TM 11-6625-2781-14-4

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL FOR

PLUG-IN UNIT, ELECTRONIC TEST EQUIPMENT PL-1400/U (HEWLETT-PACKARD MODEL 8555A) (NSN 6625-00-422-4314)

HEADQUARTERS, DEPARTMENT OF THE ARMY

19 SEPTEMBER 1978

WARNINGS

SAFETY

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

BEFORE SWITCHING ON THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding).

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

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

GROUNDING

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

HIGH VOLTAGE

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

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

Adjustments and Service described herein is performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

CAUTIONS

GROUNDING

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

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

LINE VOLTAGE SELECTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the instrument is set to the voltage of the power source.

TECHNICAL MANUAL
NO. 11-6625-2781-14-4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC *19 September 1978*

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REPORTING OF ERRORS

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

If there are no blank DA Forms 2028-2 in the back of your manual, use the standard DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to the Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MA-Q, Fort Monmouth, NJ 07703.

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

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

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS (cont'd)

TABLES

SECTION 0
INTRODUCTION

0-1. SCOPE.

This manual describes Plug-in Unit, Electronic Test Equipment PL-1400/U and provides instructions for operation and maintenance. Through-out this manual, the PL-1400/U is referred to as Hewlett-Packard Model 8555A Spectrum Analyzer RF Section.

0-2. INDEXES OF PUBLICATIONS.

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

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

0-3. FORMS AND RECORDS.

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

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

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

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

EIR's will be prepared using DA Form 2407, Maintenance Request. Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed directly to Commander, US Army CERCOM, ATTN: DRSEL-MA-Q, Fort Monmouth, NJ 07703. A reply will be furnished directly to you.

0-5. ADMINISTRATIVE STORAGE.

Administrative storage of equipment issued to and used by Army activities shall be in accordance with paragraph 4-14.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL.

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

MODEL 8555A

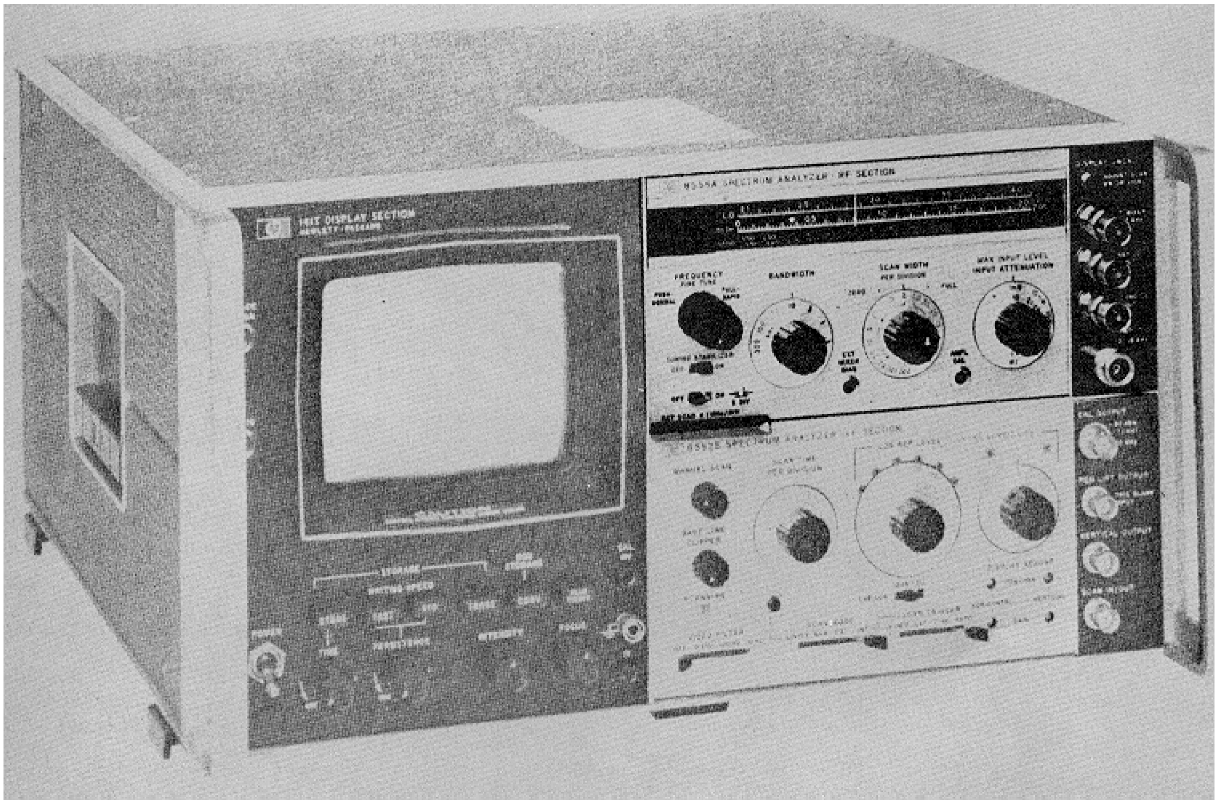


Figure 1-1. Model 8555A Spectrum Analyzer RF Section with 8552B IF Section and 141T Display Section

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test, adjust and service the Hewlett-Packard Model 8555A Spectrum Analyzer RF Section. This section covers instrument identification, description, options, accessories, specifications and other basic information.

1-3. Figure 1-1 shows the Hewlett-Packard Model 8555A Spectrum Analyzer RF Section with the Model 8552B Spectrum Analyzer IF Section and the Model 141T Display Section.

1-4. The various sections in this manual provide information as follows:

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

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

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

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

SECTION VI, REPLACEABLE PARTS, deleted. **Refer to TM 11-6625-2781-24P-4 for replaceable parts.**

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

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

1-5. Deleted.

1-6. WARNINGS AND CAUTIONS

1-7. WARNING. Ensure that the Spectrum Analyzer and any device connected to it are both properly grounded to the same power line ground. An interrupted path from earth ground to an instrument chassis safety ground (an open third-wire ground lead in a cord; for example, see Figure 1-2 below) can develop a potential (V) equal to one half of the power line voltage. This may cause a shock hazard as well as damage to the instrument.

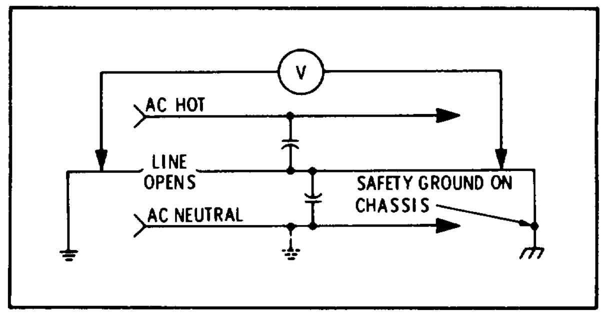


Figure 1-2. Circuit if Equipment Ground Lead Opens

1-8. CAUTION. The input circuits of the Model 8555A are susceptible to burnout if fed an excessively high signal level. To avoid costly repairs and unnecessary down time the following precautions must be taken:

1. Use maximum attenuation when applying signals of unknown amplitude.
2. Ensure that the Spectrum Analyzer Display Section and any signal source to be coupled to the Spectrum Analyzer are both connected to the same power-line ground before connecting an RF cable to the 8555A RF Input. It has been established by HP that floating either instrument from ground may cause damage to the Spectrum Analyzer input mixer assembly.
3. The input attenuation setting should not be changed while dc is applied to the RF Input.
4. Do not connect impulse generators to the Model 8555A RF Input unless they are connected through a Model 8445A Preselector.

5. Observe the following maximum input levels:

Maximum Input Levels	Power		Volts		
	dBm	Watts	Dc	Rms	Peak
Input .01-18 GHz Connector	+33[1]	2[1]	±20[2]	10	14.4
Incident on Input Mixer	+10	10 mW	±20[2]	0.707	1.0

[1] The Input Attenuation Control must be in the 30 dB or greater position when applying +33 dBm or input Mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ±20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second.

1-9. INSTRUMENTS COVERED BY MANUAL

1-10. This instrument has a two-part serial number (see Figure 1-3). The first four digits and the letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument.

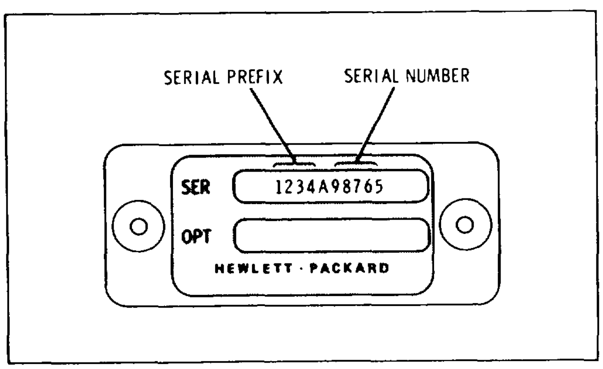


Figure 1-3. Instrument Identification

The contents of this manual apply directly to instruments having the **serial prefix 1434A and 1436A.**

1-11. An instrument manufactured after the printing of this manual may have a serial prefix that is **different from that indicated above. If so, refer to Section VII and make the applicable manual changes.**

1-12. In addition to change information, **Section VII.** 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.

1-13. For information concerning a serial number prefix not **covered in this manual, contact your nearest Hewlett-Packard office.**

1-14. DESCRIPTION

1-15. The HP Model 8555A Spectrum Analyzer RF Section is shown in Figure 1-1 with the Model 8552B Spectrum Analyzer IF Section and the Model 141T Display Section. Table 1-1, Specifications, and Table 1-2, Supplemental Performance Characteristics, are for the 8555A RF Section *when used with an 8552A/B IF Section and a 140-series Display Section*.

1-16. The 8555A plug-in is the microwave RF Section for use with the 8552-series IF section and the 140-series display section. Together they comprise a receiver that electronically scans an input signal and provides a visual display in the frequency domain. Input signal amplitude is plotted on the CRT as a function of frequency. The amplitude (Y-axis) of the CRT is calibrated in absolute units of power (dBm) or voltage (µV/mV) (50-ohm system): accordingly, absolute and relative measurements of both amplitude and frequency can be made.

1-17. The analyzer RF and IF sections form a highly sensitive super-heterodyne receiver with spectrum-scanning capabilities over the frequency range of 10 MHz to 40 GHz in 14 frequency bands. The analyzer presents a calibrated CRT display up to 2 GHz wide. Absolute calibration accuracy is maintained from 10 MHz to 18.0 GHz in 10 bands, using internal mixing. The frequency range from 12.4 GHz to 40 GHz is covered in 4 bands through the use of external mixers.

1-18. Instrument controls are arranged so that the operator can identify, type, and measure signal parameters with a minimum of switching. For wide-spectrum analysis, the operator can choose a preset scan width covering the full range of each frequency band. For a more detailed study, the spectrum width can be progressively narrowed to as little as 2 kHz/div, or the scanning capabilities can be eliminated altogether to use the instrument as a fixed-tuned receiver. A 300 kHz IF bandwidth is automatically selected for full-scan operation; for variable-scan and fixed frequency operation, bandwidths as narrow as 100 Hz can be selected. A single switch will automatically enable the first LO tuning stabilization circuit when scan widths of 100 kHz per division, or less, are selected. A signal identifier circuit, controlled by an on/off switch, allows the operator to quickly determine the harmonic mixing mode and select the appropriate frequency band. The signal identifier can be enabled for scan widths of 1 MHz per division or less.

1-19. OPTIONS

1-20. Option 001. Replaces type N with type APC-7 connector.

1-21. Option 002 for the Model 8555A is a limiter which can be installed between the RF Section's INPUT port and the input attenuator to protect input circuitry from being overdriven. See Appendix A for details regarding Option 002.

1-22. ACCESSORIES SUPPLIED

1-23. The RF Section is shipped with three coaxial type terminations and one multi-section termination. The coaxial terminations are installed on the EXT MIXER port, the FIRST LO OUTPUT port and the SECOND LO OUTPUT port. (See Figure 3-1, items 17, 18, and 19.) The multi-section termination is shipped taped to the top of the RF Section. Install the multi-section termination on the Display Section rear panel. (See item 3, Figure 3-3.) The coaxial terminations are HP part number 11593A and the multi-section termination is HP part number 08553-60122.

1-24. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-25. The 8555A Spectrum Analyzer RF Section must be mated with an 8552-series Spectrum Analyzer IF Section and one of the 140-series Display Sections or 140-series Oscilloscope Mainframes before the units can perform their function as a spectrum analyzer. The 140S/140T/143S Display Sections are equipped with a fixed-persistence/non-storage CRT, whereas the 141S and 141T Display Sections are equipped with a variable-persistence storage CRT. Overlays, to provide LOG and LINEAR graticule scales, are available for use with the standard 140A and 141A Oscilloscope Mainframe.

1-26. Operating accessories for use with the 8555/8552/140 Spectrum Analyzer are listed in Table 1-3. Operating accessories include a wave-guide mixer, adapters, filters and a frequency comb generator. An external waveguide mixer and appropriate adapters are required over the frequency range of 18 to 40 GHz.

1-27. Deleted.

1-28. Deleted.

1-29. RECOMMENDED TEST EQUIPMENT

1-30. Tables 1-4 and 1-5 list the test equipment and test equipment accessories required to check, adjust, and repair the 8555A Spectrum Analyzer RF Section. Refer to the Maintenance Allocation Chart in the appendix for the required test equipment.

Table 1-1. 8555A/8552A/8552B Specifications

FREQUENCY SPECIFICATIONS

FREQUENCY RANGE

Tuning Range

With internal mixer: 0.01 - 18.00 GHz.

With external mixer: 12.4 - 40 GHz.

Selectable continuous coarse (by means of pushpull knob) and fine tuning determine display center frequency.

Harmonic Mixing Mode

Signal Identification: Signal identifier separates unknown input signal in center of CRT into two images 2 divisions apart with image on left slightly less in amplitude when the calibrated frequency scale is advanced to the appropriate band.

Scan Width

Full Scan: Inverted marker positioned by tuning control identifies the frequency that becomes the center frequency for scan width per division and zero scan modes. The width of the scan depends on mixing mode. Scan width = n x 2000 MHz, where n is the mixing mode; e.g., for n = 2, scan width is 4 GHz.

Per Division: 16 calibrated scan widths from 2 kHz/div to 200 Mhz/div in a 2, 5, 10 sequence.

Manual Scan: (Available with 8552B only.) Scan determined by front panel control; continuously variable across CRT in either direction.

Zero Scan: Analyzer becomes fixed tuned receiver with frequency set by frequency and fine tune controls and selectable bandwidths by bandwidth control. Amplitude variations are displayed versus time on CRT.

FREQUENCY ACCURACY

Dial Accuracy: n x (+15 MHz) where n is the mixing mode.

Scan Accuracy: Frequency error between two points on the display is less than 10% of the indicated separation.

Stability:

Total Analyzer Residual FM (Fundamental Mixing)

Stabilized	Unstabilized
<100 Hz peak-to-peak	<10 kHz peak-to-peak

First LO residual FM typically 30 Hz.

Noise Sidebands: For fundamental mixing. More than 70 dB below CW signal, 50 kHz or more away from signal, with 1 kHz IF bandwidth and 100 Hz video filter.

RESOLUTION

Bandwidth Ranges: IF bandwidths of 0.10 to 300 kHz provided in a 1, 3 sequence.

Bandwidth Accuracy: Individual IF bandwidth 3 dB points calibrated to ±20%o. (10 kHz bandwidth ±5%).

Bandwidth Selectivity:

	60 dB/3 dB Bandwidth Ratio	
IF Bandwidth	**8552A**	**8552B**
10 kHz - 300 kHz	20:1	20:1
1 kHz - 3 kHz	20:1	11:1
0.1 kHz - 0.3 kHz	25:1	11:1

AMPLITUDE SPECIFICATIONS

ABSOLUTE CALIBRATION RANGE

Measurement Range

CANCEL

See "Input Specifications" for maximum levels to INPUT .01 - 18 GHz connector and to input mixer.

Log Reference Level: From -130 dBm to +10 dBm, in 10 dB steps. Log reference level vernier, 0 to -12 dB continuously.

Linear Sensitivity: From 0.1 µ/V/div to 100 mV/div in a 1,2 sequence. Linear sensitivity vernier 1 to 0.25 attenuation ratio continuously.

Sensitivity

Average Noise Level: Specified for 1 kHz band-width. Using lower bandwidths will improve average noise level: e.g., use of 100 Hz band-width will improve noise level in the 1.5 to 3.55 GHz frequency range from -117 dBm to -127 dBm max.

With INTERNAL Coaxial NMixer

Frequency Range (GHz)	Mixing Mode (n)	IF Fre (Mhz)	Average Noise Level (dBm max.)
0.01 - 2.05	1-	2050	-115
1.50 - 3.55	1-	550	-117
2.07 - 6.15	2-	2050	-108
2.60 - 4.65	1+	550	-117
4.11 - 6.15	1+	2050	-115
4.13 -10.25	3-	2050	-103
6.17 -10.25	2+	2050	-105
6.19 -14.35	4-	2050	- 95
8.23- 14.35	3+	2050	-100
10.29 -18.00	4+	2050	- 90

With 11517A EXTERNAL Waveguide Mixer and Appropriate Waveguide Tapers

Frequency Range	Average Noise Level (Typ.)
12.4 - 18.0 GHz	-90 dBm
18.0 - 26.5 GHz	-85 dBm
26.5 -40.0 GHz	-75 dBm

Table 1-1. 8555A/8552A/8552B Specifications (Continued)

Residual Responses: Referred to signal level at input mixer on fundamental mixing: <-90 dBm.

Display Range

Log: 70 dB, 10 dB/div with 8552B 2 dB/div log expand on a 16 dB.display.

Linear: From 0.1 mV to 100 mV/div in a 1, 2 sequence on an 8-division display.

Display Uncalibrated Light: Panel light warns operator of uncalibrated amplitude display if the IF or video bandwidth selected is too narrow for combination of scan width and scan time selected.

Input Attenuator Range: 0 - 50 dB in 10 dB steps.

ABSOLUTE CALIBRATION ACCURACY

The overall absolute calibration accuracy of the spectrum analyzer in a particular application is a function of the measurement technique. The following elements also affect absolute calibration accuracy:

Frequency Response: With 10 dB input attenuator setting.

Frequency Range (GHz)	Mixing Mode (n)	IF Freq. (MHz)	Frequency Response (dB max.)
0.01- 2.05	1-	2050	±1.0
1.50- 3.55	1-	550	±1.0
2.07- 6.15	2-	2050	±1.25
2.60 - 4.65	1+	550	±1.0
4.11- 6.15	1+	2050	±1.0
4.13 - 10.25	3-	2050	±1.5
6.17 - 10.25	2+	2050	±1.5
6.19 -14.35	4-	2050	±2.0
8.23 -14.35	3+	2050	±2.0
10.29 -18.00	4+	2050	±2.0

IF gain variation with different bandwidth settings:
(at 20°C).
Log: ±0.5 dB.
Linear: ±5.8%.

Amplitude Display: Log ±0.25 dB/dB but not more than ±1.5 dB over the full 70 dB display range. Linear: ±2.8% of full 8-division deflection.

Input RF Attenuator: Frequency response typically ±0.6 dB from 10 MHz to 18 GHz.

Log Reference Level: Accurate to ±0.2 dB (±2.3% Linear Sensitivity).

Log Reference Level Vernier: Accurate to ±0.1 dB (1.2%) in 0, -6, and -12 dB positions; otherwise, ±0.25 dB (±2.8%).

Calibrator Output: Amplitude -30 dBm, ±0.3 dB. Frequency 30 MHz, ±0.3 MHz (8552A),±3 kHz (8552B).

INPUT SPECIFICATIONS

Input Impedance: 5012 nominal (0.01 - 18 GHz).

Reflection Coefficient:<0.130 (1.30 SWR) for input RF attenuator settings >,10 dB.

Maximum Input Level:

CAUTION
DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01 - 18 GHz Connector	+33	2	±20	10	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

RF Input Connector: Type N female.

External Mixer Input Connector: BNC female; LO power transfer to external mixer through connector as well as 2.05 GHz IF signal return to spectrum analyzer. LO power typically 0 dBm.

SCAN TIME SPECIFICATIONS

Scan Time: 16 internal scan rates from 0.1 ms/div to 10 sec/div in a 1,2, 5 sequence.

Scan Time Accuracy: 0.1 ms/div to 20 ms/div, ±10%, 50 ms/div to 10 sec/div, ±20%.

GENERAL SPECIFICATIONS

Power Requirements: 115 or 230 volts ±10%, 50 - 60 Hz, normally less than 225 watts (varies with plug-in units used).

Dimensions: Model 140T or 141T Display Section, 9-1/16 in. H (incl. feet) x 16-3/4 in. W x 18 3/8 in. D (229 x 425 x 467 mm). Model 143S Display Section, 21 in. H (incl. feet) x 16-3/4 in. W x 18 3/8 in. D (533 x 425 x 467 mm).

Weight:
Model 8555A RF Section: Net 14 lb 15 oz (6,8 kg).
Model 8552A IF Section: Net 9 lb (4,1 kg).
Model 8552B IF Section: Net 9 lb (4,1 kg).
Model 140T Display Section: Net 37 lb (16,8 kg).
Model 141T Display Section: Net 40 lb (18 kg).
Model 143S Display Section: Net 62 lb (28,1 kg).

Table 1-2. Supplemental Performance Characteristics

SUPPLEMENTAL PERFORMANCE CHARACTERISTICS

AMPLITUDE CHARACTERISTICS

For typical sensitivity and frequency response versus input frequency, see Figure 1-4.

Spurious Responses Due to Second Harmonic Distortion: With -40 dBm incident on input mixer.

Frequency Range	2nd Harmonic Distortion
0.1 - 6.2 GHz	<-63 dB
6.2 - 10.3 GHz	<-69 dB
10.3 - 14.4 GHz	<-54 dB
14.4 - 18.5 GHz	<-51 dB

Spurious Responses Due to Third Order Intermodulation Distortion: <-70 dB with -30 dBm incident on input mixer and signal separation >1 MHz.

Video Filter: Post-detection filter used to average displayed noise. With 8552A nominal band-widths: 10 kHz and 100 Hz. With 8552B nominal bandwidths: 10 kHz, 100 Hz, and 10 Hz.

Gain Compression: For internal mixer gain compression <1 dB for -10 dBm peak or average signal level to input mixer. 11517A external mixer (12.4 - 40 GHz) gain compression, <1 dB for -15 dBm peak or average signal level to input mixer.

FREQUENCY CHARACTERISTICS

RESOLUTION

See Figure 1-5 for curves of typical 8555A/8552A and 8555A/8552A spectrum analyzer resolution for different bandwidths.

FREQUENCY DRIFT

Long Term Drift: (At fixed center frequency, after 2-hour warm-up).
Stabilized: ±3.0 kHz/10 min.
Unstabilized: ±25 kHz/10 min.

Stabilization Range: First LO can be automatically stabilized to internal crystal reference for scan widths of 100 kHz/div or less.

OUTPUT CHARACTERISTICS

First LO Output: +10 dBm; 50 ohms, 2.05 - 4.10 Ghz.

Second LO Output: +10 dBm; 50 ohms; 1500 Mhz.

Third LO Output: +5 dBm; 50 ohms (rear panel); 500 MHz.

Pen Lift Output: 0 to 14 volts (0 volts during scan cycle). Output available in Int and single scan modes and Auto, Line, and Video scan trigger.

Vertical Output: 100 mV per major division on CRT display; output impedance <100 ohms.

SCAN CHARACTERISTICS

Scan Mode:

Int: Analyzer repetitively scanned by internally generated ramp; synchronization selected by scan trigger.

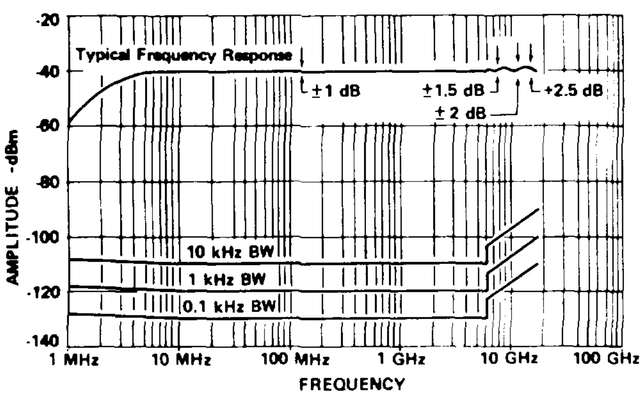


Figure 1-4. Typical Spectrum Analyzer Sensitivity and Frequency Response

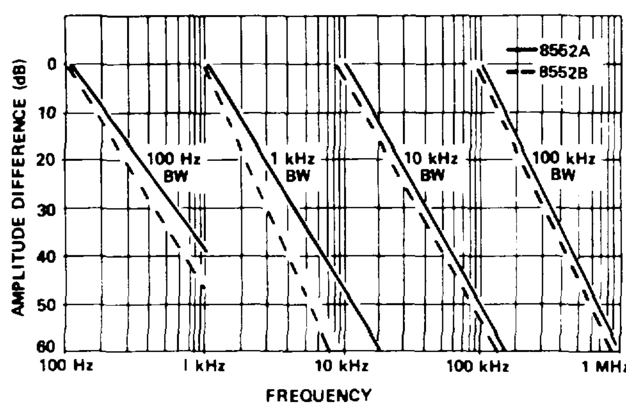


Figure 1-5. Typical Spectrum Analyzer Resolution (Fundamental Mixing)

Table 1-2. Supplemental Performance Characteristics (cont'd)

SUPPLEMENTAL PERFORMANCE CHARACTERISTICS (Continued)

Single: Single scan with reset actuated by front panel pushbutton.
Ext: Scan determined by 0 to +8 volt external signal; scan input impedance >10 kΩ.
Blanking: -1.5V external blanking signal required.
Manual: Scan determined by front panel control; continuously variable across CRT in either direction (8552B only).
Scan Trigger: For Internal Scan Mode, select between:
- Auto: Scan free runs.
- Line: Scan synchronized with power line frequency.
- Ext: Scan synchronized with >2 volt (20 volt max.) trigger signal (polarity selected by internally located switch in IF Section).
- Video: Scan internally synchronized to envelope of RF input signal (signal amplitude of 1.5 major divisions peak-to-peak required on display section CRT).

DISPLAY CHARACTERISTICS

Variable Persistence/Storage (Model 141T):

Plug-ins: Accepts Model 8550-series Spectrum Analyzer plug-ins and Model 1400-series time domain plug-ins.

Cathode-ray Tube:

Type: Post-accelerator storage tube, 9000 volt accelerating potential; aluminized P31 phosphor; etched safety glass faceplate reduces glare.

Functions Used with Time Domain Plug-ins Only: Intensity modulation, calibrator, beam finder.

Special Order: Chassis slides and adapter kit: Fixed slides, order HP Part Number 1490-0714; pivot slides, order HP Part Number 1490-0718; slide adapter kit for mounting slides on scope, order HP Part Number 1490-0721.

Persistence:

Normal: Natural persistence of P31 phosphor (approximately 0.1 second).

Variable:

Normal Writing Rate Mode: Continuously variable from less than 0.2 second to more than one minute (typically to two or three minutes).
Maximum Writing Rate Mode: Typically from 0.2 second to 15 seconds.

Erase: Manual; erasure takes approximately 350 ms; CRT ready to record immediately after erasure.
Storage Time: Normal writing rate; more than 2 hours at reduced brightness (typically 4 hours). More than one minute at maximum brightness. Fast writing speed; more than 15 minutes (typically 30 minutes) at reduced brightness or more than 15 seconds at maximum brightness.
Functions Used with Time Domain Plug-ins Only: intensity modulation, calibrator, beam finder.

Normal Persistence (Model 140T):

Plug-ins: Same as 141T.

Cathode-ray Tube:

Type: Post-accelerator, 7300 volt potential medium-short persistence P7 phosphor; tinted and etched safety glass faceplate reduces glare. (Normal persistence of P7 phosphor approximately 0.3 sec).
Graticule: 8 x 10 division (approximately 7,6 x 9,5 cm) parallax-free internal graticule; five subdivisions per major division on horizontal and vertical axes.
Functions Used with Time Domain Plug-ins Only: Same as 141T.

Normal Persistence Large Screen Display (Model 143S):

Plug-ins: Same as 141T.
Cathode-ray Tube:

Type: Post-accelerator, 20 kV accelerating potential, aluminized P7 phosphor. (Persistence approximately 0.3 sec.)
Graticule: 8 x 10 divisions (approximately 8 x 10 inch) parallax-free internal graticule, five subdivisions per major division on horizontal and vertical axes.
Functions Used with Time Domain Plug-ins Only: Same as 141T.

GENERAL CHARACTERISTICS

CRT BASELINE CLIPPER: Front panel control adjusts blanking of CRT trace baseline to allow more detailed analysis of low-repetition-rate signals and improved photographic records to be made.
Temperature Range: Operating, 0° to +40°C; storage, -40° to +75° C.

Table 1-3. Operating Accessories

Model Number	Name	Description
11517A	Waveguide Mixer	Mixes inputs from 12.4 to 40 GHz with frequencies from first LO HP 10503A Coaxial Cable terminated with BNC male connectors supplied with Mixer
11518A	Adapter	For mating 11517A Waveguide Mixer to P-band (12.4 to 18.0 GHz) system
11519A	Adapter	For mating 11517A Waveguide Mixer to K-band (18.0 to 26.5 GHz) system
11520A	Adapter	For mating 11517A Waveguide Mixer to R-band (26.5 to 40 GHz) system
8406A	Frequency Comb Generator	For calibrating scan-width function; generates precision markers with 1-, 10-, and 100-MHz spacing
8403A	Bandpass Filter	Pass band: 1 - 2 GHz
8431A	Bandpass Filter	Pass band: 2 - 4 GHz
8432A	Bandpass Filter	Pass band: 4 - 6 GHz
8433A	Bandpass Filter	Pass band: 6 - 8 GHz
8434A	Bandpass Filter	Pass band: 8 - 10 GHz
8435A	Bandpass Filter	Pass band: 4 - 8 GHz
8436A	Bandpass Filter	Pass band: 8 - 12.4 GHz
8444A	Tracking Generator	Functions as a frequency response measurement system when used with the Spectrum Analyzer. The system can be used as a sweeper or signal generator 10 MHz to 1.3 GHz.
8445B	Automatic Preselector	Functions to reduce or eliminate signal intermodulation, and multiple and spurious responses. Preselector is a low-pass filter over the 0 to 1.8 GHz range and a voltage tuned filter over the 1.8 to 18 GHz range.
8447D	Preamp	100 kHz - 1.3 GHz low noise preamp; improves sensitivity or average noise level or RF Section approximately 18 dB
360 series	Low-pass Filter	360A cuts off at 700 MHz, 360B cuts off at 1200 MHz
362A series	Low-pass Filter	Acts like bandpass when used with waveguide; available for X, P, K, R bands; eliminates signals outside normal waveguide band

Table 1-4. Test Equipment Required

Item	Minimum Specifications	Suggested Model	Use*
Frequency Comb Generator	Frequency markers spaced 1, 10, 100 MHz apart; usable to 4 GHz Frequency Accuracy: ±0.01% Output Amplitude: > - 40 dBm	HP 8406A Comb Generator	P, A
HF Signal Generator	Frequency Range: 1—50 MHz Output Amplitude: > -20 dBm Output Amplitude Accuracy: ±1% Frequency Accuracy: ±1% Output Impedance: 50 ohms	HP 606A/B HF Signal Generator	P
VHF Signal Generator	Frequency Range: 40—455 MHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 608E/F VHF Signal Generator	A, T
UHF Signal Generator	Frequency Range: 450—1230 MHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 612A UHF Signal Generator	T
Signal Generator	Frequency Range: 1.0—2.1 GHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 8614A/B Signal Generator	A, T
Signal Generator	Frequency Range: 2.0—4.0 GHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 8616A/B Signal Generator	A
Sweep Oscillator	Frequency Range: 0.1—18 GHz Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 8690B Sweep Oscillator with 8693A/B RF Unit 8694A/B RF Unit 8695A/B RF Unit 8699B RF Unit	P
Audio Oscillator	Frequency Range: 10 Hz—10 kHz Output Amplitude: 2 Vrms Frequency Accuracy: 2% Output Impedance: 600 ohms	HP 200CD Audio Oscillator	P
Test Oscillator	Frequency Range: 10 kHz—1.3 MHz Frequency Accuracy: ±3% Output Amplitude: 3 Vrms Output Impedance: 50 ohms	HP 652A Test Oscillator	A
Frequency Counter	Frequency Range: 100 kHz—18.5 GHz Accuracy: ±0.001% Sensitivity: 100 mV rms Readout Digits: 7 digits	HP 5245L Frequency Counter w/ HP 5257A Transfer Oscillator	A, T

*Use: P = PERFORMANCE; A = ADJUSTMENT; T = TROUBLESHOOTING

General Information

Table 1-4. Test Equipment Required (cont'd)

Item	Minimum Specifications	Suggested Model	*Use
Tunable RF Voltmeter	Bandwidth: 1 kHz Frequency Range: 1—1000 MHz Sensitivity: 10 mV—1 Vrms Input Impedance: ⩾ 0.1 megohms	HP 8405A Vector Voltmeter	T
Digital Voltmeter	Voltage Accuracy: ±0.2% Range Selection: manual or automatic Voltage Range: 1—1000 Vdc full scale Input Impedance: 10 megohms Polarity: Automatic indication	HP 3440A Digital Voltmeter w/ HP 3443A Plug-in	A, T
Oscilloscope	Frequency Range: Dc to 50 MHz Time Base: 1 us/div to 10 ms/div Time Base Accuracy: ±3% Dual Channel, Alternate Operation Ac or dc Coupling External Sweep Mode Voltage Accuracy: ±3% Sensitivity: 0.005 V/div	HP 180A with HP 1801A Vertical Amplifier and HP 1821A Horizontal Amplifier HP 10004 10:1 Divider Probes (2)	A, T
Power Meter	Frequency Range: 0.01—18.0 GHz Accuracy: ±1% Power Range: -20 to +10 dBm	HP 432A Power Meter with HP 8478B Thermistor Mount	A, T
Power Supply Dual DC	Output Voltage: Variable, 0—30 Vdc Output Current: 0—300 mA Meter Accuracy: 3%	HP 6205B Power Supply	T
DC Volt-Ohm-Ammeter	Voltmeter Voltage Range: 1 mV—300V Accuracy: ±1% Input Resistance: 10 megohms Ammeter Current Range: 1 μA—1A Accuracy: ±2% Ohmmeter Resistance range: 1 ohm—100 megohm Accuracy: ±5% reading at center scale	HP 412A Volt-Ohm-Ammeter	A, T

Table 1-5. Test Accessories

Item	Required Features	Suggested Model
Service Accessories	Contents: 140/141 Display Section to Spectrum Analyzer Plug-in Extender Cable Assembly (HP 11592-60015) IF to RF Unit Interconnection Extender Cable Assembly (HP 11592-60016) Selectro Female to BNC Male Test Cable, 36 inches long (HP 11592-60001) Selectro Male to Selectro Female Test Cable, 8 inches long yellow (HP 11592-60003)	HP 08555-60077

Table 1-5. Test Accessories (cont'd)

Item	Required Features	Model
Service Kit	Selectro Female to Selectro Female Cable, 8" long, red (HP 11592-60002) Extender Board Assy, 15 pins, 30 conductors, for plug-in circuit boards (HP 11592-60011) Extender Board Assy, 10 pins, 20 conductors, for plug-in circuit boards (HP 5060-0256) Extender Board Assy, 12 pins, 24 conductors, for plug-in circuit boards (HP 5060-0257) Extender Board Assy, 24 pins, 48 conductors, for plug-in circuit boards (HP 5060-0258) Cable Assy, R & P Female to BNC Male (HP 11592-60013) Cable Assy, SMA Male to BNC Male (HP 08555-60076) Wrench, box-end slotted 3/16-inch (HP 08555-20097) Selectro Jack-to-Jack Adapter (HP 1250-0827) Wrench, open-end, 15/64-inch (HP 8710-0946) OSM Plug-to-Plug Adapter (HP 1250-1158)	HP Service Kit 08555-60077

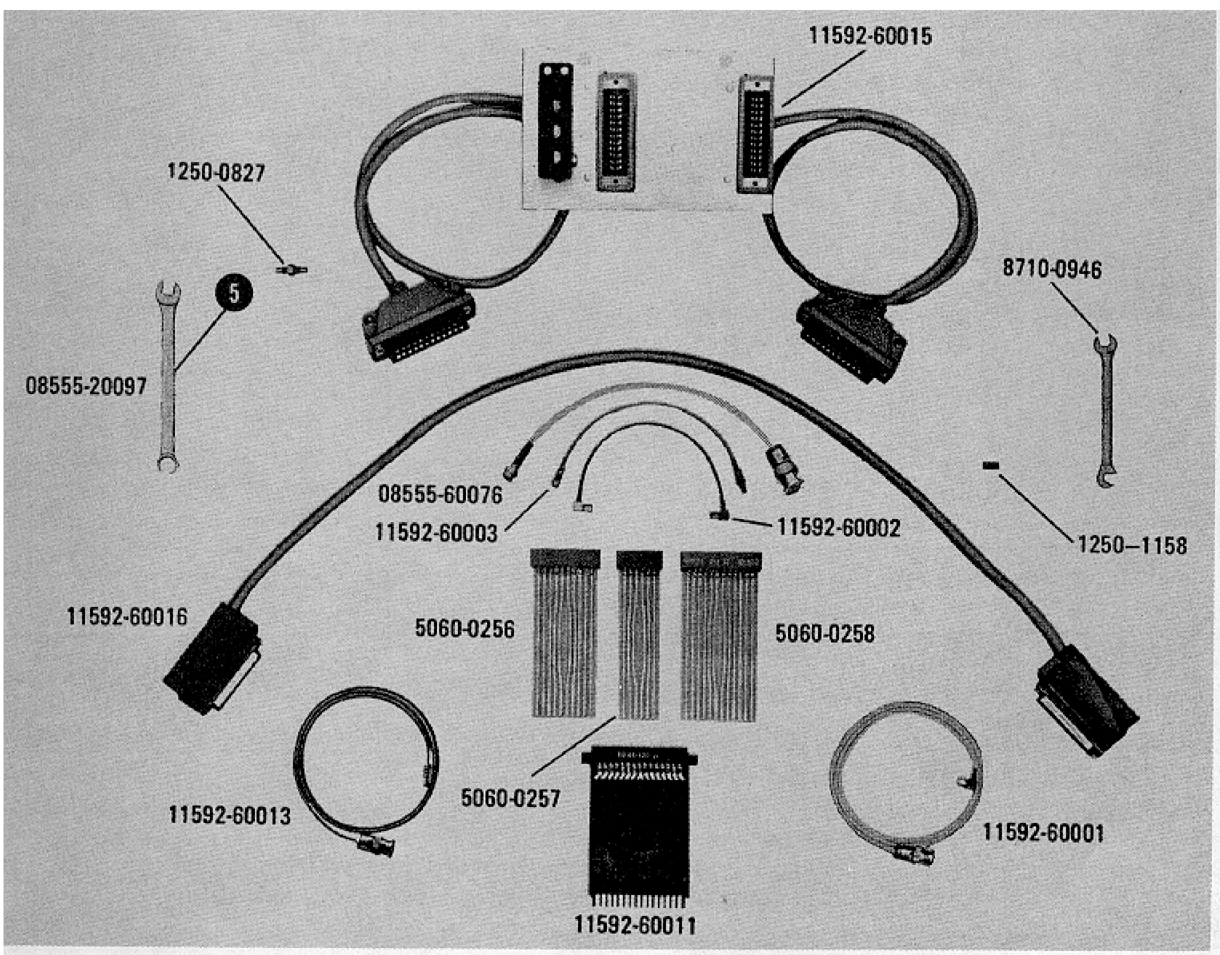


Figure 1-6. HP 08555-60077 Service Kit Required for Adjustment & Service Procedures

Table 1-5. Test Accessories (cont'd)

Item	Required Features	Suggested Model	Use*
10 dB Fixed Attenuator	Frequency Range: Dc—12.4 GHz Flatness: ±0.2 dB	HP 8491A, Option 10	A
12 dB Variable Attenuator	Frequency Range: Dc—1 GHz Flatness: ±0.3 dB	HP 355C	A
VHF Attenuator	Frequency Range: Dc—1 GHz 0—60 dB in 10 dB steps	HP 355D	A
50-ohm Termination	Frequency Range: Dc—18 GHz VSWR: 1:1 Power Rating: 0.5 Watts Connector: Type N Male	HP 909A Coaxial Termination, Option 012	P, A
Dual Directional Coupler	Frequency Range: 100 MHz—2 GHz Directivity: 32 dB	HP 778D Dual Directional Coupler	P, A
Directional Coupler (2)	Frequency Range: 1.7—12.4 GHz Directivity: 26 dB	HP 779D Directional Coupler	P
Coaxial Short	Type N Male Shorting Plug	HP 11512A	P
Low Pass Filter	Cut-off Frequency: 2.2 GHz Insertion Loss: ⩽ 1 dB below 0.9 times cut-off frequency Rejection: ⩾ 50 dB at 1.25 times cut-off freq.	HP 360C Low Pass Filter	P
BNC Tee	Two BNC Female Connectors, one Male BNC Connector	UG-274A/U HP 1250-0781	T
Adapter	SMA Jack to BNC Plug	HP 1250-0831	A
Adapter	BNC Jack to BNC Jack	UG-914A/U HP 1250-0080	A
Adapter	BNC Male to Type N Female	UG-349A/U HP 1250-0077	A, T
Adapter (2)	BNC Female to Type N Male	UG-201A/U HP 1250-0067	P,A.T
Crystal Detector	Frequency Range: 0.01—12.4 GHz Frequency Response: ±0.5 dB	HP 423A	P
Logic Level Indicator	Compatibility: DTL or TTL, Power Requirements: 5 volts ±10% across any two pins	HP 10528A Logic Clip	T
Voltage Probe	Dual Banana Plug-to-Probe Tip and Clip (Ground) Lead	HP 10025A Straight-through Voltage Probe	A, T
Cable Assy (2)	Male BNC Connectors, 48 inches long	HP 10503A	P,A,T
Cable Assy	BNC Male to Dual Banana Plug, 45 inches long	HP 11001A	P

*USE: A = ADJUSTMENT; P = PERFORMANCE; T = TROUBLESHOOTING

Table 1-5. Test Accessories (cont'd)

Item	Required Features	Suggested Model	Use*
Cable Assembly	Dual Banana Plug to Clip Lead and Probe, 60 inches long	HP 11003A	A
Cable Assembly	Male Type N Connectors, 72 inches long	HP 11500A	A
Tuning Tool, Blade	Nonmetallic Shaft, 6 inches long	General Cement 5003 (HP 8730-0013)	A, T
Tuning Tool, Slot	Nonmetallic, 6-inch shaft	Gowanda PC9668	A, T
Wrench	Open-end, 15/64-inch	HP 8710-0946	A, T
Wrench	Open-end, 5/16-inch	HP 8720-0030	A, T
Wrench	No. 6, Allen Driver	HP 5020-0289	A, T
Wrench	No. 10, Allen Driver	HP 5020-0291	A, T
Wrench	Nut Driver, 5/16-inch	HP 8720-0003	A, T
Screwdrivers	Phillips No. 1 Phillips No. 2 Pozidriv No. 1 (Small) Stanley No. 5531 Pozidriv No. 2 (Medium) Stanley No. 5332	 HP 8710-0899 HP 8710-0900	A, T A, T A, T A, T
Tuning Tool, Slot	Nonmetallic, 2.5-inch shaft	HP 8710-0095	A, T
Cover Assy	Modified display section cover (see Paragraph 3-40)	Modified HP 5060-0740	A, T
Soldering Iron	47-1/2 watt	Ungar No. 776 with No. 4037 Heating Unit	A, T
Dummy Load	Resistance: 83 ohms, 5% Wattage: 20 watts (100 ohm HP 0819-0019 and 500 ohm HP 0819-0035 in parallel)	HP 0819-0019 HP 0819-0035	T
Voltage Divider	Resistance: 22.97K 1% 1/4W 21.5K (HP 0757-0199) in series with 1.47K (HP 0757-1094)	HP 0757-0199 HP 0757-1094	A
Variable Resistor	Resistance: 2.5K ohms variable	HP 2100-2729	A
Tuning tool kit, slug	Modified 5/16-inch nut driver (HP 08555-20122) with modified number 10 Allen driver (HP 08555-20121)	HP 08555-20122 HP 08555-20121	A

*USE: A = ADJUSTMENT; P = PERFORMANCE; T = TROUBLESHOOTING

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION

2-2. Mechanical Check

2-3. Check the shipping carton for evidence of damage immediately after receipt. If there is any visible damage to the carton, request the carrier's agent be present when the instrument is unpacked. Inspect the instrument for physical damage such as bent or broken parts and dents or scratches. If damage is found refer to paragraph 2-6 for recommended claim procedures. If the instrument appears to be undamaged, perform the electrical check (see paragraph 2-4). The packaging material should be retained for possible future use.

2-4. Electrical Check

2-5. The electrical check consists of following the performance test procedures listed in Section IV. These procedures allow the operator to determine that the instrument is, or is not, operating within the specifications listed in Table 1-1. The initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the instrument does not operate as specified, refer to paragraph 2-6 for the recommended claim procedure.

2-6. CLAIMS FOR DAMAGE

2-7. If physical damage is found when the instrument is unpacked, refer to paragraph 0-3 and make out the proper form.

2-8. Deleted.

2-9. PREPARATION FOR USE

CAUTION

Before applying power, check the rear panel slide switch on the Display Section for proper position (115 or 230 volts).

2-10. Shipping Configuration

2-11. Because of individual customer requirements, shipping configurations are flexible. Preparation for use is based on the premise that the RF and IF Sections are installed in a Display Section to make the Spectrum Analyzer physically and functionally complete for use. Since the RF and IF Sections are usually received separately, the plug-ins must be mechanically fitted together, electrically connected, and inserted in a display section or oscilloscope mainframe of the 140-series. For mechanical and electrical connections, refer to Figure 2-1 and paragraph 2-20.

2-12. Power Requirements

2-13. The Spectrum Analyzer can be operated from a 50- to 60-hertz input line that supplies either a 115-volt or 230-volt (±10% in each case) power. Consumed power varies with the plug-ins used but is normally less than 225 watts. Line power enters the Display Section or Mainframe, where it is converted to dc voltages, and then is distributed to the RF and IF Sections via internal connectors.

2-14. The 115/230 power selector switch at the rear of Display Section must be set to agree with the available line voltage. If the line voltage is 115 volts, the slide switch must be positioned so that 115 is clearly visible. The instrument is internally fused for 115-volt operation, when shipped. If 230-volt source is to be used, refer to fuse replacement procedures in the display section manual.

2-15. Power Cable

2-16. To protect operating personnel, the National Electrical Manufacturers Association (NEMA) and the International Electrotechnical Commission (IEC) recommends that the instrument panel and cabinet be grounded. The Spectrum Analyzer is equipped with a three-conductor power cable; the third conductor is the ground conductor and when the cable is plugged into an appropriate receptacle, the instrument is grounded. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green lead on the adapter to ground.

2-17. Operating Environment

2-18. The Spectrum Analyzer uses a forced-air cooling system to maintain required operating temperatures within the instrument. The air intake and filter are located on the rear of the Display Section air is exhausted through the side panel perforations. When operating the instrument, choose a location which provides at least three inches of clearance around the rear and both sides. Refer to the Display Section manual for maintenance instructions for the cooling system.

2-19. Interconnections

2-20. The RF and IF Sections are normally shipped separately, the plug-ins must be mechanically fitted together, electrically connected, and then inserted in the Display Section or mainframe. To make these connections, refer to Figure 2-1 and proceed as follows:

a. Set the IF Section on a level bench. Locate slot near right rear corner of RF Section; also, locate metal tab on IF Section that engages with this slot.

b. Grasp the 8555A RF Section near middle of chassis and raise until it is a few inches above the IF Section.

c. Tilt RF Section until front of assembly is about 2 inches higher than the rear.

d. Engage assemblies in such a way that metal tab on the rear of the IF Section slips through the slot on RF Section.

e. With the preceding mechanical interface completed, gently lower RF Section until electrical plug and receptacle meet.

f. Position RF Section as required to mate the plug and receptacle. When plug and receptacle are properly aligned, only a small downward pressure is required to obtain a snug fit.

g. Position the latch on each side of the RF Section to lock the RF and IF Sections together.

h. Remove the 50-ohm lead assembly AT4 (shipped taped to top of the RF Section) and install at the AUXILIARY "A" connector on the rear panel of the Display Section. On Display Sections not equipped with an AUXILIARY "A" connector, install 50-ohm load assembly AT4 at AUXILIARY "'A" connector on rear of RF Section.

I. Pick up the RF/IF Sections and center in opening of Display Section. Push forward until assembly fits snugly into Display Section mainframe.

j. Push in front latch to securely fasten assembly in place.

2-21. To separate the RF/IF Sections from Display Section and to separate the RF Section from the IF Section, proceed as follows:

a. Push front panel latch in direction of arrow until it releases.

b. Firmly grasp the middle of latch flange and pull RF/IF Sections straight out.

c. Unlock the latch on each side of the RF section and exert an upward pulling force on front edge of RF Section.

d. When the two sections separate at the front, raise RF Section two or three inches and slide metal tab at rear of IF Section out of the slot with which it is engaged.

2-22. Three HP 11593A 50-ohm Terminations are supplied with each HP 8555A. They should be connected to the unused EXT MIXER, FIRST LO OUTPUT, and SECOND LO OUTPUT connectors on the front panel.

2-23. STORAGE AND SHIPMENT

2-24. Original Packaging

2-25. The same containers and materials used in factory packaging can be obtained through any Hewlett-Packard Sales/Service office.

2-26. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating service required, return address, instrument model number and full serial number. Mark the container FRAGILE to assure careful handling.

2-27. In any correspondence refer to the instrument by model number and full serial number.

2-28. Other Packaging Materials

2-29. The following general instructions should be followed when repackaging with commercially available materials:

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

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

INTERCONNECTIONS

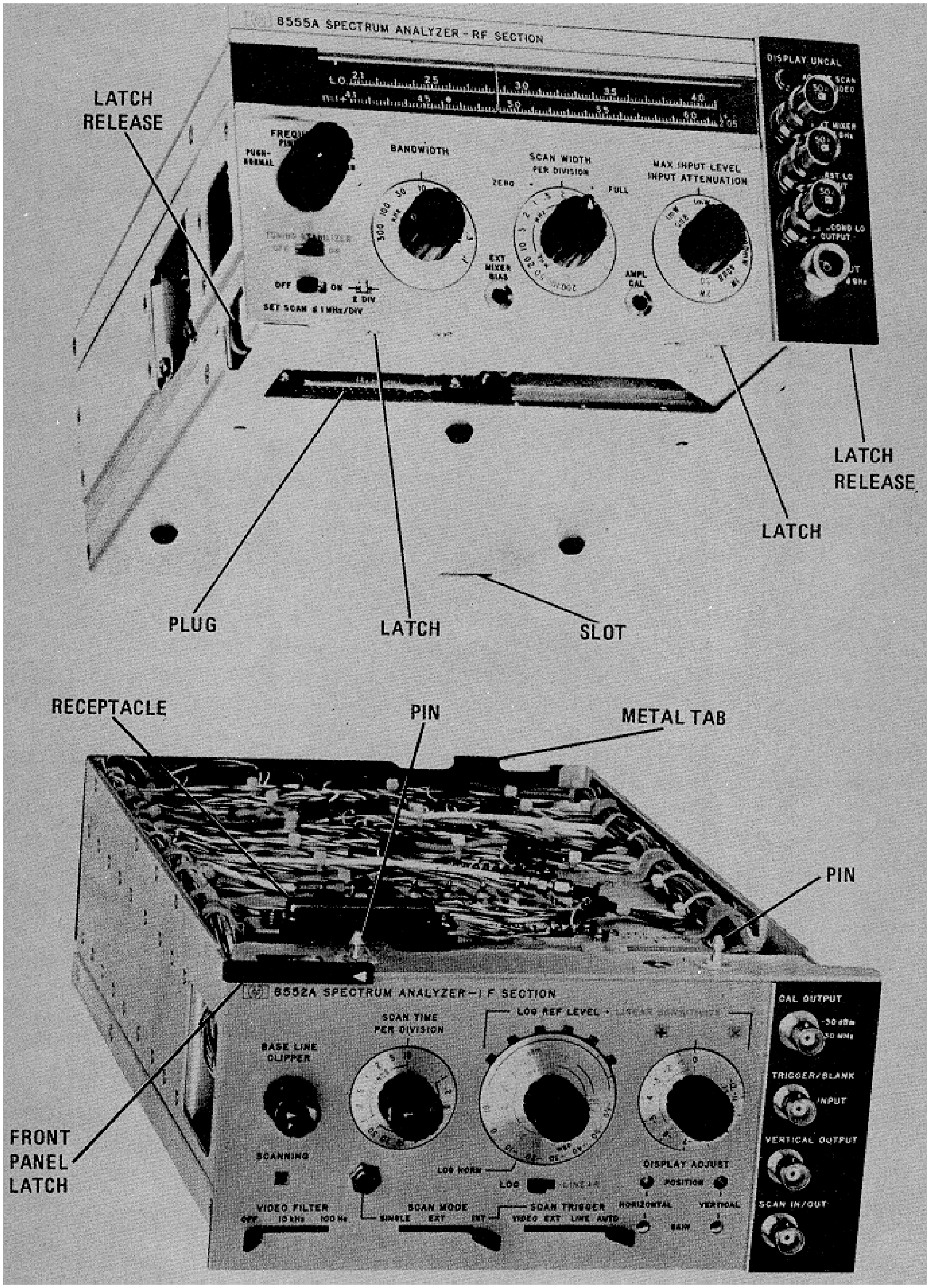


Figure 2-1. RF Section and IF Section Interconnections

c. Use enough shock-absorbing material (three to four inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the 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 provides complete operation instructions for the HP 8555A/8552A/140-series Spectrum Analyzer. Front panel controls, connectors and indicators, for the 8555A RF Section, are identified and described in Figure 3-1. Controls and indicators, for a typical Display Section and IF Section, are identified and described in Figure 3-2. Refer to the appropriate IF Section and Display Section manuals for identification and description of controls, indicators, and connectors not contained in this manual. Operational adjustments are detailed in Figure 3-3 and general operating instructions are provided in Figures 3-4 through 3-6.

3-3. PANEL FEATURES

3-4. Front panel features of the 8555A RF Section are described in Figure 3-1. Front and rear panel views of the HP 8555A/8552A1140T Spectrum Analyzer are shown in Figure 3-3. For a detailed description of the IF Section and Display Section controls and indicators, refer to the operation and service manuals for those instruments. Interconnection wiring between the RF Section and the IF Section and between the RF Section and the Display Section is contained in Section VIII of this manual.

3-5. OPERATOR'S CHECKS

3-6. Upon receipt of the instrument, or when one or more sections of the analyzer are changed, perform the operational adjustment procedures listed in Figure 3-3. This procedure corrects for minor differences between units and ensures that the RF Section, IF Section and Display Section are properly matched.

3-7. OPERATING INSTRUCTIONS

3-8. General operating instructions are contained in .Figure 3-4. These instructions will familiarize the operator with basic operating functions of the spectrum analyzer. Additional information covering signal identifying techniques and external mixer operation is contained in Figures 3-5 and 3-6.

3-9. CONTROLS, INDICATORS AND CONNECTORS

3-10. Front panel controls, indicators, and connectors are identified and briefly described in Figures 3-1 and 3-2. Operational Adjustment procedures are given in Figure 3-3. Additional information, to assist the user during instrument operation, is given in the following paragraphs.

3-11. RF Input. The RF Section is normally shipped with a Type N input connector. (Option 001 instruments are shipped with a Type APC-7 input connector.) Refer to Section VI for part numbers associated with connector J1. (See Input Mixer Diode Characteristics below.) The mixer diode, in the First Converter Assembly A12, will burn out if overloaded. This diode is not separately replaceable; it is part of a thin film microcircuit enclosed in the sealed assembly. To protect the mixer diode it is a good operating practice to always set the INPUT ATTENUATION control to 50 dB before connecting the signal input.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01-18 GHz Connector	+33	2	±20	20	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

CAUTION

Do not connect impulse generators to 8555A input. These mechanical type switching devices can generate pulses in excess of 300 volts. The broadband output from impulse generators can destroy both input attenuator and first converter. See additional information in paragraphs 3-11 through 3-13 of Operating and Service manual prior to instrument operation.

3-12. Input Attenuation. The input attenuator is connected between the RF INPUT (.01-18 Ghz) and First Converter. The attenuator should be set to reduce the signal level at the attenuator output to -10 dBm average (signal compression level). The maximum input level, for each position of the attenuator control, for less than 1 dB signal compression, is indicated in red on the attenuator control dial. Unless extra sensitivity' is required, at least 10 dB of input attenuation should be used. This provides a 50-ohm termination for currents at the IF and LO frequencies that appear at the mixer's input port. With the input attenuator set to 0 dB, the RF INPUT is a dc block, capable of withstanding +20 volts. In other attenuator positions the input is a dc return to ground of about 50-ohms and is capable of handling +400 mA (see CAUTION). When in the 0 dB position the input impedance is greater than 50 ohms. This may cause some mismatch, VSWR and display amplitude variation as the input frequency changes.

CAUTION

Care must be taken when applying dc voltage to the RF INPUT of the analyzer. Do *not* change INPUT ATTENUATION setting while dc is applied. Apply only dc voltages with rise time less than 10^6 volts per second and current with rise times less than 2×10^4 amperes per second. Do not exceed ±20 volts dc or 1.0 volt ac peaks.

3-13. Mixer Overload Characteristics. The input mixer will provide absolute calibration at signal levels up to -10 dBm, incident on the mixer. Smaller signal levels will generally be necessary for distortion measurements to assure that the measurement does not include distortion from the 8555A mixer. (See distortion data in Table 1-2 Supplemental Performance Characteristics.)

3-14. EXT MIXER Connector. Provides an output for the 2.05 to 3.1 GHz first LO signal. A dc bias voltage, adjustable from the front panel, is supplied to the external mixer through this connector. The 2.05 GHz IF signal generated by the external mixer is applied through this same connector. The HP 11517A Waveguide Mixer is recommended as an accessory along with Waveguide Adapters 11518A, 11519A and 11520A for use over the 12.4 to 40 GHz frequency range. Maximum input power for less than 1 dB signal compression is typically .03 mW peak for the 11517A. To protect the external mixer diode, inputs should never exceed 1 milliwatt. Terminate the EXT MIXER input with the 50-ohm load supplied when not in use. When using external mixing, terminate the .01-18 GHz INPUT with the 50-ohm load or set INPUT ATTENUATION to 10 or 20 dB. The input attenuator is not in the external mixing circuit, but does control the LOG REF LEVEL index lamps. Amplitude display accuracy will be approximate with INPUT ATTENUATION set to match external mixer loss.

3-15. FIRST LO OUTPUT. A 2.05 to 4.1 Ghz output from the YIG-tuned oscillator at a level of approximately +10 dBm. Available at a test point and for use with accessory equipment. Terminate the FIRST LO OUTPUT with the 50-ohm load supplied when not in use.

3-16. SECOND LO OUTPUT. A 1.5 GHz output from second LO at a power level of approximately +9 dBm. Available as a test point and for use with accessory equipment. Can be used as a test signal with INPUT ATTENUATION set to at least 20 dB. Terminate the SECOND LO OUTPUT with the 50-ohm load supplied when not in use.

3-17. Frequency Scales. Set of 14 scales selected by the Band Switch Lever. Harmonic number (n =) associated with selected scale is shown on left edge of frequency scale. IF frequency (550 MHz or 2.05 GHz being used) is shown on the right edge of the scale.

3-18. LO Scale. Indicates the fundamental frequency of the first LO (YIG). Cursor positioned by the FREQUENCY control indicates the LO fundamental center frequency in the ZERO and PER DIVISION SCAN WIDTH modes.

3-19. BAND Scale. Indicates the frequency range of each of the 14 frequency bands. Green dot on the selected Frequency Scale indicates the frequency BAND.

3-20. FREQUENCY Control. Coarse tunes the analyzer's center frequency in the ZERO and PER DIVISION SCAN WIDTH modes. It is a two-speed control (push-pull action) providing normal or rapid tuning. Do *not* use coarse tuning when analyzer is stabilized (TUNING STABILIZER ON and SCAN WIDTH PER DIVISION set to blue color-coded numbers). When stabilized, coarse tuning will cause signal to jump off CRT screen.

3-21. FINE TUNE. Three turn control fine tunes the analyzer's center frequency in the ZERO and PER DIVISION SCAN WIDTH modes. Use FINE TUNE control to tune analyzer in stabilized mode (see FREQUENCY control above). Provides a 1 MHz tuning range of the 1st LO (YIG) on fundamental mixing.

3-22. DISPLAY UNCAL. Warning indicator associated with BANDWIDTH, SCAN WIDTH, SCAN TIME PER DIVISION and VIDEO FILTER controls. Lamp lights when control settings are such that the calibration of the instrument is impaired. On some control settings it is acceptable for the DISPLAY UNCAL light to be "on" if the light subsequently goes "off" when either the SCAN TIME PER DIVISION or SCAN WIDTH PER DIVISION control is switched one position counterclockwise. The indicator lamp bulb is replaceable from the front panel. HP Part Number 2140-0259, incandescent lamp, 12 volt, .06 ampere, type T1 bulb. Turn plastic lens cover counterclockwise to remove cover.

3-23. BAND Switch Lever. Selects frequency scale from a set of 14 frequency scales. The band switch lever also controls a shaft encoder on the frequency scale drum that performs several functions:

a. Controls attenuation of the 1st LO (YIG-tuned osc.) tuning ramp to maintain scan width calibration when using harmonic mixing.

b. Optimizes the bias for the input mixer to match the harmonic number (n) of the YIG-tuned oscillator. (n = harmonic number, shown on left of each frequency scale.)

c. Controls the overall gain of the RF Section to maintain absolute calibration when using internal mixing.

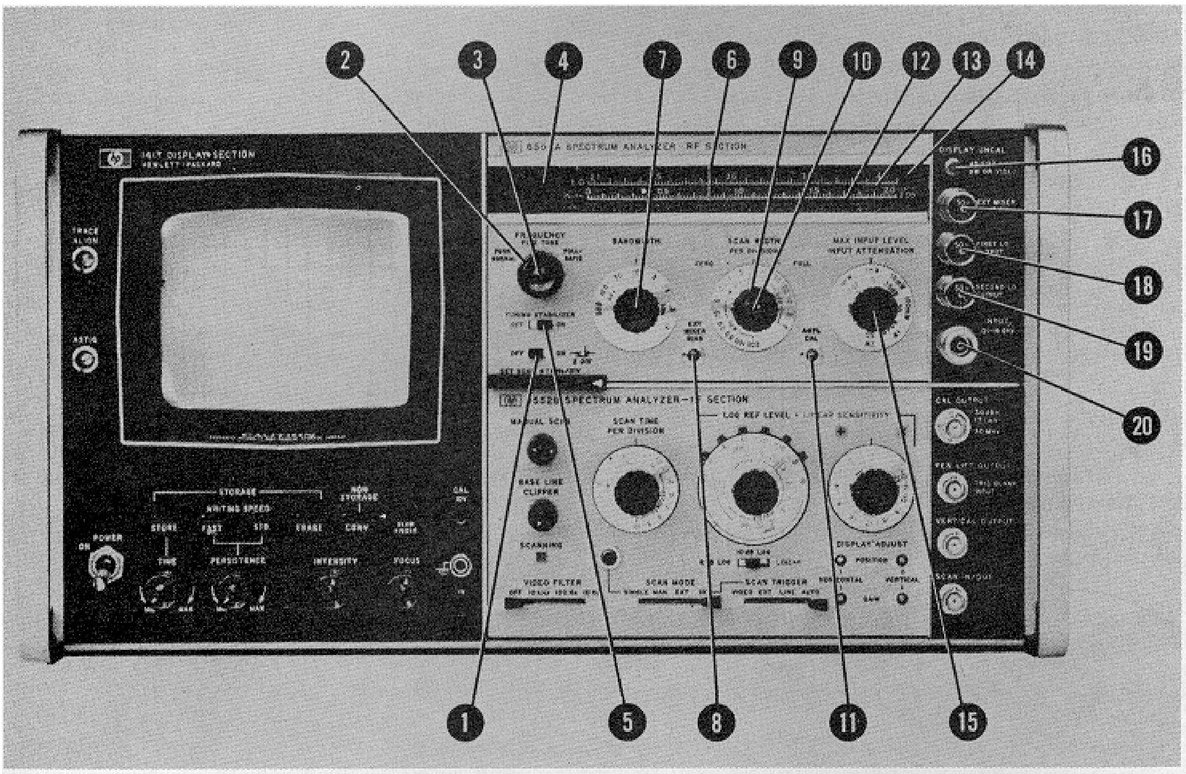
d. Controls switching of the IF signal path. Bypassing and disabling the second converter on the 1+ and 1- (550 MHz IF bands). Bypassing the first converter when using external mixing on the n=6, 10- and 10+ frequency bands.

e. Provides n ± information to signal identification circuit.

f. Provides frequency information to accessory equipment.

3-24. TUNING STABILIZER Switch. ON/OFF control for tuning stabilization circuit. The tuning stabilizer locks the first LO (YIG) to a 1 Mhz voltage-controlled crystal oscillator (VCXO) to reduce residual FM of the first LO. The circuitry is enabled when the switch is set to ON and the SCAN WIDTH switch is in the ZERO or blue color-coded PER DIVISION positions.

3-25. SIGNAL IDENTIFIER Switch. ON/OFF control for signal-identification circuit. The signal identifier circuit provides a method of determining which harmonic of the 1st LO is mixing with the input signal to give the display on the CRT. The circuitry is enabled when the switch is ON and SCAN WIDTH PER DIVISION control is set to 1 MHz or below. (See Signal Identification Technique, Figure 3-5).



(1) SIGNAL IDENTIFIER Switch: Used in signal-identification technique to identify which harmonic is being mixed with the input signal to obtain the display. See Figure 3-5.

(2) FREQUENCY Control: Coarse tunes analyzer center frequency. Push-pull action provides either normal or rapid tuning.

(3) FINE TUNE Control: Fine tunes analyzer center frequency. Three turn tuning control used in narrow (stabilized) scan widths.

(4) Band Switch Lever: Frequency range selection control. Bi-directional control, rotates Frequency Scales and Frequency Band Shaft Encoder. Shaft Encoder controls digital logic to provide automatic attenuation of 1st LO (YIG-tuned oscillator) tuning ramp to maintain calibration on harmonic mixing. The logic circuitry also controls the input mixer bias and gain of the RF Section to maintain absolute calibration. In addition, the logic circuitry controls relay switching for external mixer operation (10.4 to 40 GHz) and for 2nd converter bypass (1+ and 1-* bands).

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

(5) TUNING STABILIZER Switch: Used to lock the 1st LO to a harmonic of a voltage-tuned crystal oscillator for scan widths of 100 kHz per division or less.

(6) Dial Pointer: Indicates center frequency to which analyzer is tuned by FREQUENCY Control (2) in PER DIVISION and ZERO scan modes. Also indicates LO center frequency in PER DIVISION and ZERO scan modes. Indicates marker frequency in FULL scan mode. Ganged to FREQUENCY Control; FINE TUNE does not move dial pointer.

(7) BANDWIDTH Control: Selects 3 dB IF bandwidths to determine analyzer resolution in ZERO and PER DIVISION positions of SCAN WIDTH Mode Switch (10). 300 kHz bandwidth automatically selected in FULL scan mode.

(8) EXT MIXER BIAS: Adjusts bias on external wave-guide mixer diode; adjusted for optimum mixer sensitivity.

(9) SCAN WIDTH PER DIVISION: Indicates frequency scan calibration; scan widths from 2 kHz/div to 200 MHz/div are selectable. Scan is symmetrical about center frequency selected by FREQUENCY (2) and FINE TUNE (3). Enabled by SCAN WIDTH mode switch (10).

(10) SCAN WIDTH Mode Switch: Selects ZERO, PER DIVISION (9) or FULL scan modes. In ZERO scan mode, analyzer acts as a fixed tuned receiver at the frequency selected by FREQUENCY (2) and FINE TUNE (3). In FULL scan mode, the analyzer scans the full range of the selected frequency band.

(11) AMPL CAL: Used to match RF Section with IF Section. Sets overall gain of analyzer for absolute amplitude calibration.

(12) Frequency BANDS: Set of fourteen, indicates frequency ranges of analyzer. Green dot on Frequency Scale also indicates frequency BAND selected.

(13) Frequency Scale: Set of fourteen scales, selected by frequency BAND lever.

(14) YIG-tuned Oscillator (LO) Fundamental Frequency Scale: Pointer indicates LO center frequency.

(15) INPUT ATTENUATION: Attenuates input signal from 0 to 50 dB in 10 dB steps. Maximum input signal for 1 dB signal compression, indicated on outer dial scale.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01-18 GHz Connector	+33	2	±20	10	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels lsited apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

(16) DISPLAY UNCAL: Display uncalibrated warning lights when relationship between scan time, scan width, bandwidth, and video filtering is such that accuracy of vertical calibration is impaired.

(17) EXT MIXER Input: External mixer input for analyzer operation over (10)4 to 43 GHz frequency range. BNC female connector; accepts cable from external mixer. Supplies LO signal to external mixer and returns IF Signal from mixer. Terminate in 50 ohm load when not in use. See Figure 3-6, External Mixer Operation.

CAUTION

To prevent damage to external mixer do not apply more than 1 mW to 11517A mixer.

(18) FIRST LO OUTPUT: 2 to 4 GHz output from YIG-tuned oscillator. Female BNC connector, terminate in 50-ohm load when not in use.

(19) SECOND LO OUTPUT: (1)5 GHz output from second LO. Female BNC connector, terminate in 50-ohm load when not in use.

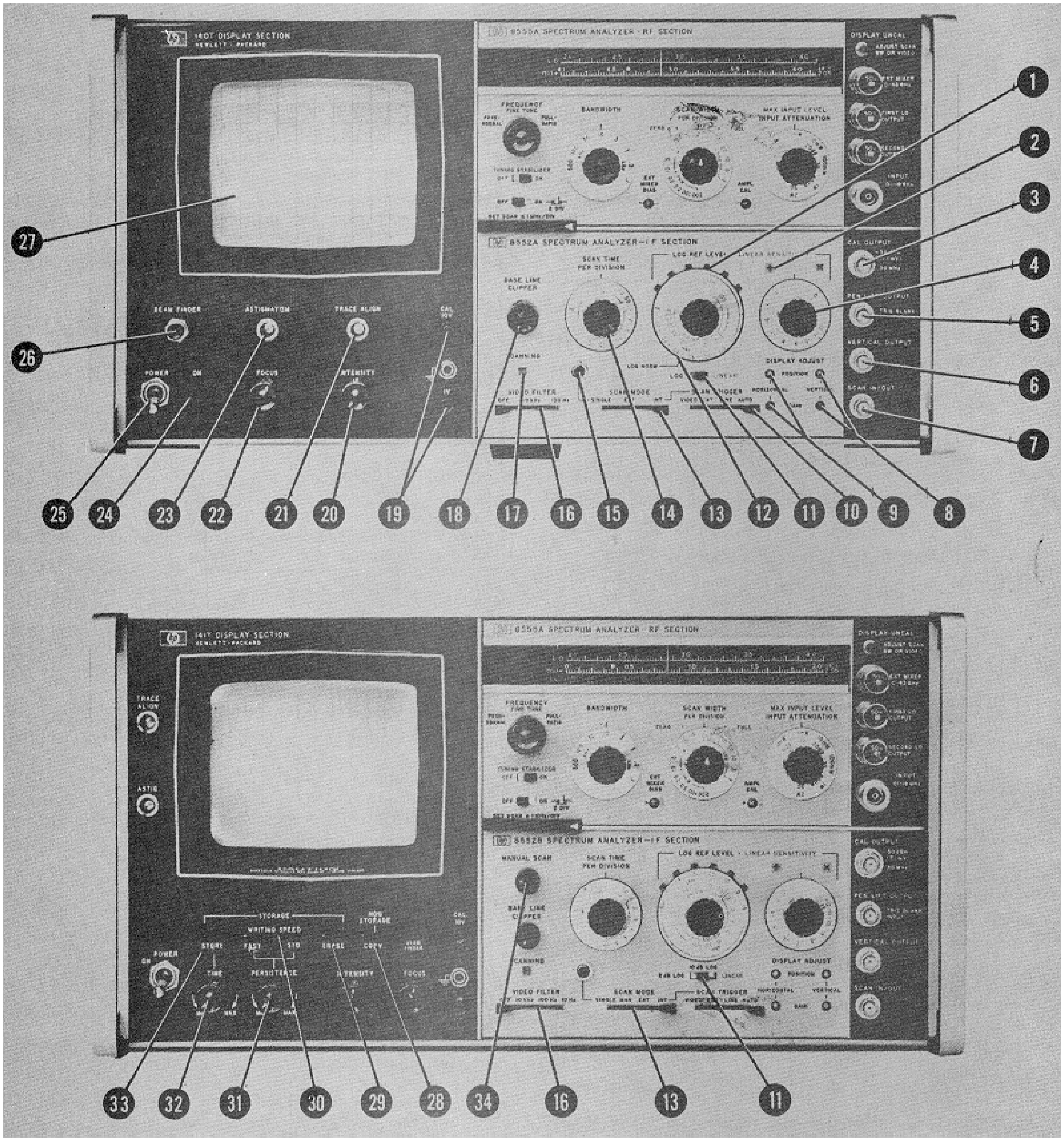
(20) RF INPUT: Input for .01 to 18 GHz signals. Female type N connector (Option 001 APC-7 connector).

CAUTION

See (15) above.

*Indicates 550 MHz FIRST IF.

Figure 3-1. Front Panel Controls Connectors and Indicators (cont'd)



(1) With LOG/LINEAR switch (11) set to LOG, lighted index lamp refers matching dB graduation to top LOG REF line of graticule; for example, if -30 dBm Is opposite lighted lamp, then top LOG REF line is -30 dBm and so serves as an absolute amplitude reference. With LOG/LINEAR switch set to LINE .lighted index lamp indicates the matching voltage graduation to be used as a per-division multiplier foe calibrated voltage readings (blue marking).

Figure 3-2. Typical Display and IF Section Controls, Connectors and Indicators

(2) Plus"+" lights when logarithmic amplification (11) is selected; times "x" lights when linear amplification (11) is selected. With "+" lighted, LOG REF line is sum (black numerals) of LOG REF LEVEL controls). With "x" lighted, per division absolute voltage amplitude is product of blue numeral LINEAR SENSITIVITY control settings.
(3) Provides a 30-MHz signal at -30 dBm for amplitude calibration of spectrum analyzer.
(4) Indicates 1 dB increments for logarithmic amplification; indicates multiplication factors up to unity for linear amplification.
(5) Provides pen lift operation to HP 7005, 7035, 7004, 7034 and all new TTL compatible HP recorders. Provides input for external blanking signal (-(1)5V) for external scan mode operation. Provides input for external positive or negative trigger pulses (2-20V), normally negative, polarity selected by internal switch in IF Section) for external scan trigger operation.
(6) Detected video output proportional to vertical deflection on CRT.
(7) For receiving an external scan ramp or output coupling for the internally-generated scan ramp. Input or output function determined by INT/EXT positions of SCAN MODE switch.
(8) Adjusts vertical position and gain of trace.
(9) Adjusts horizontal position and gain of trace.
(10) Selects scan trigger mode.
(11) Selects 10 dB logarithmic or linear display mode in 8552A plus another 2 dB log position in 8552B.
(12) The dB graduation (black numerals), opposite the lighted index lamp, indicate the power level at the LOG REF graticule line on CRT when LOG/ LINEAR (11) is set to LOG. With LOG/LINEAR set to LINEAR, the voltage graduations (blue numerals), opposite the lighted index lamp, indicate the per division multiplier for calibrated voltage amplitude.
(13) Selects scan ramp mode. Ramp is internally generated for SINGLE/INT positions but it must be externally supplied for EXT position. (Refer to Item 7). Model 8552B has an added manual scan mode position. (Refer to Item 3(4))
(14) Controls SCAN TIME PER DIVISION.
(15) Press to initiate scan with SCAN MODE switch set to SINGLE. Press during scan to stop and reset scan.
(16) Selects 100 Hz, 10 kHz or OFF position of lowpass filter for detected video in 8552A plus an added 10 Hz in 8552B.
(17) Lights for duration of each scan for single and internal scan modes.
(18) Blanks lower part of trace to prevent over-exposure of photographs due to high intensity of baseline. Blanking function also prevents blooming with a variable-persistence storage display section.
(19) Provides 1- and 10-volt, peak-to-peak, 60 Hz squarewave outputs.

CAUTION

These calibrated outputs should never be used with the spectrum analyzer. (These outputs are for use only with the 1400-series oscilloscope plug-ins.)

(20) Adjusts brightness of CRT display.

CAUTION

Excessive brightness for a static or very slow-moving trace may burn the phosphor and permanently damage the CRT. This caution is applicable to both the fixed and variable-persistence/storage CRT; however, the latter is especially vulnerable to operational errors of this type.

(21) Makes base line parallel with the horizontal graticule line.
(22) Focuses CRT beam.
(23) Used with FOCUS control (22) to obtain smallest spot with maximum roundness.
(24) Lights when line voltage is applied and instrument is turned on.
(25) Switches line voltage to instrument.
(26) When used with 1400-series oscilloscope plug-ins, intensifies and returns beam to CRT, regardless of deflection potentials. Produces no effect on analyzer displays.
(27) Display CRT with graticule lines.
(28) Selects non-storage function.

CAUTION

Use storage function when possible to prevent damage to the CRT.

(29) Press to ERASE when in STD or FAST writing speed.
(30) Selects writing speed.
(31) Varies time the trace is visible.
(32) Selects storage time.
(33) Press to store signal display. Storage time (relative display brightness) in storage mode is adjusted by (32).
(34) Manual scan control positions the electron beam on CRT when using MAN SCAN mode.

Figure 3-2. Typical Display and IF Section Controls, Connectors and Indicators (cont'd)

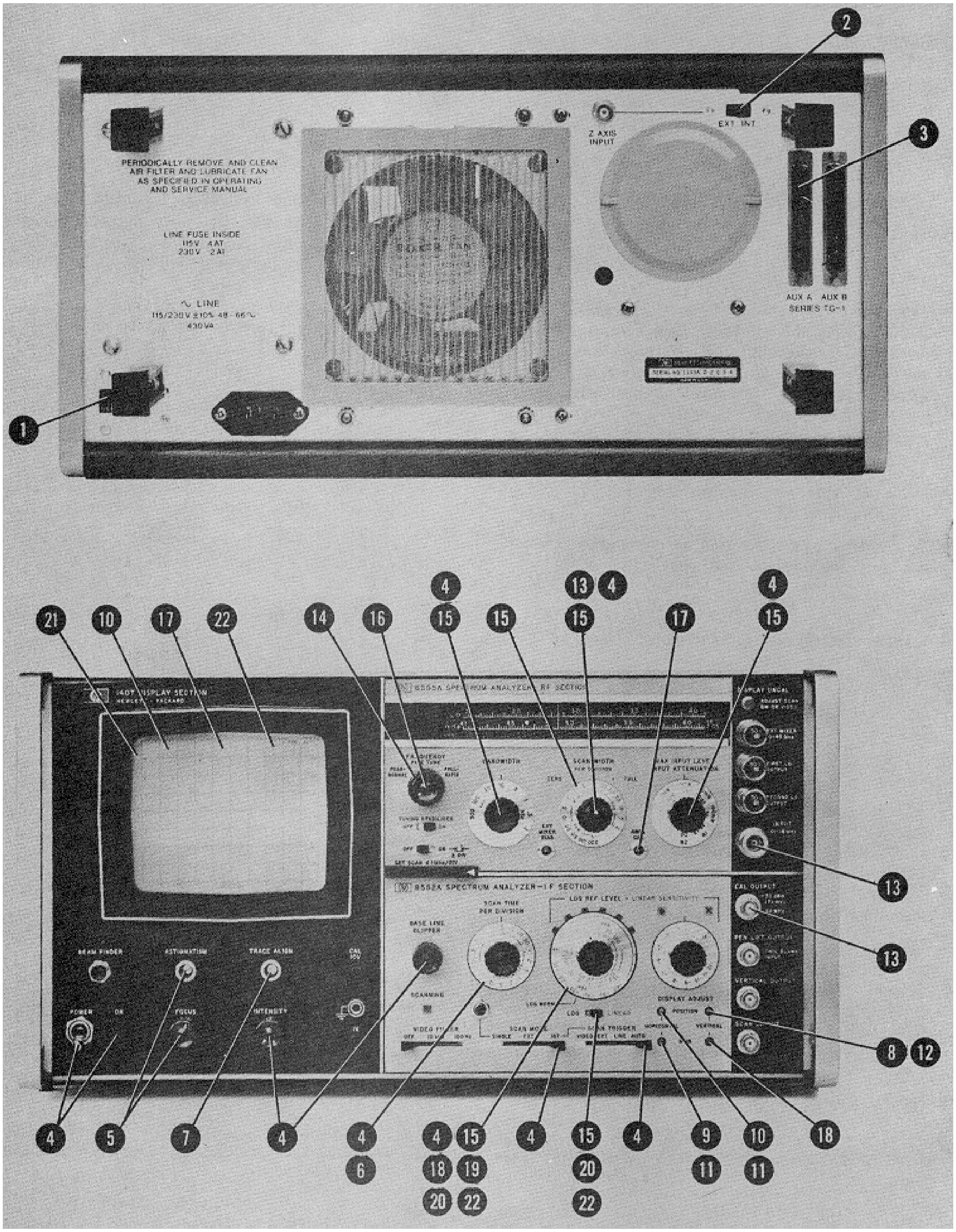


Figure 3-3. Operational Adjustments

INPUT POWER AND
INTENSITY MODULATION

(1) Set 115/230 switch to correspond with available input voltage. (The instrument is fused for 115-volt, 50/60 Hz operation; if 230-volt power is used, refer to the display section service manual for fuse replacement procedures.)
(2) Set INT/EXT switch to INT. (Set to EXT only if CRT is to be externally modulated - normally used with 1400-series time-domain plug-ins.)
(3) Connect 50-ohm termination AT(4)

FOCUS AND ASTIGMATISM ADJUSTMENTS

(4) Set:
POWER ON (up; observe that ON lamp lights)
BASE LINE CLIPPER, fully ccw
SCAN WIDTH (inner/red) to ZERO
INPUT ATTENUATION to 10 dB
BANDWIDTH to 0.3 kHz
SCAN TIME PER DIVISION to 10 SECONDS
SCAN MODE to INT.
SCAN TRIGGER to AUTO
TUNING STABILIZER to ON
FINE TUNE Control centered
LOG/LINEAR to LOG
LOG REF LEVEL Vernier: max CCW
INTENSITY clockwise until trace is medium bright (approx. 1 o'clock position).
BAND to 0-(2)05 GHz
VIDEO FILTER to OFF
(5) Adjust FOCUS and ASTIGMATISM controls until combined effect produces best resolution (maximum roundness without fuzz) of the dot.

TRACE ALIGNMENT

(6) Set SCAN TIME PER DIVISION to 10 MILLISECONDS.
(7) If not already aligned, adjust TRACE ALIGN until trace is aligned with horizontal line of graticule.

HORIZONTAL POSITION AND GAIN

(8) For convenience in making these adjustments, move trace to upper half of graticule by adjusting the VERTICAL POSITION control.
(9) Rotate HORIZONTAL GAIN until trace is of minimum length.
(10) Rotate HORIZONTAL POSITION until trace is centered on CENTER FREQUENCY line of graticule.
(11) Alternately adjust HORIZONTAL POSITION/GAIN controls until trace begins at first line of graticule and ends at last.
(12) Readjust VERTICAL POSITION until trace aligns with bottom line of graticule.

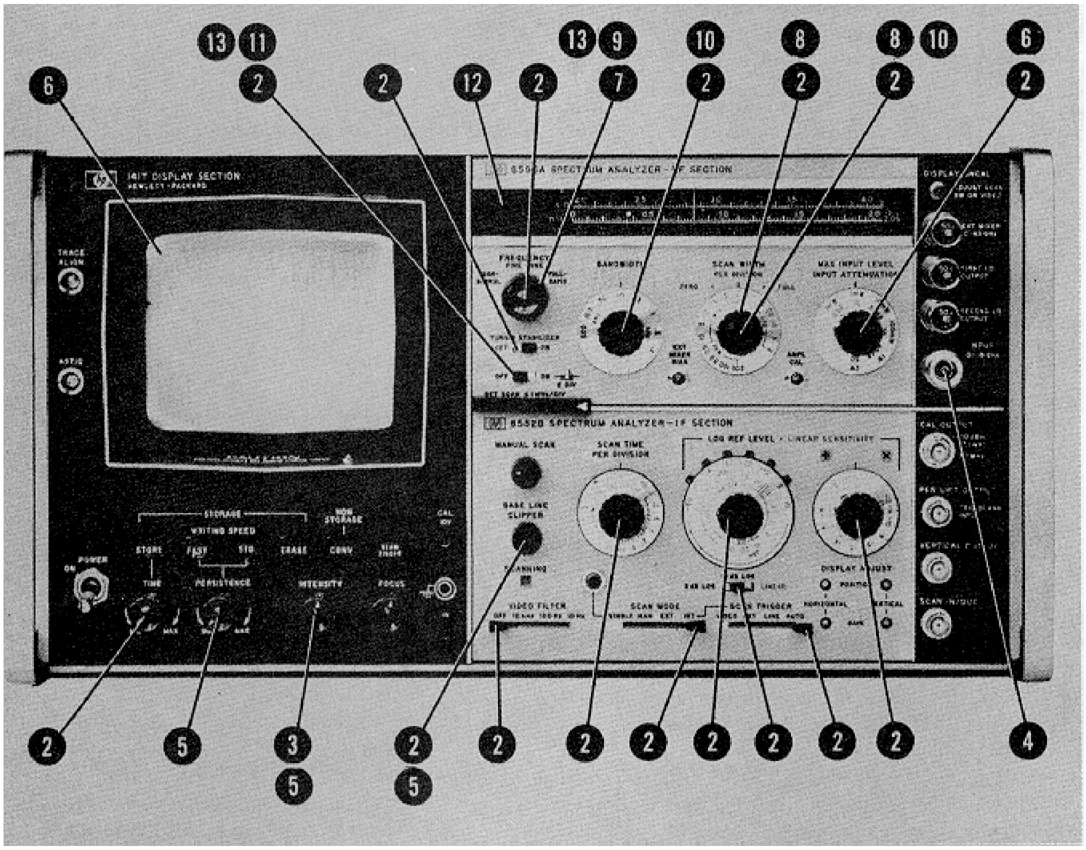
VERTICAL POSITION AND GAIN

(13) Connect CAL OUTPUT (30 MHz' -30 dBm) signal to RF INPUT; select 100 kHz BANDWIDTH, 10 MHz PER DIVISION SCAN WIDTH and set LOG REF LEVEL to +10 dBm.
(14) Tune FREQUENCY to align LO feedthru signal on -3 graticule line. The 30 MHz calibration signal should appear at the CENTER FREQUENCY graticule line with a harmonic at the +3 graticule line (60 MHz). The dial marker should indicate approximately 30 MHz.
(15) Reduce SCAN WIDTH PER DIVISION to 0.2 MHz. Center signal on display with FREQUENCY control. Reduce SCAN WIDTH PER DIVISION to 2 kHz (keep signal centered on display with FINE TUNE). Set LOG REF LEVEL to -30 dBm.
(16) FINE TUNE to center signal on display.
(17) Rotate AMPL CAL until trace is centered on top line of graticule at the CENTER FREQUENCY position.
(18) Rotate LOG REF LEVEL counterclockwise and note that the signal decreases one division (10 dB) for each calibrated switch position. If trace moves one division per step in lower part of graticule but the amplitude creeps upward near top of graticule, adjust VERTICAL GAIN until each step is equal.

LINEAR AND LOGARITHMIC ADJUSTMENT

(19) Rotate LOG REF LEVEL control until signal trace appears on fourth graticule line from bottom.
(20) Set LOG/LINEAR switch to LINEAR and rotate LOG REF LEVEL control until 1 mV/DIV is matched with the lighted index lamp.
(21) Reading from bottom of graticule (LIN scale), signal amplitude should be (7)1 millivolts. If it is not, adjust AMPL CAL for a signal amplitude of (7)1 millivolts.
(22) Set LOG/LINEAR switch to LOG. Rotate LOG REF LEVEL control until -30 dBm graduation matches the lighted index lamp. Signal trace should align with top (LOG REF) line of the graticule.

Figure 3-3. Operational Adjustments (cont'd)



(1) Perform Operational Adjustments, Figure 3-3

(2) Set controls as follows:

POWER .... ON
BANDWIDTH .... 300 kHz
SCAN WIDTH .... FULL
SCAN WIDTH PER DIVISION .... 20 MHz
INPUT ATTENUATION .... 50 dB
FINE TUNE .... Centered
TUNING STABILIZER .... ON
SIGNAL IDENTIFIER .... OFF
BASE LINE CLIPPER .... 9 o'clock
SCAN TIME PER DIVISION .... 0.2 SECONDS
LOG REF LEVEL .... +10 dBm
LOG REF LEVEL Vernier .... max CCW
LOG/LINEAR .... 10 dB LOG
SCAN MODE .... INT
SCAN TRIGGER .... AUTO
VIDEO FILTER .... 10 kHz

Figure 3-4. General Operating Instructions, .01 to 18.0 GHz

(3) Adjust INTENSITY for a display trace.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01 - 18 GHz Connector	+33	2	±20	20	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

(4) Connect input signal (any frequency between 10 MHz and 18 GHz) to RF INPUT.

(5) Adjust PERSISTENCE, INTENSITY and BASE LINE CLIPPER for a display trace without blooming.

(6) Observe display for presence of a signal. If a signal is not observed, reduce INPUT ATTENUATION in steps while observing display for a signal.

(7) When a signal (or signals) is obtained on the display, tune FREQUENCY control to position inverted marker under signal (under largest signal, if more than one signal is viewed on the display).

(8) Set SCAN WIDTH to PER DIVISION, SCAN TIME PER DIVISION to 20 MILLISECONDS and adjust INTENSITY for a convenient display.

(9) Center signal on display with FREQUENCY control.

(10) Reduce SCAN WIDTH PER DIVISION to 1 Mhz and BANDWIDTH to 30 kHz, keeping signal centered on display with FREQUENCY control. Increase SCAN TIME PER DIVISION to 50 MILLISECONDS.

(11) Set SIGNAL IDENTIFIER to ON. Note amount and direction signal shifts on alternate scan traces.

(12) Rotate Frequency Scales with Band Switch Lever until the signal shifts two divisions to the left on alternate scans and is approximately 5 dB less in amplitude.

NOTE

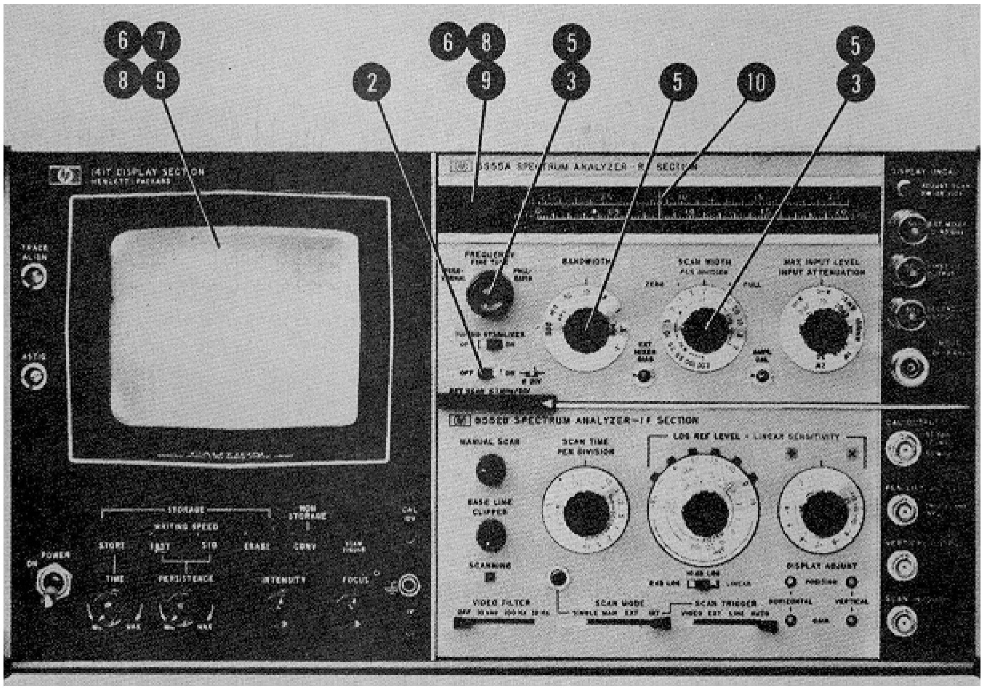
When switching from the n=1+, 550 Mhz IF Frequency Bands, allow a few seconds for instrument stabilization. Voltage to the 2nd LO (1.5 GHz) is removed when these bands are selected.

(13) Set SIGNAL IDENTIFIER switch to OFF. Center signal on CRT with FREQUENCY control. Read frequency of signal indicated by cursor on Frequency Scale.

(14) If additional signals were observed during step 7 above, they may be identified in the same manner. Set SCAN WIDTH to FULL, SCAN WIDTH PER DIVISION to 20 MHz, BANDWIDTH to 30 kHz, and SCAN TIME PER DIVISION to 0.2 SECONDS. Tune FREQUENCY control to position inverted marker under signal of interest. Repeat steps 8 through 13 to identify signal frequency.

Figure 3-4. General Operating Instructions, .01 to 18.0 GHz (cont'd)

Operation



NOTE

This procedure is given in two parts. Steps 1 through 10 provides one signal identification technique for use during normal operation. Steps 11 through 27 provides a procedure for operator familiarization.

(1) Center unknown signal on the display (use FlNE TUNE when analyzer is stabilized).

(2) Set SIGNAL IDENTIFIER switch to ON.

(3) Reduce SCAN WIDTH PER DIVISION to 1 Mhz. Keep signal centered on display with FINE TUNE control

(4) Alternate sweep scans across the display. CRT will displace the unknown signal to the left or right of center.

Figure 3-5. Signal Identification Technique

(5) Reduce SCAN WIDTH PER DIVISION and BANDWIDTH to separate other signals on the display. Keep the signal under investigation centered on the display.

(6) Note direction and spacing of signal shift on the CRT. When the correct harmonic (n) number and sign (+ or -) is selected by the BAND Switch Lever the signal will shift two divisions to the left. The shifted signal is reduced in amplitude by approximately 5 dB.

(7) If signal shifts to the right two divisions, the harmonic number is correct, however the sign (+ or - on the left edge of the Frequency Scale is wrong.

(8) If the signal shifts less than two divisions on the CRT, press the BAND Switch Lever "up" to increase the harmonic number. Note that the signal shifts in the opposite direction with each change in sign and increases in width with each increasing harmonic number.

(9) Change Band Switch Lever until the signal shift is two divisions apart with the reduced signal on the left. FINE TUNE to align the reduced signal on the -2 graticule line with the signal to be identified on the Center Frequency graticule line.

(10) Read frequency indicated by the cursor on the Frequency Scale. The signal frequency is related to the first LO harmonic by the equation Fsig = nFLO ± IF.

where Fsig = signal frequency
n = harmonic number
FLO = LO fundamental frequency
IF = frequency of first IF

NOTE

In the following familiarization procedure a known input signal is applied and the harmonic numbers producing the signals on the CRT display are identified. The input mixer is overdriven to produce signals that would not normally be present on the display.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01 - 18 GHz Connector	+33	2	±20	20	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

(11) Set analyzer controls as follows.

FREQUENCY....................................Full CCW
FINE TUNE ....Centered
BAND................................. n=(1) 0-(2)05 GHz
TUNING STABILIZER................................ ON
SIGNAL IDENTIFIER .... OFF
BANDWIDTH .... 100 kHz
SCAN WIDTH ....FULL
SCAN WIDTH PER DIVISION .... 20 MHz
INPUT ATTENUATION .... 50 dB
VIDEO FILTER..................................... 10 kHz
SCAN TIME PER DIVISION......0.2 SECONDS
SCAN MODE..INT
SCAN TRIGGER .... AUTO
LOG/LINEAR..LOG
LOG REF LEVEL .... (+30 dBm)*
POWER.. ON
WRITING SPEED .... STD
INTENSITY.......................................12 o'clock
PERSISTENCE..MAX

*2 steps CCW from +10 dBm

Figure 3-5. Signal Identification Technique (cont'd)

(12) Adjust INTENSITY for a visible scan trace without blooming. ERASE display as necessary between adjustments. Adjust BASE LINE CLIPPER to blank lower portion of scan trace. Repeat adjustments as necessary during the following steps.

CAUTION

INPUT ATTENUATION should be set to at least 20 dB before proceeding with the following step.

(13) Remove 50-ohm termination from SECOND LO OUTPUT and connect a cable from SECOND LO OUTPUT to RF INPUT.

(14) Tune FREQUENCY control to position the marker under the signal between the +2 and +3 graticule lines.

(15) Note reading on Frequency Scale. Cursor indicates 1.5 GHz.

(16) Switch SCAN WIDTH to PER DIVISION. Center signal on display with FREQUENCY control. ERASE display to remove stored signals.

(17) Set PERSISTENCE to MIN, SCAN WIDTH PER DIVISION to 1 MHz and SCAN TIME to 20 MILLISECONDS.

(18) Center signal on display. Set SIGNAL IDENTIFIER to ON. Note signal shifts to the left and is reduced in amplitude on alternate sweep scans.

(19) Set SCAN WIDTH PER DIVISION to 20 Mhz, SCAN WIDTH to FULL, INPUT ATTENUATION to 40 dB and SCAN TIME PER DIVISION to 0.2 SECONDS.

(20) Note signal display similar to Figure 3-5a. Decrease INPUT ATTENUATION to 30 dB. Note display similar to Figure 3-5b. Note that some signal levels increased more than 10 dB. The input mixer is being overdriven (see Mixer Diode Characteristics, paragraph 3-13).

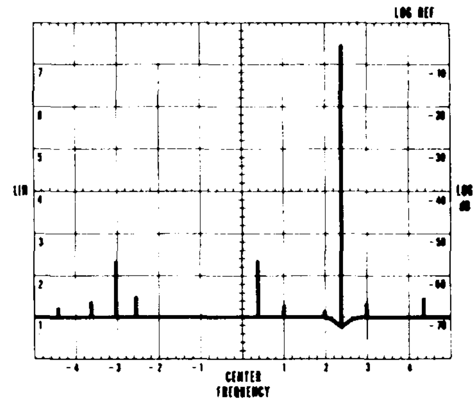


Figure 3-5a.

(21) Tune FREQUENCY control to place marker under signal at +3 graticule line.

(22) Set PERSISTENCE to MIN, SCAN WIDTH to PER DIVISION, SCAN WIDTH PER DIVISION to 10 MHz and SCAN TIME PER DIVISION to 50 MILLISECONDS. Center signal on display with FREQUENCY control. Reduce SCAN WIDTH PER DIVISION to 1 MHz. Note amount and direction of signal shift.

(23) Select n=3- 4.10 to 10.25 GHz Frequency BAND. Note change in direction and amount of shift as BAND Switch Lever is pressed. Read frequency on Frequency Scale (9 GHz).

Figure 3-5. Signal Identification Technique (cont'd)

(24) Set SCAN WIDTH to FULL and tune FREQUENCY to place marker under any signal on the display. Disregard DISPLAY UNCAL light at this time. Repeat step 22 for selected signal.

(25) Change BAND Switch Lever until the correct display is obtained. Read frequency of signal on Frequency Scale.

(26) The signal at the -4.2 graticule line (just above the analyzer's noise level) is the 9 GHz signal from the n=5- harmonic. Signal shifts to the left approximately 1 and 2/3-divisions on n=4 -Frequency Band.

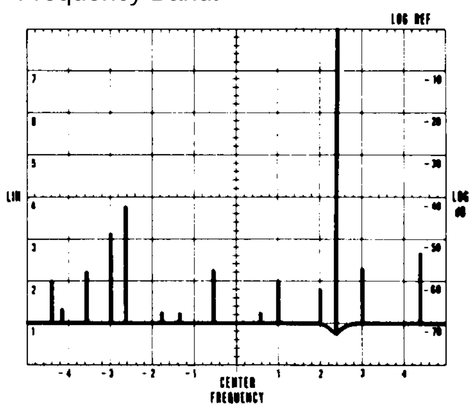


Figure 3-5b

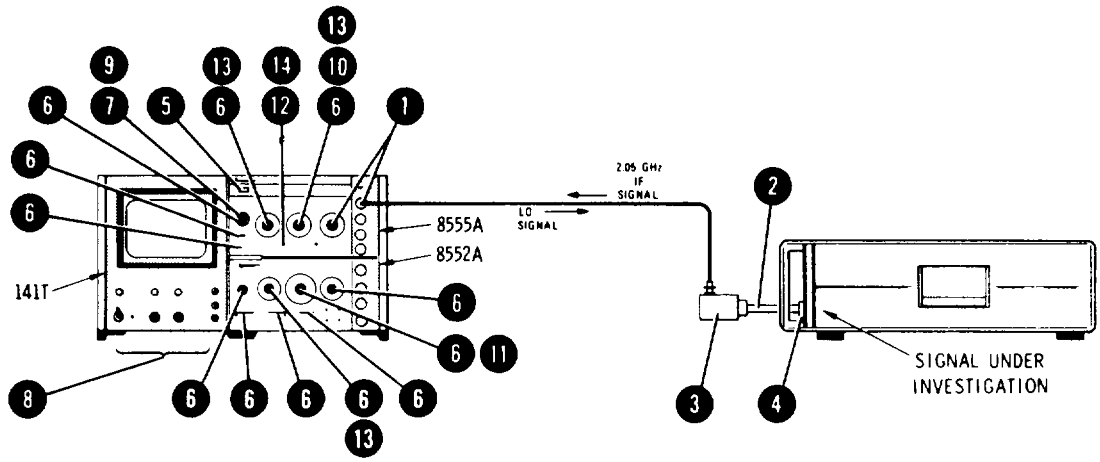
(27) Signals shown in Figure 3-5b (mixer overdriven) are as follows:

Graticule Line	Harmonic	Frequency Scale
-4.4	n = 3-	4.5 GHz
-4.2	n = 5-	See step 26
-3.0	n = 1+	4.5 GHz
-2.6	n = 2-	3.0 GHz
-1.8	n = 3-	6.0 GHz
-1.6	n = 2+	7.5 GHz
-1.4	n = 4-	9.0 GHz
+0.6	n = 3-	7.5 GHz
+1.0	n = 2-	4.5 GHz
+2.0	n = 2+	9.0 GHz
+2.4	n = 1-	1.5 GHz
+3.0	n = 3-	9.0 GHz
+4.4	n = 1+	6.0 GHz

(28) Use the formula below to determine the harmonic mixing mode for modes not on the Frequency Scales (i.e., 5, 7, 8 and 9).

$$n_{true} = \frac{2cm}{\text{actual shift}} \times (\text{displayed } n)$$

Figure 3-5. Signal Identification Technique (cont'd)



NOTE
Amplifier is not calibrated when using external mixer.

(1) Set INPUT ATTENUATION to 20 dB*. Connect cable supplied with waveguide mixer to EXT MIXER input.

CAUTION

Discharge cable to avoid damage to mixer diode. Touch edge of male BNC connector on cable to edge of female BNC connector on mixer to discharge cable. See 11517A Operating Note.

(2) Connect cable to mixer. The LO signal from the RF Section and the mixing products to the RF Section are carried in this cable.
(3) Connect appropriate waveguide adapter to the mixer.
(4) Connect waveguide adapter to signal source. For linear operation, adjust signal source for output no greater than .03 milliwatt. For minimum intermodulation and spurious signals, keep input signal level at -30 dBm or below.
(5) Set Frequency Band Switch to lowest BAND which covers range of signal under investigation. (External mixer bands are as follows: n=6- (10)25 - (22)55 GHz; n=6+ (14)35 - 2(6)65 GHz; n=10 - 1(8)45 - 3(8)95 GHz and n=10 + (22)55 -4(3)05 GHz.) When other bands are selected the external mixer circuit path is opened by coaxial switches in the RF Section.
(6) Set Analyzer controls as follows:
POWER ....ON
BAND ....See step 5
FINE TUNE .... Centered
BANDWIDTH ....300 kHz
SCAN WIDTH ....FULL
SCAN WIDTH PER DIVISION........... 10 MHz
TUNING STABILIZER .... ON
SIGNAL IDENTIFIER............................... OFF
BASE LINE CLIPPER......................12 o'clock
SCAN TIME PER DIVISION....0.2 SECONDS
LOG REF LEVEL......................................0dB
LOG REF LEVEL Vernier ....CCW
VIDEO FILTER .... OFF
SCAN TRIGGER .... AUTO
SCAN MODE ....INT
(Input attenuator Is not in external mixing circuit, but switch controls position of LOG REF LEVEL index lamps and attenuator provides termination for internal mixer input port to decrease crosstalk.)

(7)
(8) Adjust Display Section for a convenient display. (WRITING SPEED-STD, PERSISTENCE--MIN, INTENSITY-approximately 12 o'clock.)
(9) Adjust FREQUENCY control to position marker under signal of interest.
(10) Set SCAN WIDTH to PER DIVISION and adjust FREQUENCY control to center signal on display.
(11) Adjust LOG REF LEVEL for a convenient signal-to-noise ratio.
(12) Adjust EXT MIXER BIAS for best signal trace.
(13) Adjust BANDWIDTH, SCAN WIDTH PER DIVISION and SCAN TIME PER DIVISION to obtain best detail in region of interest.
(14) Readjust EXT MIXER BIAS for maximum amplitude.

Figure 3-6. External Mixer (HP 11517A) Operating Instructions

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. This section contains front panel checks and performance tests for the 8555A Spectrum Analyzer RF Section. Front panel checks for routine inspection are given in Table 4-1. Procedures for verifying that the instrument meets specifications are given in (paragraphs 4-20 through 4-26).

4-3. Perform tests in procedural order, with the test equipment called for, or with its equivalent. During any performance test, all shields and attaching hardware must be in place; the RF and IF sections must be installed in the display section.

4-4. EQUIPMENT REQUIRED

4-5. Test equipment and test accessories for performance (P), adjustment (A) and troubleshooting (T) are listed in Tables 1-4 and 1-5. Critical specifications and/or required features, for the test equipment and accessories are contained in the test equipment and test accessories tables.

4-6. FRONT PANEL CHECKS

4-7. Before proceeding to the performance tests, the instrument must be adjusted and all controls set as specified in the preset adjustment instructions in paragraphs 4-8 through 4-18. After the instrument controls are preset, proceed with the front panel checks and adjustments. The instrument should perform as called out in the check and adjustment procedures before going on to the performance tests (paragraphs 4-20 through 4-26).

4-8. Preset Adjustments

a. Turn the analyzer on and preset INTENSITY control to approximately 1 o'clock. While the analyzer is warming up, make the following control settings:

BAND.. 01-(2)05 GHz
FREQUENCY..50 MHz
FINE TUNE .... Centered
BANDWIDTH ....100 kHz
SCAN WIDTH ....PER DIVISION
SCAN WIDTH PER DIVISION ....10 MHz
INPUT ATTENUATION..10 dB
TUNING STABILIZER ....ON
SIGNAL IDENTIFIER ....OFF
BASE LINE CLIPPER.. CCW
SCAN TIME PER DIVISION.............. 5 MILLISECONDS
LOG/LINEAR..LOG
LOG REF LEVEL .... 0 dBm
LOG REF LEVEL Vernier..0
VIDEO FILTER... 10 kHz
SCAN MODE ....INT
SCAN TRIGGER..LINE

b. Connect CAL OUTPUT to RF INPUT using a BNC-to-type N cable. The analyzer display should be similar to Figure 4-1. Adjust FREQUENCY control to align the LO feedthrough signal on the left (-3) graticule of the CRT.

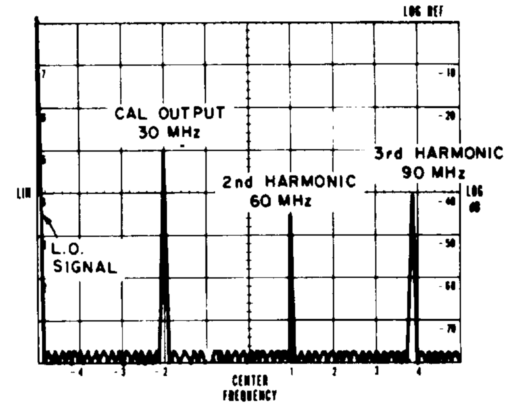


Figure 4-1. CRT Display, 0 to 100 MHz

4-9. Display Adjustments

a. Set LOG REF LEVEL max ccw.

b. Set SCAN TIME PER DIVISION to 10 SECONDS and adjust FOCUS and ASTIGMATISM for smallest round spot possible.

c. Reset SCAN TIME PER DIVISION to 10 MILLISECONDS. Adjust TRACE ALIGN so that the horizontal base line CRT trace is exactly parallel to the horizontal graticule lines.

4-10. RF and IF Section Adjustments

a. Adjust VERTICAL POSITION so that the horizontal base line CRT trace is exactly on the bottom horizontal graticule line of the CRT.

b. Set FREQUENCY to position the LO feedthrough signal on the -3 graticule line. Cursor should indicate approximately 30 MHZ on the frequency scale.

c. Adjust HORIZONTAL POSITION so display is centered on the CRT. Adjust HORIZONTAL GAIN until the displayed scan trace is exactly ten divisions wide. Some interaction between HORIZONTAL POSITION and GAIN adjustments may occur, requiring slight readjustment of the controls.

d. Set LOG REF LEVEL to 0 dBm. The amplitude of the center frequency signal (30 Mhz) should be approximately -30 dBm. The amplitudes of the individual signals may be slightly different.

NOTE

The other signals on the display are the first LO feedthrough (zero frequency) at the -3 graticule and the second harmonic of the 30 MHz calibrator signal at the +3 graticule.

e. Adjust FREQUENCY control to center 30 MHz calibrator signal, if necessary. Reduce SCAN WIDTH PER DIVISION to 10 kHz. Use FINE TUNE to center the signal on the display. With the TUNING STABILIZER set to ON (paragraph 4-8a) the analyzer's First LO is automatically locked to a crystal oscillator reference for the blue color-coded SCAN WIDTH positions. The FREQUENCY control should not be used to fine tune the analyzer; frequency would tune in 1 Mhz steps.

f. Reduce BANDWIDTH to 10 kHz keeping the 30 MHz signal centered on the display with the FINE TUNE control, if necessary.

g. Adjust the LOG REF LEVEL controls so the maximum signal amplitude is exactly on the -70 dB graticule line. (Adjust AMPL CAL signal level if necessary.) Rotate LOG REF LEVEL control seven steps in the clockwise direction. The amplitude of signal should increase in increments of one division per 10 dB step. See Figure 4-2.

h. Adjust VERTICAL GAIN to place maximum signal amplitude exactly on the LOG REF (top) graticule line.

i. Repeat steps g and h to obtain optimum adjustment of VERTICAL GAIN (increments as close to one division per 10 dB step as possible).

4-11. Ampl Cal Adjustment

a. Set the LOG REF LEVEL controls to -30 dBm (-30 and 0 on vernier).

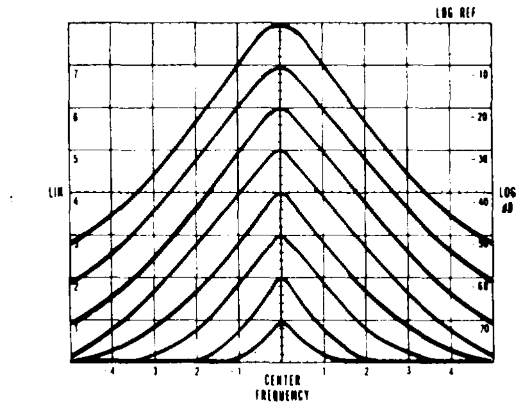


Figure 4-2. Vertical Gain Adjustment

b. Adjust AMPL CAL so that the signal amplitude (-30 dBm) is exactly on the LOG REF (top) graticule line of the CRT.

The analyzer is now calibrated in the LOG display mode.

4-12. AMPL CAL CHECK FOR LINEAR SENSITIVITY ACCURACY

4-13. In the LINEAR display mode the vertical display is calibrated in absolute voltage. For LINEAR measurements the LIN scale factors on the left side of the CRT and the blue color-coded scales of the LINEAR SENSITIVITY controls are used. The signal voltage is the product (note lighted "x" lamp) of the CRT deflection and LINEAR SENSITIVITY control settings. It is usually most convenient to normalize the LINEAR SENSITIVITY Vernier by setting it to "1" (blue scale).

a. Set LINEAR SENSITIVITY to 1 mV/DIV (1 mV x 1). Set the LOG/LINEAR switch to LINEAR. Since the -30 dBm calibrator output is equal to approximately 7.1 mV (across 50 ohms) the CRT deflection should be approximately 7.1 divisions.

b. Adjust AMPL CAL on the 8555A for approximately 7.1 division CRT deflection, if necessary. (LINEAR display is more expanded than the compressed LOG display, so adjustment of the AMPL CAL control can be made with more resolution in LINEAR without noticeable effect of the LOG calibration.)

The analyzer is now calibrated for both the LOG and LIN display modes.

4-14. FRONT PANEL CHECKS

a. Perform the Preset Adjustments, Display Adjustments and the RF and IF Adjustments (paragraphs 4-8 through 4-13) prior to performing the Front Panel Checks listed in Table 4-1.

b. With the analyzer controls as they were at the completion of the adjustment procedures, perform the following steps.

1. Set LOG/LINEAR switch to LOG.

2. Set LOG REF LEVEL to -10 dBm.

c. Perform Table 4-1 Front Panel Checks.

4-15. PERFORMANCE TESTS

4-16. The performance test given in this section are suitable for incoming inspection, troubleshooting, or preventive maintenance. During any performance test, all shields and connecting hardware must be in place and the RF section and IF section must be installed in the display section. The tests are designed to verify published instrument specifications. Perform the tests in the order given, and record data on test card (Table 4-4) and/or in the data spaces provided in each test.

4-17. The tests are arranged in the following order:

Paragraph	Test Description
4-20	Scan Accuracy (Linearity)
4-21	Frequency Response
4-22	Sensitivity (Average Noise Level)
4-23	Noise Sidebands
4-24	Residual FM
4-25	Tuning Dial Accuracy
4-26	Residual Responses

4-18. Each test is arranged so that the specification is written as it appears in the Table of Specifications in Section I. Next, a description of the test and any special instructions or problem areas are included. Each test that requires test equipment has a test setup drawing and a list of required equipment. Step 1 of each procedure gives control settings required for that particular test.

4-19. Required minimum specifications for test equipment are detailed in Table 1-4 in Section I. If substitute test equipment is used, it must meet the specifications listed in order to performance-test the analyzer.

Table 4-1. Front Panel Checks

Function	Procedure	Result
Base Line Clipper	1. Turn BASE LINE CLIPPER cw. 2. Return clipper to ccw	1. At least the bottom two divisions should be blank.
Scan	(3) SCAN TIME PER DIVISION across its range. 4. Set to 20 MILLISECONDS.	3. Scan should occur in all positions.
Scan Width	5. Turn SCAN WIDTH PER DIVISION to 10 MHz. 6. Center CAL OUTPUT signal on display and set BANDWIDTH to 300 kHz. 7. Reduce SCAN WIDTH PER DIVISION to 100 kHz; use FINE TUNE to center display.	5. 30 MHz signal and second harmonic visible. DISPLAY UNCAL light is lit. 6. DISPLAY UNCAL light is extinguished. 7. Signal remains on-screen, centered.
Tuning Stabilization	8. Carefully turn FREQUENCY. 9. Turn TUNING STABILIZER to OFF; use FREQUENCY to center display. 10. Turn TUNING STABILIZER on, use FINE TUNE to center display.	8. Signal jumps to left or right hand off of the CRT (±+1 MHz). This corresponds to the 1 MHz oscillator in the automatic tuning stabilizer circuit. 9. Signal should jump < 1 division when TUNING STABILIZER is turned off. 10. Signal should jump < 1 division.
Bandwidth & Display Uncal Light	11. Reduce BANDWIDTH and SCAN TIME PER DIVISION using FINE TUNE to center display.	11. Display should be stable and viewable so long as DISPLAY UNCAL is unlit.
Signal Identifier	12. Return BANDWIDTH to 10 kHz: SCAN WIDTH PER DIVISION to 100 kHz; and SCAN TIME PER DIVISION to 20 MILLISECONDS. Set SIGNAL IDENTIFIER to ON. 13. Turn SIGNAL IDENTIFIER off. Set BANDWIDTH to 300 kHz and SCAN TIME PER DIVISION to 2 MILLISECONDS.	12. The 30 MHz calibrator signal is displaced 2 divisions to the left and reduced approximately 5 dB on alternate scan traces. 13. Analyzer displays the 30 MHz calibrator signal.
Calibration	14. Lit index light on LOG REF LEVEL control corresponds to top line of graticule; with input attenuation at 10 dB and LOG REF LEVEL at -10 dBm, signal level is -30 dBm.	14. Calibrator signal is at -30 dBm level (two divisions down from the top of graticule).
Gain Vernier	15. Turn LOG REF LEVEL Vernier cw.	15. Signal level increases by the amount marked on vernier dial.
Attenuators	16. Turn INPUT ATTENUATION and LOG REF LEVEL in 10 dB steps.	16. Signal increases or decreases one vertical division per 10 dB step.

PERFORMANCE TESTS

4-20. Scan Accuracy

SPECIFICATION: Frequency error between two points on the display is less than 10% of the indicated separation.

DESCRIPTION: Wide scan widths are checked using a comb generator directly. Narrow scan widths are checked using a comb generator modulated by an audio oscillator. Comb generator frequency components are aligned opposite graticule lines, and the amount of error is measured.

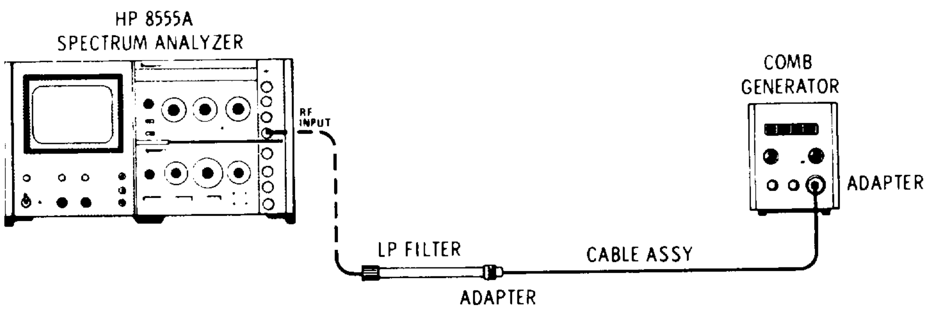


Figure 4-3. Scan Width Accuracy Test Setup

EQUIPMENT:

COMB GENERATOR	HP 8406A
AUDIO OSCILLATOR	HP 200CD
LP FILTER	HP 360C
CABLE ASSEMBLY	HP 10503A
CABLE ASSEMBLY	HP 11001A
ADAPTER (2)	UG-201A/U

1. Connect the test setup in Figure 4-3 and make the following control settings:

ANALYZER:

FREQUENCY	1.4 GHz
BANDWIDTH	300 kHz
SCAN WIDTH	PER DIVISION
SCAN WIDTH PER DIVISION	100 MHz
INPUT ATTENUATION	0 dB
SCAN TIME PER DIVISION	10 MILLISECONDS
LOG/LINEAR	LOG
LOG REF LEVEL	-20 dBm
VIDEO FILTER	OFF
SCAN MODE	INT
SCAN TRIGGER	AUTO
BAND	01-2.05 GHz

2. Set comb generator for a 100 MHz comb. A comb signal occurs every 100 MHz on the CRT display (see Figure 4-4). Tune FREQUENCY and FINE TUNE to line up a comb signal with the far left graticule line.

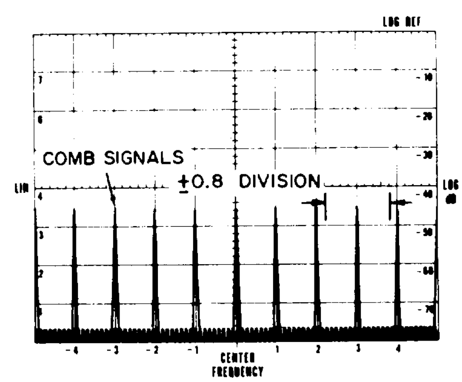


Figure 4-4. Scan Width Accuracy Measurement

PERFORMANCE TESTS

4-20. Scan Accuracy (cont'd)

3. Measure the amount of error in divisions that the comb signal deviates from the +3 graticule line. The comb signal should occur on the +3 line +0.8 division.

+2.2_____+3.8 div

4. Repeat steps 2 and 3 with SCAN WIDTH PER DIVISION set to 10 MHz and a comb frequency of 10 MHz.

+2.2_____+3.8 div

5. Repeat steps 2 and 3 with SCAN WIDTH PER DIVISION set to 1 MHz, BANDWIDTH at 10 kHz, SCAN TIME PER DIVISION to 20 MILLISECONDS, and a comb frequency of 1 MHz.

+2.2_____+3.8 div

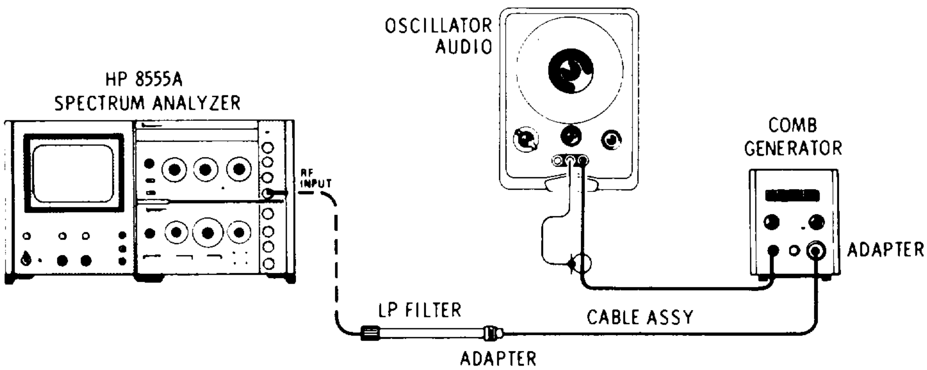


Figure 4-5. Scan Width Accuracy Test Setup

6. To test the 50 kHz SCAN WIDTH PER DIVISION setting, connect the test setup shown in Figure 4-5. Set controls as follows:

ANALYZER:

BANDWIDTH .... 3 kHz
SCAN TIME PER DIVISION .... 10 MILLISECONDS
SCAN WIDTH PER DIVISION .... 50 kHz
TUNING STABILIZER .... OFF

7. Set audio oscillator output frequency for 50 kHz and comb generator for 10 MHz comb. Maximize the comb signal amplitudes using the comb generator and audio oscillator output amplitude controls.

8. With controls set as in step 6 above, a comb signal occurs every 50 kHz on the display. Turn FINE TUNE to line up a comb signal with the far left graticule line.

4-20. Scan Accuracy (cont'd)

9. Measure the amount of error, in divisions, that the comb signal deviates from the +3 graticule line. The comb signal should occur on the +3 line +0.8 division.

+2.2_____+3.8 div

10. Repeat steps 6 through 9 with TUNING STABILIZER on.

4-21. Frequency Response

SPECIFICATION: With 10 dB input attenuator setting:

Frequency Range (Ghz)	Mixing Mode (n)	Frequency Response (dB max)
0.01-2.05	1-	± 1.0
1.50-3.55	1-	± 1.0
2.07-6.15	2.-	± 1.25
2.60-4.65	1+	± 1.0
4.11-6.15	1+	± 1.0
4.13-10.2.5	3-	± 1.5
6.17-10.2.5	2.+	± 1.5
6.19-14.35	4-	± 2.0
8.2.3-14.35	3+	± 2.0
10.2.9-18.00	4+	± 2.0

DESCRIPTION: A leveled signal source is applied to the input of the spectrum analyzer. As the source is tuned across each band of the analyzer, the analyzer CRT is observed for amplitude variations versus frequency.

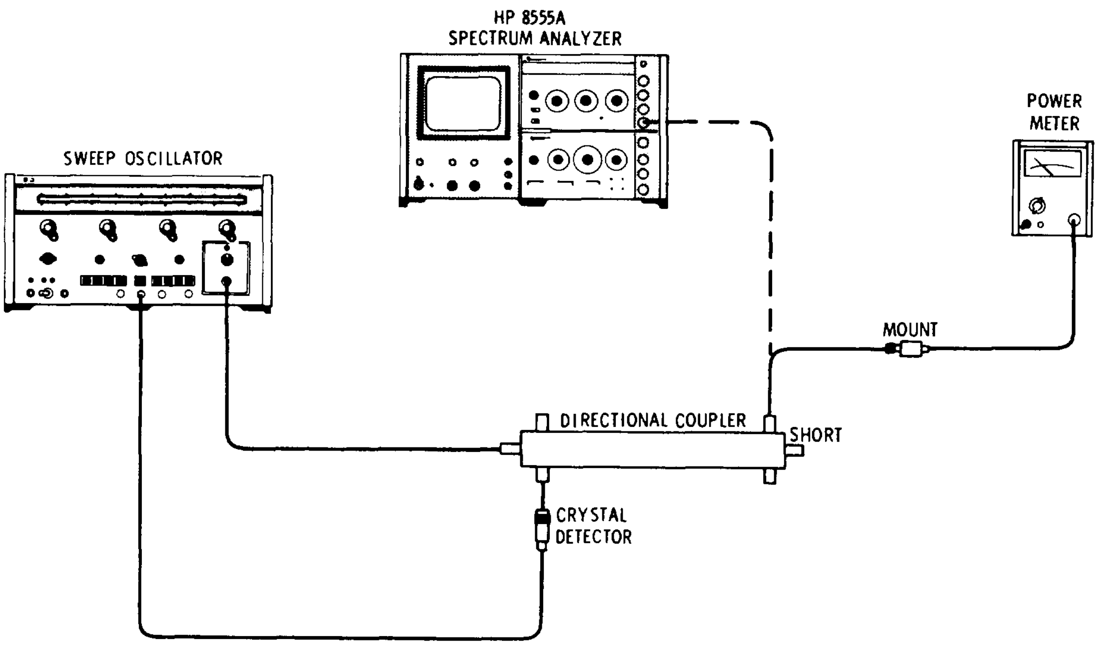


Figure 4-6. Frequency Response Test Setup, 0.1 to 2.05 GHz.

PERFORMANCE TESTS

4-21. Frequency Response (cont'd)

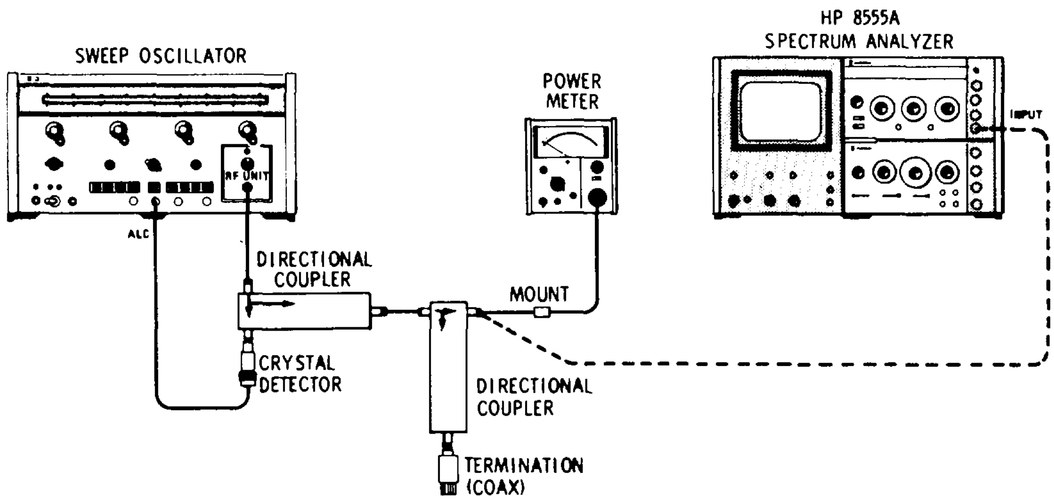


Figure 4-7. Frequency Response Test Setup, 1.5 to 18 GHz

EQUIPMENT:

SWEEP OSCILLATOR	HP 8690B
RF UNIT	HP 8699B
RF UNIT	HP 8693B
RF UNIT	HP 8694B
RF UNIT	HP 8695B
DUAL DIRECTIONAL COUPLER	HP 778D
DIRECTIONAL COUPLER (2)	HP 779D
CRYSTAL DETECTOR	HP 423A
POWER METER	HP 432A
THERMISTOR MOUNT	HP 8478B
OPTION 012 LOAD	HP 909A
TYPE N SHORT	HP 11512A

(1) Make the following analyzer control settings:

ANALYZER:

BAND	0.01-2.05 GHz
FREQUENCY	1 GHz
BANDWIDTH	300 kHz
SCAN WIDTH	PER DIVISION

PERFORMANCE TESTS

4-21. Frequency Response (cont'd)

SCAN WIDTH PER DIVISION ....200 MHz
INPUT ATTENUATION .... 10 dB
SIGNAL IDENTIFIER ....OFF
SCAN TIME PER DIVISION.... 10 MILLISECONDS
LOG/LINEAR.... LOG
LOG REF LEVEL .... -10 dBm
VIDEO FILTER....OFF
SCAN MODE.... INT
SCAN TRIGGER ....LINE

2. Connect the test setup shown in Figure 4-6 with the power meter connected at the output with the 8699B RF Unit installed in the Mainframe. Level the sweeper between 0.1 and 2.05 GHz for -10 to -20 dBm reading on the power meter.

3. With the sweeper set for CW operation, tune the sweeper between 0.1 and 2.05 GHz and note any amplitude variations as observed on the power meter. Any error must be subtracted from the frequency response measurements in the subsequent steps.

4. Connect the leveled output of the sweeper to the analyzer INPUT and tune the sweeper from 0.1 to 2.05 GHz. Amplitude variations should not exceed 0.2 divisions (+1.0 dB).

_____0.2 div

NOTE

The LINEAR display mode may be used to expand the vertical sensitivity if desired. Amplitude variations expressed in dB would then be equal to 20 log V_1/V_2 (where V_1/V_2 = amplitude variation units in volts).

5. Repeat steps 1 through 4 using the appropriate sweeper RF Unit and test setup, Figure 4-6 or 4-7 to check the remaining frequency bands of the analyzer. Adjust the analyzer FREQUENCY control and BAND to correspond to the frequency range being checked. The frequency response for each band should be within the limits tabulated below.

Table 4-2. Frequency Response

Frequency Range (GHz)	Mixing Mode (n)	IF Frequency (MHz)	Frequency Response (dB max.)
0.01- 2.05	1-	2050	± 1.0
1.50- 3.55	1-	550	± 1.0
2.07- 6.15	2-	2050	± 1.25
2.60- 4.65	1+	550	± 1.0
4.11- 6.15	1+	2050	± 1.0
4-13-10.25	3-	2050	± 1.5
6.17-10.25	2+	2050	± 1.5
6.19-14.35	4-	2050	± 2.0
8.23-14.35	3+	2050	± 2.0
10.29--18.00	4+	2050	± 2.0

4-22. Sensitivity

SPECIFICATION: Average noise level in a 1 kHz IF bandwidth with internal coaxial mixer:

.01-2.05	GHz	-115 dBm
1.50-3.55	GHz	-117 dBm
2.07--6.15	GHz	-108 dBm
2.60-4.65	GHz	-117 dBm
4.11-6.15	GHz	-115 dBm
4.13-10.25	GHz	-103 dBm
6.17-10.25	GHz	-105 dBm
6.19-14.35	GHz	- 95 dBm
8.23-14.35	GHz	-100 dBm
10.29-18.45	GHz	- 90 dBm

DESCRIPTION: Sensitivity is checked by observing the average noise power level of the analyzer using the analyzer's amplitude calibration and no input signal. The test is made using the 10 kHz IF bandwidth so that efficient use of the 100 Hz VIDEO FILTER is achieved. A 10 dB correction must then be made to give the equivalent 1 kHz bandwidth noise power level referred to the analyzer INPUT.

(1) Terminate the analyzer INPUT in 50 ohms.

(2) Make the following analyzer control settings:

BAND	1.50-3.55 GHz
FREQUENCY	1.5 GHz
TUNING STABILIZER	OFF
SIGNAL IDENTIFIER	OFF
BANDWIDTH	10 kHz
SCAN WIDTH	ZERO
INPUT ATTENUATION	0 dB
BASE LINE CLIPPER	ccw
SCAN TIME PER DIVISION	20 MILLISECONDS
LOG/LINEAR	LOG
LOG REF LEVEL	-50 dBm
LOG REF LEVEL Vernier	0
VIDEO FILTER	100 Hz
SCAN MODE	INT
SCAN TRIGGER	AUTO

(3) Tune FREQUENCY control across each band and note the average noise power level on the CRT display. The noise level should be less than the limits indicated in Table 4-3 for the appropriate BAND.

Table 4-3. Frequency Sensitivity, 10 kHz Bandwidth

BAND (GHz)	BANDWIDTH	Average Noise Level (dBm)
1.50-3.55	10 kHz	___________-107
2.60-4.65	10 kHz	___________-107
.01-2.05	10 kHz	___________-105
4.11-6.15	10 kHz	___________-105
2.07-6.15	10 kHz	___________- 98
6.17-10.25	10 kHz	___________95
4.13-10.25	10 kHz	___________- 93
8.23-14.35	10 kHz	___________- 90
6.19-14.35	10 kHz	___________- 85
10.29-18.45	10 kHz	___________-80

PERFORMANCE TESTS

4-23. Noise Sidebands

SPECIFICATION: For fundamental mixing. More than 70 dB below CW signal, 50 kHz or more away from signal, with 1 kHz IF bandwidth and 100 H-z video filter.

DESCRIPTION: A stable CW signal is applied to the spectrum analyzer and displayed on the CRT. The amplitude of the noise associated sidebands and unwanted responses close to the signal are measured.

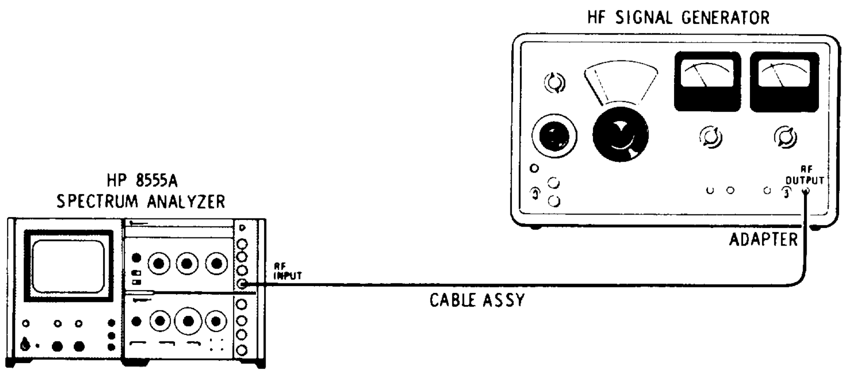


Figure 4-8. Noise Sideband Test Setup

1. Connect the signal generator RF OUTPUT to the analyzer INPUT. (See Figure 4-8). Set the generator output frequency to 30 MHz at -20 dBm.

2. Make the following control settings:

ANALYZER:

BAND .... 0.1-2.05 GHz
FREQUENCY .... 30 MHz
TUNING STABILIZER .... ON
SIGNAL IDENTIFIER .... OFF
BANDWIDTH .... 100 kHz
SCAN WIDTH .... PER DIVISION
SCAN WIDTH PER DIVISION .... 5 MHz
SCAN TIME PER DIVISION .... 10 MILLISECONDS
INPUT ATTENUATION .... 10 dB
LOG/LINEAR .... LOG
LOG REF LEVEL .... -20 dBm
VIDEO FILTER .... OFF
SCAN MODE .... INT
SCAN TRIGGER .... LINE

3. Tune the analyzer FREQUENCY to center the 30 MHz signal, and if necessary, adjust the generator level so that the signal amplitude peaks at the top graticule line.

4. Keeping the display centered, reduce the SCAN WIDTH PER DIVISION to 20 kHz. Reduce BANDWIDTH to 1 kHz, SCAN TIME PER DIVISION to 0.2 SECONDS, and VIDEO FILTER to 100 Hz.

5. Observe the noise level two and one-half divisions or greater away from the signal (50 kHz). The average noise level should be at least 70 dB below the CW signal level.

70 dB__________

PERFORMANCE TESTS

4-24. Residual FM

SPECIFICATION: Total Analyzer Residual FM (Fundamental Mixing)

	Stabilized	Unstabilized
	<100 Hz peak-to-peak	<10 kHz peak-to-peak

DESCRIPTION: The linear portion of the analyzer IF filter skirt is used to slope detect low-order residual FM. The analyzer is stabilized, and the detected FM is displayed in the time domain.

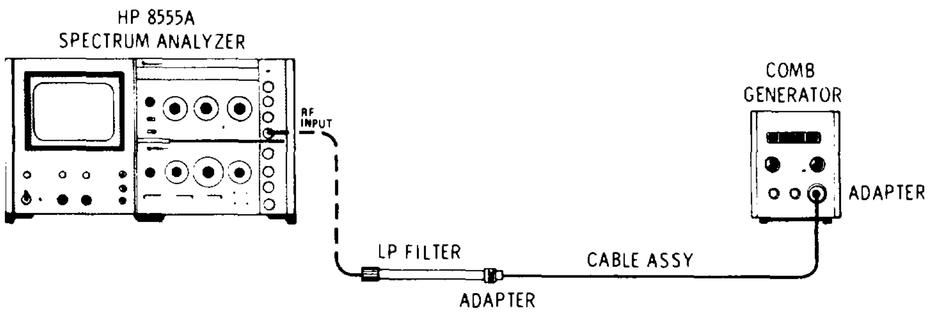


Figure 4-9. Residual FM Test Setup

EQUIPMENT:

COMB GENERATOR	HP 8406A
CABLE ASSEMBLY	HP 10503A
ADAPTER	UG-201A/U (2)
LOW PASS FILTER	HP 360C

1. Set the comb generator for a 100 MHz comb and connect the test setup shown in Figure 4-(9) Set the analyzer controls as follows:

BAND	.01-2.05 GHz
FREQUENCY	100 MHz
BANDWIDTH	30 kHz
SCAN WIDTH	PER DIVISION
SCAN WIDTH PER DIVISION	1 MHz
INPUT ATTENUATION	10 dB
TUNING STABILIZER	ON
SIGNAL IDENTIFIER	OFF
SCAN TIME PER DIVISION	10 MILLISECONDS
LOG/LINEAR	LOG
LOG REF LEVEL	-30 dBm
VIDEO FILTER	100 Hz
SCAN MODE	INT
SCAN TRIGGER	AUTO

2. Center the 100 MHz signal on the display and reduce SCAN WIDTH PER DIVISION to 2 kHz and BANDWIDTH to 1 kHz.

3. Switch LOG/LINEAR to LINEAR and adjust sensitivity for a full eight division display.

PERFORMANCE TESTS

4-24. Residual FM (cont'd)

4. Refer to Figure 4-10. Tune FINE TUNE so that the upward slope of the display intersects the CENTER FREQUENCY graticule line one division from the top.

5. Note where the slope intersects the middle horizontal graticule line:

Horizontal Displacement: __________divisions

6. Use the horizontal displacement to calculate demodulation sensitivity.

   a. Convert the horizontal displacement (divisions) into Hertz.

   Example: (2 kHz SCAN WIDTH) x (0.2 div) = 400 Hz.

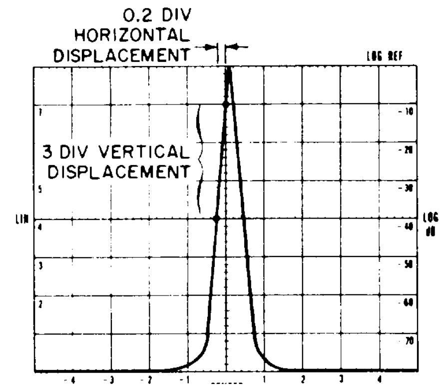


Figure 4-10. Demodulation Sensitivity measurement

b. Calculate demodulation sensitivity by dividing the vertical displacement in divisions into the horizontal displacement in Hz:

Example: $\frac{400\text{ Hz}}{3\text{ divisions}}$ = 133 Hz/div

7. Turn SCAN WIDTH to ZERO scan. Set FINE TUNE for a response level within the calibrated three division range (one division from the top to the center horizontal graticule line).

8. Measure the peak-to-peak deviation, and multiply it by the demodulation sensitivity obtained in step 6b above.

   Example: 0.5 div p-p signal deviation x 133 Hz/div = 66.5 Hz Residual FM

__________Hz peak-to-peak

4-25. Dial Accuracy

SPECIFICATION: +15 MHz on fundamental mixing.

DESCRIPTION: Center frequency accuracy is verified by displaying test signals of known frequency accuracy. Test signals are the fundamental and harmonics of a 100 MHz comb generator.

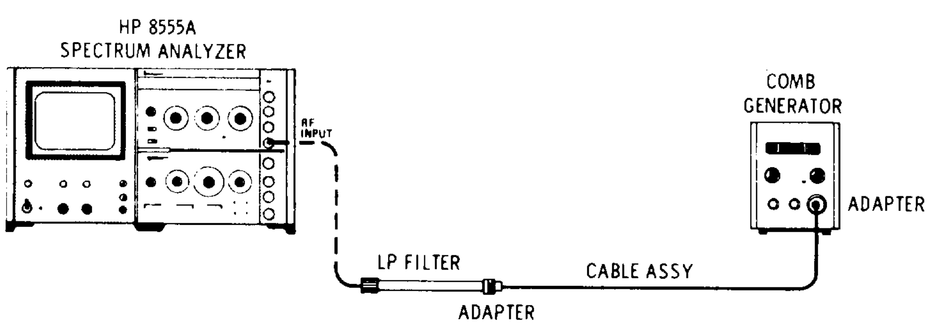


Figure 4-11. Dial Accuracy Test Setup

PERFORMANCE TESTS

4-25. Dial Accuracy (cont'd)

EQUIPMENT:

COMB GENERATOR .... HP 8406A
LP FILTER .... HP 360C
CABLE ASSEMBLY .... HP 10503A
ADAPTER (2) UG-201A/U

1. Connect the equipment as shown in Figure 4-(11) Make the following control settings:

ANALYZER:

BAND .... 01-2.05 GHz
FREQUENCY .... 100 MHz
BANDWIDTH .... 30 kHz
SCAN WIDTH .... PER DIVISION
SCAN WIDTH PER DIVISION .... 10 MHz
INPUT ATTENUATION .... 20 dB
SCAN TIME PER DIVISION .... 20 MILLISECONDS
LOG/LINEAR .... LOG
LOG REF LEVEL .... -10 dBm
VIDEO FILTER .... OFF
SCAN MODE .... INT
SCAN TRIGGER .... LINE

2. Set comb generator for 100 MHz comb and tune analyzer FREQUENCY to 100 MHz; a comb signal should be displayed +1.5 division of center graticule line.

3. Tune FREQUENCY to various dial calibration points to verify accuracy.

a.	200 MHz	-1.5________+1.5 div	f.	1200 MHz	-1.5+1.5 div
b.	400 MHz	-1.5________+1.5 div	g.	1400 MHz	-1.5+1.5 div
c.	600 MHz	-1.5________+1.5 div	h.	1600 MHz	-1.5+1.5 div
d.	800 MHz	-1.5________+1.5 div	I.	1800 MHz	-1.5+1.5 div
e.	1000 MHz	-1.5________+1.5 div	j.	2000 MHz	-1.5+1.5 div

PERFORMANCE TESTS

4-26. Residual Responses

SPECIFICATION: Referred to signal level at input mixer on fundamental mixing: <-90 dBm

DESCRIPTION: Signals present on the display with no input to the analyzer are residual responses. To check for residual responses a reference is selected so that -90 dBm is easily determined. The first LO is swept through its entire range while observing the display for any responses.

EQUIPMENT:

50Ω TERMINATION .... HP 909A

1. Set the analyzer controls as follows and terminate INPUT with 50(2)

   BAND .... 01-2.05 GHz
   FREQUENCY .... Low end stop
   SCAN WIDTH .... FULL
   INPUT ATTENUATION .... 0 dB
   SCAN TIME PER DIVISION .... 10 SECONDS
   LOG/LINEAR .... LOG
   LOG REF LEVEL .... 60 dBm
   LOG REF LEVEL Vernier 0
   VIDEO FILTER .... 100 Hz
   SCAN MODE .... INT
   SCAN TRIGGER .... AUTO

2. Observe the display as the analyzer scans its full range. No responses should occur above -90 dBm.

Residual Responses: ___________-90 dBm.

Performance Tests

Table 4-4. Performance Test Card

Para. No.	Test Description	Measurement Unit	Min.	Actual	Max.
4-20	**Scan Accuracy**				
	100 MHz PER DIVISION (800 MHz)	divisions	-0.8		+0.8
	10 MHz PER DIVISION (80 MHz)	divisions	-0.8		+0.8
	1 MHz PER DIVISION (8 MHz)	divisions	-0.8		+0.8
	50 kHz PER DIVISION (400 kHz)	divisions	-0.8		+0.8
4-21	**Frequency Response**				
	Frequency Range (GHz) — Mixing Mode (n)				
	0.01 — 2.05 — 1-	dB	-1		+1
	1.50 — 3.55 — 1-	dB	-1		+1
	2.07 — 6.15 — 2-	dB	-1		+1
	2.60 — 4.65 — 1+	dB	-1		+1
	4.11 — 6.15 — 1+	dB	-1		+1
	4.13 — 10.25 — 3-	dB	-1.5		+1.5
	6.17 — 10.25 — 2+	dB	-1.5		+1.5
	6.19 — 14.35 — 4-	dB	-2		+2
	8.23 — 14.35 — 3+	dB	-2		+2
	10.29 — 18.00 — 4+	dB	-2.5		+2.5
4-22	**Frequency Sensitivity (10 kHz Bandwidth)**				
	BAND (GHz) — BANDWIDTH				
	1.50 — 3.55 — 10 kHz	dBm	-107		
	2.60 — 4.65 — 10 kHz	dBm	-107		
	0.01 — 2.05 — 10 kHz	dBm	-105		
	4.11 — 6.15 — 10 kHz	dBm	-105		
	2.07 — 6.15 — 10 kHz	dBm	- 98		
	6.17 — 10.25 — 10 kHz	dBm	- 95		
	4.13 — 10.25 — 10 kHz	dBm	- 93		
	8.23 — 14.35 — 10 kHz	dBm	- 90		
	6.19 — 14.35 — 10 kHz	dBm	- 85		
	10.29 — 18.45 — 10 kHz	dBm	- 80		
4-23	**Noise Sidebands**				
	Average noise level below CW signal 50 kHz away, fundamental mixing, 1 kHz IF bandwidth, 100 Hz video filter.	dB	70		
4-24	**Residual FM**				
	Stabilized	Hz			100
	Unstabilized	kHz			10
4-25	**Dial Accuracy**				
	Fundamental mixing	MHz	15		+15
4-26	**Residual Responses**				
	Fundamental mixing	dBm			-90

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments required to return the analyzer RF Section to peak operating condition when repairs are required. Included in this section are test setups, checks and adjustment procedures. A test card for recording data is included at the back of this section. Adjustment location photographs are contained in foldouts in Section VIII of this manual.

5-3. The adjustment procedures are arranged in numerical order. For best results, this order should be followed. Record data, taken during adjustments, in the spaces provided or in the data test card at the end of this section. Comparison of initial data with data taken during periodic adjustments assists in preventive maintenance and troubleshooting.

5-4. EQUIPMENT REQUIRED

5-5. Tables 1-4 and 1-5 contain a tabular list of test equipment and test accessories required in the adjustment procedures. In addition, the tables contain the required minimum specifications and a suggested manufacturers model number.

5-6. In addition to the test equipment and test accessories in Tables 1-4 and 1-5, a Display Section and an IF Section are required. When the RF and IF sections are removed from the Display Section, install 50-ohm termination AT4 on rear of RF Section. Perform the Display Section and IF Section adjustments prior to performing the RF Section adjustments.

5-7. Pozidriv Screwdrivers. Many screws in the instrument appear to be Phillips, but are not. The equipment required table gives the name and number of the Pozidriv screwdrivers designed to fit these screws. To avoid damage to the screw slots, the Pozidriv screwdrivers should be used.

5-8. Slug Tuning Tool. A modified hollow-handle 5/16-inch nut driver (HP 08555-20121) that will accept a modified No.10 Allen driver (HP 08555-20121) should be used when tuning the slugs in the second converter.

5-9. Blade Tuning Tools. For adjustments requiring a nonmetallic metal-blade tuning tool, use the General Cement Model No. 5003 (HP 8730-0013). It may be necessary to cut away part of the plastic on the tuning blade end to use the tool on all the adjustments. In situations not requiring nonmetallic tuning tools, an ordinary small screwdriver or other suitable tool is sufficient. No matter what tool is used, never try to force any adjustment control in the analyzer. This is especially critical when tuning variable slugtuned inductors, and variable capacitors.

5-10. HP 08555-60077 Service Kit. The HP 08555-60077 Service Kit is an accessory item available from Hewlett-Packard for use in maintaining both the RF and IF Sections of the spectrum analyzer. Some adjustment can be made without this kit by removing the top cover from both the RF Section and the Display Section. This procedure exposes dangerous potentials in the Display Section chassis and should not be used unless absolutely necessary. Adjustments that are possible without the service kit are proceeded by a warning to install a cover over the Display Section with a cutout above the RF Section. These adjustments can and should be performed with the analyzer plug-ins installed on extender cables provided in the service kit.

5-11. Table 1-5, Accessories, contains a detailed description of the contents of the service kit. Any item in the kit may be ordered separately if desired. In the case of the 11592-60015 Extender Cable Assembly, the wiring is especially critical and fabrication should not be attempted in the field. Other items in the kit may be built in the field if desired.

5-12. Extender Cable Installation. Push the front panel latch in the direction indicated by the arrow until the latch disengages and pops out from the panel. Pull the plug-ins out of the instrument. Locate the latches on each side of the RF Section. Unlock latches and firmly pull the two sections apart. When the two sections separate at the front panel, raise the upper section until it is above the lower section by two or three inches at the front panel. Disengage the metal tab-slot connection at the rear and separate the sections. Remove top and bottom covers from the RF Section.

5-13. Place the plate end of the HP 11592-60015 Extender Cable Assembly in the Display Section and press firmly into place so that the plugs make contact. The plate and plugs cannot be installed upside down as the plate has two holes corresponding to the two guide rods in the mainframe.

5-14. Connect the upper cable plug to the RF Section and the lower cable plug to the IF Section. The plugs are keyed so that they will go on correctly and will not make contact upside down. Connect HP 11592-60016 Interconnection Cable Assembly between the RF and IF Sections. The connectors on the cable are keyed by the shape of the plug and the arrangement of the pins. Press the connectors firmly together and extend the instruments as far apart as the cable will allow without putting stress on the connectors. Remove Dummy Load Assembly AT4 from rear panel of Display Section and install at P4 on rear of RF Section.

5-15. FACTORY SELECTED COMPONENTS

5-16. Table 8-1 contains a list of factory selected components by reference designation, basis of Model 8555A selection, and schematic diagram location on which the component is illustrated. Factory selected components are designated by an asterisk (*) on the schematic diagrams in Section VIII of this manual.

5-17. RELATED ADJUSTMENTS

5-18. The following sets of adjustments are directly related. When one adjustment in a set is made, the others in that set should be checked.

5-19. Display Section Adjustments. Refer to the Display Section Operating and Service Manual.

5-20. IF Section Adjustments. Refer to the IF Section Operating and Service Manual.

5-21. RF Section Adjustments. Perform the Display Section and IF Section adjustments prior to performing the following RF Section adjustments.

ADJUSTMENTS

5-22. Input Operating Voltages, Check and Adjustment

REFERENCE: Schematic 9, Display Section and IF Section Operating and Service Manuals.

DESCRIPTION: Dc operating voltages for the RF Section are obtained from the Display Section, the IF Section and from a dual power supply in the RF Section. The Display Section provides +100 Vdc, -100 Vdc and -12.6 Vdc; the IF Section provides -10 Vdc and the RF Section provides the +20 Vdc and +10 Vdc operating voltages. The Tuning Stabilizer Control Assy A5 uses all the above voltages and provides a convenient location for measurement (see Service Sheet 9). If the plug-ins are installed on extender cables, voltage test points are accessible on the A10 Interconnect board. Remove bottom cover from RF Section for access.

EQUIPMENT:

HP 3440A Digital Voltmeter w/HP 3443A Auto Range Unit
HP 11003A Test Leads
HP 5060-0256 Extender Board
Modified Display Section Cover, see "Warning"

WARNING

The following steps apply dangerous potentials up to 7000 volts dc to exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

1. Install plug-ins on extender cables or install a cover over the Display Section with a cutout above the analyzer plug-ins.

2. With analyzer power off, remove top cover from RF Section and install Tuning Stabilizer Control Assy A5 on extender board.

3. Apply power to analyzer, measure and record the dc voltages.

Location	Normal		Actual
A5 Pin 1	+100	±1%	___________
A5 Pin E	-100	±1%	___________
A5 Pin 10	-12.6	±1%	___________
A5 Pin L	-10	.±01V	___________
A5 Pin D	+20	.±01V	___________
A5 Pin H	+10	.±02V	___________
A4 Pin A	-31	±-1.5V	___________

4. If the +100, -100 or -12.6 Vdc sources are out of tolerance, refer to Display Section Operating and Service Manual for both sequence of adjustment and adjustment procedure.

5. If the -10 Vdc source is out of tolerance, refer to the IF Section Operating and Service Manual for adjustment procedure.

6. If the +20 and/or +10 Vdc sources are out of tolerance, refer to +20/+10 volt check and adjustment procedure, paragraph 5-23.

ADJUSTMENTS

5-23. +20/+10 Volt Power Supply Check and Adjustment

REFERENCE: Schematic 15.

DESCRIPTION: The +20-volt power supply is adjusted for correct output; while the +10-volt power supply is checked for correct output. A voltage divider connected to the +20-volt source provides the reference for the +10-volt source.

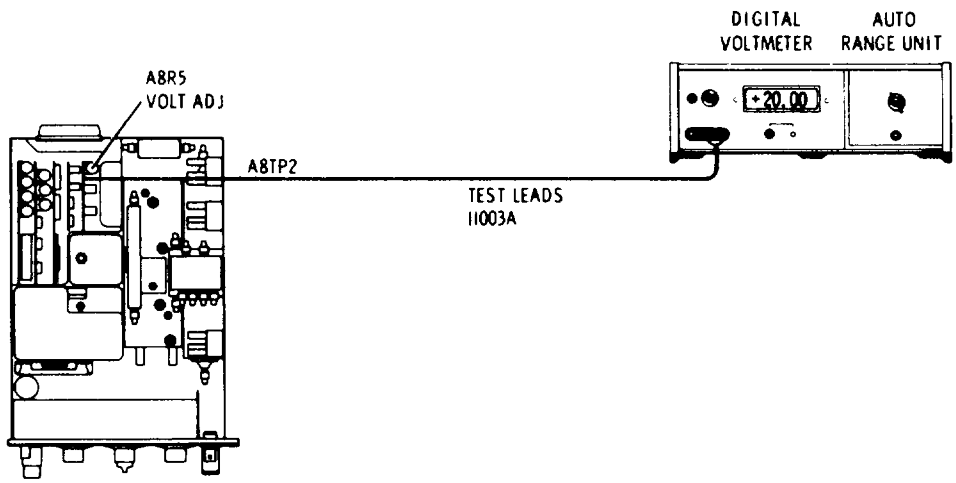


Figure 5-1. +20/+10 Volt Power Supply Check and Adjustment Test Setup

EQUIPMENT:

HP 3440A Digital Voltmeter with 3443A Auto Range Unit
HP 11003A Test Leads
Modified Display Section Cover, see "Warning"

WARNING

During the following tests dangerous potentials up to 7000 volts dc are present on exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

1. Install a cover over the Display Section with a cutout above the analyzer plug-ins.

2. Connect digital voltmeter test leads to A8TP2 and chassis ground.

3. Adjust A8R5 VOLT ADJ for an output of +20 +.01 Vdc.

__________+20 ±.01 Vdc

4. Connect test leads to A8TP1 and chassis ground.

5. Check for an output level of +10 +.02 Vdc.

__________+10 ±.02 Vdc

ADJUSTMENTS

5-24. YIG Driver Adjustments

REFERENCE: Schematic 7.

DESCRIPTION: The upper and lower voltage limits of the FREQUENCY control tuning voltage are adjusted for a precise input to the YIG driver circuit. The upper limit corresponds to 2.0 GHz on the n=1- Frequency Scale; with the lower limit corresponding to 0 GHz. The YIG driver circuit is adjusted to produce an oscillator frequency of 4.1 GHz for the upper voltage limit and a 2.05 GHz frequency for the lower voltage limit. The dial accuracy is then checked in 100 MHz increments. During all FREQUENCY control adjustments, approach all dial settings clockwise.

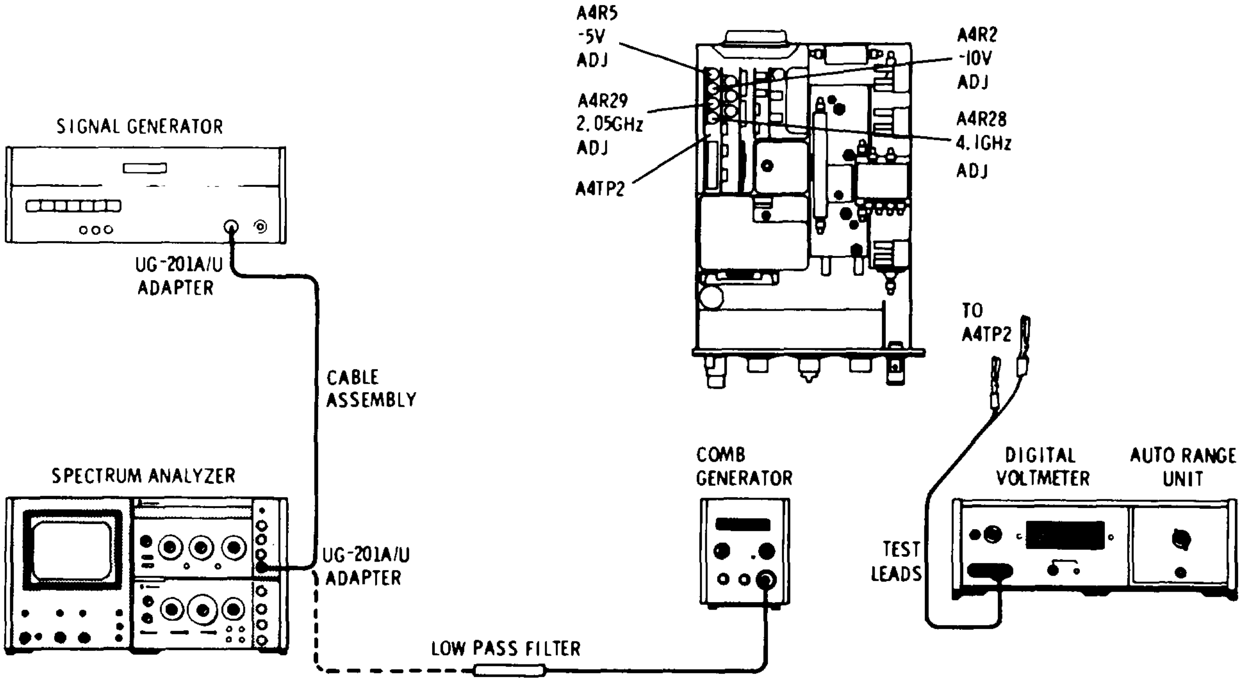


Figure 5-2. YIG Driver Adjustments

EQUIPMENT:

HP 3440A Digital Voltmeter w/HP 3443A Auto Range Unit
HP 8616A Signal Generator
HP 8406A Comb Generator
HP 11003A Test Leads
HP 10503A Cable Assembly
HP 360C 2 GHz Low-Pass Filter
Modified Display Section Cover, see "Warning"

WARNING

The following steps apply dangerous potentials up to 7000 volts dc to exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

ADJUSTMENTS

5-24. YIG Driver Adjustments (cont'd)

1. Install plug-ins on extender cables or install a cover over the Display Section with a cutout above the analyzer plug-ins.

2. Remove top cover from RF Section and connect digital voltmeter to test point A4TP2.

3. Set analyzer controls as follows:

BAND	n=1- 2.05 GHz IF
SCAN WIDTH	ZERO
SCAN WIDTH PER DIVISION	2 MHz
BANDWIDTH	100 kHz
FINE TUNE	Centered
SCAN TIME PER DIVISION	10 MILLISECONDS
INPUT ATTENUATION	10 dB
POWER	ON

NOTE

Allow sufficient time for instrument to warm up and stabilize. When making FREQUENCY control adjustments approach all dial settings clockwise. Avoid parallax error when reading dial frequency.

4. Connect the comb generator to RF Section INPUT through the low pass filter. Set comb generator for 100 MHz comb at maximum output level.

5. Set FREQUENCY control to 2.0 GHz.

6. Adjust A4R2, -10V adj. for a DVM reading of -9.878 +.005 Vdc. (-9.878 Vdc at 2.0 Ghz corresponds to -10.0 Vdc at 2.05 GHz.)

7. Set SCAN WIDTH to FULL and adjust A4R28, 4.1 GHz adj.,to dip the 2 GHz comb line (20th comb line) at the frequency marker.

8. Set SCAN WIDTH to PER DIVISION and readjust A4R28, 4.1 GHz adj., to center the 2 GHz comb line within ±1 division of the CENTER FREQUENCY graticule line.

9. Replace the comb generator input with the signal generator tuned to 2.0 GHz to ensure that comb signal used was the 2.0 GHz comb line.

10. Replace the signal generator with the comb generator and record the displacement of the comb line from center frequency.

Center Frequency ±__________div

11. Set SCAN WIDTH to ZERO, tune FREQUENCY to 0.0 GHz. See note above.

12. Adjust A4R5, - 5V adj., for - 5.000 ± .005 Vdc at A4TP2.

13. Switch SCAN WIDTH to FULL momentarily (to reset the YIG hysteresis) and then set to PER DIVISION.

14. Adjust A4R29, 2.05 GHz adj, to center the LO feedthrough on screen within ±1 division. Record displacement from center frequency.

Center Frequency ±__________div

5-24. YIG Driver Adjustments (cont'd)

15. Repeat steps 5 through 14. However, when setting the frequency - this time use the voltage at A4TP2 as an indicator of frequency setting. If the dial indication is not correct, re-adjust the appropriate voltage adjust potentiometer to correct dial indication. If more than a slight correction is needed, repeat the procedure twice to ensure proper alignment.

16. Set SCAN WIDTH PER DIVISION to 5 MHz and tune FREQUENCY control from 0 to 2 GHz in 100 MHz steps. Approach all dial settings clockwise and avoid parallax error. Note and record deviation of comb signal from center frequency at each 100 MHz step.

    Maximum deviation +3 div (15 MHz)__________

17. Set SCAN WIDTH PER DIVISION to 1 MHz and recheck deviation at 1 GHz.

    Maximum deviation +3 div (3 MHz)__________

18. If deviation at 1 GHz exceeds 3 MHz, the FREQUENCY control potentiometer can be padded to improve linearity. If the 1 GHz comb signal is high (to the right of center) connect resistor between pins 1 and 2 of the potentiometer. If low (to left of center) connect resistor between pins 2 and 3.

19. Install a 1% metal film 1/4-watt resistor, selected from the chart below, between the pins indicated in step 18.

Deviation Mhz	Resistor Value
3	422K
4	316K
5	261K
6	215K
7	178K
8	162K
10	133K
12	110K
14	90.9K
16	82.5K
18	68.1K
20	61.9K

20. Repeat steps 16 and 17.

21. Mark schematic diagram Service Sheet 7 showing location and value of resistor installed. Number resistor A1A4R4.

5-25. 2nd LO (1500 MHz) Check and Adjustment

REFERENCE: Schematic 3.

DESCRIPTION: The second local oscillator is checked for a center frequency of 1500 MHz +100 kHz. The power output level is checked and adjusted, if necessary. If the power output level is adjusted, the frequency is rechecked and adjusted if necessary.

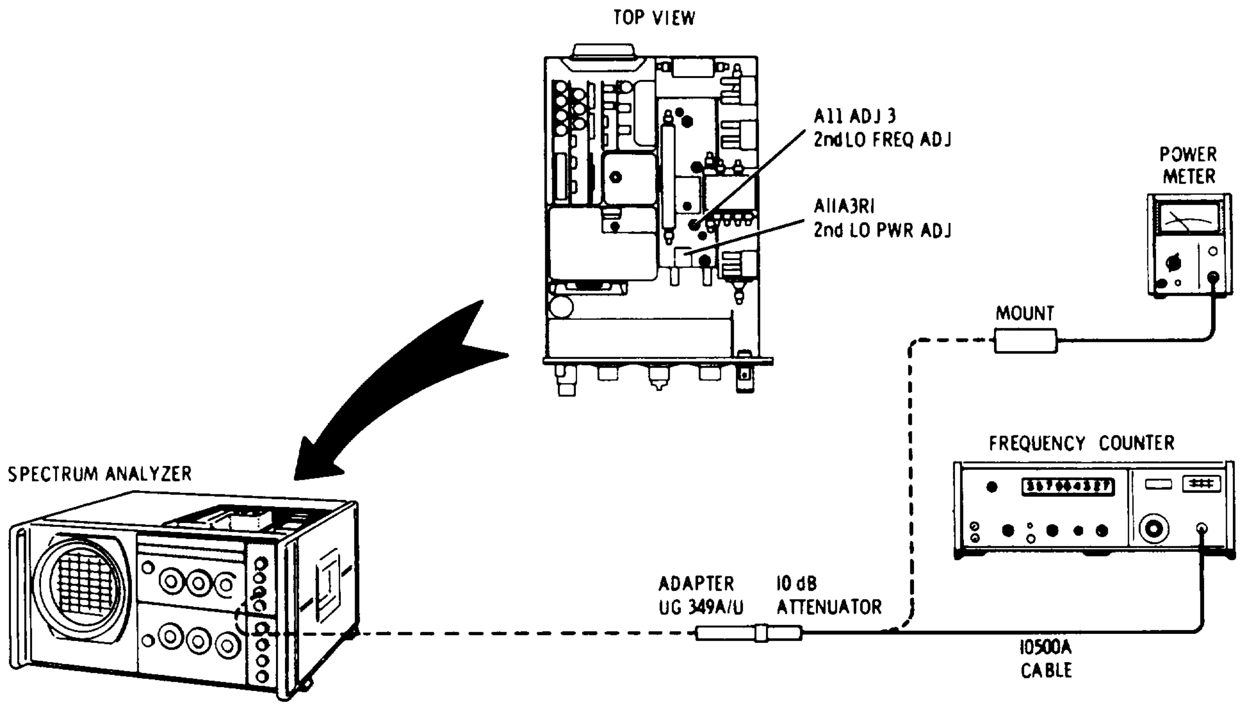


Figure 5-3. 2nd LO Frequency and Power Level Adjustment

EQUIPMENT:
- HP 5245L Frequency Counter w/5257A Transfer Oscillator
- HP 432A Power Meter w/8478B Thermistor Mount
- HP 8491A/B 10 dB Attenuator
- UG 349A/U Adapter
- Slug Tuning Tool (see paragraph 5-8)
- Modified Display Section Cover, see "Warning"

WARNING

The following steps apply dangerous potentials up to 7000 volts dc to exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

1. Install plug-ins on extender cables or install a cover on the Display Section with a cutout above the analyzer plug-ins.

2. Apply power to analyzer and allow at least two hours for stabilization.

3. Connect the 10 dB attenuator to SECOND LO OUTPUT using the UG 349A/U adapter.

5-25. 2nd LO (1500 MHz) Check and Adjustment (cont'd)

4. Select n=1- 2.05 GHz IF band and connect test setup as shown in figure below.

5. Measure 2nd LO frequency. If necessary, adjust LO tuning slug All ADJ 3 for a frequency of 1500 MHz +100 kHz.
1,499,900__________1,500,100 kHz

6. Disconnect cable to transfer oscillator at 10 dB attenuator. Connect power meter thermistor mount to 10 dB attenuator and measure power output level for indication of -3 to +1 dBm. If necessary, adjust A11A3R1 (2ND LO PWR ADJ) for a level of +9 +2 dBm.
+7__________+11 dBm

7. If A11lA3R1 is adjusted, recheck 2nd LO frequency, step 5 above.

5-26. 1.5 GHz Notch Filter and 2.05 GHz Low Pass Filter Check

REFERENCE: Schematic 3.

DESCRIPTION: The notch filter and low pass filter are checked by disconnecting the semi-rigid coax cables at KlJ1 and K3J1, inserting a signal at K3J1 and measuring the signal output at KIJ1. The 2nd LO signal is inserted and the output monitored on a power meter. All ADJ 4 is adjusted for minimum power output. The 1st LO signal is inserted and the output monitored with the power meter as the YIG oscillator is tuned from 2.05 to 4.1 GHz.

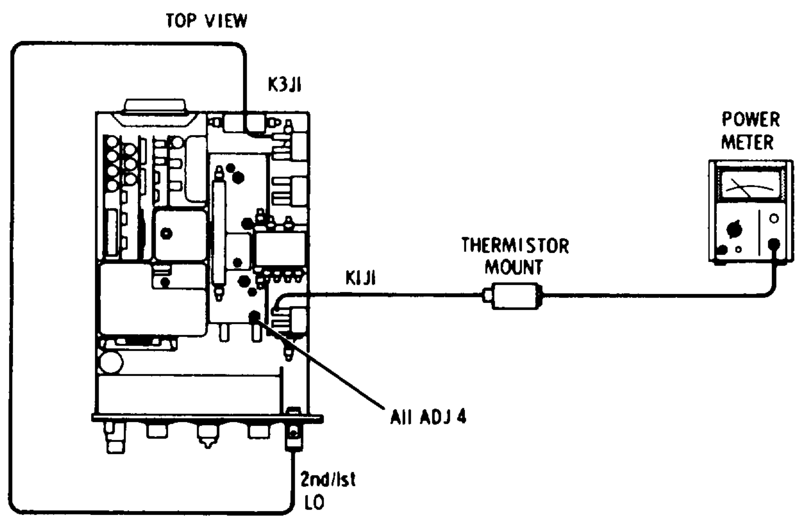


Figure 5-4. 1.5 GHz Notch Filter and 2.05 GHz Low Pass Filter Check and Adjustment Procedure

5-26. 1.5 GHz Notch Filter and 2.05 GHz Low Pass Filter Check (cont'd)

EQUIPMENT:
HP 432A Power Meter
HP 8478B Thermistor Mount
HP 11592-60001 Test Cable
HP 11592-60003 Test Cable Selectro female to Selectro male
HP 1250-1153 Adapter Type N Jack to SMA plug
Tuning Wrench (see paragraph 5-8)
Modified Display Section Cover, see "Warning"

WARNING

The following steps apply dangerous potentials up to 7000 volts dc to exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

1. Install plug-ins on extender cables or install a cover over the Display Section with a cutout above the analyzer plug-ins.
2. Disconnect Cable W13 at K3J1 and W8 at KiJ1.
3. Connect a test cable between SECOND LO OUTPUT and K3J1.
4. Connect a test cable between KlJ1 and power meter thermistor mount.
5. Select n=1- 2.05 GHz IF band; apply power to analyzer and allow sufficient time for instrument to warm up and stabilize.
6. Tune All ADJ 4 for minimum power indication on power meter.
7. Remove test cable from SECOND LO OUTPUT and connect to FIRST LO OUTPUT.
8. Tune FREQUENCY control from 0 to 2.05 GHz (oscillator signal through notch and low pass filter tunes 2.05 to 4.1 GHz).
9. Note frequency roll-off as YIG oscillator frequency is increased.
10. Insertion loss through the relays and filters can be determined by checking the loss of the test setup and comparing the difference. Disconnect the test cables from KiJ1 and K3J1. Connect the test cables together with an adapter. TuneYIG oscillator throughout its range noting signal level on power meter. Compare with power level obtained in step 9 above. Insertion loss of the low pass filter, **notch filter, K1 and K3 combined, should be less than 3 dB at 2050 MHz; equal to or greater than 50 dB above 2450 MHz.**

5-27. 2nd Converter 2.05 GHz Bandpass Adjustment

REFERENCE: Schematic 3.

DESCRIPTION: The 2.05 GHz IF bandpass cavities in the second converter are tuned for peak indication using the analyzer as a test setup. The calibrator signal is connected to the RF Section INPUT and the analyzer tuned to display the 30 MHz signal on the center of the CRT. With the analyzer operating in the linear mode, the cavities are alternately adjusted for maximum indication on the CRT. The cavities are then detuned approximately one-half dB on the high side (slugs turned clockwise) to improve flatness at the low end of the analyzer's frequency range (10 MHz).

5-27. 2nd Converter 2.05 GHz Bandpass Adjustment (cont'd)

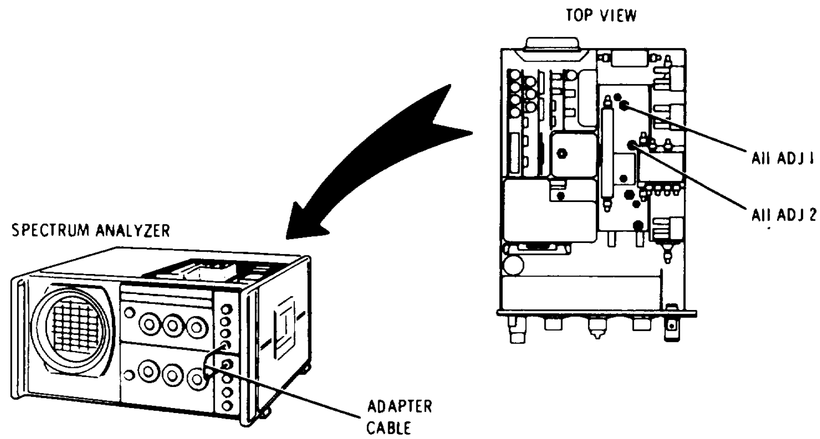


Figure 5-5. 2nd Converter 2.05 GHz IF Bandpass Adjustment

EQUIPMENT:

HP 10503A Cable Assembly
UG 201A/U Adapter
Slug Tuning Tool (see paragraph 5-8)
Modified Display Section Cover, see "Warning"

WARNING

The following steps apply dangerous potentials up to 7000 volts dc to exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

1. Install plug-ins on extender cables or install a cover over the Display Section with a cutout above the analyzer plug-ins.

2. Set analyzer controls as follows:

   FREQUENCY .... 30 MHz (n=1- 2.05 GHz IF)
   BANDWIDTH .... 300 kHz
   SCAN WIDTH PER DIVISION .... 1 MHz
   INPUT ATTENUATION .... 10 dB
   SCAN TIME PER DIVISION .... 2 MILLISECONDS
   LINEAR SENSITIVITY .... 1 mV/DIV
   SCAN MODE .... INT
   SCAN TRIGGER .... AUTO

3. Allow at least 1 hour of instrument warm-up or operating time before adjusting tuning slugs in second converter.

4. Connect CAL OUTPUT to INPUT and tune FREQUENCY to center 30 MHz signal on display.

5. Adjust LINEAR SENSITIVITY controls to peak signal at approximately the LIN 7 graticule line to establish a reference point.

6. Alternately adjust All ADJ 1 and ADJ 2 for a maximum indication on the CRT. Adjust LINEAR SENSITIVITY controls to keep signal level at the LIN 7 graticule line.

7. When a maximum indication has been obtained, tune each adjustment clockwise reducing signal level by approximately 0.2 division. (This reduces instrument sensitivity slightly, but improves flatness at the instrument's lower frequency limits.)

ADJUSTMENTS

5-28. 500 MHz Local Oscillator and Driver Check and Adjustment

REFERENCE: Schematic 4

DESCRIPTION: The 500 MHz local oscillator (3rd LO) is checked for a center frequency of 500 MHz ±50 kHz at power output of at least +1 dBm. The 500 MHz LO drive circuit, that provides the frequency shift for signal identification, is checked and adjusted to provide a two-division shift on each side of the LO center frequency. A2A4C4 FREQUENCY ADJ sets the LO center frequency. A2A2R5 FREQ SENSITIVITY ADJ determines the frequency shift, around the LO center frequency, in the signal identification operating mode. A2A2R13 FREQ LINEARITY ADJ and Factory Selected Resistor A2A2R16 determines the linear operating point and frequency of the 500 MHz LO. Perform the horizontal scan check (see IF Section Operating and Service Manual) and check output from Signal Identifier Attenuator (Service Sheet 6) prior to adjusting the 500 MHz LO or LO driver components. Allow at least a half-hour period for the oscillator to warm up and stabilize before making adjustments. Perform a center frequency check, a frequency shift check and a power output check prior to adjusting components.

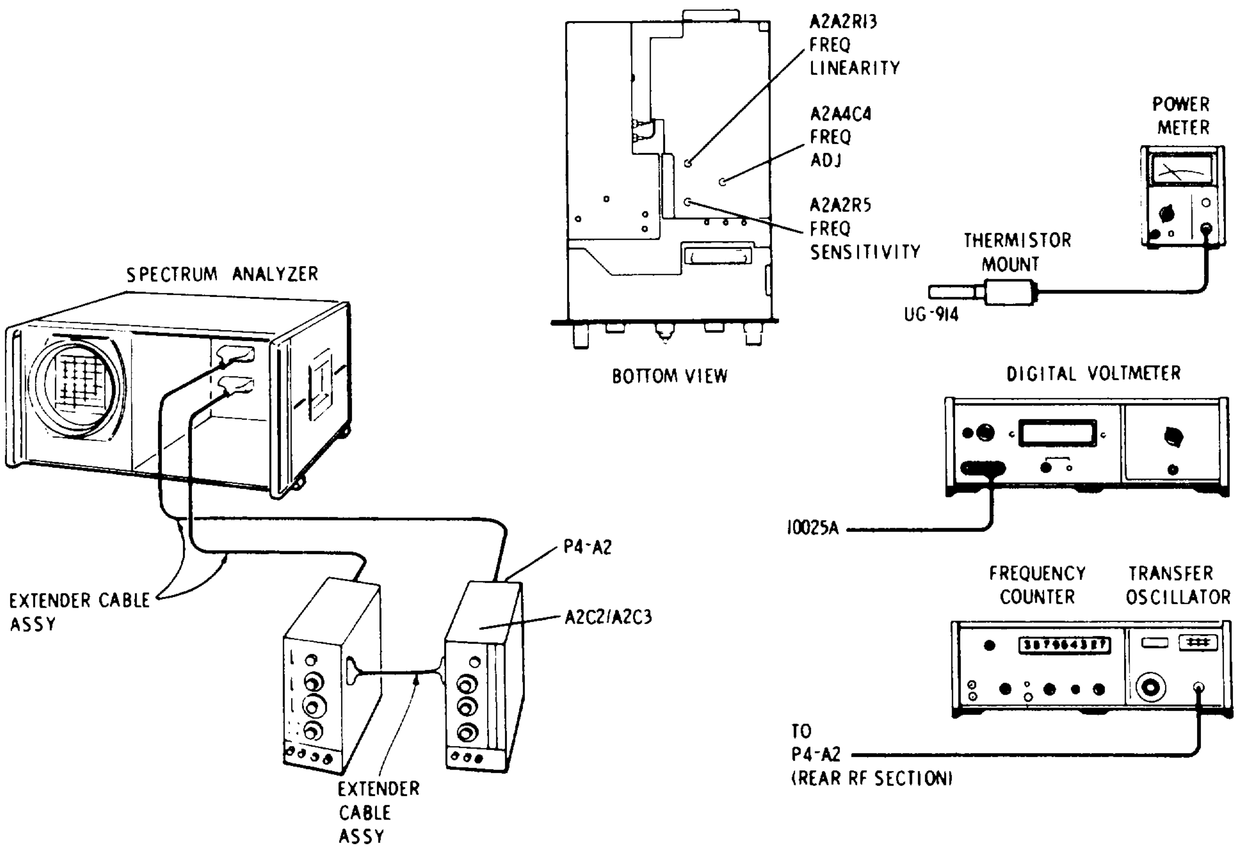


Figure 5-6. 500 MHz LO and LO Driver Adjustment Test Setup

5-28. 500 MHz Local Oscillator Check and Adjustment (cont'd)

EQUIPMENT:

HP 5245L Frequency Counter w/5257A Plug-in
HP 11592-60015 Extender Cable Assy
HP 11592-60016 RF to IF Section Interconnection Cable
HP 11592-60013 R & P Connector to BNC Male Test Cable
HP 1250-0080 Adapter BNC to BNC (UG 914/U)
HP 432A Power Meter with 8478B Thermistor Mount
HP 3440A Digital Voltmeter with HP 3443A Auto Range Unit

NOTE

The accuracy of the signal identifier frequency shift circuitry also is dependent on the accuracy of the IF Section scan width circuitry. Perform horizontal scan check (IF Section) prior to adjusting the 500 MHz LO drive components.

1. Remove RF and IF Section plug-ins from Display Section.

2. Separate RF Section from IF Section and remove bottom cover from RF Section.

3. Connect RF Section to IF Section with interconnection cable

4. Connect RF and IF Sections to Display Section with extender cable.

5. Apply power to analyzer and allow instrument to warm up and stabilize.

6. Remove AT4 Termination from P4 (or rear of Display Section) and connect 3rd LO output (P4-A2) to Frequency Counter using 11592-60013 cable.

7. Measure and record 3rd LO frequency with SIGNAL IDENTIFIER at OFF and adjust A2A4C4 FREQUENCY ADJ to 500 ±.05 MHz.

   500 ±.05 MHz__________

8. Set SCAN WIDTH to 1 MHz PER DIVISION, SIGNAL IDENTIFIER to ON and adjust BANDWIDTH and VIDEO FILTER so that the DISPLAY UNCAL lamp is out.

9. Adjust SCAN TIME PER DIVISION and Frequency Counter to provide a complete count of both the center frequency and the shifted frequency.

10. Select n=1- 2.05 GHz IF Frequency Band. Note and record frequency shift from center frequency.

    2 MHz ± 100 kHz__________

11. Select n=1+ 2.05 GHz IF Frequency Band. Note and record frequency shift from center frequency.

    2 MHz ±100 kHz__________

12. Switch SIGNAL IDENTIFIER to OFF. Connect Power Meter to 3rd LO Output. Measure and record power output level.

    >+ 1 dBm__________

13. If power output is incorrect, check dc input voltages, -10 ± 0.1 at A2C3 and +20 ±0.1 Vdc at A2C2.

14. If the frequency shift (steps 10 and 11 above) is incorrect, set SIGNAL IDENTIFIER to ON and check input signal from signal identifier attenuator for an input level of +9.9 ±0.1 Vdc on the n=1- band and -9.9 +±0.1 Vdc on the n=1+ band.

5-28. 500 MHz Local Oscillator Check and Adjustment (cont'd)

15. If the frequency shift recorded in step 10 is different from that recorded in step 11, adjust FREQ LINEARITY A2A2R13 for equal shift on each side of center frequency while switching between n=1+ and n=1- bands. Check and adjust FREQ ADJ A2A4C4 if necessary, after each adjustment of A2A2R13.

16. Adjust FREQ SENS ADJ A2A2R5 if necessary, for a 2 MHz +100 kHz shift on each side of center frequency while switching between n=1+ and n=1- bands.

17. Repeat steps 15 and 16 as necessary. Note and record results in steps 7, 10, 11, and 12.

5-29. 550 MHz Bandpass Filter and 50 MHz Filter Adjustment

REFERENCE: Schematic 4.

DESCRIPTION: With a signal applied to the analyzer INPUT, the 550 MHz bandpass filter and the 50 Mhz filter are tuned for maximum output as observed on the CRT display. Prior to adjusting the filters, perform the 500 MHz LO check, Paragraph 5-28.

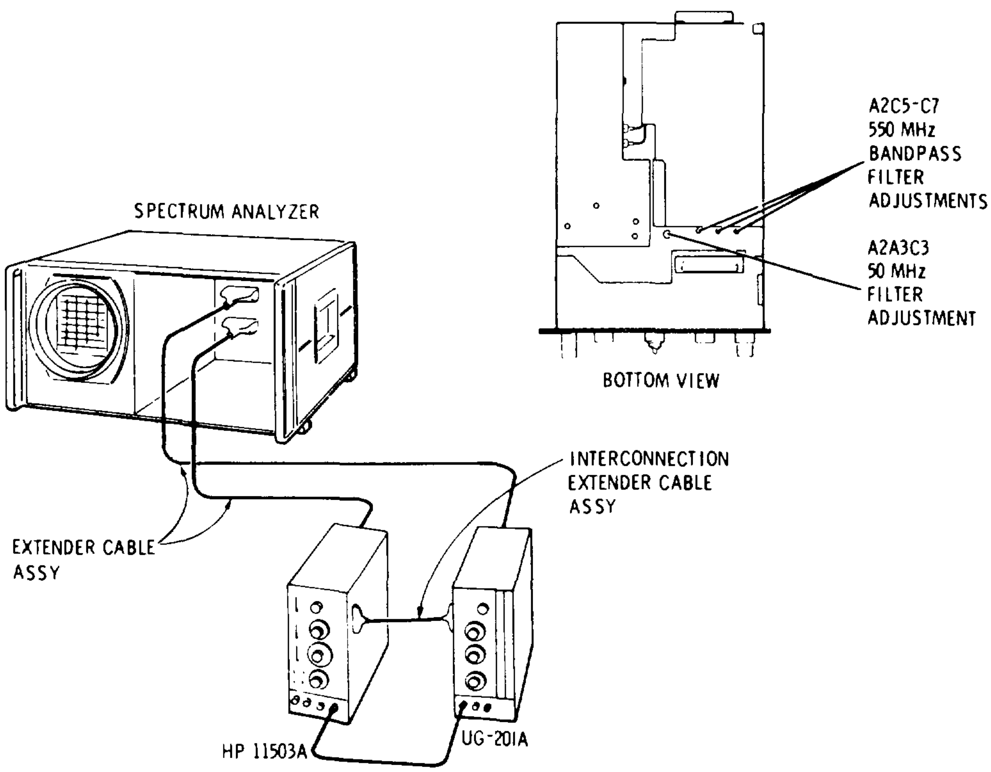


Figure 5-7. 550 MHz Bandpass Filter and 50 MHz Filter Adjustment Test Setup

5-29. 550 MHz Bandpass Filter and 50 MHz Filter Adjustment (cont'd)

EQUIPMENT:
HP 11592-60015 Extender Cable Assembly
HP 11592-60016 RF to IF Section Interconnect Cable
HP 11503A Cable Assembly
UG 201A/U Adapter
Tuning Tools, No. 6 Allen Driver and Non-metallic screwdriver.

1. Remove RF and IF Section plug-ins from Display Section.

2. Separate RF Section from IF Section and remove bottom cover from RF Section.

3. Connect RF Section to IF Section with interconnection cable.

4. Connect RF and IF Sections to Display Section with extender cable.

5. Apply power to analyzer and allow instrument to warm up and stabilize. Connect CAL OUTPUT to INPUT.

6. Set analyzer controls as follows:

   Frequency Band .... n=1- 2.05 GHz IF
   FREQUENCY .... 30 MHz
   BANDWIDTH .... 100 kHz
   SCAN WIDTH PER DIVISION .... 100 kHz
   INPUT ATTENUATION .... 10 dB
   TUNING STABILIZER .... ON
   SIGNAL IDENTIFIER .... OFF
   SCAN TIME PER DIVISION .... 10 MILLISECONDS
   LOG/LINEAR .... LINEAR
   LINEAR SENSITIVITY .... 1 mV/DIV
   VIDEO FILTER .... OFF
   SCAN MODE .... INT
   SCAN TRIGGER .... AUTO

7. Install Termination AT4 at P4 on rear of RF Section.

8. Tune FREQUENCY control to center 30 MHz signal on CRT display.

9. Adjust the three bandpass filter screws A2C5, C6 and C7 and the 50 MHz filter A2A3C3 for maximum signal indication on the CRT.

10. Repeat adjustments two or three times to obtain maximum signal indication.

11. Reinstall plug-ins and perform AMPL CAL procedure (see Section III).

5-30. 50 MHz Amplifier Check and Adjustment

REFERENCE: Schematic 5.

DESCRIPTION: The variable gain of the 50 MHz amplifier determines the absolute accuracy of the analyzer's amplitude calibration. Perform the adjustments in the order given and repeat adjustments at least one time. There are three fixed and one variable gain control steps applied to the amplifier. The fixed steps consist of the following: 5 dB gain on all bands except n=1+* 550 MHz IF Band. 15 dB gain on n=3, 4, 6, and 10 bands. Signal identifier attenuation (approximately 5 dB) on alternate scans. The variable gain step is controlled by Factory Selected resistors that match the amplifier gain to the mixer diode in the first converter. During adjustment of the 15 dB gain step the variable gain is removed by lifting resistors on the Input Mixer Gain Compensation Network A16. The variable gain step is adjusted by applying a fixed current and adjusting for a fixed gain. The 5 dB gain step is adjusted by applying a known level input signal on the n=1- 2.05 GHz IF Band and then switching to the n=1-* 550 MHz IF Band and adjusting 1-* LOW (A2A5R25) to provide the same signal level indication.

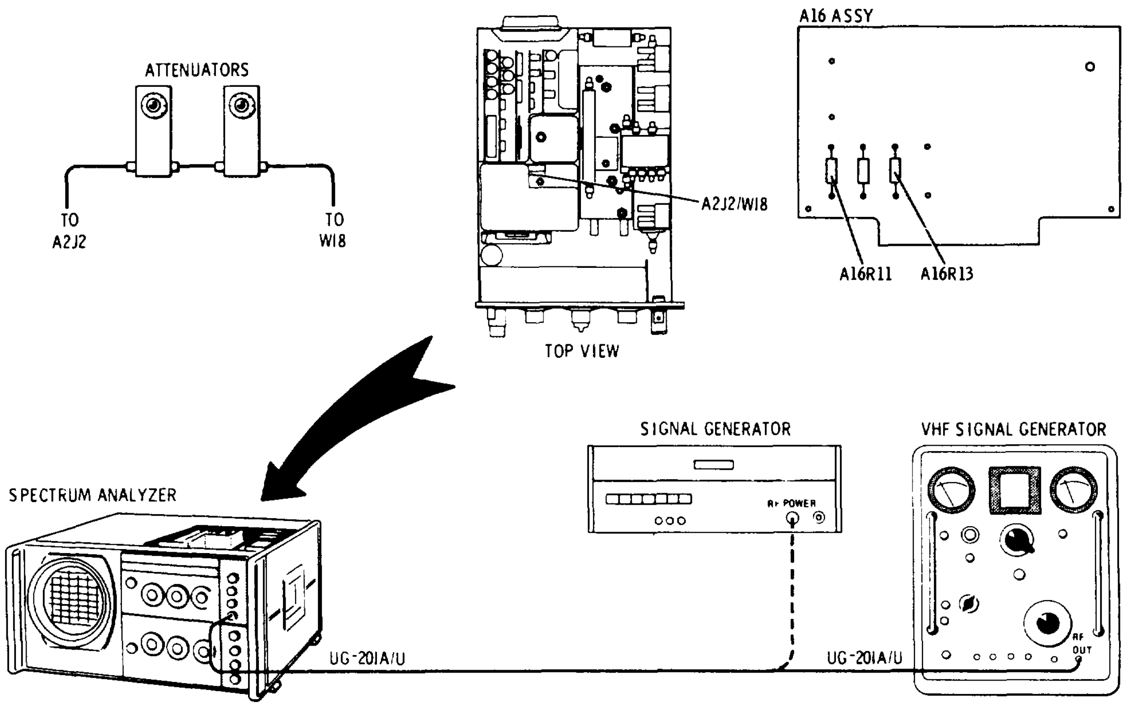


Figure 5-8. 50 MHz Amplifier Check and Adjustment Test Setup

EQUIPMENT:

- HP 608 VHF Signal Generator
- HP 8614A/B Signal Generator
- HP 355C VHF Attenuator
- HP 355D VHF Attenuator
- HP 10503A Cable Assembly (2)
- UG 201A/U Adapter (2)
- HP 11592-60001 Test Cable
- HP 1250-0831 SMA to BNC Adapter
- HP 0757-0199 Resistor 21.5K 1% 1/4 W

"Starred" values indicate Frequency Switch positions Involving a 550 MHz IF.

5-30. 50 MHz Amplifier Check and Adjustment (cont'd)

EQUIPMENT: (cont'd)
HP 0757-1094 Resistor 1.47K 1% 1/4 W
Modified Display Section Cover, see "Warning"

WARNING

The following steps apply dangerous potentials up to 7000 volts dc to exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

1. Install plug-ins on extender cables or install a cover over the display section with a cutout above the analyzer plug-ins.

2. Disconnect Cable W18 (Green) from A2J2. Install attenuators connected in series between A2J2 and Cable W18.

3. Remove Band Buffer Assy A6 and unsolder one end of Resistors A16R11 and A16R13 (A16 board mounted on A6 assembly). Reinstall band buffer board.

4. Adjust attenuators for 15 dB attenuation of 50 MHz output.

5. Connect a-15 dBm 30 MHz signal to RF Section INPUT.

6. Set analyzer controls as follows:
   BAND .... n=1- 2.05 GHz IF
   FREQUENCY .... 30 MHz
   BANDWIDTH .... 100 kHz
   SCAN WIDTH PER DIVISION .... 0.5 MHz
   INPUT ATTENUATION .... 30 dB
   SCAN TIME PER DIVISION .... 10 MILLISECONDS
   LOG/LINEAR .... LINEAR
   LINEAR SENSITIVITY .... max CCW
   SCAN MODE .... INT
   SCAN TRIGGER .... AUTO

7. Tune FREQUENCY controls to center 30 MHz signal on display CRT.

8. Select n=3- Band.

9. Adjust LINEAR SENSITIVITY controls to set signal amplitude at the LOG REF graticule line. (Adjust AMPL CAL control if necessary.)

10. Adjust A2A5C2 and A2A5C12 for maximum signal level.

11. Reset signal to LOG REF graticule with LINEAR SENSITIVITY controls.

12. Switch to n=1- 2.05 GHz IF Band.

13. Set attenuators in 50 MHz output to 0 dB.

14. Adjust A2A5R22 to -,t signal level at LOG REF graticule line.

15. Set INPUT ATTENUATION to 10 dB. Set LINEAR SENSITIVITY to 10 mV/DIV vernier control to 0.5 (on blue scale).

5-30. 50 MHz Amplifier Check and Adjustment (cont'd)

16. Reconnect resistor A16R11.

17. Adjust A2A5R4 for 37.0 mV (LOG REF level graticule is 40 mV).

18. Readjust A2A5C2 for maximum signal level and readjust A2A5R4 for 37.0 mV.

19. Unsolder resistor A16R11 again.

20. Set attenuators in 50 MHz output to 15 dB.

21. Set signal level to LOG REF graticule line with LINEAR SENSITIVITY vernier control.

22. Connect a 21.5K ohm and 1.47K ohm resistor in series and install between A2C8 and A2C9 (-12.6V 97 wire and 934 wire input to pin diode A2A5CR1).

23. Set attenuator in 50 MHz output to 0 dB.

24. Adjust A2A5C8 to set signal level at LOG REF graticule line.

25. Remove resistors connected in step 22.

26. Reconnect resistors A16R11 and A16R13.

27. Set LINEAR SENSITIVITY controls to 10 mV/DIV and to 0.5 (blue scales).

28. Center AMPL CAL potentiometer and adjust A2A5R4 for 37 mV. Adjust A2A5C2 for maximum and readjust A2A5R4 for 37 mV.

29. Remove attenuator in 50 MHz output and connect W18 Cable to A2J2.

30. Adjust A2A5C12 for maximum signal level.

31. Adjust AMPL CAL for 40 mV.

32. Disconnect the 30 MHz -15 dBm signal from RF Section INPUT and connect a 1.6 GHz -15 dBm signal.

33. Connect a 1.6 GHz signal to RF Section INPUT and tune FREQUENCY to 1.6 GHz n=1- 2.05 GHz IF Band.

34. Adjust input signal level to set signal amplitude at LOG REF graticule line.

35. Switch to n=1-* 550 MHz IF Band and tune FREQUENCY to 1.6 GHz.

36. Adjust A2A5R25 (1-* LOW) to set signal amplitude at LOG REF graticule line.

37. Unless adjustments were very minor (less than 3 mV on linear scale) repeat adjustments starting with step 2.

NOTE

The factory selected resistors in the Input Mixer Gain Compensation Network A16 are selected to match the mixer diode in the First Converter Assembly A12. Procedures for field selection and replacement are not given and are not recommended.

5-31. Tuning Stabilizer Control Adjustments

REFERENCE: Schematic 9.

DESCRIPTION: The FET OFFSET A5R55 is adjusted to provide a zero level output to the tuning stabilizer with a zero level input from the fine tune and scan width amplifier A5U1 (with the analyzer unstabilized). The TICKLER SWEEP A5R48 is adjusted to align a 1 MHz comb signal on the -5 and +5 graticule lines (analyzer in the 100 kHz PER DIVISION SCAN WIDTH and unstabilized). The analyzer is then stabilized and the VCXO SWEEP A5R58 is adjusted to provide the same sweep display as the TICKLER SWEEP adjustment in the unstabilized mode. The adjustments are then rechecked for interaction.

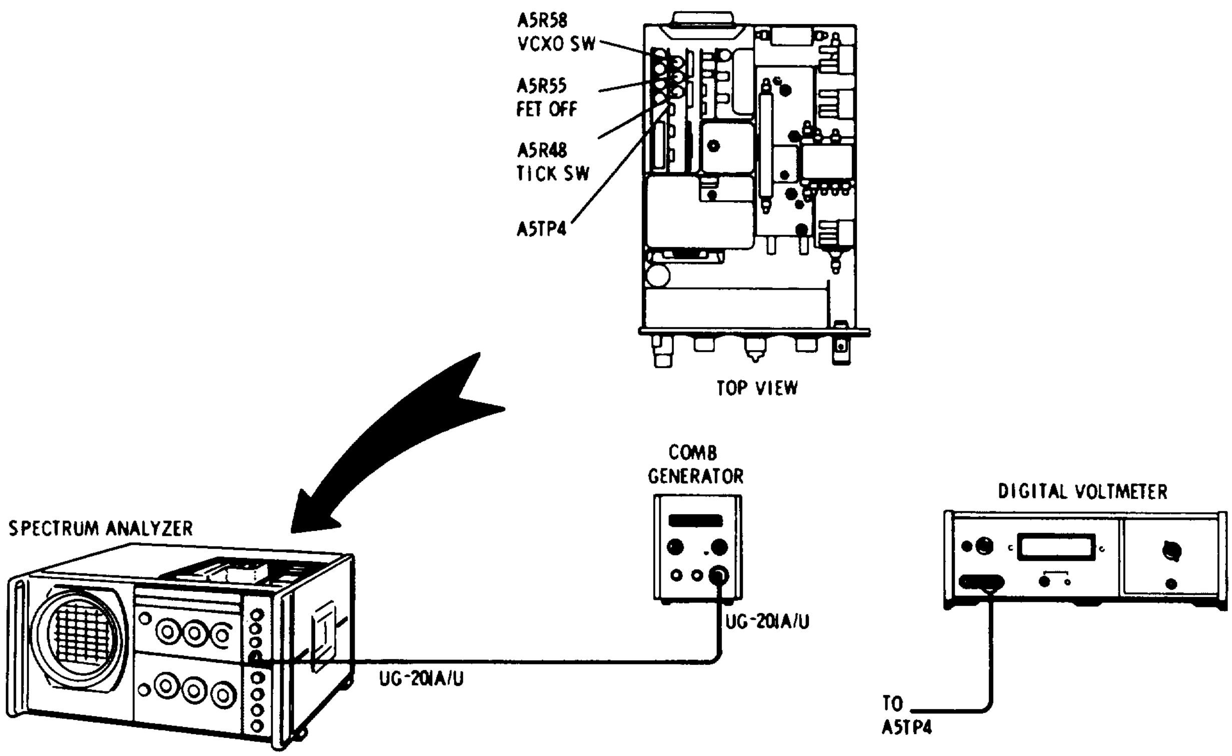


Figure 5-9. Tuning Stabilizer Control Adjustment Test Setup

EQUIPMENT:

- HP 5060-0256 Extender Board
- HP 3440A Digital Voltmeter w/HP 3443A Auto Range Unit
- HP 8406A Comb Generator
- HP 10503A Cable Assembly
- UG 201A/U Adapter (2)
- Modified Display Section Cover, see "Warning"

WARNING

The following steps apply dangerous potentials up to 7000 volts dc to exposed terminals and wiring in the Display Section chassis. Exercise extreme caution when working inside this chassis.

5-31. Tuning Stabilizer Control Adjustments (cont'd)

1. Install plug-ins on extender cables or install a cover over the Display Section with a cutout above the analyzer plug-ins.

2. Select n=1- 2.05 GHz IF band; apply power to analyzer and allow sufficient time (at least 30 minutes) for instrument to warm up and stabilize.

3. Set analyzer controls as follows:

   SCAN WIDTH PER DIVISION .... 100 kHz
   SCAN WIDTH .... ZERO
   FREQUENCY .... 10 MHz
   BANDWIDTH .... 10 kHz
   INPUT ATTENUATION .... 10 dB
   SCAN TIME PER DIVISION .... 5 MILLISECONDS
   LOG REF LEVEL .... -10dBm
   LOG/LINEAR .... LOG
   VIDEO FILTER .... OFF
   SCAN MODE .... INT
   SCAN TRIGGER .... LINE
   TUNING STABILIZER .... OFF

4. Connect Digital Voltmeter to A5 TP4 and adjust FINE TUNE control for 0.0 +0.1V indication on voltmeter.

5. Connect Digital Voltmeter to A5 TP9 and adjust FET OFFSET for 0.0 + 0.1 V

6. Set SCAN WIDTH to PER DIVISION and connect a 1 MHz comb signal to .01 - 18 GHz INPUT.

7. Adjust TICKLER SWEEP A5R48 to align the comb signals on the -5 and +5 graticule lines. Use FINE TUNE control to shift signals on the display.

8. Set TUNING STABILIZER switch to ON and adjust VCXO SWEEP A5R58 to provide the same display as in step 7 above.

9. Repeat steps 4 through 8 to check for interaction between adjustments.

5-32. Tuning Stabilizer VCXO Adjustments

REFERENCE: Schematic 10.

DESCRIPTION:

NOTE

Do not make VCXO adjustments unless required. Perform steps 1 through 9 before making adjustments. Normal component replacement should not affect alignment. Perform Tuning Stabilizer Control Adjustments prior to performing VCXO adjustments.

5-32. Tuning Stabilizer VCXO Adjustments (cont'd)

After the Tuning Stabilizer Control Adjustments (Paragraph 5-31) have been performed, the VCXO is checked for linearity. With the YIG oscillator locked to the 2050th harmonic of the VCXO, the YIG oscillator is driven with sweep to cause it's frequency to sweep 1 MHz. The VCXO is driven with sweep to cause the frequency of its 2050th harmonic to sweep 1 MHz. If the two oscillators behaved perfectly, there would be no error signal out of the discriminator (A14C4). If the error signal is within limits, no adjustment of the VCXO circuits is required. If the error signal is out of limits perform the adjustments in the order given. A14A2C3 and A14A2C16 interact, small adjustments should be made and the TUNING STABILIZER switched "OFF" and then "ON" after each adjustment to remove the dc component introduced by the adjustment. C16 is adjusted to produce the best horizontal straight line and C3 is adjusted to remove curvature in the line.

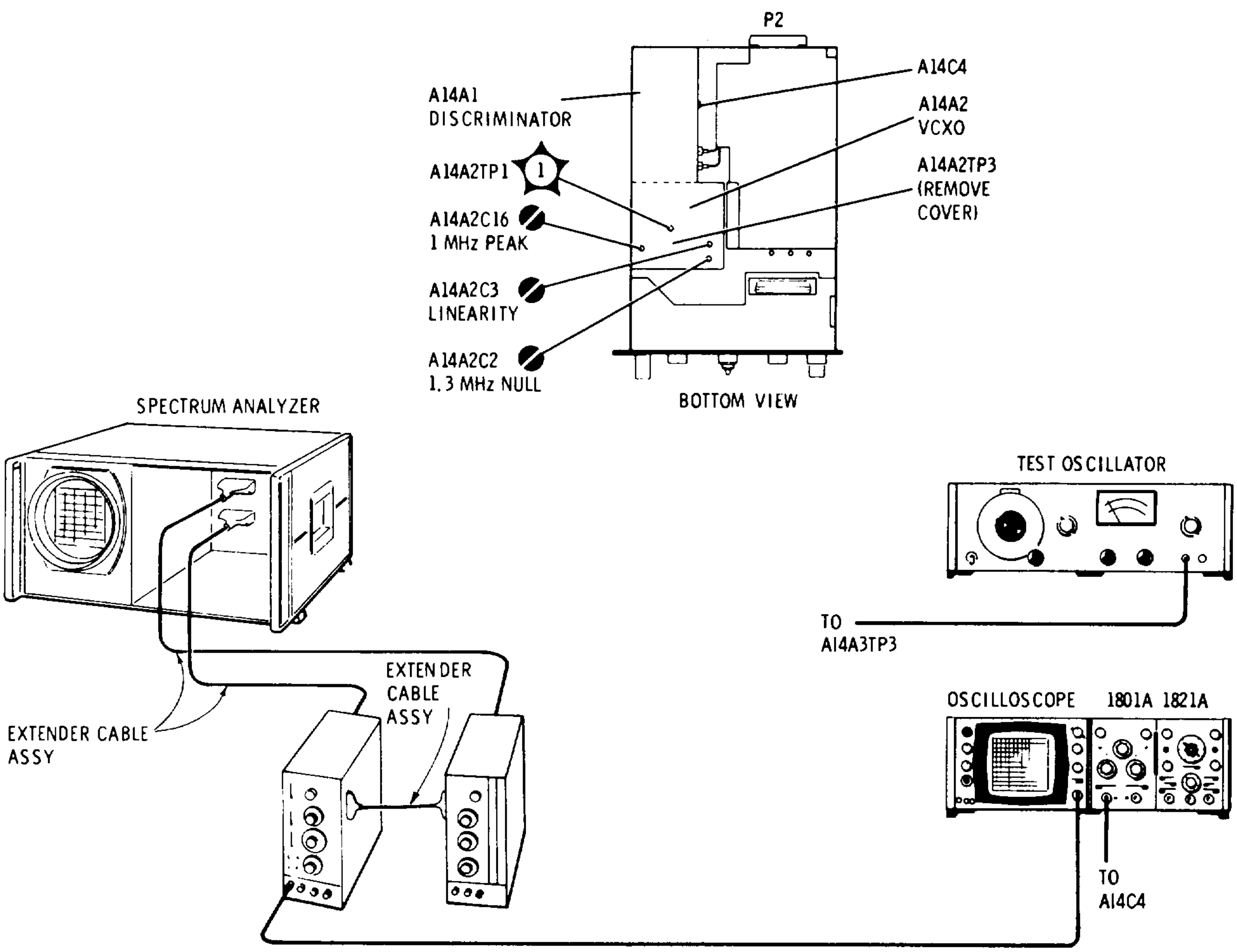


Figure 5-10. Tuning Stabilizer VCXO Adjustment Test Setup

EQUIPMENT:

HP 180A Oscilloscope w/HP 1801A/HP 1821A Plug-ins
HP 652A Test Oscillator
HP 08555-60077 Service Kit
HP 10503A Cable Assembly

ADJUSTMENTS

5-32. Tuning Stabilizer VCXO Adjustments (cont'd)

1. Remove Plug-ins from Display Section and remove bottom cover from RF Section.

2. Connect Plug-ins to Display Section using extender cables.

3. Connect IF Section SCAN IN/OUT to external horizontal input of oscilloscope.

4. Connect oscilloscope vertical input to discriminator output error signal at A14C4 (958 wire).

5. Set oscilloscope vertical sensitivity to 10 mV/DIV, dc coupled. (Straight through probe.)

6. Set analyzer controls as follows:
   BAND .... 01 - 2.05 GHz
   FREQUENCY .... 0 MHz
   SCAN WIDTH .... PER DIVISION
   SCAN WIDTH PER DIVISION .... 100 kHz
   FINE TUNE .... Centered
   TUNING STABILIZER .... ON
   SCAN TIME PER DIVISION .... 5 MILLISECONDS
   SCAN TRIGGER .... LINE

7. Switch TUNING STABILIZER "OFF" and "ON" to remove dc component on error signal. Center trace on oscilloscope with position control.

8. The line on the oscilloscope, representing the error signal must have a maximum slope of +one-half division per division to satisfy the ±10 percent scan accuracy. (The horizontal sensitivity is 100 kHz/DIV and the vertical sensitivity is 20 kHz/DIV.)

9. Adjust FINE TUNE control over its three turn range while observing the oscilloscope display. The slope must stay under ±one-half division per division.

10. If the slope is out of tolerance, disconnect the SCAN IN/OUT from the oscilloscope horizontal external input, set SCAN WIDTH to ZERO and TUNING STABILIZER to "OFF".

11. Remove A14A2 cover plate for access to test points.

12. Center A14A2C3.

13. Connect a 1.3 MHz, 3-volt peak-to-peak signal from test oscillator to A14A2TP3. (Use straight through oscilloscope probe with ground clip connected to RF Section chassis.)

14. Connect oscilloscope to A14A2TP1 using X10 probe.

15. Adjust A14A2C2 with insulated tuning tool for minimum 1.3 MHz signal at TP1.

16. Disconnect 1.3 MHz signal from TP3 and move oscilloscope probe to TP2.

17. Adjust A14A2C16 for maximum 1 MHz signal at TP2.

5-32. Tuning Stabilizer VCXO Adjustments (cont'd)

18. Repeat steps 3 through 9 above.

19. If the error slope is out of tolerance (steps 8 and 9) adjust A14A2C3 and C16 for VCXO linearity. Adjust C16 for best horizontal straight line and C3 to remove curvature in line. Adjust each in small steps and switch TUNING STABILIZER "OFF" and "ON" after each adjustment.

20. Recheck FINE TUNE control over its three turn range. If the slope does not exceed +0.5 division per division no further adjustment is necessary.

21. Repeat steps 19 and 20 as required.

22. Check Tuning Stabilizer Control Adjustments, paragraph 5-31, and if adjustments are made repeat steps 3 through 9 above to check VCXO linearity.

5-33. Analogic Test and Adjustment

REFERENCE: Schematic 13 and IF Section Operating and Service Manual.

DESCRIPTION: Perform the display calibration check below. If adjustment is required refer to IF Section Operating and Service Manual for adjustment procedure. When performing the display calibration check, if the table indicates the DISPLAY UNCAL light to be "off", it is acceptable for light to be "on" if the light subsequently goes "off", when either the SCAN TIME PER DIVISION or SCAN WIDTH PER DIVISION control is switched one position counterclockwise.

Table 5-1. Analogic Display Calibration Check

VIDEO FILTER	SCAN TIME PER DIVISION	BANDWIDTH	SCAN WIDTH PER DIVISION	SCAN WIDTH	DISPLAY UNCAL LIGHT
OFF	5 MILLISECONDS	300 kHz	200 MHz	PER DIVISION	ON
OFF	5 MILLISECONDS	300 kHz	100 MHz	PER DIVISION	OFF
OFF	5 MILLISECONDS	100 kHz	100 MHz	PER DIVISION	ON
OFF	5 MILLISECONDS	100 kHz	20 MHz	PER DIVISION	OFF
OFF	5 MILLISECONDS	30 kHz	20 MHz	PER DIVISION	ON
OFF	5 MILLISECONDS	30 kHz	2 MHz	PER DIVISION	OFF
OFF	5 MILLISECONDS	10 kHz	2 MHz	PER DIVISION	ON
OFF	5 MILLISECONDS	10 kHz	0.2 MHz	PER DIVISION	OFF
OFF	5 MILLISECONDS	3 kHz	0.2 MHz	PER DIVISION	ON
OFF	5 MILLISECONDS	3 kHz	20 kHz	PER DIVISION	OFF
OFF	5 MILLISECONDS	1 kHz	20 kHz	PER DIVISION	ON
OFF	5 MILLISECONDS	1 kHz	2 kHz	PER DIVISION	OFF
OFF	5 MILLISECONDS	0.3 kHz	2 kHz	PER DIVISION	ON
OFF	50 MILLISECONDS	0.3 kHz	2 kHz	PER DIVISION	OFF
OFF	50 MILLISECONDS	0.1 kHz	2 kHz	PER DIVISION	ON
OFF	0.2 SECOND	0.1 kHz	2 kHz	PER DIVISION	OFF
100 Hz	5 SECONDS	300 kHz	200 MHz	PER DIVISION	OFF
100 Hz	5 SECONDS	100 kHz	200 MHz	PER DIVISION	ON
100 Hz	5 SECONDS	100 kHz	50 MHz	PER DIVISION	OFF
100 Hz	5 SECONDS	30 kHz	50 MHz	PER DIVISION	ON
100 Hz	5 SECONDS	30 kHz	20 MHz	PER DIVISION	OFF
100 Hz	5 SECONDS	10 kHz	20 MHz	PER DIVISION	ON
100 Hz	5 SECONDS	10 kHz	5 MHz	PER DIVISION	CFF
100 Hz	5 SECONDS	3 kHz	5 MHz	PER DIVISION	ON
100 Hz	5 SECONDS	3 kHz	1 MHz	PER DIVISION	OFF
100 Hz	5 SECONDS	1 kHz	1 MHz	PER DIVISION	ON
100 Hz	5 SECONDS	1 kHz	0.2 MHz	PER DIVISION	OFF
100 Hz	5 SECONDS	0.3 kHz	0.2 MHz	PER DIVISION	ON
100 Hz	5 SECONDS	0.3 kHz	50 kHz	PER DIVISION	OFF
100 Hz	5 SECONDS	0.1 kHz	50 kHz	PER DIVISION	ON
100 Hz	5 SECONDS	0.1 kHz	10 kHz	PER DIVISION	OFF
100 Hz	2 SECONDS	-	-	FULL	ON
100 Hz	5 SECONDS	-	-	FULL	OFF
100 Hz	5 MILLISECONDS	A11	A11	ZERO	OFF
OFF	5 MILLISECONDS	-	-	FULL	ON
OFF	10 MILLISECONDS	-	-	FULL	OFF

Table 5-2. Check and Adjustment Test Card

Hewlett-Packard Model 8555A
RF Section
Instrument's Serial No.: 8555A: -
8552_: -

Tests Performed by__________

Date __________

Para. No.	Test Description	Measurement Unit	Min.	Actual	Max.
5-22	**Input Operating Voltages**				
	+100 Vdc supply	Vdc	+ 99	______	+101
	-100 Vdc supply	Vdc	- 99	______	- 101
	-12.6 Vdc supply	Vdc	- 12.48	______	- 12.72
	- 10 Vdc supply	Vdc	- 9.99	______	- 10.01
	+20 Vdc supply	Vdc	+19.99	______	+20.01
	+10 Vdc supply	Vdc	+ 9.98	______	+10.02
	- 31 Vdc supply	Vdc	- 29.5	______	- 32.5
5-23	**+20/+10 Volt Check and Adj**				
	+ 20 Volt supply	Vdc	+19.99	______	+20.01
	+ 10 Volt supply	Vdc	+ 9.99	______	+10.01
5-24	**YIG Driver Adjustments**				
	4.1 GHz Adjustment	divisions	- 1	______	+1
	2.05 GHz Adjustment	divisions	- 1	______	+1
	100 MHz Steps	divisions	- 3	______	+3
	1 GHz Check	divisions	- 3	______	+3
5-25	**2nd LO Check and Adjustment**				
	1500 MHz LO Frequency	MHz	1,499.9	______	1,500.1
	1500 MHz LO Power Output	dBm	+ 7	______	+ 11
5-28	**500 MHz LO Check and Adjustment**				
	500 MHz LO Frequency	MHz	499.95	______	500.05
	500 MHz LO Power Output	dBm	+ 1	______	

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

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

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

7-4. Refer to paragraph 7-10 for manual changes pertaining to later serial numbered instruments.

NOTE
Change J in Table 7-1 below is deleted.

Table 7-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
1429A	A
1416A	A,B
1343A03186 thru 1343A Prefix	A – C
1343A02986 thru 1343A03185	A – D
1326A	A – E
1325A	A – F
1311A	A – G
1232A01936 thru 1232A Prefix	A – H
1232A to 01935	A – I
1219A	A – J
1203A	A – K
1143A	A – L
1138A	A – M, and N
1116A00560 to 00760	A – M, O (N deleted)
1116A to 00560	A – M, O, P
1114A	A – M, O – Q
1043A00261 to 00335	A – M, O – R
1043A00161 to 00260	A – M, O – S
1043A to 00160	A – M, O – T
987-00120 to 00140	A – M, O – U
987- to 00120	A – M, O – V

Manual Changes

7-5. MANUAL CHANGE INSTRUCTIONS

CHANGE A

Page 8-20, Service Sheet 4:
Delete paragraphs (1) and (2)

Add paragraphs (1) and (2) as follows:

(1) 500 MHz LO Drive A2A2

The 500 MHz LO Driver sets the collector voltage and emitter currents for transistors in the 500 MHz LO. In all operating modes the collector voltage is set by a factory selected resistor A2A2R16 to a fixed level. In all modes, except Signal Identifier, the emitter current is set to a fixed level by the frequency linearity adjustment resistor A2A2R13. In the Signal Identifier operating mode, a voltage is applied to the 500 Mhz LO Driver on alternate sweep scans. The input voltage level in the range of .02 and 10.0 volts, is determined by the signal identifier attenuator on the SCAN WIDTH PER DIVISION switch. (See Service Sheet 6.) This voltage will be positive if the BAND is set to a n- Band and will be negative if set to a n+ Band. The LO driver converts the change in voltage level to a change in emitter current to the transistors in the 500 Mhz LO. The change in emitter current results in a frequency shift.

CHANGE A (cont'd)

(2) 500 MHz LO A2A4

The 500 MHz LO is a two-transistor oscillator that normally operates at a fixed frequency. In the Signal Identifier operating mode, the frequency of the LO is shifted on alternate scans by changing the transistor emitter currents. The amount of shift will be twice the setting of the SCAN WIDTH PER DIVISION switch (i.e., between 4 kHz and 2 Mhz). Note: The Signal Identifier mode is disabled above switch settings of 1 MHz. The oscillator shift will be positive for n+ Bands and negative for n- Bands. The LO output is coupled to the 550/50 MHz mixer and to the rear panel as a test point or for use with auxiliary equipment.

Delete paragraph (1)

Add paragraph (1) as follows:

(1) 500 MHz LO DRIVE A2A2 TROUBLESHOOTING PROCEDURE

Remove bottom section of third converter from the RF Section chassis (see third converter removal and replacement procedure, Service Sheet 18). Connect +20 volts to A2C1/C2 and -10 volts to A2C3 from dual power supply. Measure current drawn from power supply. Approximately 28 mA should be drawn from the 20 volt source and 16 mA from the 10 volt source.

Connect a -10 volt source to test point A2A2TPA (Signal Identifier Input) and measure voltage at A2A2TPB. Voltage level should be approximately +8.6 Vdc. Connect a +10 volt source to A2C4 and repeat measurement. Voltage level should be approximately +5.4 Vdc. (Zero volts input produce approximately +7V.)

Perform voltage measurements as listed below:
Unit of measurement: Vdc; tolerance +0.1 Vdc.

	Emitter	**Base**	**Collector**
A2A2Q1	+0.6	0	-9.2
A2A2Q2	+0.6	0	-9.9
A2A2Q3	- 9.9	-9.2	-5.8
A2A2Q4	+19.0	+19.6	+ 20.0

Delete Figure 8-23, 500 MHz LO Drive Assembly A2A2.

Add the Figure 8-23, 500 MHz LO Drive Assembly A2A2 shown here as Figure 7-1.

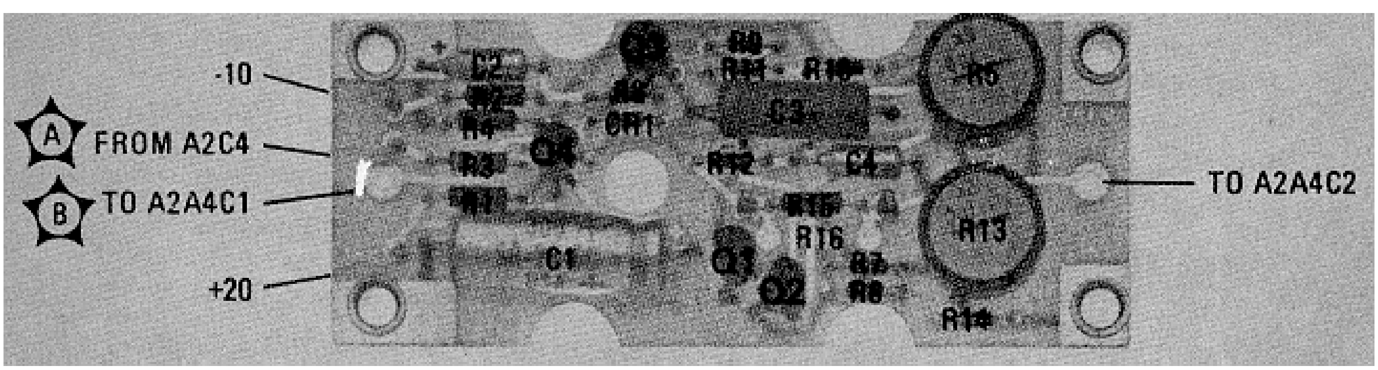


Figure 7-1. 500 MHz LO Drive Assembly A2A2 (P/O Change A)

Manual Changes

CHANGE A (cont'd)

Page 8-21, Service Sheet 4:
Delete Figure 8-24. 500 MHz LO Assembly A2A4.

Add the Figure 8-24. 500 MHz LO Assembly A2A4 shown here as Figure 7-2.

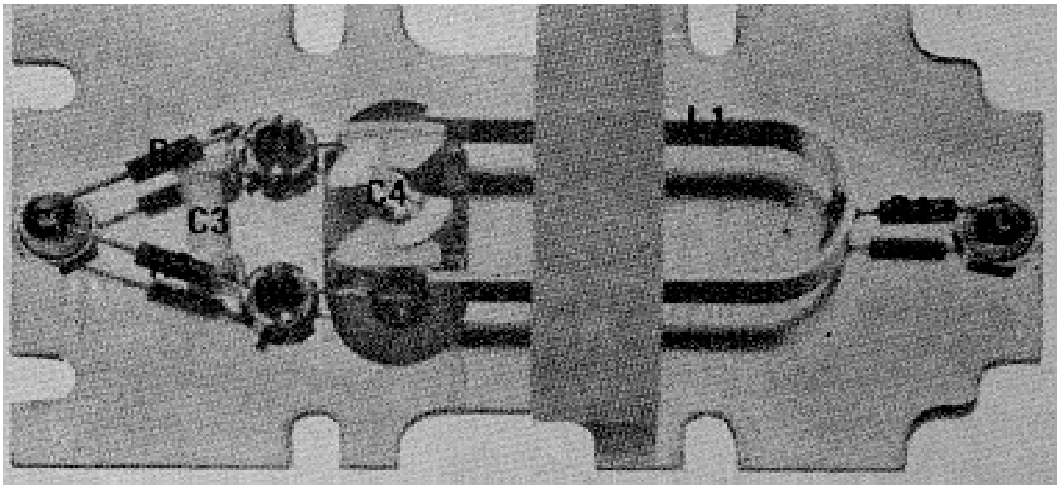


Figure 7-2. 500 MHz LO Assembly A2A4 (P/O Change A)

Delete Figure 8-27. Third Converter Assembly A2, Bottom View.

Add the Figure 8-27. Third Converter Assembly A2, Bottom View, shown here as Figure 7-3.

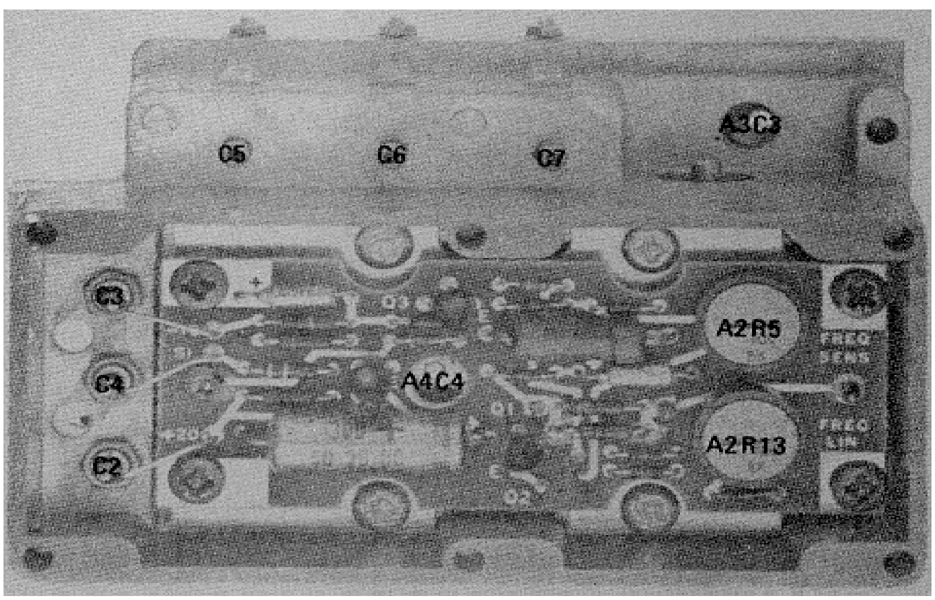


Figure 7-3. Third Converter Assembly A2, Bottom View (P/O Change A)

CHANGE A (cont'd)

Page 8-21 (cont'd)

Delete Assemblies A2A2 and A2A4 of Schematic Diagram Figure 8-28, Third Converter.

Add schematic of Assemblies A2A2 and A2A4 of Figure 8-28, Third Converter, shown here as Figure 7-4.

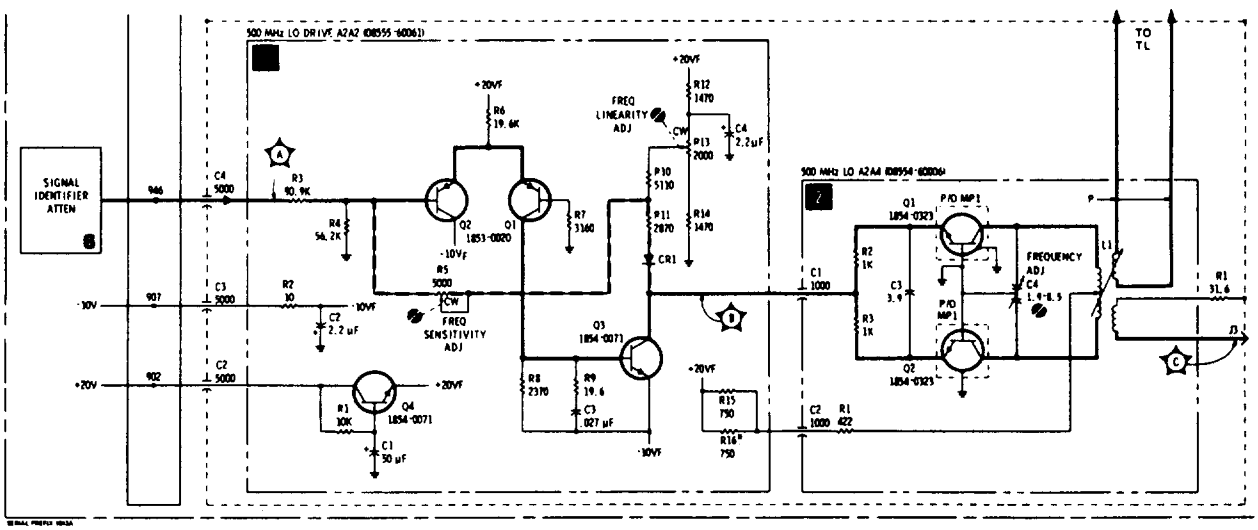


Figure 7-4. P/O Service Sheet 4, Figure 8-28, Third Converter (P/O Change A)

CHANGE B

Page 8-19, Service Sheet 3:

Change A11A1Q1 and Q2 from type 35824A to type 1854-0292.

Change A11A1C1* from 0.6 PF to 0.4 PF.

Delete NOTE 2.

CHANGE C

Page 8-2, Table 8-1:

Add A16R24; Input Mixer Bias; n=1, 3+ Bias Compensation.
Add A16R25; Input Mixer Bias; n=4+ Bias Compensation.

Page 8-17, Figure 8-17, Service Sheet 2:

Change components as shown in the following partial schematic (Figure 7-5):

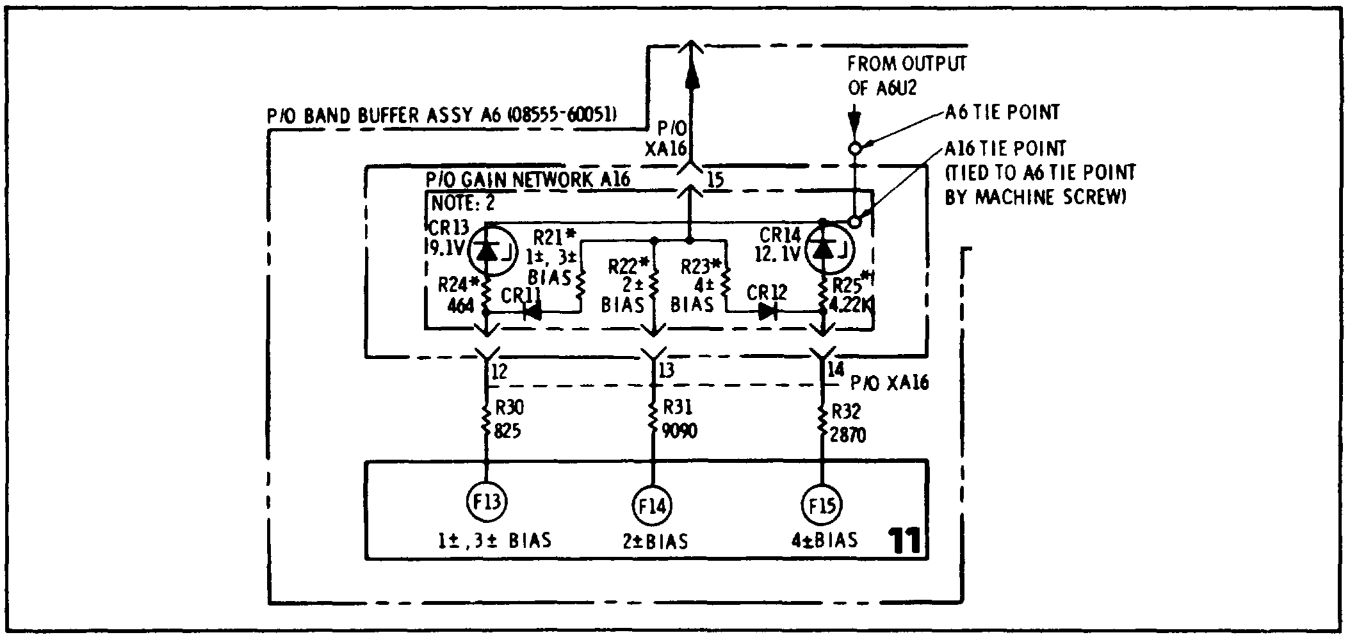


Figure 7-5. Partial Schematic of Figure 8-17 (P/O Change C)

CHANGE C (cont'd)

Page 8-27, Figure 8-41, Service Sheet 7:

Change signal path from A4U7 to AUXILIARY "B" as in the partial schematic shown as Figure 7-6.

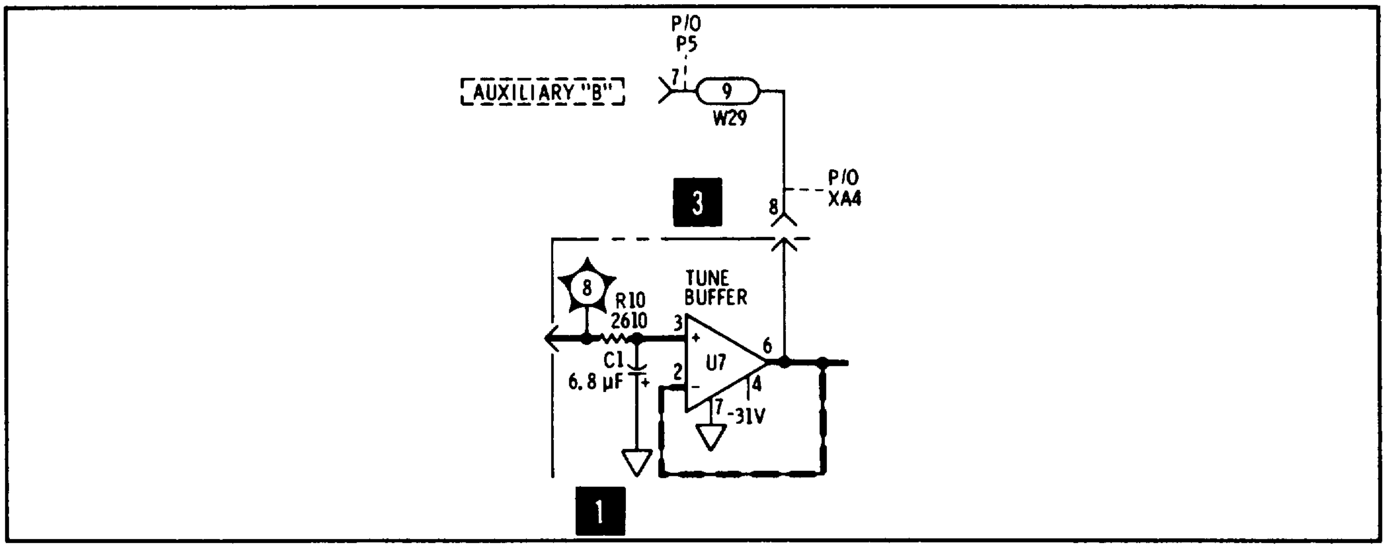


Figure 7-6. Partial Schematic of Figure 8-41 (P/O Change C)

CHANGE D

Page 8-2, Table 8-1:

Delete A2A5R19, 50 MHz Ampl., 50 MHz ampl. gain.

Page 8-23, Figure 8-34, Service Sheet 5:

Change A2A5R19* to A2A5R19, 51.1 OHM.

CHANGE E

Page 8-17, Figure 8-17, Service Sheet 2:

Change A1P6 pin numbers (four locations) in accordance with partial schematic shown here as Figure 7-7.

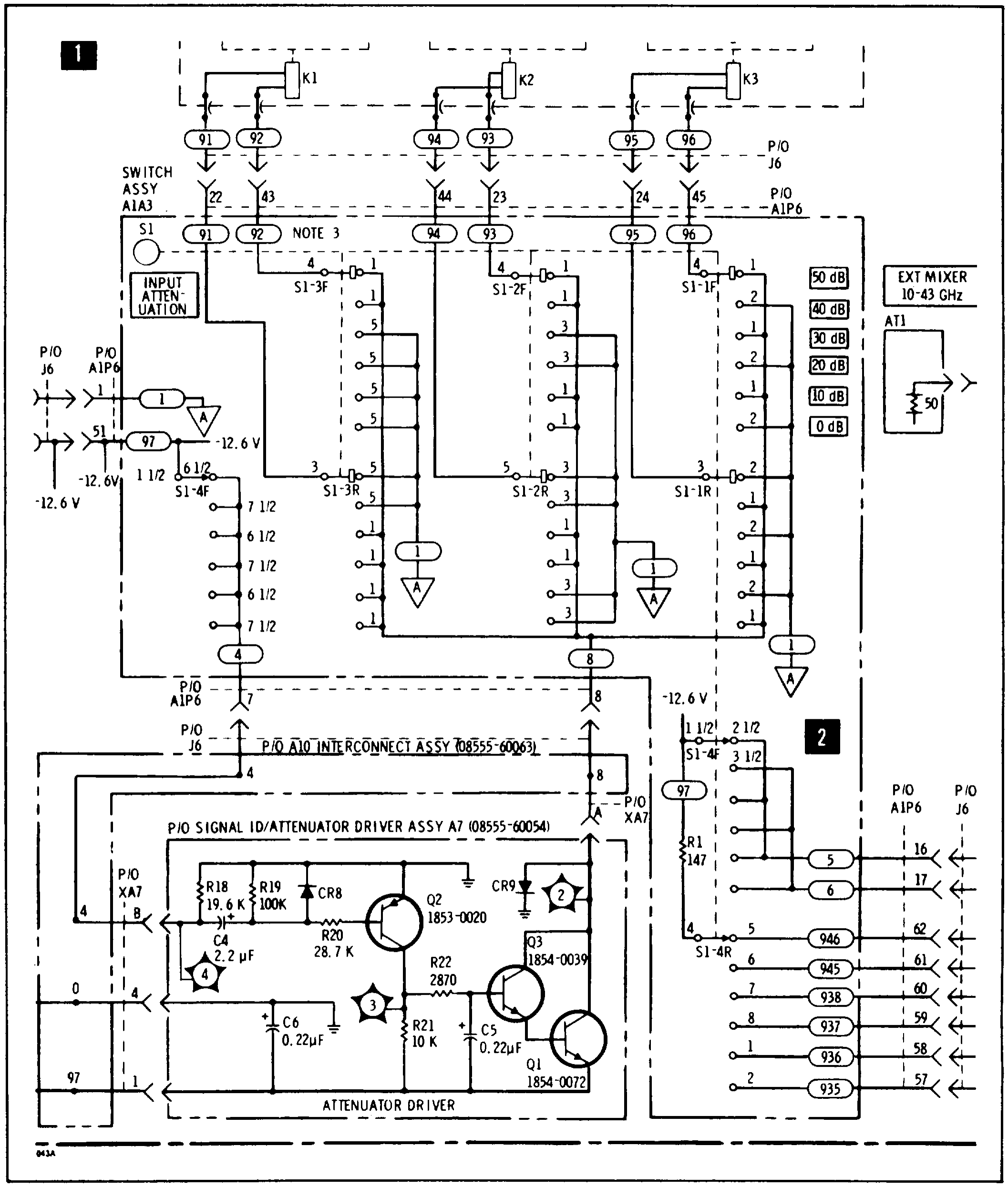


Figure 7-7. Partial Schematic of Figure 8-17 Showing A1P6 Pin Changes (P/O Change E)

CHANGE E (cont'd)

Page 8-31, Figure 8-52, Service Sheet 9:
Change the following pin numbers on A1P6 (lower left-hand comer of schematic):
Pin 52 to pin 67
Pin 55 to pin 70
Pin 31 to pin 39
Pin 9 to pin 13.
Change A5C3 to 1000.

Page 8-33, Figure 8-55, Service Sheet 10:
Change A1P6 pin 8 to pin 12 (left-hand side of schematic).

Page 8-35, Figure 8-58, Service Sheet 11:
Change the following pin numbers on A1P6 (left-hand side of schematic):
Pin 10 to pin 14
Pin 11 to pin 15
Pin 12 to pin 16
Pin 13 to pin 17
Pin 14 to pin 18

Page 8-37, Figure 8-61, Service Sheet 12:
Change A1P6 pin 29 to pin 37.

Page 8-38, Troubleshooting Procedure, Service Sheet 13:
Change pin 52 to pin 67 and pin 20 to pin 25 in first line of step 1-a.
Change pin 52 to pin 67 and pin 19 to pin 24 in first line of step 1-b.
Change pin 52 to pin 67 and pin 20 to pin 25 in first line of step 1-d.
Change pin 52 to pin 67 in first line of step 1-e.
Change pin 20 to pin 25 (appears twice) and pin 19 to pin 24 in second line of step 1-e.
Change pin 52 to pin 67 and pin 21 to pin 26 in second line of step 2-a.
Add Step 2-b.
2-b. With the switches set as in 2-a, measure the resistance between A1P6-67 (907 wire) and A1P6-5 (967 wire). (ZERO scan signal for use by external equipment.) Resistance should be approximately 3160 ohms (AlA2R20), in the FULL scan and PER DIVISION modes and infinity in ZERO scan mode.

Pages 8-25, 8-37 and 8-38, Figures 8-37, 8-60, and 8-63:
Add R20 on middle switch assembly as shown in Figure 7-8.

CHANGE E (cont'd)

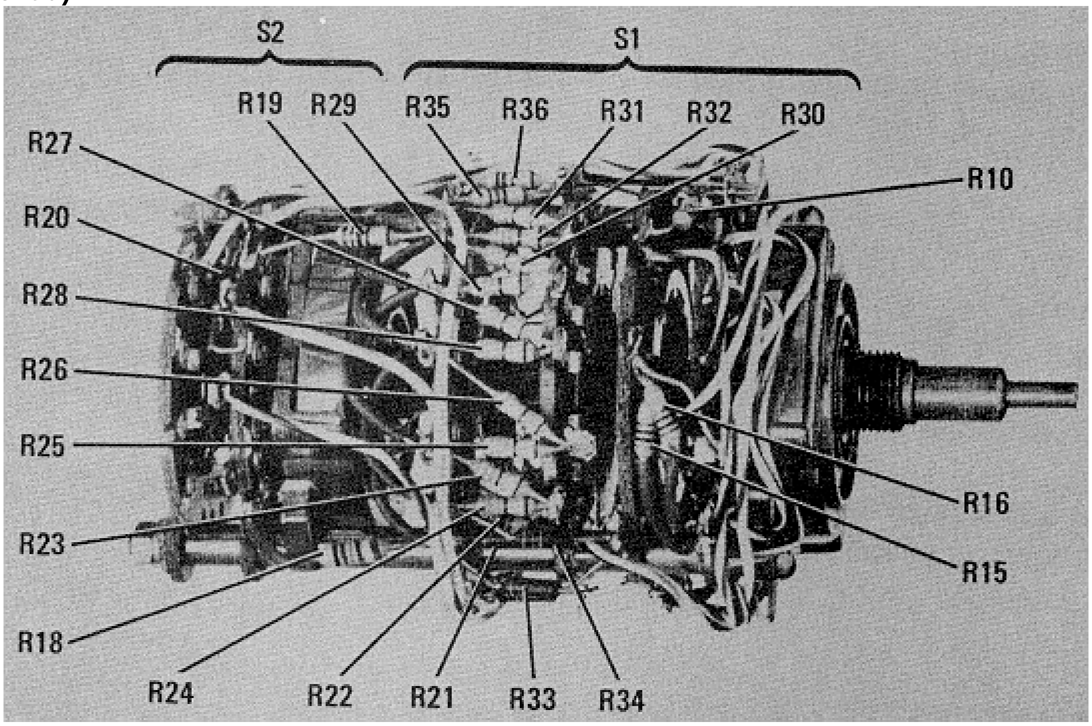


Figure 7-8. Position of R20, Figures 8-37, 8-60, and 8-63(P/O Change E)

Page 8-39, Figure 8-65, Service Sheet 13:

Change A1P6 pin 52 to pin 67 (upper left-hand comer of schematic).

Add resistor AlA2 R20 and Zero Scan Signal line (967) between shield of cable W21 and (958) line as shown in heavy lines in the partial schematic, Figure 7-9.

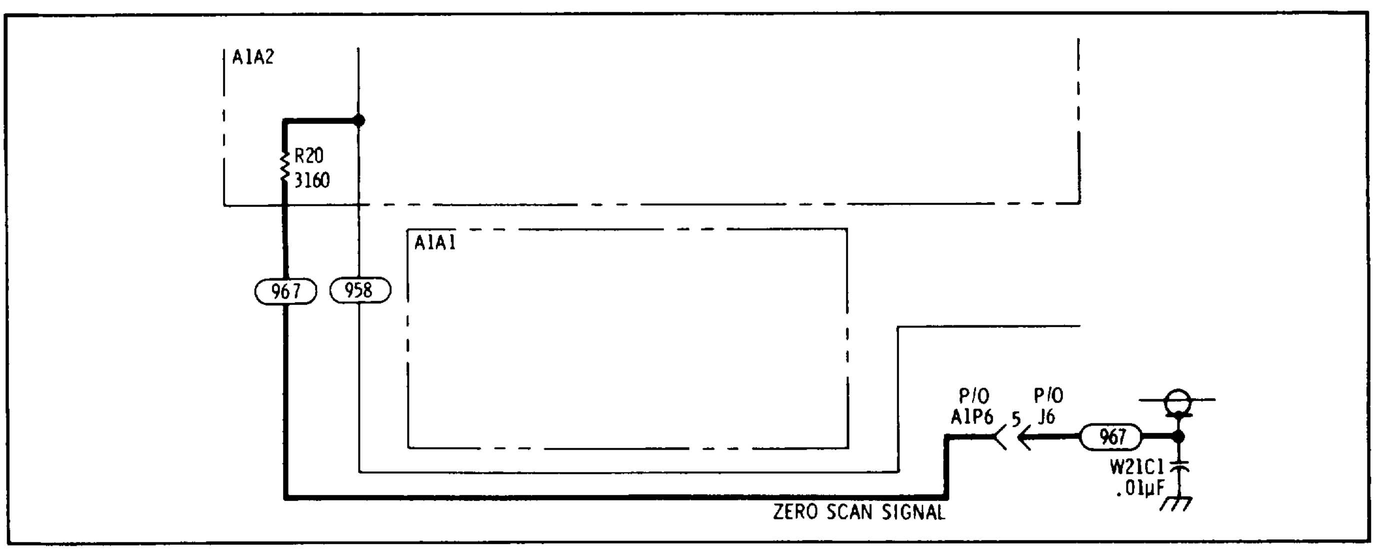


Figure 7-9. Partial Schematic of Figure 8-65, Zero Scan Signal Line to A1A2 (P/O Change E)

Change A1P6 pin 19 to pin 24, pin 20 to pin 25, and pin 21 to pin 26 (right-hand side of schematic).

CHANGE E (cont'd)

Page 8-40, Troubleshooting Procedure, Service Sheet 14:

Change pin 51 to pin 66 and pin 42 to pin 53 in first paragraph of Test Procedures.

Change the following pin numbers in second paragraph of Test Procedures:

Pin 51 to pin 66 (two entries)
Pin 42 to pin 53 (two entries)
Pin 41 to pin 52
Pin 40 to pin 51
Pin 39 to pin 50
Pin 38 to pin 49
Pin 37 to pin 48
Pin 36 to pin 47

Change the following pin numbers in third paragraph of Test Procedures:

Pin 51 to pin 66 (two entries)
Pin 36 to pin 47
Pin 37 to pin 48
Pin 38 to pin 49
Pin 40 to pin 51
Pin 41 to pin 52

Change pins 53 and 18 to pins 68 and 23 in fourth paragraph of Test Procedures.

Page 8-41, Figure 8-67, Service Sheet 14:

Change A1P6 pin 51 to pin 66 (left-hand side of schematic).

Change the pin numbers of A1P6 on right-hand side of schematic as follows:

Pin 36 to pin 47
Pin 37 to pin 48
Pin 38 to pin 49
Pin 39 to pin 50
Pin 40 to pin 51
Pin 41 to pin 52
Pin 42 to pin 53
Pin 18 to pin 23
Pin 53 to pin 68

Page 8-44, Tables 8-5 and 8-6, Service Sheet 16:

Replace with new Tables 7-2 and 7-3 supplied in this Manual Changes Supplement.

Page 8-45, Figure 8-73, Service Sheet 16:

Change pin location diagram of CONNECTOR J6/A1P6 to diagram of Figure 7-10 in this Manual Change Supplement.

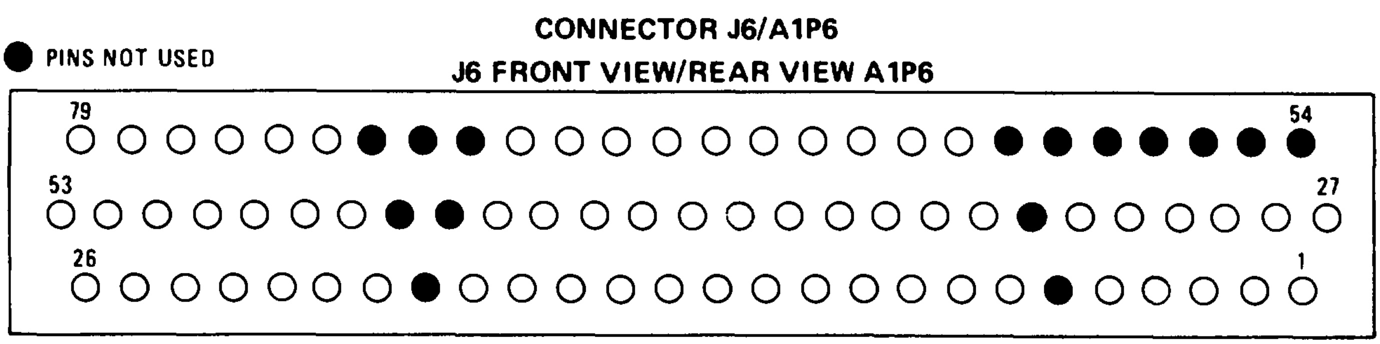


Figure 7-10. Connector Pin Location Diagram of Figure 8-72 (P/O Change E)

SERVICE SHEET 16

Table 7-2. RF Section Chassis Wiring from Connector J6 (P/O Change E)

From J6 Pin No.	Wire Color Code	Function	To	Service Sheet
1	1	-12.6V Ground Return	P2-8	2
2	903	VCXO Sweep Input	A14C6	10
3	908	External Mixer Bias	A12	2
4	946	Signal Identifier Attenuator Output	A10-946	6
5	967	Zero Scan Signal	P4-A7 shield	13
6		Open		
7	4	Attenuator Driver Trigger	A10-4	2
8	8	Attenuator Driver Output	A10-8	2
9	95	Noise Filter Control	A10-95	7
10	98	Noise Filter Control	A10-98	7
11	901	Frequency Tune Pot. Output	A10-901	7
12	904	VCXO Sweep Driver Output	A10-904	10
13	906	Fine Tune Pot. Output	A10-906	9
14	914	A Bit Band Code	A10-914	11
15	915	B Bit Band Code	A10-915	11
16	916	C Bit Band Code	A10-916	11
17	917	D Bit Band Code	A10-917	11
18	918	E Bit Band Code	A10-918	6/11
19		Open		
20	3	-5 to +5V Sweep Ramp	P3-6	7/8
21	5	Linear Gain Compensation Control	P3-7	2
22	6	Linear Gain Compensation Control	P3-8	2
23	96	Ampl. Cal Adjustment	P3-29	14
24	956	Video Filter Analogic Line	P3-38	13
25	957	Normal Analogic Line	P3-30	13
26	958	Analogic -10V Line to IF Section	P3-39	13
27	91	Attenuator Switching Voltage 40 dB	A13	2
28	92	Attenuator Switching Voltage 40 dB	A13	2
29	93	Attenuator Switching Voltage 20 dB	A13	2
30	94	Attenuator Switching Voltage 20 dB	A13	2
31	95	Attenuator Switching Voltage 10 dB	A13	2
32	96	Attenuator Switching Voltage 10 dB	A13	2
33		Open		
34	923	Frequency Tune Pot. -15.2 Volts	A10-923	7
35	924	Frequency Tune Pot. - 7.3 Volts	A10-924	7
36	925	Per Division Sweep Input	A10-925	6/8
37	926	1/n Atten. Sweep Output	A10-926	12
38	927	YIG Driver Sweep Input	A10-927	7
39	928	Scan Atten. (Narrow Scan Output)	A10-928	9/12
40	934	Sweep Buffer Output	A10-934	7
41	935	Sweep plus Tune Ampl Input	A10-935	7
42	936	Sweep plus Tune Signal	A10-936	7
43	937	Full Scan Sweep Signal	A10-937	7
44	938	Signal Identifier Enable	A10-938	6
45		Open		
46		Open		
47	913	0.1 kHz Bandwidth Control	P3-2	14
48	914	0.3 kHz Bandwidth Control	P3-3	14
49	915	1 kHz Bandwidth Control	P3-4	14
50	916	10 kHz Bandwidth Control	P3-25	14
51	917	30 kHz Bandwidth Control	P3-26	14
52	918	100 kHz Bandwidth Control	P3-27	14
53	923	300 kHz Bandwidth Control	P3-28	14
54-60		Open		

SERVICE SHEET 16 (cont'd)

Table 7-2. RF Section Chassis Wiring from Connector J6 (P/O Change E) (cont'd)

From P6 Pin No.	Wire Color Code	Function	To	Service Sheet
61	945	Signal Identifier Attenuator Input	A10-945	6
62	948	Tuning Stabilizer Enable	A10-948	8
63	968	Sweep Plus Tune or Full Scan	A10-968	7
64	978	Full Scan Frequency Marker	A10-978	7
65		Open		
66	97	-12.6 V Supply	P2-21	2
67	907	-10V Supply	A10-907	9
68	902	+20V Supply	A10-902	14
69	912	+10V Supply	A10-912	2
70	0	Ground Return	A10-0	9
71		Open		
72		Open		
73		Open		
74	935	Log Rel Level Lamp No. 1	P3-33	2
75	936	Log Ref Level Lamp No. 2	P3-34	2
76	937	Log REf Level Lamp No. 3	P3-35	2
77	938	Log Ref Level Lamp No. 4	P3-9	2
78	945	Log Ref Level Lamp No. 5	P3-10	2
79	946	Log Ref Level Lamp No. 6	P3-11	2

Table 7-3. Tuning Head Wiring from Connector A IP6 (P/O Change E)

From P6 Pin	Wire Color Code	Function	To	Service Sheet
1	1	-12.6V Ground Return	A1A3S1-3R5	2
2	903	VCXO Sweep Input	A1A4R3	10
3	908	External Mixer Bias	A1A1CR1	2
4	946	Signal Identifier Attenuator Output	A1A2S1-3R17	6
5	967	Zero Scan Signal	A1A2S2	13
6		Open		
7	4	Attenuator Driver Trigger	A1A3S1-4F6'/2	2
8	8	Attenuator Driver Output	A1A3S1-3R1	2
9	95	Noise Filter Control	A1A2S2-1R8'/2	7
10	98	Noise Filter Control	A1A2S2-1R7'/2	7
11	901	Frequency Tune Pot. Output	A1A4R1	7
12	904	VCXO Sweep Driver Output	A1A4R3	10
13	906	Fine Tune Pot. Output	A1A4R2	9
14	914	A Bit Band Code	A1A4S1A	11
15	915	B Bit Band Code	A1A4S1B	11
16	916	C Bit Band Code	A1A4S1C	11
17	917	D Bit Band Code	A1A4S1D	11
18	918	E Bit Band Code	A1A4S1E	6/11
19		Open		
20	3	-5 to +5V Sweep Ramp	A1A2S2-2F7	7/8
21	5	Linear Gain Compensation Control	A1A3S1-4F1%/2	2
22	6	Linear Gain Compensation Control	A1A3S1-4F3%/2	2
23	96	Ampi Cal Adjustment	A1R2	14
24	956	Video Filter Analogic Line	A1A2S2	13
25	957	Normal Filter Analogic Line	A1A2S1	13
26	958	Analogic -10V Line to IF Section	A1A2S1-1F9	13
27	91	Attenuator Switching Voltage, 40 dB	A1A3S1-3R3	2
28	92	Attenuator Switching Voltage, 40 dB	A1A3S1-3F4	2
29	93	Attenuator Switching Voltage, 20 dB	A1A3S1-2F4	2
30	94	Attenuator Switching Voltage, 20 dB	AIA3S1-2R5	2

Table 7-3. Tuning Head Wiring from Connector A IP6 (P/O Change E) (cont'd)

From P6 Pin No.	Wire Color Code	Function	To	Service Sheet
31	95	Attenuator Switching Voltage, 10 dB	A1A3S1-1R3	2
32	96	Attenuator Switching Voltage, 10 dB	A1A3S1-1F4	2
33		Open		
34	92	Frequency Tune Pot. -15.2 Volts	A1A4R1	
35	924	Frequency Tune Pot. - 7.3 Volts	A1A4R1	7
36	925	Per Division Sweep Input	A1A2S2-2F8	6/8
37	926	1/n Atten. Sweep Output	A1A2S1-2F2	12
38	927	YIG Driver Sweep Input	A1A2S2-2F9	7
39	928	Scan Atten (Narrow Scan Output)	A1A2S1-1R17	9/12
40	934	Sweep Buffer Output	A1A2S2-2F4	7
41	935	Sweep plus Tune Ampi Input	A1A2S2-2F3	7
42	936	Sweep plus Tune Signal	A1A2S2-1R1/2	7
43	937	Full Scan Sweep Signal	A1A2S1-1R31/2	7
44	938	Signal Identifier Enable	A1A2S1-4R17	6
45		Open		
46		Open		
47	913	0.1 kHz Bandwidth Control	A1A1S1-1R1	14
48	914	0.3 kHz Bandwidth Control	A1A1S1-1R2	14
49	915	1 kHz Bandwidth Control	A1A1S1-1R3	14
50	916	10 kHz Bandwidth Control	A1A1S1-1F5	14
51	917	30 kHz Bandwidth Control	A1A1S1-1F6	14
52	918	100 kHz Bandwidth Control	A1A1S1-1F7	14
53	923	300 kHz Bandwidth Control	A1A1S1-1F8	14
54-60		Open		
61	945	Signal Identifier Attenuator Input	A1A2S1-3R8	6
62	948	Tuning Stabilizer Enable	A1A2S2-1R11 1/2	8
63	968	Sweep Plus Tune or Full Scan	A1A2S2-1R2 1/2	7
64	978	Full Scan Frequency Marker	A1A2S2-2F12	7
65		Open		
66	97	-12.6V Supply	A1A3S1-4F1/2	2
67	907	-10V Supply	A1	9
68	902	+20V Supply	A1R3	14
69	912	+10V Supply	A1A1R11	2
70	0	Ground Return	A1	9
71		Open		
72		Open		
73		Open		
74	935	Log Rel Level Lamp. No. 1	A1A3S1-4R2	2
75	936	Log Ref Level Lamp No. 2	A1A3S1-4R1	2
76	937	Log Ref Level Lamp No. 3	A1A3S1-4R8	2
77	938	Log Ref Level Lamp. No. 4	A1A3S1-4R7	2
78	945	Log Ref Level Lamp No. 5	A1A3S1-4R6	2
79	946	Log Ref Level Lamp No. 6	A1A3S1-4R5	2

CHANGE F

Page 8-23, Figure 8-34, Service Sheet 5:
Change A2A5C8 and A2A5C12 to 1.3-5.4 pF.
Change A2A5R21 to 19.6K Ohms.
Change A2A5L3 to 1.2 pH.

Page 8-33, Figure 8-55, Service Sheet 10:
Delete AL4A2R26 and AJ4A2R27 and connecting wires.

CHANGE G

Page 8-31, Figure 8-52:
Change A5R52 to 10K.
Change A5R54 and A5R64 to 10K.

Page 8-33, Figure 8-55:
Change resistor A14A2R25 to COIL A14A2L7 1 mH.

CHANGE H

Page 8-27, Figure 8-41, Service Sheet 7:
Delete AUXILIARY "B" circuit to conform with Figure 7-11 of this Manual Correction, and change five pin numbers shown on left half of partial diagram.

CHANGE H (cont'd)

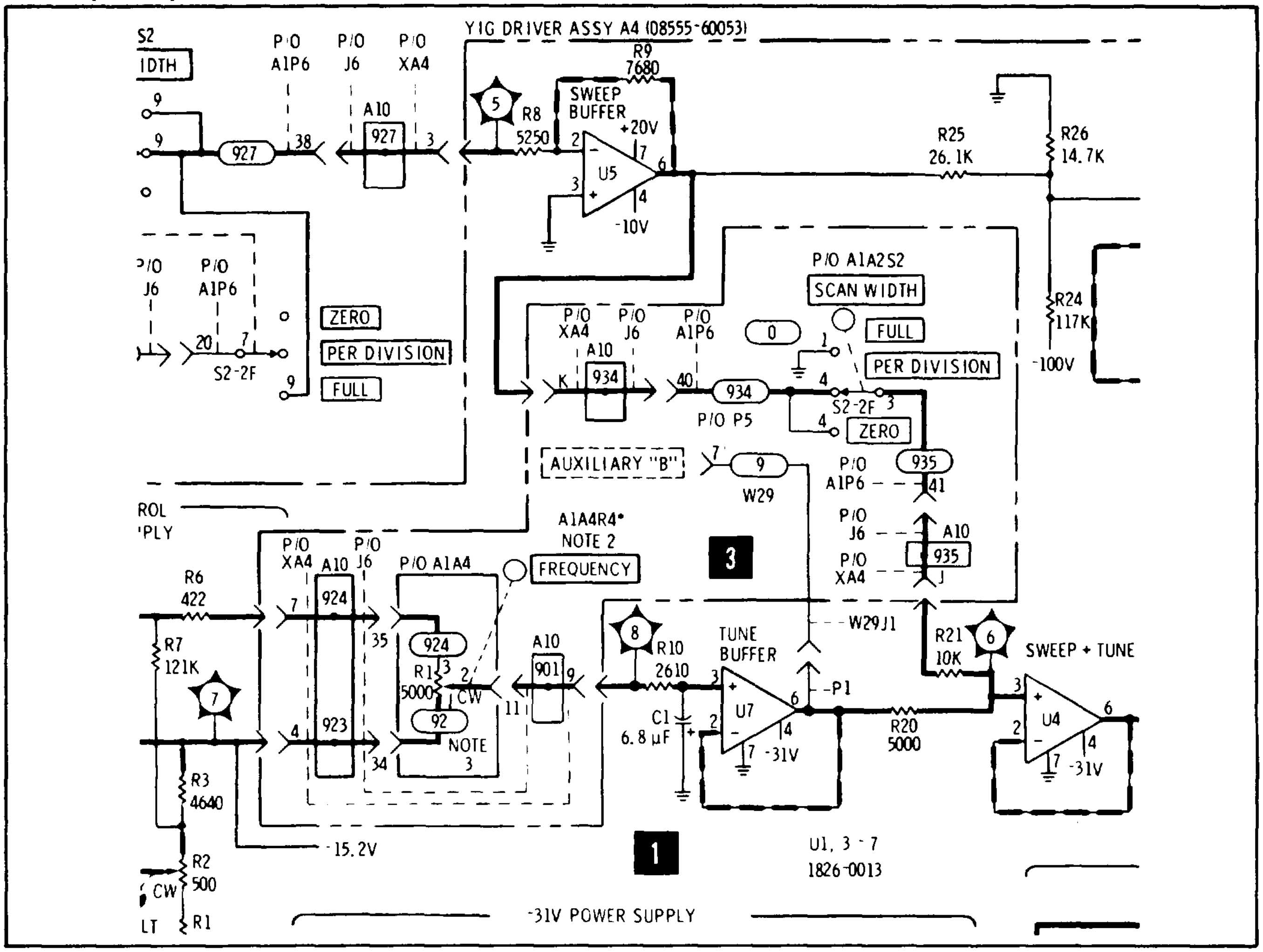


Figure 7-11. Partial Diagram of Figure 8-41, YIG Driver and Oscillator (P/O Change H)

Page 8-45, Figure 8-74, Service Sheet 16:

Replace appropriate portion of schematic with attached partial schematic shown in Figure 7-12.

CHANGE I

Page 8-23, Figure 8-34, Service Sheet 5:

Change A2A5L6 to 0.82 pH.

CHANGE J

Deleted.

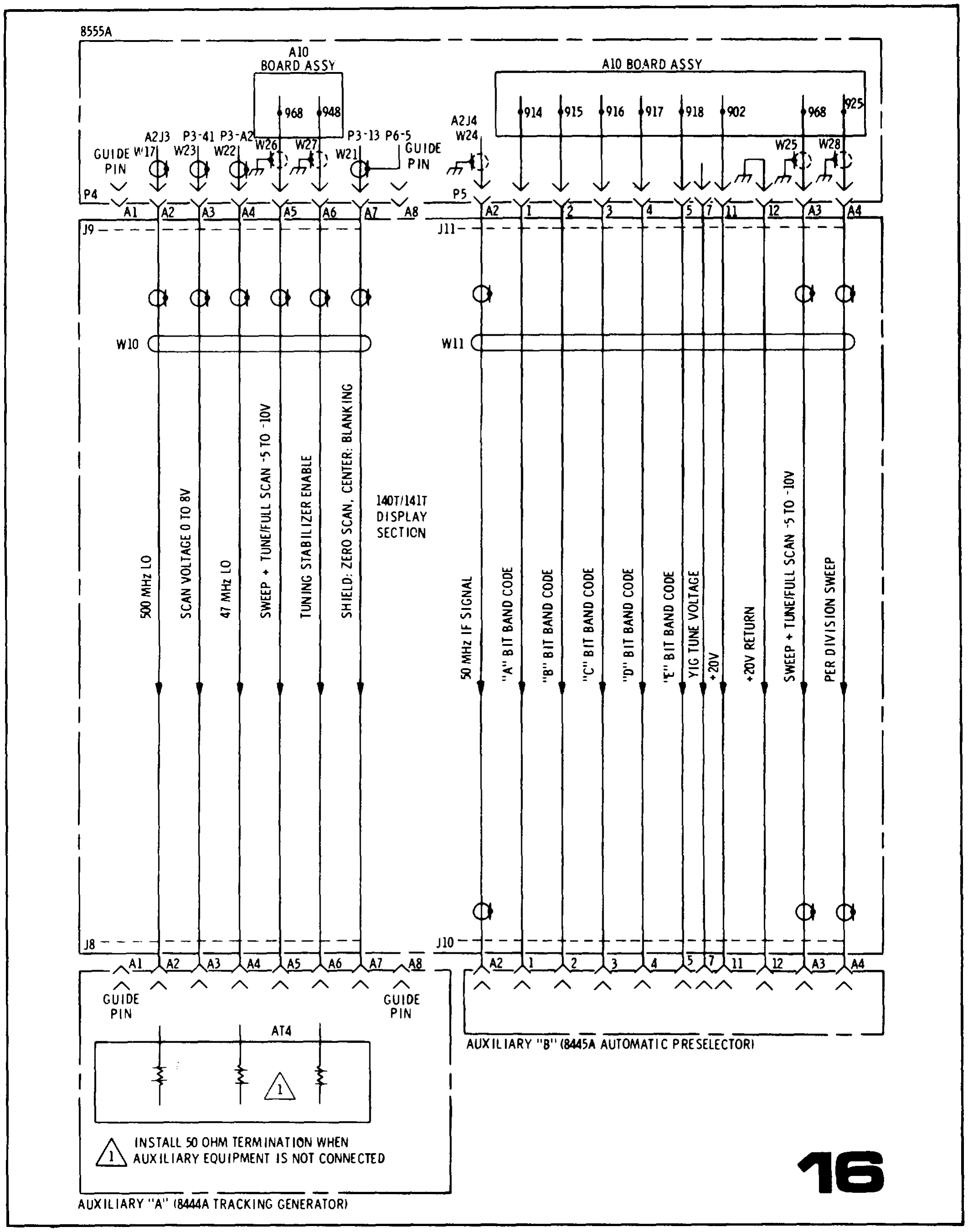


Figure 7-12. Part of Figure 8-74, RF/IF Section Interconnection Diagram (P/O Change H)

CHANGE K

Page 8-2, Table 8-1:
Delete A11AC1.

Page 8-19, Figure 8-21, Service Sheet 3:
Change A11A1C1* to read "C1 0.4."

CHANGE L

Figure 8-72, change A8C4 to indicate 6.8 UF.

CHANGE M

Delete Figures 8-60 and 8-61.

Use Figures 7-13 and 7-14 for Scan Width Switch Assembly AlA2, Component Location and Schematic Diagram.

CHANGE N

Figure 8-52, change A14A1R27 to indicate 5110 OHMS.

CHANGE 0

Figure 8-41:
Add A4C4 across A4CR6
Delete A4R46 in base circuit of A4Q2.

CHANGE P

Page 1-4, Table 1-1; Page 4-7, Para. 4-21; Page 4-9, Table 4-2: ABSOLUTE CALIBRATION ACCURACY, Frequency Response, for frequency ranges listed below.

2.07 - 6.15 2- 2050 -±1.0
10.29-18.00 4+ 2050 ±2.5

Page 8-40, change component values in 31V power supply circuit as indicated below:

A4C3	from 2 UF to 20 UF
A4R34	from 61.9K OHM to 18K OHM
A4R36	from 5110 OHM to 100 OHM
A4R40	from 10K OHM to 4640 OHM
A4R41	from 1000 OHM to 100 OHM

Figure 8-70, delete and replace with Figure 7-15, Switching Regulator Board Assembly A9A1 (08555-60056) (CHANGE P).

Figure 8-72, replace left side of schematic with Figure 7-16, Switching Regulator Schematic Diagram (08555-60056) (CHANGE P).

CHANGE Q

Figure 8-53, delete and replace with Figure 7-17. Tuning Stabilizer VCXO Assembly A14A2 (08555-60058 (CHANGE Q).

Figure 8-55, delete and replace with Figure 7-18, Tuning Stabilizer, VCXO Pulse Ampl Assy A14A2 (CHANGE Q).

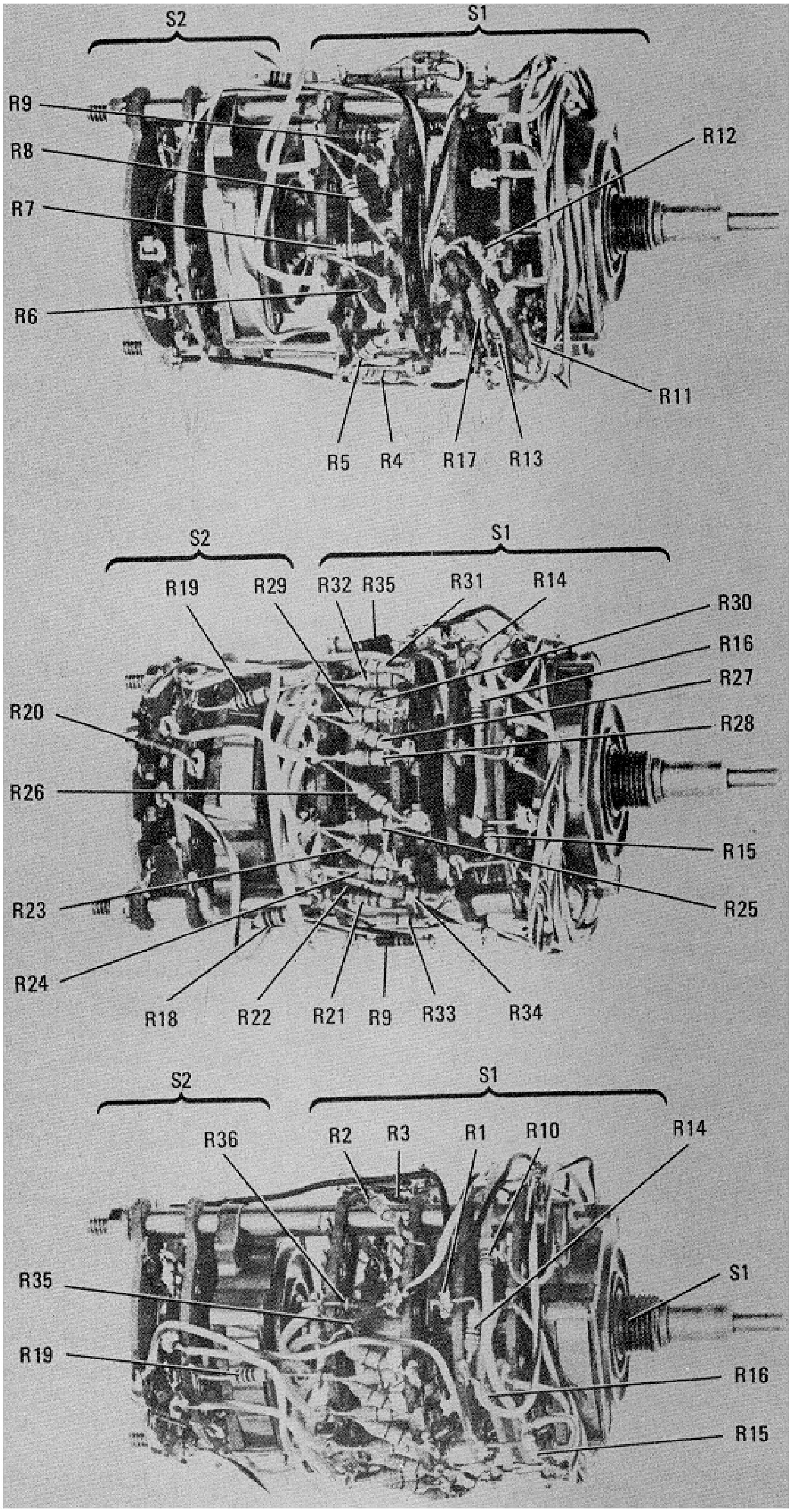


Figure 7-13. Scan Width Switch Assembly, A1A2, Figure 8-60 (Change M)

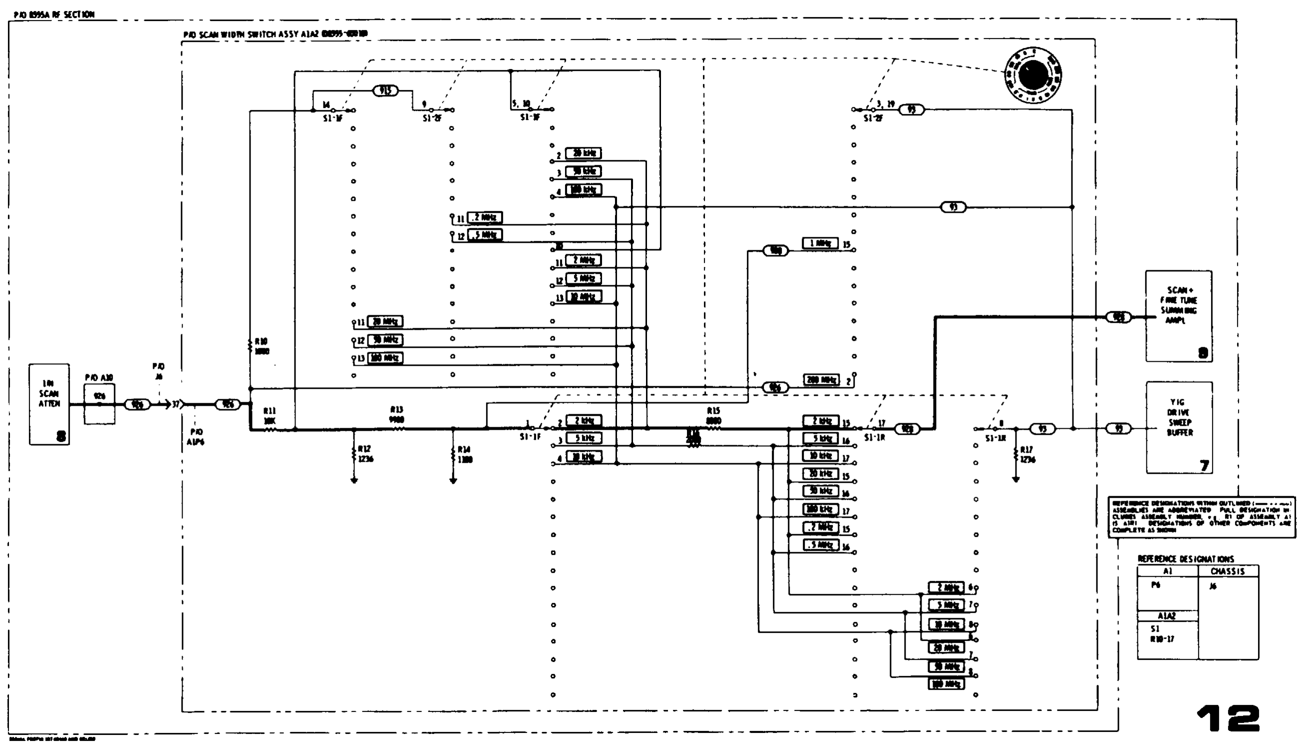


Figure 7-14. Scan Width Switch Assembly A1A2, Schematic Diagram, Figure 8-61, (Change M)

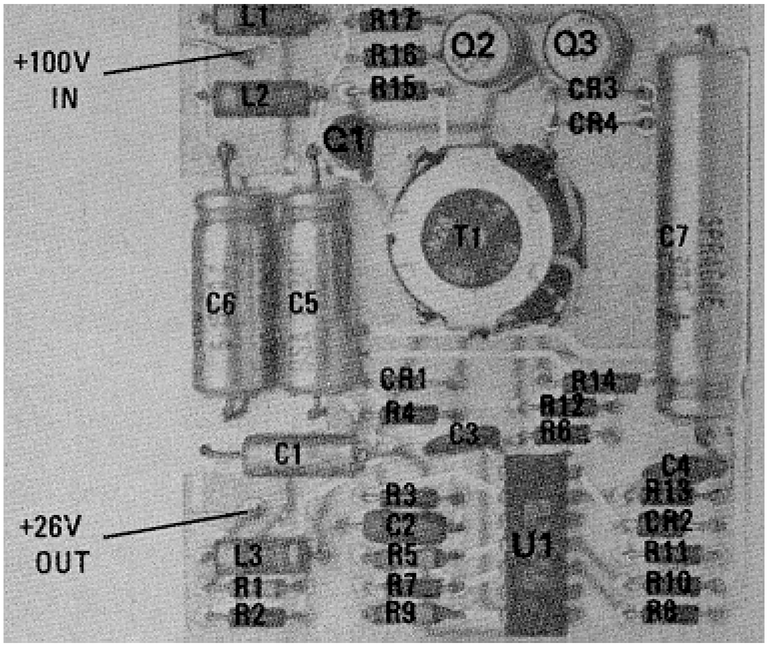


Figure 7-15. Switching Regulator Board Assembly A9A1 (08555-60056), Figure 8-70 (Change P)

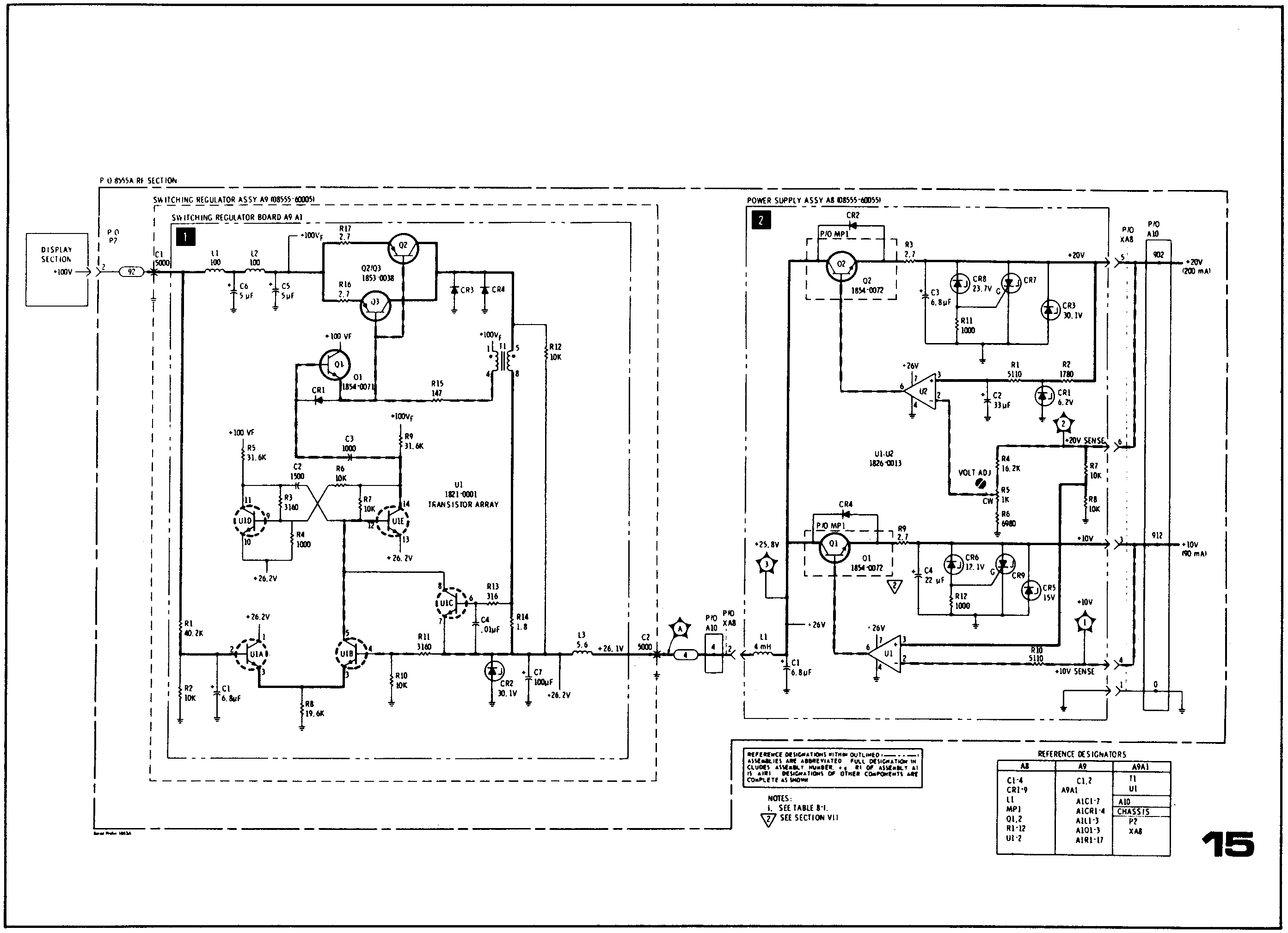


Figure 7-16. Switching Regulator Schematic Diagram (08555-60056), Figure 8-72 (Change P)

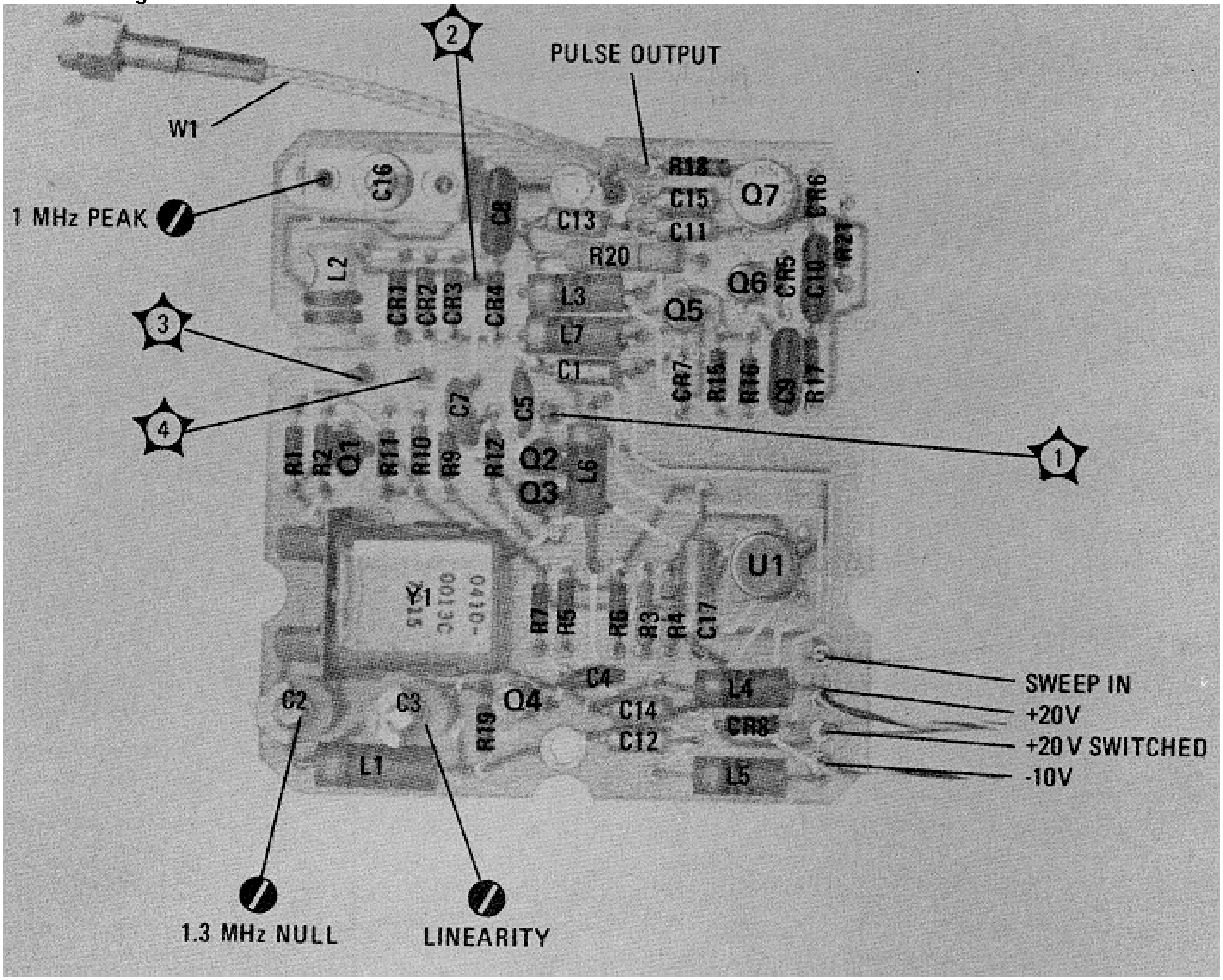


Figure 7-17. Tuning Stabilizer VCXO Assembly A14A2 (08555-60058), Figure 8-53 (Change Q)

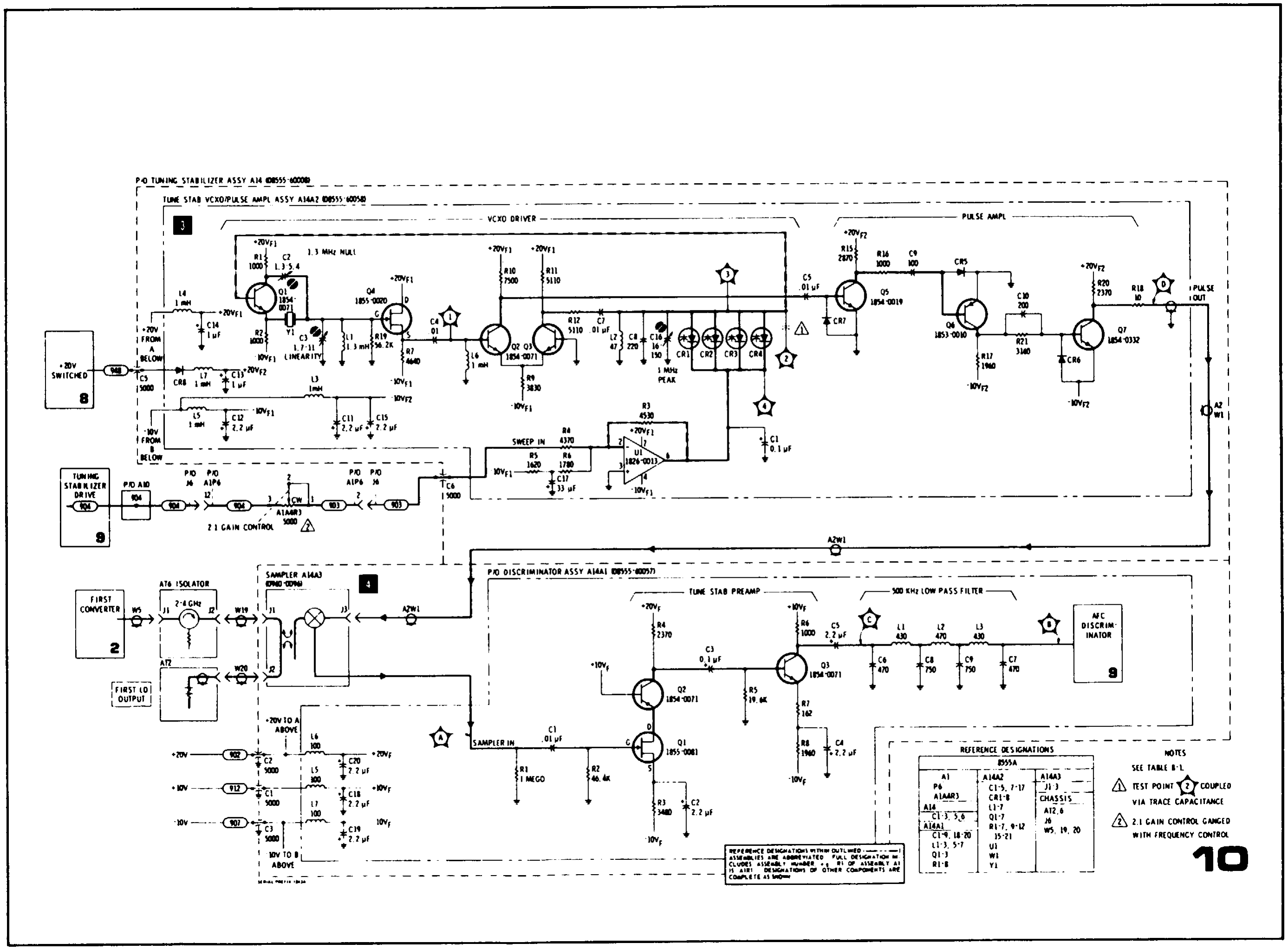


Figure 7-18. Tuning Stabilizer, VCXO Pulse Ampi Assembly A14A2, Figure 8-55, (Change Q)

CHANGE R

Figure 8-45, Band Buffer Assy A6:
Delete diode A6CR6.
Change vale of following components to read as follows:
A6R111 to 16.2K
A6R12 to 1.62K
A6R13 to 28.7K
A6R15 to 9.09K

CHANGE S

Table 1-1, change noise sideband specification to read:
Noise Sidebands: For fundamental mixing. More than 70 dB below CW signal, 30 kHz or more away from signal, with 1 kHz IF bandwidth and 100 Hz video filter.
Paragraph 4-23, change to read:
Specification: For fundamental mixing. More than 70 dB below CW signal, 30 kHz or more away from signal, with 1 kHz IF bandwidth and 100 Hz video filter.

4. Keeping the display centered, reduce the SCAN WIDTH PER DIVISION to 10 kHz. Reduce BANDWIDTH to 1 kHz. SCAN TIME PER DIVISION to 0.2 SECONDS, and VIDEO FILTER to 100 Hz.

5. Observe the noise level three divisions or greater away from the signal (30 kHz). The average noise level should be at least 70 dB below the CW signal level.

CHANGE T

Figure 8-72, change the following components to read:
A9A1C2 to 3300 and A9A1C3 to 2000.

CHANGE U

Figure 8-55, delete ferrite bead symbol and Z1 from gate lead of A14A2Q4.

CHANGE V

Figure 8-41:

Replace top right section of figure with Figure 7-19.

NOTE

1820-0401 *not* active for replacement. Orders for 1820-0401 filled with 08555-60082 and 08555-20105. Includes YIG oscillator, attenuator, adapter and cable assembly.

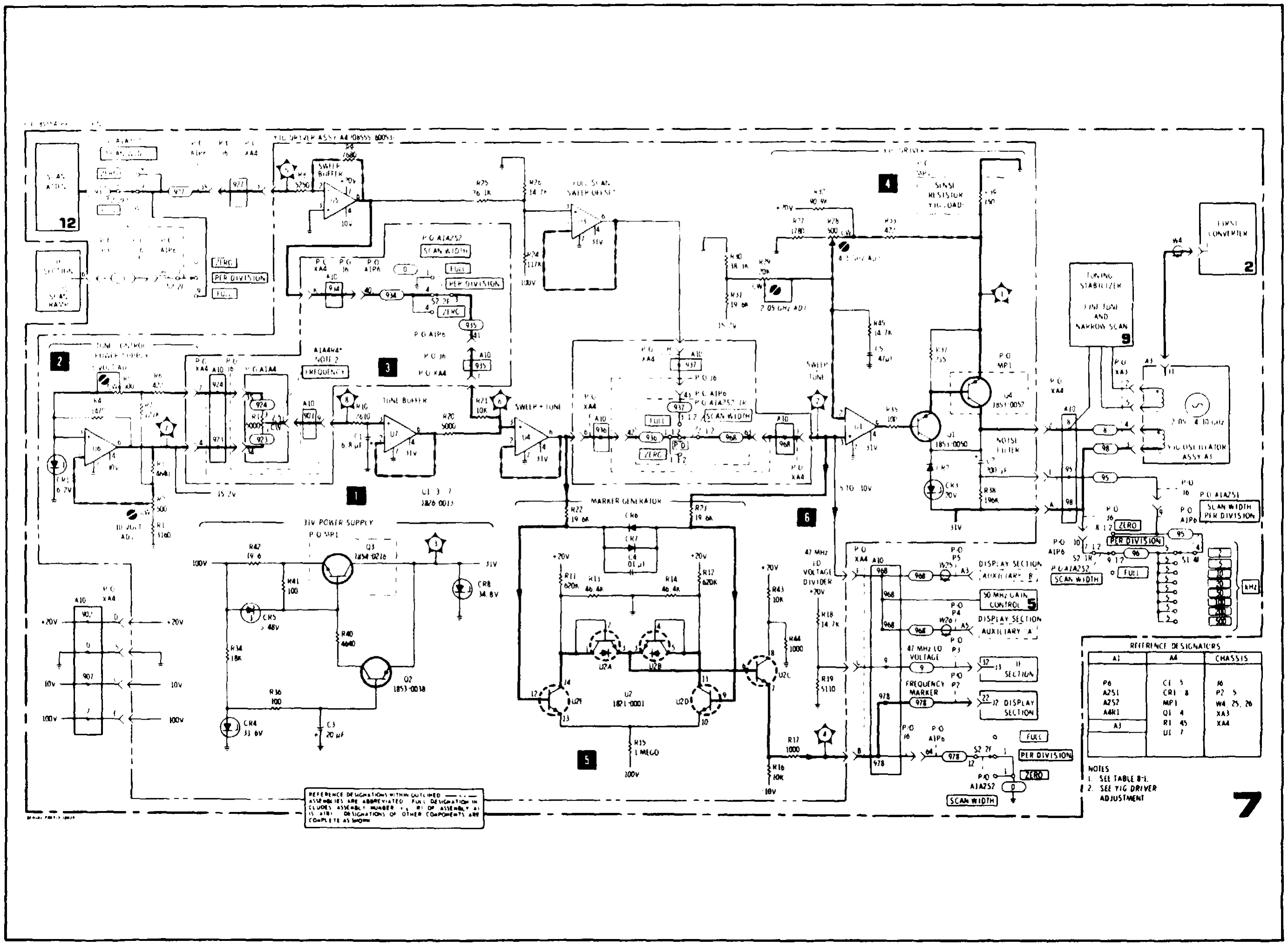


Figure 7-19. YIG Driver and Oscillator, Figure 8-41 (Change V)

7-6. INSTRUMENT CHANGES BY COMPONENT

Table 7-4. Summary of Instrument Changes

Manual Changes	Assembly Numbers											
	A1	A2	A3	A4	A5	A6	A8	A9	A11	A14	A16	W	Chassis
A		A11 A2A2 A11 A2A4											
B									A1C1* A1Q1 A1Q2				
C											CR11 CR12 CR13 CR14 R24 R25		
D		A5R19											
E	R20 C3 P6 J6				C3							21C1	
F		A5C8 A5C12 A5R21 A5L3		R20 R21						A2R26 A2R27			
G					R52 R54 R64					A2L7 A2R25			
H				P1							29J1		
I		A5L6											
' J										A2C1			
K						MP3			A1C1				
L							C4						J1
M	A2*												
N										A1R27			
O				C4 R46									
P				C3 R34 R36 R40 R41				A1CR1 A1Q2 A1Q3 A1R15 A1R16 A1R17 A1MP1 A1MP2					
Q										A2 A2R6 A2R20 A2CR9 A2R22 A2R23 A2R24			

Table 7-4. Summary of Instrument Changes (2 of 2)

Manual Changes	Assembly Numbers												
	A1	A2	A3	A4	A5	A6	A8	A9	A11	A14	A16	W	Chassis
R						CR6 CR8 R11 R12 R13 R15							
S								A1CR3 A1CR4 A1T1					
T								A1C2 A1C3					
U										A2Z1 A2Q4			
V			A3 AT1 CP1 W4										

*New parts preferred replacement.

7-7. INSTRUMENT IMPROVEMENT MODIFICATIONS

7-8. Production Memo, 8555A-1-72

HP MODEL 8555A SPECTRUM ANALYZER RF SECTION

A9 POWER SUPPLY SWITCHING REGULATOR PROBLEMS

A9 power supply switching regulators of the 8555A Spectrum Analyzer RF Section have undergone several changes to improve reliability. A rebuilt exchange assembly is available which contains all the latest assembly A9 circuit revisions.

If a failure does occur in the A9 assembly on any 8555A, the unit may be repaired under warranty by following the recommended repair strategy outlined below.

On 8555A units, serial prefixes 1043A and below:
Replace the entire 08555-60005 A9 assembly with an exchange unit, HP Part No. 08555-60080.

On 8555A units, serial prefixes 1114A and 1116A:
Replace the entire 08555-60005 A9 assembly with an exchange unit, HP Part No. 08555-60080.

or

Replace
A9A1CR3 and 4 with 1901-1067
A9A1Q1 with 1854-0071
A9A1Q2 with 1853-0308
A9A1U1 with 1821-0001
A9A1T1 with 08555-80007.

On 8555A units, serial prefix 1138A:
50 kHz spurious sidebands may be eliminated by replacing A9A1C2 with .0015 µF 0160-0298 and by replacing A9A1C3 with 1000 pF 0160-3456.

Repairs to any 08555-60005 assembly may be made using the 08555-60080 rebuilt exchange assembly. The rebuilt A9 08555-60080 assembly contains the 08555-60098 A9A1 sub-assembly. Refer to Figure 7-20 for component locations.

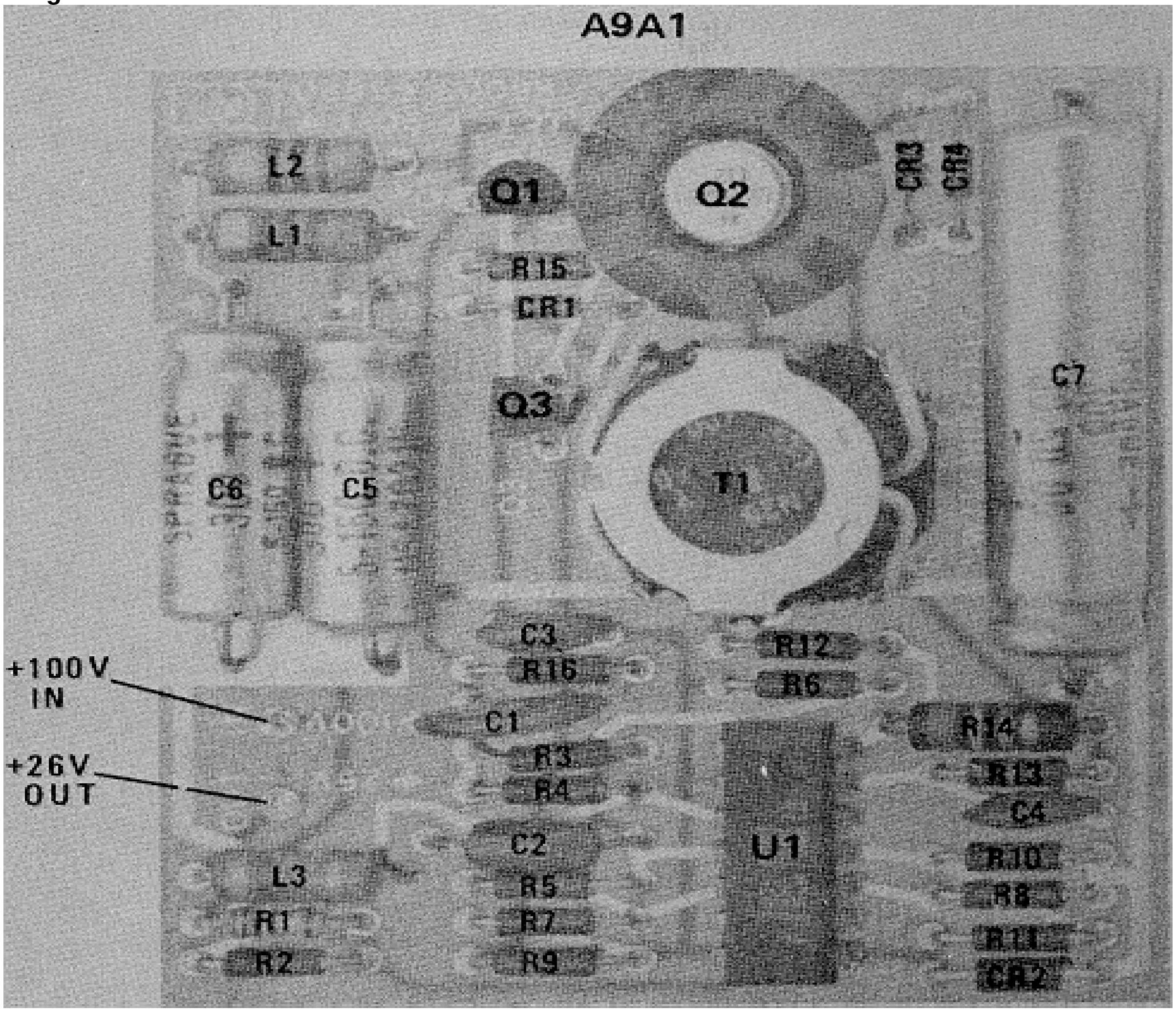


Figure 7-20. Switching Regulator Board Assembly A9A1 (08555-60098)

7-9. Service Note, 8555A-1

HP MODEL 8555A SPECTRUM ANALYZER, RF SECTION

Serials Prefixed 1232A and Below

PRESELECTOR DPM MODIFICATION

HP 8555A RF Sections with serials listed above, require a circuit wiring modification before proper operation of the HP Model 8445B Option 003 Preselector can be achieved. The digital readout driver in the 8445B requires an input signal from the A4 YIG Driver Assembly in the 8555A.

This modification consists of adding a jumper wire on the plug-in A4 assembly plus adding a wire between the A4 output connector and the rear panel P5 Auxiliary "B" connector.

PROCEDURE

1. Remove top and bottom covers from the 8555A.

2. Remove the A4, A5, and A6 board assemblies so that A4 can be modified and easy access to connector P5 can be obtained.

3. Connect an insulated 3 inch jumper wire between A4U7 pin 6 and pin 8 on the A4 board connector. Refer to .Figure 7-21.

4. Connect an insulated 4-inch wire between A1OXA4 pin 8 (on interconnect board) and rear panel Preselector connector P5 pin 7. Refer to Figure 7-22.

5. This completes the modification. Replace all board assemblies and top and bottom covers.

ELECTRICAL CHECK

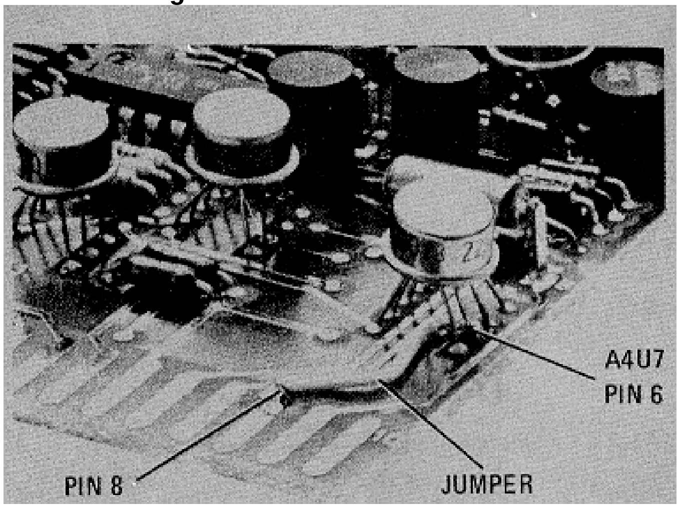
1. With 8555A installed into Display Section, turn on power.

2. Center LO feedthru signal on CRT display.

3. With a dc voltmeter measure the voltage at AUXILIARY "B" on rear panel connector P5 pin 7. Voltage should be -7.50 +0.05V.

4. With frequency dial at 4100 MHz on the LO scale, voltage at P5-7 should be -15.00 +0.05V.

Change your Operating and Service Manual per the partial schematic of the A4 assembly shown in Figure 7-23.



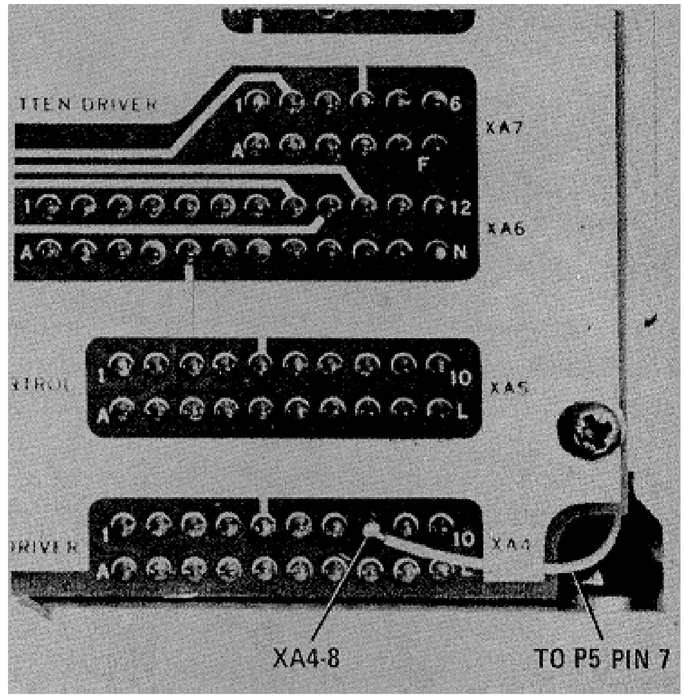


Figure 7-21. Modified A4 Board

Figure 7-22. Connection to A

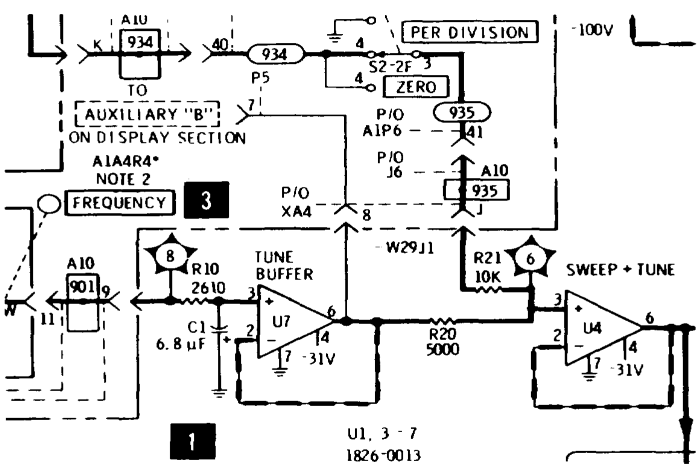


Figure 7-23. Partial Schematic of Modified A4 Assembly

7-10. The manual changes given below are for correcting errors and for adapting the manual to instruments containing improvements made after the printing of the manual. Make all ERIATA corrections first and then make all appropriate serial number related changes indicated in the table.

Serial Prefix or Number	Make Manual Changes
1441A04436 thru	1
1441A04535	1, 2
1450A thru 1450A04735	1, 2, 3
1509A	1, 2, 3, 4
1526A	1, 2, 3, 4, 5
1528A	1, 2, 3, 4, 5, 6
1545A	1, 2, 3, 4, 5, 6, 7
1619A	1, 2, 3, 4, 5, 6, 7, 8
1631A	1, 2, 3, 4, 5, 6, 7, 8, 9
1642A	

ERRATA

Page 8-1, Paragraph 8-14:
Change first line to read as follows:
"8-14. Service Accessories. A Service Accessories Kit, HP Part Number . "

Page 8-2, Table 8-1:
Add A2ASR19, 50 MHz Ampl., 50 MHz Ampl. gain.

Page 8-2, Table 8-2.
Delete A2ASR19, 50 MHz Ampl., 50 MHz ampl. gain.

Page 8-17, Figure 8-17:
On P/O GAIN NETWORK A16 schematic:
Change 416CR13 to 12.IV and A16CR14 to 9.1V.
Reverse locations of A16R21 * and A16CRI 1.

Page 8-21, Figure 8-28
Change R I Value to 31.6.
On 500 MHz LO DRIVE A2A2 schematic:
Change A2A2R16 value to 34.8K.
Change A2A2Q2 HP Part Number to 1853-W020, PNP.

Page 8-23, Figure 8-34, SERVICE SHEET 5:
Change A2A5R19 to A2A5RI9*.

ERRATA (Cont'd)

Page 8-25, Figure 8-38:
Change A1P6 pin 44 to pin 56.

Page 8-26, Figure 8-39:
Change lower test point 8 to test point 9.

Page 8-27, Figure 8-41:
Add test point 9 at junction of A4U7 pin 6 and A4R20.

Page 8-28, Figure 8-42:
Change lower voltage of A5Q1C waveform to -20V.

Page 8-31, Figure 8-52. SERVICE SHEET 9:
Change A5R42 to 4640.
Change A5R49 to 68.1.

Page 8-37, Figure 8-61:
Change YIG DRIVE SWEEP BUFFER Service Sheet 7 to P/O SCAN WIDTH SWITCH ASSY Service Sheet 7.

Page 8-40, TEST PROCEDURES, SERVICE SHEET 14.
Change first line of paragraph 1 to read as follows:

1. Connect the digital voltmeter test leads to A1P6, pin 51 ((97), --12.6 Vdc line) and pin 42 ((923), 300 kHz line).

Page 8-43, Figure 8-72, SERVICE SHEET 15:
Change Figure 8-72 as shown in partial schematic, Figure 8-72.

Page 8-46:
Change A1A4 R2 HP Part Number to 2100-3417.

Page A-6, Figure A-3:
Replace Figure A-3 with Figure A-3 of this Manual Changes.

Page A-7.
Replace figure at bottom of page A-7 with Figure 3 of this Manual Changes.

Manual Changes

ERRATA (Cont'd)

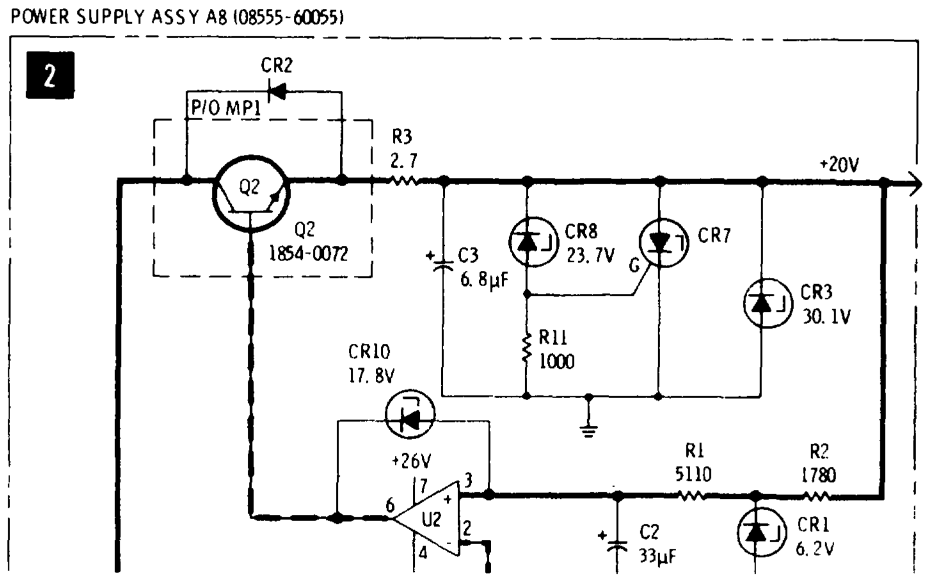


Figure 8-72. P/O Switching Regulator and +10/+20 Volt Power Supply (Errata)

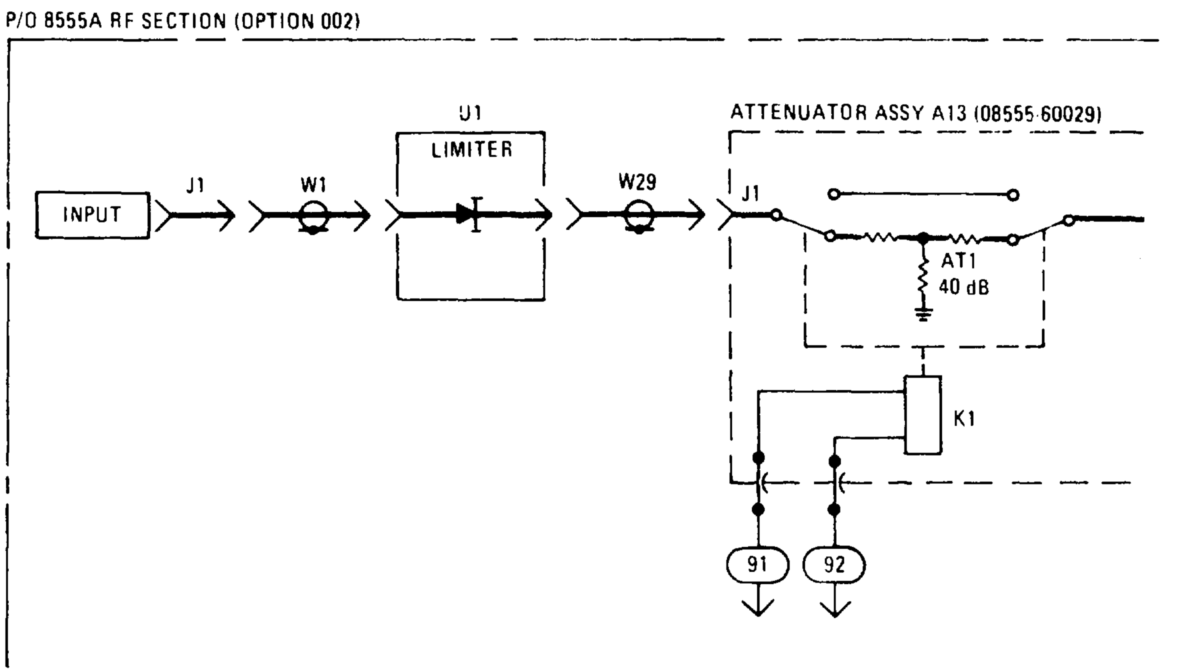


Figure 3. P/O Figure 8-17 Input Attenuator and 1st Converter Schematic Diagram (ERRATA)

TOP INTERNAL VIEW, OPTION 002

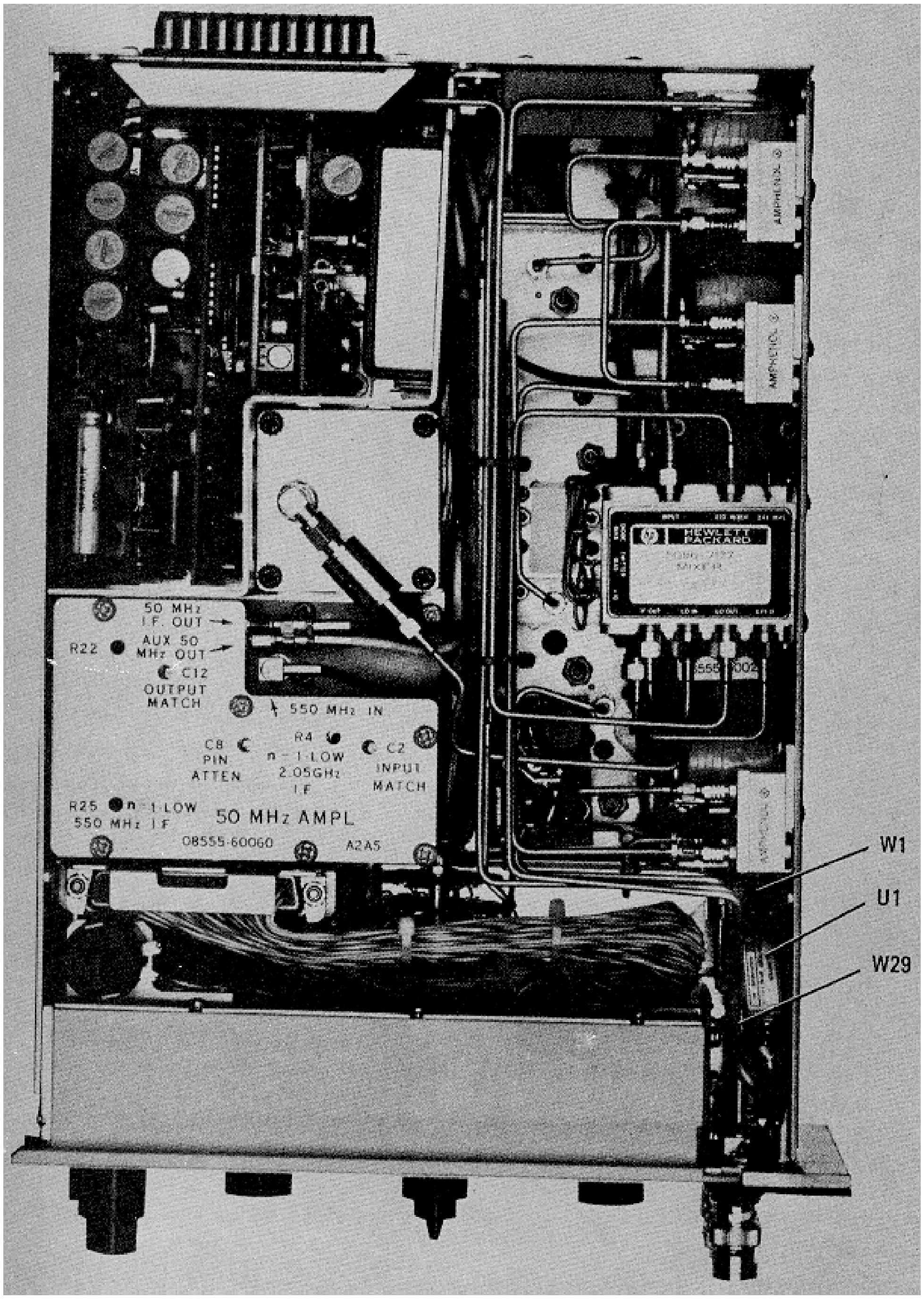


Figure A-3. 8555A RF Section, Top Internal View (Option 002) (ERRATA)

CHANGE 1

Page 8-21, Figure 8-28, SERVICE SHEET 4:
Change A2A4Q1 and A2A4Q2 to HP Part Number 1854-0681

CHANGE 2

Page 1-4, Table 1-1, FREQUENCY RANGE:
Change Full Scan, Scan Width, last sentence to read as follows:
"Scan width = n x 2050 MHz, where n is the mixing mode; e.g., for n = 2, scan width is 4.1 GHz.

Page 8-27, Figure 8-41, SERVICE SHEET 7:
Change R24 to 121K.
Change R26 to 15.6K

CHANGE 3

Page 8-31, Figure 8-49, SERVICE SHEET 9:
Replace Figure 8-49 with Figure 1 of this Manual Changes Supplement.

Page 8-31, Figure 8-52, SERVICE SHEET 9:
Change A5R37 to 19.6K.
Change A5R59 to 90.9K.

Page 8-32, Figure 8-53, SERVICE SHEET 10:
Replace Figure 8-53 with Figure 2 of this Manual Changes Supplement.

Page 8-33, Figure 8-54, SERVICE SHEET 10:
Replace Figure 8-54 with Figure 1 of this Manual Changes Supplement.

CHANGE 3 (Cont'd)

Page 8-33, Figure 8-55, SERVICE SHEET 10:
Change A14A2C8 to 240.
Change A14A2C16 to 1.7 - 11.
Add A14A2C18, 75 PF, in parallel with A14A2C16.

CHANGE 4

Page 5-14, Paragraph 5-28:
Add the following after Step 17:
18.A Set scan width to 100 kHz/ON.
18.B Set 8552A/B LOG-LINEAR switch to LINEAR.
19. Set 8555A SIG ID Switch to ON.
20. Adjust 8552A/B LOG REF LEVEL-LINEAR SENSITIVITY control/s for full screen signal display.
21. Adjust A7R23 SIG ID ADJ for signal ID level of 4.5 divisions.

Page 8-23, Figure 8-34, SERVICE SHEET 5:
Change A6U2 to 1826-0261.

Page 8-25, Figure 8-38, SERVICE SHEET 6:
Change as shown in partial schematic, P/O 8-38 (CHANGE 6).

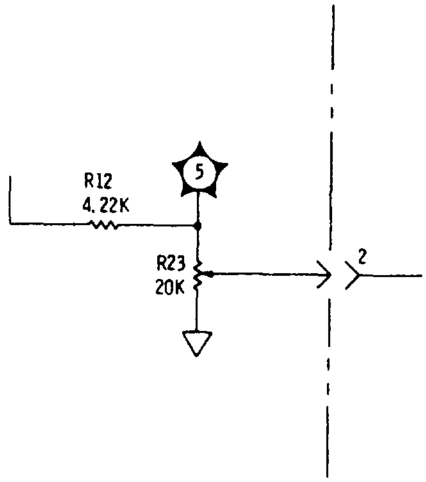
Page 8-27, Figure 8-41, SERVICE SHEET 7:
Change A4U1, A4U3, A4U4, A4U5, A4U6 and A4U7 to 1826-0261.

Page 8-29, Figure 8-45, SERVICE SHEET 8:
Change A6U1 to 1826-0261.

Page 8-31, Figure 8-52, SERVICE SHEET 9:
Change A5U1, A5U2, A5U3, A5U4 and A5U5 to 1826-0261.

Page 8-43, Figure 8-72, SERVICE SHEET 15:
Change A8U1 and A8U2 to 1826-0261.

CHANGE 4(Cont'd)



P/O Figure 8-38. Signal Identifier (CHANGE 4)

CHANGE 5

Page 8-21, Figure 8-28, SERVICE SHEET 4:
Change A2A2U1 and A2A2U2 to 1826-0261.

Page 8-33, Figure 8-55, SERVICE SHEET 10:
Change A14A2U1 to 1826-0261.

CHANGE 6

Page 8-2, Table 8-1:
Add the following after A14A1R14: A14A2R26, VCXO Driver, VCXO Linearity.

Page 8-33, Figure 8-55 - TUNE STAB VCXO/PULSE AMPL ASSY A14A2, VCXO DRIVER
Change R26 to R26*
Delete 14.7K.
Change R27 to 200K

NOTE
A14A2R27 is a FACTORY ADJUSTMENT ONLY! It has been preset for optimum performance, DO NOT ADJUST!

CHANGE 7

Page 8-29, Figure 8-45, SERVICE SHEET 8:
Change A5R35 value to 9.09K.

CHANGE 8

Page 8-27, Figure 8-41:
Change A3AT1 to 3 dB.

CHANGE 9

Page 1-5, Table 1-1, INPUT SPECIFICATIONS:
Change Reflection Coefficient specification to read:
Reflection Coefficient (Typical): For input RF attenuator settings >10 dB.

0.01 - 7.5 GHz	<0.13 (1.3 SWR)
7.5 - 18 GHz	<0.23 (1.6 SWR)

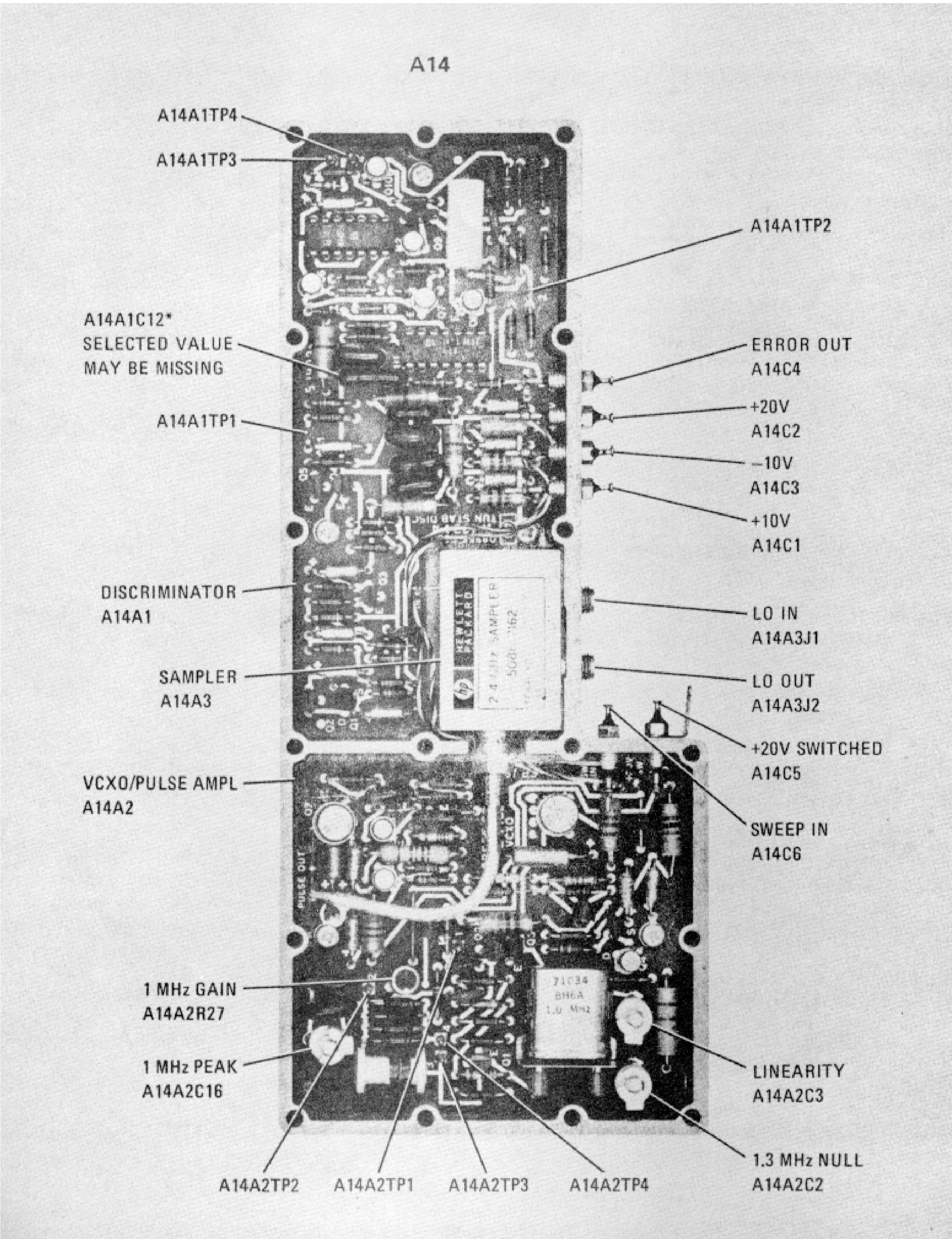


Figure 1. Tuning Stabilizer Assembly A14 (CHANGE 3)

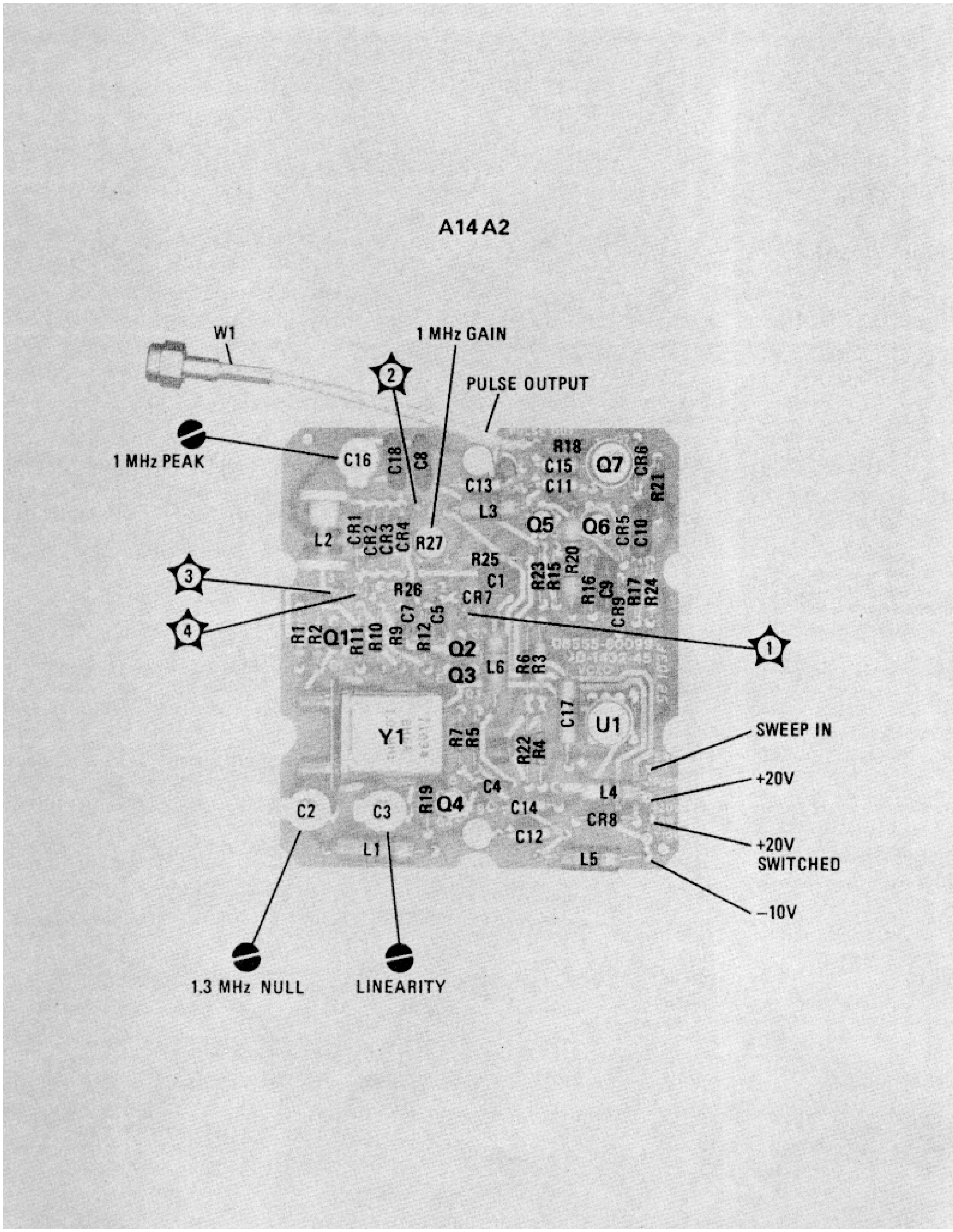


Figure 2. Tuning Stabilizer VCXO Assembly A14A2 (CHANGE 3)

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for trouble-shooting and repair of the HP 8555A Spectrum Analyzer RF Section.

8-3. PRINCIPLES OF OPERATION

8-4. Information relative to the principles of operation appears on the foldout pages opposing the Block Diagram, Service Sheet 1. Theory of operation appears on the foldout pages opposing each of the foldout schematic diagrams. The schematic diagram circuits are referenced to the theory of operation text by block numbers.

8-5. REQUIRED TEST EQUIPMENT

8-6. Test equipment and accessories required to maintain the Spectrum Analyzer RF Section are listed in the MAC. If the equipment listed is not available, equipment that meets the required specifications may be substituted (refer to Tables 1-4 and 1-5).

8-7. TROUBLESHOOTING

8-8. Troubleshooting procedures are divided into two maintenance levels in this manual. The first, a troubleshooting tree, is designed to isolate the cause of a malfunction to a circuit or assembly. In this procedure, maximum use is made of the front panel controls, indicators and the analyzer's operating capability to isolate the malfunction to the defective circuit.

8-9. The second maintenance level provides circuit analysis and test procedures to aid in isolating faults to a defective component. Circuit descriptions and test procedures for the second maintenance level are located on the pages facing the schematic diagrams. The test procedures are referenced to the schematic diagrams by block numbers.

8-10. After the cause of a malfunction has been found and remedied in any circuit containing adjustable components, the applicable procedure specified in Section V of this manual should be performed. After repairs and/or adjustments have been made, the applicable procedure specified in Section IV of this manual should be performed.

8-11. REPAIR

8-12. Factory Repaired Exchange Modules. Factory repaired exchange modules are available for modules that are not field-repairable. In addition, repaired exchange modules are available for major sub-assemblies as an alternate method of repair. The factory repaired modules are available at a considerable savings in cost over the cost of a new module.

8-13. Deleted.

8-14. Service Kit. A service kit, HP Part Number 08555-60077, is available as an aid in maintaining the 8555/8552 Spectrum Analyzer. This kit is described in Table 1-5.

8-15. Factory Selected Components. Some component values are selected at the time of final checkout at the factory. Usually these values are not extremely critical; they are selected to provide optimum compatibility with associated components. These components, which are identified on the schematics with an asterisk, are listed in Table 8-1. The recommended procedure for replacing a factory-selected component is as follows:

a. Try the original value, then perform the test specified in Section V of this manual for the circuit being repaired.

b. If the specified test cannot be satisfactorily performed, try the typical value shown in the parts list and repeat the test.

c. If the test results are still not satisfactory, substitute various values until the desired result is obtained.

8-16. Adjustable Components. Adjustable components, other than front panel operating controls, are listed in Table 8-2. Adjustment procedures for these components are contained in Section V of this manual.

8-17. Servicing Aids on Printed Circuit Boards. Servicing aids on printed circuit boards include test

Table 8-1. Factory Selected Components

Designation	Circuit	Purpose
A2A2R16	500 MHz LO Drive	Oscillator collector voltage
A4R30, 31	YIG Driver	YIG Oscillator sensitivity
A11A1C1	Second LO	Stability with turn-on
A14A1C12	Discriminator	Discriminator frequency
A14A1R14	Discriminator	Discriminator gain
A16R1	Input Mixer Gain	n=1-High Gain
A16R2	Input Mixer Gain	n=2-High Gain
A16R3	Input Mixer Gain	n=3-High Gain
A16R4	Input Mixer Gain	n=4-High Gain
A16R5	Input Mixer Gain	n=1+High Gain
A16R6	Input Mixer Gain	n=2+High Gain
A16R7	Input Mixer Gain	n=3+High Gain
A16R8	Input Mixer Gain	n=4+High Gain
A16R9	Input Mixer Gain	n=1-(550 MHz IF) High Gain
A16R10	Input Mixer Gain	n=1+(550 MHz IF) High Gain
A16R12	Input Mixer Gain	n=2-Low Gain
A16R13	Input Mixer Gain	n=3-Low Gain
A16R14	Input Mixer Gain	n=4-Low Gain
A16R15	Input Mixer Gain	n=1+Low Gain
A16R16	Input Mixer Gain	n=2+Low Gain
A16R17	Input Mixer Gain	n=3+Low Gain
A16R18	Input Mixer Gain	n=4+Low Gain
A16R20	Input Mixer Gain	n=1+(550 MHz IF) Low Gain
A16R21	Input Mixer Bias	n=1+,31
A16R22	Input Mixer Bias	n=2+ Bias
A16R23	Input Mixer Bias	n=4+ Bias
A16R24	Input Mixer Bias	n=1+, 3+ Bias Compensation
A16R25	Input Mixer Bias	n=4+ Bias Compensation

Table 8-2. Adjustable Components

Designation	Circuit	Purpose
A1R1	External Mixer	External mixer bias
A1R2	Calibration	RF to IF Section matching
A1A4R1	YIG Driver	FREQUENCY Control
A1A4R2	Tuning Stabilizer	FINE TUNE Control
A1A4R3	Tuning Stabilizer	2:1 Gain Control
A2C5	550 MHz IF	Bandpass Filter Adj.
A2C6	550 MHz IF	Bandpass Filter Adj.
A2C7	550 MHz IF	Bandpass Filter Adj.
A2A2R5	500 MHz LO Drive	Frequency Sensitivity
A2A2R13	500 MHz LO Drive	Frequency Linearity
A2A3C3	550/50 MHz Mixer	50 MHz Filter
A2A4C4	500 MHz LO	Frequency adjustment
A2A4L1	500 MHz LO	Output coupling
A2A5C2	50 MHz Ampl.	Input impedance matching
A2A5C8	50 MHz Ampl.	Pin attenuator adjustment
A2A5C12	50 MHz Ampl.	Output impedance matching
A2A5R4	50 MHz Ampl.	n=1 -Low gain adjustment
A2A5R19	50 MHz Ampl.	50 MHz ampl. gain
A2A5R22	50 MHz Ampl.	15 dB gain step adjustment
A2A5R25	50 MHz Ampl.	n=1=*Low (550 MHz IF) adj.
A4R2	YIG Driver	-10 Volt adjustment
A4R5	YIG Driver	-5 Volt adjustment
A4R28	YIG Driver	4.1 GHz YIG Osc. adjustment
A4R29	YIG Driver	2.05 GHz YIG Osc. adjustment
A5R48	Tuning Stabilizer	Tickler sweep adjustment
A5R55	Tuning Stabilizer	FET offset adjustment

Table 8-2. Adjustable Components (cont'd)

Designation	Circuit	Purpose
A5R58	Tuning Stabilizer	VCXO sweep adjustment
A8R5	Power Supply	+20 and +10 V adjustment
A11 ADJ 1	2.05 GHz IF	Bandpass filter adjustment
A11 ADJ 2	2.05 GHz IF	Bandpass filter adjustment
A11 ADJ 3	1.5 GHz LO	Frequency adjustment
A11 ADJ 4	1.5 GHz Notch Filter	1.5 GHz trap
A11A3R1	2nd LO Voltage Fit.	2nd LO power adjustment
A14A2C2	VCXO Driver	1.3 MHz Null adjustment
A14A2C3	VCXO Driver	VCXO Linearity adjustment
A14A2C16	VCXO Driver	1 MHz Peak adjustment

points, transistor designations, adjustment callouts and assembly part numbers with alpha-numerical revision information.

8-18. Part Location Aids. The location of chassis mounted parts and major assemblies are shown in Figure 8-10. In addition, a location diagram with coaxial cable interconnection information is contained on the bottom of the RF Section Top Cover.

8-19. The location of individual components mounted on printed circuit boards or assemblies are shown on the appropriate schematic. The part reference designator is the assembly designation plus the part designation. (Example: A1R1 is R1 on the Al assembly.) For specific component description and ordering information refer to **TM 11-6625-2781-24P-4.**

8-20. Diagram Notes. Table 8-3, Schematic Diagram Notes, provides information relative to symbols and values shown on schematic diagrams.

8-21. GENERAL SERVICE HINTS

8-22. The etched circuit boards used in Hewlett-Packard equipment are the plated-through type consisting of metallic conductors bonded to both sides of an insulating material. The circuit boards can be either a single layer or multi-layer board. The metallic conductors are extended through the component holes or interconnect holes by a plating process. Soldering can be performed on either side of the board with equally good results. Table 8-4 lists recommended tools and materials for use in repairing etched circuit boards. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device or wooden toothpick to remove solder from component mounting holes.

CAUTION

Do not use a sharp metal object such as an awl or twist drill for this purpose. Sharp objects may damage the plated-through conductor.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion.

8-23. Component Replacement. The following procedures are recommended when component replacement is necessary:

a. Remove defective component from board.

b. If component was unsoldered, remove solder from mounting holes with a suction device or a wooden toothpick.

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes and position component as original was positioned. Do not force leads into mounting holes; sharp lead ends may damage the plated-through conductor.

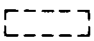
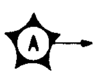
NOTE

Although not recommended when both sides of the circuit board are accessible, axial lead components such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board.

Table 8-3. Schematic Diagram Notes

SCHEMATIC DIAGRAM NOTES

Refer to USAS Y32.2-1967

R,L,C	Resistance in ohms, inductance in microhenries and capacitance in picofarads unless otherwise noted.
P/O	P/OPart of.
*	Asterisk on component denotes a factory-selected value. Value shown is typical. Capacitors may be omitted or resistors jumpered.
	Screwdriver adjustment.
	Panel control.
	Encloses front panel designations.
	Encloses rear panel designations.
	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.
	Numbered test point. Measurement terminal provided.
	Lettered test point. No measurement terminal provided.
	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.,C947) denotes white base, yellow wide stripe, violet narrow stripe.
n=1±*	n=harmonic number 1 = 1st LO fundamental ± = 1st LO above or below 1st IF * = 550 MHz 1st IF
	Chassis ground
	Assembly ground

Wrap leads of replacement component one turn around original leads. Solder wrapped connection and clip off excess lead.

8-24. GENERAL SERVICE INFORMATION

8-25. Transistors and diodes are used throughout the RF Section in circuit configurations such as delay circuits, trigger circuits, switches, oscillators and various types of amplifiers. Basic transistor operation is shown in the following pages.

8-26. Transistor In-Circuit Testing. The common causes of transistor failure are internal short circuits and open circuits. In transistor circuit testing, the most important consideration is the transistor base-to-emitter junction. The base emitter junction in a transistor is comparable to the control gridcathode relationship in a vacuum tube. The base emitter junction is essentially a solid-state diode; for the transistor to conduct, this diode must be forward biased. As with simple diodes, the forward-bias polarity is determined by the materials forming the junction. Transistor symbols on schematic diagrams reveal the bias polarity required to forward-bias the base-emitter junction. The B part of Figure 8-1 shows transistor symbols with the terminals labeled. The other two columns compare the biasing required to cause conduction and cut-off in NPN and PNP transistors. If the transistor base-emitter junction is forward biased, the transistor conducts. However, if the base-emitter junction is reverse-biased, the transistor is cut off (open). The voltage drop across a forward-biased, emitter-base junction varies with transistor collector current. For example, a germanium transistor has a typical forward-bias, base-emitter voltage of 0.2-0.3 volt when collector current is 1-10 mA, and 0.4--0.5 volt when collector current is 10-100 mA. In contrast, forward-bias voltage for silicon transistor is about twice that for germanium types; about 0.5-0.6 volt when collector current is low, and about 0.8-0.9 volt when collector current is high.

8-27. Figure 8-1, Part A, shows simplified versions of the three basic transistor circuits and gives the characteristics of each. When examining a transistor stage, first determine if the emitter-base junction is biased for conduction (forward-biased) by measuring the voltage difference between emitter and base. When using an electronic voltmeter, do not measure directly between emitter and base; there may be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure each voltage separately with respect to a common point (e.g., chassis). If the emitter-base

Table 8-4. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 47 1/2 - 56 1/2 Tip Temp: 850-900 degrees	Ungar No. 776 handle with *Ungar No. 4037 Heating Unit
Soldering* Tip	Soldering Unsoldering	*Shape: pointed	*Ungar No. PL111
De-soldering aid	To remove molten solder from connection	Suction device	Soldapult by Edsyn Co., Arleta, California
Resin (flux)	Remove excess flux from soldered area before application of protective coating.	Must not dissolve etched circuit base board material or conductor bonding agent	Freon, Aceton, Lacquer Thinner, Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred	
Protective Coating	Contamination, corrosion protection.	Good electrical insulation, corrosion-prevention properties	Krylon ** No. 1302 Humiseal Protective Coating, Type 1B12 by Columbia Technical Corporation, Woodside 77, New York

*For working on etched Boards: for general purpose work, use Ungar No. 1237 Heating Unit (37.5W, tip temperature of 750-800 degrees) and Ungar No. PL113, 1/8 Inch chisel tip.
**Krylon, Inc., Norristown, Pennsylvania

junction is forward-biased, check for amplifier action by short-circuiting base to emitter while observing collector voltage. The short circuit eliminates base-emitter bias and should cause the transistor to stop conducting (cut off). Collector voltage should then change and approach the supply voltage. Any difference is due to leakage current through the transistor and, in general, the smaller this current, the better the transistor. If the collector voltage does not change, the transistor has either an emitter-collector short circuit or emitter-base open circuit.

8-28. Field Effect Transistor (FET). Field effect transistors (see Figure 8-2) have three terminals: source, drain and gate, which correspond in function to emitter, collector, and base of junction transistors. Source and drain leads are attached to the same block (channel) of N or P semiconductor material. A band of oppositely doped material around the channel (between the source and drain leads) is connected to the gate lead.

8-29. In normal FET operation, the gate-source voltage reverse-biases the PN junction, causing an electric field that creates a depletion region in the source-drain channel. In the depletion region the number of available current carriers is reduced as the reverse biasing voltage increases, making source-drain current a function of gate-source voltage. With the input (gate-source) circuit reverse-biased, the FET presents a high impedance to its signal sources (as compared with the low impedance of the forward-biased junction transistor base-emitter circuit). Because there is no input current, FET's have less noise than junction transistors. Figure 8-2 shows the schematic symbol and biasing for N channel and P channel field effect transistors.

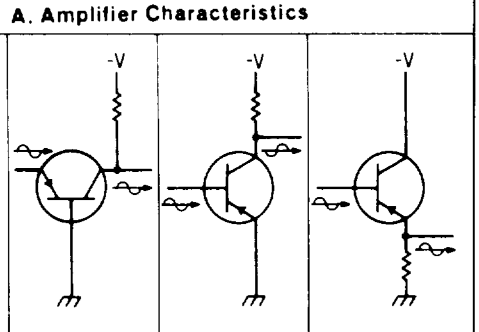
8-30. Transistor and Diode Markings. Figure 8-3 illustrates examples of diode and transistor marking methods. In addition, the emitter lead for bipolar transistors and each lead for field effect transistors is identified on the printed circuit boards.

8-31. INTEGRATED CIRCUITS AND SYMBOLS

8-32. The following paragraphs and illustrations provide basic information about integrated circuits and symbols. While a complete treatment of the subject is not within the scope of this manual, it is believed that this material will help the technician experienced with discrete devices. Typical integrated circuit packaging is illustrated in Figure 8-4.

8-33. Logic Circuits and Symbols. The Logic circuits discussed are digital in nature: their outputs are always in one of two possible states, a "1" or "0". These two states are also referred to as being either high (H) or low (L). The high and low states are relative; low must be less positive (more negative) than high, both states may be positive or negative, or high may be positive and low negative. In positive logic the more positive (H) state is a logical "1" and the more negative (L) state is a logical "0". In negative logic the more negative (L)

A. Amplifier Characteristics



CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
Input Impedance	30Ω - 50Ω	500Ω - 1500Ω	20KΩ - 500KΩ
Output Impedance	300KΩ - 500KΩ	30KΩ - 50KΩ	50Ω - 1000Ω
Voltage Gain	500 - 1500	300 - 1000	< 1
Current Gain	< 1	25 - 50	25 - 50
Power Gain	20 dB - 30 dB	25 dB - 40 dB	10 dB - 20 dB (Emitter Follower)

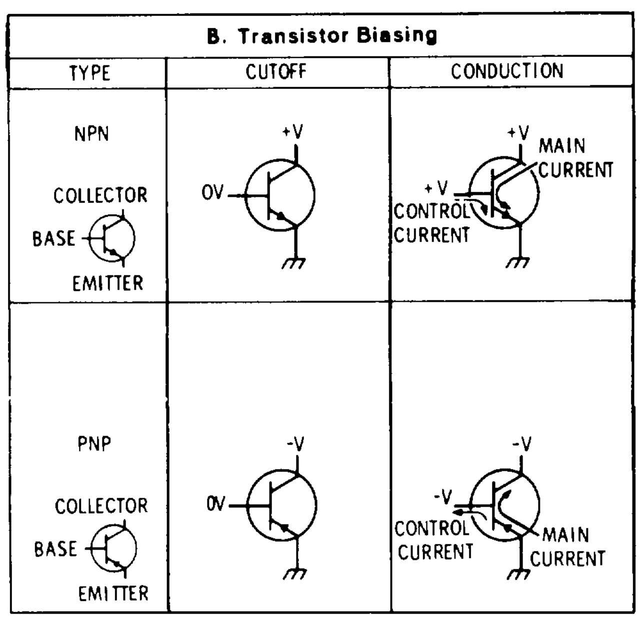
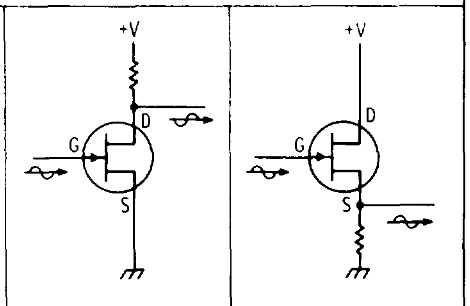


Figure 8-1. Transistor Operation

A. FET Amplifier Characteristics



CHARACTERISTIC	COMMON SOURCE	COMMON DRAIN (Source Follower)
Input Impedance	1MΩ-15MΩ	1MΩ-15MΩ
Output Impedance	5KΩ-100KΩ	1KΩ-10KΩ
Voltage Gain	10-200	< 1
Power Gain	60 dB-100 dB	40 dB-80 dB

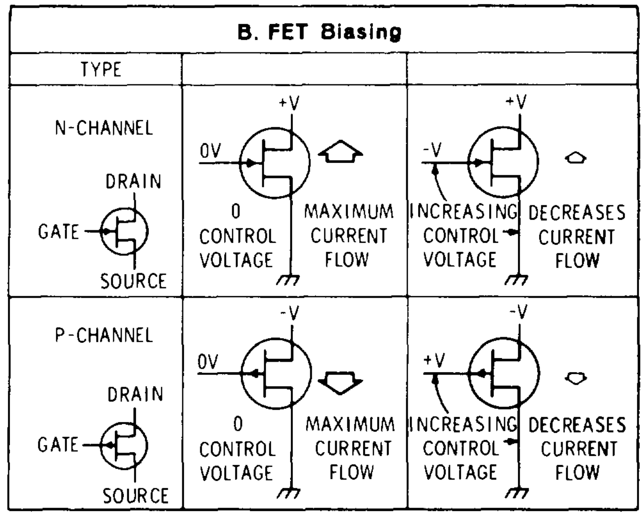


Figure 8-2. Field Effect Transistor Operation

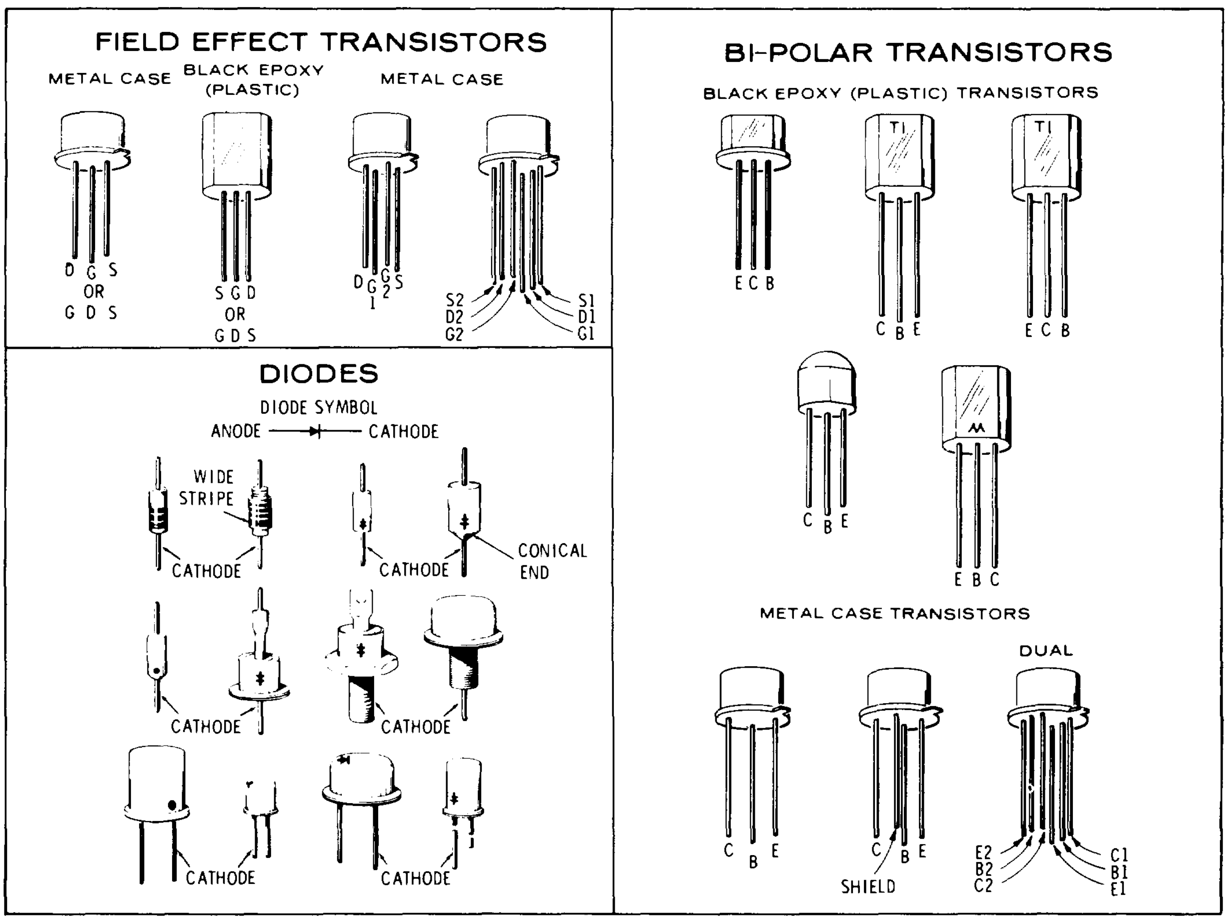


Figure 8-3. Examples of Diode and Transistor Marking Methods

state is a logical "1" and the more positive (H) state is a logical "0".

8-34. Two of the basic "building blocks" of logic circuits are the AND and OR gates. The symbols and truth tables for basic AND and OR gates are shown in Figure 8-5.

8-35. Basic AND Gate (Positive logic). The basic AND gate is a circuit which produces an output "1" when, and only when, a "1" is applied to all inputs. As shown in Figure 8-5, terminal X will be high only when terminals A and B are both high. The dot (e) shown in the AND gate is the logic term for AND. The term for a simple two input AND gate is $X = A \cdot B$ (X equals A and B). AND gates may be designed to have as many inputs as required to fill a specific requirement.

8-26. Basic OR Gate (Positive Logic). The basic OR gate is a circuit which produces a "1" output when any one, or all of the inputs are in a "1" state. As shown in Figure 8-5, terminal X will be high when either terminal A or terminal B, or both are high. The + shown in the OR gate symbol is the logic term for OR. The term for a simple two input OR gate is $X = A + B$ (X equals A or B). OR gates may be designed to have as many inputs as required for specific needs.

8-37. The symbols for AND and OR gates differ in that AND gate symbols have a flat input side and a rounded output side while OR gate symbols have a concave input side and a pointed output side.

8-38. Truth Tables. Truth tables provide a means of presenting the output state of logic devices for any set of inputs in tabular form. Truth tables contain one column for each of the inputs and a column for the output. In basic truth tables the column notations are usually H or L (for high and low) or, for binary notation, "1" or "0". More complex truth tables use other terms which will be explained where these tables appear in the text.

8-39. Logic Inversion. Adding inversion to AND and OR gates changes their characteristics. Inversion is usually accomplished by adding an inverter stage (common emitter) in front of an input or after an output. A circle added to the input or output leads indicates the portion of the circuit in which the inversion takes place. The simplest of these devices are AND and OR gates in which the output is inverted. These gates are called NAND (for Not AND) and NOR (for Not OR). Basic NAND and NOR gates are shown in Figure 8-6. When all inputs and outputs of an AND gate are inverted, it functions as an OR gate. When all inputs and outputs of an OR gate are inverted, it

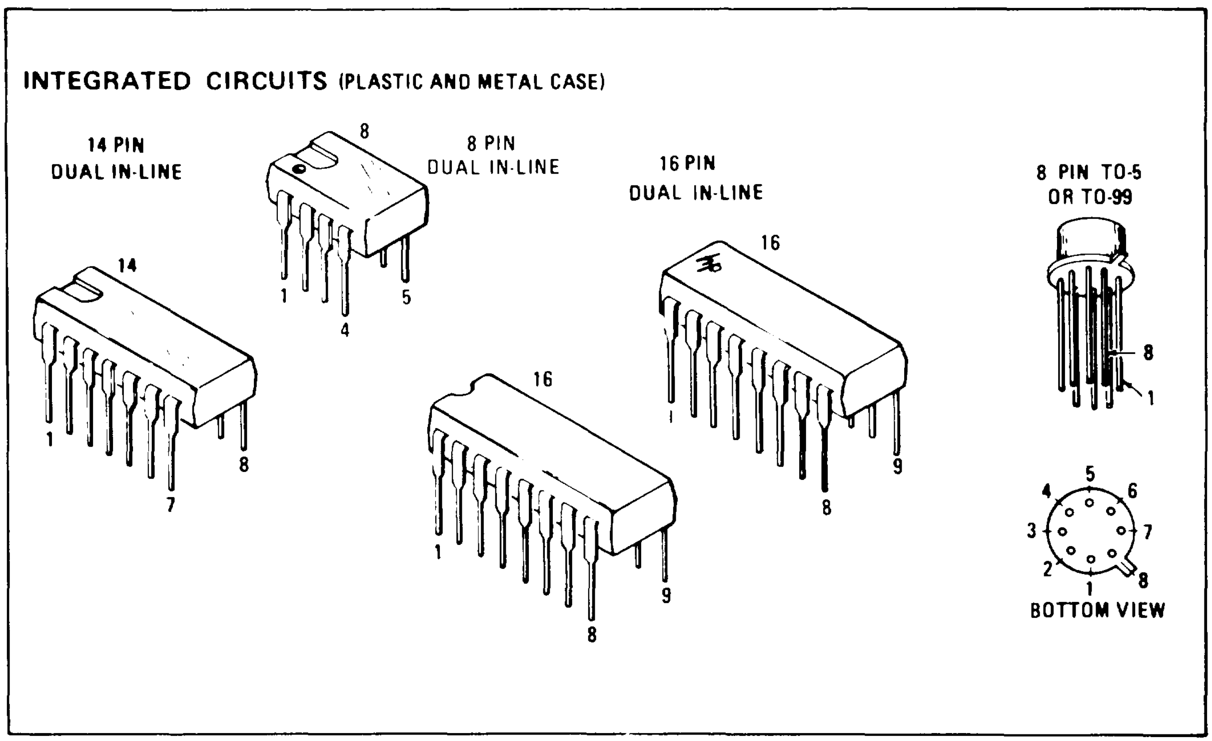


Figure 8-4. Integrated Circuit Packaging

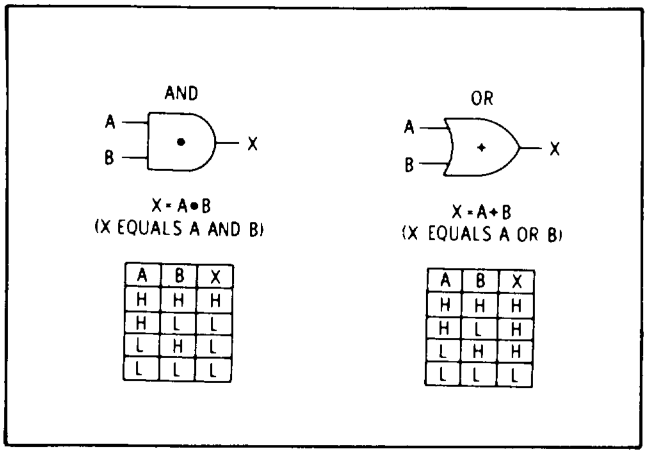


Figure 8-5. Basic AND and OR Gates

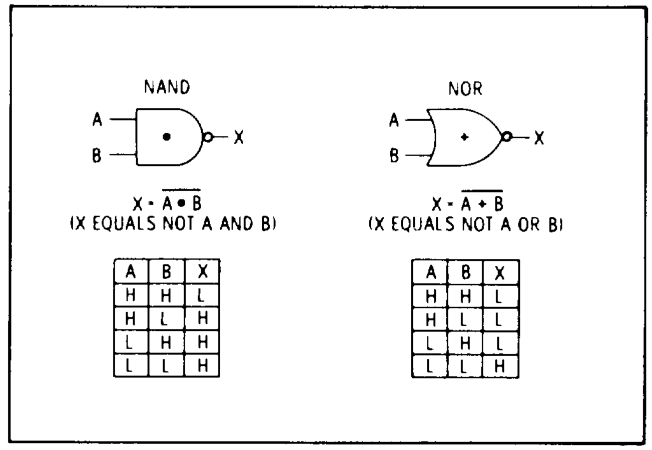


Figure 8-6. Basic NAND and NOR Gates

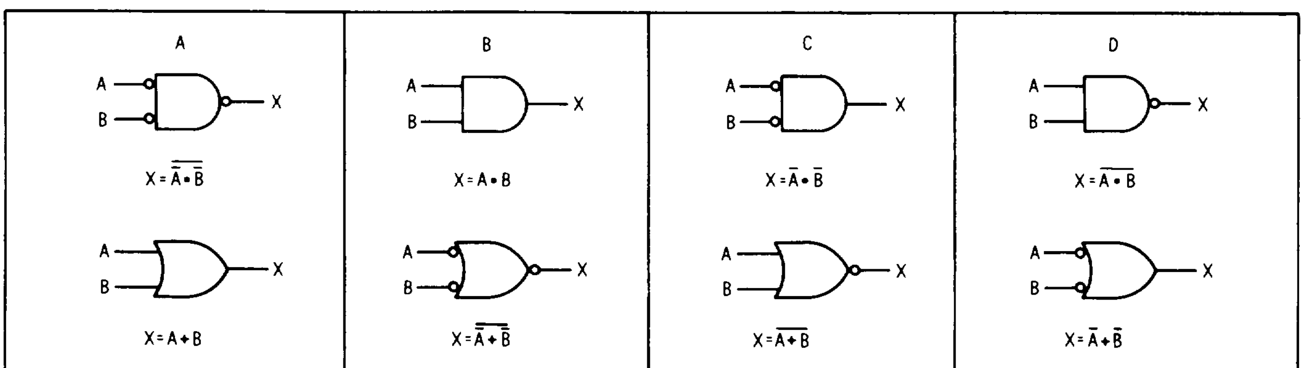
functions as an AND gate. Figure 8-7 provides information relative to various gate inversion functions.

8-40. Operational Amplifier Circuits and Symbols. Operational amplifiers are used in the RF Section to provide such functions as summing amplifiers, offset amplifiers, buffers and power supplies. The particular function is determined by the external circuit connections. Equivalent circuit and logic diagrams for type 741 operational amplifiers are contained in Figure 8-8. Circuit A is a noninverting buffer amplifier with a gain of 1. Circuit B is a non-inverting amplifier with gain determined by the resistance of R1 and R2. Circuit C is an inverting amplifier with gain determined by R1 and R2, with the input impedance determined by R2. Circuit D contains the functional circuitry and pin connection information along with an operational amplifier review.

NOTE

In circuit D it is assumed that the amplifier has high gain, low output impedance and high input impedance.

8-41. **Operational Amplifier Troubleshooting Procedure**. Measure and record the voltage level at both the - (inverting) terminal pin 2 and the + (non-inverting) terminal pin 3. The level should not differ by more than ≅ 10 mV. If the voltage level is not within ≅ 10 mV, check the external circuitry and components. If the external circuitry (input signal, operating voltages, feedback resistors) is normal, replace the operational amplifier.



A	B	X	A	B	X	A	B	X	A	B	X
H	H	H	H	H	H	H	H	L	H	H	L
H	L	H	H	L	L	H	L	L	H	L	H
L	H	H	L	H	L	L	H	L	L	H	H
L	L	L	L	L	L	L	L	H	L	L	H

Figure 8-7. Logic Comparison Diagrams

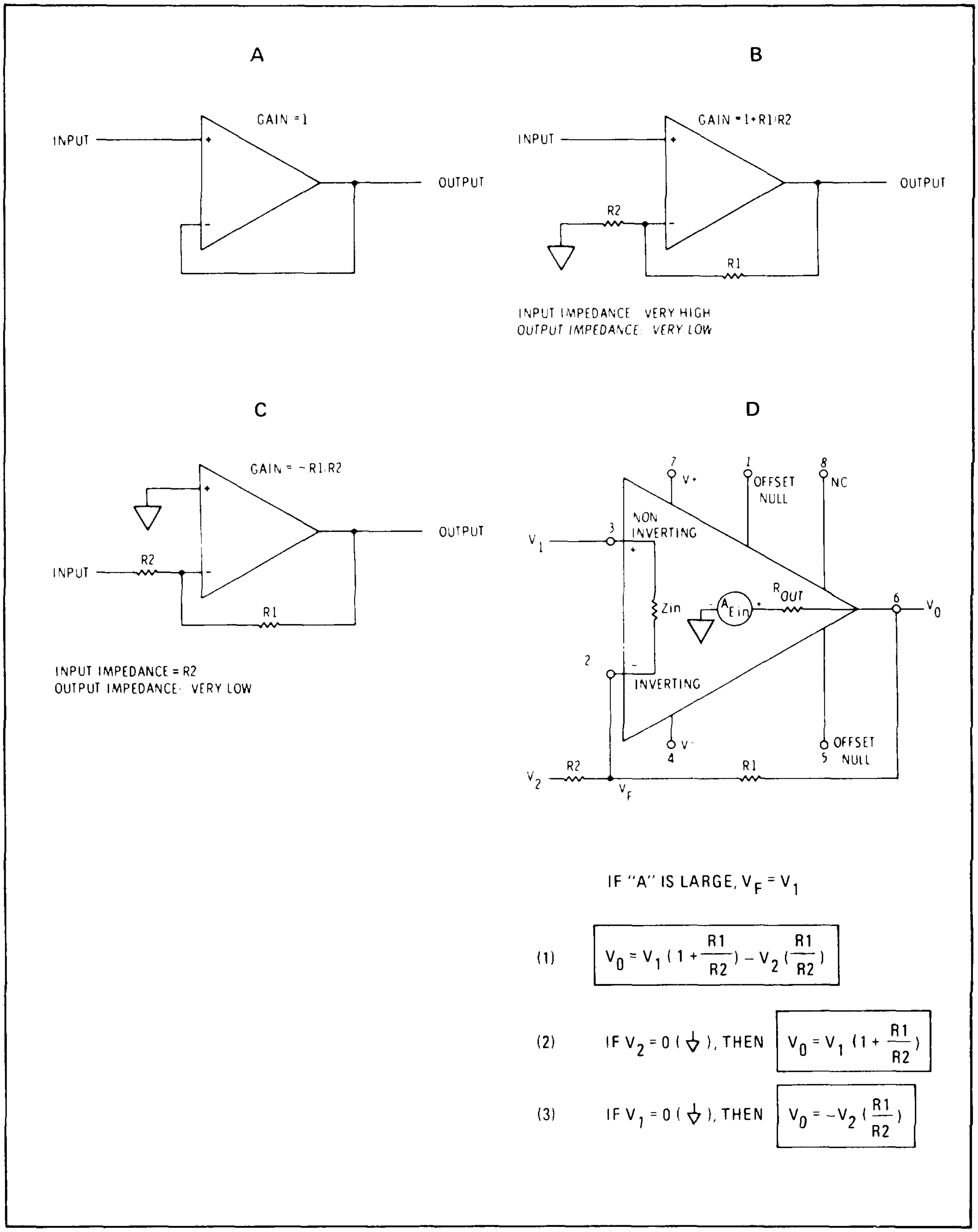


Figure 8-8. Operational Amplifier Equivalent Circuit

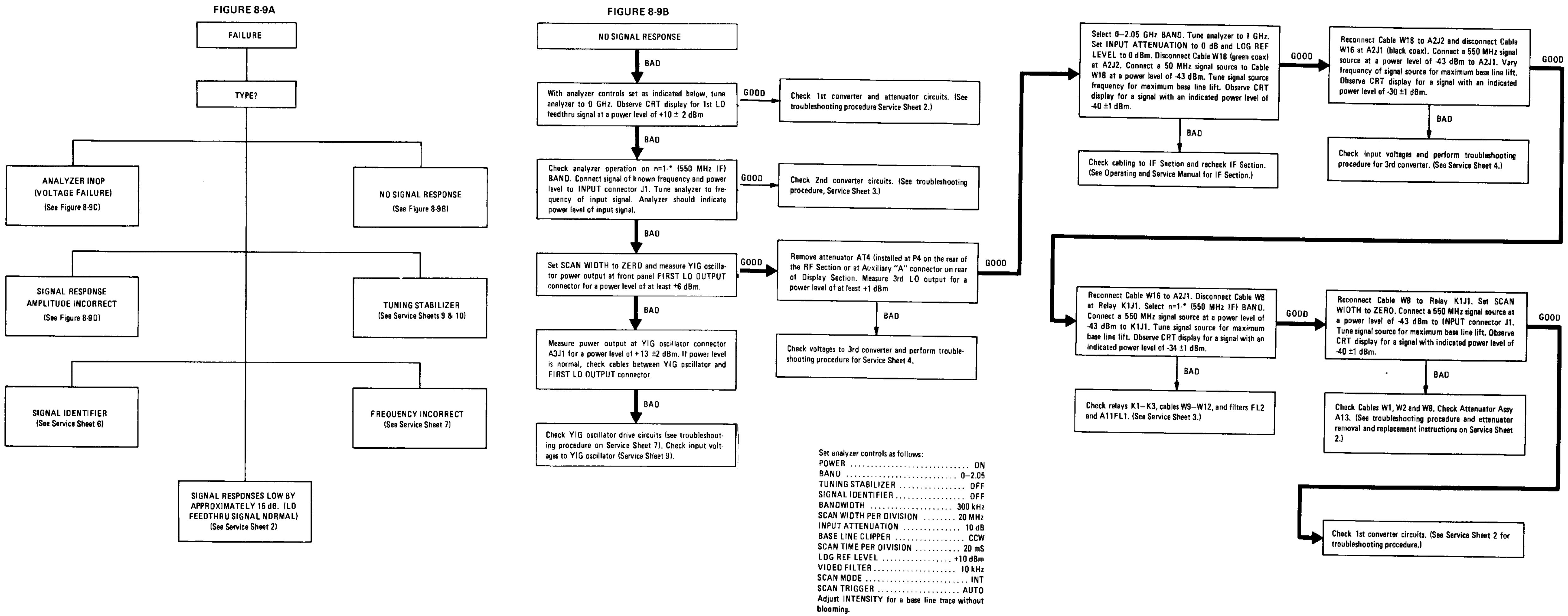


Figure 8-9. 8555A RF Section Troubleshooting Tree (1 of 2)

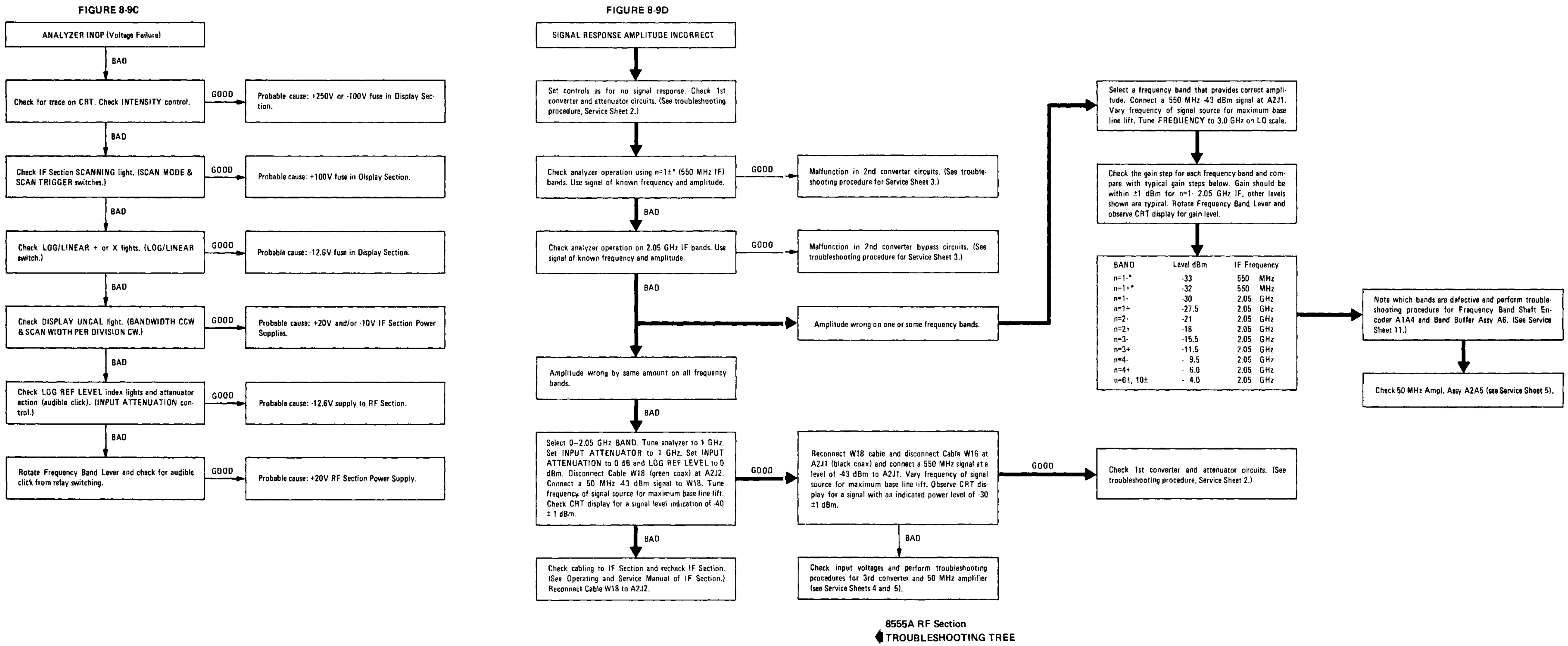
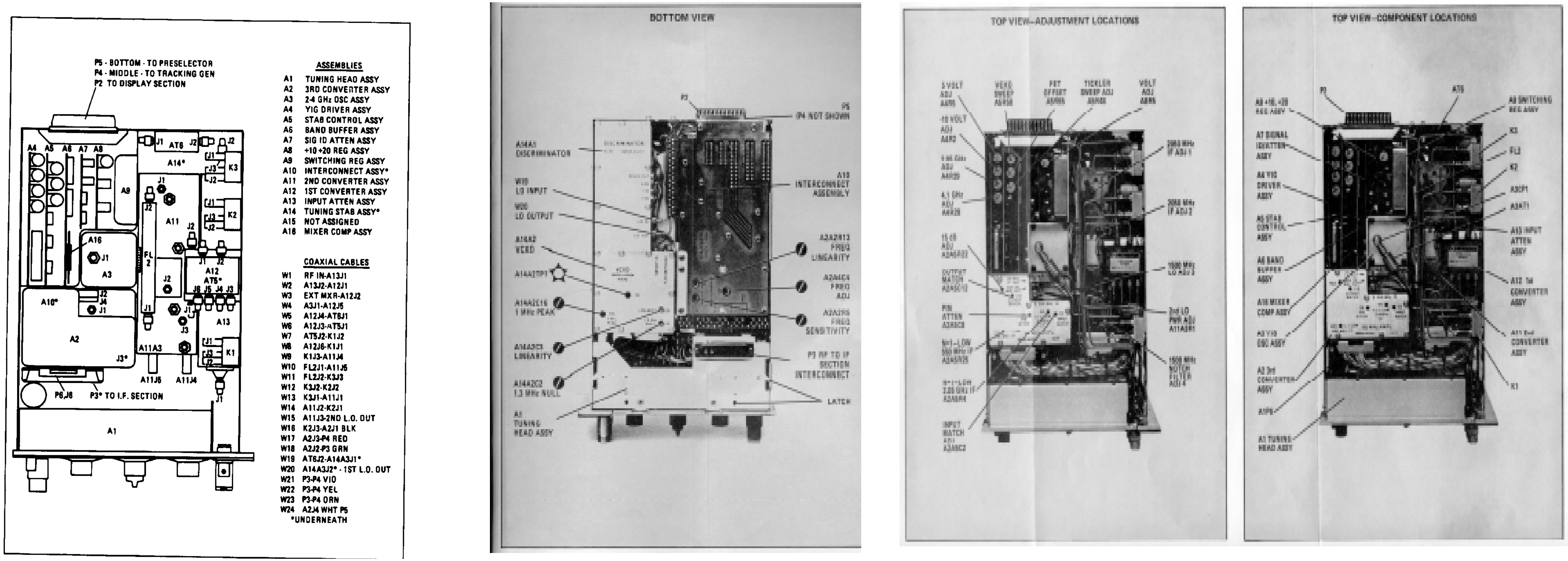


Figure 8-9. 8555A RF Section Troubleshooting Tree (2 of 2)



INTERNAL VIEWS

Figure 8-10. 8555A RF Section Top and Bottom Internal Views.

SERVICE SHEET 1

1 BLOCK DIAGRAM DESCRIPTION

The numerals in the lower corner of each block refer to Service Sheets following the block diagram and to numbered descriptive paragraphs in this block diagram description. Each of the following Service Sheets include complete schematic information, circuit descriptions, component locations and troubleshooting information for the block which it represents. Also included wherever practicable are dc levels, RF levels and oscilloscope waveforms or timing diagrams.

2 RF INPUT AND FIRST CONVERTER

RF input, for all internal mixing bands, is coupled into the first converter through a three-section attenuator. The first LO signal is coupled into the mixer in the first converter for internal mixing and through the first converter for external mixing. A coaxial relay switches the IF path for internal or external mixing.

The first converter is a sealed microcircuit unit that is factory-repairable only. The mixer is driven by the output from the first LO, a YIG (Yttrium-Iron-Garnet) controlled oscillator with a frequency range from 2.05 to 4.1 GHz. This mixer converts signals in the range of 10 MHz to 18 GHz to an IF of 2.05 GHz or 550 Mhz depending on the band selected. Conversion loss in the first converter is typically 10 dB for fundamental mixing modes.

The input attenuator provides 0 to 50 dB attenuation in 10 dB steps to the RF input signal in internal mixing modes. The attenuator is controlled by the INPUT ATTENUATION switch and attenuator driver circuit. The switch also provides control voltages for the LOG REF LEVEL lights and linear scale factor amplifier in the IF Section.

The bias generator and relay driver circuitry, controlled by band code switch logic, provide bias current to the input mixer and a switching voltage to the coaxial relay for external mixing operation.

In the external mixer circuitry, both the LO signal and an adjustable bias current are coupled to the external mixer jack on the front panel. The output from the external mixer is coupled back to the analyzer through this jack, through the first converter, and through a 2 to 4 GHz isolator and a coaxial relay to the second converter circuits.

3 SECOND CONVERTER

The second converter converts the 2.05 GHz from the first converter to 550 MHz to drive the third converter. The converter consists of a 2.05 GHz bandpass filter made of two adjustable cavities, a hot carrier diode for the mixer, a 1.5 GHz two transistor oscillator, as the local oscillator and a 550 MHz resonator at the IF port.

The second mixer is driven by the output of the second LO operating at a fixed frequency of 1.5 GHz. The oscillator frequency is determined primarily by a tuned cavity. Two cavities, tuned to 2.05 GHz, select the difference frequency between the RF input and the first LO signal. A relay driver, controlled by band code signals, switch coaxial relays to bypass the second converter when the n=1+* (550 MHz IF) bands are selected. When these bands are selected, the 1.5 GHz LO is disabled by the filtered oscillator voltage control circuitry.

A voltage filter, mounted on the second converter casting, provides filtering of the oscillator voltages to reduce

SERVICE SHEET 1 (cont'd)

hum and noise on the voltages applied to the oscillator.

An output from the second LO is coupled to the front panel for use with auxiliary equipment or for use as a test signal.

The second LO signal, flowing in the transmission path toward the first converter is attenuated by the 2.05 GHz bandpass cavities and by a notch filter tuned to the second LO frequency.

The mixer in the second converter is a single hot carrier diode. Conversion loss in the second converter is typically 4 dB.

4 THIRD CONVERTER

The third converter consists of a 550 MHz amplifier, a 550 Mhz bandpass filter, a quad diode mixer, a 500 MHz LO drive circuit, a 500 MHz LO circuit and a variable gain 50 MHz amplifier. The converter is enclosed in a two section casting with isolating compartments.

The 550 MHz amplifier is the first gain stage in the signal path and provides a gain of 11 dB. The amplifier output is coupled through a three-section 550 MHz bandpass filter to the 3rd mixer.

The mixer, a standard HP 10514C double-balanced quad diode unit, is driven by the 500 MHz LO and produces a 50 MHz output signal.

The 500 MHz LO normally operates at a fixed frequency. When the analyzer is operated in the signal identifier mode, the LO driver circuit causes the oscillator to shift frequency on alternate scans. The amount of frequency shift is determined by the signal identifier circuit (see block 6 below).

5 50 MHz VARIABLE GAIN AMPLIFIER

The 50 MHz amplifier is mounted on and is part of the third converter (see block 4 above). Amplifier gain is controlled by band code signals, by the tune and sweep signal and in the signal identifier mode by a signal from the signal identifier circuit. Band code signals provide fixed gain steps to compensate for first converter losses.

The tune and sweep signal causes the gain to increase as the frequency tunes from the low to high end of the internal mixing bands. In the signal identifier mode amplifier gain is reduced by approximately 5 dB on alternate scans to provide a visual aid in signal recognition.

The output from the 50 MHz amplifier is applied to the Spectrum Analyzer IF Section. The signal level at the output of the amplifier is -3 dB referenced to the RF INPUT for all internal mixing bands (.01 to 18 GHz) with 0 dB INPUT ATTENUATION.

6 SIGNAL IDENTIFIER

The signal identifier consists of a flip-flop (switch), an attenuator and associated switching circuitry. The switch circuit is triggered by the sweep ramp from the IF Section. The switch circuit has two outputs: one to the 50 MHz variable gain amplifier and one through an attenuator to the 500 MHz LO driver in the third converter. The signal to the 50 MHz variable gain amplifier reduces the amplifier gain by approximately 5 dB on alternate scans. The signal to the LO driver is applied through an attenuator controlled by the position of the SCAN

SERVICE SHEET 1 (cont'd)

WIDTH PER DIVISION switch. The polarity of the signal to the LO driver is controlled by band code signals to the switch output circuit. The signal level determines the amount of frequency shift of the third LO while the polarity determines the direction of frequency shift. The signal identifier circuit is disabled when a +10-volt signal is routed through either of two switches. For signal identifier operation, the SIGNAL IDENTIFIER switch must be ON, the SCAN WIDTH PER DIVISION switch must be 1 MHz per division or less. Also the SCAN WIDTH switch must be in the PER DIVISION position.

7 YIG-TUNED OSCILLATOR AND DRIVER CIRCUITS

The YIG-tuned oscillator is a transistor oscillator with a YIG sphere as the resonator. The YIG sphere's resonant frequency is proportional to the applied magnetic field, which is generated by two coils (referred to in this manual as the main coil and the tickler coil). The main coil has a nominal tuning sensitivity of 42.5 MHz/mA and the tickler coil has a nominal sensitivity of 200 kHz/mA. The FREQUENCY knob controls the dc current in the main coil and tunes the oscillator from 2.05 to 4.10 GHz. The FINE TUNE knob varies the dc current in the tickler coil and tunes the oscillator +500 kHz. The sawtooth sweep is applied to the main coil for scan widths greater than 0.5 MHz/division. For smaller scan widths, sweep is applied to the tickler coil. The input to the YIG driver (main coil driver) is controlled by the SCAN WIDTH switch. In the FULL scan position, sweep from the IF Section is applied through a sweep buffer and sweep offset buffer to the YIG driver to produce a LO scan of 2.05 to 4.05 GHz. In the PER DIVISION position of the SCAN WIDTH switch, the sweep is attenuated (see blocks 8 and 12) and applied to the same sweep buffer as the sweep for scan widths greater than 500 kHz per division.

The output of the sweep buffer is combined with the output of the FREQUENCY tune buffer in a sweep plus tune amplifier before being applied to the YIG driver. In the ZERO scan position of the SCAN WIDTH switch, only the signal from the FREQUENCY tune buffer, applied through the sweep plus tune amplifier, is applied to the YIG driver.

A marker generator circuit, enabled in the FULL scan position of the SCAN WIDTH switch, compares the sweep ramp voltage with the FREQUENCY tune voltage to produce a marker signal to the IF Section when the two voltages are equal. As a result, an inverted marker is displayed on the CRT indicating the frequency to which the FREQUENCY control is tuned. The marker indicates the frequency that becomes the center frequency when the SCAN WIDTH switch is switched to PER DIVISION or ZERO scan.

8 1/n ATTENUATOR AND TUNING STABILIZER CONTROL

The 1/n attenuator (where n equals the harmonic mixing number) functions to reduce the sweep ramp from the IF Section to maintain the calibrated per division scan width when operating on harmonic mixing modes. The attenuation is inversely proportional to the harmonic mixing number. The output of the 1/n attenuator is applied through a scan buffer to the scan attenuator circuitry block 12.

SERVICE SHEET 1 (cont'd)

The tuning stabilizer control circuitry provides for the switching and generation of control signals for the tuning stabilizer system. For stabilized operation, the TUNING STABILIZER switch must be in the ON position, the SCAN WIDTH PER DIVISION switch equal to or less than 100 kHz and the SCAN WIDTH switch in the PER DIVISION or ZERO scan positions.

The control generator provides the switching control signals to the tuning stabilizer circuit (block 9) and a momentary sweep kill signal to the 1/n attenuator. The sweep kill signal removes the sweep ramp through the stabilizer circuit to the YIG oscillator during the initial stabilization cycle.

FINE TUNE controls current in the YIG tickler coil for all scan widths (FULL, PER DIVISION, and ZERO) in both the stabilized and unstabilized mode of operation.

9 & 10 TUNING STABILIZER AND FINE TUNE CIRCUITS

In the stabilized mode of operation, the FINE TUNE signal is combined with the attenuated sweep ramp and the stabilization signal to control the current in the YIG oscillator tickler coil. In the unstabilized mode, the sweep ramp is combined with the FINE TUNE signal for SCAN WIDTH PER DIVISION of 500 kHz or less. In ZERO scan mode the FINE TUNE signal controls current in the tickler coil for unstabilized operation and is combined with the stabilization signal in the stabilized mode.

In the stabilized mode of operation, the YIG oscillator is locked to a voltage controlled crystal oscillator (VCXO). The YIG oscillator signal is routed through the first converter and a 2-4 GHz isolator to a sampler where it is mixed with harmonics of the VCXO. The sampler output is amplified and applied through a 500 kHz low-pass filter to a 240 kHz discriminator. The discriminator output (error signal) is fed back to the YIG oscillator tickler coil changing the oscillator frequency until a near zero error signal is produced at the discriminator output. As a result the oscillator is locked to a harmonic of the crystal oscillator.

When tuning stabilization is initiated the roles of the YIG oscillator and the VCXO are initially reversed. The frequency of the YIG oscillator is compared with the harmonics from the VCXO and an error signal is applied through the tune stabilizer memory circuit to shift the VCXO frequency to bring the nearest lock point to the YIG oscillator frequency. After this is accomplished, reed relay A5K1 is opened so that the shifting error signal is stored by the tune stabilizer memory circuit. The discriminator output is then supplied to the YIG oscillator tickler coil, locking the YIG oscillator frequency to the particular VCXO harmonic selected. This action allows stabilization to be accomplished without shifting the YIG oscillator frequency which would cause a center frequency shift on the display. Switching is accomplished by signals from the control generator (see Service Sheet 8).

During the initial stabilization cycle, sweep was turned off by a sweep kill command from the control generator to a sweep kill circuit (see block 8). After lock is accomplished, sweep is turned on again and is applied to both the VCXO and the YIG oscillator tickler coil. Since the YIG oscillator can lock on 1 MHz harmonics from 2050 to 4100 MHz, it is necessary to adjust the sweep amplitude applied to the VCXO as a function of the lock harmonic number.

For a given VCXO sweep, the YIG oscillator will sweep twice as much on the 4100th harmonic number as it would on the 2050th harmonic. Therefore, to maintain calibrated scan widths when locked, sweep to the VCXO is controlled by a variable resistor (2:1 Gain Control) which is ganged to the main tune (FREQUENCY) control.

11 BAND CODE SWITCH LOGIC

Band code switching logic is used in the RF Section to automatically switch various control functions. A shaft encoder switch on the frequency scale drum provides position indicating signals to a logic decoding circuit. The logic decoding section decodes the position indicating signals and generates control function signals. The band code signals control bias to the first mixer, relay control for the internal/external mixer relay, control for the second converter bypass relays, gain control for the 50 MHz amplifier, attenuation control for the 1/n attenuator, and + or - harmonic indication for the signal identifier circuit. Band code signals are also available at rear panel connector P5 for use with external equipment.

12 SCAN ATTENUATOR AND SCAN WIDTH PER DIVISION SWITCHING

The scan attenuator functions as a precision voltage divider to determine the scan width per division. The SCAN WIDTH PER DIVISION switch selects the precision resistors and routes the attenuated sweep ramp to either the YIG driver circuit (block 7) or to the tuning stabilizer circuit (block 9). For scan widths greater than 500 kHz per division the sweep ramp is applied through the YIG driver circuit to the main coil in the YIG oscillator. For scan widths of 500 kHz per division or less, the attenuated sweep ramp is applied through the tuning stabilizer circuit to the YIG oscillator tickler coil.

13 ANALOGIC

The analogic circuit functions as an analog computer and monitors the position of the SCAN WIDTH and BANDWIDTH switches in the RF Section and the SCAN TIME PER DIVISION and VIDEO FILTER switches in the IF Section. When the switches are set to any combination of positions that would cause more than 0.5 dB amplitude error due to excessive sweep rate, the analogic circuit lights the DISPLAY UNCAL lamp. There is no actual connection between the analogic circuit and the signal processing circuits.

14 BANDWIDTH SWITCHING AND AMPL CAL

The mechanical switching for the bandwidth of the 3 MHz IF in the IF Section is accomplished in the RF Section. The BANDWIDTH switch delivers voltages to the IF Section for diode switching of the selected bandwidth. The AMPL CAL circuit controls the gain of a 3 MHz calibration amplifier in the IF Section to correct for variations between different RF and IF Sections.

15 RF SECTION POWER SUPPLY

A switching regulator and dual power supply provides the +10 and +20 volt source for the RF Section. Voltages other than the +10 and +20 volts are obtained from power supplies in the IF Section and/or the Display Section. The switching regulator converts +100 Vdc to approximately +26 volts. The dual power supply converts the +26 Vdc to +10 and +20 volts in conventional series regulator feedback circuits.

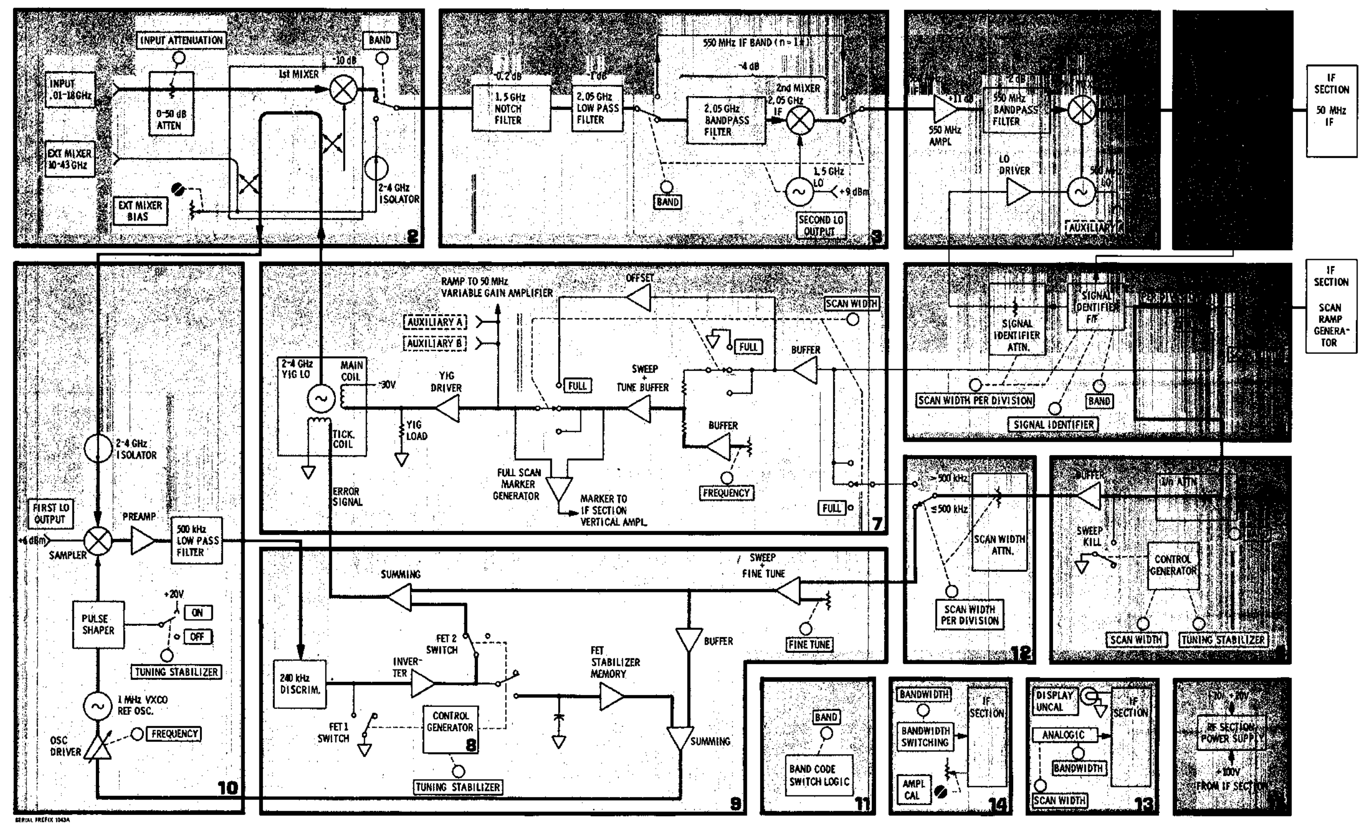


Figure 8-11. 8555A RF Section Block Diagram

SERVICE SHEET 2

THEORY OF OPERATION

Service Sheet 2 contains the schematic diagram for Attenuator A13, the First Converter A12 and their associated switching and control circuitry. Both the attenuator and first converter are sealed assemblies and are not field-repairable. Elaborate test equipment and microcircuit rework techniques are required to repair these units. (See Section VI for Exchange part numbers.) Replacement of the First Converter Assy A12 requires replacement of Gain Network Assy A16. Resistors in the gain network are factory-selected, to correct for gain variations in the first converter assembly, to maintain instrument absolute amplitude calibration accuracy. The repaired replacement First Converter A12 and matched Gain Network Assy A16 are shipped together under the same part number.

1 ATTENUATOR

The programmable Attenuator Assy A13 consists of three attenuation elements that can be inserted or removed from the signal line by latching polarized solenoids. The three elements have attenuations of 10, 20, and 40 dB over the frequency range from DC to 18 Ghz.

The INPUT ATTENUATION switch controls the attenuator to provide 0 to 50 dB attenuation in 10 dB steps. A -12 volt, 150 millisecond pulse is generated by the attenuator driver circuit each time the INPUT ATTENUATION control is switched and also when the instrument is initially switched on. The pulse is applied to all three solenoids, with polarity determined by attenuator switch wafers A1A3S1-1, S1-2 and S1-3.

The trigger input at A7TP4, on the attenuator driver circuit, is normally connected to -12.6 volts through S1-4F. When the instrument is initially switched on, this -12.6 volts, through C4, biases Q2 "on". C4 will charge through R19 and when it reaches 12V, in about 150 milliseconds, Q2 will be biased "off". Q2 controls the Darlington Pair Q3 and Q1. When Q2 is "on", Q3 and Q1 will also be "on". When Q2 is "off" Q3 and Q1 will also be "off". Thus a -12 volt, 150 millisecond pulse is produced at the output at TP2. Diode CR9 prevents a large voltage from being developed at TP2 when Q3 and Q1 are turned "off". When the INPUT ATTENUATION control is switched, the -12.6 volt input to the attenuator driver will be momentarily interrupted by switch wafer S1-4F as it goes between positions. This will reset the attenuator driver by discharging C4 through R18 and CR8. When the switch wafer reaches a position, the -12.6 volts again trigger the attenuator driver and the above action is repeated.

Wide contacts on the polarity switching wafers S1-1, S1-2 and S1-3 ensure that circuit path for the attenuator solenoids is completed before this pulse is applied.

2 LINEAR SCALE SWITCH

Contacts on switch wafer S1-4F control the linear scale factor amplifier in the analyzer's IF Section when the analyzer is operated in the LINEAR mode. Refer to the appropriate 8552 IF Section Operating and Service Manual for circuit description. Contacts on switch wafer S1-4R control voltage to the LOG REF LEVEL/LINEAR SENSITIVITY index lights in the analyzer's IF Section. The selected light, DS1 through DS6, is controlled by the position of the INPUT ATTENUATION control. (See IF Section Operating and Service Manual.)

SERVICE SHEET 2 (cont'd)

3 FIRST CONVERTER

First Converter Assy A12 is a sealed microcircuit assembly that is factory repairable. The converter mixes the input signals with the output of the YIG-tuned oscillator and provides an output to the 2.05 GHz or 550 MHz IF. Overall conversion loss of the converter is approximately 10 dB on fundamental mixing modes. The output of the YIG-tuned oscillator is coupled into both the internal mixer and the transmission path for external mixers via internal directional couplers. In addition, the YIG-tuned oscillator signal to the tuning stabilization circuit is fed through the first converter. External mixer bias is supplied from a front panel EXT MIXER BIAS control, through the converter to the EXT MIXER connector. Internal mixer bias is supplied via the Band Buffer Assy A6 and Gain Network Assy A16. The bias resistors on the Gain Network are factory selected to match the characteristics of First Converter Assy A12. Both assemblies are supplied under one part number (see Section VI). In addition to mixer bias, the converter requires both a -10 and +10 volt source for operation.

4 INTERNAL/EXTERNAL MIXING SELECTION

Coax Switch K1, controlled by a relay driver, (Service Sheet 11) switches the converter output from the internal mixing path to the external mixing path when n=6t or n=10+ frequency bands are selected. Isolator AT5 buffers the unity reflection coefficient of the second converter at the first LO frequencies (2.06 to 4.1 GHz).

TROUBLESHOOTING PROCEDURE

When a malfunction has been isolated to the 1st converter or attenuator circuits, the INPUT ATTENUATION control should be used to help isolate the malfunction. The attenuator should change the displayed signal in 10 dB steps. With each change in INPUT ATTENUATION, the relays inside the attenuator housing are triggered and produce an audible click. If trouble is suspected in the attenuator or switching circuits, proceed with steps 1 and 2 below. If a malfunction is suspected in the converter circuits, proceed with step 3 below.

EQUIPMENT REQUIRED

Oscilloscope .... HP 18(
Volt-Ohm-Ammeter ....
BNC Plug to Type N jack..
Power Meter..
Thermistor Mount ....

1 ATTENUATOR

Connect an input signal to the analyzer and check for a CRT response. If there is a response (other than LO feedthru) rotate INPUT ATTENUATION control and check for a 10 dB change in response level with each step of the INPUT ATTENUATION control. If there is no change in response level, listen for an audible click when the control is changed. If there is no audible sound, check

SERVICE SHEET 2 (cont'd)

output of the attenuator driver at A7 TP2. Install A7 assembly, using an extender board and connect oscilloscope test probe to A7 TP2. Switch INPUT ATTENUATION control and check for a -12 volt, 150 millisecond pulse, at A7 TP2. Switch the INPUT ATTENUATION control through its range while observing the oscilloscope for a pulse at each change in position. If the switching voltage is present at A7 TP2, check for both switching voltage and ground return at each input to the relays in the attenuator assembly. If switching voltage is not present at A7 TP2, check the input to the relay driver at A7 TP4. If the input is correct, check the relay driver circuit.

NOTE

The input attenuator is not field-repairable. Factory repaired exchange assemblies are available. See Section VI for HP Part Number.

2 LINEAR SCALE SWITCH

To locate a malfunction in the index light selection or amplifier compensation wiring and switching circuitry, perform a point-to-point circuit check. See schematic diagram and also the interconnecting wiring information on Service Sheet 16.

3 FIRST CONVERTER

When a malfunction has been isolated to the input mixer, use the partial schematic below to confirm mixer failure. Check diode bias on the n=1 through n=4 bands. Typical voltages as follows: n=1 and 3, -3.8 volts; n=2, -1.3 volts; n=4, -2.4 volts. The exact bias voltage is factory determined for each diode. The converter transistor can be checked by comparing the collector and emitter current. Disconnect the -10 volt lead at the emitter bias terminal and measure emitter current with a millimeter such as the HP 412A. Connect -10 volt lead and repeat measurement procedure at the +10 volt terminal. The emitter current should be 18.5 mA +20%. The collector current should be not more than 10% less than the emitter current. To check the mixer diode, turn instrument power off, disconnect diode bias lead and check front to back ratio of diode circuit. Set HP 412A to 1K ohm position, connect red (+)lead to diode bias pin and black (-) lead to emitter bias pin. Reading should be greater than 10 megohms. Less than 10 megohms indicates a shorted diode. Reverse leads, reading should be between 1K and 10K. (Infinity indicates open diode). (See 1st Converter replacement procedure below.) Measure the YIG oscillator power output at the EXT MIXER port on the front panel, using the HP 432A Power Meter and a HP 8478B Thermistor Mount. Typical power level should be between 0 and +5 dBm.

ATTENUATOR REMOVAL AND REPLACEMENT

See Service Sheet 18

FIRST CONVERTER REMOVAL AND REPLACEMENT

See Service Sheet 18.

SERVICE SHEET 2 (cont'd)

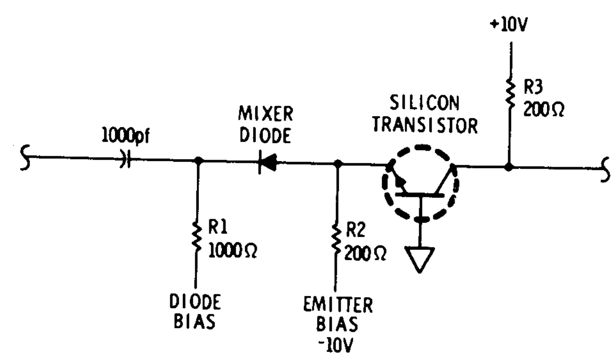


Figure 8-12. First Converter Assy, Simplified Schematic

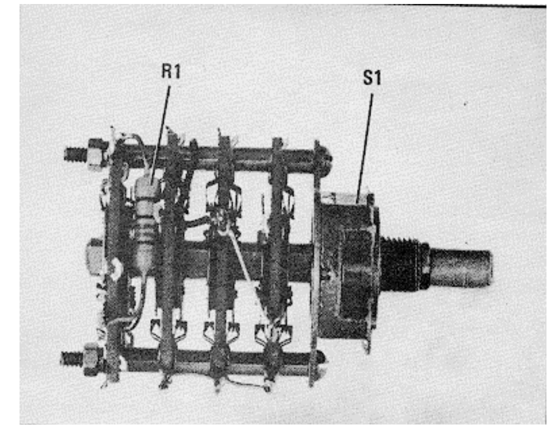


Figure 8-13. Switch Assembly A1A3

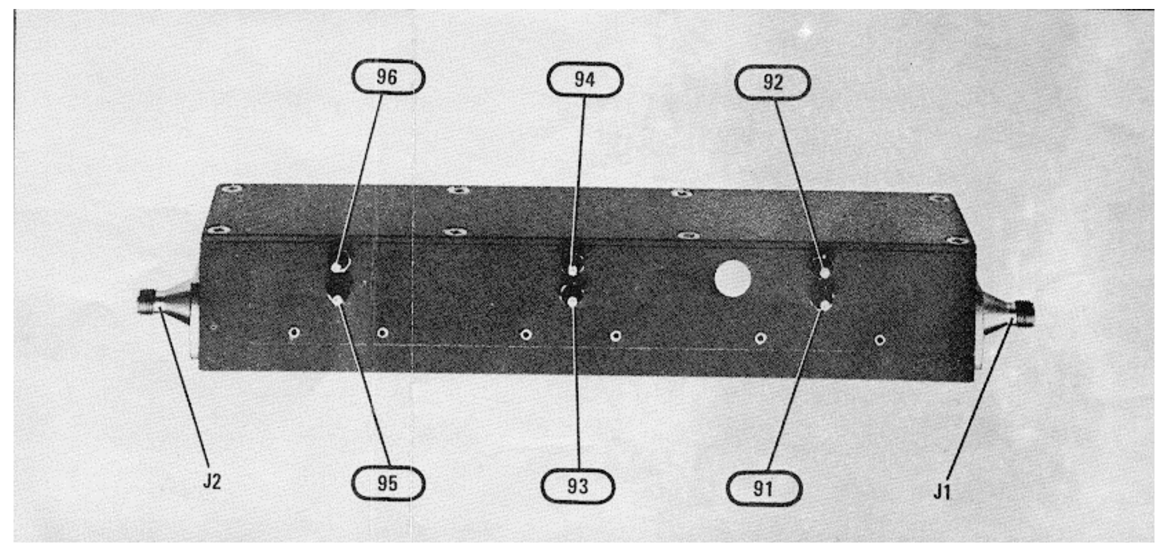


Figure 8-14. Attenuator Assembly A13

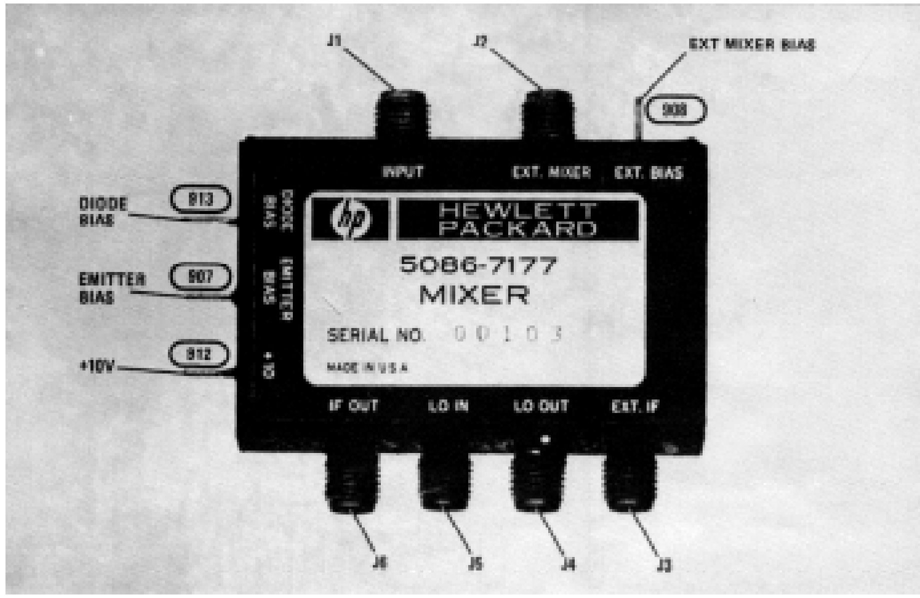


Figure 8-15. First Converter Assembly A12

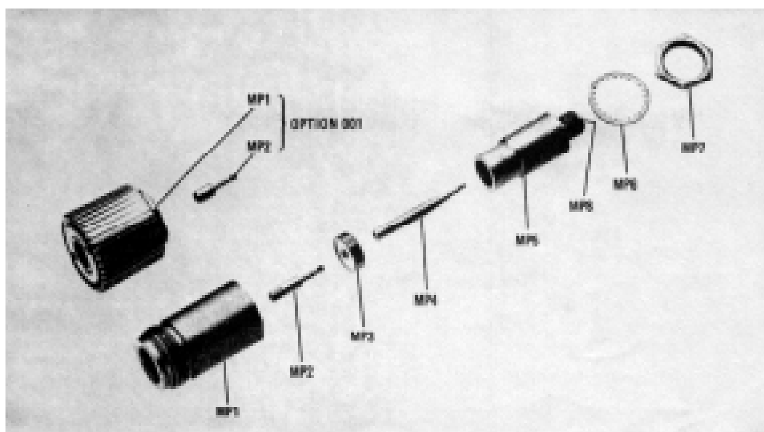


Figure 8-16. INPUT Connector J1 Exploded View

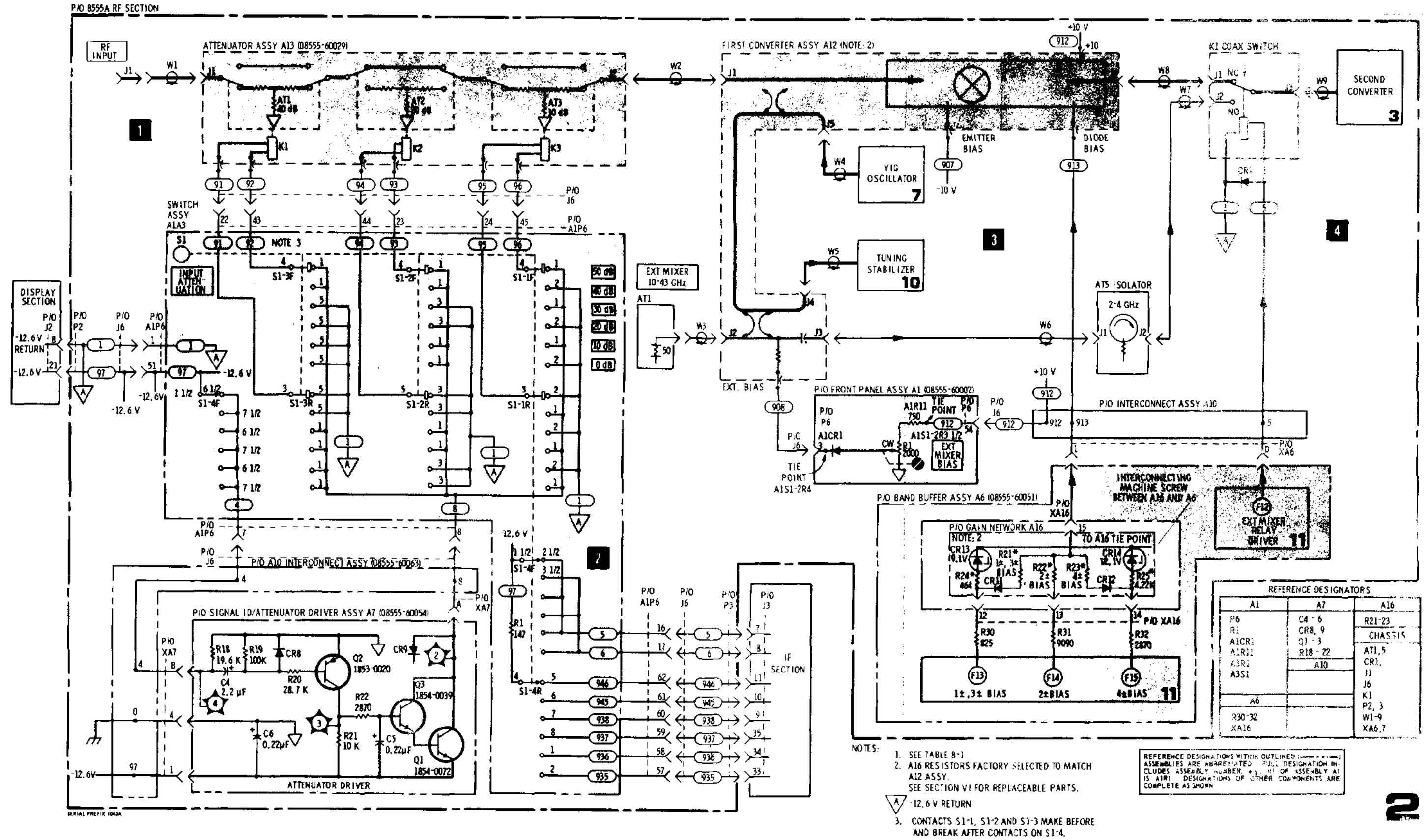


Figure 8-17. Input Attenuator and 1st Converter Schematic Diagram

Service

SERVICE SHEET 3

Service Sheet 3 contains the schematic diagrams for the Second Converter Assy All, the 2.05 GHz Low Pass Filter FL2 and the IF switching relays K2 and K3. The second converter consists of a casting containing three cavities, a two-transistor 1.5 GHz oscillator, a single diode second mixer, a 550 MHz output circuit, and a 1.5 Ghz notch filter. In addition, a voltage filter and control board, mounted on the outside of the casting, is part of the second converter (see Section VI for replaceable parts and Service Sheet 18 for an illustrated parts breakdown of the second converter).

1 NOTCH AND LOWPASS FILTERS

1.5 GHz notch filter and 2.05 GHz low pass filter. The 1.5 Ghz notch filter consists of a quarter-wave directional coupler, short circuited at one end of the auxiliary line and capacitively loaded at the other. The notch filter attenuates the 1.5 GHz oscillator signal, on the main line, to prevent it from mixing in the first converter circuits. The 2.05 GHz low pass filter is a non-adjustable sealed multi-pole filter connected in the circuit between the notch filter and the coax switch K3. The low pass filter provides attenuation of signals above 2.05 GHz.

2 IF SWITCHING

Coax Switches K2 and K3. K2 and K3 provide switching to bypass the second converter when the n=1* 550 MHz IF bands are selected. The switches are controlled by the F11 function from the Band Buffer Assy A6 (see Service Sheet 11).

3 VOLTAGE FILTER AND CONTROL

Second Converter Voltage Filter Assy All11A3. The voltage filter is mounted on and connected to the second converter via feedthru capacitors AllC1, AllC2 and a ground connecting mounting screw. The voltage filter provides a voltage switching circuit for removal of the -10 volt supply to the 1.5 GHz oscillator when the n=1 550 Mhz IF bands are selected. A11A3Q4 provides filtering of the +10 volt supply. AllQ1 through Q3 and associated components, provide filtering, switching and level control of the -10 volt supply. A11A3R1, 2nd LO power adjustment, sets the voltage level of the -10 volt supply to the 1.5 GHz oscillator. A11A3Q1 is turned "on" by the F11 function (see step 2 above) grounding the base of AllA3Q2 and removing the oscillator emitter bias.

4 SECOND CONVERTER

Second Converter LO Mixer and If. The second converter LO is a two transistor oscillator whose frequency is determined by radial cavities. Voltage to the oscillator is filtered and controlled by the voltage filter assy (see block 3). The second mixer is a single Schottky diode located between the oscillator cavity and the second 2.05 GHz IF cavity. The IF filter consists of two radial cavities that function to provide a two-pole Butterworth response. Both IF and 2nd LO cavities are adjustable by tuning slugs. The output of the second mixer is coupled through a 550 MHz bandpass filter consisting of A11A2C1, C2 and L2. R1 provides bias for the second converter.

TROUBLESHOOTING PROCEDURE

When a malfunction has been isolated to the Second Converter circuits or to isolate a malfunction in the Second Converter circuits, maximum use should be made of the instruments operating capabilities to localize the failure. The n=1+ 550 MHz IF bands bypass all of the Second Converter circuits except the 1.5 GHz Notch Filter. In addition, the second LO output is available at the front panel and can be used as a test signal.

CAUTION

Before connecting the SECOND LO OUTPUT to the analyzer's INPUT, set INPUT ATTENUATION to at least 20 dB. The output level at the SECOND LO OUTPUT is typically +9 dBm.

When operating on the n=1+ 550 MHz IF bands, the second LO is disabled. The disabling circuit can be bypassed by grounding the base of A11A3Q1. The oscillator output can then be observed at 1.5 GHz on the n=1- 550 MHz IF band.

EQUIPMENT REQUIRED

UHF Signal Generator	HP 612A
Signal Generator	HP 8614A
Digital Voltmeter	HP 3440A/3443A
Cable Assembly	HP 11592-60001
Adapter	UG 201A/U
Adapter	HP 1250-1200
Cable Assembly	HP 10503A
Adapter	HP 1250-0827

1 NOTCH AND LOW PASS FILTERS

Operation abnormal on both 550 MHz and 2.05 GHz IF bands. Set controls as follows:

BAND	n=1- 2.05 GHz IF
BANDWIDTH	300 kHz
SCAN WIDTH	ZERO
INPUT ATTENUATION	0 dB
SCAN TIME PER DIVISION	10 MILLISECONDS
LOG REF LEVEL	-20 dBm
LOG/LINEAR	LOG
SCAN MODE	INT
SCAN TRIGGER	AUTO

Connect a -60 dBm 2.05 GHz signal at J1 of Coax Switch K1. Fine tune signal source to peak signal on CRT display. Normal indication for a correctly operating system should be a signal level of approximately -50 dBm (-60 dBm input, +10 dB gain for 1st converter bypass.) If operation is abnormal, connect -60 dBm signal at J1 of Low Pass Filter FL2 and to J3 of Coax Switch K3. Negligible loss in signal level should occur in either the low pass or notch filters.

2 IF SWITCHING

Coax Switches K2 and K3 can be visually observed and checked for correct operation using the signal insertion procedure in step 1 above. K2 and K3 should energize on the n=1+ 550 MHz IF bands.

3 VOLTAGE FILTER AND CONTROL

Check the voltage level at - (negative) terminal on AllA3 while switching between the 550 MHz IF and 2.05 GHz IF bands. The voltage level should switch from approximately -9.2 volts to about 0 volts when the 550 MHz IF bands are selected. The actual voltage level depends on the setting of A11A3R1. If the voltage does not switch, check the F11 function signal from Band Buffer Assembly A6.

4 SECOND CONVERTER

The 1.5 GHz oscillator can be checked for output level and approximate frequency (with analyzer operating normally on the 550 MHz IF bands) by applying aground to the base of A11A3Q1 to enable the -10 volt supply, and observing the oscillator output on the n=1- 550 MHz IF band. If the oscillator functions correctly and there is no 550 MHz output from the Second Converter (with a 2.05 GHz input signal) check the Second Mixer and Output Assy A11A2. The mixer and output assembly can be removed from the converter assembly without removing the converter from the chassis. Refer to Service Sheet 18 for removal and replacement instructions. Note installation of the mixer diode. The diode leads from the coupling loops to the oscillator and IF cavities. One diode lead is soldered to feedback capacitor AllA2C1, the other lead is installed in a clip type socket. To install a new diode, form leads to the dimensions shown below. It may be necessary to trim the end of the diode lead that mounts in the clip to ensure that the diode mounts parallel with the block.

REMOVAL AND REPLACEMENT PROCEDURE

See Service Sheet 18.

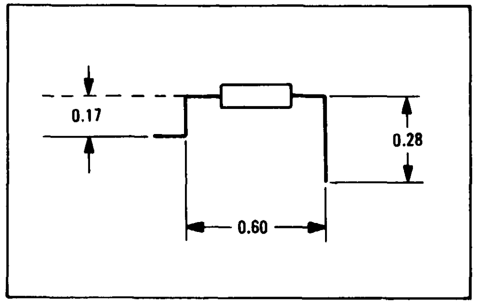


Figure 8-18. Second Mixer Diode Forming Dimensions in Inches

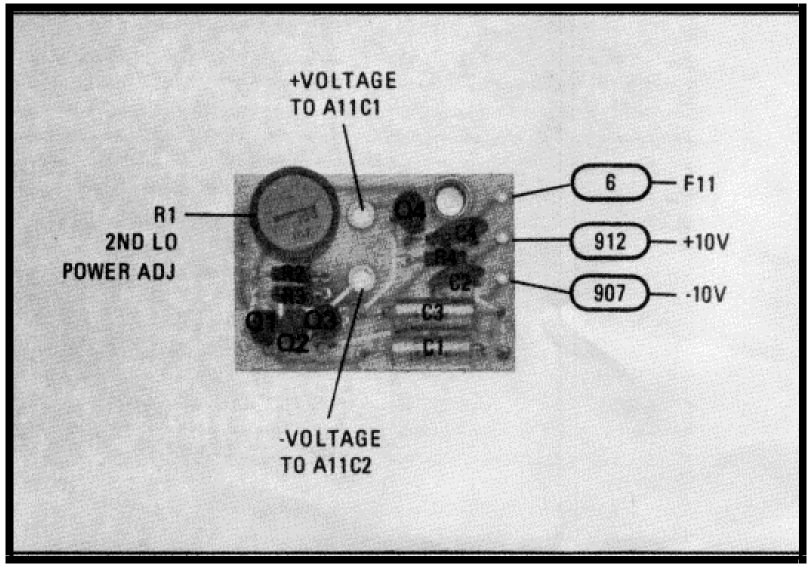


Figure 8-19. Second Converter Voltage Filter A11A3

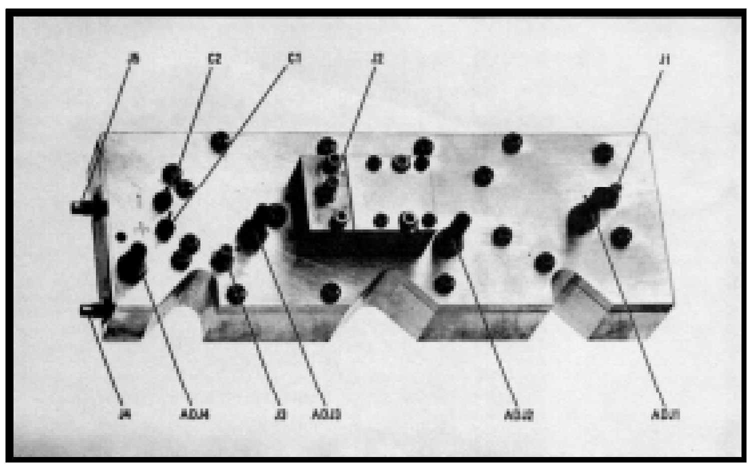
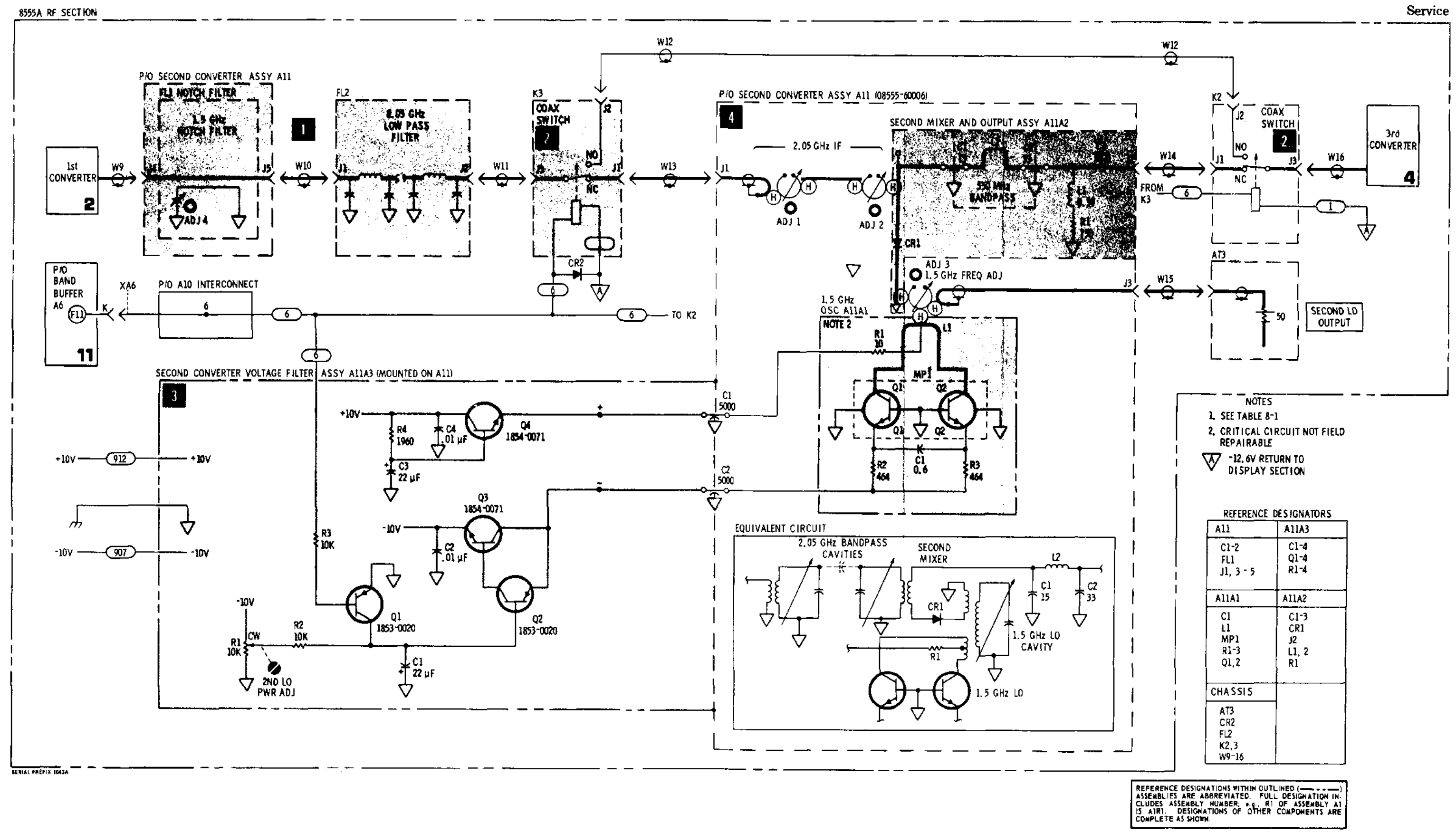


Figure 8-20. Second Converter Assembly A11 (Voltage Filter A11A3 Removed)



3

Figure 8-21. Second Converter

SERVICE SHEET 4

THEORY OF OPERATION

Service Sheet 4 contains the schematic diagram for the Third Converter Assy A2, except for the 50 MHz Amplifier which is contained in Service Sheet 5. The third converter consists of a 550 MHz Amplifier, a 500 MHz LO and LO Drive Assy, a 550 to 50 MHz Mixer, a 50 MHz Variable Gain Amplifier and a 550 MHz Bandpass Filter. Each subassembly, in the converter, is mounted in separate shielded compartments, except for the 500 MHz LO and LO driver which are mounted in the same compartment.

1 500 MHz LO Drive A2A2

The 500 MHz LO Driver-determines the voltage applied across the voltage-variable capacitor A2A4CR1 which can tune the frequency of the 500 MHz LO circuit. Except in Signal Identifier mode, the A2A4CR1 tuning voltage is set to a fixed level by the frequency linearity adjustment resistor A2A2R13. In the Signal Identifier operating mode, a voltage is applied to the 500 MHz LO Driver on alternate sweep scans. The input voltage level in the range of .02 and 10.0 volts, is determined by the signal identifier attenuator on the SCAN WIDTH PER DIVISION switch. (See Service Sheet 6.) This voltage will be positive if the BAND is set to a n- Band and will be negative if set to a n+ Band. The LO Driver converts the change in voltage to the required voltage across A2A4CR1 to shift the frequency of the 500 MHz LO to produce a signal shift of 2 cm on the CRT.

2 500 MHz LO A2A4

The 500 MHz LO is a two-transistor oscillator that normally operates at a fixed frequency. In the Signal Identifier operating mode, the frequency of the LO is shifted on alternate scans by shifting the bias on the voltage-variable capacitor A2A4CR1. The amount of shift will be twice the setting of the SCAN WIDTH PER DIVISION switch (i.e., between 4 kHz and 2 MHz). Note: the Signal Identifier mode is disabled above switch settings of 1 MHz. The oscillator shift will be positive for n+ Bands and negative for n- Bands. The LO output is coupled to the 550/50 MHz mixer and to the rear panel as a test point or for use with auxiliary equipment.

3 550 MHz Amplifier A2A1

The 550 MHz amplifier is a two-transistor amplifier which provides approximately 11 dB of gain. The amplifier input is from the second converter for all 2.05 GHz IF bands and from the first converter on the two 550 MHz IF bands. Transistor Q2 provides the amplification with Q1 providing active bias. Input impedance matching is provided by a stripline and T-match. The amplifier output is coupled by a twisted-pair wire to the 550 MHz Bandpass Filter.

4 550 MHz Bandpass Filter

The 550 MHz Bandpass Filter consists of three helical inductors and three screws that function as capacitors. Together they provide a Butterworth type filter with a 3 dB bandwidth of 8 MHz. Filter loss is approximately 2.5 dB.

5 550/50 MHz Mixer A2A3

The 550/50 MHz mixer consists of a standard HP 10514C Mixer (A2A3E1) and a 50 MHz bandpass filter. The mixer is a double-balance or ring modulator type and is a sealed non-repairable item. The 50 MHz filter attenuates the higher order outputs from the mixer.

TROUBLESHOOTING PROCEDURE

See Overall Third Converter Test Procedure below. When a malfunction has been isolated to the 500 MHz LO or LO Driver or is suspected in the 550 MHz amplifier, bandpass filter or 550/50 MHz mixer, the top housing containing the 50 MHz amplifier may be removed to gain access to the circuit boards and the bandpass filter. (See Figure 8-22.) Refer to Service Sheet 18 for converter removal and replacement procedure.

SERVICE SHEET 4 (cont'd)

EQUIPMENT REQUIRED

VHF Signal Generator.................................... HP 608D/E/F
UHF Signal Generator ....HP 612A
Digital Voltmeter .... HP 3440A/3444A
Vector Voltmeter..HP 8405A
Dual DC Power Supply ....HP 6205B
Cable Assembly....................................... HP 11592-60001
Frequency Counter/Transfer
Oscillator ....HP 5245L/5257A
Service Kit .... HP 08555-60077

OVERALL THIRD CONVERTER TROUBLE-SHOOTING PROCEDURE

(Service Sheets 4 and 5)

It is assumed that 550 MHz input at A2J1 is good and the 50 Mhz output at A2J4 is bad. (Arrived from Figure 8-9 Troubleshooting Trees.) If signal level is 3 to 5 dB low check 550 MHz and 50 Mhz filter adjustments before performing the troubleshooting procedure. A2C5, C6, C7 and A2A3C3 are adjusted for peak signal indication. Install analyzer plug-ins on extender cables. Check input voltages at third converter feedthru capacitors.

Voltage measurement conditions:

n=1- 2.05 GHz IF Band, SIGNAL IDENTIFIER OFF, SCAN WIDTH ZERO, no signal input.
(Available through hole in left side gusset.)

Wire Color Code	Capacitor	Voltage
902	A2C1/C2	+20 Vdc
907	A2C3	-10 Vdc
946	A2C4	0
97	A2C8	-12.6 Vdc
934	A2C9	- 0.6 Vdc
947	A2C10	-0.77 Vdc
935	A2C11	-12.4 Vdc
936	A2C12	-0.56 Vdc

Check third LO output for both frequency and power level at A2J3 or at rear panel connector P4-A2. The output should be 500 MHz + 50 kHz at a power level of at least +1 dBm. If the oscillator is off frequency see 500 MHz LO Check and Adjustment Procedure, Section V. If there is no oscillator signal or if power output is low, see troubleshooting procedure for 500 MHz LO Drive and LO (blocks 1 and 2 below). If the LO output is correct remove cover from 50 MHz Amplifier A2A5 and inject a 50 MHz -40 dBm level signal at IN terminal near A2A5C2. Set analyzer controls as follows: n=1- 2.05 GHz IF Band, BANDWIDTH 300 kHz, SCAN WIDTH ZERO, INPUT ATTENUATION 0 dB, SCAN TIME 10 MILLISECONDS, LOG REF LEVEL 10 dBm, SIGNAL IDENTIFIER OFF, SCAN MODE INT, and SCAN TRIGGER AUTO.

SERVICE SHEET 4

Adjust frequency of 50 MHz signal for maximum base line lift. The CRT display should indicate a signal level of approximately -30 dBm. If signal level is not correct see 50 MHz amplifier troubleshooting procedure on Service Sheet 5. If signal level is correct the malfunction is in the 550 MHz amplifier, bandpass filter or the 550/50 MHz mixer. (See blocks 3 and 4 below.)

1 500 MHz LO DRIVE A2A2 TROUBLESHOOTING PROCEDURE

Remove bottom section of third converter from the RF Section chassis (see third converter removal and replacement procedure, Service Sheet 18). Connect +20 volts to A2C1/C2 and -10 volts to A2C3 from dual power supply. Measure current drawn from power supply. Approximately 28 mA should be drawn from the 20 volt source and 16 mA from the 10 volt source.

Connect a -10 volt source to test point A2A2TPA (Signal Identifier Input) and measure voltage at A2A2TPB. Voltage level should be approximately +8.6 Vdc. Connect a +10 volt source to A2C4 and repeat measurement. Voltage level should be approximately +5.4 Vdc. (Zero volts input produce approximately +7V.)

2 500 MHz LOCAL OSCILLATOR TROUBLESHOOTING PROCEDURE

If the voltage levels in step 1 are correct and there is no output from the 500 MHz LO, remove the 500 MHz LO Drive A2A2 to gain access to the 500 MHz LO. Disconnect A2A2 from A2A4 at feedthru capacitors A2A4C1 and A2A4C2. Remove the four. screws and lift the A2A2 assembly aside. Check transistors A2A4Q1/Q2 and their associated components.

3 550 MHz AMPLIFIER TROUBLESHOOTING PROCEDURE

Connect a 550 MHz signal from the 612 Signal Generator to A2J1. Connect the 8405A Vector Voltmeter probe to test point F and set signal generator output level for an indication of -40 dBm on the vector voltmeter. Measure signal level at test point D. Signal level should indicate amplifier gain of +11 +2 dB. If the amplifier has no gain or low gain, check transistors A2AlQ1/Q2. Typical voltage measurements with no input signal given below.

	Emitter	**Base**	**Collector**
A2A1Q1	+14.6 Vdc	+14.0 Vdc	+1.3 Vdc
A2A1Q2	0	+ 0.8 Vdc	+4.4 Vdc

4 550 MHZ BANDPASS FILTER AND 550/50 MHz MIXER

Filter loss should be 2.25 +0.5 dB. A quick check of the filter can be made by removing the -10 volt source to the 500 MHz LO, covering the filter cavities with a metal plate and comparing the input signal level to the filter with the output level. Measure signal level with Vector Voltmeter at A2A1 TP D and at pins X and X' on A2A3E1. This arrangement should indicate a filter loss of approximately 6 dB. Reconnect the -10 volt source to the 500 MHz LO and measure LO input signal level to mixer E1 at pins L and L'. Signal level should be approximately +10 dBm. If both the LO and 550 MHz signals to the mixer are correct, mixer El, is probably defective. If replaced, perform Third Converter Adjustments in Section V.

REMOVAL AND REPLACEMENT PROCEDURE

See Service Sheet 18.

SERVICE SHEET 4 (cont'd)

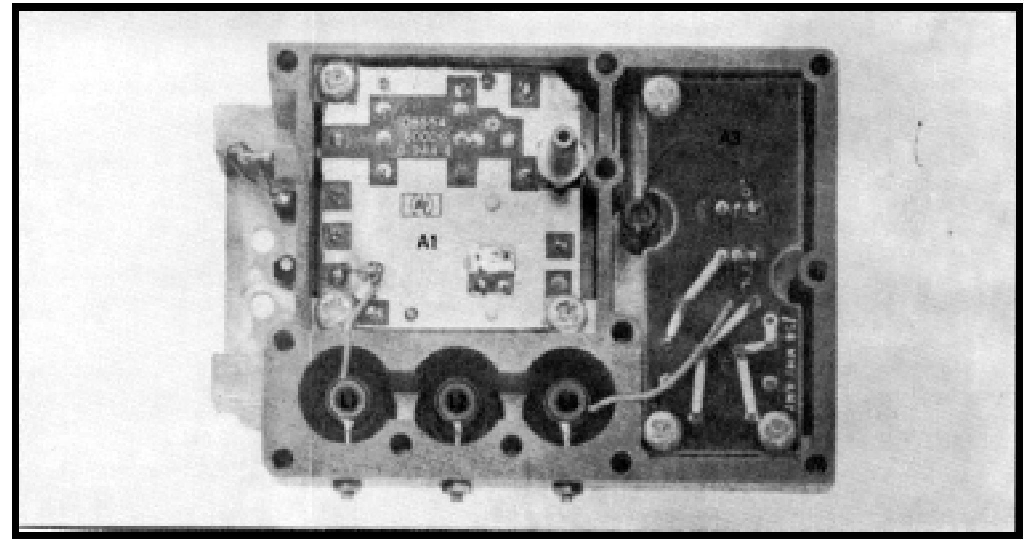


Figure 8-22. Third Converter Assembly A2 Top View (50 MHz Ampl Removed)

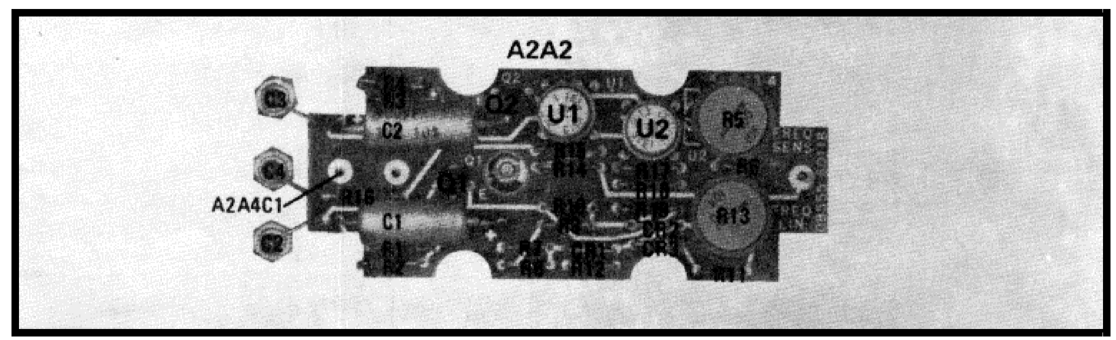


Figure 8-23. 500 MHz LO Drive Assembly A2A2

A11A1, A11A2, A11A3
Second Converter
SERVICE SHEET 3

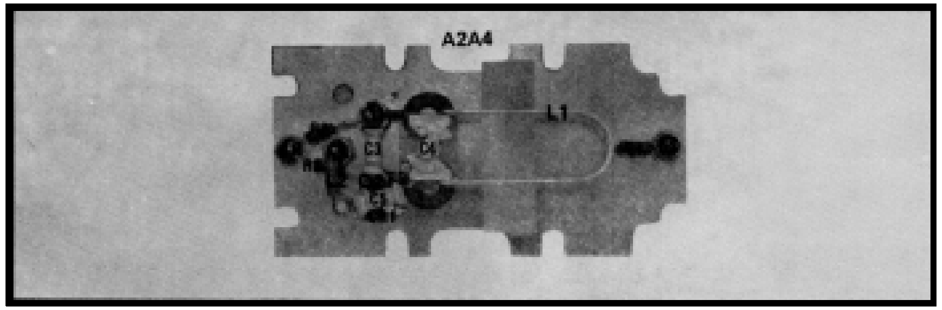


Figure 8-24. 500 MHz LO Assembly A2A4

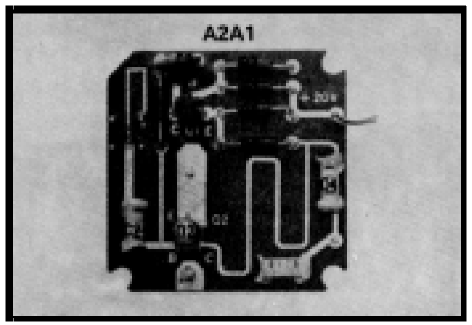


Figure 8-25. 550 MHz Ampl Assembly A2A1

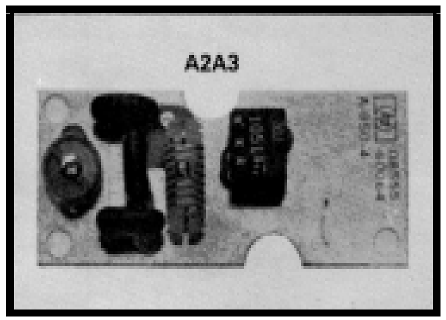


Figure 8-26. 550/50 MHz Mixer Assembly A2A1

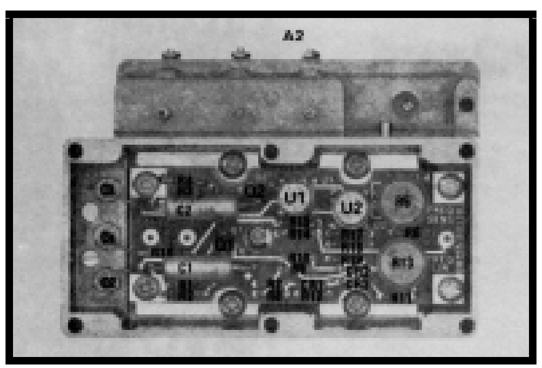


Figure 8-27. Third Converter Assembly A2, Bottom View

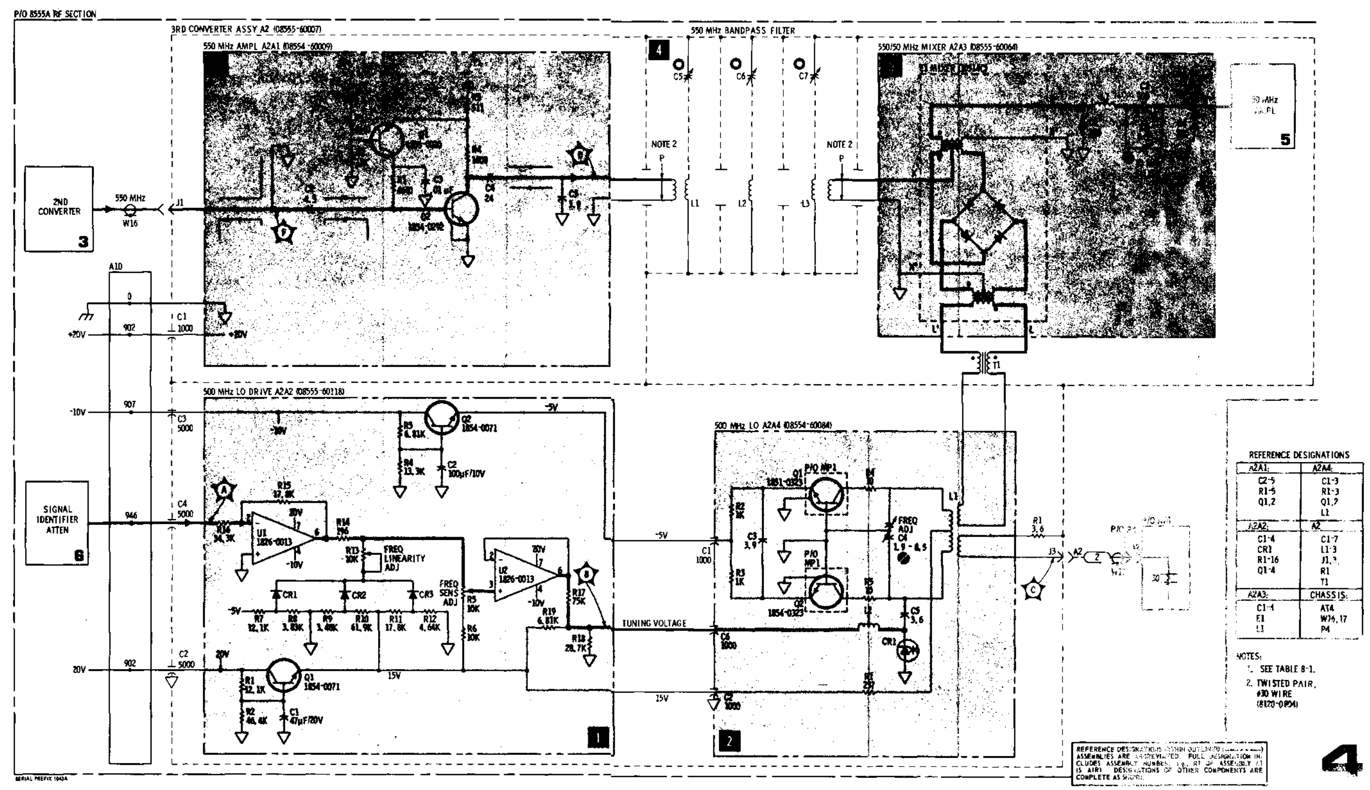


Figure 8-28. Third Converter

SERVICE
SHEET 4

SERVICE SHEET 5

THEORY OF OPERATION

Service Sheet 5 contains the schematic diagram for the 50 MHz variable gain amplifier, the input mixer gain compensation network and the gain network driving circuit, The amplifier gain is controlled to provide a constant output level to the IF Section on all Internal mixing bands (.01 to 18 GHz). The amplifier compensates for losses in the lot, 2nd and 3rd converted to maintain the overall gain of the RF Section at -8 dB. Maximum amplifier gain is provided on external mixing bands (n=6 and n-10) with minimum pin provided on the 550 MHz IF bands (n=1+*). Amplifier gin is controlled in steps over a range of approximately 28 dB. Additionally, variable gain is provided by the sweep and tune voltages for all internal mixing bands. The controlled gain of the amplifier is varied by changing current through PIN diodes which function as current controlled resistors.

1 60 MHz AMPLIFIER

Transistors A2A5Q1 and Q2 form a cascade amplifier. Amplifier gain is adjusted by A2A5R4 1-low, 2.05 GHz IF adjustment. For adjustment, see 50 MHz Amplifier Adjustment Procedure in Section V.

2 MIXER PIN DIODE

PIN Diode A2A5CR1 functions as a current controlled attenuator to match the 50 MHz amplifier with the input mixer diode in the 1st converter. Current through the diode is controlled by the Input Mixer Gain Compensation Network A16, gain control function signals Fl through F10 and the sweep plus tune voltage from A6U2. A2A5C8 provides a fixed adjustment level for the PIN diode attenuator. Emitter followers A2A5Q3 and Q4 provide circuit isolation.

3 SIGNAL IDENTIFIER PIN DIODE

PIN Diode A2A5CR2 functions as a current controlled attenuator to reduce the amplifier gain by approximately 5 dB on alternate sweep scans. Current through the diode is switched by voltage from the Signal Identifier (see Service Sheet 6).

4 50 MHz STEP GAIN AMPLIFIER

Transistor A2A5Q5 and associated components form a 50 MHz amplifier whose gain is controlled in steps by current changes through PIN diode A2A5CR3. Amplifier gain is controlled by changing emitter degeneration. The amplifier stage has three controlled gain levels. On the n=1± 550 MHz IF bands the gain level is set by A2A5R25. On the n=1 and n=2 (2.05 MHz IF bands) the F17 function signal, from the Band Buffer Assy A6, reverse biases diode A2A5CR4 to remove the gain level set by A2A5R25. On the n=3, 4, 6 and 10 bands the F16 function signal is applied through A2A5R26 and A2A5L7 to increase current through the PIN diode. Note that as current through PIN diode A2A5CR3 increases, degeneration is decreased and gain is increased. Functionally, the circuit operates to decrease amplifier gain by 5 dB on the n=1± 550 MHz IF bands, removes the 5 dB decrease in gain on the n=1± and n=2± 2.05 GHz IF bands and adds 15 dB gain on the n=3+ through the n-10± bands.

5 SWEEP PLUS TUNE AMPLIFIER

A6U2 provides gain compensation for each internal mixing band. As the YIG oscillator is tuned from the low to high end of its range, the amplifier produces a positive-going ramp that is combined with the voltage developed across the selected resistors in the gain compensation network to reduce the attenuation through PIN diode A2A5CR1. This effectively increases the gain in the 50 MHz amplifier. The operational amplifier input depends on the position of the SCAN WIDTH control and/or FREQUENCY control. In FULL scan the input is a -5 to -10 volt ramp. In PER DIVISION scan the FREQUENCY control sets the level while the position of the PER DIVISION control determines the amount of sweep. In ZERO scan the input is a voltage level determined by the position of the FREQUENCY control. The input to the operational amplifier is combined with an offset voltage

SERVICE SHEET 5 (cont'd)

(+10 volts through A6R20), amplified and inverted. A -5 to -10 volt input results in a 0 to +8 volt output. Amplifier gain is determined by resistors A6R21 and A6R19.

6 INPUT MIXER GAIN COMPENSATION NETWORK A16

Factory selected resistors in the gain network control the amount of attenuation by PIN diode A2A5CR1 (see 2 above). Resistor values are selected to match the input mixer diode in the 1st Converter Assy A12. Resistive sticks selected by function control signals (F1 through F10) from the Band Buffer (Service Sheet 11) determine the current through the PIN diode attenuator. Resistors A16R1-R10 set the gain at the high end of each band while A16R11-R20 set the gain at the low end. The active function signal has a voltage level of -12 volts which is applied to low end gain resistors. The voltage applied to the high end gain resistors depends on the SCAN WIDTH operating mode (see 5 above). The two voltages are summed in the resistor sticks to determine the attenuation current through A2A5CR1.

TROUBLESHOOTING PROCEDURE

When a malfunction has been isolated to or to isolate a malfunction in the 50 MHz amplifier, sweep plus tune amplifier or the input mixer gain compensation network, the front panel controls should be used to obtain as much information as possible. When this information is obtained, or if not obtainable, proceed with the numbered troubleshooting procedure below.

Front Panel Control Checks: set controls as follows:

POWER .... ON
BAND .... n=10+
FREQUENCY .... high end of band
SCAN WIDTH .... FULL
INPUT ATTENUATION .... 10 dB
BASE LINE CLIPPER .... max CCW
VIDEO FILTER .... 100 kHz
SCAN MODE .... INT
SCAN TRIGGER .... LINE
LOG/LINEAR .... LOG
SCAN TIME .... 10 MILLISECONDS
LOG REF LEVEL Controls .... Center trace on CRT

Disregard DISPLAY UNCAL light during this check. Compare change in display trace with the figure below as the Frequency Band Lever is positioned to select each frequency band. There should be no change in level for frequency bands n=10± through n =6±. Selection of the n=4+ band should tilt the trace with a reduction in gain on the low frequency end and an increase in gain on the high frequency end. The tilt and change in gain is a combination of the sweep plus tune amplifier output and the mixer gain compensation network. Select bands n=4- through n=3- and compare with figure. Gain reduction determined by resistors in network. Select band n=2+; signal F16 goes inactive dropping the 15 dB gain step. However, the attenuation through PIN diode A2A5CR1 is reduced by approximately 11 dB by the resistive network and the trace is reduced by approximately 4 dB. Select bands n=2- through n=1l-. The trace should drop by the approximate amounts indicated in the figure. Select n=±* bands (550 MHz IF). Function signal F17 goes inactive decreasing gain by 5 dB. However, this decrease in gain is offset by conversion loss in the 2nd converter which is bypassed on the n=1+* bands. Switch SIGNAL IDENTIFIER to ON and select 1 MHz PER DIVISION SCAN WIDTH. Two traces should appear on the display with approximately 5 dB difference in

SERVICE SHEET 5 (cont'd)

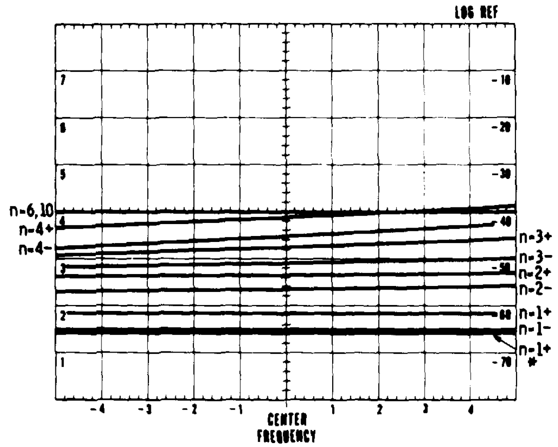


Figure 8-29. CRT Display, Gain Change Base Line Lift

level. Both the tilt and change in gain levels are matched to the first converter. Use the figure below as a guide only.

EQUIPMENT REQUIRED

Digital Voltmeter .... HP 3440A/3444A

Oscilloscope .... HP 180A/1801A/1821A

1 50 MHZ AMPLIFIER

Remove top cover from 3rd converter to gain access to the 50 Mhz amplifier. Check the +20 and -12.6 volt inputs to the amplifier. Check the input amplifier by making dc voltage measurements of A2A5Q1 and Q2. Compare with typical values shown below.

50 MHz Amplifier A2A5 Voltage Measurements

Unit of Measurement Vdc: tolerance t 0.1 Vdc;

Conditions: n=1- 2.05 GHz IF Band, SIGNAL IDENTIFIER OFF, SCAN WIDTH ZERO, no signal input.

	Source	Gate	Drain
A2A5Q1	+2.8	0	+10.06
	Emitter	Base	Collector
A2A5Q2	+10.84	+11.56	+20.0
A2A5Q3	+10.76	+11.5	+19.9
A2A5Q4	+10.0	+10.76	+19.9
A2A5Q5	+ 9.28	+10.0	+19.9

A2C9 (VAR GAIN) -0.6
A2C10 (SIG IDENT) +0.7
A2C11 (+5 dB) -12.4
A2C12 (+15 dB) -0.56

2 MIXER PIN DIODE

Check dc voltage levels for emitter followers A2A5Q3 and Q4. With analyzer controls set as indicated for the front panel checks, switch between bands n=4 and n=6. Observe CRT trace for a change from a level trace on the n=6 to a tilted trace on the n=4 band. Observe CRT trace for a change in level between bands n=4 and n=6. If no change in either tilt or level, check front to back ratio of PIN diode A2A5CR1. If no tilt (and PIN diode checks good), see 5 below. If no change in tilt and level (and PIN diode checks good), see 6 below.

SERVICE SHEET 5 (cont'd

3 SIGNAL IDENTIFIER PIN DIODE

With the analyzer operating in the signal identifier mode (SIGNAL IDENTIFIER Switch ON and SCAN WIDTH PER DIVISION set to 1 MHz or less) check voltage level at anode of A2A5CR2. Voltage level should alternate between +0.70 and -0.75 volts (approximately) for normal operation. Check front to back ratio of diode if voltage is abnormal. Signal level is attenuated by the positive voltage level. The higher the positive voltage level the greater the attenuation. When checking attenuation, measure signal attenuation, not the amount of base line shift.

4 50 MHz STEP GAIN AMPLIFIER

Check dc voltage level at cathode of PIN diode A2A5CR3. With analyzer controls set as indicated for the front panel check above, switch between bands and check voltage level. Typical levels are as follows: bands n=10, n=6, n=4 and n=3, -1.02 volts; bands n=2 and n=1, -0.54 volts; band n=1*, -0.52 volts.

5 SWEEP PLUS TUNE AMPLIFIER

The sweep plus tune amplifier A6U2 can be isolated from the following circuitry by disconnecting at the tie point between the A6 and A16 circuit boards. With the analyzer operating in full scan, compare the output voltage with the input signal. A -5 to -10 volt input ramp should produce a 0 to +8 volt output ramp. A6R21 divided by A6R19 determines amplifier gain. Voltage offset by +5 volts through A6R20.

6 INPUT MIXER GAIN COMPENSATION NETWORK

When a malfunction has been isolated to the Input Mixer Gain Compensation Network A16, remove the assembly and perform a point-to-point check of the resistive stick and diode associated with the defective band. Use markings on factory selected resistors to determine value. Replace defective resistors with resistors of the same value as the markings on the defective resistors. Perform the amplitude accuracy performance test in Section IV. The A16 assembly is matched with the First Converter Assembly A12. If one assembly is defective and cannot be repaired in the field both assemblies must be replaced (see Replaceable Parts Section VI).

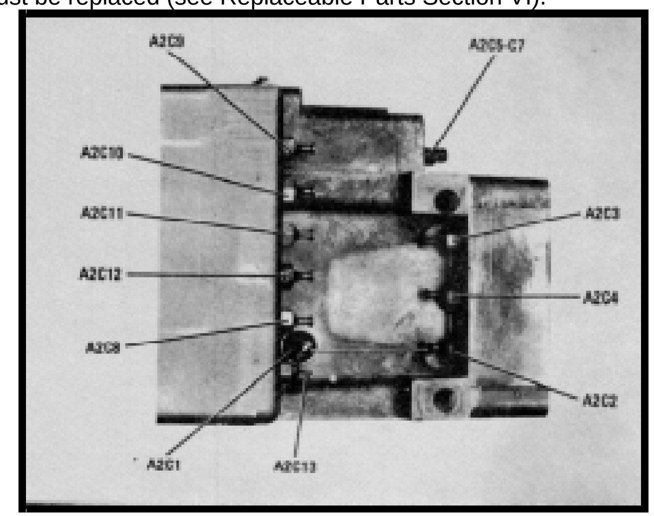


Figure 8-30. Third Converter Assembly, Side View

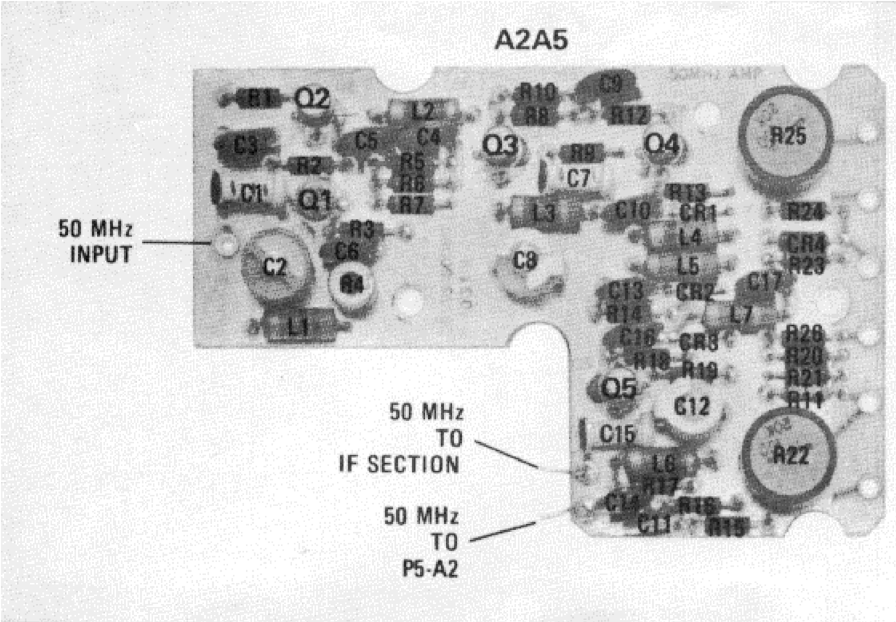


Figure 8-31. 50 MHz Ampl. Assembly, A2A5.

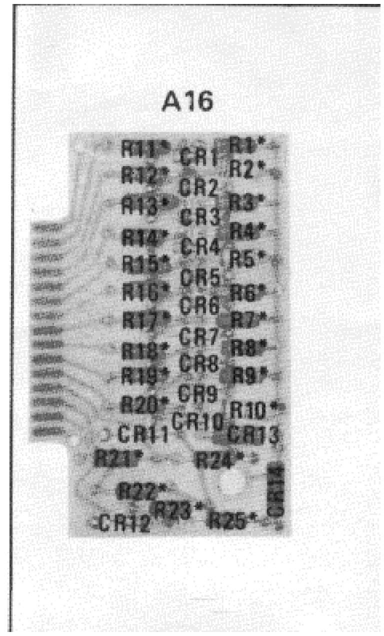


Figure 8-32. Input Mixer Network A16

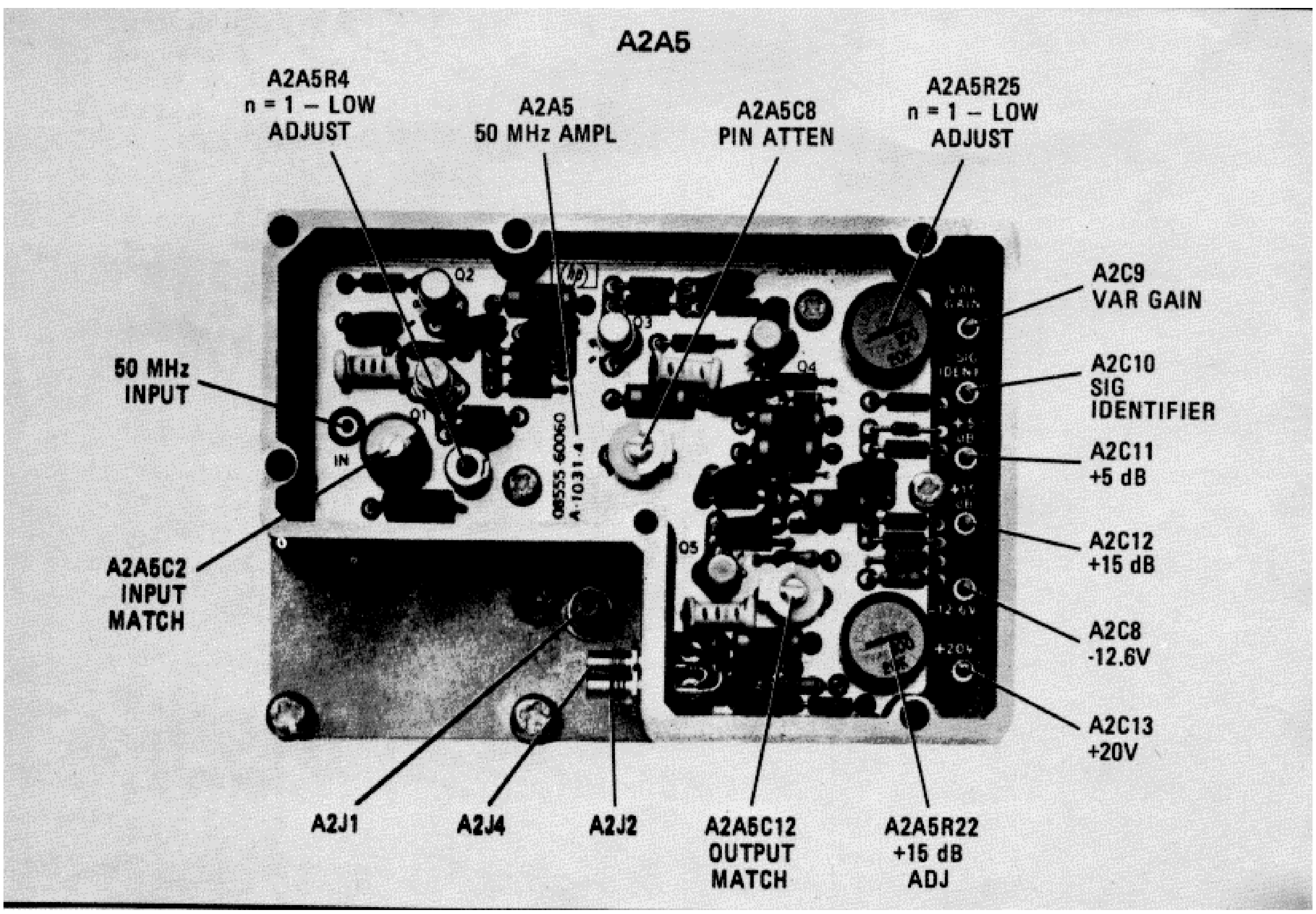


Figure 8-33. MHz Ampl. In Third Converter Casting

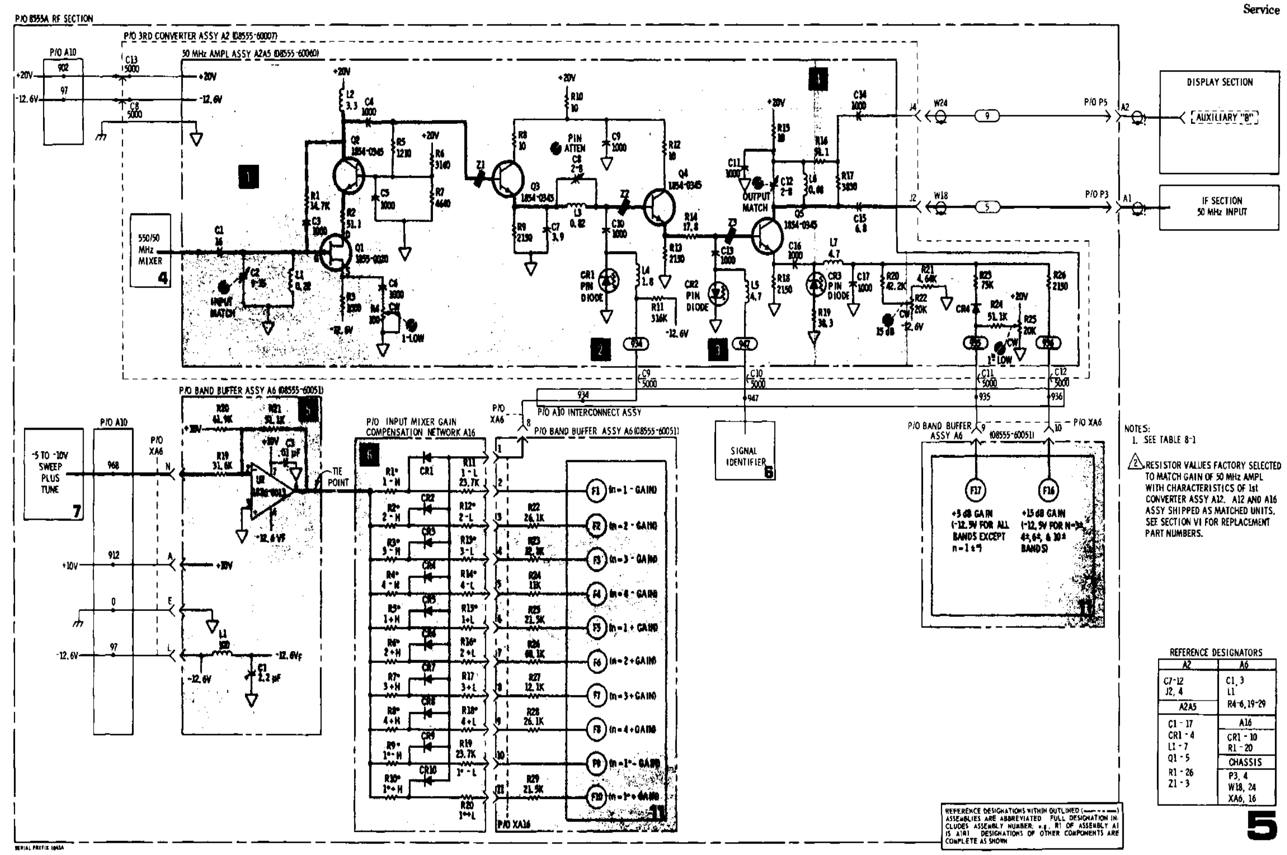


Figure 8-34. 50 MHz Ampl and Input Mixer Gain Comp Network

SERVICE SHEET 6

THEORY OF OPERATION

Service Sheet 6 contains the schematic diagram for the Signal Identifier circuitry. The Signal Identifier provides a method of determining the mixing mode (harmonic number and sign) of the First Converter which is producing a given signal on the CRT display, so that the Frequency Scale can be set to the correct range. The signal identifier circuit is enabled when the SIGNAL IDENTIFIER switch is ON and the SCAN WIDTH PER DIVISION is 1 MHz or less.

The HP 8555A is a harmonic mixing analyzer, with the mixing equation for the first conversion being:

Fsig = nFLO + IF   where Fsig = signal frequency
n = harmonic number
FLO = LO fundamental frequency
IF = frequency of first IF

The first LO frequency, FLO, has a range of 2.05 to 4.10 GHz. The harmonic number, sign, and the first IF frequency are indicated on the Frequency Scale. The mixing modes are as follows: n=1+ for the 550 MHz IF and n=l-, 1±, 2-, 2+, 3-, 3+, 4-, 4+, 6-, 6+, 10-, and 10+ for the 2.05 GHz IF. Note: there is no Frequency Scale provided for the n=5±, 7±, 8± or 9± mixing modes.

When an unknown signal is observed on the CRT, its frequency cannot be determined until the mixing mode is known. The mode indicated on the Frequency Scale is not necessarily the mode resulting in the displayed signal. Likewise, the frequency indicated on the dial is not correct unless the mixing mode is correct.

With the Signal Identifier enabled, the displayed signal will be shifted in frequency on alternate scans. The shifted signal is reduced in amplitude by about 5 dB to distinguish it from the unshifted signal. When the Frequency Scale is set to the correct mixing mode for that particular signal, the shifted signal will be two divisions to the left of the unshifted signal.

The Signal Identifier circuit shifts the Third LO, on alternate scans, by an amount equal to twice the setting of the SCAN WIDTH PER DIVISION switch. The direction of shift is determined by the sign of the band range selected. The amount and direction the displayed signal shifts on the CRT will depend on the mixing mode for that signal and the position of the BAND switch. The Signal Identifier functions by checking for the correct observed scan width and the correct direction of shift. With a n=l BAND selected, the SCAN WIDTH PER DIVISION indicates the scan width per division observed on the CRT display for a n=l mode signal. However, a n=2 mode signal will have an observed scan width of twice what the SCAN WIDTH PER DIVISION switch indicates as the sweep of the 2nd harmonic is twice that of the fundamental. When the n=2 BAND is selected the observed scan width for a n=2 mode signal will be correct. The Band Switch controls the 1/n attenuator circuit (SS9) which divides the sweep voltage going to the YIG driver assembly by the n number on the Frequency Scale. If the shifted signal is displayed by something other than two divisions, the Frequency Scale is set to the wrong harmonic number for that signal. If the shifted signal is displaced by two divisions, but in the wrong direction, the harmonic number is correct, but the sign is wrong.

1 PULSE GENERATOR

Transistors A7Q5 and Q6 function as a pulse generator (see timing diagram below). When the -5 to +5 volt sweep input goes more positive than 0.6 volt Q6 is turned "on" causing Q5 to turn "off". During retrace, when sweep input goes less positive than 0.6 volt, Q6 is turned "off" causing.Q5 to turn "on" and a negative-going pulse is applied at the junction of CR1 and CR2. As a result, during each retrace, a negative-going pulse is applied to trigger the bistable switch.

2 BISTABLE SWITCH

Transistors Q4 and Q7 with their associated components,function as a complementary-symmetry bistable switch. Both transistors are either "on" or both are "off". When the output of one is high, the output of the other is low. The circuit is enabled when the SIGNAL IDENTIFIER switch A1S1 is in the ON position and the SCAN WIDTH PER DIVISION switch A1A2S1 is in the 1 MHz or below positions. The circuit is disabled, by +10 volts being applied to the base of Q4, when the SIGNAL IDENTIFIER switch is in the OFF position or when the SCAN WIDTH PER DIVISION switch is set to 2 MHz or above. When the bistable switch is enabled, the output of the pulse generator alternately triggers the switch. The switch output at the collector of Q7 is applied to the base of Q9. The switch output at the collector of Q4 is applied to the base of Q8 and to the 50 MHz Amplifier (Service Sheet 5). The output to the 50 MHz amplifier attenuates the amplifier gain by approximately 5 dB. As a result the shifted signal on the CRT display is reduced in amplitude.

3 POLARITY SWITCH

Transistors Q8 and Q9 form a polarity switch controlled by the "E" bit band code from the BAND switch A1A4S1. The output polarity switch selects either a 0 to +10 volt or a 0 to -10 volt output on alternate scans. On the n- modes, Q8 is biased "off" from the -100 volt source and Q9 turned "on" on alternate scans by the output from the bistable switch. When one of the n+ modes are selected, the +20 volt "E" bit biases Q9 "off" and allows Q8 to be turned "on" on alternate scans by the bistable switch. The output from the polarity switch is applied through a precision attenuator, on the SCAN WIDTH PER DIVISION switch A1A2S1, to the Third Converter Assy A2.

4 ATTENUATOR

Resistors R1 through R9, mounted on the SCAN WIDTH PER DIVISION switch, form an attenuator. The resistors attenuate the output voltage from the polarity switch to maintain the 3rd LO shift at twice the setting of the SCAN WIDTH PER DIVISION switch as it is reduced from 1 MHz to 2 kHz. Typical voltage levels are given below. These voltages will change to 0 volts on alternate scans.

TROUBLESHOOTING PROCEDURE

Troubleshoot the Signal Identifier, Attenuator Driver and attenuator circuit using the voltage tables and timing diagram.

EQUIPMENT REQUIRED

Oscilloscope .... HP 180A/1801A/1821A
Digital Voltmeter .... HP 3440A/3443A
Service Kit .... HP 08555-60077

SCAN WIDTH PER DIVISION	n- Modes	n+ Modes
1 MHz	+9.93V	-9.93V
0.5 MHz	+5.17V	-5.17V
0.2 MHz	+2.03V	-2.03V
100 kHz	+1.0V	-1.00V
50 kHz	+486mV	-486mV
20 kHz	+193mV	-193mV
10 kHz	+ 97mV	- 97mV
5 kHz	+ 49mV	- 49mV
2 kHz	+ 19.6mV	- 19.6mV

A2A5, A6, A16
50 MHz Ampl and Input Mixer Gain Comp Network

SERVICE SHEET 5

SERVICE SHEET 6 (cont'd)

A7 Signal Identifier Voltage Measurements

Conditions: SIGNAL IDENTIFIER OFF, SCAN WIDTH ZERO, n=l- BAND, typical voltage levels.

Test Point	Voltage
TP1	+10.0Vdc
TP5	0.76Vdc
TP6	0Vdc
TP7	0Vdc
A7Q4b	+10.0 Vdc
A7Q4c	-0.76Vdc
A7Q5c0	Vdc
A7Q6c	+0.60 Vdc
A7Q7b	-0.35 Vdc
A7Q7c	+10.0 Vdc
A7Q8b	-10.48 Vdc
A7Q9b	+ 9.8 Vdc
A7Q8b*	-10.42 Vdc
A7Q9b*	+10.5 Vdc

*n=l + BAND

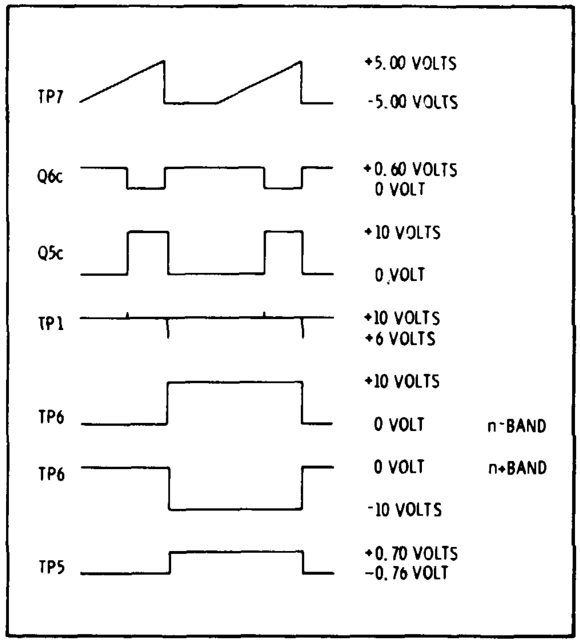


Figure 8-35. Signal Identifier Timing Diagram

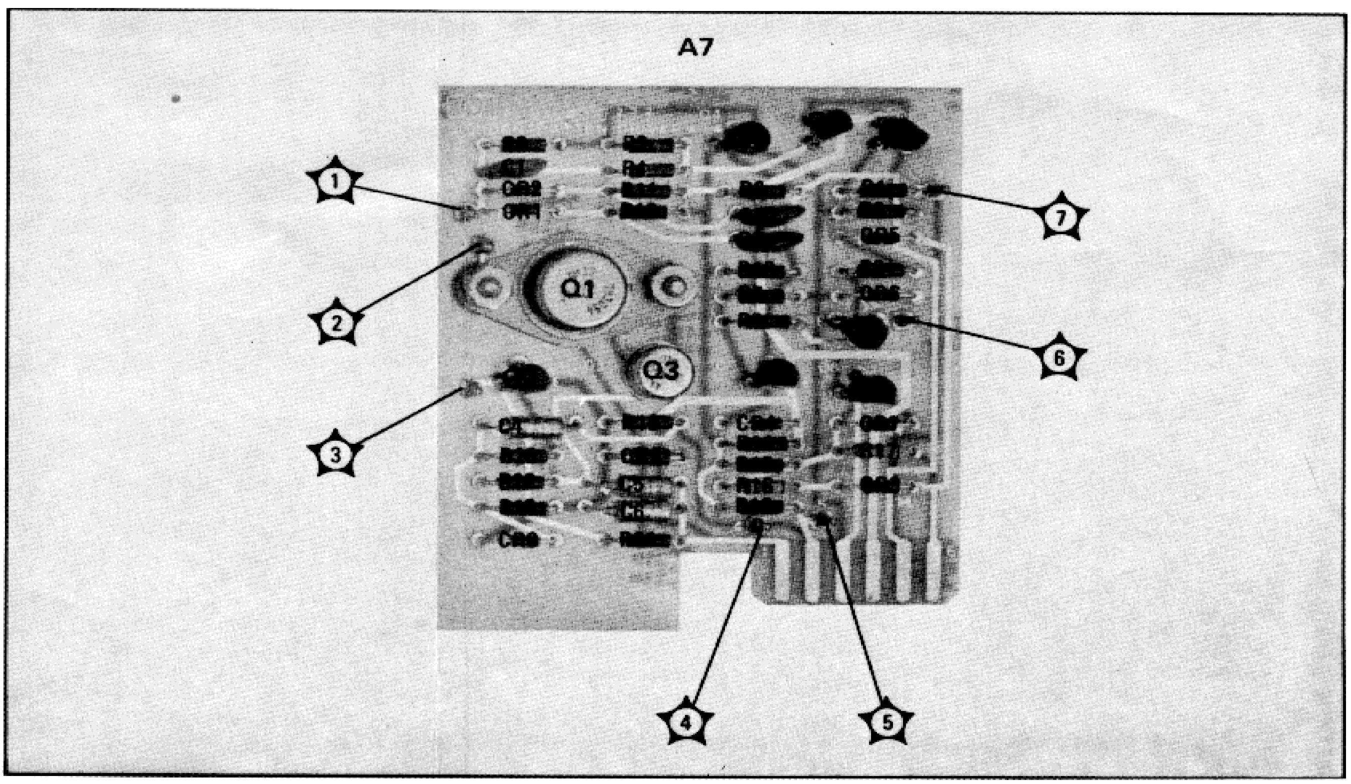


Figure 8-36. Signal Identifier and Attenuator Driver Assembly A7

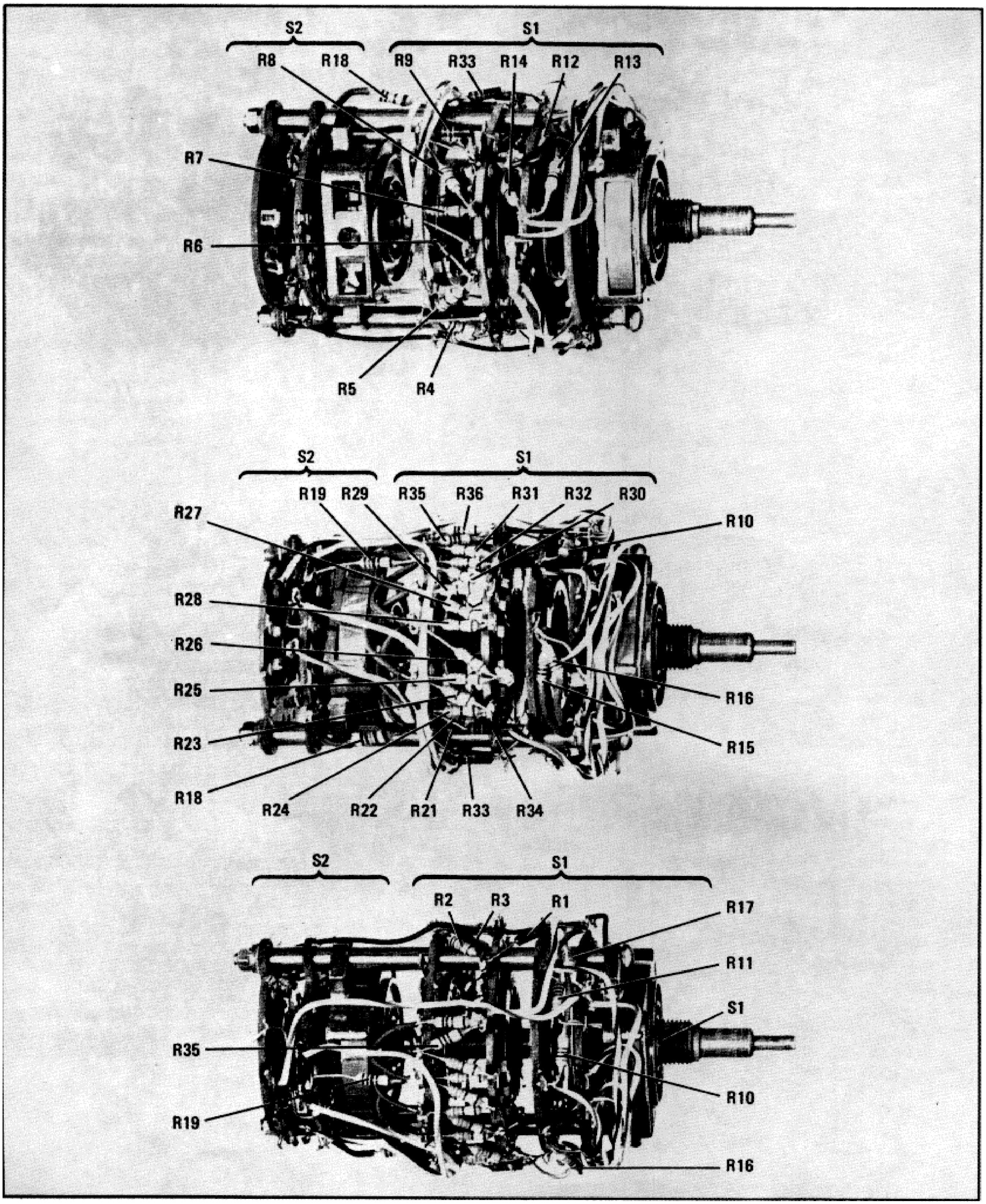


Figure 8-37. Scan Switch Assembly A1A2

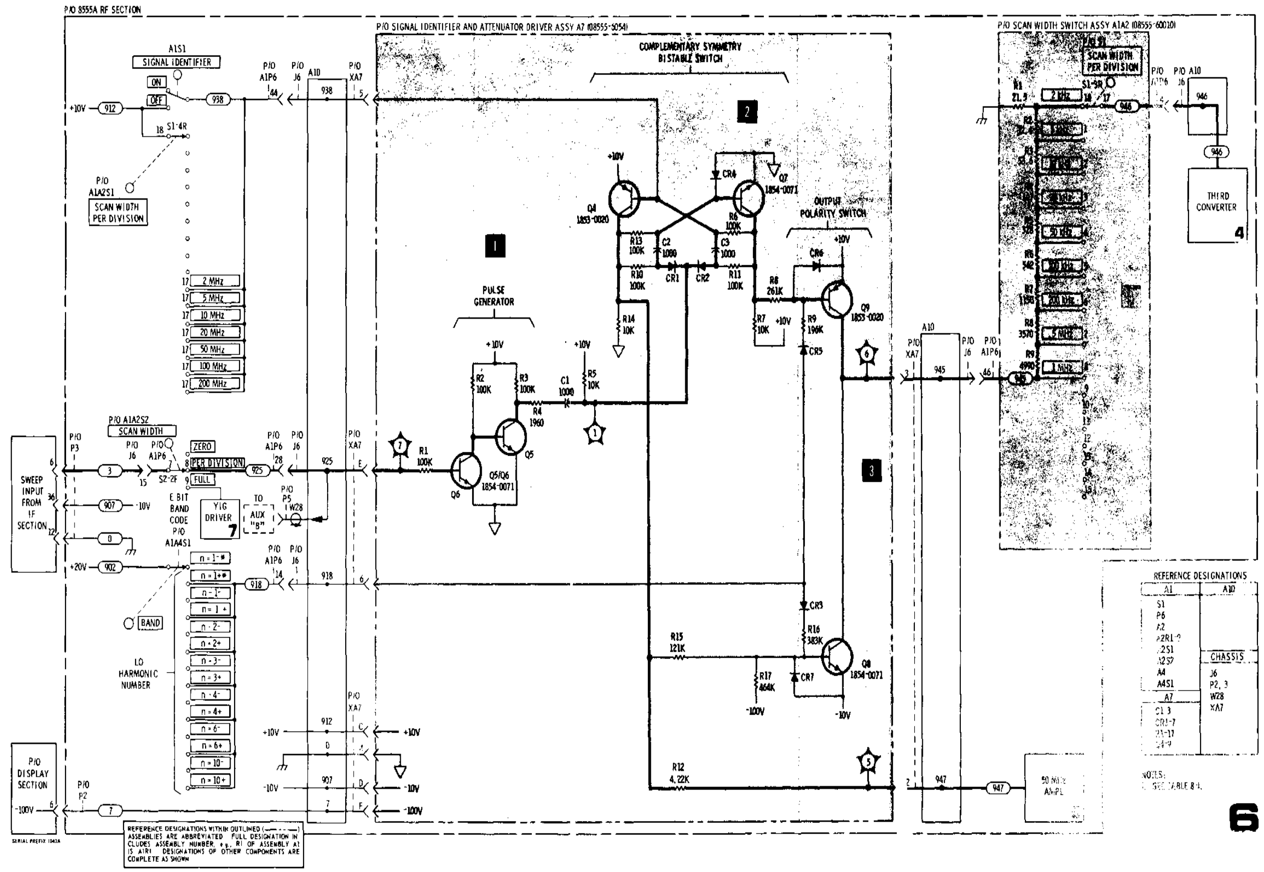


Figure 8-38. Signal Identifier

SERVICE SHEET 7

THEORY OF OPERATION

Service Sheet 7 contains the schematic diagram for the YIG Driver Assembly A4 and the associated sections of the Scan Switch A1A2S2. The YIG oscillator, which is the 1st LO, is tuned over the frequency range of 2.05 to 4.10 GHz by the YIG driver assembly. Tuning is accomplished by the drive controlling the current in the main coil of the YIG oscillator.

For ZERO SCAN WIDTH and SCAN WIDTH PER DIVISION of less than 1 MHz, only the voltage from the FREQUENCY control determines the current in the main coil. For these narrow scan widths, sweep is added to the FINE TUNE voltage to control the current in the tickler coil of the YIG oscillator (see Service Sheet 9). For SCAN WIDTH PER DIVISION of 1 MHz and above, sweep is added to the FREQUENCY control voltage to control the current in the YIG oscillator main coil.

In the FULL SCAN WIDTH mode, an offset sweep voltage controls the current to sweep the YIG oscillator from 2.05 to 4.05 GHz. Also, in the FULL SCAN WIDTH mode, a frequency marker signal is generated and supplied to the IF Section. This signal results in an inverted vee marker appearing on the CRT display at the frequency to which the FREQUENCY control is set.

A precise voltage, in the range of -5.00 to -10.00 volts, that is representative of the YIG oscillator frequency is supplied to the 50 MHz Gain Control circuitry (Service Sheet 5) and is also provided for use by external equipment (Service Sheet 16).

1 -31 VOLT POWER SUPPLY

Breakdown diode A4CR4 provides the reference voltage for the supply, with current obtained from the -100V supply through resistor R34. The reference voltage is filtered at the base of Q2 by R36 and C3. Transistors Q2 and Q3 are connected in a bootstrap pair configuration with Q2 providing the control and Q3 carrying most of the current load. The transistor pair functions like a single high current, high voltage PNP transistor with high beta. The emitter voltage of Q2, and the supply output, will be 0.6 volt more positive than the voltage at the base of Q2.

Current limiting is provided by CR5 and R42, and will occur for a current which produces about a 2.9 volt drop across R42. Any further increase in current and voltage drop across R42 would reduce the base-emitter bias of Q3; as the base is prevented from going any more positive by CR5. This reduces the conduction of Q3 which will prevent the current from increasing. Breakdown diode CR8 provides over-voltage protection for the circuits powered from the -31 volt supply. CR8 is normally turned off, but a failure in the supply causing a high voltage will cause the diode to conduct and prevent the output voltage from rising above approximately -34.8 volts. In limiting the voltage, excessive current will probably destroy the diode (short) and the -100 volt fuse in the Display Section.

2 TUNE CONTROL POWER SUPPLY

Operational Amplifier A4U6 is connected as a negative feedback regulating power supply. The supply provides two voltage levels, approximately -7.1 and -15.2 volts, to the FREQUENCY control potentiometer. These levels give the control a tuning range of -7.5 to -15 volts. In the power supply circuit, CR1 driven by the output voltage, sets the reference level at the non-inverting input of U6. Negative feedback, from the divider stick R1, R2 and R3, is applied to the inverting input of U6. The power supply output voltage at TP 7 is controlled by R2. (Note: the -5 volt adj and -10 volt adj associated with R2 and R5 refer to voltage levels measured at TP 2, *not* at TP7.) R5 sets the voltage level at the opposite end of the potentiometer from the -15.2 volt supply end. R7 reduces the interaction of the -5 volt adjustment (R5) on the -10 volt adjustment (R2). In some instruments a factory-selected resistor is added across one side of the FREQUENCY potentiometer AlA4R1. This resistor (A1A4R4) is selected to improve the linearity of the FREQUENCY potentiometer. (See YIG Driver Adjustment Procedure in Section V.)

3 SWEEP PLUS TUNE AMPLIFIERS AND CONTROL

Operational amplifier U7 provides unity gain buffering of the tune voltage from the wiper arm of the FREQUENCY control. Filtering of this tune voltage is provided by C1 and R10. The output of the tune buffer U7 is reduced by one-third by R20 and R21 and applied to the unity gain Sweep Plus Tune Amplifier U4. In both FULL and ZERO scan modes, and for PER DIVISION scans of less than 1 MHz, only tuning voltage is applied to U4. In the PER DIVISION and FULL scan modes, Sweep Buffer U5 inverts the input scan ramp and provides a gain of 1.463. In the PER DIVISION mode, the output from U5 is reduced by two-thirds and combined with the tuning voltage in summing resistors R20 and R21 and applied to U4. In the PER DIVISION and ZERO scan modes the output from the Sweep Plus Tune Amplifier U4 is applied to the YIG Driver Amplifier U1. In PER DIVISION scan of less than 1 MHz PER DIVISION and in ZERO scan mode there is no input to Sweep Buffer U5. (See Service Sheet 12.) (The sweep ramp for narrow scan widths is combined with the FINE TUNE voltage and applied to the YIG oscillator tickler coil, Service Sheet 9.) To maintain SCAN WIDTH PER DIVISION calibration on harmonic mixing modes, the sweep ramp from the IF Section is attenuated by the 1/n attenuator before going to the scan attenuator. (See Service Sheet 8.) In FULL scan mode, the output of the Sweep Buffer U5 is reduced by two-thirds and offset by R24, R25 and R26 and applied to the unity gain full scan sweep offset amplifier U3. The output of amplifier U3 is a negative going ramp of -5.000 to -9.878 volts. This ramp is applied to the YIG driver U1.

4 YIG DRIVER

The YIG driver consists of operational amplifier U1, transistors Q1, Q4 and their associated components. The input voltage to the YIG driver is a precise voltage with a level dependent on the mode of operation. In ZERO scan mode the level is between -5.000 and -10.000 volts with the level determined by the position of the FREQUENCY control (for a YIG oscillator frequency of 2.05 to 4.10 GHz). In the PER DIVISION scan mode (SCAN WIDTH PER DIVISION of 1 MHz and above) the sweep ramp from the Scan Attenuator, which has a maximum peak-to-peak level of 4.85 volts, is summed with the FREQUENCY control voltage level which has a level of -5.000 to -10.000 volts. In FULL scan mode only the -5.000 to -9.878 volt sweep ramp is applied to the YIG driver. The Sweep-Plus-Tune voltage is also applied to the Marker Generator, the 50 MHz Gain Control circuitry, and to a connector on the rear panel of the Display Section for use by external equipment. Adjustments in the YIG driver circuit correct for variations in current sensitivity of the YIG coil from unit to unit. Transistors Q1 and Q4 are connected in a darlington configuration and provide the current to drive the YIG coil. Current in the YIG coil is sensed at resistor R39 and applied as a negative feedback voltage to U1. The 4.1 GHz adjustment R28 is set to provide a YIG frequency of 4.1 GHz with -10.000 volts at TP2 and the 2.05 GHz adjustment R29 is set to provide a YIG frequency of 2.05 GHz with -5.000 volts at TP2. The circuit is arranged such that the 2.05 GHz adjustment will have little effect on the 4.10 GHz adjustment. (Refer to YIG Driver Adjustment Procedure in Section V.) C2 is a noise filter, switched in for SCAN WIDTH PER DIVISION of less than 1 MHz, when the main YIG coil is not being swept. Diodes CR2 and CR3 provide fly-back voltage limiting for transistors Q1 and Q2.

5 MARKER GENERATOR

In FULL scan mode, the marker generator is enabled and an inverted vee marker appears on the CRT at a position corresponding to the frequency to which the FREQUENCY control is set. The marker generator circuit compares the tune voltage from the FREQUENCY control with the FULL scan ramp. When the two voltages are equal, a negative-going marker signal is generated and applied to the deflection amplifier in the IF Section. A4U2 is an integrated circuit transistor array with five transistors, U2A through U2E. U2A and U2B are connected as diodes. U2D and U2E function as a comparator circuit with R15 providing a constant current source. When the input voltages to the bases of transistors U2D and U2E are not equal one transistor will be "on" while the other will be "off". The voltage at the collector of the "off" transistor will bias U2C "on" through either U2A or U2B. When the input voltages are equal, both transistors conduct, no current will flow through U2A or U2B resulting in U2C biased "off." This causes a negative pulse to be generated at TP 4.

6 47 MHz LO CONTROL

Resistors A4R18 and R19 form a resistive voltage divider for the 47 MHz LO in the IF Section. This voltage sets the 47 MHz LO to a fixed frequency. (See IF Section Operating and Service Manual.)

TROUBLESHOOTING PROCEDURE

When troubleshooting the YIG Driver Assembly A4, use the analyzer's operating controls and display to assist in isolating the malfunction to a functional circuit. If there is no output from the YIG oscillator, check the voltage at A4TP3 for a level of -31±1.5 volts. If there is an output from the YIG oscillator, compare the display produced in FULL scan with the display produced in 200 MHz PER DIVISION scan. There should be no difference in the CRT display other than the frequency marker in the FULL scan mode. See Paragraph 8-41 for operational amplifier troubleshooting procedures.

EQUIPMENT REQUIRED

Digital Voltmeter .... HP 3440A/3443A
Oscilloscope .... HP 180A/1801A/1821A
Frequency Comb Generator .... HP 8406A
Service Kit 08555-60077

Install the YIG Driver Assembly A4 on an extender board and check the -31 volt supply at test point A4TP3. If the output is correct, perform the YIG Driver Test Point Voltage Measurements listed below. Use Transistor Voltage Measurements to check Q1--4and the transistors in U2. When the malfunction has been isolated and corrected, perform YIG Driver Adjustments (see Section V).

A1A1, A7
Signal Identifier

SERVICE SHEET 7 (cont'd)

A4 YIG Driver Transistor Voltage Measurements:
Conditions: n=l- Band, SCAN WIDTH ZERO, FREQUENCY
1 GHz; unit of measurement, Vdc.

	Emitter	Base	Collector
A4Q1	-11.0	-11.6	-28.0
A4Q2	-31.0	-31.6	-67.0
A4Q3	-98.2	-97.8	-31.0
A4Q4	-10.5	-11.0	-28.0
A4U2A	-0.40	-0.55	-0.55
A4U2B	-0.40	-0.55	-0.55
A4U2C	-0.92	-0.40	+1.82
A4U2D	-8.1	-7.5	-0.55
A4U2E	-8.1	-7.5	-0.55

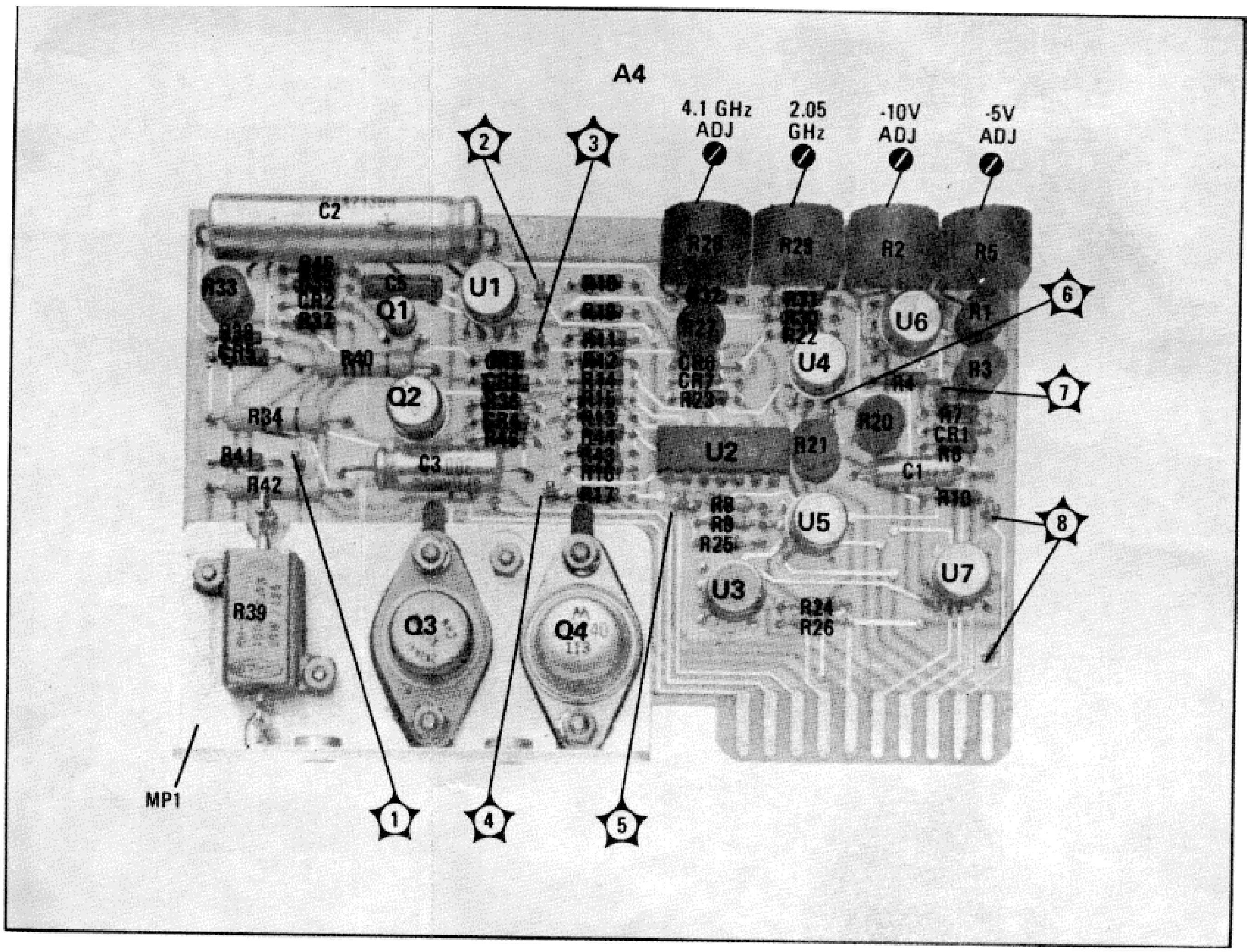


Figure 8-39. YIG Driver Assembly A4

A4 Yig Driver Test Point Voltage Measurements:
Conditions: n=l- Band, SCAN WIDTH and FREQUENCY as specified; unit of measurement, Vdc unless otherwise specified.

Test Point	Voltage	Remarks
A4TP	-7.0 Vdc	0 GHz, ZERO SCAN WIDTH
	-10.5 Vdc	1 GHz, ZERO SCAN WIDTH
	-14.0 Vdc	2 GHz, ZERO SCAN WIDTH
	7V inverted ramp centered on -10.5 Vdc	FULL SCAN or 200 MHz PER DIVISION with FREQUENCY control at 1 GHz.
A4TP2	-5.00 Vdc	0 GHz, ZERO SCAN WIDTH
	-7.44 Vdc	1 GHz, ZERO SCAN WIDTH
	-9.88 Vdc	2 GHz, ZERO SCAN WIDTH
	7.85V inverted ramp centered on -7.44 Vdc	FULL SCAN or 200 MHz PER DIVISION with FREQUENCY control at 1 GHz.
A4TP3	-31.0 Vdc	+1.5V
A4TP40		ZERO or PER DIVISION

Test Point	Voltage	Remarks
A4TP4	-0.2 Vdc w/ -2V pulses	FULL SCAN WIDTH
A4TP5	Ramp -5.0 to +5.0 Vdc	PER DIVISION or FULL SCAN
	0	ZERO SCAN WIDTH
A4TP6	-5.00 Vdc	0 GHz, ZERO SCAN WIDTH
	-7.44 Vdc	1 GHz, ZERO SCAN WIDTH
	-9.44 Vdc	2 GHz, ZERO SCAN WIDTH
	4.85V Vdc inverted ramp centered on -7.44 Vdc	200 MHz PER DIVISION SCAN, FREQUENCY 1 GHz
	0V	FULL SCAN WIDTH
A4TP7	-15.2 Vdc	
A4TP8	-7.50 Vdc	0 GHz, ZERO SCAN WIDTH
	-11.16 Vdc	1 GHz, ZERO SCAN WIDTH
	-14.83 Vdc	2 GHz, ZERO SCAN WIDTH

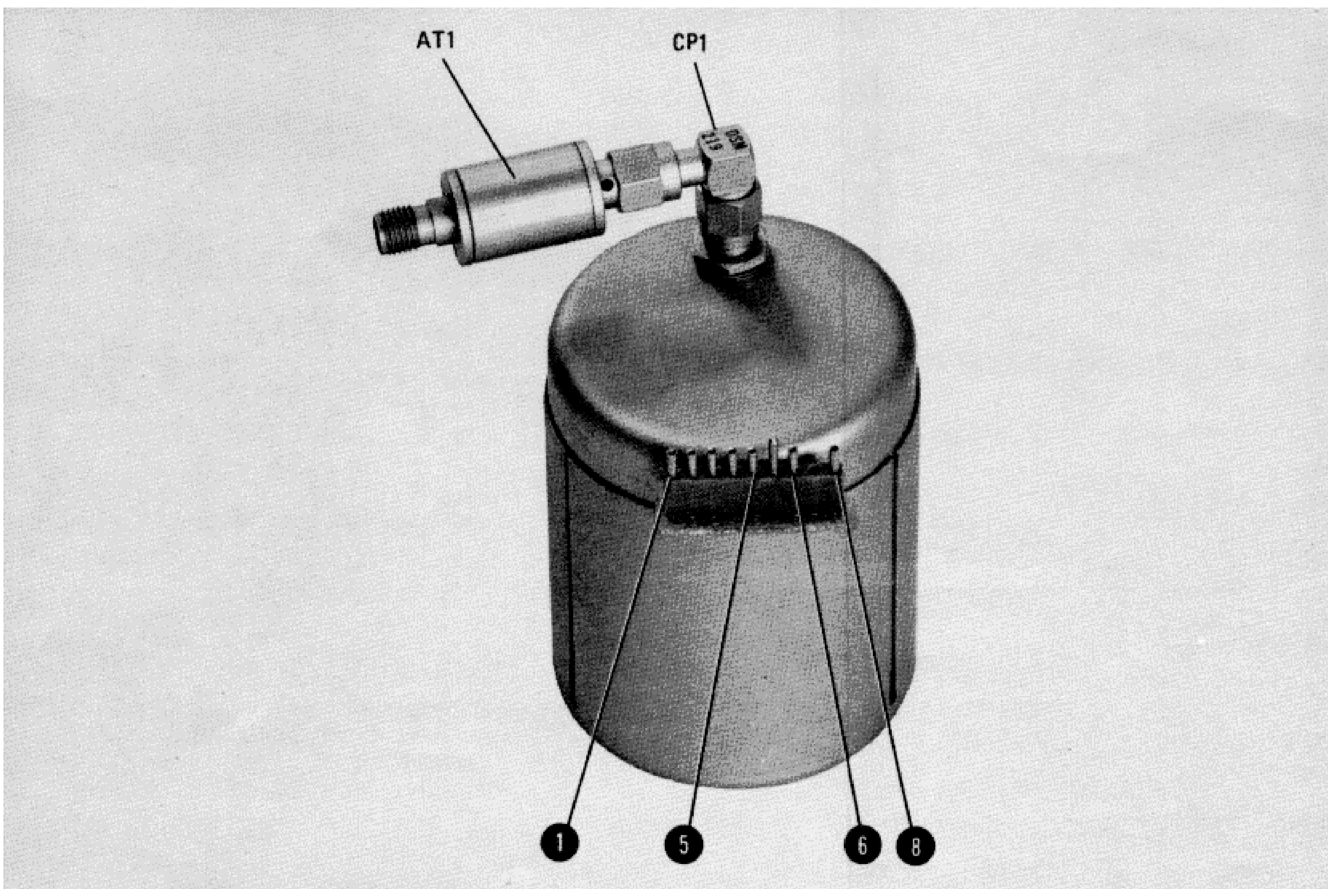


Figure 8-40. YIG Oscillator Assembly A3

Service

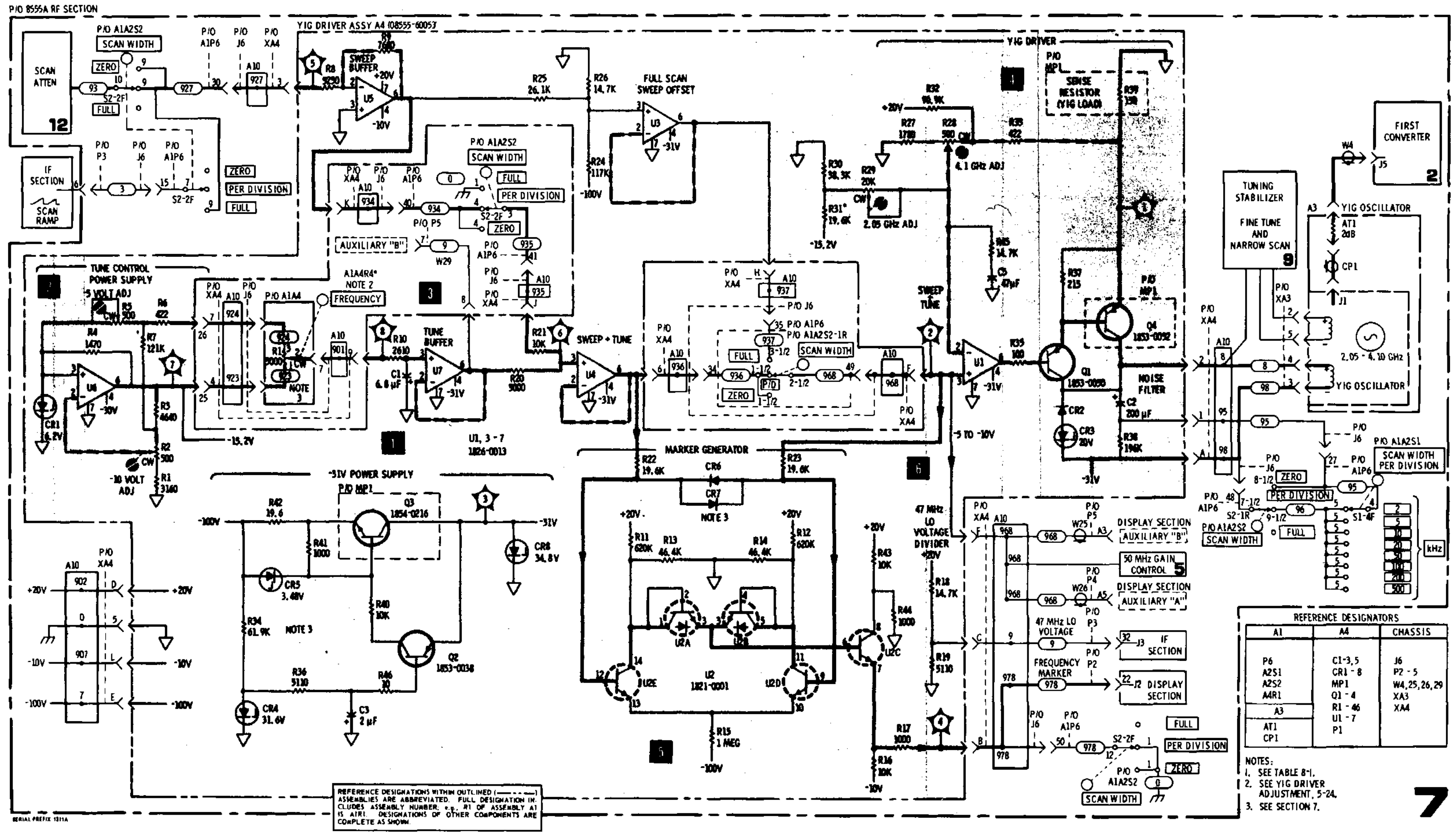


Figure 8-41. YIG Driver and Oscillator

SERVICE SHEET 8

THEORY OF OPERATION

Service Sheet 8 contains the schematic diagram for the tuning stabilizer control generator and for the 1/n sweep attenuator. The control generator provides the time sequence and switching for the tuning stabilizer circuitry. (See Service Sheet 9.) The 1/n attenuator reduces the sweep signal from the IF Section, to maintain scan width calibration on harmonic mixing modes.

1 SWITCH CONTROL

Tuning stabilization is initiated by three series-connected switches supplying +20 volts to the tuning stabilizer control generator. These switches are TUNING STABILIZER switch A1S2, SCAN WIDTH PER DIVISION switch A1A2S1 and SCAN WIDTH switch AlA2S2. The SCAN WIDTH PER DIVISION switch must be in one of the blue color-coded positions (100 kHz or below) and the SCAN WIDTH switch in ZERO or PER DIVISION before the +20 volts can be routed from the TUNING STABILIZER switch to initiate tuning stabilization. This +20 volt source is routed to the VCXO (voltage-controlled crystal oscillator) pulse amplifier (Service Sheet 10) and to the Auxiliary "A" connector P4 pin A6 on the rear panel of the Display Section.

2 CONTROL GENERATOR

The tuning stabilizer circuitry shown on Service Sheet 8 functions as a control generator to provide timing and switching control to FET 1 and FET 2 switches and memory storage relay (Service Sheet 9). In addition, a sweep kill signal is provided to the 1/n attenuator circuit (Service Sheet 8). When the +20 volts is applied to the control generator a series of timing pulses are generated to trigger events necessary to accomplish stabilization lock. These pulses are over in 300 mS. The +20 volts charges A5C8 through A5R18 turning "on" A5Q9 20 msec after the three switches are closed. A5Q9 turns "on" A5Q4 which then charges A5C4 through A5R14, turning "on" A5Q8 200 msec later. This action continues through A5Q7, A5Q6 terminating in A5Q5. The chart below is a timing diagram for control generator. The steps generated at A5Q1 through A5Q5 produce the four functions at the bottom of the chart.

At time T_o +20 volts is applied to the VCXO pulse amplifier and to the control generator. The +20 volts to the control generator triggers the sweep kill driver A5Q13 and Q14 applying a sweep kill signal (+10 volts) to A6Q5. The sweep kill signal removes the sweep from the YIG oscillator during stabilization cycle.

At time T_1, A5Q4 is turned "on" supplying a start signal for delay 2 and a turn "off" signal to FET 1 switch driver A5Qll. A5Qll is turned "off" supplying a negative turn "off" signal to FET 1 switch.

Time T_2 references the end of delay 2 when A5Q8 is turned "on" which in turn triggers A5Q3 "on" to start delay 3 and trigger relay driver A5Q12. A5Q12 is turned "off" removing the ground return for relay A5K1.

Time T_3 references the end of delay 3 when A5Q7 and Q2 are turned "on". When A5Q2 turns "on", FET 1 switch driver is triggered and delay 4 starts. A5Q10 is turned "off" turning A5Qll "on" and applying a turn "on" signal to FET 1 switch.

Time T_4 references the end of delay 4 when A5Q6 is turned "on". When A5Q6 is turned "on" FET 1 switch driver is triggered to turn FET 1 switch "off" and FET 2 switch driver A5Q1 is triggered "on". When a5Ql turns "on", FET 2 switch is turned "on" and delay 5 starts.

SERVICE SHEET 8 (cont'd)

Time T_5 references the end of delay 5 when A5Q5 is turned "on". When A5Q5 is turned "on" the sweep kill driver, A5Q13 and Q14 is triggered to remove the sweep kill signal to A6Q5. The control generator timing ends with the removal of the sweep kill signal.

3 1/n ATTENUATOR

The 1/n attenuator circuit attenuates the sweep input from the IF Section to maintain per division sweep calibration on harmonic mixing modes. The attenuator reduces the sweep voltage by the factor of 1/n. For example, on the n=2 bands, the -5 to +5 input sweep voltage is reduced to a -2.5 to +2.5 sweep output voltage. Resistive voltage dividers A6R5, R8, R12 and R16 are selectively shunted to ground by transistor switches A6Q1 through A6Q4. The transistor switches are controlled by the +20 volt band code from the frequency band shaft encoder (see Service Sheet 11).

On the n=1 bands, all switches are off. Band code bit "D" is applied on the n=l 550 MHz IF bands, but has no effect since A6Q4 requires both band code bits "C" and "D" before switching action occurs.

On the n=2 bands, A6Q1 is switched "on".

On the n=3 bands A6Q2 is switched "on." On the n=4 bands both A6Q1 and Q2 are switched "on."

On the n=6 bands A6Q3 is switched "on".

On the n=10 bands both A6Q3 and Q4 are switched "on".

4 SWEEP KILL

When tuning stabilization is initiated a +10-volt signal from the control generator is applied to the sweep kill switch A6Q5. This switch prevents the sweep from driving the YIG oscillator while the tuning stabilizer is accomplishing the steps necessary for stabilization. Sweep is grounded from time T_0 to time T_5 (see timing diagram chart). The output of the 1/n attenuator is applied through operational amplifier A6U1 to the scan attenuator (see Service Sheet 12).

TROUBLESHOOTING PROCEDURE

1 2 CONTROL GENERATOR AND SWITCHING

When a malfunction has been isolated to or to isolate a malfunction in the control generator, perform the following procedure. Remove power from the analyzer and install the Tuning Stabilizer Control Assy A5 on an extender board.

EQUIPMENT REQUIRED

Digital Voltmeter .... HP 3440A/3444A
Extender Board .... HP 5060-0258
Extender Board .... HP 5060-0256
Oscilloscope .... HP 180A/1801A/1821A

Connect digital voltmeter or oscilloscope to XA5-pin 2 on the extender board. Apply power and check switching action of A1S2, AlA2S1 and A1A2S2. When all three switches are closed, the voltage level at pin 2 should shift from approximately -8 to +20 volts. Rotate the SCAN WIDTH PER DIVISION switch through the 100 to 2 kHz positions. The +20 volt level should remain steady. The contacts on switch wafer AlA2S1-4R do not break between these positions.

To check for proper operation of the control generator, the voltage waveforms on Figure 8-41 should be observed with an oscilloscope. Set SCAN WIDTH PER DIVISION to 100 kHz; connect oscilloscope to test points indicated in the figure. Trigger the control generator by switching the TUNING STABILIZER "OFF" and then "ON" when checking each waveform. The voltage chart below provides the final (control generator sequence steps completed)transistor voltages for all transistors with the TUNING STABILIZER switch "ON".

3 1/n ATTENUATOR TROUBLESHOOTING

With the test setup as for step 1 above, install Band Buffer Assy A6 on extender board. Connect oscilloscope to A6TP1. Set SCAN WIDTH to PER DIVISION and SCAN TIME PER DIVISION to 1 MILLISECOND. Set SCAN MODE to INT and SCAN TRIGGER to LINE. Adjust oscilloscope for a convenient display. The display should be a sawtooth signal with a ramp of -5 to +5 volts on the n=l bands. The amplitude should be reduced by 1/n ±2% when the bands are switched. Rotate the BAND switch lever from n=l through n=10 BANDS while noting the attenuation of sweep on each harmonic mixing mode. The transistors should switch "on" in the following sequence:

A6Q1 on n=2 bands, A6Q2 on n=3 bands, A6Q1 and Q2 on n=4 bands, A6Q3 on n=6 bands and A6Q3 and Q4 on n=10 bands.

Check input band code and switching action of any malfunctioning circuit.

4 SWEEP KILL TROUBLESHOOTING

With test setup as in step 3 above, set BAND switch lever to select n=l BAND 2.05 GHz IF and SCAN WIDTH PER DIVISION to 100 kHz. Switch TUNING STABILIZER "ON". The sweep signal should momentarily go to zero and return (sweep is removed by the sweep kill circuitry during stabilization period, approximately 300 milliseconds).

Final Value Control Generator Voltages

Conditions: SCAN WIDTH 100 kHz PER DIVISION
TUNING STABILIZER ON, Unit of Measurement Vdc
Tolerance +0.1V unless otherwise indicated.

Test point	**Emitter**	**Base**	**Collector**
A5Q1	+10 Supply	+9.35	+9.9
A5Q2	+10 Supply	+9.35	+9.9
A5Q3	+10 Supply	+9.35	+9.9
A5Q4	+10 Supply	+9.35	+9.9
A5Q5	Ground	+0.65	+0.1
A5Q6	Ground	+0.65	+0.1
A5Q7	Ground	+0.65	+0.1
A5Q8	Ground	+0.65	+0.1
A5Q9	Ground	+0.65	+0.41
A5Q10	+10 Supply	+9.4	+9.9
A5Qll	+10 Supply	+9.9	-9.9
A5Q12	Ground	-0.3 ± 0.2	-12.6 ±0.3
A5Q13	+10 Supply	+9.35	+9.9
A5Q14	+10 Supply	+9.9	-9.9

A3, A4
YIG Driver and Oscillator

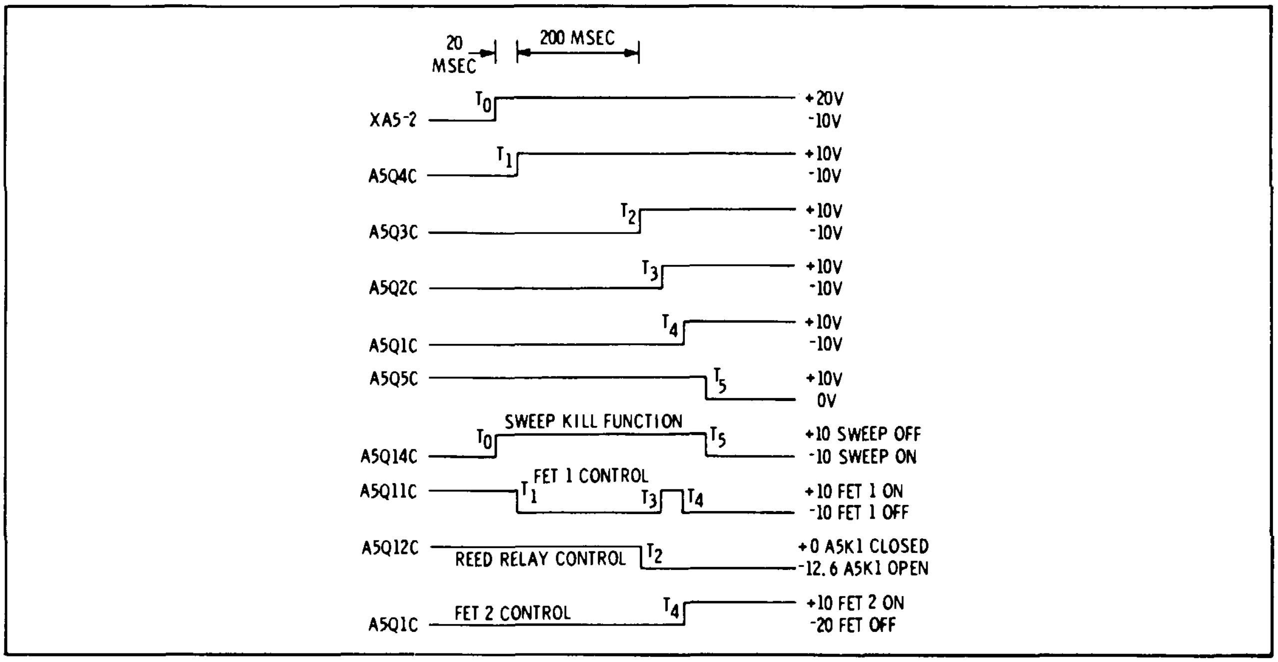


Figure 8-42. Control Generator Timing Diagram

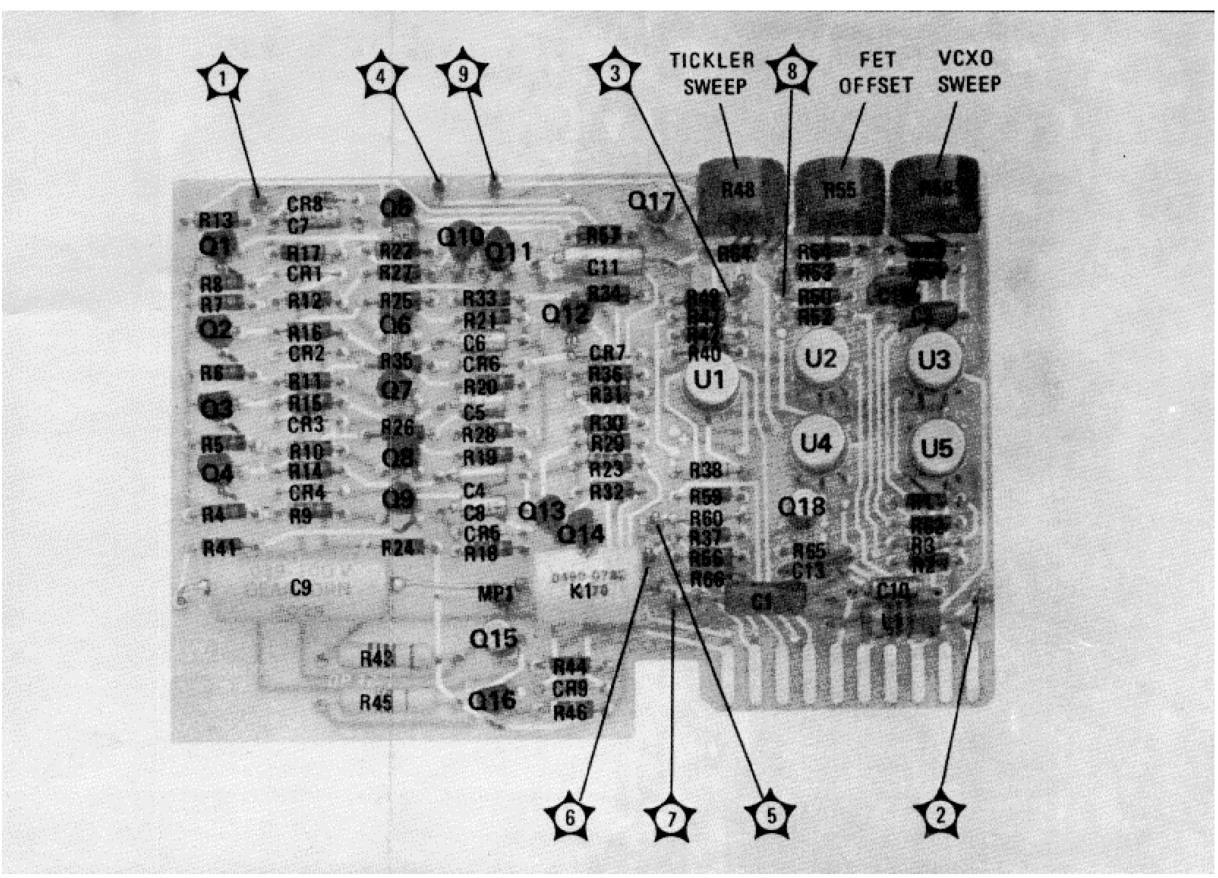


Figure 8-43. Tuning Stabilizer Control Assembly A5

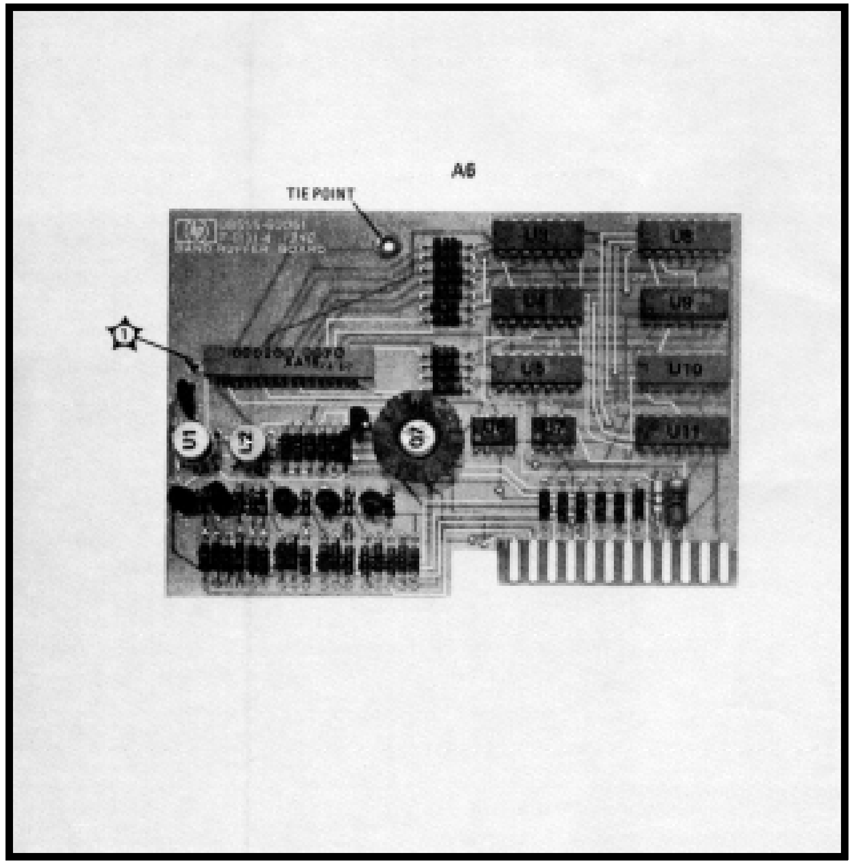


Figure 8-44. Band Buffer Assy A6 with Mixer Gain Network A16

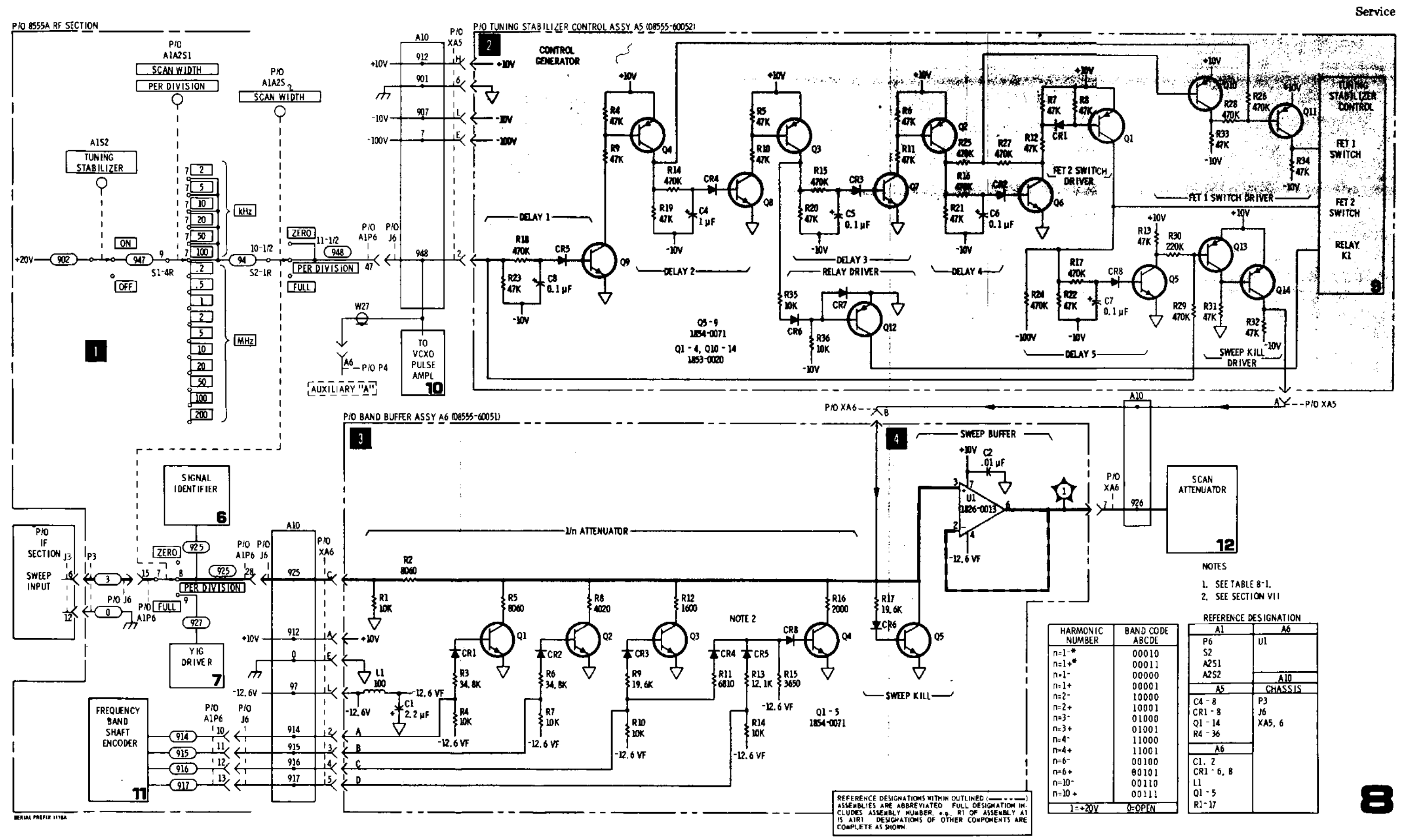


Figure 8-45. Control generator and1/n Attenuator

SERVICE
SHEET 8

SERVICE SHEETS 9 & 10

THEORY OF OPERATION TUNING STABILIZER AFC LOOPS

Service Sheets 9 and 10 contain the schematic diagram for the tuning stabilizer circuits, except for control circuits contained in Service Sheet 8.

The tuning stabilizer system locks the 1st LO (YIG oscillator) to a harmonic of a 1 MHz crystal oscillator to reduce the residual FM of the 1st LO. Stabilized operation is permitted for scan widths of 100 kHz per division or less (1 MHz total scan width).

Figure 8-46 is a simplified diagram of the tuning stabilizer system. The lock loop can be considered as an IF type AFC system. The sampler functions as a mixer with the 1st LO signal as one input and the harmonic of the 1 MHz oscillator as the other input. The 2050 harmonics between 2.05 and 4.1 GHz are mixed with the 1st LO signal in the sampler. The sampler output contains the difference and sum frequencies of the two inputs. The output is filtered by a 500 kHz low pass filter so only the difference between the LO signal and the nearest 1 MHz harmonic need be considered. The 1st LO signal can never be more than 500 kHz away from one of the harmonic pulses so there will always be an output from the filter. The output from the filter is applied to a discriminator which produces an output voltage related to frequency. (See discriminator block in simplified schematic, Figure 8-46.)

The error signal from the discriminator is fed through a compensation amplifier and combined with the sweep plus FINE TUNE signal. This signal is then applied to the YIGoscillator causing the frequency to change to produce a near zero error signal. This means that the YIG oscillator frequency will differ from a 1 MHz harmonic by approximately 240 kHz.

The word approximately is used because this is an AFC with finite loop-gain of 1000. When lock is accomplished, if the YIG oscillator has to move 100 kHz to get to a lock point, the discriminator has to provide an error voltage to do this and the difference frequency will differ from 240 kHz by 100 Hz.

To achieve initial lock, the YIG oscillator is not, actually, moved to a lock point. Instead, a lock point is brought to the YIG oscillator frequency. This is done to avoid a center frequency shift in the display when the tuning stabilizer circuit is actuated. This is

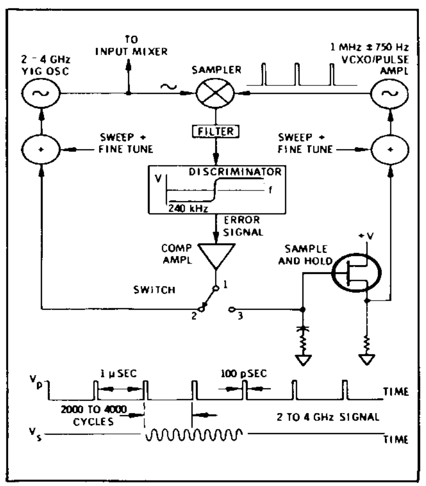


Figure 8-46. Discriminator Block Schematic

SERVICE SHEET 9 & 10 (cont'd)

accomplished by initially reversing the AFC roles of the 1 MHz oscillator and the YIG oscillator.

The error signal is initially fed back to the frequency control circuitry of the 1 MHz voltage controlled crystal oscillator (VCXO). The frequency of the VCXO is shifted to bring a lock point to the YIG oscillator (see Figure 8-46). In this connection, the YIG, rather than the VCXO, is functioning as the reference. After a fixed time, the error signal is switched from the VCXO to the YIG oscillator; locking the YIG oscillator to the stable VCXO. The error signal which moved a lock point to the YIG oscillator frequency is stored on a sample and hold circuit (A5C9).

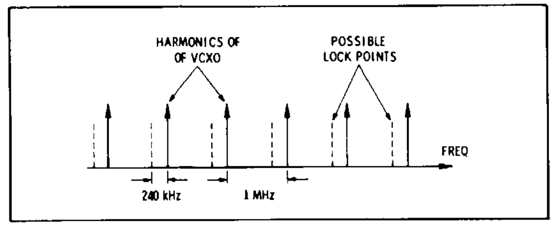


Figure 8-47. VCXO Harmonics and Lock Points

1 THEORY OF OPERATION, TUNING STABILIZER CONTROL

The tuning stabilizer control generator (Service Sheet 8) provides the properly timed commands to accomplish the tuning stabilizer switching.

At time T_0 the stabilization process begins with closure of all three of the necessary switches. (See Service Sheet 8.) At this instant, sweep is shut off and the 1 MHz pulse amplifier (Service Sheet 10) is turned on.

At time T_1, FET1 (A5Q18), (Service Sheet 9) which has been "on" shorting the error signal to ground, is turned "off". The error signal is allowed to pass through the closed contacts of A5K1, through the sample and hold circuit to the VCXO. This signal then causes the VCXO to shift frequency to move a harmonic lock point to the YIG oscillator.

At time T_2, the reed relay A5K1 opens leaving the error signal, at time T2 stored on A5C9.

At time T_3 FET1 (A5Q18) is turned "on" again to discharge A14AlC17 and A5C1.

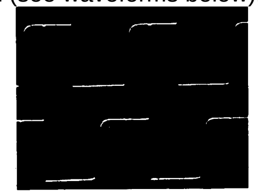
At time T_4 FET 1 is turned "off" and FET 2(A5Q17) is turned "on" routing the error signal to the YIG oscillator tickler coil.

At time T_5, sweep is turned on and the instrument functions in the stabilized mode.

2 A14A1Q4 and Q5 are emitter followers, connected to terminate the 500 kHz filter in 1000 ohms and to provide a low output impedance to drive the series resonant circuit. A14A1L4, C11 and C12 form a series resonant circuit whose "Q" is determined predominately by A14A1R14 and the resistance of inductor A14A1L4. A14A1C12 and R14 are factory selected components whose values are selected to set the frequency and "Q" of the 240 kHz resonator.

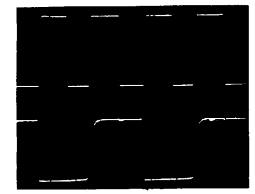
SERVICE SHEET 9 & 10 (cont'd)

2-a. A14A1U1 is a transistor array consisting of five identical transistors ina 14-pin integrated circuit package. Four of the transistors in A14A1U1 combined with A14A1Q6 and Q7 make up two independent differential comparators. The differential comparators convert the sine wave input into a squarewave output. The phase difference between the two squarewaves is a function of the input frequency. The outputs are nearly in phase at low frequencies, 90 degrees out of phase at 240 kHz (see waveforms below), and nearly out of phase at 500 kHz.



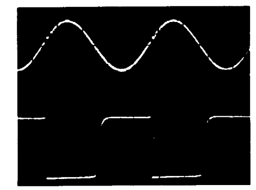
A A14A1Q7C
Volts/Div: 2
Time/Div: 1 µsec

B A14A1Q6C
Volts/Div: 2
Time/Div: 1 µsec



A A14A1TP3
Volts/Div: 2
Time/Div: 1 µsec

B A14A1Q6C
Volts/Div: 2
Time/Div: 1 µsec



A A14A1TP1
Volts/Div: 0.1
Time/Div: 1 µsec

B A14A1Q6C
Volts/Div: 2
Time/Div: 1 µsec

2-b. A14AlU2 is an integrated circuit quadruple NAND gate connected as an EXCLUSIVE OR circuit. Its output is high when the two inputs are different and low when they are the same. (Compare output waveform at TP3 with input waveforms.) The output of the EXCLUSIVE OR circuit has a dc component with an average value that is a function of frequency. The output of the EXCLUSIVE OR circuit is applied through A14AlQ8, Q9 and associated circuitry where the signal is buffered, offset and filtered. The error output signal is a dc voltage related to frequency as indicated in Figure 8-48.

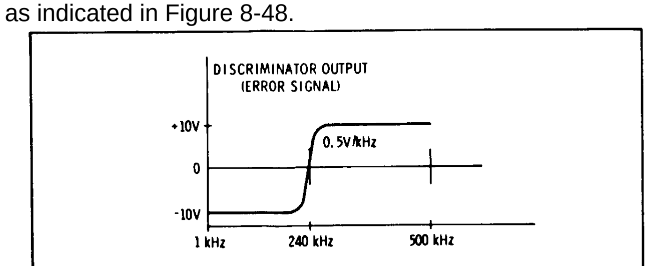


Figure 8-48. Discriminator Output Error Signal

SERVICE SHEET 9 & 10 (cont'd)

1 TUNING STABILIZER CONTROL TROUBLESHOOTING

(See Service Sheet 8 also).

When a malfunction has been isolated or to isolate a malfunction in the Tuning Stabilizer Control Assy A5, perform the trouble-shooting procedure in Service Sheet 8 prior to troubleshooting the circuitry in Service Sheet 9. If malfunction was isolated to the Tuning Stabilizer Assy A14, proceed to step 2. Separate RF and IF Sections, remove 8555A bottom cover so tuning stabilizer casting A14 is exposed. Disconnect the error signal output of this casting (958 wire at A14C4). Connect the RF Section to the IF Section and Display Section with extender cables. Install Tuning Stabilizer Control Assy A5 on an extender board.

EQUIPMENT REQUIRED

Digital Voltmeter .... HP 3440A/3444A
Oscilloscope .... HP 180A/1801A/1821A
Extender Board .... HP 5060-0256
Power Supply .... HP 6205B
Test Oscillator .... HP 652A
Service Kit .... HP 08555-60077
Volt-Ohm-Ammeter .... HP 412A

1. Set analyzer controls as follows:

BAND .... n=1- 2.05 GHz IF
BANDWIDTH .... 30 kHz
SCAN WIDTH .... 0.5 MHz PER DIVISION
INPUT ATTENUATION .... 20 dB
SCAN TIME PER DIVISION .... 1 MILLISECONDS
LOG REF LEVEL .... +10 dBm
LOG/LINEAR .... LOG
SCAN MODE .... INT
SCAN TRIGGER .... AUTO
FREQUENCY .... 1.5 GHz
FINE TUNE .... Centered
TUNING STABILIZER .... OFF

1-a. Check input sweep signal from scan width voltage divider Service Sheet 12. With INPUT ATTENUATION set to 20 dB, connect the SECOND LO OUTPUT to INPUT. Tune FREQUENCY control to center signal on CRT display. Check operational amplifiers A5U1 and U2 by checking for normal operation of the FINE TUNE control and the SIGNAL IDENTIFIER system. (FINE TUNE control has a tuning range of over 1 MHz and SIGNAL IDENTIFIER provides a two-division displacement on alternate sweep scans.) If either or both are incorrect, check input-versus-output of A5U1 and U2.

SERVICE SHEET 9 & 10 (cont'd)

1-b. With controls set as indicated above, connect oscilloscope to A5TP4. The signal at the test point should be a negative-going ramp of approximately 10 volts around a level set by the FINE TUNE control. Vary FINE TUNE control and check for a shift of at least two volts change in the dc level.

1-c. Check for a positive-going ramp at A5TP3 of approximately 9.5 volts and at A5TP8 for approximately 8.5 volts. Check for a negative-going ramp of approximately 9.5 volts at A5TP9. Set SIGNAL IDENTIFIER to OFF.

1-d. SAMPLE AND HOLD TEST

Set TUNING STABILIZER to ON; SCAN WIDTH to ZERO SCAN; SCAN WIDTH PER DIVISION to 100 kHz. With the error output wire (958) disconnected at A14C4, connect oscilloscope to A5TP4 and adjust FINE TUNE control for zero volts at test point. Connect oscilloscope to A5TP9. Voltage should be 0 + 0.1 volt. If voltage exceeds magnitude of 0.1 volt, adjust FET OFFSET A5R55 to zero voltage at A5TP9. Connect a +0.316 volt dc level signal at A5TP2. The voltage at A5TP9 should not change, indicating relay A5K1 is open. Set TUNING STABILIZER switch to OFF. The voltage level at A5TP9 should change to -1 +0.25 Vdc. Set TUNING STABILIZER switch to ON. The voltage at A5TP9 should not change, indicating proper operation of the sample and hold circuit.

2 DISCRIMINATOR TEST AND TROUBLESHOOTING

Separate RF Section from IF Section, remove bottom cover and cover from Discriminator Assy A14A1. Connect RF Section to IF Section and to Display Section using extender cables. Disconnect 958 wire from A14C4. Set TUNING STABILIZER switch to OFF.

2-a. Connect a 13 mV peak-to-peak signal at a frequency of 10 to 700 kHz from Test Point A (Service Sheet 10) to chassis ground. Note: it is not necessary to disconnect the sampler.

2-b. Vary frequency of oscillator while observing the discriminator output at A14C4 (Service Sheet 9). The discriminator output should vary as shown in Figure 8-47. If correct output is not obtained, perform the following tests:

Connect oscilloscope to A14A1TP1. The signal should be a sinusoid 0.15 to 0.3 volt peak-to-peak for frequencies between 1 and 500 kHz. The voltage level should decrease rapidly as the frequency is increased above 500 kHz. Observe signal at collectors of A14AlQ6 and Q7 with a dual channel oscilloscope. The signal should be a 0 to 5 volt squarewave. As the oscillator frequency is varied the phase relationship of the squarewaves should vary as follows: at low frequency the squarewaves should be almost in phase, at 240 kHz they should be approximately 90 degrees out of phase, at frequencies approaching 500 kHz they should be nearly out of phase.

SERVICE SHEET 9 & 10 (cont'd)

A5 Tuning Stabilizer Control Voltage Measurements

Conditions: SCAN WIDTH 100 kHz PER DIVISION, TUNING STABILIZER ON, FINE TUNE Centered (-5 Vdc at TP6), n=1- BAND, FREQUENCY 1 GHz, SCAN TIME PER DIVISION 5 SECONDS.

Test Point	Voltage	Remarks
TP1	+2.5 Vdc nominal	Unstabilized
TP1	+1.5 to +3.5 Vdc	Stabilized, goes negative with increase in frequency, goes positive with decrease in frequency.
TP2	0 Vdc nominal	
TP3	-5.5 to -3.8 Vdc	
TP4	+0.93 to -1.03 Vdc	
TP5	-0.25 to +0.25 Vdc	
TP6	0 to -10 Vdc	FINE TUNE CW to CCW
TP7	0 Vdc nominal	Level goes positive with increase in frequency and negative with decrease.
TP8	1.6 Volt	Positive going ramp.
TP9	1.8 Volt	Negative going ramp.

Transistor voltage measurements, unstabilized, ZERO SCAN.

	Emitter	Base	Collector
A5Q16	-8.67 Vdc	-8.2 Vdc	0
	Drain	Source	Gate
A5Q15	-8.67 Vdc	+2.55 Vdc	0
A5Q17	0	0	-5.7 Vdc
A5Q18	0	0	+0.5 Vdc

A14A1 Discriminator Voltage Measurements

Conditions: SCAN WIDTH 100 kHz PER DIVISION, TUNING STABILIZER ON, FINE TUNE Centered,
FREQUENCY 1 GHz, n=1- BAND, SCAN TIME 2 MILLISECONDS PER DIVISION, Typical Vdc levels indicated.

	Emitter	Base	Collector
A14A1Q4	-1.55	-0.98	0
Q5	-2.17	-1.55	0
Q6	0	+0.2	+1.7
Q7	0	+0.2	+1.7
Q8	+9.87	+9.98	-0.26
Q9	+9.87	+10.0	+0.30
Q10	+5.0	+5.66	+9.96
U1A	-0.3	0	+9.96
U1B	-0.3	0	+0.2
U1C	-0.7	0	+9.96
U1D	-0.7	0	+0.2

TP 1 0.2 volt peak-to-peak 240 kHz sine wave
TP 3 +2.8 volt level, 5.6 volt peak-to-peak 480 kHz square wave
A14C4 (Error out signal) 0 Vdc nominal.

A5, A6
Control Generator and 1/n Attenuator
SERVICE SHEET 8

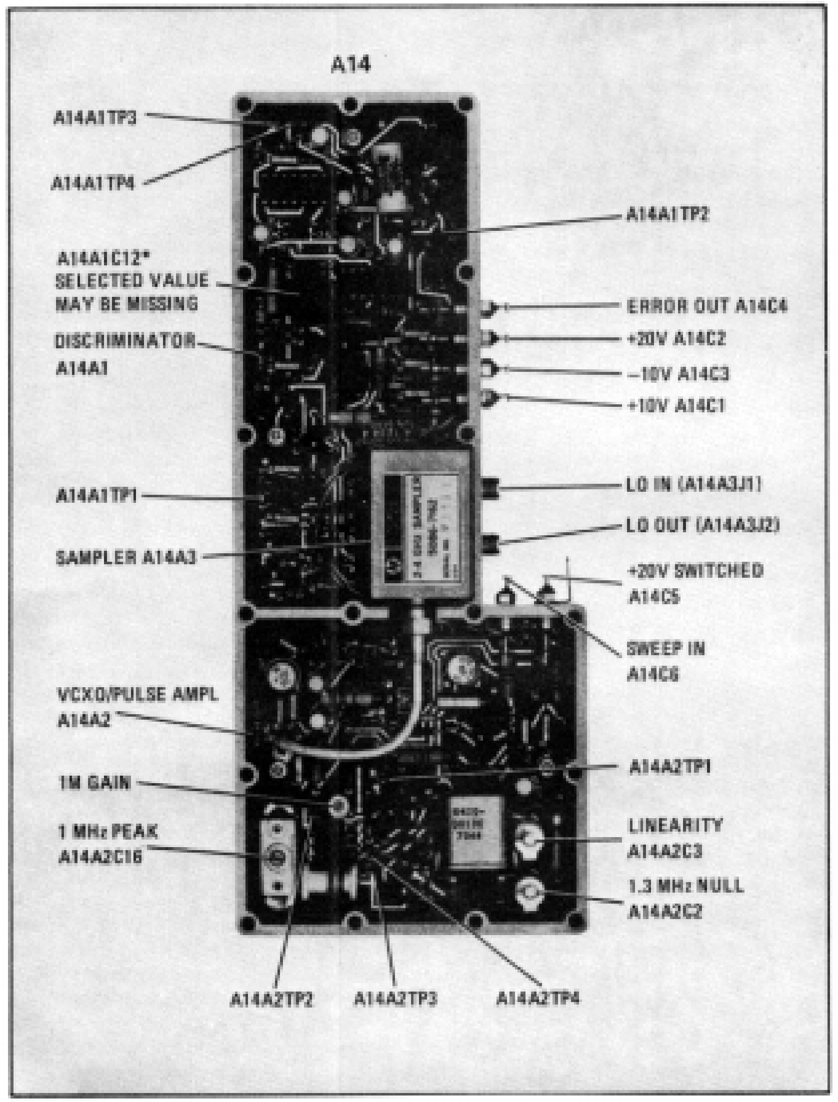


Figure 8-49. Tuning Stabilizer Assembly A14

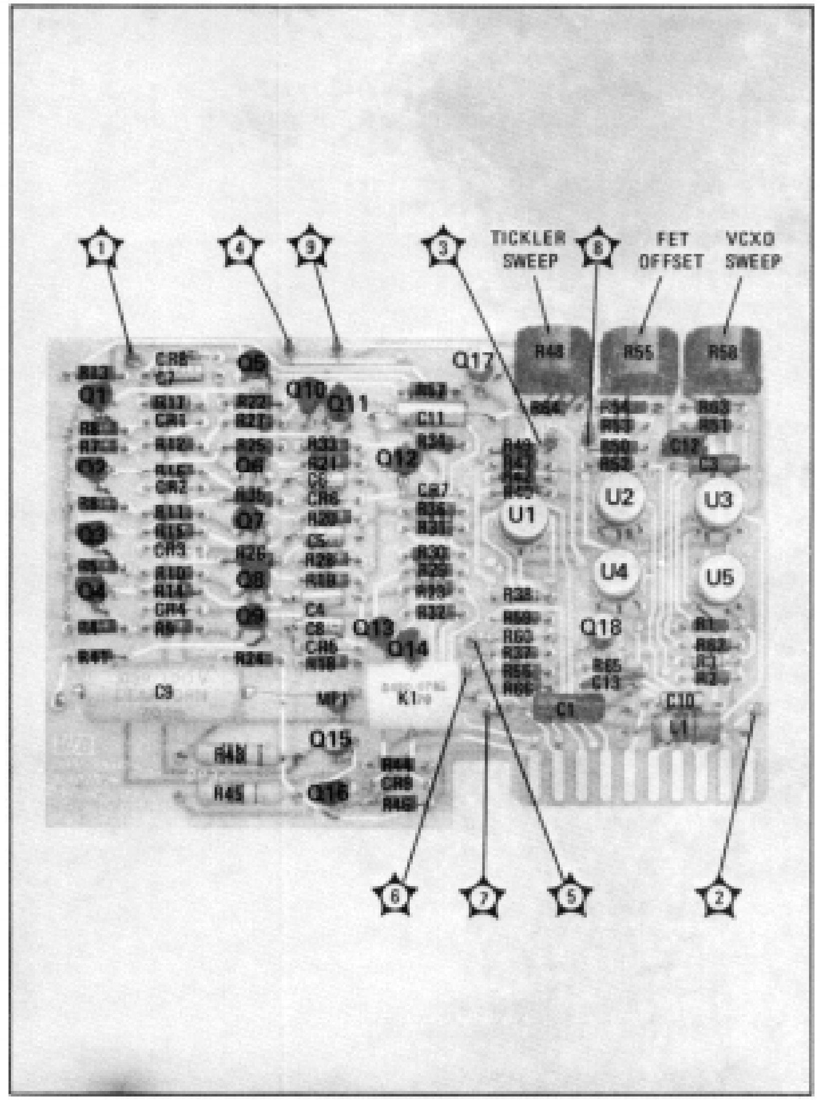


Figure 8-50. Tuning Stabilizer Control Assembly A5

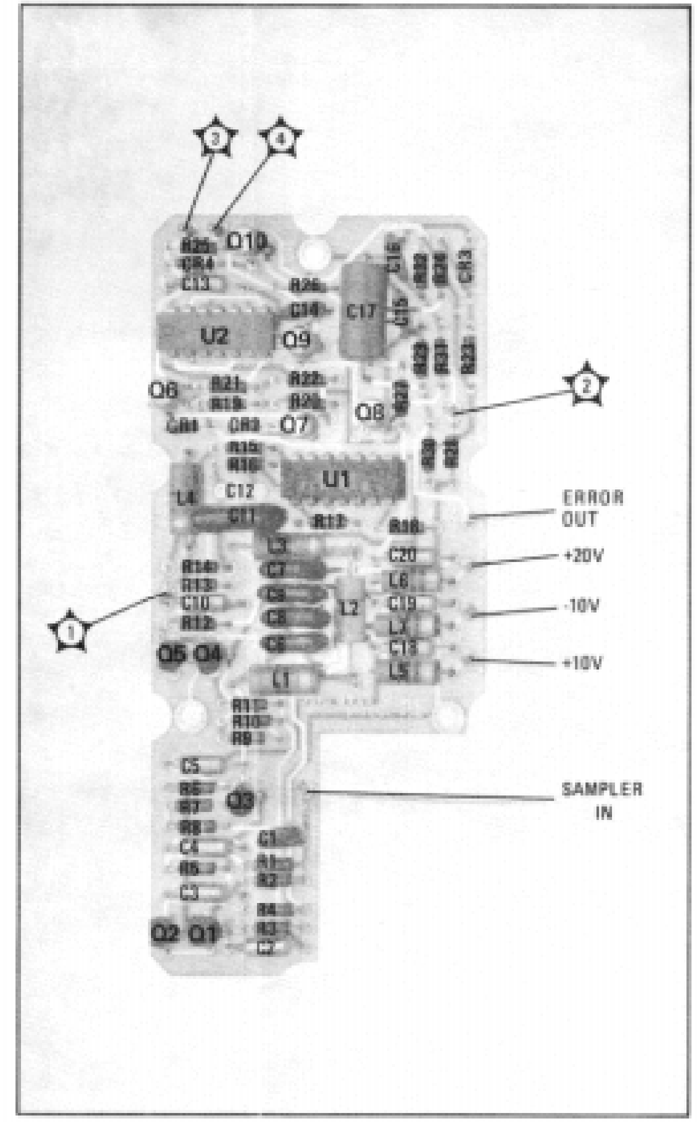


Figure 8-51. Discriminator assembly A14A1

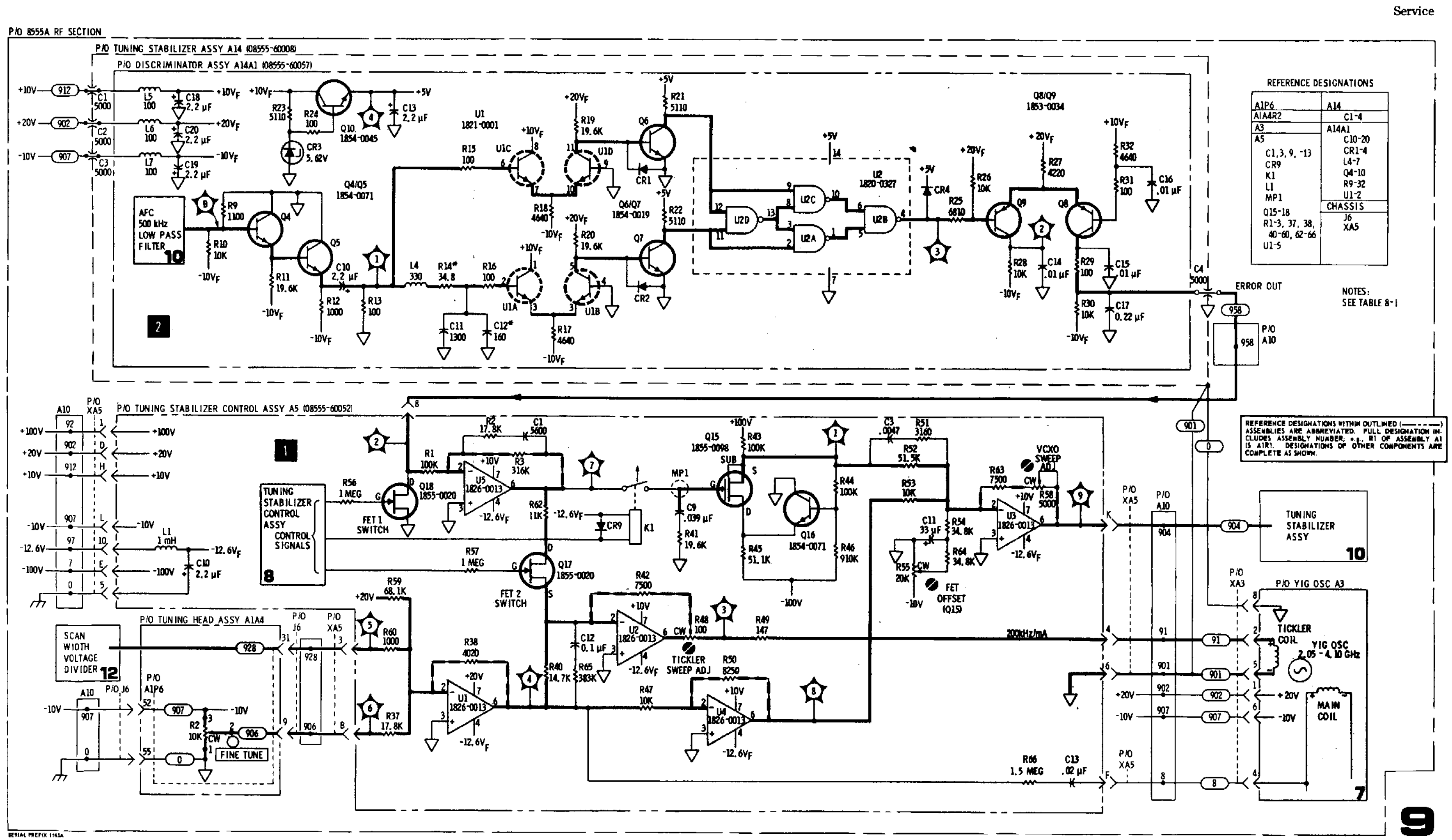


Figure 8-52. Tuning Stabilizer Control Assy A5 and Discriminator assy A14A1.

SERVICE SHEET 10

THEORY OF OPERATION

3 VCXO PULSE AMPLIFIER

The variable frequency crystal oscillator (VCXO) is the 1 MHz reference for the tuning stabilizer circuit. The 1 MHz oscillator is electronically tunable +750 Hz. The VCXO consists of a fixed frequency high "Q" crystal filter, a limiting amplifier, a variable frequency low "Q" LC filter and a driver circuit. The oscillator will oscillate at a frequency such that the phase shift through the two filters is zero. If the variable frequency LC filter is set, by voltage on the varactor diodes, to 1 MHz, the phase shift through each filter will be zero and the sum will be zero. If the frequency of the variable frequency LC filter is set different from 1 MHz, the frequency of oscillation will shift such that the phase shift through the crystal filter is equal in magnitude, but opposite in sign to the phase shift through the variable frequency filter. By changing the bias voltage on the varactor diodes A14A2CR1 through CR4, the oscillation frequency is changed. Since the "Q" of the crystal filter is much greater than the "Q" of the LC filter, the frequency stability is on the order of the crystal stability.

3-a. Bias voltage for varactor diodes A14A2CR1 through CR4 is supplied by operational amplifier A14A2U1. The input to A14A2U1 is a combination of the sweep plus fine tune signal and the output from the sample and hold circuit (SS9). This input signal must be attenuated by an amount depending on the YIG oscillator frequency. When the RF Section is tuned to the low end of any band, the YIG oscillator frequency is near 2.05 GHz. When locked to a VCXO harmonic (harmonic number near 2050) a frequency shift of 1 Hz at the VCXO will cause a shift of 2050 Hz at the YIG oscillator. When tuned near the high end of a band (YIG oscillator near 4.1 GHz, harmonic number 4100) a VCXO shift of 1 Hz will cause a frequency shift of 4100 Hz at the YIG oscillator. To correct for the change in frequency shift as the YIG oscillator is tuned toward the high end of its range, the input signal to the VCXO must be attenuated by a factor of 2.05 GHz/FLQ. This attenuation is provided by A1A4R3, the 2:1 gain control, and resistor A14A2R4 m the VCXO driver circuit. The 2:1 gain control is ganged with the FREQUENCY control.

3-b. There are three adjustable components in the VCXO circuit (see Tuning Stabilizer Adjustments in Section V). A14A2C16 1 MHz Peak adjusts center frequency of Low "Q" LC variable frequency filter. A14A2C2 1.3 MHz Null; adjusted to balance out capacitance of crystal holder A14A2Y1. A14A2C3 Linearity, adjusts VCXO circuit to provide a linear frequency change with a linear change in bias voltage to varactor diodes A14A2CR1 through CR4.

3-c. Pulse amplifier A14A2Q5 through Q7 converts the 1 MHz signal from the VCXO to a squarewave pulse of sufficient amplitude to drive the mixer diode in sampler A14A3. The positive portion of the output pulse is clamped to approximately +0.6 to +0.8 Vdc by the sampler diode (see

SERVICE SHEET 10 (cont'd)

waveform for test point TP D).

4 SAMPLER AND DISCRIMINATOR PREAMPLIFIER

Sampler A14A3 mixes the 2.05 to 4.1 GHz signal from the YIG oscillator with the harmonics from the 1 MHz VCXO and produces sum and difference output signals to the tuning stabilizer discriminator circuits. The YIG oscillator signal is routed through the 1st converter circuits (Service Sheet 2) and a 2 to 4 GHz isolator AT6 before being applied to the sampler. The YIG oscillator signal fed through the sampler is terminated in a 50-ohm load (AT2) at the front panel FIRST LO OUTPUT. The 1 MHz squarewave from the VCXO pulse amplifier drives a step recovery diode in a differentiator circuit to produce a train of very narrow pulses. The frequency spectrum of the 1 MHz pulse train is a series of 1 MHz harmonics extending through 4.1 GHz. The sampler mixes the 2050 harmonics between 2.05 and 4.1 GHz with the 2.05 to 4.1 GHz YIG oscillator signal. The output is filtered through a 500 kHz lowpass filter and applied to a 240 kHz discriminator. The output of the discriminator is fed back as an error signal shifting the YIG oscillator frequency to a lock point. At a lock point (zero output from the discriminator) the YIG oscillator frequency is offset from the nearest VXCO harmonic by approximately 240 kHz.

4-a. The sampler output is amplified by A14AlQ1 through Q3, the tuning stabilizer preamplifier, before being applied to the 500 kHz lowpass filter. The sampler output signal is a +1.8 to +2.4 Vdc level with the various output signals from the sampler superimposed on the dc signal. (See waveforms for test points TP A and C.)

4-b. A14AlL1 through L3 and A14AlC6 through C9 make up a 500 kHz Chebychef lowpass filter. This filter rejects the 1 MHz sampling signal and the unwanted sideband coming from the sampler (see waveforms for test points TP B and C).

TUNING STABILIZER TROUBLESHOOTING

(Continued from Service Sheet 9)

3, 4 VCXO/PULSE AMPLIFIER/SAMPLER/PREAMPLIFIER TROUBLESHOOTING PROCEDURE

Remove cover from VCXO/PULSE AMPL Assy A14A2. Set analyzer controls as follows:

SCAN WIDTH ....100 kHz PER DIVISION
ZERO SCAN TUNING STABILIZER .... ON

Observe voltage at A14A2TP-D with oscilloscope. The signal should be a 1 MHz squarewave between -10 +0.5V and +0.7 ±0.15V with a frequency of 1 MHz +10 kHz. If the waveform at TP-D has an upper limit approaching +20V, check for an open A2W1 Cable or open Sampler A14A3 step recovery diode. The sampler diode may be checked by inserting a wire in the pulse input connector and checking the diode with an ohmmeter. Using a HP 412A Volt-Ohm-Ammeter, on the 100 ohm

SERVICE SHEET 10 (cont'd)

range, the diode should indicate 100 to 500 ohms with the positive probe to the center conductor and the negative probe to ground. The ohmmeter should indicate greater than 1 megohm in the reverse direction.

NOTE

Other ohmmeters may give different resistance measurements. The actual value depends on the voltage of the ohmmeter.

If the voltage at TP-D is zero, check for shorted cable or shorted sampler step recovery diode by the above test. If the waveform at TP-D is wrong in some other way, check waveform at A14A2TP3 for a 1 MHz +10 kHz sinusoid with a peak-to-peak amplitude of 6 to 9 volts. (An oscilloscope probe with capacitance less than 20 pF should be used in this measurement.)

If the signal at A14A2TP-3 is correct and the signal at A14A2TP-D is incorrect, check the Pulse Ampl. circuit A14A2Q5, Q6 and Q7. If the signal at TP-3 is incorrect, disconnect the 903 wire at A14C6 and make the following dc voltage measurements with a low probe capacitance voltmeter such as the HP 412A.

A14A2U1	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 6**	**Pin 7**
	OV ±20mV	OV ±1mV	-9.7 ±0.2V	13 ±1V	19.7 ±0.2V

A14A2Q1	**Emitter**	**Base**	**Collector**
	-0.6 ±0.2V	0	+11± 2V
A14A2Q4	**Source**	**Gate**	**Drain**
	+2 to +6V	0	±19.7± 0.2V

A14A2Q2 and Q3 may be checked by applying a signal at A14A2TP1 and observing the output at TP3. Disconnect one end of A14A2C4 and connect a 1 MHz signal from TP1 to ground. The voltage at TP3 should peak between 6 and 9V when the frequency is varied around 1 MHz. The signal at the emitters of Q2 and Q3 should be a half-wave rectified sinewave with a positive peak of 2.4 ±0.5V with the negative portion clipped at -0.6 ±0.15V.

Quartz crystal A14A2Y1 can be checked for proper operation using the same test setup as for A14A2Q2 and Q3 above. Connect oscilloscope to source of FET Q4 and tune the 1 MHz signal source around 1 MHz. The 1 MHz sinewave at the source of Q4 should peak at 1 MHz.

Replace capacitor A14A2C1.

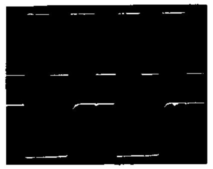
See Discriminator Test and Troubleshooting, Service Sheet 9.

NOTE

If components are replaced, see tuning stabilizer adjustments in Section V. Do not adjust components unless it is necessary.

Tuning Stabilizer Waveforms

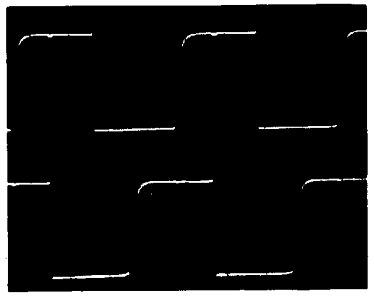
Conditions: Same as for voltage measurements. Oscilloscope dc coupled input unless otherwise indicated.



A500 kHz Filter Input
A14A1C5/L1
Volts/Div: 1
Time/Div: 1 μsec

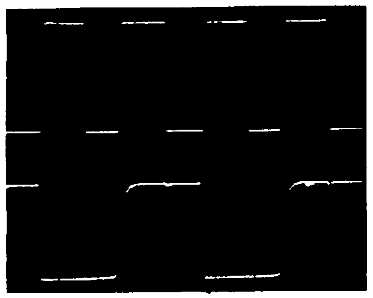
B A14AlTP B
Volts/Div: 0.1
Time/Div: 1 μsec

SERVICE SHEET 10 (cont'd)



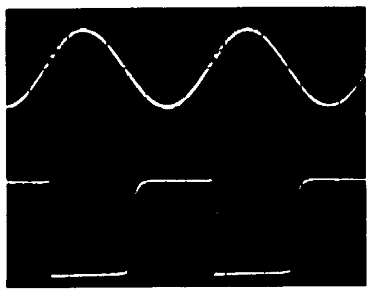
A A14A1Q7C
Volts/Div: 2
Time/Div: 1 μsec

B A14A1Q6C
Volts/Div: 2
Time/Div: 1 μsec



A A14A1TP3
Volts/Div: 2
Time/Div: 1 μsec

B A14A1Q6C
Volts/Div: 2
Time/Div: 1 μsec



A A14A1TP1
Volts/Div: 0.1
Time/Div: 1 μsec

B A14A1Q6C
Volts/Div: 2
Time/Div: 1 μsec

SERVICE SHEET 10 (cont'd)

A14A1 Discriminator Voltage Measurements

Conditions: SCAN WIDTH 100 kHz PER DIVISION, TUNING STABILIZER ON, FINE TUNE centered, FREQUENCY 1 GHz, n=1-BAND, SCAN TIME 2 MILLISECONDS PER DIVISION. Typical Vdc levels indicated.

	Source	Gate	**Drain**
A14A2Q1	+1.0	0	+9.3
	Emitter	Base	**Collector**
A14A2Q2	+9.3	+9.96	+12.6
A14A2Q3	- 0.8	- 0.2	+ 5.7

TP A +2.1
TP B -0.98 with 0.25 volt peak-to-peak 240 kHz sine wave.

REMOVAL AND REPLACEMENT PROCEDURES

See Service Sheet 18.

SERVICE SHEET 10 (cont'd)

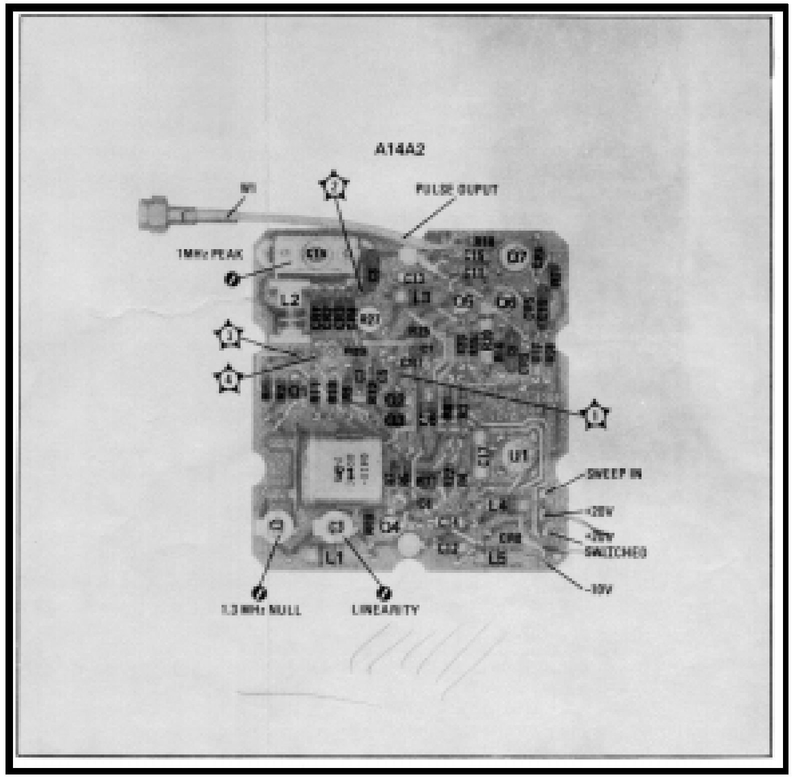


Figure 8-53. Tuning Stabilizer VCXO Assembly A14A2

A1A4, A3, A5, A14A1
Tuning Stabilizer Control and Discriminator
SERVICE SHEET 9 & 10

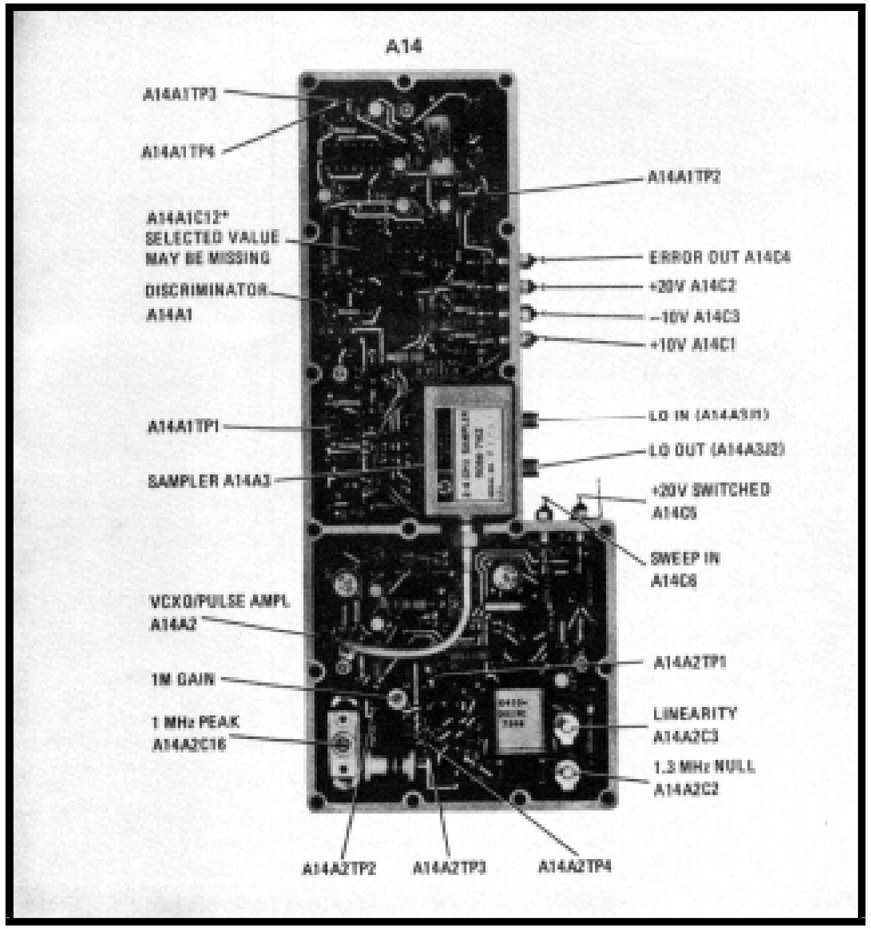


Figure 8-54. Tuning Stabilizer Assembly A14

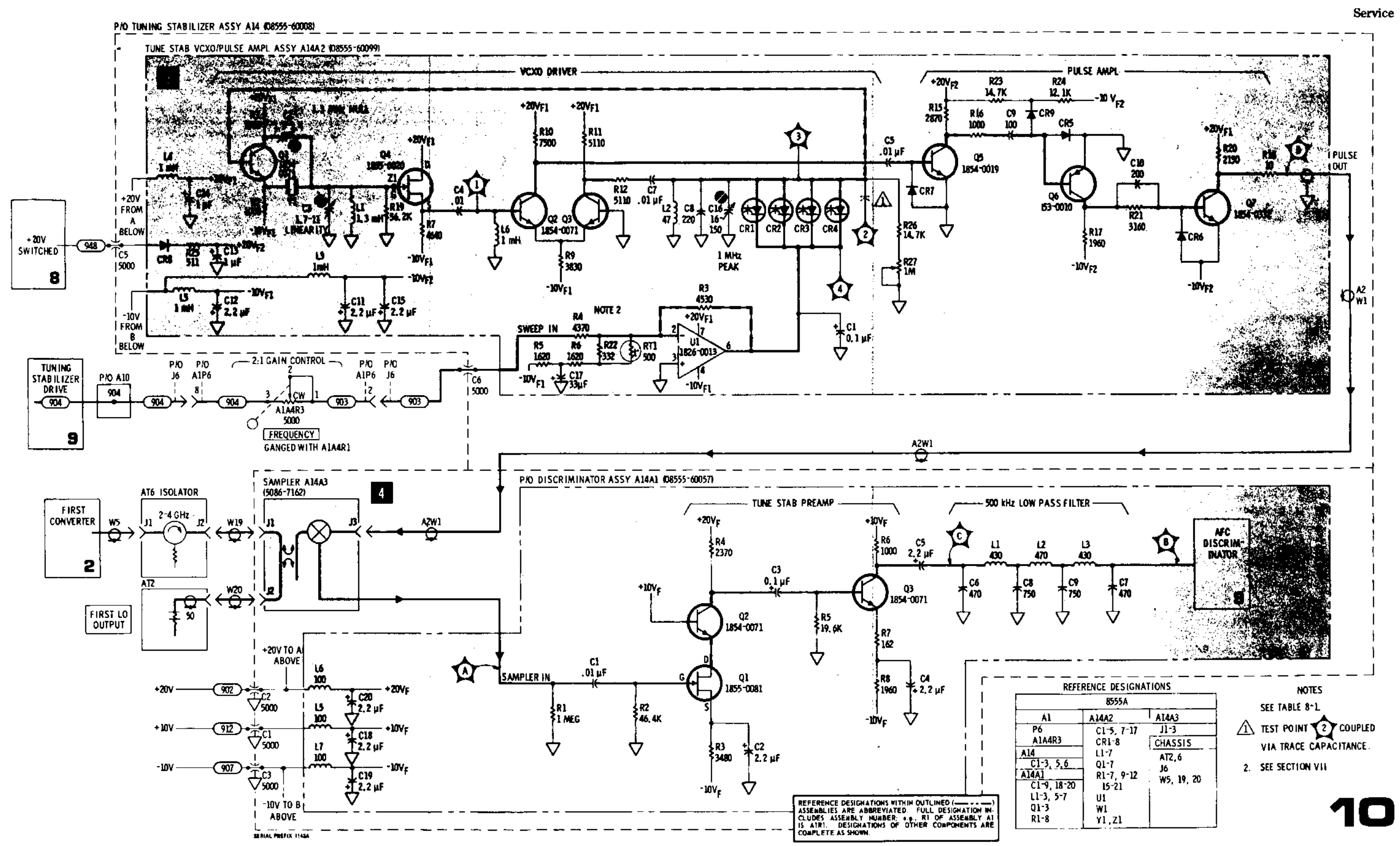


Figure 8-55. Tuning Stabilizer VCXO/Pulse Ampl Assy A14A2, Discriminator A14A1, and Sampler Assy A14Ae

THEORY OF OPERATION

Service Sheet 11 contains the schematic diagram for the band code switch logic circuitry which consists of an encoder, a driver, a decoder and a logic power supply. The circuitry provides control of bias current to the diode in the first converter; gain control to the 50 MHz variable gain amplifier; and switching control for IF and external mixer relays and the 1.5 GHz oscillator. In addition, binary band code information is supplied to the 1/n attenuator and to a plug on the rear panel to provide band code information for use by external equipment.

1 FREQUENCY BAND SHAFT ENCODER

Switch A1A4S1 on the end of the frequency scale drum performs the encoding function which provides the five bit binary code. The switch is controlled by the front panel BAND lever. The encoder output is shown in the harmonic number band code chart on the schematic diagram.

2 DECODER DRIVER

A6U11 is an integrated circuit transistor array with five transistors, U11A through U11E. Each transistor is a driver for one of the band code bits. A positive voltage from the shaft encoder biases a driver "on" and results in a negative voltage being applied to the decoder circuitry (approximately -12.6 volts). An open circuit from the shaft encoder biases a decoder driver "off". In the "off" condition the collector of the decoder driver is pulled negative (approximately -11 volts in a no-load condition) by the decoder logic voltages.

3 LOGIC POWER SUPPLY

Breakdown diode CR7 establishes the reference voltage on the base of transistor Q6. Q6 and Q7 form a Darlington pair, with the output voltage at the emitter of Q7 being about one volt more negative than the base voltage of Q6. The output, approximately -7.OV, is applied to the Vdc pins and the -12.6V is applied to the ground pins of the logic modules. This results in a positive 5.6V supply for the decoder logic.

4 DECODER LOGIC

Integrated circuits U3 through U10 decode and provide the frequency scale position information from the shaft encoder and provide control signals, F1 through F17, to control instrument operation. The control signals provide either -12.6 volts or an open circuit. Signals Fl through F10 are applied to the Input Mixer Gain Compensation, Network A16, to set the gain of the 50 MHz variable gain amplifier for each of the bands. Signals F13 through F15 are applied to the same resistor network and control the bias current for the diode in the first converter. Signal F13 sets the bias for bands n=1 and n=3, F14 sets the bias for band n=2 and F15 sets the bias for the n=4 band. (See Service Sheets 2 and 5.) Signals F16 and F17 control gain steps of 5 and 15 dB in the 50 Mhz variable gain amplifier. The 5 dB step (F17) is activated for all bands except the n=1 + 550 MHz IF bands. The 15 dB step (F16) is activated for the n=3+ through n=10+ bands. Signal F11 is -12.6 volts on the n=1± 550 MHz IF bands and controls IF switching relays K2 and K3 and also removes voltage from the 1.5 GHz oscillator (see Service Sheet 3). Signal F12 controls the external mixer relay K1 and is -12.6 volts on the n=6+ and n=10+ bands.

The decoder functions as negative logic with "1" = -12.6 volts, (the activating state) and "0" = a voltage more positive than the -12.6 volts. The output signals F1 through F16 all come from logic elements that have open collector outputs. In the "1" state the logic circuit will supply -12.6 volts for activating the function controlled by that "F" signal. In the "0" state the output of the logic circuit will be open and the voltage will depend on the connected circuitry and can vary from about -11 volts to a positive voltage.

The following charts provide logic level information for integrated circuits A6U3 through A6U10. "1" = -12 volt with "0" = a more positive level.

TROUBLESHOOTING PROCEDURE

When a malfunction has been isolated to the band code switch logic circuitry or to isolate a malfunction in the circuitry, perform the following procedure. Remove power from the analyzer and install Band Buffer Assy A6 on an extender board.

EQUIPMENT REQUIRED

Digital Voltmeter	HP 3440A/3444A
Extender Board	HP 5060-0258
Logic Clip	HP 10528A

1 FREQUENCY SHAFT ENCODER TROUBLESHOOTING

1-a. Connect the digital voltmeter test leads to pin 2 on the extender board (XA6-2) and chassis ground. Apply power to the analyzer and press Band Switch Lever to rotate the frequency band shaft encoder through each band. Check for +20-volts on bands n=2+, 2-, 4+ and 4-. If voltage is not present, check at A1A4S1 A (printed circuit switch on right end of frequency scale drum).

1-b. In the same manner, check for +20 volts at XA6 pins 3, 4, 5 and 6. Voltage should be present as shown in the harmonic number band code chart on the schematic diagram.

2 DECODER DRIVER TROUBLESHOOTING

Check decoder driver A6U11. The collector voltage will vary from a nominal value of -12.4 volts, transistor "on" (+20 volts on XA6 pins from shaft encoder) to approximately -11 volts with the transistor "off". Check the collector voltage of each transistor in A6U11 in both "on" and "off" conditions. A defective decoder logic module will normally pull the collector voltage of the associated driver transistor toward the -7.0 volt logic power supply output when the driver transistor is in the "off" condition.

3 LOGIC POWER SUPPLY TROUBLESHOOTING

Check logic power supply transistors A6Q6, A6Q7 and associated components.

4 DECODER LOGIC TROUBLESHOOTING

4-a. Decoder logic modules AllU3, U4, U5, U8, U9 and U10 can be checked for proper operation using HP 10528A Logic Clip providing the CAUTIONS listed in Logic Clip Manual are followed. Before connecting the Logic Clip, check to ensure that the module pins are not shorted to ground or to the +20 volt source. Check suspected modules for proper operation using charts in Theory of Operation.

NOTE

When using the Logic Clip a Logic "0" is indicated by a lighted diode and a Logic "1" is indicated by unlighted diode. With -12.6 volts applied to the normal ground pins and -7.0 volts applied the VCC pins, the modules are performing as if connected to a +5.6 volt source.

4-b. Check decoder logic modules A6U6 and A6U7 (relay driver modules) for proper operation using a voltmeter or oscilloscope. Check module operation against the charts in Theory of Operation. For example, with 12.4 volts applied to pins 2 and 7 of A6U7; -7.0 at pins 1 and 8; pin 6 floating (approximately -11 volts) the output at pin should be a logic "1" -12.4 volts. The output at pin 5 should be a logic "0" or zero volts. Check A6U6 in a similar manner.

NOTE

The output from the A6U6 and A6U7 modules are either 0 or -12. The output from modules A6U3 - U5 and U8 - U10 are at -12 when active and at a floating voltage level when not active.

REPAIR INSTRUCTIONS

The A16 Gain Network is mounted on the A6 Band Buffer Assy. This network is factory-selected to match the mixer in the First Converter Assy A12 and should remain with the converter. If the A6 assembly is replaced, remove the A16 assembly and install on new A6 assembly. The A6 printed circuit board contains multi-layer circuit traces. Use extreme care when replacing components.

See Figure 8-4 for pin numbering of logic modules.

SERVICE SHEET 11 (cont'd

Logic Module A6U3 Pin Numbers

BAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
n=10+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=10-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=6+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=6-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=4+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=4-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=3+	1	0	0	1	0	0	1	1	0	0	0	1	1	0
n=3-	1	1	0	0	0	1	1	0	0	1	0	0	1	0
n=2+	0	0	1	0	1	0	1	1	1	0	0	1	0	0
n=2-	0	1	0	0	1	1	1	0	1	0	1	0	0	0
n=1+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=1-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=1+*	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=1±*	1	1	0	0	1	1	1	0	1	0	0	0	1	0

Logic Module A6U4 Pin Numbers

BAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
n=10+	1	0	0	1	1	0	1	0	1	1	1	0	1	0
n=10-	1	0	0	1	1	0	1	0	1	1	1	0	1	0
n=6+	1	0	0	1	1	0	1	0	1	1	1	0	1	0
n=6-	1	0	0	1	1	0	1	0	1	1	1	0	1	0
n=4+	0	1	0	1	0	1	1	1	1	1	0	0	1	0
n=4-	0	1	0	1	0	1	1	1	1	1	0	0	1	0
n=3+	1	0	0	1	1	0	1	1	1	1	0	0	1	0
n=3-	1	0	0	1	1	0	1	1	1	1	0	0	1	0
n=2+	1	0	0	1	0	1	1	1	1	1	0	1	0	0
n=2-	1	0	0	1	0	1	1	1	1	1	0	1	0	0
n=1+	1	0	0	1	1	0	1	1	0	0	1	0	1	0
n=1-	1	0	0	1	1	0	1	1	0	0	1	0	1	0
n=1+*	1	0	1	0	1	0	1	0	1	1	1	0	1	0
n=1±*	1	0	1	0	1	0	1	0	1	1	1	0	1	0

Logic Module A6U5 Pin Numbers

BAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
n=10+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=10-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=6+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=6-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=4+	0	0	1	0	1	0	1	1	1	0	0	1	0	0
n=4-	0	1	0	0	1	1	1	0	1	0	1	0	0	0
n=3+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=3-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=2+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=2-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=1+	1	0	0	0	1	0	1	1	1	0	0	1	1	0
n=1-	1	1	0	0	1	1	1	0	1	0	0	0	1	0
n=1+*	1	0	0	1	0	0	1	1	0	0	0	1	1	0
n=1±*	1	1	0	0	0	1	1	0	0	1	0	0	1	0

Logic Module A6U6 Pin Numbers

BAND	1	2	3	4	5	6	7	8
n=10+	0	0	0	1	0	0	0	0
n=10-	0	0	0	1	0	0	0	0
n=6+	0	0	0	1	0	0	0	0
n=6-	0	0	0	1	0	0	0	0
n=4+	0	0	0	1	0	0	0	0
n=4-	0	0	0	1	0	0	0	0
n=3+	0	0	0	1	0	0	0	0
n=3-	0	0	0	1	0	0	0	0
n=2+	0	0	0	1	0	0	0	0
n=2-	0	0	0	1	0	0	0	0
n=1+	0	0	0	1	0	0	0	0
n=1-	0	0	0	1	0	0	0	0
n=1+*	0	1	1	1	1	1	0	0
n=1±*	0	1	1	1	1	1	0	0

SERVICE SHEET 11 (cont'd)

Logic Module A6U7 Pin Numbers

BAND	1	2	3	4	5	6	7	8
n=10+	0	1	1	1	1	0	1	0
n=10-	0	1	1	1	1	0	1	0
n=6+	0	1	1	1	1	0	1	0
n=6-	0	1	1	1	1	0	1	0
n=4+	0	0	0	1	1	1	0	0
n=4-	0	0	0	1	1	1	0	0
n=3+	0	0	0	1	1	1	0	0
n=3-	0	0	0	1	1	1	0	0
n=2+	0	0	0	1	0	0	0	0
n=2-	0	0	0	1	0	0	0	0
n=1+	0	0	0	1	0	0	0	0
n=1-	0	0	0	1	0	0	0	0
n=1+*	0	0	0	1	0	0	0	0
n=1±*	0	0	0	1	0	0	0	0

Logic Module A6U8 Pin Numbers

BAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
n=10+	0	0	1	0	0	1	1	1	1	0	0	1	1	0
n=10-	0	0	1	0	1	1	1	1	0	0	0	1	1	0
n=6+	0	0	1	0	0	1	1	1	1	0	0	0	1	0
n=6-	0	0	1	0	1	1	1	1	0	0	0	0	1	0
n=4+	1	1	0	0	0	1	1	1	1	0	1	0	0	0
n=4-	1	1	0	0	1	1	1	1	0	0	1	0	0	0
n=3+	0	1	0	0	0	1	1	1	1	0	1	0	0	0
n=3-	0	1	0	0	1	1	1	1	0	0	1	0	0	0
n=2+	1	0	0	0	0	1	1	1	1	0	1	0	0	0
n=2-	1	0	0	0	1	1	1	1	0	0	1	0	0	0
n=1+	0	0	1	1	0	0	1	0	1	0	1	0	0	0
n=1-	0	0	1	0	1	0	1	0	0	1	1	0	0	0
n=1+*	0	0	1	0	0	1	1	1	1	0	0	1	0	0
n=1±*	0	0	1	0	1	1	1	1	0	0	0	1	0	0

Logic Module A6U9 Pin Numbers

BAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
n=10+	1	0	1	1	1	1	1	1	1	0	1	1	0	0
n=10-	1	0	1	1	1	1	1	1	1	0	1	1	0	0
n=6+	1	1	1	1	1	1	1	1	1	0	1	1	0	0
n=6-	1	1	1	1	1	1	1	1	1	0	1	1	0	0
n=4+	0	1	1	0	0	0	1	1	0	1	1	0	1	0
n=4-	0	1	1	0	0	0	1	1	0	1	1	0	1	0
n=3+	0	1	1	1	0	1	1	1	1	1	0	0	0	0
n=3-	0	1	1	1	0	1	1	1	1	1	0	0	0	0
n=2+	0	1	1	0	1	1	1	0	0	0	1	1	1	0
n=2-	0	1	1	0	1	1	1	0	0	0	1	1	1	0
n=1+	0	1	1	1	1	1	1	1	1	0	1	1	0	0
n=1-	0	1	1	1	1	1	1	1	1	0	1	1	0	0
n=1+*	0	0	0	1	1	1	1	1	1	0	1	1	0	0
n=1±*	0	0	0	1	1	1	1	1	1	0	1	1	0	0

Logic Module A6U10 Pin Numbers

BAND	1	2	3	4	5	6	7	8	9	10	11	12	13	14
n=10+	1	0	0	1	0	1	1	0	1	1	0	0	1	0
n=10-	1	0	0	1	0	1	1	1	0	1	0	0	1	0
n=6+	0	1	0	1	0	1	1	0	1	1	0	0	1	0
n=6-	0	1	0	1	0	1	1	1	0	1	0	0	1	0
n=4+	0	1	1	0	1	0	1	0	1	1	0	0	1	0
n=4-	0	1	1	0	1	0	1	1	0	1	0	0	1	0
n=3+	0	1	1	0	0	1	1	0	1	1	0	0	1	0
n=3-	0	1	1	0	0	1	1	1	0	1	0	0	1	0
n=2+	0	1	0	1	1	0	1	0	1	1	0	0	1	0
n=2-	0	1	0	1	1	0	1	1	0	1	0	0	1	0
n=1+	0	1	0	1	0	1	1	0	1	1	0	0	1	0
n=1-	0	1	0	1	0	1	1	1	0	1	0	0	1	0
n=1+*	1	0	0	1	0	1	1	0	1	1	0	1	0	0
n=1±*	1	0	0	1	0	1	1	1	0	1	0	1	0	0

Figure 8-56. Logic State Versus Harmonic Band Number

A14A1, A13A2, A14A3
Tuning Stabilizer VCXO/Pulse Ampl, Discriminator, and Sampler
← **SERVICE SHEET 10 (cont)**

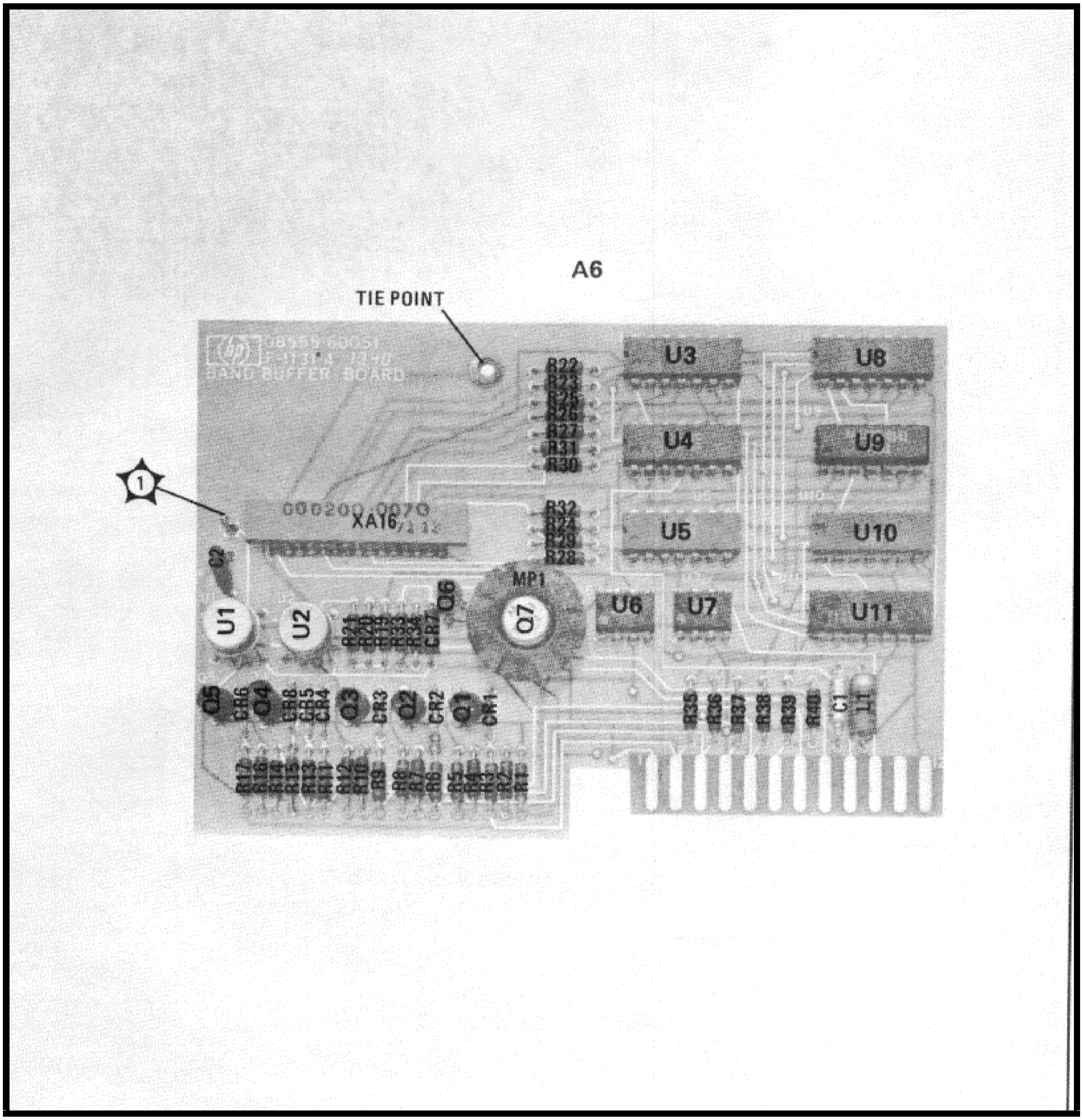


Figure 8-57. Band Buffer Assembly A6

Service

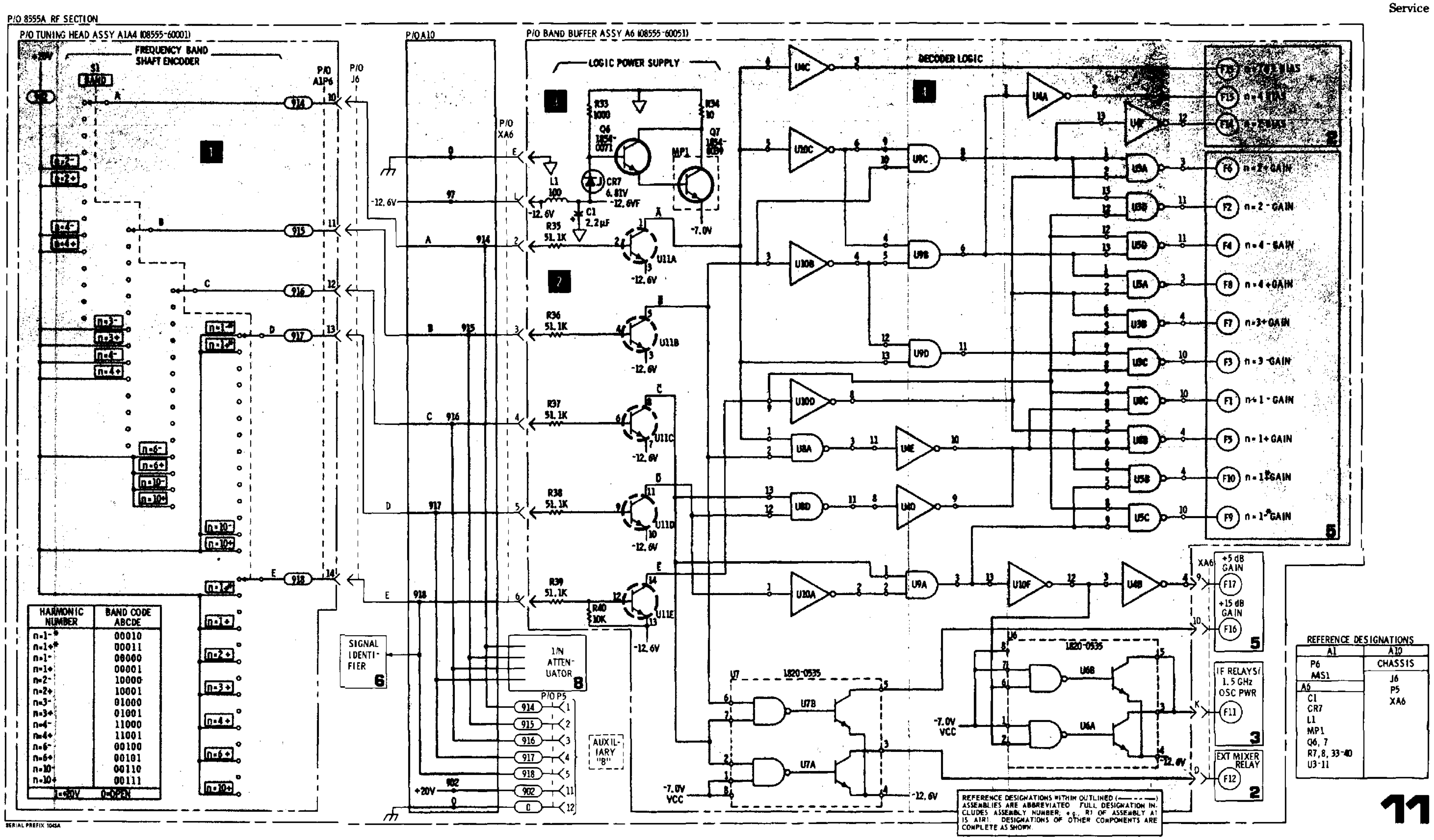


Figure 8-58. Band Code Switch Logic, Schematic Diagram

SERVICE SHEET 12

THEORY OF OPERATION

SCAN WIDTH ATTENUATOR

Service Sheet 12 contains the schematic diagram for that part of the SCAN WIDTH switch which functions as a precision resistive voltage divider to determine the scan width per division. For narrow scan widths (2 kHz to 500 kHz, PER DIVISION) the sweep ramp from the 1/n attenuator is attenuated and applied to the tuning stabilizer circuits where it is combined with the voltage from the FINE TUNE control. The narrow sweep plus fine tune voltage from the tuning stabilizer circuits is applied to the YIG oscillator tickler coil (see Service Sheet 9). For wide scan widths (1 MHz to 200 MHz, PER DIVISION) the sweep ramp is attenuated and applied to the YIG driver circuits where it is combined with the voltage from the FREQUENCY control. This sweep plus tune signal voltage is applied to the main coil of the YIG oscillator (see Service Sheet 7). The attenuation factor for each position of the SCAN WIDTH switch is contained in the Simplified Scan Width Voltage Divider Circuit.

TROUBLESHOOTING PROCEDURE

SCAN WIDTH ATTENUATOR

There are no active components in the voltage divider circuit. The sweep voltage from the IF Section can be used to check the divider ’circuitry. With the n=1 BAND selected and SCAN MODE set to SINGLE, -5.00 volts is applied to the input of the scan width attenuator. This voltage is available for measurement at the SCAN IN/OUT connector on the IF Section and can be traced through the switching and 1/n attenuator circuitry on Service Sheet 8 to the circuitry shown on Service Sheet 12. The attenuator output on the 93 wire can be measured at A5TP5 and the 938 wire can be measured at A4TP5. Use a digital voltmeter such as the HP 3440/3443 to measure the attenuator output. The chart associated with the simplified schematic contains the voltage level for each position of the SCAN WIDTH PER DIVISION switch. Connector A1P6 can be removed to isolate the voltage divider from the active circuits and an ohmmeter used for point-to-point measurements. For narrow sweep widths, 500 kHz or less, connect between A1P6 pin 37 and pin 39. For wide sweep widths connect between pins 37 and 38. Use the simplified circuit diagram to assist in checking the series resistance between the pins of A1P6 and to chassis ground. (See connector illustration facing Service Sheet 16.)

EQUIPMENT REQUIRED

Volt-Ohm-Ammeter .... HP 412A
Digital Voltmeter .... HP 3440A/3443A
Service Kit .... HP 08555-60077

TEST PROCEDURE

Perform the troubleshooting procedure listed above and compare voltages with those listed in schematic diagram chart. Perform a point-to-point check to isolate to the component level.

A1A4, A6, A10
Band Code Switch Logic,
SERVICE SHEET 11

SERVICE SHEET 12 (cont'd)

SCAN WIDTH	S1	S2	S3	Attenuation Factor	Output Voltage *	
200 MHz	-	1	-	Eo = Ein	-5.00 Vdc	93 wire to YIG Driver Sweep Buffer A5TP5
100 MHz	1	2	-	Eo = Ein/2	-2.50 Vdc	
50 MHz	1	3	-	Eo = Ein/4	-1.25 Vdc	
20 MHz	1	4	-	Eo = 0.1 Ein	-500 mVdc	
10 MHz	2	2	-	Eo = .05 Ein	-250 mVdc	
5 MHz	2	3	-	Eo = .025 Ein	-125 mVdc	
2 MHz	2	4	-	Eo = .01 Ein	- 50 mVdc	
1 MHz	3	2	-	Eo = .005 Ein	- 25 mVdc	
500 kHz	1	5	2	Eo = Ein/4	-1.25 Vdc	938 wire to Scan + Fine Tune Summing Ampl. A4TP5
200 kHz	1	5	3	Eo = 0.1 Ein	-500 mVdc	
100 kHz	2	5	1	Eo = .05 Ein	-250 mVdc	
50 kHz	2	5	2	Eo = .025 Ein	-125 mVdc	
20 kHz	2	5	3	Eo = .01 Ein	- 50 mVdc	
10 kHz	3	5	1	Eo = .005 Ein	- 25 mVdc	
5 kHz	3	5	2	Eo = .0025 Ein	- 12.5 mVdc	
2 kHz	3	5	3	Eo = .001 Ein	- 5 mVdc	

*See Troubleshooting Procedure for measurement conditions.

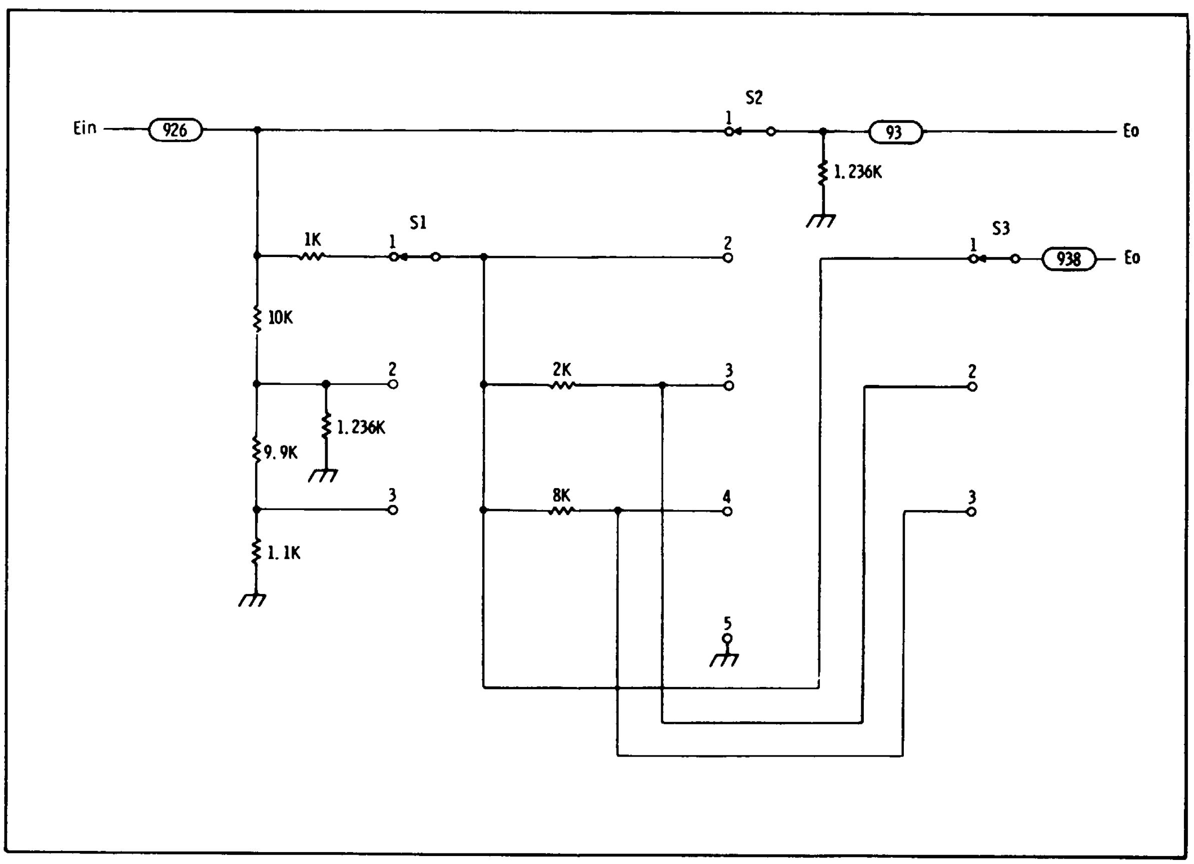


Figure 8-59. Simplified Scan Width Circuit

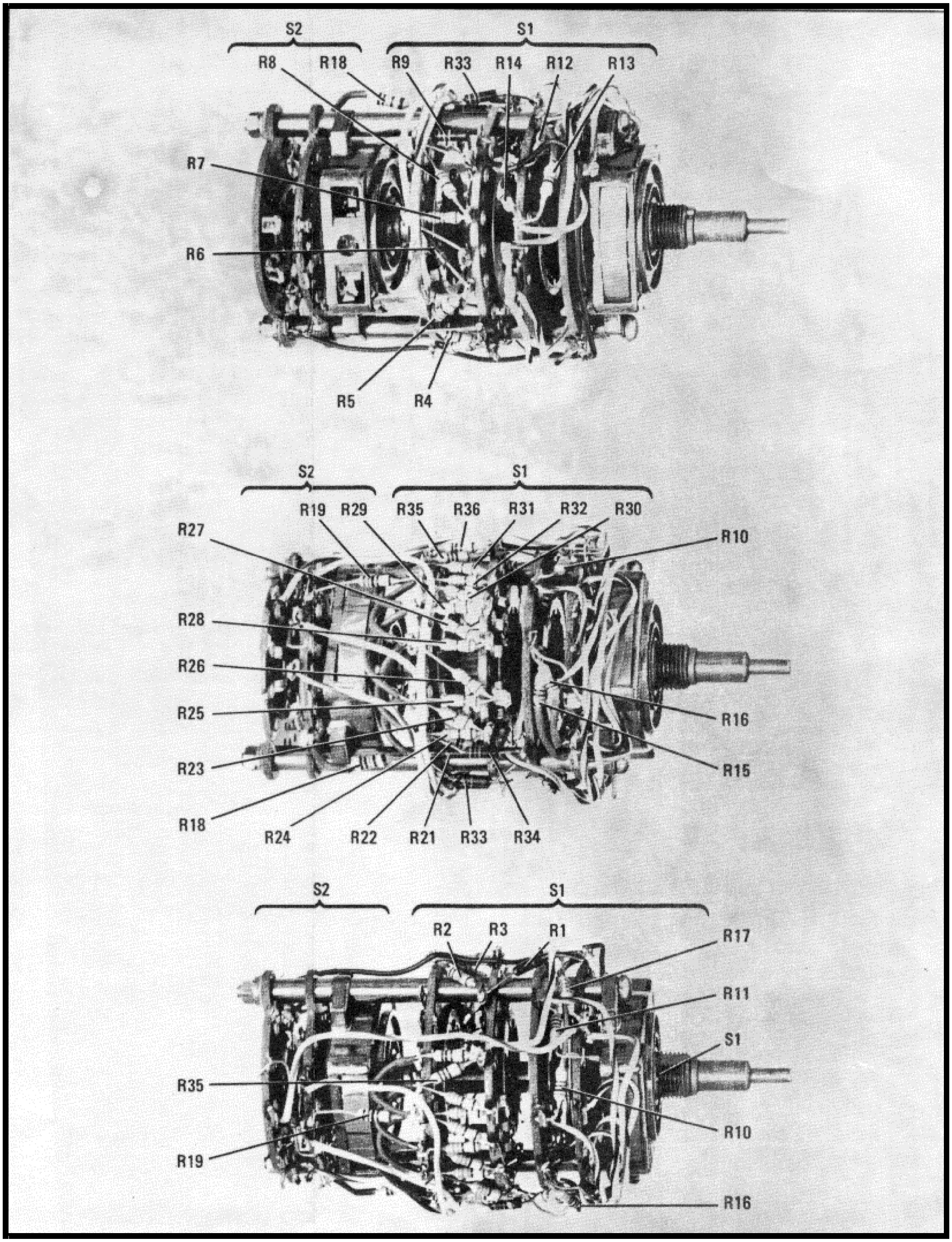
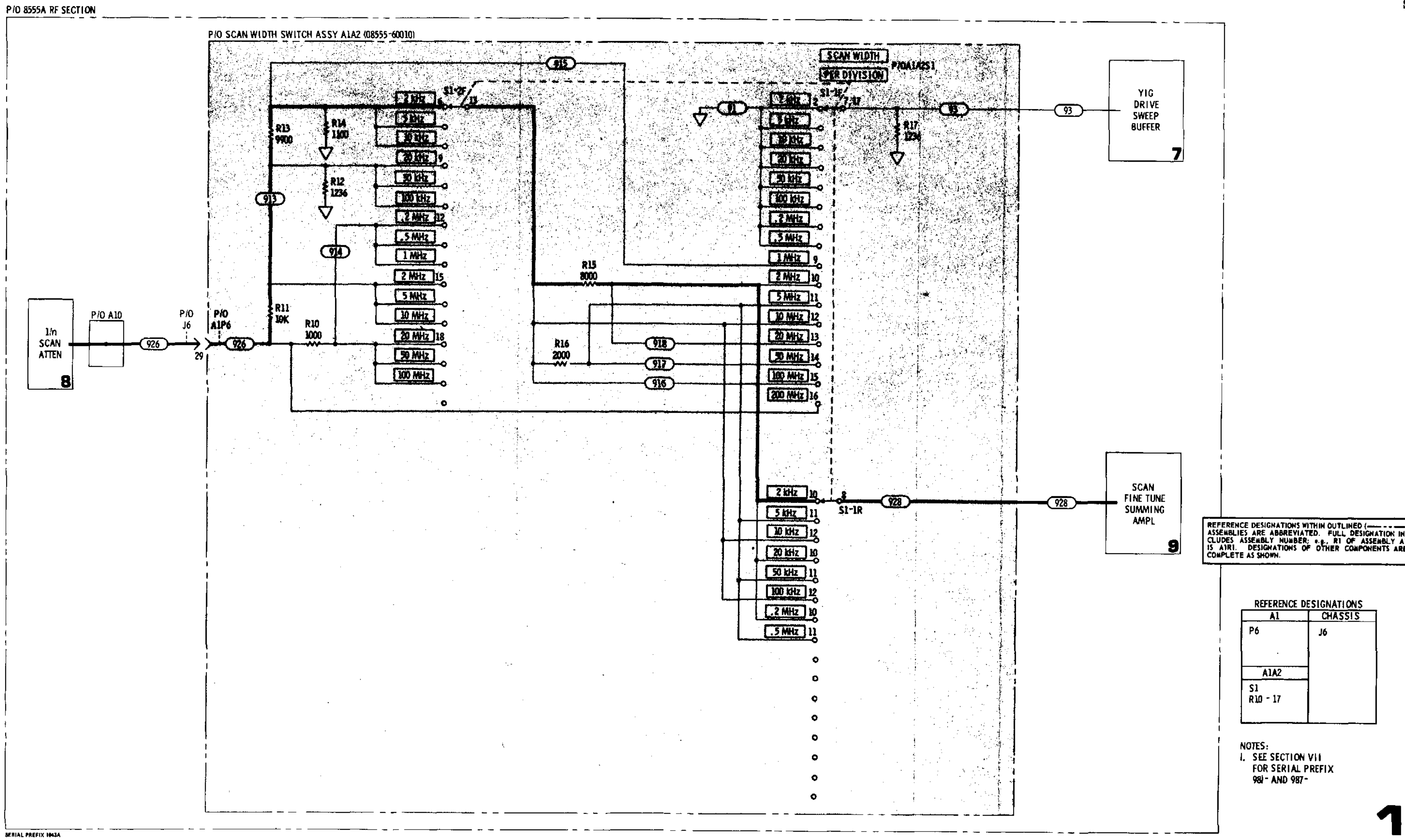


Figure 8-60. Scan Width Switch Assembly A1A2



REFERENCE DESIGNATIONS	
A1	CHASSIS
P6	J6
A1A2	
S1 R10 - 17	

NOTES:
1. SEE SECTION VII FOR SERIAL PREFIX 981- AND 987-

12

Figure 8-61. Scan Width Switch Assembly A1A2

SERVICE SHEET 13

THEORY OF OPERATION

1 ANALOGIC

Service Sheet 13 contains the schematic diagram for the Refer to the IF Section Operating and Service Manual for circuit. Refer to the IF Section Operating and Service Manual for the balance of the Analogic circuit.

The Analogic circuit is basically a small analog computer which uses resistor networks to weight the SCAN WIDTH and BANDWIDTH switches in the RF Section and the SCAN TIME PER DIVISION and VIDEO FILTER switches in the IF Section. When the switches are set to any combination of positions which do not permit accurate amplitude calibration of the analyzer (i.e., the amplitude error due to excessive sweep rate might be larger than 0.5 dB), the DISPLAY UNCAL lamp is caused to illuminate. The light will be on when the BANDWIDTH is too narrow or the SCAN WIDTH PER DIVISION is too wide for the position of the VIDEO FILTER and SCAN TIME switches. The Analogic circuit generates a simulated signal according to the position of the switches and has no actual connection to the analyzer signal processing circuits.

The switch wafers associated with the Analogic circuit controls which resistors are connected in parallel between the -10 Vdc supply and each of the two input lines of the Analogic threshold and light driver circuits in the IF Section. The normal analog line (957 wire) is responsible for enabling the threshold and light driver circuit with the VIDEO FILTER OFF. When the VIDEO FILTER is ON, the video filter analog line (956 wire) has control. At any time that the total resistance between the -10 Vdc supply and either input line is below a set value, the current will be sufficient to enable the threshold and light driver circuit, causing the DISPLAY UNCAL light to illuminate.

In the SCAN WIDTH PER DIVISION mode the resistive networks for the BANDWIDTH and SCAN WIDTH PER DIVISION switches are connected in parallel (along with the VIDEO FILTER and SCAN TIME PER DIVISION resistive networks in the IF Section). With a BANDWIDTH switch setting of 300 kHz and a SCAN WIDTH PER DIVISION switch setting of 2 kHz only resistors R21 and R22 are connected in parallel with the resistive networks in the IF Section. (See Simplified RF Section Analogic Circuit.) As the SCAN WIDTH PER DIVISION switch is increased to 200 MHz PER DIVISION or the BANDWIDTH switch is decreased to 0.1 kHz additional resistors are switched in the circuit.

In the FULL scan mode of operation, only resistors R18 and R19 are in parallel with the resistive networks in the IF Section.

In the ZERO scan mode, only the resistive network associated with the VIDEO FILTER (IF Section) is connected into the Analogic circuit. This by itself cannot turn on the DISPLAY UNCAL lamp.

TROUBLESHOOTING PROCEDURE

When a malfunction has been isolated to the RF Section Analogic circuit or to isolate a malfunction in the RF Section Analogic circuit, perform the following procedure. Remove power from the analyzer and disconnect A1P6 from J6. This isolates the BANDWIDTH and SCAN WIDTH switches from the rest of the analogic circuitry.

EQUIPMENT REQUIRED

Digital Voltmeter HP 3440A/3444A

1 ANALOGIC TROUBLESHOOTING

1-a. Connect the digital voltmeter test leads to A1P6 pin 52 (907 -10 Vdc) and pin 20 (957 analogic line). (See connector illustrations facing Service Sheet 16.) Set digital

SERVICE SHEET 13 (cont'd)

voltmeter FUNCTION to OHMS and RANGE to 1000 WIDTH to 100K. Set RF SECTION SCAN WIDTH to PER DIVISION, SCAN WIDTH PER DIVISION to 2 kHz and BANDWIDTH to 300 kHz. Rotate SCAN WIDTH PER DIVISION switch from 2 kHz through 200 MHz and compare with resistance given in the table below. Readings should be within 5% of the values shown.

1-b. Connect the digital voltmeter between A1P6, pin 52 and pin 19 (956 analogic line). Rotate SCAN WIDTH PER DIVISION switch from 200 Mhz back to 2 kHz.

1-c. Rotate BANDWIDTH switch from 300 kHz through 0.1 kHz and compare with resistance given in the table.

1-d. Connect digital voltmeter test leads between A1P6, pin 52 and pin 20. Rotate BANDWIDTH switch from 0.1 kHz to 300 kHz and compare with resistance table.

1-e. Rotate SCAN WIDTH to FULL scan. Check resistance between A1P6, pin 52 and pin 20 (same connection as step 1-d). Move test lead from pin 20 to pin 19 to complete the comparison with the values shown in the table. Reading taken should be within 5% of the values shown.

1-f. If resistance values are incorrect, use the simplified analogic circuit to help determine which resistors or wafer contacts could be defective. Check individual resistor and switch wafers. See component location illustrations.

2 SWITCH TROUBLESHOOTING

2-a. With SCAN WIDTH switch in the PER DIVISION and in FULL scan modes, measure resistance between A1P6, pin 52 (907 wire) and A1P6, pin 21 (958 wire), to check the -10 Vdc supply to the IF Section analogic. Resistance should be 0 ohms. In ZERO scan, resistance should be infinity.

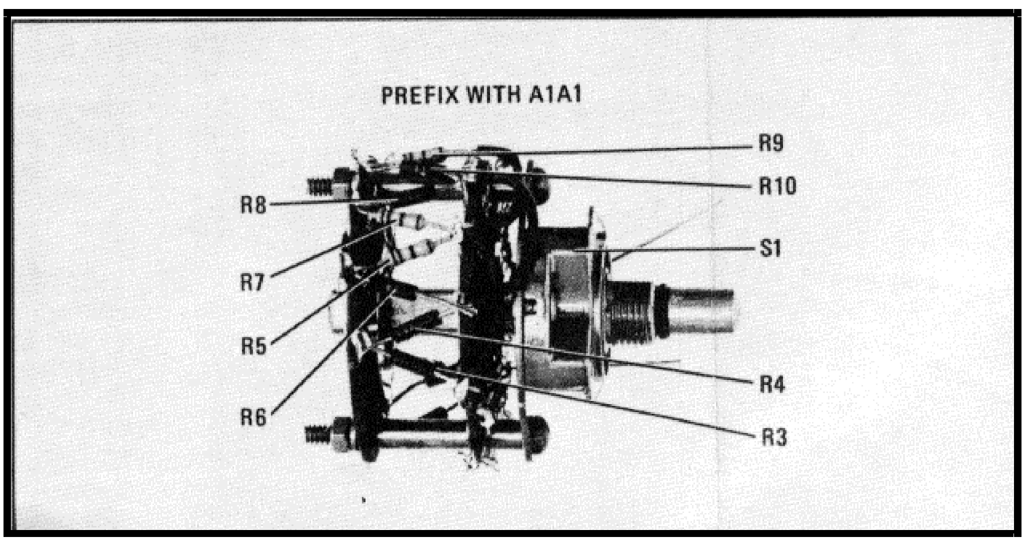


Figure 8-62. Bandwidth Switch Assembly A1A1

SERVICE SHEET 13 (cont'd)

SCAN WIDTH PER DIVISION (a)	(907 Wire, A1P6-67) to (957 Wire, A1P6-25)	907 Wire, A1P6-67) to (956 Wire, A1P6-24)
2 kHz	41.5K	44.3K
5 kHz	36.5K	39 K
10 kHz	32.7K	35 K
20 kHz	29.8K	31.8K
50 kHz	27.5K	29.2K
100 kHz	25.5K	27.2K
.2 MHz	23.9K	25.4K
.5 MHz	22.5K	23.9K
1 MHz	21.4K	22.6K
2 MHz	20.3K	21.5K
5 MHz	19.4K	20.5K
10 MHz	18.6K	19.7K
20 MHz	17.9K	18.9K
50 MHz	17.3K	18.2K
100 MHz	16.7K	17.6K
200 MHz	16.2K	17.1K
BANDWIDTH (b)		
300 kHz	41.4K	44.3K
100 kHz	31.1K	25.2K
30 kHz	25.1K	29.9K
10 kHz	21.1K	26.5K
3 kHz	18.3K	23.9K
1 kHz	16.3K	22.1K
.3 kHz	14.7K	20.8K
.1 kHz	13.5K	19.7K
SCAN WIDTH		
FULL	14.3K	14.9K

(a) BANDWIDTH at 300 kHz.
(b) SCAN WIDTH at 2 kHz PER DIVISION

Simplified Diagram Switching Logic

SCAN WIDTH PER DIVISION	Switches Closed	BANDWIDTH Switch	Switches Closed
2kHz	None		
5kHz	1		
10Hz	1, 2	0.3kHz	1,2,3,4
20kHz	1,2,3	1kHz	1,2,3
50kHz	1,2,3,4	1kHz	1,2
100kHz	7	10kHz	2,3,4
0.2MHz	1,7	30kHz	2,3
0.5MHz	1,2,7	100MHz	2
1MHz	1,2,3,7	300kHz	None
2MHz	1,2,3,4,7	300MHz	None
5MHz	6		
10MHz	1,6		
20MHz	1,2,6		
50MHz	1,2,3,6		
100MHz	1,2,3,4,6		
200MHz	1,2,3,4,5,6		

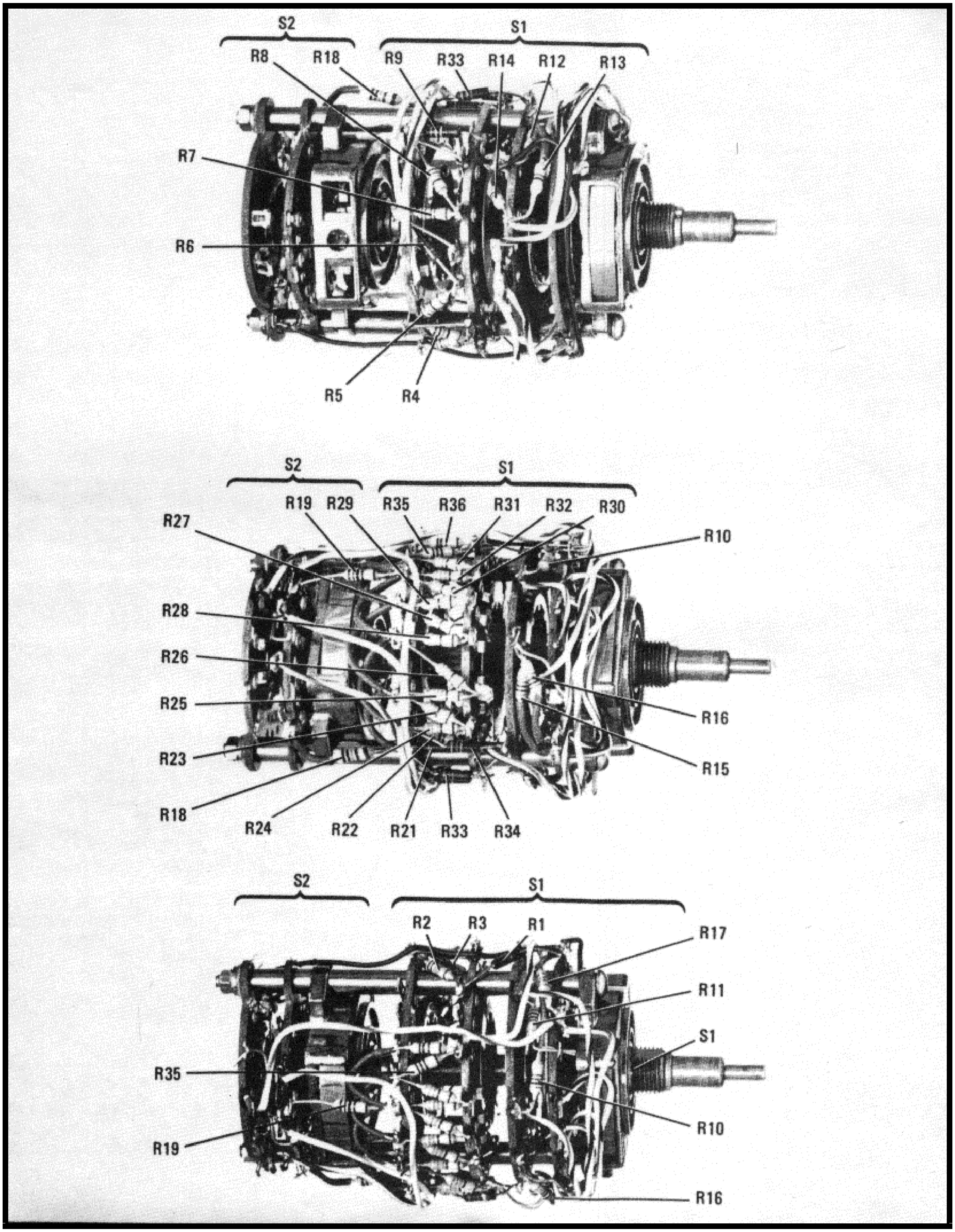


Figure 8-63. Scan Width Switch Assembly A1A2

Model 8555A

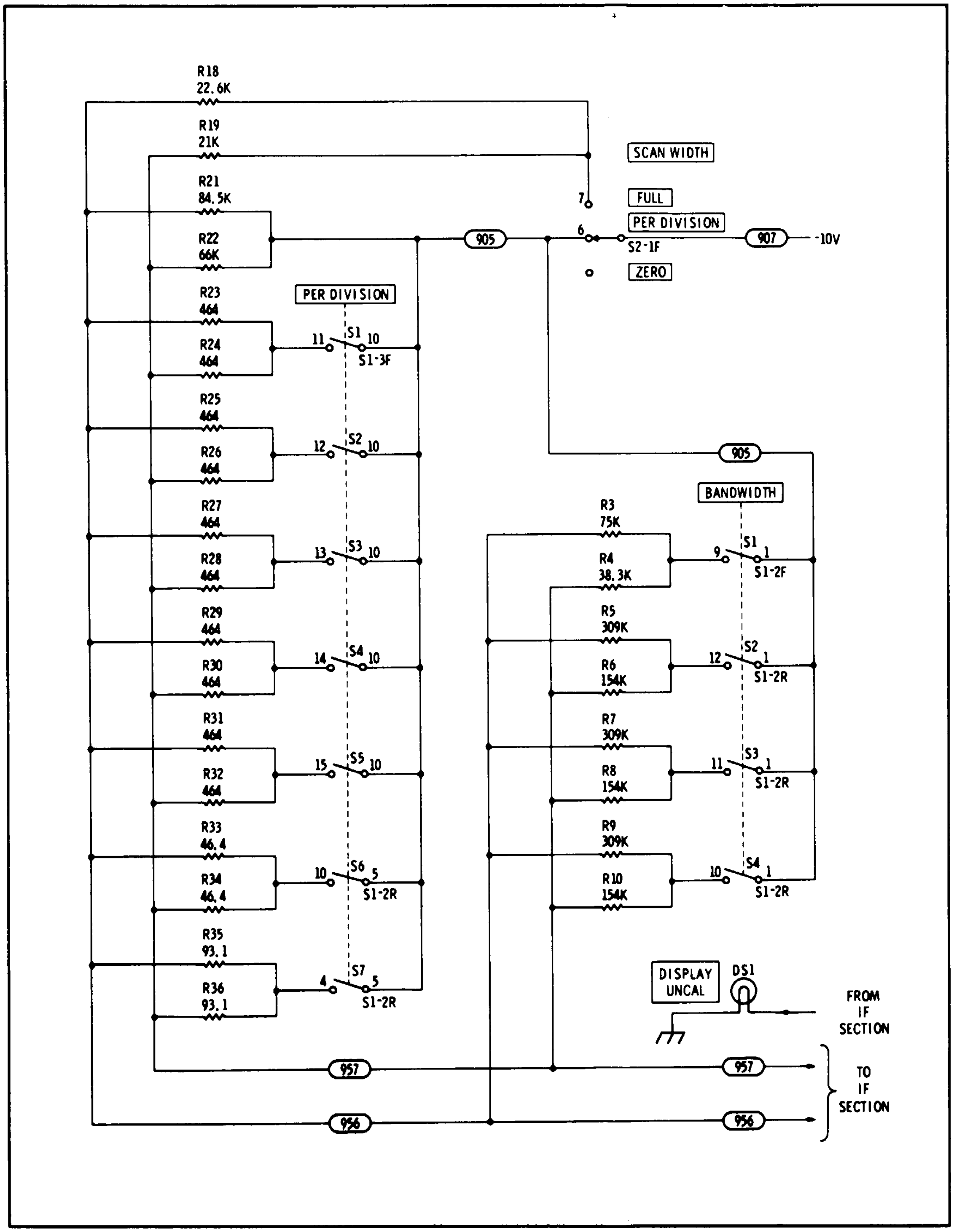


Figure 8-64. Simplified RF Section Analogic Circuit Diagram

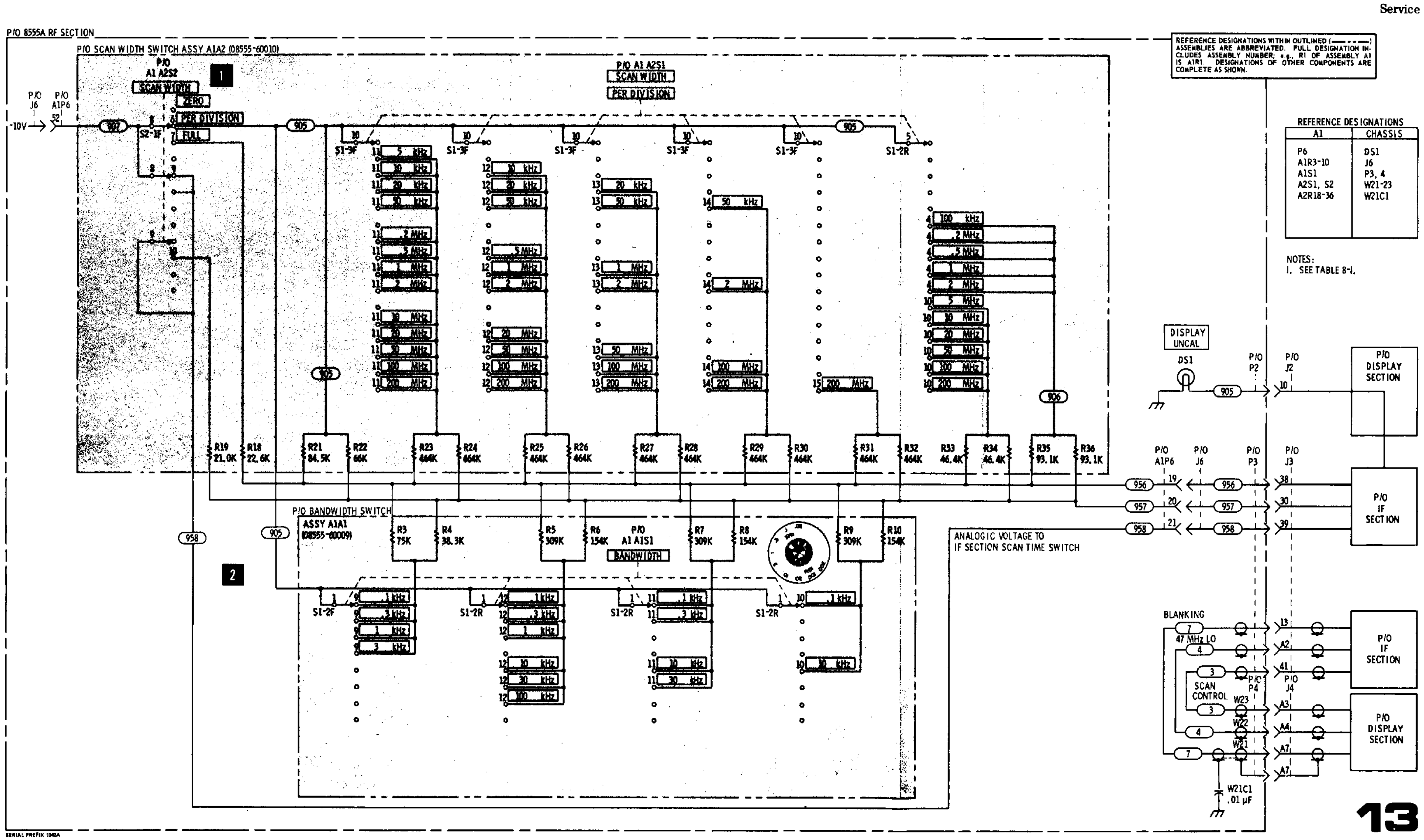


Figure 8-65. RF Section Analogic

SERVICE SHEET 14

THEORY OF OPERATION

Service Sheet 14 contains the schematic diagram for the BANDWIDTH switching, which determines the bandwidth of the 3 MHz IF in the IF Section. The AMPL CAL circuit is also contained on the schematic.

The RF Section contains only the voltage switching circuitry for the IF Section. Actual bandwidth switching is accomplished in the IF Section with diode switches.

1 P/O SCAN WIDTH SWITCH

The switch section shown provides -12.6 volts to the Bandwidth Switch Assembly for use in selecting the desired bandwidths when the analyzer is operated in the ZERO or PER DIVISION modes. In the FULL scan mode this switch removes the -12.6 volts from the Bandwidth Switch and connects it directly to the 923 control line to select the 300 kHz bandwidth.

2 P/O BANDWIDTH SWITCH

This portion of the BANDWIDTH switch provides negative and/or positive voltages from the RF Section to the IF Section bandwidth switching circuitry. The switching provides +20 volts to the 0.1, 0.3, 1, 30 and 100 kHz control lines except for the control line of the bandwidth selected. The selected bandwidth control line has -12.6 volts applied. (See IF Section Operating and Service Manual for the 3 MHz bandwidth switching.)

3 AMPLITUDE CALIBRATION CIRCUIT

The amplitude calibration circuit controls the gain of the 3 MHz calibration amplifier in the IF Section. Resistor A1R2 is an operator adjustment (front panel screwdriver adjustment) to compensate for overall gain variations between RF and IF Sections. The circuit is adjusted to provide absolute amplitude calibration of the displayed signal. See IF Section Operating and Service Manual (3 Mhz Amplifier Assy) for the balance of the circuitry.

TROUBLESHOOTING PROCEDURE

When a malfunction has been isolated to the RF Section or to isolate a switching or wiring malfunction in the RF Section, perform the following procedure. Remove power from the analyzer and disconnect A1P6 from J6. This isolates the BANDWIDTH switch, the SCAN WIDTH switch, and the AMPL CAL circuitry from the chassis wiring.

EQUIPMENT REQUIRED

Digital Voltmeter .... HP 3440A/3444A

TEST PROCEDURES

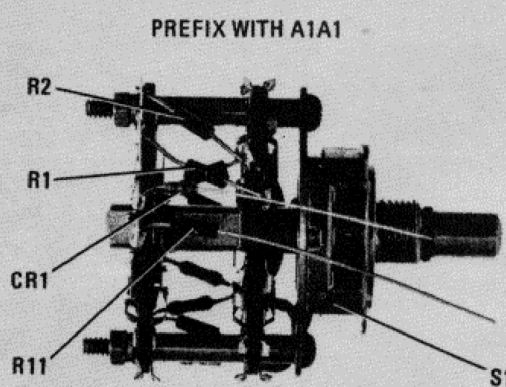
1. Connect the digital voltmeter test leads to A1P6, pin 66 (97, -12.6 Vdc line and pin 53 (923, 300 kHz line). (See illustrations facing Service Sheet 16 for connector pin locations and wire color codes.) Set digital voltmeter FUNCTION to OHMS and RANGE to 1000.

SERVICE SHEET 14 (cont'd)

Set analyzer SCAN WIDTH to FULL and BANDWIDTH to 300 kHz. Resistance should be 0 ohms. Set SCAN WIDTH to ZERO. Resistance between A1P6, pin 51 and pin 42 should be 10 ohms (AlAiR1). Switch SCAN WIDTH to PER DIVISION, resistance should remain 10 ohms. Check each of the other bandwidth switching lines by checking between A1P6, pin 51, and pins 42, 41, 40, 39, 38, 37, and 36. Note there is no 3 kHz switching line (see schematic diagram).

Connect meter leads to A1P6, pin 51 and pin 36 (0.1 kHz bandwidth selection line). Resistance should be 100 ohms for all positions of the BANDWIDTH switch except 0.1 kHz. Measure resistance between pin 51 and pins 37, 38, 40, and 41. Resistance should be 100 ohms for all positions of the BANDWIDTH except that position associated with the selection under test.

Check the AMPL CAL line by measuring resistance between A1P6, pins 53 and 18. Actual value will depend on setting of AMPL CAL potentiometer.



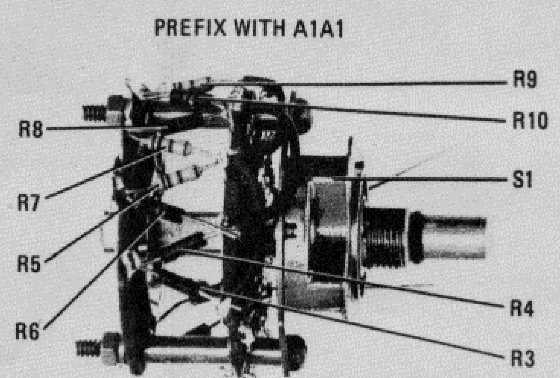


Figure 8-66. Bandwidth Switch Assembly A1A1

Service

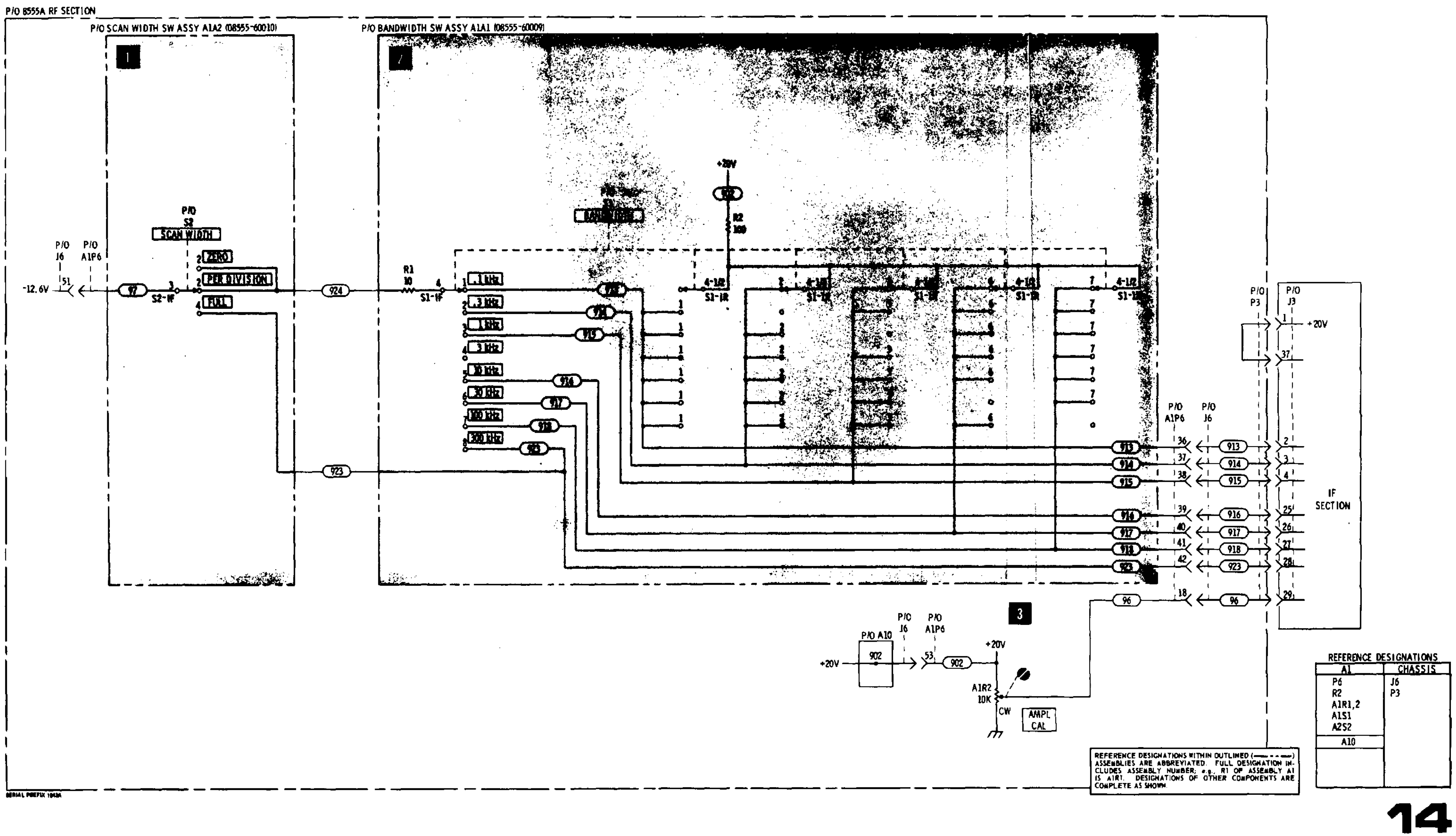


Figure 8-67. Bandwidth Switching and Ampl Cal

SERVICE SHEET 15

THEORY OF OPERATION

Service Sheet 15 contains the schematic diagram for the Switching Regulator Assy A9 and the +10, +20 Volt Regulator Assy A8. The +100 volt supply, from the Display Section, is converted to approximately +26 volts by the switching regulator. A switching regulator is used as it is much more efficient than a conventional series regulator when there is a large difference between input and output voltages. (In this case power consumption is approximately 22 watts less than it would have been if a conventional series regulator had been used.)

The +20 volt switching regulator output is not used directly to power any circuits in the instruments, but is reduced to +20 and +10 volts by conventional series voltage regulators. These "post" regulators provide better regulation and lower ripple than obtainable from the switching regulator.

1 SWITCHING REGULATOR

A simplified switching regulator circuit is shown below. When switch S is closed, capacitor C is charged through inductor L, toward the input voltage level. However, before C reaches the input level, S is opened. When S is opened, diode D provides a path for current which had been established in L. By operating S at a fast rate the voltage pulses at the switch are filtered by L and C and the average voltage level of the pulses is developed across the load. The average voltage level is dependent on the ratio of the "on" to "off" time of switch S.

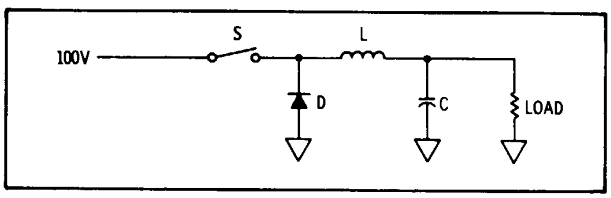


Figure 8-68. Switching Regulator Simplified Diagram

Transistor A9A1Q2 (Figure 8-72) functions as the regulator switch. The transistor is switched "on" and "off" completely rather than functioning as a variable resistor series pass element. Operating in this manner the efficiency of the regulator approaches 100%. Transformer T1 functions both as an inductor and a transformer. Winding 5 and 8 act as an inductor (L) and capacitor C7 is the output capacitor (C). Winding 1 and 4 provides regenerative (positive) feedback to the bases of the switching transistors This ensures rapid and complete switching action. Diodes CR3 and CR4 provide a path for current flowing in the inductor when the switching transistors are turned "off". Transistors U1D and U1E and their associated circuitry form an astable multivibrator that controls the switching transistors (U1 is an integrated circuit transistor array, consisting of five identical transistors). The multivibrator operates at a switching rate of about 100 kHz to provide positive and negative pulses to trigger the switching transistors. Negative pulses are coupled through C3 and CR1 to the transistor bases; while positive pulses are coupled through C3 and amplified by Q1.

Timing of the multivibrator is modified by the comparison amplifier U1A-U1B and/or current limit sense transistor U1C. The reference for the comparison amplifier is established at the base of U1A. If the output voltage is too high, conduction by transistor U1B will delay generation of a "turn-on" pulse and reduce the length of the pulse by means of the current limit sense transistor U1C. During initial "turn-on", the current limit circuit is active and allows capacitor C7 to charge in a series of steps.

2 +10, +20 VOLT REGULATOR ASSEMBLY A8

The +10 and +20 Volt regulators are series voltage regulation circuits, employing negative feedback to keep the output voltages constant. The +26 volts from the

SERVICE SHEET 15 (cont'd)

switching regulator is filtered by A8L1 and C1, to reduce the 100 kHz ripple, before being applied to the regulator circuits.

2-a. +20 VOLT REGULATOR

Transistor Q2 is the series regulator and functions as a variable resistance in series with the output. The conduction of this transistor is controlled by operational amplifier U2.

A fixed reference voltage from breakdown diode CR1 is filtered by R1 and C2 and applied to pin 3 of U2. The voltage from an adjustable voltage divider, on the +20 volt sense line, is applied to pin 2 with the voltage adjust potentiometer R5 controlling the output voltage.

Operational amplifier U2 functions as a comparison and control amplifier. U2 will control the conduction of Q2 such that the voltage at pin 2 is kept within a few microvolts of that at pin 3 (there will be an additional few millivolts difference in these voltages due to offset voltage error). This action will keep the output voltage essentially constant.

When the current requirements of the external circuitry increases, the output voltage will decrease and cause a reduction of the voltage at pin 2 of U2. This will cause an increase in the voltage at pin 6 of U2, Q2 will conduct more heavily and the output voltage will increase to very near the original level. Due to the large gain of U2, only a very small voltage decrease at pin 2 is necessary to greatly increase conduction of Q2.

R3 and C3 roll off the frequency response of the feedback loop to prevent the circuit from oscillating.

Over current protection is provided by the current limiter in the Switching Regulator Assembly A9.

Overvoltage protection for both the regulator and external circuits is provided by a "Crowbar" circuit. SCR CR7 will short the output of the regulator to ground if the output voltage should rise to approximately 24.2 volts. At this voltage CR8 will conduct current into the gate of the SCR turning it on. The SCR will remain in conduction until power to the regulator is removed. R11 prevents the SCR from being turned on by leakage currents in CR8. Diode CR3 prevents a negative voltage from being developed across the +20 volt line if a negative supply should short to the line.

2-b. +10 VOLT REGULATOR

The operation of the +10 volt regulator circuit is identical to that of the +20 volt regulator; except for the circuitry on the inputs of the operational amplifier. The reference voltage at pin 3 of U1 is obtained by the R7 and R8 voltage divider from the +20 volt sense line. The voltage at pin 2 of U1 is obtained directly from the +10 volt sense line, not through a voltage divider. The voltage adjust potentiometer R5 sets the +20 volt output which then sets the +10 volt output by establishing a +10 volt reference at pin 2 of U1.

TROUBLESHOOTING PROCEDURE

When a malfunction has been isolated to the switching regulator and +10/+20 power supply circuitry or to isolate a malfunction in the circuitry, perform the following procedure. Remove power from analyzer and install the +10/+20 volt Power Supply Assy A8 on an extender board.

SERVICE SHEET 15 (cont'd)

EQUIPMENT REQUIRED

Digital Voltmeter .... HP 3440A/3444A
Oscilloscope .... HP 180A/1801A/1821A
83 Ohm Load (100 ohm and 500 ohm 20 watt resistor connected in parallel)..
Power Supply.. HP 6205B

1 SWITCHING REGULATOR TROUBLESHOOTING

1-a. A malfunction in the switching regulator will normally blow the +100 volt fuse in the Display Section power supply. To isolate the malfunction to the switching regulator, remove the +10;+20 volt power supply and measure the open circuit voltage at A9C2. Open circuit voltage should be +30 +1.5 volts. If correct voltage is observed, connect a resistive load between A9C2 and chassis ground. Check voltage under load. Typical output level under normal load should be +26 + 1 volt. If correct voltage is obtained under load, proceed to test procedure 2.

1-b. If normal voltages were not obtained in step 1-a, remove power from analyzer and remove switching regulator from chassis (see removal procedure). Connect the HP 6205B Power Supply to provide +100 volts to the switching regulator. Connect the 83-ohm load across the regulator output. Check output voltage; typically +26 ±1 volt.

1-c. If there is no output (step 1-b) check diodes A9A1CR2 through CR4 and transistors Q2 and Q3 for shorts. If the output voltage is low or high check transistor array A9AlU1.

1-d. Use the typical voltage levels and waveforms below to isolate to the component level if system operation is marginal. Voltages and waveforms are for a normal system operating under normal load conditions.

2 +10, +20V POWER SUPPLY TROUBLESHOOTING

2-a. Install Power Supply Assy A8 on extender board. Note: Power Supply Assy secured to Interconnect Assy A10 with two screws. With power remove check resistance at A8 pins 5 and 3 to chassis ground. Typical values, pin 5 to chassis 750 ohms, pin 3 to chassis 2.2K ohms. Typical values from XA8 pin 5 to chassis 810 ohms and pin 3 to chassis 2.3K ohms with power supply assy removed from chassis. Install power supply on extender board, apply power and check voltage level at test points 1 and 2.

2-b. The voltage regulators function as a "closed loop". Generally, malfunction of almost any component may affect dc levels at all points in the circuit. Likewise a malfunction in either supply could affect the other. The +10 volt supply can be isolated from the +20 volt supply by removing one end of resistor A8R7. The +20 volt supply can then be checked independently.

2-c. Generally, if the output is completely missing or consistently high, the series regulator should be checked first for an open or shorted condition. Also, if voltage is high the SCR crowbar should be checked.

2-d. The HP 3440/3443A should be used to check for the presence or absence of dc levels. The HP 412A should be used for point-to-point resistance measurements.

2-e. After repairs have been accomplished, perform the power supply adjustment procedure in Section V. Secure the power supply to the interconnect assembly with the two screws removed in step 2-a above.

SERVICE SHEET 15 (cont'd)

A9 Switching Regulator Voltage Measurements

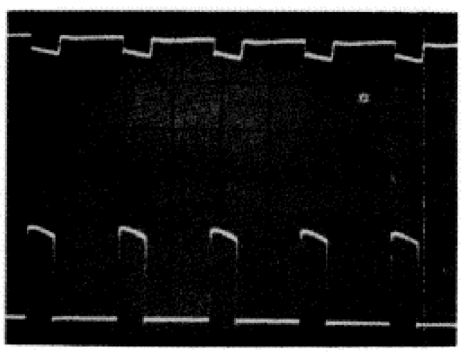
Conditions: Switching Regulator removed from RF Section. +100 volts applied A9C1, 83-ohm load connected across output. (A 100-ohm and 500-ohm 20-watt resistor connected in parallel, provide a load equivalent to a normal supply load.) Typical Vdc levels indicated.

TPA	+26.15								
A9A1U1	Pin 1	+26.25	Pin 5	+26.60	Pin 9	+27.0	Pin 13	+26.25	
	Pin 2	+19.96	Pin 6	+26.83	Pin 10	+26.25	Pin 14	+30.66	
	Pin 3	+19.30	Pin 7	+26.25	Pin 11	+27.85			
	Pin 4	+19.96	Pin 8	+26.60	Pin 12	+26.60			

	Emitter	**Base**	**Collector**
A9A1Q1	+99.2	+99.4	+99.3
A9A1Q2	+99.2	+99.2	+26.96

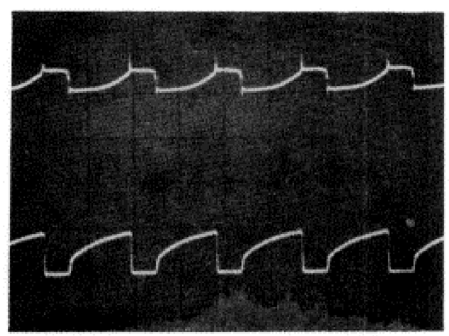
Waveforms: A9 Switching Regulator

Conditions: Same as for voltage measurements



A

B



A

B

A	B	A	B
A9A1Q1 Emitter	A9A1Q2 Collector	A9A1U1E Base	U1E Collector
Volts/Div: 10	Volts/Div: 50	Volts/Div: 2	Volts/Div: 10
Time/Div: µ5 sec	Time/Div: 5 µsec	Time/Div: 5 µsec	Time/Div: 5 µsec

REMOVAL AND REPLACEMENT PROCEDURES

See Service Sheet 18.

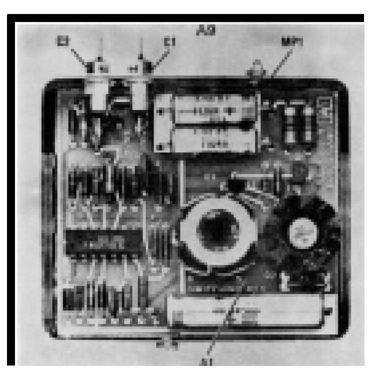


Figure 8-69. Switching Regulator Assembly A9

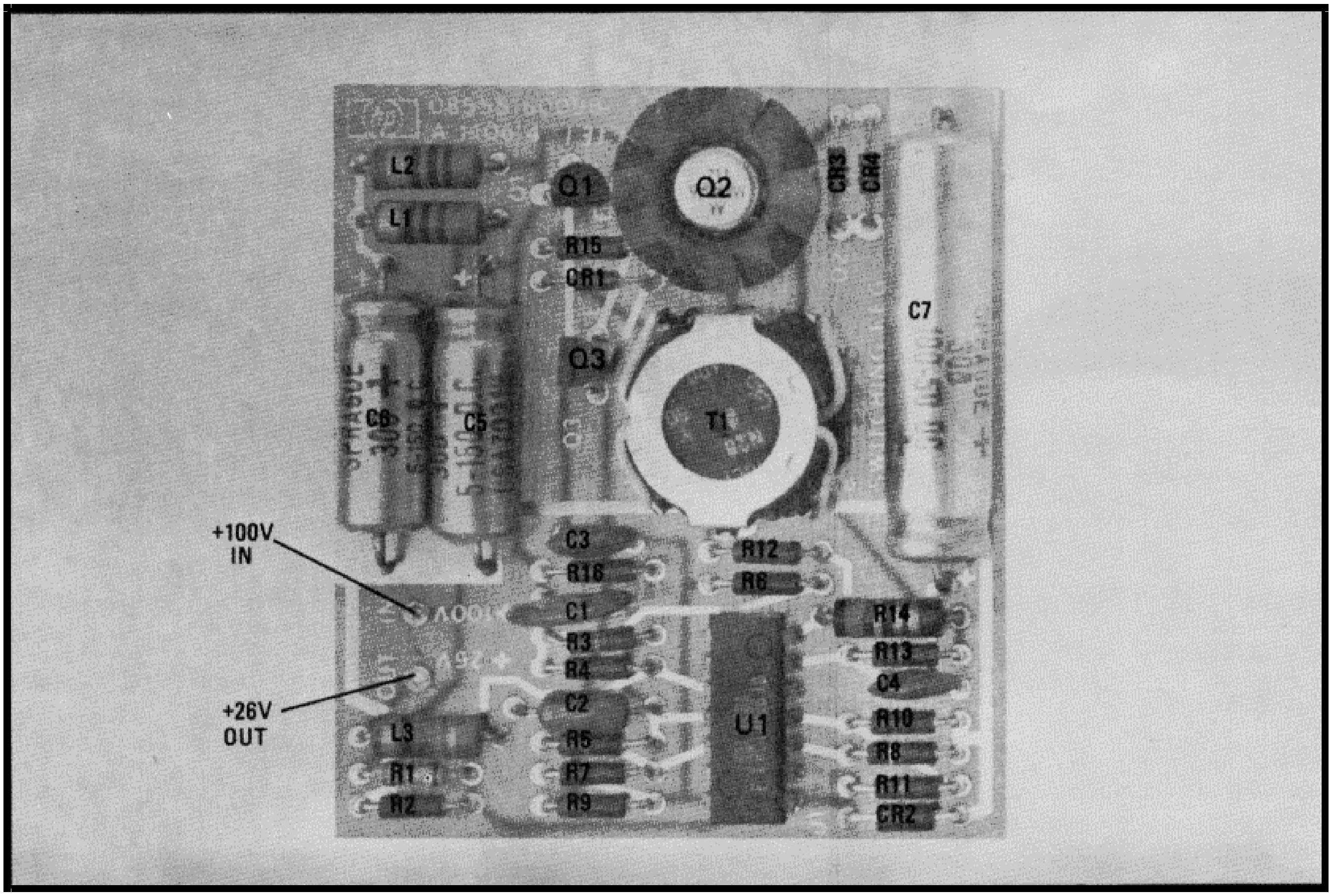


Figure 8-70. Switching Regulator board Assembly A9A1

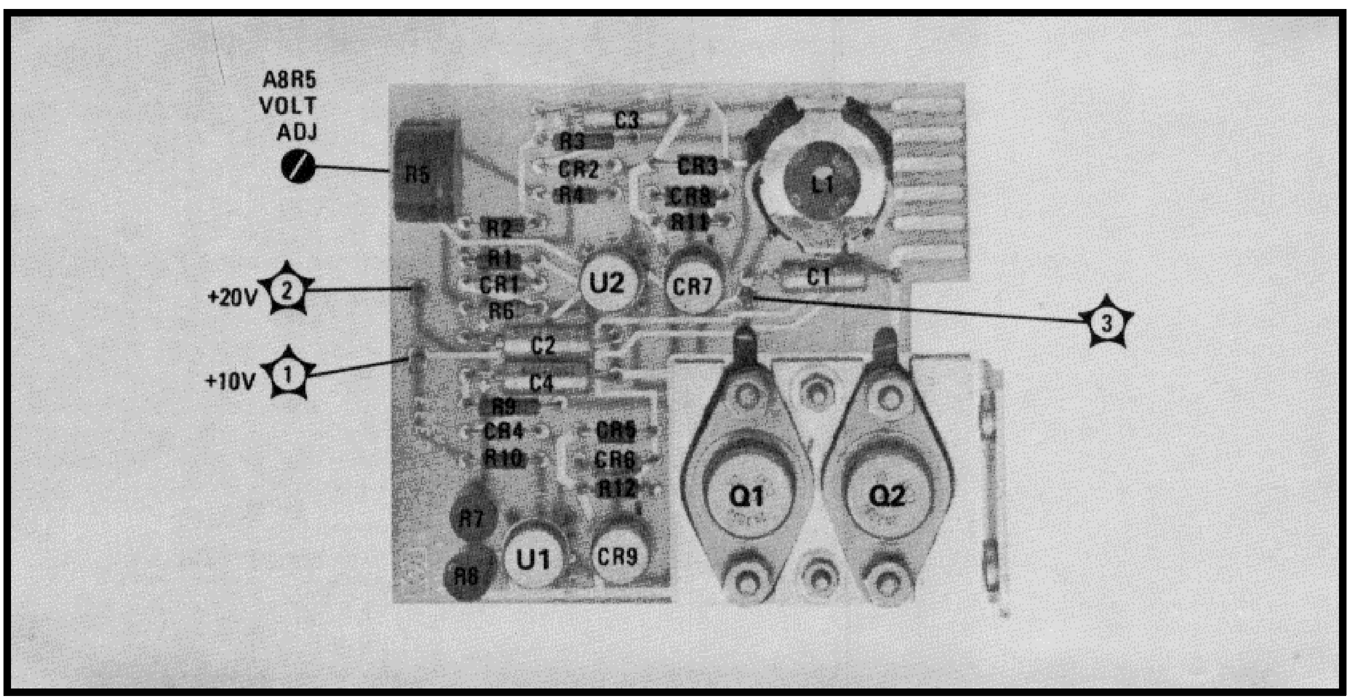
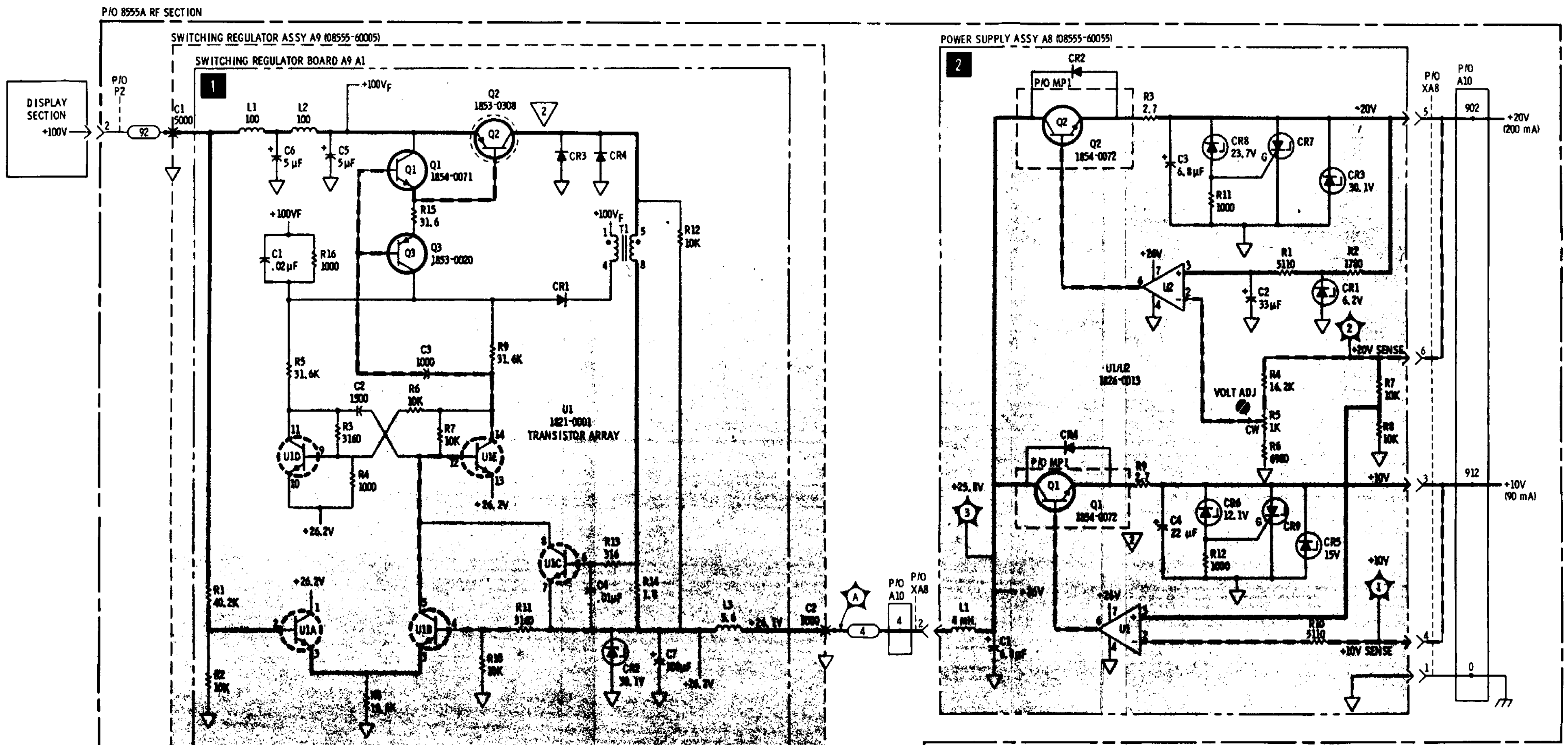


Figure 8-71. +10/+20 Volt Power Supply Assembly A8



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

NOTES:
1. SEE TABLE 8-1.
2 SEE SECTION VII

REFERENCE DESIGNATORS

A8	A9	A9A1
C1-4 CR1-9 L1 MP1 Q1,2 R1-12 U1-2	C1,2 A9A1 A1C1-7 A1CR1-4 A1L1-3 A1Q1-3 A1R1-17	T1 U1
		A10
		CHASSIS
		P2 XA8

15

Figure 8-72. Switching Regulator and +10/+20 Volt Power Supply

SERVICE SHEET 16

Table 8-5. RF Section Chassis Wiring from Connector J6 (1 of 2)

From J6 Pin No.	Wire Color Code	Function	To	Service Sheet
1	1	-12.6V Ground Return	P2-8	2
2	903	VCXO Sweep Input	A14C6	10
3	908	External Mixer Bias	A12	2
4	946	Signal Identifier Attenuator Output	A10-946	6
5	4	Attenuator Driver Trigger	A10-4	2
6	8	Attenuator Driver Output	A10-8	2
7	901	Frequency Tun Pot. Output	A10-901	7
8	904	VCXO Sweep Driver Output	A10-904	10
9	906	Fine Tune Pot. Output	A10-906	9
10	914	A Bit Band Code	A10-914	11
11	915	B Bit Band Code	A10-915	11
12	916	C Bit Band Code	A10-916	11
13	917	D Bit Band Code	A10-917	11
14	918	E Bit Band Code	A10-918	6/11
15	3	-5 to +5V Sweep Ramp	P3-6	7/8
16	5	Linear Gain Compensation Control	P3-7	2
17	6	Linear Gain Compensation Control	P3-8	2
18	96	Ampl. Cal Adjustment	P3-29	14
19	956	Video Filter Analogic Line	P3-38	13
20	957	Normal Analogic Line	P3-30	13
21	958	Analogic -10V Line to IF Section	P3-39	13
22	91	Attenuator Switching Voltage 40 dB	A13	2
23	93	Attenuator Switching Voltage 20 dB	A13	2
24	95	Attenuator Switching Voltage 10 dB	A13	2
25	923	Frequency Tune Pot. -15.2 Volts	A10-923	7
26	924	Frequency Tune Pot. -7.3 Volts	A10-924	7
27	95	Noise Filter Control	A10-95	7
28	925	Per Division Sweep Input	A10-925	6/8
29	926	1/n Atten. Sweep Output	A10-926	12
30	92'7	YIG Driver Sweep Input	A10-927	7
31	928	Scan Atten. (Narrow Scan Output)	A10-928	9/12
32	934	Sweep Buffer Output	A10-934	7
33	935	Sweep plus Tune Ampi Input	A10-935	7
34	936	Sweep plus Tune Signal	A10-936	7
35	937	Full Scan Sweep Signal	A10-937	7
36	913	0.1 kHz Bandwidth Control	P3-2	14
37	914	0.3 kHz Bandwidth Control	P3-3	14
38	915	1 kHz Bandwidth Control	P3-4	14
39	916	10 kHz Bandwidth Control	P3-25	14
40	917	30 kHz Bandwidth Control	P3-26	14
41	918	100 kHz Bandwidth Control	P3-27	14
42	923	300 kHz Bandwidth Control	P3-28	14
43	92	Attenuator Switching Voltage 40 dB	A13	2
44	94	Attenuator Switching Voltage 20 dB	A13	2
45	96	Attenuator Switching Voltage 10 dB	A13	2
46	945	Signal Identifier Attenuator Input	A10-945	6
47	948	Tuning Stabilizer Enable	A10-948	8

SERVICE SHEET 16 (Cont'd)

Table 8-5. RF Section Chassis Wiring from Connector J2 (2 of 2)

From J6 Pin No. Code	Wire Color	Function	To	Service Sheet
48	98	Noise Filter Control	A10-98	7
49	968	Sweep Plus Tune or Full Scan	A10-968	7
50	978	Full Scan Frequency Marker	A10-978	7
51	97	-12.6V Supply	P2-21	2
52	907	-10V Supply	A10-907	9
53	902	+20V Supply	A10-902	14
54	912	+10V Supply	A10-912	2
55	0	Ground Return	A10-0	9
56	938	Signal Identifier Enable	A10-938	6
57	935	Log Ref Level Lamp No. 1	P3-33	2
58	936	Log Ref Level Lamp No. 2	P3-34	2
59	937	Log Ref Level Lamp No. 3	P3-35	2
60	938	Log Ref Level Lamp No. 4	P3-9	2
61	945	Log Ref Level Lamp No. 5	P3-10	2
62	946	Log Ref Level Lamp No. 6	P3-11	2

Table 8-6. Tuning Head Wiring from Connector A1P6 (1 of 2)

From J6 Pin No.	Wire Color Code	Function	To	Service Sheet
1	1	-12.6V Ground Return	A1A3S1-3R5	2
2	903	VCXO Sweep Input	A1A4R3	10
3	908	External Mixer Bias	AlAiCR1	2
4	946	Signal Identifier Attenuator Output	A1A2S1- 3R17	6
5	4	Attenuator Driver Trigger	AlA3S1- 4F6 112	2
6	8	Attenuator Driver Output	A1A3S1- 3R1	2
7	901	Frequency Tune Pot. Output	A1A4R1	7
8	904	VCXO Sweep Driver Output	A1A4R3	10
9	906	Fine Tune Pot. Output	A1A4R2	9
10	914	A Bit Band Code	A1A4SlA	11
11	915	B Bit Band Code	AlA4SlB	11
12	916	C Bit Band Code	AlA4S1C	11
13	917	D Bit Band Code	A1A4S1D	11
14	918	E Bit Band Code	AlA4SlE	6/11
15	3	-5 to +5V Sweep Ramp	AlA2S2-F7	7/8
16	5	Linear Gain Compensation Control	AlA3S1- 4F1 1/2	2
17	6	Linear Gain Compensation Control	A1A3S1- 4F2 1/2	2
18	96	Ampi Cal Adjustment	A1R2	14
19	956	Video Filter Analogic Line	A1A2S2	13

SERVICE SHEET 16 (Cont'd)

Table 8-6. Tuning Head Wiring From Connector A1P6 (2 of 2)

From P6 Pin No.	Wire Color Code	Function	To	Service Sheet
20	957	Normal Filter Analogic Line	A1A2S1	13
21	958	Analogic -10V Line to IF Section	A1A2S1-1F9	13
22	91	Attenuator Switching Voltage, 40 dB	A1A3S1-3R3	2
23	93	Attenuator Switching Voltage, 20 dB	A1A3S1-2F4	2
24	95	Attenuator Switching Voltage, 10 dB	A1A3S1-1R3	2
25	923	Frequency Tune Pot. -15.2 Volts	A1A4R1	7
26	924	Frequency Tune Pot. -7.3 Volts	A1A4R1	7
27	95	Noise Filter Control	A1A2S2-1R8 1/2	7
28	925	Per Division Sweep Input	A1A2S2-2F8	6/8
29	926	1/n Atten. Sweep Output	A1A2S1-2F2	12
30	927	YIG Driver Sweep Input	AlA2S2-2F9	7
31	928	Scan Atten (Narrow Scan Output)	A1A2S1-1R17	9/12
32	934	Sweep Buffer Output	A1A2S2-2F4	7
33	935	Sweep plus Tune Ampi Input	A1A2S2-2F3	7
34	936	Sweep plus Tune Signal	A1A2S2-1R1 1/2	7
35	937	Full Scan Sweep Signal	A1A2S1-1R3 1/2	7
36	913	0.1 kHz Bandwidth Control	A1A1S1-1R1	14
37	914	0.3 kHz Bandwidth Control	A1A1S1-1R2	14
38	915	1 kHz Bandwidth Control	A1A1S1-1R3	14
39	916	10 kHz Bandwidth Control	A1A1S1-1F5	14
40	917	30 kHz Bandwidth Control	A1A1S1-1F6	14
41	918	100 kHz Bandwidth Control	A1A1S1-1F7	14
42	923	300 kHz Bandwidth Control	A1A1S1-1F8	14
43	92	Attenuator Switching Voltage, 40 dB	A1A3S1-3F4	2
44	94	Attenuator Switching Voltage, 20 dB	A1A3S1-2R5	2
45	96	Attenuator Switching Voltage, 10 dB	A1A3S1-1F4	2
46	945	Signal Identifier Attenuator Input	A1A2S1-3R8	6
47	948	Tuning Stabilizer Enable	AlA2S2-1R11 1/2	8
48	98	Noise Filter Control	A1A2S2-1R7 1/2	7
49	968	Sweep Plus Tune or Full Scan	A1A2S2-1R2 1/2	7
50	978	Full Scan Frequency Marker	A1A2S2-2F12	7
51	97	-12.6V Supply	A1A3S1-4F1 1/2	2
52	907	-10V Supply	A1	9
53	902	+20V Supply	A1R3	14
54	912	+10V Supply	A1A1R11	2
55	0	Ground Return	A1	9
56	938	Signal Identifier Enable	A1A2S1-4R17	6
57	935	Log Ret Level Lamp No. 1	A1A3S1-4R2	2
58	936	Log Ref Level Lamp No. 2	A1A3S1-4R1	2
59	937	Log Ref Level Lamp No. 3	A1A3S1-4R8	2
60	938	Log Ref Level Lamp No. 4	AlA3S1-4R7	2
61	945	Log Ref Level Lamp No. 5	A1A3S1-4R6	2
62	946	Log Ref Level Lamp No. 6	A1A3S1-4R5	2

SERVICE SHEET 16 (cont'd)

Table 8-7. RF Section Wiring from Connector P3

From P3 Pin No.	Wire Color Code	Function	To	Service Sheet
1	902	+20V (from pin 37)	P3-37	14
2	913	0.1 kHz Bandwidth Control	P6-47	14
3	914	0.3 kHz Bandwidth Control	P6-48	14
4	915	1 kHz Bandwidth Control	P6-49	14
5	Open			
6	3	-5 to +5V Sweep Ramp	P6-20	8
7	5	Linear Compensation Control	P6-21	2
8	6	Linear Compensation Control	P6-22	2
9	938	Log Ref Level Lamp No. 4	P6-77	2
10	945	Log Ref Level Lamp No. 5	P6-78	2
11	946	Log Ref Level Lamp No. 6	P6-79	2
12	0	Ground Return	Ground Lug	8
13	7	Blanking Signal (coax cable)	P4-A7	13
14-24		Open		
25	916	10 kHz Bandwidth Control	P6-50	14
26	917	30 kHz Bandwidth Control	P6-51	14
27	918	100 kHz Bandwidth Control	P6-52	14
28	923	300 kHz Bandwidth Control	P6-53	14
29	96	Ampl Cal Adjustment	P6-23	14
30	957	Normal Analogic Line	P6-25	13
31	Open			
32	9	47 MHz LO Voltage (Fixed)	A10-9	7
33	935	Log Ref Level Lamp No. 1	P6-74	2
34	936	Log Ref Level Lamp No. 2	P6-75	2
35	937	Log Ref Level Lamp No. 3	P6-76	2
36	907	-10V Supply	A10-907	6
37	902	+20V (to pin 1)	P3-1	14
38	956	Video Filter Analogic Line	P6-24	13
39	958	-10V Line to IF Section	P6-26	13
40		Open		
41	3	Scan Voltage 0 to 8V (coax cable)	P4-A3	13
A1	5	50 MHz IF Signal (coax cable)	A2-J2	5
A2	4	47 MHz LO Signal (coax cable)	P4-A4	13

Model 8555A

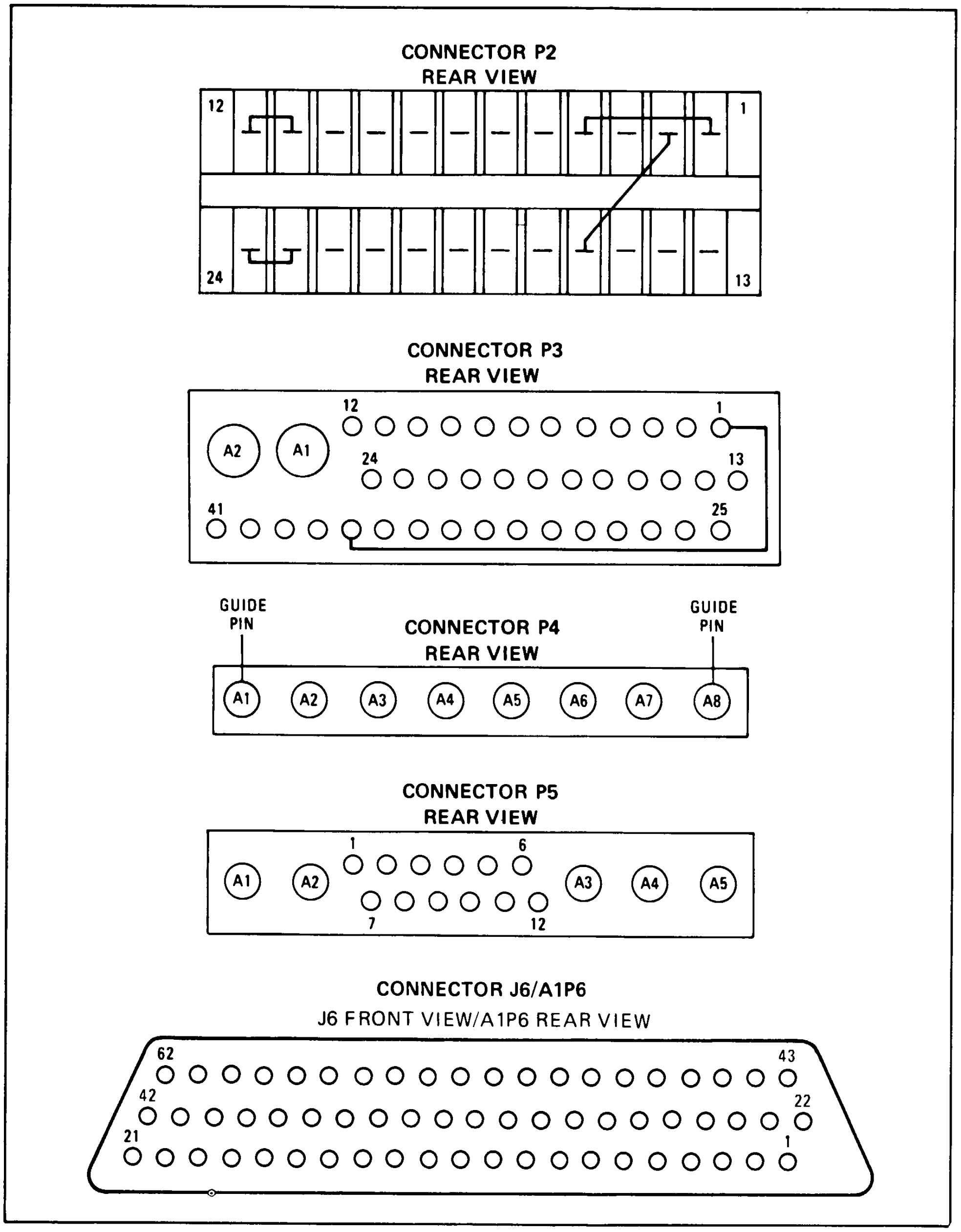


Figure 8-73. Connector Pin Location Diagram

Service

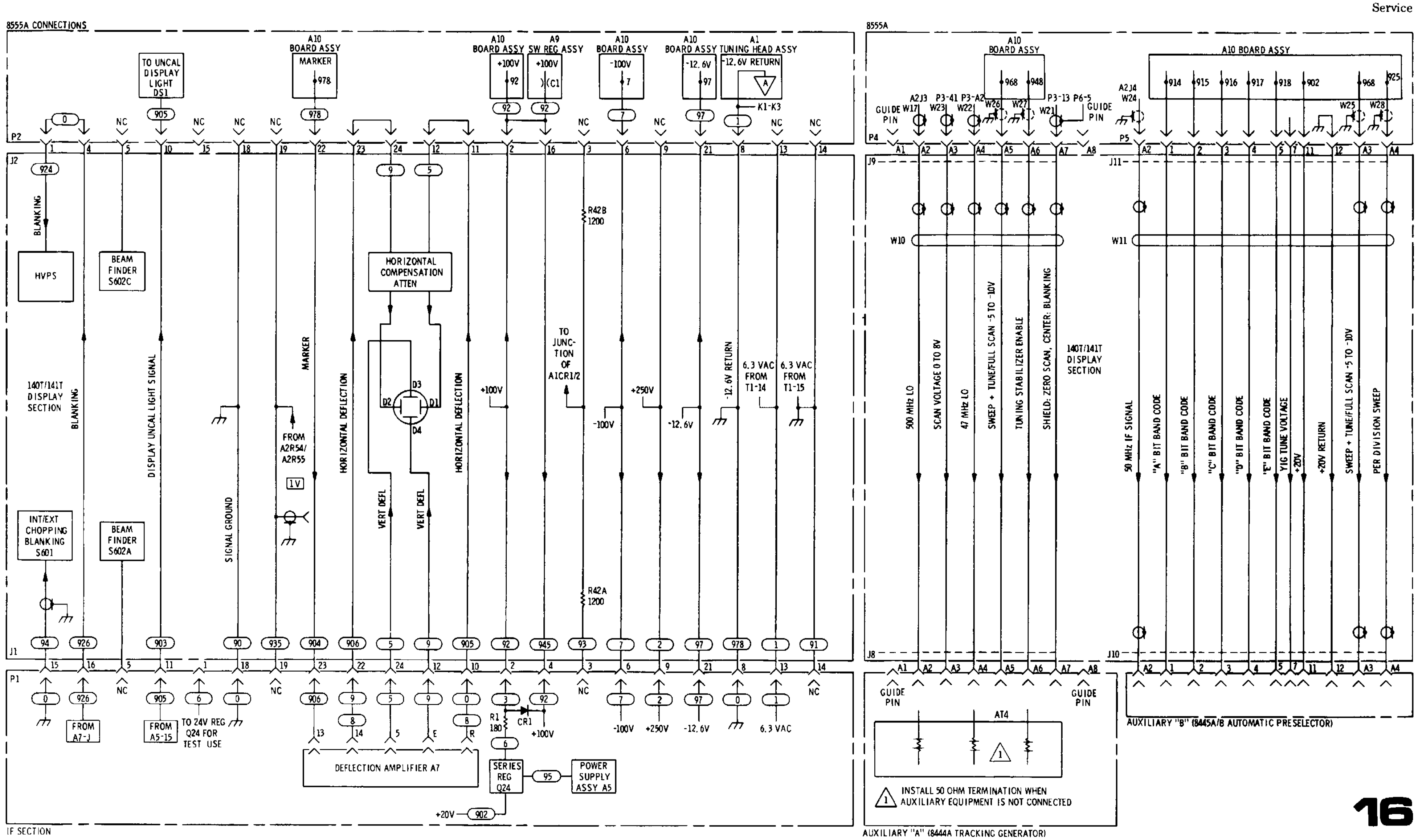


Figure 8-74. RF/IF Section Interconnection diagram

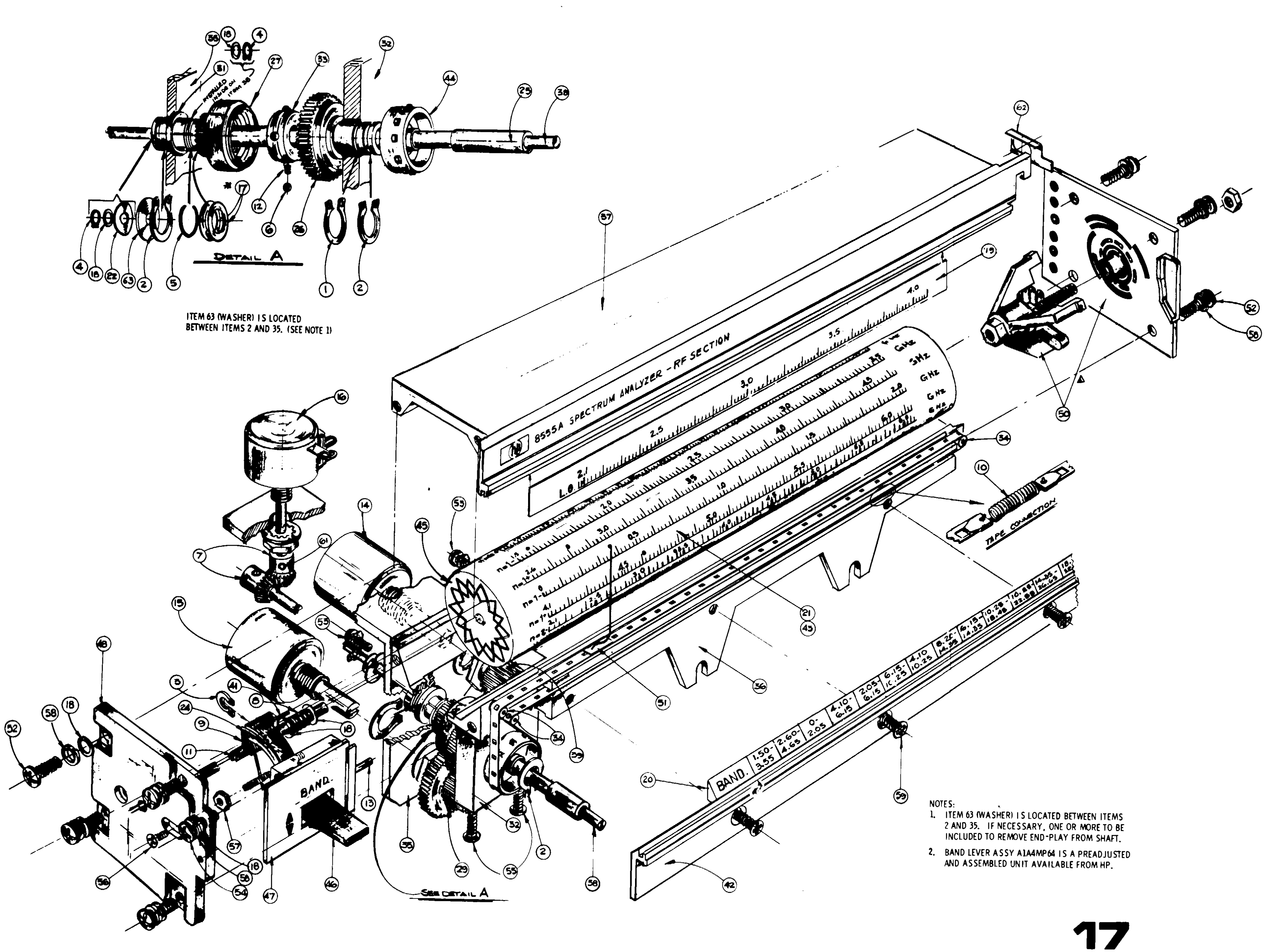


Figure 8-75. Tuning Head Assy A1A4, Illustrated Parts Breakdown

SERVICE SHEET 17 (cont'd)

Ref Design.	Index No.	Description	HP Part No.
A1A4MP1	1	RING: RETAINING FOR 0.375" DIA SHAFT	0510-0028
A1A4MP2	2	RING: RETAINING FOR 0.375" DIA SHAFT	0510-0035
A1A4MP3	3	RING: RETAINING FOR 0.125" DIA SHAFT	0510-0052
A1A4MP4	4	RING: RETAINING FOR 0.125" DIA SHAFT	0510-0082
A1A4MP5	5	RING: RETAINING FOR 0.312" DIA SHAFT	0510-1140
A1A4MP6	6	BALL BEARING: STL 0.09375" DIA	1410-0226
A1A4MP7	7	GEAR MITER: 48 DIAMETERICAL PITCH	1430-0739
A1A4MP8	8	SPRING: COMPRESSION	1460-0036
A1A4MP9	9	SPRING: TORSION	1460-1206
A1A4MP10	10	SPRING: EXTENSION 0.062" OD	1460-1212
A1A4MP11	11	PIN: D OWELL STL 0.120" X 1-1/4" LG	1480-0083
A1A4MP12	12	SPRING: COMPRESSION 0.088" OD	1460-1213
A1A4MP13	13	PIN GROOVE: 0.093" DIA	1480-0336
A1A4R3	14	R: VAR WW 5K OHM 3% LIN 1.5W	2100-2485
A1A4R1	15	R: VAR WW 15K OHM, 10% LIN 1 W	2100-2984
A1A4R2	16	R: VAR WW 10K OHM, 5% LIN 1 W	2100-2992
AlA4MP17	17	WASHER: FLAT BRS 0.005 SHIM	3050-0153
A1A4MP18	18	WASHER: FLAT 0.130" 10D	2190-0368
A1A4MP19	19	LABEL: IDENTIFICATION	08555-20029
A1A4MP20	20	LABEL: IDENTIFICATION	08555-20030
A1A4MP21	21	LABEL: IDENTIFICATION	08555-20031
A1A4MP22	22	WASHER: LOCK	2190-0926
A1A4MP23	23	COVER PLATE	08555-00003
A1A4MP24	24	LEAF SPRING: CAM DRIVE	08555-00004
A1A4MP25	25	SHAFT: MAIN	08555-20003
A1A4MP26	26	GEAR: CLUTCH AND DIAL	08555-20005
A1A4MP27	27	CLUTCH: PINION ASSY	08555-20095
A1A4MP28	28	NOT ASSIGNED	
A1A4MP29	29	GEAR: PINION ASSY	08555-20096
A1A4MP30	30	NOT ASSIGNED	
A1A4MP31	31	BEARING: REAR	08555-20011
A1A4MP32	32	BEARING: SUPPORT FRONT	08555-20012
A1A4MP33	33	CONE DRIVE	08555-20013
A1A4MP34	34	PULLEY: IDLER	08555-20014
A1A4MP35	35	PLATE: MOUNTING	08555-20015
A1A4MP36	36	LOWER EXTRUSION	08555-20016
A1A4MP37	37	UPPER EXTRUSION (LIGHT GRAY)	08555-20017
A1A4MP38	38	SHAFT: FINE TUNE	08555-20018
A1A4MP39	39	PINION: 30 T	08555-20020
A1A4MP40	40	WINDOW: DIAL	08555-20021
A1A4MP41	41	PIN: CAM DRIVE	08555-20025
A1A4MP42	42	TRIM: EXTRUSION	08555-20026
A1A4MP43	43	DRUM: DIAL	08555-20032
A1A4MP44	44	SPROCKET: 16T DRIVE	0855540003
A1A4MP45	45	CAM: 14 POSITION DRIVE	08555-40005
A1A4MP46	46	LEVER: BAND SWITCH	08555-40006
A1A4MP47	47	PLATE: LEVER (OLIVE BLACK)	08555-40014
A1A4MP48	48	CAP END	08555-40008
A1A4MP49	49	NOT ASSIGNED	
A1A4S1	50	SWITCH ASSY, BAND	08555-60050
A1A4MP51	51	DIAL CU RSO R/BELT ASSY	0350-0049
A1A4MP52	52	SCREW: PAN HO POZI DR 4-40 x 0.375"	2200-0143
A1A4MP53	53	SCREW: POZI D R 4-40 x 3.8" W/LOC K	2200-0107
A1A4MP54	54	SCREW: PAN HD POZI DR 4-40 x 0.438"	2200-0145
A1A4MP55	55	SCREW: PAN HD POZI DR 4-40 x 1-125" LG	2200-0121
A1A4MP56	56	SCREW: FLAT HD POZI DR 2-56x0.625" LG	0520-0169
A1A4MP57	57	NUT: HEX 2-56 x 0.188"	0160-0001
A1A4MP58	58	WASHER: LOCK BRONZE FOR NO.4 HDW	2190-0019
A1A4MP59	59	SCREW: FLAT HD POZI DR 4-40x0.250" LG	2200-0140
A1A4MP60	60	SCREW: SST PHH POZI DR 4-40xl/4" W/LK	2200-0103
A1A4MP61	61	SCREW: SET SST 4-40 x 1/8"	3030-0007
A1A4MP62	62	RETAINER: WINDOW	08555-00020
A1A4MP63	63	(See Note) WASHER FLAT 0.378 ID	3050-0029

Ref Des.	Item No.	Description	HP Part No.
A1C1	1	C. FXO CER 5000 PF 80-20% 200 VDCW	0160-3036
A11C2	1	C. FXD CER 5000 PF 80-20% 200 VDCW	0160-3036
A11MP1	2	SCREW: PAN HO SLOT OR 0-80 x 0.88" LG	0516-0005
A11J1	3	CONNECTOR: RF 50-OHM SCREW ON TYPE	1250-0829
A11J2	M	SEE A11A2J2	
A11J3	3	CONNECTOR: RF 50-OHM SCREW ON TYPE	12500829
A11J4	3	CONNECTOR: RF 50-0HM SCREW ON TYPE	125040829
A11J5	3	CONNECTOR: RF 50 OHM SCREW ON TYPE	125040829
A11MP2	4	SCREW: PAN HD POZI DOR 4-40 x 0.500" LG	220040111
A11MP3	5	SCREW: SST PAN HAD POZI OR 4-40 x 0.875" LG	220040117
A11MP6	6	SCREW: FLAT HAD POZI DR 4-40 x 0.250" LG	2200-0140
A11MP4	7	SCREW: FLAT HD POZI OR 4-40 x 0.875" LG	2200-0172
A11MP5	8	SCREW: PAN HO POZI DR 6.32 x 3/8 WIEK	2360-0117
A11MP7	9	NUT: HEX STL 10-32 x 3/8	2740-0003
A11MP8	10	SCREW: SOCKET CAP 4-40 THREAD	3030-0151
A11MP9	11	SCREW: SET 10-32 UNF-2A THREAD	3030-0397
A11MP10	12	INPUT-OUTPUT LOOP	08555-00033
A11MP11	13	SUPPORT: SLOT FILTER	08555-20002
A11MP12	14	SCREW: TUNING	08555-20019
A11MP17	15	CAVITY BLOCK: SECOND CONVERTER	08555-20035
A11MP13	16	CAP. OUTER ELEMENT	08555-20040
A11MP14	17	CAP: INNER ELEMENT	08555-20041
A11MP15	18	CAP: DIELECTRIC	08555-20042
A11MP16	19	COVER: PLATE SECOND CONVERTER	08555-20046
A11FL1	20	LINE SLOT FILTER	08555-20065
A11A3	21	BOARD ASSY: SECOND CONVERTER FILTER	08555-60062
A11A1	22	OSCILLATOR ASSY: 1.5 GHz	08555-60068
A11A2	23	SECOND MIXER: OUTPUT ASSY	08555-60069
A11A1C1	A	C: FXD CER 0.4 PF 0.1% 500 VOCW	0160-3636
A11A1R2	B	R: FXD MET FLM 464 OHM 1% 1/8W	0698-0082
A11A1R3	B	R: FXD MET FLM 464 OHM 1% 1/8W	0698-0082
A11A1R1	C	R: FXD MET FLM 10 OHM 1% 1/8W	0757-0346
A11A1Q1	O	TSTR:SINPN	1854-0292
A1SA1Q2	O	TSTR:SINPN	185440292
A11A1MP1	E	HOLDER: TRANSISTOR	08555-20038
A11A1L1	F	COUPLING: SECOND LO LOOP	08555-00012
A11A2C1	G	C. FXD CER 1000 PF 20% 100 VDCW	0160-2327
A11A2C2	H	C: FXO MICA 15 PF 10% 250 VOCW	0160-3550
A11A2C3	J	C: FXD MICA 33 PF 10% 250 VOCW	0160-3551
A11A2MP4	K	SCREW: PAN HO POZI DR 2-56 x 0.250" LG	052040128
A11A2R1	L	R: FXO FLM 750 OHM 2% 1/8W	0698-7233
A11A2J2	M	CONNECTOR: RF 50-OHM SCREW ON TYPE	1250-0829
A11A2MP3	N	CONNECTOR: SINGLE CONTACT	1251-1556
A11A2CR1	0	DIODE: HOT CARRIER	1901-0633
A11A2L1	P	COIL/CHOKE 0.39 UH 10%	9100-2254
A11A2MP1	R	LIO: RESONATOR HOUSING	08555400031
A11A2MP2	S	RESONATOR HOUSING	08555-20036

SERVICE SHEET 18

Service

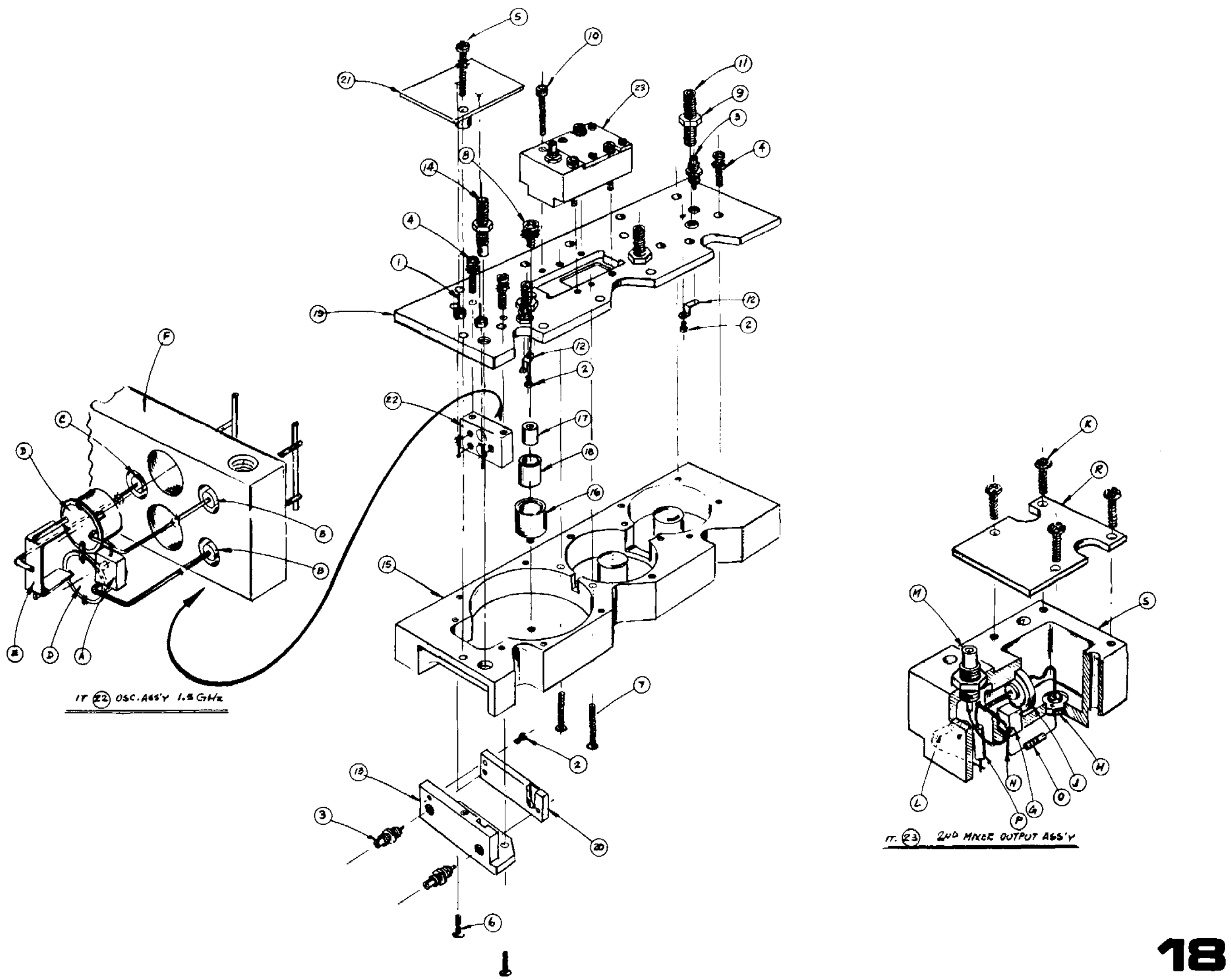


Figure 8-76. Second Converter Casting, Illustrated Parts Breakdown

SERVICE SHEET 18

REMOVAL AND REPLACEMENT INSTRUCTIONS

CAUTION

While working with and around the semi-rigid coaxial cables in the RF Section, do not bend the cables more than necessary. Do not torque the RF connectors to more than 2 inch-pounds. Be especially careful when working on the connectors on the first converter.

INPUT ATTENUATOR A13 REMOVAL AND REPLACEMENT PROCEDURE

1. Remove top cover (MP5) by removing six flat head screws.

2. Remove bottom cover (MP6) by removing four flat head screws.

3. Remove Front Panel Assy Al. The front panel assy is secured to the left side gusset (MP1) near the top front comer by one flat head screw and to the yoke assy (MP12) by two flat head screws. Disconnect front panel connector plug A1P6. Lift the front panel assy straight up while pulling out on the left side gusset.

4. Remove the right side gusset (MP4) by removing all the screws on the outside. There are six No. 4 flat head, five No. 4 pan head, two No. 6 pan head, and six No. 6 flat head screws securing the gusset.

5. Disconnect the LO OUT cable from the Tuning Stabilizer Assy A14 (Cable W20 at A14J2). Disconnect the LO IN cable from the tuning stabilizer (Cable W19 at A14J1).

6. Remove one pan head screw, securing the tuning stabilizer casting to the front of the main deck (MP8). Remove one pan head screw securing the tuning stabilizer casting to the rear panel (MP2).

7. Remove two pan head screws securing the attenuator to the main deck (MP8).

CAUTION

Be especially careful not to bend or damage the cables and connectors in the following steps.

8. Disconnect the cable from the attenuator input (W1 at A13J1). Disconnect the cable from the attenuator output (W2 at A13J2).

9. Slide the attenuator out the right side of the instrument.

10. Unsolder and remove the six wires connected to the attenuator. Note orientation of attenuator and wires.

11. Place the replacement attenuator in the same position as in step 10 and solder the six wires removed in step 10. (See Figure 8-14.)

12. Slide attenuator into position. Care *must* be taken to position the wires going to the attenuator so that the wires are not pinched between the attenuator and the second converter housing.

13. Complete the installation by reversing the procedures in steps 1 through 8. In steps 4 and 6 do not tighten the screws until all the screws are in place.

NOTE

Do not remove First Converter until replacement units are on hand. See steps 15 and 16 below.

FIRST CONVERTER A12 REMOVAL AND REPLACEMENT PROCEDURE

1. Remove top cover (MP5) by removing six flat head screws.

2. Cut the two tie wraps securing Filter FL2 to the semi-rigid coaxial cables.

3. Unsolder the wires from the first converter.

    a. 908 wire from EXT BIAS terminal
    b. 913 wire from DIODE BIAS terminal
    c. Two 907 wires from EMITTER BIAS terminal
    d. Two 912 wires from +10 terminal

4. Remove the two pan head screws securing the first converter support (MP3) to the right side gusset (MP4).

CAUTION

Be especially careful not to bend or damage cables and connectors in the following steps.

5. Disconnect EXT IF Cable W6 from first converter connector A12J3. Disconnect Cable W6 from Isolator AT5 and remove cable.

6. Disconnect the LO OUT Cable W4 from the first converter connector A12J4.

7. Disconnect LO IN Cable W4 from first converter connector A12J5.

8. Disconnect IF OUT Cable W8 from the first converter connector A12J6. Disconnect the other end of Cable W8 from Relay KlJ1 and remove cable.

9. Disconnect EXT MIXER Cable W3 from first converter connector A12J2.

10. Disconnect INPUT Cable W2 from first converter connector A12J1.

11. Remove first converter and converter support from the RF Section.

12. Remove the three flat head screws securing the first converter to the support.

13. Remove Band Buffer Board Assy A6.

14. Remove the Input Mixer Gain Compensation Network Assy A16 from the band buffer board by removing one screw and pulling the gain network assy out.

15. Package both First Converter Assy A12 and Input Mixer Gain Compensation Network Assy A16 in the reusable container in which the replacement assemblies were shipped.

16. Return defective units for factory repair and credit.

17. Replace the two units by reversing the procedure in steps 1 through 14.

NOTE

See Second Converter Mixer and Output Assy AllA2 Removal and Replacement Procedure.

SECOND CONVERTER All REMOVAL AND REPLACEMENT PROCEDURE

1. Remove top cover (MP5) by removing six flat head screws.

2. Remove bottom cover (MP6) by removing four flat head screws.

SERVICE SHEET 18 (cont'd)

3. Remove Front Panel Assy A1. The front panel assy is secured to the left side gusset (MP1) near the top front corner by one flat head screw and to the yoke assy (MP12) by two flat head screws. Disconnect front panel connector plug A1P6. Lift the front panel assy straight up while pulling out on the left side gusset.

4. Loosen the LO IN Cable W4 at the first converter connector A12J5. Disconnect the other end of this cable from the YIG oscillator connector A3J1. Lift the end of the cable removed from A3J1 up above the first converter and disconnect the cable from the first converter.

5. Disconnect Cable W12 from Relay K2J2 and Relay K3J2. (Cable W12 removed for access to K2J3 connector.) Disconnect the black flexible Cable W16 from Relay K2J3.

6. Remove three pan head screws securing Isolator AT6 to rear panel (MP2). Remove one pan head screw securing Tuning Stabilizer Assy A12 to rear panel.

7. Remove three pan head screws securing bottom flange of main deck (MP8) to the Interconnect Board A10.

8. Remove two flat head screws securing right side gusset (MP4) to yoke assy (MP12). Remove two flat head screws securing right side gusset to rear panel.

9. Carefully separate the right side of the RF Section from the left side.

10. Disconnect LO OUT Cable W20 from the tuning stabilizer connector A14J2. Disconnect LO IN Cable W19 from connector A14J1.

11. Loosen Cable W9 at Relay K1J3. Disconnect Cable W9 (input to Notch Filter AliFL1) from AllJ4. Disconnect Cable W10 Notch Filter AllFL1 output) from A11J5.

12. Disconnect the three cables from the top of the second converter. (Cable W15 from A11J3, Cable 14 from A11J2 and Cable W13 from A11J1.)

13. Remove one pan head screw securing the tuning stabilizer assy to the front of the main deck (MP8). Remove two pan head screws securing tuning stabilizer to the right side gusset. Pull the tuning stabilizer out and position it out of the way.

14. Remove the main deck (MP8) by removing the five flat head screws securing it to the attenuator and the second converter.

15. Carefully remove the second converter assy.

16. To replace the second converter, reverse the above procedure. Be careful not to pinch wires between the various assemblies.

SECOND CONVERTER MIXER AND OUTPUT ASSY A11A2
REMOVAL AND REPLACEMENT PROCEDURE

NOTE

The Mixer and Output Assy A11A2 can be removed without having to remove the second Converter Assy All (see Figure 8-76).

1. Remove the top cover (MP5) by removing six flat head screws.
2. Cut the two tie wraps securing Filter FL2 to the semi-rigid coaxial cables.

SERVICE SHEET 18 (cont'd)

3. Loosen the LO IN Cable W4 at the first converter connector A12J5. Disconnect the other end of Cable W4 from YIG oscillator connector A3J1. Lift the end of the cable removed from A3J1 up above the first converter and disconnect the cable from the first converter.

4. Disconnect the EXT MIXER Cable W3 from the first converter connector A12J2.

5. Disconnect Cable W14 from the second mixer and output assy connector A11J2. Disconnect the other end of Cable W14 from relay connector K2J1.

6. Position the wires going to the first converter out of the way of the second mixer and output assy.

CAUTION

Use care in removing the second mixer and output assy to avoid damaging the diode mounted on the bottom of the assy. Do not force the assy.

7. Remove the four socket cap screws from the assy. Lift the unit straight up until it touches the first converter, then rotate it so the RF connector AllJ2 turns and faces toward the rear of the instrument. Carefully lift the assy up and out of the instrument.

8. To replace the second converter mixer and output assy, reverse the above procedure.

THIRD CONVERTER A2 REMOVAL AND REPLACEMENT PROCEDURE

1. Remove top cover (MP5) by removing six flat head screws.

2. Remove bottom cover (MP6) by removing four flat head screws.

3. Remove the top cover of the third converter by removing six pan head screws.

4. Disconnect the three coaxial cables from the top of the third converter; Cable W18 from A2J2, Cable W24 from A2J4, and Cable W16 from A2J1.

5. Remove nut and washer securing connector A2J1 to third converter casting.

6. Remove the three pan head screws near A2J1.

7. Unsolder the +20 volt jumper wire between A2C1 and A2C13. (Available through hole in left side gusset.)

8. Unsolder the input wire to the 50 MHz Amplifier Board A2A5. This wire comes from underneath the board to the pad marked "IN" near input match capacitor A2A5C2.

9. Remove the two side and four bottom screws securing the third converter casting to the left side gusset and the Interconnect Board A10.

10. The top casting, containing the 50 MHz amplifier, can be lifted up and tilted out of the way.

11. With the top casting tilted out of the way, the 550 MHz Amplifier A2A1 and the 550/50 MHz Mixer A2A3 are exposed. (See Figure 8-22.)

12. Unsolder the three wires going to feedthru capacitors A2C2, A2C3, and A2C4.

13. Lift the third converter straight up and remove the red cable W17 from connector A2J3.

14. The converter can be lifted out and away from the chassis.

15. To remove the top casting, disconnect the wires at feedthru capacitors A2C8, A2C9, A2C10, A2C11, and A2C12.

SERVICE SHEET 18 (cont'd)

16. Remove bottom cover by removing two screws to gain access to the 500 MHz LO Drive A2A2 and the 500 MHz LO A2A4.

17. Reverse the above steps to replace the third converter.

SWITCHING REGULATOR A9 REMOVAL & REPLACEMENT PROCEDURE

1. Push wiring harness away from the two nuts that secure the switching regulator to the board shield (MP14) and remove the nuts with an open end wrench.

2. Remove the two screws securing the +10, +20 Regulator Assy A8 to the Interconnect Board A10. Remove the +10, +20 regulator board.

3. Lift the Switching Regulator Assy A9 out and disconnect the two wires. The yellow (4) wire from the +26V output and the White-Red (92) wire from the +100V input.

4. To replace the switching regulator reverse the above procedure. When installing the nuts in step 1, it is easiest to install the lower nut from the bottom of the RF Section.

TUNING STABILIZER A14 REMOVAL & REPLACEMENT PROCEDURE

1. Remove top cover (MP5) by removing six flat head screws.

2. Remove bottom cover (MP6) by removing four flat head screws.

3. Remove Front Panel Assy Al. The front panel is secured to the left side gusset (MP1) near the top front corner by one flat head screw and to the yoke assy (MP12) by two flat head screws. Disconnect the front panel connector plug (A1P6). Lift the front panel assy straight up while pulling out on the left side gusset.

4. Disconnect the LO OUT Cable W20 from A14J2. Disconnect the LO IN Cable W19 from A14J1.

5. Unsolder the wires going to feedthru capacitors on the tuning stabilizer. (ERROR OUT 958 wire, +20 902 wire, -10 907 wires (2), +10 912 wire, SWEEP IN 903 wire, +20 SWITCHED 948 wire, and GND LUG 901 and 0 wires.)

6. Remove one pan head screw securing the tuning stabilizer casting to the front of main deck (MP8).

7. Remove one pan head screw securing tuning stabilizer casting to rear panel (MP2).

8. Remove two pan head screws securing tuning stabilizer casting to right side gusset (MP4).

9. To replace the tuning stabilizer reverse the above procedure.

APPENDIX A
OPTION 002
MODEL 8555A SPECTRUM ANALYZER RF SECTION

A-1. INTRODUCTION

A-2. This supplement is intended to be used with the Hewlett-Packard Model 8555A Spectrum Analyzer RF Section Operating and Service Manual,

When used with the manual, it provides documentation for Model 8555A RF Sections with Option 002.

A-3. DESCRIPTION

A-4. Option 002 for the Model 8555A is a limiter that is installed between the RF Section's INPUT port and the input attenuator. The limiter protects the analyzer's input circuitry (especially the diodes in the first mixer) from inadvertent overloading.

A-5. Limiting action begins at signal levels of approximately 5 milliwatts; with applied signal levels of 1 watt CW (+30 dBm) or 75 watts pulse peak (0.001 duty cycle), the output from the limiter is below 100 mV. VSWR is less than 2.0:1 with applied signal levels below approximately +7 dBm. VSWR above approximately +7 dBm is unpredictable since the limiter effects its limiting by reflecting some of the applied signal.

A-6. With the limiter option, the analyzer maintains its absolute amplitude calibration from 0.1-12.4 GHz. The analyzer's distortion performance is not degraded for input signals < -40 dBm.

A-7. MANUAL CHANGES TO INCORPORATE OPTION

A-8. Make the following changes to the operating and service manual.

Page 1-5, Table 1-1:
Under "ABSOLUTE CALIBRATION ACCURACY", change to read as follows:

Frequency Response: With 10 dB input attenuator setting:

Frequency Range (GHz)	Mixing Mode (n)	IF Freq. (MHz)	Frequency Response (dB Max.)
0.1 - 2.05	1--	2050	±1.5
1.50 - 3.55	1--	550	±1.5
2.07 - 6.15	2-	2050	±1.8
2.60 - 4.65	1+	550	±1.5
4.11 - 6.15	1+	2050	±1.5
4.13 - 10.25	3-	2050	±2.0
6.17 - 10.25	2+	2050	±2.0
6.19 - 12.4	4-	2050	±2.0
8.23 - 12.4	3+	2050	±2.5
10.29 - 12.4	4+	2050	±2.5
12.4 - 18.0	4+	2050	See Typical Response

Under "INPUT SPECIFICATIONS", change to read as follows:
Reflection Coefficient: < 0.33 (2.0 VSWR).
Maximum Input Level: Continuous, 1 watt (+30 dBm).
Pulse, 75 watts peak, pulse width <l1 µs, 0.001 duty cycle.
Limiting threshold, 5 mW.

Appendix A

Page 1-6,Table 1-2:

Spurious Responses due to Third Order Intermodulation Distortion: < -70 dB with -50 dBm incident on INPUT port and signal separation > 1 MHz.

Add the following:

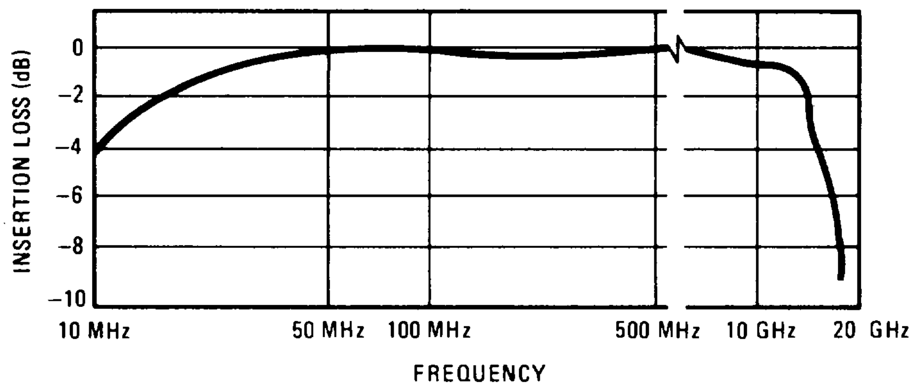


Figure A-1. Frequency Response for Option 002

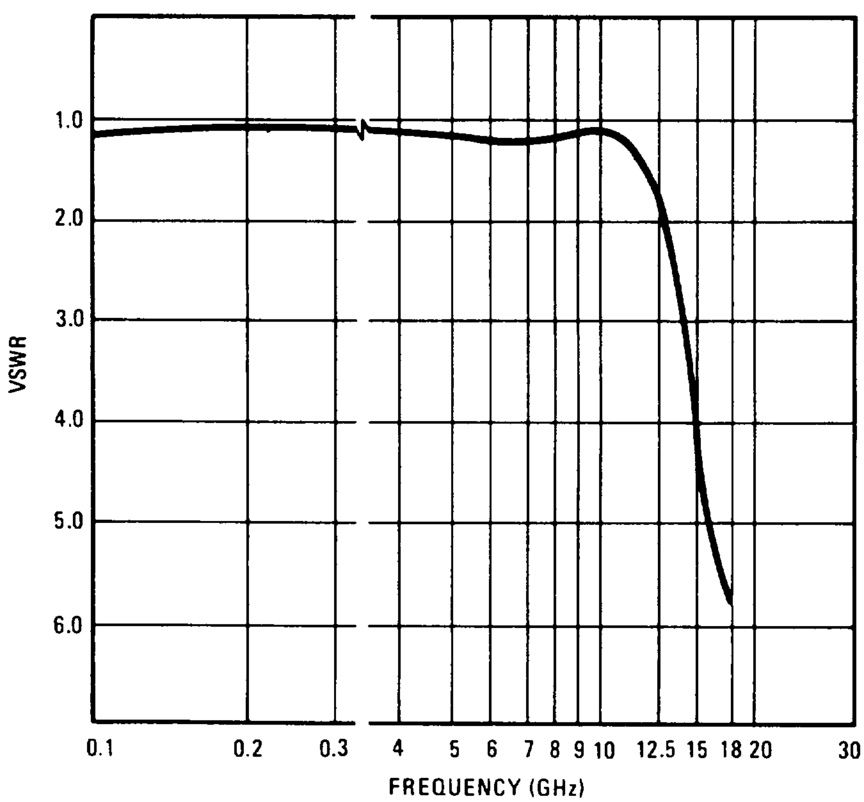


Figure A-2. Typical VSWR Versus Frequency for Option 002

NOTE

The analyzer's absolute amplitude calibration is retained with the Option 002 because the effect of the limiters insertion loss is calibrated out from 0.1 to 12.4 Ghz.

Page 3-1, paragraphs 3-11 through 3-13:

Under paragraph 3-11, add the following:

3-11A. Option 002 instruments are shipped with a diode limiter installed between the INPUT port and the input attenuator. The limiter protects the attenuator and the mixer diodes from inadvertent overloads. Maximum input level with the limiter is 1 watt continuous (+30 dBm) or 75 watts peak.

Under the caution in paragraph 3-12, add the following:
With the limiter (Option 002), do not exceed 1 watt continuous (+30 dBm) or 75 watts pulse peak (0.001 duty cycle).

Under paragraph 3-13, add the following:
3-13A. With the limiter (Option 002), the analyzer will provide absolute calibration with signal levels up to -10 dBm incident on the INPUT port. The input signal should be below -40 dBm for distortion measurements because above that level the limiter generates harmonics that are visible on the display. An external attenuator can be used to reduce input signals so that they are below -40 dBm. However, when the analyzer is used with a Model 8445 Preselector, signals that are above 1.8 GHz and are separated by >70 MHz can be inserted with levels up to -10 dBm with no measurable distortion.

Page 3-5, Figure 3-1:
Change item (15) to read as follows:

(15) INPUT ATTENUATION: attenuates input signal from 0 to 50 dB in 10 dB steps. Maximum input signal for 1 dB signal compression is as follows:

Input Signal	INPUT ATTENUATION
5 mW	> 20 dB
1 mW	10 dB
0.1 mW	0dB

CAUTION

Maximum input level is 1 watt (+30 dBm) continuous or 75 watts pulse peak (0.001 duty cycle).

To CAUTION in item (20), add "With limiter (Option 002), maximum input signal should be 1 watt (+30 dBm) continuous or 75 watts pulse peak (0.001 duty cycle)."

Page 3-9, Figure 3-3:
Add the following:

NOTE

To adjust vertical position and gain, use a 100 MHz, --30 dBm (+0.3 dB) signal from an external source and calibrate at 100 MHz. If an external source is not available and the analyzer's 30 MHz calibration signal is used, set the signal level on the display for --31.5 dBm or 5.95 mV: (the Option 002 limiter has approximately 1.5 dB of insertion loss at 30 MHz).

Page 3-11, Figure 3-4:
To CAUTION in item (3) add, "With limiter (Option 002), maximum input signal should be 1 watt (+30 dBm) continuous or 75 watts pulse peak (0.001 duty cycle)."

Page 4-1, paragraph 4-6:
Add the following:

NOTE

The Option 002 limiter has approximately 1.5 dB of insertion loss at 30 Mhz. So use the procedure given in Figure 3-3 (page 3-9) and calibrate the analyzer using a 100 MHz, -30 dBm (+0.3 dB) signal. When performing the checks given below, do not adjust VERTICAL GAIN and AMPL CAL; the 30 Mhz, --30 dBm signal from the analyzer's calibrator will appear on the display as approximately --31.5 dBm (5.95 mV).

Pages 4-7 and 4-9, paragraph 4-21:
Change "SPECIFICATION" to read as follows:
SPECIFICATION: With 10 dB input attenuator setting.

Frequency Range (Ghz)	Mixing Mode (n)	Frequency Response (dB max)
0.1 - 2.05	1-	1.5
1.50 - 3.55	1-	1.5
2.07 - 6.15	2-	1.8
2.60 - 4.65	1+	1.5
4.11 - 6.15	1+	1.5
4.13 - 10.25	3-	2.0
6.17 - 10.25	2+	2.0
6.19 - 12.4	4-	2.5
8.23 - 12.4	3+	2.5
10.29 - 12.4	4+	2.5
12.4 - 18.0	4+	See Typical Response

Change last sentence in step 4 to "Amplitude variations should not exceed 0.3 divisions (±1.5 dB).
__________0.3 div"

Change Table 4-2 to read as follows:

Table A-1. Frequency Response for Option 002

Frequency Range (GHz)	Mixing Mode (n)	IF Frequency (MHz)	Frequency Response (dB Max)
0.1 - 2.05	1-	2050	1.5
1.50 - 3.55	1-	550	1.5
2.07 - 6.15	2-	2050	1.8
2.60 - 4.65	1+	550	1.5
4.11 - 6.15	1+	2050	1.5
4.13 - 10.25	3-	2050	2.0
6.17 - 10.25	2+	2050	2.0
6.19 - 12.4	4-	2050	2.5
8.23 - 12.4	3+	2050	2.5
10.29 - 12.4	4+	2050	2.5
12.4 - 18.0	4+	2050	See Typical Response

Page 4-16, Table 4-4:
Change list for paragraph 4-21 to read as follows:

Paragraph No.	Test Description		Measurement Unit	Min.	Actual	Max.
4-21.	**Frequency Response**					
	Frequency Range (Ghz) (Ghz)	Mixing Mode (n)				
	0.1 - 2.05	1-	dB	-1.5	________	+1.5
	1.50 - 3.55	1-	dB	-1.5	________	+1.5
	2.07 - 6.15	2-	dB	-1.8	________	+1.8
	2.60 - 4.65	1+	dB	-1.5	________	+1.5
	4.11 - 6.15	1+	dB	-1.5	________	+1.5
	4.13 - 10.25	3-	dB	-2.0	________	+2.0
	6.17 - 10.25	2+	dB	-2.0	________	+2.0
	6.19 - 12.4	4-	dB	-2.5	________	+2.5
	8.23 - 12.4	3+	dB	-2.5	________	+2.5
	10.29 - 12.4	4+	dB	-2.5	________	+2.5

Page 8-13, Figure 8-10:
Replace top internal view with attached figure.

Pages 8-14 and 8-15, Service Sheet 1:
To the test, item (2), add the following:

On instruments with Option 002, there is a limiter between the INPUT port and the input attenuator. The limiter protects the attenuator and the first mixer from inadvertent overloads.

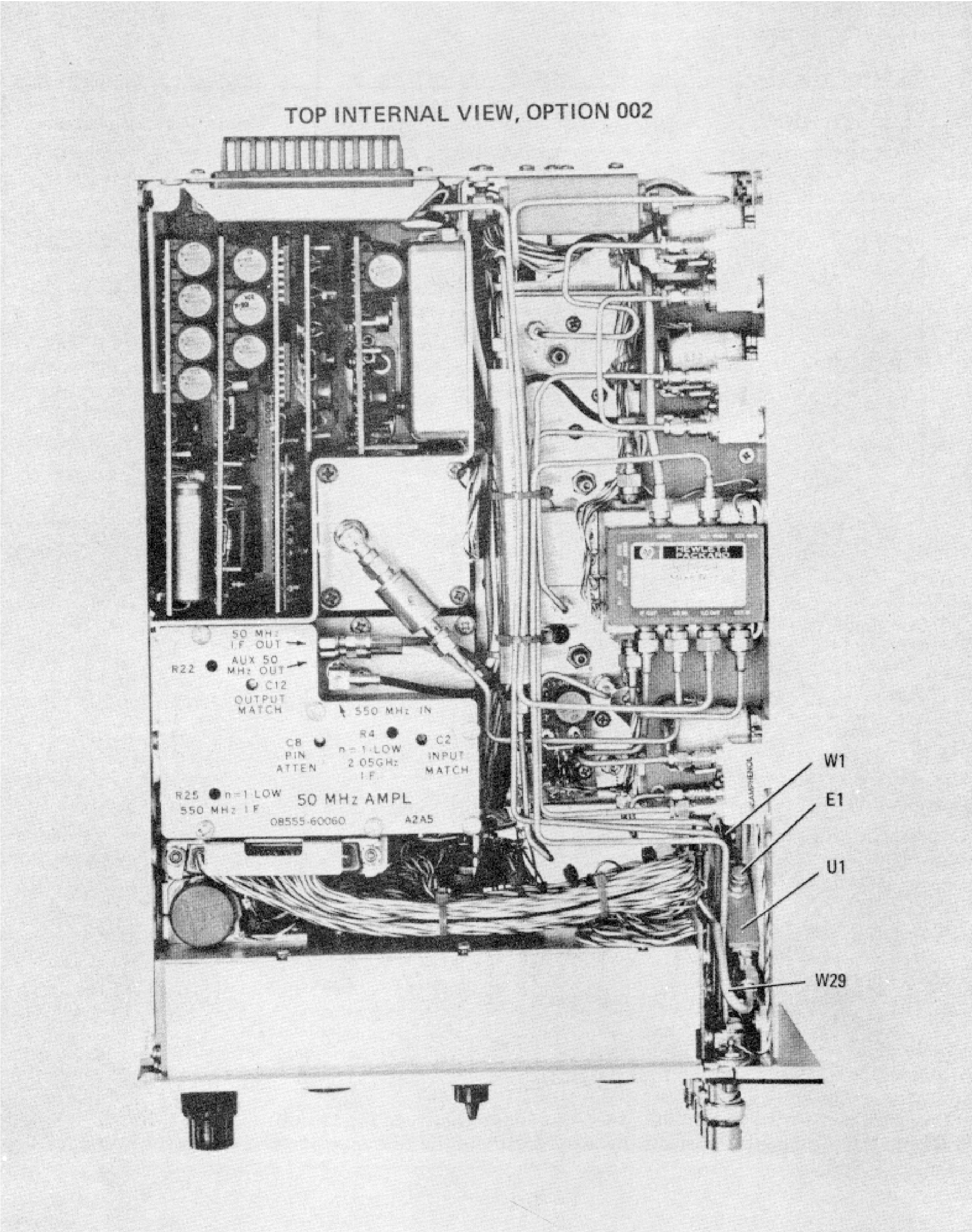
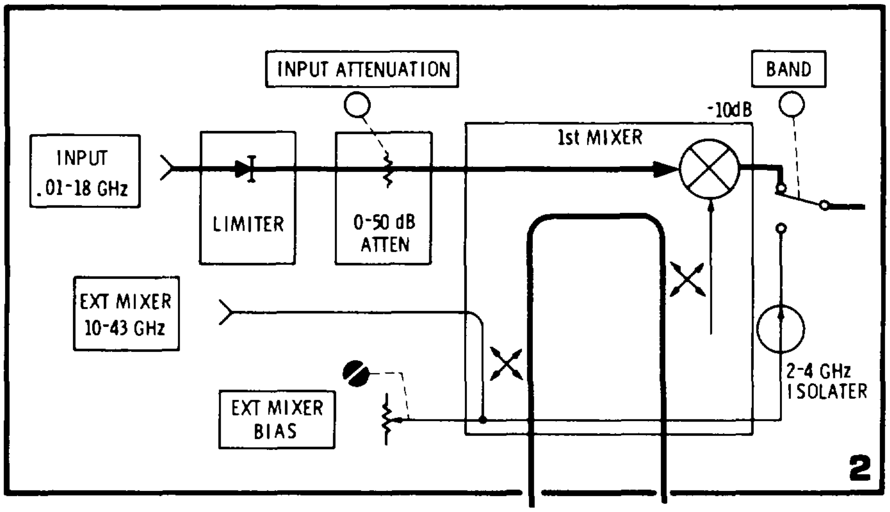


Figure A-3. 8555A RF Section, Top and Bottom Internal Views (Option 002)

To Figure 8-11, add the following:



Pages 8-16 and 8-17, Service Sheet 2:

Under "THEORY OF OPERATION", item (1), add the following:

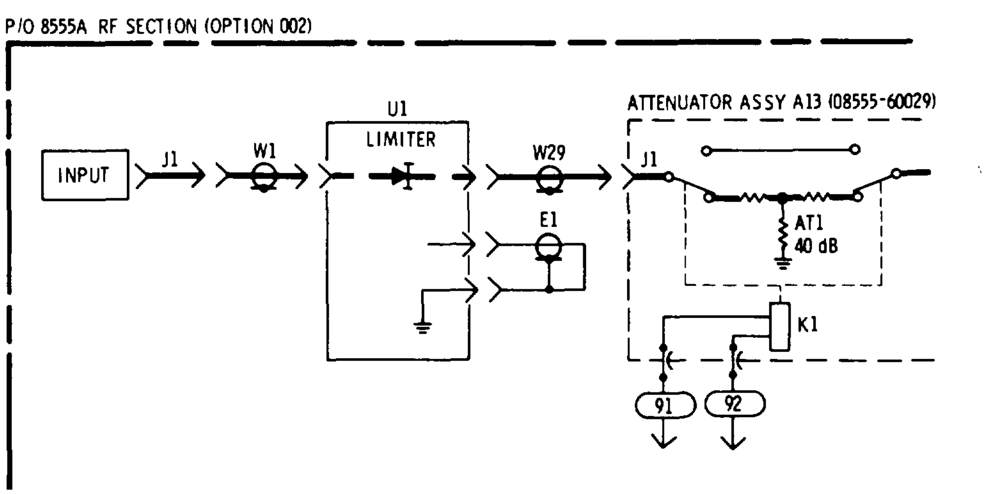
On instruments with Option 002, there is a limiter between the INPUT port and the input attenuator. The limiters frequency range is 0.1 to 12.4 GHz; it consists of two oxide passivated silicon PIN diodes which are functionally integrated into 50-ohm coaxial transmission line. The limiters diodes are not field replaceable. Limiting depends upon input power and the limiting threshold is about 5 mW.

Under "TROUBLESHOOTING PROCEDURE", item (1), add the following:

Failure of the limiter supplied with Option 002 will cause one or more of the following:

1. excessive VSWR (for Option 002)
2. excessive distortion
3. signal level appearing on display either low or nonexistent.

To Figure 8-17, replace appropriate portion of schematic with the following:



APPENDIX B

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TB43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).
TM 11-6625-2781-14&P	Operator’s, Organizational, Direct Support and General Support Maintenance Manual Including Repair Parts and Special Tools List for Spectrum Analyzer IP-1216(P)/GR (Hewlett-Packard Model 141T).
TM 11-6625-2781-14-1	Operator’s, Organizational, Direct Support and General Support Maintenance Manual for Plug-in Unit, Electronic Test Equipment PL-1388/U (Hewlett-Packard Model 8552B).

APPENDIX E

MAINTENANCE ALLOCATION

.Section I. INTRODUCTION

E-1. General

This appendix provides a summary of the maintenance operations for PL-1400 (HP-8555A). It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

E-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

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

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

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

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

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

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

E-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C - Operator/Crew
O - Organizational
F - Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

E-4. Tool and Test Equipment Requirements (Sec. III)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer’s part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

E-5. Remarks (Sec. IV)

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

(Next printed page is E-3)

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PAGE #

E-3

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

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TEAR ALONG PERFORATED LINE

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'EIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

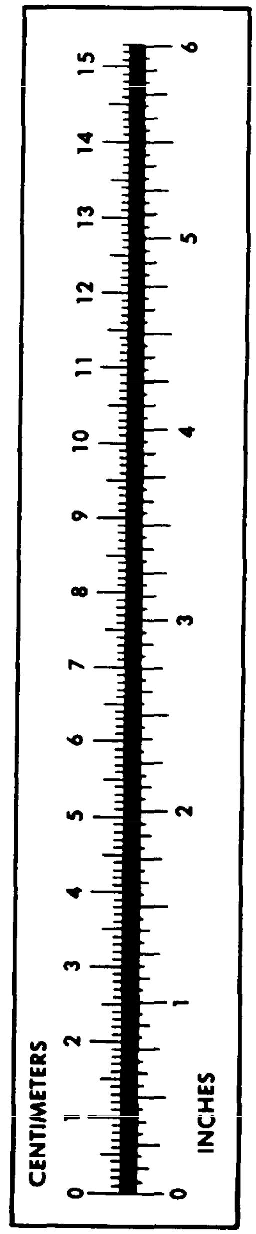
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
.allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
'ers	Gallons	0.264
.ms	Ounces	0.035
.ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
"lometers per Liter	Miles per Gallon	2.354
›meters per Hour	Miles per Hour	0.621



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