About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual is the best copy we could find; it may be incomplete or contain dated information. If we find a more recent copy in the future, we will add it to the Agilent website.

Support for Your Product

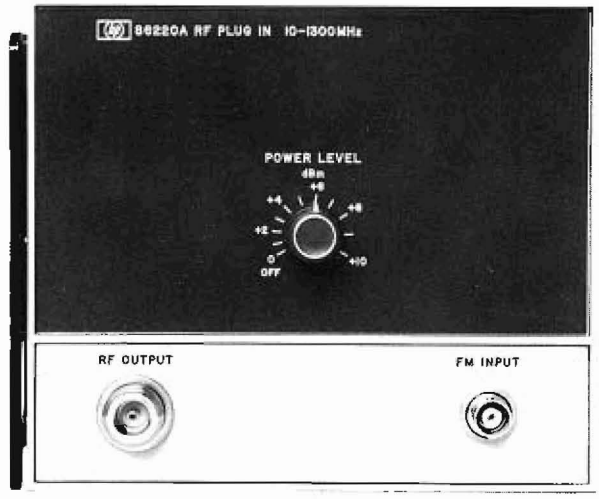
Agilent no longer sells this product. Our service centers may be able to perform calibration and repair if necessary, but no other support from Agilent is available. You will find any other available product information on the Agilent Test & Measurement website, www.tm.agilent.com.

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. In other documentation, to reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product number/name was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

OPERATING AND SERVICE MANUAL

86220A
RF PLUG-IN
10—1300 MHz



HEWLETT hp PACKARD

SAFETY

This instrument has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the instrument safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section I for general safety considerations applicable to this instrument.

CERTIFICATION

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

WARRANTY AND ASSISTANCE

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

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

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

HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

86220A
RF PLUG-IN
10 — 1300 MHz
INCLUDES OPTIONS
002 AND 004

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1506A.

With changes described in Section VII, this manual also applies to instruments with serial numbers prefixed 1135A, 1218A, 1223A, 1230A, 1319A, and 1426A.

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

1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CALIFORNIA, 95404 U.S.A.

MANUAL PART NO. 86220-90020
Microfiche Part No. 86220-90021

Printed: JANUARY 1978

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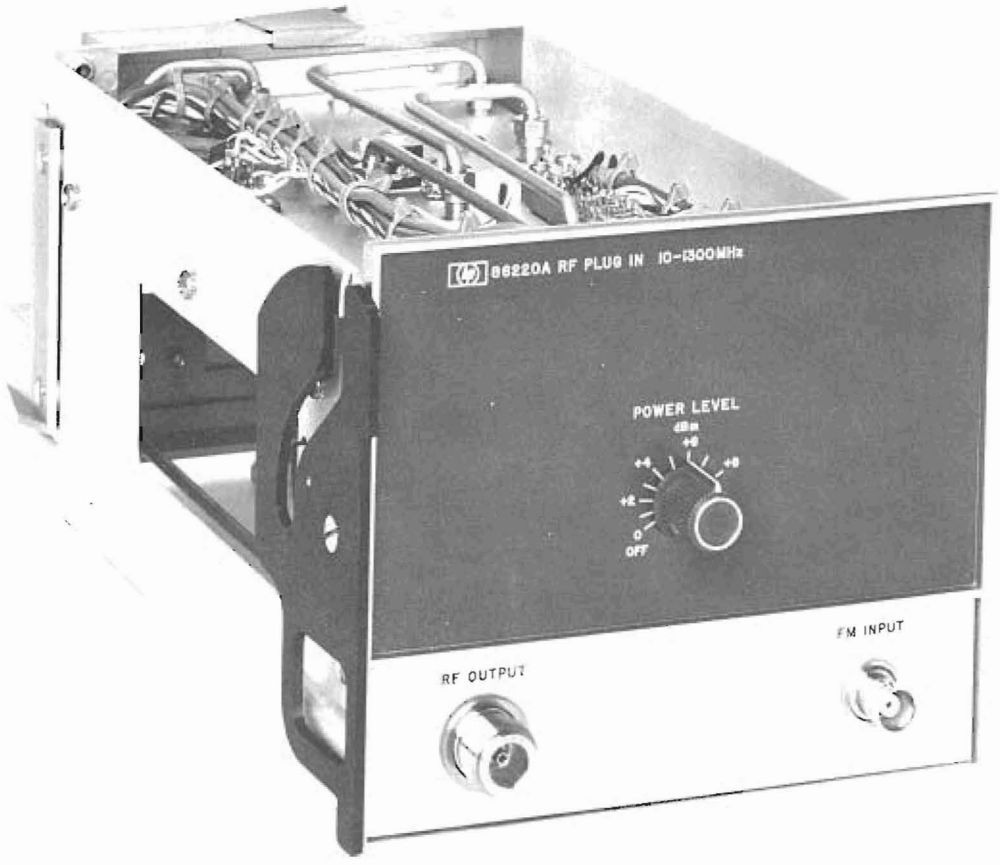
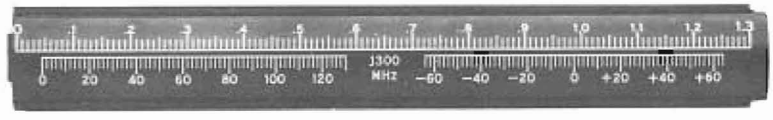


HP 86220A RF PLUG-IN

Scale for 8620A and 8620C
86220-00007



Scale for 8620B
86220-00008

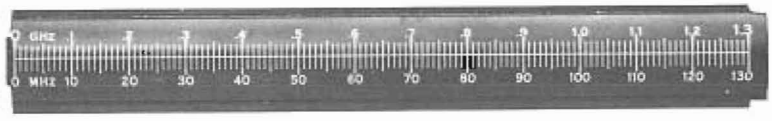


Figure 1-1. Model 86220A RF Plug-In and Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This operating and service manual applies to Hewlett-Packard Model 86220A RF Plug-in 10-1300 MHz. It contains information necessary to install, operate, test, adjust, and service the HP Model 86220A.

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

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

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

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

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

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

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

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

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

1-4. Packaged with this manual is an Operating Information Supplement. This is simply the first three sections of this manual. This supplement should stay with the instrument for use by the instrument operator.

1-5. On the front cover of this manual, below the regular 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 4 x 6-inch 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.

1-6. SPECIFICATIONS

1-7. Critical instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument may be tested. Table 1-2 lists supplemental characteristics. Supplemental characteristics are not specifications but are typical characteristics included for the information of the user.

1-8. SAFETY CONSIDERATIONS

1-9. General

1-10. This instrument has been designed and tested according to international safety standards. However, to ensure safe operation of the instrument and personal safety of the user and service personnel, the cautions and warnings in this manual must be followed.

1-11. Operation

1-12. BEFORE APPLYING POWER, refer to SAFETY CONSIDERATIONS in Section I of the Operating and Service Manual for the Mainframe.

1-13. Service

1-14. Although the instrument has been designed in accordance with international safety standards,

the information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. Service and adjustments should be performed only by qualified service personnel.

1-15. Adjustment or repair of the opened instrument with the ac power connected should be avoided as much as possible but, if necessary, should be performed only by skilled persons who know the hazard involved.

1-16. Capacitors inside the instrument may still be charged even though the instrument has been disconnected from its source of supply.

1-17. If it is suspected that protection has been impaired, the instrument should be made inoperative and secured against any unintended operation.

WARNING

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

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

CAUTION

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

1-18. INSTRUMENTS COVERED BY MANUAL

1-19. Attached to the instrument is a serial number plate (Figure 1-2). The serial number is in two parts. The first four digits and the letter are the serial number prefix; the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

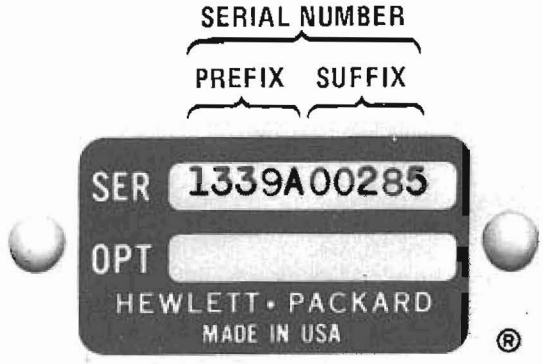


Figure 1-2. Serial Number Plate

1-20. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-21. 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 identified with this manual's print date and part number, both of which appear on the manual's title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-22. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-23. DESCRIPTION

1-24. The Model 86220A RF Plug-in is an internally leveled 10-1300 MHz source designed to operate with a Model 8620A,B, or C Sweep Oscillator Mainframe. The Sweep Oscillator mainframe and RF plug-in make up a complete electronically-tuned signal source that covers the frequency range of 10 to 1300 MHz. The 86220A frequency scale may be placed in any of the four available band positions in the 8620A, B, or C.

Table 1-1. Specifications for 86220A in 8620A, 8620B, or 8620C

SPECIFICATIONS

FREQUENCY[1]

Frequency Range:[2]
Calibrated: 10 to 1300 MHz

Frequency Accuracy:[2]
(At 25°C)
CW Mode[3]: <±10 MHz
All Sweep Modes (Sweep Time>0.1 Sec): <±15 MHz

Frequency Stability:
With Temperature: <±600 kHz/°C
With 10% Line Voltage Change: <±20 kHz
With 10 dB Power Change from specified maximum power: <±20 kHz

Residual FM in 10 kHz Bandwidth:[2]
CW Mode: <5 kHz peak

POWER OUTPUT[1]

Power Level:[2]
(For calibrated frequency range, at 25°C)
Calibrated Leveled Power: 0 to +10 dBm (± 1 dB)
RF OFF level (control fully ccw in detent): Below −40 dBm

Power Variation:
Internal Leveling (Standard):
10 to 1300 MHz: <±0.5 dB
750 to 1300 MHz (Sweep Time >0.1 sec): <±0.2 dB

Power Stability:
With 10% Line Voltage Change: <±0.1 dB

Equivalent Source SWR:
SWR: <1.3:1
Impedance: 50 ohms nominal

Spurious Signals:
Harmonics in dB below fundamental signal at +10 dBm:
10 to 750 MHz: >25 dB (>35 dB at 0 dBm)
750 to 1300 MHz: >30 dB (>40 dB at 0 dBm)
Non harmonics: Below −40 dBm

Residual AM:
(AM noise in 100 kHz bandwidth)
Residual AM: >50 dB Below maximum power.

MODULATION[1]

External FM[2]
Frequency Response: DC to 500 kHz
Maximum Deviation: ±15 MHz

Internal AM:
1 kHz square wave ON/OFF Ratio at maximum power: >35 dB

External AM:[2]
Sensitivity to a −10V input at maximum power: >35 dB
Frequency Response: DC to 10 kHz
Modulation: >50% AM

[1] Unless noted otherwise, all specifications are at 0° to 55°C.

[2] Supplemental characteristics are listed in Table 1-2.

[3] Approach desired frequency from low-frequency end of the band.

Table 1-2. Supplemental Characteristics for 86220 in 8620A, 8620B, or 8620C

SUPPLEMENTAL CHARACTERISTICS[1]

FREQUENCY

Frequency Range:
Useable Range: 10 to 1300 MHz

Frequency Drift:
Drift <200 kHz per ten minutes after one hour warm-up .

Frequency Accuracy in Remote Programmed Mode:
Typically ±6 MHz.

Frequency Reference Output:
1V/GHz

POWER

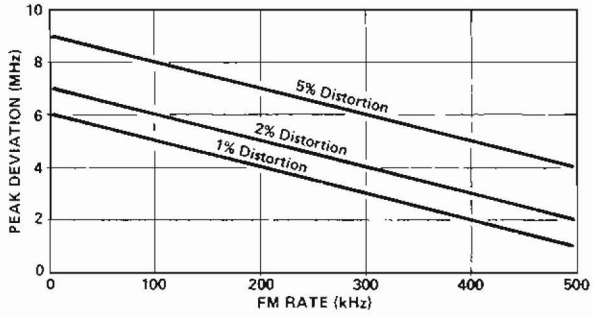
Power Flatness:
Any 20 MHz Portion: <±0.1 dB

Stability with Temperature Change:
Power Change (0 to 55°C): ±0.25 dB

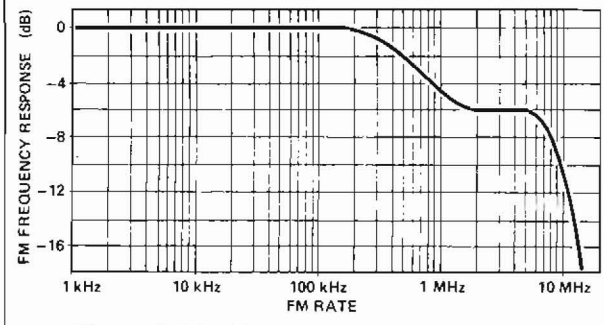
Broadband Noise (In 100 kHz bandwidth):
Noise Level: <−60 dBm

MODULATION

External FM:
Sensitivity: Approximately +3.5 MHz/V
Impedance: 50 ohms
Frequency Response: See the following two graphs.

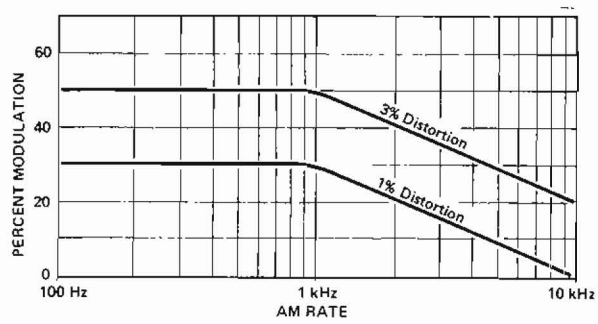


Typical 86220A FM Distortion Curve

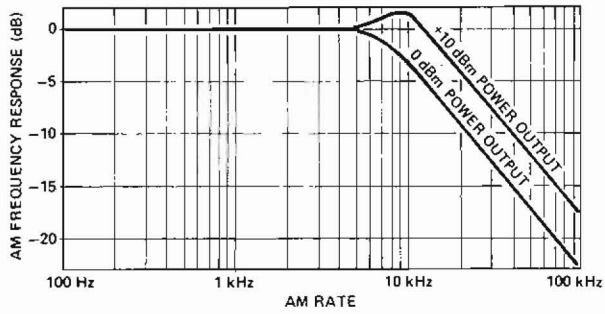


Typical 86220A FM Frequency Response (at 1 MHz peak deviation)

External AM:
Frequency Response: See the following two graphs.



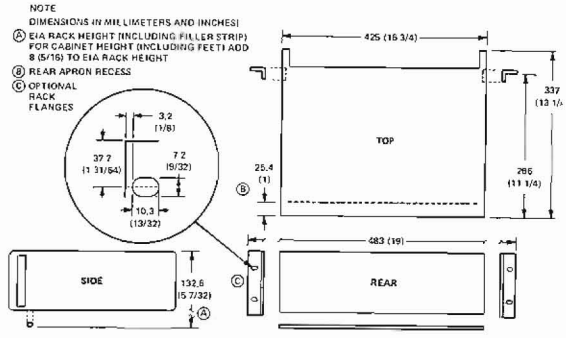
Typical 86220A AM Distortion Curve (at +10 dBm)



Typical 86220A AM Frequency Response (at 20% AM)

GENERAL CHARACTERISTICS

Oscillator Type: Heterodyne
Net Weight: 5 pounds (2,2 Kg).
Dimensions: Height: 5" (12,7 cm)
Width: 5 13/16" (14,7 cm)
Depth: 12" (30,5 cm)



Options:
Option 002: 0 to 70 dB attenuator
Option 004: Rear panel RF OUTPUT

[1] The values in this table are not specifications but are typical performance characteristics included for information to the user.

1-25. OPTIONS

1-26. Options are available (1) to include a 70 dB built-in attenuator and (2) to provide rear-panel RF output.

1-27. Option 002

1-28. Option 002 provides an internal 0 to 70-dB programmable attenuator. The attenuator controls the RF output in 10 dB steps with a front-panel switch. Complete information for Option 002 is in Appendix A.

1-29. Option 004

1-30. Option 004 moves the RF output connector from the front panel to the rear panel. Complete information for Option 004 is in Appendix B.

1-31. ACCESORIES SUPPLIED

1-32. Two frequency scales are supplied with the RF Plug-in. The scales are shown in Figure 1-1. The dial scale supplied and used with the 8620A and 8620C mainframe has HP Part No. 86220-00007. The dial scale supplied and used with the 8620B mainframes has HP Part No. 86220-00008.

1-33. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-34. To have a complete operating sweep oscillator unit, the Model 86220A RF Plug-in must be plugged into a Model 8620A, B, or C Sweep Oscillator mainframe.

1-35. EQUIPMENT AVAILABLE

1-36. Service Accessories

1-37. A Service Accessories package containing a plug-in extender cable, extender board, adjustment tools, and a coaxial extender cable may be purchased from Hewlett-Packard. The Service Accessories package is Part Number 08620-60030. This is available for convenience in aligning and troubleshooting the mainframe, the RF Plug-in, and the oscillator modules. A complete list of equipment included in the Service Accessories package is given in Table 1-3.

1-38. Service Aids

1-39. Other service aids helpful in servicing the 86220A are available and may be ordered through your nearest Hewlett-Packard Office. The service aids needed specifically for servicing the 86220A RF Plug-in are shown in Figure 1-3.

1-40. RF Section 36-Pin Extender

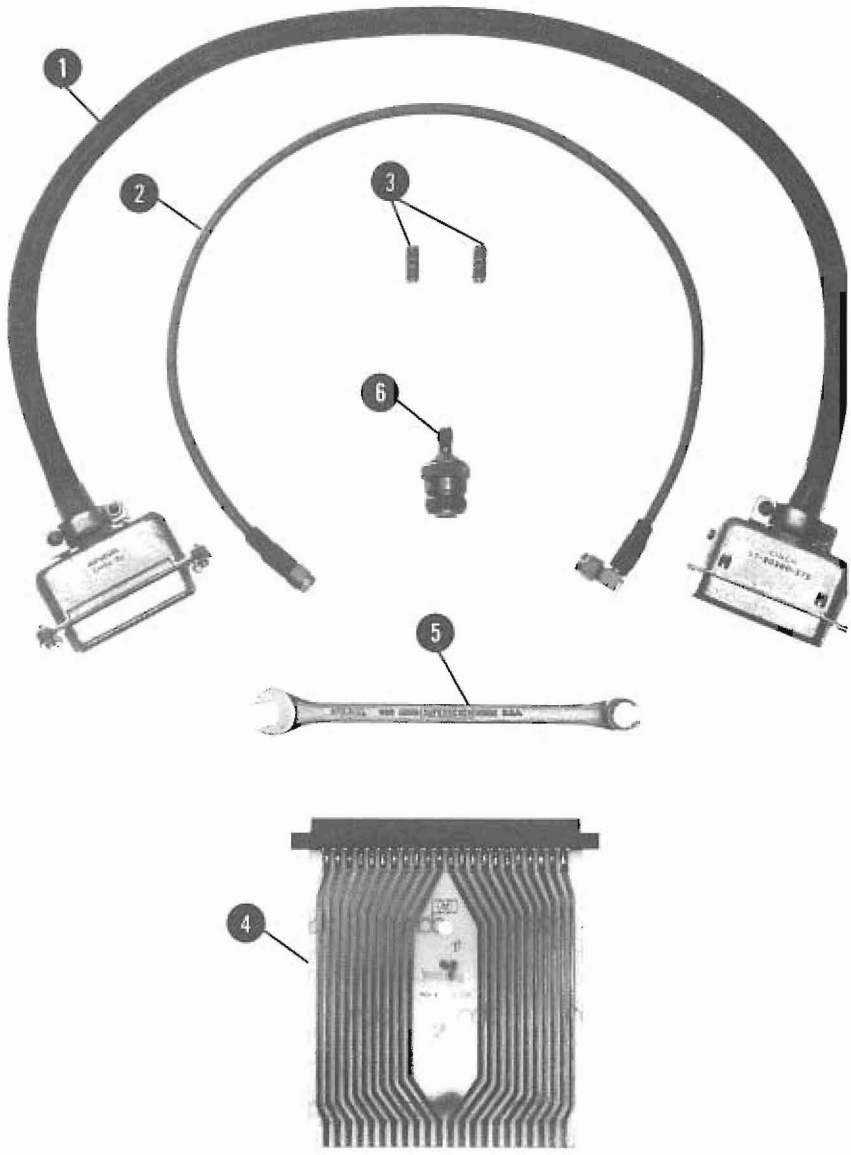
1-41. A 36-pin extender is available for extending the RF Section approximately 1 inch. This allows easy access to components located near the front of the instrument. This extender, shown in Figure 1-4, may be obtained from Hewlett-Packard by ordering Part No. 08621-60056.

1-42. RECOMMENDED TEST EQUIPMENT

1-43. Table 1-4 lists all of the equipment required for performance tests, adjustments, troubleshooting, and repair of the Hewlett-Packard Model 86220A RF Plug-in. Other equipment may be substituted if it meets or exceeds the critical specificaitons listed in the table.

Table 1-3. Equipment in Service Accessories package No. 08620-60030

Qty	Description	Part Number
1	18 pin Extender Board	5060-2041
1	8633A Troubleshooting Board	08633-60012
2	RF Connector, straight adapter, SMA Jack to SMA Jack	1250-1158
1	Extender Cable	08620-60032
1	Service Board	08620-60037
1	Alignment Tool	8830-0024
2	RF Service Cable	8120-1578



Item	Description	HP Part Number
1	Extender Cable*	08620-60032
2	RF Service Cable*	8120-1578
3	RF Connector straight adapter (2) (SMA jack to SMA jack)*	1250-1158
4	22 Pin Extender Board	5060-0630
5	End wrench 5/16 Box end slotted.	08555-20097
6	Type N to SMA Adapter	1250-1404

*Included in Service Accessories package HP Part Number 08620-60030.

Figure 1-3. Service Aids for the 86220A

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

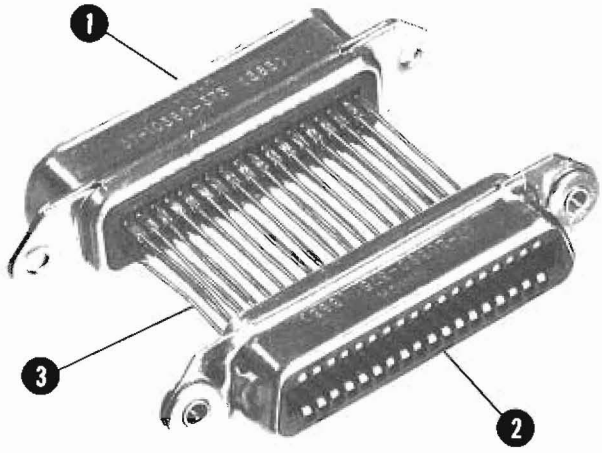
Instrument	Critical Specification	Recommended for Model	Use*
Sweep Oscillator	No Substitute	HP 8620A, B, or C	P,A,T
Test Oscillator Signal Source	Frequency: 10 Hz to 2 MHz Output: 3.16V into 50 or 600 ohms	HP 651B	P,T
Frequency Counter	Range: 10 to 1300 MHz	HP 5340A	P,A,T
Power Meter and Thermistor Mount	Frequency: 10 to 1300 MHz Range: +10 dBm to −20 dBm	HP 432A/8478B	P,A,T
DC Digital Voltmeter	Range: −50V to +50V Accuracy: 0.05%	HP 3460B	A,T
Oscilloscope	Vertical Bandwidth: 20 MHz minimum Vertical Sensitivity: 5 mV/Div Horizontal Sweep Rate: 1μs/Div max.	HP 180C/1801A/1820C	P,A,T
Spectrum Analyzer	Frequency Range: 10 MHz to 3 GHz	HP 8555A/8552B/141T	P,T
DC Power Supply	Range: 0 to 10 Vdc Current: 0.1 Amp	HP 721A	P
Crystal Detector	Frequency: 10 to 1300 MHz SWR: <1.5	HP 423A	P,T
Power Splitter	Frequency: 10 to 1300 MHz (6 dB attenuation in each arm)	HP 11667A	P,A,T
10 dB Attenuator	SWR: <1.3 Attenuation: 10 dB ±0.5 dB	HP 8491A Opt. 010	P,A,T
20 dB Attenuator	SWR: <1.3 Attenuation: 20 dB ±1.0 dB	HP 8491A Option 020	P
Adjustable AC Line Transformer	Output: 100 to 150 Volts ac Power: 150 watts	General Radio MT3A	P,T
RF Service Cables** (2 required)	Impedance: 50 ohms Connectors: SMA to SMA	HP 8120-1578	A,T
RF Connector Adapter**	SMA Jack to SMA Jack	HP 1250-1158	T
Extender Board	22-pin Connector	HP 5060-0630	T
Alignment Tool**	Hex end, non magnetic	HP 8830-0024	A
End Wrench	5/16 inch Special Box end slotted	HP 08555-20097	T

* A=Adjustment; P=Performance Test; T=Troubleshooting.
**These parts are included in Service Kit 08620-60030.

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

Instrument	Critical Specification	Recommended for Model	Use*
Type N to SMA Adapter	Connectors: SMA plug & N jack	HP 1250-1404	A,T
Allen Wrench	5/64 inch	HP 8720-0019	A
RMS Voltmeter	Scale: RMS Volts Accuracy: ±5% Frequency Range: 10 Hz to 2 MHz	HP 3400A	P
BNC Cable Assembly	Length: 2 feet	HP 11086A	P
Low-Pass Filter	Cut-Off Frequency: 700 MHz	HP 360A	P
Directional Coupler	Frequency: 0.1 – 2.0 GHz	HP 796D	P

**A=Adjustment; P=Performance Test; T=Troubleshooting.
**These parts are included in Service Kit 08620-60030.



1. 36-Pin Male Connector (2 x 18) HP Part No. 1251-0483
2. 36-Pin Female Connector (2 x 18) HP Part No. 1251-0484
3. 1-inch 20-Gage Wire HP Part No. 8151-0011

Figure 1-4. RF Section 36-Pin Extender (HP Part No. 08621-60056)

SECTION II
INSTALLATION

2-1. INTRODUCTION

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

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 elecrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the instrument combination does not pass the electrical peformance tests, refer to the 86220A Adjustments (Section V) in this manual. If, after the 86220A adjustments have been made, the instrument combination still fails to meet specifications, refer to mainframe Adjustments in the applicable mainframe Manual. If a circuit malfunction is suspected, refer to troubleshooting procedures section of this manual or applicable mainframe Manual. If the instrument does not pass the above electrical tests, or if the shipment contents are incomplete, or if there is mechanical damage or defect, 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. When the Model 86220A RF Plug-in is properly installed, it obtains all necessary power through the rear connector from the HP Model 8620A, 8620B, or 8620C Sweep Oscillator mainframe.

2-8. Operating Environment

2-9. The operating environment should be within the following limitations:

Temperature . . . . . 0 to 55°C
Humidity. . . . . <95% relative
Altitude. . . . . <15,000 feet

2-10. Mating Connectors

2-11. The mating connectors used in the HP Model 86220A RF Plug-in are shown in Table 2-1. This table identifies each connector and gives the HP Part Number of a mating connector and a part number of an alternate source.

2-12. Interconnections

2-13. For the Model 86220A RF Plug-in to operate, it must be plugged into an 8620A, B, or C mainframe. Connection is made by pushing the RF Plug-in into the mainframe so that the plug-in interface connector P1 mates with the mainframe connector J6.

2-14. To install the RF Plug-in into the mainframe:

a. Set Model 8620A/B/C mainframe line switch to off.

b. Position the drawer latch handle so that the rectangular cutout is exposed and slot is toward rear of unit.

c. Slide RF unit into place toward rear of compartment.

d. The drawer latch handle slot will engage locking pin and start to move down.

e. Press latch handle downward while still pushing in on RF Plug-in, until drawer latch is closed or flush with front panel.

Table 2-1. Model 86220A Mating Connectors

Connector	Industry Identification	HP Part Number	Alternate Source
RF OUTPUT J1	Type N, Male, UG 2IG/U	1250-0882	Specialty Connector 25P117-2
FM INPUT J2	BNC, Male, UG 88/U	1250-0256	Specialty Connector 28P118-1
FREQ REF J3	BNC, Male, UG 88/U	1250-0256	Specialty Connector 28P118-1
Interface P1	Micro-Ribbon 36 Contact Rack and Panel Plug	1251-0484	TRW, Cinch Div. 57-20360-375

2-15. Frequency Scale Installation

CAUTION

To prevent damage to frequency pointers when bandswitch drum is rotated, make certain that frequency scale is firmly in place and flush with band drum edges.

2-16. Swing-down Front Panel. To install a frequency scale in a mainframe with a swingdown front panel, proceed as follows:

a. Select correct scale. (See Figure 1-1.)

b. Disengage mainframe front-panel latch handle and tilt front panel down.

c. Depress BAND Lever until desired drum position is accessible.

NOTE

If necessary to remove a frequency scale, exert a pressure OUTWARD, away from drum on right-hand edge of scale.

d. Insert frequency scale so key (1/2-inch wide protrusion) fits into notch on left-hand side of drum. Then exert inward pressure on right-hand edge of frequency scale to snap it in place.

e. Return front panel to upright position, and re-engage front-panel latch handle.

2-17. Stationary Front Panel. To install a frequency scale in a mainframe with a stationary front panel, proceed as follows:

a. Select correct scale. (See Figure 1-1.)

WARNING

With the top cover removed, terminals are exposed that have AC voltages capable of causing death. Remove the AC line cord from the 8620A/B/C before continuing.

b. Turn off instrument and remove 8620A/B/C top cover.

c. Depress BAND lever until desired drum position is accessible.

NOTE

If necessary to remove a frequency scale, exert a pressure OUTWARD, away from drum on right-hand edge of scale.

d. Insert Frequency scale so key (a 1/2-inch wide protrusion) fits into notch on left-hand side of drum. Then exert inward pressure on right-hand edge of frequency scale to snap it in place.

2-18. STORAGE AND SHIPMENT

2-19. Environment

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

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

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

2-21. Packaging

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

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

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

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

c. Use enough shock-absorbing material (3 of 4 inch layer) around all 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.

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section explains the function of the controls and indicators of the Model 86220A RF Plug-in. It also describes typical operating modes.

3-3. PANEL FEATURES

3-4. Front and rear panel features are described in Figures 3-1 and 3-2. Description numbers match the numbers on the illustration.

3-5. OPERATOR'S CHECK

3-6. Figure 3-3 is an operator's check procedure, allowing the operator to make a quick check of the main instrument functions prior to use. The operator's check assumes that the 86220A RF Plug-in is installed in an 8620A Sweep Oscillator mainframe. The test covers the RF Plug-in and mainframe, therefore, if the correct indications are not obtained, trouble may be in either unit. If the RF Plug-in is suspected, use the performance test in Section IV to determine if the 86220A RF Plug-in is working correctly. Otherwise, follow the troubleshooting tree in Section VIII to isolate the problem.

3-7. OPERATING INSTRUCTIONS

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal could make this instrument dangerous. Intentional interruption is prohibited.

3-8. Internal Leveling

3-9. The standard 86220A is internally leveled and provides leveled power at the output port through the full range of zero to +10 dBm. A directional detector senses the RF level at the output of the amplifier and applies the detected dc-voltage to the automatic level control (ALC) circuit in the 86220A.

3-10. Internal AM

3-11. The 8620A/B/C Sweep Oscillator mainframes have an internal 1 kHz square wave for internal amplitude modulation of the RF. This provides an ON/OFF ratio of >35 dB on the model 86220A.

3-12. External AM

3-13. At approximately 6 dB below maximum power out, the 86220A RF output (CW) signal can be amplitude modulated from 0 to 100% using an external modulating signal applied to the 8620A/B/C EXT AM connector. (At maximum power out, the PIN modulator is near minimum RF attenuation and external AM signals would have little effect.) A negative 10 volts reduces the RF output power to a level at least 35 dB below maximum power output.

3-14. External FM

3-15. The 86220A RF output signal can be frequency modulated using an external modulating signal applied to the 86220A FM INPUT connector. The external FM function provides a means of obtaining an output frequency that varies under the control of an external modulation signal. A positive going voltage causes output frequency to increase while a negative going voltage causes output frequency to decrease.

3-16. Phase Lock Operation

3-17. The 86220A RF output (CW) signal may be phase-locked using an external phase-lock signal applied to the 86220A FM INPUT connector. The phase-lock function provides a means of obtaining a very stable CW frequency by transferring the frequency stability of the reference oscillator to the source. If the CW frequency starts to drift, the phase difference between the CW frequency and the reference frequency (reference oscillator) is detected, producing a dc voltage. The dc voltage is a correction signal which restores the CW frequency to its previous point. Stability of this CW frequency is determined by the stability of the reference oscillator.

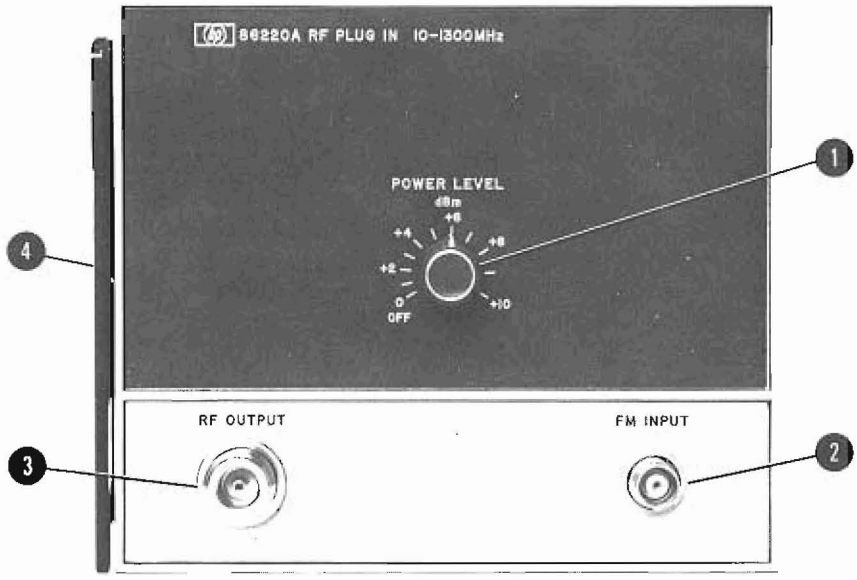
3-18. Frequency Reference

3-19. A sweep signal output is available at the rear-panel FREQ REF connector J3 for phase locking external equipment. The sweep signal is approximately 1V/GHz.

3-20. Operator's Maintenance-Fuses

3-21. Power circuits in the Model 86220A are fused in the mainframe. Supplies in the 8620A/B/C mainframe that are used to power the 86220A are +20 Volt, −10 Volt, and −40 Volt supplies. See the 8620A/B/C Operating and Service Manual for fuse replacement.

FRONT PANEL



1. **POWER LEVEL control.** Adjusts RF power output. The power output is calibrated to the dial marking. Power is internally leveled through the entire range of the POWER LEVEL control. Control at maximum counterclockwise in the OFF detent position turns the RF power off.

2. **FM INPUT connector J2.** Input for external FM modulation signal.

3. **RF OUTPUT connector J1.** Type-N 50-ohm connector for output RF signal.

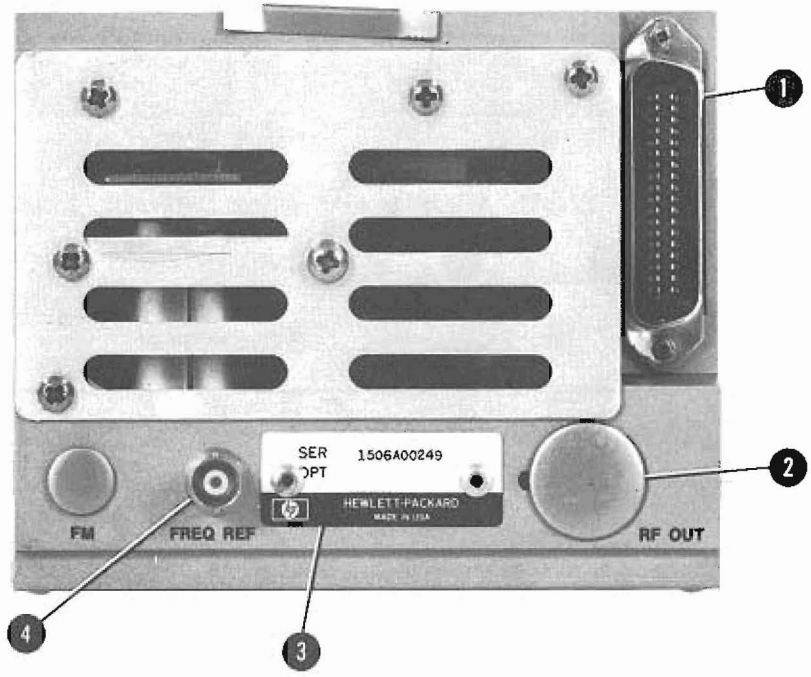
NOTE

When Option 004 is installed, the RF OUTPUT connector is on the rear panel.

4. **Drawer Latch Handle.** Push top of handle, then pull out on the bottom of the handle to remove the RF plug-in from the mainframe.

Figure 3-1. Front Panel Controls and Connectors

REAR PANEL



1. **Interface Connector P1.** Provides interconnection between 8620A/B/C mainframe and 86220A RF Plug-In.

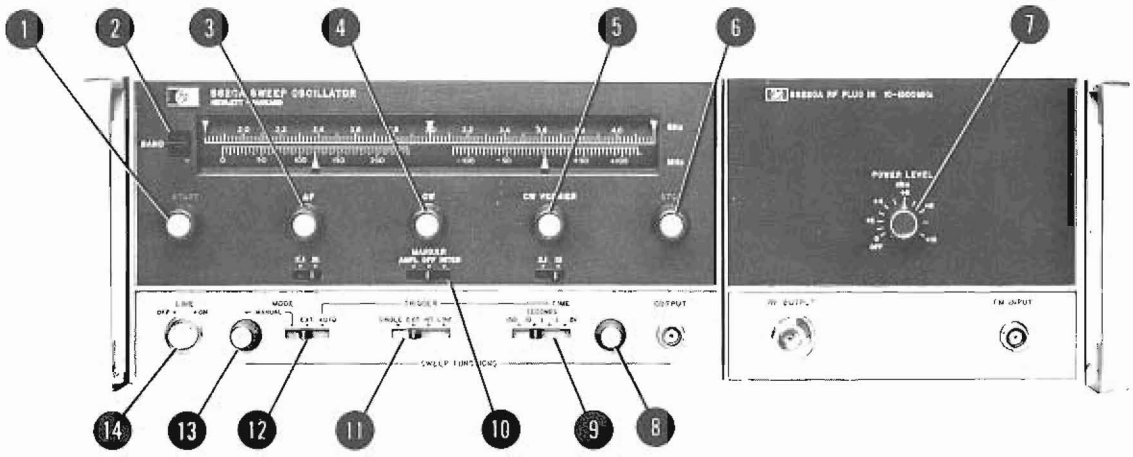
2. When Option 004 is installed, the RF output connector is mounted on the rear panel.

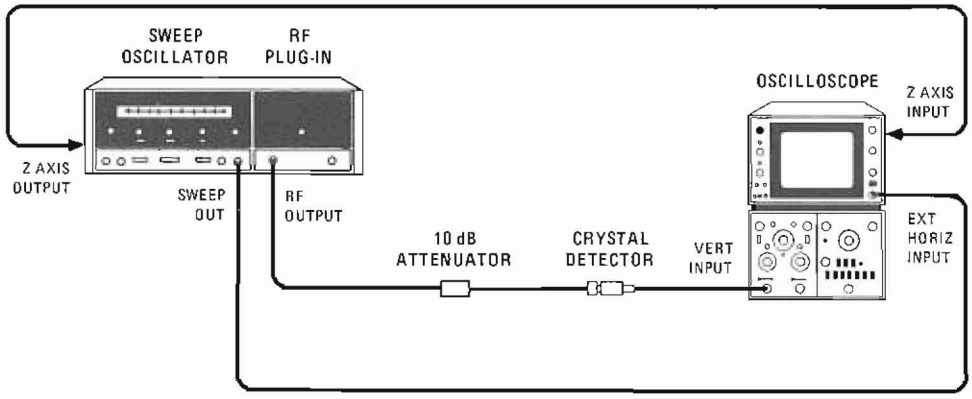
2. **Serial Numbering Label.**

3. **FREQ REF BNC Connector J3.** Provides approximately 1V/GHz ramp signal output or 10mV to 1.3V over the frequency range of 10 — 1300 MHz.

Figure 3-2. Rear Panel Connectors

OPERATOR'S CHECK





EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Oscilloscope	HP 180C/1801A/1820C
Crystal Detector	HP 423A
10 dB Attenuator	HP 8491A, Option 010

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

OPERATOR'S CHECK

PROCEDURE:

1. Set control as follows:

   8620A
   - BAND (2) ..... 10 to 1300 MHz
   - START (green) (1) ..... Low-frequency end of scale
   - STOP (red) (6) ..... High-frequency end of scale
   - CW (white) (4) ..... Center-scale
   - MARKER (10) ..... OFF
   - MODE (12) ..... AUTO
   - TRIGGER (11) ..... INT
   - TIME-SECONDS (9) ..... 1 — .01
   - TIME-SECONDS Vernier (8) ..... Full Clockwise
   - 1 kHz SQ WV/OFF (rear-panel) ..... OFF
   - RF BLANKING/OFF (rear-panel) ..... RF BLANKING
   - DISPLAY BLANKING/OFF (rear-panel) ..... OFF

   86220A
   - POWER LEVEL (7) ..... Full Clockwise

2. Depress the LINE pushbutton switch (14) to turn on the instrument. Press START pushbutton (1).

3. Check that the RF Plug-in is sweeping correctly and is leveled. This is indicated by a continuous level signal line above or below the zero volt dc level on the oscilloscope. (See Figure 3-4.)

4. Set MARKER switch (10) to AMPL position and the marker should appear on the oscilloscope trace as a pip.

5. Adjust 86220A POWER LEVEL control (7) through the full range of +10 dBm to zero dBm. The oscilloscope trace should show a smooth decrease in signal amplitude.

6. Press 8620A CW pushbutton (4). Set rear-panel 1 kHz SQ WV/OFF switch to 1 kHz SQ WV.

7. Set 86220A POWER LEVEL control (7) to zero dBm. Set oscilloscope for internal horizontal sweep. The displayed square wave should not have excessive overshoot or rounding.

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

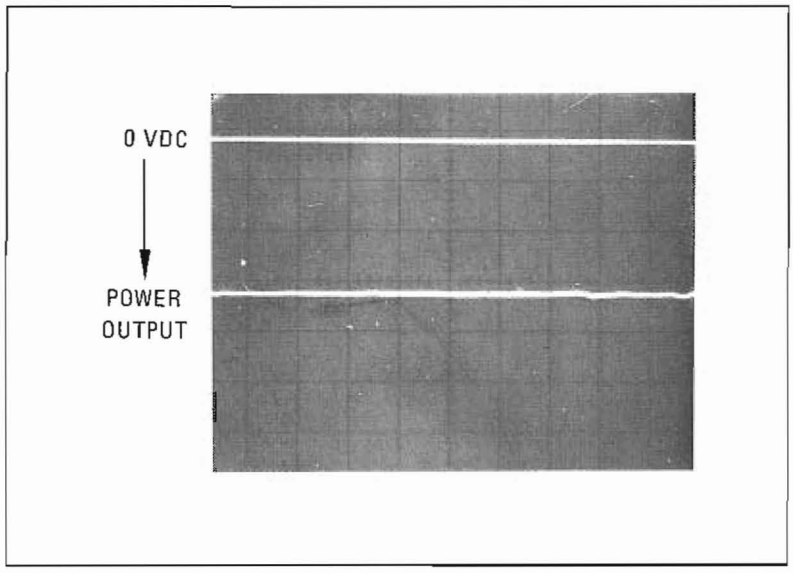


Figure 3-4. Leveled RF Power Output

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

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

4-3. EQUIPMENT REQUIRED

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

4-5. TEST RECORD

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

NOTE

In the following procedure, an 8620A mainframe is specified. However, an 8620B or 8620C may be used, but the control names will be different than those called out in the procedure. These procedures assume that the mainframe is fully calibrated to its specifications.

PERFORMANCE TESTS

4-7. FREQUENCY RANGE AND ACCURACY TEST

SPECIFICATION:

Frequency range: 10 to 1300 MHz
Frequency accuracy (at 25° C ambient):
CW mode: ±10 MHz (Approach desired CW frequency from low-frequency end of band.)
All Sweep Modes: ±15 MHz (Sweep Time >0.1 sec.)

DESCRIPTION:

The CW mode is checked at selected frequencies across the band to determine if the RF signal is within frequency tolerance. Start-Stop sweep is then selected and checked at selected frequencies across the band.

PERFORMANCE TESTS

4-7. FREQUENCY RANGE AND ACCURACY TEST (cont'd)

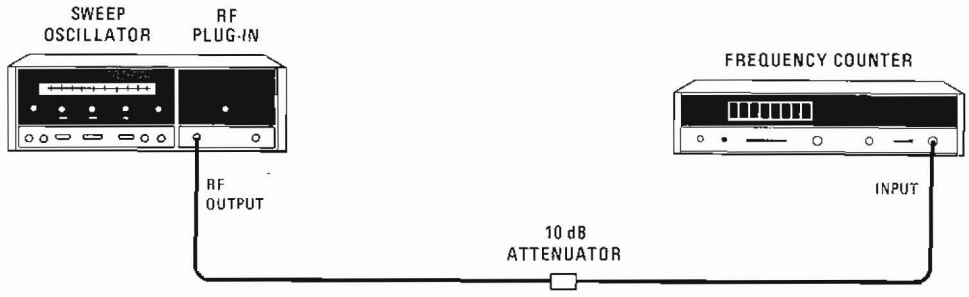


Figure 4-1. Frequency Range and Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Frequency Counter	HP 5340A
10 dB Attenuator	HP 8491A, Option 010

PROCEDURE:

a. Connect equipment as shown in Figure 4-1. Connect frequency counter through a 10 dB attenuator to the 86220A RF OUTPUT connector.

b. Set controls as follows:

86220A

POWER LEVEL	Full clockwise

8620A

BAND	10 to 1300 MHz
MODE	MANUAL
TRIGGER	INT
TIME-SECONDS	1 to .01
1 kHz SQ WV/OFF (rear panel)	OFF
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	OFF

c. Set 8620A LINE switch to ON. Allow equipment to warm up for 30 minutes. Press 8620A CW pushbutton. Set frequency counter to measure frequencies from 10 to 1300 MHz.

NOTE

Always approach frequency settings from low-frequency end.

d. Adjust CW pointer to high-frequency end, then to low-frequency end; repeat several times. Set CW pointer to each of the settings in Table 4-1 and check frequency accuracy.

PERFORMANCE TESTS

4-7. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

Table 4-1. CW Dial Accuracy

CW Pointer Setting[1] (MHz)	Frequency Counter Indication	
	Minimum	Maximum
10	0 MHz	20 MHz
50	40 MHz	60 MHz
100	90 MHz	110 MHz
300	290 MHz	310 MHz
500	490 MHz	510 MHz
800	790 MHz	810 MHz
1000	990 MHz	1010 MHz
1300	1290 MHz	1310 MHz

[1] To avoid error due to parallax when setting CW pointer to a frequency scale calibration mark, view pointer and scale directly from front of instrument panel.

e. Set Sweep MODE switch to MANUAL. Press START pushbutton. Set START and STOP pointers to each of the settings in Table 4-2 and check frequency accuracy with MANUAL sweep control either full counterclockwise (CCW) or full clockwise (CW) as specified in the table.

Table 4-2. START/STOP Dial Accuracy

START pointer[1] setting (MHz)	STOP pointer[1] setting (MHz)	MANUAL sweep control	Frequency counter indication	
			Minimum	Maximum
20	1300	CCW	5 MHz	35 MHz
20	1300	CW	1285 MHz	1315 MHz
100	1000	CW	985 MHz	1015 MHz
100	1000	CCW	85 MHz	115 MHz
200	800	CCW	185 MHz	215 MHz
200	800	CW	785 MHz	815 MHz
400	600	CW	585 MHz	615 MHz
400	600	CCW	385 MHz	415 MHz
800	200	CCW	785 MHz	815 MHz
800	200	CW	185 MHz	215 MHz
1300	20	CW	5 MHz	35 MHz
1300	20	CCW	1285 MHz	1315 MHz

[1] To avoid error due to parallax when setting CW pointer to a frequency scale calibration mark, view pointer and scale directly from front of instrument panel.

PERFORMANCE TESTS

4-8. FREQUENCY STABILITY TEST

SPECIFICATION:
Frequency stability:
With 10%change in line voltage: $< \pm 20$ kHz
With 10 dB power level change from specified maximum power: $< \pm 20$ kHz

DESCRIPTION:

Frequency is measured for change due to line voltage and power level changes.

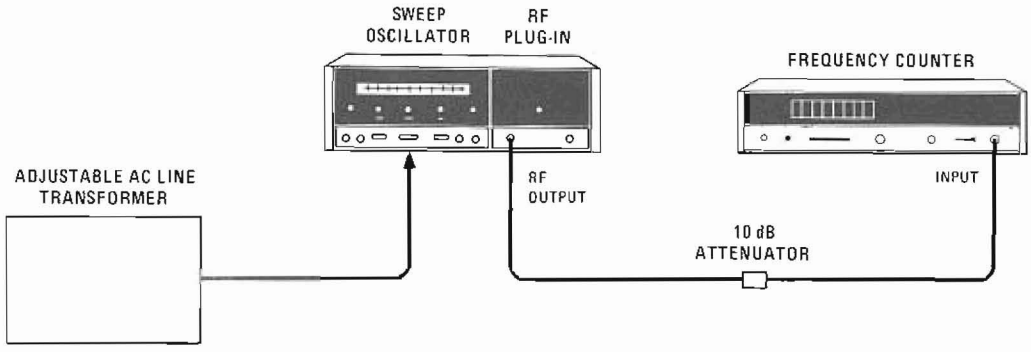


Figure 4-2. Frequency Stability Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Frequency Counter	HP 5340A
10 dB Attenuator	HP 8491A, Option 010
Adjustable AC Line Transformer	General Radio MT3A

PROCEDURE:

Frequency change with line voltage change

a. Set controls as follows:

86220A
POWER LEVEL ..... +10 dBm

8620A
BAND ..... 10 to 1300 MHz
CW pointer ..... 650 MHz
1 kHz SQ WV/OFF (rear panel) ..... OFF
RF BLANKING/OFF (rear panel) ..... RF BLANKING
DISPLAY BLANKING/OFF (rear panel) ..... OFF

b. Connect equipment as shown in Figure 4-2. Set adjustable line voltage transformer to 115 Vac. Set 8620A LINE switch to ON; press CW pushbutton. Allow 30 minutes warm up time.

PERFORMANCE TESTS

4-8. FREQUENCY STABILITY TEST (Cont'd)

c. Record the frequency indication on the counter at 115 Vac.

d. Set line voltage to 103 Vac with adjustable line transformer. The frequency change from that noted in step c should be less than ±20 kHz.

e. Set line voltage to 127 Vac with adjustable line transformer. The frequency change from that noted in step c should be less than ±20 kHz. Return line voltage to 115 Vac.

Frequency change with power level change

f. Note frequency indication on the counter. Set 86220A POWER LEVEL control to zero dBm. The frequency change should be less than ±20 kHz.

4-9. RESIDUAL FM IN 10 KHZ BANDWIDTH TEST

SPECIFICATION:

Residual FM measured in a 10 kHz bandwidth <5 kHz peak in CW mode.

DESCRIPTION:

The sweep oscillator RF output CW signal is displayed on a spectrum analyzer. The residual FM is observed on a storage display by displaying five superimposed traces.

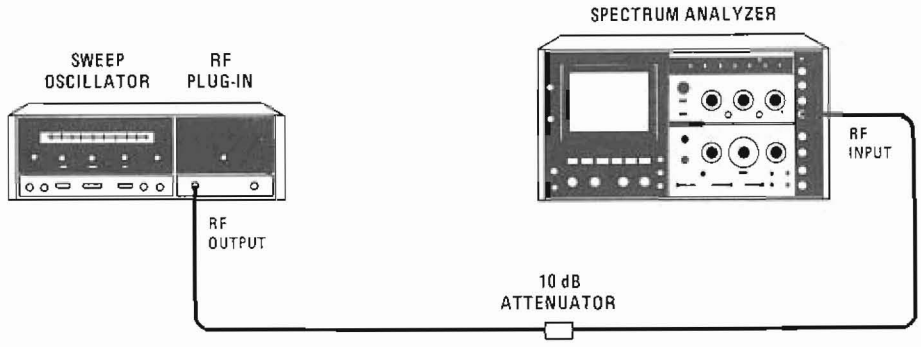


Figure 4-3. Residual FM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Spectrum Analyzer	HP 8555A/8552B/141T
10 dB Attenuator	HP 8491A, Option 010

PERFORMANCE TESTS

4-9. RESIDUAL FM IN 10 kHz BANDWIDTH TEST (cont'd)

PROCEDURE:

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

b. Set controls as follows:

86220A
POWER LEVEL ..... +10 dBm

8620A
BAND ..... 10 to 1300 MHz
CW pointer ..... 650 MHz
1 kHz SQ WV/OFF (rear panel) ..... OFF
RF BLANKING/OFF (rear panel) ..... OFF
DISPLAY BLANKING/OFF (rear panel) ..... OFF

c. Set 8620A LINE switch to ON; press 8620A CW pushbutton. Allow 30 minutes warm up time.

d. Center the RF output signal on the spectrum analyzer. Verify that the oscillator fundamental is displayed by the signal identification procedure.

e. Set the spectrum analyzer BANDWIDTH to 10 kHz and SCAN WIDTH PER DIVISION to 5 kHz while keeping signal centered on CRT display.

f. On the spectrum analyzer, select LINEAR display and adjust LINEAR SENSITIVITY vernier control for a full eight division display.

g. Set SCAN TIME PER DIVISION to 20 msec and set SCAN MODE to SINGLE sweep.

h. Push SINGLE sweep pushbutton five times at approximately one second intervals and store the resultant traces on the CRT screen.

i. The trace should be similar to Figure 4-4. The FM deviation measured across the top of the trace should be less than 10 kHz (two divisions).

PERFORMANCE TESTS

4-9. RESIDUAL FM IN 10 kHz BANDWIDTH TEST (cont'd)

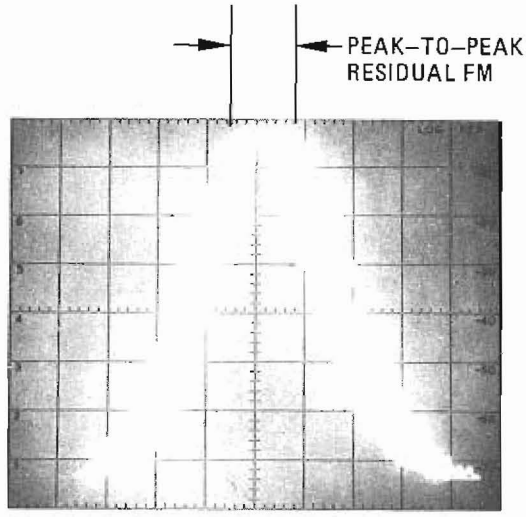


Figure 4-4. Residual FM Displayed on Spectrum Analyzer

4-10. POWER LEVEL AND VARIATION TEST

SPECIFICATION:

POWER LEVEL:

(For calibrated frequency range, at 25° C)
Calibrated Leveled Power: zero to +10 dBm (±1 dB)
Power variation at maximum leveled power:
10 to 1300 MHz: <±0.5 dB[1]
750 to 1300 MHz with sweep time >0.1 sec: <±0.2 dB
Power stability with 10% Line voltage Change: <±0.1 dB

DESCRIPTION:

Maximum leveled power is measured with a power meter. The power output specification is stated for the output of the 86220A with no options installed. Power variations across the band of a swept signal are measured on the oscilloscope trace. The trace is calibrated by changing the RF output power by the amount of the specification as noted on the power meter and the corresponding change in trace on the oscilloscope.

PERFORMANCE TESTS

4-10. POWER LEVEL AND VARIATION TEST (Cont'd)

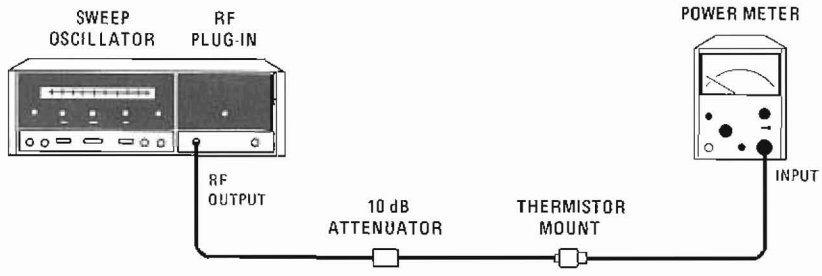


Figure 4-5. Power Level and Variation Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Power Meter	HP 432A
Oscilloscope	HP 180C/1801A/1820C
Adjustable AC Line Transformer	General Radio MT3A
Crystal Detector	HP 423A
Power Splitter	HP 11667A
Thermistor Mount	HP 8478B
10 dB Attenuator	HP 8491A, Option 010

PROCEDURE:

Initial control settings

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

b. Set controls as follows:

8620A

BAND	10 to 1300 MHz
START pointer	10 MHz
CW pointer	650 MHz
STOP pointer	1300 MHz
MARKER	OFF
MODE	AUTO
TRIGGER	INT
TIME-SECONDS	.1 to .01
TIME-SECONDS Vernier	Full Clockwise
1 kHz SQ WV/OFF (rear panel)	OFF
RF BLANKING/OFF (rear panel)	OFF
DISPLAY BLANKING/OFF (rear panel)	OFF
LINE	ON

PERFORMANCE TESTS

4-10. POWER LEVEL AND VARIATION TEST (Cont'd)

Maximum Leveled Power

c. Press 8620A START pushbutton. Adjust POWER LEVEL control to the zero dBm mark. Calculate the power output at the RF OUTPUT connector of the 86220A as follows: add the power meter indication to the actual attenuation of the 10 dB attenuator. This total should be zero dBm ±1 dB.

d. Adjust POWER LEVEL control to the +10 dBm mark. Calculate the power output at the RF OUTPUT connector of the 86220A as follows: add the power meter indication to the actual attenuation of the 10 dB attenuator. This total should be +10 dBm ±1 dB.

Leveled Power Variation

e. Connect equipment as shown in Figure 4-6.

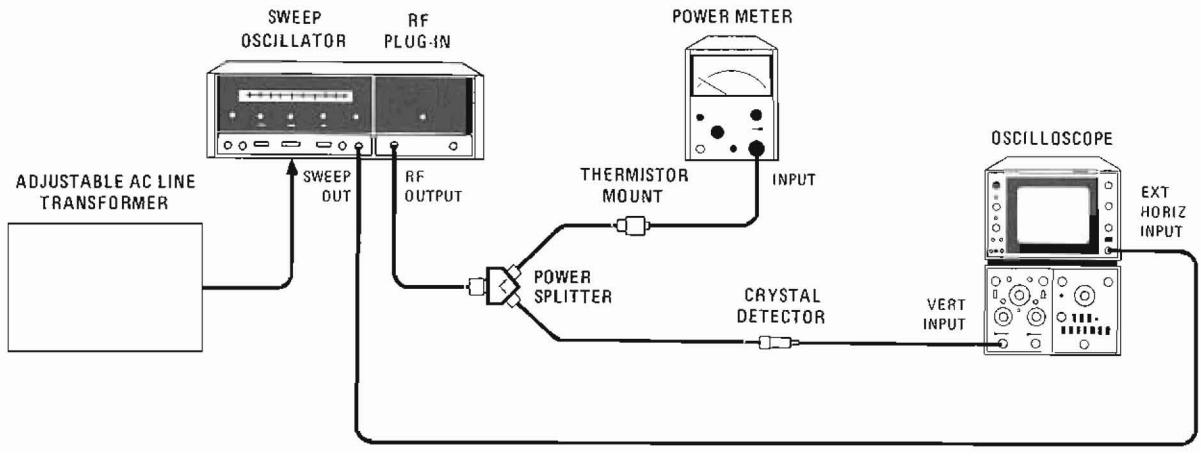


Figure 4-6. Leveled Power Variation Test Setup

f. Set adjustable AC line transformer to 115 Vac. Press 8620A CW pushbutton. Adjust oscilloscope trace to the bottom of the display and note trace position. Decrease the output power indication on the power meter by 1.0 dB by adjusting the 86220A POWER LEVEL control counterclockwise. Note position of oscilloscope trace. Again set POWER LEVEL control fully clockwise then decrease power by 0.4 dB and note position of oscilloscope trace. (The area between the positions noted represents the leveling tolerances of ±0.5 dB and ±0.2 dB.)

g. Press 8620A START pushbutton, and set rear-panel RF BLANKING/OFF switch to RF BLANKING. Adjust 86220A POWER LEVEL control fully clockwise for maximum leveled power.

h. Adjust the position of the oscilloscope trace vertically so that it is displayed between the upper and lower specification limits noted in Step f for 1.0 dB. The highest and lowest portion of the sweep trace must be within the 1.0 dB peak-to-peak limit noted.

PERFORMANCE TESTS

4-10. POWER LEVEL AND VARIATION TEST (Cont'd)

i. Set the 8620A START control to 750 MHz and set TIME-SECONDS switch to 1–.1 seconds. Adjust the position of the oscilloscope trace vertically so that it is displayed between the upper and lower specification limits noted in step f for 0.4 dB. The highest and lowest portion of the sweep trace must be within the 0.4 dB peak-to-peak limit noted.

j. Note power meter indication. Reduce ac power from adjustable ac line transformer to 103 Vac. Power meter indication should not change more than ±0.1 dB.

4-11. POWER LEVEL CONTROL TEST

SPECIFICATION:

Power Level:
(For calibrated frequency range, at 25° C)
RF OFF level (control fully ccw in detent): Below −40 dBm

DESCRIPTION:

The power level is checked on a spectrum analyzer with the POWER LEVEL control in the OFF (detent) position.

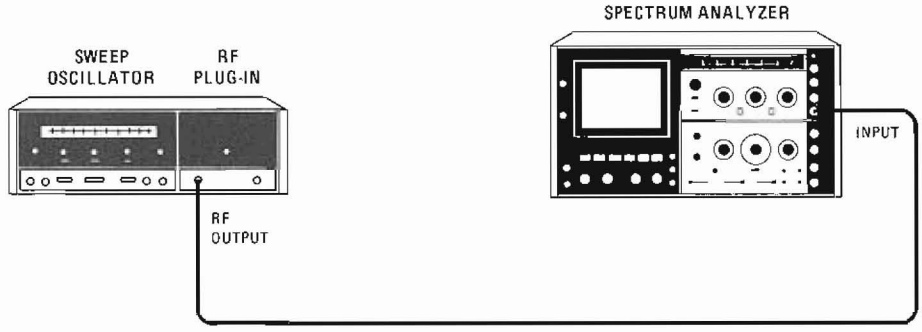


Figure 4-7. RF OFF Detent Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Spectrum Analyzer	HP 8555A/8552B/141T

PROCEDURE:

a. Connect equipment as shown in Figure 4-7.

b. Set 86220A POWER LEVEL control to +10 dBm.

PERFORMANCE TESTS

4-11. POWER LEVEL CONTROL TEST (Cont'd)

c. Select LOG display. Adjust spectrum analyzer to place the peak of the 1000 MHz fundamental signal at the top graticule of the CRT.

d. Set POWER LEVEL control fully counterclockwise to OFF detent. Spectrum analyzer should display the fundamental at or below −40 dBm.

4-12. EQUIVALENT SOURCE SWR TEST

SPECIFICATION:

SWR: <1.3
Impedance: 50 ohms nominal

DESCRIPTION:

The incident signal from the 86220A is measured using a directional coupler, crystal detector, and oscilloscope. This incident signal from the 86220A contains (1) the initial signal from the oscillator, and (2) the reflected signal. The reflected signal is developed as follows. The original oscillator signal travels down the 20-foot coaxial cable, sees the open end, and is reflected back to the 86220A source. If the reflected signal going into the RF OUTPUT connector of the 86220A sees the perfect 50-ohm source match, no signal is reflected back out of the 86220A. However, the greater the mismatch, the greater the reflected signal out of the 86220A. This reflected signal adds and subtracts in and out of phase with the incident oscillator signal and is displayed on the oscilloscope.

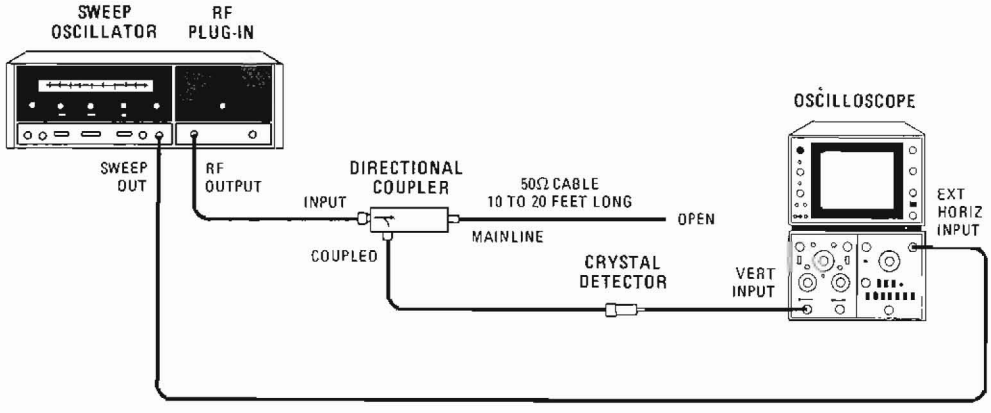


Figure 4-8. Equivalent Source SWR Test Setup

PERFORMANCE TESTS

4-12. EQUIVALENT SOURCE SWR TEST Cont'd)

EQUIPMENT:

Sweep Oscillator	HP8620A
RF Plug-in	86220A
Oscilloscope	HP 180C/1801A/1820C
Crystal Detector	HP423A
10 to 20 feet of 50-ohm Coaxial Cable	RG 214/U, or approx. equivalent
Directional Coupler	HP 796D, 0.1–2.0 GHz

PROCEDURE:

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

b. Set controls as follows:

8620A:

BAND	10 to 1300 MHz
START (green)	100 MHz
STOP (red)	1300 MHz
MARKER	OFF
MODE	AUTO
TRIGGER	INT
TIME/SECONDS	.1 — .01
TIME-SECONDS Vernier	Full Clockwise
1 kHz SQ WV/OFF (rear panel)	OFF
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	OFF

c. Set 8620A LINE switch to ON; press START pushbutton.

d. Note maximum amplitude point from zero Vdc on oscilloscope. If it is greater than −25 mV, adjust 86220A POWER LEVEL control counterclockwise for −25 mV maximum peak trace to place the crystal detector in square-law output range.

e. Display swept power output trace on oscilloscope (Figure 4-9). Select several points on trace and calculate V_{MAX}/V_{MIN}.

f. Determine the loss at selected frequency of the length of coaxial cable (between coupler end and cable open end), using manufacturer's specification for loss/foot. (Refer to Table 4-3.)

g. Convert V_{MAX}/V_{MIN} ratio noted in step e into source match SWR, using Figure 4-10 and the cable loss calculated in step f. The SWR value should be <1.3:1.

PERFORMANCE TESTS

4-12. EQUIVALENT SOURCE SWR TEST Cont'd)

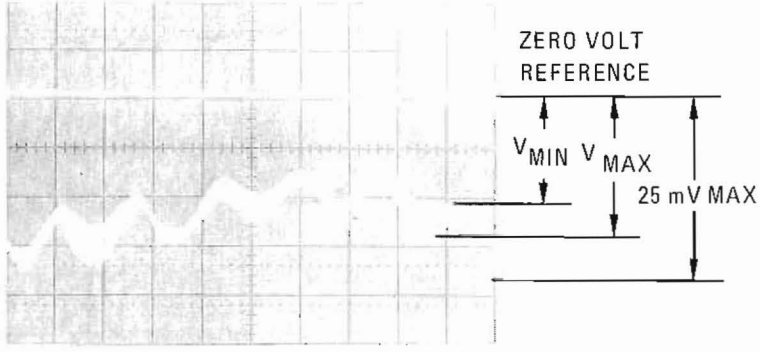


Figure 4-9. Typical Pattern of a Swept SWR Measurement.

Table 4-3. Loss in Coaxial Cable

RG Cable Type	Attenuation (dB/100 ft.) at Frequency Selected					
	0.1 GHz	0.2 GHz	0.4 GHz	0.6 GHz	1 GHz	3 GHz
58/U	2.4	3.6	5.2	6.6	8.8	16.7
98/U	2.3	3.4	5.2	6.5	9.0	17
55A/U	4.8	7.0	10.5	13.0	17	32
58A/U	6.2	9.2	14.0	17.5	23.5	45
58C/U	6.2	9.2	14.0	17.5	23.5	45
177/U	0.95	1.5	2.4	3.2	4.5	9.5
212/U	2.4	3.6	5.2	6.6	8.8	16.7
213/U	2.1	3.1	5.0	6.5	8.8	17.5
214/U	2.3	3.4	5.2	6.5	9.0	17
215/U	2.1	3.1	5.0	6.5	8.8	16.7
217/U	1.5	2.3	3.5	4.4	6.0	11.7
218/U	0.95	1.5	2.4	3.2	4.5	9.5
219/U	0.95	1.5	2.4	3.2	4.5	9.5
220/U	0.69	1.12	1.85	—	3.6	7.7
221/U	0.69	1.12	1.85	—	3.6	7.7
223/U	4.8	7.0	10.5	13.0	17.0	32
224/U	1.5	2.3	3.5	4.4	6.0	11.7

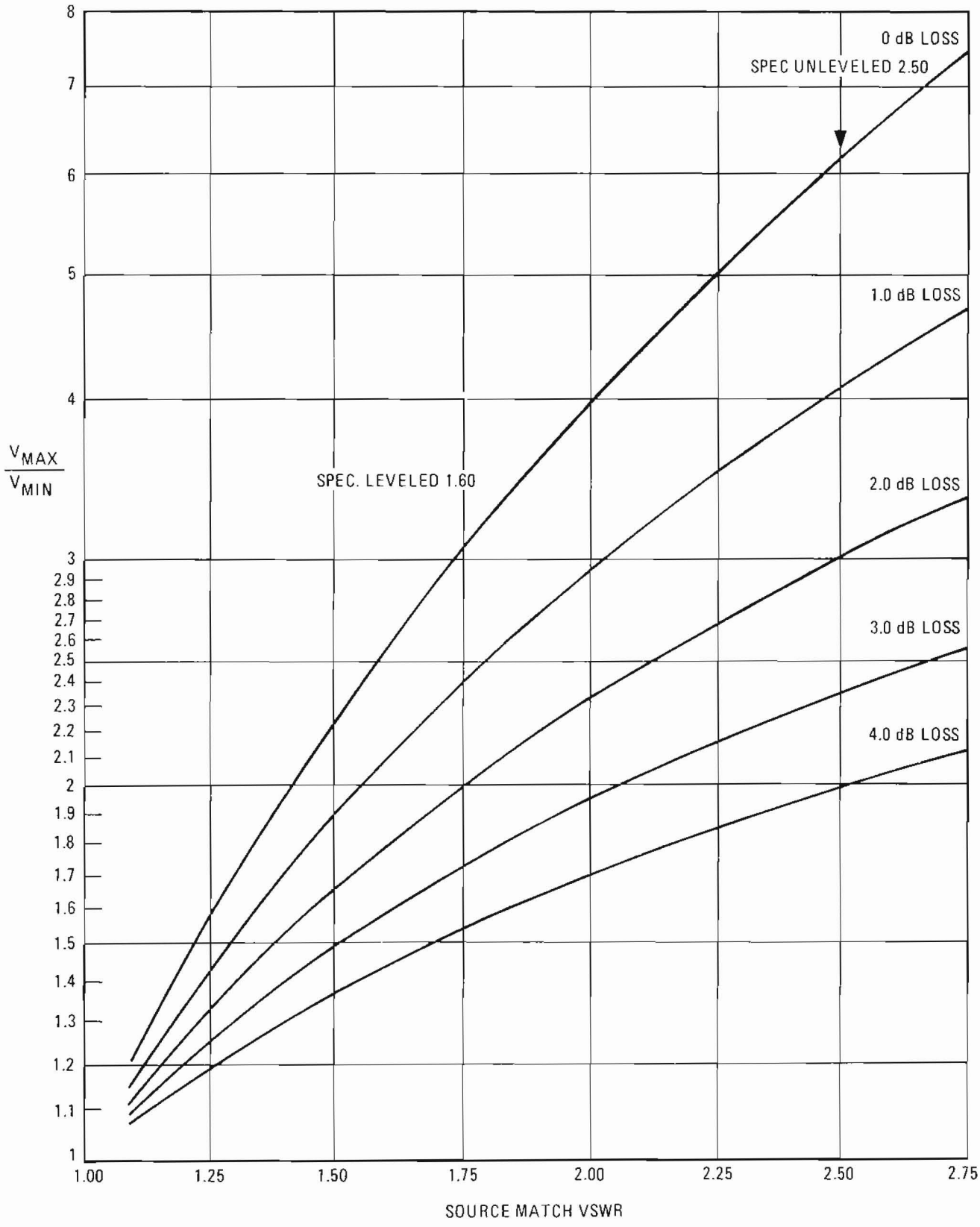


Figure 4-10. Graph to Convert Oscilloscope Trace to Source Match SWR

PERFORMANCE TESTS

4-13. SPURIOUS SIGNALS TEST

SPECIFICATION:

Harmonics in dB below fundamental signal at maximum power:
10 — 750 MHz: >25 dB (>35 dB at zero dBm output)
750 — 1300 MHz: >30 dB (>40 dB at zero dBm output)

Nonharmonics: Below −40 dBm

DESCRIPTION:

The output RF signal from the sweep oscillator is displayed in frequency domain by a spectrum analyzer to verify that the spurious signal output is below the specified level.

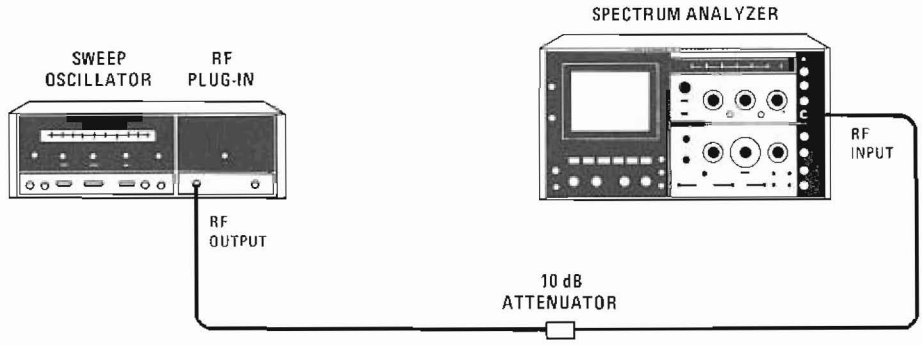


Figure 4-11. Spurious Signals Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Spectrum Analyzer	HP 8555A/8552B/141T
10 dB Attenuator	HP 8491A, Option 010

PROCEDURE:

a. Connect equipment as shown in Figure 4-11.

b. Set controls as follows:

86220A
POWER LEVEL ..... +10 dBm

8620A
BAND ..... 10 to 1300 MHz
CW pointer ..... 650 MHz
1 kHz SQ WV/OFF (rear panel) ..... OFF
RF BLANKING/OFF (rear panel) ..... RF BLANKING
DISPLAY BLANKING/OFF (rear panel) ..... OFF

PERFORMANCE TESTS

4-13. SPURIOUS SIGNALS TEST (Cont'd)

c. Set 8620A LINE switch to ON; press CW pushbutton.

NOTE

The analyzer originates some mixing harmonics that may appear on the display. If a signal is in question, increase the spectrum analyzer input attenution by 10 dBm, note if signal decreases in amplitude by 10 dB, then return the attenuator to the original position. If the signal in question comes from an external source, it will change by 10 dB. If the signal in question originates in the spectrum analyzer, the level will either change by greater or less than 10 dB or may not change at all.

d. Adjust 8620A CW control through the 10 to 1300 MHz band and observe harmonics and spurious signals. Identify signal in question as harmonic or as non-harmonic and measure the difference in dB between this signal level and the level of the fundamental frequency. Harmonics of the 10 to 750 MHz band should be >25 dB below the fundamental. Harmonics of the 750 to 1300 MHz band should be >30 dB below the fundamental. Nonharmonic spurious signals should be below −40 dBm.

e. Set 86220A POWER LEVEL control to zero dBm.

f. Adjust 8620A CW control through the 10 to 1300 MHz band and observe harmonic signals. Identify signal in question as a harmonic and measure the difference in dB between this signal level and the level of the fundamental frequency. Harmonics of the 10 to 750 MHz band should be >35 dB below the fundamental. Harmonics of the 750 to 1300 MHz band should be >40 dB below the fundamental.

4-14. RESIDUAL AM TEST

SPECIFICATION:

AM noise in a 100 kHz bandwidth at maximum power is >50 dB below carrier.

DESCRIPTION:

The carrier signal from the 86220A is amplitude modulated with a square wave from the 8620A. This modulated signal is used to establish reference on the Model 3400A RMS Voltmeter that is 9 dB below the actual carrier signal. The 9 dB reduction occurs because of the voltmeter response to a square wave and the square-law response of the crystal detector. The modulation is then removed and the magnitude of the Residual AM component is measured with respect to the established reference.

PERFORMANCE TESTS

4-14. RESIDUAL AM TEST (Cont'd)

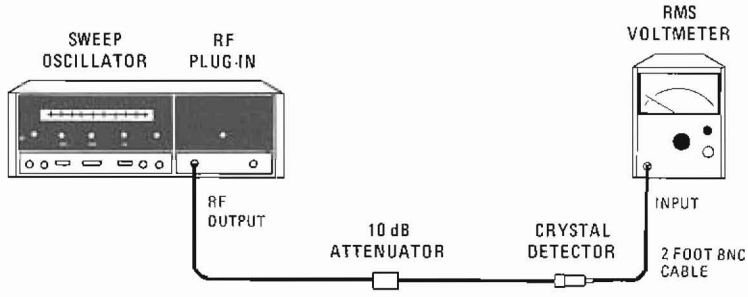


Figure 4-12. Residual AM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
RMS Voltmeter	HP 3400A
10 dB Attenuator	HP 8491A, Option 010
Crystal Detector	HP 423A
BNC Cable Assembly (2-feet)	HP 11086A

PROCEDURE:

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

b. Set controls as follows:

86220A

POWER LEVEL	+10 dBm

8620A

BAND	10 to 1300 MHz
CW pointer	650 MHz
1 kHz SQ WV/OFF (rear panel)	1 kHz SQ WV
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	OFF

c. Set 8620A LINE switch to ON; press CW pushbutton.

PERFORMANCE TESTS

4-14. RESIDUAL AM TEST (Cont'd)

d. Set the RMS voltmeter to a range that gives an on-scale indication. Note the meter indication.

e. Set the 8620A rear-panel 1 kHz SQ WV/OFF switch to OFF. Change RMS voltmeter range switch to obtain an on-scale indication. The difference between this indication and the one noted in step c should be a minimum of 41 dB.

NOTE

A 41-dB decrease in the RMS voltmeter indication corresponds to a 50 dB reduction in signal level. A correction factor of 9 dB is added because of the RMS voltmeter response to a square wave and the square-law response of the crystal detector.

4-15. EXTERNAL FM MODULATION TEST

SPECIFICATION:

Frequency Response: DC to 500 kHz
Maximum Deviation: ±15 MHz

DESCRIPTION:

The oscillator is modulated with a signal source through the input range to 500 kHz. The resulting FM deviation is slope detected on a low-pass filter and the detected signal is read on an RMS voltmeter.

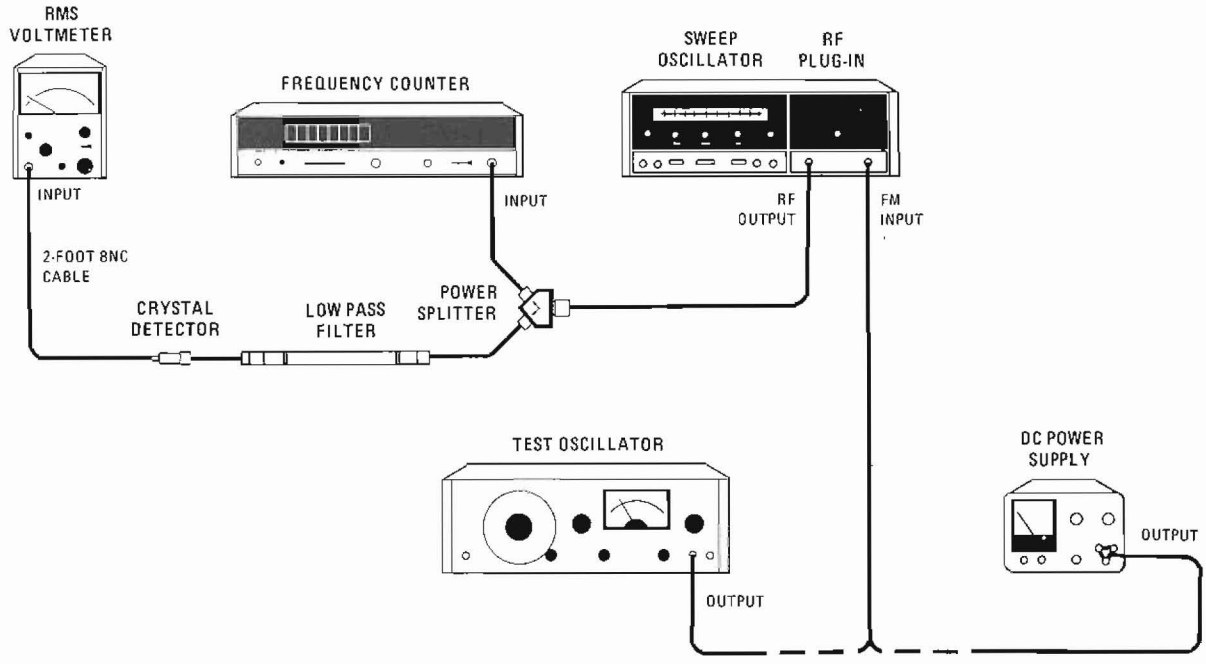


Figure 4-13. External FM Modulation Test Setup

PERFORMANCE TESTS

4-15. EXTERNAL FM MODULATION TEST (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Test Oscillator	HP 651B
Frequency Counter	HP 5340A
DC Power Supply	HP 721A
RMS Voltmeter	HP 3400A
Low-Pass Filter	HP 360A
Crystal Detector	HP 423A
BNC Cable Assembly (2-feet)	HP 11086A
Power Splitter	HP 11667A

PROCEDURE:

a. Connect equipment as shown in Figure 4-13. Press CW pushbutton.

b. Set controls as follows:

86220A

POWER LEVEL	+10 dBm

8620A

BAND	10 to 1300 MHz
CW pointer	700 MHz
1 kHz SQ WV/OFF (rear panel)	OFF
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	OFF
LINE	ON

c. Adjust test oscillator to 10 Hz, at 0.1 Volt RMS. Adjust 8620A CW frequency for maximum indication on the RMS voltmeter connected at crystal detector output. Check that the center of the range is obtained by adjusting the frequency back and forth through maximum indication.

d. Disconnect test oscillator from 86220A FM input. The frequency indicated on the frequency counter will be referred to as the "center frequency" for the remainder of the test. Connect DC power supply to the FM input with positive lead to center conductor and negative lead to ground.

e. Increase DC power supply output until the frequency counter indicates 15 MHz above the "center frequency". Note DC power supply output. (This value is equivalent to the peak modulation required to obtain ±15 MHz FM modulation deviation.) Multiply the DC voltage set at the DC power supply by 0.707 to obtain the RMS modulation value corresponding to modulation of 15 MHz.

f. Disconnect DC power supply from 86220A FM connector and connect test oscillator to FM input. Adjust test oscillator to 10 Hz. Adjust output for the RMS value equivalent to 15 MHz modulation found in step e. Note indication on RMS Voltmeter at output of crystal detector. (This value represents ±15 MHz modulation.)

g. Set test oscillator to 500 kHz and increase test oscillator output until the RMS voltmeter indicates a value equivalent to ±15 MHz modulation as noted in step f. If this value of RMS voltage is obtained, ±15 MHz modulation is obtained.

PERFORMANCE TESTS

4-16. AM MODULATION TEST

SPECIFICATION:

INTERNAL AM:
1 kHz squarewave ON/OFF ratio: >35 dB below maximum power output (+10 dBm).

EXTERNAL AM:
Sensitivity: a −10V input reduces the RF output signal >35 dB below maximum power output.
Frequency response: DC to 10 kHz
Modulation: >50% AM

DESCRIPTION:

Attenuation is checked by applying −10Vdc and observing the corresponding decrease in RF power out (35 dB below maximum power output). ON/OFF ratio is checked by applying the internal 1 kHz squarewave and observing the display.

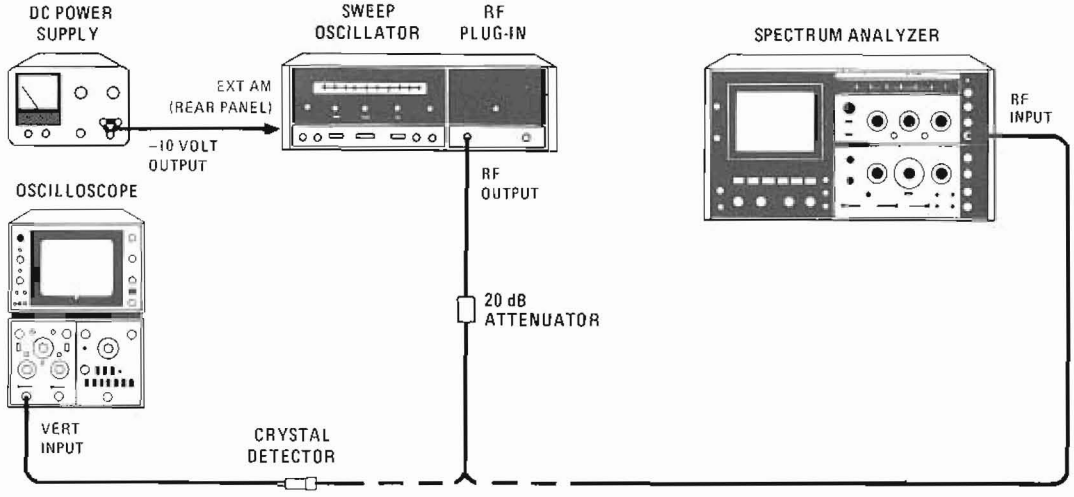


Figure 4-14. AM Modulation Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Spectrum Analyzer	HP 8555A/8552B/141T
Oscilloscope	HP 180C/1801A/1820C
DC Power Supply	HP 721A
Crystal Detector	HP 423A
20 dB Attenuator	HP 8491A, Option 020

4-16. AM MODULATION TEST (Cont'd)

PROCEDURE:

a. Connect spectrum analyzer and 20 dB attenuator to 86220A as shown in Figure 4-14.

b. Set controls as follows:

86220A
POWER LEVEL ..... +10dBm

8620A
BAND ..... 10 to 1300 MHz
CW pointer ..... 650 MHz
START pointer ..... 10 MHz
STOP pointer ..... 1300 MHz
MARKER ..... OFF
1 kHz SQ WV/OFF (rear panel) ..... OFF
RF BLANKING/OFF (rear panel) ..... RF BLANKING
DISPLAY BLANKING/OFF (rear panel) ..... OFF
LINE ..... ON

c. Press the CW pushbutton.

d. Set spectrum analyzer controls as follows:

8555A
Frequency BAND ..... 0.01 to 2.05 GHz
BANDWIDTH ..... 10 kHz
SCAN WIDTH ..... 20 MHz/division
INPUT ATTENUATION ..... 10 dB
TUNING STABILIZER ..... OFF
Signal Identifier ..... OFF

8552B
SCAN TIME ..... 5 ms/division
LOG REF LEVEL ..... 0 dBm
LOG/LINEAR ..... LOG
VIDEO FILTER ..... OFF
SCAN MODE ..... INT

External AM Sensitivity Check

e. Note the signal level of the fundamental frequency displayed on the spectrum analyzer. This is the reference level for the test.

f. Verify DC power supply connected to 8620A rear-panel EXT AM input. Adjust the external power supply for -10.0 Vdc output. The power output as observed on spectrum analyzer should decrease by >35 dB below the reference.

g. Disconnect external power supply from 8620A EXT AM connector.

4-16. AM MODULATION TEST (Cont'd)

On/Off Ratio

h. Connect the oscilloscope and crystal detector to the 86220A as shown in Figure 4-14.

i. Set controls as follows:

86220A
POWER LEVEL ..... +10 dBm

8620A
TRIGGER ..... INT
MODE ..... AUTO
TIME-SECONDS ..... 1 — .01
TIME Vernier ..... Full Clockwise
1 kHz SQ WV/OFF (rear panel) ..... 1 kHz SQ WV
RF BLANKING/OFF (rear panel) ..... RF BLANKING
DISPLAY BLANKING/OFF (rear panel) ..... OFF

j. Observe the oscilloscope trace. The blanking line should be coincident with the "OFF" portion of the signal. (This shows that the square-wave ON/OFF ratio and the blanking ON/OFF ratio are the same.)

k. Disconnect crystal detector and oscilloscope from 86220A and connect 20 dB attenuator and spectrum analyzer. Set 8620A rear-panel RF BLANKING/OFF switch to OFF. Set 8620A TRIGGER to EXT.

l. Note reference level of signal on spectrum analyzer. Set RF BLANKING/OFF switch to RF BLANKING. Power level difference should be >35 dB (ON/OFF ratio).

m. Adjust 8620A START pointer through the frequency band and note minimum and maximum power points. Check ON/OFF ratio at these points by setting the 8620A RF BLANKING/OFF switch between RF BLANKING and OFF positions. All frequency points across the band should have an ON/OFF ratio of >35 dB.

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

Hewlett-Packard Model 86220A
RF Plug-in

Test Performed by: _____

Serial No. _____

Date: _____

				Lower Limit	Measured Value	Upper Limit
4-7. FREQUENCY RANGE AND ACCURACY TEST						
d.	CW pointer setting					
	10			0 MHz	_____	20 MHz
	50			40 MHz	_____	60 MHz
	100			90 MHz	_____	110 MHz
	300			290 MHz	_____	310 MHz
	500			490 MHz	_____	510 MHz
	800			790 MHz	_____	810 MHz
	1000			990 MHz	_____	1010 MHz
	1300			1290 MHz	_____	1310 MHz
e.	START Pointer	STOP Pointer	MANUAL			
	20	1300	CCW	5 MHz	_____	35 MHz
	20	1300	CW	1285 MHz	_____	1315 MHz
	100	1000	CW	985 MHz	_____	1015 MHz
	100	1000	CCW	85 MHz	_____	115 MHz
	200	800	CCW	185 MHz	_____	215 MHz
	200	800	CW	785 MHz	_____	815 MHz
	400	600	CW	585 MHz	_____	615 MHz
	400	600	CCW	385 MHz	_____	415 MHz
	800	200	CCW	785 MHz	_____	815 MHz
	800	200	CW	185 MHz	_____	215 MHz
	1300	20	CW	5 MHz	_____	35 MHz
	1300	20	CCW	1285 MHz	_____	1315 MHz
4-8. FREQUENCY STABILITY TEST						
d.	Line Voltage change at 103 Vac				_____	±20 kHz
e.	Line Voltage change at 127 Vac				_____	±20 kHz
f.	10 dB Power Level Change				_____	±20 kHz
4-9. RESIDUAL FM IN 10 kHz BANDWIDTH TEST						
i.	Peak-to-peak Residual FM				_____	10 kHz P-P
4-10. POWER LEVEL AND VARIATION TEST						
c.	Power LEVEL zero dBm mark			−1 dBm	_____	+1 dBm
d.	POWER LEVEL +10 dBm mark			+9 dBm	_____	+11 dBm
h.	Leveling variation, 10 to 1300 MHz				_____	1 dB P-P
i.	Leveling variation, 750 to 1300 MHz (sweep time >.1 seconds)				_____	0.4 dB P-P
j.	Power change with 10% change in AC power				_____	±0.1 dB
4-11. POWER LEVEL CONTROL TEST						
d.	POWER LEVEL at OFF				_____	−40 dBm
4-12. EQUIVALENT SOURCE SWR TEST						
g.	SWR				_____	1.3:1

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

4-13. SPURIOUS SIGNALS TEST	Lower Limit	Measured Value	Upper Limit
d. Harmonics down from fundamental at +10 dBm:			
10 to 750 MHz	25 dB	_____	
750 to 1300 MHz	30 dB	_____	
Level of non harmonics		_____	–40 dBm
f. Harmonics down from fundamental at zero dBm:			
10 to 750 MHz	35 dB	_____	
750 to 1300 MHz	40 dB	_____	
4-14. RESIDUAL AM TEST			
d. Below maximum rated power	50 dB	_____	
4-15. EXTERNAL FM MODULATION TEST			
c. Modulation frequency of 500 kHz	±15 MHz	_____	
4-16. AM MODULATION TEST			
f. Attenuation with –10 Vdc input	35 dB	_____	
m. ON/OFF ratio	35 dB	_____	

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 86220A. Adjustments should be performed whenever the Model 86220A RF Plug-in performance is out of tolerance. Allow 30 minutes warmup time before performing the adjustments. Adjustment and test point locations are shown in Figure 5-1. Table 5-1 lists all of the adjustments and their functions.

5-3. EQUIPMENT REQUIRED

5-4. A list of equipment required to adjust the RF Plug-in, with recommended HP Model Numbers, is given below and also in Table 1-4.

Sweep Oscillator ..... HP 8620A
Oscilloscope ... HP 180C/1801A/1820C
Digital Voltmeter ..... HP 3460B
Frequency Counter ..... HP 5340A
Power Meter ..... HP 432A
Thermistor Mount ..... HP 8478B
Power Splitter ..... HP 11667A
Spectrum Analyzer ..... HP 8555A/8552B/141T
20 dB Attenuator ..... 8491A, Option 020
Type N to SMA Adapter ..... HP 1250-1404

5-5. RELATED ADJUSTMENTS

5-6. The adjustments should be performed in the order listed. However, if only one parameter is slightly out of tolerance, a single adjustment may be made.

5-7. ADJUSTMENT LOCATIONS

5-8. The location of the adjustments in the 86220A are shown in Figure 5-1. Location of adjustments, test points, and major assemblies are shown in Figures 8-9 and 8-10.

Table 5-1. Adjustment Controls

Control Ref. Desig.	Name	Function
No Reference designator	A4 Cavity Oscillator Freq. Tuning	Slug-tunes cavity oscillator frequency for 4.2 GHz.
A1R21	FREQ ADJ LO	Adjusts YIG oscillator A5 frequency calibration at low end of band.
A1R12	FREQ ADJ HI	Adjusts YIG oscillator A5 frequency calibration at high end of band.
A1R1	MAX LEVEL	Adjusts power calibration at +10 dBm end of POWER LEVEL control.
A1R13	MIN LEVEL	Adjusts power calibration at zero dBm end of POWER LEVEL control.
A1R43	BLANK ADJ	Adjusts for good frequency response to 1 kHz modulation at zero dBm power level.
A1R45	CAVITY BIAS	No adjustment of this control is required. Control is preset to center-range at the factory.

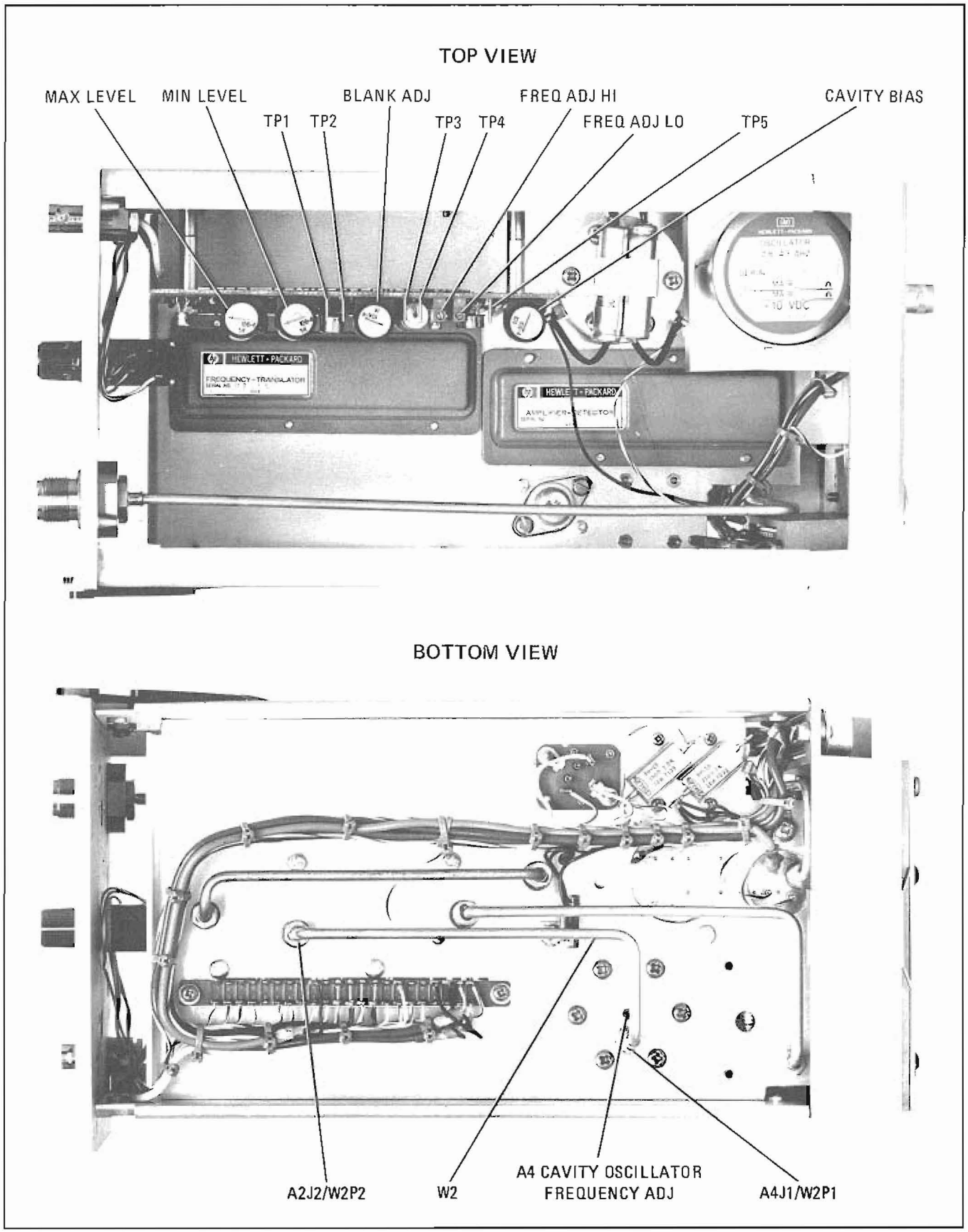


Figure 5-1. Adjustment and Test Point Locations

ADJUSTMENTS

5-9. A4 CAVITY OSCILLATOR FREQUENCY ADJUSTMENT

DESCRIPTION:

The output frequency of A4 Cavity Oscillator is monitored with a frequency counter and adjusted if necessary.

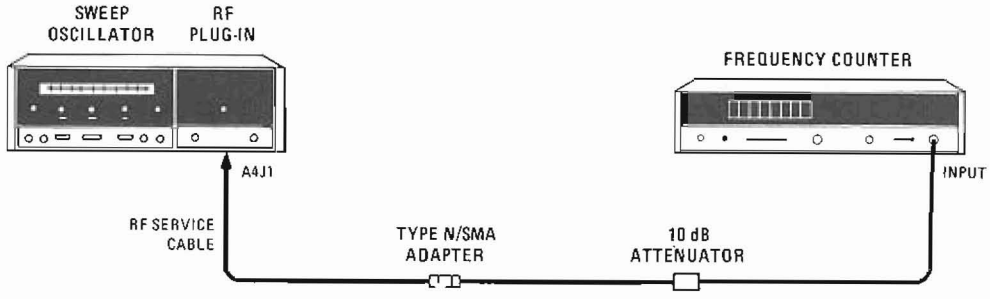


Figure 5-2. A4 Cavity Oscillator Frequency Adjustment Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Frequency Counter	HP 5340A
RF Service Cable	HP 8120-1578
Type N to SMA Adapter	HP 1250-1404
10 dB Attenuator	HP 8491A, Option 010

PROCEDURE:

a. Connect equipment as shown in Figure 5-2 as follows: Disconnect cable W2 from connector A4J1 on A4 cavity oscillator. Connect frequency counter to A4J1 through a 10 dB attenuator, a Type-N to SMA adapter, and an RF service cable.

b. Press 8620A CW pushbutton. Adjust A4 frequency adjustment slug (located near A4J1) with 5/64-inch Allen wrench for a 4.2 GHz ±5 MHz counter indication.

c. Reconnect W2P1 to A4J1.

ADJUSTMENTS

5-10. YIG OSCILLATOR HIGH AND LOW FREQUENCY LIMITS ADJUSTMENT

DESCRIPTION:

The high and low frequency ends of the band are adjusted for correct calibration.

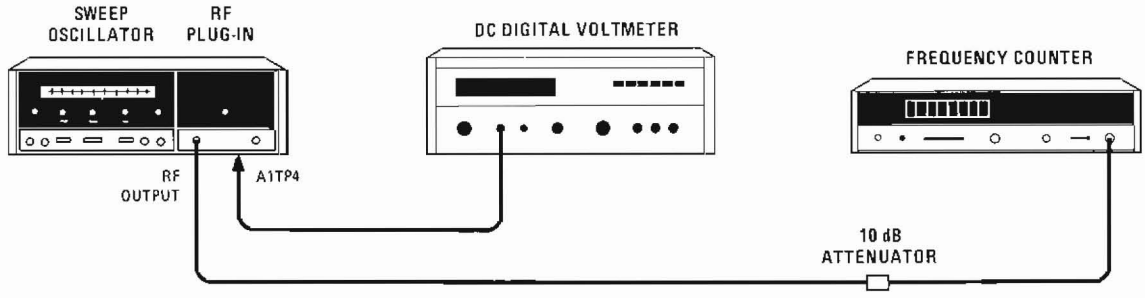


Figure 5-3. YIG Oscillator High and Low Frequency Limit Adjustment Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Frequency Counter	HP 5340A
DC Digital Voltmeter	HP 3460B
10 dB Attenuator	HP 8491A, Option 010

PROCEDURE:

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

b. Set controls as follows:

86220A
POWER LEVEL ..... +10 dBm

8620A
BAND ..... 10 to 1300 MHz

ADJUSTMENTS

5-10. YIG OSCILLATOR HIGH AND LOW FREQUENCY LIMITS ADJUSTMENTS (Cont'd)

c. Press 8620A CW Pushbutton. Adjust CW pointer for a +0.100 Vdc ±0.005 Vdc indication on DC Digital Voltmeter (DVM).

NOTE

A1R21 can be misadjusted so that zero-beat comes in center of band rather than at low-frequency end.

d. Adjust resistor A1R21 FREQ ADJ LO for 13.0 MHz ±2 MHz indication on frequency counter.

e. Adjust CW pointer for a +10.00 Vdc ±0.005 Vdc indication on DVM.

f. Adjust resistor A1R12 FREQ ADJ HI for 1300 MHz ±2 MHz indication on frequency counter.

g. Adjust 8620A CW pointer to obtain each of the DVM indications listed in Table 5-2 and check corresponding frequency counter indications agains limits given. If necessary, compromise adjust A1R21 and A1R12 to achieve limits across full band.

Table 5-2. YIG Oscilator High and Low Frequency Limits Adjustments

Set CW for DVM Indication (+Vdc)	Frequency Counter Indication		Compromise Adjustment
	Minimum	Maximum	
0.100 ±0.005 Vdc	3 MHz	23 MHz	A1R21 (FREQ ADJ LO)
0.500 ±0.005 Vdc	55 MHz	75 MHz	
1.000 ±0.005 Vdc	120 MHz	140 MHz	
2.000 ±0.005 Vdc	250 MHz	270 MHz	
4.000 ±0.005 Vdc	510 MHz	530 MHz	A1R12 (FREQ ADJ HI)
6.000 ±0.005 Vdc	770 MHz	790 MHz	
8.000 ±0.005 Vdc	1030 MHz	1050 MHz	
10.000 ±0.005 Vdc	1290 MHz	1310 MHz	

5-11. MINIMUM AND MAXIMUM POWER ADJUSTMENT

DESCRIPTION:

The power level is calibrated through the range of zero dBm to +10 dBm.

ADJUSTMENTS

5-11. MINIMUM AND MAXIMUM POWER ADJUSTMENT (Cont'd)

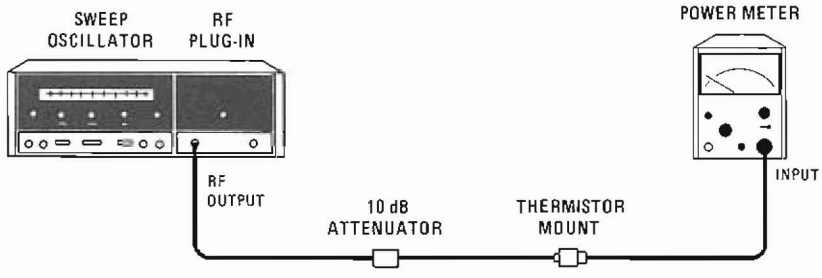


Figure 5-4. Minimum and Maximum Power Adjustment Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Power Meter	HP 432A
Thermistor Mount	HP 8478B
10 dB Attenuator	HP 8491A, Option 10

PROCEDURE:

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

b. Set controls as follows:

86220A
POWER LEVEL ..... +10 dBm

8620A
BAND ..... 10 to 1300 MHz
CW Pointer ..... 1000 MHz

c. Press 8620A CW pushbutton. Adjust resistor A1R1 MAX LEVEL for zero dBm ±0.1 dB indication on power meter. (Zero dBm indication on meter corresponds to +10 dBm out.)

d. Set POWER LEVEL control to zero dBm. Adjust resistor A1R13 MIN LEVEL for −10 dBm ±0.1 dB indication on power meter. (−10 dBm indication on meter corresponds to 0 dBm out.)

e. Check POWER LEVEL setting of +10 dBm and zero dBm again and if necessary repeat steps c and d.

f. Adjust POWER LEVEL control through the range of 0 to +10 dBm. Check power meter indication at each major power division. Indication should be −10 dB below POWER LEVEL control dial setting ±1 dB. If out of tolerance, readjust A1R1 MAX LEVEL or A1R13 MIN LEVEL to bring POWER LEVEL control dial seting within tolerance through the entire range.

ADJUSTMENTS

5-12. BLANKING LEVEL ADJUSTMENT

DESCRIPTION:

The positive clamping level for the main ALC amplifier is adjusted for minimum overshoot and rounding of the 1 kHz square-wave modulation signal.

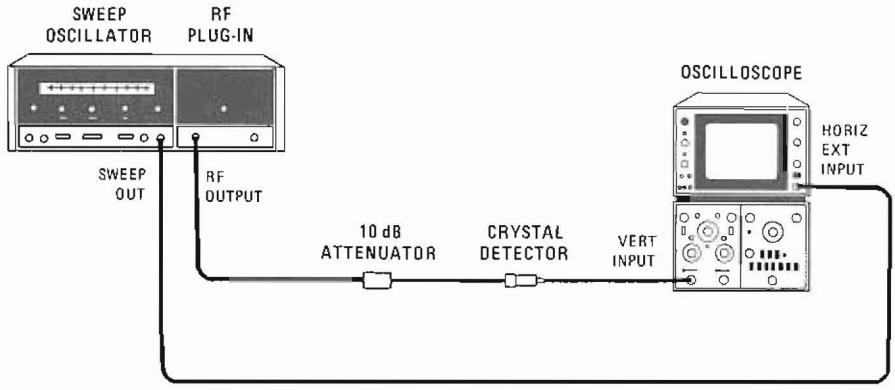


Figure 5-5. Blanking Level Adjustment Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Oscilloscope	HP 180C/1801A/1820C
Crystal Detector	HP 423A
10 dB Attenuator	HP 8491A, Option 010

PROCEDURE:

a. Connect equipment as shown in Figure 5-5. Press 8620A CW pushbutton.

b. Set controls as follows:

86220A

POWER LEVEL	0 dBm

8620A

BAND	10 to 1300 MHz
CW Pointer	1000 MHz
TIME-SECONDS	.1 — .01
TIME-SECONDS Vernier	Full Clockwise
1 kHz SQ WV/OFF (rear panel)	1 kHz SQ WV
RF BLANKING/OFF (rear panel)	RF BLANKING
DISPLAY BLANKING/OFF (rear panel)	OFF

ADJUSTMENTS

5-12. BLANKING LEVEL ADJUSTMENT (Cont'd)

c. Set oscilloscope for internal sweep. Observe squarewave signal on oscilloscope. Adjust 8620A TIME-SECONDS Vernier to make waveform stationary.

d. Adjust resistor A1R43 BLANK ADJ for the best compromise between minimum overshoot and minimum rounding on the corners.

e. There is interaction between the blanking adjustment and the ON/OFF ratio. Perform AM Modulation test in Section IV to be sure ON/OFF ratio is still within specification. If not, set A1R43 BLANKING ADJ full counterclockwise. Then adjust clockwise as far as possible for best squarewave, while still maintaining ON/OFF ratio within specifications.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 gives all the manufacturer's code numbers that are used in the parts list.

6-3. Abbreviations

6-4. Table 6-1 gives a list of abbreviations used in the parts list, schematics, and throughout the manual. In some cases, two forms of the abbreviation are given, one all capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals, since the computer readout does not print lower case letters. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-5. Replaceable Parts List

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

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

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

c. Miscellaneous parts.

d. Illustrated parts breakdown, if appropriate.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

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

c. The description of the part.

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

e. Manufacturer code number for the part.

NOTE

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

6-7. ORDERING INSTRUCTIONS

6-8. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

Table 6-1. Reference Designators and Abbreviations Used in Manual (1 of 2)

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	P	= plug	V	= vacuum tube, neon bulb photocell, etc.
B	= motor	FL	= filter	Q	= transistor		
C	= capacitor	J	= jack	R	= resistor	W	= cable
CR	= diode	K	= relay	S	= switch	X	= socket
DL	= delay line	L	= inductor	T	= transformer	Y	= crystal
DS	= device signaling (lamp)	M	= meter	TP	= test point		
E	= misc electronic part	MP	= mechanical part	U	= integrated circuit		

ABBREVIATIONS

A	= amperes	DET	= detector	IC	= integrated circuit
ac*	= alternating current	deg*	= degree	ID	= inner diameter
ACCESS	= accessory	°C	= degree Celsius	IF	= intermediate freq.
ADJ	= adjustment	°F	= degree Fahrenheit	IMPG	= impregnated
AFC	= automatic frequency control	°K	= degree Kelvin	INCD	= incandescent
		°R	= degree Rankine	INCL	= include(s)
AGC	= automatic gain control	DEPC	= deposited carbon	INS	= insulation(ed)
		DIA	= diameter	INT	= internal
AL	= aluminum	DIV	= division		
ALC	= automatic leveling control	DPDT	= double pole double throw	kHz*	= kilo Hertz
				kΩ	= kilohm
AM	= amplitude modulation	DR	= drive	kV*	= kilovolt
AMPL	= amplifier				
ASSY	= assembly	DVM	= digital voltmeter	LED	= light-emitting diode
AUX	= auxiliary				
		ELECT	= electrolytic	LF	= low frequency
BAL	= balance	ENCAP	= encapsulated	LG	= long
BCD	= binary coded decimal	EXT	= external	LH	= left hand
BD	= board			LIM	= limit
BFO	= beat frequency oscillator	F	= farads	LIN	= linear taper
		FET	= field effect transistor	LK WASH	= lock washer
BH	= binder head	FH	= flat head	LO	= low
BPF	= bandpass filter	FIL H	= Fillister head	LOG	= logarithmic taper
BRS	= brass	FM	= frequency modulation	LPF	= low pass filter
BWO	= backward wave oscillator	FP	= front panel	LV	= low voltage
		FREQ	= frequency		
		FXD	- fixed	mA*	= milliampere
CAL	= calibrate			MAX	= maximum
CCW	= counterclockwise	G	= giga (10^9)	MΩ	= megohm
CER	= ceramic	GE	= germanium	MET FLM	= metal film
CHAN	= channel	GHz	= giga Hertz	MET OX	= metallic oxide
COAX	= coaxial	GL	= glass	MFR	= manufacturer
COEF	= coefficient	GRD	= ground(ed)	mH*	= millihenry
COM	= common			MHz	= mega Hertz
COMP	= composition	H	= henry	mV*	= millivolt
CONN	= connector	HET	= heterodyne	mW*	= milliwatt or microwave
CRT	= cathode-ray tube	HEX	= hexagonal		
CW	= clockwise or continuous wave	HD	= head	MIN	= minimum
		HF	= high frequency	MOD	= modulator
D-A	= digital-to-analog	HI	= high	MOS	= metal-oxide semiconductor
dB*	= decibel	HP	= Hewlett-Packard		
dBm*	= decibels referenced to 1 mW	HPF	= high pass filter	MTG	= mounting
		HV	= high voltage	MTR	= meter
dc*	= direct current	Hz	= Hertz	MY	= mylar

Table 6-1. Reference Designators and Abbreviations Used in Manual (2 of 2)

ABBREVIATIONS

N	= north or nano (10^{-9})
NC	= no connection
N/C	= normally closed
NE	= neon
N/O	= normally open
NOM	= nominal
NORM	= normal
NPN	= negative-positive negative
OD	= outer diameter
OH	= oval head
OP AMP	= operational amplifier
OPT	= option
OSC	= oscillator
OX	= oxide
P or Pk	= peak
PC	= printed circuit
pF*	= picofarads = 10^{12} farads
PHL	= Phillips
PIN	= positive-intrinsic-negative
PIV	= peak inverse voltage
PL	= phase lock
PNP	= positive-negative-positive
P/O	= part of
PORC	= porcelain
POS	= position(s)
POT	= potentiometer
PP	= peak-to-peak
PREAMP	= preamplifier
PT	= point
RECT	= rectifier
REF	= reference
REPL	= replaceable
RF	= radio frequency
RH	= round head or right hand
RMS	= root-mean square
RND	= round
R & P	= rack and panel
S-B	= slow-blow
SCR	= silicone controlled rectifier, or screw
SEC	= second
SECT	= section(s)
SEMICON	= semiconductor
SI	= silicon
SIL	= silver
SMA	= sub-miniature connector
SMC	= micro-miniature connector
S-parameter	= scattering parameter
SPDT	= single pole double throw
SPG	= spring
SPST	= single pole single throw
SST	= stainless steel
STL	= steel
SQ	= square
SYNC	= synchronize
TA	= tantalum
TD	= time delay
TERM	= terminal
TGL	= toggle
THD	= thread
THRU	= through
TI	= titanium
TO	= tolerance
TRIM	= trimmer
TSTR	= transistor
TWT	= traveling wave tube
μ*	= micro = 10^{-6}
UNREG	= unregulated
V	= volt
VA	= voltampere
VAR	= variable
Vdc*	= volts direct current
VDCW	= dc working volts
VF	= filtered voltage
VTO	= voltage-tuned oscillator
VTVM	= vacuum-tube voltmeter
VX	= switched voltage
W/	= with
W	= watt
WW	= wirewound
W/O	= without
YIG	= Yittrium-Iron-Garnett

*Upper-case letters are always used in the parts list.

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	86220-60001	1	BOARD ASSY:ALC/YIG DRIVER	28480	86220-60001
A1C1	0180-0116	1	C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X903582-DYS
A1C2	0180-0374	1	C:FXD TANT. 10 UF 10% 20VDCW	56289	150D106X902082-DYS
A1C3	0160-0164	1	C:FXD MY 0.039 UF 10% 200VDCW	56289	192P39392-PTS
A1C4	0180-0291	2	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A1C5	0180-2486	1	C:FXD TANT 470 UF 20% 30VDCW	28480	0180-2486
A1C6	0160-3533	1	C:FXD MICA 470 UF 5% 100VDCW	28480	0160-3533
A1C7	0180-0373	1	C:FXD ELECT 0.68 UF 10% 35VDCW	56289	150D684X9035A2-DYS
A1C8	0160-2264	1	C:FXD CER 20 PF 5% 500VDCW	72982	301-000-C0G0-200J
A1C9	0160-0298	1	C:FXD MY 0.0015 UF 10% 200VDCW	56289	192P15292-PTS
A1C10	0180-0197	1	C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A1C11	0180-0376	1	C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X9035A2-DYS
A1CR1	1901-0025	5	DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR4	1901-0159	2	DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR5	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR6	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A1CR7	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR8	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1CR9	1902-3002	1	DIODE BREAKDOWN:2.37V 5%	28480	1902-3002
A1K1	0490-0884	1	RELAY:REED	28480	0490-0884
A1Q1	1853-0050	3	TSTR:SI PNP	28480	1853-0050
A1Q2	1853-0050		TSTR:SI PNP	28480	1853-0050
A1Q3	1854-0404	3	TSTR:SI NPN	28480	1854-0404
A1Q4	1854-0039	1	TSTR:SI NPN	80131	2N3053
A1Q5	1853-0050		TSTR:SI PNP	28480	1853-0050
A1Q6	1854-0404		TSTR:SI NPN	28480	1854-0404
A1Q7	1854-0404		TSTR:SI NPN	28480	1854-0404
A1R1	2100-1760	2	R:VAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A1R2	0757-0465	1	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A1R3	0698-3157	2	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1R4	0757-0984	1	R:FXD MET FLM 10.0 OHM 1% 1/2W	28480	0757-0984
A1R5	0698-3615	1	R:FXD MET OX 47 OHM 5% 2W	28480	0698-3615
A1R6	0757-0442	6	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R7	0757-0278	2	R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A1R8	0811-1198	1	R:FXD WW 3.0K OHM 0.1% 3/32W	28480	0811-1198
A1R9	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1R10	0698-3260	1	R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A1R11	0757-0288	1	R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A1R12	2100-2852	1	R:VAR WW 1000 OHM 10% 1W	28480	2100-2852
A1R13	2100-1760		R:VAR WW 5K OHM 5% TYPE V 1W	28480	2100-1760
A1R14	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R15	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R16	0698-3160	1	R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A1R17	0757-0280	2	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R18	0757-0458	2	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1R19	0698-0082	2	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A1R20	0757-0279	2	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A1R21	2100-1739	1	R:VAR WW 5K OHM 10% 1W	28480	2100-1739
A1R22	0699-0001	1	R:FXD COMP 2.7 OHM 10% 1/2W	01121	EB 27G1
A1R23	0698-5552	1	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0698-5552
A1R24	0698-3454	2	R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A1R25	0698-3454		R:FXD MET FLM 215K OHM 1% 1/8W	28480	0698-3454
A1R26	0757-0401	1	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R27	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1R28	0698-3153	1	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A1R29	0698-3155	1	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R31	0698-7256	1	R:FXD FLM 6810 OHM 2% 1/8W	28480	0698-7256
A1R32	0698-3441	1	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A1R33	0698-0083	1	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A1R34	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A1R36	0757-0290	1	R:FXD MET FLM 6.19K OHM 1% 1/8W	28480	0757-0290
A1R37	0757-0438	2	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R38	0757-0289	1	R:FXD MET FLM 13.3K OHM 1% 1/8W	28480	0757-0289
A1R39	0757-0278		R:FXD MET FLM 1.78K OHM 1% 1/8W	28480	0757-0278
A1R40	0698-3156	1	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A1R41	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R42	0757-0440	1	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1R43	2100-1758	1	R:VAR WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A1R44	0698-0082		R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A1R45	2100-1755	1	R:VAR WW 100 OHM 5% TYPE V 1W	28480	2100-1755
A1R46	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R47	0757-0411		R:FXD MET FLM 332 OHM 1% 1/8W	28480	0757-0411

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1U1, U2	1826-0013	3	IC:LINEAR	28480	1826-0013
A1U3	1820-0223	1	IC:OPERATIONAL AMPLIFIER	28480	1820-0223
A1U4	1826-0013		IC:LINEAR	28480	1826-0013
A2	5086-7003	1	FREQUENCY TRANSLATOR	28480	0960-2007
A3	5086-7004	1	AMP/DETECTOR	28480	0960-2008
A4	86220-60005	1	CAVITY OSCILLATOR ASSY	28480	86220-60005
A5	5086-7024	1	YIG TUNED OSCILLATOR INSTRUMENTS WITH 1135A SERIAL PREFIX ALSO ORDER W1	28480	0960-2035
A6	0950-1284	1	COAXIAL ATTENUATOR,0 TO 70DB(OPT 002 ONLY)	28480	0950-1284
C1	0180-2144	1	C:FXD ELECT 200 UF +75-10% 25VDCW	28480	0180-2144
C2	0180-2216	1	C:FXD AL ELECT 350 UF +75-10% 16VDCW	56289	30D357G016DH2-DSM
C3	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
CR1	1901-0159	1	DIODE:POWER RECT, SI 400V MAX	02037	SR1358-4
J1			P/O W8 (SEE W8 BELOW)		
J2			P/O W4 (SEE W4 BELOW)		
J3	1250-0083	1	CONNECTOR;BNC (FREQ REF)	24931	28JR-130-1
P1	1251-0483		CONNECTOR;R&P MALE 36 CONTACT PLUG	71785	57-10360-375
Q1	1853-0052	1	TSTR:SI PNP	80131	2N3740
R1	0811-1179	1	R:FXD WW 200 OHM 1% 12W	28480	0811-1179
R2	0811-2880	1	R:FXD WW 150 OHM 1.0% 12W	28480	0811-2880
R3	2100-3185	1	R:VAR CERMET 1K OHM 10% LIN 2W	28480	2100-3185
T1	0960-0189	1	TRANSFORMER:50 TO 70 OHM(MATCHING) (OPTION 003 ONLY)	28480	0960-0189
W1	8120-1837	1	CABLE ASSY(3.950" LG) (YIG-TRANSLATOR)	94142	813935
W2	8120-1740	1	CABLE ASSY(4.312" LG) (CAVITY-TRANSLATOR)	94142	813934
W3	86220-60006	1	CABLE ASSY:ORANGE, DET OUTPUT	28480	86220-60006
W4	86220-60004	1	CABLE ASSY:YELLOW, FM INPUT (INCLUDES J2)	28480	86220-60004
W5	86220-60007	1	CABLE ASSY:GREEN, TUNING VOLTAGE	28480	86220-60007
W7	8120-1742	1	CABLE ASSY(4.411" LG) (TRANSLATOR-AMPLIFIER)	94142	813933
W8	86220-20008	1	CABLE:RF OUTPUT (INCLUDES J1)	28480	86220-20008
W9	86220-20005	1	CABLE:AMP-ATTENUATOR (OPTION 002 ONLY)	28480	86220-20005
W10	86220-20013	1	CABLE:RF OUT (OPTION 002 ONLY)	28480	86220-20013
W11	86220-20015	1	CABLE ASSY:REAR OUT (OPTION 004 ONLY)	28480	86220-20015
W12	86220-20018		CABLE ASSY:REAR OUT (OPTIONS 002 & 004)		
XA1	1251-0233	1	CONNECTOR:PC EDGE 2 X 22 CONTACTS	71785	251-22-30-261
			MISCELLANEOUS		
	0370-1111	1	KNOB:BAR (OPTION 002 ONLY)	28480	0370-1111
	7120-2821	1	IDENTIFICATION PLATE	28480	7120-2821
	00692-210	2	PIN:KEY	28480	00692-210
	08731-210	1	NUT:LOCK	28480	08731-210
	6960-0016	1	PLUG:NYLON 0.125" DIA HOLE	28480	6960-0016
	86220-00007	1	SCALE:FOR 8620A	28480	86220-00007
	86220-00008	1	SCALE:FOR 8620B	28480	86220-00008
	86220-00012	1	BRACKET	28480	86220-00012

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
1	08621-20052	1	SCREW: DRAWER LATCH	28480	08621-20052
2	08621-20051	1	HANDLE: DRAWER LATCH	28480	08621-20051
3	3050-0028	1	WASHER: LATCH HANDLE	28480	3050-0028
4	1460-1186	1	WIREFORM: LATCH SPRING	28480	1460-1186
5	86220-00004	1	FRAME: LEFT	28480	86220-00004
6	86220-00001	1	DECK	28480	86220-00001
7	2360-0182	3	SCREW: FLAT HD POZIDRIVE	28480	2360-0182
8	2360-0181	1	SCREW: FLAT HEAD POZIDRIVE	28480	2360-0181
9	0590-0106	2	NUT: LOCK	28480	0590-0106
10	86220-20017	1	FRAME: DRAWER REAR	28480	86220-20017
11	0590-0131	2	SCREW: CONNECTOR	28480	0590-0131
12	2360-0115	10	SCREW: PAN HEAD POZIDRIVE	28480	2360-0115
13	2510-0065	1	SCREW: PAN HEAD	28480	2510-0065
14	2190-0017	1	WASHER, LOCK	28480	2190-0017
15	86220-00011	1	COVER: REAR	28480	86220-00011
16	6960-0046	1	BUTTON PLUG	28480	6960-0046
17	2190-0016	1	WASHER: LOCK	28480	2190-0016
18	2950-0006	1	NUT: HEX	28480	2950-0006
19	86220-20016	1	YIG SUPPORT	28480	86220-20016
20	86220-00005	1	FRAME: RIGHT	28480	86220-00005
21	2360-0127	2	SCREW: PAN HEAD PC BRD	28480	2360-0127
22	2420-0003	1	NUT: HEX	28480	2420-0003
23	2190-0008	1	WASHER: LOCK	28480	2190-0008
24	0360-0009	1	LUG: TERMINAL SOLDER	28480	0360-0009
25	0380-0010	2	STAND OFF: PC BRD	28480	0380-0010

Figure 6-1. Cabinet Parts (1 of 3)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
26	86210-20003	1	PANEL-SUB	28480	86210-20003
27	86220-00002	1	PANEL: FRONT UPPER	28480	86220-00002
27	86220-00006	1	PANEL: FRONT, UPPER (OPT 002)	28480	86220-00006
28	86220-00010	1	PANEL: FRONT, LOWER	28480	86220-00010
28	86220-00014	1	PANEL: FRONT, LOWER (OPT 004)	28480	86220-00014
29	0590-0012	1	NUT: KNURLED	28480	0590-0012
30	08731-210	1	NUT: LOCK, KNURLED	28480	08731-210
31	0370-1103	1	KNOB, BASE, PTR, .5 IN, OBP, OBP DECAL	28480	0370-1103
32	3030-0007	4	SCREW: LOCK, ALLEN	28480	3030-0007
33	2950-0043	1	NUT HEX	28480	2950-0043

Figure 6-1. Cabinet Parts (2 of 3)

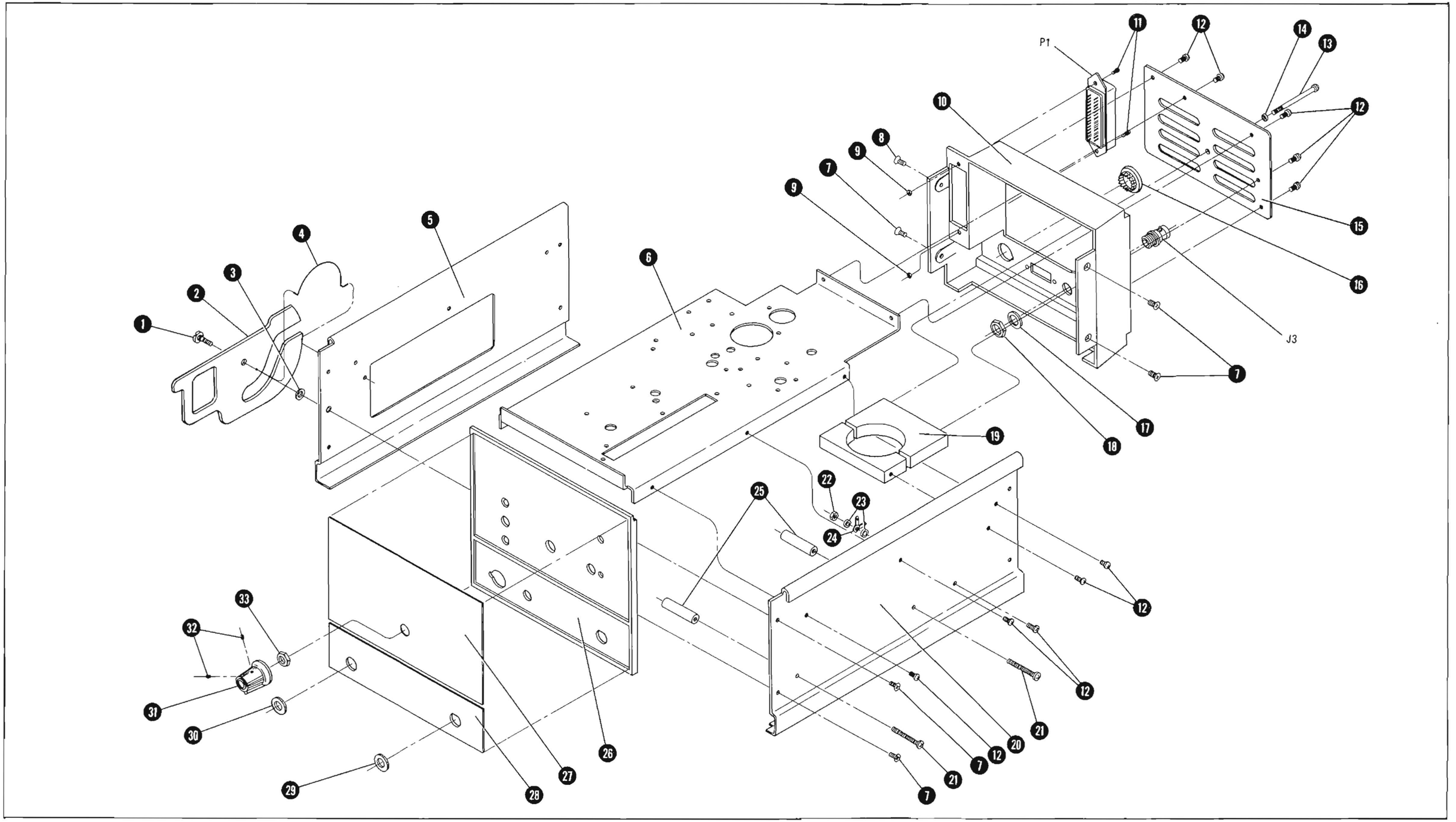


Figure 6-1. Cabinet Parts (3 of 3)

Table 6-3. Manufacturers Code List

MFR No.	Manufacturer Name	Address	Zip Code
0000	U.S.A. Common	Any Supplier of U.S.A	
01121	Allen Bradley Co.	Milwaukee, Wisc.	53204
02660	Amphenol Corp.	Broadview, Ill.	60153
04009	Arrow, Hart & Hegeman Elect. Co.	Hartford, Conn.	06106
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Ariz.	85008
07263	Fairchild Camera & Inst. Corp. Semiconductor Division	Mountain View, Calif.	94040
24931	Speciality Connector Co., Inc.	Indianapolis, Ind.	46227
28480	Hewlett-Packard Company	Palo Alto, California	94304
56289	Sprague Electric Co.	N. Adams, Mass.	01247
71785	Cinch Mfg. Co. Div. TRW Inc.	Elk Grove Village, Ill.	60007
72982	Erie Technological Prod. Inc.	Erie, Pa.	16512
80131	Electronic Industries Association	Washington, D.C.	20006
94142	Phelps Dodge Cooper Prod. Corp. Habirshaw Cable & Wire Div.	Yonkers, N.Y.	10022

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

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

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

7-4. If your instrument serial number is not listed on the title page of this manual, or in Table 7-1, it may be documented in a yellow MANUAL CHANGES supplement. For additional important information about serial number coverage refer to INSTRUMENTS COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes	Serial Prefix or Number	Make Manual Changes
1426A and 1319A	A	1218A	A, B, C
1230A and 1223A	A, B	1135A	A, B, C, D

7-5. MANUAL CHANGE INSTRUCTIONS

CHANGE A

Page 1-4, Table 1-2:
Change Frequency Reference Output: 1V/GHz to Sweep Reference Output: 100 MHz/Volt.

Page 3-2, Paragraphs 3-18 and 3-19:
Change paragraphs to read as follows:

3-18. Sweep Reference

3-19. A DC voltage, which is an analog of frequency, is available for referencing or phase locking external equipment to the Plug-in. The sweep reference signal is approximately 100 MHz/Volt.

Page 3-3, Figure 3-2:
Change FREQ REF labeling on rear panel to SWEEP REF.
Change item 4 to read: SWEEP REF connector. Provides 0 to 13 volt ramp signal from the Plug-in. The signal is used as a DC analog of frequency.

Page 6-4, Table 6-2:
Delete A1R47
Add A1R30 HP Part Number 0757-0442 R:FXD MET FLM 10.0K OHM 1% 1/8W.
Add A1R35 HP Part Number 0757-0279 R:FXD MET FLM 3.16K OHM 1% 1/8W.
Change A1R41 to HP Part Number 0757-0438 R:FXD MET FLM 5.11K OHM 1% 1/8W.

CHANGE A (Cont'd)

Page 8-10, Figure 8-5:
Change Troubleshooting Flow Diagram as shown in Figure 7-1.

Page 8-13, Figure 8-7:
Replace Figure 8-7 with Figure 7-4.

Page 8-13, Figure 8-8:
Change A1 YIG Driver/ALC Board Assembly, Schematic as shown in Figure 7-2.

Page 8-13, Figure 8-8:
Change A1 YIG Driver/ALC Board Assembly, Schematic as shown in Figure 7-3.

CHANGE B

Page 6-5, Table 6-2:
Delete CR1; HP Part Number 1901-0159; DIODE; POWER RECT, S1, 400V MAX VRM 750 mA.

Page 8-13, Figure 8-8:
Delete CR1 from A1 YIG Driver/ALC Board Assembly, schematic located between XA1 U and XA1 M.

NOTE

CR1 has ben added to instruments with serial prefix 1319A and above to prevent tripping the over-voltage protection circuit when the 86220A is removed from the mainframe while power is on. It is recommended this modification be performed on instruments with serial prefix below 1319A as well.

CHANGE C

Page 6-7, Figure 6-1:
HP Part Number 86220-00014 has been added to make available a LOWER FRONT PANEL for OPTION 004 ONLY. This panel does not have an RF OUTPUT connector hole since OPTION 004 provides for a rear-panel RF OUTPUT connector.

CHANGE D

Page 6-5, Table 6-2:
A5 HP Part Number 5086-7024 YIG TUNED OSCILLATOR has been modified requiring a new output cable. YIG OSCILLATOR replacements in instruments with 1135A prefix also require this new cable.

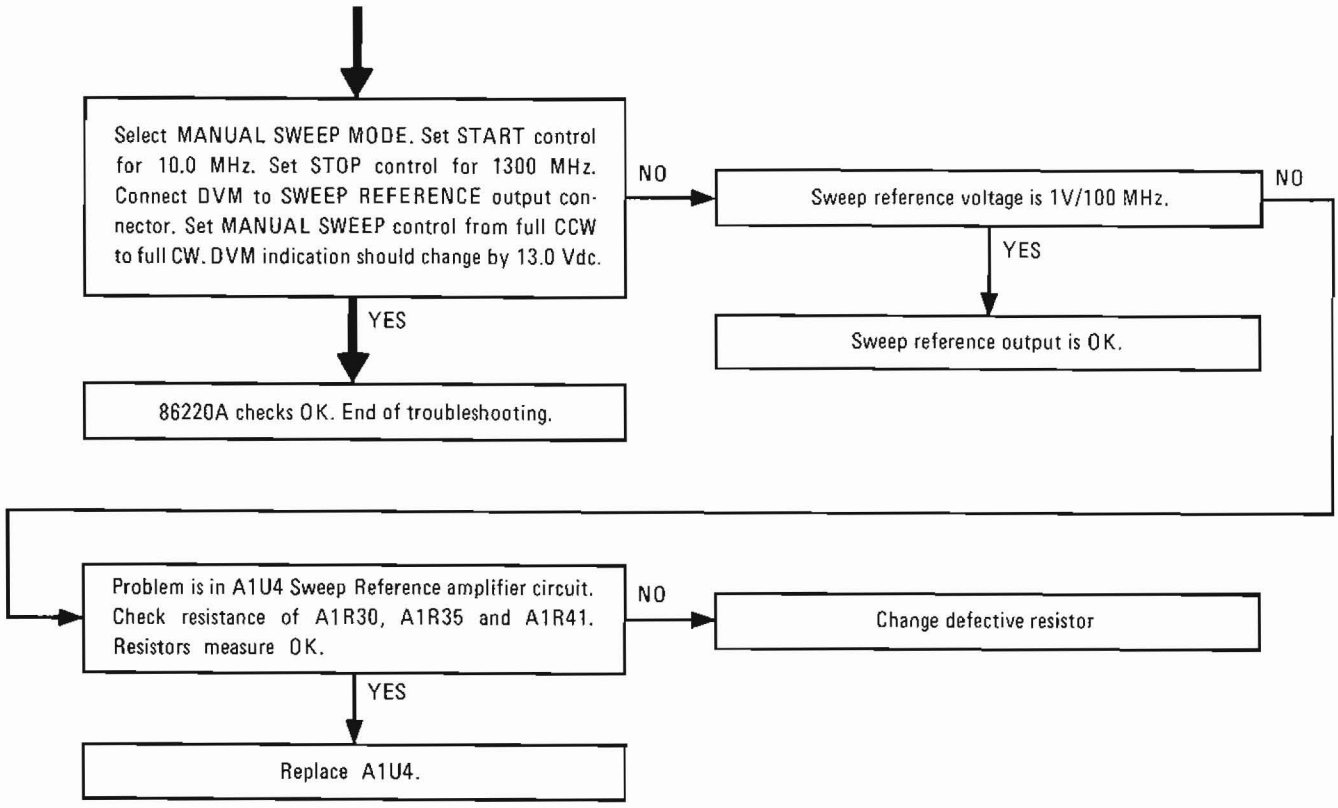


Figure 7-1. P/O Figure 8-5. Troubleshooting Flow Diagram (CHANGE A)

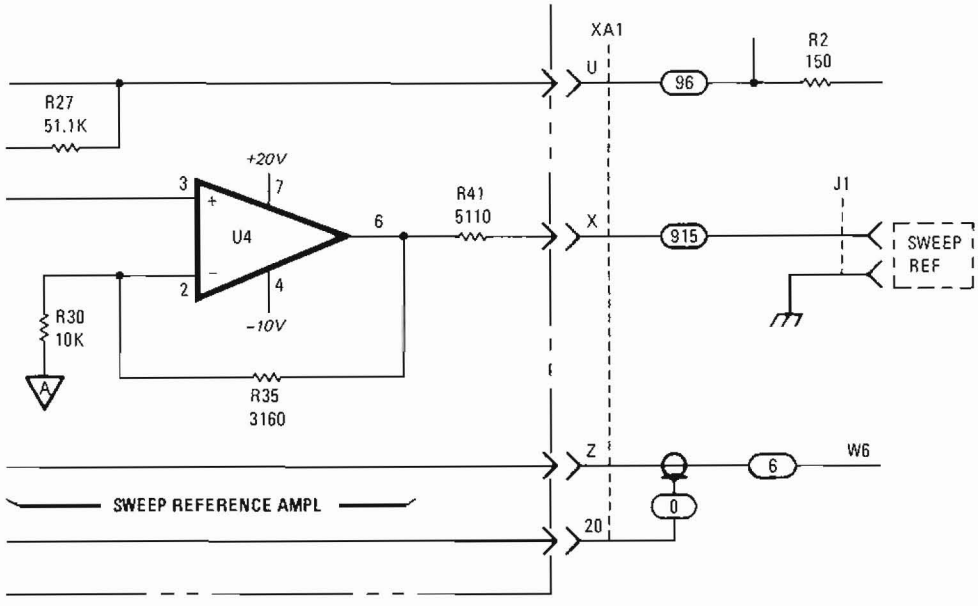


Figure 7-2. P/O Figure 8-8. A1 YIG Driver/ALC Board Assembly, Schematic (CHANGE A)

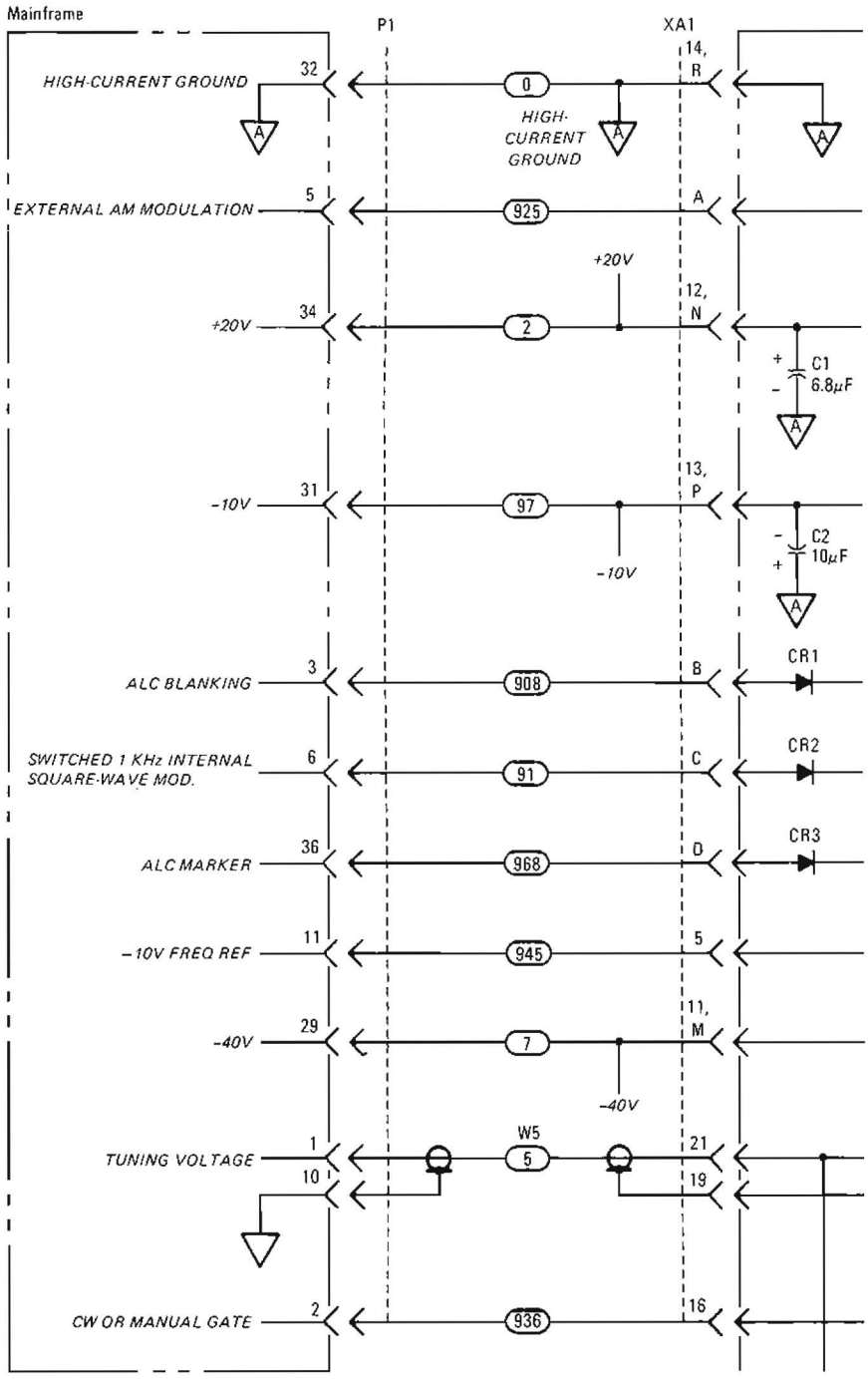


Figure 7-3. P/O Figure 8-8. A1 YIG Driver/ALC Board Assembly, Schematic (CHANGE A)

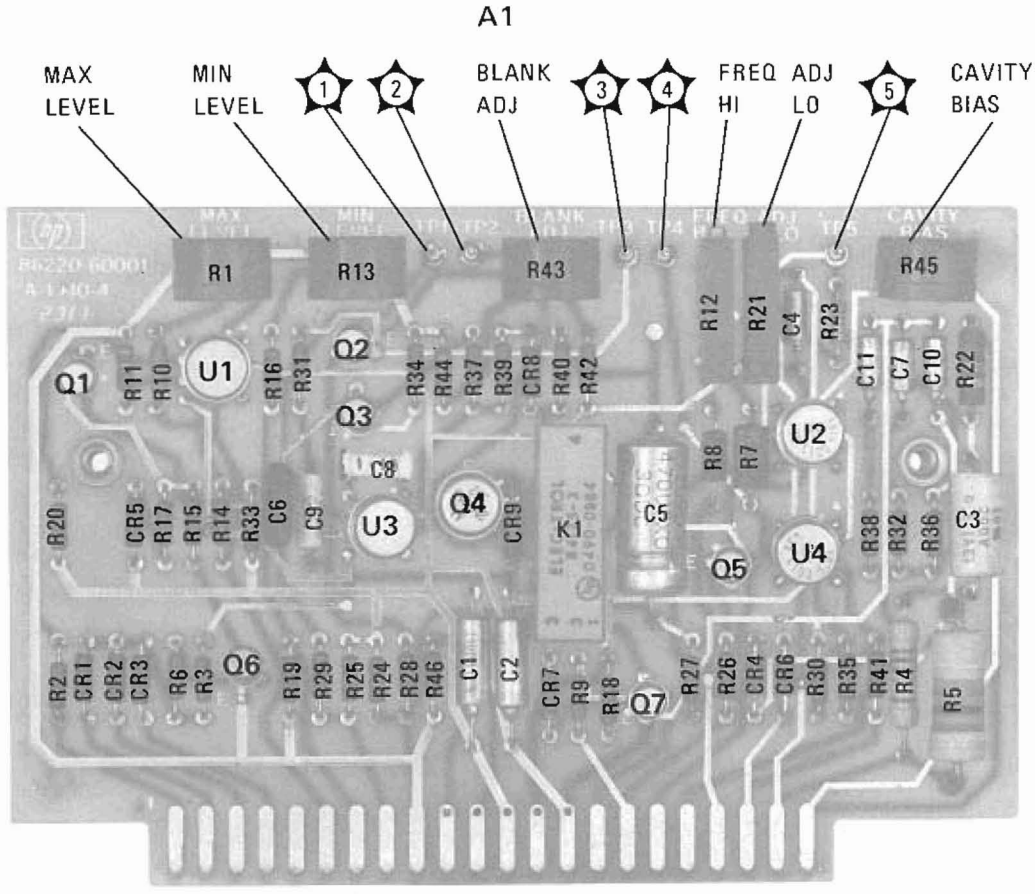


Figure 7-4. Replacement for Figure 8-7. A1 YIG Driver/ALC Board, Component Locations (CHANGE A)

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for testing, troubleshooting, and repairing the model 86220A RF Plug-in.

8-3. PRINCIPLES OF OPERATION

8-4. Detailed circuit description for the schematic diagram is placed on the facing left-hand fold-out page. This places material needed for printed-circuit-level diagnosis in one location and allows easy correlation between function and specific circuit.

8-5. TROUBLESHOOTING

8-6. Troubleshooting is divided into two maintenance levels in this manual. The first is the assembly level, which isolates the cause of the malfunction to a circuit or assembly. A troubleshooting flow diagram provides a simple step-by-step procedure to identify the defective assembly.

8-7. The second maintenance level isolates the trouble to the component level. A schematic diagram is provided along with a detailed circuit description to aid in troubleshooting down to the component level within the assembly.

8-8. RECOMMENDED TEST EQUIPMENT

8-9. Test equipment and accessories required to maintain the Model 86220A are listed in Table 1-4. If the equipment listed is not available, equipment that meets the minimum specification shown may be substituted.

8-10. Service Accessories

8-11. A Service Accessories package, HP Part No. 08620-60030, is available as an aid in maintaining the Model 86220A. This package is described in Table 1-3.

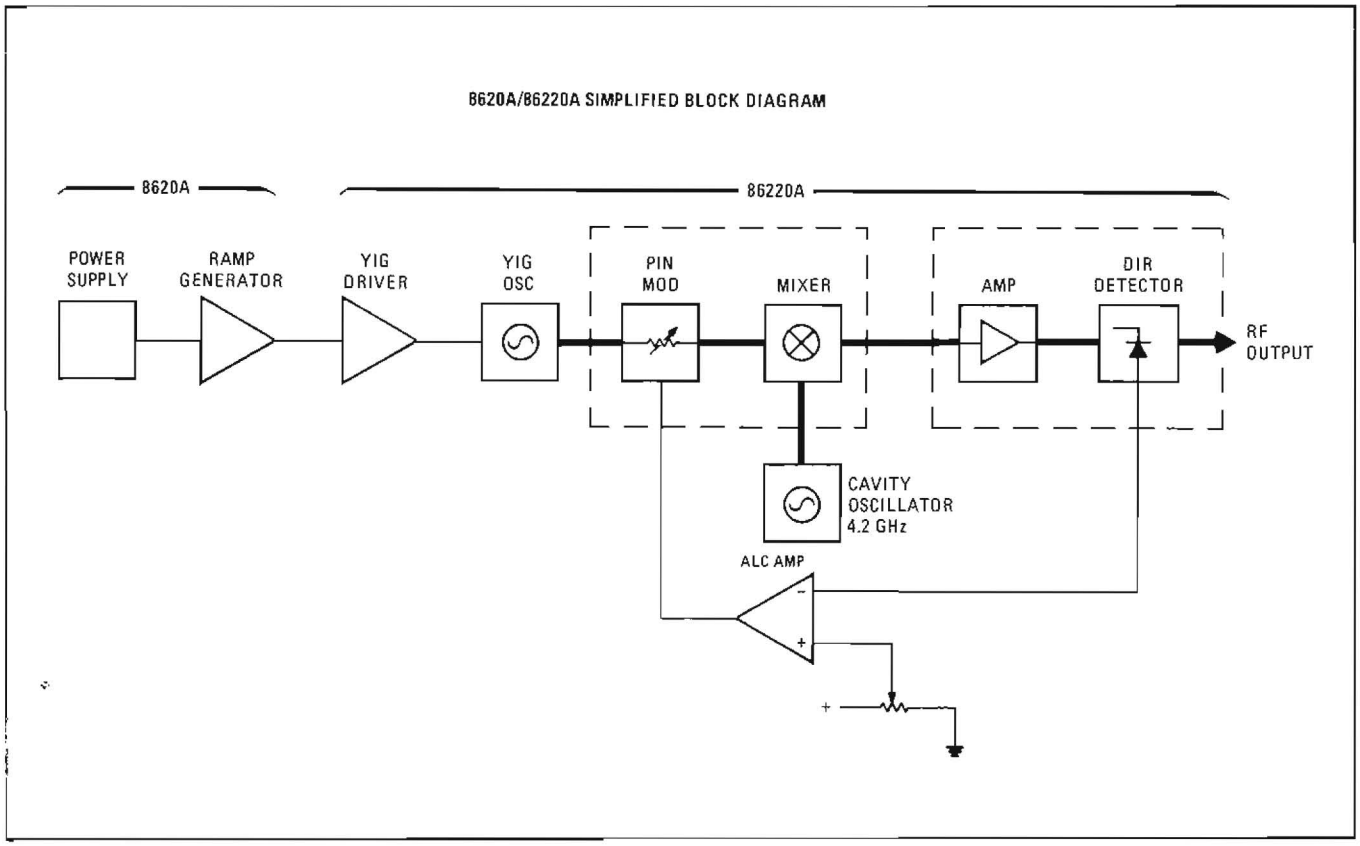


Figure 8-1. 8620A/86220A Simplified Block Diagram

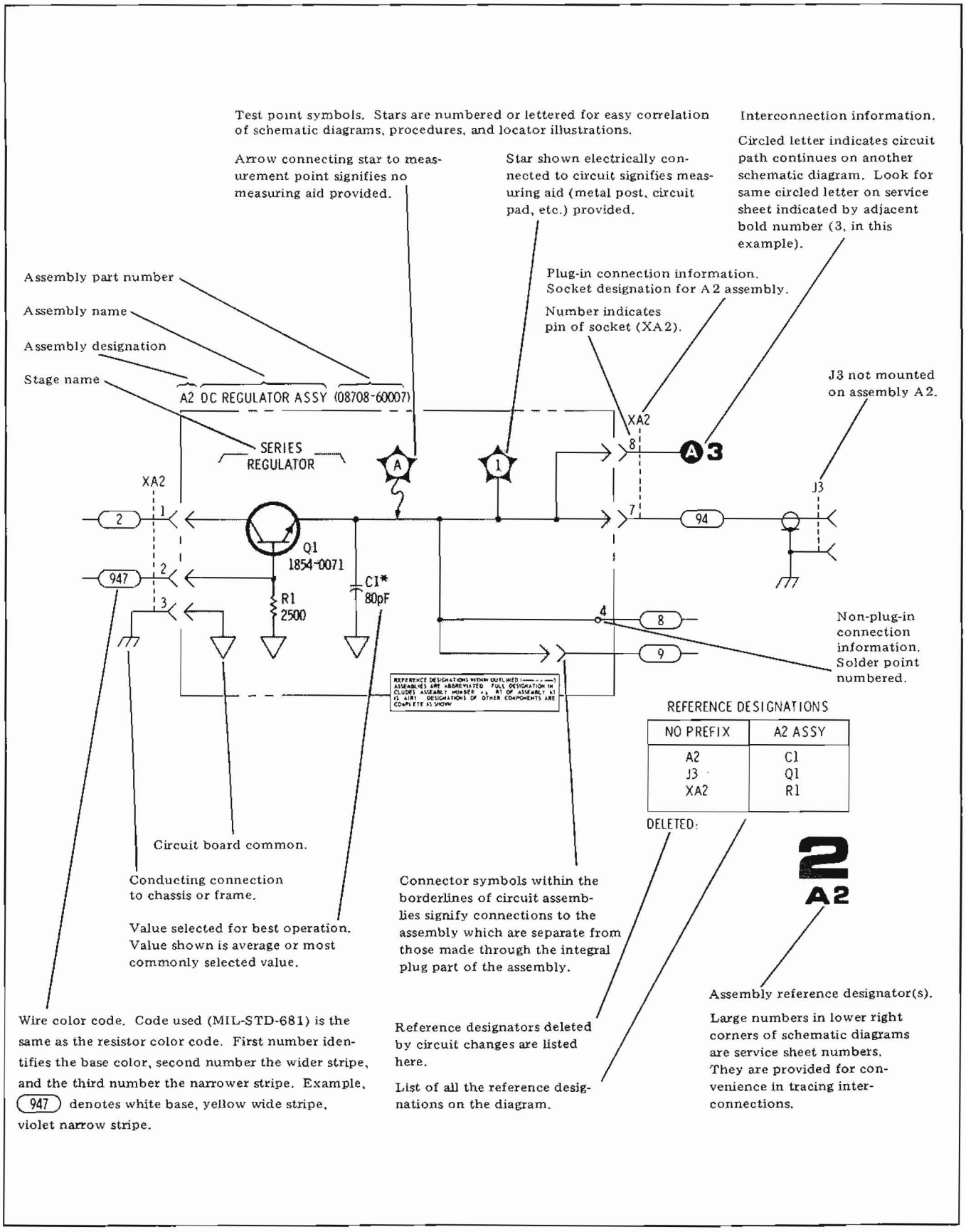


Figure 8-2. General Information on Schematic Diagrams

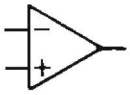
SCHEMATIC DIAGRAM NOTES

R, L, C	Resistance is in ohms, inductance is in microhenries, capacitance is in picofarads, unless otherwise noted.
P/O	Part of.
*	Asterisk denotes a factory-selected value. Value shown is typical.
○	Panel control.
⊘	Screwdriver adjustment.
	Encloses front panel designation.
	Encloses rear panel designation.
	Circuit assembly borderline.
	Other assembly borderline.
	Heavy line with arrows indicates path and direction of main signal.
	Heavy dashed line with arrows indicates path and direction of main feedback.
	Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.
	Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number identifies the narrower stripe; e.g. (947) denotes white base, yellow wide stripe, violet narrow stripe.
	Number = Service Sheet number for off-page connection. Letter = off-page connection.
	Light-emitting diode (LED).
	Breakdown diode.
	PIN diode.
	Field effect transistor (FET) with N-type base.

Figure 8-3. Schematic Diagram Notes (1 of 3)

SCHEMATIC DIAGRAM NOTES (Cont'd)


Field effect transistor (FET) with P-type base.


Operational amplifier (integrated circuit).


Test point location. Number denotes test point number.


Assembly ground.


Chassis ground.


Earth ground.


Common connection on same page.


High-current ground.

Voltages noted within circuits are measured with respect to chassis ground and have a ±10% tolerance.

Conditions for waveforms and dc voltages on schematic and block diagram are as follows:

a. DC Voltages are measured in CW mode (CW pushbutton pressed) and controls set as follows:

86220A
POWER LEVEL .....Full Clockwise

8620A
START pointer .....10 MHz
CW pointer .....650 MHz
STOP pointer .....1300 MHz
MARKER .....OFF
MODE .....AUTO
TRIGGER .....INT
TIME-SECONDS .....1 — .01
TIME Vernier .....Full Clockwise
1 kHz SQ WV/OFF .....OFF
RF BLANKING/OFF .....RF BLANKING
DISPLAY BLANKING/OFF .....OFF
LINE .....ON

Figure 8-3. Schematic Diagram Notes (2 of 3)

SCHEMATIC DIAGRAM NOTES (Cont'd)

b. Waveforms on schematic are displayed on oscilloscope with 8620A in START/STOP mode (START pushbutton pressed). Control settings are as noted in step a.

c. Waveforms on Troubleshooting Block Diagram are displayed as follows:

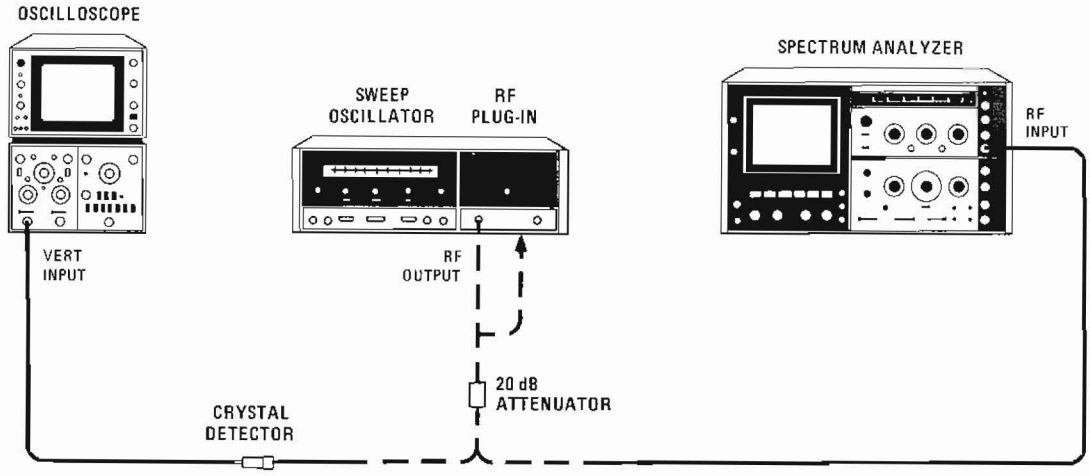
1. YIG Oscillator Output at A5J1; displayed on spectrum analyzer with 8620A in CW mode and CW pointer set to 1300 MHz.

2. 4.2 GHz Cavity Oscillator Output at A4J1; displayed on spectrum analyzer.

3. Frequency Translator Output at A2J1; displayed on oscilloscope with 8620A in START/STOP mode. Control settings are as noted in step a.

4. RF Output at J1; displayed on spectrum analyzer with 8620A in CW mode and CW pointer set to 1300 MHz. Control settings are as noted in step a.

5. ALC waveform at A1TP3; displayed on oscilloscope with 8620A in START/STOP mode. Control settings are as noted in step a.

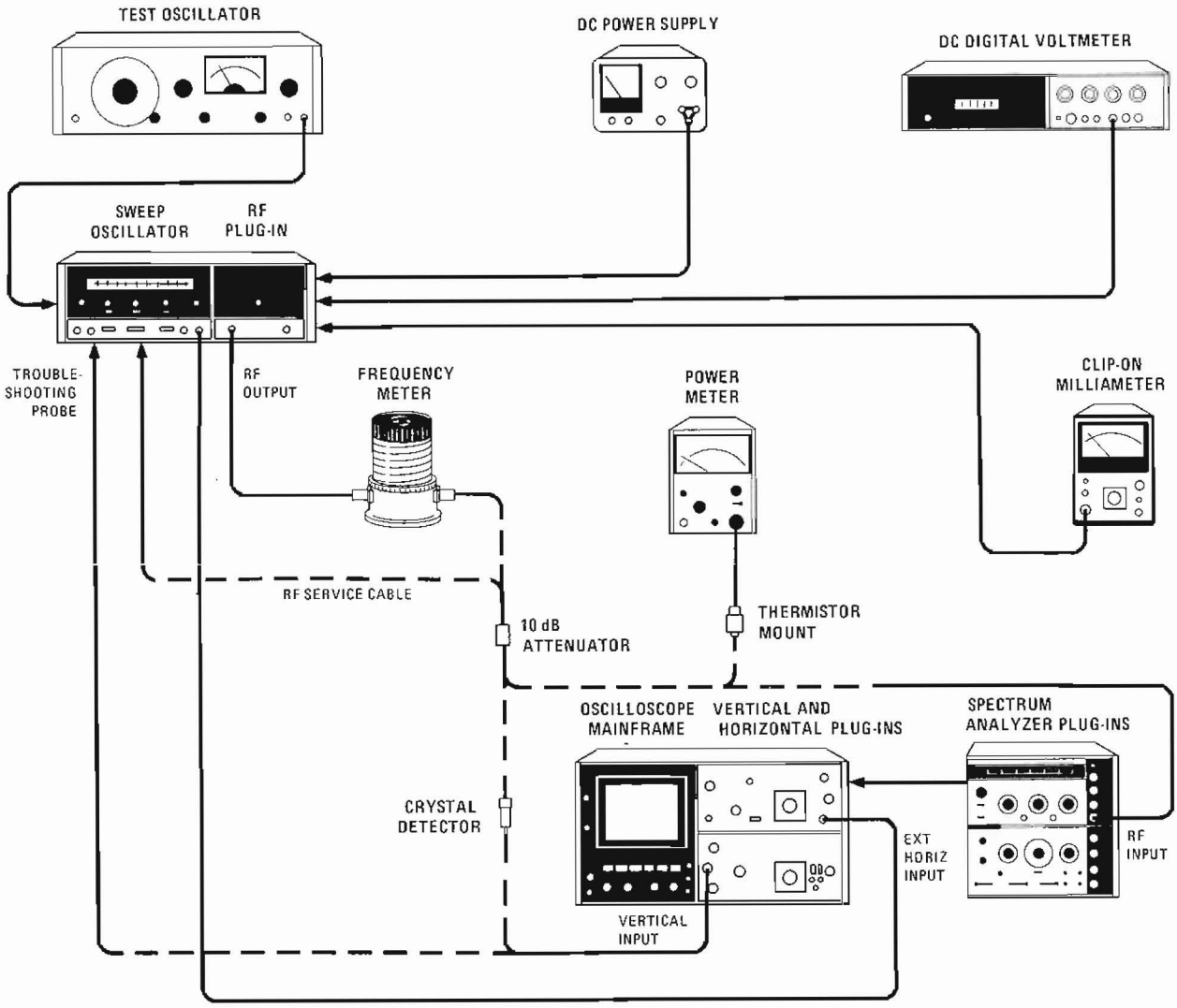


Equipment Setup for DC Voltages and Waveforms

EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Spectrum Analyzer	HP 8555A/8552B/141T
Oscilloscope	HP 180A/1801A/1820A
20 dB Attenuator	HP 8491A, Option 020
Crystal Detector	HP 423A

Figure 8-3. Schematic Diagram Notes (3 of 3)



EQUIPMENT:

Sweep Oscillator	HP 8620A
RF Plug-in	HP 86220A
Clip-on Milliammeter	HP 428B
DC Digital Voltmeter	HP 3460B
DC Power Supply	HP 721A
Test Oscillator	HP 651B
Oscilloscope mainframe	HP 141T
Oscilloscope Vertical Plug-in	HP 1407A
Oscilloscope Horizontal Plug-in	HP 142A
Spectrum Analyzer IF Section	HP 8552B
Spectrum Analyzer RF Section	HP 855A
Power Meter & Thermistor Mount	HP 432A/8478B
Frequency Meter	HP 536A
10 dB Attenuator	HP 8491A, Option 10
Crystal Detector	HP 423A
RF Service Cable	HP 8120-1578
Type N to SMA Adapter	HP 1250-1404

Figure 8-4. Troubleshooting Test Setup

SHEET 1

INITIAL SETUP

Connect equipment as shown in figure 8-5. Remove 8620A top & bottom covers. Set the controls as follows:

BAND . . . . . 10 to 1300 MHz
START pointer . . . . . 10.0 MHz
STOP pointer . . . . . 1300.0 MHz
CW pointer . . . . . 650 MHz
MODE . . . . . AUTO
TRIGGER . . . . . INT
TIME-SECONDS . . . . . .1 to 0.1 sec
SECONDS VERNIER . . . . . Full Clockwise
AM MOD . . . . . OFF
RF BLANKING . . . . . ON

Set 86220A controls as follows:

POWER LEVEL . . . . . +10 dBm

SWEPT RF POWER INDICATION

Turn the 8620A LINE switch ON. The light in the LINE switch and the START and STOP lights should light.

NO → 86220A LOADS 8620A POWER SUPPLIES

Turn 8620A off. Remove 86220A. Turn 8620A on. The START and STOP lights are lit.

NO → Problem in 8620A mainframe. Troubleshoot per the 8620A Operating and Service Manual.

YES

86220A is loading down 8620A +20V or –40V power supply. Remove the A1 board from the 86220A. Reinstall the 86220A in the 8620A. The START and STOP lights are lit.

NO → Unsolder the +20V red wire from A5 YIG Oscillator. 8620A START and STOP lights now light.

NO

YES

YES

Reinstall the A1 board. Set POWER LEVEL control maximum CCW (in detent) to OFF position. START and STOP lights are now lit.

NO → Replace A1 board or troubleshoot to faulty component.

YES

Unsolder C2 from cavity oscillator. Set POWER level control maximum CW. START and STOP lights are now lit.

NO → Replace A4 cavity oscillator.

YES

Replace shorted C2.

YES

NOTE
The 8620A +20V, +5V, and –40V power supplies are OK.

Press CW pushbutton. CW light turns on & stays on and START and STOP lights turns off & stay off.

NO → Turn 8620A OFF. Remove 86220A. Turn 8620A ON. Press CW button. CW light turns on and stays lit, START and STOP lights turn off and stay off.

NO → Problem in 8620A mainframe. Troubleshoot per the 8620A Operating & Service Manual.

YES

Turn 8620A OFF. Remove 86220A. Turn 8620A ON. Press CW button. CW light turns on and stays lit, START and STOP lights turn off and stay off.

YES

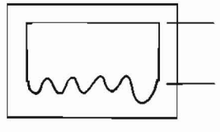
NOTE
The 8620A –10v power supply is OK.

Unsolder the –10V white-violet wire from A5 YIG Oscillator. Reinstall the 86220A in the 8620A. Turn 8620A on. Press CW pushbutton. CW light turns ON and stays lit and START and STOP lights turn off and stay off.

YES

Replace A5 YIG Oscillator.

8620A power supplies OK. Select auto sweep by pressing the START pushbutton. Adjust oscilliscope for 10 CM external horizontal sweep. Adjust vertical sensitivity for ≈5 CM separation between the blanking line & the detected RF voltage. Detected RF power is present.



NO

YES → NOTE
RF power present at RF output connector.

CW

86220A LOADS 8620A POWER SUPPLIES

Turn 8620A off. Remove 86220A. Turn 8620A on. The START and STOP lights are lit.

NO → Problem in 8620A mainframe. Troubleshoot per the 8620A Operating and Service Manual.

YES

86220A is loading down 8620A +20V or –40V power supply. Remove the A1 board from the 86220A. Reinstall the 86220A in the 8620A. The START and STOP lights are lit.

NO → Unsolder the +20V red wire from A5 YIG Oscillator. 8620A START and STOP lights now light.

NO → Unsolder the –40V violet wire from A5 YIG Oscillator. 8620A START and STOP lights now light.

YES → Replace A5 YIG Oscillator.

NO → Unsolder the two +20V red wires from the A3 Amplifier. 8620A START and STOP lights now light.

YES → Replace A3 Amplifier.

NO → Unsolder the +20V red wire from A4 8620A START and STOP lights now l

YES → Replace A4 cavity Oscilla

YES

Reinstall the A1 board. Set POWER LEVEL control maximum CCW (in detent) to OFF position. START and STOP lights are now lit.

NO → Replace A1 board or troubleshoot to faulty component.

YES

Unsolder C2 from cavity oscillator. Set POWER level control maximum CW. START and STOP lights are now lit.

NO → Replace A4 cavity oscillator.

YES

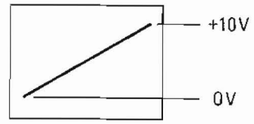
Replace shorted C2.

FROM SHEET 2

(E)

NO RF OUTPUT
OR FREQUENCY WRONG

Connect Oscilloscope to A1TP5. Tuning voltage is as shown.



NO → Connect oscilloscope to A1TP4. Tur shown.

YES → With DVM, measure power supply vo XA1:
Pin N = 20 Vdc ±0.5 Vd
Pin P,S = 10 Vdc ±0.5 V
Pin M = –40 Vdc ±0.5 \

YES

(D)

TO SHEET 2

CW FREQUENCY

Select CW mode. Connect frequency counter to 86220A RF OUTPUT connector. CW frequency is 650 MHz ±10 MHz. Turn CW control to 10.0 MHz, counter should indicate 10 MHz ±10MHz. Set CW control for 1300 MHz and counter should indicate 1300 MHz ±10 MHz.

NO → Problem is A1Q5, A1R26, or components R1 or Q1. Use ohm defective component.

YES

NOTE
CW frequency is OK

(A)

TO SHEET 2

Turn 8620A OFF. Remove 86220A. Turn 8620A ON. Press CW button. CW light turns on and stays lit, START and STOP lights turn off and stay off.

NO → Problem in 8620A mainframe. Troubleshoot per the 8620A Operating & Service Manual.

YES

Unsolder the –10V white-violet wire from A5 YIG Oscillator. Reinstall the 86220A in the 8620A. Turn 8620A on. Press CW pushbutton. CW light turns ON and stays lit and START and STOP lights turn off and stay off.

YES

Replace A5 YIG Oscillator.

NOTE
RF power present at RF output connector.

YES → Problem in 86220A wiring from P1 t power supplies not adjusted correctly

Select CW mode. Connect DVM betw and 3. Difference is <10 mVdc.

(D)

TO SHEET 2

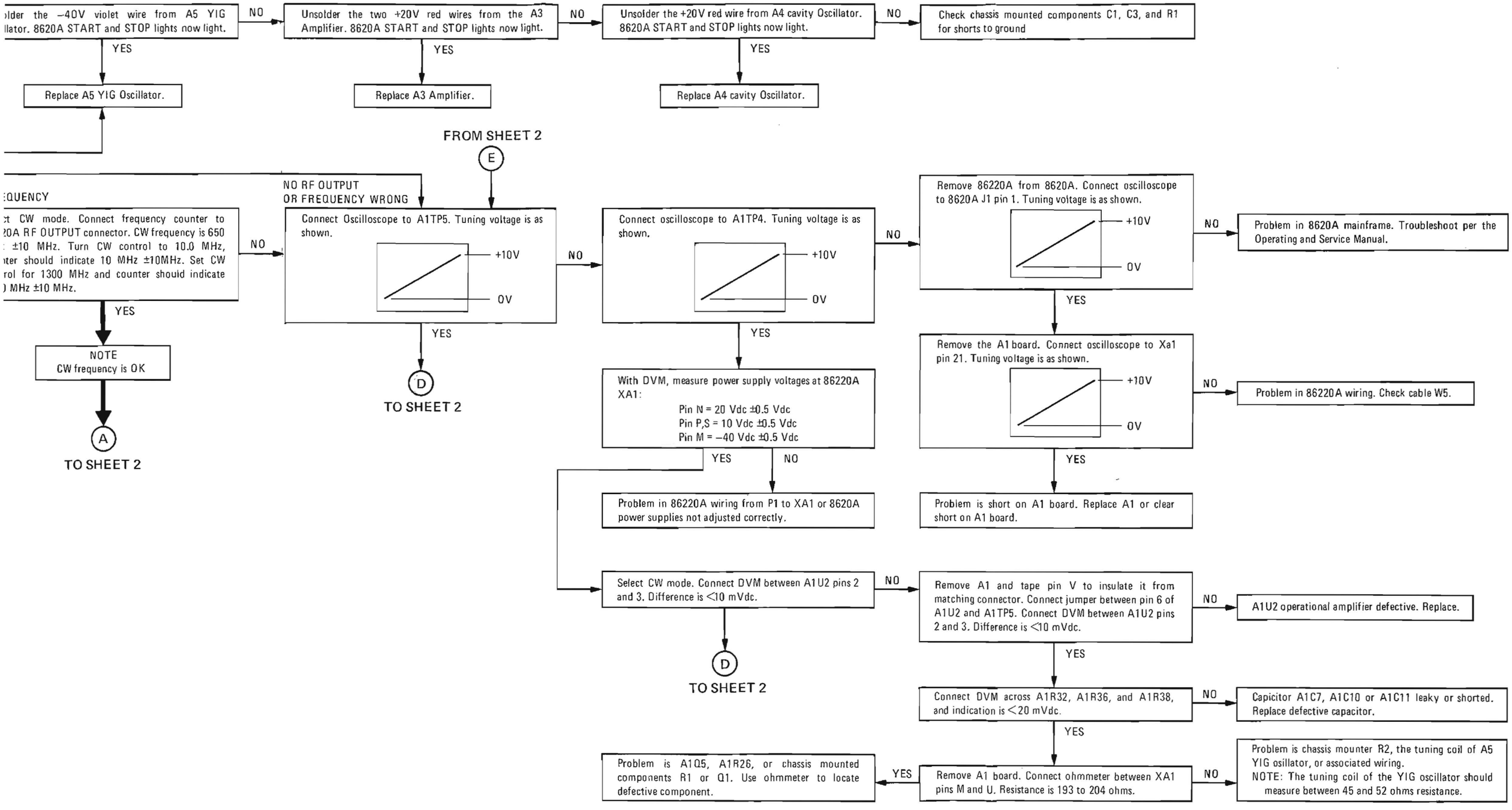


Figure 8-5. Troubleshooting Flow Diagram (1 of 4)

SHEET 2

FROM SHEET 1 (A)

Select MANUAL sweep mode. Connect power meter and thermistor mount to 86220A. Set 86220A POWER LEVEL control for +10 dBm. Manually sweep the band. The power meter indicates +10 dBm ±1.0 dB across band.

NO → FROM SHEETS 1 & 3 (D)

YES

NOTE
RF Power output is within specifications.

(B) TO SHEET 3

FROM SHEETS 1 & 3 (D)

Disconnect modulator control lead (white-red-yellow) wire from A2 Frequency Translator. Select AUTO sweep mode. Power meter indicates >+9 dBm.

NO → Measure the voltages to A4 cavity oscillator. Plus lead (red wire) = +20Vdc ±0.5 Vdc; – lead (white-orange-green) wire = –8 Vdc ± 2 Vdc.

NO → Check for continuity on +20 V line between + terminal on A4 and XA1 pin 12. Set POWER LEVEL control to OFF (ccw detent). Connect DVM to XA1 pin 22 and indication is –10 Vdc ± 0.5 Vdc.

NO → Set RF POWER LEVEL control to +10 dBm. Check for continuity from XA1 pin 22 to the – bias input of A4 cavity oscillator.

NO → Unsolder chassis mounted C2. Connect DVM to – lead of A4 Oscillator and indication is –8Vdc ± 2 Vdc.

NO →

YES

YES

YES

YES

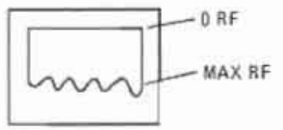
Select MANUAL sweep mode. Manually sweep the band while measuring the power output. RF power ≥ 9 dBm across the band.

NO → (to Measure the voltages to A4 cavity oscillator.)

YES

FROM SHEET 3 (F)

Select auto sweep mode. Disconnect control lead (white-red-yellow) wire from A2 Frequency Translator. The voltage wave shape at A1TP2 should be as shown.



NO → Unsolder the center conductor of the shielded cable W3 from A3 amplifier detector, pin 3. Detected RF voltage at A3, pin 3 is >0.03Vdc.

NO → Replace A3 Amp/detector.

YES

YES

Check for continuity from disconnected end of W3 cable to A1TP2. Also check center conductor for short to ground. Wiring OK.

NO → Repair or replace defective cable.

YES

Problem is on A1 board, Q2, U3, or associated circuitry. Replace A1 board or troubleshoot to defective component.

Connect DVM to A1TP3. Indication is +3Vdc ±0.3Vdc.

NO → Connect A1TP2 to A1TP3. Voltage at A1TP1 equals voltage at A1TP2 ±10mV.

YES

YES

Connect DVM to XA1 pin 10. Indication is –8Vdc ±0.8Vdc.

NO → Problem is A1Q4 or associated circuitry. Replace A1 board or troubleshoot to defective component.

YES

Reconnect the 924 (white-red-yellow) wire to A2 frequency translator. Measure control voltage at A2 Freq. Translator, pin 924. DVM should indicate ≈ –0.7Vdc average with POWER LEVEL control at +10dBm.

YES

Replace A2 Frequency Translator.

Connect oscilloscope to A1TP1. Blanking line is +3.0Vdc ±1Vdc. RF ON line is +0.3 ± 0.4V.

YES

Turn RF blanking OFF. Connect audio generator to EXT AM input. Set audio generator for 4V P-P at 1 kHz. Connect oscilloscope to XA1, pin F and waveform is 0.4V P-P.

YES

Set POWER LEVEL control to +10dBm. Measure voltage at A3 amplifier detector where 904 (white-black-yellow) wire connects. Voltage is 0.4V P-P.

YES

Measure voltage at A3 amplifier/detector where 906 (white-black-yellow) wire connects. Voltage is 0.4V P-P.

Check for continuity on +20 V line between + terminal on A4 and XA1 pin 12. Set POWER LEVEL control to OFF (ccw detent). Connect DVM to XA1 pin 22 and indication is −10 Vdc ± 0.5 Vdc.

NO → Replace A1R45.

YES

Set RF POWER LEVEL control to +10 dBm. Check for continuity from XA1 pin 22 to the − bias input of A4 cavity oscillator.

NO → Problem in S1 POWER LEVEL switch or associated wiring.

YES

Unsolder chassis mounted C2. Connect DVM to − lead of A4 Oscillator and indication is −8Vdc ± 2 Vdc.

NO → Replace A4 Cavity Oscillator.

YES → Replace capacitor C2.

Measure the voltages to the A5 YIG Oscillator
Point 7 (violet wire) = −40 Vdc ± 0.5 Vdc
Point 6 (blue-wire) = 0 Vdc ± 0.5 Vdc
Point 97 (white-violet-wire) = −10Vdc ± 0.5Vdc
Point 2 (red wire) = +20Vdc ± 0.5 Vdc

NO → Problem is in wiring from 86220A P1 to A5 YIG Oscillator.

YES

With clip on milliammeter, measure current flow to YIG oscillator as follows:
Wire 917 white-brown-violet = 84 mA ± 10mA
Wire 97 white-violet = 85 mA ± 10mA
Wire 2 red = 80 mA ± 10mA

NO → Replace A5 YIG Oscillator.

YES

With clip-on millammeter, measure current flow to A4 Cavity Oscillator as follows:
Wire 2 red = 27 mA ± 7 mA
Wire 935 white-orange-green = 27 mA ± 7 mA

NO → Unsolder chassis mounted C1 and C2 from A4 Cavity Oscillator. Current measurements now correct.

NO → Replace A4 Cavity Oscillator.

YES → Capacitor C1 or C2 defective. Connect back one at a time to determine defective one then replace it.

YES

FAULTY RF COMPONENT

Disconnect RF Cable (W2) from A4 Cavity Oscillator. Connect power meter to A4J1 through a flexible RF service cable. Measured power is +10 to +13 dBm.

NO → Replace A4 Cavity Oscillator.

YES

Connect frequency counter to output of A4 Cavity Oscillator, A4J1. Frequency is 4.2 GHz ±5 MHz.

NO → Adjust frequency of A4 Cavity Oscillator. Frequency adjustable to 4.2 GHz ±5 MHz.

NO → Replace A4 Cavity Oscillator.

YES

Heat run for 24 Hrs. Check frequency of A4 cavity oscillator. Frequency changed.

NO → Troubleshooting completed.

YES → Replace A4 Cavity Oscillator.

YES

Reconnect RF cable (W2) to A4 Cavity Oscillator. Disconnect RF cable W1 from A5 YIG Oscillator. Connect power meter to A5 YIG Oscillator through a flexible RF service cable. Measured power is +10 to +16 dBm.

NO → Replace A5 YIG Oscillator.

YES

With frequency counter, measure frequency of A5 YIG Oscillator at A5J1. Signal tuneable from 2.9 to 4.19 GHz.

NO → Voltage at A1TP5 is tunable from +6.4 Vdc to −0.2 Vdc ±1.7 Vdc.

(E) TO SHEET 1

YES

Replace A5 YIG Oscillator.

YES

Reconnect RF cable W1 to A5J1 on YIG Oscillator. Disconnect W7 from A2 Frequency Translator A2J1. Connect Spectrum Analyzer through a flexible service cable to A2 Frequency Translator, A2J1. Fundamental power ≥ −24 dBm.

NO → Replace A2 Frequency Translator.

YES → Replace A3 Amplifier/Detector.

Replace A3 Amp/detector.

Repair or replace defective cable.

Connect A1TP2 to A1TP3. Voltage at A1TP1 equals voltage at A1TP2 ± 10mV.

NO → Replace defective A1U3.

YES

Connect oscilloscope to A1TP1. Blanking line is +3.0Vdc ±1Vdc. RF ON line is +0.3 ± 0.4V.

NO → Problem in A1Q1, A1Q6, or associated circuitry.

YES

Turn RF blanking OFF. Connect audio generator to EXT AM input. Set audio generator for 4V P-P at 1 kHz. Connect oscilloscope to XA1, pin F and waveform is 0.4V P-P.

NO → Problem in A1U1 or associated circuitry.

YES

Set POWER LEVEL control to +10dBm. Measure voltage at A3 amplifier detector where 904 (white-black-yellow) wire connects. Voltage is 0.4V P-P.

NO → Problem in R3 POWER LEVEL control. Replace R3.

YES

Measure voltage at A3 amplifier/detector where 906 (white-black-yellow) wire connects. Voltage is 0.4V P-P.

NO → Replace defective A3 Amplifier/detector.

TROUBLESHOOTING FLOW DIAGRAM (1 of 4)

Figure 8-5. Troubleshooting Flow Diagram (2 of 4)

SHEET 3

FROM SHEET 2 (B)

Set 86220A POWER level control to 0 dBm. Power meter indicates zero dBm ±1dB.

NO → Power level adjustable to 0 dBm with A1R13 minimum level adjustment pot.

NO → Set POWER LEVEL control to 10 dBm. Power is +10 dBm on power meter.

NO → (D) TO SHEET 2

YES

YES

YES

NOTE
POWER LEVEL control OK.

Adjust A1R13 minimum level adjustment for 0 dBm RF power output. Head run for 24 hrs. and minimum power output is still 0 dBm.

NO → Set POWER LEVEL control to 0 dBm. Voltage at XA1 pin H is adjustable with A1R13 minimum level adjust. Adjustment range is ≈0.2Vdc.

NO → Problem is A1R13, A1R16, or A1R19. Troubleshoot circuit to faulty component.

YES

YES

Troubleshooting complete.

Set A1R13 minimum power control to maximum ccw. Set A1R1 maximum level control to maximum ccw. The voltage at A3 amplifier detector where the 904 (white-black-yellow) wire connects is variable with the POWER LEVEL control from ≈–1.0Vdc to 4.5 Vdc.

NO → Problem in external AM amplifier A1U1 or associated circuitry.

YES

Select AUTO sweep mode. Connect frequency meter between 86220A RF OUTPUT connector and oscilloscope crystal detector. Set START control to 1000 MHz and STOP control to 1300 MHz. The start of the sweep is 1000MHz± 15 MHz. The stop of the sweep is 1300MHz± 15MHz.

NO → SWEPT FREQUENCY OUT OF SPECIFICATION

Check voltage at A1Q7 collector with DVM. Collector is +20 Vdc.

NO → Check voltage at A1Q7 base. Base is > – 2.0Vdc.

NO → Problem is in 8620A 100-10 SEL MANUAL/CW Gate.

YES

YES

YES

Replace A1Q7.

NOTE
Swept-frequency accuracy OK.

Resistance from pin 3 to pin 4 of A1K1 is 51.1K ohm.

NO → Replace A1K1.

Select CW mode. Connect 86220A RF OUTPUT to Spectrum analyzer. Set 86220A POWER LEVEL control to +10 dBm. Tun the 8620A/86220A slowly through the band and observe the Spectrum Analyzer for spurious and harmonic signals.

Spurious signals are >40 dB down from fundamental power.

From 10-750 MHz, harmonics are >25 dB down from fundamental power.

From 750-1300 MHz, harmonics are >30 dB down from fundamental power.

NO → Spurious signals on Spectrum Analyzer are below –40 dBm.

NO → Disconnect W7 RF cable from A2 Frequency Translator. Connect external power supply negative lead to pin XA1 pin 10 and positive lead to ground. Adjust power supply to obtain –24 dBm fundamental signal on the Spectrum Analyzer. Spurious signals are 50 dB below fundamental signal.

NO → Replace A2 Frequency Translator.

YES

YES

YES

Replace A3 Amplifier/Detector Assembly.

Harmonics of 10 to 750 MHz are >25 dB below the fundamental. Harmonics of 750 to 1300 MHz >30 dB below fundamental.

NO → Disconnect W7 RF cable from A2 Frequency Translator. Use front panel POWER LEVEL control to obtain –24 dBm fundamental signal on the Spectrum Analyzer. Harmonics are 36 dB below fundamental signal.

NO → Replace A2 Frequency Translator.

YES

YES

Spurious signals are within specifications.

Replace A3 Amplifier/Detector Assembly.

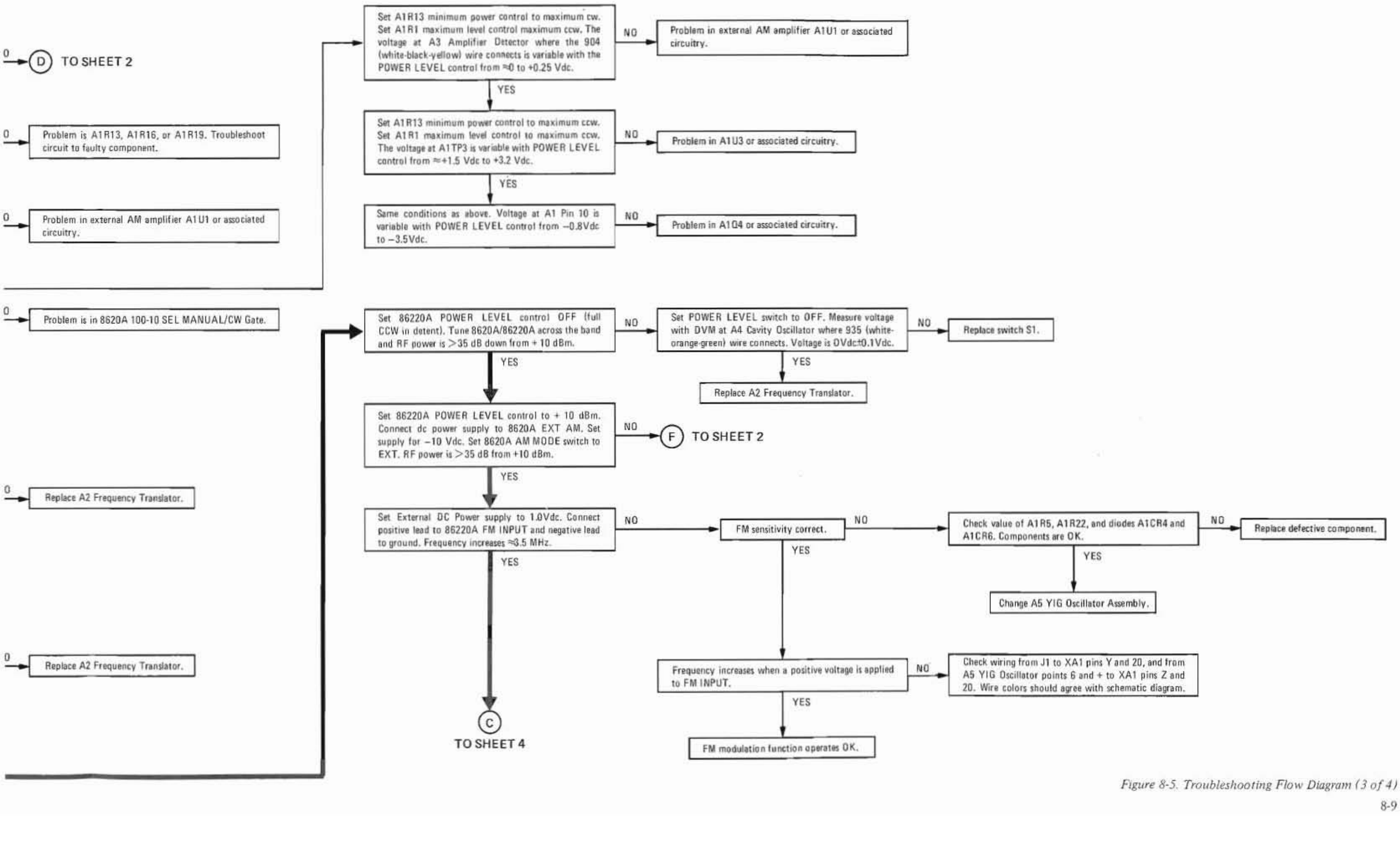


Figure 8-5. Troubleshooting Flow Diagram (3 of 4)

SHEET 4

FROM SHEET 3

C

Select CW MODE. Measure residual FM with Spectrum Analyzer. Residual FM is ≤10 KHz P-P.

NO

Residual FM in CW mode displayed on Spectrum Analyzer is <10kHz P-P.

NO

YES

Residual FM OK.

With oscilloscope, measure ripple voltages on power supplies;

XA1 Pin	Voltage	Indication
N	+ 20V	< 50 μV P-P ripple
P	− 10V	< 50 μV P-P ripple
M	− 40V	<125 μV P-P ripple
S	− 10V	< 50 μV P-P ripple
	Freq. Ref.	
21	Tuning Voltage	< 50 μV P-P

NO

Problem is in 8620A mainframe.

YES

With oscilloscope, measure ripple voltage at A1TP5. It should be <50μV P-P.

NO

Set 8620A START control to place the pointer at the same frequency as the CW pointer. Set MANUAL sweep control fully CCW. Select MANUAL SWEEP Mode. Residual FM ≈ 3 times greater than CW FM.

YES

CW filter switch circuit OK. Problem is noise component on tuning voltage or noise generated from current driver circuit A1U2, A1Q5, or chassis mounted Q1, R1, or R2.

YES

Disconnect W1 RF cable from A5 YIG oscillator. FM measured with Spectrum Analyzer at output of A5, YIG, A5J1 is <10KHz P-P.

NO

Replace A5 YIG Oscillator Assembly.

YES

Disconnect W2 RF cable from A4 cavity Oscillator, A4J1. FM measured with Spectrum Analyzer at output of A4 Cavity Oscillator, A4J1 is <10KHz P-P.

NO

Check chassis mounted C1 and C2. Capacitors OK.

YES

Replace A4 Cavity oscillator.

YES

Disconnect W7 RF cable from A2 Frequency Translator. FM measured with Spectrum Analyzer at output of A2,A2J1 is <10KHz P-P.

NO

Replace A2 Frequency Translator.

YES

Replace A3 Amplifier/Detector.

Select MANUAL SWEEP MODE. Set START control for 10.0 OMHz. Set STOP control for 1300MHz. Connect DVM to SWEEP REFERENCE output connector. Set MANUAL SWEEP control from full CCW to full CW. DVM indication should change by 13.0Vdc.

NO

Sweep reference voltage is 1V/100 MHz.

NO

YES

Sweep reference output is OK.

Problem is in A1U4 Sweep Reference amplifier circuit. Check resistance of A1R30, A1R35 and A1R41. Resistors measure OK.

NO

Change defective resistor.

YES

Replace A1U4.

YES

86220A checks OK. End of troubleshooting.

TROUBLESHOOTING FLOW DIAGRAM (3 of 4)

Figure 8-5. Tro

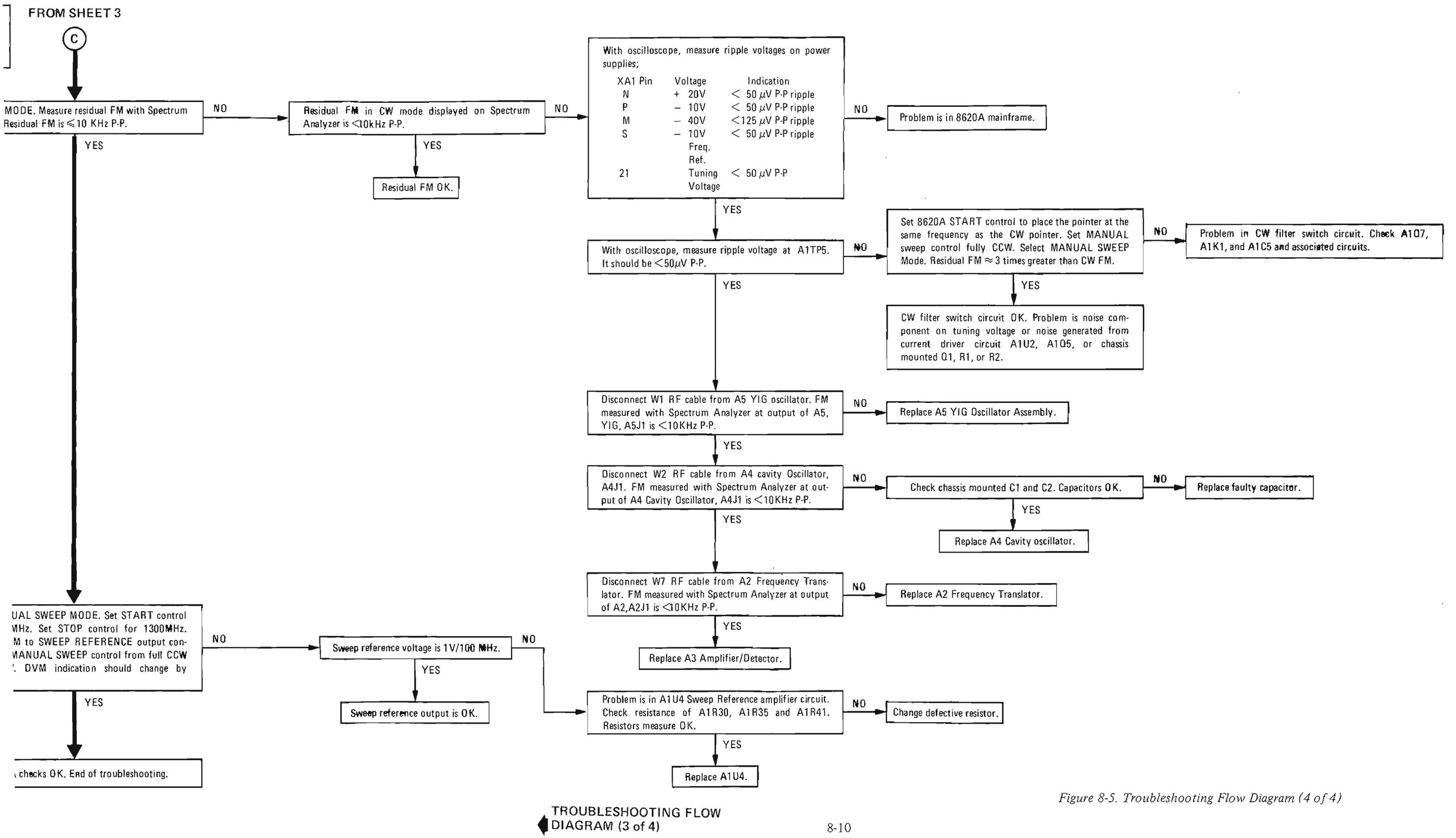


Figure 8-5. Troubleshooting Flow Diagram (4 of 4)

Mainframe

86220A RF Plug-in

A1 YIG DRIVER BOARD ASSEMBLY

A5 YIG-Tuned Oscillator

A2 Frequency Translator

A3 Amplifier/Detector

A4 Cavity Oscillator

Cavity Bias

−10VDC

2.9 GHz
+16 dBm

4.2 GHz
+11 dBm

0 dBm

0 dBm

TUNING VOLTAGE

J6

1

Yig driver

U2

Freq Adj Hi

Freq Adj Low

J1

J3

Attenuator

Pin Mod

5 GHz Low-Pass Filter

Mixer

1.45 GHz Low-Pass Filter

J1

J1

Amplifier

Attenuator

Amplifier

924 CONTROL

CW OR SLOW SWEEP

2

+20V

C5
470μF

−40V

Modulator Driver

Q4

3

Blanking Adjust

Blanking Clamp
Q2

ALC Amplifier

U3

+

−

BLANKING SUMMING AMPLIFIER

1 kHz SQUARE WAVE

6

BLANKING

3

VOLTAGE MARKER

36

Q1,Q6

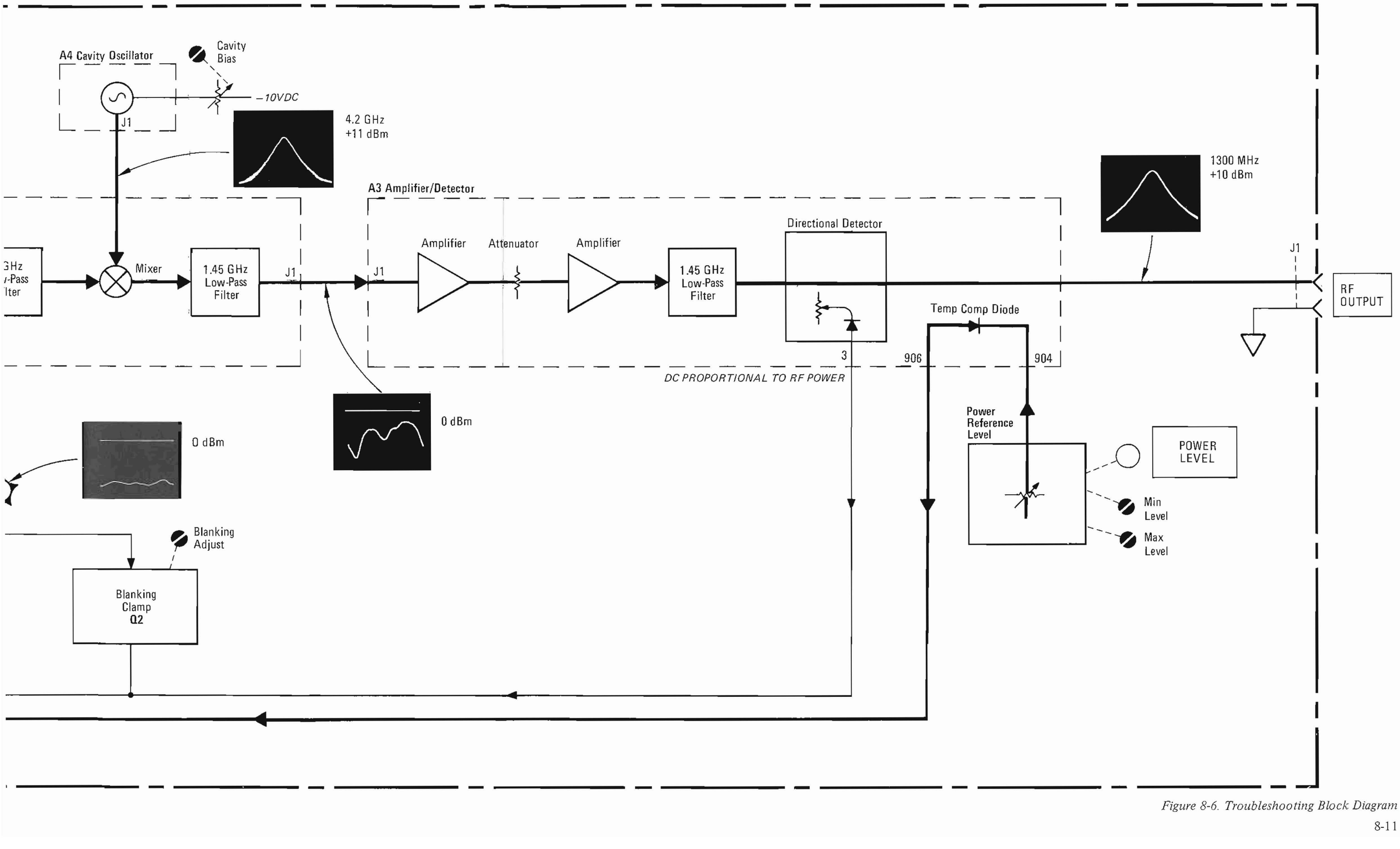


Figure 8-6. Troubleshooting Block Diagram

THEORY OF OPERATION

INTRODUCTION

The 8620 series Sweep Oscillator/86220A RF Plug-in combination provides either a swept frequency or a single frequency RF signal over the range of 10 to 1300 MHz, which can be modulated either internally with 1 kHz AM, or externally with an external AM or FM source. It provides internally leveled RF power over the range of 0 to +10 dBm. It provides a frequency reference output voltage of approximately 1V/GHz for phase locking external equipment.

SWEEP OSCILLATOR MAINFRAME

The Sweep Oscillator mainframe (8620 series) provides all power supply voltages used by the 86220A RF Plug-in. It also provides a 1 kHz modulation signal (for internally modulating the RF power) as well as blanking and marker signals.

A 0 to +10V tuning voltage ramp is generated by the mainframe which provides tuning control of the RF plug-in. In FULL SWEEP mode or when green and red poiners are set for full-scale sweep, this ramp is a swept voltage of 0 to +10Vdc. With the green and red pointers set for any sweep range other than full-scale, only a portion of this ramp is generated, in proportion to the sweep range selected. The frequency scale, which is calibrated in increments from 0 to 1300 MHz is directly related to the 0 to +10V ramp. The 0 MHz frequency-scale-mark relates to 0 Vdc tuning voltage and the 1300 MHz frequency-scale-mark relates to +10 Vdc tuning voltage.

The voltage ramp is applied to the YIG Driver circuit in the 86220A RF Plug-in.

86220A RF PLUG-IN

The 86220A RF Plug-in circuitry can be divided into two basic sections; the RF Signal Generator Circuits, that generates, filters, and amplifies the RF signal, and the ALC Circuits, that sets and maintains the RF power level and provides internal modulation capability.

RF Signal Generator Circuits

YIG Driver. The Tuning Voltage Current Driver (YIG Driver) is basically a variable current source that generates a current proportional to the tuning voltage ramp generated by and received from the sweep oscillator mainframe. This current is applied to the main coil of the A5 YIG Tuned Oscillator assembly.

YIG Oscillator. The YIG Oscillator produces an RF Output signal proportional to the amount of current applied to the main YIG coil. The frequency of this output is designed to be between 4.19 GHz and 2.90 GHz. A tuning voltage ramp of zero to +10V applied to the YIG Driver will produce the amount of current necessary to sweep the YIG Oscillator through its full range, 4.19 — 2.90 GHz. Any portion of the ramp less than full range will produce a proportional lesser amount of current and the YIG Oscillator will sweep through a shorter range. A constant voltage level applied to the YIG Driver produces a constant current and the YIG Oscillator generates a single RF frequency. The output of the YIG Oscillator is applied to the A2 Frequency Translator. The tuning sensitivity of the YIG Oscillator is approximately 24 ma/GHz which means that for every 24 ma of current provided by the YIG Driver, the YIG Oscillator will tune 1 GHz. This sensitivity figure will vary slightly betweeen oscillators and also between the low and high end of the oscillator frequency range. Two adjustments (FREQ ADJ HI A1R12 and FREQ ADJ LO A1R21) are provided to compensate for these variations.

A CW FILTER SWITCH is provided to improve residual FM characteristics in either the CW or MANUAL sweep modes. When either CW or MANUAL sweep is selected, the CW FILTER SWITCH is energized adding a large capacitor to the YIG Driver/YIG Oscillator circuits. This provides more filtering to improve residual FM. This filter cannot be used in any sweep mode since it would affect the RC time constant of the sweep.

4.2 GHz Cavity Oscillator. The 4.2 GHz Cavity Oscillator uses a single transistor located inside a tuned cavity. This tuned cavity oscillates at a frequency of 4.2 GHz. The output of the Cavity Oscillator is applied to the A2 Frequency Translator.

Frequency Translator. The Frequency Translator is basically a mixer which mixes the output of the YIG Oscillator (4.19–2.90 GHz) and the output of the Cavity Oscillator (4.2 GHz). The output of the YIG Oscillator (4.19–2.90 GHz) is applied to the Frequency Translator. It is first alternated, then coupled through a PIN Modulator and a 5 GHz low pass filter (to remove any unwanted harmonics) into a mixer. It is mixed with the 4.2 GHz from the Cavity Oscillator and the difference frequency is coupled out of the mixer through a 1.45 GHz low pass filter (to remove any unwanted mixing products) to the A3 Amplifier/Detector. With a zero to +10V tuning voltage ramp applied to the YIG Driver, the YIG Driver will produce the current necessary to sweep the YIG Oscillator from 4.19 GHz down to 2.90 GHz.

NOTE

The YIG Oscillator sweeps down in frequency as the tuning voltage ramp sweeps up in voltage.

When the zero to +10V tuning voltage applied to the YIG Driver is at 0V the YIG Oscillator output is 4.19 GHz. When this frequency is mixed with the 4.20 GHz from the Cavity Oscillator, a difference frequency of 10 MHz is produced. When the tuning voltage is at +10V, the YIG Oscillator output of 2.90 GHz, is mixed with the 4.20 GHz to produce a 1300 MHz difference frequency.

Amplifier/Detector. The 10 to 1300 MHz difference frequency from the A2 Frequency Translator is applied to the A3 Amplifier/Detector. Within the Amplifier/Detector it is amplified by two stages of amplification and coupled through a 1.45 GHz low pass filter and a directional detector to the RF OUTPUT J1.

ALC Circuitry

Power Level Control. The front panel POWER LEVEL control sets a reference voltage at the positive input to the ALC AMPLIFIER which is the reference input. The range of this reference voltage is determined by the setting of MAX LEVEL A1R1 and MIN LEVEL A1R13.

Main ALC Amplifier. The ALC Amplifier provides a voltage output in proportion to the reference voltage input set by the POWER LEVEL control. This voltage output regulates the amount of current provided by the MODULATOR DRIVER.

Modulator Driver. The Modulator Driver is basically a current source that provides current in proportion to the DC output voltage of the main ALC amplifier.

Pin Modulator. The Pin Modulator, physically located in the A2 FREQUENCY TRANSLATOR assembly, is basically a variable attenuator. The attenuation is directly proportional to the amount of current provided by the modulator driver. Since the Pin Modulator is in the RF signal path, the RF signal is attenuated by an amount proportional to the drive current. The amount of current is determined by the reference voltage set by the POWER LEVEL control which sets the RF power level at the Pin Modulator.

Directional Detector. The Directional Detector, physically located in the A3 AMPLIFIER/DETECTOR assembly, couples out a small amount of the RF power. This sampled RF power, proportional to the overall RF power, is dissipated across a diode also located in the A3 AMPLIFIER/DETECTOR assembly. The voltage drop across this diode is directly proportional to the RF power dissipated. This voltage is felt at the negative input to the main ALC amplifier where it is compared to the voltage at the positive input set by the POWER LEVEL control. If these two voltage inputs are equal, it indicates that the power level at the directional detector is equal to the power level set by the POWER LEVEL control. If these two voltage inputs are unequal, it indicates that the power level at the directional detector is not equal to the power level set by the POWER LEVEL control. If the voltage

inputs to the ALC Amplifier are unequal, the ALC output voltage either increases or decreases an amount proportional to the difference in the inputs. This change in ALC output voltage changes the amount of current provided by the modulator driver which changes the amount of attenuation provided by the Pin Modulator. This change in attenuation changes the RF power level at the Pin Modulator which is detected by the directional detector. The change in power level at the directional detector changes the correction voltage at the negative input to the ALC amplifier. If the negative input is now equal to the positive input of the ALC amplifier the circuit is stable and power is level and calibrated. If the voltage at the negative input is not equal to the voltage at the positive input the process is repeated until the two inputs are equal. If the reference input changes (by changing the POWER LEVEL control setting) the ALC circuit corrects for the change to maintain a leveled and calibrated RF power output.

Marker/Blanking /1 kHz Modulation Amplifier. The Marker/Blanking/1 kHz Modulation Amplifier sums the internal modulation inputs (Marker, Blanking and 1 kHz AM) producing a voltage output which is felt at the reference (positive) input to the ALC amplifier. This voltage at the ALC amplifier reference input modulates the already present voltage level set by the POWER LEVEL control. This modulates the RF signal at the Pin Modulator. Since the internal modulation inputs are applied to the reference (positive) input of the ALC Amplifier, the PIN Modulator is driven so hard the directional detector cannot supply enough correction to override this modulation. The modulation, therefore, will appear at the RF OUTPUT J1.

Blanking Clamp. To ensure that the modulated output closely resembles the modulation input in appearance, a Blanking Clamp is provided to limit the degree of saturation of the ALC Amplifier. By preventing the ALC Amplifier from going into full saturation, the Blanking Clamp ensures a fast return from saturation. This ensures sharply defined trailing edges of the modulation current applied to the PIN Modulator. The saturation level is adjustable with BLANK ADJ control A1R43.

Negative Feedback Amplifier. The Negative Feedback Amplifier is provided in the MAIN ALC AMPLIFIER circuit to compensate for abrupt changes in the ALC amplifier reference input such as markers or amplitude modulation signals. Without this negative feedback, an abrupt voltage change at the ALC reference input would cause the Pin Modulator to react so quickly there would be overshooting. A signal of reverse polarity is routed back to the reference input. This slows down the input signal enough for the PIN MODULATOR to react without overshooting.

Temperature Compensation Diode.

To compensate for varying temperatures, a temperature compensation diode is physically located in the same assembly package (A3 AMPLIFIER/DETECTOR) as the directional detector diode. This diode is in the ALC Amplifier reference (positive) input circuit, therefore, any temperature change will be sensed at the reference input and compensate the RF signal level.

External AM Amplifier

Any external AM signal applied to the EXT AM input of the sweep oscillator mainframe is applied to the input of the external AM amplifier in the 86220A. The output of the external AM amplifier is felt at the POWER LEVEL control which changes or modulates the reference voltage at the ALC AMPLIFIER input. This modulates the RF OUTPUT in the same manner as the internal AM signal.

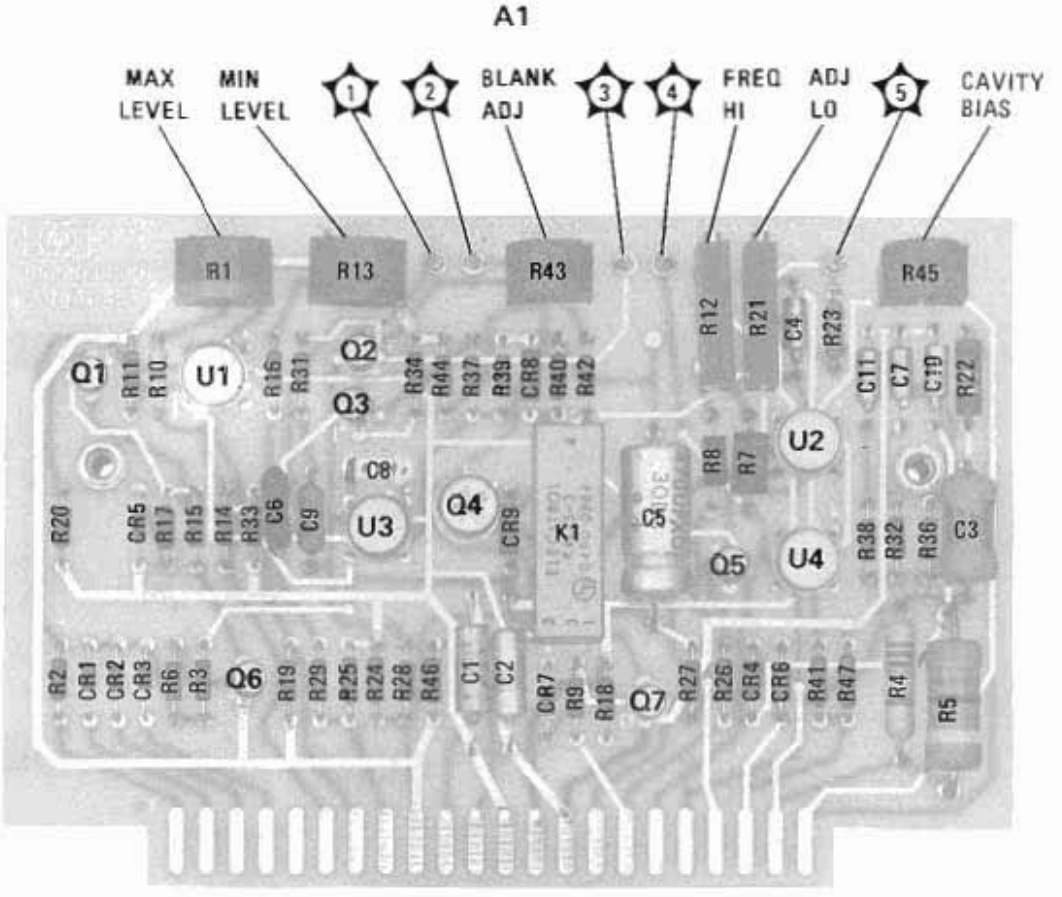
Frequency Reference Amplifier

The 0 to +10V tuning voltage ramp applied to the YIG DRIVER circuit is also applied to the FREQUENCY REFERENCE AMPLIFIER. The output of the FREQUENCY REFERENCE AMPLIFIER is developed across a voltage divider network such that the FREQ REF output is approximately 1V/GHz. In other words, the 0 to +1.3V ramp.

FM Input

Frequency Modulation signals applied to the FM INPUT connector are coupled through a high frequency compensation circuit to the FM coil of the YIG Oscillator. At high FM frequencies the response of the YIG Oscillator FM coil experiences roll-off. To compensate for this, the resistance of the input RC network is decreased thus improving overall response. Amplitude of the FM signals are limited in both directions by a pair of clamp diodes.

◀ TROUBLESHOOTING BLOCK DIAGRAM



R30 AND R35 NOT ASSIGNED.

Figure 8-7. A1 YIG Driver/ALC Board, Component Locations

Mainframe

P1

XA1

A1 YIG DRIVER BOARD ASSEMBLY (NOTE 1)

HIGH-CURRENT GROUND

EXTERNAL AM

+20V

-10V

ALC BLANKING

SWITCHED 1 KHz INTERNAL SQUARE-WAVE MOD

ALC MARKER

-10V

-40V

TUNING VOLTAGE

RETRACE BLANKING

CW AND MANUAL GATE

FM INPUT

TO "+" OF YIG FM COIL

EXTERNAL AM AMPL

MARKER/BLANKING/ 1 KHz MODULATION AMPL

POWER TEMP. COMP.

P/O A3 Amplifier/Detector

TEMP. COMP. DIODE

POWER LEVEL

MAIN ALC AMPL

BLANK ADJ.

NEG. FEEDBACK AMPL

MODULATOR DRIVER

FREQ ADJ LO

FREQ ADJ HI

CW FILTER SWITCH

TUNING VOLTAGE CURRENT DRIVER

FREQUENCY REFERENCE AMPLIFIER

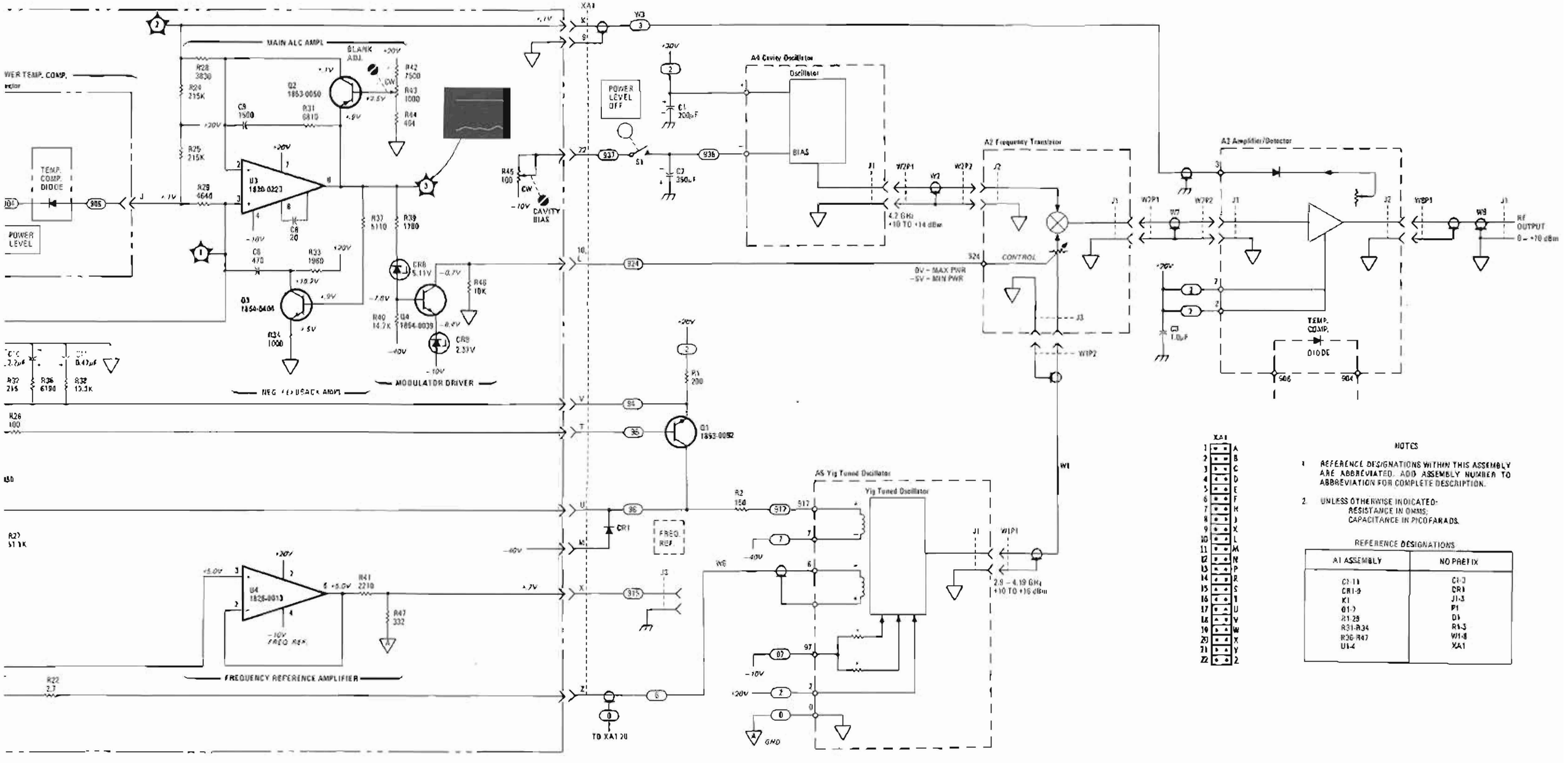
POWER LEVEL OFF

CAVITY BIAS

FREQ. REF.

TO XA1 J0

SERIAL PREFIX: 1506A



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS.

REFERENCE DESIGNATIONS

A1 ASSEMBLY	NO PREFIX
C1-11	C1-3
CR1-9	CR1
K1	J1-3
Q1-7	P1
R1-28	Q1
R31-R34	R1-3
R36-R47	W1-8
U1-4	XA1

Figure 8-8. A1 YIG Driver/ALC Board Assembly, Schematic

A1 YIG DRIVER/
ALC BOARD ASSEMBLY

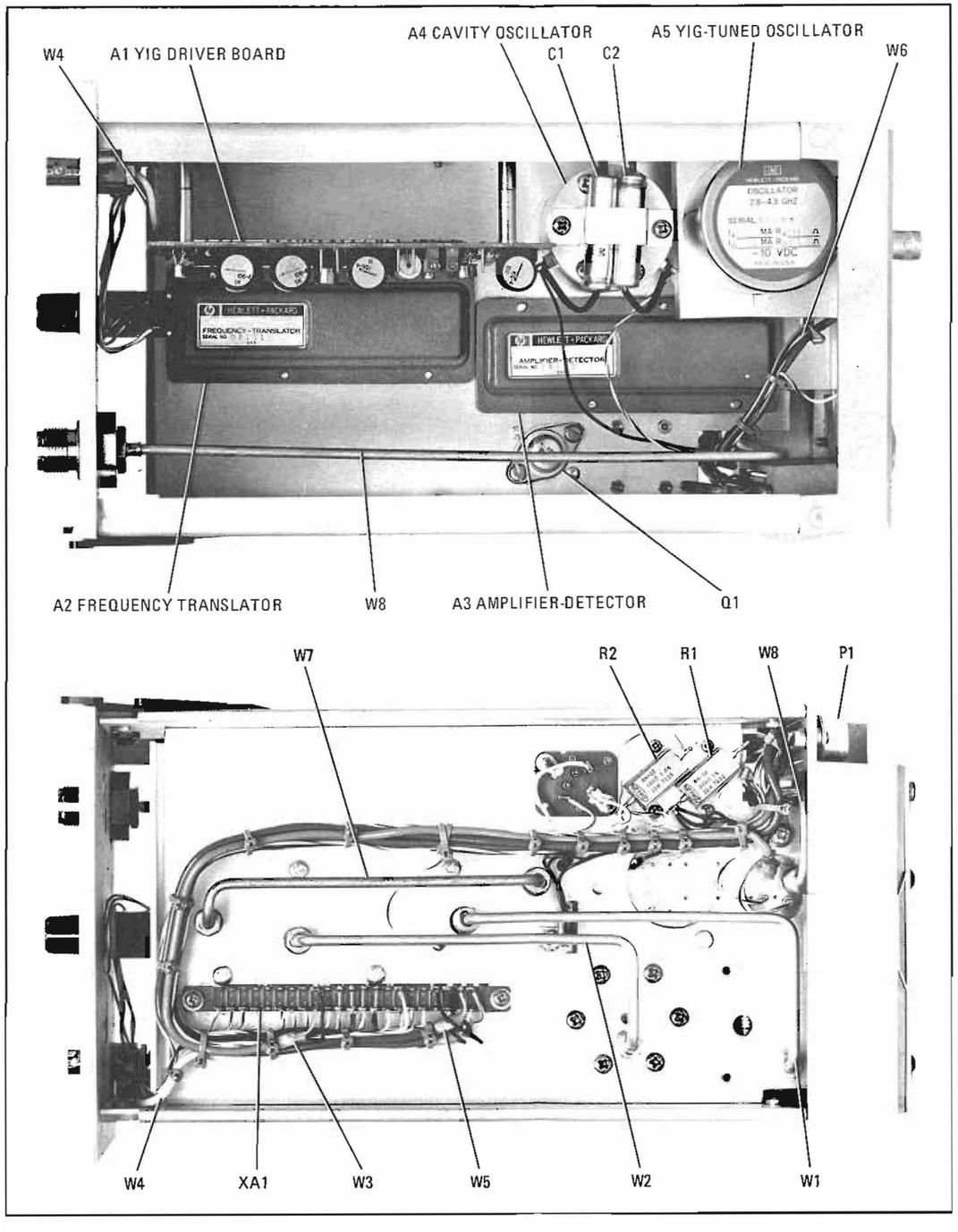


Figure 8-9. Major Assemblies of the Model 86220A

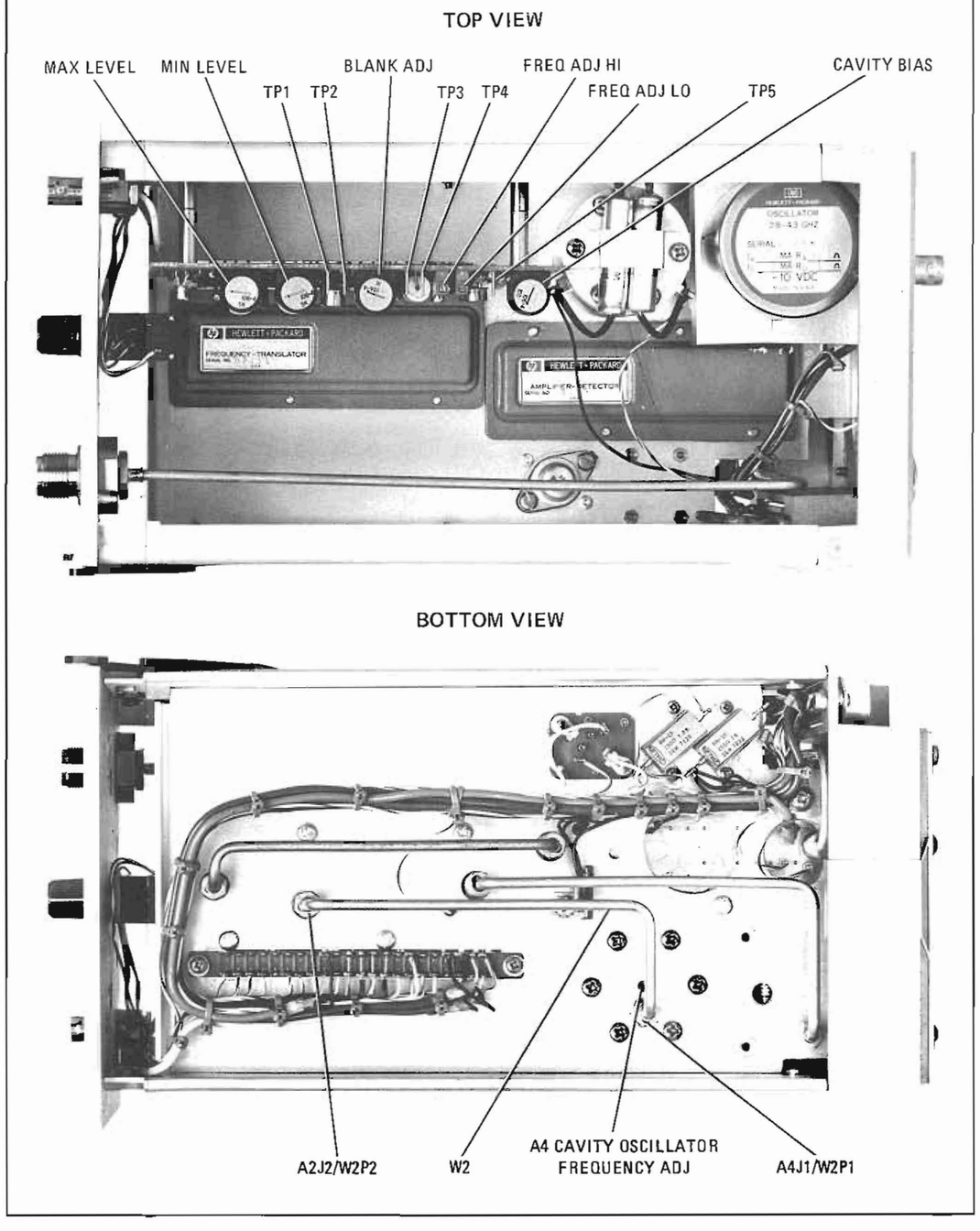


Figure 8-10. Adjustment and Test Point Locations

MAJOR ASSEMBLIES
ADJUSTMENT AND TEST
POINT LOCATIONS

APPENDIX A
MODEL 86220A RF PLUG-IN, OPTION 002

A1. INTRODUCTION

A2. This Appendix describes the differences in the Model 86220A RF Plug-in with Option 002 installed. In addition it describes the manual changes necessary to document the addition of Option 002. Replaceable parts for Option 002 are contained in Section VI, Table 6-2.

A-3. DESCRIPTION

A4. The model 86220A Option 002 incorporates a 0 to 70 dB attenuator in the RF signal output path. This allows signal attenuation to be selected in 10-dB steps through a 70-dB range.

A5. MANUAL CHANGES TO INCORPORATE OPTION 002

A6. SECTION I, GENERAL INFORMATION

Change POWER VARIATION specification for attenuator steps 0 — 60 dB to ±1 dB.
Change POWER VARIATION specification for attenuator set at 70 dB to ±1.5 dB.
Add POWER LEVEL CONTROL specification as follows:
Range: 10 dB vernier change within each 10-dB attenuator step. 80 dB nominal range.

Accuracy: <±2 dB for attenuator steps 0–60 dB.
<±2.5 dB for attenuator set at 70 dB.

A7. SECTION III, OPERATION

Replace Figure 3-1 with Figure A2.

Figure 3-3, PROCEDURE:
Change step 1 86220A control settings to the following:

POWER LEVEL dBm, 0 — 70 dB .....0 dB
POWER LEVEL dBm, vernier (0 to +10) .....Full clockwise

A8. Section IV, PERFORMANCE TESTS

Add, to all of the performance test procedures, instructions in initial control settings to set POWER LEVEL dBm, 0 — 70 dB attenuator, to 0 dB.

POWER LEVEL AND VARIATION TEST
Change specifications for Calibrated Leveled Power to: zero to +10 dBm (±2 dB).
Change specification for power variation at maximum leveled power for all conditions to ±1 dB.
Change the last sentence of step c to: This total should be zero dBm ±2 dB.
Change the last sentence of step d to: This total should be +10 dBm ±2 dB.
Change step f as follows:

f. Set adjustable AC line transformer to 115 VAC. Press 8620A CW pushbutton. Adjust oscilloscope trace to the bottom of the display and note trace position. Decrease the output power indication on the power meter by 2.0 dB by adjusting the 86220A POWER LEVEL vernier control counterclockwise and note position of oscilloscope trace. (The area between the position noted represents the leveling tolerance of ±1 dB.)

Change step h and i as follows:

h. Adjust the position of the oscilloscope trace vertically so that it is displayed between the upper and lower specification limits noted in step f for 2 dB. The highest and lowest portion of the sweep trace must be within the 2 dB peak-to-peak limit noted.

i. Deleted.

Change the last sentence of step j as follows: Power meter indication should not change more than ±1 dB.

POWER LEVEL CONTROL TEST

Add the specifications for the power level control as follows:

Range: 10 dB vernier change within each 10-dB attenuator step. 80 dB nominal range.
Accurcy: <±2 dB

Change the DESCRIPTION as follows:

DESCRIPTION:

The RF power output is checked through the 10-dB vernier range and the 0 — 70 dB step attenuator range of the POWER LEVEL controls. The OFF position of the vernier control is also checked to see that the signal is reduced below −40 dBm.

Change step b and c as follows:

b. Press 8620A CW pushbutton. Set 86220A POWER LEVEL dBm 0 — 70 dB attenuator to zero and zero to +10 dBm control to zero dBm.

c. Select LOG display. Adjust spectrum analyzer to place the peak of the 1000 MHz fundamental signal at the top graticule line of the CRT.

Add step e and f as follows:

e. Set POWER LEVEL vernier control to +10 dBm and 0 — 70 dB attenuator to zero dB. Adjust spectrum analyzer to place the peak of the 1000 MHz fundamental signal at the top graticule line of the CRT.

f. Set POWER LEVEL 0 — 70 dB step attenuator to the positions listed in Table A-1 and check for the correct indication on the spectrum analyzer.

Table A-1. Attenuator Step Test Limits

POWER LEVEL 0-70 dB Step Attenuator (dB)	Indication on Spectrum Analyzer
0	Reference
10	0 dBm ±2 dB
20	−20 dBm ±2 dB
30	−30 dBm ±2 dB
40	−40 dBm ±2 dB
50	−50 dBm ±2 dB
60	−50 dBm ±2 dB
70	−60 dBm ±2.5 dB

Table 4-2. Performance Test Record

Change paragraph 4-10 measurement limits as follows:

Step c lower limit to − dBm and upper limit to +2 dBm.
Step d lower limit to +8 dBm and upper limit to +12 dBm.
Step h upper limit to 2 dB P-P.
Delete step i.
Step j upper limit to ±1 dB.

Add to paragraph 4-11 the following:

f. 0 — 70 dB step attenuator at

	Lower Limit	Upper Limit
10 dB	−2 dBm	+2 dBm
20 dB	−12 dBm	−8 dBm
30 dB	−22 dBm	−18 dBm
40 dB	−32 dBm	−28 dBm
50 dB	−42 dBm	−38 dBm
60 dB	−52 dBm	−48 dBm
70 dB	−62.5 dBm	−57.5 dBm

A9. SECTION V, ADJUSTMENTS

Add to all of the adjustment procedures, instructions in initial control setting to set POWER LEVEL dBm 0–70 dB attenuator, to 0 dB.

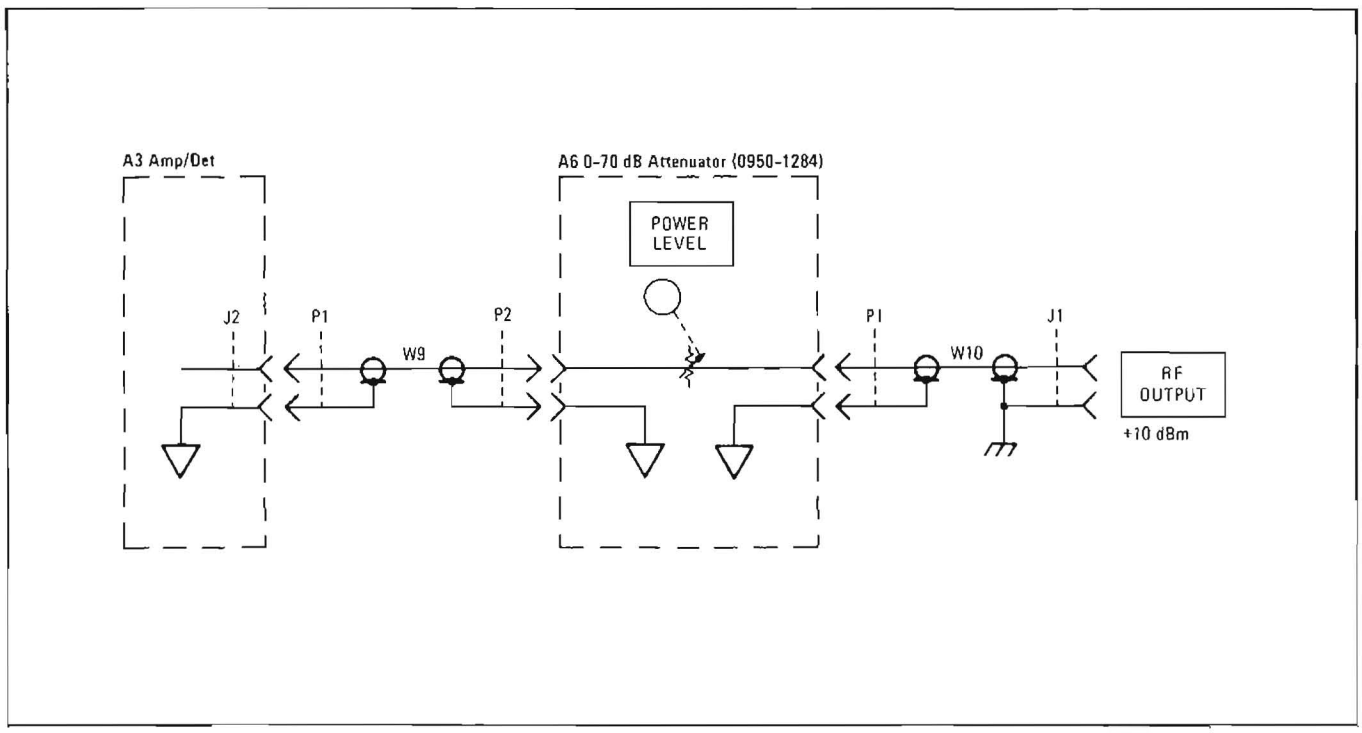


Figure A-1. P/O Figure 8-8. A1 YIG Driver /ALC Board Assembly, Schematic (Option 002)

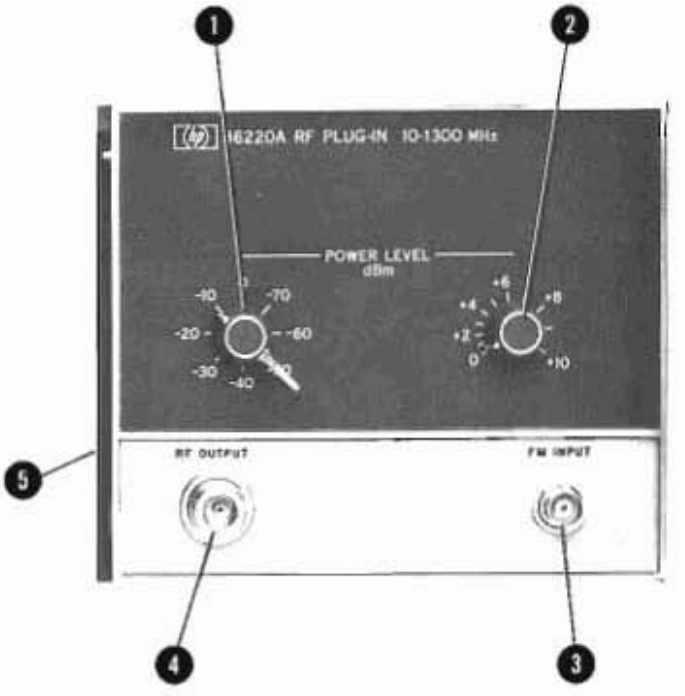
MINIMUM AND MAXIMUM POWER ADJUSTMENT

Change third sentence of step f as follows: Indication should be −10 dB below POWER LEVEL control dial setting ±2 dB.

A10. Section VIII, SERVICE

Delete Cable W8 and insert the partial schematic A-1 showing A6 attenuator and cables W9 and W10.

FRONT PANEL CONTROLS AND CONNECTORS



1 POWER LEVEL dBm zero-to-70 dB 10 dB/step attenuator (Option 002). Adjusts RF power output level in 10 dB steps. It works with the vernier POWER LEVEL control (2) to give continuous power level control through 80 dB range.

2 POWER LEVEL dBm vernier control. Adjusts RF power output through a 10 dB range. Control acts as vernier for each step of 0 — 70 dB step attenuator. Absolute dBm dial calibration is valid only when 0 — 70 dB attenuator is in zero dB position. OFF detent position turns the RF signal off.

3 FM INPUT connector. Input for external FM modulation signal.

4 RF OUTPUT connector. Type-N 50-ohm connector for output RF signal.

NOTE

When Option 004 is installed, the RF OUTPUT connector is on the rear panel.

5 Drawer Latch Handle. Push the top of the handle, then pull out on the bottom of the handle to remove the RF plug-in from the mainframe.

Figure A-2. Front Panel Controls and Connectors (Option 002)

APPENDIX B
MODEL 86220A, RF PLUG-IN, OPTION 004

B1. INTRODUCTION

B2. This Appendix describes the differences in the Model 86220A RF plug-in with Option 004 intalled. Replaceable parts for Option 004 are contained in Section VI, Table 6-2.

B3. DESCRIPTION

B4. The Model 86220A Option 004 uses a rear-panel RF OUTPUT connector.

B5. MANUAL CHANGES

B6. Section III, OPERATION

Change all Operator's Check equipment setups to indicate connection of RF output on rear panel.
Figure 3-1.
Delete item 3 . Figure 3-2.
Change item 2 to read: RF OUTPUT connector J1. Type-N 50-ohm connector for output RF signal.

B7. Section IV, PERFORMANCE TESTS

Change all performance test setups to indicate connection of RF Output on rear panel.

B8. Section V, ADJUSTMENTS

Change all adjustment test setups to indicate connection of RF Output on rear panel.

B9. Section VIII, SERVICE

Figure 8-6. Troubleshooting Block Diagram:
Replace applicable part of Figure 8-6 with partial schematic, Figure B-1.

Figure 8-8. A1 YIG Driver/ALC Board Assembly, Schematic:
Replace applicable part of Figure 8-8 with partial schematic, Figure B-2.

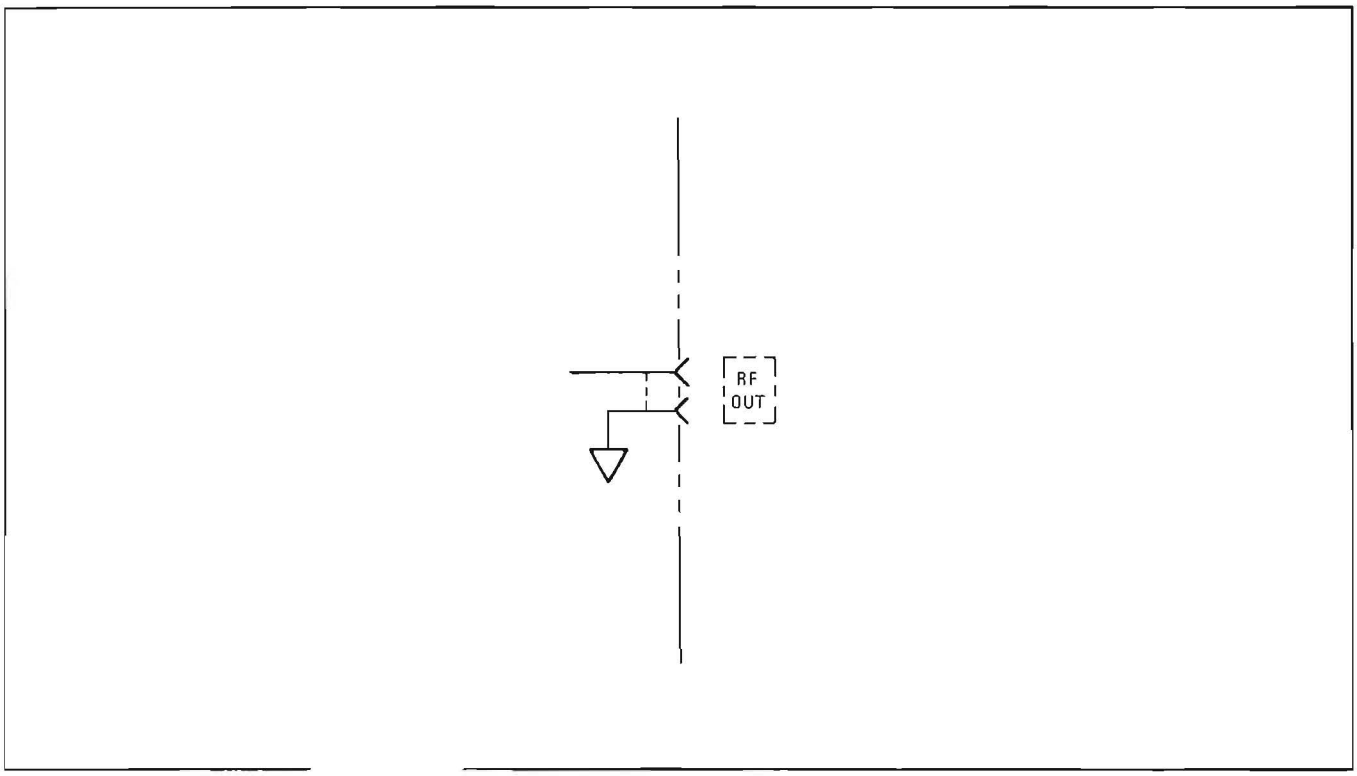


Figure B-1. Figure 8-6. Troubleshooting Block Diagram (Option 004)

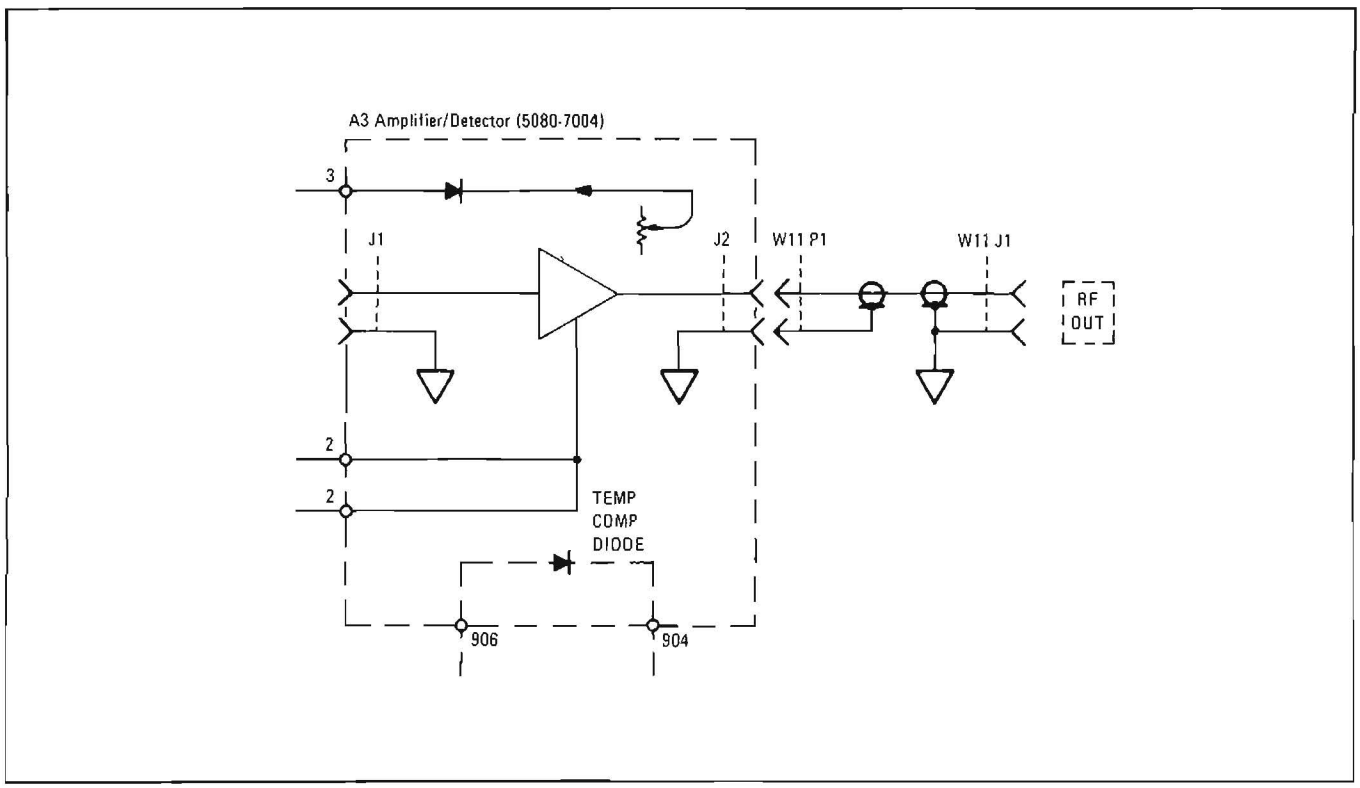


Figure B-2. P/O Figure 8-8. A1 YIG Driver/ALC Board Assembly, Schematic (Option 004)

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