a very small capacitance to ground (C1) and the 21.4 MHz third IF signal flowing through CR6. The anode of CR6 is at +10 volts (from the center tap of T1) so the current in CR6 is proportional to the voltage on the BW7 line. Since CR6 is a PIN diode, its RF resistance is inversely proportional to the current flowing through it. If we simplify the circuitry as shown in Figure 8-17, we see that the Q of the LC tank circuit is directly proportional to the series resistance R of the PIN diode CR6. By decreasing the current through CR6, thus increasing its resistance, the Q of the tank circuit is proportionally increased. If we again examine the table to the right of the schematic diagram, we find that for narrower bandwidths down to 100 kHz, the positive potential on the BW7 line increases, decreasing the forward bias of CR6. This increases the resistance of CR6, increasing the Q of the tank circuit. Since bandwidth is inversely proportional to the Q (Q = fo/BW), increasing the Q decreases the bandwidth. Transistor Q6 is a source follower which transforms the high impedance of the LC tank down to a low impedance and has unity gain. A portion of the output signal is fed back through C30, CR7, and T1 in phase with the input signal (positive feedback). The amount of feedback is controlled by the current through CR7 which is set by adjusting R1 LC FDB adjustment. The feedback is provided to compensate for the loss of the LC tank circuit. If the amount of feedback is incorrect, the amplitude of the signal displayed on the analyzer will change when different bandwidths are selected. The second pole of the bandwidth filter is nearly identical to the first pole and the description of the circuitry may be treated in the same manner.

Crystal Bandwidth Filter

Using the table to the right of the schematic diagram, in crystal mode with 30 kHz RESOLUTION BW, we find that BW5 (test point N) is at 0 volts (coming from the front panel RESOLUTION BW control A1A2S5). The BW6 line (test point 0) is at +9.0 volts supplied by PIN drive buffer A3U2A, and the BW7 line (test point P) is at +15 volts supplied by A3U2B. The 0 volts on the BW5 line at the anodes of CR1 and CR2 turns these two diodes off. This ground also provides a path through R17 and R18 that biases Q1 ON. Transistor Q1 is an emitter follower which transforms the high impedance input down to a lower impedance to provide the proper drive for crystal Y1. Diode CR5 has +10 volts on the anode (from the center tap of T1) so CR5 is conducting. This places about +9.4 volts at the cathode of CR3 so it will be turned off. The +15 volts on the BW7 line reverse biases CR6 so the LC mode signal path is turned off. The +9 volts on the BW6 line places the cathode of CR4 at approximately +9 volts on the BW6 line which provides a small current flow through CR4. Since CR4 is a PIN diode, is RF resistance is inversely proportional to the current flowing through it. If we simplify the circuitry as shown in Figure 8-18, we see that the Q of the crystal is inversely proportional to the parallel resistance R. By increasing the current through CR4, thus reducing its resistance, the Q of the crystal circuit is proportionally increased. If we again examine the table to the right of the schematic diagram, we find that for narrower bandwidths the positive potential on the BW6 line decreases, increasing the forward bias of CR4. This decreases the resistance of CR4, increasing the Q of the crystal circuit. Since bandwidth is inversely proportional to Q, increasing the Q decreases the bandwidth. In the crystal mode, the LC tank circuit is still in the signal path. Capacitor C3 XTL CNTR adjustment is used to tune the tank circuit to the crystal frequency so the center frequency remains the same when switching between crystal and LC bandwidths. Capacitors C1, C2, and C3 are interacting adjustments. Capacitor C2 XTL SYM adjustment is adjusted to tune out the parallel capacitance of crystal Y1 to provide good symmetry. The second pole of the bandwidth filter is nearly identical to the first pole and the description of the circuitry may be treated in the same manner.

A5 Second Converter Assembly
A6 21.4 MHz Preamplifier Assembly
SERVICE SHEET 3

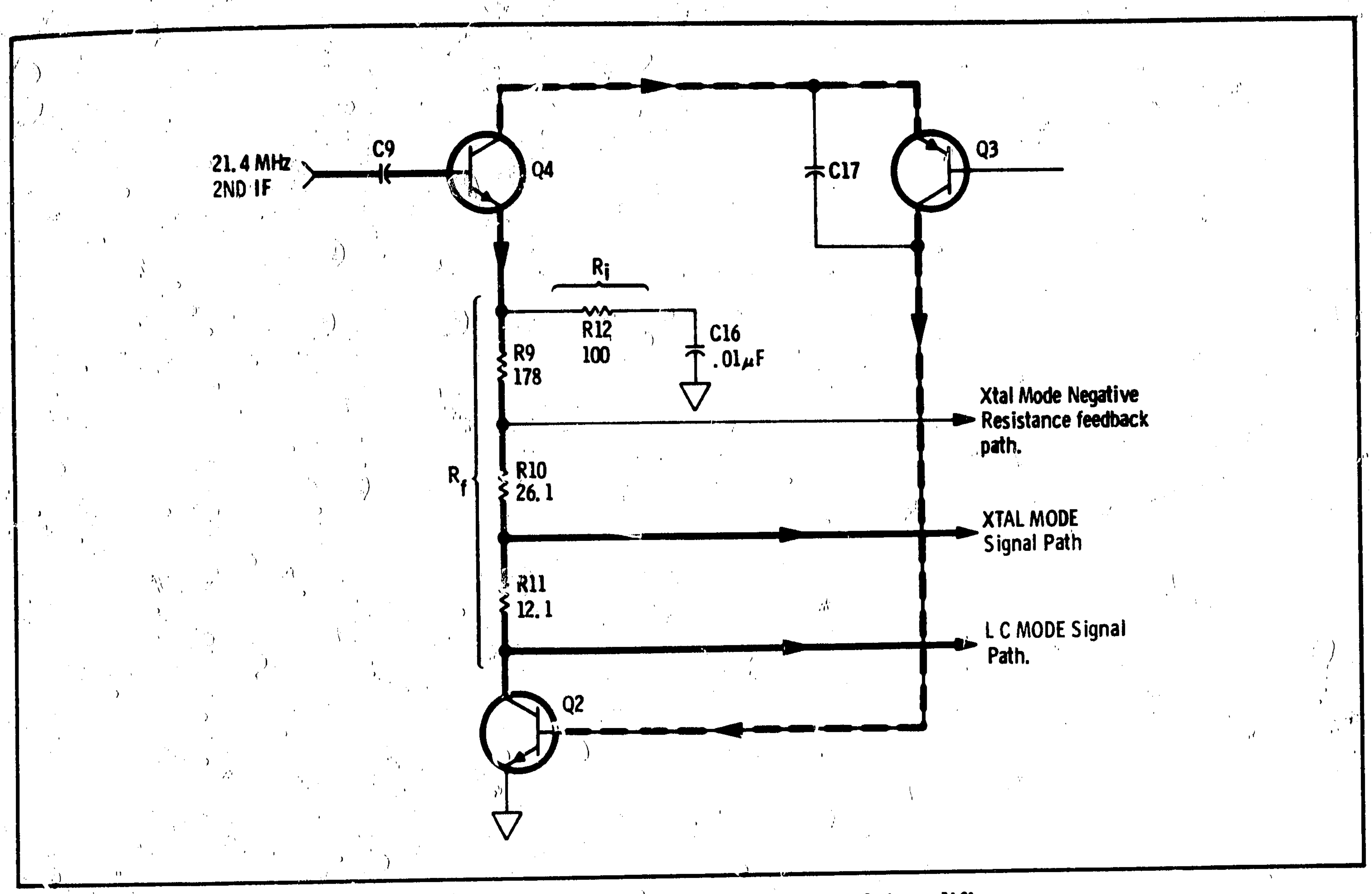


Figure 8-16. Simplified Schematic of Amplifier

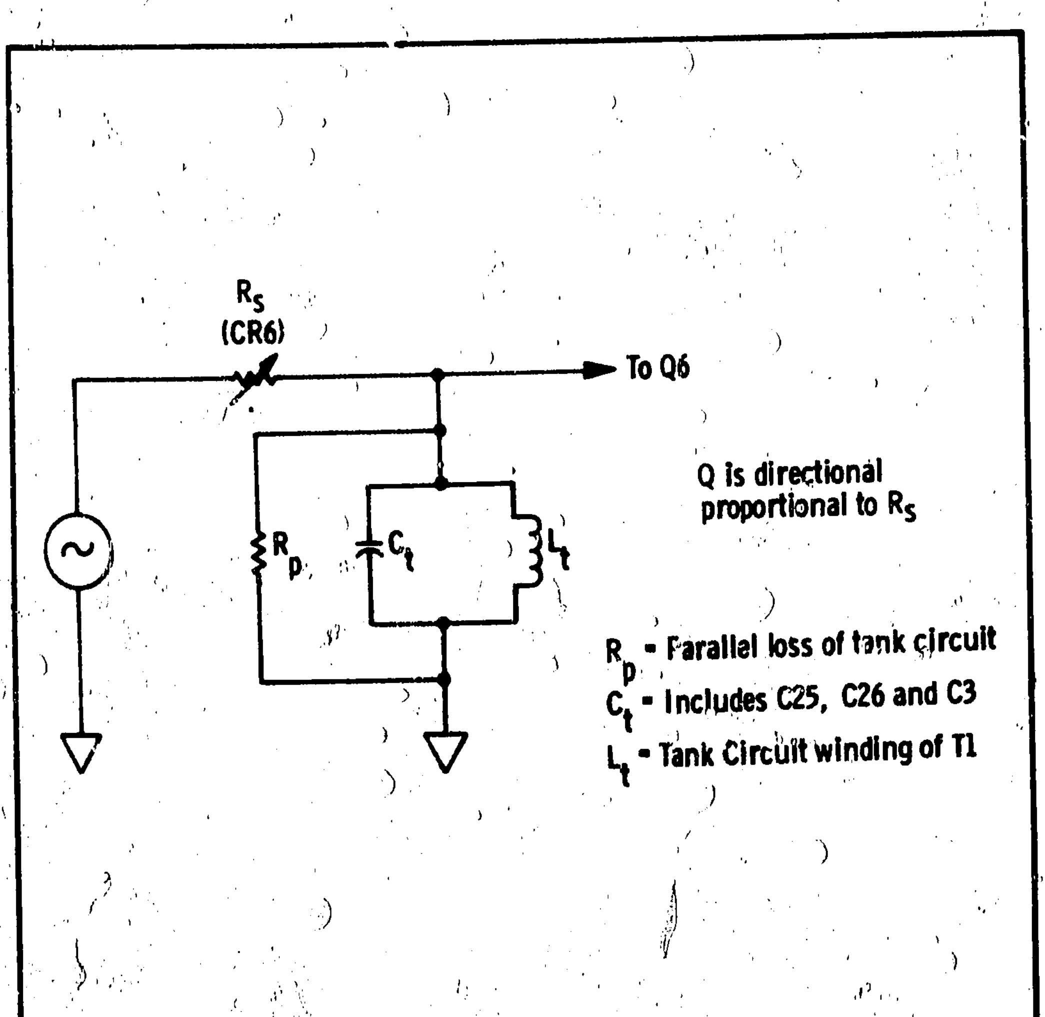


Figure 8-17. Simplified Schematic of LC Bandwidth Filter

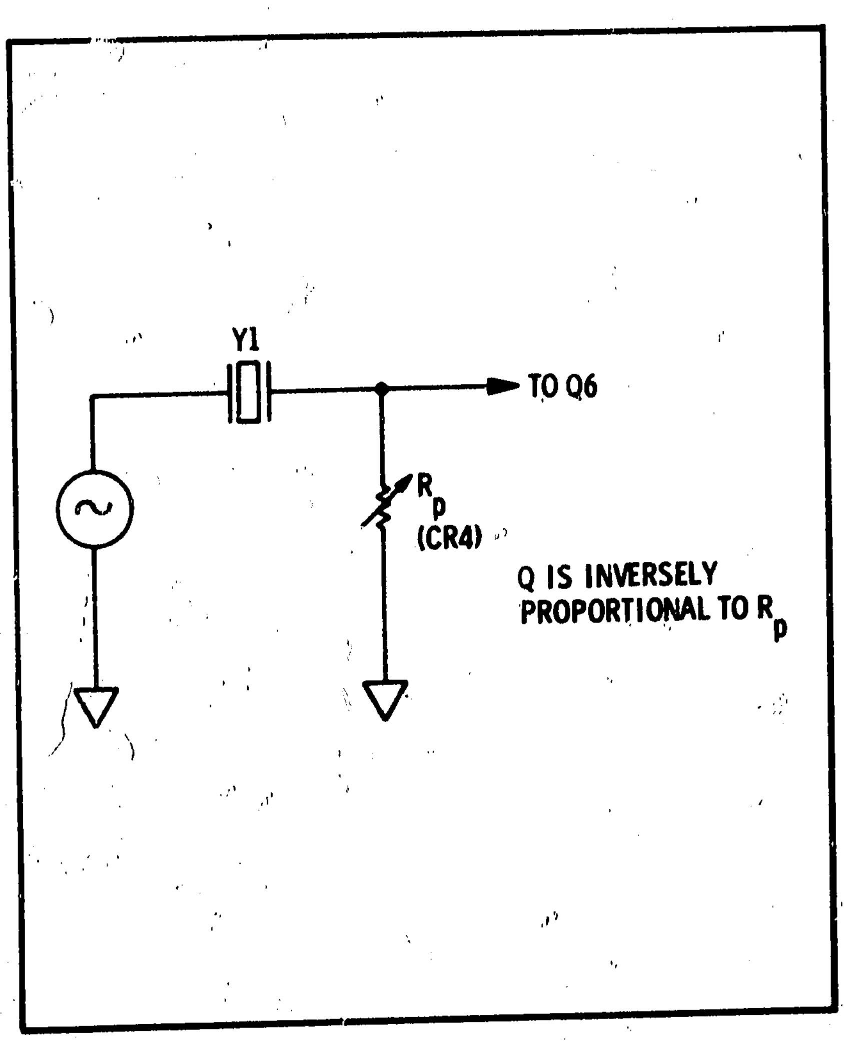


Figure 8-18. Simplified Schematic of Crystal Bandwidth Filter

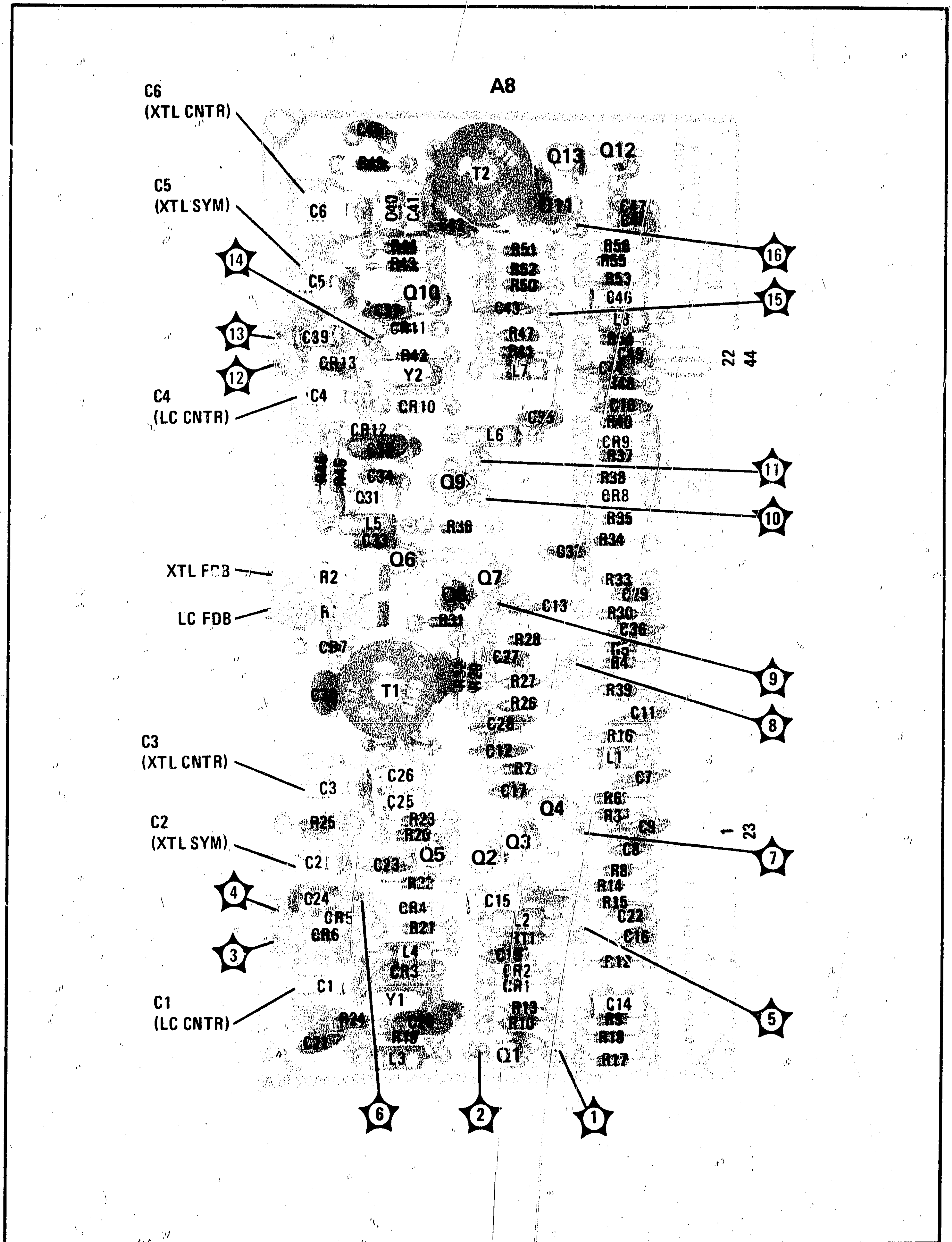
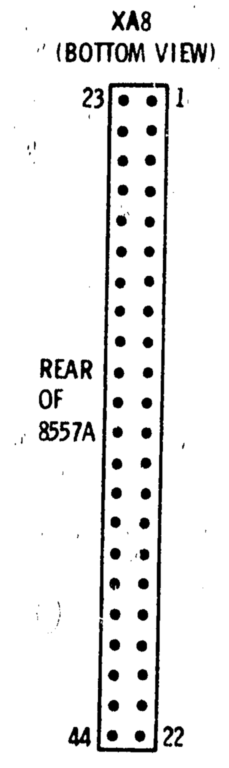


Figure 8-19. A8 Bandwidth Filter Assembly, Component Locations

NOTES:

1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.
2. A8Y1, A8Y2, A10Y1 AND A10Y2 ARE MATCHED CRYSTALS. IF REPLACEMENT BECOMES NECESSARY, ALL FOUR CRYSTALS MUST BE REPLACED WITH A NEW MATCHED SET.



FRONT PANEL BANDWIDTHS	2 POLE BANDWIDTH	1 POLE BANDWIDTH	MODE	TYPICAL VALUES BW5 VOLTS (N)	BW6 VOLTS (O)	BW7 VOLTS (P)
3 MHz	4.42 MHz	6.9 MHz	LC	+15	-6.2	+1.3
1 MHz	1.48 MHz	2.3 MHz	LC	15	-6.2	+7.7
300 KHz	442 KHz	690 KHz	LC	+15	-6.2	+9.3
100 KHz	148 KHz	230 KHz	LC	+15	-6.2	+9.8
30 KHz	44.2 KHz	69 KHz	XTL	0	+9.0	+14.2
10 KHz	14.8 KHz	23 KHz	XTL	0	+8.5	+14.2
3 KHz	4.42 KHz	6.9 KHz	XTL	0	+7.2	+14.2
1 KHz	1.48 KHz	2.3 KHz	XTL	0	+2.2	+14.2

REFERENCE DESIGNATIONS

A8 ASSY	A13 ASSY
C1-49 CR1-13 E1-4 L1-8 Q1-13 R1-57 T1,2	XA8

4
A8

Figure 8-20. A8 Bandwidth Filter Assembly Schematic

SERVICE SHEET 5

A9 STEP GAIN ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A9 Step Gain Assembly contains three amplifier stages to provide a 0 to 50 dB amplification of the 21.4 MHz second IF signal. The amplifier stages are selected by the front panel REFERENCE LEVEL dBm switch A1A2S1. After the final 20 dB amplifier there is a two-section bandpass filter. In conjunction with the front panel REF LEVEL FINE control A1A2R12, the step gain assembly contains circuitry for the 0 to 12 dB fine control for the reference level. A TEST/NORM switch is incorporated to aid adjustments in LOG mode.

Ref Level Fine Control

The front panel REF LEVEL FINE control A1A2R12 provides approximately 0.3 to 12.3 dB of attenuation at the base of A9Q7. (See Figure 8-21.) The current flow through PIN diode CR3 determines the amount of signal attenuation, and therefore the reference level. For example: if PIN diode current flow is increased, more RF signal is shunted or bypassed to ground. A9C12 provided the RF bypass to ground and isolates the variable dc voltage of the REF LEVEL FINE adjustment from ground.

0 dB and −12 dB Adjustments. A minimum current flow through the PIN diode (maximum allowable diode resistance) is established by the −12 dB potentiometer A9R6 so the diode is never completely cut off. Adjustment of A9R6 sets the 0.3 dB point and is adjusted with the REF LEVEL FINE control fully clockwise (−12 position).

The maximum current flow through the PIN diode is set by the 0 dB potentiometer A9R5. A9R5 is adjusted to the 12.3 dB attenuation point with the REF LEVEL FINE control fully counterclockwise (0 position).

PIN Diode Current Source. Transistors A9Q8 and A9Q9 are identical current sources. The maximum current is set by the 0 dB adjustment A9R5 in the common base circuit. Diode A9CR1 provides temperature compensation for the transistors.

PIN Diode Bias Voltage. A9Q8 provides current for a bias voltage applied to the anode of the PIN diode. The voltage source consists of A9R6, A9R17, and A9CR2. Diode A9CR2 provides temperature compensation for the PIN diode. Inductor A9L5 isolates the current source from the RF signal.

PIN Diode Attenuator. A9Q9 provides current for a variable voltage source at the cathode of the PIN diode. A resistance is formed by REF LEVEL FINE control A1A2R12 and fixed resistor A9R9. The fixed 316K ohm resistor across A1A2R12 is used to shape the value of the potentiometer to match the PIN diode resistance changes. The front panel REF LEVEL FINE control varies the voltage at the PIN diode cathode and thus varies diode current flow. When REF LEVEL FINE control A1A2R12 is fully clockwise, the PIN diode is at minimum conduction and maximum signal is applied to the base of A9Q7. Conversely, when the REF LEVEL FINE control A1A2R12 is fully counterclockwise, the PIN diode is forward biased at maximum conduction and minimum signal is applied to A9Q7.

Buffer Amplifier. Buffer amplifier A9Q7 operates in an emitter-follower configuration and provides isolation between the 0 and 12 dB controls and the 10 dB Amplifier.

Step Gain Amplifiers

The three step gain amplifiers can be considered as operational amplifiers. An equivalent circuit for the three stages is shown in Figure 8-22. The gain for each amplifier is $Av=1 + R_f/R_i$. The feedback resistance R_f for the 10 dB Amplifier is A9R26, 562 ohms; and for the 20 dB Amplifiers is A9R32 and A9R38, 750 ohms. The input resistance R_i is a combination of a fixed series resistance (56.2 ohms) and the controlled resistance of the PIN diodes. The resistance of the PIN diodes is approximately 10 to 1000 ohms and increases as the forward bias current is decreased from 100 mA to 1 μA. R_i for the 10 dB Amplifier is approximately 260 ohms and 83 ohms for the 20 dB Amplifiers.

Selection of the correct combination of step gain amplifiers is effected by the front panel REFERENCE LEVEL dBm switch A1A2S1. Rotating the switch grounds the emitter circuit of the selected amplifier(s) allowing current to flow through the PIN diode(s). The possible switch combinations allow the gain to vary from unity (all switches open) to 50 dB maximum gain with all three emitter circuits grounded.

TEST/NORM Switch

A TEST/NORM switch A9S1 is included in the emitter paths of the 20 dB step gain amplifiers. The switch provided minimal noise in the LOG amplifier for use when making LOG amplifier adjustments.

Bandpass Filter

The output of the step gain amplifiers is coupled through a two-section bandpass filter. The filter consists of A9L9, A9L10, A9C24, and A9C25 and provides rejection of signals outside the region of 21.4 MHz.

◀ A8 Bandwidth Filter Assembly
SERVICE SHEET 4

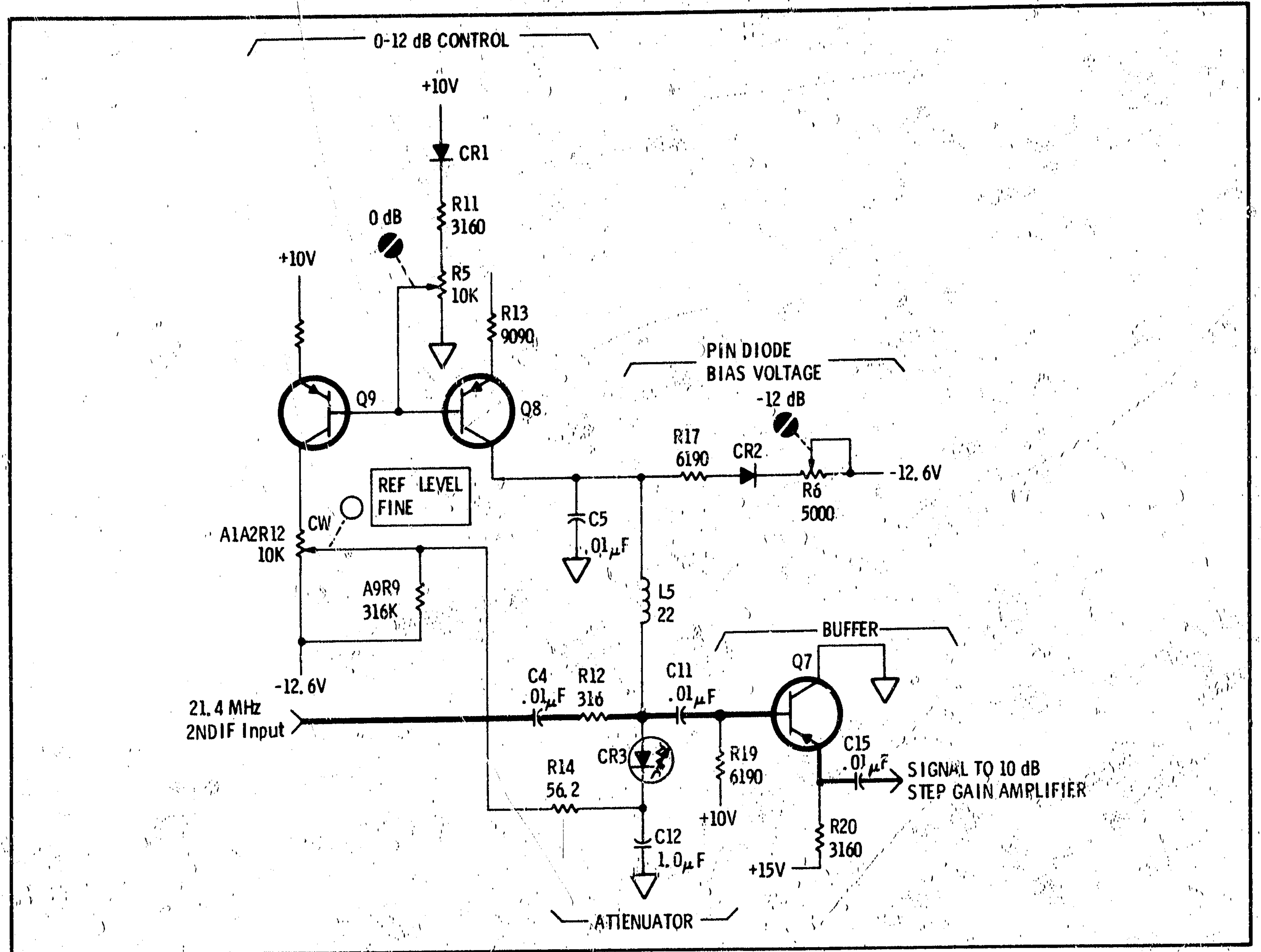
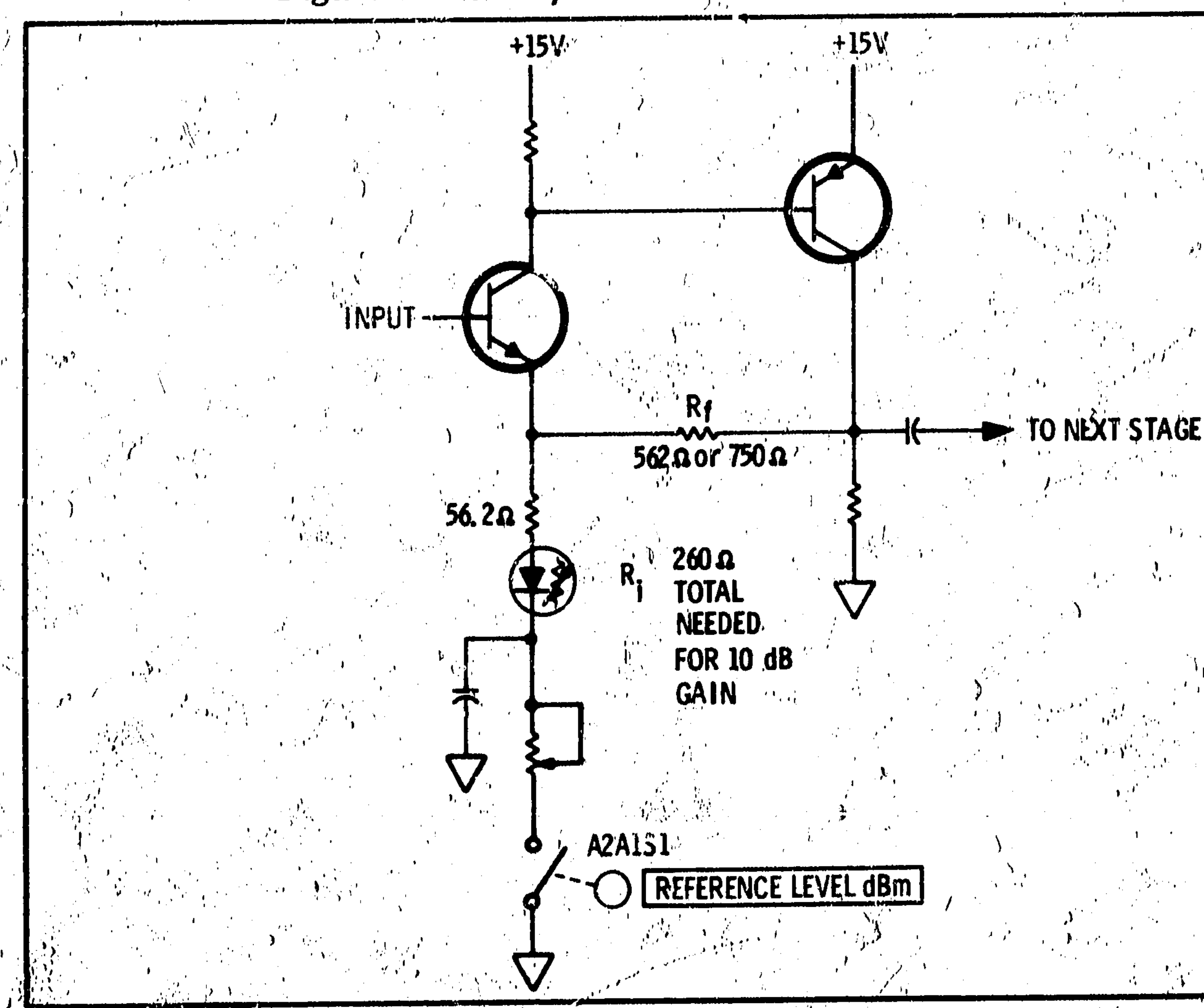


Figure 8-21. Reference Level Fine and 0-12 dB Controls, Simplified Diagram



10 dB GAIN

$$\text{Gain dB} = 20 \text{ Log } (1 + \frac{R_f}{R_i})$$

$$= 20 \text{ Log } (1 + \frac{562}{260})$$

$$= 20 \text{ Log } (3.16)$$

$$= 10 \text{ dB}$$

20 dB GAIN

$$\text{Gain dB} = 20 \text{ Log } (1 + \frac{R_f}{R_i})$$

$$= 20 \text{ Log } (1 + \frac{750}{83})$$

$$= 20 \text{ Log } (10)$$

$$= 20 \text{ dB}$$

Figure 8-22. Equivalent Circuit For Step Gain Amplifiers

A9

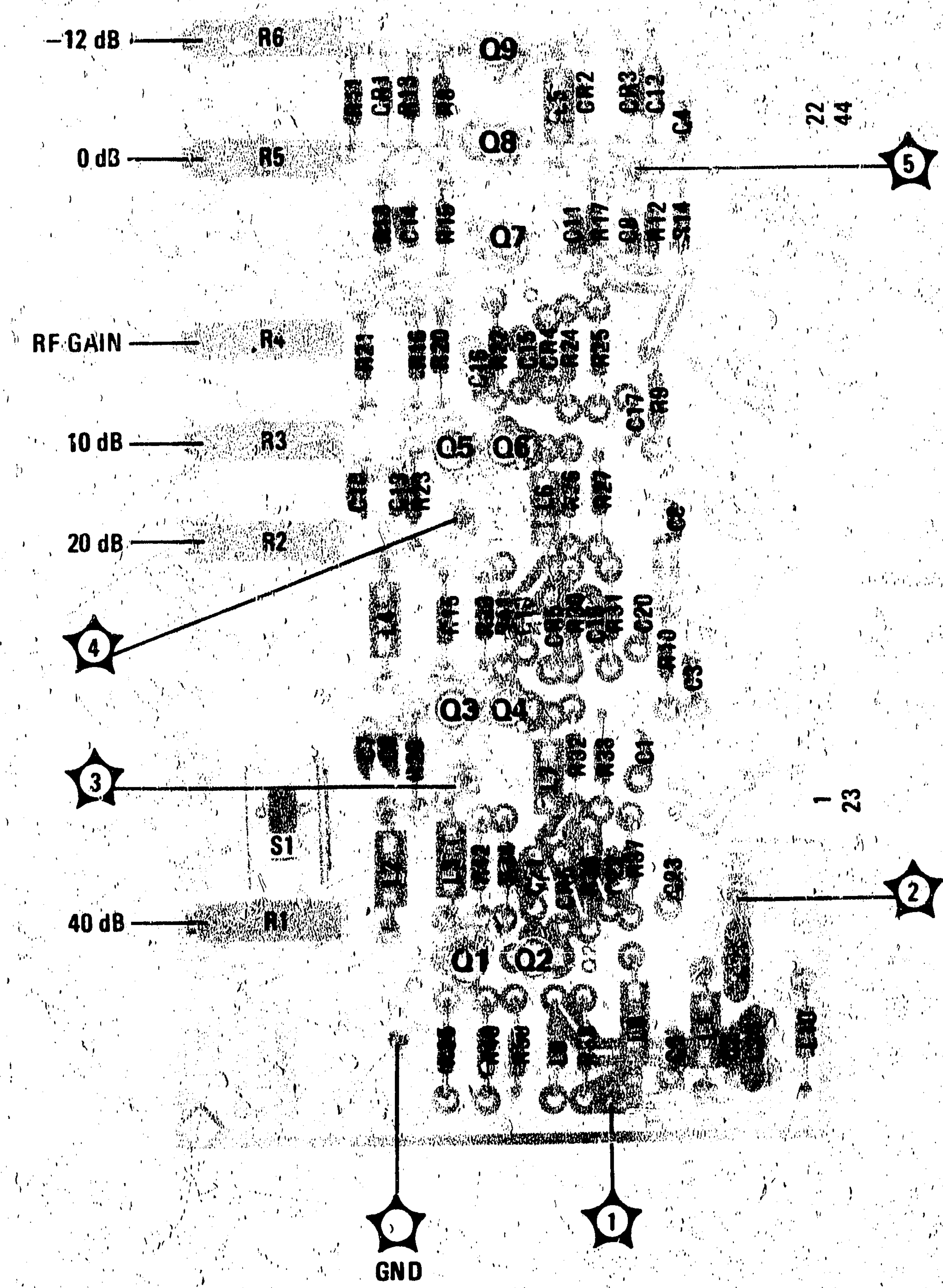
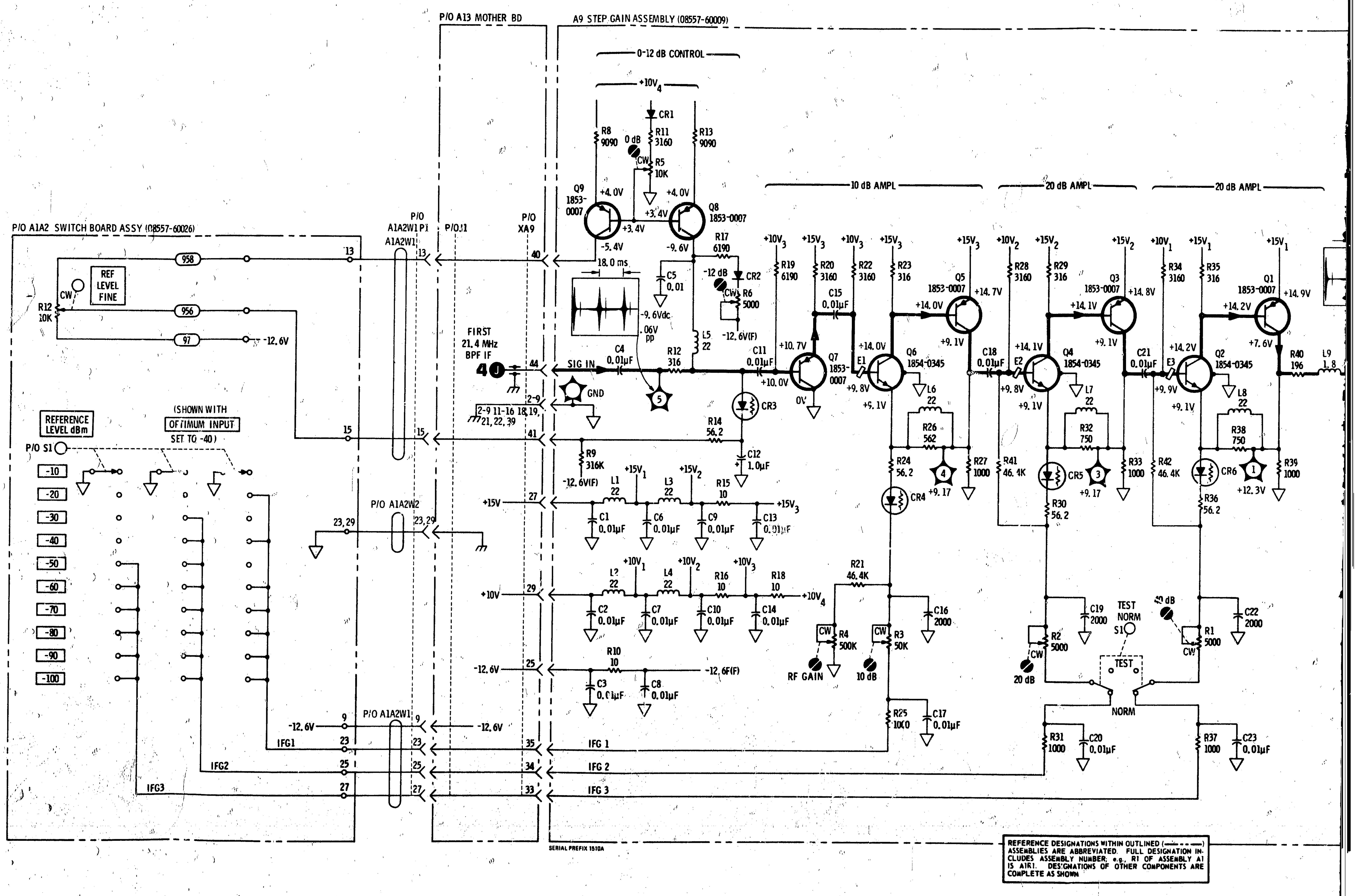


Figure 8-23. A9 Step Gain Assembly, Components Locations

NOTES
SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.

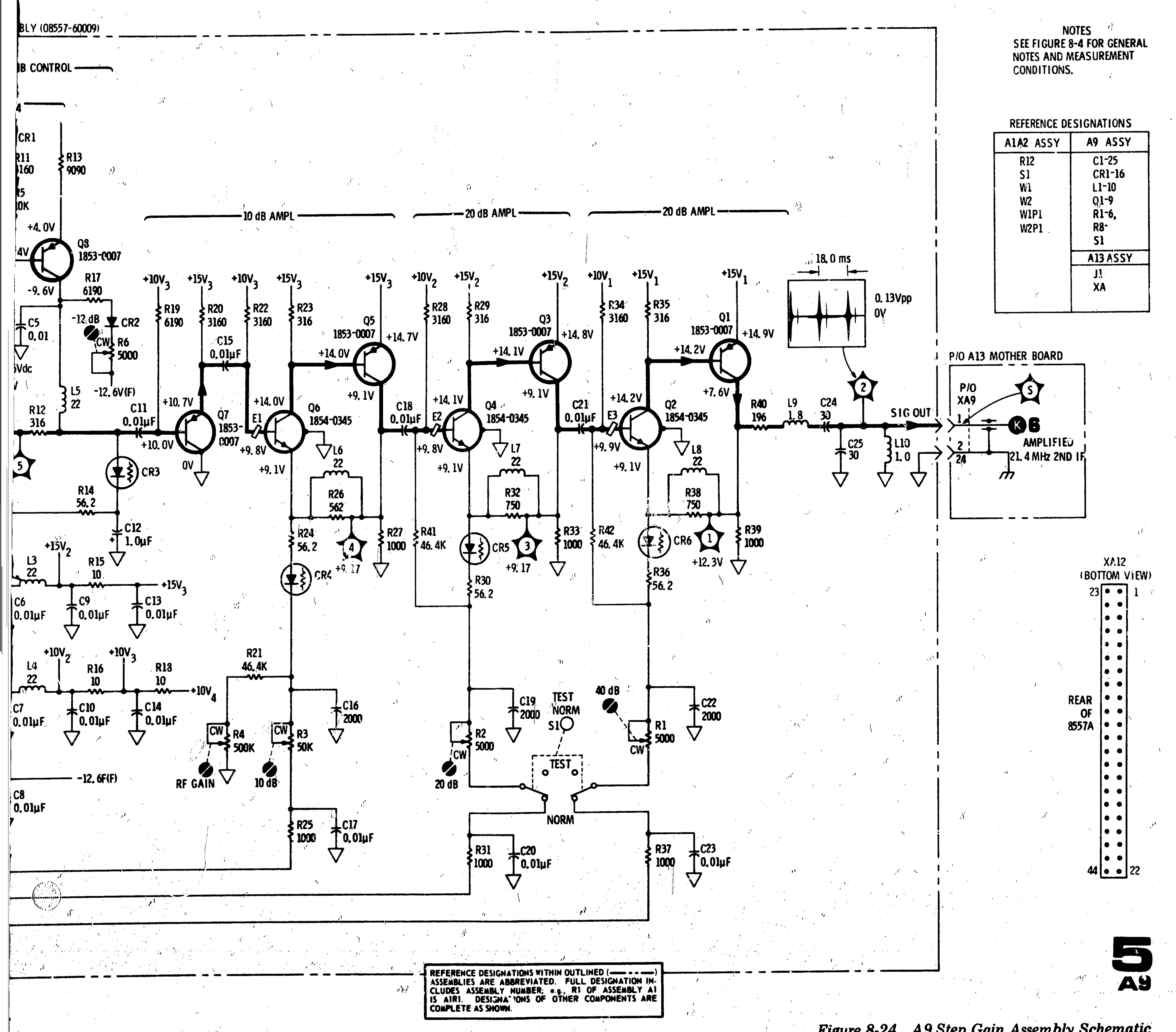
REFERENCE DESIGNATIONS

A1A2 ASSY	A9 ASSY
R12	C1-25
S1	CR1-16
W1	L1-10
W2	Q1-9
W1P1	R1-6,
W2P1	R8-
	S1
	A13 ASSY
	J1
	XA



IF GAIN (dB)

REFERENCE LEVEL dBm	OPTIMUM INPUT					
	10	0	-10	-20	-30	-40
30	10	0				
20	20	10	0			
10	30	20	10	0		
0	40	30	20	10	0	
-10	50	40	30	20	10	0
-20	60	50	40	30	20	10
-30	70	60	50	40	30	20
-40	80	70	60	50	40	30
-50	90	80	70	60	50	40
-60		90	80	70	60	50
-70			90	80	70	60
-80				90	80	70
-90					90	80
-100						90



5 A9

Figure 8-24. A9 Step Gain Assembly Schematic

SERVICE INFO

CON'T

SERVICE SHEET 6

A10 BANDWIDTH FILTER ASSEMBLY CIRCUIT DESCRIPTION

General Description

The Bandwidth Filter Assembly provides 10 dB of gain at 21.4 MHz with bandwidths from 3 MHz to 1 kHz. The front-panel RESOLUTION BW switch is used to select one of eight available bandwidth settings (3 MHz, 1 MHz, 300 kHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, and 1 kHz). The four narrower bandwidths (1 kHz through 30 kHz) are obtained from four synchronously-tuned crystal filters. The four wider bandwidths (100 kHz through 3 MHz are obtained from four synchronously tuned LC tank circuits. The four stages of bandwidth filters are on two identical printed circuit boards, A8 and A10. The four crystals on the bandwidth filter assemblies, A8Y1, A8Y2, A10Y1, and A10Y2 are a factory-selected matched set. If replacement of a bandwidth filter board becomes necessary, the new board is shipped with two crystals installed and two other crystals which must be used to replace the crystals on the other bandwidth filter board.

Amplifier

The input amplifier stage, Q2, Q3 and Q4, of the A10 Bandwidth Filter Assembly gives 10 dB of gain in LC or XTL mode to provide a +10 dBm signal at the input of the A11 Log Amplifier Assembly. It can be treated as an operational amplifier as shown in Figure 8-25. Transistor Q3 provides base drive for Q2 bias with no signal gain due to the placement of C17 between the collector and the emitter of Q3. Transistor Q2 provides negative feedback to Q4. The formula for gain in this configuration is $Av = 1 + R_f/R_i$ where Av is voltage gain, R_f is feedback resistance, and R_i is input resistance. Plugging the values shown in Figure 8-28 into the formula yields Av = 1 + [(178 + 26.1 + 12.1)/100] = 3.16. A voltage gain of 3.16 represents a stage gain of 10 dB (dB = 20 log Av).

LC Bandwidth Filter

Using the table to the right of the schematic diagram, in LC mode with 3 MHz RESOLUTION BW we find that BW5 (test point N) is at +15 volts (coming from the front-panel RESOLUTION BW control A1A2S5). The BW6 line (test point 0) is at +10 volts supplied by the a PIN drive buffer, A3U2A, and the BW7 line (test point P) is at +3.0 volts supplied by PIN drive buffer A3U2B. The +15 volts on the BW5 line applies a high positive potential at the anodes of CR1, CR2, CR3, and CR4 causing them all to conduct. It also applies a positive voltage at the base of Q1 turning Q1 off. Diode CR1 supplies the proper collector current to Q2 (since Q1 is turned off). Diodes CR2, CR3, and CR4 drop about 0.6 volts each, placing the emitter of Q5 at approximately +13.2 volts. Since the base supply is at +10 volts, Q5 is now conducting at saturation. Thus, a relatively large current flows through CR2, CR3, and CR4 creating a signal path from ground through C22, CR2, CR3, CR4, and C23 back to ground. So we see that in the LC mode the crystal driver Q1 is turned off and crystal Y1 is effectively shorted through the path described above. The anode of CR5 is at about +10 volts (from the center tap of T1) and its cathode is at approximately +13.8V (+15V minus the voltage drops across CR2 and CR3). Thus CR5 is reverse biased and is not conducting. Looking back into CR5, the LC tank circuit sees only a very small capacitance to ground (C1) and the 21.4 MHz third IF signal flowing through CR6. The anode of CR6 is at +10 volts (from the center tap of T1) so the current in CR6 is proportional to the voltage on the BW7 line. Since CR6 is a PIN diode, its RF resistance is inversely proportional to the current flowing through it. If we simplify the circuitry as shown in Figure 8-26, we see that the Q of the LC tank circuit is directly proportional to the series resistance R_s of the PIN diode CR6. By decreasing the current through CR6, thus increasing its resistance, the Q of the tank circuit is proportionally increased. If we again examine the table to the right of the schematic diagram, we find that for narrower bandwidths down to 100 kHz, the positive potential on the BW7 line increases, decreasing the forward bias of CR6. This increases the resistance of CR6, increasing the Q of the tank circuit. Since bandwidth is inversely proportional to the Q ($Q=f_0/BW$), increasing the Q decreases the bandwidth. Transistor Q6 is a source follower which transforms the high impedance of the LC tank down to a low impedance and has unity gain. A portion of the output signal is fed back through C30, CR7, and T1 in phase with the input signal (positive feedback). The amount of feedback is controlled by the current through CR7 which is set by adjusting R1 LC FDB adjustment. The feedback is provided to compensate for the loss of the LC tank circuit. If the amount of feedback is incorrect, the amplitude of the signal displayed on the analyzer will change when different bandwidths are selected. The second pole of the bandwidth filter is nearly identical to the first pole and the description of the circuitry may be treated in the same manner.

Crystal Bandwidth Filter

Using the table to the right of the schematic diagram, in crystal mode with 30 kHz RESOLUTION BW, we find that BW5 (test point N) is at 0 volts (coming from the front panel RESOLUTION BW control A1A2S5). The BW6 line (test point 0) is at +9.0 volts supplied by PIN drive buffer A3U2A, and the BW7 line (test point p) is at +15 volts supplied by A3U2B. The 0 volts on the BW5 line at the anodes of CR1 and CR2 turns these two diodes off. This ground also provides a path through R17 and R18 that biases Q1 ON. Transistor Q1 is an emitter follower which transforms the high impedance input down to a lower impedance to provide the proper drive for crystal Y1. Diode CR5 has +10 volts on the anode (from the center tap of T1) so CR5 is conducting. This places about +9.4 volts at the cathode of CR3 so it will be turned off. The +15 volts on the BW7 line reverse biases CR6 so the LC mode signal path is turned off. The +9 volts on the BW6 line places the cathode of CR4 at approximately +9 volts which provides a small current flow through CR4. Since CR4 is a PIN diode, its RF resistance is inversely proportional to the current flowing through it. If we simplify the circuitry as shown in Figure 8-27, we see that the Q of the crystal circuit is inversely proportional to the parallel resistance R_p. By increasing the current through CR4, thus reducing its resistance, the Q of the crystal circuit is proportionally increased. If we again examine the table to the right of the schematic diagram, we find that for narrower bandwidths the positive potential on the BW6 line decreases, increasing the forward bias of CR4. This decreases the resistance of CR4, increasing the Q of the crystal circuit. Since bandwidth is inversely proportional to Q, increasing the Q decrease the bandwidth. In the crystal mode, the LC tank circuit is still in the signal path. Capacitor C3 XTL CNTR adjustment is used to tune the tank circuit to the crystal frequency so the center frequency remains the same when switching between crystal and LC bandwidths. Capacitors C1, C2, and C3 are interacting adjustments. Capacitor C2 XTL SYM adjustment is adjusted to tune out the parallel capacitance of crystal Y1 to provide good symmetry. The second pole of the bandwidth filter is nearly identical to the first pole and the description of the circuitry may be treated in the same manner.

◀ A9 Step Gain Assembly
SERVICE SHEET 5

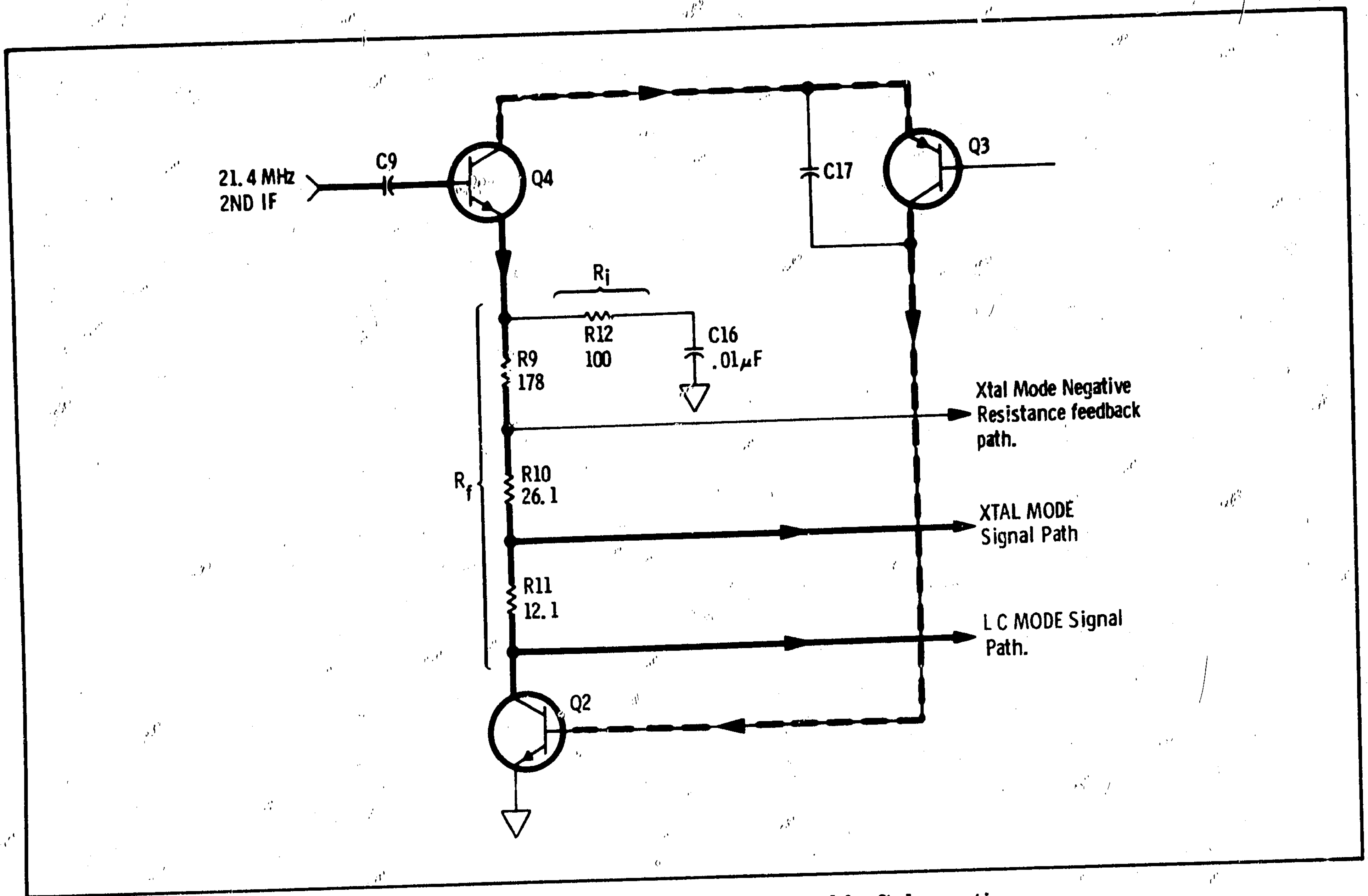


Figure 8-25. A9 Step Gain Assembly Schematic

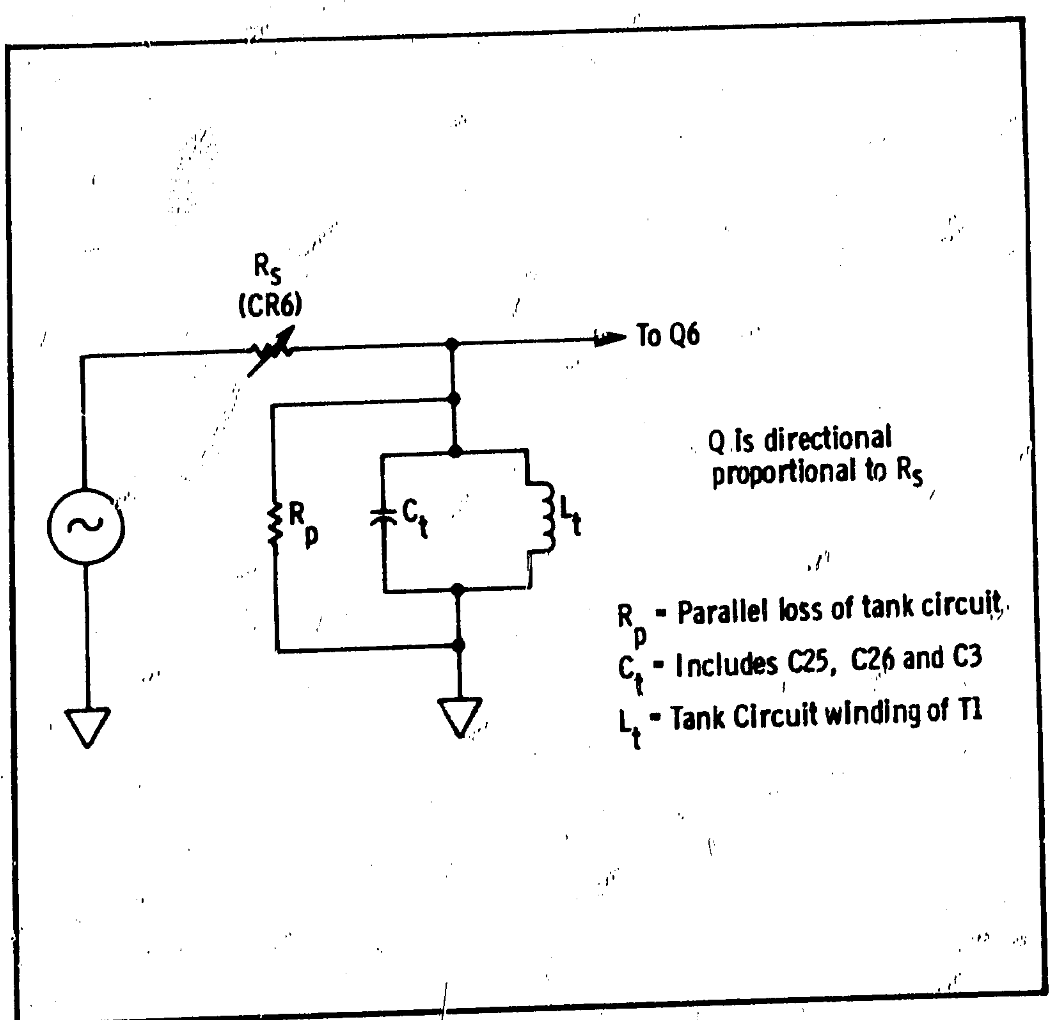


Figure 8-26. Simplified Schematic of LC Bandwidth Filter

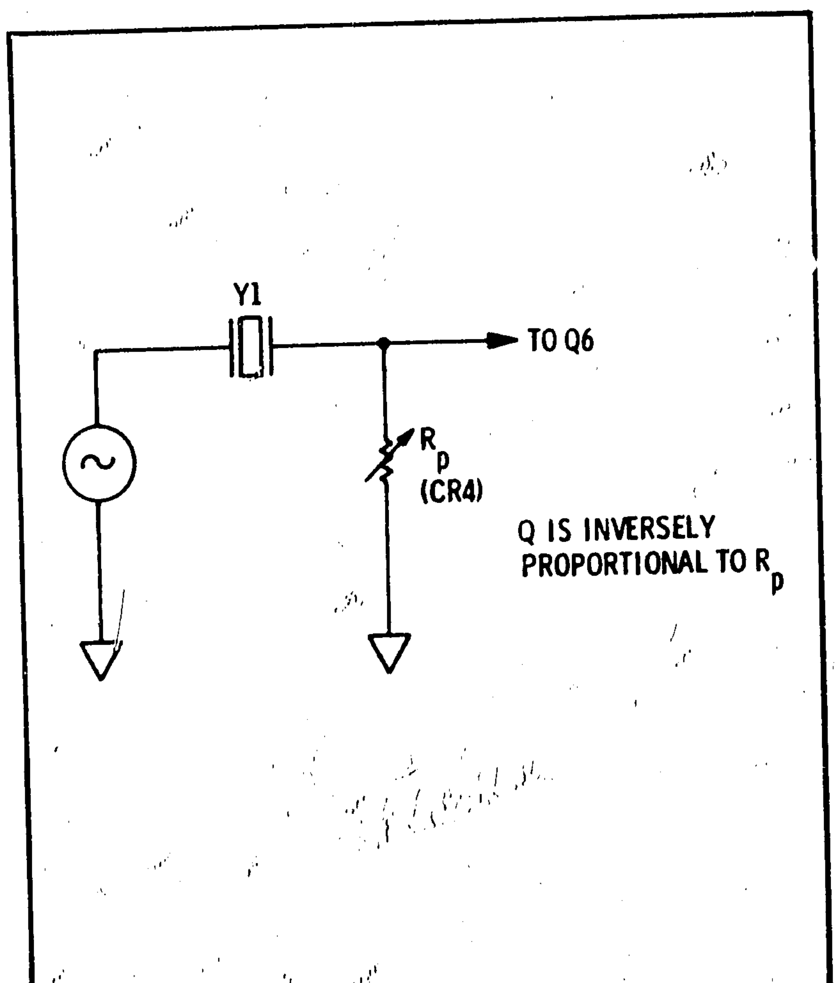


Figure 8-27. Simplified Schematic of Crystal Bandwidth Filter

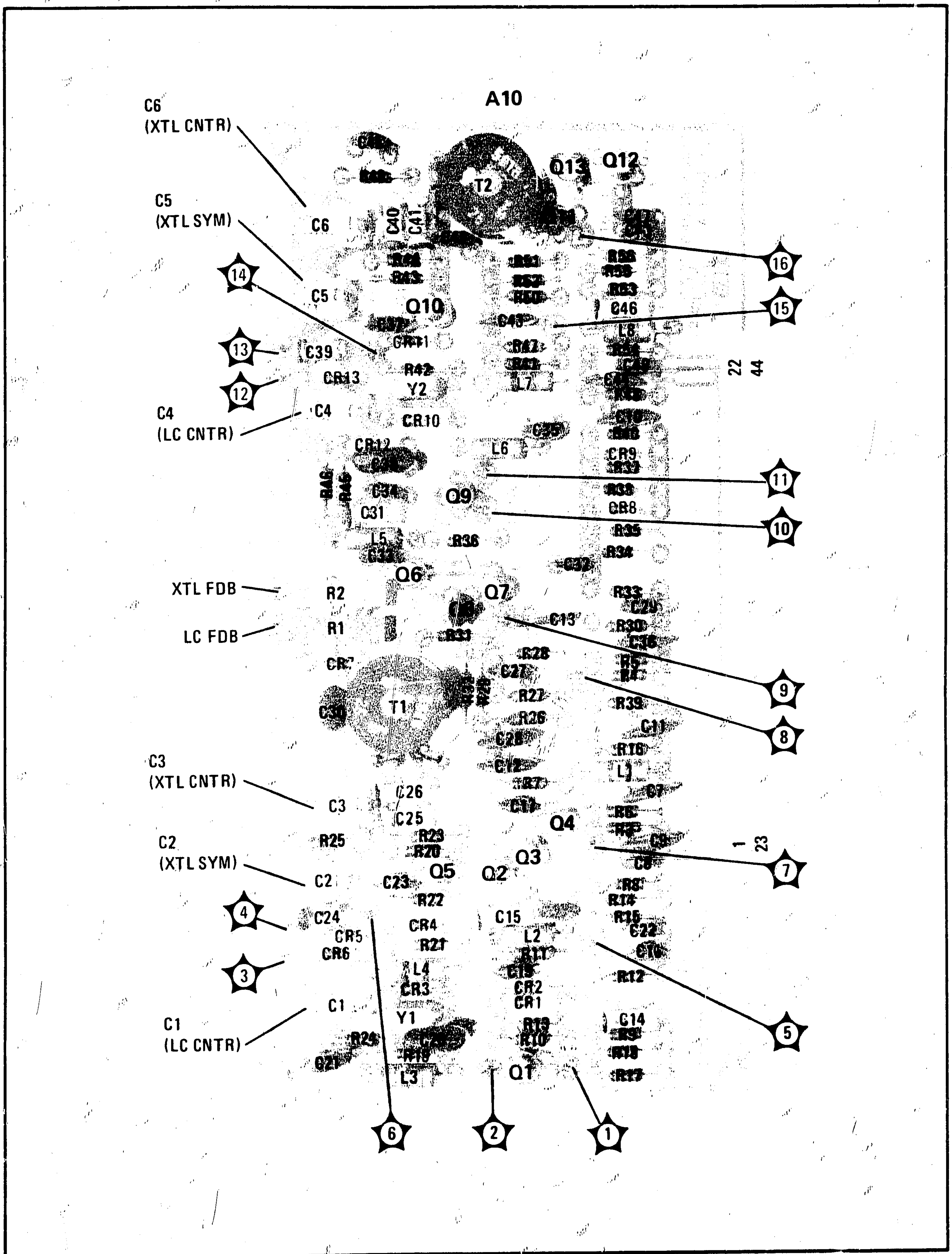


Figure 8-28. A10 Bandwidth Filter Assembly, Component Locations

NOTES:

1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.
2. A8Y1, A8Y2, A10Y1 AND A10Y2 ARE MATCHED CRYSTALS. IF REPLACEMENT BECOMES NECESSARY, ALL FOUR CRYSTALS MUST BE REPLACED WITH A NEW MATCHED SET.

FRONT PANEL BANDWIDTHS	2 POLE BANDWIDTH	1 POLE BANDWIDTH	MODE	TYPICAL VALUES BW5 VOLTS (N)	BW6 VOLTS (O)	BW7 VOLTS (P)
3 MHz	4.42 MHz	6.9 MHz	LC	+15	-6.2	+1.3
1 MHz	1.48 MHz	2.3 MHz	LC	+15	-6.2	+7.7
300 KHz	442 KHz	690 KHz	LC	+15	-6.2	+9.3
100 KHz	148 KHz	230 KHz	LC	+15	-6.2	+9.8
30 KHz	44.2 KHz	69 KHz	XTL	0	+9.0	+14.2
10 KHz	14.8 KHz	23 KHz	XTL	0	+8.5	+14.2
3 KHz	4.42 KHz	6.9 KHz	XTL	0	+7.2	+14.2
1 KHz	1.48 KHz	2.3 KHz	XTL	0	+2.2	+14.2

REFERENCE DESIGNATIONS

NO PREFIX	A13 ASSY
P1	R6, 7 XA10
A10 ASSY	
C1 - 49 CR1 - 13 E1 - 4 L1 - 8 Q1 - 13 R1 - 57 T1, 2	

6
A10

Figure 8-29. A10 Bandwidth Filter Assembly Schematic

A11 LOG AMPLIFIER ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A11 LOG Amplifier Assembly provides signal display capability in either a LINear or LOG mode. It also operates in conjunction with the A9 Step Gain Assembly to provide the last 40 dB of step gain amplification of the 21.4 MHz IF signal.

The LOG amplifier has seven amplifier stages, with each stage capable of providing both linear and logarithmic amplification. Following the amplifier stages, the signal is detected to produce the vertical display signal. An offset circuit, following the detector, is used in the LOG mode to offset the vertical output in steps equivalent to 40 dB of IF gain.

LOG Mode of Operation

LOG Amplifier General Description. The seven amplifier stages limit the gain in sequence to provide 70 dB of LOG amplification. Each stage consists of an emitter follower voltage source driving a common-base amplifier whose gain decreases with increasing signal level.

LOG Amplifier Gain. A simplified LOG amplifier stage is shown in Figure 8-30. In the LOG mode, Q23 is ON, forward biasing (0.4 volts) Shottky diodes CR11 and CR13. Amplifier gain is set by the ratio of R34 to the total resistance R_T between the emitters of Q3 and Q4.

$$\text{Gain} = 1 + \frac{R34}{R_T}$$

R_T is minimum (approximately 150 ohms) for small signals when the ac signal current in the log diodes CR11 and CR13 is small compared to their dc bias current. As the ac signal level is increased, the ac signal current increases to the level of the dc bias current and R_T increases due to current-limiting in the diodes.

The initial gain of the stage (10 dB) is set by the bias current through the diodes CR11 and CR13. The bias current is controlled by the temperature compensated −10V supply at the emitter of Q23. The final gain of the stage (0 dB) is set by the circuit configuration (R_T becomes very large) and can be slightly adjusted by R46*.

LOG Step Gain. The last 40 dB of LOG step gain is produced in the 0 − 40 dB Amplifier circuit (LOG offset) following the detector. When this gain is used, there is 50 dB of gain in the A9 Step Gain Assembly so the analyzer noise is amplified into the range of the LOG amplifier. This makes further amplification unnecessary since any signal below the range of the LOG amplifier would be below the noise level. The output of the detector can then be offset in 100 mV steps corresponding to 10 dB of IF amplification. This offset is provided by Q22 operating as a stepped current source into R121. With the 10 dB/DIV − 1 dB/DIV—LIN switch A1A2S2 in both LOG positions, +15V is routed through the contact closures of the REFERENCE LEVEL dBm switch A1A2S1 to the IF gain control lines IFG4, IFG5, and IFG6. With an IF gain control line connected to +15V through A1A2S1 and A1A2S2, a LOG-shift diode CR30, CR31, or CR32 is forward biased and this bias current, determined by R122, R123, or R124 flows into the emitter of current source Q22. IFG4 and IFG5 each provide 10 dB (100 mV) of log offset gain and IFG6 provides 20 dB (200 mV). The LOG GAIN adjustment A14R1 sets the operating point of Q22 for 100 mV steps.

LINEAR Mode of Operation

Linear Gain. In LIN mode, the limiting action is removed from each of the seven amplifier stages. Referring to Figure 8-30, Q23 is turned OFF in LIN mode and the dc bias current in the log diodes CR11 and CR13 is zero. With dc bias current zero, the total resistance R_T is maximum and the stage has approximately unity gain. In some stages, the log diodes may be turned ON by an IF gain step (IFG5 and IFG6) when −10V is applied to either CR1 or CR2. However, the signal levels in these stages will always be low enough in LIN mode that no limiting takes place in the log diodes.

Linear Step Gain. The 10 dB of linear gain that each stage has at low signal levels in the LOG mode, is used in the LIN mode as switched gain. The gain is controlled by bias current. This type of gain is used in amplifier stages 2, 3, and 4 to obtain 30 dB of gain and is switched in as follows. With REFERENCE LEVEL dBm switch A1A2S1 at −80, the −10V is routed through A1A2S2 and A1A2S1 to the IF Gain 5 (IFG5) control line. The −10V forward biases CR2 and the −10V is applied to the log diodes CR20 and CR21 in stage 4, providing 10 dB of gain. When A1A2S1 is at −90, the −10V is routed to IFG6, CR1, and applied to the log diodes in stages 2 and 3, providing 20 dB of gain. All three stages (2, 3, and 4) are activated when A1A2S1 is at −100, providing 30 dB of gain.

Alternate Linear Gain. In the last three amplifier stages, the signal current is too large for the bias current of the log diodes and an alternate method to obtain linear gain must be used. This alternate gain path selects 10 dB of gain as follows. With REFERENCE LEVEL dBm switch A1A2S1 in −70, −80, −90, or −100 position, −10V is routed to IF Gain 4 (IFG4), to R74, and the cathode of CR26. The 3480 ohm resistor R74 allows a higher dc bias current for CR26. This provides a signal path through R84 and CR26 that does not limit.

In the sixth and seventh stages, the alternate signal path is used to set the gain at about 6dB per stage. The purpose of this fixed gain is to properly scale between the LOG and LIN modes. These stages are activated by the −10V from the 10 dB/DIV − 1 dB/DIV—LIN switch A1A2S2 to the cathodes of CR14 (R38) and CR29 (R120). R16, in the signal path of the seventh stage is factory selected to establish the correct linear gain for the individual LOG Amplifier Assembly.

LIN Gain Adjust. The linear gain steps are set to 10 dB per step by adjusting the LIN GAIN control A11R3. This control changes the output voltage of the −10V regulator U1A. Changing the −10V adjusts the diode bias current to the proper value for 10 dB gain steps.

LOG/LIN Relationship

In LIN mode, when approximately 700 mV rms (+10 dBm) is applied to the input of the LOG amplifier, the voltage at the output of stage 7 (TP7) is about 1.5 Vrms. With the same input signal in LOG mode the output of TP7 is about 2.0 Vrms. To maintain equal relationship with maximum input signal (trace at the top of the display) the output in LOG mode must be attenuated. This relationship is set by using a PIN diode attenuator CR16 and CR18, and the LOG/LIN adjustment A11R2.

PIN Diode Attenuator.

In LIN mode, −10V is applied to the base of Q16 turning it ON. This causes the PIN diode CR16 to be at maximum conduction. The −10V is also coupled to the anode of PIN diode CR18 and it is OFF. Therefore, in LIN mode there is no attenuation and the signal from stage 7 is coupled directly to emitter follower Q17. However, in LOG mode, +15V is applied to CR18 anode and to the base of Q16; CR18 is forward biased and Q16 is open. PIN diode CR16 operates with a fixed bias current set by CR2, R53, and R60. PIN diodes CR16 and CR18 form a voltage divider to the incoming signal with CR18 operating as a variable impedance. The amount of signal attenuation depends upon the impedance of CR18 which is set by the LOG/LIN adjustment A11R2.

Detector and Low Pass Filter

The signal output is applied to a Low Impedance Driver, Q17, which is the voltage source to drive Q18. Q18 is the current driver for the detector. Q19 is a half-wave rectifier and is biased just below cutoff by CR24. When the input signal is positive, Q19 is in conduction, and is cut off when the input signal is negative. The detector output is routed to a low pass filter and unity-gain buffer amplifier, Q20 and Q21, which provides the video output.

−10V and −7V Regulators

Temperature compensation is provided for the −10V and −7V regulators. Q24 is connected as a diode and operates as the temperature sensing element. Temperature variations cause changes in collector voltage. The voltage change at Q24 is applied to U1A pin 6 and U1B pin 3 to regulate the two voltages. The −10V regulator provides approximately −10V to a filter network for distribution throughout the LOG amplifier. The regulated −7V is the current source for the PIN diode CR18.

NOTE

For complete adjustment procedure see Section V.

LIN GAIN Adjustment. The LIN GAIN adjustment A11R3 adjusts the −10V regulator output voltage. However, this voltage is set for 10 dB linear gain steps and not for −10V. Referring to Figure 8-32, the voltage value of −10V (F_1), for example, is an arbitrary value and not a true −10V.

LOG/LIN Adjustment. The LOG/LIN adjustment A11R2 is used primarily to adjust the shape of the LOG amplifier input versus output curve (log fidelity). This adjustment is made after the LIN GAIN adjustment since the −10V regulator output also affects the log fidelity curve. The relationship between LOG and LIN modes is primarily adjusted by selecting R16*. The value of R16 sets the initial gain in the LIN mode with 0 dB LINear step GAIN. Only small variations between LOG and LIN outputs are corrected with A11R2.

LOG GAIN Adjustment. The LOG GAIN adjustment A11R1 is set for 100 mV steps (a total of 400 mV) at the vertical output (in 10 dB/div) with constant input.

NOTE

The TEST/NORM switch A9S1 (on the A9 Step Gain Assembly) when in TEST position, limits the gain of the A9 assembly to 10 dB. This allows the LOG GAIN and LIN GAIN controls to be adjusted with minimum input noise.

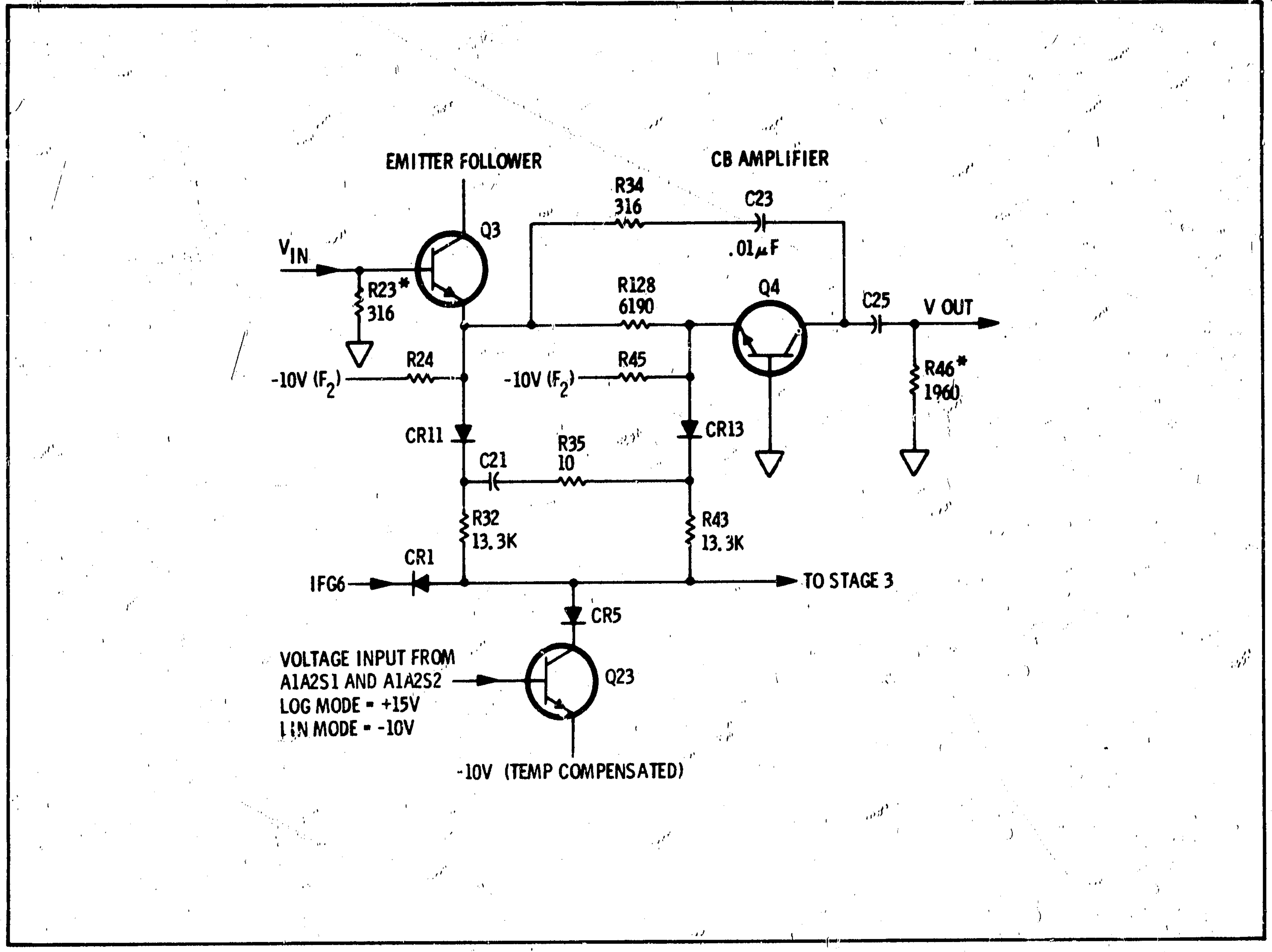


Figure 8-30. Simplfied Log Amplifier Stage

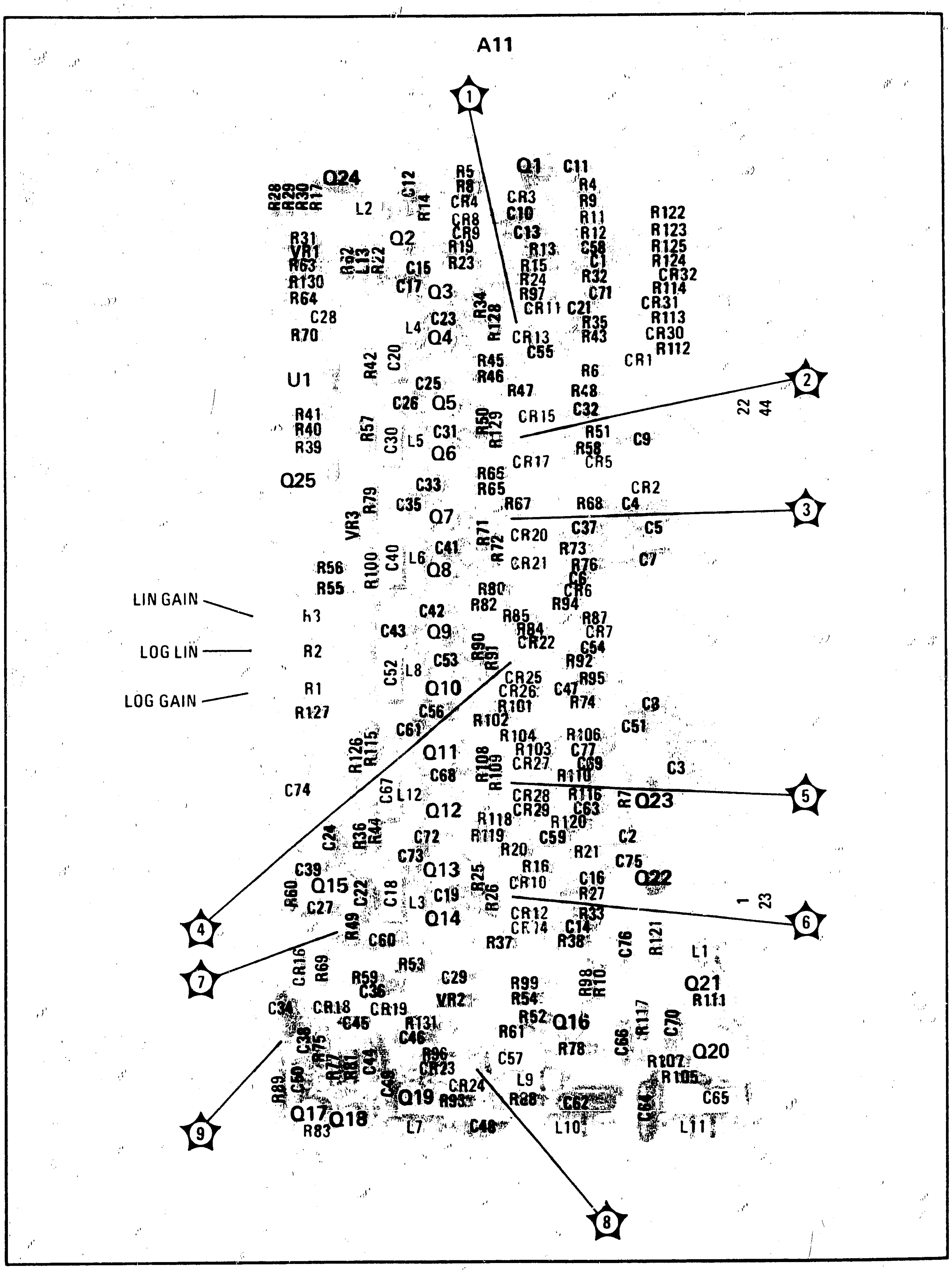


Figure 8-31. A11 Log Amplifier Assembly, Component Locations

Figure 8-32. A11 Log Amplifier Assembly Schematic

SERVICE SHEET 8

A3 SWEEP GENERATOR ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A3 Sweep Generator Assembly generates a –5 volt to +5 volt linear sweep ramp. The SWEEP TIME/DIV settings vary from 0.1 mSEC/DIV to 10 SEC/DIV giving full scan sweep times from 1 ms to 100 sec. The sweep may be synchronized with either the video input INT or LINE voltage. Non-synchronous FREE RUN and SINGLE sweep modes are also incorporated. SINGLE sweep may be started or stopped by the front panel SWEEP TRIGGER switch. A RETRACE voltage is generated and applied to the A12 Vertical Driver Assembly.

Sweep Generator Circuit

Referring to Figure 8-33, the operation for generating a sweep voltage ramp in AUTO SWEEP is as follows. The ramp begins when the dead-time capacitor C13 charges to about 1.2V through R52. This turns Q10 ON applying a negative voltage to U1 pin 2. Output of comparator U1 rises to approximately +14V and reset-diode CR3 is reverse biased. With CR3 OFF, the constant current source applies a positive charge to the timing capacitor, C3. As C3 charges, the voltage at U1 pin 2 increases until it reaches +2.68V. At this time the ramp output is at +5 volts. With equal voltages at U1 pins 2 and 3, U1 turns OFF and its output goes negative. This negative change of approximately –12V is coupled to the anode of CR12. With CR12 reverse biased, the current source for Q10 is removed and Q10 turns OFF. U1 continues to discharge C3 and C13 until the voltage at pin 2, set by the voltage divider R39, R50, and R55, reaches –7.32 volts. The ramp remains at –5V (dead time) until the dead-time capacitor C13 charges through R52 to 1.2V, turning ON Q10, repeating the sweep cycle.

Other components in the sweep generator have the following functions. (See Figure 8-37.) C6 is a speed-up capacitor for U1 switching. C8 and R43 desensitize U1 from power spikes. C9 provides frequency compensation for U1 and C7 feedback compensation. CR8, CR7, and R47 are used to bring U1 out of saturation at the end of the ramp to improve switching speed. C12 is dead-time capacitor for 0.1 mSEC to 1 mSEC and C13 is dead-time capacitor for 2 mSEC to 10 mSEC and AUTO.

Fast/Slow Sweep Time Operation. Timing capacitors C2 and C3 are used to provide fast and slow sweep operation. When a fast sweep time (1 ms/div) is selected by TIME/DIV switch A1A2S3, the FAST SWEEP control line is grounded, turning OFF Q49 and Q45. With Q45 OFF, C2 and C3 are in series and the timing capacitor becomes C2. With Q49 OFF, the +15V at R44 will reverse bias CR9 and CR6, so C13 is switched out of the dead-time circuit. The short dead time (about 0.4 ms) is set by C12. In sweep times 1 ms/div (or in AUTO sweep times), the FAST SWEEP control line is open, Q49 and Q45 are both ON. With Q45 ON, a ground is provided for C3 and it becomes the timing capacitor. If the same amount of charging current is supplied to a larger capacitor, it will charge at a slower rate. CR6 and CR9 are ON due to the conduction of Q49. C12 and C13 are in parallel, so the longer dead time (about 7.5 ms) is set by C13.

FREE RUN Operation. When selecting FREE RUN or triggered modes, the state of Q10 is controlled by CR10 and R49. In FREE RUN modes, +15V through the SWEEP TRIGGER switch A1A2S4 is applied to the voltage divider R49 and R54. The voltage at the cathode of CR10 is approximately +1.5V and CR10 does not conduct. The circuit free runs and Q10 conducts when U1 switches ON and OFF at a time determined by the RC time constants.

INT (Video Input) Operation

When the SWEEP TRIGGER switch A1A2S4 is in INT position, Q10 is held cutoff by R54 and CR10. A sweep can then be generated only when a negative pulse is applied to the emitter of Q10. The negative pulse is generated by a Pulse Shaper circuit. The pulse shaper consists of a Schmitt trigger (Q38 and Q39), a differentiator (C15 and R57), and an emitter follower, Q12. When the SWEEP TRIGGER switch is in INT position, video from the A12 Vertical Driver Assembly is routed through the switch to the base of Q39. Q39 is normally OFF and Q38 is conducting. On the positive portion of the video input, Q39 is driven into conduction turning Q38 OFF. The switching of Q39 and Q38 is speeded-up by feedback from the collector of Q39 to the base of Q38 through C11 and R45. When Q39 switches ON, the negative change at the collector is differentiated by C15 and R57 and coupled through Q12 to the emitter of Q10. The negative pulse causes Q10 to turn ON. The components CR8, R51, and CR11 keep Q10 ON while the ramp is being generated. After the ramp is completed, the circuit returns to its dead-time state and another trigger is required to generate another sweep. Trigger pulses from Q39, which may occur during the sweep, have no effect since Q10 is already ON.

LINE (Line Voltage Sync) Operation

The sweep may be synchronized with the ac line voltage in the same manner as described in INT mode. With SWEEP TRIGGER switch A1A2S4 in LINE position, a 2 Vrms to 4 Vrms line sync signal (amplitude dependent upon mainframe used) is applied to XA3 pin 2.

SINGLE Sweep Trigger and Abort

Q10 is initially held OFF by R54 and CR10. Q9 is ON, and voltage divider R62 and R63 charges C17 to +2.8V. When the SWEEP TRIGGER switch A1A2R4 is set to SINGLE (spring-loaded position), +15V is applied to R60 turning ON Q11. This shorts the positive end of C17 to ground and produces a negative pulse at the emitter of Q10. This turns Q10 ON, starting a sweep.

During the generation of a sweep, Q9 is OFF and the voltage divider R62 and R63 charges C17 to –4V. The sweep may be aborted (reset to –5V) by pressing the SINGLE switch to the spring-loaded position. This switches ON Q11. The negative end of C17 is shorted to ground, a positive pulse is generated at the emitter of Q10, and Q10 is turned OFF aborting the sweep.

MANUAL Sweep Mode

Manual control of the sweep is obtained with the SWEEP TIME/DIV switch A1A2S3 in MAN. (See Figure 8-34.) A ground is usually applied to the base of Q37 in all sweep modes except MANUAL: the ground holds Q37 and Q36 OFF. With A1A2S3 in MAN position, Q37 and Q36 are turned ON. Q36 turns Q10 ON and keeps it ON. CR3 is ON and the feedback loop to the timing capacitor is closed. Turning the MANUAL SWEEP control A1A2R4 changes the input current at U1 pin 2. Since the output current through R50 is constant, any change in MANUAL SWEEP current must be compensated by a change in the current through R39, thereby varying the ramp output voltage.

Sweep Generator Current Source

Current for the generation of the sweep is provided by a current source as shown in the simplified circuit in Figure 8-35. A Temperature Dependent Power Supply A3U3B provides a nominal +10V; A3Q6 is the temperature sensing element (diode). The following switches control current to operational amplifier U3A pin 2: RESOLUTION BW switch A1A2S6, FREQ SPAN/DIV switch A1A2S5, VIDEO FILTER potentiometer A1A2R10, and SWEEP TIME/DIV switch A1A2S3. In the AUTO sweep time mode, the sweep time is controlled by the RESOLUTION BW, FREQ SPAN/DIV, and VIDEO FILTER which set the currents to U3A. These currents are summed by U3A to produce a voltage proprotional to the log of the sweep time. Q5 is the current dirver and converts voltage variations into current variations proportional to sweep time. The current is applied to the timing capacitor in the Sweep Generator circuit.

Q7 provides temperature compensation for Q5. Q8 is a constant current regulator for Q7. In AUTO, the sweep time is limited to 1 ms and longer because current is limited to 1 mA by Q4/R28.

In the calibrated SWEEP TIME/DIV mode, the gate of Q48 is grounded. This turns Q48 OFF and disconnects the currents proportional to RESOLUTION BW, FREQ SPAN/DIV, and VIDEO FILTER. Calibrated sweep times are now produced by the currents to U3A through A3R15 – A3R19 that are grounded in various combinations by the SWEEP TIME/DIV switch A1A2S3.

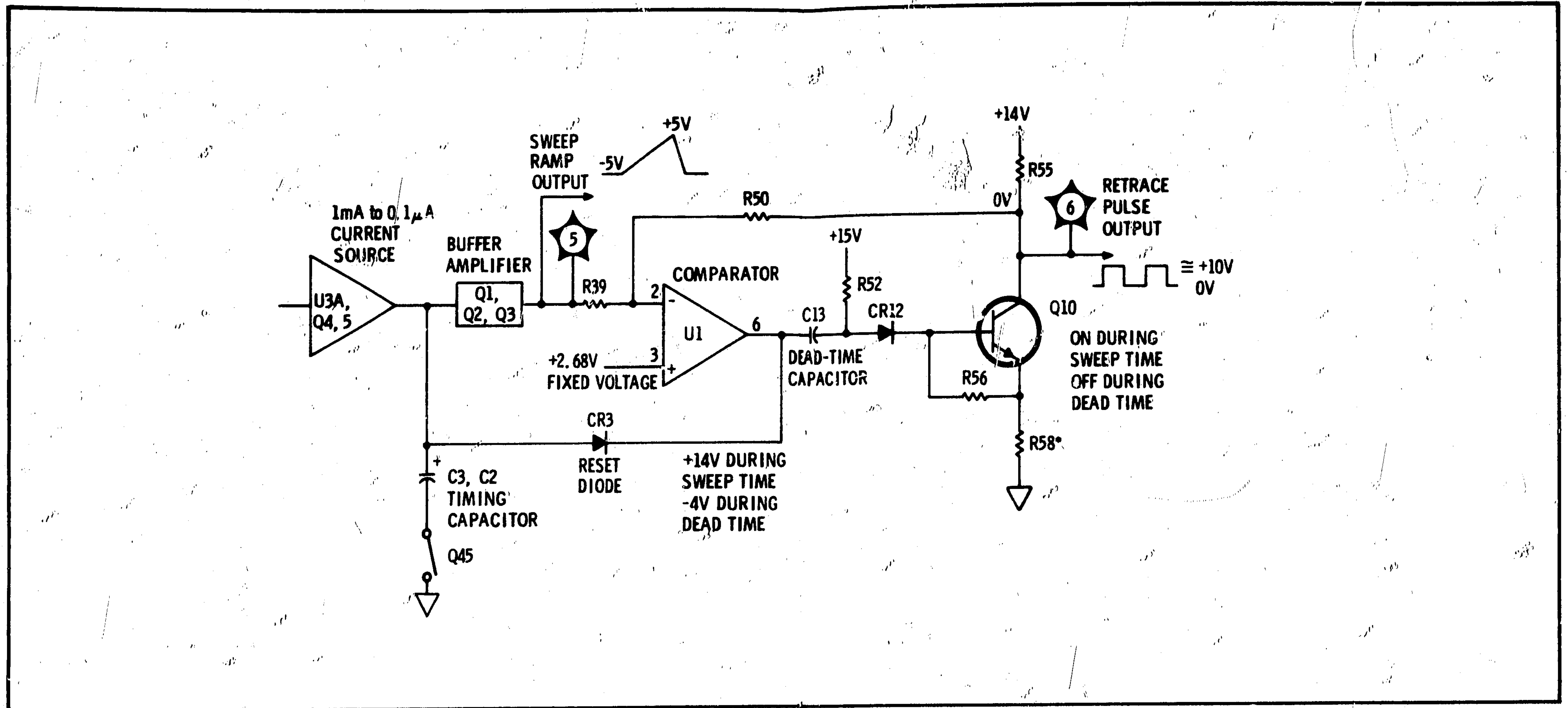


Figure 8-33. Simplified Sweep Generator in Auto Mode

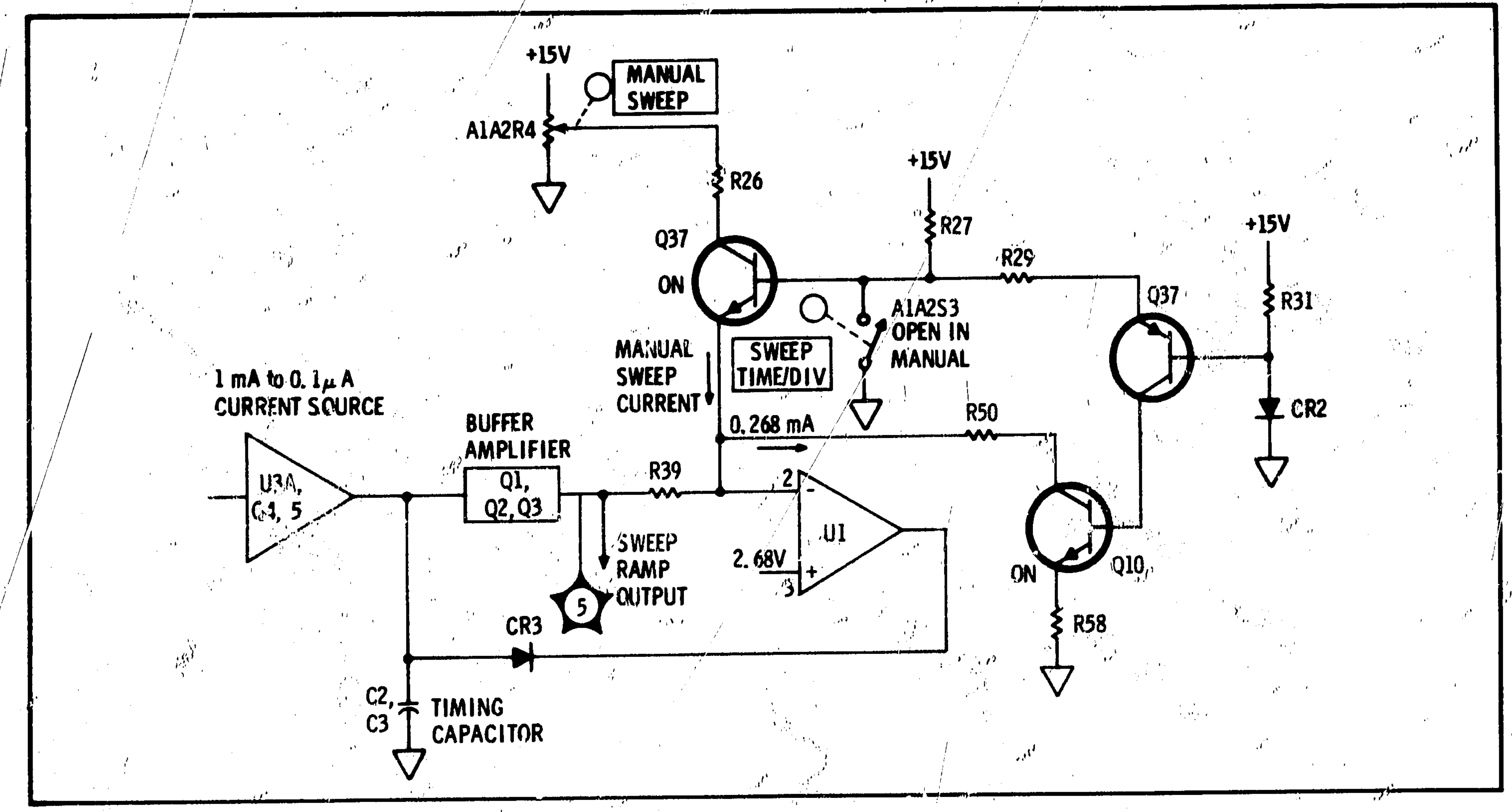


Figure 8-34. Simplified Manual Sweep Circuit

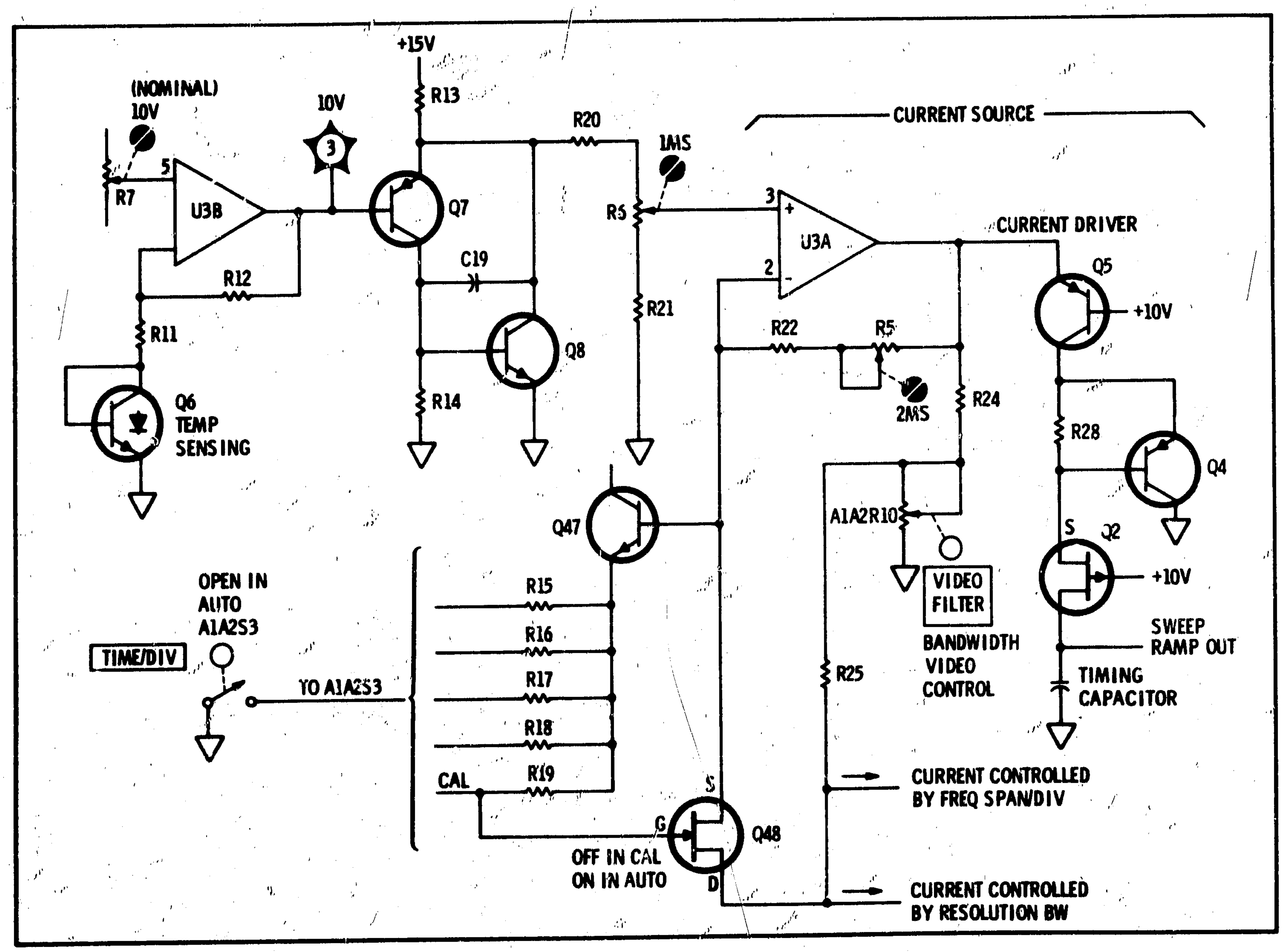


Figure 8-35. Simplified Circuit For Sweep Generator Current Source

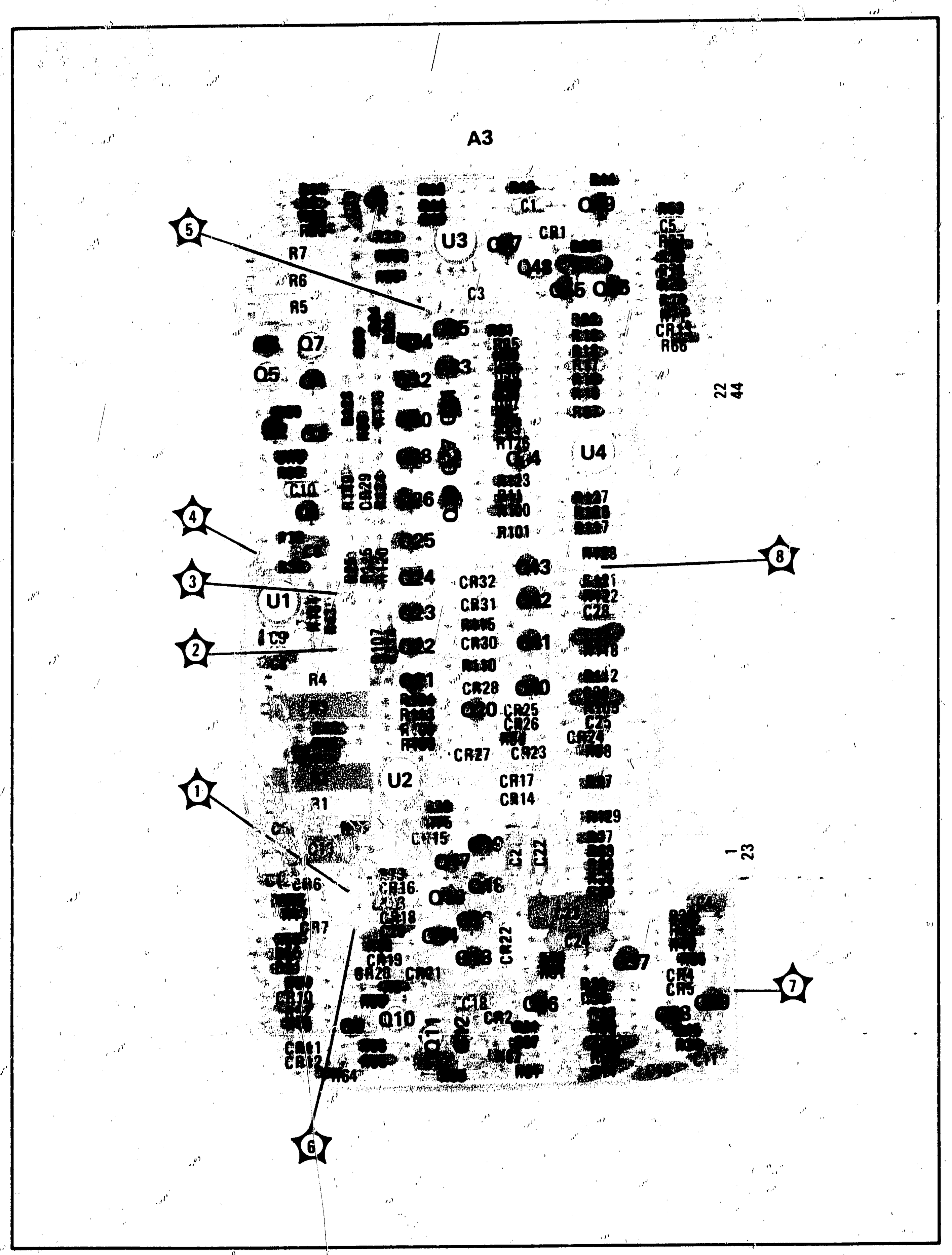


Figure 8-36. A3 Sweep Generator Assembly, Component Locations

REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

REFERENCE DESIGNATIONS

NO PREFIX	A3 ASSY
[illegible]1 R10	C1-19 CR1-7, 9-12 Q1-12, Q36-39 Q45 Q47-49 R5-R65, R130 U1, U3 [illegible]1
A1A2 ASSY	**[illegible] ASSY**
R4 S[illegible] S W[illegible] W[illegible] W2 W2P1	C1[illegible] J1, [illegible] R2-5 XA3

NOTES

1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.
2. A3MP1 IS A THERMAL LINK, HP PART NUMBER 1205-0202.
3. A3Q4 IS A 1mA CURRENT LIMITER.
4. WAVEFORM PRESENT WITH ONLY SWEEP TRIGGER CONTROL SET TO LINE
5. SEE SERVICE SHEET 9 FOR PIN CONFIGURATIONS.

8
A3

Figure 8-37. Part of A3 Sweep Generator Assembly Schematic

SERVICE SHEET 9

A3 SWEEP GENERATOR ASSEMBLY, CIRCUIT DESCRIPTION

General Description

Service Sheet 9 contains the Resolution Bandwidth Control circuit, the Video Filter, the Sweep Attenuator circuit, and +V Sweep Offset circuit. The Resolution Bandwidth Control circuit has three purposes. First it provides the bandwidth filter control current to the PIN diodes on the A8 and A10 Bandwidth Filter Assemblies. Secondly, it provides a current to the Sweep Generator Current Source to control the AUTO sweep time circuit as a function of RESOLUTION BANDWIDTH control setting. Thirdly, it switches in the proper capacitor for the RC lowpass VIDEO FILTER to provide video filtering as a constant percentage of RESOLUTION BANDWIDTH. The sweep attenuator circuit attenuates the sweep ramp to the A7 Frequency Control Assembly in proportion to the FREQ SPAN/DIV selected. It also provides a current to the Sweep Generator Current Source to control the AUTO sweep time circuit as a function of FREQ SPAN/DIV. The +V Sweep Offset circuit offsets the voltage ramp by +5 volts so the voltage ramp, when START frequency is selected, is from 0 V to +10V instead of –5V to +5V.

Resolution BW Control

General. Referring to Service Sheet 8, Figure 8-37 and 8-35, when the sweep time CAL line (ST5) is grounded, resistors A3R15 — A3R18 are connected to ground in different combinations and change the current into A3U3A as a function of the selected sweep time. By connecting other resistances to ground (shown on Service Sheet 9), currents controlled by the Resolution Bandwidth, Video Filter, and Frequency Span can be generated. These currents are coupled through A3Q48, which is ON in AUTO, and are summed by A3U3A. The AUTO Sweep Current generated on Service Sheet 9 is proportional to the LOG of the desired sweep time. Sweep time is a function of the bandwidth, scan width, and video filtering.

The bandwidth in the A8 and A10 bandwidth Filter Assemblies is set by the voltage applied to the control terminals. The bandwidth filter has two modes of operation: LC filter mode (BW7) and crystal (XTAL) filter mode (BW6). The LC mode of operation includes the 3 MHz, 1 MHz, 300 kHz, and 100 kHz bandwidths. The narrow bandwidths, 30 kHz, 10 kHz, 3 kHz, and 1 kHz are used in XTAL mode.

XTAL Resolution BW Control. When selecting 3 kHz BW (BW2) (XTAL mode) (Figure 8-38), two actions take place. A +15V is routed through the RESOLTUION BW switch A1A2S5 to the base of transistors A3Q15 and Q21. These two transistors turn ON, turning ON A3Q18 and Q41, and ground one end of capacitors A3C22 and C26. At the same time BW5 from A1A2S5 is open, so A3R97 turns OFF A3Q20 and a –0.6V is applied to the cathode of A3CR27. The negative voltage at A3U2B pin 6 from the voltage divider causes LC PIN Drive Buffer U2B to saturate positive. With A3U2B saturated, it turns OFF the LC section of the BW filter assemblies. At the same time, current from A3Q21 is applied to the sweep generator current source for control of the sweep time.

In XTAL mode, the biasing on the XTAL PIN Drive Buffer A3U2A makes it a unity gain amplifier. The conduction of A3Q15 and Q18 connects A3R83 in parallel with A3R76 — R2. This resistance combination provided the correct voltage to control the PIN diodes on the BW filter assemblies for the 3 KHz resolution bandwidth.

Referring to Figure 8-41, when other resolution bandwidths are selected, corresponding transistor pairs are turned ON. This changes the input voltage to the XTAL PIN drive buffer A3U2A, varies the AUTO sweep current to A3Q48, and selects the capacitor used in the VIDEO FILTER. In the 30 kHz bandwidth (BW4), the sweep time is correct without switching in additional AUTO sweep control current. The 30 kHz BW control A3R2 adjusts the 30 kHz resolution bandwidth to allow for PIN diode tolerances.

LC Resolution BW Control. When selecting 300 kHz BW (BW2) in LC mode (Figure 8-38), +15V is applied to the XTAL or LC line (BW5) from the RESOLUTION BW switch A1A2S5. This +15V performs three functions. First it drives A3U2A to a maximum negative output voltage. Next A3Q20 is turned ON and A3U2B is alloed to operate at unity gain. The negative voltage output from the XTAL PIN Drive Buffer A3U2A disables the XTAL section of the BW filter assemblies, and also is applied to A3CR18 to keep transistors A3Q15 and Q18 from conducting. The +15V from the RESOLUTION BW switch A1A2S5 (BW2 line) turns ON A3Q21 and Q41. With A3Q21 and Q41 conducting and A3Q15/Q18 OFF, only A3C26 is connected to the Video Filter line and A3R110 is connected in parallel with A3R3 — R109. The addition of A3R110 changes the resistance of the voltage divider that exists between +10V (A3CR14, R103) and ground. A voltage is established at A3U2B pin 5 that sets the output voltage of the operational amplifier. The op amp output voltage determines the BW of the bandwidth filter assemblies.

Referring the Service Sheet 9, the selection of LC bandwidths with the RESOLUTION BW switch A1A2S5 turns ON other transistor pairs. This changes the input voltage to the LC PIN drive buffer A3U2B, varies the AUTO sweep current to A3Q48, and selects the capacitor used in the VIDEO FILTER. The negative voltage from A3U2A ensures that none of the transistor pairs for the narrower bandwidths turn ON. This keeps the large capacitors A3C21, C22, C23, and C24 from being connected to ground, and capacitors A3C25, C26, C27 and C19* (plus stray capacitance) become the video filter capacitors for the appropriate LC bandwidths. The resistor placed in parallel with A3R3 and R109 controls the output voltage of A3U2B for the proper LC bandwidth PIN drive. In the 100 kHz resolution bandwith (BW1), the sweep time is correct without switching in additional AUTO sweep control current. The 100 kHz BW control A3R3 adjusts the 100 kHz resolution bandwidth to allow for PIN diode tolerances. The conduction of A3Q20 adds A3R104 to speed up the AUTO sweep time for the wider LC resolution bandwidths.

VIDEO FILTER/MAX

The video filter consists of capacitors A3C22 and C26 (the effect of C26 is negligible), resistor A11R121, and one section of front-panel VIDEO FILTER control A1A2R11. In AUTO sweep time, VIDEO FILTER control A1A2R10 controls the sweep time as a function of the amount of video filtering. A1A2R10 and A1A2R11 are ganged together and comprise the VIDEO FILTER control.)

When the VIDEO FILTER control A1A2R10/11 is rotated fully clockwise, the detent at the MAX position, A1A2S8, applies +15V to the base of A3Q24. The conduction of A3Q24 and Q43 adds A3C28 to the Video Filter line.

Sweep Attenuator

The Sweep Attenuator circuit changes the amplitude of the sweep voltage applied to the A4 Frequency Control Assembly as a function of the FREQ SPAN/DIV selected. The attenuator attenuates the –5V to +5V ramp routed through XA3 pin 39 in a divide by 1, 2, 5, and 10 sequence from a divide-by-1 to a divide-by-200. The circuit also generates an auto-sweep control current used to control the AUTO sweep time circuit as a function of the frequency span.

The sweep attenuator has two voltage dividers buffered by the unity gain voltage follower A3U4. The divider at the input of A3U4 provides either a divide-by-two or a divide-by-five; the divider at the output of the A3U4 provides a divide-by-one, a divide-by-ten, and a divide-by-one hundred.

The divide-by-two stage (FS3) is selected in Figure 8-39. A +15V turns ON A3Q31 and Q32 grounding a 10K ohm resistor A3R90. The –5V to +5V ramp is divided across the input resistor A3R67 (10K ohms) and A3R90 (10K ohms). The ramp is now divided in half and applied to the sweep buffer A3U4 pin 3. The dividers at the output of A3U4 ($\overline{FS4}$ and $\overline{FS5}$) have reversed control logic; they are normally connected to +15V by FREQ SPAN/DIV control A1A2S6 and open when selected. A3Q44 is a gate to drive A30. When $\overline{FS4}$ and $\overline{FS5}$ are connected to +15V, A8Q44 is OFF and Q30 is ON, connecting the divide-by-one divider at the output of A3U4. If either $\overline{FS4}$ and $\overline{FS5}$ are open, A3Q30 is OFF and Q28 or Q25 is ON, providing either a divide-by-ten or divide-by-one hundred. AUTO sweep control current is applied to A3Q48 as a function of frequency span by A3Q34, Q30, Q32, Q26, and Q25 and the appropriate resistors.

+V Sweep Offset

Normally the START-CENTER switch A1A2S7 is in the CENTER position. The +15V back biases A3Q47 and holds it OFF.

Switching to START allows A3Q46 to conduct and adds 0.5 mA of current through A3R67 to offset the sweep ramp. With START-CENTER switch in START position, the tuning ramp starts at 0V and goes positive.

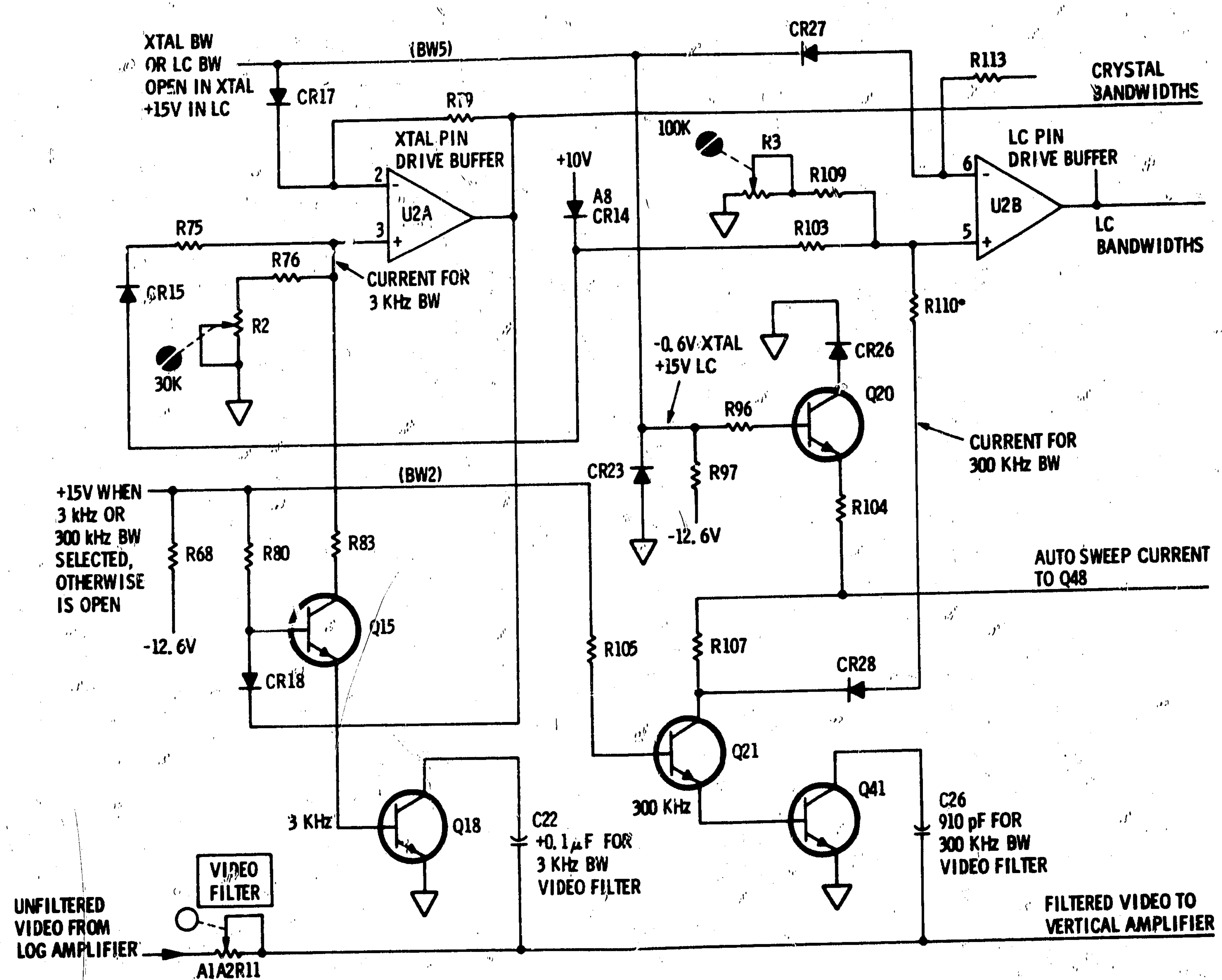


Figure 8-38. Bandwidth and Video Filter Circuit for 3KHz, 300 KHz (BW2)

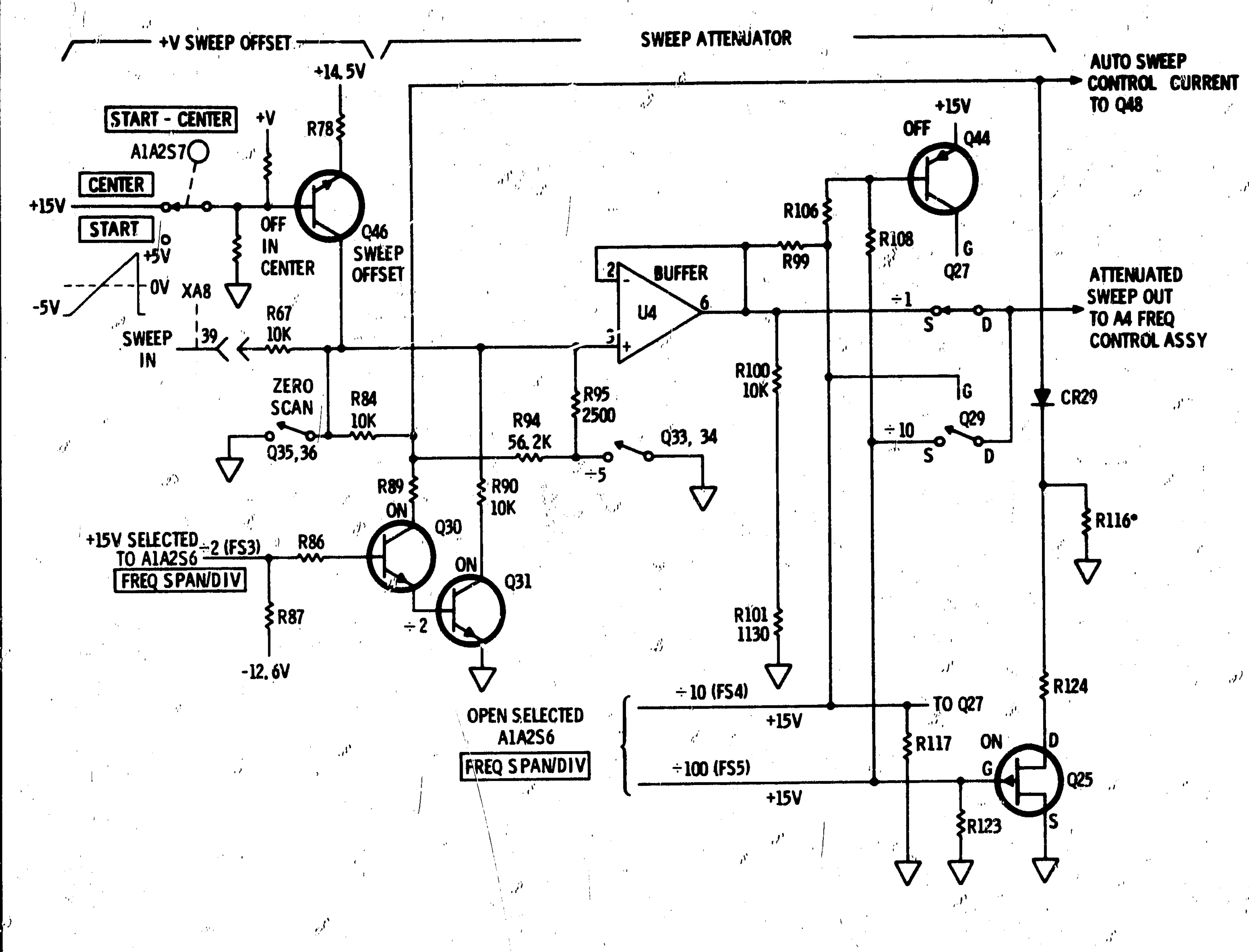


Figure 8-39. Simplified Sweep Attenuator and +V Sweep Offset Circuit

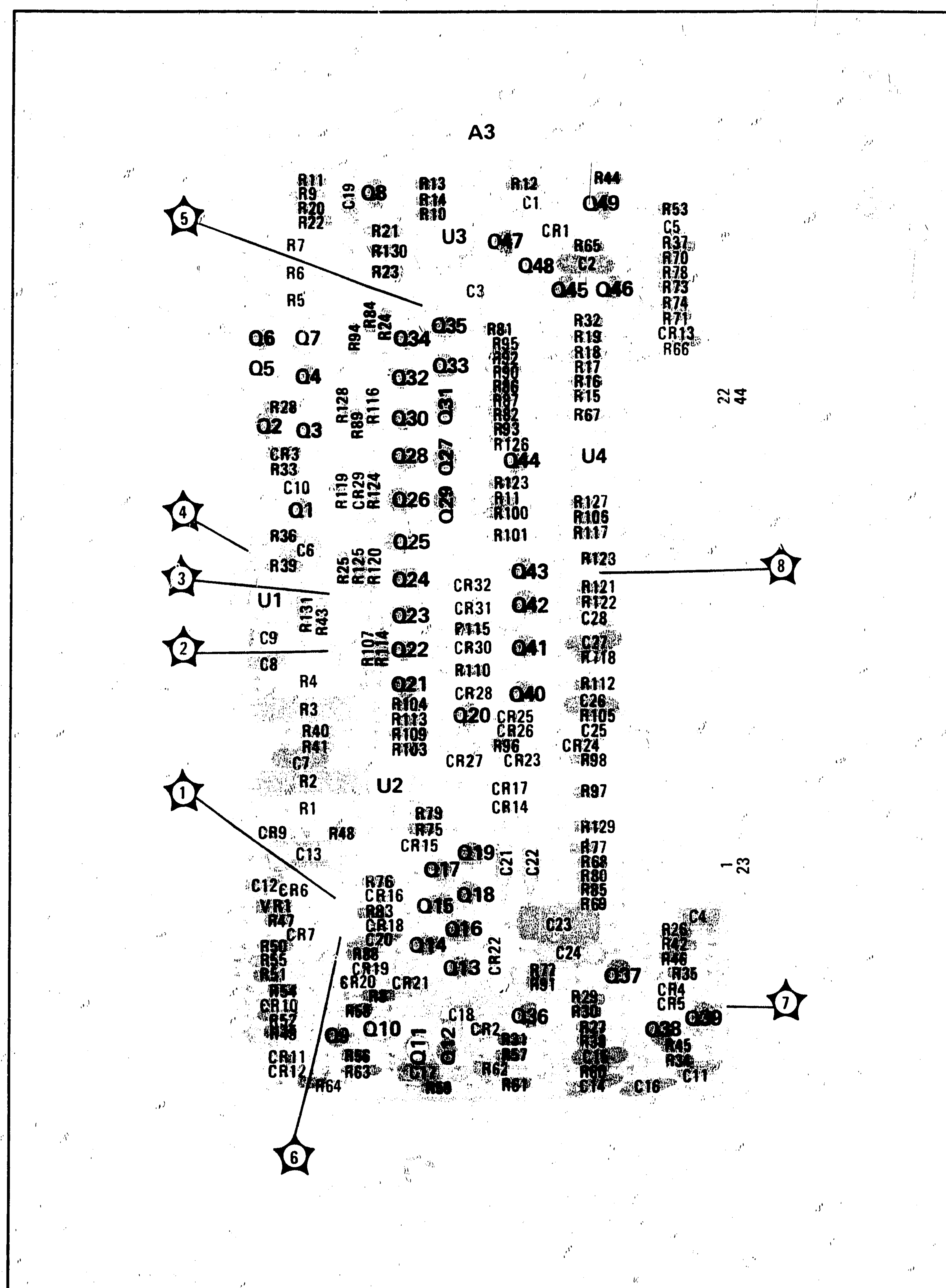
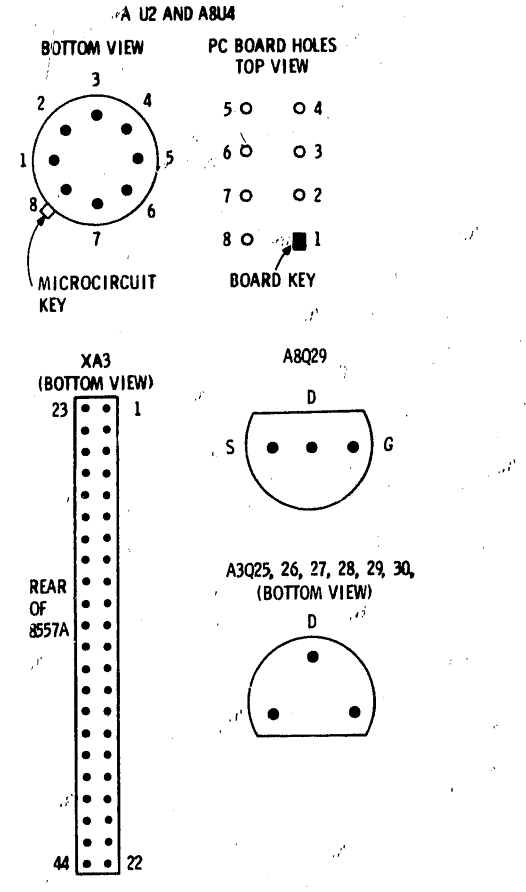


Figure 8-40. A3 Sweep Generator Assembly, Component Locations

NOTES
1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.



REFERENCE DESIGNATIONS WITHIN OUTLINED (—— - - ——) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER, e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN

REFERENCE DESIGNATIONS

A1A2 ASSY	A3 ASSY	A13 ASSY
R11 S5, 6, 7, 8	C20-28 CR 13-32 Q13-36 Q41-45 Q47 R1-4 R66-101 R103-107 R109-129 U2, 4	J1 XA8

DELETED: A3R102 and A3R108

9
A3

Figure 8-41. Part of A3 Sweep Generator Assembly Schematic

SERVICE SHEET 10

A12 VERTICAL DRIVER ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A12 Vertical Driver Assembly provides a preamplifier circuit to amplify the detected and filtered video from the log amplifier. The video signal needed to trigger the sweep generator in INT mode is picked off at the preamplifier. A vertical driver (differential amplifier) provides push-pull drive to the vertical deflection plates.

The blanking and pen lift drive signals are also generated on the A12 assembly.

Preamplifier

The detected and filtered video input (0V to 0.8V) from the A11 Log Amplifier Assembly is applied to the gate of A12Q17A. A12Q17, Q11, Q12, and Q18 make up a differential amplifier. The gate of Q17A is the noninverting input and the gate of Q17B is the inverting input. The output at the emitter of Q18 is feedback applied to the gate of Q17B through voltage divider A12R11, R12, and R13. The voltage gain of the preamplifier is 1 + R11/(R12 + R13) = 10. (See Figure 8-42.) With an input voltage range of 0V to 0.8V, the maximum signal measured at the output of A12Q18 (TP3) is 8 volts. (This signal coupled through A12R17 is the trigger voltage for INT mode.) A buffer amplifier consisting of A12U1A, U1B, and Q20 provides isolation between the preamplifier and vertical driver. A12U1D and Q13 are current sources to bias the differential amplifier.

The vertical deflection sensitivity of the vertical driver is 0.8V for full-scale deflection. Since the vertical preamplifier output signal is 0 to 8 volts, to obtain the correct signal amplitude, a divide-by-ten and an offset circuit are used.

10 dB/DIV and LIN. The preamp output is divided by 10 when the 10 dB/DIV — 1 dB/DIV—LIN switch A1A2S2 is in either LIN or 10 dB/DIV. (See Figure 8-46.) With LIN or 10 dB/DIV selected, +15V is applied to the Expand line, back biasing A12CR1, and turning A12Q19 ON. Also, A12CR2 is ON and CR3 is OFF. With A12Q19 ON, a voltage divider consisting of A12R18, R20, and Q19 divides the preamp output by 10. (See Figure 8-42.)

1 dB/DIV. With 1 dB/DIV selected, the Expand line is open and A12Q19 is held OFF by A12CR1 and R22. The divide-by-ten circuit is disabled and the full 8-volt preamp voltage is available. Since only the 0.8V peak can be displayed, the signal to the buffer amplifier is offset by -7.2 volts as follows. A current source A12U1C is ON, drawing current through A12CR3 and R18. The voltage drop across R18 is set for 7.2V, so the 8V input is shifted -7.2V below ground. When the signal goes below ground (0V), A12CR4 conducts and clamps the signal at -0.6V. The 1 dB OFFSET adjustment A12R1 sets the current for the correct voltage shift.

Beamfinder. With 1 dB/DIV selected, the baseline, normally at the bottom graticule line in LIN or 10 dB/DIV, drops offscreen. With no signal or baseline present, there will be no display trace. This condition could possibly be misinterpreted as a display malfunction. By pressing the beamfinder switch on the mainframe, the -12.6V on the beamfinder line is removed, turning A12Q19 ON and disabling the current source A12U1C. The display reverts to 10 dB/DIV vertically, with the horizontal becoming smaller and the trace being intensified in the mainframe.

Current Source

The A12 assembly contains a temperature-compensated voltage that controls four current sources: A12U1D, Q13, U1C, and Q15. The temperature-sensing element A12U1E (connected as a diode) tracks the base-emitter temperature changes of the current source transistors. Approximately -6V is provided by the voltage regulator diode A12VR1 and U1E.

Vertical Driver

The certical driver is a differential amplifier that consists of A12Q2, Q3, Q6, Q7 and Q14 with Q15 as the current source. (See Figure 8-43.) The 0V to 0.8V vertical signal from the output of the preamplifier is converted to a push-pull signal to drive the CRT vertical deflection plates. A12Q14 is a dual transistor used as the input stage to the vertical driver circuit. The reference input level at the base of A12Q14A is set by the VERT POSN control A1A2R6. The gain of the vertical driver is set by the voltage divider consisting of A12R39, R42 and VERT GAIN control A1A2R7. The transistor pairs A12Q2/Q6 and A12Q3/Q7 are current-to-voltage amplifiers and are driven by the current from the collectors of A12Q14A and B respectively. Diodes A12CR5 through CR8 protect the bases of A12Q2, Q3, Q6, and Q7 to prevent them from being driven more negative than approximately 0.6V (the voltage drop across a diode). The resistors A12R44 and R52 decouple the capacitive load of the CRT plates from the emitters of A12Q2 and Q3, preventing overshoot and ringing in the vertical driver.

Blanking OR Gate

Normally A12Q4 is OFF placing a 0V at the base of A12Q9 turning it ON. A12Q4 requires a positive voltage or about 1 mA to turn ON, cutting Q9 OFF. A positive voltage into the OR circuit provides positive BLANKING OUTPUT to the mainframe. There are four conditions that cause blanking of the sweep. (See Figure 8-44.)

Vertical/Baseline Comparator

The Vertical/Baseline Comparator circuit consists of A12Q16 and Q8. The baseline clipping reference voltage is set by the front panel BASELINE CLIPPER control A1A2R1 which varies the base voltage of A12Q16. The vertical preamplifier output signal is applied to the base of A12Q8. (This signal also provides the rear panel AUX VERT OUTPUT to P1 pin 14.) The signal voltage at the base of A12Q8 is compared to the dc reference on Q16. When the signal voltage becomes more negative than the reference, Q8 turns ON and the positive voltage turns A12Q4 ON, blanking the display.

Pen Lift Drive

The display is blanked during retrace and the dead time of the sweep voltage. The Retrace Blanking input from A3Q9 in the sweep generator circuit, is applied to the emitter of buffer amplifier A12Q1. When the sweep ramp is turned OFF (dead time), the retrace blanking signal rises to +10V. The +10V connected to the base of A12Q4 produces the blanking output. The same +10V retrace blanking input is applied to the base of A12Q5 and the collector of A12Q10 rises to +15V. A12Q10 provides a signal that can be used to drive the Pen Lift input on an X—Y recorder. This signal will cause the pen to lift during the analyzer sweep retrace and dead time. Breakdown diodes A12VR2 and VR3 suppress the high positive and negative voltage transients that some X—Y recorder pen lift coils can generate.

Front panel SWEEP Indicator

The SWEEP indicator A1A2DS1 is ON when the Pen Lift Output is LOW (0V); A1A2CR1 is forward biased. During retrace, the +15V back biases A1A2CR1 and the SWEEP indicator is OFF.

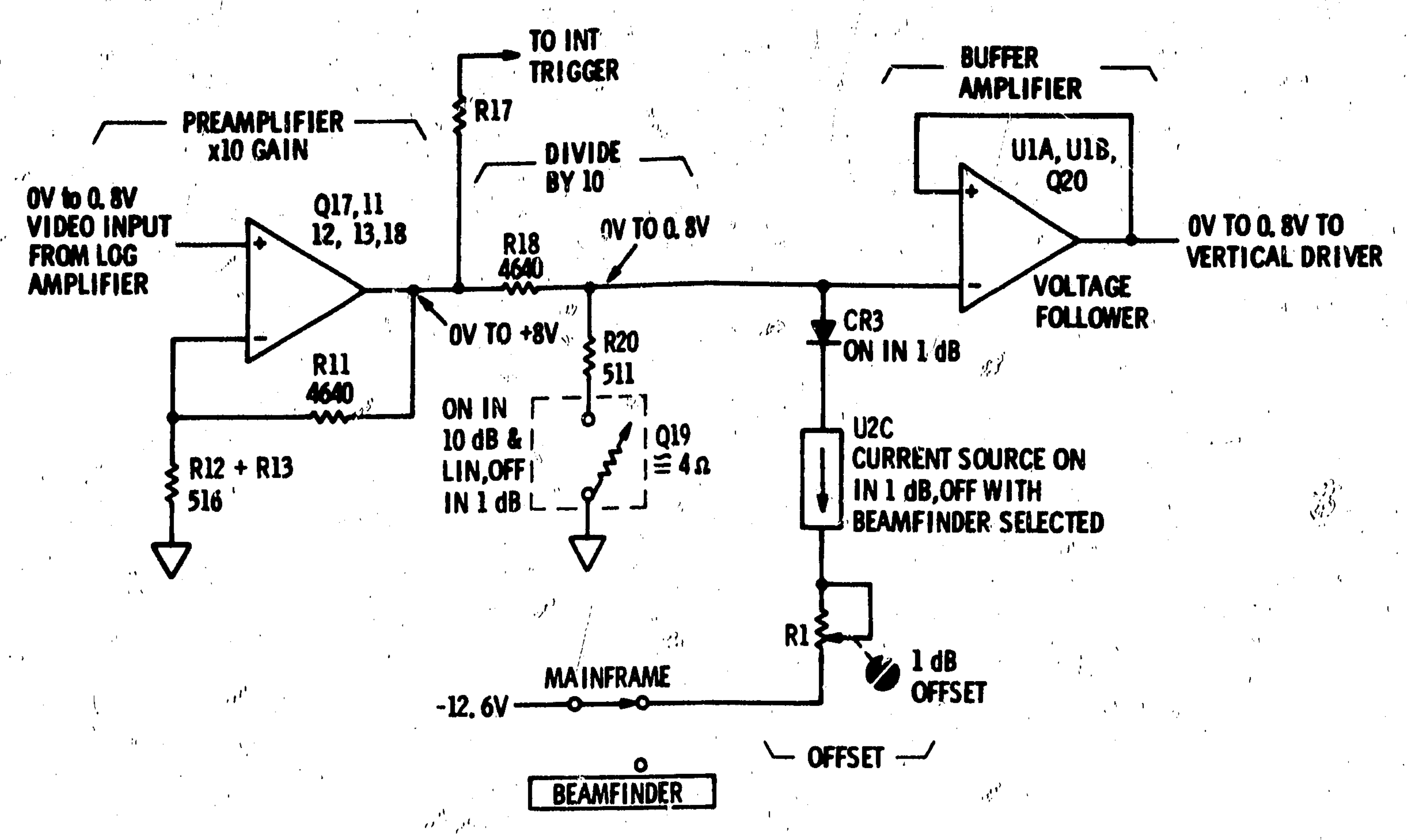


Figure 8-42. Simplified Preamplifier Circuit

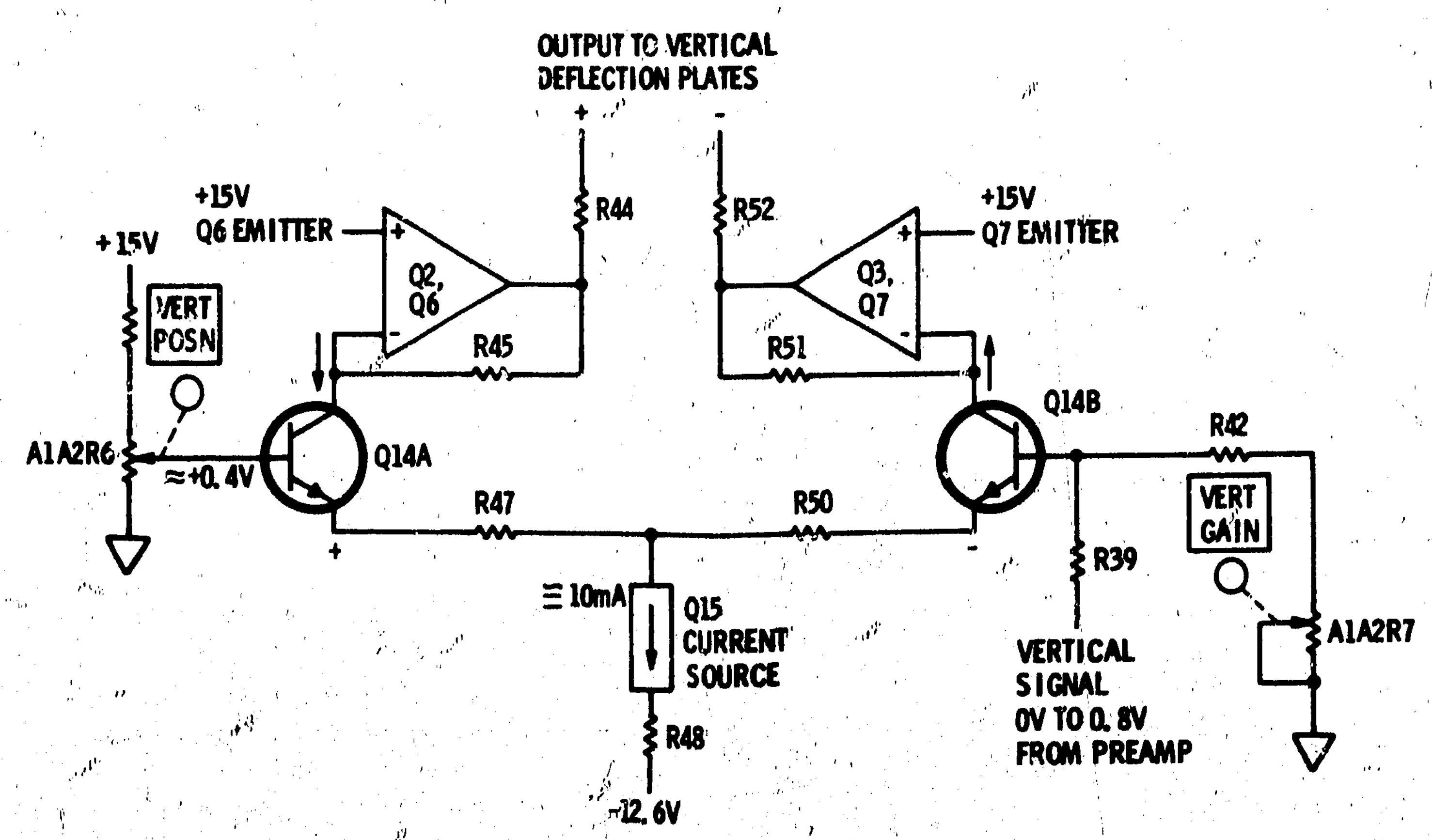


Figure 8-43. Simplified Vertical Driver Circuit

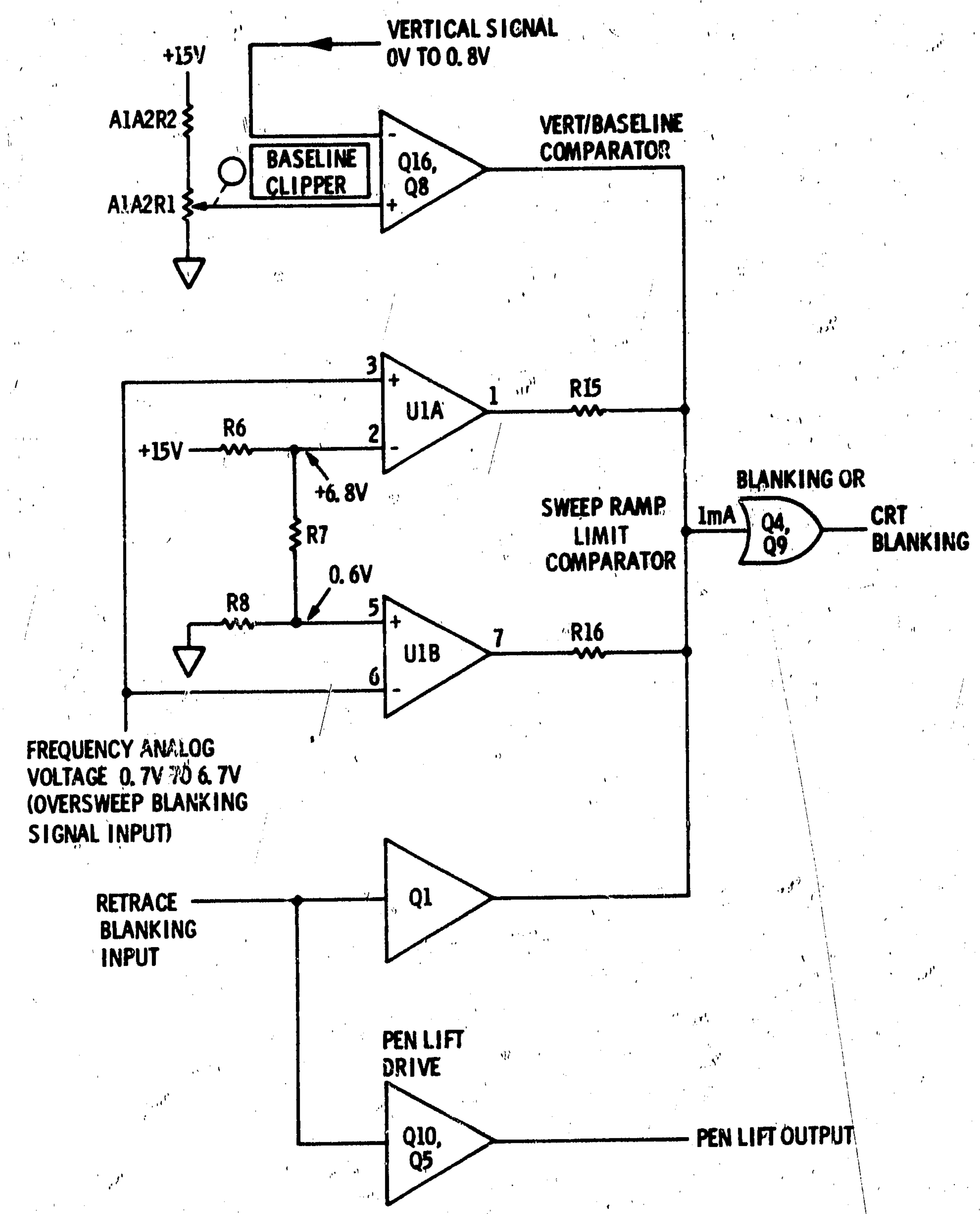


Figure 8-44. Blanking Circuit Block Diagram

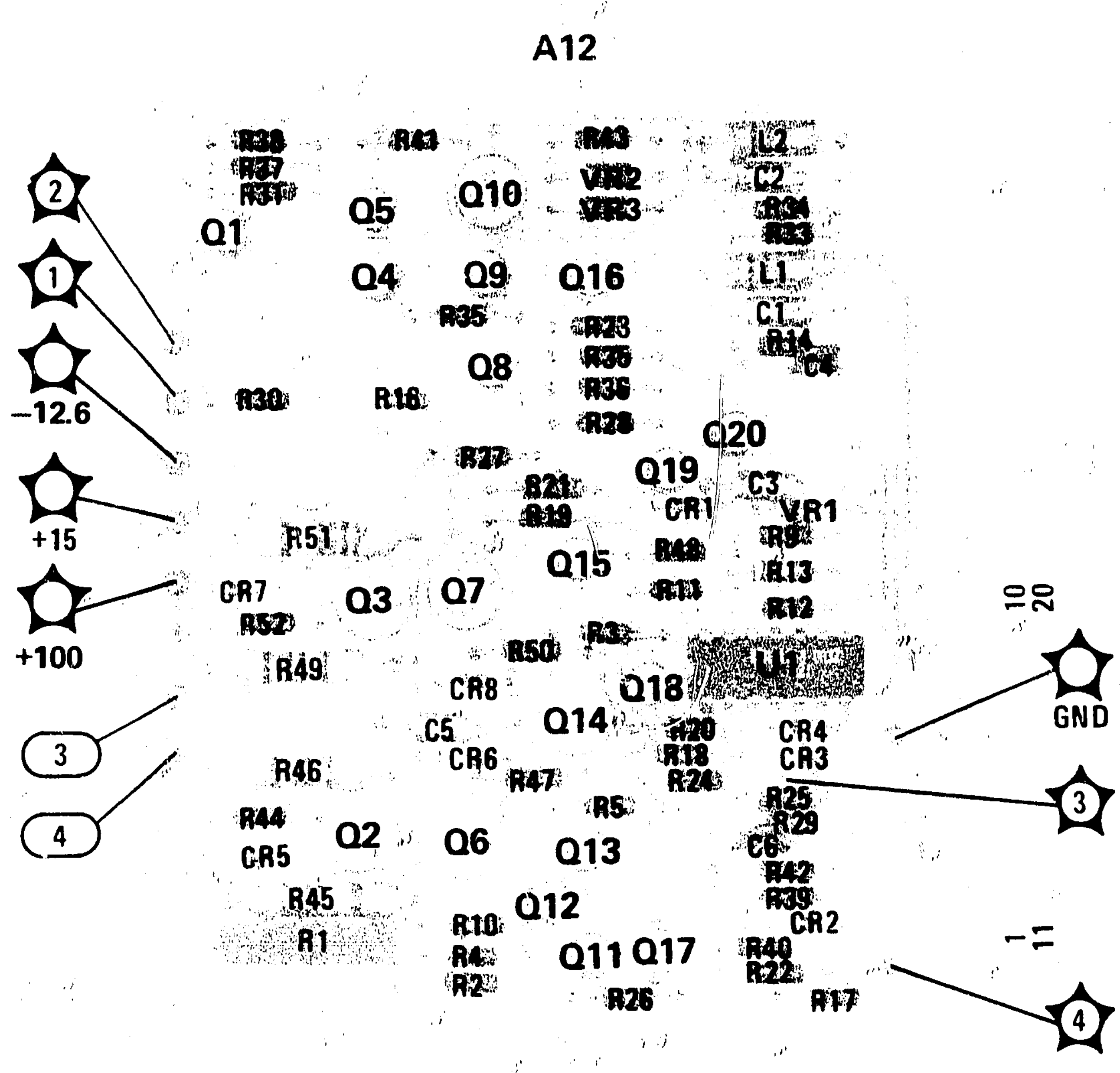


Figure 8-45. A12 Vertical Driver Assembly Component Locations

NOTES

1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.

REFERENCE DESIGNATIONS

NO PREFIX	A12 ASSY	A13 ASSY
P1 W7 W7P1-P3	C1-6 CR1-8 J1, J2 L1, L2 Q1-20 R1-52 U1 VR1-3	J1, J2 VR1-2 XA12
A1A2 ASSY		
CR1 DS1 R1, 2, 5-8, 13 S2 VR1		

10
A12

Figure 8-46. A12 Vertical Driver Assembly Schematic

SERVICE SHEET 11

A4 FREQUENCY CONTROL ASSEMBLY, CIRCUIT DESCRIPTION

General Description

The A4 Frequency Control Assembly consists of a +14V Regulator, a −11.5V Regulator, a Tune Summer amplifier, a Full Scan Switch, a Step Attenuator, a Frequency Analog Buffer, an Oversweep Blanking circuit, a Shaping amplifier, an Offset Current Source, a Shaping network, and a Marker Generator.

The A4 Frequency Control Assembly provides the proper tuning voltage to the first LO as well as providing oversweep blanking. The oversweep blanking signal blanks the CRT trace 10 MHz below the LO feedthrough and above 360 MHz. The Frequency Control Assembly provides two regulated voltages, +14V and −11.5V which are used as supply voltages for its own circuitry and also for A3 and A7 assemblies.

+14 Regulator

The +15V from the mainframe provides the input voltage to the +14V regulator. Dual transistor Q1A/Q1B serves as a differential comparator. If the voltage at the base of Q1A increases, Q1A turns ON and Q1B turns OFF. The collector voltage of Q1A decreases, the drive voltage at the base of Q3. The voltage at the collector of Q3 increases placing less forward bias across the base-emitter junction of Q12. This reduces conduction through the series regulator Q12, decreasing the voltage at TP1 and returning the regulated output to +14V. Diodes CR1, CR2 and CR3 provide short-circuit protection of Q12. Potentiometer R6 sets the +14V regulated output by adjusting the amount of current through R20 and R21.

−11.5V Regulator

The −12.6V from the mainframe provides the input voltage to the −11.5V regulator. The circuitry is very similar to the +14V regulator. Dual transistor Q2A/Q2B serves as a comparator, comparing the voltage at the base of Q2B to a negative reference voltage from zener diode VR1. The output of Q2B drives Q4 which controls the −11.5V series regulator Q11. Capacitor C10 provides filtering to eliminate zener noise. Diodes CR5, CR6 and CR7 provide short-circuit protection of Q11. The −11.5V regulator has no adjustment. The regulated output level is dependent on the +14V regulator setting and VR1.

Tune Summer Amplifier

The −6.2 volts across zener diode VR1 goes to the bottom side of the three tuning pots, COARSE TUNE, FINE TUNE and FREQ ZERO, and to the inverting input of U1 (see Figure 8-50). U1 inverts the −6.2V from VR1 and provides approximately +7V to the top side of the tuning pots. The 350 MHz adjustment R13 is adjusted to give the proper tuning range. The three tuning voltages go to U9, the Tune Summer Amplifier. The COARSE TUNE voltage goes to the non-inverting input of U9 while the FREQ ZERO and FINE TUNE voltages are summed in the inverting input of U9. The voltage gains of U9 are adjusted by R1, R2, and R4 to give the proper tuning sensitivities.

Full Scan Switch

The output of U9 goes to Full Scan Switch Q7. When the FREQ SPAN/DIV control is in F (full scan), transistor Q7 is OFF, which isolates the tuning voltage from the first local oscillator. In any FREQ SPAN/DIV setting other than full scan, Q7 is turned on which allows the tune voltage to be summed with the sweep voltage across the summing network of R31 and R32. Resistor R33 provides the proper gain for the sweep signal in full scan(Q7 OFF).

Step Attenuator

For FREQ SPAN/DIV settings of 200 kHz or less the sweep signal is attenuated. The sweep ramp input from the A3 Sweep Generator Assembly is applied to the non-inverting input of buffer amplifier U8.

If the FREQ SPAN/DIV control is set at 500 kHz or greater, the FS5 line is placed at +15V from A1A2S6 (see Service Sheet 9). The +15V turns Q10 OFF turning Q5 ON. It also turns Q6 OFF. The sweep ramp is thus applied to the input of U2 through Q5, unattenuated (see Figure 8-47). If the FREQ SPAN/DIV control is set at 200 kHz or less, the FS5 line is open (OV). The OV level on the FS5 line reverse biases CR4 permitting Q10 to turn ON, turning Q5 OFF. It also turns Q6 ON providing a sweep ramp signal path through divider network R9 and R10 and through Q6 to the input of U2. In this case the amplitude of the sweep ramp is divided by 100. (See Figure 8-47).

Frequency Analog Buffer

The output of U2 is summed with the tuning voltage across R31 and R32 unless full scan mode is selected. The sweep plus tune voltage goes to the frequency analog buffer amplifier U5. The output of U5 goes to U4A and U4B, the oversweep blanking comparator. The output of U5 also provides the Freq Analog signal which goes to the 21.4 MHz Preamp A6.

Oversweep Blanking

U4A and U4B serve as a comparator for the oversweep blanking control. The Frequency Analog signal at pin 6 of U5, is applied to U4A and U4B. In unblanked operation, the outputs of U4A and U4B will typically be about −10V. If the frequency analog voltage at the non-inverting input pin 3 of U4A is higher than the voltage at pin 2, the output of U4A will go high and cause the CRT to be blanked above 360 MHz. In a similar manner, if the frequency analog voltage at pin 6 of U4B is lower than the voltage of pin 5, then the output of U4B will go high and cause the CRT to be blanked below −10 MHz (10 MHz below the LO feedthrough). The blanking points are set by R41 and R42 to correspond to +360 MHz and −10 MHz.

Shaping Amplifier

The sweep plus tune signal from the junction of R31 and R32 also goes to U6, the Shaping Amplifier. The voltage out of the Shaping Amplifier must go from roughly +4V to +18V, so VR2, a 10V zener diode is included in the amplifier circuit to offset the voltage. VR2 is maintained at its zener voltage, 10V, by current through R43 and R49 to give +22V maximum at test point 9. Without the +100V there would be less than +14V available at test point 9. The output of the Shaping Amplifier goes through filter R44 and C15 to the First LO Assembly A7A2. Capacitor C16 is switched in for additional noise filtering in the two most narrow RESOLUTION BW settings (see, Figure 8-48). Capacitor C18 is switched in when zero scan mode is selected (FREQ SPAN/DIV set at 0).

Offset Current Source

The offset current source is comprised of U7, Q8 and associated circuitry. The constant current at the source of Q8 is pulled down from the +100V through R39, R43 and R49. The current through R39 provides the offset voltage, when the input to U6 goes from roughly −3.5 to +3.5V, that enables the voltage at TP9 to go from +4V to +20V. U7 compares the drain current of Q8 through R46 and R47 to the voltage across the divider of R54 and R50.

Shaping Network

The shaping network is basically a variable resistor used to change the gain of shaping amplifier U6. The resistance is dependent upon the voltage level going into the non-inverting input of U6 since feedback through R39 will cuase the inverting input to track the non-inverting input of U6. As the voltage at the inverting input of U6 increases, diodes CR22, CR24, CR28 and on up to CR32 will progressively turn on. As these diodes turn on, more resistors will be placed in parallel thereby decreasing the resistance and increasing the gain of U6 as the input voltage at U6 increases. Diodes CR20, CR21, CR23, and CR26 progressively decrease the gain of U6 as the input voltage to U6 increases. This combination makes possible the matching of varying tuning curves of the first local oscillator due to different varactors. Transistor Q16 is a voltage source that provides about +2.7V at TP11 and Q9 is a constant current source that sets the turn on voltages for the diodes.

Marker Generator

U3 is the marker generator which only operates in the full scan mode. When the sweep voltage at the non-inverting input of U3A is near the tune voltage level at the inverting input, the output of U3A will be a positive going ramp. U3B will invert this to give a negative going ramp. As long as the positive ramp output of U3A is less than the negative ramp output of U3B, the output through CR14 to XA4 pin 6 will be a positive going ramp. When the output of U3A becomes more positive than U3B, the output to A4 will be taken from U3B and will be a negative going ramp. Together these two ramps give a triangular notch which is inverted in the Vertical Driver Assembly A12 to give a marker on the CRT.

A12 Vertical Driver Assembly

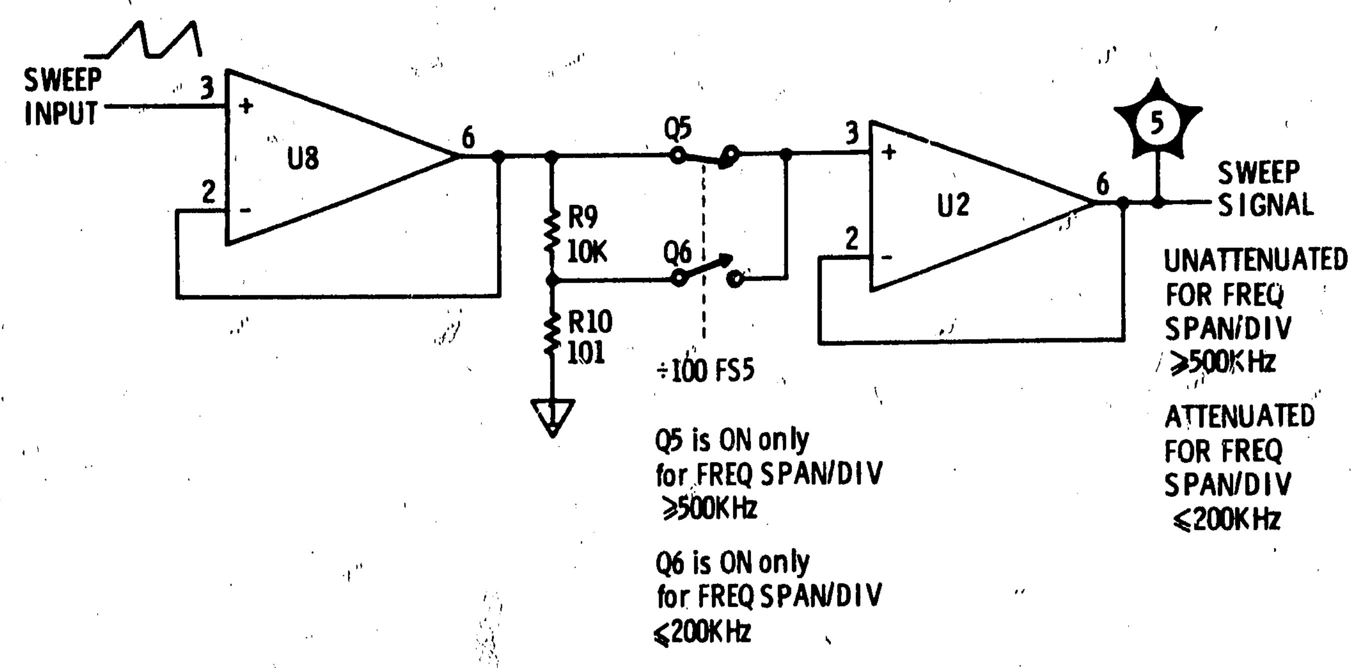


Figure 8-47. Simplified Schematic of Step Attenuator

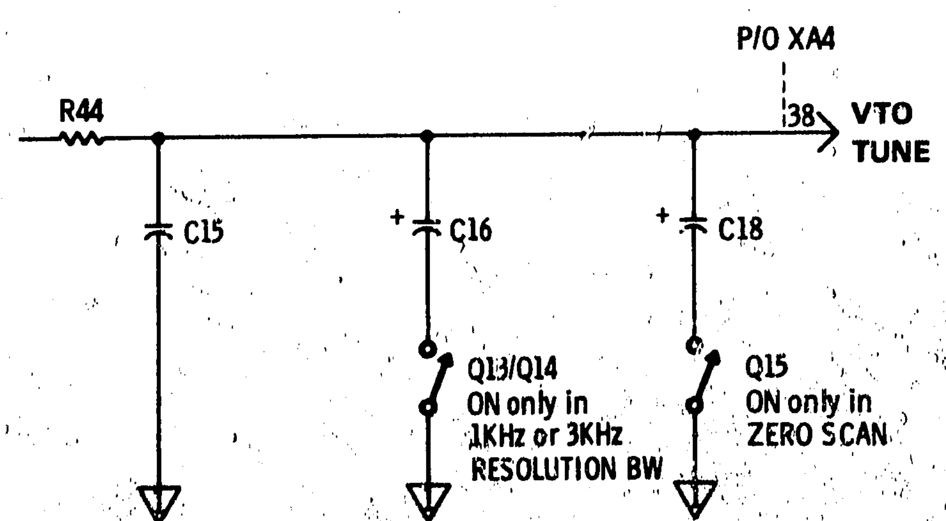


Figure 8-48. Simplified Schematic of VTO Tune Voltage Noise Filtering

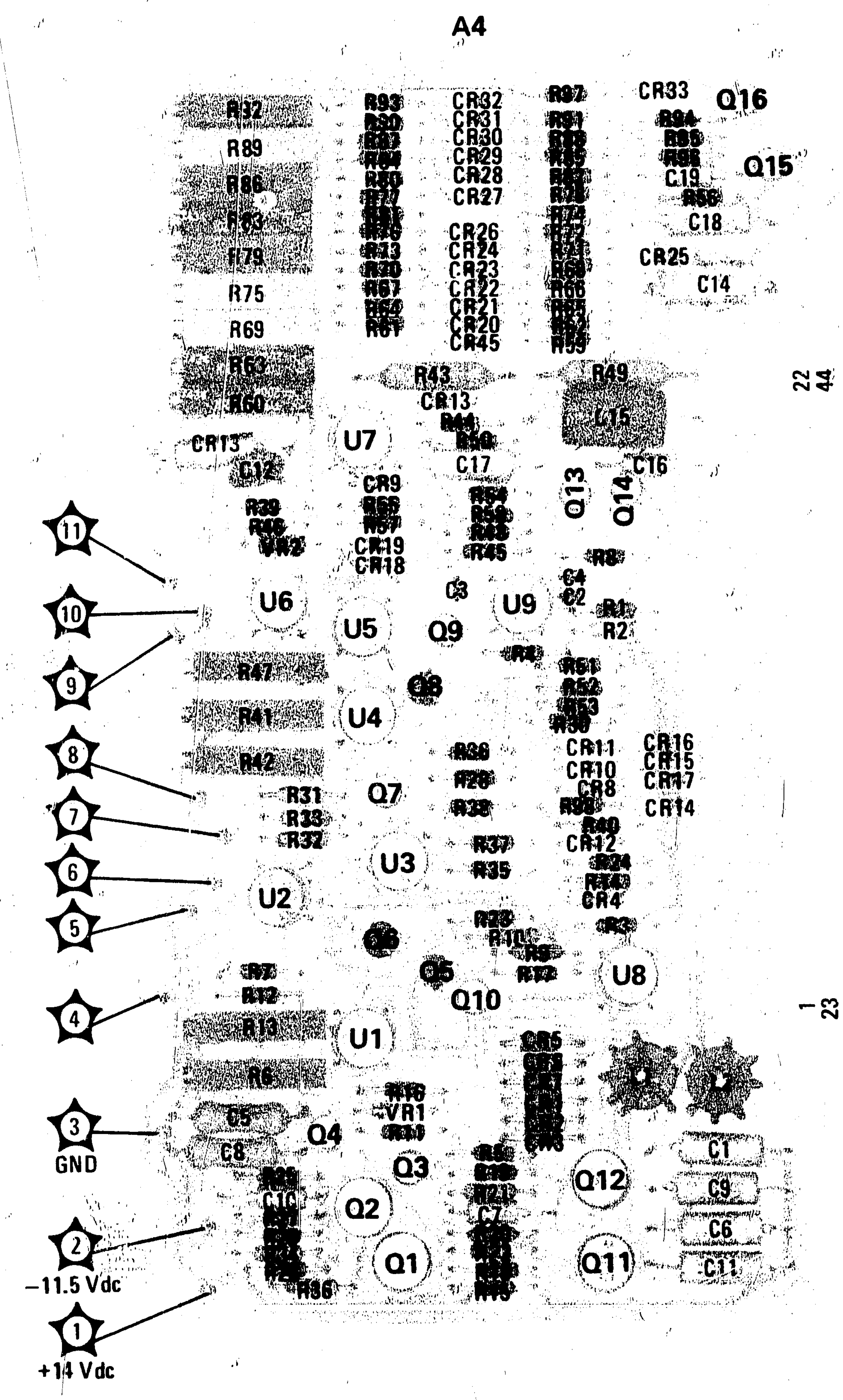
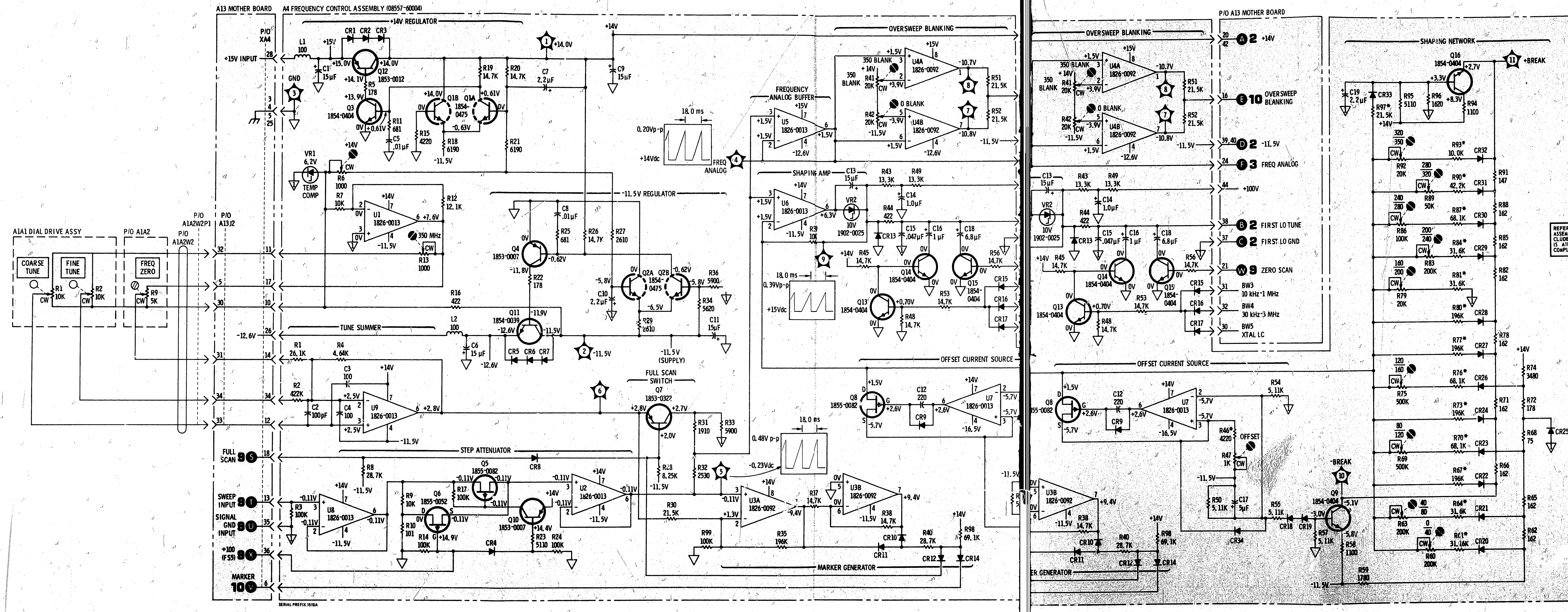


Figure 8-49. A4 Frequency Control Assembly, Component Locations



REFERENCE DESIGNATIONS

A1A2	A4 ASSY
R1 R2	C1-19 CR1-34 L1-2 Q1-16 R1-99 U1-9 VR1-2
A1A2 ASSY	
R9	

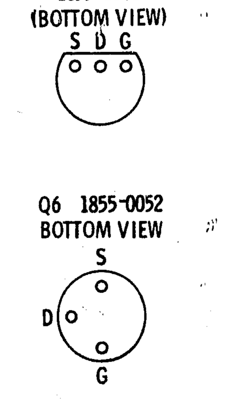
NOTES

1. SEE FIGURE 8-4 FOR GENERAL NOTES AND MEASUREMENT CONDITIONS.

REFERENCE DESIGNATIONS WITHIN OUTLINED (—— - - ——) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

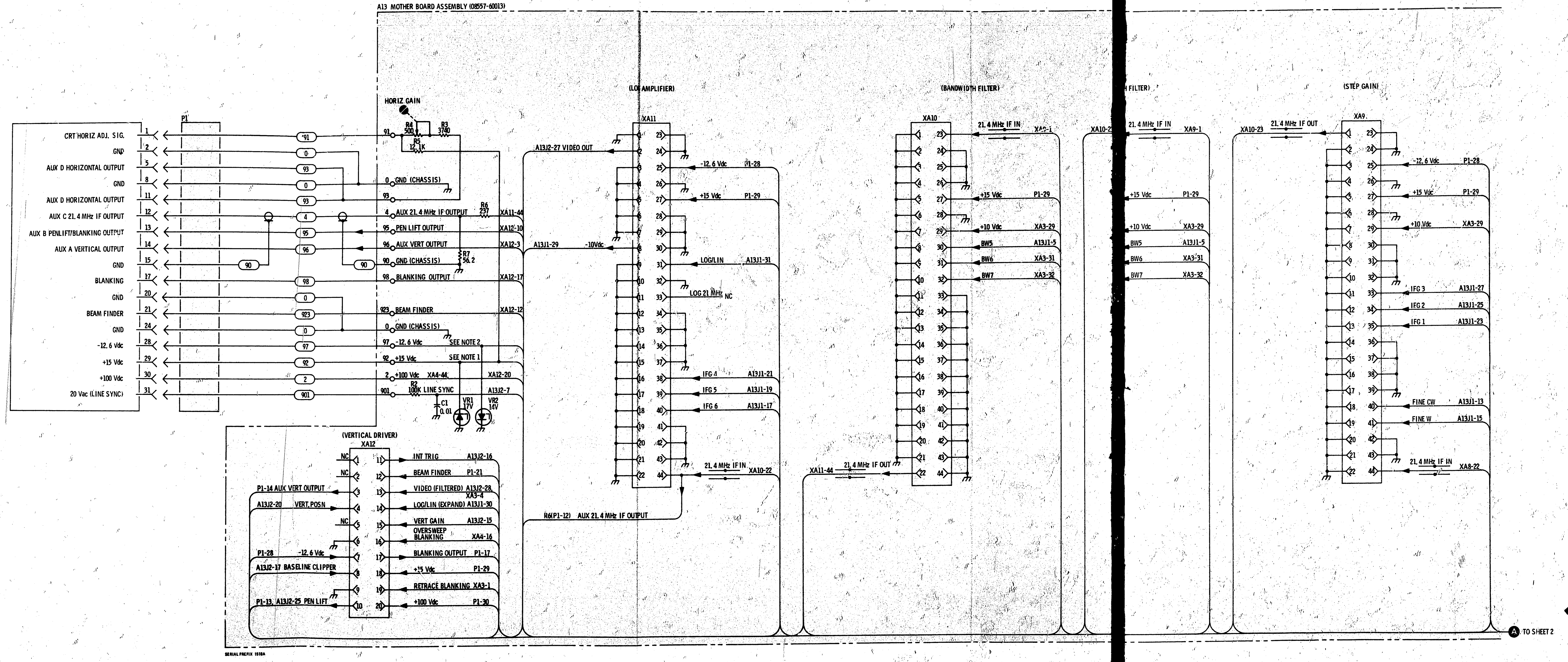
1855-0082 (BOTTOM VIEW)

Q6 1855-0052 BOTTOM VIEW



11
A4

Figure 8-50. A4 Frequency Control Assembly Schematic



12
A13

Figure 8-51. A13 Mother Board Assembly Schematic (1 of 2)

A4 Frequency Control Assembly
SERVICE SHEET 11

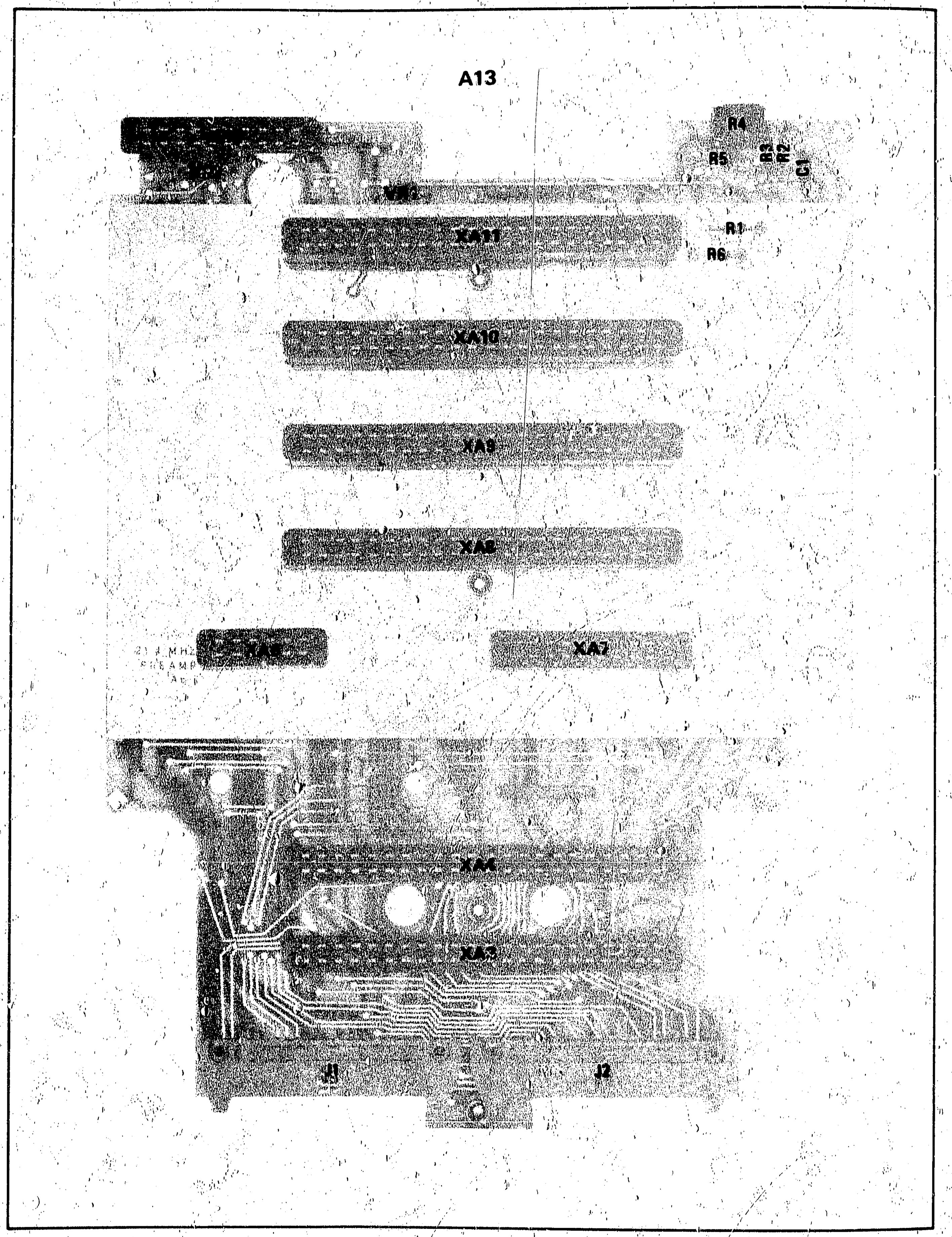
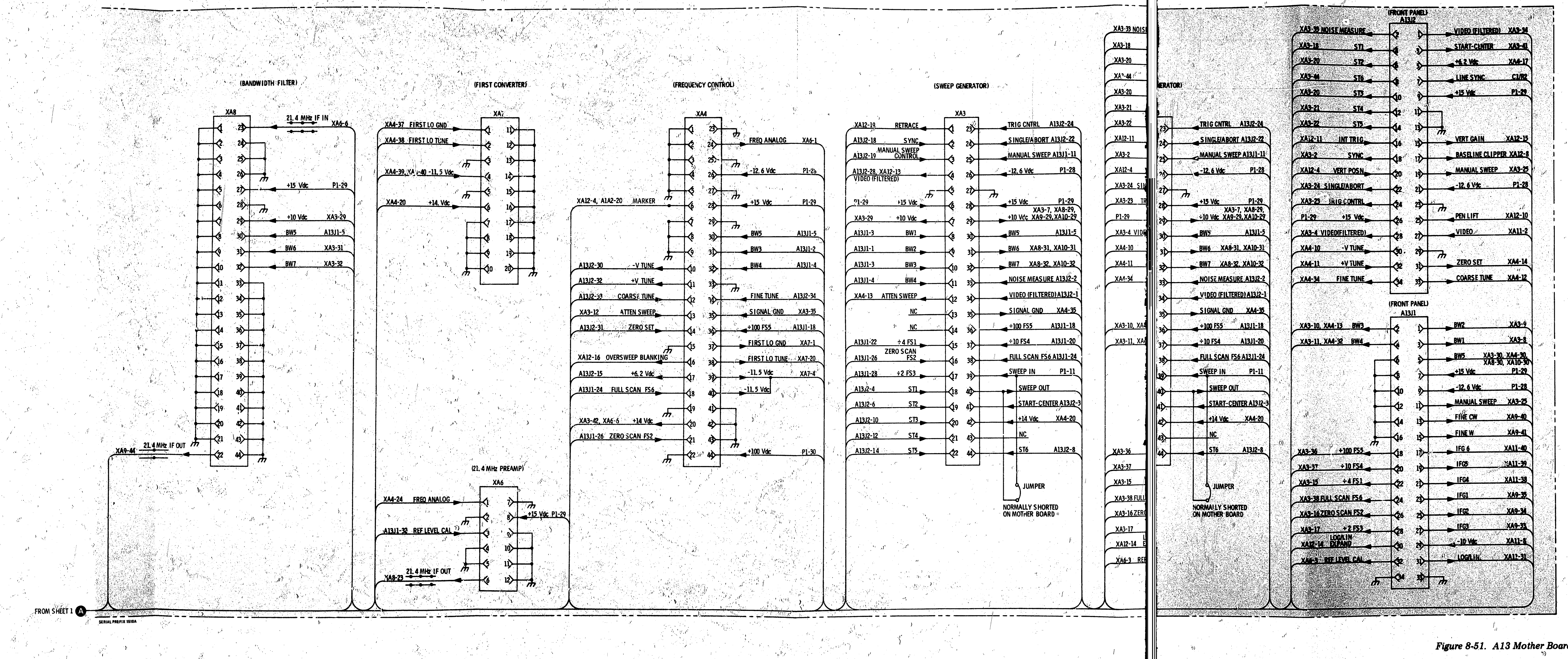


Figure 8-52. A13 Mother Board, Component Locations



1. THE +15 Vdc LINE GOES TO THE FOLLOWING POINTS: A13J1-7, A13J2-9, A13J2-26 XA3-6, XA3-28, XA4-28, XA6-8, XA8-27, XA9-27, XA10-27, XA12-18.
2. THE -12.6 VDC LINE GOES TO THE FOLLOWING POINTS: A13J1-9, A13J2-21, XA3-26, XA4-26, XA9-25, XA11-25, XA12-7.
3. ARROWS DENOTE SIGNAL FLOW

OUTGOING SIGNAL

INCOMING SIGNAL

Figure 8-51. A13 Mother Board Assembly Schematic (2 of 2)

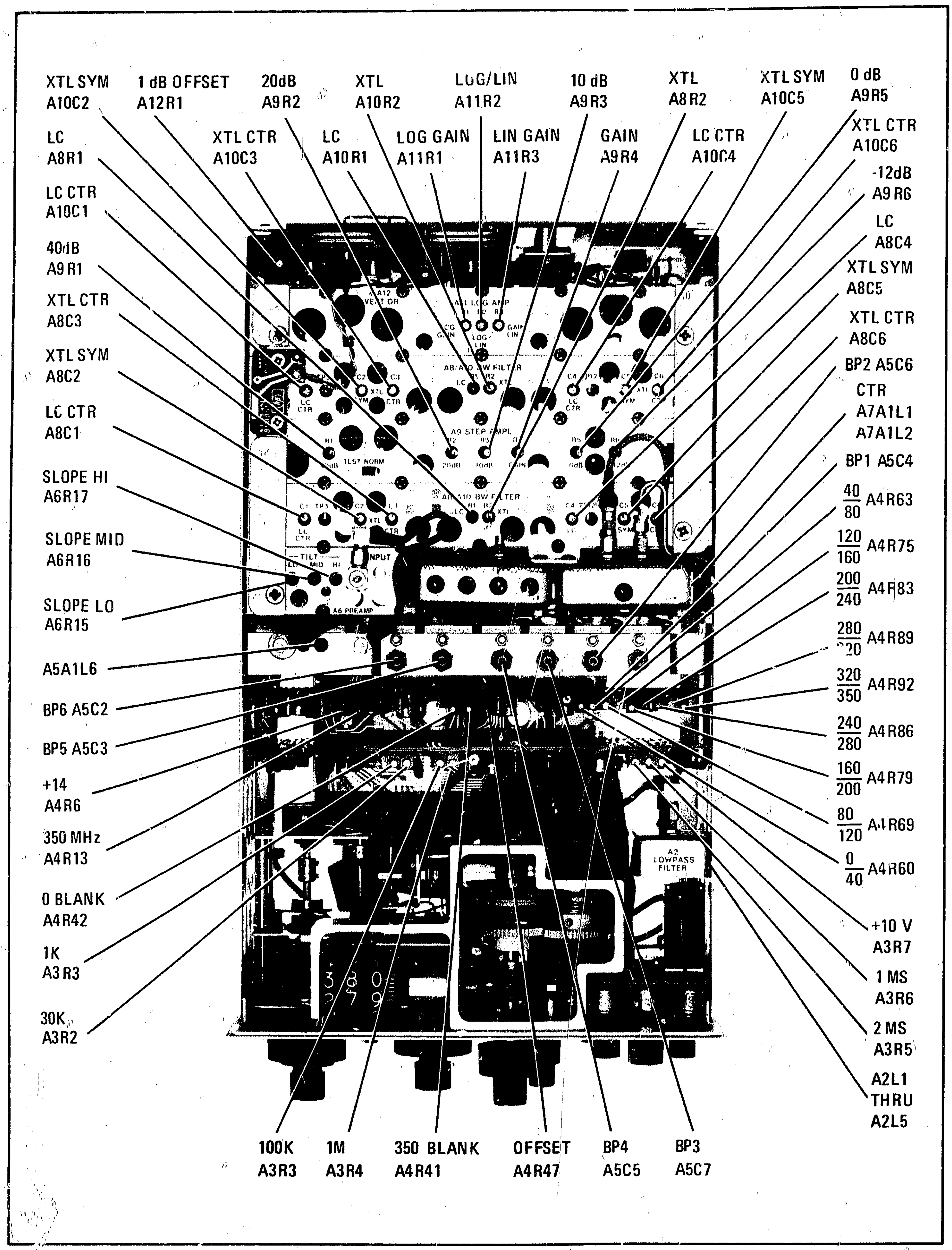


Figure 8-53. Adjustment Locations

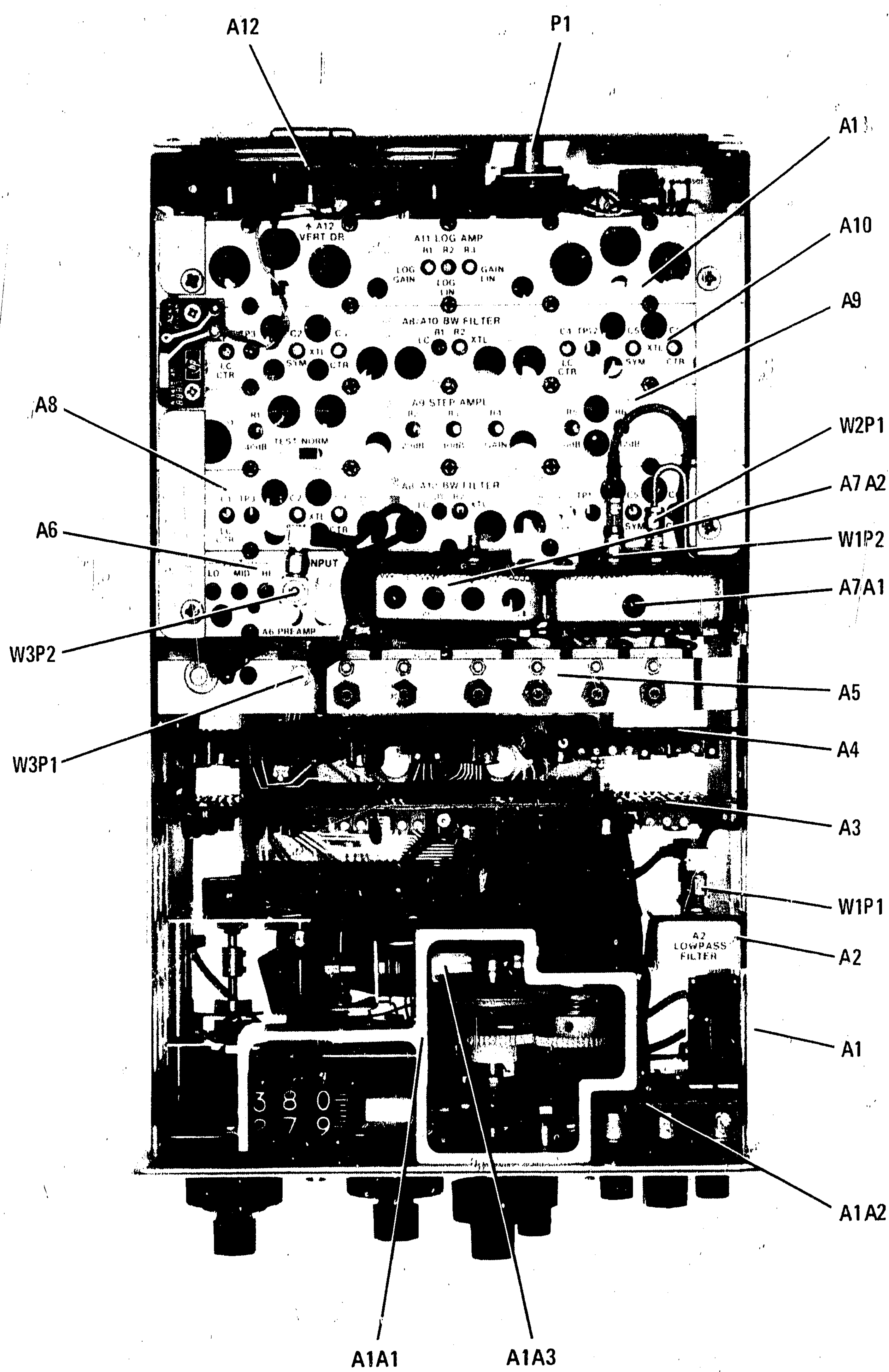


Figure 8-54. Top View, Major Assembly and Component Locations

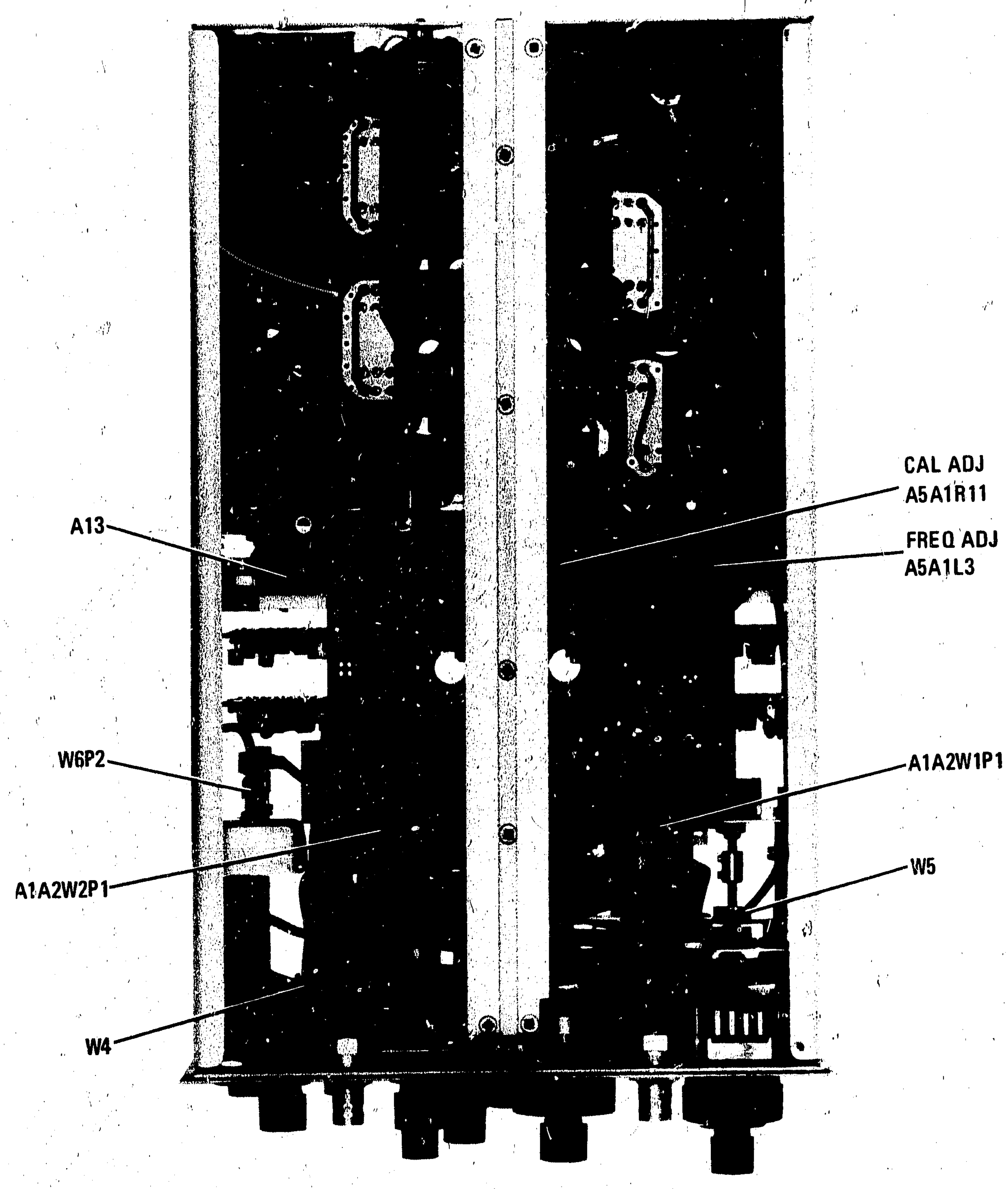
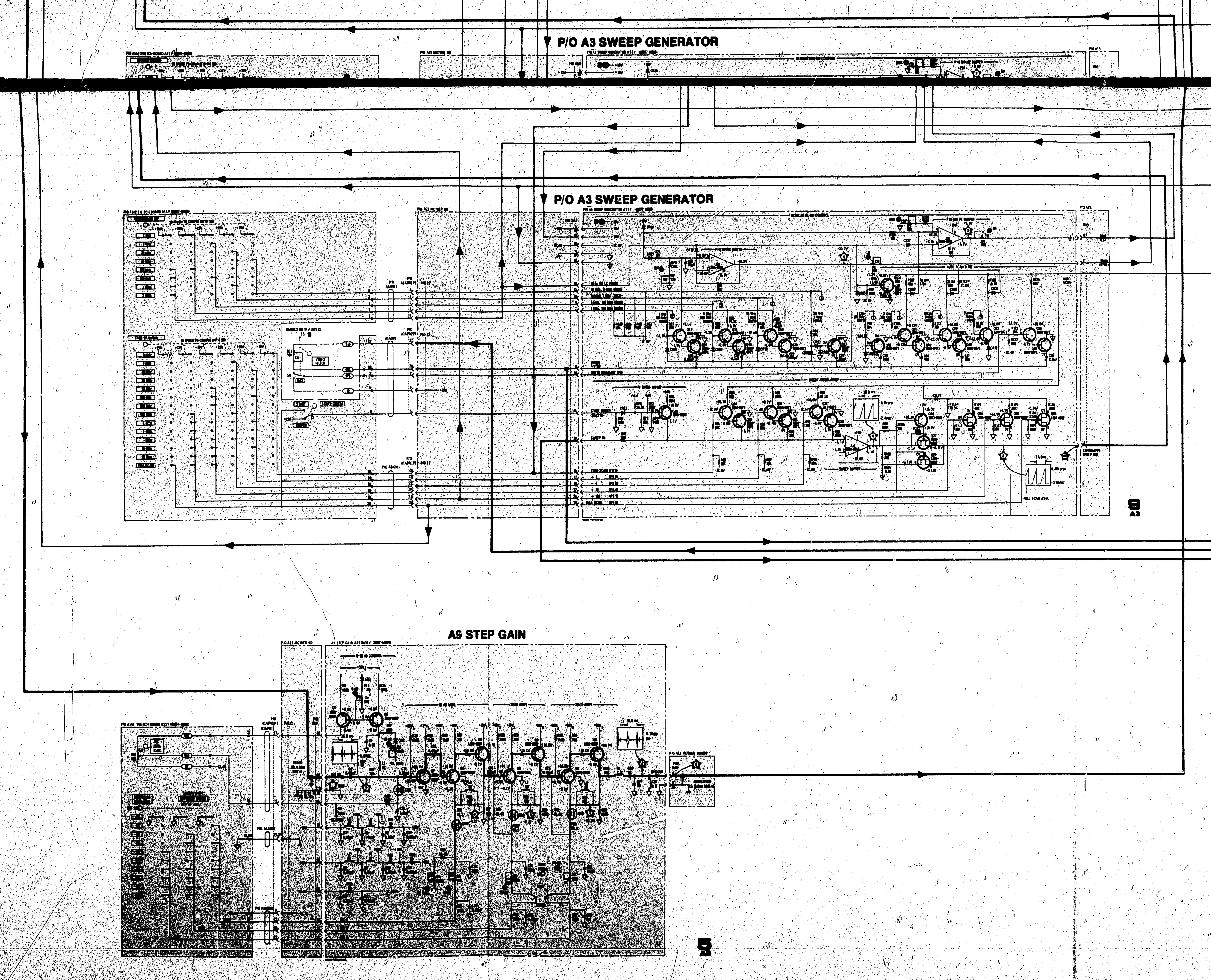


Figure 8-55. Bottom View, Major Assembly and Adjustment Locations

A7 FIRST CONVERTER
A5 SECOND CONVERTER
A6 21.4 MHz PREAMPLIFIER
A8 BANDWIDTH FILTER
2
3
4
A4 FREQUENCY CONTROL
A10 BANDWIDTH FILTER
A10 BANDWIDTH FILTER
A11 LOG AMPLIFIER
11
7
P/O A3 SWEEP GENERATOR
A12 VERTICAL DRIVER

SCHEMATIC DIAGRAMS



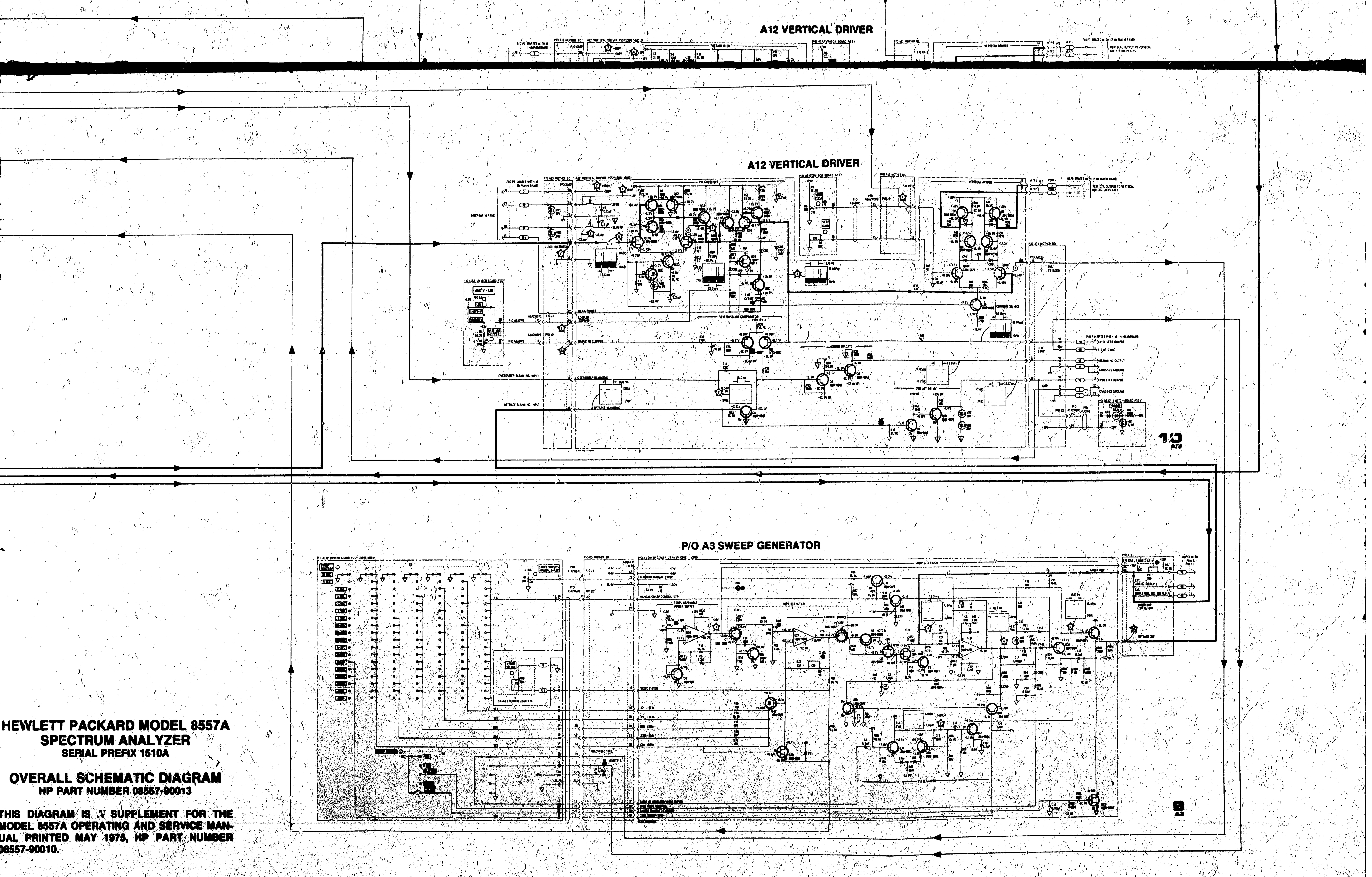
HEWLETT PACKARD MODEL 8557A SPECTRUM ANALYZER

SERIAL PREFIX 1510A

OVERALL SCHEMATIC DIAGRAM

HP PART NUMBER 08557-90013

THIS DIAGRAM IS A SUPPLEMENT FOR THE MODEL 8557A OPERATING AND SERVICE MANUAL PRINTED MAY 1975, HP PART NUMBER 08557-90010.



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