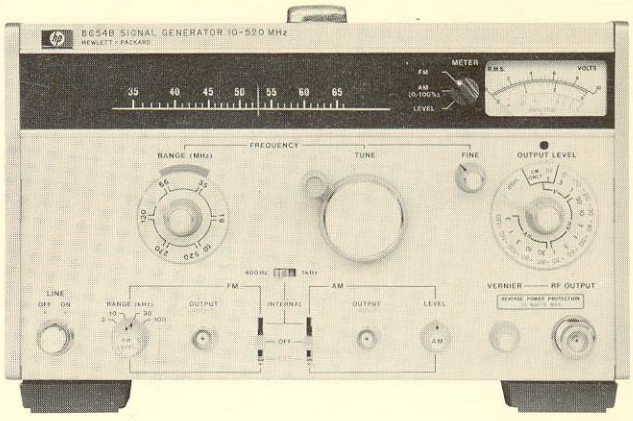
OPERATING AND SERVICE MANUAL

SIGNAL GENERATOR

8654B

PRELIMINARY MANUAL

SEE INSIDE COVER FOR MAILER



HEWLETT hp PACKARD

HP 8654B

HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

SIGNAL GENERATOR
8654B

(including Option 003)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1512A.

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

1501 PAGE MILL ROAD, PALO ALTO, CALIFORNIA, U.S.A.

MANUAL PART NO. 08654-90012
Microfiche Part No. 08654-90013
Operating Supplement Part No. 08654-90014

Printed JULY 1975

CONTENTS

CONTENTS (cont'd)

ILLUSTRATIONS

ILLUSTRATIONS (cont'd)

TABLES

WARNINGS

SAFETY

To avoid the possibility of injury or death, the following precautions must be followed before the instrument is switched on:

a. If this instrument is to be energized via an autotransformer for voltage reduction, make sure that the common terminal is connected to the earthed pole of the power source.

b. The power cable plug shall only be inserted into a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor (grounding).

c. Before switching on the instrument, the protective earth terminal of the instrument must be connected to a protective conductor of the power cord. This is accomplished by ensuring that the instrument's internal earth terminal is correctly connected to the instrument's chassis and that the power cord is wired correctly (see Service Sheet 7).

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

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

HIGH VOLTAGE

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

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

FUSES

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

CAUTIONS

GROUNDING

Any interruption of the protective (grounding) conductor inside or outside the instrument is likely to cause damage to the instrument. To avoid damage, this instrument and all line powered devices connected to it must be connected to the same earth ground (see Section II).

LINE VOLTAGE

Be sure to select the correct fuse rating for the selected line voltage (see LINE VOLTAGE SELECTION in Section II); fuse ratings are listed on the rear panel.

To prevent damage to the instrument, make the line voltage selection *before* connecting line power. Also ensure that the line power cord is connected to a line power socket that is provided with a protective earth contact.

SAFETY

To avoid the possibility of damage to test equipment, read completely through each test before starting it. Make any preliminary control settings necessary for correct test equipment operation.

SEMI-RIGID COAX

While working with and around the semi-rigid coaxial cables in the generator, do *not* bend the cables more than necessary. Do *not* torque the RF connectors to more than *5 inch-pounds.*

MODEL 8654B

POWER CABLE

FUSE

NOTE: See ACCESSORIES SUPPLIED in Section I for more details.

Figure 1-1. HP Model 8654B and Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains information pertaining to installation, operation, testing, adjustment, and maintenance of the Model 8654B Signal Generator.

1-3. The information in this manual is divided into sections as shown below:

Section I, GENERAL INFORMATION, instrument identification, description, accessories, specifications and other basic information.

Section II, INSTALLATION, incoming inspection, power requirements, mounting, packing, and shipping of the instrument.

Section III, OPERATION, provides information relative to operating the instrument.

Section IV, PERFORMANCE TESTS, provides information required to ascertain that the instrument is performing in accordance with published specifications.

Section V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repairs are made.

Section VI, REPLACEABLE PARTS, provides ordering information for replaceable parts and assemblies.

Section VII, MANUAL CHANGES, reserved to provide manual change information in future revisions of this manual.

Section VIII, SERVICE, includes information required to troubleshoot and repair the instrument.

1-4. Figure 1-1 shows the Hewlett-Packard Model 8654B Signal Generator with accessories supplied. Refer to ACCESSORIES SUPPLIED in this section for more details.

1-5. Packaged with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of this manual. Additional copies of the Operating Information supplement may be ordered separately through your nearest Hewlett-Packard office. The part number is listed on the title page of this manual.

1-6. On the title page of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order 4x6-inch microfilm transparencies of the manual. Each microfiche contains up to 60 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplements as well as all pertinent Service Notes.

1-7. Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument may be tested.

1-8. INSTRUMENTS COVERED BY MANUAL

1-9. This instrument has a two-part serial number. The first four digits and the letter comprise the serial number prefix, which denotes the instrument's configuration. The last five digits form the suffix that is unique to each instrument.

1-10. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes supplement that contains change information that documents the differences.

1-11. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-12. For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-13. DESCRIPTION

1-14. The HP 8654B Signal Generator is a portable, solid-state RF source providing calibrated and leveled signals from 10 to 520 MHz, and from +10 to −130 dBm. An internal oscillator provides calibrated amplitude and frequency modulation at 400 and 1000 Hz. Calibrated modulation from an external source is also possible. A front-panel meter indicates output level, percent AM, or FM peak frequency deviation.

1-15. OPTIONS

1-16. Option 003 adds internal reverse power protection for the Signal Generator's output circuitry (guaranteed to protect against reverse power up to 25 watts). The protection circuit uses a limiter and relay to prevent damage to the output circuitry and to automatically restore generator operation when reverse power is removed. Option 003 also protects the instrument when the LINE switch is off.

1-17. ACCESSORIES SUPPLIED

1-18. The accessories supplied with the 8654B are:

a. A 0.175 amp fuse for use when the available line voltage is 220/240 Vac.

b. A power cable. Refer to Power Cables in Section II for HP Part Number.

1-19. EQUIPMENT AVAILABLE

1-20. Information may be obtained on the accessories and equipment, or they may be ordered by contacting your nearest Hewlett-Packard office. Refer to the HP model number.

1-21. Complementary Equipment

1-22. HP Model 651B Oscillator. Fully compatible for external modulation of the Signal Generator.

1-23. HP Model 8447C Amplifier. Suitable for increasing the output level of the 8654B. Typical gain is 30 dB.

1-24. HP Model 8447E Amplifier. Suitable for increasing the output level of the 8654B. Typical gain is 22 dB; much wider frequency range than the HP 8447C.

1-25. HP Model 5300A/5303B Electronic Counter. May be used to monitor the output frequency of the Signal Generator.

1-26. Accessories

1-27. HP Model 11507A Output Termination. May be used to match the Signal Generator's 50-ohm output to high or low impedance circuits (5-ohms minimum) at frequencies to 65 MHz. Also, may be used as a dummy antenna for receiver measurements.

1-28. HP Model 11687A 50 to 75-ohm Adapter. May be used to match the 50-ohm Signal Generator output to a 75-ohm load. Calibrated output in volts.

1-29. HP Model 11690A Frequency Doubler. Extends the usable frequency range of signal sources to 1 GHz. Typical conversion loss is 12 dB.

1-30. HP Model 10514A Double Balanced Mixer. May be used as a current controlled attenuator; amplitude, pulse, or square wave modulator; or phase detector.

1-31. Transit Case. Protects the 8654B from damage while transporting it from location to location. Meets the requirements of MIL-C-4150. HP Part Number 9211-1895.

1-32. SERVICE AND USER AIDS

1-33. Video Tapes. Video tapes covering instrument use, application, and service are available. Contact the nearest Hewlett-Packard Sales and Service office for a list of presently available tapes.

1-34. Application Notes. Informative notes concerning the use of signal generators are also available from the nearest Hewlett-Packard Sales and Service office.

1-35. Service Notes. Hewlett-Packard makes design improvements to its current line of instruments on a continuing basis. Many of these improvements can be incorporated in earlier produced instruments. Modification and general service information is passed on in the form of Service Notes. To obtain the Service Notes contact the nearest Hewlett-Packard Sales and Service office.

1-36. RECOMMENDED TEST EQUIPMENT

1-37. The equipment recommended for performance testing, adjustments and troubleshooting is listed in Table 1-2. Only equipment that meets or exceeds the critical specifications should be used in place of that shown in the table.

NOTE

The safety classification of this instrument is Safety Class I. It has been designed and tested according to IEC Publication 348 "Safety Requirements for Electronic Measuring Apparatus" and has been supplied in safe condition. The instruction manual contains information, warnings, and cautions which must be followed by the user to ensure safe operation and to retain the instrument in safe condition.

Table 1-1. Specifications (1 of 2)

SPECIFICATIONS

Specifications apply from 10 to 520 MHz for output power ≤ +10 dBm and over the top 10 dB of output level vernier range unless otherwise specified.

FREQUENCY CHARACTERISTICS

Range: 10 to 520 MHz in 6 bands:
10 to 19 MHz
19 to 35 MHz
35 to 66 MHz
66 to 130 MHz
130 to 270 MHz
270 to 520 MHz

Accuracy: ±3% after 2-hour warmup.

Settability: Settable to within 5 ppm of the desired frequency with an external indicator after 1-hour warmup.

Stability (after 2-hour warmup and 15 min. after frequency change): < (1 kHz plus 20 ppm)/5 min.

SPECTRAL PURITY

Harmonic Distortion (output power ≤ +3 dBm): >20 dB below carrier.

Subharmonics and Non-harmonic Spurious (excluding line related): >100 dB down.

Residual AM (average rms): >55 dB below carrier in a 50 Hz to 15 kHz post-detection noise bandwidth.

Residual FM on CW (averaged rms deviation): <0.3 ppm in a 0.3 to 3 kHz post-detection noise bandwidth. <0.5 ppm in a 50 Hz to 15 kHz post-detection noise bandwidth.

OUTPUT CHARACTERISTICS

Range: 10 dB steps and a 13 dB vernier provide power settings from +10 dBm to −130 dBm (0.7V to 0.07 μV) into 50Ω.

Impedance: 50Ω ac coupled. SWR <1.3 on 0.1V range or lower. With Option 003, SWR < 1.5 on 0.1V range or lower.

Level Accuracy:

Using Top 10 dB of Vernier Range					Using Full Vernier Range
Output Level (dBm)	+10 to −7	−7 to −57	−57 to −97	−97 to −127	+10 to −130
Total Accuracy as indicated on Level Meter (dB)	±1.5	±2.0	±2.5	±3.0	Add ±0.5

Note: Level Accuracy error consists of allowances for meter accuracy, detector linearity, temperature, flatness, attenuator accuracy, and twice the measurement error. All but the attenuator accuracy and the measurement error can be calibrated out with a power meter at a fixed frequency and a fixed vernier setting.

Level Flatness: ±1 dB referenced to the output at 250 MHz for output levels > −7 dBm.

Auxiliary RF Output: > −7 dBm (100 mV) into 50Ω.

Leakage (with all RF outputs terminated properly): Leakage limits are below those specified in MIL-I-6181D. Furthermore, with an output level <0.01V, less than 0.5 μV is induced in a 2-turn, 1-inch diameter loop 1 inch away from any surface and measured into a 50Ω receiver.

Reverse Power Damage Level:
75 Vdc maximum. Output Range 1V and 0.3V: 250 mW (+24 dBm). All other output ranges: 500 mW (+27 dBm).

Reverse Power Protection (Option 003): Protects signal generator from accidental applications of up to 25W (+44 dBm) of RF power (between 10 and 520 MHz) into generator output.

Table 1-1. Specifications (2 of 2)

SPECIFICATIONS

MODULATION CHARACTERISTICS

Amplitude Modulation: Specifications apply for output power <+3 dBm.[1]

Depth: 0 to 90%.

Modulation Rate: Internal, 400 and 1000 Hz ±10%; External 3 dB bandwidth, dc-coupled to >20 kHz.

External AM Sensitivity[2]: (0.1 ± 0.01)% AM/mVpk into 600Ω.

Indicated AM Accuracy[2]: ±(5% of readings +5% of full scale).

Peak Incidental Frequency Deviation (30% AM)[2]: less than 200 Hz.

Envelope Distortion[2]: <3%, 0 to 70% modulation; <5%, 90% modulation.

Frequency Modulation: fully calibrated.

Peak Deviation: 0 to 30 kHz from 10 to 520 MHz. 0 to 100 kHz from 80 to 520 MHz.

Deviation Ranges: 0 to 3 kHz, 0 to 10 kHz, 0 to 30 kHz, 0 to 100 kHz.

Modulation Rate: Internal, 400 and 1000 Hz ±10%. External 3 dB bandwidth, dc coupled to >25 kHz.

FM Distortion[2]: <2% for deviations up to 30 kHz, <3% for deviations up to 100 kHz.

External FM Sensitivity[2]: 1 volt peak yields maximum deviation indicated on peak deviation meter with FM LEVEL vernier at fully cw position.

Sensitivity Accuracy (15° to 35°C)[2]: ±10%. For 100 kHz deviation range above 130 MHz, ±13%.

Indicated FM Accuracy (15° to 35°C)[2]: ± (10% of reading +3% of full scale). For 100 kHz deviation range above 130 MHz, add 3% of reading.

Incidental AM[2]: <1% AM at 30 kHz deviation.

GENERAL CHARACTERISTICS

Power: 100, 120, 220, or 240 volts +5%, −10%, 48 to 440 Hz; 15VA maximum, 2.29 m (7½ ft) power cable furnished with mains plugs to match destination requirements.

Weight: Net, 7.9 kg (17 lb, 6 oz).

Dimensions: 266 mm wide x 178 mm high x 305 mm deep (10½" x 7" x 12").

---

[1] AM is possible above +3 dBm as long as the combination of the AM depth plus carrier output level does not exceed +9 dBm.

[2] 400 and 1000 Hz modulation rates.

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

Instrument Type	Critical Specifications	Suggested Model	Use*
20 dB Amplifier	Range: 0.5—520 MHz Gain: 20 to 25 dB Flatness over Range: ±2 dB Impedance: 50Ω Noise Figure: < 5 dB	HP 8447A	P
20 dB Amplifier	Range: 400—1200 MHz Gain: > 20 dB Flatness: ±2 dB Impedance: 50Ω Noise Figure: < 5 dB to 1 GHz	HP 8447B	P
40 dB Amplifier	Range: 5 Hz to 50 kHz Gain: 20 and 40 dB ±1 dB Input Impedance: > 5kΩ Output Impedance: 50Ω Noise: < 25 μVrms referred to input Output: > 1 Vrms into 50Ω	HP 465A	P
One-Inch Loop Antenna	2-turn, 1 inch dia., 1 inch from end To ensure measurement accuracy, no substitution is possible. Fabrication depends upon machining and assembling to very close tolerances.	HP 08640-60501	P
10 dB Step Attenuator	Attenuation: 0—50 dB in 10 dB steps Range: 0.45—550 MHz Accuracy: ±1.5 dB to 50 dB below 520 MHz; ±0.3 dB to 50 dB at 1000 Hz	HP 355D	P, A
10 dB Attenuator	Accuracy: ±0.5 dB to 550 MHz	HP 8491A Opt 010	P, A
Digital Multimeter	Voltage Range: 1V or less Display: 4½ digits or more DC Accuracy: ± (0.03% of reading +0.02% of range) AC Accuracy: ± (0.25% of reading +0.05% of range) Ohms Range: to 1 MΩ	HP 34702A/ 34740A	P, A, T
Distortion Analyzer	Range: 20 Hz to 10 kHz Distortion Range: <0.1% Minimum Input: <300 mVrms	HP 331A	P, A
FM Discriminator	Ranges: 100 kHz to 10 MHz Linear Analog Output: 1V for full scale	HP 5210A	P, A
Filter Kit	Output Low-pass Filters for HP 5210A FM Discriminator (10 kHz and 50 kHz Butterworth filters)	HP 10531A	P, A
520/1040 MHz Notch Filter	Notch Frequency Accuracy: 500—540 MHz Notch Rejection: > 60 dB See Figure 1-2.	HP 08640-60502	P

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

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

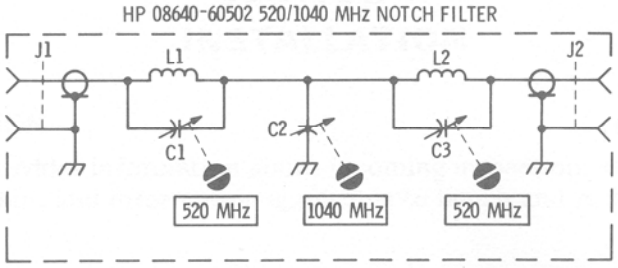
Instrument Type	Critical Specifications	Suggested Model	Use*
4 MHz Low-pass Filter	4 MHz low-pass (3 pole) Impedance: 50Ω SWR: <1.5:1 Ripple: <±0.2 dB	CIR-Q-TEL FLT/21B-4-3/ 50-3A/3B	P, A
15 kHz Low-pass Filter	15 kHz low-pass (7 pole) Impedance: 50Ω Ripple: <±0.2 dB	CIR-Q-TEL FLT/21B-15K-7/50-3A/3B	P
3 kHz Low-pass Filter	3 kHz low-pass (5 pole) Impedance: 50Ω Ripple: <±0.2 dB	CIR-Q-TEL FLT/21B-3K-5/50-3A/3B	P
Frequency Counter	Range: to 520 MHz Input Sensitivity: <100 mV Inputs: 50Ω and high impedance (1 MΩ) Accuracy: ±0.1%	HP 5327C	P, A, T
Frequency Counter (If available, substitute for HP 5327C)	Range: to 520 MHz Input Sensitivity: <100 mV Inputs: 50Ω and high impedance (1 MΩ) Accuracy: ±0.1% Short Term Stability: $<20 \times 19^{-9}$ rms for 1s Must be able to display frequency difference measured sequentially between two channels and to produce an external gate pulse at start of each count.	HP 5345A/5333A	A
Mixer	Double Balanced Range: 10—550 MHz	HP 10514A	P, A
Oscilloscope	50 MHz Real Time Sensitivity: 5 mV/division	HP 1820C/1801A/ 182C	P, T
Power Meter	Range: 10—550 MHz Input Level: —20 to +20 dBm Accuracy: ±1% of reading	HP 435A	P, A, T
With Power Sensor (Thermocouple)	SWR: < 1.2:1	With HP 8481A	
RMS Voltmeter	Range: 10 Hz to 50 kHz Reading: True rms (ac only) Voltage Range: 1 mV to 10V full scale Accuracy: 1% of full scale 50 Hz to 50 kHz Scale: Voltage and dB	HP 3400A	P
Signal Generator	Range: 10—550 MHz Output: > +7 dBm into 50Ω Drift: <20 ppm/10 min.	HP 8640A	P, A

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

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

Instrument Type	Critical Specifications	Suggested Model	Use*
Signal Generator (cont)	Residual FM: <50 Hz rms in 20 Hz to 15 kHz post-detection noise bandwidth; <30 Hz rms in 0.3—3 kHz post detection noise bandwidth at 270—520 MHz.	HP 8640A	P, A
Spectrum Analyzer	Range: 10—1200 MHz Amplitude Calibration: Display Accuracy: ±0.25 dB/dB but not more than 1.5 dB over 70 dB dynamic range Flatness: ±1 dB IF Gain Step Accuracy: ±0.2 dB Vertical Reference Scale: 10 dB/division log, 2 dB/division (or less) log, and linear display calibration. Average Noise Level: <—102 dBm with 10 kHz IF bandwidth Spurious Responses: > 60 dB down for inputs of —40 dBm or less Maximum Bandwidth: ⩾ 300 kHz Span Width: 0—1 GHz Compatible with Tracking Generator	HP 8558B/182C Opt. 807	P, A
Test Oscillator	Range: 10 Hz to 50 kHz Output Impedance: 600Ω and 50Ω Distortion: > 40 dB down Output Level: > 1 Vrms	HP 651B	P, A
Tracking Generator	Output: to 0 dBm (50Ω) Flatness: ±0.5 dB Compatible with Spectrum Analyzer HP 8558B/182C	HP 8444A Opt. 058	P, A
SWR Bridge	Range: 10—550 MHz Directivity: > 40 dB Connectors: Type N	Wiltron Model 60N50	P, A
FM Deviation Adjustment Board	Produces ±0.949V square wave triggered by an external counter. Resistance substitution circuit. No substitution is possible	HP 08654-60084	A
50Ω Load (2 req.)		HP 11593A	P
50Ω Load	SWR <1.05 (dc—550 MHz)	HP 908A	A
Coaxial Short (Male Type-N)		HP 11512A	P, A
Double Shielded Cable (BNC,Male,coaxial (2 req.)		HP 08708-6033	P

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



C1-3 2-8 pF CERAMIC TRIMMER (HP 0121-0060).
J1 BNC MALE CONNECTOR (HP 1250-0045).
J2 BNC FEMALE CONNECTOR (HP 1250-0083).
L1,2 1.5 INCH NO. 18 ENAMELED WIRE, 2 TURNS.
BOX AND LID.

REJECTION: 60 dB AT NOTCH
NOTCH FREQUENCY ACCURACY: 500-540 MHz

Figure 1-2. 520/1040 MHz Notch Filter

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides information about incoming inspection, selecting the input line voltage, operating environment, and information applicable to bench and rack mounting.

2-3. INITIAL INSPECTION

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

2-5. PREPARATION FOR USE

2-6. Meter Zeroing

2-7. With the power off, the meter's pointer should be positioned directly over zero. If the pointer is not on zero, insert a screwdriver into the adjustment screw, (beneath meter), and align the pointer with zero on the meter scale.

2-8. Power Requirements

2-9. The 8654B Signal Generator requires a power source of 100, 120, 220 or 240 Vac +5% −10%, 48 to 440 Hz single phase. Power consumption is less than 30 VA.

2-10. Line Voltage Selection

2-11. Figure 2-1 provides instructions for line voltage and fuse selection. The line voltage selection card and the proper fuse are factory installed for 120 Vac operation.

CAUTION

To prevent damage to the instrument make the line voltage selection before connecting the power cable.

NOTE

The correct fuse rating for the line voltage is shown on the rear panel. More information about the fuses is given in Section I, ACCESSORIES SUPPLIED, and in the Replaceable Parts table in Section VI.

2-12. Power Cable

2-13. In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet.

The type of power cable plug shipped with each instrument depends on the country of destination. Refer to Figure 2-2 for the part numbers of the power cable plugs available.

WARNING

The protection provided by grounding the instrument may be lost if any power cable other than the three-pronged type supplied is used to couple the ac line voltage to the instrument.

2-14. Operating Environment

2-15. The operating environment should be within the following limitations:

Temperature	0 to +55°C
Humidity	<95% relative
Altitude	<4600 metres (15,000 feet)

2-16. Bench Operation

2-17. The instrument cabinet has plastic feet and foldaway tilt stands for convenience in bench operation. The plastic feet are shaped to ensure self-aligning of the instruments when stacked. The tilt stands raise the front of the instrument for easier viewing of the control panel.

2-18. Rack Mounting

2-19. Rack Adapter Frames. Hewlett-Packard adapter frames are an economical means of rack mounting instruments that are narrower than full rack width. A set of spacer clamps, supplied with each adapter frame, permits instruments of different dimensions to be combined and rack mounted as a unit. Accessory blanks are available for filling unused spaces.

2-20. Combining Cases. Model 1051A and 1052A Combining Cases are metal enclosures that allow combinations of third or half-rackwidth instruments to be assembled for use on a workbench or for mounting in a rack of standard 19-inch spacing. Each case includes a set of partitions for positioning and retaining instruments, and a rack mounting kit. No tools are required for installing the partitions. For bench use the cases have the same convenience features as full rackwidth instruments (i.e., foldaway tilt stands and specially-designed feet for easier instrument stacking). Accessories available for the combining cases include fan kits, blank filler panels, and snap-on full width control panel covers.

2-21. STORAGE AND SHIPMENT

2-22. Environment

2-23. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment.

Temperature	—40 to +75°C
Humidity	<95% relative
Altitude	<7600 metres (25,000 feet)

2-24. Packaging

2-25. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and

full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

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

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

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

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

d. Seal the shipping container securely.

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

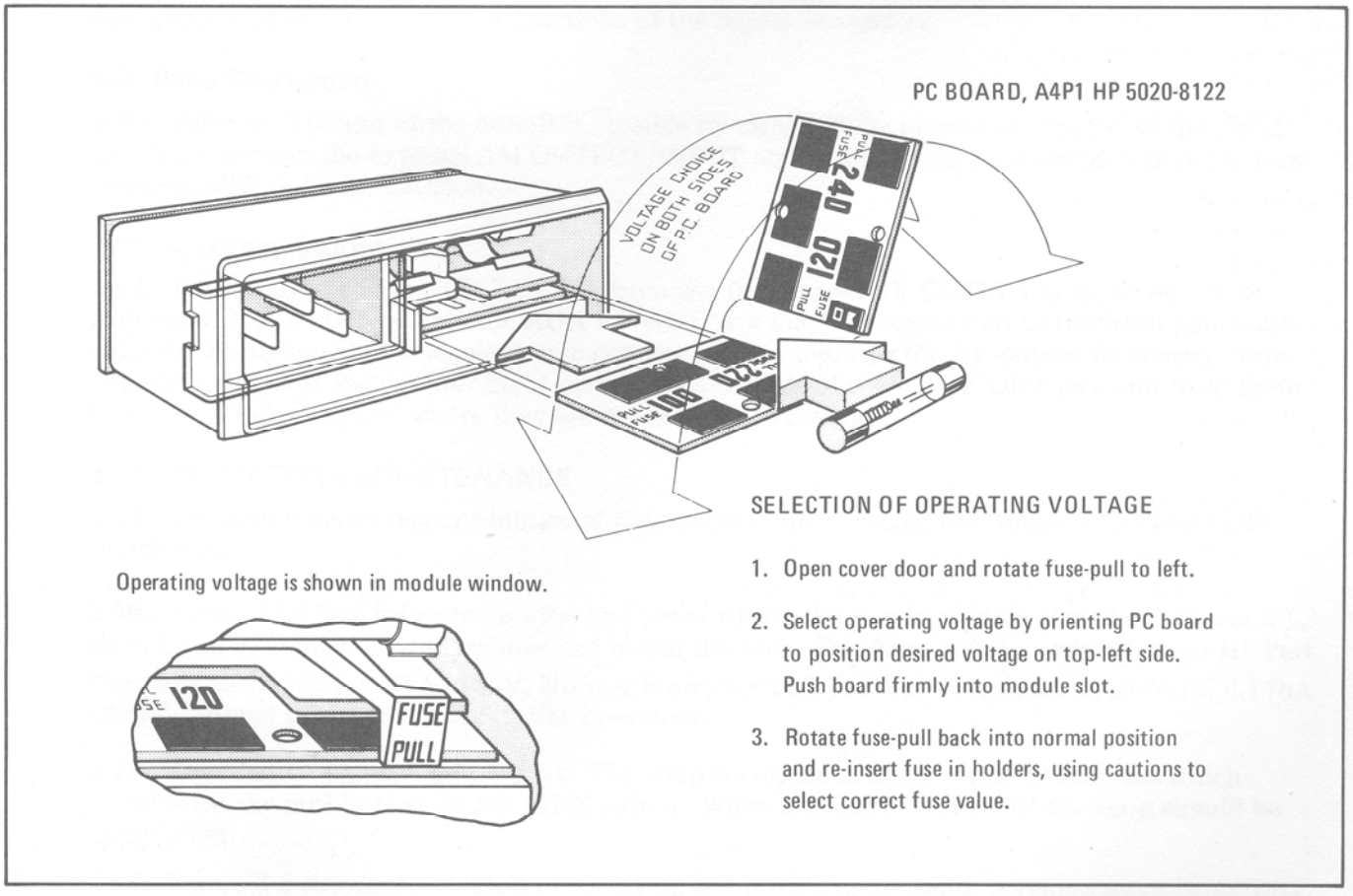


Figure 2-1. Line Voltage Selection

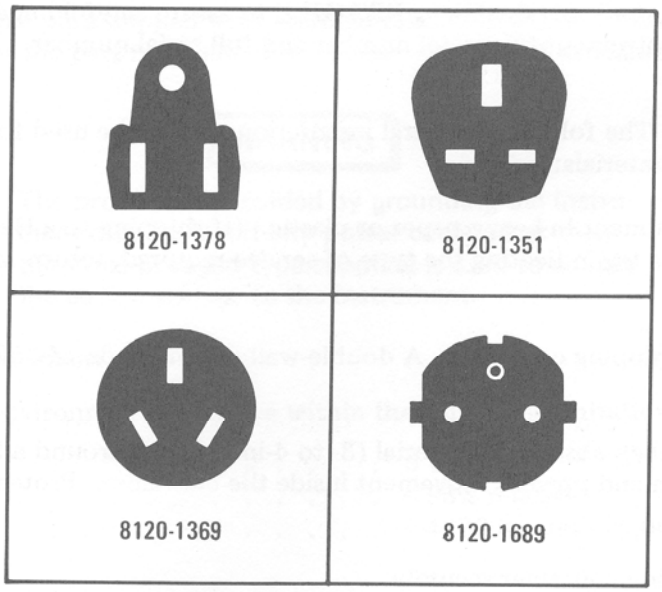


Figure 2-2. Power Cables Available

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section provides complete operating instructions for the HP 8654B Signal Generator. The instructions consist of panel features, operator's checks, operating instructions, and operator's maintenance.

3-3. PANEL FEATURES

3-4. Front and rear panel features of the 8654B Signal Generator are described in Figures 3-1 and 3-2. These figures contain a detailed description of the Signal Generator controls, indicators, and connectors.

3-5. OPERATOR'S CHECKS

3-6. Upon receipt of the instrument, or to check the Signal Generator for an indication of normal operation, perform the operational procedures listed in Figure 3-3. These procedures are designed to familiarize the operator with the Signal Generator and permit a determination of operating capabilities.

3-7. OPERATING INSTRUCTIONS

3-8. General operating instructions are contained in Figure 3-4. The instructions will familiarize the operator with basic operating functions of the Signal Generator.

3-9. Pulse Modulation

3-10. Pulse modulation of the 8654B is possible by using a pulse generator coupled to the signal generator through the external AM OUTPUT/INPUT connector. Figure 3-4 explains in detail how to accomplish pulse modulation.

3-11. Auxiliary Output

3-12. The isolation of the AUX RF OUT from the front panel RF OUTPUT is typically 30 dB. Any signal that is coupled into the AUX RF OUT jack may be transmitted to the front panel output. An example of this is an electronic counter used to monitor the RF output frequency. Subharmonic signals at the counter input may be coupled into the AUX RF OUT jack and from there to the front panel output where they are transmitted to the load.

3-13. OPERATOR'S MAINTENANCE

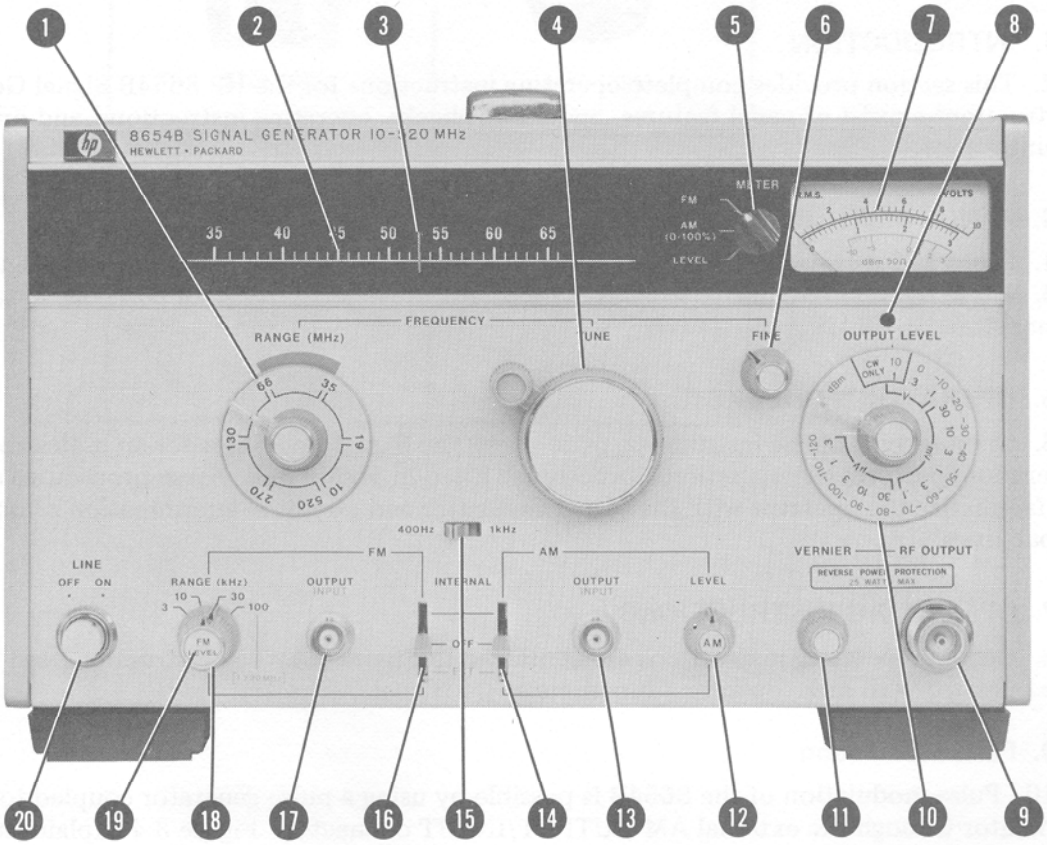
3-14. The maintenance responsibilities of the operator are replacing the primary fuse and LINE switch lamp.

3-15. Fuses. The fuse is located on the rear panel within the power module assembly. Figure 2-1, steps 1 and 3, explain how to remove and install the fuse. The fuses may be ordered under HP Part Numbers 2110-0004, 0.25A (250V, Normal Blow) for 100/120 Vac operation; 2110-0479, 0.175A (250V, Normal Blow) for 220/240 Vac operation.

3-16. Line Switch Lamp Replacement. The lamp is contained in the white plastic lens which doubles for the pushbutton on the LINE switch. When the instrument is ON the lamp should be illuminated.

3-17. Figure 3-5 shows the method of removing and installing the lamp. A replacement lamp, DS1, may be ordered under HP Part Number 2140-0244.

FRONT PANEL FEATURES



1 FREQUENCY RANGE (MHz) Switch. Selects the frequency band as indicated on the control skirt.

2 Frequency Scale. Shows the range of frequencies selected by the FREQUENCY RANGE (MHz) control.

3 Cursor. Indicates the output frequency; controlled by FREQUENCY TUNE control.

4 FREQUENCY TUNE Control. Tunes to the desired output frequency within the selected band.

5 METER Switch. Selects Meter function.
FM: peak frequency deviation.
AM: percent AM.
LEVEL: output level in dBm or volts.

6 FREQUENCY FINE TUNE Control. Optimizes frequency settability.

7 Meter. Function controlled by METER switch.
FM (0—3 or 0—10 scale): read FM peak frequency deviation directly from Meter within the range indicated by FM RANGE (kHz) knob.
AM (0—10 scale): read value of percent AM within 0 and 100% directly from Meter.
LEVEL (dBm 50Ω scale): determine output level (dBm) by adding values indicated on OUTPUT LEVEL knob and meter's scale.
LEVEL (0—3 or 0—10 scale): read output level (volts) directly from meter within the range indicated on OUTPUT LEVEL knob. OUTPUT LEVEL knob indicates full-scale deflection.

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

FRONT PANEL FEATURES

8 Mechanical Zeroing Adjustment. Screwdriver adjustment used to align meter indicator on zero (see procedure in Section II).

9 RF OUTPUT Connector. Type N-female coaxial. Output level: +10 to −130 dBm (0.7 Vrms to 0.07 μVrms) across a 50Ω load. AM is restricted in the +10 dBm range.

NOTE

With Option 003 installed, the generator's output circuitry is protected against reverse power applications up to 25 watts (see label).

10 OUTPUT LEVEL Switch. Selects output range as shown on knob skirt, +10 to −120 dBm (1V to 0.3 μV).

11 VERNIER. RF output continuously variable within a 13 dB range as indicated by the meter.

12 AM LEVEL Control. Varies percent AM of RF signal (internal or external AM mode). Set percent AM using Meter.

13 AM OUTPUT/INPUT Connector. BNC-female, coaxial. AM INTERNAL mode: open-circuit output level ~5Vrms, output impedance ~10kΩ. AM EXT (external) mode: input impedance ~600Ω dc coupled. With AM LEVEL set fully cw, 1 Vpk. input produces 100% AM and full-scale meter deflection (0—10 scale).

CAUTION

Applied voltages greater than 10Vpk (ac + dc) can damage the AM circuitry.

14 AM Source Switch. Selects amplitude modulation source: INTERNAL, EXT (external), or OFF.

NOTE

A mechanical interlock prevents simultaneous internal AM and FM. However, simultaneous AM and FM is possible if at least one source is external.

15 400 Hz/1 kHz Switch. Selects 400 Hz or 1 kHz internal modulation signal.

16 FM Source Switch. Selects frequency modulation source: INTERNAL, EXT (external), or OFF.

NOTE

A mechanical interlock prevents simultaneous internal AM and FM. However, simultaneous AM and FM is possible, if at least one source is external.

17 FM OUTPUT/INPUT Connector. BNC-female, coaxial. FM INTERNAL mode: open-circuit output level ~5 Vrms, output impedance ~10kΩ. FM EXT (external) mode: input impedance ~600Ω, dc coupled. With FM LEVEL set fully cw, 1 Vpk produces full-scale meter deflection and the maximum peak frequency deviation determined by FM RANGE (kHz). See table below.

FM RANGE (kHz)	Meter Scale	Full-Scale Deviation (kHz)
3	0—3	3.16
10	0—10	10
30	0—3	31.6
100	0—10	100

CAUTION

Applied voltages greater than 10 Vpk (ac + dc) can damage the FM circuitry.

18 FM RANGE (kHz) Switch. Selects one of four peak frequency deviation ranges: 0—3 kHz, 0—10 kHz, 0—30 kHz, or 0—100 kHz. Peak frequency deviation is set with FM LEVEL control.

NOTES

FM is not specified on the 100 kHz range for RF signals less than 80 MHz.

For best FM performance, use lowest range which includes the peak deviation desired.

19 FM LEVEL Control. Varies peak frequency deviation (internal or external FM mode). Maximum peak deviation determined by FM RANGE (kHz) setting. Set peak deviation using meter.

20 LINE OFF/ON Switch. Controls primary power. Illuminated when switch is set to "ON".

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

REAR PANEL FEATURES

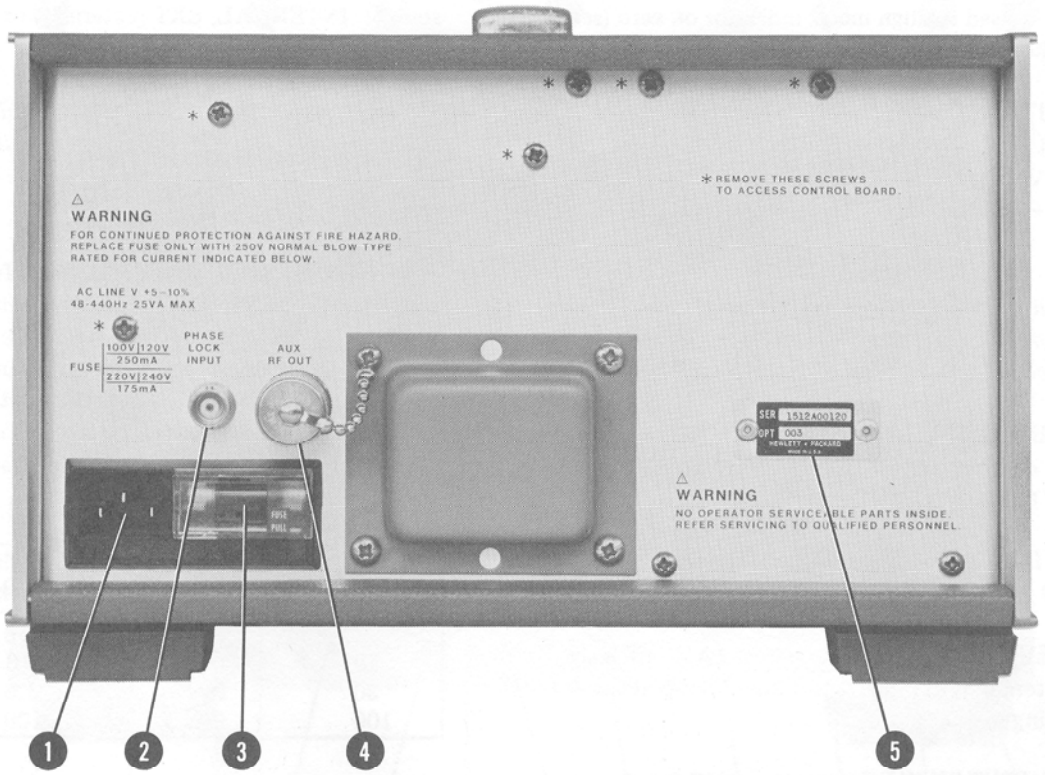


Figure 3-2. Rear Panel Features (1 of 2)

REAR PANEL FEATURES

1 **Line Power Module.** Permits operation from 100, 120, 220 or 240 Vac. The number visible in window indicates nominal line voltage to which instrument must be connected (see Figure 2-1). Center conductor is safety earth ground.

WARNING

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

2 **PHASE LOCK INPUT Connector.** BNC- female, coaxial, couples output of an external phase lock synchronizer to the electronic fine tuning circuit in the Signal Generator. Stability (drift) of generator is then determined primarily by stability of reference oscillator in the synchronizer. (Synchronizer's input can be connected to AUX RF OUT.)

NOTES

Use of a phase lock synchronizer will likely cause some degradation of FM sensitivity accuracy and indicated FM accuracy.

Do not use HP Model 8708A synchronizer or any low-impedance source to drive the PHASE LOCK INPUT port.

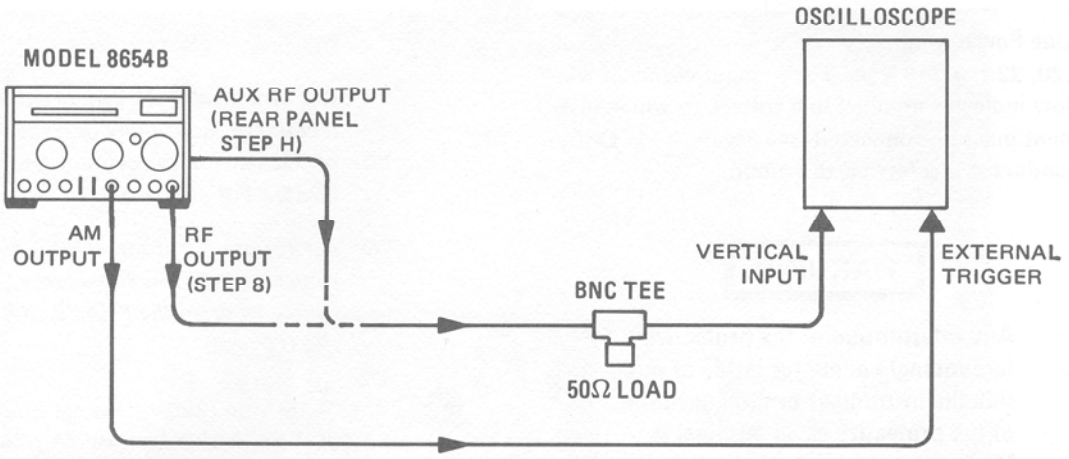
3 **Fuse.** 0.25 Amp (250V, Normal Blow) for 100/120 Vac. 0.175 Amp (250V, Normal Blow) for 220/240 Vac.

4 **AUX RF OUT Connector.** Type-N female, coaxial. >-7 dBm (fixed level) into a 50Ω load, 10—520 MHz. Signal does not contain amplitude modulation but does contain calibrated frequency modulation.

5 **Serial Number Plate.** First four numbers and letter comprise the prefix that denotes the instrument configuration. The last five digits form the suffix that is unique to each instrument. The Serial Number plate also indicates any options supplied with instrument.

Figure 3-2. Rear Panel Features (2 of 2)

OPERATOR'S CHECKS



a. Verify that the power transformer primary is matched to the line voltage and that the correct fuse is installed within the rear panel Power Module Assembly. See Line Voltage Selection in Section II.

b. Couple the power cable to the power outlet and Power Module receptacles. When the LINE switch is set to ON, the lamp within the switch lens should be illuminated.

c. Set the generator's controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	10.0 MHz
OUTPUT LEVEL	0.1 Vrms
VERNIER	full scale meter reading (0.1 Vrms)
AM	OFF
FM	OFF
400 Hz/1 kHz	1 kHz

d. Connect the equipment as shown above and verify that the 10.0 MHz signal has an output level of ~ 0.3 Vp-p.

NOTE

The oscilloscope must have a bandwidth of >10 MHz to perform these checks.

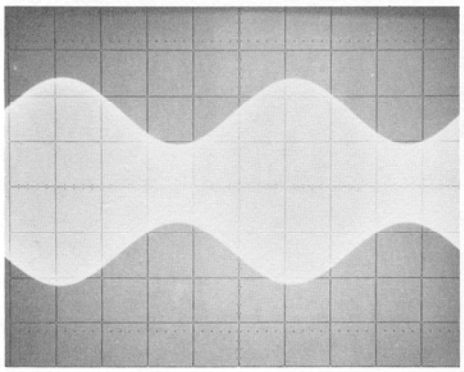
If the oscilloscope has a 50Ω input impedance, the BNC tee and 50Ω load should be omitted.

e. Set the 8654B AM Source to INTERNAL; set the oscilloscope time base trigger to external.

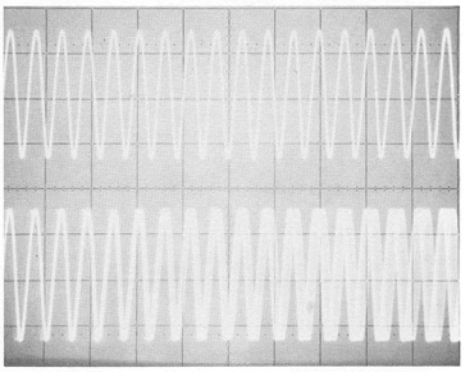
Figure 3-3. Operator's Checks (1 of 2)

OPERATOR'S CHECKS

f. Set METER Switch to AM and rotate AM LEVEL control cw until the meter indicates 50% modulation depth. Verify that the AM envelope display shows a peak-to-valley voltage difference of about 0.15V with a period of 1.0 ms.



Typical AM Envelope



Typical FM Display with CW Display for Comparison

g. Set the 400 Hz/1 kHz switch to 400 Hz; verify the AM envelope period is 2.5 ms.

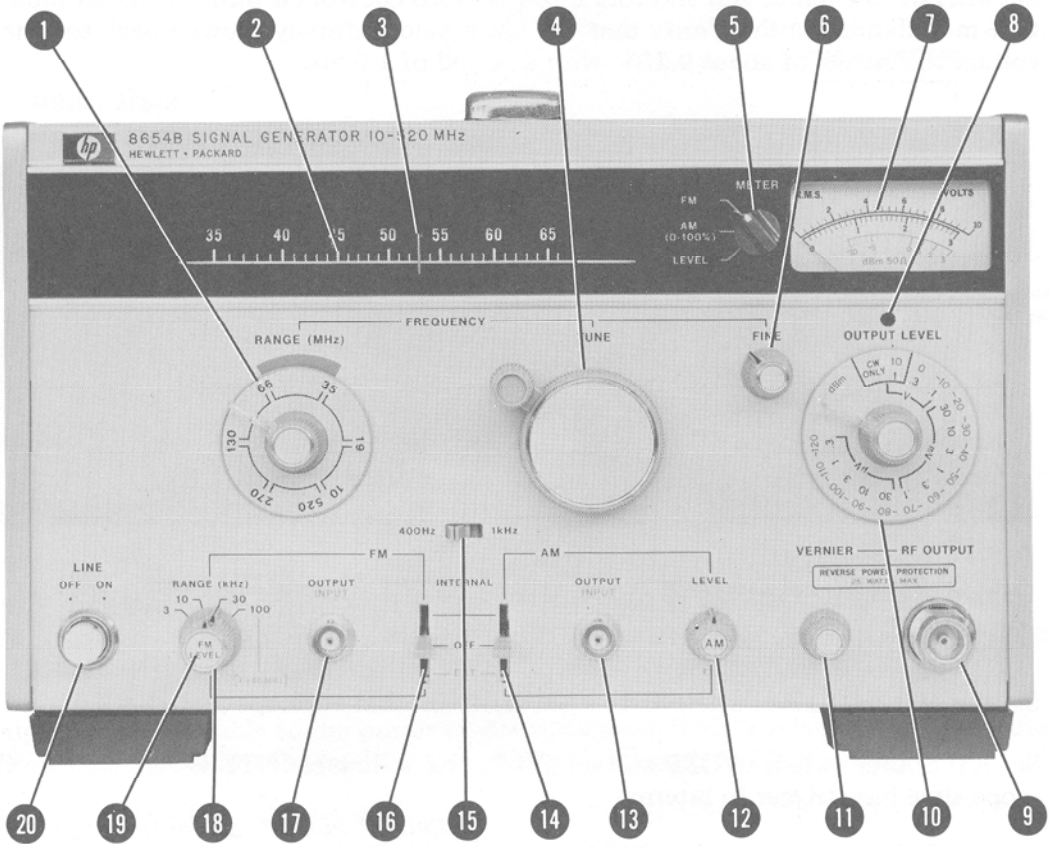
h. Set AM Source switch to OFF and set FM Source switch to INTERNAL. Set the Oscilloscope time base trigger to internal.

i. Set METER switch to FM and FM RANGE (kHz) to 30 kHz. Adjust FM LEVEL so that the meter indicates 30 kHz peak frequency deviation. Verify that the oscilloscope shows the typical FM display.

j. Connect the generator's AUX RF OUT (rear panel) to the oscilloscope's vertical input and verify that a 10.0 MHz signal of >0.3 Vp-p is displayed.

Figure 3-3. Operator's Checks (2 of 2)

OPERATING INSTRUCTIONS



TURN ON

a. Verify that the power transformer primary is matched to the line voltage. See Line Voltage Selection in Section II.

b. Check the fuse, which is contained in the Power Module Assembly, for the correct rating. The voltage and current ratings are given in a table on the rear panel. If necessary, change the fuse.

c. Connect the power cable to the power outlet and the Power Module receptacles. Press the LINE switch (20) and release. The switch should remain in, the lamp within the plastic lens should be illuminated, and the cursor on the curved portion of the switch should indicate ON.

NOTE

To ensure the 8654B will perform to the standards set forth in the published specifications, let the instrument warm up for two hours before using.

Figure 3-4. Operating Instructions (1 of 5)

OPERATING INSTRUCTIONS

FREQUENCY SELECTION

d. Set FREQUENCY RANGE (MHz) (1) to the band which includes the desired carrier frequency.

e. Tune to the carrier frequency with the FREQUENCY TUNE control (4) ; FREQUENCY FINE Tune (6) provides greater tuning resolution. The Cursor (3) indicates the carrier frequency.

OUTPUT LEVEL SELECTION

f. Set METER switch (5) to LEVEL. Set the OUTPUT LEVEL control (10) and VERNIER (11) to the desired output level. For optimum AM performance and level meter accuracy, the VERNIER control should be set for a meter indication of −7 to +3 on the dBm scale (> 1/3 full scale). Amplitude modulation is restricted in the +10 dBm range.

g. Vary the VERNIER until the level indicated on the OUTPUT LEVEL knob skirt (10) added to the Meter indication (7) equals the desired level. Keep meter indication between −7 to +3 on the dBm scale (> 1/3 full scale). Amplitude modulation is restricted in the +10 dBm range.

AM—INTERNAL

h. Set AM Source (14) to INTERNAL.

i. Select 400 Hz or 1 kHz modulation rate with the 400 Hz/1 kHz frequency switch (15).

j. Set METER switch (5) to AM and vary AM LEVEL control (12) until the Meter (7) indicates the desired modulation depth. Use top scale (10 = 100%).

AM—EXTERNAL

k. Set METER switch (5) to AM, and AM Source (14) to EXT. Apply signal to the AM OUTPUT/INPUT connector (13) (600 ohm load impedance). The Signal Generator requires 1 Vpk (0.7071 Vrms) for 100% modulation. Set percent AM using AM LEVEL (12) and Meter (7).

CAUTION

Damage to the generator's internal circuitry may occur if inputs greater than 10 Vpk (ac + dc) are coupled to the AM OUTPUT/INPUT connector.

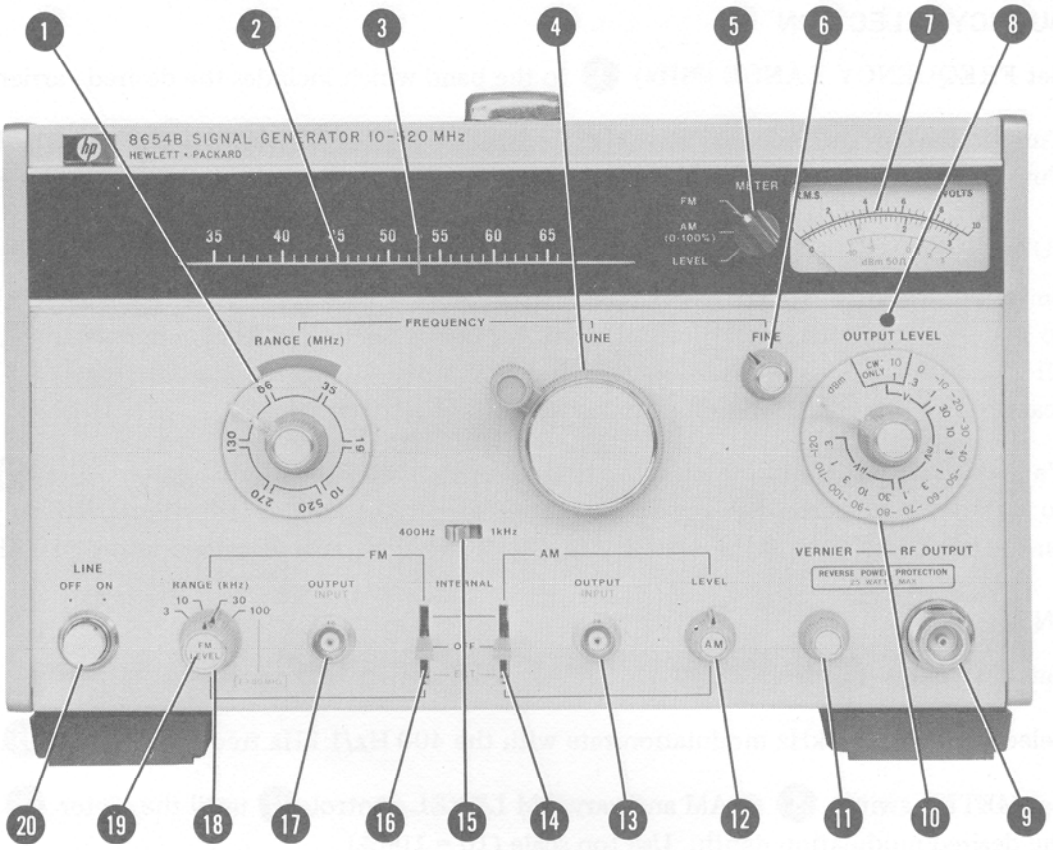
NOTES

The meter is calibrated for percent AM when AM LEVEL (12) is fully cw and 1 Vpk input signal produces full-scale meter deflection.

. . . continued

Figure 3-4. Operating Instructions (2 of 5)

OPERATING INSTRUCTIONS



NOTES

Amplitude modulation is not recommended when the OUTPUT LEVEL control is set to +10 dBm. If AM is necessary, monitor the RF output with an oscilloscope; verify that the distortion is minimal. Frequency modulation is permissible on the +10 dBm range.

The AM meter responds to the negative peaks of the modulation signal. If the modulation signal waveform is asymmetrical or if it has a dc component, the meter reading will be in error.

FM–INTERNAL

l. Set FM Source (16) to INTERNAL.

m. Select 400 Hz or 1 kHz internal modulating rate with the 400 Hz/1 kHz frequency switch (15).

n. Select desired peak deviation range with FM RANGE (kHz) control (18). Set METER switch (5) to FM and vary FM LEVEL control (19) until the Meter (7) indicates desired deviation.

Figure 3-4. Operating Instructions (3 of 5)

OPERATING INSTRUCTIONS

NOTE

FM is not specified on the 100 kHz range for RF signals less than 80 MHz.

FM—EXTERNAL

o. Set METER switch (5) to FM, and FM Source (16) to EXT. Set FM RANGE (kHz) (18) to the lowest range that includes the frequency deviation desired. Apply signal to the FM OUTPUT/INPUT connector (17) (600 ohm load impedance). The Signal Generator requires 1 Vpk (0.7071 Vrms) for maximum peak frequency deviation on any FM range. Set peak frequency deviation using FM LEVEL (19) and Meter (7) .

CAUTION

Damage to the generator's internal circuitry may occur if inputs greater than 10 Vpk (ac + dc) are coupled to the FM OUTPUT/ INPUT connector.

NOTES

The meter is calibrated for peak frequency deviation when FM LEVEL (19) is fully cw and 1 Vpk input signal produces full-scale meter deflection as follows:

FM RANGE (kHz)	Meter Scale	Full-Scale Deviation (kHz)
3	0—3	3.16
10	0—10	10
30	0—3	31.6
100	0—10	100

FM is not specified on the 100 kHz range for RF signals less than 80 MHz.

SIMULTANEOUS AM AND FM

p. Simultaneous AM and FM is possible if at least one of the modulation sources is external. Follow the appropriate steps above for internal or external modulation.

PULSE MODULATION

q. Set FREQUENCY RANGE (MHz) and TUNE controls to the desired frequency, the AM and FM Source controls to OFF, and AM LEVEL fully cw.

r. Set OUTPUT LEVEL and VERNIER controls to the desired output level. (This will be the output level during pulse on-time.)

Figure 3-4. Operating Instructions (4 of 5)

OPERATING INSTRUCTIONS

s. Connect a pulse generator to the AM OUTPUT/INPUT connector.

t. Set the pulse generator controls to produce a pulse on-time voltage of 0.0 Vdc and an off-time voltage of −1.5 Vdc. Set other pertinent pulse generator controls.

CAUTION

Damage to the generator's input circuitry may occur if inputs greater than 10 Vpk (ac + dc) are coupled to the AM OUTPUT/INPUT connector.

NOTES

The pulse-on time voltage must be 0.0 Vdc or the output level during the on-time will not be equal to the preset level.

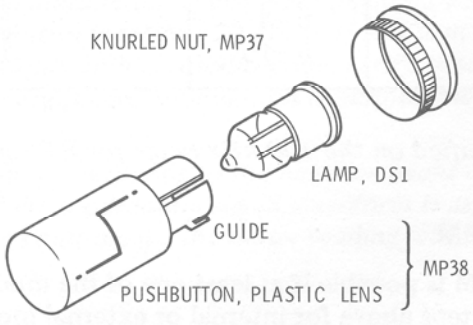
The On-Off ratio is typically > 40 dB.

u. Set AM Source to EXT.

NOTE

Rise time for pulse modulated output is typically 50 µs.

Figure 3-4. Operating Instructions (5 of 5)



POWER LAMP REPLACEMENT

1. Remove lens by pulling straight out.
2. Replace lamp.
3. To replace lens, align guide with notch in receptacle. Push straight in.

Figure 3-5. Lamp Replacement

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the HP Model 8654B using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in Section III under Operator's Checks.

4-3. EQUIPMENT REQUIRED

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

4-5. TEST RECORD

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

4-7. PERFORMANCE TESTS

4-8. The performance tests given in this section are suitable for incoming inspection, troubleshooting or preventative maintenance. During any performance test, all shields and connecting hardware must be in place. The tests are designed to verify published instrument specifications. Perform the tests in the order given and record the data on the test card and/or in the data spaces provided throughout each procedure.

NOTES

Unless otherwise specified, no warmup period is required for these tests.

Line voltage must be within +5%, —10% of nominal if the performance tests are to be considered valid.

4-9. The specifications are written as they appear in Table 1-1, Specifications. A description of the test and any special instructions or problem areas are included. Most tests that require test equipment have a setup drawing; and each have a list of the required equipment. The initial steps of each procedure give control settings required for that particular test.

PERFORMANCE TESTS

4-10. FREQUENCY ACCURACY TEST

SPECIFICATION:

Accuracy: ±3% after 2-hour warmup.

DESCRIPTION:

The frequency at several points on each range is measured with a counter.

EQUIPMENT:

Frequency Counter	HP 5327C

PROCEDURE:

1. Connect Signal Generator RF OUTPUT to counter's high frequency input after setting controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
FINE TUNE	Centered
OUTPUT LEVEL	0 dBm
AM	OFF
FM	OFF

2. After a 2-hour warmup, precisely set Signal Generator frequency to each point listed in the following table. Counter should read within ±3% of dial indication.

Generator Frequency		Counter Reading (MHz)
RANGE (MHz)	Dial Indication (MHz)	
270—520	500	485 _____ 515
	450	437 _____ 464
	400	388 _____ 412
	350	340 _____ 361
	300	291 _____ 309
130—270	130	126.1 _____ 133.9
	150	145.5 _____ 154.5
	170	164.9 _____ 175.1
	190	184.3 _____ 195.7
	210	203.7 _____ 216.3
	230	223.1 _____ 236.9
	250	242.5 _____ 257.5
	270	261.9 _____ 278.1

PERFORMANCE TESTS

4-10. FREQUENCY ACCURACY TEST (cont'd)

Generator Frequency		Counter Reading (MHz)
RANGE (MHz)	Dial Indication (MHz)	
66—130	130	126.1 _____ 133.9
	120	116.4 _____ 123.6
	110	106.7 _____ 113.3
	100	97.0 _____ 103.0
	90	87.3 _____ 92.7
	80	77.6 _____ 82.4
	70	67.9 _____ 72.1
35—66	35	34.0 _____ 36.1
	40	38.8 _____ 41.2
	45	43.7 _____ 46.4
	50	48.5 _____ 51.5
	55	53.4 _____ 56.7
	60	58.2 _____ 61.8
	65	63.1 _____ 67.0
19—35	35	33.95 _____ 36.05
	30	29.10 _____ 30.90
	25	24.25 _____ 25.75
	20	19.40 _____ 20.60
10—19	10	9.70 _____ 10.30
	12	11.64 _____ 12.36
	14	13.58 _____ 14.42
	16	15.52 _____ 16.48
	18	17.46 _____ 18.54

4-11. SETTABILITY TEST

SPECIFICATION:

Settable to within 5 ppm of the desired frequency with an external indicator after 1-hour warmup.

DESCRIPTION:

Using a frequency counter as a monitor, the output of the Signal Generator is set to within 5 ppm of the desired frequency.

EQUIPMENT:

Frequency Counter . . . . . HP 5327C

PERFORMANCE TESTS

4-11. SETTABILITY TEST (cont'd)

PROCEDURE:

1. Connect Signal Generator RF OUTPUT to counter's high frequency input after setting controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
OUTPUT LEVEL	0 dBm
AM	OFF
FM	OFF

2. After a 1-hour warmup, verify that the Signal Generator frequency may be set to within 5 ppm of 500, 400, 200, and 10 MHz while monitoring the output frequency on the counter.

Verification of Settability _____(√)

4-12. FREQUENCY STABILITY TEST

SPECIFICATION:

Stability (after 2-hour warmup and 15 minutes after frequency change): < (1 kHz plus 20 ppm)/5 min.

DESCRIPTION:

Frequency drift is checked with a counter after a 2-hour warmup and 15 minutes after a frequency range change.

EQUIPMENT:

Frequency Counter	HP 5327C

PROCEDURE:

1. Set Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
OUTPUT LEVEL	0 dBm
AM	OFF
FM	OFF

2. Warm up Signal Generator and counter for 2 hours.

3. Connect Signal Generator RF OUTPUT to counter's high frequency input. Set counter gate time to obtain 100 Hz resolution.

4. Note counter reading at beginning and end of a 5-minute period. The difference in counter readings should be less than 11 kHz.

_____ 11 kHz

PERFORMANCE TESTS

4-12. FREQUENCY STABILITY TEST (cont'd)

NOTE

During these tests, ambient temperature and line voltage should be constant.

5. Set FREQUENCY RANGE to 130—270 MHz and FREQUENCY TUNE to 250 MHz. Let Signal Generator stabilize for 15 minutes.

6. Note counter reading at beginning and end of a 5-minute period. The difference in counter readings should be less than 6 kHz. _____ 6 kHz

4-13. HARMONIC DISTORTION TEST

SPECIFICATION:

Harmonic Distortion (output power $\leq$ + 3 dBm): $>$ 20 dB below carrier.

DESCRIPTION:

Harmonics are measured with a spectrum analyzer at a +3 dBm output from the Signal Generator as the frequency is tuned from 10 to 520 MHz.

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C

PROCEDURE:

1. Connect Signal Generator RF OUTPUT to spectrum analyzer input after setting generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	520 MHz
OUTPUT LEVEL	+3 dBm (meter reads +3 dB)
AM	OFF
FM	OFF

2. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, and optimum input level to 0 dBm (40 dB attenuation). Set analyzer frequency span and center frequency controls, and set Signal Generator FREQUENCY RANGE control as listed in following table. For each FREQUENCY RANGE, tune generator across the band. Record minimum difference of harmonic levels with respect to fundamental. Harmonics should be more than 20 dB down from fundamental.

PERFORMANCE TESTS

4-13. HARMONIC DISTORTION TEST (cont'd)

Spectrum Analyzer		Signal Generator	Harmonics (dB down from carrier)
Frequency Span Per Division (MHz)	Center Frequency (MHz)	FREQUENCY RANGE (MHz)	
100	700	270—520	20 _____
100	600	130—270	20 _____
100	500	66—130	20 _____
50	250	35—66	20 _____
20	100	19—35	20 _____
10	50	10—19	20 _____

4-14. SUBHARMONICS AND NON-HARMONIC SPURIOUS TEST

SPECIFICATION:

Subharmonics and non-harmonic spurious (excluding line related): >100 dB down.

DESCRIPTION:

The fundamental of the RF signal is removed by a notch filter to prevent overdriving the spectrum analyzer. The filtered signal is amplified and displayed on a spectrum analyzer, and the spectrum is examined for subharmonics and other spurious signals.

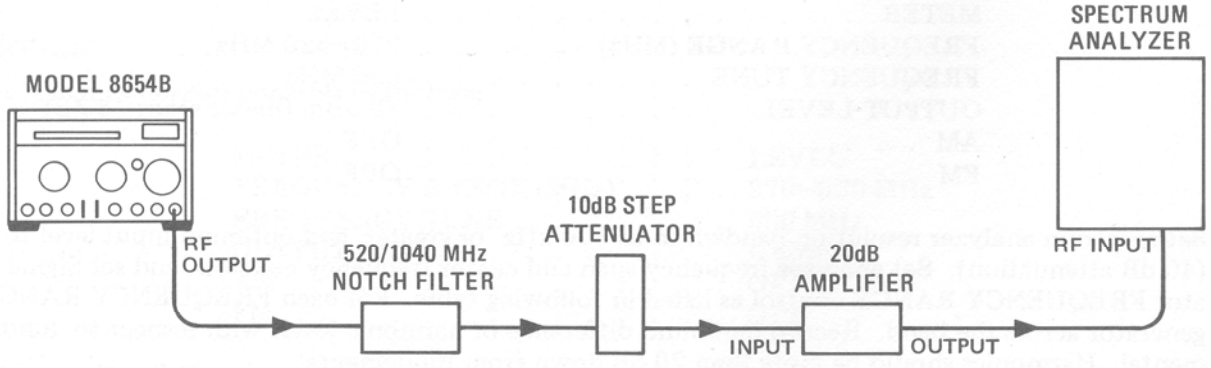


Figure 4-1. Subharmonic and Non-Harmonic Spurious Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C
20 dB Amplifier	HP 8447A
10 dB Step Attenuator	HP 355D
520/1040 MHz Notch Filter . . .	HP 08640-60502

PERFORMANCE TESTS

4-14. SUBHARMONICS AND NON-HARMONIC SPURIOUS TEST (cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-1 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	130—270 MHz
FREQUENCY TUNE	270 MHz
OUTPUT LEVEL	+10 dBm
AM	OFF
FM	OFF

2. Set step attenuator to 50 dB. Set spectrum analyzer optimum input level to —40 dBm (0 dB attenuation), vertical scale to 10 dB/division log, vertical reference control to —10 dBm, resolution bandwidth to 30 kHz, frequency span to 1 MHz per division, and tune frequency controls to set 270 MHz signal at center of display. Adjust vertical reference level controls to set signal peak to top graticule line on display.

3. Set FREQUENCY RANGE (MHz) to 270—520 MHz. Set step attenuator to 0 dB. Tune analyzer frequency controls to display signal at approximately 520 MHz. Tune generator FREQUENCY TUNE until signal is minimum (approximately 520 MHz). Signal should be below top graticule line.

4. Tune spectrum analyzer slowly down to 10 MHz and check display for spurious signals. Spurious signals should be more than 50 dB below top graticule line (i.e., more than 100 dB down from reference).

100 dB _____

NOTE

If a spurious signal is noted, verify that it is not being picked up from an external source by reducing Signal Generator OUTPUT LEVEL switch 10 dB. A true spurious signal will also drop 10 dB.

4-15. RESIDUAL AM TEST

SPECIFICATION:

Residual AM (average rms): >55 dB below carrier in a 50 Hz to 15 kHz post-detection noise bandwidth.

DESCRIPTION:

To calibrate the system, the Signal Generator is internally amplitude modulated at a 10% depth. The AM is demodulated with a spectrum analyzer in a zero-frequency span mode. The demodulated AM is amplified and measured with a true rms voltmeter which becomes a reference of 20 dB down from the carrier. The AM is shut off and the amount of residual AM is measured relative to the 20 dB reference. A filter at the voltmeter input defines the measurement bandwidth.

4-15. RESIDUAL AM TEST (cont'd)

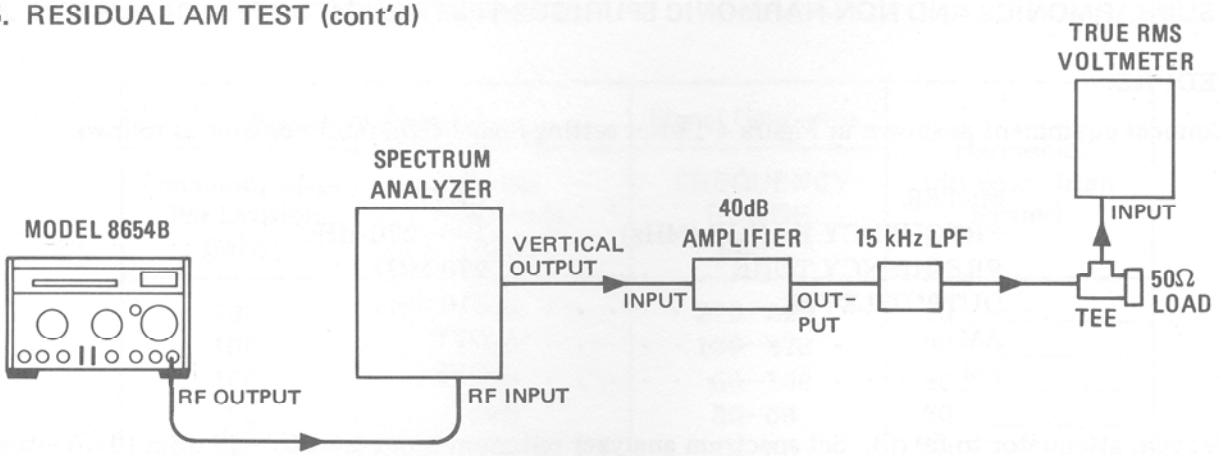


Figure 4-2. Residual AM Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C Opt 807
40 dB Amplifier	HP 465A
True RMS Voltmeter	HP 3400A
15 kHz Low-pass Filter	CIR-Q-TEL 7 Pole
50Ω Load	HP 11593A

PROCEDURE:

1. Connect equipment as shown in Figure 4-2 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
OUTPUT LEVEL	—40 dBm (meter reads 0 dB)
AM	INTERNAL
AM LEVEL	Fully ccw
FM	OFF
400 Hz/1 kHz	1 kHz

2. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to —40 dBm (0 dB attenuation), vertical scale to linear, display smoothing to minimum (off) and adjust frequency controls to center 500 MHz signal on display. Set frequency span to 0, fine adjust frequency controls to peak signal on display. Adjust vertical reference level controls to bring signal level to approximately the fifth graticule line from the bottom.

3. Set METER to AM and adjust AM LEVEL for a panel meter reading of 10%.

4. Readjust analyzer vertical scale control to a convenient reference on voltmeter's dB scale. This reference is 20 dB down from the carrier.

NOTE

If amplifier clipping is suspected, check the voltmeter input with an oscilloscope. If it is clipping, set the amplifier gain to 20 dB.

4-15. RESIDUAL AM TEST (cont'd)

5. Set AM to OFF. Voltmeter average reading should drop more than 35 dB (i.e., more than 55 dB down from carrier).

55 dB _____

4-16. RESIDUAL FM TEST

SPECIFICATION:

Residual FM on CW (averaged rms deviation): <0.3 ppm in a 0.3 to 3 kHz post-detection noise bandwidth. <0.5 ppm in a 50 Hz to 15 kHz post-detection noise bandwidth.

DESCRIPTION:

The residual FM present on the Signal Generator output is demodulated by an FM discriminator whose output is amplified and measured with a true rms voltmeter. A filter at the voltmeter input defines the measurement bandwidth. A reference generator and mixer convert the RF output of the test Signal Generator to within the range of the discriminator.

NOTE

The residual FM of the reference generator should be less than 1/3 of that specified for the 8654B since the test measures the residual FM of both generators simultaneously. Also, both generators should be free from mechanical vibrations and loud noises for this test.

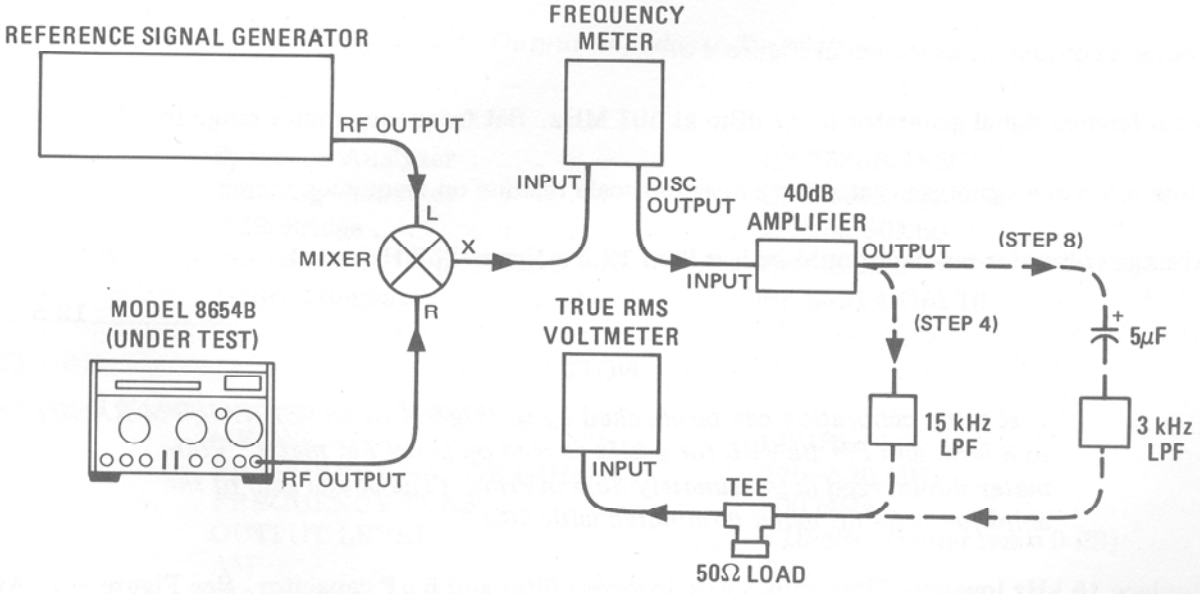


Figure 4-3. Residual FM Test Setup

PERFORMANCE TESTS

4-16. RESIDUAL FM TEST (cont'd)

EQUIPMENT:

Frequency Meter	HP 5210A
Filter Kit (for Frequency Meter)	HP 10531A
True RMS Voltmeter	HP 3400A
40 dB Amplifier	HP 465A
Reference Signal Generator	HP 8640A
Mixer	HP 10514A
3 kHz Low-pass Filter	CIR-Q-TEL 5 Pole
15 kHz Low-pass Filter	CIR-Q-TEL 7 Pole
Capacitor 5 μF	HP 0180-2211
50 Ohm Load	HP 11593A

PROCEDURE:

1. Set test Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
OUTPUT LEVEL	—10 dBm
AM	OFF
FM	OFF

2. Install shorting board in frequency meter and calibrate for 1 Vdc (at output jack) for a full-scale meter reading.

3. Install 50 kHz Butterworth low-pass filter in frequency meter.

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

5. Set reference signal generator to +7 dBm at 501 MHz. Set frequency meter range to 1 MHz.

6. Tune reference signal generator for a near full-scale reading on frequency meter.

7. Average voltmeter reading should be less than 12.5 mVrms (250 Hz—rms).

_____12.5 mVrms

NOTE

Test setup calibration can be checked by setting FM to INTERNAL, FM RANGE to 3 kHz, and FM LEVEL for 1 kHz as read on panel FM meter. Voltmeter should read approximately 35.4 mVrms. (The actual gain of the amplifier is 34 dB when terminated with 50Ω.)

8. Replace 15 kHz low-pass filter with 3 kHz low-pass filter and 5 μF capacitor. See Figure 4-3. Average voltmeter reading should be less than 7.5 mVrms (150 Hz—rms).

_____7.5 mVrms

PERFORMANCE TESTS

4-17. OUTPUT IMPEDANCE TEST

SPECIFICATION:

Impedance: 50Ω ac coupled. SWR <1.3 on 0.1V range or lower. With Option 003, SWR <1.5 on 0.1V range or lower.

DESCRIPTION:

A tracking generator is used as an external 50Ω signal source to feed an SWR bridge. The output port of the bridge is connected to a spectrum analyzer. The through port of the bridge is connected to a short circuit to establish a reference, then to the generator output. Return loss versus frequency is displayed on the spectrum analyzer.

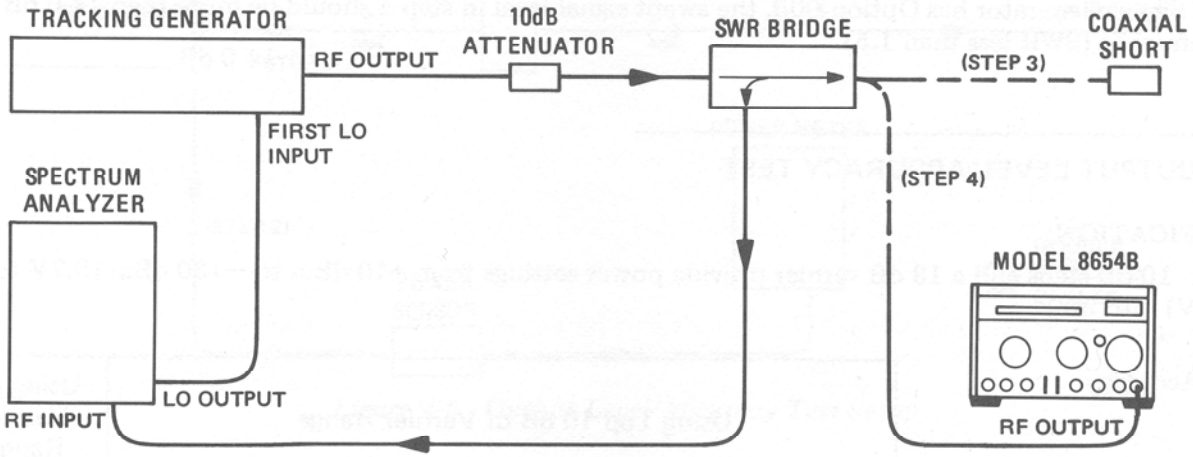


Figure 4-4. Output Impedance Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C
Tracking Generator	HP 8444A Opt 058
SWR Bridge	Wiltron 60N50
Coaxial Short, Type N Male	HP 11512A
10 dB Attenuator	HP 8491A Opt 10

PROCEDURE:

1. Set Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
OUTPUT LEVEL	—10 dBm (meter reads 0 dB)
AM	OFF
FM	OFF

PERFORMANCE TESTS

4-17. OUTPUT IMPEDANCE TEST (cont'd)

2. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to −20 dBm (20 dB attenuation), and frequency controls for a frequency span of 0 to 500 MHz. Set tracking generator output for 0 dBm.

3. Connect equipment as shown in Figure 4-4. Connect coaxial short to bridge output port. Use spectrum analyzer vertical reference level controls to set swept signal display to top graticule line of display with 10 dB/division log vertical scale.

4. Remove coaxial short and connect bridge output port to Signal Generator RF OUTPUT. Ignoring signal present at 500 MHz, verify that a swept signal level is more than 17.7 dB below reference (SWR less than 1.3) from 10 to 520 MHz (non-Option 003 only).

17.7 dB_____

5. If Signal Generator has Option 003, the swept signal level in step 4 should be more than 14.0 dB below reference (SWR less than 1.5).

14.0 dB _____

4-18. OUTPUT LEVEL ACCURACY TEST

SPECIFICATION:

Range: 10 dB steps and a 13 dB vernier provide power settings from +10 dBm to −130 dBm (0.7V to 0.07 μV) into 50Ω.

Level Accuracy:

	Using Top 10 dB of Vernier Range				Using Full Vernier Range
Output Level (dBm)	**+10 to −7**	**−7 to −57**	**−57 to −97**	**−97 to −127**	**+10 to −130**
Total Accuracy as indicated on Level Meter (dB)	±1.5	±2.0	± 2.5	±3.0	Add ±0.5

DESCRIPTION:

The RF level accuracy for the +10 and 0 dBm ranges is measured with a power meter. For the lower ranges, a reference signal is established on a spectrum analyzer display, the Signal Generator OUTPUT LEVEL switch and the spectrum analyzer vertical scale log reference level control are stepped together and any amplitude variations appear on the analyzer display. An RF attenuator and amplifier at the RF OUTPUT are adjusted for analyzer compatibility and best sensitivity.

PERFORMANCE TESTS

4-18. OUTPUT LEVEL ACCURACY TEST (cont'd)

NOTE

This measurement uses an IF substitution technique in which the spectrum analyzer IF is the standard. The IF step accuracy should be within ±0.2 dB overall. The IF step accuracy can be checked using the above technique by comparing a lab calibrated attenuator (such as HP Model 355D Option H36) with the IF step control at the frequency of attenuator calibration (e.g. 3 MHz for the HP 355D Option H36).

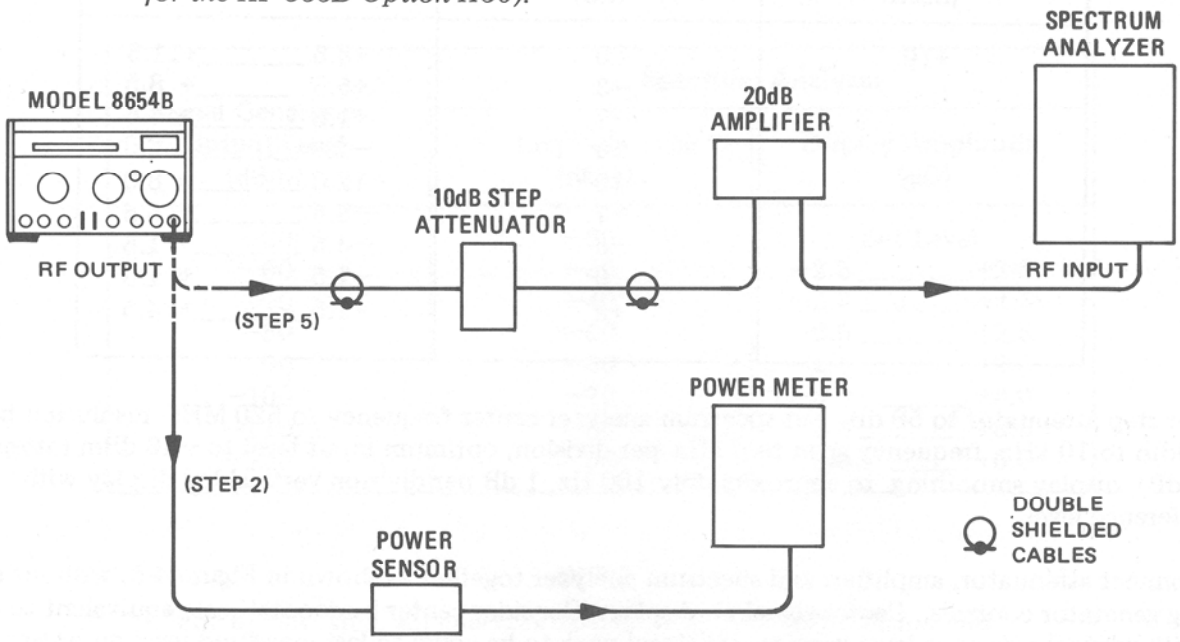


Figure 4-5. Output Level Accuracy Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C
Power Meter/Sensor	HP 435A/8481A
20 dB Amplifier	HP 8447A
10 dB Step Attenuator	HP 355D
Double Shielded Cables (2 required)	HP 08708-6033

PROCEDURE:

1. Set Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	520 MHz
OUTPUT LEVEL	+10 dBm
AM	OFF
FM	OFF

2. Set power meter controls to +15 dBm range. Connect power sensor to Signal Generator RF OUTPUT.

PERFORMANCE TESTS

4-18. OUTPUT LEVEL ACCURACY TEST (cont'd)

3. Set Signal Generator RF OUTPUT level as shown in table below; verify that level is within the specified tolerance.

Signal Generator		Power Meter Reading (dBm)
OUTPUT LEVEL Switch (dBm)	Panel Meter Reading (dB)	
+10	0	+8.5 _____ +11.5
	−3	+5.5 _____ + 8.5
	−7	+1.5 _____ + 4.5
	−10	−2.0 _____ + 2.0
0	−10	−12.0 _____ − 8.0
	−7	−8.5 _____ − 5.5
	−3	−4.5 _____ − 1.5
	0	−1.5 _____ + 1.5
	+3	+1.5 _____ + 4.5

4. Set step attenuator to 50 dB. Set spectrum analyzer center frequency to 520 MHz, resolution bandwidth to 10 kHz, frequency span to 5 kHz per division, optimum input level to −40 dBm (attenuation, 0 dB), display smoothing to approximately 100 Hz, 1 dB per division vertical log display with −20 dBm reference level.

5. Connect attenuator, amplifier, and spectrum analyzer together as shown in Figure 4-5, without disturbing generator controls. Center signal on display. Consider center horizontal scale equivalent to +3 dBm. With vertical reference level vernier ; set signal peak to be equal to last measured level on power meter.

NOTE

If, for example, the last power meter reading was +2.6 dBm, the vertical scale resolution is 1 dB/division, therefore, the signal peak should be 0.4 dB or 0.4 division below the center scale reference.

6. Set Signal Generator OUTPUT LEVEL control and analyzer vertical scale log control as shown in the following table. Verify that amplitude falls within ±2.0 dB (2 divisions) of center scale reference in each case.

Signal Generator Output Level (dB)	Spectrum Analyzer	
	Log Reference (dBm)	Display Amplitude (dB)
0	−20	Set Level
−10	−30	−2.0 _____ +2.0
−20	−40	−2.0 _____ +2.0
−30	−50	−2.0 _____ +2.0
−40	−60	−2.0 _____ +2.0
−50	−70	−2.0 _____ +2.0

PERFORMANCE TESTS

4-18. OUTPUT LEVEL ACCURACY TEST (cont'd)

7. Set analyzer's vertical reference level to −20 dBm and reset 10 dB step attenuator to 0 dB. With vertical reference level vernier set signal peak to same level, with respect to horizontal center scale reference, as last measurement recorded on preceding table.

8. Set Signal Generator OUTPUT LEVEL control and analyzer vertical reference level as shown in following table. Verify that amplitude is within tolerance specified.

Signal Generator Output Level (dBm)	Spectrum Analyzer	
	Log Reference (dBm)	Display Amplitude (dB)
−50	−20	Set Level
−60	−30	−2.5 _____ +2.5
−70	−40	−2.5 _____ +2.5
−80	−50	−2.5 _____ +2.5
−90	−60	−2.5 _____ +2.5
−100	−70	−3.0 _____ +3.0
−110	−80	−3.0 _____ +3.0
−120	−90	−3.0 _____ +3.0

NOTE

For the last step, set analyzer vertical scale to 10 dB/division and verify that noise level is at least 10 dB below signal.

4-19. OUTPUT LEVEL FLATNESS TEST

SPECIFICATION:

Level Flatness: ±1 dB referenced to the output at 250 MHz for output levels > −7 dBm.

DESCRIPTION:

An output level reference is established at 250 MHz and the maximum and minimum output levels are measured as the Signal Generator is tuned across each band. The test is performed at both maximum and minimum specified ALC reference levels.

EQUIPMENT:

Power Meter and Sensor . . . . . HP 435A/8481A

4-19. OUTPUT LEVEL FLATNESS TEST (cont'd)

PROCEDURE:

1. Set Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	130—270 MHz
FREQUENCY TUNE	250 MHz
OUTPUT LEVEL	+10 dBm
AM	OFF
FM	OFF

2. Set power meter range to +10 dBm. Connect power sensor to Signal Generator RF OUTPUT.

3. Adjust Signal Generator VERNIER control for power meter reading of +9 dBm at 250 MHz.

4. Slowly tune Generator across each band and note maximum and minimum power readings for each range. The maximum should not exceed +10 dBm and the minimum should not be less than +8 dBm.

Frequency Range (MHz)	Power Meter Reading	
	Minimum (dBm)	Maximum (dBm)
270—520	+8 _____	_____ +10
130—270	+8_____	_____ +10
66—130	+8_____	_____ +10
35—66	+8_____	_____ +10
19—35	+8_____	_____ +10
10—19	+8_____	_____ +10

5. Set Signal Generator frequency to 250 MHz; set OUTPUT LEVEL to 0 dBm and adjust VERNIER for panel meter reading of —7 dB.

6. Set power meter range to —5 dBm and adjust Signal Generator VERNIER for power meter reading of —7 dBm.

7. Slowly tune generator across each band and note maximum and minimum power meter readings for each range. The maximum should not exceed —6 dBm and the minimum should not be less than —8 dBm.

PERFORMANCE TESTS

4-19. OUTPUT LEVEL FLATNESS TEST (cont'd)

Frequency Range (MHz)	Power Meter Reading	
	Minimum (dBm)	Maximum (dBm)
270—520	−8 _____	_____ −6
130—270	−8_____	_____ −6
66—130	−8_____	_____ −6
35—66	−8_____	_____ −6
19—35	−8_____	_____ −6
10—19	−8_____	_____ −6

4-20. AUXILIARY RF OUTPUT TEST

SPECIFICATION:

Auxiliary RF Output: > −7 dBm (100 mV) in 50Ω.

DESCRIPTION:

The power level from the auxiliary output is measured across all frequency ranges at maximum specified RF output.

EQUIPMENT:

Power Meter and Sensor	HP 435A/8481A
50Ω Load	HP 11593A

PROCEDURE:

1. Connect a 50Ω load to Signal Generator RF OUTPUT, then set controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz) . .	10—19 MHz
FREQUENCY TUNE	10 MHz
OUTPUT LEVEL	+10 dBm
AM	OFF
FM	OFF

2. Connect power sensor to rear panel AUX RF OUT.

3. Tune generator across all nominal frequency ranges. Power meter should indicate more than −7 dBm for all ranges.

−7 dBm _____ (√)

PERFORMANCE TESTS

4-21. OUTPUT LEAKAGE TEST

SPECIFICATION:

Leakage (with all RF outputs terminated properly):

Leakage limits are below those specified in MIL-1-6181D. Furthermore, with an output level <0.01V, less than 0.5 μV is induced in a 2-turn, 1-inch diameter loop 1 inch away from any surface and measured into a 50Ω receiver.

DESCRIPTION:

A loop antenna is held one inch from all surfaces of the Signal Generator and any leakage monitored with a spectrum analyzer. The loop antenna is suspended in a molding so that when the molding is in contact with a surface, the loop antenna is one inch from the surface.

NOTES

The use of a screen room may be necessary to reduce interference from other sources.

Do not hold the antenna near the loop end while performing test.

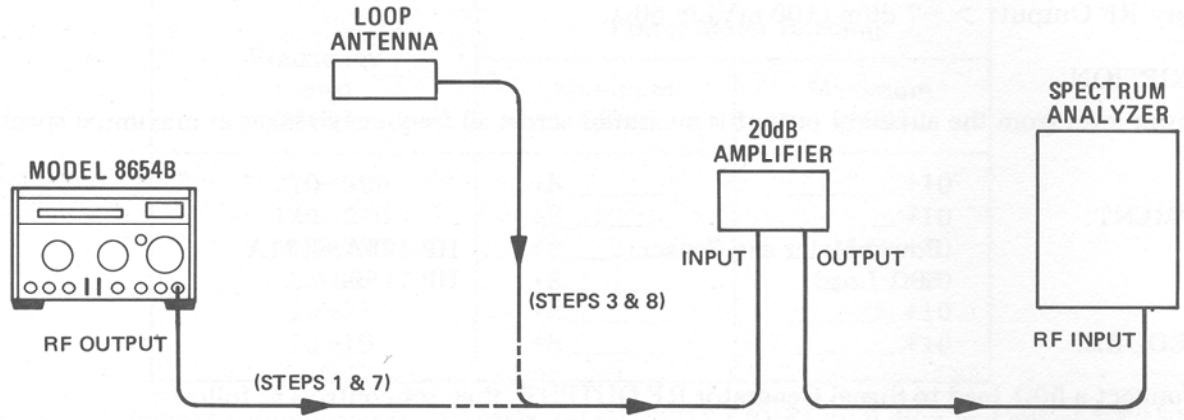


Figure 4-6. Output Leakage Test Setup

EQUIPMENT:

Loop Antenna	HP 08640-60501
20 dB Amplifier (0.1—400 MHz)	HP 8447A
20 dB Amplifier (400—1200 MHz)	HP 8447B
Spectrum Analyzer	HP 8558B/182C
50 Ohm Load (2 required)	HP 11593A

PROCEDURE:

1. Connect equipment as shown in Figure 4-6 (with Signal Generator connected to spectrum analyzer through 0.1 to 400 MHz amplifier). Set generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	66—130 MHz

PERFORMANCE TESTS

4-21. OUTPUT LEAKAGE TEST (cont'd)

FREQUENCY TUNE	100 MHz
OUTPUT LEVEL	−113 dBm (meter reads −3 dBm)
AM	OFF
FM	OFF

2. Set Spectrum analyzer resolution bandwidth to 30 kHz, optimum input level to −40 dBm (0 dB input attenuation), frequency span to 50 kHz per division, vertical scale to 10 dB/division log, display smoothing to approximately 100 Hz, and center frequency controls to locate 100 MHz signal. Use vertical reference level controls to set −113 dBm signal to −40 dB graticule line on display.

3. Disconnect generator from analyzer and connect 50 ohm loads to generator RF OUTPUT and rear panel AUX RF OUT connectors. Set analyzer frequency span to 20 MHz per division.

4. Connect loop antenna to analyzer through 0.1—400 MHz 20 dB amplifier. Hold the one-inch side of loop antenna cylinder in contact with various surfaces of Signal Generator and observe display for the duration of a sweep. All signals and noise should be below −40 dB graticule line on display (i.e., less than −113 dBm or 0.5 μV) from 10 to 200 MHz.

(√) _____ 0.5 μV)

5. Set analyzer center frequency control to 300 MHz and repeat step 4. All signals and noise should be below −40 dB graticule line on display (i.e., less than −113 dBm or 0.5 μV) from 200—400 MHz.

(√) _____ 0.5 μV

6. Replace amplifier with 400—1200 MHz 20 dB amplifier. Set analyzer center frequency controls to 500 MHz. Set generator FREQUENCY RANGE (MHz) to 270—520 MHz and FREQUENCY TUNE to 500 MHz.

7. Connect generator to analyzer and calibrate analyzer at 500 MHz as in step 2.

8. Re-terminate Signal Generator RF OUTPUT and connect loop antenna to amplifier. Set analyzer frequency span to 20 MHz per division.

9. Hold antenna in contact with various surfaces of Signal Generator and observe display. All signals and noise should be below −40 dB graticule line on display (i.e., less than −113 dBm or 0.5 μV) from 400—600 MHz.

(√) _____ 0.5 μV

10. Set analyzer frequency to 700, 900, and 1100 MHz, and repeat step 9 at each setting. All signals and noise should be below −40 dB graticule line on display (i.e., less than −113 dBm or 0.5 μV).

600—800 MHz:	(√) _____	0.5 μV
800—1000 MHz:	(√) _____	0.5 μV
1000—1200 MHz:	(√) _____	0.5 μV

PERFORMANCE TESTS

4-22. INTERNAL MODULATION RATE ACCURACY TEST

SPECIFICATION:

Modulation Rate: Internal, 400 and 1000 Hz ± 10%.

DESCRIPTION:

The modulation oscillator frequency is measured at the AM and FM output jacks with a frequency counter.

EQUIPMENT:

Frequency Counter . . . . . HP 5327C

PROCEDURE:

1. Connect counter high impedance input to AM OUTPUT jack. Set AM to INTERNAL and set 400 Hz/1 kHz switch to 400 Hz. Counter should read 400 ± 40 Hz.

   360 _____ 440 Hz

2. Set 400 Hz/1 kHz switch to 1 kHz. Counter should read 1000 ± 100 Hz.

   900 _____ 1100 Hz

3. Connect counter to FM OUTPUT jack. Set FM to INTERNAL. Counter should read 1000 ± 100 Hz.

   900 _____ 1100 Hz

4. Set 400 Hz/1 kHz switch to 400 Hz. Counter should read 400 ± 40 Hz.

   360 _____ 440 Hz

4-23. AM BANDWIDTH TEST

SPECIFICATION:

External 3 dB bandwidth, dc coupled to >20 kHz.

DESCRIPTION:

The Signal Generator is externally amplitude modulated by a test oscillator. The AM is demodulated with a spectrum analyzer in a zero span mode. The AM is observed directly on the display and any change in AM depth is observed as the modulation rate is increased.

PERFORMANCE TESTS

4-23. AM BANDWIDTH TEST (cont'd)

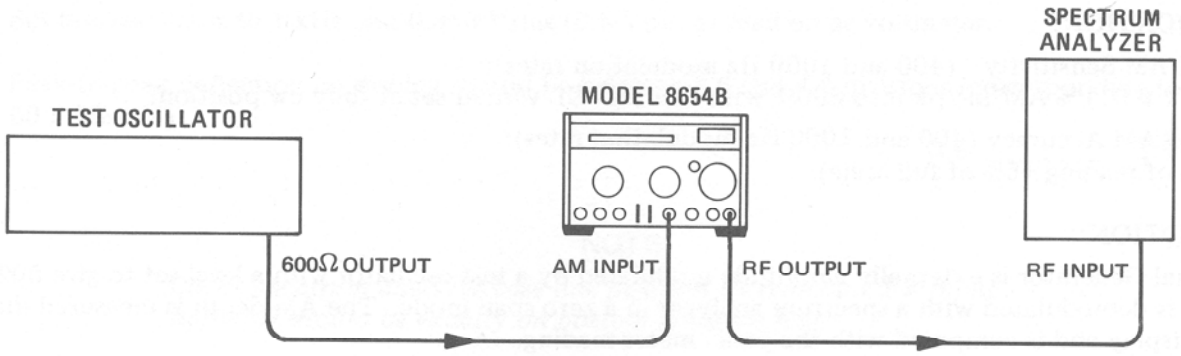


Figure 4-7. AM Bandwidth Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C
Test Oscillator	HP 651B

PROCEDURE:

1. Connect equipment as shown in Figure 4-7 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	520 MHz
OUTPUT LEVEL	—37 dBm (meter reads +3 dB)
AM	INTERNAL
AM LEVEL	Fully ccw
FM	OFF

2. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to —40 dBm (0 dB attenuation), vertical scale to linear, display smoothing to minimum (off), and adjust center frequency controls to center 520 MHz signal on display. Set frequency span to 0; fine adjust frequency controls to peak signal on display. Adjust vertical reference level controls to bring signal level to fourth graticule line from bottom of display.

3. Set test oscillator to 1 kHz and approximately 1 Vrms into 600Ω.

4. Increase AM LEVEL until 4 divisions peak-to-peak of vertical deflection are obtained on display. (Internally trigger spectrum analyzer.)

5. Increase frequency of test oscillator to 20 kHz without changing its level. Peak-to-peak deflection on display should remain greater than 2.8 divisions for frequencies up to 20 kHz (i.e., >3 dB).

2.8 divisions _____

PERFORMANCE TESTS

4-24. AM SENSITIVITY AND INDICATED ACCURACY TEST

SPECIFICATION:

External AM Sensitivity (400 and 1000 Hz modulation rates):
(0.10 ± 0.01) % AM/mVpk into 600Ω with AM LEVEL vernier set at fully cw position.

Indicated AM Accuracy (400 and 1000 Hz modulation rates):
± (5% of reading +5% of full scale).

DESCRIPTION:

The Signal Generator is externally amplitude modulated by a test oscillator with a level set to give 50% AM. The AM is demodulated with a spectrum analyzer in a zero span mode. The AM depth is measured directly on the display and is compared with the panel meter reading.

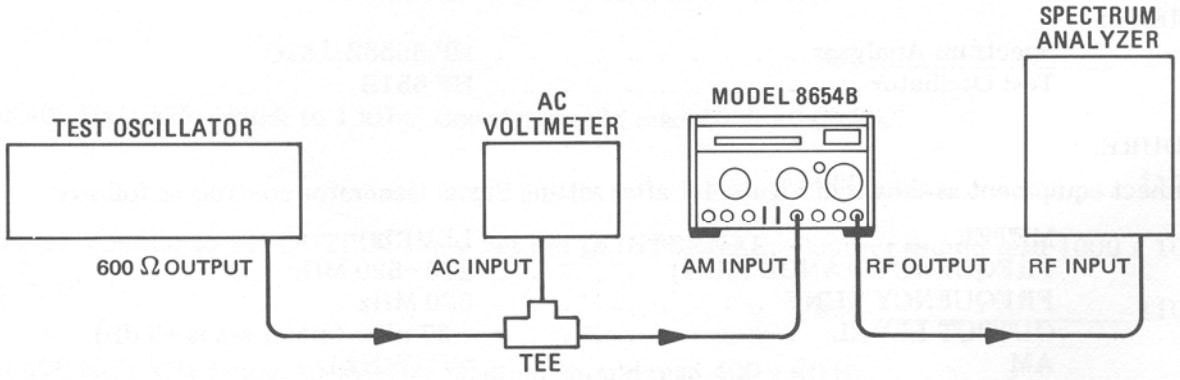


Figure 4-8. AM Sensitivity and Indicated Accuracy Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C
Test Oscillator	HP 651B
Multimeter	HP 34740A/34702A

PROCEDURE:

1. Connect equipment as shown in Figure 4-8 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	520 MHz
OUTPUT LEVEL	—37 dBm (meter reads +3 dB)
AM	EXT
AM LEVEL	Fully cw
FM	OFF

2. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to —40 dBm (0 dB attenuation), vertical scale to linear, display smoothing to between 10 and 50 kHz, and adjust center frequency controls to center 520 MHz signal on display. Adjust vertical reference level controls to bring signal level to fourth graticule line from bottom of display.

PERFORMANCE TESTS

4-24. AM SENSITIVITY AND INDICATED ACCURACY TEST (cont'd)

3. Set test oscillator to 1 kHz and 0.353 Vrms (0.5 Vpk) as read on ac voltmeter.

4. Peak-to-peak deflection on display should be between 3.6 and 4.4 divisions (corresponding to 50 ± 5% AM).

3.6 _____ 4.4 divisions

NOTE

Check spectrum analyzer base line position by removing RF input. Base line should be exactly on bottom graticule line.

5. Adjust both test oscillator level and spectrum analyzer vertical level as needed for signal to span the second and sixth graticule lines from the bottom of display.

6. Set METER to AM. Meter should read between 42.5% and 57.5% (i.e., 50.0 ± 7.5% AM).

42.5% _____ 57.5%

4-25. PEAK INCIDENTAL FREQUENCY DEVIATION TEST

SPECIFICATION:

Peak Incidental Frequency Deviation (30% AM, 400 and 1000 Hz modulation rates): less than 200 Hz.

DESCRIPTION:

The incidental frequency deviation present on the Signal Generator output (when amplitude modulated at 30% depth and 1 kHz rate) is demodulated by an FM discriminator whose output is amplified and measured with an oscilloscope. The system is first calibrated by noting the signal level on the oscilloscope with a known amount of FM applied. A reference generator and mixer convert the RF output of the test Signal Generator to within the range of the discriminator.

EQUIPMENT:

Frequency Meter	HP 5210A
Filter Kit (for Frequency Meter)	HP 10531A
Oscilloscope	HP 1820C/1801A/182C
40 dB Amplifier	HP 465A
Reference Signal Generator	HP 8640A
Mixer	HP 10514A
3 kHz Low-pass Filter	CIR-Q-TEL 5 Pole
50Ω Load	HP 11593A

PERFORMANCE TESTS

4-25. PEAK INCIDENTAL FREQUENCY DEVIATION TEST (cont'd)

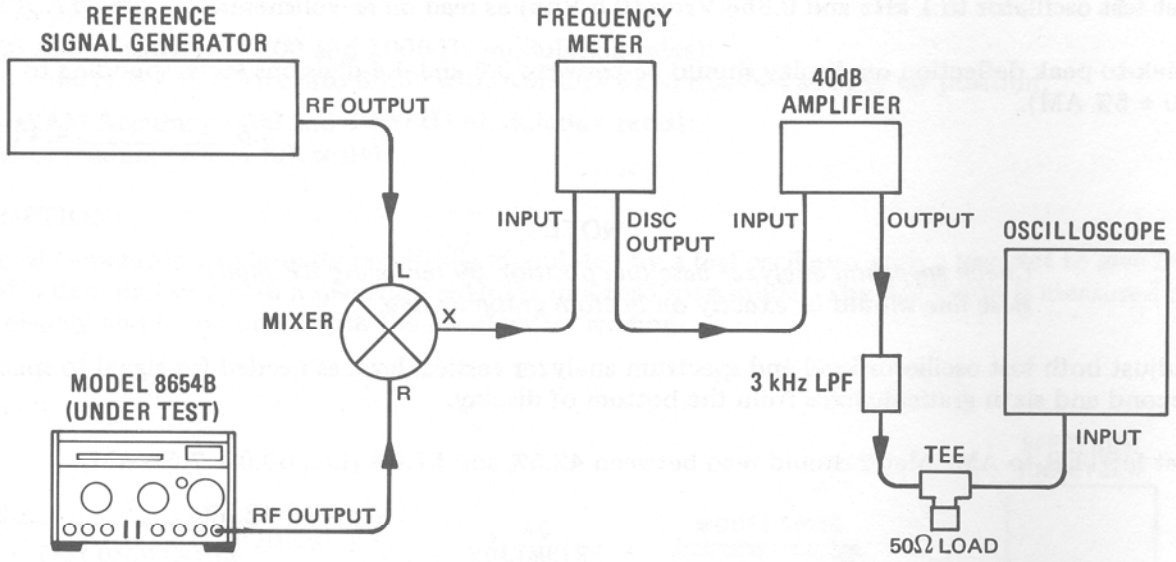


Figure 4-9. Peak Incidental Frequency Deviation Test Setup

PROCEDURE:

1. Connect equipment as shown in Figure 4-9 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
OUTPUT LEVEL	—27 dBm (meter reads +3 dB)
AM	OFF
FM	INTERNAL
FM RANGE (kHz)	3 kHz
FM LEVEL	Fully ccw
400 Hz/1 kHz Switch	1 kHz

2. Install 10 kHz Butterworth low-pass filter in frequency meter.

3. Set reference signal generator to +7 dBm at 501 MHz. Set frequency meter range to 1 MHz and trigger level to 0.01 Vrms.

4. Tune reference generator for a near full-scale reading on frequency meter.

5. Set METER to FM. Increase test generator FM LEVEL for 1 kHz FM deviation as read on panel meter.

6. Adjust oscilloscope gain for 5 divisions of peak-to-peak deflection of the demodulated FM signal.

7. Set FM to OFF and AM to INTERNAL. Set METER to AM. Adjust AM LEVEL for 30% AM as read on panel meter.

PERFORMANCE TESTS

4-25. PEAK INCIDENTAL FREQUENCY DEVIATION TEST (cont'd)

8. Observe signal on oscilloscope and adjust frequency meter trigger level for smallest 1 kHz signal. Peak-to-peak deflection of 1 kHz signal (not including any low frequency variations) should be less than 1 division (i.e., 1/5 of the 1 kHz calibration level or 200 Hz peak).

_____ 1 division

NOTE

If a substitute for the frequency meter is used, it must be carefully checked for its internal AM to phase modulation conversion.

4-26. AM DISTORTION TEST

SPECIFICATION:

Envelope Distortion (400 and 1000 Hz modulation rates): <3%, 0 to 70% modulation; <5%, 90% modulation.

DESCRIPTION:

The Signal Generator is internally amplitude modulated. The AM is demodulated with a spectrum analyzer in a zero-frequency span mode. The distortion of the demodulated signal (present at the vertical output of the spectrum analyzer) is measured with a distortion analyzer. The measurement is made at a low ALC reference level where AM distortion is typically greatest.

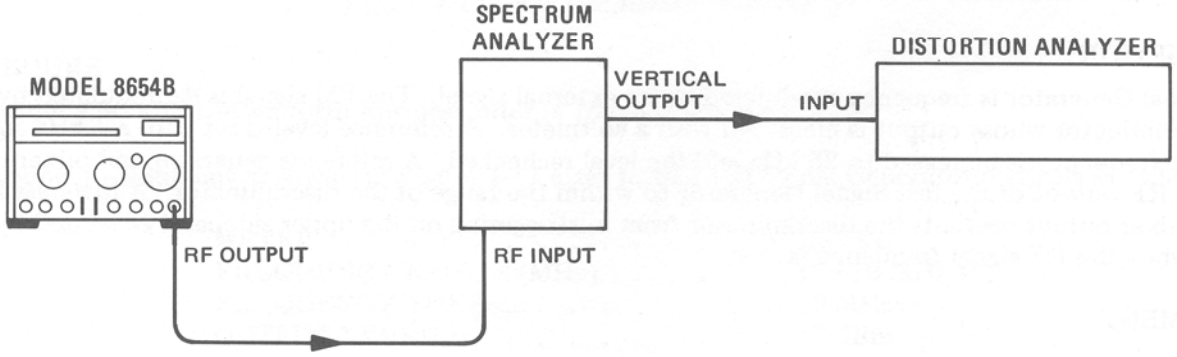


Figure 4-10. AM Distortion Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C Opt 807
Distortion Analyzer	HP 331A

PROCEDURE:

1. Connect equipment as shown in Figure 4-10 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	520 MHz
OUTPUT LEVEL	—37 dBm (meter reads —7 dB)
AM	INTERNAL
AM LEVEL	Fully ccw
FM	OFF
400 Hz/1 kHz Switch	1 kHz

PERFORMANCE TESTS

4-26. AM DISTORTION TEST (cont'd)

2. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to −40 dBm (0 dB attenuation), vertical scale to linear, and adjust center frequency controls to center 520 MHz signal on display. Set frequency span to 0; fine adjust frequency controls to peak signal on display. Adjust vertical reference level controls to center signal on display. Set display smoothing to between 10 and 50 kHz.

3. Adjust AM LEVEL for front panel meter reading of 70% AM when METER is set to AM.

4. Calibrate distortion analyzer to measure distortion which should be less than 3%.

_____ 3%

5. Increase AM LEVEL to 90% as read on panel meter.

6. Recalibrate distortion analyzer. Distortion should be less than 5%. _____ 5%

4-27. FM BANDWIDTH TEST

SPECIFICATION:

External 3 dB bandwidth, dc coupled to >25 kHz.

DESCRIPTION:

The Signal Generator is frequency modulated by an external signal. The FM signal is demodulated by an FM discriminator whose output is measured with a voltmeter. A reference level is set with a 1 kHz signal, then the frequency is increased to 25 kHz and the level rechecked. A reference generator and mixer convert the RF output of the test Signal Generator to within the range of the discriminator. A low-pass filter at the mixer output prevents the discriminator from mistriggering on the upper sideband generated by the mixer when the RF signal frequency is low.

EQUIPMENT:

Frequency Meter	HP 5210A
Filter Kit (for Frequency Meter)	HP 10531A
Multimeter	HP 34702A/34740A
Signal Generator (reference)	HP 8640A
Test Oscillator	HP 651B
Mixer	HP 10514A
4 MHz Low-pass Filter	CIR-Q-TEL 3 Pole

PERFORMANCE TESTS

4-27. FM BANDWIDTH TEST (cont'd)

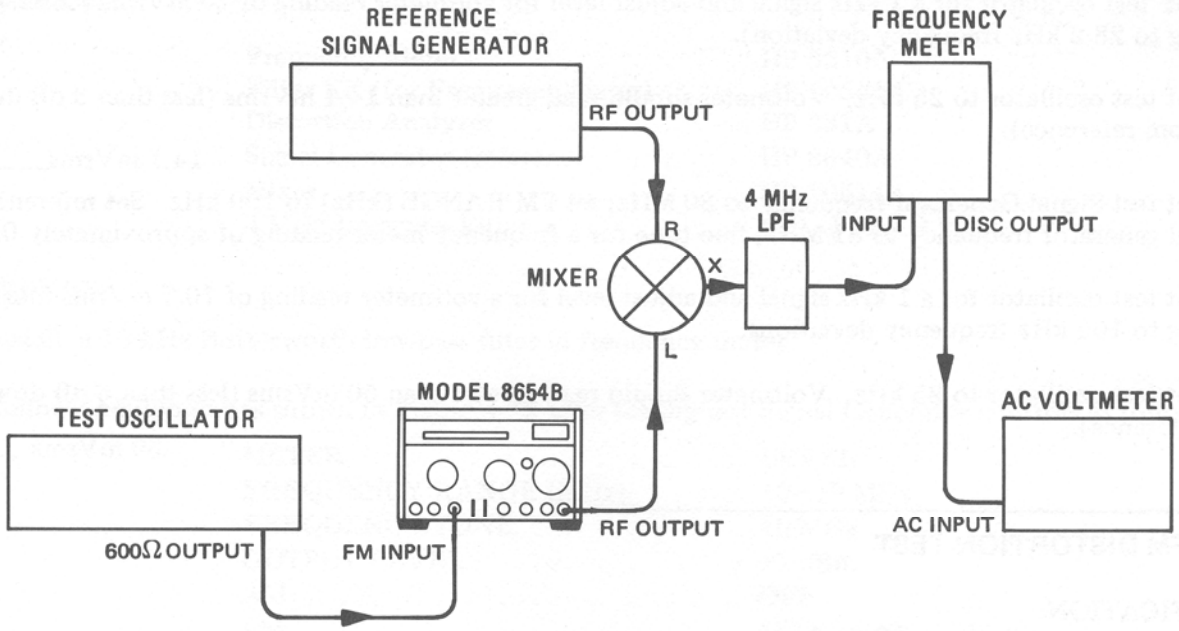


Figure 4-11. FM Bandwidth Test Setup

PROCEDURE:

1. Install a 50 kHz Butterworth low-pass filter in frequency meter.

2. Connect equipment as shown in Figure 4-11 after setting test Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	10 MHz
OUTPUT LEVEL	+7 dBm
AM	OFF
FM	EXT
FM RANGE (kHz)	30 kHz
FM LEVEL	Fully cw

3. Set reference signal generator for a —7 dBm signal at 11 MHz.

4. Set frequency meter to trigger on input signal; set frequency range to 1 MHz. Fine tune reference signal generator for an on-scale frequency meter reading of approximately 0.8 MHz.

NOTE

If any readings appear to be highly erroneous, check the triggering on the frequency meter. The discriminator output should also be monitored on an oscilloscope and should appear as a pure sinewave.

PERFORMANCE TESTS

4-27. FM BANDWIDTH TEST (cont'd)

5. Set test oscillator for a 1 kHz signal and adjust level for voltmeter reading of 20 mVrms (corresponding to 28.2 kHz frequency deviation).

6. Set test oscillator to 25 kHz. Voltmeter should read greater than 14.1 mVrms (less than 3 dB down from reference).

14.1 mVrms_____

7. Set test Signal Generator frequency to 80 MHz; set FM RANGE (kHz) to 100 kHz. Set reference signal generator frequency to 81 MHz; fine tune for a frequency meter reading of approximately 0.8 MHz.

8. Set test oscillator for a 1 kHz signal and adjust level for a voltmeter reading of 70.7 mVrms (corresponding to 100 kHz frequency deviation).

9. Set test oscillator to 25 kHz. Voltmeter should read greater than 50 mVrms (less than 3 dB down from reference).

50 mVrms _____

4-28. FM DISTORTION TEST

SPECIFICATION:

FM Distortion (400 and 1000 Hz modulation rates): <2% for deviations up to 30 kHz, <3% for deviations up to 100 kHz.

DESCRIPTION:

The Signal Generator is frequency modulated internally at a 1 kHz rate. The FM signal is demodulated by an FM discriminator whose output is checked with a distortion analyzer. A reference generator and mixer convert the RF output of the test Signal Generator to within the range of the discriminator. A low-pass filter at the mixer output prevents the discriminator from mistriggering on the upper sideband generated by the mixer when the RF signal frequency is low.

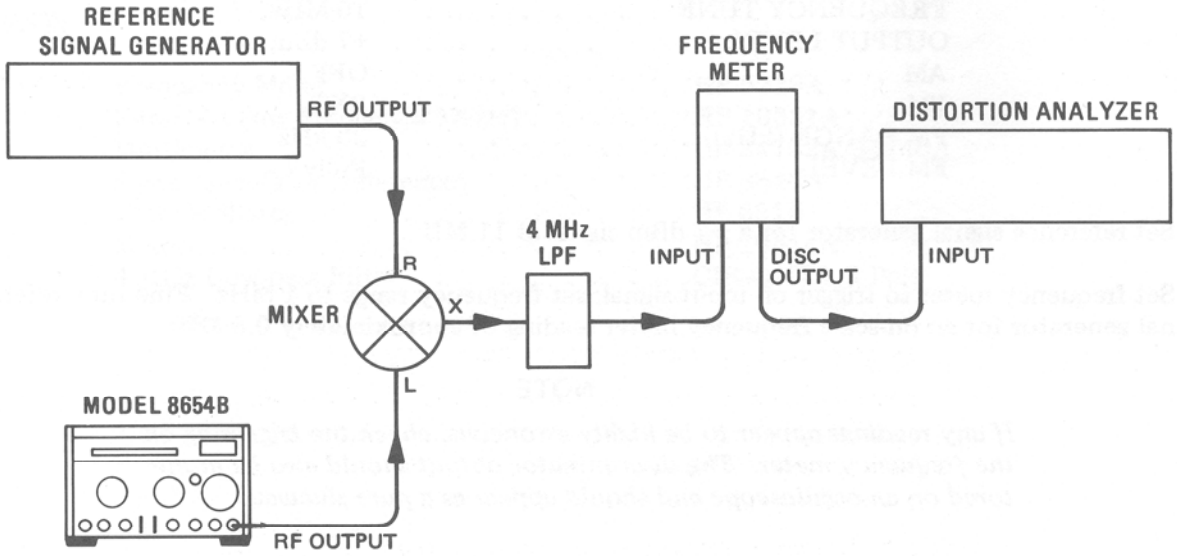


Figure 4-12. FM Distortion Test Setup

PERFORMANCE TESTS

4-28. FM DISTORTION TEST (cont'd)

EQUIPMENT:

Frequency Meter	HP 5210A
Filter Kit (for Frequency Meter)	HP 10531A
Distortion Analyzer	HP 331A
Signal Generator (reference)	HP 8640A
Mixer	HP 10514A
4 MHz Low-pass Filter	CIR-Q-TEL 3 Pole

PROCEDURE:

1. Install a 10 kHz Butterworth low-pass filter in frequency meter.

2. Connect equipment as shown in Figure 4-12 after setting test Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	10 MHz
OUTPUT LEVEL	+7 dBm
AM	OFF
FM	INTERNAL
FM RANGE (kHz)	30 kHz
FM LEVEL	Fully ccw
400 Hz/1 kHz Switch	1 kHz

3. Set reference signal generator for a —7 dBm signal at 11 MHz.

4. Set METER to FM and FM LEVEL for a panel meter reading of 30 kHz.

5. Set frequency meter to trigger on input signal; set frequency range to 1 MHz. Fine tune reference signal generator for an on-scale frequency meter reading of approximately 0.8 MHz.

6. Set test and reference generators to the following frequencies. For each setting, fine tune reference generator to obtain frequency meter reading of approximately 0.8 MHz. Calibrate distortion analyzer for 1 kHz signal and measure distortion which should be less than 2%.

NOTES

The set level on the distortion analyzer will need to be set to a low range because of the low level of the discriminator output. This level becomes the 100% level. Also, this calibration need be re-checked only if the reading is suspect.

If any reading appears to be highly erroneous, check the triggering on the frequency meter. The discriminator output should also be monitored on an oscilloscope and should appear as a pure sinewave.

If a frequency meter filter greater than 10 kHz is used, the noise in the system may appear to contribute to distortion.

4-28. FM DISTORTION TEST (cont'd)

RANGE (MHz)	FREQUENCY TUNE	Ref. Gen. Frequency	Distortion
10—19	10 MHz	11 MHz	_____ 2%
	14 MHz	15 MHz	_____ 2%
	19 MHz	20 MHz	_____ 2%
19—35	19 MHz	20 MHz	_____ 2%
	27 MHz	28 MHz	_____ 2%
	35 MHz	36 MHz	_____ 2%
35—66	35 MHz	36 MHz	_____ 2%
	50 MHz	51 MHz	_____ 2%
	66 MHz	67 MHz	_____ 2%
66—130	66 MHz	67 MHz	_____ 2%

7. Set FM RANGE (kHz) to 100 kHz and adjust FM LEVEL for a panel meter reading of 100 kHz. Recalibrate distortion analyzer for 1 kHz and continue using settings listed below. Distortion should be less than 3%.

RANGE (MHz)	FREQUENCY TUNE	Ref. Gen. Frequency	Distortion
66—130	80 MHz	79 MHz	_____ 3%
	130 MHz	129 MHz	_____ 3%
130—270	130 MHz	129 MHz	_____ 3%
	190 MHz	189 MHz	_____ 3%
	270 MHz	269 MHz	_____ 3%
270—520	270 MHz	269 MHz	_____ 3%
	400 MHz	399 MHz	_____ 3%
	520 MHz	519 MHz	_____ 3%

4-29. FM SENSITIVITY AND METER ACCURACY TEST

SPECIFICATION:

External FM Sensitivity (400 and 1000 Hz modulation rates): 1 volt peak yields maximum deviation indicated on peak deviation meter with FM LEVEL vernier at fully cw position.

Sensitivity Accuracy (15° to 35°C, 400 and 1000 Hz modulation rates): ±10%. For 100 kHz deviation above 130 MHz, ±13 %.

4-29. FM SENSITIVITY AND METER ACCURACY TEST (cont'd)

SPECIFICATION (cont'd)

Indicated FM Accuracy (15° to 35°C, 400 and 1000 Hz modulation rates): ± (10% of reading +3% of full scale). For 100 kHz deviation above 130 MHz add 3% of reading.

DESCRIPTION:

The Signal Generator is frequency modulated by an externally applied 1 Vpk signal. The FM signal is demodulated by an FM discriminator whose output is measured with a voltmeter. A reference generator and mixer convert the RF output of the test Signal Generator to within the range of the discriminator. A low-pass filter at the mixer output prevents the discriminator from mistriggering on the upper sideband generated by the mixer when the RF signal frequency is low.

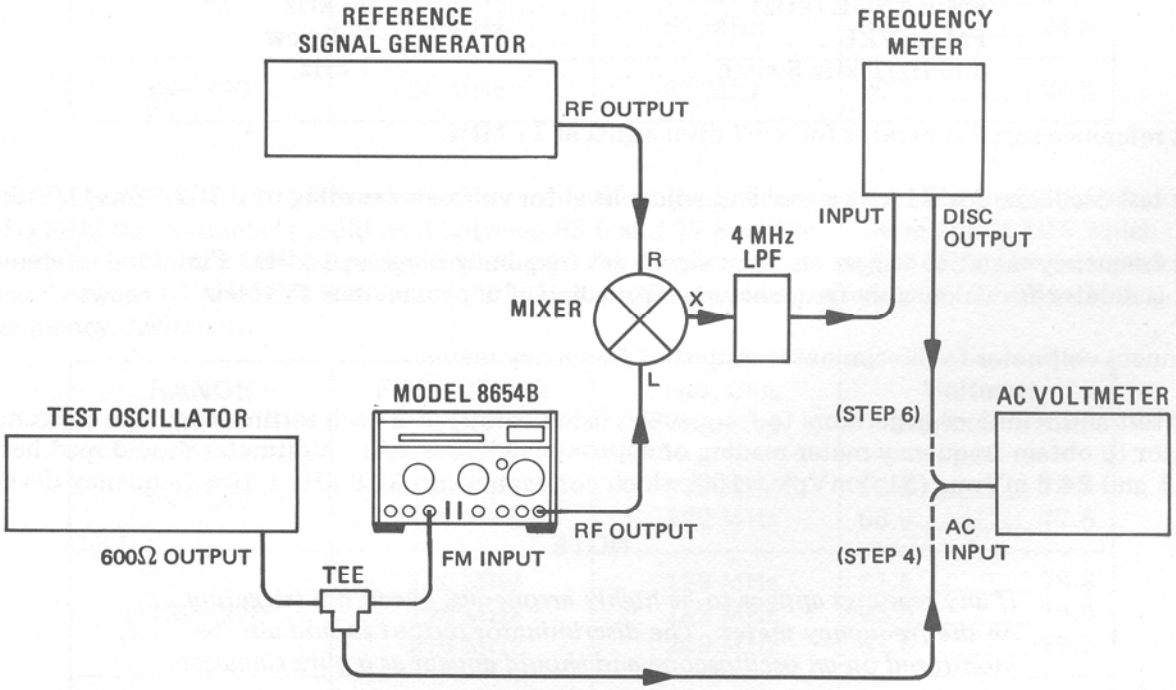


Figure 4-13. FM Sensitivity and Meter Accuracy Test Setup

EQUIPMENT:

Frequency Meter	HP 5210A
Filter Kit (for Frequency Meter)	HP 10531A
Multimeter	HP 34702A/34740A
Signal Generator (reference)	HP 8640A
Test Oscillator	HP 651B
Mixer	HP 10514A
4 MHz Low-pass Filter	CIR-Q-TEL 3 Pole

PERFORMANCE TESTS

4-29. FM SENSITIVITY AND METER ACCURACY TEST (cont'd)

PROCEDURE:

1. Install shorting board in frequency meter and calibrate it for 1 Vdc at output jack for a full-scale meter reading. Remove shorting board and install a 50 kHz Butterworth low-pass filter.

2. Connect equipment as shown in Figure 4-13 after setting test Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	10 MHz
OUTPUT LEVEL	+7 dBm
AM	OFF
FM	EXT
FM RANGE (kHz)	30 kHz
FM LEVEL	Fully cw
400 Hz/1 kHz Switch	1 kHz

3. Set reference signal generator for a −7 dBm signal at 11 MHz.

4. Set test oscillator for a 1 kHz signal and adjust level for voltmeter reading of 0.707 Vrms (1 Vpk).

5. Set frequency meter to trigger on input signal; set frequency range to 1 MHz. Fine tune reference signal generator for an on-scale frequency meter reading of approximately 0.8 MHz.

6. Connect voltmeter to discriminator output of frequency meter.

7. Set test and reference generators to frequencies listed below. For each setting, fine tune reference generator to obtain frequency meter reading of approximately 0.8 MHz. Voltmeter should read between 20.1 and 24.6 mVrms (31.6 mVpk ± 10% which corresponds to 31.6 kHz ± 10% frequency deviation).

NOTE

If any readings appear to be highly erroneous, check the triggering on the frequency meter. The discriminator output should also be monitored on an oscilloscope and should appear as a pure sinewave.

PERFORMANCE TESTS

4-29. FM SENSITIVITY AND METER ACCURACY TEST (cont'd)

RANGE (MHz)	FREQUENCY TUNE	Ref. Gen. Frequency	Voltmeter Limits (mVrms)
10—19	10 MHz 14 MHz 19 MHz	11 MHz 15 MHz 20 MHz	20.1 _____ 24.6 20.1 _____ 24.6 20.1 _____ 24.6
19—35	19 MHz 27 MHz 35 MHz	20 MHz 28 MHz 36 MHz	20.1 _____ 24.6 20.1 _____ 24.6 20.1 _____ 24.6
35—66	35 MHz 50 MHz 66 MHz	36 MHz 51 MHz 67 MHz	20.1 _____ 24.6 20.1 _____ 24.6 20.1 _____ 24.6
66—130	66 MHz	67 MHz	20.1 _____ 24.6

8. Set FM RANGE to 100 kHz and continue using the settings listed below. For frequencies below 130 MHz the voltmeter should read between 63.6 and 77.8 mVrms (100 mVpk ± 10% which corresponds to 100 kHz ±10% frequency deviation). For frequencies above 130 MHz, the voltmeter should read between 61.5 and 79.9 mVrms (100 mVpk ±13% which corresponds to 100 kHz ±13% frequency deviation).

RANGE (MHz)	FREQUENCY TUNE	Ref. Gen. Frequency	Voltmeter Limits (mVrms)
66—130	80 MHz 130 MHz	79 MHz 129 MHz	63.6 _____ 77.8 63.6 _____ 77.8
130—270	130 MHz 190 MHz 270 MHz	129 MHz 189 MHz 269 MHz	61.5 _____ 79.9 61.5 _____ 79.9 61.5 _____ 79.9
270—520	270 MHz 400 MHz 520 MHz	269 MHz 399 MHz 519 MHz	61.5 _____ 79.9 61.5 _____ 79.9 61.5 _____ 79.9

9. Set METER to FM and FM to INTERNAL at 1 kHz. Adjust FM LEVEL for a reading of 10 (100 kHz) on test Signal Generator panel meter.

10. Continue as before using the following settings. For frequencies above 130 MHz, the voltmeter should read between 59.4 and 82.0 mVrms (100 mVpk± 16% which corresponds to 100 kHz ± 16% frequency deviation). For frequencies below 130 MHz, the voltmeter should read between 61.5 and 79.9 mVrms (100 mVpk ± 13% which corresponds to 100 kHz ± 13% deviation).

PERFORMANCE TESTS

4-29. FM SENSITIVITY AND METER ACCURACY TEST (cont'd)

RANGE (MHz)	FREQUENCY TUNE	Ref. Gen. Frequency	Voltmeter Limits (mVrms)
270—520	520 MHz	519 MHz	59.4 _____ 82.0
	400 MHz	399 MHz	59.4 _____ 82.0
	270 MHz	269 MHz	59.4 _____ 82.0
130—270	270 MHz	269 MHz	59.4 _____ 82.0
	190 MHz	189 MHz	59.4 _____ 82.0
	130 MHz	129 MHz	59.4 _____ 82.0
66—130	130 MHz	129 MHz	61.5 _____ 79.9
	80 MHz	79 MHz	61.5 _____ 79.9

11. Set FM RANGE (kHz) to 30 kHz. If necessary adjust FM LEVEL to maintain a panel meter reading of 10 on the 10 scale which corresponds to 31.6 kHz deviation as read on 3 scale. Continue using settings listed below. Voltmeter should read between 19.5 and 25.3 mVrms (31.6 mVpk ± 13% which corresponds to 31.6 kHz ± 13% frequency deviation).

RANGE (MHz)	FREQUENCY TUNE	Ref. Gen. Frequency	Voltmeter Limits (mVrms)
66—130	66 MHz	67 MHz	19.5 _____ 25.3
35—66	66 MHz	67 MHz	19.5 _____ 25.3
	50 MHz	51 MHz	19.5 _____ 25.3
	35 MHz	36 MHz	19.5 _____ 25.3
19—35	35 MHz	36 MHz	19.5 _____ 25.3
	27 MHz	28 MHz	19.5 _____ 25.3
	19 MHz	20 MHz	19.5 _____ 25.3
10—19	19 MHz	20 MHz	19.5 _____ 25.3
	14 MHz	15 MHz	19.5 _____ 25.3
	10 MHz	11 MHz	19.5 _____ 25.3

4-30. INCIDENTAL AM TEST

SPECIFICATION:

Incidental AM (400 and 1000 Hz modulation rates): <1% AM at 30 kHz deviation.

DESCRIPTION:

The Signal Generator is first internally amplitude modulated at a 10% depth. The AM is demodulated with a spectrum analyzer in a zero-frequency span mode. The demodulated signal (present at the vertical output of the spectrum analyzer) is displayed on an oscilloscope. The AM is switched off and 30 kHz of FM deviation applied to the signal. The AM present is compared with the previous 10% level.

PERFORMANCE TESTS

4-30. INCIDENTAL AM TEST (cont'd)

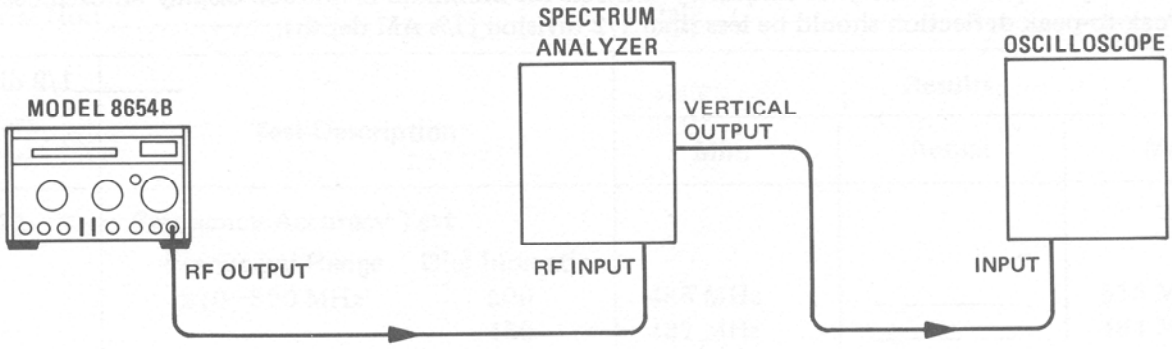


Figure 4-14. Incidental AM Test Setup

NOTE

For this measurement the resolution bandwidth of the spectrum analyzer must be at least 3 MHz.

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C Opt 807
Oscilloscope	HP 1820C/1801A/182C

PROCEDURE:

1. Connect equipment as shown in Figure 4-14 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	500 MHz
OUTPUT LEVEL	—37 dBm (meter reads +3 dB)
AM	INTERNAL
AM LEVEL	Fully ccw
FM	OFF
FM RANGE (kHz)	30 kHz
FM LEVEL	Fully cw
400 Hz/1 kHz Switch	1 kHz

2. Set spectrum analyzer resolution bandwidth to 3 MHz or greater, optimum input level to —40 dBm (0 dB attenuation), vertical scale to linear, and display smoothing between 10 and 50 kHz. Adjust center frequency controls to center signal on display, then set frequency span to 0 and fine adjust frequency controls to peak signal on display. Adjust vertical reference level controls to bring display to approximately the sixth graticule line from bottom.

3. Set METER to AM. Adjust AM LEVEL for 10% AM as read on panel meter.

4. Adjust oscilloscope to view AM signal with 5 divisions of peak-to-peak deflection.

5. Set AM to OFF, FM to INTERNAL, METER to FM, and adjust FM LEVEL for 30 kHz deviation as read on panel meter.

4-30. INCIDENTAL AM TEST (cont'd)

6. Fine adjust spectrum analyzer frequency controls for minimum amplitude display on oscilloscope. Peak-to-peak deflection should be less than 1/2 division (1% AM depth).

_____1/2 division

Table 4-1. Performance Test Record (1 of 6)

Hewlett-Packard
Model 8654B
Signal Generator
Serial No.: _____

Tested By _____

Date _____

Para. No.	Test Description		Results		
			Min.	Actual	Max.
4-10.	**Frequency Accuracy Test**				
	Frequency Range	**Dial Indication**			
	270—520 MHz	500	485 MHz	_____	515 MHz
		450	437 MHz	_____	464 MHz
		400	388 MHz	_____	412 MHz
		350	340 MHz	_____	361 MHz
		300	291 MHz	_____	309 MHz
	130—270 MHz	130	126.1 MHz	_____	133.9 MHz
		150	145.5 MHz	_____	154.5 MHz
		170	164.9 MHz	_____	175.1 MHz
		190	184.3 MHz	_____	195.7 MHz
		210	203.7 MHz	_____	216.3 MHz
		230	223.1 MHz	_____	236.9 MHz
		250	242.5 MHz	_____	257.5 MHz
		270	261.9 MHz	_____	278.1 MHz
	66—130 MHz	130	126.1 MHz	_____	133.9 MHz
		120	116.4 MHz	_____	123.6 MHz
		110	106.7 MHz	_____	113.3 MHz
		100	97.0 MHz	_____	103.0 MHz
		90	87.3 MHz	_____	92.7 MHz
		80	77.6 MHz	_____	82.4 MHz
		70	67.9 MHz	_____	72.1 MHz
	35—66 MHz	35	34.0 MHz	_____	36.1 MHz
		40	38.8 MHz	_____	41.2 MHz
		45	43.7 MHz	_____	46.4 MHz
		50	48.5 MHz	_____	51.5 MHz
		55	53.4 MHz	_____	56.7 MHz
		60	58.2 MHz	_____	61.8 MHz
		65	63.1 MHz	_____	67.0 MHz
	19—35 MHz	35	33.95 MHz	_____	36.05 MHz
		30	29.10 MHz	_____	30.90 MHz
		25	24.25 MHz	_____	25.75 MHz
		20	19.40 MHz	_____	20.60 MHz

Table 4-1. Performance Test Record (2 of 6)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-10.	**Frequency Accuracy Test (cont'd)**			
	Frequency Range **Dial Indication**			
	10—19 MHz 10	9.70 MHz	_____	10.30 MHz
	12	11.64 MHz	_____	12.36 MHz
	14	13.58 MHz	_____	14.42 MHz
	16	15.52 MHz	_____	16.48 MHz
	18	17.46 MHz	_____	18.54 MHz
4-11.	**Settability Test**			
	Verification of Settability		_____	(√)
4-12.	**Frequency Stability Test**			
	500 MHz		_____	11 kHz
	250 MHz		_____	6 kHz
4-13.	**Harmonic Distortion Test**			
	Frequency Range			
	270—520 MHz	20 dB	_____	
	130—270 MHz	20 dB	_____	
	66—130 MHz	20 dB	_____	
	35—66 MHz	20 dB	_____	
	19—35 MHz	20 dB	_____	
	10—19 MHz	20 dB	_____	
4-14.	**Subharmonics and Non-Harmonic Spurious Test**	100 dB	_____	
4-15.	**Residual AM Test**	55 dB	_____	
4-16.	**Residual FM Test**			
	50 Hz—15 kHz Noise BW		_____	12.5 mVrms
	0.3—3 kHz Noise BW		_____	7.5 mVrms
4-17.	**Output Impedance Test**			
	Standard	17.7 dB	_____	
	Option 003	14.0 dB	_____	
4-18.	**Output Level Accuracy Test**			
	Output Level Switch **Meter**			
	+10 dBm 0 dB	+8.5 dBm	_____	+11.5 dBm
	−3 dB	+5.5 dBm	_____	+ 8.5 dBm
	−7 dB	+1.5 dBm	_____	+ 4.5 dBm
	−10 dB	−2.0 dBm	_____	+ 2.0 dBm

Table 4-1. Performance Test Record (3 of 6)

Para. No.	Test Description		Results		
			Min.	Actual	Max.
4-18.	**Output Level Accuracy Test (cont'd)**				
	Output Level Switch	**Meter**			
	0 dBm	−10 dB	−12.0 dBm	_____	−8.0 dBm
		−7 dB	−8.5 dBm	_____	−5.5 dBm
		−3 dB	−4.5 dBm	_____	−1.5 dBm
		0 dB	−1.5 dBm	_____	+1.5 dBm
		+3 dB	+1.5 dBm	_____	+4.5 dBm
	−10 dBm		−2.0 dB	_____	+2.0 dB
	−20 dBm		−2.0 dB	_____	+2.0 dB
	−30 dBm		−2.0 dB	_____	+2.0 dB
	−40 dBm		−2.0 dB	_____	+2.0 dB
	−50 dBm		−2.0 dB	_____	+2.0 dB
	−60 dBm		−2.5 dB	_____	+2.5 dB
	−70 dBm		−2.5 dB	_____	+2.5 dB
	−80 dBm		−2.5 dB	_____	+2.5 dB
	−90 dBm		−2.5 dB	_____	+2.5 dB
	−100 dBm		−3.0 dB	_____	+3.0 dB
	−110 dBm		−3.0 dB	_____	+3.0 dB
	−120 dBm		−3.0 dB	_____	+3.0 dB
4-19.	**Output Level Flatness Test**				
	Output Level	**Frequency Range**			
	+9 dBm	270—520 MHz	+8 dBm	____ ____	+10 dBm
		130—270 MHz	+8 dBm	____ ____	+10 dBm
		66—130 MHz	+8 dBm	____ ____	+10 dBm
		35—66 MHz	+8 dBm	____ ____	+10 dBm
		19—35 MHz	+8 dBm	____ ____	+10 dBm
		10—19 MHz	+8 dBm	____ ____	+10 dBm
	−7 dBm	270—520 MHz	−8 dBm	____ ____	−6 dBm
		130—270 MHz	−8 dBm	____ ____	−6 dBm
		66—130 MHz	−8 dBm	____ ____	−6 dBm
		35—66 MHz	−8 dBm	____ ____	−6 dBm
		19—35 MHz	−8 dBm	____ ____	−6 dBm
		10—19 MHz	−8 dBm	____ ____	−6 dBm

Table 4-1. Performance Test Record (4 of 6)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-20.	**Auxiliary RF Output Test**	−7 dBm	_____	(√)
4-21.	**Output Leakage Test**			
	10—200 MHz	(√)	_____	0.5 μV
	200—400 MHz	(√)	_____	0.5 μV
	400—600 MHz	(√)	_____	0.5 μV
	600—800 MHz	(√)	_____	0.5 μV
	800—1000 MHz	(√)	_____	0.5 μV
	1000—1200 MHz	(√)	_____	0.5 μV
4-22.	**Internal Modulation Rate Accuracy Test**			
	AM 400 Hz	360 Hz	_____	440 Hz
	AM 1 kHz	900 Hz	_____	1100 Hz
	FM 1 kHz	900 Hz	_____	1100 Hz
	FM 400 Hz	360 Hz	_____	440 Hz
4-23.	**AM Bandwidth Test**	2.8 div.	_____	
4-24.	**AM Sensitivity and Indicated Accuracy Test**			
	Sensitivity	3.6 div.	_____	4.4 div.
	Meter Accuracy	42.5%	_____	57.5%
4-25.	**Peak Incidental Frequency Deviation Test**		_____	1 div.
4-26.	**AM Distortion Test**			
	0—70% AM		_____	3%
	90% AM		_____	5%
4-27.	**FM Bandwidth Test**			
	FM Range			
	30 kHz	14.1 mVrms	_____	
	100 kHz	50 mVrms	_____	
4-28.	**FM Distortion Test**			
	FM Range **Frequency Tune**			
	30 kHz 10 MHz		_____	2%
	14 MHz		_____	2%
	19 MHz		_____	2%
	19 MHz		_____	2%
	27 MHz		_____	2%

Table 4-1. Performance Test Record (5 of 6)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-28.	**FM Distortion Test (cont'd)**			
	FM Range / Frequency Tune			
	30 kHz / 35 MHz		_____	2%
	35 MHz		_____	2%
	50 MHz		_____	2%
	66 MHz		_____	2%
	66 MHz		_____	2%
	100 kHz / 80 MHz		_____	3%
	130 MHz		_____	3%
	130 MHz		_____	3%
	190 MHz		_____	3%
	270 MHz		_____	3%
	270 MHz		_____	3%
	400 MHz		_____	3%
	520 MHz		_____	3%
4-29.	**FM Sensitivity and Meter Accuracy Test**			
	FM / FM Range / Frequency Tune			
	EXT 30 kHz / 10 MHz	20.1 mVrms	_____	24.6 mVrms
	14 MHz	20.1 mVrms	_____	24.6 mVrms
	19 MHz	20.1 mVrms	_____	24.6 mVrms
	19 MHz	20.1 mVrms	_____	24.6 mVrms
	27 MHz	20.1 mVrms	_____	24.6 mVrms
	35 MHz	20.1 mVrms	_____	24.6 mVrms
	35 MHz	20.1 mVrms	_____	24.6 mVrms
	50 MHz	20.1 mVrms	_____	24.6 mVrms
	66 MHz	20.1 mVrms	_____	24.6 mVrms
	66 MHz	20.1 mVrms	_____	24.6 mVrms
	100 kHz / 80 MHz	63.6 mVrms	_____	77.8 mVrms
	130 MHz	63.6 mVrms	_____	77.8 mVrms
	130 MHz	61.5 mVrms	_____	79.9 mVrms
	190 MHz	61.5 mVrms	_____	79.9 mVrms
	270 MHz	61.5 mVrms	_____	79.9 mVrms
	270 MHz	61.5 mVrms	_____	79.9 mVrms
	400 MHz	61.5 mVrms	_____	79.9 mVrms
	520 MHz	61.5 mVrms	_____	79.9 mVrms

Table 4-1. Performance Test Record (6 of 6)

Para. No.	Test Description			Results		
				Min.	Actual	Max.
4-29.	**FM Sensitivity and Meter Accuracy Test (cont'd)**					
	FM	**FM Range**	**Frequency Tune**			
	INTER-NAL	100 kHz	520 MHz	59.4 mVrms	_____	82.0 mVrms
			400 MHz	59.4 mVrms	_____	82.0 mVrms
			270 MHz	59.4 mVrms	_____	82.0 mVrms
			270 MHz	59.4 mVrms	_____	82.0 mVrms
			190 MHz	59.4 mVrms	_____	82.0 mVrms
			130 MHz	59.4 mVrms	_____	82.0 mVrms
			130 MHz	61.5 mVrms	_____	79.9 mVrms
			80 MHz	61.5 mVrms	_____	79.9 mVrms
		30 kHz	66 MHz	19.5 mVrms	_____	25.3 mVrms
			66 MHz	19.5 mVrms	_____	25.3 mVrms
			50 MHz	19.5 mVrms	_____	25.3 mVrms
			35 MHz	19.5 mVrms	_____	25.3 mVrms
			35 MHz	19.5 mVrms	_____	25.3 mVrms
			27 MHz	19.5 mVrms	_____	25.3 mVrms
			19 MHz	19.5 mVrms	_____	25.3 mVrms
			19 MHz	19.5 mVrms	_____	25.3 mVrms
			14 MHz	19.5 mVrms	_____	25.3 mVrms
			10 MHz	19.5 mVrms	_____	25.3 mVrms
4-30.	**Incidental AM Test**				_____	1/2 div.

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes the adjustments which will return the HP Model 8654B to peak operating condition. The adjustments are to be performed whenever the performance test results are out of tolerance. This may occur over a period of time because of aging of components within the instrument or because of repair or replacement of certain components, parts, or assemblies. Table 5-2 contains information pertaining to assemblies or parts repaired or replaced, the performance tests which verify the Signal Generator is performing to its maximum capability, and the adjustments to be made if its performance isn't at peak efficiency. Information is also provided about the equipment required to perform the tests, instructions for locating the adjustable components, and factory-selected components.

5-3. The adjustment procedure includes: reference to service sheets where the adjustable components are shown, a description of the test including any problem areas or special instructions, a test equipment setup diagram, the test equipment recommended for the test, and a step-by-step procedure for performing the adjustments.

5-4. EQUIPMENT REQUIRED

5-5. The test equipment required for the adjustment procedures is listed in Table 1-2, Recommended Test Equipment. The critical specifications of substitute test instruments must meet or exceed the standards listed in the table if the performance of the generator is to meet the standards set forth in Table 1-1, Specifications.

5-6. FACTORY-SELECTED COMPONENTS

5-7. Factory-selected components are identified on the schematics and parts list by an asterisk which follows the reference designator. The nominal value of the components is normally shown. The manual change sheets will provide updated information pertaining to the selected components. Table 5-1 lists the reference designator, the criterion used for selecting a particular value, the normal value range, and the service sheet where the component part is shown.

5-8. RELATED ADJUSTMENTS

5-9. The adjustments in this section should be peformed when troubleshooting or performance tests indicate that an adjustable circuit is not operating correctly. Perform the adjustments *after* repairing or replacing the circuit. The required adjustments are specified in Table 5-2.

5-10. After making the adjustments, repeat the performance tests (found in Section 4) specified in the table. In general, if the RF Section casting was opened (or any RF connectors removed) during a repair, the Output Leakage Test should be performed. Performance tests should also be made for any assembly that had a component changed, even if the changed component was not defective. The power supplies should be checked whenever an assembly has been repaired.

NOTE

Table 5-2 can also be used for troubleshooting. If the generator failed one or more performance tests, cross-referencing to the associated assembly or circuitry will often indicate the source of the failure.

5-11. ADJUSTMENT LOCATIONS

5-12. If an adjustable component is mounted on a printed circuit board, it will be shown in the component location diagram which accompanies each schematic.

WARNING

Adjustments described herein are performed with power supplied to the instrument while protective covers are removed. Energy available may, if contacted, result in personal injury or death.

Refer to front matter of manual for additional important cautions and warnings.

Table 5-1. Factory Selected Components (1 of 2)

Reference Designator	Basis of Selection	Normal Value Range	Service Sheet
R6	Selected for a meter reading of < -10 dB with the RF OUTPUT VERNIER set fully ccw. The Meter Adjustments (5—16) should be performed before resistor selection.	909—1000Ω	4
A1A1C4	(See A1A3C6 selection.) If removing A1A3C6 does not solve the RF output flatness/harmonic problem, remove A1A1C4. Perform Harmonic Distortion Test (4-13) and Output Level Flatness Test (4-19).	0 or 6.8 pF	3
A1A1R29	Selected for harmonic levels within published specifications. After resistor selection, verify that RF output power is greater than +10 dBm.	147—215Ω	3
A1A1R39	Selected for output level flatness within specification on the 270—520 MHz band. If frequency response peaks out of specification on the high end of band, decrease value of the resistor.	90.9—121Ω	3
A1A3C6 (see note)	Selected for output level flatness and carrier harmonics within specifications (on the 270—520 MHz band). Normally, when the capacitor is removed, flatness is improved but harmonic content is increased. (See also A1A1C4 selection.) Perform Harmonic Distortion Test (4-13) and Output Level Flatness Test (4-19).	0 or 4.3 pF	2
A1A3C12 (see note)	Selected to provide A1A3C2 adequate adjustment range to lower maximum output frequency on 270—520 MHz band.	0—1.0 pF	2

Table 5-1. Factory Selected Components (2 of 2)

Reference Designator	Basis of Selection	Normal Value Range	Service Sheet
A3R53	Selected to provide correct meter reading in the +10 dBm OUTPUT LEVEL range. Perform Meter Adjustments (5—16)	1330-1470 Ω	4
A5R2 A5R4 A5R6 A5R8 A5R10 A5R12 A5R14 A5R22-25 A5R28-30 A5R33 A5R35 A5R38 A5R40 A5R44 A5R48 (see note)	Breakpoint, slope and exponent network resistors. Perform Preliminary FM Adjustments (5-20), FM Distortion Adjustment (5-21) and FM Deviation Adjustment (5-22)	—	5
A5R66 A5R68 A5R70 A5R72 A5R74 A5R76 A5R84 A5R89 A5R91 (see note)	Exponent network, 100 kHz, 3 kHz and 10 kHz resistors. Perform Preliminary FM Adjustments (5-20), FM Distortion Adjustments (5-21), and FM Deviation Adjustment (5-22).	—	6

NOTE

Replacing these components may require FM adjustments. FM adjustments are complex and time consuming, and require special test equipment.

Table 5-2. Related Repairs, Performance Tests and Adjustment Procedures

Assembly, Circuit or Part Repaired	Performance Test (After Repair Completed)	Adjustment Procedure (If Necessary)
All electrical repairs	——	Power Supply Adjustment (5-13)
A1A1 RF Amplifier/ALC Board Assembly	Output Level Accuracy Test (4-18) AM Sensitivity and Indicated Accuracy Test (4-24) AM Distortion Test (4-26)	Detector Bias and AM Distortion Adjustment (5-14) AM Sensitivity Adjustment (5-15) Meter Adjustments (5-16)
A1A2 FM Modulator Board Assembly (see note)	Frequency Accuracy Test (4-10) FM Distortion Test (4-28) FM Sensitivity and Meter Accuracy Test (4-29)	Tuning Capacitor and Pulley Adjustment (5-17) Frequency Adjustments (5-18 or 5-19) Preliminary FM Adjustments (5-20) FM Distortion Adjustment (5-21) FM Deviation Adjustment (5-22)
A1A3 RF Oscillator Board Assembly (see note)	Frequency Accuracy Test (4-10) FM Distortion Test (4-28) FM Sensitivity and Meter Accuracy Test (4-29)	Frequency Adjustments (5-18 or 5-19) Preliminary FM Adjustments (5-20) FM Distortion Adjustment (5-21) FM Deviation Adjustment (5-22)
A1A4 Turret Assembly (see note)	Frequency Accuracy Test (4-10) FM Distortion Test (4-28) FM Sensitivity and Meter Accuracy Test (4-29)	Frequency Adjustments (5-18 or 5-19) Preliminary FM Adjustments (5-20) FM Distortion Adjustment (5-21) FM Deviation Adjustment (5-22)
A1C3 Tuning Capacitor (see note)	Frequency Accuracy Test (4-10) FM Distortion Test (4-28) FM Sensitivity and Meter Accuracy Test (4-29)	Tuning Capacitor and Pulley Adjustment (5-17) Frequency Adjustments (5-18 or 5-19) Preliminary FM Adjustments (5-20) FM Distortion Adjustment (5-21) FM Deviation Adjustment (5-22)
Dial Stringing (see note)	Frequency Accuracy Test (4-10)	Tuning Capacitor and Pulley Adjustment (5-17) Frequency Adjustments (5-18 or 5-19) Preliminary FM Adjustments (5-20) FM Distortion Adjustment (5-21) FM Deviation Adjustment (5-22)
A3 Assembly (Shaping Amplifier only)	Output Level Accuracy Test (4-18) AM Sensitivity and Indicated Accuracy Test (4-24) AM Distortion Test (4-26)	Detector Bias and AM Distortion Adjustment (5-14) Meter Adjustments (5-16)

Table 5-2. Related Repairs, Performance Tests and Adjustment Procedure (2 of 2)

Assembly, Circuit or Part Repaired	Performance Test (After Repair Completed)	Adjustment Procedure (If Necessary)
A3 Assembly (Audio Detector and Meter Driver only)	AM Sensitivity and Indicated Accuracy Test (4-24)	Meter Adjustments (5-16)
A5 FM Driver Board Assembly (see note)	FM Distortion Test (4-28) FM Sensitivity and Meter Accuracy Test (4-29)	Preliminary FM Adjustments (5-20) FM Distortion Adjustment (5-21) FM Deviation Adjustment (5-22)
A6A1 Reverse Power Protection Board Assembly (Option 003 only)	———	Output Impedance Adjustment (Option 003 only, 5-23) Reverse Power Level Sense Adjustment (Option 003 only, 5-24)
M1 Meter	AM Sensitivity and Indicated Accuracy (4-24)	Meter Adjustments (5-16)

NOTE

Repairs to these assemblies may require FM adjustments. FM adjustments are complex and time consuming, and require special test equipment.

ADJUSTMENTS

5-13. POWER SUPPLY ADJUSTMENT

REFERENCE:

Service Sheet 7.

DESCRIPTION:

A dc voltmeter is used to monitor the +20V supply voltage as it is adjusted.

EQUIPMENT:

Multimeter	HP 34702A/34740A

PROCEDURE:

1. Remove instrument top cover.

2. Set Signal Generator LINE switch to ON. Connect voltmeter to A3TP7. Adjust +20V Adjust control A3R5 for voltmeter reading of +20.0 ± 0.2 Vdc.

5-14. DETECTOR BIAS AND AM DISTORTION ADJUSTMENT

REFERENCE:

Service Sheets 3 and 4.

DESCRIPTION:

The RF Detector Bias is adjusted so the RF output voltage tracks the ALC dc reference voltage which is set by the VERNIER control. The Distortion Null is adjusted so the RF envelope accurately represents the audio AM drive signal at low ALC reference levels. Since the two adjustments interact, the adjustments may need to be repeated. A spectrum analyzer is used to detect the RF output level and AM signal. The ALC reference is monitored with a dc voltmeter.

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C
Multimeter	HP 34702A/34740A
10 dB Step Attenuator	HP 355D

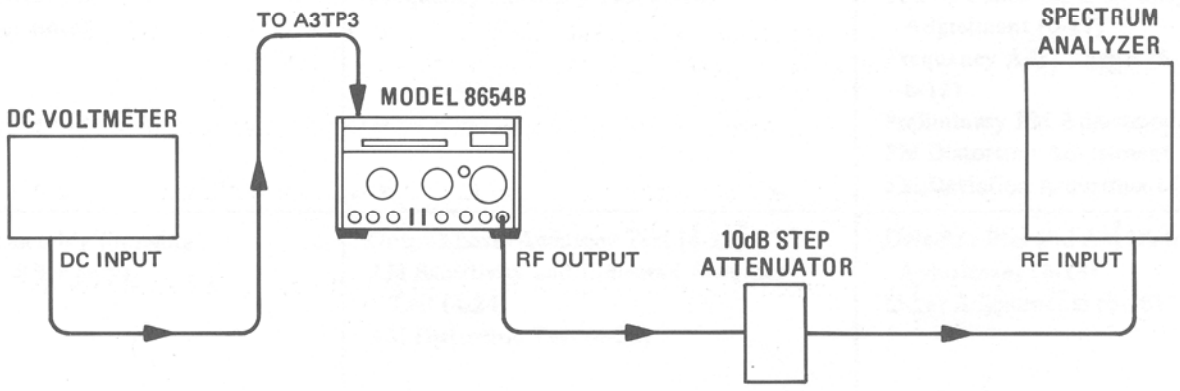


Figure 5-1. Detector Bias and AM Distortion Adjustment Setup

ADJUSTMENTS

5-14. DETECTOR BIAS AND AM DISTORTION ADJUSTMENT (cont'd)

PROCEDURE:

1. Remove instrument top and bottom covers and large hole plug on bottom side of A1 RF Assembly.

2. Center Detector Bias potentiometer A1A1R32 (Service Sheet 3) and Distortion Adjust potentiometer A3R52 (Service Sheet 4).

3. Connect equipment as shown in Figure 5-1 after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	35—66 MHz
FREQUENCY TUNE	50 MHz
OUTPUT LEVEL	+10 dBm
AM Source	INT
AM LEVEL	Fully ccw
FM Source	OFF
400 Hz/1 kHz Switch	400 Hz

4. Set step attenuator to 20 dB.

5. Set Signal Generator RF OUTPUT VERNIER for voltmeter reading of —2.00 Vdc at A3TP3.

6. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to 0 dBm (40 dB attenuation), vertical scale to linear , display smoothing to between 10 and 50 kHz, and adjust frequency controls to center 50 MHz signal on display. Set frequency span to 0 and fine adjust frequency controls to peak signal on display. Adjust vertical reference level controls to bring signal to fifth graticule line from bottom of display.

7. Set Signal Generator OUTPUT LEVEL switch to 0 dBm, and adjust VERNIER for voltmeter reading of —0.20 Vdc.

8. Set step attenuator to 0 dB. Use non-metallic tool to adjust Detector Bias control A1A1R32 to bring signal to same reference level (fifth line from bottom).

9. Repeat steps 4 to 8 until RF signal level is same for both —2.00 Vdc and —0.20 Vdc ALC reference levels.

10. With —0.20 Vdc at A3TP3 as set above, adjust AM LEVEL control so that upper peak of sine wave is at eighth graticule line from bottom of display (set analyzer to trigger internally).

11. Adjust Distortion Adjust control A3R52 so that lower peak of sine wave is at second graticule line.

12. Set AM LEVEL fully ccw. If level has shifted more than 0.2 division from fifth graticule line, set OUTPUT LEVEL to +10 dBm and repeat steps 4 to 12.

13. Perform AM Sensitivity Adjustment (5-15) , AM Distortion Test (4-26) and AM Sensitivity and Indicated Accuracy Test (4-24).

5-15. AM SENSITIVITY ADJUSTMENT

REFERENCE:

Service Sheet 4

DESCRIPTION:

The Signal Generator is externally amplitude modulated by a test oscillator with a level set to give 60% AM. The AM is demodulated with a spectrum analyzer in a zero span mode. The AM depth is measured directly on the display and is compared with the panel meter reading.

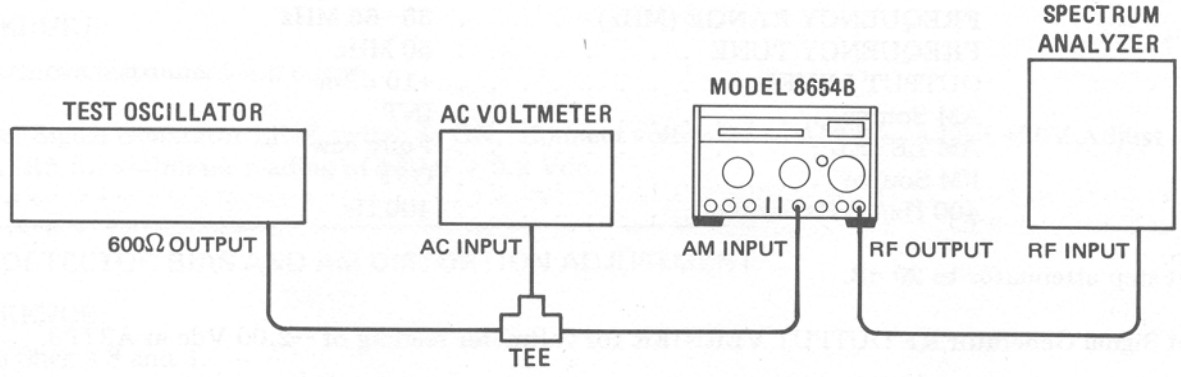


Figure 5-2. AM Sensitivity Adjustment Setup

EQUIPMENT:

Spectrum Analyzer	HP 8558B/182C
Test Oscillator	HP 651B
Digital Voltmeter	HP 34702A/34740A

PROCEDURE:

1. Connect equipment as shown in Figure 5-2, after setting Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	35—66 MHz
FREQUENCY TUNE	50 MHz
OUTPUT LEVEL	—37 dBm (meter reads +3 dB)
AM	EXT
AM LEVEL	Fully cw
FM	OFF

2. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to —40 dBm (0 dB attenuation), vertical scale to linear, display smoothing to between 10 and 50 kHz, and adjust center frequency controls to center 520 MHz signal on display. Adjust vertical reference level controls to bring signal level to fifth graticule line from bottom of display.

3. Set test oscillator to 1 kHz and adjust level for 0.424 Vrms (0.6 Vpk) as read on ac voltmeter.

5-15. AM SENSITIVITY ADJUSTMENT (cont'd)

4. Adjust AM Gain potentiometer A3R34 for peak-to-peak deflection of 6 divisions on display (corresponding to 60% AM).

NOTE

Check spectrum analyzer base line position by removing RF input. Base line should be exactly on bottom graticule line.

5-16. METER ADJUSTMENTS

REFERENCE:

Service Sheet 4.

DESCRIPTION:

The meter is set mechanically to zero. Then the meter amplifier gain and zero controls are adjusted so the meter tracks the actual RF output as monitored with a power meter. Finally, the audio detector gain is adjusted.

EQUIPMENT:

Power Meter and Sensor	HP 435/8481A
Digital Voltmeter	HP 34702A/34740A
Test Oscillator	HP 651A

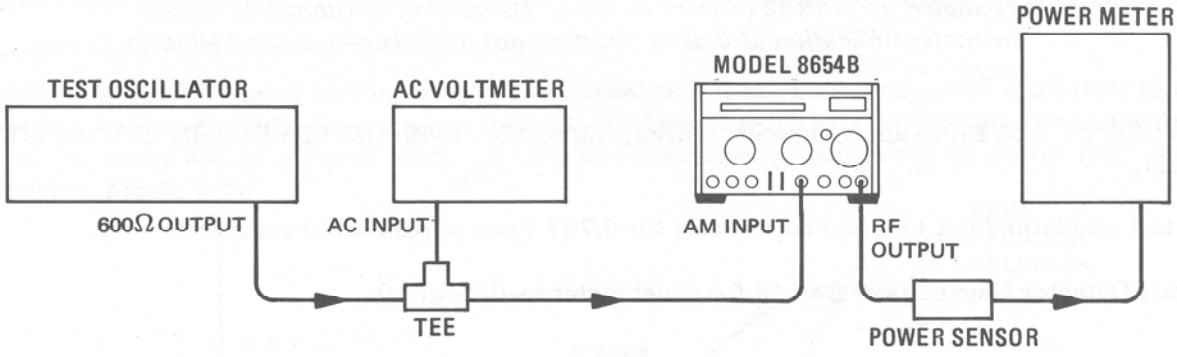


Figure 5-3. Meter Adjustments Setup

PROCEDURE:

1. Set Signal Generator LINE switch to OFF. Allow time for meter to fall to rest. Set meter pointer to zero with front panel meter adjust screw.

2. Set LINE switch to ON. Connect equipment as shown in Figure 5-3 after setting Signal Generator controls as follows:

5-16. METER ADJUSTMENTS (cont'd)

METER	LEVEL
FREQUENCY RANGE (MHz)	35—66 MHz
FREQUENCY TUNE	50 MHz
OUTPUT LEVEL	+10 dBm
AM	OFF
AM LEVEL	Fully cw
FM	OFF

3. Allow at least a 5-minute warmup. Set power meter range to measure +10 dBm.

4. Adjust RF OUTPUT VERNIER for power meter reading of +10 dBm. Adjust Meter Gain control A3R57 for 0 dB as read on Signal Generator panel meter.

5. Set OUTPUT LEVEL switch to 0 dBm and adjust VERNIER for power meter reading of —7 dBm. Adjust Meter Zero control A3R54 for —7 dB as read on panel meter.

6. Adjust RF OUTPUT VERNIER for power meter reading 0 dBm. If panel meter does not read within ±0.2 dB of 0 dBm, slightly readjust Meter Gain A3R57 for proper reading.

7. Repeat steps 4 to 6, adjusting Meter Gain A3R57 and Meter Zero A3R54 as needed until panel meter reads within ±0.2 dB of power meter reading for levels of +10, 0 and —7 dBm.

NOTE

If it is not possible to attain meter readings within ±0.2 dB of power meter reading for levels of +10 and 0 dBm, select a different value of resistance for A3R53 (1330—1470Ω). Decreasing resistance increases the meter indication at 0 dBm but does not directly affect the +10 dBm range.

8. Set OUTPUT LEVEL to approximately 0 dBm, AM to EXT (with AM LEVEL fully cw), and METER to AM.

9. Set test oscillator for 1 kHz and adjust level for 0.707 Vrms as read on ac voltmeter.

10. Adjust Detector Gain control A3R45 for panel meter reading of 10.

NOTE

Check that Meter jumper (connected to A3C27) is in N (normal) position.

5-17. TUNING CAPACITOR PULLEY ADJUSTMENT

REFERENCE:

Service Sheet 2.

DESCRIPTION:

The position of the capacitor pulley on the capacitor shaft is set for the full tuning range of the capacitor as the frequency is tuned from stop to stop. The pulley is correctly adjusted when the frequency can be

5-17. TUNING CAPACITOR PULLEY ADJUSTMENT (cont'd)

tuned through minimum at the low frequency end of the dial and through maximum at the high end (refer to Figure 5-4).

NOTE

Performing the Tuning Capacitor Pulley Adjustment will require that FM adjustments also be performed. FM adjustments are complex and time consuming, and require special test equipment.

EQUIPMENT:

Frequency Counter	HP 5327C

PROCEDURE:

1. Remove the RF Assembly cover as described in Section 8.

2. Connect the counter's high frequency input to RF Amplifier output connector A1A1J3. Set Signal Generator controls as follows:

FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	Fully ccw to stop
OUTPUT LEVEL	0 dBm
VERNIER	Fully cw
AM	OFF
FM	OFF

3. Check that the FREQUENCY TUNE control is against the counterclockwise (low frequency) stop.

4. Loosen the two setscrews on the capacitor pulley.

5. Use a non-metalic tuning tool inserted in the slotted end of the tuning capacitor shaft (C3) to adjust the low frequency foldback as read on the counter, from 5 to 10 kHz beyond the frequency minimum. The frequency will be approximately 9.5 MHz and the capacitor blades will be almost fully meshed (refer to Figure 5-2).

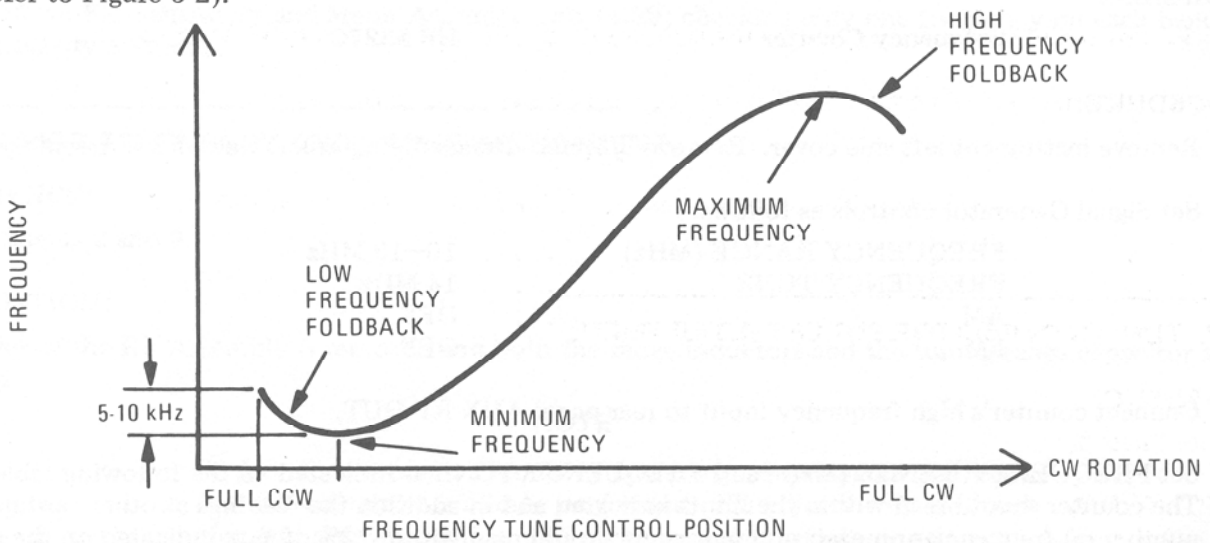


Figure 5-4. Proper Capacitor Tuning Characteristics

ADJUSTMENTS

5-17. TUNING CAPACITOR PULLEY ADJUSTMENT (cont'd)

6. Tighten the pulley setscrews.

CAUTION

Verify that the pulley does not rub against the oscillator cables or chassis parts, and that the dial cord does not rub against the casting as it passes through the holes.

7. Tune the frequency up a few turns and then back to the counterclockwise stop. Check that the frequency tunes from 5 to 10 kHz beyond the minimum.

NOTE

Some frequency foldback is also normal at the high end of the frequency band.

8. Perform the Frequency and Range Adjustments (5-18 or 5-19), Preliminary FM Adjustments (5-20), FM Distortion Adjustment (5-21) and FM Deviation Adjustment (5-22).

5-18. MINOR FREQUENCY AND RANGE ADJUSTMENT

REFERENCE:

Service Sheet 2.

DESCRIPTION:

Minor frequency adjustments can be made to the range inductors through a hole in the RF Assembly without disassembling it. Normally, no FM system readjustments are required when only minor frequency adjustments are made. If major frequency adjustments are to be made, perform the MAJOR FREQUENCY AND RANGE ADJUSTMENT instead.

EQUIPMENT:

Frequency Counter	HP 5327C

PROCEDURE:

1. Remove instrument left side cover. Remove 3/4-inch threaded plug in left side of RF Assembly.

2. Set Signal Generator controls as follows:

FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	14 MHz
AM	OFF
FM	OFF

3. Connect counter's high frequency input to rear panel AUX RF OUT.

4. Set FREQUENCY RANGE (MHz) and FREQUENCY TUNE as indicated in the following table. The counter should read within the limits indicated and in addition the readings at other cardinal (or numbered) frequencies on each nominal range should read within ±2% of that indicated on the dial.

5-18. MINOR FREQUENCY AND RANGE ADJUSTMENT (cont'd)

Frequency Range (MHz)	Dial Indication (MHz)	Counter Reading Limits (MHz)	Adjustment Inductor
10—19	14	13.72 _____ 14.28	A1A4L1
19—35	26	25.48 _____ 26.52	A1A4L2
35—66	50	49.0 _____ 51.0	A1A4L3
66—130	100	98.0 _____ 102.0	A1A4L4
130—270	200	196.0 _____ 204.0	A1A4L5
270—520	370	362.6 _____ 377.4	A1A4L6

5. If any frequencies are out of limits, adjust appropriate inductor, listed in table above, by rotating FREQUENCY RANGE (MHz) 3 positions and adjusting inductor through hole in RF Assembly. Rotate FREQUENCY RANGE (MHz) 3 positions and recheck frequency accuracy. Repeat until all frequencies are within ±2% of that indicated by the dial.

NOTES

To adjust A1A4L5, set LINE to OFF. Using a small pair of needle nose pliers, pinch both loops in by equal amounts. This will raise the frequency.

To adjust A1A4L6, set LINE to OFF. Using a small 50W soldering iron, add equal amounts of solder to two slots in inductor strip. This will raise the frequency.

3. If it is not possible to bring the frequency within specified limits, perform MAJOR FREQUENCY AND RANGE ADJUSTMENT.

4. Install threaded plug and instrument side cover.

5. Perform FM Sensitivity and Meter Accuracy Test (4-29) checking only one frequency on each band for sensitivity accuracy.

5-19. MAJOR FREQUENCY AND RANGE ADJUSTMENT

REFERENCE:

Service Sheets 2 and 3.

DESCRIPTION:

The cover of the RF Assembly is removed and both the range inductors and the tuning range capacitor are adjusted.

NOTE

Performing the Major Frequency and Range Adjustment will require that FM adjustments also be performed. FM adjustments are complex and time consuming, and require special test equipment.

5-19. MAJOR FREQUENCY AND RANGE ADJUSTMENT (cont'd)

EQUIPMENT:

Frequency Counter	HP 5327C
Power Meter	HP 435A/8481A

PROCEDURE:

1. Remove the RF Assembly and RF Assembly cover as described in Section 8.

2. Connect the counter's high frequency input to RF Amplifier output connector A1A1J3. Set Signal Generator's controls as follows:

FREQUENCY RANGE (MHz)	270—520 MHz
FREQUENCY TUNE	270 MHz
OUTPUT LEVEL	0 dBm
VERNIER	Fully cw
AM	OFF
FM	OFF

3. Adjust the 270—520 MHz turret inductor A1A4L6 for a counter reading of 270 ± 2.7 MHz.

NOTE

Before adjusting the inductor, set LINE to OFF. To increase frequency add equal amounts of solder to two slots in the inductor strip. To lower frequency bend the inductor tab.

4. Set FREQUENCY TUNE to 520 MHz and adjust Tuning Range capacitor A1A3C2 for a reading of 520 ± 5.2 MHz.

NOTE

If 520 MHz is not attainable, see the selection procedure for capacitor A1A3C12 in Table 5-1.

5. Check at least four FREQUENCY TUNE settings on the band to ensure ±2% accuracy for each setting.

6. Set FREQUENCY TUNE to any convenient location on each of the other five bands. Adjust the turret inductors for counter readings within 1% of the dial indication.

NOTE

On the 130—270 MHz band, the inductor is adjusted by spreading or pinching the inductor loops. On the 10—130 MHz bands adjustment is accomplished with a tuning slug in the inductor.

7. Check at least four FREQUENCY TUNE settings on each band to ensure ±2% accuracy for each setting. Readjust the turret inductors as necessary to attain this overall accuracy.

8. Connect the power meter's sensor to RF Oscillator output connector A1A3J1. Output power should be greater than +3 dBm at all FREQUENCY RANGE (MHz) and FREQUENCY TUNE settings.

5-19. MAJOR FREQUENCY AND RANGE ADJUSTMENT (cont'd)

9. Replace RF Assembly cover and install the RF Assembly in the instrument.

10. Perform the Preliminary FM Adjustments (5-20), FM Distortion Adjustment (5-21), and FM Deviation Adjustment (5-22).

5-20. PRELIMINARY FM ADJUSTMENTS

REFERENCE:

Service Sheets 5, 6 and 7.

DESCRIPTION:

Various dc voltages and voltage nulls on the FM Driver Assembly are adjusted.

EQUIPMENT:

Digital Voltmeter	HP 34702A/34740A
Frequency Counter	HP 5327A

PROCEDURE:

1. Remove instrument top cover.

2. Connect a jumper wire between A5TP8 (Service Sheet 6) and ground (A5TP12).

3. Connect frequency counter to rear panel AUX RF OUT after setting Signal Generator controls as follows:

FREQUENCY RANGE (MHz)	19—35 MHz
FREQUENCY TUNE	35 MHz
FINE TUNE	centered
AM	OFF
FM	OFF
FM RANGE (kHz)	30 kHz

4. Connect dc voltmeter to A5TP3 (Service Sheet 5). Use testpoint A5TP12 (Service Sheet 7) as common ground. Set FREQUENCY TUNE for 35.0 MHz as read on counter.

5. Adjust ADJ A A5R16 (Service Sheet 5) for voltmeter reading of +10.00 Vdc.

6. Set FREQUENCY TUNE for 19.0 MHz as read on counter.

7. Adjust ADJ B A5R18 (Service Sheet 5) for voltmeter reading of +5.40 Vdc.

8. Repeat steps 3 through 6 until voltages are within ± 0.10 Vdc of those specified at 19.0 and 35.0 MHz.

9. Connect dc voltmeter to A5TP5 (Service Sheet 5). Set FREQUENCY TUNE for 25.0 MHz as read on counter.

10. Remove jumper wire between A5TP8 and TP12.

5-20. PRELIMINARY FM ADJUSTMENTS (cont'd)

11. Adjust ADJ C A5R42 (Service Sheet 5) for voltmeter reading of 0.60 ± 0.20 Vdc.

12. Connect dc voltmeter to A5TP6 (Service Sheet 6).

13. Adjust ADJ F A5R122 (Service Sheet 6) for 0.00 ± 0.20 Vdc.

14. Connect dc voltmeter to A5TP8 (Service Sheet 6).

15. Connect a jumper wire between A5TP10 (Service Sheet 6) and ground (A5TP12).

16. Adjust ADJ E A5R63 (Service Sheet 6) so that voltage at A5TP8 remains constant within ± 0.20V as frequency is tuned between 19 and 35 MHz.

NOTE

The voltage will be approximately 0 Vdc but need not be exactly 0 Vdc; however, it must be constant as the frequency is tuned.

17. Remove jumper wire between A5TP10 and TP12. Connect jumper wire between A5TP8 and ground (A5TP12).

18. Connect dc voltmeter to A5TP10.

19. Adjust ADJ D R104 (Service Sheet 6) for voltmeter reading of 0.0 ± 0.1 mVdc.

20. Remove jumper wire between A5TP8 and TP12.

21. Connect dc voltmeter to A5TP5. Set FREQUENCY TUNE to 25.0 MHz (on frequency counter).

22. Adjust ADJ C A5R42 for a voltmeter reading of 0.60 ± 0.01 Vdc.

23. Perform FM Distortion Adjustment (5-21) and FM Deviation Adjustment (5-22).

5-21. FM DISTORTION ADJUSTMENT

REFERENCE:

Service Sheet 6.

DESCRIPTION:

The Signal Generator is frequency modulated internally at a 1 kHz rate. The FM signal is demodulated by an FM discriminator. The deviation level is measured at the discriminator output, and set to 30.0 kHz. The distortion is then measured and adjusted to be minimum. A reference generator and mixer convert the RF output of the test Signal Generator to within the range of the discriminator. A low-pass filter at the mixer output prevents the discriminator from mis-triggering on the upper sideband generated by the mixer when the RF is low in frequency.

ADJUSTMENTS

5-21. FM DISTORTION ADJUSTMENT (cont'd)

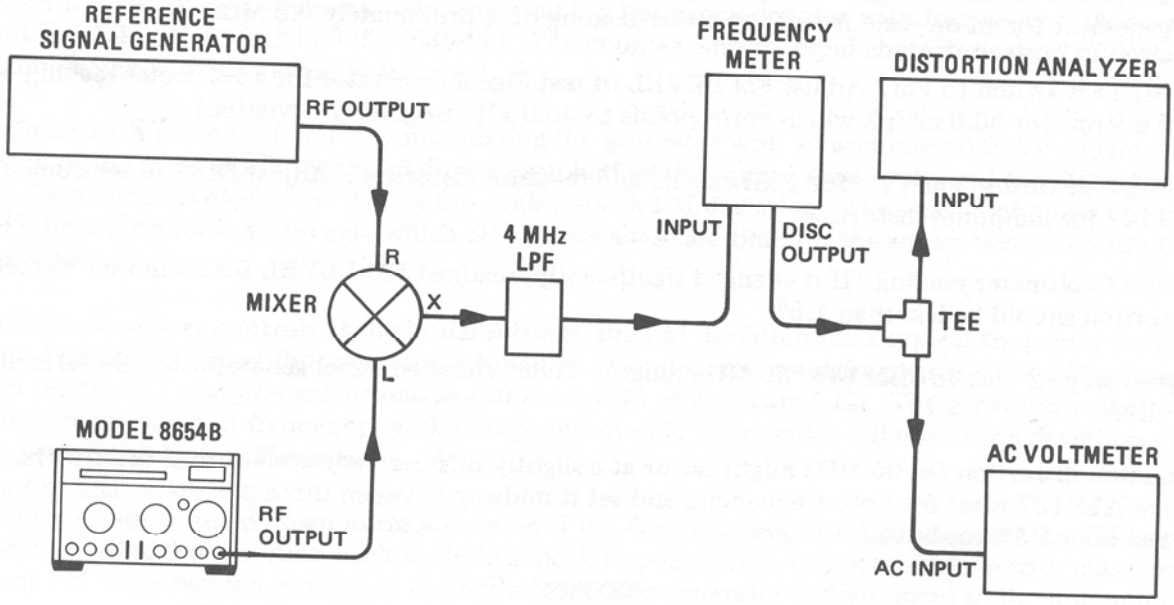


Figure 5-5. FM Distortion Adjustment Setup

EQUIPMENT:

Frequency Meter	HP 5210A
Filter Kit (for Frequency Meter)	HP 10531A
Distortion Analyzer	HP 331A
Signal Generator (reference)	HP 8640A
Multimeter	HP 34702A/34740A
Mixer	HP 10514A
4 MHz Low-pass Filter	CIR-Q-TEL 3 Pole

PROCEDURE:

1. Install shorting board in frequency meter and calibrate it for 1 Vdc at output jack for a full-scale meter reading. Remove shorting board and install a 50 kHz Butterworth low-pass filter.

2. Connect equipment as shown in Figure 5-5 after setting test Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	10 MHz
OUTPUT LEVEL	+7 dBm (meter reads —3 dB)
AM	OFF
FM	INT
FM RANGE (kHz)	30 kHz
FM LEVEL	Fully ccw
400 Hz/1 kHz	1 kHz

ADJUSTMENTS

5-21. FM DISTORTION ADJUSTMENT (cont'd)

3. Set reference signal generator for a −7 dBm signal at 11 MHz.

4. Set frequency meter to trigger on input signal; set frequency range to 1 MHz. Fine tune reference signal generator for an on-scale frequency meter reading of approximately 0.8 MHz.

5. Set METER switch to FM. Adjust FM LEVEL of test Signal Generator for a voltmeter reading of 21.2 mVrms (or 30.0 mVpk which corresponds to 30.0 kHz frequency deviation).

6. Calibrate distortion analyzer for 1 kHz signal and measure distortion. Adjust DIST potentiometer A5R107 for minimum distortion.

7. Recheck voltmeter reading. If it changed significantly, readjust FM LEVEL for minimum distortion. Distortion should be less than 1.5%.

8. Repeat steps 2-7 at 35 MHz (35—66 MHz range). Tune reference signal generator to 36 MHz at −7 dBm.

9. Minimum distortion for 35 MHz might occur at a slightly different adjustment than at 10 MHz. Note where A5R107 is set for both frequencies and set it midway between those positions. Distortion must be less than 1.5% for both frequencies.

NOTES

The set level on the distortion analyzer will need to be set to a lower range because of the low level of the discriminator output. This level becomes the 100% level.

If distortion is excessive, check discriminator output with an oscilloscope. If the signal is clipped, reduce FM LEVEL slightly until clipping ceases; adjust DIST potentiometer A5R107 for minimum distortion; then repeat with proper FM LEVEL.

If a frequency meter filter greater than 10 kHz is used, the noise in the system may appear to contribute to distortion.

10. Perform FM Deviation Adjustment (5-22).

5-22. FM DEVIATION ADJUSTMENT

REFERENCE:

Service Sheet 5 and 6.

DESCRIPTION:

With this procedure the FM deviation for each frequency range is calibrated. This is done by selecting resistors that set the breakpoint, slope, exponent, and gain of the FM driving circuits. (These are parameters that affect the FM deviation vs. frequency tuning and range.) The FM meter and deviation ranges are also calibrated.

5-22. FM DEVIATION ADJUSTMENT (cont'd)

A special test accessory (HP 08654-60084 FM Deviation Adjustment Board) is required. It has a built-in square wave generator and a set of switches and potentiometers which substitute for the resistors to be selected during the calibration. After calibration of a given band, the potentiometers are switched to an ohmmeter for ease of measurement. Also required is a frequency counter with frequency difference measurement capability (HP Model 5345A/5353A). The counter permits rapid characterization of deviation vs. carrier frequency without having to be tuned.

The adjustment is made by frequency modulating the generator with an accurate ±0.949V square wave. The frequency of the generator is measured during each half of the square wave cycle, and the difference between the two frequencies is displayed. This is the peak-to-peak FM deviation. The change of phase of the square wave is initiated by the counter gate which also allows adequate time for the square wave to settle before initiating the count.

With the test accessory controls at the initial settings, the FM deviation for a typical frequency range is as shown in Figure 5-6a. First the generator is tuned to a nominal midband frequency. The FM gain is then adjusted for 60 kHz peak-to-peak deviation (30 kHz peak) as in Figure 5-6b. The generator is then tuned to the maximum nominal frequency on the range and the FM exponent is adjusted for a deviation of 60 kHz peak-to-peak as in Figure 5-6c.

Now the generator is tuned down in frequency until the deviation begins to increase and the FM breakpoint is adjusted to bring the deviation back to 60 kHz peak-to-peak. This, however, is done with maximum correction or FM slope and the result is as in Figure 5-6d. The generator is then tuned to the minimum nominal frequency and the FM slope is adjusted for 60 kHz peak-to-peak deviation.

Figure 5-6e shows a properly adjusted generator. The frequency range should be carefully checked for constant deviation. Figure 5-6f shows the deviation response of a range with an improper breakpoint adjustment.

The 270—520 MHz FREQUENCY RANGE has two FM breakpoint and slope adjustments. The adjustment of this range, however, follows the same principles as for the other ranges. Finally, the FM gain for the other three deviation ranges is adjusted.

To aid in visualizing FM deviation flatness, throughout this procedure, plot counter readings on the graphs in Figure 5-8.

Before performing this adjustment, perform Preliminary FM Adjustments (5-20) and FM Distortion Adjustment (5-21).

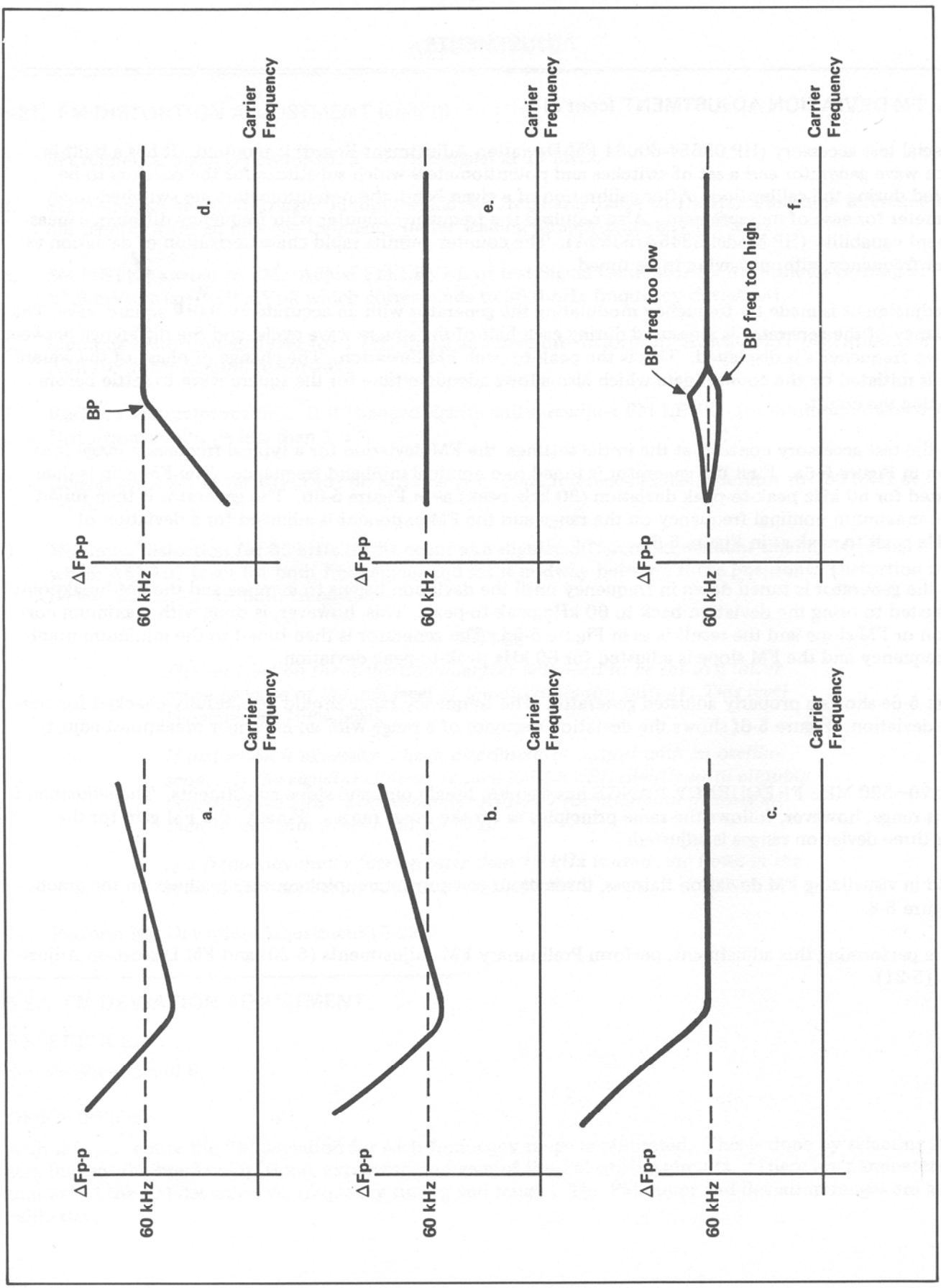


Figure 5-6. FM Deviation vs Carrier Frequency for Various Stages of FM Deviation Calibration

5-22. FM DEVIATION ADJUSTMENT (cont'd)

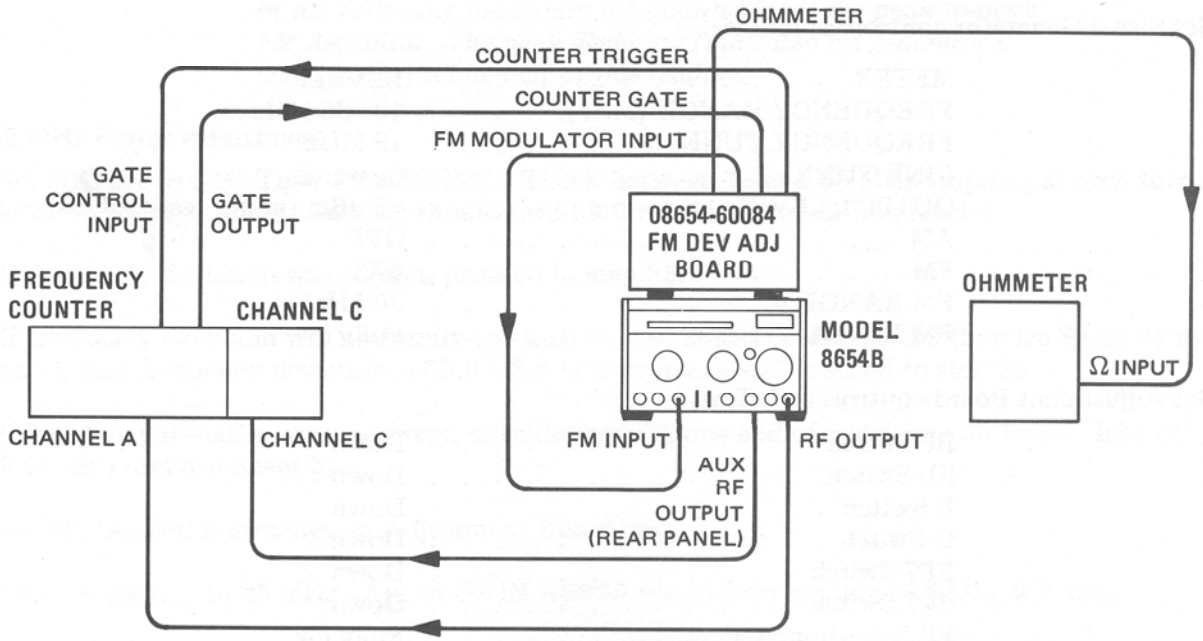


Figure 5-7. FM Deviation Adjustment Setup

EQUIPMENT:

Frequency Counter	HP 5345A/5353A
Multimeter	HP 34702A/34740A
FM Deviation Adjustment Board . . .	HP 08654-60084

PROCEDURE:

NOTE

Do to the complex nature of this adjustment, it is extremely important that you read and understand the information presented under DESCRIPTION.

Initial Setup

1. Remove instrument top cover.
2. Mount FM Deviation Adjustment Board to rear panel (use two screws from top cover).
3. Interconnect instruments as shown in Figure 5-7.
4. Remove two ribbon cables from A5 FM Driver Board Assembly and connect to corresponding connector jacks J1 and J2 on Adjustment Board. Connect three ribbon cables from Adjustment Board to corresponding connector jacks A5J1, J2, and J3 on A5 FM Driver Board Assembly.

ADJUSTMENTS

5-22. FM DEVIATION ADJUSTMENT (cont'd)

5. Set Signal Generator controls as follows:

METER	LEVEL
FREQUENCY RANGE (MHz)	19—35 MHz
FREQUENCY TUNE	19 MHz
FINE TUNE	Centered
OUTPUT LEVEL	+3 dBm (meter reads +3 dB)
AM	OFF
FM	EXT
FM RANGE	30 kHz
FM LEVEL	Fully cw

6. Set Adjustment Board controls as follows:

BP Switch	Down
SL Switch	Down
E Switch	Down
G Switch	Down
BP7 Switch	Down
SL7 Switch	Down
BP Potentiometer	Fully cw
SL Potentiometer	Fully cw
E Potentiometer	Fully ccw
G Potentiometer	Fully ccw
BP7 Potentiometer	Fully cw
SL7 Potentiometer	Fully cw

7. Set frequency counter controls as follows:

FUNCTION		PLUG IN
GATE TIME		10 mS
DISPLAY POSITION		AUTO
CHANNEL A	LEVEL	PRESET
	Impedance	50Ω
	ATTEN	x1
	Mode	SEP
CHANNEL C	LEVEL	PRESET
	Impedance	50Ω
	ATTEN	x1
FUNCTION		FREQ C-A
GATE CONTROL INPUT (rear panel)		EXT ARM

NOTES

The Adjustment Board must have been preadjusted to give a ±0.949 ± 0.003 V square wave at the Signal Generator FM INPUT. If it does not, disconnect the input to the counter gate and check the FM drive (out of the coaxial cable) with a dc voltmeter. The toggle switch can be used to reverse the phase of the drive voltage. See Service Note P-08654-60084.

(continued)

5-22. FM DEVIATION ADJUSTMENT (cont'd)

In the following procedure the counter reads the peak-to-peak FM deviation. The peak deviation (indicated on generator's panel meter) is one-half of this reading.

19—35 MHz Range Adjustment

8. Set METER to FM. Tune FREQUENCY TUNE between 19 and 35 MHz stopping at each turn of the knob to check counter. Counter should read 60.0 ± 3.6 kHz for all frequencies.

9. If frequency deviation was correct, proceed to step 25.

10. If frequency deviation was uniformly too high or low, adjust GAIN A5R59 (Service Sheet 6) and check that frequency deviation is 60.0 ± 3.6 kHz across range. Proceed to step 25.

11. If frequency deviation was incorrect, unsolder and lift one end of resistors A5R4 (2B), R23 (2S), and R44 (2E) (Service Sheet 5).

12. Set BP, SL, and E switches on Adjustment Board up.

13. Tune frequency to 25 MHz. Adjust GAIN A5R59 for counter reading of 60.0 ± 0.2 kHz.

14. Tune frequency to 35 MHz. Adjust E potentiometer on Adjustment Board for counter reading of 60.0 ± 0.6 kHz.

15. Tune back to 25 MHz stopping at each turn of knob to check counter. To aid in visualizing deviation flatness, plot counter readings on Figure 5-8. Counter should read 60.0 ± 3.6 kHz for these frequencies.

16. If frequency deviation was incorrect, readjust GAIN A5R59 and E on Adjustment Board for best compromise.

17. Tune down in frequency below 25 MHz until deviation increases 1 kHz above deviation at 25 MHz. Adjust BP potentiometer on Adjustment Board for counter reading of 60.0 ± 0.2 kHz.

18. Tune frequency to 19 MHz. Adjust SL potentiometer on Adjustment Board for counter reading of 60.0 ± 0.6 kHz.

19. Tune back to 25 MHz stopping at each turn of knob to check counter. If desired, plot counter readings on Figure 5-8. Counter should read 60.0 ± 3.6 kHz for these frequencies.

20. If frequency deviation was incorrect, readjust BP and SL on Adjustment Board for best compromise.

21. Recheck deviation from 19 to 35 MHz. If deviation is not 60.0 ± 3.6 kHz, readjust GAIN A5R59 and BP, SL, and E on Adjustment Board for best compromise.

22. Set G, BP7 and SL7 switches up. Measure resistance of BP, SL, and E potentiometers by setting each corresponding switch down, noting resistance, on Table 5-3, Resistor Selection Record, and returning switch up.

23. Select nearest standard value resistors to those resistances measured in step 22 and solder them in place of A5R4(2B), R23 (2S), and R44(2E); enter values in Table 5-3. A listing of standard value resistors (±1% tolerance) and corresponding HP part numbers is found in Table 5-4.

5-22. FM DEVIATION ADJUSTMENT (cont'd)

24. Disconnect five ribbon cables and DIP plugs. Connect two DIP plugs (A1A5P1 and P2) to corresponding connectors on the A5 FM Driver Board Assembly (A5J1 and J2). The counter reading should be 60.0 ± 3.6 kHz.

NOTE

If counter reading is not within tolerance, the error may be due to test cable and contact resistances in the FM Deviation Adjustment Board. Replace resistors with the next higher standard value resistors and measure again.

Allow enough time for resistors to cool before making measurement.

10–19, 35–66, 66–130, 130–270 MHz Range Adjustments

NOTE

Perform steps 25 through 42 one range at a time and return to step 25 after each range.

25. Connect FM Deviation Adjustment Board and set controls as in steps 4 and 6.

26. Set FREQUENCY RANGE as listed below and tune across nominal range stopping at each turn of knob to check counter. Counter should read 60.0 ± 3.6 kHz for all frequencies.

FREQUENCY RANGE (MHz)
10–19
35–66
66–130
130–270

27. If frequency deviation was correct, proceed to next frequency range and repeat step 26.

NOTE

If frequency deviation was uniformly too high or low, proceed with the following steps but remove only the resistor related to the "G" adjustment and adjust only G on the Adjustment Board (BP, SL, and E switches up).

28. If frequency deviation was incorrect, unsolder and lift one end of resistors listed below.

FREQUENCY RANGE (MHz)	Resistors			
	BP	SL	E	G
10–19	A5R2 (1B)	A5R22 (1S)	A5R48 (1E)	A5R66 (1G)
35–66	A5R6 (3B)	A5R24 (3S)	A5R40 (3E)	A5R70 (3G)
66–130	A5R8 (4B)	A5R25 (4S)	A5R38 (4E)	A5R72 (4G)
130–270	A5R10 (5B)	A5R28 (5S)	A5R35 (5E)	A5R74 (5G)

5-22. FM DEVIATION ADJUSTMENT (cont'd)

29. Set BP, SL, E, and G switches on Adjustment board up.

30. Tune to frequency listed below. Adjust G potentiometer on Adjustment Board for counter reading of 60.0 ± 0.2 kHz.

FREQUENCY RANGE (MHz)	Frequency Set (MHz)
10—19	13.3
35—66	47
66—130	91
130—270	180

31. Tune to frequency listed below. Adjust E potentiometer on Adjustment Board for counter reading of 60.0 ± 0.6 kHz.

FREQUENCY RANGE (MHz)	Frequency Set (MHz)
10—19	19
35—66	66
66—130	130
130—270	270

32. Tune back to frequency of step 30 stopping at each turn of knob to check counter. To aid in visualizing deviation flatness, plot counter readings on Figure 5-8. Counter should read 60.0 ± 1.8 for these frequencies.

33. If frequency deviation was incorrect, readjust potentiometers G and E on Adjustment Board for best compromise.

34. Tune down in frequency below that of step 30 until deviation increases 1 kHz above deviation at frequency of step 30. Adjust BP potentiometer on Adjustment Board for counter reading of 60.0 ± 0.2 kHz.

35. Tune to frequency listed below. Adjust SL potentiometer on Adjustment Board for counter reading of 60.0 ± 0.6 kHz.

FREQUENCY RANGE (MHz)	Frequency Set MHz
10—19	10
35—66	35
66—130	66
130—270	130

5-22. FM DEVIATION ADJUSTMENT (cont'd)

36. Tune back to frequency of step 30 stopping at each turn of knob to check counter. If desired, plot counter readings on Figure 5-8. Counter should read 60.0 ± 3.6 kHz for these frequencies.

37. If frequency deviation was incorrect, readjust BP and SL on Adjustment Board for best compromise.

38. Recheck deviation across entire band. If deviation is not 60.0 ± 3.6 kHz, readjust BP, SL, E, and G potentiometers on Adjustment Board for best compromise.

39. Measure resistance of BP, SL, E, and G potentiometers by setting each corresponding switch down, noting resistance in Table 5-3, Resistor Selection Record, and returning switch up.

40. Select nearest standard value resistors to those resistances measured in step 39 and solder them in place of the resistors listed in step 28; enter value in Table 5-3. A listing of standard value resistors (±1% tolerance) and corresponding HP part number is found in Table 5-4.

41. Disconnect five ribbon cables and DIP plugs. Connect two DIP plugs (A1A5P1 and P2) to corresponding connectors on the A5 FM Driver Board Assembly (A5J1 and A5J2). The counter reading should be 60.0 ± 3.6 kHz.

NOTES

If counter reading is not within tolerance, the error may be due to test cable and contact resistances in the FM Deviation Adjustment Board. Replace resistors with the next higher standard value resistors and measure again.

Allow enough time for resistors to cool before making measurements.

42. Proceed to next range and begin at step 25.

270–520 MHz Range Adjustment

43. Connect FM Deviation Adjustment Board and set controls as in steps 4 and 6.

44. Set FREQUENCY RANGE to 270—520 MHz and tune between 270 and 520 MHz stopping at each turn of knob to check counter. Counter should read 60.0 ± 3.6 kHz for all frequencies.

45. If frequency deviation was correct, proceed to step 64.

NOTE

If frequency deviation was uniformly too high or low, proceed with the following steps but remove only resistor A5R76 (6G) and adjust only potentiometer G on the Adjustment Board (BP, SL, E, BP7, and SL7 switches up).

46. If frequency deviation was incorrect, unsolder and lift one end of resistors A5R12 (6B), R14 (7B), R29 (6S), R30 (7S), R33 (6E) and R76 (6G).

47. Set BP, SL, E, G, BP7, and SL7 switches on Adjustment Board up.

5-22. FM DEVIATION ADJUSTMENT (cont'd)

48. Tune frequency to 400 MHz. Adjust G potentiometer on Adjustment Board for counter reading of 60.0 ± 0.2 kHz.

49. Tune frequency to 520 MHz. Adjust E potentiometer on Adjustment Board for counter reading of 60.0 ± 0.6 kHz.

50. Tune back to 400 MHz stopping at each turn of the knob to check counter. To aid in visualizing deviation flatness, plot counter readings on Figure 5-8. Counter should read 60.0 ± 3.6 kHz for these frequencies.

51. If frequency deviation was incorrect, readjust potentiometers G and E on Adjustment Board for best compromise.

52. Tune down in frequency below 400 MHz until deviation increases 1 kHz above deviation at 400 MHz. Adjust BP potentiometer on Adjustment Board for counter reading of 60.0 ± 0.2 kHz. Note carrier frequency.

53. Continue tuning down in frequency to 50 MHz below frequency noted in step 52. Note this frequency. Adjust SL potentiometer on Adjustment Board for counter reading of 60.0 ± 0.6 kHz.

54. Tune back to frequency noted in step 52 stopping at each turn of knob to check counter. If desired, plot counter readings on Figure 5-8. Counter should read 60.0 ± 3.6 kHz.

55. If frequency deviation was incorrect, readjust potentiometers BP and SL on Adjustment Board for best compromise for frequencies between 400 MHz and that noted in step 53.

56. Continue tuning down in frequency until deviation increases to 61.5 kHz. Adjust BP7 potentiometer on Adjustment Board for counter reading of 60.0 ± 0.2 kHz.

57. Tune frequency to 270 MHz. Adjust SL7 potentiometer on Adjustment board for counter reading of 60.0 ± 0.6 kHz.

58. Tune back to frequency noted in step 53 stopping at each turn of knob to check counter. If desired, plot counter readings on Figure 5-8. Counter should read 60.0 ± 3.6 kHz.

59. If frequency deviation was incorrect, readjust potentiometers BP7 and SL7 on Adjustment Board for best compromise.

60. Recheck deviation from 270 to 520 MHz. If deviation is not 60.0 ± 3.6 kHz, readjust potentiometers BP, SL, E, G, BP7, and SL7 on Adjustment Board for best compromise.

NOTE

On this range all adjustments are interactive. Before readjusting any control, consider its effect as shown in Figure 5-6, then make only a slight adjustment of the control and note its effect. Adjustment to better than 60.0 ± 3.6 kHz is not recommended.

61. Measure resistance of BP, SL, E, G, BP2, and SL2 potentiometers by setting each corresponding switch down, noting resistance, and returning switch up.

5-22. FM DEVIATION ADJUSTMENT (cont'd)

62. Select nearest standard value resistors to those resistances measured in step 61 and solder them in place of A5R12 (6B), R14 (7B), R29 (6S), R30 (7S), R33 (6E) and R76 (6G). Enter values in Table 5-3. A listing of standard value resistors (±1% tolerance) and corresponding HP part numbers is found in Table 5-4.

63. Disconnect five ribbon cables and DIP plugs. Connect two DIP plugs (A1A5P1 and P2) to corresponding connectors on the A5 FM Driver Board Assembly (A5J1 and J2). The counter reading should be 60.0 ± 3.6 kHz.

NOTES

If counter reading is not within tolerance, the error may be due to test cable and contact resistance in the FM Deviation Adjustment Board. Replace resistors with next higher standard value resistors and measure again.

Allow enough time for resistors to cool before making measurements.

FM Range Adjustment

64. Connect FM Deviation Adjustment Board and set controls as in steps 5 and 6. Set BP, SL, E and G switches down. Set FREQUENCY RANGE on Signal Generator to 19—35 MHz.

65. Tune frequency until counter reading of 60.0 ± 0.2 kHz is noted. Set FM RANGE to 3 kHz.

66. Set counter GATE TIME to 100 mS.

67. Counter should read 6.00 ± 0.06 kHz. If it does not, insert (but do not solder) a resistor in place of A5R89 (3 kHz) of a value that gives correct deviation (try 1100Ω first). Then solder resistor in place.

68. Set FM RANGE to 30 kHz. Repeat step 65.

69. Set FM RANGE to 10 kHz. Counter should read 18.97 ± 0.19 kHz. If it does not, insert (but do not solder) a resistor in place of A5R91 (10 kHz) of a value that gives correct deviation (try 1470Ω first). Then solder resistor in place.

70. Set FM RANGE to 30 kHz. Set FREQUENCY RANGE to 66—130 MHz. Adjust FREQUENCY TUNE above 80 MHz and such that counter indicates 60.0 ± 0.2 kHz.

71. Set FM RANGE to 100 kHz. Counter should read 189.7 ± 1.9 kHz. If it does not, insert (but do not solder) a resistor in place of A5R84 (100 kHz) of a value that gives correct deviation (try 34.8 kΩ first). Then solder resistor in place.

72. Remove Adjustment Board, reconnect ribbon cables and replace instrument top cover.

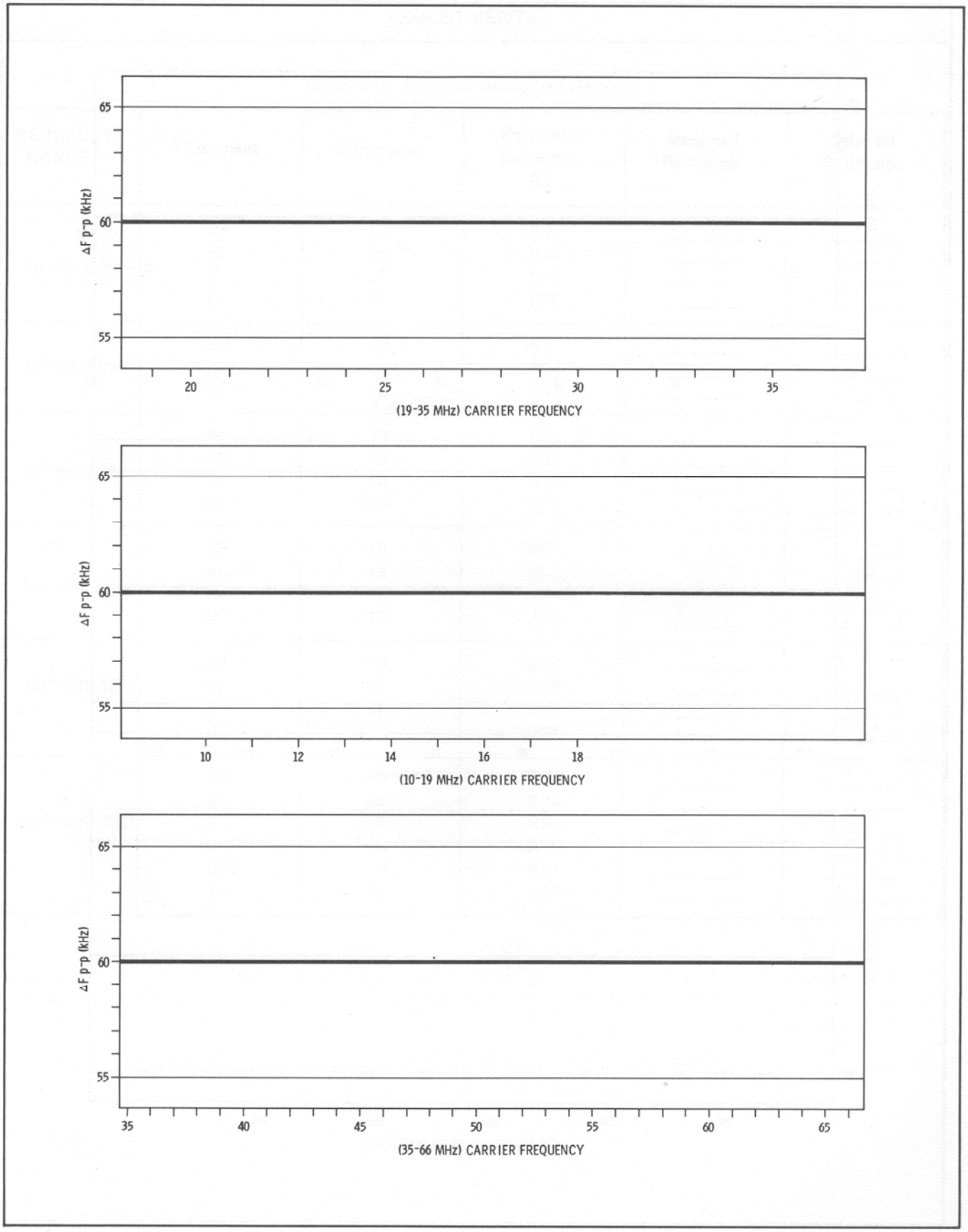


Figure 5-8. Counter Readings, FM Deviation vs. Carrier Frequency (1 of 2)

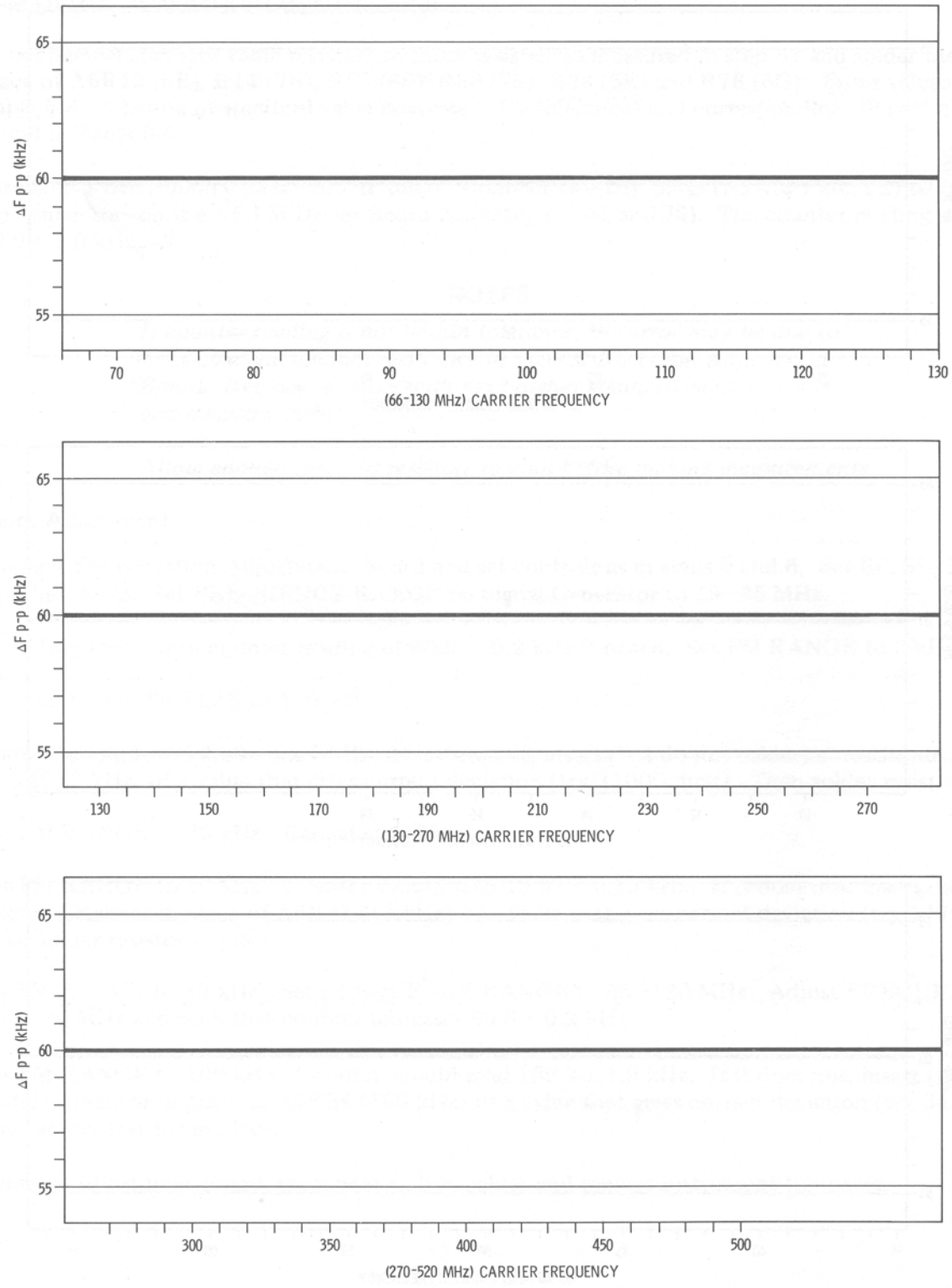


Figure 5-8. Counter Readings, FM Deviation vs. Carrier Frequency (2 of 2)

ADJUSTMENTS

Table 5-3. Resistor Selection Record

FREQUENCY RANGE	Adjustment	Mnemonic	Reference Designator A5	Measured Resistance	Selected Resistance
10—19 MHz	BP	1B	R2	_____	_____
	SL	1S	R22	_____	_____
	E	1E	R48	_____	_____
	G	1G	R66	_____	_____
19—35 MHz	BP	2B	R4	_____	_____
	SL	2S	R23	_____	_____
	E	2E	R44	_____	_____
35—66 MHz	BP	3B	R6	_____	_____
	SL	3S	R24	_____	_____
	E	3E	R40	_____	_____
	G	3G	R70	_____	_____
66—130 MHz	BP	4B	R8	_____	_____
	SL	4S	R25	_____	_____
	E	4E	R38	_____	_____
	G	4G	R72	_____	_____
130—270 MHz	BP	5B	R10	_____	_____
	SL	5S	R28	_____	_____
	E	5E	R35	_____	_____
	G	SG	R74	_____	_____
270—520 MHz	BP	6B	R12	_____	_____
	SL	6S	R29	_____	_____
	E	6E	R33	_____	_____
	G	6G	R76	_____	_____
	BP2	7B	R14	_____	_____
	SL2	7S	R30	_____	_____

Table 5-4. Standard Value Resistors (±1%, 1/8W, Metal Film)

Ohms	HP Part Number	Ohms	HP Part Number
51.1	0757-0394	4.64K	0698-3155
56.2	0757-0395	5.11K	0757-0438
61.9	0757-0276	5.62K	0757-0200
68.1	0757-0397	6.19K	0757-0290
75.0	0757-0398	6.81K	0757-0439
82.5	0757-0399	7.50K	0757-0440
		8.25K	0757-0441
90.9	0757-0400	9.09K	0757-0288
100	0757-0401		
110	0757-0402	10.0K	0757-0442
121	0757-0403	11.0K	0757-0443
133	0698-3437	12.1K	0757-0444
		13.3K	0757-0289
147	0698-3438	14.7K	0698-3156
162	0757-0405	16.2K	0757-0447
178	0698-3439	17.8K	0698-3136
196	0698-3440	19.6K	0698-3157
215	0698-3441		
237	0698-3442	21.5K	0757-0199
		23.7K	0698-3158
261	0698-3132	26.1K	0698-3159
287	0698-3443	28.7K	0698-3449
316	0698-3444	31.6K	0698-3160
348	0698-3445	34.8K	0757-0123
383	0698-3446	38.3K	0698-3161
		42.2K	0698-3450
422	0698-3447	46.4K	0698-3162
464	0698-0082	51.1K	0757-0458
511	0757-0416	56.2K	0757-0459
562	0757-0417	61.9K	0757-0460
619	0757-0418	68.1K	0757-0461
		75.0K	0757-0462
681	0757-0419	82.5K	0757-0463
750	0757-0420		
825	0757-0421	90.9K	0757-0464
909	0757-0422	100K	0757-0465
1.0K	0757-0280	110K	0757-0466
		121K	0757-0467
1.1K	0757-0424	133K	0698-3451
1.21K	0757-0274		
1.33K	0757-0317	147K	0698-3452
1.47K	0757-1094	162K	0757-0470
		178K	0698-3243
1.62K	0757-0428	196K	0698-3453
1.78K	0757-0278		
1.96K	0698-0083	215K	0698-3454
2.15K	0698-0084	237K	0698-3266
		261K	0698-3455
2.37K	0698-3150	287K	0698-3456
2.61K	0698-0085		
2.87K	0698-3151	316K	0698-3457
3.16K	0757-0279	348K	0698-3458
3.48K	0698-3152	383K	0698-3459
		422K	0698-3460
3.83K	0698-3153	464K	0698-3260
4.22K	0698-3154		

5-23. OUTPUT IMPEDANCE ADJUSTMENT (Option 003 only)

REFERENCE:
Service Sheet 3A.

DESCRIPTION:

A tracking generator is used as an external 50Ω signal source to feed and SWR bridge. The output connector of the bridge is connected to a spectrum analyzer. The through connector of the bridge is connected to a short circuit to establish a reference, then to the output of A6 Reverse Power Protection Assembly. Return loss versus frequency is displayed on the spectrum analyzer.

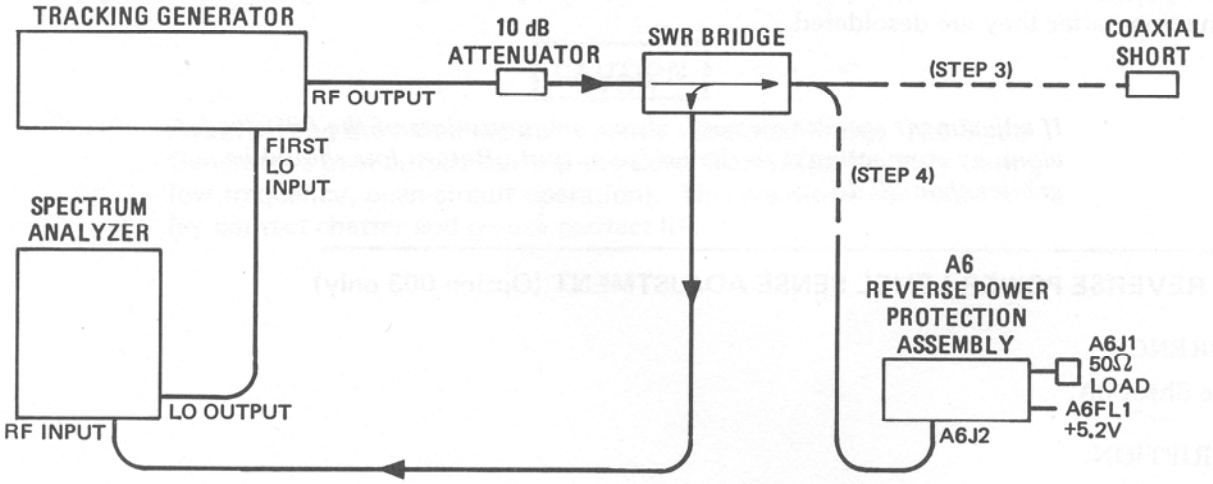


Figure 5-9. Output Impedance Adjustment Setup (Option 003)

EQUIPMENT:

Tracking Generator	HP 8444 Opt 058
Spectrum Analyzer	HP 8558B/182C
SWR Bridge	Wiltron 60N50
Coaxial Short	HP 11512A
10 dB Attenuator	HP 8491A Opt 10
50Ω Load	HP 908A

PROCEDURE:

1. Remove instrument bottom cover and bottom RF Assembly support bar.

2. Remove cables and screws securing A6 Reverse Power Protection Assembly. Orient assembly so that circuit components are accessible and the +5.2V supply and ground (if needed) are connected.

3. Connect equipment as shown in Figure 5-9.

4. Set spectrum analyzer resolution bandwidth to 300 kHz or greater, optimum input level to −20 dBm (20 dB attenuation), and frequency controls for a frequency span of 0 to 500 MHz. Set tracking generator output for 0 dBm.

ADJUSTMENTS

5-23. OUTPUT IMPEDANCE ADJUSTMENT (Option 003 only) (cont'd)

5. To establish a reference level, connect coaxial short to bridge output port. Use the spectrum analyzer's vertical reference level controls to set swept signal display to top graticule line of display with 10 dB/division log vertical scale.

6. Remove coaxial short and connect bridge output to output jack A6J2.

7. Set Signal Generator LINE to ON.

8. The level now shown on the spectrum analyzer should be greater than 18 dB down from the reference level set in step 5. If not, adjust FLATNESS ADJ, A6A1C9, or A6A1L1 and L2 for minimum level (i.e., maximum return loss). A6A1L1 and L2 can be adjusted by bending them, or raising and lowering them after they are desoldered.

NOTE

If adjustment seems necessary, check the return loss of the 50Ω load alone by connecting it to the bridge output. Return loss should be greater than 30 dB.

5-24. REVERSE POWER LEVEL SENSE ADJUSTMENT (Option 003 only)

REFERENCE:

Service Sheet 3A.

DESCRIPTION:

The output jack, A6J2 of Reverse Power Protection Assembly (A21) is driven by a 1 MHz source. Input jack A6J1 is monitored by a high impedance ac voltmeter. The LEVEL SENSE ADJ is set to trip the Level Sensor at a signal level of 1.8 Vrms.

NOTE

This procedure is also useful for verifying the operation of the reverse power protection without endangering the generator output circuitry.

EQUIPMENT:

Test Oscillator	HP 651B
Digital Voltmeter	HP 34702A/34740A

PROCEDURE:

1. Remove instrument bottom cover and bottom RF Assembly support bar.

2. Remove cables and screws securing A6 Reverse Power Protection Assembly. Orient assembly so that circuit components are accessible and the +5.2V supply and ground (if needed) are connected.

3. Connect voltmeter to input jack A6J1.

4. Connect 50Ω output of test oscillator to output jack A6J1. Set test oscillator frequency to 1 MHz at approximately 3 Vrms into an open circuit.

5-24. REVERSE POWER LEVEL SENSE ADJUSTMENT (Option 003 only) (cont'd)

5. Set Signal Generator LINE to ON.

6. Slowly increase test oscillator level until the reading on the voltmeter switches to zero. Note the signal level at which this occurs. The signal level should be between 1.7 and 1.9 Vrms. If the signal level is incorrect, adjust A6A1R2, LEVEL SENSE ADJ, until switching occurs within the correct limits.

NOTE

Always approach switching point from a lower level. The Level Sensor has a small amount of hysteresis causing the switching point to be lower for a decreasing signal level than for an increasing level.

CAUTION

Avoid setting the switching point below the stated limits. The Signal Generator's own output can trip the Level Sensor (particularly during low frequency, open-circuit operation). This condition can cause relay contact chatter and reduce contact life.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designation order. Table 6-3 contains the names and addresses that correspond with the manufacturers' code numbers.

6-3. ABBREVIATIONS

6-4. Table 6-1 lists abbreviations used in the parts list, schematics and throughout the manual. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-5. REPLACEABLE PARTS LIST

6-6. Table 6-2 is the list of replaceable parts and is organized as follows:

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

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

c. Miscellaneous parts.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

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

c. The description of the part.

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

e. The manufacturer's number for the part.

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

NOTE

Total quantities for optional assemblies are totaled by assembly and not integrated into the standard list.

6-7. ORDERING INFORMATION

6-8. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, description and function of the part, and number of parts required. Address the order to the nearest Hewlett-Packard office.

6-10. PARTS PROVISIONING

6-11. Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has a "Spare Parts Kit" available for this purpose. The kit consists of selected replaceable assemblies and components for this instrument. The contents of the kit and the "Recommended Spares" list are based on failure reports and repair data, and parts support for one year. A complimentary "Recommended Spares" list for this instrument may be obtained on request and the "Spare Parts Kit" may be ordered through your nearest Hewlett-Packard office.

Table 6-1. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

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

NOTE

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

Table 6-1. Reference Designations and Abbreviations (cont'd)

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

NOTE

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

MULTIPLIERS

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

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	08654-60026	1	RF SECTION ASSEMBLY	28480	08654-60026
A1C1	0160-2049	1	CAPACITOR-FXD 5000PF +80-20% 500WVDC CER	28480	0160-2049
A1C2	0180-0049	3	CAPACITOR-FXD; 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A1C3	0121-0016	1	CAPACITOR-V AIR DIEL 3.5/31.5PF 990V	94033	404-2
A1C4	0180-0089	2	CAPACITOR-FXD; 10UF+50-10% 150VDC AL	56289	30D106F150DD2
A1E1	9170-0029	6	CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A1E2	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A1E3	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A1E4	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A1E5	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A1E6	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A1E7	9170-0957	1	CORE, TOROID, NSR, P/O A1W1	02114	1041T060 3E2A
A1FL1	9135-0002	3	FILTER; LINE 10A	28480	9135-0002
A1FL2	9135-0002		FILTER; LINE 10A	28480	9135-0002
A1FL3	1810-0119	5	CAPACITOR FEED-THRU FILTER	01121	BE001-DA104P
A1FL4	1810-0119		CAPACITOR FEED-THRU FILTER	01121	BE001-DA104P
A1FL5	1810-0119		CAPACITOR FEED-THRU FILTER	01121	BE001-DA104P
A1FL6	1810-0119		CAPACITOR FEED-THRU FILTER	01121	BE001-DA104P
A1FL7	1810-0119		CAPACITOR FEED-THRU FILTER	01121	BE001-DA104P
A1FL8	9135-0002		FILTER; LINE 10A	28480	9135-0002
A1L1	9140-0114	3	COIL-FXD MOLDED RF CHOKE 10UH 10%	24226	15/102
A1L2	9140-0114		COIL-FXD MOLDED RF CHOKE 10UH 10%	24226	15/102
A1MP1	0360-0365	2	TERMINAL, SLDR LUG, 6 SCR, 0.143" DIA	78189	2104-06-00
A1MP2	0360-0365		TERMINAL, SLDR LUG, 6 SCR, 0.143" DIA	78189	2104-06-00
A1MP3	0360-0007	1	TERMINAL, SLDR LUG, 10 SCR, .195/.1 ID	78189	2501-10-00
A1MP4	0510-0042	4	RETAINER, PUSH ON, .125 DIA, CAD PLT	97464	6100-12-ST-CD
A1MP5	0510-0042		RETAINER, PUSH ON, .125 DIA, CAD PLT	97464	6100-12-ST-CD
A1MP6	0510-0042		RETAINER, PUSH ON, .125 DIA, CAD PLT	97464	6100-12-ST-CD
A1MP7	0510-0042		RETAINER, PUSH ON, .125 DIA, CAD PLT	97464	6100-12-ST-CD
A1MP8	0510-0235	1	RETAINER, RING, .375 DIA, CAD PLT STL	97464	1000-37-ST-CD
A1MP9	0510-0294	1	PIN:SPRING SST 1/16 X 11/16" LG	00000	OBD
A1MP10	0890-0573	4	TUBING FLEX .093-ID NPRN RBR .063-THK-W	76385	COMPOUND AX-1060
A1MP11	0890-0573		TUBING FLEX .093-ID NPRN RBR .063-THK-W	76385	COMPOUND AX-1060
A1MP12	0890-0573		TUBING FLEX .093-ID NPRN RBR .063-THK-W	76385	COMPOUND AX-1060
A1MP13	0890-0573		TUBING FLEX .093-ID NPRN RBR .063-THK-W	76385	COMPOUND AX-1060
A1MP14	1200-0081	2	INSULATOR, BSHG,FLG, .115 ID	26365	974-307
A1MP15	1200-0081		INSULATOR, BSHG,FLG, .115 ID	26365	974-307
A1MP16	1400-0024	2	CLAMP-CA .5-IN-WD NYL	28520	3324
A1MP17	1460-0195	1	SPRING EXT-LOOPS .125-OD .5-LG MUW	28480	1460-0195
A1MP18	1500-0432	1	BALL DRIVE .25-ID 1.09-OD 1.807-L	28480	1500-0432
A1MP19	1530-1766	1	DAMP PAD, BACK(SPECIAL)	0085M	A-1530-1766
A1MP20	1530-1767	1	DAMP PAD, COVER(SPECIAL)	0085M	A-1530-1767
A1MP21	2190-0019	3	WASHER-LK HLCL NO. 4 .115 IN ID .226 IN	28480	2190-0019
A1MP22	2190-0019		WASHER-LK HLCL NO. 4 .115 IN ID .226 IN	28480	2190-0019
A1MP23	2190-0019		WASHER-LK HLCL NO. 4 .115 IN ID .226 IN	28480	2190-0019
A1MP24	2190-0124	3	WASHER-LK INTL T NO. 10 .195 IN ID .311	24931	LW101-30
A1MP25	2190-0124		WASHER-LK INTL T NO. 10 .195 IN ID .311	24931	LW101-30
A1MP26	2190-0124		WASHER-LK INTL T NO. 10 .195 IN ID .311	24931	LW101-30
A1MP27	2190-0888	2	WASHER-FL NM NO. 6 .156 IN ID .25 IN OD	28480	2190-0888
A1MP28	2190-0888		WASHER-FL NM NO. 6 .156 IN ID .25 IN OD	28480	2190-0888
A1MP29	2950-0078	3	NUT-HEX-DBL CHAM 10-32-THD .067-THK .25	24931	HN100-11
A1MP30	2950-0078		NUT-HEX-DBL CHAM 10-32-THD .067-THK .25	24931	HN100-11
A1MP31	2950-0078		NUT-HEX-DBL CHAM 10-32-THD .067-THK .25	24931	HN100-11
A1MP32	3030-0564	4	SCREW, SET 10-32 UNF-3A X 0.875" LG.	00000	OBD
A1MP33	3030-0564		SCREW, SET 10-32 UNF-3A X 0.875" LG.	00000	OBD
A1MP34	3030-0564		SCREW, SET 10-32 UNF-3A X 0.875" LG.	00000	OBD
A1MP35	3030-0564		SCREW, SET 10-32 UNF-3A X 0.875" LG.	00000	OBD
A1MP36	3050-0105	2	WASHER-FL MTLC NO. 4 .125 IN ID .281 IN	28480	3050-0105
A1MP37	3050-0105		WASHER-FL MTLC NO. 4 .125 IN ID .281 IN	28480	3050-0105
A1MP38	3050-0188	1	WASHER-SPR CRVD NO. 3/8 .385 IN ID .683	78189	3502-20-19
A1MP39	3050-0274	3	WASHER-FL MTLC NO. 3/8 .39 IN ID .75 IN	28480	3050-0274
A1MP40	3050-0274		WASHER-FL MTLC NO. 3/8 .39 IN ID .75 IN	28480	3050-0274
A1MP41	3050-0274		WASHER-FL MTLC NO. 3/8 .39 IN ID .75 IN	28480	3050-0274
A1MP42	3050-0316	2	WASHER-SPR CRVD NO. 3/8 .386 IN ID .81	28480	3050-0316
A1MP43	3050-0316		WASHER-SPR CRVD NO. 3/8 .386 IN ID .81	28480	3050-0316
A1MP44	3130-0013	4	WASHER:SILVER PLATED 0.002" OD/ID	76854	4862-2
A1MP45	3130-0013		WASHER:SILVER PLATED 0.002" OD/ID	76854	4862-2
A1MP46	3130-0013		WASHER:SILVER PLATED 0.002" OD/ID	76854	4862-2
A1MP47	3130-0013		WASHER:SILVER PLATED 0.002" OD/ID	76854	4862-2
A1MP48	4320-0281	4	DAMPING PAD, ROUND	28480	4320-0281
A1MP49	4320-0281		DAMPING PAD, ROUND	28480	4320-0281
A1MP50	4320-0281		DAMPING PAD, ROUND	28480	4320-0281

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
A1MP51	4320-0281		DAMPING PAD, ROUND	28480	4320-0281
A1MP52	4320-0283	2	DAMPING PAD, U CHANNEL	28480	4320-0283
A1MP53	4320-0283		DAMPING PAD, U CHANNEL	28480	4320-0283
A1MP54	8160-0008	1	RFI ROUND STRIP AL .25-OD	07700	20-21103
A1MP55	8160-0021	2	RFI ROUND STRIP BRS AG PL .125-OD	07700	20-31101
A1MP56	8300-0006	4	BRAID, NYLON	28480	8300-0006
A1MP57	606A-102	1	ROLLER DETENT	28480	606A-102
A1MP58	606A-918	1	SPRING LEAF	28480	606A-918
A1MP59	608D-59C	1	DETENT SPRING	28480	608D-59C
A1MP60	03200-00011	1	CURSOR	28480	03200-00011
A1MP61	03200-00019	1	CONTACT	28480	03200-00019
A1MP62	03200-60018	3	PULLEY & BRACKET ASSEMBLY	28480	03200-60018
A1MP63	03200-60018		PULLEY & BRACKET ASSEMBLY	28480	03200-60018
A1MP64	03200-60018		PULLEY & BRACKET ASSEMBLY	28480	03200-60018
A1MP65	03200-60019	1	PULLEY & BRACKET ASSEMBLY	28480	03200-60019
A1MP66	08654-00003	1	CHASSIS-OSCILLATOR	28480	08654-00003
A1MP67	08654-00014	2	GASKET FEED THRU SHIELD	28480	08654-00014
A1MP68	08654-00014		GASKET FEED THRU SHIELD	28480	08654-00014
A1MP69	08654-00023	1	CLAMP BRAID	28480	08654-00023
A1MP70	08654-00029	1	BRACKET, POT MOUNTING	28480	08654-00029
A1MP71	08654-00034	1	COVER, RF AMPLIFIER	28480	08654-00034
A1MP72	08654-00042	2	CONTACT, CAPACITOR	28480	08654-00042
A1MP73	08654-00042		CONTACT, CAPACITOR	28480	08654-00042
A1MP74	08654-20048	1	PULLEY, CAPACITOR DRIVE	28480	08654-20048
A1MP75	08654-20051	1	PULLEY, POT DRIVE	28480	08654-20051
A1MP76	08654-20053	1	BUSHING	28480	08654-20053
A1MP77	08654-20055	1	SHAFT, FREQUENCY	28480	08654-20055
A1MP78	08654-20057	1	PLATE, FREQUENCY	28480	08654-20057
A1MP79	08654-20058	1	END PLATE, RF AMPLIFIER	28480	08654-20058
A1MP80	08654-20059	1	SHIELD, RF AMPLIFIER	28480	08654-20059
A1MP81	08654-20060	1	DIVIDER, RF AMPLIFIER	28480	08654-20060
A1MP82	08654-20061	1	SHIELD, FEED THRU	28480	08654-20061
A1MP83	08654-20062	1	BASE PLATE, MACH	28480	08654-20062
A1MP84	08654-20063	2	GUIDE, ROD CURSOR	28480	08654-20063
A1MP85	08654-20063		GUIDE, ROD CURSOR	28480	08654-20063
A1MP86	08654-20064	1	GEAR, CENTER SHAFT M	28480	08654-20064
A1MP87	08654-20070	2	PLUG, THREADED	28480	08654-20070
A1MP88	08654-20070		PLUG, THREADED	28480	08654-20070
A1MP89	08654-20074	1	SHAFT ASSEMBLY, DIAL DRIVE	28480	08654-20074
A1MP90	08654-20076	1	COVER, RF SECTION	28480	08654-20076
A1MP91	08654-20077	1	SHAFT ASSEMBLY, COUNTER	28480	08654-20077
A1MP92	08654-20078	1	SHAFT ASSEMBLY, TURRET	28480	08654-20078
A1MP93	08654-20083	1	DRUM ASSEMBLY, DIAL	28480	08654-20083
A1MP94	3030-0001	1	SCREW-SET 8-32 .188-IN-LG SMALL CUP-PT	28480	3030-0001
A1MP95	2680-0105	4	SCREW-MACH 10-32 .625-IN-LG PAN-HD	28480	2680-0105
A1MP96	2190-0034	4	WASHER-LK HLCL NO. 10 .194 IN ID .337 IN	28480	2190-0034
A1MP97	2510-0103	2	SCREW-MACH 8-32 .375-IN-LG PAN-HD	28480	2510-0103
A1MP98	2190-0087	3	WASHER-LK HLCL NO. 8 .168 IN ID .296 IN	72800	KANTLINK
A1MP99	2200-0145	2	SCREW-MACH 4-40 .438-IN-LG PAN-HD	28480	2200-0145
A1MP100	2360-0117	8	SCREW-MACH 6-32 .375-IN-LG PAN-HD	28480	2360-0117
A1MP101	2360-0115	20	SCREW-MACH 6-32 .312-IN-LG PAN-HD	28480	2360-0115
A1MP102	3050-0010	5	WASHER-FL MTLC NO. 6 .147 IN ID .312 IN	76210	65
A1MP103	3050-0066	5	WASHER-FL MTLC NO. 6 .147 IN ID .375 IN	28480	3050-0066
A1MP104	2420-0001	2	NUT-HEX-W/LKWR 6-32-THD .109-THK .312	28480	2420-0001
A1MP105	2360-0123	2	SCREW-MACH 6-32 .625-IN-LG PAN-HD	28480	2360-0123
A1MP106	1400-0015	1	CLAMP, CABLE, .25 DIA .375 W STL	73734	1550
A1MP107	2190-0014	4	WASHER-LK INTL T NO. 2 .089 IN ID .185	78189	1902-00
A1MP108	0510-0060	1	RETAINER, RING, .375 DIA, CAD PLT STL	79136	5555-37-S-MD
A1MP109	2360-0192	7	SCREW-MACH 6-32 .25-IN-LG 100 DEG FL-HD	28480	2360-0192
A1MP110	2200-0153	3	SCREW-MACH 4-40 .875-IN-LG PAN-HD	28480	2200-0153
A1MP111	2200-0172	2	SCREW-MACH 4-40 .875-IN-LG 82 DEG FL-HD	28480	2200-0172
A1MP112	3050-0071	1	WASHER-FL MTLC NO. 8 .169 IN ID .438 IN	28480	3050-0071
A1MP113	2510-0109	1	SCREW-MACH 8-32 .625-IN-LG PAN-HD	28480	2510-0109
A1MP114	2360-0121	1	SCREW-MACH 6-32 .5-IN-LG PAN-HD POZI-REC	28480	2360-0121
A1MP115	2260-0009	2	NUT-HEX-W/LKWR 4-40-THD .094-THK .25-A/F	28480	2260-0009
A1MP116	2200-0107	8	SCREW-MACH 4-40 .375-IN-LG PAN-HD	28480	2200-0107
A1MP117	2200-0101	2	SCREW-MACH 4-40 .188-IN-LG PAN-HD	28480	2200-0101
A1MP118	2950-0006	1	NUT-HEX-DBL CHAM 1/4-32-THD .094-THK	73734	9000
A1MP119	2190-0067	1	WASHER-LK INTL T NO. 1/4 .256 IN ID .408	78189	1914-05
A1MP120	3030-0007	2	SCREW-SET 4-40 .125-IN-LG SMALL CUP-PT	28480	3030-0007
A1MP121	0520-0129	1	SCREW-MACH 2-56 .312-IN-LG PAN-HD	28480	0520-0129
A1MP122	0590-0106	1	NUT-HEX-PLSTC LKG 2-56-THD .141-THK .25	72962	22NM-26
A1MP123	1400-0249	1	CLAMP; CABLE TIE: .75 DIA .091 W 3.62 L	06383	PLT1M-M-8
A1MP124	1400-0024		CLAMP-CA .5-IN-WD NYL	28520	3324

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1MP125	2200-0113	1	SCREW-MACH 4-40 .625-IN-LG PAN-HD	28480	2200-0113
A1MP126	0610-0002	1	NUT-HEX-DBL CHAM 2-56-THD .062-THK .188	28480	0610-0002
A1MP127	2360-0299	1	SCREW-SET 6-32 .125-IN-LG CUP-PT SLT-REC	28480	2360-0299
A1MP128	08654-00039	1	BRACKET, CAPACITOR MOUNT	28480	08654-00039
A1R1	0757-0416	3	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R2	2100-3458	1	RESISTOR	28480	2100-3458
A1W1	08654-60035	1	CABLE ASSEMBLY, RF OSC OUT, (INCL A1E7)	28480	08654-60035
A1A1	08654-60102	1	BOARD ASSEMBLY, RF AMPLIFIER/ALC	28480	08654-60102
A1A1	08654-60044		RESTORED 08654-60102, REQUIRES EXCHANGE	28480	08654-60044
A1A1C1	0160-3879	16	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C2	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C3	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C4*	0160-3565	1	CAPACITOR-FXD 6.8PF +-.5PF 100WVDC CER *FACTORY SELECTED PART	28480	0160-3565
A1A1C5	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C6	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C7	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C8	0160-3878	5	CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A1C9	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C10	0160-2257	4	CAPACITOR-FXD 10PF +-5% 500WVDC CER	28480	0160-2257
A1A1C11	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C12	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C13	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C14	0160-2204	2	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A1A1C15	0160-3877	1	CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A1A1C16	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C17	0160-3873	1	CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A1A1C18	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C19	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C20	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A1C21	0160-3875	2	CAPACITOR-FXD 22PF +-5% 200WVDC CER	28480	0160-3875
A1A1C22	0160-3876	1	CAPACITOR-FXD 47PF +-20% 200WVDC CER	28480	0160-3876
A1A1C23	0160-3875		CAPACITOR-FXD 22PF +-5% 200WVDC CER	28480	0160-3875
A1A1C24	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A1CR1	1901-0033	6	DIODE-GEN PRP 180V 200MA	28480	1901-0033
A1A1CR2	1901-0747	2	DIODE	28480	1901-0747
A1A1CR3	1901-0747		DIODE	28480	1901-0747
A1A1CR4	1901-0535	4	DIODE-SCHOTTKY	28480	1901-0535
A1A1CR5	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1J1	1250-1220	3	CONNECTOR-RF SMC M PC	98291	50-051-0109
A1A1J2	1250-1220		CONNECTOR-RF SMC M PC	98291	50-051-0109
A1A1J3	1250-1220		CONNECTOR-RF SMC M PC	98291	50-051-0109
A1A1L1	9140-0114		COIL-FXD MOLDED RF CHOKE 10UH 10%	24226	15/102
A1A1L2	9100-2252	1	COIL-FXD MOLDED RF CHOKE 270MH 10%	24226	10/270
A1A1L3	08654-80001	1	INDUCTOR, RF 15 NH	28480	08654-80001
A1A1L4	08654-80003	1	INDUCTOR, RF 45 NH	28480	08654-80003
A1A1L5	9100-1623	1	COIL-FXD MOLDED RF CHOKE 27UH 5%	24226	15/272
A1A1L6	08654-80002	1	INDUCTOR, RF 35 NH	28480	08654-80002
A1A1L7	9100-2247	1	COIL-FXD MOLDED RF CHOKE 100MH 10%	24226	10/100
A1A1MP1	0340-0008	1	TERMINAL-STUD DBL TURRET PRESS MTG	98291	ST-1000-L2
A1A1MP2	08654-00019	1	SHIELD, BUFFER AMPLIFIER	28480	08654-00019
A1A1MP3	08654-00020	1	SHIELD, MODULATOR	28480	08654-00020
A1A1MP4	08654-00021	1	STRAP GROUND	28480	08654-00021
A1A1Q1	5086-7118	7	HP-21 TO TO-72 PACKAGE	28480	5086-7118
A1A1Q1	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q2	1855-0020	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A1A1Q3	5086-7118		HP-21 TO TO-72 PACKAGE	28480	5086-7118
A1A1Q3	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q4	5086-7118		HP-21 TO TO-72 PACKAGE	28480	5086-7118
A1A1Q4	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q5	5086-7118		HP-21 TO TO-72 PACKAGE	28480	5086-7118
A1A1Q5	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q6	5086-7118		HP-21 TO TO-72 PACKAGE	28480	5086-7118
A1A1Q6	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q7	5086-7118		HP-21 TO TO-72 PACKAGE	28480	5086-7118
A1A1Q7	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q8	1853-0020	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1A1Q9	1854-0071	3	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1A1Q10	1853-0001	1	TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A1A1R1	0698-7216	4	RESISTOR 147 2% .05W F TC=0+-100	24546	C3-1/8-T0-147R-G
A1A1R2	0698-7208	2	RESISTOR 68.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-68R1-G
A1A1R3	0698-7232	1	RESISTOR 681 2% .05W F TC=0+-100	24546	C3-1/8-T0-681R-G
A1A1R4	0698-7227	1	RESISTOR 422 2% .05W F TC=0+-100	24546	C3-1/8-T0-422R-G
A1A1R5	0698-7205	3	RESISTOR 51.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G

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
A1A1R6	0698-7196	1	RESISTOR 21.5 2% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A1A1R7	0698-7253	3	RESISTOR 5.11K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5111-G
A1A1R8	0698-7277	2	RESISTOR 51.1K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5112-G
A1A1R9	0698-7253		RESISTOR 5.11K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5111-G
A1A1R10	0698-7214	1	RESISTOR 121 2% .05W F TC=0+-100	24546	C3-1/8-T0-121R-G
A1A1R11	0698-7188	5	RESISTOR 10 2% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A1A1R12	0698-7207	1	RESISTOR 61.9 2% .05W F TC=0+-100	24546	C3-1/8-T00-61R9-G
A1A1R13	0698-7205		RESISTOR 51.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G
A1A1R14	0698-7224	1	RESISTOR 316 2% .05W F TC=0+-100	24546	C3-1/8-T0-316R-G
A1A1R15	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1A1R16	0757-0814	1	RESISTOR 511 1% .5W F TC=0+-100	19701	MF7C1/2-T0-511R-F
A1A1R17	0698-7205		RESISTOR 51.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G
A1A1R18	0757-0442	19	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1A1R19	0698-7284	2	RESISTOR 100K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1003-G
A1A1R20	0698-7239	1	RESISTOR 1.33K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1331-G
A1A1R21	0698-7247	1	RESISTOR 2.87K 2% .05W F TC=0+-100	24546	C3-1/8-T0-2871-G
A1A1R22	0698-7277		RESISTOR 51.1K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5112-G
A1A1R23	0698-7198	2	RESISTOR 26.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-26R1-G
A1A1R24	0698-7217	1	RESISTOR 162 2% .05W F TC=0+-100	24546	C3-1/8-T0-162R-G
A1A1R25	0698-7209	1	RESISTOR 75 2% .05W F TC=0+-100	24546	C3-1/8-T00-75R0-G
A1A1R26	0698-7198		RESISTOR 26.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-26R1-G
A1A1R27	0698-7188		RESISTOR 10 2% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A1A1R28	0698-3444	3	RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A1A1R29*	0698-7220	1	RESISTOR 215 2% .05W F TC=0+-100 *FACTORY SELECTED PART	24546	C3-1/8-T0-215R-G
A1A1R30	0698-7248	5	RESISTOR 3.16K 2% .05W F TC=0+-100	24546	C3-1/8-T0-3161-G
A1A1R31	0698-7269	1	RESISTOR 23.7K 2% .05W F TC=0+-100	24546	C3-1/8-T0-2372-G
A1A1R32	2100-2497	2	RESISTOR-VAR TRMR 2KOHM 10% C TOP ADJ	19701	ET50W202
A1A1R33	0698-7245	1	RESISTOR 2.37K 2% .05W F TC=0+-100	24546	C3-1/8-T0-2371-G
A1A1R34	0698-7195	1	RESISTOR 19.6 2% .05W F TC=0+-100	24546	C3-1/8-T00-19R6-G
A1A1R35	0698-7279	1	RESISTOR 61.9K 2% .05W F TC=0+-100	24546	C3-1/8-T0-6192-G
A1A1R36	0698-7286	1	RESISTOR 121K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1213-G
A1A1R37	0698-7253		RESISTOR 5.11K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5111-G
A1A1R38	0698-7201	1	RESISTOR 34.8 2% .05W F TC=0+-100	24546	C3-1/8-T00-34R8-G
A1A1R39*	0698-7212	1	RESISTOR 100 2% .05W F TC=0+-100 *FACTORY SELECTED PART	24546	C3-1/8-T0-100R-G
A1A1R40	0698-7256	1	RESISTOR 6.81K 2% .05W F TC=0+-100	24546	C3-1/8-T0-6811-G
A1A1R41	0698-7284		RESISTOR 100K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1003-G
A1A1TP1	0360-0124	5	TERMINAL STRIP, .040" DIA	28480	0360-0124
A1A1TP2	0360-0124		TERMINAL STRIP, .040" DIA	28480	0360-0124
A1A1TP3	0360-0124		TERMINAL STRIP, .040" DIA	28480	0360-0124
A1A1TP4	0360-0124		TERMINAL STRIP, .040" DIA	28480	0360-0124
A1A1TP5	0360-0124		TERMINAL STRIP, .040" DIA	28480	0360-0124
A1A1U1	1820-0223	2	IC LM301AH	27014	LM301AH
A1A2	08654-60104	1	BOARD ASSEMBLY, FM MODULATOR	28480	08654-60104
A1A2C1	0160-3872	2	CAPACITOR-FXD 2.2PF +-.25PF 200WVDC CER	28480	0160-3872
A1A2C2	0160-4289	2	CAPACITOR-FXD 15PF +-5% 100WVDC CER	95275	VK25BA150J
A1A2C3	0160-4289		CAPACITOR-FXD 15PF +-5% 100WVDC CER	95275	VK25BA150J
A1A2C4	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200WVDC CER	28480	0160-3872
A1A2CR1	0122-0245	2	DIODE-VVC 1N5139 6.8PF 10%	04713	1N5139
A1A2CR2	0122-0245		DIODE-VVC 1N5139 6.8PF 10%	04713	1N5139
A1A2L1			NSR, P/O ETCHED CIRCUIT BOARD		
A1A2L2			NSR, P/O ETCHED CIRCUIT BOARD		
A1A2MP1	08654-00040	1	BRACKET, FM MODULATOR BOARD	28480	08654-00040
A1A2R1	0698-7260	6	RESISTOR 10K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1002-G
A1A2R2	0698-7260		RESISTOR 10K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1002-G
A1A2R3	0698-7260		RESISTOR 10K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1002-G
A1A3	08654-60003	1	BOARD ASSEMBLY, RF OSCILLATOR	28480	08654-60003
A1A3C1	0180-0116	3	CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A1A3C2	0121-0447	1	CAPACITOR; VAR; TRMR; CER; 1.5/2.5PF	00865	7S-TRIKO-03 1.5-2.5
A1A3C3	0160-0682	2	CAPACITOR-FXD 3.3PF +-.5PF 200WVDC CER	28480	0160-0682
A1A3C4	0160-0682		CAPACITOR-FXD 3.3PF +-.5PF 200WVDC CER	28480	0160-0682
A1A3C5	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A3C6*	0160-2248	1	CAPACITOR-FXD 4.3PF +-.25PF 500WVDC CER FACTORY SELECTED PART	28480	0160-2248
A1A3C7	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A3C8	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A3C9	0160-0174	1	CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A3C10	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A3C11	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A3C12*	0160-2236	1	CAPACITOR-FXD 1PF+-.25PF 500WVDC CER *FACTORY SELECTED PART	28480	0160-2236
A1A3CR1, CR2	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A3J1	1250-0835	1	CONNECTOR-RF SMC M PC	24931	37JR104-2
A1A3Q1	1854-0345	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1A3Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A1A3Q3	5086-7118		HP-21 TO TO-72 PACKAGE	28480	5086-7118
	1205-0037	7	HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A3Q4	1854-0404	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A3Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A3Q6	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A1A3R1	0698-7216		RESISTOR 147 2% .05W F TC=0+-100	24546	C3-1/8-TO-147R-G
A1A3R2	0698-7236	2	RESISTOR 1K 2% .05W F TC=0+-100	24546	C3-1/8-TO-1001-G
A1A3R3	0698-7236		RESISTOR 1K 2% .05W F TC=0+-100	24546	C3-1/8-TO-1001-G
A1A3R4	0698-7248		RESISTOR 3.16K 2% .05W F TC=0+-100	24546	C3-1/8-TO-3161-G
A1A3R5	0698-7260		RESISTOR 10K 2% .05W F TC=0+-100	24546	C3-1/8-TO-1002-G
A1A3R6	0698-7216		RESISTOR 147 2% .05W F TC=0+-100	24546	C3-1/8-TO-147R-G
A1A3R7	0698-7188		RESISTOR 10 2% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A1A3R8	0698-7260		RESISTOR 10K 2% .05W F TC=0+-100	24546	C3-1/8-TO-1002-G
A1A3R9	0698-7248		RESISTOR 3.16K 2% .05W F TC=0+-100	24546	C3-1/8-TO-3161-G
A1A3R10	0698-7248		RESISTOR 3.16K 2% .05W F TC=0+-100	24546	C3-1/8-TO-3161-G
A1A3R11	0698-7228	1	RESISTOR 464 2% .05W F TC=0+-100	24546	C3-1/8-TO-464R-G
A1A3R12	0698-7248		RESISTOR 3.16K 2% .05W F TC=0+-100	24546	C3-1/8-TO-3161-G
A1A3R13	0698-7188		RESISTOR 10 2% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A1A3R14	0698-7208		RESISTOR 68.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-68R1-G
A1A3R15	0698-7216		RESISTOR 147 2% .05W F TC=0+-100	24546	C3-1/8-TO-147R-G
A1A3R16	0698-7230	1	RESISTOR 562 2% .05W F TC=0+-100	24546	C3-1/8-TO-562R-G
A1A3R17	0698-3260	2	RESISTOR 464K 1% .125W F TC=0+-100	03888	PME55S
A1A3R18	0698-7188		RESISTOR 10 2% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A1A3R19	0698-7204	1	RESISTOR 46.4 2% .05W F TC=0+-100	24546	C3-1/8-T00-46R4-G
A1A3R20	0698-7260		RESISTOR 10K 2% .05W F TC=0+-100	24546	C3-1/8-TO-1002-G
A1A3R21	0698-7229	1	RESISTOR 511 2% .05W F TC=0+-100	24546	C3-1/8-TO-511R-G
A1A4	08654-60021	1	TURRET ASSEMBLY	28480	08654-60021
A1A4E1	9170-0847	3	CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATED
A1A4E2	9170-0847		CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATED
A1A4E3	9170-0847		CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATED
A1A4R1	0686-1015	5	RESISTOR 100 5% .5W CC TC=0+529	01121	EB1015
A1A4R2	0686-1015		RESISTOR 100 5% .5W CC TC=0+529	01121	EB1015
A1A4R3	0686-1015		RESISTOR 100 5% .5W CC TC=0+529	01121	EB1015
A1A4R4	0686-1015		RESISTOR 100 5% .5W CC TC=0+529	01121	EB1015
A1A4R5	0686-1015		RESISTOR 100 5% .5W CC TC=0+529	01121	EB1015
A1A5	08654-60028	1	SWITCH ASSEMBLY, ROTARY P.C.	28480	08654-60028
A1A5J1			NSR, P/O A1A5.		
A1A5J2			NSR, P/O A1A5.		
A1A5W1			NSR, P/O A1A5.		
A1A5W2			NSR, P/O A1A5.		
A2	08654-60024	1	ATTENUATOR ASSEMBLY(INCL A2J1 AND A2J2) NOT RECOMMENDED FOR FIELD REPAIR	28480	08654-60024
A2	08654-60023		RESTORED 08654-60024, REQUIRES EXCHANGE	28480	08654-60023
A2J1			NSR, P/O A2		
A2J2			NSR, P/O A2		
A3	08654-60101	1	BOARD ASSEMBLY, CONTROL/POWER SUPPLY	28480	08654-60101
A3C1	0160-2055	8	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C3	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C4	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C5	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C6	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C7	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C8	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A3C9	0180-2181	2	CAPACITOR-FXD; 1300UF+75-10% 50VDC AL	56289	36D132G050AA2A
A3C10	0180-2181		CAPACITOR-FXD; 1300UF+75-10% 50VDC AL	56289	36D132G050AA2A
A3C11	0180-0049		CAPACITOR-FXD; 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A3C12	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A3C13	0160-0161	1	CAPACITOR-FXD .01UF +-10% 200WVDC POLYE	56289	292P10392
A3C14	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A3C15	0160-3460	1	CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0160-3460

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
A3C16	0160-2194	1	CAPACITOR-FXD .18UF +-5% 200WVDC POLYE	28480	0160-2194
A3C17	0160-3456	1	CAPACITOR-FXD 1000PF +-10% 1000WVDC CER	28480	0160-3456
A3C18	0180-2206	1	CAPACITOR-FXD: 60UF+-10% 6VDC TA-SOLID	56289	150D606X900682
A3C19	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A3C20	0160-0300	1	CAPACITOR-FXD 2700PF +-10% 200WVDC POLYE	56289	292P27292
A3C21	0180-0291	4	CAPACITOR-FXD: 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A3C22	0160-3534	1	CAPACITOR-FXD 510PF +-5% 100WVDC MICA	28480	0160-3534
A3C23	0160-2257		CAPACITOR-FXD 10PF +-5% 500WVDC CER	28480	0160-2257
A3C24	0160-2257		CAPACITOR-FXD 10PF +-5% 500WVDC CER	28480	0160-2257
A3C25	0180-0228	1	CAPACITOR-FXD: 22UF+-10% 15VDC TA-SOLID	56289	150D226X9015B2
A3C26	0180-0291		CAPACITOR-FXD: 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A3C27	0160-2201	5	CAPACITOR-FXD 51PF +-5% 300WVDC MICA	28480	0160-2201
A3C28	0180-0049		CAPACITOR-FXD: 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A3CR1	1901-0364	2	DIODE-MULT FULL WAVE BRIDGE RECTIFIER	04713	SDA 10185-4
A3CR2	1901-0364		DIODE-MULT FULL WAVE BRIDGE RECTIFIER	04713	SDA 10185-4
A3CR3	1901-0040	16	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR5	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR6	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR7	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR8	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR9	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR10	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR11	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR12	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR13	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR14	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR15	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR16	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR17	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3CR18	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A3MP1,MP2,MP3	0360-1514	28	TERMINAL-STUD SGL PIN PRESS MTG	28480	0360-1514
A3Q1	1854-0072	2	TRANSISTOR NPN 2N3054 SI TO-66 PD=25W	02735	2N3054
	08654-20031	1	HEAT SINK, TO-66	28480	08654-20031
A3Q2	1853-0012	1	TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A3Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q5	1854-0072		TRANSISTOR NPN 2N3054 SI TO-66 PD=25W	02735	2N3054
A3Q6	1854-0022	2	TRANSISTOR NPN SI PD=700MW TO-39	07263	S17843
A3R1	0757-0278		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1781-F
A3R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R3	0757-0438	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A3R4	0757-0290	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A3R5	2100-1758	1	RESISTOR-VAR TRMR 1KOHM 5% WW SIDE ADJ	GB027	CT-106-4
A3R6	0698-3156	3	RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1472-F
A3R7	0683-0475	2	RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A3R8	0698-3633	1	RESISTOR 390 5% 2W MO TC=0+-200	24546	FP42-2-T00-390R-J
A3R9	0683-0475		RESISTOR 4.7 5% .25W FC TC=-400/+500	01121	CB47G5
A3R10	0757-0394	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A3R11	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F
A3R12	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R13	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R14	0757-0465	10	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A3R15	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A3R16	0811-2816	1	RESISTOR 1.8 5% .75W PW TC=0+-50	07088	KM-050
A3R17	0698-3628	1	RESISTOR 220 5% 2W MO TC=0+-200	24546	FP42-2-T00-220R-J
A3R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R19	0698-3440	1	RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-TO-196R-F
A3R20	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F
A3R21	0757-0464	4	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-TO-9092-F
A3R22	0757-0463	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8252-F
A3R23	0698-3457	3	RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A3R24	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R25	0757-0441	3	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A3R26	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R27	0757-0458	6	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5112-F
A3R28	0698-3161	2	RESISTOR 38.3K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3832-F
A3R29	0698-3158	3	RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2372-F
A3R30	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R31	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A3R32	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R33	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A3R34	2100-2489	1	RESISTOR-VAR TRMR 5KOHM 10% C SIDE ADJ	19701	ET50X502
A3R35	0757-0447	3	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1622-F

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
A3R36	0698-3458	3	RESISTOR 348K 1% .125W F TC=0+-100	03888	PME55S
A3R37	0698-3162	2	RESISTOR 46.4K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4642-F
A3R38	0757-0279	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R39	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A3R40	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3R41	0757-0461	1	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A3R42	0698-3459	2	RESISTOR 383K 1% .125W F TC=0+-100	03888	PME55S
A3R43	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R44	0757-0462	1	RESISTOR 75.0K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A3R45	2100-2517	1	RESISTOR-VAR TRMR 50KOHM 10% C SIDE ADJ	19701	ET50X503
A3R46	0698-3260		RESISTOR 464K 1% .125W F TC=0+-100	03888	PME55S
A3R47	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3R48	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R49	0698-3454	1	RESISTOR 215K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2153-F
A3R50	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R51	0757-0180	1	RESISTOR 31.6 1% .125W F TC=0+-100	24546	C5-1/4-T0-31R6-F
A3R52	2100-2516	2	RESISTOR-VAR TRMR 100KOHM 10% C SIDE ADJ	84048	172-104
A3R53*	0698-4424	1	RESISTOR 1.4K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	16299	C4-1/8-T0-1401-F
A3R54	2100-2516		RESISTOR-VAR TRMR 100KOHM 10% C SIDE ADJ	84048	172-104
A3R55	0683-2265	1	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A3R56	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A3R57	2100-2514		RESISTOR-VAR TRMR 20KOHM 10% C SIDE ADJ	19701	ET50X203
A3R58	0698-3450	1	RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A3R59	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A3R60	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R61	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1662-F
A3R62	0757-0288	2	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C 1/8-T0-9091-F
A3R63	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A3S1	3101-0973	1	SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC	79727	GF126-0018
A3TP1-13	0360-1514		TERMINAL-STUD SGL PIN PRESS MTG	28480	0360-1514
A3U1	1820-0223		IC LM301AH	27014	LM301AH
A3U2	1826-0013	4	IC AMPLIFIER	28480	1826-0013
A3U3	1826-0288	1	IC,LIN DUAL OP. AMPL. 15K AVOL	02735	83376
A3U4	1826-0092	4	IC AMPLIFIER	28480	1826-0092
A3U5	1826-0013		IC AMPLIFIER	28480	1826-0013
A3U6	1826-0013		IC AMPLIFIER	28480	1826-0013
A3VR1	1902-0680	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.25W	03877	1N827
A3VR2	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A3VR3	1902-0049	1	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	04713	SZ 10939-122
A4	5060-9422	1	LINE MODULE(INCLUDES A4J1, A4P1).	28480	5060-9422
A4J1			CONNECTOR, NSR, P/O A4		
A4P1	5020-8122	1	CARD, VOLTAGE SELECT (SEE SECTION II)	28480	5020-8122
A5	08654-60106	1	BOARD ASSEMBLY, FM DRIVER	28480	08654-60106
A5C1	0160-3447	1	CAPACITOR-FXD 470PF +-10% 1000WVDC CER	28480	0160-3447
A5C2	0160-3467	4	CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3467
A5C3	0160-2201		CAPACITOR-FXD 51PF +-5% 300WVDC MICA	28480	0160-2201
A5C4	0160-3467		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3467
A5C5	0160-3467		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3467
A5C6	0160-2201		CAPACITOR-FXD 51PF +-5% 300WVDC MICA	28480	0160-2201
A5C7	0160-4084	5	CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A5C8	0160-3467		CAPACITOR-FXD 100PF +-10% 1000WVDC CER	28480	0160-3467
A5C9	0180-0374	1	CAPACITOR-FXD; 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A5C10	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A5C11	0180-0058	4	CAPACITOR-FXD; 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A5C12	0180-0058		CAPACITOR-FXD; 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A5C13	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A5C14	0160-2264	1	CAPACITOR-FXD 20PF +-5% 500WVDC CER	28480	0160-2264
A5C15	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A5C16	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A5C17	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A5C18	0160-4084		CAPACITOR-FXD .1UF +-20% 50WVDC CER	28480	0160-4084
A5C19	0180-0058		CAPACITOR-FXD; 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A5C20	0180-0058		CAPACITOR-FXD; 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A5C21	0140-0210	1	CAPACITOR-FXD 270PF +-5% 300WVDC MICA	72136	DM15F271J0300WV1CR
A5C22	0180-0100	1	CAPACITOR-FXD; 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A5C23	0160-2205	1	CAPACITOR-FXD 120PF +-5% 300WVDC MICA	28480	0160-2205
A5C24	0160-2257		CAPACITOR-FXD 10PF +-5% 500WVDC CER	28480	0160-2257
A5C25	0160-0157	1	CAPACITOR-FXD 4700PF +-10% 200WVDC POLYE	56289	292P47292

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
A5C26	0180-0089		CAPACITOR-FXD; 10UF+50-10% 150VDC AL	56289	30D106F150DD2
A5C27	0140-0198	1	CAPACITOR-FXD 200PF +-5% 300WVDC MICA	72136	DM15F201J0300WV1CR
A5C28	0160-2201		CAPACITOR-FXD 51PF +-5% 300WVDC MICA	28480	0160-2201
A5C29	0160-2201		CAPACITOR-FXD 51PF +-5% 300WVDC MICA	28480	0160-2201
A5CR1	1901-1011	2	DIODE; MULT; DIODE ARRAY	28480	1901-1011
A5CR2	1901-1011		DIODE; MULT; DIODE ARRAY	28480	1901-1011
A5CR3	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A5CR4	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A5CR5	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A5CR6	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A5CR7	1901-0159	2	DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A5CR8	1901-0159		DIODE-PWR RECT 400V 750MA	04713	SR1358-4
A5CR9	1901-0033		DIODE-GEN PRP 180V 200MA	28480	1901-0033
A5J1	1200-0508	3	SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	06776	ICN-143-S3W
A5J2	1200-0508		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	06776	ICN-143-S3W
A5J3	1200-0508		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	06776	ICN-143-S3W
A5L1	9140-0137	3	COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A5L2	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A5L3	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A5MP1-MP58	0360-0065	58	TERMINAL-STUD FKD SWGFRM MTG	28480	0360-0065
A5Q1	1854-0022		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A5Q2	1854-0023	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A5R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R2*	0757-0439	8	RESISTOR 6.81K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-6811-F
A5R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R4*	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-6811-F
A5R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R6*	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-6811-F
A5R7	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R8*	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-6811-F
A5R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R10*	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-6811-F
A5R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R12*	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-6811-F
A5R13	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R14*	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-6811-F
A5R15	0757-0440	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7501-F
A5R16	2100-2216	2	RESISTOR-VAR TRMR 5KOHM 10% C TOP ADJ	84048	170-502
A5R17	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A5R18	2100-2497		RESISTOR-VAR TRMR 2KOHM 10% C TOP ADJ	19701	ET50W202
A5R19	0698-3152	1	RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3481-F
A5R20	0757-0200	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5621-F
A5R21	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A5R22*	0757-0470	7	RESISTOR 162K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1623-F
A5R23*	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1623-F
A5R24*	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1623-F
A5R25*	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1623-F
A5R26	0698-3458		RESISTOR 348K 1% .125W F TC=0+-100	03888	PME55S
A5R27	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A5R28*	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1623-F
A5R29*	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1623-F
A5R30*	0757-0470		RESISTOR 162K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1623-F
A5R31	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5112-F
A5R32	0757-0399	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-TO-82R5-F
A5R33*	0757-0419	1	RESISTOR 681 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-681R-F
A5R34	0757-0405	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-TO-162R-F
A5R35*	0757-0274	3	RESISTOR 1.21K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-TO-1213-F
A5R36	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A5R37	0698-3441	2	RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-TO-215R-F

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
A5R38*	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1213-F
A5R39	0698-3442	3	RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A5R40*	0757-0428	2	RESISTOR 1.62K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1621-F
A5R41	0757-0467	3	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A5R42	2100-3161	1	RESISTOR-VAR TRMR 20KOHM 10% C SIDE ADJ	32997	3006P-1-203
A5R43	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A5R44*	0757-0278	2	RESISTOR 1.78K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1781-F
A5R45	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A5R46	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A5R47	0698-3432	1	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A5R48*	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1621-F
A5R49	0698-3458		RESISTOR 348K 1% .125W F TC=0+-100	03888	PME55S
A5R50	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A5R51	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A5R52	0698-0082	1	RESISTOR 464 1% .125W F TC=0+-100	16299	C4-1/8-T0-4640-F
A5R53	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A5R54	0757-0485	1	RESISTOR 681K 1% .125W F TC=0+-100	24546	NA4
A5R55	0698-0085	3	RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A5R56	0757-0299	1	RESISTOR 825K 1% .25W F TC=0+-25	24546	NE60
A5R57	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A5R58	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A5R59	2100-2216		RESISTOR-VAR TRMR 5KOHM 10% C TOP ADJ	84048	170-502
A5R60	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R61	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A5R62	0698-8625	2	RESISTOR 1.0K OHM 0.1% 0.1W F	28480	0698-8625
A5R63	2100-3052	1	RESISTOR-VAR TRMR 50 OHM 20% C SIDE ADJ	32997	3006P-1-500
A5R64	0698-8625		RESISTOR 1.0K OHM 0.1% 0.1W F	28480	0698-8625
A5R65	0698-0083	7	RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A5R66*	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1622-F
A5R67	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A5R68*			NORMALLY OPEN *FACTORY SELECTED PART		
A5R69	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A5R70*	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	19701	MF4C1/8-T0-9091-F
A5R71	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A5R72*	0757-0444	1	RESISTOR 12.1K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1212-F
A5R73	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A5R74*	0757-0443	1	RESISTOR 11K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1102-F
A5R75	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A5R76*	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-8251-F
A5R77	0698-3162		RESISTOR 46.4K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4642-F
A5R78	0698-3449	2	RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A5R79	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A5R80	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A5R81	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A5R82	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A5R83	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A5R84*	0757-0123	2	RESISTOR 34.8K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C5-1/4-T0-3482-F
A5R85	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A5R86	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A5R87	0698-3445	1	RESISTOR 348 1% .125W F TC=0+-100	16299	C4-1/8-T0-348R-F
A5R88	0698-3435	1	RESISTOR 38.3 1% .125W F TC=0+-100	16299	C4-1/8-T0-38R3-F
A5R89*	0757-0424	4	RESISTOR 1.1K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1101-F
A5R90	0698-3439	1	RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A5R91*	0757-1094	2	RESISTOR 1.47K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1471-F
A5R92	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A5R93	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A5R94	0757-0420	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A5R95	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A5R96	0698-7332	1	RESISTOR 1M 1% .125W F TC=0+-100	19701	MF5C1/8-T0-1004-F
A5R97	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A5R98	0757-0464		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A5R99	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A5R100	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A5R101	0698-3161		RESISTOR 38.3K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3832-F

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5R102	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R103	0698-3153	1	RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A5R104	2100-3103	1	RESISTOR-VAR TRMR 10KOHM 10% C SIDE ADJ	32997	3006P-1-103
A5R105	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R106	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A5R107	2100-1986	1	RESISTOR-VAR TRMR 1KOHM 10% C TOP ADJ	84048	170-102
A5R108	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A5R109	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A5R110	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R111	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R112	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R113	0698-3132	1	RESISTOR 261 1% .125W F TC=0+-100	16299	C4-1/8-T0-2610-F
A5R114	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A5R115	0757-0288		RESISTOR 9.09K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9091-F
A5R116	0698-3459		RESISTOR 383K 1% .125W F TC=0+-100	03888	PME55S
A5R117	0757-0464		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A5R118	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A5R119	0698-3158	1	RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A5R120	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R121	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A5R122	2100-2655	1	RESISTOR-VAR TRMR 100KOHM 10% C TOP ADJ	19701	ET50W104
A5RT1	0839-0026	2	THERMISTOR, NEG TC, 10K DISC	73168	JA4112
A5RT2	0839-0026		THERMISTOR, NEG TC, 10K DISC	73168	JA4112
A5TP1-12	0360-1514		TERMINAL-STUD SGL PIN PRESS MTG	28480	0360-1514
A5U1	1826-0092		IC AMPLIFIER	28480	1826-0092
A5U2	1826-0081	2	IC LM318H	27014	LM318H
A5U3	1826-0081		IC LM318H	27014	LM318H
A5U4	1826-0059	3	IC LM201AH	27014	LM201AH
A5U5	1826-0013		IC AMPLIFIER	28480	1826-0013
A5U6	1826-0035	2	IC LM308AH	27014	LM308AH
A5U7	1826-0035		IC LM308AH	27014	LM308AH
A5U8	1826-0092		IC AMPLIFIER	28480	1826-0092
A5U9	1826-0059		IC LM201AH	27014	LM201AH
A5U10	1826-0092		IC AMPLIFIER	28480	1826-0092
A5U11	1826-0059		IC LM201AH	27014	LM201AH
A5VR1	1902-3345	1	DIODE-ZNR 51.1V 5% DO-7 PD=.4W TC=+.081%	04713	SZ 10939-386

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
A6	08654-60037	1	REVERSE POWER ASSEMBLY (OPTION 003 ONLY)	28480	08654-60037
A6FL1	9135-0002	1	FILTER; LINE 10A	28480	9135-0002
A6J1	1250-0829	1	CONNECTOR-RF SMC M SGL HOLE FR	98291	50-045-4610
A6J2	1250-0830	1	CONNECTOR-RF SMC M SGL HOLE FR	2K497	701872
A6MP1	08640-20191	1	HOUSING, REVERSE POWER	28480	08640-20191
A6A1	08640-60049	1	BOARD ASSEMBLY, REVERSE POWER PROTECTION	28480	08640-60049
A6A1C1	0160-0576	3	CAPACITOR-FXD .1UF +-20% 50WVDC CER	26654	2130BR050R104M
A6A1C2	0160-0576		CAPACITOR-FXD .1UF +-20% 50WVDC CER	26654	2130BR050R104M
A6A1C3	0160-3879	2	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A6A1C4	0180-0197	1	CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6A1C5	0160-3877	1	CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A6A1C6	0160-0576		CAPACITOR-FXD .1UF +-20% 50WVDC CER	26654	2130BR050R104M
A6A1C7	0160-3875	1	CAPACITOR-FXD 22PF +-5% 200WVDC CER	28480	0160-3875
A6A1C8	0160-3873	1	CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A6A1C9	0121-0448	1	CAPACITOR; VAR; TRMR; CER; 2.5/5PF	0086S	5S-TRIKO-03, 2.5 -
A6A1C10	0160-0699	1	CAPACITOR-FXD 1PF +-.1PF 100WVDC CER	28480	0160-0699
A6A1C11	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A6A1CR1	1901-0050	2	DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A6A1CR2	1901-0518	2	DIODE-SCHOTTKY	28480	1901-0518
A6A1CR3	1901-0050		DIODE-SWITCHING 2NS 80V 200MA	28480	1901-0050
A6A1CR4	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A6A1K1	0490-1073	1	RELAY-REED 1A .25A 120V CONT 4.5V-COIL	28480	0490-1073
A6A1L1	1460-1395	2	WIREFORM, INDUCTOR	28480	1460-1395
A6A1L2	1460-1395		WIREFORM, INDUCTOR	28480	1460-1395
A6A1MP1	0363-0105	2	CONTACT	28480	0363-0105
A6A1MP2	0363-0105		CONTACT	28480	0363-0105
A6A1Q1	1854-0210	3	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A6A1Q2	1854-0210		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A6A1Q3	1854-0210		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A6A1R1	0698-7241	1	RESISTOR 1.62K 2% .05W F TC=0+-100	16299	C3-1/8-TO-1621-G
A6A1R2	2100-1986	1	RESISTOR-VAR TRMR 1KOHM 10% C TOP ADJ	84048	170-102
A6A1R3	0683-1055	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A6A1R4	0698-7277	2	RESISTOR 51.1K 2% .05W F TC=0+-100	24546	C3-1/8-TO-5112-G
A6A1R5	0698-7212	1	RESISTOR 100 2% .05W F TC=0+-100	24546	C3-1/8-TO-100R-G
A6A1R6	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A6A1R7	0698-7277		RESISTOR 51.1K 2% .05W F TC=0+-100	24546	C3-1/8-TO-5112-G
A6A1R8	0698-7236	1	RESISTOR 1K 2% .05W F TC=0+-100	24546	C3-1/8-TO-1001-G
A6A1R9	0698-7229	2	RESISTOR 511 2% .05W F TC=0+-100	24546	C3-1/8-TO-511R-G
A6A1R10	0698-7229		RESISTOR 511 2% .05W F TC=0+-100	24546	C3-1/8-TO-511R-G
A6A1R11	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A6A1U1	1826-0026	1	IC COMPARATOR (ANALOG)	27014	LM311H
A6A1VR1	1902-0554	2	DIODE-ZNR 10V 5% DO-15 PD=1W TC=+.06%	28480	1902-0554
A6A1VR2	1902-0244	1	DIODE-ZNR 30.1V 5% DO-15 PD=1W TC=+.075%	28480	1902-0244
A6A1VR3	1902-0554		DIODE-ZNR 10V 5% DO-15 PD=1W TC=+.06%	28480	1902-0554

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
			CHASSIS PARTS		
C1	0160-0163	1	CAPACITOR-FXD .033UF +-10% 200WVDC POLYE	56289	292P33392
DS1	2140-0244	1	LAMP, GLOW, BULB T-2, 105V (SEE SECTION III)	00501	A1H
F1	2110-0004	1	FUSE .25A 250V NORMAL BLO 1.25X.25 IEC (FOR 100/120V OPERATION) (SEE SECTION III)	71400	AGC-1/4
F1	2110-0479	1	FUSE .175A 250V NORMAL BLO 1.25X.25 (FOR 220/240V OPERATION) (SEE SECTION III)	75915	312.175
J1	1251-0198	1	CONNECTOR; PC EDGE; 6-CONT; SOLDER EYE	71785	251-06-30-261
J2			(AUX RF OUT) NSR, P/O W3		
J3			(RF OUTPUT) NSR, P/O W5		
J4	1250-0083	1	CONNECTOR-RF BNC FEM SGL HOLE FR (PHASE LOCK INPUT)	24931	28JR-130-1
J5			NSR, P/O W2		
J6	1250-0118	2	CONNECTOR-RF BNC FEM SGL HOLE FR (AM IN/OUT)	9D949	31-2221-1022
J7	1250-0118		CONNECTOR-RF BNC FEM SGL HOLE FR (FM IN/OUT)	9D949	31-2221-1022
M1	1120-1551	1	METER:0-1 MA, 2-1/4" METER CASE SIZE	28480	1120-1551
MP1	5000-8876	2	COVER SIDE 6 X 11 SM	28480	5000-8876
MP2	1440-0077	2	HANDLE-CMPNT	12136	346
MP3	1440-0077		HANDLE-CMPNT	12136	346
MP4	1440-0076	1	HANDLE, SPCL 7.75 L	12136	1775-354 COLOR Y3106
MP5	08654-00037	1	COVER, TOP	28480	08654-00037
MP6	08654-20081	1	INSULATOR, FM DRIVER	28480	08654-20081
MP7	08654-00047	1	PANEL, REAR	28480	08654-00047
MP8	5000-8876		COVER SIDE 6 X 11 SM	28480	5000-8876
MP9	5060-0703	2	FRAME ASSEMBLY, 6 X 11 SM	28480	5060-0703
MP10	5060-0703		FRAME ASSEMBLY, 6 X 11 SM	28480	5060-0703
MP11	08654-00024	1	COVER, BOTTOM	28480	08654-00024
MP12	5040-7201	4	FEET	28480	5040-7201
MP13	5040-7201		FEET	28480	5040-7201
MP14	1460-1345	2	SPRING WFRM 1.34-W 3-LG SST	28480	1460-1345
MP15	1460-1345		SPRING WFRM 1.34-W 3-LG SST	28480	1460-1345
MP16	5040-7201		FEET	28480	5040-7201
MP17	5040-7201		FEET	28480	5040-7201
MP18	08654-00028	1	SUB-PANEL, FRONT	28480	08654-00028
MP19	08654-00027	1	PANEL, FRONT	28480	08654-00027
MP20	7200-1263	1	EXTRUSION:ALUM.(AA6063-T5 ALLOY)	28480	7200-1263
MP21	08654-20050	1	WINDOW	28480	08654-20050
MP22	08654-20049	1	TRIM TOP	28480	08654-20049
MP23	7120-1254	1	LABEL-IDENT "HP" LOGO EMBOSSED	28480	7120-1254
MP24	0370-2628	1	KNOB, METER BAR	28480	0370-2628
MP25	0370-2383	1	KNOB-BASE-PTR .375 IN JGK MGP-DECAL	28480	0370-2383
MP26	0370-0585	1	KNOB, ATTENUATOR (OUTPUT LEVEL)	28480	0370-0585
MP27	7120-4787	1	LABEL REVERSE POWER (OPT 003 ONLY)	28480	7120-4787
MP28	0590-0505	1	NUT, KNURLED 5/8-24 UNEF-2B THREAD	73743	TD-801
MP29	0370-2623	1	KNOB BASE,PTR,.375", JGK, MGP (VERNIER)	28480	0370-2623
MP30	0370-2776	1	KNOB, AM LEVEL	28480	0370-2776
MP31	0370-2245	1	KNOB-BASE-CRK 1.5 IN JGK MGP-DECAL (FREQUENCY TUNE)	28480	0370-2245
MP32	0370-0929	2	KNOB:LEVER, JADE GREY (AM)	28480	0370-0929
MP33	08640-40052	1	LEVER, SLIDE SWITCH (400HZ/1KHZ)	28480	08640-40052
MP34	0370-0929		KNOB:LEVER, JADE GREY (FM)	28480	0370-0929
MP35	0370-1100	1	KNOB, BASE-CONC PTR, .5 IN, JGK (FM RANGE (KHZ)	28480	0370-1100
MP36	0370-2777	1	KNOB, FM LEVEL	28480	0370-2777
MP37	0590-0923	1	NUT-KNURLED R 1/2-32-THD .125-THK .635 (SEE SECTION III)	28480	0590-0923
MP38	3101-0559	1	SWITCH-PB ACCESS CAP PUSHBUTTON; TRL WHT (SEE SECTION III)	28480	3101-0559
MP39	0370-2778	1	KNOB, FREQUENCY RANGE (MHZ)	28480	0370-2778
MP40	1250-0522	1	CAP-COAX; NON-SHORTING N	24931	25PC100-1
MP41	7120-2359	1	SER PLT "SER OPT (ETC)"	28480	7120-2359
MP42	08654-00033	1	BRACKET, ATTENUATOR SUPPORT	28480	08654-00033
MP43	08654-00031	1	BRACKET, METER SWITCH	28480	08654-00031

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP44	08654-00049	1	BRACKET, RF CONNECTOR SUPPORT	28480	08654-00049
MP45	08654-00048	1	BRACKET, FM DRIVE BOARD MOUNTING	28480	08654-00048
MP46	08654-20080	2	STANDOFF, T COVER	28480	08654-20080
MP47	7120-4294	1	LABEL, WARNING	28480	7120-4294
MP48	08654-00052	1	BRACKET, METER SUPPORT	28480	08654-00052
MP49	1500-0431	1	COUPLER-FLEX .125-ID .25-OD 1.05-L	28480	1500-0431
MP50	08654-20052	1	SHAFT, METER KNOB	28480	08654-20052
MP51	08654-20069	1	DAMP BAR TOP	28480	08654-20069
MP52	5001-0135	1	WRENCH COMB	28480	5001-0135
MP53	7120-4628	1	LABEL INFORMATION "CAUTION"	28480	7120-4628
MP54	08654-20080		STANDOFF, T COVER	28480	08654-20080
MP55	08654-00032	1	HINGE, FM DRIVER BOARD	28480	08654-00032
MP56	08654-00008	1	BRACKET, CONNECTOR	28480	08654-00008
MP57	08654-20071	1	DAMP BAR BOTTOM	28480	08654-20071
MP58	5040-0218	1	COUPLER	28480	5040-0218
MP59	8160-0245	1	GASKET (OPT 003 ONLY)	28480	8160-0245
MP60	1401-0101	1	COVER, POWER MODULE	28480	1401-0101
MP61	08654-00022	1	PLATE, LOCKOUT	28480	08654-00022
MP62	08654-00030	1	BRACKET, COUPLER/SHORT BUSHING	28480	08654-00030
MP63	08654-00045	1	BRACKET, ATTENUATOR	28480	08654-00045
P1	08654-20105	1	BOARD, TERMINAL	28480	08654-20105
R1	2100-2661	1	RESISTOR-VAR 1K 20% CC	01121	TYPE W
R2	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
R3	2100-3428	1	RESISTOR-VAR 1K 20% CC	01121	70A4G024S102M
R4	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
R5	2100-2492	2	RESISTOR-VAR 5K 20% CC	71450	SERIES 300
R6*	0757-0280	5	RESISTOR 1K 1% .125W F TC=0+-100 *FACTORY SELECTED PART	24546	C4-1/8-T0-1001-F
R7	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
R8	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3162-F
R9	2100-2492		RESISTOR-VAR 5K 20% CC	71450	SERIES 300
R10	0757-0398	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
R11	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
			LINE (INCLUDES DS1, MP1 AND MP2)		
S1	3101-1903	1	SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC (400 HZ/1KHZ)	28480	3101-1903
S2	3100-3304	2	SWITCH, LEVER (AM)	28480	3100-3304
S3	3100-3304		SWITCH, LEVER (FM)	28480	3100-3304
S4	3130-0398	1	WAFER:SECTION 1.718" DIA	76854	TYPE LK
S5	3100-3298	1	SWITCH, ROTARY (METER)	28480	3100-3298
S6	3101-1394	1	SWITCH-PB DPDT DB ALTNG 10.5A 250VAC	00501	53-67280-120/A1H
S7	3100-3324	1	SWITCH-RTRY DP4T-NS .812 IN CTR SPCG (FM RANGE)	28480	3100-3324
T1	9100-3568	1	TRANSFORMER, POWER	28480	9100-3568
W1	8120-1378	1	CABLE CA ASSY 3-COND 18AWG AC POWER (REFER TO SECTION II)	28480	8120-1378
W2	8120-0668	1	CABLE; COAX; .086 OD (BUFFER AMPL OUT) INCLUDES J5.	28480	8120-0668
W3	8120-2175	1	CABLE ASSEMBLY, AUX RF OUTPUT (INCLUDES J2)	28480	8120-2175
W4	8120-0667	1	CABLE; COAX; .086 OD (RF AMPL. OUT)	28480	8120-0667
W5	8120-0670	1	CABLE; COAX; .086 OD RF OUTPUT, INCLUDES J3(STANDARD ONLY)	28480	8120-0670
W5	8120-2110	1	CABLE ASSY,SEMI-RIGID FORMED .086 COAX RF OUTPUT, INCLUDES J3(OPT 003 ONLY)	28480	8120-2110
W6	8120-1593	1	CABLE SHLD 5-COND 22AWG (LINE SWITCH)	28480	8120-1593
W7	8120-0789	3	CABLE, COAX, 50 OHM, .11 OD, 28AWG (+55V)	28480	8120-0789
	8090-0394	6	SLEEVE-TERMN SLDR-HT SHRK .175/.2-ID	06090	C-142-51
W8	8120-0789		CABLE, COAX, 50 OHM, .11 OD, 28AWG (FM DRIVE)	28480	8120-0789
	8090-0394		SLEEVE-TERMN SLDR-HT SHRK .175/.2-ID	06090	C-142-51
W9	8120-0789		CABLE, COAX, 50 OHM, .11 OD, 28AWG (FM MOD INPUT)	28480	8120-0789
	8090-0394		SLEEVE-TERMN SLDR-HT SHRK .175/.2-ID	06090	C-142-51

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
W10	8120-2109	1	CABLE ASSY,SEMI-RIGID FORMED .086 COAX ATTENUATOR OUTPUT (OPT 003 ONLY)	28480	8120-2109
XA1			NOT ASSIGNED		
XA2			NOT ASSIGNED		
XA3	1251-0159	1	CONNECTOR; PC EDGE; 15-CONT; SOLDER EYE	71785	251-15-30-261
XA4			NOT ASSIGNED		
XA5	1251-2346	1	CONNECTOR; PC EDGE; 18-CONT; TOP SOLDER	26742	91-6918-1112-00

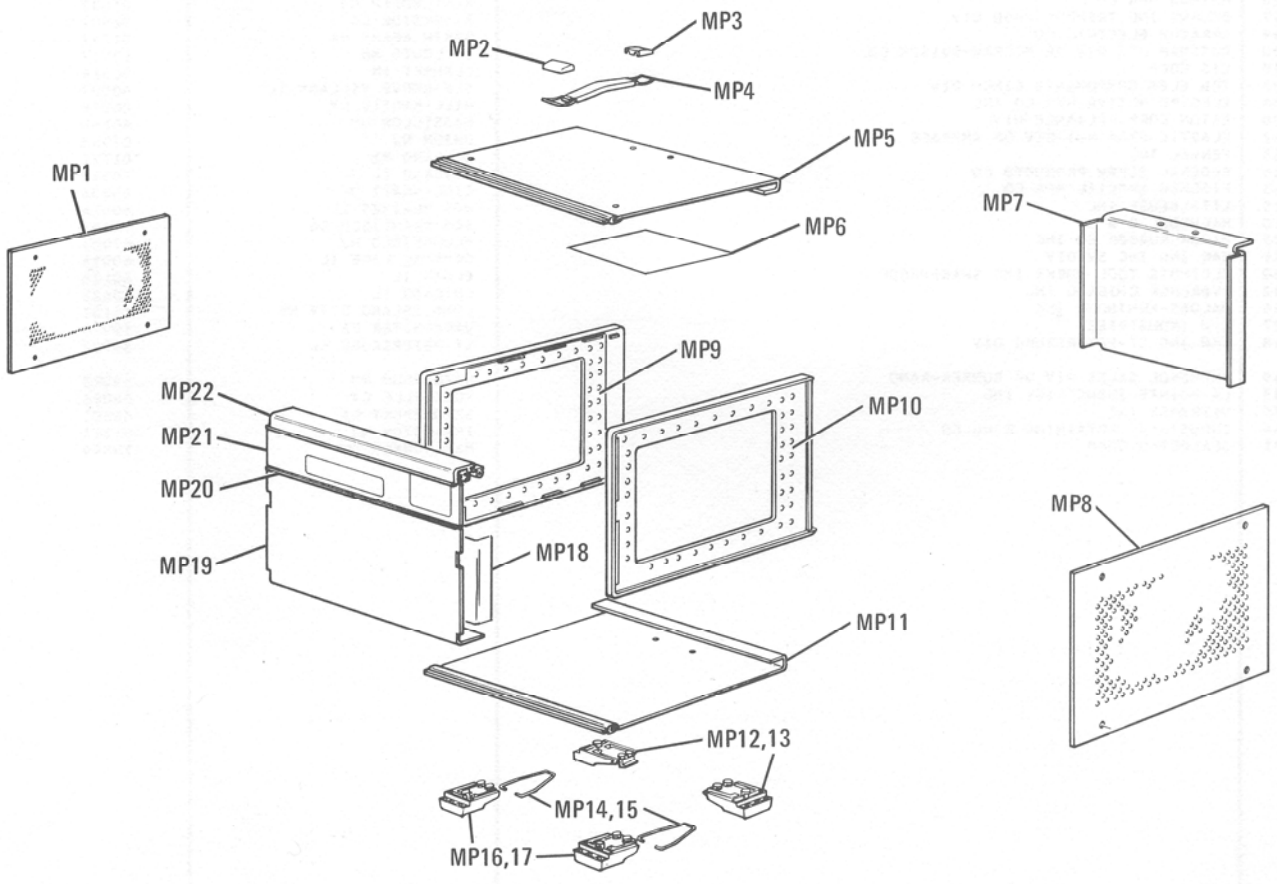


Figure 6-1. Cabinet Parts Exploded View

Table 6-3. Code List of Manufactures

Mfr Code	Manufacturer Name	Address	Zip Code
G8027	NEOHM	ENGLAND	
00000	U.S.A. COMMON	ANY SUPPLIER OF THE U.S.A.	
00501	ILLUMINATED PRODUCTS INC	ANAHEIM CA	92803
00865	STETTNER-TRUSH INC	CAZENOVIA NY	13035
01121	ALLEN BRADLEY CO	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02114	FERROXCUBE CORP	SAUGERTIES NY	12477
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03877	TRANSITRON ELECTRONIC CORP	WAKEFIELD MA	01880
03888	PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
06090	RAYCHEM CORP	MENLO PARK CA	94025
06383	PANDUIT CORP	TINLEY PARK IL	60477
06776	ROBINSON NUGENT INC	NEW ALBANY IN	47150
07088	KELVIN ELECTRIC CO	VAN NUYS CA	91401
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
07700	TECHNICAL WIRE PRODUCTS INC	CRANFORD NJ	07016
12136	PHILADELPHIA HANDLE CO INC	CAMDEN NJ	08103
16299	CORNING GL WK ELEC CMPNT DIV	RALEIGH NC	27604
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
2K497	CABLEWAVE SYSTEMS INC	NORTH HAVEN CT	06473
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS IN	46227
26365	GRIES REPRODUCER CORP	NEW ROCHELLE NY	10802
26654	VARADYNE INC	SANTA MONICA CA	90403
26742	METHODE ELECTRONICS INC	CHICAGO IL	60656
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
28520	HEYMAN MFG CO	KENILWORTH NJ	07033
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
71400	BUSSMAN MFG DIV OF MCGRAW-EDISON CO	ST LOUIS MO	63017
71450	CTS CORP	ELKHART IN	46514
71785	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VILLAGE IL	60007
72136	ELECTRO MOTIVE MFG CO INC	WILLIMANTIC CT	06226
72800	EATON CORP RELIANCE DIV	MASSILLON OH	44640
72962	ELASTIC STOP NUT DIV OF AMERACE	UNION NJ	07083
73168	FENWAL INC	ASHLAND MA	01721
73734	FEDERAL SCREW PRODUCTS CO	CHICAGO IL	60618
73743	FISCHER SPECIAL MFG CO	CINCINNATI OH	45206
75915	LITTLEFUSE INC	DES PLAINES IL	60016
76210	MARWEDEL C W	SAN FRANCISCO CA	94103
76385	MINOR RUBBER CO INC	BLOOMFIELD NJ	07003
76854	OAK IND INC SW DIV	CRYSTAL LAKE IL	60014
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN IL	60126
78452	EVERLOCK CHICAGO INC	CHICAGO IL	60622
79136	WALDES-KOHINOOR INC	LONG ISLAND CITY NY	11101
79727	C-W INDUSTRIES	WARMINSTER PA	18974
84048	TRW INC ST PETERSBURG DIV	ST PETERSBURG FL	33702
9D949	AMPHENOL SALES DIV OF BUNKER-RAMO	HAZELWOOD MO	63042
94033	LA POINTE INDUSTRIES INC	ROCKVILLE CT	06066
95275	VITRAMON INC	BRIDGEPORT CT	06601
97464	INDUSTRIAL RETAINING RING CO	IRVINGTON NJ	07111
98291	SEALECTRO CORP	MAMARONECK NY	10544

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section normally contains information for adapting this manual to instruments for which the content does not apply directly. Since this manual does apply directly to instruments having serial numbers listed on the title page, no change information is given here. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for additional important information about serial number coverage.

MANUAL IDENTIFICATION

Model Number: 8654B
Date Printed: July 1975
Part Number: 08654-90012

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

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes
1521A	Errata
1529A	1
1531A	1, 2

Serial Prefix or Number	Make Manual Changes
1532A	1—3
1550A	1—4
►1612A	1—5

► NEW ITEM

ERRATA

Title Page

Under **SERIAL NUMBERS,** add "and 1521A" after 1512A.

►Page 2-3, Figure 2-1:

NOTE: *The recommended replacement for A4P1 is PC Board 5020-8157 (see Change 5).*

Page 5-2, Table 5-1:

Add the following:

Reference Designator	Basis of Selection	Normal Value Range	Service Sheet
A1A1R25	Selected for harmonic distortion and Auxiliary RF output level within specifications. Perform Harmonic Distortion Test (4-13). If harmonics exceed the specified level, increase the value of A1A1R25. Perform Auxiliary RF Output Test (4-20) to ensure that the RF level exceeds specified level after A1A1R25 has been changed.	75-121Ω	3

Pages 5-24 thru 5-28, paragraph 5-22:

Change steps 24, 41 and 63 to read as follows:

"Reconnect DIP plugs A1A5P1 and P2 to the A5 FM Driver Board Assembly. (Do not disconnect the test cable from A5J3. However, ensure that all slide switches on adjustment board are down.) Counter reading should be 60.0 ±3.6 kHz."

Continued . . .

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.

26 March 1976
10 Pages

HEWLETT hp PACKARD

Printed in U.S.A.

ERRATA (Cont'd)

Pages 5-24 thru 5-28 (cont'd)

In step 27, change the note as follows:

" . . . *(BP, SL and E switches down).*"

In step 45, change the note as follows:

" . . . *(BP, SL, E, BP7 and SL7 switches down).*"

Page 6-6, Table 6-2:

Change A1MP126 to 0610-0011 NUT, HEX 2-56 x 0.156 DIA.

Change A1A1 08654-60044 to 08654-60022, RESTORED 08654-60002 OR 60102, REQUIRES EXCHANGE.

Change A1A1Q1 and Q3 to 1854-0696 TRANSISTOR NPN SI TO-72 PD=200 mW.

Change A1A1Q4 to 5086-4218 TRANSISTOR NPN, HP-21 TO-72

Change A1A1Q5 thru Q7 to 1854-0696 TRANSISTOR NPN SI TO-72 PD=200 mW.

NOTE

If it is necessary to replace standard A1A1 assembly, HP 08654-60002 (or 60022, Restored) is the recommended replacement. It would also be necessary to replace RF Amplifier Divider Bar A1MP81, with HP 08654-20021 (see Change 1).

Page 6-8, Table 6-2:

Change A1A3Q3 to 5086-4218 TRANSISTOR, NPN, HP-21 TO-72.

►Add A1A5MP1 08654-00054 LABEL, CONNECTOR.

Page 6-9, Table 6-2:

Add A3C29 0180-0089 CAPACITOR-FXD 10 UF +75—10% 50 VDC AL.

►**A3R7.** The recommended replacement for A3R7 is 2.7 ohm resistor 0683-0275 (see Change 5).

► Page 6-10, Table 6-2:

A4, A4P1. The recommended replacement part number for A4 is 0960-0444 and 5020-8157 for A4P1 (see Change 5).

Page 6-13, Table 6-2:

Change A5R112 to 0698-3157, RESISTOR 19.6K 1% 0.125W F TC=0 ±100.

NOTE

Resistor 0698-3157 is the recommended replacement for A5R112 in instruments originally equipped with other resistors.

Page 6-14, Table 6-2:

Change part number for A6A1 to 08654-60109 (see note).

Add A6FL2 9135-0002 FILTER; 10A.

Change A6A1VR1 and VR3 to 1902-3048 DIODE-ZNR 3.48V 5% DO-7 PD=0.4W TC=-0.058% (see note).

Add A6A1MP3 08654-00053 LABEL (see note).

NOTE

The changes to A6A1, A6A1VR1, A6A1VR3 and A6A1MP3 apply only for instruments with serial number prefixes 1512A, 1521A, 1529A and 1531A.

Page 6-15, Table 6-2:

Change C1 to 0160-0180 CAPACITOR-FXD 0.033 UF ±5% 200 WVDC POLYE.

Page 6-16, Table 6-2:

MP62. Bracket 08654-20088 with four spacers 3050-0010 (MP64) is the recommended replacement for bracket MP62 (see Change 3).

Delete the description "LINE (INCLUDES DS1, MP1 AND MP2)" from above S1 and add it to the description for S6.

ERRATA (Cont'd)

Service Sheet 2 (schematic):
Change the part number of A1A3Q3 to 5086-4218.

Service Sheet 3 (schematic):
On the A1A1 assembly, make the following changes.
Change the value of L1 to 10 μH.
Change the part numbers for Q1, Q3, Q5, Q6, and Q7 to 1854-0696.
Change the part number for Q4 to 5086-4218.
Add an asterisk (*) to R25.

Service Sheet 3A (schematic):
Change part number for A6A1 Assembly to 08654-60109.
Change values of A6A1VR1 and VR3 to 3.48V.

NOTE

The changes for A6A1, A6A1VR1 and VR3 apply only for instruments with serial number prefixes 1512A, 1521A, 1529A and 1531A.

Service Sheet 5 (component locations):
In Figure 8-14, change R20 to R27 and R27 to R20.

Service Sheet 7 (component locations):
In Figure 8-19, change R112 to R117 and R117 to R112.

Service Sheet 7 (schematic):
Change the value of resistor A5R112 to 19.6K.

►**A4.** The recommended replacement for A4 is Line Module 0960-0444 (see Change 5).

CHANGE 1

Page 5-2, Table 5-1:
Delete A1A1R25 (see Errata).
Change A1A1R29 to A1A1R28.
Change A1A1R39 to A1A1R31.

Page 6-5, Table 6-2:
Change A1MP81 to 08654-20021 (see note).

Pages 6-6 and 6-7, Table 6-2:
Replace entire parts list for A1A1 RF Amplifier/ALC Board Assembly with the attached list.

NOTE

A1A1 assembly 08654-60002 (or 60022 restored), with A1MP81 08654-20021, is the recommended replacement in instruments with serial numbers below 1529A.

Service Sheet 3 (component locations):
Replace Figure 8-8 with attached figure.

Service Sheet 3 (schematic):
Replace entire schematic with attached Figure 8-9.

Table 6-2. Replaceable Parts (P/O Change 1, 1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A1	08654-60002	1	RF AMPLIFIER/ALC ASSEMBLY	28480	08654-60002
A1A1	08654-60022		RESTORED 08654-60002 OR 60102, REQUIRES EXCHANGE	28480	08654-60022
A1A1C1	0160-3879	13	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C2	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C3	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C4*	0160-3565	1	CAPACITOR-FXD 6.8PF +-.5PF 100WVDC CER *FACTORY SELECTED PART	28480	0160-3565
A1A1C5	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C6	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C7	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C8	0160-3878	4	CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A1C9	0140-0191	1	CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A1A1C10	0160-0162	1	CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A1A1C11	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C12	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A1C13	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C14	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C15	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C16	0160-3877	1	CAPACITOR-FXD 100PF +-20% 200WVDC CER	28480	0160-3877
A1A1C17	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C18	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C19	0160-3873	1	CAPACITOR-FXD 4.7PF +-.5PF 200WVDC CER	28480	0160-3873
A1A1C20	0160-3875	2	CAPACITOR-FXD 22PF +-5% 200WVDC CER	28480	0160-3875
A1A1C21	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A1C22	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A1A1C23	0160-3876	1	CAPACITOR-FXD 47PF +-20% 200WVDC CER	28480	0160-3876
A1A1C24	0160-3875		CAPACITOR-FXD 22PF +-5% 200WVDC CER	28480	0160-3875
A1A1C25	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A1A1CR1	1901-0040	1	DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A1A1CR2	1901-0747	2	DIODE-PIN	28480	1901-0747
A1A1CR3	1901-0747		DIODE-PIN	28480	1901-0747
A1A1CR4	1901-0535	2	DIODE-SCHOTTKY	28480	1901-0535
A1A1CR5	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A1A1J1	1250-1220	3	CONNECTOR-RF SMC M PC	98291	50-051-0109
A1A1J2	1250-1220		CONNECTOR-RF SMC M PC	98291	50-051-0109
A1A1J3	1250-1220		CONNECTOR-RF SMC M PC	98291	50-051-0109
A1A1L1	9140-0114	1	COIL-FXD MOLDED RF CHOKE 10UH 10%	24226	15/102
A1A1L2	9100-2252	1	COIL-FXD MOLDED RF CHOKE .27UH 10%	24226	10/270
A1A1L3	08654-80001	1	INDUCTOR, RF 15 NH	28480	08654-80001
A1A1L4	08654-80003	1	INDUCTOR, RF 45 NH	28480	08654-80003
A1A1L5	9100-1623	1	COIL-FXD MOLDED RF CHOKE 27UH 5%	24226	15/272
A1A1L6	08654-80002	1	INDUCTOR, RF 35 NH	28480	08654-80002
A1A1L7	9100-2247	1	COIL-FXD MOLDED RF CHOKE .1UH 10%	24226	10/100
A1A1MP1	0340-0008	1	TERMINAL-STUD DBL-TUR PRESS-MTG	98291	ST-1000-L2
A1A1MP2	08654-00019	1	SHIELD, BUFFER AMPLIFIER	28480	08654-00019
A1A1MP3	08654-00020	1	SHIELD, MODULATOR	28480	08654-00020
A1A1MP4	08654-00021	1	GROUND STRAP	28480	08654-00021
A1A1Q1	1854-0696	5	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0696
	1205-0037	6	HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q2	1855-0020	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A1A1Q3	1854-0696		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0696
	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q4	5086-4218	1	HP-21 TO 72 PKG	28480	5086-4218
	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q5	1854-0696		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0696
	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q6	1854-0696		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0696
	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG BFx89	28480	1205-0037
A1A1Q7	1854-0696		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0696
	1205-0037		HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A1A1Q8	1853-0020	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1A1Q9	1854-0071	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1A1R1*	0698-7216	1	RESISTOR 147 2% .05W F TC=0+-100 *FACTORY SELECTED PART	24546	C3-1/8-T0-147R-G
A1A1R2	0698-7208	1	RESISTOR 68.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-68R1-G
A1A1R3	0698-7232	1	RESISTOR 681 2% .05W F TC=0+-100	24546	C3-1/8-T0-681R-G
A1A1R4	0698-7284	3	RESISTOR 100K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1003-G
A1A1R5	0698-7227	1	RESISTOR 422 2% .05W F TC=0+-100	24546	C3-1/8-T0-422R-G
A1A1R6	0698-7205	2	RESISTOR 51.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G
A1A1R7	0698-7196	1	RESISTOR 21.5 2% .05W F TC=0+-100	24546	C3-1/8-T00-21R5-G
A1A1R8	0698-7253	3	RESISTOR 5.11K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5111-G
A1A1R9	0698-7229	1	RESISTOR 511 2% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (P/O Change 1, 2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A1R10	0698-7253		RESISTOR 5.11K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5111-G
A1A1R11	0698-7222	1	RESISTOR 261 2% .05W F TC=0+-100	24546	C3-1/8-T0-261R-G
A1A1R12	0698-7224	1	RESISTOR 316 2% .05W F TC=0+-100	24546	C3-1/8-T0-316R-G
A1A1R13	0698-7214	2	RESISTOR 121 2% .05W F TC=0+-100	24546	C3-1/8-T0-121R-G
A1A1R14	0698-7188	2	RESISTOR 10 2% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A1A1R15*	0698-7207	1	RESISTOR 61.9 2% .05W F TC=0+-100 *FACTORY SELECTED PART	24546	C3-1/8-T00-61R9-G
A1A1R16	0698-7205		RESISTOR 51.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-51R1-G
A1A1R17	0698-7284		RESISTOR 100K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1003-G
A1A1R18	0757-0814	1	RESISTOR 511 1% .5W F TC=0+-100	19701	MF7C1/2-T0-511R-F
A1A1R19	0698-7239	1	RESISTOR 1.33K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1331-G
A1A1R20	0698-7247	1	RESISTOR 2.87K 2% .05W F TC=0+-100	24546	C3-1/8-T0-2871-G
A1A1R21	0698-7214		RESISTOR 121 2% .05W F TC=0+-100	24546	C3-1/8-T0-121R-G
A1A1R22	0698-3444	1	RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A1A1R23	0698-7198	2	RESISTOR 26.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-26R1-G
A1A1R24	0698-7217	1	RESISTOR 162 2% .05W F TC=0+-100	24546	C3-1/8-T0-162R-G
A1A1R25	0698-7198		RESISTOR 26.1 2% .05W F TC=0+-100	24546	C3-1/8-T00-26R1-G
A1A1R26	0698-7284		RESISTOR 100K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1003-G
A1A1R27	0698-7188		RESISTOR 10 2% .05W F TC=0+-100	24546	C3-1/8-T00-10R-G
A1A1R28*	0698-7220	1	RESISTOR 215 2% .05W F TC=0+-100 *FACTORY SELECTED PART	24546	C3-1/8-T0-215R-G
A1A1R29	0698-7256	1	RESISTOR 6.81K 2% .05W F TC=0+-100	24546	C3-1/8-T0-6811-G
A1A1R30	0698-7195	1	RESISTOR 19.6 2% .05W F TC=0+-100	24546	C3-1/8-T00-19R6-G
A1A1R31*	0698-7212	1	RESISTOR 100 2% .05W F TC=0+-100 *FACTORY SELECTED PART	24546	C3-1/8-T0-100R-G
A1A1R32	0698-7253		RESISTOR 5.11K 2% .05W F TC=0+-100	24546	C3-1/8-T0-5111-G
A1A1R33	0698-7279	1	RESISTOR 61.9K 2% .05W F TC=0+-100	24546	C3-1/8-T0-6192-G
A1A1R34	0698-7286	1	RESISTOR 121K 2% .05W F TC=0+-100	24546	C3-1/8-T0-1213-G
A1A1R35	0698-7201	1	RESISTOR 34.8 2% .05W F TC=0+-100	24546	C3-1/8-T00-34R8-G
A1A1R36	0698-7248	1	RESISTOR 3.16K 2% .05W F TC=0+-100	24546	C3-1/8-T0-3161-G
A1A1R37	0698-7269	1	RESISTOR 23.7K 2% .05W F TC=0+-100	24546	C3-1/8-T0-2372-G
A1A1R38	0698-7245	1	RESISTOR 2.37K 2% .05W F TC=0+-100	24546	C3-1/8-T0-2371-G
A1A1R39	2100-2497	1	RESISTOR-TRMR 2K 10% C TOP-ADJ 1-TURN	19701	ET50W202
A1A1TP1	0360-0124	5	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A1A1TP2	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A1A1TP3	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A1A1TP4	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A1A1TP5	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A1A1U1	1826-0013	1	IC OP AMP	28480	1826-0013

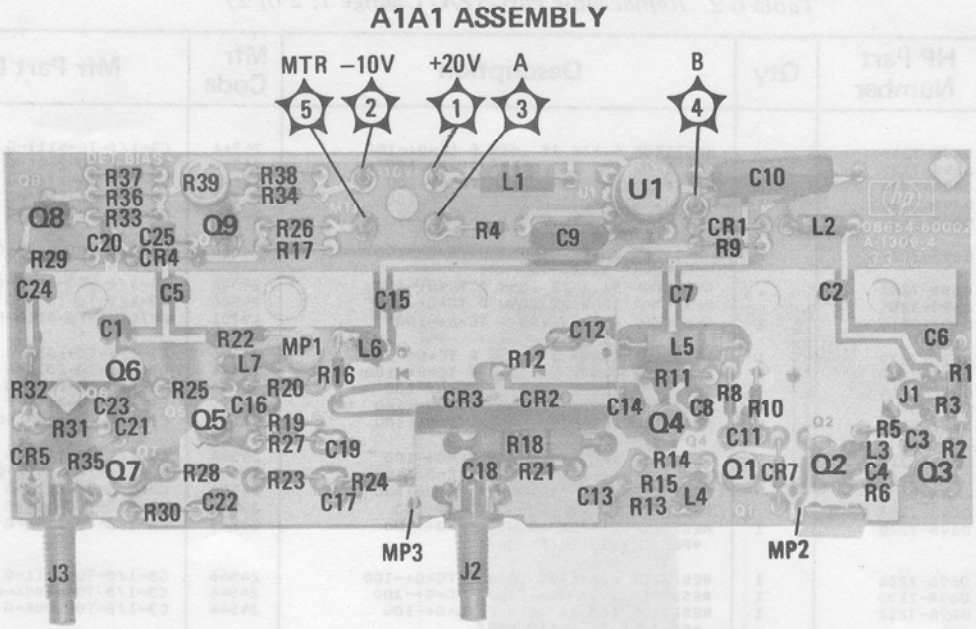


Figure 8-8. A1A1 RF Amplifier/ALC Assembly Component Locations (P/O Change 1)

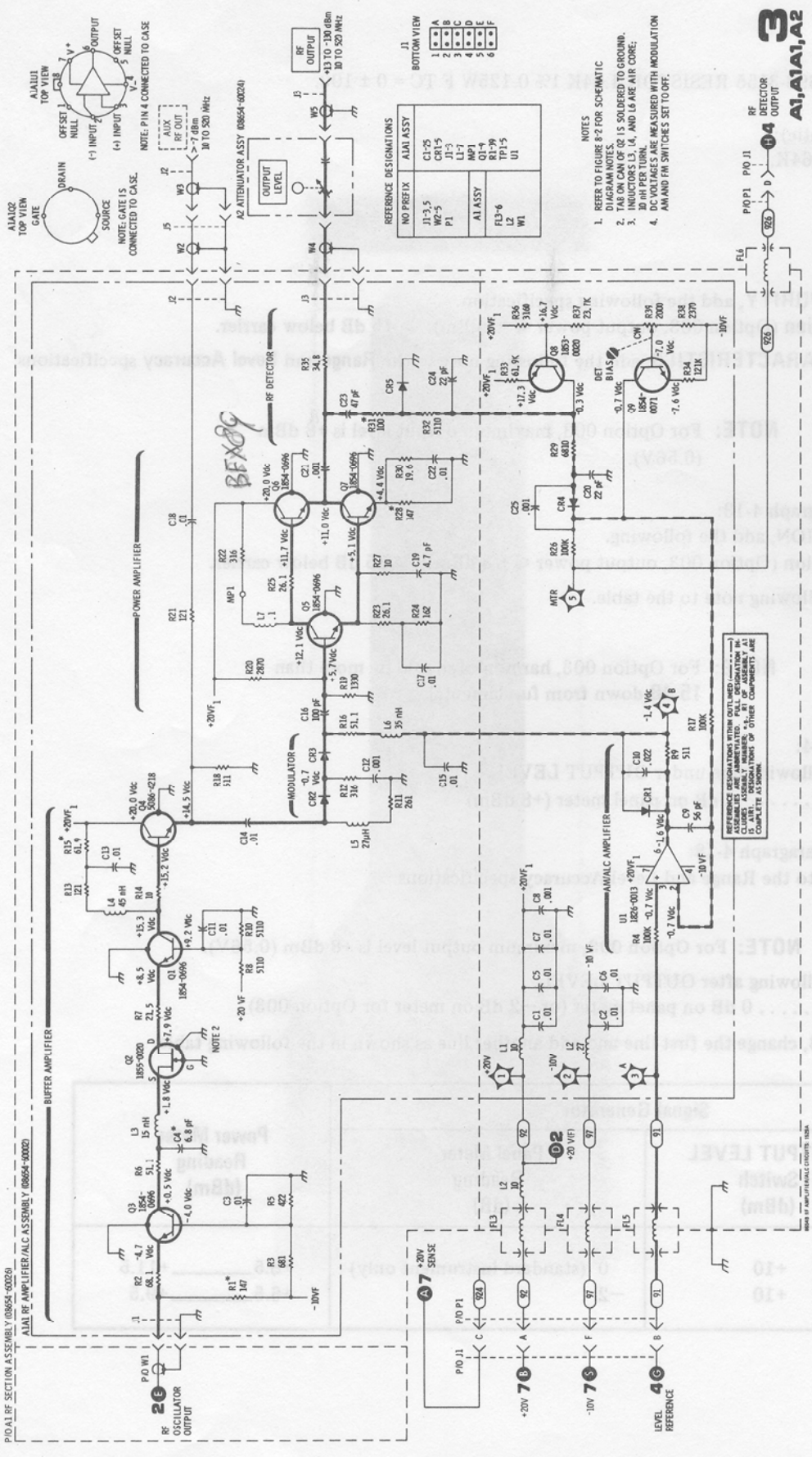


Figure 8-9. RF Amplifier/ALC Assembly Schematic Diagram (P/O Change 1)

CHANGE 2

Page 6-10, Table 6-2:
Change A3R60 to 0698-3155 RESISTOR 4.64K 1% 0.125W F TC = 0 ± 100.

Service Sheet 4 (schematic):
Change A3R60 to 4.64K.

CHANGE 3

Page 1-4, Table 1-1:
Under **SPECTRAL PURITY**, add the following specification.
Harmonic Distortion (Option 003, output power ≤ + 3dBm): > 15 dB below carrier.
Under **OUTPUT CHARACTERISTICS**, add the following note to the **Range** and **Level Accuracy** specifications.

NOTE: For Option 003, maximum output level is +8 dBm (0.56V).

Pages 4-5 and 4-6, paragraph 4-13:
Under SPECIFICATION, add the following.
Harmonic Distortion (Option 003, output power ≤ + 3 dBm): > 15 dB below carrier.
In step 2, add the following note to the table.

NOTE: For Option 003, harmonics should be more than **15 dB** down from fundamental.

Page 4-7, paragraph 4-14:
In step 1, add the following line under OUTPUT LEVEL.
VERNIER . . . . . —2 dB on panel meter (+8 dBm)

Pages 4-12 thru 4-14, paragraph 4-18:
Add following note to the Range and Level Accuracy specifications.

NOTE: For Option 003, maximum output level is +8 dBm (0.56V).

In step 1, add the following after OUTPUT LEVEL.
VERNIER . . . . . 0 dB on panel meter (or —2 dB on meter for Option 003)
In the table in step 3, change the first line and add another line as shown in the following table.

Signal Generator		Power Meter Reading (dBm)
OUTPUT LEVEL Switch (dBm)	Panel Meter Reading (dB)	
+10	0 (standard instrument only)	+8.5_____+11.5
+10	—2	+6.5_____+9.5

Page 4-16, paragraph 4-19:

In step 3, add the following at end of sentence.

". . . (+7 dBm for Option 003)."

In step 4, add the following note.

NOTE: For Option 003, the maximum power reading should not exceed +8 dBm and the minimum should not be less than +6 dBm.

Page 5-10, paragraph 5-16:

For Option 003, add step 4a to be performed in place of step 4.

4a. Adjust RF OUTPUT VERNIER for power meter reading of **+8 dBm**. Adjust Meter Gain control A3R57 for −2 dB as read on Signal Generator panel meter.

In step 7 (and note) change +10 to +8 for Option 003 only.

Page 6-4, Table 6-2:

Change A1 to read as follows.

A1 08654-60026 RF SECTION ASSEMBLY (STANDARD)
A1 08654-60049 RF SECTION ASSEMBLY (OPTION 003)

Pages 6-6 and 6-7, Table 6-2 (see Change 1):

Add the note, "STANDARD INSTRUMENT ONLY," to the descriptions of A1A1 08654-60002, A1A1Q6 and A1A1Q7.

Add the following lines to the parts list.

A1A1 08654-60050 BOARD ASSEMBLY, RF AMPLIFIER/ALC (OPTION 003)
A1A1 08654-60051 RESTORED 08654-60050 REQUIRES EXCHANGE
A1A1MP5 08654-00055 LABEL, BOARD IDENTIFICATION (OPTION 003)
A1A1Q6 5086-4218 HP-21 TO-72 PKG (OPTION 003)
A1A1Q7 5086-4218 HP-21 TO-72 PKG (OPTION 003)

Page 6-16, Table 6-2:

Change MP62 to 08654-20088.

Add MP64 3050-0010 (Qty-4) WASHER (SPACER) FLAT MTL NO. 6 0.147 IN ID.

NOTE

Bracket 08654-20088 with four spacers (MP64) is the recommended replacement for MP62 in instruments with serial number prefixes below 1532A.

Service Sheet 2 (schematic):

Add the following note.

NOTE: For Option 003 only, part number for A1 Assembly is 08654-60049.

Service Sheet 3 (schematic, see Change 1):

Add the following note:

NOTE: For Option 003 only, change part number for A1 Assembly to 08654-60049, part number for A1A1 Assembly to 08654-60050, and part numbers for A1A1Q6 and Q7 to 5086-4218.

CHANGE 4

Page 6-12, Table 6-2:
Change A5R59 to 2100-3056 RESISTOR — VAR TRMR 5 KOHM C SIDE — ADJ 17 TURN.

► CHANGE 5

Page 2-3, Figure 2-1:
Change HP part number for PC Board A4P1 to 5020-8157 (see note).

Page 6-9, Table 6-2:
Change A3R7 to 0683-0275 RESISTOR 2.7 OHM 5% 0.25W FC TC = —400/+500 (see note).

Page 6-10, Table 6-2:
Change A4 to 0960-0444 (see note).
Change A4P1 to 5020-8157 (see note).

Service Sheet 7 (schematic):
Change part number for A4 Assembly to 0960-0444.
Change A3R7 to 2.7Ω.

NOTE

The parts listed here for A4, A4P1 and A3R7 are the recommended replacements in instruments with serial number prefixes below 1612A.

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. Service information for the HP Model 8654B is found in this section. It includes principles of operation, troubleshooting, and repair information.

WARNING

The service information found in this section is often used with power supplied and protective covers removed from the instrument. Energy available at many points may, if contacted, result in personal injury or death.

Refer to front matter of manual for additional important cautions and warnings.

8-3. The Service Sheets include a troubleshooting block diagram, schematic diagrams, pc board photos, instrument internal views and an illustrated parts breakdown of the A1 RF Section Assembly.

8-4. Figure 8-2, Schematic Diagram Notes, aids in interpreting symbols on the schematics. Table 6-1, Reference Designations and Abbreviations, provides additional information for use with the schematics.

8-5. PRINCIPLES OF OPERATION (Refer to Service Sheet 1)

8-6. RF Oscillator/FM Modulator Circuits (Service Sheet 2)

8-7. The RF source of the Signal Generator is an LC oscillator. Six frequency bands are selected by switching tank circuit inductors (**FREQUENCY RANGE MHz** switch). A variable capacitor (**FREQUENCY TUNE** control) provides tuning across individual bands. Varactor diodes parallel to the tuning capacitor provide electronic fine tuning (**FINE TUNE** control), FM modulation, and phase-lock control through a rear panel connector.

8-8. RF Amplifier/ALC Circuits (Service Sheet 3)

8-9. A Buffer Amplifier isolates the oscillator from the Modulator (a rear panel auxiliary output is taken from the Buffer Amplifier output). The Modulator is a current-controlled RF attenuator which sets the RF level and applies amplitude or pulse modulation to the RF signal. A Power Amplifier increases the level of the RF signal from the Modulator. The output is coupled to the RF Detector and Attenuator Assembly (**OUTPUT LEVEL** switch). The RF Detector produces a dc output which is proportional to the RF signal level. The AM/ALC Amplifier compares the RF Detector output with an ALC reference voltage (controlled by **RF OUTPUT VERNIER**). An error voltage sets the Modulator's drive current which causes the RF signal level to track the dc reference voltage. When the ALC reference voltage has a superimposed audio signal, the RF signal is amplitude modulated.

8-10. Reverse Power Protection (Service Sheet 3A, Option 003)

8-11. The Reverse Power Protection circuit (Option 003 only) uses a relay to open the RF signal path if excessive power is applied to the RF OUTPUT connector. In this manner the generator's output circuitry is protected. The relay automatically closes to restore generator operation when

reverse power has been removed. (The relay is also open when the LINE switch is set to OFF.)

8-12. Control Circuits (Service Sheet 4)

8-13. An Audio Oscillator is enabled when either **AM** or **FM** switches is set to INTERNAL. The **400 Hz/1 kHz** switch selects the modulation rate. The audio signal is either switched to the AM or FM OUTPUT/INPUT connectors, or passed through an Audio Amplifier to the internal AM or FM circuits (a mechanical interlock prevents simultaneous internal AM and FM).

8-14. During FM operation, the audio signal level (either internal or external) is adjusted by the **FM LEVEL** control. The signal is then coupled to an FM Driver (Service Sheet 6).

8-15. During AM operation, the audio signal level (either internal or external) is adjusted by the **AM LEVEL** control. A Level Reference Amplifier sums the audio signal with a constant dc level and produces a negative ALC reference voltage.

8-16. The **RF OUTPUT VERNIER** adjusts the reference voltage (with or without AM) to vary the RF signal within a 13 dB range. On all output level ranges but +10 dBm, the negative reference voltage is decreased by adding a voltage divider resistor to the Vernier, to produce the first 10 dB of output attenuation. A Shaping Amplifier adds a small amount of distortion to low level ALC signals to compensate for low level non-linearity in the RF Detector. The Shaping Amplifier drives the AM/ALC Amplifier.

8-17. The **METER** switch selects the input signal to a Meter Driver from either the RF or Audio Detectors. The meter provides indications of RF output level, percent AM, or FM peak frequency deviation.

8-18. FM Circuits (Service Sheets 5 and 6)

8-19. The Signal Generator is frequency modulated by varying reverse bias on varactor diodes parallel to the RF Oscillator tank circuit (Service Sheet 2). FM rate is determined by the frequency of the signal applied to the FM Modulator. Frequency deviation is determined by the voltage change across the varactor diodes and the effect the capacitance change has on the oscillator frequency. The level of FM drive signal is determined by the gain of the FM Driver Amplifier and the input level to the amplifier.

8-20. A DC Shaping Circuit supplies a dc voltage to control FM signal gain. The voltage level is a function of the **FREQUENCY RANGE (MHz)** switch and **FREQUENCY TUNE** control.

8-21. An FM Driver Amplifier controls FM signal level to produce a predictable amount of frequency deviation as RF changes. When **FREQUENCY RANGE (MHz)** is switched, the FM Driver gain changes sufficiently to maintain constant frequency deviation with band changes. When **FREQUENCY TUNE** is varied, voltage from the DC Control Circuits changes to produce a change in FM Driver gain. The FM Driver output changes varactor diode capacitance and produces a predictable relationship between diode capacitance and total RF Oscillator capacitance. In this manner, peak deviation can be constant throughout the tuning range of a frequency band. FM gain is also a function of the **FM RANGE (kHz)** switch.

8-22. A Varactor Shaping Amplifier controls a voltage fed back into the gain amplifier to maintain minimum FM distortion at any output frequency. The Shaping Amplifier compensates for non-linearity in the voltage-capacitance curve of the varactor diodes. Thus diode capacitance changes necessary to produce different frequency deviations will be linear with respect to input modulating voltage.

8-23. TROUBLESHOOTING

8-24. Use the troubleshooting block diagram (Service Sheet 1) to isolate the trouble to a specific section of the instrument. Then turn to the service sheet (indicated by bold number in lower right corner of block) and isolate the trouble to the defective component.

8-25. When using the troubleshooting block diagram, initially set the generator's controls as indicated in the box at the right of the diagram. Then change the control settings as instructed by the boxes throughout the diagram to make specific measurements. Always return controls to their initial settings after completing a measurement.

8-26. If the problem has been isolated to Service Sheet 5 or 6 (FM control or driver circuits), use the following information to isolate the trouble to the faulty component.

8-27. Service Sheet 5

8-28. The circuits on this part of the A5 FM Driver Board Assembly are dc shaping circuits only. The output of the circuit is at A5TP5. The dc voltage at A5TP5 is a function of frequency range and tuning. Troubleshoot the circuit by checking the dc voltages at the test points given in Table 8-1 for various frequency settings. Also use an oscilloscope to check the outputs of the amplifiers for spurious oscillations.

TEST EQUIPMENT

Multimeter	HP 34702A/34740A
Oscilloscope	HP 180C/1801A/1820C

INITIAL CONTROL SETTINGS

FREQUENCY FINE TUNE	Fully ccw
AM	OFF
FM	OFF
FM RANGE (kHz)	30 kHz
FM LEVEL	Fully ccw

Table 8-1. FM Driver Assembly Troubleshooting (Service Sheet 5)

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	A5TP3 (Vdc)		A5TPA (Vdc)		A5TPB (Vdc)		A5TP5 (Vdc)	
		Min	Max	Min	Max	Min	Max	Min	Max
10–19	10	5.2	5.6	5.4	5.8	–0.69	–0.61	1.9	2.3
19–35	Do not change setting	5.2	5.6	5.4	5.8	–0.69	–0.61	1.9	2.3
35–66	"	5.2	5.6	5.4	5.8	–0.69	–0.61	1.9	2.3
66–130	"	5.2	5.6	5.4	5.8	–0.69	–0.61	2.0	2.4
130–270	"	5.2	5.6	5.5	5.9	–0.69	–0.61	2.1	2.5
270–520	"	5.2	5.6	5.8	6.2	–0.69	–0.61	2.5	3.1
10–19	18	9.5	9.9	9.5	9.9	–0.70	–0.62	–1.4	–1.0
19–35	Do not change setting	9.5	9.9	9.5	9.9	–0.70	–0.62	–1.4	–1.0
35–66	"	9.5	9.9	9.5	9.9	–0.70	–0.62	–1.4	–1.0
66–130	"	9.5	9.9	9.5	9.9	–0.70	–0.62	–1.6	–1.2
130–270	"	9.5	9.9	9.5	9.9	–0.70	–0.62	–2.0	–1.6
270–520	"	9.5	9.9	9.5	9.9	–0.70	–0.62	–4.0	–3.2

8-29. Service Sheet 6

8-30. The circuits on this part of the A5 FM Driver Board Assembly are non-linear ac and dc shaping circuits. The output of the circuit is at A5TP8 which drives the varactor diodes on the A1A2 FM Modulator Board Assembly. The ac voltage at A5TP8 is a function of frequency range and FM deviation range as well as the FM input signal and the frequency tune voltage at A5TP5 (Service Sheet 5).

8-31. To troubleshoot the circuit, first verify that the voltage is correct at A5TP5 (see Troubleshooting, Service Sheet 5), then check the ac and dc voltages given in the procedure below. Check the voltages in the order listed. If only one frequency range is defective, check only that range. If FM deviation is only slightly in error, performing the FM adjustments may correct for this. Also use an oscilloscope to check the outputs of the operational amplifiers for spurious oscillation.

NOTE

Distortion in the ac waveforms is normal at A5TPG and A5TP10 especially where the relative input voltage at A5TP9 is large. The waveform, however, should be smooth with no clipping.

TEST EQUIPMENT:

Multimeter	HP 34702A/34740A
Oscilloscope	HP 180C/1801A/1820C
Test Oscillator	HP 651B

PROCEDURE:

1. Unsolder jumper wire between test points A5TP8 and TP9.

2. Set Signal Generator controls as follows:

FREQUENCY RANGE (MHz)	10—19 MHz
FREQUENCY TUNE	10 MHz
FINE TUNE	Fully cw
AM	OFF
FM	INTERNAL
FM RANGE (kHz)	30 kHz
FM LEVEL	Fully cw
400 Hz/1 kHz	1 kHz

3. Connect voltmeter to A5TP7 and adjust FM LEVEL for 600 mVrms.

4. Set FREQUENCY RANGE (MHz), FREQUENCY TUNE, and FM as listed in Table 8-2 and check ac and dc voltages at the test points indicated.

Table 8-2. FM Driver Board Assembly Troubleshooting (Service Sheet 6)

FREQUENCY RANGE (MHz)	FREQUENCY TUNE (MHz)	A5TP6 with FM OFF (mVdc)		A5TP6 with FM INTERNAL (mVrms)		A5TPC with FM OFF (mVdc)		A5TPC with FM INTERNAL (mVrms)		A5TP8 with FM OFF (mVdc)		A5TP8 with FM INTERNAL (mVrms)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
10–19	10	–0.5	+0.5	5.0	5.8	–20	+20	105	135	–500	+500	2800	3400
19–35	Do not change setting	–0.5	+0.5	5.0	5.8	–20	+20	105	135	–300	+300	1600	2000
35–66	"	–0.5	+0.5	5.0	5.8	–20	+20	170	230	–300	+300	3100	3800
66–130	"	–0.5	+0.5	5.0	5.8	–20	+20	180	240	–150	+150	1500	1900
130–270	"	–0.5	+0.5	5.0	5.8	–20	+20	200	260	– 75	+ 75	900	1100
270–520	"	–0.5	+0.5	5.0	5.8	–20	+20	330	450	–100	+100	1600	2100
10–19	19	–0.5	+0.5	5.0	5.8	–20	+20	18	25	–500	+500	500	600
19–35	Do not change setting	–0.5	+0.5	5.0	5.8	–20	+20	18	25	–300	+300	250	350
35–66	"	–0.5	+0.5	5.0	5.8	–20	+20	28	38	–300	+300	500	650
66–130	"	–0.5	+0.5	5.0	5.8	–20	+20	25	35	–150	+150	220	270
130–270	"	–0.5	+0.5	5.0	5.8	–20	+20	20	28	– 75	+ 75	90	160
270–520	"	–0.5	+0.5	5.0	5.8	–20	+20	10	15	–100	+100	40	120

5. Set FM to OFF. Connect test oscillator to A5TP9. Set frequency to 1 kHz and adjust level for 3 Vrms at A5TP9.

6. Set FREQUENCY RANGE (MHz) as listed in Table 8-3 and check ac and dc voltages at test points listed.

NOTE

Disconnect Test Oscillator from A5TP9 when measuring dc voltages.

Table 8-3. FM Driver Board Assembly Troubleshooting (Service Sheet 6)

FREQUENCY RANGE (MHz)	A5TPD (Vdc)		A5TPE (Vdc)		A5TPF (Vdc)		A5TPF (mVrms)		A5TPG (mVdc)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
10–35	+10.3	+10.7	+2.20	+2.50	–1.40	–1.20	290	360	–650	–590
35–270	+28.2	+30.6	+6.2	+7.00	–3.80	–3.30	290	360	–680	–610
270–520	+47.0	+50.0	+10.3	+11.4	–6.20	–5.50	290	360	–690	–620

FREQUENCY RANGE (MHz)	A5TPG (mVrms)		A5TP10 (mVdc)		A5TP10 (mVrms)	
	Min	Max	Min	Max	Min	Max
10–35	10	12	–10	+10	14	18
35–270	3.4	4.2	+35	+55	6	8
270–520	2.2	2.7	+55	+80	4	6

7. Resolder jumper between A5TP8 and TP9.

8-32. RECOMMENDED TEST EQUIPMENT

8-33. Test equipment and test equipment accessories required to maintain the Signal Generator are listed in Table 1-2. Equipment other than that listed may be used if it meets the listed critical specifications.

8-34. DISASSEMBLY AND ASSEMBLY PROCEDURES

8-35. The following procedures describe how to remove, disassemble and reinstall the A1 RF Section Assembly. The instructions for disassembling and installing portions of the A1 RF Section Assembly refer to parts identified on Service Sheet A (illustrated parts breakdown). Table 8-4 following these procedures is the legend for Service Sheet A, relating each item to its reference designator.

8-36. Figure 8-1 is a diagram of the path the dial string must follow when restrung. Use approximately four feet of cord with a double knot in the middle. Begin by placing the knot in the slot on potentiometer pulley and proceed from there. Perform the Tuning Capacitor and Pulley Adjustment (5-17), Frequency Adjustments (5-18 or 5-19), Preliminary FM Adjustments (5-20), FM Distortion Adjustment (5-21) and FM Deviation Adjustment (5-22).

NOTE

FM Adjustments are complex and time consuming, and require special test equipment.

8-37. A1 RF Section Assembly Removal and Installation Procedures

A1 RF Section Assembly Removal

1. Refer to Figure 6-1. Remove instrument's four covers (14 machine screws).

2. Remove A5 FM Driver Board Assembly by carefully disconnecting the ribbon cable connectors (at A5J1 and A5J2), and extracting the board from the 18-pin edge connector. The pins on the ribbon cable connectors are easily bent and should be protected whenever removed from their sockets.

3. Remove the Top Trim strip (MP22, see Figure 6-1) by first removing two machine screws and the meter support bracket. Remove two machine screws (one long, one short) and lift the trim strip with meter from the generator. Slide the meter off the trim strip and return it to the instrument.

CAUTION

Since the meter is not secured, care must be taken that it does not fall out when the instrument is tilted.

4. Remove 18-pin edge connector, XA5, by removing two self-locking screws in the side frame.

5. Loosen two allen setscrews each to remove the front panel FREQUENCY RANGE and TUNE knobs.

6. Using the wrench supplied in the instrument, disconnect semi-rigid cables W2 at J5 and W4 at A2J1.

7. Remove two pan-head screws and lockwashers that secure the FM Driver Board support bracket. Remove bracket.

8. Remove four flat-head screws that secure the top RF Assembly support bar. Remove the bar.

CAUTION

Bars on top and bottom of instrument support the full weight of the RF Section Assembly. To avoid damaging stress to semi-rigid coaxial cables W2 and W4, disconnect cables at J5 and A2J1 before removing support bars.

9. Disconnect 12-pin printed circuit card P1.

10. Carefully lift A1 RF Section Assembly from instrument.

NOTE

Whenever RF Assembly is out of the instrument, take care not to bend dial cursor. It is also recommended that semi-rigid coaxial cables W2 and W4 be disconnected from the RF Assembly (at A1A1J2 and A1A1J3).

A1 RF Section Assembly Installation

CAUTION

While working with and around the semi-rigid coaxial cables in the generator, do not bend the cables more than necessary. Do not torque the RF connectors to more than 5 inch-pounds.

MICROPHONICS

To minimize the possibility of microphonics in the generator, perform steps 1 and 2 before installing the RF Section Assembly.

1. Check that semi-rigid coaxial cables W2 and W4 are firmly connected to A1A1J2 and A1A1J3.

2. Ensure that four large pan-head screws that secure the RF Assembly cover are tight.

3. Install the RF Assembly in the generator by performing steps 2 through 10 of the disassembly procedure in reverse order.

MICROPHONICS

To minimize the possibility of microphonics in the generator, perform steps 4 through 8 before replacing the instrument covers.

4. Check that four rubber damper pads are in place in the top and bottom support bars.

5. Check that semi-rigid coaxial cables W2 and W4 are firmly connected at J5 and A2J1. The cables should not be touching the FM Board support bracket, the RF assembly casting, or the

Attenuator assembly casting. The cables should be wrapped together at approximately 2-inch intervals.

6. Check that the FM Driver Board bracket holds the FM Driver Board securely. If not, lift the board and press the bracket in. However, the bracket must not touch the semi-rigid coaxial cables or the RF connectors.

7. The ribbon cables to the FM Driver Board should pass between the semi-rigid coaxial cables and the Attenuator assembly.

8. Check that the FREQUENCY RANGE and TUNE knobs do not touch the front panel as they turn through their range.

9. Replace the four instrument covers ensuring that all screws are tight.

8-38. A1 RF Section Disassembly and Assembly (Refer to Service Sheet A)

Rotary Switch Assembly Removal (A1A5)

1. To remove the Rotary Switch Assembly (142) the following items must be removed.

   a. RF Section Assembly
   b. Pan-head screw with lockwasher (147)
   c. Pan-head screw and lockwasher (152, 150).

RF Section Cover Removal (A1MP90)

1. To remove the RF Section cover (32) the following items must be removed.

   a. RF Section Assembly
   b. Four pan-head screws with lockwashers (3, 4).

RF Amplifier/ALC Board Assembly Removal (A1A1)

1. To remove the RF Amplifier/ALC assembly (23) the following items must be removed.

   a. RF Section Assembly
   b. RF Section cover (32)
   c. RF Amplifier cover (27) [four pan-head screws with lockwashers (28) and three pan-head screws and lockwashers (30) and (29)]
   d. Three RF connectors at (24), (56), and (85)
   e. Three hex nuts and lockwashers on RF jacks (24), (56), and (85)
   f. 9/16-inch bushing (54)
   g. RF Amplifier center divider (25) [two flat-head screws (57)]
   h. Four wires.

WARNING

The edges of the RFI gasket on the amplifier cover (27) are sharp and can cause personal injury if not handled with care.

NOTES

The shield and ground clip near Q2 may easily be broken off. If so they must be resoldered before assembly installation to ensure proper operation of the RF Amplifier/ ALC circuits.

If the assembly is to be checked for malfunctions with the board assembly removed from the casting, a ground wire must be attached from circuit board ground to chassis ground.

RF Oscillator Board Assembly Removal (A1A3)

1. To remove the RF Oscillator Board Assembly (34) the following items must be removed.
   a. RF Section Assembly
   b. RF section cover (32)
   c. RF connector at (19)
   d. Two hex nuts and lockwashers (36, 37)
   e. Two wires.

CAUTION

Be careful not to damage the capacitors close to the two hex nuts. It may be necessary to grind down the sides of the hex-nut driver to gain necessary clearance with the capacitors.

Turret Assembly Removal (A1A4)

1. To remove the Turret Assembly (8) the following items must be removed.
   a. RF Section Assembly
   b. RF section cover (32)
   c. Heat sinks on transistors A1A3Q1 and Q2
   d. RF connector at (19)
2. Loosen two allen setscrews that secure turret to the Turret Assembly shaft (110).
3. Set turret to a mid-range position and gently pull it off the shaft.

CAUTION

Do not lift or pull the Turret Assembly by the inductor coils. Be careful not to snag the coils on the RF Oscillator Board.

FM Modulator Board Assembly Removal (A1A2)

1. To remove the FM Modulator Board Assembly (49) the following items must be removed.
   a. A1 RF Section Assembly
   b. RF section cover (32)
   c. Turret Assembly (8)
   d. Two pan-head screws with lockwashers (40), and four flat washers (41)
   e. Two hex nuts and lockwashers [same as (36) and (37)]
   f. Two wires.

Frequency Tune Capacitor Removal (A1C3)

1. To remove the Frequency Tune capacitor (47), the following items must be removed.
   a. A1 RF Section Assembly
   b. RF section cover (32)
   c. RF Oscillator Board Assembly (34)
   d. Turret Assembly (8)
   e. FM Modulator Board Assembly (49)
2. The tuning capacitor pulley must be removed. If care is taken and the following steps followed, it should not be necessary to restring the pulley (see Figure 8-1) if restringing is necessary).
   a. Disconnect spring (58) and tape it to pulley
   b. Tape both ends of string securely to the pulley
   c. Loosen two allen setscrews and remove pulley from tuning capacitor shaft.
3. Remove two pan-head screws (48) and locknuts (60) at the capacitor mounting bracket (59).

Frequency Tune Capacitor Installation (A1C3)

1. Install the Frequency Tune capacitor by reversing the procedures for removal.

FM Modulator Board Assembly Installation (A1A2)

1. If the Frequency Tune capacitor (59) has been removed, it must be installed before installation of the FM Modulator Board Assembly.
2. Install the FM Modulator Board Assembly by reversing the procedures for removal.

CAUTION

Do not overtighten the hex nuts. The mounting studs are easily stripped.

Turret Assembly Installation (A1A4)

1. If the Frequency Tune capacitor or FM Modulator Board Assembly has been removed, it must be installed before installation of the Turret Assembly.
2. If the RF Oscillator is in place, remove the heat sinks from transistors A1A3Q1 and Q2 and the RF connector at (19).
3. Turn Turret Assembly (8) to a mid-range position and carefully press it onto the shaft (110) [metal ring against contact (44)].

CAUTION

Do not lift or pull the Turret Assembly by the inductor coils. Be careful not to snag the coils on the RF Oscillator Board.

4. Turn frequency dial to 270—520 MHz range. Turn turret so that the inductor pins for 270—520 MHz band are touching the capacitor contacts (inductor is metal plate, no wire). Center

inductor pins (in two planes) on capacitor contacts and tighten two allen setscrews to shaft.

5. Check all bands for proper contact of the inductor pins with the capacitor contacts. If adjustment is required, loosen two pan-head screws (71) on capacitor bracket and two pan-head screws (40) on FM Modulator Board bracket. Make adjustment by moving entire capacitor assembly just enough so that the contacts make positive contact with the inductor pins.

6. Replace the heat sinks on transistors A1A3Q1 and Q2, and the RF connector at (19).

RF Oscillator Board Assembly Installation (A1A3)

1. Install the RF Oscillator Board Assembly (34) by reversing the procedures for removal.

CAUTION

Do not overtighten the hex nuts. The mounting studs are easily stripped.

NOTE

When resoldering the two wires, it is important that they be twisted, and the four ferrite beads should be alternating and not touching.

RF Amplifier/ALC Board Assembly Installation (A1A1)

1. Install the RF Amplifier/ALC Assembly (23) by replacing the following items. Replace all nuts and screws loosely first, then proceed as directed.
   a. Four wires
   b. RF Amplifier/ALC Board Assembly (do not pinch wires beneath board.)
   c. RF Amplifier center divider (25) [two flat-head screws (30)]
   d. 9/16-inch bushing (54) tightly in place
   e. Three hex nuts and lockwashers on RF jacks (24, 56 and 85).

2. Tighten nuts and screws in the following order.
   a. Two hex nuts on RF jacks (56 and 85)
   b. Hex nut on RF jack (24)
   c. Two flat-head screws (57) on RF Amplifier center divider (25).

3. Replace RF Amplifier cover by inserting (loosely) three pan-head screws and lockwashers (30 and 29), and four pan-head screws with lockwashers (28).

NOTE

RFI gasket should mesh neatly against the base plate (82).

4. While pressing down and forward on the cover, tighten three center screws first, then four corner screws.

5. Connect RF connector from flexible coaxial cable firmly on RF jack (24).

RF Section Cover Installation (A1MP90)

MICROPHONICS

In order to minimize the possibility of microphonics and RFI in the generator, perform steps 1 through 6 before replacing the RF section cover.

1. Ensure that the leads from two filter capacitors (65 and 66) are not touching each other or the capacitor bodies.

2. Any loose wires on the turret inductors should be glued using coil varnish.[1]

3. Apply lateral pressure to the large pulley (31) on the Frequency Tune capacitor shaft. If the shaft is loose, it can be tightened with a screw and locknut on the end of the capacitor opposite the pulley.

4. Check that the ferrite bead (17) on the coaxial cable at RF jack (19) is glued in place and not touching the RF connector. If necessary, use a silicon rubber cement. [2]

5. Ensure that all nuts, screws, connectors, etc., are tight.

6. Ensure that the RFI braid (33) is in place and properly meshed to the RF section cover (32).

7. Lift cover into position and replace four pan-head screws and lockwashers (3 and 4) and secure them tightly.

Rotary Switch Assembly Installation (A1A5)

1. Place Rotary Switch Assembly (8) in place and insert pan-head screw with lockwasher (147).

2. Replace pan-head screw and lockwasher (152 and 150) at lug (149).

---

[1] E.g., 1202 Glyptal Clear Air Drying and Baking Varnish, General Electric Supply Co., Insulating Material Products Dept., No. 1 Cambell Rd., Schenectady, N.Y., 12306 (HP 6010-0034).

[2] E.g., Silastic 732 RTV Adhesive Sealant, Dow Corning Corporation, Midland, Mi., 48640 (HP 0470-0033).

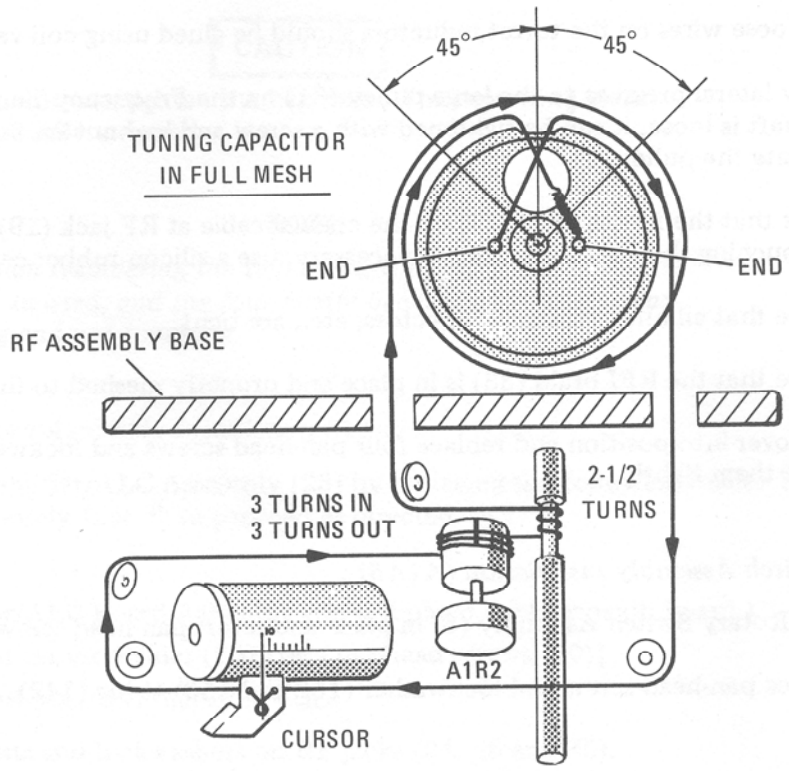


Figure 8-1. Dial Stringing Diagram

SCHEMATIC DIAGRAM NOTES

Resistance in ohms, capacitance in microfarads, inductance in microhenries unless otherwise noted.

* Asterisk denotes a factory-selected value. Value shown is typical. Part may be omitted.

Tool-aided adjustment.

Manual control

Encloses front-panel designation.

Encloses rear-panel designation.

Circuit assembly borderline.

Other assembly borderline. Also used to indicate mechanical interconnection (ganging).

Heavy line with arrows indicates path and direction of main signal.

Heavy dashed line with arrows indicates path and direction of main feedback.

CW Wiper moves toward CW with clockwise rotation of control (as viewed from shaft or knob).

1 Numbered or Lettered Test point. Measurement aid provided.

Encloses wire color code. Code used is the same as the resistor color code. First number identifies the base color, second number identifies the wider stripe, third number identifies the narrower stripe. E.g., (947) denotes white base, yellow wide stripe, violet narrow stripe.

A direct conducting connection to the earth, or a conducting connection to a structure that has a similar function (e.g., the frame of an air, sea, or land vehicle).

A conducting connection to a chassis or frame.

Common connections. All like-designated points are connected.

K 6 Letter = off page connection.

Number = Service Sheet number for off page connection.

Figure 8-2. Schematic Diagram Notes (1 of 2)

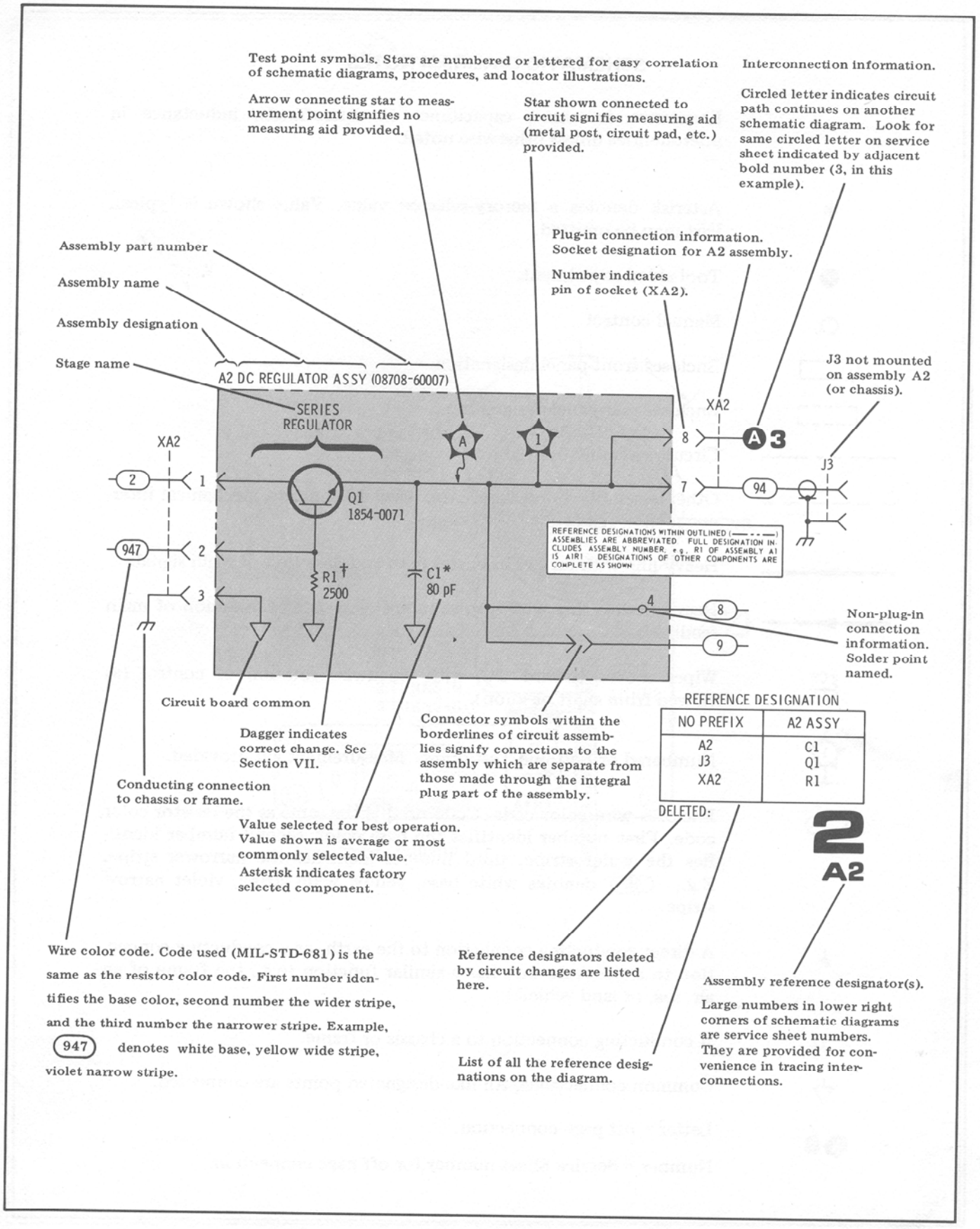


Figure 8-2. Schematic Diagram Notes (2 of 2)

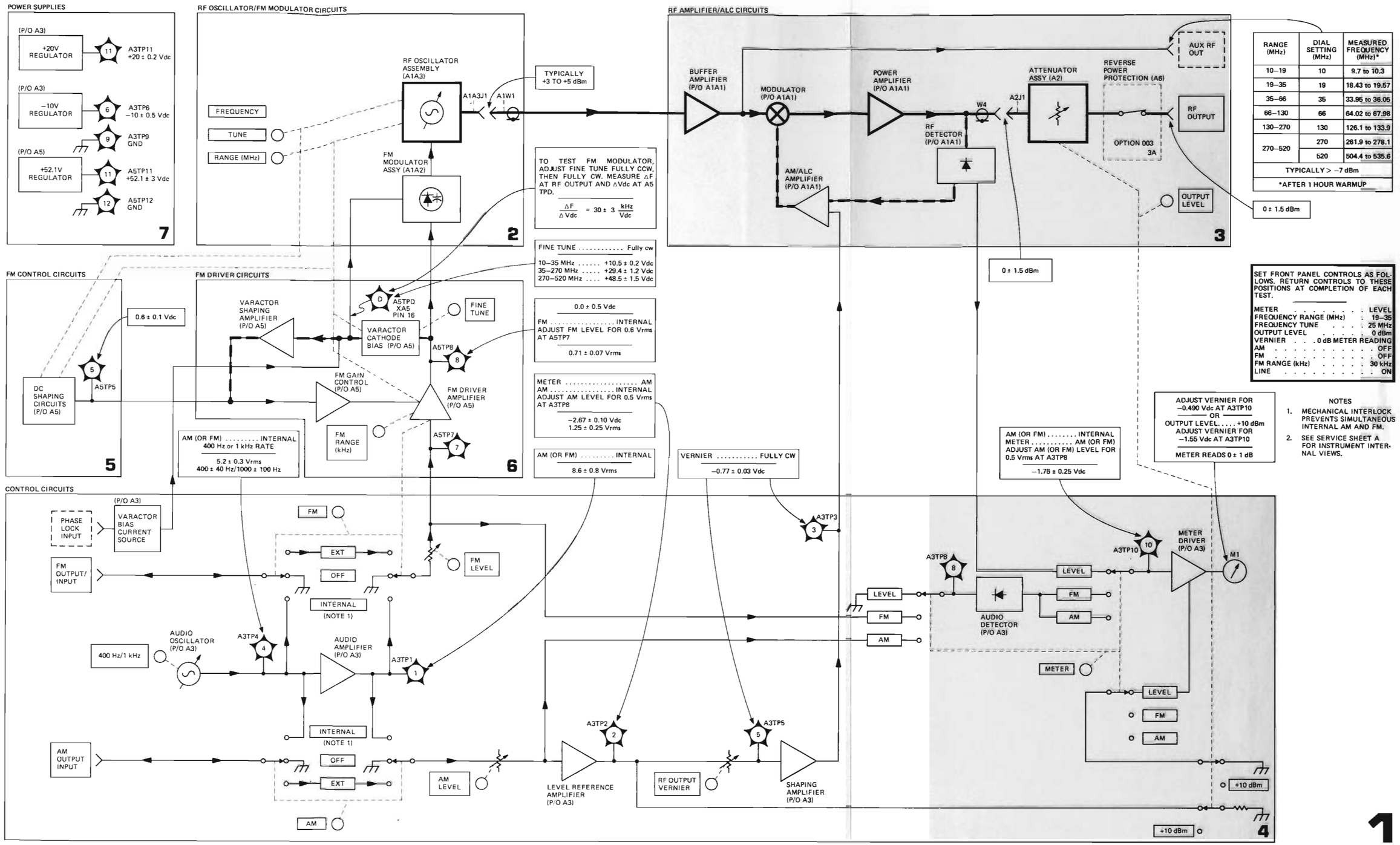


Figure 8-3. Troubleshooting Block Diagram

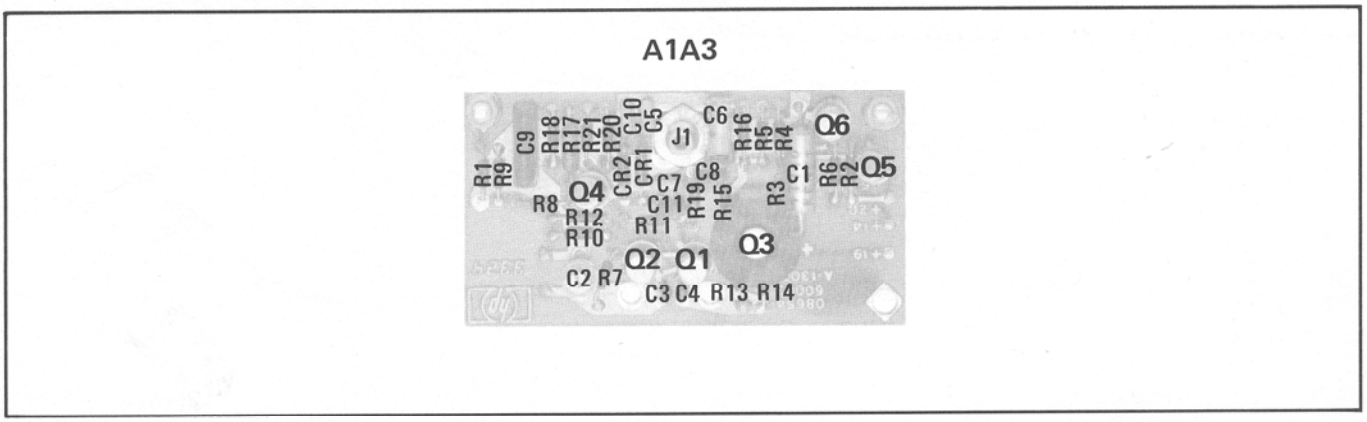


Figure 8-4. A1A3 RF Oscillator Board Assembly Component Locations

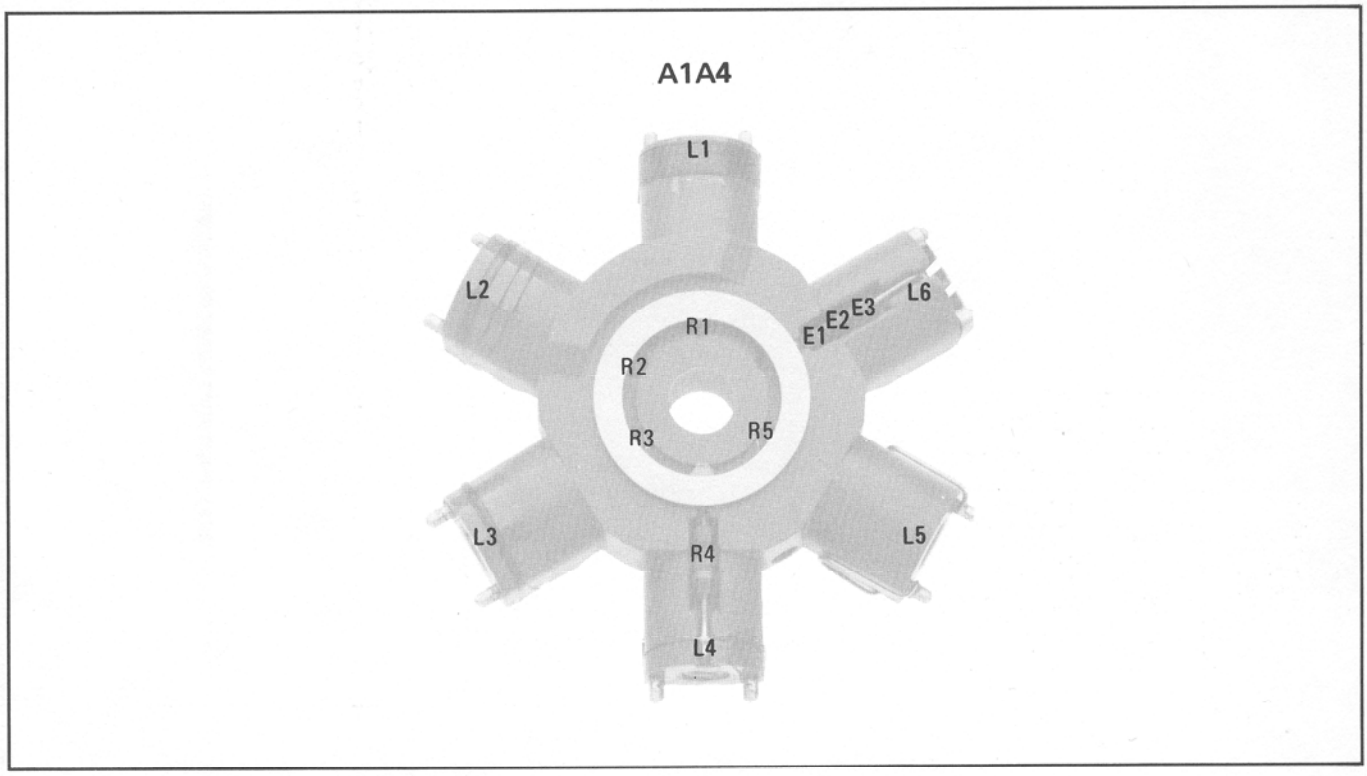


Figure 8-5. A1A4 Turret Assembly Component Locations

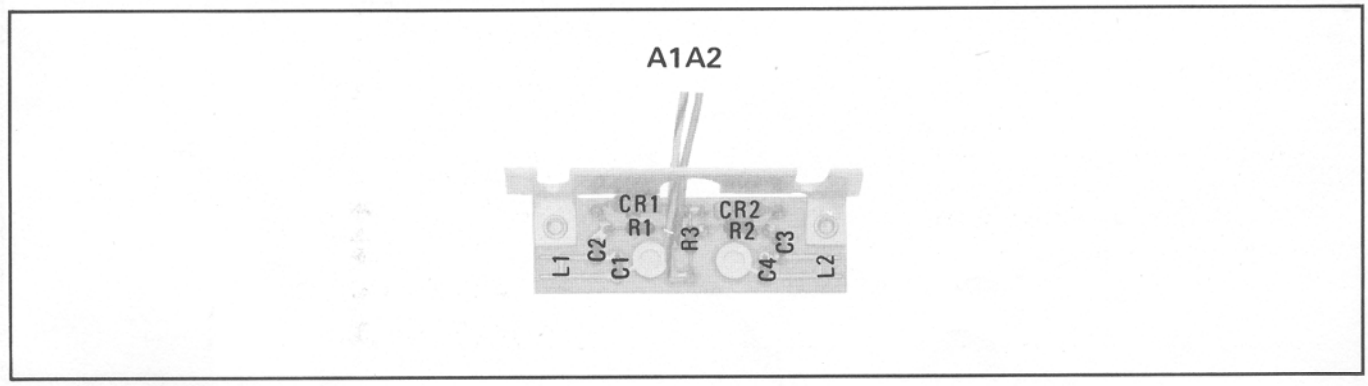
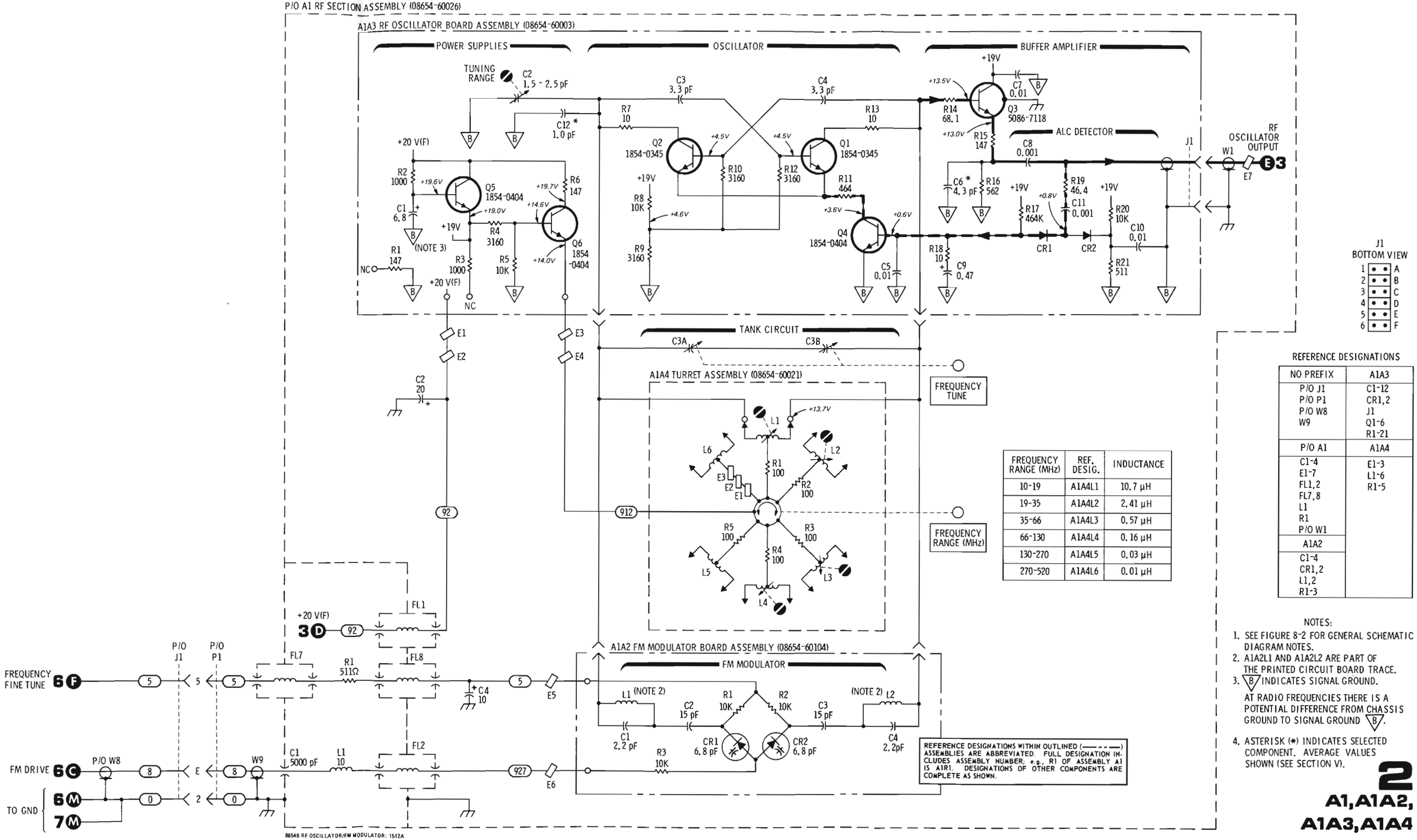


Figure 8-6. A1A2 FM Modulator Board Assembly Component Locations



FREQUENCY RANGE (MHz)	REF. DESIG.	INDUCTANCE
10-19	A1A4L1	10.7 μH
19-35	A1A4L2	2.41 μH
35-66	A1A4L3	0.57 μH
66-130	A1A4L4	0.16 μH
130-270	A1A4L5	0.03 μH
270-520	A1A4L6	0.01 μH

J1 BOTTOM VIEW

1	• •	A
2	• •	B
3	• •	C
4	• •	D
5	• •	E
6	• •	F

REFERENCE DESIGNATIONS

NO PREFIX	A1A3
P/O J1 P/O P1 P/O W8 W9	C1-12 CR1,2 J1 Q1-6 R1-21
P/O A1	A1A4
C1-4 E1-7 FL1,2 FL7,8 L1 R1 P/O W1	E1-3 L1-6 R1-5
A1A2	
C1-4 CR1,2 L1,2 R1-3	

NOTES:

1. SEE FIGURE 8-2 FOR GENERAL SCHEMATIC DIAGRAM NOTES.
2. A1A2L1 AND A1A2L2 ARE PART OF THE PRINTED CIRCUIT BOARD TRACE.
3. ▽B INDICATES SIGNAL GROUND.
   AT RADIO FREQUENCIES THERE IS A POTENTIAL DIFFERENCE FROM CHASSIS GROUND TO SIGNAL GROUND ▽B.
4. ASTERISK (*) INDICATES SELECTED COMPONENT. AVERAGE VALUES SHOWN (SEE SECTION V).

2
A1, A1A2, A1A3, A1A4

Figure 8-7. RF Oscillator, FM Modulator Schematic Diagram

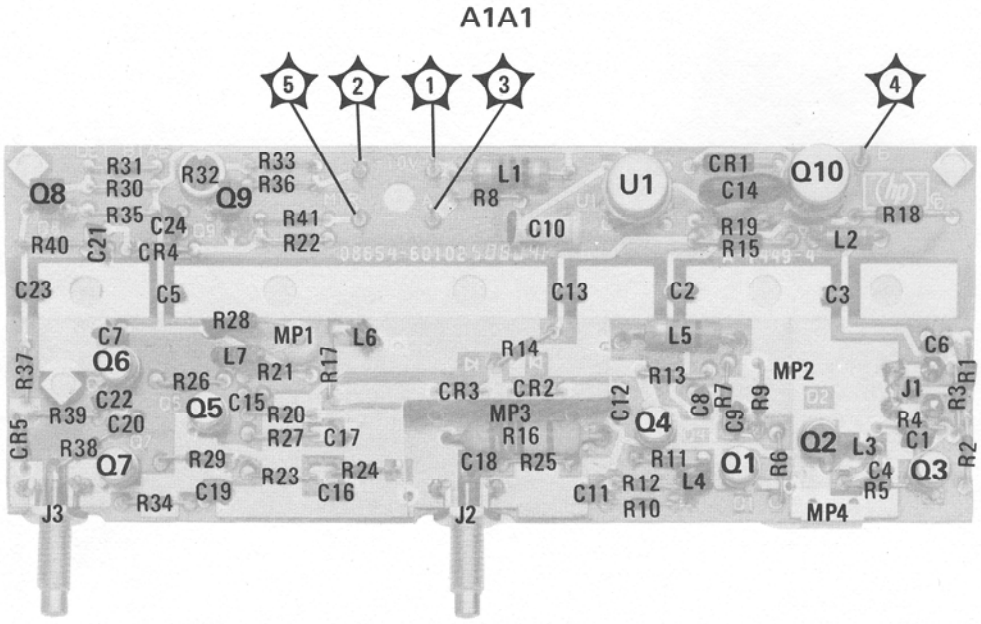


Figure 8-8. A1A1 RF Amplifier/ALC Board Assembly Component Locations

P/O A1 RF SECTION ASSEMBLY (08654-60026)

A1A1 RF AMPLIFIER/ALC BOARD ASSEMBLY (08654-60102)

BUFFER AMPLIFIER

POWER AMPLIFIER

MODULATOR

RF DETECTOR

AM/ALC AMPLIFIER

RF OSCILLATOR OUTPUT 2 E W1

-10 V(F)

+20 V(F1)

+20V 7 B

+20V SENSE 7 A

-10V 7 S

LEVEL 4 G REFERENCE

+20 V(F) D 2

MTR 5

RF OUTPUT U 4

AUX RF OUT

A2 ATTENUATOR ASSY (08654-60024)

OUTPUT LEVEL

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.

8654B RF AMPLIFIER/ALC CIRCUITS: 1512A

A1A1U1 AND CIRCUIT BOARD TOP VIEW

A1A1Q2 CIRCUIT BOARD BOTTOM VIEW

J1 BOTTOM VIEW

REFERENCE DESIGNATIONS	
NO PREFIX	A1A1
P/O J1 J2, 3, 5 P/O P1 W2-5	C1-24 CR1-5 J1-3 L1-7 MP1 Q1-10 R1-41 TP1-5 U1
P/O A1	A2
FL3-6 L2 P/O W1	J1, 2

NOTES:

1. REFER TO FIGURE 8-2 FOR GENERAL SCHEMATIC DIAGRAM NOTES.
2. DC VOLTAGES ARE MEASURED WITH AM AND FM SWITCHES SET TO OFF.
3. ASTERISK (*) INDICATES SELECTED COMPONENT. AVERAGE VALUES SHOWN (SEE SECTION V).

3
A1, A1A1, A2

Figure 8-9. RF Amplifier/ALC Assembly Schematic Diagram

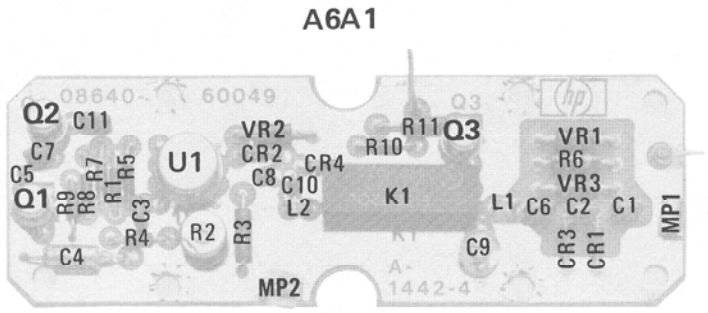
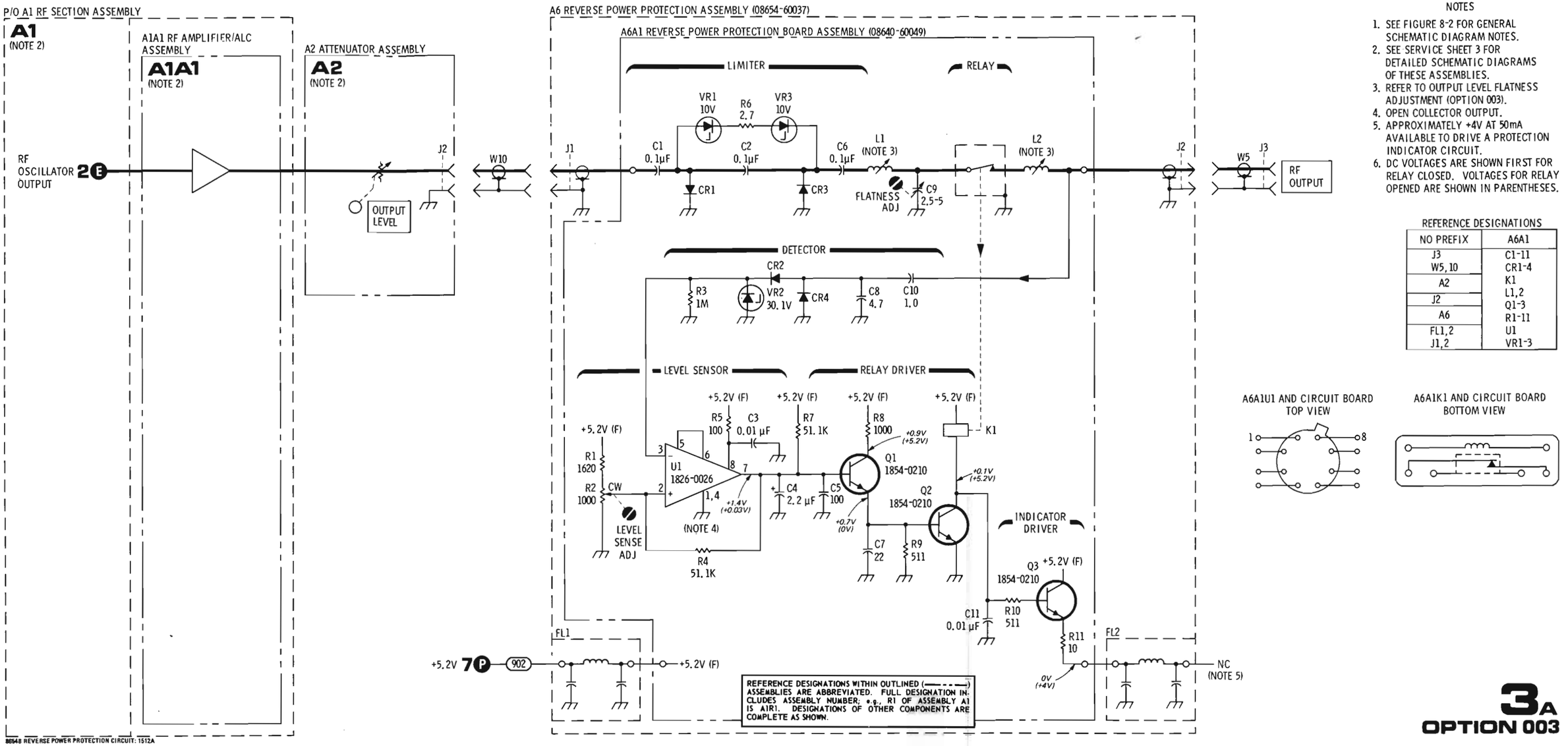


Figure 8-10. A6A1 Reverse Power Protection Board Assembly Component Locations



NOTES

1. SEE FIGURE 8-2 FOR GENERAL SCHEMATIC DIAGRAM NOTES.
2. SEE SERVICE SHEET 3 FOR DETAILED SCHEMATIC DIAGRAMS OF THESE ASSEMBLIES.
3. REFER TO OUTPUT LEVEL FLATNESS ADJUSTMENT (OPTION 003).
4. OPEN COLLECTOR OUTPUT.
5. APPROXIMATELY +4V AT 50mA AVAILABLE TO DRIVE A PROTECTION INDICATOR CIRCUIT.
6. DC VOLTAGES ARE SHOWN FIRST FOR RELAY CLOSED. VOLTAGES FOR RELAY OPENED ARE SHOWN IN PARENTHESES.

REFERENCE DESIGNATIONS

NO PREFIX	A6A1
J3 W5, 10	C1-11 CR1-4
A2	K1
J2	L1,2 Q1-3
A6	R1-11
FL1,2 J1,2	U1 VR1-3

A6A1U1 AND CIRCUIT BOARD TOP VIEW

A6A1K1 AND CIRCUIT BOARD BOTTOM VIEW

3A OPTION 003

Figure 8-11. Reverse Power Protection Assembly Schematic Diagram

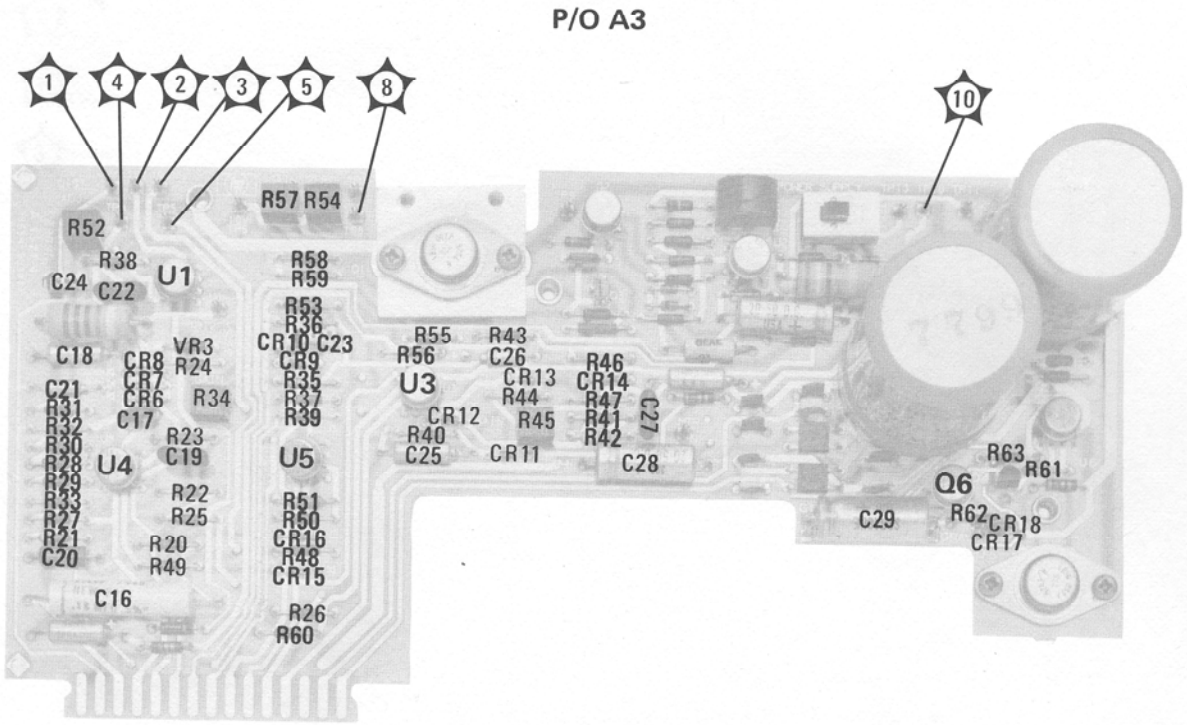
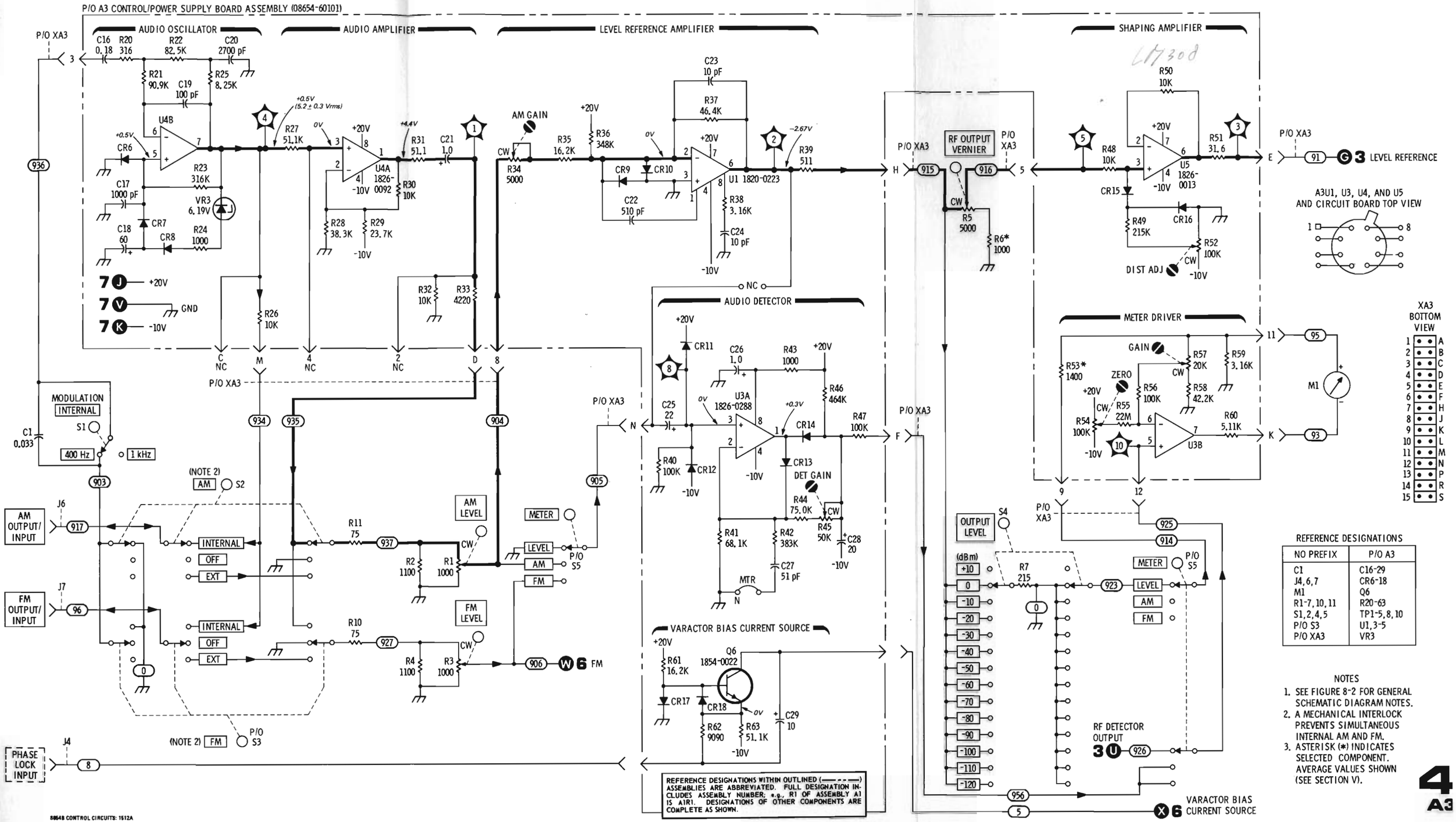


Figure 8-12. P/O A3 Control/Power Supply Board Assembly Component Locations



REFERENCE DESIGNATIONS	
NO PREFIX	P/O A3
C1	C16-29
J4,6,7	CR6-18
M1	Q6
R1-7,10,11	R20-63
S1,2,4,5	TP1-5,8,10
P/O S3	U1,3-5
P/O XA3	VR3

NOTES

1. SEE FIGURE 8-2 FOR GENERAL SCHEMATIC DIAGRAM NOTES.
2. A MECHANICAL INTERLOCK PREVENTS SIMULTANEOUS INTERNAL AM AND FM.
3. ASTERISK (*) INDICATES SELECTED COMPONENT. AVERAGE VALUES SHOWN (SEE SECTION V).

4 A3

Figure 8-13. P/O A3 Assembly (Control) Schematic Diagram

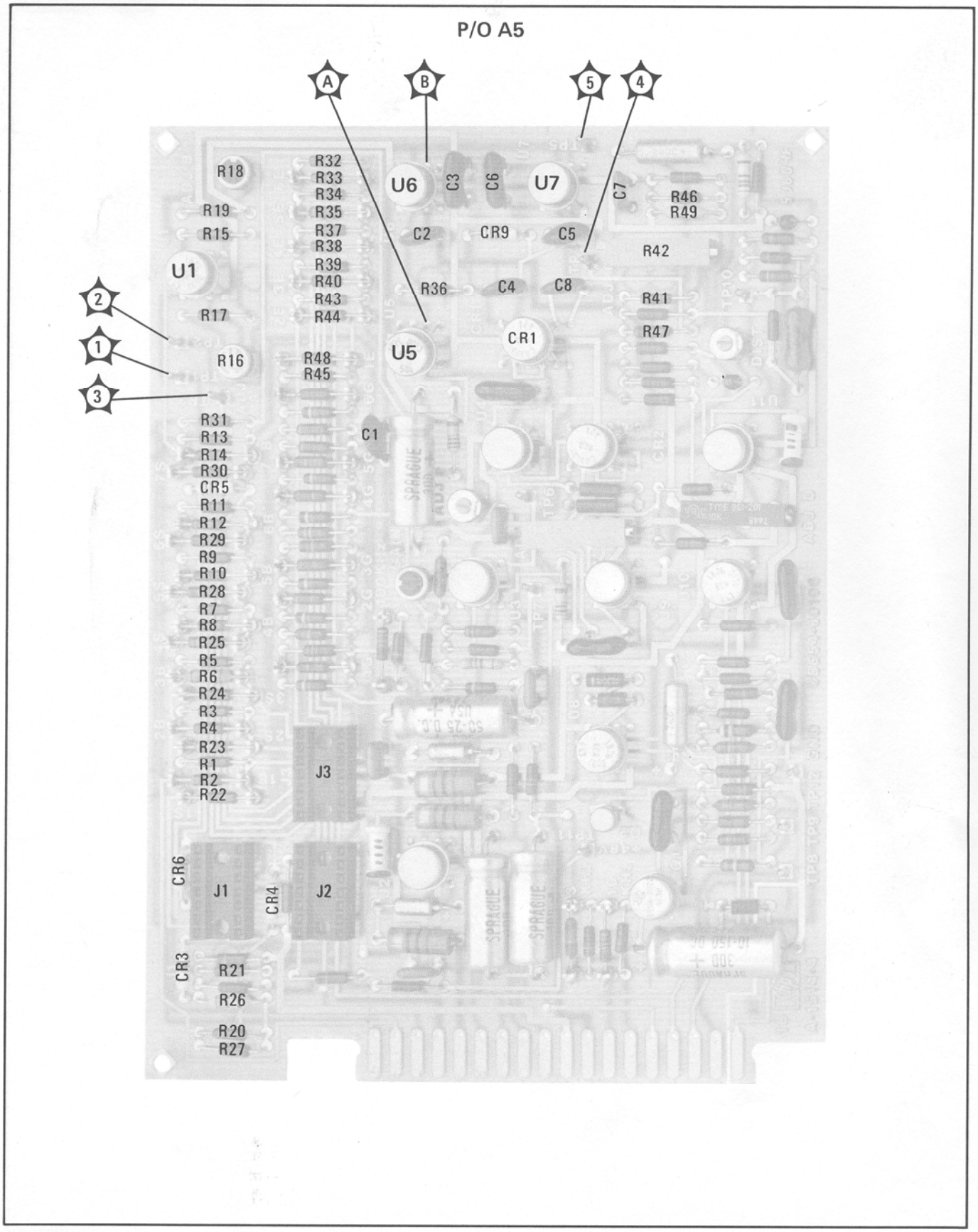
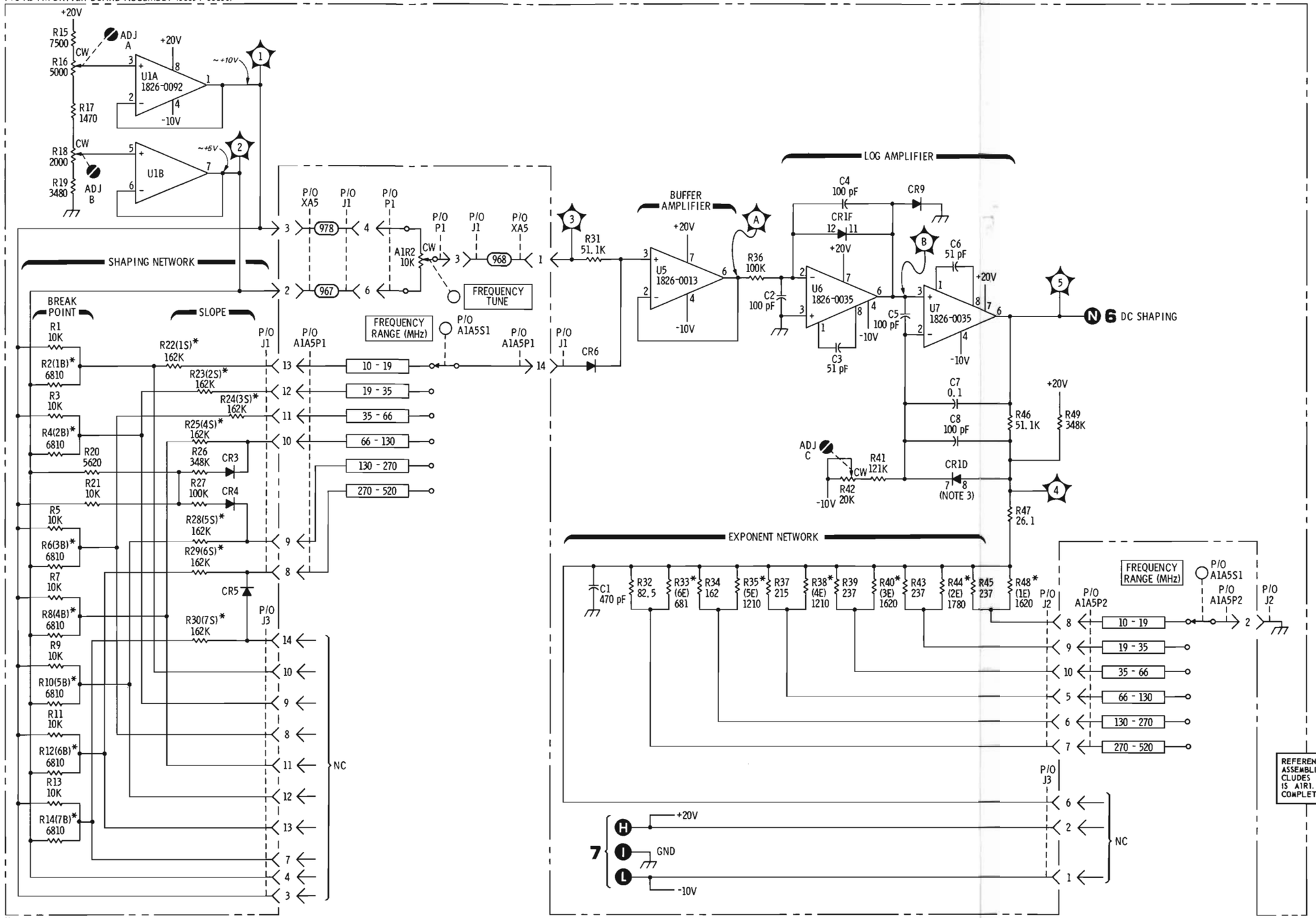


Figure 8-14. P/O A5 FM Driver Board Assembly Component Locations

P/O A5 FM DRIVER BOARD ASSEMBLY (08654-60106)



8654B FM DC SHAPING CIRCUIT: 1512A

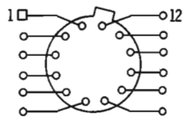
REFERENCE DESIGNATIONS

NO PREFIX	P/O A5
P/O J1 P/O P1 P/O XA5	C1-8 CR1, 3-6, 9 P/O J1-3 R1-49 TP1-5 U1, 5-7
P/O A1	
R2	
P/O A1A5	
P/O P1, 2 P/O S1	

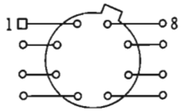
NOTES

1. SEE FIGURE 8-2 FOR GENERAL SCHEMATIC DIAGRAM NOTES.
2. ASTERISK (*) INDICATES SELECTED COMPONENT. AVERAGE VALUES SHOWN (SEE SECTION V).
3. ON DIODE ARRAY A5CR1, PIN 10 CONNECTED TO -10V.

A5CR1 AND CIRCUIT BOARD TOP VIEW



A5U1, 5-7 AND CIRCUIT BOARD TOP VIEW



A5J1-3 BOTTOM VIEW

5 P/O A5

Figure 8-15. P/O A5 Assembly (FM Control) Schematic Diagram

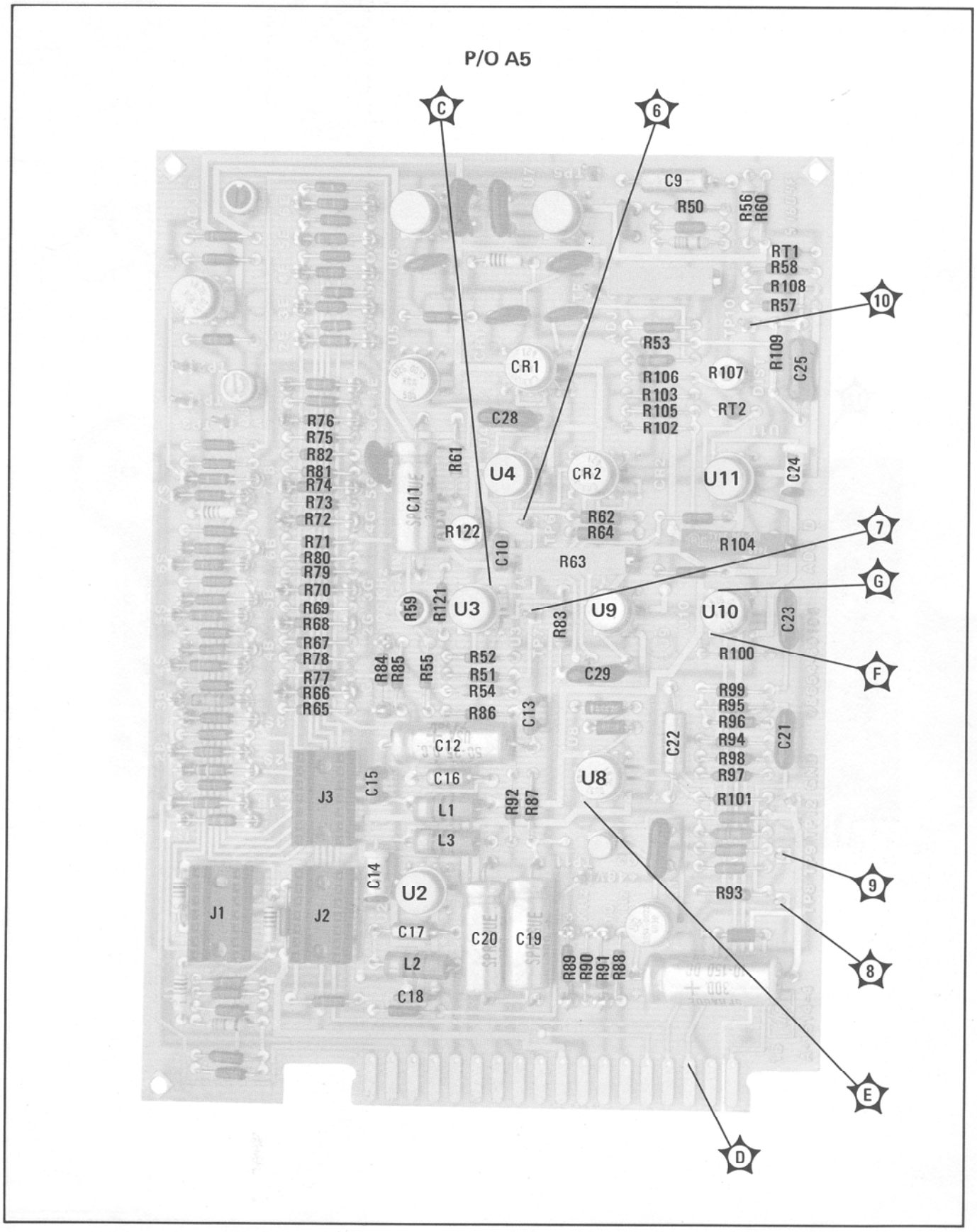


Figure 8-16. P/O A5 FM Driver Board Assembly Component Locations

P/O A5 FM DRIVER BOARD ASSEMBLY (08654-60106)

FM GAIN CONTROL

FM PREAMPLIFIER

FM DRIVER AMPLIFIER

GAIN NETWORK

VARACTOR

VARACTOR CATHODE BIAS

5N DC SHAPING

4W FM

7 (H +20V, I GND, L -10V)

2F FREQUENCY FINE TUNE

4X VARACTOR BIAS CURRENT SOURCE

FM RANGE (kHz): 10, 30, 100, EXT, OFF, INTERNAL

FREQUENCY RANGE (MHz): 10-19, 19-35, 35-66, 66-130, 130-270, 270-520

FM P/O S3

P/O J3 5 NC

82,5 Hz 1Vrms 560k

AIN CONTROL

REFERENCE DESIGNATIONS

NO PREFIX	P/O A5
R9 P/O S3 S7 P/O W8 P/O XA5	C9-25, 28, 29 CR1, 2 P/O J1-3 L1-3 R50-109
P/O A1A5	R121, 122 RT1, 2
P/O P1, 2 P/O S1	TP 6-10 U2-4, 9-11 P/O U8

NOTES

1. SEE FIGURE 8-2 FOR GENERAL SCHEMATIC DIAGRAM NOTES.
2. ASTERISK (*) INDICATES SELECTED COMPONENT. AVERAGE VALUE SHOWN (SEE SECTION V).
3. ON DIODE ARRAYS, A5CR1 AND CR2, PIN 10 IS CONNECTED TO -10V.
4. NORMALLY OPEN

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.

A5CR1,2 AND CIRCUIT BOARD TOP VIEW

A5U2-4, 8-11 AND CIRCUIT BOARD TOP VIEW

A5J1-3 BOTTOM VIEW

6 P/O A5

Figure 8-17. P/O A5 Assembly (FM Driver) Schematic Diagram

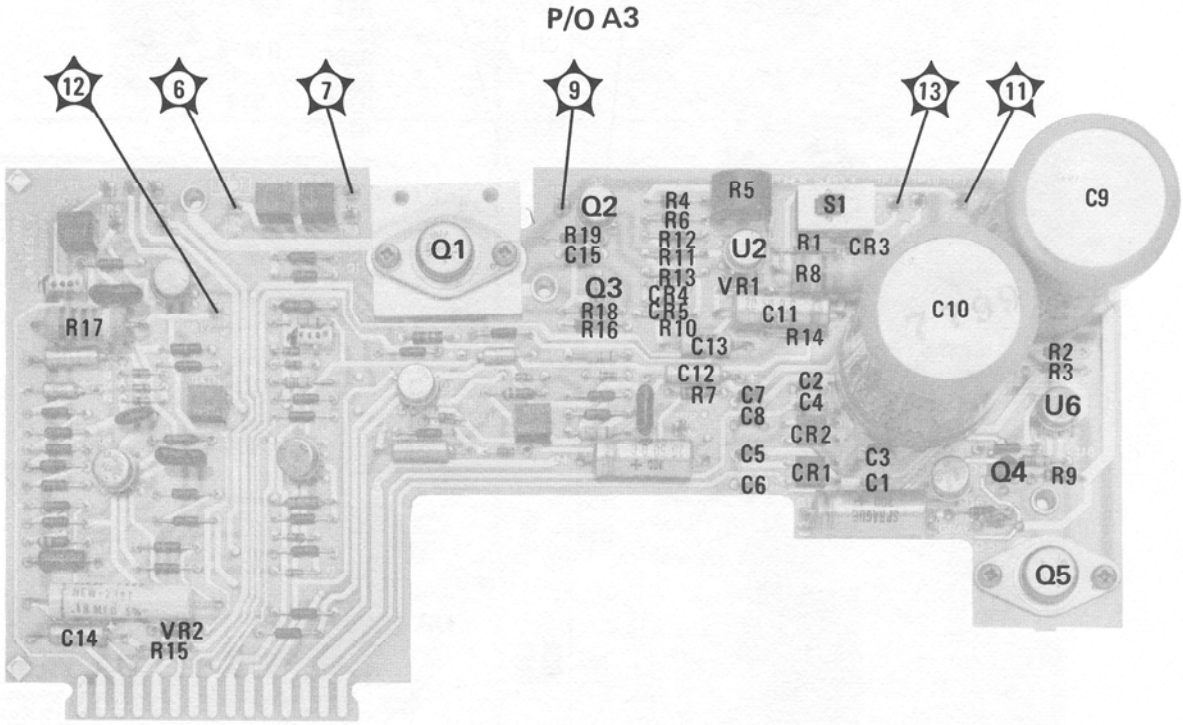


Figure 8-18. P/O A3 Control/Power Supply Board Assembly Component Locations

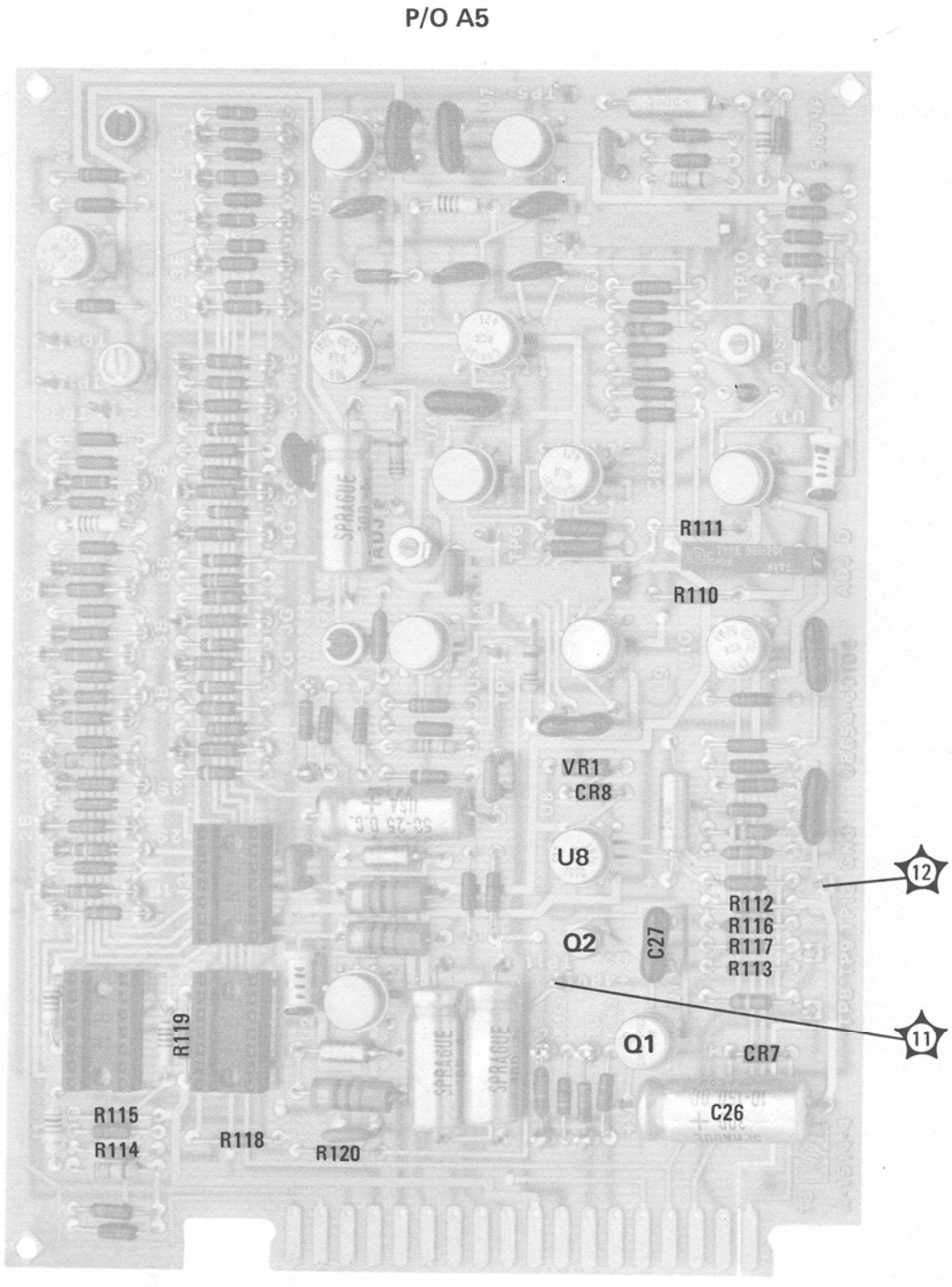


Figure 8-19. P/O A5 FM Driver Board Assembly Component Locations

P/O A3 CONTROL/POWER SUPPLY BOARD ASSEMBLY (08654-60101)

+20V REGULATOR

-10V REGULATOR

OFF ON

S6 LINE

R8 31.6K

DS1

918 98 928 948

8

A4 LINE MODULE (5060-9422)

W6

H B M D

W1

R S F1 (NOTE 2)

54

LINE VOLTAGE
100, 120, 220, 240
VAC +5%, -10%
48 TO 440 Hz

P N

POWER CABLE

A 3
J 0
D 05
K 04
L 02

J1

A B C D E F P1 LINE VOLTAGE SELECTOR CARD

100 VAC
120 VAC
220 VAC
240 VAC

P/O XA3

+20V SENSE 3A 924

7

S1 POWER SUPPLY ISOLATION SWITCH

NORM TEST

CR3

NORM TEST

R8 390

13

J4 +20V

7

6

J

P/O XA3

92 B3 +20V

902 P3A +5.2V

8

92

902

R17 220

+20V

11

VR2 5.1V

12 +5.2V

+20±0.2V

R15 2.7

C14 6.8

C1 0.01

CR1

C5 0.01

VR1 6.2V

C11 20

R4 6190

R10 51.1

R13 10K

+2.4V

+0.7V

R11 316

C13 0.01

+13.8V

R1 1780

R5 1000 CW

U2 1826-0013

R12 1000

Q2 1853-0012

C15 0.05

+13.8V

+20V ADJ

R6 14.7K

CR4 CR5

+1.3V

R19 196

-6V

R14 100K

-4V

R18 10K

Q3 1854-0071

R16 1.8

-5V

Q1 1854-0072

0V

9

A

0

0

90

97

V4 GND

B

90

K4 -10V

-10V

6

S3 -10V

-10±0.5V

10

97

T1

2 15 23.8 Vrms 1

S

C3 0.01

C6 0.01

C9 1300

+3V

+0.3V

R9 4.7

+20V

C2 0.01

CR2

C7 0.01

R2 10K

0V

Q5 1854-0072

0V

C10 1300

U6 1826-0013

Q4 1854-0071

+0.9V

4 14 12.4 Vrms 3 R

R7 4.7

C12 6.8

C4 0.01

C8 0.01

R3 5110

8 13 NC

53 Vrms

6 P NC

902

8

0

00648: POWER SUPPLY CIRCUITS: 1512A

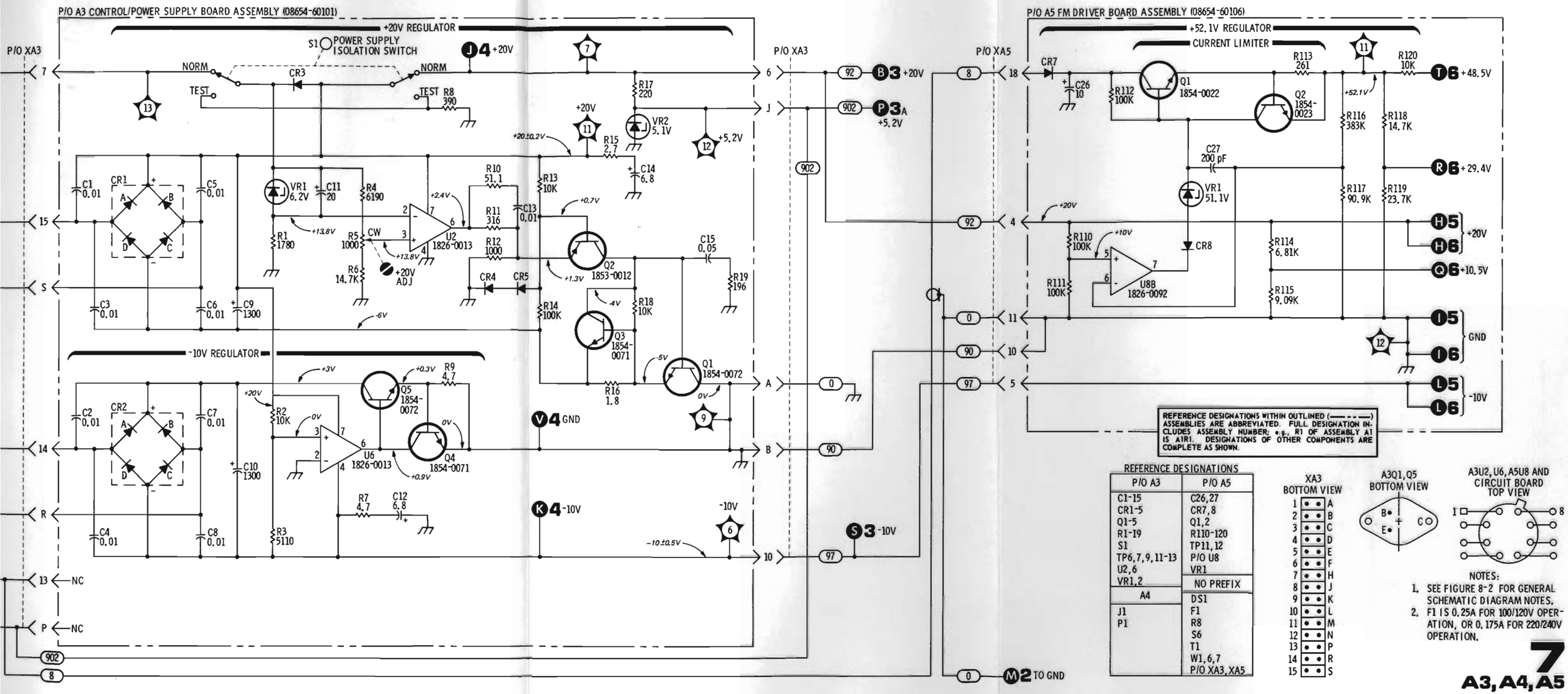
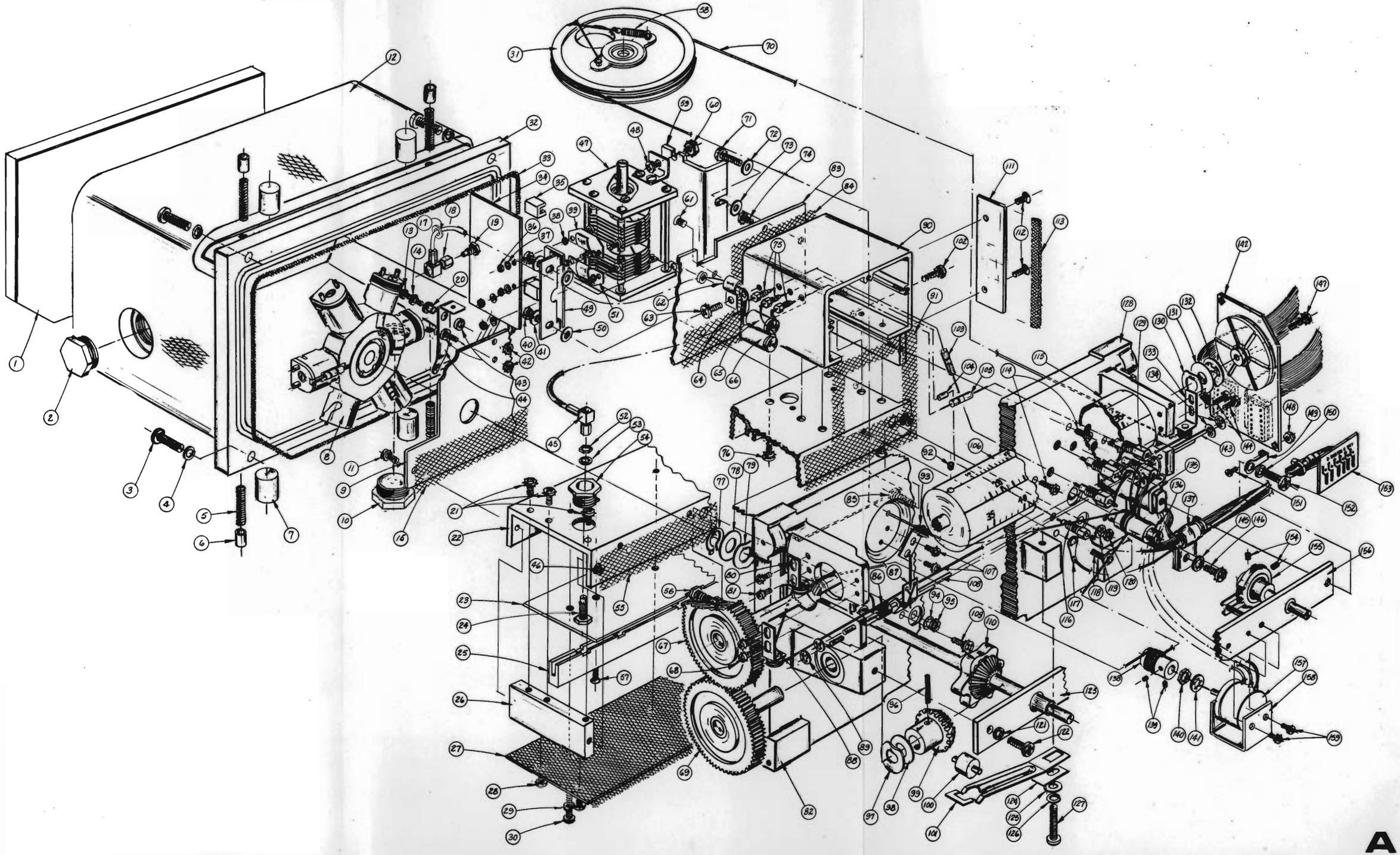


Figure 8-20. Power Supplies, Schematic Diagram

Table 8-4. A1 Assembly Legend (Service Sheet A)

Item	Reference Designator	Item	Reference Designator	Item	Reference Designator
1	A1MP19	55	A1MP68	109	A1MP101
2	A1MP87	56	A1A1J2	110	A1MP92
3	A1MP95 (4)	57	A1MP111 (2)	111	A1MP69
4	A1MP96 (4)	58	A1MP17	112	A1MP109
5	A1MP32-35	59	A1MP128	113	A1MP54
6	A1MP10, 11	60	A1MP104 (2)	114	A1MP100
7	A1MP48-51	61	A1MP109	115	A1MP93
8	A1A4	62	A1MP106	116	A1C1
9	A1MP66	63	A1MP101	117	A1MP2
10	A1MP88	64	A1MP1	118	A1MP101
11	A1MP100 (8)	65	A1C2	119	A1MP26
12	A1MP20	66	A1C4	120	A1MP31
13	A1MP99 (2)	67	A1MP89	121	A1MP98 (2)
14	A1MP36, 37	68	A1MP116 (8)	122	A1MP97 (2)
15	A1MP67	69	A1MP91	123	A1MP78
16	Not assigned	70	A1MP56	124	A1MP58
17	P/O A1W1	71	A1MP105 (2)	125	A1MP112
18	P/O A1W1	72	A1MP103 (5)	126	A1MP98
19	A1A3J1	73	A1MP103	127	A1MP113
20	A1MP14, 15	74	A1MP100	128	A1MP83
21	A1MP101 (20)	75	A1FL1, 2, 8	129	A1FL3-7
22	A1MP80	76	A1MP101	130	A1MP43
23	A1A1	77	A1MP108	131	A1MP41
24	A1A1J1	78	A1MP39	132	A1MP8
25	A1MP81	79	A1MP38	133	A1MP64
26	A1MP79	80	A1MP65	134	A1MP6, 7
27	A1MP71	81	A1MP116	135	A1MP123
28	A1MP101	82	A1MP83	136	A1MP77
29	A1MP21-23	83	A1MP66	137	A1MP124
30	A1MP110 (3)	84	A1MP67	138	A1MP75
31	A1MP74	85	A1A1J3	139	A1MP120 (2)
32	A1MP90	86	A1MP12, 13	140	A1MP118
33	A1MP55	87	A1MP60	141	A1MP119
34	A1A3	88	A1MP62	142	A1A5
35	A1MP52, 53	89	A1MP4, 5	143	A1MP85
36	A1MP126	90	A1MP82	144	A1MP116
37	A1MP107 (4)	91	A1MP68	145	A1MP103
38	A1MP44-47	92	A1MP94	146	A1MP100
39	A1MP72	93	A1MP63	147	A1MP125
40	A1MP100	94	A1MP25	148	A1MP122
41	A1MP102 (5)	95	A1MP30	149	A1MP3
42	A1MP15 (2)	96	A1MP9	150	A1MP98
43	A1MP27, 28	97	A1MP42	151	A1MP121
44	A1MP61	98	A1MP40	152	A1MP97
45	P/O A1W1	99	A1MP86	153	P1
46	A1MP109 (7)	100	A1MP57	154	A1MP127
47	A1C3	101	A1MP59	155	A1MP18
48	A1MP101	102	A1MP114	156	A1MP78
49	A1A2	103	A1L1	157	A1R2
50	A1MP102	104	A1R1	158	A1MP70
51	A1MP73	105	A1L2	159	A1MP117 (2)
52	A1MP29	106	A1MP93		
53	A1MP24	107	A1MP116		
54	A1MP76	108	A1MP84		



A

Figure 8-21. RF Section Assembly Illustrated Parts Breakdown

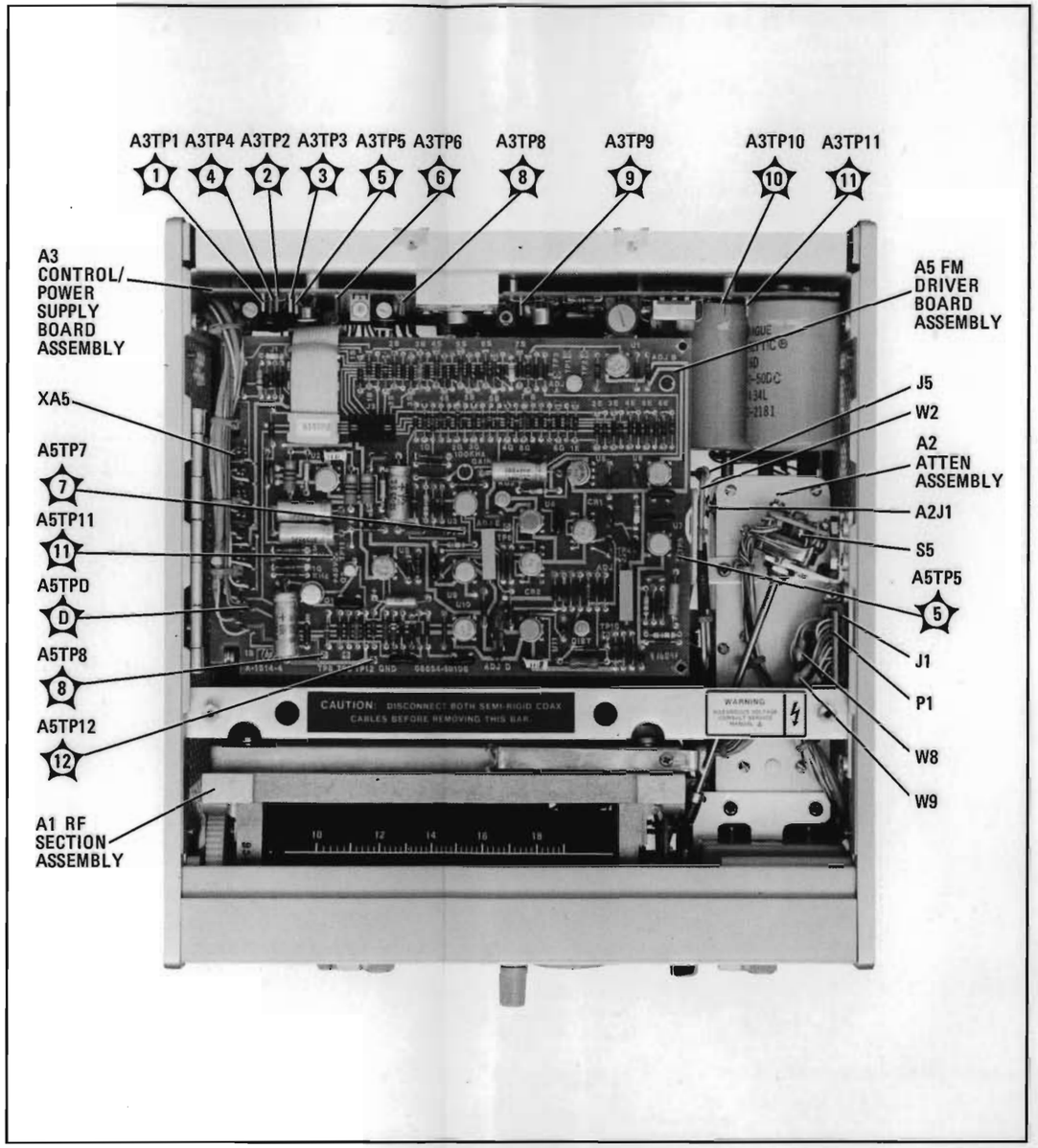


Figure 8-22. Top Internal View

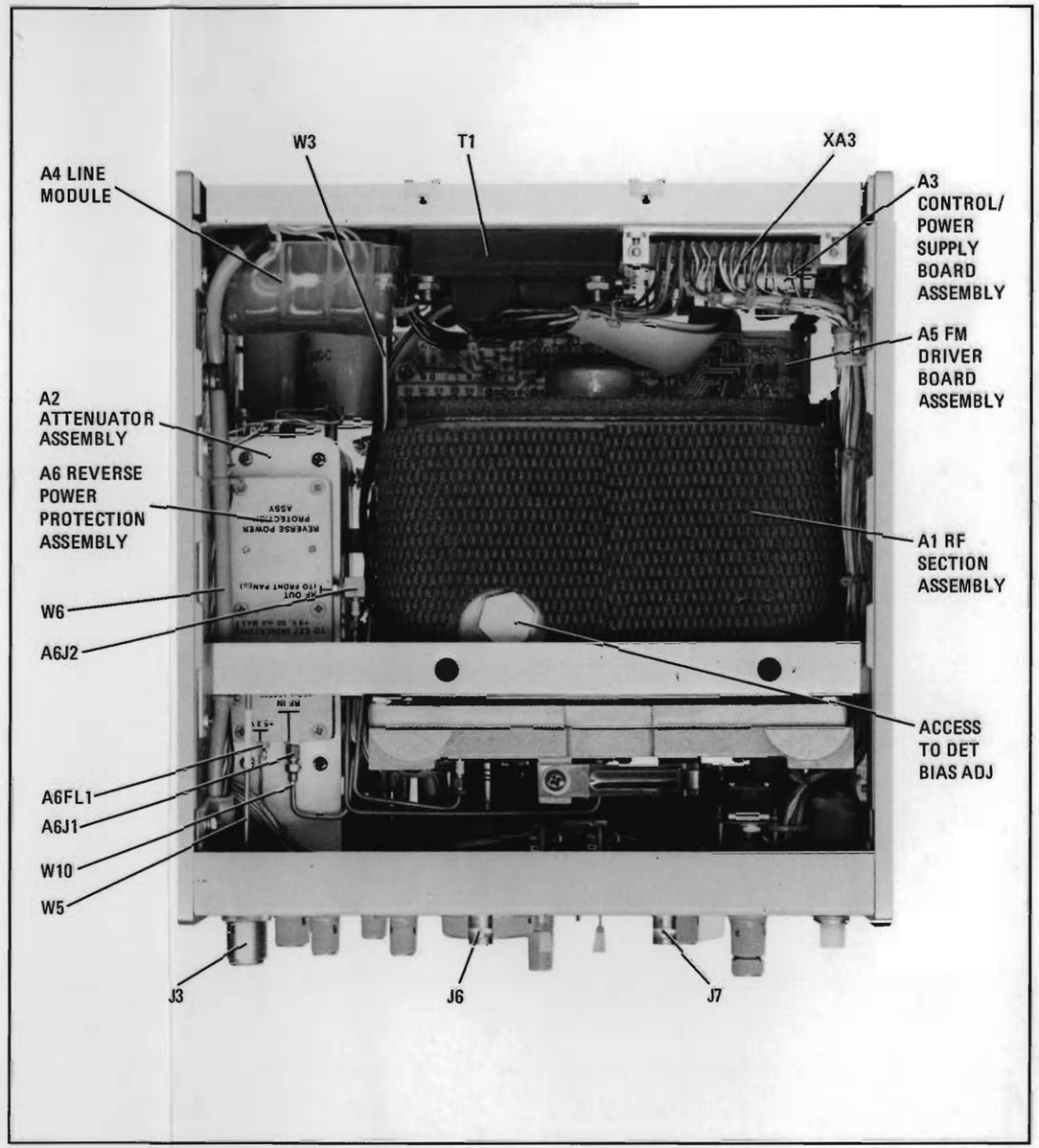


Figure 8-23. Bottom Internal View (Option 003 shown)