TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

FOR

PLUG-IN UNIT, RF SECTION HEWLETT-PACKARD MODEL 86601A (NSN 6625-00-005-1226)

HEADQUARTERS, DEPARTMENT OF THE ARMY

OCTOBER 1979

TECHNICAL MANUAL
No. 11-6625-2837-14&P-6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 23 October 1979

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REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028-2 located in the back of the manual. Simply tear out the self-addressed form, fill it out as shown on the sample, fold it where shown, and drop it in the mail.

If there are no blank DA Forms 2028-2 in the back of your manual, use the standard DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to the Commander, US Army Communications and Electronics Material Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07762.

In either case a reply will be furnished direct to you.

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications, the format has not been structured to consider levels of maintenance.

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SECTION 0

INTRODUCTION

0-1. SCOPE

This manual describes Plug-in Unit, Rf section, Hewlett-Packard Model 86601A and provides instructions for operation and maintenance.

0-2. INDEXES OF PUBLICATIONS

a. DA Pam 310–4. **Refer to the latest issue of DA Pam 310–4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.**

b. DA Pam 310–7. **Refer to DA Pam 310–7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.**

0-3. MAINTENANCE FORMS, RECORDS, AND REPORTS

a. Reports of Maintenance and Unsatisfactory Equipment. **Department of the Army forms and procedures used for equipment maintenance will be those described by TM 38–750, The Army Maintenance Management System.**

b. Report of Packaging ad Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment **Report (DISREP) (SF 361) as prescribed in AR 55–38/NAVSUPINST 4610.33B/AFR 75–18/MCO P4610.19C and DLAR 4500.15.**

0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

EIR can and must be submitted by anyone who is aware of an unsatisfactory condition with the equip ment design or use. It is not necessary to show a new design or tit a better way to perform a procedure; just simply tell why the design is unfavorable or why a procedure is difficult. EIR may be submitted on SF 368 (Quality Deficiency Report). Mail direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished to you.

0-5. ADMINISTRATIVE STORAGE

Administrative storage **equipment issued to and** used by Army activities shall be in accordance with paragraph 2-16.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

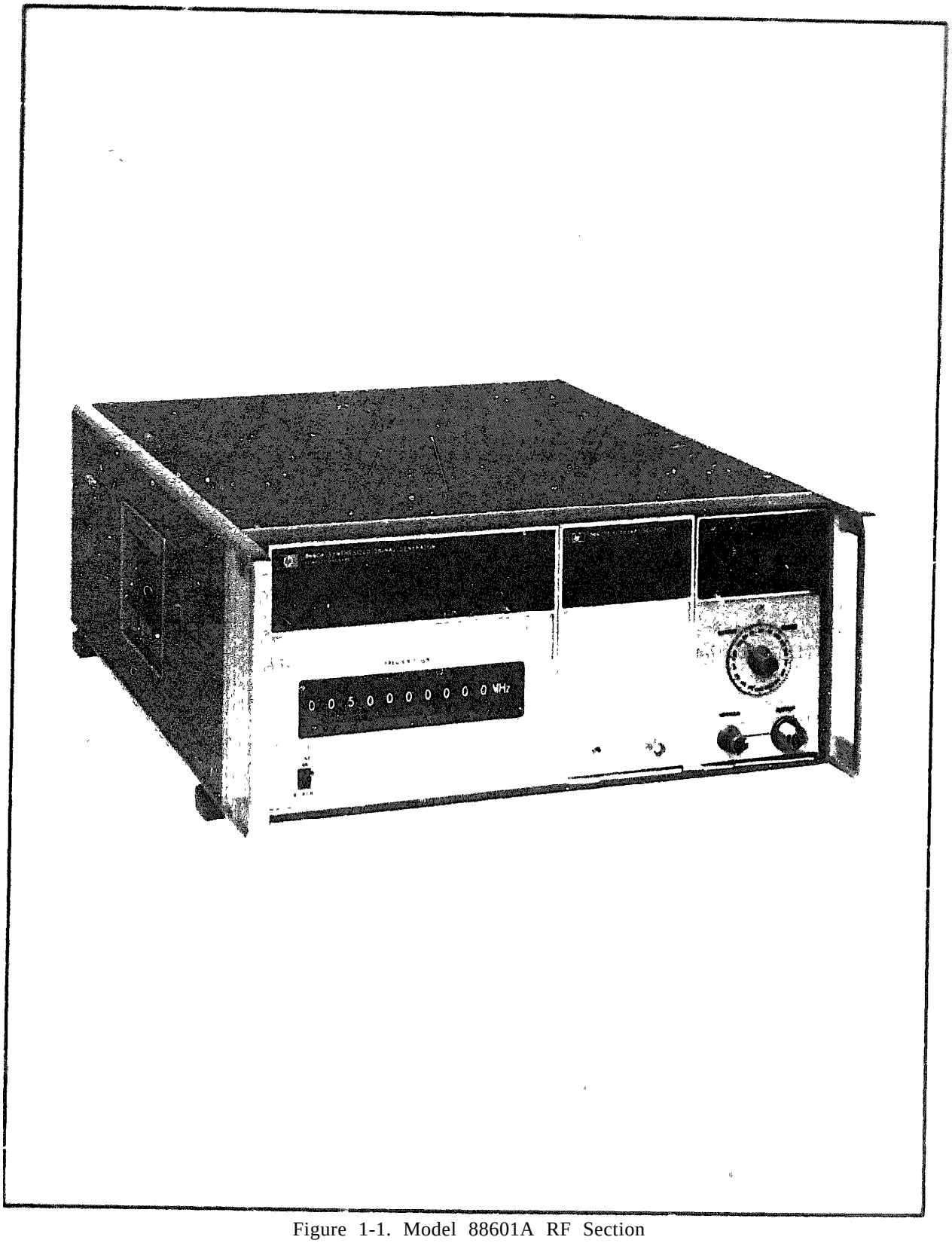


Figure 1-1. Model 88601A RF Section

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. The Hewlett-Packard Model 86601A RF Section is an rf output plug-in designed for use with the Hewlett-Packard Model 8660 Synthesized Signal Generator mainframes.

1-3. This manual contains all information required to install, operate, test, adjust, and service the HP Model 86601A. This section covers instrument identification, specifications and other basic information.

1-4. Figure 1-1 shows a front view of the HP Model 86601A installed in the HP Model 8660A mainframe ready for use.

1-5. The various sections of this manual provide information as follows:

a. SECTION II, INSTALLATION, provides information relative to incoming inspection, power requirements, mounting, packing and shipping, etc.

b. SECTION III, OPERATION, provides information relative to operating the instrument.

c. SECTION IV, PERFORMANCE TESTS, provides information required to asccitain that the instrument is performin, in accordance with published specifications.

d. SECTION V, ADJUSTMENTS, provides inform&ion required to properly adjust and align the instrument after repairs are made.

e. SECTION VI REPLACEABLE PARTS provides ordering information for all parts and assemblies.

f. SECTION VII, MANUAL CHANGES, normally will contain no relevant information in the original issue of a manual. This section is reserved to provide backdated and updated information in manual revisions or reprints.

g. SECTION VIII, SERVICE, includes all information required to service the instrument.

1-6. INSTRUMENTS COVERED BY MANUAL

1-7. A ten-digit number (see Figure 1-2) is affixed to the rear panel of all Hewlett-Packard instruments. When the first five digits (serial prefix) of your instrument matches serial prefix number 1335A, the contents of this manual applies directly to it. An instrument manufactured after the printing of this manual may have a different serial prefix number; if so, refer to Section VII and make the applicable manual changes.

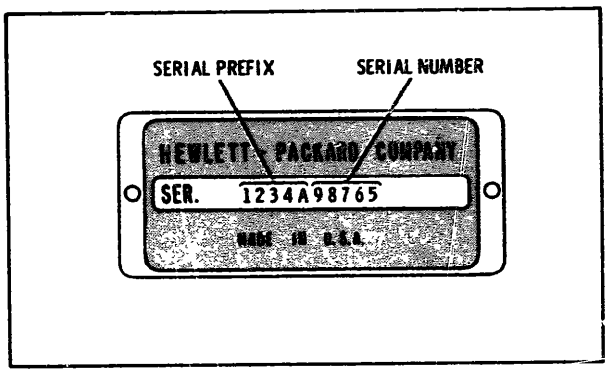


Figure 1-2. Instrument Identification

1-8. DESCRIPTION

1-9. The HP Model 86601A RF Section output plug-in provides a .01 to 109.999999 MHz output when installed in one of the HP Model 8660 mainframes. The output frequency may be selected in increments as low as 1 Hz or 100 Hz depending on the mainframe used.

1-10. The only operator controls on the Model 86601A are the attenuator (OUTPUT RANGE and VERNIER) controls. These controls provide a means of setting the rf output at any level between -146 dBm and +13 dBm. In remote operation these controls are inhibited; attenuation is controlled by a remote programming device in 1 dB and 10 dB steps.

1-11. Complete specifications for the Model 86601A are provided in Table 1-1.

1-12. OPTIONS

Option 001: No RF output attenuator. Output level adjustable from +13 to 0 dBm.

1-13. ACCESSORIES AVAILABLE

1-14. An extender cable, HP Part Number 11672-60001, is required to extend the plug-in for maintenance purposes. This extender cable is a part of the HP 11672A Service Kit, but may be ordered Separately.

1-15. TEST EQUIPMENT AND ACCESSORIES

1-16. Table 1-2 lists the test equipment and accessories recommended to test, adjust and service the Model 86601A. Refer to the Maintenance Allocation Chart in the Appendix for the required test equipment.

Table 1-1. *Model* 86602A Specifications

FREQUENCY CHARACTERISTICS

Frequency Range:

0.01 to 109.999999 MHz. Selectable in 1 Hz or 100 Hz steps (depending on mainframe used).

Frequency Accuracy and Stability:

CW frequency accuracy and long term stability are determined by the reference oscillator in the 8660 mainframe or by an external reference if used.

Switching Time:

Less than 5 ms to be within 100 Hz of any new frequency selected. Less than 100 ms to be within 5 Hz of any new frequency selected. Maximum stepping rate: 1 ms per step.

Harmonic Signals: (Output terminated in 50 Ohms)
All harmonically related signals are at least 40 dB below the selected output signal.

Spurious Signals:

All nonharmonically related spurious signals are at least 80 dB below the selected output signal. Power line related spurious signals are at least 70 dB below the carrier.

Signal-to-phase Noise Ratio:

Greater than 50 dB in a 30 kHz band centered on the carrier excluding a 1 Hz band centered on the carrier.

Residual FM:

< 1 Hz rms in 2 kHz bandwidth centered on carrier.

Signal-to-AM Noise Ratio:

Greater than 70 dB in a 30 kHz band centered on the carrier, excluding a 1 Hz BW centered on the carrier.

OUTPUT CHARACTERISTICS

Output Level:

Continuously adjustable from +13 to −146 dBm (1.0 V to 0.01 μVrms) into 50-ohm resistive load; output attenuator calibrated in 10 dB steps from 1.0 V (+13 dBm) full scale to 0.03 μV (−137 dBm) full scale; vernier provides continuous adjustment between attenuator ranges; output level indicated on output level meter calibrated in volts and dBm into 50 ohms.

Output Accuracy: (Local and Remote Modes)
± 1 dB from +13 dBm to −66 dBm. ± 2 dB from −67 dBm to −146 dBm.

Flatness: Output level variation with frequency is less than ± 0.5 dB across the entire frequency range.

Output Level Switching Time. Any level change may be accomplished in less than 50 ms. Any change to another level on the same attenuator range may be accomplished in 5 ms in Remote mode.

Impedance: 50 ohms. SWR less than 2.0 on +10 dBm (1.0 V) attenuator range, less than 1.3 on 0 dBm (0.3 V) range and below

Table 1-1. Model 86601A Specifications (Cont'd)

MODULATION CHARACTERISTICS
(With the Model 86632A AM/FM Modulation Section)

Amplitude Modulation:*

Modulation Depth: 0 to 95% on all output ranges.

ON/OFF Ratio: At least 25 dB with output meter at 0 dB or above.

Carrier Envelope Distortion: (Modulating signal distortion < 0.3%). Less than 1% at 30% AM. Less than 3% at 70% AM. Less than 5% at 90% AM.

Incidental PM: Less than 0.2 radians peak at 30% AM.

Incidental FM: 0.2 x fmod.

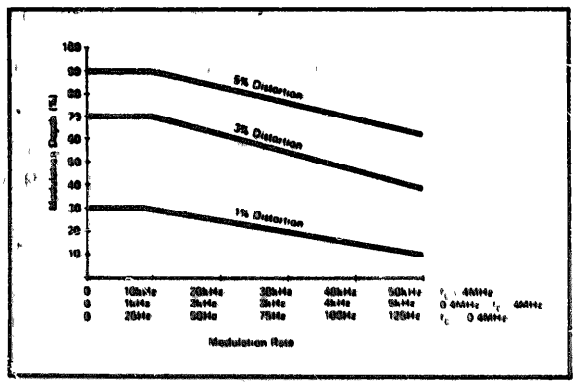
AM 3 dB Bandwidth:

Center Frequency	0 to 30% AM	70% AM	90% AM
Fc <0.4 MHz	200 Hz	125 Hz	100 Hz
0.4 ≤Fc <4 MHz	10 kHz	6 kHz	5 kHz
Fc ≥4 MHz	100 kHz	60 kHz	50 kHz

AM Distortion: (at 400 Hz and 1 kHz rates)

Frequency Range	30%	70%	90%
0.4-110 MHz	<1%	<3%	<5%

Typical distortion for other conditions is show in curves below.



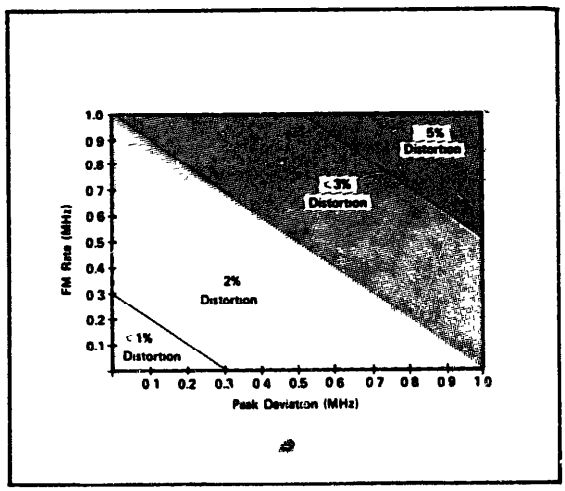
Typical 86601A AM distortion curves

Frequency Modulation:**

Rate: DC to 1 MHz.

Maximum Deviation: 1 MHz.

Incidental AM: With 75 kHz peak deviation at 1 kHz rate, AM modulation sidebands are < −60 dB.



Typical 86601A FM distortion curves

GENERAL

Leakage:
Meets radiated and conducted limits of MIL-I-6181D.

Size: Plut-in to fit Model 8660 mainframe.

Weight: Net, 11 lbs (5 kg). Shipping 15 lbs (6,8 kg).

*Uncalibrated amplitude modulation is also possible with the Model 86631A Auxiliary Section installed.

**In the FM mode, carrier frequency stability is determined by a free-running modulation oscillator in the Model 86632 Modulation Section. The oscillator can be phase-locked momentarily to remove drift by depressing the Model 86632A CF CAL button. Oscillator drift is less than 5 kHz/day after warmup.

Table 1-2. Test and Equipment and Accessories List

ITEM	MINIMUM SPECIFICATIONS	SUGGESTED MODEL	USE*
Digital Voltmeter	Accuracy: ± .2% Range: .00 to 60 Volts	HP 3440A with HP 3443A plug-in	S
AC Voltmeter	5 kHz to 500 kHz 1 mV to 10 Volts	HP 403A	P
RF Millivoltmeter	1 MHz to 600 MHz 10 mV to 1 Volt	HP 411A	A
High Frequency dB Voltmeter	± .2 dB from 10 kHz to 500 kHz +20 to −20 dB	HP 400GL	A, P
Vector Voltmeter	± .2 dB from 1 MHz to 600 MHz +10 to −50 dB	HP 8405A	P, S
Broadband Sampling Voltmeter	± 5% from 100 kHz to 150 MHz +20 to −20 dB	HP 3406A	A, P
Oscilloscope	DC to 50 MHz, delayed sweep, time base 50 ns to 1s	HP 180A with HP 1801A and HP 1821A plug-ins	P, S
10 ÷ 1 divider probes (two)	10:1 divider 10 Megohm 10 pF	HP 10004	
Spectrum Analyzer	± .5 dB from 10 kHz to 110 MHz Measurement Accuracy ±2 dB	HP 140S with HP 8553B and HP 8552B plug-ins	A, P
Spectrum Analyzer	± 1 dB from 1 MHz to 700 MHz Measurement Accuracy ± 2 dB	HP 140S with HP 8554L and HP 8552B plug-ins	A, P, S
Tracking Generator Spectrum Analyzer System	± 1.75 dB from 1 MHz to 700 MHz Measurement Accuracy ± 3.25 dB	HP 8444A with HP 8554L Spectrum Analyzer	A, P
Test Oscillator	10 Hz to 20 kHz .1 V to 1 V	HP 651B	A, P
Synthesized Signal Generator	± 1 Hz from .01 MHz to 110 MHz ± 2 dB from +10 to −90 dBm	HP 8660 with HP 86631A and HP 86601A plug-ins	P
Modulator Section	1 kHz FM with 1 MHz peak deviation	HP 86632A	P
Electronic Counter/ Frequency Converter	Range: 0—50 MHz; 0—500 MHz with the plug-in	HP 5245M with HP 5253B plug-in	A, P, S
Computing Counter	50 kHz to 50 MHz with a 1 ms count gate and and external trigger	HP 5360A with HP 5365A plug-in	P
Wave Analyzer	20 Hz to 10 kHz	HP 302A	P
Crystal Detector	100 kHz to 10 MHz	HP 8471A	P
Power Supply	0—10 volts	HP 721	P, S
Marked Card Programmer	Negative true output ground = true +5 V = false	HP 3260A (only) Opt 001	P, S
Frequency Meter/ FM Discriminator	100 kHz to 10 MHz with 1 volt sensitivity	HP 5210A	P
Variable Coaxial Attenuator	Refer to calibration curve	HP H38-355D (only)	A, P
Double Balanced Mixer	1 MHz to 110 MHz	HP 10514A	P
BNC Tee		UG 274 B/U	A, P, S

*USE — A = Adjustments; P = Performance Tests; S = Service

Table 1-2. Test Equipment and Accessories List (cont'd)

ITEM	MINIMUM SPECIFICATIONS	SUGGESTED MODEL	USE*
50 Ohm Dummy Load		HP 1250-0207	A, P,S
Variable Phase Generator	Distortion less than 3% Range: 1 kHz to 20 kHz	HP 203A	P
15 kHz Lowpass Filters (two)	Special	(see Figure 1-3)	P
100 kHz Lowpass Filter	Special	(see Figure 1-4)	P
40 dB Amplifier	Special	(see Figure 1-5)	P
Service Kit	Consisting of: Adapter: BNC female to OSM male Adapter: BNC female, Sealectro female Adapter: BNC female, Sealectro female Adapter: Right angle OSM male/female Sealectro jack (printed circuit mount) Adapter: Se alectro Tee Tool: Adjustment Cable: Extender, 66 pin, gray Cable: Extender, 42 pin, gray Cable Assy: Sealectro male and female, 24 inches long, gray Cable Assy: Sealectro male and female right angle connectors 24" long, red Cable Assy. Sealectro right angle female, BNC male, 24" long, gray Cable Assy: Sealectro male and female, 24" long, gray with blue stripe	HP 11672A 1250-1200 1250-1236 1250-1237 1250-1249 1250-1255 1250-1391 8830-0024 11672-60001 11672-60002 11672-60003 11672-60004 11672-60005 11672-60006	A, S

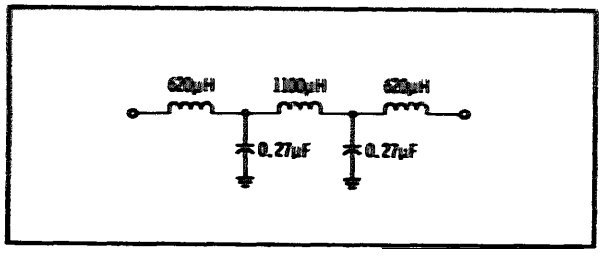


Figure 1-3. 15 kHz Lowpass Filter

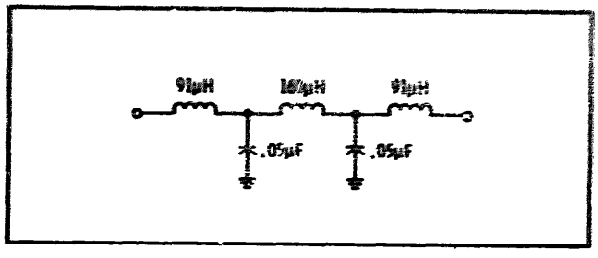


Figure 1-4. 100 kHz Lowpass Filter

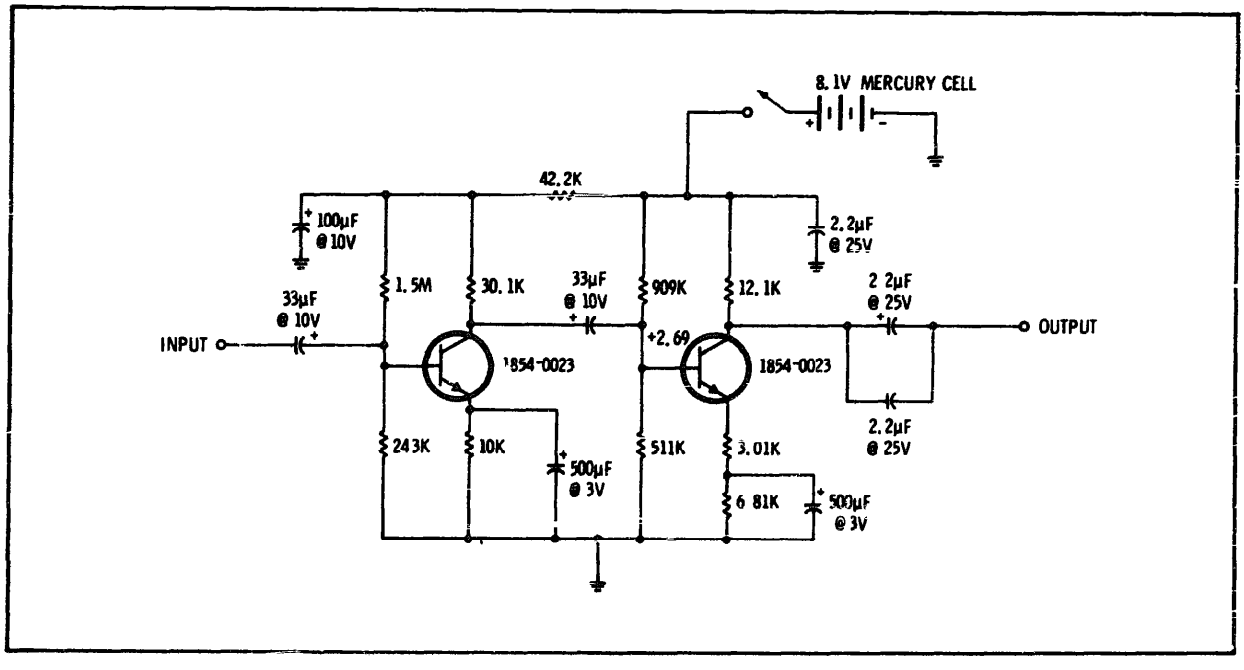


Figure 1-5. 40 dB Amplifier

Table 1-3. 40 dB Amplifier Specifications

Gain	**44 dB at 25°C**
Bandwidth	**100 kHz (3 dB down)**
Noise Bandwidth	**157 kHz**
Input Impedance	**75 K**
Output Impedance	**12 K**
Current Drain	**260 µA**
Output (Maximum)	**1V**
Dynamic Range	**66 dB**

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION

2-2. Mechanical Check

2-3. If the shipping carton shows visible signs of damage when received, the carrier's agent should be present when the instrument is unpacked. If the agent is not present, retain the packaging material to aid in evaluating the cause of damage if the instrument is physically damaged or is not functioning properly.

2-4. Inspect the instrument for physical damage such as bent or broken parts and dents or scratches. If damage is found refer to paragraph 2-7 for recommended claim procedure. If the instrument appears to be free of damage, perform the electrical check (see paragraph 2-5). The packaging material should be retained for possible future use.

2-5. Electrical Check

2-6. The electrical performance check consists of performing the performance test procedures in Section IV of this manual. These procedures enable the operator to determine that the instrument is, or is not, operating within the specifications listed in Table 1-1. The initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the instrument does not operate as specified, refer to paragraph 2-7 for the recommended claim procedure.

2-7. Claims for Damage

2-8. If physical damage is found when the instrument is unpacked, notify the carrier and the nearest Hewlett-Packard Sales/Service office immediately. The HP Sales/Service office will arrange for repair or replacement without waiting for a claim to be settled with the carrier.

2-9. Deleted.

2-10. Preparation for Use

2-11. There are no special requirements for preparation for use for the Model 86601A. Be sure that the main frame preparation for use requirements are met.

2-12. Power Requirements

2-13. All power required for operation of the Model 86601A is furnished by the mainframe.

2-14. Operating Environment

2-15. Cooling air is provided by a fan in the mainframe. This assures that the ambient temperature of the instrument stays within reasonable temperature limits when the instrument is operated at room temperatures between 0 and 55 degrees C (32 to 131 degrees F).

2-16. Storage and Shipment

2-17 If the instrument is to be stored for an extended period of time it should be enclosed in a clean sealed enclosure.

2-18. Original Packaging

2-19. The same containers and materials used in factory packaging can be obtained through any Hewlett-Packard Sales/Service office l

2-20. If the instrument is being returned to Hewlett-Packard for service 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.

2-21. In any correspondence refer to the instrument by model number and full serial number.

2-22. Other Packaging Material

2-23. The following general instructions should be followed when repackaging with commercially available materials :

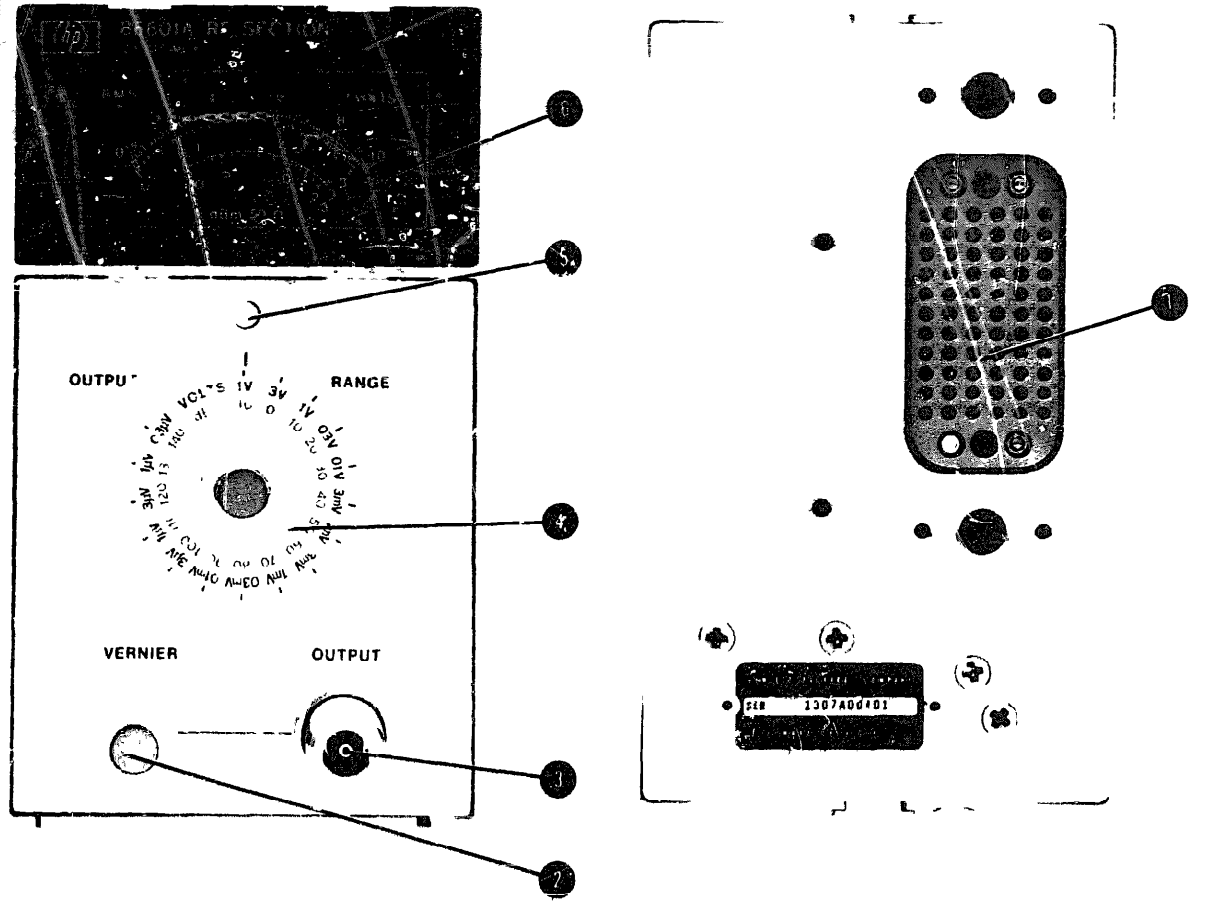
a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard Service office or center, attach a tag indicating the type of service required, return address, model number and full serial number.)

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

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

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

FRONT AND REAR PANELS



1. **Rear Panel Connector.** Mates with plug in the RF Section compartment of the mainframe.
2. **VERNIER.** Adjusts output level over a 13 dB range.
3. **OUTPUT.** RF Frequency output selected by mainframe or remote programmer.
4. **OUTPUT RANGE.** Provides 150 dB of attenuation May be remotely programmed.
5. **Meter Adjust Screw.** For Meter Calibration
6. **Output Meter.** Direct Reading, RMS volts or dBm into 50 ohms.

Figure 3-1. Front and Rear Panel Controls, Indicators and Connectors

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section provides operating instructions for the Hewlett-Packard Model 86601A RF Section.

3-3. The Model 86601A was designed to accept the precise digitally controlled signals from the Model 8660 mainframe and convert them to the selected output frequency by means of mixing and filtering. It will be necessary to have the Operating Manuals for the mainframe and the modulation section (if used) to efficiently operate the instrument.

NOTE

If a modulation plug-in section is not used it will be necessary to have the Model 86631A Auxiliary Section in place in the modulation plug-in drawer.

3-4. PANEL FEATURES

3-5. Front and rear panel controls, indicators and connectors of the Model 86601A are shown in Figure 3-1.

3-6. OPERATING PRINCIPLES

3-7. The Model 86601A may be operated by front panel controls in the local mode or externally programmed in the remote mode.

NOTE

The remote mode is selected by the external programming device which places a ground on pin 5 of the blue ribbon connector (J3) on the rear panel of the Model 8660A/B mainframe.

3-8. The only operator controls on the Model 86601A are the attenuator controls. These controls enable the operator to set the output level at any point between −146 and +13 dBm.

3-9. The front panel attenuator controls are inhibited when the instrument is operated in the remote mode.

NOTE

Model 86601A Option 001 instruments do not include the 150 dB (10 dB steps) programmable attenuator.

3-10. In Option 001 instruments the output of the Model 86601A may be adjusted, in the local mode, from +13 to 0 dBm by means of the VERNIER control; in the remote mode the output may be reduced by 9 dB in 1 dB steps.

3-11. OPERATOR'S CHECKS

3-12. During checkout at the factory the Model 86601A RF Section if adjusted for proper operation. No adjustment should be required when the instrument is received.

3-13. The Operator's Checks specified in Section III of the mainframe are adequate for checking the output frequency of the Model 86601A.

3-14. If a plug-in Modulation Section is being used, the checks specified in Section III of the Modulation Section Manual should also be performed.

SECTION IV

PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. This section **provides** instructions for performance testing the Model 86601A RF Section plug-in. it is assumed in all tests that the Model 86601A is interconnected with a mainframe that is known to be functioning properly.

4-3. Purpose.

4-4. The performance test procedures are used to check instrument performance for incoming inspection and periodic evaluation. The tests are designed to verify published specifications for the instrument. Each test applies directly to a listed specification (see Table l-l).

4-5. **Each performance test procedure begins by quoting the specification which it verifies. Next, a description of the test and any special instructions are listed.**

4-6. Test Equipment R**equired** The test equipment required for performance testing is listed in Table 1-2 and in the individual tests. Test instruments other than those listed may be used providing their performance equals or exceeds the specifications listed in Table 1-2.

4-7. Front Panel Checks and Adjustments. Refer to paragraph 3-11, Operator's Checks.

4-8. PERFORMANCE TESTS

PERFORMANCE TESTS

4-9. FREQUENCY RANGE

SPECIFICATION: 0.01 to 109.999999 MHz selectable in 1 Hz steps (OPT 004 mainframes; 100 Hz steps).

DESCRIPTION: This test verifies the output frequency range of the Model 86601A RF Section plug-in.

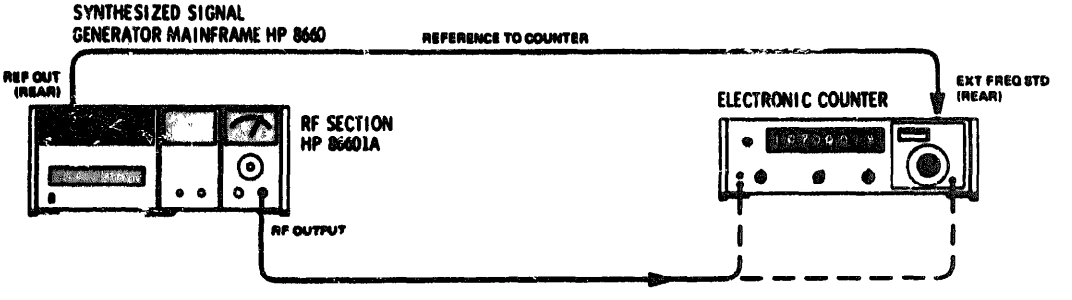


Figure 4-1. Frequency Range and Accuracy Test Setup

RECOMMENDED TEST EQUIPMENT:

Electronic Counter/Frequency Converter Plug-in . . . . . HP 5245M/5253B

PROCEDURE:

1. **Connect the mainframe REFERENCE OUTPUT to the counter EXT STD FREQ input and set the counter mode switch to EXT STD.**

2. **Set the mainframe center frequency to 10.000 kHz and check the output frequency with the counter (Allow for the accuracy of the counter used, model recommended is specified at ±1 count)**

PERFORMANCE TESTS

4-9. FREQUENCY RANGE (cont'd)

3. Set the center freqency to 109.999999 MHz (Opt. 004 mainframe set to 109.9999 MHz) at 0 dBm and check with the counter and the frequency converter plug-in.

4-10. FREQUENCY ACCURACY AND STABILITY

SPECIFICATION: CW frequency accuracy and long term stability are determined by the crystal oscillator in the mainframe or by an external reference standard.

NOTE

If there is any reason to doubt the accuracy or stability of the internal crystal oscillator refer to Section IV of the mainframe manual.

4-11. OUTPUT ACCURACY AND LEVEL

SPECIFICATION: ±1 dB from +13 dBm to −66 dBm and ±2 dB from −67 dBm to −146 dBm.
Output Level: +13 dBm to −146 dBm into 50 ohms.

DESCRIPTION: This test checks output amplitude accuracy from +10 dBm to −70 dBm by comparing the internal attenuator to a precision external attenuator.

NOTE

All sections of the internal programmable attenuator are checked separately. In addition, the 10 dB, 20 dB, and 40 dB sections are checked in all possible combinations. The sum of the inaccuracies of the −60 dBm and −70 dBm tests should not exceed ± 2 dBm.

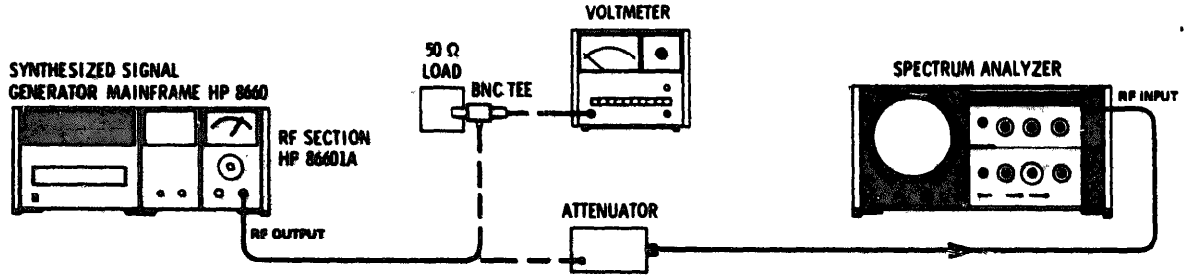


Figure 4-2. Output Accuracy and Level Test Setup

RECOMMENDED TEST EQUIPMENT:

Broadband Sampling Voltmeter	HP 3406A
50 Ohm Termination	1250-0207
Variable Coaxial Attenuator (Precision)	HP H38-355D
BNC Tee	UG 274B/U
Spectrum Analyzer	HP 8553B/8552B/140S

PROCEDURE:

1. Set the Model 86601A OUTPUT RANGE and VERNIER to +10 dBm.
2. Set the mainframe center frequency to 30 MHz.

PERFORMANCE TESTS

4-11. OUTPUT ACCURACY AND LEVEL (cont'd)

3 . **Connect the rf output of the Model 86601A to the sampling voltmeter. Terminate with 50 ohms. The sampling voltmeter should indicate +10 dBm ±1 dBm (if it does not, refer to paragraph 5-14 and calibrate the metering circuit). Change VERNIER in 1 dB increments and verify that the sampling** voltmeter indicates the correct level ±1 dB. Disconnect the sampling voltmeter.

4. Set the external attenuator to SO dB and connect it between the Model 86601A OUTPUT and the Spectrum Analyzer RF INPUT. Set the Model 86601A output level to +10 dBm.

5. Set a convenient reference level on the Spectrum Analyzer with the vertical scale (LOG 2 dB/Div).

6. Change the external attenuator to 70 dB and the Model 86601A OUTPUT RANGE to 0 dBm. The Spectrum Analyzer display should be within ± 1 dB of the established reference level.

7. Continue decreasing the attenuation of the external attenuator and the Model 86601A OUTPUT RANGE in 10 dB steps until the OUTPUT RANGE is set to -70 dBm and the external attenuator is set to 0 dB. The spectrum Analyzer display should remain within ±1 dB for levels down to --70 dBm. These tests assure the specification of ±2 dB from -67 dBm to -146 dBm.

4-12. OUTPUT FLATNESS

SPECIFICATION: Output flatness: Output level variations with frequency <± 0.5 dBm across the frequency range.

DESCRIPTION: This test verifies flatness of the output signal from 10 kHz to 109.9 MHz.

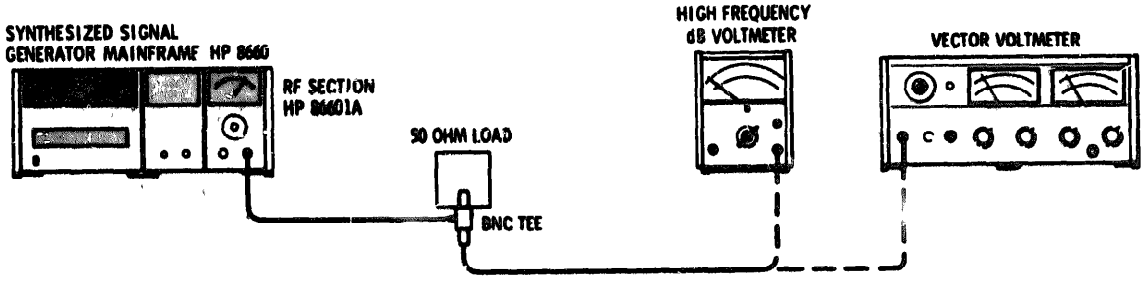


Figure 4-3. Output Flatness Test Setup

RECOMMENDED TEST EQUIPMENT:

High Frequency dB Voltmeter	**HP 400 GL**
Vector Voltmeter	**HP 8405A**
50 Ohm Dummy Load	**HP 1250-0207**
BNC Tee	**UG274B/U**

PROCEDURE:

1 . **Set the mainframe center frequency to 10 kHz.**

2 . **Set the Model 86601A OUTPUT RANGE and VERNIER for a front panel meter reading of +10 dBm.**

PERFORMANCE TESTS

4-12. OUTPUT FLATNESS (con'd)

3. **Connect the Model 86601A OUTPUT to the High Frequency** dB **Voltmeter through** a **BNC** Tee **terminated in 50 ohms.**

4. **Set the meter RANGE switch for a convenient mid-scale reading** on the High Frequency dB voltmeter.

5. **Change the mainframe center frequency to 50 kHz,** then 100 kHz, and finally 500 kHz. The level read **on the High Frequency dB Voltmeter should remain** within a ±0.5 dB window.

6. **Disconnect the High Frequen**cy dB Voltmeter and connect the Vector Voltmeter to the Model 86601A **OUTPUT (terminated in 50 ohms).**

7. **Select** a Vector Voltmeter range that will provide a convenient mid-scale reference with the mainframe **center freq**uency set to 1 MHz.

8. **Change th**e mainframe center frequency to 10 MHz, then 50 MHz, and finally 109.9 MHz. The reference level indicated on the Vector Voltmeter should remain within the ±0.5 dB window.

4-13. IMPEDANCE: 50 OHMS

SPECIFICATION: SWR less than 2:1 on +10 dBm output range; less than 1.3:1 on 0 dBm output range and below.

DESCRIPTION: The Model 86601A RF OUTPUT is measured with a voltmeter, first with no external load, then with a 50 ohm external dummy load. The source resistance R_S is determined and the SWR is calculated by dividing R_O by R_S (or R_S by R_O if R_O is < R_S).

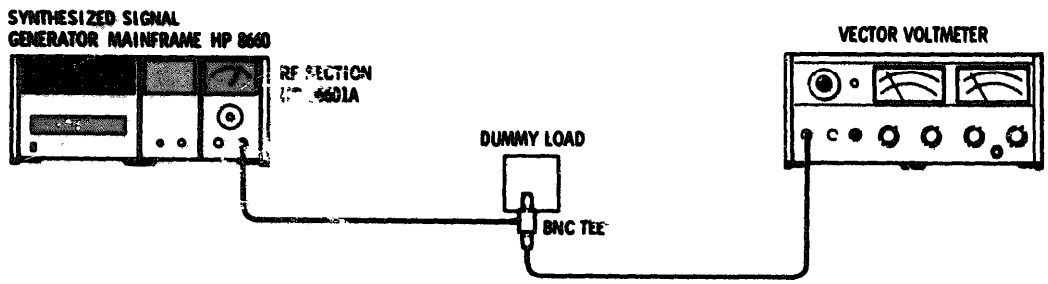


Figure 4-4. Impedance Test Setup

RECOMMENDED TEST EQUIPMENT:

Vector Voltmeter	HP 8405A
50 Ohm Dummy Load	HP 1250-0207
BNC Tee	UG 274 B/U

PROCEDURE:

1. **Set the mainframe center frequency to 50 MHz. Set the Model 86601A OUTPUT RANGE to +10 dBm.**

PERFORMANCE TESTS

4-13. IMPEDANCE: 50 OHMS (cont'd)

2 . **Connect the Model 8660iA OUTPUT to the Vector Voltmeter through a BNC Tee (unterminated).**

3. Record the RF output level.

V_{OC} _____ mVrms

4. Terminate the BNC Tee 50 ohms.

5. Record the RF output level.

V_1 _____ mVrms

6. The Model 86601A source resistance is found by using the following formula:

$$R_S = \frac{R_O V_{OC}}{V_1} - R_O$$

V_{OC} = 1st measurement (step 3)

V_1 = 2nd measurement (step 5)
R_O = 50 ohm termination

7. Determine SWR. SWR = $\frac{R_O}{R_S}$ or $\frac{R_S}{R_O}$. SWR should be < 2.0:1.

8. Record SWR

9. Reduce the Model 86601A OUTPUT RANGE to 0 dBm.

10. Repeat steps 2 through 8 at 0 dBm. SWR should be < 1.3:1.

11. Record SWR

4-14. HARMONIC SIGNALS

SPECIFICATION: With the Model 86601A terminated in 50 ohms **all harmonically related signals are at least 40** dB below the selected frequency.

DESCRIPTION: This **test checks** second and third harmonics **across the entire output frequency range of the** Model 86601A.

Figure 4-5. Harmonic Signal Test Setup

PERFORMANCE TESTS

4-14. HARMONIC SIGNALS (cont'd)

RECOMMENDED TEST EQUIPMENT:

Spectrum Analyzer . . . . . HP 8554L/8552B/140S

PROCEDURE:

1. Set the Model 8660 1A OUTPUT RANGE to -10 dBm and set the VERNIER control to +3 dBm.

2. Connect the Model 8660A OUTPUT to the Spectrum Analyzer RF INPUT and set the Spectrum Analyzer INPUT ATTENUATION to 20 dB.

3. Check second and third harmonics at the following center frequencies: 10 kHz, 400 kHz, 4 MHz, 10 MHz, and 109.9 ~~MHz.~~ All harmonic signals should be more than 40 dB below the level of the fundamental frequencies.

4-15. SPURIOUS SIGNALS

SPECIFICATION: All nonharmonically related spurious signals are at least 80 dB below the selected output signal. Power line related spurious signals are at least 70 dB below the carrier.

DESCRIPTION: This test checks for common spurious signals by mixing the signal from the unit under test with a reference signal offset by 1 kHz. The Wave Analyzer measures common spurious signals generated in the unit under test.

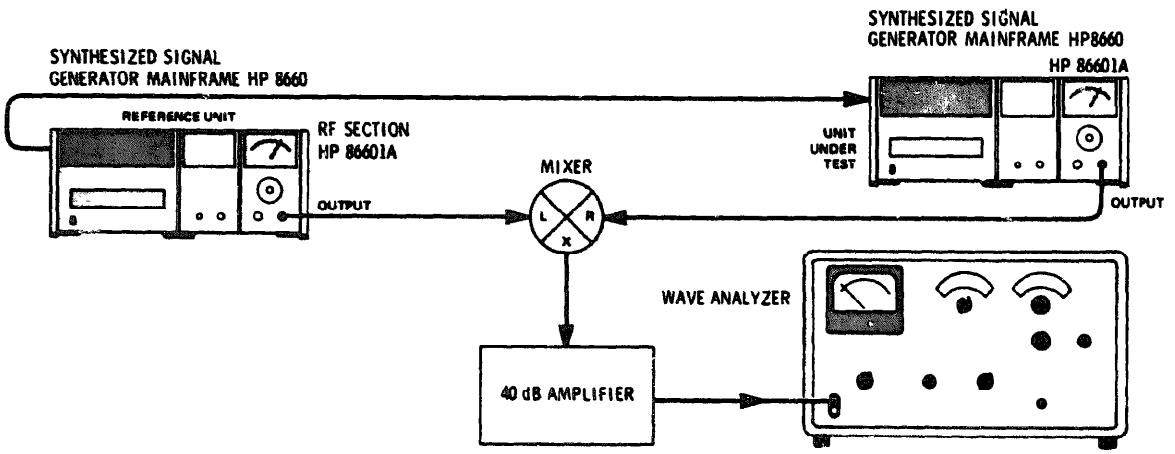


Figure 4-6. Spurious Signal Test Setup

RECOMMENDED TEST EQUIPMENT:

Synthesized Signal Generator . . HP 8660/86601A/86631A
Double Balanced Mixer . . . . . HP 10514A
Wave Analyzer . . . . . HP 302A
40 dB Amplifier (special) see details in Figure 1-5.

PROCEDURE:

1. Connect the rear panel REFERENCE OUTPUT from the reference unit to the rear panel REFERENCE INPUT of the unit under test and set the REFERENCE SELECTOR of the unit under test to EXT.

PERFORMANCE TESTS

4-15. SPURIOUS SIGNALS (cont'd)

2. Connect the equipment as shown in Figure 4-6.
3. Set the reference unit center frequency to 50.001 MHz and the output level to +13 dBm.
4. Set the center frequency of the unit under test to 50 MHz and the output level to -87 dBm.
5. Set the Wave Analyze; mode switch to NORMAL and scale value to RELATIVE.
6. Set the wave Analyzer to 1 kHz and adjust levels for a 0 dB reading on the scale.
7. Set the unit under test OUTPUT RANGE and VERNIER to -7 dBm.
8. Set the reference unit and the unit under test as shown in Table 4-1 and note that spurious levels are lower than -80 dB (0 dB on Wave Analyzer scale).
9. Corrected reading is -80 dB minus the Wave Analyzer meter reading.

Table 4-1. Spurious Signal Checks

Unit Under Test MHz	Reference Unit MHz	Spurious Level
101	47.001	_____
109.99	20.031	_____
103.1	81.401	_____
29.595	29.451	_____
29.595	29.801	_____
29.595	29.587	_____

4-16. SIGNAL-TO-PHASE NOISE RATIO

SPECIFICATION: Lower than -50 dB in a 30 kHz band centered on the carrier excluding a 1 Hz band centered on the carrier.

DESCRIPTION: This test checks the signal-to-phase noise ratio across the Model 86601A output frequency range. The AC Voltmeter specified excludes 1 Hz.

4-10. SIGNAL-TO-PHASE NOISE RATIO

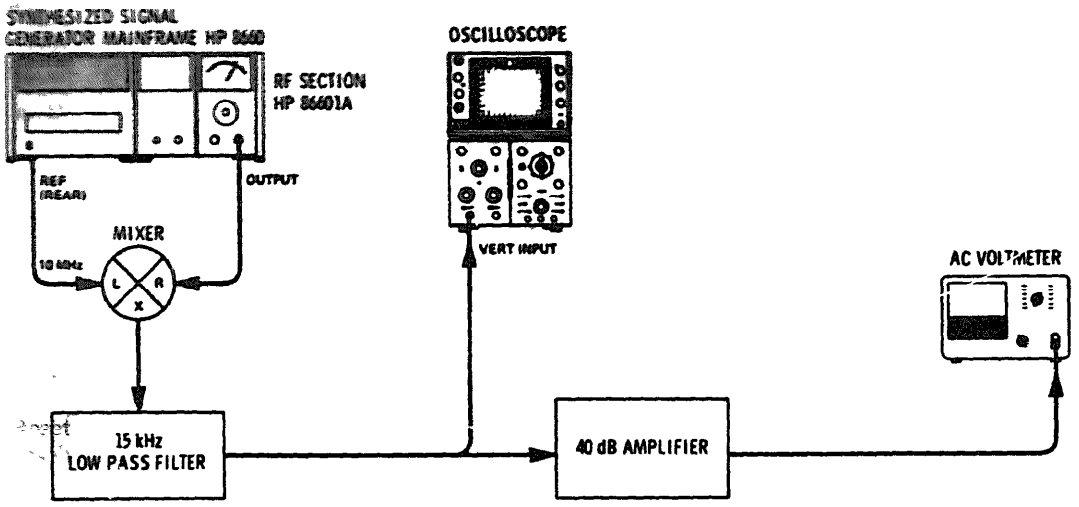


Figure 4-7. Signal-to-Phase Noise Test Setup

RECOMMENDED TEST EQUIPMENT:

Oscilloscope	HP 180A/1801A/1821A
Double Balanced Mixer	HP 10514A
AC Voltmeter	HP 403A
40 dB Amplifier (special) see details in Figure 1-5.	
Low Pass Filter (special) see details in Figure 1-3.	

PROCEDURE:

1. Connect the equipment as shown in Figure 4-7.
2. Set the mainframe center frequency to 10.001 MHz. Set the Model 86601A OUTPUT RANGE to -60 dBm and the VERNIER for a meter reading of +3 dBm.
3. Set the RF Voltmeter Function Switch to 1 CPS-1 MC and record the reading. _____ dB
4. Set the mainframe center frequency to 10.000100 MHz and the OUTPUT RANGE to -10 dBm.
5. Adjust the oscilloscope for an eight-division amplitude display of the 100 Hz signal.
6. Set the mainframe center frequency to 10.0000001 MHz and note that the oscilloscope baseline alternately rises and falls over the eight-division display.
7. Reset the mainframe center frequency to 10.000000 MHz at a time that will cause the oscilloscope baseline trace to stop at the center graticule line.
8. Repeat steps 6 and 7 until the oscilloscope baseline trace is stopped within ±1/10 div. of the center graticule line.
9. Read the noise level on the AC Voltmeter. Noise = −50 dB ± the difference in meter readings. The meter reading should be lower than the reference established in step 3. (Example: Meter reading is 3 dB lower, noise is −53 dB.)
10. Noise should be lower than −50 dB. Record noise level. _____ dB

PERFORMANCE TESTS

4-17. SIGNAL-TO-AM NOISE RATIO

SPECIFICATION: Lower than -70 dB in a 30 kHz hand centered on the carrier excluding a 1 Hz bandwidth centered on the carrier.

DESCRIPTION: This test checks AM noise across the Model 86601A frequency range. The AC voltmeter specified excludes 1 Hz.

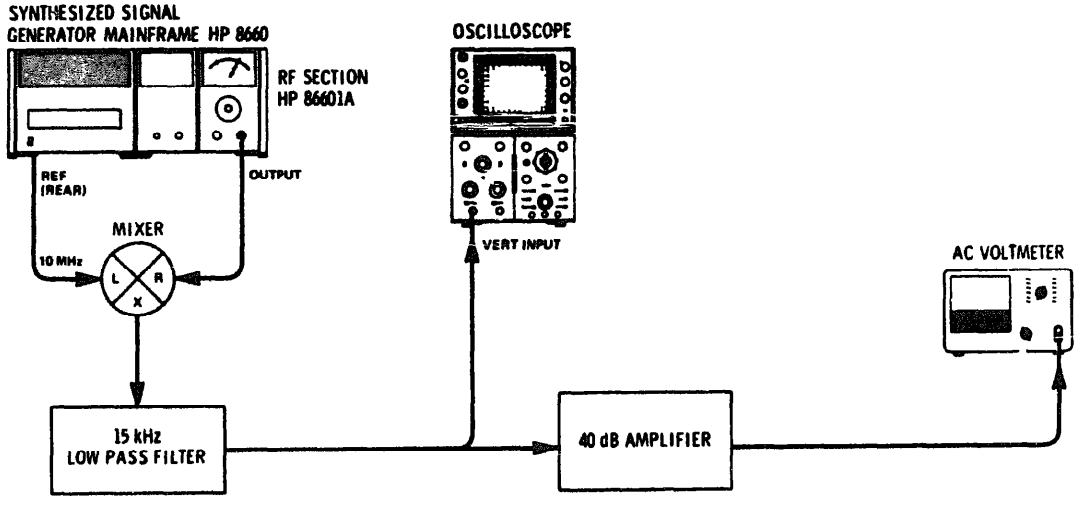


Figure 4-8. Signal-to-AM Noise Ratio Test Setup

RECOMMENDED TEST EQUIPMENT

Oscilloscope	HP 180A/1801A/1821A
Double Balanced Mixer	HP10514A
AC Voltmeter	HP 403A
40 dB Amplifier (special); see details in **Figure 1-5.**	
Low Pass Filter (special); see details in **Figure 1-3.**	

PROCEDURE:

1. Connect the equipment **as shown in Figure 4-8.**
2. **Set the mainframe center frequency to 10.001000 MHz**
3. **Set the Model 86601A OUTPUT RANGE to −80 dBm and the VERNIER to +3 dBm**
4. **Set the AC Voltmeter range for an on-scale reading with the function switch set to 1 CPS 1 MC**
   Record the Meter Reading ____ dB
5. **Set the mainframe center frequency to 10.000100 MHz and the OUTPUT RANGE to −10 dBm**
6. **Adjust the oscilloscope for an eight-division amplitude display of the 100 Hz signal**
7. **Set the mainframe center frequency to 10.000001 MHz and note that the oscilloscope baseline alternately rises and falls over the eight division display**

PERFORMANCE TESTS

4-17. SIGNAL-TO-AM NOISE RATION (cont'd)

8 . **Reset the mainframe center frequency to 10.000000** MHz at a time that will cause the oscilloscope **baseline trace to stop at the top graticule line of the CR**T.

9 . **Repeat steps 7 and 8 until the oscill**oscope baseline trace is stopped at the top graticule line ±1/10 div.

10. **Read the noise level** on the AC Voltmeter. Noise = -70 dB ± the difference in meter readings. The **meter reading should** be lower than the reference established in step 4. Example: Meter reading is 3 dB **lower, noise level is —73 dB.**

11. **Noise** should be lower than -70 dB.

Record Noise Level dB

4-18. RESIDUAL FM

SPECIFICATION: <1 Hz rms in 2 kHz bandwidth centered on the carrier.

DESCRIPTION: Residual FM is checked indirectly in the checks for signal-to-phase noise across the Model 86601A frequency range.

4-19. AMPLITUDE MODULATION

SPECIFICATION: 0 to 95% on all output ranges (with Model 86632A or 86631A Modulation Section in place).

DESCRIPTION: This test checks AM frequency response with the mainframe center frequency set to 50 MHz, 3 MHz, and 300 kHz. AM rate is provided from a test oscillator and measured on a Spectrum Analyzer and Oscilloscope.

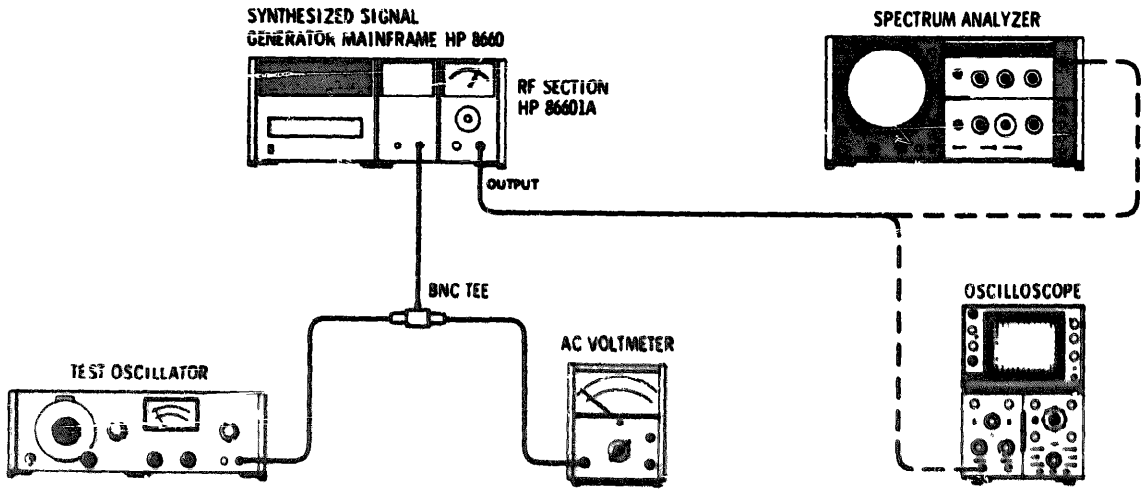


Figure 4-9. Amplitude Modulation Test Setup

PERFORMANCE TESTS

4-19. AMPLITUDE MODULATION (cont'd)

RECOMMENDED TEST EQUIPMENT:

Spectrum Analyzer	HP 8553B/8552B/140S
High Frequency dB Voltmeter	HP 400 GL
Oscilloscope	HP 180A/1801A/1821A
Test Oscillator	HP 651B
BNC Tee	UG 274 B/U

PROCEDURE:

1. Connect the equipment as shown in Figure 4-9.

2. Set the Spectrum Analyzer as follows: INPUT ATTENUATION 30 dB, BANDWIDTH 1 kHz, SCAN WIDTH 10 kHz, CENTER FREQUENCY 50 MHz, LOG-LINEAR 2 dB/Div, SCAN TIME 20 mSec/Div and VIDEO FILTER to OFF,

3. Set the mainframe center frequency to 50 MHz and the Model 86601A output level to +3 dBm.

4. Set the Model 86631A AM switch to ON (if the Model 86632A is being used, set the MODE switch to AM and the SOURCE switch to EXTERNAL AC and AM to 50%).

5. Set the Test Oscillator output to 10 kHz at .5 Vrms as read on AC Voltmeter.

6. Adjust the spectrum analyzer until the carrier is at the top graticule line. Amplitude Modulation should be 50% ±5% with sidebands down -12 dB ±0.5 dB.

7. Adjust the Test Oscillator frequency from 10 Hz to 50 kHz. The AM % should be flat ± 4 db from 10 Hz to 20 kHz and down 3 dB at about 50 kHz.

8. Set the mainframe center frequency to 3 MHz and analyzer scan width to 2 kHz. Adjust the Test Oscillator frequency from 10 Hz to 10 kHz. The sidebands should be flat ±.2 dB to 2 kHz; down 2 dB at about 5 kHz; down 8 dB at about 10 kHz.

9. Set the mainframe center frequency to 300 kHz. Disconnect the rf OUTPUT from the Spectrum Analyzer and connect it to the Oscilloscope.

10. **Set the Test Oscillator to 25 Hz and adjust the Oscilloscope for 8 division vertical display of the envelope only. Set the Test Oscillator frequency to 100 Hz. The Oscilloscope display should be > 7 divisions.**

4-20. **AMPLITUDE MODULATION: ON/OFF RATIO**

SPECIFICATION: At least 25 dB with output meter at 0 dBm or above.

DESCRIPTION: This test verifies the Amplitude Modulation ON/OFF ratio of the Model 86601. AM is shut off with a power supply and rf output level change is measured on an AC Voltmeter

PERFORMANCE TESTS

4-20. AMPLITUDE MODULATION: ON/OFF RATIO

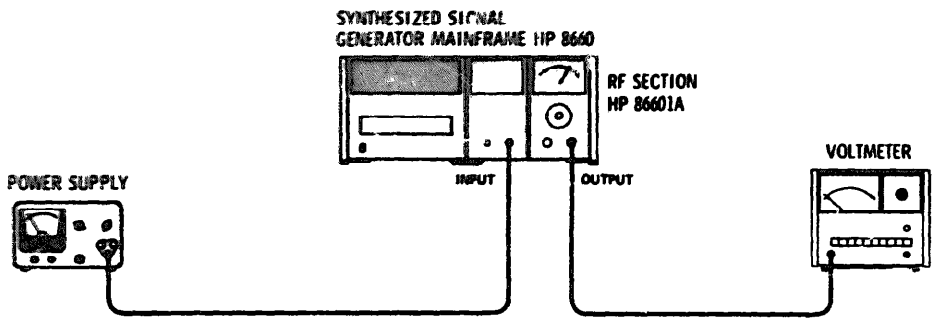


Figure 4-10. Amplitude Modulation ON/OFF Ratio Test Setup

RECOMMENDED TEST EQUIPMENT:

Broadband Sampling Voltmeter	HP 8406A
Power Supply	HP 721A

PROCEDURE:

1. Connect the equipment as shown in Figure 4-10 (with the Model 86631A AM switch off).
2. Set the power supply to +4 Vdc.
3. Set the mainframe center frequency to 50 MHz and output level of the Model 86601A to +13 dBm. Set a reference point on the Voltmeter.
4. Switch the Model 86631A AM switch to ON.
5. The Model 86601A output level should drop to <-12 dBm. (25 dB ON/OFF ratio).

4-21. AMPLITUDE MODULATION CARRIER ENVELOPE DISTORTION

SPECIFICATION: Envelope distortion should be less than 1% at 30% AM. Less than 3% at 70% AM. Less than 5% at 90% AM.

DESCRIPTION: Amplitude Modulation distortion is checked at 30%, 70% and 90%.

PERFORMANCE TESTS

4-21. AMPLITUDE MODULATION CARRIER ENVELOPE DISTORTION (cont'd)

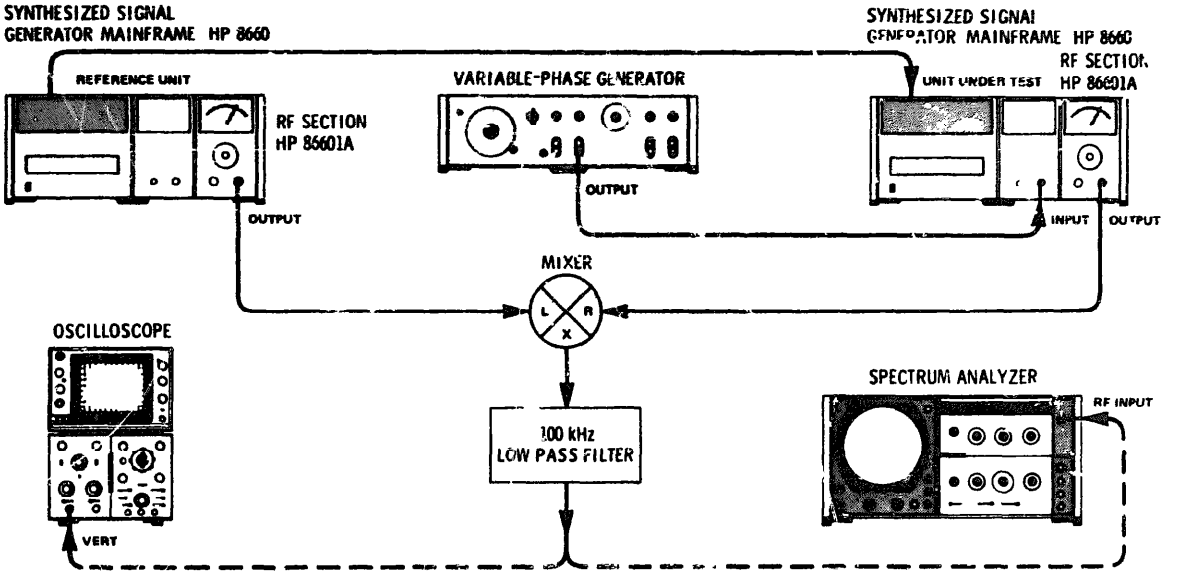


Figure 4-11. Amplitude Modulation Carrier Envelope Distortion Test Setup

RECOMMENDED TEST EQUIPMENT':

Double Balanced Mixer	HP 10514A
Spectrum Analyzer	HP 8553B/8552B/140S
Synthesized Signal Generator	HP 8660A/B/866C1A/86631A
Variable Phase Generator	
Oscilloscope	HP 180A/1801A/1821A

Low Pass Filter 100 kHz (special); see details in Figure 1-4.

PROCEDURE:

1. Connect the equipment as shown in Figure 4-11.
2. Connect the rear panel REFERENCE OUTPUT from the reference unit to the rear panel REFERENCE INPUT of the unit under test and set the REFERENCE SELECTOR of the unit under test to EXT.
3. Set the mainframe center frequency of time unit under test to 109.9 MHz Set the Model 86601A under test OUTPUT RANGE to --20 dBm and the VERNIER to +3 dBm.
4. Connect the Variable-Phase Generator output to the Model 86631A AM input Set the Variable Phase Generator output to 10 kHz and place the Model 86631A AM switch in the OFF position
5. Set the reference mainframe center frequency to 109.91 MHz and the Model 86607A output level to +13 dBm.
6. Set the DC Coupled Oscilloscope to .005 V/Div.
7. Set the Spectrum Analyzer controls as follows: INPUT ATTENUATION 40 dB, SCAN WIDTH PER DIVISION 10 kHz, SCAN TIME PER DIVISION 20 mSec, BANDWIDTH 1 kHz, LOG SCALE 10 dB/Div. Adjust vertical level until the 10 kHz signal is at the top graticule line of the Spectrum Analyzer. Set the Oscilloscope for 8 divisions of vertical deflection

PERFORMANCE TESTS

4-21. **AMPLITUDE MODULATION CARRIER ENVELOPE DISTORTION (cont'd)**

8. **Set the reference unit mainframe center frequency to 109.900001 MHz and note that the Oscilloscope baseline alternately rises and falls over the 8-division display.**

9. **Reset the reference unit mainframe center frequency to 109.900000 MHz at a time that will cause the Oscilloscope baseline trace to stop at the top graticule line of the CRT.**

10. **Repeat steps 8 and 9 until the oscilloscope baseline trace is stopped at the top graticule line ±1/10 div.**

11. **Set the Model 86631A EXTERNAL AM switch to ON and adjust the Variable Phase Generator output level until the 10 kHz signal on the Spectrum Analyzer is 10.5 dB below the reference level (30% AM).**

12. **Using the AM fundamental as a reference, measure the second, third and fourth harmonics on the spectrum analyzer. Use Table 4-2 to convert the dB measurements to power ratio. Add power ratios and convert the sum of the power ratios back to dB by using Table 4-2. Total should be > 40 dB from the 30% reference level or about 1%**

Example:

Second Harmonic	−45 dB = .32	} =.73 = -41.5 dB
Third Harmonic	−45 dB = .31	
Fourth Harmonic	−50 dB = .1	

13. Adjust the Variable Phase Generator until the 10 kHz fundamental is 3 dB below the reference (top graticule line) (70% AM). Using the 10 kHz fundamental as a reference, measure the second,-third and fourth harmonica and use Table 4-2 as in step 10. Total harmonics should be > 30 dB below the 70% reference level (3%).

Table 4-2. Carrier Envelope Distortion Test

dB	Power Ratio $X10^{-4}$	dB	Power Ratio $X10^{-4}$
20	100.00000	46	.25119
21	79.43282	47	.19953
22	63.09573	48	.15849
23	50.11872	49	.12589
24	39.81072	50	.10000
25	31.62278	51	.07943
26	25.11886	52	.06310
27	19.95262	53	.05012
28	15.84893	54	.03981
29	12.58925	55	.03162
30	10.00000	56	.02512
31	7.94328	57	.01995
32	6.30957	58	.01585
33	5.01187	59	.01259
34	3.98107	60	.01000
35	3.16228	61	.00794
36	2.51189	62	.00631
37	1.99526	63	.00501
38	1.58489	64	.00398
39	1.25893	65	.00316
40	1.00000	66	.00251
41	.79433	67	.00200
42	.63096	68	.00158
43	.50119	69	.00126
44	.39811	70	.00100
45	.31623	71	.00079

PERFORMANCE TESTS

4-21. **AMPLITUDE MODULATION CARRIER ENVELOPE DISTORTION (cont'd)**

14. **Adjust the Variable Phase Generator until the 10 kHz fundamental is 1 dB below the reference (top graticule line) (90% AM). Measure the second, third, and fourth harmonics and use Table 4-2 as in step 10. Total harmonics should be >26 dB below the 90% reference level (5%).**

4-22. INCIDENTAL PHASE MODULATION

SPECIFICATION: Less than 0.2 radians peak at 30% AM.

DESCRIPTION: This test checks the AM to PM ratio. AM is set to 30% Modulation with an external Test Oscillator. The ratio is measured with a Wave Analyzer.

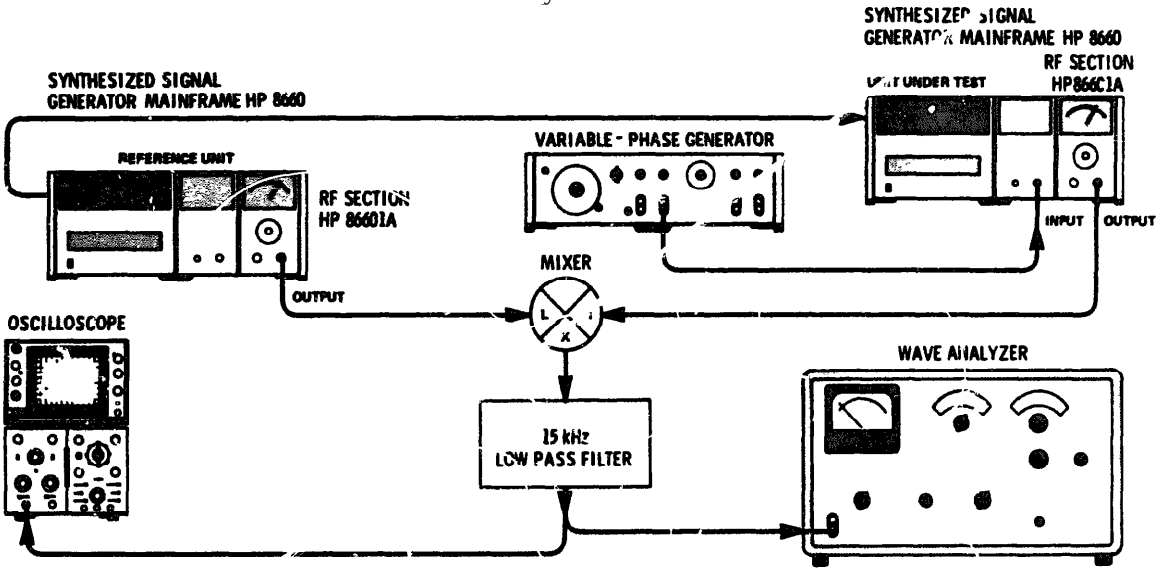


Figure 4-12. Incidental PM Test Setup

RECOMMENDED TEST EQUIPMENT:

Synthesized Signal Generator	HP 8660A/B/86601A/86631A
Oscilloscope	HP 180A/1801A/1821A
Test Oscillator	HP 651B
Wave Analyzer	HP 302A
Double Balanced Mixer	HP 10514A
15 kHz Low Pass Filter (special); see details in Figure 1-3.	
Variable Phase Generator	HP 203A

PROCEDURE:

1. Connect the equipment as shown in Figure 4-12.
2. **Connect the rear panel REFERENCE OUTPUT from the reference unit to the rear panel REFERENCE INPUT of the unit under test and set the REFERENCE SELECTOR switch on the unit under test to EXT.**
3. **Set the Oscilloscope to DC coupled, .01 V/Div and 5 mSec/Div.**
4. **Set the center frequency of the unit under test to 50 MHz. Set the Model 86601A (unit under test) OUTPUT RANGE to −20 dBm and the VERNIER for a meter reading of +3 dBm.**
5. **Connect the Test Oscillator output to the Model 86631A INPUT. Set the Model 86631A EXTERNAL AM to OFF.**
6. **Set the Test Oscillator frequency to 1 kHz.**

PERFORMANCE TESTS

4-22. **INCIDENTAL PHASE MODULATION (cont'd)**

7. **Set the reference unit mainframe center frequency to 50.000100 MHz at +3 dBm.**

8. **Adjust the Oscilloscope for an 8-division vertical display of the dc coupled 100 Hz signal.**

9. **Set the reference unit mainframe center frequency to 50.000000** 1 MHz and note **that the Oscilloscope baseline alternately rises and falls over the 8-division display.**

10. **Reset the reference unit mainframe center** frequency to 50.000000 MHz at a time that will cause the **Oscilloscope baseline trace to stop at the to**p graticule line of the CRT.

11. **Repeat steps** 9 and 10 until the oscilloscope baseline trace is stopped at the top graticule line ±1/10 div.

12. **Switch th**e unit under test Model 86631A EXTERNAL AM switch to ON and adjust the Test Oscillator for a 2.4 division deflection on the Oscilloscope (30% AM) with the Oscilloscope ac coupled. Reset **Oscilloscop**e to dc coupled.

13. Set the Wave Analyzer near 1 kHz for a peak and set a convenient 0 dB reference in the relative mode (this is the AM level).

14. Switch the EXTERNAL AM switch on the Model 86631A to OFF.

15. Repeat steps 9 and 10 until oscilloscope baseline trace is stopped at center graticule line ±1/10 div.

16. Switch the Model 86631A EXTERNAL AM switch to ON and take a reading from the Wave Analyzer for the PM level. The AM to PM ratio should be >5 dB.

4-23. FREQUENCY MODULATION

SPECIFICATION: Rate DC to 1 MHz. Maximum deviation 1 MHz.

DESCRIPTION: This test checks FM distortion and the 1 MHz maximum deviation FM deviation is checked at 1 kHz rate. To check maximum deviation at the maximum rate requires special equipment.

NOTE

This test is valid only when the Model 86632A Modulation Section is used.

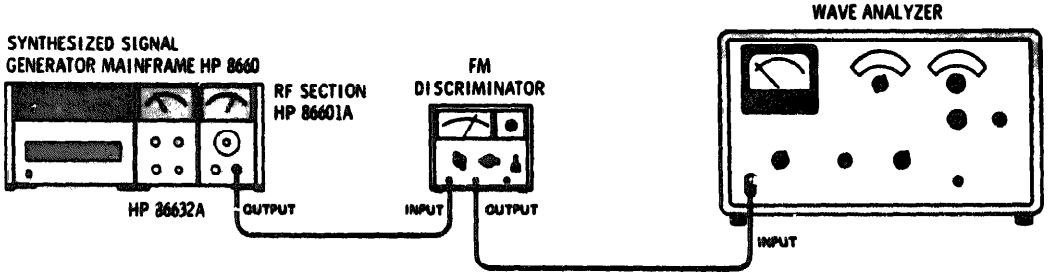


Figure 4-13. Frequency Modulation Test Setup

RECOMMENDED TEST EQUIPMENT:

Frequency Meter/FM Discriminator	**HP 5210A**
Wave Analyzer	**HP 302A**

PERFORMANCE TESTS

4-23. FREQUENCY MODULATION (cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-13.
2. Set the Model 86632A MODE switch to FM X10 and the SOURCE switch to INTERNAL 1000. Set the MODULATION LEVEL control for full scale meter deflection and depress the FM CF CAL.
3. Set the center frequency to 8.5 MHz and the Model 86601A output level to +13 dBm.
4. Calibrate the Frequency Meter/FM Discriminator.
5. Install a 20 kHz low pass filter in the Frequency Meter/FM Discriminator. (See the Service Manual for the Frequency Meter/FM discriminator for details.)
6. Set the Frequency Meter/FM Discriminator for 1 V input sensitivity and 10 MHz range.
7. Set the Wave Analyzer near 1 kHz and peak the reading (absolute). The Wave Analyzer meter should indicate 70.7 mVrms (1 MHz = 200 mV p-p or 70.7 mVrms). Set the Wave Analyzer to relative and adjust for a 0 dB reading.
8. Set the Wave Analyzer near 2 kHz (second harmonic). Note the reading in dB on the Wave Analyzer meter.

   dB
9. Set the Wave Analyzer near 3 kHz (third harmonic). Note the reading in dB on the Wave Analyzer meter.

   dB
10. Use Table 4-2, page 4-14, to obtain power ratios for the levels recorded in steps 8 and 9, then use Table 4-2 to find the dB level corresponding to the sum of the two ratios. This should be down 34 dB from the fundamental frequency level.

    Record this level dB

4-24. FREQUENCY SWITCHING TIME

SPECIFICATION: Less than 5 milliseconds to be within 100 Hz of any new frequency selected. Less than 100 milliseconds to be within 5 Hz of any new frequency selected. Maximum stepping rate: 1 millisecond per step.

DESCRIPTION: In this test the Synthesized Signal Generator is remotely programmed and the switching time is detected by a computing counter. The frequencies used in this procedure were selected for wont-case conditions.

PERFORMANCE TESTS

4-24. **FREQUENCY SWITCHING TIME (cont'd)**

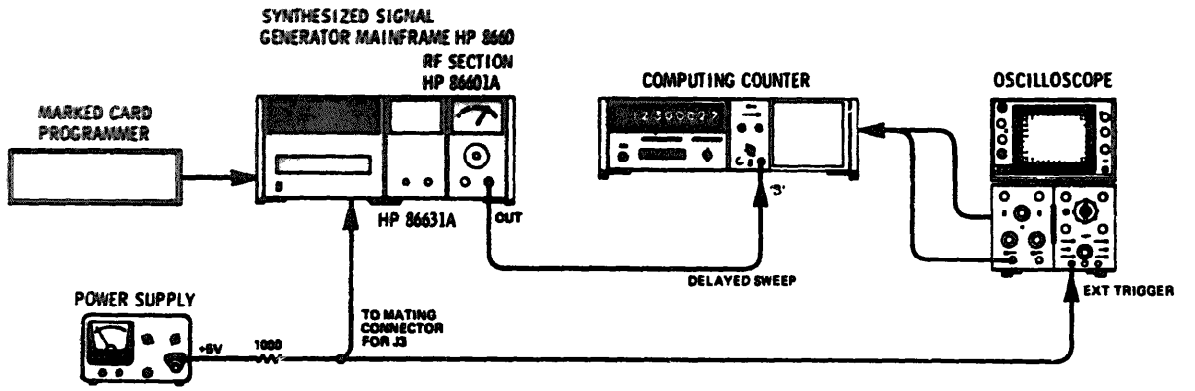


Figure 4-14. Frequency Switching Time Test Setup

RECOMMENDED TEST EQUIPMENT:

DC Power Supply	HP 721A
Computing Counter	HP 5360A/5365A
Marked Card Programmer	HP 3260A/OPT 001
Oscilloscope	HP 180A/1801A/1822A

PROCEDURE:

1. Connect the +5V from the DC Power Supply to pin 17 of the mating connector for J3 through a 1000 ohm resistor. Pin 17 (flag) of the Card Reader's output connector is also used to trigger the main input of the Oscilloscope.

2. Interconnect the Marked Card Programmer with J3 on the rear panel of the Synthesized Signal Generator.

3. Connect the Oscilloscope DELAYED SWEEP OUTPUT (rear panel connector) through a BNC Tee connector to the Oscilloscope vertical Channel A input and to the Ext. Time Measurement Input on the rear panel of the Computing Counter.

4. **Set the Computing Counter controls as follows: rear panel switch to TRIGGER, "B" Channel to X1 sensitivity, Module button depressed, display digits necessary for resolution, measurement time on 1 and counter gate time to 1 millisecond.**

5. **Program the Synthesized Signal Generator to 29.999999 MHz.**

6. **Set the Oscilloscope controls as follows: Trigger ACS EXT -10 — Slope, Trigger level at about 11:C0 o'clock, Sweep Mode Auto, Delay Trigger AUTO, Main Sweep 1 mSec, Delay Sweep, .05 μSec, and Main sweep mode.**

7. **Set the start of the Oscilloscope trace at the first vertical CRT graticule line. Use the Oscilloscope delay control to set the delay spike 4.5 divisions from the CRT left graticule line.**

8. **Switch the Oscilloscope sweep mode from AUTO to NORMAL.**

PERFORMANCE TESTS

4-24. FREQUENCY **SWITCHING TIME (cont'd)**

9. Program the Synthesized Signal Generator to 30.000000 MHz. The frequency read on the Computing Counter should be 30 MHz ± 100 Hz.

10. Program the Synthesized Signal Generator to 29.999999 MHz. The frequency read on the Computing Counter should again be within ±100 Hz of the programmed frequency.

11. Set the Oscilloscope normal sweep to 10 mSec and the delay sweep to 1 uSec.

12. Set the Oscilloscope sweep mode to auto and the delay control for a delay spike at the center vertical graticule line of the CRT.

13. Set the Oscilloscope main trigger to normal and the Computing Counter gate tune to 100 mSec.

14. Program the Synthesized Signal Generator to 30.000000 MHz. The frequency readout of the Computing Counter should be within ±5 Hz of the programmed frequency.

15. Program the Synthesized Signal Generator to 29.999999 MHz. The frequency readout of the Computing Counter should again be within ±5 Hz of the programmed frequency.

4-25. OUTPUT LEVEL SWITCHING TIME

SPECIFICATION: Any level change may be accomplished in less than 50 mSec. Any change to another level on the same attenuator range may be accomplished in 5 mSec in the remote mode.

DESCRIPTION: This test checks amplitude switching speeds in the remote mode with center frequencies of 100 kHz and 1 MHz. The Model 86601 rf output is detected and measured on an Oscilloscope.

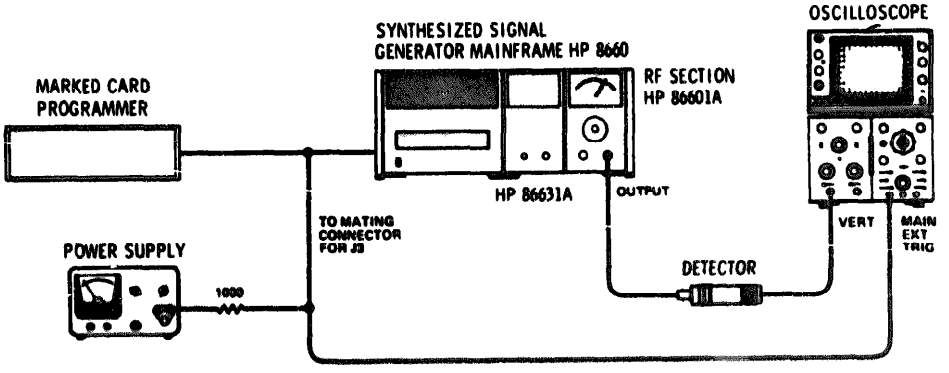


Figure 4-15. Output Level Switching Time Test Setup

RECOMMENDED TEST EQUIPMENT:

Marked Card Programmer	**HP 3260A, Opt. 001**
Oscilloscope	**HP 180A/1801A/1822A**
Crystal Detector	**HP 8471A**

PERFORMANCE TESTS

4-25. OUTPUT LEVEL SWITCHING TIME (cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-15. Note that the +5 V from the DC Power Supply is connected through a 1000 ohm resistor to pin 17 of the mating connector to J3 and to the External trigger input of the Oscilloscope.

2. Connect the Model 86601A rf output to the channel A input of the Oscilloscope through a Crystal Detector.

3. Set the Oscilloscope as follows: Main Time/Div 5 mSec. Vertical Input DC Coupled, .5V/Div, Normal Sweep, Ext Trigger ± 10, — Slope, ASC, Trigger level about 11:00 o'clock.

4. Program the mainframe center frequency to 100 kHz. Program the Model 86601A attenuation to the following settings; 0 dB, -5 dB, -9 dB. Switching time should be <5 mSec.

5. Program attenuation to 0 dB, then to -20 dB. Switching time should be <50 mSec.

6. Repeat tests 4 and 5 with center frequency set to 1 MHz.

4-26. INCIDENTAL AM

SPECIFICATION: With 75 kHz peak deviation at a 1 kHz rate, AM modulation sidebands are down 60 dB from the fundamental.

DESCRIPTION: This test measures AM modulation with the unit under test FM modulated at 75 kHz peak deviation. A reference level is set on the Wave Analyzer with the two Synthesized Signal Generators offset by 1 kHz. The unit under test is then programmed to produce a 1 kHz frequency modulated signal with 75 kHz peak deviation.

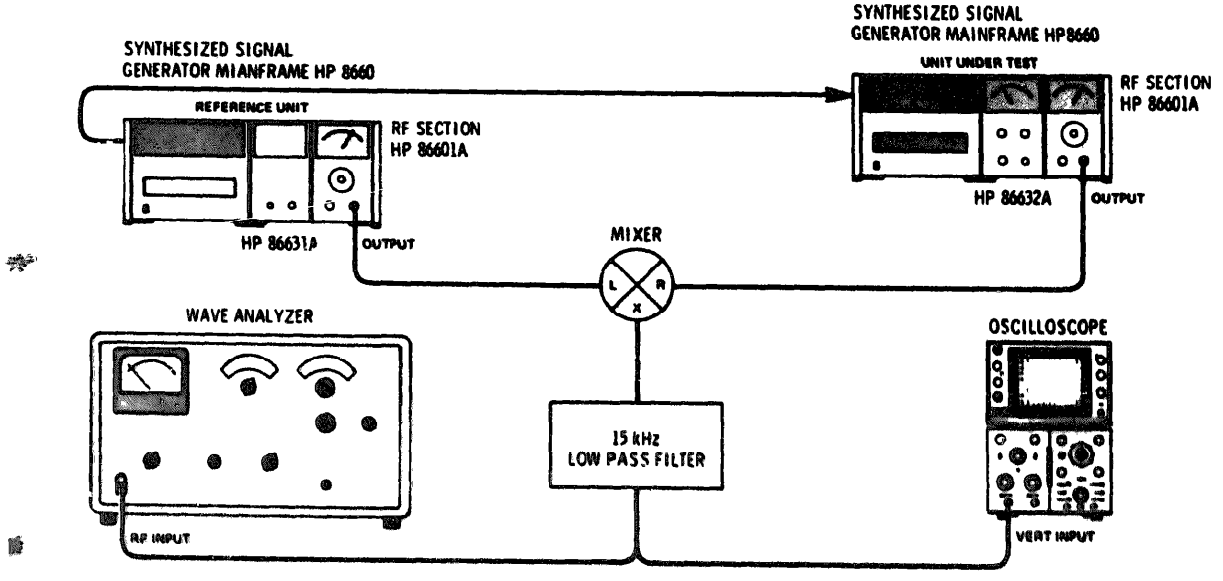


Figure 4-16. Incidental AM Test Setup

PERFORMANCE TESTS

4-26. INCIDENTAL AM (cont'd)

RECOMMENDED TEST EQUIPMENT

Synthesized Signal Generator	**8660/86631A/8660**1A
Modulation Section	. . . . . **HP 8663**2A
Oscilloscope	HP180A/1801A/P821A
Wave Analyzer .	HP302A
Double Balanced i & &	HP 10514A

15kHz Low Pass Filter (special): see details in Table 1-2.

PROCEDURE:

1. Connect equipment as shown in Figure 4-16.
2. Connect the rear panel REFERENCE OUTPUT from the reference unit to the rear panel REFERENCE INPUT of the unit under test and set the REFERENCE SELECTOR of the unit under test to EXT.
3. Set the unit under test center frequency to 50 MHz and the output level to -7 dBm.
4. Set the reference unit center frequency to 50.061 MHz and the output level to +13 dBm.
5. Set the wave Analyzer near 1 kHz and peak the meter, Set the Wave Analyzer meter level to 0 dB in the relative mode. Set the Oscilloscope for 8-division deflection.
6. Set the reference unit mainframe center frequency to 50.0000001 MHz and note that the Oscilloscope baseline alternately rises and falls over the 8 division display.
7. Reset the reference unit mainframe center frequency to 50.000000 MHz at a time that will cause the Oscilloscope baseline trace to stop at the top graticule line of the CRT.
8. Repeat steps 6 and 7 until the baseline stops on the top CRT graticule ±1/10 div.
9. Set the Model 86632A Modulation Section to 1 kHz FM Xl and 75 kHz deviation (75% on the meter).
10. Note the Wave Analyzer reading. Should be >-60 dB down from the reference level.

Meter Reading dB

Table 4-3. Performance Test Record

Hewlett-Packard
Model 86601A
RF Section
Serial Number _____ Tested By _____
Date _____

Paragraph Number	Test
4-13	**IMPEDANCE** Step 8 Record SWR _____ Step 11 Record SWR _____
4-15	**SPURIOUS SIGNALS** Record Levels 101 MHz _____ 109.99 MHz _____ 103.1 MHz _____ 25.595 MHz _____
4-16	**SIGNAL TO PHASE NOISE RATIO** Step 3 Record Level _____ dB Step 10 Record Level _____ dB
4-17	**SIGNAL TO AM NOISE RATIO** Step 4 Record Level _____ dB Step 11 Record Level _____ dB
4-21	**AMPLITUDE MODULATION CARRIER ENVELOPE DISTORTION** Step 12 Record Level _____ dB
4-23	**FREQUENCY MODULATION** Step 8 Record Level _____ dB Step 9 Record Level _____ dB Step 10 Record Level _____ dB
4-26	**INCIDENTAL AM** Step 10 Record Level _____ dB

SECTION V

ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments and checks required to return the Model 86601A to peak operating capability when repairs have been made. Adjustment locations are identified pictorially on Section VIII foldout service sheets referred to in the individual tests.

5-3. If repairs to any filter have been made, it should be necessary to adjust only the circuit in which the component failure occurred.

5-4. If component failure occurs in any circuit other than the logic circuits, it will be necessary to recalibrate the RF output meter circuit (refer to paragraph 5-14).

5-5. If component failure occurs in A3 or A9, the AM input and AGC circuits must be readjusted (refer to paragraph 5-15).

5-6. If component failure occurs in the A6 preamplifier or the A2 Power amplifier (other than AGC), the harmonic levels should be readjusted (refer to paragraph 5-16).

5-7. RECOMMENDED TEST EQUIPMENT

5-8. Each adjustment procedure in this section contains a list of test equipment and accessories required to perform the procedure. Each test setup identifies test equipment and accessories by call-outs.

5-9. Minimum specifications for test equipment used in the adjustment procedures are detailed in Table 1-2. Because the Model 86601A is an extremely accurate instrument, minimum specifications in Table 1-2 are particularly important in performing these adjustment procedures.

5-10. SERVICE KIT

5-11. The HP 11678A Service Kit is an accessory item available from Hewlett-Packard for use in maintaining the Model 66601A RF Section.

5-12. Table 1-2 contains a detailed description of the service kit. Any item in the kit may be ordered separately.

NOTES

a. The RF Section adjustments should be made with the Model 86601A installed in the mainframe with the cover removed whenever possible. It will be necessary to remove the mainframe top cover and the top guide rail for the Model 86601A. To make in-circuit adjustments for the 480 MHz Active bandpass filter or the dual filter (A12), it will be necessary to use the extender cable (1167260001) which is part of the service kit.

b. A modulation section or an auxiliary section must be installed in the mainframe during these adjustments.

c. All tests in which a counter is used should be made with the mainframe and the counter driven by a common frequency standard. If the Hewlett-Packard Model 5245M Electronic counter is used, the mainframe internal reference may be used as the common source.

5-13. CHECKS AND ADJUSTMENTS

ADJUSTMENTS

5-14. RF OUTPUT METER CALIBRATION

REFERENCE: Service Sheet 3 and Figures 5-1 **and** 8-21 of **this** Manual Ch**anges** supplement.

DESCRIPTION: The rf output m**eter reading** is **adjus**ted at +3 and -7 dBm to ensure tracking across the **range of the VERNIER contro1.**

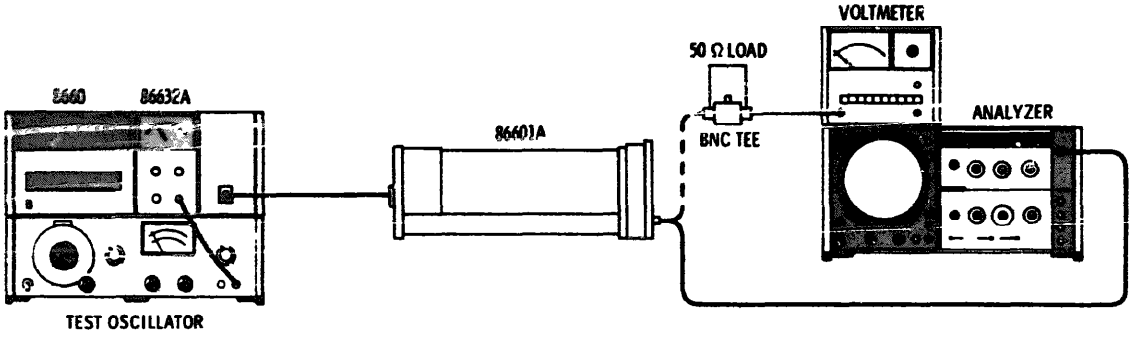


Figure 5-1. RF Output Meter Calibration Setup

RECOMMENDED TEST EQUIPMENT:

Test Oscillator	HP 651B
Broadband Sampling voltmeter	H 3406A
BNC Tee Connector	UG 274 B/U
50 ohm load	HP 1250-0207
Extender Cable	HP 11672-60001
Spectrum Analyzer	HP 140/8552/8553

PROCEDURE:

1. Clean the Model 86601A meter face with anti-static**tic sc.** . . (Recommended: STATNUL manufactured by Weston Instruments Inc. Newark, NJ.)

2. Connect the equipment **as shown in Figure 1.**

3. **Set the OUTPUT RANGE to +10 dBm and the VERNIER full CW** Set the m**ainframe center frequency to 10 MHz.**

4. **Set the REF ADJ (A9R2) for a +13.5 dBm reading on the volt.neter.**

5. **Set the Model 86601A VERNIER for a +13 dBm reading on the voltmeter. Adjust A9R32 for a +3 dBm reading on the 86601A meter (full scale).**

6. **Disconnect the output rf cable from the BNC Tee and connect it to the spectrum analyzer RF INPUT.**

ADJUSTMENTS

5-14. RF OUTPUT METER CALIBRATION (Cont')

7. Connect the Test Oscillator output to the Model 86632A input (10 kHz, 1V, verify level with the AC Voltmeter). Set the Model 86632A to AM, EXT, AC coupled and 50% modulation as indicated on the Model 86632A meter.

8. Set the spectrum analyzer so that the 10 MHz center frequency is at the top graticule line. Verify that the AM sidebands are -12 dB below the center frequency fundamental (50% modulation).

9. Adjust the Model 86601A VERNIER until the fundamental (10 MHz) is 10 dB below the reference setting. Adjust A1R34 DET for 50% modulation (AM sidebands down -12 dBm from the fundamental).

10. A9R32 and A2R34 interact. Repeat steps 5 through 9 until the modulation displayed on the spectrum analyzer remains at 50%.

11. Disconnect the Test Oscillator and set the Model 86632A to OFF. Disconnect the spectrum analyzer and connect the AC Voltmeter to the Model 86601A OUTPUT.

12. Set the 86601A to +13 dBm as measured by the voltmeter.

13. Adjust A9R32 as necessary for a Model 86601A meter reading of +3 dBm.

14. Turn the Model 86601A VERNIER control CCW until the AC voltmeter reads +3 dBm (10 dB less than step 12).

15. Adjust A9R34 for a Model 86601A meter reading of -7 dBm.

16. Repeat steps 11 through 15 until the Model 86601A meter tracks the AC voltmeter, (from +3 dBm to -7 dBm ± 25 dBrn 86601A Meter).

ADJUSTMENTS

5-15. HARMONIC DISTORTION CHECKS AND ADJUSTMENTS

REFERENCE: Service Sheet 3.

DESCRIPTION: This bias levels for the Preamplifier and the Power Amplifier are set to minimize distortion.

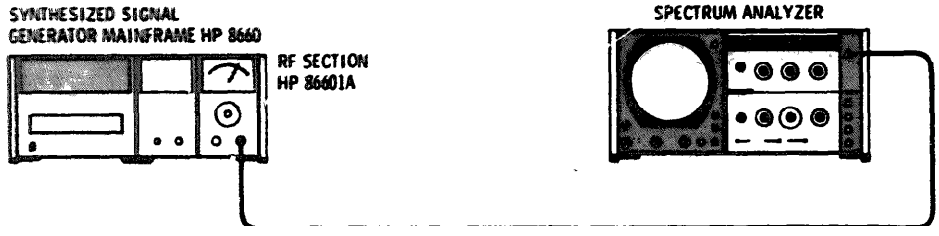


Figure 5-2. Harmonic Distortion Adjustment Setup

RECOMMENDED TEST EQUIPMENT:

Spectrum Analyzer	HP 140/8554L/8552B

PROCEDURE:

1. Connect the equipment as shown in Figure 5-3.
2. Set the mainframe center frequency to 60 MHz and the Model 86601A output amplitude to 0 dBm.
3. Set the Spectrum Analyzer controls as follows: CENTER FREQUENCY - 60 MHz, INPUT ATTENUATION - 20 dB, LOG REP LEVEL - 0 dBm, BANDWIDTH - 100 kHz, SCAN WIDTH PER DIVISION - 50 MHz, SCAN TIME PER DIVISION - 10 MILLISECONDS and LOG/LINEAR - LOG.
4. Adjust the preamplifier BIAS (A6R1) and the power amplifier BIAS (A2R6) until the second harmonic (120 MHz) is more than 50 dB down from the fundamental frequency.
5. Set the mainframe and the Spectrum Analyzer center frequency to 109 MHz.
6. Adjust the power amplifier BIAS (A1R6) until the second harmonic (218 MHz) is more than 44 dB down from the fundamental frequency.
7. **Change the mainframe and the Spectrum Analyzer in 10 MHz steps from 100 MHz to 10 MHz, stopping at each step and checking the harmonic levels on the Spectrum Analyzer. All harmonic levels should be more than 40 dB below the amplitude of the fundamental frequencies.**
8. **Record the harmonic levels in Table 5-1.**

ADJUSTMENTS

5-15. HARMONIC DISTORTION CHECKS AND ADJUSTMENTS (Cont'd)

Table 5-1. Harmonic Distortion Level Checks

Fundamental Frequencies	Harmonic Levels		
	Second	Third	Fourth
109 MHz			
100 MHz			
90 MHz			
80 MHz			
70 MHz			
60 MHz			
50 MHz			
40 MHz			
30 MHz			
20 MHz			
10 MHz			

5-16. AMPLITUDE MODULATION CALIBRATION

REFERENCE: Service Sheets 3 and 4.

DESCRIPTION: The AM input and AGC circuits are properly adjusted to allow the use of any plug-in Modulation Section without recalibration.

5-16. AMPLITUDE MODULATION CALIBRATION (Cont'd)

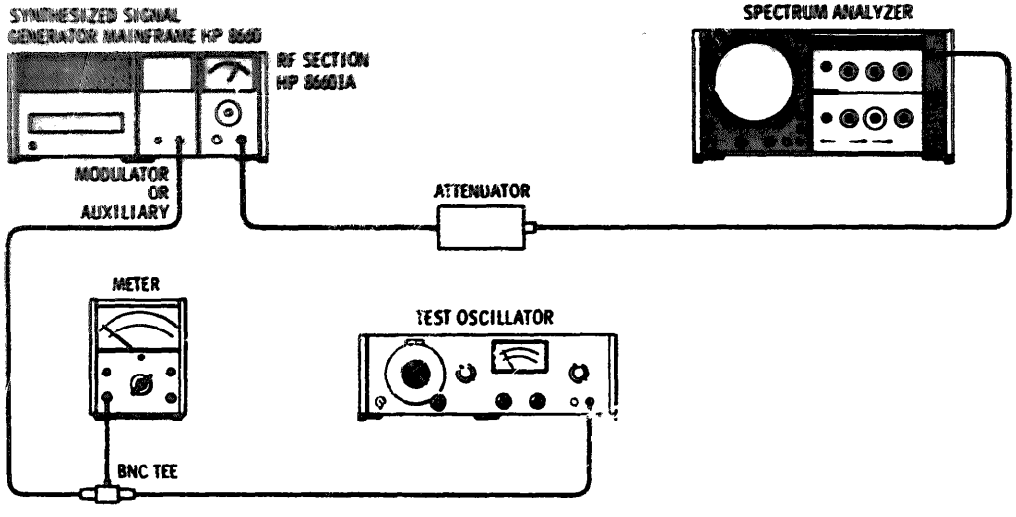


Figure 5-3. Amplitude Modulation Calibration Setup

RECOMMENDED TEST EQUIPMENT:

Precision Attenuator	HP H38-355D
Test Oscillator	HP 651B
Spectrum Analyzer	HP 140/8553B/8552B
High Frequency dB Voltmeter	HP 400GL
BNC Tee Connector	UG 274B/U

PROCEDURE:

Using the 86631A Auxiliary Section. (If the Model 86632A Modulation Section is used, use step 2-a instead of step 2.)

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

2. Monitor the output amplitude of the Test Oscillator with the High Frequency dB Voltmeter. Set the Test Oscillator frequency to 1 kHz and the output amplitude to 0.5 volts rms with the Model 86631 EXTERNAL AM switch to ON.

2-a. Set the Model 86632A to AM mode; source 1 kHz, internal modulation level for 50% AM on the 86632A meter.

3. Set the mainframe center frequency to 50 MHz, the Model 86601A output amplitude to +13 dBm and the Precision Attenuator to 20 dB.

4. **Set the Spectrum Analyzer controls as follows: CENTER FREQUENCY — 50 MHz, INPUT ATTENUATION — 10 dB, LOG REF LEVEL — 0 dBm, LOG/LINEAR — 2 dB LOG, SCAN TIME PER DIVISION — .1 SECONDS' SCAN WIDTH PER DIVISION — .5 kHz, AND BANDWIDTH — .1 kHz.**

5. **Adjust the AM CAL control (A9R13) for sidebands 12 dB down from the center frequency amplitude (see typical waveform in Figure 5-2).**

ADJUSTMENTS

5-17. A12 FILTER ASSEMBLY CHECKS AND ADJUSTMENTS

REFERENCE: **Service Sheet 2.**

DESCRIPTION: The bandpass filters in the A12 assembly are adjusted for minimum insertion loss and maximum flatness over the specified bandwidth.

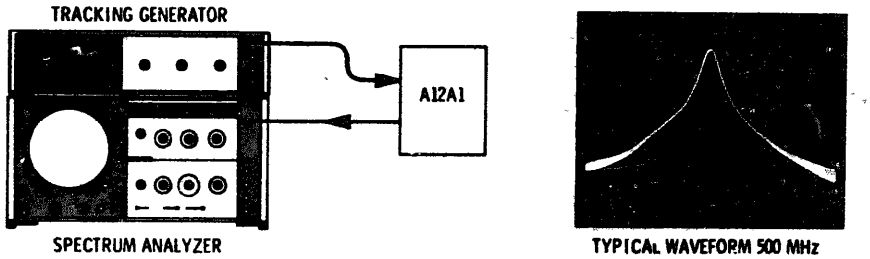


Figure 5-4. A12A1 Filter Adjustment Setup

RECOMMENDED TEST EQUIPMENT:

Tracking Generator	HP 8444A
Spectrum Analyzer	HP 140/8554L/8552B
RF Millivoltmeter	HP 411A
Electronic Counter	HP 5245M/5253B
BNC Tee Connector	UG 274B/U

PROCEDURE: 500 MHz Bandpass Filter A12A1

1. Remove the A12 Dual Filter assembly from the Model 86601A.
2. Connect the tracking Generator to the Spectrum Analyzer. (Refer to the Tracking Generator Operating and Service Manual for interconnections.)
3. Set the Spectrum Analyzer controls as follows: INPUT ATTENUATION - 20 dB, LOG/LINEAR - 10 dB LOG, LOG REF LEVEL - +10 dBm, SCAN WIDTH PER DIVISION -- 20 MHz, SCAN TIME PER DIVISION - 10 MILLISECONDS and BANDWIDTH - 300 kHz.
4. Connect the Tracking Generator RF OUTPUT to the Counter with the Spectrum Analyzer in the ZERO scan mode.
5. **Set the Spectrum Analyzer center frequency to 500 MHz as displayed on the Counter and disconnect the counter.**
6. **Set the Tracking Generator LEVEL to 0 dBm as a reference.**
7. **Connect the A12A1 filter to the equipment as shown in Figure 5-4.**
8. **Change the Spectrum Analyzer SCAN WIDTH from ZERO to PER DIVISION.**
9. **Adjust A12A1C1 and A12A1C2 for minimum insertion loss and maximum flatness.**
10. **Record the insertion loss and flatness.**

Insertion Loss _____ dB

Flatness (peak-to-peak) _____ dB

ADJUSTMENTS

5-17. **A12 FILTER ASSEMBLY CHECKS AND ADJUSTMENTS (cont'd)**

11. **Disconnect the cables from the 500 MHz Bandpass Filter.**

PROCEDURE: 450/460 Bandpass Filter A12A2

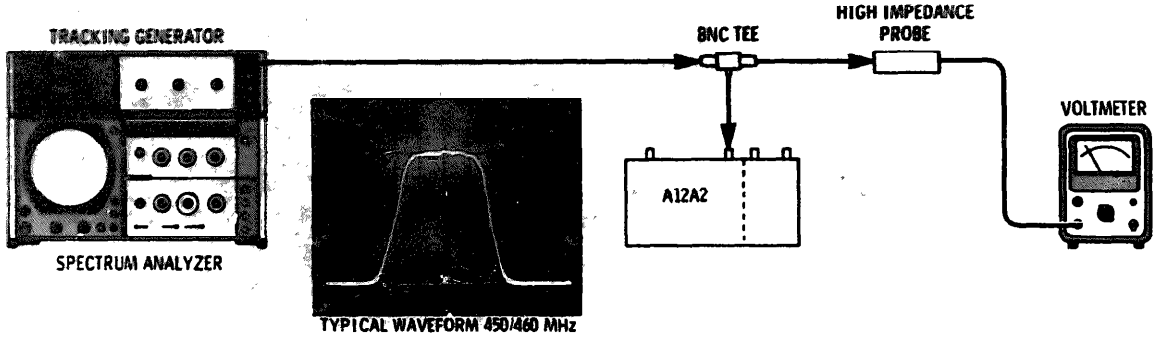


Figure 5-5. Preliminary Adjustment Setup (450/460 Bandpass Filter)

1. Remove the A12 Dual Filter assembly from the Model 86601A.
2. Connect the Tracking Generator to the Spectrum Analyzer. (Refer to the Tracking Generator Operating and Service Manual for interconnections.}
3. Set the Spectrum Analyzer as follows: INPUT ATTENUATION - 20 dB, LOG/LINEAR - 10 dB LOG, LOG REF LEVEL - 0 dBm, SCAN WIDTH PER DIVISION - 5 MHz, SCAN TIME PER DIVISION - 5 MILLISECONDS and BANDWIDTH - 300 kHz.
4. Connect the Tracking Generator RF OUTPUT to the Counter with the Spectrum Analyzer in the ZERO scan mode.
5. Set the Spectrum Analyzer center frequency to 455 MHz as displayed on the Counter and disconnect the Counter.
6. Set the Tracking Generator LEVEL to -14 dBm as a reference.
7. Connect the equipment together as shown in Figure 5-5.
8. Use a screwdriver to short the rotor of C2 to the casting. Adjust Cl for a maximum level on the Voltmeter.
9. Short C3 to the casting and adjust C2 for minimum reading on the Voltmeter.
10. **Short C4 to the casting and adjust C3 for maximum reading** on the Voltmeter.
11. **Short C5 to the casting and adjust C4 for minimum reading on the Voltmeter.**
12. **Short C6 to the casting and adjust C5 for maximum reading on the Voltmeter.**
13. **Short C7 to the casting and adjust C6 for minimum reading on the Voltmeter.**
14. **Adjust C7 for a maximum reading on the Voltmeter.**

ADJUSTMENTS

5-17. A12 FILTER ASSEMBLY CHECKS AND ADJUSTMENTS (cont'd)

15. **Disconnect the Tracking Generator, the Voltmeter and the BNC Tee Connector.**

16. Connect the equipment shown in Figure 5-4.

17. Change the Spectrum Analyzer scan mode from ZERO scan to SCAN WIDTH PER DIVISION.

18. Adjust Cl and C7 for minimum insertion loss and maximum flatness. (Insertion loss is approximately 5 dB.)

19. Adjust C2 through C6 for optimum flatness and minimum insertion loss.

20. Record the ripple, insertion loss and roll-off.

Ripple	2 dB maximum peak-to-peak	_____ dB
Insertion loss	6 dB maximum	_____ dB
Rolloff	55 dB down at 440 MHz	- d B
	55 down at 470 MHz	_____ dB

5-18. 480 MHz ACTIVE FILTER CHECKS AND ADJUSTMENTS

REFERENCE: Service Sheet 2.

DESCRIPTION: The 480 MHz bandpass filter in the A4 assembly is adjusted for maximum flatness and minimum insertion loss.

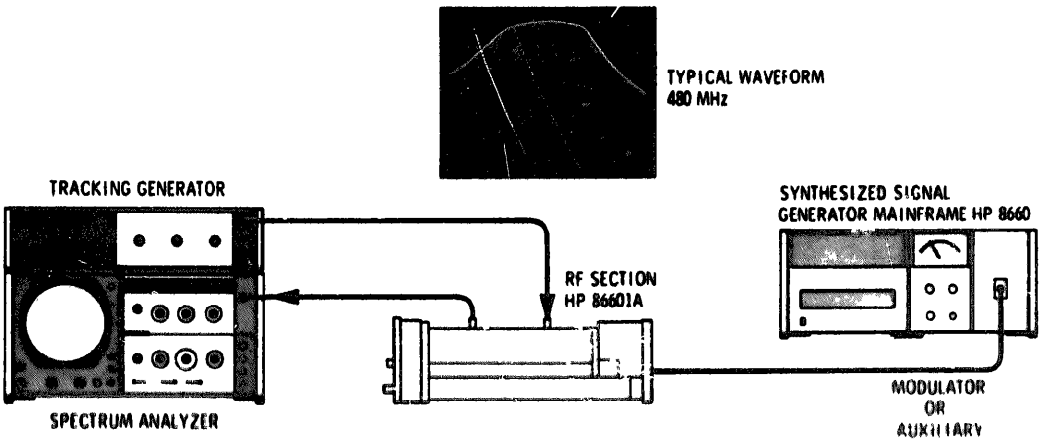


Figure 5-6. Active Filter Adjustment Setup

RECOMMENDED TEST EQUIPMENT:

Tracking Generator	HP 8444A
Spectrum Analyzer	HP 140/8554L/8552B
Electronic Counter	HP 5245M/5253B
Extender Cable	HP 11672-60001

ADJUSTMENTS

5-19. 480 MHz ACTIVE FILTER CHECKS AND ADJUSTMENTS (cont'd)

PROCEDURE:

1. Remove the Model 86601A from the mainframe. Remove the cover and reconnect the Model 86601A with extender cable 11672-60001.

2. Connect the Tracking Generator to the Spectrum Analyzer. (Refer to the Tracking Generator Operating and Service Manual.)

3. Set the Spectrum Analyzer controls as follows: INPUT ATTENUATION - 20 dB, LOG REF LEVEL — +10 dBm, SCAN WIDTH PER DIVISION — 2 MHz, SCAN TIME PER DIVISION - 10 MILLISECONDS and BANDWIDTH — 300 kHz.

4. Connect the Tracking Generator RF OUTPUT to the Electronic Counter with the Spectrum Analyzer in the ZERO scan mode.

5. Set the Spectrum Analyzer frequency to 480 MHz as indicated by the Electronic Counter.

6. Set the Tracking Generator LEVEL to -14 dBm as a reference.

7. Connect the equipment as shown in Figure 5-6.

8. Adjust A4C1, 2, 3 and 4 for maximum output and maximum flatness across the bandwidth. At 480 MHz, gain should be greater than or equal to 17 dB. The response curve should rolloff to more than 3 dB down at 477 and 483 MHz.

9. Record the gain and rolloff.

Gain at 480 MHz _____ dB

Rolloff at 477 MHz _____ dB

Roiloff at 483 MHz _____ dB

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. Table 6-1 provides correct stock numbers for use when ordering assemblies on an exchange basis. These factory-repaired assemblies are available-on an exchange-for-credit basis at a considerable savings cost.

6-3. Table 6-2 lists the meanings of the abbreviations and reference designations used in the table of replaceable parts.

6-4. Table 6-3 lists 86601A replaceable parts in alpha-numerical order of their reference designation.

6-5. Table 6-4 contains the names and addresses that correspond to the manufacturers' code numbers.

6-6. ORDERING INFORMATION

6-7. **To order a part listed in the replaceable parts table, note the Hewlett-Packard part number and then cross-reference that part number to the National Stock Number listed in table 6-5. Then order through normal ordering channels.**

6-8. If the part number does not have a National Stock Number, then order through normal ordering channels using the Hewlett-Packard part number.

6-9. Refer to table 6-5 for part number to NSN cross-reference.

Table 6-1. Part Numbers for Assembly Exchange Orders

Assembly	New Part No.	Exchange No.
A2 Power Amplifier Assembly	86601-60018	86601-60107
A3 Feedback Amplifier	86601-60065	86601-60115
A4 Active Filter	86601-60023	86601-60110
A5 Modulator Assembly	86601-60080	86601-60117
A6 Preamplifier Assembly	86601-60017	86601-60106
A8 Attenuator Driver Assembly	86601-60006	86601-60102
A9 Reference Assembly	86601-60063	86601-60113
A10 Logic Assembly	86601-60118	86601-60119
A12 Dual Filter	86601-60022	86601-60112
A13 Programmable Attenuator	86601-60039	86601-60109
A14 Low Pass Filter	86601-60021	86601-60111
A20 600 MHz Low Pass Filter	86601-60066	86601-60116

Table 6-2. Reference Designators and Abbreviations Used in Parts List

REFERENCE DESIGNATORS

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

ABBREVIATIONS

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

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1			FRONT PANEL ASSEMBLY		
A1C1	0160-2437	6	C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A1C2	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A1C3	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A1C4	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A1C5	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A1C6	0160-2437		C:FXD CER 5000 PF +80-20% 200VDCW	72982	2425-000-X5V-502P
A1C7	0160-3744	2	C:CER FEED-THRU 1000 PF 200VDCW	72982	2425-000-X5U0-102Z
A1M1	1120-0540	1	METER:2-1/2", 1 MA (FOR STANDARD INSTRUMENT)	32171	820720
A1M1	1120-0542	1	METER:2-1/2", 1MA (FOR OPTION 001)	28480	1120-0542
A1MP1	86601-20017	1	HOUSING FRONT	28480	86601-20017
A1MP2	86601-20069	1	FRAME,FRONT PANEL	28480	86601-20069
A1MP3	86601-00034	1	PANEL:FRONT (FOR STANDARD INSTRUMENT ONLY)	28480	86601-00034
A1MP3	86601-00035	1	PANEL:FRONT(OPT 001)	28480	86601-00035
A1MP3					
A1MP4	86601-00036	1	MOUNT:METER	28480	86601-00036
A1MP5	86601-20070	1	WINDOW	28480	86601-20070
A1MP6	86601-40018	1	SCREW:ADJ METER	28480	86601-40018
A1R1	2100-3113	1	R:VAR COMP 2500 OHM 10% 1C CLOG 1/4W	28480	2100-3113
A1R2	0698-3430	1	R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-3430
A1S1	3100-3022	1	SWITCH:ROTARY 2 SECTION 16 POSITION	76854	TYPE LK
A2	86601-60018	1	POWER AMPLIFIER ASSY	28480	86601-60018
A2C1	0180-0197	21	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C2	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C3	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C5	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C6	0160-2327	1	C:FXD CER 1000 PF 20% 100VDCW	96733	81C48X102M
A2C7	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C8	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C9	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C10	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C11	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C12	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C13	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C14	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C15	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C16	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A2C17	0180-2205	2	C:FXD ELECT 0.33 UF 10% 35VDCW	56289	150D334X9035A2-DYS
A2C18	0160-3446	2	C:FXD CER 220 PF 10% 1KVDCW	56289	C0168102F221KS25-CDH
A2C19	0180-2205		C:FXD ELECT 0.33 UF 10% 35VDCW	56289	150D334X9035A2-DYS
A2C20	0180-0058	4	C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSN
A2C21	0160-3449	2	C:FXD CER 2000 PF 10% 250VDCW	56289	C0678251F202KS25-CDH
A2C22	0160-3449		C:FXD CER 2000 PF 10% 250VDCW	56289	C0678251F202KS25-CDH
A2C23	0160-3446		C:FXD CER 220 PF 10% 1KVDCW	56289	C0168102F221KS25-CDH
A2C24	0160-3447	2	C:FXD CER 470 PF 10% 1000VDCW	56289	C0168102F471KS25-CDH
A2C25	0160-3447		C:FXD CER 470 PF 10% 1000VDCW	56289	C0168102F471KS25-CDH
A2C26	0160-3036	16	C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A2C27	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A2C28	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A2C29	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A2CR1	1902-0041	2	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A2CR2	1901-0535	3	DIODE:HYBRID HOT CARRIER	28480	1901-0535
A2CR3	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A2CR4	1902-3036	2	DIODE:BREAKDOWN 5.36V 5%	04713	SZ10939-36
A2CR5	1901-0535		DIODE:HYBRID HOT CARRIER	28480	1901-0535
A2J1	1250-0901	11	CONNECTOR:RF BULKHEAD	15538	1104/0
A2J2	1250-0901		CONNECTOR:RF BULKHEAD	15538	1104/0
A2J3	1250-0901		CONNECTOR:RF BULKHEAD	15538	1104/0
A2L1	9100-1627	4	COIL/CHOKE 39 UH 5%	02142	19-1815-39
A2L2	9100-1627		COIL/CHOKE 39 UH 5%	02142	19-1815-39
A2L3	9140-0237	4	COIL:FXD 220 UH 5%	28480	9140-0737
A2MP1	86601-60003	1	BOARD ASSY:POWER AMPLIFIER	28480	86601-60003
A2MP2	86601-20024	1	COVER:POWER AMPLIFIER ASSY	28480	86601-20024
A2Q1	1853-0293	3	TRANSISTOR PNP	80131	2N5583

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2Q2	1853-0293		TSTR:SI PNP	80131	2N5583
A2Q3	1854-0501	2	TSTR:SI NPN	04713	MM8623
A2Q4	1854-0501		TSTR:SI NPN	04713	MM8023
A2Q5	1853-0293		TSTR:SI PNP	80131	2N5583
A2Q6	1853-0020	12	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q7	1854-0071	12	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2Q9	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q10	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q11	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2Q13	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2R1	0757-0420	1	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A2R2	0698-0082	9	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A2R3	0764-0015	1	R:FXD MET FLM 560 OHM 5% 2W	28480	0764-0015
A2R4	0698-3637	1	R:FXD MET GX 820 OHM 5% 2W	28480	0698-3637
A2R5	0757-0402	1	R:FXD MET FLM 110 OHM 1% 1/8W	28480	0757-0402
A2R6	2100-1754	1	R:VAR WW 50 OHM 5% TYPE V 1W	28480	2100-1754
A2R7	0757-0316	3	R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A2R8	0757-0294	3	R:FXD MET FLM 17.8 OHM 1% 1/8W	28480	0757-0294
A2R9	0757-0294		R:FXD MET FLM 17.8 OHM 1% 1/8W	28480	0757-0294
A2R10	0757-0316		R:FXD MET FLM 42.2 OHM 1% 1/8W	28480	0757-0316
A2R11	0757-0399	1	R:FXD MET FLM 82.5 OHM 1% 1/8W	28480	0757-0399
A2R12	0757-0394	1	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A2R13	0698-0085	3	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A2R14	0757-0421	1	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A2R15	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A2R16	0757-0401	8	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A2R17	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A2R18	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A2R19	0757-0438	9	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A2R20	0757-0317	3	R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A2R21	0757-1094	2	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A2R22	0757-0290	2	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A2R23	0698-3158	2	R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A2R24	0698-3158		R:FXD MET FLM 23.7K OHM 1% 1/8W	28480	0698-3158
A2R25	0757-1094		R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A2R26	0757-0290		R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A2R27	0757-0465	1	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A2R28	0757-0458	1	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R29	0757-0442	8	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R30	0757-0317		R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A2R31	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A2R32	0698-0083	15	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A2R33	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A2R34	2100-1755	1	R:VAR WW 100 OHM 5% TYPE V 1W	28480	2100-1755
A2R35	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A2R36	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A2R37	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A2R38	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3	86601-60065	1	FEED BACK AMPLIFIER ASSY	28480	86601-60065
A3C1	0160-2199	3	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A3C2	0160-3452	1	C:FXD DISC CER 0.02 UF 20% 100VDCW	56289	C023B101H203M529-CUH
A3C3	0160-2204	1	C:FXD MICA 100PF 5%	72136	RDM15FC101J3C
A3C4	0160-0198	1	C:FXD MICA 200 PF 5%	72136	RDM15FC201J3C
A3C5	0180-0058		C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A3C6	0160-0157	1	C:FXD MY 0.0047 UF 10% 200VDCW	56289	192P47292-PTS
A3C7	0170-0040	1	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A3C8	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A3C9	0180-0058		C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A3C10	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A3C11	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A3C12	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A3C13	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A3C14	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A3C15	0160-3744		C:CER FEED-THRU 1000 PF 200VDCW	72982	2425-000-X5U0-102Z
A3CR1	1902-3036		DIODE:BREAKDOWN 5.16V 5%	04713	SZ10939-38
A3CR2	1902-0048	3	DIODE:BRKDWN 6.81V 5%	04713	SZ10939-134
A3CR3	1910-0016	1	DIODE:GE 60 MIV	28480	1910-0016
A3J1	1250-1194	6	CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-049-0010
A3J2	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-049-0010

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3L1	9140-0158	3	COIL:FXD RF 1 UH 10%	99800	1025-20
A3L2	9140-0237		COIL:FXD 200 UH 5%	28480	9140-0237
A3L3	9140-0237		COIL:FXD 200 UH 5%	28480	9140-0237
A3L4	9140-0237		COIL:FXD 200 UH 5%	28480	9140-0237
A3MP1	86601-60062	1	BOARD ASSY:FEED BACK AMPLIFIER	28480	86601-60062
A3MP2	86601-20066	1	COVER:FEED BACK AMPLIFIER	28480	86601-20066
A3Q1	1855-0020	3	TSTR:SI FET N-CHANNEL	28480	1855-0020
A3Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q6	1855-0020		TSTR:SI FET N-CHANNEL	28480	1855-0020
A3Q7	1855-0020		TSTR:SI FET N-CHANNEL	28480	1855-0020
A3Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q9	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3R1	0698-3157	1	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A3R2	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R3	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R4	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R5	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R6	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R7	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R8	0757-0461	1	R:FXD MET FLM 68.1K OHM 1% 1/8W	28480	0757-0461
A3R9	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R10	0757-0280	14	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R11	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R12	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R13	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R14	0698-3161	1	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A3R15	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R16	0698-3132	1	R:FXD FLM 261 OHM 1% 1/8W	28480	0698-3132
A3R17	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A3R18	0757-0447	1	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A3R19	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R20	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R21	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A3U1	1820-0476	1	IC:DP AMP. HI-SPEED	07263	05F7715353
A4	86601-60023	1	FILTER ASSY:ACTIVE	28480	86601-60023
A4C1	0121-0465	13	C:VAR AIR 10 PF	28480	0121-0465
A4C2	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A4C3	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A4C4	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A4C5	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A4C6	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A4J1	1250-0901		CONNECTOR:RF BULKHEAD	15558	110 /D
A4J2	1250-0901		CONNECTOR:RF BULKHEAD	15558	1104/D
A4MP1	86601-40007	1	BOTTOM:ACTIVE FILTER DIEL.	28480	86601-40007
A4MP2	86601-20037	1	INSERT:ACTIVE FILTER ASSY	28480	86601-20037
A4MP3	86601-20035	1	HOUSING:ACTIVE FILTER ASSY	28480	86601-20035
A4MP4	86601-20026	1	STRIPLINE	28480	86601-20026
A4MP5	86601-00009	1	COVER:ACTIVE FILTER ASSY	28480	86601-00009
A4A1	86601-60011	1	BOARD ASSY:INPUT AMPLIFIER	28480	86601-60011
A4A1C1	0160-3878	1	C:FXD CER 1000 PF 20% 100VDCW	90201	CW20598X7R102M
A4A1C2	0160-3878	19	C:FXD CER 1000 PF 20% 100VDCW	90201	CW20598X7R102M
A4A1C3	0121-0447	10	C:VAR CER 1.5-7.5 PF 63VDCW	28480	0121-0447
A4A1C4	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	90201	CW20598X7R102M
A4A1C5	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	90201	CW20598X7R102M
A4A1C6	0121-0447		C:VAR CER 1.5-7.5 PF 63VDCW	28480	0121-0447
A4A1C7	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	90201	CW20598X7R102M
A4A1L1	9100-2247	4	COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A4A1Q1	1854-0345	10	TSTR:SI NPN	80131	2N5179
A4A1Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A4A1R1	0698-3429	5	R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A4A1R2	0698-3151	8	R:FXD MET FLM 7.87K OHM 1% 1/8W	28480	0698-3151
A4A1R3	0757-0439	8	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A4A1R4	0698-3440	11	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A4A1R5	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4A1R6	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A4A1R7	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A4A1R8	0698-3443	3	R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A4A1R9	0757-0294		R:FXD MET FLM 17.8 OHM 1% 1/8W	28480	0757-0294
A4A1R10	0698-3443		R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A4A2	86601-60012	1	BOARD ASSY:OUTPUT AMPLIFIER	28480	86601-60012
A4A2C1	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A4A2C2	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A4A2C3	0121-0447		C:VAR CER 1.5-2.5 PF 63VDCW	28480	0121-0447
A4A2C4	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A4A2C5	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A4A2C6	0121-0447		C:VAR CER 1.5-2.5 PF 63VDCW	28480	0121-0447
A4A2C7	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A4A2L1	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A4A2Q1	1854-0345		TSTR:SI NPN	80131	2N5179
A4A2Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A4A2R1	0698-3429		R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A4A2R2	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A4A2R3	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A4A2R4	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A4A2R5	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A4A2R6	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A4A2R7	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5	86601-60080	1	MODULATOR ASSY	28480	86601-60080
A5C1	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A5C2	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A5C3	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A5J1	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A5J2	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A5J3	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A5J4	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A5MP1	86601-20065	1	DIVIDER:MODULATOR	28480	86601-20065
A5MP2	86601-20067	1	CABLE:MODULATOR	28480	86601-20067
A5MP3	86601-20072	1	COVER:MODULATOR ASSY	28480	86601-20072
A5A1	86601-60078	1	BOARD ASSY:MODULATOR	28480	86601-60078
A5A1C1	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A5A1C2	0121-0447		C:VAR CER 1.5-2.5 PF 63VDCW	28480	0121-0447
A5A1C3	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A5A1C4	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A5A1C5	0121-0447		C:VAR CER 1.5-2.5 PF 63VDCW	28480	0121-0447
A5A1C6	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A5A1C7	0160-2208	2	C:FXD MICA 330 PF 5% 300VDCW	28480	0160-2208
A5A1C8	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2C59X7R102M
A5A1C9	0160-3466	1	C:FXD CER 100 PF 10% 250VDCW	56289	C157P251F101KS22-COM
A5A1C10	0160-3456	4	C:FXD CER 1000 PF 10% 250VDCW	56289	C067P251F102KS22-COM
A5A1E1	0960-2070	2	MIXER:500 MHZ	28480	0960-2070
A5A1K1	0490-1013	1	RELAY:REED 500 OHM 10% 5V	15636	R2040-1
A5A1L1	08660-80005	4	INDUCTOR	28480	08660-80005
A5A1L2	08660-80005		INDUCTOR	28480	08660-80005
A5A1L3	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A5A1L4	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A5A1Q1	1854-0345		TSTR:SI NPN	80131	2N5179
A5A1Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A5A1R1	0698-3429		R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A5A1R2	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A1R3	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A1R4	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A1R5	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A1R6	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A1R7	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A1R8	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5A1R9	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5A1R10	0757-1000	1	R:FXD MET FLM 91.1 OHM 1% 1/2W	28480	0757-1000

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A2	86601-60060	1	BOARD ASSY:MODULATOR II	28480	86601-60060
A5A2C1	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A5A2C2	0121-0447		C:VAR CER 1.5-2.5 PF 63VDCW	28480	0121-0447
A5A2C3	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A5A2C4	0121-0447		C:VAR CER 1.5-2.5 PF 63VDCW	28480	0121-0447
A5A2C5	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A5A2C6	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A5A2C7	0160-3878		C:FXD CER 1000 PF 20% 100VDCW	80031	CV2059X7R102M
A5A2C8	0160-2208		C:FXD MICA 330 PF 5% 300VDCW	28480	0160-2208
A5A2E1	0960-2070		MIXER:500 MHZ	28480	0960-2070
A5A2L1	08660-80005		INDUCTOR	28480	08660-80005
A5A2L2	08660-80005		INDUCTOR	28480	08660-80005
A5A2L3	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A5A2L4	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A5A2Q1	1854-0345		TSTR:SI NPN	80131	2N5179
A5A2Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A5A2R1	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A2R2	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A2R3	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A2R4	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A2R5	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A2R6	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A2R7	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A5A2R8	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6	86601-60017	1	PRE-AMPLIFIER ASSY	28480	86601-60017
A6C1	0180-0058		C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A6C2	0160-2306	2	C:FXD MICA 27 PF 5%	28480	0160-2306
A6C3	0160-2306		C:FXD MICA 27 PF 5%	28480	0160-2306
A6C4	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C5	0160-2150	2	C:FXD MICA 33 PF 5%	28480	0160-2150
A6C6	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A6C7	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A6C8	0160-2055	1	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A6C9	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C10	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C11	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C12	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A6C13	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9C20A2-DYS
A6C14	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A6C15	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A6CR1	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6CR2	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6J1	1250-0901		CONNECTOR:RF BULKHEAD	55556	1104/0
A6J2	1250-0901		CONNECTOR:RF BULKHEAD	55556	1104/0
A6L1	9100-1627		COIL/CHOKE 39 UH 5%	02142	15-1315-2J
A6L2	86601-80004	2	COIL	28480	86601-80004
A6L3	9100-2248	1	COIL/CHOKE 0.12 UH 10%	02142	09-4416-2K
A6L4	86601-80004		COIL	28480	86601-80004
A6MP1	86601-20023	1	COVER:PRE-AMPLIFIER ASSY	28480	86601-20023
A6MP2	86601-60002	1	BOARD ASSY:PRE-AMPLIFIER	28480	86601-60002
A6Q1	1854-0345		TSTR:SI NPN	80131	2N5179
A6Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A6Q3	1854-0247	1	TSTR:SI NPN	28480	1854-0247
A6R1	2100-1799	1	R:VAR WW 2K OHM 5% TYPE V 1W	28480	2100-1799
A6R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R3	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R4	0757-0316		R:FXD MET FLM 47.2 OHM 1% 1/8W	28480	0757-0316
A6R5	0757-0274	1	R:FXD MET FLM 1.24K OHM 1% 1/8W	28480	0757-0274
A6R6	0757-0405	2	R:FXD MET FLM 162 OHM 1% 1/8W	28480	0757-0405
A6R7	2083-0645	1	R:FXD COMP 9.1 OHM 5% 1/4W	01121	EB 9145
A6R8	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A6R9	0757-0317		R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A6R10	0757-0405		R:FXD MET FLM 162 OHM 1% 1/8W	28480	0757-0405
A6R11	0757-0346	1	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A6R12	0757-0417	1	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A6R13	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A6R14	0757-0180	1	R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0757-0180
A6R15	0698-3402	1	R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3402

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	86601-60009	1	BOARD ASSY:MOTHER	28480	86601-60009
A7P1	1251-2857	2	CONNECTOR STRIP:14 MALE CONTACT	02660	221-1515
A7XA7	1251-2857		CONNECTOR STRIP:14 MALE CONTACT	0266C	221-1515
A7XA8	1251-1626	1	CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A7XA9	1251-2034	1	CONNECTOR:PC EDGE (2 X 10) 20 CONTACT	71785	252-10-30-300
A7XA10	1251-1388	1	CONNECTOR:PC (2 X 15) 30 CONTACT	71785	252-15-30-008
A8	86601-60006	1	BOARD ASSY:ATTENUATOR DRIVER FOR OPTION 001, OMIT A8	28480	86601-60006
A8CR1	1902-3002	4	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A8CR2	1902-3002		DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A8CR3	1902-3002		DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A8CR4	1902-3002		DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A8CR5	1901-0025	9	DIODE:SILICON 100MA/1V	07263	FD 2387
A8CR6	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A8CR7	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A8CR8	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A8CR9	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A8CR10	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A8CR11	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A8CR12	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A8Q1	1853-0213	4	TSTR:SI PNP	80131	2N4236
A8Q2	1854-0361	4	TSTR:SI NPN	80131	2N4239
A8Q3	1853-0213		TSTR:SI PNP	80131	2N4236
A8Q4	1854-0361		TSTR:SI NPN	80131	2N4239
A8Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A8Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q8	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A8Q9	1853-0213		TSTR:SI PNP	80131	2N4236
A8Q10	1854-0361		TSTR:SI NPN	80131	2N4239
A8Q11	1853-0213		TSTR:SI PNP	80131	2N4236
A8Q12	1854-0361		TSTR:SI NPN	80131	2N4239
A8Q13	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q14	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A8Q15	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q16	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A8R1	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R2	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R3	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R4	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A8R5	0757-0159	8	R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R6	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A8R7	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R8	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R9	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A8R10	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R11	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R12	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A8R13	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R14	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R15	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A8R16	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A8R17	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A8R18	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A8R19	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A8R20	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A8R21	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A8R22	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A8R23	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A8R24	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A9	86601-60003	1	BOARD ASSY:REFERENCE	28480	86601-60003
A9C1	0160-2226	1	C:FXD MICA 2200 PF 5% 100VDCW	28480	0160-2226
A9CR1	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-48

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A9K1	0490-0916	6	RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K2	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K3	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K4	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K5	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K6	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A9Q2	1853-0015	5	TSTR:SI PNP	80131	2N3640
A9Q3	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q4	1853-0322	4	TSTR:SI PNP	80131	2N2946A
A9Q5	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q6	1853-0322		TSTR:SI PNP	80131	2N2946A
A9Q7	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q8	1853-0322		TSTR:SI PNP	80131	2N2946A
A9Q9	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A9Q11	1853-0322		TSTR:SI PNP	80131	2N2946A
A9R1	0757-0418	2	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A9R2	2100-2413	1	R:VAR FLM 200 OHM 10% LIN 1/2W	28480	2100-2413
A9R3	0757-0418		R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A9R4	0698-3443		R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A9R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R7	0698-3446	1	R:FXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446
A9R8	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R9	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R10	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R11	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R12	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R13	2100-2633	2	R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A9R14	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R15	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R16	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R17	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R18	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R19	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R20	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R21	0698-4482	1	R:FXD FLM 17.4K OHM 1% 1/8W	28480	0698-4482
A9R22	0698-3498	1	R:FXD MET FLM 8.66K OHM 1% 1/8W	28480	0698-3498
A9R23	0698-3154	1	R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A9R24	0698-4430	1	R:FXD FLM 1.91K OHM 1% 1/8W	28480	0698-4430
A9R25	0698-4406	2	R:FXD FLM 115 OHM 1% 1/8W	28480	0698-4406
A9R26	0698-4406		R:FXD FLM 115 OHM 1% 1/8W	28480	0698-4406
A9R27	0698-3486	2	R:FXD FLM 232 OHM 1% 1/8W	28480	0698-3486
A9R28	0698-3486		R:FXD FLM 232 OHM 1% 1/8W	28480	0698-3486
A9R29	0698-3510	2	R:FXD MET FLM 453 OHM 1% 1/8W	28480	0698-3510
A9R30	0698-3510		R:FXD MET FLM 453 OHM 1% 1/8W	28480	0698-3510
A9R31	0698-3495	2	R:FXD MET FLM 866 OHM 1% 1/8W	28480	0698-3495
A9R32	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A9R33	0698-3495		R:FXD MET FLM 866 OHM 1% 1/8W	28480	0698-3495
A9R34	2100-2632	1	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-2632
A9R35	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R36	0698-3453	1	R:FXD MET FLM 196K OHM 1% 1/8W	28480	0698-3453
A9R37	0698-3150	1	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A9U1	1826-0201	1	INTEGRATED CIRCUIT:OPERATIONAL AMPL	04713	MC1439G
A10	86601-60008	1	BCA-D ASSY:LOGIC	28480	86601-60008
A10C1	0180-0228	1	C:FXD ELECT 22 UF 10% 10VDCW	56289	196D226X9010S2 DYS
A10L1	9140-1627		C:FXD/CHOKE 30 UH 5%	02114	19-1319-23
A10U1	1820-0908	1	IC:DEC-BIT BUFFER ARRAY	18324	N8202A
A10U2	1820-0830	1	IC:TTL DCD TO BINARY/BINARY TO DCD	06713	MC4001P
A10U3	1820-0054	4	IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A10U4	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A10U5	1820-0877	1	IC:TTL DUAL D F/F	01295	SN7474N
A10U6	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A10U7	1820-0054		IC:TTL QUAD 2-INPT NAND GATE	01295	SN7400N
A11	86601-60010	1	BINARY PROM/REG	28480	86601-60010

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11MP1	1251-1313	13	CONTACT:R 6 P FEMALE CONNECTOR	02660	220-562
A11MP2	1251-2858	1	CONNECTOR BODY:15-OPEN POSITIONS	74868	221-1615
A11MP4	1251-3087	18	CONTACT:R 6 P CONNECTOR 816 FEMALE	81312	1CC-09C85
A11MP5	5040-C383	1	CONNECTOR FACE:66-PIN	28480	5040-C383
A11W1	86601-60041	1	SEE W1	28480	86601-60041
A11W3	86601-60037	2	SEE W3	28480	86601-60037
A11W6	86601-60038	2	SEE W6	28480	86601-60038
A11W11	86601-60040	2	SEE W11	28480	86601-60040
A11W17	86601-60049	2	SEE W17	28480	86601-60049
A11W18	86601-60086	2	SEE W18	28480	86601-60086
A12	86601-60022	1	FILTER ASSY:DUAL	28480	86601-60022
A12J1	1250-0901		CONNECTOR:RF BULKHEAD	15538	11C4/D
A12J2	1250-0901		CONNECTOR:RF BULKHEAD	15538	11C4/D
A12J3	1250-0901		CONNECTOR:RF BULKHEAD	15538	11C4/D
A12J4	1250-0901		CONNECTOR:RF BULKHEAD	15538	11C4/D
A12MP1	86601-30004	1	COVER:DUAL FILTER	28480	86601-30004
A12MP2	86601-00025	1	GASKET	28480	86601-00025
A12MP3	86601-20027	1	STRIPLINE-455	28480	86601-20027
A12MP4	86601-20028	1	STRIPLINE-500	28480	86601-20028
A12MP5	86601-20030	1	INSERT-455	28480	86601-20030
A12MP6	86601-20031	1	INSERT-500	28480	86601-20031
A12MP7	86601-20034	1	HOUSING:DUAL FILTER	28480	86601-20034
A12MP8	86601-40003	2	BOTTOM-455 DIEL	28480	86601-40003
A12MP8	86601-40005	2	BOTTOM-500 DIEL	28480	86601-40005
A12A1			BAND PASS FILTER:500 MHZ		
A12A1C1	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A1C2	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A2			BAND PASS FILTER:450-460 MHZ		
A12A2C1	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A2C2	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A2C3	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A2C4	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A2C5	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A2C6	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A12A2C7	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A13	86601-60039	1	ATTENUATOR ASSY:5 SECTION FOR OPTION 001, OMIT A13.	28480	86601-60039
A14	86601-60021	1	FILTER ASSY:LOW PASS	28480	86601-60021
A14C1	0160-2150		C:FXD MICA 33 PF 5%	28480	0160-2150
A14C2	0160-2257	1	C:FXD CER 10 PF 5% 500VDCW	72982	301-000-COH0-100J
A14C3	0160-2308	1	C:FXD MICA 36 PF 5%	28480	0160-2308
A14C4	0160-2200	1	C:FXD MICA 63 PF 5%	72136	RDM15E63CJ3C
A14C5	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A14C6	0160-2199		C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A14C7	0160-2265	1	C:FXD CER 22 PF 5% 500VDCW	72982	301-NPO-22PF
A14L1	86601-80001	1	COIL:FXD 47	28480	86601-80001
A14L2	86601-80002	1	COIL:2 T	28480	86601-80002
A14L3	86601-80003	1	COIL:2-1/2 T	28480	86601-80003
A14MP1	86601-60010	1	BOARD ASSY:LOW PASS FILTER	28480	86601-60010
A14MP2	7800-1042	1	CAN:RECTANGULAR 0.954" X 2.334"	02679	MU-5794-CA-CRS-HYD
A14MP3	10514-0005	1	BRACKET:SEL	28480	10514-0005
A14J1	1250-1021	2	CONNECTOR:RF 50 OHM SNAP ON TYPE	98291	51-043-4410
A14J2	1250-1021		CONNECTOR:RF 50 OHM SNAP ON TYPE	98291	51-043-4410
A14MP4	86601-00027	1	CAN:LP FILTER	28480	86601-00027
A15	10514A-004/H58	1	MIXER:DOUBLE BALANCED	28480	10514A-004/H58
A16	10514A-OPT 004	2	MIXER DOUBLE BALANCED	28480	10514A-OPT 004

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17	10514A-004		MIXER-DOUBLE BALANCED	28480	10514A-004
A18	86601-60091	1	WIRING HARNESS:MAIN	28480	86601-60091
A18MP1	1200-0063	17	LUG:CRIMP	28480	1200-0063
A18MP2	1251-2262	2	CONNECTOR:PC(2 X 10)20 CONTACTS	76530	251-10-30-400
A18MP3	1251-3087		CONTACT:R & P CONNECTOR #16 FEMALE	81312	100-05085
A18MP4	5020-0176	17	INSULATOR FOR SNAP-ON PINS	28480	5020-0176
A19	86601-60089	2	CABLE ASSY GRAY/YEL	28480	86601-60089
A19W4	86601-60030	1	SEE W4	28480	86601-60030
A19W8	86601-60069	2	SEE W8	28480	86601-60069
A19W9	86601-60068	2	SEE W9	28480	86601-60068
A19W10	86601-60071	2	SEE W10	28480	86601-60071
A19W13	86601-60032	2	SEE W13	28480	86601-30032
A19W19	86601-60070	2	SEE W19	28480	86601-60070
W1	86601-60041		CABLE ASSY:WHITE/GREEN	28480	86601-60041
W2	86601-60035	1	CABLE ASSY:GRAY	28480	86601-60035
W3	86601-60037		CABLE ASSY:WHITE/RED	28480	86601-60037
W4	86601-60089		CABLE ASSY GRAY/YEL	28480	86601-60089
W5	86601-60029	1	CABLE ASSY:GRAY/ORANGE	28480	86601-60029
W6	86601-60038		CABLE ASSY:WHITE/ORANGE	28480	86601-60038
W7	86601-60034	1	CABLE ASSY:GRAY	28480	86601-60034
W8	86601-60069		CABLE ASSY:GRAY/WHI E	28480	86601-60069
W9	86601-60068		CABLE ASSY:GRAY/BLACK	28480	86601-60068
W10	86601-60071		CABLE ASSY:GRAY/GREEN	28480	86601-60071
W11	86601-60040		CABLE ASSY:WHITE/YELLOW	28480	86601-60040
W12	86601-60036	1	CABLE ASSY:GRAY	28480	86601-60036
W13	86601-60032		CABLE ASSY:GRAY/BLUE	28480	86601-30032
W14	86601-60027	1	CABLE ASSY:GRAY/RED	28480	86601-60027
W15	86601-60026	1	CABLE ASSY:GRAY/BROWN	28480	86601-60026
W16	86601-60059	1	CABLE ASSY:ATTENUATOR, GRAY	28480	86601-60059
W16			(FOR OPTION 001)		
W16	86601-60028	1	CABLE ASSY:ATTENUATOR, GRAY	28480	86601-60028
W16			FOR OPTION 001 OMIT 86601-60028		
W17	86601-60049		CABLE ASSY:GRAY/ORANGE	28480	86601-60049
W18	86601-60086		CABLE ASSY:WHITE/GREEN	28480	86601-60086
W19	86601-60070		CABLE ASSY:GRAY/VIOLET	28480	86601-60070
XA7-1	1251-2530	1	CONNECTOR:PC EDGE(2 X 6)12 CONTACT	71785	251-06-30-400
XA7-2	1251-2262		CONNECTOR:PC(2 X 10)20 CONTACTS	76530	251-10-30-400
			MISCELLANEOUS		
	0370-1089	1	KNOB:RND JADE GRAY FOR 0.125" DIA SHAFT	28480	0370-1089
	0370-2108	1	KNOB:BAR W/SKIRT, JADE GRAY	28480	0370-2108
	1250-0914	1	BODY:RF CONNECTOR	02660	131-150
			FOR OPTION 001 ONLY		
	1250-0915	1	CONTACT:RF CONNECTOR	02660	131-149
			FOR OPTION 001 ONLY		
	7120-0004	1	NAMEPLATE:SERIAL	28480	7120-0004
	7124-1688	1	LABEL:ID(MODEL/OPTION)	28480	7124-1688
	5040-0306	1	INSULATOR	28480	5040-0306
			FOR OPTION 001 ONLY		
	08555-20093	1	CENTER CONDUCTOR	28480	08555-20093
			FOR OPTION 001 ONLY		
	08555-20094	1	BODY:BULKHEAD	28480	08555-20094
			FOR OPTION 001 ONLY		
	08761-2027	1	INSULATOR	28480	08761-2027
			FOR OPTION 001 ONLY		
	86601-00001	1	PANEL:FRONT	28480	86601-00001
			FOR STANDARD INSTRUMENT ONLY		
	86601-00002	1	MOUNT:METER	28480	86601-00002
	86601-00006	1	BRACKET:MIXER	28480	86601-00006
	86601-00013	1	LATCH	28480	86601-00013
	86601-00014	1	BRACKET:ATTENUATOR	28480	86601-00014
			FOR STANDARD INSTRUMENT ONLY		
	86601-00028	1	PANEL:REAR	28480	86601-00028
			FOR OPTION 001 ONLY		
	86601-00029	1	COVER:OUTER	28480	86601-00029
	86601-00030	1	CIRCUIT BD ASSY	28480	86601-00030

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	86601-20013	2	EXTRUSION:SHIELD	28480	86601-20013
	86601-20014	1	EXTRUSION:ENC PLATE	28480	86601-20014
	86601-20015	2	EXTRUSION:DIVIDER	28480	86601-20015
	86601-20016	1	FRAME:FRONT PANEL	28480	86601-20016
	86601-20018	1	PANEL:REAR	28480	86601-20018
	86601-20019	1	STUD LATCH	28480	86601-20019
	86601-20020	1	WASHER:LATCH	28480	86601-20020
	86601-20051	1	WINDOW	28480	86601-20051
	86601-40017	1	SCREW:METER ADJUST	28480	86601-40017

See Introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3	86601-60019	1	FEED-BACK AMPLIFIER ASSY	28480	86601-60019
A3C1	0180-0058	2	C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A3C2	0180-0058		C:FXD AL ELECT 50 UF +75-10% 25VDCW	56289	30D506G025CC2-DSM
A3C3	0160-2204	1	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A3C4	0140-0198	2	C:FXD MICA 200 PF 5%	72136	RDM15F201J3C
A3C5	0160-2199	1	C:FXD MICA 30 PF 5% 300VDCW	28480	0160-2199
A3C6	0160-3452	1	C:FXD DISC CER 0.02 UF 20% 100VDCW	56289	C023B101H203MS25-COM
A3C7	0180-1735	1	C:FXD ELECT 0.22 UF 10% 35VDCW	28480	0180-1735
A3C8	0180-0116	1	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X903582-DYS
A3C9	0160-0158	1	C:FXD MY 0.0056 UF 10% 200VDCW	56289	192P56292-PTS
A3C10	0160-3063	5	C:FXD MICA 390 PF 5% 300VDCW	00853	RDM19F391J3S
A3C11	0160-3063		C:FXD MICA 390 PF 5% 300VDCW	00853	RDM19F391J3S
A3C12	0160-3063		C:FXD MICA 390 PF 5% 300VDCW	00853	RDM19F391J3S
A3C13	0160-3063		C:FXD MICA 390 PF 5% 300VDCW	00853	RDM19F391J3S
A3C14	0160-3063		C:FXD MICA 390 PF 5% 300VDCW	00853	RDM19F391J3S
A3C15	0160-3744	1	C:CER FEED-THRU 1000 PF 200VDCW	72982	2425-000-X5U0-102Z
A3CR1	1902-0041	2	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-58
A3CR2	1902-3036	1	DIODE:BREAKDOWN 3.16V 5%	04713	SZ10939-38
A3J1	1250-0901	5	CONNECTOR:RF BULKHEAD	15558	1104/D
A3J2	1250-0901		CONNECTOR:RF BULKHEAD	15558	1104/D
A3L1	9140-1058	1	COIL/CHOKE 1 UH	28480	9140-1058
A3L2	9140-0237	3	COIL:FXD 200 UH 5%	28480	9140-0237
A3L3	9140-0237		COIL:FXD 200 UH 5%	28480	9140-0237
A3L4	9140-0237		COIL:FXD 200 UH 5%	28480	9140-0237
A3L5	9100-1667	1	COIL/CHOKE 3900 UH 5%	82142	24-1313-20J
A3MP1	86601-00025	1	GASKET	28480	86601-00025
A3MP2	86601-60004	1	BOARD ASSY:FEED-BACK AMPLIFIER	28480	86601-60004
A3Q1	1855-0020	3	TSTR:SI FET N-CHANNEL	28480	1855-0020
A3Q2	1853-0020	3	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q4	1854-0071	5	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q6	1855-0020		TSTR:SI FET N-CHANNEL	28480	1855-0020
A3Q7	1855-0020		TSTR:SI FET N-CHANNEL	28480	1855-0020
A3Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q9	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3R1	0698-3150	1	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R2	0698-0083	11	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R3	0698-3157	2	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A3R4	0757-0442	6	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R7	0698-3153	3	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A3R8	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A3R9	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A3R10	0757-0280	4	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R11	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A3R12	0757-0438	2	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R13	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A3R14	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A3R15	0757-0401	2	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R16	0698-0085	1	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A3R17	0698-3151	5	R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A3R18	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A3R19	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R20	0757-0447	1	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A3R21	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A3U1	1820-0476	1	IC:OP. AMP. HI-SPEED	07263	USF7715303
A5	86601-60016	1	MODULATOR ASSY	28480	86601-60016
A5C1	0160-3036	1	C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A5J1	1250-0901		CONNECTOR:RF BULKHEAD	15558	1104/D
A5J2	1250-0901		CONNECTOR:RF BULKHEAD	15558	1104/D
A5J3	1250-0901		CONNECTOR:RF BULKHEAD	15558	1104/D
A5MP1	86601-20022	1	COVER:MODULATOR ASSY	28480	86601-20022
A5A1	86601-60001	1	BOARD ASSY:MODULATOR	28480	86601-60001
A5A1C1	0160-3456	7	C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102K122-COM
A5A1C2	0160-2200	1	C:FXD MICA 150 PF 5% 300VDCW	28480	0160-2200

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A1C3	0160-2236	2	C:FXD CER 1.0 PF 500VDCW	72982	301-000-CCKO-109C
A5A1C4	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A5A1C5	0160-2327	5	C:FXD CER 1000 PF 20% 100VDCW	96733	81C48X102M
A5A1C6	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A5A1C7	0160-2236		C:FXD CER 1.0 PF 500VDCW	72982	3C1-000-CCKO-109C
A5A1C8	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A5A1C9	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	81C48X102M
A5A1C10	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	81C48X102M
A5A1C11	0160-2238	1	C:FXD CER 1.5 PF 500VDCW	72982	3C1-000-CCKO-159C
A5A1C12	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A5A1C13	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	81C48X102M
A5A1C14	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A5A1C15	0160-2237	1	C:FXD CER 1.2+/-0.25 PF 500VDCW	72982	301-000-CCKO-129C
A5A1C16	0160-3456		C:FXD CER 1000 PF 10% 250VDCW	56289	C067F251F102KS22-CDH
A5A1C17	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	81C48X102M
A5A1E1	0960-2070	1	MIXER:500 MHZ	28480	0960-2070
A5A1L1	9100-2247	1	COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A5A1L2	9140-0158	1	COIL:FXD RF 1 UH 10%	59800	1025-20
A5A1Q1	1854-0345	4	TSTR:SI NPN	80131	2N5179
A5A1Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A5A1Q3	1854-0345		TSTR:SI NPN	80131	2N5179
A5A1Q4	1854-0345		TSTR:SI NPN	80131	2N5179
A5A1R1	0757-0439	4	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A1R2	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A1R3	0698-7195	1	R:FXD MET FLM 19.6 OHM 2% 1/8W	28480	0698-7195
A5A1R4	0698-3440	4	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A1R5	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A1R6	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A1R7	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A1R8	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A1R9	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A1R10	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A1R11	0757-0439		R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A5A1R12	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A5A1R13	0698-3440		R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-3440
A5A1R14	0698-3438	2	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A5A1R15	0698-3435	1	R:FXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A5A1R16	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A5A2	86601-60020	1	FILTER:LOW PASS 600 MHZ	28480	86601-60020
A9	86601-60005	1	BOARD ASSY:REFERENCE	28480	86601-60005
A9C1	0160-2226	1	C:FXD MICA 2200 PF 5% 300VDCW	28480	0160-2226
A9CR1	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A9CR2	1901-0025	1	DIODE:SILICON 100MA/1V	07263	FD 2387
A9K1	0490-0916	6	RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K2	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K3	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9K4	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231C51
A9K5	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231C51
A9K6	0490-0916		RELAY:REED 1 FORM A 0.5 AMP	15636	RA30231051
A9Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A9Q2	1853-0015	5	TSTR:SI PNP	80131	2N3640
A9Q3	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q4	1853-0322	4	TSTR:SI PNP	80131	2N2946A
A9Q5	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q6	1853-0322		TSTR:SI PNP	80131	2N2946A
A9Q7	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q8	1853-0322		TSTR:SI PNP	80131	2N2946A
A9Q9	1853-0015		TSTR:SI PNP	80131	2N3640
A9Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A9Q11	1853-0322		TSTR:SI PNP	80131	2N2946A
A9R1	2100-2633	2	R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A9R2	0757-0418	1	R:FXD MET FLM 619 OHM 1% 1/8W	28480	0757-0418
A9R3	2100-2633		R:VAR CERMET 1K OHM 10% LIN 1/2W	28480	2100-2633
A9R4	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R5	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R6	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R7	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R8	0698-4406	2	R:FXD FLM 115 OHM 1% 1/8W	28480	0698-4406
A9R9	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9R10	0698-4482	1	RESFXD FLM 17.4K OHM 1% 1/8W	28480	0698-4482
A9R11	0698-4436		RESFXD FLM 115 OHM 1% 1/8W	28480	0698-4436
A9R12	0698-0083		RESFXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R13	0698-3486	2	RESFXD FLM 232 OHM 1% 1/8W	28480	0698-3486
A9R14	0757-0280		RESFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R15	0698-0083		RESFXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R16	0698-3498	1	RESFXD MET FLM 8.66K OHM 1% 1/8W	28480	0698-3498
A9R17	0698-3486		RESFXD FLM 232 OHM 1% 1/8W	28480	0698-3486
A9R18	0698-0083		RESFXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R19	0698-3510	2	RESFXD MET FLM 453 OHM 1% 1/8W	28480	0698-3510
A9R20	0698-0083		RESFXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R21	0698-3154	1	RESFXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A9R22	0698-3510		RESFXD MET FLM 453 OHM 1% 1/8W	28480	0698-3510
A9R23	0698-0083		RESFXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R24	0698-3495	2	RESFXD MET FLM 866 OHM 1% 1/8W	28480	0698-3495
A9R25	0698-0083		RESFXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A9R26	0698-4430	1	RESFXD FLM 1.91K OHM 1% 1/8W	28480	0698-4430
A9R27	0698-3495		RESFXD MET FLM 866 OHM 1% 1/8W	28480	0698-3495
A9R28	0757-0280		RESFXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A9R29	0757-0442		RESFXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A9R30	2100-2522	1	RESVAR CERMET 10K OHM 10% LIN 1/2W	28480	2100-2522
A9R31	0698-3453	1	RESFXD MET FLM 196K OHM 1% 1/8W	28480	0698-3453
A9R32	0698-3446	1	RESFXD MET FLM 383 OHM 1% 1/8W	28480	0698-3446
A9U1	1820-0201	1	INTEGRATED CIRCUIT:OPERATIONAL AMPL	04713	MC1439G

Table 6-4. Manufacturer's Code List

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
02114	FERROXCUBE CORP.	SAUGERTIES, N.Y.	12477
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
02875	HUDSON TOOL & DIE CO.	NEWARK, N.J.	07105
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
15550	NICON ELECTRONICS INC.	GARDEN CITY LONG IS., N.Y.	11530
15636	ELEC-TROL INC.	NORTHRIDGE, CALIF.	91325
18324	SIGNETICS CORP.	SUNNYVALE, CALIF.	94086
28480	HEWLETT-PACKARD CO. CORPORATE HQ	YOUR NEAREST HP OFFICE	
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72928	GUDEMAN DIV. GULTON IND. INC.	CHICAGO, ILL.	60610
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
74868	AMPHENOL CORP. RF DIV.	DANBURY, CONN	06810
76930	CINCH MONADNOCK MILLS DIV. TRW INC.	CITY OF INDUSTRY, CALIF.	91746
78854	OAK MFG. CO. DIV. OAK ELECTRO/NETICS CORP.	CRYSTAL LAKE, ILL.	60014
80031	MEPCO DIV. SESSIONS CLOCK CO.	MORRISTOWN, N.J.	07960
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
81312	WINCHESTER ELECTRONICS DIV. LITTON IND. INC.	OAKVILLE, CONN.	06779
82142	AIRCO SPEER ELECT. COMP.	DU BOIS, PA.	15801
90733	SAN FERNANDO ELECT. MFG. CO.	SAN FERNANDO, CALIF.	91341
98291	SEALECTRO CORP.	MAMARONECK, N.Y.	10544
99800	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052

TABLE 6-5
PART NUMBER-NATIONAL STOCK NUMBER
CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
[illegible]	96733	5910-00-244-7171	0180-0116	28480	5910-00-809-4701
CV2059X7R102M	80031	5910-01-022-6482	0180-0197	28480	5910-00-850-5355
MC1439G	04713	5962-00-252-0225	0180-0228	28480	5910-00-719-9907
MC4001P	04713	5962-00-455-1814	0180-1735	28480	5910-00-430-6016
RA30231051	15636	5945-00-233-1542	0683-0565	28480	5905-00-931-1066
RDM15E430J3C	72136	5910-00-195-4107	0698-0082	28480	5905-00-974-6075
RDM15F101J3C	72136	5910-00-463-5949	0698-0083	28480	5905-00-407-0052
R2846-1	15636	5945-00-448-6876	0698-0085	28480	5905-00-998-1814
SN7400N	01295	5962-00-865-4625	0698-3132	28480	5905-00-828-0388
SN7474N	01295	5962-00-106-4287	0698-3150	28480	5905-00-481-1357
SZ10939-134	04713	5961-00-912-3099	0698-3151	28480	5905-00-246-8634
SZ10939-38	04713	5961-00-350-2205	0698-3153	28480	5905-00-974-6081
0140-0198	28480	5910-00-914-2605	0698-3154	28480	5905-00-891-4215
0160-0157	28480	5910-00-961-9591	0698-3157	28480	5905-00-433-6904
0160-0158	28480	5910-00-497-7598	0698-3158	28480	5905-00-858-8927
0160-2055	28480	5910-00-211-1611	0698-3159	28480	5905-00-407-0053
0160-2199	28480	5910-00-244-7164	0698-3161	28480	5905-00-974-6082
0160-2200	28480	5910-00-195-4107	0698-3429	28480	5905-00-407-0075
0160-2204	28480	5910-00-463-5949	0698-3430	28480	5905-00-420-7136
0160-2208	28480	5910-00-430-5685	0698-3438	28480	5905-0-974-6080
0160-2226	28480	5910-00-885-6540	0698-3440	28480	5905-00-828-0377
0160-2236	28480	5910-00-444-6724	0698-3443	28480	5905-00-194-0341
0160-2265	28480	5910-00-444-6725	0698-3446	28480	5905-00-974-6083
0160-2306	28480	5910-00-883-6281	0698-3453	28480	5905-00-078-1548
0160-2327	28480	5910-00-244-7171	0698-3498	28480	5905-00-478-2244
0160-2437	28480	5910-00-431-3956	0698-3510	28480	5905-00-407-0107
0160-3036	28480	5940-00-138-1326	0698-7195	28480	5905-00-161-8921
0160-3447	28480	5910-00-913-0802	0698-7229	28480	5905-01-009-7560
0160-3456	28480	5910-01-014-2874	0757-0159	28480	5905-00-830-6677
0160-3876	28480	5910-00-348-2617	0757-0180	28480	5905-00-972-4907
0170-0040	28480	5910-00-829-0245	0757-0274	28480	5905-00-858-9105
0180-0058	28480	5910-00-027-7069	0757-0280	28480	5905-00-853-8190

TABLE 6-5
PART NUMBER-NATIONAL STOCK NUMBER
CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER
0757-0290	28480	5905-00-858-8826
0757-0294	28480	5905-00-974-5709
0757-0316	28480	5905-00-981-7475
0757-0317	28480	5905-00-244-7189
0757-0346	28480	5905-00-998-1906
0757-0394	28480	5905-00-412-4036
0757-0399	28480	5905-00-929-7774
0757-0401	28480	5905-00-981-7529
0757-0402	28480	5905-00-405-8091
0757-0405	28480	5905-00-493-0738
0757-0417	28480	5905-00-858-9417
0757-0418	28480	5905-00-412-4037
0757-0421	28480	5905-00-891-4219
0757-0438	28480	5905-00-929-2529
0757-0439	28480	5905-00-990-0303
0757-0442	28480	5905-00-998-1792
0757-0447	28480	5905-00-981-7530
0757-0458	28480	5905-00-494-4628
0757-0461	28480	5905-00-089-7577
0757-0465	28480	5905-00-904-4412
0757-1000	28480	5905-00-057-8480
0757-1094	28480	5905-00-917-0580
08555-20093	28480	5999-00-08-8444
08660-80005	28480	5950-00-443-9518
1025-20	99800	5950-00-059-5920
1200-0063	28480	5990-00-937-4420
1205-0011	28480	5990-00-789-3794
1250-0901	28480	5935-00-477-1147
1250-0914	28480	5935-00-434-3040
1251-2034	28480	5935-00-267-2973
1251-2262	28480	5935-00-026-0952
1251-3087	28480	5999-01-079-9981
131-149	02660	5999-00-479-8176
1820-0054	28480	5962-00-138-5248
1820-0077	28480	5962-00-138-5250
1820-0201	28480	5962-00-252-0225
1853-0015	28480	5961-00-927-0845
1853-0020	28480	5961-00-904-2540
1853-0213	28480	5961-00-937-1409
1854-0071	28480	5961-00-137-4608
1854-0247	28480	5961-00-464-4049
1854-0345	28480	5961-00-401-0507
1854-0361	28480	5961-00-400-5973
1854-0404	28480	5961-00-408-9807
1855-0020	28480	5961-00-105-8867
1901-0025	28480	5961-00-978-7468
1901-0535	28480	5961-00-451-8685
1902-0041	28480	5961-00-858-7372
1902-0048	28480	5961-00-912-3099
1902-3036	28480	5961-00-350-2205
1910-0016	28480	5961-00-954-9182
2N3640	80131	5961-00-927-0845
2N4236	80131	5961-00-937-1409
2N4239	80131	5961-00-400-5973
2N5179	80131	5961-00-401-0507
2100-1754	28480	5905-00-407-0077
2100-1755	28480	5905-00-407-0078
2100-1759	28480	5905-00-221-7472
2100-2413	28480	5905-00-138-5086
2100-2922	28480	5905-00-476-5797
2100-2932	28480	5905-00-476-5718
2100-2933	28480	5905-00-476-5796
2100-3113	28480	5905-00-470-3420
251-06-30-400	71785	5905-00-405-7709

TABLE 6-5
PART NUMBER-NATIONAL STOCK NUMBER
CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
252-10-30-300	71785	5935-00-267-2973			
252-12-30-300	71785	5935-00-448-2236			
252-15-30-008	71785	5935-00-138-5209			
5020-0176	28480	5970-00-531-7134			
5040-0306	28480	5970-00-470-7622			
9100-1627	28480	5950-00-475-4996			
9100-2247	28480	5950-00-405-3735			
9140-0158	28480	5950-00-059-5920			
9140-0237	28480	5950-00-431-3216			
9170-0029	28480	5950-00-406-6419			

SECTION VII

MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information for adapting this manual to instruments for which the content does not apply directly.

7-3. To adapt this manual to your instrument, refer to Table 7-1 and make all of the manual changes listed opposite your instrument serial number. Perform these changes in the sequence listed.

7-4. Refer to paragraph 7-8 for manual changes pertaining to later aerial numbered instruments.

Table 7-1. Manual changes by Serial Number

Serial Prefix or Number	Make Manual Changes	Serial Prefix or Number	Make Manual Changes
1317A	A	1214A	A - F
1307A	A, B	1201A	A - G
1250A	A - C	1150A	A - H
1249A	A - D	1110A	A - I
1223A	A - E		

7-5. MANUAL CHANGE INSTRUCTIONS

7-6. **Unless otherwise noted, make manual changes in the alphabetical order in which they appear until the serial prefix of your instrument is reached.**

7-7. Table 7-3 **provides a cross reference of assemblies to changes.**

CHANGE A

Page 8-19, Figure 8-26 (A10 assembly)

Change part number to 86601-60008 and exchange part number to 86601-60104 Refer to Figure 7-2 for a partial schematic. Component part numbers and reference designators do not change

CHANGE B

Page 8-17, Figure 8-24 and Table 6-3 (A9 assembly)

Delete A9R37. Replace with printed circuit trace.

CHANGE C

Table 6-3

Change A3J1 and A3J2 to: 1250-0901 CONNECTOR RF BULKHEAD 15558 1104 D

CHANGE C (Cont'd)

Table 6-3 (Cont'd)
Change A5J1 and A5J2 to: 1250-0901 CONNECTOR: RF BULKHEAD 15558 1104/D
Delete: 86601-00051, BRACKET: MIXER 28480 86601-00051.
86601-20080, GUIDE: PLUG-IN 28480 86601-20080.
86601-00052, COVER: HALF 28480 86601-00052.
Add: 86601-00006, BRACKET: MIXER 28480 86601-00006
86601-00029, COVER, OUTER 28480 86601-00029.

CHANGE D

Table 6-3
Change A1M1 part number to 1120-1561 (Option 001 1120-1563)

Page 8-17, Figure 8-24 and Table 6-3 (A3 assembly)
Change A3R4 to 0757-0442 R:FXD MET F:M 10.0 K OHM 1% 1/8 W.

Page 8-17, Figure 8-24 and Table 6-3 (A9 assembly)
Change A9R32 to 2100-2522 R:VARCERMET 10K OHM 10% LIN 1/2W.

CHANGE E

Page 8-13, Figure 8-17 (A5 assembly)
Move inductive bead A5A1Z1 from the Base of A5A1Q1 to the Base of A5A1Q2.

CHANGE F

Page 8-13, Figure 8-17, Table 6-1 and Table 6-3 (A5 assembly)
Change part number to 86601-60064 and exchange part number to 36601-60114.
Delete: A5J4, A5C3, A5A1C10, ASA1R10, A5A1K1.
Relabel the input to A5J1 CNTRL, change the wire color code to 80 and make the input symbol 4A.
Connect the lead from A5J1 to A1A5R9.

NOTE

If your instrument has serial prefix 110A or 1150A do not make these changes in your manual.

CHANGE G

Table 6-3
Change A1M1 part number to 1120-1545 (Option 001 1120-1553).
Change 86601-00034 to 86601-00001.
86601-00036 to 86601-00002.
86601-00035 to 86601-00028.
86601-20069 to 86601-20016.
86601-20070 to 36601-20051.
86601-40018 to 86601-40017.

CHANGE H

Page 8-13, Figure 8-17 and Table 6-1 (A5 assembly)
Change part number to 86601-60016 and exchange part number to 86601-60105.
Refer to Figure 7-3 for schematic, Figure 7-4 for component locations and Table 7-2 for replaceable parts.

CHANGE H (Cont'd)

Page 8-17, Figure 8-24 and Table 6-1 (A9 assembly)
Change part number to 86601-60005 and exchange part number to 86601-60102.
Refer to Figure 7-5 for schematic, Figure 7-6 for component locations and Table 7-2 for replaceable Parts.

Page 8-17, Figure 8-24 and Table 6-1 (A3 assembly)
Change part number to 86601-60019 and exchange part number to 86601-60108.
Refer to Figure 7-7 for schematic, Figure 7-8 for component locations and Table 702 for replaceable parts.

Page 8-13, Figure 8-17 and Table 6-1
Delete the A20 assembly 86601-60066.

CHANGE I

Page 8-13, Figure 8-17 and Table 6-3 (A4 assembly)
Change A4A1 and A4A2 components as follows:

C1 and C4 to 24 pF 0160-2266	R2 and R6 to 3830 ohms 0698-3153
C2 to .001 uF 0160-3456	R4 and R7 to 215 ohms 0698-3441
C5 and C7 to 1000 pF 0160-2327	Q1 and Q2 to 1854-0431

Delete the inductive bead, Z1, part number 9170-0029 from the base lead of A4A2Q2.

Page 5-2, Paragraph 5-14
Substitute the following procedure.

RF OUTPUT METER CALIBRATION

REFERENCE: Service Sheets 3 and 4.

DESCRIPTION: The rf output meter reading is adjusted at +3 and -7 dBm to ensure tracking across the range of the VERNIER control.

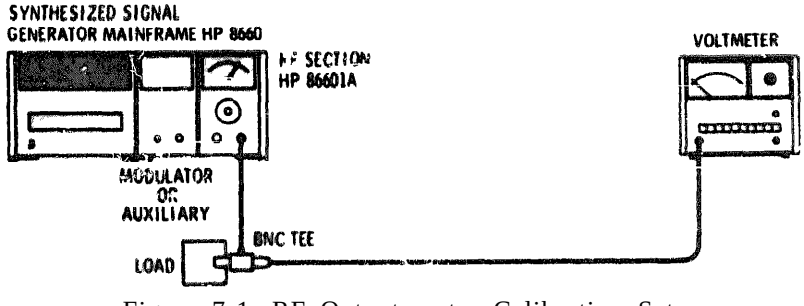


Figure 7-1. RF Output meter Calibration Setup

RECOMMENDED TEST EQUIPMENT:

Broadband Sampling Voltmeter	HP 3406A
BNC Tee Connector	UG274B/U
50 Ohm Load	HP 1250-0.
Extender Cable	HP 11672-6

CHANGE I (Cont'd)

RF OUTPUT METER CALIBRATION (cont'd)

PROCEDURE:

1. Clean the Model 86601A meter face with anti-static solution. (Recommended: "STATNUL" manufactured by Weston Instruments Inc., Newark, NJ.)
2. Connect the BNC Tee connector to the 86601A OUTPUT, the 50 ohm load and the Broadband Sampling Voltmeter as shown in Figure 5-1.
3. Set the OUTPUT RANGE switch to +10 dBm and the VERNIER full clockwise.
4. Set the mainframe center frequency to 50 MHz.
5. Set the REF ADJ control (A9R2) for a +13.5 dBm reading on the Broadband Sampling Voltmeter
6. Adjust the VERNIER control counterclockwise to obtain a reading of +3 dBm on the Broadband Sampling Voltmeter.
7. Set the MTR ADJ Contro1 (A9R32) for a reading on the Model 86601A output meter of +13 dBm
8. Adjust the VERNIER control counterclockwise for a reading on the Model 86601A output meter -7 dBm.
9. Set the DET control (A2R34) for a +3 dBm reading on the Broadband Sampling Voltmeter.
10. Repeat steps 5 through 9 until no further adjustment is necessary.

Table 7-2. Assembly-Change Cross Reference Index

Assembly	Change								
	A	B	C	D	E	F	G	H	I
A1				X			X		
A3			X	X				X	
A4									X
A5			X		X	F		X	
A9	X	X		X				X	
A10								X	

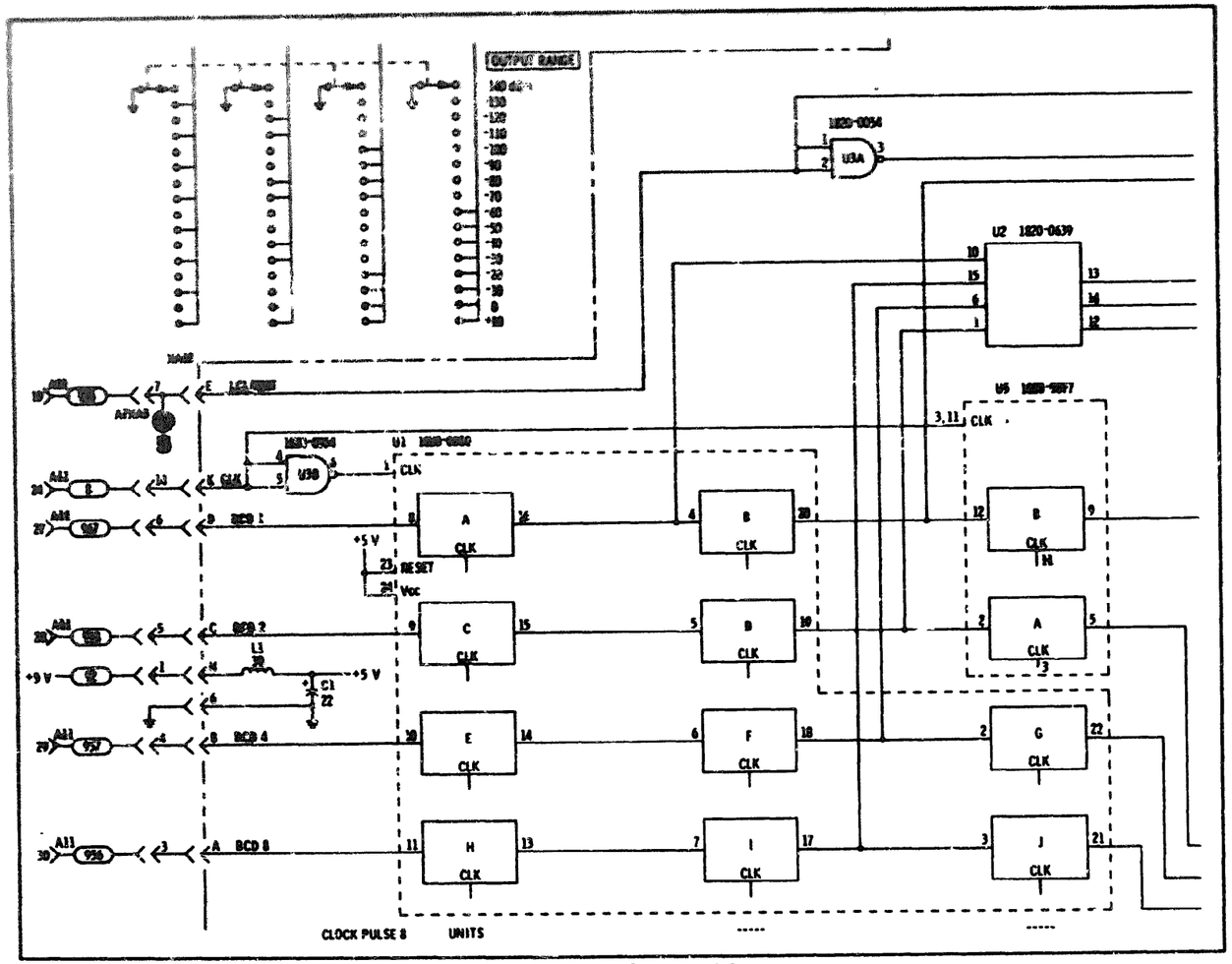


Figure 7-2. Partial Logic Schematic

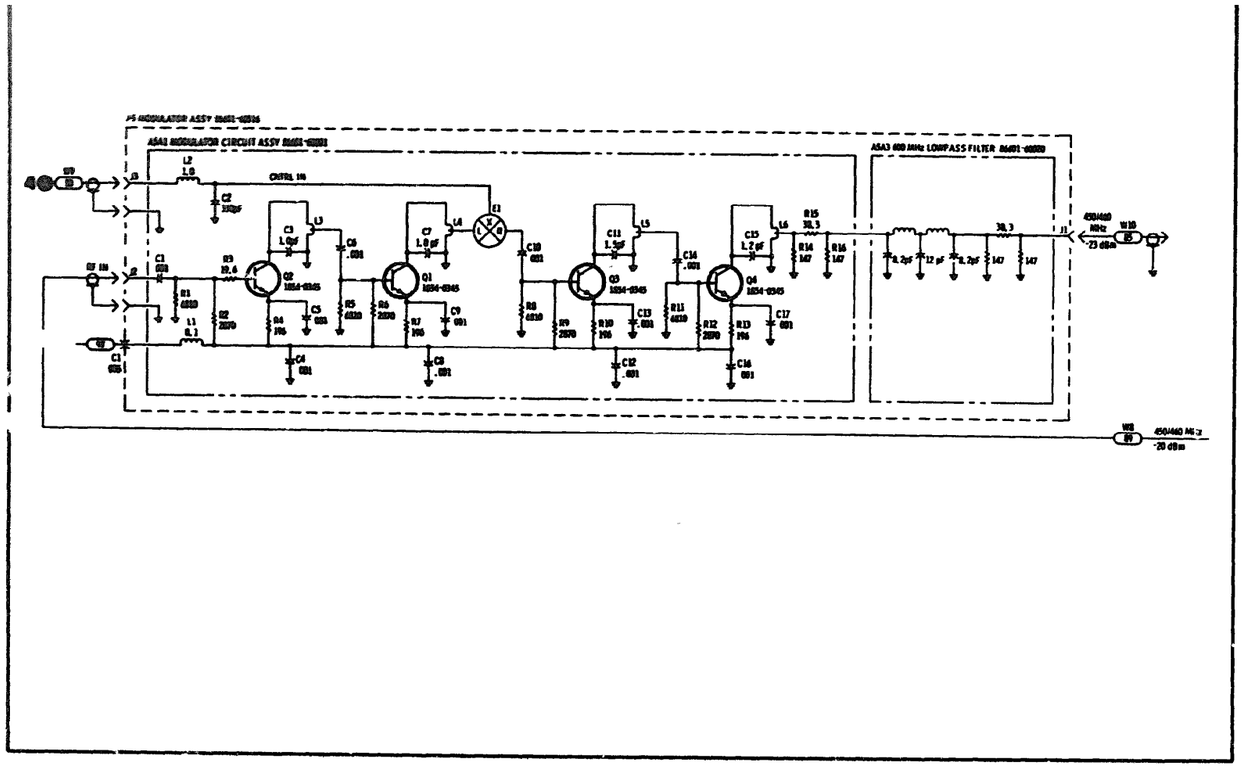


Figure 7-3. A5 Modulator Assembly 86601-60001

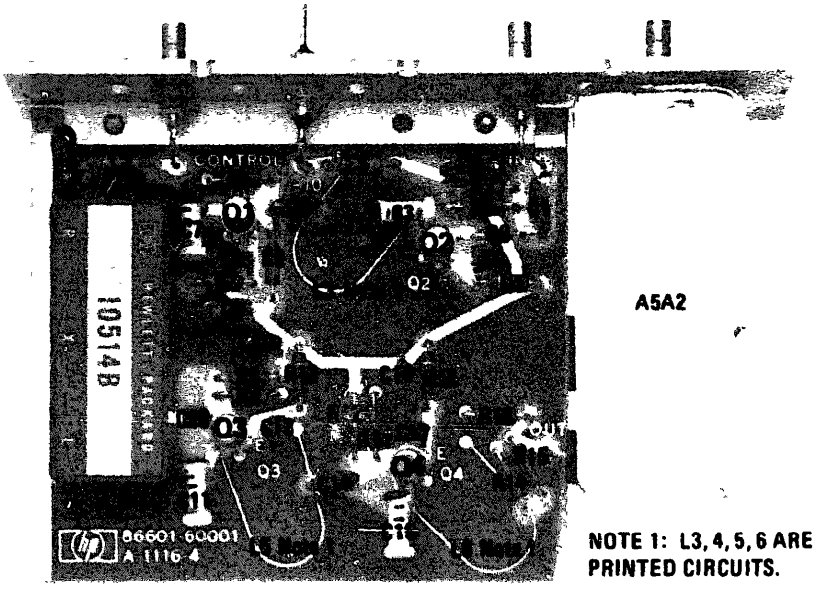


Figure 7-4. Modulator Assembly Component Locations

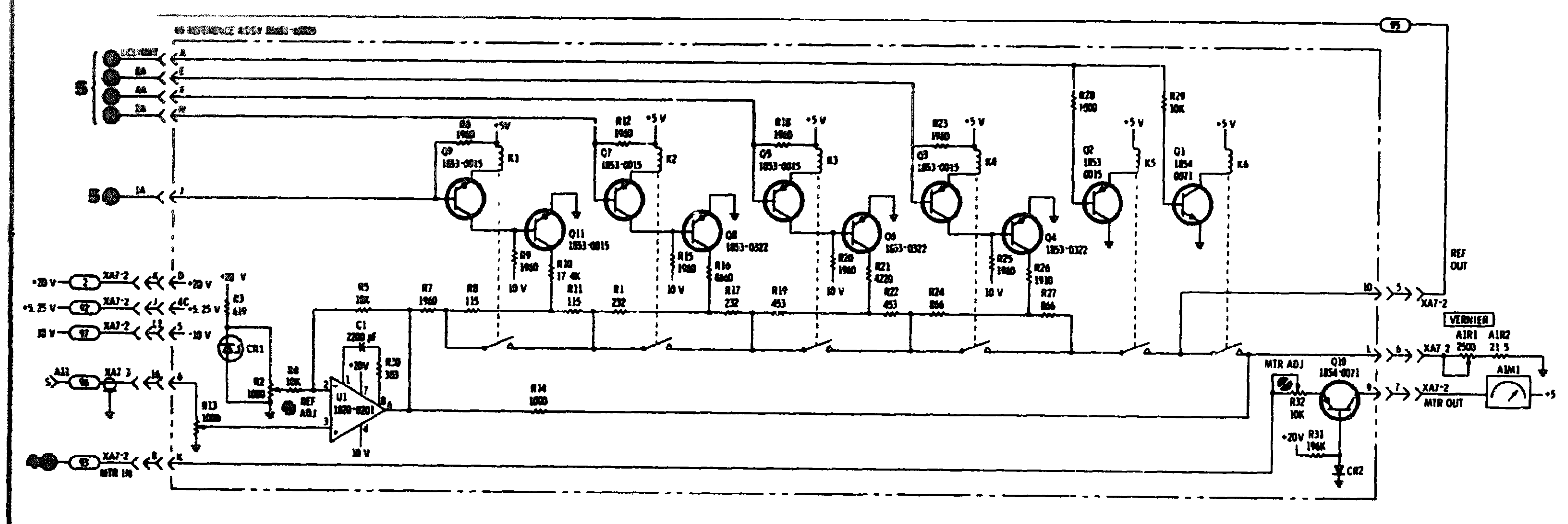


Figure 7-5. Reference Assembly

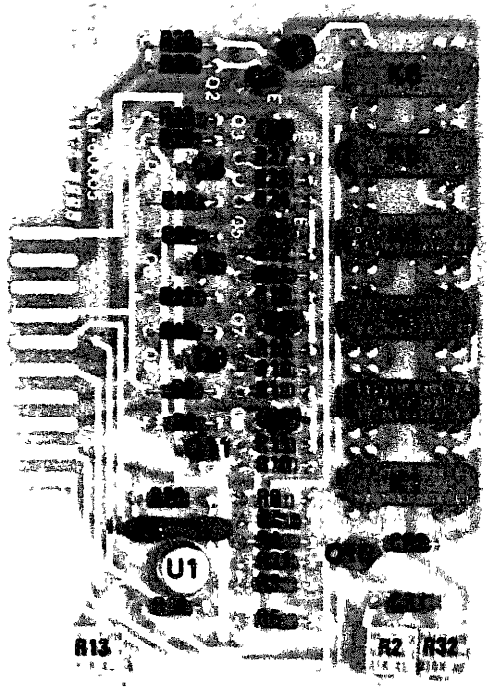


Figure 7-6. Reference Assembly Component Location

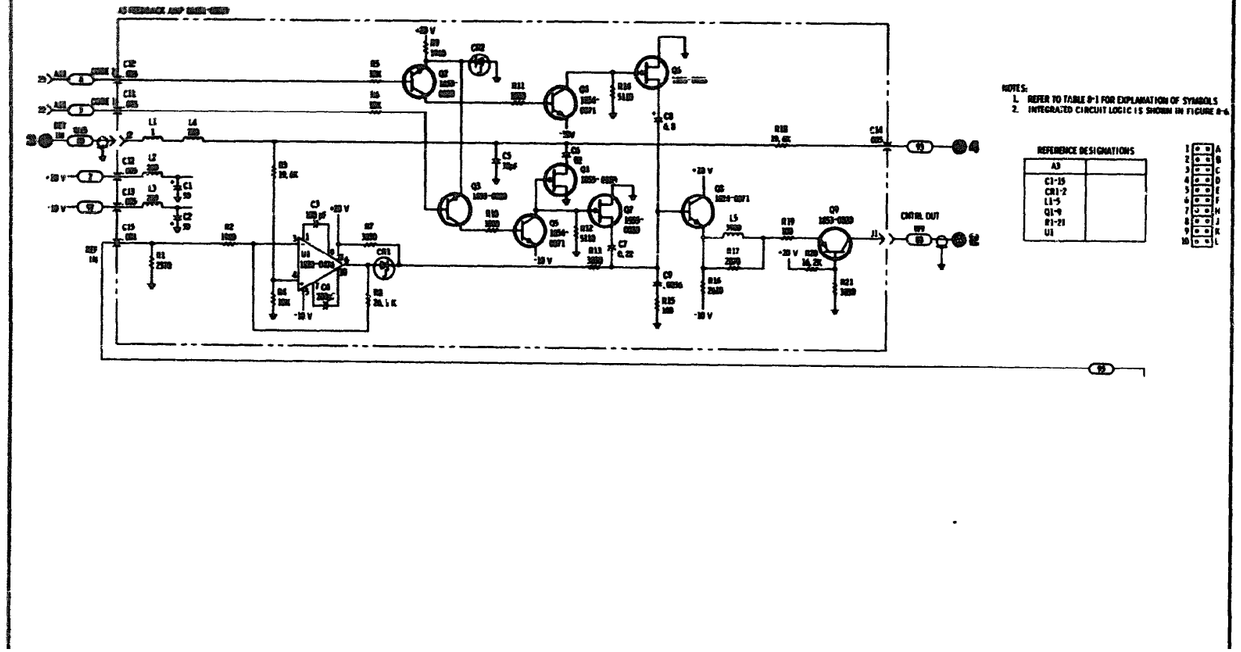


Figure 7-7. Feedback Amplifier

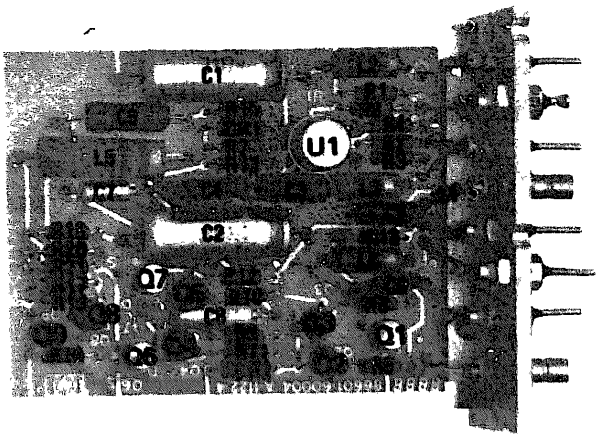


Figure 7-8. Feedback Amplifier Component Locations

Manual Changes

7-8. The manual changes given below are for correcting errors and for adapting the manual to instruments containing improvements made after the printing of the manual. Make all ERRATA corrections first and then make all appropriate serial number related changes indicated in the table.

Serial Prefix or Number	Make Manual Changes
1443A	1
1508A	1, 2
1520A	1, 2, 3
1524A	1 through 4
1551A	1 through 5
1616A	1 through 6

Serial Prefix or Number	Make Manual Changes
► 1623A	1 through 5

► NEW ITEM

ERRATA

Page 1-2, Table 1-1:

"Change the heading "Spurious Signals" to "Spurious Signals (CW and AM only)".
Change the heading "Signal-to-Phase Noise Ratio" to "Signal-to-Phase Noise Ratio (CW and AM only)".
Change the heading "Residual FM" to "Residual FM (CW and AM only)".

Page 4-6, paragraph 4-15:

Change the first sentence of the SPECIFICATION to "All non-harmonically related spurious signals (in the CW and AM modes) are at least 80 dB below the selected output signal."

Page, paragraph 4-16:

Add the following to the SPECIFICATION sentence "in the CW and AM modes only".

Page 4-10, paragraph 4-18:

Add the following to the SPECIFICATION sentence "in the CW and AM modes only"

Page 4-13, Figure 4-11:

Change the Variable-Phase Generator's output to the sine-wave output connector (one connector to the left of the output shown).

Page 6-3, Table 6-3:

Change A1M1 HP Part Numbers to 1120-0540 (EXCEPT OPTION 001) and 1120-0542 (OPTION 001 ONLY)

Page 6-5 and 6-6, Table 6-3:

Change the A4 and A5 parts list as shown in the table in this supplement.

Page 6-8, Table 6-3:

Add A20, 86601-60066, 600 MHz Low Pass Filter Assembly

CHANGE 1

Page 6-8:

Replace the parts list for the A8 assembly with the new portion of Table 6-3 found in this supplement.

Page 8-21:

Replace Figure 8-27 with the new component location diagram found in this supplement.
Replace Figure 8-28 with the new schematic found in this supplement.

CHANGE 2

Change A1M1 HP Part Number 1120-0540 (EXCEPT OPTION 001) to 1120-0543 (EXCEPT OPTION 001).

CHANGE 3

Page 6-5, Table 6-3:

Change A4A1C1, A4A1C4, A4A2C1, and A4A2C4 to 0160-3875, CAPACITOR FXD 22 pF ±5% 200 SVDC CER, 28480, 0160-3875.

Add to A4A1 miscellaneous, 1200-0172, 2, INSULATOR XSTR TO-18, 28480, 1200-0172.

Add to A4A2 miscellaneous, 1200-0172, 2, INSULATOR XSTR TO-18, 28480, 1200-0172.

Page 6-6, Table 6-3:

Change A5A1C1, A5A1C4, A5A2C1, and A5A2C5 to 0160-3875, CAPACITOR FXD 22 pF ±5% 200 WVDC CER, 28480, 0160-3875.

Delete A5A1Z1

Add to A5A1 miscellaneous, 1200-0172, 2, INSULATOR XSTR TO-18, 28480, 1200-0172.

Add to A5A2 miscellaneous, 1200-0172, 2, INSULATOR XSTR TO-18, 28480, 1200-0172.

Page 6-8, Table 6-3:

Change A8R5, R6, R16, R16, R25 and R26 to 0683-0335, RESISTOR 3.3 5% .25W FC TC--400/+500, 01121, CB33G5.

Page 8-13, Figure 8-13 (Service Sheet 2):

Change the value of the following capacitors to 22 pF: A4A1C1, A4A1C4, A4A2C1, A4A2C4, A5A1C1, ABA1C4, **A5A2C1, and A5A2C5.**

Page 8-21, Figure 8-28:

Change the value of A8R5, R6, R15, R16, R25, and R26 to 3.3 ohms.

NOTE

Refer to Change 1 of this supplement.

CHANGE 4

Page 6-1, Table 6-1:

Change the A13 Programmable Attenuator to A13 Attenuator.

Change the New Part No. of the A13 Attenuator to 86603-60043.

Page 6-9, Table 6-3 and page 8-21, Figure 8-28:

Change the HP Part Number of A13 to 86603-60043. The Exchange Part No. is unchanged.

Table 6-3. Replaceable Parts (P/O Errata; Page 1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4	86601-60023	1	FILTER ASSEMBLY, ACTIVE	28480	86601-60023
	86601-00009	1	COVER, ACTIVE FILTER ASSY	28480	86601-00009
	86601-20026	1	STRIPLINE	28480	86601-20026
	86601-20035	1	HOUSING, ACTIVE FILTER ASSY	28480	86601-20035
	86601-20037	1	INSERT, ACTIVE FILTER ASSY	28480	86601-20037
	86601-40007	2	BOTTOM, ACTIVE FILTER DIEL.	28480	86601-40007
A4C1	0121-0465	4	C:VAR AIR 10 PF	28480	0121-0465
A4C2	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A4C3	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A4C4	0121-0465		C:VAR AIR 10 PF	28480	0121-0465
A4C5	0160-3036	5	CAPACITOR-FXD 5000PF +80-20% 200WVDC CER	28480	0160-3036
A4C6	0160-3036		CAPACITOR-FXD 5000PF +80-20% 200WVDC CER	28480	0160-3036
A4J1	1250-0901	2	CONNECTOR-RF SMB M SGL HOLE FR	2K497	700166
A4J2	1250-0901		CONNECTOR-RF SMB M SGL HOLE FR	2K497	700166
A4A1	86601-60011	1	BOARD ASSEMBLY, INPUT AMPLIFIER	28480	86601-60011
A4A1C1	0160-3878	20	CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A1C2	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A1C3	0121-0447	8	CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	TS-TRIKO-03 1.5-2.5
A4A1C4	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A1C5	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A1C6	0121-0447		CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	TS-TRIKO-03 1.5-2.5
A4A1C7	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A1L1	9100-2247	4	COIL-FXD MOLDED RF CHOKE 100UH 10%	24226	10/100
A4A1L2	08660-80005	8	INDUCTOR	28480	08660-80005
A4A1L3	08660-80005		INDUCTOR	28480	08660-80005
A4A1Q1	1854-0345	3	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A1Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A1R1	0698-3429	3	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19A6-F
A4A1R2	0698-3151	8	RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A4A1R3	0757-0439	8	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A1R4	0698-3440	8	RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4A1R5	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A1R6	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A4A1R7	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4A1R8	0698-3443	2	RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A4A1R9	0757-0294	1	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A4A1R10	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A4A2	86601-60012	1	BOARD ASSEMBLY, OUTPUT AMPLIFIER	28480	86601-60012
A4A2C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A2C2	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A2C3	0121-0447		CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	TS-TRIKO-03 1.5-2.5
A4A2C4	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A2C5	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A2C6	0121-0447		CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	TS-TRIKO-03 1.5-2.5
A4A2C7	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A4A2L1	9100-2247		COIL-FXD MOLDED RF CHOKE 100UH 10%	24226	10/100
A4A2L2	08660-80005		INDUCTOR	28480	08660-80005
A4A2L3	08660-80005		INDUCTOR	28480	08660-80005
A4A2Q1	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A2Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A2R1	0698-3429		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19A6-F
A4A2R2	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A4A2R3	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A2R4	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4A2R5	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A2R6	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A4A2R7	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4A2R8	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A4A2R9	0757-0294		RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A4A2R10	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A4A3	0698-3429		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19A6-F
A4A3R1	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A4A3R2	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R3	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4A3R4	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A4A3R5	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A4A3R6	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4A3L1	9170-0029	1	CORE, MAG, SHIELDING BEAD 150 OD .047	84411	56-590-4A42/4A
A5	86601-60020	1	MODULATOR ASSEMBLY	28480	86601-60020
	86601-20045	1	DIVIDER, PLANAR	28480	86601-20045
	86601-20072	1	COVER, MODULATOR ASSEMBLY	28480	86601-20072
A5C1	0160-3036		CAPACITOR-FXD 5000PF +80-20% 200WVDC CER	28480	0160-3036
A5C2	0160-3036		CAPACITOR-FXD 5000PF +80-20% 200WVDC CER	28480	0160-3036
A5C3	0160-3036		CAPACITOR-FXD 5000PF +80-20% 200WVDC CER	28480	0160-3036
A5C4	1250-1196	4	CONNECTOR-SMB M SGL HOLE FR	98291	52-040-4010
A5C5	1250-1196		CONNECTOR-SMB M SGL HOLE FR	98291	52-040-4010
A5C6	1250-1196		CONNECTOR-SMB M SGL HOLE FR	98291	52-040-4010
A5C7	1250-1196		CONNECTOR-SMB M SGL HOLE FR	98291	52-040-4010

Table 6-3. Replaceable Parts (P/O Errata; Page 2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A1	86601-60070	1	BOARD ASSEMBLY, MODULATOR	28480	86601-60070
A5A1C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C2	0121-0447		CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	75-TRIKO-03 1.5-2.5
A5A1C3	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C4	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C5	0121-0447		CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	75-TRIKO-03 1.5-2.5
A5A1C6	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C7	0160-2208	2	CAPACITOR-FXD 330PF +-5% 300WVDC MICA	28480	0160-2208
A5A1C8	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A1C9	0160-3466	2	CAPACITOR-FXD 100PF +-10% 100WVDC CER	28480	0160-3466
A5A1C10	0160-3456	1	CAPACITOR-FXD 100PF +-10% 100WVDC CER	28480	0160-3456
A5A1E1	105148	2	MIXER, 500 MHZ	28480	105148
A5A1K1	0490-1013	1	RELAY: REED; DC .25A 25W CONTS 5V COIL	28480	0490-1013
A5A1L1	08660-80005		INDUCTOR	28480	08660-80005
A5A1L2	08660-80005		INDUCTOR	28480	08660-80005
A5A1L3	9100-2247		COIL-FXD MOLDED RF CHOKE 100MH 10%	24226	10/100
A5A1L4	9140-0138	2	COIL-FXD MOLDED RF CHOKE 1UH 10%	24226	10/101
A5A1Q1	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A5A1Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A5A1R1	0698-3429		RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A5A1R2	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A5A1R3	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A5A1R4	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A5A1R5	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A5A1R6	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A5A1R7	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A5A1R8	0757-0280	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5A1R9	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5A1R10	0757-1090	1	RESISTOR 91.1 1% .5W F TC=0+-100	19701	MF7C1/2-T0-91R1-F
A5A1Z1	9170-0029		CORE, MAG, SHIELDING BEAD, .138 OD .047	02114	56-590-65A2/4A
A5A2	86601-60060	1	BOARD ASSEMBLY, MODULATOR II	28480	86601-60060
A5A2C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A2C2	0121-0447		CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	75-TRIKO-03 1.5-2.5
A5A2C3	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A2C4	0121-0447		CAPACITOR: VAR; TRMR; CER; 1.5/2.5PF	00865	75-TRIKO-03 1.5-2.5
A5A2C5	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A2C6	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A2C7	0160-3466		CAPACITOR-FXD 100PF +-10% 100WVDC CER	28480	0160-3466
A5A2C8	0160-2208		CAPACITOR-FXD 330PF +-5% 300WVDC MICA	28480	0160-2208
A5A2C9	0160-3878		CAPACITOR-FXD 1000PF +-20% 100WVDC CER	28480	0160-3878
A5A2E1	105148		MIXER, 500 MHZ	28480	105148
A5A2L1	08660-80005		INDUCTOR	28480	08660-80005
A5A2L2	08660-80005		INDUCTOR	28480	08660-80005
A5A2L3	9100-2247		COIL-FXD MOLDED RF CHOKE 100MH 10%	24226	10/100
A5A2L4	9140-0138		COIL-FXD MOLDED RF CHOKE 1UH 10%	24226	10/101
A5A2Q1	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A5A2Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A5A2R1	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A5A2R2	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A5A2R3	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A5A2R4	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A5A2R5	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A5A2R6	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A5A2R7	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5A2R8	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5A2W1	86601-20067	1	CABLE, MODULATOR	28480	86601-20067

Table 6-3. Replaceable Parts (P/O Change 1)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8	86602-60040	1	ATTENUATOR DRIVER ASSY	28480	86602-60040
A8CR1	1901-0025	8	DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8CR2	1901-0025		DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8CR3	1901-0025		DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8CR4	1901-0025		DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8CR5	1901-0025		DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8CR6	1901-0025		DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8CR7	1901-0025		DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8CR8	1901-0025		DIODE-GEN PRP 100V 200MA	28480	1901-0025
A8Q1	1853-0213	4	TRANSISTOR PNP 2N4236 SI CHIP PD=1W	04713	2N4236
A8Q2	1854-0361	4	TRANSISTOR NPN 2N4239 SI PD=800MW	04713	2N4239
A8Q3	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8Q4	1854-0071	8	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q5	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A8Q6	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8Q7	1853-0213		TRANSISTOR PNP 2N4236 SI CHIP PD=1W	04713	2N4236
A8Q8	1854-0361		TRANSISTOR NPN 2N4239 SI PD=800MW	04713	2N4239
A8Q9	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q11	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A8Q12	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8Q13	1853-0213		TRANSISTOR PNP 2N4236 SI CHIP PD=1W	04713	2N4236
A8Q14	1854-0361		TRANSISTOR NPN 2N4239 SI PD=800MW	04713	2N4239
A8Q15	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8Q16	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q17	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A8Q18	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8Q19	1853-0213		TRANSISTOR PNP 2N4236 SI CHIP PD=1W	04713	2N4236
A8Q20	1854-0361		TRANSISTOR NPN 2N4239 SI PD=800MW	04713	2N4239
A8Q21	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8Q22	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q23	1854-0404		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A8Q24	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A8R1	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R2	0757-0159	8	RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R3	0757-0159		RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R4	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A8R5	0811-2815	4	RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R6	0811-2815		RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R7	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R8	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R9	0698-4002	4	RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8R10	0698-4002		RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8R11	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R12	0757-0159		RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R13	0757-0159		RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R14	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A8R15	0811-2815		RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R16	0811-2815		RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R17	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R18	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R19	0698-4002		RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8R20	0698-4002		RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8R21	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R22	0757-0159		RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R23	0757-0159		RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R24	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A8R25	0811-2815		RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R26	0811-2815		RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R27	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R28	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R29	0698-4002		RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8R30	0698-4002		RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8R31	0757-0280		RESISTOR 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A8R32	0757-0159		RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R33	0757-0159		RESISTOR 1K 1% .5W F TUBULAR	19701	MF7C1/2-T0-1R0-F
A8R34	0698-3440		RESISTOR 196 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-196R-F
A8R35	0811-2815		RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R36	0811-2815		RESISTOR 1.5 OHM 5% .5W PW TUBULAR	91637	RS1/2-T2-1R5-J
A8R37	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R38	0757-0401		RESISTOR 100 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-101-F
A8R39	0698-4002		RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8R40	0698-4002		RESISTOR 5K 1% .125W F TUBULAR	16299	C4-1/8-T0-5001-F
A8VR1	1902-3082		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=	04713	SZ 10939-2
A8VR2	1902-3082		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=	04713	SZ 10939-2
A8VR3	1902-3082		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=	04713	SZ 10939-2
A8VR4	1902-3082		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=	04713	SZ 10939-2

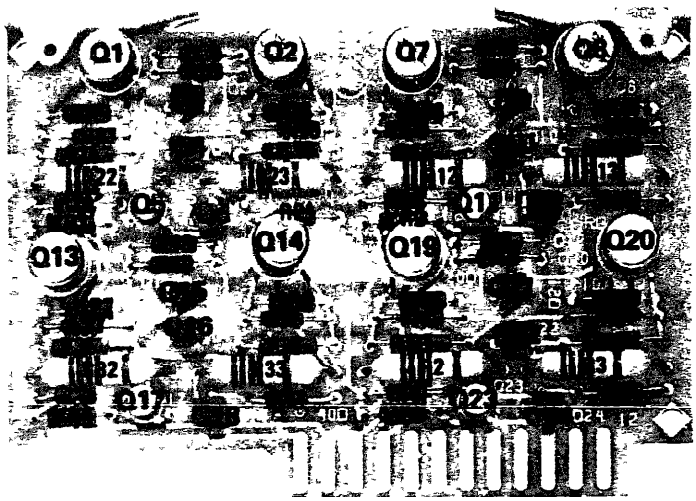


Figure 8-27. Attenuator Driver Component Locations (P/O Change 1)

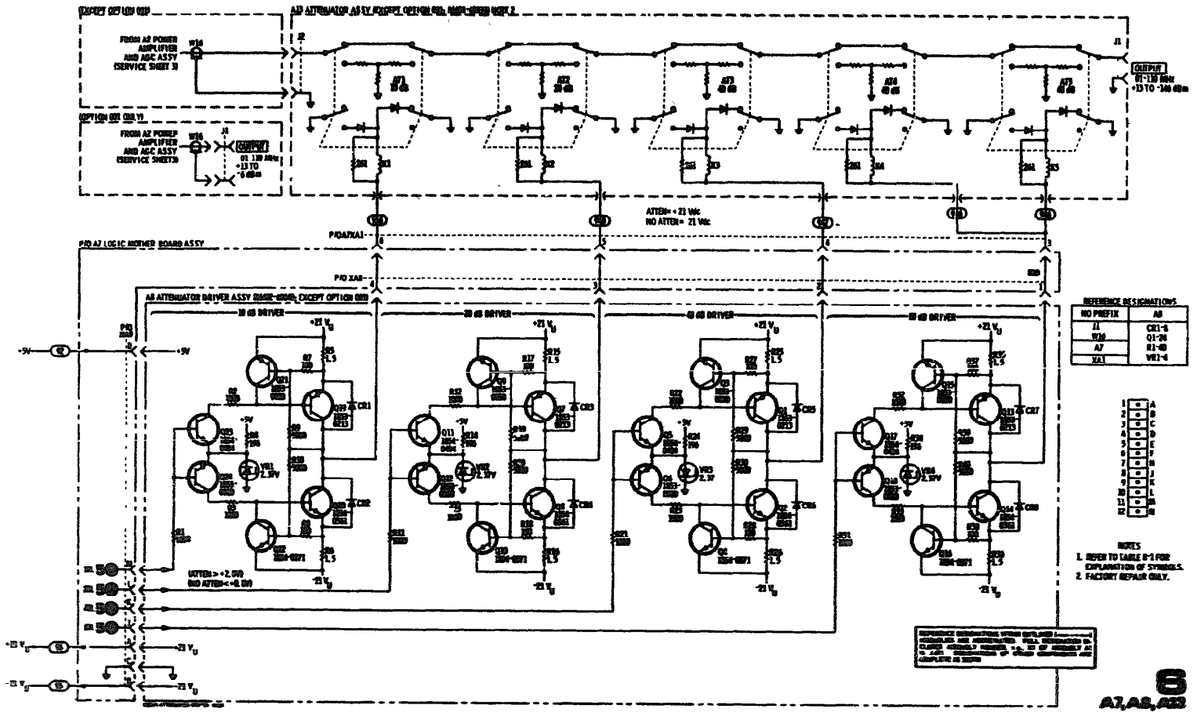


Figure 8-28. Attenuator Driver Assembly (P/O Change 1)

CHANGE 5

Page 6-8, Table 6-3 and page 8-21, Figure 8-28 (Service Sheet 6):

Delete A8R9, R10, R19, R20, R29, R30, R39 and R40.

CHANGE 8

Page 5-1:

Add the following paragraph:

FACTORY SELECTED COMPONENTS

Factory selected components are identified on the schematics **and parts list by** an asterisk which follows the reference designator. The normal value of the components are shown. The **manual change sheets will provide updated information pertaining to the selected components. Tabel 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.**

Page 5-1:

Add the following table:

Factory Selected Components

Reference Designator	Selected For	Normal Value Range	Service Sheet
A2R39	Minimum AM distortion at 90% AM depth with VERNIER control set for meter reading of −6 dB and OUTPUT RANGE switch set to +10 dBm.	400Ω to ∞	3
A5A1R1, A5A1R6, A5A2R1, A5A2R2, A5A2R6, A5A2R7, A5A2R8, and A5A2R12	Gain of ≥ 41 dB with +0.5 Vdc on the control input; ≤ 1 dB with +0.1 Vdc on the control line. Change the resistors as indicated in the Modulator Assembly Adjustments.	68.1Ω or omitted 68.1Ω or 511Ω 68.1Ω or omitted 0 or 26.1Ω 68.1Ω or 511Ω 68.1Ω or 511Ω 68.1Ω or omitted	2

Manual Changes

Page 5-10:
Add the following adjustment procedure.

5-19. MODULATOR ASSEMBLY ADJUSTMENT

REFERENCE: Service Sheet 2.

DESCRIPTION: The fixed dynamic range of the modulator is set so the gain extremes extend beyond specified limits. The gain extremes are set by selecting resistors with a specific control voltage input to the modulators.

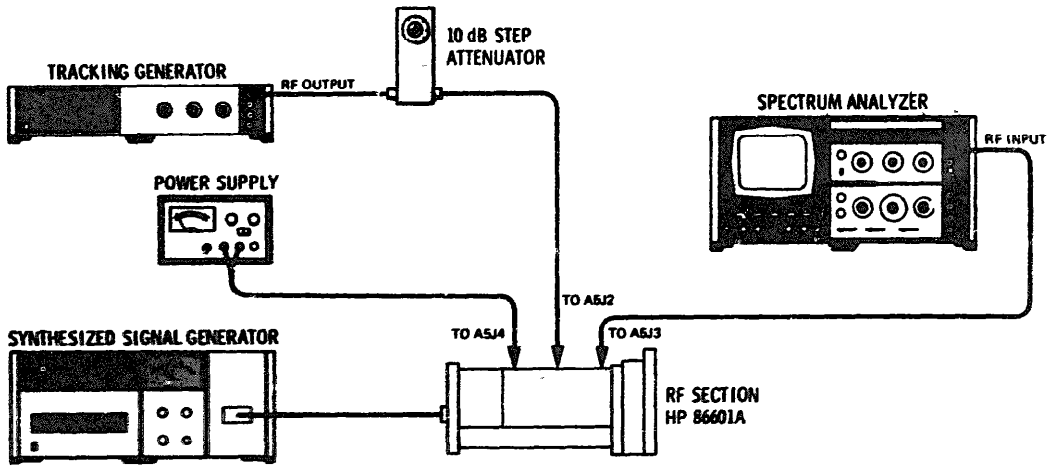


Figure 5-7. Modulator Assembly Adjustment Test Setup.

EQUIPMENT:

Tracking Generator	**HP 8444A**
Spectrum Analyzer	**HP 140T/8554L/8552B**
Electronic Counter	**HP 5245M/5253B**
Extender Cable	**HP 11672-60001**
10 dB Step Attenuator	**HP 355D**
Power Supply	**HP 6214A**

PROCEDURE:

1. **Remove the Model 86601A from the mainframe. Remove the cover and reconnect the Model 86601A with extender cable 11672-60001.**
2. **Connect the Tracking Generator to the Spectrum Analyzer. (Refer to the Tracking Generator Operating and Service Manual.)**
3. **Set the Spectrum Analyzer controls as follows: INPUT ATTENUATION 20 dB, LOG REF LEVEL +10 dBm, SCAN WIDTH PER DIVISION 2 MHz, SCAN TIME PER DIVISION 10 MILLISECONDS and BANDWIDTH 300 kHz.**
4. **Connect the Tracking Generator RF OUTPUT to the Electronic Counter with the Spectrum Analyzer in the ZERO scan mode.**
5. **Set the Spectrum Analyzer frequency to 455 MHz as indicated by the Electronic Counter.**
6. **Set the 10 dB step attenuator for 10 dB attenuation. Adjust the Tracking Generator LEVEL to a reference of −24 dBm as measured on the analyzer display**

CHANGE 6 (Cont'd)

7. Set the power supply voltage to +5.0 WC.

8. Connect the equipment as shown in Figure 5-7.

9. **Verify that the output is greater than or equal to +18 dBm. If the output is correct, proceed to step 10. Otherwise, change the following resistors in the order shown until the output is at least +18 dBm.**

Reference Designator	Change To
A5A1R1 A5A2R12	remove 511Ω
A5A2R1 A5A2R6	remove 511Ω
A5A1R6 A5A2R7	511Ω remove
A5A2R2 A5A2R8	0Ω (wire) 0Ω (wire)

10. **Set the power supply voltage to +0.10 Vdc. Verify that the output is less than or equal to −23 dBm. If the output is correct, the adjustment is complete. Otherwise, change the following resistors in the order shown until the output is the less than or equal to −23 dBm. If any resistors are changed, return to step 7 and recheck the levels in step 9.**

Reference Designator	Change To
A5A2R1 A5A2R6	68.1Ω 68.1Ω
A5A2R12 A5A2E1	68.1Ω 68.1Ω
A5A1R6 A5A2R7	68.1Ω 68.1Ω
A5A2R2 A5A2R8	26.1Ω 26.1Ω

Page 6-6, Table 6-6

Add A2R29, [illegible] RESISTOR 619 1% .125W T TC=0+100

Add A2 MISCELLANEOUS, 1205-0811, 1, HEAT DISSIPATOR SGL TO-5 TO-18 PKG (FOR USE WITH A2Q3-5)

Add A2 MISCELLANEOUS, 1205-0811, 2, HEAT DISSIPATOR SGL TO-5 TO-18 PKG

CHANGE 6 (Cont'd)

Page 6-5 and 6-6, Table 6-3:

Change the parts list for the A5 Assembly as shown in the table.

Page 8-13, Figure 8-17 (Service Sheet 2):

Change the diagram as shown in the partial schematic.

Page 8-15, Figure 8-20 (Service Sheet 3):

Add A2R39*, 619 ohms, in parallel with A2CR5.

Table 6-3. Replaceable Parts (P/O Change 6; 1 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
[illegible]	[illegible]	1	MODULATOR ASSEMBLY	[illegible]	[illegible]
[illegible]	[illegible]	3	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2	MIXER, DOUBLE BALANCED [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		MIXER, DOUBLE BALANCED [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	4	CONNECTOR-RF [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CONNECTOR-RF [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CONNECTOR-RF [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CONNECTOR-RF [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	CABLE ASSEMBLY, MODULATOR	[illegible]	[illegible]
			[illegible]		
	[illegible]	1	[illegible]	[illegible]	[illegible]
	[illegible]	1	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 6-3. Replaceable Part (P/O Change 6; 2 of 2)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]

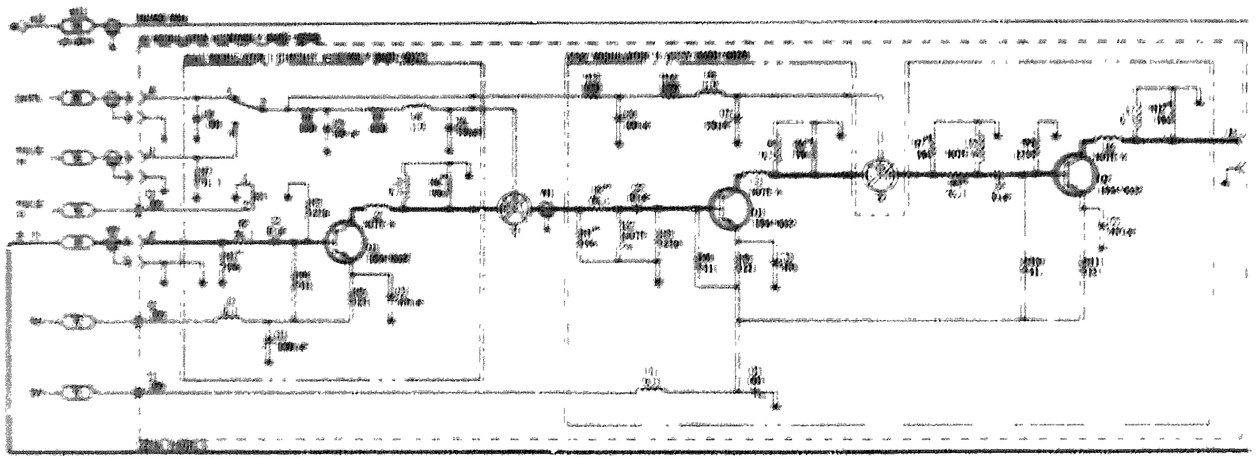


Figure 6-3. Filters, Mixers, and Modulator Schematics (partial schematic, part of Change 6)

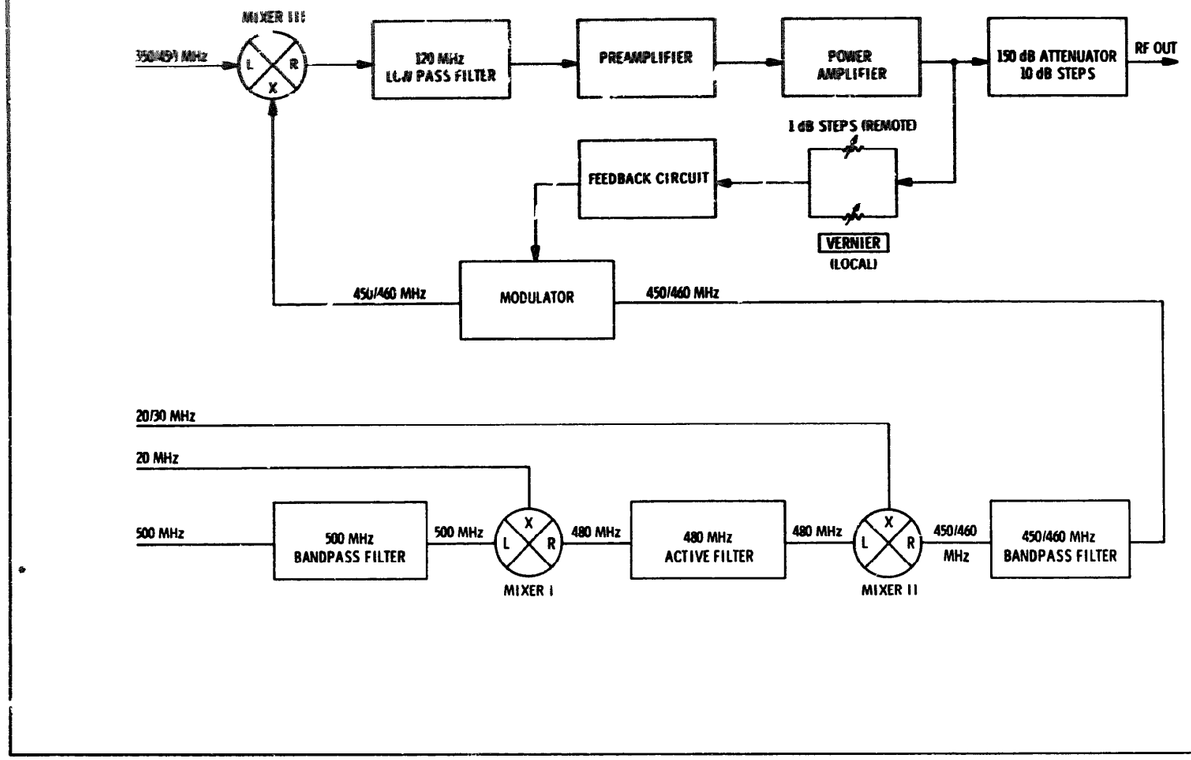


Figure 8-1. Model 86601A Simplified Block Diagram

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. **This section provides instructions for testing, troubleshooting and repairing the Hewlett-Packard Model 86601A RF Section. Information throughout this section is based on the assumption that the Model 86601A is interconnected with a Model 8660 Synthesized Signal Generator that is** functioning properly.

8-3. PRINCIPLES OF OPERATION

8-4. Figure 8-1, Simplified Block Diagram, and the following discussion illustrate the basic principles of the Model 86601A. More detailed information about principles of operation of the Model 86601A may be found in the text for Service Sheet 1. In addition, detailed information to the circuit level is provided on the individual service sheets.

8-5. The Model 86601A RF Section has no internal oscillators. The output frequency is developed by mixing and filtering the precise digitally controlled rf inputs from the mainframe. The inputs from the mainframe are:

a. A 500 MHz signal from the reference section.

b. A 20 MHz signal from the reference section which is coupled through the Modulation Section.

NOTE

In the FM mode the 20 MHz signal is generated in the Modulation Section.

c. A signal between 20.000001 and 30.00000 MHz (1 Hz resolution) from the SL1 Loop.

NOTE

In option 004 mainframes this signal is between 20.0001 and 30.0000 MHz (100 Hz resolution).

d. A signal between 350 and 450 MHz (10 MHz steps) from the RF Loop.

8-6. There are three mixers in the Model 86601A. Mixer I mixes the 500 MHz and the 20 MHz inputs to produce a 480 MHz output. The 480 MHz signal is amplified and filtered and then coupled to Mixer II where it is mixed with the 20 to 30 MHz signal from the mainframe SL1 Loop to provide a 450 to 460 MHz output. The output of Mixer II is filtered and amplified, and in the AM mode, modulated before it is coupled to Mixer III. In Mixer III the 450 to 460 MHz signal is mixed with the 350 to 450 MHz signal to produce the final output frequency which is between. .01 and 100.999999 MHz (.01 to 109.9999 MHz when option 004 mainframe is used).

8-7. The output of Mixer III is coupled through two 120 MHz low pass filters and a pre-amplifier to the power amplifier.

8-8. The power amplifier assembly contains an Automatic Gain Control circuit which controls a feedback amplifier in the leveling loop. Code 1 and Code 2 inputs from the mainframe DCU operate an electronic band switch to aid in leveling the rf output across the output range.

8-9. Three attenuators are used to control the output level of the Model 86601A. These attenuators function as follows:

a. In the local mode a 150 dB programmable attenuator, OUTPUT RANGE, controls the output level from +10 dBm to -140 dBm in 10 dB steps. A VERNIER control adds the capability of setting the output level to +13 dBm and to other points between the 10 dB steps.

b. In the remote mode the 150 dB **programmable attenuator is** remotely controlled **and the front panel control**s (OUTPUT RANGE **and VERNIER) are inoperat**ive. A1 dB per step **programmable attenuator in** the Model 86601A is **remotely programmed to se**t the output level **between the 10 dB steps of th**e 150 dB attenuator.

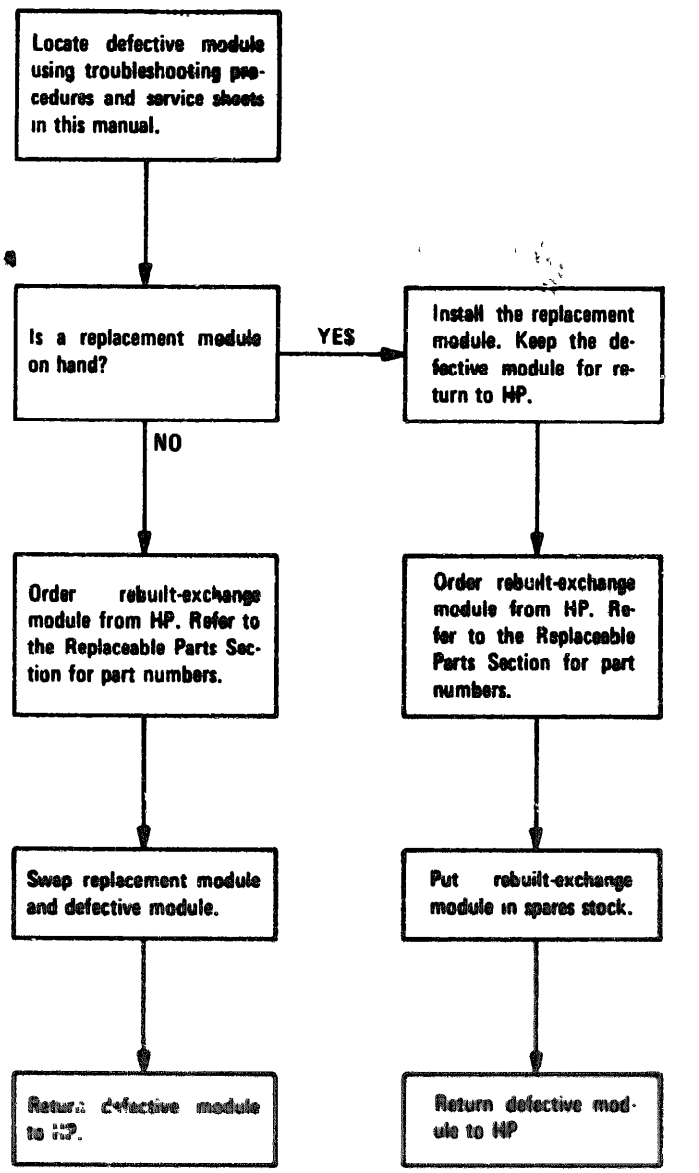
8-10.0 RECOMMENDED TEST EQUIPMENT

8-11. **Test equipment and accessories required to maintain the Model 86601A are listed in the Maintenance Allocation Chart. Substitute test equipments are listed in Table 1-2.**

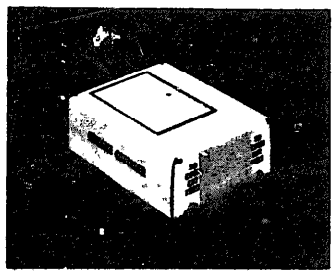
8-12. TROUBLESHOOTING

8-13. **Troubleshooting procedures are divided into two maintenance levels in this manual.**

The module exchange program described here is a method of keeping your Hewlett-Packard instrument in service without repairing the instrument to the component level.



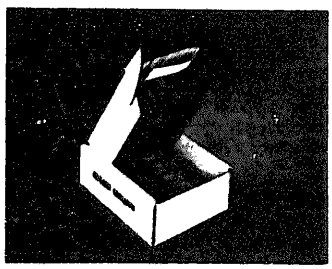
A.



Rebuilt-exchange modules are shipped individually in boxes like this. In addition to the circuit module, the box contains:

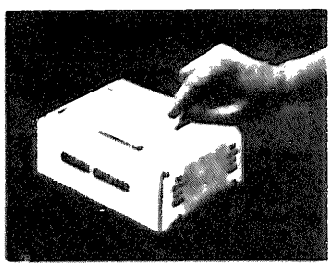
Module repair report
Return address label
Tape for resealing box

B.



Open box carefully - it will be used to return defective module to HP Complete repair report. Place it and defective module in box. Be sure to remove enclosed return address label.

C.



Seal box with tape provided Inside U.S.A , stick preprinted return address label over label already on box, and return box to HP Outside U.S.A., do not use address label instead, address box to the nearest HP office

Figure 8-2. Diagram of Module Exchange Program

SECTION VIII

SERVICE

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NOTE

In the FM mode the 20 MHz signal is generated in the Modulation Section.

c. A signal between 20.000001 and 30.00000 MHz (1 Hz resolution) from the SL1 Loop.

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b. In the remote mode the 150 dB programmable attenuator is remotely controlled and the front panel controls (OUTPUT RANGE and VERNIER) are inoperative. A 1 dB per step programmable attenuator in the Model 86601A is remotely programmed to set the output level between the 10 dB steps of the 150 dB attenuator

8-10. RECOMMENDED TEST EQUIPMENT

8-11. Test equipment and accessories required to maintain the Model 86601A are listed in the Maintenance Allocation Chart. Substitute test equipments are listed in Table 1-2.

8-12. TROUBLESHOOTING

8-13. Troubleshooting procedures are divided into two maintenance levels in this manual.

8-14. The first maintenance level is designed to utilize the Hewlett-Packard Module Exchange Program. A troubleshooting tree enables a relatively inexperienced technician to isolate the cause of a malfunction to a circuit board or assembly. A factory-repaired replacement for the defective circuit board or assembly may be ordered through the nearest HP Sales and Service office using the special part numbers listed in Table 6-1. Refer to paragraph 8-18 and to figure 8-2 for additional information relative to the Module Exchange Program.

8-15. The second maintenance level involves repairing the instrument to the component level. The troubleshooting tree, in addition to aiding in the detection of faulty circuit boards or assemblies, also refers the technician to the appropriate service sheets to be used if repairs are to be accomplished to the component level. Circuit descriptions and test procedures for this maintenance level are located on the page facing the schematic diagram of the circuit to be repaired.

8-16. If the cause of a malfunction is found and remedied in any circuit contianing adjustable components, the applicable adjustment procedure in Section V of this manual should be performed.

8-17. REPAIR

8-18. Module Exchange. This instrument, because of its modular design, may be repaired by simply replacing a defective module. Modular design is a method of construction that groups individual circuits on a replaceable assembly. Modular design, coupled with a factory-repaired module exchange program, eliminates the need to repair to the component level. Factory-repaired modules are available on an exchange-for-credit basis that reduces module cost substantially below the cost of a new module.

8-19. This manual provides a procedure which enables the technician to quickly isolate the cause of a malfunction to a defective module.

8-20. Exchange modules should be ordered by the exchange numbers shown in Table 6-1 from the nearest HP Sales and Service office

8-21. Figure 8-2 illustrates the module exchange program.

NOTE

Do not send a defective module to the HP office until the replacement module is received.

8-22. Voltage Requirements. All power required to operate the Model 86601A is provided by the mainframe.

8-23. Servicing Aids on Printed Circuit Boards. Servicing aids on printed circuit boards include test points, transistor and integrated circuit reference designations, adjustment callouts and assembly stock numbers.

8-24. Circuit Board Extenders. Circuit board extenders are provided with the mainframe. These extender boards enable the technician to extend plug-in boards clear of the assembly to provide easy access to components and test points. See Figure 8-3 for a typical example of extender board Use.

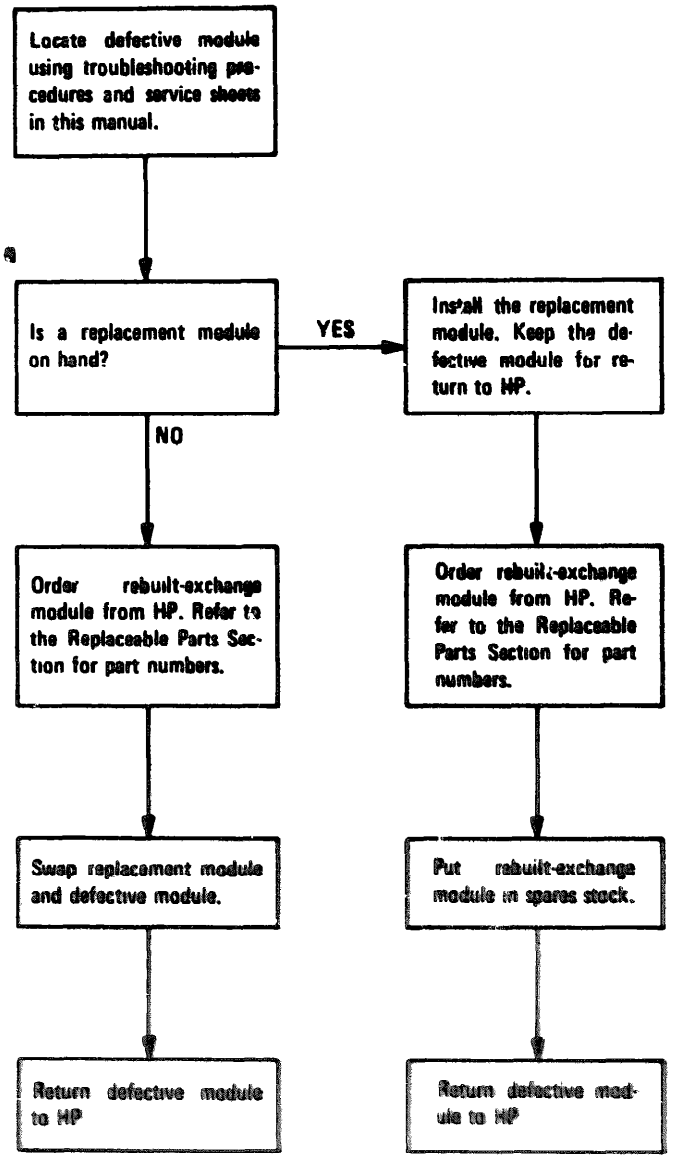
8-25. Diagram Notes. Table 8-1, Schematic Diagram Notes, provides information relative to symbols and values shown on the schematic diagrams.

8-26. Part Location Aids. The locations of chassis mounted parts and major assemblies are shown in Figure 8-6 The locations of individual components mounted on printed circuit boards or other assemblies are shown on the appropriate schematic page or on the page opposite it The part reference designator (as listed in Section VI) is the assembly designation plus the part designation (Example A10R1 is R1 on the A10 assembly) For specific component descriptions refer to the parts list in Section VI of this manual

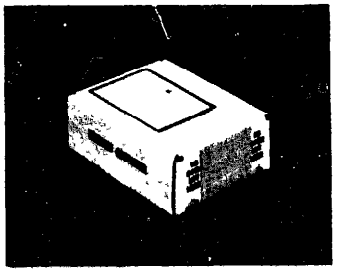
8-27. Table 8-2 lists all assemblies and provides location information for photos, schematics, etc

8-28. Integrated Circuits. Integrated circuit packaging is shown in Figure 8-5 Many types of IC's are used in the Model 86601A In order to avoid duplicating information on the individual schematics, all IC outlines and pin numbers are shown in Figure 8-5

The module exchange program described here is a method of keeping your Hewlett-Packard instrument in service without repairing the instrument to the component level.



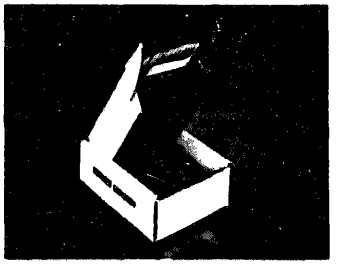
A.



Rebuilt-exchange modules are shipped individually in boxes like this. In addition to the circuit module, the box contains:

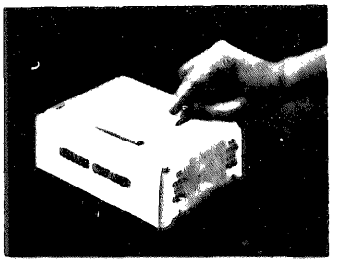
Module repair report
Return address label
Tape for resealing box

B.



Open box carefully - it will be used to return defective module to HP. Complete repair report. Place it and defective module in box. Be sure to remove enclosed return address label.

C.



Seal box with tape provided. Inside U.S.A., stick preprinted return address label over label already on box, and return box to HP. Outside U.S.A., do not use address label; instead, address box to the nearest HP office.

Figure 8-2. Diagram of Module Exchange Program

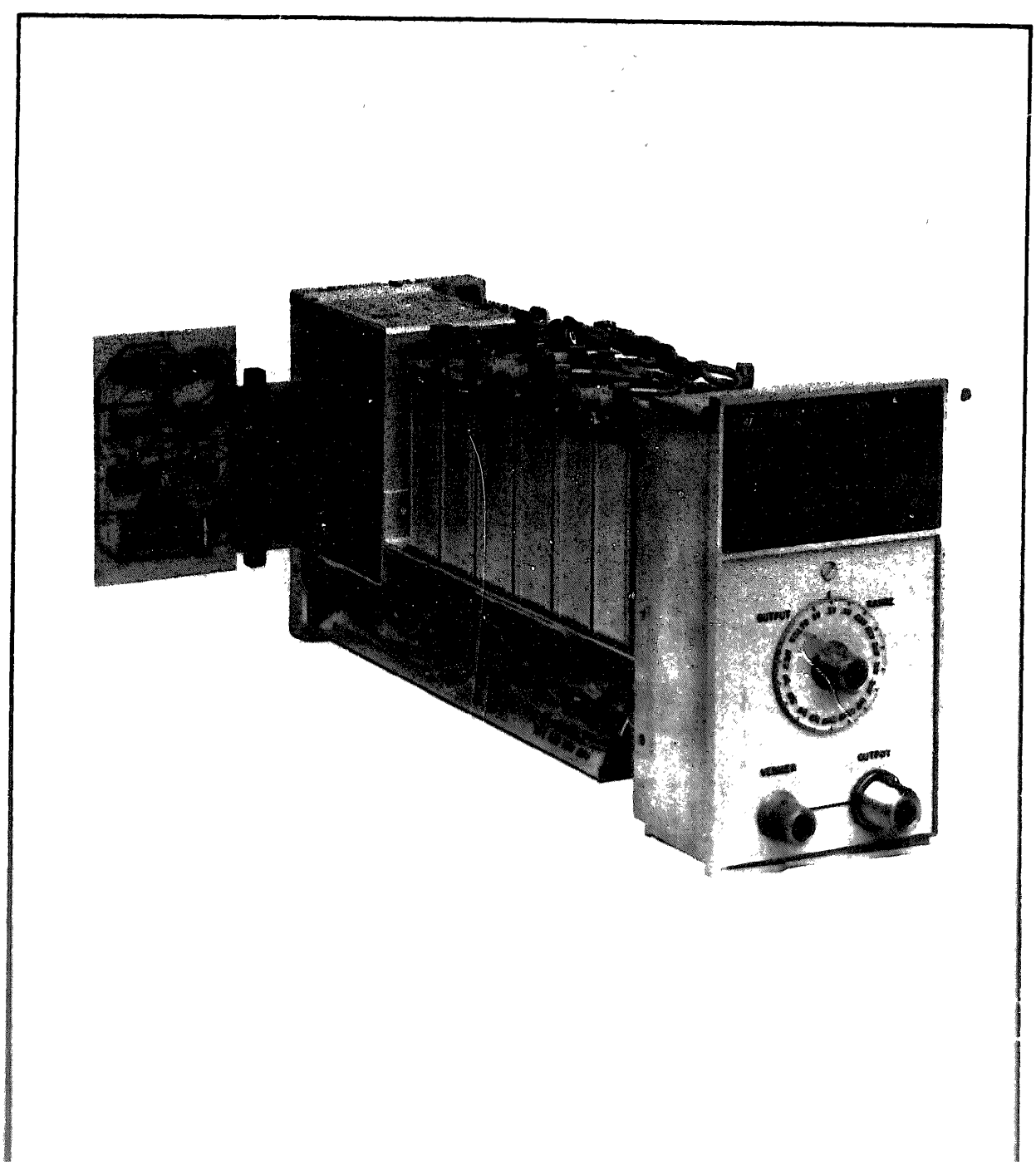


Figure 8-3. Model 86601A with Circuit Board Extended for Maintenance

Table 8-1. Schematic Diagram Notes

SCHEMATIC DIAGRAM NOTES

Inductance is in microhenries, Resistance is in ohms and Capacitance IS in microfarads unless otherwise noted.

P/O part of

Screwdriver Adjustment

Panel Control

Encloses Front Panel designations

Encloses Rear Panel designations

Circuit assembly borderline

Other assembly borderline

CW Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.

Numbers in stars on circuit assemblies show locations of test points

Encloses WIPE color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number the narrower stripe Example; (947) denotes white base, yellow wide stripe, violet narrow stripe.

A 2 Indicates an output from a schematic that goes to an input identified as A on Service Sheet 2

6 K Indicates an input to a schematic that comes from an output identified as K on Service Sheet 6.

Indicates Circuit ground

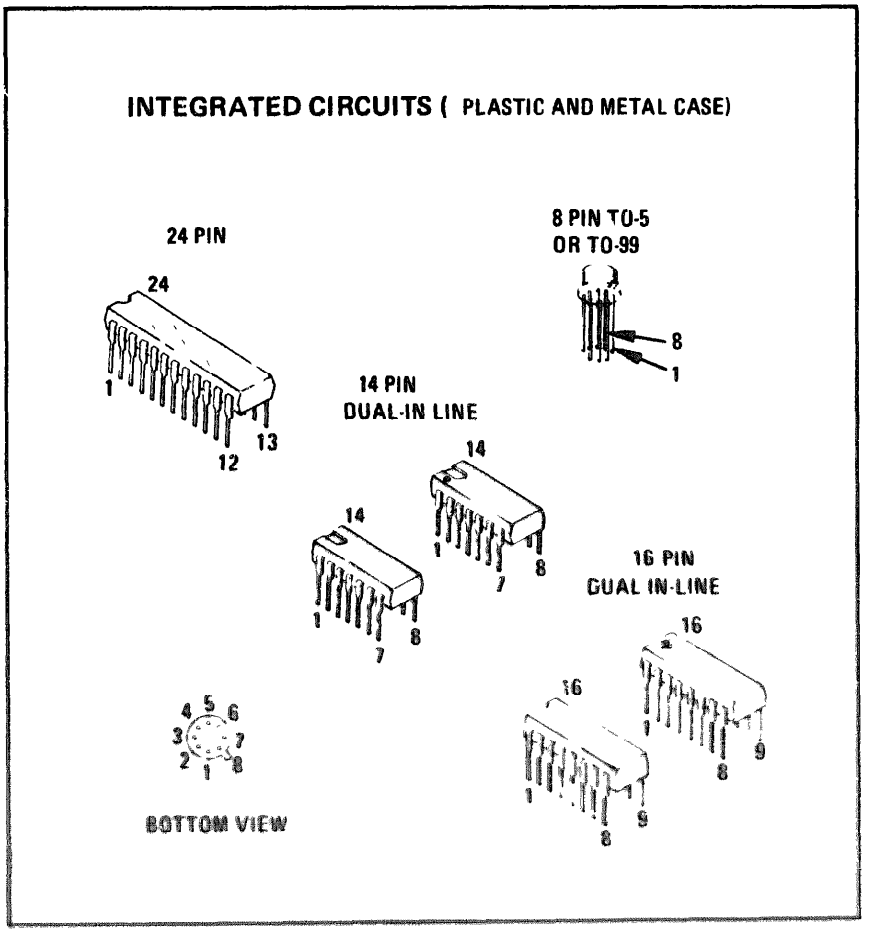


Figure 8-4. *Integrated Circuit Packaging*

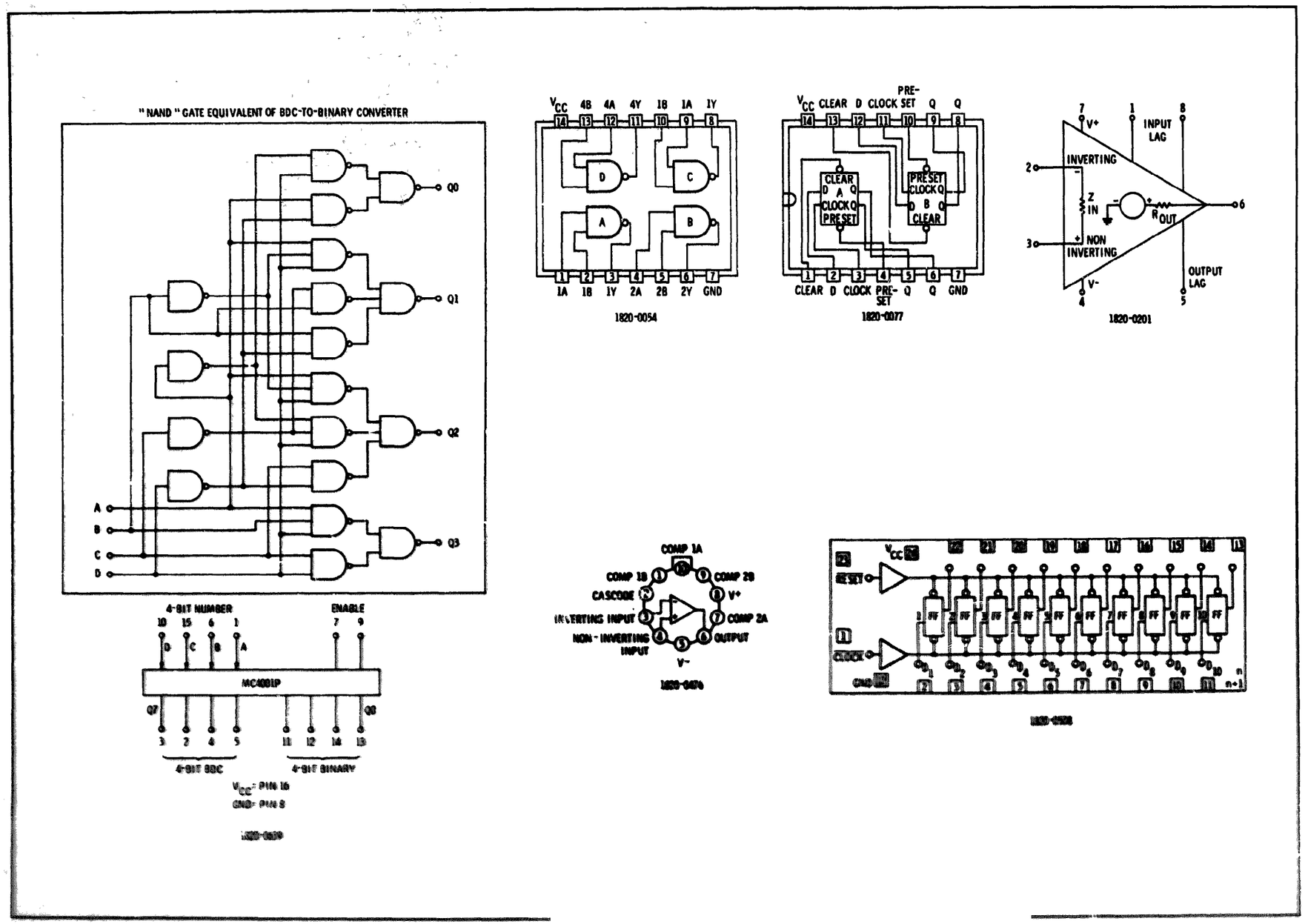


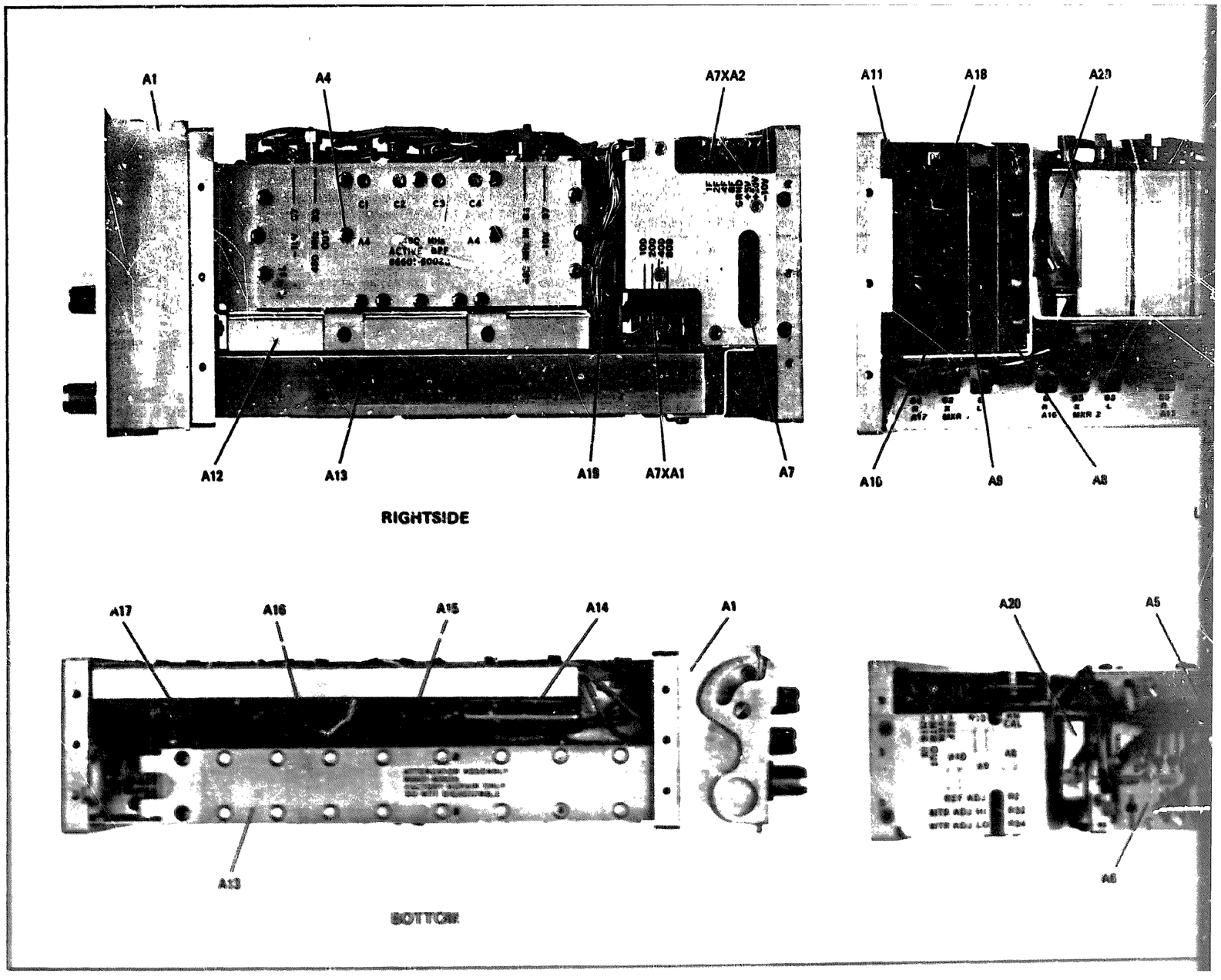
Figure 8-5. Integrated Circuits used in Model 86601A

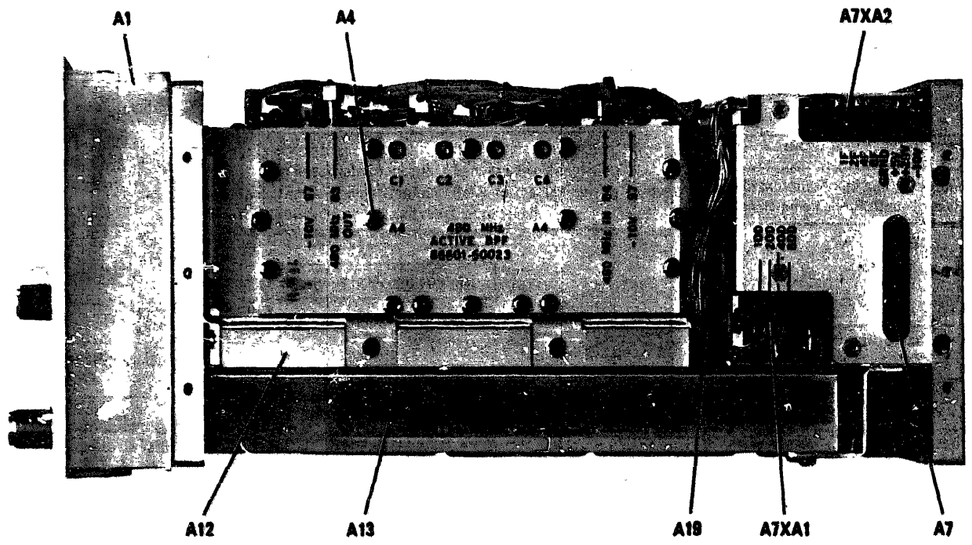
Table 8-2. Assembly Locations

Assy No.	and Description	Service Sheet
A1	Front Housing	
A2	Power Amplifier	3
A3	Feedback Amplifier	4
A4	480 MHz Bandpass Filter	2
A5	Modulator Assembly	2
A6	Preamplifier	3
A7	Mother Board	2
A8	Attenuator Driver	6
A9	Reference Assembly	4
A10	Logic Assembly	5
A11	Rear Connector Assembly	
A12	Dual Filter	2
A13	Programmable Attenuator	6
A15	Mixer III	2
A16	Mixer II	2
A17	Mixer I	2
A18	Wiring Harness	
A19	Wiring Harness	
A20	Filter	

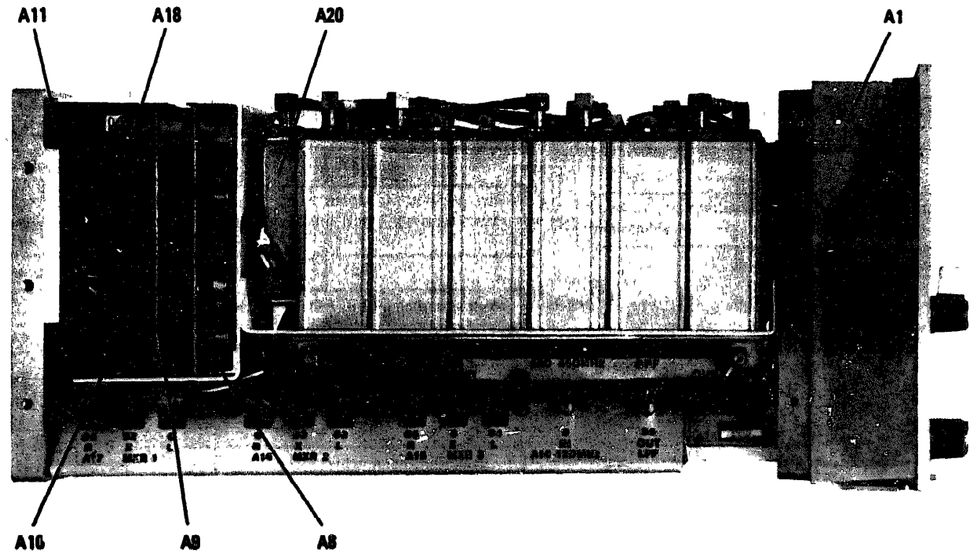
Table 5-8. Assembly Locations

Assy No. and Description		Service Sheet	Photo Figure 8-2
A1	Front Housing		6, 21
A2	Power Amplifier	3	6, 19
A3	Feedback Amplifier	4	6, 22
A4	480 MH. Bandpass Filter	2	6, 13
A5	Modulator Assembly	2	6, 16
A6	Preamplifier	3	6, 18
A7	Mother Board	2	6, 10
A8	Attenuator Driver	6	6, 27
A9	Reference Assembly	4	6, 23
A10	Logic Assembly	5	6, 25
A11	Rear Connector Assembly		1
A12	Dual Filter	2	6, 15
A13	Programmable Attenuator	6	6
A15	Mixer III	2	6
A16	Mixer II	2	6
A17	Mixer I	2	6
A18	Wiring Harness		6
A19	Wiring Harness		6
A20	Filter		6, 14

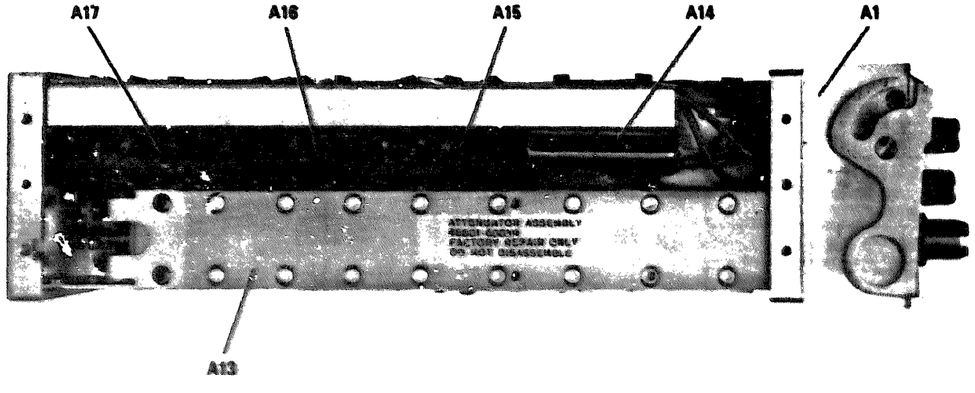




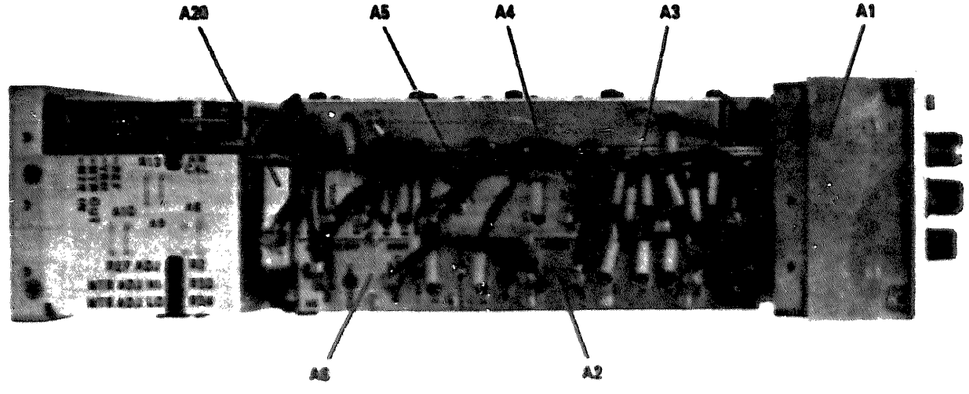
RIGHTSIDE



LEFTSIDE



BOTTOM



TOP

Figure 8-6. *Chassis Mounted Parts and Assembly Locations*

START HERE

Refer to mainframe manual Section V and check power supplies. All voltages are present. NO → Repair mainframe power supply.

YES

Connect the RF Section (cover removed) to the mainframe with extender cable part no. 11672-60001 and check for dc levels on the mother board. (Test points are available at right rear of the RF Section.) All voltages are present. NO → Check interconnections between the RF Section and the mainframe power supply.

YES

Check the L/R test point on the mother board. L = local >+2V, R = remove <+.7V. To simulate remote operation ground pin 5 of the programming input connector on the rear panel of the mainframe.) L/R checks good. NO → Refer to mainframe manual and recheck LCL/RMT on the DCU Mother board. Checks good.

Refer to mainframe DCU and Interface troubleshooting tree.

NO

YES

Check interconnections between the mainframe DCU and the RF Section.

YES

Local and remote functions operate properly. NO → Local operation is OK. 1 dB steps cannot be remotely programmed. Extend the A9 assembly with an extender board and check dc inputs. (Pin D +21V, pin 4 +5.25V, pin 5 −10V. All voltages are present. NO → Check mother board.

YES NO

YES

Recheck L/R at XA9 pin A. Checks good. NO → Check mother board.

YES

Use an oscilloscope or a voltmeter to check "A" logic levels at XA9 pins E, F, H and J. Refer to Figure 1 for correct logic levels. Logic levels check good. YES → A9 Assembly is defective. Order replacement assembly or refer to Service Sheet 4 and repair as required.

NO

Replace the A9 assembly in the chassis. Extend the A10 assembly with an extender board and check dc inputs. (XA10 pin 7 = 5.25V.) Voltage is present. NO → Check mother board

YES

If 1 dB steps are being checked, recheck the "A" logic levels at XA10 pins 8, 9, 10 and 11. Refer to Figure 1 for correct logic levels. Logic levels check good. YES → Check mother board. Repeat A9 test.

NO

Check the "M" logic levels at XA10 pins A, B, C, and D. Refer to Figure 3 for correct logic levels. Logic levels check good. YES → A10 assembly is defective. Order replacement assembly or refer to Service Sheet 5 and repair as required.

NO

Check the mother board and wiring. Checks good. YES → Refer to mainframe DCU and interface troubleshooting tree.

NO

Repair or replace.

NO

The output meter reads the output power. YES

Check the +20V input to the A2 assembly (red lead). Voltage is present. NO → Check mother board.

YES

Check code 1 and code 2 inputs to the A2 assembly. Set center frequency as shown. NO → Recheck on mainframe A3A3 assembly pins J and R Checks good.

C.F.	1	2
> 4 MHz	0	0
> .4 <4 MHz	+3V	0V
< .4 MHz	+3V	+3V

Code lines check good.

NO

Check interconnections to the RF Section.

YES

Refer to mainframe DCU and interface troubleshoot ing tree

YES

Disconnect DET OUT from the A2 assembly and reconnect using a Tee connector. Measure the voltage at the Tee connector. Should read −2.5V with output set to 1.0V and −.5V with 2V rf output. Voltage levels check good. NO → A2 assembly is defective Order replacement assembl or refer to Service Sheet 3 and repair as required

YES

Check for −10V, +20V, code 1 and code 2 on the A3 assembly. All inputs are correct. NO → Check wiring and mother board.

YES

Measure the MTR voltage on the A3 assembly. Should read −.6V for instruments with serial numbers below 00320, −.3V for serial numbers 00320 and higher for a 1V rf output and −.1V for a .2V rf output. Voltage levels check good. NO → A3 assembly is defective Order a replacemer assembly or refer to Service Sheet 4 and repair required

YES

Disconnect the lead from the A3 MTR feed through and connect a 100K resistor from the feedthrough to ground (NOTE for instruments with serial number 00320 and higher, use a 10K resistor). Front panel meter indicates +5 ± .05V. Remove resistor and restore wiring. NO → Remove the front panel and check the +5V lead to th meter +5V is present

NO

Check +5V wiring

YES

Check wiring between MTR OUT and meter Wirin checks good

YES

Meter is defectwe

YES

Measure the MTR IN voltage at the top mother board connector. Should read −.6V for instruments with serial numbers below 00320, −.3V for serial numbers 00320 and higher for a 1V rf output and −.1V for a .2V rf output. Voltage levels check good NO → Check wiring between MTR IN and the A3 MT input

YES

Extend the A9 assembly with an extender board and check the meter voltage at pin K. Voltage is same as last step. NO → A9 assembly is defective. Order replacement or ref to Service Sheet 4 and repair as required

YES

Check wiring between A9 pin K and MTR OUT

AM modulation level is OK

Check the +20V input to the A2 assembly (red lead). Voltage is present.

NO → Check mother board.

YES

Check code 1 and code 2 inputs to the A2 assembly. Set center frequency as shown.

C.F.	1	2
> 4 MHz	0	0
> .4 < 4 MHz	+3V	0V
< .4 MHz	+3V	+3V

Code lines check good.

NO → Recheck on mainframe A3A3 assembly pins J and R. Checks good.

NO → Check interconnections to the RF Section.

YES → Refer to mainframe DCU and interface troubleshooting tree.

YES

Disconnect DET OUT from the A2 assembly and reconnect using a Tee connector. Measure the voltage at the Tee connector. Should read –2.5V with output set to 1.0V and –.5V with .2V rf output. Voltage levels check good.

NO → A2 assembly is defective. Order replacement assembly or refer to Service Sheet 3 and repair as required.

YES

Check for –10V, +20V, code 1 and code 2 on the A3 assembly. All inputs are correct.

NO → Check wiring and mother board.

YES

Measure the MTR voltage on the A3 assembly. Should read –.6V for instruments with serial numbers below 00320, –.3V for serial numbers 00320 and higher for a 1V rf output and –.1V for a .2V rf output. Voltage levels check good.

NO → A3 assembly is defective. Order a replacement assembly or refer to Service Sheet 4 and repair as required.

YES

Disconnect the lead from the A3 MTR feed through and connect a 100K resistor from the feed through to ground (NOTE: for instruments with serial number 00320 and higher, use a 10K resistor). Front panel meter indicates +5 ± .05V. Remove resistor and restore wiring.

NO → Remove the front panel and check the +5V lead to the meter. +5V is present.

NO → Check +5V wiring.

YES → Check wiring between MTR OUT and meter. Wiring checks good.

YES → Meter is defective.

YES

Measure the MTR IN voltage at the top mother board connector. Should read –.6V for instruments with serial numbers below 00320, –.3V for serial numbers 00320 and higher for a 1V rf output and –.1V for a .2V rf output. Voltage levels check good.

NO → Check wiring between MTR IN and the A3 MTR input.

YES

Extend the A9 assembly with an extender board and check the meter voltage at pin K. Voltage is same as last step.

NO → A9 assembly is defective. Order replacement or refer to Service Sheet 4 and repair as required.

YES

Check wiring between A9 pin K and MTR OUT.

NO

...output power.

YES

Use a Spectrum Analyzer and a Counter to verify the four rf inputs as follows:

500 MHz at least +3 dBm at the output end of cable W1.

350/450 MHz at +12 to +14 dBm at the output end of Cable W11 (see note 1).

20/30 MHz at –4 to –7 dBm at the output end of Cable W6 (see note 2).

20 MHz at –3 to –6 dBm at the output end of Cable W3.

All frequencies and levels are as specified.

NO → Check interconnections to mainframe. If interconnections are all good, refer to the mainframe troubleshooting tree and repair as required.

NO → Check interconnections to the Modulation Section. Then check interconnections between the Modulation Section and the mainframe. Refer to the appropriate troubleshooting tree and repair as required.

YES

Check dc inputs to A2, A3, A4, A5 and A6. All dc levels are OK.

NO → Check wiring to dc input points.

YES

Check the A2 RF OUT. With the VERNIER control turned full clockwise level is +13 dBm.

NO

YES

Check the rf level at the attenuator end of cable W16. Level is +13 dBm.

NO → Replace cable

YES

Check 10D, 20D, 30D and 40D lines at lower mother board connector. See Figure 2. +21V = attenuator in, –21V = attenuator out. Checks OK.

NO → Remove lower mother board connector and measure resistance from "D" leads to ground. All leads measure 3000 ohms or more.

NO → Check wiring. Wiring checks good.

NO → Repair wiring.

YES → A13 attenuator assembly is defective. Order replacement.

YES

Recheck D lines at the attenuator. All check OK.

NO → Repair wiring.

YES

Problem is in the Modulation Section or the interconnections.

NO

AM modulation operation is incorrect. RF output level is OK.

YES → Set the modulation section to AM 50%. Check level at AM Test Point at right rear of the Model 8663A behind the cover. Level = 1.4V p-p.

NO

A9 assembly is defective. Order a replacement or refer to Service Sheet 4 and repair as required.

YES

Check code 1 and code 2 inputs to the A2 assembly. Set center frequency as follows

CF	C1	C2
> 4 MHz	0V	0V
> .4 < 4 MHz	+ 3V	0V
< .4 MHz	+ 3V	+3V

Code lines check good

NO

Recheck code 1 and code 2 on the mainframe A3A3 assembly pins J and R. Code lines check good

NO → Check wiring

YES

Refer to mainframe DCU and interface troubleshooting tree

YES

Extend the A8 assembly and check the dc inputs (pin A + 21V, pin D + 5.25V and pin B –21V.) All voltages are present

YES

Recheck "D" lines on the A8 assembly (see Figure 2). All lines check good

NO

Extend the A10 assembly with an extender board and check the dc input (XA10 pin 7 + 5.25V). Check L/R line at XA10 pin 5. L = Local = > 2V, R = remote = < + 7V. Levels are correct

YES

Check "L" lines at XA10 pins 15, 14, 13 and 12. See Figure 2. ON = greater than +2V. Levels are correct

NO

Check "R" lines at XA10 pins R, P and N. See Figure 2. ON = greater than +2V. OFF = 0V. Levels are correct

NO

Recheck "F" lines on mother board. Levels are correct

NO

Remove front panel and check "F" lines on switch. Levels are correct

YES

Check wiring

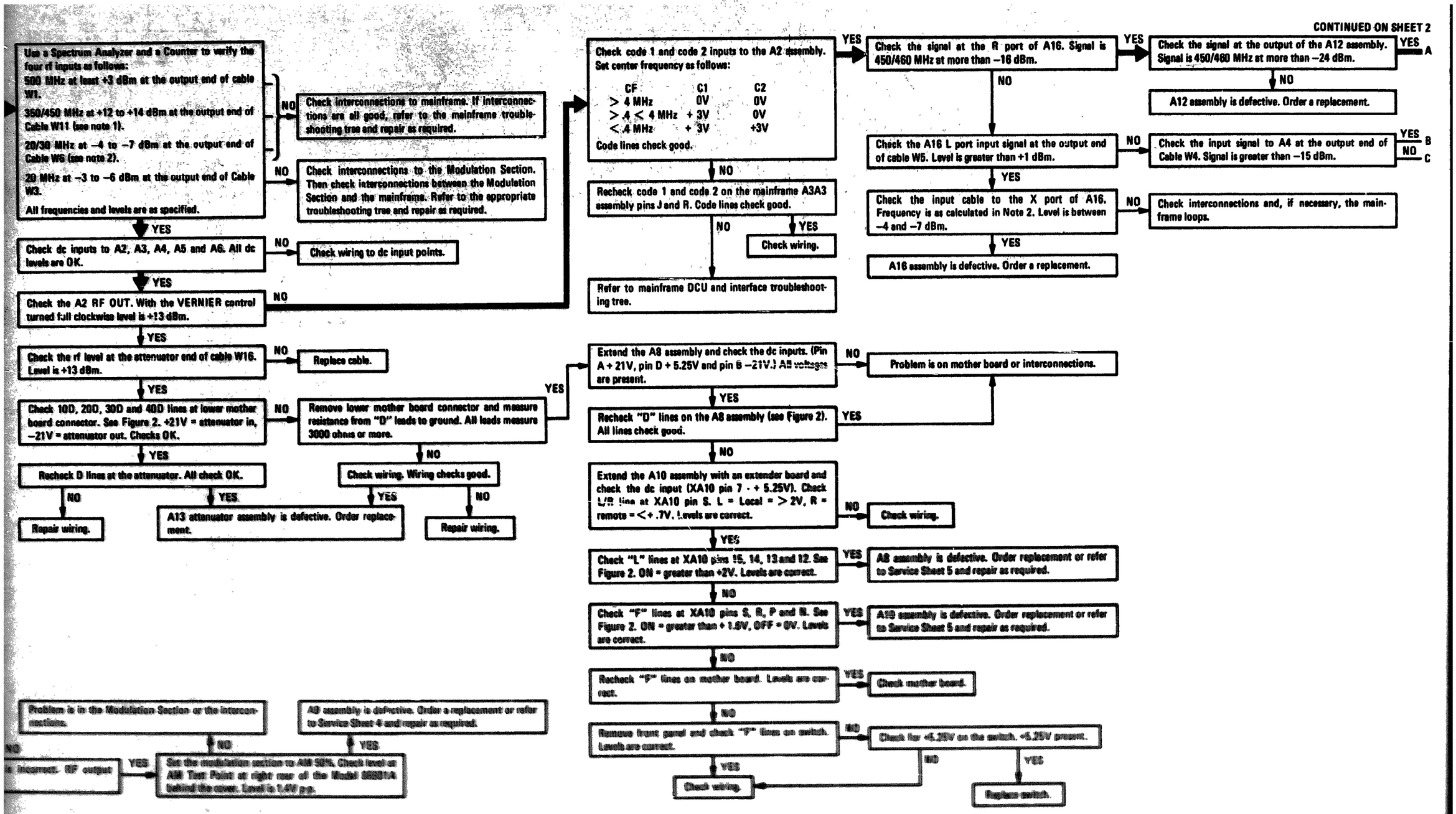
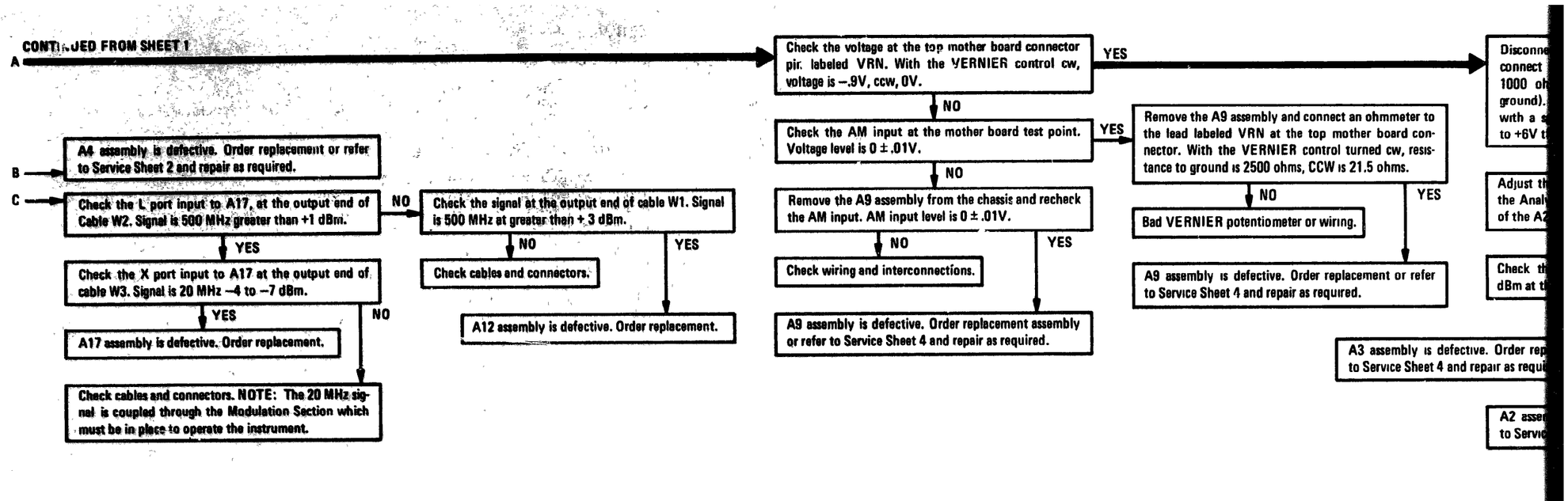


Figure 8-7. *Model 86601A Troubleshooting Tree (1 of 2)*



NOTE:

1. The output frequency from the high frequency section in the mainframe can be determined by subtracting number 1 of digit 9 and digit 8 from 450 MHz. Example: programmed frequency is 70 MHz.

   450 MHz
   70 MHz
   380 MHz

   The output frequency is 380 MHz.

2. The output frequency of the SL1 loop may be determined by subtracting the last 7 digits of the programmed frequency from 30.000000 MHz. Example: programmed frequency is 7.654321 MHz.

   30.000000
   7.654321
   SL1 frequency is 22.345679

Figure 1

"A" lines check.

ON = >+2V OFF = <+.7V

1 dB atten steps	BCD	8	4	2	1
+3		0	0	0	0
+2		0	0	0	1
+1		0	0	1	0
0		0	0	1	1
–1		0	1	0	0
–2		0	1	0	1
–3		0	1	1	0
–4		0	1	1	1
–5		1	0	0	0
–6		1	0	0	1

Figure 2

"D" lines ON = +21V, OFF, = –21V
"L" lines ON = >+2V, OFF = <+.7V
"F" lines ON = +1.6V, OFF = +.7V

10 dB atten steps	BCD	8	4	2	1
+10 dB		0	0	0	0
0		0	0	0	1
–10		0	0	1	0
–20		0	0	1	1
–30		0	1	0	0
–40		0	1	0	1
–50		0	1	1	0
–60		0	1	1	1
–70		1	0	0	0
–80		1	0	0	1
–90		1	0	1	0
–100		1	0	1	1
–110		1	1	0	0
–120		1	1	0	1
–130		1	1	1	0
–140		1	1	1	1

Figure 3

"M"
the
with
See
See

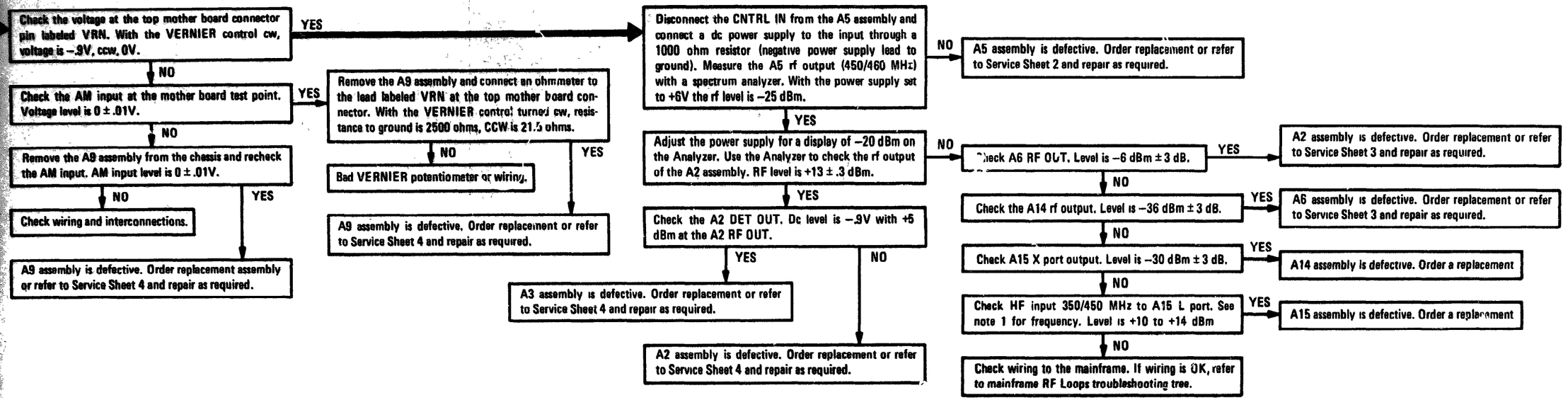


Figure 2

BCD	8	4	2	1
	0	0	0	0
	0	0	0	1
	0	0	1	0
	0	0	1	1
	0	1	0	0
	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
	1	0	0	1

Figure 3

"D" lines ON = +21V, OFF, = –21V
"L" lines ON = >+2V, OFF = <+.7V
"F" lines ON = +1.6V, OFF = +.7V

10 dB atten steps	BCD	8	4	2	1
+10 dB		0	0	0	0
0		0	0	0	1
–10		0	0	1	0
–20		0	0	1	1
–30		0	1	0	0
–40		0	1	0	1
–50		0	1	1	0
–60		0	1	1	1
–70		1	0	0	0
–80		1	0	0	1
–90		1	0	1	0
–100		1	0	1	1
–110		1	1	0	0
–120		1	1	0	1
–130		1	1	1	0
–140		1	1	1	1

"M" lines check ON = >+2V, OFF <+.7V. Trigger the Oscilloscope with the clock signal from the mainframe A1A1 assembly. Data is coincident with the last three clock pulses. The first seven clock pulses are not used.

EXAMPLE: 129 dB attenuation.

See Figure 2 for 10 dB step code

See Figure 1 for 1 dB step code.

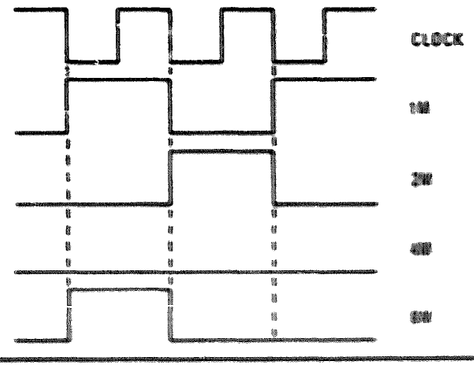


Figure 8-7. *Model 8660 IA Troubleshooting Tree (2 of 2*

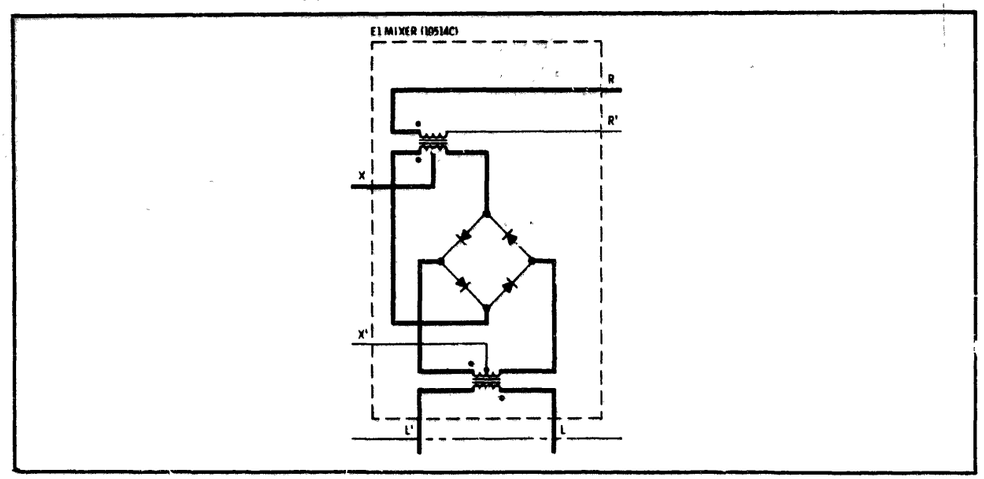


Figure 8-9. Mixer Schematic Diagram

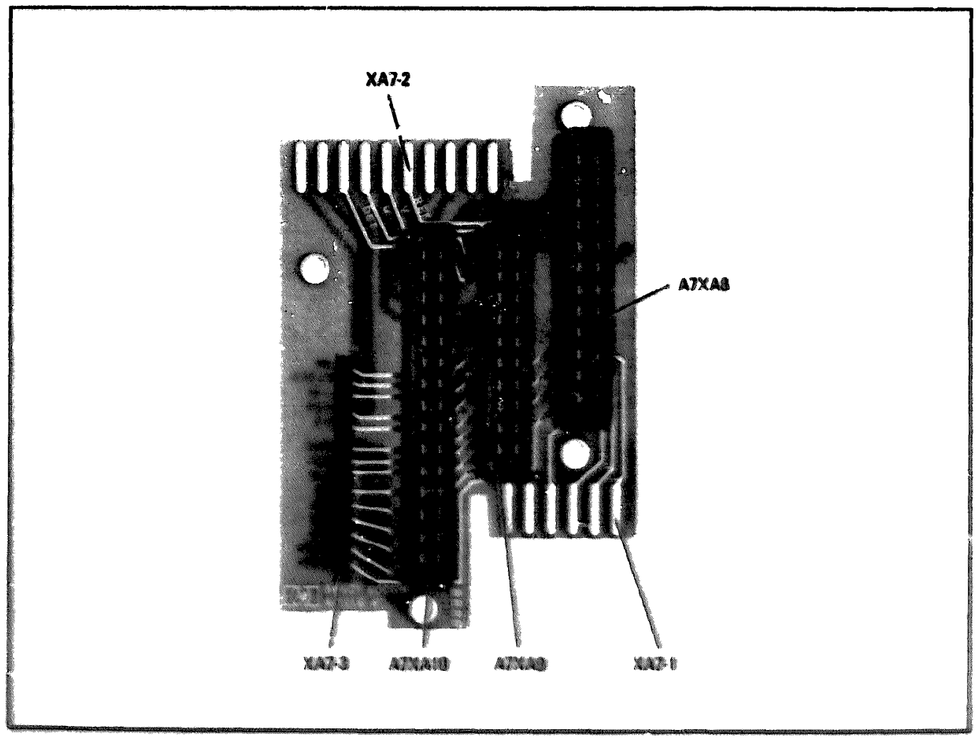
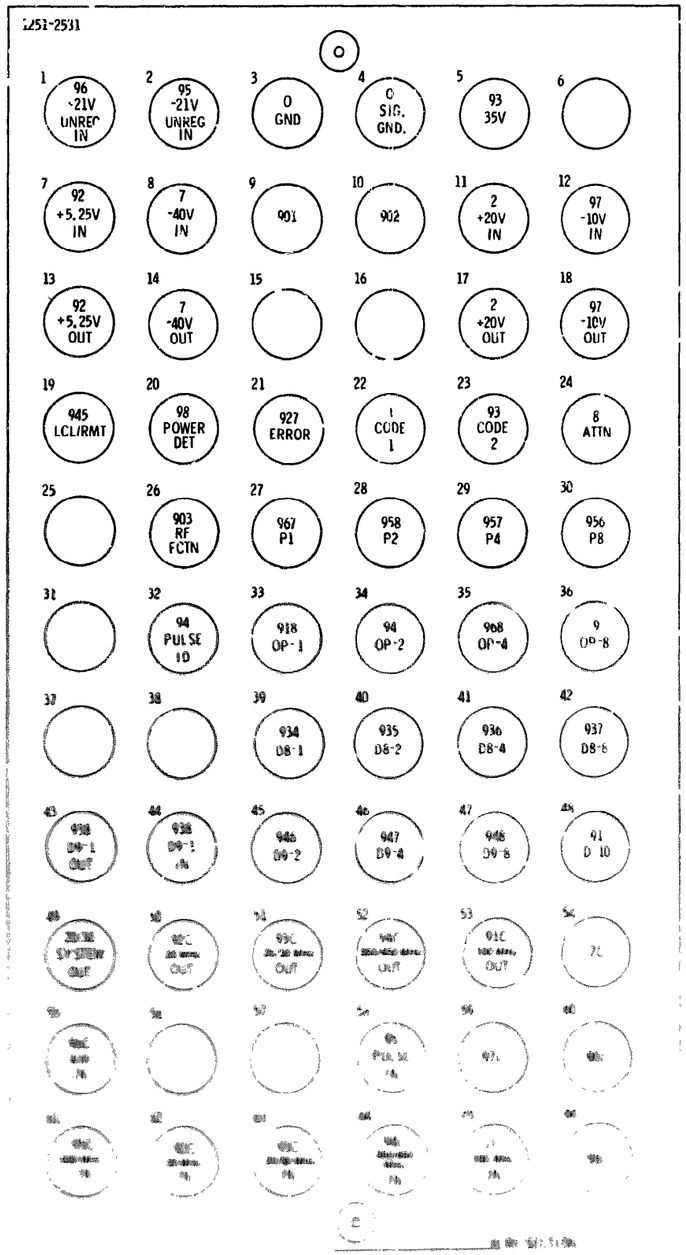
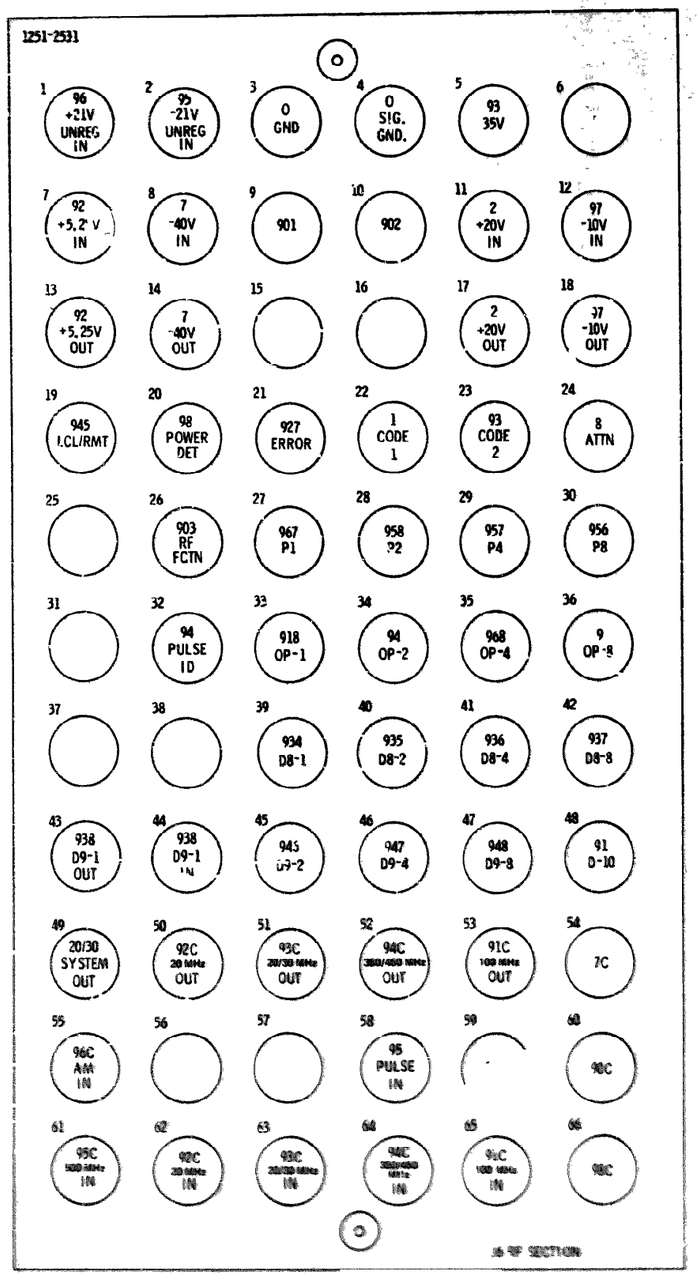


Figure 8-10. *Mother Board Component Locations*



NOTES
1 PART NUMBERS SHOWN INCLUDE PINS
2 COAX PINS ARE HP PA REGULAR PINS ARE HP
3 A TOOL KIT WINCHEST 107X-1 IS REQUIRED TO PINS
4 A TOO WINCHES 10°-1000 AND A TOOL LO CATALOG NUMBER 10°- INSTALL COAX PINS

Figure 8-11 *Input Connector*



NOTES:
1. PART NUMBERS SHOWN FOR CONNECTORS DO NOT INCLUDE PINS
2. COAX PINS ARE HP PART NUMBER 1251-2041 REGULAR PINS ARE HP PART NUMBER 1251-1908
3. A TOOL KIT, WINCHESTER CATALOG NUMBER 107K4 IS REQUIRED TO INSTALL THE REGULAR PINS.
4. A TOOL KIT, WINCHESTER CATALOG NUMBER 107-0600 AND A TOOL LOCATOR WINCHESTER CATALOG NUMBER 107-0602 IS REQUIRED TO INSTALL COAX PINS.

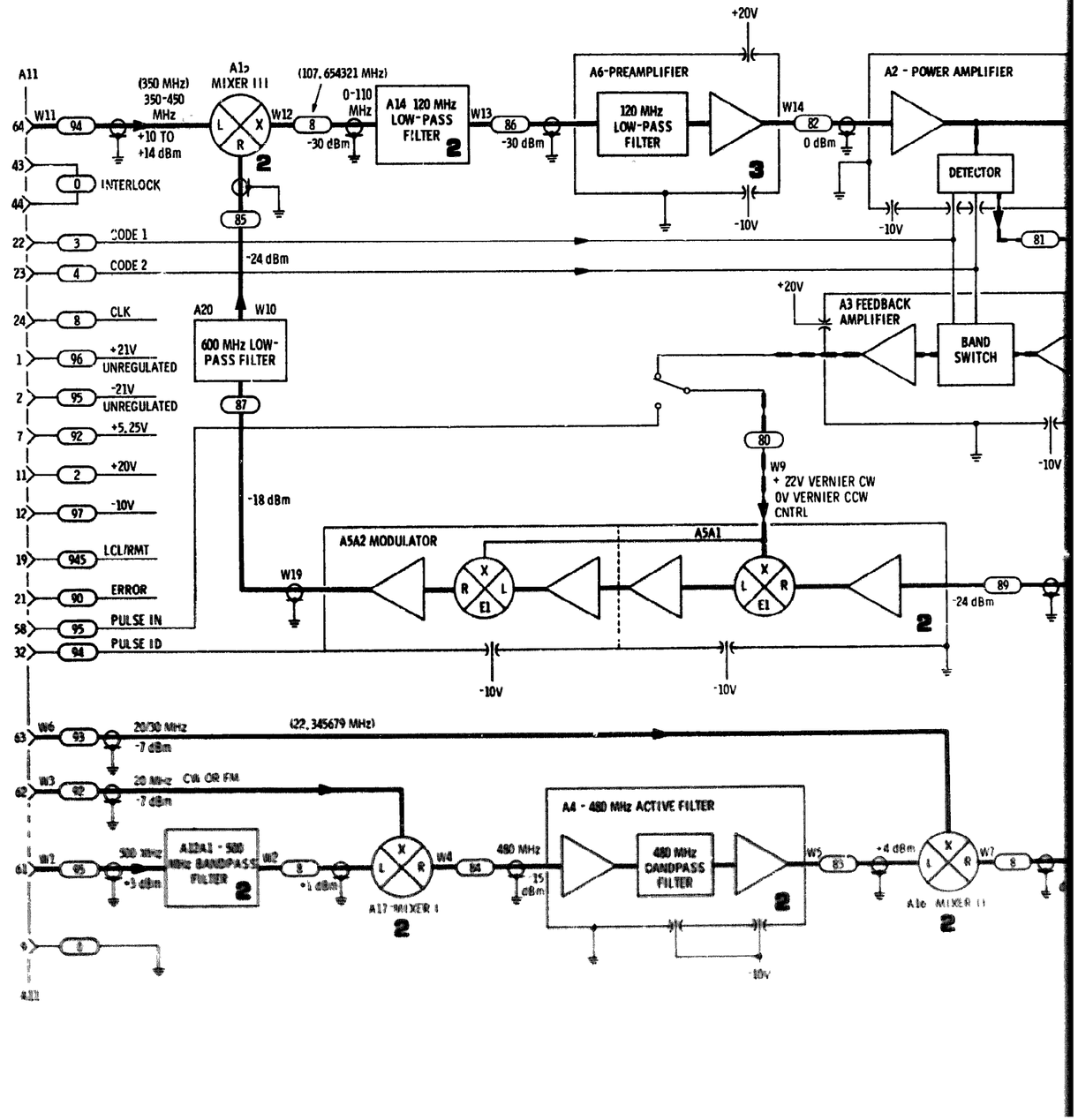


Figure 8-11. *Input Connector*

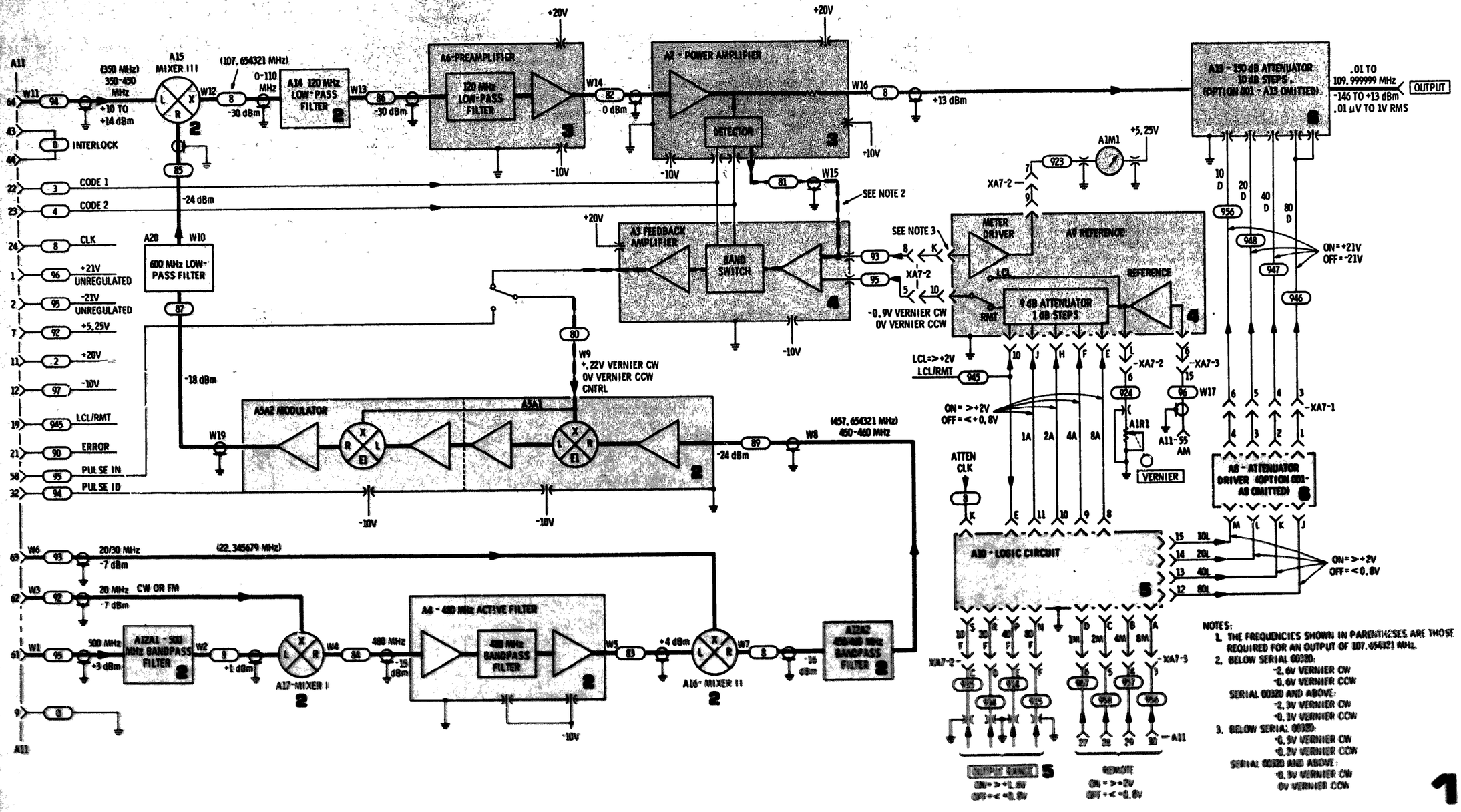


Figure 8-12. *Model 86601A Block Diagram*

SERVICE SHEET 2

INPUT SIGNALS PROCESSING

Normally, causes of a malfunction in the Model 86601A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting trees.

When trouble has been isolated to a specific circuit board or assembly it should be removed and reinstalled in a position which provides easy access to test points and components. In some cases this may be accomplished by using extender boards; in others, it will be necessary to reconnect rf and dc inputs and outputs with the assembly removed from the housing in which it is normally contained.

TEST EQUIPMENT REQUIRED (See Table 1-2)

Digital Voltmeter . . . . . Low Voltage Power Supply
Electronic Counter . . . . . Spectrum Analyzer
Vector Voltmeter

GENERAL INFORMATION

The circuits shown and described on Service Sheet 2 convert the 4 inputs from the mainframe, by means of mixing and filtering processes, to the selected output frequency. The various filters greatly reduce harmonic signals, undesired mixing products, and spurious signals. The amplifiers between the mixers compensate for the insertion losses of the filters and mixers.

500 MHz BANDPASS FILTER (A12A1)

The 500 MHz bandpass filter effectively traps all harmonics of the 500 MHz input signal and the 100 MHz signal from which it is derived. Insertion loss is about 2 dB and the bandpass is typically 3 MHz at 3 dB points on the response curve.

MIXER I (A17)

Mixer I is a matched-quad-diode double-balanced mixer. The inputs to the mixer are the precise 500 MHz output from the reference section in the mainframe and a precise 20 MHz signal from the reference section in the mainframe or a 20 MHz signal which is generated in the modulator section plug-in. Both of the input signals are balanced out in the mixer and only the sum and difference signals are available at the output port. The output of Mixer I is coupled to the A4 assembly.

480 MHz ACTIVE FILTER (A4)

The A4 active filter consists of two identical two-stage tuned amplifiers separated by a bandpass filter. Each of the two-stage amplifiers has a gain of about 10 dB. The filter has an insertion loss of about 2 dB and the bandpass is typically 6 MHz at 3 dB points on the response curve.

MIXER II (A16)

Mixer II is the same as Mixer I. This mixer mixes the 480 MHz signal from the A4 assembly with a signal between 20.000001 and 30.000000 MHz from the SL1 loop in the mainframe. The difference signal (450/460MHz) at the output port is coupled to the A12A2 assembly.

450/460 MHz BANDPASS FILTER (A12A2)

The A12A2 450/460 MHz bandpass filter has an insertion loss of about 5 dB. The passband is centered at 455 MHz and typically is 12 MHz at 2 dB points on the response curve.

MODULATOR ASSEMBLY (A5)

The signal from the 450/460 MHz bandpass filter is coupled to the A5 modulator assembly. A two-stage amplifier amplifies the signal before it is coupled to the L port of a double balanced mixer (E1) which acts as an attenuator to control the rf output level of the 86601A.

SERVICE SHEET 2 (cont'd)

When the instrument is operated in the CW or FM modes the input to the X port of E1 is dc bias level that is controlled by the leveling loop and the reference assembly. Its purpose is to assure that the rf output from the instrument remains constant at a specific level,

When the instrument is operated in the AM mode, an ac modulating signal is superimposed on the dc bias level to the X port of E1. The amplitude of the ac signal controls the percentage of modulation of the Model 86601A output rf signal.

The output of the modulator is applied through a 600 MHz lowpass filter (A20) which has an insertion loss of about 7 dB and a 4 dB pad to Mixer III,

MIXER III (A15)

Mixer III is the same as Mixers I and II. This mixer mixes the 450/460 MHz output of the A5 assembly with a 350/450 MHz (10 MHz steps) from the high frequency loop in the mainframe. The output of Mixer III is between .01 and 110 MHz, The exact output frequency is selected by the mainframe in increments as low as 1 Hz except when the mainframe is an option 004 instrument. Mainframe option 004 limits frequency selection to 100 Hz increments (frequency selection is still exact).

120 MHz LOWPASS FILTER (A14)

The output of Mixer III is applied to the pre-amplifier (A6 shown en Service Sheet 3) through a 120 MHz lowpass filter. This filter sharply attenuates all harmonic and spurious signals above 120 MHz. Insertion loss for signals below 120 MHz is typically less than 1 dB.

NOTES

1. Verify the presence of dc operating voltages before taking other measurements. If dc voltages are not present check connections to the mainframe. If interconnections are good refer to the mainframe manual and make necessary repairs.
2. All measurements are taken with the Spectrum Analyzer unless otherwise specified.

TEST PROCEDURE

Test 1-a. Measure the amplitude of the 500 MHz signal at the output end of W2. If the amplitude is greater than, or equal to +1 dBm, proceed to test 2-a. If the amplitude is less than +1 dBm, proceed to test 1-b.

Test 1-b. Measure the amplitude of the 500 MHz signal at the output end of cable W1. If the amplitude is equal to, or greater than +3 dBm, use a counter to verify that the frequency is exactly 500 MHz. If the amplitude and frequency are correct, repair or replace the A12 assembly or cable W2. If the specified signal is not present check cable W1. If Cable W1 is good, refer to the mainframe manual, trouble is in the mainframe reference section or in interconnections.

TEST PROCEDURE

Test 2-a. Measure the 480 MHz signal at the output end of Cable W4. If the amplitude is -14 dBm, ±2 dB, proceed to test 3-a. If the amplitude is low, proceed to test 2-b.

Tart 2-b. Measure the amplitude of the 20 MHz signal at the output end of cable W3. If the amplitude is -5 dBm ±1 dB, use a counter to verify that the frequency is exactly 20 MHz (instrument operating in CW or AM mode). If the amplitude and frequency are correct, replace the A17 assembly or cable W4. If the specified signal is not present check cable W3. If cable W3 is good, refer to the mainframe manual; trouble is in the mainframe reference section or in interconnections.

NOTE

The 20 MHz signal is coupled to the Model 86601A through the Modulation drawer. A modulation or Auxiliary section must be in place in the modulator drawer.

TEST PROCEDURE q

Test 3-a. Measure the amplitude of the 480 MHz signal at the output end of cable W5. If the signal is equal to, or greater than, +1 dBm, proceed to test 4-a. If the amplitude is low, proceed to test 3-b. Measure the 480 MHz signal at the output of the A4 assembly at J1.

TEST PROCEDURE

Test 4-a. Measure the 450/460 MHz signal at the output end of cable W7. If the amplitude is −14 dBm ±2 dB, proceed to TEST PROCEDURE 5. If the amplitude is low, proceed to Test 4-b.

Test 4-b. Measure the 20/30 MHz signal at the output end of cable W6. Tne amplitude should be −6 dBm ±2 dB. Use the counter to check the frequency at the output end of cable W6.

NOTE

The 20/30 MHz frequency may be determined by subtracting thumbwheel digits 1 through 7 from 30.000000 MHz. EXAMPLE: Thumbwheels are set to 0107.654321 MHz.

```
30.000000
 7.654321
-----------
22.345679
```

If the signal amplitude and frequency are correct, repair or replace Mixer II or cable W7

FM modes the input
trolled by the leveling
to assure that the rf
a specific level.

ode, an ac modulating
he X port of E1. The
nge of modulation of

h a 600 MHz lowpass
t 7 dB and a 4 dB pad

his mixer mixes the
a 350/450 MHz (10
the mainframe. The
Hz. The exact output
ements as low as 1 Hz
nstrument. Mainframe
100 Hz increments

mplifier (A6 shown on
lter. This filter sharply
ls above 120 MHz.
pically less than 1 dB.

g voltages before
voltages are not
e mainframe. If
the mainframe

h the Spectrum

Hz signal at the output
or equal to +1 dBm,
an +1 dBm, proceed to

Hz signal at the output
to, or greater than +3
cy is exactly 500 MHz.
pair or replace the A12
l is not present check
e mainframe manual;
or in interconnections.

SERVICE SHEET 2 (cont'd)

TEST PROCEDURE

Test 2-a. Measure the 480 MHz signal at the output end of Cable W4. If the amplitude is −14 dBm, ±2 dB, proceed to test 3-a. If the amplitude is low, proceed to test 2-b.

Test 2-b. Measure the amplitude of the 20 MHz signal at the output end of cable W3. If the amplitude is −5 dBm ±1 dB, use a counter to verify that the frequency is exactly 20 MHz (instrument operating in CW or AM mode). If the amplitude and frequency are correct, replace the A17 assembly or cable W4. If the specified signal is not present check cable W3. If cable W3 is good, refer to the mainframe manual; trouble is in the mainframe reference section or in interconnections.

NOTE

The 20 MHz signal is coupled to the Model 86601A through the Modulation drawer. A modulation or Auxiliary section must be in place in the modulator drawer.

TEST PROCEDURE

Test 3-a. Measure the amplitude of the 480 MHz signal at the output end of cable W5. If the signal is equal to, or greater than, +1 dBm, proceed to test 4-a. If the amplitude is low, proceed to test 3-b.

3-b. Measure the 480 MHz signal at the output of the A4 assembly at J1.

TEST PROCEDURE

Test 4-a. Measure the 450/460 MHz signal at the output end of cable W7. If the amplitude is −14 dBm ±2 dB, proceed to TEST PROCEDURE 5. If the amplitude is low, proceed to Test 4-b.

Test 4-b. Measure the 20/30 MHz signal at the output end of cable W6. The amplitude should be −6 dBm ±2 dB. Use the counter to check the frequency at the output end of cable W6.

NOTE

The 20/30 MHz frequency may be determined by subtracting thumbwheel digits 1 through 7 from 30.000000 MHz. EXAMPLE: Thumbwheels are set to 0107.654321 MHz.

```
30.000000
 7.654321
---------
22.345679
```

If the signal amplitude and frequency are correct, repair or replace Mixer II or cable W7.

If the signal is missing or level is low, check cable W6; if W6 is good the problem is in the mainframe.

If the frequency is incorrect, trouble is in the mainframe.

TEST PROCEDURE

Test 5-a. Measure the 450/460 MHz signal at the output end of cable W8. If the amplitude is −22 dBm ±2 dB, proceed to TEST PROCEDURE 6. If the amplitude is low, repair or replace the A12 bandpass filter or cable W8.

TEST PROCEDURE

Test 6-a. Measure the signal at the output end of cable W10. If the signal is equal to or greater than −23 dBm, proceed to TEST PROCEDURE 7. If the signal is less than -23 dBm, proceed to test 6-b.

Test 6-b. Disconnect the CNTRL IN lead from the AS assembly and connect a power supply in its place (0 volts initially, 1000 ohms' in series with positive lead, negative lead to ground). Monitor the output of cable W10 and slowly raise the power supply output to about 600 millivolts. If the signal at the output end of cable W10 is now about -23 dBm, the problem is in the feedback loop or associated circuits; refer to Service Sheet 3. If the output signal did not increase with application of the dc level, proceed to Test 6-c.

Test 6-c. Remove the A5 assembly from the chassis and reconnect the leads. NOTE: Be sure to use an insulating material between the assembly and the **chassis** to avoid damage to the circuit.

Connect the Vector Voltmeter channel A input to the RF IN at J2 and lock the meter to the signal. Use the Vector Voltmeter channel B probe to trace the signal through the assembly.

When repairs are completed the A2 and A6 assembly adjustment procedures should be performed.

TEST PROCEDURE

Test 7-a. Measure the signal at the output end of cable W12. The signal should be −30 ±3 dBm at the center frequency selected by the mainframe.

If the correct signal is present proceed to Test 7-b.

If the correct signal is not present, check Mixer III, the 350/450 MHz input from the mainframe (W11) and cables W11 and W12.

NOTE

The 350/450 MHz frequency may be determined by subtracting digits 8 and 9 from 450 MHz. (Digit 9 is always a zero or a one.) Example: Thumbwheels are set to 0107.654321 MHz.

```
450.000000
x 10x.xxxxx
-----------
343.000000 MHz
```

SERVICE SHEET 2 (cont'd)

Test 7-b. Measure the signal at the output end of cable W13. The signal should be -30 ±3 dBm at the center frequency selected by the mainframe.

If the signal is not present, check the 120 MHz low pass filter and cable W13.

Block Diagram

SERVICE SHEET 1

E SHEET 2 (cont'd)

nal is missing or level is low, check cable W6; if W6 is problem is in the mainframe.

equency is incorrect, trouble is in the mainframe.

ROCEDURE ■

. Measure the 450/460 MHz signal at the output end of 3. If the amplitude is −22 dBm ±2 dB, proceed to TEST DURE 6. If the amplitude is low, repair or replace the dpass filter or cable W8.

ROCEDURE ■

. Measure the signal at the output end of cable W10. If al is equal to or greater than −23 dBm, proceed to ROCEDURE 7. If the signal is less than −23 dBm, to test 6-b.

. Disconnect the CNTRL IN lead from the A5 assembly nect a power supply in its place (0 volts initially, 1000 series with positive lead, negative lead to ground). the output of cable W10 and slowly raise the power utput to about 500 millivolts. If the signal at the output able W10 is now about −23 dBm, the problem is in the loop or associated circuits; refer to Service Sheet 3. If put signal did not increase with application of the dc oceed to Test 6-c.

. Remove the A5 assembly from the chassis and ct the leads. NOTE: Be sure to use an insulating between the assembly and the chassis to avoid damage rcuit.

the Vector Voltmeter channel A input to the RF IN at lock the meter to the signal. Use the Vector Voltmeter B probe to trace the signal through the assembly.

pairs are completed the A2 and A6 assembly adjustment res should be performed.

ROCEDURE ■

. Measure the signal at the output end of cable W12. nal should be −30 ±3 dBm at the center frequency by the mainframe.

rrect signal is present proceed to Test 7-b.

orrect signal is not present, check Mixer III, the 350/450 put from the mainframe (W11) and cables W11 and W12.

NOTE

350/450 MHz frequency may be determined by tracting digits 8 and 9 from 450 MHz. (Digit 9 is always a or a one.) Example: Thumbwheels are set to 7.854321 MHz.

```
  450.000000
x 10x.xxxxx
-------------
 350.000000 MHz
```

SERVICE SHEET 2 (cont'd)

Test 7-b. Measure the signal at the output end of cable W13. The signal should be −30 ±3 dBm at the center frequency selected by the mainframe.

If the signal is not present, check the 120 MHz low pass filter and cable W13.

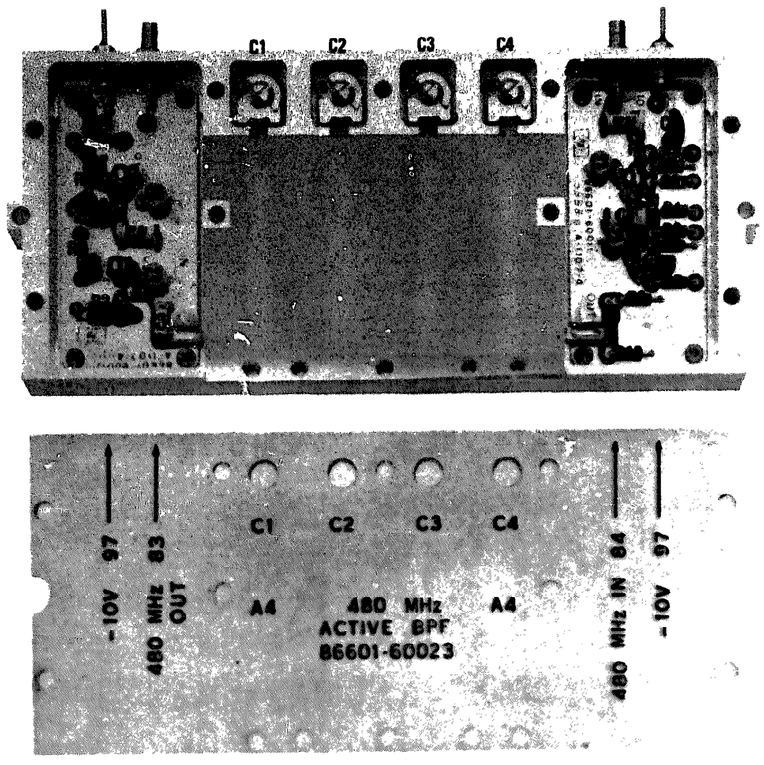


Figure 8-14. *480 MHz Band Pass Filter Component Locations*

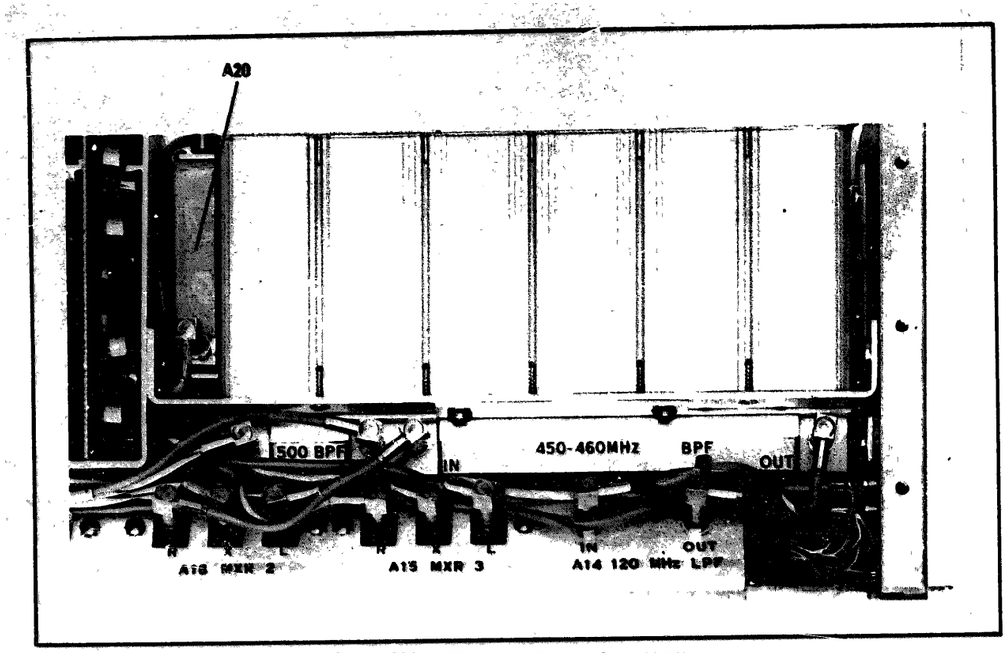


Figure 8-14. 600 MHz Low Pass Filter (A20) Location

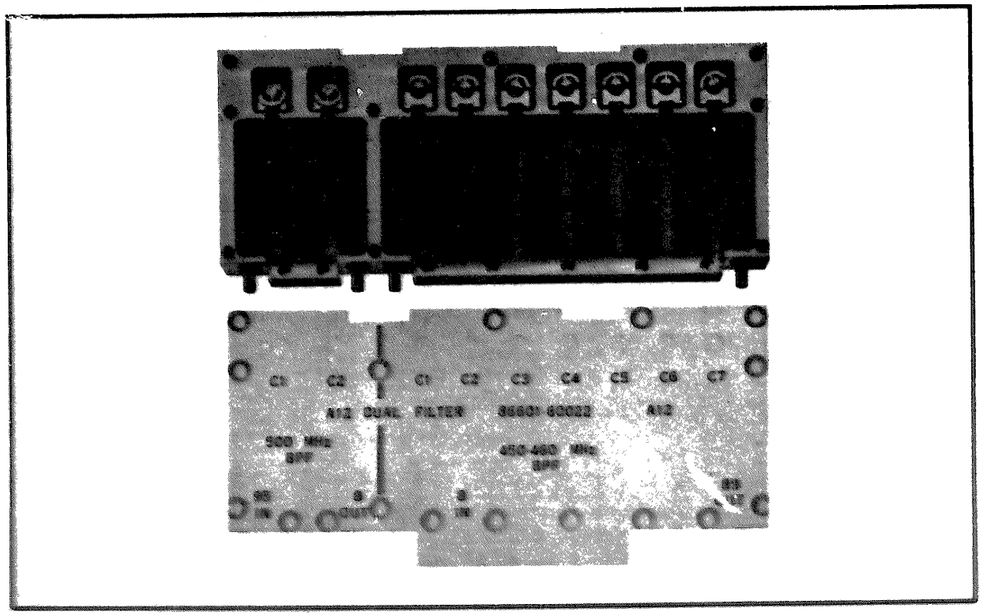


Figure 8-15. *Dual Filter Adjustment Locations*

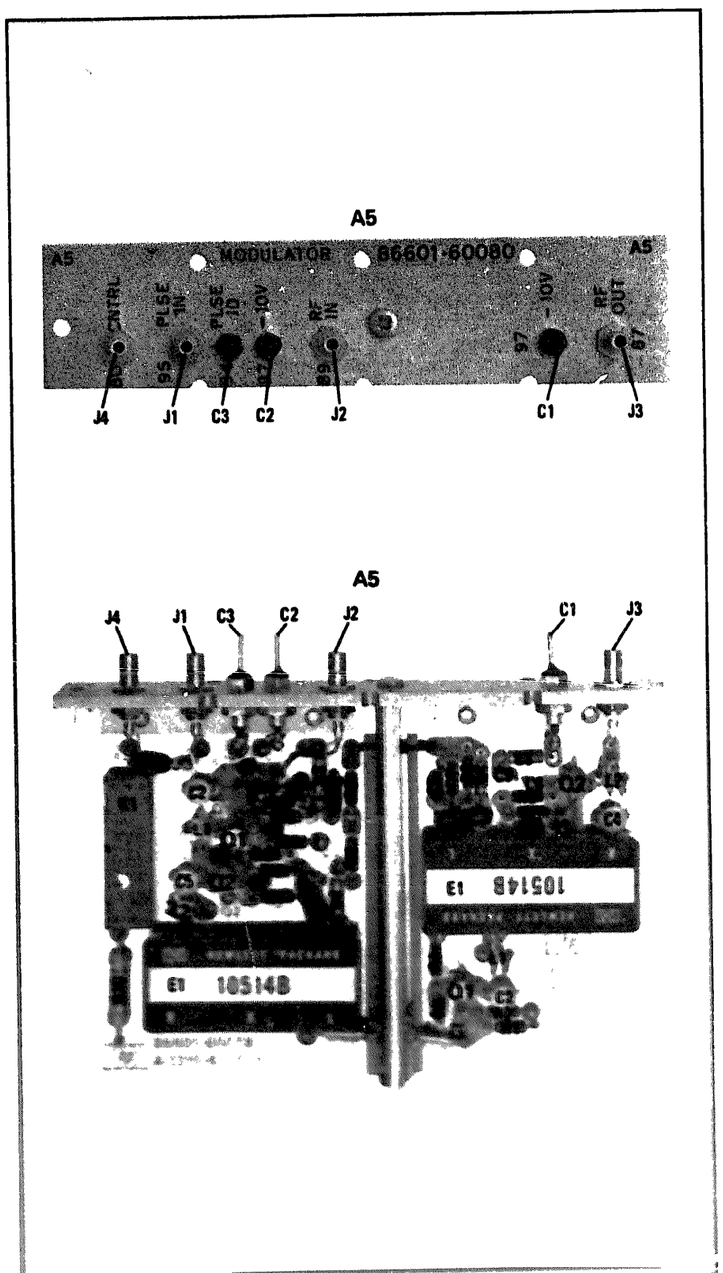
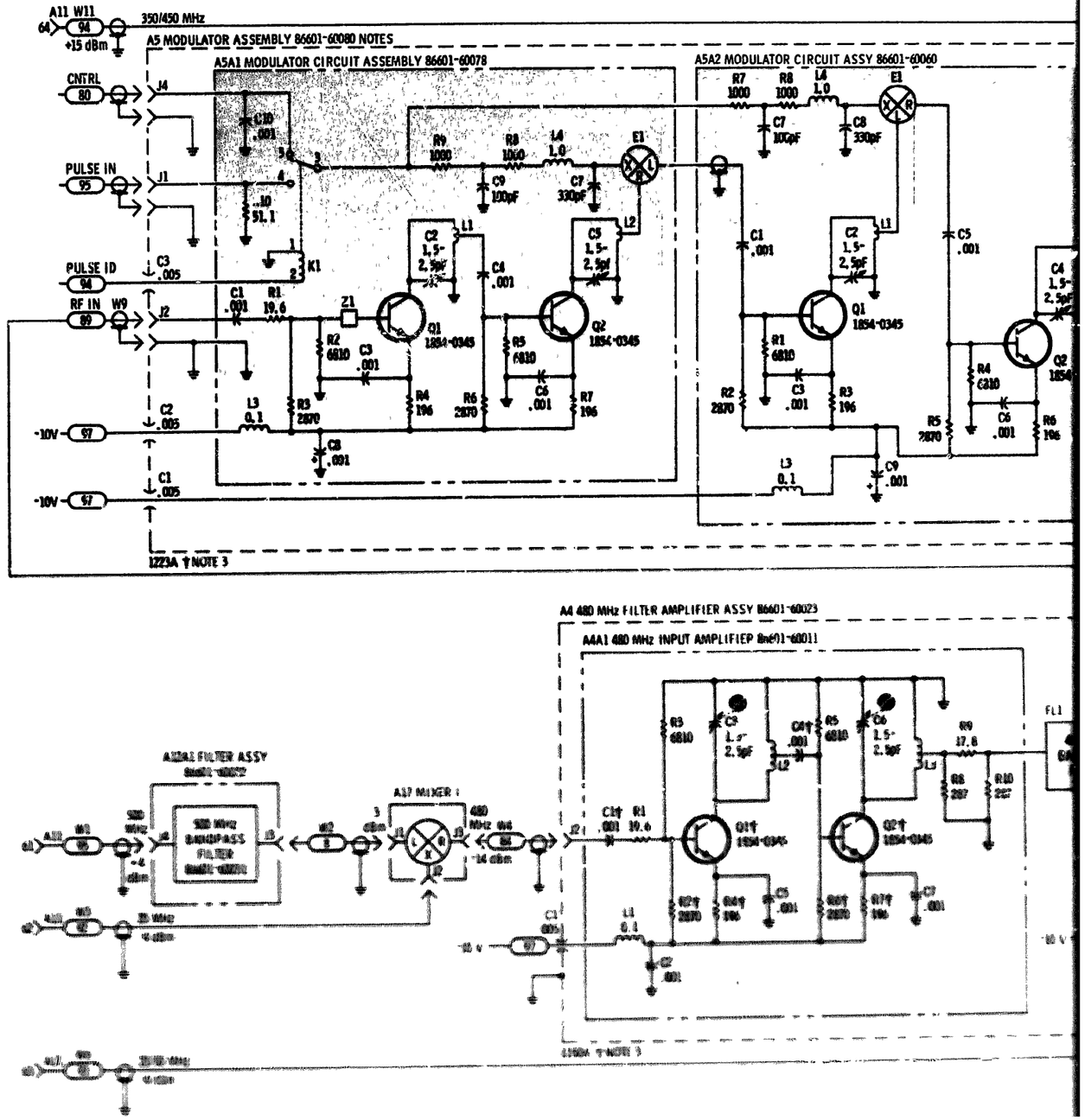
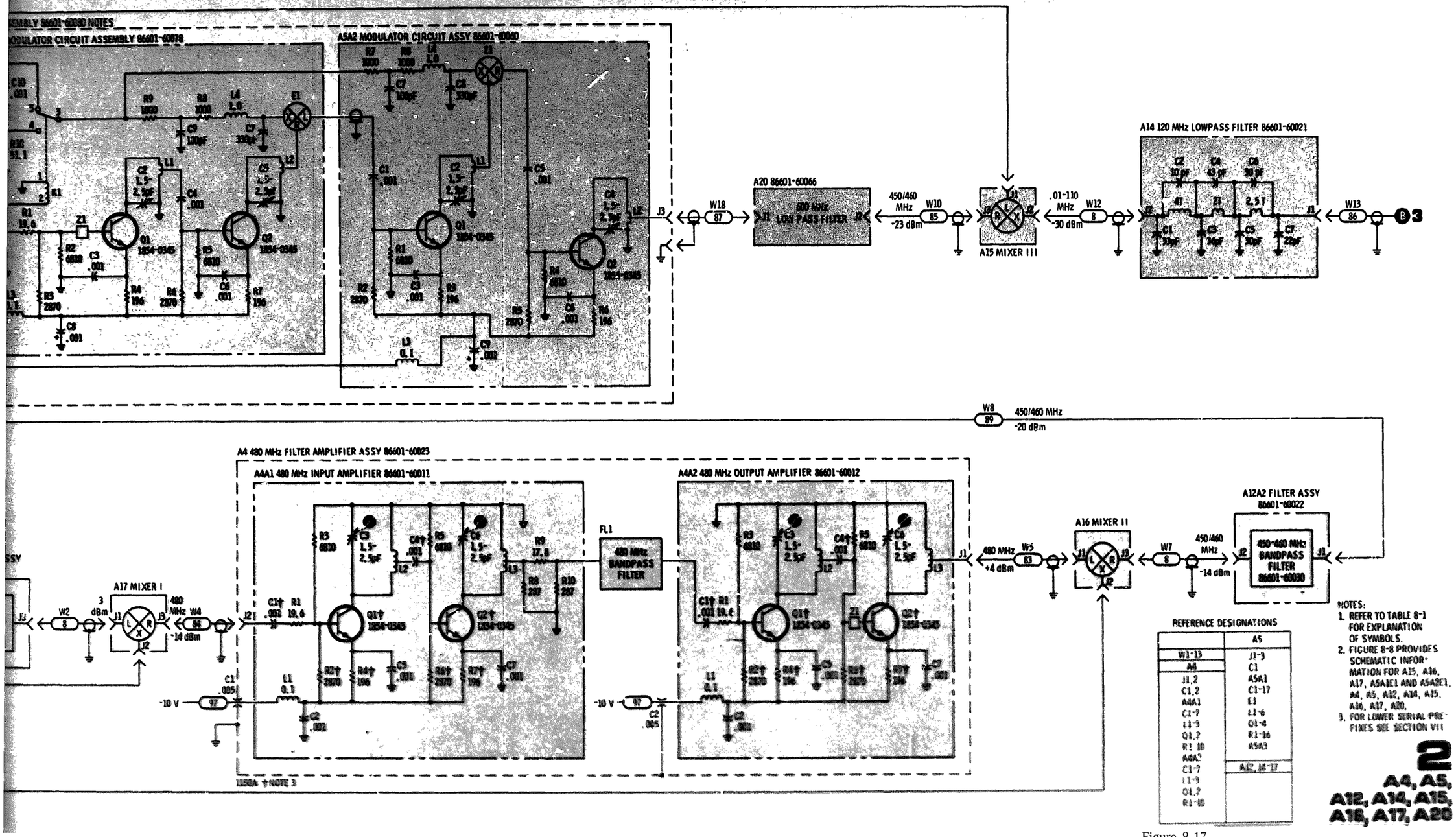


Figure 8-16. *Modulator Assembly Component Locations*

SERVICE SHEET 2


A11 W11
64
94
+15 dBm
350/450 MHz
A5 MODULATOR ASSEMBLY 86601-60080 NOTES
A5A1 MODULATOR CIRCUIT ASSEMBLY 86601-60078
A5A2 MODULATOR CIRCUIT ASSY 86601-60060
CNTRL
80
J4
PULSE IN
95
J1
PULSE ID
96
C3 .005
RF IN
89
W9
J2
-10V
97
C2 .005
C1 .005
C10 .001
..10 51.1
K1
C1 .001
R1 19.6
Z1
R2 6810
C3 .001
R3 2870
L3 0.1
C8 .091
R4 196
R6 2870
C9 100pF
R8 1060
L4 1.0
C7 330pF
E1
C2 1.5-2.5pF
L1
C4 .001
Q1 1854-0345
C5 1.5-2.5pF
L2
Q2 1854-0345
R5 6810
C6 .001
R7 196
R7 1000
R8 1000
C7 100pF
C8 330pF
C1 .001
C2 1.5-2.5pF
C5 .001
R1 6810
C3 .001
R2 2870
R3 196
R5 2870
R4 6810
C6 .001
R6 196
C9 .001
1223A †NOTE 3
A4 480 MHz FILTER AMPLIFIER ASSY 86601-60023
A4A1 480 MHz INPUT AMPLIFIER 86601-60011
A11A1 FILTER ASSY
A11 MIXER
480 MHz BANDPASS FILTER
480 MHz
-14 dBm
3 dBm
-4 dBm
R5 6810
C5 1.5-2.5pF
C4† .001
L2
R9 17.8
R8 287
R10 287
C1† .001
R1 19.6
Q1† 1854-0345
Q2† 1854-0345
R2† 2870
R4† 196
C3 .001
R6† 2870
R7† 196
C7 .001
L1 0.1
C2 .001
FL1



REFERENCE DESIGNATIONS

	A5
W1-13	J1-3
A4	C1
J1,2	A5A1
C1,2	C1-17
A4A1	E1
C1-7	L1-6
L1-3	Q1-4
Q1,2	R1-16
R1-10	A5A3
A4A2	
C1-7	A12, 14-17
L1-3	
Q1,2	
R1-10	

NOTES:
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS.
2. FIGURE 8-8 PROVIDES SCHEMATIC INFORMATION FOR A15, A16, A17, A5A1E1 AND A5A2C1, A4, A5, A12, A14, A15, A16, A17, A20.
3. FOR LOWER SERIAL PREFIXES SEE SECTION VII

2
A4, A5, A12, A14, A15, A16, A17, A20

Figure 8-17. *Filters, Mixers and Modulator Schematic*

SERVICE SHEET 3

PREAMPLIFIER AND POWER AMPLIFIER ASSEMBLIES

Normally, the cause of a malfunction in the Model 86601A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree.

When trouble is traced to the A6 or A2 assemblies remove the defective assembly from the housing and reconnect the dc and rf inputs and outputs to provide access to test points and components. Be sure to use an insulating material between the circuit board and chassis to prevent short circuits.

TEST EQUIPMENT REQUIRED: (See Table 1-2.)

Digital Voltmeter
Counter
Spectrum Analyzer
Low Voltage DC Power Supply

PREAMPLFIER ASSEMBLY A6

The rf signal from the A14 120 MHz Low Pass Filter is coupled to the base of Q1 through another 120 MHz Low Pass Filter (L2, 3, 4; C2, 3) and a peaking circuit (R4, C5).

The output of Q1 is amplified by Q2 and applied to the base of emitter-follower Q3, The signal at the emitter of Q2 provides a feedback bias to aid in leveling the flatness of the amplifier over the frequency range.

The output of emitter-follower Q3 is coupled through R14 and C13 to the input of the power amplifier assembly A2. The gain **of the A6 preamplifier assem**bly is about 30 dB.

POWER AMPLIFIER AND AGC ASSEMBLY A2

The rf signal from the preamplifier is coupled through C1 to the base of emitter-follower Q1. The signal from Q1 is used to drive complementary symmetry amplifier Q2/Q3. The output of Q2/Q3 provides:

a. A feedback signal to optimize flatness of the output signal.

b. The rf output to the 150 dB programmable attenuator.

c. The signal to drive the Automatic Gain Control Circuit (AGC).

Q4 and Q5 couple the rf signal to detector CR2/CR3 and also provides isolation between the AGC circuits and the rf output.

When the output frequency of the Model 86601A is above 4 MHz, transistors Q6 through Q11 have no effect on AGC operation. The effective time constant of the detector circuit is controlled solely by R23/C18 and R24/C23.

When the output frequency of the Model 86601A is between 400 kHz and 4 MHz, the Code 1 input from the mainframe DCU is high (about +3V) and Q7 is turned on to provide a ground

return for C22. The Code 1 signal also turns off Q10 to turn on Q11 and provide a ground return for C21. With C21 and C22 in the circuit the effective time constant is enlarged to improve the response of the detector circuit.

When an output rf signal below 400 kHz is selected the Code 2 input also goes high. This high level turns on Q8 to provid a ground return for C19. Q9 is turned off to turn on Q6 which provides a ground return for C17. The effective time constant of the detector is again increased to improve the response of the AGC circuit for the lower frequency signals.

The output of emitter-follower Q13 is applied across a voltage divider and the desired output level is controlled by R31. C24 and C25 by-pass remaining rf signals to ground.

NOTES

1. Verify the presence of dc operating voltages before taking other measurements. If dc voltages are not present, check connections to the mainframe. If the interconnections are good, refer to the mainframe manual and make repairs as required.

2. Unless otherwise specified, all measurements are taken with the Spectrum Analyzer.

3. If repairs are made in any part of the circuits shown on Service Sheet 3, the appropriate adjustment procedures in Section V of this manual should be performed.

4. These procedures assume that the cause of malfunction has been isolated to the A2 or A6 **assembly as a result** of performing the tests specified in the **troubleshooting** tree.

TEST PROCEDURE 0

Test 1-a. Use the Spectrum Analyzer to trace the input signal to the defective stage in the A6 assembly and repair as required.

A4, A5 Input Signals Processing

SERVICE SHEET 2

TEST PROCEDURE 1

If the rf output is low, or not present at all, at the RF connector on the A2 assembly proceed to test 2-a. If output level flatness is not correct at low frequencies proceed to test 2-b.

Test 2-a. Use the Spectrum Analyzer to trace the input sig the defective stage and repair as required.

Test 2-b. Recheck the code 1 and code 2 inputs at t assembly.

Frequency	Code 1	C
> 4 MHz	< 150 mV	< 15
> .4 MHz < 4 MHz	> +3 v	< 15
< .4 MHZ	> +3 v	> +

If code 1 and code 2 levels are not as specified recheck inputs from the mainframe. If the inputs from the main are not present refer to the mainframe manual and repa required.

If code 1 and code 2 signals are present and the rf flatness is as specified above 4 MHz but is not as specified 4 MHz, proceed to Test 2-c. If the code 1 and code 2 sig present and the rf flatness is as specified above .4 MHz b below .4 MHz, proceed to Test 2d. If the rf output flat also incorrect above 4 MHz, proceed to Test 2-e.

Test 2-c. Check Q7, Q10, Q11 and associated compone and Q11 should be on (saturated), and Q10 should be off

Test 2-d. Check **Q8, Q9, Q6 and associated components.** Q8 should be on **(saturated) and Q9 should be off**

Test 2-e. Disconnect the DET OUT and reconnect it usin connector. Connect the digital voltmeter to the third T and monitor the dc level of the AGC signal. With the rf set to +13 dBm the digital voltmeter should i approximately −2.6V. With the VERNIER control se reading of −10 dBm on the Model 86601A meter the voltmeter should indicate approximately −0.6V

If the AGC dc levels are not as specified perform the app adjustment procedures in Section V of this manual

If the adjustment procedures do not eliminate the p check Q4, Q5, Q12, Q13 and associated components.

SERVICE SHEET 3 (cont'd)

return for C22. The Code 1 signal also turns off Q10 to turn on Q11 and provide a ground return for C21. With C21 and C22 in the circuit the effective time constant is enlarged to improve the response of the detector circuit.

When an output rf signal below 400 kHz is selected the Code 2 input also goes high. This high level turns on Q8 to provide a ground return for C19. Q9 is turned off to turn on Q6 which provides a ground return for C17. The effective time constant of the detector is again increased to improve the response of the AGC circuit for the lower frequency signals.

The output of emitter-follower Q13 is applied across a voltage divider and the desired output level is controlled by R31. C24 and C25 by-pass remaining rf signals to ground.

NOTES

1. Verify the presence of dc operating voltages before taking other measurements. If dc voltages are not present, check connections to the mainframe. If the interconnections are good, refer to the mainframe manual and make repairs as required.

2. Unless otherwise specified, all measurements are taken with the Spectrum Analyzer.

3. If repairs are made in any part of the circuits shown on Service Sheet 3, the appropriate adjustment procedures in Section V of this manual should be performed.

4. These procedures assume that the cause of malfunction has been isolated to the A2 or A6 assembly as a result of performing the tests specified in the troubleshooting tree.

TEST PROCEDURE

Test 1-a. Use the Spectrum Analyzer to trace the input signal to the defective stage in the A6 assembly and repair as required.

SERVICE SHEET 3 (cont'd)

TEST PROCEDURE

If the rf output is low, or not present at all, at the RF OUT connector on the A2 assembly proceed to test 2-a. If the rf output level flatness is not correct at low frequencies proceed to test 2-b.

Test 2-a. Use the Spectrum Analyzer to trace the input signal to the defective stage and repair as required.

Test 2-b. Recheck the code 1 and code 2 inputs at the A2 assembly.

Frequency	Code 1	Code 2
> 4 MHz	< 150 mV	< 150 mV
> .4 MHz < 4 MHz	> +3 V	< 150 mV
< .4 MHz	> +3 V	> +3 V

If code 1 and code 2 levels are not as specified recheck the inputs from the mainframe. If the inputs from the mainframe are not present refer to the mainframe manual and repair as required.

If code 1 and code 2 signals are present and the rf output flatness is as specified above 4 MHz but is not as specified below 4 MHz, proceed to Test 2-c. If the code 1 and code 2 signals are present and the rf flatness is as specified above .4 MHz but not below .4 MHz, proceed to Test 2-d. If the rf output flatness is also incorrect above 4 MHz, proceed to Test 2-e.

Test 2-c. Check Q7, Q10, Q11 and associated components. Q7 and Q11 should be on (saturated), and Q10 should be off.

Test 2-d. Check Q8, Q9, Q6 and associated components. Q6 and Q8 should be on (saturated) and Q9 should be off.

Test 2-e. Disconnect the DET OUT and reconnect it using a Tee connector. Connect the digital voltmeter to the third Tee port and monitor the dc level of the AGC signal. With the rf output set to +13 dBm the digital voltmeter should indicate approximately −2.6V. With the VERNIER control set for a reading of −10 dBm on the Model 86601A meter the digital voltmeter should indicate approximately −0.6V.

If the AGC dc levels are not as specified perform the applicable adjustment procedures in Section V of this manual.

If the adjustment procedures do not eliminate the problem check Q4, Q5, Q12, Q13 and associated components.

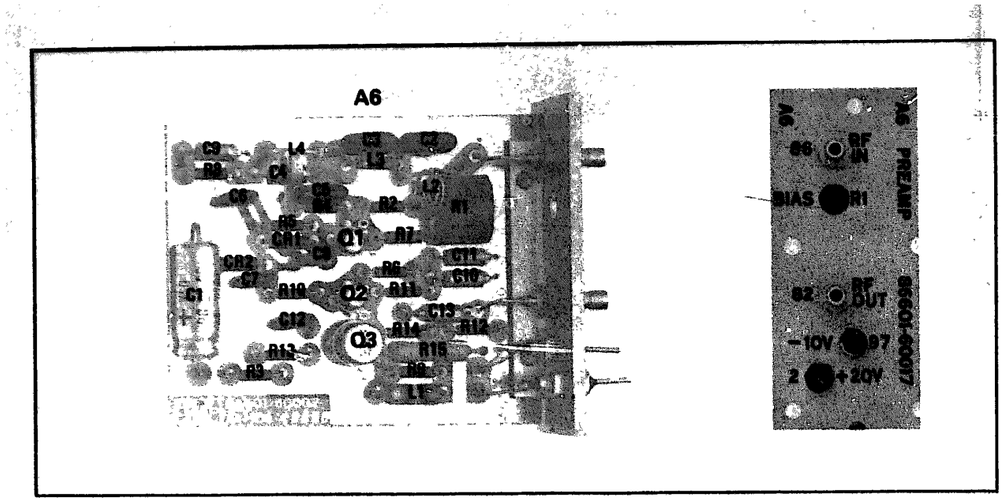


Figure 8-18. Preamplifier Component Locations

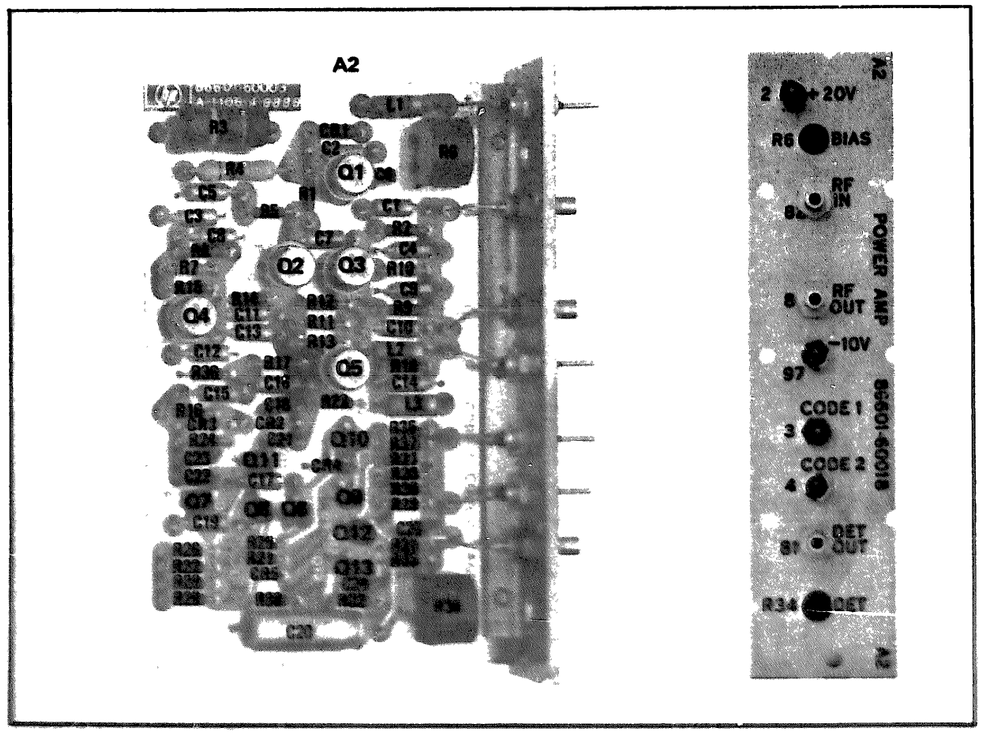


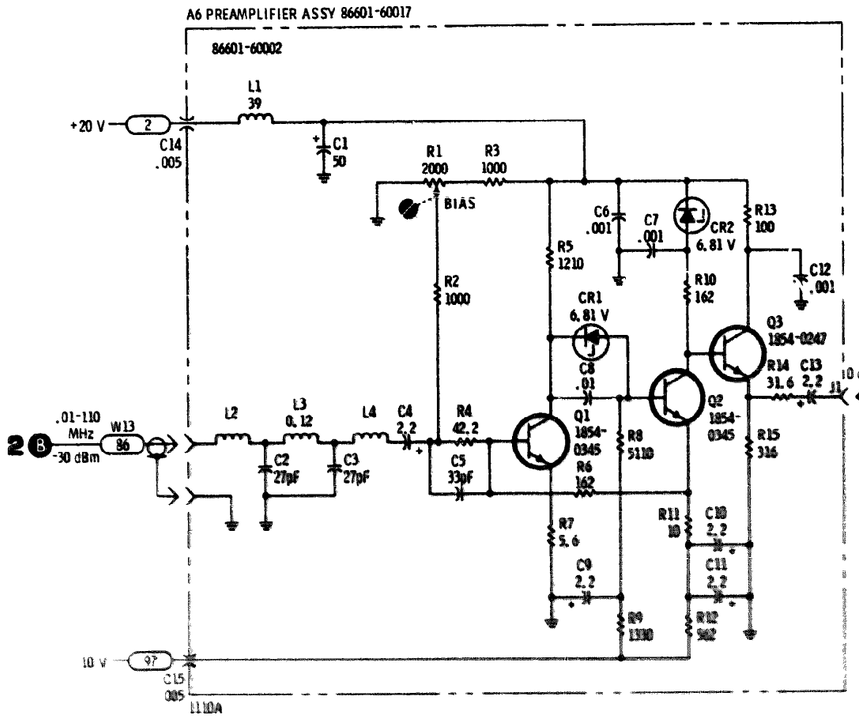
Figure 8-19. *Power Amplifier and AGC Component Locations*

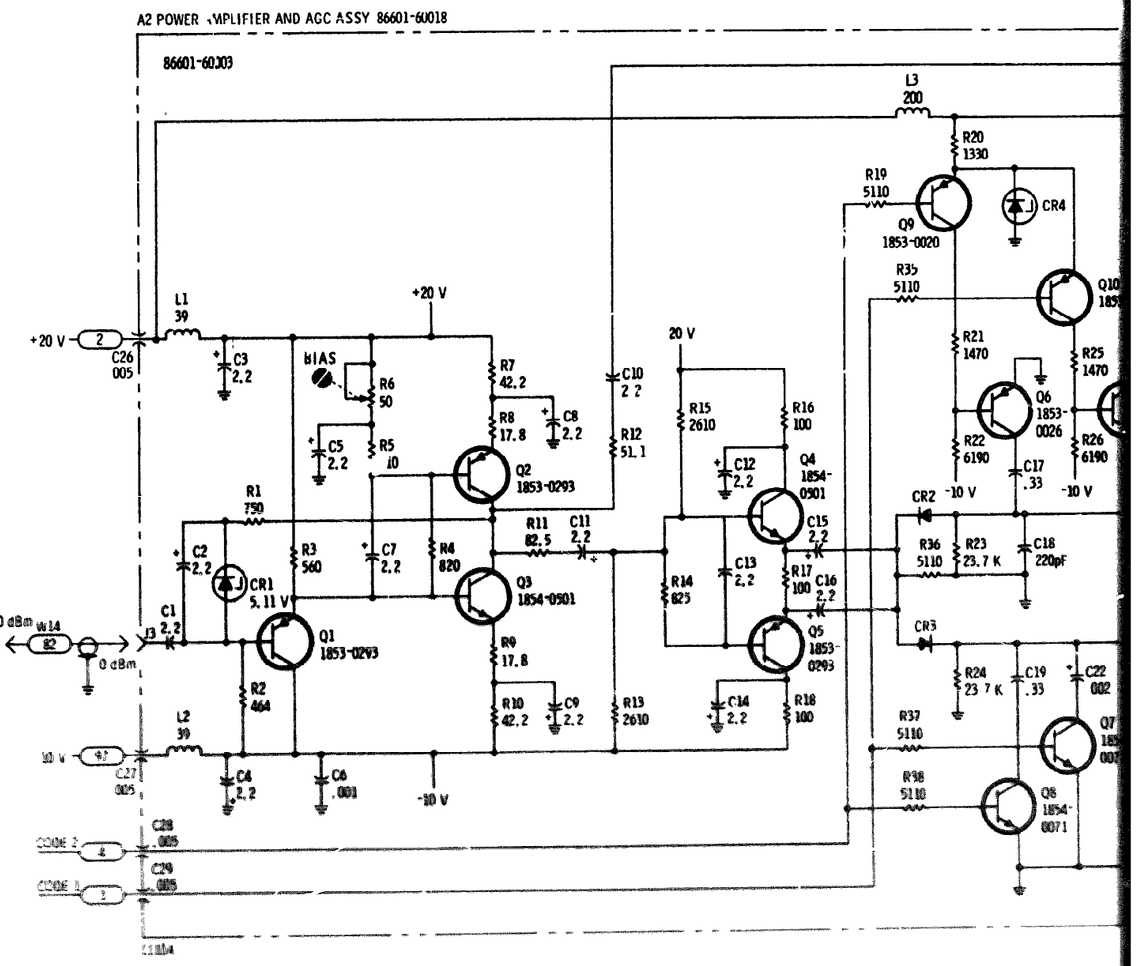
SERVICE SHEET 3

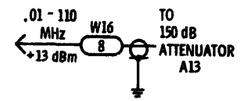
REFERENCE DESIGNATIONS

	A2
W13-16	C1-29
A6	CR1-4
C1-15	L1-3
CR1,2	Q1-13
L1-4	R1-38
Q1-3	
R1-15	

NOTES-
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS







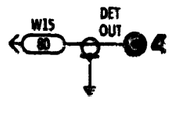
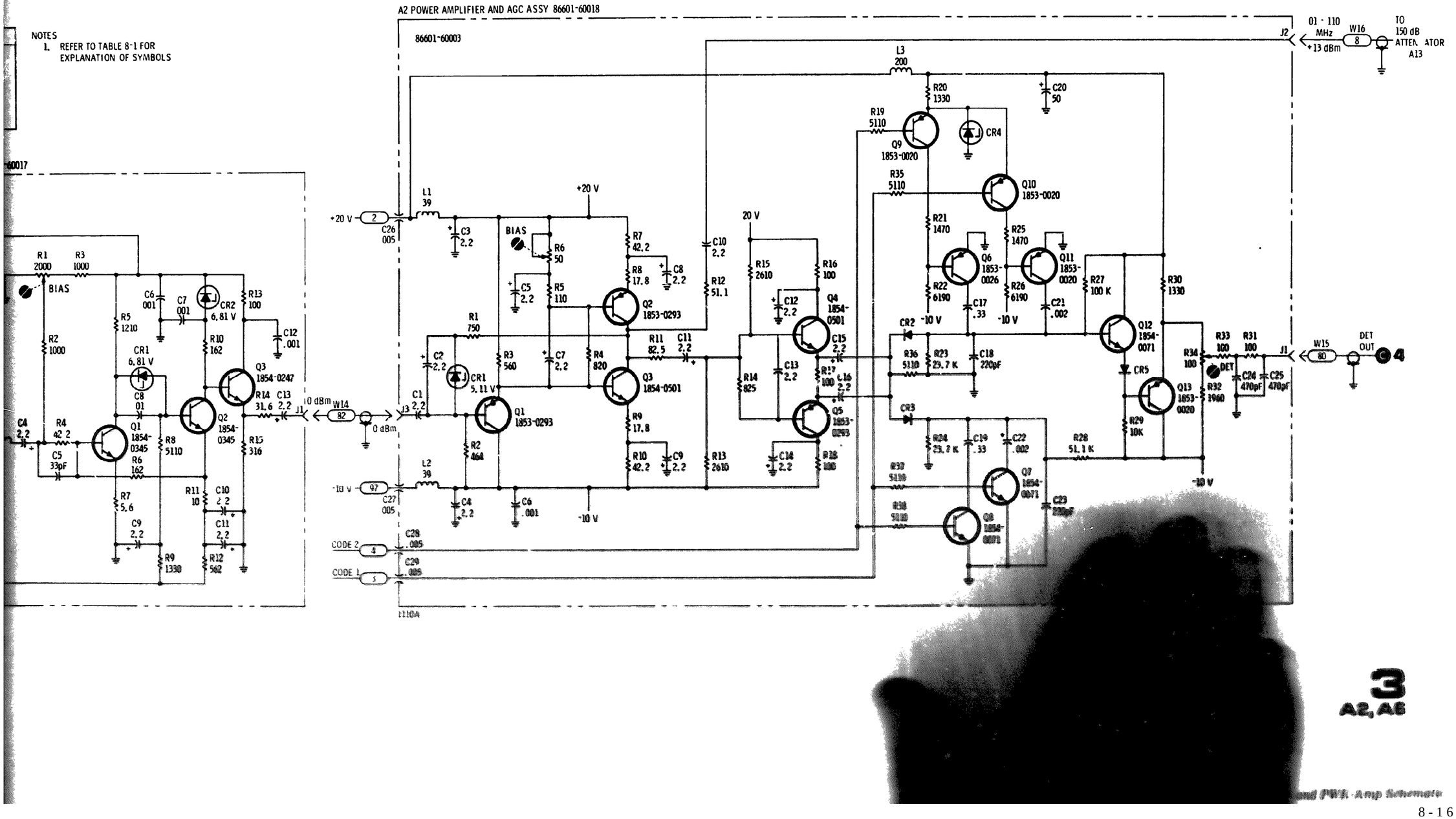


Figure 8-20. and PWR Amp Schematic

NOTES
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS

A2 POWER AMPLIFIER AND AGC ASSY 86601-60018

86601-60003



A2, A6

Power Amp Schematic

SERVICE SHEET 4

Normally, the cause of a malfunction in the Model 86601A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree.

When the cause of trouble has been isolated to the A3 assembly, it must be removed from the well and reconnected to provide access to test points and components.

When the cause of trouble has been isolated to the A9 assembly it may be extended for maintenance with an extender board.

TEST EQUIPMENT REQUIRED

Digital Voltmeter	Extender Cable
Marked Card Programmer	Power Supply
Spectrum Analyzer	

NOTE

A voltage designated as a high in this text will be > +2.2V unless otherwise noted and a low will be <+0.8V.

■ REFERENCE AMPLIFIER ASSEMBLY A9

The output rf level from the A2 Power Amplifier is controlled by a dc reference from the A9 assembly.

The voltage source for the reference level is operational amplifier U1. When the instrument is in the CW mode the source voltage is −2V. The dc level at the output of U1 is coupled to the feedback amplifier, A3, in one of two ways.

In local operation the LCL/RMT input (XA9 pin A) is high. Q2 is turned off and Q1 is turned on to energize K6. The output of U1 is applied to a voltage divider network (R14, A1R1 and A1R2). The front panel VERNIER control (A1R1) is capable of controlling the rf output of the A2 power amplifier assembly from +13 dBm to 0 dBm. At an output rf level of +13 dBm the dc level to the feedback amplifier is −1V.

In remote operation the LCL/RMT input (XA9 pin A) is low. Q1 is turned off and Q2 is turned on to energize K5. The dc level to the A3 assembly is now controlled by K1 through K4 which are, in turn, controlled by the 1A, 2A, 4A, and 8A input lines. As an example, if the programmed output is +13 dBm, the inputs on 1A, 2A, 4A and 8A are all low; K1 through K4 are all energized and −1V is coupled to the A3 assembly. If an output of +12 dBm is programmed in, input line 1A now goes high, Q9 is turned off, relay K1 is de-energized, and Q11 is turned on to provide a ground return for R10. Resistors R8, R10 and R11 reduce the reference level to the feedback amplifier by the amount required to ensure a 1 dB decrease of the rf output from the A2 power amplifier assembly.

Relays K2, K3, K4 and associated components operate in the same manner as K1 except that the associated resistive networks are weighted to produce 2, 4 and 8 dB of attenuation to the A2 rf output.

The front panel rf output meter is functional in both local and remote modes. The DET output from A2 is filtered in the A3 assembly and then applied to the meter driver stage (Q10) in the A9 assembly.

SERVICE SHEET 4 (cont'd)

■ FEEDBACK AMPLIFIER ASSEMBLY A3

Differential amplifier U1 has as its inputs the negative dc reference from the reference assembly and the DET output of the A2 assembly. These two inputs are compared and the difference determines theoutput of U1 at pin 6.

The output from U1 is coupled through Q8 and Q9 to the modulator assembly (A6) where it is used as a gain control, This gain control level directly affects the A2 power amplifier rf and AGC output levels. When the rf output of the A2 assembly reaches the programmed level the loop is stabilized and the output of U1 is a steady dc level (CW mode).

In the AM mode the amplitude modulating signal is superimposed on the reference level from the AS assembly. The amplitude modulating signal also appears at the output of U1 and it is used to modulate the center frequency in the A5 assembly.

As long as the output frequency of the Model 86601A is greater than 4 MHz the frequency rolloff of the feedback amplifier is controlled by R15 and C9.

Code 1 and code 2 signals from the mainframe DCU alter the response time of the circuit in the following manner:

When the selected output frequency is below 4 MHz (but above 400 kHz), the code 1 line is high and Q7 is turned on to provide a ground return for C7. This increases the time constant of the circuit and improves the response at the selected frequency.

Note that Q1 is also turned on to provide a ground return for C6 to maintain leveling accuracy.

When an output frequency below 800 kHz is selected the code 2 line also goes high to turn on Q6. **This provides a ground return** for C8 to further increase the respo**nse time of the circuit.**

The code 1 and code 2 levels ensure that **the rf output level remains** constant over the entire frequency range o**f the instrument.**

NOTES

1. **Verify the presence of dc operating voltages before taking other measurements. If dc voltages are not present, check connections to the mainframe. If interconnections are good refer to the mainframe manual and make necessary repairs.**

2. **After making repairs in either of the circuits shown, the adjustment procedure specified in Section V of this manual should be performed.**

3. **These procedures assume that the cause of malfunction has been isolated to the A3 or A9 assemblies as a result of performing the tests specified in the troubleshooting trees.**

TEST PROCEDURE ■

One of the following conditions exists:

The Model 86601A rf output is present but the output meter does not operate properly — proceed to Test 1-a.

SERVICE SHEET 4 (cont'd)

The Model 86601A output level in local mode is properly controlled by the VERNIER control but remote 1 dB step programming is inaccurate - proceed to Test l-c.

The Model 86601A output level is programmable but the VERNIER control does not properly control the output level - proceed to Test 1-d.

Neither the VERNIER control (local) or the 1 dB step attenuator (remote) operate properly - proceed to Test le.

Test 1-a. Extend the AS assembly from the chassis on an extender board. With the Model 86601A VERNIER and OUTPUT RANGE controls set for a +13 dBm output measure the dc level at XA9 pin K. The dc level should be about -550 mV, Set the Model 86601A output to -10 dBm. The dc level at XA9 pin K should be about -225 mV. If the voltage is not present proceed to Test l-b.

If the dc levels at XA9 pin K are as specified use the digital voltmeter to check the dc level at XA7-2 pin 7. With the Model 86601A output set to +13 dBm the dc level should be about +5.05 V. Turn the VERNIER control full counterclockwise - the dc level should increase to about +5.2 V.

If the dc level at XA7-1 pin 7 is not present the meter or wiring to the +5.25V input is defective.

If the dc level at XA7-2 pin 7 is present, but does not vary as the VERNIER control is rotated, Q10 or associated components are defective.

If the dc level at XA7-2 pin 7 is present and varies as the VERNIER control is rotated, but the Model 86601A output meter does not change, the meter is defective.

Test 1-b. Recheck for the dc levels specified for XA9 pin K at the white-orange MTR lead on the A3 assembly. If the levels are now present, check the interconnections to the A9 assembly. If the dc levels still are not present proceed to Test Procedure 2.

Test 1-c. In the local mode set the instrument for a 30 MHz +13 dBm output. Monitor the output with the spectrum analyzer and set the analyzer controls to display the peak of the signal at the top graticule line.

In the remote mode program 1, 2, 4 and 8 dB steps of attenuation. Observe the Model 86601A output meter and the analyzer display. If one or more of the steps do not produce the desired results check the logic levels at XA9 pins E, F, H and/or J against the levels shown in Table 8-3. If these levels are correct, one or more of the relay/relay driver circuits is defective Example: If the 1 dB step is defective, check Q9, Q11, K1 and associated components.

If the logic levels at XA9 pins E, F, H and J are not correct, trouble is in the logic circuit (see Service Sheet 5), the mainframe, or the programming device.

SERVICE SHEET 4 (cont'd)

Table 8-3. 1dB Attenuation Checks

Attenuation (dB)	XA9 Pins			
dB	E	F	H	J
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

Test 1-d. With the instrument turned on in the local mode check for continuity between XA9 pins 10 and L. If a direct short does not exist between these pins check Q1 and K6.

If the direct short between XAQ pins 10 and L is present check A9R14, A1R1, A1R2 and interconnections.

Test 1-e. Perform the adjustment procedures specified in paragraphs 5-14 and 5-15. If the adjustments cannot be made A9U is probably defective.

TEST PROCEDURE ■

Test 2-a. Disconnect the input from CNTRL IN. Connect a low **voltage power supply through a** 1000 ohm resistor to CONTROL IN **(—ground). With the front panel** VERNIER control set full clockwise **adjust the power supply for a +1**3 dBm output.

Measure the voltage at U1 pin 3 (—0.8V) and U1 pin 4 (0.9V). If the **voltages are correct, proceed to test 2-b.**

If the level at U1 pin 4 is incorrect refer to Service Sheet 3.

If the level at U1 pin 3 is incorrect, refer to TEST PROCEDURE 1 of this Service Sheet.

Test 2-b. Measure the voltage at U1 pin 6 (should be approximately 850 mV). If the voltage is correct, check Q8, Q9 and associated components. If the voltage is incorrect, check U1 and associated components.

Test 2-c. Verify that the rf output meter is tracking the DET output to the meter driver at XA7-2 pin 8.

Set the front panel VERNIER control for output meter readings of 1.0V, 0.6V, and 0.2V. The dc level at XA7-2 pin 8 should be —0.6 ± 0.1V, —0.35 ± 0.1V and —0.1 ± .05V respectively.

Repeat the tests with the rf output set to 4.1, 2.1 and 0.1 MHz. The dc levels specified at XA7-2 pin 8 should be the same at all three frequencies; if they are not, determine which code line is not functioning properly and check the associated transistor switching circuit.

A2, A6 Preamplifier and Power Amplifier Assemblies

◆ SERVICE SHEET 3

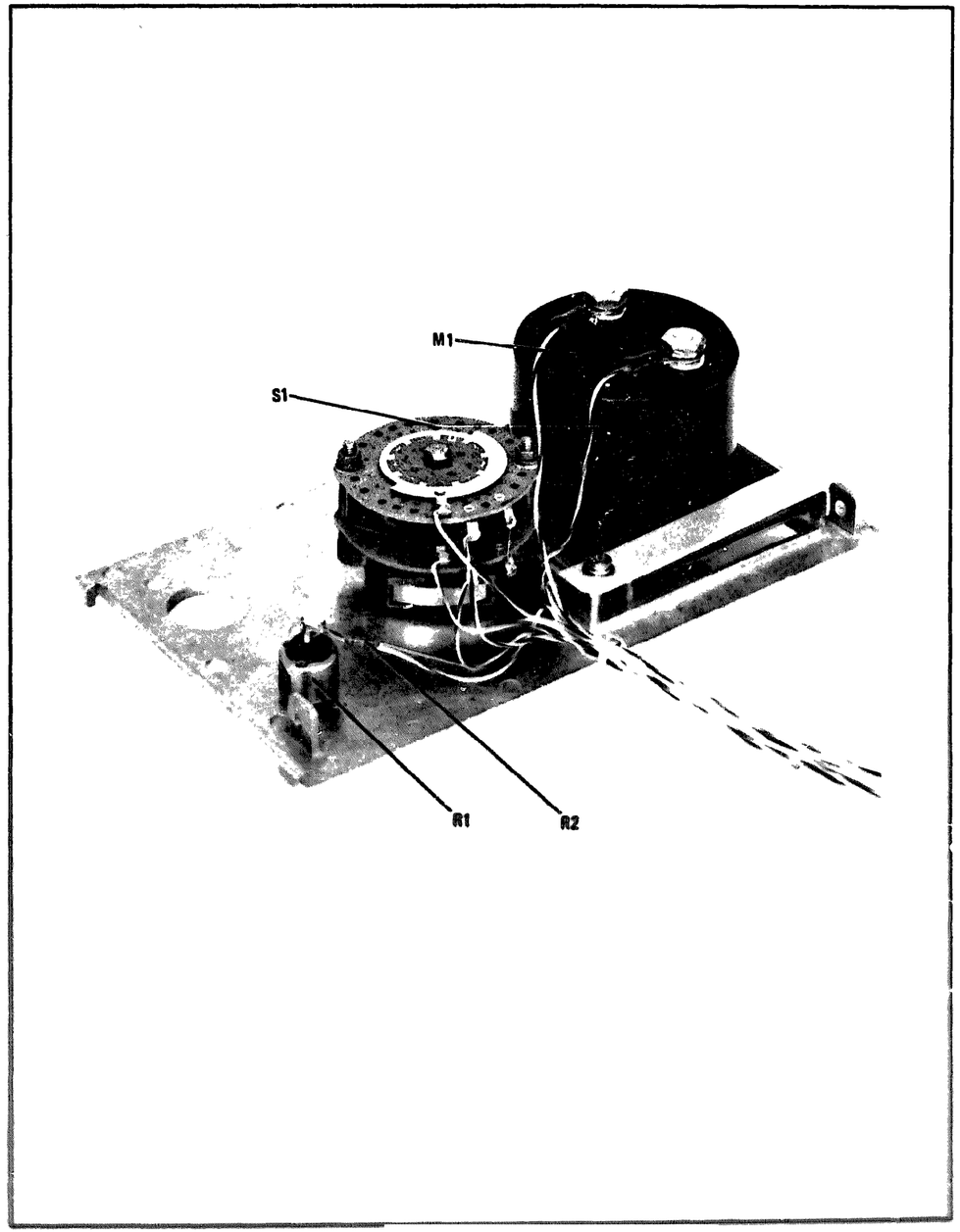


Figure 8-21. *Front Panel Component Locations*

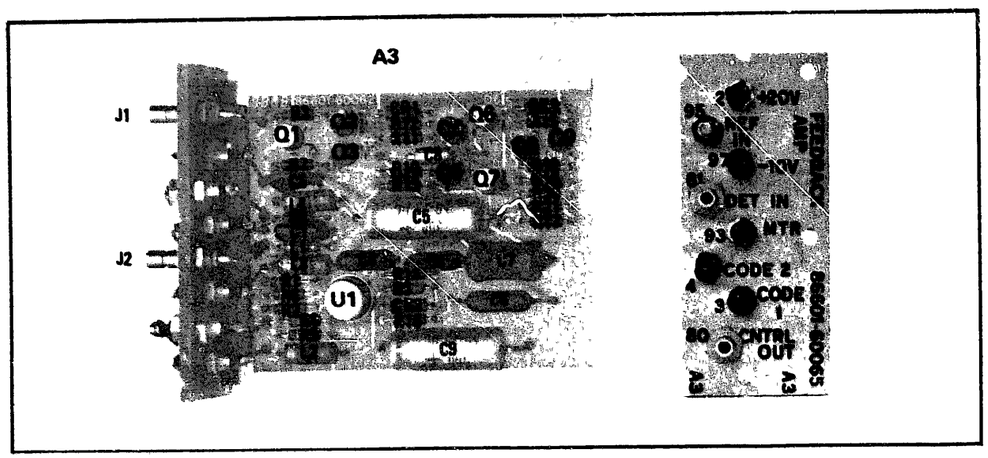


Figure 8-22. Feedback Amplifier Component Locations

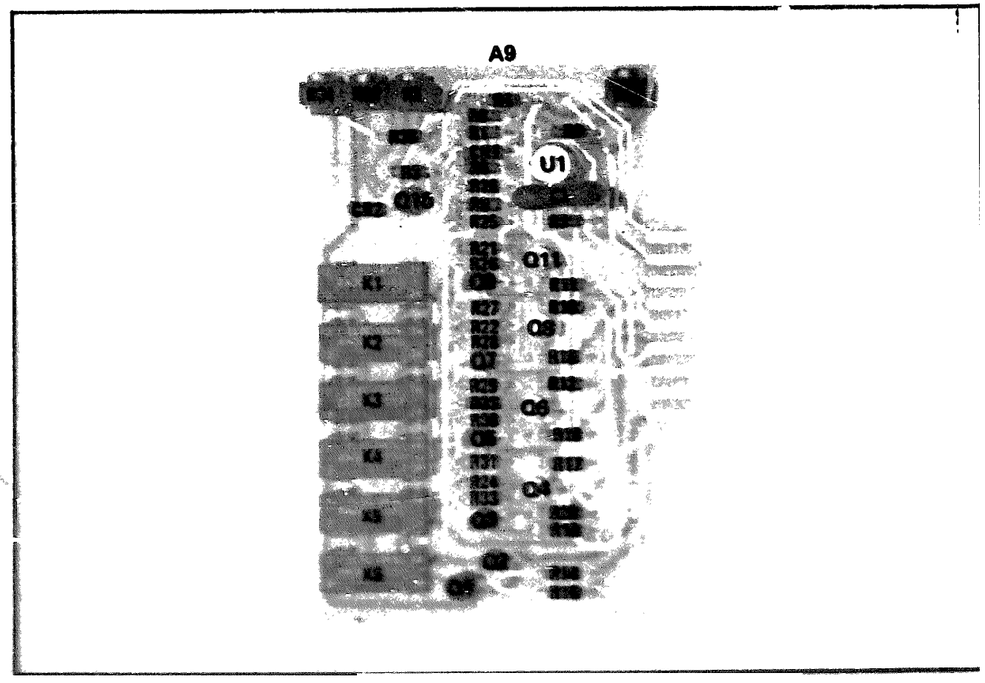
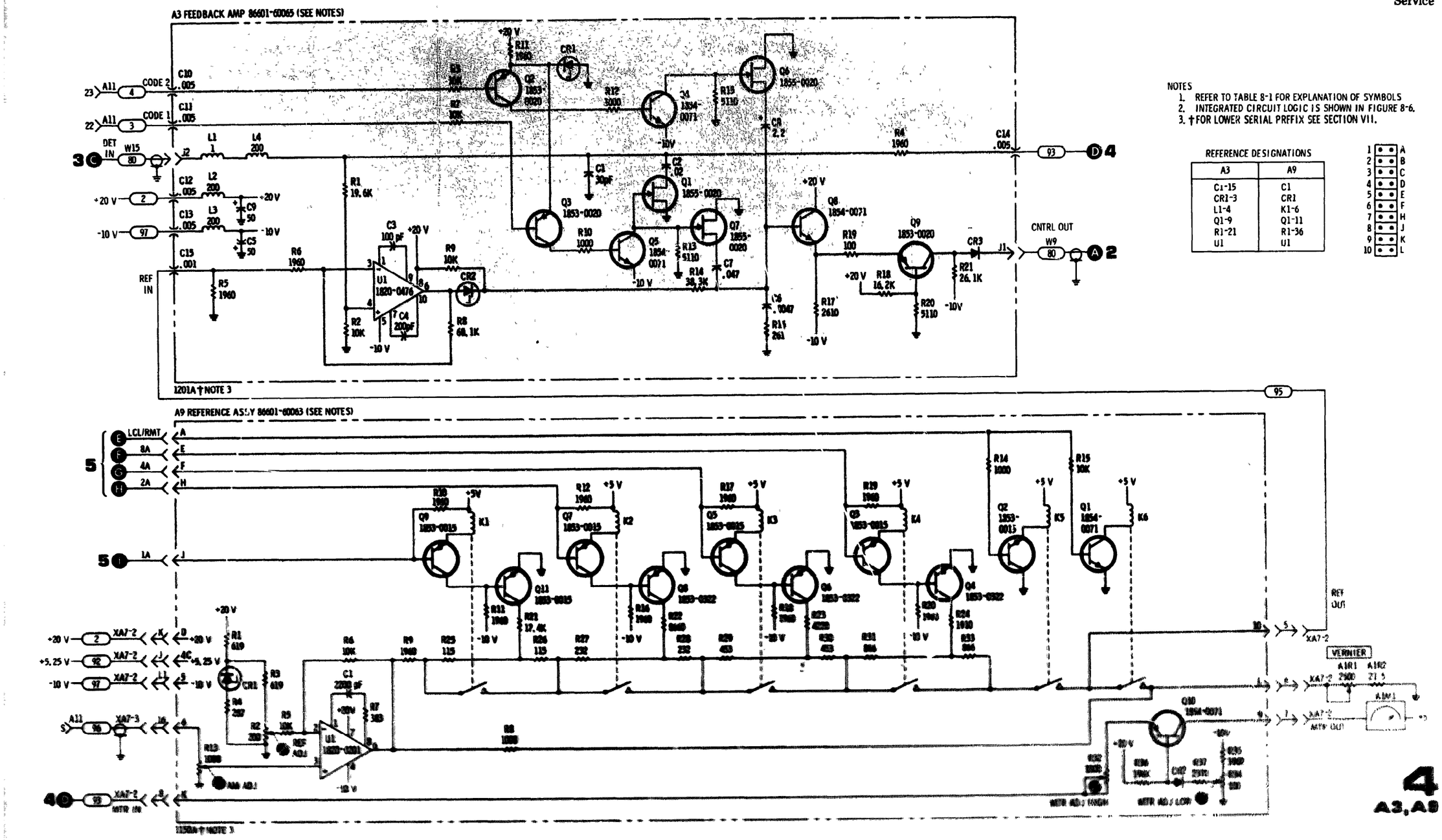


Figure 8-23. *Reference Assembly Component Locations*

SERVICE SHEET 4



NOTES
1. REFER TO TABLE 8-1 FOR EXPLANATION OF SYMBOLS
2. INTEGRATED CIRCUIT LOGIC IS SHOWN IN FIGURE 8-6.
3. †FOR LOWER SERIAL PREFIX SEE SECTION VII.

REFERENCE DESIGNATIONS

A3	A9
C1-15	C1
CR1-3	CR1
L1-4	K1-6
Q1-9	Q1-11
R1-21	R1-36
U1	U1

Figure 8-24 *Feedback Amplifier and Reference Assy Schematic*

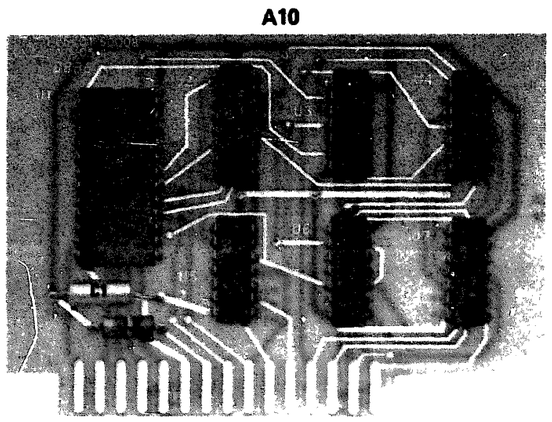


Figure 8-25. *Logic Assembly Component Locations*

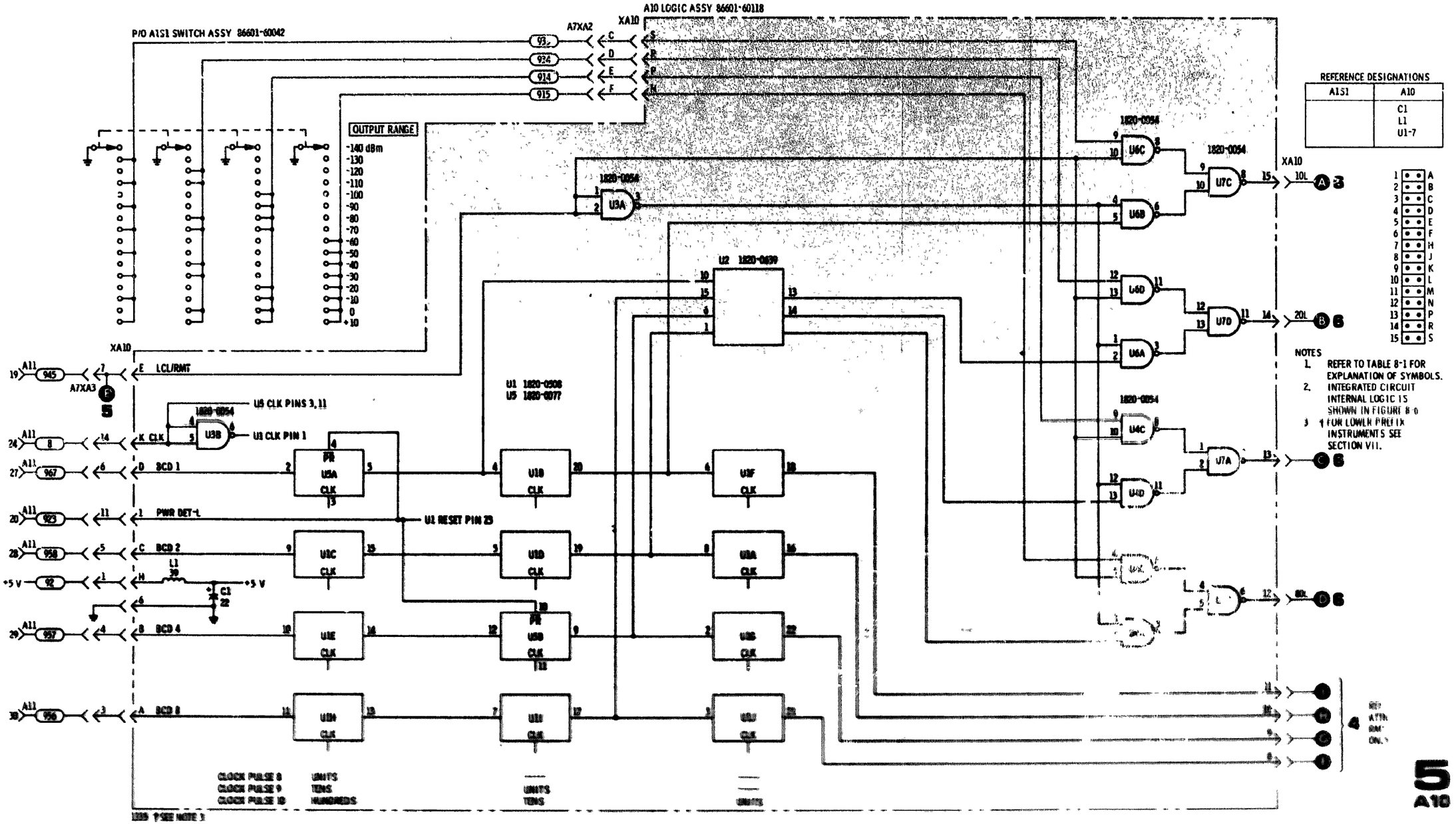


Figure 8-26 *Logic and Driver Circuit Schematic*

SERVICE SHEET 6

Normally, causes of malfunction in the Model 86601A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree.

When trouble has been isolated to the A8 assembly, the defective assembly should be extended from the chassis with an extender board to provide access to test points and components.

EQUIPMENT REQUIRED:

Digital Voltmeter
Extender Cable

ATTENUATOR AND DRIVER ASSEMBLIES

The programmable attenuator is a five-section relay operated attenuator. Them are one 10 dB, one: 20 dB and three 40 dB sections in the attenuator. Two of the 40 dB attenuator sections are in series to provide 80 dB of attenuation.

NOTE

The programmable attenuator is not considered a field repairable item. If found defective it should be returned to the factory for repairs, or a replacement may be ordered as a module exchange item.

The A8 attenuator driver assembly consists of four identical transistor switching circuits. These switching circuits are controlled by the binary (1 — 2 — 4 — 8) inputs from the A10 logic assembly. Since the switching circuits are all identical, only the binary 1 (10 dB) circuit will be discussed.

When the binary input at XA8 pin M is low Q15 and Q11 are turned off, Q16 and Q12 are turned on, and —21V is applied to the 10 dB section of the 150 dB programmable attenuator through XA8 pin 4. The 10 dB section of the attenuator is bypassed (no attenuation provided).

When the binary input at XA8 pin M is high Q16 and Q12 are turned off, Q15 and Q11 are turned on, and +21V is applied to the 10 dB section of the 150 dB programmable attenuator through XA8 pin 4. The 10 dB section of the attenuator is enabled and 10 dB of attenuation is inserted into the rf output signal path.

The 150 dB programmable attenuator sections are selected by binary 1 — 2 — 4 — 8 inputs to the A8 assembly from 0 0 0 0 to 1 1 1 1 to provide 16 discrete 10 dB steps.

NOTE

The programmed attenuation must be subtracted from +13 dBm in order to determine the rf output level of the Model 86601A. Example: with 129 dB of attenuation programmed in, the rf output will be —116 dBm.

TEST PROCEDURE

Table 8-4 provides input and output level information for the attenuator driver assembly. Make the checks in local mode.

Table 8-4. Attenuator Driver Levels

OUTPUT RANGE (dBm)	XA8 pins								
	M	L	K	J	4	3	2	1	
—140	H	H	H	H	H	H	H	H	
—130	L	H	H	H	L	H	H	H	
—120	H	L	H	H	H	L	H	H	
—110	L	L	H	H	L	L	H	H	
—100	H	H	L	H	H	H	L	H	
— 90	L	H	L	H	L	H	L	H	
— 80	H	L	L	H	H	L	L	H	
— 70	L	L	L	H	L	L	L	H	
— 60	H	H	H	L	H	H	H	L	
— 50	L	H	H	L	L	H	H	L	
— 40	H	L	H	L	H	L	H	L	
— 30	L	L	H	L	L	L	H	L	
— 20	H	H	L	L	H	H	L	L	
— 10	L	H	L	L	L	H	L	L	
0	H	L	L	L	H	L	L	L	
+ 10	L	L	L	L	L	L	L	L	

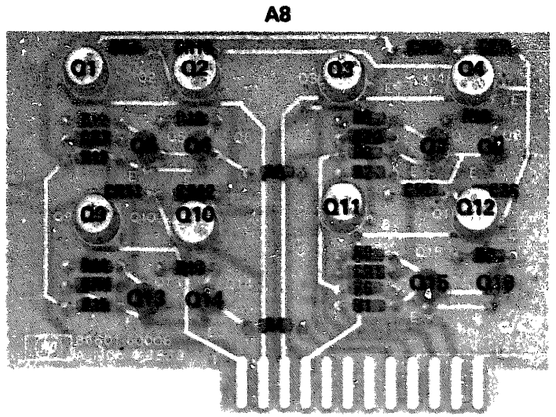
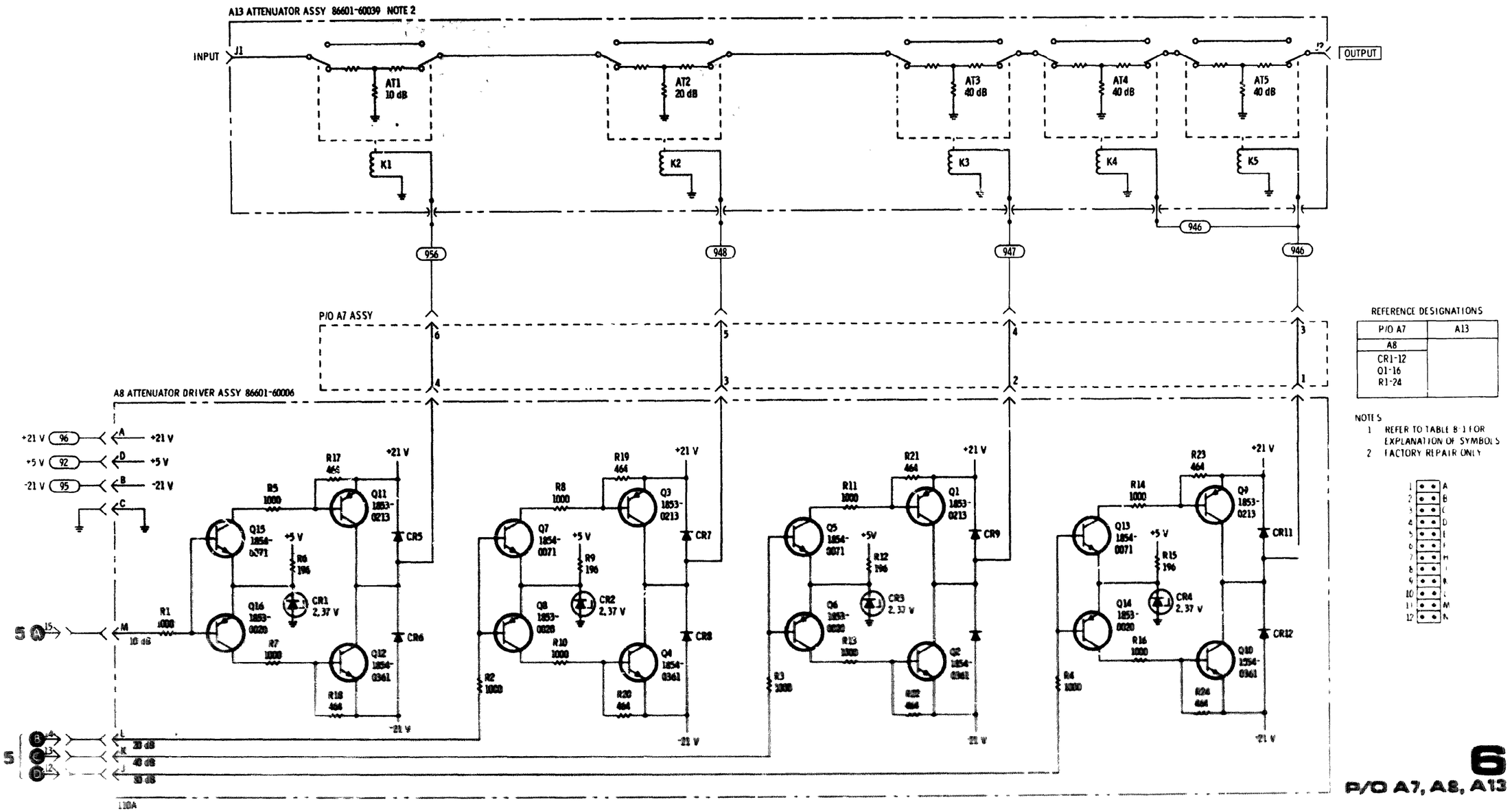


Figure 8-27. *Attenuator Driver Component Locations*



REFERENCE DESIGNATIONS

P/O A7	A13
A8	
CR1-12 Q1-16 R1-24	

NOTES
1. REFER TO TABLE 8-11 FOR EXPLANATION OF SYMBOLS
2. FACTORY REPAIR ONLY

Figure 8-28. Attenuator Driver Schematic

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).
TM 11-6625-2837-14-1	Operator's, Organizational, DS and GS Maintenance Manual for Signal Generator, Hewlett-Packard Model 8660C Including Extension Module, Hewlett-Packard Model 11661B.

APPENDIX D

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

D-1. General.

This appendix provides a summary of the maintenance operations for R.F. Section Plug-In HP 86601A. It authroizes categories of maintenance for specific maintenance functions on repairable item and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

D-2. Maintenance Function.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item., or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components

D-3. Column Entries.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies and modules for which maintenance is authorized

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions it is understood for purposes of having the group numbers in the [illegible] and [illegible] sequence

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C–Operator/Crew
O–Organizational
F–Direct Support
H–General Support
D–Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

D-4. Tool and Test Equipment Requirements (Sect. III).

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

D-5. Remarks (Sect.IV).

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in Section II.

(Next printed page is D-)

SECTION II MAINTENANCE ALLOCATION CHART
FOR
R.F. SECTION PLUG-IN HP 86601A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	C	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
0 0	R.F. SECTION PLUG-IN HP 86601A	Inspect		0.2				Visual	
		Test		0.3				Simple, oper-ational	
		Test				0.5		1 thru 7	
		Adjust				0.6		8	
		Install		0.2				27	
		Replace		0.3				27	
		Repair				1.0		8	
		Overhaul					8.0	1 thru 26	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR

TM 11-6625-2837-14&P-6 R.F. SECTION PLUG-IN HP 86601A

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	H, D	ANALYZER, SPECTRUM TS-723/U	6625-00-668-9418	
2	H, D	GENERATOR, SIGNAL AN/USM-205	6625-00-788-9672	
3	H, D	MULTIMETER, ME-26/U	6625-00-913-9781	
4	H, D	OSCILLOSCOPE AN/USM-281	6625-00-106-9622	
5	H, D	VOLTMETER AN/GSM-64	6625-00-022-7894	
6	H, D	VOLTMETER AN/URM-145	6625-00-973-3986	
7	H, D	VOLTMETER ME-30/U	662500O-643-1670	
8	H, D	TCOL KIT TK-100/G	5180-00-605-0075	
9	D	ANALYZER, SPECTRUM HP 141T		
10	D	PLUG-IN HP 8552B		
11	D	PLUG-IN HP 8553B		
12	D	PLUG-IN HP 8554B		
13	D	PLUG-IN HP 8556A		
14	D	GENERATOR, SIGNAL HP 203A		
15	D	GENERATOR, SIGNAL HP 8444A		
16	D	VOLTMETER HP 3406A		
17	D	VOLTMETER HP 8406A		
18	D	ATTENUATOR HP H38-355D		
19	D	DETECTOR HP 8471A		
20	D	DISCRIMINATOR, FM HP 5210A		
21	D	DUMMY LOAD HP 1250-0207		
22	D	MARKED CARD PROGRAMMER HP 32604		
23	D	MIXER, DOUBLE BALANCED HP 10514A		
24	D	POWER SUPPLY HP 721		
25	D	PROBE HP 10004		
26	D	SERVICE KIT HP 11672A		
27	O	TOOLS AND TEST EQUIPMENT AVAILABLE TO THE REPAIRER BECAUSE OF HIS/HER ASSIGNED MISSION.		

APPENDIX E

REPAIR PARTS AND SPECIAL TOOLS LISTS

Refer to Section VI, Replaceable Parts, for all maintenance repair parts.

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DATE 10 July 1975

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TM 11-5840-340-20P	23 Jan 78	Radar Set AN/PRC-76

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PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.
33			
44		19	
45			

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

For item 2, change the NSN to read: 5835-00-134-9186.
Reason: Accuracy.

Identify the cover on the junction box (item no. 5).
Reason: It is a separate item and is not called out on figure 19.

Add the cover of the junction box as an item in the listing for figure 19.
Reason: Same as above.

TYPED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE
SSG I. M. DeSpirito 999-1776	SSG I M DeSpirito

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Ft Huachuca (5)
Ft Richardson (CERCOM Ofc) (1)
Ft Carson (5)
Ft Gillem (10)
WSMR (1)

USAERDAA (1)
USAERDAW (1)
Army Dep (1) except
LBAD (10)
SAAD (30)
TOAD (14)
SHAD (3)
USA Dep (1)
Sig Sec USA Dep (1)
Units org under fol TOE:
(1 copy each unit)
29-134
29-136
(2 copies each unit)
29-207
29-610

ARNG: None
USAR: None

For explanation of abbreviations used, see AR 310-50.

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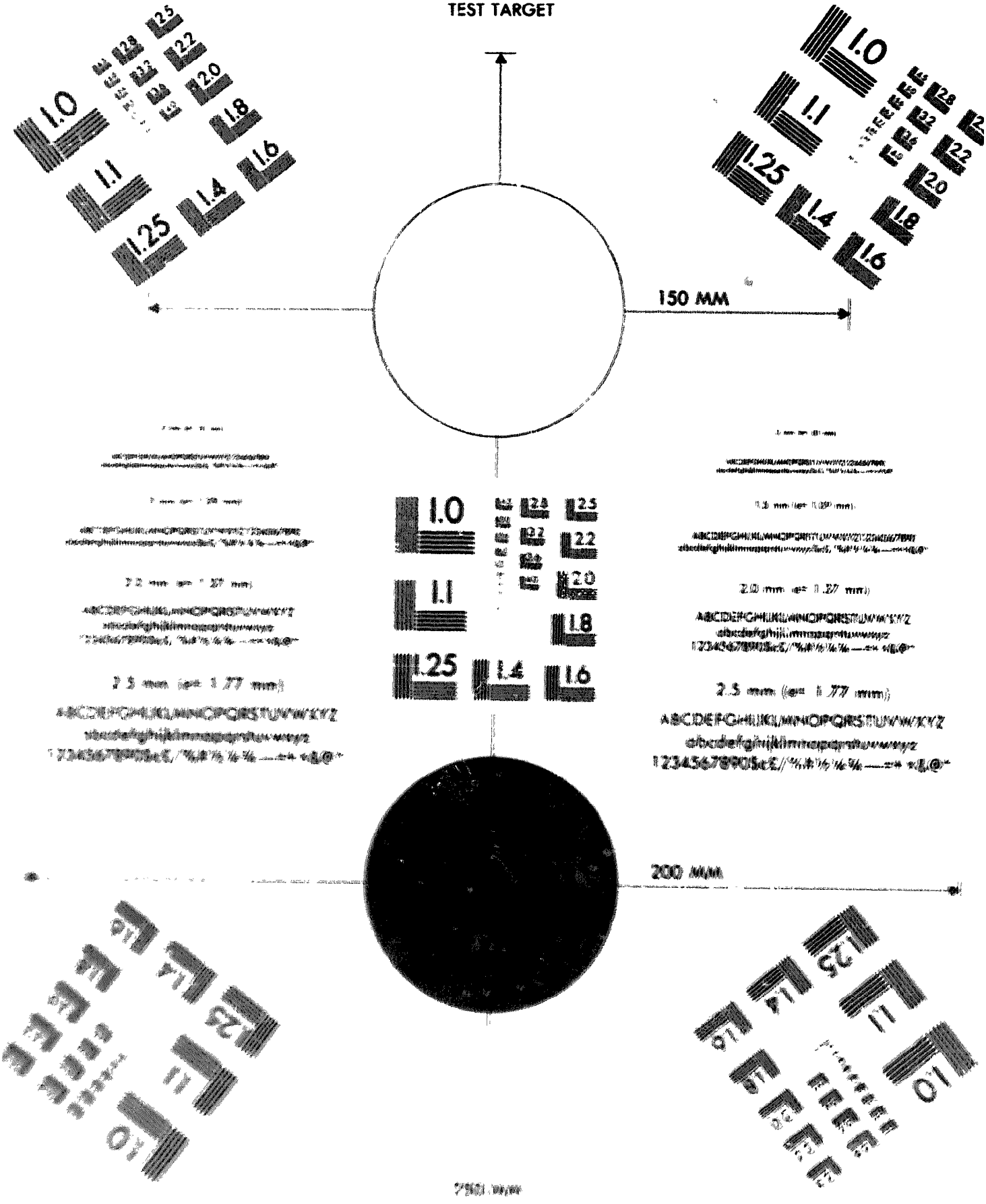

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