TECHNICAL MANUAL

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

FOR

RF SECTION HP-86602B (NSN 6625-01-031-8853)

HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 1981

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4. SEND FOR HELP AS SOON AS POSSIBLE

5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNING

SAFETY

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to retain the instrument in safe condition. Be sure to read and follow the safety information in Sections 11, III, V, an VIII.

BEFORE CONNECTING THIS SYSTEM TO LINE (MAINS) VOLTAGE, the safety and installation instructions found in Sections II and III of the mainframe manual should be followed.

HIGH VOLTAGE

Adjustments and troubleshooting are often performed with power supplied to the instrument while protective covers are removed. Energy available at many points may constitute a shock hazard

The multi-pin plug connector which provides inter connection from mainframe to RF Section, will be exposed with the RF Section removed from the right-hand mainframe cavity. With the Line (Mains Voltage off and power cord disconnected, power supply voltages may still remain and may constitute a shock hazard.

CAUTION

COMPATIBILITY

Damage to the synthesized signal generator system may result if an option 002 RF Section is used with unmodified Model 8660A or 8660B main-frames with serial prefixes 1349A and below.

PERFORMANCE TESTING

To avoid the possibility of damage to the instrument or test equipment, read completely through each test before starting it. Then make any preliminary control settings necessary before continuing with the procedure.

PLUG-IN REMOVAL

Before removing the RF Section plug-in from the mainframe, remove the line (Mains) voltage by disconnecting the power cable from the power outlet.

SEMI-RIGID COAX

Slight but repeated bending of the semi-rigid coaxial cable will damage them very quickly. Bend the cables as little as possible. If necessary, loosen the assembly to release the cable.

WARNING

Voltages are present in this instrument, when energized, which can cause death on contact.

The multi-pin plug connector which provides interconnection from mainframe to RF Section, will be exposed with the RF Section removed from the righthand mainframe cavity. With the line voltage off and power cord disconnected, power supply voltage may still remain and may constitute a shock hazard.

TM 11-6625-2825-14&p-7

TECHNICAL MANUAL	)	HEADQUARTERS
	)	DEPARTMENT OF THE ARMY
No. 11-6625-2825-14&p-7	)	Washington, D.C., 18 October 1981

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT

AND GENERAL SUPPORT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS

FOR

RF SECTION PLUG-IN, HEWLETT-PACKARD MODEL 86602B

(NSN 6625-01-031-8853)

CURRENT AS OF 30 JANUARY 1981

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703. 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. The manual was not prepared in accordance with military specifications; therefore, the format has not been structured to consider categories of maintenance. Section IX contains improvements made after the printing of the manufacturer's manual.

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NOTE

Users of this manual are advised to consult SECTION IX, ERRATA. SECTION IX contains errors and changes in text and illustrations. The user should correct the errors and perform the changes indicated, as needed.

SECTION 0

INTRODUCTION

0-1. Scope

This manual describes RF Section Hewlett-Packard Model 86602B, hereinafter referred to as the RF Section, and provides instructions for its operation and maintenance.

This manual applies directly to instruments with serial numbers prefixed 1638A. It is also applicable to instruments with other serial number prefixes for which manual changes are given in SECTION VII.
SECTION VI includes Table 6-4, a cross reference between the Hewlett-Packard part numbers and the equivalent NATO/NATIONAL Stock Numbers (NSN).
Appendix A provides a reference of pertinent Department of the Army publications.
Appendix B contains the Maintenance Allocation Chart (MAC) which defines the levels and scope of maintenance functions for the equipment in the Army system and a list of the tools and test equipment required.

0-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of the 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 (MWOs) 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 prescribed by TM 38-750, the Army Maintenance Management System.

b. Report of Item and Packaging Discrepancies. Fill out and forward SF 364 (Report of Discrepancy (ROD) as prescribed in AR 735-11-2/DLAR 4140.55/NAVSUPINST 4440.127E/AFR 400.54/MCO 4430.E.

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)

If your HP 86602B RF Section needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to: Commander, US Army Communications - Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703. We'll send you a reply.

0-5. Administrative Storage.

Store in accordance with Paragraphs 2-17 through 2-22.

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.

MODEL 86602B

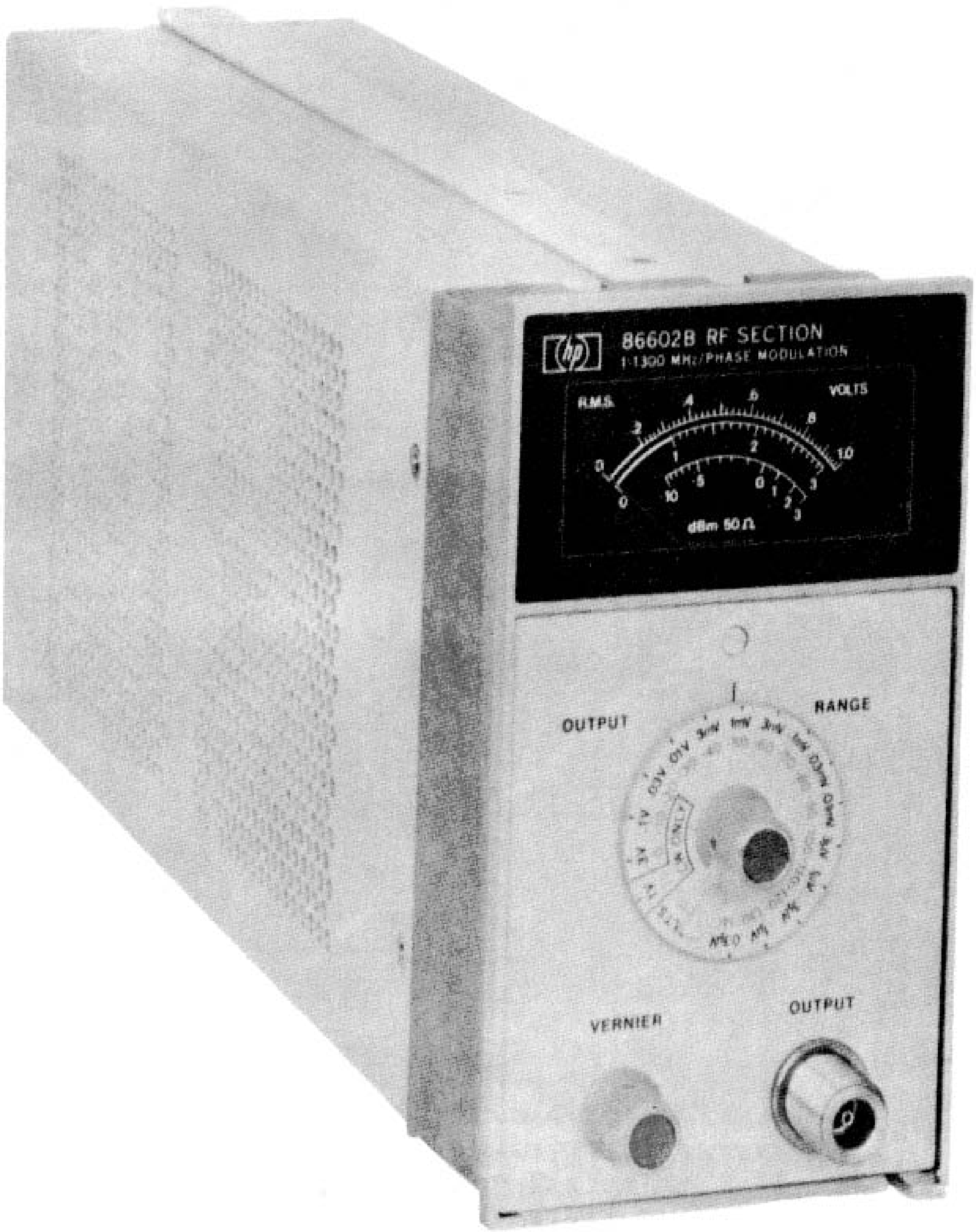


Figure 1-1. HP Model 86602B RF Section (Option 002 Shown)

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test, adjust and service the Hewlett-Packard Model 86602B RF Section plug-in, hereinafter referred to as the RF Section. For information concerning related equipment, such as the Hewlett-Packard Model 8660-series mainframes or the Model 11661 Frequency Extension Module, refer to the appropriate manual or manuals.

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

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

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

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

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

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

f. SECTION VI, REPLACEABLE PARTS, contains information required to order all replacement parts and assemblies.

g. SECTION VII, MANUAL CHANGES, provides information to document all serial number prefixes listed on the title page.

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

1-4. Figure 1-1 shows the Option 002 RF Section.

1-5. DELETED

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

1-7. SPECIFICATIONS

1-8. Instrument specifications are listed in Table 1-1. These specifications are the performance standards, or limits against which the instrument may be tested.

1-9. INSTRUMENTS COVERED BY MANUAL 1-10. This instrument has a two-part serial number. The first four digits and the letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix(es) as listed under SERIAL NUMBERS on the title page.

1-11. For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-12. MANUAL CHANGE SUPPLEMENTS

1-13. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial

Table 1-1. Models 86602B/11661 Specifications (1 of 3)

SPECIFICATIONS

FREQUENCY CHARACTERISTICS

Range: 1.0 to 1299.999999 MHz selectable in 1 Hz steps. Frequencies from 200 kHz to 1 MHz may also be selected with some degradation in specifications.

Accuracy and Stability[1]: CW frequency accuracy and long term stability are determined by the aging rate of the time base (internal or external) and its sensitivity to changes in temperature and line voltage. Internal reference oscillator accuracy = + aging rate ± 3 x 10^{-10} /°C ± 3 x 10^{-10}/1% change in line voltage

Switching Time: 6 ms to be within 50 Hz of any new frequency selected; 100 ms to be within 5 Hz of any new frequency delected.

Largest Digit Changed	Error at:	
	1 ms	1 ms
1 Hz 10 Hz	<1 Hz	<1 Hz
100 Hz	<100 Hz	<1 Hz
1 kHz 10 kHz	<500 Hz	<10 Hz
100 kHz 1 MHz	<500 Hz	<50 Hz
10 MHz	<500 Hz	<50 Hz
100 MHz, 1 GHz	Undefined	<50 Hz

Typical 86602B/11661 Frequency Switching Characteristics

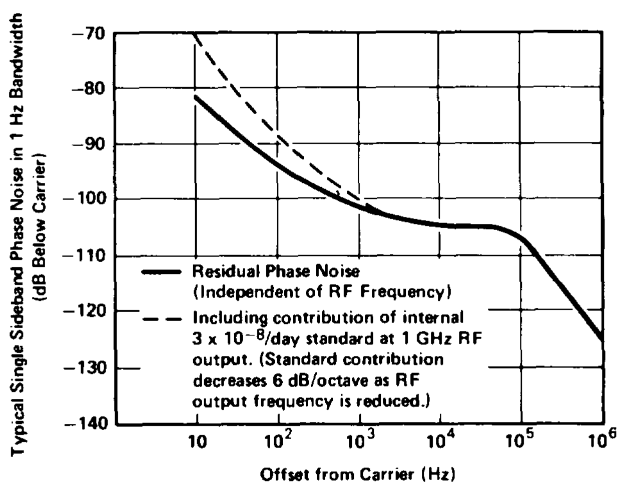
Harmonic Signals:
All harmonically related signals are at least 30 dB below the desired output signal for output levels <+3 dBm. (25 dB down for output levels above +3 dBm.)

Spurious Signals (CW, AM, and OM only):
80 dB down from carrier at frequencies <700 MHz
80 dB down from carrier within 45 MHz of the carrier at frequencies ≥700 MHz
70 dB down from carrier >45 MHz from carrier at frequencies ≥700 MHz
50 dB down from carrier on the +10 dBm range.

All Power Line Related spurious signals are 70 dB down from carrier.

Signal-to-Phase Noise Ratio (CW, AM, and OM only):
Greater than 45 dB in a 30 kHz band centered on the carrier and excluding a 1 Hz band centered on the carrier.

Typical SSB Phase Noise Curve:



Typical 86602B Phase Noise

Signal-to-AM Noise Ratio: Greater than 65 dB down in a 30 kHz bandwidth centered on the carrier and excluding a 1 Hz band centered on the carrier

[1] Aging rate for the time base of standard mainframes is 3 x 10-8/day: for option 001 mainframes, 3 x 10^{-9}/day.

Table 1-1. Models 86602B/11661 Specifications (2 of 3)

OUTPUT CHARACTERISTICS

Level: Continuously adjustable from +10 to -146 dBm (0.7 Vrms to 0.01 /Vrms) into a 50Q resistive load. Output attenuator calibrated in 10 dB steps from 1.OV full scale (+10 dBm range) to 0.03 pVrms full scale (-140 dBm range). Vernier provides continuous adjustment between attenuator ranges. Output level indicated on output level meter calibrated in volts and dBm into 50 ohms.

Accuracy: (Local and remote modes)
+ 1.5 dB to -76 dBm; + 2.0 dB to -146 dBm at meter readings between +3 and -6 dB.

Flatness: Output level variation with frequency is less than ±1.0 dB from 1-1300 MHz at meter readings between +3 and --6 dB.

Level Switching Time: In the remote mode any level change can be accomplished in less than 50 ms. Any change to another level on the same attenuator range can be accomplished in less than 5 ms.

Impedance: 50Q.

VSWR: <2.0 on +10 and O dBm range; <1.3 on -10 dBm range and below.

MODULATION CHARACTERISTICS
(With compatible Modulation Sections)

Amplitude Modulation:

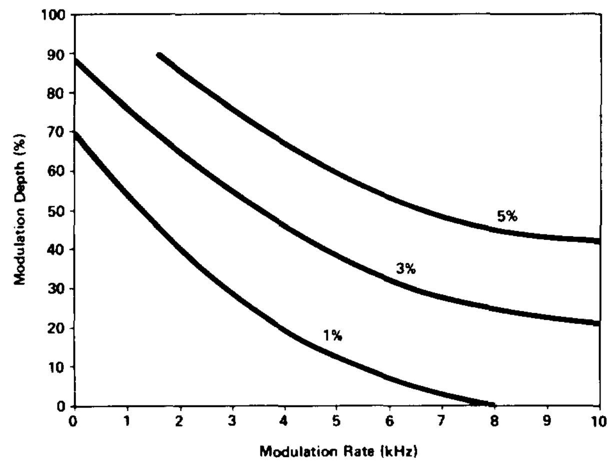
Depth: 0 - 90% for RF output level meter readings from +3 to -6 dB and only at +3 dBm and below.

AM 3 db Bandwidth:

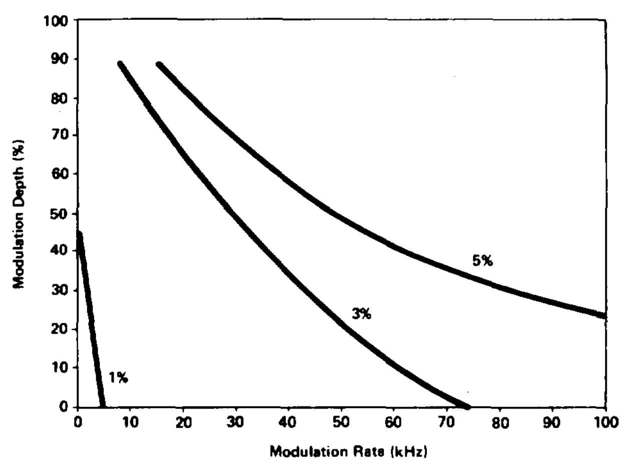
AM 3 dB Bandwidth:

Center Frequency	AM 3 dB Bandwidth		
	0 to 30% AM	0 to 70% AM	0 to 90% AM
<10 MHz	10 kHz	6 kHz	5 kHz
≥10 MHz	100 kHz	60 kHz	50 kHz

AM Total Harmonic Distortion[2]		
AT 30% AM	AT 70% AM	AT 90% AM
<1%	<3%	<5%



Typical AM Distortion (Center Frequency <10 MHz)



Typical AM Distortion (Center Frequency > 10 MHz)

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

Incidental FM: Less than 0.2 times the frequency of modulation (Hz) at 30% AM.

[2] Applies only at 400 Hz and 1 kHz rates with the RF Section front panel meter indicating from O to +3 dBm. At a meter indication of 6 dB the distortion approximately doubles. The modulating signal distortion must be <0.3% for the system performance to meet these specifications.

Table 1-1. Models 86602B/1 1661 Specifications (3 of 3)

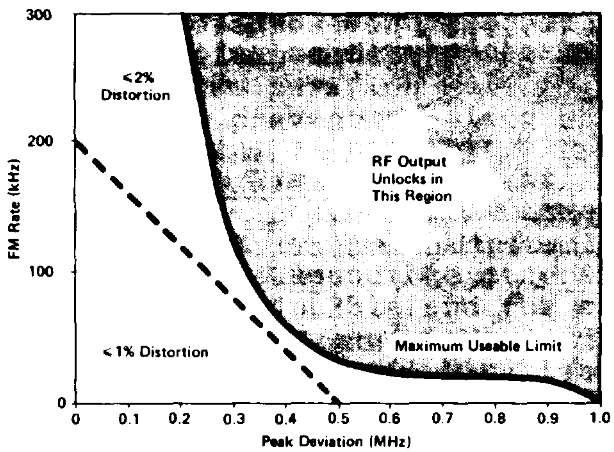
FREQUENCY MODULATION

Rate: DC to 200 kHz with the 86632B and 86635A.
20 Hz to 100 kHz with the 86633B.

Maximum Deviation (peak):
200 kHz with the 86632B and 86635A
100 kHz with the 86633B

Incidental AM: AM sidebands are greater than 60 dB down from the carrier with 75 kHz peak deviation at a 1 kHz rate.

FM Total Harmonic Distortion (at rates up to 20 kHz);
<1% up to 200 kHz deviation. (External modulating signal distortion must be less than 0.3%.)
Residual FM: less than 10 Hz rms average in 300 kHz, Post-detection bandwidth, FM x 0.1 mode.



Typical FM Distortion Curve

PULSE MODULATION
(With the 86631B Auxiliary Section only)

Source: External

Rise/Fall Time: 50 ns.

ON/OFF Ratio: At least 40 dB.

Input Level Required: -10-+ 0.5 Vdc turns RF on.

PHASE MODULATION
(Option 002 Instruments only)

Rate:

with 86635A dc to 1 MHz
with 86634A
dc to 1 MHz at center frequencies less than 100 MHz dc to 10 MHz at center frequencies greater or equal to 100 MHz.

Maximum Peak Deviation:
0 to 100 degrees peak. May be overdriven to 2 radians (1150) in the Modulation Section's external dc mode.

∅M Distortion:

<5% up to 1 MHz rates
<7% up to 5 MHz rates
<15% up to 10 MHz rates

(External modulation signal distortion must be less than 0.3% to meet this specification.)

REMOTE PROGRAMMING
(Through the 8660-series mainframes)

Frequency: Programmable in 1 Hz steps.

Output Level: Programmable in 1 dB steps from +10 to -146 dBm.

Modulation: See specifications for modulation section installed.

GENERAL

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

Size: Plug-in to fit 8660-series mainframe.
Weight: Net 9 lb (3.9 kg).

prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes supplement that contains "change information" that documents the differences.

1-14. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-15. DESCRIPTION

1-16. The HP Model 86602B RF Section is one of several RF Sections available for use in an 8660-series Synthesized Signal Generator System. This RF Section plug-in is used with an option 100 8660-series mainframe (Frequency Extension Module installed). The RF Section provides precisely tuned RF output frequencies over the 1 to 1300 MHz range with 1 Hz frequency resolution (8660-series option 004 instruments have resolutions of 100 Hz.) Frequencies from 200 kHz to 1 MHz can also be generated with some degradation in the amplitude leveling and other related specifications.

1-17. The output power can be set to any level between +10 and --146 dBm by means of the front panel VERNIER and calibrated OUTPUT RANGE controls. A front panel-mounted meter and the OUTPUT RANGE switch indicate the output power and voltage levels delivered by the RF Section to any external load having a characteristic impedance of 50 ohms. Output power levels are maintained within + 1 dB of selected values through internal leveling of the output signal over the full frequency range of the instrument.

1-18. Amplitude, frequency, phase, or pulse modulation of the RF OUTPUT signal can be accomplished within the RF Section by using the appropriate Auxiliary or Modulation Section plug-in.

1-19. External programming permits remote selection of the output signal frequency in 1 Hz steps (100 Hz for option 004 mainframes) and the output power in 1 dB steps over the full operating range of the instrument. External programming is accomplished via the mainframe computer-compatible interface and digital control unit circuits.

1-20. OPTIONS

1-21. This RF Section has two options available. They affect the instrument's RF output level, and phase modulation capabilities.

1-22. Option 001. The RF output attenuator is removed. This limits the RF output level range from +10 to -6 dBm.

1-23. Option 002. Circuits are added to provide the phase modulation capability. A compatible modulation section is required.

1-24. COMPATIBILITY

1-25. Except for Option 002 instruments, the Model 86602B is compatible with all 8660-series option 100 mainframes, all AM-FM Modulation Sections and the Auxiliary Section. This RF Section is partially compatible with the FM/OM Modulation Section.

CAUTION

Damage to the signal generator system may result if an option 002 RF Section is used with Model 8660A or 8660B main-frames with serial prefixes 1349A and below.

1-26. Option 002 instruments are compatible with all instruments which are part of the Model 8660-series Synthesized Signal Generator System except early model 8660A and 8660B Mainframes. Refer to the paragraph entitled Modifications in Section II of this manual for further information.

1-27. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-28. System Mainframe

1-29. The mainframe uses phase-locked loops to accurately generate clock, reference, and tuning signals required for operation of the Synthesized Signal Generator System. Front panel-mounted mainframe controls are used to digitally tune two phase-locked loops in the Frequency Extension Module which, in turn, produce two high-frequency output signals that are applied to the RF Section. The RF Section mixes the two signals and presents their frequency difference at the front panel OUTPUT jack. The output frequency is either the value selected by the mainframe front panel controls or external programming.

1-30. The mainframe power supply provides all dc operating voltages required by the RF Section, Frequency Extension Module, and Modulation Section plug-ins. Remote programming of the plug-ins is accomplished via the mainframe interface and digital control unit circuits.

1-31. Frequency Extension Module

1-32. The Frequency Extension Module plug-in extends the output frequency range of the main-frame to meet the input requirements of the RF Section. The Frequency Extension Module plug-in contains two high-frequency phase-locked loops which receive digital tuning signals, variable synthesized signals, and fixed synthesized signals from the mainframe. The phase-locked loops use the main-frame signals, in conjunction with the output frequency from a 4.43 GHz oscillator that is common to both loops, to produce two high-frequency output signals that are supplied to the RF Section. One output signal is generated by a phase-locked loop using a Voltage Controlled Oscillator (VCO) that is tuneable in 1 Hz steps (100 Hz steps for option 004 mainframe) over the 3.95 to 4.05 GHz range. The other output signal is generated by a phase-locked loop using a Yittrium-Iron-Garnet (YIG) oscillator that is tunable in 100 MHz steps over the 3.95 to 2.75 GHz range. The two outputs from the Frequency Extension Module plug-in are applied to the RF Section for mixing, amplification of the converted signal, and final output power level control.

1-33. Auxiliary Section

1-34. The Auxiliary Section plug-in provides a means of applying externally generated amplitude or pulse modulation drive signals to modulate the RF Section's output carrier.

1-35. Modulation Section Plug-ins

1-36. The Model 86630-series Modulation Section plug-ins can accept external modulation drive signals or generate internal drive signals to amplitude, frequency, phase or pulse modulate the RF Sections output signal.

1-37. EQUIPMENT AVAILABLE

1-38. Extender cables, coaxial adapters, and an adjustment tool are available for use in performance testing, adjusting, and maintaining the RF Section. Each piece may be ordered separately or as part of the 11672A Service Kit.

1-39. Extender cards for use in servicing the RF Section and a type N to BNC adapter for use on the front panel RF OUTPUT connector are contained in the HP Rack Mount Kit, Part Number 08660-60070, that is supplied with the mainframe.

1-40. SAFETY CONSIDERATIONS

1-41. This instrument has been designed in accord-ance with international safety standards and has been supplied in safe condition.

1-42. Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to retain the instrument in safe condition. Be sure to read and follow the safety information in Sections II, III, V, and VIII.

1-43. RECOMMENDED TEST EQUIPMENT 1-44.

Table 1-2 lists the test equipment and accessories recommended for use in testing, adjusting, and servicing the RF Section. If any of the recommended test equipment is unavailable, instruments with equivalent specifications may be used. See Appendix B, Section III.

See Appendix B, Section III

Table 1-2. Recommended Test Equipment (1 of 4)

Item	Critical Specifications	Suggested Model	Use*
Adapter (Male Type N to GR874)	Frequency range 100 MHz to 1.3 GHz	HP 1250-0847	P
Adapter, SMA-to-BNC	2 required	OSM 21190	P
Adapter, SMA-to-OSM Right Angle	OSM 219		P
Adapter, Type N-to-SMA	OSM 21040	P	
Amplifier, 20 dB	-20 dB gain at 30 MHz Input SWR <1.7	HP 8447A	P
Amplifier, 40 dB	Special	(see Figure 1-2)	P
Analyzer, Distortion	20 Hz to 20 kHz; must measure <0.1% distortion	HP 333A	P
Analyzer, Spectrum	Measurement Accuracy +2.0 dB from 1 kHz to 110 MHz	HP 8553B with HP 8552B and HP 1-10T	P.,A
Analyzer, Spectrum	Measurement Accuracy +2.0 dB from 10 MHz to 8 GHz	HP 8555A with HP 8552B and HP 140T	P. A, T
Analyzer, Wave	Center frequencies 20 to 40 kHz Resolution bandwidth <3 Hz Bandpass shape factor 10:1 Analog output 0 to 5V Noise level (at 11 kHz center frequency with a 3 Hz bandwidth) <-150 dBV	HP 3581A	P
Attenuator, 3 dB Fixed	3 dB	HP 8491A Option 003	P
Attenuator, 10 dB Step	Calibrated at 30 MHz; refer to calibration curve	HP 355D-H38 (only)	P, A
Attenuator, 40 dB Fixed	40 dB	HP 8491A Option 040	P
Cables, Double Shielded	Minimum input <300 mVrms (5 required)	HP 08708-6033	P
Capacitor, 1500 pF		HP 0160-2222	P
Capacitor, 100 pF	HP 0180-2207	P	
Connector, BNC Panel Mount	HP 1250-0118	T	

*Use: P = Performance Tests, A = Adjustments, T = Troubleshooting

Table 1-2. Recommended Test Equipment (2 of 4)

Item	Critical Specifications	Suggested Model	Use*
Counter, Computing	50 kHz to 50 MHz with a 1 ms gate time and external trigger; 1 Hz resolution	HP 5360A with HP 5365A plug-in	P
Counter, Frequency	Range: 0.2-1300 MHz Resolution: 1 Hz 10 MHz external reference output 7.2 Vrms output into 170 ohms	HP 5340A	P
Coupler, Directional	Frequency range 100 MHz to 1.3 GHz	HP 778D Option 12	P
Detector, Crystal	1 to 1200 MHz	HP 8471A	P
Detector, Crystal	10 MHz to 1.3 GHz	HP 423A	P, A
FM Discriminator	Input frequency 100 kHz to 10 MHz Linear Analog Output 1V full scale	HP 5210A	P, A
Filter Kit	Accessory for HP 5210A	HP 10513A	P, A
Filter, Low Pass, 15 kHz	Special	(see Figure 1-3)	P
Filter, Low Pass, 4 MHz	Cutoff frequency: 4 MHz FLT/21B-4-3/50-3A/3B	CIR-Q-TEL	P
Filter, Low Pass, 2200 MHz	Cutoff frequency: 2200 MHz	HP 360C	P
Filters, Low Pass, 100 kHz	100 kHz at 50 and 600 ohms	Specials (See Figure 1-4)	A
Filters, Low Pass, 1 MHz	1 MHz - 50 and 600 ohms	Specials (See Figure 1-4)	P, A
Filters, Low Pass, 5 and 10 MHz	5 and 10 MHz - 50 ohms	Specials (See Figure 1-4)	P
Filter, Band Pass	Pass band 1-2 GHz	HP 8430A	P
Generator, Function	Distortion less than 0.3% Range: 0.5 Hz to 20 kHz Output level: 0.1 to 2.0 Vrms into 600 ohms	HP 203A	P
Generator, Pulse	Output -10 Vpk with <10 ns risetime in 600 ohms	HP 8013B	P
Generator, Sweep	Sweep Width 0.1 to 100 MHz Output Level +20 to -80 dBm Flatness +0.25 dB	HP 8601A	A
Generator, Synthe-sized Signal	+1 Hz from 1 MHz to 1300 MHz, +7 dBm output 10 MHz Reference output >0.5V into 170 ohms	HP 8660 with HP 86631B	P, A

*Use: P = Performance Tests, A = Adjustments, T = Troubleshooting

Table 1-2. Recommended Test Equipment (3 of 4)

Item	Critical Specifications	Suggested Model	Use*
Mixer, Double Balanced	1 MHz to 110 MHz	HP 10514A	A
Mixer, Double Balanced	300 to 1300 MHz	Watkins-Johnson M1J	P
Oscillator, Test 1.0 to 2.0 Vrms into 600 or 50 ohms	1 kHz to 10 MHz	HP 651B	P, A
Oscilloscope	Vertical: Bandwidth 50 MHz with sensitivity of 5mV/ division minimum Horizontal: Sweep time 10 ns to 1 s Delayed sweep External triggering to 100 MHz	HP 180C with HP 1801A and HP 1821A plug-ins	P, A, T
Oscilloscope, 10:1 divider probes	Input impedance 10 megohm shunted by 10 pF	HP 10004	P, A, T
Power MeterISensor	Range: -10 to +10 dBm from 10 MHz to 1.3 GHz	HP 435A/8481A	P, A, T
Power Supply, DC	0-10 volts	HP 721A	P
Programmer, Marked Card	Capable of programming BCD or HP-IB data	HP 3260A Option 001	P, A
Probe, Logic	TTL Compatible	HP 10525T	T
Resistor, 1000 ohm	+2%	HP 0757-0280	P, A
Resistor, 10K ohm	+2%	HP 0757-0442	P
Resistor, 100K ohm	f2%	HP 0698-7284	P
Service Kit	Interconnect cables, adaptors, and coaxial cables compatible to 8660-series plus and jacks parts list)	HP 11672A (See Operating Note or mainframe manual for	A, T
Stub, Adjustable	Frequency range 100 MHz to 1.3 GHz	General Radio 874-D50L	P
Tee, Coaxial	2 required	HP 1250-0781 (BNC)	P, A
Termination, 50 ohm Feed Thru	50 ohm	HP 11048C	P

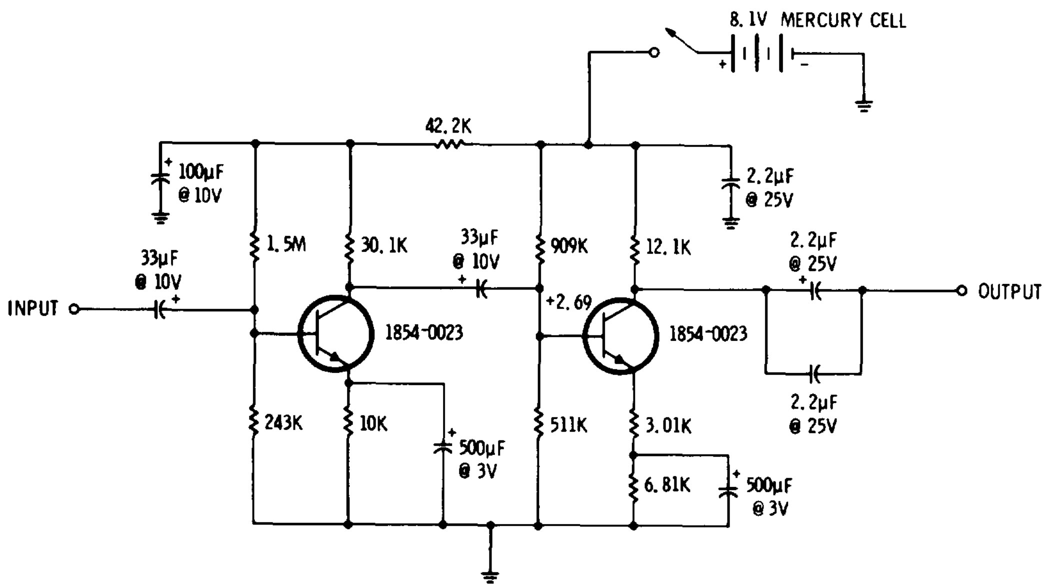
*Use: P = Performance, A = Adjustments, T = Troubleshooting

Table 1-2. Recommended Test Equipment (4 of 4)

Item	Critical Specifications	Suggested Model	Use*
Termination, 50 ohm	50 ohm, (2 required)	HP 11593A	P
Test Set, Phase Modulation	Input Frequency Range 250 to 950 MHz Distortion <2% up to 2 MHz rates <3.5% up to 5 MHz <5.0% up to 10 MHz	HP 8660C-K10 (only)	P, A
Voltmeter, AC	Accuracy +2% of full scale from 1 Hz to 1 MHz 1 mVrms to 10 Vrms full scale	HP 403B	P, A, T
Voltmeter, Digital	Range 0.00 to 60.00 volts DC Accuracy +(0.3%, of reading +0.01% of range) AC Accuracy +(0.25% of reading +0.05% of range) 45 Hz to 20 kHz	HP 34740A/34702A	P, A, T
Voltmeter, Vector	Frequency range 5 to 15 MHz Input level 100 mVrms to 1 Vrms Analog output: +0.5 Vdc for +180°	HP 8405A	P

*Use: P = Performance Tests. A = Adjustments, T = Troubleshooting

40 dB TEST AMPLIFIER



Amplifier Specifications

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

Figure 1-2. 40 dB Test Amlifier

15 kHz LPF

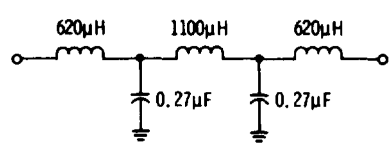
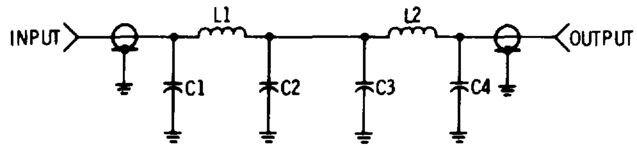


Figure 1-3. 15 kHz Low Pass Filter

LOW PASS FILTERS



100 kHz - 50 ohms

C1, C4	0.015 µF	Mylar	0160-0194
C2	0.027 µF	Mylar	0170-0066
C3	0.022 µF	Mylar	0160-0162
L1, L2	100 µH		9140-0210

100 kHz - 600 ohms

C1, C4	1300 pF	0160-2221
C2	3000 pF	0160-2229
C3	1100 pF	0160-2219
L1, L2	1200 µH	9100-1655

1 MHz -50 ohms

C1, C4	1500 pF	0160-2222
C2	3300 pF	0160-2230
C3	1600 pF	0160-2223
L1, L2	10H ±10%	9140-0114

1 MHz - 600 ohms

C1, C4	130 pF	0140-0195
C2	300 pF	0160-2207
C3	120, µH	0140-0194
L1, L2	120 µ	9100-1637

5 MHz - 50 ohms

C1, C2, C4	300 pF	0160-2207
C3	680 pF	0160-3537
L1, L2	2 µH	9100-3345

10 MHz - 50 ohms

C1, C4	150 pF	0140-0196
C2	330 pF	0160-2208
C3	160 pH	0160-2206
L1, L2	1 µH±10%	9140-0096

NOTE

Unless otherwise noted, tolerance of components is ± 5% and capacitors are mica. Part numbers are Hewlett-Packard

Figure 1-4. Low Pass Filters

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides information relative to initial inspection, preparation for use, and storage and shipment of the Model 86602B RF Section plug-in. Initial Inspection provides instructions to be followed when an instrument is received in a damaged condition. Preparation For Use gives all necessary interconnection and installation instructions. Storage and Shipment provides instructions and environmental limitations pertaining to instrument storage. Also provided are packing and packaging instructions which should be followed in preparing the instrument for shipment.

2-3. INITIAL INSPECTION

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

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. All power required for operation of the RF Section is furnished by the mainframe. This RF Section requires approximately 40 volt-amperes.

2-8. Interconnections

2-9. Prior to installing the RF Section plug-in into the mainframe, verify that the Frequency Extension Module plug-in and interconnecting cable assemblies have been installed in accordance with the instructions contained in the Frequency Extension Module manual.

2-10. Modifications

2-11. A power supply modification to older versions of Model 8660A and 8660B mainframes are required if they are to be used with the option 002 RF Section.

CAUTION

Damage to the synthesized signal generator system may result if an option 002 RF Section is used with an older 8660A or 8660B mainframe.

2-12. Due to the increased power consumption of the option 002 instrument, mainframes with serial prefixes 1349A and below must be modified by installing a Field Update Kit. For mainframe configurations other than option 003 (60 Hz line operation), order kit number 08660-60273. For option 003 mainframes (50 - 400 Hz line operation) order kit number 08660-60274.

NOTE

Verify that a new higher current fuse, HP Part Number 2110-0365, 4A Slow Blow, is used in mainframes with the power supply modification.

2-13. Operating Environment

2-14. The RF Section is designed to operate within the following environmental conditions:

Temperature	0° to +55°C
Humidity	less than 95% relative
Altitude	less than 15,000 feet

2-15. Installation Instructions

WARNING

The multi-pin plug connector which provides interconnection from mainframe to RF Section, will be exposed with the RF Section removed from the right-hand mainframe cavity. With the Line (Mains) Voltage off and power cord disconnected, power supply voltages may still remain which, if contacted, may constitute a shock hazard.

2-16. Insert the plug-in approximately half-way into the right cavity of the mainframe. Rotate the latch (lower right corner) to the left until it protrudes perpendicular to the front panel. Refer to Figure 2-1, which shows the plug-in partially inserted into the mainframe and the latch rotated to a position that is perpendicular to the plug-in front panel. Push the plug-in all the way into the mainframe cavity and then rotate the latch to the right until it snaps into position.

2-17. STORAGE AND SHIPMENT

2-18. Environment

2-19. The storage and shipping environment of the RF Section should not exceed the following limits:
Temperature................................ 40° to +75°C
Humidity....................................... less than 95% relative
Altitude... less than 25,000 feet

2-20. Packaging

2-21. Original Type Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial
Figure 2-1. RF Section Partially Inserted into Mainframe
number. Also mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-22. Other Packaging. The following general instructions should be used for re-packaging with commercially available materials:

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

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

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

d. Seal the shipping container securely.

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

Figure 2-1. RF Section Partially Inserted into Mainframe

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section contains information which will enable the operator to learn to operate and quickly check for proper operation of the RF Section plug-in as part of the Synthesized Signal Generator System.

3-3. PANEL FEATURES

3-4. The front and rear panel controls, connectors, and indicators of the RF Section and its options are described by Figure 3-1 and 3-2.

3-5. OPERATOR'S CHECKS

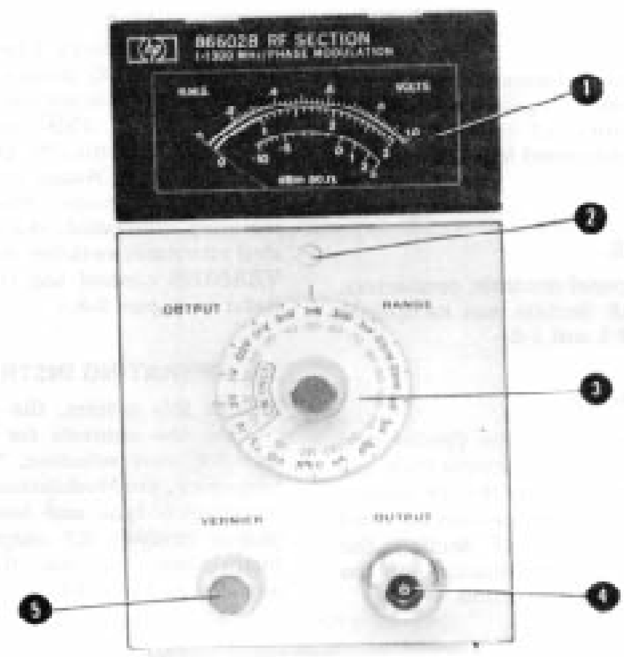
3-6. The RF Section, as part of the Synthesized Signal Generator System, accepts inputs from the rest of the system but controls only the RF output level. Even though the controlled circuits for most other functions are within the RF Section, the actual checks are found in the manual of the instrument which controls that function.

3-7. The Operator's Checks in this manual are intended to verify proper operation of the circuits which control and are controlled by the RF output level controls. This includes the meter, the VERNIER control, the OUTPUT RANGE switch, and the Output Range Attenuator when operating in the local mode. When the system is being remotely controlled, the 1 dB and 10 dB remote step attentator switches are checked in place of the VERNIER control and OUTPUT RANGE switch. Refer to Figure 3-3.

3-8. OPERATING INSTRUCTIONS

3-9. In this system, the mainframe and plug-ins contain the controls for frequency, modulation, and RF level selection. The mainframe controls frequency, the Modulation Section plug-in controls modulation type and level, and the RF Section plug-in controls RF output level. The Operating Instructions for the RF Section plug-in are included in Table 3-1.

FRONT PANEL FEATURES



NOTE

The front panel of the option 002 instrument is shown. The standard instrument does not have the term PHASE MODULATION after 1-1300 MHz. The option 001 instrument has an OUTPUT RANGE switch which shows only the +10 and 0 dBm ranges.

(1) **Meter**. Indicates the RF Output level in Vrms and dBm (50w) with the scale reference indicated by the OUTPUT RANGE switch.

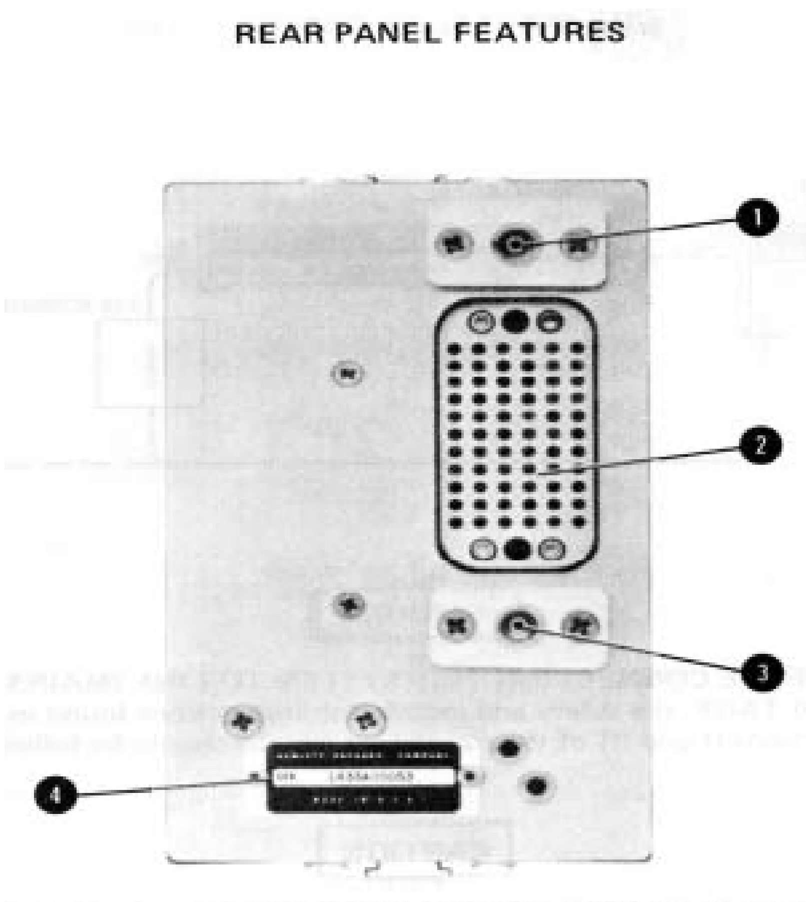
(2) **Mechanical Meter Zero Control**. Sets the Panel Meter indicator to zero when the mainframe LINE Switch is set to STBY.

(3) **OUTPUT RANGE Switch**. Sets the output level range of all except option 001 instruments from +10 to -140 dBm (502) in 10 dB steps. For option 001 instruments, +10 and 0 dBm ranges only.

(4) **OUTPUT Jack**. Type-N female coaxial connector. RF Output level +10 to -146 dBm (0.7 Vrms to 0.01 /lVrms) into a 50Q load. Frequency range is 1 to 1299.999 999 MHz in 1 Hz steps.

(5) **VERNIER Control**. RF Output continuously var-iable within the useable range (+3 to --6 dB) as indicated by the meter.

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



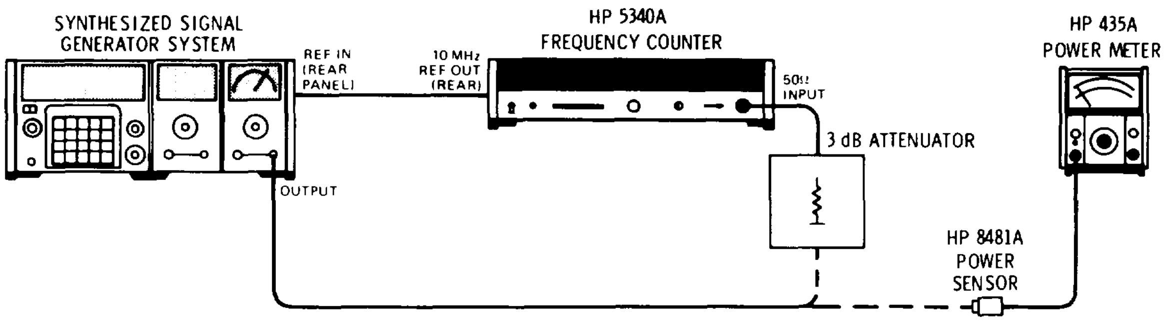
(1) **Coaxial Plug**. Connects the 3.95 to 2.75 GHz RF Input signal to the RF Section from the Frequency Extension Module.

(2) **Interconnect Plug**. Provides interconnection of power supply voltages; RF and control signals between the RF Section plug-in and the Main-frame, Frequency Extension Module, and Modulation Section plug-in.

(3) **Coaxial Plug**. Connects the 3.95 to 4.05 GHz LO Input signal to the RF Section plug-in from the Frequency Extension Module.

(4) **Serial Number Plate**. Metal plate with stamped serial number. Four-digit and letter for prefix. Suffix is unique to an instrument.

Figure 3-2. Rear Panel Connectors and Indicators



WARNING

BEFORE CONNECTING THIS SYSTEM TO LINE (MAINS) VOLTAGE, the safety and installation instructions found in Sections II and III of the mainframe manual should be followed.

CAUTION

Damage to the signal generator system may occur if option 002 RF Sections are used with unmodified 8660A and 8660B main frames with serial prefixes 1349A and below. See the paragraph entitled Modifications in Section II.

NOTE

Refer to Section HI for RF Section Installation instructions.

1. Set the System controls as follows:

Mainframe	
LINE Switch	ON
REFERENCESELECTOR	EXT
CENTER FREQUENCY	500 MHz
Modulation Section plug-in	
MODE Switch	OFF
RF Section plug-in	
OUTPUT RANGE Switch	0 dBm
VERNIER Control	+3 dB meter reading

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

OPERATOR'S CHECKS

2. Connect the RF Section OUTPUT to the power sensor input. Verify that the amplitude of the 500 MHz signal is approximately +3 dBm.

3. Set the OUTPUT RANGE Switch to +10 dBm and adjust the VERNIER control for a -3 dB meter reading. Verify that the output level is approximately +7 dBm.

4. Connect the RF Section OUTPUT to the frequency counter input through the 3 dB attenuator. Verify that the signal is accurate within +1 Hz.

5. To check the remote control capabilities of the RF Section, connect a control unit to the mainframe. Repeat steps 1 through 4 while the system is remotely programmed from an external source. Application Note 164-1 "Programming the 8660A/B Synthesized Signal Generator" provides the information needed for remote BCD operation of this system. Application Note 164-2 "Calculator Control of the 8660A/B/C Synthesized Signal Generator" provides the information needed for calculator control of the system using the HP-IB (option 005). Section III of the mainframe manual contains the same information in abridged form.

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

Table 3-1. Operating Instructions (1 of 2)

OPERATING INSTRUCTIONS

TURN ON

WARNING

BEFORE CONNECTING THIS SYSTEM TO THE LINE (MAINS) VOLTAGE, the safety and installation instructions found in Sections II and III of the mainframe manual should be followed.

CAUTION

Damage to the signal generator system may occur if option 002 RF Sections are used with unmodified 8660A and 8660B main- frames with serial prefixes 1349A and below. See the paragraph entitled Modifications in Section II.

NOTE

Refer to Section II for RF Section Installation Instructions.

1. Set the mainframe's LINE Switch to ON and the rear panel REFERENCE SELECTOR Switch to INT. Wait for the mainframe "oven" indication to go out.

FREQUENCY SELECTION

2. Refer to Section III of the mainframe operating and service manual for information on system frequency selection.

RF OUTPUT LEVEL

3. dBm. Set the OUTPUT RANGE switch to within +3 and --6 dB of the desired output level. Adjust the VERNIER control for a meter reading which when added to the OUTPUT RANGE switch indication equals the desired output level.

4. VOLTS. To set the RF output level in rms volts, the OUTPUT RANGE switch selected the full scale meter reading and the VERNIER control is adjusted for the correct voltage reading on the meter. The voltage level for meter scale 1.0 should not be set below 0.32 of full scale. The voltage level should not be set below 1 when using the meter scale of 3.

NOTE

In order to achieve the output level accuracy specified, the level selected must be S<+10 dBm and the RF Section front panel meter reading must be as stated above.

5. Connect the RF Output to the Device Under Test. The front panel meter reading of RF Output level will be correct only if the input impedance of the Device Under Test is 50w2.

Table 3-1. Operating Instructions (2 of 2)

MODULATION SELECTION

6. Refer to Section III of the Modulation Section plug-in operating and service manual for information relating to selection of modulation type and level.

REMOTE OPERATION

7. Application Note 164-1 "Programming the 8660A/B Synthesized Signal Generator" provides most of the information needed for remote BCD operation of this system. AN 164-2 "Calculator Control of the 8660A/B/C Synthesized Signal Generator" provides information for remote HP-IB operation of this system. In abridged form, Section III of the mainframe manuals contain the same information.

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

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

4-3. EQUIPMENT REQUIRED

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

4-5. TEST RECORD

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

4-7. PERFORMANCE TESTS

4-8. For each test, the specifications are written exactly as they appear in the specification table in Section I. Next, a description of the test and any special instructions or problem areas are included. Most tests that require test equipment have a setup drawing; each has a list of required equipment. The initial steps of each procedure give control settings required for that particular list.

CAUTION

To avoid the possibility of damage to the instrument or test equipment, read completely through each test before starting it. Then make any preliminary control settings before continuing with the procedure.

4-9. FREQUENCY RANGE

SPECIFICATION:
1 to 1299.999999 MHz selectable in 1 Hz steps. Frequencies from 200 to kHz to 1 MHz may also be selected with some degradation in specifications.

DESCRIPTION:
The Synthesized Signal Generator System RF OUTPUT is monitored by a frequency counter which supplies a common time base reference signal. The frequencies are checked at the extremes. Any specified frequency may be checked.

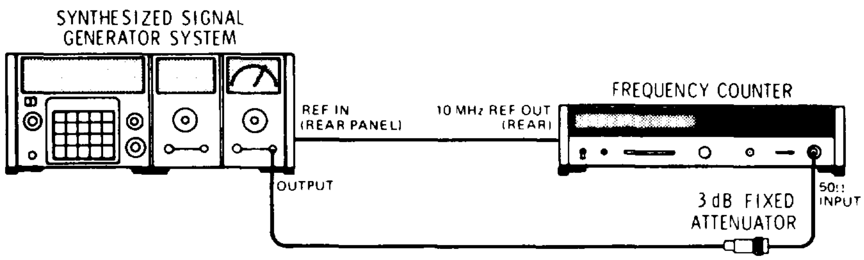


Figure 4-1. Frequency Range Test Setup

EQUIPMENT:

Frequency Counter... .... HP 5340A
10 dB Fixed Attenuator .... HP 8491A Opt 003

NOTE

In the following procedure, allow for accuracy of counter used. -Model recommended is specified at +1 count.

1. Connect frequency counter 10 MHz output reference signal to mainframe EXT REF input as shown in Figure 4-1 and set mainframe rear panel REF switch to EXT.

2. Set the RF Section OUTPUT RANGE switch to 0 dBm; set the VERNIER control full CW.

3. Set mainframe center frequency to 1.000 000 MHz and check RF section output frequency with counter. Record the frequency.

   0.999999_______________________1.000001 MHz

4. Set mainframe center frequency to 1299.999 999 MHz (Option 004 mainframe set to 1299.,space 9999 MHz) and check RF Section output frequency with counter. Record the frequency.

   1299.999 998________________1300.000 000 MHz

PERFORMANCE TESTS

4-10. FREQUENCY ACCURACY AND STABILITY

SPECIFICATION:
CW frequency accuracy and long term stability are determined by the aging rate of the time base (internal or external) and its sensitivity to changes in temperature and line voltage. Internal reference oscillator accuracy = + aging rate +3 x 10-10/° C + 3 x 10-10/1% change in line voltage. (Aging rate for the time base in the standard mainframe is 3 x 10- 8/day; for option 001 mainframes, 3 x 10-9/day.)

NOTE
If there is any reason to doubt the mainframe crystal oscillator accuracy or stability, refer to the performance test in Section IV of the mainframe manual.

4-11. FREQUENCY SWITCHING TIME

SPECIFICATION:
6 ms to be within 50 Hz of any new frequency selected; 100 ms to be within 0.5 Hz of any new frequency selected.

DESCRIPTION:
A change in the Synthesized Signal Generator System's frequency is remotely programmed; after a preset time interval the frequency is measured. A trigger pulse from the programming device is first coupled to the oscilloscope. The pulse is delayed a preset interval by the oscilloscope and then coupled to the computing counter at which time the frequency is measured.

NOTE
The frequencies in this test were selected for worst-case conditions (longest switching time).

4-11. FREQUENCY SWITCHING TIME (Cont'd)

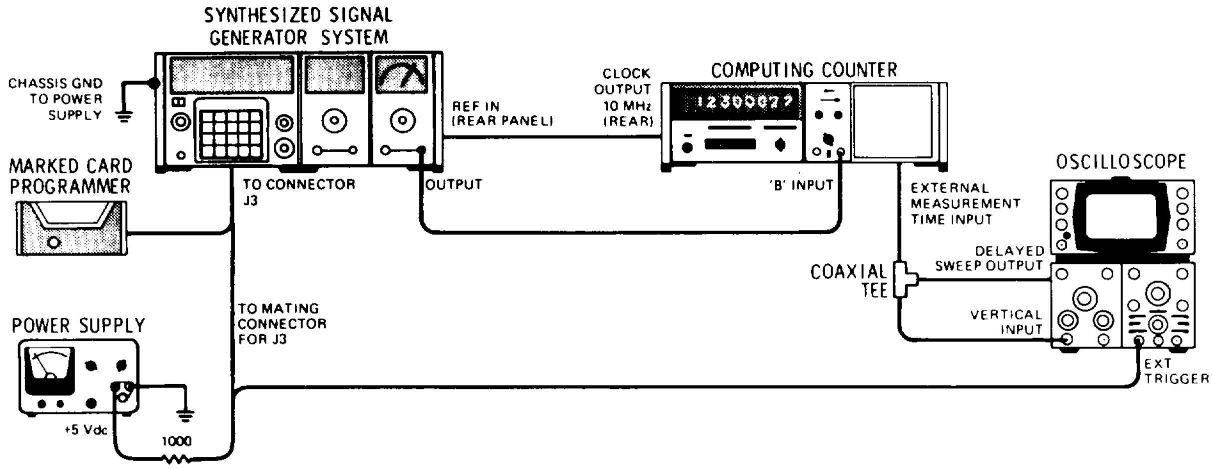


Figure 4-2. Frequency Switching Time Test Setup

EQUIPMENT:

DC Power Supply....................................HP 721A
Computing Counter..................................HP 5360A/5365A
Marked Card Programmer.........................HP 3260A Opt 001
Oscilloscope...HP 180C/1801A/1821A
Coaxial Tee..HP 1250-0781

PROCEDURE:

1. Connect the dc power supply +5 volt output through a 1000 ohm resistor to pin 17 of the mating connector for J3. Pin 17 (flag) of the Marked Card Programmer output connector is also connected to the oscilloscope ext trigger input.

2. Connect the marked card programmer to mainframe rear panel connector J3.

3. Connect oscilloscope delayed sweep output through a BNC TEE to oscilloscope channel A vertical input and to computing counter rear panel external time measurement input.

4. Set counter controls as follows: rear panel switch to trigger; "B" channel to X1 sensitivity; module switch pressed; digits displayed for necessary resolution; measurement time to 1; counter gate time to 1 ms.

5 Program the System for 29.999 999 MHz. Set the mainframe rear panel reference switch to external.

6. Set oscilloscope controls as follows: trigger to ac slow; ext, negative slope, trigger level at about 9:00 o'clock; sweep mode auto; delay trigger auto; main sweep 1 ms; delay sweep 0.1 ps; main sweep mode.

7. Set oscilloscope trace to start at left vertical graticule line. Use oscilloscope delay control to delay spike 5.5 divisions from CRT left graticule line.

8. Switch oscilloscope sweep mode from auto to normal.

4-11. FREQUENCY SWITCHING TIME (Cont'd)

9 Program the system for 30.000 000 MHz. Frequency displayed on computing counter should be 30 MHz + 50 Hz. Record the frequency.

29.999950__________________30.000050 MHz

10. Program the system for 29.999 999 MHz. Frequency displayed on counter should be within ± 50 Hz of 29.999 999 MHz.

29.999949__________________30.000049 MHz

11. Set Oscilloscope normal sweep for 10 ms and delay sweep to 1 us.

12. Set Oscilloscope sweep mode to auto and delay control for delay spike 9.5 divisions from the CRT left graticule line.

13. Set Oscilloscope main trigger to normal and computing counter gate time to 10 ms.

14. Program the System for 30.000 000 MHz. Frequency displayed on computing counter should be within + 5 Hz or programmed frequency.

29.999995__________________30.000005 MHz

15. Program the System for 29.999 999 MHz. Frequency Displayed on computing counter should be within + 5 Hz of programmed frequency.

29.999994___________________30.000004 MHz

NOTE

To reduce the effect of random errors, steps 5 through 10 and 13 through 15 may be repeated several times (5 minimum). Record the average frequency.

4-12. OUTPUT LEVEL SWITCHING TIME

SPECIFICATION:
In remote mode, any level change can be accomplished in less than 50 ms. Any change to another level on the same attenuator range can be accomplished in 5 ms.

DESCRIPTION:
The Synthesized Signal Generator System RF OUTPUT level (attenuation) is remotely programmed while the RF OUTPUT is detected and monitored by an oscilloscope. Because the oscilloscope is triggered by the programming device, the time needed to effect the level change may be measured directly on the oscilloscope CRT.

4-12 OUTPUT LEVEL SWITCHING TIME (Cont'd)

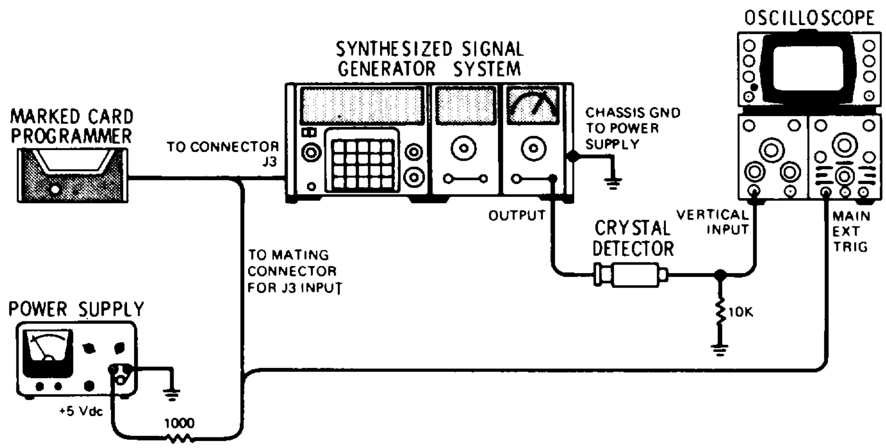


Figure 4-3. Output Level Switching Time Test Setup

EQUIPMENT:

Marked Card Programmer	HP 3260A Opt 001
Oscilloscope	HP 180C/1801A/1821A
Crystal Detector	HP 8471A
Power Supply	HP 721A

PROCEDURE:

1. Connect equipment as illustrated in Figure 4-3. Note that + 5 volt output from DC Power Supply is connected through a 1000 ohm resistor to pin 17 of mating connector to J3 and to Oscilloscope external trigger input.

2. Connect RF Section OUTPUT through crystal detector to oscilloscope Channel A input.

3. Set Oscilloscope controls as follows: Main Time/Div, 5 ms; Vertical input, dc coupled, 0.2 V/Div; Normal Sweep; Ext Trigger, negative slope, AC slow Trigger level about 9:00 o'clock.

4. Program the System's center frequency for 500 MHz and 10 dB attenuation of the RF output signal. Reprogram for 19 dB attenuation. Switching time should be less than 5 ms. Record switching time.

   10 to 19 dB________________________5 ms

5. Program RF Section attenuation for 10 dB, then for 30 dB. Switching time should be less than 50 ms.

   10 to 30 dB________________________50 ms

4-12. OUTPUT LEVEL SWITCHING TIME (Cont'd)

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

10 to 19 dB__________________________5 ms

4-13A. OUTPUT ACCURACY

SPECIFICATION: (for local and remote modes)
±1.5 dB to -76 dBm; ±2.0 dB to -146 dBm at meter readings between +3 and -6 dB.

DESCRIPTION:
The RF level accuracy for the ±10 and 0 dBm ranges is measured with a power meter. For the lower ranges, an IF substitution measurement technique is used.

RF level (attenuation) measurements using IF substitution is accomplished by 1) converting the RF output to a low frequency IF signal, 2) offsetting the decrease in RF level (increase in attenuation) by an equal decrease in IF attenuation. This maintains a fairly constant output level at the IF load. The intermediate frequency is selected on the basis of availability of a precision attenuator. Therefore, any variation in output level from an established reference is primarily due to the RF attenuator.

4-13A. OUTPUT ACCURACY (Cont'd)

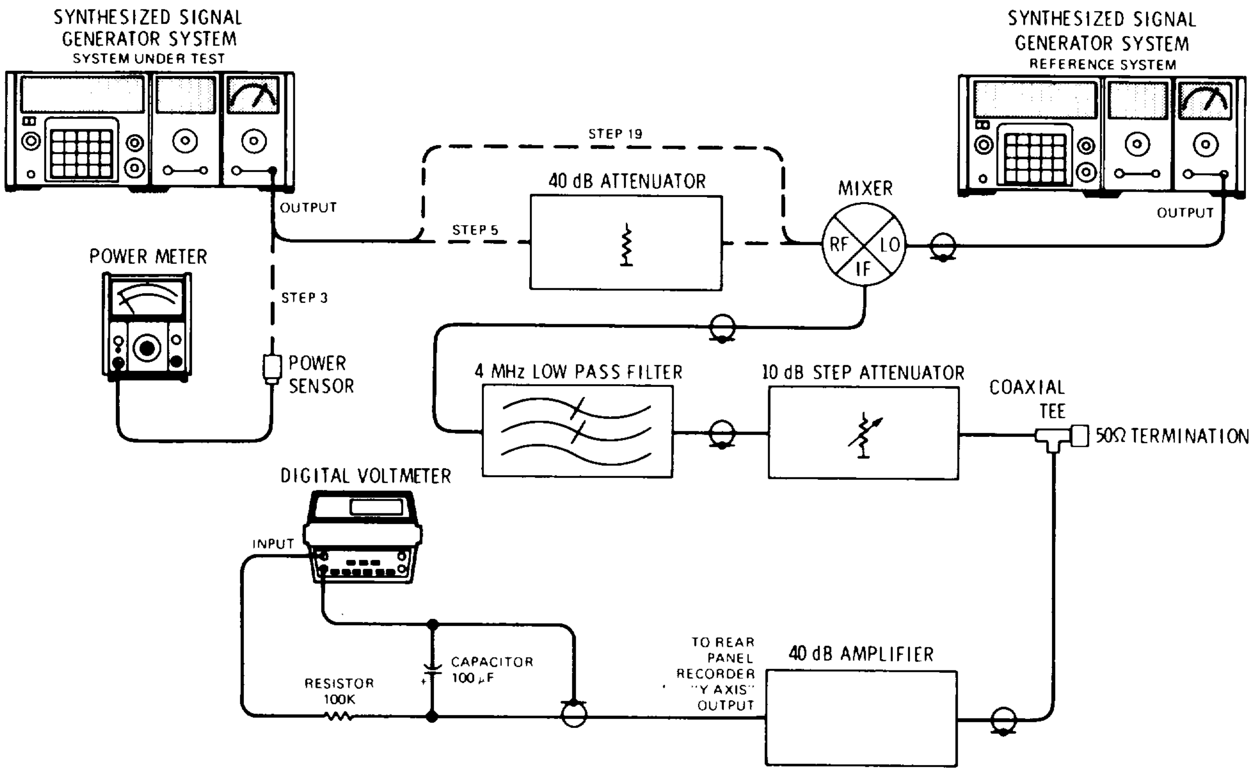


Figure 4-4A. Output Accuracy Test Setup

EQUIPMENT:

Power Meter/Sensor	HP 435A/8481A
Synthesized Signal Generator	HP 8660C/86602B/86631B
40 dB Attenuator	HP 8491A Option 040
Mixer.	Watkins-Johnson M1J
4 MHz Low Pass Filter.	CIRC-Q-TEL FLT/21B-4-3/50-3A/3B
Coaxial Tee	1250-0781 (BNC)
50 Ohm Termination...	HP 11593A
40 dB Amplifier	(See Figure 1-2)
Double Shielded Cables (5 required)	HP 08708-6033
Capacitor, 100 #F	.HP 0180-2207
Resistor, 100 k.	HP 0698-7284
Type N-to SMA Adaptor	OSM 21040
SMA-to-OSM Right Angle Adapter	OSM 219
SMA-to-BNC Adapter (2)	OSM 21190
10 dB Step Attenuator	HP 355D Option H38
Wave Analyzer	HP 3581A

4-13A. OUTPUT ACCURACY (Cont'd)

PROCEDURE:

1. Set the System Under Test Controls for a center frequency of 1000.000000 MHz and an output level of +10 dBm.

2. Set the power meter controls for the +15 dBm range.

3. Connect the power sensor to the RF Section OUTPUT jack of the System Under Test.

4. Set the RF Section controls as shown in the table below and verify that the RF output level is within the specified tolerance.

Synthesized Signal Generator System		Power Reading Reading (dBm)
OUTPUT RANGE Switch (dBm)	Panel Meter Reading (dB)	
+10	0	+8.5________+11.5
+10	-3	+5.5________+ 8.5
+10	-6	+2.5________+ 5.5
0	-6	-7.5_________- 4.5
0	-3	-4.5_________- 1.5
0	0	-1.5_________+ 1.5
0	+3	+1.5_________+ 4.5

NOTE

Be careful not to vary the RF Section 's VERNIER control setting throughout the rest of this procedure.

5. Connect the 40 dB attenuator directly to the OUTPUT jack of the RF Section in place of the power sensor.

6. Connect the "R" port of the mixer directly to the 40 dB attenuator using the Type N-to SMA adapter and the SMA-to-OSM right angle adapter.

7. Connect the 4 MHz Low Pass Filter to the "I" port of the mixer with a SMA-to-BNC adapter.

8. Connect the cable from the Reference System output to the "L" port of the mixer with a SMA-to-BNC adapter.

NOTE

Be sure all connections are tight to prevent RF leakage.

9. Set the reference system controls for a center frequency of 1000.011000 and an output level of +7 dBm. Set the rear panel reference selector to external.

10. Set the 10 dB Step Attenuator to 50 dB.

4-13A. OUTPUT ACCURACY (Cont'd)

11. Set the wave analyzer controls as follows: frequency 11 kHz, resolution bandwidth 3 Hz, sweep mode off, dBv/LIN - dBm 600:1 switch to dBv/LIN, amplitude reference level -40 dB, AFC switch unlock and scale 10 dB.

12. Connect the other equipment which follows the 4 MHz Low Pass Filter as shown in Figure 4-4A.

13. Tune the wave analyzer frequency control for the maximum meter reading. Adjust the input sensitivity and vernier controls for a midscale meter reading. Press the AFC control for frequency lock.

14. Wait 30 seconds for the DVM reading to stabilize. Record the DVM reading. This is the reference level equivalent to the last power meter reading (+3 dBm).

15. Use the following formula to calculate the obsolute RF output level from the System Under Test:

    dBm = dBm1 -A dB +2(V-Vre_{ff}
    dBm is the RF output level
    dBm1 is the actual RF level measured at the +3 dBm (O dBm OUTPUT RANGE setting) in Step 4.
    A dB is the difference in 10 dB step attenuator setting.
    V is the DVM reading for each individual OUTPUT RANGE.
    Vref is the reference DVM reading.

NOTE

The wave analyzer recorder output sensitivity is 2dB/volt.

16. Set the RF Section OUTPUT RANGE switch to -10 dBm; set the 10 dB step attenuator to the 40 dB. Wait 30 seconds for the reading to stabilize. Record the DVM reading in the table following step 17. Calculate and record the RF level in the table.

EXAMPLE:

dBm = dBm1 --(ΔdB) +2 (V1 -Vref)
    dBm1 = 2.8 dBm
    ΔdB = 10 dB
    V1= 2.388 Vdc
    Vref = 2.433 Vdc (from step 14)
dBm = 2.8 - (10) +2(2.388-2.433)
    = 2.8 -10 +2(-0.045)
    = -7.29 dBm

4-13A. OUTPUT ACCURACY (Cont'd)

17. Continue as in step 16,space to measure, record and calculate the DVM reading and RF level for each OUTPUT RANGE setting as shown in the following table.

Output Range Switch	10dB Step Attenuator (dB)	DVM Reading (Vdc)	Absolute RF Output Level (dBm)		
			Min.	Actual	Max.
0	50	________	+ 1.5	________	+ 4.5
- 10	40	________	- 8.5	________	- 5.5
-20	30	________	-18.5	________	-15.5
-40	10	________	-38.5	________	-35.5
-50	0	________	-48.5	________	-45.5

18. Set the 10 dB step attenuator to 50 dB.

19. Remove the 40 dB attenuator and connect the mixer directly to the OUTPUT jack of the system under test.

20. Increase the wave analyzer's input sensitivity by 10 dB. Ifnecessary,space adjust the input sensitivity vernier for a midscale meter reading.

21. Transfer the last calculated RF output level on the preceding table to the first line on the following table. Wait 30 seconds and record the new DVM reading (Vref).

22. Use the formula and the new Vref level to calculate the RF level for each range shown in the following table.

Output Range Switch (dBm)	10 dB Step Attenuator (dB)	DVM Reading (Vdc)	Absolute RF Output Level (dBm)		
			Min.	Actual	Max.
-50	50	________	-48.5	________	-45.5
-60	40	________	-58.5	________	-55.5
-70	30	________	-68.5	________	-65.5
-80	20	________	-79.0	________	-75.0
-90	10	________	-89.0	________	-85.0
-100	0	________	-99.0	________	-95.0

23. Set the wave analyzer's AFC switch to unlock (OFF). Adjust the frequency control for the peak reading equal to the last recorded DVM reading on the previous table.

24 Set the 10 dB step attenuator to 30 dB.

4-13A. OUTPUT ACCURACY (Cont'd)

25. Set the wave analyzer amplitude reference level to -60 dB. Increase the input sensitivity 10 dB.

26 Transfer the last RF output level reading on the preceding table to the first line of the following table. After 30 seconds record the new DVM reference on the first line of the following table.

27. Measure, calculate,space and record the DVM reading and RF level for each OUTPUT RANGE Setting as shown in the following table. Due to the high noise levels evident on this test, there is appreciable deviation in the wave analyzer and DVM readings. Record the average reading.

Output Range Switch (dBm)	10dB Step Attenuator (dB)	DVM Reading (Vdc)	Absolute RF Output Level (dBm)		
			Min.	Actual	Max.
-100	30	_______	-99.0	_________	-95.0
-110	20	_______	-109.0	_________	-105.0
-120	10	_______	-119.0	_________	-115.0
-130	0	_______	-129.0	_________	125.0

NOTE

Output level accuracy may be checked at any frequency between 300 and 2000 MHz using this procedure. This procedure may also be used at the frequency extremes if a well shielded mixer specified for the desired frequency range is used in place of the Watkins Johnson M1J.

4-13B. OUTPUT ACCURACY - ALTERNATE PROCEDURE

SPECIFICATION:
+1.5 dB to -76 dBm; +2.0 dB to -146 dBm at meter readings between +3 and -6 dB.

DESCRIPTION:
The RF Level Accuracy for the +10 and 0 dBm ranges is measured with a power meter. A reference level is established and accuracy is checked from 0 dBm to -80 dBm by comparing the RF Section attenuation against a calibrated 10 dB step attenuator.

NOTE

This procedure checks all sections of the RF Section Attenuator separately. Also, the 10 dB, 20 dB, and 40 dB sections are checked in all possible combinations. The sum of the -70 dBm inaccuracy at -80 dBm shall not exceed +1.0 dB.

4-13B. OUTPUT ACCURACY - ALTERNATE PROCEDURE (Cont'd)

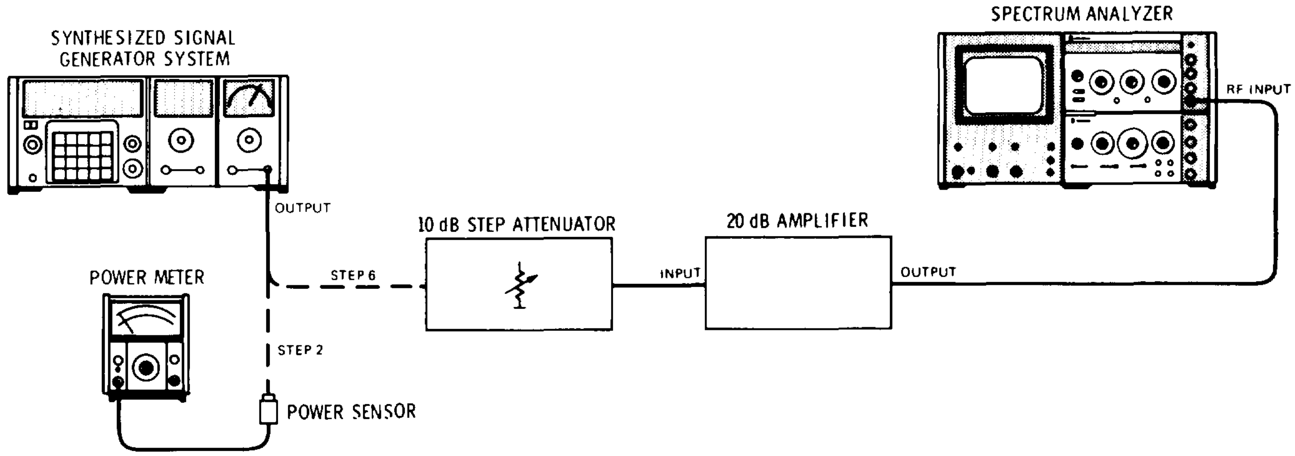


Figure 4-4B. Output Accuracy Test Setup (Alternate Procedure)

EQUIPMENT:

Spectrum Analyzer.. HP 8555A/8552B/140T
Power Meter/Sensor. .... HP 435A/8481A
10 dB Step Attenuator.. HP 355D Option H38
20 dB Amplifier... HP 8447A

PROCEDURE:

1. Set the system controls for a frequency of 30 MHz and an output level of +10 dBm.

2. Connect the power sensor to the RF Section's OUTPUT jack.

3. Set the RF Output Level as shown in the table below and verify that the level is within the specified tolerance.

Synthesized Signal Generator System		Power Meter Reading (dBm)
Output Range Switch (dBm)	Panel Meter Reading (dB)	
+10	0	+8.5_______+11.5
+10	-3	+5.5_______+ 8.5
+10	-6	+2.5_______+ 5.5
0	-6	-7.5________-4.5
0	-3	-4.5________-1.5
0	0	-1.5________+1.5
0	+3	+1.5________+4.5

4-13B. OUTPUT ACCURACY - ALTERNATE PROCEDURE (Cont'd)

NOTE

Do not change the RF Section VERNIER Control Setting until this procedure is completed.

4. Set the spectrum analyzer controls as follows: center frequency 30 MHz, frequency span per division 5 kHz, resolution bandwidth 3 kHz, input attenutation 10 dB, vertical sensitivity per division 2 dB and sweep time per division 5 ms.

5. Set the 10 dB Step attenuator switch to the 80 dB range.

6. Connect the equipment as shown in Figure 4-4B.

7. Adjust the reference level range and vernier to extablish a reference level on the analyzer display.

8. On the first line of the following table, record the power meter reading shown on the preceding table for the OUTPUT RANGE Setting of 0 dBm and the panel meter reading of +3 dB. This is the absolute RF level which corresponds to the display reference.

9. Set the OUTPUT RANGE switch and the 10 dB step attenuator range switch settings as shown on each line of the following table. Record the display variation from the established reference.

10. Calculate the RF level using the following formula:

dBm = dBm1 - ΔAdB10 + ΔdB
dBm is the RF output level
dBm1 is the RF level measured at +3 dBm (0 dBm OUTPUT RANGE setting) in step 3.
Δ dB_{10} is the change in 10 dB Step Attenuator level
Δ dB is the variation from the established display reference for each OUTPUT RANGE setting.

For example, results of the first step are:

dBm1 =+2.8
ΔA dB_{10} = 10
ΔA dB = -0.2
dBm = +2.8 dBm -10 dB +(-0.2) dB
= -7.4 dBm

4-13B. OUTPUT ACCURACY - ALTERNATE PROCEDURE (Cont'd)

Output Range Switch (dBm)	10 dB Step Attenuator (dB)	RF Output Level (dBm)		
		Min.	Measured	Max.
0	80	+ 1.5	________	+ 4.5
-10	70	-8.5	________	- 5.5
-20	60	-18.5	________	-15.5
-30	50	-28.5	________	-25.5
-40	40	-38.5	________	-35.5
-50	30	-48.5	________	-45.5
-60	20	-58.5	________	-55.5
-70	10	-68.5	________	-65.5
-80	0	-79.0	________	-75.0

11. Subtract the two levels obtained for OUTPUT RANGES of -70 and -80 dBm. The level change should be 10 + 1 dB.

9 dB________________________________11 dB

4-14. OUTPUT FLATNESS

SPECIFICATION:
Output level variation with frequency is less than +1.0 dB from 1-1300 MHz at front panel meter readings between +3 and -6 dB.

DESCRIPTION:
After an output level reference is established, power level measurements are made at various frequencies across the range of the Synthesized Signal Generator System. The Output levels must fall within the limits specified.

EQUIPMENT:

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

PROCEDURE:

1. Zero the Power Meter.

2. Set the system center frequency to 1000 MHz.

3. Set the Power Meter range switch to 0 dBm; set the RF Section OUTPUT RANGE Switch and VERNIER Control for an output level of -1.0 dBm as read on the power meter.

4-14. OUTPUT FLATNESS (Cont'd)

4. Measure and record the power level indicated by the Power Meter at the following center frequencies: 1 MHz, 10 MHz, 100 MHz, 200,space 400,space 600,space 800,space and 1299 MHz.

1 MHz	-2.0	________	0.0 dBm
10 MHz	-2.0	________	0.0 dBm
100 MHz	-2.0	________	0.0 dBm
200 MHz	-2.0	________	0.0 dBm
400 MHz	-2.0	________	0.0 dBm
600 MHz	-2.0	________	0.0 dBm
800 MHz	-2.0	________	0.0 dBm
1299 MHz	-2.0	________	0.0 dBm

4-15. HARMONIC SIGNALS

SPECIFICATION:
All harmonically related signals are at least 30 dB below the desired output signal for output levels < +3 dBm. (25 dB down for output levels above +3 dBm.)

DESCRIPTION:
A spectrum analyzer is used to measure the relative levels of the second and third carrier harmonics with respect to the carrier fundamental at various center frequencies.

EQUIPMENT:
Spectrum Analyzer.. HP 8555A/8552B/140T

PROCEDURE:

1. Set the system center frequency to 1299 MHz; set the RF Section OUTPUT RANGE switch and VERNIER control for an output level of +10 dBm.

2. Connect the power meter/sensor to the system RF OUTPUT jack.

3. Readjust the VERNIER control for a power meter reading of +10 dBm.

4. Set the spectrum analyzer input attenuation to 30 dB. Connect the RF Section OUTPUT jack to the spectrum analyzer RF input.

5. Set the other spectrum analyzer controls for convenient viewing of the carrier. Adjust the controls as necessary to view the second and third harmonics. Record the harmonic levels relative to the fundamental signal.

	Second	Third
1299 MHz >,space 25 dB down	______	______

4-15. HARMONIC SIGNALS (Cont'd)

6. Repeat steps 1 through 5 at the other frequencies listed. Record the levels.

	Second	Third
1000 MHz>-25 dB down	______	______
500 MHz>25 dB down	______	______
100 MHz>25 dB down	______	______
10 MHz >25 dB down	______	______

7. Set the system center frequency to 100 MHz; set the RF Section OUTPUT RANGE switch to 0 dBm and the VERNIER control for a front panel meter reading of +3 dB. Record the harmonic levels.

	Second	Third
100 MHz >-30 dB down	______	______

4-16 PULSE MODULATION RISETIME

SPECIFICATION:
50 nanoseconds.

DESCRIPTION:
The external pulse generator output is coupled to the RF Section plug-in through the Model 86631B Auxiliary Section. The pulse modulated signal is detected and the rise time measured with an oscilloscope.

4-16. PULSE MODULATION RISETIME (Cont'd)

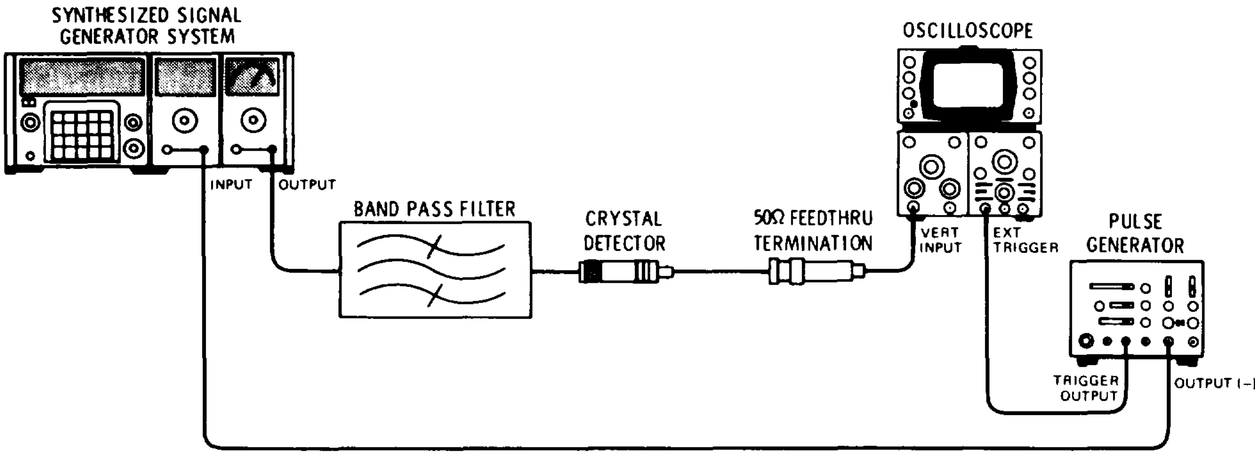


Figure 4-5. Pulse Modulation Risetime Test Setup

EQUIPMENT:

Pulse Generator..	HP 8013A
Oscilloscope..	HP 180C/1801A/1821A
Crystal Detector	HP 423A
Termination, 50Ω Feedthru.....................................	HP 11048C
Band Pass Filter..	HP 8430A PROCEDURE:

1. Set System center frequency to 1200 MHz.

2. Set the RF Section OUTPUT RANGE switch and VERNIER control for an output of +10 dBm.

3. Set the Auxiliary Section external modulation switch to pulse; set pulse level control full cw.

4. Adjust pulse generator output for -10 Vpk (into 50Q) with risetime <10 ns; set pulse repetition rate and width to convenient values.

5. Connect equipment as illustrated in Figure 4-5.

6. Adjust oscilloscope to display leading edge of detected pulse modulated RF signal. Risetime, as measured between the 10% and 90% amplitude points on leading edge should be 50 nanoseconds or less.

__________________50 ns

4-17. PULSE MODULATION ON/OFF RATIO

SPECIFICATION:
At least 40 dB

DESCRIPTION:
An HP Model 86631B Auxiliary Section is inserted in the left cavity of the mainframe. Inputs of -9.5Vdc (pulse-on) and 0 Vdc (pulse-off) are input to the Auxiliary Section while the RF output of the system is monitored by a spectrum analyzer. The ratio of the pulse-off and pulse-on RF levels is the on/off ratio.

EQUIPMENT:

Spectrum Analyzer.. HP 8555A/8552B/140T
Power Supply.. HP 6215A

PROCEDURE:

1. Set System center frequency to 500 MHz, RF Section OUTPUT RANGE Switch and VERNIER control for an output level of +10 dBm, and Auxiliary Section external modulation switch to pulse.

2. Set spectrum analyzer input attenuation to 30 dB; connect the RF Section OUTPUT to the analyzer RF input.

3. Connect -9.5 Vdc from the power supply to the Auxiliary Section input.

4. Adjust the analyzer controls for a CRT display of the carrier. Establish the reference by positioning the carrier peak on the top horizontal graticule line.

5. Set the power supply output to 0.0 Vdc. Set the Pulse Level control fully clockwise. The signal displayed on Spectrum Analyzer should be >40 dB down with respect to the reference. Record the displayed level.

40 dB down__________

4-18. AMPLITUDE MODULATION DEPTH AND 3 dB BANDWIDTH

SPECIFICATION:
Depth: 0-90% for RF output level meter readings from +3 to -6 dB and only at +3 dBm and below. 3 dB
Bandwidth:
At center frequencies <10 MHz
10 kHz from 0 - 30% AM
6 kHz from 0 - 70% AM
5 kHz from 0 - 90% AM
At center frequencies >10 MHz
100 kHz from 0 - 30% AM
60 kHz from 0 - 70% AM
50 kHz from 0 --90% AM

NOTE

To check AM accuracy, refer to section IV of the appropriate modulation section Operating and Service manual.

PERFORMANCE TESTS

4-18. AMPLITUDE MODULATION DEPTH AND 3 dB BANDWIDTH (Cont'd)

DESCRIPTION:
The system Rf output is amplitude modulated. The signal is demodulated by a peak detector in a spectrum analyzer (the frequency span width is set to zero). The ac and dc components are measured with a voltmeter at the detector (vertical) output. First, the dc component is set to -283 mVdc plus a detector offset correction. Then, the ac component is measured. The AM level (%) is ½ (one half) the rms output.

Because of the required measurement accuracy, the accuracy of the spectrum analyzer's detector offset must be known to +2 mVdc. The offset voltage is calculated by measuring the change in the detector output for a change in the RF input and assuming a linear detector over the range of the levels used.

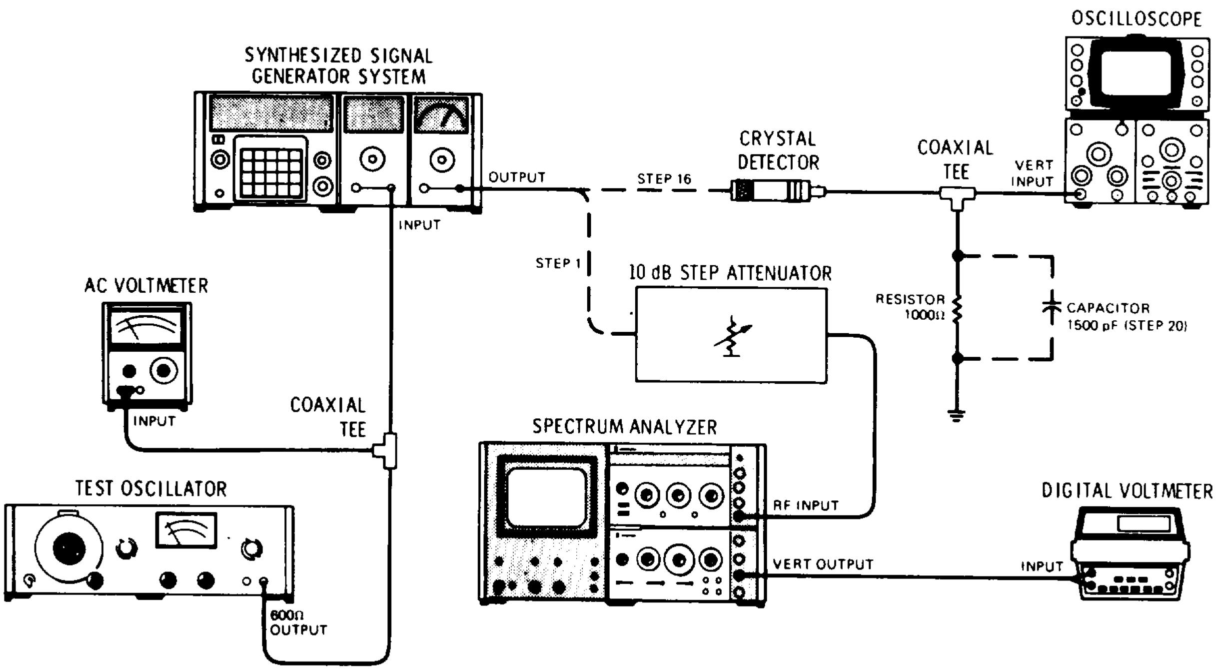


Figure 4-6. Amplitude Modulation Depth and 3 dB Bandwidth Test Setup

EQUIPMENT:

Test Oscillator	HP 651B
AC Voltmeter	HP 403B
10 dB Step Attenuator	HP 3550 Option H38
Spectrum Analyzer	HP 8555A/8552B/140T
Digital Voltmeter	HP 34740A/34702A
Coaxial Tee (2 required)	HP 1250-0781
Crystal Detector	HP 423A
Oscilloscope	HP 180C/1801A/1821A
Resistor 1K	HP 0757-0280

4-18. AMPLITUDE MODULATION DEPTH AND 3 dB BANDWIDTH (Cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-6 (step 1).

2. Set the synthesized signal generator controls as follows: center frequency 30 MHz, OUTPUT RANGE 10 dBm, VERNIER control for a panel meter reading of 0 dB, and AM off.

3. Let the spectrum analyzer warm up for 1 hour to minimize drift of the spectrum analyzer detector output. Set 10 dB step attenuator to 10 dB attenuation.

4. Set the spectrum analyzer center frequency to 30 MHz, frequency span per division 5 MHz, resolution bandwidth 300 kHz; input attenuation to 20 dB, and vertical sensitivity per division 10 dB. Adjust the center frequency control to center the display. Set the frequency span to zero and tune to peak the trace.

NOTE

Throughout this test, continually check that the signal is peaked for maximum deflection. Tune the center frequency control for maximum signal deflection.

5. Set the vertical scale to linear and adjust the reference level vernier for a digital voltmeter reading of 200 mVdc.

6. Set the 10 dB step attenuator to 0 dB and record the digital voltmeter reading.

    ________________mVdc

7. Set the 10 dB Step Attenuator to 20 dB and record the digital voltmeter reading.

    ________________mVdc

8. Calculate the offset voltage using the following formula:

$$V_{off} = \frac{\text{mVdc} + 200a}{1-a}$$

Where Voff is the offset voltage in millivolts mVdc is the DVM reading in millivolts a is 3.16 (step 5) or 0.316 (step 6).

For example:

mVdc = -687 in step 5

$$\text{therefore } V_{off} = \frac{-687 + 200\,(3.16)}{1-(3.16)} = +25.5 \text{ mVdc}$$

9. Find the value of V_{off} for step 6. The difference between the two should be < 4 m Vdc. Use the average value of V_{off}.

10. Set the 10 dB step Attenuator to 10 dB.

PERFORMANCE TESTS

4-18. AMPLITUDE MODULATION DEPTH AND 3 dB BANDWIDTH (Cont'd)

11. Set the system center frequency to 500 MHz, the modulation mode to AM, the modulation source to external, and a modulation level of 30% (0.3 Vrms input to an Auxiliary Section; 1.5 Vrms to a Modulation Section) at a 1 kHz rate.

12. Set the spectrum analyzer center frequency control to 500 MHz, frequency span to zero, and peak the trace. Set the reference level vernier for a digital voltmeter reading of -283 mVdc + $Vof_{f.}$ See Steps 8 and 9.

13. Set the DVM controls to measure the peak detector's ac component. The modulation level (%) is 1/2 (one-half) the DVM reading (Vrms). Record the reading for 30% AM.

    50 mVrms________________________70 mVrms

14. Set the modulation section (test oscillator) controls for 70% AM. Record the DVM reading.

    130 mVrms______________________150 mVrms

15. Set the modulation section (test oscillator) controls for 90% AM. Record the DVM reading

    170 mVrms______________________190 mVrms

16. Connect the crystal detector to the RF Section OUTPUT jack.

17. Set the modulation section and test oscillator controls for an AM level of 30% (0.3 Vrms input to an auxiliary section; 1.5 Vrms to a modulation section) at a 5 kHz rate.

18. Set the oscilloscope controls for a 5 division peak-to-peak display of the demodulated signal.

19. Increase the test oscillator frequency to 100 kHz. The signal amplitude should be >3.5 divisions peak-to-peak.

    3.5 div. p-p__________________

20. Install the 1500 Pf capacitor as shown in Figure 4-6.

21. Repeat steps 17 through 19 with center frequency set to 9 MHz. Increase the test oscillator frequency from 5 to 10 kHz. Record the signal amplitude.

    3.5 div. p-p__________________

4-19. FREQUENCY MODULATION RATE AND DEVIATION

SPECIFICATION:
Rate: DC to 200 kHz with the 86632B or 86635A.
20 Hz to 100 kHz with the 86633B.
Maximum Deviation (Peak):
200 kHz with the 86632B and 86635A.
100 kHz with the 86633B.

NOTE

To check the frequency modulation rate and deviation, refer to the performance test in Section IV of the applicable modulation section manual.

4-20. OUTPUT IMPEDANCE AND VSWR

SPECIFICATION:

Impedance: 50Ω
VSWR: <2.0 on +10 and 0 dBm ranges; <1.3 on -10 dBm range and below.

DESCRIPTION:
The Synthesized Signal Generator System's output signal is reflected back into the RF OUTPUT jack by a coaxial short at the end of an adjustable stub (a variable length of air-line). This reflected signal is re-reflected by any mismatch at the jack. The re-reflected signal combines with the output signal according to the relative phase and magnitude of the two signals. The combined signal is monitored by a directional coupler and then measured by a voltmeter or spectrum analyzer. Maximum and minimum power levels are noted as the electrical length of the stub is varied (i.e. the electrical distance from the RF OUTPUT jack to the coaxial short is varied). The maximum allowable change in voltage or dB is calculated from the following formulas.

$$VSWR = \frac{Vmax}{Vmin}$$

$$Vmax = (VSWR)\ (Vmin)$$

$$dB = 20 \log \frac{(Vmax)}{(Vmin)}$$

$$dB = 20 \log (VSWR)$$

4-20. OUTPUT IMPEDANCE AND VSWR (Cont'd)

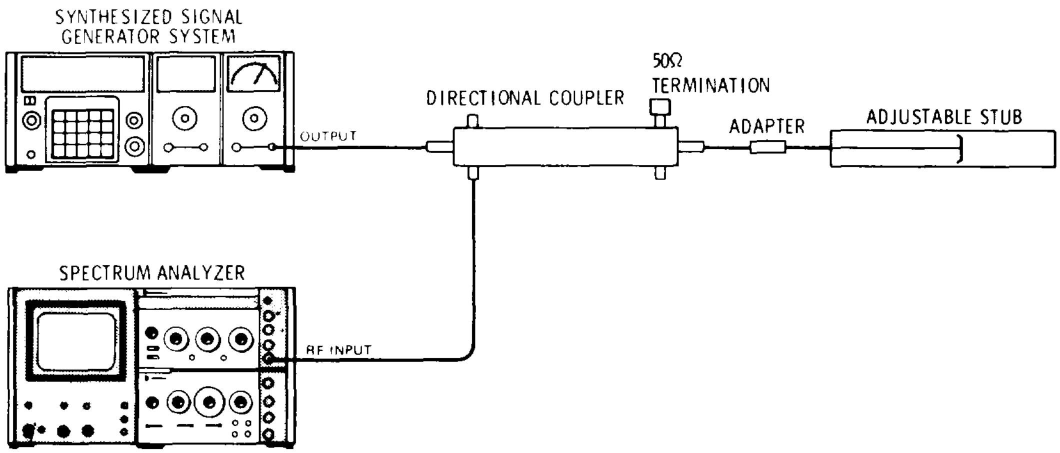


Figure 4-7. Output Impedance Test Setup

EQUIPMENT:

Directional Coupler	HP 778D Opt 12
Adapter (Male Type N to GR 874)	HP 1250-0847
Adjustable Stub..	General Radio 874-D50L
Spectrum Analyzer	HP 8555/8552B/140T
5052 Termination	HP 11593A

PROCEDURE:

1. Set the Synthesized Signal Generator system center frequency to 500 MHz, the OUTPUT RANGE switch to +10 dBm, and the VERNIER control for a panel meter reading of 0 dB.

2. Set up the equipment as shown in Figure 4-7.

3. Set the spectrum analyzer controls for a convenient display of the signal. Set the vertical sensitivity to 2 dB per division.

4. Adjust the stub for a minimum indication on the spectrum analyzer display. Adjust the reference level range and vernier controls for a convenient reference level.

5. Adjust the stub for a maximum indication on the display. The signal level increase should be <6 dB (VSWR <2.0).

____________________6dB

6 Set the system's OUTPUT RANGE switch to 0 dBm. Adjust the VERNIER control for a panel meter reading of +3 dB.

7 Repeat steps 3 and 4. The signal level increase should be <6 dB (VSWR <2.0).

____________________6dB

8. Set the system's OUTPUT RANGE switch to -10 dBm.

4-20. OUTPUT IMPEDANCE AND VSWR (Cont'd)

9. Repeat steps 3 and 4. The signal level increase should be <2.3 dB (VSWR <1.3).

10. If desired, repeat at other frequencies between 100 MHz and 1 GHz.

____________________2.3 dB

NOTE

The steps given above effectively check VSWR at all settings of the output attenuator.

4-21. SIGNAL-TO-PHASE NOISE RATIO

SPECIFICATION: (For AM,s CW, and OM modes only)

Greater than 45 dB in a 30 kHz band centered on the carrier and excluding a 1 Hz band centered on the carrier.

DESCRIPTION:
AC voltage measurements proportional to carrier amplitude and residual carrier phase deviation are compared for the signal-to-phase noise ratio. The Synthesized Signal Generator System's reference and RF output (carrier) signals are mixed and the difference frequency is monitored by an oscilloscope and ac voltmeter. The mixer output (proportional to the carrier amplitude) is noted. The two signals are then frequency synchronized with phase difference of 180°. (This phase difference provides maximum resolution for voltage measurements at the mixer output which are proportional to the change of phase of the RF output signal.) This ac voltage is proportional to the phase noise and when compared to the carrier voltage yields the signal-to-phase noise ratio.

NOTE

A 3 dB correction factor takes into account the non-correlated noise contribution of the reference system. The noise levels of the reference system and the system under test are assumed to be equal.

4-21 SIGNAL-TO-PHASE NOISE RATIO (Cont'd)

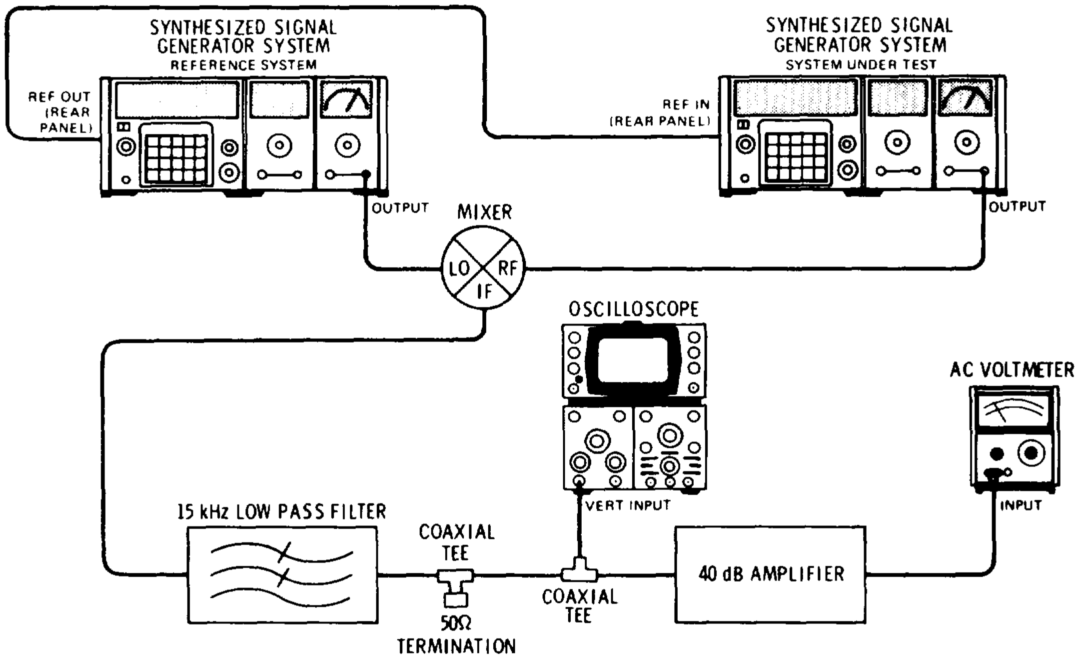


Figure 4-8. Signal-to-Phase Nose Ratio Test Setup

EQUIPMENT:

Synthesized Signal Generator System	HP 8660C/86602B/86631B
Oscilloscope	HP 180C/1801A/1821A
Coaxial Tee	HP 1250-0781 (BNC)
Double Balanced Mixer	Watkins-Johnson M1J
AC Voltmeter	HP 403B
40 dB Amplifier	(See Figure 1-2)
15 kHz Low Pass Filter	(See Figure 1-3)
502 Termination	HP 11593A

PROCEDURE:

1. Set the controls of the system under test as follows: center frequency 500.001000 MHz and the output level to -47 dBm (OUTPUT RANGE switch set to -50 dBm).

2. Set the controls of the reference system as follows: center frequency 500.000000 MHz and the output level to +7 dBm.

3. Connect the equipment as shown in Figure 4-8.

4. Record the relative ac voltmeter reading.

_______________dB

4-21. SIGNAL-TO-PHASE NOISE RATIO (Cont'd)

5. Set the system under test OUTPUT RANGE switch to -10 dBm (-7 dBm output level).

6. Adjust the oscilloscope display of the 1 kHz signal for an amplitude of eight divisions. Set the oscilloscope vertical input to ground and adjust the vertical position control so the trace lies over the center horizontal line of the graticule. Set the vertical input to dc coupled.

7. Set the system under test center frequency to 500.000001 MHz and note that oscilloscope baseline trace alternately rises and falls over eight-division display. (510.0001 MHz; Option 004).

8. Reset the center frequency to 500.000000 MHz at a time that causes the oscilloscope baseline trace to stop within + 1/10 division of the center horizontal line of the graticule.

9. Read the noise level on the ac voltmeter. Signal-to-phase noise ratio equals the sum of the attenuator change and the reference system noise contribution minus the change in voltmeter reading (in dB). Signal-to-phase noise ratio = 40 dB +3 dB - (+A dB). For example, the voltmeter reading is 8 dB below the reference (-8 dB). Therefore, the signal-to-phase noise ratio = 40 + 3 - (-8) = 51 dB down.

10. Record the ratio.

45 dB down__________

4-22. SIGNAL-TO-AM NOISE RATIO

SPECIFICATION:
Greater than 65 dB in a 30 kHz bandwidth centered on the carrier excluding a 1 Hz band centered on the carrier.

DESCRIPTION:
A comparison of ac voltage measurements proportional to carrier amplitude and AM noise yields the signal-to-AM noise ratio. First, a carrier reference level is determined by measuring the detected ac voltage for 30% AM (the detected signal is 10.5 dB below the carrier level). Then the AM noise level is measured and the signal-to-AM noise ratio is determined.

4-22. SIGNAL-TO-AM NOISE RATIO (Cont'd)

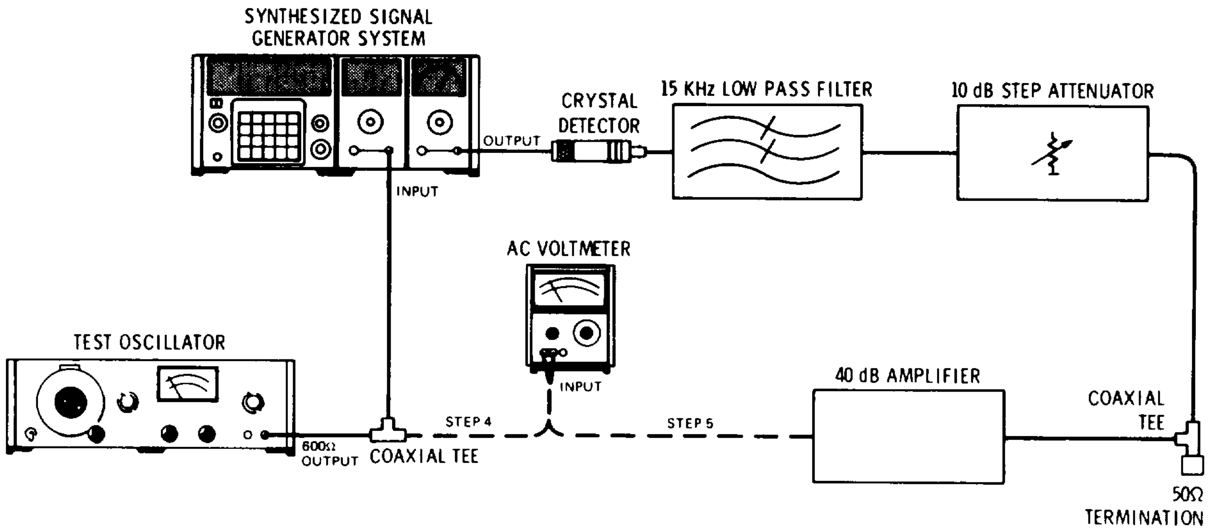


Figure 4-9. Signal-to-AM Noise Test Setup

EQUIPMENT:

10 dB Step Attenuator	HP 355D Option H38
40 dB Amplifier	Special (See figure 1-2)
Crystal Detector	HP 423A
15 kHz Low Pass Filter	Special (See figure 1-3)
Test Oscillator	HP 651B
502 Termination	HP 11593A
Coaxial Tee	HP 1250-0781
AC Voltmeter	HP 403B

PROCEDURE:

1. Set the 10 dB step attenuator to 50 dB.

2. Set the system center frequency to 500 MHz and the RF output level to +3 dBm (O dBm OUTPUT RANGE).

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

4. Set the system's modulation section controls for the AM mode and an external modulation source. The modulation level control and/or the test oscillator controls are set for a modulation level of 30% (0.3 Vrms to an auxiliary section; 1.5 Vrms to a modulation section) at a 1 kHz rate.

NOTE

The ac voltmeter can be used to monitor the modulation or auxiliary section input voltage while it is being set.

5. Record the ac voltmeter reading of the 40 dB amplifier output in dB.

_______________dB

4-22. SIGNAL-TO-AM NOISE RATIO (Cont'd)

6. Set the system's modulation mode to off.

7. Set the 10 dB step attenuator to 0 dB.

8. Record the ac voltmeter reading.dB

9. The signal-to-AM noise ratio is equal to the sum of the change in attenuation level and the level of the 30% AM level relative to the carrier minus the change in ac voltmeter reading in dB. Therefore, signal-to-AM noise ratio = 50 dB + 10.5 dB - (+A dB). For example,space the ac voltmeter reading is 12 dB down (below) the reference level and the signal-to-AM noise ratio = 50 + 10.5 - (-12) or 72.5 dB down.

10. Record the ratio.

65 dB down__________

4-23. RESIDUAL FM

SPECIFICATION:
In the FM XO.1 MODE, <10 Hz-rms average in a 300 Hz to 3 kHz post-detection band.

DESCRIPTION:
An FM discriminator is used to measure the residual FM of the signal generator system in the FM mode. A reference generator and mixer are used to down-convert the RF output to the frequency range of the discriminator. The discriminator output is amplified, filtered and measured with a voltmeter. The rms voltmeter reading is proportional to the rms residual FM deviation.

NOTE

Below 300 Hz, the 5 MF capacitor rolls off the 3 kHz low pass filter output.

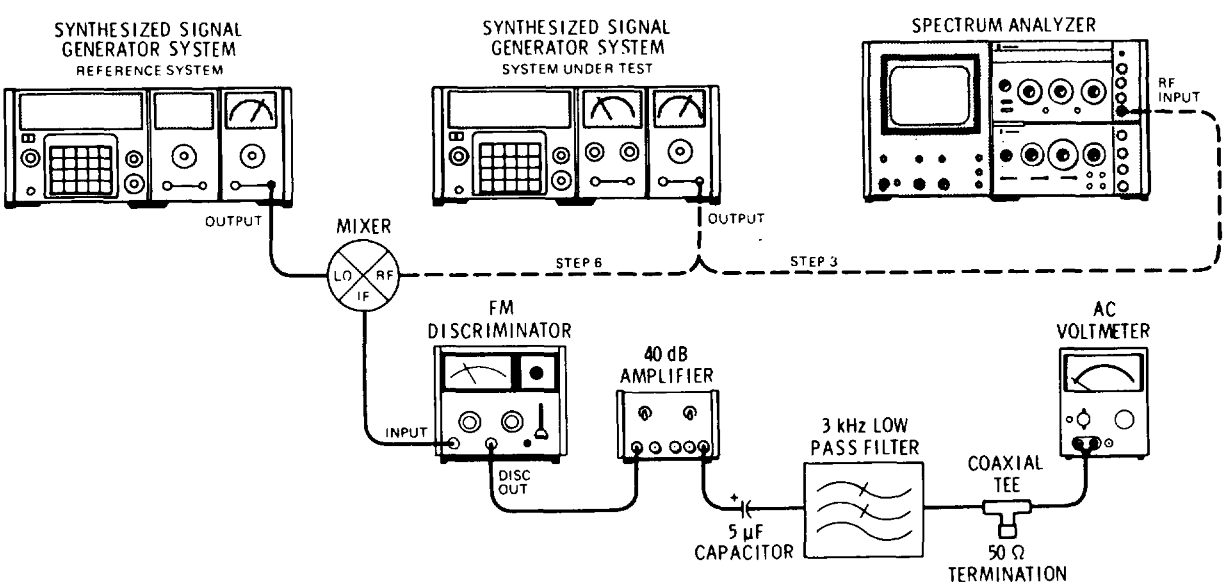


Figure 4-10. Residual FM Test Setup

4-23. RESIDUAL FM (Cont'd)

EQUIPMENT:

Synthesized Signal Generator System	HP 8660C/86602B/86631B
Coaxial Tee	HP 1250-0781 (BNC)
FM Discriminator	HP 5210A
50 Ohm Termination	HP 11593A
40 dB Amplifier (34 dB into 502)	HP 465A
AC Voltmeter	HP 403B
Capacitor, 5 µF	HP 0180-2211
Mixer	Watkins-Johnson M1J
3 kHz Low Pass Filter	CIR-Q-TEL FLT/21B-3K-5/50-3A/3B
Spectrum Analyzer	HP 8555A/8552B/140T

PROCEDURE:

1. Set the system under test center frequency to 1200.0 MHz, the output level to +10 dBm, the modulation mode to FM XO.1 modulation source to internal 1 kHz, and set the modulation level control for a meter reading of 2.4 kHz-peak.

2. Set the spectrum analyzer controls for a center frequency of 1200 MHz, frequency span per division 2 kHz, resolution bandwidth 0.3 kHz, input attenuation 40 dB, vertical sensitivity per division 10 dB, and sweep time per division to 50 ms. Adjust the controls as necessary for a convenient display of the FM signal.

3. Connect the System Under Test OUTPUT jack to the spectrum analyzer's RF input jack as shown in Figure 4-10.

4. Adjust the signal generator's modulation level control to null the carrier (2.4048 kHz-pk).

5. Set the Reference System center frequency to 1200.1 MHz, the RF output level to +10 dBm, and modulation off.

6. Disconnect the spectrum analyzer from the System Under Test and connect the other equipment as shown in Figure 4-10.

7. Set the FM discriminator controls to the 100 kHz range and the sensitivity to 0.01 Vrms (full scale). Install a 10 kHz Butterworth Low Pass Filter in the discriminator output. (Refer to the FM discriminator's operating and service manual).

8. Adjust the FM discriminator's sensitivity control for an ac voltmeter reading of 0.850 Vrms. (This ensures the sensitivity of the measurement is 2.00/vO/Hz-rms per millivolt-rms. The V2 factor accounts for the residual FM contributed by the reference system.)

9. Set the System Under Test modulation source switch for external ac (leveled); set the modulation level control full clockwise.

10. Press the CF CAL switch (Models 86632A and 86635A only) several times.

11. Verify and record that the residual FM is less than 10 Hz-rms (less than 7.10 mVrms).

__________< 7.10 mVrms

4-24. AMPLITUDE MODULATION DISTORTION

SPECIFICATION:
AM distortion at 30% AM is < 1%, at 70% AM is < 3%, and at 90% AM is < 5%.

NOTES

1. *The AM distortion specification applies only at 400 and 1000 Hz rates, with a front panel meter indication of 0 to +3 dB, and at OUTPUT RANGE switch settings of < 0 dBm. At a meter indication of -6 dB, the distortion approximately doubles. The modulating signal distortion must be < 0.3% for the system performance to meet the specifications.*

2. *If the signal generator system does not meet the AM distortion specification, refer to the Systems Troubleshooting information in Section VIII (Service Sheet 1) in this manual.*

DESCRIPTION:
To measure AM distortion, a distortion analyzer is connected to the video output of a spectrum analyzer. In the zero frequency-span mode, the video output of the spectrum analyzer is the detected RF signal. The signal generator system controls are set for a specific AM level and the distortion level is measured.

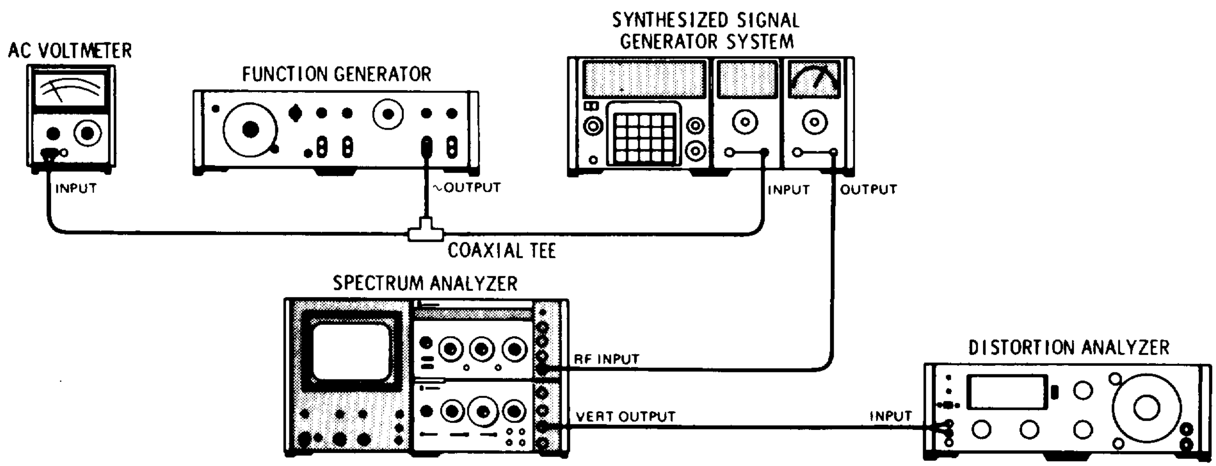


Figure 4-11. Amplitude Modulation Distortion Test Setup.

EQUIPMENT:

Distortion Analyzer....................................	.HP 333A
Spectrum Analyzer....................................	HP 8555A/8552B/140T
Function Generator..................................	HP 203A
AC Voltmeter..	HP 403B

4-24. AMPLITUDE MODULATION DISTORTION (Cont'd)

PROCEDURE:

1. Set the signal generator system controls for a center frequency of 1000 MHz, the output level to -20 dBm (OUTPUT RANGE -20 dBm), and the modulation mode to off.

2. Set the spectrum analyzer center frequency to 1000 MHz, frequency span per division 1 MHz, resolution bandwidth 300 kHz, input attenuation 20 dB, vertical sensitivity per division 10 dB and video filter to 10 kHz.

3. Connect the equipment as shown in Figure 4-11.

4. Set the spectrum analyzer's tuning stabilizer to on. Adjust the center frequency fine tune to center the signal on the display. Set the reference switch and vernier to center the trace vertically.

5. Set the frequency span per division to zero, and the vertical scale to linear. Peak the trace by adjusting the fine tune center frequency control. Center the trace vertically with the vertical sensitivity and vernier controls.

6. Set the signal generator system's modulation mode to AM, the source to external, and set the modulation level to 30%. If a modulation section plug-in is installed in the Signal Generator mainframe, set the test oscillator controls to 1.5 Vrms at 1000 Hz. If an auxiliary section plug-in is installed, set the test oscillator controls to 0.3 Vrms at 1000 Hz.

7. Measure the total harmonic distortion. With the trace peaked on the display, the distortion should be less than 1%.

    ___________ 1%

8. Set the System modulation level to 70% AM. If the Auxiliary Section plug-in is being used, set the test oscillator to an output of 0.7 Vrms.

9. Measure the total harmonic distortion. With the trace peaked on the display, the distortion should be less than 3%.

    ___________ 3%

10. Set the system modulation level to 90% AM.3%

10. Set the system modulation level to 90% AM. If the Auxiliary Section plug-in is being used, set the test oscillator to an output of 0.9 Vrms.

11. Measure the total harmonic distortion. With the trace peaked on the display, the distortion should be less than 5%.

    ___________ 5%

4-25. INCIDENTAL PHASE MODULATION

SPECIFICATION:
At 30% AM < 0.2 radians

DESCRIPTION:
The phase difference between the signal generators is monitored with a vector voltmeter. Amplitude modulation is applied to the system under test. The peak-to-peak phase variation incidental to the amplitude modulation is read on the vector voltmeter.

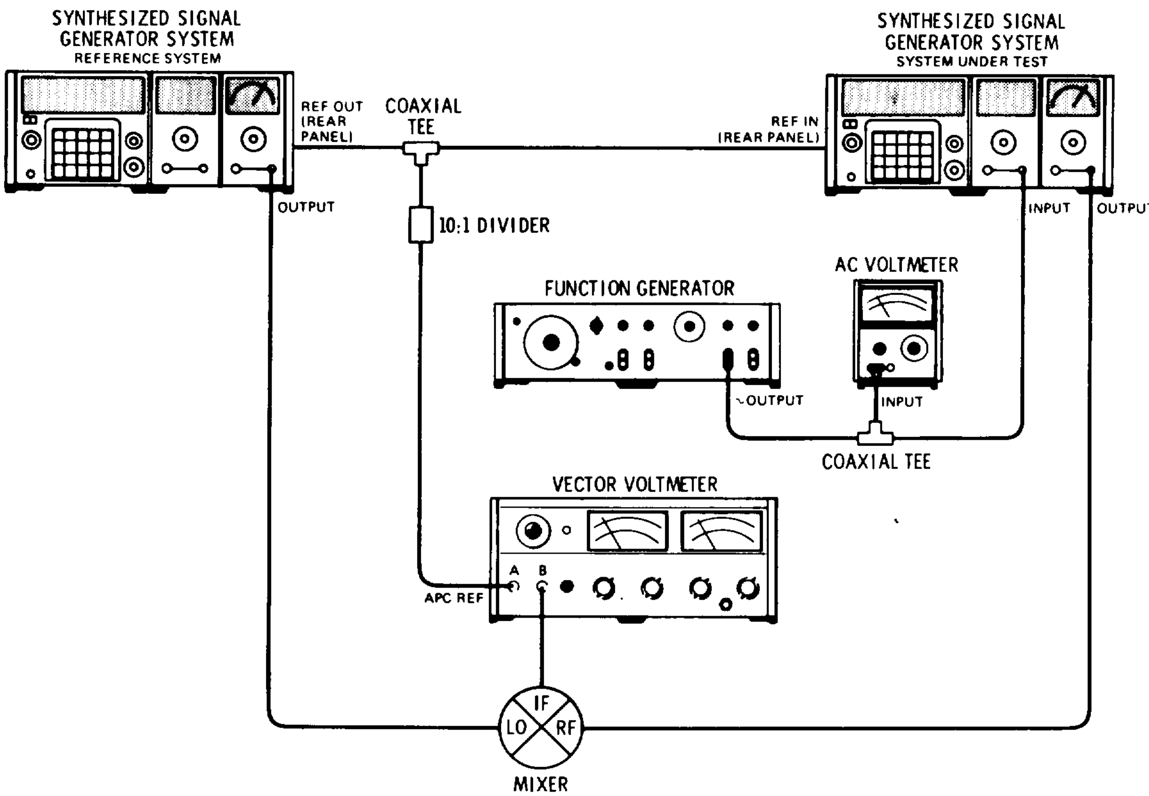


Figure 4-12. Incidental Phase Modulation Test Setup

EQUIPMENT:

Synthesized Signal Generator	HP 8660C/86602B/86631B
Function Generator	HP 203A
Vector Voltmeter (with 10:1 voltage divider probe)	HP 8405A
AC Voltmeter...	HP 403B
Mixer	Watkins-Johnson M1J

4-25. INCIDENTAL PHASE MODULATION (Cont'd)

PROCEDURE:

1. Set the system under test rear panel reference selector to external, center frequency 500 MHz, output level -10 dBm (OUTPUT RANGE -10 dBm) and AM mode to off.

2. Set the reference system center frequency to 510 MHz and the output level to +7 dBm (OUTPUT RANGE +10 dBm).

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

4. Adjust the vector voltmeter's frequency range control to 10 MHz, phase range switch to +180, and the phase meter offset switch for a near or on scale phase reading (Phase reading will drift somewhat due to phase drift in the synthesized signal generator outputs).

5. Set the system under test modulation mode to AM, the source to external, and the modulation level to 30%. Set the input level to 0.3 Vrms at 1 kHz if an auxiliary section is inserted into the mainframe of the system under test. If a modulation section is used, the input level should be 1.5 Vrms at 1 kHz. Use the external dc source if an 86632B or 86633B Modulation Section is used.

6. Set the function generator controls for a modulation rate of 0.5 Hz. (The low rate is necessary for the vector voltmeter's metering circuitry. The modulation level is still 30%.)

7. The phase reading will vary at a 0.5 Hz rate. If necessary, readjust the vector voltmeter's phase meter offset switch for an on scale reading.

8. Note the peak-to-peak phase variation caused by the 0.5 Hz AM. Visually disregard the random phase variations caused by phase drift in the synthesized signal generator outputs. Divide the reading by 2 to obtain the peak phase deviation. The phase deviation should be less than 11.50 - peak (0.2 radians-peak)

_______________11.5°-pk

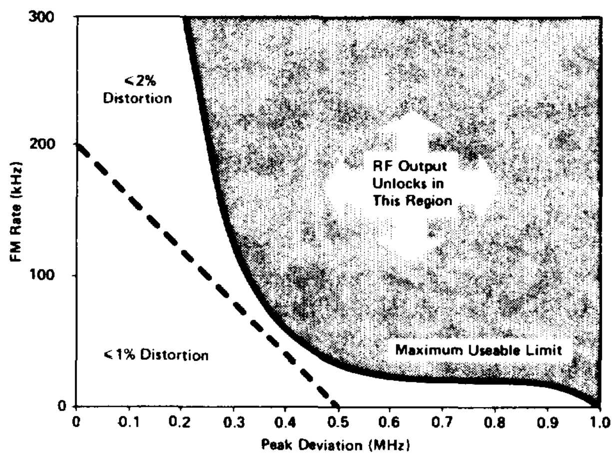
4-26. FREQUENCY MODULATION DISTORTION

SPECIFICATION:
Total harmonic distortion for modulation rates up to 20 kHz, < 1% up to 200 kHz peak deviation. Distortion from an external source must be < 0.3% to meet these specifications.

NOTES

1. *In the FM mode, typical Residual FM in a 0.3 to 3 kHz audio bandwidth is <15 Hz and may limit minimum Noise and Distortion measurements at deviations <2 kHz peak.*

2. *If the signal generator system does not meet the FM distortion specification, refer to the System's Troubleshooting information in Section VIII (Service Sheet 1) in this manual.*



DESCRIPTION:

A test oscillator input is used to frequency modulate the RF OUTPUT of the Synthesized Signal Generator System. The output is connected to a FM discriminator. To eliminate the carrier, the demodulated signal is passed through a 100 kHz lowpass filter at the discriminator output. The amplitude of the first harmonic is established as the reference level on the wave analyzer. The levels of the second and third harmonics are measured, added, and the total is compared to the reference level to indicate the level of FM distortion.

NOTE

This procedure is valid only if the HP 86635A is used.

4-26. FREQUENCY MODULATION DISTORTION (Cont'd)

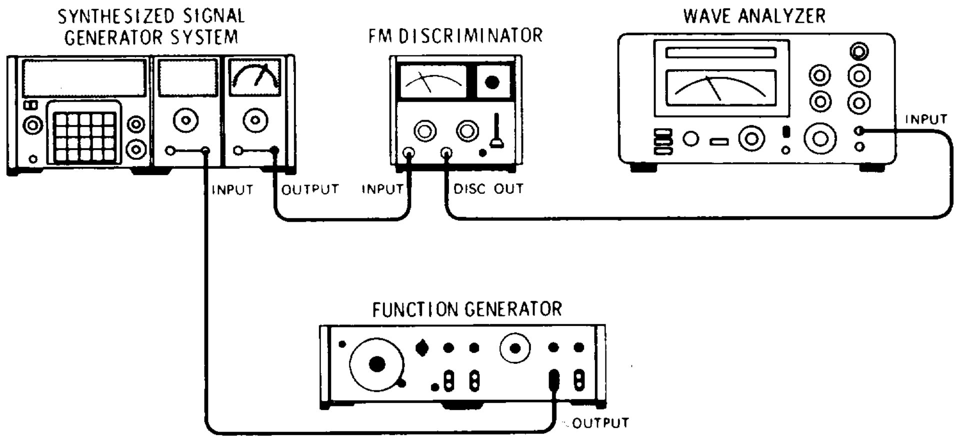


Figure 4-13. Frequency Modulation Distortion Test Setup

EQUIPMENT:

FM Discriminator......................................	HP 5210A
Wave Analyzer...	HP 3581A
Function Generator..................................	HP 203A

NOTE

This performance test is normally performed with either an HP model 86632B or 86635A Modulation Section inserted into the signal generator mainframe. Control settings in parenthesis apply only to the Model 86633B.

1. Set the signal generator system center frequency to 8.5 MHz and set the OUTPUT RANGE switch to +10 dBm. Adjust the VERNIER control for a -3 dB meter reading.

2. Connect equipment as illustrated in Figure 4-13.

3. Set Modulation Section MODE to FM X10 (FM X1) and source switch to EXTERNAL AC. Adjust Modulation Section modulation level control for 200 kHz (100 kHz) peak deviation and press FM CF CAL switch.

NOTE

The 86633B does not have an FM CF CAL switch.

4. Set the function generator output for 10 kHz at 1.5 Vrms.

5. Install a 100 kHz low pass filter in the FM Discriminator. (Refer to the FM Discriminator Operating and Service Manual for details).

4-26. FREQUENCY MODULATION DISTORTION (Cont'd)

6. Adjust the FM Discriminator for 1 volt rms input sensitivity. Set the controls for the 10 MHz range.

7. Set the wave analyzer scale switch to 90 dB, reference level to normal, resolution bandwidth 30 Hz, sweep mode off, and AFC on.

8. Peak the meter reading near 10 kHz with the frequency control. Verify that the AFC locks and the amplitude is ~-37 dBV (14.4 mVrms). Use the input sensitivity switch and vernier control and the amplitude reference level control to establish a reference level at 0 dB.

9. Set the frequency to ~ 20 kHz (second harmonic) and peak the meter reading. Record the meter reading.

___________ dB

10. Set the frequency to ~ 30 kHz (third harmonic) and peak the meter reading. Record the meter reading.

___________ dB

11. Use Table 4-1 to obtain power ratios for the levels recorded in steps 8 and 9. Then use Table 4-1 to find the dB level corresponding to the sum of the ratios. The resultant level should be -> 40 dB down from the fundamental frequency level. Record the level.

40 dB down

4-26. FREQUENCY MODULATION DISTORTION (Cont'd)

Table 4-1. dB To Power Ratio Conversion

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		

4-27. INCIDENTAL AM

SPECIFICATION:

AM sidebands > 60 dB down from carrier with FM peak deviation of 75 kHz at a 1 kHz rate.

DESCRIPTION:

A reference is established on the wave analyzer by detecting an AM signal of known modulation level and rate from the Synthesized Signal Generator System. The output is frequency modulated at a specified rate and level. The incidental AM level is detected during frequency modulation and compared to the carrier amplitude.

4-27. INCIDENTAL AM (Cont'd)

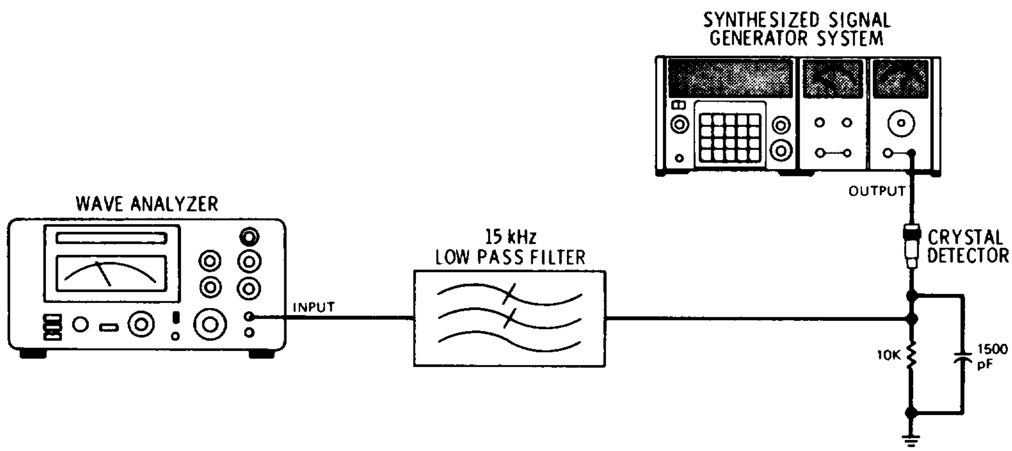


Figure 4-14. Incidental AM Test Setup

EQUIPMENT:

Wave Analyzer	HP 3581A
Crystal Detector	HP 8471A
15 kHz Low Pass Filter	(See Figure 1-3)
Resistor 10K	HP 0757-0442
Capacitor 1500 p......................................	HP 0160-2222

PROCEDURE:

1. Set the signal generator system controls for a center frequency of 100 MHz, a +3 dBm output level, the amplitude modulation mode, an internal source at 1 kHz rate, and a modulation level of 50%.

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

3. Set the wave analyzer controls for the 90 dB scale, AFC on, and resolution bandwidth 30 Hz. Tune the wave analyzer for a peak meter indication near 1 kHz. Set a reference level of 0 dB using the input sensitivity switch and the amplitude reference switch. This reference level (AM sidebands) is 12 dB down from carrier signal (50% AM).

4. Set the system modulation section controls for FM mode, and a modulation level of 75 kHz peak deviation.

5. The meter reading should be > 48 dB down (> 60 dB down from carrier).

______________60 dB down

4-28. SPURIOUS SIGNALS, NARROWBAND

SPECIFICATION:
All narrowband spurious signals in the CW, AM, and OM modes are:

80 dB down from carrier at frequencies < 700 MHz
80 dB down from carrier within 45 MHz of the carrier at frequencies >- 700 MHz
50 dB down from carrier on the +10 dBm range.

ALL power line related spurious signals are 70 dB down from the carrier.

DESCRIPTION:
The outputs of two Synthesized Signal Generator Systems which use the same time base reference are mixed and the difference frequency is amplified and coupled to the wave analyzer. A reference level is established, various selected frequencies are then set on the two generator systems, and the spurious signal levels are measured.

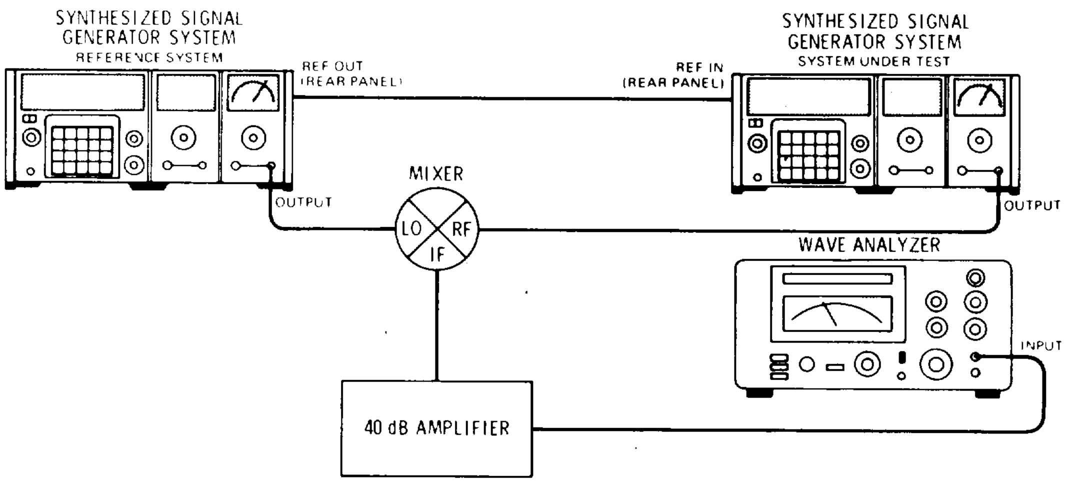


Figure 4-15. Narrowband Spurious Signal Test Setup.

EQUIPMENT:

Synthesized Signal Generator	HP 8660C/86602B/86631B
Double Balanced Mixer............................	Watkins Johnson M1J
Wave Analyzer	HP 3581A
40 dB Amplifier..	See Figure 1-2

PROCEDURE:

1. Connect the equipment as illustrated in Figure 4-15.

2. Connect rear panel REFERENCE OUTPUT from reference system to rear panel REFERENCE INPUT of system under test. Set REFERENCE SELECTOR of system under test to EXT.

3. On reference system. set the mainframe center frequency to 500.001 MHz, the OUTPUT RANGE switch to +10 dBm, and adjust VERNIER control to a -3 dB meter reading.

4-28. SPURIOUS SIGNALS, NARROWBAND (Cont'd)

4. On system under test, set mainframe center frequency to 500 MHz, the RF Section OUTPUT RANGE switch to -80 dBm, and adjust VERNIER control to 0 dB indication on meter scale.

5. Set the wave analyzer scale switch to 90 dB, amplitude reference to -60, dBV mode, resolution band-width 3 Hz, display smoothing to max, and AFC on.

6. Set wave analyzer frequency control to 1 kHz and adjust the input sensitivity for a 0 dB indication on meter scale.

7. On system under test, set the OUTPUT RANGE switch to -10 dBm and adjust VERNIER to 0 dB indication on meter scale.

8. On reference system and system under test, set mainframe center frequency values to those listed in Table 4-2 and verify that levels of corresponding spurious signals are in accordance with specification. The corrected reading of spurious level relative to carrier is 70 dB - (+ difference level), therefore a reading of -13 dB relative to the reference level (step 6) gives the spurious signal level. 70 dB -(-13 dB) = 83 dB down.

NOTE

It may be necessary to slightly readjust the Wave Analyzer Frequency control to locate the spurious signal.

Table 4-2. Narrowband Spurious Signals Checks

System Under Test	Reference System	Level Measured (dBdown)
100.280000 MHz	100.561000 MHz	80 dB ________
200.280000 MHz	200.561000 MHz	80 dB ________
409.720000 MHz	409.441000 MHz	80 dB ________
509.720000 MHz	509.441000 MHz	80 dB ________
1109.720000 MHz	1109.441000 MHz	80 dB ________
1209.720000 MHz	1209.441000 MHz	80 dB ________

4-29. SPURIOUS SIGNALS, WIDEBAND

SPECIFICATION:

All wideband non-harmonically related spurious signals in the CW, AM, and OM modes are:

80 dB down from carrier at frequencies < 700 MHz
80 dB down from carrier > 45 MHz from carrier at frequencies > 700 MHz
50 dB down from carrier on the +10 dBm range.

4-29. SPURIOUS SIGNALS, WIDEBAND (Cont'd)

DESCRIPTION:

The RF OUTPUT of the Synthesized Signal Generator System is monitored by a spectrum analyzer after being passed through a 2200 MHz low pass filter. Selected signals which fall within the specified range are measured.

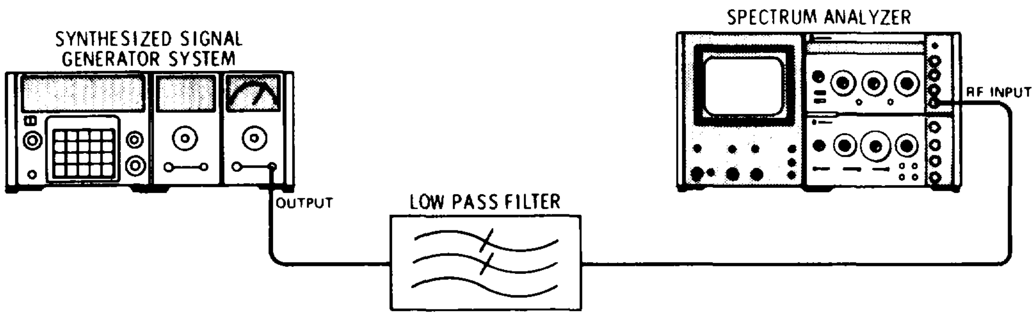


Figure 4-16. Wideband Spurious Signal Test Setup

EQUIPMENT:

Spectrum Analyzer .... HP 8555A/8552B/140T
Low Pass Filter (2200 MHz)...................... HP 360C

PROCEDURE:

1. Connect equipment as illustrated in Figure 4-16.

2. With the RF Section OUTPUT RANGE switch set to +10 dBm and VERNIER control adjusted for 0 dB meter indication, set mainframe center frequency to those values listed in Table 4-3 and adjust the Spectrum Analyzer to measure corresponding spurious signal level relative to the carrier.

Table 4-3. Wideband Spurious Signals Checks

Mainframe Frequency	Spurious Frequency	Level Measured
1299.9 MHz	150 MHz	50 dB down ________
	1150 MHz	50 dB down ________
	1450 MHz	50 dB down ________
1000 MHz	950 MHz	50 dB down ________
	1050 MHz	50 dB down ________
999.9 MHz	950 MHz	50 dB down ________
	1050 MHz	50 dB down ________
800.0 MHz	750 MHz	50 dB down ________
799.9 MHz	850 MHz	50 dB down ________

4-30. PHASE MODULATION PEAK DEVIATION

SPECIFICATION:
0 to 100 degrees peak. May be overdriven to 2 radians (1150) in Modulation Section external dc mode.

NOTE

To check Phase Modulation peak deviation, refer to Section IV of the appropriate Modulation Section Operating and Service Manual.

4-31A. PHASE MODULATION DISTORTION

SPECIFICATION:
<5% up to 1 MHz rates, <7% up to 5 MHz rates, and <15% up to 10 MHz rates External modulation signal distortion must be <0.3% to meet this specification.

NOTES

1. *Using this procedure, the proof of performance for phase modulation distortion is valid only when the HP 86635A Modulation Section is being used in the signal generator system. The change in distortion level from the 20 Hz rate as used in this procedure to the maximum I MHz rate is minimal. This procedure is, however, not a complete check for the Model 86634A which can use modulation rates up to 10 MHz.*

2. *If the signal generator system does not meet the OM distortion specification, refer to the System's Trouble-shooting information in Section VIII (Service Sheet 1) in this manual.*

DESCRIPTION:

The phase modulated output of the System Under Test is demodulated using a vector voltmeter. The vector voltmeter output is set to a linear portion of its operating range and the total harmonic distortion of the demodulated signal is measured.

4-31A. PHASE MODULATION DISTORTION (Cont'd)

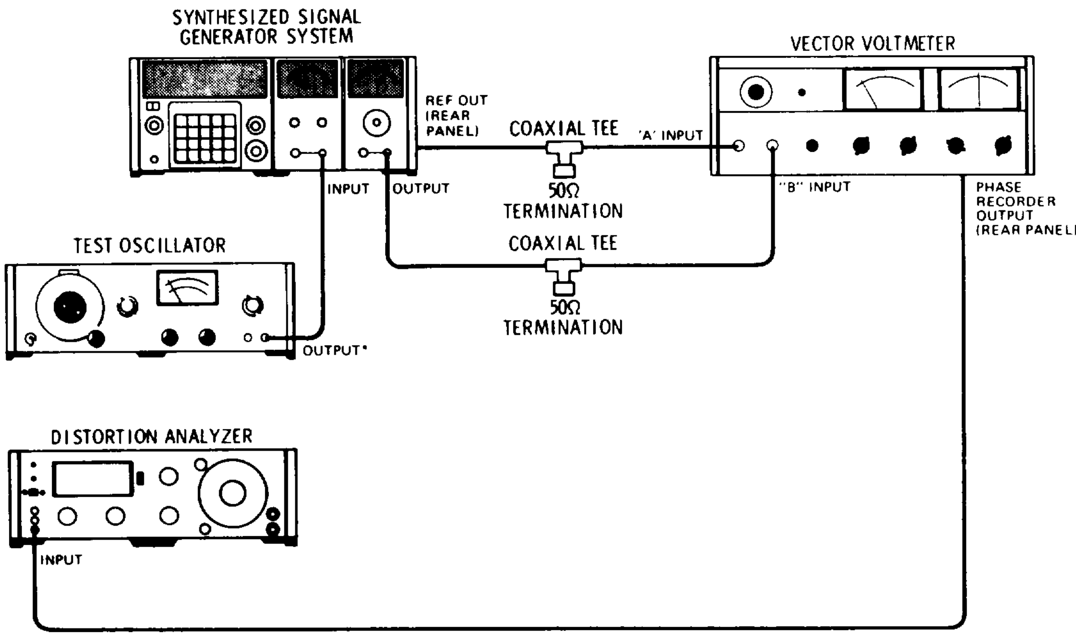


Figure 4-17A. Phase Modulation Distortion Test Setup

EQUIPMENT:

Vector Voltmeter	HP 8405A
Test Oscillator	HP 651B
Distortion Analyzer	HP 333A
50Ω Termination	HP 11593A
Coaxial Tee..	HP 1250-0781

PROCEDURE:

1. Set the Synthesized Signal Generator System controls for a center frequency of 10.000 000 MHz and an output level of +3 dBm (O dBm range).

2. Set the test oscillator output to 1.5 Vrms at 20 Hz. Set the signal generator system's modulation mode to off.

3. Connect the instruments as shown in Figure 4-17A.

4. Set the vector voltmeter's phase range switch to +180°. Set the meter offset switch for a phase meter reading of 0 +100.

5. Set the modulation section controls for the OM mode and a modulation level of 1000 as indicated by the front panel meter.

*In Figure 4-16A, the test oscillator output is 50 ohms when the modulation section is a Model 86634A and 600 ohms when used with a Model 86635A.

4-31A. PHASE MODULATION DISTORTION (Cont'd)

6. Measure the total harmonic distortion of the 20 Hz demodulated signal using the distortion analyzer. Distortion should be <5%.

5%

4-31B. PHASE MODULATION DISTORTION -ALTERNATE PROCEDURE

SPECIFICATION:

< 5% up to 1 MHz rates
< 7% up to 5 MHz rates
< 15% up to 10 MHz rates

NOTES

1. *The HP Model 86635A Modulation Section has a maximum specified phase modulation rate of 1 MHz. Therefore, only the < 5% distortion specification is applicable. Because the maximum modulation rate of the Model 86634A is 10 MHz, all the specified distortion levels apply.*

2. *If the signal generator system does not meet the OM distortion specification, refer to the System's Troubleshooting information in Section VIII (Service' Sheet 1) in this manual.*

DESCRIPTION:

The phase modulated output of the System Under Test is demodulated using a phase modulation test set. The harmonic levels are measured with a spectrum analyzer and the total harmonic distortion is calculated. A low pass filter is used between test oscillator and modulation section to insure that the modulation drive signal has less than 0.3% distortion.

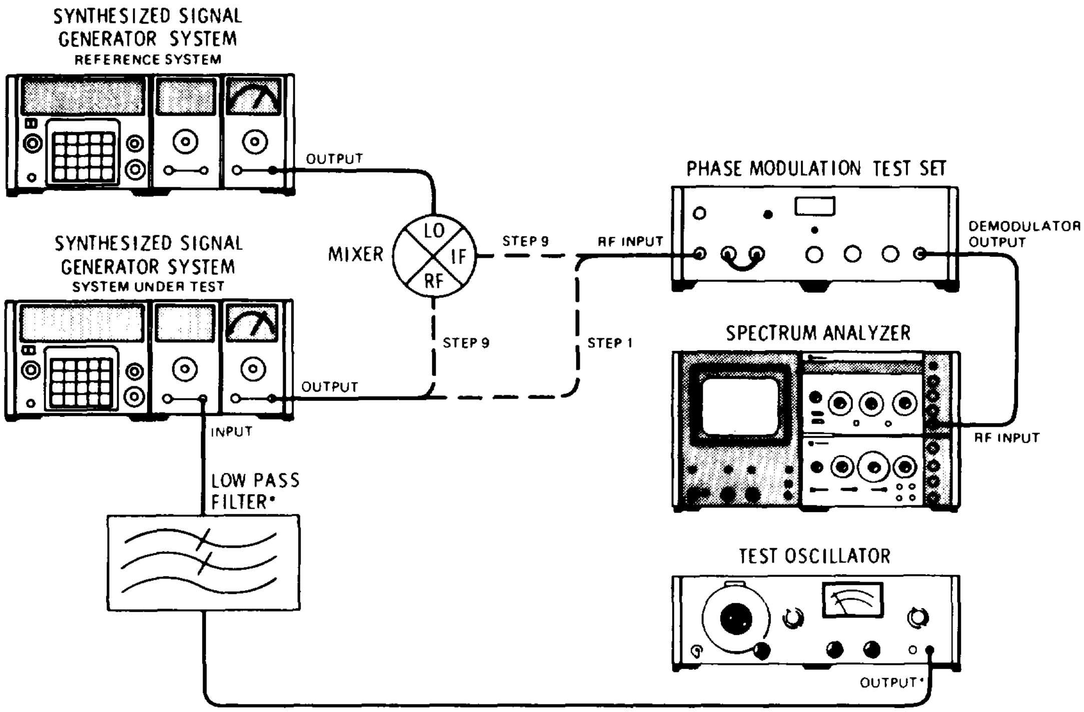


Figure 4-17B. Phase Modulation Distortion Test Setup (Alternate Procedure)

EQUIPMENT:

Synthesized Signal Generator	HP 8660C/86602B/86631B
Test Oscillator..	HP 651B
Mixer	Watkins Johnson M1J
Phase Modulation Test Set.......................	HP 8660C-K10
Spectrum Analyzer...................................	HP 8553B/8552B/140T
Low Pass Filters (1 MHz 600Ω; 1, 5, and 10 MHz --50Ω)	Specials (See Figure 1-4)

PROCEDURE:

1. Set the Test Oscillator to 1 MHz, connect a 1 MHz low pass filter (50 ohm for 86634A, 600 ohm for 86635A) to appropriate test oscillator output and adjust for 1.7 Vrms output. Connect the rest of the equipment as shown in Figure 4-17B.

2. Set the system under test for 300 MHz center frequency and +3 dBm output (O dBm range). Connect the RF output jack directly to the RF input of the phase modulation test set.

3. Set the system under test controls for OM with a modulation level of 1000 peak deviation.

*In Figure 4-16B. **the test** oscillator output impedance and Low Pass Filter impedance is 50 ohms when the modulation section is a
Model 86634A and 600 ohms with a Model 86635A.

4-31B. PHASE MODULATION DISTORTION - ALTERNATE PROCEDURE (Cont'd)

4. View the signal generator output on the spectrum analyzer display. Record the level of the second and third harmonics of the demodulated output signal with respect to the fundamental.

5. Use Table 4-1 to obtain power ratios of the harmonics. Then use Table 4-1 to find the dB level corresponding to sum of the two ratios. The resultant level should be < 5% or >- 26 dB down.

   86634A 26 dB down ____________
   86635A 26 dB down ____________

6. Set the center frequency of the system under test to 299.9 MHz.

7. Set the test oscillator to 1 MHz (10 MHz), connect the 1 MHz (10 MHz) low pass filter to the appropriate oscillator output (50 or 600Ω) and adjust for an output of 1.7 Vrms.

8. Repeat steps 3-5. Total harmonic distortion should be < 5% or > 26 dB down (< 15% or >- 16.5 dB down).

   86634A 16.5 dB down ____________
   86635A 26 dB down ____________

9. Set the center frequency of the system under test to 1200 MHz. Connect the mixer and the reference system as shown in Figure 4-17B.

10. Set the reference system center frequency to 900 MHz with an RF output level of +7 dBm.

11. Increase the RF output level of the system under test (if necessary) until the Phase Modulation Test Set phase locks.

12. Set the test oscillator frequency to 1 MHz (5 MHz). Connect the 1 MHz (5 MHz) low pass filter (50 or 600Ω) to the oscillator output. Adjust the test oscillator output level to 1.7 Vrms. Set the system under test modulation level to 1000 peak deviation.

13. Repeat steps 3-5. Total harmonic distortion should be < 5% or > 26 dB down (< 7% or >- 23.1 dB down).

   86634A 23.1 dB down ____________
   86635A 26 dB down ____________

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

Hewlett-Packard
Models 86602B/11661
RF Section/Frequency Extension Module

Tested By ______

Serial No. ______ Date ______

Para. No.	Test	Results		
		Min.	Actual	Max.
4-9.	FREQUENCY RANGE			
	1.000 000 MHz	–1 Hz	______	+1 Hz
	1299.999 999 MHz	–1 Hz	______	+1 Hz
4-11.	FREQUENCY SWITCHING TIME			
	6 ms to be within 50 Hz of any new frequency			
	Step 9 - 30.000 000 MHz ± 50 Hz	–50 Hz	______	+50 Hz
	Step 10 - 29.999 999 MHz ± 50 Hz	–50 Hz	______	+50 Hz
	100 ms to be within 5 Hz of any new frequency			
	Step 14 - 30.000 000 MHz ± 5 Hz	–5 Hz	______	+5 Hz
	Step 15 - 29.999 999 MHz ± 5 Hz	–5 Hz	______	+5 Hz
4-12.	OUTPUT LEVEL SWITCHING TIME			
	Remote programming of level change on same range accomplished in 5 ms, maximum, at 50 MHz.			
	Step 4 - 10 to 19 dB		______	5 ms
	Level change to another range accomplished in 50 ms, maximum at 50 MHz.			
	Step 5 - 10 to 30 dB		______	50 ms
	Remote programming of level change on same range accomplished in 5 ms, maximum, at 1 MHz.			
	Step 6 - 10 to 19 dB		______	5 ms

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

Para. No.	Test		Results: Min.	Results: Actual	Results: Max.
4-13A.	**OUTPUT ACCURACY**				
	OUTPUT RANGE	**Front Panel Meter Reading**			
	+10 dBm	0 dB	+ 8.5 dBm	______	+ 11.5 dBm
	+10 dBm	–3 dB	+ 5.5 dBm	______	+ 8.5 dBm
	+10 dBm	–6 dB	+ 2.5 dBm	______	+ 5.5 dBm
	0 dBm	–6 dB	– 7.5 dBm	______	– 4.5 dBm
	0 dBm	–3 dB	– 4.5 dBm	______	– 1.5 dBm
	0 dBm	0 dB	– 1.5 dBm	______	+ 1.5 dBm
	0 dBm	+3 dB	+ 1.5 dBm	______	+ 4.5 dBm
	– 10 dBm	+3 dB	– 8.5 dBm	______	– 5.5 dBm
	– 20 dBm	+3 dB	– 18.5 dBm	______	– 15.5 dBm
	– 30 dBm	+3 dB	– 28.5 dBm	______	– 25.5 dBm
	– 40 dBm	+3 dB	– 38.5 dBm	______	– 35.5 dBm
	– 50 dBm	+3 dB	– 48.5 dBm	______	– 45.5 dBm
	– 60 dBm	+3 dB	– 58.5 dBm	______	– 55.5 dBm
	– 70 dBm	+3 dB	– 68.5 dBm	______	– 65.5 dBm
	– 80 dBm	+3 dB	– 79.0 dBm	______	– 75.0 dBm
	– 90 dBm	+3 dB	– 89.0 dBm	______	– 85.0 dBm
	–100 dBm	+3 dB	– 99.0 dBm	______	– 95.0 dBm
	–110 dBm	+3 dB	–109.0 dBm	______	–105.0 dBm
	–120 dBm	+3 dB	–119.0 dBm	______	–115.0 dBm
	–130 dBm	+3 dB	–129.0 dBm	______	–125.0 dBm
4-13B.	**OUTPUT ACCURACY – ALTERNATE PROCEDURE**				
	OUTPUT RANGE	**Front Panel Meter Reading**			
	10 dBm	0 dB	+ 8.5 dBm	______	+ 11.5 dBm
	10 dBm	–3 dB	+ 5.5 dBm	______	+ 8.5 dBm
	10 dBm	–6 dB	+ 2.5 dBm	______	+ 5.5 dBm
	0 dBm	–6 dB	– 7.5 dBm	______	– 4.5 dBm
	0 dBm	–3 dB	– 4.5 dBm	______	– 1.5 dBm
	0 dBm	0 dB	– 1.5 dBm	______	+ 1.5 dBm
	0 dBm	3 dB	+ 1.5 dBm	______	+ 4.5 dBm
	– 10 dBm	3 dB	– 8.5 dBm	______	– 5.5 dBm
	– 20 dBm	3 dB	– 18.5 dBm	______	– 15.5 dBm
	– 30 dBm	3 dB	– 28.5 dBm	______	– 25.5 dBm
	– 40 dBm	3 dB	– 38.5 dBm	______	– 35.5 dBm
	– 50 dBm	3 dB	– 48.5 dBm	______	– 45.5 dBm
	– 60 dBm	3 dB	– 58.5 dBm	______	– 55.5 dBm
	– 70 dBm	3 dB	– 68.5 dBm	______	– 65.5 dBm
	– 80 dBm	3 dB	– 79.0 dBm	______	– 75.0 dBm
	Level change from the –70 to –80 dBm OUTPUT RANGE		9.0 dB	______	11.0 dB

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

Para. No.	Test	Results		
		Min.	Actual	Max.
4-14.	**OUTPUT FLATNESS**			
	Reference Level is −1.0 dBm at 1000 MHz.			
	1 MHz	− 2.0 dBm	______	0.0 dBm
	10 MHz	− 2.0 dBm	______	0.0 dBm
	100 MHz	− 2.0 dBm	______	0.0 dBm
	200 MHz	− 2.0 dBm	______	0.0 dBm
	400 MHz	− 2.0 dBm	______	0.0 dBm
	600 MHz	− 2.0 dBm	______	0.0 dBm
	800 MHz	− 2.0 dBm	______	0.0 dBm
	1299 MHz	− 2.0 dBm	______	0.0 dBm
4-15.	**HARMONIC SIGNALS**			
	OUTPUT RANGE = +10 dBm			
	Step 5 - 1299 MHz			
	Second Harmonic	25 dB down	______	
	Third Harmonic	25 dB down	______	
	Step 6 - 1000 MHz			
	Second Harmonic	25 dB down	______	
	Third Harmonic	25 dB down	______	
	Step 6 - 500 MHz			
	Second Harmonic	25 dB down	______	
	Third Harmonic	25 dB down	______	
	Step 6 - 100 MHz			
	Second Harmonic	25 dB down	______	
	Third Harmonic	25 dB down	______	
	Step 6 - 10 MHz			
	Second Harmonic	25 dB down	______	
	Third Harmonic	25 dB down	______	
	OUTPUT RANGE = 0 dBm			
	Step 7 - 100 MHz			
	Second Harmonic	30 dB down	______	
	Third Harmonic	30 dB down	______	
4-16.	**PULSE MODULATION RISETIME**			
	Risetime (10% to 90% amplitude points)		______	50 ns
4-17.	**PULSE MODULATION ON/OFF RATIO**			
	On/Off Ratio	40 dB	______	

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

Para. No.	Test	Results Min.	Actual	Max.
4-18.	**AMPLITUDE MODULATION DEPTH AND 3 dB BANDWIDTH** Frequency = 500 MHz OUTPUT RANGE = –10 dBm Rate = 1 kHz			
	Step 13 - 30% AM	50 mVrms	______	70 mVrms
	Step 14 - 70% AM	130 mVrms	______	150 mVrms
	Step 15 - 90% AM	170 mVrms	______	190 mVrms
	Frequency = 500 MHz OUTPUT RANGE = –10 dBm AM = 30%			
	Step 19 - 5 kHz rate (reference 5 div. p-p)			
	AM less than 3 dB down (<3.5 div. p-p) at 100 kHz	3.5 div. p-p	______	
	Frequency - 1 - 9 MHz OUTPUT RANGE = –10 dBm AM - 30%			
	Step 21 - 5 kHz rate (reference 5 div. p-p)			
	AM less than 3 dB down (>3.5 div. p-p) at 10 kHz	3.5 div. p-p	______	
4-20.	**OUTPUT IMPEDANCE** Center Frequency 500 MHz OUTPUT RANGE +10 dBm dB = 20 log (VSWR)			
	dB = 6.0 for VSWR = 2.0		______	6 dB
	OUTPUT RANGE dBm dB = 6.0 for VSWR = 2.0		______	6 dB
	OUTPUT RANGE –10 dBm dB = 2.3 for VSWR = 1.3		______	2.3 dB
4-21.	**SIGNAL-TO-PHASE NOISE RATIO** Noise Level	45 dB down	______	
4-22.	**SIGNAL-TO-AM NOISE RATIO** Noise Level	65 dB down	______	
4-23.	**RESIDUAL FM** Less than 10 Hz-rms average		______	7.10 mVrms

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

Para. No.	Test	Results		
		Min.	Actual	Max.
4-24.	**AMPLITUDE MODULATION DISTORTION**			
	Step 7 - 30% AM			
	Total Distortion (<1%)		________	1%
	Step 9 - 70% AM			
	Total Distortion (<3%)		________	3%
	Step 11 - 90% AM			
	Total Distortion (<5%)		________	5%
4-25.	**INCIDENTAL PHASE MODULATION**			
	Step 8 - <0.2 radians peak (<11.5° peak)		________	
4-26.	**FREQUENCY MODULATION DISTORTION**			
	Total Distortion <2%	37 dB down	________	
4-27.	**INCIDENTAL AM**			
	Incidental AM	60 dB down	________	
4-28.	**SPURIOUS SIGNALS, NARROWBAND**			
	(All spurious signals down from carrier 80 dB minimum.)			
	Spurious Response			
	System Under Test — Reference Unit			
	100.280000 MHz — 100.561000 MHz	80 dB down	________	
	200.280000 MHz — 200.561000 MHz	80 dB down	________	
	409.720000 MHz — 409.441000 MHz	80 dB down	________	
	509.720000 MHz — 509.441000 MHz	80 dB down	________	
	1109.720000 MHz — 1109.441000 MHz	80 dB down	________	
	1209.720000 MHz — 1209.441000 MHz	80 dB down	________	
4-29.	**SPURIOUS SIGNALS, WIDEBAND**			
	(All spurious signals down from carrier 50 dB, minimum.)			
	Spurious Response			
	Mainframe Frequency — Spur Frequency			
	1299 MHz — 150 MHz	50 dB down	________	
	1150 MHz	50 dB down	________	
	1450 MHz	50 dB down	________	
	1000 MHz — 950 MHz	50 dB down	________	
	1050 MHz	50 dB down	________	
	999.9 MHz — 950 MHz	50 dB down	________	
	1050 MHz	50 dB down	________	
	800.0 MHz — 750 MHz	50 dB down	________	
	799.9 MHz — 850 MHz	50 dB down	________	

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

Para. No.	Test	Results		
		Min.	Actual	Max.
4-31A.	**PHASE MODULATION DISTORTION** Step 6 - Distortion (<5%) ≤ 1 MHz rate	<5%	________	
4-31B.	**PHASE MODULATION DISTORTION — ALTERNATE PROCEDURE**			
	Step 5 - 300 MHz at			
	1 MHz rate 86634A <5%	26 dB down	________	
	1 MHz rate 86635A <5%	26 dB down	________	
	Step 6 - 299.9 MHz at			
	10 MHz rate 86634A <15%	16.5 dB down	________	
	1 MHz rate 86635A <5%	26 dB down	________	
	Step 13 - 1900 MHz at			
	5 MHz rate 86634A <7%	23.1 dB down	________	
	1 MHz rate 86635A <5%	26 dB down	________	

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section contains adjustment procedure: required to assure peak performance of the Mode 86602B RF Section. The RF Section should be adjusted after any repair or if the unit, in conjunction with the Frequency Extension Module, fails to meet the specifications listed in Section IV of this manual. Prior to making any adjustments, allow the RF Section warmup for 30minutes.

5-3. The order in which some adjustments are made to the RF Section is critical. Perform the adjustments under the conditions presented in this section. Do not attempt to make adjustment randomly to the instrument. Prior to making any adjustments to the RF Section, refer to the paragraph entitled Related Adjustments.

5-4. EQUIPMENT REQUIRED

5-5. Each adjustment procedure in this section contains a list of test equipment and accessories: required to perform the adjustment. The test equipment is also identified by callouts in the test setup diagrams included with each procedure.

5-6. If substitutions must be made for the specified test equipment, refer to Table 1-2 for the minimum specifications of the test equipment to be used in the adjustment procedures. Since the Synthesized Signal Generator System is extremely accurate, it is particularly important that the test equipment used in the adjustment procedure meets the critical specifications listed in the table

5-7. The HP 11672A Service Kit is an accessories item available from Hewlett-Packard for use it maintaining the RF Section. A detailed listing of the items contained in the service kit is provided in the 11672A Operating Note and in Section I of the mainframe manuals. Any item in the kit may be ordered separately.

5-8. SAFETY CONSIDERATIONS

5-9. Although this instrument has been designed in accordance with international safety standards, this manual and the system mainframe manual contain information, cautions, and warnings which must be followed to ensure safe operation and to retain the complete system in safe condition. Service adjustments should be performed only by qualified service personnel.

NOTE

Refer to the mainframe manual for safety information relating to ac line (Mains) voltage, fuses, protective earth grounding, etc.

5-10. Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

5-11. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

WARNING

Adjustments described herein are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may constitute a shock hazard.

5-12. FACTORY SELECTED COMPONENTS

5-13. 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. Table 5-1 lists the reference designator, the criterion used for selecting a particular value, the normal value range, and the service sheet where the component part is shown.

5-14. RELATED ADJUSTMENTS

5-15. The RF Output Level and 1 dB Step Attenuator Adjustments interact. The Amplitude Modulation Input Circuit Adjustment is dependent on and should be performed after the previous mentioned adjustments. The Phase Modulation Level and Distortion Adjustment is affected by and should he performed after the Phase Modulator Driver Frequency Response Adjustment. All other adjustments are independent.

5-16. If the RF Output Level Adjustment is performed, the 1 dB Step Attenuator Adjustment should follow immediately. Repeat these procedures until the RF levels are within the stated limits without further adjustment. Then perform the Amplitude Modulation Input Circuit Adjustment If the Phase Modulator Driver Frequency Response Adjustment is performed, the Phase Modulator Level and Distortion Adjustment should be performed.

5-17. If the RF Output Level and 1 dB Steel Attenuator Adjustments are not performed, the Amplitude Modulation Input Circuit Adjustment may be considered independent. If the Phase Modulator Driver Frequency Response Adjustment is not performed, the Phase Modulation Level and Distortion Adjustment may be considered independent.

5-18. ADJUSTMENT LOCATIONS

5-19. The last foldout in this manual contains table which cross-references pictorial and schematic locations of the adjustable controls. The figure accompanying the table shows the locations of adjustable controls, assemblies, and chassis-mounted parts.

5-20. ADJUSTMENTS

5-21. Before performing the adjustment procedures (1) disconnect the mainframe (Mains) Power Cable, (2) remove the RF Section from the main-frame, and (3) remove the RF Section covers. At this point, the RF Section is either reinserted into the mainframe or connected to the mainframe with interconnection cables supplied in the Service Kit. If the RF Section is reinserted into the mainframe for adjustments, the mainframe top and/or right side covers must be removed. Refer to the left-hand foldout page immediately preceding the last foldout in this manual for procedures explaining how to remove the RF Section from the main-frame, the RF Section cover removal, and how to interconnect the RF Section and mainframe for adjustments.

NOTE

It may be necessary to remove the upper guide rail to gain access to some of the adjustable components.

5-22. POST ADJUSTMENT TESTS

5-23. After adjustments are performed verify that the system performance is within the parameters specified for the RF Section and Frequency Extension Module. Perform the applicable performance test(s) found in Section IV.

WARNING

The multi-pin plug connector (on main-frame), which provides interconnection to the RF Section, will expose power supply voltages which may remain on the pins after the RF Section is removed and after the (Mains) power cable is disconnected from the mainframe. Be careful to avoid contact with the pins during interconnection with RF Section.

Table 5-1. Factory Selected components

Reference Designator	Selected For	Normal Value Range	Service Sheet
A4R17	Accurately sets the 10 dB difference in the power output between OUTPUT RANGE switch settings of +10 and 0 dBm (the VERNIER control is not moved).	237Ω	6
A16R5	Sets the adjustment range of the Gain Tracking Control A16R4. Refer to the Phase Modulator Driver Adjustments procedure.	10 to 316Ω	5

5-24. RF OUTPUT LEVEL ADJUSTMENT

REFERENCE:

Service Sheet 6.

DESCRIPTION:

The Meter and Detector Bias controls are adjusted alternately at specific RF Output levels until the VERNIER'S control of the RF Output is linear across the control range.

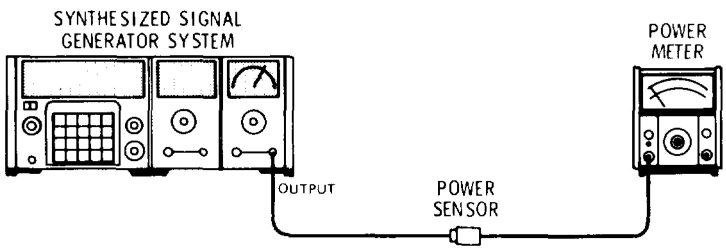


Figure 5-1. RF Output Level Adjustment Test Setup

EQUIPMENT:

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

PROCEDURE:

NOTE

*Prior to performing the procedure, clean the meter face with antistatic glass cleaner.**

1. Extract the RF Section from the mainframe. Remove the mainframe top cover and the RF Section covers. Insert the RF Section into the mainframe.

2. Zero the external Power Meter.

3. Interconnect the equipment as illustrated in Figure 5-1.

4. Set the system's center frequency to 1000 MHz and the RF Section's OUTPUT RANGE switch to the 0 dBm position.

5. Adjust the VERNIER control for a +3.0 dBm indication on the external Power Meter.

6. Adjust MTR potentiometer A4R26 for a +3.0 dB indication on the front panel meter.

7. Adjust the VERNIER control for a front panel meter indication of --6.0 dB.

8. Adjust the BIAS potentiometer A4R13 for a -6.0 dBm indication on external Power Meter.

9. Repeat steps 5 through 8 until the RF Section's front panel meter indicates power levels that are with-in ±0.3 dB of the external Power Meter indications with no further adjustment.

*STATNUL by Weston Instrument Inc., Newark, New Jersey

5-25. 1 dB STEP ATTENUATOR ADJUSTMENT

REFERENCE:

Service Sheet 7.

DESCRIPTION:

RF Level and RF Linearity controls are adjusted alternately at specific RF Output levels until the programmed 1 dB step control of RF Output is linear across the range (10 dB).

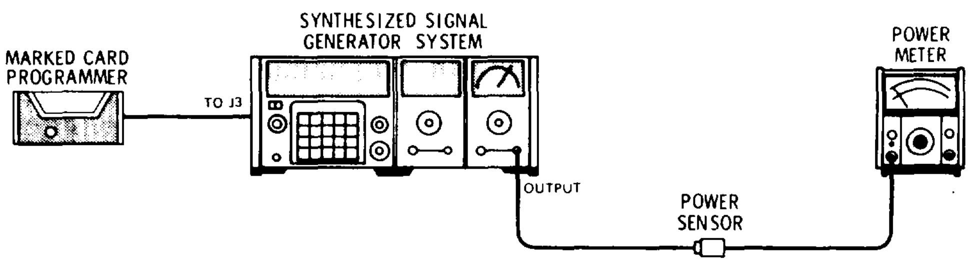


Figure 5-2. 1 dB Step Attenuator Adjustment Test Setup

EQUIPMENT:

Marked Card Programmer	HP 3260A Opt 001
Power Meter/Sensor	HP 435A/8481A

PROCEDURE:

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

2. Zero the external Power Meter.

3. Use a Marked Card Programmer to program the mainframe for a center frequency of 1000 MHz and the RF Section for an output power level of +3 dBm.

4. Adjust the RF Section's RF Level Control A10OR7 for a +3.0 dBm indication on the power meter.

5. Use the Marked Card Programmer to program the RF Section for an output power level of -6 dBm.

6. Adjust the Linearity control A3R4 for a -6.0 dBm indication on the power meter.

7. Repeat steps 3 through 6 until the programmed output power levels are within ± 0.3 dB of the required power meter indication.

8. Recheck the power meter readings for the RF Output Level Adjustments. If necessary, perform the adjustments again. Then check the power meter readings for this procedure. Alternately perform one procedure and check the power meter readings on the other until the RF levels are within tolerance without further adjustment.

5-25. 1 dB STEP ATTENUATOR ADJUSTMENT (Cont'd)

9. Perform the Amplitude Modulation Input Circuit Adjustments.

5-26. AMPLITUDE MODULATION INPUT CIRCUIT ADJUSTMENT

REFERENCE:

Service Sheet 7.

DESCRIPTION:

A specific modulation drive level is coupled to the RF Section. The RF output signal is demodulated by a peak detector in a spectrum analyzer (when the frequency-span width is set to zero). The ac and dc components are measured with a voltmeter at the detector (vertical) output. First, the dc component is set to 283 mVdc plus the detector offset correction. Then, the ac component is measured. The AM level (%) is 1/2 (one half) the rms output.

Because of the required measurement accuracy, the accuracy of the spectrum analyzer's detector offset must be known to ±2m Vdc. The offset voltage is calculated by measuring the change in the detector output for a change in the RF input and assuming a linear detector over the range of the levels used.

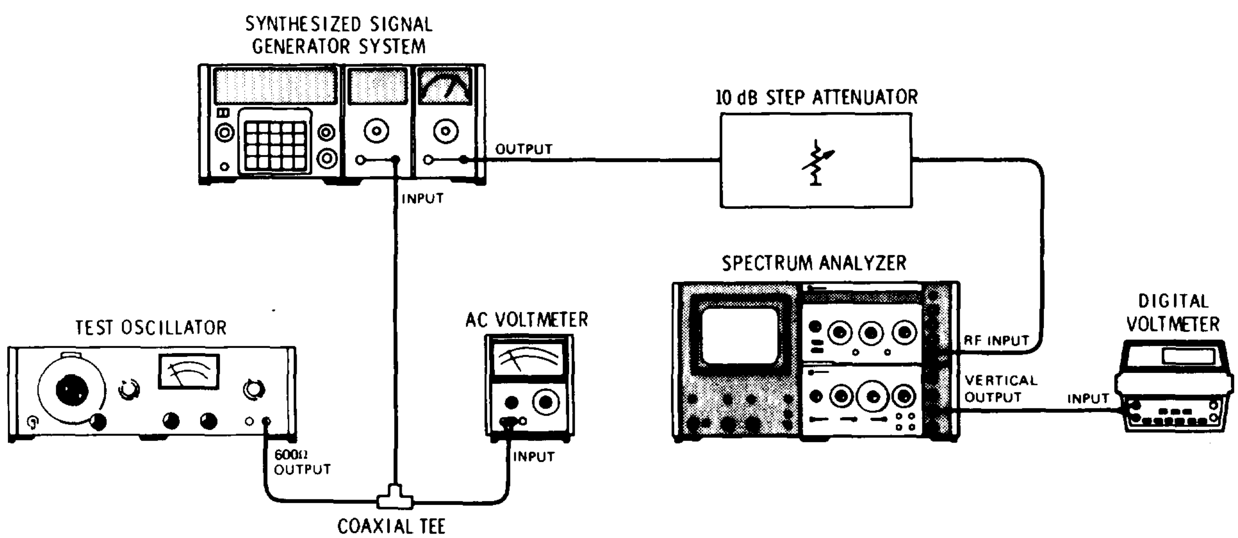


Figure 5-3. Amplitude Modulation Input Circuit Adjustment Test Setup

EQUIPMENT:

Test Oscillator	HP 651B
AC Voltmeter	HP 403B
10 dB Step Attenuator	HP H38-355D
Spectrum Analyzer	HP 8555A/8552B/140T
Digital Voltmeter	HP 34740A/34702A
Coaxial Tee (2 required)	HP 1250-0781
Crystal Detector	HP 423A
Oscilloscope	HP 180C/1801A/1821A
Resistor, 1K	HP 0757-0280

5-26. AMPLITUDE MODULATION INPUT CIRCUIT ADJUSTMENT (Cont'd)

PROCEDURE:

1. Remove the RF Section from the mainframe. Remove the mainframe top cover and the RF Section covers. Insert the RF Section into the mainframe.

2. Connect the equipment as shown in Figure 5-3.

3. Set the synthesized signal generator controls as follows: center frequency 30 MHz, OUTPUT RANGE 0 dBm. VERNIER control for a panel meter reading of +3 dB, and AM off.

4. Let the spectrum analyzer warm up for 1 hour to minimize drift of the spectrum analyzer detector output. Set the 10 dB step attenuator to 10 dB attenuation.

5. Set the spectrum analyzer center frequency to 30 MHz, frequency span per division 5 MHz, resolution bandwidth 300 kHz; input attenuation to 20 dB, and vertical sensitivity per division 10 dB. Adjust the center frequency control to center the display. Set the frequency span to zero and tune to peak the trace.

NOTE

Throughout this test, continually check that the signal is peaked for maximum deflection. Tune the center frequency control for maximum signal deflection.

6. Set the vertical scale to linear and adjust the reference level vernier for a digital voltmeter reading of -200 mVdc.

7. Set the 10 dB step attenuator to 0 dB and record the digital voltmeter reading.

__________ mVdc

8. Set the 10 dB Step Attenuator to 20 dB and record the digital voltmeter reading.

__________ mVdc

9. Calculate the offset voltage using the following formula:

$$V\ off = \frac{mVdc + 200a}{1 - \alpha}$$

Where Voff is the offset voltage in millivolts mVdc is the DVM reading in millivolts. α is 3.16 (step 7) and 0.316 (step 8).

For example:

mVdc = —-687 in step 7

Therefore Voff =— 687+200(3.16) =+25.5 mVdc
1 - (3.16)-+5 m

10. Find the value of Voff for step 8. The difference between the two should be <4 mVdc. Use the average value of Voff.

Voff= ________ mVdc

5-26. AMPLITUDE MODULATION INPUT CIRCUIT ADJUSTMENT (Cont'd)

11. Set the 10 dB step attenuator to 10 dB.

12. Set the system center frequency to 1000 MHz, the modulation mode to AM, the modulation source to external, and a modulation level of 50% (0.5 Vrms input to an Auxiliary Section) at a 1 kHz rate.

13. Set the spectrum analyzer center frequency control to 1000 MHz, and set the reference level vernier for digital voltmeter reading of — 283 mVdc + $Vof_{f.}$ See Step 10.

14. Set the DVM controls to measure the peak detector's ac component. The modulation level (%) is 1/2 (one-half) the DVM reading (Vrms). Adjust the AM CAL Control A10R5 for a reading of 100 mVrms.

15. Set the RF Section's VERNIER control for a front panel meter reading of — -6 dB.

16. Set the DVM to monitor the dc vertical output. Reset the DVM reading of —283 mVdc + Voff.

17. Set the DVM to monitor the ac vertical output. Adjust the AM Linearity control A10OR2 for a DVM reading of 100 mVrms.

18. Repeat steps 13 through 17 until the DVM reading is 100 ±2 mVrms at RF Section meter readings of +3 and -6 dB without further adjustment.

5-27. PHASE MODULATOR DRIVER FREQUENCY RESPONSE ADJUSTMENTS

REFERENCE:

Service Sheet 5.

DESCRIPTION:

The output of a sweep generator is connected to the A16 Phase Modulator Driver Assembly input while a spectrum analyzer monitors the system's phase modulated RF output. The frequency response control is adjusted for maximum flatness to ±40 MHz and for minimum peaking at 80 MHz.

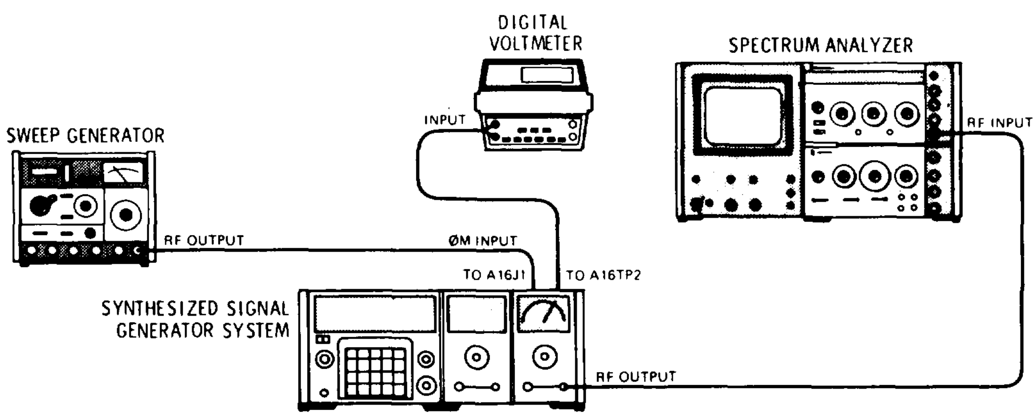


Figure 5-4. Phase Modulator Driver Frequency Response Adjustment Test Setup

5-27. PHASE MODULATOR DRIVER FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

EQUIPMENT:

Sweep Generator...	HP 8601A
Spectrum Analyzer...	HP 8555A/8552B/140T
Digital Voltmeter	HP 34740A/34702A

PROCEDURE:

1. Remove the RF Section from the mainframe. Remove the mainframe top cover and the RF Section covers and top guide rail.

2. Remove cable W12 from the OM Input A16J1 and wrap the connector with insulating tape. Connect 11672-60005 (from the Service Kit) to A16J1. Route the BNC end of cable into the cavity and out through the top of the mainframe. Carefully reinstall the RF Section so as not to damage the cables.

3. Set the sweep generator controls as follows: sweep range 110 MHz, frequency 100 MHz, output level -10 dBm, sweep video, sweep mode free-slow, and sweep vernier full clockwise.

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

5. Set the synthesized signal generator controls for a center frequency of 1.05 GHz and an output level of 0 dBm.

6. Set the spectrum analyzer controls for center frequency of 1.05 GHz, frequency span per division 20 MHz, resolution bandwidth 300 kHz, input attenuation 30 dB, vertical sensitivity per division linear, and sweep time per division 2 ms.
7. Center the RF Section's Gain Tracking Adj control, A16R27.

8. Set the Second Harmonic Adj control for +7.0 Vdc on A16TP2.

9. Remove the DVM connection to A16TP2 before continuing.

10. Set the Third Harmonic and Gain Adj controls (A16R1 and A16R2) to their full counter clockwise position.

11. Adjust the sweep generator output level so the sidebands are approximately 34 dB below carrier level.

12. Adjust the Frequency Response Control A16C7 for maximum flatness within 40 MHz of the carrier and for the minimum peaking at frequencies from 60 to 80 MHz.

13. Disconnect sweep generator from the A16 Assembly and set signal generator LINE switch to STBY.

14. Carefully remove the RF Section. Be careful not to damage the cables. Reconnect W12 to A16J1.

5-28A. PHASE MODULATION LEVEL AND DISTORTION ADJUSTMENTS

REFERENCE:

Service Sheet 5.

DESCRIPTION:
The phase modulated signal from the synthesized signal generator is monitored by a spectrum analyzer and is adjusted to the modulation level indicated by the modulation level meter. The phase modulated signal is then mixed down, the difference frequency is connected to an FM discriminator, and the detected output is connected to the spectrum analyzer. The adjustments are set to minimize harmonic distortion. The modulation level and distortion adjustments are repeated until both are within the required accuracy.

5-28 A. PHASE MODULATION LEVEL AND DISTORTION ADJUSTMENTS (Cont'd)

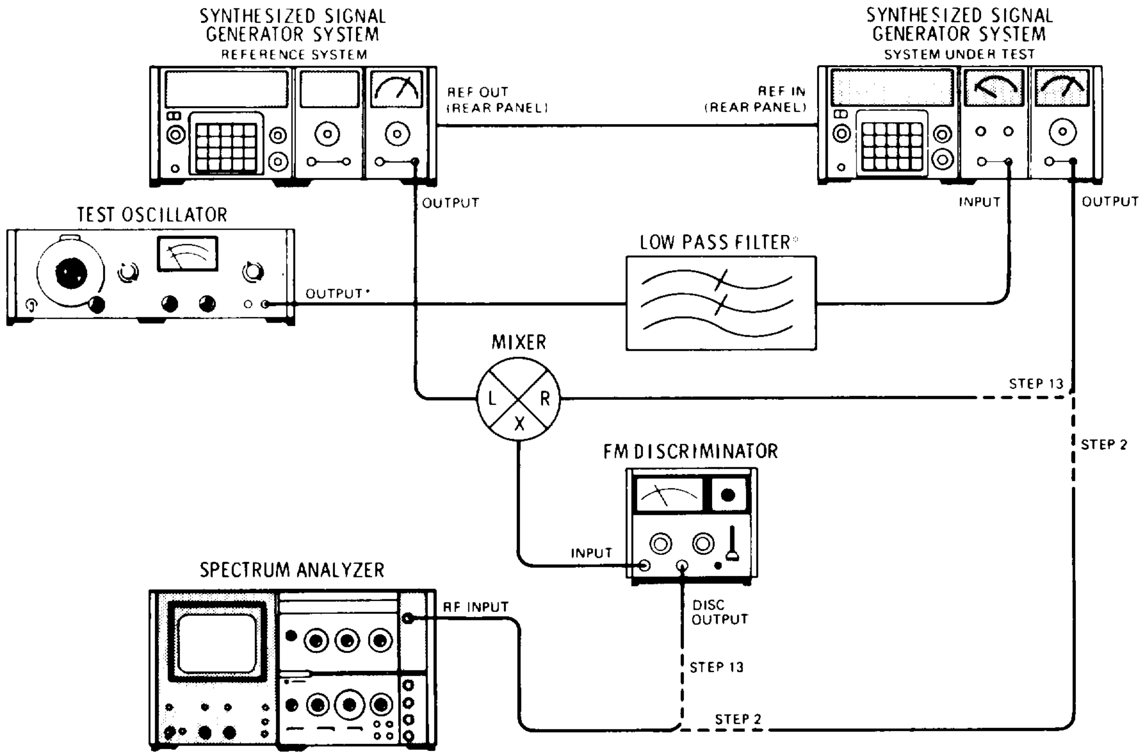


Figure 5-5A. Phase Modulation Level and Distortion Adjustment Test Setup

EQUIPMENT:

Spectrum Analyzer...............................HP 8553B/8552B/140T
Synthesized Signal Generator System ....HP 8660C/86603A/86631B
Test Oscillator ....HP 651B
FM Discriminator..................................HP 5210A
Mixer, Doubler Balanced......................HP 10514A
Low Pass Filters (100 kHz at 5012 or 6001)....Special (See Figure 1-4)

PROCEDURE:

1. Extract the RF Section from mainframe. Remove the mainframe top cover, the RF Section covers, and the top guide rail. Insert the RF Section back into the mainframe.

2. Connect the equipment as shown in Figure 5-5A. Connect the output of the System Under Test directly to the spectrum analyzer RF input. Be sure to use the correct impedance test oscillator output and the correct low pass filter.

3. Set the test oscillator output to 100 kHz at 1.5 Vrms.

4. Set the System Under Test center frequency to 100 MHz with a 0 dBm OUTPUT level.

*In Figure 5-5A. the test oscillator output and low pass filter impedances are 50s when the modulation section being used is a Model 86634A
and 60012 when used with an 86635A.

5-28A. PHASE MODULATION LEVEL AND DISTORTION ADJUSTMENTS (Cont'd)

5. Set the spectrum analyzer controls for a center frequency of 100 MHz, resolution bandwidth of 10 kHz, frequency span per division of 0.5 MHz, sweep time per division of 10 ms, input attenuation of 30 dB, vertical scale per division to 2 dB and adjust the reference level to a readable level.

6. Set the Modulation Section controls for OM mode, external AC source, and a modulation level of exactly 82° as read on the front panel meter.

7. Adjust A16R2 so the carrier and first sidebands are of equal amplitude.

8. Step the System Under Test center frequency down 1 Hz to 99.999999 MHz. Adjust A16R27 so the carrier and first sidebands are equal.

9. Set the FM discriminator controls for the 10 MHz range and 0.1V sensitivity, and insert an internal 1 MHz low-pass filter.

10. Set the spectrum analyzer controls for a center frequency of 100 kHz, resolution bandwidth to 3 kHz, frequency span per division to 100 kHz, input attenuation to 0 dB, log reference level to a convenient level, vertical sensitivity per division to 10 dB, and scan time per division to 20 ms.

11. Set the Reference System controls for a center frequency of 109 MHz and an output level of +7 dBm.

12. Set the System Under Test center frequency to 100 MHz; set the modulation level to 100° as read on the front panel meter.

13. Refer to Figure 5-5 and connect the System Under Test OUTPUT to the "RF" input of the mixer. Connect the FM Discriminator output to the spectrum analyzer RF input.

14. Adjust the spectrum analyzer's reference level control so the peak of the fundamental 100 kHz signal is viewed on the CRT display at the log reference graticule line.

15. Adjust A16R36 to null the second harmonic level; adjust A16R1 to null the third harmonic level.

NOTE

Observing harmonic distortion of a OM signal after passing it through an FM discriminator results in an increase in level of 6 dB per octave. There- fore, the measured second harmonic level will be 6 dB higher and the third harmonic level 9.5 dB higher than with a phase demodulator.

16. Step the System Under Test center frequency down 1 Hz. Note the direction and amount of readjustment of A16R36 and R1 necessary to null the second and third harmonics.

17. Set A16R36 and R1 for the best compromise (minimum second and third harmonic levels) at both center frequency settings of 99.999999 and 100.000000 MHz.

18. Set the System Under Test center frequency to 100 MHz; set the modulation level to 82 degrees as indicated on the Modulation Section meter.

19. Reconnect the RF Section output directly to the spectrum analyzer input.

5-28A. PHASE MODULATION LEVEL AND DISTORTION ADJUSTMENTS (Cont'd)

20. Adjust A16R2 for equal carrier and first sideband levels.

21. Step center frequency down 1 Hz to 99.999999 MHz and adjust A16R27 for equal amplitude carrier and first sidebands.

22. Repeat steps 4 through 22 until all the conditions below are met without further adjustment.

    a. Carrier and first sidebands are equal within 0.5 dB when changing Center Frequency of System Under Test between 100 and 99.999999 MHz (Steps 7-8).

    b. Second harmonic levels are equal within 4 dB or >40 dB down from the fundamental as indicated by the spectrum analyzer at center frequencies of 100 an,, 99.999999 MHz (Step 17).

    c. Third harmonic levels are equal within 4 dB or >35 dB down from the fundamental as indicated by spectrum analyzer at center frequencies of 300 and 299.999999 MHz (Step 17).

23. Replace the RF Section top guide rail and covers, and the mainframe cover.

5-28B. PHASE MODULATION LEVEL AND DISTORTION ADJUSTMENTS - ALTERNATE PROCEDURE

REFERENCE:
Service Sheet 5.

DESCRIPTION:
The phase modulated signal from the synthesized signal generator is monitored by a spectrum analyzer and is adjusted to the modulation level indicated by the modulation level meter. The phase modulated signal is then mixed down, the difference frequency is connected to a phase demodulator, and the detected output is connected to the spectrum analyzer. The adjustments are set to minimize harmonic distortion. The modulation level and distortion adjustments are repeated until both are within the required accuracy.

5-28B. PHASE MODULATION LEVEL AND DISTORTION ADJUSTMENTS - ALTERNATE PROCEDURE (Cont'd)

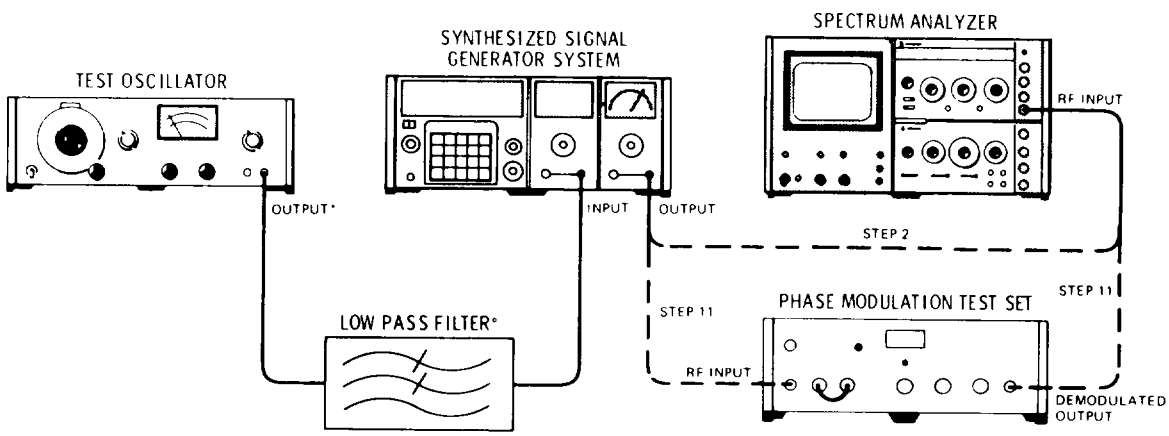


Figure 5-5B. Phase Modulation Level and Distortion Adjustment Test Setup (Alternate Procedure)

EQUIPMENT:

Spectrum Analyzer .... HP 8553B/8552B/140T
Test Oscillator................................... HP 651B
Low Pass Filters (1 MHz at 500 or 6002) ..... Special (See Figure 1-4)
Phase Modulation Test Set.............. HP 8660C-K10

PROCEDURE:

1. Extract the RF Section from mainframe. Remove the mainframe top cover, the RF Section covers, and the top guide rail. Insert the RF Section back into the mainframe.
2. Connect the equipment as shown in Figure 5-5A. Connect the output of the System Under Test directly to the spectrum analyzer RF input. Be sure to use the correct impedance test oscillator output and the correct low pass filter.
3. Set the test oscillator output to 100 kHz at 1.5 Vrms.
4. Set the System Under Test center frequency to 100 MHz with a 0 dBm OUTPUT level.
5. Set the spectrum analzer controls for a center frequency of 100 MHz, resolution bandwidth of 10 kHz, frequency span per division of 0.5 MHz, sweep time per division of 10 ms, input attenuation of 30 dB, vertical scale per division of 2 dB, and adjust the reference level to a readable level.
6. Set the Modulation Section controls for OM mode, external AC source, and a modulation level of exactly 82° as read on the front panel meter.

*In Figure 5-5B, the test oscillator output and low pass filter impedances are 50 ohms when the modulation section being used is a Model
86634A and 600 ohm when used with an 86635A.

5-28B. PHASE MODULATION LEVEL AND DISTORTION ADJUSTMENTS - ALTERNATE PROCEDURE (Cont'd)

7. Adjust A16R2 so the carrier and first sidebands are of equal amplitude.

8. Step the System Under Test center frequency down 1 Hz to 99.999999 MHz. Adjust A16R27 so the carrier and first sidebands are equal.

9. Set the spectrum analyzer controls for a center frequency of 2 MHz, resolution bandwidth to 30 kHz, frequency span per division to 0.5 MHz, input attenuation to 30 dB, log reference level to a convenient level, vertical sensitivity per division to 10 dB, and scan time per division to 10 ms.

10. Set the System Under Test center frequency to 300 MHz with a modulation level of 100° as read on the front panel meter.

11. Connect the phase modulation test set between the signal generator output and the spectrum analyzer input as shown in Figure 5-5B.

12. Adjust the spectrum analyzer's reference level so the peak of the fundamental 1 MHz signal is viewed on the CRT display at the log reference graticule line.

13. Adjust A16R36 to null the second harmonic level; adjust A16R1 to null the third harmonic level.

14. Step the System Under Test center frequency down 1 Hz. Note the direction and amount of readjustment of A16R36 and R1 necessary to null the second and third harmonics.

15. Set A16R36 and R1 for the best compromise (minimum second and third harmonic levels) at both center frequency settings of 299.999999 and 300 MHz*

16. Set the System Under Test center frequency to 100 MHz; set the modulation level to 82° as indicated on the Modulation Section meter.

17. Reconnect the RF Section output directly to the spectrum analyzer input.

18. Adjust A16R2 for equal carrier and first sideband levels.

19. Step the center frequency down 1 Hz to 99.999999 MHz and adjust A16R27 for equal amplitude carrier and first sidebands.

20. Repeat steps 4 through 20 until all the conditions below are met without further adjustment.

    a. Carrier and first sidebands are equal within 0.5 dB when changing Center Frequency of System under Test between 100 and 99.999999 MHz (Steps 7-8).
    b. Second harmonic levels are equal within 4 dB or > 46 down from the fundamental. at center frequencies of 300 and 299.999999 MHz (Step 15).
    c. Third harmonic levels are equal within 4 dB or >46 dB down from the fundamental at center frequencies of 300 and 299.999999 MHz (Step 15).

21. Replace the RF Section top guide rail and covers, and the mainframe cover.

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

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

6-3. EXCHANGE ASSEMBLIES

6-4. The A13 Attenuator Assembly may be re placed on an exchange basis, thus affording a con siderable cost saving. Exchange, factory-repaired and tested assemblies are available only on a trade basis; therefore, the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number. The A13 assembly exchange part number is 86601-60109.

6-5. ABBREVIATIONS

6-6. Table 6-1 lists abbreviations used in the part list, schematics and throughout the manual. I some cases, two forms of the abbreviation are used one all in capital letters, and one partial or n capitals. This occurs because the abbreviations i the parts list are always all capitals. However, in the schematics and other parts of the manual other abbreviation forms are used with both lower case and upper case letters.

6-7. REPLACEABLE PARTS LIST

6-8. Table 6-2 is the list of replaceable parts and in organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.
b. Chassis-mounted parts in alpha-numerical order by reference designation.
c. Miscellaneous parts.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.
b. The total quantity (Qty) used in the instrument.
c. The description of the part.
d. A typical manufacturer of the part in a five-digit code.
e The manufacturer's number for the part.

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

(Next printed page is 6-3)

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

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

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

NOTE

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

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

MOD .... modulator
MOM ...... momentary
MOS .... metal-oxide semiconductor
ms .... millisecond
MTG .... mounting
MTR ... meter (indicating device)
mV .... millivolt
mVac ...... millivolt, ac
mVdc ...... millivolt, dc
mVpk .... millivolt, peak
mVp-p ... millivolt, peak-to-peak
mVrms .... millivolt, rms
mW .... milliwatt
MUX .... *multiplex*
MY .... mylar
μA .... microampere
μF .... microfarad
μH .... microhenry
μmho .... micromho
μs .... microsecond
μV .... microvolt
μVac ...... microvolt, ac
μVdc ..... microvolt, dc
μVpk ... microvolt, peak
μVp-p ... microvolt, peak-to-peak
μVrms .... microvolt, rms
μW .... microwatt
nA .... nanoampere
NC ...... no connection
N/C .... normally closed
NE .... neon
NEG .... negative
nF .... nanofarad
NI PL ...... nickel plate
N/O ..... normally open
NOM .... nominal
NORM .... normal
NPN ... negative-positive-negative
NPO .... negative-positive zero (zero temperature coefficient)
NRFR .. not recommended for field replacement
NSR ..... not separately replaceable
ns .... nanosecond
nW .... nanowatt
OBD ... order by description

OD ..... outside diameter
OH .... oval head
OP AMPL ... operational amplifier
OPT .... option
OSC .... oscillator
OX .... oxide
oz .... ounce
Ω .... ohm
P .... peak (used in parts list)
PAM .... pulse-amplitude modulation
PC ...... printed circuit
PCM .. pulse-code modulation; pulse-count modulation
PDM ..... pulse-duration modulation
pF .... picofarad
PH BRZ phosphor bronze
PHL .... Phillips
PIN ... positive-intrinsic-negative
PIV .... peak inverse voltage
pk .... peak
PL .... phase lock
PLO .... phase lock oscillator
PM .... phase modulation
PNP ... positive-negative-positive
P/O .... part of
POLY ...... polystyrene
PORC .... porcelain
POS .. positive; position(s) (used in parts list)
POSN .... position
POT ..... potentiometer
p-p .... peak-to-peak
PP .... peak-to-peak (used in parts list)
PPM ..... pulse-position modulation
PREAMPL ... preamplifier
PRF .... pulse-repetition frequency
PRR .... pulse repetition rate
ps .... picosecond
PT .... point
PTM .... pulse-time modulation
PWM .... pulse-width modulation

PWV ...... peak working voltage
RC .... resistance-capacitance
RECT .... rectifier
REF .... reference
REG .... regulated
REPL ...... replaceable
RF ..... radio frequency
RFI .... radio frequency interference
RH .... round head; right hand
RLC .... resistance-inductance-capacitance
RMO ... rack mount only
rms .... root-mean-square
RND .... round
ROM .. read-only memory
R&P ..... rack and panel
RWV ... reverse working voltage
S ... scattering parameter
s .... second (time)
..." . second (plane angle)
S-B ..... slow-blow (fuse) (used in parts list)
SCR ... silicon controlled rectifier; screw
SE .... selenium
SECT .... sections
SEMICON ..... semiconductor
SHF ...... superhigh frequency
SI .... silicon
SIL .... silver
SL .... slide
SNR .. signal-to-noise ratio
SPDT ...... single-pole, double-throw
SPG .... spring
SR .... split ring
SPST ...... single-pole, single-throw
SSB ..... single sideband
SST ...... stainless steel
STL .... steel
SQ .... square
SWR .. standing-wave ratio
SYNC ...... synchronize
T .. timed (slow-blow fuse)
TA .... tantalum
TC .... temperature compensating

TD .... time delay
TERM .... terminal
TFT .. thin-film transistor
TGL .... toggle
THD .... thread
THRU .... through
TI .... titanium
TOL .... tolerance
TRIM .... trimmer
TSTR .... transistor
TTL .. transistor-transistor logic
TV .... television
TVI television interference
TWT .. traveling wave tube
U ..... micro (10^{-6}) (used *in parts list)*
UF ... microfarad (used in parts list)
UHF .. ultrahigh frequency
UNREG .... unregulated
V .... volt
VA .... voltampere
Vac .... volts, ac
VAR .... variable
VCO ... voltage-controlled oscillator
Vdc .... volts, dc
VDCW. . volts, dc, working (used in parts list)
V(F) ...... volts, filtered
VFO .. variable-frequency oscillator
VHF ...... very-high frequency
Vpk .... volts, peak
Vp-p .. volts, peak-to-peak
Vrms .... volts, rms
VSWR ... voltage standing wave ratio
VTO ...... voltage-tuned oscillator
VTVM .... vacuum-tube voltmeter
V(X) ..... volts, switched
W .... watt
W/ .... with
WIV .... working inverse voltage
WW .... wirewound
W/O .... without
YIG .. yttrium-iron-garnet
Z_o .... characteristic impedance

NOTE

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

MULTIPLIERS

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

See TABLE 6-4, Parts to National Stock Number Cross Reference

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	86602-60002	1	MODULATOR FILTER ASSY	28480	86602-60002
A1C1	0160-3874	1	CAPACITOR-FXD 1OPf: +-.PF 200WVDC CER	28480	060-3874
AJ11	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A1J2	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	9360-1514
A1L1	9140-0158	2	COIL-FXD MOLDED RF CHOKE IUH 10	24226	O/101101
A1L2	9140-0158		COIL-FXD MOLDED RF CHOKE IUH l10	24226	10/101
A1L3	9100-2247	1	COIL-FXD MOLDED RF CHOKELUH 10	24226	10D100
A1P1	1251-3172	5	CONNECTOR;1-CONT SKT .03 DIA	00779	2-331677-9
A1P2	1251-3172		CONNECTOR;1-CONT SKT .03 DIA	00779	2-331677-9
A1P3	1251-3172		CONNECTOR 1-CONT SKT .03 DIA	00779	2-331677-9
A1P4	1251-3112		CONNECTOR;1-CONT SKT .03 DIA	00779	2-331677-9
A1P5	1251--3172		CONNECTOR;1-CONT SKT .03 DIA	00779	2-3316177-9
A2	86603-60001	1	ALC MOTHER BCARD ASSY	28480	86603-60001
A2C1	0160-2204	2	CAPACITOP-FXD 100IPF-51 300WVOC MICA	28480	0160-2204
A2C2	060-3457	1	CAPACITOR-FXC 2000PF +-10T 250WVDC CER	28480	0160-3457
A2J1	1250-1255	1	CONNECTOR-RF SMB M PC	98291	SL-O51-0000
A2K1	0490-0916	3	RELAY-REED 1A .56 50V CONT 5V-COIL	28480	0490-0916
A201	1854-0404	5	TRANSISTOR NPN SI TO-18 P09360MW	28480	1854-0404
A2R1	069-0084	1	RESISTOR 2.15K 1t .125W F TC-0-100	16299	C4-1/8-TO-2151-F
A282	0757-1060	1	RESISTOR 196 IT .5w F TC=0-10O	19701	MFTCI/2-TO0196R-F
A2R3	0757-0441	1	RESISTOR 8.25K It .125w F TC-0-100	24546	C4-1/8-TD-8251-F
A2R4	0698-3405	1	RESISTOR 422 1 .5W F TC-0+-100	19701	MFTC/2-TO-422R-F
A205	0757-0438	10	RESISTOR 5.11K T .125w F TC-0--100	24546	C4-1/8-TO -5111-F
A209	0757-0276	1	RESISTOR 61.9 11 .125w F TC-0-100	24546	C4-1/8-TD-6192-F
A2Vet	1902-3139	1	DIODE-ZNR 8.25V 5% DO-7 PD0.4w TC-a.0531	04713	S2 10939-158
A2XA3	1251-1626	3	CONNECTOR-PC EDGE 12-CONT/ROw 2-ROWS	71785	252-12-30-300
A2XA4	1251-1626		CONNECTOR-PC EDGE l2-CONT/ROW 2-ROWS	71785	252-12-30-300
A2XA16	1251-1626		CONNECTOR-PC EDGE I2-CONTIROW 2-ROWS	71785	252-12-30-300
			A2 MISCELLANEOUS		
	0360-1514	6	TERMINAL-STUD SOL-PIN PRESS-ITG	28480	0360-1514
A3	8660260040	1	ALC AMNPLIFIER ASSY	28480	86602-60040
A3C1	3180-tOS8	2	CAPACITOR-FXO 50UFa75-10t 25¥DC AL	56289	300506G025CC2
A3C2	0180-0058		CAPACITOR-FXD 50UF+75T10t 25VDC AL	56289	300506G025CC2
A3C3	0140-0193	1	CAPACITOR-FXD 82PF a-51 300WVDC MICA	04522	DM15E820J0300WV1CR
A3C4	0160-2199	2	CAPACITOR-FXO 30PF t51300WVDC MICA	28480	0160-2199
AI3CS	0160-2199	1	CAPACITOR-FXO300PF +-51 300WVDC MICA	28480	0160-2199
A3C6	0160-0302	1	CAPACITOR-FXD.018UF +-10% 200WVDC POLYE	56289	292P18392
63C7	0160-3468	1	CAPACITOR-FXDZ2UF +1.03 BOWVOC POLYE	56289	292P1249"8
A3C8	0160-2204		CAPACITOR-FXC 100PF a-51 300WVOC MICA	28480	0160-2204
A3C9	0160-2238	1	CAPACITOR-FXD1.5PF +.25PF 500WVDC CER	28480	0160-2238
A3CR1	1901-0047	3	DIODE-SWITCHING 20V 75MA IONS	28480	1901-0047
A3CR2	1901-0047		DIODE-SWITCHING 20V 75MA IONS	28480	1901-0047
A3CR3	1901-0047		DIODE-SWITCHING 20V 75MA IONS	28480	1901-0047
A3CR4	1901-0050	2	DIODE-SWITCHING8OV 2OONA 2NS 00-7	28480	1901-0050
A3K1	0490-0916		RELAY-REED IA .56 50V CONT 5V-COIL	2R480	0490-0916
A3L1	91402--0237	4	COIL-FOE MOLDED RF CHOKE 0ZO0UH 51	24226	151203
A3L2	9140-0237		COIL-FXD MOLDED RF CHOKE 200UH S51	24226	15/203
A313	9140-0105	1	COIL-FXD MOLDED RF CHOKE 8.2UH 10	24226	151821
A301	1853-0020	3	TRANSISTOR PNP SI PD-300MW FT-I1SOMHZ	28480	1853-0020
A302	1854-0404		TRANSISTOR NPN SI TO-18 PD-36OMW	20480	1854-0404
A303	1855-0020	1	TRANSISTOR J-FET N-CHAN D-MODE0-18 SI	28480	1805-0020
A304	1853-0034	5	TRANSISTOR PNP SI T-18 P9036ONW	28480	1853-0034
A305	18S3-0020		TRANSISTOR PNP SI PD-300RW FT-1SOMHZ	28480	1853-0020
A306	1853-0034		TRANSISTOR PNP SI TO-is PD0360AW	28480	1853-0034
A307	1854-0404		TRANSISTOR NPN S1 70-8 PD-360MW	28480	1854-0404
6308	1854-0404		TRANSISTOR NPN SI T0-18 PD0360MW	28490	1R54-0404
A309	1853-0034		TRANSISTOR PNP SI TO-l8 PD9360MW	28480	1853-0034
A3010	1854-0221	2	TRANSISTOR-DUAL NPPO-T950MW	28480	1854-0221
A3Q11	1854-0053	1	TRANSISTOR NPN 2N2218 SI TI-5 P0=800Mw	04713	2N2218

See Introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R16	0698-0083		RESISTOR 1.96K 1% .125W F TO-04-100	16299	C4-1/8-TO-1961-F
A4R17*	0689-3442	1	RESISTOR 237 1% .125 F TO-0+-100	16299	C4-1/8-TO-237R-F
A4R18	0757-0280		*FACTORY SELECTED PART	24546	C4-1/8-TO-1001-F
A4R19	0698-3447	2	RESISTOR 1K 1% .125W F TO+-100	16299	C4-1/8-TO-422R-F
A4R20	0698-0082	2	RESISTOR 422 1%.125W F TO +-100	16299	C4-1/8-TO 4640-F
A4R21	0698-3447	1	RESISTOR 464 1% .125W F TO +-100	16299	C4-1/8-TO-422R-F
A4R22	0698-3157	1	RESISTOR 422 1% .125W F TO +-100	16299	C4-1/8-TO-1962-F
A4R23	0698-3455	1	RESISTOR 19.6K 1% .125W F TO +-100	16299	C4-1/8-TO-2613-F
A4R24	0757-0439		RESISTOR 261K 1% .125W F TO +-100	24546	C4-1/8-TO-6811-F
A4R25	0698-0082	1	RESISTOR 6.81K 1% .125W F TO+-100	16299	C4-1/8-TO-4640-F
A4R26	2100-2489	1	RESISTOR	19701	ET50X02
A451	3101-0973	1	SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC PC	79727	GF126-0018
A4TP1	0360-1514		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-1514
A4TP12	0360-1514		TERMINAL-STUD SGL-PIN PRESS MTG	28480	0360-1514
A4U1	1826-0013	1	IC DP AMP	28480	1826-0013
			A4 MISCELLANEOUS		
	4040-0748		EXTRACTOR -PC BD BLK POLYC .062-BD-THNKS	28480	4040-0748
	1480-0073	4	PIN:DRIVE 0.25"LG	00000	OBD
	4040-0751	1	EXTRACTOR-PC BD ORN POLYC 0.62-BD-THNKS	28480	4040-0751
	1480-0073		PIN:DRIVE 0.25"LG	00000	OBD
A5	5086-7049	1	MODULATOR ASSY	28480	5086-7049
A5J1			NSR		
A5J2			NSR		
A5J3			NSR		
A5J4			NSR		
A5J5			NSR		
A5J6			NSR		
A6	5086-7048	1	AMPLIFIER DETECTOR ASSEMBLY	28480	5086-7048
A6J1			NSR		
A6J2			NSR		
A6J3			NSR		
A6J4			NSR		
A6J5			NSR		
A6J6			NSR		
A7	86602-60044	1	MIXER ASSY (EXCEPT OPTION 002)	28480	86602-60044
A7J1	86601-20022	3	CONNECT, BULKHEAD	28480	86602-20022
A7J2	86602-20022		CONNECT, BULKHEAD	28480	86602-20022
A7J3	86602-20022		CONNECT, BULKHEAD	28480	86602-20022
			A7 MISCELLANEOUS	28480	
	0360-0124	3	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
	5001-002	1	COVER, FILTER	28480	5001-0002
	86602-00003	1	COVER,MIXER,SMALL	28480	86602-00003
	86602-20026	1	BUSHING	28480	86602-20026
	86602-20029	1	SUPPRESSOR	28480	86602-20029
	86603-00005	1	COVER,MIXER,LARGE	28480	86603-00005
	86603-20024	1	HOUSING, MIXER	28480	86603-20024
A7A1	86602-20009	1	BALUN MIXER ASSY	28480	86602-20009
A7A2	86602-60008	1	BALANCE MIXER ASSY	28480	86602-60008
A7A2CR1	5080-0271	1	DIODE, SILICON, MATCHED QUAD	28480	5080-0271
A7A3	5086-7066	1	LOW PASS FILTER ASSY, 1.45GHZ	28480	5086-7066
A7A4	86603-20023	1	TRANSISTOR ASSY	28480	86603-20023
A7A5	86602-20044	1	TRANSISTOR ASSY	28480	86602-20044

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	86603-60023	1	MIXER ASSY (OPTION 002 ONLY)	28480	86603-60023
A7 C1	0160-4082	1	CAPACITOR-FXD 1000PF +-20% 200WVDC CER	28480	0160-4082
A7 J1	86602-20022	3	CONNECTOR, BULKHEAD	28480	86602-20022
A7 J2	86602-20022		CONNECTOR, BULKHEAD	28480	86602-20022
A7 J3	86602-20022		CONNECTOR, BULKHEAD	28480	86602-20022
A7 L1	9100-1666	1	COIL-FXD MOLDED RF CHOKE 3.6MH 5%	24226	22/364
			A7 MISCELLANEOUS	83330	
	0340-0044	1	TERMINAL-STUD DBL-TUR PRESS MTG	28480	92-1500
	0360-0124	1	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
	5001-0002	1	COVER, FILTER	28480	5001-0002
	86602-00003	1	COVER, MIXER, SMALL	28480	86602-00003
	86602-20026	1	BUSHING	28480	86602-20026
	86602-20029	1	SUPPRESSOR	28480	86602-20029
	86603-00005	1	COVER, MIXER, LARGE	28480	86603-00005
	86603-20024	1	HOUSING, MIXER	28480	86603-20024
A7A1	86603-20009	1	BALUN MIXER ASSY	28480	86603-20009
A7A2	86603-60008	1	BALANCE MIXER ASSY	28480	86602-60008
A7A2CR1	5080-0271	1	DIODE SILICON , MATCHED QUAD	28480	5080-0271
A7A3	5086-7066	1	LOW PASS FILTER ASSY, 1.45 GHZ	28480	5086-7066
A7A4	86603-20023	1	TRANSISTOR ASSY	28480	86603-20023
A7A5	86603-60010	1	LOW PASS FILTER ASSY, 50 MHz (OPT 002 ONLY)	28480	86603-60010
A7A5 C1	0160-4303	2	CAPACITOR-FXD .027UF +-10% 50WVDC CER	26654	38X050S273K
A7A5 C2	0160-4305	2	CAPACITOR-FXD 47PF +-10% 100WVDC CER	28480	0160-4305
A7A5 C3	0160-4308	1	CAPACITOR-FXD 33PF +-10% 100WVDC CER	26654	2BN100S330K
A7A5 C4	0160-4247		CAPACITOR-FXD .047 UF +-10% 100WVDC CER	28480	0160-4247
A7A5 C5	0160-4303		CAPACITOR-FXD .027 UF +-10% 100WVDC CER	26654	38X050S273K
A7A5 C6	0160-4305	1	CAPACITOR-FXD 47 PF +- 10% 100WVDC CER	28480	0160-4305
A7A5 CR1	1901-0639	2	DIODE-PIN 110V	28480	1901-0639
A7A5 CR2	1901-0639		DIODE-PIN 110V	28480	1901-0639
A7A5 L1	86603-80001	2	INDUCTOR, TOROID	28480	86603-80001
A7A5 L2	86603-80001		INDUCTOR, TOROID	28480	86603-80001
A7A5 R1	0698-7222	2	RESISTOR 261 2% .05W F TO-0-+-100	24546	C3-1/8-TO-261R-G
A7A5 R2	0698-7222		RESISTOR 261 2% .05W F TO 0-+-100	24546	C3-1/8-TO-261R-G
A7A5 R3	0698-7229	1	RESISTOR 261 2% .05W F TO-0-+-100	28480	C3-1/8-TO-511R-G
A8	86603-67003	1	4 GHZ AMPLIFIER ASSY (EXCEPT OPTION 002)	28480	86603-67003
A8	86603-67001	1	4 GHZ AMPLIFIER ASSY (OPTION 002 ONLY)	28480	8660-67001
A8J1			NSR		
A8J2			NSR		
A9	86602-60040	1	ATTENUATOR DRIVER ASSY (EXCEPT OPTION 001)	28480	86602-60040
A9CR1	1901-0025	8	DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9CR2	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9CR3	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9CR4	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9CR5	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9CR6	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9CR7	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9CR8	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A9Q1	1853-0213	4	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A9Q2	1854-0361	4	TRANSISTOR PNP 2N4239 SI TO-5 PD =800MW	04713	2N4239
A9Q3	1853-0020	17	TRANSISTOR PNP SI PD=300MW FT=150MHz	28480	1853-0020
A9Q4	1854-0071	4	TRANSISTOR PNP SI PD=300MW FT=200MHz	28480	1854-0071
A9Q5	1854-0404	5	TRANSISTOR PNP SI TD=18 PD 360MW	28480	1854-0404
A9Q6	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHz	28480	1853-0020
A9Q7	1853-0213		TRANSISTOR PNP 2N4236 SI TO=5 PD=1W	04713	2N4236
A9Q8	1854-0361		TRANSISTOR PNP 2N4239 SI TO=5 PD=800MW	04713	2N4239
A9Q9	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHz	28480	1853-0020
A9Q10	1854-0071		TRANSISTOR PNP SI PD=300MW FT=200MHz	28480	18540071
A9Q11	1854-0404		TRANSISTOR PNP SI TD=18 PD 360MW	28480	1854-0404
A9Q12	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHz	28480	1853-0020
A9Q13	1854-0213		TRANSISTOR PNP 2N4236 SI TO=5 PD=1W	04713	2N4236
A9Q14	1850-361		TRANSISTOR PNP 2N4239 SI TO=5 PD=800MW	24713	2N4239
A9Q15	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHz	28480	1853-0020

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9016	1853-0071		TRANSISTOR NPN SI PO-300NM FT-200MHz	28480	1854-0071
A9017	1853-0404		TRANSISTOR NPN SI TD-18 PD.360NM	28480	185-0404
A9Q18	1853-0020		TRANSISTOR PNP SI PD-3001i FT.150MH	28480	1853-0020
A9019	1853-0213		TRANSISTOR PNP 2N4236 SI TO-5 PD-W	04713	2N4236
A9020	1853-0036		TRANSISTCR NPN 2N4239 SI T-S5 PD-800M	04713	2N4239
A9021	1853-0020		TRANSISTOR PNP SI PD-300WM FT-101HHZ	28480	1853-0020
A9022	1854-0071		TRANSISTOR NPN SI PD-300MW FT-200MHZ	28480	1854-0071
A9023	1054-0404		TRANSISTOR NPN SI TD-18 PO-360NM	28480	185-0404
A9024	1853-0020		TRANSISTOR PNP SI PD-300NM FT-150HZ	28480	1853-0020
A9R1	0757-0280	11	RESISTOR 1K LI .125W F TD-0-100	24546	C4-1/8-TO-1001-F
A9R2	0757-0159	8	RESISTOR 1K IS .5F TD-0+-100	19701	MF7C1/2-TO-IRO-F
A9R3	0757-0159		RESISTOR 1K It .5W F TD-0+-IO0	19701	F7TCIZ2-TO-IRO-F
A9R4	0698-3440	4	RESISTOR 196 It .125H F TD-0-100	16299	C4-1/8-TO-1 96R-F
A9R5t	0683-0335	6	RESISTOR 3.3 51 .25WFC TD--400/+500	01121	C833G5
A9R6t	0683-0335		RESISTOR 3.3 5S .25N FC TD--400/+500	01121	CB33GS
A9R7	0757-0401	8	RESISTOR 100 11.125N F TO-0-100	24546	C4-118-TO-101-F
A9R8	0757-0401		RESISTOR 100 11 .125i F TO-0+-100	24546	C4-18-T-L101-F
A9R9			DELETED		
A9R10			DELETED		
A9R11	0757-0280		RESISTOR IK 1I .125M F TO-0+-100	24546	C4-1/8-TO-1001-F
A9R12	0757-0159		RESISTOR IK 11 .5W F TO-0+-100	19701	NF7C1/2-TO-IRO-F
A9R13	0757-0159		RESISTOR IK 1 .5W F TO-0+-100	19701	NF7CI/2-TO-IRO-F
A9R14	0698-3440		RESISTOR 196 13 .125N F TO-0+-100	16299	C4-1/8-TO-196R-F
A9R15	0683-0335		RESISTOR 3.3 51 .25W FC TO--400/+500	01121	CR3365
A9R16	0683-0335		RESISTOR 3.3 51 .25S FC TO--400/+500	01121	C833G5
A9R17	0757-0401		RESISTOR 100 I1 .1251 F TO-0- 100	24546	C4-1/8-TO-101-F
A9R18	0757-0401		RESISTOR 100 11 .125W F TO-0+-100	24546	C4I/8-TO-101-F
A9R19			DELETED		
A9R20t			DELETED		
A9R21	0757-0280		RESISTOR IK I1 .125W F TO-0+-100	24546	C4-18-TO-1001-F
A9R22	0757-0159		RESISTOR IK 13 .5w F TO-0+-100	19701	HFTC1/2-TO-IRO-F
A9R23	0757-0159		RESISTOR 1K 1I .SW F TO-0+-100	19701	HF7C2lZ-TO-lRO-F
A9R24	0698-3440		RESISTOR 196 11 .125W F TO-0-+-100	16299	C4-1/8-TO-196R-F
A9R25	0683-0335		RESISTOR 3.3 5S .25W FC TC--4,00/+500	31121	C833G5
A9R26	0683 0335		PRSISTOP 3.3 51 .25L FC TC--4001+500	01121	CR33G5
A9R27	0757-0401		RESISTOR 100 11 .125M F TC-O,I00	24546	C4-128-TO-101-F
A9R28	0757-0401		RESISTOR 100 11 .125W F TC-O+-100	24546	C4-1/8-TO-101-F
A9R29			DELETED		
A9R30 t			DELETED		
A9R31	0757-0280		RESISTOR 1K 11 .125L F TO-0100	24546	C4-18-TO-1001-F
A9R32	0757-0159		RESISTOR 1K IX .SW F TO-0+-100	19701	MFT7C/2-TO-IPO-F
A9R33	0757-0159		RESISTOR IK 1t .5S F TC-O+-100	19701	F7C1IZ-TO-IRO-F
A9R34	0698-3440		RESISTOR 196 11 .125W F TC-O'100	16299	C4-18-TO-196R-F
A9R35	0811-2815	2	RESISTOR 1.' 5S .75L PW TC-O, 50	91637	PSI12-T2-RS5-J
A9R36	0811-2815		RESISTOR 1.5 51 .75M PW TC-O+-50	91637	PS1/2-T2—IR5-J
A9R37	0757-0401		RESISTOR 100 11 .125L F TC-O+-100	24546	C4-1/8-TO-101-F
A9R38	0757-0401		RESISTOR 100 I3 .125W F TC.O+ 100	24546	C4-18-TO-101-F
A9R39t			DELETED		
A9R40 t			DELETED		
A9VR1	1902-3002	4	DIODE-ZNR 2.37V 53 DO 7 PO-.4W TC--.0742	04713	SI 10939-2
A9VRZ	1902-3002		DIODE-ZNR 2.37V 51 DO-7 PDO.4W TC--.074S	04713	SZ 10939-2
A9VR3	1902-3002		DIODE-ZNR 2.371 5S D0-T PCD-.4 TC--.0742	04713	SZ 10939-2
A9VR4	1902-3002		DIODE-ZNR 2.37V 5S 00-7 PD-.4W TC--.074S	04713	SZ 10939-2
			A9 P MISCELLANEOUS		
	1480-0073	7	PIN:ORIVF 0.250' LG	00000	080
	4040-0752	2	EXTRACTOR-PC BD YEL POLYC .062-BD-THNKS		
A10	86602-60006	1	REFERENCE ASSY	28480	86602-60006
A1C1			NOT ASSIGNED		
A10C2	01800291	2	CAPACITOR FXO IUF+10 35VDC TA	56289	1500105X9035A2
A10K1	0490-0916	6	RELAY-REED IA .5A 50V CONT 5V-COIL	28480	0490-0916
A10K2	0490-0916		RELAY-REED IA .5A SOV CONT 5Y-COIL	28480	0490-0916
A10K3	0490-0916		RELAY-REED IA .5A 50V CONT 5V-COIL	28480	0490-0916
A10K4	0490 0916		RELAY-REEO IA 5A 50V CONT 5V-COIL	28480	0490-0916
A10K5	0490-0916		RELAY-REED IA .5A 50V CONT 5V-COIL	28480	0490-C916
A10K6	0490-0916		RELAY-REED IA .5A 50V CONT 5V-COIL	28480	0490-0916
A10Q1	1853-0020		TRANSISTOR PNP SI PO-300HM FT-150NHZ	28480	1853-0020
AIC02	1853-0020		TRANSISTCR PNP SI PO-300NW FT-150NHZ	28480	1853-0020
Ai003	1853-0020		TRANSISTOR PNP SI PO-3001M FT.150MHZ	28480	1853-0020
AO14	1853-0020		TRANSISTOR PNP SI PD-300MW FT-150NHZ	28480	1853-0020
A1005	1853-0020		TRANSISTOR PRP SI PO-300MN FT-150HHZ	28480	1853-0020

See introduction to this section for ordering information

FOR BACKDATING, SEE TABLE 7-1.

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10Q6	1853-0020		TRANSISTOR PFNP SPO-30OMW FT.ISOMHZ	28480	1853-0020
A10Q7	1853-OC20		TRANSISTOR PNP SI PDO300MW FTS150HHn	28480	1853-0020
A10Q8	1853-0020		TRANSISTOR PNP SI PD-30OMW FTI1SOMHZ	2840	1853-0020
A10Q9	1853-0020		TRANSISTOR PNP SI PD-30o0N FT-150MHZ	28480	1853-OC2J
A10Q10	1854-0404		TRANSISTOR NPN SI TO-I8 PD-360MW	28480	1854-004
A10Q11	1855-0082	1	TRANSISTOR MOSFET P-CHAN O-MODE SI	28480	1855-0082
A10R1	0757-0279	1	RESISTOR 3.16K 1 .125W F TC-O-100	24546	C4-1/8-T-3161-F
A10R2	2100-2517	1	RESISTOR-TRMR 50K 10t C SIDE-AOJ I-TURN	30993	ET5X50O3
A10R3	0757-0280		RESISTOR IK It .125w F TC-O=100	24546	C4-1/8-TO-1001-F
A10R4	0757-0817	1	RESI STOR 750 1I .5W F TC-O+-100	19701	MFTCIZ2-TO-751-F
A10R5	2100-2633	3	RESISTOR-TRMR IK 10X C SIDE-ADJ I-TURN	30983	ETSOX1O2
A10R6	0757-0443	1	RESISTOR IIK 1I .125w F TC-O+-1OO	24546	C4-1/8-TO-lOZ-F
A10R7	2100-2633		RESISTOR-TRMR 1K 10% C SIDE-AD0J 1-TURN	30983	ETSOX102
A10R8	0757-0416	2	RESISTOR 511 1I .125W F TC-O0100	24546	C4-1/8-TO-511R-F
A10R9	0757-0280		RESISTOR LI 1X .125w F TC-O+-100	24546	C4-1/8-TO-1001-F
A10R10	0698-3260	2	RESISTOR 464K IS .125W F TC-O-100	0388	PME55SSS
A10R11	0698-3260		RESISTOR 464K I1 .125 F TC=-.100	03888	PFME5S
A10R12	0698-3453	1	RESISTOR 196K 1t .125w F TC-O-100	16299	CI1/8-TO-1963-F
A10R13	0757-0439	1	RESISTOR 6.81K 11 .125W F TC-O= -100	24546	C4-1/8-TO-6811-F
A10R14	0683-1065	1	RESISTOR 10ON 5 .25w FC TC--900/+1100	01121	C81065
A10R15	0757-0280		RESISTOR IK 1I .125w F TC-O+-100	24546	C4-1/8-TO-1001-F
A10R16	0690-3450	1	RESISTOR 42.2K 11 .IZS F TC-O-100	16299	C4-1/8-TO-4222-F
A10R10	0757-0280		RESISTOR IK I1 .125w F TC-O+-100	24546	C4-1/8-TO-1001-F
A10R18	0698-0083	10	RESISTOR 1.96K 1IS .125 F TC-100	16299	C4-1I8-TO-1961-F
A10R19	0698-0083		RESISTOR 1.96K 11 .125W F TC=-100	16299	C4-118-TI-1961-F
A10R20	0698-0083		RESISTOR 1.96K 1 .125w F TC-O-100	16299	C4-1/8-TO-1961-F
A10R21	069-4406	2	RESISTOR 115 1I .125w F TC-0O*100	16299	C4I1/8-TO-L15R-F
A10R22	0698-4482	1	RESISTOR 17.4K 11 .125 F TC-O+-100	03888	PME55-1/8-T0-1742-F
A10R23	0698-4406		RESISTOR 115 1I .125w F TC-O+-100	16299	CI-/8-TO-115P- F
A10R24	0698-0083		RESISTOR 1.96K 11 .125w F TC-Oe100	16299	C4-1/8-TO-1961-F
A10R25	0698-0083		RESISTOR 1.96K 1I .125w F TC-O+-100	16299	C4-I18-TO-1961-F
A10R26	0698-3486	2	RESISTOR 232 1% .125w F TO-O+-100	16299	C4-1/8-TO-232R-F
A10R27	0698-3498	1	RESISTOR 8.66K 1% .125w F TO-O-100	16299	C4-1/8-TO-866R-F
A10R28	0698-3486		RESISTOR 232 1% .125W F TO-O+-l00	16299	C4-1/8-TO-232R-F
A10R29	0690-0083		RESISTOR 1.96% 1% .125W F TO-O-100	16299	C4-1/8-TO-1961-F
A10R30	0698-0083		RESISTOR 1.96K 1% .125w F TO-O 100	16299	C4-1/8-TO-1961-F
A10R31	0698-3510	2	RESISTOR 453 1% .125w F TO-O+-100	16299	C4-1/8-TO-453R-F
A10R32	0698-3154	1	RESISTOR 4.22K 1% .125W F TO-O+I00	16299	C4-1/8-TO-4221-F
A10R33	0698-3510		RESISTOR 453 1% .125w F TO+-0100	16299	C4-1/8-TO-453R-F
A10R34	0698-0083		RESISTOR 1.96K 1% .125w F TO-0100	16299	C4-1/8-TO-1961-F
A10R3S	0691-0083		RESISTOR 1.96K 1% .125I F TO-O I100	16299	C4-1/8-TO-1961-F
A10R36	0698-3495	2	RESISTOR 866 1% .125W F TO-O-100I	16299	C4-1/8-TO-866R-F
A10R37	0698-4430	1	RESISTOR 1.91K 1% .125w F TO-O100	16299	C4-1/8-TO-1911-F
A10R38	0698-3495		RESISTOR 866 I% .Z15N F TO-O- 100	16299	C4-1/8-TO-866R-F
A10R39	0757-0280		RESISTOR 1K 1% .125w F TO*-100	24546	C4-1/8-TO-1001-F
A10R40	0757-0442	3	RESISTOR 10K 1% .125W F TO-O-100	24546	C4-1/8-TO-1002-F
A10R41	0757-0442		RESISTOR 10K 1 % .125W F TO-O- 100	24546	C4-1/8-TO-1002-F
A10U1	1826-0081	1	IC LM 318 OP ANP	27014	LM318H
A10VR1	1902-0041		DIODE-ZNR 5.11V 53 DO-7 PDI-.4TC--.009	04T13	SZ 10939-98
			A10 MISCELLANEOUS		
	4040-0753	2	EXTRACTOR-PC 80 GRN POLYC .062-8D-THKNS	28480	4040-0753
	1480-0073		PIN:DRIVE 0.250- LG	00000	080
	4040-0753		EXTRACTOR-PC 80 GRN POLYC .062-6D-THKNS	28480	4040-0753
	1480-0073		PIN:ORIVE 0.250" LG	0000G	080
A11	86603-60029	1	LOGIC ASSY	28480	86603-60029
A11C1	0180-2206	1	CAPACITOR-FXO 60UFILOI 6VOC TA	56289	1500606X900682
A11L1	9140-0105	1	COIL-FXO MOLOED RF CHCKE 8.2UH 10	24226	15/821
A11U1	1820-0508	1	IC N8202N RGTR	18324	N8202N
A11U2	1820-0077	1	IC SN74 74 N FLIP-FLOP	01295	SN74744
A11U3	1820-0069	1	IC SN74 20 N GATE	01295	SN742ON
A11U4	1820-0305	2	IC:TTL 4-81T BINARY FULL ADDER	01295	SN7483N
A11U5	1820-0054	4	IC SNT4 00 N GATE	01295	SN7400N
A11U6	1820-0054		IC SNT4 00 N GATE	01295	SNT400N
A11U7	1820-0305		IC:TTL 4-BIT BINARY FULL ADDER	01295	SN7483N
A11U8	1820-0114	2	IC SN74 04 N INV	01295	SN7404N
A1LI9	1820-0054		IC SN74 00 N GATE	01295	SN740ON
A11U10	1820-0054		IC SN74 00 N GATE	01295	SN7400N

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			A11 MISCELLANEOUS		
	4040-0754	1	EXTRACTOR, PC BD BLU POLYC .062-D-THKNS	28480	4040-0754
	1480-0073	1	PIN: DRIVE 0.250" LG	00000	0BD
	86603-00007	1	INSULATOR	28480	9200-6-B-091
A12	86602-60038	1	LOGIC MOTHER BOARD ASSY	28480	86602-60038
A12C1	0160-2055	2	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A12C2	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
A12L1	9140-0144	2	COIL-FXD MOLDED RF CHOKE 4.7UH 10%	24226	10/471
A12L2	9140-0144		COIL-FXD MOLDED RF CHOKE 4.7UH 10%	24226	10/471
A12XA9	1251-11626	1	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	71785	252-12-30-300
A12XA10	1251-2034	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	71785	252-10-30-300
A12XA11	1251-1388	1	CONNECTOR-PC EDGE 15 CONT/ROW 2-ROWS	71785	252-15-30-008
A13	86603-60043	1	ATTENUATOR ASSY(EXCEPT OPTION 001)	28480	86603-60043
A13	86601-60109		RESTORED 86603-60043, REQUIRES EXCHANGE	28480	86601-60109
A13J1			NSR		
A13J2			NSR		
A14	86602-60041	1	WIRING HARNESS, MAIN(EXCEPT OPT'S 001-002 (INCLUDES P5, P7, P8, P13 & P14	28480	86602-60041
			WIRING HARNESS, MAIN (OPTION 001 ONLY)	28480	86602-60042
A14	86602-60045		WIRING HARNESS,MAIN (OPTION 002 ONLY) (INCLUDES P5, P7, P8, P13 & P14	28480	86602-60045
A15	86602-60035	1	20 MHz AMPLIFIER ASSY	28480	86602-60035
A15C1	0160-2437	7	CAPACITOR-FXD 5000PF +80-20% 200WVDC CER	28480	0160-2437
			NSR		
A15J1	1250-1194	3	CONNECTOR-RF SM-SLD M SGL-HOLE-FR 50-OHM	28480	1250-1194
			NSR		
A15J2	1250-1194		CONNECTOR-RF SM-SLD M SGL-HOLE-FR 50-OHM	28480	1250-1194
			NSR		
A16†	86603-60041	1	BOARD ASSEMBLY, PHASE MODULATOR DRIVER (OPTION 002)	28480	86603-60041
A16C1	0180-0228	1	CAPACITOR-FXD 22UF +-10% 15 VDC TA	56289	150D226X9015B2
A16C2	0160-0575	5	CAPACITOR-FXD .047UF +-20% 50WVDC CER	28480	0160-0575
A16C3	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A16C4	0160-0575		CAPACITOR-FXD .047UF +-20% 50WVDC CER	28480	0160-0575
A16C5	0160-0575		CAPACITOR-FXD .047UF +-20% 50WVDC CER	28480	0160-0575
A16C6	0180-0374	1	CAPACITOR-FXD 10UF +-10% 20VDC TA	56289	150D106X9020B2
A16C7	0121-0494	1	CAPACITOR-V TRMR-CER 2/6.5PF 250V PC-MTG	0086s	7-S TRIKO-13
A16C8	0160-4084		CAPACITOR-FXD 0.1 UF +-20% 50WVDC CER	28480	0160-0575
A16C9	0160-0575		CAPACITOR-FXD .047UF +-20% 50WVDC CER	28480	0160-0575
A16CR1	1901-0179	2	DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A16CR2	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A16CR3	1901-0033	6	DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A16CR4	1901-0033		DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A16CR5	1901-0033		DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A16CR6	1901-0539	1	DIODE-SCHOTTKY	28480	1901-0539
A16CR7	1901-0033		DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A16CR8	1901-0033		DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A16CR9	1901-0033		DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A16E1	0410-0184	1	OVEN:COMPONENT	01295	5ST1-2
A16J1	1250-1377	2	CONNECTOR-RF SMB FEM PC	2K497	700214
A16J2	1250-1377		CONNECTOR-RF SMB FEM PC	2K497	700214
A16L1	9140-0158	1	COIL-FXD MOLDED RF CHOKE 1UH 10%	24226	10/101
A16Q1	1853-0075	2	TRANSISTOR-DUAL PNP PD=400MW	28480	1853-0075
A16Q2	1854-0295	1	TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A16Q3	1853-0075		TRANSISTOR-DUAL PNP PD+400MW	28480	1853-0075
A16Q4	1855-0327	1	TRANSISTOR J-FET 2N4416 N-CHAN D-MODE	01295	2N4416
A16Q5	1854-0457	1	TRANSISTOR-DUAL NPN PD+400MW	28480	1854-0457
A16Q6	1853-0352	1	TRANSISTOR PNP SI TO-92 PD+350MW FT=1GHZ	28480	1853-0352
A16Q7	1854-0013	1	TRANSISTOR NPN 2N2218A SI TO-5 PD=880MW	04713	2N2218A
A16Q8	1853-0012	1	TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
	0340-0850	2	INSULATOR-XSTR NYLON WHITE	28480	0340-0850
A16Q9	1853-0451	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-
A16Q10	1854-0023	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A16R1	2100-3095	2	RESISTOR -TRMR 200 10% C SIDE ADJ-17-TURN	32997	3006P-I-201
A16R2	2100-3095		RESISTOR-TRMR 200 10% C SIDE ADJ 17-TURN	32997	3006P-I-201
A16R3	0698-7236	7	RESISTOR 1K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1001-G
A16R4	0698-7241	1	RESISTOR 1.62K 2% F TO-+-100	16299	C3-1/8-TO-1621-G
A16R5	0698-7236		RESISTOR 1K 2% .05W F TO-0-+10C	24546	C3-1/8-TO-1001-G

See introduction to this section for ordering information

FOR BACKDATING, SEE TABLE 7-1.

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16R6	0698-7234	1	RESISTOR 825 2% .05W F TO=0+-100	24546	C3-1/8-TO-825R-G
A16R7	0698-7236		RESISTOR 1K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1001-G
A16R8	0698-7226	1	RESISTOR 383 2% .05W F TO =0+-100	24546	C3-1/8-TO-383R-G
A16R9	0698-7236		RESISTOR 1K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1001-G
A16R10	0698-7216	1	RESISTOR 147 2% .05W F TO=0+-100	24546	C3-1/8-TO-147R-G
A16R11	0698-7260	4	RESISTOR 10K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1002-G
A16R12	0698-7217	2	RESISTOR 162 2% .05W F TO=0+-100	24546	C3-1/8-TO-162R-G
A16R13	0698-7212	3	RESISTOR 100 2% .05W F TO=0+-100	24546	C3-1/8-TO-100R-G
A16R14	0698-7260		RESISTOR 10K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1002-G
A16R15	0698-0083	3	RESISTOR 1.96K 1% .125 F TO=0+-100	24546	C3-1/8-TO-1961-F
A16R16	0698-7280	2	RESISTOR 31.6 2% .05W F TO=0+-100	24546	C3-1/8-TO-31R6-G
A16R17	0698-7221	2	RESISTOR 237 2% .05W F TO=0+-100	24546	C3-1/8-TO-237R-G
A16R18	0698-7260		RESISTOR 10K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1002-G
A16R19	0698-7200		RESISTOR 31.6 2% .05W F TO=0+-100	24546	C3-1/8-TO-31R6-G
A16R20	0698-7221		RESISTOR 237 2% .05W F TO=0+-100	24546	C3-1/8-TO-237R-G
A16R21	0698-7260		RESISTOR 10K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1002-G
A16R22	0698-7217		RESISTOR 162 2% .05W F TO=0+-100	24546	C3-1/8-TO-162R-G
A16R23	0698-7212		RESISTOR 100 2% .05W F TO=0+-100	24546	C3-1/8-TO-100R-G
A16R24	0698-7209	1	RESISTOR 75 2% .05W F TO=0+-100	24546	C3-1/8-TO-750R-G
A16R25	0698-0083		RESISTOR 1.96K 1% .05W F TO=0+-100	24546	C3-1/8-TO-1961-F
A16R26	0698-7213	3	RESISTOR 110 2% .05W F TO=0+-100	24546	C3-1/8-TO-110R-G
A16R27	2100-2633	1	RESISTOR TRMR 1K 10% .C SIDE-ACJ 17-TURN	30983	ET050X102
A16R28	0698-0083		RESISTOR 1.96K 1% .05W F TO=0+-100	16299	C3-1/8-TO-1961-F
A16R29	0698-7213		RESISTOR 110 2% .05W F TO=0+-100	24546	C3-1/8-TO-110R-G
A16R30	0698-7219	2	RESISTOR 196 2% .05W F TO=0+-100	24546	C3-1/8-TO-196R-G
A16R31	0698-7236		RESISTOR 1K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1001-G
A16R32	0698-7248	2	RESISTOR 3.16K 2%.05W F TO=0+-100	24546	C3-1/8-TO-3161-G
A16R33	0698-7219		RESISTOR 196 2% .05W F TO=0+-100	24546	C3-1/8-TO-196R-G
A16R34	0698-7243	1	RESISTOR 1.96K.05W F TO=0+-100	24546	C3-1/8-TO-1961-G
A16R35	0757-0418	1	RESISTOR 619 1% .125W F TO=0+-100	24546	C3-1/8-TO-619R-F
A16R36	2100-3123	1	RESISTOR TRMR 1K 10% .C SIDE-ACJ 17-TURN	24546	3006P-1-501
A16R37	0757-0421	1	RESISTOR 825 1% .125W F TO=0+-100	24546	C3-1/8-TO-825R-F
A16R38	0698-7213		RESISTOR 110 2% .05W F TO=0+-100	24546	C3-1/8-TO-110R-G
A16R39	0698-7233	1	RESISTOR 750K 2% .05W F TO=0+-100	24546	C3-1/8-TO-750R-G
A16R40	0698-7202	2	RESISTOR 38.3 2% .05W F TO=0+-100	24546	C3-1/8-TO-383R-G
A16R41	0698-7202		RESISTOR 38.3 2% .05W F TO=0+-100	24546	C3-1/8-TO-383R-G
A16R42	0757-0280	1	RESISTOR 1K 1% .05W F TO=0+-100	24546	C3-1/8-TO-1001-G
A16R43	0698-212		RESISTOR 100 2% .05W F TO=0+-100	24546	C3-1/8-TO-100R-G
A16R44	0698-7236		RESISTOR 1K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1001-G
A16R45	0698-0085	1	RESISTOR 2.61K 1% .05W F TO=0+-100	24546	C3-1/8-TO-2611-F
A16R46	0698-7195		RESISTOR 19.6 2% .05W F TO=0+-100	24546	C3-1/8-TO-196R-G
A16R47	0698-7188	2	RESISTOR 10 2% .05W F TO=0+-100	24546	C3-1/8-TO-10R-G
A16R48	0698-7188	2	RESISTOR 10 2% .05W F TO=0+-100	24546	C3-1/8-TO-10R-G
A16R49	0698-7236		RESISTOR 1K 2% .05W F TO=0+-100	24546	C3-1/8-TO-1001-G
A16R50	0698-7248		RESISTOR 3.16K 2% .05W F TO=0+-100	24546	C3-1/8-TO-3161-G
A16R51	0698-7195		RESISTOR 19.6 2% .05W F TO=0+-100	24546	C3-1/8-TO-196R-G
A16RT1	0839-0004	1	THERMISTOR NEG TO 2K BEAD	83196	32A3
A16TP1	0360-0124	2	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A16TP2	0360-0124	2	TERMIANL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
A16U1	1858-0032	1	IC CA3146E XSTR ARRAY	02735	CA3146E
A16VR1	1902-0554	1	DIODE-ZNR 10V 5% DO-15 PD-1W TO-+.06%	28480	1902-0554
A16VR2	1902-0579	1	DIODE-ZNR 5.11V 5% DO-15 PD-1W TO--.009	28480	1902-0579
			A16 MISCELLANEOUS		
	4040-0748	1	EXTRACTOR -PC BD REG POLYC .062-BD-THNKS	28480	4040-0748
	1480-0073	2	PIN DRIVE 0.250M LG	00000	OBD
	4040-0750	1	EXTRACTOR-PC BD REG POLYC .062-BD-THNKS	28480	4040-0750
	1480-0073	1	PIN DRIVE 0.250M LG	00000	OBD
A17	86603-60042	1	PHASE MODULATOR ASSEMBLY	28480	86603-60042
A17C1	0160-4304	4	CAPACITOR-FXD 10PF +-10% 100WVDC CER	28480	0160-4304
A17C2	0160-4304		CAPACITOR-FXD 10PF +-10% 100WVDC CER	28480	0160-4304
A17C3	0160-4304		CAPACITOR-FXD 10PF +-10% 100WVDC CER	29480	0160-4304
A17C4	0160-4304		CAPACITOR-FXD 10PF +-10% 100WVDC CER	28480	0160-4304
A17CR1	0122-0074	2	DIODE-WC.7PF 10% CO/C25-MIN-4 BVR-40V	96341	MA45644
A17CR2	0122-0074		DIODE-WC.7PF 10% CO/C25-MIN-4 BVR-40V	96341	MA45644
A17J1	1250-1194	1	CONNECTOR-RF SM-SLD M SGL-HOLE-FR 50OHM	28480	1250-1194
A17P1	1250-0563	2	CONNECTOR-RF SMA M 4 HOLE FLG FR	28480	1250-0563
A17P2	1250-0563		CONNECTOR-RF SMA M 4 HOLE FKLG FR	28480	1250-0563
			A17 MISCELLANEOUS		
	86603-00004	1	COVER, PHASE MODULATOR HOUSING	28480	86603-00004
	86603-20011	1	HOUSING. PHASE MODULATOR	28480	86603-20011

See introduction to this section for ordering information

Section 6

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	86602-00006	1	Support, Bottom	28480	86602-00006
	86602-00007	1	Panel, Front (OPTION 001 ONLY)	28480	86602-00007
	86602-20019	2	Plate, Front Support	28480	86602-00019
	86603-20028		Plate, Rear Support	28480	86603-20028
	86602-20028	2	Guide, Connector	28480	86602-20028
	86603-00001	1	Support, Right Front	28480	
	86603-00002	1	Support, Right Rear	28480	86603-0001
	86603-00003	1	Support, Mixer	28480	86603-00002
	86603-00008	1	Support, Left	28480	86603-00008
	86602-20041	1	Window (EXCEPT OPTION 002)	28480	86602-20041
	86602-20042	1	Window (OPTION 002 ON LY)	28480	86602-20042

Table 6-3. Code List of Manufacturers

Mfr Code	Manufacturer Name	Address	Zip Code
00000	U.S.A. COMMON	ANY SUPPLIER OF THE U.S.A.	
007119	AMP INC	HARRISBURG PA	17105
0086S	STETTNER-TRUSH INC	CAZENOVIA NY	13035
01121	ALLEN-BRAULEY Co	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SENICONO CMPNT DIV	DALLAS TX	75231
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03888	PYROFILM CORP	WHIPPANY NJ	07981
04713	NOTOROLA SEHICONDUCTOR PRODUCTS	PHOENIX AZ	8(008
06540	ANATOH ELEK HARDWARE DIV OF MITE	NEW ROCHELLE NY	10"L2
16299	CORNING GL wK ELEC CMPNT DIV	RALEIGH NC	27604
18324	SIGNETICS CORP	SUNNYVALE CA	94086
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	7606?
2K497	CABLEWAVE SYSTEMS INC	NORTH HAVEN CT	06473
24226	IGOANDA ELECTRONICS CORP	GOMANDA NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORO PA	16701
24931	SPECIALTY CONNECTOR CO INC	INDIANAPOLIS IN	46227
26654	VARADYNE INC	SANTA MONICA CA	90403
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
28480	HEWLETT-PACKARD CO CORPORATE NH	PALO ALTO CA	94304
30983	NEPCO/ELECTRA CORP	SAN DIEGO CA	92121
32171	MOOUTEC INC	NORWALK CT	06854
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS KA	01247
71002	BIRNBACK CO INC	FREEPORT LI NY	11520
71785	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VILLAGE IL	60007
73734	FEDERAL SCRE PROOUCTS CO	CHICAGO IL	60618
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN IL	60126
79727	C-W INDUSTRIES	WARMINSTER PA	18974
81312	WINCHESTER ELEK DIV LITTON INO INC	DAKVILLE CT	06779
90949	AMPHENOL SALES DIV OF BUNKER-RAHO	HAZELWOOD NO	63042
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601
95238	CONTINENTAL CONNECTOR CORP	WOODSIDE NY	11377
96341	MICROWAVE ASSOCIATES INC	BURLINGTON IA	01801
98291	SEALECTRO CORP	MAMARONECK NY	10544

Table 6-4.

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
CB33G5	01121	5905-00-485-2918	0698-0084	28480	5905-00-974-6073
ET50X502	19701	5905-01-013-2344	0698-0085	28480	5905-00-998-1814
GF126-0018	79727	5930-00-412-0939	0698-3154	28480	5905-00-891-4215
SN7400N	01295	5962-00-922-3138	0698-3155	28480	5905-00-976-3418
SN7404N	01295	5962-00-404-2559	0698-3157	28480	5905-00-433-6904
SN7420N	01295	5962-00-927-1567	0698-3159	28480	5905-00-407-0053
SN7432N	01295	5962-00-276-9929	0698-3260	28480	5905-00-998-1809
SN7474N	01295	5962-00-106-4287	0698-3403	28480	5905-00-469-2957
SN7483N	01295	5962-00-011-2762	0698-3405	28480	5905-00-405-3723
0140-0193	28480	5910-00-774-7319	0698-3430	28480	5905-00-420-7136
0160-0127	28480	5910-00-809-5484	0698-3440	28480	5905-00-828-0377
0160-2055	28480	5910-00-211-1611	0698-3442	28480	5905-00-489-6773
0160-2199	28480	5910-00-244-7164	0698-3447	28480	5905-00-828-0404
0160-2204	28480	5910-00-463-5949	0698-3450	28480	5905-00-826-3262
0160-2207	28480	5910-00-430-5675	0698-3453	28480	5905-00-078-1548
0160-2244	28480	5910-00-008-4451	0698-3455	28480	5905-00-407-0060
0160-2436	28480	5910-00-472-5005	0698-3486	28480	5905-00-998-1919
0160-2437	28480	5910-00-431-3956	0698-3495	28480	5905-01-042-5033
0160-3457	28480	5910-00-832-9122	0698-3498	28480	5905-00-478-2244
0160-3874	28480	5910-01-057-8163	0698-3510	28480	5905-00-407-0107
0160-3879	28480	5910-00-477-8011	0698-4002	28480	5905-00-009-4322
0160-4084	28480	5910-01-057-8158	0698-4482	28480	5905-00-407-0116
0180-0058	28480	5910-00-027-7069	0698-7188	28480	5905-00-138-7304
0180-0116	28480	5910-00-809-4701	0698-7195	28480	5905-00-161-8921
0180-0228	28480	5910-00-719-9907	0698-7200	28480	5905-00-161-8936
0180-0291	28480	5910-00-931-7055	0698-7212	28480	5905-00-138-7305
0180-0374	28480	5910-00-931-7050	0698-7216	28480	5905-00-138-7307
0180-1743	28480	5910-00-430-6017	0698-7229	28480	5905-01-009-7560
0180-2206	28480	5910-00-879-7313	0698-7233	28480	5905-00-160-5437
0360-0124	28480	5940-00-993-9338	0757-0159	28480	5905-00-830-6677
0698-0082	28480	5905-00-974-6075	0757-0198	28480	5905-00-830-6188
0698-0083	28480	5905-00-407-0052	0757-0276	28480	5905-00-479-4628

TABLE 6-4 (continued)

PART NUMBER—NATIONAL STOCK NUMBER
CROSS-REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
0757-0279	28480	5905-00-221-8310	1251-2034	28480	5935-00-267-2973
0757-0280	28480	5905-00-853-8190	1251-2262	28480	5935-01-026-0952
0757-0346	28480	5905-00-998-1906	1251-2293	28480	5999-00-477-1360
0757-0394	28480	5905-00-412-4036	1251-3087	28480	5999-01-029-9983
0757-0399	28480	5905-00-929-7774	150D104X9035A2	56289	5910-00-189-3178
0757-0401	28480	5905-00-981-7529	150D105X9035A2	56289	5910-00-421-8346
0757-0416	28480	5905-00-998-1795	150D106X9020B2	56289	5910-00-936-1522
0757-0418	28480	5905-00-412-4037	150D226X9015B2	56289	5910-00-807-7253
0757-0420	28480	5905-00-493-5404	150D685X9035B2	56289	5910-00-104-0145
0757-0438	28480	5905-00-929-2529	1820-0054	28480	5962-00-138-5248
0757-0439	28480	5905-00-990-0303	1820-0077	28480	5962-00-138-5250
0757-0441	28480	5905-00-858-6799	1820-0174	28480	5962-00-404-2559
0757-0442	28480	5905-00-998-1792	1820-0305	28480	5962-00-011-2762
0757-0443	28480	5905-00-891-4252	1826-0013	28480	5962-00-247-9568
0757-0465	28480	5905-00-904-4412	1826-0081	28480	5962-01-021-5220
0757-0482	28480	5905-00-857-0060	1853-0018	28480	5961-00-989-2747
0757-0817	28480	5905-00-909-1778	1853-0020	28480	5961-00-904-2540
0757-1060	28480	5905-00-405-8094	1853-0034	28480	5961-00-987-4700
0757-1094	28480	5905-00-917-0580	1853-0050	28480	5961-00-138-7314
0764-0013	28480	5905-00-931-6977	1853-0075	28480	5961-00-758-5355
0839-0004	28480	5905-00-539-2095	1853-0213	28480	5961-00-937-1409
08555-20093	28480	5999-00-008-8444	1853-0352	28480	5961-01-051-4015
08731-210	28480	5310-00-401-6934	1854-0023	28480	5961-00-998-1923
0960-0084	28480	5985-00-787-2899	1854-0071	28480	5961-00-137-4608
10/471	24226	5950-00-961-9600	1854-0221	28480	5961-00-836-1887
1120-0543	28480	6625-01-057-4031	1854-0247	28480	5961-00-464-4049
1200-0173	28480	5999-00-008-7037	1854-0295	28480	5961-00-493-0789
1250-0872	28480	5935-00-147-4284	1854-0345	28480	5961-00-401-0507
1250-0914	28480	5935-00-434-3040	1854-0361	28480	5961-00-400-5973
1250-1194	28480	5935-00-446-4102	1854-0404	28480	5961-00-408-9807
1250-1221	28480	5935-00-594-0720	1854-0457	28480	5961-01-055-4186
1250-1227	28480	5935-00-009-1329	1855-0020	28480	5961-00-105-8867

TABLE 6-4 (continued)

PART NUMBER --NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
1855-0081	28480	5961-00-350-8299	3006P-1-102	32997	5905-00-107-4881
1855-0082	28480	5961-00-442-9470	3006P-1-201	32997	5905-00-101-2350
1855-0327	28480	5961-00-107-2678	3006P-1-501	32997	5905-00-428-5335
1901-0025	28480	5961-00-978-7468	3100-3050	28480	5930-01-064-1150
1901-0033	28480	5961-00-821-0710	3101-0973	28480	5930-00-455-0120
1901-0047	28480	5961-00-929-7778	4040-0748	28480	5999-00-230-8834
1901-0050	28480	5961-00-914-7496	4040-0749	28480	6625-00-031-4796
1901-0179	28480	5961-00-853-7934	4040-0750	28480	5999-00-415-1213
1901-0539	28480	5961-00-577-0558	4040-0751	28480	5999-00-230-8835
1901-0639	28480	5961-00-787-3394	4040-0752	28480	5999-00-230-8832
1902-0041	28480	5961-00-858-7372	4040-0753	28480	5999-00-230-8836
1902-0554	28480	5961-00-918-7501	4040-0754	28480	5999-00-230-8837
1902-0579	28480	5961-00-452-0438	5040-0306	28480	5970-00-470-7622
1902-3002	28480	5961-00-252-1307	5080-0271	28480	5961-00-513-2726
1902-3036	28480	5961-00-350-2205	5086-7049	28480	5840-01-039-2123
1902-3139	28480	5961-00-494-4848	51-051-0000	98291	5935-00-539-1940
2-331677-9	00779	5935-01-017-6539	52-328-0019	98291	5935-00-506-7332
2N2218	04713	5961-00-985-2363	60373-2	00779	5999-00-173-3441
2N2218A	04713	5961-00-922-2944	86601-60109	28480	5895-01-037-5355
2N4236	04713	5961-00-937-1409	86602-20022	28480	5935-01-057-3785
2N4239	04713	5961-00-400-5973	86602-20044	28480	6625-01-063-5591
2N5179	04713	5961-00-401-0507	86602-60008	28480	6625-01-051-6623
2N5245	01295	5961-00-350-8299	86602-60035	28480	6625-01-040-0827
2100-2489	28480	5905-00-105-1774	86603-67003	28480	6625-01-028-9762
2100-2517	28480	5905-00-161-9090	9100-1629	28480	5950-00-430-6864
2100-2633	28480	5905-00-476-5796	9100-1640	28480	5950-00-765-2814
2100-3095	28480	5905-01-052-9092	9100-2247	28480	5950-00-405-3735
2100-3113	28480	5905-00-470-3420	9135-0009	28480	5915-01-039-0268
2100-3154	28480	5905-00-615-8111	9140-0105	28480	5950-01-009-9864
251-10-30-400	71785	5935-01-026-0952	9140-0144	28480	5950-00-837-6029
252-12-30-300	71785	5935-00-448-2236	9140-0158	28480	5950-00-059-5920
252-15-30-008	71785	5935-00-138-5209	9140-0210	28480	5950-00-431-3215
30D506G025CC2	56289	5910-00-247-2075	9140-0237	28480	5950-00-431-3216

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains manual change instructions for backdating this manual for HP M 86602B RF Sections that have serial number fixes that are lower than 1638A. This section contains modification suggestions and proceed that are recommended to improve the perform, and reliability of your instrument.

7-3. MANUAL CHANGES

7-4. To adapt this manual to your instrument, refer to Table 7-1 and make all of the ma changes listed opposite your instrument's serial prefix. The manual changes are listed in serial pre- fix sequence and should be made in the sequence listed. For example, Change A should be made after Change B; Change B should be made after Change C; etc. Table 7-2 is a summary of changes by component.

7-5. If your instrument's serial prefix is not listed on the title page of this manual or in Table 7-1, it may be documented in a MANUAL CHANGES supplement. For additional important information about serial number coverage, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes by Serial Number

Serial Prefix	Make Manual Changes
1433A, 1518A	E, D, C, B, A
1519A	E, D, C, B
1524A	E, D, C
1543A	E, D
1551A	E

Table 7-2. Summary of Changes by Component

Change	A9	A11	A13	A16	A17
A	R5,R6,R15, R16,R25,R26				
B			Assy Part No. & Parts List	Assy Part No. & Parts List	Assy Part No.
C					C4
D	R9,R10,R19, R20,R29, R39,R40				
E	U7				

7-6. MANUAL CHANGE INSTRUCTIONS

CHANGE A

Table 6-2:
Change A9R5, R6, R15, R16, R25, and R26 to 0811-2815 RESISTOR 1.5 OHM 5% 0.75W PW TC=0+-50.

Service Sheet 8:
Change the value of A9R5, R6, R15, R16, R25, and R26 to 1.5 OHM.

CHANGE B

Figure 5-4:
Replace with Figure 7-1.

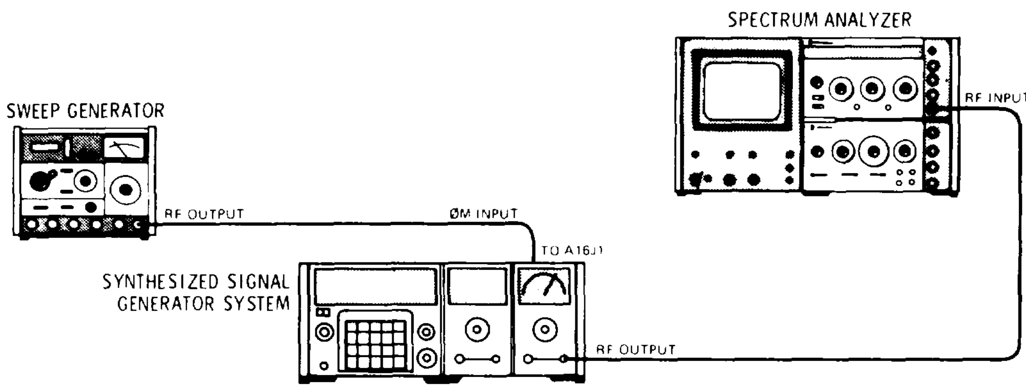


Figure 7-1. Phase Modulator Driver Frequency Response Adjustment Test Setup (Change B)

Paragraph 5-27, EQUIPMENT:
Delete Digital Voltmeter.
Change the PROCEDURE as follows:
3. Set the sweep generator controls as follows: sweep range to 110 MHz, frequency to 80 MHz, output level at -10 dBm, sweep video, and sweep mode free-slow.

6. Set the spectrum analyzer controls for center frequency of 1.05 GHz, frequency span per division 20 MHz, resolution bandwidth 300 kHz, input attenuation 30 dB, vertical sensitivity per division 10 dB, and sweep time per division 2 ms.

7. Adjust the sweep generator output level so the sidebands are approximately 34 dB below the carrier level.

8. Set the spectrum analyzer vertical sensitivity per division to 2 dB.

9. Adjust the Frequency Response control (A16C8) for maximum flatness within 40 MHz of the carrier and for the minimum peaking at 80 MHz.

10. Disconnect the sweep generator from the A16 Assembly and set the signal generator LINE switch to STBY.

11. Carefully remove the RF Section. Be careful not to damage the cables. Reconnect W12 to A16J1.

Figure 5-5A:
Change the reference "step 13" to "step 15" in two places.

CHANGE B (Cont'd)

Paragraph 5-28A:

Change the last sentence of step 2 to "Be sure to use the correct test oscillator output and the correct low pass filter."

Paragraph 5-28A:

Replace steps 8 through 15 with the following:

8. Step the System Under Test center frequency down 1 Hz to 99.999999 MHz. The carrier and first sidebands should be within 0.5 dB. If the difference is less than or equal to 0.4 dB, proceed to step 11. If the difference is greater than 0.5 dB and if the OM deviation is <82° (first sideband is of lower amplitude than the carrier) proceed to step 9. If the OM deviation is >82° proceed to step 10.

9. Adjust A16R4 one-eighth turn cw. If A16R4 is in contact with the ccw stop, increase the value of A16R5. (The normal value range is 10 to 316Q.) Set the frequency of the System Under Test to 100 MHz and repeat steps 7 and 8.

10. Adjust A16R4 one-eighth turn cw. If A16R4 is in contact with the cw stop, decrease the value of A16R5. (The normal value range is 10 to 316f.) Set the frequency of the System Under Test to 100 MHz and repeat steps 7 and 8.

11. Set the FM discriminator controls for the 10 MHz range and the 0.1V sensitivity, and insert an internal 1 MHz low-pass filter.

12 Set the spectrum analyzer controls for a center frequency of 200 kHz, resolution bandwidth to 3 kHz, frequency span per division to 50 kHz, input attenuation to 0 dB, log reference level to a convenient level, vertical sensitivity per division to 10 dB, and scan time per division to 10 ms.

13. Set the Reference System controls for a center frequency of 309 MHz and an output level of +7 dBm.

14. Set the System Under Test center frequency to 300 MHz with a modulation level of 100° as read on the front panel meter.

15. Refer to Figure 5-5A and connect the System Under Test OUTPUT to the "RF" input of the mixer. Connect the FM Discriminator output to the spectrum analyzer RF input.

16. Adjust the spectrum analyzer's reference level control so the peak of the fundamental 100 kHz signal is viewed on the CRT display at the log reference graticule line.

17. Adjust A16R3 to null the second harmonic level; adjust A16R1 to null the third harmonic level.

NOTE

Observing harmonic distortion of a OM signal after passing it through an FM discriminator results in an increase in level of 6 dB per octave. Therefore, the second harmonic will be 6 dB higher and the third harmonic 9.5 dB higher than with a phase demodulator.

Paragraph 5-28A:

Replace steps 16 through 23 with the following:

18. Step the System Under Test center frequency down 1 Hz. Note the direction and amount of re- adjustment of A16R3 and R1 necessary to null the second and third harmonics.

CHANGE B (Cont'd)

Paragraph 5-28A (cont'd)

19. Set A16R3 and Ri for the best compromise (minimum second and third harmonic levels) at both center frequency settings of 299.999999 and 300 MHz.

20. Repeat steps 4 through 20 until all the conditions below are met without further adjustment.

    a Carrier and first sidebands are equal within 0.5 dB when changing Center Frequency of System Under Test between 100 and 99.999999 MHz (Steps 7-8).

    b. Second harmonic levels are equal within 4 dB or >40 dB down from the fundamental as indicated by the spectrum analyzer at center frequencies of 300 and 299.999999 MHz (Step 19).

    c. Third harmonic levels are equal within 4 dB or>35 dB down from the fundamental as indicated by the spectrum analyzer frequencies of 300 and 299.999999 MHz (Step 19).

21. Replace the mainframe cover and wait 10 minutes. Check to see if the conditions outlined in step 21 are still met. If not repeat steps 4 through 21.

Figure 5-5B:
Change the reference "step 11" to "step 13".

Figure 5-28B:
Change the second sentence of step 2 to "Be sure to use the correct test oscillator output and the correct low pass filter."

Paragraph 5-28B:
Replace steps 8 through 21 with the following:

8. Step the System Under Test center frequency down 1 Hz to 99.999999 MHz. The carrier and first sidebands should be within 0.5 dB. If the difference is less than or equal to 0.5 dB, proceed to Step 11. If the difference is greater than 0.5 dB and if the OM deviation is <82° (first sideband is of lower amplitude than the carrier) proceed to Step 9. If the OM deviation is >82° proceed to Step 10.

9. Adjust A16R4 one-eighth turn ccw. If A16R4 is in contact with the ccw stop, increase the value of A16R5. (The normal value range is 10 to 316 ohms.) Set the frequency of the System Under Test to 100 MHz and repeat Steps 7 and 8.

10. Adjust A16R4 one-eighth turn cw. If A16R4 is in contact with the cw stop, decrease the value of A16R5. (The normal value range is 10 to 316 ohms.) Set the frequency of the System Under Test to 100 MHz and repeat Steps 7 and 8.

11. Set the spectrum analyzer controls for a center frequency of 2 MHz, resolution bandwidth to 30 kHz, frequency span per division to 0.5 MHz, input attenuation to 0 dB, log reference level to a convenient level, vertical sensitivity per division to 10 dB, and scan time per division to 10 ms.

12. Set the System Under Test center frequency to 300 MHz with a modulation level of 100° as read on the front panel meter.

13. Connect the phase modulation test set between the signal generator output and the spectrum analyzer input as shown in Figure 5-5B.

14. Adjust the spectrum analyzer's reference level so the peak of the fundamental 1 MHz signal is viewed on the CRT display at the log reference graticule line.

CHANGE B (Cont'd)

15. Adjust A16R3 to null the second harmonic level; adjust A16R1 to null the third harmonic level.

16. Step the System Under Test center frequency down 1 Hz. Note the direction and amount of read- injustment of A16R3 and R1 necessary to null the second and third harmonics.

17. Set A16R3 and R1 for the best compromise (minimum second and third harmonic levels) at both center frequency settings of 299.999999 and 300 MHz.

18. Repeat steps 4 through 20 until all the conditions below are met without further adjustment.

    a. Carrier and first sidebands are equal within 0.5 dB when changing Center Frequency of System Under Test between 100 and 99.999999 MHz (Steps 7-8).

    b. Second harmonic levels are equal within 4 dB or >40 dB down from the fundamental at center frequencies of 300 and 299.999999 MHz (Step 17).

    c. Third harmonic levels are equal within 4 dB or >35 dB down from the fundamental at center frequencies of 300 and 299.999999 MHz (Step 17).

19. Replace the mainframe cover and wait 10 minutes. Check to see if the conditions outlined in Step 18 are still met. If not, repeat steps 4 through 19.

Table 6-2:

Change A13 to 86601-60039 ATTENUATOR ASSY (except Option 001).

Replace the A16 Assembly parts list with the one in this change.

Figure 8-12:

Replace with Figure 7-2.

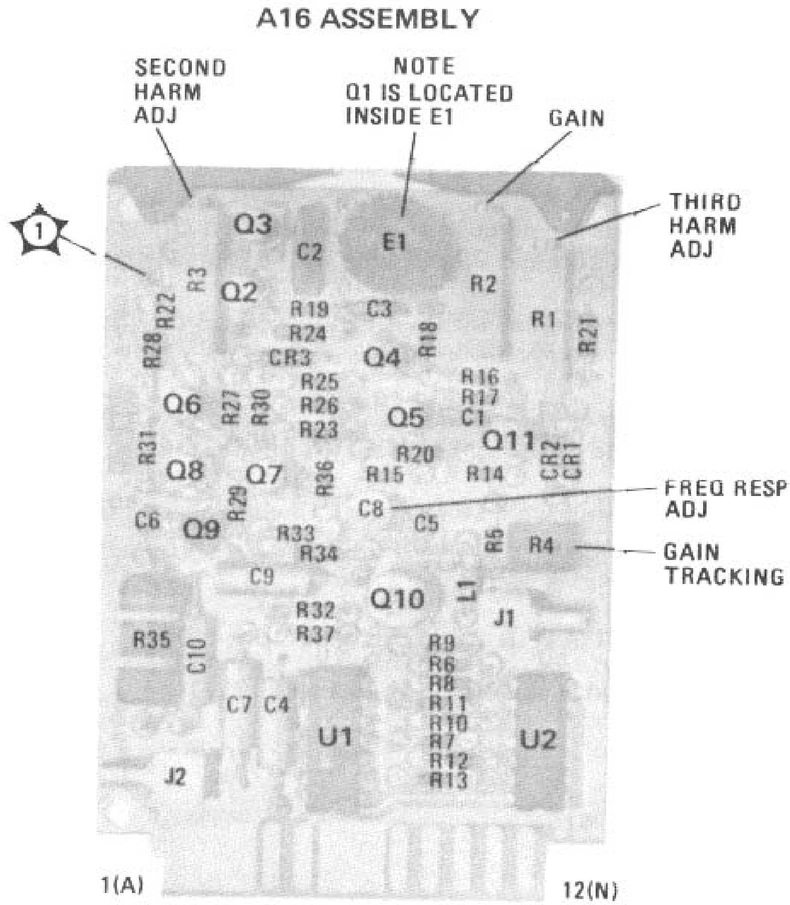


Figure 7-2. A16 Phase Modulator Driver Assembly Component and Test Point Locations (Change B

Table 7-3. P/O Table 6-2. Replaceable Parts (P/O Change B)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16	86603-60002	1	PHASE MODULATOR DRIVER ASSY (OPTION 002 ONLY)	28480	86603-60002
A16C1	0160-4247		CAPACITOR-FXD	28480	0160-4247
A16C2	0160-0127	1	CAPACITOR-FXD	28480	0160-0127
A16C3	0160-4247		CAPACITOR-FXD	28480	0160-4247
A16C4	0180-0374	4	CAPACITOR-FXD	56289	150D106X9020B2
A16C5	0160-3874	1	CAPACITOR-FXD	28480	0160-3874
A16C6	0160-3879	1	CAPACITOR-FXD	28480	0160-3879
A16C7	0180-0228	2	CAPACITOR-FXD	56289	150D106X9010B2
A16C8	0121-0447	1	CAPACITOR-FXD	00865	5S-TRIKO-04
A16C9	0180-0374		CAPACITOR-FXD	56289	150D106X9020B2
A16C10	0180-0228		CAPACITOR-FXD	56289	150D106X9010B2
A16CR1	1901-0179	2	DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A16CR2	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A16CR3	1901-0033	1	DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A16E1	0410-0184	1	OVEN: COMPONENT	01295	5ST1-2
A16J1	1250-1377	2	CONNECTOR-RF SMB FEM PC	2K497	700214
A16J2	1250-1377		CONNECTOR-RF SMB FEM PC	2K497	700214
A16L1	9140-0158	1	COIL-FXD MOLDED RF CHOKE 1UH 10%	24226	10/101
A16Q1	1855-0327	1	TRANSISTOR J-FET 2N4416 N-CHAN D-MODE	01295	2N4416
A16Q2	1854-0023	2	TRANSISTOR NPN SI TO-18 PD-360MW	28480	1854-0023
A16Q3	1853-0050	1	TRANSISTOR PNP SI TO-18 PD-360MW	28480	1853-0050
A16Q4	1853-0018	2	TRANSISTOR PNP SI TO-72 PD-200MW FT-1GHZ	28480	1853-0018
A16Q5	1853-0018		TRANSISTOR PNP SI TO-72 PD-200MW FT-1GHZ	28480	1853-0018
A16Q6	1854-0345	2	TRANSISTOR PNP 2N5179 SI TO-72 PD-200MW	04713	2N5179
A16Q7	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD-200MW	04713	2N5179
A16Q8	1853-0034	1	TRANSISTOR NPN SI TO-18 PD-360MW	28480	1853-0034
A16Q9	1855-0081	1	TRANSISTOR J-FET 2N5245 N-CHAN D-MODE SI	01295	2N5245
A16Q10	1854-0247	1	TRANSISTOR NPN SI TO-39 PD-1W FT-800MW	28480	1854-0247
A16Q11	1854-0023		TRANSISTOR NPN SI TO-18 PD-360MW	28480	1854-0023
A16R1	2100-3123	1	RESISTOR-TRMR 500 10% C SIDE -ADJ 17-TURN	28480	3006P-1-501
A16R2	2100-3095	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006P-1-201
A16R3	2100-3154	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-102
A16R4	2100-2633		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TURN	32997	ET50X102
A16R5	0698-7216	1	RESISTOR 147 2% .05W F TO-0+-100	30983	C3-1/8-TO-1002-G
A16R6	0698-7260	4	RESISTOR 10K 2% .05W F TO-0+-100	24546	C3-1/8-TO-8251-G
A16R7	0698-7258	1	RESISTOR 8.25K 2% .05W F TO-0+-100	24546	C3-1/8-TO-1002-G
A16R8	0698-7260		RESISTOR 10K 2% .05W F TO-0+-100	24546	C3-1/8-TO-3831-G
A16R9	0698-7250	1	RESISTOR 3.83K 2% .05W F TO-0+-100	24546	C3-1/8-TO-1002-G
A16R10	0698-7260		RESISTOR 10K 2% .05W F TO-0+-100	24546	C3-1/8-TO-1961-G
A16R11	0698-7243	1	RESISTOR 1.96K 2% .05W F TO-0+-100	24546	C3-1/8-TO-1002-G
A16R12	0698-7260		RESISTOR 10K 2% .05W F TO-0+-100	24546	C3-1/8-TO-1001-G
A16R13	0698-7236		RESISTOR 1K 2% .05W F TO-0+-100	24546	C3-1/8-TO-2151-G
A16R14	0698-7244	3	RESISTOR 2.15K 2% .05W F TO-0+-100	24546	C3-1/8-TO-2151-G
A16R15	0698-7244	3	RESISTOR 2.15K 2% .05W F TO-0+-100	24546	C3-1/8-TO-2151-G
A16R16	0698-7244		RESISTOR 2.15K 2% .05W F TO-0+-100	24546	C3-1/8-TO-196R-
A16R17	0698-7219	2	RESISTOR 196 2% .05W F TO-0+-100	24546	C3-1/8-TO-196R-G
A16R18	0698-7219		RESISTOR 196 2% .05W F TO-0+-100	24546	C3-1/8-TO-3161-G
A16R19	0698-7248	1	RESISTOR 3.16K 2% .05W F TO-0+-100	24546	C3-1/8-TO-619RG
A16R20	0757-0418	2	RESISTOR 619 1% .05W F TO-0+-100	24546	C3-1/8-TO-619R-G
A16R21	0757-0418		RESISTOR 619 1% .05W F TO-0+-100	24546	C3-1/8-TO-1961-G
A16R22	0698-0083		RESISTOR 1.96K 1% .05W F TO-0+-100	16299	C3-1/8-TO-100R-G
A16R23	0698-7212	4	RESISTOR 100 2% .05W F TO-0+-100	24546	C3-1/8-TO-511R-F
A16R24	0757-0416		RESISTOR 511 1% .05W F TO-0+-100	24546	C3-1/8-TO-100R-F
A16R25	0698-7212		RESISTOR 100 2% .05W F TO-0+-100	24546	C3-1/8-TO-1001-F
A16R26	0698-7236		RESISTOR 1K 2% .05W F TO-0+-100	24546	C3-1/8-TO-10R-G
A16R27	0698-7188	2	RESISTOR 10 2% .05W F TO-0+-100	24546	C3-1/8-TO-1001-F
A16R28	0757-0280		RESISTOR 1K 1% .05W F TO-0+-100	24546	C3-1/8-TO-100R-G
A16R29	0698-7212		RESISTOR 100 2% .05W F TO-0+-100	24546	C3-1/8-TO-10R-G
A16R30	0698-7188		RESISTOR 10 2% .05W F TO-0+-100	24546	C3-1/8-TO-19R6-G
A16R31	0698-7195	3	RESISTOR 19.6 2% .05W F TO-0+-100	24546	C3-1/8-TO-19R6-G
A16R32	0698-7195		RESISTOR 19.6 2% .05W F TO-0+-100	24546	C3-1/8-TO-100R-G
A16R33	0698-7212		RESISTOR 100 2% .05W F TO-0+-100	24546	C3-1/8-TO-1001-G
A16R34	0757-0280		RESISTOR 1K 1% .05W F TO-0+-100	24546	C3-1/8-TO-390R-F
A16R35	0698-3633	1	RESISTOR 390 2% .05W F TO-0+-100	24546	FP42-2-TOO-390R-J
A16R36	0698-7236		RESISTOR 1K 2% .05W F TO-0+-100	24546	C3-1/8-TO-1001-G
A1637	0698-7195		RESISTOR 19.6 2% .05W F TO-0+-100	24546	C3-1/8-TOO-19R6-G
A16U1	1858-0032	1	IC CA3146E XSTR ARRAY	02735	CA3146E
A16U2	1820-0174		IC SN74 04 N INV	01295	SN7404N
			A16 MISCELLANEOUS		
	1200-0173	1	INSUALTOR-XSTR TO-5 .075-THK	28480	1200-0173
	1480-0073		PIN: DRIVE 0.250" LG	00000	OBD
	4040-0748	1	EXTRACTOR-PC BD BLK POLYC .062-BD-THKNS-	28480	4040-0748
	4040-0750	1	EXTRACTOR -PC BD-RED POLYC .062-BD-THKNS	28480	4040-0750

See introduction to this section for ordering information

Table 7-3. P/O Table 6-2 Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A17	86603-60019	1	PHASE MODULATOR ASSY (O\0 PT. 002 ONLY)	28480	86603-60019
	86603-00004	1	COVER, PHASE MODULATOR HOUSING	28480	86603-00004
	86603-200011	1	HOUSING, PHASE MODULATOR	28480	86603-20011
A17J1	1250-1194		CONNECTOR-RF SM-SLD M SGL-HOLE-FR 50 OHM	28480	1250-1194
A17P1	1250-0563	2	CONNECTOR-RF SMA M 4 HOLE FLG FR	28480	1250-0563
A17P2	1250-0563		CONNECTOR-RF SMA M 4 HOLE FLG FR	28480	1250-0563
A17A1	86603-60003	1	PHASE MODULATOR BOARD ASSY	28480	86603-60003
A17A1C1	0160-0559	3	CAPACITOR-FXD 10PF+-10% 100WVDC CER	28480	0160-0559
A17A1C2	0160-0559		CAPACITOR-FXD 10PF+-10% 100WVDC CER	28480	0160-0559
A17A1C3	0160-0559		CAPACITOR-FXD 10PF+-10% 100WVDC CER	28480	0160-0559
A17A1CR1	0122-0074	2	DIODE VVC.7PF 10% CO/C25-MIN=4 BVR=40V	96341	MA45644
A17A1CR2	0122-0074		DIODE VVC.7PF 10% CO/C25 MIN=4 BVR=40V	96341	MA45644

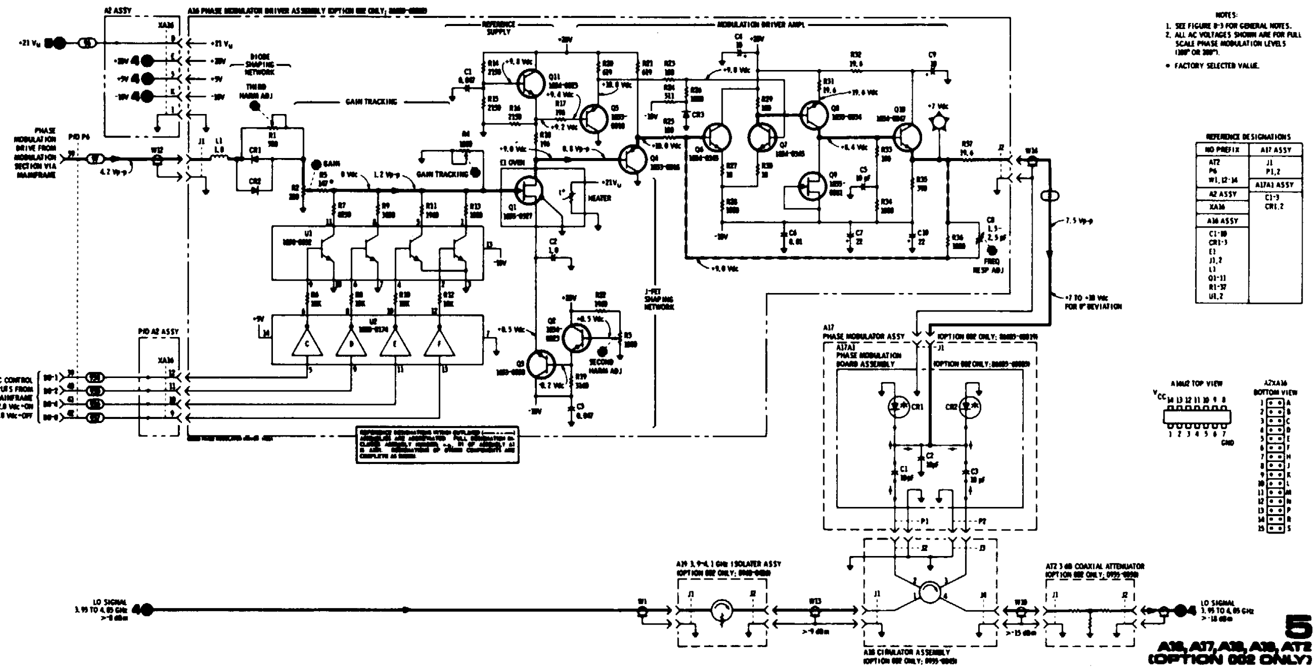


Figure 7-3. Phase Modulation Section Schematic Diagram (Option 002) (Change B)

CHANGE C

Page 6-12, Table 6-2:

Change:

A17C1 to A17A1C1
A17C2 to A17AlC2
A17C3 to A17AlC3
A17CR1 to A17AlCR1
A17CR2 to A17AlCR2

Add A17A1, 86603-60003, 1, PHASE MODULATOR BOARD ASSY, 28480, 86603-60003.

Delete A17C4.

Figure 8-13:

Replace with Figure 7-4.

A17 ASSEMBLY

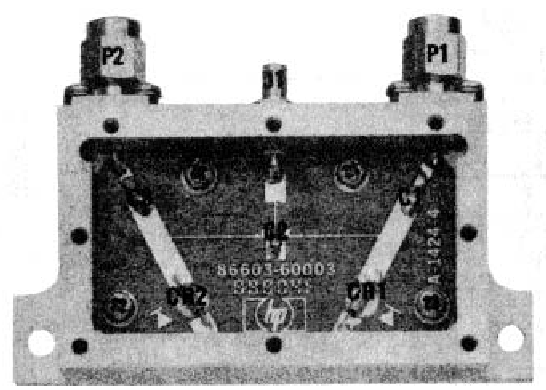


Figure 7-4. A17 Phase Modulator Assembly Component Locations (Change C)

CHANGE C (Cont'd)

Figure 8-14:

Change the diagram as shown in the partial schematic, Figure 7-5:

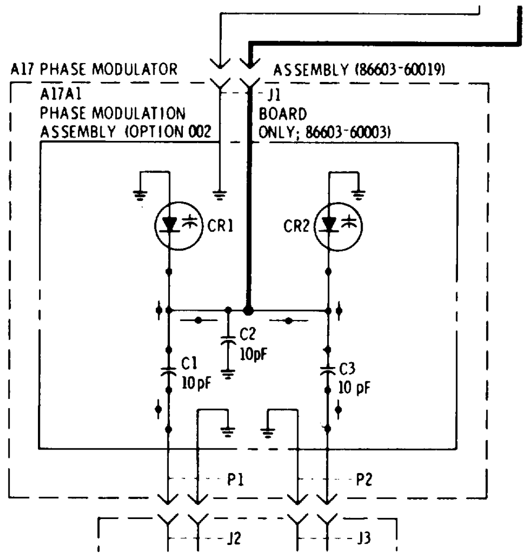


Figure 7-5. P/O Phase Modulation Section Schematic Diagram (Change C)

CHANGE D

Table 6-2:

Add A9R9, R10, R19, R20, R29, R30, R39, R40 0698-4002 RESISTOR 5K 1% 125W.

Figure 8-21:

Mark the locations of:

R29, 30 between Q1 and Q2
R19, 20 between Q7 and Q8
R39, 40 between Q13 and Q14
R9, 10 between Q19 and Q20

Figure 8-22:

Change the schematic as shown in Figure 7-6.

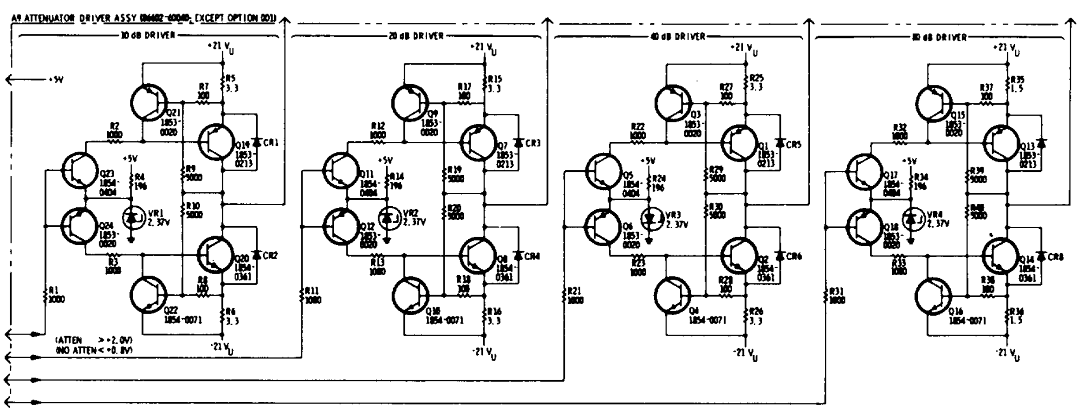


Figure 7-6. P/O Attenuator Section Schematic Diagram (Change D)

CHANGE E

Table 6-2:

Change A11U7 to 1820-0639 IC MC 4001P CONV.

Service Sheet 9:

Change the schematic as shown in Figure 7-7.

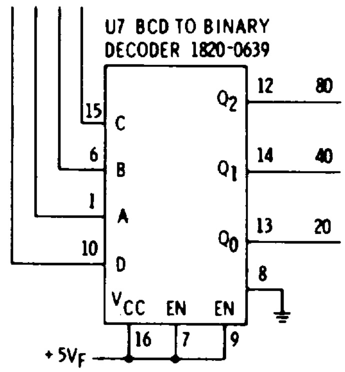


Figure 7-7. P/O All Logic Assembly Schematic Diagram (Change E)

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section contains troubleshooting and repair information for the RF Section plug-in. Safety of technical personnel is considered. Circuit operation and troubleshooting on system, plug-in and assembly levels is provided.

8-3. The service sheets normally include principles of operation and troubleshooting information, a component location diagram, and a schematic, all of which apply to a specific portion of circuitry within the instrument.

8-4. Information related to operation of the RF Section plug-in as part of the 8660-series Synthesized Signal Generator System is provided in Service Sheet 1.
8-5. Service Sheets 2 and 3 include an overview of RF Section operation, troubleshooting on an assembly or stage level, and a troubleshooting block diagram. The block diagrams also serve as an index for the remaining service sheets.

8-6. The Schematic Diagram Notes, Figure 8-3, aid in interpreting the schematics.

8-7. The last foldout in the manual includes a table which cross-references all pictorial and schematic locations of each assembly, chassis mounted component, and adjustable component. The figure is a pictorial representation of the RF Section and shows location of the aforementioned parts.

8-8. SAFETY CONSIDERATIONS

8-9. Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition (see Sections II, III, and V). Service and adjustments should be performed only by qualified service personnel.

8-10. Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

8-11. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

WARNING

The service information is often used with power supplied and protective covers removed from the instrument. Energy available at many points may constitute a shock hazard.

8-12. PRINCIPLES OF OPERATION

8-13. The Principles of System Operation ex-plains how the RF Section operates within the Synthesized Signal Generator System, i.e., how other sections affect the RF Section and in turn how they are affected by the RF Section. Control functions in both local and remote modes are also explained.

8-14. Service Sheet 1 includes a block diagram and an explanation of system operation with respect to the RF Section.

8-15. Overall operation of the RF Section is discussed in Service Sheet 2 and 3. The remaining service sheets are concerned only with sections and/or circuit assemblies within the RF Section plug-in.

8-16. TROUBLESHOOTING

NOTE

When a malfunction occurs, refer to Section VIII of the HP Model 8660-series mainframe Operating and Service Manual to begin troubleshooting (System Troubleshooting Guide). Then, if that information indicates possible problems in the RF Section, refer to the Systems Troubleshooting information in Service Sheet 1. This information may be used to isolate the defect to the RF Section, another plug-in, or the main-frame. If the problem is in this plug-in, turn to Service Sheet 2 for further troubleshooting information.

8-17. System Troubleshooting

8-18. The System Troubleshooting information in Section VIII of the HP 8660-series mainframe manual should be used when first attempting to isolate a circuit defect. If the defect cannot be isolated to an individual instrument in the system the technician is normally directed to the System Troubleshooting in the RF Section manual (Service Sheet 1). The problem may then be isolated to the RF Section, Modulation Section, Frequency Extension Module, or the mainframe.

8-19. RF Section Troubleshooting

8-20. When the defect has been isolated to the RF Section, refer to Service Sheet 2. This information is used to isolate the problem to a section or assembly.

8-21. Troubleshooting Aids

8-22. Circuit Board Aids. Test points are physically located on the circuit boards as metal posts or circuit pads and usually have either a reference designator (such as TP1) or a label which relates to the function (AM, Pulse, ID, etc.). Transistor emitters, diode cathodes, the positive lead of electrolytic capacitors, and pin 1 of integrated circuits are indicated by a variety of symbols such as E, a diode symbol, +, and a tear-drop shape respectively. Also, a square circuit pad (as opposed to the round pad) may be used in place of any of the previously mentioned symbols.

8-23. Service Sheet Aids. RF levels, ac voltages and dc voltages are often shown on schematic diagrams. Integrated circuit connection diagram plus diagrams of relays and printed circuit connectors help to locate specific inputs and outputs Notes are used to explain certain circuits or mechanical configurations not easily shown on the schematic.

8-24. The locations of individual component mounted on printed circuit boards are found or individual service sheets on the pictorial representation of the circuit boards. Chassis mounted parts, major assemblies, and adjustable component locations are found on the last foldout in this manual.

8-25. Table 8-3, Schematic Diagram Notes, provides information relative to symbols and value shown on the schematic diagrams.

8-26. Service Kit and Extender Boards. The HP 11672A Service Kit contains interconnect cables, RF cables, various coaxial adaptors, and an adjustment tool, all of which are useful in servicing the RF Section plug-in. Refer to the HP 11672A Operating Note for a listing and pictorial representation of the contents. A list of the service kit contents is also found in the Test Equipment and accessories list in Section I of the mainframe manual.

8-27. 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. Refer to the list found under Accessories Supplied in Section I of the mainframe manual.

8-28. RECOMMENDED TEST EQUIPMENT

8-29. Table 1-2 lists the test equipment and accessories recommended for use in servicing the instrument. If any of the recommended test equipment is unavailable, instruments with equivalent specifications may be used.
See Appendix B, Section III.

8-30. REPAIR

8-31. General Disassembly Procedures

8-32. Procedures for removing the RF Section plug-in from the mainframe and the covers from the plug-in are found on the left-hand foldout page immediately preceding the last foldout in the manual.

8-33. The machine screws used throughout the plug-in have a Pozidriv head. Pozidriv is very similar in appearance to the Phillips head, but using a Phillips screwdriver may damage the Pozidriv screw head.

8-34. Non-Repairable Assemblies

8-35. Repairs should not be attempted on the following assemblies if any is found to be defective during troubleshooting:

A5 Modulator Assembly
A6 1-1300 MHz Amplifier Assembly
A8 4 GHz Amplifier Assembly
A13 Attenuator Assembly
A15 20 MHz Amplifier Assembly
A18 Circulator Assembly
A19 3.9 - 4.1 GHz Isolator Assembly
AT1 Isolator
AT2 3 dB Attenuator
FL1 4 GHz Band Pass Filter

8-36. Module Exchange Program

8-37. Only the A13 Attenuator is available as restored assembly. It may be ordered as a replacement under the Module Exchange Program. Refer to Section VI for ordering information.

8-38. Repair Procedures

8-39. LO Signal Circuits Repair Procedure. Refer to Figure 8-1. This procedure is used in conjunction with Service Sheet 2 for isolating circuit defect which are evident as a phase modulation problem or an incorrect LO signal level (option 002 instruments only). Perform the procedure if one of the following components is suspected of being defective: W1, W2, W10, W13, W14, A7, A8, A17, A1 A19, or AT2.

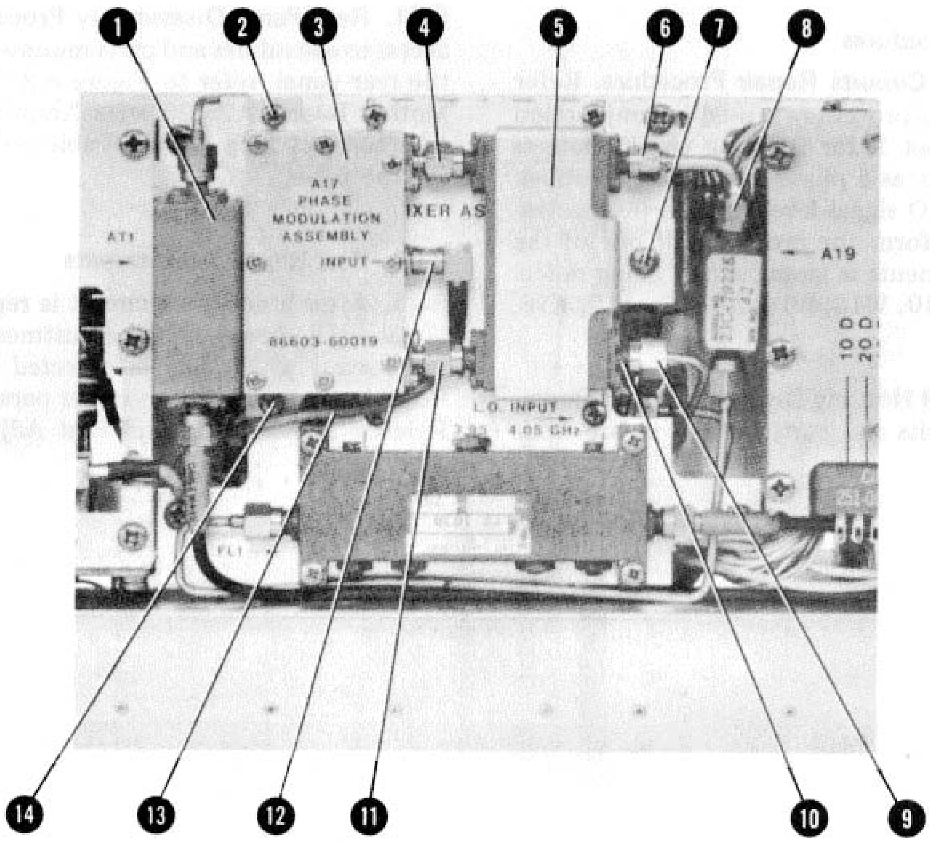
8-40. Front Panel Housing Disassembly and Repair Procedure. Circuits and parts located in the front Panel Housing are the meter, output range switch, and vernier control. Perform the procedure in Table 8-1 to gain access to these circuits for purposes of repair.

8-41. Rear Panel Disassembly Procedure. To gain access to assemblies and parts mounted on or behind the rear panel, refer to Figure 8-2. The A12 Logic Mother Board, A15 20 MHz Amplifier, and the P6 Interconnect Plug are accessible only after removing the panel.

8-42. Post Repair Adjustments

8-43. After a defective circuit is repaired, refer to Section V and perform the adjustment procedure(s) for circuits which *may be affected* by the change. Consider the instructions under paragraphs entitled Related Adjustments and Post Adjustment Tests.

LO SIGNAL CIRCUITS REPAIR



NOTE

In conjunction with this procedure, use the troubleshooting information on Service Sheet 2 to isolate a circuit malfunction to one of the following assemblies, circuits, or cables: A 7, A8, A18, A19, AT2, W1, W2, W10, or W13 (RF problem); A 1 7 or W14 (phase modulation problem). The procedure applies for option 002 instruments only.

a. Set the System Line switch to Standby.

b. Remove screws (2), (7) and (14) to release the A17 Phase Modulator (3) and A18 Circulator (5) Assemblies.

c. With a 5/16" open end wrench, loosen the SMA connectors (6), (8), and (3). Carefully pull the assemblies (3) and (5) away from the aluminum decking until A17 (3) slips past AT1 (1).

Figure 8-1. LO Signal Circuits Repair (1 of 3)

d. **Phase Modulation Problems.** Separate A17 and A18 at connectors 4 and 11. Set the system LINE switch to ON. Measure the output of W14 at connector

e. Set the system LINE switch to Standby, replace the defective part of assembly. Reassemble the items in the reverse order given for disassembly.

Be sure W14 13 runs under connector 11 and is not crushed under A17 7 .

f. **RF Problems**. To measure the LO signal at the output of A18 10, remove the SMA connectors 6 and 8 ,and set the System LINE switch to ON.

g. If the output from A18 is correct, proceed to step h. Otherwise, determine which of A18, W13, A19, or W1 is defective by measuring the outputs of W13, A19, and W1. Refer to Service Sheet 2.

h. Disconnect the System's line (Mains) power. Release the A20 Assembly by removing the screws (one each where circuit board and aluminum decking meet). Lift the assembly straight up. Connect a ground lead from the chassis to the angle bracket which is connected to the ground point on the circuit board.

i. Remove cable W2 at the A8 Assembly output. (The A8 output jack is closer to the top of the RF Section).

j. Reconnect the System's line (Mains) power. Measure the output level from A8 (refer to Service Sheet 2). If the output level is correct, determine if cable W2 or the A7 Mixer Assembly is defective. If the level is incorrect, proceed to step k.

k. Remove the three screws which secure the A8 Assembly. Remove the cable connector 9 at the output of A18. Carefully pull A8 away from the decking so the end of AT2 (connected to the input of A8) is exposed.

l. With the wrench, loosen and remove AT2 from A8. Carefully remove W10 and AT2 from between the decking.

m. Reconnect the cable to the output of A18 10 .Check the outputs from AT2 and W10 to determine if AT2, W10, or A8 is defective (refer to Service Sheet 2).

Figure 8-1. LO Signal Circuits Repair (2 of 3)

n. Discard the defective part or assembly. Reassemble the items removed in the reverse order (leave A20 till last).

CAUTION

When tightening the coaxial connectors, be sure the other end of the cable can be connected without bending the cable. Be sure all connectors are tightened but only enough to ensure a good connection. Excessive bending of semi-rigid coax or excessive tightening of the connectors may damage the cables and/or connectors beyond repair.

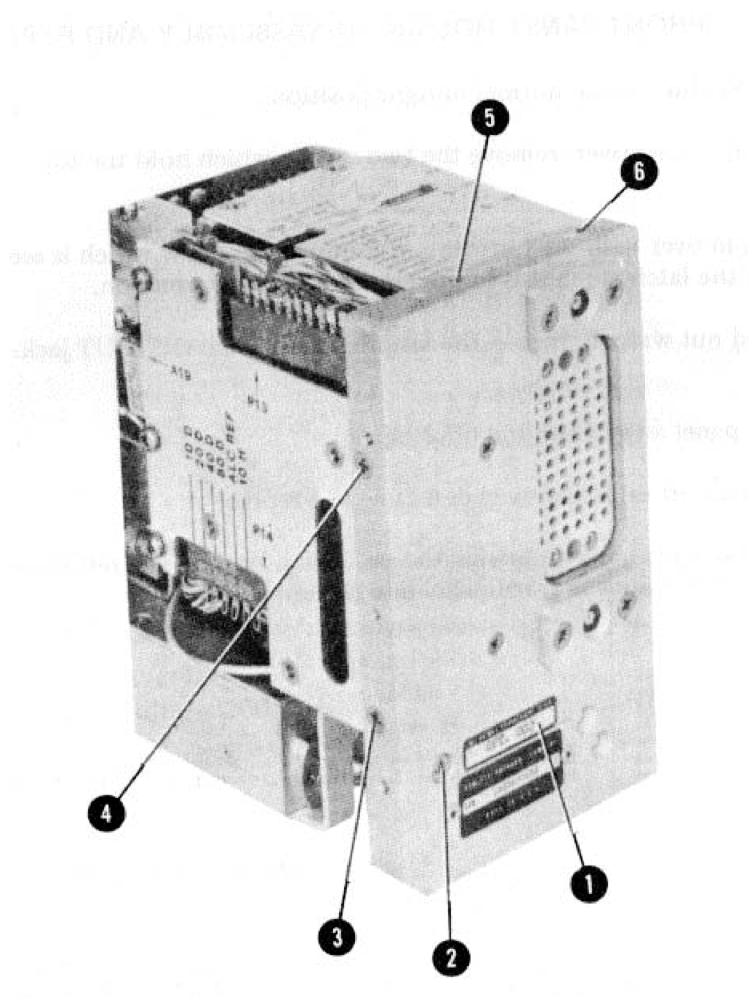
Figure 8-1. LO Signal Circuits Repair (3 of 3)

Table 8-1. Front Panel Housing Repair

FRONT PANEL HOUSING DISASSEMBLY AND REPAIR

a. Place the RF Section in the normal upright position.
b. With a Pozidriv screwdriver, remove the two screws which hold the top of the front panel to the housing.
c. Turn the plug-in over with the bottom up. Remove the screw which is seen through the curved cutout slot in the latch when it is in the closed or latched position.
d. With a knurled nut wrench, loosen the knurled nut on the OUTPUT jack. Remove the nut by hand.
e. Pull the front panel away from the housing.
f. Determine what part or assembly is defective and replace it.
g. Reinstall the front panel by following the preceding steps in the reverse order. Be careful not to crush any wires between the front panel and the chassis.

REAR PANEL DISASSEMBLY



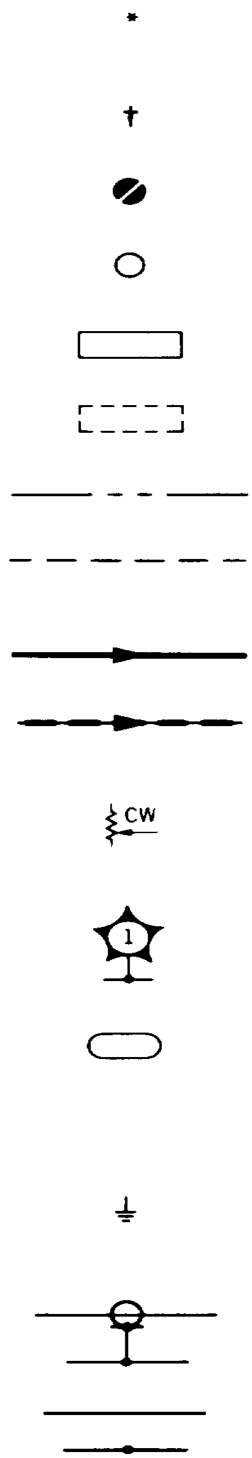
a. On the rear panel, remove screws (1) and (2) which hold the A13 Assembly in place. Screw (1) is located under the Option 002 sticker.

b. Remove the screws (5) and (6) which hold the top rear deck to the rear panel.

c. Remove the screws (3) and (4) which hold the rear panel to the left rear deck. Carefully pull the rear panel back and away to expose the assemblies and parts.

Figure 8-2. Rear Panel Disassembly

SCHEMATIC DIAGRAM NOTES



Resistance in ohms, capacitance in microfarads, inductance in microhenries other otherwise noted.

Asterisk denotes a factory-selected value. Value shown is typical. Part may be omitted.

Indicates backdating. Refer to Table 7-2.

Tool-aided adjustment.

Manual control.

Encloses front-panel designation.

Encloses rear-panel designation.

Circuit assembly borderline.

Other assembly borderline. Also used to indicate mechanical inter-connection (ganging).

Heavy line with arrows indicates path and direction of main signal.

Heavy dashed line with arrows indicates path and direction of main feedback.

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

Numbered Test point Measure-ment aid provided.

Lettered Test point. No measurement Aid provided.

Encloses wire color code. Code used is the same as the resistor color code. First number identifies the base color, second number identifies the wider strip, third number identifies the narrower stripe. E.g., 9 denotes white base, yellow wide stripe, violet narrow stripe.

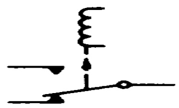
A direct conducting connection to the earth, or a conducting
connection to a structure that has a similar function (e.g., the frame of an air, sea, or land vehicle).

Coaxial or shielded cable.

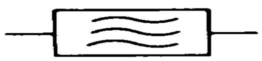
Stripline (i.e., RF transmission line above ground).

Figure 8-3. Schematic Diagram Notes (1 of 3)

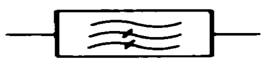
SCHEMATIC DIAGRAM NOTES



Arrows on relays indicate direction of arm movement when energized.



Filters. Specific type indicated by crosses on curved lines.



Example of Highpass Filter.

SWITCH DESIGNATIONS

EXAMPLE: A3S1AR(2-1/2)

A3S1 = SWITCH SI WITHIN
ASSEMBLY A3
A = 1STWAFER FROM
FRONT (A=IST, ETC)
R = REAR OF WAFER
(F=FRONT)
(2-1/2) =TERMINAL LOCATION
(2-1/2) (VIEWED FROM
FRONT)

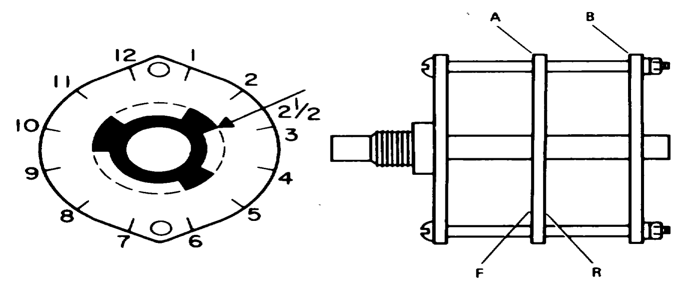


Figure 8-3. Schematic Diagram Notes (2 3)

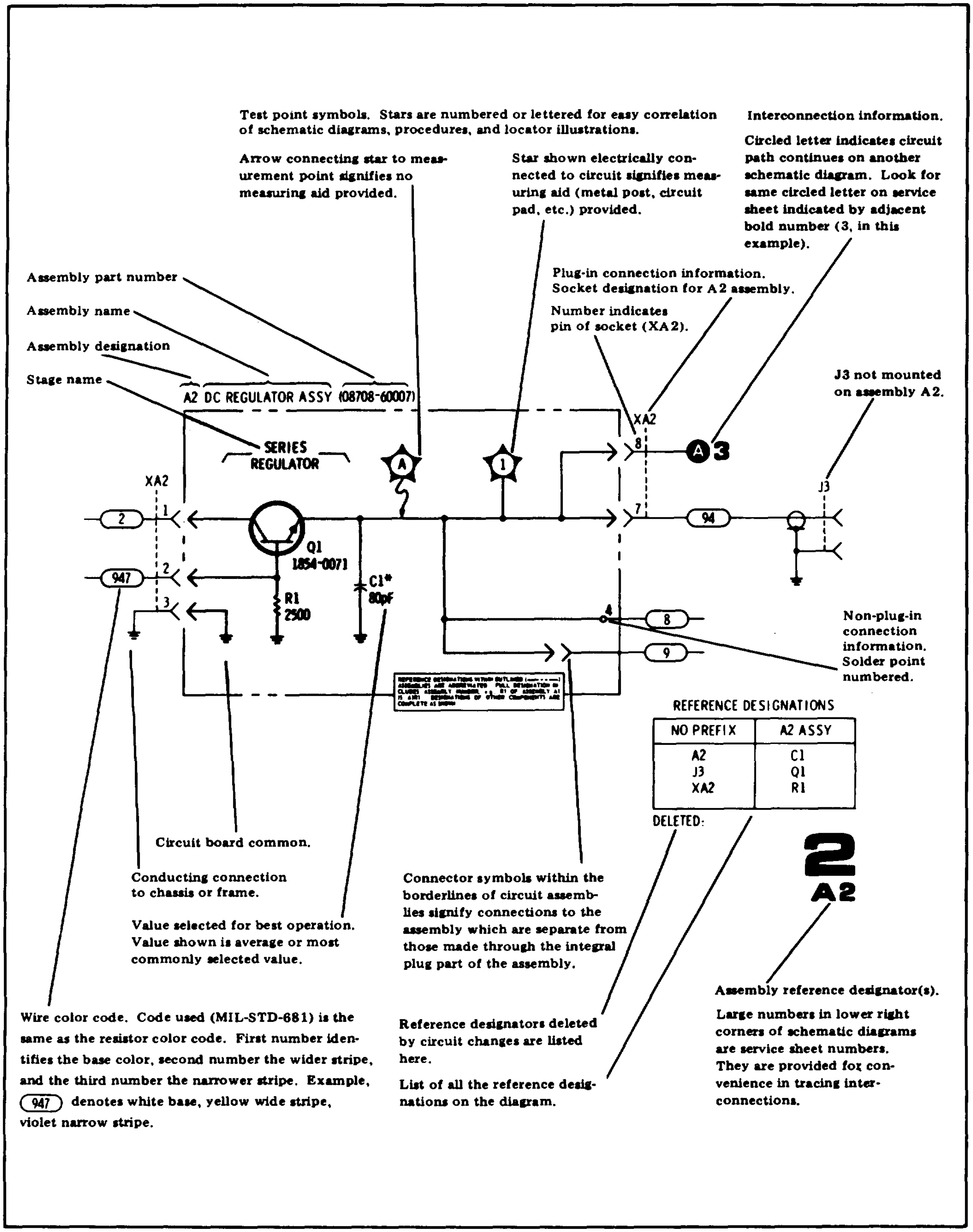


Figure 8-3. Schematic Diagram Notes (3 of 3)

SERVICE SHEET 1

NOTE

When a malfunction occurs, refer to Section VIII of the HP Model 8660- series mainframe Operating and Service Manual to begin troubleshooting (System Troubleshooting Guide). Then, if that information indicates possible problems in the RF Section, refer to the Systems Troubleshooting information in this manual (Service Sheet 1). This information may be used to Isolate the defect to the RF Section, another plug-in, or the mainframe. If the problem Is In this plug-in, refer to Service Sheet 2 for further troubleshooting information.

RF SECTION OPERATION IN THE SYNTHE SIZED SIGNAL GENERATOR SYSTEM

In order to understand the operation of the RF Section or to effectively troubleshoot it, the entire Synthesized Signal Generator System must be understood. The emphasis here is on the RF Section and its relationship with the other units which make up the system.

PRINCIPLES OF OPERATION

The HP Model 86602B RF Section Plug-in (as par of the HP 8660-series Synthesized Signal Generator System, has an RF Output of +10 to -146 dBm across 5092 from 1 to 1299.999999 MHz. The RF signals coupled from mainframe to the Frequency Extension Module are converted to two phase. locked outputs which are coupled to the RF Section. The signals are mixed, amplified, and coupled to the OUTPUT jack through the RF Attenuator. The RF detector produces a dc output proportional to the RF output signal. The dc output is compared to a reference voltage. Any difference in dc levels produces an error current which drives the PIN diode modulator. The current flow through the PIN diodes controls the RF output level. The negative feedback loop described, is an ALC loop which holds the RF output level constant.

Output Frequency Selection The desired output frequency is selected by the Digital Control Unit (DCU) in the mainframe Control logic levels to the mainframe RF circuits set the frequencies of the signals to the Frequency Extension Module. Other logic levels are coupled to the extension module from the mainframe to set the frequency of the generated RF outputs which are coupled to RF Section. The signals are mixed and the converted signal is coupled to the OUTPUT jack.

Modulation Selection

Depending on the Auxiliary or Modulation Section, amplitude, frequency, phase, or pulse modulation may be selected.

a. The amplitude modulation drive signal is coupled to the RF Section from the Modulation Section. The drive signal is superimposed on the reference level which controls the ALC loop. Thus, the ALC loop causes the RF output level to change at the modulation signal rate.

b. Frequency modulation is accomplished by setting the modulation mode control to FM. The modulation drive signal frequency modulates a 20 MHz VCO signal which is generated in the Modulation Section. This signal is coupled to the RF Section, amplified, and coupled on to the Frequency Extension Module. The extension module circuits transfer the frequency modulation information from the 20 MHz signal to the 3.95 to 2.75 GHz oscillator signal. This signal is then coupled to the RF Section circuits.

c. Phase modulation occurs when the selected modulation mode is set to M. The modulation drive signal from the modulation section is applied to the LO signal so its phase deviation varies with the drive signal amplitude.

d. The Pulse ID logic input opens the ALC loop so there is no RF output without a pulse modulation drive signal. A -10 volt peak pulse will momentarily bias the RF output on.

RF Output Level Selection

The RF output level is selected by the front panel OUTPUT RANGE switch and the VERNIER control. The VERNIER control (in conjunction with the front panel meter) is used to set the output within a usable range of 10 dB. The OUTPUT RANGE switch controls the output level range by inserting attenuation in 10 dB steps to 150 dB.

SERVICE SHEET 1 (Cont'd)

Remote Operation

In remote mode the frequency, modulation, and RF output levels are programmed into the DCU. Through parallel BCD PI (plug-in) control lines, an input is sent to the various storage registers. A one-of-six address selects the register which will accept the information. Frequency information is routed into one of 3 registers: center frequency, step (except 8660A), and sweep (except 8660A). Modulation information is routed to either the Modulation Mode/Source register or the Modulation Level register. RF output level (attenuation) information is routed to the attenuation storage register in the RF Section by addressing the ATTN CLK.

The attenuation information is stored in the register until new data is received. Until that time the stored information is connected through various logic and decoding circuits and applied to the relays and switches which set the RF output level to the desired value. The RF Section front panel controls are inoperative in the remote mode.

SYSTEM TROUBLESHOOTING

When a malfunction occurs, refer to Section VIII of the HP Model 8660-series mainframe Operating and Service Manual to begin troubleshooting (System Troubleshooting Guide). Then, if that information indicates possible problems in the RF Section, return to this service sheet and perform the following tests which may help isolate the problem to an instrument (mainframe or a plug-in).

Preparing the R F Section for Troubleshooting

Follow the Removal and Disassembly Procedures on the foldout page which just preceeds the last foldout in the manual. Follow the directions for removing the RF Section from mainframe, removing its covers, and making the interconnections from mainframe to RF Section for troubleshooting purposes.

Output Level Incorrect

The following steps check the signal levels input to the RF Section from the Frequency Extension Module. Also, the attenuation data input to the RF Section must be checked if the instrument is being operated in the remote mode.

a. Disconnect the RF cable connected to P2 (on rear panel above the multi-pin connector P6). Measure the level of the 3.95 to 2.75 GHz signal from the cable with a spectrum analyzer (>+10 dBm). Reconnect the cable to P2.

b. Disconnect the RF cable connected to P1 (on rear panel below the multi-pin connector). Measure the level of the 3.95 to 4.05 GHz signal from the cable with a spectrum analyzer (>-4 dBm). Reconnect the cable to P1.

c. If either signal level from the extension module is incorrect, the problem is either in the extension module or the interconnections to the RF Section. Check the continuity of the cables and, if necessary, refer to the extension module manual for further troubleshooting information.

d. If both signal levels are correct and the system is being operated in the remote mode, switch to local (front panel) control. If the problem is still evident, refer to Service Sheet 2 for further troubleshooting information.

e. If the problem disappears, check continuity of the input data lines (PI-1, PI-2, PI-4, and PI-8) and the ATTN CLK input to the mainframe. If continuity exists, proceed to Section VIII of the mainframe manual and troubleshoot the DCU. Otherwise, refer to Service Sheet 3.

Frequency Problems

The mainframe center frequency readout is correct but the frequency at the RF Section's front panel jack is incorrect. The mainframe, and the frequency Extension Module contain the only controlled frequency sections. If the RF frequencies to the extension module are incorrect or if the levels are too low, the circuit defect is in the mainframe or the interconnections to the extension module (including the A15 20 MHz Amplifier Assembly). If these levels and frequencies are all correct, the extension module is malfunctioning or the data input from the mainframe DCU is incorrect.

NOTE

If the coaxial test cable 11672-60008 (for checking outputs from the multi-pin connector J6) is not available, proceed to step b.

SERVICE SHEET 1 (Cont'd)

RF Signal Levels

Pin Numbers J6 (Main-frame) or Inter-connect Cable	Frequency* (MHz)	Signal Level (dBm)
62	20 MHz ± 1 Hz	>-7 dBm
63	20 to 30 MHz + 1 Hz	>-7 dBm
64	360 to 450 MHz + 1 Hz	>+10 dBm
65	100 MHz + 1 Hz	>+10 dBm

*To achieve the 1 117 tolerance, the System mainframe and the frequency counter must share a common timebase.

a. Check the low frequency RF inputs to the RF Section. Set the mainframe Line switch to standby (STBY), disconnect the interconnect cable from the multi-pin connector P6 on the RF Section rear panel. Return the mainframe line switch to the ON position. Check the frequencies and levels according to the tables with a spectrum analyzer and a frequency counter. If the levels and frequencies are all correct, the same signals must be checked to ensure continuity into the Frequency Extension Module. Refer to the Troubleshooting Information in the extension module manual. Otherwise, proceed to step b.

b. Check the RF signal levels and frequencies at their assembly outputs' in the mainframe. Refer to the Section VIII of the mainframe manual. Check the 20 Mhz FM/CW signal at A4J7, 100 MHz at A4J8, and 360 to 450 MHz at A4J12. The 20 to 30 MHz signal is found on the A2 Mother Board Assembly which is located directly beneath the A4 Assembly. The tables of frequencies and levels still apply for these measurements. If any of the outputs are incorrect, refer to the appropriate troubleshooting information relating to the circuits which generate that particular frequency in Section VIII of the mainframe manual.

c. If all inputs (step b) are correct and if any of the J6 outputs (step a) were incorrect, check continuity of the interconnections to the RF Section. In the case of problems with the 20 MHz CW'/FMI signal, refer to the Modulation Section manual. If all inputs (step b) are correct and the J6 outputs to the RF Section were not checked, proceed to the extension module for further troubleshooting Information.

Center Frequency Versus
Frequency of 360 to 450 MHz Signal

Center Frequency Readout	**Actual Frequency (350 to 450 MHz Signal)**
0.00 GHz	450 MHz
0.01	440
0.02	430
0.03	420
0.04	410
0.05	400
0.06	390
0.07	380
0.08	370
0.09	360
0.10	450

NOTE

If the problem is not in the RF Section or interconnections, the information in the Frequency Extension Module will determine if the problem is in the digit 8, 9, and 10 logic control units from the mainframe or the frequency controlled circuits in the extension module.

Modulation Problems

Amplitude, Frequency, and Phase Modulation. Defects in modulation circuits can usually be classed as either accuracy or distortion problems. In each case it must be determined if the problem is in the Modulation Section, RF Section, or (in FM mode only), the Frequency Extension Module.

a. System modulation accuracy is checked by performing the appropriate performance test in Section IV of the modulation section manual. If the results indicate a problem exists, check the modulation section output with a full scale level setting. The table indicates where to make the measurement, the type of measurement, and the normal signal measured. A coaxial cable from the 11672A Service Kit (11672-60008) connects to the appropriate signal on J6 (the mainframe-to-RF Section interconnect jack).

If the measured signal shows the output modulation signal is incorrect, perform the appropriate adjustment in Section V of the modulation section manual. If the signal cannot be properly adjusted, refer to Section VIII of the modulation section

SERVICE SHEET 1 (Cont'd)

Assembly (refer to the last foldout for its location). If either the signal or dc voltage is not present, check continuity back to the Auxiliary Section. If necessary, refer to the H

Model 86631B Operating Note and troubleshoot the Auxiliary Section. Otherwise, refer to Service Sheet 1 for more troubleshooting information.

Center Frequency Versus Frequency of 20 to 30 MHz Signal

Center Frequency Readout (MHz)	Exact Frequency (20 to 30 MHz Signal) (MHz)	Center Frequency Readout (MHz)	Exact Frequency (20 to 30 MHz Signal) (MHz)	Center Frequency Readout (MHz)	Exact Frequency (20 to 30 MHz Signal) (MHz)
0.000000	30.000000	0.000400	29.999600	0.080000	29.920000
0.000001	29.999999	0.000500	29.999500	0.090000	29.910000
0.000002	29.999998	0.000600	29.999400	0.100000	29.900000
0.000003	29.999997	0.000700	29.999300	0.200000	29.800000
0.000004	29.999996	0.000800	29.999200	0.300000	29.700000
0.000005	29.999995	0.000900	29.999100	0.400000	29.600000
0.000006	29.999994	0.001000	29.999000	0.500000	29.500000
0.000007	29.999993	0.002000	29.998000	0.600000	29.400000
0.000008	29.999992	0.003000	29.997000	0.700000	29.300000
0.000009	29.999991	0.004000	29.996000	0.800000	29.200000
0.000010	29.999990	0.005000	29.995000	0.900000	29.100000
0.000020	29.999980	0.006000	29.994000	1.000000	29.000000
0.000030	29.999970	0.007000	29.993000	2.000000	28.000000
0.000040	29.999960	0.008000	19.992000	3.000000	27.000000
0.000050	29.999950	0.009000	29.991000	4.000000	26.000000
0.000060	29.999940	0.010000	29.990000	5.000000	25.000000
0.000070	29.999930	0.020000	29.980000	6.000000	24.000000
0.000080	29.999920	0.030000	29.970000	7.000000	23.000000
0.000090	29.999910	0.040000	29.960000	8.000000	22.000000
0.000100	29.999900	0.050000	29.950000	9.000000	21.000000
0.000200	29.999800	0.060000	29.940000	9.999999	20.000001
0.000300	29.999700	0.070000	29.930000		

SERVICE SHEET 1 (Cont'd)

manual for further troubleshooting information. Once the adjustment is satisfactorily made, recheck the system modulation accuracy. If the system accuracy is still incorrect, perform the appropriate adjustment procedure in Section V of the RF Section manual. If this adjustment cannot satisfactorily be made, refer to the troubleshooting information of Service Sheet 2.

b. Modulation distortion problems are verified by performing the appropriate distortion test determined by the modulation type (refer to Section IV of this manual). If the test indicates an excessive distortion level is present in the RF output signal, the source of the distortion must be determined. Measurements of the signals from the Modulation
Section may be made at the J6 connector after the RF Section has been removed. For each modulation type, the output distortion is typically <1%. If the distortion is excessive, refer to the troubleshooting information in Section VIII of the modulation section manual. Otherwise, perform the appropriate adjustment procedures in Section V of the RF Section manual. Recheck the performance test in Section IV of this manual. If necessary, refer to the troubleshooting information in Service Sheet 2.

Unusual Phase Modulation Level Problems. If phase modulation level accuracy varies excessively with system center frequency, check the gain tracking inputs (Digit 8) for the correct logic level for the selected center frequency. If the logic levels are incorrect, refer to the mainframe manual for further troubleshooting information. If the inputs are correct, refer to Service Sheet 2.

Pulse Modulation Problems. Pulse Modulation of the Signal Generator System is accomplished by using the HP Model 86631B Auxiliary Section and an external pulse generator.

a. Set the Auxiliary Section external modulation control to Pulse. To the input jack couple an external pulse of -10 Vpk with the "pulse off" voltage set to 0 Vdc.

b. Measure the voltage on the test point labeled PULSE (located on a circuit board at the right side rear of the plug-in). This voltage should be about +5 Vdc. Also, check the pulse input from the white-green cable where it enters the A2 Assembly. If either the signal or dc voltage is not present, check continuity back to the Auxiliary Section. If necessary, refer to the HP Model 86631B Operating Note and troubleshoot the Auxiliary Section. Otherwise, refer to Service Sheet 2 for more troubleshooting information.

Modulation Accuracy Test Levels

Modulation Type	Measurement Location	Signal Parameter Measured	Measured Signal (for Full Scale) Modulation Level
Amplitude 1	A12 Assembly at test point labeled AM. (Right side rear of plug-in or J6 pin 55.	AC Voltage	2.8 Vp-p (1.0 Vrms) at 1 kHz rate
Frequency2	Pin 62 of J6	Frequency Deviation (peak)	20 MHz +10 kHz (FM x 1 range) at 1 kHz rate
Phase 1	A16 Assembly input (white/ green cable) or J6 pin 59	AC Voltage	4.2 Vp-p (1.5 Vrms) at 1 kHz rate

1 If the input is very low or non-existant, verify that continuity of the input exists back to the modulation section. If continuity exists, refer to Service Sheet 2.

2 If no frequency modulation of the RF Signal is present or if the RF signal is incorrect only in the FM mode, refer to Section VIII of the modulation section manual for further troubleshooting information.

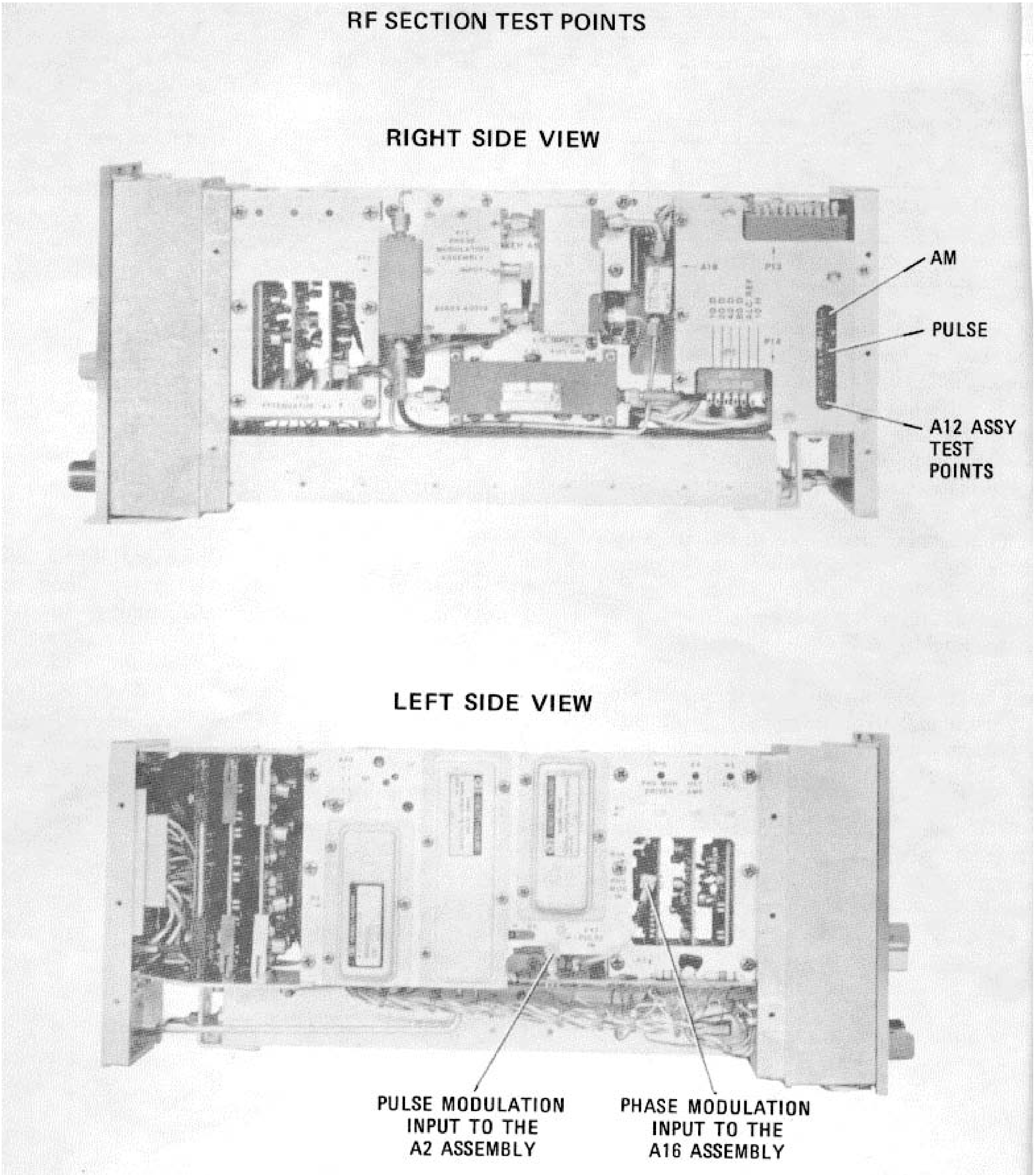


Figure 8-4. System Test Point Locations

MAINFRAME INTERCONNECT JACK

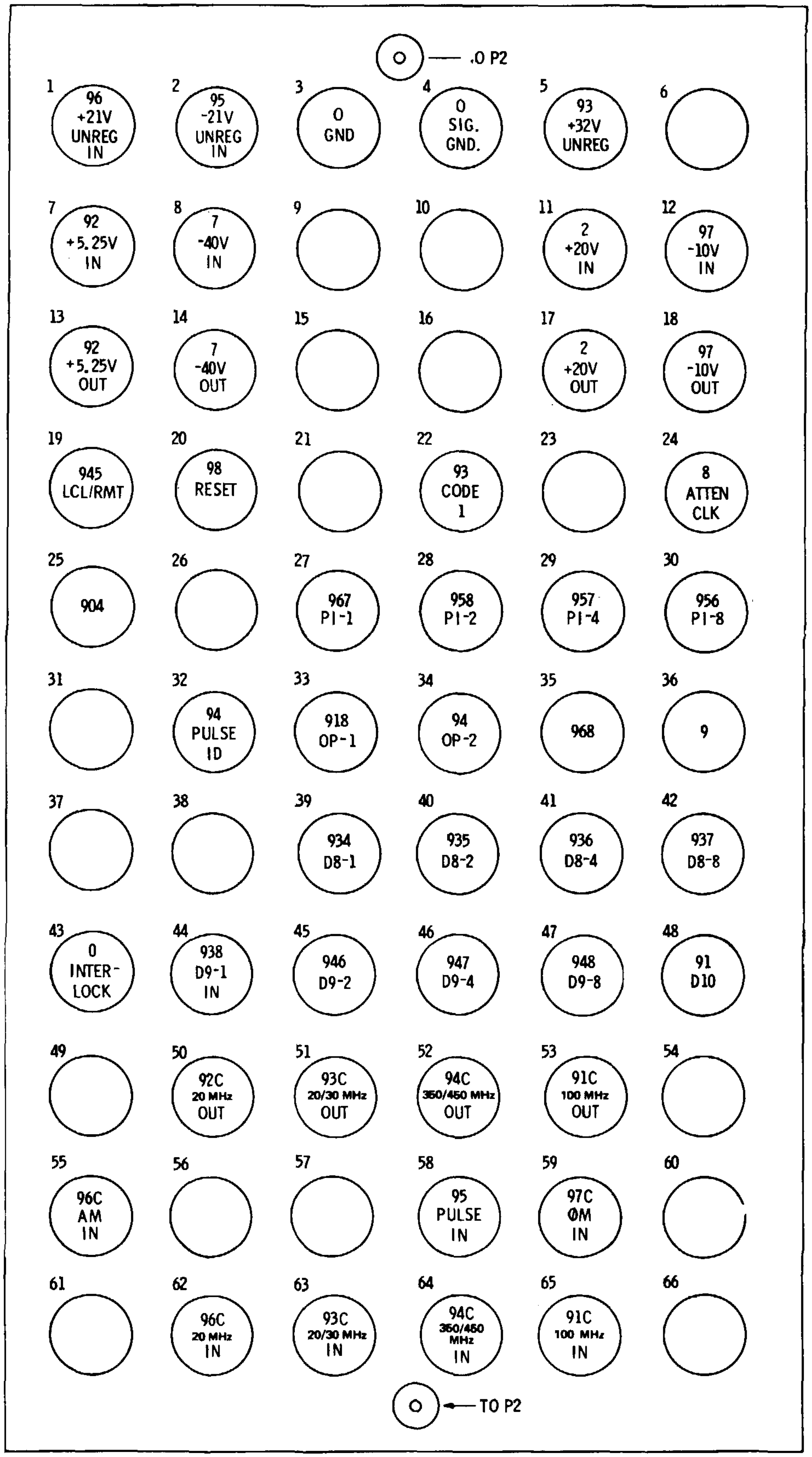


Figure 8-5. Mainframe Interconnect Jack

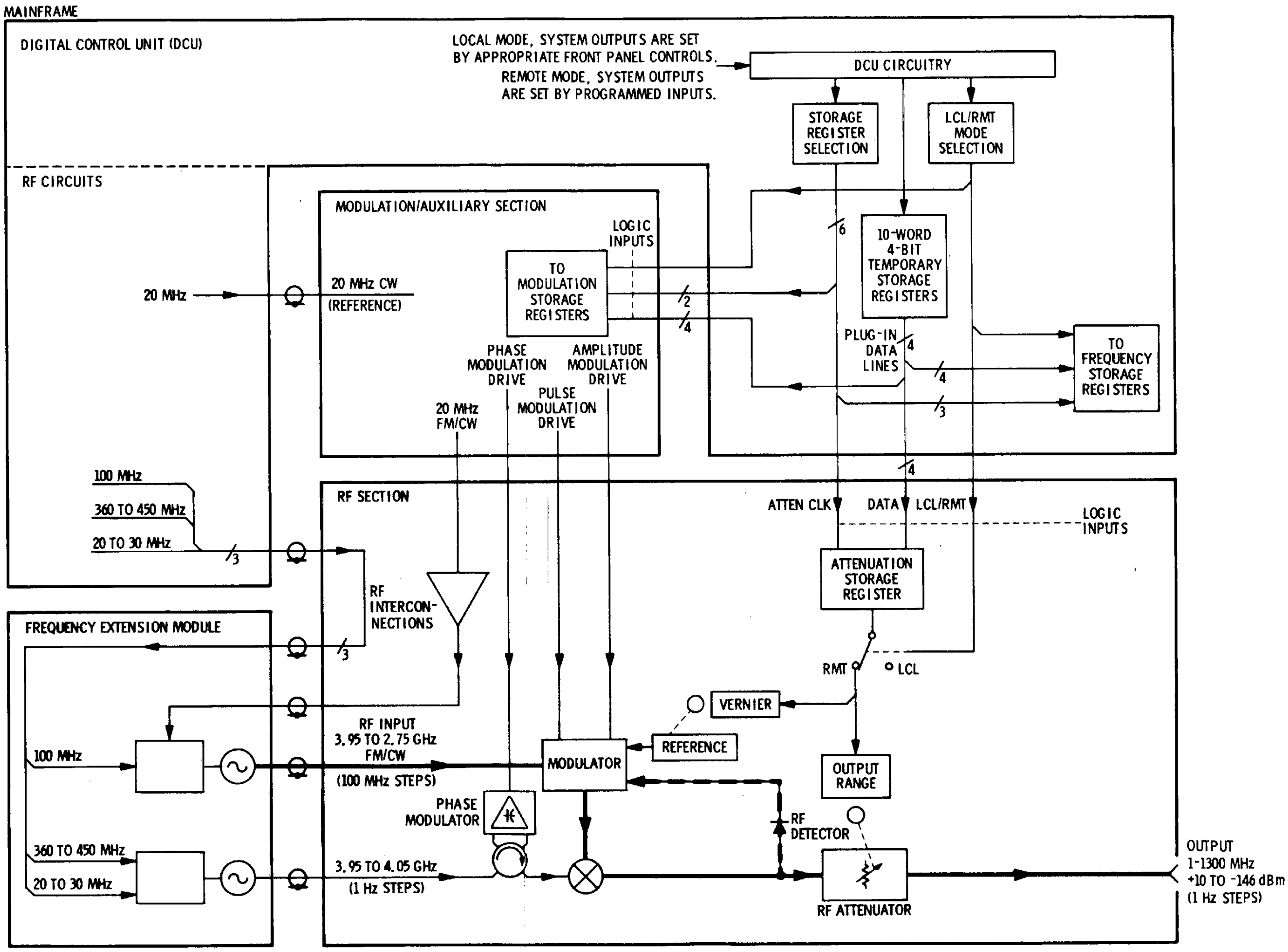


Figure 8-6. System Troubleshooting Block Diagram

SERVICE SHEET 2

NOTE

When a malfunction occurs, refer to Section VIII of the HP Model 8660-series mainframe Operating and Service Manual to begin trouble-shooting (System Troubleshooting Guide). Then, if that information indicates possible problems in the RF Section, refer to the System Troubleshooting information (Service Sheet 1) in this manual. This information may be used to isolate the defect to the RF Section, another plug-in, or the mainframe. If the problem is in this plug-in, return to this service sheet for further troubleshooting information.

ANALOG CIRCUITS

PRINCIPLES OF OPERATION

General

The LO and RF input signals from the frequency Extension Module are mixed and the difference frequency output is amplified and coupled to the OUTPUT jack. Thus, frequencies between 1 and 1300 MHz may be selected in 1 Hz steps.

The RF output voltage level is detected and compared to a stable reference. The result-ant error voltage is used to control the level of the RF signal as it is passed through the Modulator assembly. This ALC (Automatic Level Control) loop, therefore, maintains a relatively constant output level across the system's specified output range.

The RF output level may be either locally controlled (front panel operation) or remotely controlled (programmed input). In either case, the logic control input is coupled to the Logic Section. This input data is manipulated so it selects the level of attenuation of the RF output signal by controlling the 10 and/or 1 dB Step Attenuators.

A power supply, RF interconnections, and a 20 MHz amplifier are contained in the RF Section. They supply the power and RF signals which operate the Frequency Extension Module.

Phase Modulator Section

The phase modulation drive signal from the Modulation section is coupled to the A16 Phase Modulation Driver Assembly where it passes through a gain tracking circuit (frequency variable attenuator). This circuit keeps the phase deviation constant with change in system center frequency because the sensitivity of the phase modulator circuitry changes with respect to the LO frequency. The signal is then amplified and coupled to the Phase Modulator Assembly.

Phase modulation of the LO signal occurs when the signal (which passes through the Circulator Assembly to the Phase Modulator Assembly) is reflected back into the circulator. The phase of the reflected signal with respect to the incident signal is dependent on the instantaneous modulation drive voltage present at the phase modulator. The LO signal is first passed through the isolator, through port 1 (J1) to port 2 (J2) of the circulator, and on to the phase modulator. The reflected signal is passed from port 2 to port 3 (J3) where it is again reflected from the phase modulator with additional phase shift approximately equal to that which occurred at port 2. The signal is passed from port 3 to port 4 (J4) and through the 3 dB attenuator to the 4 GHz Amplifier Assembly.

In other than option 002 instruments (no phase modulation circuits), the LO signal is coupled directly from FL1 to the A8 4.0 GHz Amplifier Assembly.

Mixer Section

The mixer output is derived from mixing the LO and RF inputs. The phase modulated or cw LO signal is amplified and coupled to the Mixer Assembly. The RF signal passes through the Isolator (20 dB reverse isolation) to the Modulator Assembly where it encounters variable series attenuation. The series attenuation is controlled by the bias signal from the ALC feedback loop. The modulator's RF output signal is coupled directly to the Mixer where it is mixed with the LO signal. The difference frequency output is coupled to the Amplifier/Detector Assembly.

Amplifier/Detector Section

The RF input to the Amplifier/Detector Assembly is amplified 41 dB. This high level signal is coupled to the 10 dB Step Attenuator.

The Amplifier/Detector Assembly also contains the RF Detector circuit. It produces a dc voltage which is proportional to the peak RF output voltage. This signal, which is amplified to drive the front panel meter and the AM Gain compensation circuits in the Reference Assembly, is also coupled to the ALC Amplifier Assembly.

ALC Section

Reference Assembly. In the Local Mode, the RF output level is set by the front panel controls. The unmodulated RF level to the 10 dB Attenuator is set by the ALC loop's dc bias voltage which, in turn, is controlled by the VERNIER setting.

In the AM mode the modulation drive signal is superimposed on the reference voltage. The average amplitude of the RF output is dependent on the average dc level (which is equal to the dc reference voltage) while the instantaneous RF output voltage and its rate of change (modulation characteristics) are dependent on the superimposed modulation drive signal.

In the remote mode, the entire system responds to programmed inputs; the front panel controls of all instruments are inhibited. In the RF Section, the reference output is coupled to the ALC Assembly through the 1 dB Step Attenuator. Therefore, the vernier function is controlled by the 1 dB Step Attenuator.

ALC Amplifier. The ALC Amplifier compares the Detector Amplifier Assembly output to the Reference Assembly output. Any change

SERVICE SHEET 2 (Cont'd)

in the detected RF level or the reference level is immediately reflected at the ALC assembly output. This output is coupled to the A5 Modulator Assembly as the Modulator Bias signal. Because the RF input to the 10 dB Step Attenuator is directly proportional to the Modulator RF output level (which is controlled by the Modulation Bias Signal), the ALC feedback loop is completed.

Pulse Modulation Circuits. During Pulse Modulation, the ALC loop is opened at the ALC Amplifier output. With no signal input, a positive bias voltage to the A5 Modulation Assembly causes the RF signal output to be at least 40 dB down (60 dB down at center frequencies >1300 MHz) from the "on-condition". A -10 Vdc pulse biases the RF "on".

Attenuation Section

The Attenuator Section operates identically in local and remote modes. The inputs from the Logic Section (10D, 20D, 40D, and 80D) select the level of attenuation of the RF signal passing through the 10 dB Step Attenuator.

TROUBLESHOOTING

It is assumed that a problem has been isolated to the RF Section as a result of using the System Troubleshooting Guide found in Section VIII of the HP Model 8660-series mainframe Operating and Service Manual and the information entitled System Troubleshooting on Service Sheet 1. Troubleshoot the RF Section using the test equipment, information, and procedures which follow.

Test Equipment

Spectrum Analyzer .... HP 8555A/8552B/140T
Oscilloscope .... HP 180C/1801A/1821A
Digital Voltmeter .... HP 34740A/34702A

Test 1. It is good practice to first check the power supply inputs to the RF Section and at the same time, it may help to check AM, Pulse ID or any other inputs which relate to the problem. The inputs may be checked at the A12 Assembly test points on the right-side rear of this plug-in.

A12 Assembly Test Points

-10V	-10.0 + 0.1 Vdc
+ 20V	+ 20.0 + 0.1 Vdc
-20Vu	-21.0 + 0.2 Vdc
+ 20VI	+20.0 + 0.2 Vdc

Test 2. If the problem is related to incorrect output level, proceed to Test 3. If it is a unique type problem such as amplitude modulation, noise, etc., refer to the following items for additional troubleshooting hints.

a. **Frequency Problems.** Normally not caused by RF Section. Refer to Section VIII of the mainframe manual or Service Sheet 1 of this manual.

b. **Spurious Signals.** May **be isolated by** checking for signal at various locations in the RF Section. Setting the A4S1 switch to Test may help to isolate the problem to the RF circuitry or ALC loop.

c. **Noise.** Generally, noise originates in Frequency Extension Module or the A15 20 MHz Amplifier Assembly.

d. **Amplitude Modulation.** Verify that the AM signal reaches the A10 Reference Assembly.

If amplitude modulation level changes with an RF level change, check the RF Section front panel meter reading versus measured RF OUTPUT level. If the panel meter reading is correct, refer to Service Sheet 7 (check AM Gain input and related circuits). Otherwise, check the meter driver amplifier and related components shown on Service Sheet 6.

Distortion problems may be caused by defective components associated with the ALC Bandwidth Input. Check the logic inputs from Service Sheet 3. Then refer to Service Sheet 3, 6, or 7.

If the amplitude modulation level differs from the level shown, perform the related adjustment procedures in Section V to see if the error is corrected. Be sure the fault isn't in the Modulation Section. An input of 1.0 Vrms to the A10 Reference Assembly should equal 100% AM level.

e**. Phase Modulation.** The output of the A16 Phase Modulator Driver Assembly is a distorted sinusoidal waveform of approximately 7.5 Vp-p a full scale Modulation Section meter indication. If the output is incorrect, check the output of the cable, W12, to determine if W12 or A16 is defective. The output should be 1.5 Vrms. If the output of the A16 assembly is correct, either W14 or A17 is defective. Refer to the paragraph entitled LO Signal Circuits Repair procedure in Section VIII of this manual for disassembly and repair procedures.

Phase modulation distortion problems in the RF section will generally be caused by the A16 Phase Modulator Driver Assembly or the A17 Phase Modulator Assembly. Refer to Service Sheet 5.

NOTE

Excessive incidental AM during phase modulation may be caused by incorrect operation of the 50 MHz Low Pass Filter. Check the control input and the RF output level of the filter. Refer to Service Sheet 4.

f. **Pulse Modulation.** Problems may be isolated by checking Pulse In and Pulse ID inputs. Also, check continuity from A5 Modulator Assembly inputs from Auxiliary Section.

g**. Incorrect Front Panel Meter Reading**. Refer to **Test 3.**

Test 3. If the RF output level is incorrect by more than 1 or 2 dB, proceed to Test 4. Otherwise check the 10H input to the A10

SERVICE SHEET 2 (Cont'd)

Assembly related components. Refer to Service Sheet 3 if the input is incorrect. If necessary refer to Section V and perform the RF

Output Level and 1 dB Step Attenuator Adjustment procedures. If the Adjustments cannot be done or do not correct the tracking across the VERNIER range, check the Meter Driver and meter circuitry, and the AM Gain circuits. Refer to Service Sheets 6 and 7 respectively. Also check the circuits in the A4 Assembly which are influenced by the 10H input.

Test 4. Proceed to Test 5 if the RF output level is higher than normal. The RF outputs listed in each step of this test (4) are lower than normal. The voltages enclosed in parenthesis are Modulator Bias Signal ranges. They indicate that the ALC loop is (1) holding the RF output low, (2) is trying to increase the RF output or (3) that a quiescent level, although incorrect, has been reached. Refer to the block diagram for the normal range of Modulator Bias Signal levels.

a. The RF output is low but the ALC loop is trying to increase the level (≥-3 Vdc). Check the RF outputs of FL1, A7, and A6 to isolate the problem to Service Sheets 4 (for other than option 002 instruments), Service Sheets 4 or 5 (option 002 instruments only), or Service Sheet 6 respectively.

If the output of FL1 is correct and the output of A7 is incorrect, the problem may be on either Service Sheets 4 or 5 in option 002 instruments. In this case, refer to the LO Signal Circuits Repair procedure and the Troubleshooting Block Diagram to isolate the problem to an assembly or cable.

On other than option 002 instruments, if the output of A7 is defective, refer to Service Sheet 4.

Each of these assemblies and circuits, if defective, must be replaced as a unit with the exception of A7. If A7 is defective, refer to Service Sheet 4 for further troubleshooting information.

b. The RF output is low and the ALC loop is holding the modulator Bias Signal level low (≥+10 Vdc). First, check the A10 reference Assembly output with the VERNIER control set to the pw and ccw position with A4S1 in the Normal position. If the output is abnormal, refer to the troubleshooting information on Service Sheet 7. A normal output indicates the defect is either on the A3 ALC Assembly, or the A4 Detector Amplifier Assembly.

Set the A4S1 switch to the Test position. If the Modulator Bias Signal exhibits the same response as shown in the following table, the problem is probably in the A4 Detector Amplifier Assembly. (Check the Detector Signal input at A4 pin 11.)

System Troubleshooting Block Diagram
🡐SERVICE SHEET 1

SERVICE SHEET 2 (Cont'd)

Modulator Bias Signal

A4S1 Switch	Vernier Control Settings			
	CW		CCW	
	904	907	904	907
Normal	+0.2 Vdc	+0.4 Vdc	+1 to +11 Vdc	+0.8 Vdc
Test	-4 Vdc	-3.0Vdc	+0.3Vdc	+0.5Vdc

c. **The Modulator Bias Signal is at a quiescent level but is lower (more positive) than normal.** Check the A10 Reference Assembly output level. If the output is lower (more positive than normal), check the 1A, 2A, 4A, and 8A inputs to the A10 Assembly (remote mode only). If they are correct or the instrument is in local mode, refer to Service Sheet 7. If the remote inputs are incorrect or the problem is associated with the 10 dB Step Attenuator, refer to troubleshooting information on Service Sheet 3. Otherwise, check the detector output and reference at A4 pin 10 and 11. Refer to Service Sheet 6.

Test 5. The RF outputs listed in each step of this test are higher than normal. The voltages enclosed in parentheses are Modulator Bias Signal ranges. They indicate that the ALC loop (1) is holding the RF output high, (2) is trying to decrease the output level or (3) that a quiescent level, although incorrect, has been reached. Refer to the block diagram for normal values of Modulator Bias Signal.

a. **High RF output level; the ALC has in-creased the level (>, -3 Vdc).** Check the A10 Reference Assembly output. If the response to VERNIER control settings is abnormal, refer to Service Sheet 7 and troubleshoot the A10 Assembly. If the response is normal, set the A4S1 switch to test. If the Modulator Bias Signal responds to the VERNIER control settings as indicated by the table of Test 4b, check that the detector output responds properly to the increased RF signal level (check A4 pin 10 and 11) and refer to Service Sheet 6. Otherwise, turn to Service Sheet 7 and continue troubleshooting.

b. **High RF output level; the ALC is trying to decrease the level (, >+10 Vdc).** The A5 Modulator Assembly or associated circuitry is probably defective (refer to Service Sheet 4).

c. **The Modulator Bias Signal is at a quiescent level but higher (more negative) than normal.** Check the A10 Reference Assembly output. If the A10 output is more negative than normal, check the 1A, 2A, 4A, and 8A inputs to the A10 assembly (remote mode only). If the A10 outputs are correct or the instrument is in local mode, refer to Service sheet 7. If the remote inputs are incorrect or the problem is associated with the 10 dB Step Attenuator, refer to the troubleshooting information on Service Sheet 3. Otherwise, check that the detector output responds properly to the increased RF signal level (check A4 pins 10 and 11). Refer to Service Sheet 6.

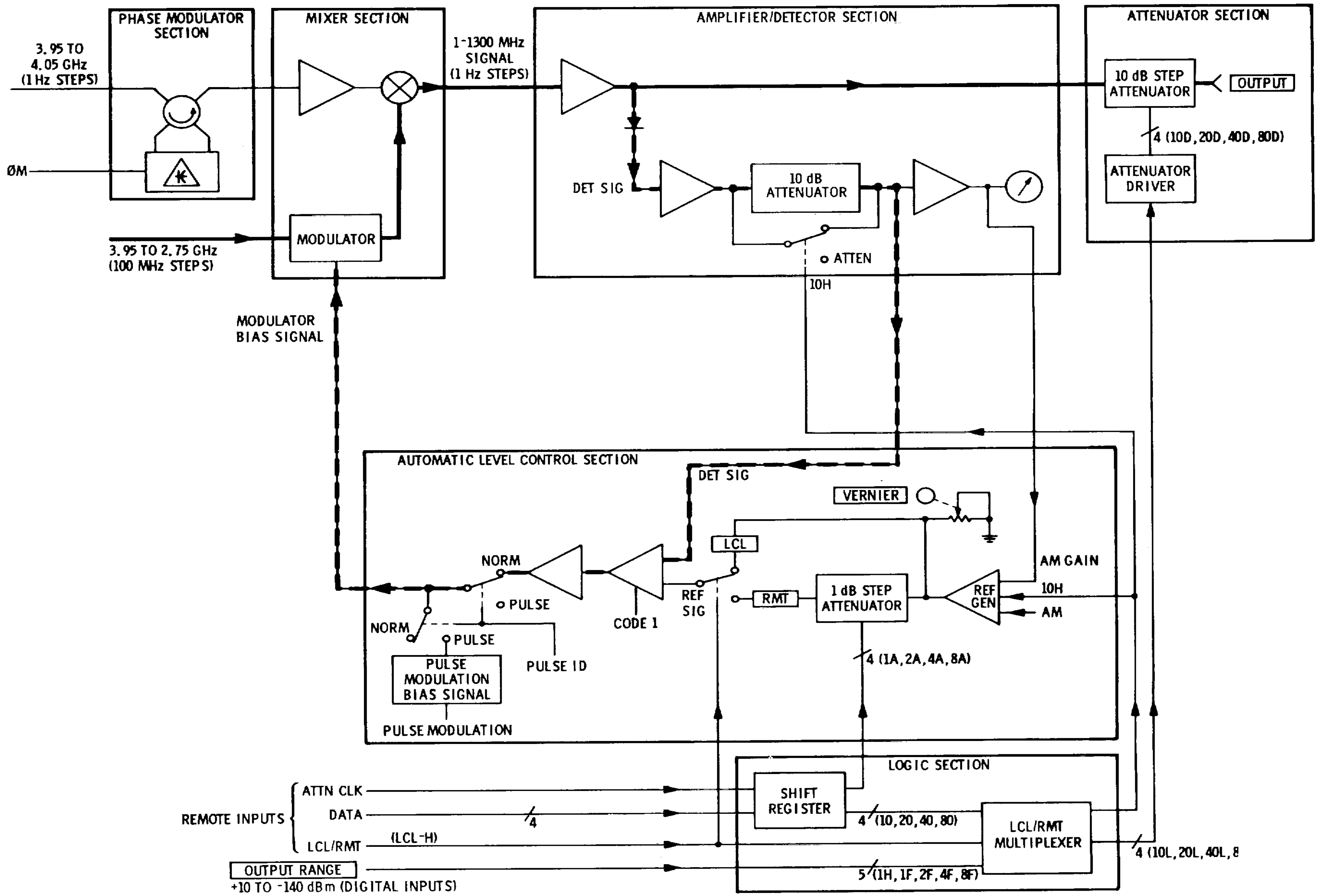


Figure 8-7. RF Section Simplified Block Diagram

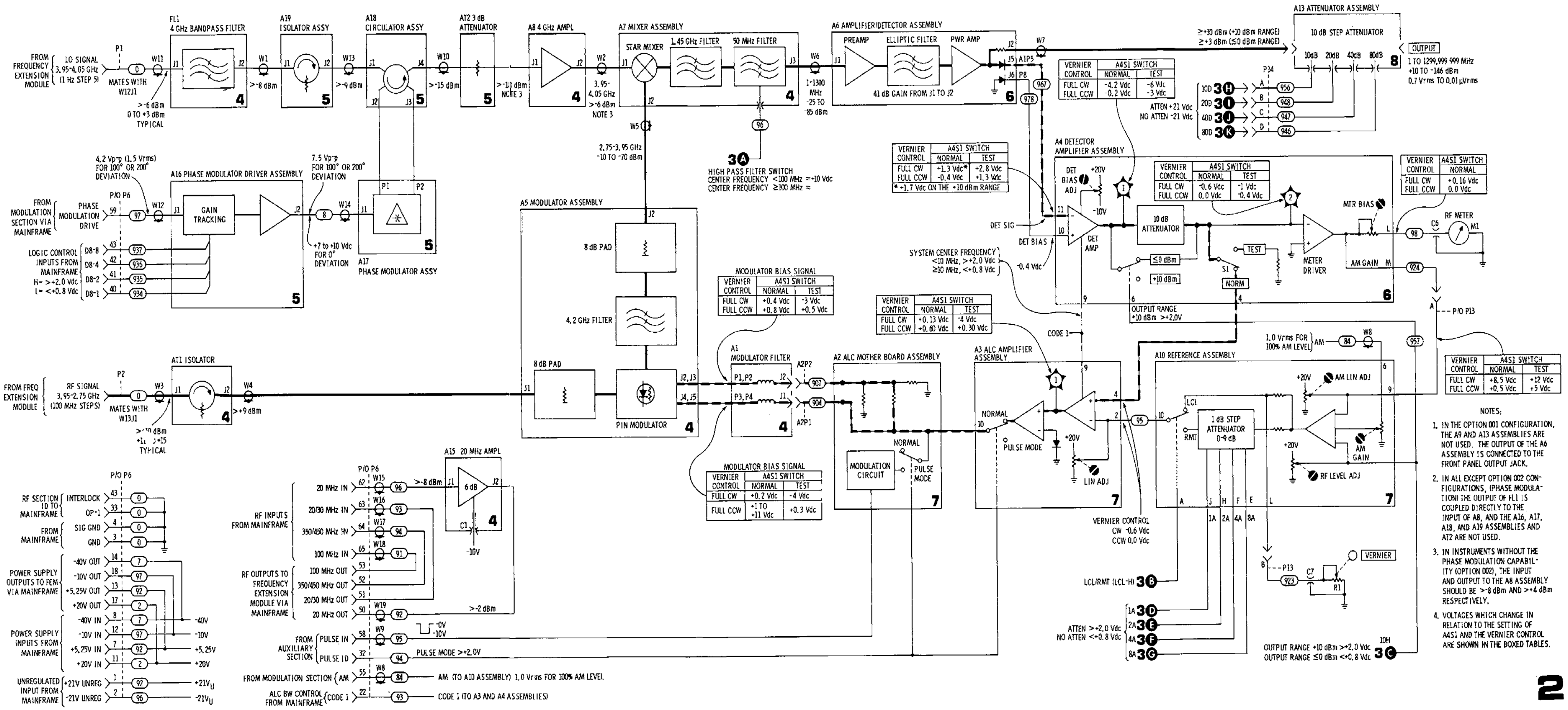


Figure 8-8. Main Troubleshooting Block Diagram

SERVICE SHEET 3

NOTE

When a malfunction occurs, refer to Section VIII of the HP Model 8660-series mainframe Operating and Service Manual to begin troubleshooting (System Trouble-shooting Guide). Then, if that information indicates possible problems in the RF Section, refer to the System Troubleshooting information in Service Sheet 1. This information may be used to isolate the defect to the RF Section, another plug-in, or the mainframe. If the problem is in this plug-in, return to Service Sheet 2 for further troubleshooting information.

LOGIC CIRCUITRY

PRINCIPLES OF OPERATION

General

In this instrument, logic inputs to the analog circuits control functions such as 1 dB and 10 dB steps of attenuation of the RF output signal. These inputs also influence the phase modulation signal.

In the remote mode, all control signals are external to the RF Section. In the local mode, the OUTPUT RANGE switch selects the range by using a binary coded hexadecimal output with an extra overrange line. Also, the VERNIER control is analog in nature.

Filter Control Assembly

The ninth and tenth digit BCD inputs from the mainframe (100 MHz and 1 GHz) are used to control the A7A5 50 MHz Low Pass Filter.

The decoder circuit determines when the frequency output from the A7 Assembly is greater than 100 MHz. The A7A5 50 MHz High Pass Filter is switched on which effectively traps any low frequency phase modulation drive signals which would otherwise be amplified and passed on to the RF output.

Logic Assembly

Local operation of the 10 dB Step Attenuator is selected by a logic high on the LCL/RMT input. Thus, control of the 10 dB Step Attenuator by the inputs from the front panel OUTPUT RANGE switch is enabled while the remote inputs are inhibited.

In Remote mode, a logic low in the LCL/RMT inputs inhibits front panel control and enables data information flow from the mainframe to the Logic Assembly. The ATTN CLK controls the actual data input on the PI-1, PI-2, PI-4, and PI-8 lines. The OUTPUTS to the 10 dB Step Attenuator (10L, 20L, 40L, 80L), the over-range (10H), and the 1 dB Step Attenuator outputs (1A, 2A, 4A, 8A) are all controlled by external programming in the Remote Mode. A safety feature, the RESET input, sets the 10 dB Step Attenuator to the maximum attenuation when the Remote mode is first initiated.

Attenuator Driver Assembly

The inputs from the Logic Assembly (10L, 20L, 40L, and 80L) switch the equivalent attenuator drive outputs (10D, 20D, 40D, and 80D). These outputs provide the higher voltages and current needed to drive the relays in the A13 Attenuator Assembly.

TROUBLESHOOTING

Malfunctions in the RF Section which appear to be a logic problem may be an analog circuit problem. Refer to Service Sheet 2 to begin troubleshooting and return here if necessary.

Test Equipment

Oscilloscope ....HP 180C/1801A/1821A
Digital Voltmeter ....HP 34740A/34702A
Logic Probe ....HP 10525T

General

If the malfunction is isolated to the logic circuits, the related inputs must be checked before an attempt is made to troubleshoot the individual circuit assemblies. The control levels are fixed and may change when a new center frequency or mode of operation (local or remote) has been selected. The clocked or momentary inputs, PI (plug-in), ATTN CLK, and RESET occur only at the instant the center frequency or mode change is made.

Local Mode

In local mode, the inputs mentioned in the preceding paragraph are not used. The 1A, 2A, 4A, and 8A outputs are also not used. (VERNIER control replaces the 1 dB step attenuator.) Check the 1F, 2F, 4F, 8F, and 1H inputs against the levels shown for the S1 switch in the diagram.

Remote Mode

Check the Logic Assembly PI, ATTN CLK, and RESET inputs. Switch to the local mode and then back to the remote mode of operation. Verify that the attenuation level has reset to 150 dB by checking the 10L, 20L, 40L, 80L, and 10H outputs [10H and 10L should be low (<+0.8 Vdc) while 20L, 40L, and 80L outputs should be high (>+2.0 Vdc)]. The momentary low input (O Vdc as compared to the normal +5 Vdc) may be observed on an oscilloscope at the instant of switching. A logic probe may also be used to verify the presence of the reset pulse. To verify that the PI (data) and ATTN CLK inputs are correct, program the information shown in the table at the

Main Troubleshooting Block Diagram
←SERVICE SHEET 2

SERVICE SHEET 3 (Cont'd)

bottom of this page. Check each output for the correct level. If any level is incorrect, the presence of the data and/or the ATTN CLK inputs may be checked at the instant of programming with an oscilloscope or logic probe.

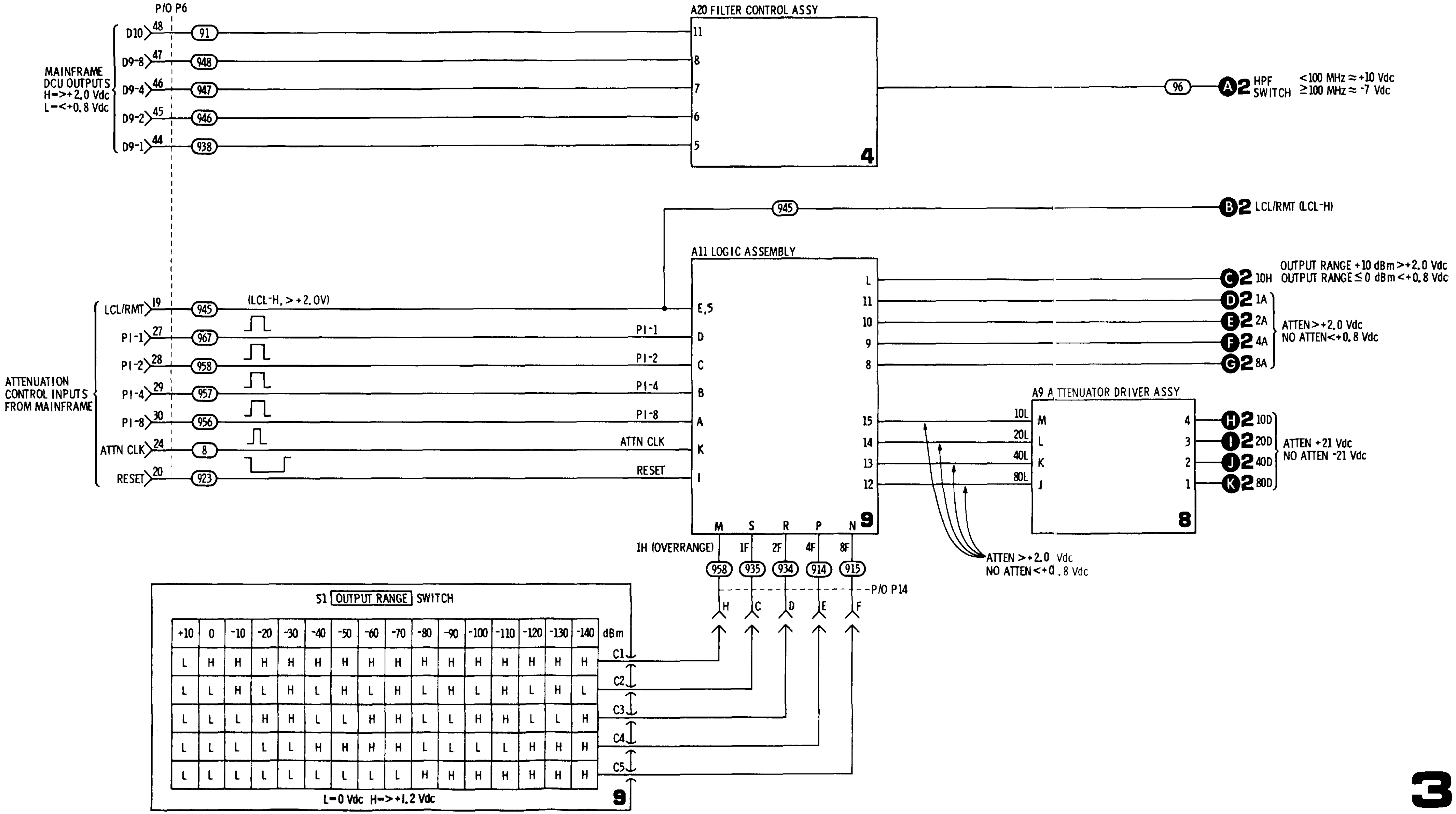
Check the A9 Attenuator Driver Assembly outputs against the inputs.

NOTE

If the problem is isolated between the inputs and outputs of an assembly, refer to the appropriate Service Sheet as indicated on the diagram.

Programmed Attenuation	RF Output Level	Outputs								
		1A 1 dB	2A 2 dB	4A 4 dB	8A 8 dB	10L 10 dB	20L 20 dB	40L 40 dB	80L 80 dB	10H 10 dB
7 dB	+6 dBm	H	H	H	L	L	L	L	L	L
87 dB	−74 dBm	H	H	H	L	H	H	H	L	H
98 dB	−85 dBm	L	L	L	H	L	L	L	H	H

H = Attenuation = >+2.0 Vdc
L = No Attenuation = <+0.8 Vdc



dBm	+10	0	-10	-20	-30	-40	-50	-60	-70	-80	-90	-100	-110	-120	-130	-140
C1	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
C2	L	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
C3	L	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H
C4	L	L	L	L	L	H	H	H	H	L	L	L	L	H	H	H
C5	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H

3

Figure 8-9. Logic Troubleshooting Block Diagram

SERVICE SHEET 4

NOTE

When a malfunction occurs, refer to Section VIII of the HP Model 8660-series mainframe Operating and Service Manual *to begin troubleshooting (System Troubleshooting Guide). Then, if that information indicates possible problems in the RF Section, refer to the Systems Troubleshooting information (Service Sheet 1). This information maybe used to isolate the defect to the RF Section, another plug-in, or the mainframe. If the problem is in this plug-in, refer to Service Sheet 2 for further troubleshooting information.*

MIXER SECTION

PRINCIPLES OF OPERATION

General

The LO signal is filtered and amplified to drive the mixer. The RF signal is leveled and may be amplitude modulated at the A5 Modulator Assembly. After passing through the Modulator, the RF Signal and LO Signal are mixed; the difference frequency is passed on for further amplification.

4 GHz Bandpass Filter/Amplifier

Unwanted sidebands are eliminated from the LO signal by passing the signal through a bandpass filter. In option 002 instruments, the LO signal is coupled to the phase modulation circuits before being input to the 4 GHz Amplifier. The signal is amplified to a high level to drive the mixer.

Isolator

The 3.95 to 2.75 GHz RF Signal is passed through the Isolator to the Modulator Assembly. Reverse signal attenuation is about 20 dB.

Modulator Assembly

The effect of the PIN diode Modulator on the RF Signal is that of a variable attenuator. The level of attenuation and therefore the modulator RF output is dependent on the Modulator Bias Signal dc level.

The PIN Diode Modulator has dynamic attenuation range of >50 dB. A more positive modulator bias signal turns off the series diodes while the shunt diodes are forward biased. The shunt diodes and the series resistor form a voltage divider which attenuates the RF Signal. As the bias voltage goes more negative, the impedance of the shunt diodes increases while the series diodes impedance decreases. Therefore, the RF signal attenuation decreases. The shunt diodes effectively control the attenuation from 12 to >50 dB down while the series diodes are effective only to about 12 dB down.

Logic Troubleshooting Block Diagram
←SERVICE SHEET 3

SERVICE SHEET 4 (Cont'd)

The RF output level at the front panel jack is directly proportional to the Modulator Assembly RF output. The Modulator Bias Signal controls the A5 Modulator Assembly output and is dependent on an error voltage derived from comparing the RF detector output to the reference dc level.

Mixer Assembly

The RF Signal is passed through a low pass filter and attenuator before leaving the Modulator Assembly. Then the RF signal is mixed with the LO signal in the Mixer Assembly, the mixer output passes through a low pass filter, and the difference frequency is a 1-1300 MHz phase-locked signal with frequency resolution of 1 Hz.

At center frequencies >, 100 MHz, the High Pass Filter Control input from the A20 Filter Control Assembly to the A7A5 Assembly causes the mixer output to pass through the 50 MHz High Pass Filter. This reduces incidental AM distortion generated by the phase modulated signal in the balanced mixer.

TROUBLESHOOTING

It is assumed that the troubleshooting information on Service Sheet 1 was used to isolate a circuit defect to the assemblies or cables shown on the accompanying diagram. Troubleshoot the Mixer Section by using the test equipment and procedures given below.

NOTE

In Option 002 instruments, a defect cannot easily be isolated to circuits shown on this schematic diagram. Refer to Service Sheet 2 and the repair procedure entitled LO Signal Circuits Repair.

Test Equipment

Spectrum Analyzer ....HP 8555A/8552B/140T
Power Meter ....HP 435A/8481A
Digital Voltmeter ....HP 34740A/34702A
Service Kit ....HP 11672A

Test 1. Check the power supply inputs to the A8 Assembly (+20V and -10V). If correct, proceed to Test 2. Otherwise check for continuity of interconnections to mainframe or an A8 Assembly defect.

CAUTION

Slight but repeated bending of semi-rigid coaxial cables will damage them very quickly. Bend the cables as little as possible. If necessary, loosen the assembly to release the cable.

Test 2. If the RF power output is greater than normal (refer to the schematic), the A5 Modulator Assembly is probably defective. If the power output is less than normal, checking the difference assembly outputs will quickly isolate the defective assembly or cable.

NOTE

Defects in the A15 20 MHz Amplifier Assembly and RF interconnections from mainframe to Frequency Extension Module (through the RF Section) normally will be isolated by using the Systems Troubleshooting (Service Sheet 1).

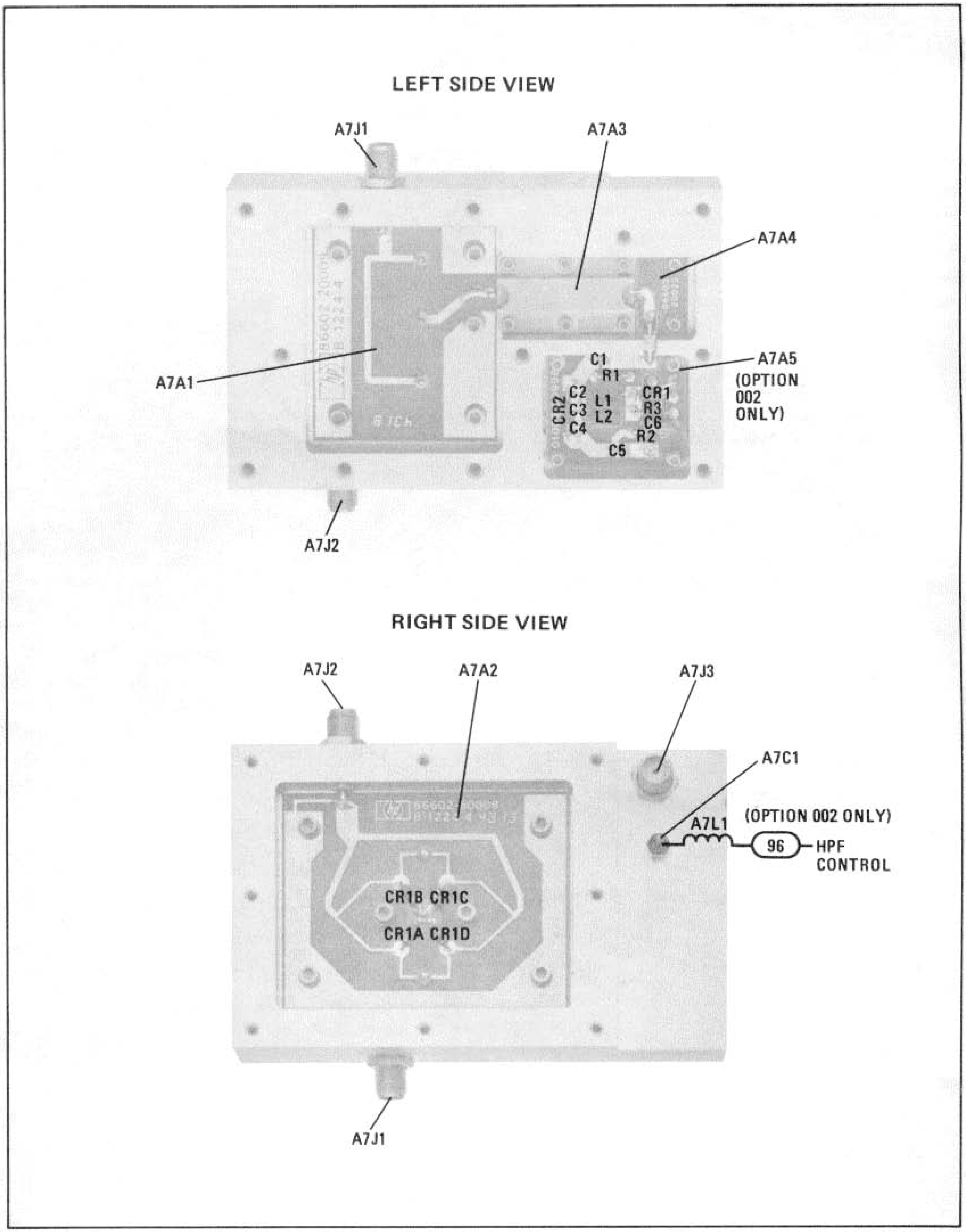


Figure 8-10. A7 Mixer Assembly's subAssembly and Component Locations

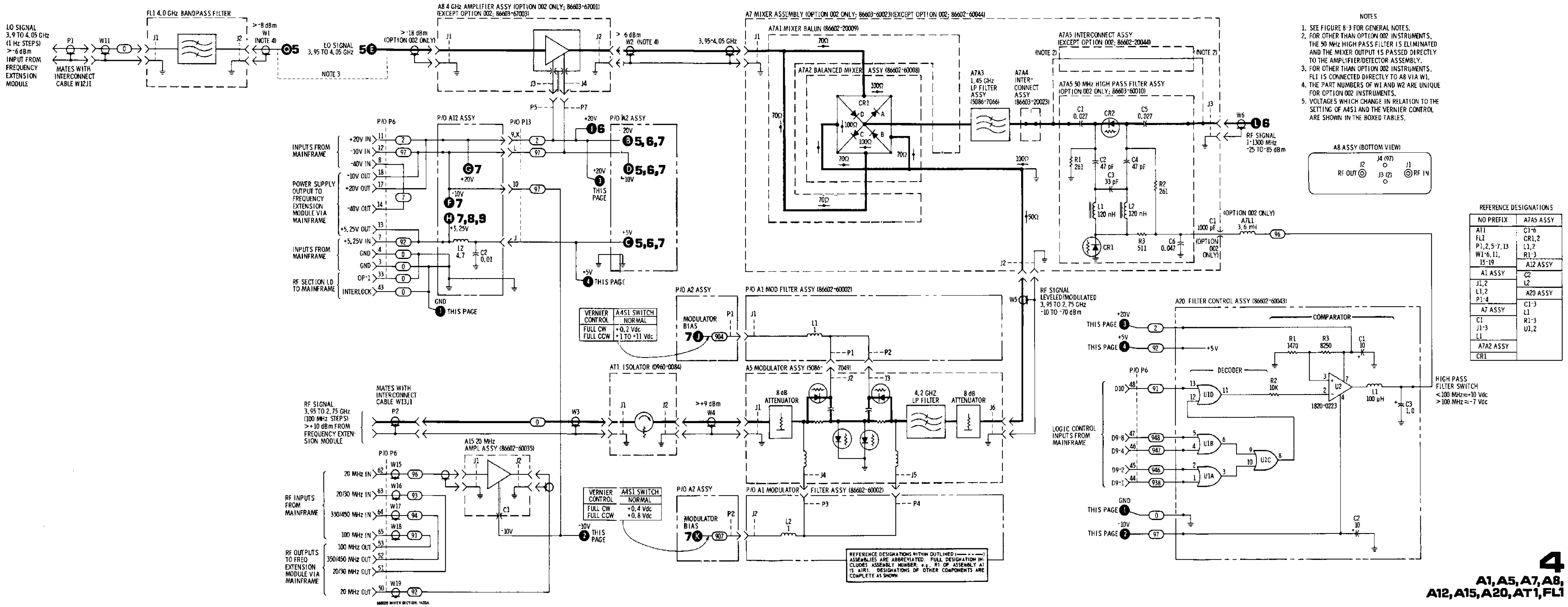


Figure 8-11. Mixer Section Schematic Diagram

SERVICE SHEET 5

NOTE

When a malfunction occurs, refer to Section VIII of the HP Model 8660-series mainframe Operating and Service Manual to begin troubleshooting (System Troubleshooting Guide). Then, if that information indicates possible problems in the RF Section, refer to the Systems Troubleshoot- ing information which precedes Service Sheet 1. This information may be used to isolate the defect to the RF Section, another plug-in, or the mainframe. If the problem is in this plug-in, refer to Service Sheet 1 for further troubleshooting information.

PRINCIPLES OF OPERATION

General

The phase modulation drive signal from the modulation section is coupled to the A16 Phase Modulation Driver Assembly. The signal is predistorted and the overall gain is varied (with respect to LC frequency) to compensate for the frequency sensitivity of the Al'7 Phase Modulator Assembly. The signal is amplified before being connected to the phase modulator.

With minimal loss, the LO signal passes through the A19 3.9-4.1 GHz Isolator Assembly to the A18 Circulator Assembly. The signal passes from port 1 to port 2 and on to the phase modulator. In the phase modulator, the varactor diode, A17A1CR1, reactively terminates the stripline transmission line which reflects the LO signal. Changing the bias voltage applied to the varactor diode changes the termination reactance. This causes the reflected signal to shift in phase with respect to the incident input signal. The reflected LO signal travels back down the transmission line and through port 2 to port 3, where it again enters the phase modulator. The same sequence of events occurs. Thus, the phase shift of the LO signal reflected back to port 3 is approximately doubled.

The phase modulated LO signal continues from port 3 to port 4, through the AT2 3 dB Attenuator and on to the A8 4 GHz Amplifier Assembly. Due to the high input reflection coefficient of the 4 GHz: Amplifier, a large portion of the signal is reflected back to port 4, through to port 1, and on to the Frequency Extension Module. The AT2 3 dB Attenuator and A19 3.9-4.1 GHz Isolator Assemblies, reduce the level of the reflected signal to minimize the interference created in the extension module VCO circuits.

A16 Phase Modulator Driver Assembly

The shunt capacity of W12 and A16L1 forms a low pass filter which improves the frequency response of the input modulation drive signal up to 10 MHz.

SERVICE SHEET 5 (Cont'd)

Diode Shaping Network. The shaping network introduces third order distortion to higher level input signals (when the A16CR2 diode begins to conduct). The level of distortion is adjusted with A16R1 to compensate for the third order distortion inherent in the phase modulator transfer characteristics. The demodulated third order phase modulation sidebands are minimized by adjusting A16R1, the Third Harmonic Adjust control.

Gain Tracking. Gain tracking of the modulation drive signal is introduced to compensate for the phase modulator's inability to produce a constant phase deviation at different LO frequencies. At higher LO frequencies, the phase modulator sensitivity is lower and a higher level modulation drive signal is required to produce the same phase deviation. The modulation drive signal level is changed, with respect to the LO frequency, by the digitally controlled attenuator A16U1 and differential amplifiers A16Q1 and Q2. At system center frequencies where digit 8 (10 MHz steps) is zero (LO frequency is 3.95 MHz) logic lows (< +0.8 Vdc) are present at inputs to A16U1. Lows cause cause the attenuator stage to be off with minimum attenuation of the signal at the junction of A16R12, R13. The differential voltage across the bases of A16Q1 is essentially zero and the gain is unity. When an input to A16U1 is high the transistor stage is turned on, current flows from the modulator drive signal path through either A16R4, R6, R8, or R10. Any difference in amplitude between the bases of A16Q1 is amplified and coupled to A16Q2 where it is further amplified. The differential output voltage across A16R27 is coupled to the gate of A16Q4. The gain control, A16R2, sets the modulation level at 3.95 GHz (unity gain). The Gain Tracking control adjusts the rate of change of attenuation with respect to the LO frequency by setting the phase modulation level at 4.05 GHz (maxi- mum gain).

J-FET Shaping Circuit. The J-FET A16Q1 is biased so it introduces second order distortion to the modulation drive signal. This distortion compensates for the second order distortion in the transfer characteristics of the phase modulator. The transfer characteristics of the phase modulator are varied by changing the dc output from the A16 Assembly. The Second Harmonic Adjust Control A16R3 sets the second order distortion level of A16Q1 (by controlling the drain current flow) and the dc output from A16 (which is proportional to the A16Q1 drain voltage). The distortion level is set by demodulating the system's RF output and nulling the second order harmonic distortion.

Modulation **Driver Amplifier.** The J-FET output is coupled to the discrete component operational amplifier made up of A16Q5 through Q7 and their associated components. The amplifier's high frequency rolloff is set by A16C7. The gain of approximately 10 is determined primarily by A16R49, 100O2, and A16R38, 110. The network of A16RT1, A16R38 and R39 aid in reducing gain changes due to J-FET drift with temperature.

A17 Phase Modulator Assembly. In the phase modulator, the LO signal passes through the blocking capacitors and down the stripline transmission lines to the varactor diode terminations, A17A1CR1 and CR2. The amount of phase shift between the incident and reflected signals is determined by the varactor capacitance.

The varactor capacitance is voltage variable. The dc bias input sets the quiescent phase shift. The instantaneous phase shift is dependent on the sum of the dc bias and the ac modulation drive signal input to the phase modulator.

TROUBLESHOOTING

It is assumed that the troubleshooting information on Service Sheet 2 and the LO Signal Circuits Repair procedure were used to isolate the defect to one of the Assemblies. Troubleshoot the A16 or A17 Assemblies by using the following procedure.

Test Equipment

Digital Voltmeter ....HP 34740A/34702A
Oscilloscope.. ....HP 180C/1801A/1821A
Spectrum Analyzer ....HP 8555A/8552B/140T

A16 and A17 Assembly circuit malfunctions usually result in incorrect or no modulation drive, incorrect gain tracking, or unwanted distortion. Distortion may be due to misadjusted or defective components.

Set the system's modulation section switches for OM mode, internal 1 kHz source, and adjust the modulation level control for a full scale meter reading (100° or 200°). Refer to the schematics for the typical voltages.

Al Modulator Filter Assembly
A2 ALC Mother Board Assembly
A5 Modulator Assembly
A7 Mixer Assembly
A8 4 GHz Amplifier Assembly
A12 Logic Mother Board Assembly
A15 20 MHz Amplifier Assembly
AT1 Isolator
FL1 4 GHz Band Pass Filter

←SERVICE SHEET 4

SERVICE SHEET 5 (Cont'd)

1 kHz source, and adjust the modulation level control for a full scale meter reading (1000 or 200°). Refer to the schematics for the typical voltages.

A16 Assembly
Test 1. Check the power supply inputs to the A16 Assembly.

Test 2. Check the peak-to-peak ac voltages at the various points as indicated on the schematic. If all seem to be correct, refer to Section V and readjust the phase modulation circuits.

Test 3. If the output of the discrete component operational amplifier is defective, check the dc output and compare it to the dc inputs. If the change in dc output voltage from normal does not follow the change in input dc voltage, the problem is probably in Q4 through Q10 or their associated components. For example, the output voltage is more positive than normal.

Test 4. Check the dc voltages on A16Q1 through Q3 and Qll.

Test 5. If the gain tracking is incorrect, check and compare the inputs and outputs of A16U1 and U2.

A17 Assembly
Test 1. Remove the assembly cover. Check for the presence of the dc bias and ac voltage on the varactor diodes, A17CR1 and CR2.

Test 2. Verify that A17C1 and C3 are not defective.

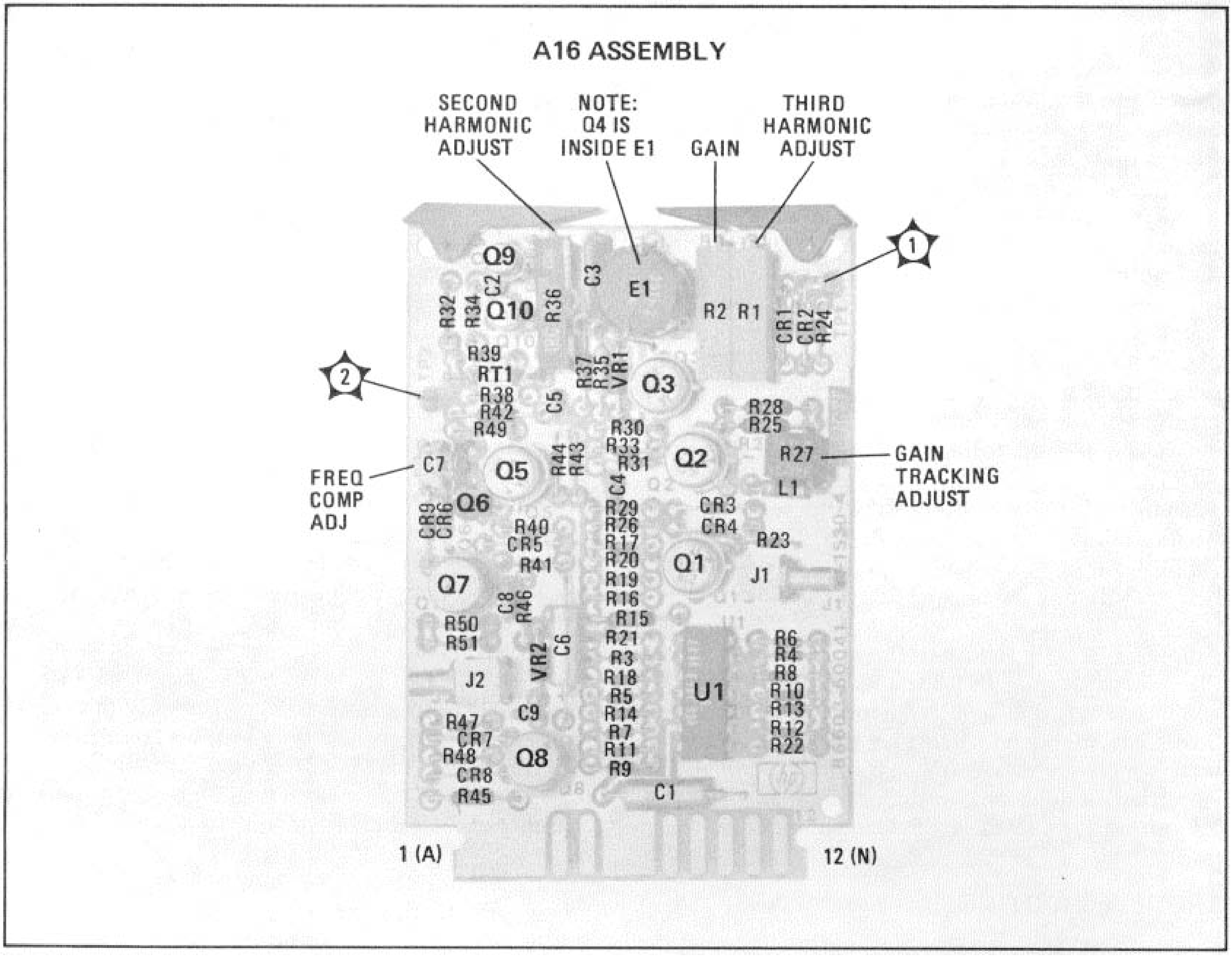


Figure 8-12. A16 Phase Modulator Driver Assembly Component and Test Point Locations

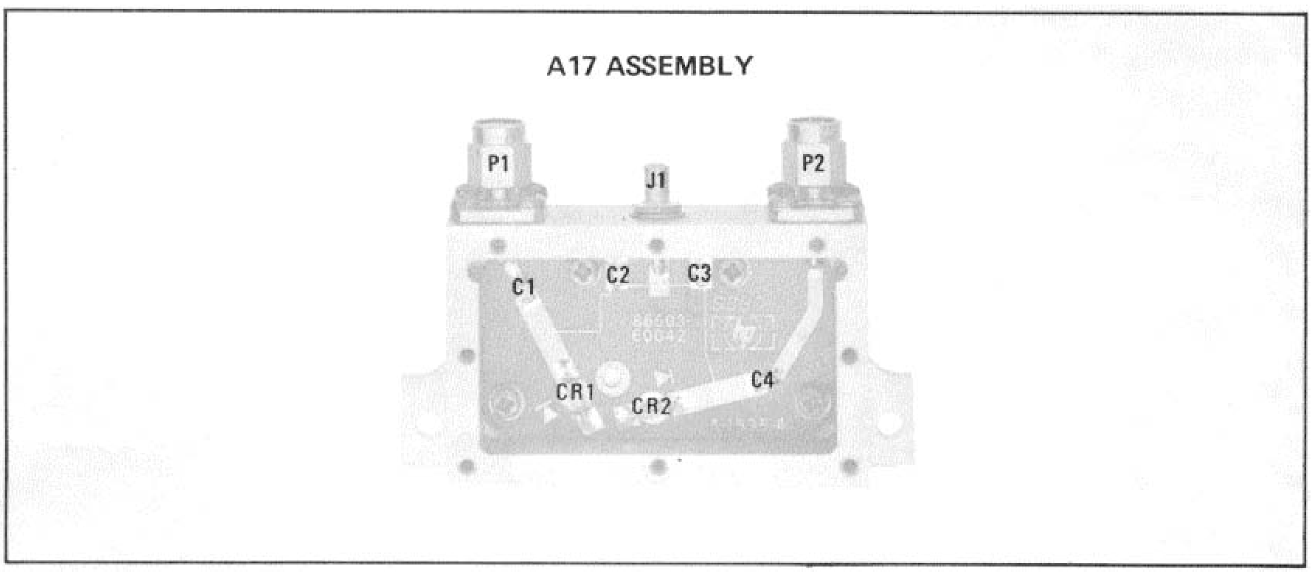


Figure 8-13. A17 Phase Modulator Assembly component Locations

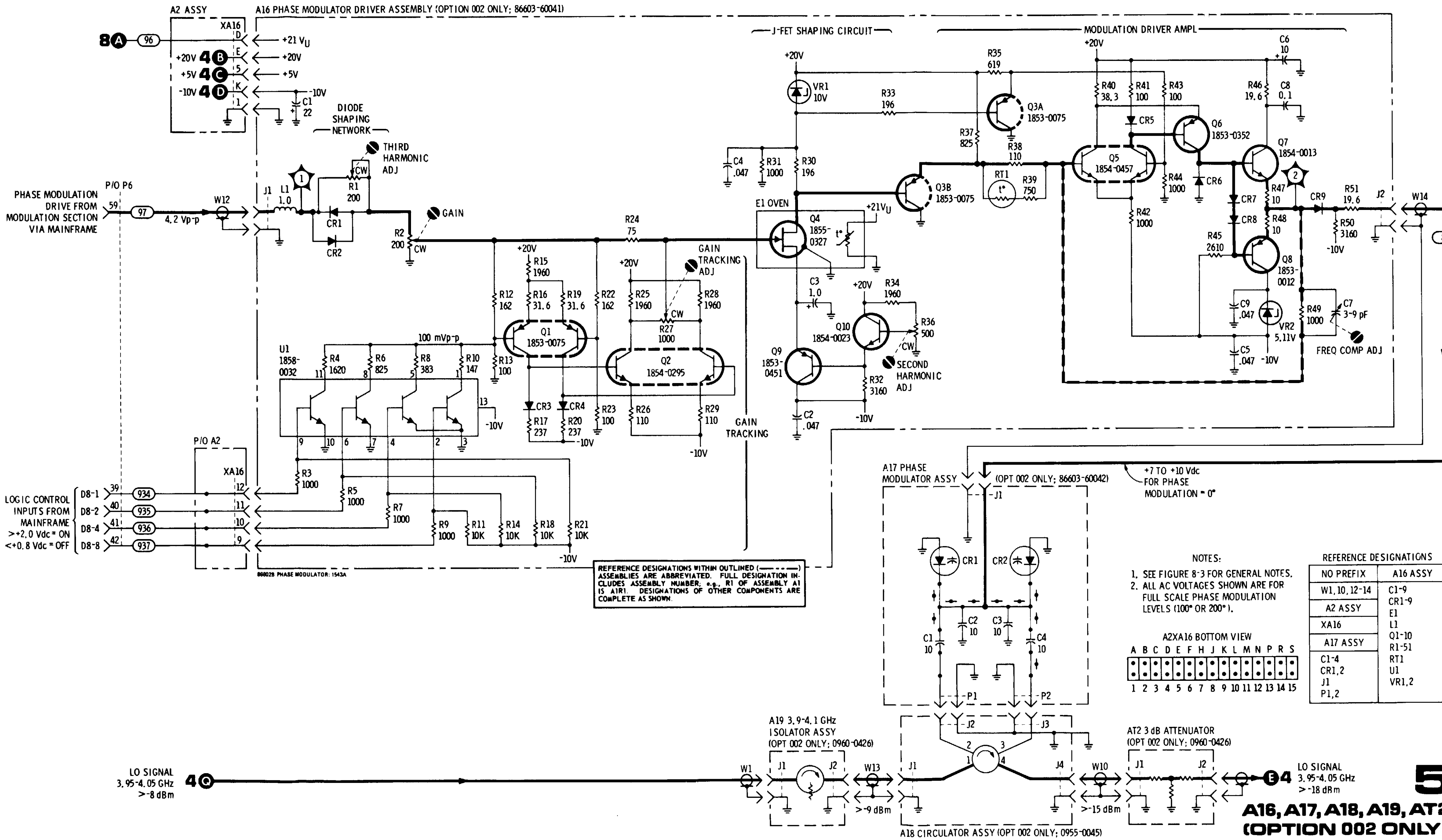


Figure 8-14. Phase Modulation Section Schematic Diagram (Option 002)

SERVICE SHEET 6

NOTE

When a malfunction occurs, refer to Section VIII of the Model 8660-series mainframe Operating and Service Manual to begin troubleshooting (Systems Troubleshooting Guide). Then, if that information indicates possible problems in the RF Section, refer to the Systems troubleshoot- ing information in Service Sheet 1 in this manual. This information may be used to isolate the defect to the RF Section, another plug-in, or the mainframe. If the problem is in this plug-in, refer to Service Sheet 2 for further troubleshooting information.

PRINCIPLES OF OPERATION

Amplifier/Detector Assembly

The A6 1-1300 MHz Amplifier Assembly contains an RF Preamplifier and Amplifier which are separated by an elliptic low pass filter. The combined RF gain is approximately 41 dB.

The RF Detector provides a dc output which is proportional to the peak RF output from the A6 Assembly. The dc level charges the 68 pF capacitor which is coupled to the A3 Detector Amplifier Assembly.

Detector Amplifier Assembly

A small bias current through the RF and Reference Diodes is set by the A4R13 Detector Bias Adjustment for maximum detector sensitivity. Beyond the initial bias current, any further change in current flow is due to temperature variations. Because the two diodes are located in the same thermal environment, an increase in current flow through the RF Detector Diode is matched by an equal increase in current flow through the Reference Diode. The Reference Diode current is coupled to the non-inverting input of the Detector Amplifier (a discrete operational amplifier comprised of A4Q3, A4Q2, A4Q1 and associated components) while the RF Detector Diode output is coupled to the inverting output. Therefore, any change in current flow due to a change in temperature is cancelled in the operational amplifier which leaves the output level dependent only on the peak RF output from the A6 Assembly.

At center frequenices of <10 MHz, the Code 1 input causes A4Q4 to be biased on which connects A4C3 parallel with the 68 pF capacitor found in the Amplifier/Detector Assembly.

A16 Phase Modulator Driver Assembly
A17 Phase Modulator Assembly
A18 Circulator Assembly
A19 3.9-4.1 GHz Isolator Assembly
AT2 3 dB Attenuator
←SERVICE SHEET 5 (Option 002)

SERVICE SHEET 6 (Cont'd)

As the center frequency is decreased, the detector output needs to be retained for a longer period of time so the leveling circuits respond to the average RF level rather than the instantaneous level.

In output ranges of SO dBm, the Detector Amplifier is coupled directly to the A3 ALC Amplifier Assembly. The output is compared to a dc reference level and an error signal results which is coupled to the A5 Modulator Assembly to complete the ALC loop. When OUTPUT RANGE switch is set to +10 dBm, the 10OH logic input goes high (x+5 Vdc) and turns A4Q5 off. Relay A4K1 opens and the dc voltage is attenuated 10 dB by A4R19, A4R20, A4R21, and resistors on the A3 assembly. The RF output signal increases 10 dB which brings the dc output to the A3 ALC Amplifier input back to the quiescent level present before switching to the +10 dBm range.

Amplifier A4U1 functions as an active low pass filter because of A4R23 and A4C5 which are connected in the feedback loop. The amplifier drives the meter and provides a compensating dc level which varies the AM drive input to keep the amplifier modulation level constant with change in RF output level (VERNIER Control setting).

TROUBLESHOOTING

It is assumed that the troubleshooting information Service Sheet 2 was used to isolate a circuit defect to the assemblies shown on the accompany- ing diagram. Troubleshoot the Amplifier/Detector and Detector Amplifier Assemblies by using the test equipment and procedures given below.

Test Equipment

Spectrum Analyzer .... HP 8555A/8552B/140T
Digital Voltmeter .... HP 34740A/34702A

Test 1. If the circuit problem is associated with the meter and AM Gain output rather than the RF Output level, proceed to Test 2. Check the Detector Output, Detector Amplifier Output A4TP1, and output to ALC Amplifier to see if they are tracking the RF output level. Set A4S1 to the test position. If the RF Amplifier output remains low, the A6 assembly or an associated cable is probably defective. If the RF output increases, measure the detector and A4TP1 and A4TP2 voltages. If the detector output doesn't respond properly, the A6 assembly or an associated input component on the A4 assembly, is probably defective. If the detector output increases but the A4TP1 voltage doesn't go more negative, the Detector Amplifier or an associated component is probably defective.

If the RF output level is *incorrect* only in the +10 dBm range *or is correct* only in the +10 dBm range, and the 10H input is correct for all ranges, the 10 dB attenuator, the relay (A4K1), or an associated component is probably defective.

Test 2. Monitor the RF output with a Spectrum Analyzer. If the modulation level changes with respect to the RF carrier amplitude (change the VERNIER control to three or four different settings), A4U1 or associated components are probably defective. Otherwise, the meter control is misadjusted or the meter connections or an associated component is probably defective.

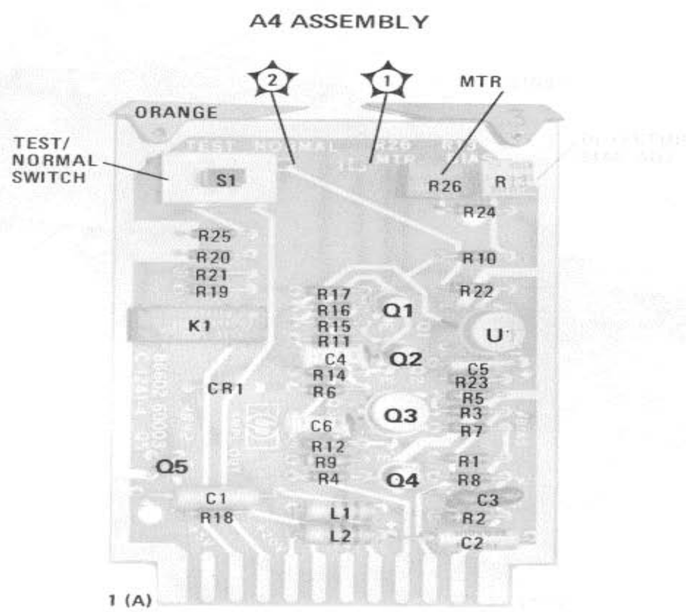


Figure 8-15. A4 Detector Amplifier Assembly Component and Test Point Locations.

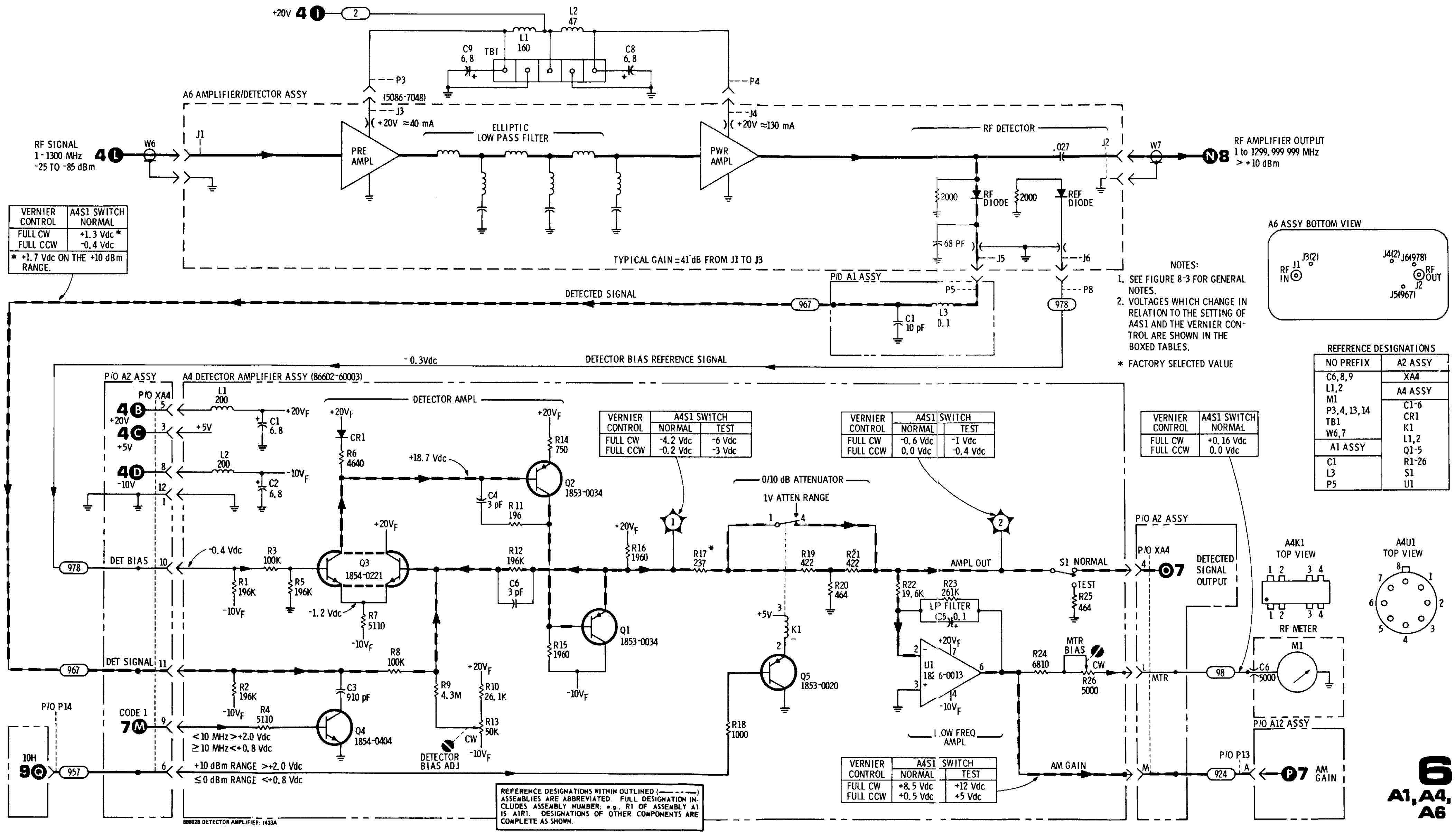


Figure 8-16. Amplifier/Detector Section Schematic Diagram

SERVICE SHEET 7

NOTE

When a malfunction occurs, refer to Section VIII of the Model 8660-series mainframe manual to begin troubleshooting (Systems Troubleshooting Guide). If the information then indicates possible problems in the RF Section, refer to the Systems Troubleshooting information Service Sheet 1 in this manual. This information may be used to isolate the defect to the RF Section, another plug-in, or the mainframe. If the problem is in this plug-in, refer to Service Sheet 2 for further troubleshooting information.

PRINCIPLES OF OPERATION

General

The detected signal output from the A4 Detector Amplifier Assembly is coupled into the A3 ALC Amplifier Assembly where it is compared to the reference input. Any difference in dc input levels causes an error output signal (i.e., a change from the loop quiescent state) at the difference amplifier output A3TP1. The error signal is coupled through the Gain-Shaping Amplifier to the A5 Modulator Assembly which controls the RF output level. The change in RF output level is reflected in a dc level change at the input to the dc amplifier. The change serves to balance the original error output signal at A3TP1.

A10 Reference Assembly

The Reference Assembly output is coupled to the ALC circuit where it is compared to the Detector Amplifier output. An error signal is generated which causes the RF signal to follow the reference dc level or, in AM mode, a low frequency ac signal which is superimposed on the reference dc output.

A reference dc level is established by A1OVR1. This dc level is coupled to the inverting input of AlOUl where (in the +10 dBm range only) a small RF Detector diode linearity compensation current is added from the 10H input through resistor AlOR14. The output of AlOUl passes through a remotely controlled attenuator or an adjustable voltage divider which includes R1 VERNIER Control. This provides fine adjustment of the reference output, i.e., the RF Output level over a 10 dB range.

The Amplitude Modulation drive signal is input at the non-inverting input of A1OU1. The AM Gain input is a dc compensation signal which effects the level of the AM drive input. As the VERNIER control is rotated cw, the dc level goes more negative which increases the RF Output level. At the same time a negative change of the AM Gain compensation increases the modulation drive signal attenuation of the AM drive signal input to A10U1. The resulting increase in modulation drive signal at the output of AlOUl tends to keep the percentage modulation level constant with change in RF output level.

In the remote mode, the front panel VERNIER control of the RF output level is inhibited and the 1 dB step attenuator assumes "vernier" control over

SERVICE SHEET 7 (Cont'd)

a 10 dB range. A logic low (<+0.8 Vdc) on the LCL/RMT input lines biases A1OQ10 off, which opens the contacts of A1OK6 and isolates the VERNIER control. At the same time, AlOQi is biased on which closes the contacts of A1OK5 and enables the 1 dB step attenuator. With no attenuation (RF vernier maximum) the 1A, 2A, 4A, and 8A inputs are all logic lows. Programmed attenuation levels will cause a logic high to appear on the appropriate input. For example, if 1 dB of attenuation is programmed (equivalent to a +2 dB front panel meter reading), a voltage of +5 Vdc will be found on A12XA10 pin J. This voltage biases A10OQ9 off. Relay AlOK1 opens which causes the reference to be attenuated through A10OR21 and A10R22 (which is coupled to ground through A10OQ8). When A10OQ9 is turned off, bias current is supplied through A10OR20 from the negative supply to turn A10OQ8 on. Transistor A10OQ8 is baised through the base-to-collector junction instead of the normal base-to-emitter junction.

Each step of attenuation is operated in the same manner. The values of the resistors in the voltage divider stick are weighted for greater attenuation of voltage output to the ALC circuits as the programmed attenuation levels are increased.

ALC Amplifier Assembly

The Detector Amplifier output, which is proportional to the RF output level, is compared to the Reference output in the ALC Amplifier Assembly.

The detector signal is coupled to the non-inverting input of the discrete operational amplifier (A3Q10, A3Q9, and associated components) while the reference input is coupled to the inverting input. Under normal operating conditions a change in reference input causes an error output signal at A3TP1. This signal passes through the Gain-Shaping Amplifier where it is coupled to the A5 Modulator Assembly. This change in Modulation Bias Signal causes the RF output to change. The change is reflected in the Detector Amplifier input to the ALC loop. This change serves to balance the error signal at A3TP1 and a new quiescent voltage is established. In a similar fashion, the change in RF output loading or a change in signal level input from the Frequency Extension Module is compensated for in the ALC loop. For example, a decrease in output level due to increased loading causes a positive change in the Detector Amplifier output to the ALC Amplifier. The resultant change in Modulator Bias Signal is negative which decreases the A5 Modulator Assembly Attenuation of the RF Signal and subsequently increases the RF output level.

At <10 MHz, a logic high (>+2.0 Vdc) at the Code 1 input biases A3Q5 off, A3Q2 is biased off, and A3Q3 is turned on. A3C6 is now coupled to ground which effectively reduces the bandwidth of the ALC loop. This occurs so the ALC loop does not respond to individual cyclic variations in the RF Signal but rather to the relatively long term peak output of the RF Detector.

Gain-Shaping Amplifier

The Gain-Shaping Amplifier is a discrete operational amplifier made up of A3Q7, A3Q8, A3Q6, A3Qll, A3Q4, and their associated components. The gain-shaping component is A3CR1. When A3CR1 is reverse biased the gain of the amplifier is unity (times one). As the instantaneous base voltage of A3Q6 is increased (by either positive dc level or positive excursions of an AM drive signal) A3CR1 is forward biased and the amplifier gain is dependent on the ratio of A3R3 and the effective resistance of A3CR1. This variable gain is used to compensate for the non-linearity of the A5 Modulator Assembly's input voltage to RF attenuation transfer function.

Pulse Modulation

In the Pulse Modulation mode (HP Model 86631B Auxiliary Section is used in place of a Modulation Section), a PULSE ID logic high (-+5 Vdc) turns A3Q1 off which opens A3K1 and thus opens the ALC loop. At the same time, the PULSE ID input biases A2Q1 on, closes A2K1, and connects the Pulse In through A2R9, A2C2, and A2VR1 to the A5 Modulator Assembly. Without a pulse input, the positive bias through A2R8 biases the Modulator for maximum attenuation and reduces the power output to a minimum (>40 dB down). A -10 Vdc input pulse is required to cause the Modulator to exhibit minimum attenuation to the RF Signal.

TROUBLESHOOTING

It is assumed that the Troubleshooting information on Service Sheet 1 was used to isolate a circuit defect to the assemblies shown on the accompanying diagram. Troubleshoot the Reference and ALC Amplifier Assemblies and pulse modulation circuits by using the test equipment and procedures given below.

Test Equipment

Digital Voltmeter .... HP 34740A/34702A

Test 1. Check the power supply inputs to the A3 and A10 assemblies at A2XA3 pin 5 (+20V), pin 3 (+5V), and pin 8 (-10V) and A12XA10 pin D (+20V), pin C (+5V), and pin 5(-10V). If the voltages are correct proceed to Test 2. If incorrect, check the continuity of the inputs from the A12 Assembly.

Test 2. Check the Reference Output at P14 Pin E. If the output level is incorrect for the extreme settings of the vernier control or 1 dB Step Attenuator settings, (see schematic for levels) proceed to Test 3. If the output is correct, set A4S1 and check the levels at A3TP1 with the VERNIER (or 1 dB Step Attenuator) set to one extreme and then the other. If the output levels are normal, the Gain-Shaping Amplifier or the Modulator Bias Signal resistors are probably defective. Also check the Pulse ID input and the relays. Otherwise, the Difference Amplifier is probably defective.

A4 Detector Amplifier Assembly
A6 Amplifier/Detector Assembly
←SERVICE SHEET 6

SERVICE SHEET 7 (Cont'd)

Test 3. Check the reference diode A1OVR1, and Reference Amplifier AlOUl and their associated components. If the unit responds only to the local control or responds to remote control and not to the VERNIER, check the LCL/RMT input and the relay. If the reference output is incorrect in remote mode only, check the 1 dB Step Attenuator, relays, transistor switches, and other associated components. Small changes in RF Output level may be traceable to defective components coupled to the 10H input. If it was found that the amplitude modulation level varies with RF Output level, check the components associated with the AM Gain input. If the AM drive signal is reaching the RF Section, verify that it is reaching the A10 Assembly circuitry. Determine which component or part is defective, repair or replace it.

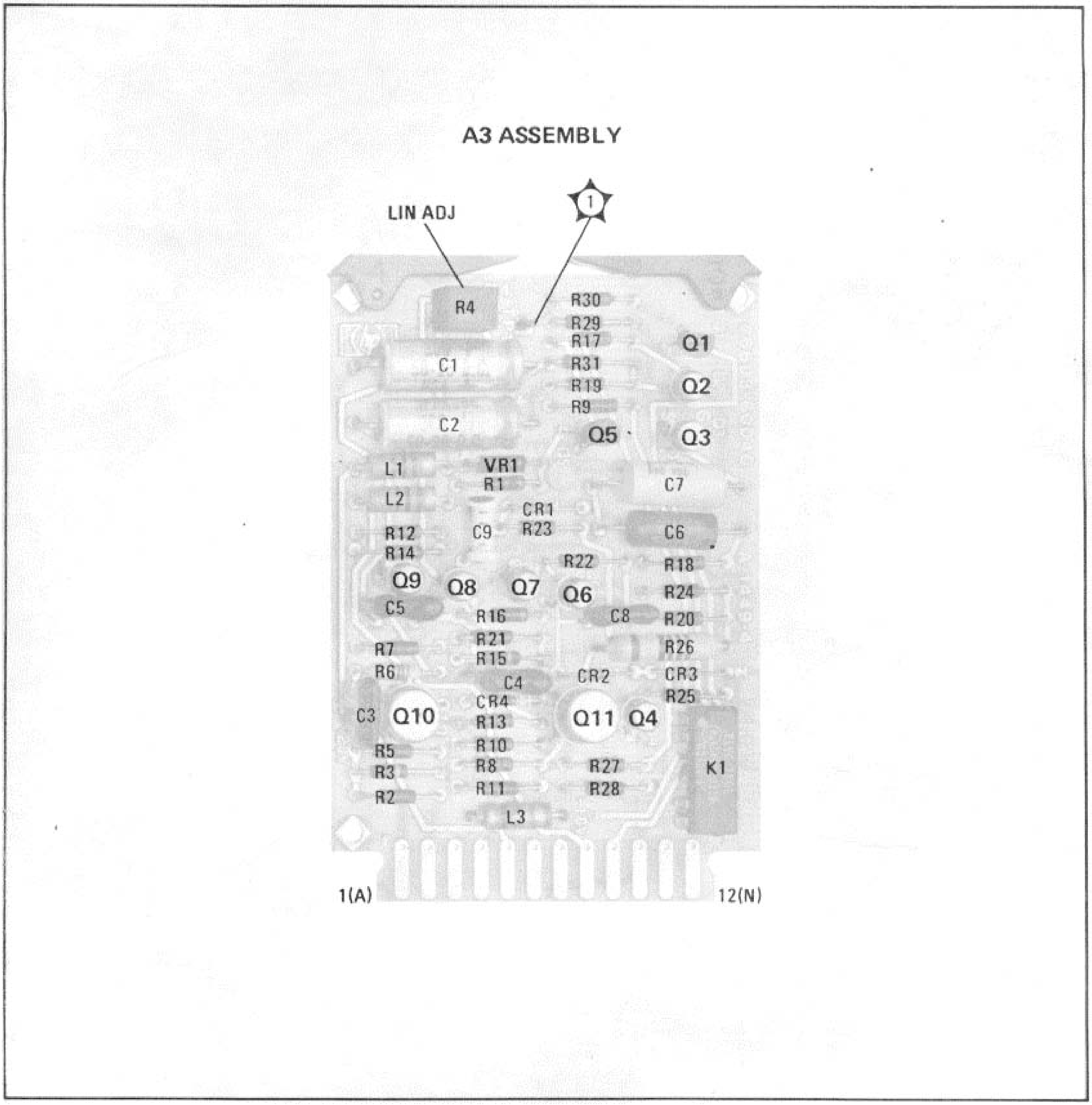


Figure 8-17. A3 ALC Amplifier Assembly Component and Test Point Locations

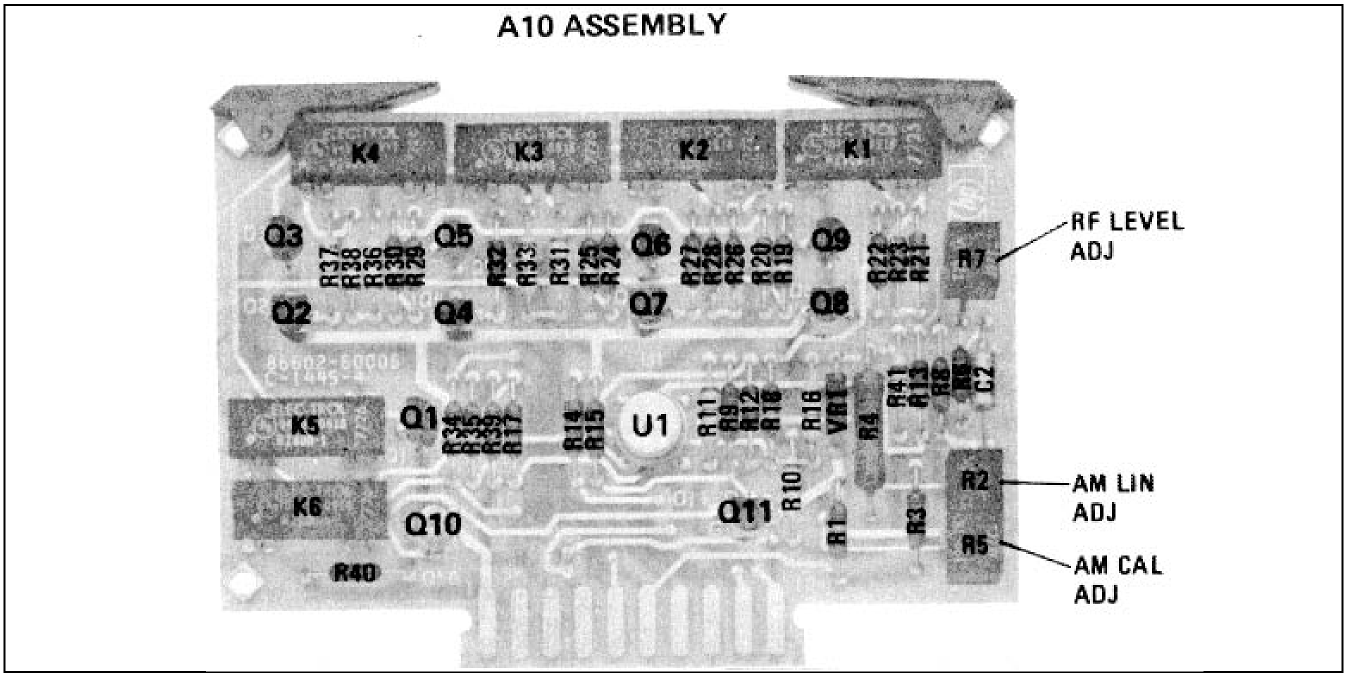


Figure 8-18. A10 Reference Assembly Component Locations

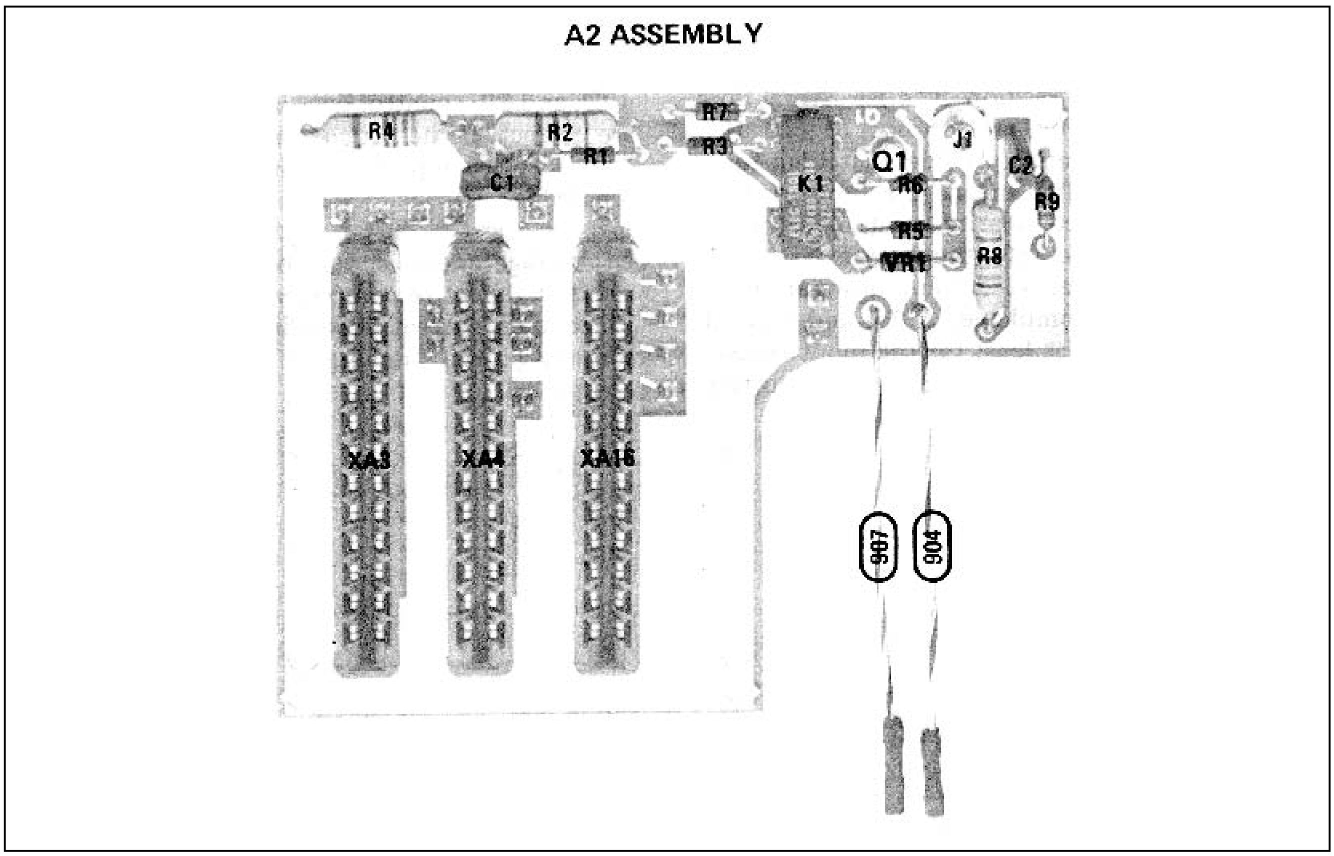


Figure 8-19. A2 ALC Mother Board Assembly Component Locations

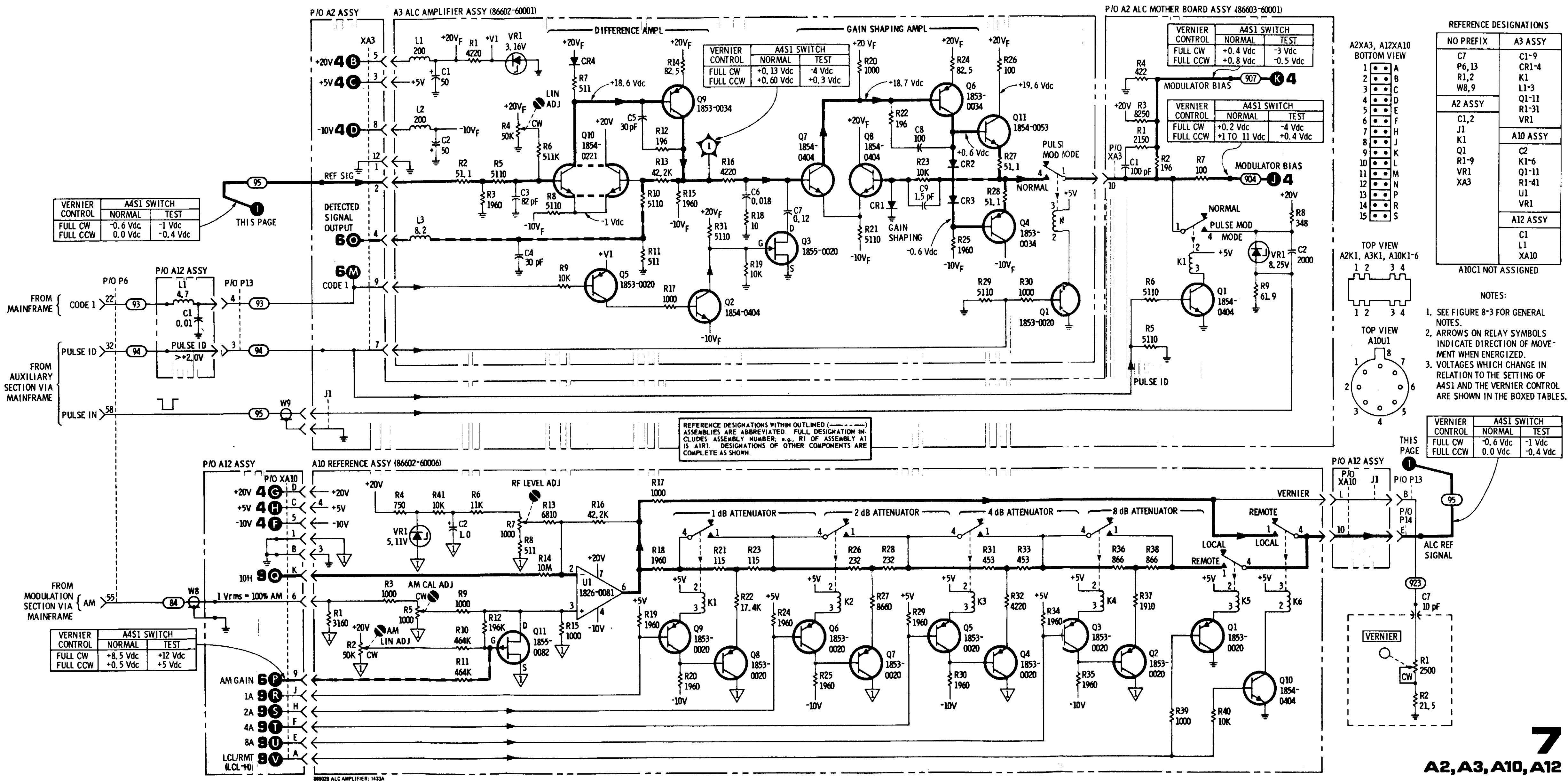


Figure 8-20. ALC Section Schematic Diagram

SERVICE SHEET 8

NOTE

When a malfunction occurs, refer to Section VIII of the Model 8660-series mainframe manual to begin troubleshooting (System Troubleshooting Guide). If the information then indicates possible problems in the RF Section, refer to the Systems Troubleshooting information in Service Sheet 1 of this manual. This information may be used to isolate the defect to the RF Section, another plug-in or the mainframe. If the problem is in this plug-in refer to Service Sheet 2 for further troubleshooting information before returning here.

PRINCIPLES OF OPERATION

Logic high inputs (>+2.0 Vdc) from the All Logic Board Assembly will cause the driver transistors supply current to switch the appropriate attenuator section in the A13 Attenuator Assembly. A logic low (<+0.8 Vdc) switches out the attention. For example, if 10 dB of attenuation desired, the 10L input goes high, A9Q23 is biased; A9Q19 is also biased on and supplies driving current to switch A13K1. The relay arms all drop down into the lower position. The RF Signal flow is now through attenuator section AT1 (10 d The two lower relay arms provide a latching function for the relay. This means that until a drive current of the correct polarity is input to the Attenuator Drive Assembly, the relay is latched its present state. Also, no current flows after the switching has been completed. A9R4 and A9V. provide the proper bias level for the input transistors so they will respond correctly to the input.

A9CR1 provides protection for the driver transistor from the inductive switching transient which occurs when the drive current through the relay is turned off. A9Q21 limits the current flow through A9Q19.

The other attenuator sections function the same way as the 10 dB section. However, the 80 dB section actually uses two 40 dB sections in parallel.

TROUBLESHOOTING

It is assumed that the troubleshooting information on Service Sheet 2 was used to isolate a circuit defect to the assemblies shown on the accompanying diagram. Troubleshoot the Attenuator and Attenuator Driver Assemblies using the test equipment and procedures given below.

Test Equipment
Digital Voltmeter ....HP 34740A/34702A

The malfunction may be isolated to either the A13 or A9 Assemblies by measuring the O1D, 20D, 40D, and 80D control lines and determining if they are correct. If the problem is in the A13 Assembly DO NOT attempt to repair it. It is not a field repairable unit.

DC voltage checks should be sufficient to quickly isolate a defective component in the A9 Assembly. Remember, current flows through the drive transistors only until latching of the relays in A13 is completed.

A2 ALC Mother Board Assembly
A3 ALC Amplifier Assembly
A10 Reference Assembly
←SERVICE SHEET 7

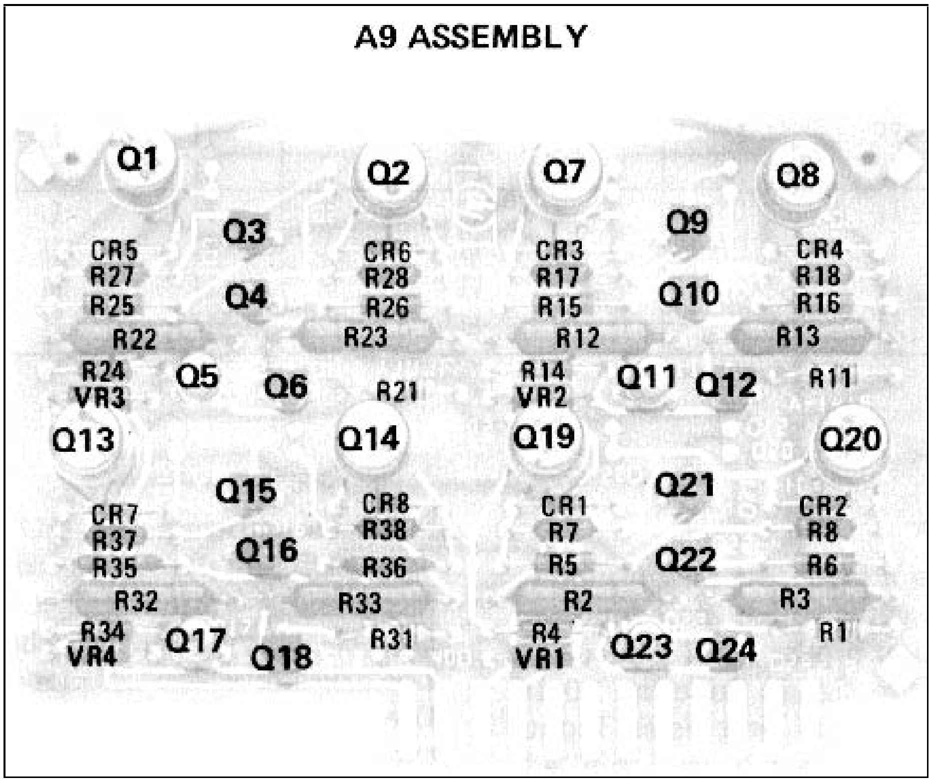


Figure 8-21. A9 Attenuator Driver Assembly Component Locations.

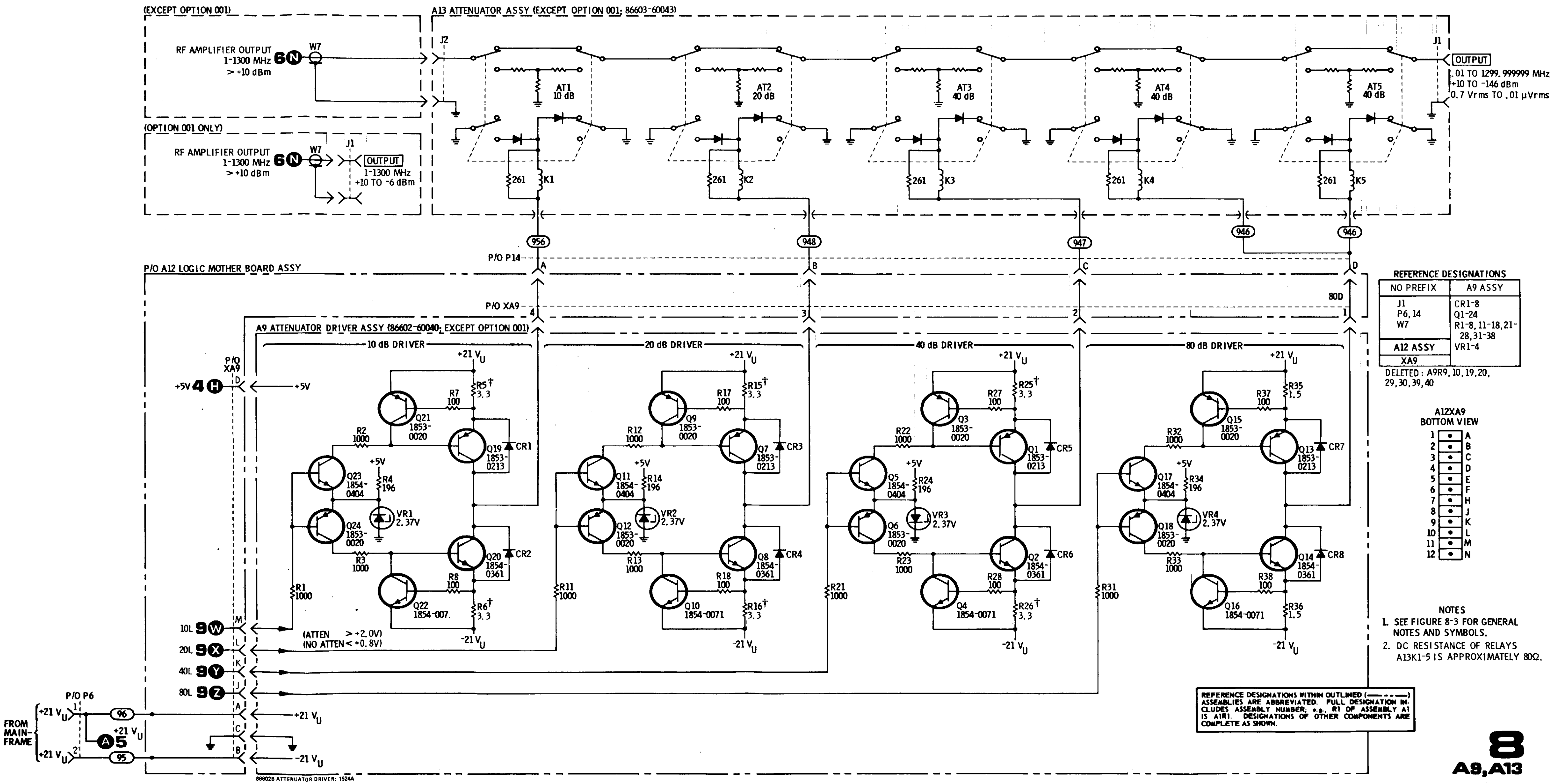


Figure 8-22. Attenuator Section Schematic Diagram

NOTE

When a malfunction occurs, refer to Section VIII of the Model 8660-series mainframe manual to begin troubleshooting (Systems Troubleshooting Guide). If the information then indicates possible problems in the RF Section, refer to the Systems Troubleshooting information in Service Sheet 1 of this manual. This information is used to isolate the defect to the RF Section, another plug-in, or the. mainframe. If the problem is in this plug-in, refer to Service Sheet 2 for preliminary troubleshooting information.

PRINCIPLES OF OPERATION

Local (Front panel) Control

The front panel OUTPUT RANGE switch provides a binary coded hexadecimal input (1F, 2F, 4F, 8F) and an over range input (1H) to the All Assembly in the local mode. The LCL/RMT input is logic high (>+1.3 Vdc) which causes the switch inputs to be gated directly to the outputs to the attenuator driver circuits and the 10H output. The following table shows the logic states of the inputs from the OUTPUT RANGE switch S1. The input signals are all active highs (attenuation) as are the outputs.

Local Inputs to A11 Logic Assembly

OUTPUT RANGE Switch Setting	Binary Coded Hexadecimal Input*				Over-Range Input*
	8F	4F	2F	1F	1H
+10	L	L	L	L	L
0	L	L	L	L	H
—10	L	L	L	H	H
—20	L	L	H	L	H
—30	L	L	H	H	H
—40	L	H	L	L	H
—50	L	H	L	H	H
—60	L	H	H	L	H
—70	L	H	H	H	H
—80	H	L	L	L	H
—90	H	L	L	H	H
—100	H	L	H	L	H
—110	H	L	H	H	H
—120	H	H	L	L	H
—130	H	H	L	H	H
—140	H	H	H	L	H

*L = < +0.8 Vdc; H = > +1.3 Vdc

Remote Operation

In the remote mode, 3 digits of BCD attenuation information are clocked into the All Assembly Shift Registers from the System mainframe. On the ATTN CLK input, a series of 10 pulses are received at pin K. These pulses are coupled to the trigger (T) input to the shift registers. The data input, which is synchronized with the pulses, contain no usable information for the first seven pulses. On the eighth pulse, units information is clocked into the left-handed column of registers with logic highs indicating data ones and lows indicating zeroes. On the ninth pulse, the units information is shifted to the center column of registers while tens information is entered into the left hand registers. On the tenth pulse, the units word is shifted into and stored in the right hand column, the tens information in the center registers, and the hundreds information in the left registers.

The BCD information stored in the units registers is coupled to the 1 dB Step Attenuator on the A10 Reference Assembly. (In local mode these outputs are not used. The VERNIER control is used for fine control of output level.)

The other two digits of BCD information are coupled to the BCD-to-Binary Decoder. The binary tens line actually bypasses the decoder because it expresses odd or even value in either the BCD or binary coded hexadecimal format. The second digit (20, 40 and 80) and third digit (100) in BCD format are output from the BCD-to-Binary Decoder in a 20, 40, and 80 binary format. With the tens level, these outputs are binary coded hexadecimal. In order to obtain the over-range output (10H), the 10, 20, 40 and 80 coded signals are inverted and coupled to a four input nand gate. The nand gate (over-range) output is low only with zero input attenuation (i.e., all the BCD-to-Binary Decoder output lines are low). The over-range level is coupled to All U5C and therefore to the 10H output. It is also coupled to the Full Adder along with the 10, 20, 40, and 80 lines. The inputs to the adder are connected so a value of 10 is subtracted from the input with the Over-Range inactive (high); when the over-range line is low the output follows the input directly. The following tables express the assembly inputs and outputs, the BCD-to-Binary converter inputs and outputs, and the Full Adder inputs and outputs. In each case, a level of >+2.0 Vdc is a logic high and <+0.8 Vdc is logic low.

Logic Assembly Inputs Versus Outputs

Programmed Attenuation Input						OUTPUT RANGE	Logic Assembly Output				
Decimal	2-Digit BCD					Decimal					Over-range
(dB)	100	80	40	20	10	(dBm)	80L	40L	20L	10L	10H
0	L	L	L	L	L	+10	L	L	L	L	H
10	L	L	L	L	H	0	L	L	L	L	L
20	L	L	L	H	L	−10	L	L	L	H	L
30	L	L	L	H	H	−20	L	L	H	L	L
40	L	L	H	L	L	−30	L	L	H	H	L
50	L	L	H	L	H	−40	L	H	L	L	L
60	L	L	H	H	L	−50	L	H	L	H	L
70	L	L	H	H	H	−60	L	H	H	L	L
80	L	H	L	L	L	−70	L	H	H	H	L
90	L	H	L	L	H	−80	H	L	L	L	L
100	H	L	L	L	L	−90	H	L	L	H	L
110	H	L	L	L	H	−100	H	L	H	L	L
120	H	L	L	H	L	−110	H	L	H	H	L
130	H	L	L	H	H	−120	H	H	L	L	L
140	H	L	H	L	L	−130	H	H	L	H	L
150	H	L	H	L	H	−140	H	H	H	L	L

BCD-To-Binary Converter

Input				Output		
100	80	40	20	80	40	20
L	L	L	L	L	L	L
L	L	L	H	L	L	H
L	L	H	L	L	H	L
L	L	H	H	L	H	H
L	H	L	L	H	L	L
H	L	L	L	H	L	H
H	L	L	H	H	H	L
H	L	H	L	H	H	H

SERVICE SHEET 9 (Cont'd)

Full Adder

Inputs					Outputs			
A_4	A_3	A_2	A_1	C_0, B_2, B_3, B_4	∑4	∑3	∑2	∑1
80	40	20	10	Over-Range	80	40	20	10
L	L	L	L	L	L	L	L	L
L	L	L	H	H	L	L	L	L
L	L	H	L	H	L	L	L	H
L	L	H	H	H	L	L	H	L
L	H	L	L	H	L	L	H	H
L	H	L	H	H	L	H	L	L
L	H	H	L	H	L	H	L	H
L	H	H	H	H	L	H	H	L
H	L	L	L	H	L	H	H	H
H	L	L	H	H	H	L	L	L
H	L	H	L	H	H	L	L	H
H	L	H	H	H	H	L	H	L
H	H	L	L	H	L	L	H	H
H	H	L	H	H	H	H	L	L
H	H	H	L	H	H	H	L	H
H	H	H	H	H	H	H	H	L

Local Remote Multiplex
The LCL/RMT input is a logic low in the remote mode. This enables the gates which are connected to the remote attenuation inputs (Full Adder and Over-range) so the remote signals drive the 10 Db Step Attenuator. At the same time logic inputs from the OUTPUT RANGE switch are inhibited.

TROUBLESHOOTING
It is assumed that the troubleshooting information on Service Sheet 1 was used to isolate a circuit defect to the assembly shown on the accompanying diagram. Troubleshoot the Logic Assembly by using the test equipment and procedures given below.

Test Equipment
Digital Voltmeter ....HP 34740A/34702A

If the problem is evident only in the local mode of operation, check the OUTPUT RANGE switch, continuity of the connections to the All assembly, and the Local/Remote Multiplexer. Refer to the table showing the OUTPUT RANGE switch output. If the defect is evident only in the remote mode of operation, check the shift registers, the BCD-to-Binary Decoder, the Full Adder, and the Local/Remote Multiplexer for proper operation. Use the tables showing inputs versus outputs as a tool to isolate the defective component. If the defect is evident in both the Local and Remote modes, the Local/Remote Multiplexer or an associated component is probably defective.

NOTE

If the inputs and outputs of the All Logic Assembly are correct, check the 10 dB step attenuator (Service Sheet 6) in all ranges, the 10 dB attenuator in the A4 Detector Amplifier Assembly, and the 1 dB Step Attenuator in the A10 Reference Assembly (also the 10OH in-puts and associated components). Also, check the 1 dB and 10 dB Step Attenuator outputs with attenuation inputs of 1, 2, 4, and 8 dB and 10, 20, 40, and 80 dB.

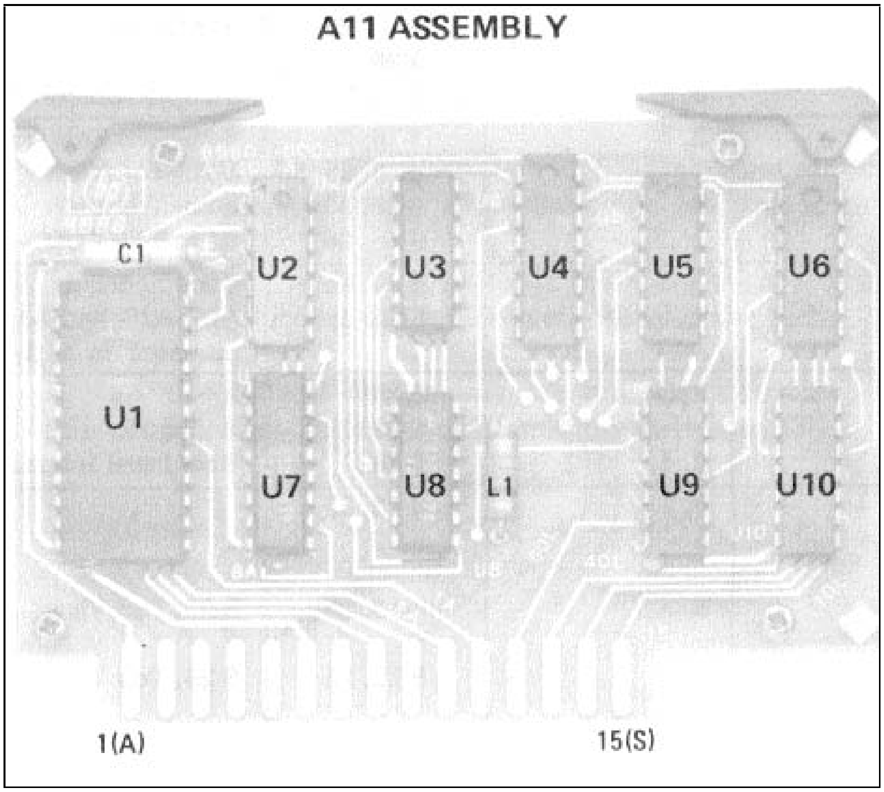


Figure 8-23. A11 Logic Assembly Component Locations.

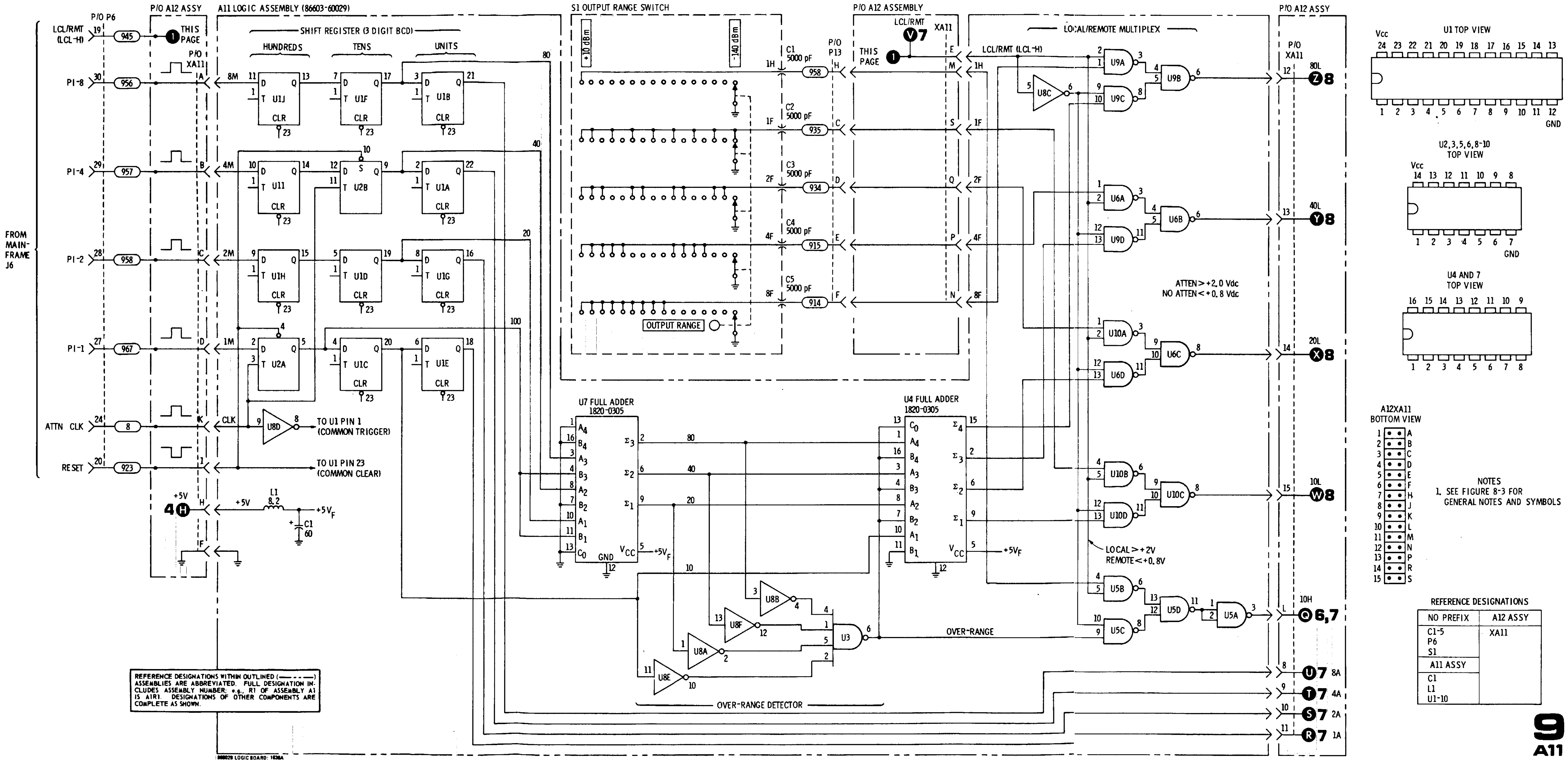


Figure 8-24. A11 Logic Assembly Schematic Diagram.

DISASSEMBLY AND INTERCONNECTION PROCEDURES

CAUTION

Before removing the RF Section plug-in from the mainframe, remove the main (Mains) voltage by disconnecting the power cable from the power outlet.

RF Section Plug-in Removal

a. Release the latch below the front panel OUTPUT jack.

b. Pull the latch out while rotating it to the left until it is perpendicular to the front panel. This separates the mating plug and jack (plug-in to mainframe).

c. Grasp the latch and pull the plug-in straight out from mainframe.

Plug-in Cover Removal

a. Remove the 16 Pozidriv screws from both covers.

b. Loosen the 4 screws which hold the teflon/aluminum plug-in guide in place.

c. Remove the covers and set them aside.

d. If necessary, remove the plug-in guides by removing the screws.

Interconnection of RF Section to Mainframe for Troubleshooting Purposes

After the RF Section is removed from the mainframe and its covers have been removed, the RF Section must be reconnected to the mainframe with interconnecting extender cables before troubleshooting can begin.

CAUTION

With the mainframe top cover removed, power is supplied to the system during troubleshooting. Energy available at many points may constitute a shock hazard.

a. Remove the mainframe top cover. First remove the 4 Pozidriv screws; then slide the cover back and off the mainframe siderails.

NOTE

The interconnect cables and adapters are parts found in the HP 11672A Service Kit. They may all be ordered in the kit or as individual pieces. Refer to the 11672A Operating Note for a pictorial cross reference.

DISASSEMBLY AND INTERCONNECTION PROCEDURES (Cont'd)

b. Make connection from J6 (mainframe) to P6 (RF Section rear panel) with the 11672-60001 multi-pin interconnect cable.

CAUTION

To avoid contact with the line voltage, remove the line (main) power cable from the power outlet before removing or connecting cables to the Frequency Extension Module.

c. Connect the 1250-1236 adapter to the 11672-60005 gray coaxial cable. Insert the adapter into P2 (on the RF Section rear panel above the multipin connector).

d. Remove the gray-blue cable from the jack on the rear side of the Frequency Extension Module. Connect the gray coaxial cable to the extension module jack.

e. Take the 11672-60004 red coaxial cable and connect it to P1 (RF Section rear panel below the multi-pin connector).

f. Disconnect the gray cable from the other extension module output jack. Connect the red coaxial cable to the jack.

g. Reconnect the mainframe line (Main) power cable to the power outlet and set the mainframe line switch to ON.

All Logic Assembly
←SERVICE SHEET 9

Table 8-2. Assemblies, Chassis Mounted Parts, and Adjustable Component Locations (1 of 2)

Reference Designator	Service Sheet	Figures	Remarks
A1 Assembly	2, 4	—	Circuit board, mounted on aluminum deck opposite the A5 Assembly.
A2 Assembly	2, 4, 7	8-19, 25	A3, A4, and A16 plug into connectors mounted on A2.
A3 Assembly	2, 7	8-17, 25	
A3R4, ADJ, LIN	7	8-17, 25	8-25, Top View
A4 Assembly	2, 6	8-15, 25	
A4R13 ADJ, DET BIAS	6	8-15, 25	8-15, Top View
A4R26 ADJ, MTR BIAS	6	8-15, 25	8-15, Top View
A4S1 SWITCH, TEST/NORMAL	2, 6	8-15, 25	8-15, Top View
A5 Assembly	2, 4	8-25	
A6 Assembly	2, 6	8-25	
A7 Assembly	2, 4	8-10, 25	Top View
A8 Assembly	2, 4	8-25	
A9 Assembly	3, 8	8-21, 25	8-25, Left Side View
A10 Assembly	2, 7	8-18, 25	8-25, Left Side View
A10R2, ADJ, AM LIN	7	8-18, 25	8-25, Top View
A10R5 ADJ, AM CAL	7	8-18, 25	8-25, Top View
A10R7 ADJ, RF LEVEL	7	8-18, 25	8-25, Top View
A11 Assembly	3, 9	8-23, 25	8-25, Left Side View
A12 Assembly	2, 4	8-25	(A9, A10, and A11 plug into connectors mounted on A12)
A13 Assembly	2, 8	8-25	
A14 Assembly	—	8-25	Wiring Harness
A15 Assembly	2, 4	8-25	Rear Panel Internal View
A16 Assembly	2, 5	8-12, 25	
A16C8 ADJ, FREQ RESP	5	8-12	
A16R1 ADJ, THIRD HARM	5	8-12, 25	8-25, Top View
A16R2, ADJ, GAIN	5	8-12, 25	8-25, Top View
A16R3 ADJ, SECOND HARM	5	8-12, 25	8-25, Top View
A16R4 ADJ, GAIN TRACKING	5	8-12, 25	8-25, Left Side View
A17 Assembly	2, 5	8-13, 25	
A18 Assembly	2, 5	8-25	
A19 Assembly	2, 5	8-25	
A20 Assembly	3, 4	8-25	8-25, Top View
AT1	4	8-25	
AT2	5	—	Not Shown, connected at A8 input
C1-5	3, 9	8-25	8-25, Left Side View Insert
C6	2, 6	8-25	8-25, Left Side View Insert
C7	2, 7	8-25	8-25, Left Side View Insert
C8, 9	6	—	Mounted on TB1 (see 8-25 Top View)
FL1	2, 4	8-25	8-25, Right Side View
J1	8	8-25	
L1, 2	6	—	Mounted on TB1 (see 8-25, Top View)
M1	2, 6	8-25	8-25, Front Panel Internal View

Table 8-2. Assemblies, Chassis Mounted Parts, and Adjustable Component Locations (2 of 2)

Reference Designator	Service Sheet	Figures	Remarks
P1, 2	2, 4	3-2	3-2, P2 is ① and P1 is ③
P3, 4	6		Not Shown, +20V inputs to A6.
P5	4		Not Shown, +20V input to A8
P6	2, 3, 4, 5, 7, 8, 9	3-2, 8-25	3-2, P6 is ②
P7	4		Not Shown, −10V input to A8
P13	2, 4, 6, 7, 8, 9	8-25	
P14	2, 6, 8	8-25	
R1	2, 7	8-25	8-25, Front Panel Internal View
R2	7	8-25	8-25, Front Panel Internal View
S1	3, 9	8-25	8-25, Front Panel Internal View
TB1	6	8-25	Top View
W1*	2, 5	8-25	Right Side View, FL1 Output
W2*	2, 4	8-25	Top View, A8 Output
W3	2, 4	8-25	AT1 Input, grey/blue
W4*	2, 4	8-25	AT1 Output
W5*	2, 4	8-25	Top View, A5 Output
W6*	2, 4, 6	8-25	Top View, A6 Input
W7*	2, 6, 8	8-25	A13 Input
W8	2, 7	8-25	AM Input to A12, grey/yellow
W9	2, 7	8-4, 25	Pulse Input to A2, white/green
W10*	2, 5	8-25	A18 Output
W11	2, 4	8-25	FL1 Input, grey
W12	2, 5	8-4, 25	ϕM Input to A16, white/violet
W13*	2, 4, 5	8-25	A18 Input
W14	2, 5	8-25	Right Side View, A16 Output, grey
W15	2, 4	8-25	A15 Input from P6, white/blue
W16	2, 4		Not Shown, P6 Interconnect Cable, white/orange
W17	2, 4	8-25	Rear Panel Internal View, P6 Interconnect Cable, white/yellow
W18	2, 4	8-25	Rear Panel Internal View, P6 Interconnect Cable, white/brown
W19	2, 4	8-25	A15 Output to P6, white/red

*Indicates semi-rigid coaxial cable.

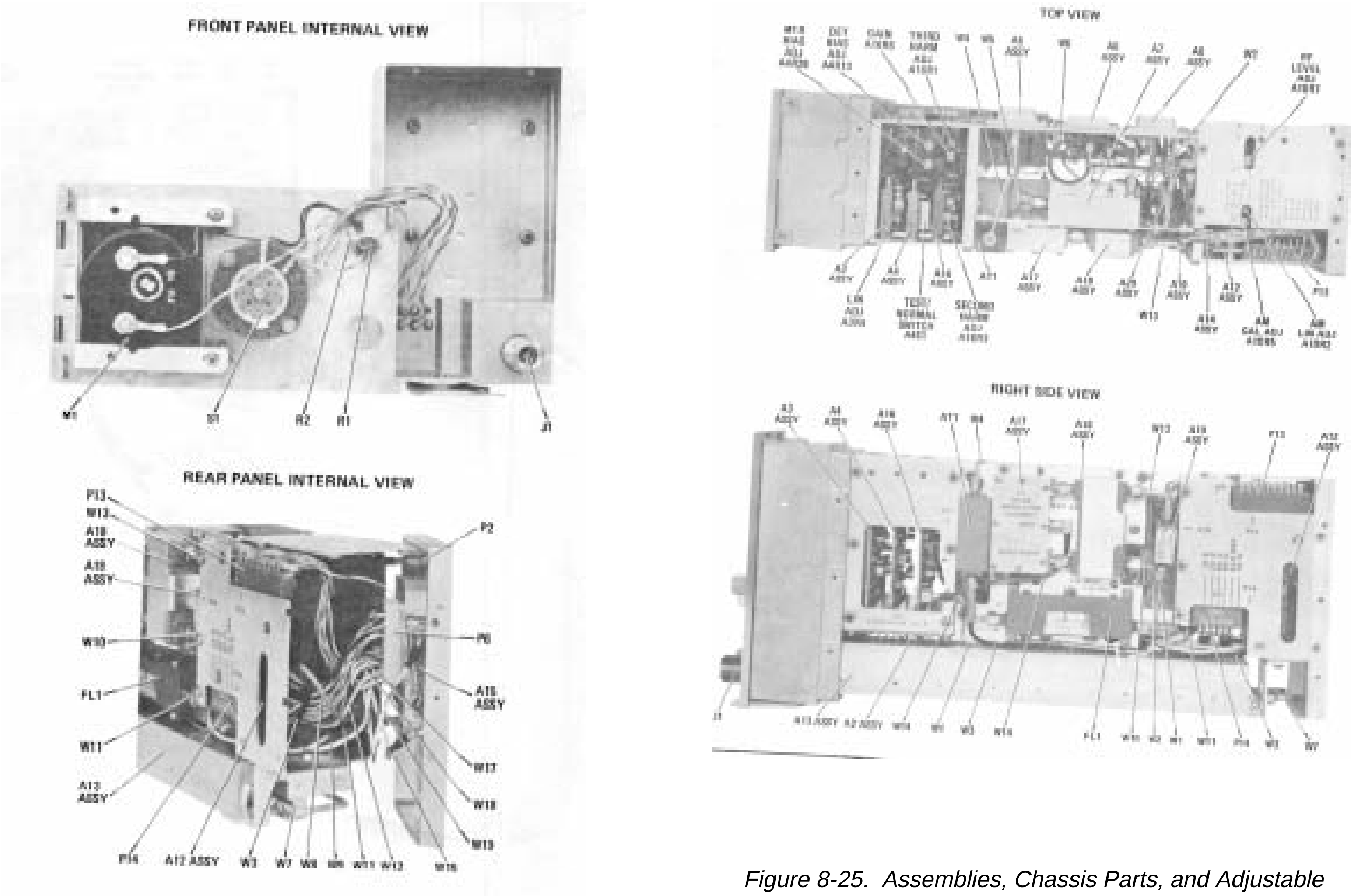


Figure 8-25. Assemblies, Chassis Parts, and Adjustable Component Locations

ERRATA

RF SECTION 1-1300 MHz

MANUAL IDENTIFICATION
Model Number: 86602B
Date Printed: Oct. 1977
Part Number: 86602-90021

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

To use this supplement:

Make all ERRATA corrections

Serial Prefix or Number	Make Manual Changes	Serial Prefix or Number	Make Manual Changes
1734A	1		
1812A	1, 2		
1850A	1, 2, 3		
► 1920A	1 through 4		

ERRATA

Page 6-7 and 6-8,space Table 6-2:
Delete A7A3 HP Part Number. Not separately field replaceable, order new A7 Assembly.

CHANGE 1

Page 6-8, Table 6-2:
Replace the parts list for the A9 Attenuator Driver Assembly found in this supplement (Part of Change 1).

Page 8-31, Figure 8-21:
Replace Figure 8-21 with the component locations diagram in this supplement (Part of Change 1).

Page 8-31, Figure 8-22 (Service Sheet 8):
Replace Figure 8-22 with the schematic found in this supplement (Part of Change 1).

NOTE

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

TABLE 6-2. Replaceable Parts (P/O Change 1)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9	86601-60129	1	ATTENUATOR DRIVER ASSEMBLY	28480	68801-60129
A9C1	0160-0127	4	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A9C2	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A9C3	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A9C4	0160-0127		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A9MP1	1480-0073	2	PIN: DRIVE 0.250” LG	0000J	OBD
A9MP2	1480-0073		PIN: DRIVE 0.250” LG	0000J	OBD
A9MP3	4080-0073	2	EXTRACTOR-PC BOARD YEL POLYC	28480	4040-0752
A9MP4	4080-0073		EXTRACTOR-PC BOARD YEL POLYC	28480	4040-0752
A9Q1	1853-0213	4	TRANSISTOR PNP 2N4236 SI TO-5PD=1W	04713	2N4236
A9Q2	1854-0361	4	TRANSISTOR NPN 2N4239 SI TO-5 PD=800MW	04713	2N4239
A9Q3	1853-0213		TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A9Q4	1854-0361		TRANSISTOR NPN 2N4239 SI TO-5 PD=800MW	04713	2N4239
A9Q5	1854-0071	4	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q6	1853-0020	4	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A9Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1584-0071
A9Q8	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A9Q9	1853-0213		TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A9Q10	1854-0361		TRANSISTOR NPN 2N4239 SI TO-5 PD=800MW	04713	2N4239
A9Q11	1853-0213		TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A9Q12	1854-0361		TRANSISTOR NPN 2N4239 SI TO-5 PD=800MW	04713	2N4239
A9Q13	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q14	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A9Q15	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A9Q16	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A9R1	0757-0280	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A9R2	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A9R3	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A9R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A0R5	0757-0159	8	RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-196R-F
A9R6	0698-3440	3	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-TO-196R-F
A9R7	0757-0159		RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A9R8	0757-0159		RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A9R9	0698-3440		RESISTOR196 1% .125W F TC=0+-100	24546	C4-1/8-TO-196R-F
A9R10	0757-0159		RESISTOR 1K 1% ,5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A9R11	0757-0159		RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A9R12	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-TO-196R-F
A9R13	0757-0159		RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A9R14	0757-0159		RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A9R15	0757-0401	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A9R16	0757-0159		RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A9R17	0698-0082	8	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9R18	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9R19	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9R20	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9R21	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9R22	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9R23	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9R24	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-TO-4640-F
A9VR1	1902-3002	4	DIODE-ZNR 2.37V 5% 00-7 PD=.4W TC=-.074%	04713	8Z 10930-2
A9VR2	1902-3002		DIODE-ZNR 2.37V 5% 00-7 PD=.4W TC=-.074%	04713	8Z 10930-2
A9VR3	1902-3002		DIODE-ZNR 2.37V 5% 00-7 PD=.4W TC=-.074%	04713	8Z 10930-2
A9VR4	1902-3002		DIODE-ZNR 2.37V 5% 00-7 PD=.4W TC=-.074%	04713	8Z 10930-2

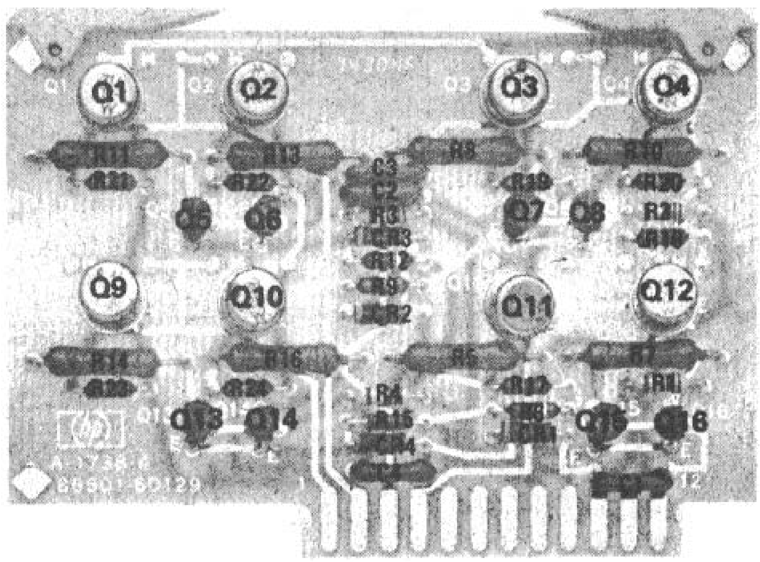


Figure 8-21. A9 Attenuator Driver Assembly Component Locations (P/O Change 1)

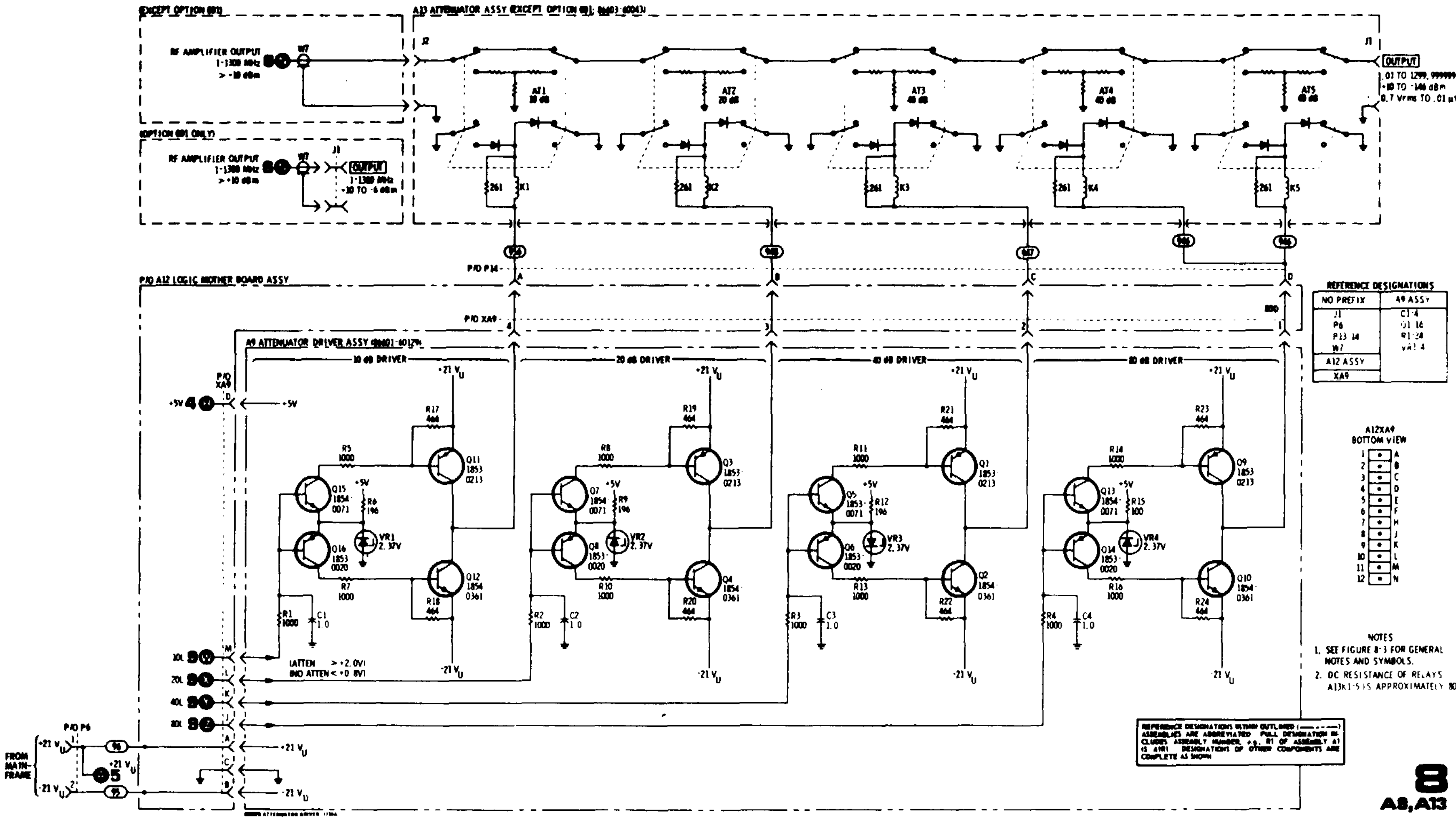


Figure 8-22. Attenuator Section Schematic Diagram (P/O Change 1)

CHANGE 2

Page 6-13, Table 6-2:
Add under CHASSIS PARTS, L3 9170-0499 CORE TOROID AL-2135-NH/T.

Page 8-23, Figure 8-11 (Service Sheet 4):
Add L3 in series with +20V line (red wire) between A12P13 pins 9,K and P5.

CHANGE 3

Page 5-2, Table 5-1:
Add to the table:

Reference Designator	Selected For	Normal Value Range	Service Sheet
A20R4	Current limiting in R1, R2, and R3 of the 50 MHZ High Pass Filter	None to 1.96k	4

The procedure for selecting the resistor (A20R4) is:

1. Measure the voltage (Vdc) to ground at the junction of A7L1 and A7C1.

2. If Vdc A 11.0, no resistor is needed.

3. If 11.0 < Vdc < 14.0, select a 1.96K resistor.

4. If Vdc > 14.0, select a 1.OK resistor.

Page 6-13, Table 6-2:
Add A20R4* 0698-7236 RESISTOR 1K 1% 0.05W F TC-O+100. *FACTORY SELECTED PART.

Page 8-23, Figure 8-11 (Service Sheet 4):
Add, to the A20 Filter Control Assembly, R4* 1000 from the junction of L1 and C3 to ground.
Add to the REFERENCE DESIGNATION BOX, under A20, R4.

CHANGE 4

Page 6-5, Table 6-2:
Change A2R9 to 0764-0013 RESISTOR 56 5%0 2W MO TC - 0 + 200.

Page 8-29, Figure 8.20 (Service Sheet 7):
Change A2R9 to 56.

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Publications.
TM 38-750	The Army Maintenance Management System (TAIMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX B

MAINTENANCE ALLOCATION

SECTION I. INTRODUCTION

D-1. General

This appendix provides a summary of the maintenance operations for the Model 86602B RF Section. It authorizes categories of maintenance for specific maintenance functions on repairable items 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.

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 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 per-formed 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 solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a “work time” 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 categories, appropriate “work time” figures will be shown for each category. The number of task-hours specified by the “work time” 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

0 - 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 main-tenance 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 amd 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.

The next page is B-5.

SECTION II MAINTENANCE ALLOCATION CHART FOR

RF SECTION HP-86602A & B

(1)	(2)	(3)	(4)					(5)	(6)
GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE CATEGORY C	O	F	H	D	TOOLS AND EQUIPMENT	REMARKS
00	RF SECTION	Inspect	0.3						
		Test					2	1-27	
		Adjust					3	27	
		Repair					2	27	
01	MODULATOR FILTER ASSEMBLY (Al)	Inspect				0.3		27	
		Test				0.5		1,5,13,26	
		Replace				0.1		27	
		Repair					0.5	27	
02	ALC MOTHER BOARD ASSEMBLY (A2)	Inspect				0.3		27	
		Test				0.5		1,5.13,26	
		Replace				0.1		27	
		Repair					0.5	27	
03	ALC AMPLIFIER ASSEMBLY (A3)	Inspect				0.3		27	
		Test				0.5		1	
		Replace				0.1		27	
		Repair					0.5	27	
04	DETECTOR AMPLIFIER ASSEMBLY (A4)	Inspect				0.3		27	
		Test				0.5		1,5	
		Replace				0.1		27	
		Repair					0.5	27	
05	2.75 - 3.95 GHz **NO**DULATOR ASSEMBLY (A5)	Inspect				0.3		27	
		Test				0.5		1,5,13,26	
		Replace				0.1		27	
06	1-1300 MHz AMPLIFIER/DETECTOR ASSEMBLY (A6)	Inspect				0.3		27	
		Test				0.5		1,5	
		Replace				0.1		27	
07	MIXER ASSEMBLY (A7)	Inspect				0.3		27	
		Test				0.5		1,5,13,26	
		Replace				0.1		27	
		Repair					0.5	27	
08	4.0 GHz AMPLIFIER ASSEMBLY (A8)	Inspect				0.3		27	
		Test				0.5		1,5,13,26	
		Replace				0.1		27	
09	ATTENUATOR DRIVER ASSEMBLY (A9)	Inspect				0.3		27	
		Test				0.5		1	
		Replace				0.1		27	
		Repair					0.5	27	
10	REFERENCE ASSEMBLY (A10)	Inspect				0.3		27	
		Test				0.5		1	
		Replace				0.1		27	
		Repair					0.5	27	
11	LOGIC ASSEMBLY (All)	Inspect				0.3		27	
		Test				0.5		1	
		Replace				0.1		27	
		Repair					0.5	27	
12	10 DB STEP ATTENUATOR ASSEMBLY (A13)	Inspect				0.3		27	
		Test				0.5		1	
		Replace					0.1	27	
13	20 MHz AMPLIFIER (A15)	Inspect				0.3		27	
		Test				0.5		1,5,13,26	
		Replace				0.1		27	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR

RF SECTION 86602A & B

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	H	DIGITAL VOLTMETER HP 34740A	6625-00-578-6751	
2	D	VOLTMETER, ELECTRONIC ME-30C/U	6625-00-929-1897	
3	D	VECTOR VOLTMETER ME-512/U	6625-00-929-1897	
4	D	OSCILLOSCOPE TEK 5440		
5	H	SPECTRUM ANALYZER TEK 80009	6625-00-558-2329	
6	D	TEST OSCILLATOR HP 651B	6625-00-937-4961	
7	D	SYNTESIZED SIGNAL 8660A	6625-01-008-3284	
8	D	MODULATOR SECTION HP 86632A	6625-00-607-9858	
9	D	COMPUTING COUNTER HP 5360A w/HP 5365A PLUG-IN	7025-00-607-9858	
10	D	WAVE ANALYZER HP 3581A	6625-21-872-1210	
11	D	POWER SUPPLY JF 332	6625-00-481-8901	
12	D	FREQUENCY METER HP 5345 AULF	4935-01-034-9167	
13	H	POWER METER ME-441/U	6625-00-436-4883	
14	D	ATTENUATOR HP 355C	6625-00-866-9462	
15	D	PULSE GENERATOR SC-1105OS/U	6625-01-010-3524	
16	D	CRYSTAL DETECTOR HP 8471A OR EQUIVALENT	5985-00-125-1313	
17	D	MARKED CARD PROGRAMMER HP 3260A OPTION 001		
18	D	DOUBLE BALANCED MIXER HP 10514A OR EQUIVALENT	5985-00-895-4608	
19	D	FUNCTION GENERATOR HP 203A OR EQUIVALENT	6625-00-456-2712	
20	D	MICROWAVE FREQUENCY COUNTER HP 5340A	6625-00-498-8946	
21	D	POWER METER HP 435A	6625-01-033-6593	
22	D	THERMISTOR MOUNT HP 8478B	6625-00-811-2435	
23	D	PULSE GENERATOR HP 8013A	6625-01-010-3524	
24	D	TERMINATION 50s' HP 11048C OR EQUIVALENT		
25	D	DOUBLE BALANCED MIXER WATKINS JOHNSON MIJ		
26	H	SERVICE KIT HP 11672A	5895-01-031-5210	
27	H	COMMON TOOLS AVALIABLE TO REPAIR PERSON		

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