Errata

Title & Document Type: **8407A Network Analyzer Operating and Service Manual**

Manual Part Number: **08407-90038**

Revision Date: **December 1971**

About this Manual

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HP References in this Manual

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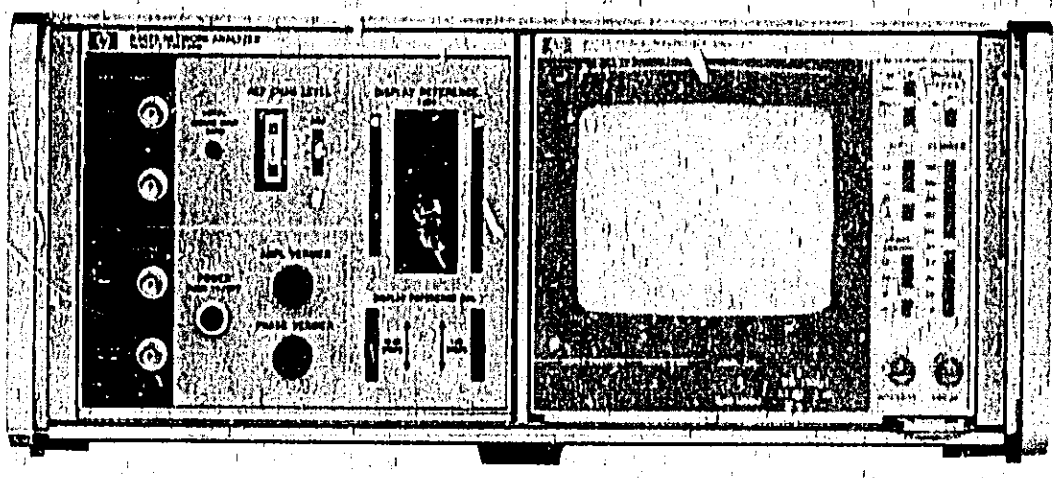
OPERATING AND SERVICE MANUAL

NETWORK ANALYZER

8407A



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CERTIFICATION

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

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of one year from the date of shipment. Hewlett-Packard will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard, and provided the preventive maintenance procedures in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

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OPERATING AND SERVICE MANUAL

NETWORK ANALYZER
8407A

Serial Prefix: 1144A

This manual applies directly to HP Model 8407A Network Analyzer having serial prefix number 1144A.

Serial Prefixes Not Listed

For serial prefixes above 1144A, a "Manual Changes" sheet is included with this manual. For serial prefixes below 1144A, see Appendix I.

Manual Part No. 08407-90038
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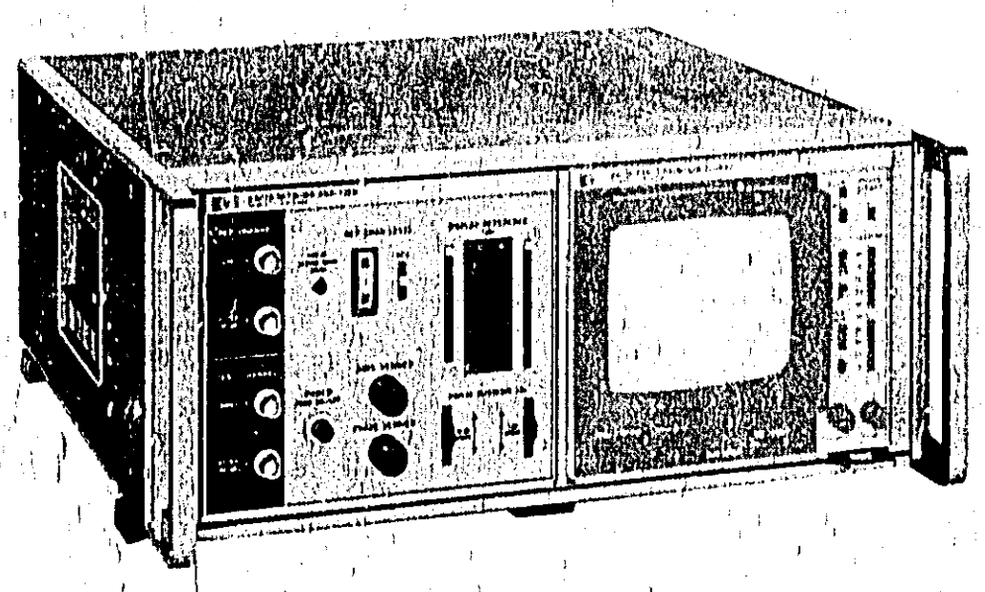

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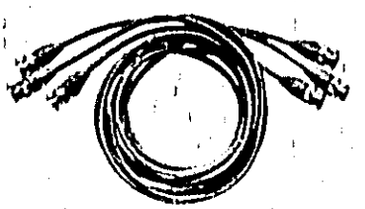

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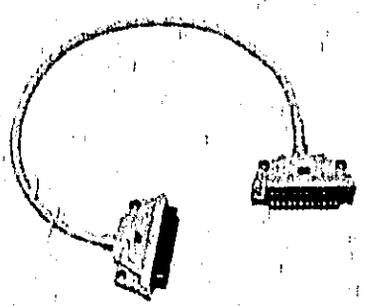

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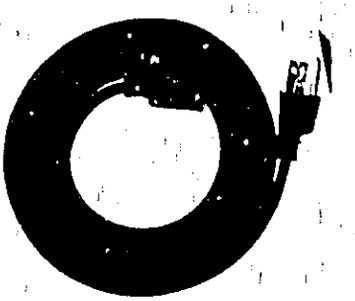

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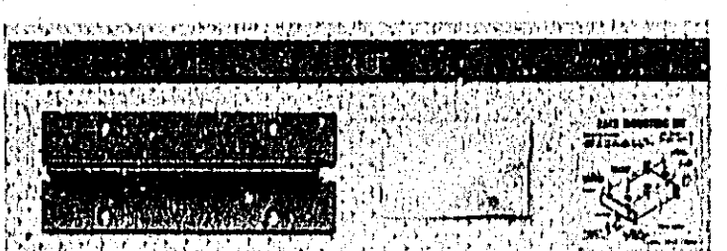


RACK MOUNTING KIT

Figure 1-1. Model 8407A and Accessories

SECTION I
GENERAL INFORMATION

1-1. DESCRIPTION

NOTE

The Model 8407A Network Analyzer may be maintained using the modular exchange program provided by the factory. See Paragraph 5-3 for details.

1-2. The Model 8407A Network Analyzer, together with an appropriate plug-in display unit and swept frequency source, measures the phase and amplitude ratio of RF signals in the 0.1 to 110 MHz range. With appropriate accessories, the instrument may also be used as a reflectometer, measuring phase and magnitude of a reflected signal.

1-3. The 8407A measures phase angles from zero to 360 degrees and amplitude ratios over a dynamic range of 80 dB. These measurements may be made at single frequencies or over swept segments of the operating range.

1-4. Typical measurements possible with the network analyzer include:

1) Swept-frequency response measurements of amplitude and phase through a system, filter, or amplifier.

2) Group delay measurements for communications systems.

3) Antenna testing.

4) Comparison of amplitude and phase of matched amplifiers.

1-5. The Model 8407A converts the two RF signals being measured to two 278-kHz signals that have the same relative amplitude and phase as the original RF signals. These two 278 kHz signals are applied to the plug-in display where the phase and amplitude information is detected and displayed. Operating power for the plug-in display is furnished by the 8407A.

1-6. The network analyzer automatically tracks the reference input signals. In sweep mode, the sweep width is limited only by the RF signal source being used. The 8407A is specifically designed for use with the HP Models 8601A and 8690B/8698B Sweep Oscillators. The 8601A sweeps the range between 0.1 and 110 MHz and the 8690B/8698B sweeps the range between 0.4 and 110 MHz.

1-7. The RF signal applied to the reference input of the 8407A is used to actuate the automatic tuning as well as develop the automatic gain control (AGC) signal for both reference and test channels. A reference channel level meter continuously monitors the reference signal and indicates whether the level is in the range required for making measurements.

1-8. Controls on the Model 8407A include a reference channel level step attenuator, display reference (amplitude offset) attenuator, and amplitude and phase vernier adjustments. The display reference attenuators allow a reference level trace to be placed at a convenient position on the plug-in display.

1-9. The complete list of specifications for the Model 8407A Network Analyzer is given in Table 1-1. Specifications that include the plug-in display unit performance are given in the Operating and Service Manuals for the display units.

1-10. ACCESSORIES FURNISHED

1-11. A detachable power cable, a rack-mounting kit, a servicing cable, two 50-ohm terminations and three BNC cables are supplied with Model 8407A.

1-12. Rack Mounting Kit

1-13. The rack-mounting kit contains all the hardware needed to adapt the Model 8407A cabinet for installation in equipment racks having standard 19-inch spacing. Instructions for conversion to rack-mounting are included with the kit.

1-14. Servicing Cable

1-15. The servicing cable permits all necessary interconnections to be made between the Model 8407A and a plug-in display unit with the unit outside the plug-in compartment.

Table 1-1. Specifications

FREQUENCY RANGE:
0.1 to 110 MHz.

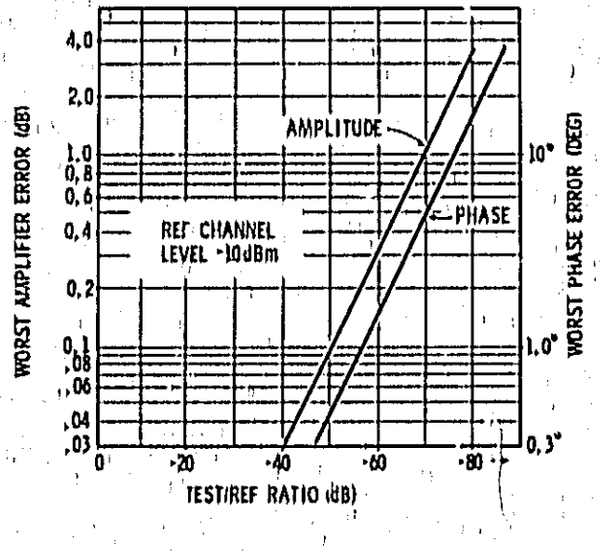
TEST INPUT:
Direct: −10 to −90 dBm, signal range.
Attenuated: +20 to −50 dBm, signal range.
Impedance: 50 ohms, VSWR <1.08.
Option 008: 75 ohm, VSWR <1.08.
Damage Level: +26 dBm/50 Vdc.

REFERENCE INPUT:
Direct: −10 to −60 dBm.
Attenuated: +20 to −20 dBm.
Impedance: 50 ohms, VSWR <1.08.
Option 008: 75 ohms, VSWR <1.08.
Damage Level: +26 dBm/50 Vdc.

AMPLITUDE ACCURACY:
Frequency Response, TEST inputs > − 60 dBm DIRECT (may be calibrated out): ± 0.2 dB, 0.1 to 110 MHz; ±0.05 dB over any 10 MHz portion. Typically ±0.05 dB, 0.1 to 110 MHz for DIRECT inputs (REFERENCE level of −10 dBm).

Display Reference: <0.05 dB/1-dB step, total error does not exceed 0.1 dB; <0.1 dB/10 dB-step, total error does not exceed 0.25 dB.

Crosstalk: When REFERENCE CHANNEL level equals −10 dBm (conditions for best signal-to-noise ratio), amplitude error due to crosstalk and residual low-level signals is ≤ that shown on the graph below.



Common Mode Level Variation (AGC tracking): <0.5 dB/10 dB over 30 dB operating range. For minor source and transducer variations (<0.05 dB), this error is negligible.

PHASE ACCURACY:
(amplitude reading must be on-scale at the 10 dB/division setting on the 8412A)

Frequency Response, TEST inputs >−60 dBm DIRECT (may be calibrated out); ±5 degrees, 0.1 to 110 MHz, ±2 degrees over any 10 MHz portion, 1 to 110 MHz. Typically ±2 degrees, 1 to 110 MHz for DIRECT inputs (REFERENCE level of −10 dBm).

Display Reference: <0.5°/10 dB step; total error does not exceed 3°.

Crosstalk: When REFERENCE CHANNEL level equals −10 dBm (conditions for best signal-to-noise ratio), phase error due to crosstalk and residual low-level signals is ≤ that shown on the graph above.

Common Mode Level Variation (AGC tracking): <0.8°/10 dB over 30 dB operating range. For minor source and transducer variation (<0.5 dB), this error is negligible.

POWER:
65 watts, 50−60 Hz, 115/230 Vac ±10%.

WEIGHT:
Net, 32 lb (14.6 kg).
Shipping, 39 lb (17.8 kg).

DIMENSIONS:
7-1/4 in. high, 18-3/8 in. deep, 16-3/4 inches wide.

1-16. ACCESSORIES AVAILABLE

1-17. Two accessory kits are designed specifically for the 8407A and are as follows:

1) 11652A Reflection-Transmission Kit

2) 11654A Passive Probe Kit.

1-18. Other accessories available are the 1123A Active Voltage Probe, the 10020A Resistive Divider Probe, and the 1110A Clip-on Current Probe.

1-19. The 11652A Reflection-Transmission Kit facilitates measurement of return loss, VSWR, complex impedance and reflection coefficient, as well as transmission magnitude and phase. Included in the kit are the Model 8721A directional bridge, a precision termination and low-leakage cables.

1-20. The 11654A Passive Probe Kit allows probing directly into circuits with minimum disturbance. Measurements may be made of either voltage or current with the probe kit.

1-21. The 1123A Active Voltage Probe is valuable for probing low-level signals accurately. This probe has a 220 MHz bandwidth (3 dB). Two probes are recommended for the 8407A.

1-22. The 10020A Resistive Divider Probe allows matching various source impedances. Six division ratios from 1:1 to 100:1 are provided. Two probes are required for the 8407A.

1-23. The 1110A Clip-on Current Probe is convenient for simply "clipping on" circuit leads for current measurements. Frequency range of the probe is up to 40 MHz.

1-24. DISPLAY UNITS

1-25. All plug-in display units designed for use with the Model 8407A are completely interchangeable. These units are powered by the Model 8407A with all necessary interconnections made automatically when the unit is properly installed.

1-26. Model 8412A Phase-Magnitude Display

1-27. The Model 8412A is used in either transmission or reflection measurements to display phase and magnitude characteristics of a unit under test. Two traces, one magnitude and the other phase, are shown simultaneously on a built-in cathode ray tube. Magnitude is calibrated in dB and phase in degrees. The 8412A also supplies simultaneous external output voltages proportional to the magnitude and phase for use with a graphic recorder. Marker signals spot-intensify the trace for frequency reference and blanking signals eliminate the trace between sweep intervals.

1-28. Model 8413A Phase-Gain Indicator

1-29. The Model 8413A is intended for fixed- and swept-frequency transmission or reflection measurements, providing phase and amplitude information in two forms: meter indication and analog voltage. The meter indicates phase or amplitude according to the function selected, while the analog voltages are continuously produced by both phase and amplitude circuits. The meter has center-zero scales with phase ranges of ±6°, ±18°, ±60°, and ±180° and amplitude ranges of ±3, ±10, and ±30 dB. Calibrated phase offset in 10° steps allows any phase angle to be read on the best-resolution range of ±6°. The analog voltages can be used to obtain calibrated plots of phase angle and amplitude ratio against frequency on a conventional dual-trace oscilloscope or graphic recorder.

1-30. Model 8414A Polar Display

1-31. The Model 8414A displays reflection measurements (impedance, admittance, reflection coefficient, return loss). It displays amplitude and phase in polar form on a built-in cathode ray tube, and provides simultaneous voltages proportional to the amplitude and phase components of the display. Frequency marker and blanking signals can be applied to the Model 8414A. Marker signals spot-intensify the trace for frequency reference, while blanking signals eliminate the trace between sweep intervals when there is no RF power. Supplied Smith Chart graticule overlays permit impedance and admittance to be read directly from the display.

1-32. SIGNAL SOURCE REQUIREMENTS

1-33. The Model 8407A Network Analyzer is specifically designed to be used with the HP Model 8601A and 8690B/8698B Sweep Generators. The 8601A sweeper covers the RF band between 0.1 and 110 MHz and the 8690B/8698B has a range between 0.4 and 110 MHz. A signal from the internal voltage-tuned oscillator (VTO) in the sweeper is used as an integral part of the 8407A phase-lock system. The VTO sweeps between 200.1 MHz and 310 MHz and is frequency-locked to the sweeper RF output signal. The power levels from the sweeper are +20 dBm maximum at the RF output and −3 to −15 dBm minimum at the VTO output. Flatness of the RF output should be at least 0.5 dB over the full range, harmonics should be at least 30 dB below the carrier and spurious signals at least 35 dB below the carrier.

1-34. INSTRUMENTS COVERED BY MANUAL

1-35. This manual applies directly to instruments having a serial prefix number listed on the title page (first three numbers of serial number). If the serial prefix of your instrument is other than those listed, there are differences between the instrument described in this manual and your instrument. These differences are described in Appendix I at the rear of this manual or in a Manual Changes Sheet supplied with this manual. If the Manual Changes sheet is missing, the information can be obtained from your nearest Hewlett-Packard Sales and Service Office. (See lists at the back of this manual.) The Manual Changes Sheet may also include an errata section which describes manual correction information which applies to the manual for all instruments.

SECTION II
INSTALLATION

2-1. INITIAL MECHANICAL INSPECTION

2-2. The Network Analyzer was carefully inspected, both mechanically and electrically, prior to shipment. If external damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Check the instrument for external damage such as broken controls or connectors and dents or scratches on the panel surface. If damage is evident, refer to Paragraph 2-5 for recommended claim procedure and Paragraph 2-7 for repackaging information. If the shipping carton is not damaged, check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. If the instrument appears undamaged, check for all supplied accessories, then perform the electrical check (Paragraph 2-3).

2-3. INITIAL ELECTRICAL INSPECTION

2-4. Check the electrical performance of the Network Analyzer as soon as possible after receipt by performing the Performance Test (Paragraph 5-8 through 5-21). The Performance Test procedure compares the electrical performance to the specifications of Table 1-1. This test is also suitable for incoming quality control inspection. If the Network Analyzer does not perform within the specifications, refer to Paragraph 2-5 for recommended claim procedure and Paragraph 2-7 for repackaging information.

2-5. CLAIMS

2-6. If physical damage is evident, or if the instrument does not meet specifications when received, notify the carrier and the nearest Hewlett-Packard Sales and Service Office. (See list at back of manual.) The sales and service office will arrange for repair or replacement without waiting for settlement of a claim with the carrier.

2-7. REPACKAGING FOR SHIPMENT

2-8. Using Original Packaging

2-9. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard sales and service offices listed at the back of this manual. If the Model 8407A 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.

2-10. Using Other Packaging

2-11. The following general instructions should be used for repackaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard service office or 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 to 4" layer) around all sides of instrument to provide firm cushioning and prevent movement inside the container. Protect control panel with cardboard.

d. Seal the shipping container securely and mark it FRAGILE to assure careful handling.

e. In any correspondence, refer to instrument by model number and full serial number.

2-12. PREPARATION FOR USE

2-13. Power Requirements

2-14. The 8407A Network Analyzer requires a power source of 115 or 230 Vac ±10%, 50 to 60 Hz single phase. Power required is approximately 65 watts.

2-15. Selecting 115- or 230-Volt Operation

2-16. A rear panel two-position slide switch permits operation from either a 115 or 230 volt ac power source. The number visible on the switch indicates the line voltage to which the instrument

should be connected. To prepare the Model 8407A for operation, position the 115/230 volt slide switch so that the number visible on the slider corresponds to the line voltage.

CAUTION

To avoid damage to the instrument, set the 115/230 volt switch for the line voltage to be used before connecting the power cable.

2-17. Power Cable

2-18. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panels and cabinets be grounded. Accordingly, the network analyzer is equipped with a three-conductor power cable which grounds the panel and cabinet when plugged into an appropriate receptacle. The offset pin of the three-prong connector is the ground pin. To preserve the protection feature when operating the Network Analyzer from a two-contact outlet, use a three-prong to two-prong adapter (HP Stock No. 1251-0048) and connect the green pigtail on the adapter to ground.

2-19. Cooling

2-20. Clearances for ventilation should be 3 to 4 inches at the rear of the cabinet and 2 to 3 inches at the sides. The clearances provided by the plastic feet in bench stacking and the filler strips in rack mounting are adequate for the top and bottom cabinet surfaces.

2-21. Bench Operation

2-22. The Model 8407A cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The tilt stand inclines the instrument for ease in reading the meter. The plastic feet provide clearance for air circulation and make the Model 8407A self-aligning when stacked on other Hewlett-Packard full rack-width modular instruments.

2-23. Rack Mounting

2-24. The rack-mounting kit contains all the hardware needed for adapting the Model 8407A cabinet for installation in equipment racks having standard 19-inch spacing. Preparation for rack mounting is illustrated in Figure 2-1.

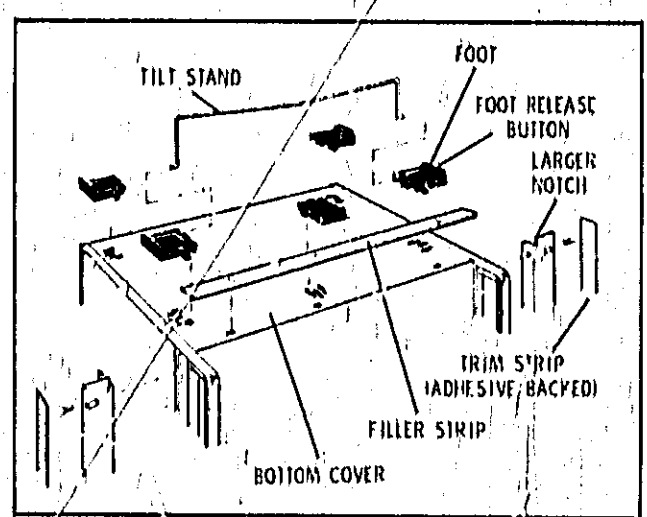


Figure 2-1. Preparation for Rack Mounting

OPERATION AND THEORY

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This operating section explains the function of the controls and indicators of the Model 8407A Network Analyzer and describes typical test setups for making transmission and reflection measurements. More detailed test setups are contained in the Operating and Service Manuals covering the individual plug-in display units such as the Model 8412A Phase-Magnitude Display or the Model 8414A Polar Display.

3-3. OPERATING PRECAUTIONS

3-4. Maximum Input Power

3-5. Do not apply more than +26 dBm or 50 Vdc to the front-panel reference or test channel DIRECT or ATTEN, input connectors or damage to the input circuits may occur.

3-6. Over-Voltage and Transient Protection

3-7. Transients may trigger the ±20V power supplies over-voltage protection. This condition can occur if the power is on when a display unit is either removed or installed in the mainframe. The over-voltage protection can also be triggered when turning 8407A power on and off very rapidly. To reset the ±20V supplies, turn the 8407A power off and allow a minimum of ten seconds, turn the power on and resume operation. If the over-voltage protection has been triggered for an extended period it may be necessary to turn the 8407A power off for about five minutes.

3-8. PANEL FEATURES

3-9. Front and rear panel features are described in Figures 3-1 and 3-2. Description numbers match the numbers on the illustration.

3-10. INSTRUCTIONS FOR MAKING MEASUREMENTS

3-11. A general operating procedure is given to show the principles of operating the network analyzer. Since a number of input transducers may be used and a number of plug-in displays are available, no attempt has been made to cover all combinations of instruments. However, the general test procedure given may be adapted for use with any input or display equipment. For step-by-step instructions, using any specific plug-in display, refer to the Operating and Service Manual for that plug-in. Additional operating information for the Network Analyzer, as well as error analyses of measurements, is contained in the HP manual "RF Network Analysis with the HP 8407A", available upon request.

3-12. TRANSMISSION MEASUREMENTS

3-13. To perform a typical transmission measurement, use the following general procedure:

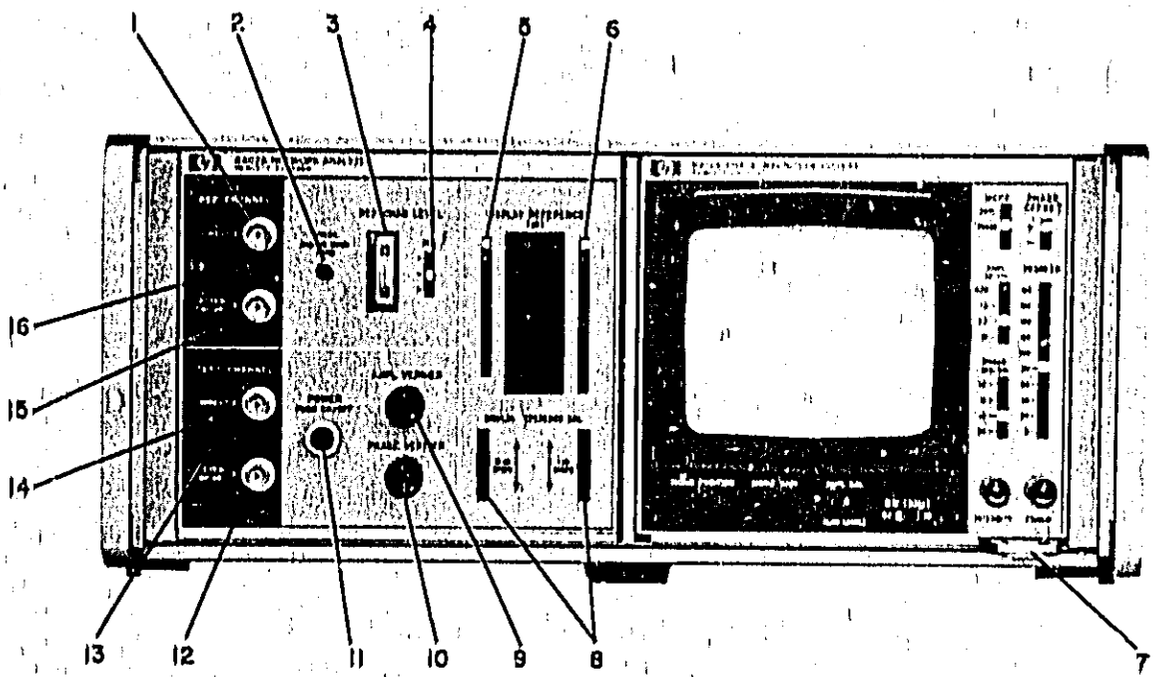
1. Connect equipment as shown in Figure 3-3, selecting one of the alternate test setups. Determine the approximate signal levels at the reference and test channel inputs and select either the DIRECT or ATTEN input connector for each channel.

2. Remove the unit or units under test and connect both reference and test cables to the signal source for initial calibration. If alternate test setup No. 1 or 2 is used, connect the 8407A inputs to the outputs of the power splitter. If test setup No. 3 or 4 is used, connect both of the 8407A probes to the input of the unit under test.

3. Adjust the signal source rf output level for an indication in the OPERATE range of the REF CHAN LEVEL meter. Be sure that the UNCAL REDUCE INPUT RATIO light is not lit. If it is lit, the ratio between the test channel and the reference channel signals must be changed. The reference channel signal level may be increased either by the REF CHAN LEVEL ADJ switch or by changing the rf input cable from the ATTEN (40 dB) connector to DIRECT input. If the REF CHAN LEVEL meter indicates above the OPERATE range, reduce the rf signal level from the sweeper. The signal ratio between channels may also be reduced by reducing the signal level into the test channel. This may be done by changing the input rf cable from the test channel DIRECT connector to the ATTEN (40 dB) input or by reducing the rf signal level from the sweeper.

4. Adjust the plug-in display unit (8412A, 8413A, or 8414A) for a convenient zero reference. If an 8412A is used, adjust for center screen. The 8407A DISPLAY REFERENCE CAL thumbwheel controls should be set to

FRONT PANEL FEATURES



1. REF CHANNEL DIRECT Input Connector. Reference channel RF input for signal inputs in the range of −10 to −90 dBm. If the input RF signal is greater than −10 dBm, the ATTEN input should be used. In this case a 50-ohm termination must be connected to DIRECT input.

2. UNCAL REDUCE INPUT RATIO light. This is an overload indicator that monitors signal levels of the test channel within the instrument. When an overload occurs, either the reference channel signal must be increased, or the test channel signal must be decreased. The reference channel signal may be increased by either adjusting the REF CHANNEL LEVEL ADJ attenuator switch or by changing the RF input cable from ATTEN to DIRECT input. The test channel signal may be decreased by changing the RF input cable from DIRECT to ATTEN input, or by reducing the RF signal level from the sweep oscillator.

3. REF CHAN LEVEL Meter. An indication in the OPERATE range of the meter shows that the reference-channel input signal level is in the correct range to make signal measurements.

4. REF CHAN LEVEL ADJ Switch. The Switch is a three-position attenuator in the reference channel. Each step is 20 dB. The switch allows the reference channel signal to be adjusted to produce a REF CHAN LEVEL meter indication in the OPERATE range.

5. DISPLAY REFERENCE (dB) Ten dB/Step Switch. This switch offsets the amplitude trace on the plug-in display by adding or reducing gain of the test channel in 10 dB steps.

6. DISPLAY REFERENCE (dB) One dB/Step Switch. This switch offsets the amplitude

Figure 3-1. Front Panel Features (1 of 2)

FRONT PANEL FEATURES

trace or the plug-in display by adding or reducing gain of the test channel in 1 dB steps.

7. Pivoting lever [illegible] retains, and extracts the plug-in display units.

8. DISPLAY REFERENCE CAL Thumbwheels. These thumbwheels set the scales for the DISPLAY REFERENCE 10 dB/step and 1 dB/step switches. This allows the scales to be set at zero dB for the calibration position of the switches. When measuring gain or attenuation, the displayed magnitude trace may be returned to the calibration point on the graticule with the DISPLAY REFERENCE switches. This allows the total gain or attenuation of the unit under test to be read directly from the DISPLAY REFERENCE scales.

9. AMPL VERNIER Control. Uncalibrated test channel gain vernier with at least 2 dB of continuous range. Gain increases with clockwise rotation.

10. PHASE VERNIER Control. Uncalibrated vernier adjustments of the phase between reference and test channel signals. Range is at least 50 degrees.

11. POWER ON/OFF Switch. Combination line power switch and power indicator. Switch lights when instrument is on.

12. TEST CHANNEL ATTEN (40 dB) Input Connector. Test channel RF input that attenuates the RF input signal by 40 dB greater than the TEST CHANNEL DIRECT input. Signal input range for the ATTEN input is between +20 and −50 dBm. If the input RF signal is less than −50 dBm, the DIRECT input should be used. Damage level is above +26 dBm and 50 Vdc.

13. TEST CHANNEL PROBE POWER Connector. Provides power for active test-channel accessory probe.

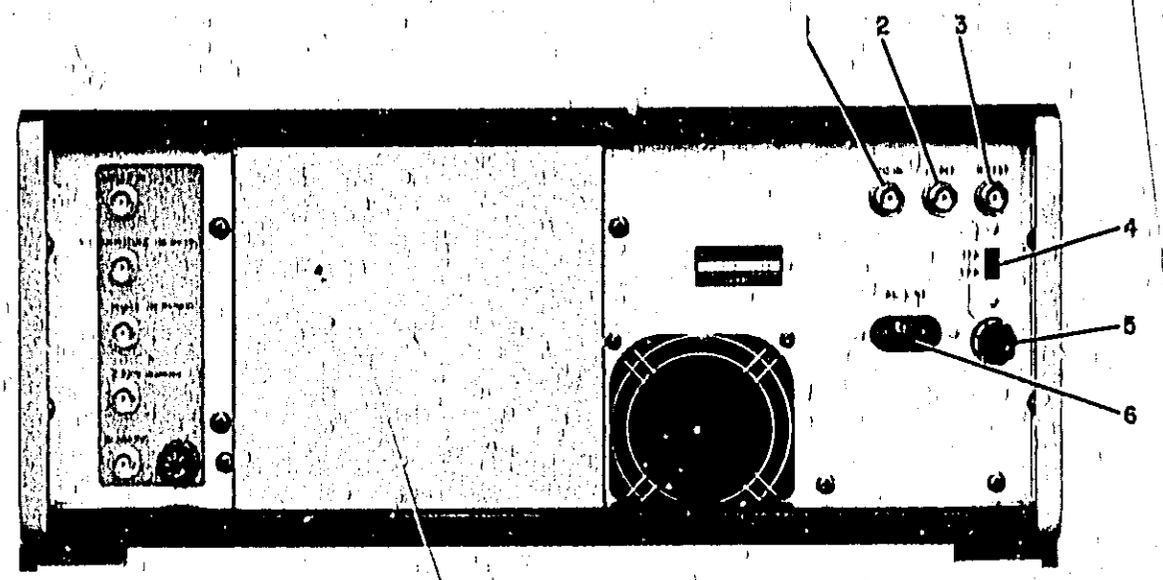
14. TEST CHANNEL DIRECT Input Connector. Test channel RF input that is used for signal inputs in the range of −10 to −90 dBm. If the input RF signal is greater than −10 dBm, the ATTEN input should be used. In this case, a 50-ohm termination must be connected to DIRECT input. Damage level is above +26 dBm and 50 Vdc.

15. REF CHANNEL ATTEN (40 dB) Input Connector. Reference channel RF input that attenuates the RF input signal by 40 dB greater than the REF CHANNEL DIRECT input. Signal input range for the ATTEN input is between +20 and −50 dBm. Damage level is above +26 dBm and 50 Vdc.

16. REF CHANNEL PROBE POWER connector. Provides power for active reference-channel accessory probe.

Figure 3-1. Front Panel Features (2 of 2)

REAR PANEL FEATURES



1. VTO IN Connector. Input for voltage tuned oscillator (VTO) signal from sweeper. VTO signal frequency should be in the range of 200.1 to 310 MHz and power level should be between −5 and −15 dBm nominal. The VTO signal is frequency locked to the sweeper RF output signal. The HP 8601A or 8690B/8698B Sweep Oscillator VTO output provides the proper signal.

2. IF REF Connector. IF reference channel signal output. This signal is a 278 kHz sine wave with fixed amplitude at about 1 volt p-p.

3. IF TEST Connector. IF test channel signal output. This is a 278 kHz sine wave signal containing all the amplitude and phase information present on the RF input signal. Amplitude range is 0 to about 1 volt p-p.

4. Line Voltage Selector. Permits operation from 115 or 230 Vac. Number showing on the slider is the selected operating voltage. Adjacent number on the panel is the correct line fuse rating.

5. Power Line Fuseholder. Fuse should have rating shown adjacent to the number on line voltage selector.

6. AC LINE Power Cable Connector. NEMA type with offset pin connected to 8407A cabinet. Power requirements: 115 or 230 Vac ±10%, 50 to 60 Hz, approximately 85 VA.

Figure 3-2. Rear Panel Features

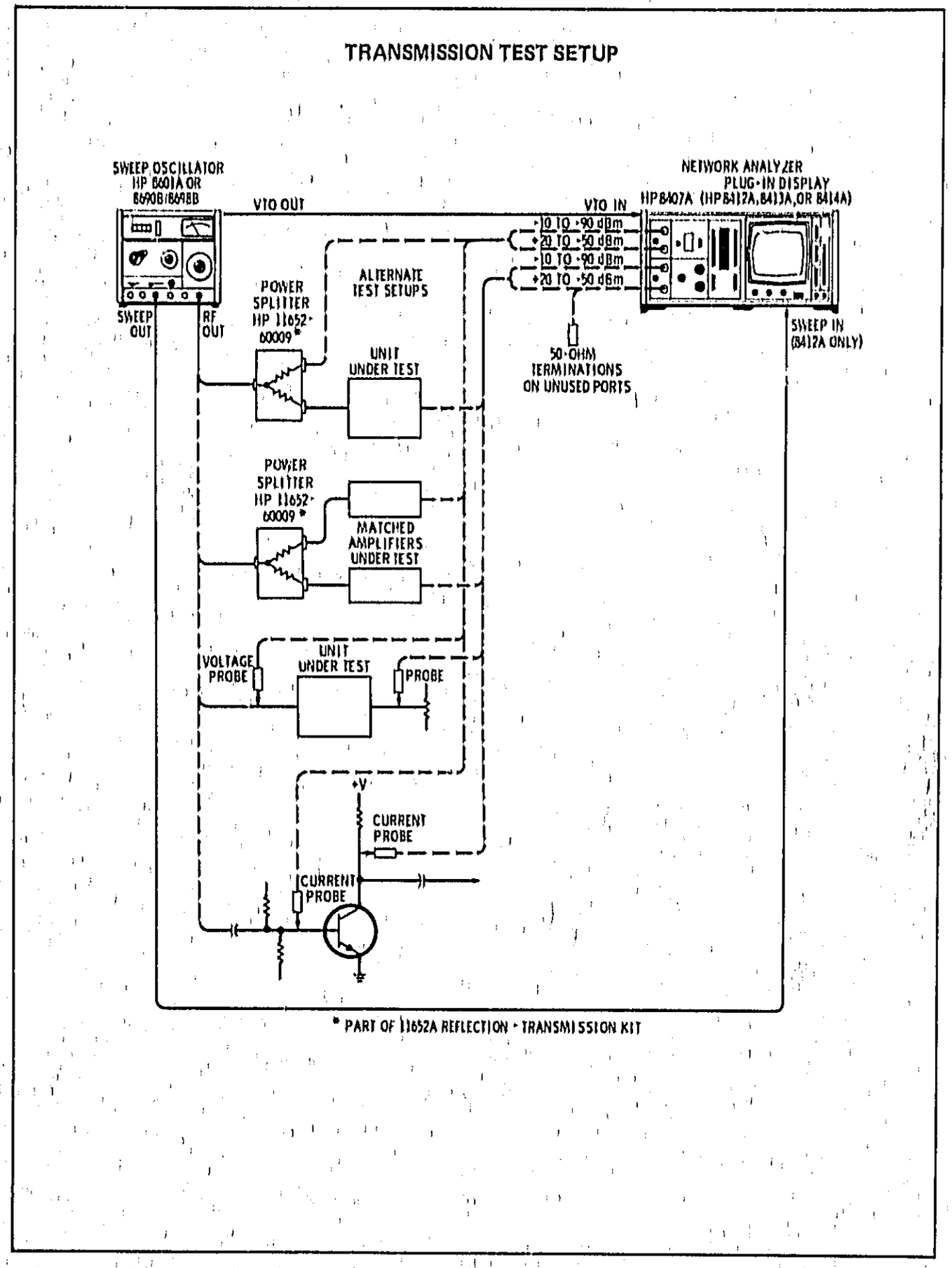


Figure 3-3. Transmission Test Setup

zero dB for the calibraton setting of the DISPLAY REFERENCE switches.

5. Reconnect the unit under test into the test setup and make a transmission measurement. The attenuation or gain may be determined by adjusting the DISPLAY REFERENCE switches to place a selected section of the trace on the calibration graticule. The attenuation or gain of the unit under test may then be read directly from the DISPLAY REFERENCE switch setting.

3-14. REFLECTION MEASUREMENTS.

3-15. To perform a typical reflection measurement, use the following general procedure:

1. Connect equipment as shown in Figure 3-4. Connect the RF short to the LOAD port of the directional bridge. Set the REF CHAN LEVEL ADJ switch to the middle position.

2. Adjust the signal source RF output level for an indication in the OPERATE range of the REF CHAN LEVEL meter. Be sure the test channel UNCAL REDUCE INPUT RATIO light is not lit. If it is lit, reduce the RF power from the signal source or change the REF CHAN LEVEL ADJ switch position until the light goes out.

3. With the RF short installed on the LOAD port, the reflection coefficient is 1.0 at 180 degrees and the return loss is zero dB. Adjust the plug-in display unit (8412A, 8413A, or 8414A) for a convenient zero reference. If an 8412A is used, adjust the 8407A DISPLAY REFERENCE and AMPL VERNIER controls for a magnitude trace on the top graticule line of the 8412A CRT and adjust 8407A PHASE VERNIER to position the phase trace on a convenient graticule line. If an 8413A is used with an oscilloscope for swept operation, adjust the oscilloscope amplitude trace to the top graticule on the CRT and the phase trace at a convenient center scale position. If an 8414A is used, adjust the 8407A DISPLAY REFERENCE, AMPL VERNIER controls to adjust the dot to the center left edge of the CRT.

4. Remove the RF short from the LOAD port of the directional bridge and connect the unit under test to the port. Make the reflection measurement.

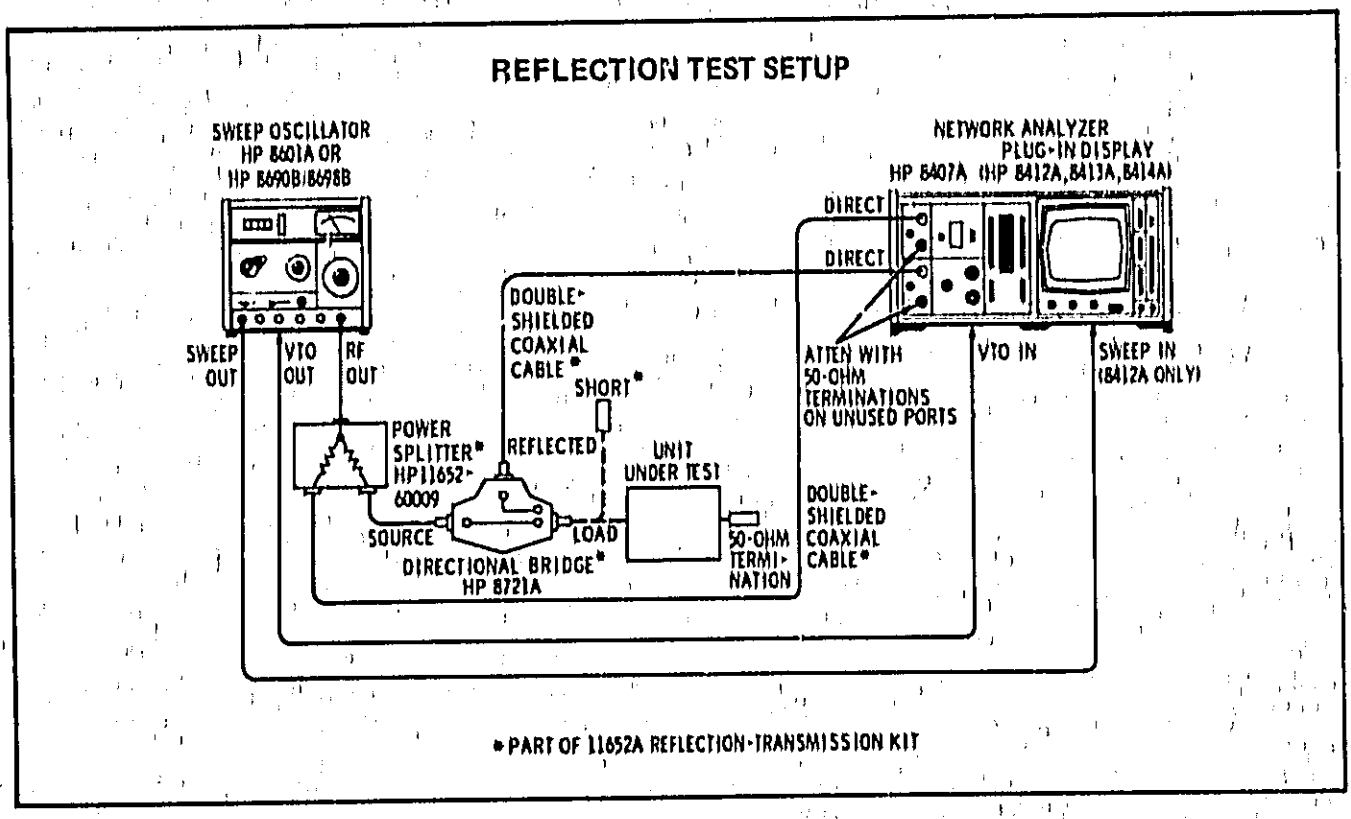


Figure 3-4. Reflection Test Setup

SECTION IV
PRINCIPLES OF OPERATION

4-1. GENERAL.

4-2. The Model 8407A Network Analyzer converts rf input signals to 278 kHz IF signals, while retaining the amplitude and phase information of the original rf input signals. An automatic gain control circuit levels the common-mode signal variations, allowing accurate measurements of amplitude and phase difference between the reference and test channels. The 278 kHz IF signals are applied to the input of a plug-in display, where the signals are detected and displayed on a CRT or meter as phase and magnitude information.

4-3. The 8407A contains precision attenuators in the test channel to facilitate amplitude measurements. Built-in input signal attenuators in both test and reference channels allow a wide range of rf input signal levels.

4-4. A simplified block diagram of the 8407A is shown in Figure 4-1. A more detailed block diagram is shown in Figure 7-7 and detailed theory of operation is presented in Section VII opposite the individual schematic diagrams.

4-5. SIMPLIFIED BLOCK DIAGRAM DESCRIPTION.

4-6. As shown in Figure 4-1, the reference and the test signals may be applied to either an attenuated or a direct input. The direct inputs are for rf signals in the range of −10 dBm to −90 dBm and the attenuated inputs accomodate signal inputs of +20 to −50 dBm. The 0.1 to 110 MHz rf test and reference signals are each mixed in separate IF mixer circuits that are driven by a common local oscillator signal. The output of the two IF mixers is a 278 kHz reference and a test IF signal.

4-7. The local oscillator signal applied to the IF mixers is derived from the difference between the 199.722 MHz oscillator and the VTO signal from the sweeper. The VTO signal from the sweeper is 200 MHz away from the rf input test and reference signals. In order to hold the 199.722 MHz oscillator on frequency, the 278 kHz IF signal is compared to a 278 kHz crystal oscillator in a phase detector circuit, and a resultant correction voltage is applied to the 199.722 MHz oscillator. These circuits form a phase-lock loop to hold the IF at 278 kHz. When the IF signal is not at 278 kHz, the 199.722 MHz oscillator searches above and below that frequency to attempt to phase lock the incoming rf signal. When 278 kHz is sensed from the IF, the oscillator stops searching and locks with the incoming rf signal.

4-8. An automatic level control circuit maintains a constant local oscillator (LO) signal level to the IF mixers. Holding the LO signal constant is necessary to obtain high-accuracy amplitude measurements.

4-9. The reference channel IF signal passes through a step attenuator that provides 20 dB/step of attenuation. This accomodates a wide range of reference channel signals without overloading the reference channel IF amplifier. The setting of the reference channel step attenuator does, however, affect the test channel amplitude, since the gain of the test channel AGC IF amplifier is controlled by the common AGC feedback amplifier which operates from the reference channel signal.

4-10. The AGC IF amplifiers in the reference and test channels, together with the AGC feedback amplifier, level the IF signals to eliminate common-mode signal-level variations. This allows precise amplitude measurements with an unleveled rf sweep oscillator source.

4-11. The reference channel contains a phase shift network that allows the phase of the reference channel to be changed approximately 50 degrees by the front panel PHASE VERNIER control. The output from the phase shift circuit is applied to the plug-in display and to the rear panel IF REF OUT connector.

4-12. The test channel signal from the IF mixer passes through the AGC IF amplifier, leveling the common mode variations in signal level. The output of the test channel IF mixer and the output of the AGC IF amplifier both are monitored by overload detector circuits. These circuits detect signal levels that are above a preset level and light the UNCAL REDUCE INPUT RATIO light. When this light is lit, the signal level passing through the test

channel IF stages is too high to make accurate measurements. If the overload occurs in the IF mixer, the test channel rf input signal must be reduced to eliminate the overload. However, if the overload occurs in the test channel AGC IF amplifier, the overload may be eliminated either by reducing the rf input signal to the test channel or by obtaining a higher AGC voltage into the test channel AGC IF amplifier. Increasing the AGC voltage will reduce the gain of the IF amplifier and eliminate overload in that stage. Higher AGC voltage is obtained by increasing the signal level through the reference channel IF amplifier. This may be accomplished either by changing the REF CHAN LEVEL ADJ to a higher position or by increasing the RF input signal level at the reference channel input.

4-13. The 278 kHz test channel IF signal from the AGC IF amplifier passes through a 10 dB/step and a 1 dB/step attenuator controlled from the front panel DISPLAY REFERENCE switches. These switches allow up to 89 dB of amplitude offset for convenience in setting amplitude reference levels and making amplitude measurements. The AMPL VERNIER control also works through the 1 dB/step IF attenuator for fine adjustment of the amplitude trace on the plug-in display.

4-14. The output from the 1 dB/step IF attenuator is the test channel amplitude and phase signals for the plug-in display. The test channel signal is also applied to the rear panel IF TEST OUT connector.

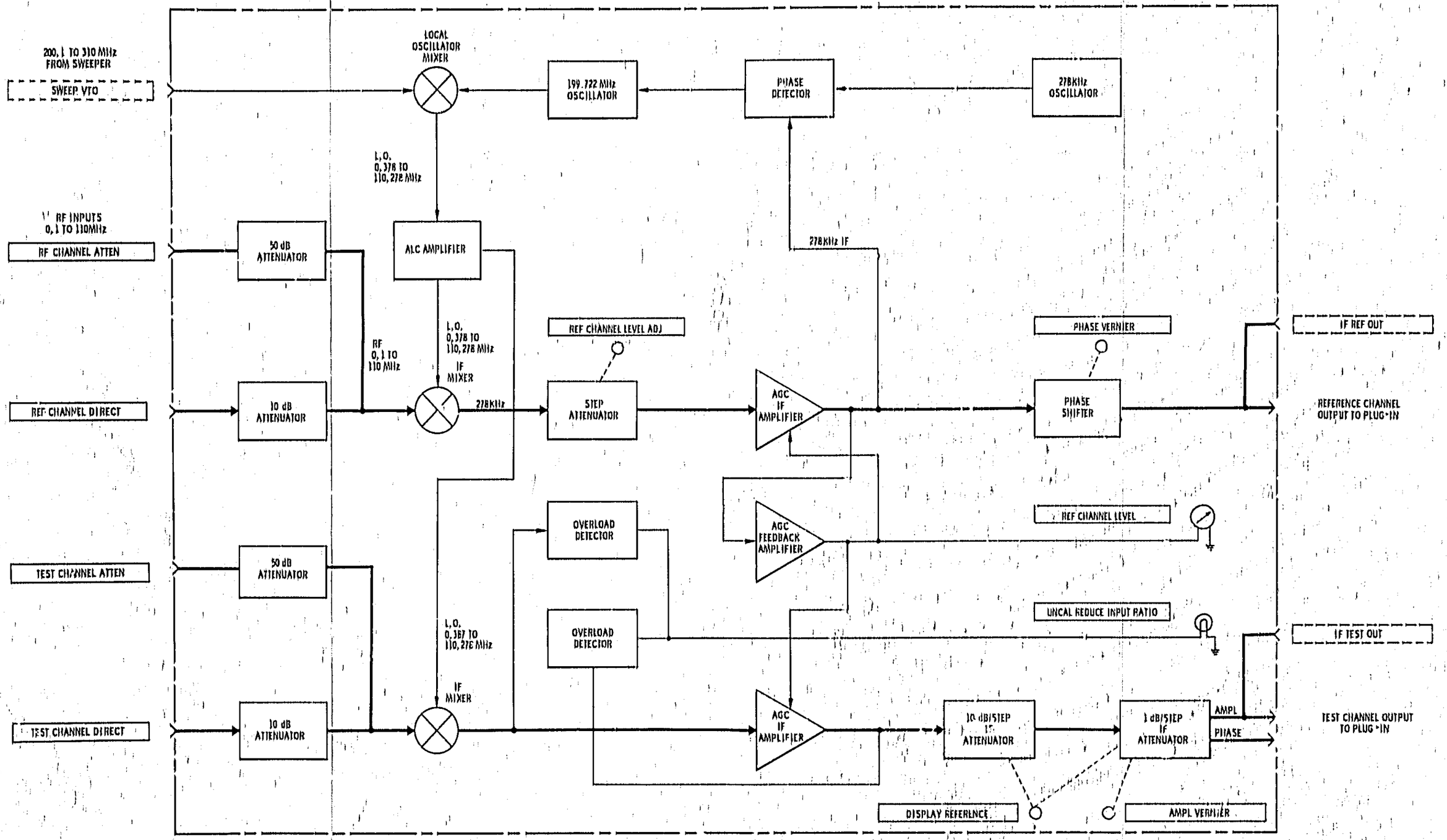


Figure 4-1. Simplified Block Diagram

MAINTENANCE

SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. This section provides instructions for performance testing, calibration, and troubleshooting of the HP8407A Network Analyzer. Test equipment required for these procedures is listed in Table 5-2. If the test equipment recommended is not available, other equipment may be used if its performance meets the "Critical Specifications" listed in the table.

5-3. PRINTED CIRCUIT BOARD EXCHANGE

5-4. The 8407A is unique in that the printed circuit boards of the instrument have been carefully designed to be independent of each other so that problems can be easily isolated to the board level. HP encourages the use of the troubleshooting tree in Section VII for isolating problems to the board level and has made rebuilt-exchange printed circuit boards available to complement this repair approach. The rebuilt-exchange boards are available at a much reduced cost from a new board. The lower price is dependent on the return of the defective board to HP. A replacement board should be ordered by the rebuilt-exchange stock number listed in Table 5-1. The board can be ordered through the nearest Hewlett-Packard Sales and Service office listed in the back of this manual. The exchange board will immediately be sent directly from our stock of service parts. Upon receiving the replacement board, the faulty board should be returned in the same special carton in which the new board was received. Do not return a defective board to HP until the replacement board has been received.

5-5. If a defective exchange board will not be returned to HP and the ordered board is for spare parts stock, etc., a new board should be ordered, using the new assembly stock number listed in Table 5-1 or 6-1.

5-6. MAINTENANCE PRECAUTIONS

CAUTION

Do not apply greater than +26 dBm RF power or 50 Vdc at the RF input connectors of the 8407A or damage to the internal components may result.

5-7. PERFORMANCE TESTS

5-8. The procedures in Table 5-3 test the performance of the 8407A. These procedures may be used during incoming inspection, periodic evaluation, or after repair or alignment. The test may be performed without access to the instrument interior. The specifications of Table 1-1 are the performance standards.

5-9. ALIGNMENT PROCEDURES

5-10. Alignment procedures are given in Table 5-5. These procedures should not be performed as a routine maintenance procedure but should be used (1) after replacement of a part or component, (2) when the performance test shows that the specifications of Table 1-1 cannot be met, or (3) when instructed to do so in the troubleshooting tree (Figure 7-5). Before attempting any adjustment, allow 30 minutes warm-up time for the 8407A and plug-in.

5-11. Table 5-2 lists the test equipment required for alignment, Table 5-4 lists the alignment controls, and Figure 7-4 shows the location of the controls.

5-12. TROUBLESHOOTING

5-13. The troubleshooting procedures are given in Figure 7-5. They should be performed in the order given, since each step presumes the proper readout in preceding steps. The troubleshooting tree should isolate trouble to a defective printed circuit board or chassis-mounted part. If further fault isolation is desired, use the individual schematic diagram for the defective board and troubleshoot, using the waveforms and voltages on the schematic diagram. The troubleshooting tree assumes that chassis wiring and cabling is not defective. If this type of trouble occurs, use standard troubleshooting techniques to locate trouble.

5-14. SELECTED COMPONENTS

5-15. Some component values are selected during manufacturing in order to achieve a desired circuit performance. The typical value used in a circuit is shown on the schematic, along with a star after the

value. These components are listed in the parts list as "factory selected."

5-16. In the 8407A, A4R58, A8R20, A11R24, and A14R47 are factory selected. A4R58 is selected to produce an overload indication when a signal above a predetermined level passes through the test channel converter. A8R20 is selected to obtain the correct I.F. test channel output. A11R24 is selected to obtain a specific IF reference channel output signal. A14R47 is selected for a specific phase-locked oscillator output.

Table 5-1. Rebuilt-Exchange Assembly Part Numbers

Assembly	New Part No.	Rebuilt-Exchange Assy Part No.
A1 Front Panel Switch Assembly	08407-60014	08407-60143
A2 Front Panel Assembly	08407-60022	08407-60144
A2A1 Phase Vernier	08407-60052	08407-60115
A2A2 Amplitude Vernier	08407-60053	08407-60116
A3 Ref Channel Converter	08407-60093	08407-60101 (A3 and A4 Matched Set and W10 Cable)
A4 Test Channel Converter	08407-60092	
A5 Rectifier Assembly	08407-60026	08407-60117
A6 Master Board	08407-60015	None
A7 Programmable IF Attenuator	08407-60011	08407-60103
A8 Test Channel AGC Amplifier	08407-60005	08407-60104 (A8 & A11 Matched Pair)
A9 Test IF Bandpass Filter	08407-60006	08407-60105
A10 AGC Feedback Amplifier	08407-60010	08407-60106
A11 Reference Channel AGC Amplifier	08407-60004	08407-60104 (A8 & A11 Matched Pair)
A12 Reference IF Bandpass Filter	08407-60006	08407-60105
A13 Automatic Level Control	08407-60002	08407-60102
A14 Phase-Lock Oscillator	08407-60123	08407-60107
A15 Local Oscillator Mixer	08407-60012	08407-60110
A16 VTO Amplifier	08407-60001	08407-60112
A17 Power Supply	08407-60013	08407-60113

Table 5-2. Recommended Test Equipment

Instrument	Critical Specifications	Recommended HP Model
Dual Trace Oscilloscope with 10 pF 10:1 probes	Vertical Amplifier: Dual trace Bandwidth: 50 MHz minimum Horizontal Sweep Rate: 0.1 μS/cm Vertical Sensitivity: 5 mV/cm	180A/1801A/1820A
DC Digital Voltmeter	Accuracy: 0.05% Input Impedance: 10 megohms minimum Automatic Range Selection: Range to 150V	3439A/3443A
Sweep Oscillator	Range: 0.1 to 110 MHz RF Output: +13 dBm VTO Output: Tracks 200 MHz from RF Output signal.	8601A (0.1—110 MHz) 8690B/8698B (0.4—110 MHz)
Spectrum Analyzer	Frequency: 500 kHz to 350 MHz	8554L/8552A/141S
Plug-In Indicator	No substitute	8412A
0—120 dB Step Attenuator (calibrated)	Attenuation: 0 to 80 dB in 10 dB steps Input and Output Impedance: 50 ohms Calibration: Amplitude at each 10-dB step to 80 dB, Phase at 80 dB referenced from 0 dB position. Calibration Accuracy: ±0.3 dB, ±1 degree Calibration Frequency: 10 MHz and 40 MHz	355D, calibrated by Standards Laboratory
0—12 dB Step Attenuator (calibrated)	Attenuation: 0 to 10 dB in 1-dB steps Input and Output Impedance: 50 ohms Calibration: Amplitude at each 1-dB step to 10 dB, referenced from 0-dB position. Calibration Accuracy: ±0.1 dB Calibration Frequency: 40 MHz	355C, calibrated by Standards Laboratory
Transmission—Reflection Accessory Kit	Includes: Power Splitter, HP 11652-60009 Directional Bridge, HP 8721A BNC Short, HP 1250-0929 3 Double-Shielded coaxial cables BNC 50-ohm load, HP 11652-60001 Plug-Plug Adapter, HP 1250-0080 BNC Elbow, HP 1250-0076	11652A
BNC Tee	Impedance: 50 ohms Connectors: BNC	1250-0781 (UG274 B/U)
50-ohm Termination (2 required)	Impedance: 50 ohms Connector: BNC	1250-0207
Subminiature RF Tee Adapter, Jack-Plug-Jack	Impedance: 50 ohms Type: Subminiature coaxial	1250-0838
Subminiature RF Adapter, Plug-Plug	Impedance: 50 ohms Type: Subminiature coaxial	1250-1113
Subminiature RF to BNC Adapter	Impedance: 50 ohms Type: Subminiature coaxial and BNC	1250-0831

Table 5-3. Performance Test

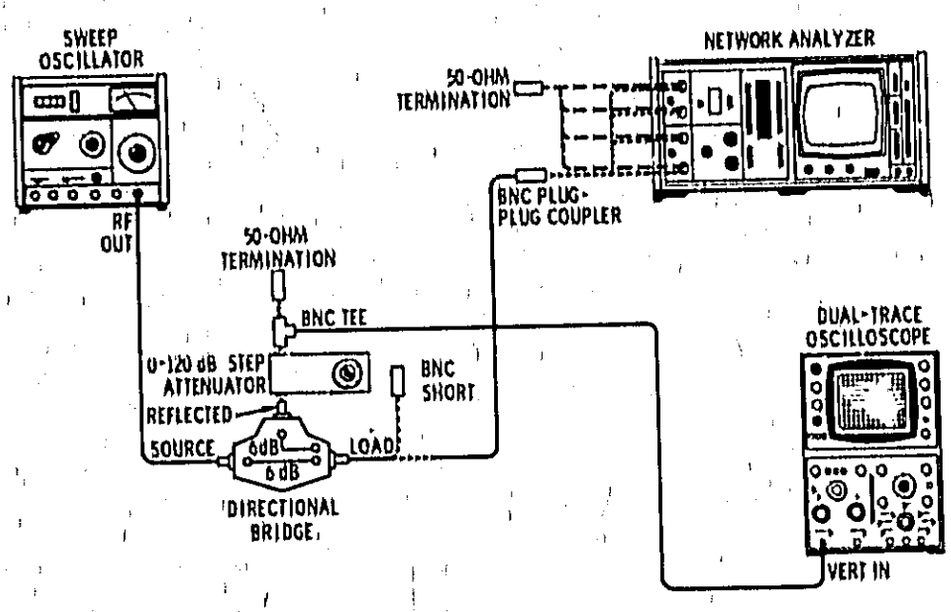
TEST	PROCEDURE
	NOTE The sweep oscillator RF blanking should be off for all performance tests. CAUTION Do not apply greater than +26 dBm RF signal or 50 Vdc to any of the 8407A input connectors or damage to the internal components may result.
1	**RF INPUT CONNECTOR VSWR** SPECIFICATIONS: Test and reference channel input connectors have VSWR <1.08. DESCRIPTION: A reference level is obtained by applying a signal at the SOURCE input of the directional bridge that will produce a +20 dBm RF signal at the LOAD output of the bridge. This signal is reflected back to the oscilloscope through the REFLECTED arm of the bridge. With a BNC short connected to the LOAD connector of the bridge, the reflection coefficient of the LOAD port is 1.0 and all of the signal is reflected. This reference signal is noted at the oscilloscope as a reference. The short is then removed, the directional bridge connected to one of the 8407A input ports, and the reflected signal from the input port is noted. The reflection coefficient (ρ) may be calculated by dividing the reflected value by the reference value. The reflection coefficient is easily converted to VSWR mathematically. TEST SETUP: 

Table 5-3. Performance Test (cont'd)

TEST 1 (cont'd)

PROCEDURE

EQUIPMENT REQUIRED:

Sweep Oscillator, HP 8601A or 8690B/8698B
Directional Bridge, HP 8721A (Part of Kit) *
Oscilloscope, HP 180A/1801A/1820A
Two 50-Ohm Terminations (inc. with 8407A)
BNC Tee, HP Stock No. 1250-0781 (UG274 B/U)
BNC Short*
BNC Plug-Plug Coupler, HP Stock No. 1250-0216 (UG 491)*
0—120 dB Step Attenuator, HP 355D

*Part of Reflection-Transmission Accessory Kit, HP 11852A

PROCEDURE:

CAUTION

Do not apply greater than +26 dBm RF signal or 50 Vdc to any of the 8407A input connectors or damage to the internal components may result.

a. Turn 8407A on. Set sweep oscillator at 40 MHz for CW operation. Connect BNC short to directional bridge LOAD connector. Set 0—120 dB step attenuator to 30 dB. Set oscilloscope to most sensitive range. Adjust sweep oscillator RF output for a four centimeter P-P trace on oscilloscope. This is the reference level and represents a reflection coefficient at the bridge LOAD port of 1.0.

b. Set 0-120 dB step attenuator to zero dB. Disconnect the BNC short from bridge LOAD port and connect LOAD port of bridge to 8407A input ports, one at a time. When measuring VSWR of one port, connect a 50-ohm termination to the other port of the same channel. The table below gives the oscilloscope indication limits for a VSWR of 1.08 with the uncertainty due to the 40 dB directivity of the directional bridge.

Oscilloscope Indication (P-P)	VSWR of Port is Within Tolerance
Less than 4 cm	Yes
4 to 8 cm	Uncertain
Greater than 8 cm	No

2 CROSSTALK

SPECIFICATION: Crosstalk and residual low-level signals are below —90 dBm.

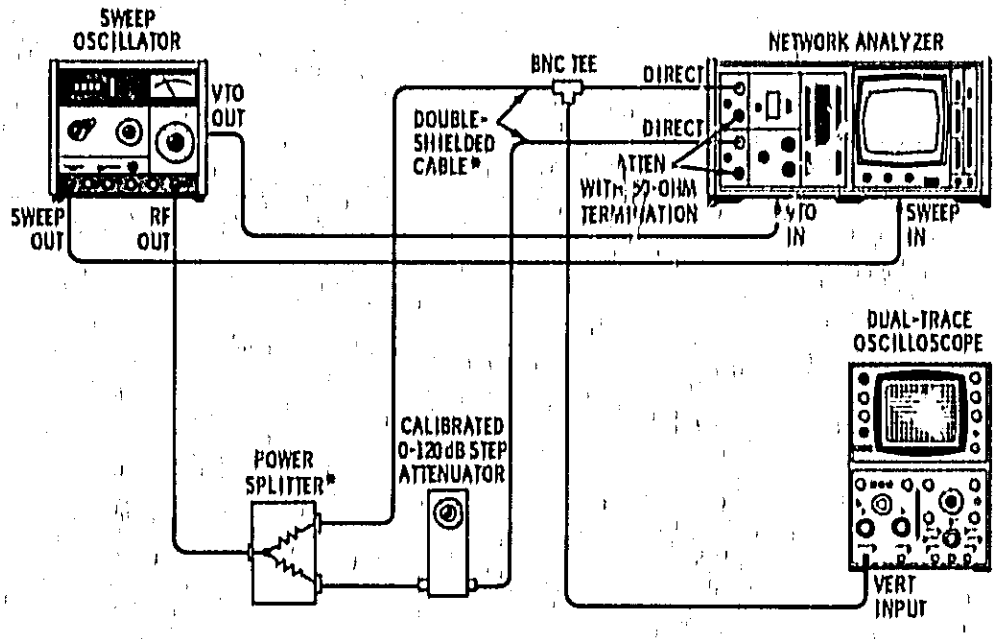
NOTE

The amplitude and phase error due to crosstalk and residual low-level signals will be less than or equal to that shown on the graph in the table of specifications when the level measured in this test is below —90 dBm.

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
2 (cont'd)	DESCRIPTION: The input level to both channels is set to −10 dBm. A reference level is obtained on the display unit and the test channel input signal is disconnected. With RF signal applied only to the reference channel, any signal present in the test channel is due to signal leakage between channels (crosstalk) and test channel residual low-level signals. The test channel signal with the input disconnected is measured on the display unit.

TEST SETUP:



EQUIPMENT REQUIRED:

Sweep Oscillator, HP 8601A or 8690B/8698B
Plug-In Indicator, HP 8412A
Oscilloscope, HP 180A/1801A/1820A
Power Splitter, HP 11652-60009 Part of Accessory Kit*)
0 — 120 dB Step Attenuator, HP 355D (calibrated in amplitude & phase at 40 MHz)
Two Double Shielded Cables (Part of Accessory Kit*)
Two 50-Ohm Terminations (Inc. with 8407A)
BNC Tee, HP Stock No. 1250-0781 (UG274 B/U)

*Part of HP 11652A Accessory Kit

PROCEDURE:

a. Connect equipment as shown in test setup. Adjust the sweep oscillator output level for −4 dBm. (Minus 4 dBm less the power splitter insertion loss of 6 dB = −10 dBm at 8407A input). Connect both power splitter outputs to the 8407A DIRECT inputs.

b. Set sweep oscillator for full bandwidth sweep between 1 and 110 MHz. Set RF blanking and markers off. Set 8407A REF CHAN LEVEL ADJ switch to lower position. Set 8412A BW(kHz) switch to 0.1 , MODE switch to AMPL, and AMPL

Table 5-3. Performance Test (cont'd)

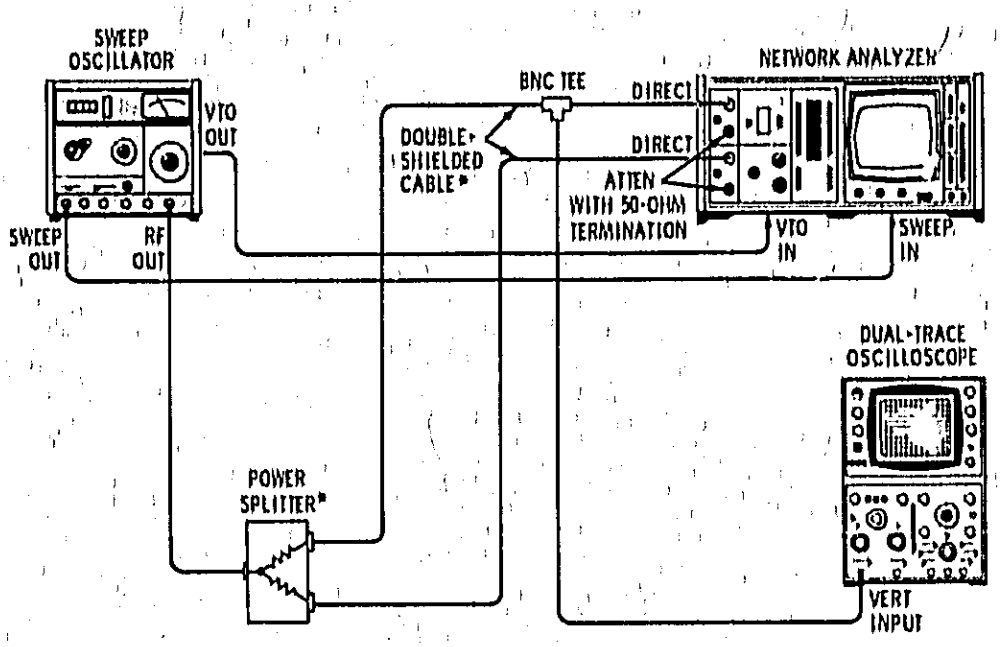
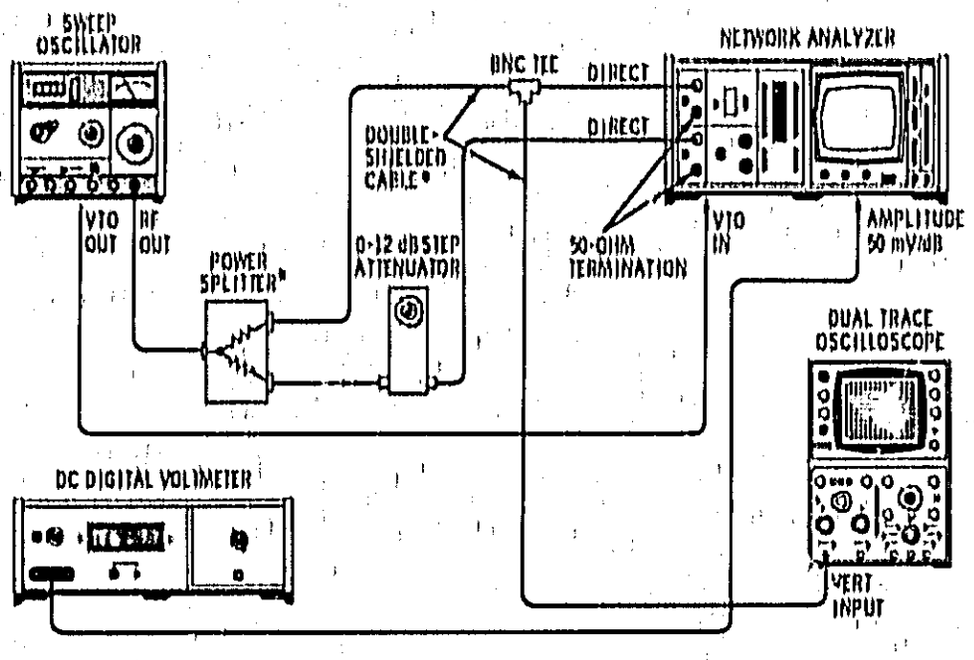
TEST	PROCEDURE
2 (cont'd)	DB/DIV switch to 10. Adjust 8407A DISPLAY REFERENCE switches and AMPL VERNIER control to place the 8412A amplitude trace on the top graticule line. The displayed trace is the −10 dBm reference. e. Disconnect the test channel input signal. Move the 10 dB/step DISPLAY REFERENCE switch one position up. The bottom 8412A graticule line is now −100 dBm. The displayed trace should be below the −90 dBm graticule line.
3	**COMMON MODE LEVEL VARIATIONS (AGC TRACKING)** SPECIFICATIONS: Amplitude change is <0,5 dB/10 dB step and phase change is <0,8 degrees/10 dB step over 30 dB operating range. DESCRIPTION: The common-mode sweep oscillator signal is adjusted through a 30-dB range and the accompanying change in the amplitude and phase trace is observed on the display unit. TEST SETUP:  EQUIPMENT REQUIRED: Sweep Oscillator, HP 8601A or 8690B/8698B Plug-In Indicator, HP 8412A Oscilloscope, HP 180A/1801A/1820A Power Splitter, HP 11652-60009 (Part of Accessory Kit*) Two double Shielded Cables (Part of Accessory Kit*) Two 50-Ohm Terminations (included with 8407A) BNC Tee, HP Stock No. 1250-0781 (UG 274 B/U) *Part of HP 11652A Accessory Kit

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
3 (cont'd)	PROCEDURE: a. Connect equipment as shown in test setup. Adjust the sweep oscillator output level for −4 dBm. (Minus 4 dBm less power splitter insertion loss of 6 dB = −10 dBm at 8407A input.) Connect both power splitter outputs to the 8407A DIRECT inputs. b. Set sweep oscillator for minimum sweep width at any frequency in the 8407A operating range. Set 8407A REF CHAN LEVEL ADJ switch to lower position. Set 8412A BW(kHz) switch to 0.1, MODE switch to DUAL, AMPL DB/DIV switch to 0.25, and PHASE DEG/DIV switch to 1.0. c. Adjust the 8407A DISPLAY REFERENCE switches and AMPLITUDE VERNIER control to place the amplitude trace on a major graticule line. Adjust the PHASE VERNIER control to place the phase trace on a major graticule line. d. Reduce the RF output from the sweep oscillator by 80 dB, one 10 dB step at a time, and note change in phase and amplitude trace position at each 10 dB step. The amplitude trace should not move more than 0.5 dB and the phase trace should not move more than 0.8 degrees for each 10 dB step.
4	**DISPLAY REFERENCE 1 dB/STEP AMPLITUDE ACCURACY** SPECIFICATION: Amplitude Accuracy is <0.05 dB/1 dB step, total error does not exceed 0.1 dB. DESCRIPTION: The equipment is set up to obtain a zero dB indication (zero volts on DVM) with the 8407A 1 dB/step DISPLAY REFERENCE switch at the top position. The accuracy of each 1 dB step is measured separately using the display unit 50 mV/dB output. The test channel input level, 8407A 10 dB/step DISPLAY REFERENCE switch and AMPLITUDE VERNIER control are used to establish a new zero dB reference after each 1 dB step. By making each measurement over the same 1 dB range of the display unit, any error in the display unit will appear as a constant error for each DISPLAY REFERENCE step and may be calculated out.

Table 5-8. Performance Test (cont'd)

TEST	PROCEDURE
4 (cont'd)	TEST SETUP:



EQUIPMENT REQUIRED:

Sweep Oscillator, HP 8601A or 8690B/8698B
Plug-In Indicator, HP 8412A
Oscilloscope, HP 180A/1801A/1820A
DC Digital Voltmeter, HP 3439A/3443A
Power Splitter, HP 11352-60009 (Part of Accessory Kit*)
Two Double Shielded Cables (Part of Accessory Kit*)
Two 50-Ohm Terminations (included with 8407A)
BNC Tee, HP Stock No. 1250-0781 (UG 274 B/U)
0 – 12 dB Step Attenuator, HP 355C

*Part of HP 11852A Accessory Kit.

PROCEDURE:

NOTE

When using an 8412A Phase Magnitude Display Unit, perform the low-level adjustment as follows. Make this adjustment with as much precision as possible. Adjust the input power level from the sweeper and the 8407A REF CHANNEL LEVEL ADJ., DISPLAY REFERENCE 1 dB/step, and AMPLITUDE VERNIER control to obtain a zero-volt indication on the DVM with the 10dB/step DISPLAY REFERENCE switch at four positions down from the top (+40). Move the 10 dB/step DISPLAY REFERENCE switch to the bottom position. Adjust 8412A front panel AMPL CAL (LOW LEVEL) control for –2V on DVM. Repeat this adjustment until the zero and –2V indications are as precise as possible.

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
4 (cont'd)	a. Connect equipment as shown in the test setup. Connect the step attenuator between the power splitter and 8407A test channel DIRECT input. b. Set the 8407A REF CHAN LEVEL ADJ to the middle position. Set the sweep oscillator for minimum sweep width at any frequency in the 8407A operating range. Adjust the RF output level for an 8407A REF CHAN LEVEL meter indication in the middle of the OPERATE range. c. Set the 8407A DISPLAY REFERENCE 1 dB/step switch to the top position and adjust the DISPLAY REFERENCE CAL thumbwheel for 0. d. Adjust the test channel input level (zero to 12 dB step attenuator at the test channel input), 8407A DISPLAY REFERENCE 10 dB/step switch, and AMPLITUDE VERNIER for zero ±0.5 mV on DVM. e. Check each DISPLAY REFERENCE 1 dB step as follows: (1) Set the DISPLAY REFERENCE 1 dB/step switch one position down. (2) The DVM indication should be −50 mV. Record the difference between −50 mV and the measured voltage as shown in the table below. (3) Adjust the test channel input level (1 dB step attenuator at the test channel input), 8407A DISPLAY REFERENCE 10 dB/step switch, and AMPLITUDE VERNIER control for zero ±0.5 mV on DVM. (4) Repeat the above steps to check the remaining 1 dB/step positions. (5) If the DVM indications are all out of tolerance on one side of −50 mV, the difference between −50 mV and the mean of all the readings may be the display unit error. Repeat this test using a second display unit, calculate the mean and correct each reading to the difference between the mean and the measured value.

Table 5-3. Performance Test (cont'd)

TEST 4 (cont'd)

PROCEDURE

Example of DISPLAY REFERENCE 1 dB/step Accuracy Table

Step/dB	DVM Indication	Error in mV	Error in dB*
0/0	Zero	Reference	
1/1	−49,7	−0,3	−0,006
2/2	−50,7	+0,07	< +0,002
3/3	−49,85	−0,15	−0,003
4/4	−50,1	+0,1	+0,002
5/5	−49,75	−0,25	−0,005
6/6	−50	Zero	Zero
7/7	−50,16	+0,16	< +0,004
8/8	−49,9	−0,1	−0,002
9/9	−50	Zero	Zero

*The error in mV is converted to dB by the calibration factor of the output connector: 50 mV/dB.

f. Add algebraically the error of each 1 dB step to the total of previous steps. For the example above: −0,006 + (+0,002) = −0,004 + (−0,003) = −0,007 + (+0,002) = −0,005 + (−0,005) = −0,01 + (+0,004) = −0,006 + (−0,002) = −0,008 dB. The total error is the difference between the maximum and minimum values. In this case total error is −0,01 − (−0,004) = −0,006 dB.

The maximum error allowable is < 0,05 dB/1 dB step and a total error of < 0,1 dB.

5

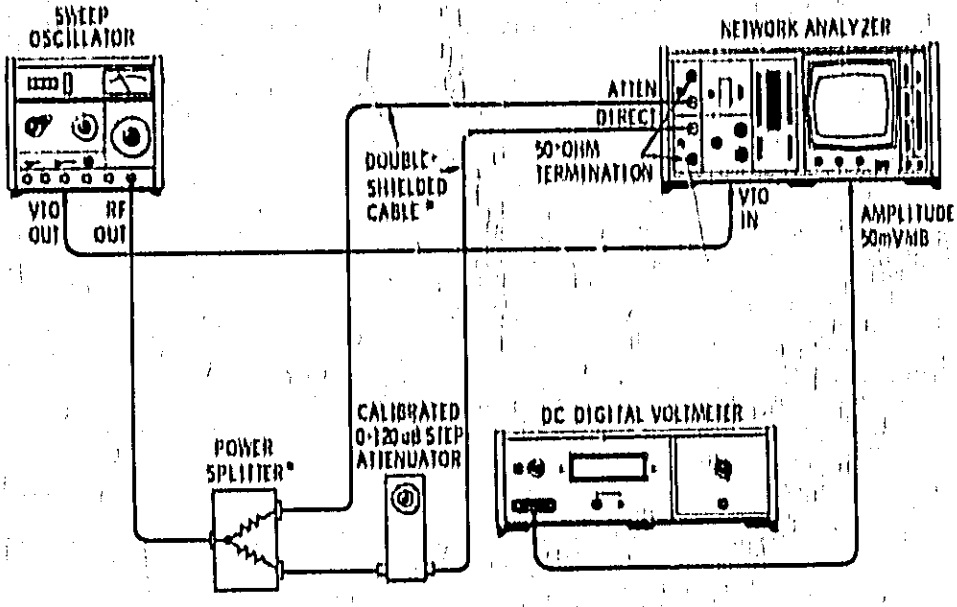
DISPLAY REFERENCE 10 dB/STEP ACCURACY

SPECIFICATION: Amplitude accuracy is <0,1 dB/10 dB/step, total error does not exceed 0,25 dB. Phase accuracy is <0,5°/10 dB step, total error does not exceed 3 degrees.

DESCRIPTION: The equipment is set up to obtain a zero dB indication (zero volts on DVM) and zero phase indication (on display unit) with the 8407A 10 dB step DISPLAY REFERENCE switch at the top position. The accuracy of each 10 dB step is measured separately. The test channel input level and 8407A AMPLITUDE VERNIER control are used to establish a new zero dB reference and the 8407A PHASE VERNIER is used to establish a new phase reference after each 10 dB step. By making each measurement over the same 10 dB range of the display unit, any error in the display unit will appear as a constant error for each DISPLAY REFERENCE step and may be calculated out.

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
5 (cont'd)	TEST SETUP:



EQUIPMENT REQUIRED:

Sweep Oscillator, HP 8601A or 8690B/8698B
Plug-In Indicator, HP 8412A
De Digital Voltmeter, HP 3439A/3443A
Power Splitter, HP 11652-60009 (Part of Accessory Kit*)
Two Double Shielded Cables (Part of Accessory Kit*)
Two 50-Ohm Terminations (included with 8407A)
0 — 120 dB Ste, Attenuator, HP 355D

*Part of HP 11652A Accessory Kit.

PROCEDURE:

NOTE

When using an 8412A Phase Magnitude Display Unit, perform the low-level adjustment as follows. Make this adjustment with as much precision as possible. Adjust the output power level from the sweep oscillator and the 8407A REF CHANNEL LEVEL ADJ., DISPLAY REFERENCE 1 dB/step, and AMPLITUDE VERNIER control to obtain a zero-volt indication on the DVM with the 10 dB/step DISPLAY REFERENCE switch at four positions down from the top (+40 dB). Move the 10 dB/step DISPLAY REFERENCE switch to the bottom position (+80 dB). Adjust 8412A front panel AMPL CAL (LOW LEVEL) control for —2.00 Vdc on DVM. Repeat this adjustment until the zero and —2V indications are as precise as possible.

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
6 (cont'd)	a. Connect equipment as shown in test setup. Connect the reference channel input to the 8407A REF CHANNEL ATTEN input. Connect the step attenuator between the power splitter and 8407A TEST CHANNEL DIRECT input. Set the 0–120 dB attenuator to 80 dB. Set the 8407A REF CHAN LEVEL ADJ switch to the middle position. b. Set the 8407A DISPLAY REFERENCE 10 dB/step switch to the top position and adjust the DISPLAY REFERENCE CAL thumbwheel for 0. c. Set the sweep oscillator for minimum sweep width at any frequency in the 8407A operating range. Adjust the RF output level for maximum power out or until the 8407A REF CHAN LEVEL meter indicates slightly above the OPERATE region, whichever comes first. d. Adjust the 8407A DISPLAY REFERENCE 1 dB/step switch and AMPLITUDE VERNIER control for zero ±0.5 mV on DVM. Adjust the display unit PHASE OFFSET and 8407A PHASE VERNIER for a zero degree phase reference on the display unit. e. Check each DISPLAY REFERENCE 10 dB step as follows: (1) Set the DISPLAY REFERENCE 10 dB/step switch one position down. (2) The DVM indication should be −500 mV. Record the difference between −500 mV and the measured voltage as shown in the table below. Record the phase shift indication of the display unit. (3) Increase the test channel input power by 10 dB by removing 10 dB from the step attenuator at the test channel input. Adjust the 8407A AMPLITUDE VERNIER control for a zero ±0.5 mV DVM indication and adjust the PHASE VERNIER for a zero degree phase indication. (4) Repeat the above steps to check the remaining 10 dB/step positions. Note: The 8407A REDUCE INPUT RATIO light may come on at high test channel input levels. If so, reduce the sweep oscillator output power to extinguish the light. (5) If the DVM indications are all out of tolerance on one side of −500 mV, the difference between −500 mV and the mean of all the readings may be the display unit error. Repeat this test using a second display unit or calculate the mean and correct each reading to the difference between the mean and the measured value.

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
5 (cont'd)	

Example of DISPLAY REFERENCE 10 dB/Step Accuracy Table

Step/dB	DVM Indication	Error in mV	Error in dB	Phase Error
0/0	Zero	Reference		
1/10	−504	+4	+,08	−0,2°
2/20	−499	−1	−,02	−0,4°
3/30	−497,5	−2,5	−,05	−0,3°
4/40	−502	+2	+,04	−0,2°
5/50	−499,5	−0,5	−,01	−0,2°
6/60	−501	+1	+,02	−0,15°
7/70	−503	+3	+,06	−0,2°
8/80	−498	−2	−,04	−0,4°

f. Add algebraically the error of each 10 dB step to the total of previous steps. For the example above:

+,08 + (−,02) = +,06
+,06 + (−,05) = +,01 minimum
+,01 + (+,04) = +,05
+,05 + (−,01) = +,04
+,04 + (+,02) = +,06
+,06 + (+,06) = +,12 maximum
+,12 + (−,04) = +,08

The total error is the difference between the maximum and minimum values. In this case total amplitude error is +0,12 −(+,01) = 0,11 dB, and the total phase is −0,2° −(−1,95°) = 1,75°. The error per dB step should be less than 0,1 dB and 0,5°. The total error should be less than 0,25 dB and 3°.

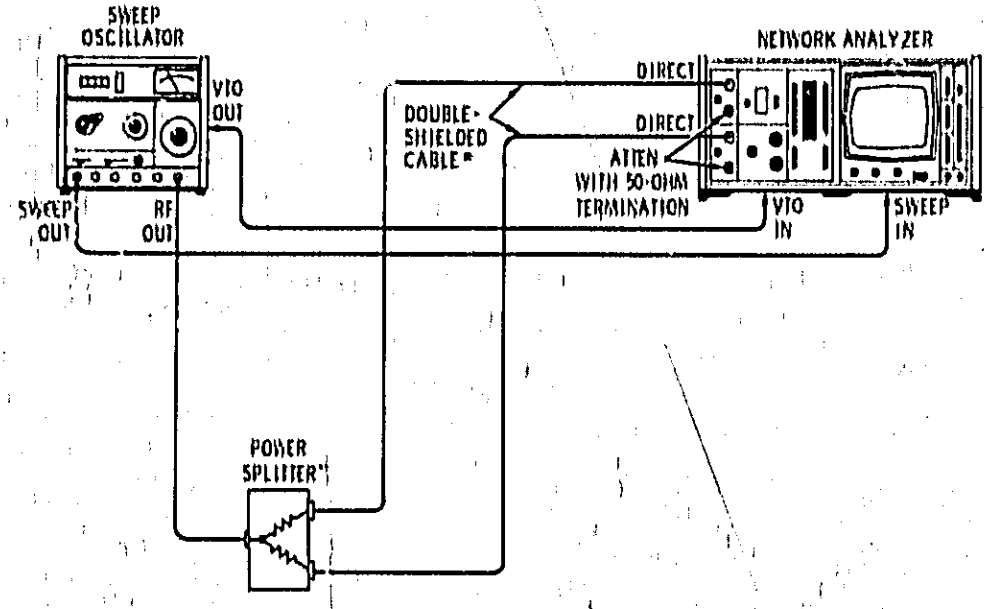
6	**FREQUENCY RESPONSE (REFERENCE input −10 dBm, TEST input >−60 dBm DIRECT)**

SPECIFICATION: Frequency response is ±0,2 dB and ±5 degrees, 0,1 to 110 MHz; ±0,05 dB and ±2 degrees over any 10 MHz portion.

DESCRIPTION: The equipment is set up for a calibration trace. The frequency response is checked over the operating range of 0,1 to 110 MHz in two bands. Both the amplitude and phase response is observed in each band. A 10 MHz portion of the operating range is selected and the amplitude and phase response is observed over this 10 MHz portion.

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
6 (cont'd)	TEST SETUP:



EQUIPMENT REQUIRED:

Sweep Oscillator, HP 8601A or 8690B/8698B
Plug-In Indicator, HP 8412A
Power Splitter, HP 11652-60009 (Part of Accessory Kit*)
Two double shielded Cables (Part of Accessory Kit*)
Two 50-Ohm Terminations (included with 8407A)

*Part of HP 11652A Accessory Kit.

PROCEDURE:

a. Connect equipment as shown in the test setup. Adjust the sweep oscillator output level for −4 dBm. (Minus 4 dBm less the power splitter loss of 6 dB = −10 dBm at 8407A input.)

b. Set sweep oscillator for full bandwidth sweep between 0.1 and 11 MHz. Set RF blanking and markers off. Set 8407A REF CHAN LEVEL ADJ switch to lower position. Set 8412A BW(kHz) switch to 0.1, MODE switch to AMPL, and AMPL DB/DIV switch to 0.25.

c. Adjust 8407A DISPLAY REFERENCE switches and AMPL VERNIER control to place the 8412A amplitude trace on the center graticule line. Slow sweep repetition rate until good trace detail is present. The trace should be within ±4 small graticule divisions (±0.2 dB) of the center graticule line.

Table 5-3. Performance Test (cont'd)

TEST	PROCEDURE
6 (cont'd)	d. Set 8412A MODE switch to PHASE and PHASE DEG/DIV switch to 10. Adjust 8407A PHASE VERNIER to place 8412A phase trace over center graticule line. If the overall trace slopes one way, the coaxial cables between the power splitter and the 8407A input connectors should be changed to equal length to eliminate this linear phase shift. The phase trace should be within ±2.5 small graticule divisions (±5 degrees) of the center graticule line. e. Set the sweep oscillator to sweep between 1 and 110 MHz. f. Adjust 8407A PHASE VERNIER to place 8412A trace over center graticule line. The phase trace should be within ±2.5 small graticule divisions (±5 degrees) of the center graticule line. g. Set 8412A MODE switch to AMPL. Adjust 8407A AMPL VERNIER control to place the 8412A amplitude trace on the center graticule line. The trace should be within ±4 small graticule divisions (±0.2 dB) of the center graticule line. h. Select any 10 MHz portion between 0.1 and 110 MHz (portion with worst frequency response). Set the sweep oscillator to sweep this 10 MHz portion. i. Adjust 8407A AMPL VERNIER control to place the 8412A amplitude trace on the center graticule line. The trace should be within ±1 small graticule division (±0.05 dB) of the center line. j. Set 8412A MODE switch to PHASE and PHASE DEG/DIV switch to 1. Adjust 8407A PHASE VERNIER to place 8412A phase trace over center graticule line. The phase trace should be within two major graticule divisions (±2 degrees) of the center line.

Table 5-1. Performance Check Test Card

Hewlett-Packard Model 8407A Network Analyzer Tests Performed by _____

Serial No. _____ Date: _____

Test	Description	Upper Limit	Test Value	Lower Limit
1	RF INPUT CONNECTOR VSWR			
	REF CHANNEL DIRECT	8 cm		
	REF CHANNEL ATTEN	8 cm		
	TEST CHANNEL DIRECT	8 cm		
	TEST CHANNEL ATTEN	8 cm		
2	CROSSTALK			
	Signal Level	Below −90 dBm		
3	COMMON MODE LEVEL VARIATIONS (AGC TRACKING)			
	Amplitude	10 dB steps		
		0,5 dB		
		0,5 dB		
		0,5 dB		
	Phase	10 dB steps		
		0,8 deg.		
		0,8 deg.		
		0,8 deg.		
4	DISPLAY REFERENCE 1 dB/STEP ATTENUATOR ACCURACY	1 dB step		
		0,05 dB		
		0,05 dB		
		0,05 dB		
		0,05 dB		
		0,05 dB		
		0,05 dB		
		0,05 dB		
		0,05 dB		
		0,05 dB		
		Overall 0,1 dB		
5	DISPLAY REFERENCE 10 dB/STEP ACCURACY	10 dB steps		

	Ampl.	Phase
10 dB	0,1 dB	0,5°
20 dB	0,1 dB	0,5°
30 dB	0,1 dB	0,5°
40 dB	0,1 dB	0,5°
50 dB	0,1 dB	0,5°
60 dB	0,1 dB	0,5°
70 dB	0,1 dB	0,5°
80 dB	0,1 dB	0,5°

Overall 0,25 dB/3°

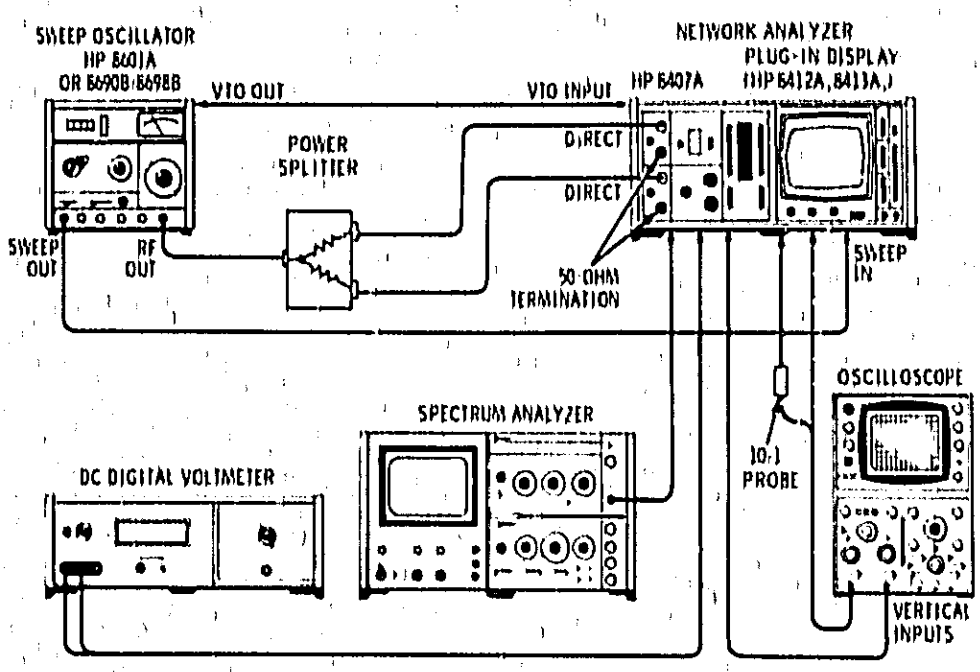
Table 5-4. Performance Check Test Card (cont'd)

Test	Description		Upper Limit	Test Value	Lower Limit
6	FREQUENCY RESPONSE				
	0.1 — 11 MHz	Amplitude	±4 small divisions (±0.2 dB)	———	
		Phase	±2.5 small divisions (± 5 deg.)	———	
	1 — 110 MHz	Phase	±2.5 small divisions (± 5 deg.)	———	
		Amplitude	±4 small divisions (±0.2 dB)	———	
	10 MHz Segment	Amplitude	±1 small division (± 0.05 dB)	———	
		Phase	±2 major divisions (±2 deg.)	———	

Table 5-5. Alignment Controls and Selected Components

Align, Test (Table 5-6)	Reference Designator	Name	Function Adjusted
2	A17R7	+20V	+20 Vdc Power Supply output
2	A17R16	−20V	−20 Vdc Power Supply output
3	A14L7	PLO	Adjusts frequency of phase-locked oscillator for best swept-frequency phase lock
4	A13R27	LO LEVEL	Adjusts local oscillator signal level at reference and test channel converters
4	A14R47 (Selected value)	PLO output	Adjusts PLO output level
5	A3L1	PHASE	Adjusts phase tracking of reference channel converter
5	A3L2	AMPLITUDE	Adjusts amplitude tracking of reference channel converter
5	A4L1	PHASE	Adjusts phase tracking of test channel converter
5	A4L2	AMPLITUDE	Adjusts amplitude tracking of test channel converter
6	A8R20 (Selected value)	IF TEST output	Adjusts IF test channel output level
6	A11R24 (Selected value)	IF REF output	Adjusts IF Reference channel output level
7	A4R58 (Selected value)	OVERLOAD LEVEL	Adjusts overload circuit of test channel converter to switch on at a selected signal level

SETUP FOR ALIGNMENT



EQUIPMENT REQUIRED:

Sweep Oscillator, HP Model 8601A or 8690B/8698B
Power Splitter, HP Part No. 11652-60009*
Oscilloscope (500 kHz/50 mV) with
10:1 Divider Probe, HP Model 180A/1802A/1820A
Spectrum Analyzer, HP Model 8552A/8554L/141S
DC Digital Voltmeter, HP Model 3439A/3433A
Adapter (subm-to-BNC) ,HP Part No. 1250-0831.

*Part of HP Model 11652A Accessory Kit.

Figure 5-1. Equipment Setup for Alignment Procedures

Table 5-6. Alignment Procedure

TEST	PROCEDURE AND DESCRIPTION
1	**INITIAL SETUP** DESCRIPTION: Set up and adjust instrument for phase-locked condition. PROCEDURE: a. Connect equipment as shown in Figure 5-1. Remove 8407A top and bottom covers. Place the 8407A on its side and loosen the two screws securing the converter assemblies and swing the casting out away from the chassis. b. Set 8407A controls as follows: DISPLAY REFERENCE CAL . . . . . Zero dB at top switch position DISPLAY REFERENCE . . . . . 10 dB/step switch and 1 dB/step switch at top position (0 dB) REF CHAN LEVEL ADJ . . . . . Middle position AMPL VERNIER . . . . . Midrange PHASE VERNIER . . . . . Midrange c. Set sweep oscillator controls for single-frequency (CW) operation at 1 MHz. d. Adjust sweep oscillator RF output for a REF CHANNEL LEVEL meter indication near the top of the OPERATE range.
2	**POWER SUPPLY (A17R7 and A17R16).** DESCRIPTION: the ±20 Volt power supplies are adjusted for correct output. NOTE If an overvoltage of >22 Vdc occurs at either the +20 or −20 Vdc power supply output, the power supply will turn off (approximately 1.5 Vdc output). To clear the condition, turn power off and set A17R7 and A17R16 to midrange. Apply power and adjust for ±20 Vdc. PROCEDURE: a. Check for +20 Vdc ±0.1 Vdc at A17TP3 with DVM. If out of tolerance, adjust A17R7. b. Check for −20 Vdc ±0.1 Vdc at A17TP2 with DVM. If out of tolerance adjust A17R16.

Table 5-6. Alignment Procedure (cont'd)

TEST	PROCEDURE AND DESCRIPTION
3	**PHASE LOCKED OSCILLATOR ADJUSTMENT (A14L7)** DESCRIPTION: The output of A16 is first checked to be sure the RF output is sufficient for proper phase-lock operation. The phase-locked oscillator is then adjusted to produce a 278 kHz IF signal from the test and reference converters A3 and A4. When the phase-locked oscillator is adjusted near the correct frequency (199.722 MHz), a phase detector locks and holds the oscillator, producing a constant 278 kHz IF signal. The oscillator frequency is adjusted for a correction voltage of approximately 9 Vdc. This places the natural frequency of the oscillator in the middle of the capture range. PROCEDURE: a. Check output of A16 VTO Amplifier Assembly as follows: (1) Disconnect coax cable from A6 Assembly connector labeled VTO OUT (accessible under swing out converter casting). Connect Spectrum Analyzer input to VTO OUT connector. (2) Set Sweep Oscillator for single frequency operation and slowly tune across high range to 110 MHz. The signal level at VTO OUT connector should be greater than +2 dBm across VTO range to 310 MHz. Note: Signal levels below 0 dBm may cause phase-lock problems. (3) Reconnect coax cable to A16 Assembly VTO OUT connector. b. Set 8407A controls as follows: (1) REF CHAN LEVEL to bottom position. (2) DISPLAY REFERENCE 10 dB switch two steps from bottom position. (3) DISPLAY REFERENCE 1 dB switch five steps from bottom position. c. Set Sweep Oscillator for single frequency operation with output level of −1 dBm (−10 dBm into 8407A). d. Connect one oscilloscope input to 8407A rear panel IF REF connector. Connect the other oscilloscope input (using 10:1 divider probe) to A14 Assembly PLO TUN pin on A6 Master Board. Note: If dual trace oscilloscope is not available, connect DC voltmeter to PLO TUN pin. e. Adjust A14L7 tuning slug to top of coil form. Slowly adjust tuning slug in until signal at IF REF output is a 278 kHz (3.6 microsecond period) sinewave and dc voltage level at PLO TUN pin is −9 Vdc ±0.5 Vdc. NOTE Once A14L7 is adjusted, it is important that the tuning slug remain fixed. Therefore apply a small amount of glue (such as "Q-dope") on the tuning slug. f. Glue tuning slug A14L7 in position.

Table 5-6. Alignment Procedure (cont'd)

TEST	PROCEDURE AND DESCRIPTION
4	**LOCAL OSCILLATOR SIGNAL LEVEL ADJUST (A13R27, A14R47)** DESCRIPTION: Phase-locked oscillator A14 and ALC amplifier A13 are adjusted to obtain the correct level of Local Oscillator signal to converters A3 and A4. PROCEDURE: a. Check output of A15 LO Mixer Assembly as follows: (1) Disconnect coax cable from A6 Master Board Assembly connector labeled LO-OUT-TO-ALC. Connect Spectrum Analyzer input to LO-OUT-TO-ALC connector. (This is the output of A15.) (2) Set Sweep Oscillator for single frequency operation and slowly tune across high range to 110 MHz. The signal level at LO-OUT-TO-ALC connector should be −30 to −40 dBm from about 1.3 to 110.2 MHz. If necessary, check A14 Assembly output at A6 Master Board Assembly connector labeled PLO OUT. PLO output should be −13 dBm ± 4 dB. Select value for A14R47 to obtain −13 dBm signal level. (See Figure 7-14 for component location.) Typical range of values for A14R47 is 511 to 750 ohms. Reconnect PLO OUT and check again for −30 to −40 dBm at LO-OUT-TO-ALC connector. (3) Reconnect coax cable to LO-OUT-TO-ALC connector. b. Disconnect coax cable from A6 Assembly connector labeled LO-TO-CONV. (This is the output of A13.) Connect Spectrum Analyzer input to LO-TO-CONV connector. c. With Sweep Oscillator set for single frequency operation, slowly tune across high range to 110 MHz. The signal level at LO-TO-CONV connector should be 0 dBm ±2 dB from 1.3 to 110.2 MHz. If necessary, adjust A13R27 for signal level of 0 dBm ±2 dB. d. Reconnect coax cable to LO-TO-CONV connector.
5	**CONVERTER AMPLITUDE AND PHASE TRACKING (A3L1, A3L2, A4L1 and A4L2)** DESCRIPTION: The reference and test converters are adjusted for best amplitude and phase tracking over the entire band. Correct tracking is indicated by horizontal amplitude and phase traces on the 8412A. PROCEDURE: NOTE If the display plug-in used is an 8413A, connect oscilloscope vertical inputs to 8413A front panel AMPL 50 MV/DB and PHASE 10 MV/DEG connectors. Also connect Sweep Oscillator SWEEP OUT to oscilloscope external horizontal input.

Table 5-6. Alignment Procedure (cont'd)

TEST	PROCEDURE AND DESCRIPTION
6 (cont'd)	a. Adjust amplitude tracking as follows: (1) Set Sweep Oscillator for widest (FULL) sweep width on high frequency range with an output level of −35 dBm. (2) Swept amplitude display should not vary more than 0.2 dB across range. If necessary, adjust A4L2 and A3L2 for desired response. (3) Set Sweep Oscillator for widest sweep width on low frequency range. (4) Swept amplitude display should vary less than 0.2 dB across frequency range. If necessary, adjust A4L2 and A3L2 for desired response. If adjustment is made, repeat amplitude tracking adjustments until no further adjustment is required. If unable to obtain less than 0.2 dB variation, adjust A13R27 slightly and repeat amplitude tracking adjustment. If A13R27 is adjusted, recheck Local Oscillator Signal Level Adjustment, Test 4. b. Adjust phase tracking as follows: (1) With Sweep Oscillator set for widest sweep width on low frequency range, the swept phase display should not vary more than four degrees across frequency range. If necessary adjust A4L1 and A3L1 for desired response. (2) Set Sweep Oscillator for widest sweep width on high frequency range. (3) The swept phase display should not vary more than four degrees across frequency range. If necessary, adjust A4L1 and A3L1 for desired response. If adjustment is made, repeat phase tracking adjustments until no further adjustment is required. NOTE If unable to obtain less than four degrees variation on high frequency range, adjust A13R27 slightly and repeat both amplitude and phase tracking adjustments. If A13R27 is adjusted, recheck Local Oscillator Signal Level Adjustment, Test 4.

Table 5-6. Alignment Procedure (cont'd)

TEST	PROCEDURE AND DESCRIPTION
6	**REFERENCE AND TEST CHANNEL LEVEL ADJUSTMENT (A8R20 and A11R24)** DESCRIPTION: The reference channel IF output is adjusted by selecting the value of the feedback resistor in the reference channel AGC amplifier. PROCEDURE: a. Adjust 8407A controls as follows: (1) REF CHAN LEVEL ADJ to middle position. (2) DISPLAY REFERENCE 10 dB switch to top position. (3) DISPLAY REFERENCE 1 dB switch four steps down from top position. b. Adjust Sweep Oscillator for single frequency operation with an output level of −35 dBm. c. Connect oscilloscope to 8407A rear panel IF REF OUTPUT. The signal amplitude should be 1,4 ±0,3V peak-to-peak. If necessary, select value for A11R24 to obtain the desired signal level. Typical range of values for A11R24 is 16,2K to 121K ohms. d. Connect Oscilloscope to 8407A rear panel IF TEST OUTPUT. The signal amplitude should be 320 mV ±40 mV. If necessary, select value for A8R20 to obtain the desired signal level. Typical range of values for A8R20 is 10K to 29K ohms.
7	**OVERLOAD LIGHT ADJUSTMENT (A4R58)** DESCRIPTION: The signal level that causes the overload light to go from off to on is checked. A resistor in overload amplifier is changed to obtain the correct switching range. PROCEDURE: a. Install a BNC tee in test channel between Power Splitter and 8407A TEST CHANNEL DIRECT input. Connect Oscilloscope to BNC tee. b. Set Sweep Oscillator for single frequency operation on the low frequency range. Adjust output level for 200 mV peak-to-peak signal on oscilloscope and then 250 mV. The UNCAL REDUCE INPUT RATIO light should be off with 200 mV input and on with 250 mV input. If necessary select value for A4R58 to obtain desired indications. Typical range of values for A4R58 is 10K to 42,2K ohms.

PARTS LIST

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts and assemblies. Table 6-1 provides an index of reference designations and abbreviations used in the replaceable parts list. Table 6-2 is the replaceable parts list in reference designator order. This list contains component description, part number, and other information necessary for ordering parts. Table 6-3 provides code number identification of manufacturers.

6-3. ORDERING INFORMATION

6-4. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office (see list at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers.

6-5. To obtain a part that is not listed, include:

a. Instrument model number.
b. Instrument serial number.
c. Description of the part.
d. Function and location of the part.

Table 6-1. Reference Designators and Abbreviations Used in Parts List

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor	FL	= filter	Q	= transistor		
BT	= battery	J	= jack	R	= resistor		
C	= capacitor	K	= relay	RT	= thermistor	VR	= voltage regulator
CP	= coupler	L	= inductor	S	= switch		
CR	= diode	LS	= loud speaker	T	= transformer	W	= cable
DL	= delay line	M	= meter	TB	= terminal board	X	= socket
DS	= device signaling (lamp)	MK	= microphone	TP	= test point	Y	= crystal
E	= misc electronic part	MP	= mechanical part	U	= integrated circuit	Z	= tuned cavity, network

ABBREVIATIONS

A	= amperes	H	= henries	N/O	= normally open	RMO	= rack mount only
AFC	= automatic frequency control	HDW	= hardware	NOM	= nominal	RMS	= root-mean square
		HEX	= hexagonal	NPO	= negative positive zero (zero temperature coefficient)	RWV	= reverse working voltage
AMPL	= amplifier	HG	= mercury				
		HR	= hour(s)			S-B	= slow-blow
BFO	= beat frequency oscillator	Hz	= Hertz	NPN	= negative-positive-negative	SCR	= screw
						SE	= selenium
BE CU	= beryllium copper	IF	= intermediate freq	NRFR	= not recommended for field replacement	SECT	= section(s)
BH	= binder head	IMPG	= impregnated			SEMICON	= semiconductor
BP	= bandpass	INCD	= incandescent			SI	= silicon
BRS	= brass	INCL	= include(s)	NSR	= not separately replaceable	SIL	= silver
BWO	= backward wave oscillator	INS	= insulation(ed)			SL	= slide
		INT	= internal			SPG	= spring
				OBD	= order by description	SPL	= special
CCW	= counterclockwise	K	= kilo = 1000			SST	= Stainless steel
CER	= ceramic			OH	= oval head	SR	= split ring
CMO	= cabinet mount only			OX	= oxide	STL	= steel
COEF	= coefficient	LH	= left hand				
COM	= common	LIN	= linear taper	P	= peak	TA	= tantalum
COMP	= composition	LK WASH	= lock washer	PC	= printed circuit	TD	= time delay
COMPL	= complete	LOG	= logarithmic taper	PF	= picofarads = 10^{-12} farads	TGL	= toggle
CONN	= connector	LPF	= low pass filter			THD	= thread
CP	= cadmium plate			PH BRZ	= phosphor bronze	TI	= titanium
CRT	= cathode-ray tube			PHIL	= Phillips	TOL	= tolerance
CW	= clockwise	M	= milli = 10^{-3}	PIV	= peak inverse voltage	TRIM	= trimmer
		MEG	= meg = 10^{6}			TWT	= traveling wave tube
DEPC	= deposited carbon	MET FLM	= metal film	PNP	= positive-negative-positive		
DR	= drive	MET OX	= metallic oxide				
		MFR	= manufacturer	P/O	= part of		
ELECT	= electrolytic	MHz	= mega Hertz	POLY	= polystyrene	μ	= micro = 10^{-6}
ENCAP	= encapsulated	MINAT	= miniature	PORC	= porcelain		
EXT	= external	MOM	= momentary	POS	= position(s)	VAR	= variable
		MOS	= metalized substrate	POT	= potentiometer	VDCW	= dc working volts
F	= farads			PP	= peak-to-peak		
FH	= flat head	MTG	= mounting	PT	= point		
FIL H	= Fillister head	MY	= "mylar"	PWV	= peak working voltage	W/	= with
FXD	= fixed					W	= watts
		N	= nano (10^{-9})	RECT	= rectifier	WIV	= working inverse voltage
G	= giga (10^{9})	N/C	= normally closed	RF	= radio frequency	WW	= wirewound
GE	= germanium	NE	= neon	RH	= round head or right hand	W/O	= without
GL	= glass	NI PL	= nickel plate				
GRD	= grounded)						

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	08407-60014	1	FRONT PANEL SWITCH ASSY	28480	08407-60014
A1	08407-60143	1	REBUILT 08407-60014, REQUIRES EXCHANGE	28480	08407-60143
A1C1	0160-2242	1	CERD CER 2.4 PF	72982	301-NPO-2.4 PF
A1C2	0160-2250	4	CERD CER 5.1 PF 500VDCW	72982	301-000-COHO-519E
A1C3	0160-2255	1	CERD CER 8.2 PF 500VDCW	72982	301-000-COHO-829C
A1C4	0160-2259	3	CERD CER 12 PF 5% 500VDCW	72982	301-000-C060-120J
A1C5	0160-2262	1	CERD CER 16 PF 5% 500VDCW	72982	301-000-C060-160J
A1C6	0160-2264	4	CERD CER 20 PF 5% 500VDCW	72982	301-000-C060-200J
A1C7	0160-2266	3	CERD CER 24 PF 5% 500VDCW	72982	301-000-C060-240J
A1C8	0160-2269	1	CERD CER 33 PF 5% 500VDCW	72982	301-000-C060-330J
A1C9	0160-2267	1	CERD CER 33 PF 5% 500VDCW	72982	301-000-C060-330J
A1CR1	1901-0025	7	DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR4	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1R1	0698-7400	1	RESD FLM 8,198K OHM 0,1% 1/8W	28480	0698-7400
A1R2	0698-7405	1	RESD FLM 3,862K OHM 0,1% 1/8W	28480	0698-7405
A1R3	0698-7402	1	RESD FLM 2,426K OHM 0,1% 1/8W	28480	0698-7402
A1R4	0698-7401	1	RESD FLM 1,781K OHM 0,1% 1/8W	28480	0698-7401
A1R5	0698-7403	1	RESD FLM 1,289K OHM 0,1% 1/8W	28480	0698-7403
A1R6	0698-7404	1	RESD FLM 1,008K OHM 0,1% 1/8W	28480	0698-7404
A1R7	0698-7500	1	RESD FLM 807,3 OHM 0,1% 1/8W	28480	0698-7500
A1R8	0698-7406	1	RESD FLM 681,4 OHM 0,1% 1/8W	28480	0698-7406
A1R9	0698-7399	1	RESD FLM 549,9 OHM 0,1% 1/8W	28480	0698-7399
A1XA2	5060-0112	1	CONNECTOR:16 CONTACTS	28480	5060-0112
A2	05330-80003	1	CONNECTOR:PC 18 PIN	28480	05330-80003
	08407-60022	1	FRONT PANEL ASSY, (LESS A2A1 AND A2A2)	28480	08407-60022
A2	08407-60144	1	REBUILT 08407-60022, REQUIRES EXCHANGE	28480	08407-60144
A2C1	0180-0291	45	CERD ELECT 1,0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A2CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A2CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A2CR3	1902-0041	3	DIODE:BREAKDOWN 6,11V 5%	04713	SZ10939-98
A2J1	1251-1604	2	CONNECTOR:PC EDGE 1 ROW 22 CONTACT	71785	252-22-30-910
	1251-1636	1	CONNECTOR:SINGLE MALE CONTACT	28480	1251-1636
A2Q1	1853-0020	13	TSTR:SI PNP:SELECTED FROM 2N3702	28480	1853-0020
A2Q2	1853-0001	1	TSTR:SI PNP:SELECTED FROM 2N1132	28480	1853-0001
A2Q3	1854-0071	36	TSTR:SI NPN:SELECTED FROM 2N3704	28480	1854-0071
A2R1	0757-0442	12	RESD MET FLM 10,0K OHM 1% 1/8W	28480	0757-0442
A2R2	0757-0465	2	RESD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A2R3	0698-3443	1	RESD MET FLM 287 OHM 1% 1/8W RECOMMENDED REPLACEMENT	28480	0698-3443
A2R4	0757-0416	10	RESD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A2R5	0757-0442	11	RESD MET FLM 10,0K OHM 1% 1/8W	28480	0757-0442
A2R6	0698-0083		RESD MET FLM 1,96K OHM 1% 1/8W	28480	0698-0083
A2R7	0757-0442		RESD MET FLM 10,0K OHM 1% 1/8W	28480	0757-0442
A2R8	0757-0465		RESD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A2R9	0698-3628	1	RESD MET OX 200 OHM 5% 2W	28480	0698-3628
A2R10	0757-0442		RESD MET FLM 10,0K OHM 1% 1/8W	28480	0757-0442
A2R11	0757-0442		RESD MET FLM 10,0K OHM 1% 1/8W	28480	0757-0442
A2U1	1826-0007	1	IC:LINEAR, RECOMMENDED REPLACEMENT	28480	1826-0007
A2A1	08407-60052	1	PHASE VERNIER ASSY	28480	08407-60052
A2A1	08407-60116		REBUILT 08407-60052, REQUIRES EXCHANGE	28480	08407-60116
A2A1C1	0140-0200	2	CERD MICA 390 PF 5%	72136	RDM15F391-J3C
A2A1C2	0140-0200		CERD MICA 390 PF 5%	72136	RDM15F391-J3C
A2A1C3	0160-3060	43	CERD CER 0,1 UF 20% 25VDCW	56289	3C42A-CML
A2A1C4	0180-0291		CERD ELECT 1,0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A2A1C5	0160-2207	1	CERD MICA 300 PF 5%	28480	0160-2207
A2A1C6	0160-3060		CERD CER 0,1 UF 20% 25VDCW	56289	3C42A-CML
A2A1J1	1250-0828	9	CONNECTOR:RF 50-OHM SCREW ON TYPE	98291	50-043-4410
A2A1J2	1250-0828		CONNECTOR:RF 50-OHM SCREW ON TYPE	98291	50-043-4410
A2A1J3	1250-0828		CONNECTOR:RF 50-OHM SCREW ON TYPE	98291	50-043-4410
A2A1MP1	08407-00131	1	SHIELD:CAN	28480	08407-00031
A2A1Q1	1853-0050	1	TSTR:SI PNP	28480	1853-0050
A2A1Q2	1854-0071		TSTR:SI NPN:SELECTED FROM 2N3704	28480	1854-0071
A2A1Q3	1854-0071		TSTR:SI NPN:SELECTED FROM 2N3704	28480	1854-0071
A2A1R1	0698-3450	3	RESD MET FLM 42,2K OHM 1% 1/8W	28480	0698-3450
A2A1R2	0698-3451	15	RESD MET FLM 133K OHM 1% 1/8W	28480	0698-3451
A2A1R3	0757-0401	5	RESD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A2A1R4	0757-0280	40	RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2A1R5	0757-0428	5	RESD MET FLM 1,62K OHM 1% 1/8W	28480	0757-0428
A2A1R6	0757-0424	5	RESD MET FLM 1,10K OHM 1% 1/8W	28480	0757-0424
A2A1R7	0757-0199	4	RESD MET FLM 21,5K OHM 1% 1/8W	28480	0757-0199
A2A1R8	0698-0084	9	RESD MET FLM 2,15K OHM 1% 1/8W	28480	0698-0084

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A1R4	0698-3440	1	RESD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A2A1R10	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A2A1R11	0757-0279	6	RESD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A2A2	08407-60093	1	AMPLITUDE VERNIER ASSY	28480	08407-60093
A2A2	08407-60114	1	REBUILT 08407-60093, REQUIRES EXCHANGE	28480	08407-60114
A2A2C1	0160-0291		CAPACITOR-FXD 0.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A2A2C2	0160-3060		CAPACITOR-FXD 0.1 UF 20% 25VDCW	56289	3C42A-CML
A2A2C3	0160-3060		CAPACITOR-FXD 0.1 UF 20% 25VDCW	56289	3C42A-CML
A2A2C4	0160-3490	8	CAPACITOR-FXD 1.0 UF 20% 50VDCW	72982	8131-050-651-105M
A2A2C5	0180-0291		CAPACITOR-FXD 0.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A2A2C6	0160-3060		CAPACITOR-FXD 0.1 UF 20% 25VDCW	56289	3C42A-CML
A2A2J1	1250-0828		CONNECTOR-RF 50-OHM SCREW ON TYPE	98291	50-043-4610
A2A2J2	1250-0828		CONNECTOR-RF 50-OHM SCREW ON TYPE	98291	50-043-4610
A2A2J3	1250-0828		CONNECTOR-RF 50-OHM SCREW ON TYPE	98291	50-043-4610
A2A2MP1	08407-00056	1	SHIELD:CAN	28480	08407-00056
A2A2Q1	1853-0020		TRANSISTOR PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2A2Q2	1854-0345	12	TRANSISTOR NPN	80131	2N5179
A2A2Q3	1854-0345		TRANSISTOR NPN	80131	2N5179
A2A2R1	0757-0443	1	RESD MET FLM 11.0K OHM 1% 1/8W	28480	0757-0443
A2A2R2	0757-0290	9	RESD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A2A2R3	0698-3184	4	RESD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3184
A2A2R4	0757-0398	4	RESD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A2A2R5	0698-3445	6	RESD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A2A2R6	0698-3491	1	RESD MET FLM 1K OHM 0.1% 1/8W	28480	0698-3491
A2A2R7	0698-0082	3	RESD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A2A2R8	0698-0082		RESD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A2A2R9	0698-3440		RESD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A2A2R10	0757-0398		RESD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A2A2R11	0698-3449	1	RESD MET FLM 29.7K OHM 1% 1/8W	28480	0698-3449
A3	08407-60091	1	BOARD ASSY:REFERENCE CHANNEL CONVERTER ORDER 08407-60154 A3,A4, & W10 MATCHED PAIR(WITHOUT EXCHANGE)	28480	08407-60091
A3	08407-60101	2	REBUILT 08407-60092 & 08407-60093(A3-A4) MATCHED PAIR(INCLUDES W10, 08407-60060 MATCHED 1.0, TEST CABLE,REQUIRES EXCHANGE	28480	08407-60101
A3C1	0160-3491	5	CAPACITOR-FXD 0.47 UF 20% 50VDCW	72982	8131-050-651-474M
A3C2	0180-0291		CAPACITOR-FXD 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C3	0160-2264		CAPACITOR-FXD 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A3C4	0180-0291		CAPACITOR-FXD 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C5	0180-0291		CAPACITOR-FXD 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C6	0160-3060		CAPACITOR-FXD 0.1 UF 20% 25VDCW	56289	3C42A-CML
A3C7	0160-3060		CAPACITOR-FXD 0.1 UF 20% 25VDCW	56289	3C42A-CML
A3C8	0160-3491		CAPACITOR-FXD 0.47 UF 20% 50VDCW	72982	8131-050-651-474M
A3C9	0180-0291		CAPACITOR-FXD 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C10	0160-3490		CAPACITOR-FXD 1.0 UF 20% 50VDCW	72982	8131-050-651-105M
A3C11	0160-3490		CAPACITOR-FXD 1.0 UF 20% 50VDCW	72982	8131-050-651-105M
A3C12	0160-2259		CAPACITOR-FXD 12 PF 5% 500VDCW	72982	301-000-C0G0-120J
A3C13	0180-0291		CAPACITOR-FXD 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C14	0160-0134	3	CAPACITOR-FXD MICA 220PF 5% 300VDCW	14655	RDM15FF221J3C
A3C15	0180-0291		CAPACITOR-FXD 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C16	0180-0291		CAPACITOR-FXD 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C17	0180-3490		CAPACITOR-FXD 1.0 UF 20% 50VDCW	72982	8131-050-651-105M
A3C18	0160-2219	2	CAPACITOR-FXD MICA 1100 PF 5%	28480	0160-2219
A3C19	0180-0197	4	CAPACITOR-FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A3C20	0160-3076	3	CAPACITOR-FXD CER 470 PF 5% 200VDCW	71590	CRD
A3C21	0160-0184	3	CAPACITOR-FXD MICA 8200 PF 1% 100VDCW	28480	0160-0184
A3C22	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C23	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C24	0160-0174	20	CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	8C11A75-CML
A3C25	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C26	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	8C11A75-CML
A3C27	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C28	0140-0210	1	CAPACITOR-FXD MICA 270 PF 5%	28480	0140-0210
A3C29	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	8C11A75-CML
A3C30	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D106X9035A2-DYS
A3C31	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	8C11A75-CML
A3C32	0160-2437	6	CAPACITOR-FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A3C33	0160-2437		CAPACITOR-FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A3C34	0160-2437		CAPACITOR-FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A3CR1	1901-0450	2	DIODE:SILICON	28480	1901-0450
A3CR2	1901-0044	1	DIODE:SILICON ZENER/1V	28480	1901-0044
A3J1	1250-1205	12	CONNECTOR-PC RT ANGLE	28480	1250-1205
A3J2	1250-1205		CONNECTOR-PC RT ANGLE	28480	1250-1205
A3J3	1250-1205		CONNECTOR-PC RT ANGLE	28480	1250-1205
A3J4	1250-1205		CONNECTOR-PC RT ANGLE	28480	1250-1205

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3L1	08407-60029	4	COIL ASSY:LO MF AM	28480	08407-60029
A3L2	08407-60029		COIL ASSY:LO MF AM	28480	08407-60029
A3L3	9100-2209	3	INDUCTOR:57.8 UH 1%	28480	9100-2209
A3L4	9140-0180	1	COIL/CHOKE 2.70 UH 10%	28480	9140-0180
A3Q1	1854-0431	6	TST#16: NPN (REPLACEABLE BY RCA 2N5179)	28480	1854-0431
A3Q2	1854-0431		TST#16: NPN (REPLACEABLE BY RCA 2N5179)	28480	1854-0431
A3Q3	1854-0431		TST#16: NPN (REPLACEABLE BY RCA 2N5179)	28480	1854-0431
A3Q4	1854-0071		TST#16: NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q5	1854-0071		TST#16: NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q6	1854-0071		TST#16: NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q7	1853-0070		TST#16: PNP(SELECTED FROM 2N3702)	28480	1853-0070
A3Q8	1853-0034	3	TST#16: PNP(SELECTED FROM 2N3251)	28480	1853-0034
A3Q9	1854-0471	8	TST#16: NPN	28480	1854-0471
A3Q10	1854-0471		TST#16: NPN	28480	1854-0471
A3Q11	1854-0471		TST#16: NPN	28480	1854-0471
A3Q12	1854-0071		TST#16: NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3R1	0757-0419	8	RIFXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A3R2	0698-3448		RIFXD MET FLM 348 OHM 1% 1/8W	28480	0698-3448
A3R3	0698-3435	18	RIFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A3R4	0757-0418	2	RIFXD MET FLM 316 OHM 1% 1/8W	28480	0757-0418
A3R5	0757-0317	8	RIFXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A3R6	0698-3435		RIFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A3R7	0698-3442	9	RIFXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A3R8	0757-0419		RIFXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A3R9	0757-1094	8	RIFXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A3R10	0757-1094		RIFXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A3R11	0757-1094		RIFXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A3R12	0698-3442		RIFXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A3R13	0757-0400	4	RIFXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A3R14	0757-0400		RIFXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A3R15	0698-7608	4	RIFXD FLM 192.6 OHM 0.5% 1/8W	28480	0698-7608
A3R16	0698-7607	8	RIFXD FLM 182.2 OHM 0.25% 1/8W	28480	0698-7607
A3R17	0698-7608		RIFXD FLM 192.6 OHM 0.5% 1/8W	28480	0698-7608
A3R18	0698-7607		RIFXD FLM 182.2 OHM 0.25% 1/8W	28480	0698-7607
A3R19	0698-5194	4	RIFXD MET FLM 71.5 OHM 0.25% 1/8W	28480	0698-5194
A3R20	0698-5401	4	RIFXD MET FLM 247.5Ω OHM 0.25% 1/8W	28480	0698-5401
A3R21	0698-5196	4	RIFXD MET FLM 98.25 OHM 0.25% 1/8W	28480	0698-5196
A3R22	0698-5192	4	RIFXD MET FLM 61.11 OHM 0.25% 1/8W	28480	0698-5192
A3R23	0698-3435		RIFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A3R24	0698-5196		RIFXD MET FLM 98.25 OHM 0.25% 1/8W	28480	0698-5196
A3R25	0698-5194		RIFXD MET FLM 71.5Ω OHM 0.25% 1/8W	28480	0698-5194
A3R26	0698-5196		RIFXD MET FLM 98.25 OHM 0.25% 1/8W	28480	0698-5196
A3R27	0698-5192		RIFXD MET FLM 61.11 OHM 0.25% 1/8W	28480	0698-5192
A3R28	0698-5401		RIFXD MET FLM 247.5Ω OHM 0.25% 1/8W	28480	0698-5401
A3R29	0698-3445		RIFXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A3R30	0698-7607		RIFXD FLM 182.2 OHM 0.25% 1/8W	28480	0698-7607
A3R31	0698-7607		RIFXD FLM 182.2 OHM 0.25% 1/8W	28480	0698-7607
A3R32	0698-0083		RIFXD MET FLM 1.54K OHM 1% 1/8W	28480	0698-0083
A3R33	0698-3435		RIFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A3R34	0698-0085	4	RIFXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A3R35	0757-0274	3	RIFXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A3R36	0757-0280		RIFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R37	0757-0421	2	RIFXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A3R38	0698-3428	2	RIFXD MET FLM 14.7 OHM 1% 1/8W	28480	0698-3428
A3R39	0757-0419		RIFXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A3R40	0757-0420	5	RIFXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A3R41	0757-0316	9	RIFXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A3R42	0757-0420		RIFXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A3R43	0757-0394	8	RIFXD MET FLM 61.9 OHM 1% 1/8W	28480	0757-0394
A3R44	0698-3435		RIFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A3R45	0698-3151	3	RIFXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A3R46	0757-0280		RIFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R47	0698-7230	8	RIFXD FLM 3.83K OHM 2% 1/8W	28480	0698-7230
A3R48	0698-3132	4	RIFXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A3R49	0698-3450		RIFXD MET FLM 42.2K OHM 1% 1/8W	28480	0698-3450
A3R50	0757-0438	14	RIFXD MET FLM 6.11K OHM 1% 1/8W	28480	0757-0438
A3R51	0698-3132		RIFXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A3R52	0757-0288	3	RIFXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A3R53	0757-0403	2	RIFXD MET FLM 121 OHM 1% 1/8W	28480	0757-0403
A3R54	0757-0428		RIFXD MET FLM 1.69K OHM 1% 1/8W	28480	0757-0428
A3R55	0757-0419		RIFXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A3R56	0757-0288		RIFXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A3R57	0698-3447	3	RIFXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A3R58	0757-0199		RIFXD MET FLM 21.0K OHM 1% 1/8W	28480	0757-0199
A3R59	0757-0199		RIFXD MET FLM 21.0K OHM 1% 1/8W	28480	0757-0199

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R80	0757-0459	1	RIFXD MET FLM 86.6K OHM 1% 1/8W	28480	0757-0459
A3R81	0698-3450		RIFXD MET FLM 42.2K OHM 1% 1/8W	28480	0698-3450
A3R82	0757-0422	3	RIFXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A3R83	0757-0280		RIFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R84	0757-0316		RIFXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A3R85	0698-3159	3	RIFXD MET FLM 24.3K OHM 1% 1/8W	28480	0698-3159
A3R86	0757-0290		RIFXD MET FLM 5.49K OHM 1% 1/8W	28480	0757-0290
A3R87	0698-7250		RIFXD FLM 3.83K OHM 2% 1/8W	28480	0698-7250
A3T1	9170-0847		HEADISHIELDING, RECOMMEND REPLACEMENT	07114	56-590-65-3B
A3T2	9170-0847		HEADISHIELDING	02114	56-590-65-3B
A3Z3	9170-0847		HEADISHIELDING RECOMMENDED REPLACEMENT	02114	56-590-65-3B
A3A1	10514A	2	MIXER:DIODE:BALANCED	28480	10514A
A4	08407-60092	1	TEST CHANNEL CONVERTER ASSY (ORDER 08407-60154 A3A4, & W10 MATCHED PAIR(WITHOUT EXCHANGE)	28480	08407-60092
A4	08407-60101		REBUILT 08407-60092 & 08407-60093(A3-4) MATCHED PR,(INCL, W10, 08407-60040 MATCHED L,O, TEST CABLE)REQUIRES EXCHANGE	28480	08407-60101
A4C1	0160-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C2	0160-3491		CIFXD CER 0.47 UF 20% 50VDCW	72982	8131-050-A5L-474M
A4C3	0160-2264		CIFXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A4C4	0160-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C5	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C6	0160-3060		CIFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A4C7	0160-3060		CIFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A4C8	0160-3491		CIFXD CER 0.47 UF 20% 50VDCW	72982	8131-050-A5L-474M
A4C9	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C10	0160-3490		CIFXD CER 1.0 UF 20% 50VDCW	72982	8131-050-A5L-105M
A4C11	0160-3490		CIFXD CER 1.0 UF 20% 50VDCW	72982	8131-050-A5L-105M
A4C12	0160-2259		CIFXD CER 12 PF 5% 500VDCW	72982	301-000-C0G0-120J
A4C13	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C14	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C15	0160-3490		CIFXD CER 1.0 UF 20% 50VDCW	72982	8131-050-A5L-105M
A4C16	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C17	0160-0124		CIFXD MICA 220PF 5% 300VDCW	14655	RDM15FF221J3C
A4C18	0160-2437		CIFXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A4C19	0160-2437		CIFXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A4C20	0160-2219		CIFXD MICA 1100 PF 5%	28480	0160-2219
A4C21	0180-0197		CIFXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DY5
A4C22	0160-3076		CIFXD CER 470 PF 5% 200VDCW	71590	080
A4C23	0160-0184		CIFXD MICA 8200 PF 1% 100VDCW	28480	0160-0184
A4C24	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C25	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C26	0160-0174		CIFXD CER 0.47 UF +80-20% 25VDCW	56289	8C11B76-CML
A4C27	0160-0174		CIFXD CER 0.47 UF +80-20% 25VDCW	56289	8C11B76-CML
A4C28	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C29	0180-0291		CIFXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A4C30	0160-3491		CIFXD CER 0.47 UF 20% 50VDCW	72982	8131-050-A5L-474M
A4C31	0160-2437		CIFXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A4CR1	1901-0450		DIODE:SILICON	28480	1901-0450
A4J1	1250-1205		CONNECTOR:PC RT ANGLE	28480	1250-1205
A4J2	1250-1205		CONNECTOR:PC RT ANGLE	28480	1250-1205
A4J3	1250-1205		CONNECTOR:PC RT ANGLE	28480	1250-1205
A4J4	1250-1205		CONNECTOR:PC RT ANGLE	28480	1250-1205
A4L1	08407-60029		COIL ASSY:1.0 UH 5%	28480	08407-60029
A4L2	08407-60029		COIL ASSY:1.0 UH 5%	28480	08407-60029
A4L3	9100-2209		INDUCTOR:37.8 UH 5%	28480	9100-2209
A4L4	9140-0180		C,FL/CHOKE 2.70 UH 10%	28480	9140-0180
A4Q1	1854-0431		TSTR:SI NPN (REPLACEABLE BY RCA 2N5179)	28480	1854-0431
A4Q2	1854-0431		TSTR:SI NPN (REPLACEABLE BY RCA 2N5179)	28480	1854-0431
A4Q3	1854-0431		TSTR:SI NPN (REPLACEABLE BY RCA 2N5179)	28480	1854-0431
A4Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A4Q8	1853-0034		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0034
A4Q9	1854-0471		TSTR:SI NPN	28480	1854-0471
A4Q10	1854-0471		TSTR:SI NPN	28480	1854-0471
A4Q11	1854-0471		TSTR:SI NPN	28480	1854-0471
A4R1	0698-3435		RIFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A4R2	0757-0419		RIFXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A4R3	0698-3445		RIFXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A4R4	0757-0418		RIFXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R5	0757-0317		RESD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A4R6	0698-3435		RESD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A4R7	0698-3442		RESD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A4R8	0757-0419		RESD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A4R9	0757-1094		RESD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A4R10	0757-1094		RESD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A4R11	0757-1094		RESD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A4R12	0757-0430		RESD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A4R13	0757-0400		RESD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A4R14	0698-3442		RESD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A4R15	0698-7608		RESD FLM 192.5 OHM 0.5% 1/8W	28480	0698-7608
A4R16	0698-7607		RESD FLM 122.2 OHM 0.25% 1/8W	28480	0698-7607
A4R17	0698-7608		RESD FLM 192.5 OHM 0.5% 1/8W	28480	0698-7608
A4R18	0698-7607		RESD FLM 122.2 OHM 0.25% 1/8W	28480	0698-7607
A4R19	0698-5194		RESD MET FLM 71.15 OHM 0.25% 1/8W	28480	0698-5194
A4R20	0698-5401		RESD MET FLM 247.50 OHM 0.25% 1/8W	28480	0698-5401
A4R21	0698-5196		RESD MET FLM 96.25 OHM 0.25% 1/8W	28480	0698-5196
A4R22	0698-5192		RESD MET FLM 61.11 OHM 0.25% 1/8W	28480	0698-5192
A4R23	0698-5196		RESD MET FLM 96.25 OHM 0.25% 1/8W	28480	0698-5196
A4R24	0698-3435		RESD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A4R25	0698-5194		RESD MET FLM 71.15 OHM 0.25% 1/8W	28480	0698-5194
A4R26	0698-5196		RESD MET FLM 96.25 OHM 0.25% 1/8W	28480	0698-5196
A4R27	0698-5192		RESD MET FLM 61.11 OHM 0.25% 1/8W	28480	0698-5192
A4R28	0698-5401		RESD MET FLM 247.50 OHM 0.25% 1/8W	28480	0698-5401
A4R29	0698-7607		RESD FLM 122.2 OHM 0.25% 1/8W	28480	0698-7607
A4R30	0698-3435		RESD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A4R31	0698-7607		RESD FLM 122.2 OHM 0.25% 1/8W	28480	0698-7607
A4R32	0698-0085		RESD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A4R33	0757-0274		RESD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A4R34	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R35	0698-3445		RESD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A4R36	0698-0083		RESD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A4R37	0757-0421		RESD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A4R38	0698-3428		RESD MET FLM 14.7 OHM 1% 1/8W	28480	0698-3428
A4R39	0757-0419		RESD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A4R40	0757-0420		RESD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A4R41	0757-0316		RESD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A4R42	0757-0420		RESD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A4R43	0757-0394		RESD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A4R44	0698-3435		RESD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A4R45	0757-0317		RESD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A4R46	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R47	0698-3153	8	RESD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A4R48	0698-3153		RESD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A4R49	0698-3159		RESD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A4R50	0757-0440	3	RESD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A4R51	0757-0317		RESD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A4R52	0698-0083		RESD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A4R53	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R54	0757-0424		RESD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424
A4R55	0757-0463	2	RESD MET FLM 82.5K OHM 1% 1/8W	28480	0757-0463
A4R56	0698-3160	1	RESD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A4R57	0698-3150	2	RESD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A4R58	0698-3159		RESD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
			FACTORY SELECTED PART		
A4R59	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R60	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A4R61	0757-0316		RESD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A4Z1	9170-0847		READ-SHIELDING	02114	56-590-65-3B
			RECOMMENDED REPLACEMENT		
A4Z2	9170-0847		READ-SHIELDING	02114	56-590-65-3B
			RECOMMENDED REPLACEMENT		
A4Z3	9170-0847		READ-SHIELDING	02114	56-590-65-3B
			RECOMMENDED REPLACEMENT		
A4Z4	9170-0847		READ-SHIELDING	02114	56-590-65-3B
			RECOMMENDED REPLACEMENT		
A4A1	103148		MIXER-DOUBLE BALANCED	28480	103148
A5	08407-60026	1	RECTIFIER BOARD ASSY	28480	08407-60026
A5	08407-60117	1	REBUILT 08407-60026, REQUIRES EXCHANGE	28480	08407-60117
A5C1	0160-0168	3	CAPAC MY 0.1 UF 100 200VDCW	56289	192P10492-P75
			RECOMMENDED REPLACEMENT		
A5C2	0160-0168		CAPAC MY 0.1 UF 100 200VDCW	56289	192P10492-P75
			RECOMMENDED REPLACEMENT		
A5CR1	1901-0200	4	DIODE-SILICON 100 PIV 3A	02735	1N4998
A5CR2	1901-0200		DIODE-SILICON 100 PIV 3A	02735	1N4998

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5CR3	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A5CR4	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A6	08407-60014		FRONT PANEL SWITCH ASSY	28480	08407-60014
A6C1	0160-3036	2	CAPACITOR:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A6C2	0160-3036		CAPACITOR:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A6J1	1251-1604		CONNECTOR:RF BNC 50-OHM SCREW ON TYPE	71785	282-22-30-310
A6J2	1250-0828		CONNECTOR:RF 50-OHM SCREW ON TYPE	98291	50-043-4610
A6J3	1250-0828		CONNECTOR:RF 50-OHM SCREW ON TYPE	98291	50-043-4610
A6J4	1250-0828		CONNECTOR:RF 50-OHM SCREW ON TYPE	98291	50-043-4610
A6R1	0757-0442		RESISTOR:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6XA1 THRU A6XA6			NOT ASSIGNED		
A6XA7A	1251-2283	4	CONNECTOR:RF BNC TUNING TYPE CONTACTS	95354	190-221-00
A6XA7B	1251-2282	3	CONNECTOR:RF EDGE & FORK CONTACT	95354	190-220-00
A6XA8A	1251-2283		CONNECTOR:RF BNC TUNING TYPE CONTACTS	95354	190-221-00
A6XA8B	1251-2282		CONNECTOR:RF EDGE & FORK CONTACT	95354	190-220-00
A6XA9	1251-2337	2	CONNECTOR:RF BNC TUNING TYPE CONTACTS	95354	190-230-00
A6XA10A	1251-1283	2	CONNECTOR:RF BNC TUNING TYPE CONTACTS	02660	143-006-07-1158
A6XA10B	1251-1283		CONNECTOR:RF BNC TUNING TYPE CONTACTS	02660	143-006-07-1158
A6XA11A	1251-2283		CONNECTOR:RF BNC TUNING TYPE CONTACTS	95354	190-221-00
A6XA11B	1251-2282		CONNECTOR:RF EDGE & FORK CONTACT	95354	190-220-00
A6XA12	1251-2337		CONNECTOR:RF BNC TUNING TYPE CONTACTS	95354	190-230-00
A6XA13A	1251-2283		CONNECTOR:RF BNC TUNING TYPE CONTACTS	95354	190-221-00
A6XA13B	1251-2281	1	CONNECTOR:RF EDGE & FORK CONTACT	95354	190-219-00
A6XA14A	1251-0478	6	CONNECTOR:RF (2 X 6) 12 CONTACTS	71785	282-06-30-340
A6XA14B	1251-0478		CONNECTOR:RF (2 X 6) 12 CONTACTS	71785	282-06-30-340
A6XA15			NOT ASSIGNED		
A6XA16A	1251-2397	1	CONNECTOR:RF EDGE & FORK CONTACT	95354	190-237-00
A6XA16B	1251-2396	1	CONNECTOR:RF EDGE & FORK CONTACT	95354	190-238-00
A6XA17A	1251-0478		CONNECTOR:RF (2 X 6) 12 CONTACTS	71785	282-06-30-340
A6XA17B	1251-0478		CONNECTOR:RF (2 X 6) 12 CONTACTS	71785	282-06-30-340
A6XA18A	1251-0478		CONNECTOR:RF (2 X 6) 12 CONTACTS	71785	282-06-30-340
A6XA18B	1251-0478		CONNECTOR:RF (2 X 6) 12 CONTACTS	71785	282-06-30-340
A7	08407-60011	1	PROGRAMMABLE IF ATTENUATOR ASSY	28480	08407-60011
A7	08407-60103	1	REBUILT 08407-60011, REQUIRES EXCHANGE	28480	08407-60103
A7C1	0180-2206	3	CAPACITOR:FXD ELECT 60 UF 10% 6VDCW	56289	150D606X9006B2
A7C2	0180-1746	13	CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C3	0180-0228	1	CAPACITOR:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A7C4	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C5	0180-1743	8	CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C6	0180-1743		CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C7	0180-1743		CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C8	0180-1743		CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C9	0180-2206		CAPACITOR:FXD ELECT 60 UF 10% 6VDCW	56289	150D606X9006B2
A7C10	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C11	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C12	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C13	0180-1743		CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C14	0180-1743		CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C15	0180-0291		CAPACITOR:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A7C16	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C17	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C18	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C19	0180-1743		CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C20	0180-1743		CAPACITOR:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A7C21	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C22	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C23	0180-1746		CAPACITOR:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A7C24	0140-0193	1	CAPACITOR:FXD MICA .82 PF 5%	28480	0140-0193
A7C25	0180-2206		CAPACITOR:FXD ELECT 60 UF 10% 6VDCW	56289	150D606X9006B2
A7C26	0160-2249	4	CAPACITOR:FXD CER 4.7 PF 500VDCW	72982	301-NPO-4.7 PF
A7C27	0160-2201	3	CAPACITOR:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A7C28	0160-2249		CAPACITOR:FXD CER 4.7 PF 500VDCW	72982	301-NPO-4.7 PF
A7C29	0160-2201		CAPACITOR:FXD MICA 51 PF 5%	72136	RDM15E510J1C
A7C30	0140-0205	1	CAPACITOR:FXD MICA 62 PF 5% 300VDCW	00853	RDM15E620J3C
A7C31	0160-2199	2	CAPACITOR:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A7C32	0160-2249		CAPACITOR:FXD CER 4.7 PF 500VDCW	72982	301-NPO-4.7 PF
A7C33	0160-2249		CAPACITOR:FXD CER 4.7 PF 500VDCW	72982	301-NPO-4.7 PF
A7CR1	1901-0039	9	DIODE:SILICON 200MA 50WV	28480	1901-0039
A7CR2	1901-0039		DIODE:SILICON 200MA 50WV	28480	1901-0039
A7CR3	1901-0039		DIODE:SILICON 200MA 50WV	28480	1901-0039
A7CR4	1901-0039		DIODE:SILICON 200MA 50WV	28480	1901-0039
A7CR5	1901-0039		DIODE:SILICON 200MA 50WV	28480	1901-0039
A7CR6	1901-0039		DIODE:SILICON 200MA 50WV	28480	1901-0039
A7K1	0490-0884	4	RELAY:REED, RECOMMENDED REPLACEMENT	28480	0490-0884

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7K2	0490-0884		RELAY:REED, RECOMMENDED REPLACEMENT	28480	0490-0884
A7K3	0490-0884		RELAY:REED, RECOMMENDED REPLACEMENT	28480	0490-0884
A7K4	0490-0884		RELAY:REED, RECOMMENDED REPLACEMENT	28480	0490-0884
A7Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q2	1854-0023	1	TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A7Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q4	1853-0010	4	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A7Q5	1854-0053	2	TSTR:SI NPN	80131	2N2218
A7Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q7	1853-0010		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0010
A7Q8	1854-0053		TSTR:SI NPN	80131	2N2218
A7Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7R1	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R2	0698-3438	15	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R3	0698-0083		R:FXD MET FLM 1.98K OHM 1% 1/8W	28480	0698-0083
A7R4	0757-0438		R:FXD MET FLM 9.11K OHM 1% 1/8W	28480	0757-0438
A7R5	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R6	0698-0024	1	R:FXD MET FLM 2.61K OHM 1% 1/2W	28480	0698-0024
A7R7	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A7R8	0698-7395	1	R:FXD FLM 3.8K OHM 0.1% 1/8W	28480	0698-7395
A7R9	0698-7396	1	R:FXD FLM 1.474K OHM 0.1% 1/8W	28480	0698-7396
A7R10	0698-7397	1	R:FXD FLM 211.1 OHM 0.1% 1/8W	28480	0698-7397
A7R11	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R12	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R13	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R14	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R15	0698-6996	3	R:FXD FLM 200 OHM 0.1% 1/8W	28480	0698-6996
A7R16	0698-3157	4	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A7R17	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A7R18	0698-3161	4	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A7R19	0757-0317		R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A7R20	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A7R21	0757-0200	9	R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7R22	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A7R23	0698-3444	3	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7R24	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A7R25	0698-7398	2	R:FXD FLM 6.124K OHM 0.1% 1/8W	28480	0698-7398
A7R26	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A7R27	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R28	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R29	0698-6996		R:FXD FLM 200 OHM 0.1% 1/8W	28480	0698-6996
A7R30	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A7R31	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A7R32	0698-3161		R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A7R33	0757-0317		R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A7R34	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A7R35	0757-0200		R:FXD MET FLM 5.62K OHM 1% 1/8W	28480	0757-0200
A7R36	0698-3447		R:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A7R37	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A7R38	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A7R39	0698-7398		R:FXD FLM 6.124K OHM 0.1% 1/8W	28480	0698-7398
A7R40	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A7R41	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R42	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A7R43	0698-6996		R:FXD FLM 200 OHM 0.1% 1/8W	28480	0698-6996
A7R44	0698-3155	5	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A7R45	0757-0438		R:FXD MET FLM 9.11K OHM 1% 1/8W	28480	0757-0438
A7R46	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A7R47	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
AB	08407-60005	1	TEST CHANNEL AGC AMPLIFIER ASSY, ORDER 08407-6003B AB & A11 MATCHED PAIR (WITHOUT EXCHANGE)	28480	08407-60005
AB	08407-60104	2	REBUILT 08407-60004 & 08407-60005(AB-11 MATCHED PAIR) REQUIRES EXCHANGE.	28480	08407-60104
ABC1	0180-0116	25	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DY5
ABC2	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DY5
ABC3	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DY5
ABC4	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DY5
ABC5	0160-2910	5	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
ABC6	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
ABC7	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8C8	0160-2257	4	CAPACITOR-FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A8C9	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B7S-CM5
A8C10	0180-1746		CAPACITOR-FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A8C11	0160-2250		CAPACITOR-FXD CER 5.1 PF 500VDCW	72982	301-000-COH0-5R1E
A8C12	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A8C13	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A8C14	0170-0040	4	CAPACITOR-FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A8C15	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A8C16	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A8C17	0160-3460	1	CAPACITOR-FXD CER 0.05 UF +80-20% 100VDCW	56289	C023E101L5U3ZE522-CDH
A8CR1	1901-0039		DIODE-SILICON 200MA 80MV	28480	1901-0039
A8CR2	1902-0041		DIODE-BREAKDOWN 5.11V 5%	04713	SZ10939-98
A8CR3	1901-0039		DIODE-SILICON 200MA 80MV	28480	1901-0039
A8J1	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A8U2	1853-0020		TSTR-SI PNP (SELECTED FROM 2N3702)	28480	1853-0020
A8U3	1854-0295	2	TSTR-SI NPN	28480	1854-0295
A8U4	08407-80004	1	TRANSISTOR-MATCHED QUAD	28480	08407-80004
A8U4			(A8U4,5 & A11U4,5) REPLACE IN MATCHED 4		
A8U4	1205-0207	1	HEAT DISSIPATOR-SEMICON DUAL TO-5	13103	3207A
A8U5			PART OF A8U4		
A8U6	1854-0221	3	TSTR-SI NPN (REPL BY 2N4044)	28480	1854-0221
A8U7	1853-0010		TSTR-SI PNP (SELECTED FROM 2N3251)	28480	1853-0010
A8U8	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A8R1	0757-0438		RESISTOR-FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R2	0757-0438		RESISTOR-FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A8R3	0757-0280		RESISTOR-FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R4	0698-0083		RESISTOR-FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A8R5	0757-0280		RESISTOR-FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R6	0757-0441	1	RESISTOR-FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A8R7	0757-0278	3	RESISTOR-FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A8R8	0698-0084		RESISTOR-FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A8R9	0757-0424		RESISTOR-FXD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424
A8R10	0698-3151		RESISTOR-FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A8R11	0757-0439	2	RESISTOR-FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A8R12	0757-0398		RESISTOR-FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A8R13	0757-0416		RESISTOR-FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A8R14	0757-0817	4	RESISTOR-FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A8R15	0698-3404	3	RESISTOR-FXD MET FLM 383 OHM 1% 1/2W	28480	0698-3404
A8R16	0757-0416		RESISTOR-FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A8R17	0757-0817		RESISTOR-FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817
A8R18	0698-3161		RESISTOR-FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A8R19	0698-3161		RESISTOR-FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A8R20	0757-0447	1	RESISTOR-FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A8R20			FACTORY SELECTED PART		
A8R21	0698-3152	1	RESISTOR-FXD MET FLM 3.48K OHM 1% 1/8W	28480	0698-3152
A8R22	0698-7085		RESISTOR-FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-7085
A8R23	0698-0085		RESISTOR-FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A8R24	0757-0839	1	RESISTOR-FXD MET FLM 10K OHM 1% 1/2W	28480	0757-0839
A8R25	0757-0398		RESISTOR-FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A8R26	0757-0461	1	RESISTOR-FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A8R27	0757-0346	2	RESISTOR-FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A8T1	9100-2870	2	TRANSFORMER	28480	9100-2870
A8T2	9100-2869	2	TRANSFORMER	28480	9100-2869
A9	08407-60006	1	BAND PASS FILTER ASSY	28480	08407-60006
A9	08407-60105	2	REBUILT 08407-60006, REQUIRES EXCHANGE	28480	08407-60105
A9C1	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CM5
A9C2	0140-0184		CAPACITOR-FXD MICA 8200 PF 1% 100VDCW	28480	0140-0184
A9C3	0160-3076		CAPACITOR-FXD CER 470 PF 5% 200VDCW	71590	DBD
A9C4	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A9C5	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CM5
A9C6	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CM5
A9C7	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CM5
A9J1	1250-1195	4	CONNECTOR-RF SUB-MINIATURE SERIES	98291	52-053-0000
A9J2	1250-1195		CONNECTOR-RF SUB-MINIATURE SERIES	98291	52-053-0000
A9J3	1250-1195		CONNECTOR-RF SUB-MINIATURE SERIES	98291	52-053-0000
A9J4	1250-1195		CONNECTOR-RF SUB-MINIATURE SERIES	98291	52-053-0000
A9L1	9100-2209		INDUCTOR-37.8 UH 1%	28480	9100-2209
A9Q1	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A9Q2	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A9R1	0698-7236	7	RESISTOR-FXD FLM 1K OHM 2% 1/8W	28480	0698-7236
A9R2	0698-7260	8	RESISTOR-FXD FLM 10K OHM 2% 1/8W	28480	0698-7260
A9R3	0698-7260		RESISTOR-FXD FLM 10K OHM 2% 1/8W	28480	0698-7260
A9R4	0698-7219	2	RESISTOR-FXD FLM 196 OHM 2% 1/8W	28480	0698-7219
A9R5	0698-7260		RESISTOR-FXD FLM 10K OHM 2% 1/8W	28480	0698-7260
A9R6	0698-7260		RESISTOR-FXD FLM 10K OHM 2% 1/8W	28480	0698-7260

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R7	0698-7219		RESISTOR 150 OHM 2% 1/4W	28480	0698-7219
A10	08407-60010	1	AGC FEEDBACK AMPLIFIER ASSY	28480	08407-60010
A10	08407-60106	1	REBUILT 08407-60010, REQUIRES EXCHANGE	28480	08407-60106
A10C1	0180-0197		CAPACITOR-FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A10C2	0180-0197		CAPACITOR-FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A10C3	0180-0197		CAPACITOR-FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A10C4	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A10C5	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A10C6	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C7	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A10C8	0180-0197		CAPACITOR-FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A10C9	0140-0196	1	CAPACITOR-FXD MICA 150 PF 5%	72136	DM15F151J3C
A10C10	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C11	0180-0197		CAPACITOR-FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A10C12	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A10C13	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C14	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C15	0140-0134		CAPACITOR-FXD MICA 220PF 5% 300VDCW	14655	RL 07F221J3C
A10C16	0160-2200	1	CAPACITOR-FXD MICA 43 PF 5%	72136	DM15F430J3C
A10C17	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A10C18	0160-2930		CAPACITOR-FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A10C19	0160-0183	1	CAPACITOR-MY 0.001 UF 10% 200VDCW	56289	192P10292-PT5
A10C20	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C21	0160-2257		CAPACITOR-FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A10C22	0160-0167	1	CAPACITOR-MY .002 UF 10% 200VDCW	56289	192P20292-PT5
A10C23	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C24	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10C25	0160-2201		CAPACITOR-FXD MICA 81 PF 5%	72136	DM15E810J3C
A10C26	0160-0168	1	CAPACITOR-MY 0.0056 UF 10% 200VDCW	56289	192P56292-PT5
A10C27	0160-2257		CAPACITOR-FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A10C28	0160-2257		CAPACITOR-FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A10C29	0180-0116		CAPACITOR-FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A10CR1	1901-0050	12	DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR2	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR3	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR4	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR5	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR6	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR7	1902-3182	1	DIODE-BREAKDOWN-SI-SILICON 12.1V 5%	28480	1902-3182
A10CR8	1902-0048	1	DIODE-BREAKDOWN 6.81V 5%	04713	SZ10939-134
A10CR9	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR10	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR11	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR12	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR13	1901-0050		DIODE-SI 200 MA AT 1V	07263	FDA 6308
A10CR14	1910-0016	1	DIODE-GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A10L1	9100-2573	1	INDUCTOR-SHIELDED 1 MH 10%	82142	1mh-10%K
A10L2	9140-0137	3	COIL-FXD RF 1000 UH 5%	28480	9140-0137
A10L3	9140-0137		COIL-FXD RF 1000 UH 5%	28480	9140-0137
A10Q1	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A10Q2	1853-0020		TSTR-SI PNP (SELECTED FROM 2N3702)	28480	1853-0020
A10Q3	1853-0020		TSTR-SI PNP (SELECTED FROM 2N3702)	28480	1853-0020
A10Q4	1854-0221		TSTR-SI NPN (REPL.BY 2N4044)	28480	1854-0221
A10Q5	1855-0050	1	TSTR-SI FET DUAL	28480	1855-0050
A10Q6	1855-0332	1	TSTR-SI	80131	2N138
A10Q7	1854-0009	3	TSTR-SI NPN	80131	2N709
A10Q8	1854-0009		TSTR-SI NPN	80131	2N709
A10Q9	1854-0009		TSTR-SI NPN	80131	2N709
A10Q10	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A10Q11	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A10Q12	1854-0071		TSTR-SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A10R1	0757-0280		RESISTOR-FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R2	0757-0438		RESISTOR-FXD MET FLM 8.11K OHM 1% 1/8W	28480	0757-0438
A10R3	0757-1078	1	RESISTOR-FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1078
A10R4	0757-0401		RESISTOR-FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A10R5	0757-0280		RESISTOR-FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R6	0757-0280		RESISTOR-FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R7	0698-0083		RESISTOR-FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A10R8	0698-0083		RESISTOR-FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A10R9	0698-0083		RESISTOR-FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A10R10	0757-0280		RESISTOR-FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R11	0698-0083		RESISTOR-FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A10R12	0757-0401		RESISTOR-FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A10R13	0698-3155		RESISTOR-FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3155
A10R14	0698-0083		RESISTOR-FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10R15	0757-0442		RESD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A10R16	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R17	0698-0082		RESD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A10R18	0698-3153		RESD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A10R19	0757-0317		RESD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A10R20	0698-3404		RESD MET FLM 383 OHM 1% 1/8W	28480	0698-3404
A10R21	0698-3155		RESD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A10R22	0737-0424		RESD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424
A10R23	0757-0438		RESD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A10R24	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R25	0698-0083		RESD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A10R26	0698-3154		RESD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A10R27	0698-3155		RESD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A10R28	0683-5035	1	RESD COMP 3 MEGOHM 5% 1/4W	01121	CB 3055
A10R29	0698-3153		RESD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A10R30	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R31	0757-0199		RESD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A10R32	0698-3157		RESD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A10R33	0757-0274		RESD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A10R34	0757-1094		RESD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A10R35	0757-1094		RESD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A10R36	0757-0438		RESD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A10R37	0698-3157		RESD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A10R38	0698-3440		RESD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A10R39	0757-0279		RESD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0279
A10R40	0698-3440		RESD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A10R41	0698-3435		RESD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A10R42	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A10R43	0698-3439	1	RESD MET FLM 178 OHM 1% 1/8W	28480	0698-3439
A10R44	0698-3136	1	RESD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A10R45	0698-3132		RESD FLM 261 OHM 1% 1/8W	28480	0698-3132
A10R46	0757-0421	1	RESD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0421
A10R47	0757-0289	1	RESD MET FLM 19.1K OHM 1% 1/8W	28480	0757-0289
A10R48	0698-0084		RESD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A10R49	0698-3155		RESD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A10U1	1820-0321	1	INTEGRATED CIRCUIT(HI-SPEED COMPARATOR	01295	SN72 710L
A11	08407-60004	1	REFERENCE CHANNEL AGC AMPLIFIER ASSY, ORDER 08407-60036 AS A ALL MATCHED PAIR (WITHOUT EXCHANGE)	28480	08407-60004
A11	08407-A0104		REBUILT 08407-60004 & 08407-60005(AR-11 MATCHED PAIR)REQUIRES EXCHANGE	28480	08407-A0104
A11C1	0180-0116		CAPAD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C2	0180-0116		CAPAD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C3	0180-0116		CAPAD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C4	0180-0116		CAPAD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C5	0160-2930		CAPAD CER .01 UF +80-20% 100VDCW	91418	7A
A11C6	0180-0291		CAPAD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A11C7	0140-0174		CAPAD CER 0.47 UF +80-20% 25VDCW	56289	SC115F6-CML
A11C8	0180-1744		CAPAD ELECT 15 UF 10% 20VDCW	28480	0180-1744
A11C9	0140-2214	1	CAPAD MICA 680 PF 5%	28480	0140-2214
A11C10	0140-2306	1	CAPAD MICA 82 PF 5%	28480	0140-2306
A11C11	0160-2234	1	CAPAD CER 0.01 PF 500VDCW	72982	301-000-C0K0-B182
A11C12	0180-0116		CAPAD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C13	0180-0116		CAPAD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A11C14	0170-0040		CAPAD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A11CR1	1901-0039		DIODE:SILICON 200MA 80WV	28480	1901-0039
A11CR2	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A11CR3	1901-0050		DIODE:SI 200 MA AT 1V	07263	FDH A1N4
A11J1	9100-1649	1	COIL/CHOKE RFC 1UH 5%	28480	9100-1649
A11Q1	1854-0071		TST:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A11Q2	1853-0020		TST:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A11Q3	1854-0295		TST:SI NPN	28480	1854-0295
A11Q4			PART OF A8Q4		
A11Q5			PART OF A8Q4		
A11Q6	1854-0221		TST:SI NPN(REPL,BY 2N4044)	28480	1854-0221
A11Q7	1853-0010		TST:SI PNP(SELECTED FROM 2N2907)	28480	1853-0010
A11R1	0757-0438		RESD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A11R2	0757-0438		RESD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A11R3	0757-0416		RESD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A11R4	0698-3154		RESD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A11R5	0698-3440		RESD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A11R6	0757-0288		RESD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A11R7	0757-0278		RESD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A11R8	0698-0084		RESD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A11R9	0757-0424		RESD MET FLM 1.10K OHM 1% 1/8W	28480	0757-0424

Table 6-2, Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1[A1]0	0698-3438		RESD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1[A1]1	0698-3151		RESD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A1[A1]2	0757-0439		RESD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A1[A1]3	0757-0416		RESD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A1[A1]4	0757-0817		RESD MET FLM 750 OHM 1% 1/8W	28480	0757-0817
A1[A1]5	0698-3404		RESD MET FLM 383 OHM 1% 1/8W	28480	0698-3404
A1[A1]6	0757-0416		RESD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A1[A1]7	0757-0817		RESD MET FLM 750 OHM 1% 1/8W	28480	0757-0817
A1[A1]8	0698-3438		RESD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1[A1]9	0757-0422		RESD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A1[A2]0	0757-0422		RESD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A1[A2]1	0757-0290		RESD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1[A2]2	0757-0428		RESD MET FLM 1.69K OHM 1% 1/8W	28480	0757-0428
A1[A2]3	0757-0279		RESD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1[A2]4	0757-0463		RESD MET FLM 82.5K OHM 1% 1/8W	28480	0757-0463
A1[A2]5			FACTORY SELECTED PART		
A1[A2]6	0757-0442	1	RESD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1[A2]7	0757-0278		RESD MET FLM 3.32K OHM 1% 1/8W	28480	0757-0278
A1[A2]8	0757-0279		RESD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1[A2]9	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1[A3]0	0757-0346		RESD MET FLM 30 OHM 1% 1/8W	28480	0757-0346
A1[T]1	9100-2870		TRANSFORMER	28480	9100-2870
A1[T]2	9100-2869		TRANSFORMER	28480	9100-2869
A1A2	08407-60005	1	RF BYPASS FILTER ASSY SAME AS A9, USE PREFIX A12	28480	08407-60006
A1A2	08407-60105		REMUILT 08407-60006, REQUIRES EXCHANGE	28480	08407-60105
A1A3	08407-60002	1	BOARD ASSY:ALC AMPLIFIER	28480	08407-60002
A1A3	08407-60102	1	REMUILT 08407-60002,REQUIRES EXCHANGE	28480	08407-60102
A1[C]1	0160-0174		CAPACITOR-FXD 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]2	0160-2265	2	CAPACITOR-FXD 22 PF 5% 300VDCW	72982	301-000-COH0-220F
A1[C]3	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[C]4	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[C]5	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]6	0160-2199		CAPACITOR-MICA 30 PF 5% 300VDCW	28480	0160-2199
A1[C]7	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]8	0160-3080		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1[C]9	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]10	0160-2250		CAPACITOR-FXD CER 5.1 PF 500VDCW	72982	301-000-COH0-5190
A1[C]11	0160-2265		CAPACITOR-FXD CER 22 PF 5% 300VDCW	72982	301-NP0-220F
A1[C]12	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]13	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[C]14	0160-3080		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1[C]15	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[C]16	0160-0163	1	CAPACITOR-MY 0.033 UF 10% 200VDCW	56289	192P33392-P15
A1[C]17	0160-0162	1	CAPACITOR-MY 0.022 UF 10% 200VDCW	56289	192P22392-P15
A1[C]18	0160-0166	1	CAPACITOR-MY 0.068 UF 10% 200VDCW	56289	192P68392-P15
A1[C]19	0160-0162	1	CAPACITOR-MY 0.022 UF 10% 200VDCW	56289	192P22392-P15
A1[C]20	0160-0165	1	CAPACITOR-MY 0.056 UF 10% 200VDCW	56289	192P56392-P15
A1[C]21	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[C]22	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]23	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]24	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]25	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]26	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]27	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]28	0160-0174		CAPACITOR-FXD CER 0.47 UF +80-20% 25VDCW	56289	5C11B75-CML
A1[C]29	0160-3080		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1[C]30	0160-3080		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1[C]31	0160-3080		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1[C]32	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[C]33	0160-3080		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1[C]34	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[C]35	0180-0291		CAPACITOR-FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DY5
A1[L]1	9100-2285	1	COIL/CHOKE 0.47 UH 10%	28480	9100-2285
A1[L]2	9100-2280	1	COIL/CHOKE 0.18 UH 10%	28480	9100-2280
A1[L]3	9100-2284	1	COIL/CHOKE .39 UH 10%	28480	9100-2284
A1[L]4	9140-0237	1	COIL:FXD 200 UH 5% RECOMMENDED REPLACEMENT	28480	9140-0237
A1[L]5	9100-1646	1	COIL/CHOKE 910 UH 5% RECOMMENDED REPLACEMENT	82142	19-1331-26J
A1[L]6	9140-0158	3	COIL:FXD RF 1 UH 10%	99800	1025-20
A1[L]7	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A1[L]8	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A1[Q]1	1854-0345		TRANSI: NPN	80131	2N5179
A1[Q]2	1854-0345		TRANSI: NPN	80131	2N5179

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1Q1	1854-0345		TSTR:SI NPN	80131	2N5179
A1Q4	1854-0247	2	TSTR:SI NPN	28480	1854-0247
A1Q5	1854-0280	1	TSTR:SI NPN DUAL	28480	1854-0280
A1Q6	1854-0345		TSTR:SI NPN	80131	2N5179
A1Q7	1854-0247		TSTR:SI NPN	28480	1854-0247
A1Q8	1853-0034		TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0034
A1Q9	1854-0471		TSTR:SI NPN	28480	1854-0471
A1R1	0698-3435		RESFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A1R2	0698-3442		RESFXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A1R3	0698-3442		RESFXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A1R4	0757-0416		RESFXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A1R5	0757-0317		RESFXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A1R6	0698-3435		RESFXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A1R7	0757-0294	1	RESFXD MET FLM 17.8 OHM 1% 1/8W	28480	0757-0294
A1R8	0698-0084		RESFXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A1R9	0698-3437	2	RESFXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A1R10	0757-0394		RESFXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A1R11	0698-0083		RESFXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A1R12	0698-3430	3	RESFXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1R13	0757-0200		RESFXD MET FLM 6.62K OHM 1% 1/8W	28480	0757-0200
A1R14	0757-0279		RESFXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R15	0698-3432	1	RESFXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A1R16	0698-3442		RESFXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A1R17	0698-3442		RESFXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A1R18	0698-3430		RESFXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1R19	0698-3430		RESFXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1R20	0698-3150		RESFXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A1R21	0757-0403		RESFXD MET FLM 121 OHM 1% 1/8W	28480	0757-0403
A1R22	0757-0438		RESFXD MET FLM 6.11K OHM 1% 1/8W	28480	0757-0438
A1R23	0698-3156	1	RESFXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A1R24	0757-0438		RESFXD MET FLM 6.11K OHM 1% 1/8W	28480	0757-0438
A1R25	0757-0280		RESFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R26	0757-0442		RESFXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R27	2100-2521	1	RESVAR FLM 2000 OHM 10% LIN 1/2W	28480	2100-2521
A1R28	0757-0401		RESFXD MET FLM 100 OHM 1% 1/8W RECOMMENDED REPLACEMENT	28480	0757-0401
A1R29	0698-3154		RESFXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A1R30	0757-0420		RESFXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A1R31	0698-3445		RESFXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445
A1R32	0757-0290		RESFXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R33	0757-0290		RESFXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R34	0757-0419		RESFXD MET FLM 681 OHM 1% 1/8W	28480	0757-0419
A1R35	0698-3444		RESFXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A1R36	0698-3437		RESFXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A1R37	0757-0316		RESFXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A1R38	0698-3132		RESFXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A1R39	0698-3442		RESFXD MET FLM 237 OHM 1% 1/8W	28480	0698-3442
A1R40	0698-3153		RESFXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R41	0757-0280		RESFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R42	0757-0280		RESFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R43	0757-0401		RESFXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R44	0757-0316		RESFXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A1R45	0757-0316		RESFXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A1U1			NOT ASSIGNED		
A1U2	1821-0001	1	TRANSISTOR ARRAY:SI NPN	02735	CA3046
A1Z1	9170-0847		BEAD:SHIELDING, RECOMMENDED REPLACEMENT	02114	56-590-65-3B
A1Z2	9170-0847		BEAD:SHIELDING, RECOMMENDED REPLACEMENT	02114	56-590-65-3B
A1Z3	9170-0847		BEAD:SHIELDING, RECOMMENDED REPLACEMENT	02114	56-590-65-3B
A1Z4	9170-0847		BEAD:SHIELDING, RECOMMENDED REPLACEMENT	02114	56-590-65-3B
A1A	08407-60123	1	BOARD ASSY:PHASE-LOCKED OSCILLATOR RECOMMENDED REPLACEMENT	28480	08407-60123
A1A	08407-60107	1	REBUILT 08407-60123,REQUIRES EXCHANGE	28480	08407-60107
A1AC1	0160-3060		CAPFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CNL
A1AC2	0160-3060		CAPFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CNL
A1AC3	0160-2206	2	CAPFXD MICA 180 PF 5%	28480	0160-2206
A1AC4	0160-2206		CAPFXD MICA 180 PF 5%	28480	0160-2206
A1AC5	0160-3060		CAPFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CNL
A1AC6	0160-3060		CAPFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CNL
A1AC7	0160-3060		CAPFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CNL
A1AC8	0160-3060		CAPFXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CNL
A1AC9	0180-0116		CAPFXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1AC10	0180-0116		CAPACITOR-FXD 6.8 UF ±20% 35VDCW	56289	150D685X9035B2-DYS
A1AC11	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC12	0180-0197		CAPACITOR-FXD ELECT 2.2 UF ±20% 20VDCW	56289	150D225X9020A2-DYS
A1AC13	0180-0100	3	CAPACITOR-FXD ELECT 4.7 UF ±20% 35VDCW	56289	150D475X9035B2-DYS
A1AC14	0180-0197		CAPACITOR-FXD ELECT 2.2 UF ±20% 20VDCW	56289	150D225X9020A2-DYS
A1AC15	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC16	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC17	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC18	0160-3499		CAPACITOR-FXD CER 1.0 UF 20% 50VDCW	72982	301-000-X81-105M
A1AC19	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC20	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC21	0180-0116		CAPACITOR-FXD ELECT 6.8 UF ±20% 35VDCW	56289	150D685X9035B2-DYS
A1AC22	0180-0116		CAPACITOR-FXD ELECT 6.8 UF ±20% 35VDCW	56289	150D685X9035B2-DYS
A1AC23	0160-2014	1	CAPACITOR-FXD MICA 82 PF 5% 500VDCW	00853	RDM15E820J5K
A1AC24	0160-0050	2	CAPACITOR-FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E1022S3A-CDH
A1AC25	0160-0384	1	CAPACITOR-VAR CER 2.3 TO 9.25 PF 500VDCW	72982	301-000-521HD-339C
A1AC26			FACTORY SELECTED PART		
A1AC26	0160-3533	1	CAPACITOR-FXD MICA 510 PF 5% 100VDCW	72136	RDM15F511J1C
A1AC27	0180-0115	1	CAPACITOR-FXD CER 27 PF 10% 500VDCW	72982	301-000-U2J0-270K
A1AC28	0160-2884		CAPACITOR-FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A1AC29	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC30	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC31	0160-0050		CAPACITOR-FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E1022S3A-CDH
A1AC32	0160-2257		CAPACITOR-FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A1AC33	0160-2257		CAPACITOR-FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A1AC34	0160-3534	2	CAPACITOR-FXD MICA 510 PF 5% 100VDCW	00853	RDM15F511J1C
A1AC35	0160-3534		CAPACITOR-FXD MICA 510 PF 5% 100VDCW	00853	RDM15F511J1C
A1AC36	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC37	0160-3060		CAPACITOR-FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A1AC38	0160-2246	1	CAPACITOR-FXD CER 3.4+/-0.25 PF 500VDCW	72982	301-000-C0J0-3R4C
			FACTORY SELECTED PART		
A1AC39	0160-2284		CAPACITOR-FXD CER 24 PF 5% 500VDCW	72982	301-000-C0G0-240J
A1ACR1	1901-0025		DIODE-SILICON 100MA/1V	07263	FD 2387
A1ACR2	1902-0025	1	DIODE-BREAKDOWN 10.0V 5% 400 MW	28480	1902-0025
A1ACR3	0122-0263	1	DIODE-VOLTAGE VAR 47 PF 10% 60WV	04713	SNB-148
			RECOMMENDED REPLACEMENT		
A1AJ1	1250-1205		CONNECTOR-PC MT ANGLE	28480	1250-1205
A1AL1	9100-1408	2	COIL-CHOKE 1400 UH 5%	99800	9300-38
A1AL2	9100-1408		COIL-CHOKE 1400 UH 5%	99800	9300-38
A1AL3	9100-2247	10	COIL-FXD RF 0.10 UH 10%	28480	9100-2247
A1AL4	9100-1643	2	COIL-CHOKE 300 UH 5%	28480	9100-1643
A1AL5	9100-1643		COIL-CHOKE 300 UH 5%	28480	9100-1643
A1AL6	9100-2247		COIL-FXD RF 0.10 UH 10%	28480	9100-2247
A1AL7	08407-80008	1	COIL ASSY-ADJUSTABLE	28480	08407-80008
A1AL8	9100-2247		COIL-FXD RF 0.10 UH 10%	28480	9100-2247
A1AL9	9100-2248	3	COIL-CHOKE 0.12 UH 10%	82142	CY-4416-2K
A1AL10	9100-2247		COIL-FXD RF 0.10 UH 10%	28480	9100-2247
A1AL11	9140-0137		COIL-FXD RF 1000 UH 5%	28480	9140-0137
A1AL12	9100-1639	1	COIL-CHOKE 150 UH 5%	82142	15-131B-1AJ
A1Q1	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q2	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q3	1853-0020		TRANSISTOR-PNP (SELECTED FROM 2N3702)	28480	1853-0020
A1Q4	1853-0020		TRANSISTOR-PNP (SELECTED FROM 2N3702)	28480	1853-0020
A1Q5	1853-0020		TRANSISTOR-PNP (SELECTED FROM 2N3702)	28480	1853-0020
A1Q6	1853-0020		TRANSISTOR-PNP (SELECTED FROM 2N3702)	28480	1853-0020
A1Q7	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q8	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q9	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q10	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q11	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q12	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q13	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1Q14	1854-0411		TRANSISTOR-NPN	80131	2N5179
A1Q15	1854-0471		TRANSISTOR-NPN	28480	1854-0471
A1Q16	1854-0071		TRANSISTOR-NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1R1	0698-7255	4	RESISTOR-FXD FLM 6.19K OHM 2% 1/8W	28480	0698-7255
A1R2	0698-7255		RESISTOR-FXD FLM 6.19K OHM 2% 1/8W	28480	0698-7255
A1R3	0698-7248	2	RESISTOR-FXD FLM 3.16K OHM 2% 1/8W	28480	0698-7248
A1R4	0698-7248		RESISTOR-FXD FLM 3.16K OHM 2% 1/8W	28480	0698-7248
A1R5	0698-7265	2	RESISTOR-FXD FLM 14.2K OHM 2% 1/8W	28480	0698-7265
A1R6	0698-7265		RESISTOR-FXD FLM 14.2K OHM 2% 1/8W	28480	0698-7265
A1R7	0698-7255		RESISTOR-FXD FLM 6.19K OHM 2% 1/8W	28480	0698-7255
A1R8	0698-7255		RESISTOR-FXD FLM 6.19K OHM 2% 1/8W	28480	0698-7255
A1R9	0698-7250		RESISTOR-FXD FLM 3.83K OHM 2% 1/8W	28480	0698-7250
A1R10	0698-7250		RESISTOR-FXD FLM 3.83K OHM 2% 1/8W	28480	0698-7250

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A8J1	0698-7257	4	RESD FLM 7.5K OHM 2% 1/8W	28480	0698-7257
A1A8J2	0698-7257		RESD FLM 7.5K OHM 2% 1/8W	28480	0698-7257
A1A8J3	0698-7282	1	RESD FLM 4.64K OHM 2% 1/8W	28480	0698-7282
A1A8J4	0698-7237		RESD FLM 1.1K OHM 2% 1/8W	28480	0698-7237
A1A8J5	0698-7240		RESD FLM 10K OHM 2% 1/8W	28480	0698-7240
A1A8J6	0698-7240		RESD FLM 10K OHM 2% 1/8W	28480	0698-7240
A1A8J7	0698-7250		RESD FLM 3.83K OHM 2% 1/8W	28480	0698-7250
A1A8J8	0698-7250		RESD FLM 3.83K OHM 2% 1/8W	28480	0698-7250
A1A8J9	0698-7269	1	RESD FLM 23.7K OHM 2% 1/8W	28480	0698-7269
A1A8J10	0698-7246	1	RESD FLM 2610 OHM 2% 1/8W	28480	0698-7246
A1A8J11	0698-7234		RESD FLM 1K OHM 2% 1/8W	28480	0698-7234
A1A8J12	0698-7267	9	RESD NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A1A8J13	0698-7267		RESD NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A1A8J14	0698-7244	1	RESD FLM 2.18K OHM 2% 1/8W	28480	0698-7244
A1A8J15	0698-7257		RESD FLM 7.5K OHM 2% 1/8W	28480	0698-7257
A1A8J16	0698-7222	4	RESD FLM 261 OHM 2% 1/8W	28480	0698-7222
A1A8J17	0698-7267		RESD NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A1A8J18	0698-7222		RESD FLM 261 OHM 2% 1/8W	28480	0698-7222
A1A8J19	0698-7231	2	RESD FLM 619 OHM 2% 1/8W	28480	0698-7231
A1A8J20	0698-7209	1	RESD FLM 75 OHM 2% 1/8W	28480	0698-7209
A1A8J21	0698-7267		RESD NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A1A8J22	0698-7222		RESD FLM 261 OHM 2% 1/8W	28480	0698-7222
A1A8J23	0698-7231		RESD FLM 619 OHM 2% 1/8W	28480	0698-7231
A1A8J24	0698-7257		RESD FLM 7.5K OHM 2% 1/8W	28480	0698-7257
A1A8J25	0698-7222		RESD FLM 261 OHM 2% 1/8W	28480	0698-7222
A1A8J26	0698-7267		RESD NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A1A8J27	0698-7253		RESD NET FLM 6.11K OHM 2% 1/8W	28480	0698-7253
A1A8J28	0698-7244	1	RESD FLM 14.7K OHM 2% 1/8W	28480	0698-7244
A1A8J29	0698-7257		RESD FLM 7.5K OHM 2% 1/8W	28480	0698-7257
A1A8J30	0698-7240		RESD FLM 10K OHM 2% 1/8W	28480	0698-7240
A1A8J31	0698-7240		RESD FLM 10K OHM 2% 1/8W	28480	0698-7240
A1A8J32	0698-7234		RESD FLM 1K OHM 2% 1/8W	28480	0698-7234
A1A8J33			RECOMMENDED REPLACEMENT W/A1A8J43		
A1A8J34	0698-7243	1	RESD FLM 1.96K OHM 2% 1/8W	28480	0698-7243
A1A8J35			RECOMMENDED REPLACEMENT W/ A1A8J42		
A1A8J36	0698-7212	1	RESD FLM 100 OHM 2% 1/8W	28480	0698-7212
A1A8J37	0698-7250		RESD FLM 3.83K OHM 2% 1/8W	28480	0698-7250
A1A8J38	0698-7234		RESD FLM 1K OHM 2% 1/8W	28480	0698-7234
A1A8J39	0698-7229	1	RESD FLM 511 OHM 2% 1/8W	28480	0698-7229
A1A8J40			FACTORY SELECTED PART		
A1A8J41	0698-7223	1	RESD FLM 287 OHM 2% 1/8W	28480	0698-7223
A1A8J42	0757-0159	2	RESD NET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A1A8J43	0757-0159		RESD NET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A1A8J44	0698-7205	1	RESD FLM 51.1 OHM 2% 1/8W	28480	0698-7205
A1A8J45	2100-1761	1	RSVAR MM 10K OHM 5% TYPE V 1W	28480	2100-1761
A1A8J46	0698-7253		RESD NET FLM 6.11K OHM 2% 1/8W	28480	0698-7253
A1A8J47	0698-7238	1	RESD FLM 2.8K OHM 2% 1/8W	28480	0698-7238
A1A8J48	0698-7259	1	RESD FLM 9.09K OHM 2% 1/8W	28480	0698-7259
A1A8J49	0698-7234		RESD FLM 1K OHM 2% 1/8W	28480	0698-7234
A1A8J50	0698-7234		RESD FLM 1K OHM 2% 1/8W	28480	0698-7234
A1A8J51	0698-7234		RESD FLM 1K OHM 2% 1/8W	28480	0698-7234
A1A8J52	0698-7221	1	RESD FLM 237 OHM 2% 1/8W	28480	0698-7221
A1A8J53	0698-7250		RESD FLM 3.83K OHM 2% 1/8W	28480	0698-7250
A1Y1	0410-0195	1	CRYSTAL(QUARTZ	28480	0410-0195
	1200-0770	1	SOCKET(CRYSTAL	91506	8000-AG-26
A1Y2	0410-0194	1	CRYSTAL(QUARTZ	28480	0410-0194
A1Y2	9170-0847		BEADS(SHIELDING,	02114	56-590-65-3B
A1	08407-60012	1	RECOMMENDED REPLACEMENT LO MIXER ASSY	28480	08407-60012
A1	08407-60110	1	(RENULT 08407-60012, REQUIRES EXCHANGE	28480	08407-60110
A1BC1	0160-2260	4	CAPAC CER 13 PF 5% 300VDCW	72982	301-000-C0G0 130J
A1BC2	0160-2260		CAPAC CER 13 PF 5% 300VDCW	72982	301-000-C0G0 130J
A1BC3	0160-2260		CAPAC CER 13 PF 5% 300VDCW	72982	301-000-C0G0 130J
A1BC4	0160-2260		CAPAC CER 13 PF 5% 300VDCW	72982	301-000-C0G0 130J
A1BC5	0160-0179	4	CAPAC MICA 33 PF 5% 300VDCW	00853	DM15E330J 300V
A1BC6	0160-0179		CAPAC MICA 33 PF 5% 300VDCW	00853	DM15E330J 300V
A1BC7	0160-0179		CAPAC MICA 33 PF 5% 300VDCW	00853	DM15E330J 300V
A1BC8	0160-0179		CAPAC MICA 33 PF 5% 300VDCW	00853	DM15E330J 300V
A1BC9	0160-2266		CAPAC CER 24 PF 5% 300VDCW	72982	301-000-C0G0-240J
A1BCR1	1901-0514-8454	1	DIODE:SILICON MATCHED QUAD	28480	1901-0514-8454
A1BCR2	1901-0514-8454		DIODE:SILICON MATCHED QUAD	28480	1901-0514-8454
A1BCR3	1901-0514-8454		DIODE:SILICON MATCHED QUAD	28480	1901-0514-8454
A1BCR4	1901-0514-8454		DIODE:SILICON MATCHED QUAD	28480	1901-0514-8454
A1BJ1	1250-1205		CONNECTOR:PC AT ANGLE	28480	1250-1205
A1BJ2	1250-1205		CONNECTOR:PC AT ANGLE	28480	1250-1205

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1J1	1250-1205	1	CONNECTOR-RF BNC,PC,RT ANGLE	28480	1250-1205
A1L1	9100-2247	1	COIL,FXD RF CH 10 UH 10%	28480	9100-2247
A1L2	9100-2249	2	COIL,FXD RF CH 15 UH 10%	28480	9100-2249
A1L3	9100-2249		COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A1L4	9100-2249		COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A1L5	9100-2247	1	COIL,FXD RF CH 0.10 UH 10%	28480	9100-2247
A1L6	9100-2247		COIL,FXD RF CH 0.10 UH 10%	28480	9100-2247
A1L7	9100-2249		COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A1L8	9100-2249		COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A1L9	9100-2249		COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A1L10	9100-2247		COIL,FXD RF CH 0.10 UH 10%	28480	9100-2247
A1R1	0698-3435	1	RESISTOR,FXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A1R2	0698-3438	1	RESISTOR,FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1R3	0698-3438		RESISTOR,FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1R4	0698-3435		RESISTOR,FXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A1R5	0698-3438		RESISTOR,FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1R6	0698-3438		RESISTOR,FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A1R7	0757-0394	1	RESISTOR,FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A1T1	08553-6024	1	TRANSFORMER,RF (CODE=YELLOW)	28480	08553-6024
A1T2	08553-6012	4	TRANSFORMER,RF (CODE=BLUE)	28480	08553-6012
A1T3	08553-6012		TRANSFORMER,RF (CODE=BLUE)	28480	08553-6012
A1	08407-60001	1	VTO AMPLIFIER ASSY	28480	08407-60001
A1	08407-60112	1	REPAIR 08407-60001, REQUIRES EXCHANGE	28480	08407-60112
A1C1	0150-0093	14	CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C2	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C3	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C4	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C5	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C6	0150-2280		CAPACITOR,FXD CER 5.1 PF 500VDCW	72982	301-000-COH0-519E
A1C7	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C8	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C9	0160-3060		CAPACITOR,FXD CER 0.1 UF 20% 25VDCW	56289	3CA2A-CML
A1C10	0160-3060		CAPACITOR,FXD CER 0.1 UF 20% 25VDCW	56289	3CA2A-CML
A1C11	0160-2261	2	CAPACITOR,FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A1C12	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C13	0160-2261		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C14	0160-3060		CAPACITOR,FXD CER 15 PF 5% 500VDCW	72982	301-NPO-15 PF
A1C15	0150-0093		CAPACITOR,FXD CER 0.1 UF 20% 25VDCW	56289	3CA2A-CML
A1C16	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C17			CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C18	0160-3060		CAPACITOR,FXD CER 0.1 UF 20% 25VDCW	56289	3CA2A-CML
A1C19	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C20	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C21	0150-0093		CAPACITOR,FXD CER 0.01 UF +80-20% 100VDCW	72982	801-K8000-11
A1C22	0160-2251	2	CAPACITOR,FXD CER 5.6 PF 500VDCW	72982	301-000-COH0-569G
A1C23	0160-2251		CAPACITOR,FXD CER 5.6 PF 500VDCW	72982	301-000-COH0-569G
A1C24	0160-3060		CAPACITOR,FXD CER 0.1 UF 20% 25VDCW	56289	3CA2A-CML
A1C25	0160-0059	2	CAPACITOR,FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-COJ0-339C
A1C26	0160-2263	2	CAPACITOR,FXD CER 18 PF 5% 500VDCW	72982	301-000-C0G0-180J
A1C27	0160-2249	1	CAPACITOR,FXD CER 2.7PF-0.25 PF 500VDCW	72982	301-000-COJ0-279C
A1C28	0160-2263		CAPACITOR,FXD CER 18 PF 5% 500VDCW	72982	301-000-C0G0-180J
A1C29	0160-0059		CAPACITOR,FXD CER 3.3-0.25 PF 500VDCW	72982	301-000-COJ0-339C
A1L1	9100-0346	3	COIL,FXD 0.05 UH 20%	36196	H-10886
A1L2	9100-0346		COIL,FXD 0.05 UH 20%	36196	H-10886
A1L3	9100-2235		COIL/CHOKE 0.47 UH 10%	28480	9100-2235
A1L4	9100-0346		COIL,FXD 0.05 UH 20%	36196	H-10886
A1L5	9100-2235		COIL/CHOKE 0.47 UH 10%	28480	9100-2235
A1L6	9100-2248		COIL/CHOKE 0.12 UH 10%	82142	09-4416-2K
A1L7	9100-2249		COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A1L8	9100-2247		COIL,FXD RF 0.10 UH 10%	28480	9100-2247
A1L9	9100-2248		COIL/CHOKE 0.12 UH 10%	82142	09-4416-2K
A1L10	9100-2247		COIL,FXD RF 0.10 UH 10%	28480	9100-2247
A1Q1	1854-0345		TESTRIS NPN	80131	2N5179
A1Q2	1854-0345		TESTRIS NPN	80131	2N5179
A1Q3	1854-0345		TESTRIS NPN	80131	2N5179
A1Q4	1854-0332	2	TESTRIS NPN	02735	38868
A1Q5	1854-0332		TESTRIS NPN	02735	38868
A1Q6	1854-0345		TESTRIS NPN	80131	2N5179
A1Q7	1854-0345		TESTRIS NPN	80131	2N5179
A1R1	0757-0316		RESISTOR,FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A1R2	0757-0280		RESISTOR,FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R3	0757-0280		RESISTOR,FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R4	0683-1225	2	RESISTOR,FXD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1R5	0757-0394		RESISTOR,FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A1R6	0757-0316		RESISTOR,FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

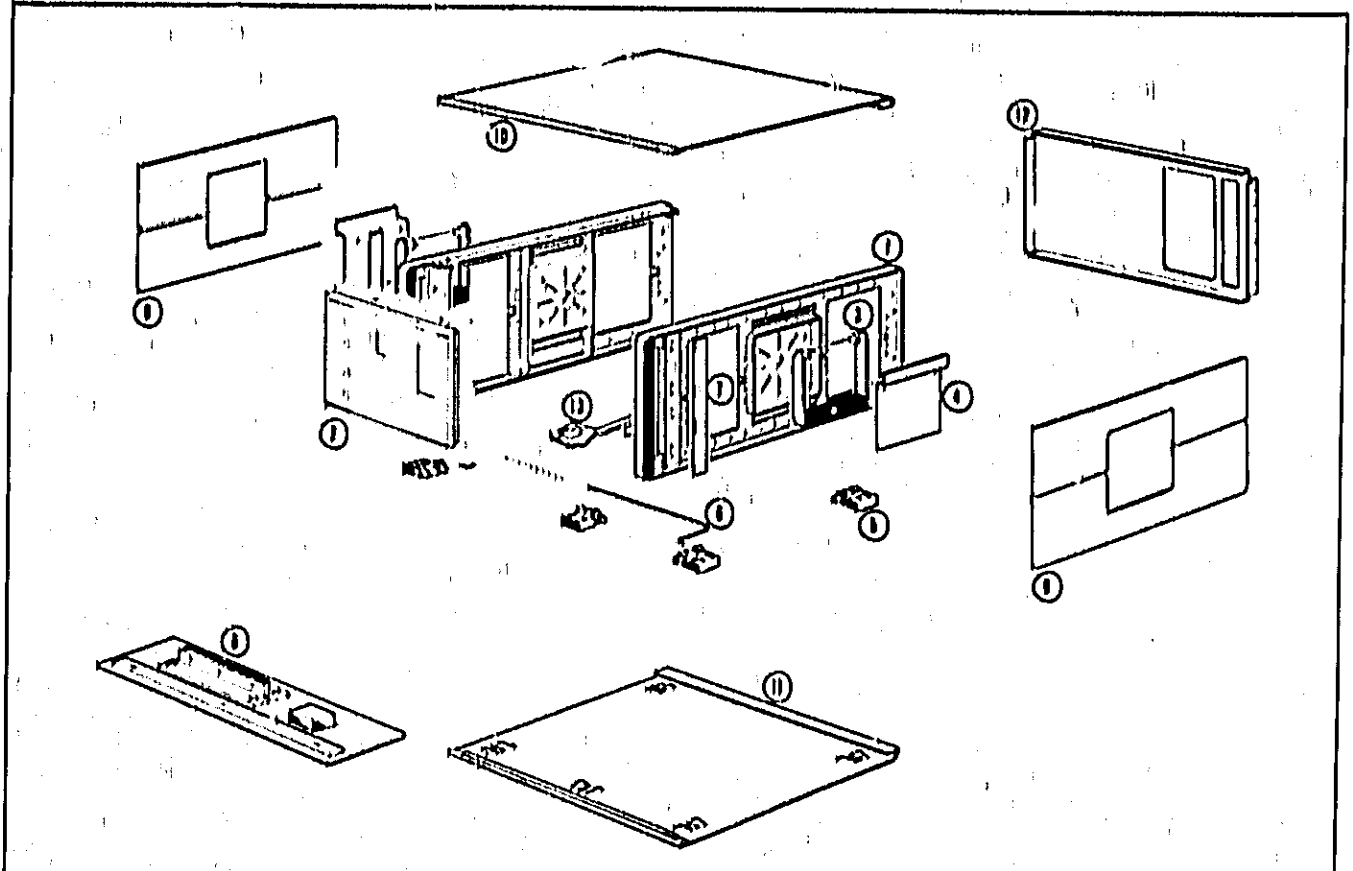
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R47	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R48	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R49	0683-1225		RESD COMP 1200 OHM 5% 1/4W	01121	CB 1225
A1R50	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R51	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R52	0683-2005	2	RESD COMP 20 OHM 5% 1/4W	01121	CB 2005
A1R53	0683-9115	1	RESD COMP 910 OHM 5% 1/4W	01121	CB 9115
A1R54	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R55	0683-1325	1	RESD COMP 1300 OHM 5% 1/4W	01121	CB 1325
A1R56	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R57	0757-0818	2	RESD MET FLM 887 OHM 1% 1/8W	28480	0757-0818
A1R58	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R59	0757-0818	2	RESD MET FLM 887 OHM 1% 1/8W	28480	0757-0818
A1R60	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R61	0683-2005		RESD COMP 20 OHM 5% 1/4W	01121	CB 2005
A1R62	0757-0818		RESD MET FLM 887 OHM 1% 1/8W	28480	0757-0818
A1R63	0757-0818		RESD MET FLM 887 OHM 1% 1/8W	28480	0757-0818
A1R64	0757-0158	1	RESD MET FLM 619 OHM 1% 1/8W	28480	0757-0158
A1R65	0683-2025	2	RESD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A1R66	0683-2025		RESD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A1T1	08552-6018	1	TRANSFORMER:RF(CODE=RED)	28480	08552-6018
A1T2	08553-6012		TRANSFORMER:RF(CODE=BLUE)	28480	08553-6012
A1T3	08553-6012		TRANSFORMER:RF(CODE=BLUE)	28480	08553-6012
A1U1	9170-0847		READ:SHIELDING, RECOMMENDED REPLACEMENT	02114	SA-590-65-3B
A1U2	9170-0847		READ:SHIELDING, RECOMMENDED REPLACEMENT	02114	SA-590-65-3B
A1U3	9170-0847		READ:SHIELDING, RECOMMENDED REPLACEMENT	02114	SA-590-65-3B
A1U4	9170-0847		READ:SHIELDING, RECOMMENDED REPLACEMENT	02114	SA-590-65-3B
A17	08407-60013	1	BOARD ASSY:POWER SUPPLY	28480	08407-60013
A17	08407-60113	1	REBUILT 08407-60013, REQUIRES EXCHANGE	28480	08407-60113
A17C1	0160-2211	2	CAPACITOR:FXD MICA 510 PF 5% 300VDCW	28480	0160-2211
A17C2	0160-2211		CAPACITOR:FXD MICA 510 PF 5% 300VDCW	28480	0160-2211
A17C3	0180-0100		CAPACITOR:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A17C4	0180-0100		CAPACITOR:FXD ELECT 4.7 UF 10% 35VDCW	56289	150D475X9035B2-DYS
A17C5	0170-0040		CAPACITOR:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A17C6	0170-0040		CAPACITOR:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A17CR1	1902-3245	2	DIODE:BREAKDOWN:SILICON 21.5V 5%	28480	1902-3245
A17CR2	1901-0158	4	DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A17CR3	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A17CR4	1884-0012	2	RECTIFIER:SILICON CONTROLLED 2N3528 RECOMMENDED REPLACEMENT	02735	2N3528
A17CR5	1902-3245		DIODE BREAKDOWN:SILICON 21.5V 5%	28480	1902-3245
A17CR6	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A17CR7	1901-0158		DIODE:SILICON 0.75A 200 PIV	28480	1901-0158
A17CR8	1884-0012		RECTIFIER:SILICON CONTROLLED 2N3528 RECOMMENDED REPLACEMENT	02735	2N3528
A17Q1	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A17Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A17Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A17Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A17Q5	1854-0039	2	TSTR:SI NPN	80131	2N3053
A17Q6	1854-0039		TSTR:SI NPN	80131	2N3053
A17R1	0812-0020	2	RESD WW 0.39 OHM 5% 3W	28480	0812-0020
A17R2	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A17R3	0757-0442		RESD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A17R4	0698-0083		RESD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A17R5	0698-0083		RESD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A17R6	0757-0442		RESD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A17R7	2100-1758	2	RESVAR WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A17R8	0757-0438		RESD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A17R9	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A17R10	0812-0020		RESD WW 0.39 OHM 5% 3W	28480	0812-0020
A17R11	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A17R12	0757-0442		RESD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A17R13	0698-0083		RESD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A17R14	0698-0083		RESD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A17R15	0757-0442		RESD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A17R16	2100-1758		RESVAR WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A17R17	0757-0438		RESD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A17R18	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A17R19	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A17R20	0757-0280		RESD MET FLM 1K OHM 1% 1/8W	28480	0757-0280

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1[R2]	0757-0440		RESD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1[R3]	0757-0440		RESD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1U1	1820-0196	2	IC(LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
	1200-0196	1	SOCKET(INTEGRATED CIRCUIT 10 PIN	91506	8058-1053
A1TP2	1820-0196		IC(LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
			CHASSIS PARTS		
A1	3140-0709	1	FAN(AXIAL 115V 50/60HZ	28480	3140-0709
C6	0180-2274	2	FXD ELECT 4400 UF +75-10% 20VDCW	56289	30D442G020AD2A-DDN
C7	0180-2274		FXD ELECT 4400 UF +75-10% 20VDCW	56289	30D442G020AD2A-DDN
C8	0160-0168		CAPAC MY 0.1 UF 10% 200VDCW	56289	192P10492-PT5
CR1	1902-1226	1	DIODE BREAKDOWN(6.2V 5%	04713	1N3998A
	1200-0080	2	INSULATOR(TRANSISTOR MTG.	71785	296834
CR2	1902-1234	1	DIODE BREAKDOWN(7.5V 5%	04713	1N4000A
	1200-0080		INSULATOR(TRANSISTOR MTG.	71785	296834
DS1	3140-0744	1	LAMP(GLOW MINIATURE 95V	07034	A511
DS2	2140-0092	1	LAMP(INCANDESCENT 6.0V 0.040A	71744	CM 885
	1460-0165	1	LAMPHOLDER(FOR T-1 SERIES	08717	302R
	1490-0371	1	LENS(LAMPHOLDER, AMBER	08717	302-A(LENS)
			RECOMMENDED REPLACEMENT		
F1	2110-0001	1	FUSE(1 AMP 250V	75915	312001.
			(250V OPERATION)RECOMMENDED REPLACEMENT		
F2	2110-0002	1	FUSE(CARTRIDGE 2 AMP 3 AG	75915	312.002
			(115V OPERATION)RECOMMENDED REPLACEMENT		
	1400-0084	1	FUSEHOLDER(EXTRACTION POST TYPE	75915	342014
FL1	9100-2877	1	FILTER(LINE	05245	FI242
J1	1250-0102	4	CONNECTOR(BNC	28480	1250-0102
J2	0060-0467	2	CONNECTOR(MALE PROBE	28480	0060-0467
J3	1250-0102		CONNECTOR(BNC	28480	1250-0102
J4	1250-0102		CONNECTOR(BNC	28480	1250-0102
J5	0060-0467		CONNECTOR(MALE PROBE	28480	0060-0467
J6	1250-0102		CONNECTOR(BNC	28480	1250-0102
J7	1250-0870	3	BODY(RF CONNECTOR REAR MTG	27264	28JR112-1
J8	1250-0870		BODY(RF CONNECTOR REAR MTG	27264	28JR112-1
J9	1250-0870		BODY(RF CONNECTOR REAR MTG	27264	28JR112-1
J10			PART OF FL1		
J11	08410-20029	1	CONNECTOR(FEMALE MOD	28480	08410-20029
M1	1120-1525	1	METER	28480	1120-1525
Q1	1854-0459	2	TST(SI) NPN	04713	2N1095
Q2	1854-0459		TST(SI) NPN	04713	2N1095
R1	2100-2726	1	RVAR CERMET 1K OHM 20% LIN 2W	28480	2100-2726
R2	2100-2727	1	RVAR CERMET 500 OHM 20% LIN 2W	28480	2100-2727
R3	0698-7276	1	RESD FLM 46.4K OHM 1% 1/8W	28480	0698-7276
S1	3101-1244	1	SWITCH(PUSHBUTTON DPDT-DB	07034	82-BB480-120/A511
S2	3101-1234	1	SWITCH(SLIDE DPDT	82389	11A-1242
T1	9100-2871	1	TRANSFORMER(POWER	28480	9100-2871
W1	08407-60046	1	CABLE ASSY(FLEX	28480	08407-60046
W2	08407-60121	1	CABLE ASSY(POWER,	28480	08407-60121
			INCLUDES DS1, R2, S1,		
W3	08407-60064	1	CABLE ASSY(REF CHAN DIRECT RF INPT	28480	08407-60064
W4	08407-60065	1	CABLE ASSY(REF CHAN ATTEN RF INPT	28480	08407-60065
W5	08407-60066	1	CABLE ASSY(TEST CHAN DIRECT RF INPUT	28480	08407-60066
W6	08407-60067	1	CABLE ASSY(TEST CHAN ATTEN RF INPUT	28480	08407-60067
W7	08407-60076	1	CABLE ASSY(PHASE VERNIER POT TO AZAL	28480	08407-60076
W8	08407-60077	1	CABLE ASSY(AMPL VERNIER POT TO AZAL	28480	08407-60077
W9	08407-60039	1	CABLE ASSY(PHASE-LOCKED OSC OUTPT TO LO	28480	08407-60039
W10	08407-60040	1	CABLE ASSY(LOCAL OSC TO TEST CHAN CONV	28480	08407-60040
W11	08407-60078	1	CABLE ASSY(REF CHAN FROM RPP TO PLUG-IN	28480	08407-60078
W12	08407-60079	1	CABLE ASSY(TEST CHAN AMPL FROM RPP TO	28480	08407-60079
W13	08407-60080	1	CABLE ASSY(TEST CHAN PHASE FROM RPP	28480	08407-60080
W14	08407-60042	1	CABLE ASSY(REF CHAN RPP TO REAR PANEL	28480	08407-60042
W15	08407-60043	1	CABLE ASSY(TEST CHAN RPP TO REAR PANEL	28480	08407-60043
W16	08407-60044	1	CABLE ASSY(REAR PANEL VTO INPT TO VTO	28480	08407-60044
W17	8120-1348	1	CABLE ASSY(POWER, DETACHABLE	70903	KH5-7041
W18	08407-60041	1	CABLE ASSY(VTO AMP OUT TO LO MIXER	28480	08407-60041
W19	08407-60045	1	CABLE ASSY(LOCAL OSC OUT TO AUTO LEVEL	28480	08407-60045
W20	08407-60062	1	CABLE ASSY(LOCAL OSC TO REF CHAN CONV	28480	08407-60062
W21	08407-60068	1	CABLE ASSY(TEST AGC AMP TO IF ATTEN	28480	08407-60068
W22	08407-60070	1	CABLE ASSY(TEST IF ATTEN TO AMPL VER	28480	08407-60070
W23	08407-60071	1	CABLE ASSY(TEST CHAN CONV TO AGC AMPL	28480	08407-60071
W24	08407-60072	1	CABLE ASSY(AMPL VER TO TEST CHAN(RPP)	28480	08407-60072
W25	08407-60073	1	CABLE ASSY(REF CHAN CONV TO REF AGC AMP	28480	08407-60073
W26	08407-60074	1	CABLE ASSY(REF AGC AMPL TO PHASE VER	28480	08407-60074
W27	08407-60075	1	CABLE ASSY(PHASE VER TO REF CHAN(RPP)	28480	08407-60075
XA1			NOT ASSIGNED		
XA5			NOT ASSIGNED		

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts



Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			CABINET PARTS		
			NOTE THE GENERAL COLOR SCHEMES ARE AS FOLLOWS: 8407A(STD) - INDICATES COLOR SCHEME WHICH INCLUDE MINT GRAY FRONT PANEL AND OLIVE GRAY CABINET. 8407A(OPT A88)-INDICATES LITE GRAY PANEL 8407A(OPT A95)-INDICATES COMPLETE COLOR SCHEME OF LITE GRAY PANEL & BLUE GRAY CABINET.		
1	5060-0232	1	FRAME ASSY:MODIFIED	28480	5060-0232
2	08407-60146	1	PANEL ASSY:FRONT(STANDARD)	28480	08407-60146
2	08407-60055	1	PANEL ASSY:FRONT(OPTIONS)	28480	08407-60055
3	5060-0222	1	HANDLE ASSY:RH SIDE	28480	5060-0222
4	5060-8735	1	RETAINER HANDLE ASSY,OLIVE GRAY(STANDARD)	28480	5060-8735
4	5060-0765	1	RETAINER-HANDLE ASSY,(OPTIONS)	28480	5060-0765
5	5060-0767	1	FOOT ASSY:FM	28480	5060-0767
6	1490-0030	1	STAND:TILT	28480	1490-0030
7	5000-0052	1	PLATE:FLUTED ALUMINUM	28480	5000-0052
8	5060-8741	1	KEYTRACK MOUNT,GRAY(STANDARD)	28480	5060-8741
8	5060-0776	1	KEYTRACK MOUNT,LIGHT GRAY(OPTIONS)	28480	5060-0776
9	5000-8719	1	COVER:SIDE 7 X 16,OLIVE GRAY(STANDARD)	28480	5000-8719
9	5000-0743	1	COVER:SIDE,BLUE GRAY(OPTION A95)	28480	5000-0743
10	5060-0767	1	COVER ASSY:TOP,OLIVE GRAY(STANDARD)	28480	5060-0767
10	5060-0727	1	COVER ASSY:TOP,BLUE GRAY(OPTION A95)	28480	5060-0227
11	5060-0268	1	COVER ASSY:BOTTOM,OLIVE GRAY(STANDARD)	28480	5060-0268
11	5060-0228	1	COVER ASSY:BOTTOM,BLUE GRAY(OPTION A95)	28480	5060-0228
12	08407-00057	1	PANEL:REAR	28480	08407-00057
12	08407-A0122	1	PANEL ASSY:REAR	28480	08407-A0122
13	5040-0361	1	LOCK:EXTRACTOR(STANDARD)	28480	5040-0361
13	5040-0272	1	LOCK:EXTRACTOR,LIGHT GRAY(OPTIONS)	28480	5040-0272

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
XA6	1251-2138	1	CONNECTOR:PC (2 X 18) 36 CONTACT	03877	614-093-19
			MISCELLANEOUS		
	0370-0103	1	KNOB:BLK W/ARROW 5/8" DD 1/4" SHAFT	28480	0370-0103
	0380-0175	1	STANDOFF:6-32 INTERNAL THREAD	00000	ORD
	0380-0178	1	STANDOFF:6-32 INTERNAL THREAD	00000	ORD
	08407-00052	1	PLATE:SPRING	28480	08407-00052
	08407-00053	1	DIVIDER READOUT	28480	08407-00053
	08407-20044	1	WINDOW	28480	08407-20044
	08407-20046	1	SPACER READOUT	28480	08407-20046
	08407-20048	1	STANDOFF:FRONT PANEL BOARD	28480	08407-20048
	08407-20049	1	SPACER:DIODE	28480	08407-20049
	08407-20055	1	STANDOFF:SWITCH BOARD	28480	08407-20055
	08407-60094	1	READOUT ASSY	28480	08407-60094
	5060-0050	1	BOARD EXTENDER:8 PIN	28480	5060-0050
	03950-4001	1	EXTRACTOR:TOOL	28480	03950-4001
	08407-00021	1	DIVIDER BOARD	28480	08407-00021
	11593A	1	TERMINATION:50 OHM	28480	11593A
	08410-60067	1	CABLE ASSY:SERVICE	28480	08410-60067
	10503A	1	CABLE ASSY:BNC SHIELDED (3 EA)	28480	10503A
	5020-7977	1	TRIM:UPPER FRAME(MINT GRAY)	28480	5020-7977
	5020-3278	1	TRIM:UPPER FRAME(LIGHT GRAY)	28480	5020-3278
	5020-7978	1	TRIM:LOWER FRAME(MINT GRAY)	28480	5020-7978
	5020-3276	1	TRIM:LOWER FRAME(LIGHT GRAY)	28480	5020-3276
	08407-00063	1	DECK:SL(DE)STANDARD)	28480	08407-00063
	08407-00011	1	DECK:SL(DE)OPT A99)	28480	08407-00011
	08407-20126	1	FRAME:UPPER(STANDARD)	28480	08407-20126
	08407-20041	1	FRAME:UPPER(OPTIONS)	28480	08407-20041
	08407-40005	1	DIVIDER:CENTER(STANDARD)	28480	08407-40005
	08407-40001	1	DIVIDER:CENTER(OPTIONS)	28480	08407-40001
	08410-20053	1	FRAME:LOWER(STANDARD)	28480	08410-20053
	08410-2015	1	FRAME:LOWER(LIGHT GRAY)	28480	08410-2015

Table 6-3. Code List of Manufacturers

MFR. NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00853	SANGAMO ELECTRIC CO.,PICKENS DIV.	PICKENS, S.C.	29671
01121	ALLEN BRADLEY CO.	MILWAUKEE, WISC.	53204
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
02114	FERROXCUBE CORP.	SAUGERTIES, N.Y.	12477
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
02735	RCA SOLID STATE & RECEIVING TUBE DIV.	SOMERVILLE, N.J.	08876
03877	TRANSITRON ELECTRONIC CORP.	WAKEFIELD, MASS.	01880
04713	MOTOROLA SEMICONDUCTOR PROD.,INC.	PHOENIX, ARIZ.	85008
05245	COMPONENTS CORP.	CHICAGO, ILL.	60657
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
08717	SLOAN CO. THE	SUN VALLEY, CALIF.	91352
13103	THERMALLOY CO.	DALLAS, TEX.	75247
14655	CORNELL DUBILIER ELECT. DIV.FEDERAL PACIFIC ELECT. CO.	NEWARK, N.J.	07102
27701	SPECIALITIES MFG. CO. INC.	BRIDGEPORT, CONN.	06601
28480	HEWLETT-PACKARD COMPANY	PALO ALTO, CALIF.	94304
36196	STANWYCK COIL PROD. LTD.	HAWKESBURY ONTARIO, CANADA	
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
70903	BELDEN CORP.	CHICAGO, ILL.	60644
71590	GLOBE UNION INC. CENTRALAB DIV.	MILWAUKEE, WISC.	53201
71744	CHICAGO MINIATURE LAMP WORKS	CHICAGO, ILL.	60640
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
75915	LITTELFUSE INC.	DES PLAINES, ILL.	60016
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
82142	AIRCO SPEER ELECT. COMP.	DU BOIS, PA.	15801
82389	SWITCHCRAFT INC.	CHICAGO, ILL.	60630
87216	MARCMAX INDUSTRIES	ANAHEIM, CALIF.	92803
91418	RADIO MATERIALS CO.	CHICAGO, ILL.	60646
91506	AUGAT INC.	ATTLEBORO, MASS.	02703
93332	SYLVANIA ELECTRIC PROD. INC. SEMICONDUCTOR DIV.	WOBURN, MASS.	01801
95354	METHODE MFG. CO.	ROLLING MEADOWS, ILL.	60008
98291	SEALECTRO CORP.	MAMARONECK, N.Y.	10544
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052

See introduction to this section for ordering information

SERVICE INFORMATION

SECTION VII
SERVICE

7-1. INTRODUCTION

7-2. The schematic diagrams in this section represent the circuits electrically. They are not wiring diagrams, though wire colors are given where practical.

7-3. The large numbers in the lower right corners of the schematics are the schematic numbers. These numbers are used to cross reference connections between schematics. Smaller numbers preceded by A, located below the schematic number, list the assemblies included in the schematic.

7-4. Some of the general information obtainable from the schematic diagrams is shown in Figure 7-1. Notes and explanations of symbols pertaining to all the diagrams are contained in Figure 7-2. Figure 7-2 also contains the test setup and measurement conditions required to obtain the normal test point waveforms and voltages noted on the schematic diagrams. Notes about specific components, circuits, or conditions are given on the diagram to which they apply.

7-5. As an aid to finding components and assemblies in the set of diagrams, each diagram has a box labelled Reference Designations that contains all the reference designations appearing on the diagram.

7-6. An asterisk indicates a factory selected part. The component value shown is the typical or most commonly selected value.

7-7. Component procurement information and specific component descriptions are included in Section VI. Refer to page 6-1 for information on how to order parts.

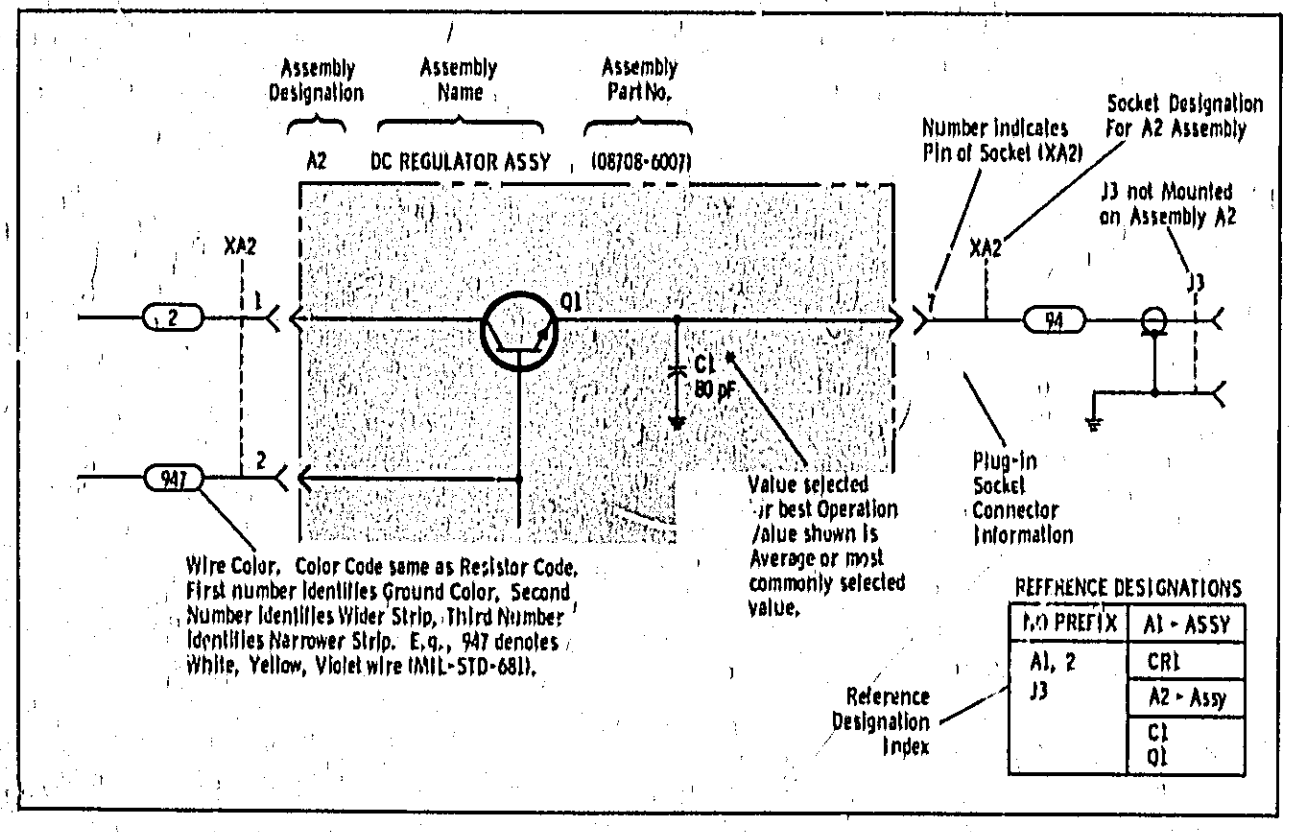


Figure 7-1. General Information on Schematic Diagrams

SCHEMATIC DIAGRAM NOTES

Refer to MIL Std 15B for Symbols Not Shown

Resistance is in ohms and capacitance is in microfarads unless otherwise noted.

P/O = part of.

*Asterisk denotes a factory-selected value. Value shown is typical. Capacitors may be omitted or resistors jumpered.

Screwdriver adjustment.

Panel control.

Encloses front panel designations.

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.

Numbers in circles on circuit assemblies show locations of test points.

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.

Voltage regulator (breakdown diode).

Denotes Field Effect transistor (FET) with N-type base.

Denotes FET with P-type base.

Denotes Capacitive diode (Varicap, varactor).

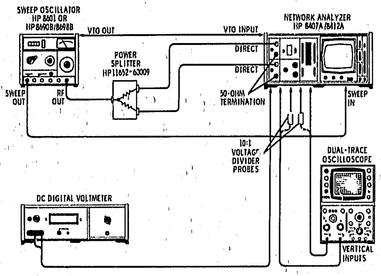
Denotes Silicon Controlled Rectifier.

P-Type Metal Oxide Substrate FET (MOSFET)

N-Type Metal Oxide Substrate FET (MOSFET)

Figure 7-2. Schematic Diagram Notes (1 of 2)

SCHEMATIC DIAGRAM NOTES (cont'd)



CONDITIONS FOR WAVEFORMS AND DC VOLTAGES ON SCHEMATICS.

a. Connect equipment as shown in test setup.

b. Set 8407A controls as follows:

DISPLAY REFERENCE CAL — Zero dB at top switch positions.
DISPLAY REFERENCE — 10 dB/step switch and 1 dB/step switch at top position (0 dB).
REF CHANNEL LEVEL ADJ — Middle position.
AMPL VERNIER — Midrange.
PHASE VERNIER — Midrange.

c. Set sweep oscillator controls for single-frequency (CW) operation at 1 MHz.

d. Adjust sweep oscillator RF for 20 mV P-P at REF CHANNEL DIRECT input tee as read on oscilloscope.

e. On Model 8412A Plug-in, set controls as follows:

MODE to DUAL
AMPL DB/DIV to 10
PHASE DEG/DIV to 90
PHASE OFFSET polarity to +
DEGREES to zero
INTENSITY for moderate trace intensity

Figure 7-2. Schematic Diagram Notes (2 of 2)

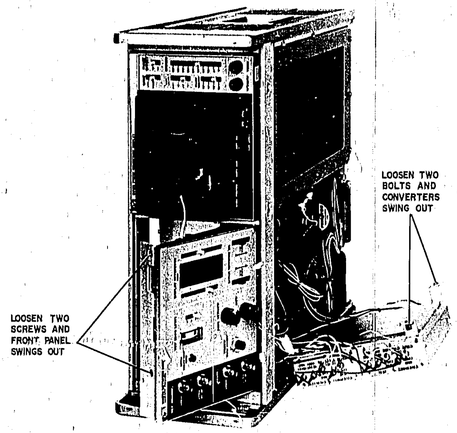


Figure 7-3. Cabinet Disassembly for Maintenance

TOP

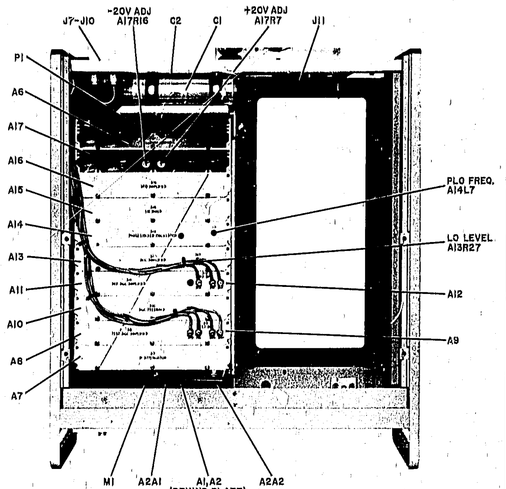


Figure 7-4. Location of Major Assemblies and Adjustment Points (1 of 2)

BOTTOM

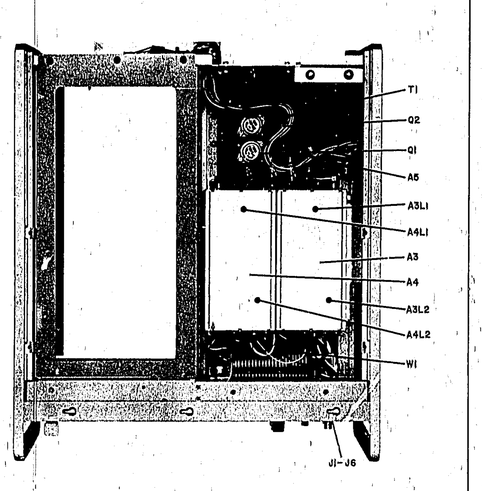


Figure 7-4. Location of Major Assemblies and Adjustment Points (2 of 2)

TEST SETUP

NOTE
When connections to PC plug-in boards are referenced, convenient access is obtained in most cases by using extension boards, HP Stock No. 5060-0050. However, some boards will operate erratically when unshielded and should not be placed on extension boards. These boards are A14, A15, and A16.

Connect equipment as shown in test setup (Figure 7-6). Install 8412A Phase-Magnitude Display into 8407A. Set 8407A controls as follows:
REF CHAN LEVEL ADJ switch to middle position
DISPLAY REFERENCE switches to top position
AMPL VERNIER and PHASE VERNIER controls to midrange
DISPLAY REFERENCE CAL for zero dB at top
Power pushbutton lighted.

Set 8412A controls as follows:
MODE switch to DUAL
AMPL DB/DIV switch to 10
PHASE DEG/DIV switch to 90
PHASE switch to +
BW (kHz) switch to 10

Set sweep oscillator for single-frequency CW operation at 1.0 MHz.

YES

INPUT SIGNALS

Connect oscilloscope to J1 (REF CHANNEL DIRECT) using a BNC tee at the input connector, and adjust the sweep oscillator for 20 mV peak-to-peak on oscilloscope.

NO

Sweep oscillator or power splitter defective, or short in A3.

YES

Connect oscilloscope to J4 (TEST CHANNEL DIRECT) through a BNC tee. And waveform should be 20 mV peak-to-peak on oscilloscope.

NO

Power splitter defective or short in A4.

YES

FRONT PANEL VISUAL CHECK

Check for an indication on the REF CHAN LEVEL meter near the top of the OPERATE range.

NO

POWER SUPPLY

Check with digital voltmeter (DVM) for +20 Vdc ±1.0 Vdc at A17TP3 and −20 Vdc ±1.0 Vdc at A17TP2.

If indication is just slightly out of tolerance, make slight adjustment of either A17R7 (+20V) or A17R16 (-20V).

Transients may trigger ±20 volt overvoltage protection. If so, turn instrument off about 5 minutes, then back on again and power supply should come on again.

INCORRECT OR NO VOLTAGE AT A17TP3

Check with DVM for +30 Vdc, ± 4 Vdc at A17TP4.

NO

Trouble is in diodes A5CR1 or A5CR2, or transformer T1.

YES

Trouble is in A17, series regulator Q1, or short on +20 volt line.

INCORRECT OR NO VOLTAGE AT BOTH A17TP2 AND A17TP3

If zero Vdc at both test points, trouble is probably fuse F1, transformer T1, or power switch S1.

YES

INCORRECT OR NO VOLTAGE AT A17TP2

CAUTION
DVM input must be floating and not grounded for this step.

Check with DVM for −30 Vdc ±4 Vdc between A17TP1 and A17TP2.

NO

Trouble is in diodes A5CR3 or A5CR4 or transformer T1.

YES

Trouble is in A17, series regulator Q2, or short on −20 volt line.

YES

REFERENCE CHANNEL

Connect oscilloscope to rear panel IF REF OUT (J8) and waveform should be 1.2 volt peak-to-peak, 278 kHz.

NO

YES

Put A12 on board extender and connect oscilloscope to A12TP2. Waveform should be 3.0 volt ±0.5 volt peak-to-peak, 278 kHz.

NO

Trouble is in A2A1 ± 50-degree phase shifter (part of A2 front panel assembly).

YES

Connect oscilloscope to J11-24 (plug-in interface connector) and check for 2.2 volts peak-to-peak.

NO

Trouble is in A12 reference channel IF bandpass filter.

YES

Trouble is in A12 reference channel IF band-pass filter.

PHASE-LOCK LOOP

Put A11 on board extenders and check waveform with oscilloscope at XA11-11 for a 3.5 volt peak-to-peak, ± 0.5 volt peak-to-peak, 278 kHz phase-locked signal.

NO WAVEFORM

TO SHEET 2

SEARCH WAVEFORM PRESENT

If search waveform is present as shown below, trouble is in A14 phase-locked oscillator. Align A14L7 according to alignment procedures (Table 5-6, Test 3). If alignment does not correct problem, replace PLO A14.

200 TO 500 KHz

>2V p-p

WAVEFORM PRESENT BUT NOT PHASE LOCKED

If 278 kHz waveform is present but not phase-locked as shown below, trouble is in A14 phase-locked oscillator.

278 KHz

>2V p-p

YES

Check for 0.16 Vdc ± 0.02 Vdc at A6TP1 with DVM.

NO

Trouble is in A10 AGC feedback amplifier.

YES

Trouble is in meter driver in A2 front panel assembly or in REF CHAN LEVEL meter M1.

TO SHEET 2

Figure 7-5. Troubleshooting Tree (1 of 2)

FROM SHEET 1

Disconnect miniature coaxial cable at A3 LO connector at bottom of A6 master board and connect oscilloscope to disconnected cable from A13 LO TO CONV output (XA13-10). Waveform should be a 1.4V peak-to-peak searching sine wave signal. (Reconnect cable after measurement.)

NO → Disconnect miniature coaxial cable at A15 LO OUT TO ALC connector at bottom of A6 master board. Connect oscilloscope to A15 LO OUT TO ALC connector and waveform should be 10 mV peak-to-peak searching waveform. (Reconnect cable after measurement.)

NO → Disconnect miniature coaxial cable at A14 PLO OUT connector at bottom of A6 master board. Connect spectrum analyzer to A14 PLO OUT connector and signal level should be −13 dBm. (Reconnect cable after measurement.)

NO → Trouble is in A14 Phase-locked oscillator.

YES

Disconnect miniature coaxial cable at A16 VTO OUT at bottom of A6 master board. Connect spectrum analyzer to A16 VTO OUT connector and signal level should be > +2 dBm. (Reconnect cable after measurement.)

NO → Trouble is in A16 VTO Amplifier.

YES

Trouble is in A15 LO mixer.

YES

Trouble is in A13 Auto level control amplifier.

YES

Check waveform with oscilloscope at XA11-2 for a 0.4V peak-to-peak, 278 kHz searching sine wave signal.

NO → Trouble is in A3 reference channel converter.

YES

Trouble is in A11 Reference AGC amplifier.

FROM SHEET 1

SHEET 2

TEST CHANNEL

Connect oscilloscope to rear panel IF TEST OUT (J7) and waveform should be 0.4 to 0.6 volts peak-to-peak.

NO → Put A7 on board extender and connect oscilloscope to XA7-2. Waveform should be 70 mV peak-to-peak 278 kHz signal.

NO → Put A8 on board extender and connect oscilloscope to XA8-2. Waveform should be 0.25 volt peak-to-peak, 278 kHz signal.

NO → Disconnect cable from A4 LO connector. Connect oscilloscope to disconnected cable. Waveform should be 0.63 volt peak-to-peak.

NO → Trouble is in A13 auto level control amplifier.

YES

Trouble is in A4 test channel converter.

YES

Trouble is in A8 Test AGC amplifier.

YES

Connect oscilloscope to XA7-11. Waveform should be 1.4 volt peak-to-peak, 278 kHz signal.

NO → Trouble is in A7 IF attenuator.

YES

Put A9 on board extender and connect oscilloscope to A9TP2. Waveform should be 1.0 volt peak-to-peak, 278 kHz signal.

NO → Trouble is in A2A2 units attenuator, part of A2 front panel assembly.

YES

Trouble is in A9 Test Channel IF bandpass filter.

YES

Connect oscilloscope to J11-3 (plug-in interface connector) and check for 0.8 to 1.3 volts peak-to-peak.

NO → Trouble is in A9 Test Channel IF bandpass filter.

YES

Set sweep oscillator for swept mode over 10 kHz or narrower band. Check 8412A display for proper amplitude and phase trace as shown below. Both amplitude and phase traces should be straight and relatively smooth. (Noise should be less than 1 small division peak-to-peak.)

NO → If either the amplitude or phase trace is not a smooth line in one segment of the trace, trouble is probably poor phase-lock. Perform phase-lock adjustment described in Table 5-5, Test 4.

If no trace is present on 8412A, check for 480V peak-to-peak between J11-20 and J11-21. If correct voltage is not present, trouble is in power transformer T1.

If trace is still not present, suspect 8412A plug-in. Refer to 8412A Operating and Service Manual.

YES

TO SHEET 3

Figure 7-5. Troubleshooting Tree (2 of 3)

SHEET 3

AMPLITUDE RANGE

NOTE

Be sure 8412A low level adjustment has been made. Incorrect adjustment of 8412A AMPL CAL control would give false indication of a malfunction in 8407A.

Set DISPLAY REFERENCE 1 dB/STEP switch and AMPL VERNIER control as necessary to place 8412A trace at top line of graticule.

Set 355D Attenuator one step at a time to 80 dB. Amplitude trace on 8412A should move down 8 large graticule divisions ±2 small graticule divisions. (Return the 355D attenuator setting to 0 dB.)

NO

If trace movement is out of tolerance in the zero to 30 dB setting of 355D attenuator, trouble is probably saturation in an amplifier stage. Connect oscilloscope and note peak-to-peak waveform at XA8-2, XA7-2, XA7-11, XA9-1, and J7 (IF TEST OUT on rear panel); calculate gain of each stage. Insert 30 dB of attenuation with 355D attenuator, again observe waveform at each stage, and calculate gain. Compare gain to determine which stage is saturating under large-signal conditions.

YES

DISPLAY REFERENCE 10 dB/STEP

Set DISPLAY REFERENCE 10 dB/step switch to each position and 8412A display should change by 10 dB/step.

NO

Check for correct signal voltage to IF attenuator relays from front-panel switch circuits as follows:

DISPLAY REFERENCE 10 dB/STEP	−19 VDC at XA7 PINS
0 (top)	6, 9, 10
+10	6, 9, 10
+20	9, 10
+30	6, 10
+40	5, 10
+50	10
+60	6
+70	5
+80	None

NO

Trouble is in A1 front-panel switch assy.

YES

Trouble is in A7 IF attenuator.

FROM SHEET 2

Set DISPLAY REFERENCE 1 dB/step switch to each position and 8412A display should change by 1 dB/step.

NO

Turn off 8407A and check resistance between A2A2, Pins 2 and 3 (ground). The following resistance values should be obtained:

DISPLAY REFERENCE 1 dB/STEP	RESISTANCE (OHMS)
0 (top)	∞
+1	8195
+2	3802
+3	2424
+4	1710
+5	1285
+6	1005
+7	807.3
+8	661.4
+9	549.9

NO

Trouble is in A1 front-panel switch assy.

YES

Trouble is in A2A2 Amplitude Vernier.

Adjust AMPLITUDE VERNIER control through its range and amplitude trace on 8412A should move smoothly.

NO

Disconnect coaxial cable at A2A2 amplitude VERNIER connector on front panel assembly and measure resistance across cable as AMPLITUDE VERNIER is adjusted. Resistance should be between zero and 600 ohms.

NO

Trouble is AMPL VERNIER control R2.

YES

Trouble is in A2A2 Amplitude Vernier.

Adjust PHASE VERNIER control through its range and phase trace on 8412A should move smoothly.

NO

Disconnect coaxial xable at A2A1 phase-vernier VERNIER connector on front panel assembly. Measure resistance of 1K across coaxial cable through full range of PHASE VERNIER control. (This indicates R1 is not open and C3 is not shorted.) Reconnect coaxial cable to VERNIER connector on A2A1 through a miniature coaxial tee and connect oscilloscope to tee. Adjust PHASE VERNIER control through its range and oscilloscope waveform should change between zero and 1.2V P-P.

NO

If amplitude stays at 1.2V P-P, trouble is C3.
If amplitude is less than 1V P-P maximum, trouble is in A2A1 Phase Vernier.

YES

Trouble is in A2A1 Phase Vernier.

YES

Troubleshooting Complete

Figure 7-5. Troubleshooting Tree (3 of 3)

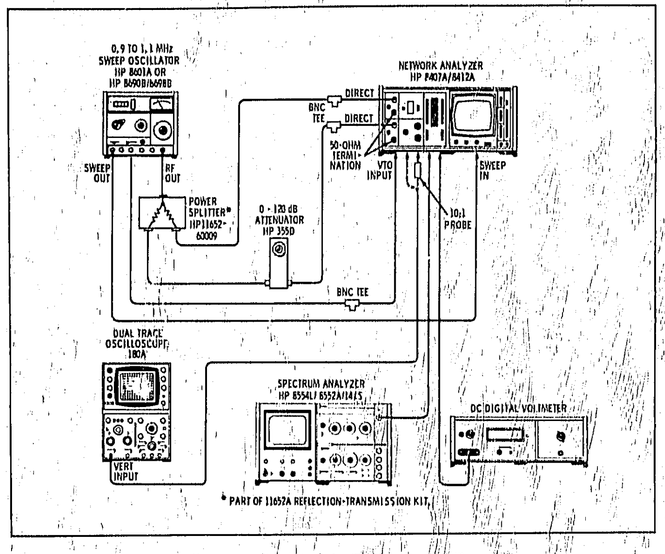


Figure 7-6. Test Setup for Troubleshooting Tree and Block Diagram

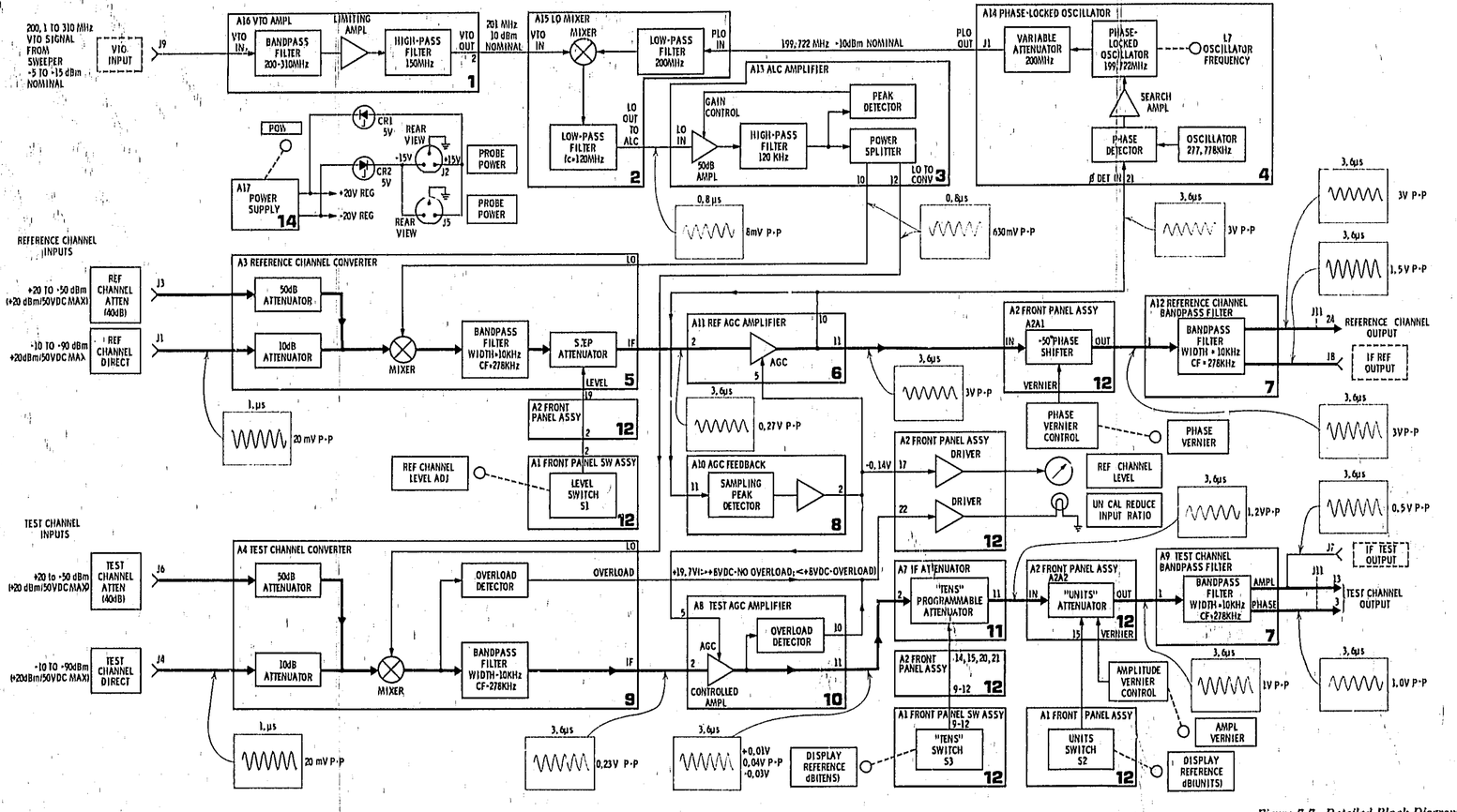


Figure 7-7. Detailed Block Diagram

SERVICE SHEET 1

A16 VTO Amplifier

BUFFER AMPLIFIER

Q1 forms a grounded base RF amplifier. Z1 suppresses spurious oscillations. Transformer T1 forms the output load for Q1, coupling the 200 to 310 MHz RF signal to the bandpass filter.

BANDPASS FILTER

A multisection bandpass filter is formed by a group of parallel-resonate and series-resonate circuits. The passband is from 200 to 310 MHz.

LIMITING AMPLIFIER

Q2 forms a grounded-base RF amplifier followed by three grounded-emitter stages, Q3, Q4, and Q5. Transformer T2 changes from single-ended to push-pull drive for push-pull amplifiers Q6 and Q7. Transformer T3 is a conventional push-pull output transformer with a low-impedance output winding.

150 MHz HIGH-PASS FILTER

Capacitors C22 and C23 and inductors L6 and L7 form a high-pass filter. This filters any harmonics or mixing products below 150 MHz.

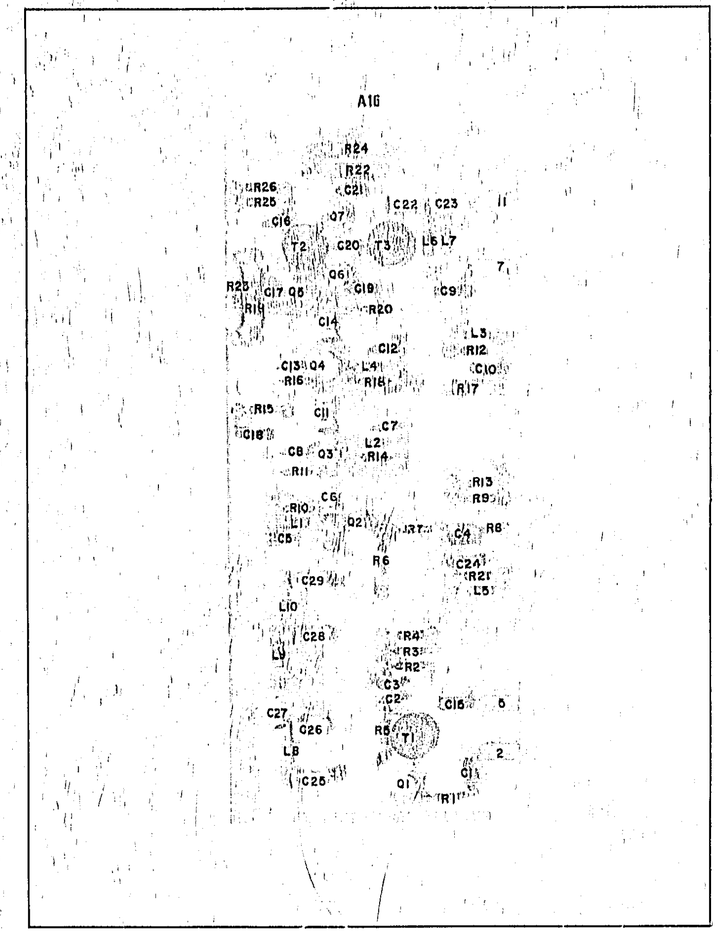
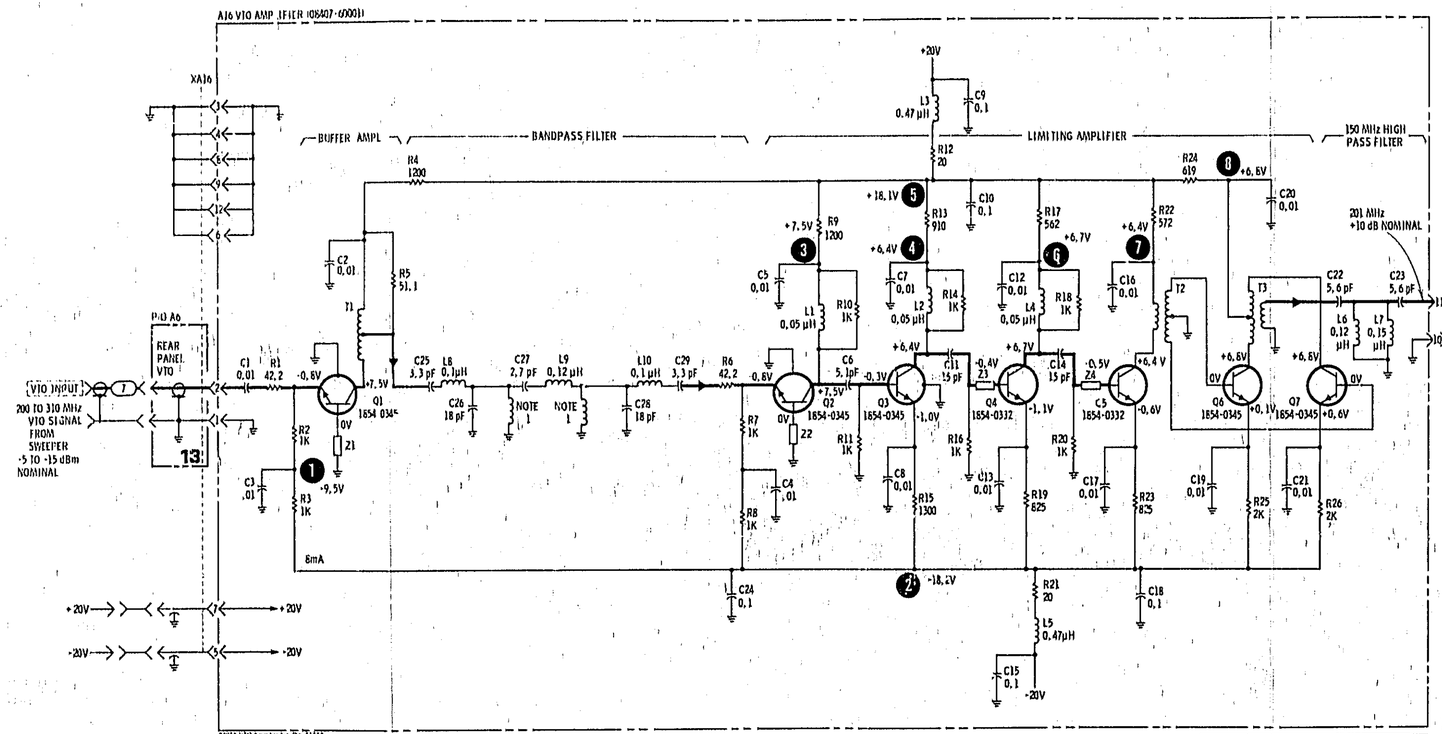


Figure 7-8. Parts Location for VTO Amplifier A16



NOTE: 1. TWO INDUCTORS IN BANDPASS FILTER 08407-60050 ARE PRINTED CIRCUIT SPIRALS.

2. SEE FIGURE 7-2 FOR MEASUREMENT CONDITIONS AND TEST SETUP TO OBTAIN WAVEFORMS AND VOLTAGES SHOWN.

Figure 7-9. VTO Amplifier A16, Schematic Diagram

SERVICE SHEET 2

A15 LO Mixer

200 MHz LOW-PASS FILTER

A low-pass filter prevents harmonics of the phase-locked oscillator from reaching the mixer. This keeps the mixing products to a minimum and produces a clean local oscillator signal.

MIXER

The 200 to 310 MHz VTO signal and the 199.722 MHz PLO signal are transformer-coupled into a balanced diode bridge. The output at the centertap of T3 is the local oscillator signal.

110 MHz LOW-PASS FILTER

The low-pass filter cuts off signals above 110.278 MHz. The signals of concern are the 199.722 MHz phase-locked oscillator and the 200 to 310 MHz VTO signals which were used in the mixer to produce a difference frequency called the local oscillator signal.

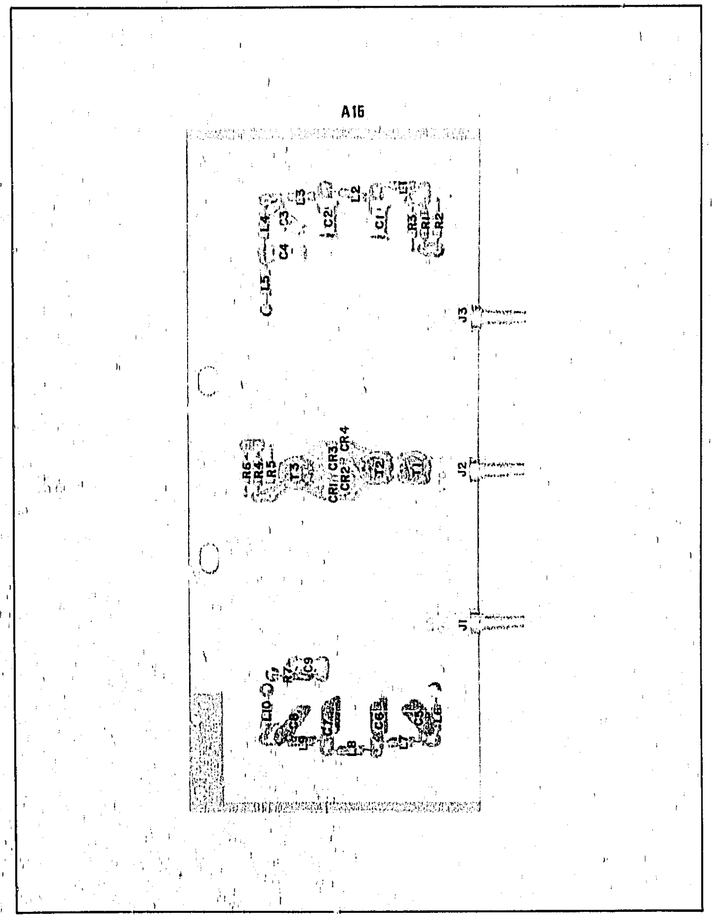


Figure 7-10. Parts Location for Local Oscillator Mixer A15

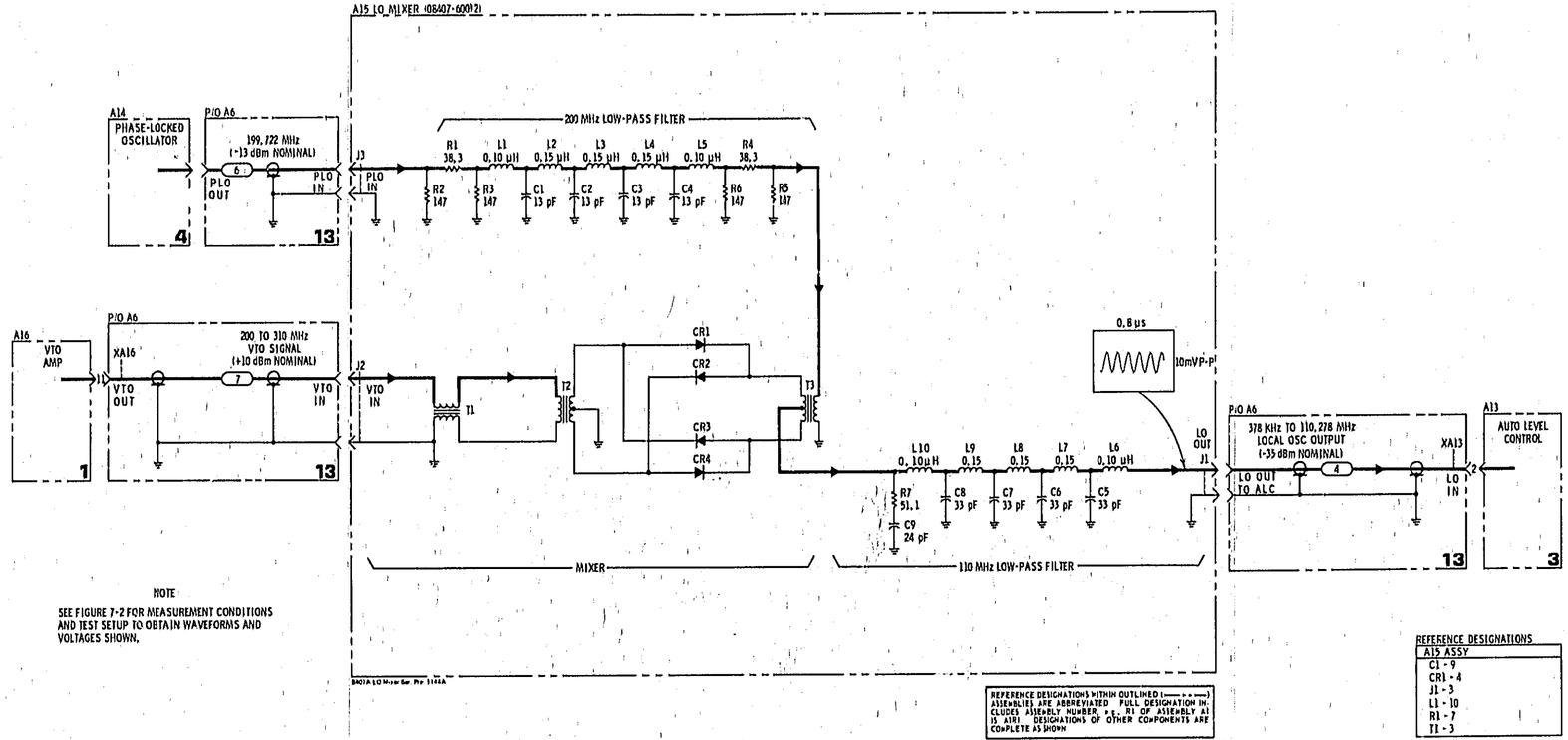


Figure 7-11. Local Oscillator Mixer A15, Schematic Diagram

SERVICE SHEET 3

A13 Automatic Level Control

X10 AMPLIFIER

The local oscillator signal passes through an X10 amplifier composed of Q1 and Q2. Q1 is a grounded base amplifier driving emitter follower Q2. Q2 drives amplifier Q3. The gain of Q3 changes with frequency because of bypass capacitors C5 and C6 and inductor L2.

FREQUENCY-DEPENDENT-GAIN AMPLIFIER

The gain of amplifiers Q3 and Q4 is dependent on frequency. It provides higher gain at the higher frequencies. This is obtained by the time constant of C6-R12 and C11-R18 which bypass the emitters at the higher frequencies.

DIFFERENTIAL AMPLIFIER

A differential amplifier is formed by the two sections of Q5. The stage is driven through the emitter by Q4. One base circuit sets the local oscillator level (LO LEVEL) and the other base circuit receives the feedback signal for leveling. The bias on the bases of Q5 changes the effective collector load impedance of Q4 thus changing the gain of Q4.

100 kHz HIGH-PASS FILTER

A high-pass filter is formed by C16-C20 and L4 and L5. This filters out any mixing products below 100 kHz, providing a clean local-oscillator signal.

X1 AMPLIFIER (Q8 & Q9)

Q8 and Q9 form a complementary emitter follower with a gain of one. The local oscillator (LO) signal at the output of Q8,Q9 is a leveled signal of fairly constant amplitude through the LO signal range.

A13

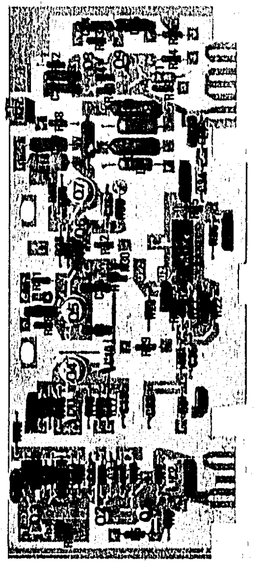


Figure 7-12. Parts Location for Automatic Level Control Amplifier A13

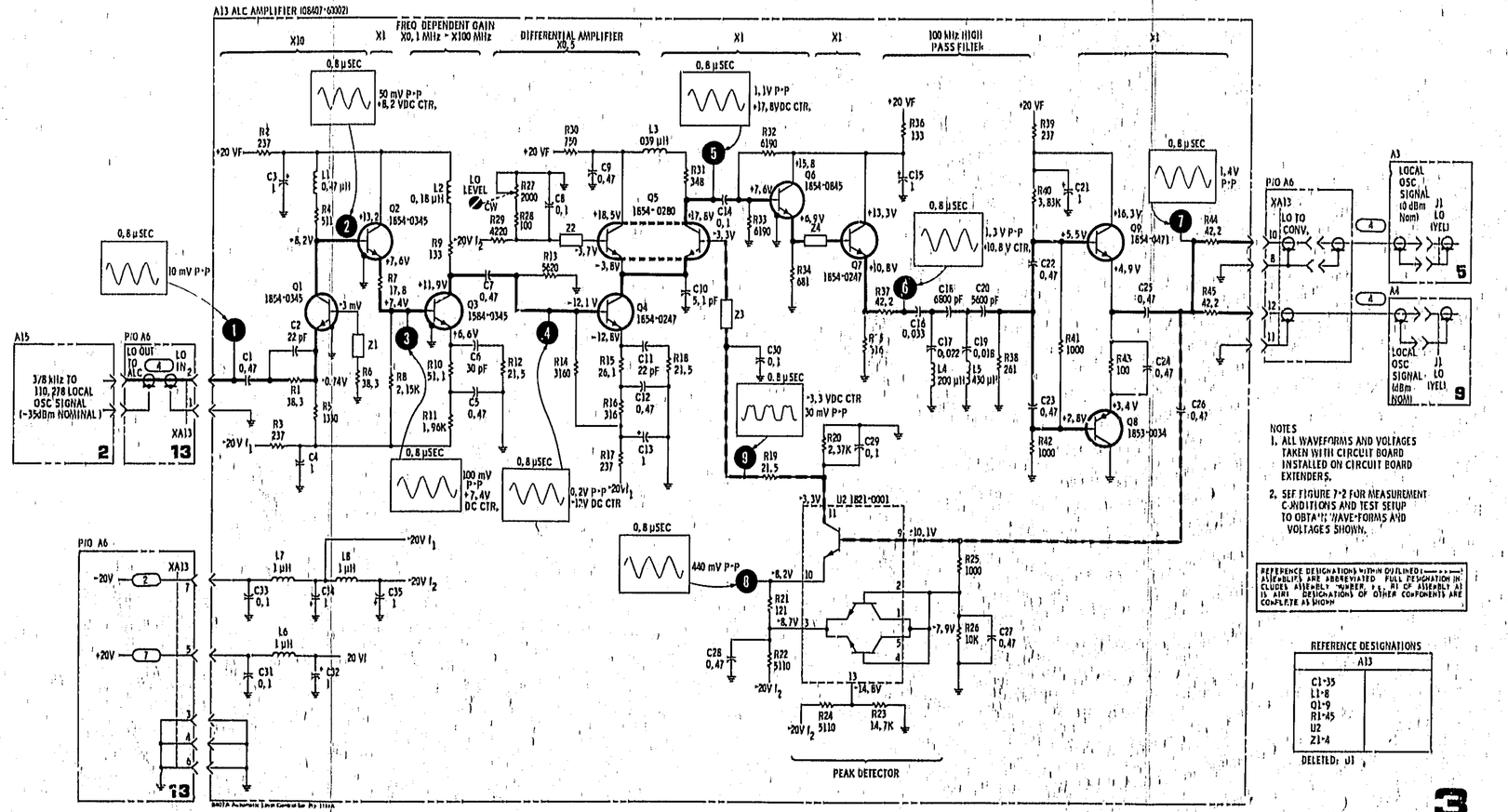


Figure 7-13. Automatic Level Control Amplifier A13, Schematic Diagram

SERVICE SHEET 4

A14 Phase-Locked Oscillator

PHASE DETECTOR

The 278 kHz reference oscillator signal at the bases of Q9 and Q11 acts as the gating signal for the detector circuit. Detection occurs in the two differential amplifier circuits formed by Q7, Q8, Q10 and Q12. Q13 forms a constant current supply for the phase detector.

SEARCH AMPLIFIER

The search amplifier is formed by constant current source Q5 and differential amplifier Q3 and Q4. The dc voltage from the search amplifier passes through emitter-follower Q6. This dc voltage is applied to the phase-locked oscillator, producing a correction in phase or frequency necessary to maintain a 278 kHz reference channel IF signal. When loss of phase lock occurs, the search amplifier produces a sawtooth signal that causes the 199.850 MHz oscillator to sweep above and below the crystal frequency. When the sweep produces a momentary reference channel IF signal of 278 kHz, the signal produces a dc output from the phase detector which stops the search, and locks the phase-lock oscillator.

278 kHz REFERENCE OSCILLATOR

Q1 and Q2 form a crystal oscillator at 277.778 kHz. The output is used to compare with the reference channel IF signal.

PHASE-LOCK OSCILLATOR

Oscillator Q15 produces a 199.722 MHz phase-locked oscillator (PLO) signal. The frequency may be changed by the adjustment of inductor L7 to center the capture range. The frequency of the oscillator is controlled through the capture range by a dc signal from the phase detector. This dc signal is applied to CR3 and changes the effective capacity presented to the circuit by CR3. This, in turn, changes the oscillator frequency and causes phase tracking between the oscillator and the RF input signal.

BUFFER

Buffer amplifier Q14 is a grounded-base configuration. It provides isolation between the PLO and the variable attenuator circuit. Isolation is necessary to prevent changes in the attenuator from reflecting into the PLO and pulling it out of phase lock.

LOW-PASS FILTER 250 MHz

A low-pass filter is formed by C32, C33, and L8-L10. This removes mixing products and harmonics above the PLO frequency range.

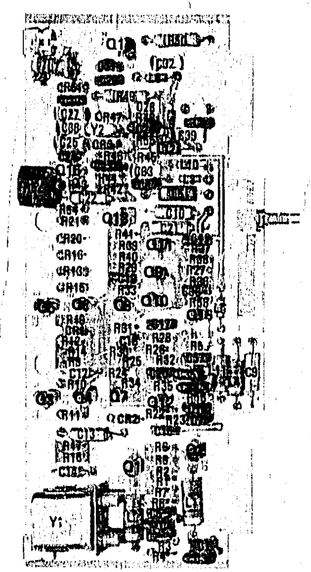
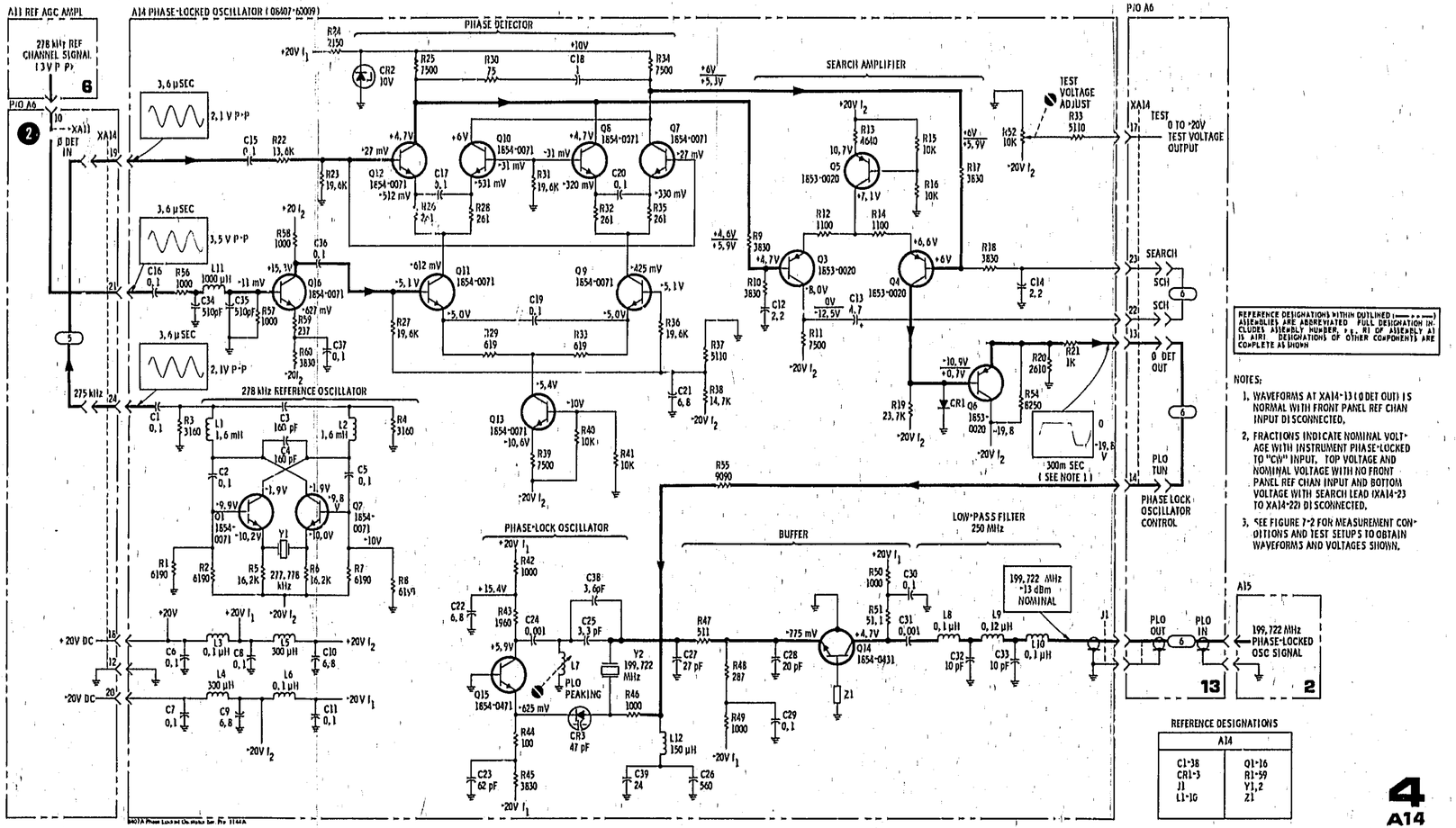


Figure 7-14. Parts Location for Phase-Locked Oscillator A14



NOTES:

1. WAVEFORMS AT XA14-13 (Ø DET OUT) IS NORMAL WITH FRONT PANEL REF CHAN INPUT DISCONNECTED.
2. FRACTIONS INDICATE NOMINAL VOLTAGE WITH INSTRUMENT PHASE-LOCKED TO "CW" INPUT. TOP VOLTAGE AND NOMINAL VOLTAGE WITH NO FRONT PANEL REF CHAN INPUT AND BOTTOM VOLTAGE WITH SEARCH LEAD (XA14-23 TO XA14-22) DISCONNECTED.
3. SEE FIGURE 7-2 FOR MEASUREMENT CONDITIONS AND TEST SETUPS TO OBTAIN WAVEFORMS AND VOLTAGES SHOWN.

REFERENCE DESIGNATIONS WITHIN OUTLINED (——— • • ———) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER (i.e., R1 OF ASSEMBLY A1 IS A1R1). DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN

Figure 7-15. Phase-Locked Oscillator A14, Schematic Diagram

SERVICE SHEET 5

A3 Reference Channel Converter

LOCAL OSCILLATOR AMPLIFIER

Q11 is a grounded base configuration RF amplifier followed by emitter-follower Q10. L1 adjusts swept-frequency phase tracking between the test and reference channel converters. The output of Q10 is amplified by complementary amplifiers Q8 and Q9.

RF AMPLIFIER

Q1 forms a grounded base amplifier. L2 adjusts the swept frequency amplitude tracking between converters A3 and A4. The RF input to Q1 comes either through a 10 dB attenuator from the DIRECT input or through a 50 dB attenuator from the ATTEN input. Q2 and Q3 are direct-coupled emitter followers to isolate the RF amplifier circuit from balanced mixer A3A1.

MIXER

Balanced mixer A3A1 mixes the local oscillator signal with the RF input signal to produce a 278 kHz difference signal.

26 dB AMPLIFIER

Q4, Q5, and Q12 form an IF amplifier. The overall gain of this amplifier is controlled by Q6 and Q7. Control input to Q6 and Q7 is furnished by the front-panel REF CHAN LEVEL ADJ switch. Each change in switch position produces a 20 dB nominal change in the test channel output due to the AGC amplifier action.

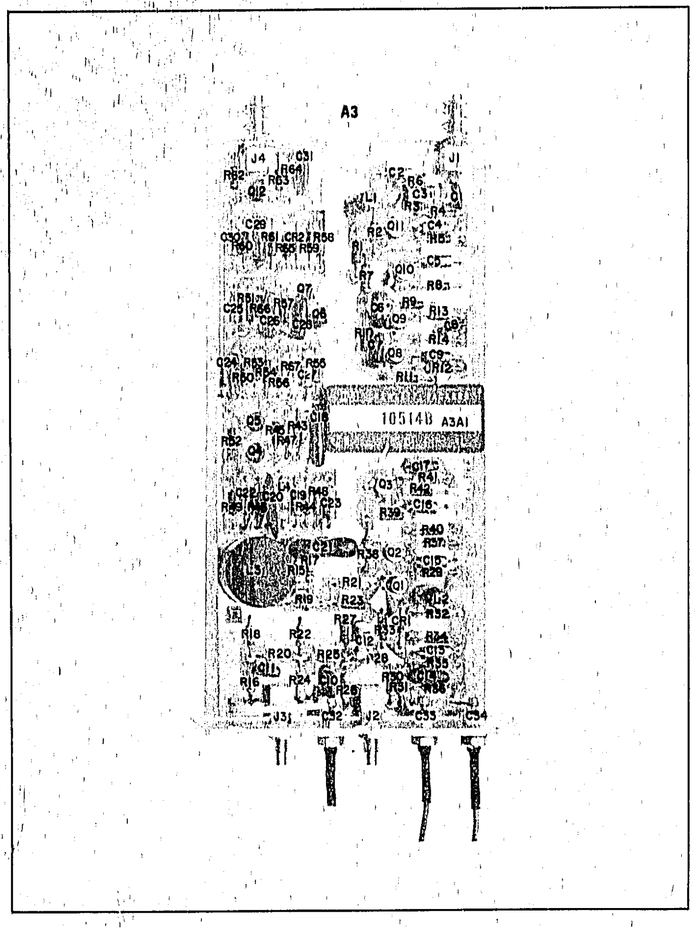


Figure 7-16. Parts Location for Reference Channel Converter A3

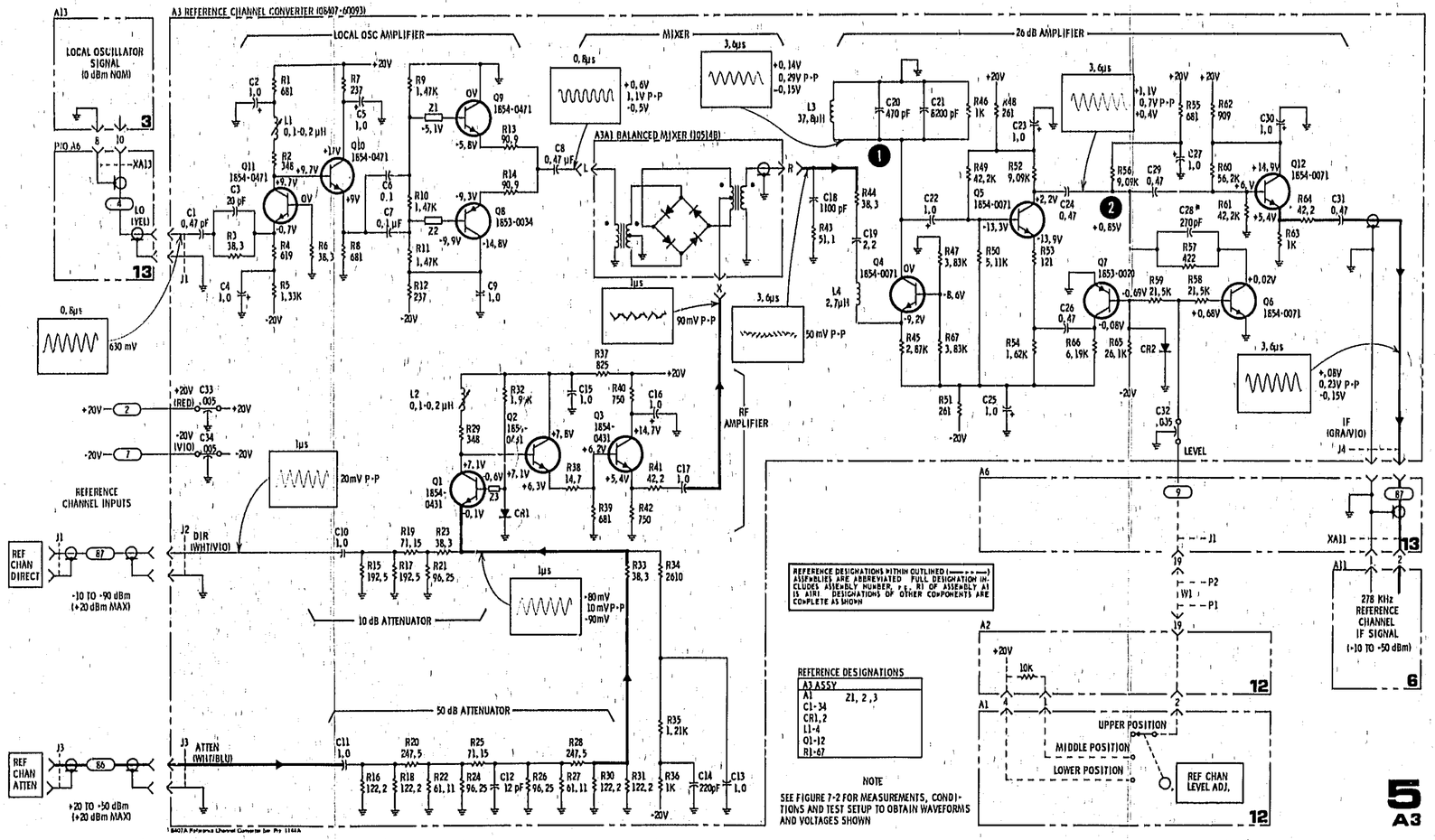


Figure 7-17. Reference Channel Converter A3, Schematic Diagram

SERVICE SHEET 6

A11 Reference Channel AGC Amplifier

20 dB AMPLIFIER

Q1 and Q2 form a high-gain IF amplifier. T1 changes the output from single-ended to push-pull output.

PUSH-PULL AMPLIFIER

Q3 forms a push-pull amplifier which drives T2 through amplifier gain control Q4 and Q5.

AMPLIFIER GAIN CONTROL

Signal flow between Q3A–Q3B and transformer T2 is controlled at Q4 and Q5 by the AGC control signal from A10. As the AGC control signal goes in the positive direction, Q5A and Q5B turn on and Q4A and Q4B turn off. This gives maximum IF signal to transformer T2. Conversely, when the AGC control signal goes in the negative direction, Q5A and Q5B turn off and Q4A and Q4B turn on. This gives the minimum IF signal to transformer T2. Instead of the signal flowing through Q5A and Q5B to transformer T2, the IF signal flows through Q4A and Q4B to ground.

IF AMPLIFIER

Q6A and Q6B form a differential amplifier followed by amplifier Q7. A feedback loop is formed between the output of Q7 and the input of Q6A by resistors R24 and R25, and capacitor C11.

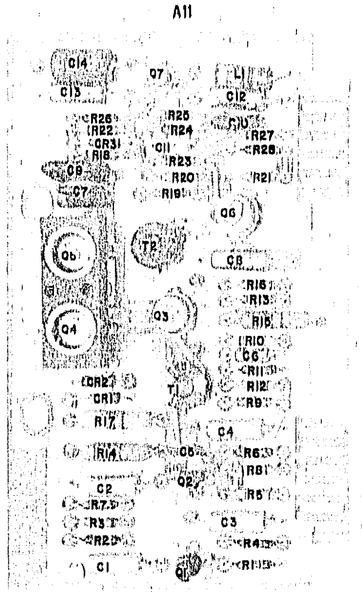
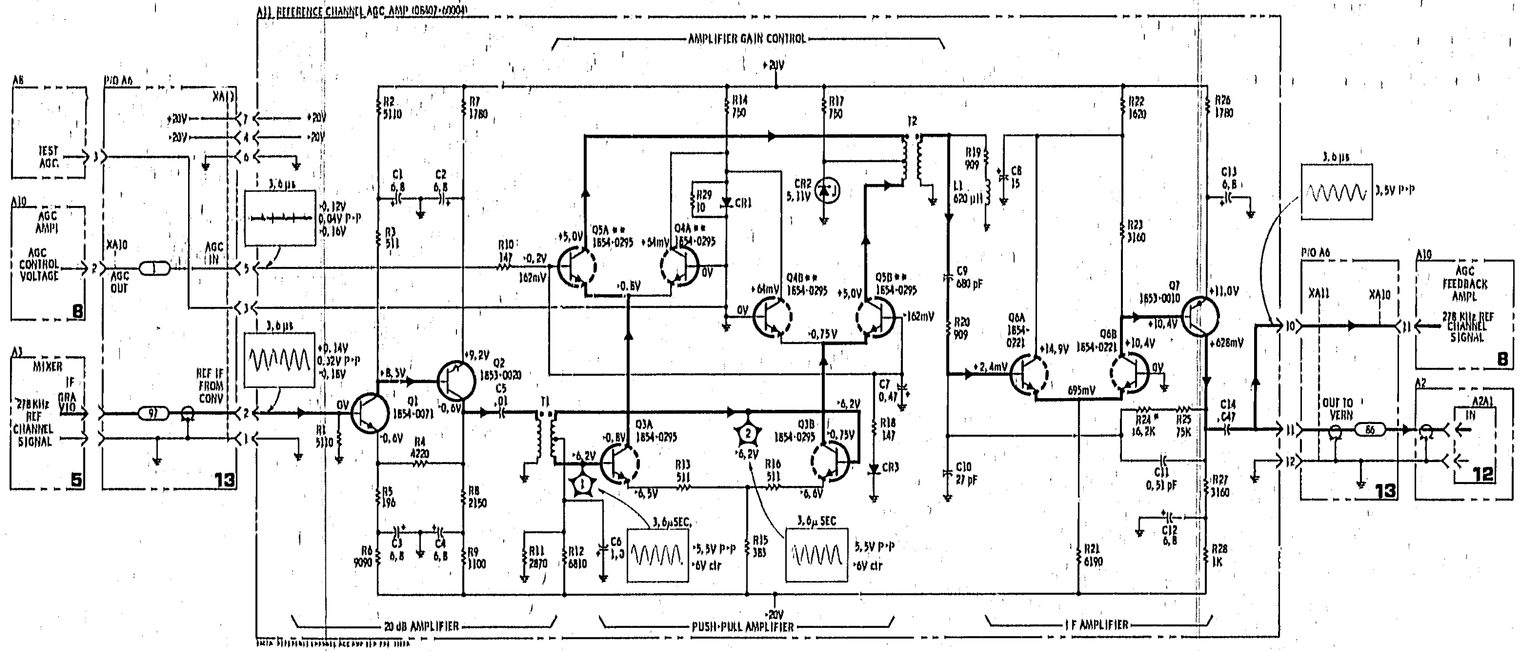


Figure 7-18. Parts Location for Reference Channel AGC Amplifier A11



NOTES;

1. SEE FIGURE 7-2 FOR MEASUREMENT CONDITIONS AND TEST SETUP TO OBTAIN WAVEFORMS AND VOLTAGES SHOWN.

**DUAL TRANSISTORS A804, A805, A1104 AND A1105 ARE A MATCHED SET OF FOUR. IF ANY ONE OF THE TRANSISTORS NEEDS TO BE REPLACED, ALL FOUR SHOULD BE REPLACED BY A FACTORY-SELECTED MATCHED SET.

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

A11 ASSY	
C1-14	1), 2
CR1-R3	
Q1-8	
R1-26	

6
A11

Figure 7-19. Reference Channel AGC Amplifier A11, Schematic Diagram

SERVICE SHEET 7

A9 Test IF Bandpass Filter & A12 Reference IF Bandpass Filter

PASSBAND FILTER

A9 and A12 are identical circuit boards. L1, C2, and C3 form a parallel-resonate circuit at 278 kHz, allowing only the IF signal to be passed by the circuit.

OUTPUT EMITTER FOLLOWERS

Q1 and Q2 are conventional emitter followers. The output of Q2 is 6-dB lower than Q1 because of the voltage divider, R2 and R3, at the input.

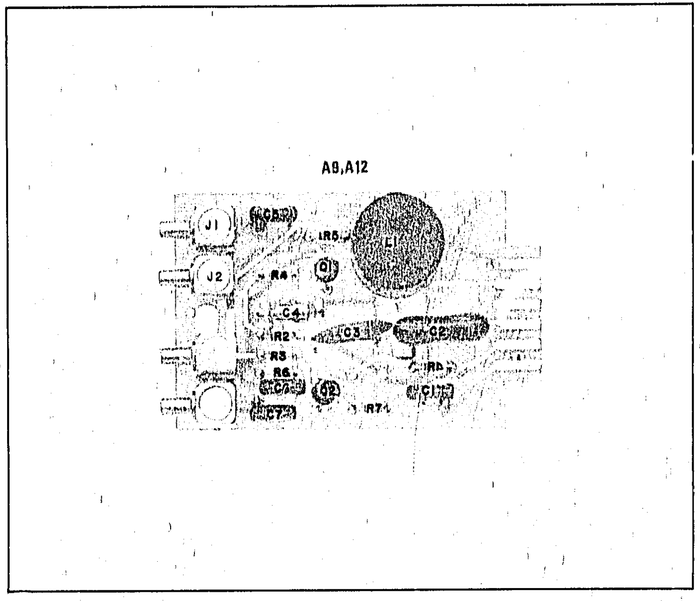


Figure 7-20. Parts Location for IF Bandpass Filters A9 and A12

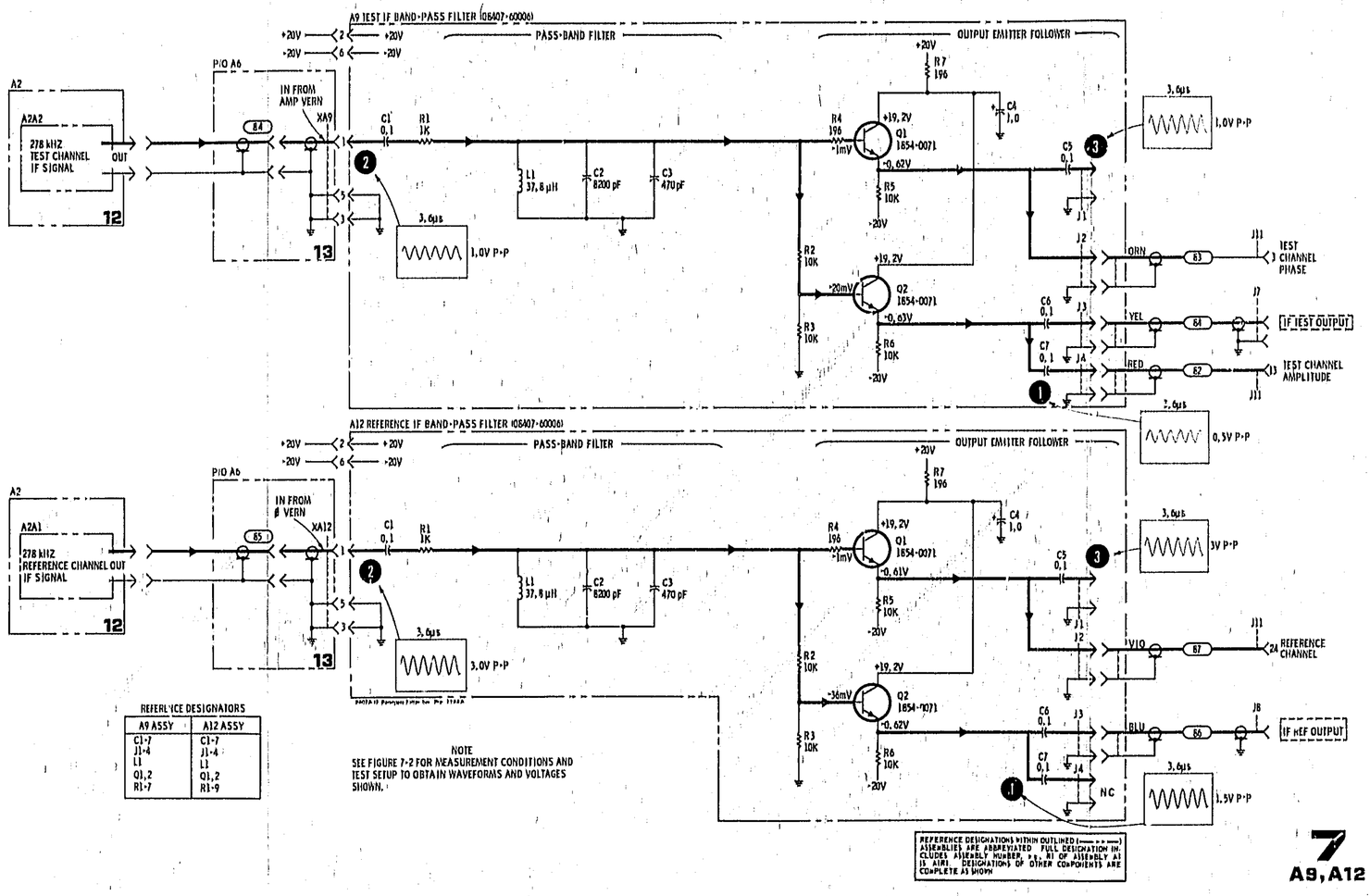


Figure 7-21. IF Bandpass Filter A9 and A12, Schematic Diagram

SERVICE SHEET 8

A10 AGC Feedback Amplifier

90-DEGREE PHASE SHIFTER

The reference channel IF signal passes through Q12 to the input of Q11. The IF signal is shifted by 90 degrees through Q11 primarily due to capacitor C9 between base and collector. Amplifier U1 squares the 278 kHz signal.

FREQUENCY DOUBLER

The frequency doubler consists of diode bridge CR9-CR12 and differential amplifier Q7 and Q8. The square-wave pulse at A10TP4 is rectified by the diode bridge. A negative pulse is coupled through C17 to the base of Q7. This pulse passes through Q7 and Q8 and is applied to Q6 as a positive-going gate pulse. This pulse coincides with a negative peak from the full-wave rectifier. Also, a negative pulse from the diode bridge passes through C18 and is applied to Q8 base. This pulse is inverted through Q8, forming a positive pulse to Q6 gate. This gives a positive-going pulse train at the gate of Q6 which corresponds in timing with the peaks of the pulse train from the full-wave rectifier.

FULL-WAVE RECTIFIER

The 278 kHz reference-channel signal at test point 7 is effectively full-wave rectified through Q10 and the associated diodes. The negative-going portion of the sine wave is rectified by CR2. The positive-going portion of the sine wave is inverted through Q10, making it negative going. This negative-going signal is detected by CR3. The resultant waveform at test point 6 is a series of negative peaks with a repetition rate twice the frequency of the original 278 kHz sine wave. CR5 and CR6 provide temperature compensation.

SAMPLE AND HOLD

Q6 samples the peak amplitude of the signal at the source and produces a dc output at A10TP1. Each gate pulse (A10TP3) occurs coincident with a negative peak at A10TP6. The peak amplitude at A10TP6 varies with varying signal levels at the reference channel input.

DC AMPLIFIER

The dc voltage level at A10TP1 is amplified by a differential amplifier, Q4A and Q4B, driven by two FET's, Q5A and Q5B. Another differential amplifier, Q2 and Q3, drives emitter-follower Q1. The dc output from Q1 emitter is the automatic gain control voltage used to level both test and reference channels, as well as drive the REF-CHANNEL-LEVEL meter driver circuit.

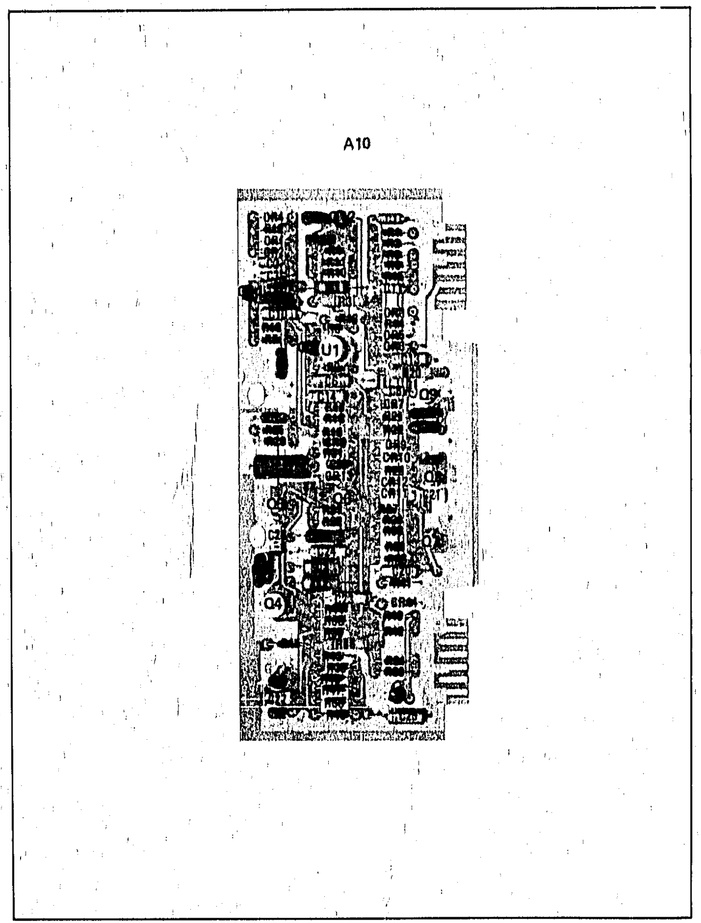
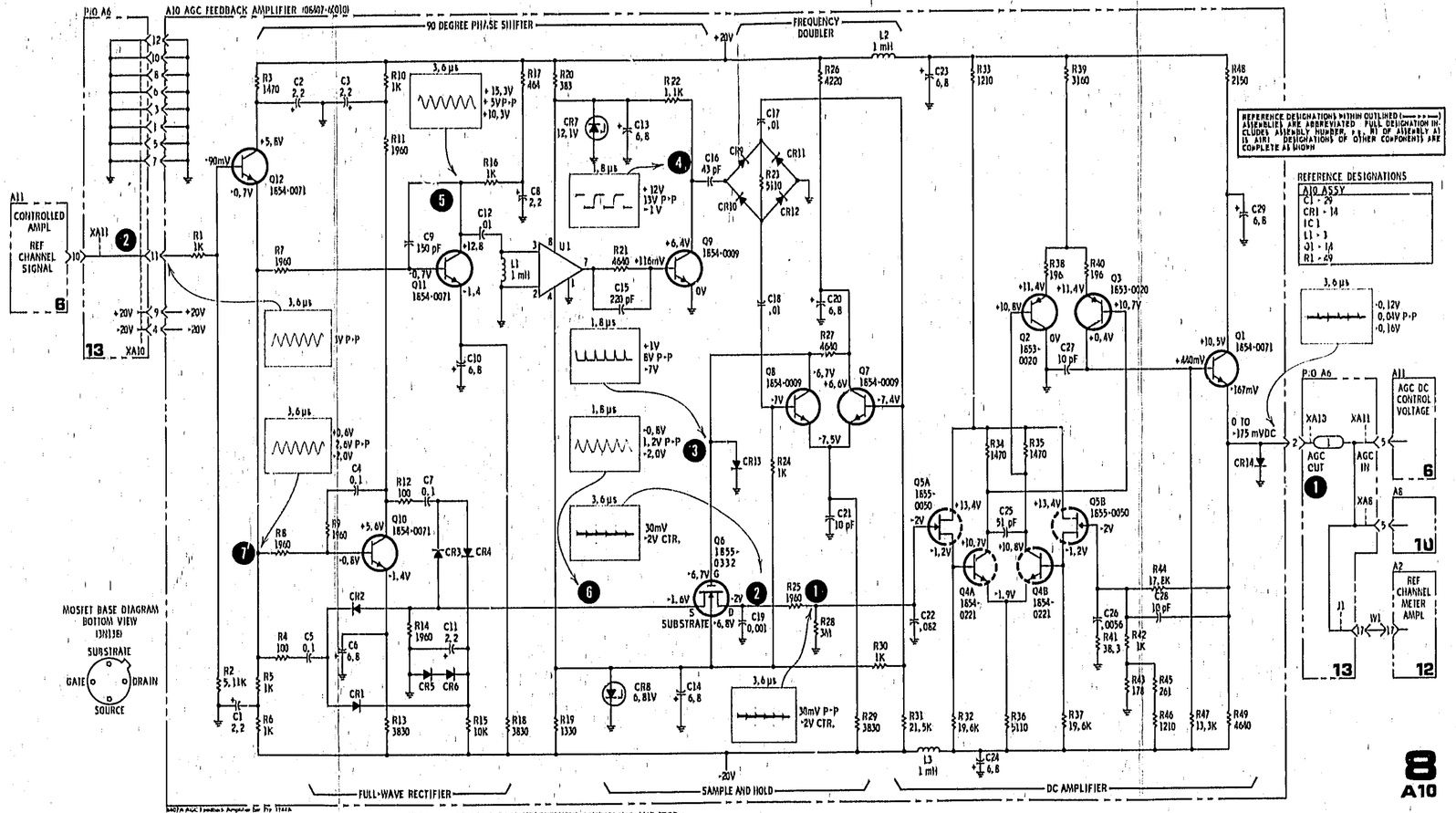


Figure 7-22. Parts Location for AGC Feedback Amplifier A10



NOTE SEE FIGURE 7-2 FOR MEASUREMENT CONDITIONS AND TEST SETUP TO OBTAIN WAVEFORMS AND VOLTAGES SHOWN.

Figure 7-23. AGC Feedback Amplifier A10, Schematic Diagram

SERVICE SHEET 9

A4 Test Channel Converter

LOCAL OSCILLATOR AMPLIFIER

Q11 is a grounded base configuration RF amplifier, followed by emitter-follower Q10. L1 adjusts swept-frequency phase tracking between the test and reference channel converters. The output of Q10 is amplified by complementary amplifiers Q8 and Q9.

RF AMPLIFIER

Q1 forms a grounded base amplifier. L2 adjusts the swept frequency amplitude tracking between converters A3 and A4. The RF input to Q1 comes either through a 10 dB attenuator from the DIRECT input or through a 50-dB attenuator from the ATTEN input. Q2 and Q3 are direct-coupled emitter followers to isolate the RF amplifier circuit from balanced mixer A4A1.

MIXER

Balanced mixer A4A1 mixes the local oscillator signal with the RF input signal to produce a 278 kHz difference signal.

26 dB IF AMPLIFIER

Q4, Q5, and Q7 form an IF amplifier. Q7 provides isolation for the amplifier stages and provides a low-impedance output. L3, C22, C23, and R46 form a low-Q parallel-resonate circuit at 278 kHz and effectively provides a bandpass filter for the 278 kHz IF signal.

OVERLOAD AMPLIFIER

Q6 senses the amplitude of the IF signal and turns on when a preselected limit is reached. The value of resistor R58 is selected for the correct turn-on level. The overload amplifier makes a closure to ground when turned on that switches the overload light driver and turns on the UNCAL REDUCE INPUT RATIO light.

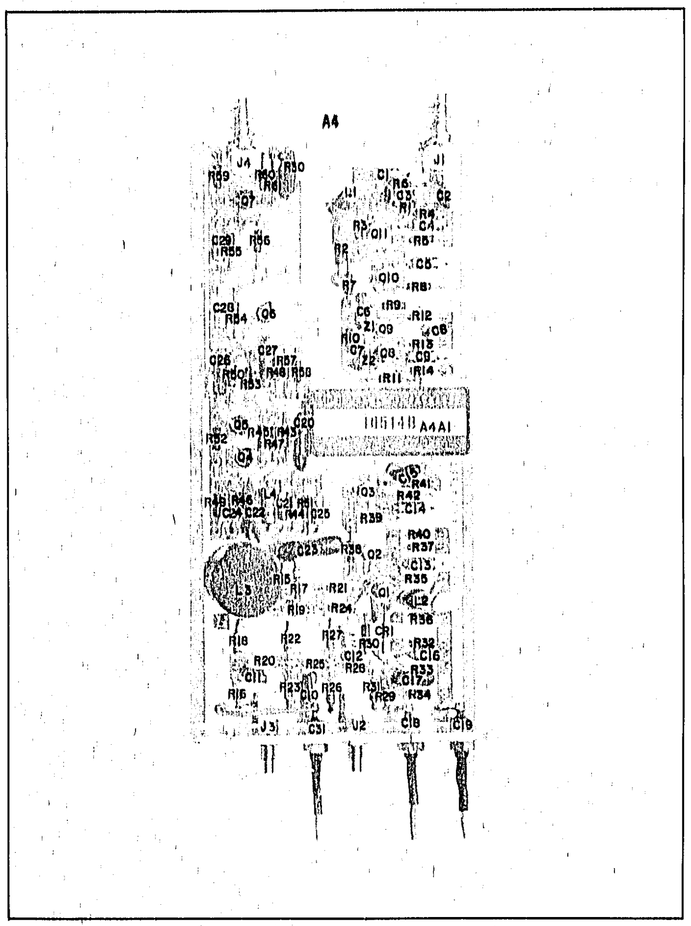


Figure 7-24. Parts Location for Test Channel Converter A4

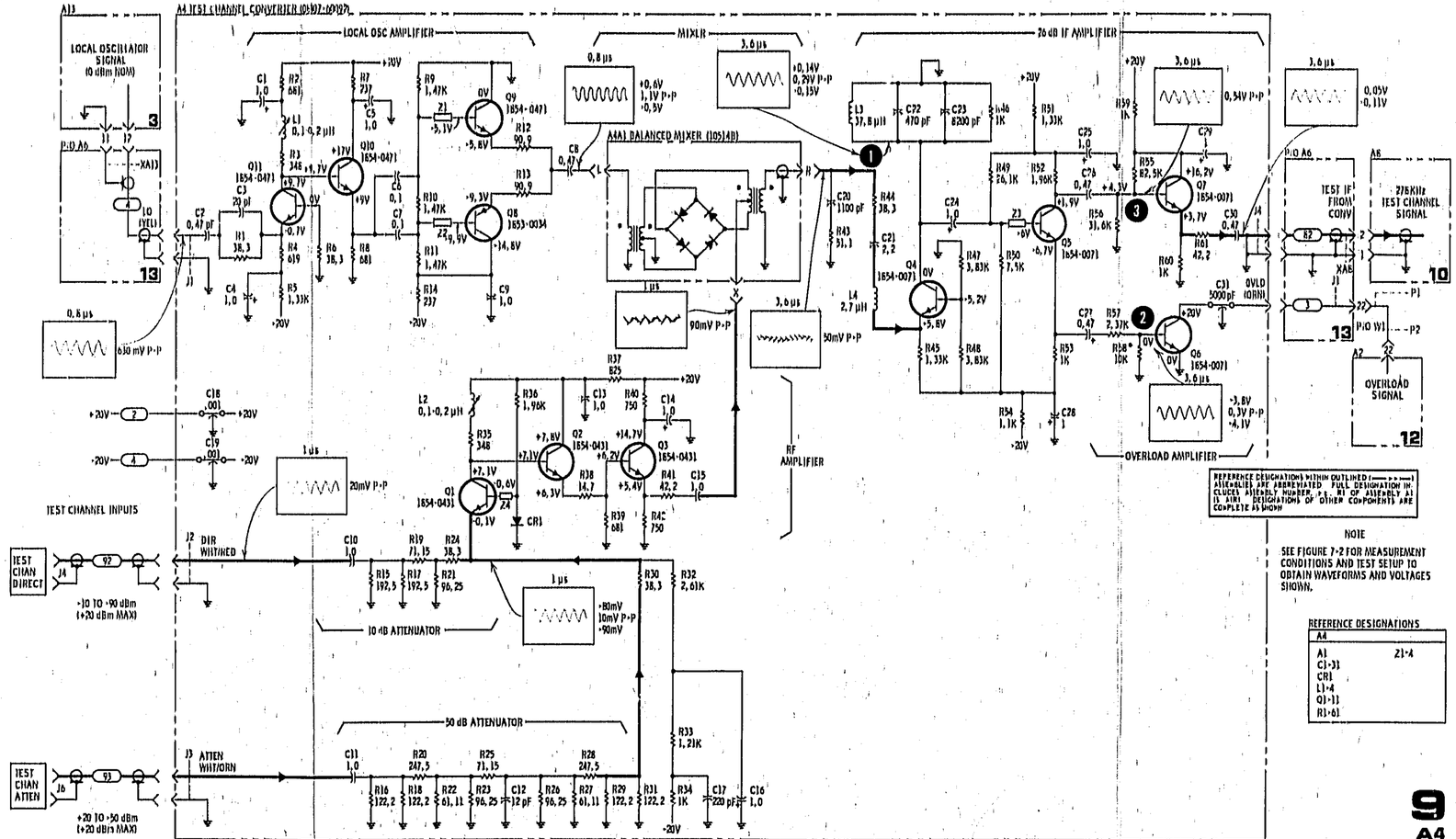


Figure 7-25. Test Channel Converter A4, Schematic Diagram

SERVICE SHEET 10

AB Test Channel AGC Amplifier

7-dB AMPLIFIER

Q1 and Q2 form an input IF amplifier. T1 changes the output from single-ended to push-pull output.

PUSH-PULL AMPLIFIER

Q3 forms a push-pull amplifier which drives T2 through amplifier gain control Q4 and Q5.

AMPLIFIER GAIN CONTROL

Signal flow between Q3A–Q3B and transformer T2 is controlled at Q4 and Q5 by the AGC control signal from A10. As the AGC control signal goes in the positive direction, Q5A and Q5B turn on and Q4A and Q4B turn off. This gives maximum IF signal to transformer T2. Conversely, when the AGC control signal goes in the negative direction, Q5A and Q5B turn off and Q4A and Q4B turn on. This gives the minimum IF signal to transformer T2. Instead of the signal flowing through Q5A and Q5B to transformer /T2,the IF signal flows through Q4A and Q4B to ground.

IF AMPLIFIER

Q6A and Q6B form a differential amplifier followed by amplifier Q7. A feedback loop is formed between the output of Q7 and the input of Q6A by resistor R20 and capacitor C11.

OVERLOAD

Q8 is the overload detector. When the IF signal amplitude exceeds a pre-selected limit Q8 conducts, causing the UNCAL REDUCE INPUT RATIO light to come on.

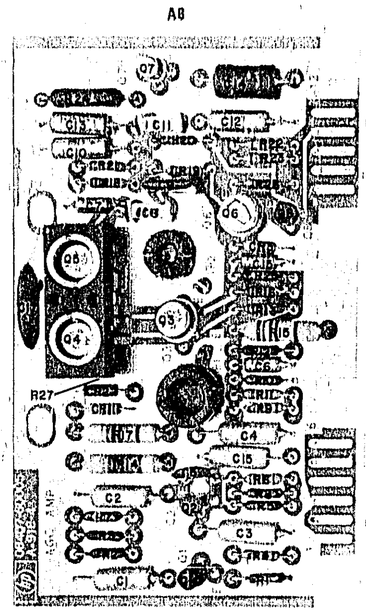
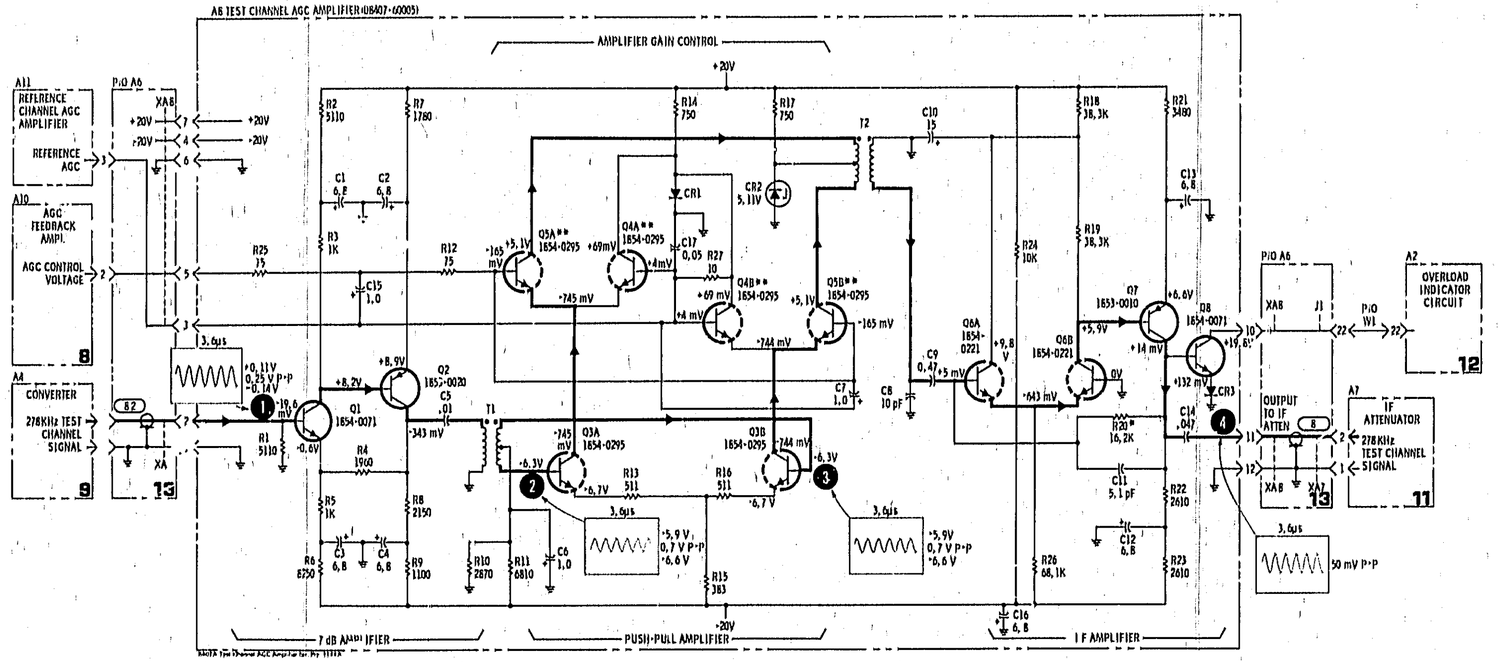


Figure 7-26. Parts Location for Test Channel AGC Amplifier A8



NOTES:

1. SEE FIGURE 7-2 FOR MEASUREMENT CONDITIONS AND TEST SETUP TO OBTAIN WAVEFORMS AND VOLTAGES SHOWN.
2. SELECTED AT FACTORY
   DUAL TRANSISTORS A804, A805, A1104, & A1105 ARE A MATCHED SET OF FOUR. IF ANY ONE OF THE TRANSISTORS NEEDS TO BE REPLACED, ALL FOUR SHOULD BE REPLACED BY A FACTORY-SELECTED MATCHED SET.

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

A8 ASSY	
C1-18	T1, 2
CR1-3	
Q1-8	
R1-26	

10
A8

Figure 7-27. Test Channel AGC Amplifier A8, Schematic Diagram

SERVICE SHEET 11

A7 Programmable IF Attenuator

BUFFER

The two-or-three stage buffers are used to provide isolation between attenuator sections. This prevents interaction between adjacent sections.

10- OR 20-DB ATTENUATOR

Relay K1 connects R9 in parallel with R8 and decreases IF attenuation by 10 dB. Relay K2 connects R10 to ground and decreases IF attenuation by 20 dB. K1 and K2 should be operated individually for proper circuit function. The front-panel switch actuates K1 or K2 one at a time.

30 DB ATTENUATOR

Relays K3 and K4 are 30 dB attenuator stages. Relay K3 shorts across R25 and K4 across R39 which decreases the attenuation of the IF signal by 30 dB for each relay.

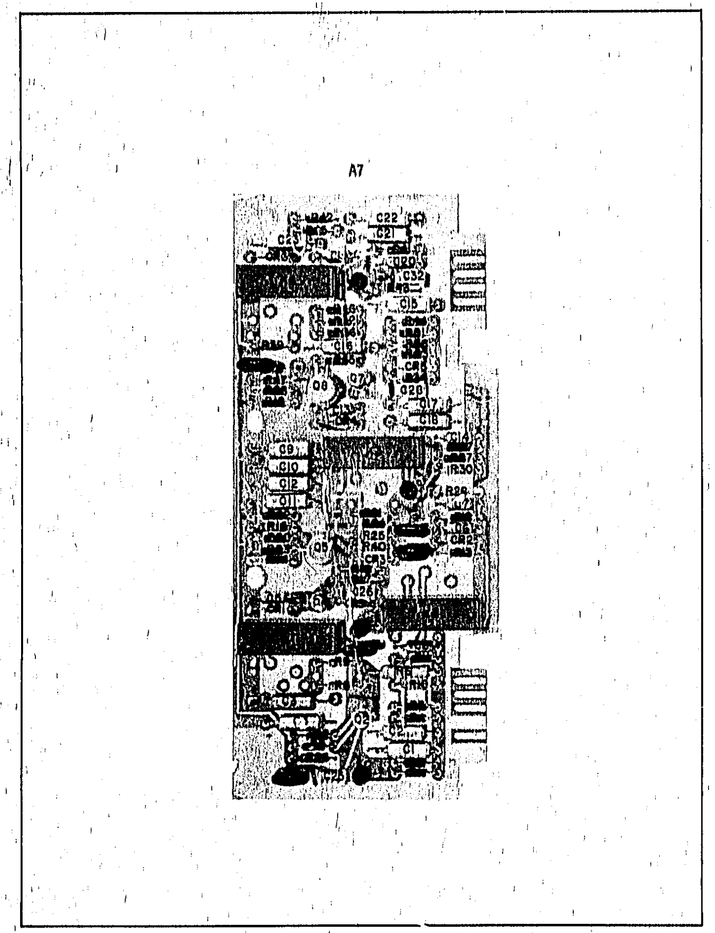


Figure 7-28. Parts Location for Programmable IF Attenuator A7

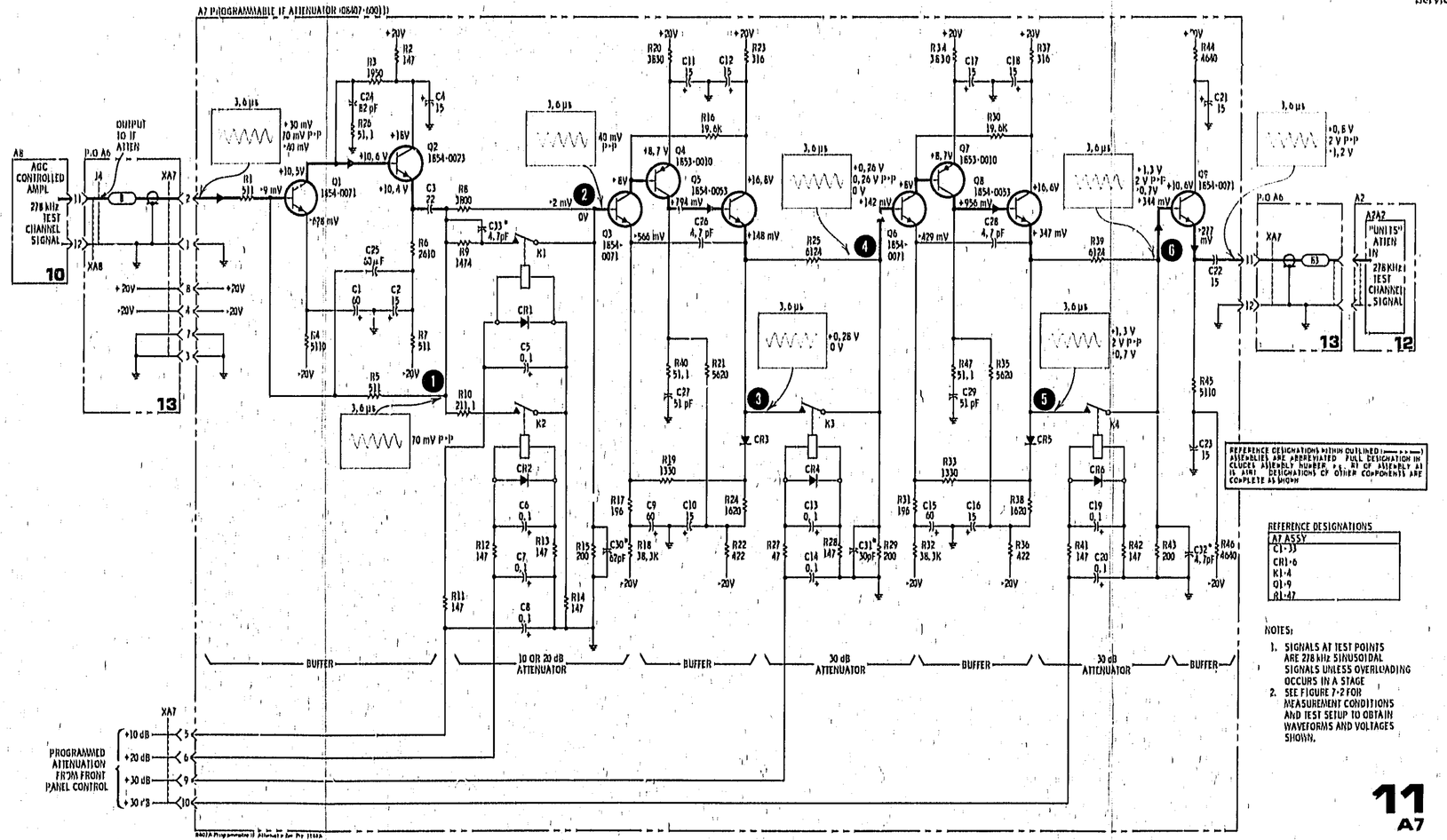


Figure 7-29. Programmable IF Attenuator A7, Schematic Diagram

SERVICE SHEET 12

A1 Front Panel Switch Assembly & A2 Front Panel Assembly

A2 COMPONENTS

A2Q3 is an auto/manual switch. This is used for computer remote control to disable the manual DISPLAY REFERENCE 10 dB/step switch. In manual mode, Q3 conducts, applying −20 Vdc to the wiper side of the DISPLAY REFERENCE 10-dB/step switches.

Integrated circuit U1 amplifies the AGC signal, driving the REF CHAN LEVEL meter. Diodes CR1 and CR2 prevent any overvoltage from damaging the meter.

Transistors Q1 and Q2 amplify the overload signal from the test chan[illegible] converter and test channel AGC amplifier, driving the UNCAL REDUCE INPUT RATIO light.

A2A1 PHASE VERNIER

The 278 kHz reference channel IF signal passes through A2A1Q1 — A2A1Q3 with no amplification. The prime purpose of the circuit is to shift phase with the PHASE VERNIER control, R1.

A2A2 AMPLITUDE VERNIER

The 278 kHz test channel IF channel is attenuated with the AMPL VERNIER control R2 by changing the effective by-pass to ground of A2A2C1.

The amount of by-pass to ground exhibited by A2A2C1 is controlled by the DISPLAY REFERENCE 1-dB/step switch which changes the resistance between by-pass capacitor C1 and ground.

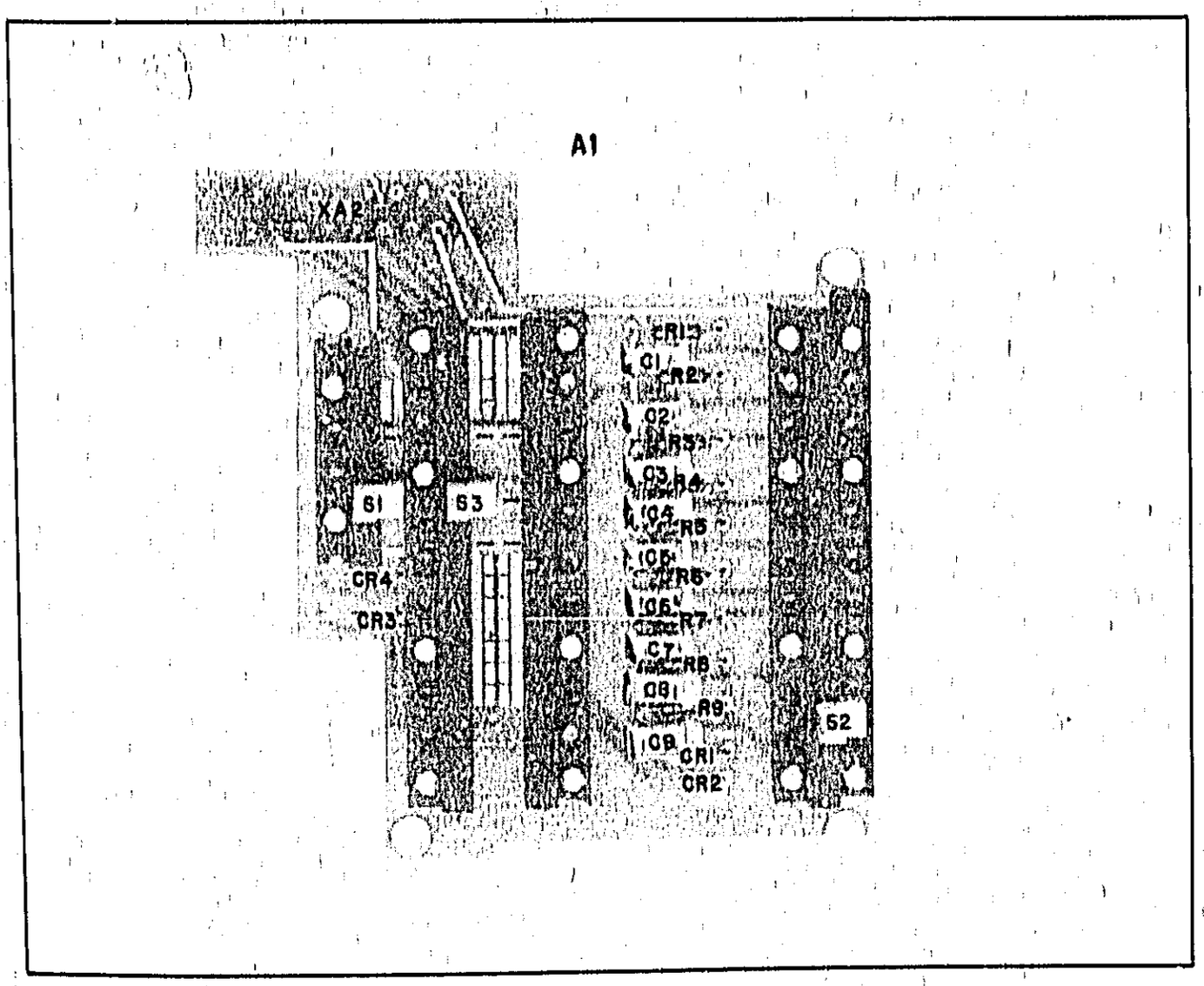


Figure 7-30. Parts Location for Front Panel Assembly A1 and A2 (1 of 2)

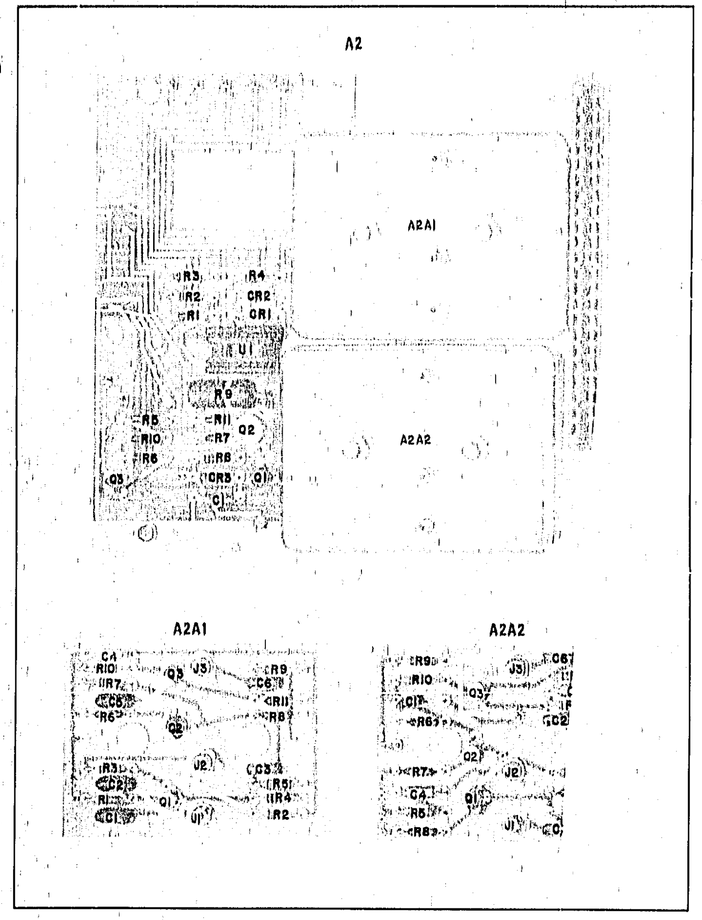


Figure 7-30. Parts Location for Front Panel Assembly A1 and A2 (2 of 2)

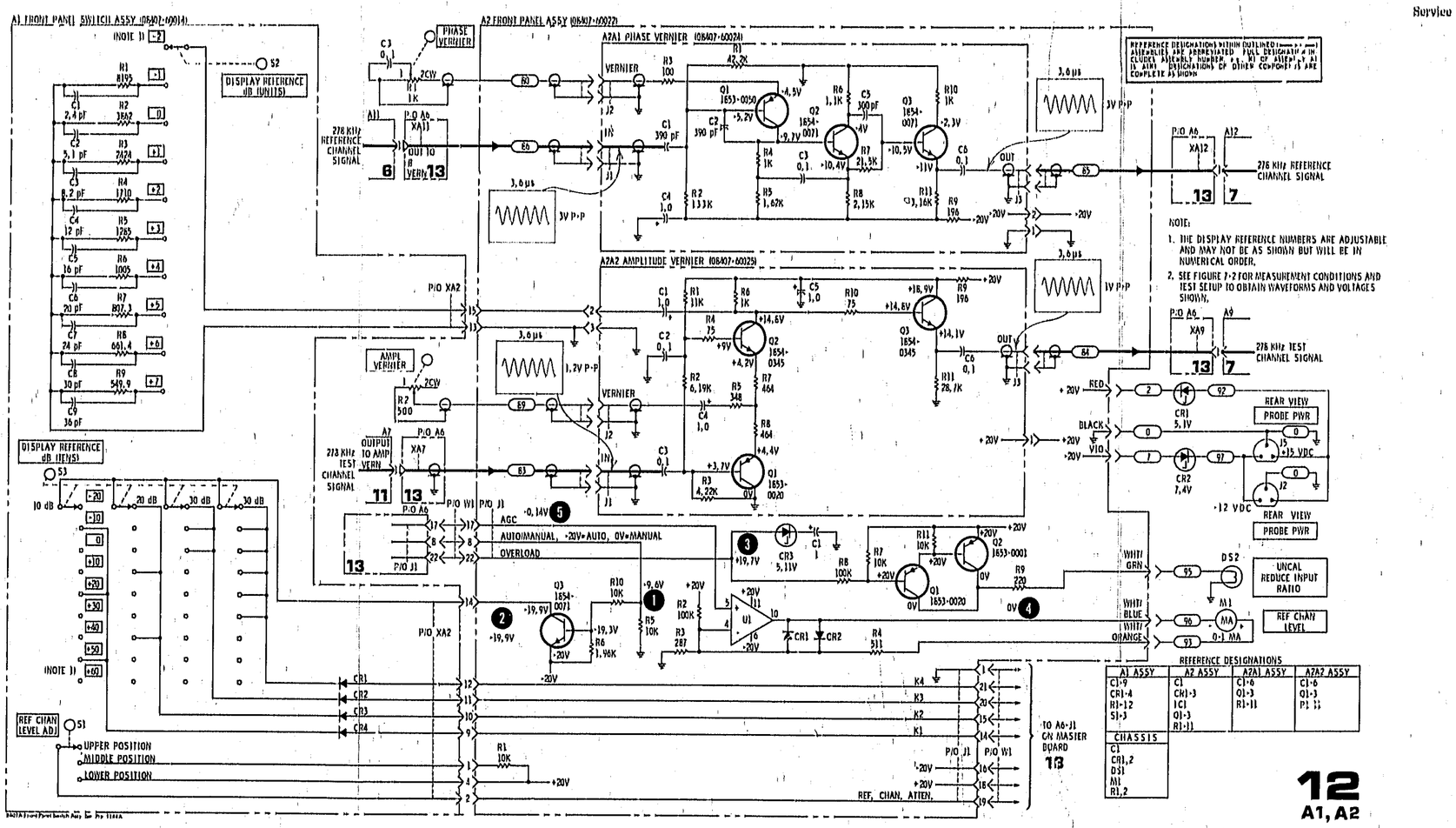


Figure 7-31. Front Panel Assembly A1 and A2, Schematic Diagram

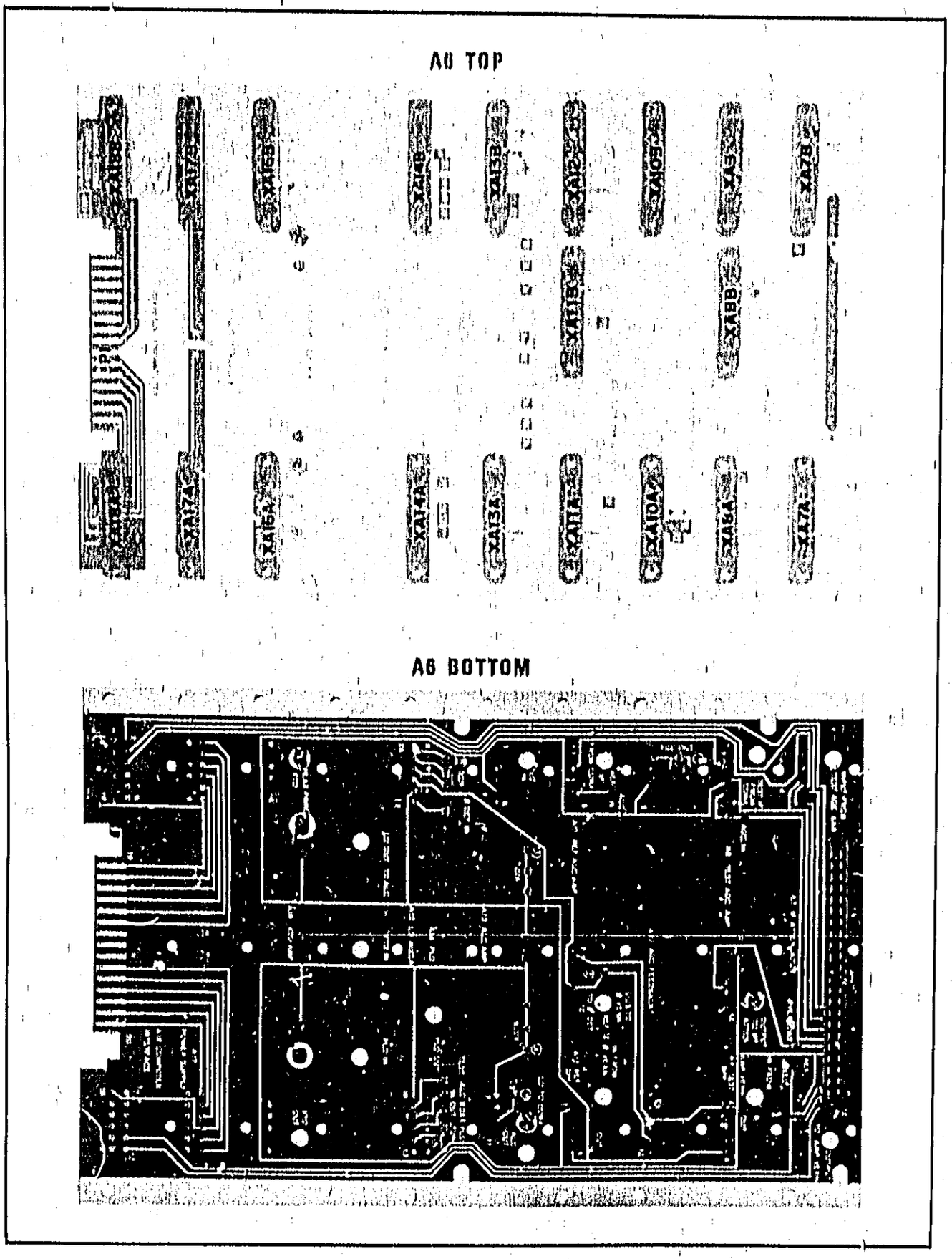


Figure 7-32. Parts Location for Master Board A6

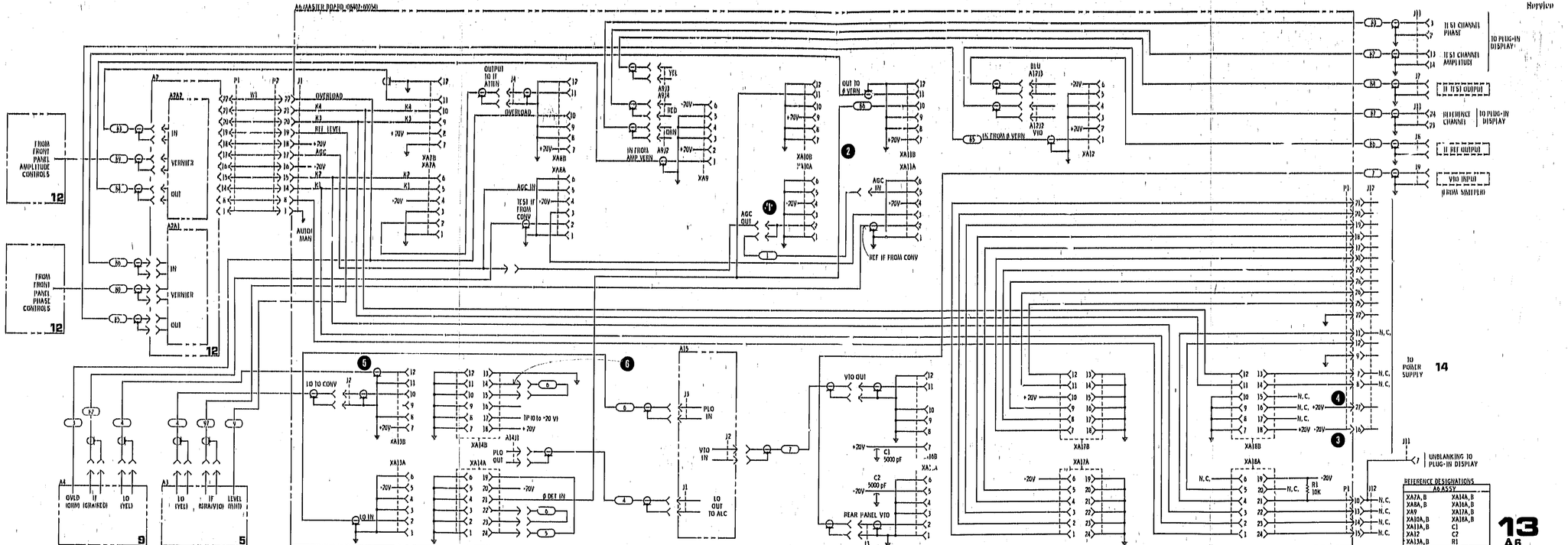


Figure 7-33. Master Board A6, Schematic Diagram

SERVICE SHEET 14

A5 Rectifier Assembly and A17 Power Supply

+20V POWER SUPPLY

An overload limiter senses current through R1. When an overload occurs, Q3 and Q4 turn on, causing Q5 and series regulator Q1 to turn off.

The regulator feedback loop starting at A17TP3 is through R6, R7, U2, and Q5 to the base of Q1. A change in the +20V output, due to a change in load, produces a change through the regulator loop which changes the effective resistance of series regulator Q1 and brings the output voltage back to +20 Vdc.

Overvoltage protection is provided by A17CR4. If the output voltage rises to above 21.5 Vdc, CR4 conducts and causes the overload limiter Q3 to actuate. Overvoltage may inadvertently occur during adjustment of R7 and the supply will go to near-zero volt output. To clear overload, set R7 to mid-position, turn main power off, then on again. This should clear trouble and allow R7 to be adjusted for +20 Vdc output.

−20V POWER SUPPLY

The −20V supply functions identically to the +20V supply, except that the −20 Vdc output is taken from the point on the circuit corresponding the ground point on the +20V supply and the −20V dc ground return is connected to a point that corresponds to the +20V output on the +20V supply.

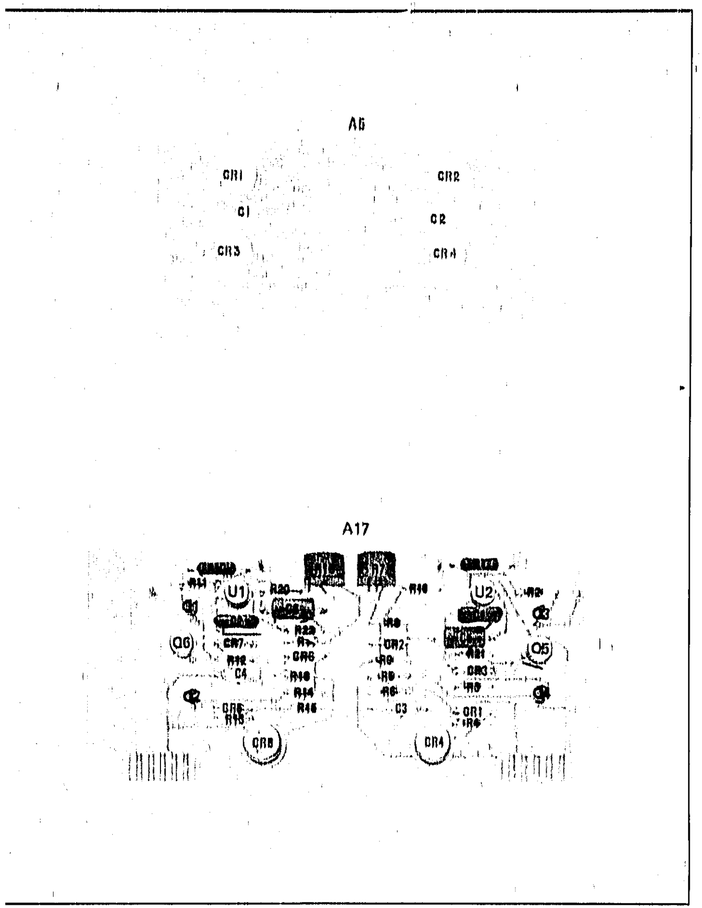


Figure 7-34. Parts Location for Diode Board A5 and Power Supply A17

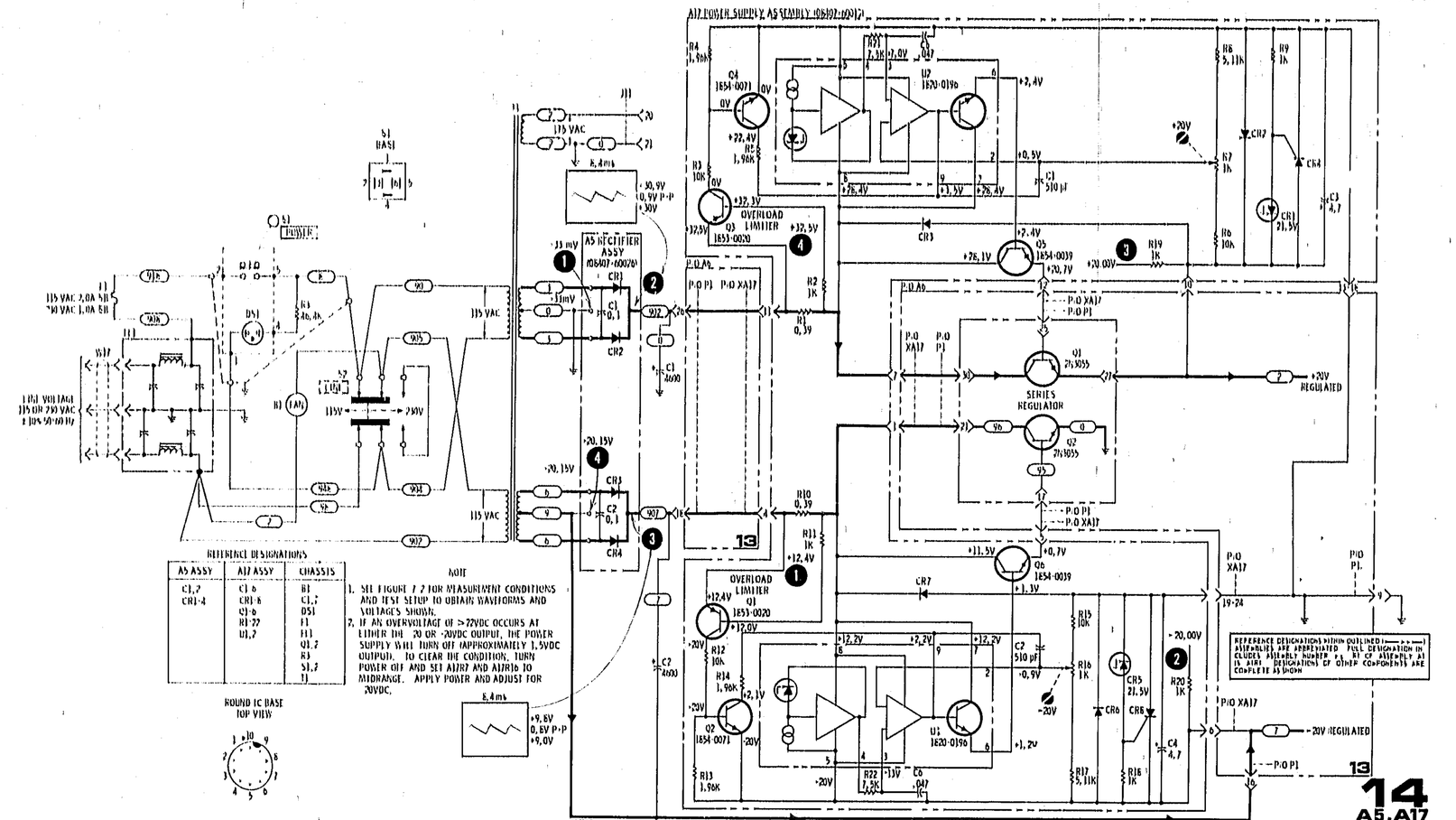
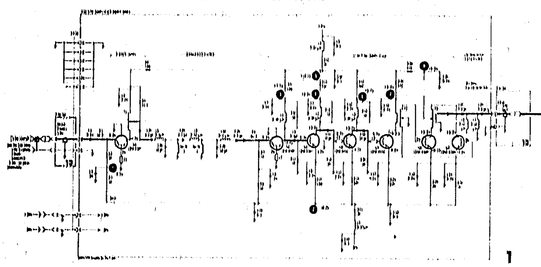


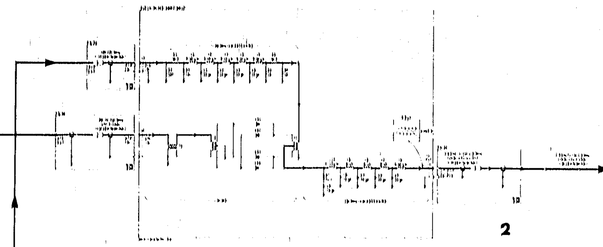
Figure 7-35. Power Supply A17 and Diode Board A5, Schematic Diagram

A16 VTO AMPLIFIER



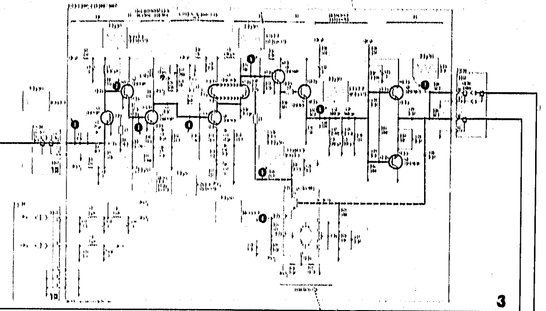
1

A15 LO MIXER



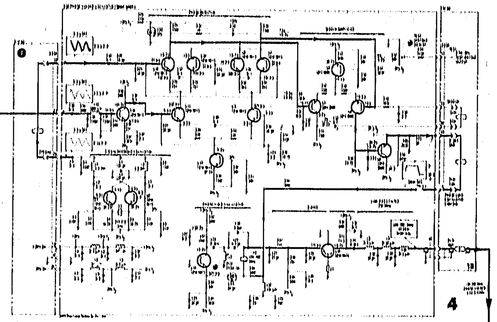
2

A13 AUTOMATIC LEVEL CONTROL



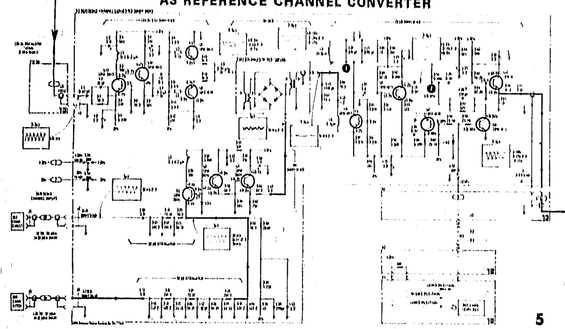
3

A14 PHASE-LOCKED OSCILLATOR



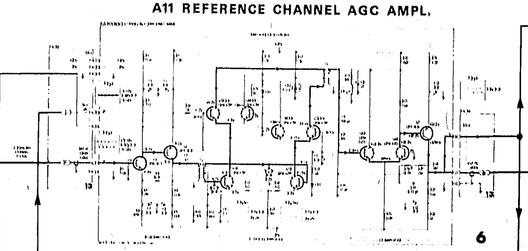
4

A3 REFERENCE CHANNEL CONVERTER



5

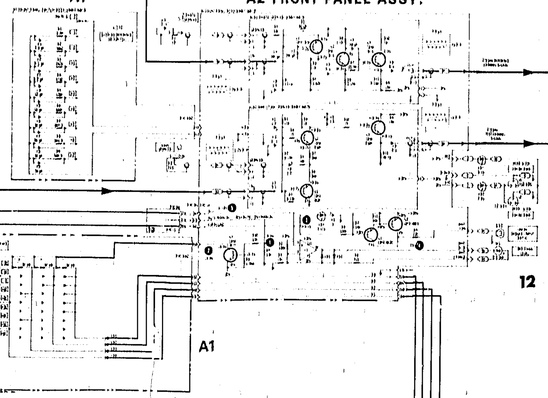
A11 REFERENCE CHANNEL AGC AMPL.



6

A1

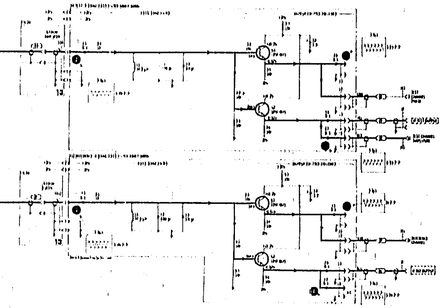
A2 FRONT PANEL ASSY.



12

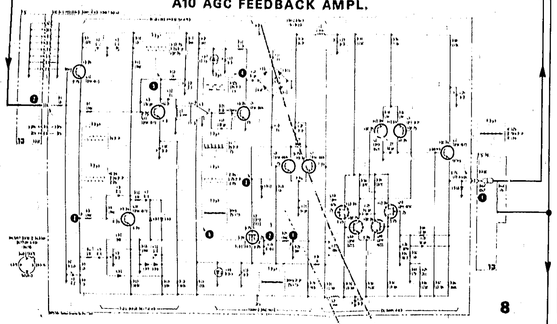
A1

A9 & A12 IF BAND-PASS FILTER



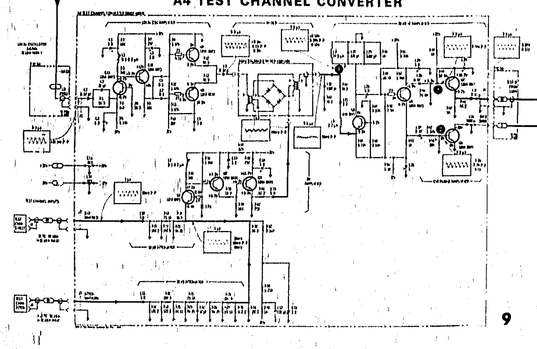
7

A10 AGC FEEDBACK AMPL.



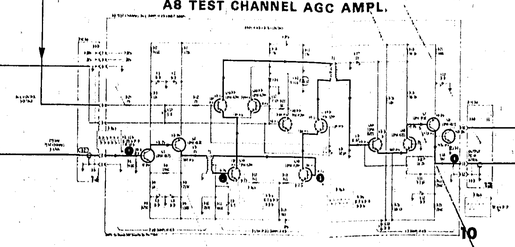
8

A4 TEST CHANNEL CONVERTER



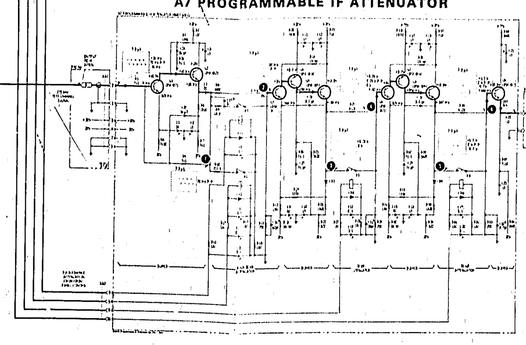
9

A8 TEST CHANNEL AGC AMPL.



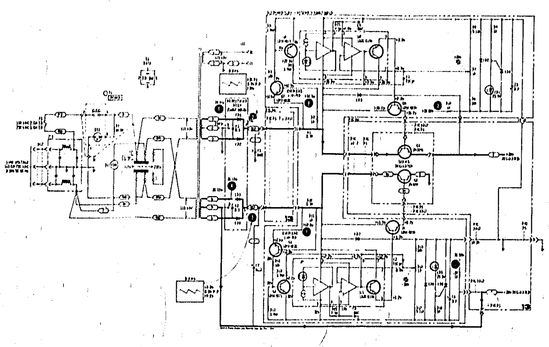
10

A7 PROGRAMMABLE IF ATTENUATOR



11

A17 POWER SUPPLY & A5 RECTIFIER ASSY



14

MODEL 8407A NETWORK ANALYZER
OVERALL SCHEMATIC DIAGRAM
SERIAL PREFIX 1144A

APPENDIX

APPENDIX I

MANUAL CHANGES

I-1. INTRODUCTION

I-2. To adapt this manual to instruments with serial numbers listed in the table below, make the indicated manual changes.

I-3. Information for adapting this manual to instruments with serial numbers not listed in the table below may be included in a yellow MANUAL CHANGES insert supplied with this manual. Information about serial numbers not covered in any of these ways can be obtained from the nearest Hewlett-Packard office.

Serial Prefix or Number	Make Manual Changes
924-00101 thru 924-00110	A thru M
924-00111 thru 924-00130	A thru L
944-00131 thru 944-00150	A thru K
948-00151 thru 948-00165	A thru J
948-00166 thru 948-00175	A thru I
959-00176 thru 959-00245	A thru H
965-00246 thru 965-00315	A thru G

Serial Prefix or Number	Make Manual Changes
972-00316 thru 972-00385	A thru F
983-00386 thru 938-00445	A thru E
1103A00446 thru 1103A00505	A thru D
1103A00506 thru 1103A00555	A, B, C
1103A00556 thru 1103A00580	A, B
1103A00581 thru 1103A00605	A
1141A	No change

CHANGE A:

Page 6-14, Table 6-1:
Change A14C26 to HP Part No. 0140-0197, C: FXD, 180 pF 300 VDCW
Delete A14C39
Delete A14L12
Change A14R21 to HP Part No. 0698-7260, R: FXD, 10K OHM 2%
Delete A14R55

CHANGE A (cont'd)

Page 7-15, Figure 7-15:
Change A14C26 to 180 pF
Delete A14C39
Delete A14L12 and jumper across connections
Change A14R21 to 10K ohm
Delete A14R55 and jumper across connections.

Page 7-15, Figure 7-14:
Replace Figure 7-14 in Section VII of Manual with Figure 7-14 (Change A) in this Appendix.

CHANGE B

Page 6-2, Table 6-1:
Change A2R3 to HP Part No. 0698-3132, R: FXD 261 OHM 1% 1/8W. Recommended replacement is 0698-3443, 287 OHM.

Page 6-3, Table 6-1:
Change A3C28 to HP Part No. 0160-2208, C: FXD, 330 PF 300V. Recommended replacement is 0140-0210, 270 PF.

Page 7-17, Figure 7-17:
Change A3C28 to 330 pF.

Page 7-31, Figure 7-31:
Change A2R3 to 261 OHMS.

CHANGE C

Page 6-8, Table 6-1:
Change A5C1 and A5C2 to HP Part No. 0160-2930, C: FXD CER 0.01 UF +80 −20% 100 VDCW. Recommended replacement is 0160-0168, 0.1 UF.

Page 6-11, Table 6-1
Add under A10U1 Part No. 1200-0195, SOCKET: INTEGRATED CIRCUIT. It is recommended that this socket be removed for better reliability.

Page 7-35, Figure 7-35:
Change A5C1 and C2 to 0.01 UF.

CHANGE D

Page 6-5, Table 6-1:
Change A3Z1, Z2 and Z3 to HP Part No. 9170-0016. Recommended replacement is 9170-0847.

Page 6-6, Table 6-1:
Change A4Z1, Z2, Z3 and Z4 to HP Part No. 9170-0016. Recommended replacement is 9170-0847.

Page 6-13, Table 6-1:
Change A13Z1, Z2, Z3 and Z4 to HP Part No. 9170-0016. Recommended replacement is 9170-0847.

Page 6-15, Table 6-1:
Change A14Z1 to HP Part No. 9170-0016. Recommended replacement is 9170-0847.

Page 6-17, Table 6-1:
Change A16Z1, Z2, Z3 and Z4 to HP Part No. 9170-0016. Recommended replacement is 9170-0847.

CHANGE E

Page 6-9, Table 6-1:
Change A8C12 and A8C13 to HP Part No. 0180-1746, C: FXD ELECT 15 UF 10%, 20 VDCW.
Add A8C18, HP Part No. 0160-2667, C: FXD 36 PF 500 VDCW.
Change A8R4 to HP Part No. 0698-3150 R: FXD MET FLM 2.37K OHM 1% 1/8W.
Change A8R20 to HP Part No. 0757-0290 R: FXD MET FLM 6.19K OHM 1% 1/8W, FACTORY SELECTED.

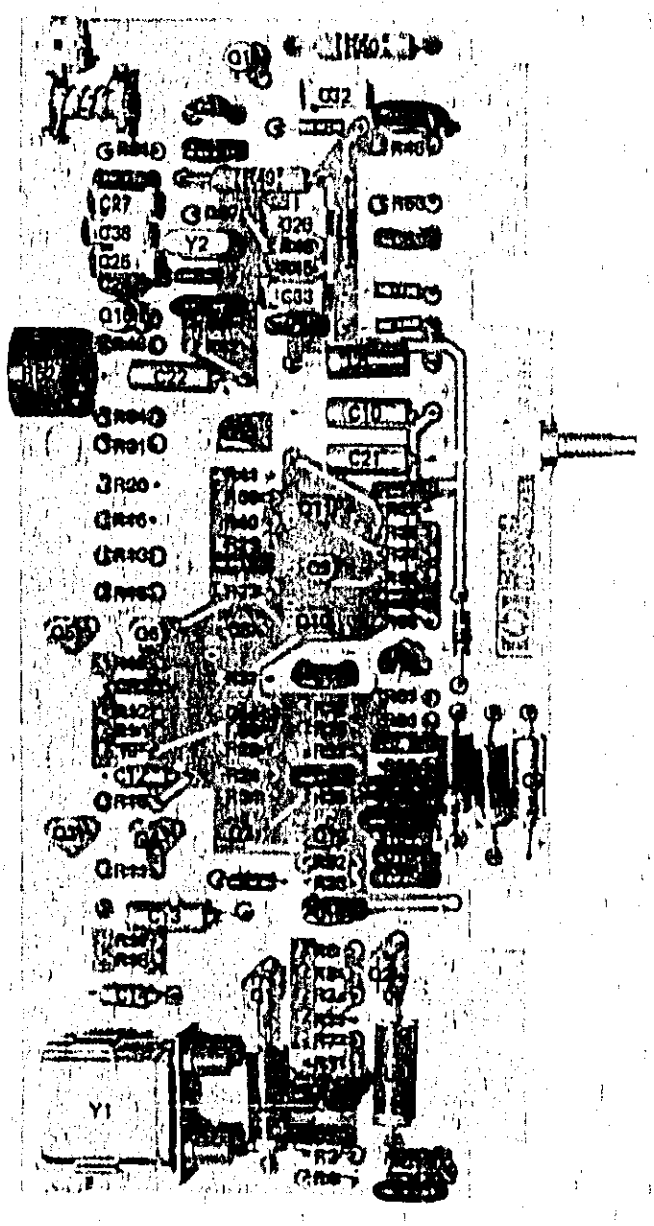


Figure 7-14. Parts Location for Phase-Locked Oscillator A14 (Change A, Serial No. 983-00446 thru 1103A00605)

CHANGE E (cont'd)

Page 6-9, Table 6-1 (cont'd):
Delete A8R27.

Page 6-11, Table 6-1:
Change A11C12 and A11C13 to HP Part No. 0180-1746, C: FXD ELECT 15 UF 10% 20 VDCW.

Page 6-12, Table 6-1:
Delete A11R29.
Change A11T1 to HP Part No. 9100-2854.

Page 6-13, Table 6-1:
Change A13R28 to HP Part No. 0757-0416, R: FXD MET FLM 511 OHM 1% 1/8W. Recommended replacement is 0757-0401, 100 OHMS.

Page 6-14, Table 6-1:
Change A14C25 to HP Part No. 0160-2255, C: FXD CER 8.2 ±0.25 PF 500 VDCW.
Delete A14C34-A14C38.
Delete A14L11.
Delete A14Q16.

Page 6-15, Table 6-1:
Delete A14R56 - A14R60.

Page 6-17, Table 6-1:
Change A17CR4 and CR8 to HP Part No. 1884-0073. Recommended replacement is 1884-0012.
Change A17R1 and R10 to HP Part No. 0812-0017, R: FXD WW 0.25 OHMS 5%, 3W.

Page 7-13, Figure 7-13:
Change A13R28 to 511 OHMS.

Page 7-15, Figures 7-14 and 7-15:
Replace Figure 7-14 and Figure 7-15 in Section VII of Manual with Figures 7-14 and 7-15 (Change E) in this Appendix.

Page 7-19, Figure 7-19:
Change A11C12 and A11C13 to 15 UF.
Delete A11R29.

Page 7-27, Figure 7-27:
Change A8C12 and A8C13 to 15 UF;
Change A8R4 to 2370 OHM.
Change A8R20 to 6190 OHMS, FACTORY SELECTED.
Delete A8C18 and connect A8R27, a 10 ohm resistor, in its place.

Page 7-35, Figure 7-35:
Change A17R1 and A17R10 to 0.25 OHMS.

CHANGE F

Page 6-7, Table 6-1:
Change A7C25 to HP Part No. 0160-2250, C: FXD CER 5.1—0.25 PF 500 VDCW.
Delete A7C30—A7C33.
Change A7K1—A7K4 to HP Part No. 0490-0760, RELAY: REED 0.1 AMP MAX. 250V MIN. Recommended replacement is 0490-0884.

Page 7-29, Figures 7-28 and 7-29:
Replace Figure 7-28 and Figure 7-29 in Section VII of Manual with Figures 7-28 and 7-29 (Change F) in this Appendix.

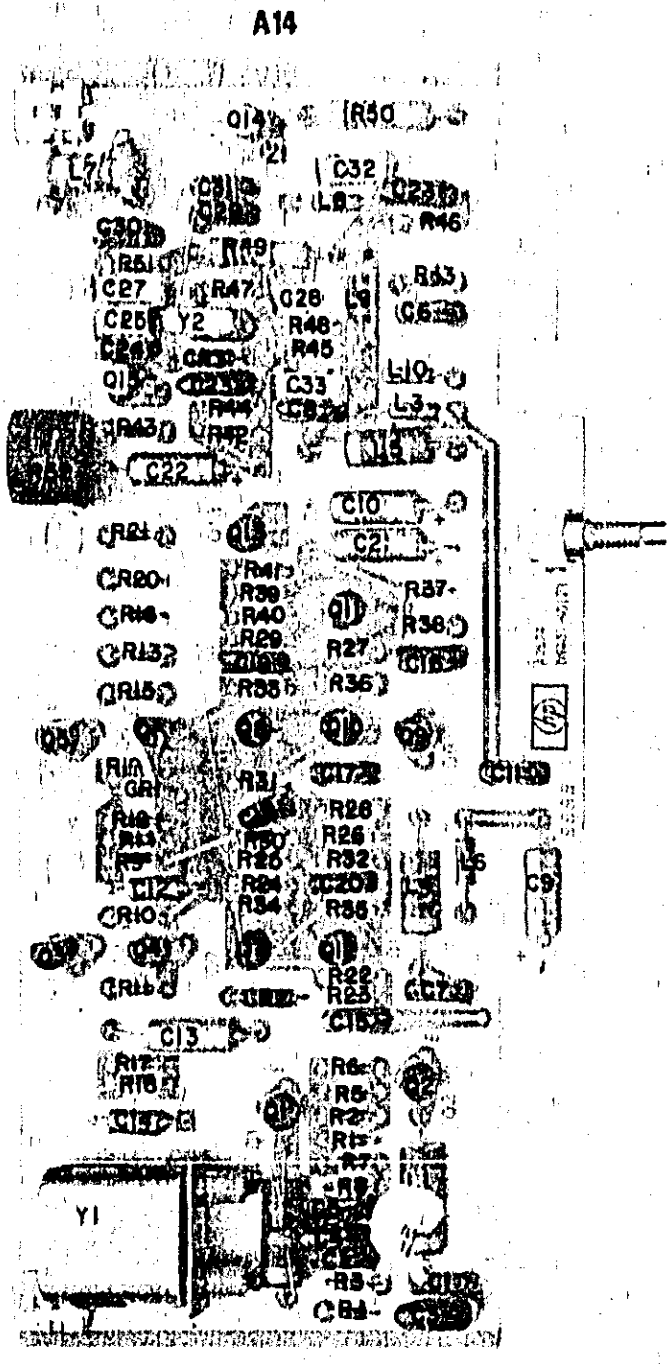


Figure 7-14. Parts Location for Phase-Locked Oscillator A14 (Change E, Serial No. 948-00176 thru 983-00445)

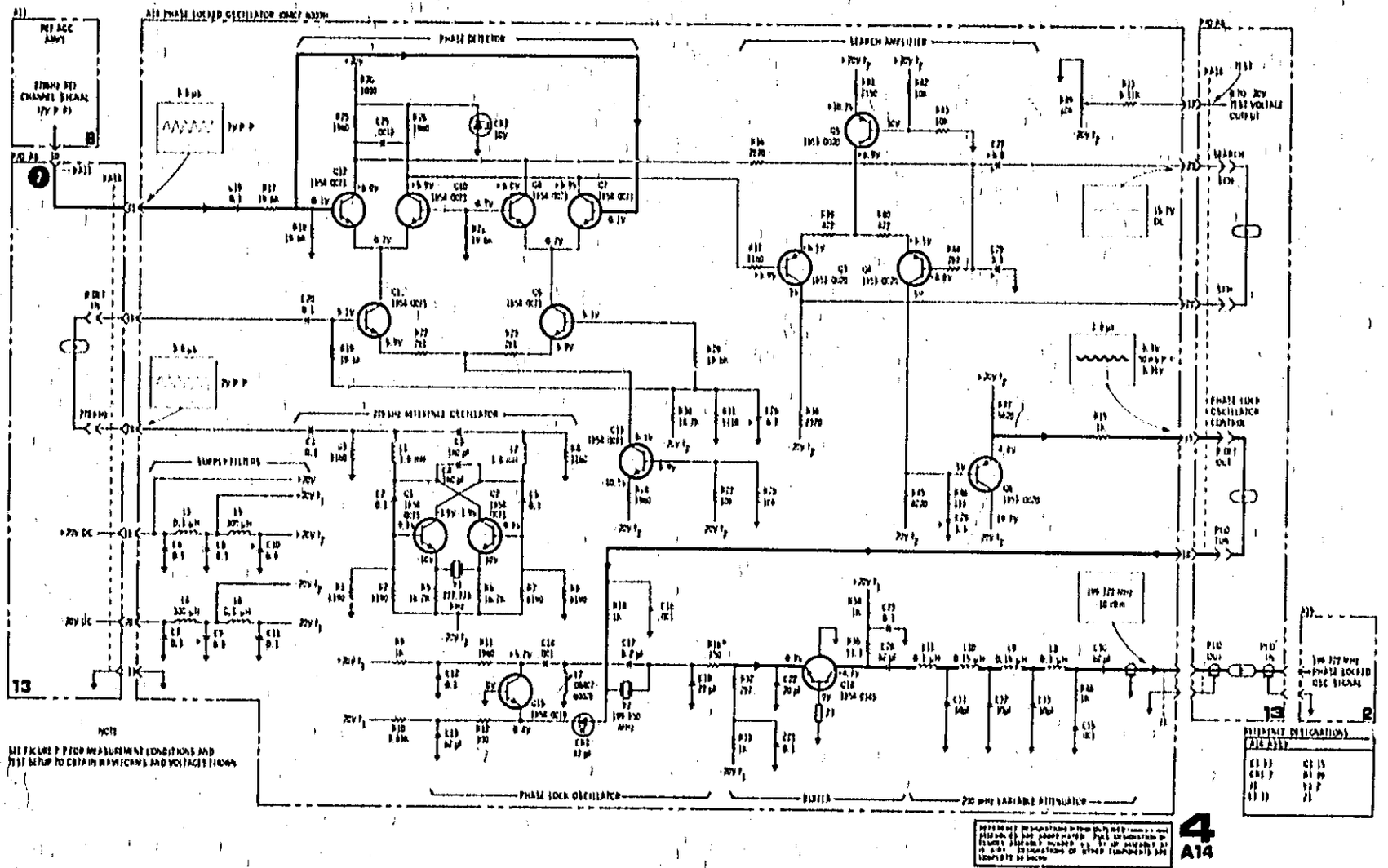


Figure 7-15. Phase-Locked Oscillator A14, Schematic (Change E, Serial No. 948-00176 thru 983-00445)

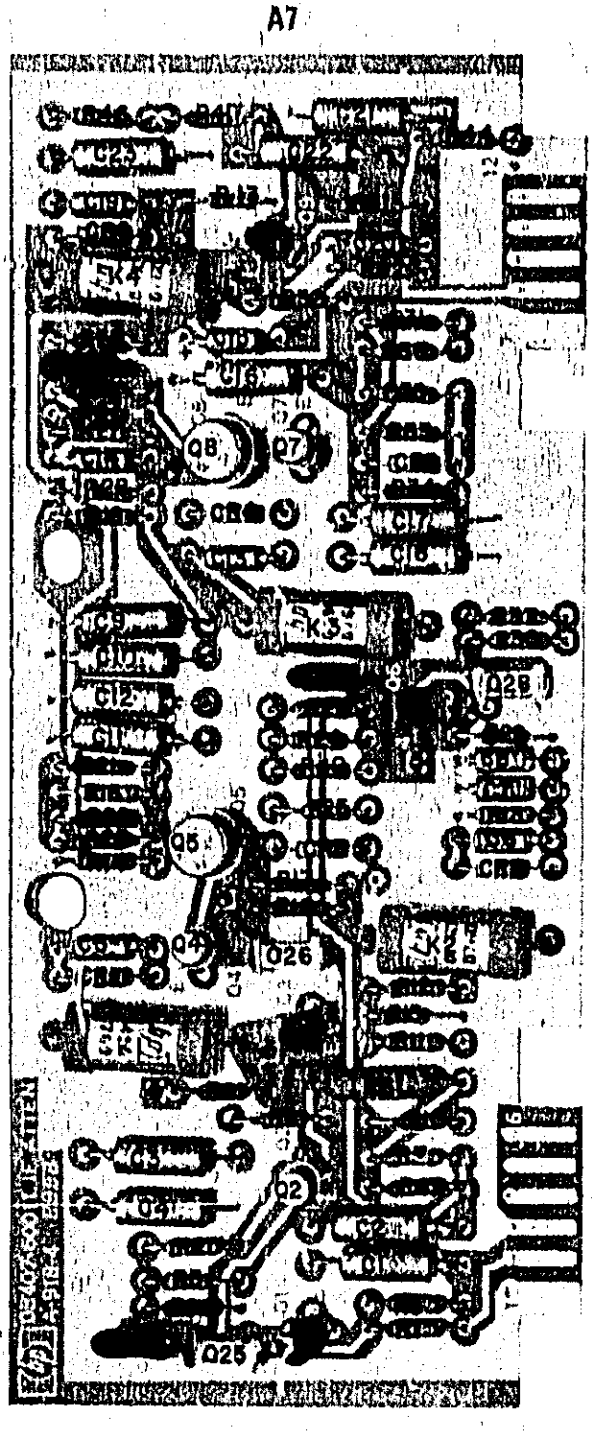


Figure 7-28. Parts Location for Programmable IF Attenuator A7 (Change F, Serial No. 972-00385 and Below)

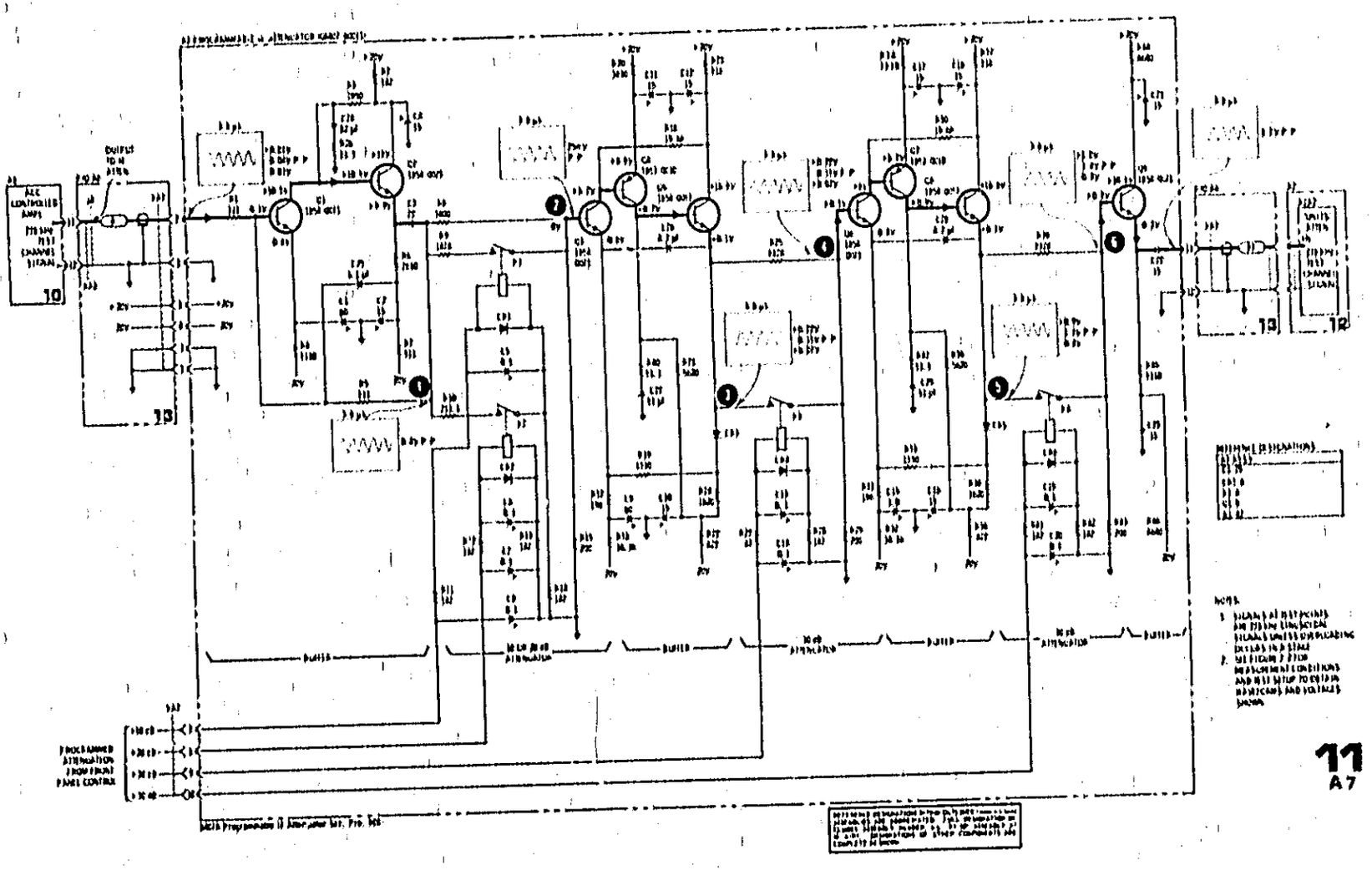


Figure 7-29. Programmable IF Attenuator A7, Schematic (Change F, Serial No. 972-00385 and Below)

CHANGE G

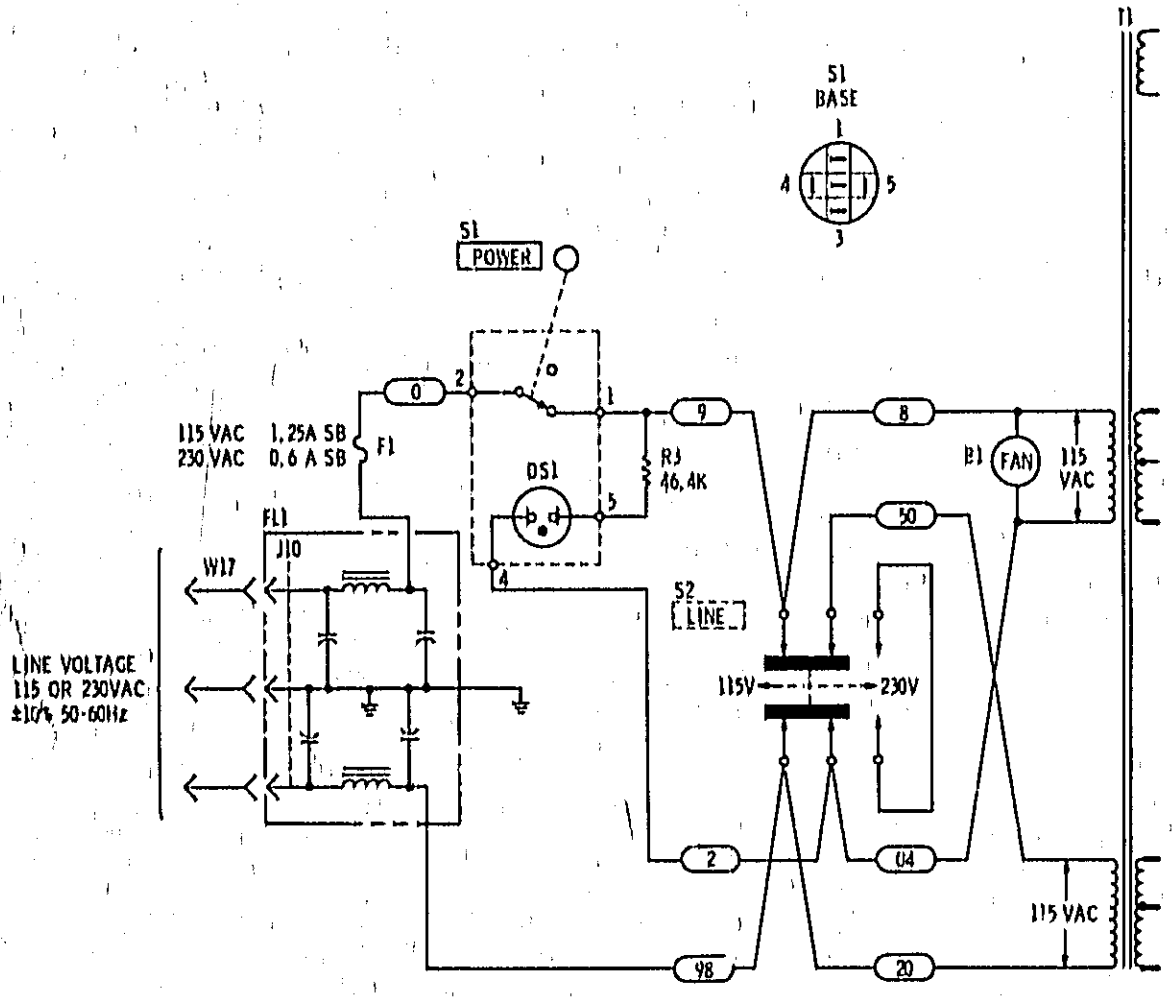
Page 6-18, Table 6-1:
Change FL1 to HP Part No. 9100-2686.
Change W2 to HP Part No. 08407-60050.
Change W17 to HP Part No. 08407-60059.
Change S1 to HP Part No. 3101-0100.

Page 6-19, Table 6-1:

Change CABINET PART, Item 12 to:

12 08407-00002 PANEL: REAR
12 08407-60056 PANEL ASSY: REAR

Page 7-35, Figure 7-35:
Change power-supply schematic in manual, Section VII, per the attached partial schematic.



Part of Figure 7-35. Power Supply A17 and Diode Board A5, Schematic (Change G, Serial No. 965-00315 and Below)

CHANGE H

Page 6-9, Table 6-1:
Change A8C17 to HP Part No. 0160-0174, C: FXD CER 0.47 UF +80 −20% 25VDCW.
Delete A8C18.

Page 6-17, Table 6-1:
Delete A17C5 and A17C6.
Delete A17R19 and A17R20.

Page 6-18, Table 6-1:
Delete A17R21 and A17R22.

Page 7-19, Figure 7-19:
Replace Figure 7-19 in Section VII of Manual with Figure 7-19 (Change H) in this Appendix.

Page 7-27, Figure 7-27:
Replace Figure 7-27 in Section VII of Manual with Figure 7-27 (Change H) in this Appendix.

Page 7-35, Figures 7-34 and 7-35:
Replace Figures 7-34 and 7-35 in Section VII of manual with Figures 7-34 and 7-35 (Change H) in this Appendix.

CHANGE I

Page 5-19, Table 5-5, under "Align Test (Table 5-5)" Change:

4	A14R16 (Selected value)	PLO OUTPUT	Adjusts PLO output level.

Page 6-13, Table 6-1:
Change A14 to HP Part No. 08407-60009 and also change all of the associated A14 board components per the attached parts list. If it is necessary to replace A14, it should be replaced with HP Part No. 08407-60123 or 08407-60107 (rebuilt). At the same time A13 must be replaced with 08407-60002 or 08407-60102 (rebuilt).

Page 7-15, Figures 7-14 and 7-15:
Change parts location photo and circuit board schematic of A14 per attached Figures 7-14 and 7-15.

CHANGE J

Page 7-33, Figure 7-33:
Connect together to a single ground XA8A pins 1, 3, and 6, and XA11A pin 3.

CHANGE K

Page 6-12, Table 6-1:
Change A13L4 to HP Part No. 9100-1623, COIL/CHOKE 27 UH 5%. Recommended Replacement is 9140-0237, 200 UH.
Change A13L5 to HP Part No. 9100-1627, COIL/CHOKE 39 UH 5%. Recommended Replacement is 9100-1646, 430 UH.

Page 7-13, Figure 7-13:
Change A13L4 to 27 UH
Change A13L5 to 39 UH.

CHANGE L

Page 6-12, Table 6-1:
Change A13 to HP Part No. 08407-60003 and also change all of the associated A13 board components per the attached parts list. If it is necessary to replace A13, it should be replaced with HP Part No. 08407-60002 or 08407-60102 (rebuilt). At the same time A14 must be replaced with 08407-60123 or 08407-60107 (rebuilt).

On A14 Parts List included with this appendix:
Add A14CR3, 4, and 5, HP Part No. 0122-0201, C: VOLTAGE VAR 15 pF 10% 30WV.
Delete A14C31, 32, and 33.
Change A14R16 to HP Part No. 0698-7224, R: FXD FLM 316 OHM 2% 1/8W.

Page 7-13, Figures 7-12 and 7-13:
Change parts location photo and circuit board schematic of A13 per attached Figure 7-12 and 7-13.

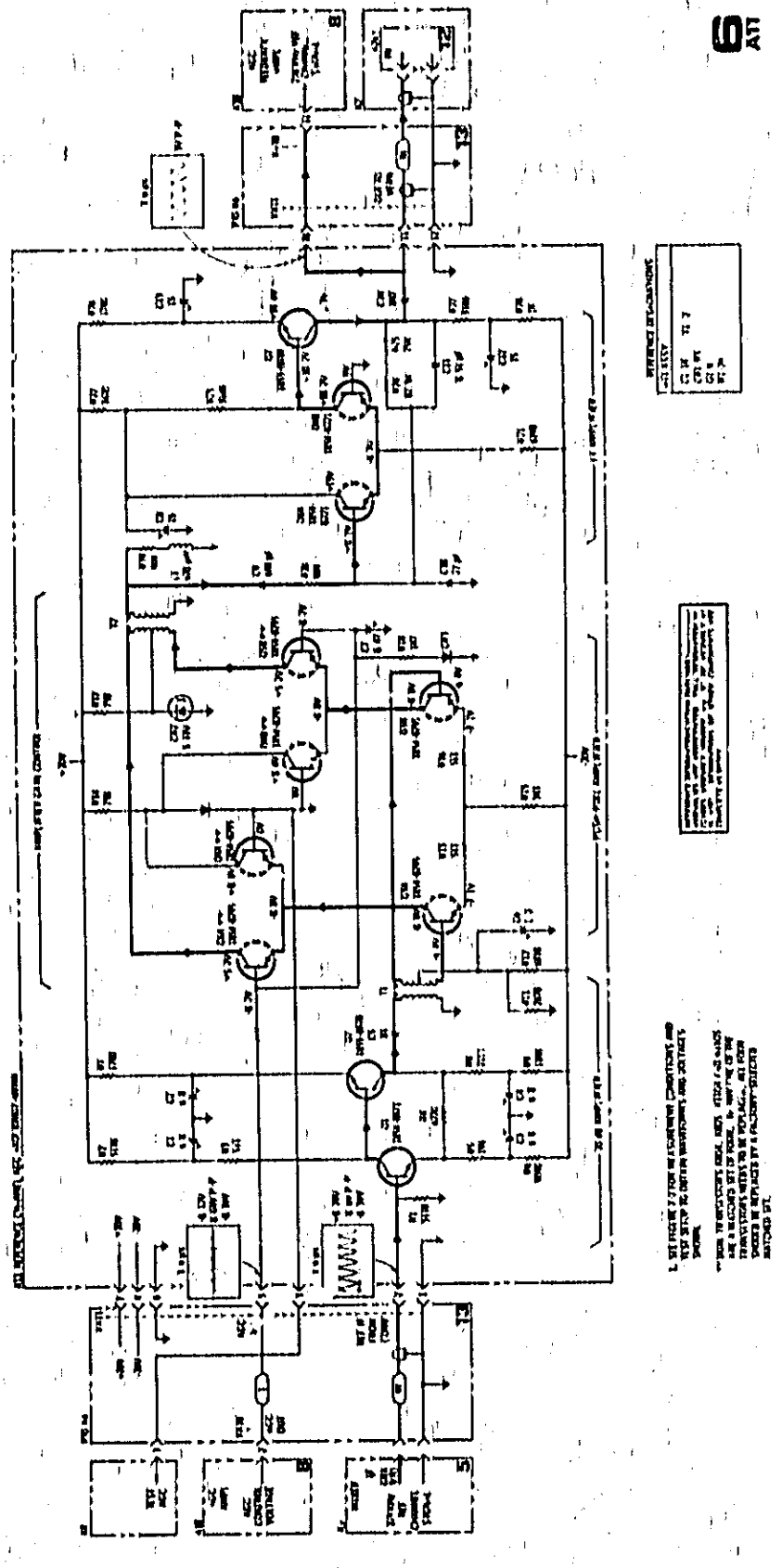


Figure 7-19. Reference Channel AGC Amplifier A11, Schematic (Change H, Serial No. 959-00245 and Below)

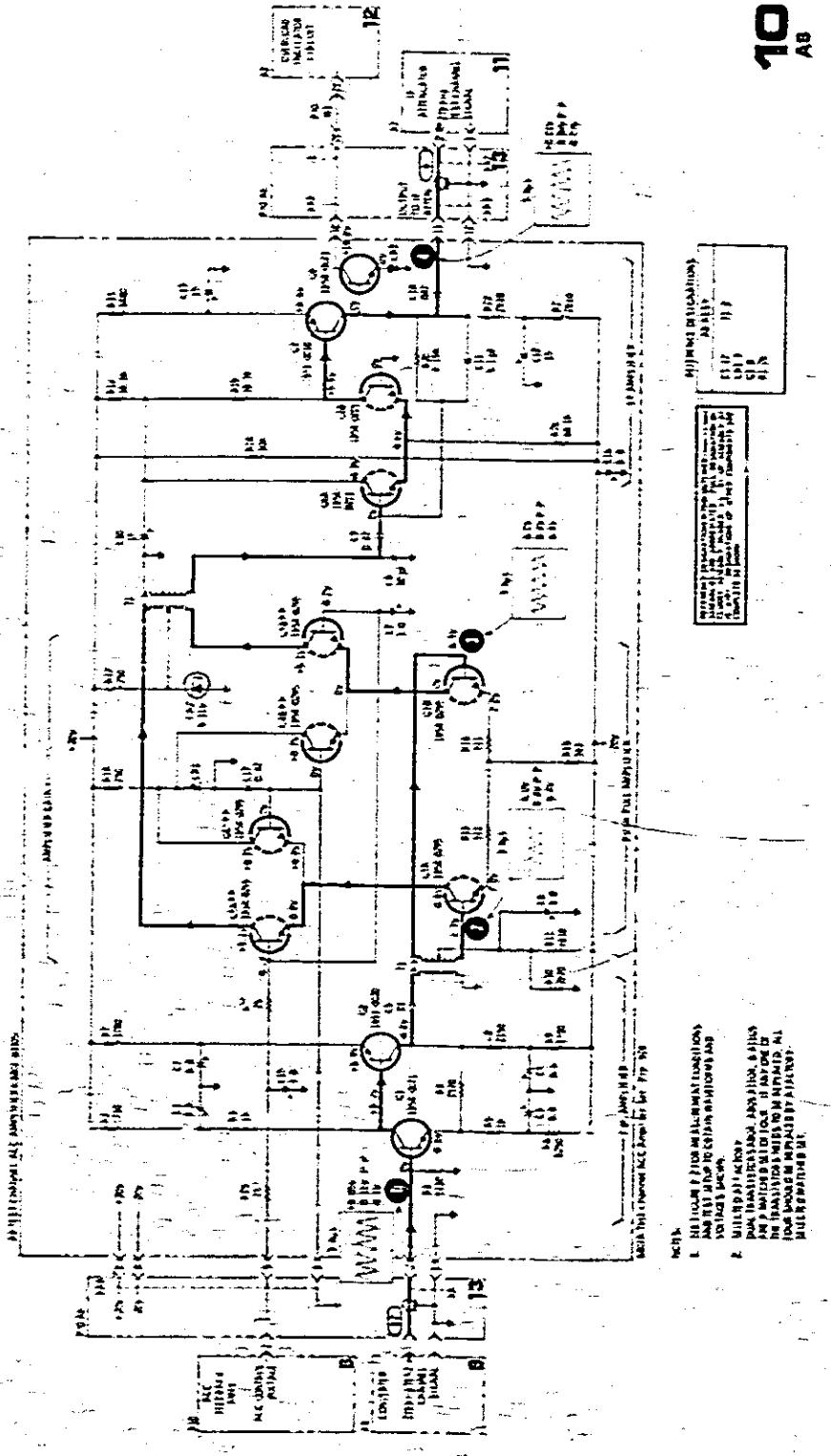


Figure 7-27. Test Channel AGC Amplifier A8, Schematic (Change H, Serial No. 959-00245 and Below)

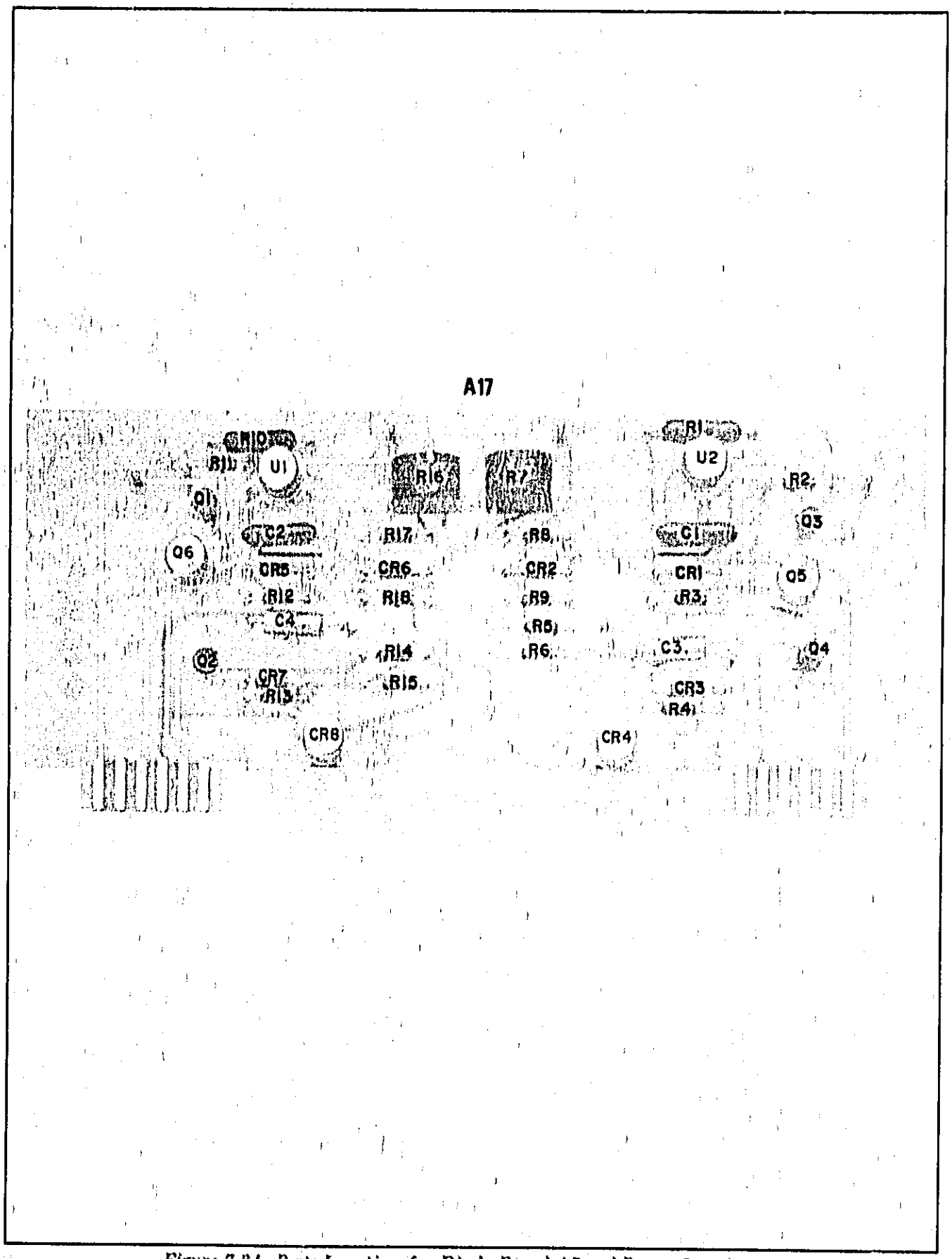


Figure 7-34. Parts Location for Diode Board A5 and Power Supply A17 (Change H, Serial No. 959-00245 and Below)

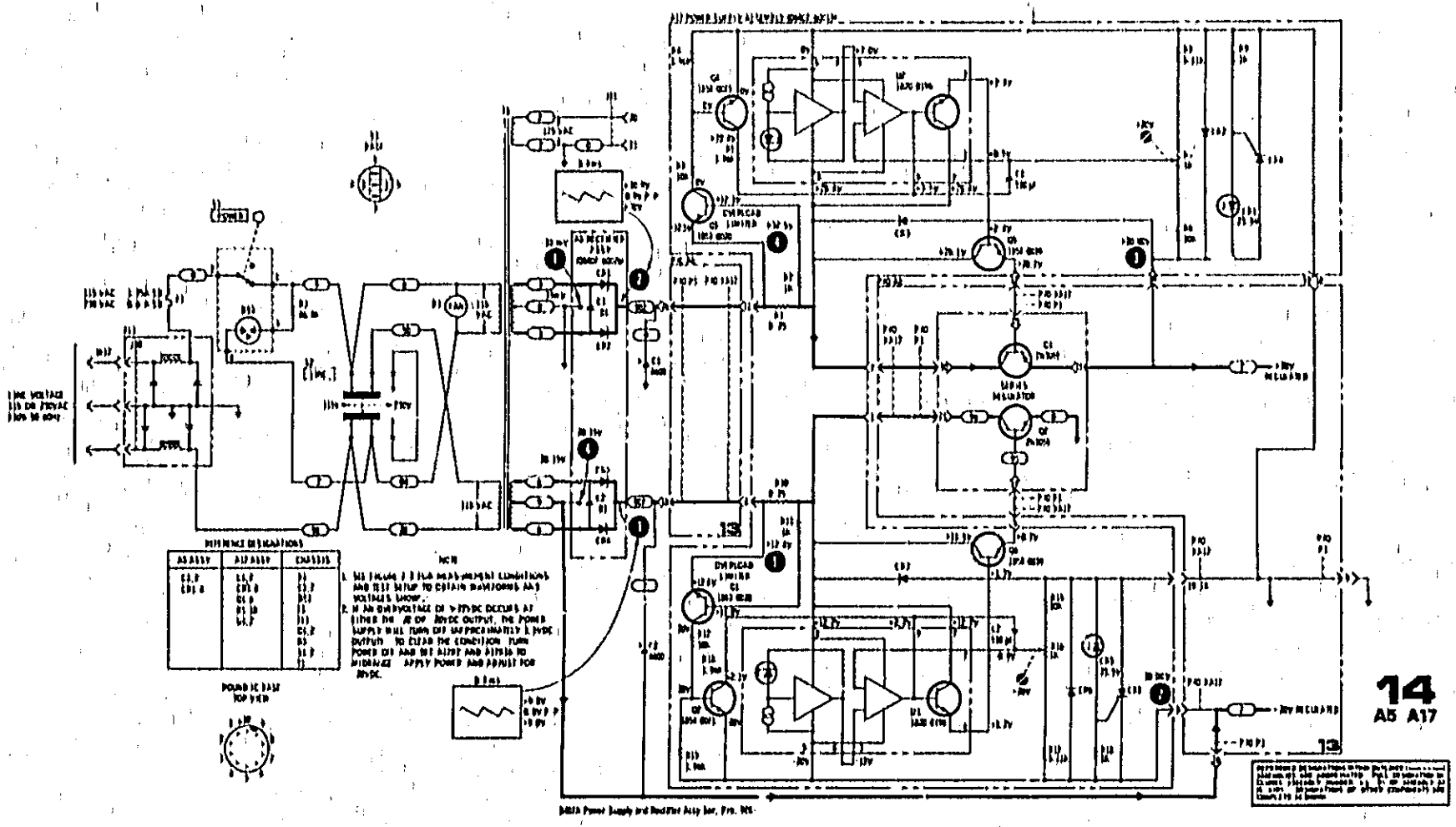


Figure 7-35. Power Supply A17,and Diode Board A5, Schematic (Change H, Serial No. 959-00245 and Below)

Table 6-1. Parts List for A13 in instruments with serial number 924-00130 and below; and A14 in instruments with serial number 948-00175 and below.

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13	08407-60003	1	ALC AMPLIFIER ASSY RECOMMENDED REPLACEMENT IS 08407-60002 OR 08407-60102(REBUILT). AT THE SAME TIME A14 MUST BE REPLACED WITH 08407-60123 OR 08407-60107(REBUILT)	28480	08407-60003
A13	08407-60102	1	REBUILT EXCHANGE ASSY	28480	08407-60102
A13C1	0180-0291	5	CAPD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
A13C2	0160-0174	5	CAPD CER 0.47 UF +80-20% 25VDCW	56289	5C11875-CML
A13C3	0160-0174		CAPD CER 0.47 UF +80-20% 25VDCW	56289	5C11875-CML
A13C4	0180-0291		CAPD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
A13C5	0160-3060	16	CAPD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A13C6	0160-3060		CAPD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A13C7	0160-0174		CAPD CER 0.47 UF +80-20% 25VDCW	56289	5C11875-CML
A13C8	0160-0157	1	CAPD MY 0.0047 UF 10% 200VDCW	56289	192P47292-PTS
A13C9	0160-0174		CAPD CER 0.47 UF +80-20% 25VDCW	56289	5C11875-CML
A13C10	0160-3060		CAPD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A13C11	0160-0164	1	CAPD MY 0.039 UF 10% 200VDCW	56289	192P39392-PTS
A13C12	0160-0156	1	CAPD MY 0.0039 UF 10% 200VDCW	56289	192P39292-PTS
A13C13	0160-0161	1	CAPD MY 0.012 UF 10% 200VDCW	56289	192P12392-PTS
A13C14	0160-0158	1	CAPD MY 0.0056 UF 10% 200VDCW	56289	192P56292-PTS
A13C15	0180-0291		CAPD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
A13C16	0180-0174		CAPD CER 0.47 UF +80-20% 25VDCW	56289	5C11875-CML
A13C17	0180-1743	1	CAPD ELECT 0.1 UF 10% 35VDCW	56289	1500104X9035A2-DYS
A13C18	0180-0291		CAPD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
A13C19	0160-3060		CAPD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A13C20	0170-0040	1	CAPD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A13C21	0180-0291		CAPD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
A13CR1	1901-0025	2	DIODE:SILICON 100MA/1V	07263	FD 2387
A13CR2	1901-0347	1	DIODE:SILICON 8V	28480	1901-0347
A13CR3	1902-3002	1	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A13CR4	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A13CR5	1902-0064	1	DIODE BREAKDOWN:7.5V	28480	1902-0064
A13L1	9140-0096	2	COIL/CHOKE 1.00 UH 10%	99800	1537-12
A13L2	9140-0096		COIL/CHOKE 1.00 UH 10%	99800	1537-12
A13L3	9100-1612	1	COIL:FXD RF 0.33 UH 20%	28480	9100-1612
A13L4	9100-1623	1	COIL/CHOKE 27.0 UH 5%	99800	1537-48
A13L5	9100-1627	1	COIL/CHOKE 39 UH 5%	82142	18-1315-2J
A13Q1	1854-0345	4	TSTR:SI NPN	80131	2N5179
A13Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A13Q3	1854-0345		TSTR:SI NPN	80131	2N5179
A13Q4	1853-0018	1	TSTR:SI PNP(SELECTED FROM 2N4260)	28480	1853-0018
A13Q5	1853-0020	7	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A13Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A13Q7	1854-0071	10	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13Q8	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A13R1	0757-0346	1	RES:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A13R2	0757-0316	1	RES:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A13R3	0757-0422	1	RES:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A13R4	0698-3102	2	RES:FXD MET FLM 237 OHM 1% 1/2W	28480	0698-3102
A13R5	0698-3447	1	RES:FXD MET FLM 422 OHM 1% 1/8W	28480	0698-3447
A13R6	0683-1025	1	RES:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A13R7	0698-3102		RES:FXD MET FLM 237 OHM 1% 1/2W	28480	0698-3102
A13R8	0698-0084	2	RES:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A13R9	0698-3432	2	RES:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A13R10	0757-0280	2	RES:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A13R11	0698-3432		RES:FXD MET FLM 26.1 OHM 1% 1/8W	28480	0698-3432
A13R12	0698-0084		RES:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A13R13	0757-0400	2	RES:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A13R14	0757-0400		RES:FXD MET FLM 90.9 OHM 1% 1/8W	28480	0757-0400
A13R15	0757-0280		RES:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A13R16	0757-0279	2	RES:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A13R17	0757-0416	1	RES:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A13R18	0757-0401	1	RES:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A13R19	0757-0279		RES:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A13R20	0698-3434	3	RES:FXD MET FLM 34.8 OHM 1% 1/8W	28480	0698-3434
A13R21	0698-3434		RES:FXD MET FLM 34.8 OHM 1% 1/8W	28480	0698-3434
A13R22	0698-3434		RES:FXD MET FLM 34.8 OHM 1% 1/8W	28480	0698-3434
A13R23	0698-3153	1	RES:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A13R24	0757-0421	1	RES:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A13R25	0698-3155	1	RES:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A13R26	0698-3446	1	RES:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446
A13R27	2100-1757	1	RES:VAR WW 500 OHM 5% TYPE V LW	28480	2100-1757
A13R28	0757-0442	1	RES:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A13R29	0757-0438	1	RES:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A13R30	0757-0420	1	RES:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420

Table 6-1. Parts List for A13 in instruments with serial number 924-00130 and below; and A14 in instruments with serial number 948-00175 and below.

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13R31	0757-0278	1	RESISTOR 1.78K OHM 1% 1/8W	28480	0757-0278
A13R32	0698-0083	2	RESISTOR 1.96K OHM 1% 1/8W	28480	0698-0083
A13R33	0698-0083		RESISTOR 1.96K OHM 1% 1/8W	28480	0698-0083
A13R34	0698-4037	2	RESISTOR 46.4 OHM 1% 1/8W	28480	0698-4037
A13R35	0698-4037		RESISTOR 46.4 OHM 1% 1/8W	28480	0698-4037
A1321	9170-0016	2	HEADS:MAGNETIC SHIELDING	02114	56-590-65/38
A14	08407-60009	1	BOARD ASSY:PHASE-LOCKED OSCILLATOR RECOMMENDED REPLACEMENT IS 08407-60123 OR 08407-60107(REBUILT). AT THE SAME TIME A13 MUST BE REPLACED WITH 08407-60002 OR 08407-60107(REBUILT)	28480	08407-60009
A14	08407-60107	1	REBUILT 08407-60123;REQUIRES EXCHANGE	28480	08407-60107
A14C1	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C2	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C3	0160-2206	2	CAPACITOR:FXD MICA 180 PF 5%	28480	0160-2206
A14C4	0160-2206		CAPACITOR:FXD MICA 180 PF 5%	28480	0160-2206
A14C5	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C6	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C7	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C8	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C9	0180-0116	4	CAPACITOR:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A14C10	0180-0116		CAPACITOR:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A14C11	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C12	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C13	0160-2016	1	CAPACITOR:FXD MICA 62 PF 5% 500VDCW	00853	RDM15E620J5S
A14C14	0150-0050	3	CAPACITOR:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102Z5B-CDH
A14C15	0150-0050		CAPACITOR:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102Z5B-CDH
A14C16	0150-0050		CAPACITOR:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102Z5B-CDH
A14C17	0160-2255	1	CAPACITOR:FXD CER 6.2 PF 500VDCW	72982	301-000-COHD-829C
A14C18	0150-0115	1	CAPACITOR:FXD CER 27 PF 10% 500VDCW	72982	301-000-U2J0-270K
A14C19	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C20	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C21	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C22	0160-2264	1	CAPACITOR:FXD CER 20 PF 5% 500VDCW	72982	301-000-COGD-200J
A14C23	0160-3060		CAPACITOR:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A14C24	0160-2016		CAPACITOR:FXD MICA 62 PF 5% 500VDCW	00853	RDM15E620J5S
A14C25	0160-0299	1	CAPACITOR:FXD MY 1800 PF 10% 200VDCW	56289	192P18292-P75
A14C26	0180-0116		CAPACITOR:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A14C27	0180-0116		CAPACITOR:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A14C28	0180-2141	1	CAPACITOR:FXD ELECT 3.3 UF 10% 50VDCW	56289	150D335X9050B2-DYS
A14C29	0180-1745	1	CAPACITOR:FXD ELECT 1.5 UF 10% 20VDCW	28480	0180-1745
A14C30	0160-2016		CAPACITOR:FXD MICA 62 PF 5% 500VDCW	00853	RDM15E620J5S
A14CR1	0122-0763	1	DIODE:VOLTAGE VAR 47 PF 10% 60WV	04713	1N5148
A14CR2	1902-0025	1	DIODE:BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A14CR3	0122-0701	19	DIODE:VOLTAGE VAR 15 PF 10% 30WV	04713	SMV315-201
A14CR4	0122-0701		DIODE:VOLTAGE VAR 15 PF 10% 30WV	04713	SMV315-201
A14CR5	0122-0701		DIODE:VOLTAGE VAR 15 PF 10% 30WV	04713	SMV315-201
A14J1	1250-1205	1	CONNECTOR:PC RT ANGLE	28480	1250-1205
A14L1	9100-1658	2	COIL/CHOKE 1600 UH 5%	99800	2500-38
A14L2	9100-1658		COIL/CHOKE 1600 UH 5%	99800	2500-38
A14L3	9100-2247	4	COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A14L4	9100-1643	2	COIL/CHOKE 300 UH 5%	28480	9100-1643
A14L5	9100-1643		COIL/CHOKE 300 UH 5%	28480	9100-1643
A14L6	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A14L7	08407-60028	1	COIL ASSY:ADJ	28480	08407-60028
A14L8	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A14L9	9100-2249	2	COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A14L10	9100-2249		COIL/CHOKE 0.15 UH 10%	28480	9100-2249
A14L11	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A14Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A14Q4	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A14Q5	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A14Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A14Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q11	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q13	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q14	1854-0431		TSTR:SI NPN	80131	2N5179
A14Q15	1854-0019	1	TSTR:SI NPN	28480	1854-0019
A14R1	0698-7255	4	RESISTOR 6.19K OHM 2% 1/8W	28480	0698-7255

Table 6-1. Parts List for A13 in instruments with serial number 924-00130 and below; and A14 in instruments with serial number 948-00175 and below.

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14R2	0698-7255		RESISTOR FILM 6.19K OHM 2% 1/8W	28480	0698-7255
A14R3	0698-7248	1	RESISTOR FILM 3.16K OHM 2% 1/8W	28480	0698-7248
A14R4	0698-7248		RESISTOR FILM 3.16K OHM 2% 1/8W	28480	0698-7248
A14R5	0698-7265	2	RESISTOR FILM 16.2K OHM 2% 1/8W	28480	0698-7265
A14R6	0698-7265		RESISTOR FILM 16.2K OHM 2% 1/8W	28480	0698-7265
A14R7	0698-7255		RESISTOR FILM 6.19K OHM 2% 1/8W	28480	0698-7255
A14R8	0698-7255		RESISTOR FILM 6.19K OHM 2% 1/8W	28480	0698-7255
A14R9	0698-7236	4	RESISTOR FILM 1K OHM 2% 1/8W	28480	0698-7236
A14R10	0698-7250	1	RESISTOR FILM 3.83K OHM 2% 1/8W	28480	0698-7250
A14R11	0698-7243	4	RESISTOR FILM 1.96K OHM 2% 1/8W	28480	0698-7243
A14R12	0698-7212	1	RESISTOR FILM 100 OHM 2% 1/8W	28480	0698-7212
A14R13	0698-7253	2	RESISTOR NET FLM 5.11K OHM 2% 1/8W	28480	0698-7253
A14R14	0698-7236		RESISTOR FILM 1K OHM 2% 1/8W	28480	0698-7236
A14R15	0698-7236		RESISTOR FILM 1K OHM 2% 1/8W	28480	0698-7236
A14R16	0698-7233	1	RESISTOR FILM 750 OHM 2% 1/8W	28480	0698-7233
A14R16			FACTORY SELECTED PART		
A14R17	0698-7267	5	RESISTOR NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A14R18	0698-7267		RESISTOR NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A14R19	0698-7267		RESISTOR NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A14R20	0757-0159	3	RESISTOR NET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A14R21	0698-7267		RESISTOR NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A14R22	0698-7222	2	RESISTOR FLM 261 OHM 2% 1/8W	28480	0698-7222
A14R23	0698-7222		RESISTOR FLM 261 OHM 2% 1/8W	28480	0698-7222
A14R24	0698-7243		RESISTOR FLM 1.96K OHM 2% 1/8W	28480	0698-7243
A14R25	0698-7243		RESISTOR FLM 1.96K OHM 2% 1/8W	28480	0698-7243
A14R26	0698-7243		RESISTOR FLM 1.96K OHM 2% 1/8W	28480	0698-7243
A14R27	0698-7260	4	RESISTOR FLM 10K OHM 2% 1/8W	28480	0698-7260
A14R28	0698-7260		RESISTOR FLM 10K OHM 2% 1/8W	28480	0698-7260
A14R29	0698-7267		RESISTOR NET FLM 19.6K OHM 2% 1/8W	28480	0698-7267
A14R30	0698-7264	1	RESISTOR FLM 14.7K OHM 2% 1/8W	28480	0698-7264
A14R31	0698-7253		RESISTOR NET FLM 5.11K OHM 2% 1/8W	28480	0698-7253
A14R32	0698-7223	2	RESISTOR FLM 287 OHM 2% 1/8W	28480	0698-7223
A14R33	0757-0159		RESISTOR NET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A14R34	0757-0159		RESISTOR NET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A14R35	0698-7205	1	RESISTOR FLM 51.1 OHM 2% 1/8W	28480	0698-7205
A14R36	0698-7247	1	RESISTOR FLM 2.87K OHM 2% 1/8W	28480	0698-7247
A14R37	0698-7248		RESISTOR FLM 3.16K OHM 2% 1/8W	28480	0698-7248
A14R38	0698-7245	1	RESISTOR NET FLM 2.37K OHM 2% 1/8W	28480	0698-7245
A14R39	0698-7227	2	RESISTOR FLM 422 OHM 2% 1/8W	28480	0698-7227
A14R40	0698-7227		RESISTOR FLM 422 OHM 2% 1/8W	28480	0698-7227
A14R41	0698-7244	1	RESISTOR FLM 2.15K OHM 2% 1/8W	28480	0698-7244
A14R42	0698-7260		RESISTOR FLM 10K OHM 2% 1/8W	28480	0698-7260
A14R43	0698-7260		RESISTOR FLM 10K OHM 2% 1/8W	28480	0698-7260
A14R44	0698-7223		RESISTOR FLM 287 OHM 2% 1/8W	28480	0698-7223
A14R45	0698-7251	1	RESISTOR FLM 4.22K OHM 2% 1/8W	28480	0698-7251
A14R46	0698-7215	1	RESISTOR FLM 133 OHM 2% 1/8W	28480	0698-7215
A14R47	0698-7254	1	RESISTOR FLM 5.62K OHM 2% 1/8W	28480	0698-7254
A14R48	0698-7236		RESISTOR FLM 1K OHM 2% 1/8W	28480	0698-7236
A14R49	2100-1761	1	RIVAR MW 10K OHM 5% TYPE V 1W	28480	2100-1761
A14XY1	1200-0770	1	SOCKET:CRYSTAL	91506	8000-AG-26
A14Y1	0410-0195	1	CRYSTAL:QUARTZ	28480	0410-0195
A14Y2	0410-0194	1	CRYSTAL:QUARTZ	28480	0410-0194
A14Z1	9170-9016		BEAD:MAGNETIC SHIELDING	02114	FA-590-65/38

See Introduction to this section for ordering information

A14

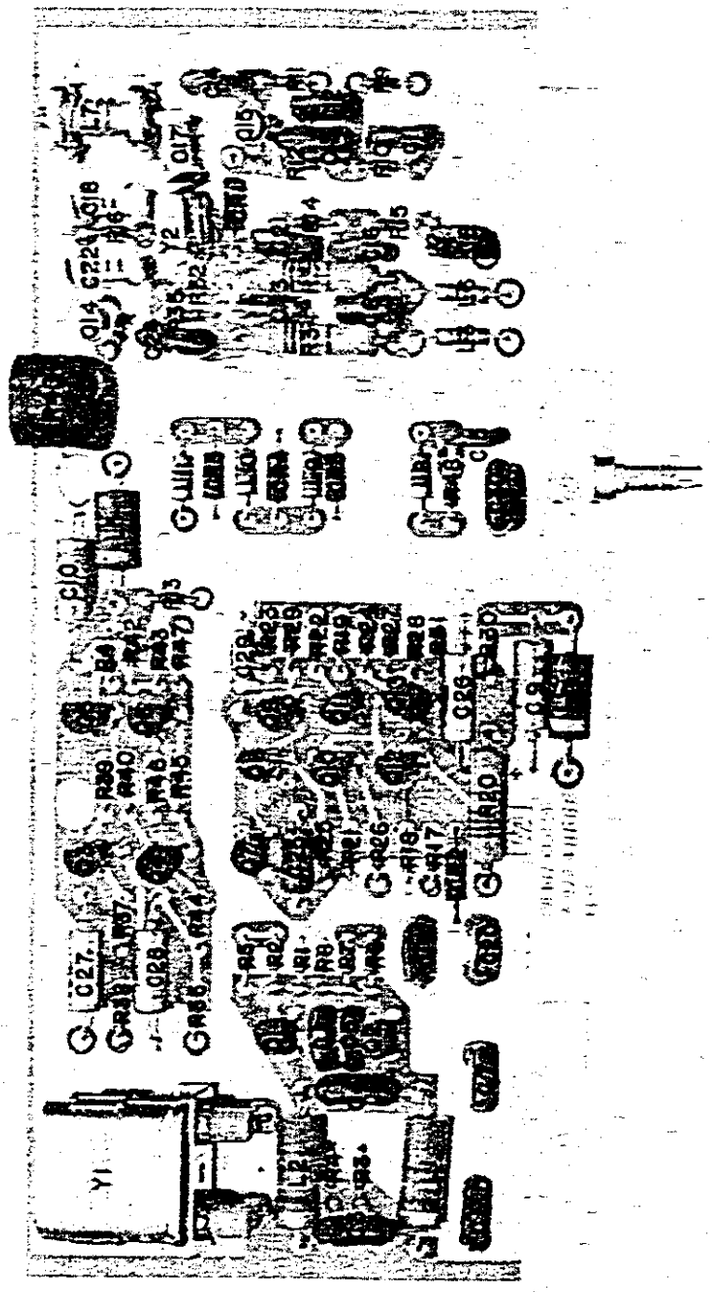


Figure 7-14. Parts Location for Phase-Locked Oscillator A14 (Change I, Serial No. 924-00131 thru 948-00175

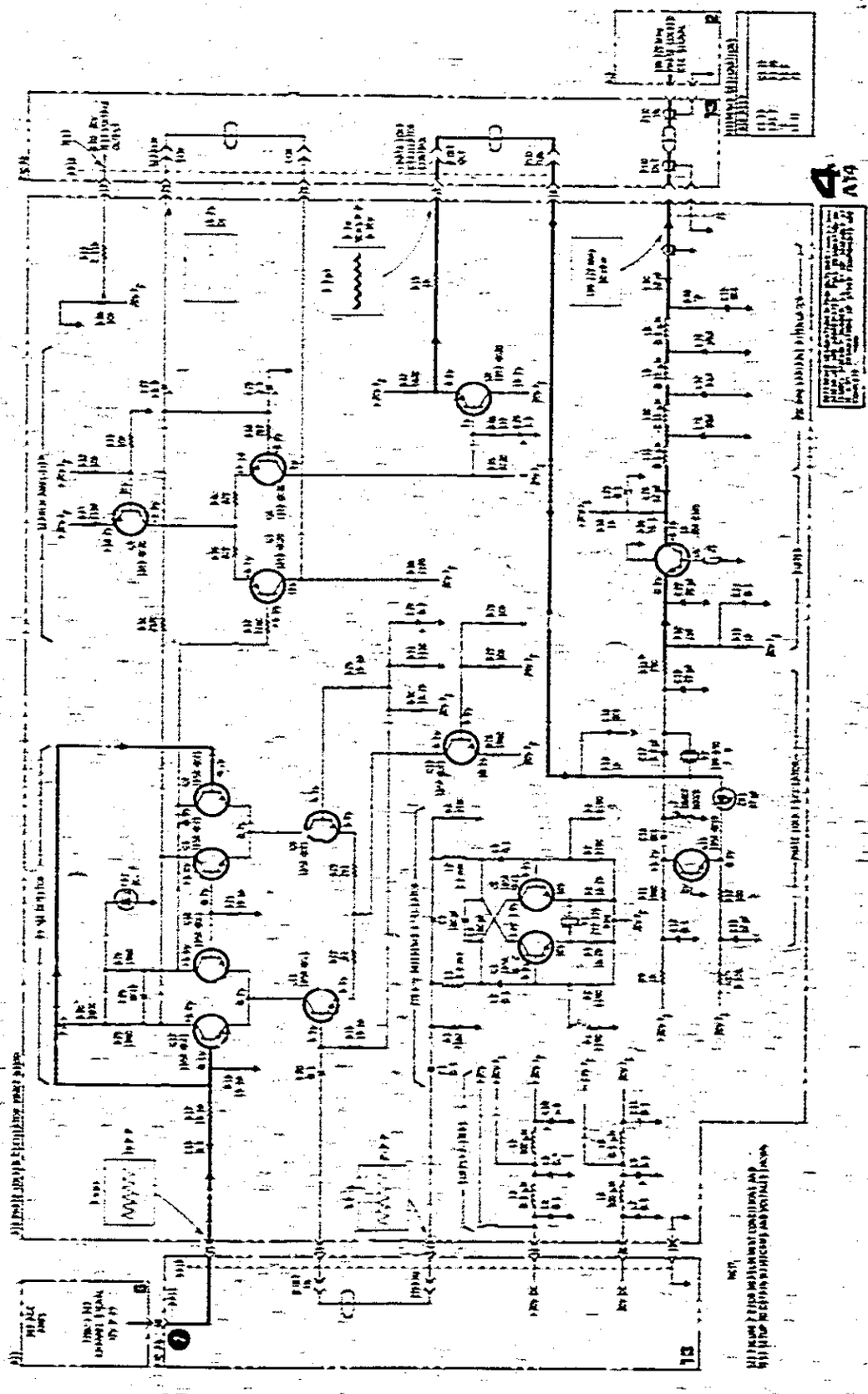


Figure 7-15. Phase-Locked Oscillator A14, Schematic (Change 1, Serial No. 924-00113 thru 948-00175)

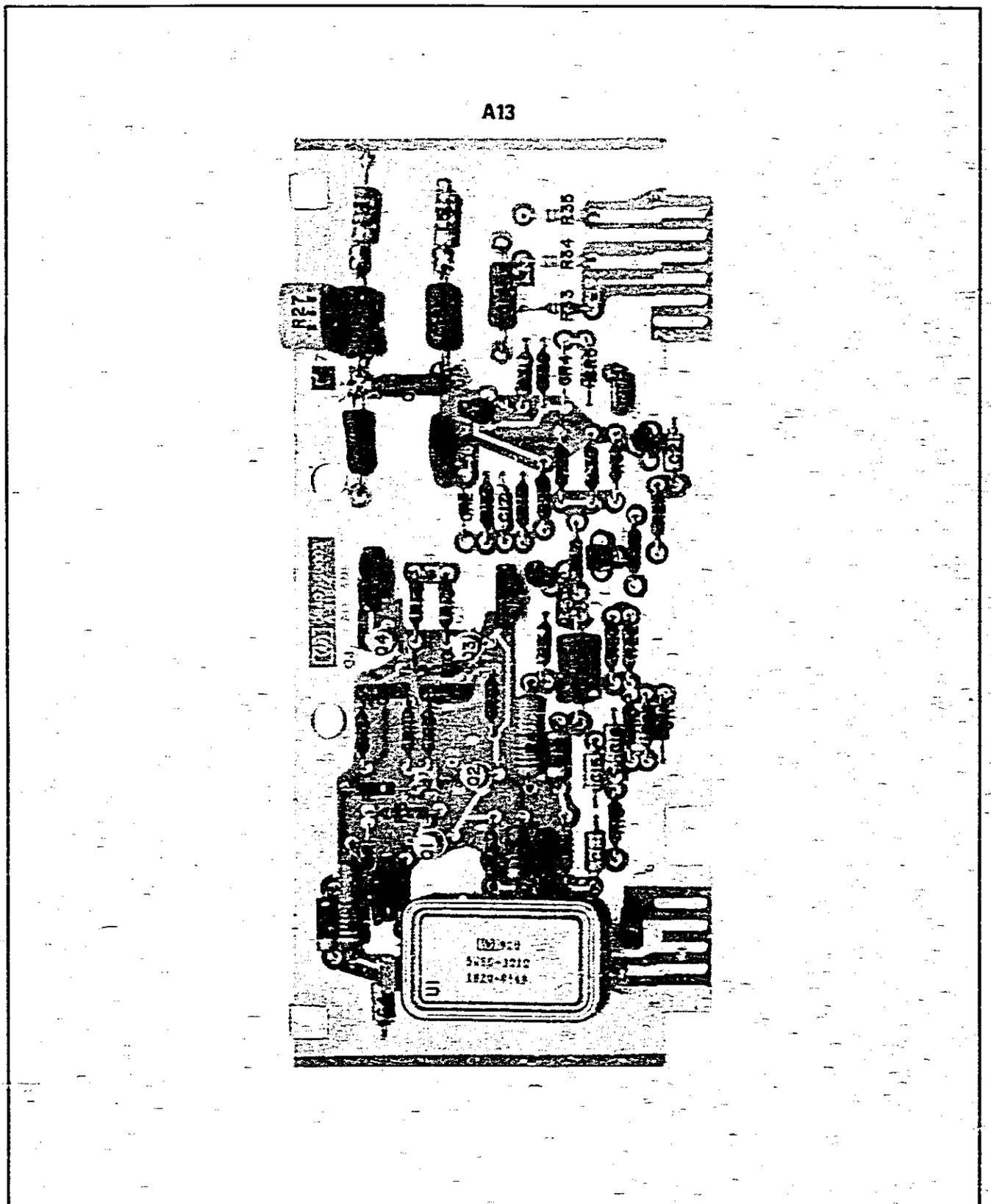


Figure 7-12. Parts Location for Automatic Level Control Amplifier A13 (Change L, Serial No. 924-00130 and Below)

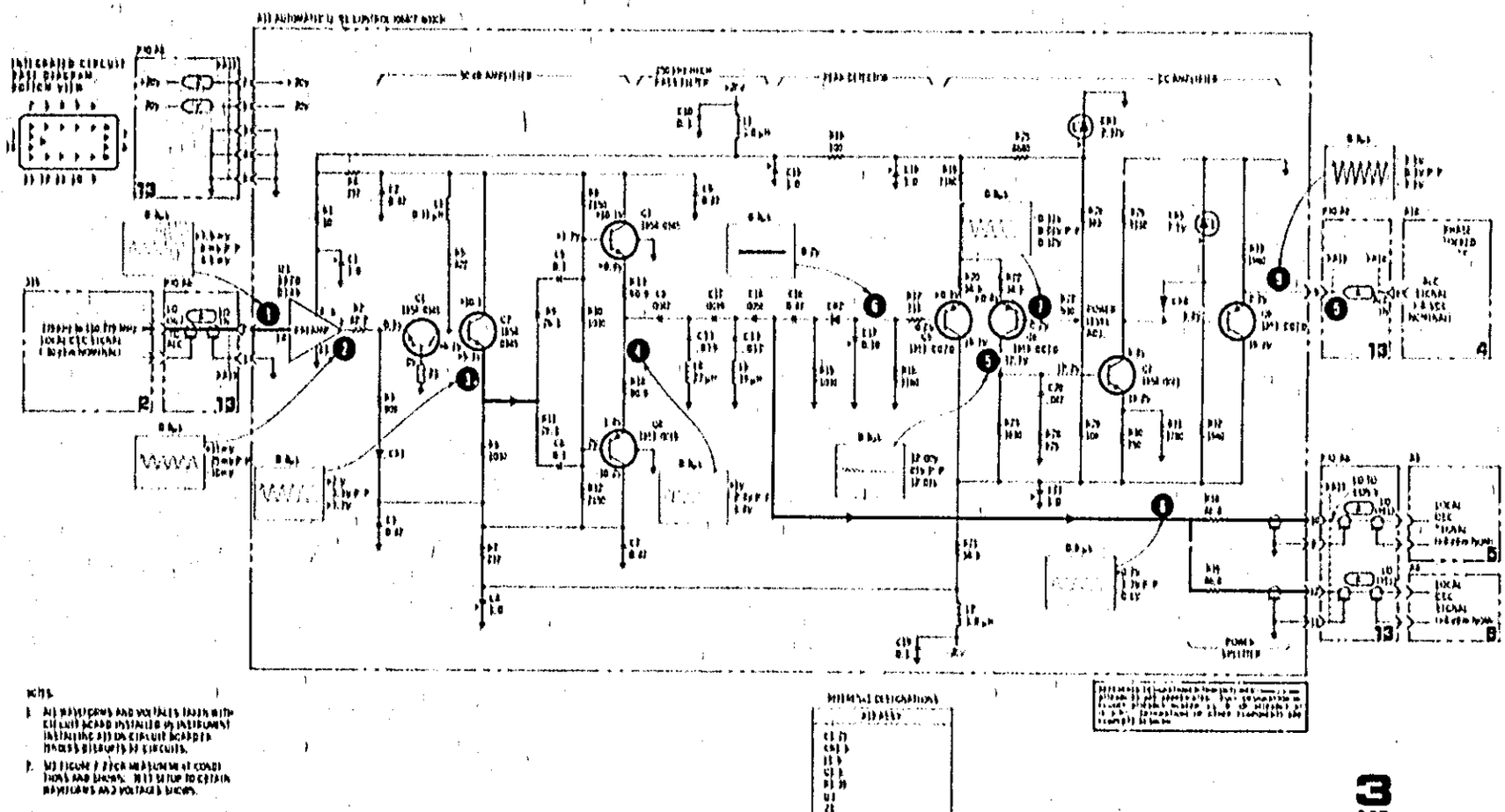


Figure 7-13. Automatic Level Control Amplifier A13, Schematic (Change L, Serial No. 924-00130 and Below)

A14

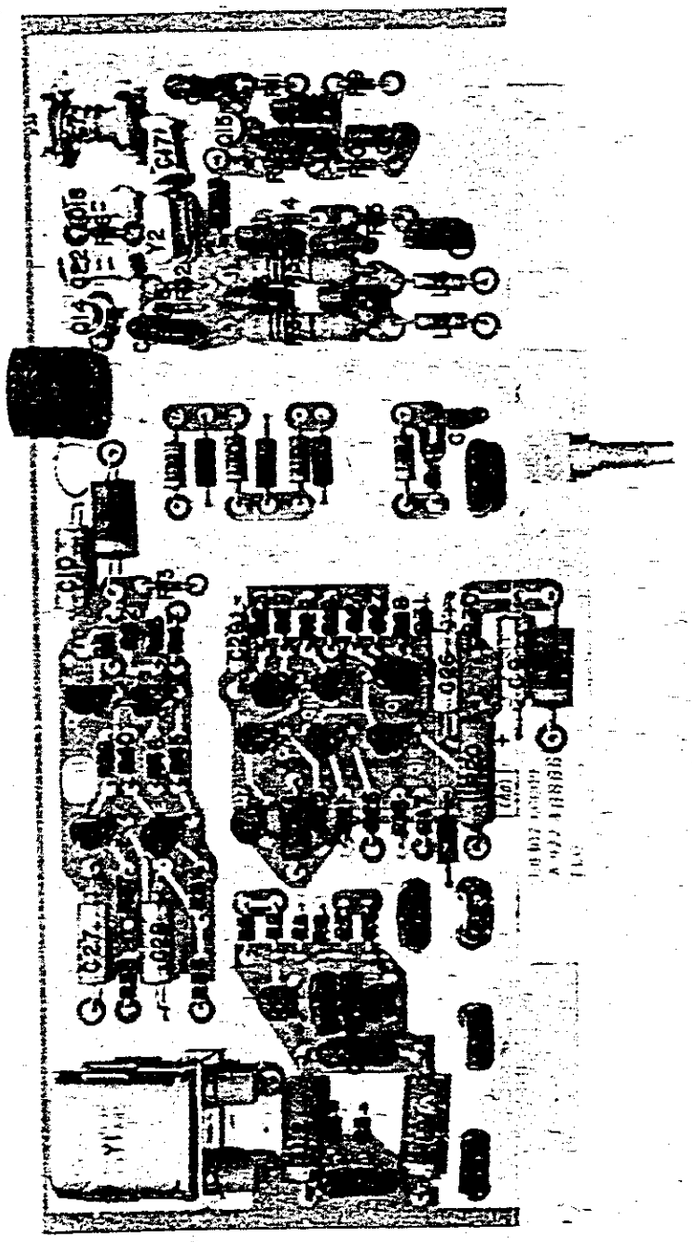


Figure 7-14. Parts Location for Phase-Locked Oscillator A14 (Change L, Serial No. 924-00130 and Below)

On Figure 7-15 (Change I) included with this appendix:
Delete A14C31, C32, and C33; put in their place A14CR3, CR4, and CR5; all 15 pF voltages variable capacitors with cathodes wired to ground.
Add a yellow wire connecting XA13 pin 9 to XA14 pin 16.

CHANGE M

Page 6-10, Table 6-1:
Delete A10CR14.

Page 6-17, Table 6-1:
Delete A17C3 and A17C4.

Page 7-23, Figure 7-23:
Delete A10CR14.

Page 7-35, Figure 7-35:
Delete A17C3 and A17C4.

APPENDIX II
OPTION 008, MANUAL SUPPLEMENT

INTRODUCTION

This supplement describes the differences in the Model 8407A Network Analyzer with Option 008 installed. In addition, it describes the manual changes necessary to document the addition of Option 008.

DESCRIPTION

The Model 8407A Option 008 Network Analyzer is used to test devices used in a 75-ohm system. The addition of Option 008 consists of installing four 50-to-75 ohm matching resistors (HP Part No. 11658-60001) in the 8407A front panel. In all other respects the instrument is a standard 8407A. The original front-panel 50-ohm BNC connectors mate with these adapters. Therefore, the 8407A can be converted to 50-ohm inputs at any time by removing the 50-to-75-ohm matching resistors and securing the original 50-ohm BNC connectors to the front panel. However, if frequent changes from 75 to 50 ohms are required, it would be more convenient to use two model 11658A 50-to-75-ohm matching resistors which are externally connected to the front panel.

NOTE

The front panel connectors not in use are terminated with 50-ohm terminations for both the standard instrument and Option 008. The resultant mismatch for the Option 008 does not affect the measurement because this mismatch is padded out by internal attenuators.

MODIFICATION KIT

Modification kit for field installation of this option is Part No. 08407-60145.

MANUAL CHANGES TO INCORPORATE OPTION

Page 1-2, Table 1-1:
Change TEST INPUT and REFERENCE INPUT impedance to 75 ohms.

Page 1-3, Paragraph 1-17:
Change (1) entry to: 11652A, Option 008 Reflection-Transmission Kit
Delete (2) 11654A Passive Probe Kit.

Page 1-3, Paragraph 1-18:
Delete entire paragraph.

Page 1-3, Paragraph 1-19:
Add "Option 008" after "11652A" and after "8721A."

Page 1-3, Paragraph 1-20 thru 1-23:
Delete paragraphs 1-20 thru 1-23.

Page 3-5, Figure 3-3:
Add "Option 008" after all references to 8407A and 11652A.

Change 11652-60009 to 11652-60019.

Page 3-6, Figure 3-4:
Add "Option 008" after all references to 8407A, 11652A and 8721A.

Change 11652-60009 to 11652-60019.

Page 5-3, Table 5-2:
Add "Option 008" after 8721A and 11652A in Transmission-Reflection Accessory Kit.

Change 11652-60009 to 11652-60019.

Pages 5-5, 5-6, 5-7, 5-9, 5-12, and 5-15:
Add "Option 008" to references to 8721A and 11652A.

Change 11652-60009 to 11652-60019.

Page 6-20, Table 6-1:
Add to the miscellaneous list the following:
11658-60001, 4 ea. matching resistor assy.
7120-2821, Identification Plate.
08407-20124, 4 each washers.
2950-0035, 4 each hexagon nuts.
2190-0068, 4 each washers.

Page 7-17, Figure 7-17:
Add a 50-to-75-ohm adapter at the end of Reference input connectors J1 and J3 consisting of a 25-ohm resistor in series with the line with a connector on both ends.

Page 7-25, Figure 7-25:
Add a 50-to-75-ohm adapter at the end of test channel input connectors J4 and J6 consisting of a 25-ohm resistor in series with the line with a connector on both ends.

MANUAL CHANGES

MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 8407A
Date Printed: December 1971
Part Number: 08407-90038

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement, make all ERRATA corrections and all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
1144A00656 thru 1144A00705	1
1144A00706 thru 1144A00905	1, 2
1317A00906 thru 1317A00935	1, 2, 3
1317A00936 thru 1317A01195	1, 2, 3, 4
1450A01196 thru 1450A Prefix	1 – 5

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
1635A Prefix	1 – 6
1706A Prefix thru 1706A01780; and 1706A01791, 1706A01793, and 1706A01794	1 – 7
1706A01781 thru 1706A Prefix (Except not 1706A01791, 1706A01793, and 1706A01794); and 2006A Prefix	1 – 8
2121A	1 – 9
2304A	1 – 10

►NEW ITEM

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

Printed in U.S.A.

13 FEBRUARY 1984

42 pages

HEWLETT PACKARD

The following Service Notes are available from your local HP Sales and Service Office.

Service Note	Serial Number	Description
8407A-2A	976-00335 and below	*Improved Operation Modifications.* Recommended IC Replacements
8407A-3	983-00445 and below	*Recommended Power Supply Modifications.* Increases short circuit protection.
8407A-4	All serials	*Phase Locked Oscillator Replacement Procedure and 8407A Alignment Procedure.*
8407A-5	Prefix 1144A and below	*Improved Power Supply Kit.* Superseded by Service Note 8407A-7.
8407A-6	All serials	*Phase Locked Oscillator Troubleshooting.*
8407A-7	Prefix 1317A	*Power Supply Improvement Modifications.*
8407A-8	All serials	*Repair Manual and Troubleshooting Procedure.*
8407A-9	All serials	*Recommended Replacements for A10Q7 and A10Q9.*
8407A-10	All serials	*A17 Power Supply Assembly Improvements.*

ERRATA

Inside front cover:
Insert new information regarding CERTIFICATION, WARRANTY, and ASSISTANCE immediately inside front cover of manual (new information sheet supplied in this Manual Changes Supplement). (ERRATA)

Page 1-0, Figure 1-1:
Delete RACK MOUNTING KIT.

Page 1-1, General Information:
Insert new Safety Considerations (supplied in this Manual Changes Supplement) preceding Paragraph 1-1. (ERRATA)

Page 1-1, Paragraph 1-11:
Delete all references to Rack Mounting Kit.

Page 1-1, Paragraph 1-13:
Change to read:
"A Rack Mounting Kit is available to install the instrument in a 19-inch rack. Rack Mounting Kits may be obtained through your nearest Hewlett-Packard Office by ordering HP Part Number 5060-8741."

ERRATA (Cont'd)

Page 1-2, Table 1-1:
Change the graph's left vertical axis to "Worst Amplitude Error (dB)."

Page 3-1, Paragraph 3-10:
Add:

NOTE

When using an 8601A, to avoid degradation of phase locking at high sweep speeds, turn RF Blanking off.

►Page 3-1, Paragraph 3-11:
Delete the last sentence.

Page 3-2, Figure 3-1:
Change the second sentence in Item 1 to read:
"Reference channel RF input for signal inputs in the range of −10 to −60 dBm."

Page 3-3, Figure 3-1:
Change the third sentence in Item 15 to read:
"Signal input range for the REF CHANNEL ATTEN input is between +20 and −20 dBm."

Page 4-1, Paragraph 4-6:
Change the second sentence to read:
"The direct inputs are for RF signals in the range of −10 to −60 dBm for the Reference channel and −10 to −90 dBm for the Test channel, and the attenuated inputs are for RF signals in the range of +20 to −20 dBm for the Reference channel and +20 to −50 dBm for the Test channel."

Page 5-6, Table 5-3 (Test No. 2):
Delete the oscilloscope and BNC TEE from the TEST SETUP and EQUIPMENT REQUIRED.
Connect the double shielded cable to the 8407A DIRECT input.

Page 5-7, Table 5-3 (Test No. 3):
Delete the oscilloscope and BNC TEE from the TEST SETUP and EQUIPMENT REQUIRED.
Connect the double shielded cable to the 8407A DIRECT input.

Page 5-9, Table 5-3 (Test No. 4):
Delete the oscilloscope and BNC TEE from the TEST SETUP and EQUIPMENT REQUIRED.
Connect the double shielded cable to the 8407A DIRECT input.
Change the TEST SETUP to show that the cable between the step attenuator and the 8470A DIRECT input is a double shielded cable.

Page 5-14, Table 5-3 (Test No. 5):
Change the second to last sentence in step f to read:
"the error per 10 dB step should be less than 0.1 dB and 0.5°."

Page 6-2, Table 6-2:
Delete A1, HP Part Number 08407-60143.
Delete A2, HP Part Number 08407-60144.
Change A2Q3 to HP Part Number 1854-0404 TRANSISTOR NPN SI TO-18 PD=360 mW (Recommended Replacement).
Change description of A2R3 as follows: R:FXD MET FLM 287 OHM 1% 1/8W, (FACTORY SELECTED, TYPICAL VALUE SHOWN).
Delete A2A1, HP Part Number 08407-60115.
Change A2A1Q2 and A2A1Q3 to HP Part Number 1854-0882 TRANSISTOR NPN PD=300 mW FT=200 MHz (Recommended Replacement).

ERRATA (Cont'd)

Page 6-3, Table 6-2:
Delete A2A2, HP Part Number 08407-60116.
Change A2A2C1 to HP Part Number 0160-3490 C:FXD CER 1.0 µF 20% 50 VDCW.
Change A2A2C4 to HP Part Number 0180-0291 C:FXD ELECT 1.0 µF 10% 35 VDCW.
Change the first entry of A3 to HP Part Number 08407-60154, REFERENCE AND TEST CHANNEL CONVERTERS A3, A4, and W10 MATCHED PAIR (WITHOUT EXCHANGE).
Add to A3C12 description the following: "(Factory Selected, Typical Value shown.)"

Page 6-4, Table 6-2:
Change A3Q1, A3Q2, and A3Q3 to HP Part Number 1854-0345 TRANSISTOR NPN 2N5179 SI TO-72 PD=200 mW, Mfr. Code 04713, Mfr. Part Number 2N5179.
Change A3Q4 and A3Q5 to HP Part Number 1854-0882 TRANSISTOR NPN PD=300 mW FT=200 MHz (Recommended Replacement).
Change A3Q6 to HP Part Number 1854-0404 TRANSISTOR NPN SI TO-18 PD=360 mW (Recommended Replacement).

Page 6-5, Table 6-2:
Change A3A1 to HP Part Number 0955-0076.
Change the first entry of A4 to HP Part Number 08407-60154, REFERENCE AND TEST CHANNEL CONVERTERS A3, A4, and W10 MATCHED PAIR (WITHOUT EXCHANGE).
Add to A4C12 description the following: "(Factory Selected, Typical Value shown.)"
Change A4Q1, A4Q2, and A4Q3 to HP Part Number 1854-0345 TRANSISTOR NPN 2N5179 SI TO-72 PD=200 mW, Mfr. Code 04713, Mfr. Part Number 2N5179 (Recommended Replacement).
Change A4Q4 and A4Q5 to HP Part Number 1854-0882 TRANSISTOR NPN PD=300 mW FT=200 MHz (Recommended Replacement).
Change A4Q6 to HP Part Number 1854-0404 TRANSISTOR NPN SI TO-18 PD=360 mW (Recommended Replacement).

Page 6-6, Table 6-2:
Change A4A1 to HP Part Number 0955-0076.

Page 6-7, Table 6-2:
Change A6 to HP Part Number 08407-60015, Master Board Assy.
Delete A7, HP Part Number 08407-60103.

Page 6-8, Table 6-2:
Delete A8, HP Part Number 08407-60104.

Page 6-9, Table 6-2:
Change A8Q6 to HP Part Number 1854-0475.
Change A8Q8 to HP Part Number 1854-0404 TRANSISTOR NPN SI TO-18 PD=360 mW (Recommended Replacement).
Delete A9, HP Part Number 08407-60105.
Add to A9C3 description the following: "(Factory Selected, Typical Value shown.)"
Change A9Q1 and A9Q2 to HP Part Number 1854-0404 TRANSISTOR NPN SI TO-18 PD=360 mW (Recommended Replacement).

ERRATA (Cont'd)

Page 6-10, Table 6-2:
Delete A10, HP Part Number 08407-60106.
Change A10Q4 to HP Part Number 1854-0475.
Change A10Q7 to HP Part Number 1854-0071.
Change A10Q11 to HP Part Number 1854-0404 TRANSISTOR NPN SI TO-18 PD=360 mW (Recommended Replacement).

Page 6-11, Table 6-2:
Delete A11, HP Part Number 08407-60104.
Change A11Q6 to HP Part Number 1854-0475.

Page 6-12, Table 6-2:
Delete A12, HP Part Number 08407-60105.
Delete A13, HP Part Number 08407-60102.
Change A13C18 to HP Part Number 0160-0159.
Change A13C20 to HP Part Number 0160-0158.

Page 6-14, Table 6-2:
Change A14Q14 to HP Part Number 1854-0345 TRANSISTOR NPN 2N5179 SI TO-72 PD=200 mW, Mfr. Code 04713, Mfr. Part Number 2N5179 (Recommended Replacement).
Change A14Q16 to HP Part Number 1854-0404 TRANSISTOR NPN SI TO-18 PD=360 mW (Recommended Replacement).

Page 6-15, Table 6-2:
Delete A15, HP Part Number 08407-60110.
Change A15CR1 through A15CR4 to HP Part Number 5080-0271.

Page 6-16, Table 6-2:
Delete A16, HP Part Number 08407-60112.

Page 6-17, Table 6-2:
Delete A17, HP Part Number 08407-60113.
Change A17C1 and A17C2 to 0160-2387, CD0, C:FXD MICA 1000PF 1% 500VDC
Change HP Part Number and Mfr. Part Number of A17CR2, A17CR3, A17CR6, and A17CR7 to 1901-0026.

Page 6-18, Table 6-2:
Change the description of the first "F1" listing (HP Part Number 2110-0001) as follows:
FUSE: 1 AMP 250V (220 and 240V OPERATION) RECOMMENDED REPLACEMENT.
Change the description of the second "F1" listing (HP Part Number 2110-0002) as follows:
FUSE: CARTRIDGE 2 AMP 3 AG (100 and 120V OPERATION) RECOMMENDED REPLACEMENT.
Change Part Number 1400-0084 FUSE HOLDER after the second "F1" listing to three separate items as follows:
HP PART NUMBER 2110-0564, FUSEHOLDER BODY 12A MAX FOR UL. (RECOMMENDED REPLACEMENT).
HP PART NUMBER 2110-0565, FUSEHOLDER CAP 12A MAX FOR UL. (RECOMMENDED REPLACEMENT).
HP PART NUMBER 2110-0569, NUT-FUSEHOLDER THREAD M12.7x1.5 DBL. (RECOMMENDED REPLACEMENT).
Change FL1 to HP Part Number 9100-3910 (Recommended Replacement).
Add HP Part Numbers:
7120-4163 LABEL, INFO: QTY 1
08407-00047, CD8, THUMBWHEEL
08407-20044, CD7, WINDOW
08407-00014, CD9, PLASTIC STRIP, 1 CD
08407-00015, CD0, PLASTIC STRIP, 10 CD

ERRATA (Cont'd)

Page 6-19, Table 6-2:
Delete the NOTE regarding color schemes for Cabinet Parts, as Options A85 and X95 are no longer available.
Delete the following entries from the Parts List:

2	08407-60055	PANEL ASSY: FRONT (OPTIONS)
4	5060-0765	RETAINER-HANDLE ASSY, (OPTIONS)
8	5060-0776	KIT: RACK MOUNT, LIGHT GRAY (OPTIONS)
9	5000-0743	COVER: SIDE, BLUE GRAY (OPTION X95)
10	5060-0227	COVER ASSY: TOP, BLUE GRAY (OPTION X95)
11	5060-0228	COVER ASSY: BOTTOM, BLUE GRAY (OPTION X95)
13	5040-0272	LOCK: EXTRACTOR, LIGHT GRAY (OPTIONS)

Page 6-20, Table 6-2:
Delete the following entries from the Parts List:

5020-3275	TRIM: UPPER FRAME (LIGHT GRAY)
5020-3276	TRIM: LOWER FRAME (LIGHT GRAY)
08407-00011	DECK: SLIDE (OPT X95)
08407-20041	FRAME: UPPER (OPTIONS)
08407-40001	DIVIDER: CENTER (OPTIONS)
08410-2015	FRAME: LOWER (LIGHT GRAY)

Page 7-1:
Add the attached Repair Procedure (Paragraphs 7-8 through 7-29).

Page 7-7, Figure 7-7:
Change the REF CHANNEL ATTEN (40 dB) J3 input to read:
"+20 to −20 dBm (+20 dBm/50 VDC MAX)"
Change the REF CHANNEL DIRECT J1 input to read:
"−10 to −60 dBm (+20 dBm/50 VDC MAX)"

Page 7-15, Figure 7-15:
Change A14Q14 to HP Part Number 1854-0345.
Change A14Q16 to HP Part Number 1854-0404.

Page 7-17, Figure 7-17:
Change the value of A3C1 to 0.47 μF.
Change the REF CHANNEL DIRECT J1 input to read:
"−10 to −60 dBm (+20 dBm MAX)"
Change the REF CHANNEL ATTEN J3 input to read:
"+20 to −20 dBm (+20 dBm MAX)"
Change A3Q1, A3Q2, and A3Q3 to HP Part Number 1854-0345.
Change A3Q4 and A3Q5 to HP Part Number 1854-0882.
Change A3Q6 to HP Part Number 1854-0404.

Page 7-21, Figure 7-21:
Change A9Q1 and A9Q2 to HP Part Number 1854-0404.
Change A12Q1 and A12Q2 to HP Part Number 1854-0404.

ERRATA (Cont'd)

Page 7-23, Figure 7-23:
Change A10Q7 to HP Part Number 1854-0071.
Change A10Q11 to HP Part Number 1854-0404.

Page 7-25, Figure 7-25:
Change the value of A4C2 to 0.47 μF.
Change A4Q1, A4Q2, and A4Q3 to HP Part Number 1854-0345.
Change A4Q4 and A4Q5 to HP Part Number 1854-0882.
Change A4Q6 to HP Part Number 1854-0404.

Page 7-27, Figure 7-27:
Change A8Q8 to HP Part Number 1854-0404.

Page 7-31, Figure 7-31:
Change A2Q3 to HP Part Number 1854-0404.
Change A2A1Q2 and A2A1Q3 to HP Part Number 1854-0882.

Page 7-35, Figure 7-35:
Change A17C1 and A17C2 to 1000PF.

CHANGE 1

Page 6-9, Table 6-2:
Change A8R27 to HP Part No. 0698-7118, RESISTOR FXD F TUBULAR 10 OHMS 2% 1/8W (Recommended Replacement).

CHANGE 2

Page 6-4, Table 6-2:
Change A3L1 and A3L2 to HP Part No. 08407-80009 and add to description: "(Recommended Replacement)".

Page 6-5, Table 6-2:
Change A4L1 and A4L2 to HP Part Number 08407-80009 and add to description: "(Recommended Replacement)".

CHANGE 3

Page 6-6, Table 6-2:
Change A5 to HP Part Number 08407-60155.
Delete Rebuilt A5 entry.
Delete A5C1 and A5C2.
Change A5CR1 to HP Part Number 1901-0364, Diode, Mult., Full Wave Bridge Rectifier.
Delete A5CR2.

Page 6-7, Table 6-2:
Change A5CR3 to HP Part Number 1901-0364, Diode, Mult., Full Wave Bridge Rectifier.
Delete A5CR4.

Page 6-18, Table 6-2:
Change T1 to HP Part Number 9100-0560, TRANSFORMER: POWER (RECOMMENDED REPLACEMENT): (A5 RECTIFIER BOARD MUST BE HP Part No. 08470-60155.)

Page 7-35, Figure 7-35:
Change T1 Power Transformer and A5 Rectifier Assembly as shown in the attached partial schematic shown on page 7 of this Manual Changes Supplement.

CHANGE 4

Page 6-18, Table 6-2:
Change W10 to W10* and add to the description as follows:
*FACTORY SELECTED PART
NOTE: When ordering state length within 1/2 inch.
Normal length is 15 to 20 inches.

CHANGE 5

Page 6-6, Table 6-2:
Change A5CR1 to HP Part Number 1906-0027.

Page 6-7, Table 6-2:
Change A5CR3 to HP Part Number 1906-0027.

CHANGE 6

Page 6-10, Table 6-2:
Change A10Q7 to HP Part No. 1854-0071 TSTR:SI NPN.
Change A10Q9 to HP Part No. 1854-0019 TSTR:SI NPN.

Page 6-17, Table 6-2:
Add A17C7 and A17C8 HP Part No. 0160-3060 C:FXD .1UF +-20% 25WVDC CER.
Change A17CR1 and A17CR5 to HP Part No. 1902-3256 DIODE:ZENER 23.7V 5%.
Change A17Q1 and A17Q3 to HP Part No. 1853-0050 TSTR:SI PNP.
Change A17Q2 and A17Q4 to HP Part No. 1854-0404 TSTR:SI NPN.

Page 7-23, Figure 7-23:
Change A10Q7 to HP Part No. 1854-0071.
Change A10Q9 to HP Part No. 1854-0019.

Page 7-35, Figure 7-35:
Add A17C7 (.1 μF in parallel with A17R4 (1.96K).
Add A17C8 (.1 μF) in parallel with A17R13 (1.96K).
Change A17CR1 and A17CR5 breakdown voltages to 23.7V.
Change A17Q1 and A17Q3 to HP Part No. 1853-0050.
Change the primary power circuit as shown on the partial schematic in this Change Sheet (CHANGE 7)

CHANGE 7

Page 6-18, Table 6-2:
Change S1 to HP Part No. 3101-2195 PUSHBUTTON: SWITCH,DPST.
Change W2 to HP Part No. 08407-60157.

Page 7-35, Figure 7-35:
Change the primary power circuit as shown on the attached partial schematic (Figure 7-35A).

CHANGE 8

Serial prefix change only.

CHANGE 9

Page 6-6, Table 6-2:
Change A5 to HP Part Number 08407-60060.
Change A5CR1 to HP Part Number 1906-0096 (Recommended Replacement).

Page 6-7, Table 6-2:
Change A5CR3 to HP Part Number 1906-0096 (Recommended Replacement).

Page 7-35, Figure 7-34:
Replace A5 Diode Board Parts Locations with partial *Figure 7-34. Parts Location for Diode Board A5 and Power Supply A17* of this Change Sheet (*CHANGE 9*).

CHANGE 10

Page 6-17, Table 6-2:
Change A17 Part Number to 08407-60161
Change A17CR4 and A17CR8 Part Number to 1884-0244 and add to Description: (To be used with MP1)
Add A17MP1, 1205-0011, Heat Sink (to be used with A17CR4 and A17CR8)

CERTIFICATION

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

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

Indicates hazardous voltages.

Indicates earth (ground) terminal.

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

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

SAFETY EARTH GROUND

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an autotransformer make sure the common terminal is connected to the neutral (grounded side of mains supply).

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

Repair Procedure (Page 1 of 23) (ERRATA)

7-8. REPAIR PROCEDURE

7-9. The procedures and tests in this repair section are designed to locate defects at the board or sub-assembly level. Before using this repair section, consult the service notes given on page one of this supplement to see if your problem is related to one of them.

7-10. Environmental

7-11. The 8407A will lose phase lock if operated at room temperatures above 90 degrees F (32 degrees C) or below 60 degrees F (16 degrees C). See Paragraph 7-23 for adjusting for extreme environmental operation temperatures (above 90 degrees F or below 60 degrees F).

7-12. Materials Required

7-13. The following list of tools and equipment are required for the repair procedure.

a. *Tools:*

Coil Slug Alignment Tool	HP Part Number 8730-0016
Open End Wrench 15/64 in. (5.95MM)	HP Part Number 8710-0946 or 08640-00027

b. *Parts*

BNC to subminiature plug	HP Part Number 1250-0832
Subminiature Screw-on Jack-Jack-Jack	HP Part Number 1250-0827
Straight Adapter Subminiature Plug-Plug	HP Part Number 1250-1113
Q-Dope (Small Bottle)	HP Part Number 6010-0014

c. *Test Equipment*

TRANSMISSION/REFLECTION KIT	HP Model 11652A
POWER SPLITTER	HP Part Number 11652-60009
1 FT Double Shielded Cable Assy (Qty 2)	HP Part Number 11652-60002
2 FT Double Shielded Cable Assy	HP Part Number 11652-60003
SWEEP OSCILLATOR	HP Model 8601A (HP 8690B/8698B can be substituted)
OSCILLOSCOPE (500 kHz/50 mV)	HP Model 180A/1802A/1820A (recommended)
SPECTRUM ANALYZER	HP Model 8552A/8554B
DC DIGITAL VOLTMETER	HP Model 3439A/3444A (recommended)
PLUG-IN DISPLAY	HP Model 8412A (HP 8413A can be substituted)

7-14. Construction of a "T"

7-15. Construct the "T" connector shown in Figure 7-2A. The purpose of constructing the "T" is to provide a necessary troubleshooting aid for the 8407A. It allows the technician to measure signal levels and still maintain phase lock of the 8407A.

Repair Procedure (Page 2 of 23) (ERRATA)

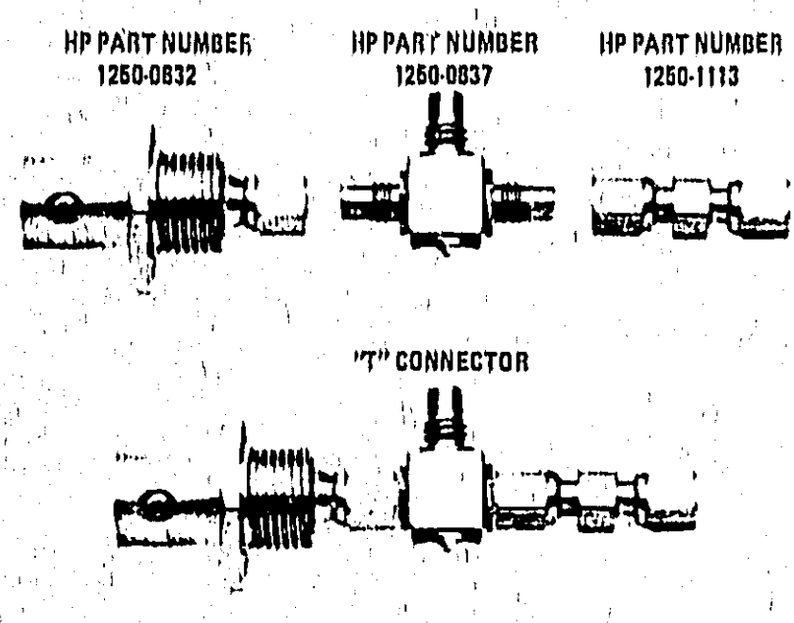


Figure 7-2A. "T" Connector Assembly

WARNING

With the covers removed, hazardous voltages are exposed. Servicing should be performed by qualified personnel who know the hazards involved.

7-16. Initial Setup Procedure

a. Remove 8407A top and bottom covers. Place 8407A on its side and loosen the two straight slot casting retaining screws (accessible from bottom) securing the converter assembly casting, and swing the casting out (see Figure 7-2B).

b. Connect the equipment as shown in Figure 7-2C.

*c. Set 8407A controls as follows:

DISPLAY REFERENCE CAL	Step 1, Move 10dB and 1dB Display Reference switches to top of slide. Step 2, Set thumb wheels so Zero appears at top of DISPLAY REFERENCE windows as in Figure 7-2B.
DISPLAY REFERENCE	10 dB/division slide switch set at +60 dB 1 dB/division slide switch set between 0 dB and +6 dB
REF CHAN LEVEL ADJ	bottom position
AMPL VERNIER	Midrange
PHASE VERNIER	Midrange

*d. Set 8412A controls as follows:

MODE	DUAL
AMPL DB/DIV	10
PHASE DEG/DIV	90 or 100
PHASE OFFSET	In + position
DEGREES	Set for "0"
BW (kHz)	0.1 position

*Figure 7-2B shows controls of 8407A and 8412A in the initial setup position.

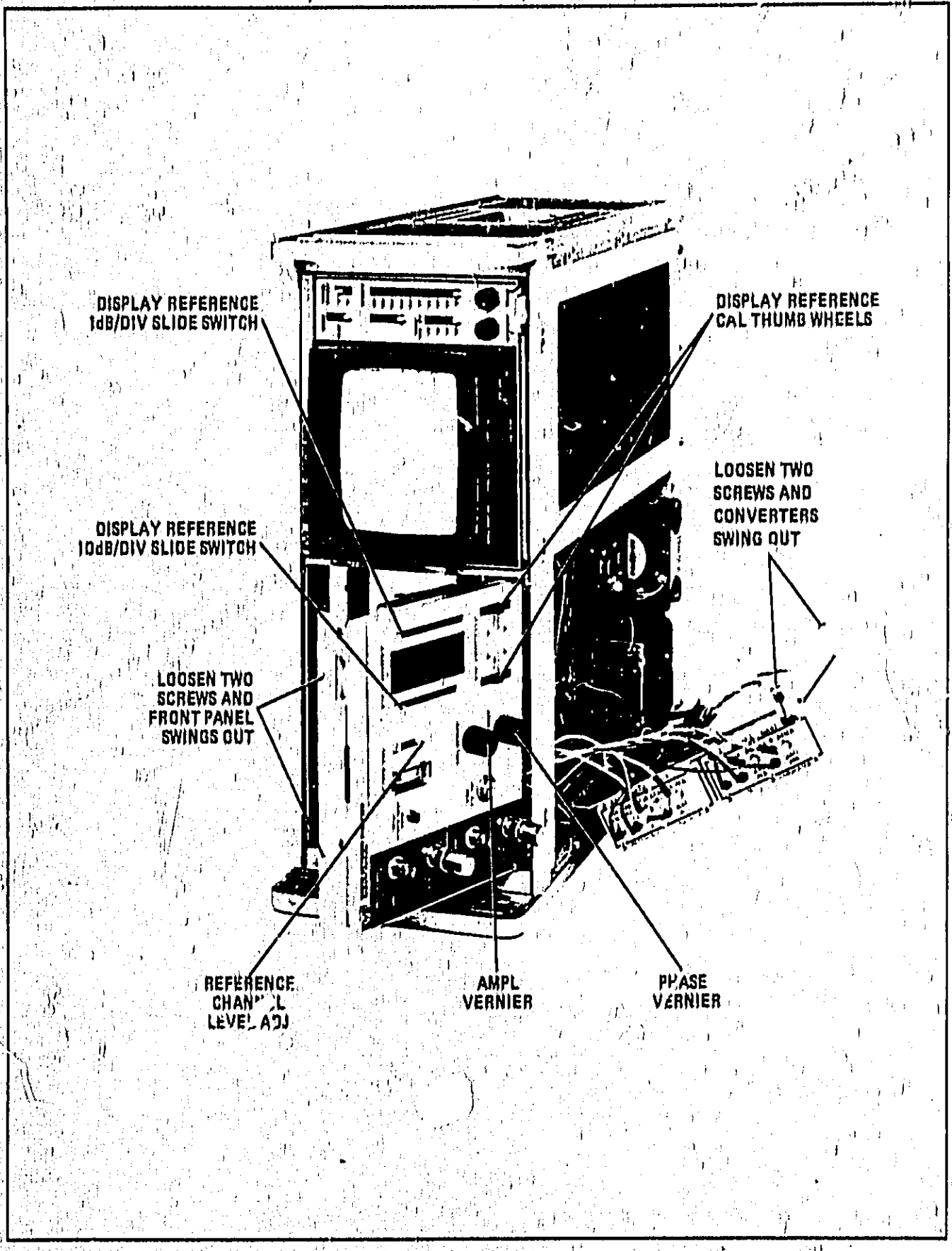


Figure 7-2B. Cabinet Disassembly and Initial Front Panel Control Setup Positions

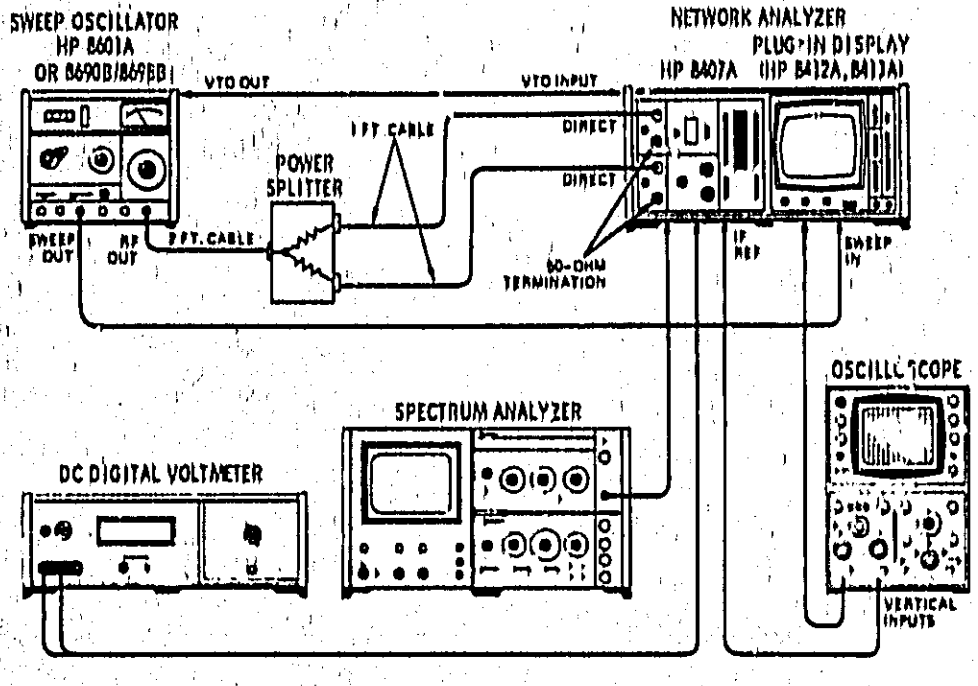


Figure 7-2C. Repair Procedure Test Setup

e. Set 8601A as follows:

OUTPUT LEVEL	0 dBm
OUTPUT LEVEL VERNIER	Adjust for −4 dBm on dB scale of meter.
SWEEP	SYM
RANGE	11
FREQUENCY	1 MHz
SYM SWEEP WIDTH	.01 — 0.1 MHz
SYM SWEEP WIDTH VERNIER	full counter clockwise
CRYSTAL CAL	OFF
TRIG/LINE/FREE switch	switch to LINE
SWEEP MODE	FAST
SWEEP MODE Potentiometer	Midrange
1 KHz MOD SWITCH	OFF

f. Set 8552A/8554B Spectrum Analyzer as follows:

TUNING STABILIZER	ON position (up)
BANDWIDTH	300 kHz
SCAN WIDTH	20 MHz and PER-DIVISION (red Knob Center)
INPUT ATTENUATION	10 dB
BASE LINE CLIPPER	Full counter clockwise
SCAN TIME PER DIVISION	1.0 millisecond
LOG REF LEVEL	10 dB or 0 dB
LOG REF LEVEL VERNIER	0 dB

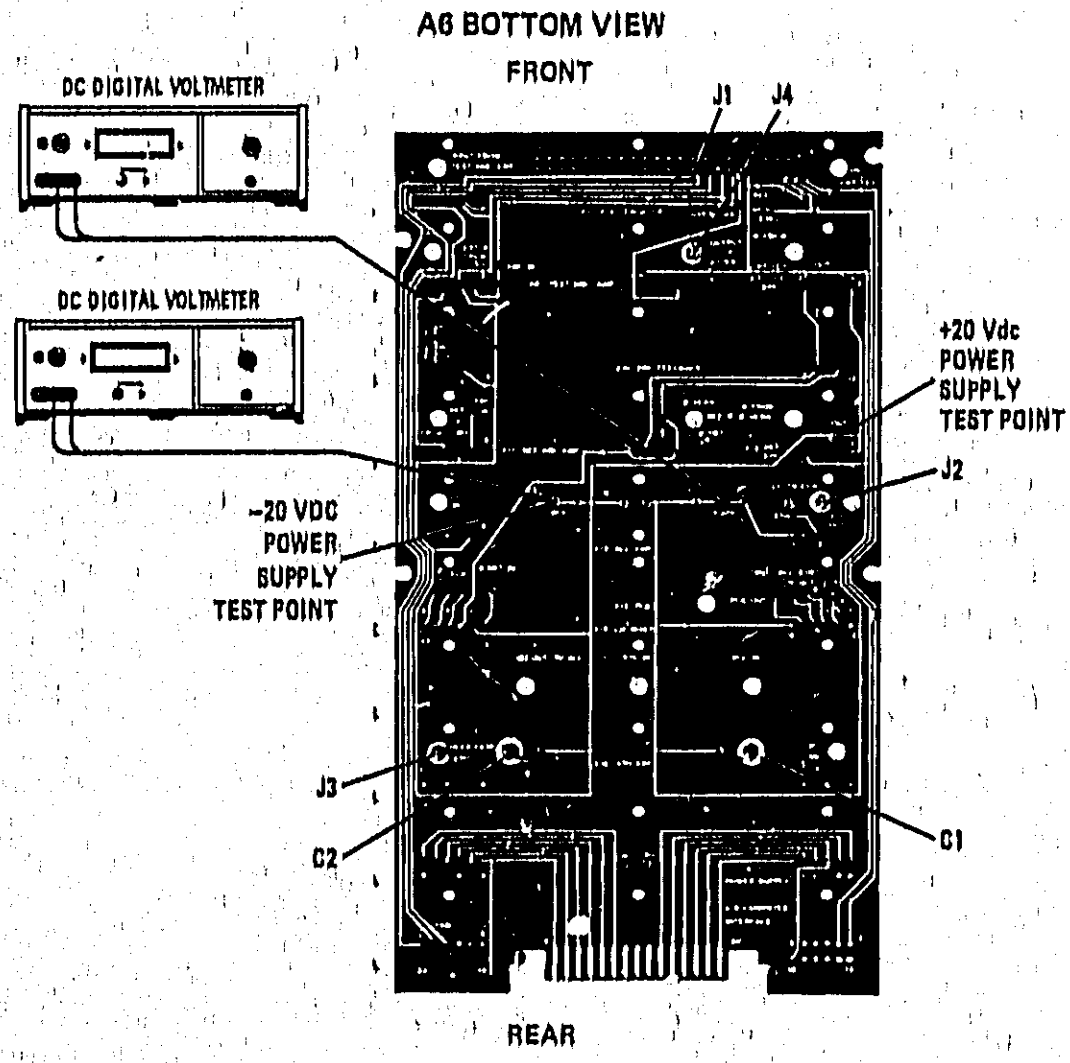


Figure 7-2D. Plus and Minus 20 Vdc Power Supply Test Point Location

Repair Procedure (Page 6 of 23) (ERRATA)

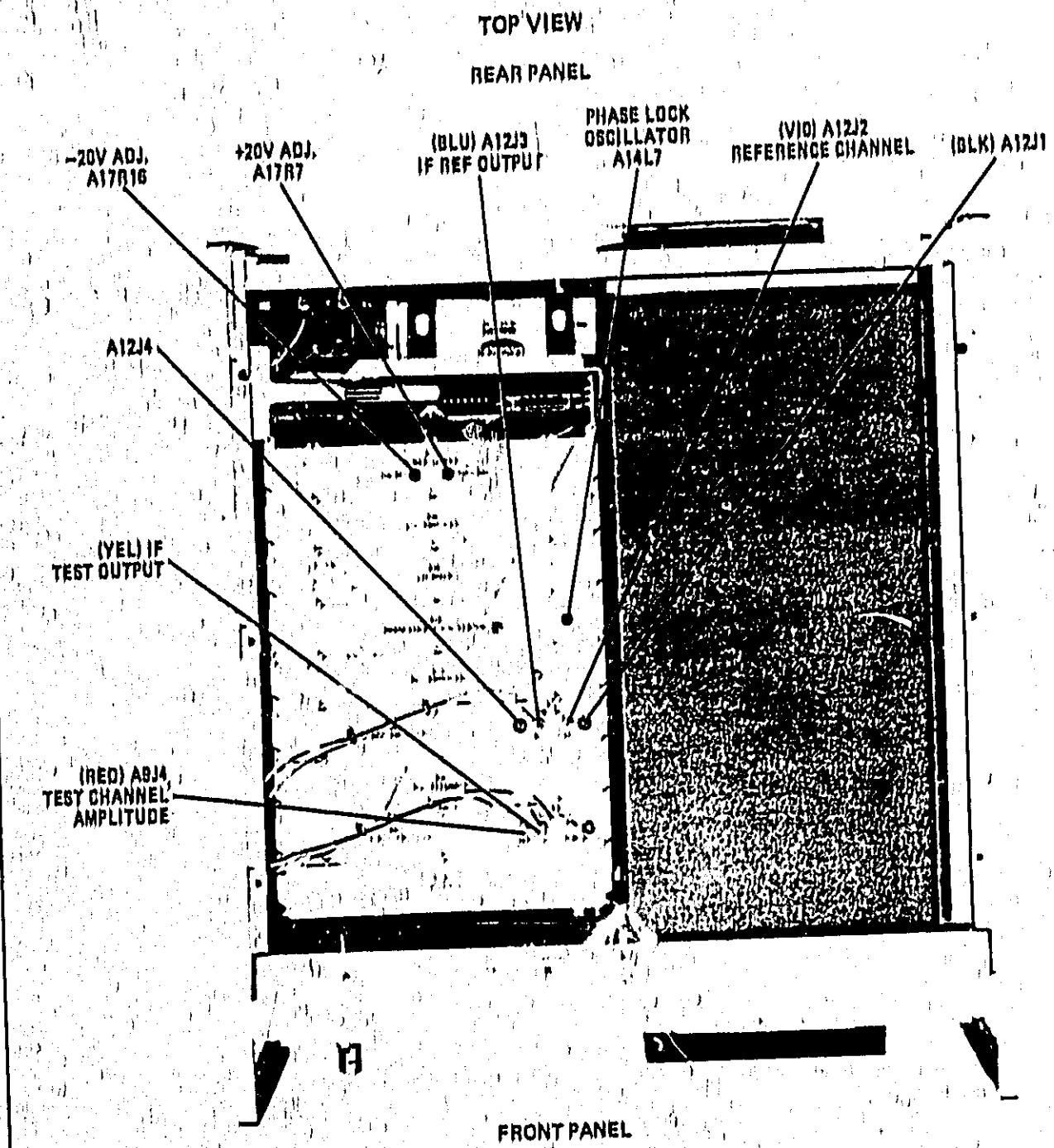
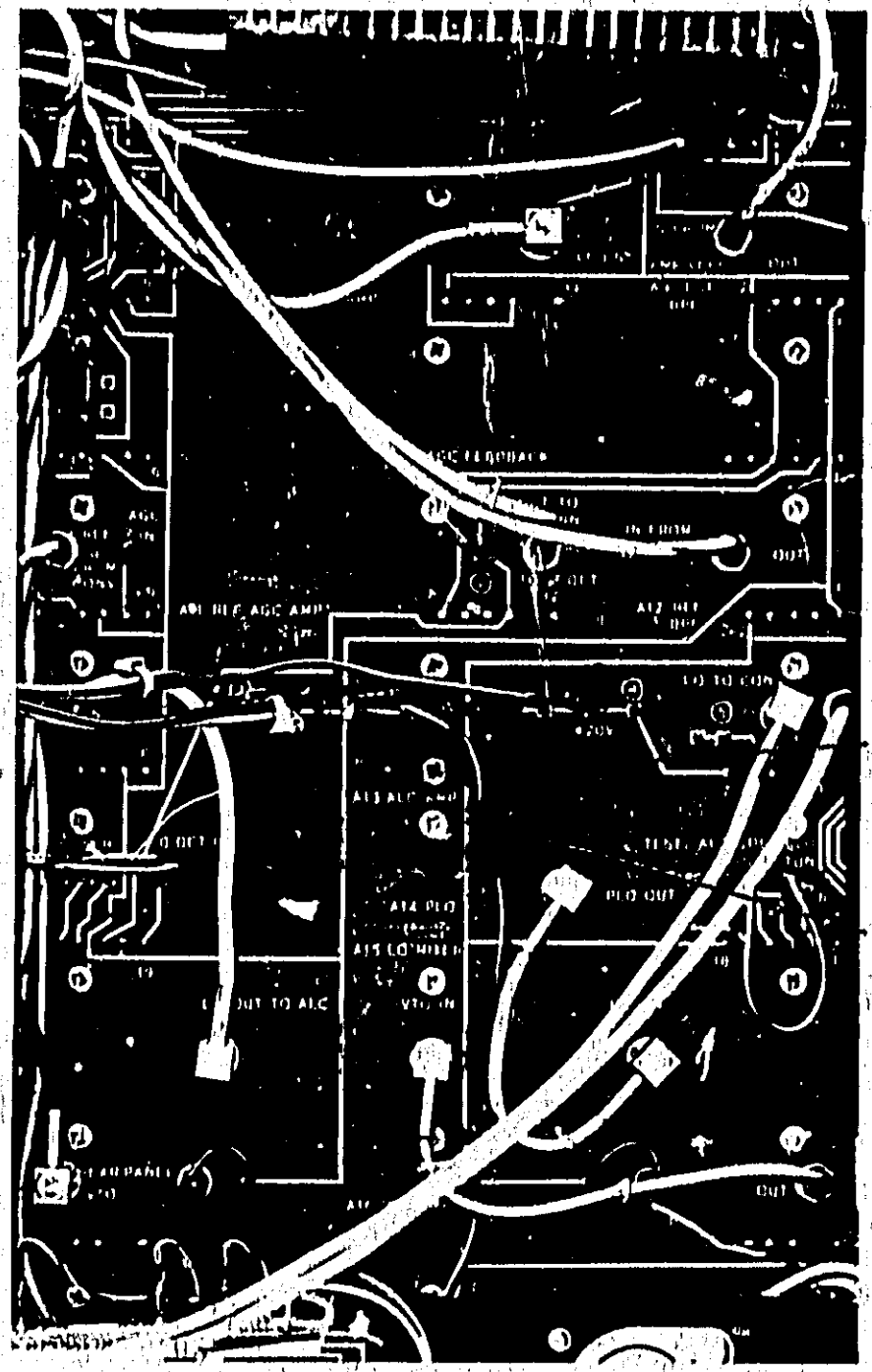


Figure 7-2E. Power Supply and Phase Lock Adjustment Location

A6 BOTTOM VIEW

FRONT

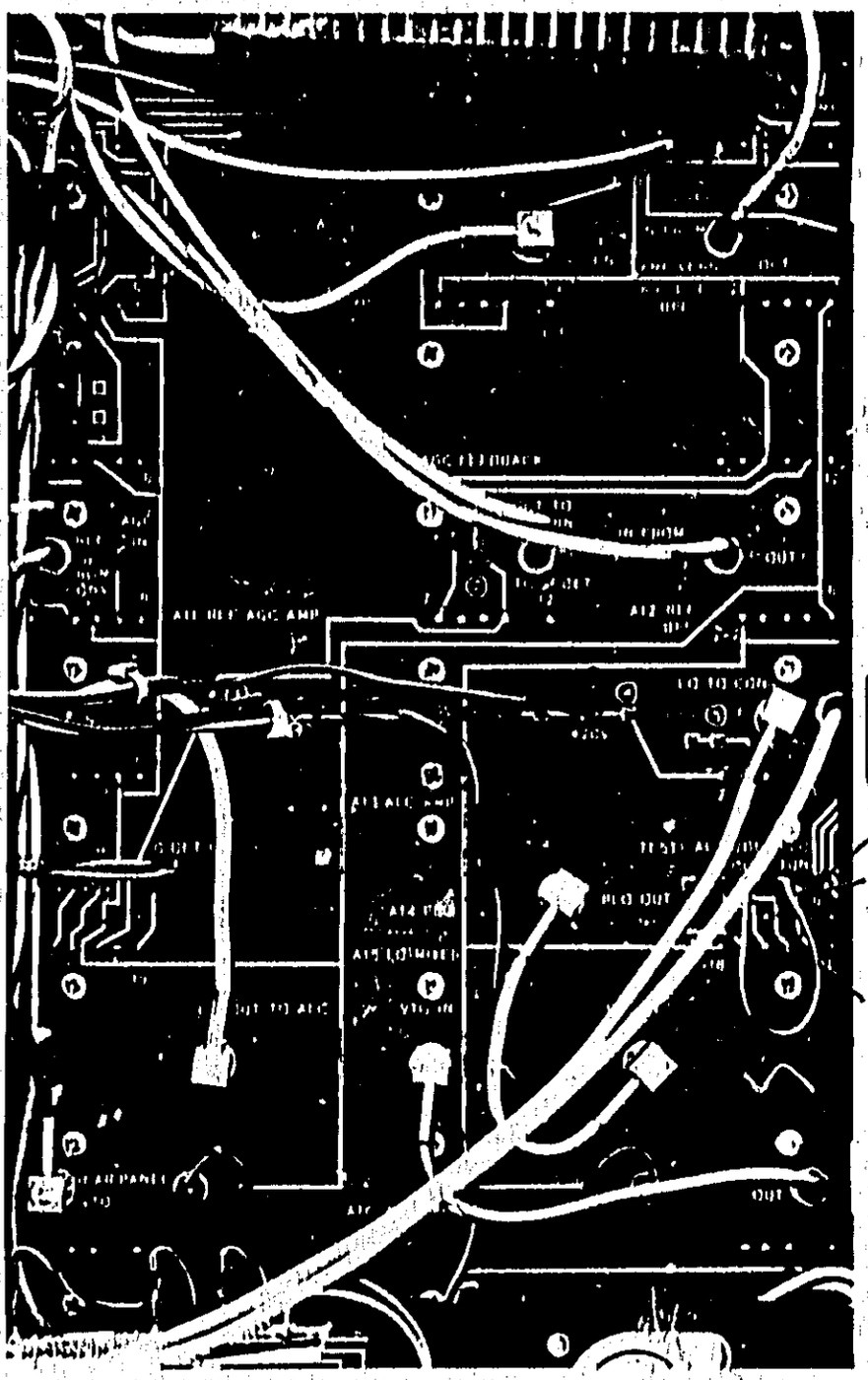


REAR

Figure 7-2F. Location of ±20V dc RED and VIOLET Power Supply Wires

A6 BOTTOM VIEW

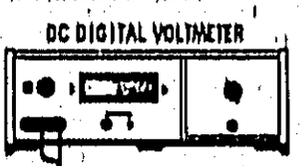
FRONT



REAR

NOTE
A READING OF
–4 VDC TO –16 VDC
INDICATES THE 8407A
IS PHASE LOCKED.

DC DIGITAL VOLTMETER



PIN 6

BLUE
JUMPER

Figure 7-20. Test for PHASE LOCK

Repair Procedure (Page 9 of 23) (ERRATA)

f. Set 8552A/8554B Spectrum Analyzer as follows (cont'd):

LOG/LINEAR switch	LOG
VIDEO FILTER	OFF
SCAN MODE	INT
SCAN TRIGGER	AUTO

7-17. Initial Turn-on Procedure

7-18. The 8407A power supplies should always be checked before troubleshooting procedures are performed. The procedure for turning on the 8407A is a follows:

NOTE

An out-of-tolerance voltage reading of more than ±0.3 volts can cause a loss of phase lock.

Power Supply

a. Connect a Digital Volt Meter to the "+" 20V supply on the bottom of the A6 Master Board of the 8407A (marked +20V), (See Figure 7-2D). Turn on the power to the 8407A. The +20V supply should be +20V + 0.01V. If this supply is out of specification, adjust A17R7 (see Figure 7-2E) Now connect the DVM to the −20 volt supply. It should read −20volts ± 0.01 volts. If it is out of tolerance, adjust A17R16 (see Figure 7-2E). If the + or − 20Vdc power supply is low, (less than 15V) turn off the power. Connect ohmmeter first to the +20V supply test point and ground, then to the −20V supply test point and ground (see Figure 7-2F). The resistance to ground of the +20V supply should be 800Ω±100Ω and the −20V supply ground should be ≈500Ω±200Ω. If there is a short to ground on one of the supplies, printed circuit boards may be pulled (with the instrument still off) until the board with the short is located.

CAUTION

Turn off the power to the 8407A, when either the + or −20 volt supply is down (shorted), when inserting or removing the plug-in display (8412A), when removing or inserting boards, or when removing or inserting the "T". If power is left on, arcing of connector pins may result.

NOTE

To troubleshoot the instrument with a defective power supply, disconnect the RED and VIOLET ±20 Vdc power supply wires, (they are twisted together) from the A6 Master Board. (See Figure 7-2F for location of RED and VIOLET power supply wires.) This disconnects the power supply from the rest of the boards in the instrument.

b. Check the power supply ripple by connecting an AC voltmeter to the RED and VIOLET wires from the ±20V supplies. The ripple should be less than 3 mV rms.

Test for Phase Lock

c. To determine if the 8407A is phase locked, perform the following procedure: Connect the B channel of the scope to the IF Reference (IF REF) output on the rear panel of the 8407A as shown in Figure 3-2. The Reference IF signal level should be 1.3 volts ± 0.2 volts peak-to-peak, sine wave. The Reference Channel Level Adjust (REF CH LEVEL ADJ) meter should be at the top of the "OPERATE" range. Connect the digital voltmeter to pin 6 (right next to the blue jumper on the bottom of the A6 Master Board, marked PLO TUN), see Figure 7-2G. The dc level should be between −4 and −18 volts dc. If all the above conditions are met, the 8407A is phase locked.

7-19. 8407A Troubleshooting Procedure

7-20. Problems with the 8407A can be located by performing Step a if the 8407A does not phase lock, or performing Step b if it phase locks. See Paragraph 7-18 step d and paragraph 7-23 to determine if the 8407A can be made to phase lock.

Step a. Phase-Lock Loop Not Locked

If the phase lock loop does not lock, perform the following:
1. Allow the 8407A to warm up for 30 minutes.
2. If the instrument still doesn't phase lock perform Tests "A", VTO, PLO & LO MIXER tests (paragraph 7-21) and Tests "B" Reference Channel Signal Level Tests (paragraphs 7-26 and 7-27).

Step b. Phase-Lock Loop Locks Up

If the phase-lock loop locks up do the following:
1. By exercising the DISPLAY REFERENCE 10 dB and 1 dB per division slide switches and by decreasing the AMPL DB/DIV sensitivity, center the amplitude trace on the 8412A. The amplitude trace should appear on the CRT at 64 dB ±2 dB (as read at DISPLAY REFERENCE window). If it is slightly out of tolerance (about 2 dB above or below tolerance) perform Section "D", MISCELLANEOUS NON-TRACEABLE PROBLEMS (paragraph 7-29). If it is well out of spec, perform Test "B", Reference Channel Signal Levels (paragraph 7-27), and Test "C", Test Channel Signal Levels (paragraph 7-28).
2. With the PHASE VERNIER knob centered, the phase trace should appear at the center of the 8412A ± about 20 degrees and should vary either side of zero (center of 8412A CRT) at least 15 degrees. If this is slightly out of tolerance (≈ ± 5 degrees) perform test "D", MISCELLANEOUS NON-TRACEABLE PROBLEMS (paragraph 7-29). If it is greatly out-of-tolerance, perform test "B", Reference Channel Signal Levels (paragraph 7-27) and test "C", Test Channel Signal Levels (paragraph 7-28).
3. If both traces appear after performing Steps b-1 and b-2, the problem in the 8407A will probably be covered in Test "D" Miscellaneous Non-Traceable Problems (paragraph 7-29).

7-21. "A" Tests (A16 VTO, A15 LO MIXER, A14 PLO, and A13 ALC)

7-22. The "A" tests can be performed with the 8407A phase-locked or unlocked.

For the "A" tests, Set 8601A as follows:

SWEEP	FULL
RANGE	1-110 MHz

a. *16 Voltage Tuned Oscillator (VTO):*

Description: Measure the Voltage Tuned Oscillator amplifier output level at connector marked (VTO OUT). It should be + 5 dBm ±3 dB.

Procedure: Set the spectrum analyzer frequency knob for 200 MHz on the center frequency MHz window. Connect a BNC cable to the RF INPUT of the spectrum analyzer and the other end to the "T" connector. (See Figure 7-2A for construction of a "T".) Disconnect the violet cable from the male SMC connector marked VTO IN on the A6 master board. Connect the spectrum analyzer to the violet cable female SMC connector (see Figure 7-2H). It will show a swept signal (see Figure 7-21). The amplitude level at 200 MHz should be +5 dBm ± 3 dB. The amplitude level of the swept signal should not fall off more than 3 dB over 5 horizontal divisions (or 100 MHz).

b. *A14 Phase Lock Oscillator (PLO)*

Description: Measure the phase lock oscillator output signal level at connector marked (PLO OUT); it should be −13 dBm ± 3 dB.

Procedure: Set the spectrum analyzer frequency knob for 200 MHz. Disconnect the blue cable from the male SMC connector marked PLO IN on the A6 master board. Connect the spectrum analyzer to the blue cable female SMC connector which was removed from PLO IN (see Figure 7-2J). Measure the single frequency output of the Phase Lock Oscillator (PLO), see Figure 7-2K. It should be −13 dBm ± 3 dB. (To adjust the amplitude level of this signal, there is a star value resistor A14R47 with value limits of 511Ω to 1kΩ. As the resistance of A14R47 is increased, the PLO power is decreased. (See Figure 7-14 for location of A14R47.)

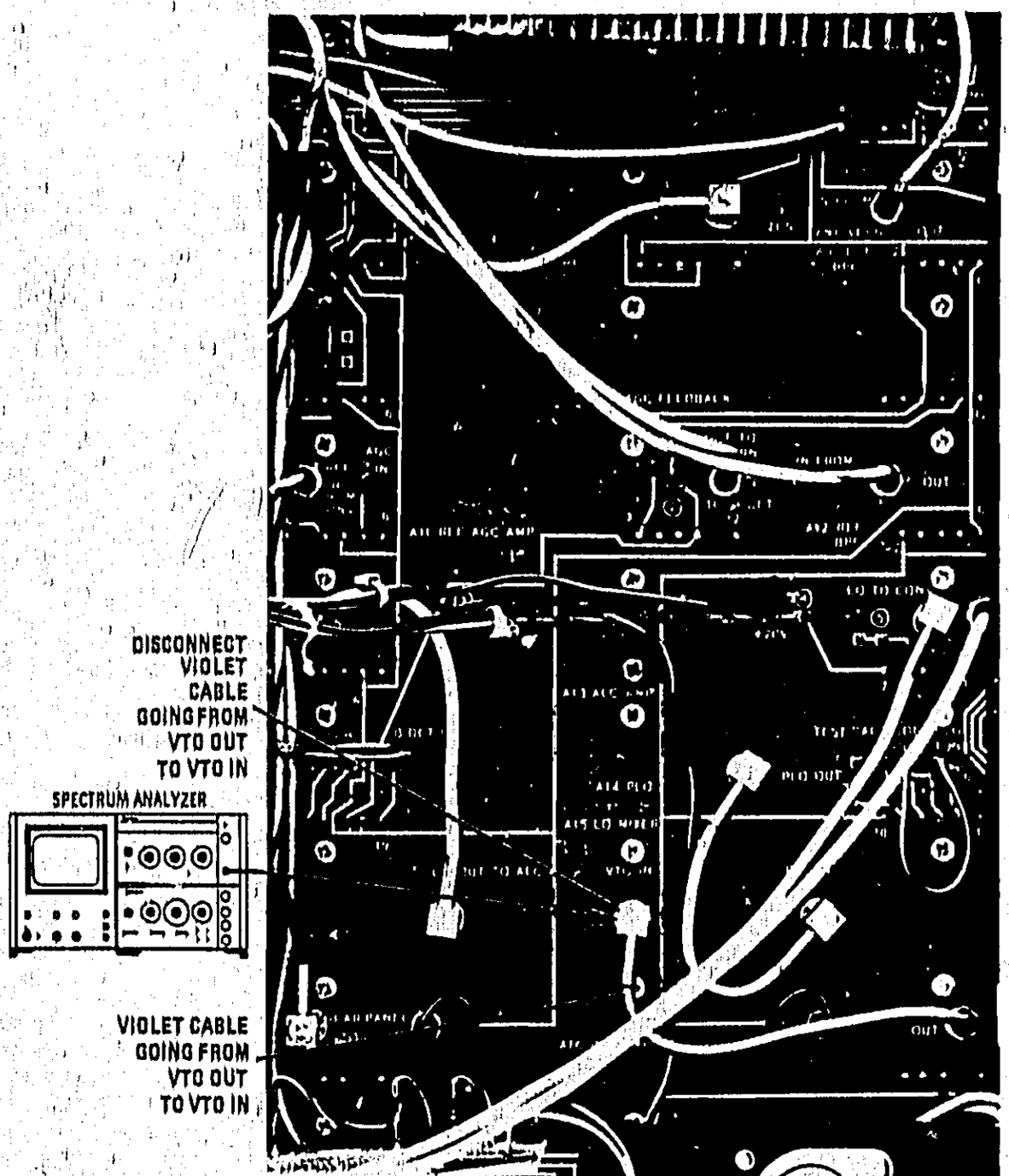
7-23. If the 8407A will not phase-lock, do the following:

a. Reconnect blue cable to male SMC connector marked PLO IN (see Figure 7-2J).

b. Connect the digital voltmeter to Pin 6 (right next to the blue jumper-wire on the bottom of the A6 master board, marked PLO TUN) (see Figure 7-2G). Make sure there is a dc search voltage searching from −4 to −18 volts dc.

A6 BOTTOM VIEW

FRONT



REAR

Figure 7-2H. A16 Voltage-Tuned Oscillator Measurement

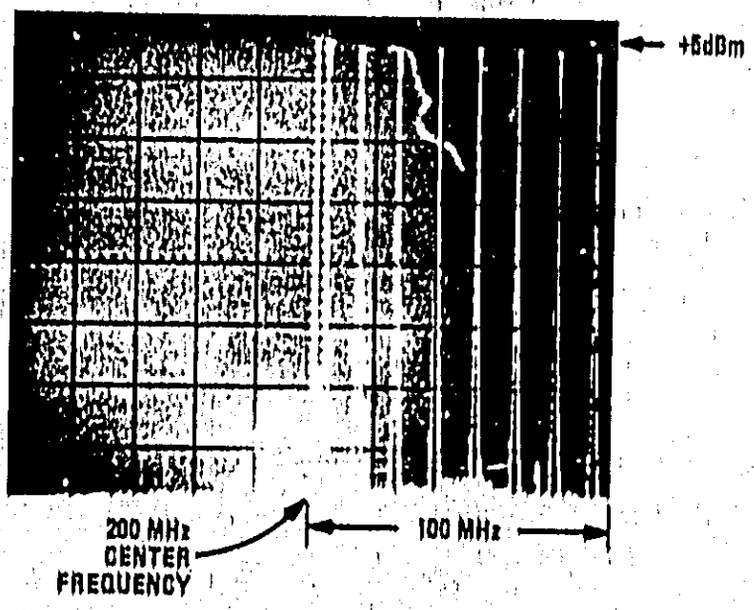


Figure 7-2I. Swept Signal with 200 MHz Center Frequency

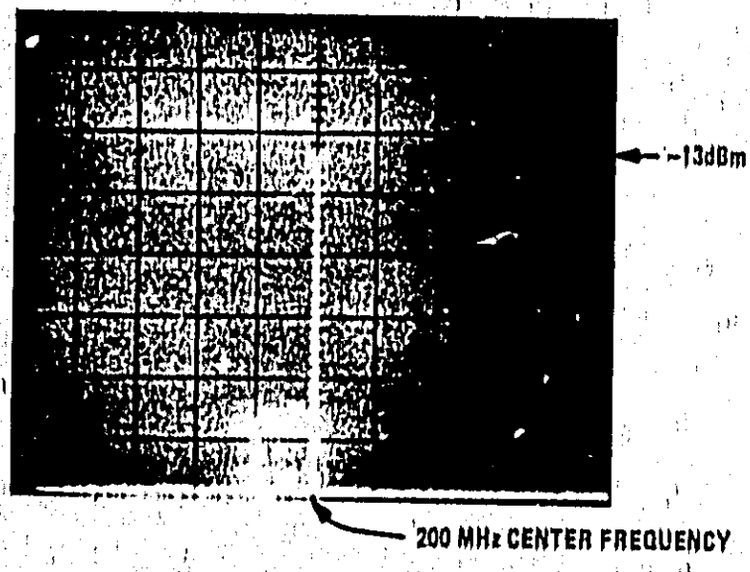


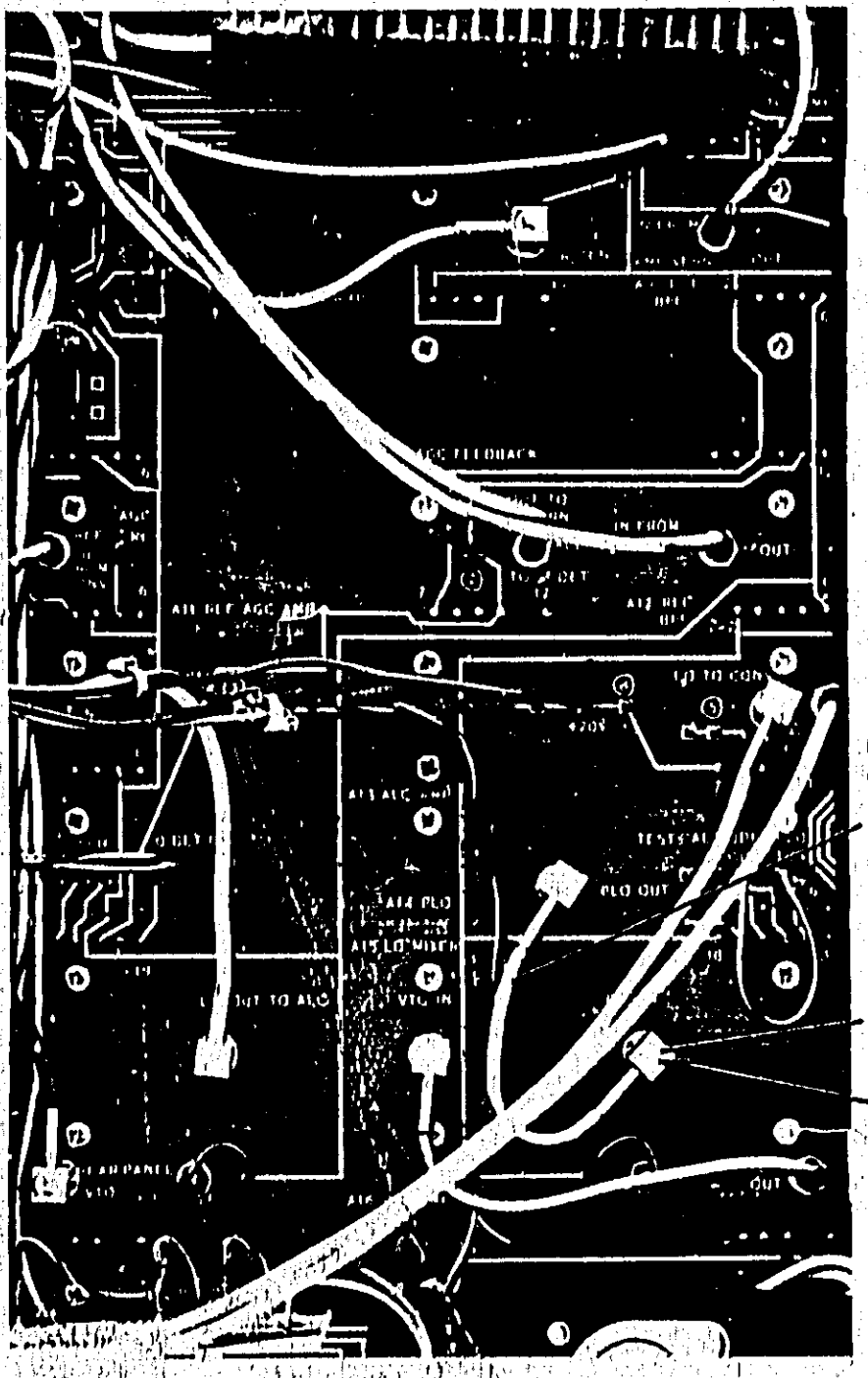
Figure 7-2K. Phase-Lock Oscillator Signal

c. Using a non-metallic adjusting tool, adjust A14L7 to get the instrument to phase lock. (On the top of the 8407A there is an access hole marked L7 for this purpose (see Figure 7-2E). If the "Q" Dope that should be on the coil prevents you from doing this, remove the A14 Phase Lock Oscillator board from the instrument. Because the slug used in L7 is slotted on both ends, the slug can now be broken loose from the bottom of L7 coil form.

d. When adjusting L7, start the slug at the top of the coil and turn it downwards to phase-lock the instrument. If the instrument phase locks, allow the 8407A to warm up for at least one hour (see Note below). While monitoring Phase Lock Tuning (PLO TUN) voltage, adjust L7 until the instrument phase locks and the PLO TUN voltage is between −9 and −8.5 volts dc.

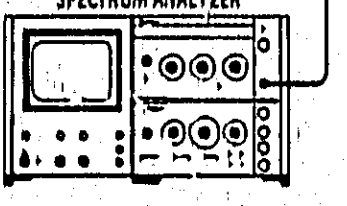
A6 BOTTOM VIEW

FRONT



BLUE CABLE GOING FROM PLO IN TO PLO OUT

DISCONNECT BLUE CABLE HERE AT PLO IN



REAR

Figure 7-2J. A14 Phase-Lock Oscillator Measurement

Repair Procedure (Page 1-1 of 23) (ERRATA)

NOTE

If the 8407A is being used in extreme environmental temperatures above or below the normal range of 60° to 80°F (32° to 16°C), allow at least one hour warm-up in the extreme environment in which the instrument will be used before performing paragraph 7-23, step d.

e. To ensure that the PLO board is locked on the correct frequency, extend the cable length to the test channel direct input 4 to 8 inches longer than the cable to the reference channel direct input (use cable 11652-60004). Set the 8601A SWEEP to FULL, the phase trace should fall off drastically (see Figure 7-2L). If the phase trace shifts upward (see Figure 7-2M), the PLO is locked on the wrong frequency. (To correct, repeat Step d above.) Then apply a small amount of glue (such as "Q" Dope), while still watching the PLO TUN voltage, so that the slug does not slip.

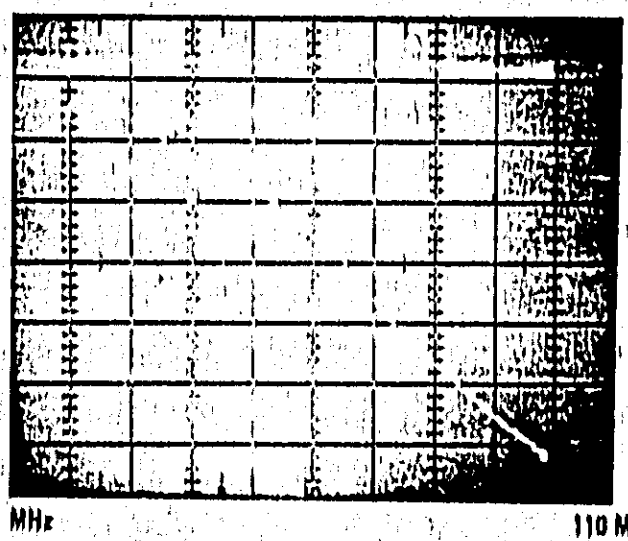


Figure 7-2L. PLO Locked on Correct Frequency

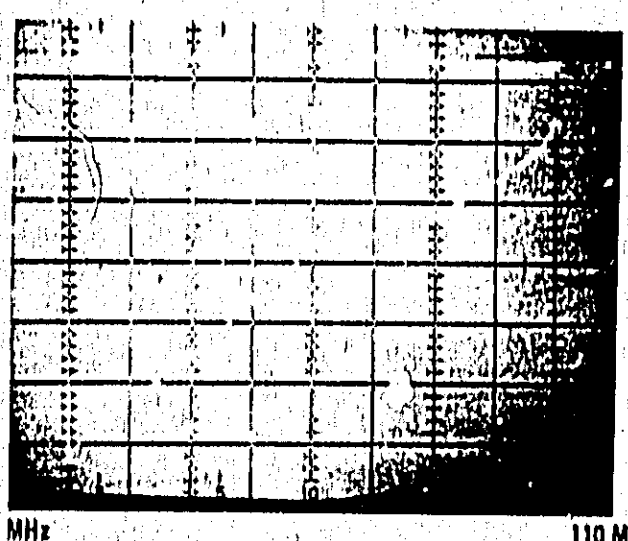
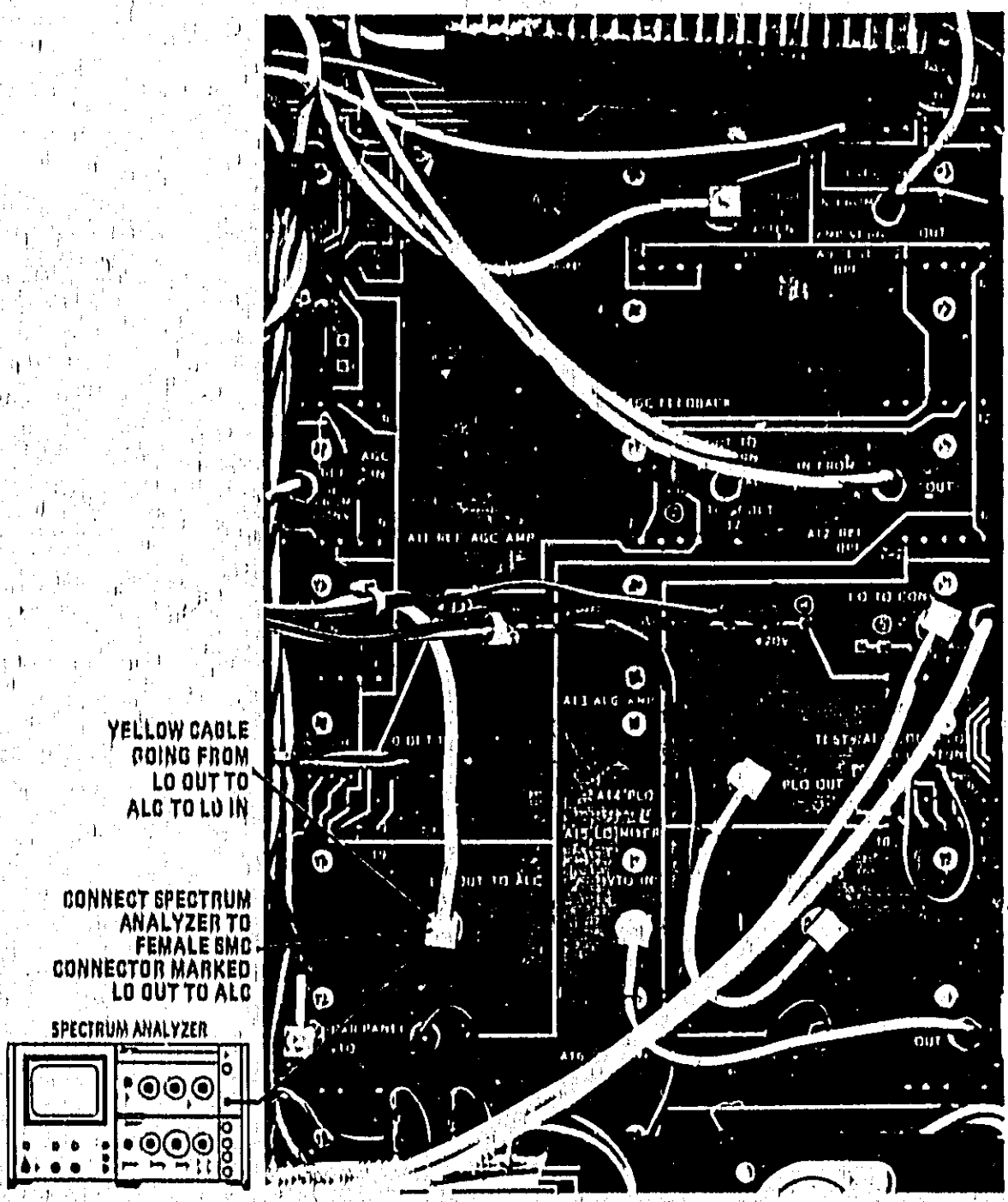


Figure 7-2M. PLO Locked on Wrong Frequency

A6 BOTTOM VIEW

FRONT



REAR

Figure 7-2N. A15 Local Oscillator Measurement.

7-24. A15 Local Oscillator-Mixer (LO)

Description: Measure the local oscillator output signal level at connector marked (LO OUT TO ALC); it should be −35 dBm ±3 dB.

Procedure: Set the spectrum analyzer FREQUENCY knob for 278 kHz on CENTER FREQUENCY MHz window and the LOG REF LEVEL to + 10 dB. Disconnect the yellow cable going from LO OUT to ALC to LO IN from the male SMC connector marked LO OUT TO ALC on the bottom of the A6 master board. Connect the spectrum anlayzer to the male SMC connector marked LO OUT TO ALC on the A6 board (see Figure 7-2N). The output should be a swept signal sweeping from the 278 kHz main signal. The output at 278 kHz should be −35 dBm ± 3 dB and should not fall below −40 dBm over 5 horizontal divisions (or 100 MHz (see Figure 7-2P).

7-25. A13 Automatic Level Control Amplifier (ALC AMP)

Description: Measure the automatic level control output signal at connector marked (LO TO CONV); it should be 0 dBm ± 3 dB.

Procedure: Disconnect the yellow cable going from LO TO CONV to the A4 Test converter board from the male SMC connector marked LO (YEL). Set the FREQUENCY knob on the spectrum analyzer for 278 KHz. Connect the spectrum analyzer to the yellow cable female SMC connector that was disconnected (see Figure 7-2Q). The spectrum analyzer should show a swept display as shown in Figure 7-2R. The output level at 278 kHz should be 0 dBm ± 3 dB and should not fall more than 3 dB over 5 horizontal divisions (100 MHz). Repeat the above procedure for yellow cable to the A3 reference converter board. The output of the ALC AMP board can be adjusted by A13R27 on the top of the 8407A (see Figure 7-2E).

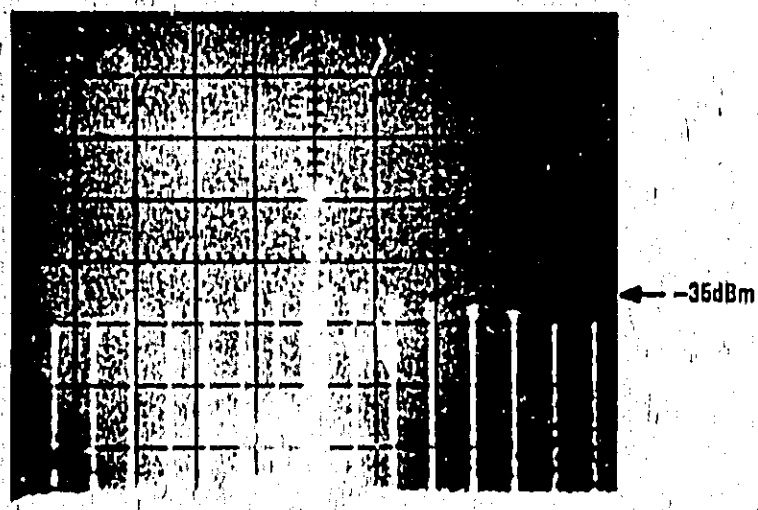


Figure 7-2P. Local Oscillator Signal

7-26. "B" Test When the 8407A Phase-Lock Loop is Unlocked (If the 8407A is Phase-locked, go to paragraph 7-27 and disregard paragraph 7-26).

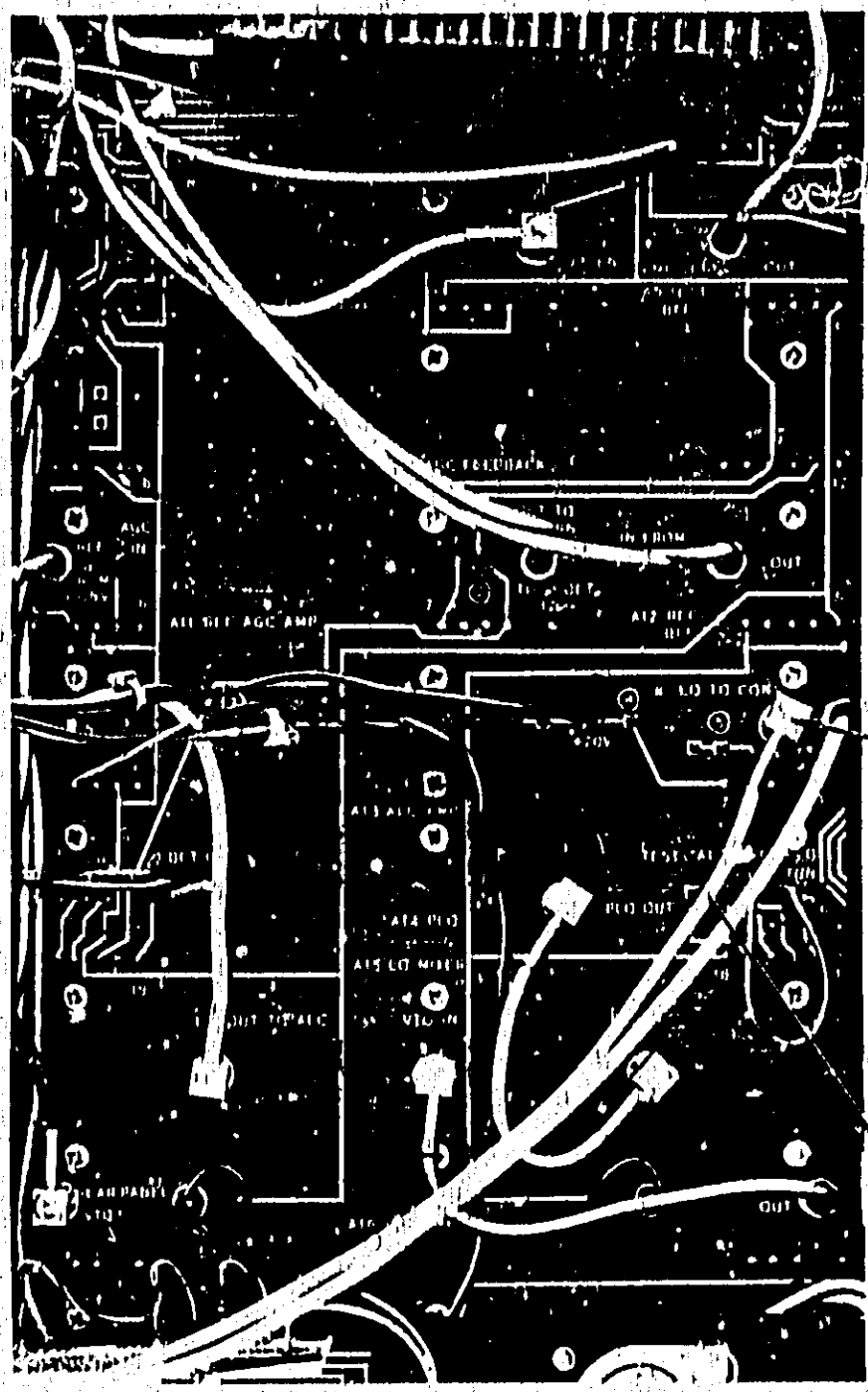
The "B" Test given in paragraph 7-27 must be performed differently, when the 8407A is not phase-locked. First, set the 8601A SWEEP to Symetrical (SYM) and the FREQUENCY to 2 MHz.

On the 8407A set both the 10 dB and 1 dB DISPLAY REFERENCE slider switches for zero (the top of the DISPLAY REFERENCE window), and the reference channel level adjust (REF CHAN LEVEL ADJ) at the bottom. Disconnect the BNC cable including the "T" connector from the spectrum analyzer and connect it to the A channel of the oscilloscope.

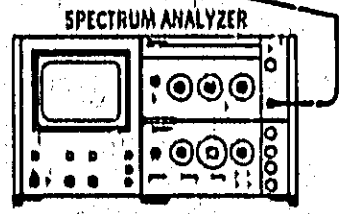
Perform the measurements in paragraph 7-27 "B" Test (REFERENCE CHANNEL SIGNAL LEVELS), ignoring the notations concerning phase. The amplitude levels will be about the same, but when viewing these waveforms, they will appear

A6 BOTTOM VIEW

FRONT



REAR



SPECTRUM ANALYZER

YELLOW CABLE GOING FROM LO TO CONV TO A4 TEST CONVERTER BOARD

Figure 7-2Q. A13 Automatic Level Control Measurement

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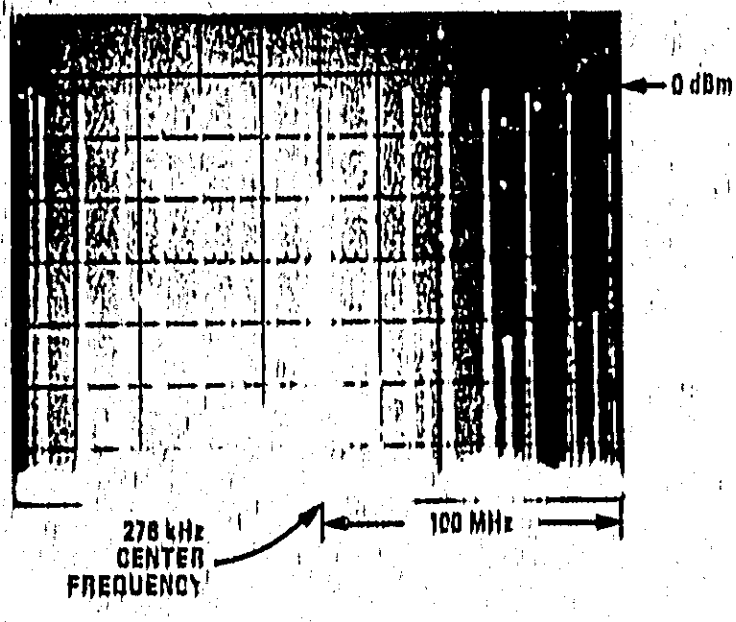

Figure 7-2R. Automatic Level Control Ampl. Output

as a blur. The amplitude level of these signals is varying so fast that it causes this blurring effect and it may be difficult to trigger the scope (so adjust the scope TRIGGERING to obtain the best waveform on the display of the scope). The maximum amplitude level of these fluctuating waveforms is the actual signal level of that stage. The stage which exhibits a very low signal level or none at all is the stage that is causing the phase-lock loop to unlock.

7-27. "B" Test (Reference Channel Signal Levels)

a. *The reference channel converter board signal level*

Description: Measure reference channel converter board signal level between the GRAY-VIOLET cable from A3 and the SMC connector marked IF (GRA/VIO) on the aluminum converter casting (300 mV ± 50 mV p-p sinewaves 180 degrees ± 30 degrees out of phase).

Procedure: Set 8601A SWEEP to Symetrical (SYM) and the FREQUENCY to 2 MHz. On the 8407A set both the 10 dB and 1 dB DISPLAY REFERENCE slider switches for zero (the top of the DISPLAY REFERENCE window), and the reference channel level adjust (REF CHAN LEVEL ADJ) at the bottom. Disconnect the BNC cable including the "T" connector from the spectrum analyzer and connect it to the A channel of the oscilloscope. Set the oscilloscope to trigger on the B channel (which is the Reference Channel IF) and display the A Channel (the signal being measured). To do this on the HP 180A scope with 1802A/1820A Plug-ins, set the DISPLAY switch to ALT B. The oscilloscope will remain set this way for the remainder of the "B" Tests (Reference Channel Signal Levels). Insert the "T" connector between the GRAY-VIOLET cable from A3 at the rear of the reference channel converter board casting and the male SMC connector marked IF (GRA/VIO) on the converter casting. The output level should be 300 mV ± 50 mV peak-to-peak sinewave and 180 degrees ±30 degrees out-of-phase with Reference Channel IF. If the converter board output is bad, be sure to check the A13 ALC amplifier output to the Reference Channel Converter Board A3 (see paragraph 7-2R).

b. *Reference AGC amplifier signal level*

Description: Measure reference AGC amplifier signal level between the Gray-Blue cable from A11 and the SMC connector marked INPUT (BLUE) on the top of the A2A1 PHASE VERNIER can (3V p-p sinewave in phase).

Procedure: Remove the two screws on the top rail on the front of the 8407A and let the front panel swing down (see Figure 7-2B). Insert the "T" connector (see Figure 7-2A) between the GRAY-BLUE cable from A11 Reference

Channel AGC Amplifier and the male SMC connector marked INPUT (BLUE) on the A2A1 Phase Vernier. The signal level should be 3V ± 0.3V p-p sinewave and ± 10 degrees in phase with the Reference Channel IF.*

***NOTE**

If the output of the A11 Reference AGC Amplifier is very low or not present at all, check the output at the A8 Test AGC Amplifier (see paragraph 7-28). If the Test AGC Amplifier level is all right, the problem is in the Reference Channel AGC Amplifier. If the signal at the Test AGC Amplifier is also bad, the trouble is probably the AGC FEEDBACK board (A10).

c. *Phase Vernier Output Level*

Description: Measure the Phase Vernier Output Level (3V p-p sinewave in phase).

Procedure: Insert the "T" connector between the GRAY-GREEN cable from A12 Reference IF Bandpass Filter and the male SMC connector marked OUTPUT (GRN) from A2A1 Phase Vernier. The output level should be 3V ±0.2V p-p sinewave and ±30 degrees in phase with Reference Channel IF.

d. *Reference Channel Bandpass Filter Outputs (A12 BPF Filter) Test 1.*

Description: Measure the IF Reference Output of the A12 Bandpass Filter Board (1.3V p-p sinewave in phase).

Procedure: Connect the "T" connector to the male SMC Bandpass Filter Connector A12J4 (No Markings) on the top of the 8407A (see Figure 7-2E). The output should be 1.3 volts ± 0.2V p-p sinewave and ± 30 degrees in phase with the Reference Channel IF.

Insert the "T" connector between the GRAY-BLUE cable from rear panel of the 8407A and the A12 REF IF Bandpass Filter male SMC connector A12J3 marked BLU on top of the A12 board cover. The output level should also be 1.3 ± 0.2V p-p sinewave and in phase ± 30 degrees with the Reference Channel IF.

e. *Reference Channel Bandpass Filter Outputs (A12 BPF Filter) Test 2.*

Description: Measure the Reference Channel Signal to the 3412A (2.7V p-p sinewave in phase).

Procedure: Insert the "T" between the GRAY-VIOLET cable from J11 used to connect the display plug-ins to the 8407A and the male SMC connector, A12J2 marked V10 on top of the A12 board cover. The output level should be 2.7V ± 0.2V p-p sinewave and in phase ± 30 degrees with the Reference Channel IF.

Measure this same signal as above but this time connect the "T" connector to the male SMC connector marked BLK on top of the A12 board cover. The output level should be 2.7V ± 0.2V p-p sinewave and in phase ± 30 degrees with the Reference Channel IF.

7-28. Tests "C" Test Channel Signal Levels

a. Description: Measure Test Channel Converter Board A4 Signal Levels (2.5V ± 0.7V p-p sinewave 180 degrees ± 30 degrees out of phase).

Procedure: Set 8601A SWEEP to Symetrical (SYM) and the FREQUENCY to 2 MHz. On the 8407A set both the 10 dB and 1 dB DISPLAY REFERENCE slider switches for zero (the top of the DISPLAY REFERENCE window), and the reference channel level adjust (REF CHAN LEVEL ADJ) at the bottom. Disconnect the BNC cable including the "T" connector from the spectrum analyzer and connect it to the A channel of the oscilloscope. Set the oscilloscope to trigger on the B channel (reference channel IF) and display the A channel (the signal being measured). To do this on an HP 180A scope, and 1802A/1820A plug-ins, set the DISPLAY switch to ALT B. The oscilloscope will remain set up this way for the remainder of the Test Channel Signal Level Tests.

Insert the "T" connector which is now connected to the A Channel of the scope botwgen the GRAY-RED cable and the male SMC connector marked IF (GRA/RED). This connector is located at the rear of the A4 Test Channel Converter Board casting. The signal level should be 2.5V ±.7V p-p sinewave and 180 degrees ±30 degrees out of phase with the Reference Channel IF. If the converter board output is bad, be sure to check the ALC Amplifier output to the test converter board (see paragraph7-25).

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b. *Test AGC Amplifier Output Level*

Description: Measure the A8 Test AGC Amplifier output level (450 mV ± 50 mV p-p sinewave 180 degrees out of phase).

Procedure: Insert the "T" connector between the GRAY cable (located on the bottom of the 8407A), and the male SMC connector marked OUTPUT TO IF ATTEN on the A6 master board. Measure the signal level. It should be 450 ± 50 mV p-p sinewave and 180 degrees ± 30 degrees out of phase with the Reference Channel IF.

c. *IF Attenuator Output Level*

Description: Measure the IF Attenuator Output level of A7, (7.5V p-p ± 0.8 Volts in phase).

Procedure: Remove the two screws on the top-front rail of the 8407A (see Figure 7-2B) and let the front panel swing open. Insert the "T" connector between the GRAY-ORANGE cable from A7 IF Attenuator Board and the male SMC connector marked INPUT/ORN on the A2A1 (1 dB Attenuator and Vernier). The waveform that appears should look like that in Figure 7-2S, with peak-to-peak amplitude of 7.5 volts ± 0.8 volts and be in phase ± 30 degrees with the Reference Channel IF.

d. *Amplitude Vernier Output*

Description: Measure the Amplitude Vernier Output Level from A2A2, (4.3V p-p in phase).

Procedure: With the front panel of the 8407A still down, insert the "T" connection between the GRAY-YELLOW cable from A9 (Test IF BPF Board) and the male SMC connector marked OUTPUT/ (YEL). The waveform displayed on the scope should look like Figure 7-2T, with a peak-to-peak amplitude of 4.3 volts ± 0.4 volts in phase ± 30 degrees with the Reference Channel IF.

e. *Test Channel Bandpass Filter Outputs*

Description: Measure the Test Channel Bandpass Filter Outputs (2V p-p in phase).

Procedure: On the top of the 8407A, insert the "T" connector between the GRAY-RED cable from J11 display plug-in connector and the male SMC connector marked (RED) on top of the A9 TEST IF BPF Board cover (see Figure 7-2E). Measure this signal level on the scope (which is the IF Test Output). It should be 2 ± 0.2V peak-to-peak and in phase ± 30 degrees with the Reference Channel IF.

On the top of the 8407A, insert the "T" connector between the GRAY-YELLOW cable from J7 on the Rear Panel of the 8407A and the male SMC connector, marked (YEL) on top of the A9 Board cover (see Figure 7-2E). This signal is also the IF Test (same as the 8407A rear panel BNC) output, and should also be 2V ± 0.2V p-p and in phase ± 30 degrees with the Reference Channel IF.

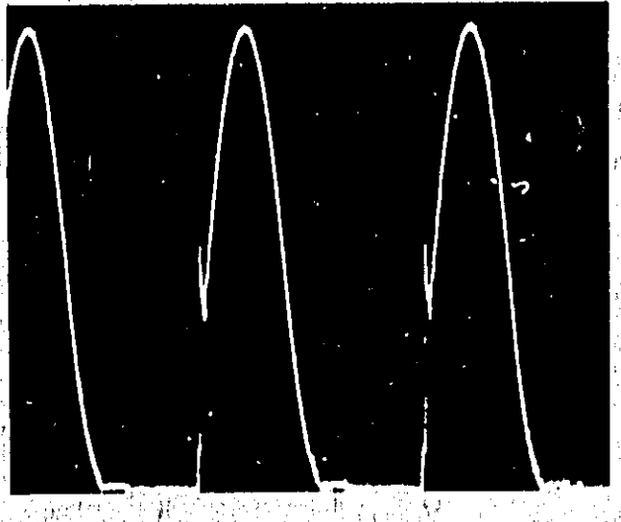

Figure 7-2S. IF Attenuator Output Waveform

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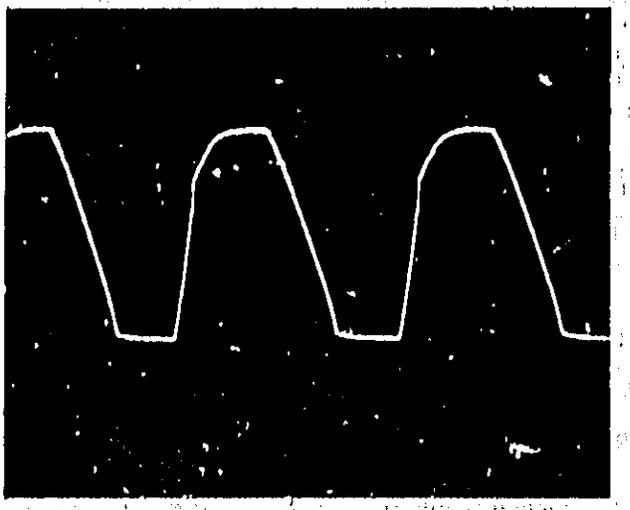

4.3 VOLTS ± 0.4 VOLTS
PEAK-TO-PEAK
IN PHASE WITH
THE IF REFERENCE

Figure 7-2T. Amplitude Vernier Output Waveform

f. Test Channel Phase Signals

Description: Measure the Test Channel Phase Signals at A9 (4.2V p-p in phase).

Procedure: Insert the "T" connector between the GRAY-ORANGE cable from J11 rear panel display plug-in connector and the male SMC connector marked (ORN) on top of the A9 TEST IF BPF Board Cover. The output level should be 4.2 volts ± 0.3 volts p-p and in phase ± 30 degrees with the Reference Channel IF.

Measure this signal level again by inserting the "T" into the connector marked WHT from the top of A9. The signal level should also be 4.2V ± 0.3V p-p and in phase ± 30 degrees with the Reference Channel IF.

7-28. Tests "D" Miscellaneous Non-Traceable Problems

By performing the following tests, subtle problems with the 8407A can be detected and diagnosed.

The equipment should be set up as shown in the "Initial Setup" section at the beginning of this Repair Procedure section (see paragraph 7-16). (There is no need for the spectrum analyzer for "D" Tests.) Also, be sure the preliminary tests have been completed, that is, the power supply has been checked, the Phase Lock Loop is locked (see paragraph 7-18), and the Amplitude and Phase traces have been located and are being displayed on the CRT of the 8412A. (Set the 8412A PHASE DEG/DIV switch to 1.0 and the AMPL DB/DIV switch to 0.25. Set the 8601A to high band, 1—110 MHz and FULL SWEEP.

a. At any point in the tests (when there is a proper input to the 8407A) the Amplitude Trace excursion should not exceed one division (0.25 dB) and the Phase Trace excursion shall not exceed five divisions (or 5 degrees).

b. Increase the input to the 8407A from —10 dBm to —8 dBm by operating the OUTPUT LEVEL VERNIER knob on the 8601A (turn knob until 2 dB has been added to the initial reading of the OUTPUT LEVEL meter). The amplitude trace should not shift more than 0.4 divisions and the UNCAL lamp should remain off.

c. Decrease the input level to the 8407A from —10 dBm to —40 dBm, in 10 dB steps using the OUTPUT LEVEL switch on the 8601A. The amplitude trace should not shift more than 1 division (0.25 dB) per 10 dB step and the Phase Lock loop must remain locked. Using the OUTPUT LEVEL VERNIER, decrease the input level to the 8407A from —40 dBm to —45 dBm (subtract 5 dB from the OUTPUT LEVEL meter). Again, the amplitude trace should not shift more than 1 additional division (0.25 dB) and the Phase Lock Loop must remain locked.

d. Now on the 8407A, switch the REF CHAN LEVEL ADJ switch to the top position, the DISPLAY REFERENCE 10 dB slide switch to 20 dB (as seen on the DISPLAY REFERENCE window), and the 1 dB DISPLAY REFERENCE slide switch between 2 dB and 6 dB. Locate the amplitude trace by exercising the 1 dB DISPLAY REFERENCE switch and the AMPL VERNIER knob so that the amplitude trace is displayed on the CRT of the 8412A. Also exercise the PHASE VERNIER knob so the Phase trace appears on the 8412A when the 8601A output is decreased.

e. Perform steps a, b, and c of this test with the 8601A "HIGH" and "LOW" bands (with the SWEEP switch in the 1—110 MHz position, then in the 0.1—11 MHz position). Note that the Phase Lock Loop must remain locked during the "High" and "Low" band tests.

f. Change equipment settings from INITIAL SET-UP (as shown in paragraph 7-16) as follows:

8601A

OUTPUT LEVEL Switch & VERNIER	Adjust for −30 dBm input to the 8407A (setting of −20 dBm on OUTPUT LEVEL switch and −4 dBm reading on OUTPUT LEVEL meter)
SWEEP lever	to SYM
FREQUENCY knob	to 30 MHz

8412A

MODE	AMPL
AMPL DB/DIV	To the 10 position (or 2.5 as required)

8407A

REF CHAN LEVEL ADJ	CENTER position

The following tests check the 8407A front panel switch A1, the IF Attenuator Board A7 and the related connections.

g. Set the 8407A DISPLAY REFERENCE 10 dB slide switch for 0 dB and adjust the AMPL VERNIER and DISPLAY REFERENCE 1 dB slide switch so that the amplitude trace on the 8412A is on the top line of the 8412A's CRT. Now switch the DISPLAY REFERENCE 10 dB switch to 80 dB (bottom position). On the 8412A adjust the AMPL CAL (LOW LEVEL) screw so that the amplitude trace is on the bottom line of the 8412A's CRT. Then reset the DISPLAY REFERENCE to 0.

h. Exercise the 8407A's DISPLAY REFERENCE 10 dB switch to insure that the trace shifts 1 division per 10 dB step.

i. Set the 8407A's DISPLAY REFERENCE 10 dB switch at 40 dB on the DISPLAY REFERENCE window. Switch the 8412A's AMPL DB/DIV to 2.5. Exercise the DISPLAY REFERENCE 1 dB switch and ensure that the amplitude trace shifts 0.4 division per 1 dB step.

j. Noise and Cross-Talk Test.
Switch the 8412A's AMPL DB/DIV switch to 10 then repeat step "g" above.
Switch the 8601A's SWEEP switch to FULL and OUTPUT LEVEL switch to 0 dBm (or −10 dBm input to the 8407A).
Switch the 8407A's REF CH LEVEL ADJ switch to the bottom position.
Now remove the RF input to the TEST CHANNEL of the 8407A. The amplitude trace should (at any point on the trace) be at least 6.7 divisions below the top line on the 8412A CRT (or −97 dBm).

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XI. SOLUTIONS TO PROBLEMS FOUND DURING THE "D" TESTS ARE GIVEN BELOW.

a. If the instrument will not pass section "a" of these tests, select A4R57 (from 2.37KΩ to 4.2KΩ); this may solve the problem.

b. In steps "b" through "e", if the traces do not shift (or track), it is probably the matched set of Dual Transistors (A11Q4 and Q5; and A8Q4 and Q5). First try interchanging the dual transistors on the Test AGC A8 board and the REF AGC A11 board. Because this set of matched Dual Transistors are matched at the factory and must be ordered, it is advised A8Q3 and A8Q6 and A11Q3 and A11Q6 be closely looked at and replaced to see if this will cure your tracking problem, before ordering a matched set of Dual Transistors (part number 08407-80004). If during steps "b", "c" and "d" the Phase Lock Loop unlocks, the problem is probably the Phase Lock Oscillator Board (PLO A14). After checking paragraphs 7-22, step b and 7-23, steps a through e of this Repair Procedure (to ensure the PLO board is properly adjusted), the PLO board should probably be replaced as it would probably be more practical to order a PLO board (HP Part Number 08408-60107) than to attempt to repair it.

c. If during steps "b" and "c" (the "HIGH" band tests), the amplitude trace excursion is out-of-tolerance (by a few tenths of a division), adjust A3L2 and/or A4L2. If the Phase Trace Excursion is out-of-tolerance (by about a division), adjust A3L1 and/or A4L1.

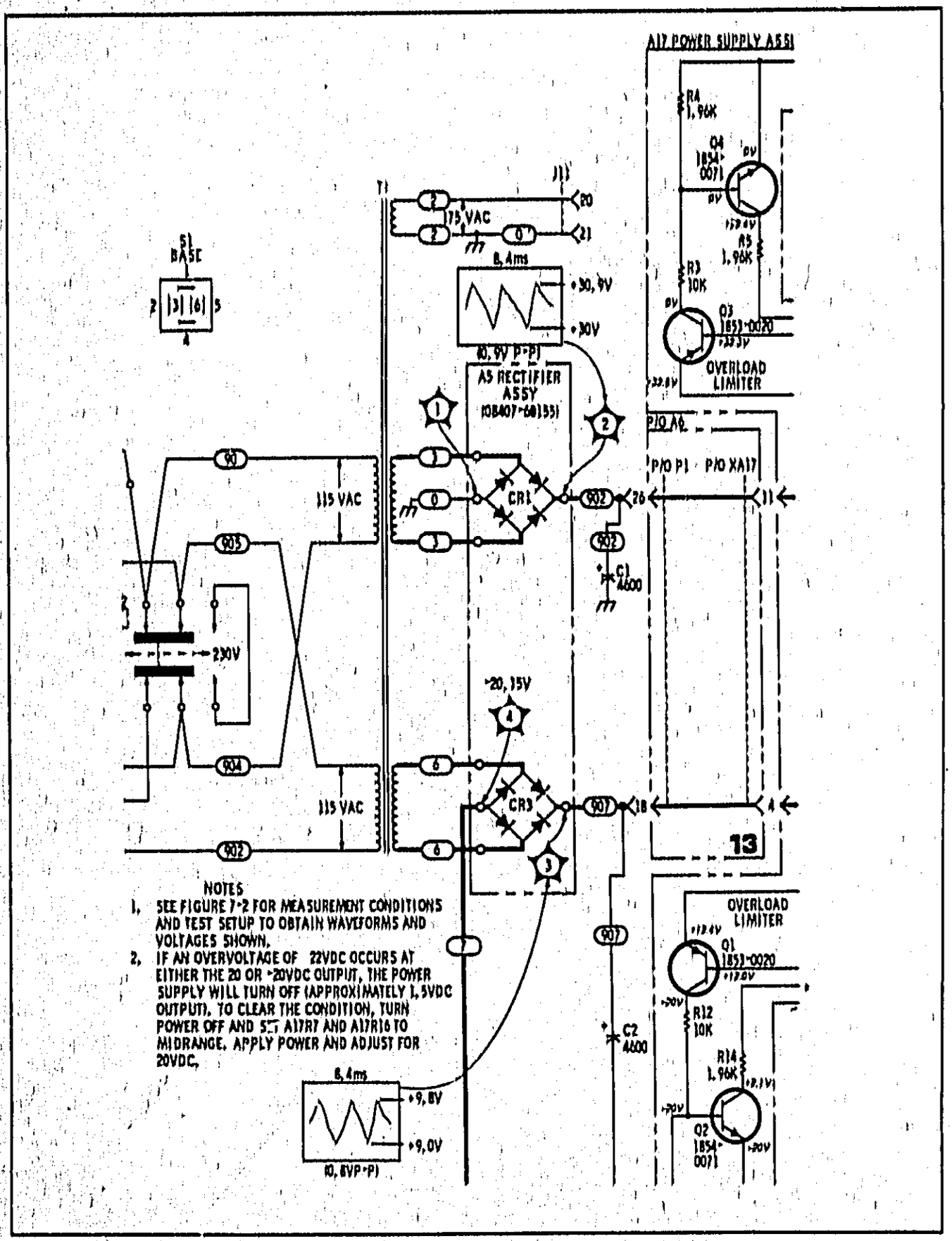
d. If during step "e" (Low Band Tests), the phase or amplitude or phase trace excursion is out of spec, try adjusting A13R27. (Re-check paragraph 7-25 to ensure the automatic level control amplifier A13 is still within tolerance.) Next, try exchanging the mixer (10514B) on the Test Converter board (A4) and the one on the Reference Converter board (A3).

If the above adjustments (c and d) will not compensate for the trace excursion and it is determined that the trouble is the Test and/or Reference Converter board(s), it is advised that both boards be replaced. (Boards are available on the HP Exchange Program, Part Number 08407-60101.) This is advised because A3Q1, A3Q2, A3Q3, A3Q9, A3Q10, A3Q11, and A4Q1, A4Q2, A4Q3, A4Q9, A4Q10, A4Q11, and both 10514B's are all factory selected for adjustment of trace excursion and large numbers of all the above are generally required to select from. However, Tests "A" (VTO, PLO, LO MIXER AND ALC AMP), Test "B" (Reference Channel Signal Level) and Tests "C" (Test Channel Signal Levels) should be carefully performed before determining the converter boards are bad.

e. For Noise and Cross-Talk be sure to check the power supply ripple, A17U1 AND/OR A17U2 often cause Power Supply Noise, (Paragraph 7-18, Power Supply, test a, b, and c), then carefully perform Tests "A" (VTO, PLO, LO MIXER, ALC), Test "B" (Reference Channel Signal Levels) and Test "C" (Test Channel Signal Levels), watching the signal and waveforms closely.

f. The amplitude trace centering can be adjusted by selecting star value resistors A11R24 (11.1KΩ to 100KΩ) and/or A8R20 (16.2KΩ to 21.5KΩ).

g. The phase trace centering can be adjusted by a star value selected capacitor on each of the Bandpass Filter boards (A9 and A12).



P/O Figure 7-35. Power Supply A17 and Diode Board A5 Schematic Diagram (CHANGE 3)

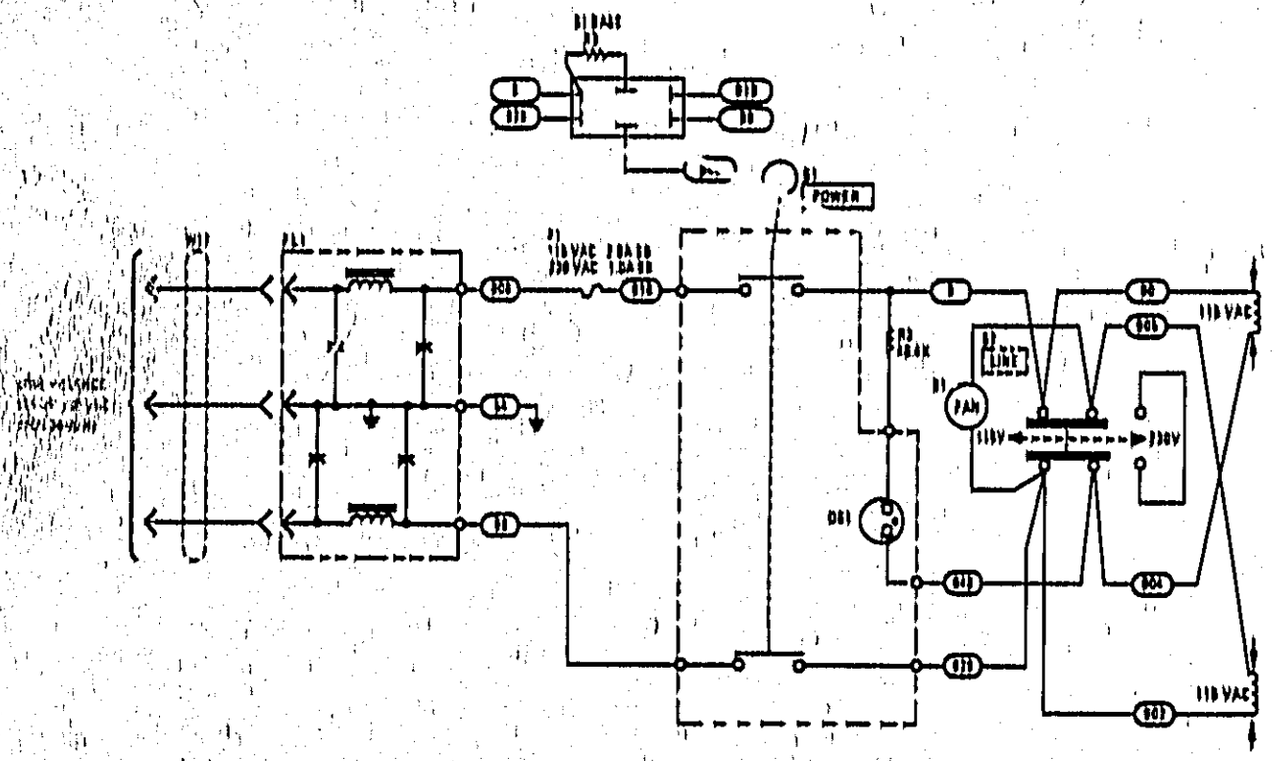
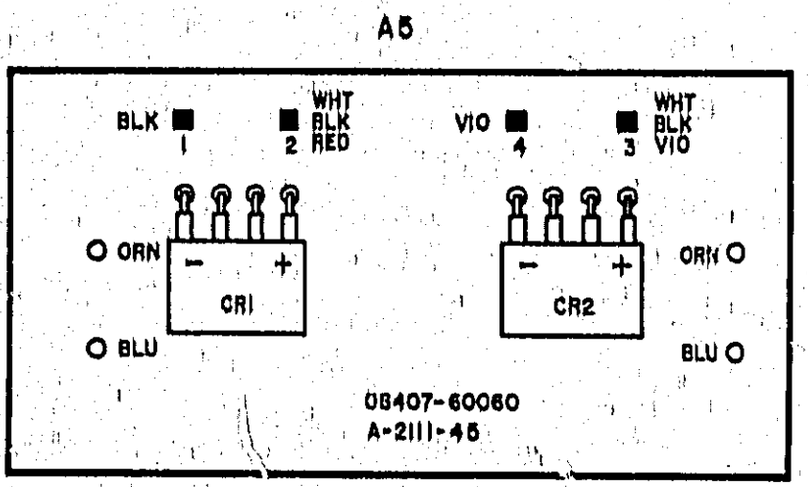


Figure 7-35A. Power Supply Partial Schematic Diagram (CHANGE 7)



P/O Figure 7-34. Parts Location for Diode Board A5 and Power Supply A17 (CHANGE 9)