TM 11-6625-2949-14

TECHNICAL MANUAL

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

RADIO INTERFERENCE MEASURING SET

AN/URM-200 (NSN 6625-00-776-0595)
-01-083-9446

AND

ELECTROMETRICS MODEL EMC-25

HEADQUARTERS, DEPARTMENT OF THE ARMY

OCTOBER 1979

TECHNICAL MANUAL
No. 11-6625-2949-14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *31 October 1979*

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

RADIO INTERFERENCE MEASURING SET AN/URM-200 (NSN 6625-00-776-0595) AND ELECTROMETRIC MODEL EMC-25

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know.

Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Forms 2028–2 located in the back of this manual direct to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL–ME–MQ, Fort Monmouth, NJ 07703.

A reply will be sent to you.

Table of Contents

Table of Contents

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

Table of Contents

List of Illustrations

LIST OF ILLUSTRATIONS (Cont'd)

List of Tables

SECTION I

Introduction and Specifications

1.1 THE MANUAL

This manual includes all relevant information for the successful operation, maintenance and repair of Interference Analyzer EMC-25.

1.2 THE EMC-25

The EMC-25 Interference Analyzer is designed for use as the major component of interference analysis systems for the 10 kHz to 1 GHz range. The instrument itself is a programmable selective RF voltmeter, compatible with a wide variety of peripheral equipment. A selection of antennas permits the measurement of radiated electric and magnetic field intensity, while various output devices are available to simplify data reduction and extend the EMC-25's usefulness as a system component.

The EMC-25 is used as an RFI/EMC meter, a field strength meter, a frequency-selective two-terminal voltmeter, and for other applications requiring a highly sensitive, shielded receiving instrument.

Frequency tuning, band selection, internal sweep voltage, impulse generator operation and level, bandwidth selection, detector dwell operation, and vernier gain (Cal) all can be externally programmed. Outputs are provided for the pre-IF and post-IF, DC-coupled AM and FM video, audio, voltage analog of frequency, voltage analog of amplitude, binary band indication, and for the impulse generator.

Instructions for operating accessory equipment are Supplied with each accessory. Specific applications are discussed in separate application notes. Field intensities are determined by the simple addition of the calibration factors supplied in the respective instruction manual for the antenna being employed.

1.3 UNPACKING

1.3.1 Remove the instrument carefully from the shipping carton and examine thoroughly for shipping damage. If there is any damage, replace the instrument in the shipping carton and immediately inform the manufacturer and the shipping company of the nature of the damage, the serial number of the instrument, the delivery date, and the invoice number.

1.3.2 Check contents of the carton against shipping slip to be sure that all components and accessory items ordered are present. Notify the manufacturer immediately of any missing items.

1.4 ELECTRONIC SHIPPING DAMAGE

1.4.1 Before leaving the factory, this instrument was subjected to a complete operational check. However, it is possible that electronic damage may have occurred in transit. It is desirable, therefore, to check the operation of the instrument as soon as possible after unpacking.

To do so, perform the calibration tests outlined in paragraph 3.2. If the instrument does not calibrate using the referenced procedures, inform our Customer Service Dept. (518) 843-2600, giving the basic information required in paragraph 1.3.1.

1.5 INSTALLATION

1.5.1 The EMC-25 is designed for bench-top operation, field-portable operation, or for installation in a conventional 19-inch equipment rack.

1.5.2 Rack mounting requires the use of two adapter mounting brackets (ABM-25). Using these brackets, install the instrument by the following procedure. (See Figure 1-1.)

a. Remove the four plastic feet.

b. With six 3/8-inch No. 8-32 binder head screws, fasten brackets to sides of instrument at matching screw holes.

c. Before installing in equipment rack, provide underneath support sufficient to carry the weight of the instrument.

1.6 ELECTRICAL SPECIFICATIONS

1.6.1 FREQUENCY RANGE. The usable frequency range extends from 10 kHz to 1 GHz in 15 bands.

Each band provides a minimum of two percent overlap at each end with respect to adjacent bands.

1.6.2 FREQUENCY ACCURACY. Frequency accuracy is within plus or minus two percent of indicated frequency. (With FINE TUNE control at mid-rotation).

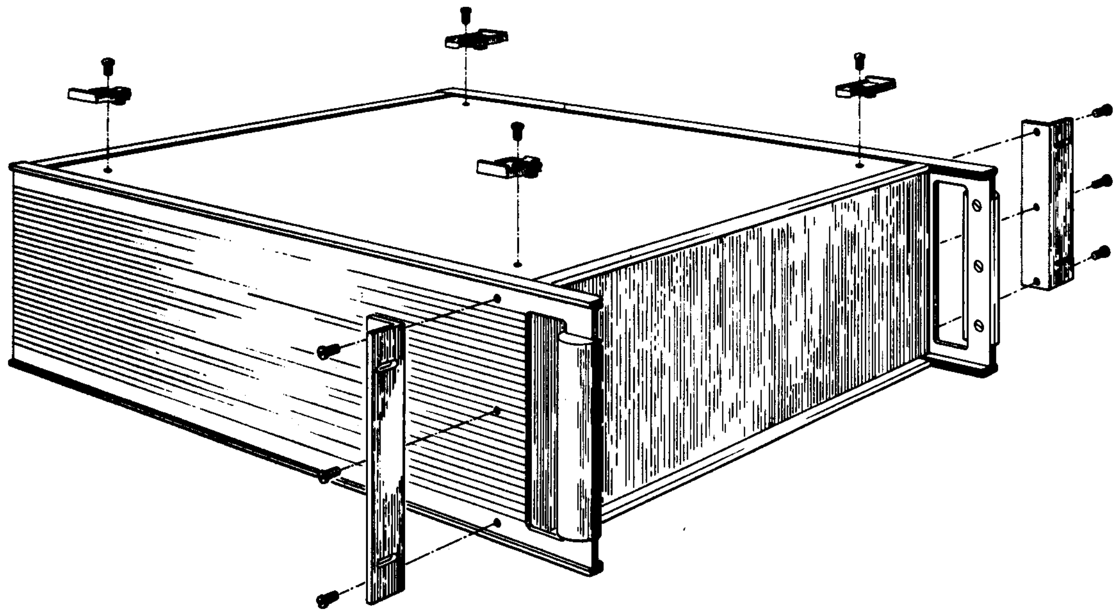


Figure 1.1 Interference Analyzer (Inverted), Installation Drawing

NOTE: **The 4 feet screws are 3/8” No. 6-32 and the 6 rack mount screws are 3/8” No. 8-32 Binder Head.**

1.6.3 INPUT IMPEDANCE. Input impedance is a nominal 50 ohms.

1.6.4 VOLTAGE ACCURACY. Two-terminal CW voltage measurements, referenced against the internal calibrator, are accurate within ±2.0 dB.

1.6.5 SENSITIVITY/BANDWIDTH. Table 1-1 shows the sensitivity and bandwidth of the EMC-25 Interference Analyzer.

1.6.6 SPURIOUS REJECTION. Rejection to Image and IF, and other spurious frequencies typically exceeds 60 dB and is never worse than 45 dB throughout the entire 10 kHz to 1000 MHz range.

1.6.7 VOLTAGE RANGE. The analyzer is capable of measuring signals as large as 1.0 V rms. Voltage ranges are obtained by means of a 20 dB per step attenuator. Overall front panel meter range is 60 dB. Front-end attenuation is inserted in al I positions except the most sensitive (0 dB). Remote position is used in conjunction with the programmable attenuator, Model PSA-25/ESC-125 Programmer.

1.6.8 FREQUENCY CONTROL. The analyzer is tunable over any single band by means of a front panel control, or by the application of a suitable voltage to a rear panel connector.

Frequency bands are switched by a dual front panel pushbutton control or, remotely thru J4. Band indication to the remote location is accomplished by means of binary switch closures.

1.6.9 DETECTOR FUNCTIONS

1.6.9.1 CARRIER. Responding to the rms value of an unmodulated sine wave and having nominal 600 milliseconds charge and discharge times.

1.6.9.2 QUASI-PEAK. As in CARRIER except nominal charge time is one millisecond and discharge time 600 milliseconds.

1.6.9.3 PEAK. As in CARRIER except charge time is $\ll 1\mu S$ and discharge time is sufficiently long to read an impulse of 10 PPS rep rate with less than 0.1 dB decrease in accuracy.

1.6.9.4 SLIDEBACK. A metered. indication of the detector biasing required for aural extinct ion of signals.

1.6.10 OUTPUTS

1.6.10.1 POST-IF: 3.0 mV rms nominal into 50 ohms for Bands 1-10, 1.0 mV rms nominal into 50 ohms for Bands 11-15.

1.6.10.2 PRE-IF: 50 uV rms nominal into 50 ohms.

1.6.10.3 AM VIDEO: 50 mV PEAK nominal into 91 ohms. FM VIDEO: 100 mV PEAK nominal into 91 ohms.

1.6.10.4 AUDIO: 100 mV nominal into 600 ohms.

TABLE 1.1. SENSITIVITY AND BANDWIDTH

BAND	FREQUENCY RANGE	BANDWIDTHS (3db) (Nominal)			*SENSITIVITY		
		.1 NB	NB	WB	.1NB	NB	IMPULSE WB db/uV/MHz
1	10.0 kHz – 35.0 kHz	50 Hz	500 Hz	4 kHz	.016	.04	+34
2	35.0 kHz – 75.0 kHz	50 Hz	500 Hz	4 kHz	.016	.04	+33
3	70.0 kHz – 150 kHz	50 Hz	500 Hz	4 kHz	.016	.05	+33
4	120 kHz – 240 kHz	50 Hz	500 Hz	4 kHz	.016	.05	+33
5	240 kHz – 500 kHz	50 Hz	500 Hz	4 kHz	.016	.06	+33
6	0.5 MHz– 1.1 MHz	50 Hz	500 Hz	5 kHz	.016	.06	+32
7	1.1 MHz – 2.4 MHz	50 Hz	500 Hz	5 kHz	.016	.06	+32
8	2.4 MHz – 5.5 MHz	500 Hz	5 kHz	50 kHz	.03	.10	+22
9	5.5 MHz– 12.5 MHz	500 Hz	5 kHz	50 kHz	.03	.10	+22
10	12.5 MHz– 30 MHz	500 Hz	5 kHz	50 kHz	.03	.10	+24
11	20 MHz – 45 MHz	5 kHz	50 kHz	500 kHz	.22	0.6	+20
12	45 MHz– 100 MHz	5 kHz	50 kHz	500 kHz	.22	0.8	+20
13	100 MHz – 200 MHz	5 kHz	50 kHz	500 kHz	.22	0.8	+20
14	200 MHz– 500 MHz	5 kHz	50 kHz	500 kHz	.35	1.0	+23
15	500 MHz–lOOO MHZ	5 kHz	50 kHz	500 kHz	.50	1.6	+30

* NOTE: Tangential Sensitivity – defined as the internal noise level or as the input signal level required to raise the meter reading 3 dB above the instrument noise. Tangential Sensitivity level is at least 8 dB above minimum discernible signal (MDS). MDS is sometimes defined as being 0.5 dB above the noise level.

1.6.10.5 RECORDER, External Meter: 1 mA at 1500 ohms.

1.6.10.6 X-Y PLOTTING: Y-Axis 0 to +1.5 VDC nominal into greater than 10 k ohms. X-Axis 0 to +1.5 VDC nominal into greater than 10K ohms.

1.6.11 CALIBRATION: The instrument includes a built-in wideband calibration system. Freq. Range 10 kHz to 1 GHz, nominal 100 Hz rep. rate, activated as transfer standard by front panel "Cal" Pushbutton. Variable level output at rear-panel connection when externally programmed with variable DC.

1.6.12 POWER REQUIREMENTS. AC 105V to 130V or 210V to 260V, 50-450 Hz, as well as from an external DC source. Also available, an internal battery, rechargeable (option).

1.7 MECHANICAL CONSTRUCTION

The EMC-25 is divided into three major compartments: the main compartment, the power supply and the control section. The instrument is of unit construction. Interior assemblies are fastened to the bulkhead and front and rear panels by means of machine screws, and by quarter-turn fasteners to permanently welded fixtures.

SECTION II
Theory of Operation

2.1 GENERAL

In the following discussion, the receiver is divided into three sections. The Power Supply Section covers the power sources and the DC supplies and regulators required. The receiver section follows the signal flow from the RF input to the video detector output. The control section includes the Tuning Voltage, Calibration, Audio and Band Switching Circuitry.

2.2 POWER SUPPLY

2.2.1 GENERAL

To permit field operation and to reduce the possibility of ground loops in laboratory work, an optional rechargeable nickel-cadmium battery can be used as the primary power source. When used, this battery is located in the main shielded compartment (see Fig. 6.1). The bottom cover of the receiver must be removed to gain access to it.

When the receiver is plugged into an AC source, but turned off, a two-step charger circuit maintains the battery at full charge. For AC operation, the primary DC voltage is supplied by a bridge regulator and the primary regulator. The primary regulator supplies +24V and -12V. These voltages are used' to operate various relays, the high voltage converter, and the impulse generator, and to supply the low voltage regulators.

This power supply circuitry is housed in a compartment at the rear of the receiver, and can be removed for service by removing two screws on the rear panel. Also located in this compartment is the high voltage converter. This is a doubly-shielded sealed unit that supplies +150 volts as power source for varactor tuning and impulse generator circuits.

The low voltage regulator circuit is located at the rear of the main shielded compartment on a plate that also contains the power distribution terminal boards A5TB1. Service access is gained by removing the bottom cover of the receiver. The low voltage regulators supply the +12 and -6V used by the majority of the receiver circuits.

The primary power supply is designed to operate u rider the following power source conditions with a minimum of operator involvement.

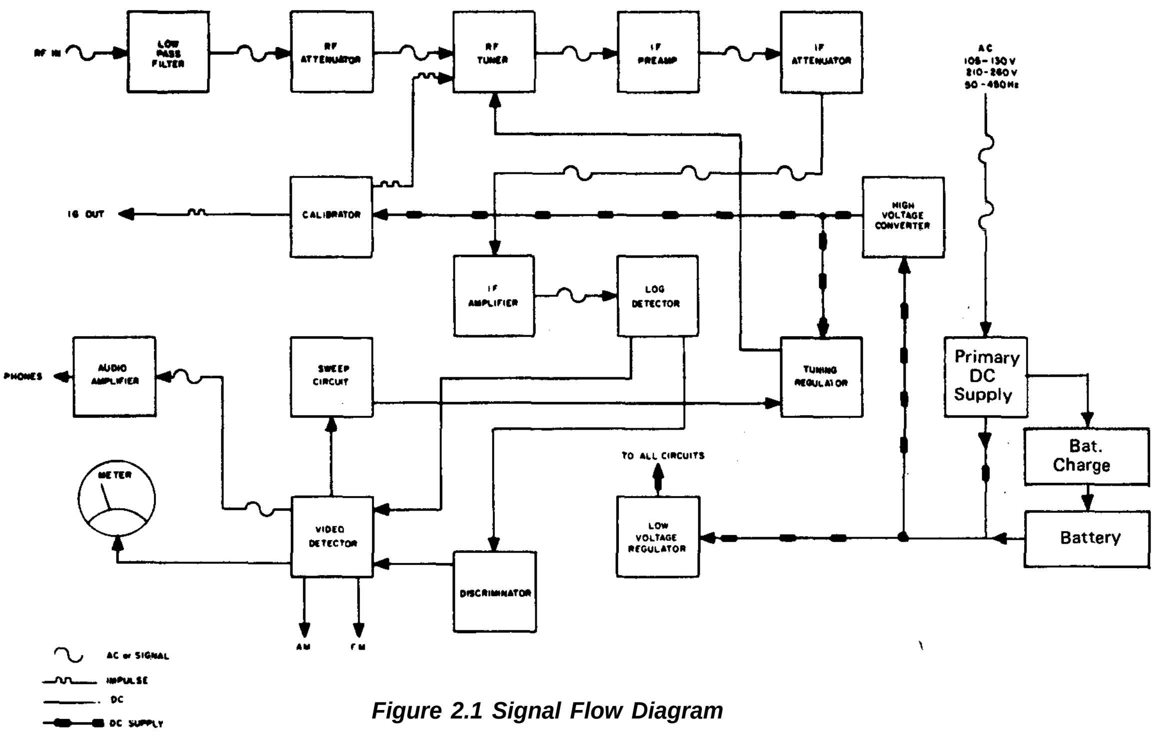


Figure 2.1 Signal Flow Diagram

2.2.1.1 BATTERY OPERATION. When the optional nickel cadmium rechargeable battery A6 is installed, and when the EMC-25 is not connected to an external AC source, the battery functions as the primary power source. When connected to an AC source with the EMC-25 turned off, a two-step charger maintains the battery at full charge. When connected to an AC source with the EMC-25 turned on, the AC source supplies the power for operation.

2.2.1.2 AC OPERATION. The EMC-25 operates from a 110 or 220V, 50 to 400 Hz supply. A switch (A5A1S1) selects the voltage (110 or 220V). This switch is located on the Power Supply Panel at the rear of the receiver. It is necessary to operate this switch with a screwdriver blade, since an inadvertent operation of the switch could cause receiver damage. Unless otherwise specified the receiver is set for 110V operation when it leaves the factory.

2.2.1.3 The EMC-25 may be operated from a DC source of 50±5V with a 2 amp capacity. A special power cord is used connecting to pins E (+) and C (-) of the rear panel power connector A5A1J1.

2.2.2 AC OPERATION

Refer to Fig. 6.27

The AC source entering the power supply module A5 via Power cable PDC-25 is connected to the primaries of power transformer A5A1T1 via the 110V/220V selection switch A5A1S1. In the 120V position, the two primaries are connected in parallel, while in the 220V position the primaries are connected in series. The secondary of A5A1T1 is fused (2 amp, A5A1F1), rather than the primary, so that the fuse need not be changed when the source voltage is changed. A bridge rectifier (CR7, CR8, CR 11 and CR 14), is located on plug-in printed circuit board A5P2. The rectified output of bridge (approximately 60V} is filtered by capacitor A5A1C1 and is connected to the primary voltage regulator circuit. The primary regulator circuit consists of a positive series regulator (A5A1Q1, A5A1 CR5) and a negative shunt regulator (A5A1Q3). The current required to operate zener diode A5A1 CR5 (24V) is supplied from the rectified supply via A5A1R24. Since A5A1CR5 keeps the base of the Darlington emitter follower A5A1Q1 at approximately 24V in respect to ground, its emitter voltage will be about 23V. The high gain of A5A1Q1 provides a stiffly regulated 23V supply at currents exceeding 1 ampere.

The negative shunt regulator circuit equalizes the current drawn through the negative and positive supplies, and establishes a ground reference for both the rectifier and the battery. A 12V zener diode (A5A1CR6) is connected from the negative supply to ground via A5A1R2. Since the EMC-25 receiver normally draws more current from the positive supply, current will pass through A5A1CR6, developing a voltage across A5A1R2. This voltage is fed to the non-inverting operational amplifier U2 on the printed circuit board A5A1P2. The feedback loop of this amplifier (R13, R16) results in a 33DB gain. The amplified output of U2 drives emitter follower Q6 which in turn drives the shunt regulator A5A1Q3, connected between the negative supply and ground. As a result, the negative supply is referenced to ground by zener A5A1CR1, but the current required to maintain this reference is passed by A5A1Q3. A 24 volt zener on the board (CR 13) supplies the operating voltage for the amplifier circuit.

2.2.3 INTERNAL BATTERY OPERATION

Refer to Fig. 6.27

If the EMC-25 has the optional battery, A6 installed, it will operate from the battery whenever the AC supply is removed. The battery, mounted in the main shielded compartment, has a nominal source voltage of 32V. It is connected to the power supply section (A5) via the feed-thru filter assembly A5A2. A5A2-C9 is the negative battery, while A5A2-C4 is the positive battery source. When no AC power source is present, the primary positive buss is supplied via diode A5A1CR2. The positive series regulator A5A1Q1 is not used. The negative shunt regulator A5A1Q3 operates in the same manner as for AC operation, resulting in a primary supply of - 12V and +20V. In AC operation A5A1CR2 is back-biased by the higher positive supply voltage, so no current is drawn from the battery. Resistor A5A1R1 provides a trickle charge current to the battery when the receiver is on and in AC operation.

2.2.4 BATTERY CHARGING

Refer to Fig. 6.27

The two-step charger circuit operates only when the receiver is turned off and when it is connected to an AC source. While a battery is charging there is little temperature rise due to the charge current, since most of the supplied energy is used to create a chemical change in the battery. However, as the battery approaches an over-charged condition there is a sharp temperature rise. The battery pack contains two internal thermistors. TC2 samples the internal battery temperature while TC-1 samples the battery case temperature. These two thermistors, connected via A5A2-C8 and A5A2-C7 to the power supply printed circuit board A5P2, form the two bottom legs of a bridge circuit at the input of differential amplifier circuit U1. The upper legs of the bridge consist of R23 and the series circuit consisting of R22 and R21. R21 is used to adjust the balance of the bridge, and is normally adjusted to provide a 4° F temperature imbalance. This imbalance results in no current through R6, causing Q5 to be cut off. The voltage on the collector of Q5, determined by zener diode CR9, will be about 5V less positive than the bridge rectifier output. A5A1Q2 is a current source whose base is connected to Q5, and whose emitter is connected through R12 to the positive bridge voltage. These conditions cause the current source to pass approximately 250MA which, passing through blocking diode A5A1CR1 to the battery A6 constitutes the high charge current level. When the battery has become fully charged, its internal temperature will begin to rise. When the temperature differential between TC1 and TC2 exceeds about 4° F, the changing resistances of the thermistors unbalance the bridge in the opposite direction. A current flow from U1 pin 8 through R6 saturates Q5. This causes the emitter-base voltage of current source A5A1Q2 to drop to almost OV, and A5A1Q2 will be cutoff. The only charge current to the battery now is the approximately 20ma passing through trickle charge resistor A5A1R1. Zener diode CR10 provides the operating voltage for U1. Diodes CR 17, 18, 19, 20 provide protection for U1 in the event no battery is installed. When the receiver is turned on, a switched positive primary voltage is connected to the emitter of Q4 via R20 and A5A2-C10. Q4 conducts, causing the thermistor bridge to become unbalanced, thus inhibiting the high charge current circuit. The front panel charge light circuit is connected via A5FL-16 to the positive rectifier circuit, and will be on whenever the receiver is connected to an AC supply. This light does not indicate whether full charge or trickle charge is present. Diodes CR 1 and CR3 isolate the battery circuit from the rectifier circuit.

2.2.5 OPERATION FROM AN EXTERNAL DC SOURCE
Refer to Fig. 6.27

When a 50 ±5V supply of 2 amperes capacity is connected between pins E (positive) and C (negative), of the power input jack A5A1J1, this voltage replaces the voltage developed at the output of the bridge rectifier during AC operation. Otherwise the power supply operation is identical to AC operation. CR 12 and CR 16 prevent possible damage to the receiver in the event of a reversed-polarity input. Thermal cut-outs S2 and S3 provide overvoltage protection for the receiver, and short protection for the external supply.

2.2.6 HIGH VOLTAGE CONVERTER (A5A1A1)
Refer to Fig. 6.28

To supply the regulated 100 volts required by the tuning regulator, and 84 volts for the calibrator, a high voltage converter is located inside the power supply casting to convert the DC supply voltage to approximately 150 VDC. This converter consists of a class "C" oscillator, operating at 200 kHz. The high voltage converter is sealed, and is not field-repairable. If faulty operation of the converter is encountered, remove the converter from EMC-25 power supply casting and return it to factory for replacement.

2.3 ATTENUATORS

A single front panel control having 20 dB increments is used to adjust the input signal level to the instrument. Both RF and IF attenuation is provided by this control. The first attenuator position avoids RF attenuation and thus provides maximum sensitivity of the instrument, whereas further attenuation steps add RF attenuation to improve the input impedance characteristic and prevent RF overload. Reduction of the noise displayed on the meter results from adding IF attenuation. Table 2.1 lists the amount of attenuation used.

TABLE 2.1 RF & IF ATTENUATION

Atten. Pos.	Attenuation RF dB		IF dB		Total dB
Remote	0	+	14	=	14
0/20	0	+	0	=	0
20/40	6	+	14	=	20
40/60	16	+	24	=	40
60/80	36	+	24	=	60
80/1 00	56	+	24	=	80
100	76	+	24	=	100

2.4 RF TUNER (A2)
Refer to Fig. 6.5

The function of the RF Tuner is to select and amplify RF signals, convert these signals to desired IF freq, and preamplify the IF signal.

The frequency range (10 kHz – 1 GHz) of the EMC-25 is covered in 15 bands. The band selection is accomplished by using 15 bandstrips mounted on a rotor in the RF Tuner.

For Bands 1-9, the only components on the bandstrips are RF and LO transformers, coils, trimmer and padder capacitors, loading resistors, and coupling capacitors.

For Band 10-15, part or all of the active RF circuitry is mounted on the bandstrip. This is done to minimize lead lengths and stray capacities at the higher frequencies.

In Bands 3, 4 and 13-15, double conversion is used to improve image rejection and other characteristics. Table 2.2 shows the IF frequencies and LO frequencies for all bands.

A Stator Board is mounted adjacent to the rotor. This printed circuit board contains the components not included in the rotor to complete the circuitry required for tuning. Connections are made between the bandstrips on the rotor and the Stator Board by means of thirty nickel-plated spring contacts.

2.4.1 BANDS 1-9 (A2A1-A2A9)
Except Bands 3 and 4
Refer to Fig. 6.5

The operation of Bands 1-9 can be seen by following the signal flow through Band 1. Fig. 6.5 RF Tuner (A2) is a schematic drawing of the Stator Board with Band 1 bandstrip in position. Fig. 6.6 is the schematic for Bandstrips 1-9.

The RF signal comes from the Calibrator Assembly (A9) through a semi-rigid coaxial cable. This coaxial cable center conductor is connected to Pin 2 of the contact strip of the Stator Board. Pin 1 and Pin 3 are used as ground for the coaxial cable. The signal passes through Pin 2 to the untuned primary of T0101 on the bandstrip. The untuned primary presents a nominal 50-ohm impedance at the frequency to which the receiver is tuned. T0101 is a voltage step-up transformer with a tuned secondary. The secondary of T0101 is tuned by voltage variable capacitors which are mounted on the Stator Board and are connected to the secondary of T0101 through Pin 4 and Pin 6. The secondary of T0101 is also tuned by a Trimmer capacitor mounted on the bandstrip. This is a tracking adjustment used only in the initial setup of the band. Voltage variable capacitors CR1 and CR2 tune T0101 over the frequency range of the bandstrip. The tuning voltage for CR1 and CR2 is derived from the Tuning Regulator (A5P4).

The voltage variable capacitors mounted on the Stator Board, CR1, CR2, etc., are actually two voltage variable capacitors CR1A and CR1B connected in series. The series connection is required to prevent large RF signals from changing the DC bias voltage at low tuning voltages and thus detuning the circuit.

Bands 1-7 use CR1 and CR2 in parallel to obtain a higher capacitance for tuning. Bands 8 and 9 use only CR1 since a low capacitance is sufficient.

The gate of the field effect transistor, Q1, mounted on the Stator Board is connected to the secondary of T0101 through Pin 5. The gate of the field effect transistor is a high impedance. The function of T0101 is to transform this impedance to the 50-ohm input impedance and at the same time, it is a tuned circuit which provides preelection. The diodes CR3 and CR4, that are connected to the gate of Q1 provide over-voltage protection.

The field effect transistor, Q1, and the bipolar transistor, Q2, are a cascode RF amplifier. Their function is to amplify the RF signal. The signal goes from the collector of Q2 to the double-tuned circuit on the bandstrip used for preelection; selectivity of the double-tuned circuit is higher than for a single-tuned circuit.

The collector supply voltage for Q2 comes from Pin 10 through L0102 on the bandstrip to Pin 8. Voltage variable capacitor CR5 is connected to L0102 thru Pin 9, and CR6 on the Stator Board is connected through Pin 11. CR5 and CR6 are the main tuning for L0102 and derive their tuning voltage from the same point as CR1 and CR2. A Trimmer capacitor on the bandstrip is a tracking adjustment.

Voltage variable capacitor, CR7, on the Stator Board is connected to L0103 through Pin 13. Voltage variable capacitor CR8 on the Stator Board is connected to L0103 thru Pin 15. CR7 and CR8 are the main tuning for L0103 and derive their tuning voltage from the same point as CR1 and CR2. A Trimmer capacitor is a tracking adjustment for L0103.

The RF signal output from the double-tuned circuit comes from the voltage divider at Pin #16 on the bandstrip. The RF signal output goes through Pin 16 to the gate of the field effect transistor Q3 on the Stator Board. Field effect transistor Q3 and transistor Q4 are a unity gain impedance convener, used to drive mixer Q5, Q6.

Transistors Q5 and Q6 on the Stator Board constitute a balanced mixer which mixes the RF signal and the local oscillator signal to generate an IF signal. A balanced mixer is required in order to cancel any local oscillator signal at the output of the mixer, since at the low frequency end of Band 1, the local oscillator frequency is very close to IF frequency.

Transistors Q5 and Q6 are matched for V_{BE} and H_{FE} so that their gain and mixing characteristics are nearly identical.

The RF signal is introduced at the emitter of Q5 and the base of Q6 and LO signal at the base of Q5 and the emitter of Q6. RF and LO signals introduced at the bases produce collector currents 180° out-of-phase with the input signals. Signals applied to the emitters produce in-phase Collector currents components. As the Collectors of Q5 and Q6 are connected together, the Collector currents produced by RF signals will be out-of-phase and equal in amplitude, causing cancellation at this point. LO signals will be similarly cancelled.

The IF signals generated in the emitter base junction of Q5 and Q6 are identical, so IF signals at the collectors of Q5 and Q6 are additives. The transformer T2001 and capacitor C51 in the collector of Q5 and Q6 is a tuned circuit tuned to the 175 kHz, one of the IF frequencies. This tank circuit is connected to the collector of Q5 and Q6 through diode switch CR9, Bandstrips utilizing the 175 kHz IF have a jumper wire on the bandstrip connecting Pin 20, a +12V point, to Pin 17; this causes CR9 to conduct which connects the 175 kHz IF signal. it then is taken from the secondary of T2001 and connected to TP2 on the Preamp Board through a coaxial cable.

The transformer T3001 and capacitor C52 in the collector of Q5 and Q6 is a tuned circuit tuned to 1.6 MHz. This tank is connected to the collector of Q5 and Q6 by the diode switch CR 10. Bandstrips utilizing the 1.6 MHz IF have a jumper wire on the bandstrip from Pin 18 to Pin 20, a +12V point; this causes CR10 to conduct which connects the 1.6 MHz tuned circuit to the collector Q6. The 1.6 MHz IF is taken from the secondary of T3001 and connected to TP3 on the Preamp board through a coaxial cable.

Refer to Table 2.2 for the IF frequency used with each bandstrip.

Band 1-9 Local Oscillator Operation

The Local Oscillator for Bands 1-10 are similar except for frequency. The operation of the Local Oscillator can be seen by following the operation of the Band 1 LO. Q11, on the Stator Board is the oscillator transistor. The collector of Q11 drives the parallel tuned circuit consisting of the primary T0104, on the bandstrip and voltage variable capacitors CR11 and CR12 on the Stator Board. The feedback signal comes from the tap on the primary of T0104 and goes to the emitter of Q11. This oscillator is in a Hartley configuration. The output signal from the oscillator comes from the secondary of T0104.

Transistors Q10, Q12, and Q13 A and B comprise an automatic level control circuit for the oscillator. The oscillator drive to the mixer is also applied to the base of Q13A, while a DC voltage, set by the oscillator level control, R52, is applied to the base of Q13B. Since Q13 A and B share a common emitter circuit, Q13A will conduct only when the peak positive oscillator level exceeds the DC reference set by R52. Conduction of Q13A charges C60, and results in a decreased conduction of Q13B. The emitter output of Q13B, averaged by C51, controls the emitter drive of the oscillator, Q11 through Q10 and Q12. A decrease in oscillator level will cause the

TABLE 2.2

INPUT AND LO FREQUENCIES

BAND	INPUT FREQ.	IF FREQ.	1St LO FREQ.	2nd IF FREQ.	2nd LO FREQ.
1	10-35 kHz	175kHz	185-210 kHz		
2	35-75 kHz	175 kHz	210-250 kHz		
3	70-150 kHz	1.6 MHz	1.670-1.750 MHz	175 kHz	1.425 MHz
4	120-240 k Hz	1.6 MHz	1.72-1.84 MHz	175 kHz	1.425 MHz
5	240-500 kHz	175 kHz	415-675 MHz		
6	.5-1.1 MHz	175 kHz	.675-1.275 MHz		
7	1.1-2.4 MHz	175 kHz	1.275-2.575 MHz		
8	2.4-5.5 MHz	1.6 MHz	4.0-7.1 MHz		
9	5.5-12.5 MHz	1.6 MHz	7.1-14.1 MHz		
10	12.5-30 MHz	1.6 MHz	14.1 -31.6 MHz		
11	20-45 MHz	8.7 MHz	28.7 -53.7 MHz		
12	45-100 MHz	8.7 MHz	53.7 -108.7 MHz		
13	100-200 MHz	38.7 MHz	138.7-238.7 MHz	8.7 MHz	30.0 MHz
14	200-500 MHz	68.7 MHz	268.7 -568.7 MHz	8.7 MHz	60.0 MHz
15	500-1000 MHz	98.7 MHz	598.7 -1098.7 MHz	8.7 MHz	90.0 MHz

average conduction of Q13B to increase, resulting in an increased drive to the oscillator, while an increase in oscillator level will result in a decreased oscillator drive.

The local oscillator output is taken from the secondary of T0104 and passes to the gate of field effect transistor Q8. Transistor Q8 and transistor Q7 form a unity gain impedance converter similar to Q3 and Q4. The local oscillator signal is coupled from the source of Q8 to the emitter of Q6 and the base of Q5, the mixer transistors.

2.4.2 BAND 10 (A2A10)

Refer to Fig. 6.7

The operation of Band 10 is similar to Bands 1-9 except, due to lead length consideration, the whole RF amplifier is on the bandstrip. Referring to Fig. 6.7, Band 10 Schematic Diagram, the RF signal passes through Pin 2 to the untuned primary of T1. T1 is a voltage step-up transformer and the secondary is tuned by voltage variable capacitor CR1 on the bandstrip. The secondary of T1 is connected to the base of Q1. Transistors Q1 and Q2 are the 1st RF amplifier. They are connected in a cascode configuration. The collector of Q2 drives a single tuned tank which consists of the primary of T2 and voltage variable capacitors CR5, CR6, CR7 and CR8. The RF signal is taken from the secondary of T2 and goes to the base of Q3. Q3 and Q4 are the 2nd RF amplifier and are connected in a cascode configuration. The collector of Q4 drives the double-tuned bottom coupled network consisting of L1 and L2. L1 is tuned by voltage variable capacitors CR9, CR10, CR11, and CR12. L2 is tuned by voltage variable capacitors CR13, CR14, CR15 and CR16. The double-tuned network is coupled using C16 and lead inductance as the coupling reactance. The RF signal output is taken from L2 through R22 and Pin 16 to the Stator Board. The signal passes through Q3 and Q4 to the signal injection. point of the mixer Q5 and Q6. The local oscillator for Band 10 operates in the same manner as in Band 1-9.

2.4.3 BAND 11 (A2A11)

Refer to Fig. 6.8

Band 11 is self-contained in the bandstrip except for the mixer. Referring to Fig. 6.8, Band 11 Schematic Drawing, the RF signal passes through Pin 2 to a tap on the primary of T1. The primary of T1 is tuned by voltage variable capacitor, CR1.

The RF signal passes from the untuned secondary of T1 to the base of Q1. Transistors Q1 and Q2 are the 1st RF amplifier connected in a cascode configuration. The collector of Q2 drives the tuned circuit of L1 tuned by voltage variable capacitors CR2 and CR3, The RF signal from a tap on L1 drives the base of Q3. Q3 and Q4 are connected in a cascode configuration and are the 2nd RF amplifier. The collector of Q4 is connected to the primary of T3. The primary of T3 is tuned by voltage variable capacitors CR4 and CR5. The RF signal output comes from the secondary of T3 and passes through Pin 19 to the signal injection point of the mixer for the 8.7 MHz IF on the Stator Board Factory selected resistors R35 and R21 provide gain adjustment.

Referring to Fig. 6.5, the RF signal comes from Pin 19 to the base of Q9, the mixer for 8.7 MHz IF. The local oscillator signal comes from Pin 21 to the emitter of Q9. The 8.7 MHz 1 F signal is generated in the collector of Q9. The primary of T4001 is connected to the collector of Q9 and is tuned by C56. The IF signal comes from the secondary of T4001 and goes to TP5 on the Pre-amp Board through a coaxial cable.

Referring to Fig. 6.8, Band 11 Schematic Diagram, Q6 is the local oscillator. Q6 is in a common emitter configuration with the collector connected to the primary of T4. The primary of T4 is tuned by voltage variable capacitors CR6 and CR7. C39 is a tracking adjustment. The feedback for the oscillator comes from an inverting winding on T4 and goes through R26 and C42 to the base of Q6. The local oscillator output from the secondary of T4 drives the buffer amplifier Q5. The output of the buffer amplifier passes through Pin 21 to the emitter of A2Q9, the 8.7 MHz mixer.

2.4.4 BAND 12 (A2A12)

Refer to Fig. 6.9

Band 12 is a self-contained bandstrip which operates in a similar manner to Band 11.

The RF amplifiers for Band 12 are similar in operation to Band 11. The mixer and mixer injection is also the same as in Band 11.

Q5 is the local oscillator connected in a common emitter configuration. The collector of Q5 is connected to the primary of T4. The primary of T4 is tuned by voltage variable capacitor CR6. The feedback for the oscillator comes from the collector of Q5 through a phase shift network consisting of C37, L5, CR7, CR8, and the input impedance of Q5, CR7 and CR8 are voltage variable capacitors. The local oscillator output comes from the secondary o T4 through Pin 21 to the emitter of A2Q9, the 8. MHz mixer on the Stator Board.

2.4.5 BAND 13 (A2A13)

Refer to Fig. 6.10

Band 13 is a self-contained bandstrip, except for the second mixer circuit which is on the Stator Board.

Referring to Fig. 6-10, Band 13 Schematic Diagram, the RF signal enters the bandstrip at Pin 2. The RF signal goes from Pin 2 to the tap of L2, a 50-ohm impedance point at the tuned frequency.

and voltage variable capacitor CR2 and C1 form the input parallel resonance circuit. The output is developed across a tap of L2 and goes to the base of transistor Q2. The collector of Q2 drives the tap of L3. L3 and voltage variable capacitor CR5 and capacitor C7 form a parallel, resonant circuit for the output of the 1st RF amplifier. One side of L3 is AC grounded through C47 and the other side of L3 is AC coupled through C8 to CR5 and C7. The output of this tuned circuit goes through the coupling capacitor C9 and R17 to the base of Q5, the 2nd RF amplifier. The collector of Q5 drives a tap on L9. L9, voltage variable capacitor CR8, and capacitor C 18 form a parallel resonant circuit. One end of L9 is AC grounded through C60; the other end is AC coupled through C20 to CR8 and C18. The output of the tuned circuit goes through C21 and R28 to the emitters of Q8 and Q9, which form a balanced mixer.

In order to achieve the proper image rejection, Band 13 is double converted. The 1st mixer is Q8 and Q9. The 1st LO signal comes from voltage variable oscillator, Q4. Q4 is in a common emitter configuration. The Collector is tuned by the parallel resonant circuit formed by the primary inductance of T1, C12, and voltage variable capacitors CR6 and 7. The feedback path is from the collector through the phase shift network consisting of L6, voltage variable capacitors CR3 and CR4 and L5, to the base of Q4. The 1st LO output goes from the secondary of T1 to the base of Q7. The LO signal at the emitter of Q7 drives the base of Q8. The LO signal at the collector of Q7, which is 180° out-of-phase with the signal at the emitter of Q7, drives the base of Q9. The RF signal is applied to the emitters of Q8 and Q9. The series-tuned circuit formed by L16, C44 and C45 in the emitter of Q8 and Q9 is resonant at the 1st IF frequency of 38.7 MHz. This circuit is used to improve the IF rejection of the bandstrip. The collectors of Q8 and Q9 drive the parallel resonant circuit formed by the primary inductance of T2 and capacitors C24, C25, and C26. This circuit is resonant at the 1st IF frequency of 38.7 MHz. The output of the mixer circuit goes from the secondary of T2 to the base of Q10, the 1st IF buffer amplifier. The collector of Q10 drives the parallel-resonant circuit formed by the primary in-ctance of T3 and capacitor C29. One end of the primary of T3 is AC grounded through C31. This circuit is resonant at the 1st IF frequency of 38.7 MHz. The output of the 1st IF buffer goes from the secondary of T3, through Pin 19 to the 8.7 MHz mixer on the Stator Board. This mixer is used for final conversion to 8.7 MHz.

The LO signal for the 8.7 MHz mixer is provided by the 30 MHz Crystal Oscillator Q12. Q12 is in a Colpitts configuration with the collector driving the parallel resonant circuit consisting of the primary inductance of T4, and capacitors C36, C37, and C38. The feedback signal goes from the junction of C37 and C38, through crystal Y1, to the emitter of Q12. The base of Q11, the LO buffer amplifier is coupled to the LO oscillator through the secondary of T4. The output of Q11 goes from the collector through Pin 21 to the 8.7 MHz mixer on the Stator Board. Q13 and associated circuitry are for units with LO output option only.

2.4.6 BAND 14 (A2A14)

Refer to Fig. 6.11

Band 14 is a self-contained band and operates in the following manner:

Referring to Fig. 6.11, Band 14 Schematic Diagram the RF signal enters the bandstrip through Pin 2, and goes to the tap on L1. L1 and voltage variable capacitor CR 1 form a parallel resonant circuit. The signal goes from the tap on L1 to the base of Q1, the 1st RF amplifier. The signal goes from the collector of Q1 to the tap on L5. L5 and voltage variable capacitors CR3 and CR4, form a parallel resonant circuit.

The output of the tuned circuit goes from the tap on L5, through R6 and C4 to the base of Q2, the 2nd RF amplifier. The signal goes from the collector of Q2 to L8. L8 and voltage variable capacitors CR5 and CR6 form a parallel resonant circuit. The output goes from the tap on L8, through R11 to the emitter of Q5, the RF buffer amplifier. The output of Q5 goes from the Collector to the emitter of Q4. Q4 and Q6 form the 1st mixer.

Like Band 13, Band 14 has a double conversion.

The first LO signal comes from voltage variable oscillator, Q3. Q3 has a grounded base and the collector is tuned by the parallel resonant circuit consisting of L12 and L11 in parallel and voltage variable capacitors CR8 and CR9. The feedback signal goes from the tap of L11 through voltage variable capacitor CR7 to the emitter of Q3. The LO output goes from the tap on L11 through R21 to the base of Q4.

Q4 and Q6 are in a cascode configuration and form the 1st mixer. The signal is applied to the emitter of Q4 and the 1st LO is applied to the base of Q4. The 1st IF signal, 68.7 MHz, goes from the collector of Q6 to the parallel resonant circuit formed by the primary inductance of T1 and C22. This circuit is resonant at the 1st IF frequency. The 1st IF signal goes from the secondary of T1 through R28 to the base of Q7 and also through R40 to a tap on L16. L16 and C24 form a parallel resonant circuit of 68.7 MHz. This circuit is used to improve the 1st IF selectivity. Q7 is an amplifier at the 1st IF frequency 68.7 MHz. The collector of Q3 is connected to the parallel resonant circuit formed by the primary inductance of T2 and C25. The output is taken from the secondary of T2 and goes through R39 and Pin 19 to the 8.7 MHz mixer on the Stator Board which acts as the second mixer in the double conversion.

The 2nd LO signal comes from the 60 MHz Crystal Oscillator, Q8, on the bandstrip. Q8 is in a Colpitts configuration. The collector goes to the parallel resonant circuit formed by L22, C29, C30, and C31. The feedback signal goes from the junction of C31 and C29 through Crystal Y1 to the emitter of Q8. The output of the oscillator is from the tap on L22, through C27, R36 and C26 to Pin 21 out to the Stator Board.

Q9 and associated circuitry are for units with LO output option only.

2.4.7 BAND 15 (A2A15)
Refer to Fig. 6.12

Band 15 is a self-contained bandstrip and operates in the following manner:

Referring to Fig. 6.12, Band 15 Schematic Diagram, the RF signal goes through Pin 2 to the input coupling loop of the first voltage tunable bandpass filter. There is a series-resonant circuit from the input to the ground. The circuit consists of L1, C1, C54 and voltage-variable capacitors CR1 and CR2. The circuit is resonant at the image frequency and acts as an image trap.

The tunable bandpass filter is tuned by voltage variable capacitor, CR3. The signal goes from the output coupling loop through C6 to the base of Q1. Q1 and Q2 form a direct-coupled cascode amplifier, whose output is fed through C9 to the input coupling loop of the second voltage tuned bandpass filter, which is tuned by the voltage variable capacitor of CR4. The output of this second filter drives amplifier Q3. The output of Q3 is coupled through C17 and R12 to the input loop of the third voltage-tunable bandpass filter. This filter is tuned by the voltage-variable capacitor CR5.

The signal goes from the output coupling loop of the third bandpass filter, through R20, to the base of Q5, a broadband RF amplifier. The output of Q5 is coupled through C33 to the emitter of Q8. Q7 and Q8 are in a cascode configuration and form the 1st mixer.

The IF output is taken from the collector of Q7 and fed to a resonant circuit consisting of the primary of T2, C40 and C55. This circuit is tuned to the 1st IF frequency, (98.7 MHz). The secondary of T2 couples the IF signal thru R37 to the base of Q6, the 1st IF amplifier. Transformer T1 in the collector of Q6 is also tuned by means of C37, to 98.7 MHz. The output of this amplifier is coupled by means of the secondary of T1, thru R31 and Pin 19 of the bandstrip to the 8.7 MHz, 2nd mixer on the stator board.

The local oscillator signal for the 1st mixer comes from the voltage-variable oscillator, Q9. Q9 has a grounded base, and the collector is tuned by the parallel resonant circuit consisting of L16, in parallel with voltage-variable capacitors CR6 and CR7. The feedback signal goes from the tap on L16 through voltage-variable capacitor CR8 and C52 to the emitter of Q9. The LO output signal goes from the emitter of Q9, through a coaxial cable, and through C39 and R39, to the base of Q8 of the 1st mixer.

The local oscillator signal for the second mixer comes from the 90 M Hz Crystal Oscillator Q4, a Colpitts configuration. The collector is tuned by the parallel resonant circuit consisting of L11, C20, C24, and C25. The feedback signal goes from the junction of C20 and C21, through the crystal Y1, to the emitter of Q4.

The local oscillator signal goes from the tap on L11 through C27, a coaxial cable, and Pin 21 to the 8.7 MHz mixer on the Stator Board.

Q10 and associated circuitry are for units with LO output option only.

2.5 PREAMPLIFIER (A2A16A2)
Refer to Fig. 6.13

Bands 1, 2, 5,6 and 7 use an IF frequency of 175 kHz. The IF output of the mixer on the Stator Board goes to TP1 on the Preamp Board. TP1 is connected to the untuned primary coil of T2002. T2002 is a voltage step-up transformer, with the secondary tuned to 175 kHz by C7. The IF signal comes from the tap on the secondary coil of T2002 and goes to the base of Q2, an emitter follower. A switch on the rotor of the RF Tuner controls the -6V for the 175 kHz Preamp. When the proper bandstrip is in position, a -6V is applied to 175 kHz -6V" terminal on the Preamp Board. This biases Q2 on and causes the diode switch CR6 and CR7 to conduct. The 175 kHz IF signal then goes from the emitter of Q2 through CR6 and CR7 to the base of Q5.

Bands 8-10 use an IF frequency of 1.6 MHz. The IF output of the mixer on the Stator Board goes to TP3 on the Preamp Board. TP3 is connected to the untuned primary coil of T3002. T3002 is a voltage step-up transformer, with the secondary coil tuned to 1.6 MHz by C2. The IF signal comes from the tap on the secondary coil of T3002 and goes to the base of Q3, an emitter follower. When the proper bandstrip is in position, -6V is applied to the “1.6 MHz - 6V” terminal on the Preamp Board. This biases Q3 on and causes the diode switch consisting of CR2, CR3, CR4 and CR5 to conduct. The 1.6 MHz IF signal goes from the emitter of Q3 through the diode switch to the base of Q5.

Bands 3 and 4 utilize a final IF frequency of 175 kHz, but since 175 kHz is also an RF input frequency to the band, Bands 3 and 4 are double converted. The 1st IF frequency, 1.6 MHz, is generated in the mixer on the Stator Board. The 1.6 MHz, IF signal on Band 3 & 4 follows the same path as the regular 1.6 MHz IF signal, except when Band 3 or 4 is in position, -6V is applied to "CONVERTER -6V" terminal on the Preamp Board. This energizes the 1.425 MHz, crystal oscillator, Q1. The oscillator output is taken from the secondary coil of T5001, and is applied across CR2, CR3, CR4 and CR5. In this mode of operation diode switch CR2, CR3, CR4 and CR5 becomes the second mixer generating 175 kHz. The output of the second mixer goes to the base of Q5.

Bands 11-15 use a final IF frequency of 8.7 MHz. The IF frequency comes from the mixer on the Stator Board and goes to TP5 on the Preamp Board. The IF signal goes to the untuned primary coil of T4002. T4002 is a voltage step-up transformer and the secondary coil is tuned to 8.7 MHz by C1. The IF signal is taken from a tap on the secondary coil of T4002 and goes to the base of Q4, an emitter follower. When the proper band is in position, -6V is applied to the "8.7 MHz -6V" terminal on the Preamp Board. This turns Q4 on. The IF signal then goes from the emitter of Q4 to the base of Q5.

Q5, Q6, and Q7 form a variable gain wideband amplifier. This amplifier has a bandpass from below 175 kHz to above 8.7 MHz, covering all three IF frequencies and is common to all three. The gain of this amplifier is varied by light-variable resistors Rλ and Rλ2 in the emitter circuit of Q5. These elements are connected in parallel and determine the gain of the amplifier in conjunction with R31, the feedback resistor. The resistance of the signal elements of Rλ and R is varied by the current in control elements within R and R The control current for R and Rλ comes from the "CAL" control on the front panel of the receiver to the "GAIN" terminal on the Preamp Board. The control signal then goes through a dual emitter follower, Q8 and Q9. The control signal goes from the emitter of Q9 to the control elements of R and R in series. This yields approximately 20 dB of gain control and is used to calibrate the receiver.

The output of the wideband amplifier comes from the emitter of Q7. The IF signal goes from the emitter of Q7 through R34 to relays K-1 and K-2, and resistors R34, R38, R39, R43, and R44 o form the IF step attenuator. The IF step attenuator is electrically controlled by the RF step attenuator. Their values are such that each step of the front panel control gives an overall of 20dB attenuation, but as the attenuation is increased from 0dB position, the noise level on the meter decreases increasing the dynamic range. The output of the IF attenuator goes to connector A2J3 on the RF tuner housing. The IF signal then goes through a coaxial cable to A3J1 on the IF Amplifier Assembly.

The output of the IF step attenuator also goes to the base of Q10, an emitter follower with the output at the emitter. This signal goes through R41 to connector A2J2 on the RF Tuner housing. This signal is the PRE IF OUTPUT and goes from A2J2 through a coaxial cable to A1J101 on the rear receiver housing.

2.6 IF AMPLIFIER (A3)

Refer to Fig. 6.16

The EMC-25 uses three different final IF frequencies and three IF amplifiers. Each IF amplifier has a similar selectivity curve and configuration. The IF selectivity curve in the WIDE BANDWIDTH position is that of five under-coupled doubled-tuned circuits with a coupling coefficient of 0.85.

Although the center frequency the bandwidth, and the gain of each IF amplifier is different, operation of all the IF amplifiers is basically the same.

An IF signal comes from A2J3 on the Preamp Board to A3J1 on the IF Amp. The switch mounted on the rotor in the RF Tuner turns on the proper IF strip by applying -6V to the proper IF (eg. "8.7 MHz -6V" turns on the 8.7 MHz IF amplifier while the other IF amplifiers stay off).

The 8.7 MHz IF signal goes from A3J1 through C1, L4001, and R1 in series to the emitter of Q1. C1 and L4001 are series resonant at 8.7 MHz and present a 50-ohm impedance to J1. This series tuned network, the tank circuit at the input to the preamp, and the tank circuit at the output of the mixer on the Stator Board, are equivalent to one double-tuned network.

Q1 is the 1st stage of IF amplification. The collector of Q1 is tuned by a double-tuned under-coupled network consisting of L4002 C5, the primary inductance of T4004, and C6. Capacitor C4 is the coupling reactance. This network is top coupled and each half has an equal Q factor. Q4 and the unloaded Q of L4002 determine the circuit Q of the 1st half. R5, the unloaded Q of T4003, and the load resistance reflected from the secondary of T4003 determine the circuit Q of the 2nd half.

Each amplifier stage operates in the same manner and is double-tuned and under-coupled to successively increase the "Q" factor to present the proper bandwidths to the Log Detector.

When the "BANDWIDTH" switch on the front panel of the receiver is in the WIDE position the "Bandwidth Command" voltage is -6V. This causes diode switches CR1 and CR3 to be open (off) and diode switch CR2 to conduct in the on position. Then the output of the 1st stage goes from the secondary of T4003 through CR2 to the emitter of Q4, the 2nd stage of IF amplification.

When the BANDWIDTH switch is in the NARROW position, the "Bandwidth Command" voltage is +12V. This causes diode switches CR1 and CR3 to conduct, or to be in the on position and diode switch CR2 to be open or in the off position. Then the output of the 1st stage goes from the secondary of T4003 through CR1 and R6 to the emitter of Q2. The single tuned circuit in the collector of Q2 determines the NARROW bandwidth. The tank consists of L4004 and capacitor C12. R11 is the loading resistor. The output of the tank goes through R12 to the gate of the source follower Q3. The output of Q3 goes from the source through CR3 to the emitter of Q4, the second stage. The tank in the collector of Q2 has a very high Q. R11 is factory adjusted for the proper narrow bandwidth. R6 is factory adjusted so that the gain in NARROW band is the same as in WIDE band.

The output of the last stage of each channel goes to an emitter follower, Q7, that presents the proper impedance match to the Log Detector.

The outputs of all three channels are combined through A3A1 (R32), A3A2 (R33) and A3A3 (R32) and go to J3. This output, the POST IF OUTPUT, then goes through a coaxial cable to A11-J102 on the rear of the receiver.

2.7 .1 NB FILTER (A12) (OPTIONAL)

Refer to Fig. 6.19

The "N" Option to the EMC-25 consists of an internally mounted crystal filter to provide a third, narrower bandwidth. This filter is located in a shielded housing within the EMC-25 main compartment. It shapes the bandpass response characteristic to a 4-pole Gaussian response. The ultra narrow bandwidth is nominally one percent of the wide bandwidth and ten percent of the narrow bandwidth.

The filter assembly consists of three IF channels (175 kHz, 1.6 MHz, and 8.7 MHz) Corresponding to the three IF frequencies of the EMC-25, each channel having a crystal filter and an amplifier. It is located in the circuit between the IF amplifier and Log Detector. When correctly adjusted, the overall insertion loss through the filter operation is 0 dB which allows the gain characteristic "of the EMC-25 receiver to remain unchanged.

2.7.1 CONTROL PARAMETERS FOR "N" OPTION

Refer to Fig. 6.19

The front panel BANDWIDTH switch selects voltages supplied to the 0.1 NB Command line; +12 volts is applied in the 0.1 NB position and an open circuit in the NB position. +12 volts supplied to the filter stage will forward bias CR1, CR4 and CR7 and back bias CR2, CR3, CR5, CR6, CR8, and CR9 allowing signals from the quartz crystal filter to be connected to the amplifier. An open circuit supplied to the command line will back bias CR1, CR4, or CR7 and forward bias CR2 and CR3, CR5 and CR6, or CR8 and CR9, by-passing the filter. Minus six volts supplied by the IF command circuit to the EMC-25 to one of the amplifiers causes that particular channel to operate.

An adjustment in each by-pass circuit of the three channels, (R3, R26, R48) allows the insertion loss of this circuit to be adjusted to match the loss of the corresponding quartz crystal filter. The feedback amplifier, consisting of three transistors, Q7, Q8 and Q9, regains the insertion loss through the filter stage and is adjusted to maintain 0 dB loss. Each channel has an individual gain control (R14, R37 and R59).

2.8 DETECTION SYSTEM

The Detection System of the EMC-25 is contained in three individual modules, the Log Detector (A4), Video Detector (A7), and the Discriminator (A8). The Log Detector and the Discriminator are located in the main shielded compartment and the Video Detector is attached to the bulkhead that separates the control section from the main compartment. The input to the detection system is a linear IF signal from the output of the IF amplifier. The three IF amplifiers have dynamic ranges of approximately 90 dB between noise and the limit levels. Outputs from the detection system include the front panel meter, audio, AM VIDEO, FM VIDEO, and a DC correction voltage to the AFC circuit. Amplitude detection is done in two steps; the Log Detector simultaneously envelope detects the IF signal and provides an output proportional to the log of the peak value of the IF signal, then the Video Detector detects the video signal from the Log Detector output and applies the selected charge and discharge time constants. FM detection is accomplished in the discriminator and the audio signal is recovered in the Video Detector. Refer to Figure 2.2 for a block diagram of the detection system.

2.9 LOG DETECTOR (A4)

Refer to Fig. 6.17

Following each IF amplifier, a seven-stage sequential detection system is used for a logging detector. The design is unique in its simplicity, in that no delay lines are used. Matched precision components preclude the need for any adjustment of this circuit other than the maximum and minimum scale points. There are two outputs from the circuit. One

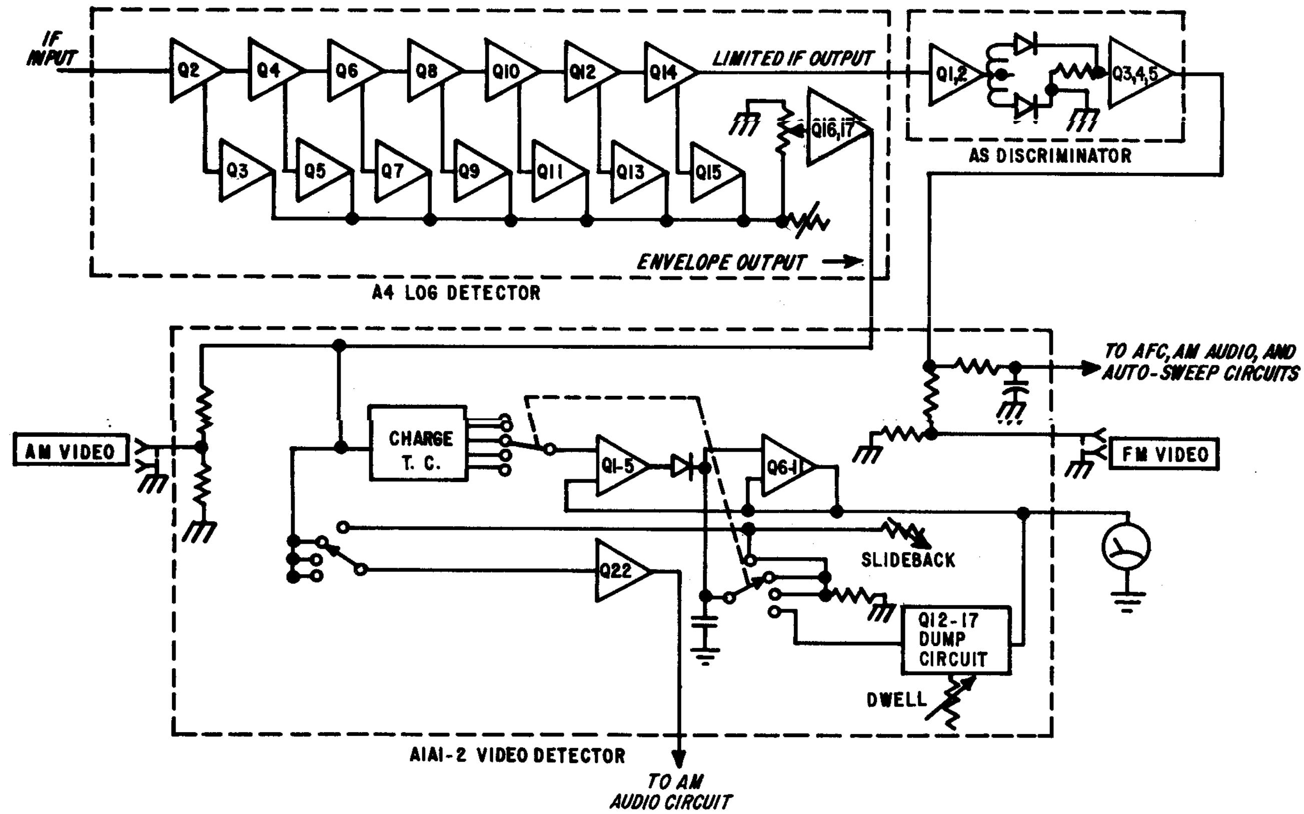


Figure 2.2. Detection System

is a limited IF signal, the other a DC-coupled reproduction of the logged envelope of the signal.

Figure 2.3 illustrates a single stage of the log detector. There are seven similar stages with the IF output of each stage tied in turn to the input of the next stage. The video output of each stage is in parallel with the output of all other stages. The operation of all stages is identical.

Q4 is connected as a grounded emitter amplifier and Q5 is connected as a grounded base amplifier. For small signal levels, Q4 acts as a linear amplifier with the gain approximately determined by the ratio between the emitter resistor (R10) and the collector load which consists of R9, R14 and the input impedance of Q6 has a second-order effect. Under these conditions a fixed current flows in Q5 determined by R10, R11, and R12. Transistors Q4 and Q5 are matched for both H_{FE} and V_{BE} and all transistors with in a particular log strip are selected from a particular H_{FE} grouping.

Under large signal conditions Q4 current its to provide a square wave to the next stage. simultaneously, detection takes place in the emitter-base junction of Q4 causing C15 to charge to a more positive potential. The combination of R11 and C16 further filters any IF frequency at this point so that a DC potential is presented to the emitter of Q5. At this point Q5 will be cut off, resulting in no collector current flow. Component values are proportioned so that the video stage associated with Q6 will be cut off at approximately the same time as Q4 begins its detection.

As signal level increases, each video stage, commencing with the last one in the strip and proceeding towards the input, will cut off. The Collector currents of Q5 and all the other video stages are totaled together in R44 and R45, resulting in a DC voltage, appearing at the point labeled "video line, " proportional to the log of the input signal value. The time constants are proportioned so that the signal on the video line will follow the peak value of the instantaneous signal amplitude. Complementary emitter followers, Q16 and Q17, provide a low impedance output to feed the video detector. Q14, the output IF stage in each of the strips, provides a limited IF signal output to the discriminator.

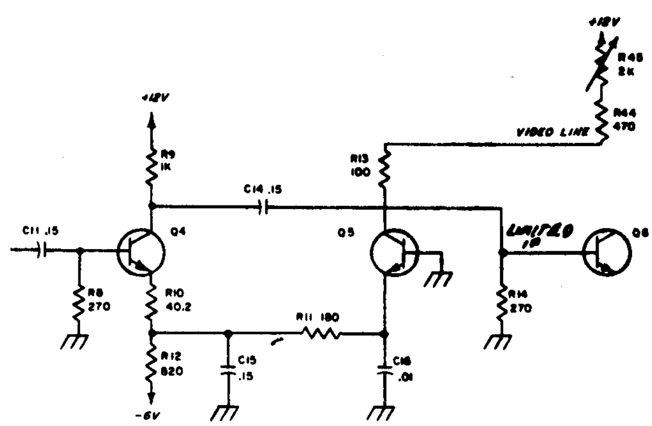


Figure 2.3. Single Stage (Log Detector)

2.10 VIDEO DETECTOR (A7)

Refer to Fig. 6.21

The Video Detector contains two operational amplifiers. The first operational amplifier (Q1-Q5) drives the diode detector CR1. The input is to the base of Q1 via an RC network switched by the front-panel Detector function switch, wafer S1A. The input RC networks establish the detector rise times. The feedback to this operational amplifier is from the signal output (base of Q11) to the base of Q2. This results in unity gain for the overall detector circuit. Since the detector diode CR1 is within the feedback circuit its forward conduction voltage drop is cancelled out.

The second operational amplifier consists of Q6-Q10, whose input is the detected signal from CR1. The high input impedance of this FET amplifier prevents loading of the detector decay time constants. The low output impedance of this unity gain amplifier drives the front panel meter. The detector decay times are established by R-C networks switched by S1B. In the Carrier and Quasi-peak positions of the Detector function switch R34 and C7 provide a 600ms decay time. In the Peak position, the decay time is slow, since the only discharge path for C9 is through R33 and the normally unbiased CR2. In the Slideback position of the detector function switch, a 0 to 1.5V DC voltage set by the front panel Slideback control biases the cathode of CR1. This keeps CR1 cut off for all input levels below the set threshold, while it will pass any input levels exceeding the threshold. The higher level signal components are AC coupled through C14 to the gate of Q22. This is a source follower that supplies the AM signal to the audio amplifier circuit, A1P2.

Q16 controls the detector decay time in the Peak detector mode. When cut off, the collector of Q16 is equal to the output signal level, since it is coupled to the output through R30. The Peak detector hold time will be long, since both the anode and cathode of CR2 are at the same potential. When Q16 is saturated by operation of the dwell circuit (Q12-Q15) or by an external dump command, the collector of Q16 will go slightly negative, due to the negative bias supplied by Q17. This causes CR2 to be forward biased, allowing C9 to discharge rapidly through R33.

The dwell circuit that controls the conduction of Q16 consists of an emitter coupled differential amplifier (Q13 and Q14) driven by the signal output through a pair of emitter followers (Q12 and Q15). Under steady state conditions the inputs to Q13 and Q14 will be slightly unbalanced by different base bias resistors (R25 and R29). This imbalance causes Q13 to conduct enough to saturate Q16, resulting in a “dumped” condition of the peak detector.

A positive input pulse will be coupled to the input of Q13 through Q12. However, the same pulse will not be coupled to Q14, since the capacitor, C5, causes Q15 to become cut off, by holding its emitter constant. This differential voltage change causes Q13 to be cut off, resulting in the cut off of Q16. With CR2 no longer forward biased, the peak detector will have a long hold time. After a period of time determined by the setting of the front panel Dwell Control, R29, C5 will charge through R29 to the point where Q5 again conducts. Q13 now will conduct again, saturating Q16, and initiating a new “dump” cycle. During the dump, C5 is quickly discharged through Q15, readying the dwell circuit for the next positive-going signal input. When the front panel Dwell control is fully CCW, switch S2 opens the emitter circuits of Q13 and Q14, inhibiting dump circuit operation.

When the front panel CAL button is depressed, relay K1 in the detector is energized, forcing the detector into a fast-discharge, peak-detection mode, overriding the Detector function switch position.

2.11 DISCRIMINATOR (A8)

Refer to Fig. 6.18

Each of the three log detector channels produces a limited output of approximately 1 volt rms. These outputs are fed to the three inputs of the Discriminator, A8. In each channel of the Discriminator, transistors Q1 and Q2 further limit and amplify the signal before applying it to the discriminator transformer. Diodes CR1 and CR2 and the associated components form a conventional Foster-Seely type discriminator. A two section RC filter follows this to further remove IF frequency components from the video signal. Transistors Q3, Q4, and Q5 form an operation amplifier connected for a gain of unity which presents a high impedance to the discriminator and a low impedance to the output. As in the IF amplifier and log detector, the -6 volt supply leads are switched to each of the channels as determined by the RF tuner band selector. Due to the fact that the output signal must swing both positive and negative, diode CR3 is included to completely disconnect those unused channels from the common output line.

2.12 CALIBRATOR A9

Refer to Fig. 6.4

2.12.1. GENERAL

The impulse generator is located on the front bulkhead and is connected into the circuit via a fanning strip A9FS8 connected to terminal board A11TB8 and coaxial connectors A9J2, A9J3 and A9J5. When the CAL control is pressed, the impulse generator is activated and connected to the RF tuner input, to be used as a transfer standard for the amplitude calibration of the receiver. It generates narrow pulses at a repetition rate of about 50 Hz whose harmonic output provide a uniform frequency spectrum covering the entire frequency tuning range of the EMC-25. Pressing the CAL control also overrides the front panel settings of the Attenuator, Bandwidth and Detector Function controls, so that these controls need not be pre-set by the operator before calibration.

2.12.2 IMPULSE GENERATOR CIRCUITRY.

Q1 and Q2 comprise an R-C coupled multi-vibrator circuit whose negative source voltage is supplied by the operation of CAL switch A1S2. The operating frequency of the multivibrator is determined by the time constants of the coupling networks C3-R4 and C4-R5. The output of the multivibrator drives Q3 which in turn drives the mechanical impulse generator K1 consisting of a mercury-wetted reed relay in a coaxial structure, activated by a surrounding coil. Before the reed switch is closed, a short section of coaxial line is charged to a DC potential through a series resistor. The DC charging voltage is adjustable on a band-by-band basis by the level control circuitry (A1P2). When the reed switch closes the charged line is discharged. This results in a pulse whose amplitude is al to the charging voltage, and whose duration is determined by the physical charged line length (about 0.2 nanoseconds). Input transfer relays, K2 and K3 are both energized by the CAL switch operation via A9FS8. As a result, the impulse is fed through K2 and K3 to the RF tuner input A1A2J5. A 6dB resistive attenuator at the output of the impulse generator establishes its output impedance. When K2 and K3 are de-energized the RF input attenuator is connected to the RF Tuner via the contacts of K3.

Besides energizing the impulse generator circuit, activating the CAL switch causes the following circuit changes:

a. Relay K1 in the video detector A1A1 is energized, causing the detector to be set to peak.

b. The circuitry for the IF attenuator relays K1 and K2 on the preamplifier board A2A16A2 is opened, causing both relays to be de-energized regardless of the front panel Attenuator position.

c. The Bandwidth is set to “wide”, overriding the front panel switch.

The source for the charge voltage is the 50V from the high voltage converter A5A1A1. his is regulated to 84 volts by R1 and gas regulator tube V1. This regulated voltage supplies the charging voltage to the impulse generator via a voltage divider circuit consisting of R2 and the level adjust controls on A1P2. The IG level adjust circuit consists of nine potentiometers on A1P2 that are individually switched into the circuit, depending on the band selected, by wafer switches A10S1C that are ganged to the frequency drum.

2.12.3 REMOTE OPERATION

When the front panel control switch is in its remote position, the impulse generator is controlled remotely through the rear panel remote connector A1J4. The impulse generator is activated via pin R of A1J4. The charge voltage level enters the receiver through Pin z. The IG transfer switch (K2, K3) maybe separately energized through Pin BB. If the IG is remotely activated, but the IG transfer switch is not energized, the impulse generator output is present at the rear panel IG output connector. This is used to include external cable losses in the calibration of automated systems.

2.13 TUNING VOLTAGE CIRCUITRY

2.13.1 GENERAL

The EMC-25 receiver is tuned across each band by a 0 to 1.5 volt tuning voltage. This tuning voltage may originate from the EMC-25 front-panel tuning control, from an external source, or from the internally-generated sweep of the EMC-25. The frequency of the EMC-25 varies almost linearly with this tuning voltage. The generation or processing of this low-voltage tuning voltage is performed by the plug-in Sweep/Tune board A1P1 mounted in a socket attached at the front panel behind the front panel meter. It is the rearmost of two printed circuit boards at this location. To obtain an unobstructed access to the board for service, the front panel must be removed. However, adjustments maybe made by removing the EMC-25 bottom cover.

The 0 to 1.5V low voltage tuning signal drives a non-linear amplifier on the tuning regulator board A5P4. This plug-in board is located at the rear of the main shielded compartment in a bracket on the side of the power supply housing, and is the board closest to the housing, The 0 to 1.5 volt input results in a shaped 0 to 100V output which constitutes the varactor tuning voltage. It is the shaping of this board that results in the approximate frequency linearity of the input tuning voltage, since otherwise the varactor tuning would be quite non-linear.

2.13.2 SWEEP TUNE BOARD: A1P1

Refer to Fig. 6.23

2.13.2.1 GENERAL. The functions of the sweep tune board are as follows:

a. For manual tuning, the circuitry acts as a buffer between the tuning control A1R3 output and the tuning regulator A5P4 input. The output of the board is modified by fine tuning and AFC inputs.

b. For remote operation, an external tuning voltage replaces the tuning control at the input to the board. This external tuning voltage is applied via the rear remote connector A1J4 and the local remote switch A1S7. A buffer amplifier having a guarded ground circuit reduces FMing of the tuning, due to common mode pickup, by referencing the ground circuit to the external source ground.

c. In sweep mode, a linear sweep generator on the board provides the tuning voltage. The sweep speed is controlled by an auto-sweep circuit also on the board. This circuit varies the sweep speed from a basic 30 seconds/band to as much as 60 mn/band depending on the character of the RF input. An input from the FM detector circuit is processed to detect cw signals. When a cw signal is detected the sweep is slowed to a rate determined by the front panel sweep time control A1R5. After slowly sweeping across the cw signal, the sweep rate speeds up to its basic fast rate. This circuit allows cw signals to be recorded at their true amplitudes even when using the slow-rise-time average detector mode, while at the same time providing the fastest practical overall sweep speed.

d. The sweep tune board supplies the X deflection voltages and the pen control logic to drive an X-Y plotter.

2.13.2.2 SWEEP TUNE BOARD OPERATION.

Referring to Fig. 6..23, U1, a FET input, unity gain differential amplifier is used to provide a high level of common mode rejection when using a remote tuning source, since both the input and ground return circuits are referenced to the external source. The inputs (pins 12 and 14 of the board) are switched by the remote-local switch to either the output of the tuning control A1R3, or to pins C (tune input) and J (tune ground) of remote connector A1J4 located on the rear panel. When the Sweep-Manual switch A1S3 is set to Manual, the output of U1, appearing at Pin 15 of the board, is connected to the non-inverting input of U4 via Pin 18 of the board. The U4 circuit is also a unity gain FET input amplifier. An input to Pin 19 of the board comes from the dual front panel fine tune controls A1R2A and A1R2B. The voltage change caused by the adjusting of these controls, connected to the inverting input of U4 through R25 and R26, modifies the output voltage of U4 by about ± and ±0.1 respectively, providing fine tune control. A negative voltage at Pin 6 and a positive voltage at Pin 22 of the board supply the DC voltages for the fine tune controls. A second input to the inverting input of U4 is the remote fine tune input at Pin 17. An external voltage, applied to Pin 17 via Pin E of A1J4 of +12 to -12V will effect an overall tuning change of approximately 4%. A third input to the inverting input of U4 is Pin 16. When the front panel AFC switch A1S9 is “on,” an FM signal from the discriminator circuit, filtered by R27 and C10 and 11, provides AFC lock-in, by slightly changing the output tuning voltage according to the amplitude and polarity of the FM video signal. R29 is the zero adjustment for U4. Since its setting affects the low-frequency end of a band, it is called the low-frequency adjustment. The 1.5V source for the tuning control, coming from Pin 21 of the board, is affected by series variable resistor R23. This adjustment is called the high-frequency adjustment since it sets the maximum tuning voltage.

When the sweep manual switch A1S3 is set to sweep, pins 4 and 18 are connected together. A 10 µfd capacitor (A1C1) is externally connected from Pin 4 to ground. Q2 is a current source whose conduction is controlled by the operation of the auto sweep circuit, and by the setting of the front panel sweep time control A1R5. The collector of Q2 is referenced to the tuning voltage output, (pin 6 of U4) via R32 and R31. The voltage drop across R32, and R31, determined by the setting of R31, and the conduction of Q2, becomes the charging voltage for sweep capacitor A1C1, since U4 is unity gain and i output will be equal to the charge on the sweep capacitor at its input. Sweep capacitor A1C1 will therefore charge through charge resistor R36 at a rate determined by the voltage drop across R31 and R32. R31 is used to adjust the slowest sweep rate.

Assuming Q4, the auto-sweep switching transistor, is turned off, the conduction of current source Q2 is controlled by its fixed base voltage, and the total resistance in its emitter circuit. Pin #5 of the board is connected to the arm of front panel sweep tune control A1R5 which is connected as a series resistor to +12V. When the sweep speed control is set to 60 rein, its full 100K ohm resistance will be in series with the emitter of Q2 and a slow sweep will result. When the sweep speed control is set to 1 minute only R37 and R33 limit the conduction of Q2, and the sweep speed will be fast. R33 is used to calibrate the fast sweep time.

When Q4 is saturated by the auto-sweep circuit, the emitter of Q2 now has a second, relatively low resistance path through R52 and R43 +12 volts. Therefore, with Q4 conducting the swewp speed cannot be slowed below a sweep speed of approximately 30 seconds, regardless of the sweep speed setting.

The FM signal from the discriminate enters the board at Pin 9 and is filtered by R41 an C13, to remove FM noise and modulation. The low frequency component of the FM signal is AC coupled through C12 to the inverting input of operational amplifier U3B. A clamping diode, CR8, clamps the input signal in a positive direction, since it will conduct on a negatively going signal and charge C12. The gain of U3 is approximately 60dB, set by the ratio of R47 and R41. However, CR7 limits the positive output swing of U3 to about +0.5V. R42 biases the inverting input, so that its normal no-signal state is positive saturation (+0.5V t). When the low-frequency component of the FM signal moves in a positive direction, indicating the proximity of a cw signal, Pin 6 of U3 will be driven positive, causing its output to go to negative saturation (about -5V). Normally, Q3 will be saturated by the positive output of U3 causing Q4 to be saturated, resulting in a fast sweep. When a signal is detected, both Q3 and Q4 are cut off by the negative swing of U3. With Q4 cut off, the sweep speed is determined by the setting of the front panel sweep time control A1R5.

The X output for an external X-Y plotter is provided by unity gain operational amplifier U2B. This amplifier isolates the tuning voltage from the plotter. Pin 2 of the board is connected to Pin B of the rear panel remote connector A1 J4.

The X-Y plotter pen position is controlled by the state of comparator U2A. While generating a sweep U2A is saturated positive, since its inverting input is the sweep voltage. This causes Q1 to be saturated resulting in a ground pen-down signal at Pin 1 of the board. This pin is connected to the rear otter connector A1J5 pin D and remote connector A1J4 Pin M. When the sweep voltage exceeds 1.5 volts set by R4, the output of U2A swings negative, cutting off Q1, resulting in a pen-up signal. The negative swing of U2A also is fed through CR2 and R6 to the non-inverting input of U2A. This latches U2A negatively regardless of the sweep voltage variation. During the sweep the positive output of U2A, coupled through CR3 to the noninverting input of U3A, causes its output to be positive and CR4 to be back-biased. At the end of the sweep, U2A swings negative, CR3 is back-biased, and Pin 3 of U3A goes to ground. Since the positive tuning voltage is applied to the inverting input of U3A through R14, its output swings negative, forward biasing CR4. The negative current through R35 discharges the sweep capacitor A1C1. When the tuning voltage following the discharge of A1C1 goes slightly negative, the output of U3A again swings positive, ending the race cycle.

To initiate a new sweep, the sweep-start itch A1S4 is pressed. One set of contacts of A1S4 shorts the sweep capacitor A1C1 to ground while a second set of contacts charges A1C2, a capacitor mounted on the switch and connected to +20V. When the switch is released, the charged capacitor A1C2 is connected to Pin 3 of the sweep-tune board. The discharge of the capacitor thru R1 to the non-inverting input of U2A causes it to become unlatched and its output swings positive, starting a new sweep cycle.

2.13.3 A5P4 TUNING REGULATOR: Refer to Fig. 6.24

This plug-in printed circuit board is located in the main shielded compartment in a card guide bracket attached to the side of the power supply compartment. Its function is to amplify and shape the 0 to 1.5V tuning voltage signal from the Sweep/Tune board A1P1, resulting in a nonlinear 0 to 100V varactor tuning output voltage. As the voltage vs frequency characteristic of the varactors is very non-linear, the shaping is required to obtain approximately linear input-tuning-voltage vs frequency characteristics,

The 0 to 1.5V input tuning voltage is applied to the gate of FET Q5 via pin 22 of the board. Q5 and Q6 and current source Q8 provide a high impedance differential input for operational amplifier U1. The output of U1 is referenced to the +150 volt supply by Q2. This 150V supply from the high voltage converter A5A1 enters the board at pin 5. Q4 is an emitter follower driven by U2 via CR1. The output of Q4 (Pin 3 of the board) is the varactor tuning voltage. Pin 3 and pin 4 are internally connected together. The negative feedback circuit for the amplifier consists of R15, biased diodes CR5-CR9, and resistors R18-R27. The gain of the amplifier circuit is established by the characteristics of this feed-back network. Each of the shaping diodes (CR5-CR9) is individually back-biased at different levels by a pair of biasing resistors in its cathode circuit. Q7 is a voltage regulator supplying the bias networks.

The feed-back loop forces the voltage at the gate of Q6 to be equal to the input voltage to Q5. The amplitude of this voltage and the biasing networks for shaping diodes CR5-CR9 determine the circuit gain. With an 0v tuning level in, all diodes will be back-biased and the overall gain will be set by a resistive network consisting of R15, R37, R1 and R17. R36, by applying a variable DC bias to Q6, is used as a zero adjustment. If the input tuning voltage is increased until it exceeds the back bias of CR5, supplied by R18 and R20, CR5 will conduct. The resulting increase in gain is determined by the parallel value of R18 and R19. As the input tuning voltage is further increased towards 1.5V, CR6 through CR9 will be turned on in sequence, as the tuning voltage exceeds their respective individual biases. The circuit gain is further increased as each diode is turned on. The resultant non-linear gain-vs-input characteristics shape the varactor tuning voltage output to provide approximately linear tuning voltage vs frequency. Emitter follower Q3 allows the varactor tuning line to be discharged quickly when the receiver is being swept remotely. Zener diode CR2 (105V) prevents the tuning line from becoming so positive that varactor damage could result. Diodes CR3 and CR4 protect U1 from transients.

2.14 AUDIO AMPLIFIER/CAL LEVEL BOARD A1P2 Refer to Fig. 6.22

2.14.1 GENERAL

This plug-in board is located in a bracket on the front panel, between the output meter and the sweep/tune board (A1P1). Circuits on the board perform the two separate receiver functions described below:

a. The board contains an audio amplifier circuit that processes and amplifies the AM video or FM video signals. The audio output of the board is available at the front panel phone jack A1J2 and also at the rear panel remote connector A1J4 (Pins FF and DD).

b. This board also contains nine impulse generator level adjustments. This allows a band-by-band adjustment of the impulse generator output level, eliminating the need for calibration charts.

2.14.2 AUDIO AMPLIFIER OPERATION:

A logged AM signal from the video detector board is applied to Pin 12 of the board (A1P2). A biased diode network, CR2 and CR3 provide an anti-log circuit by attenuating the smaller amplitude signals more, and the higher amplitude signals less, using the log characteristics of the diodes. The anti-logged AM audio signal appears at Pin 13 and is fed to the front panel AM/FM audio switch. The FM audio or AM audio signal is switched to Pin 19 of the audio board by the AM/FM audio switch.

The audio signal is fed to Pin 10 of U2, which is the base of a transistor used as an emitter follower, to match the high input impedance to the low impedance of the audio amplifier.

U1 is a differential amplifier with a cascode input. The audio signal from Pin 1 of U2, is fed to Pin 7 of U1, which is the cascode input. The signal at this input modulates the current through the differential amplifier portion of U1. One differential input, Pin 5 of U1 is grounded.

A zero to +12 volt control voltage from the front panel audio level control is applied to Pin 16 of the audio board. A resistive voltage divider and offset network, consisting of R4 and R6 changes the audio control voltage to approximately -0.5 to +0.5 volts. This control voltage is applied to the second differential input of U1 (Pin 1). The amount of control voltage determines how the audio modulated current will divide between the two transistors of the differential amplifier.

When the audio control is fully clockwise, a control voltage of +0.5 volts is applied to Pin 1 of U1, The entire audio modulated current is directed to Pin 6 of U1, and appears across load resistor R11 as an audio voltage. When the audio control is fully counterclockwise, a control voltage of -0.5 volts applied to Pin 1 of U1, causing no audio modulated current to be applied to Pin 6 and therefore no audio voltage will appear across load resistor R11. Intermediate settings of the audio control will result various audio voltages across load resistor R1 Therefore, the Audio Gain is controlled by a DC voltage from the front panel gain control.

U2, a CA5020, contains a push-pull power output state with a differential input. The audio signal from U1 is coupled through C5 to one input (Pin 3) of U2, while the second input (Pin 2) is connected to AC common through C7. The push-pull outputs (pins 4 and 7) are connected to an audio transformer (A1T1) mounted on the card-guide bracket, via pins 17 and 14 of the board. The primary center tap of the transformer is connected to a +9V source supplied by a regulator on the band via pin 22. The regulator consists of zener reference CR5 and series passer Q1. The zener reference also supplies the operating voltage for both U1 and U2. The secondary of the output transformer A1T1 is connected to the front panel phone jack A1J2 and to the remote connector A1J4 pins FF and DD.

2.14.3 IG LEVEL ADJUSTMENTS

The IF level adjustments R19 through R27 form the ground leg of a voltage divider connected to the +82V regulated source contained in the impulse generator assembly A9. A wafer switch ganged to the frequency drum selects one of the adjustments according to the following table:

Frequency Band	IG Level Adjustment
1,3,4	R27
2,5,6,7	R26
8	R25
9,10	R24
11	R19
12	R20
13	R21
14	R22
15	R23

The setting of the adjustments controls the DC charging voltage to the impulse generator, which establishes the peak level of the impulse. The band-by-band adjustment of the IG level allows amplitude calibration of each band without the need to refer to a calibration chart. The IG level controls are connected to the frequency drum switch via terminal board A11-TB10 and A11-TB11 which allows removal of the frequency drum assembly without unsoldering wires.

2.15 BAND CONTROL BOARD, A5P3
Refer to Fig. 6.25

2.15.1 GENERAL

Bandswitching is accomplished by means of a reversible motor drive for the turret mechanism. Forward and reverse order band selection is initiated locally through the use of the front panel momentary step-up (A1S8) and step-down (A1S7) switches, or remotely via the rear panel remote connector A1J4 Pins C and Y. As long as a band-step signal is present the turret will continue to turn in the direction selected. Absence of the band-step signal causes the turret to stop at the next band. A momentary band-step signal will cause the turret to step one band. Also included in this board is the low battery. cut-off circuit. During battery operation, if the total battery voltage drops below 25 volts, the receiver will automatically be turned off, preventing battery damage from excessive discharge.

2.15.2 FORWARD MOTOR CONTROL

Q2 and Q9 form a hi-stable cathode-coupled multi-vibrator circuit. In its motor-off state, Q2 is cut-off, and Q9 is saturated by a bias supplied by R19, CR5 and CR6. As a result, both Q1 and Q2 will be cut-off, as will the motor drive transistor Q11. A positive pulse at pin 20 of the band, caused by a forward band step signal will drive Q2 into conduction. The resultant voltage spike across R4 will cause R9 to become cut-off. The resultant positive bias to the base of Q2 via R6 will keep Q2 conducting and Q9 cut off. This causes both Q1 and Q2 to become saturated. The conduction of Q1 will result in a positive output at pin 8 of the board. This motor signal is brought to the remote connector A1J4 Pin F and also, through diode logic CR5 and CR6 to the antenna control connector A1J3, Pins D and E. The logic signal is used to inhibit the operation of the Antenna Switching circuit while the motor is turning. The condition of Q3 turns on the motor drive transistor Q11. Both the motor A9B1 and the motor clutch A9K1 are connected between +20V supply and the collector of Q11. The emitter of Q11 is connected through R32 to the -12V supply. With Q11 conducting, both the clutch and the motor will be energized. CR12 and R32 form a current limiting circuit protecting both the motor and Q11 during start-up. The clutch is connected to Pin 16 of the board. Diode CR9 protects the circuit from inductive surges of the clutch. The motor is connected to the circuit by reversing relay K1, which reverses the connections to the motor during reverse operation. CR10, CR11 and CR14 protect the circuit from the inductive surges of the motor.

A microswitch A2S1 mounted on the RF turret housing is activated by the turret band detent mechanism. While the turret is turning, between bands, the micro-switch A2S1 connects Pin 19 of the board to the+ Raw source. Capacitor C2 will charge to this voltage through CR3. Each time the turret detents, Pin 19 is connected to ground via micro-switch A2S1. The resultant discharge of C2 through R5, R3, R6 and R39 will cause Q2 to become cut-off. Once cut-off, the resultant conduction of Q9 keeps Q2 cut-off, and both the motor and the clutch are de-energized.

2.15.3 REVERSE MOTOR OPERATION

A positive pulse to Pin 21 of the board is coupled through CR4 to the input of the hi-stable multi-vibrator (Q2 and Q9). The operation of the motor drive circuit is identical to that for forward operation. The positive input is also coupled through R10 and R11 to the base of Q7, saturating it. This saturates the reverse relay driver Q9, causing K1 to energize. This reverses the supply to the armature of the drive motor causing reverse rotation. Q11 is a “motor-on” sensing transistor which conducts whenever the motor is drawing current. This “motor-on” signal, and a motor-reverse signal derived from the collector of Q4 comprise the inputs to a “Nand” Logic circuit consisting of Q5 and Q6. A simultaneous “motor-on” and “motor-reverse” signal will cause Q5 and Q6 to conduct, keeping the reverse relay energized, When a band is selected and the drive motor is deenergized, Q11 becomes cut-off. With no drive to Q6, the reverse relay is de-energized.

Q8 is also driven by the “motor-on” signal and will be saturated whenever the band motor is energized. Q8 inhibits the input to Q7, preventing motor reversal while the motor is turning.

2.16 L/O OPTION (A2A16A4)
Refer to Fig. 6.14

The Model EMC-25L Receiver may incorporate an LO option, which outputs the LO Frequency of all bands to the receiver rear panel.

This option allows the operator to connect a frequency counter to the LO Output connector (near Panel), for the purpose of reading the LO frequency directly on the counter. Refer to *Table 2.3 (Example Frequencies).*

In the, L/O option, an RF Amplifier (Module A2A16A4), has been added to the RF tuner and hard wired to the contacts on the Statorboard.

TABLE 2.3

BAND	LO Frequency= Received Frequency+ IF Frequency
1,2,5,6,7,	(2.175 MHz) = (2.0 MHz) + 175 KHZ
3,4,8,9, 10,	(7.6 MHz = (6.0 MHz) + 1600 KHz (1.6 MHz)
11, 12	(48.7 MHz = (40 MHz) + 8700 KHz (8.7 MHz)
13	(188.7 MHz = (150 MHZ) + 38.7 MHz
14	(548.7 MHz) = (480 MHz) + 68.7 MHz
15	(698.7 MHz) = (600 MHz) + 98.7 MHz

2.17 PICKUP DEVICES

2.17.1 RVR-25 ROD ANTENNA (10 kHz to 30 MHz) (Refer to Fig. 6.29)

The RVR-25 consists of a 41” Telescoping rod, a counterpoise (ground plane), and an antenna base which houses the remotely switchable matching transformers. It may be either bench or tripod mounted, and is connected to the EMC-25 receiver by an RF cable (CAC-25) and a band-switching control cable (ACC-25). The antenna is mainly sensitive to the electric field component. As the source impedance of the rod is high and frequency dependent, optimum matching to the 50 ohm input of the EMC-25 requires the band-by-band switching of impedance transformers. This is done by a rotary-solenoid-driven wafer switch in the base of. the RVR-25. Band logic signals from the EMC-25, consisting of binary logic on four control wires, are used to select the correct switch position as described in paragraph 2.17.1.1. An injection input (J2) on the antenna base is used for calibration purposes in automated systems. An input signal, attenuated by R23 and R25, is coupled to the primary ground return of the matching transformers. This injected signal will exhibit the same relative frequency-vs-amplitude characteristics as the antenna.

The electric field strength in terms of dBuv/m (dB above one microvolt per meter) is determined by adding the antenna factor for the specific RVR-25 being used, to the two-terminal output of the antenna as measured by the EMC-25.

2.17.1.1 ANTENNA BAND-SWITCHING Refer to Fig. 6.29

The primary band code, and the required operating power are received by the antenna from the EMC-25 via the control cable ACC-25. CR3, and Q3 comprise a 3.6V series regulator circuit that supplies the power to the logic circuitry. Q4 and Q5 are dual NOR gates, connected as inverters, as the logic circuitry requires both the positive and inverted band logic from the EM C-25. Q8, Q9, Q11, Q12 and K1 form the drive circuitry for the rotary solenoid switch B1. The normal output of NOR gate Q6B (Pin 6) is low. Q8 is therefore cut-off, causing the base of emitter follower Q8 to be -12V. The resultant minus voltage keeps Q11 cut-off. Q12 will not conduct, so that both K1 and B1 will be de-energized.

Logic NOR gates Q7A and B are fed either inverted or non-inverted band code signals, depending upon the positions of switch wafers S1AF, S1AR, S1BF and S1BR. If all four inputs to Q4 (A and B) are low, the common output of these gates will be high. This high input to Q6B will cause its output to be low. With Q8 off the rotary solenoid circuit will not be energized. A high at any one of the four inputs of Q7 indicates the solenoid switch does not correspond to the EMC-25 band logic. The resultant low at the common Q7 output can cause a high at the output of Q6B if its second input is also low. This will result in a “motor-on” condition, a the rotary solenoid will step the wafer switch until all the inputs to Q7 become low. Q6A develops a “motor inhibit” signal whenever bands 11 through 15 are selected by the EMC-25, as the antenna does not cover this frequency range. A simultaneous 4 and 8 band code from the EMC-25 results in both the inverted inputs to Q6A being low, preventing switch operation.

When the solenoid switch is being driven, the sequence of events is as follows:

A high at the output of Q6B causes Q8, Q9, Q11 and Q12 to conduct, causing K1 to be energized through S2. S2 is mounted on the rotary solenoid and coupled to it through a toggle cam. The contacts of K1 complete the rotary solenoid circuit and cause B1 to energize, turning the wafer switch through a ratchet mechanism. When B1 is fully energized the toggle cam opens S2. K1 and B1 both become de-energized and a spring returns B1 to its de-energized position. The ratchet coupling prevents the wafer switch from moving. When B1 is completely de-energized, S2 is again closed. If the new wafer switch position still does not correspond to the EMC-25 band code the output of Q6B will again be high and a new stepping cycle will be initiated. This continues until the output of Q6B goes low, indicating correlation between the wafer switch and the band code logic. Whenever K1 is energized, Q10 is saturated by the voltage drop across R22. This keeps K1 latched as long as S2 is closed, insuring that the rotary solenoid will become fully energized.

2.17.2 ALR-25 LOOP ANTENNA, 10 kHz to 30 MHz Refer to Fig. 6.30

The ALR-25 consists of a single-turn shielded loop having a 17-inch diameter. Since the source impedance of the loop is low, and frequency dependent, matching transformers are switched into the circuit by band code signals from the EMC-25 receiver. Paragraph 2.17.1.1 describes the operation of the rotary solenoid drive circuit used for the remote switching of the matching transformers.

An injection input (J2) is used for calibration in automated systems. A signal to J2 is terminated in 50 ohms (R24) and is fed through R23 to a wire closely coupled to the receiving loop. R23 acts as a current source for the low impedance injection loop, so that the field it generates approximates the normal magnetic field received by the antenna, and can be used for antenna calibration.

Although the antenna is designed to respond only to the magnetic field component of the received signal, the antenna factor chart (Fig. 3.6) calibrates the antenna in terms of the equivalent far-field electric component. When the antenna factor is added the output voltage of the antenna, as measured by the EMC-25 receiver, the result is in terms of dB/uv/m (dB above one microvolt per meter). To determine the actual magnetic field in terms of dBuat (dB above one micro-ampere turn), 51.5dB is subtracted from the electric field measurement. This correction factor is derived from the impedance in free space.

2.17.3 BIA-25 BICONICAL ANTENNA (20 MHz to 200 MHz)

This antenna consists of two “eggbeater”-shaped dipole elements and a boom-shaped body housing a broad-band matching network. The shape of the dipole elements and the construction of the matching network result in a broadband response. Typical antenna factors for this antenna are shown in Fig. 3.7. The pattern is the same donut shape as a standard tuned dipole. In use, the antenna must be rotated in both its axes for maximum signal response, as it is both directional and plane-polarized. It is designed for tripod mounting on the TRP-25 by means of the adjustable clamp on its boom.

2.17.4 LCA-25 LOG CONICAL SPIRAL ANTENNA (200 MHz to 1000 MHz)

The LCA-25 is a traveling wave antenna consisting of two logarithmically-spaced spiral elements having a conical configuration. It is directional, having maximum sensitivity with the apex of the cone pointed toward the signal source. It is clock-wise circularly polarized, and therefore has the same sensitivity to plane-polarized signals, regardless of their orientation. its geometric configuration makes it cover the wide frequency range of 200 to 1000 MHz.

Fig. 3.8 shows atypical antenna factor for a spacing of one meter from the radiating source. The curve is corrected for the insertion loss of the CAC-25 RF cable.

2.17.5 CURRENT PROBE - PCL-25

The PCL-25 is a magnetic pickup device which is clamped around a single conductor to measure the RF current flowing in it. It consists of a multi-turn ferrite core toroid coil that is split and hinged to fit around a conductor. The coil becomes the secondary of a step-up transformer, whose single turn primary consists of the conductor it is fastened around, It is calibrated over the frequency range of 10 kHz to 110 MHz. Fig. 3.9 gives a typical correction factor for the probe which, when added to the terminated (50 ohm) two-terminal output of the probes, as measured by the EMC-25 receiver, results in a measurement of the RF current flowing through the test conductor in terms of dBua. (dB above one microampere). The current is measured only through one conductor at a time, If it should be used around more than one conductor its output is proportional to the vector sum of the current flowing in each conductor. If the measurement is made around two conductors carrying out of phase RF currents, a very small current will be measured even though each conductor may be carrying a large current.

2.17.6 MAGNETIC PICKUP PROBES, MFA-25, MFB-25 and MFC-25

The magnetic probe set consists of three small handheld shielded loops, each designed for a specific frequency range. They are uncalibrated and intended for use in identifying the source of a localized magnetic radiation.

The MFA-25 is a 55-turn loop designed to operate over the frequency range of 10 to 520 k Hz. It is red in color.

The MFB-25 is a five-turn loop used over the 0.48 to 25 MHz range. It is white in color.

The MFC-25 is a single-turn loop covering the 22 to 230 MHz range, and is blue in color. Probe resonances make a magnetic loop impractical above 230 MHz.

2.17.7 ELECTRO-STATIC FIELD PROBE EFP-25

This is an uncalibrated hand-held probe used to investigate the source of a localized electric field. It is useful over the entire frequency range of the EMC-25 (10 kHz to 1000 MHz).

SECTION III
Operating Instructions

3.1 GENERAL

This section provides instructions for operation of the Interference Analyzer, Model EMC-25 in all modes. Instructions are also. included for pre-operating calibrations, accessory operation and reading interpretation.

CAUTION

Read all information in this Section before attempting operation.

Improper operation may cause costly damage to the instrument.

3.2 OPERATIONAL PRECAUTIONS

3.2.1 POWER SOURCE SWITCH

An AC power source switch (110/220V) located on the power supply panel located on the rear of the EMC-25 receiver. This switch must be set according to the AC Power Source. Operation on 220V AC with this switch set to 110V AC can cause extensive circuit damage.

3.2.2 MANUAL/SWEEP SWITCH

Switch must be in the manual position to permit local operation of the frequency control dial.

3.2.3 LOCAL/REMOTE Switch must be in local position for manual operations.

3.2.4 INPUT VOLTAGE. Damage to the input attenuator may result if signals larger than 5 volts rms are applied continuously. Pulse signals must be less than 0.5 watt average power and 500 watts peak power.

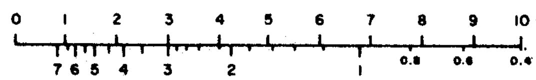
3.2.5 OFF FREQUENCY SIGNALS. Any perhet receiver such as the EMC-25 may generate spurious signals when one or more high-level signals are applied to its input. The exact amplitude of the resultant signal is dependent on so many variables hat specific prediction is not feasible.

Despite the many design precautions taken to minimize such responses, they will appear under some conditions. One method of determining whether a signal is spurious or not is to increase the input attenuation by 20 dB and note which signals drop by that amount. Any signals decreasing by more or less than 20 dB are spurious. The SPD-125 Spectrum Analyzer accessory is a useful aid in this regard.

3.2.6 TUNING ACCURACY. Stated tuning accuracy is met with the FINE TUNE control at mid-rotation. The FINE TUNE control is intended only for tuning narrow-band signals in the high frequency range.

3.2.7 AMPLITUDE ACCURACY. For signals close to the noise level of the instrument, a correction must be made. Use the Correction Factor Scale below.

DB METER READING (ABOVE NOISE)



CORRECTION FACTOR (SUBTRACT)

Top Scale is that increase in dB in meter reading over noise level when input signal is applied,

Bottom Scale is that amount in dB to be subtracted from total meter reading to find actual signal level.

EXAMPLE:

Internal Noise	-30 dB (above 1uV)
Meter indication with signal applied	-25dB
Increase in meter reading (30-25)	5dB
From Scale: amount to be subtracted	1.65dB

Actual signal level equals:
(-25) - 1.65=-26.65 dB (above 1uV)

The EMC-25 cannot be satisfactorily calibrated when the AFC is in operation. Carriers can be measured with AFC on, only if the signal has been peaked on the meter using the F I NE TUNE control.

3.3 CONTROL FUNCTIONS

3.3.1 ATTENUATOR AND REMOTE POSITION. The attenuator adds attenuation to the RF and IF circuits in 20 dB increments. The black numbers are added to the meter reading to obtain the proper scale multiplier for Bands 1-10. The orange backed numbers are used for Bands 11-15. The REMOTE position is used only when an external attenuator is used, in lieu of the internal.

3.3.2 TUNING. The main manual frequency control for the instrument causes the cursor of the frequency dial to move and indicate the frequency to which the instrument is tuned.

3.3.3 FINE TUNING. A dual vernier control covering approximately one percent of a band is used to facilitate tuning of narrowband signals and is especially useful on the higher bands.

3.3.4 TUNING MODE. A two-position selector switch which determines whether frequency tuning is to be done manually or swept automatically.

3.3.5 SWEEP START. Resets the internal circuit to the low end of the band selected when the tuning mode switch is in sweep position. Upon its release the receiver sweeps upward in frequency linearly with time, at a speed which is set by the sweep time control and the Auto-Sweep circuit. It also controls the plotter pen lift.

3.3.6 CAL SWITCH. Activates the impulse generator calibrator and disconnects the receiver input.

3.3.7 BAND STEP SWITCHES. Actuates internal step motor to move up or down to band desired.

3.3.8 AFC SWITCH. This switch activates the automatic frequency control when a desired frequency has been located.

3.3.9 AM/FM AUDIO SWITCH. This switch selects the desired audio signal.

3.3.10 DWELL. Adjusts the length of time the detector holds a signal level when the Detector Function switch is in the PEAK mode. Extreme counterclockwise rotation provides maximum "dwell." (See Section 3.3.18.5.) Turn the DWELL control CW until switch S2 just clicks. This is the maximum "dwell" time for the dump. The fully clockwise position allows the detector to hold the applied signal for only 50µs. (approx.) This is the "dwell full on" position. intermediate positions of the dwell control change the hold time of the detector proportionately.

3.3.11 THRESHOLD. Adjusts the aural extinction point when the Detector Function switch is in the "slideback" mode.

3.3.12 AUDIO. Adjusts the audio output level to the phone jack.

3.3.13 BAT TEST. When pressed, the lower scale on the front panel meter indicates the optional battery condition.

3.3.14 BANDWIDTH. Switches the receiver to either the Wide or Narrow bandwidth with respective values specified for the frequency band selected. The selected bandwidths are according to Table 1.1.

3.3.15 CAL GAIN. Adjusts the receiver gain to permit amplitude calibration.

3.3.16 POWER SWITCH. Used to place the instrument in operation.

3.3.17 SWEEPTIME

The Auto Sweep circuit controls the sweep time of the EMC-25. With no signal applied to the EMC-25 receiver, the sweep rate is set at 30 seconds per band. The position of the Auto Sweep control in this case does not affect the sweep rate. When a CW signal is encountered during the sweep, the Auto Sweep circuit will slow the sweep according to the setting of the front panel Auto-Sweep control. Once the CW signal is tuned through, the sweep time will revert to its basic 30 seconds per band rate.

3.3.18 DETECTOR FUNCTION SWITCH

3.3.18.1 GENERAL. Careful use of the DETECTOR FUNCTION switch, BANDWIDTH switch and associated controls can yield much information about the type of signal being received. Some functions are useful only for manual use, while others can be used both manually and automatically.

3.3.18.2 SLIDEBACK POSITION.

Very weak signals or broad-band signals having different repetition rates may be measured aurally using the Slideback function.

a. Calibrate according to para. 3.8.1.
b. Turn the ATTENUATOR to obtain a reading "on scale."
c. Plug in PHONES. Turn AUDIO CW. Turn THRESHOLD CCW.
d. Adjust AUDIO so that background hiss can barely be heard.
e. Adjust THRESHOLD until peaks of the signal being measured are heard, then turn CW slowly until they just become inaudible.
f. Read meter and add factors as in paragraph 3.8.2.

3.3.18.3 CARRIER POSITION. In the CARRIER position, the meter indicates the rms value of the carrier with all modulation stripped off by the detector's time constant. When using this position, it should be remembered that high peak signal levels might overload the EMC-25 and result in erroneous readings. If the DETECTOR FUNCTION switch is first placed in PEAK and the ATTENUATOR adjusted so that full scale meter deflection is not exceeded, the CARRI E R function can then be used with assurance that overload will not occur.

3.3.18.4 QUASI-PEAK. In the Quasi-PEAK position, the metering circuitry provides a one millisecond charge time constant and a 600 millisecond discharge time constant. Since the EMC-25 accomplishes this detection subsequent to logarithmic envelope detection, the result does not conform to CISPR, ANSI and VDE, which require strict linearity and bandpass characteristics. However, the optional CRM-25 adapts the EMC-25 to meet these requirements.

3.3.18.5 PEAK. The PEAK measurement circuit has a rise time less than 1 μ sec. Fall time is greater than 10 seconds with the DWELL control fully counterclockwise (the normal position for manual operation). The PEAK circuit is calibrated in terms of the rms value of an unmodulated carrier for unmodulated signals. Pulsed RF signals will be read as the rms value of the carrier at the peak of the modulation. There are no significant low repetition rate errors until the rate is below one pulse per second.

3.3.19 AFC OPERATION. Accurate CARRIER measurements of drifting signals can be made if the AFC circuit is used. To properly use the AFC:

a. Set controls:
DETECTOR FUNCTION - CARR
BANDWIDTH - As desired
TUNING MODE - Man

b. Using the TUNING and FINE TUNING controls, tune the signal for maximum meter indication.

c. Turn the TUNING MODE switch to AFC and repeak the signal with the FINE TUNE control.

3.3.20 BANDWIDTH CONTROL. A variation of at least 6:1 in 3 dB bandwidth is selectable with the BANDWIDTH control. The available bandwidths, which vary with the band in use, are shown, in Section 1.6.5.

Maximum CW sensitivity is obtained in the NARROW bandwidth, but if it is desired to recover the signal's modulation, the bandwidth should be chosen carefully, consistent with the width of modulation.

Maximum impulse sensitivity is obtained in the WIDE bandwidth, for which all calibration curves are given. The method for determining whether a signal is classified broad band or narrow band is given in paragraph 3.8.3.1.

3.3.21 BATTERY INDICATOR. The front panel meter indicates the condition of the internal optional battery, when BAT test button is pressed.

3.3.22 CHARGE INDICATOR. With AC Power applied to rear of instrument, the charge indicator will be lit.

3.3.23 POWER ON INDICATOR. Illuminates when instrument is on, extinguished when instrument is off.

3.3.24 LOCAL/REMOTE SWITCH. When in *local* position, control of the instrument will be from the f rent panel. In *remote,* many of the receiver functions are controlled from the rear panel Remote Connector A1J4. *Remote* would be used when options such as ESC-125 Programmer, SPD-125 Spectrum display, or computer control is desirable. These options connect to rear panel remote connector.

3.4 FRONT PANEL CONNECTORS

3.4.1 RF INPUT. The nominal 50-ohm input terminal to which the signal is to be measured is applied.

3.4.2 PHONES. Phone jack for audio output.

3.5 CONNECTION FUNCTIONS - REAR PANEL

3.5.1 I.G. OUTPUT. The I.G. output connector is used in conjunction with automated or semi-automated systems, not used in normal unit operation. Command signals to remote connector A1J4 cause the output of the impulse generator to be present at the I.G. output connector when the Local-Remote switch is in Remote.

3.5.2 AM VIDEO. A nominal 91-ohm output that is proportional to the logarithm of amplitude of the input signal.

3.5.3 FM VIDEO. A nominal 91-ohm output that is proportional to the instantaneous frequency of the input signal.

3.5.4 REMOTE CONNECTOR (50 pin). This connector provides for remotely controlling the EMC-25 functions such as bandswitching, attenuation, gain, etc.

3.5.5 PLOTTER CONNECTOR (11 pin). This connector is used to connect an external plotter to the receiver for a permanent record copy when the receiver is not in a system, i.e. used independently.

3.5.6 ANTENNA CONNECTOR (MS ROUND). This connector is used to connect the ALR or RVR remote antenna to provide Remote Switching of the antennas.

3.5.7 PRE-IF OUTPUT. Provides a linear signal at one of the three IF frequencies depending upon the band in use. Impedance is nominally 50-ohms. Voltage level and bandwidth depend on the band in use. This output should be capped when unused, and terminated in 50-ohms during use.

3.5.8 POST-IF OUTPUT. Provides a linear signal at one of three I F frequencies and selected bandwidth as determined by the band in use and position of the BANDWIDTH switch. The output is approximately 3 mV for bands 1 through 8, and 1 mV for bands 9 through 15. This output should be capped when unused and terminated in 50-ohms when in use.

3.5.9 POWER INPUT. AC power or external DC may be connected here to operate unit or charge internal *optional* battery.

3.6 POWER SUPPLY

3.6.1 POWER REQUIREMENTS. Unless otherwise specified on the purchase order, the EMC-25 is normally wired for operation with the following power supplies:

a. External 105 to 120 volt AC, at 50 to 400 Hz.
b. External 45 to 55 volt DC.

3.6.2 110/220 SELECT. A switch on the power supply compartment cover changes power supply to operate from 105 to 130 volts AC or 210 to 260 volts.

3.6.3 FUSE 2 AMP 3AG SLO-BLO.

3.6.4 BATTERY OPERATION (Optional)

To operate the EMC-25 on internal battery, turn on the POWER switch. Press battery test and if meter reads in operate range, instrument may be put into use. It is advisable to check the battery condition periodically during extended use.

A fully charged battery will operate the EMC-25 for at least eight hours. Use of the bandstepping motor in the EMC-25 will shorten the operating cycle moderately; the exact amount depending on the duty cycle of its use. The instrument should not be stored with a discharged battery longer than one week. During long storage periods, the battery should be brought to full charge at least once every three months.

3.6.5 BATTERY POWER SUPPLY

The optional battery pack (BAT-25) incorporates 24, 4A.H., 1.2V nickel-cadmium cells.

The battery can be used for 8 hours sustained operation without charging. It will fully recharge after such usage in 12 to 16 hours. To recharge the battery, connect the instrument to an external AC source. Battery charging is automatically controlled by the instrument and will occur with the POWER switch OFF only.

Because testing with this instrument is usually performed sporadically for periods of time, it is difficult to know the charge condition of the battery. The front panel meter indicates the approximate battery condition, when bat. test button is pressed.

To charge the battery, set the line voltage switch on the rear panel to the appropriate position, and connect the line cord PCD-25. The front charge light will glow, indicating that the charger is operating. The POWER switch must be OFF to obtain charge.

3.6.6 CHARGING THE BATTERY

Battery life is a function of many factors in addition to the charge/discharge ratio. However, maximum life will be obtained from the EMC-25 if the following principles are observed:

a. Operation of the EMC-25 when it is connected to AC power produces no discharge of the battery and avoids the need for re-charging to replenish loss.

b. As long as the interval between periods of use does not exceed one week, any loss of charge resulting from battery-only operation for a period (T) can be replenished by recharging with the unit off the same length of time, (T).

c. When the EMC-25 is being used only infrequently its battery can be kept in optimum and charged condition between use by connecting the EMC-25 to AC, with the front-panel power switch “off,” for a total of 6 to 8 hours each week.

3.6.7 BATTERY PROTECTION CIRCUITS

3.6.7.1 OVERCHARGING

Overcharging will not be possible, because the charger circuit automatically reduces charging current as soon as overcharging reaches a significant level.

3.6.7.2 EXCESSIVE DISCHARGE

Excessive Discharge will not be possible, because the flow of battery current to all circuits is automatically interrupted, as soon as battery voltage drops to a value indicating negligible remaining capacity.

3.6.7.3 LINE OPERATION

To operate the instrument from an AC line, adjust the' line voltage before connecting the PCD-25 line cord. Then turn. the POWER switch on and check the battery condition (if internal battery option is installed) by pressing the BAT TEST button and noting if the meter reads in the "operate" region.

3.6.7.4 EXTERNAL BATTERY

Battery operation for periods longer than 8 hours may be accomplished by using external storage batteries in conjunction with power cord PDD-25. To operate, connect an external floating battery of 45 to 56 volts utilizing the PDD-25. The red clip should be connected to the positive battery terminal.

CAUTION

Do not ground the battery terminals or establish a reference ground. Let the external supply "float" above ground.

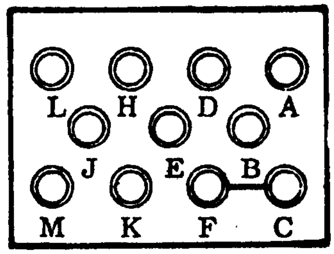
3.7 REMOTE OPERATION

3.7.1 PROGRAMMING

Remote programming of the EMC-25 is achieved through the REMOTE connector by either voltage or resistance control. Fig. 3.2 illustrates the REMOTE connector with the letter corresponding to each input and the legend denotes each pin function.

3.7.2 X-Y PLOTTING

3.7.2.1 GENERAL. With the addition of an X-Y Plotter, such as Electro-Metrics Model EXY-125B, the internal sweep circuit can be used to make semi-automatic measurements. (Fig. 3.1)



A Pen Comm (—)
B X Out (+X)
C Shield Gnd
D Pen Lift Coil (N/O) (+)
E X Comm (Gnd) (-)
F Y Comm (Gnd) (-)
M "Y" Out (+Y)

Figure 3.1 Recorder Connector (A1J5 Front View)

3.7.2.2 CALIBRATION X-Y PLOTTER WITH EMC-25

Calibration is accomplished as follows:

a. Leaving the Tuning Mode selector in MANUAL, tune the EMC-25 to the low frequency end of any band.

b. Adjust the plotter X-ZERO to bring the Pen to the left-hand margin of the paper.

c. Tune to the high frequency end of the band and adjust the X-GAIN control of the plotter to the right hand margin of the paper.

d. Repeat steps a) thru c) as required.

e. Adjust the plotter Y-ZERO until the noise reads Slightly above the bottom margin.

f. Place DET to slideback and adjust threshold for full scale.

g. Adjust the plotter Y-gain control to bring the pen to the top margin.

h. Place the Tuning Mode selector in the SWEEP position; set the SWEEP time control to desired position. Depress and release the START button. The EMC-25 will sweep across the chosen band. The noise level and various IG levels may be plotted on the paper to provide calibration lines. If it is decided to recheck a signal after automatically scanning, the Tuning Mode switch should be moved back to MAN.

3.7.3 EXTERNAL CONTROL. Through use of the outputs provided at the REMOTE 50-pin connector on the rear panel of the EMC-25, many functions may be remotely programmed.

Outputs from the receiver include X and Y outputs for X-Y plotting, binary switch closure indication of band in use, and sufficient power to operate a number of external accessories.

Inputs to the EMC-25 receiver can remotely control frequency band changing, bandwidth, Cal Level gain, I.G. operation, and external dump.

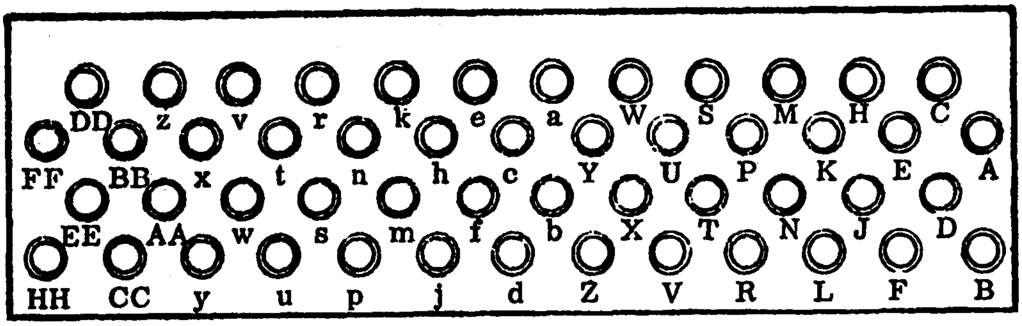


Figure 3.2 Remote Connector A1J4 (Front View)

A	Tuning Pot Arm (Manual)
B	Spare
C	Tuning Voltage Input (0 to +1.5V nom.)
D	Spare
E	Fine Tune
F	Antenna Inhibit
H	Spare
J	Tune GND
K	Analog GN
L	Spare
M	X-Y Plot Pen Lift +
N	Pen Lift Command –
P	Gain Control iN
R	IG Drive Command –6V
S	Bandwidth Command
T	Dwell Command
U	Bandwidth select (+12V = NB) (–6V = WB)
V	+12 volts
w	0.1 NB Select
X	-6 Volts DC (Regulated)
Y	Band Step ↓
z	Digital GND
a	Peak Comm.
b+	Y out
c+	x out
d	Spare
e	Band Step ↑
f	Spare
h	Band Logic Command
j	80 dB Attenuator
k	0-1 Band Logic
m	Spare
n	0-2 Band Logic
p	40 dB Attenuator
r	0-4 Band Logic
s	20 dB Attenuator
t	0-8 Band Logic
u	Spare
v	Spare
w	Remote Attenuator
x	IG Contacts (-300v to +300v for ext. level)
Y	Spare
z	IG Level Out
AA	Gnd
BB	Shunt Cal Command -12 VDC Activate
CC	-7 to -15 VDC Raw
DD	Audio Gnd
EE	HV Raw 110V (Min) 220V (Max)
FF	Audio Out
HH	+15 to +24 VDC Raw

ANTENNA CONTROL CONNECTOR

A	GND
B	1-Logic
C	2-Logic
D	4-Logic
E	8-Logic
G	Cal Command (-6V, +12V)
H	-12VDC
I	+20 VDC

3.8 PRE-OPERATIONAL CALIBRATIONS

All measurements made with the EMC-25 are based on its calibration as a two-terminal voltmeter. The built-in calibration standard is an impulse generator whose spectrum is essentially flat between 10 kHz and 1 GHz.

Calibration factors are also provided for making broadband measurements. Fig. 3.3 is the broadband factor calibration chart.

3.8.1 CW CALIBRATION. To calibrate the EMC-25 for directly reading signal levels in microvolt or dB above one microvolt proceed as follows:

a. Set controls:

FREQUENCY	-	As required
TUNING MODE	-	Manual
AFC	-	OFF
Local/Remote	-	Local

b. Depress the SHUNT CAL button and simultaneously rotate the CAL knob until the meter indicates zero.

c. The instrument is now calibrated. dB above one microvolt may now be read by algebraically adding the dB value shown on the meter to that indicated at the ATTENUATOR setting. The black values are used for Bands 1-10 (white frequency scale) and the orange for Bands 11-15 (orange frequency scale).

For the bands covering up to 30 MHz (white frequency scale, microvolt values may be read directly from the meter when the attenuator is in the 0 dB position. Full scale various attenuator position (orange or black) areas follows:

ATTENUATOR	FULL SCALE VOLTAGE
0 (black only)	10uV
20	100uV
40	1 mV
60	10 mV
80	100 mV
100	1 V

d. Set the DETECTOR FUNCTION switch and ATTENUATOR as required by the signal being measured. The BANDWIDTH switch may beset to either Wide or Narrow, as required by the signal bandwidth or noise considerations.

3.8.2 BROADBAND MEASUREMENT

To calibrate the EMC-25 for reading signal levels in dB above one microvolt per mega hertz, proceed as follows:

a. Calibrate as per 3.8.1.

b. Set detector function to peak.

c. The instrument's gain is now set properly. To read signals in terms of dB/uV/MHz, algebraically add the broadband conversion factor given in Fig. 3.3 to the meter reading and attenuator settings.

3.8.3 BROADBAND/NARROWBAND MEASUREMENTS

The procedure for determining if a response is broadband or narrowband in character is given in para. 3.8.3.1.

When the frequency spectrum of a received signal is much wider than the bandwidth of the receiver, the response is classified broadband. Broadband measurements are made in the PEAK detector mode, and WIDE bandwidth setting. The broadband correction factor (Fig. 3.3) is added to the measured peak signal level to obtain the broadband level in terms of dBuv/MHz (dB above one microvolt per MHz). If an antenna or pickup probe is used, its correction factor is also added. In the case of a radiated field, this results in a measurement in terms of dBuv/m/MHz (dB above one microvolt per meter per MHz). Some examples of broadband sources are auto-ignition, powerline interference and some radar and multiplex transmissions.

When the modulation spectrum of a signal is not wider than the receiver's bandwidth, it is classified narrowband. The broadband correction factor is not used, and the measurement is in terms of dBuv, or dBuv/m (dB above one microvolt per meter) with the applicable antenna factor added, PEAK, QUASI-PEAK, or CARRIER DETECTOR functions may be used. The CARR detector function gives the best cw sensitivity, and responds to the average of the modulation envelope. The PEAK detector function has poorer small signal sensitivity, and measures the Peak of the modulation envelope. The QUASI-PEAK detector function provides a small signal sensitivity close to CARR, and measures the peak of the modulation envelope.

3.8.3.1 BROADBAND/NARROWBAND DETERMINATION

The following is a procedure for determining the broadband or narrowband character of a signal:

a. Set the receiver controls as follows:

BANDWIDTH	-	WIDE
DETECTOR	-	PEAK
TUNING MODE	-	MANUAL
CONTROL	-	LOCAL
TUNING/BAND	-	as required
DWELL	-	Mid-range

b. Tune the receiver for the peak of the desired signal and note the amplitude. ,

c. Tune the receiver downward in frequency and note the frequency at which the response falls off by 3 dB.

d. Starting at the peak amplitude frequency, (step 6) tune the receiver upward in frequency, and note the frequency at which the response again falls off by 3dB.

e. Subtract the lower frequency (step c) from the upper frequency (step d). The signal is classified broadband if this frequency difference is greater than the frequency differences listed below:

Bands 1-7 (14 kHz to 2.4 MHz) greater than 20 kHz

Bands 8-10 (2.4 MHz to 30 MHz) greater than 200 kHz

Bands 11-15 (20 MHz to 1000 MHz) greater than 2 MHZ

f. If the frequency difference is less than listed above, the response is narrowband in character.

3.9 ACCESSORIES

3.9.1 GENERAL. A wide range of programming, pickup, and convenience accessories are available for the EMC-25. Programming accessories are those which utilize the inherent capability of the EMC-25 for remote control to provide an automated capability. Pick-up devices extend the EMC-25 capability from a two-terminal tunable voltmeter to a field and current measuring device. Convenience accessories extend the utility of the instrument by providing audible outputs, convenient junction points and remote meter indication, etc.

3.9.2 PROGRAMMING ACCESSORIES. The model ESC-125A Programmer utilizes the sweep, bandswitching, and X and Y output capability of the EMC-25 to provide completely automatic amplitude vs. frequency X-Y plotting of the spectrum from 10 kHz to 1 GHz. The rapid sweep capability of the EMC-25 is utilized by the SPD-125 Spectrum Display Module. The CRT of this accessory can display an entire EMC-25 octave bend at one time, a band sector, or provide an amplitude vs. time display of modulation on a selected carrier.

3.9.3 CONVENIENCE ACCESSORIES RIM-25 REMOTE METER

This accessory item allows amplitude readings to be made at a location up to 25 feet from the EMC-25 receiver. It consists of an output meter in a small metal enclosure and a permanently attached 25 foot cable. In operation, the connector at the end of the cable is connected to the plotter connector at the rear of the EMC-25. This connects the remote meter in parallel with the front panel meter of the EMC-25. Because of the small loading effect, the EMC-25 should be amplitude calibrated following connection of the Remote Meter.

3.10 ANTENNAS AND PICKUP DEVICES

3.10.1 GENERAL

For the measurement of an electromagnetic field, various antennas are used with the EMC-25 Interference Analyzer. Each of the calibrated pickup devices requires a correction factor to be added to the indicated EMC-25 input level to determine the true field strength. Since the antenna factor normally varies with frequency, this correction factor is termed an “antenna factor” in the case of antennas and is presented in the form of a graph. Typical graphs for the various antennas/pickup devices are shown as Fig. 3.5 through 3.9. Actual correction factors accompany the respective pickup devices.

3.10.2 RVR-25 ANTENNA

This rod antenna measures the electric field component of an electromagnetic signal over the frequency range of 10 kHz to 30 MHz. To operate first connect the counterpoise (ground plane) GPA-25 to the top of the antenna base by means of four captive thumb-screws. Next, screw the telescopic rod into the socket in the center of the circular insulator of the base. and extend it fully (41"). The antennas may be bench-mounted or mounted on the TRP-25 tripod. For screen room applications, where practical, the ground plan should be bonded to the screen room wall. Control cable, ACC-25, is connected between the multi-pen connector on the antenna base, and the rear-panel antenna control connector of the EMC-25, to band switch the antenna automatically according to the EMC-25 band setting. Next, connect RF cable, CAC-25, from the RF input connector on the antenna base to the RF input on the front panel of the EMC-25. The signal injection connector on the antenna base is not used. Since most signals in the frequency range of this antenna are vertically polarized, and since the antenna is omni-directional in the horizontal plane, it does not normally need to be oriented for best reception. Once the desired signal is tuned in on the EMC-25, and the input level to the EMC-25 determined, the antenna factor for the frequency used is determined by referring to the antenna factor graph for the actual RVR-25 being used. This factor is added to the measured input level. This results in the electric field measurement in terms of dBuv/m. (dB above one microvolt per meter).

NOTE

Proper operation of the impulse generator, utilized as the built-in calibration standard, requires that the EMC-25 be physically situated within 30° of horizontal. Also, when operating normally, a moderate amount of "bounce" in the meter reading of the calibration is to be expected. The operator visually must average the reading to set the level specified on the chart.

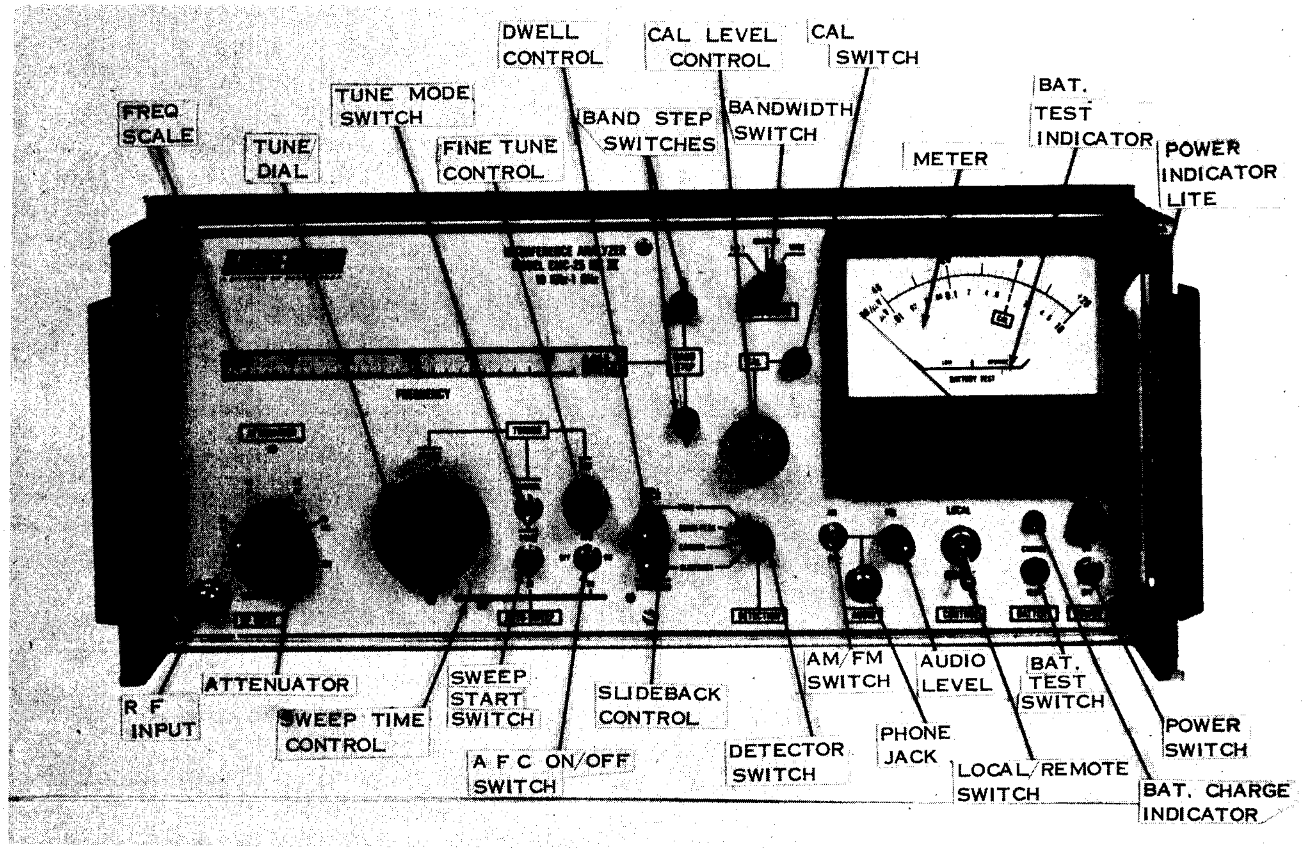
Band Number	Frequency Range	Broadband Conversion Factor*
1	10.0 kHz – 35.0 kHz	
2	35.0 kHz – 75.0kHz	
3	70.0 kHz – 150 kHz	
4	120 kHz – 240 kHz	
5	240 kHz - 500 kHz	
6	0.5 MHz – 1.1 MHz	
7	1.1 MHz – 2.4 MHz	
8	2.4 MHz - 5.5 MHz	
9	5.5 MHz – 12.5 MHz	
10	12.5 MHz – 30 MHz	
11	20 MHz – 45MHz	
12	45 MHz – 100 MHz	
13	100 MHz - 200 MHz	
14	200 MHz – 500 MHz	
15	500 MHz – 1000 MHz	

Add to meter DB reading and attenuator reading to obtain broadband signal level (DB/uv/MHz).

Figure 3.3
Calibration Chart-Broad and Narrow Band

***This certifies that the procedures and factors given in Fig. 3.3 Section 3.8.1 for EMC-25 S/N _______________ are traceable to the National Bureau of Standards. Calibration data is maintained on file for reference as required.**

Date _____________ ______________________________
Quality Control Mgr.



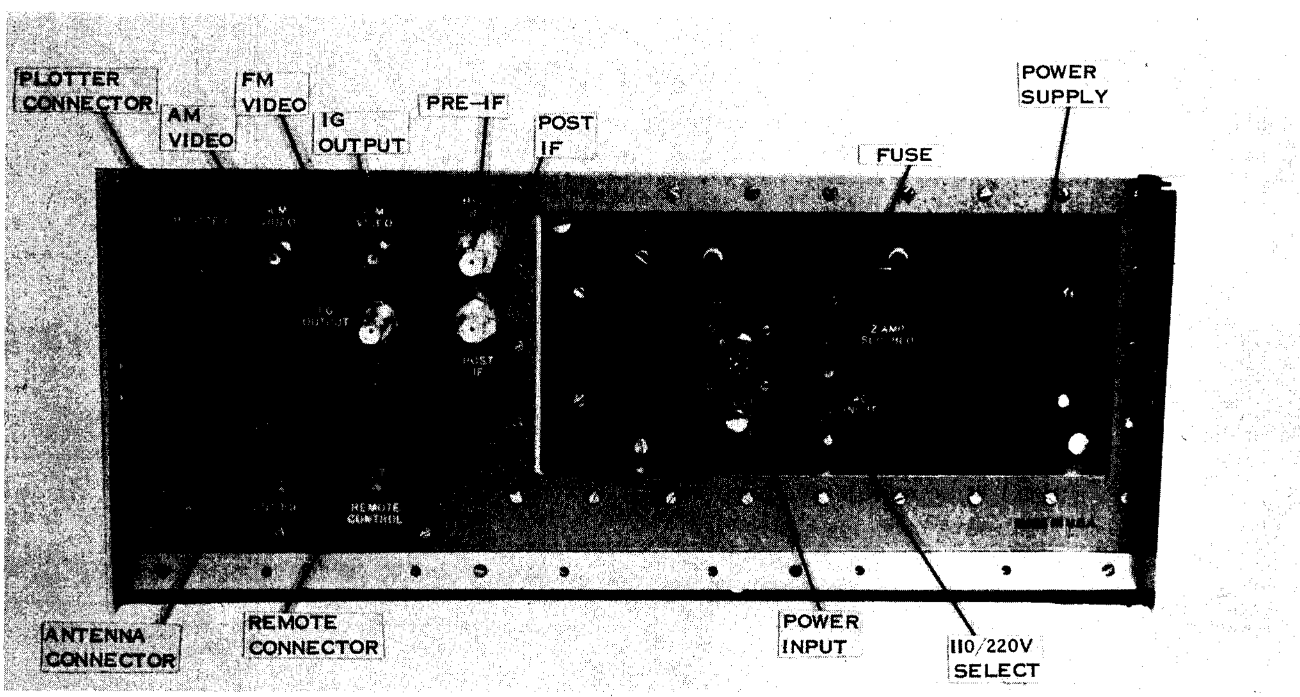


Figure 3.4
Front & Rear Panel
Connectors & Controls

3.10.3 ALR-25 ANTENNA

This loop antenna measures the magnetic field component of the electromagnetic field over the frequency range of 10 kHz to 30 MHz. However, its antenna factor converts into terms of the equivalent electric field. It is connected to the EMC-25 by means of a control cable (ACC-25) connected from the multi-pen connector on the antenna base to the rear panel EMC-25 antenna control connector and an RF cable CAC-25 connected from the RF output of the antenna base to the front panel RF input to the EMC-25. The ALR-25 may be either bench-mounted or mounted on the TRP-25 tripod. It is bi-directional in the plane of the loop, and must be oriented for best sensitivity. In use, the signal of interest is tuned in and the antenna is rotated for highest level. The input level to the EMC-25 is determined and the antenna factor obtained from the graph furnished with the ALR-25 being used. The resulting answer is the equivalent electric field expressed in dB uv/m (dB above one microvolt per meter). To determine the actual magnetic field, expressed in terms of dBuat (dB above one microampere turn) an additional correction factor of 51.5dB is subtracted.

3.10.4 BIA-25 BICONICAL DIPOLE ANTENNA (20 MHz - 200 MHz)

This broadband dipole antenna is normally stored disassembled. It consists of two “Egg-beater’’-shaped dipole elements which are screwed into one end of the “Dumbbell-shaped” boom. An adjustable clamp on the boom is used for tripod mounting (TRP-25), using the AMT-25 antenna mount adapter and one or two of the MSA-25 mast sections. The antenna is connected to the EMC-25 RF input by means of the CAC-25 cable. The antenna is both hi-directional and polarized, so that it must be rotated and turned on its axis for maximum signal indication. The antenna factor for the frequency of measurements, taken from the chart furnished with the BIA-25, is added to the measured EMC-25 input to determine the incident field strength expressed in terms of dBuv/m. (dB above one microvolt per meter)

3.10.5 LCA-25 LOG CONICAL SPIRAL ANTENNA (200 - 1000 MHz)

This antenna is connected to the EMC-25 by means of the CAC-25 RF cable. It is mounted to the TRP-25 tripod using the AMT-25 antenna mount adapter and one or two MSA-25 mast sections. It is uni-directional and most sensitive when the apex of the cone is pointed toward the radiating source. It is circularly polarized so that it is not necessary to rotate the antenna on its axis, regardless of the direction of polarization of the received signal. Typical near field (1 meter spacing) antenna factors are given in Fig. 3.8. When the appropriate antenna factor, from data furnished with the respective LCA-25, is added to the EMC-25 input level the result is the field strength in terms of dBuv/m.

3.10.6 PCL-25 CURRENT PROBE (10 kHz to 110 MHZ)

This hinged magnetic pickup device is made to enclose a single conductor, to measure the RF current traveling on it. In use, the donut-shaped probe is opened by loosening the thumb screw and swinging it open on its hinge. A single conductor is positioned in the center hole and the probe is closed and secured by the thumb screw. The probe is connected to the EMC-25 front panel RF input connector using the CAC-25 RF cable. The EMC-25 is tuned to the frequency of interest and an amplitude measurement made. The probe correction factor, obtained from the curve furnished with the probe, is added to this EMC-25 input level. The result is in terms of dB μa (dB above one microampere). If more than one conductor is positioned through the probe an error will result as the probe will measure the vector sum of the currents.

3.10.7 MFA-25 and MFB-25 AND MFC-25 MAGNETIC FIELD PROBES

These small hand-held loops, color-coded by frequency range, are uncalibrated and are intended for use in locating the source of localized magnetic radiation. The red probe (MFA-25 is for use over the 10 kHz to 520 k Hz frequency range. The white probe (MFB-25) is used from 0.48 MHz to 25 MHz. The blue probe (MFC-25) is used from 22 MHz to 230 MHz. These magnetic probes are not used above 230 MHz.

3.10.8 EFP-25 ELECTRO-STATIC FIELD PROBE (10 kHz - 1000 MHz)

This is a hand-held uncalibrated probe used to investigate the source of localized electric field radiation. it is useful over the entire 10 kHz to 1000 MHz frequency range of the EMC-25 Interference Analyzer.

ANTENNA FACTOR CHART

RVR-25

(TYPICAL)

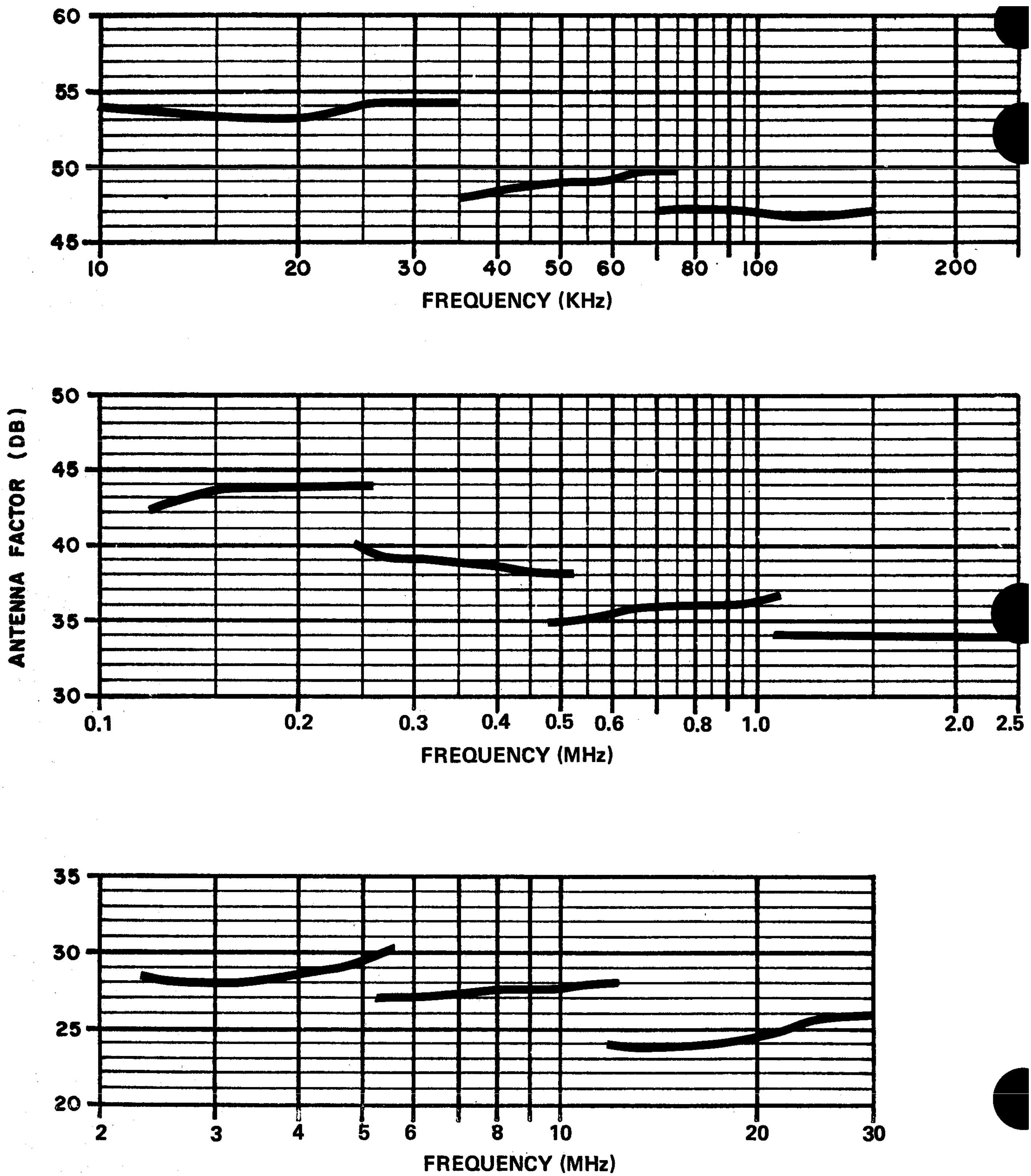


Fig. 3.5

ANTENNA FACTOR CHART
ALR-25
(TYPICAL)

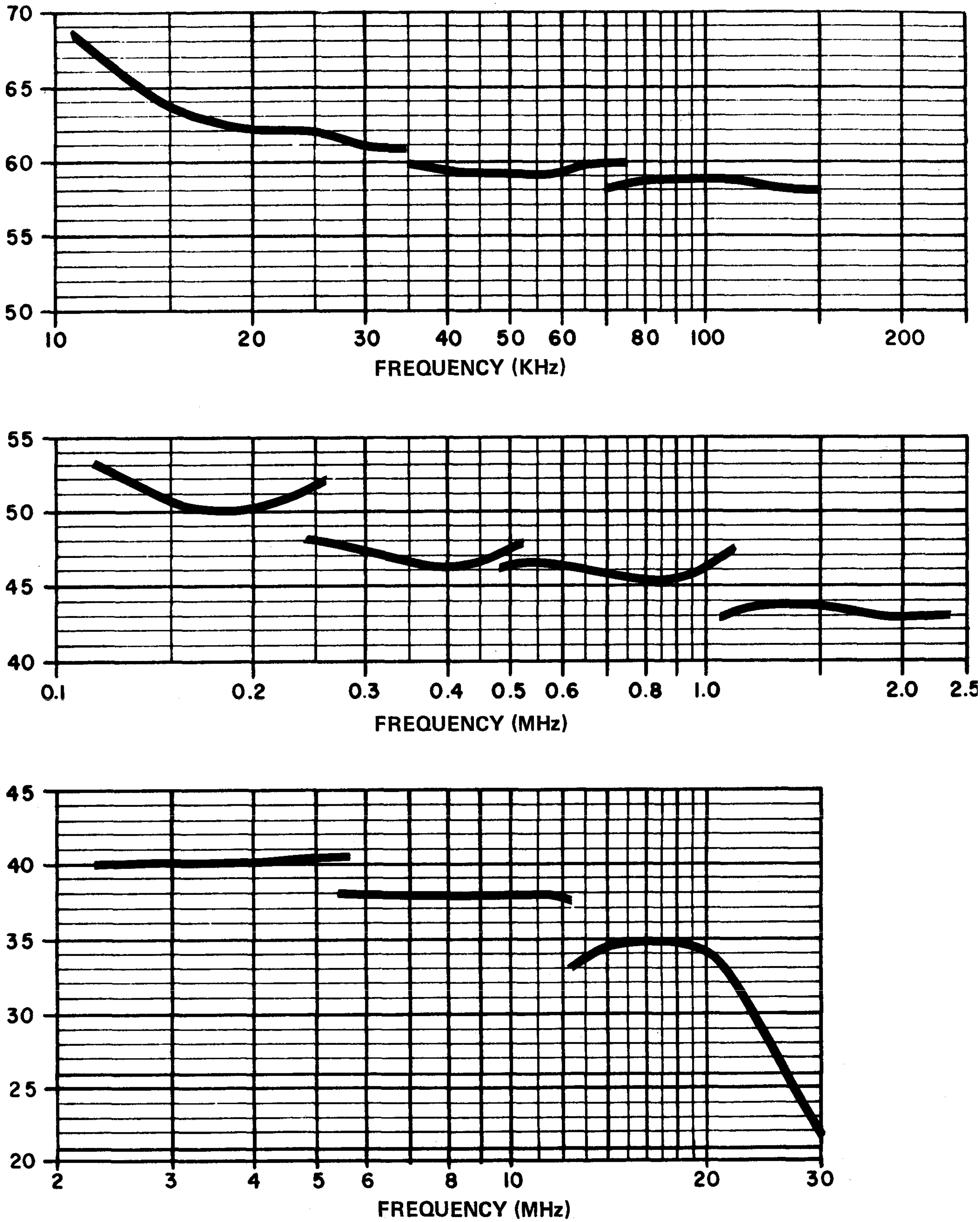


Fig. 3.6

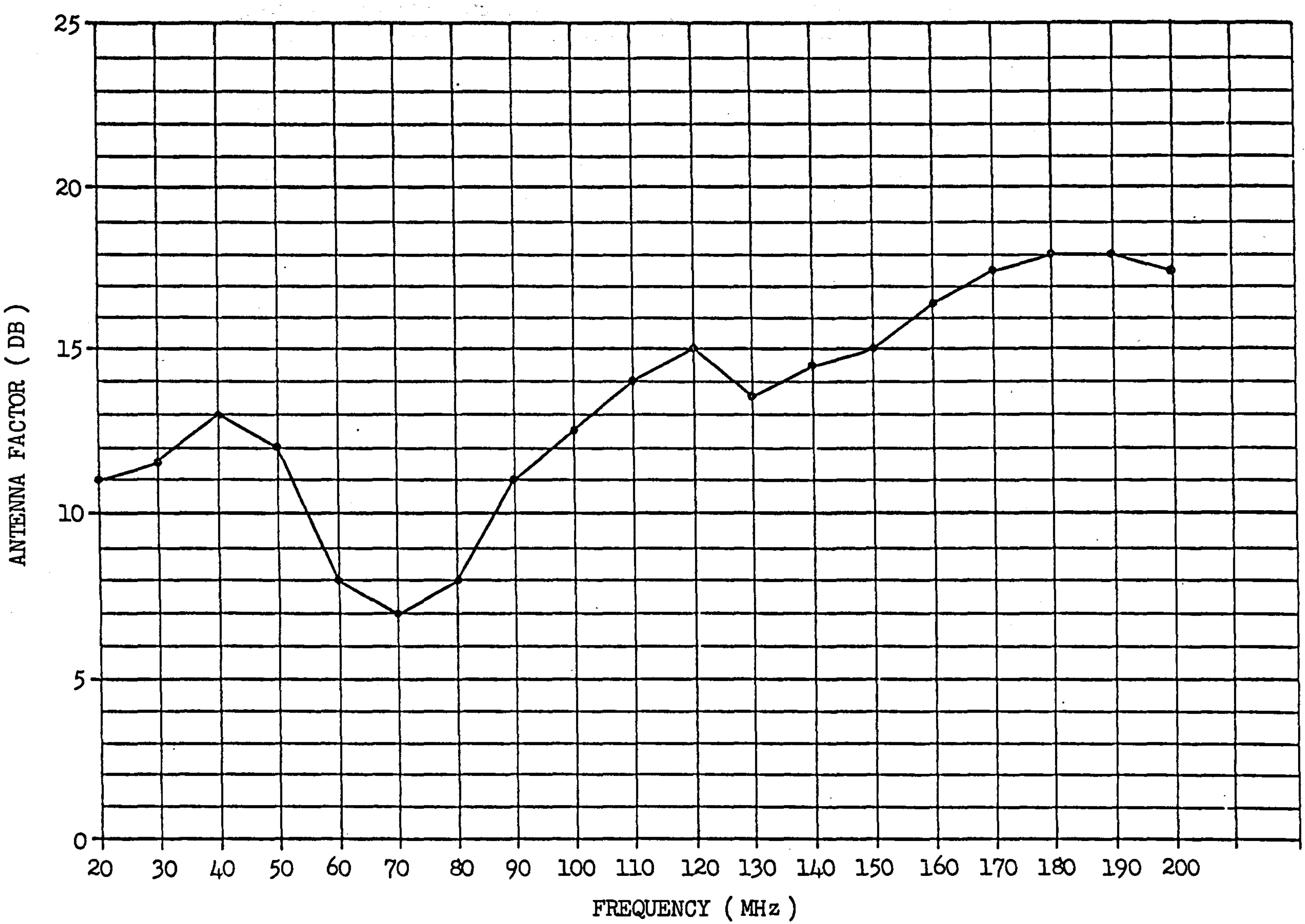
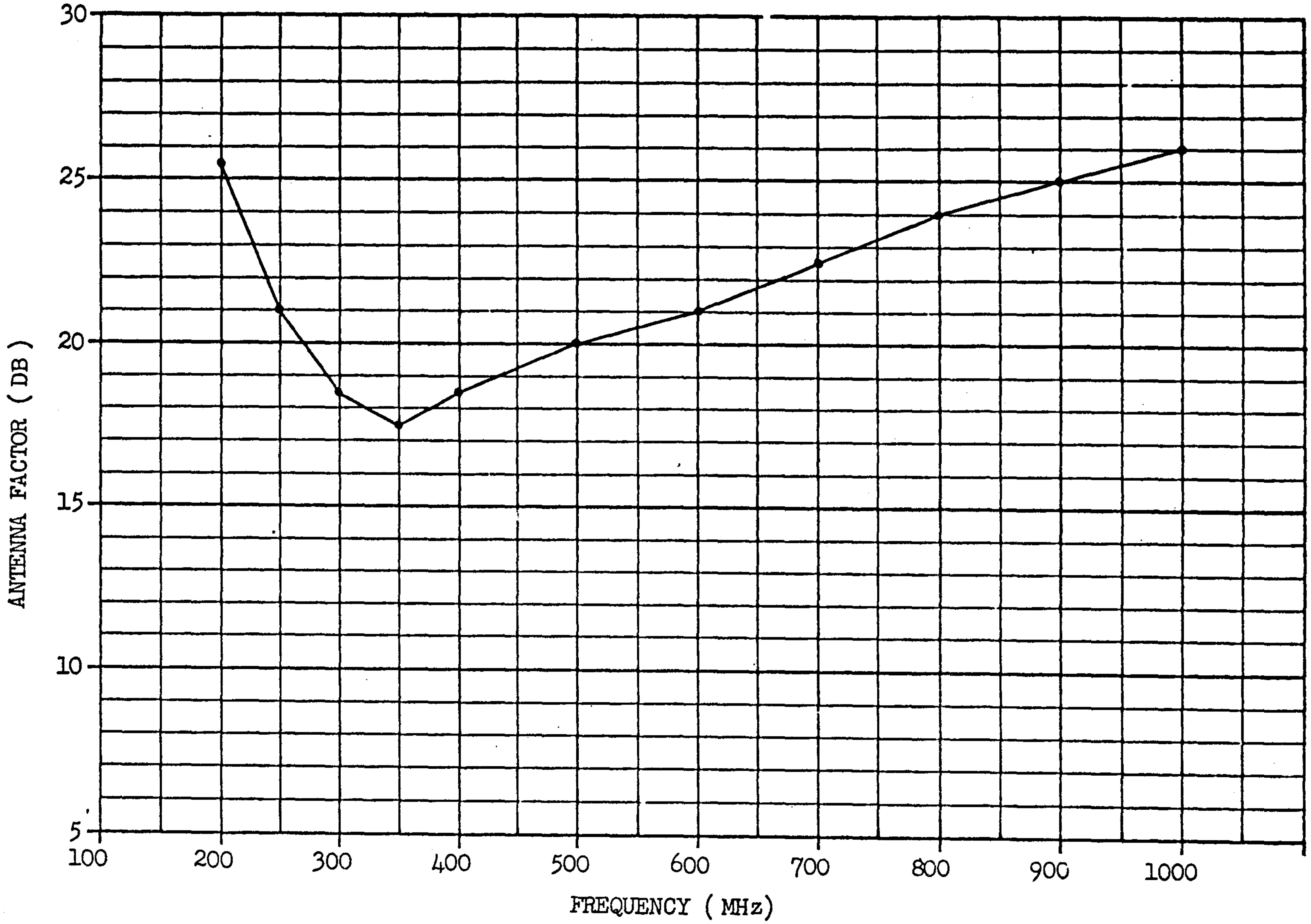


Fig. 3.7

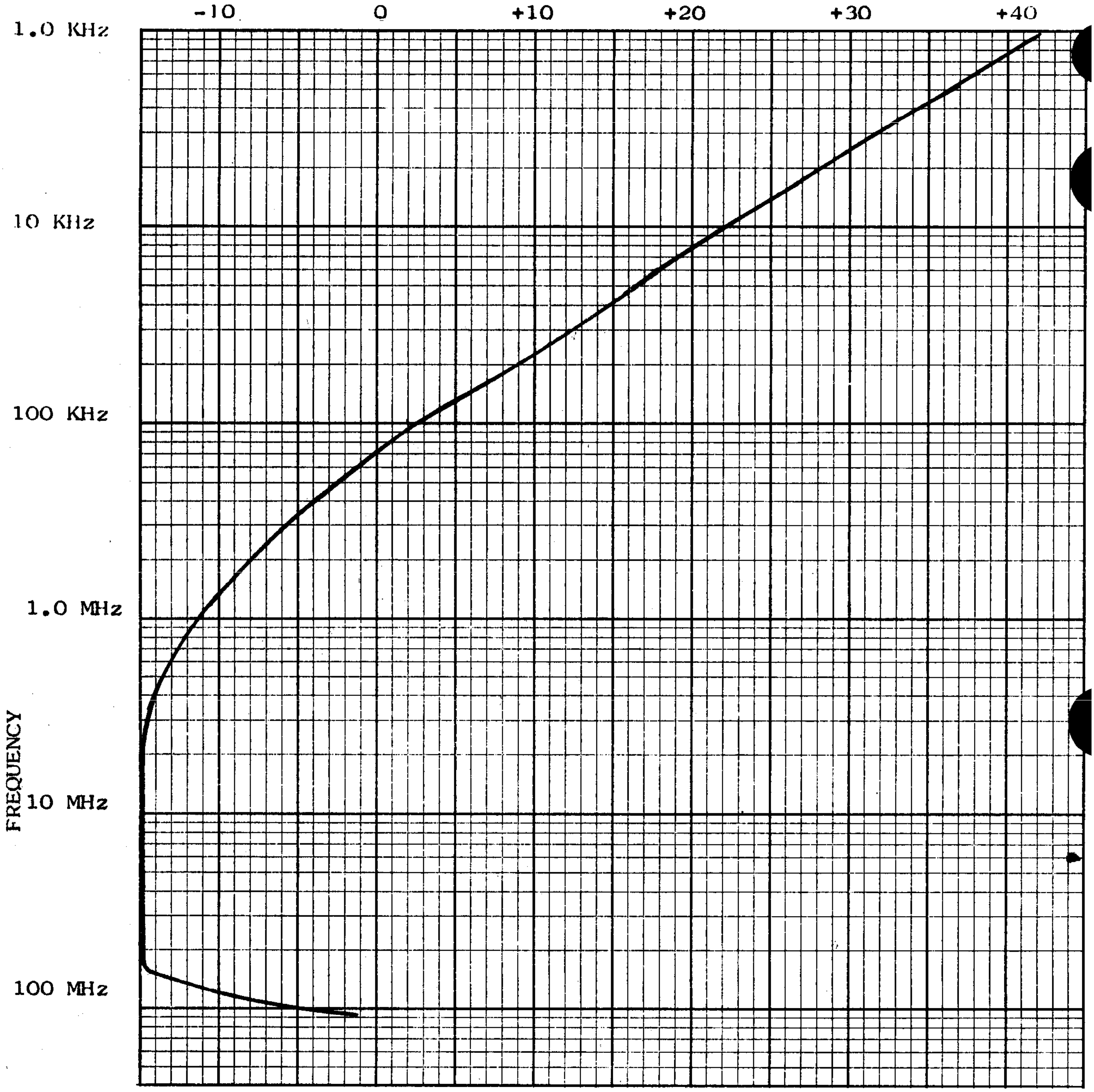
Typical Antenna Factor vs Frequency for the Tensor Model 4104 Biconical Antenna

Fig. 3.8



Typical Specification Compliance Testing Antenna Factor, 1 Meter Spacing, Circular Polarization
Model LCA-25 Log-Conical Antenna

TYPICAL CORRECTION FACTOR in DB



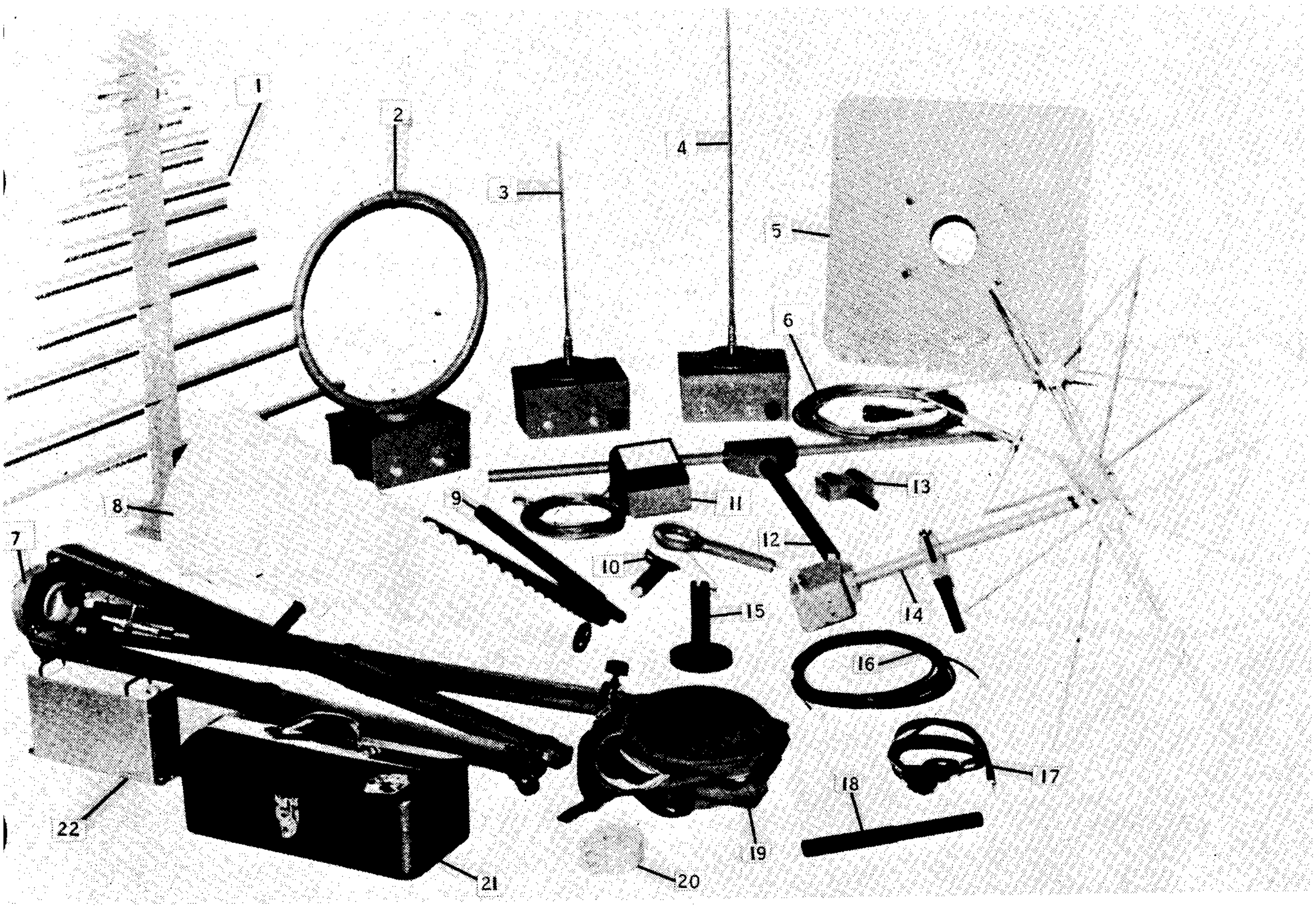
INSTRUCTIONS

ADD FACTOR (DB) SHOWN ABOVE TO CONVERT 2 TERMINAL EMC-25 READING TO CONDUCTED CURRENT.

PCL-25 CURRENT PROBE

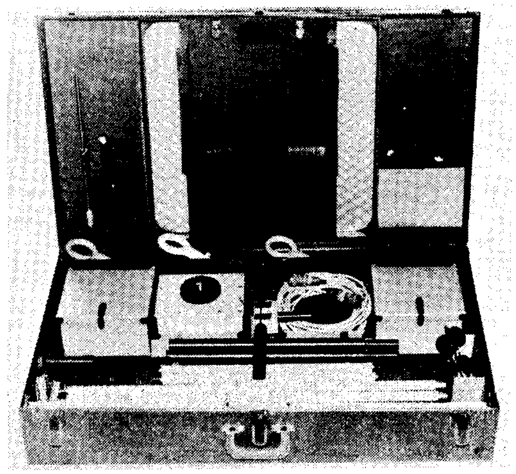
Fig. 3.9

EMC-25 ACCESSORIES

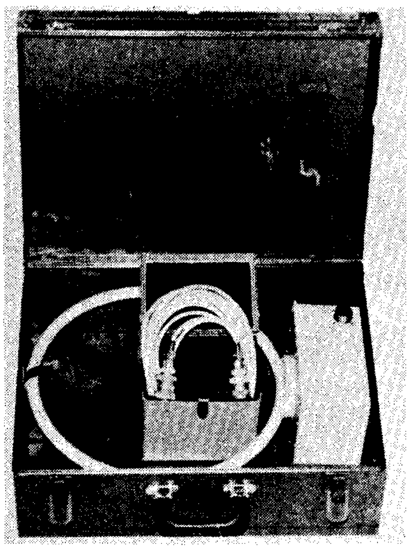


1. LPAA-25 Log Periodic Antenna (200-1 000 MHz)
2. ALR-25 Loop Antenna, Remotely Switchable (10 kHz - 30 MHz)
3. RVR-25 Vertical 41 in. Antenna, Remotely Switchable (10 kHz - 30 MHz)
4. RVA-25 Vertical 82 in. Antenna, Remote Active (10 kHz - 30 MHz)
5. GPA-25 Counterpoise (2' X 2')
6. ACC-25B Control Cable, Remote Antenna
7. TRP-25 Tripod, Rugged w/Bag
8. LCA-25 Log Conical Spiral Antenna (200 MHz - 1000 MHz)
9. MSA-25 Mast Section (20 in.)
10. MFA, B, C-25 Magnetic Field Probes (10 kHz - 520 kHz, 480 kHz - 25 MHz, 22 MHz - 230 MHz)
11. RIM-25 Remote Meter
12. BDA-25 Broadband Dipole Antenna (20–200 MHz)
13. CMT-25 Clamp Mount
14. BIA-25 Biconical Antenna (20-200 MHz)
15. AMT-25 Antenna Mount
16. CAC-25 25 ft. Coax Cable
17. EHF-25 Earphones, Hi Intelligibility
18. EFP-25 Electrostatic Field Probe
19. TRB-25 Tripod Bag.
20. PCL-25 Clamp-on Probe (10 kHz - 110 MHz)
21. ATK-25 Tool Kit
22. BAT-25 EMC-25 Battery Pack

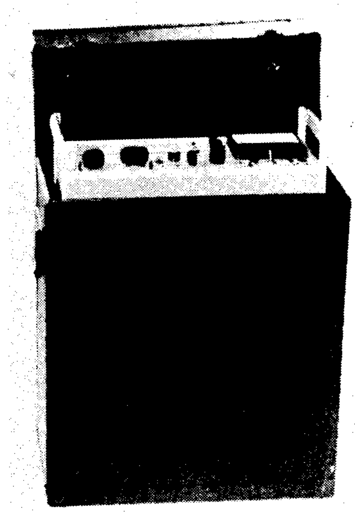
Fig. 3.10



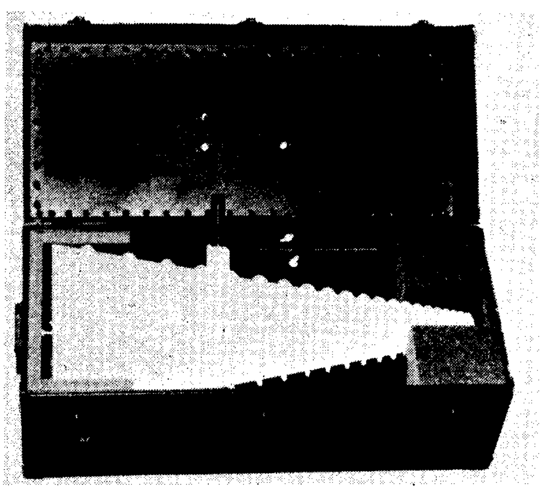
LVC-25
Low Frequency Antenna Case
For Antennas and Accessories



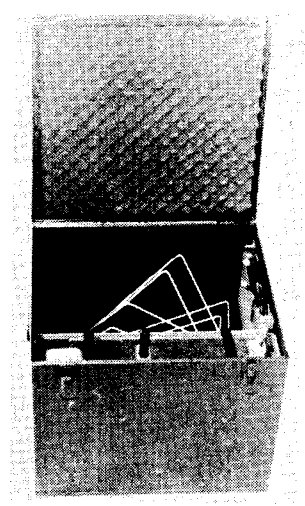
LCC-25
Conical Carrying Case
For LCA-25 Antenna



ICC-25
EMC-25 Carrying Case



LAC-25
Antenna Carrying Case



BCC-25
Biconical Carrying Case

Fig. 3.11

SECTION 3.11

Operator Preventative Maintenance Checks and Services

NOTE: Within designated interval these checks are to be performed in the order listed.

ITEM NO.	INTERVAL B	D	A	W	M	ITEM TO BE INSPECTED	Procedure: Check for and have repaired or adjusted as necessary
1	•	•	•	•		Receiver Battery Condition	Battery equipped receivers only Unit ON, Press BAT test. Read condition on front panel meter. Charge if necessary.
2				•		CAL check	Press CAL button. See if CAL control can be adjusted for 0dB meter reading, each band.
3					•	Amplitude Accuracy Check	Calibrate center band. Feed in amplitude calibrated cw signal. Determine calibration accuracy each band. An error > ±2dB indicates service required.
4		•				Operating Frequency Check	Tune in signal of known frequency. Read indicated frequency. Error greater than ±2% indicates service required.
5					•	Frequency Check	Check frequency accuracy, 3 places each band, using known frequency source. Error exceeding ±2% indicates service required.
6		•				Control Operation	Note any mechanical or electrical fault caused by front panel control operation.
7					•	Band change Mechanism	Note if bandstrip is detented when single band stepped to each band, both forward and reverse. The centered position of the frequency dial is an indication of proper detenting.
8					•	Frequency Dial Mechanism	Set to Band 7. Can cursor be placed below last low end dial mark and above last high end dial mark? Is tuning dial and cursor movement free and uniform?

Note: Interval Key
- B - Before
- D - During
- A - After
- W - Weekly
- M - Monthly

SECTION IV

Performance Check-Out

4.1 GENERAL

The Performance Tests listed in this section are designed to give specific information as to the operational status of the instrument. The results of these tests will indicate whether the EMC-25 is performing within specification limits or not, and whether repair or recalibration is necessary. The results of these tests as an incoming inspection check should be recorded and used as a standard for further testing at every maintenance level.

When testing for VOLTAGE ACCURACY, FREQUENCY ACCURACY, CW SENSITIVITY, IMPULSE SENSITIVITY and IMAGE REJECTION, refer to three test frequencies per band. These tests shall be performed at the first and last indicated frequencies and at a frequency in the center of each of the 15 bands.

Table 4-1 lists recommended test equipment, required characteristics and when equipment is used.

4.2 WHEN TO TEST

The performance tests should be used:

a. As a part of the incoming inspection check with the results permanently recorded.

b. Periodically as a part of the maintenance check for every 2,000 hours of use.

c. As a part of the repair procedure to locate malfunctioning circuits.

TABLE 4.1 Recommended Test Equipment

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	USE
Signal Generators HP-651 HP-608 HP-612	10 kHz – 1000 MHz Calibrated Attenuator .1uV to 1.0V output 10kHz to 25 MHz .1uV to 0.1V output 25 MHz to 1 GHz Amplitude Accuracy ± 1 dB Frequency Accuracy (checked with Frequency Counter below) 50 ohms source impedance	Performance check-out Alignment Calibration
Impulse Generator EMD CIG-25	Calibrated 0 to +90 dB uV/MHz	Calibration Performance check-out
Step Attenuator H/P 355D	Calibrated 0-120dB Accuracy ± 0.1 dB Referred to 0 dB Position	Performance check-out Calibration Alignment
Frequency Counter HP-5246 HP-5253 HP-5254	Calibrated 10 kHz – 1 GHz Accuracy ± 0.1%	Performance check-out Alignment Calibration
Digital Volt-Ohmmeter	3½ Digits 1.5V to 1500V f.s. ±0.1% + 1 Digit Accuracy	Alignment Repair
Video Voltmeter HP-400E	Average or RMS responding 10 MHz Frequency Response 10MV to 10V f.s. ± 2% Accuracy 1M ohm input impedance	Alignment Repair
Oscilloscope Tektronix-453	50MV to 10V f.s. DC coupled 10MHz Frequency Response 1 sec to 0.1 u sec/CM time base	Alignment Repair

4.3 PERFORMANCE TESTING PROCEDURE

a. Unless otherwise specified in the test, the front panel controls shall beset as follows:

ATTENUATOR	40 dB Black
TUNING MODE	MAN
FINE TUNING	Mechanical Center
LOCAL/REMOTE	Local
DETECTOR FUNCTION	Carr
AUDIO	Fully CCW
BANDWIDTH	WB
POWER	ON

b. The following tests may be performed in any sequence desired. However, it is recommended that they be performed in the order in which they are listed. To minimize time spent in band switching, tuning, etc. as many readings as possible should be taken while set to any given frequency.

4.4 ACCURACY AND PERFORMANCE

4.4.1 PRECAUTIONS

a. When making measurements such as the Voltage Accuracy Test, caution should be taken to avoid ground loops between AC operated equipment.

b. The proper source impedance must be presented to the instrument's input, Some Impulse Generators will work properly only if a pad is placed at their output.

c. Interconnecting cables should be of the shortest length possible or of known loss.

d. A 20 minute warm-up period for the EMC-25 should be allowed before beginning the tests.

e. The EMC-25 must be within 30° of the horizontal position and right side up whenever its internal impulse generator is used.

f. Some Impulse Generators are calibrated in, terms of equivalent peak CW voltage while the majority are in terms of equivalent rms voltage. It' should be noted that a 3 dB difference exists between the two types, and 3 dB must be subtracted from a peak voltage calibrated instrument's indicated output, to obtain the equivalent rms value. The EMC-25 is calibrated in terms of the equivalent rms value of the peak signal for impulse signals.

g. Accuracy of the test equipment must be commensurate with that of the parameter being measured.

4.4.2 CW VOLTAGE ACCURACY

a. Depress and hold in the CAL pushbutton switch. Rotate the CAL a front panel meter reading of zero for the band and frequency undergoing test. Release the CAL pushbutton.

b. Using a signal source with a 50-ohm output impedance tuned to the EMC-25 selected frequency, apply a signal to the RF INPUT jack of the proper amplitude, 100 uV for 10 kHz to 30 MHz and 1 mV for 20 MHz to 1 GHz. Record the difference between the actual meter reading and the proper reading of 0 dB.

c. Repeat steps a) and b) at 3 test frequencies o each band, 1-15. Voltage accuracy is ±2.0 dB at all frequencies.

4.4.3 BROADBAND VOLTAGE ACCURACY

a. Depress and hold in the CAL pushbutton switch. Rotate the CAL gain control to produce a front panel meter reading of zero for the band and frequency undergoing test. Release the CAL pushbutton.

b. Using a calibrated Impulse Generator, apply a signal to the RF INPUT jack of the proper amplitude, 80 dBuV/MHz for bands 1-7 and 60 dBuV/MHz for bands 8-15.

c. Add the meter reading obtained to the factor given for the frequency under test on Broadband conversion Chart and attenuator setting to obtain broadband level.

4.4.4 FREQUENCY ACCURACY

a. With the BANDWIDTH switch in the NB position, the DETECTOR FUNCTION switch in the CARR position and the CAL gain control set at approximately mechanical center, adjust the main TUNING knob on the EMC-25 so that the cursor is exactly on each of the 3 test frequencies per band, being careful to view the scale straight-on to eliminate parallax.

b. Adjust the frequency of the signal source to the vicinity of the test frequency and set its level for a meter reading of approximately "0" dB.

c. Carefully adjust the frequency of the signal source for a peak indication on the EMC-25 front panel meter. Frequency accuracy specification is ±2% of the indicated frequency (with the FINE TUNE control at its mechanical center).

d. Perform steps a) through c) for 3 test frequencies on each band 1-15.

4.4.5 ATTENUATOR ACCURACY

a. With the ATTENUATOR in the 40 dB (black) position, the DETECTOR FUNCTION switch in the CARR position, and the TUNING set to the approximate center of band 6, apply a 100 uV CW signal. Adjust the signal generator for a peak indication on the meter and adjust the CAL gain control for 0 dB on the meter.

b. Change the signal source attenuator in 20 dB steps while changing the EMC-25 ATTENUATOR accordingly, Record the difference between the actual meter readings and the 0 dB mark. Specification for ATTENUATOR accuracy is ±1 dB.

c. Repeat steps a) and b) on Band 8 and on Band 11, changing the input level to 1 mV on Band 11.

4.4.6 CW SENSITIVITY

a. With the ATTENUATOR in the "0" dB position, BANDWIDTH switch in the NARROW position and the DETECTOR FUNCTION switch in the CARR position, apply a 10 uV signal for the 3 test frequencies on bands 1-10 and adjust the CAL gain control for a full scale meter indication.

b. Disconnect the generator, terminate the EMC-25 RF INPUT with a 50 ohm load, and read the residual noise indicated on the meter. Since residual noise equals tangential sensitivity, record this reading. Sensitivity specifications may be obtained from Section 1.

c. Apply a 100 uV signal and adjust the "CAL" control for a full scale meter indication for the 3 test frequencies on bands 11-15.

d. Disconnect the generator and record the sensitivity as discussed in step b).

4.4.7 IMPULSE SENSITIVITY

a. With the ATTENUATOR in the 0 dB position, bandwidth to wide, detector function to peak, apply an impulse signal to the RF INPUT, increasing the level until the meter reads 3 dB above the residual noise.

b. The level applied by the generator is the impulse sensitivity. Sensitivity specifications may be obtained from Section 1.

c. Follow this procedure at the three test frequencies for all bands 1-15.

4.4.8 BANDWIDTH

a. With the DETECTOR FUNCTION in the CAR R position, attenuator to 40 dB black, tune the EMC-25 to a mid range frequency on band 6 and adjust the CAL gain control for "0" dB on the meter with 100 uV input from a signal generator.

b. Increase the signal generator output by 3 dB on the EMC-25 meter and increase the frequency of the generator until the meter reads "0" dB. Note and record the frequency of the generator.

c. With the same output level as in step b), decrease the frequency of the generator until the meter again reads "0" dB. Note and record the frequency of the generator. The difference between the two recorded frequencies if the 3 dB IF wideband bandwidth at that frequency. Bandwidth specification may be obtained from Section 1.

d. Repeat the steps a) through c) for Band 8 at a frequency in the center of the band.

e. Increase the generator output . mV and repeat the procedure on band 11 at a frequency in the center of the band.

f. Change the BANDWIDTH switch to the NB position and repeat steps a) through e).

g. Change the BANDWIDTH switch to 0.1 NB position (if the EMC-25 has the N OPTION included) and repeat steps a) through e).

4.4.9 METER TRACKING AND DYNAMIC RANGE

a. With the ATTENUATOR selector in the 40 dB (black) position, the DETECTOR FUNCTION switch in the CARR position, the BANDWIDTH switch in the NB position and at a frequency in the center of Band 6 apply a 100 uV CW signal from a signal generator. Adjust the signal generator for a peak indication on the EMC-25 meter and adjust the CAL gain control for "0" dB on the meter.

b. Decrease the original signal to the EMC-25 by 20 dB and note that the meter reading has dropped to- 20dB, within a ±2 dB specification.

c. Increase the original signal to the EMC-25 by 20 dB and note the meter reads full scale ±2.0 dB.

d. Repeat the above procedure at a frequency in the center of band 8.

e. Increase the generator output to 1 mV and repeat steps a) through c) at a frequency in the center of band 11.

4.4.10 IMAGE REJECTION

a. With the ATTENUATOR in the 40 dB (black) position, the BANDWIDTH switch in the NB position, and the DETECTOR FUNCTION switch in the CARR position, apply a CW signal level of 1 mV at each of the three test frequencies on each band, 1-10, and tune the generator for a peak indication on the meter.

b. Adjust the CAL gain control for a full scale indication on the meter.

c. Tune the generator to twice the I F frequency plus the EMC-25 indicated frequency.

Example: Band 1, 14 kHz
2 (175 kHz) + (14 kHz) =
364 kHz = Image Frequency

d. Increase the generator output by 30 dB and tune the generator for a peak indication on the EMC-25 meter.

e. Record the difference between full scale and the meter reading from step d), adding 30 dB; this is the Image Rejection. Specification for Image Rejection is 45 dB minimum.

f. Repeat steps a) through e) for bands 11-15, except increase the signal output to 10 mV for a full scale indication at three test frequencies for each band. See Table 2-3 for first and second IF frequencies for each band.

4.4.11 IF REJECTION

a. With the ATTEN selection in the 40 dB (black) position, the BANDWIDTH switch in the NB position, and the DETECTOR FUNCTION switch in the CARR position, inject a signal level of 1 mV at a frequency in the center of each band, 1-10 and tune the generator for a peak indication on the EMC-25 meter.

b. Adjust the CAL gain control for a full scale deflection on the meter.

c. Tune the generator to the first IF frequency and increase the generator output by 30 dB.

d. Tune the frequency of the signal generator for maximum meter deflection.

e. Record the difference between full scale and the meter reading from step d, adding 30 dB; this is IF Rejection. Specification for IF Rejection is 45 dB minimum.

f. Repeat the steps a) through e) for bands 11-15 except increase the signal output at the frequencies for bands 11-15 to 10 mV for full scale indication.

g. Repeat steps a) through e) for the second IF frequencies of bands 3,4,13,14,15 and record the data.

4.4.12 SPURIOUS RESPONSE

a. Place the ATTENUATOR switch in the 0 dB position, the DETECTOR FUNCTION switch to the CARR position, and the BANDWIDTH to NB position. Terminate the RF input with 50 ohms.

b. With all input signals disconnected, slowly tune the EMC-25 through each entire band covering and recording the frequency of any on-scale responses.

SECTION V
Maintenance and Repair

5.1 GENERAL

This section provides the information necessary for maintenance, repair and calibration of the Interference Analyzer EMC-25. Repair of as complex an instrument as the EMC-25, should only be attempted by qualified technicians who are thoroughly acquainted with EMC equipment and measurement techniques. It is recommended that this entire section be read before attempting any of the procedures presented herein.

5.2 MAINTENANCE

To maintain the EMC-25 it is recommended that a check be made after 2000 hours of normal use. This check should consist of performing the tests in Section IV, with the results compared against the specification limits, to determine if the instrument is operating properly.

NOTE

CW calibration MUST be performed first.

5.3 CALIBRATION PROCEDURE

CAUTION

The EMC-25 must be upright and within ±30° of horizontal or the impluse calibrator will not operate properly. If the instrument has been vertical or upside down for a long period, it is advisable to shake it while in the horizontal position before calibrating. This insures repeatability of the impulse generator.

a. CW CALIBRATION

1. Set the front panel controls as follows:

LOCAL/REMOTE	- Local
TUNING MODE	- MAN
DETECTOR FUNCTION	- CARR
BANDWIDTH	- WIDE
ATTENUATOR	- 40dB (BLACK)

2. Set the EMC-25 to a center-band frequency of the band being checked. Depress the CAL button and adjust the CAL gain control for a 0 dB meter reading.

3. Feed a calibrated CW signal to the RF input at the frequency selected and peak the signal generator for maximum on the EMC-25 meter. For Band 1 through Band 10, the CW level is 100 uV, in Band 11 through Band 15, the CW level is 1.0 mV. The meter should read 0 dB ±2.0 dB. If the reading is out of tolerance, the IG level adjustments should be made as described in paragraph 5.8.4.

b. BROAD BAND CONVERSION FACTORS

1. Following the CW calibration of each band, change the DETECTOR FUNCTION switch to the PEAK position and select a frequency.

2. Depress the CAL button and adjust the CAL gain control until the meter reads zero.

3. Connect an impulse generator to the RF INPUT connector. Set DWELL to CCW. For Bands 1-7 set the IG level to 80 dB uV/M Hz at the frequency selected and read the meter. Convert the meter reading to the Broadband factor by using Fig. 5.1.

4. For Bands 8-10 set the IG level to 60 dB uV/M Hz at the frequency selected and read the meter. Convert the meter reading to the Broadband factor.

5. For Bands 11-15 set the IG level to 60dB uV/M Hz at the frequency selected and read the meter. Convert the meter reading to the Broadband factor.

6. Compare your measurements with the factors given in Fig. 3.1. A difference of ±2.0 dB is within the tolerance limits of the test equipments used. A more significant difference could indicate a faulty PEAK DETECTOR, a faulty IF AMPLIFIER, or front end tracking problems.

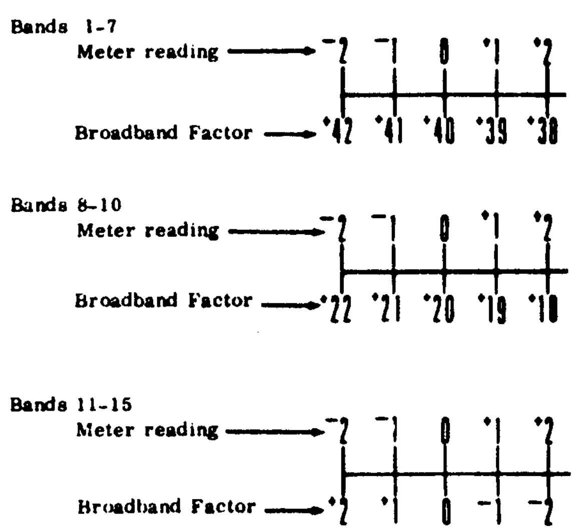


Figure 5.1 Broadband Factors

5.4 REPAIR

Repair should take place when one of the following conditions exists:

a. There is an obvious fault in operation.

b. Operation is outside the specification limits and cannot be restored by recalibrating the EMC-25.

5.4.1 REPAIR PROCEDURES

5.4.1.1 METHOD

1. Use of the Repair Sequence Guide, Fig. 5.4 to determine the proper order of repair. (Refer to Fig. 5.2).
2. Replace the defective module if that is the desired level of service.
3. Repair the defective module using signal tracing and voltage measurement techniques in conjunction with the information given in Sections III and IV.
4. Align and calibrate the EMC-25 after repair has taken place per Fig. 5.5.

5.4.1.2 MODULE REPLACEMENT

1. All assemblies, modules and printed circuit boards are replaceable without affecting the overall characteristics and specification limits of the EMC-25, *providing* alignment and calibration is performed after replacement in the sequence given in Fig. 5.4.
2. Many modules may be removed by loosening quarter-turn fasteners while others require removing their retaining screws.

5.4.1.3 COMPONENT REPLACEMENT

1. The Reference Data section provides all the information necessary to narrow the trouble spot to individual component replacement.
2. The Theory of Operation section provides circuit function and operating principles that may be used as an aid to malfunction location and correction.

5.4.1.4 PRINTED CIRCUIT BOARD PRECAUTIONS

1. Do not remove circuit boards while power is on; power should be turned off and al l external power disconnected.
2. Never touch the printed surface with bare fingers; skin oils can create leakage paths.
3. Use a grounded soldering iron to avoid destruction of semi-conductors.
4. Avoid excessive heat when repairing a board.
5. After repair, clean the printed surface of all contaminants, excess solder and resin using a Freon-base cleaner. Be sure that excess solder has not created new circuit paths.

5.4.2 REPAIR SEQUENCE GUIDE (Fig. 5.2)

Fig. 5.2 illustrates the order in which EMC-25 repair must be performed. Circuitry within the EMC-25 is interdependent, therefore repair and alignment must be performed in the sequence stated below:

a. Use Table 5.1 to determine whether the fault can be corrected without opening the instrument, or if access to the interior is necessary.

b. If access is required to the interior of the instrument, see Section 5.5 and proceed to the next leg of the Repair Sequency Guide, Power Supply. Use the Power Supply Checking Fig. 5.3 to determine if the Power Supply is operating correctly.

c. After the Power Supply has been checked and/or corrected, proceed to the next leg, IF and Detection Circuitry check. Use Fig. 5.4 to determine if the IF and Detection System is operating properly.

d. After the IF and Detection System has been checked and/or corrected and aligned, proceed to the next leg, Calibrator and RF Tuner Circuitry check. Use Fig. 5.5 to determine if the Calibrator and RF Tuner circuits are operating properly.

e. After the Calibrator and RF Tuner Circuits have been checked and/or corrected and aligned, proceed to the final leg, Specification check. Return to Section IV and check all specifications by performing each test.

5.4.3 COMMON FAULTS (Table 5.1)

Table 5.1 lists the most common faults found during performance tests and during normal operation. Perform the checks in the order indicated on the Table.

5.4.3.1 BATTERY TEST (Optional)

Press Bat. test button and check the Battery indicator (front panel). If the meter reads oper. the battery is operable; if not, the battery needs charging. Charge the battery according to the procedure in Section III.

5.4.3.2 CONTROL SETTINGS

Check the control settings on the front panel with the operation procedure being used in Section III.

5.4.3.3 OPERATIONAL ERRORS

It is recommended that the operator be completely familiar with Section III Operating instructions and Accessory Operation.

TABLE 5.1

COMMON FAULTS

FAULT	Control Settings: Local Control	Control Settings: Manual Tune	Control Settings: Detector	Control Settings: Other	Batt-Test	Line Fuse	Connections: Power Cable	Connections: RF- Input Cable	Connections: Control Cable	Test Equip. Calibration	Check Remote Connector Voltages	Access to Interior May be Required
1. Unit in operative												
a. On battery only					✓						✓	✓
b. All bands	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
c. One or more bands					✓			✓			✓	✓
d. "On" light won't light				✓	✓	✓	✓				✓	✓
e. Charge light off						✓	✓				✓	✓
f. Meter Pins +			✓		✓						✓	✓
g. Meter Pins –					✓						✓	✓
h. Meter dead	✓				✓	✓	✓				✓	✓
i. Unit won't tune	✓	✓			✓			✓			✓	✓
2. Amplitude error												
a. All bands	✓	✓	✓	✓	✓			✓		✓	✓	✓
b. One or more bands				✓	✓			✓		✓	✓	✓
c. Attenuator Accuracy			✓							✓	✓	✓
d. Meter tracking			✓		✓					✓	✓	✓
e. Can't calibrate	✓				✓						✓	✓
3. Frequency accuracy				✓	✓					✓	✓	✓
4. Sensitivity				✓	✓			✓		✓	✓	✓
5. Bandwidth			✓	✓	✓					✓	✓	✓
6. Image/IF rejection				✓	✓					✓	✓	✓
7. Spurious response				✓	✓					✓	✓	✓
8. Powered accessories					✓				✓		✓	✓
9. Can't change bands	✓				✓	✓					✓	✓

Checks/Tests (Left to Right) ✓

4.3.4 TEST EQUIPMENT ACCURACY

It is imperative that the test equipment accuracy be commensurate with the parameters being measured and all sources of error be carefully computed.

5.4.3.5 REMOTE CONNECTOR VOLTAGES

A voltage check at the pins listed in Table 5.2 on the REMOTE connector will assure the correcta voltages from the regulators for proper operation.

TABLE 5.2
REMOTE CONNECTOR VOLTAGES

PIN	DC VOLTAGE
AA	GND
EE	+110V min.
V	+11.9V to +12.1V
X	-5.9V to 6.1V
HH	+15V min.
CC	-9V min.

5.5 DISASSEMBLY-ASSEMBLY and ACCESS

See Fig. 5.2 Location Guide

"CAUTION": Before proceeding with any of the procedures listed below, disconnect the AC power input on the rear of the unit.

5.5.1 BOTTOM COVE R REMOVAL

1. The unit is placed bottom side up
2. Remove all the retaining screws (4-40x3/16) around the perimeter of the unit's main compartment.
3. Slip back the cover to free it from the front mounting slot.
4. To replace the cover, reverse the procedure.

NOTE: After the bottom cover is removed, the units that have the optional battery pack installed should have the battery plug removed from the battery jack A6J1 and inserted into the dummy receptacle A5J1. This will prevent accidental turn-on of the unit and inadvertent shorts.

5.5.2 FRONT PANEL (A1) REMOVAL

1. Remove the bottom cover as per 5.5,1,
2. Remove the dwell, slideback, and detector function switch knobs on front panel. A #4 Allen wrench is used to, remove the knobs.
3. Disconnect the coaxial cable from the front of the I.G. (A9) to the RF attenuator (A1A3). A 5/16 wrench is used to disconnect the cable.
4. Remove the six screws (6-32x7/16) that secures the front panel in place.
5. Remove front panel from unit with care to avoid damage to the wiring harness that is connected to the front panel.

NOTE: The front panel cannot be completely disconnected from the main unit. For normal maintenance work, the wiring harness has enough slack to allow the front panel to swing out and over to the left side of the unit.

6. The replacement of the front panel is accomplished by reversing the above procedure. When resecuring the f rent panel to the unit, check to see that the wiring harness avoids the gears on the cylindrical scale by lying in a folded loop in the lower left hand corner near the All A2 filter plate.

5.5.3 OPTIONAL BATTERY (A6) INSTALLATION

1. Remove the bottom cover as per 5.5.1
2. Insert the battery pack into the unit with the battery connector jack (A6J1) towards the center of the receiver.
3. Tighten the four quarter-turn fasteners to secure the battery pack into the unit. Use a screwdriver with a 6-inch minimum shaft length and a ¼-inch minimum blade width.
4. Remove battery plug from the dummy receptacle (A5J1) and insert it into the battery connector jack (A6J1).

NOTE: See section 5.6.1 for the charger adjustment procedure to setup the charge rate into the battery.

5.5.3.1 OPTIONAL BATTERY (A6) REMOVAL

1. To remove the optional battery pack, reverse the procedure given in 5.5.3.

5.5.4 RF TUNER (A2) COVER REMOVAL

1. Remove the bottom cover as per 5.5.1 and if installed, remove the optional battery pack (A6) as per 5.5.3.1.
2. Remove the flat head screws (6-32x7/16) from the top of the upper cover.
3. Remove the three binder head (6-32x3/16) and the four flat-head screws on the rear side of the upper cover. These screws will have to be removed with either a stubby or right-angle screwdriver.
4. To replace the RF tuner cover, reverse the above procedure.

5.5.5 IMPULSE GENERATOR (CALIBRATOR A9) REMOVAL

1. Remove the bottom cover as per 5.5.1, remove the front panel (A 1) as per 5.5.2, and remove the RF tuner cover as per 5.5.4.
2. Disconnect rigid coaxial cable connected the rear I.G. connector protruding from the front bulkhead.
3. Disconnect the two coaxial cables going to the RF attenuator (A1A3) and to the rear pane from the connectors on the front side of the impulse generator.

NOTE: Use a 5/16 open-end wrench to remove the cables in step 2 and step 3.

4. Loosen and remove the I.G. fanning strip (A9FS8) from the terminal block (A11-TB8) on the front bulkhead.

5. Remove the four flat head screws securing the I.G. to the front bulkhead and remove I.G. from the unit.

6. To install an I.G. reverse the above procedure.

5.6 VIDEO DETECTOR (A7) REMOVAL

1. Remove bottom cover as per 5.5.1 and front panel per 5.5.2.

2. Remove the two coaxial cables (#4 and #5) from the connectors on the rear of the video detector which protrude through the front bulkhead.

3. Remove the three coaxial cables (#11, #12, and #13) from the left side of the video detector.

4. Loosen and remove the fanning strip (A7FS9) from the terminal block A11-TB9.

5. Remove the four screws which secures the video detector to the front bulkhead.

6. To install a video detector reverse the above procedure.

5.5.7 SUBMODULE ASSEMBLY REMOVAL (A3, A4, A8)

1. Remove the bottom cover as per 5.5.1.

2. Remove coaxial cable #15 from the side of the turret.

3. Remove the two coaxial cables (#4 and #5) from the front bulkhead where the video detector connectors protrude through the bulkhead.

4. Remove the clamp which hold the two coaxial cables (#4, #5) to the front bulkhead.

5. Loosen and remove the three fanning strips (one for each submodule) A3FS2, A4FS3, and A8FS6 from the A5TB1 terminal block. See Fig. location guide.

6. Remove the clamp which holds down the wiring harnesses to the A5 Power Supply Assembly.

7. Loosen the six quarter-turn fasteners which secure the three submodules (A3, A4, and A8) into the unit. Use a screwdriver with a 6-inch minimum shaft length and a ¼-inch minimum blade width.

8. Pull the submodule package straight up. When it is far enough out, remove coaxial cable #14 from the A3 IF module. The submodule package can now be removed from the unit.

9. Remove the brace which secures the modules together. The brace is secured by six screws (4-40x3/16) recessed in the brace. Also disconnect d remove all interconnecting coaxial cables.

10. If the optional 0.1 narrow band crystal filter module (A12) is included in the unit; the same procedure is followed except that there is an additional fanning strip (A12FS7) to be removed from terminal block A5TB1 and coaxial cable #14 is removed from the 0.1 narrow band crystal filter module (A12) instead of the A3 I.F. module.

11. To install the submodule package reverse the above procedure except the brace is not installed until the submodules fasten into the unit.

5.5.8 CYLINDRICAL FREQUENCY SCALE (A-10) REMOVAL AND INSTALLATION

1. Remove the bottom cover as per 5.5.1 and remove the front panel (A1) as per 5.5.2.

2. Located on the left side of the cylindrical frequency scale (A10) under the video detector module (A7) is a large bevel gear. At a right angle to the large bevel gear is a small bevel gear on a shaft which comes through the front bulkhead from the turret. Loosen the two #8 Allen set screws in the small bevel gear.

3. Remove the four screws (8-32x5/8) which secures the cylindrical frequency scale to the front bulkhead. Use a screwdriver with a 6-inch minimum shaft length and a ¼-inch minimum blade width.

4. Carefully and gently pull the cylindrical frequency scale towards the front of the unit with a slight rocking action. The small bevel gear must slide along and off the end of the shaft.

5. With the cylindrical frequency scale pulled out and away from the front bulkhead, loosen and remove the two fanning strips A10FS10 and A10FS11 from their respective terminals blocks A11-TB10 and A11-TB11. (See Fig. 6.2) The cylindrical frequency scale is now completely disconnected from the unit. The assembly should be handled with care to prevent damage to the scale markings, the wiring harness, the wafer switches, and the gearing.

NOTE: One end bracket is not retained on the cylindrical frequency scale shaft and could slide off if handled carelessly.

6. To install a cylindrical frequency scale assembly follow the procedure given in steps 7-14.

7. Reconnect the two fanning strips A10FS and A10FS-11 to the A11TB-10 and A11TB-11 terminal blocks.

8. When reinserting the cylindrical frequency scale assembly into the unit, the shaft which comes through the front bulkhead must slide through the bearing hole located in the cylindrical frequency scale assembly support bracket. As the shaft end comes through the hole, slide the small bevel gear onto the shaft.

9. Continue to move the cylindrical frequency scale assembly back until it rests against the front bulkhead. The shaft must continue to slide through the bracket bearing hole and the small bevel gear.

10. Secure the cylindrical frequency scale assembly to the front bulkhead with four mounting

screws (8-32x5/8). Before tightening any screws check to see that the wiring harness is free and not pinched under the support brackets.

11. Slide the small bevel gear forward until it meets and mates with the large bevel gear. Tighten the two #8 Allen set screws to fix the gear on the shaft.

12. To replace the front panel A1 see 5.5.2.

13. See 5.5.10 for alignment of frequency scale with the turret band strip position.

14. To replace the bottom cover see 5.5.1.

5.5.9 RF TUNER (TURRET A2) REMOVAL AND INSTALLATION

1. Remove the bottom cover as per 5.5.1, remove the front panel (A1) as per 5.5.2, remove the RF tuner cover as per 5.5.4, remove the submodules A3, A4, and A8 as per 5.5.7, and remove the cylindrical frequency scale A10 as per 5.5.8.

2. Disconnect the rigid RF input coaxial cable from the connector (A9-J5) which protrudes through the front bulkhead from the A9 I.G. module. Use a 5/16 inch open end wrench to remove the rigid coaxial cable.

3. Loosen and remove the two fanning strips (A2FS4 and A2FS5) from the ASTB1 terminal block.

4. Remove the coaxial cable #10 from the side of the turret. Use a ¼-inch open-end wrench to disconnect the cable.

5. Remove the five flat head screws (8-32x5/16) which secure the turret to the front bulkhead.

6. Lift up the rear of the turret until it clears the angle brace which transverses the chassis in back of the turret.

7. When the turret is clear of the angle brace, pull the turret towards the rear of the unit, holding the cylindrical frequency scale drive shaft which goes through the front bulkhead until the shaft is pulled free of the gear train assembly A2A16A3.

8. The turret can now be lifted up and out of the unit. Remove the frequency scale drive shaft from its clearance hole in the front bulkhead.

9. To install an A2 turret assembly follow the procedure given in steps 10-18.

10. The frequency scale drive shaft is inserted in its front bulkhead clearance hole from the rear and positioned with its gear against the front bulkhead.

11. Set the turret into the unit near the A5 Power Supply Assembly. The turret will rest on the angle brace which transverses the unit.

12. Move the turret towards the front bulkhead and engage the cylindrical frequency scale drive shaft. The two bearings on the end of the shaft Slide into seats in the gear train assembly A2A16A3. The turret will beat an angle until it clears the rear angle brace.

13. Continue to move the turret forward until it is against the front bulkhead and the rear of the turret clears the angle brace and drops down in front of it.

14. Secure the turret to the front bulkhead with five flat-head screws (S32x5/16). Push the frequency scale drive shaft into the gear train assembly to firmly seat the two bearings and mate the spur gear on the shaft with the gears on the gear train assembly.

15. To replace the cylindrical frequency scale see 5.5.8.

16. To replace the front panel see 5.5.2.

17. See 5.5.10 for alignment of frequency scale with the turret band strip position.

18. To replace the submodules see 5.5.7, to replace the RF tuner cover see 5.5.4 and to replace the bottom cover see 5.5.1

5.5.10 CYLINDRICAL SCALE WINDOW ALIGNMENT

1, Remove the bottom cover as per 5.5.1.

2. Loosen the two #8 Allen set screws in the frequency scale drive gear. This is located on the gear train assembly A2A16A3, on the shaft which goes through the front bulkhead.

3. Rotate the cylindrical scale until the correct scale markings for the band selected is exactly centered in the front panel window. When this ha been accomplished, tighten the set screws in the frequency scale drive gear.

5.5.11 POWER SUPPLY MODULE (A5A1) REMOVAL

The power supply module (A5A1) is located inside the power supply assembly (A5) and contains the raw voltage supplies, the high voltage converter A5A1A1, and the circuit which controls the charge rate of the optional battery pack.

The power supply module (A5A1) may be removed from the Power Supply Assembly (A5) which is located at the rear of the unit, by removing the two screws (one in each diagonally opposite corner) that secure the power supply module (A5A1) to the power supply assembly (A5).

The power supply module (A5A1) can then be removed from the power supply assembly (A5). Power should first be removed, as it is possible to generate inadvertent shorts during removal. Care should be exercised when removing or working on the power supply Module (A5A1) since the cable connecting the A5A1 module to the power supply assembly (A5)is hard-wired to a filter feed-through plate (A5A2). The cable has enough slack for normal servicing and repair operation.

5.5.12 POWER SUPPLY ASSEMBLY (A5) REMOVAL

The removal of this assembly is required only to gain access to the connectors for the A5P3 and A5P4 P.C. boards or to replace the entire A5 assembly.

The Power Supply Assembly A5 consists of the power supply module A5A1, the filter feed-thru plate A5A2, the A5TB1 terminal block plate, the TO-3 size voltage regulator for +12V DC (A5U1) and -6V DC (A5U2), and, in a bracket on the side of the assembly, the band-select P.C. board (A5P3) and the tuning regulator P.C. board (A5P4).

Follow the procedure given below to remove and replace the Power Supply Assembly:

1. Remove the bottom cover as per 5.5.1 and, if installed, remove the optional battery pack as per 5.5.3.
2. Loosen and remove all fanning strips from the A5TB1 terminal block (A11FS1, A3FS2, A2FS3, A2FS4, A2FS5, and A8FS6).
3. Remove the clamp which secures the wiring harnesses to the A5TB1 mounting plate.
4. Remove the screws (4-40x5/16) which fasten the Power Supply Assembly A5 to the rear panel of the main unit.
5. Pull the Power Supply Assembly towards the front of the unit until all protrusions on the rear of the Power Supply Assembly are clear.
6. Lift the Power Supply Assembly up and out of the unit.
7. To install the Power Supply Assembly reverse the above procedure.

5.5.13 RF INPUT LOW PASS FILTER (A1A2) REMOVAL

1. Remove the bottom cover as per 5.5.1.
2. Remove the 5/8-inch nut which secures the RF Low Pass Filter to the front panel with a 5/8-inch spin-tight.
3. Remove the rigid coaxial cable from the RF Attenuator A1A3 with a 5/16-inch open-end wrench.
4. Pull the RF Low Pass Filter back and at the same time lift up to remove the filter out of the unit.
5. To install the RF Low Pass Filter reverse the procedure above.

5.5.14 FREQUENCY TUNING ASSEMBLY (A1A1) REMOVAL

1. Remove the bottom cover as per 5.5.1 and remove the front panel (A1) as per 5.5.2.
2. Remove the tuning dial knob by loosening the two #6 Allen set screws which secures the knob to the tuning assembly shaft.
3. Unsolder the three wires on the tuning pot A1A1R1 using a 25-30 watt soldering iron. Identify each wire with a tag to allow correct placement when reconnecting the wires to the tuning pot.
4. Remove the three flathead screws which secures the frequency tuning assembly to the front panel.
5. The frequency tuning assembly is now free to be removed.
6. To install a frequency tuning assembly reverse the above procedure.

5.5.15 RF ATTENUATOR (A1A3) REMOVAL

1. Remove the bottom cover as per 5.5.1 and the front panel as per 5.5.2.
2. Put the attenuator in the remote position and lay the front panel on its face.
3. Carefully loosen but do not remove the two screws which secure the wafers of the A1A3S1 attenuator switch to the rear of the RF Attenuator.
4. Slide the wafers, screws, and assorted spacers-washers as a complete assembly off the shaft on the end of the RF Attenuator. Put a 4-40 nut on each screw to hold the switch assembly together. Be careful during this procedure not to disturb the positioning of the movable rotor section of each wafer.
5. Disconnect the rigid coaxial cable that comes from the Low. Pass Filter A1A2 and the coaxial cable that goes to the J3 connector of the A9 calibrator. Use a 5/16-inch open-end wrench for this purpose.
6. Remove the attenuator knob by loosening the two #8 Allen set screws which secure the knob to the attenuator shaft.
7. Remove the nut from the attenuator shaft using a 1/2-inch spin-tight. Remove the two flathead screws which secure the RF attenuator to the f rent panel.

NOTE: If the flathead screws (8-32x1/4) are lost or missing, they must be replaced with the same length screw as noted. Any longer screw length would cause interference with the operation of the RF Attenuator mechanism.

8. The RF Attenuator is now free and can be removed from the front panel.
9. To install a RF Attenuator reverse the above procedure.

Set the RF Attenuator to the remote position before installing the attenuator.

When reinstalling the two wafers on the rear of the attenuator care should be taken not to disturb the positioning of the rotor section of each wafer. The possibility does exist that one or both of the wipers could be turned 180 out. However, if care is taken when initially removing the wafers and again when installing the wafers this possibility will be greatly reduced.

5.5.16 MICROSWITCH ALIGNMENT

The microswitch (A2S1) is located on the RF Tuner Assembly above the Detent Arm. It can be aligned by the following procedure:

1. Remove the bottom cover as per 5.5.1.
2. Loosen the two alignment screws that secures the microswitch to the RF Tuner Assembly.
3. Manually rotate the Turret until the front panel window shows the scale halfway between bands.
4. Push the microswitch down until a "click" is heard, then tighten the alignment screws.
5. Rotate the Turret and listen for a "click" when the Detent Arm moves just out or just into the detent position.
6. Check the detent action with the unit on by stepping the Turret in a forward and a reverse direction using the push-button step switches on the front panel, When either step button is pushed and released, the Turret should step only one band.

"WARNING"

If the microswitch alignment is wrong or misadjusted the Turret will keep on stepping without stopping.

5.6 POWER SUPPLY CHECKING (Table 5.3)

Terminal Board A5TB1 (See Fig. 6.1) is the main distribution for the Power Supply. Table 5.3 lists each terminal voltage, isolation from ground, and conditions under which the voltages appear. All voltages are nominal unless limits are shown. Polarity of the ohmmeter used to measure resistance from the terminals to ground must be the same polarity as the voltmeter used to measure DC voltages.

5.6.1 CHARGER ADJUSTMENT PROCEDURE (With Optional Battery)

NOTE:

Before proceeding with he following, be sure AC power to receiver has been disconnected for at least 8 to 10 hours to bring battery back to room temperature, Front panel power switch must be off to perform following:

a. Disconnect the unit from the AC power source.

b. Remove the Charger Board A5A1P2 and insert it into a 22 pin extender plugged into the socket from which the board was removed.

c. Temporarily connect a 68K ohm, ¼, ±10% resistor between pins 14 and 21 of the charger board socket. Connect a digital voltmeter across pin 14 and pin 18.

d. Restore the AC power input.

e. Adjust A5A1P2-R21 (10K POT) on the charger board until the digital volmeter reads 100mV ± 10mV DC.

f. Remove the AC power, the added 68K resistor, and the DC meter and restore the charger board to its normal socket. Fasten the Power Supply chassis in its housing and resume normal operation.

5.7 IF AND DETECTION SYSTEM CHECKING

5.7.1 VIDEO DETECTOR (A7)

CARRIER DETECTOR OPERATION

a. Remove cable #4 from the rear of the Video Detector.

b Rotate the Detector Function switch to the CARRIER position, with the DWELL control full CCW the meter should read just below the △40 db point on the meter.

c. Rotate the Detector Function switch to the PEAK position and turn the DWELL full CW. The meter should read just below the -40 dB point on the meter.

d. Return the Detector Function switch to the CARRIER position. The meter should continue read as in part c.

e. Apply +1.5V DC to the connector where cable #4 was connected to the VIDEO DETECTOR. This should produce an approximate full scale reading on the meter.

f. Reconnect cable #4 to the VIDEO DETECTOR.

g. Set EMC-25 controls as follows:

ATTENUATOR	40/60 dB position
DETECTOR	CARRIER position
BAND POSITION	BAND 2
FREQUENCY	60 kHz
DWELL	FULL CCW (OFF)
SLIDEBACK (THRESHOLD)	FULL CCW (OFF)
BANDWIDTH	NARROW BAND

h. Apply to the RF input a 60 kHz CW signal at 100 uV. Peak the receiver for maximum on the front panel meter. Adjust the CAL GAIN control for a 0 dB reading on the front panel meter.

i. Change Detector Function to PEAK position, the meter should read 0 dB +1.0 dB.

TABLE 5.3

Power Supply Terminal Strip

A5TB1

TERMINAL NUMBER	FUNCTION	DC VOLTS	MIN. RESISTANCE (OHMS)
	Motor On	+4 During Step	4K
2	Band Step ↓	+12 During Step	10K
3	Band Step ↑	+12 During Step	10K
4	- Raw	-15	250
5	+ Raw	+24	800
6	.1 NB Control	+12 During .1 NB	60
7	+HV Raw	+110–+200	200K
8	Bandwidth Control	-6WB/+12NB	60
9	Low Voltage Tune Tuning	0 to 1.5 varies with 1.5K	
10	+Regulated	+11.95 to +12.05	150
11	- Regulated	-5.95 to +6.05	60
12	Cal Control	+7 to 12 varies with Cal	60Ω to 50K
13	IF Atten. #1 Control	-120/20 db pos.	390
14	IF Atten. #2 Control	-12 Remote + 20/40 Pos.	390
15	Ground	0	0
16	Preamp Select	-6 Band 1-7	60
17	Preamp Select	-6 "	60
18	Preamp Sleet	-Band 11-15	60
19	High Voltage Tune	+0.3 to 101 varies with Tuning	25K
20	+Motor	+20 During Step	800
21	-Motor	-12 During Step	250
22	Micro-Switch	GND Except +22 During Step	0
23	+Raw Switched	+20	800
24	- Clutch	-12 During Step	
25	Spare	0	
26	Spare	0	
27	IF Amp. & Disc. Select	6 Band 1-7	60
28	IF Amp. & Disc. Select	6 Band 8-10	60
29	IF Amp. & Disc. Select	6 Bands 11-15	60
30	Ground	0	0
31	+Regulated	+11.95 to +12.05	150
32	Bandwidth Select	-6WB/+12NB	60
33	Log. Det. Select	-6 Band 1-7	60
34	Log. Det. Select	-6 Band 8-10	60
35	Log. Det. Select	-6 Band 11-15	60
36	Ground	0	0
37	+Regulated	+11.95 to +12.05	150
38	.1 NB Select	+12 During .1 NB	60

j. With the DWELL still full CCW (OFF), remove the signal from the RF input. The meter should decay slowly, no faster than 10 dB/20 seconds.

k. Reconnect the CW signal to the RF input, turn the DWELL approximately half way on. Disconnect the signal, the meter should decay slowly for short period of time then drop suddenly to the noise level reading on the meter. This checks the peak detector function.

1. Reconnect signal to the RF input, change Detector Function switch to CARRIER position and the DWELL full CCW (OFF). Setting your reference in CARRIER at 0 dB, switch the function switch between CARRIER, SLIDE BACK, and QUASI-PEAK the readings should be within ±1.0 dB of each other.

m. With no signal input, switch the function switch to the SLIDEBACK position. Turn THRESHOLD control from full CCW to full CW, the meter needle should go from the noise level reading to the +20.0 dB point on the meter.

5.7.2 LOG DETECTOR (A4)

a. Remove the brace from the Log Detector, IF Amplifier and Discriminator and loosen the six-quarter-turn fasteners.

b. Make sure the harnesses are free from the clamps on the Discriminator chassis.

c. Lay a piece of masonite atop the bottom of the instrument.

d. Lift the three chassis from the EMC-25 and place them on the board with the Log Amplifier on top.

e. Remove cable #8 from J3, cable #7 from J2, and cable #6 from J1 on the Log Detector chassis.

f. Set the Detector Function switch to CARRIER.

g. Set the BAND SELECTOR to the Band 1 position for 175 kHz alignment and connect a calibrated signal generator to A4J3 through a 10 dB step external Attenuator. Set the signal generator output level at 72.5 mV.

h. Set the external Attenuator for 20 dB and adjust A4A1-R51 for 0dB on the meter.

i. Reset the external attenuator for 50 dB and adjust A4A1-R45 for -30 dB on the meter.

j. Repeat steps “n” and “i” until the meter linearity meets a specification of ± 1.0 dB above 0 dB and ± 2.0 dB below 0 dB on the meter.

k. Switch to the Band 8 position for 1.6 MHz alignment.

l. Set the Signal Generator to 1.6 MHz and connect to A4J2 through the 10 dB Step Attenuator. Set the signal generator output level at 72.5 mV.

m. Set the external Attenuator for 20 dB and adjust A4A2-R51 for 0 dB on the meter.

n. Reset the external Attenuator for 50 dB and adjust A4A2-R45 for -30 dB on the meter.

o. Repeat steps “m” and “n” until the meter linearity meets a specification of ± 1.0 dB above 0 dB and ± 2.0 dB below 0 dB on the meter.

p. Switch to the Band 11 position for 8.7 MHz alignment.

q. Set the signal generator to 8.7 MHz and connect to A4J1 through the 10 dB step attenuator. Set the signal generator output level at 31.5 mV.

r. Set the external Attenuator for 20 dB and adjust A4A3-R51 for 0 dB on the meter.

s. Reset the external Attenuator for 50 dB and adjust A4A3-R45 for -30 dB on the meter.

t. Repeat steps “r” and “s” until the meter linearity meets a specification of ± 1.0 dB above 0 dB and ± 2.0 dB below 0 dB on the meter.

u. Reconnect all cables, but do not replace the chassis in the unit.

NOTE

This is a preliminary adjustment to assure proper operation of the Log and Video Detector. Final adjustment occurs when the IF and DETECTION SYSTEM is interconnected.

5.7.3 IF AMPLIFIER (A3)

The IF Amplifier alignment determines the bandwidth and gain and contributes to several other important parameters as well, This alignment is extremely stable and should not be disturbed unless one or more of the frequency determining elements are replaced.

In N option instruments, IF Amplifiers are aligned for approximately 3 dB higher gain than normal instruments. The higher gain is obtained through an increase in the value of C21. In an N option instrument, the frequency to which the aligning signal generator is tuned is set by tuning it for maximum response on the EMC-25 while in the 0.1 NB position.

The procedure below applies only to realignment of a previously operative 1 F Amplifier. Initial factory alignment is considerably more complex.

5.7.3.1 175 kHZ AMPLIFIER ALIGNMENT

a. Set the EMC-25 controls:

BANDWIDTH	-	NARROW
DETECTOR FUNCTION	-	CARR
BAND Selector	-	Any 1-7

b. Remove cable #15 from the RF Tuner and connect it to a signal generator. Set the signal generator to 220 µV output at 175 kHz.

c. Tune all the inductors for maximum indication on the EMC-25 meter in he following order: L2004, L2010, L2009, L2008, L2007, L2006, L2005, L2003, L2002, and L2001.

d. Change the BANDWIDTH switch to WIDE. The meter should change less than ±0.5 dB. Note the meter reading.

e. if the meter reading is not within ± 1 dB of full scale, A3A1C21 should be adjusted for full scale indication.

f. If the difference in meter reading is greater than ±0.5 dB, A3A1R6 will have to be adjusted for proper NARROW gain.

g. Repeat step c) if steps e) or f) are performed.

h. Change the BANDWIDTH switch to NARROW and note the EMC-25 meter reading.

i. Increase the signal generator output by 3 dB. Tune it both higher and lower in frequency, noting the frequencies at which the EMC-25 meter reading is the same as in step h. The difference between these frequencies is the NARROW bandwidth.

j. If the bandwidth is not between 450 hz and 550 Hz, A3A1R11 and will have to be adjusted, followed by a repetition of step f.

5.7.3.2 1.6 MHz ALIGNMENT

a. Set the EMC-25 controls:

BANDWIDTH	- NARROW
DETECTOR FUNCTION	- CARR
BAN D Selector	- Any 8-10

b. Remove cable #15 from the RF Tuner and connect it to a signal generator. Set the signal generator to 700 μV output at 1.6 MHz.

c. Tune C4 for a minimum indication (null) on the EMC-25 meter.

d. Tune all the inductors for maximum indication on the EMC-25 meter in the following order: L3004, L3010, L3009, L3008, L3007, L3006, L3005, L3003, L3002, and L3001.

e. Tune C4 for a maximum indication on the EMC-25 meter.

f. Reduce the output of the signal generator until the EMC-25 meter reads +20 dB.

g. Tune C4 until the EMC-25 meter reads +18 dB.

h. Change the BANDWIDTH switch to WIDE. Reset the signal generator 700 μV output. Note the EMC-25 meter reading.

i. If the EMC-25 meter reading is above the +20 dB mark, continue to change C4 until it reads +20 dB. If it is below +19 dB, A3A2C21 should be adjusted to raise it to approximately +20 dB.

j. Change the BANDWIDTH switch to NARROW. The meter should change less than +0.5 dB.

k. If the difference between WIDE and NARROW is greater than ±0.5 dB, A3A2R7 will have to be adjusted. Retune L3004 if A3A2R7 is changed.

l. Leave the BANDWIDTH switch in the NARROW position and note the EMC-25 meter reading.

m. Increase the signal generator output by 3 dB. Tune it both higher and lower in frequency, noting the frequencies at which the EMC-25 meter reading is the same as in step one. The difference between these is the narrow bandwidth,

n. If the bandwidth is not between 4.5 kHz and 5.5 kHz, A3A2R12 will have to be adjusted, followed by a repetition of step k.

5.7.3.3 8.7 MHz ALIGNMENT

a. Set the EMC-25 controls:

BANDWIDTH	- NARROW
DETECTOR FUNCTION	- CARR
BAND Selector	- Any 11-15

b. Remove cable #15 from the RF Tuner and connect it to a signal generator. Set the signal generator to 2.0 mV output at 8.7 MHz.

c. Tune all the inductors for maximum indication on the EMC-25 meter in the following order. L4004, L4010, L4009, L4008, L4007, L4006, L4005, L4003, L4002, and L4001.

d. Tune C4, C21, C26 and C33 for minimum indication on the EMC-25 meter.

e. Change the BANDWIDTH switch to WIDE. Note the EMC-25 meter reading.

f. Tune C26 and C33 individually for maximum EMC-25 meter reading and note the increase in each case.

g. Tune C26 and C33 for minimum indication on the EMC-25 meter.

h. Tune C4 and C21 individually for maximum EMC-25 meter indication, then reduce *each* 3 dB.

i. Note the difference between the EMC-25 meter reading and +20 dB (full scale). Increase C26 and C33 by equal amounts to cause the EMC-25 meter to read +20 dB, but in no case increase them closer than 2 dB to their maximum range determined in steps e) and f).

j. If the EMC-25 meter reading cannot be increased to +20 dB in step i), C4 and C21 may each be increased as much as 1 dB.

k. If the EMC-25 meter reading still cannot be increased to +20 dB, then A3A3R25 may be decreased in value.

l. Change thel BANDWIDTH switch to NARROW. The meter should change less than ±0.5 dB.

m. If the difference between WIDE and NARROW is greater than ±0.5 dB, A3A3R6 will have to be adjusted. Retune L4005 if A3A3R6 is changed.

n. Leave the BANDWIDTH switch in the NARROW position and note the EMC-25 meter reading.

o. Increase the signal output by 3 dB. Tune it both higher and lower in frequency, noting the frequencies at which the EMC-25 meter reading is the same as in step n). The difference between these is the narrow bandwidth.

p. If the bandwidth is not between 45 kHz and 55 kHz, A3A3R11 will have to be adjusted, followed by a repetition of steps l) and m).

5.7.3.4 N OPTION (CRYSTAL FILTER) ALIGNMENT

a. Set the EMC-25 controls:

BANDWIDTH	- 0.1 NARROW
DETECTOR FUNCTION	- CARR
BAND Selector	

- Band 1 when adjusting 175 kHz.
- Band 8 when adjusting 1.6 MHz.
- Band 11 when adjusting 8.7 MHz.

b. Remove cable #15 from the RF Tuner and connect it to a signal generator capable of tuning to the three IF frequencies. Tune the signal generator to obtain a maximum response on the EMC-25 meter and adjust its level for a meter reading of 0 dB.

c. Disconnect the filter assembly (A12) from the circuit by connecting the three IF Amplifier outputs directly to the three Log Detector inputs.

d. Leaving the BANDWIDTH switch in the 0.1 NARROW position, note whether the meter reading is still 0 dB.

e. If the meter reading is not 0 dB, the amplifier gain control needs adjustment as described in steps f) through h). If the reading is 0 dB, proceed to steps g) and i).

f. Without touching the frequency control of the signal generator, change the amplitude until the meter reads 0 dB.

g. Reconnect the filter assembly (A12).

h. Adjust R59 (175 kHz), R37 (1.6 MHz) or R14 (8.7 MHz) until a 0 dB meter reading is realized in each case.

i. Change the BANDWIDTH switch to the WB position and note any change in the meter reading.

j. If the meter reading changes by greater than ± 1 dB, the bypass gain control needs adjustment as follows:

k. Adjust R48 (175 kHz), R26 (1.6 MHz), or R3 (8.7 MHz) until the meter reading is once again 0 dB in each case.

5.7.4 DISCRIMINATOR (A8) ALIGNMENT

Discriminator alignment is extremely stable. Realignment should be performed only when a signal on Band 7, 10, and 14 cannot be satisfactorily acquired and locked with AFC as described in Section III, or when IF Amplifier is realigned.

5.7.4.1 175 kHz DISCRIMINATOR

a. Set the EMC-25 controls:

BAND	- 1-7
BANDWIDTH	- WIDE
DETECTOR FUNCTION	- CARR

b. Disconnect cable #15 from the RF Tuner and connect it to a signal generator.

c. Disconnect cable #5 from the rear of the Video Detector and connect it to a voltmeter with a resolution of 4 digits at 1.500 volts.

d. Tune the signal generator to 175.0 kHz and adjust its output level to cause the EMC-25 meter to read 0 dB.

e. Adjust T2003 for 0.000 volts indication.

f. Change the signal generator frequency to 172.5 kHz and note the negative voltage (normal reading is- 1.0 to - 1.5 volts).

g. Change the signal generator frequency to 177.5 kHz and note the positive voltage, If it is not the same as that noted in step f), adjust T2002.

h. Interaction between T2002 and T2003 will necessitate the repetition of steps d) through g).

i. T2001 tunes very broadly and needs to be aligned only if it is replaced. To tune it, connect a high impedance DC voltmeter to the junction of C11 and C12; set frequency level per step d) and tune for peak indication on the voltmeter.

5.7.4.2 1.6 MHz DISCRIMINATOR

a. Set the EMC-25 controls:

BAND	- 8-10
BANDWIDTH	- WIDE
DETECTOR FUNCTION	- CARR

b. Disconnect cable #15 from the RF Tuner and connect it to a signal generator.

c. Disconnect cable #5 from the rear of the Video Detector and connect it to a voltmeter with a resolution of 4 digits at 15.00 volts.

d. Tune the signal generator to 1.600 MHz and adjust its output level to cause the EMC-25 meter to read 0 dB.

e. Adjust T3003 for 0.000 volts indication.

f. Change the signal generator frequency to 1.575 MHz and note the negative voltage (normal) reading is -1.5 to -2.0 volts).

g. Change the signal generator frequency to 1.625 MHz and note the positive voltage. If it is not the same as that noted in step f), adjust T3002.

h. Interaction between T3002 and T3003 will necessitate the repetition of steps d) through g).

i. T3001 tunes very broadly and needs to be aligned only if it or C2 is replaced. To tune it, connect a high impedance DC voltmeter to the junction of C8 and C9; set frequency and level per step d) and tune for peak indication on the voltmeter.

5.7.4.3 8.7 MHz DISCRIMINATOR

a. Set the EMC-25 controls:

BAND -	-	11-15
BANDWIDTH	-	WIDE
DETECTOR FUNCTION	-	CARR

b. Disconnect cable #15 from the RF Tuner and connect it to a signal generator.

c. Disconnect cable #15 from the rear of the Video Detector and connect it to a voltmeter with a resolution of 4 digits at 15.00 volts.

d. Tune the signal generator at 8.7000 MHz and adjust its output level to cause the EMC-25 meter to read 0 dB.

e. Adjust T4003 for 0.000 volts indication.

f. Change the signal generator frequency to 8.450 MHz and note the negative voltage (normal reading is -1.5 to -2.5 volts).

g. Change the signal generator frequency to 8,950 MHz and note the positive voltage. If it is not the same as that noted in step f), adjust T4002.

h. Interaction between T4002 and T4003 will necessitate the repetition of steps d) through g).

i. T4001 tunes very broadly and need be aligned only if it or C2 is replaced. To tune it, connect a high impedance DC voltmeter to the junction of C8 and C9; set frequency and level per step d) and tune for peak indication on the voltmeter.

5.7.4.4 N-OPTION EMC-25 DISCRIMINATOR ALIGNMENT

Following are additional alignment instructions for N Version EMC-25s. This procedure does not include the adjustment of the narrowband filter unit.

AFC Adjustments: (Each IF Frequency)

1. Connect a sensitive DC coupled oscilloscope to the AFC output terminal of the Video Detector (feed thru capacitor C22 on the righthand rear side of Video Detector).

2. Set bandwidth switch to WI DE, AFC switch to OFF, ATTENUATOR in CAL, Tuning to MAN, Tuning Mode OFF, Detector Function to CARR.

3. Feed in a full scale CW signal from a signal generator. Slowly sweep the frequency of the generator back and forth across the frequency to which the receiver is tuned, noting the symmetry of the discriminator output on the scope.

4. Adjust the Discriminator Transformers T002 and T003 so that the peak positive and peak negative output voltage swings are symmetrical about the noise line, and also so that, when the signal generator voltage is adjusted for maximum meter deflection, the discriminator output voltage as indicated on the scope is the same as the mean noise base line viewed when the input signal frequency is far from the resonant frequency to which the receive is tuned.

5. Now turn the bandwidth switch to 0.1 NB. With no signal tuned in, adjust the sensitivity and positioning of the scope so that noise of 2 to 3 cm is presented in the center position of the screen,

6. Adjust the discriminator input transformer T001 for a minimum noise level, and for symmetry in the noise wave shape about the base line.

7. Now very slowly vary the signal generator back and forth across the resonant frequency to which the receiver is tuned. Make slight adjustments to discriminator T003 so that the small portion of the discriminator curve which is now present (because of the 0.1 NB filter) is symmetrically centered around the mean noise level.

8. Now turn the AFC switch to “ON.” Carefully tune and fine-tune the receiver until it has acquired the signal, and it is adjusted for maximum amplitude. Now remove the input signal momentarily, (disconnect the input), then reconnect it and note if the signal is recaptured. If not, a careful trial and error adjustment is required as follows:

a. Turn slug T003 slightly clockwise. Then tune in the signal for maximum amplitude, disconnect and reconnect the input signal and note if signal is captured.

b. If the signal is not recaptured, but seems closer to the recapture point, turn slug T003 slightly more clockwise, retune for maximum, one more disconnect and reconnect the signal, and note if the signal is recaptured.

c. If the clockwise adjustments seem to be moving the signal further from the recapture point (more fine-tuning required to retune the signal), repeat the above procedure, turning discriminator transformer slug T003 in a counterclockwise direction.

d. Continue the trial and error adjustment until the signal is recaptured.

e. Since this adjustment depends on the receiver’s noise level, and since this noise level and character varies from band-to-band, and for different frequency setting on one band, recapture may not be possible for all tuning control settings on all bands. Since the top band in each IF frequency range (Bands 7, 10, and 15) will be the most critical in tuning, these bands should be used for the discriminator adjustment. The tuning control should be about center band frequency range.

5.7.5 LOG DETECTOR (A4) TOUCH-UP

This alignment corrects for IF Amplifier non-linearity and is performed only after the Video Detector, Log Detector, Crystal Filter and IF Amplifier prove operable.

a. Set the Band Selector to the Band 1 position for 175 kHz alignment.

b. Set the BANDWIDTH switch in the NARROW position.

c. Connect a Signal Generator through a 10 dB step External Attenuator to the IF Amplifier input cable #15. Set the generator to 175 kHz at a level of 220 uV and tune it for a peak response on the EMC-25 meter.

d. Set the 10 dB External Step Attenuator for 20 dB of attenuation and adjust A4A1R51 on the Log Detector for 0 dB on the meter.

e. Add another 30 dB of attenuation on the External Attenuator and adjust A4A1R45 for -30 dB on the meter.

f. Repeat steps d) and e) until the meter linearity meets a specification of ± 1.0 dB above 0 dB and ± 2.O dB below 0 dB on the meter.

g. Switch to the Band 8 position for 1.6 MHz alignment.

h. Set the Signal Generator to 1.6 MHz at a level of 700 uV and tune it for a peak response on the EMC-25 meter.

i. Set the External Step Attenuator for 20 dB of attenuation and adjust A4A2R51 for 0 dB on the meter.

j. Add another 30 dB of attenuation on the External Step Attenuator and adjust A4A2R45 for -30 dB on the meter.

k. Repeat steps i) and j) until the meter linearity meets a specification of ± 1.0 dB above 0 dB and ± 2.0 dB below 0 dB on the meter.

l. Switch to the Band 11 position for 8.7 MHz alignment.

m. Set the Signal Generator to 8.7 MHz at a level of 2.0 mV and tune it for a peak response on the EMC-25 meter.

n. Set the External Step Attenuator for 20 dB of attenuation and adjust A4A3R51 for 0 dB on the meter.

o. Add another 30 dB of attenuation on the External Step Attenuator and adjust A4A3R45 for -30 dB on the meter.

p. Repeat steps n) and o) until meter linearity meets a specification of ± 1.0 dB above 0 dB and ± 2.0 dB below 0 dB on the meter.

5.8 CALIBRATION - RF TUNER CHECK Refer to Fig.

CAUTION

Procedures in Section 5.8.1, 5.8.2, and 5.8.3 affect the frequency accuracy of the EMC-25. Do not perform these procedures if the Frequency Accuracy Test (Section 4.4.4) results are satisfactory. Section 5.8.1 affects all Bands, while Section 5.8.2 and 5.8.3 chiefly affect the low-frequency end of Bands 1-10. Should a single Band be out of alignment, see Section 5.9 and the procedure for individual Band Strip Alignment for that particular Band.

5.8.1 TUNING VOLTAGE ADJUSTMENTS

The bottom cover must be removed to make the following adjustments. Refer to Fig. 6.1 for the location of the controls on the sweep board A1P1 and the tuning regulator boards, A5P4.

1. Set the band selector to Band 7. Set the fine tuning controls to the center of their ranges.
2. Connect an accurate 01.5V voltmeter between terminal 9 of terminal board A5TB1 and ground.
3. Set the frequency dial so that the frequency cursor is against the low frequency mechanical stop.
4. Adjust the low and frequency adjustment (R29) on the tune/sweep board A1P1 for 0.00V.
5. Reconnect the voltmeter between the TV test point on the RF Tuner and ground.
6. Adjust the frequency control so that the cursor is positioned over the lowest frequency calibration line. Adjust R36 on the tuning regulator board A5P4 for 0V.
7. Change the voltmeter to its 100V range. Adjust the frequency control so that the cursor is located over the last high frequency calibration mark.
8. Adjust the high end control (R23) on tune/sweep board A1P1 for a 98V meter reading.
9. Repeat steps 6, 7 and 8 to overcome control interaction.

5.8.1.1 SWEEP ADJUSTMENT (SWEEP TUNE BOARD A1P1)

Refer to Fig. 6.1 for control locations.

The bottom cover on the front panel must be removed to make these adjustments.

1. Disable the auto-sweep circuit by temporarily connecting a jumper between pins 8 and 13 of the tune/sweep board A1A2.
2. Monitor the voltage between the TV test point on the RF tuner A1A2 and ground (100V range).
3. Set the tune mode switch to sweep, set sweep time control for 1 minute. Press and release the sweep start button.
4. Monitor the sweep voltage present at the TV test point. When the voltage reaches 98V, the sweep should reset.
5. If the voltage is not within ± 1V of 98V when the sweep resets, adjust the fast sweep control, R4 A1P1 and repeat steps 3 and 4 until the correct end-of-sweep voltage is obtained.
6. Connect the voltmeter between the junction of R30 and R31 (negative) and the junction of R32,

R36 (positive) on the tune/sweep board A1P1. Set the sweep tune control for 30 minutes. Initiate a sweep by pressing and releasing the sweep start switch.

7. Adjust the slow sweep control, R31 and A1P1 for a voltage reading of 0.58 volts.

8. Set the sweep time for a 1 minute. Adjust the fast sweep control R31 on A1P1 for a 1.70 volt reading.

9. Remove the meter, and the jumper wire between pins 8 and 13 of A1P1, and reassemble the unit.

5.8.2 VARACTOR BIAS

1. Varactor biasing is set by adjusting bias networks mounted on the stator board. Biasing is preset by factory selected resistors in bias networks. Bias voltage ranges from -0.2 to- 1.0 volt.

5.8.3 OSCILLATOR LEVEL

Connect as oscilloscope to Pin 23 of the 30 contact pins for the band segments and adjust the oscillator level control R52, at the rear of the RF Tuner for 400 mV peak-to-peak for bands 1-10. This voltage should not vary more than ±50 mV at any frequency, 10 kHz - 30 MHz.

5.8.4 CAL LEVEL ADJUSTMENTS

The audio/IG level board A1P2 contains the level adjustments. Refer to Fig. 6.1 for the board placement and the location of the adjustments on the board. Accurately calibrated CW signal sources covering the 10 kHz to 1 GHz frequency range are required.

1. Remove the bottom cover of the EMC-25 receiver. Place the EMC-25 in its normal operating position with the front section overhanging the test bench to allow access to the adjustments on A1P2.

2. Set the EMC-25 controls as follows:

ATTENUATOR	-	40/60 dB
DETECTOR	-	CARR
BANDWIDTH	-	WIDE

3. Tune the receiver to 100 kHz (band 3). Feed a 100 uV, 100 kHz CW signal to the RF input. Carefully tune the signal in. Adjust the front panel CAL control for a 0 dB front panel meter reading. Hold in the CAL button and adjust R27 on A1P2 for a 0 dB meter reading.

4. Set the receiver-to 20 kHz (band 1). Calibrate t by depressing the CAL button and turning the CAL control for a 0 dB meter reading. Next feed a 100 uV 20 kHz signal to the RF input and tune it in. it should read 0 dB on the meter. Note any error.

5. Repeat step 4 at 200 kHz (band 4).

6. If the errors noted in step 4 or 5 exceed ± 1 dB, readjust R27 to obtain the best overall accuracy for bands 1,3, and 4.

7. Set the receiver to 800 kHz (band 6). Feed in a 100 uV 800 kHz signal, and tune it in. Adjust the CAL control for a 0 dB meter reading. Depress the CAL button and adjust R26 for a 0 dB reading.

8. Check the calibration accuracy at 60 kHz (band 2), 400kHz (band 5) and 1.5 MHz (band 7), as in step 4.

9. If the calibration error exceeds ± 1 dB for bands 2, 5, or 7, R26 should be readjusted for the best overall accuracy.

10. Set the EMC-25 to 4 MHz (band 8). Tune in a 100 uV, 4 MHz CW signal from the generator. Adjust CAL for 0 dB, press the CAL button and adjust R25 for a 0 dB reading.

11. Repeat the procedure of Step 10 at 9 MHz (band 9) using R24 as the adjustment.

12. Check the calibration accuracy at 20 MHz (band 10) as outlined in step 4.

13. If the calibration error exceeds ± 1 dB, readjust R24 for the best overall accuracy.

14. Set the EMC-25 to 35 MHz (band 11). Tune in a 1-0 mV CW signal at 35 MHz. Adjust the CAL control for a 0 dB meter reading. Press the CAL button and adjust R19 for a 0 dB meter reading.

15. Calibrate bands 12, 13, 14 and 15 in the same way. The CW input signal level is 1.0 mV.

Calibrate band 12 at 80 MHz using R20.
Calibrate band 13 at 160 MHz using R21.
Calibrate band 14 at 350 MHz using R22.
Calibrate band 15 at 700 MHz using R23.

5.8.5 MIXER BALANCE

1. With the RF INPUT free of any connections, set the EMC-25 to the Band 1 position, the FREQUENCY selector to the low end stop, the BANDWIDTH switch in WIDE and the CAL control fully CW.

2. Adjust the Mixer Balance Control R38 at the rear of the RF TUNER until the front panel meter reaches a null (minimum) indication.

5.8.6 175 kHz MIXER AND PRE AMP TUNING

1. Set the EMC-25 controls as follows:

BAND SELECTOR	-	Band 2
FREQUENCY	-	120 kHz
TUNING MODE	-	MAN
DETECTOR FUNCTION	-	CARR
BANDWIDTH	-	NARROW

2. Connect a signal to the RF INPUT connector, tune it to 175 kHz, and starting at minimum, gradu-

ally increase the output level until the EMC-25 meter reads approximately 0 dB. Tune the signal generator for a peak response on the EMC-25 meter.

3. Adjust T2001, the 175 kHz Mixer transformer at the rear of the RF Tuner until the meter reaches a peak indication.

4. Refer to the schematic diagram of the Pre Amp board and adjust T2002, the 175 kHz adjustment on the Pre Amp board until the meter reaches a peak indication.

5.8.7 1.6 MHz MIXER AND PRE AMP TUNING

1. Set the EMC-25 controls as follows:

BAND SELECTOR	- Band 8
FREQUENCY	- 2.5 MHz
TUNING MODE	- MAN
DETECTOR FUNCTION	- CARR
BANDWIDTH	- NARROW

2. Connect a signal generator to the RF INPUT connector, tune it to 1.6 MHz, and starting at minimum gradually increase the output level until the EMC-25 meter reads approximately 0 dB. Tune the signal generator for a peak response on the EMC-25 meter.

3. Adjust the T3001 1.6 MHz Mixer transformer at the rear of the RF Tuner, until the meter reaches a peak indication.

4. Refer to the schematic diagram of the Pre Amp board and adjust T3002, the 1.6 MHz adjustment on the Pre Amp board until the meter reaches a peak indication.

5.8.8 8.7 MHz MIXER AND PRE AMP TUNING

1. Set the EMC-25 controls as follows:

BAND SELECTOR	- Band 11
FREQUENCY	- 25 MHz
TUNING MODE	- MAN
DETECTOR FUNCTION	- CARR
BANDWIDTH	- NARROW

2. Connect a signal generator to the RF INPUT connector, tune it to 8.7 MHz, and starting at minimum, gradually increase the output level until the EMC-25 meter reads approximately 0 dB. Tune the signal generator for a peak response on the EMC-25.

3. Adjust the T4001 8.7 MHz Mixer transformer, located on the section behind the 30 contact pins for the band segments, until the meter reaches a peak indication.

4. Refer to the schematic diagram of the Pre Amp board and adjust T4002, the 8.7 MHz adjustment on the Pre Amp Board until the meter reaches a peak indication.

5.9 BAND SEGMENTS

NOTES

1. To obtain access to the bend being aligned, it may be necessary to remove certain bands from the turret.
2. Contact pins are numbered 1 through 30 from left to right when viewed from the front panel, with EMC-25 upside down.
3. Set the EMC-25 front panel controls as follows:

ATTENUATOR	- 20dB (Black)
FINE TUNE	- Mechanical Center
TUNING MODE	- MAN
CAL Control	- FULLY CCW
BANDWIDTH	- WIDE
DETECTOR FUNCTION	- CARR
AUDIO	- FULLY CCW
POWER	- ON

5.9.1 BANDS 1-9 (A2A1-A2A9)

1. Connect a signal generator to the RF INPUT connector and set the output to 10 μV. Tune the EMC-25 and the signal generator to the first indicated frequency line of each band. Ex. Band 1, 10 kHz; Band 2,35 kHz) and apply a signal.

2. Adjust the coil and trimmer pad nearest Pin 30 (right side) for a peak indication on the front panel meter. This is local oscillator and will affect freq. only.

3. Adjust each coil starting from the opposite end of the band (nearest Pin 1) until the meter is at maximum deflection.

4. Change the EMC-25 FREQ control to the last indicated line of each bend and change the signal generator frequency accordingly.

5. Adjust the capacitor nearest Pin 30 (right side) for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

6. Adjust each capacitor starting from the opposite end of the band (nearest Pin 1) until the meter is at maximum deflection.

5.9.2 BAND 10 (A2A10)

1. Connect a signal generator to the RF INPUT connector and set the output to 10 PV. Tune the signal generator and the EMC-25 to 13 MHz and apply the signal.

2. Adjust T3 for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

3. Adjust T1, T2, L1 and L2 respective y, until the meter is at maximum deflection.

4. Change the signal generator and the EMC-25 FREQ control to 30 MHz and apply the signal.

5. Adjust capacitor C24 for a peak indication on the front panel meter. Local oscillator, adjust for freq. only.

6. Adjust capacitors Cl and C7 respectively until the meter is at maximum deflection.

5.9.3 BAND 11-15 (A2A11-A2A15)

Proper operation of Band 11, 12, 13, 14 and 15 Band Strips depends upon the arrangement of components and short lead lengths. Due to the critical nature of these circuits, field repair is not recommended. Schematic diagrams are included in Section VI as an aid to understanding EMC-25 operation and for emergency repair only.

5.10 STORAGE

Storage: To protect the equipment from damage, loss, and dust, the receiver and its accessories should be stored in their respective transit cases. If the optional battery A6 is installed, storage should not exceed 3 months unless the battery is recharged at 3-month intervals by connecting the receiver to an AC source for a 24-hour period. For longer periods of unattended storage, the battery should be removed (see paragraph 5.5.3.1). Prior to and following long-term storage, the performance checkout procedure of Section IV should be performed and any indicated adjustments or repairs made.

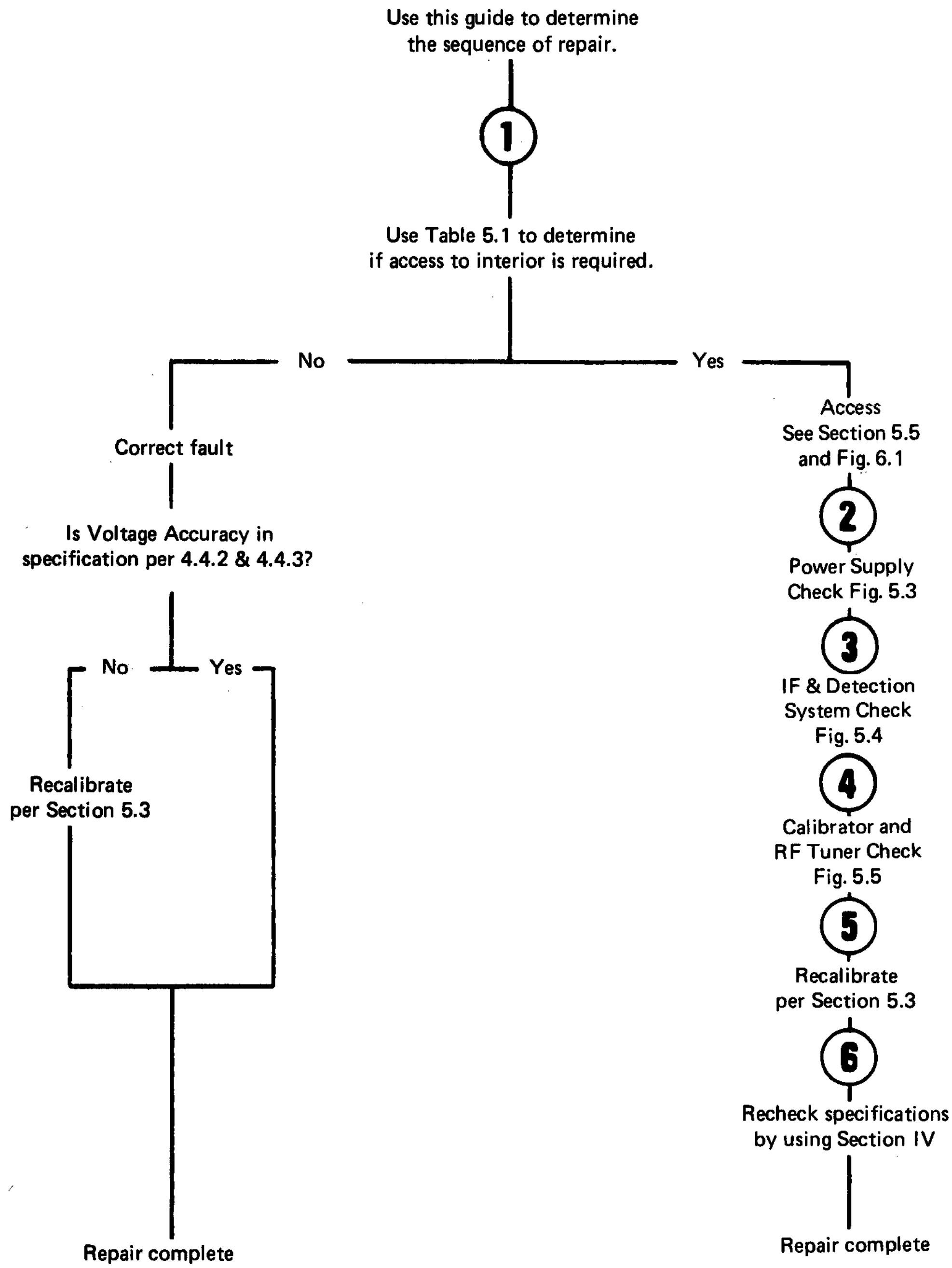


Figure 5.2

Repair Sequence Guide

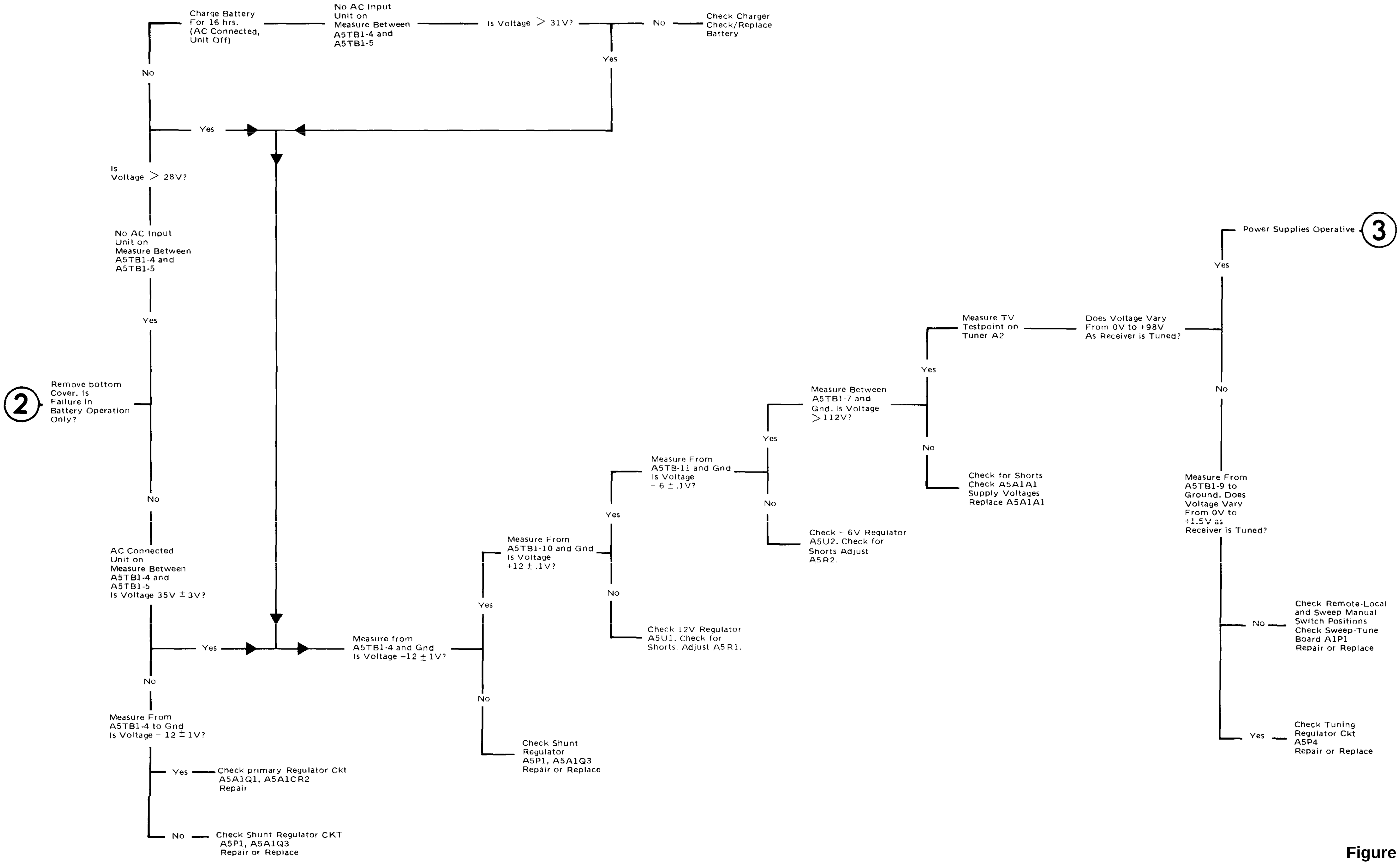


Figure 5.3
Power Supply Checking

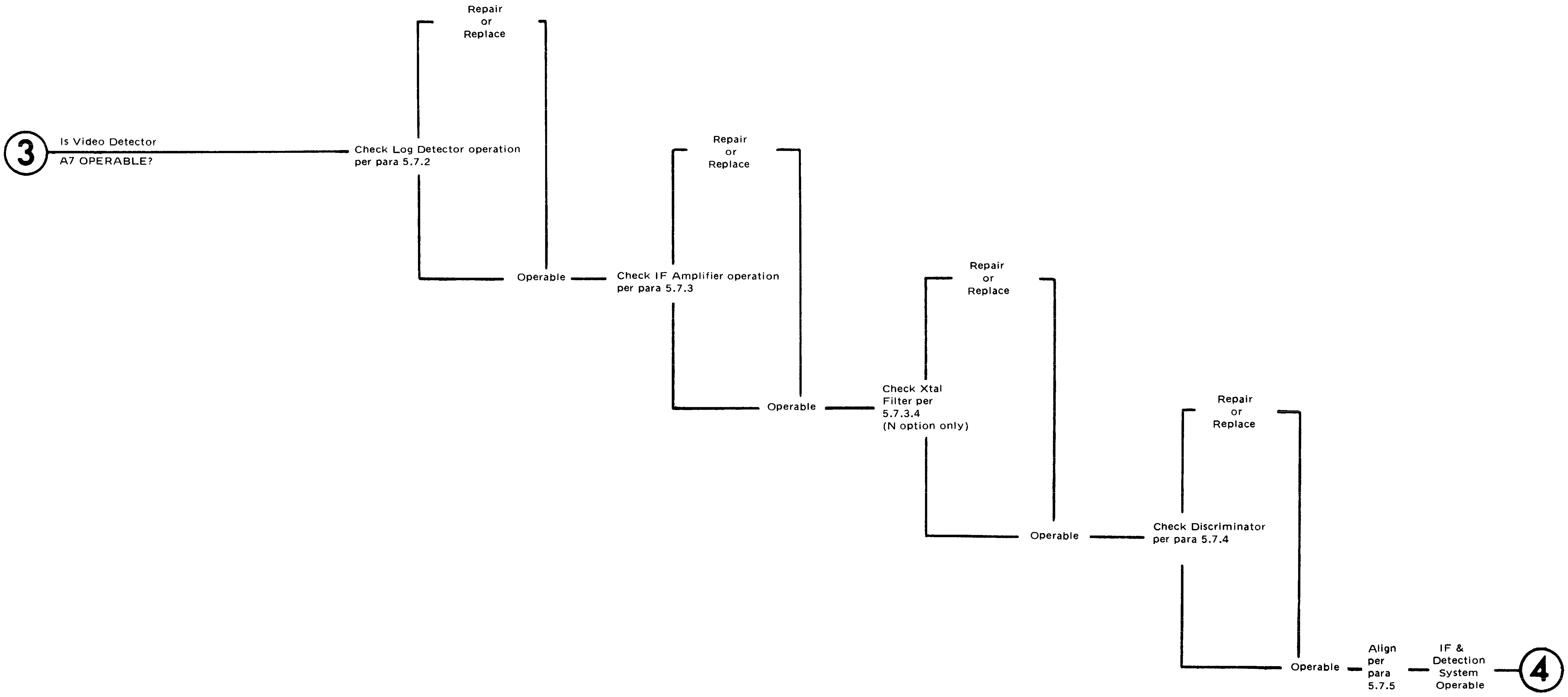


Figure 5.4
IF and Detection System Checking

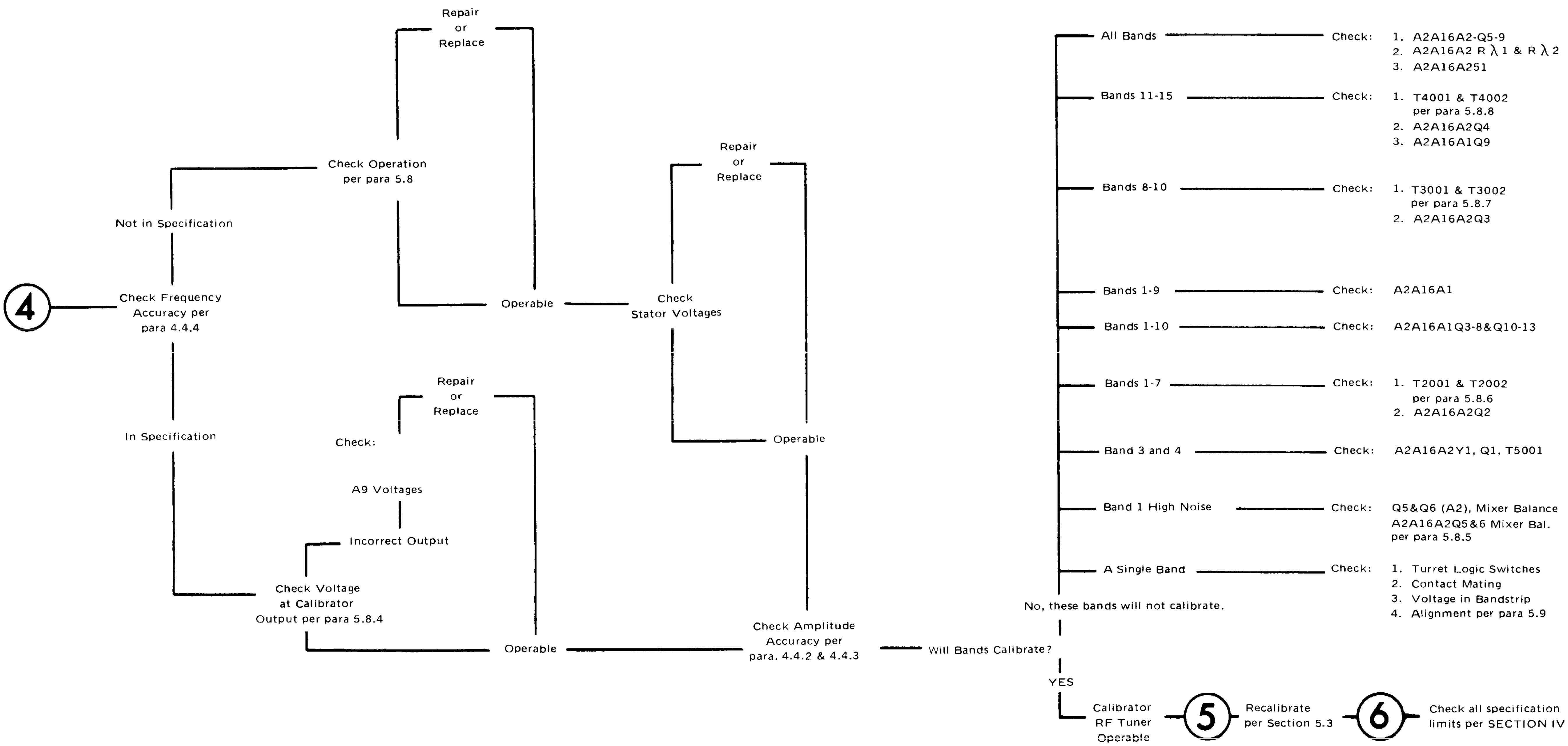


Figure 5.5
Calibrator and RF Tuner Checking

SECTION VI

Reference Data

6.1 GENERAL

6.1.1 This section contains information which will be helpful in signal tracing during instrument checkout and/or maintenance. These electrical drawings are presented, as near as possible, in the order of signal flow within the instrument.

LIST OF DIAGRAMS

TABLE 6.1

REPLACEABLE MODULES, BOARDS, AND ASSEMBLIES	
Description	Nomenclature
Frequency Tuning Assembly	A1A1
Low Pass Filter (Sealed)	A1A2
RF Attenuator (Sealed)	A1A3
Front Panel Meter	A1M1
Sweep Tune P.C. Board	A1P1
Audio Amplifier P.C. Board	A1P2
RF Tuner (Complete)	A2
Band 1	A2A1
Band 2	A2A2
Band 3	A2A3
Band 4	A2A4
Band 5	A2A5
Band 6	A2A6
Band 7	A2A7
Band 8	A2A8
Band 9	A2A9
Band 10	A2A10
Band 11 (Sealed)	A2A11
Band 12 (Sealed)	A2A12
Band 13 (Sealed)	A2A13
Band 14 (Sealed)	A2A14
Band 15 (Sealed)	A2A15
Stator Board	A2A16A1
Preamplifier Board	A2A16A2
Gear Train Assembly	A2A16A3
LO Option Assembly (Optional)	A2A16A4

TABLE 6.1 (Continued)

REPLACEABLE MODULES, BOARDS, AND ASSEMBLIES	
Description	Nomenclature
IF Amplifier	A3
175 kHz P.C. Board	A3A1
1.6 MHz P.C. Board	A3A2
8.7 MHz P.C. Board	A3A3
Log Detector	A4
175 kHz P.C. Board	A4A1
1.6 MHz P.C. Board	A4A2
8.7 MHz P.C. Board	A4A3
Power Supply	A5
Raw Voltage Supply	A5A1
High Voltage Converter (Sealed)	A5A1A1
Power Supply P.C. Board	A5A1P2
Feed Thru Plate	A5A2
Band Control P.C. Board	A5P3
Tuning Regulator P.C. Board	A5P4
Battery Pack	A6
Video Detector	A7
Video Detector P.C. Board	A7A1
FM Discriminator	A8
175 kHz P.C. Board	A8A1
1.6 MHz P.C. Board	A8A2
8.7 MHz P.C. Board	A8A3
Impulse Calibrator	A9
Frequency Scale	A10
Bulkhead Feed Thru Plate	A11A2
Power Cable (AC)	PCD-25

TABLE 6.2

RECOMMENDED SPARE PARTS LIST FOR MODEL EMC-25 INTERFERENCE ANALYZER			
Description	Recommended Quantity 1 set	10 sets	Part No.
Semiconductor	3	10	1N3064
Semiconductor (Matched Pair)	1	4	2N4416
Semiconductor	1	4	2N4416
Semiconductor (Matched Pair)	2	5	2N3690
Semiconductor	2	6	2N3690
Semiconductor (Matched Pair)	2	5	2N3563
Semiconductor	1	2	2N2920
Semiconductor	1	2	2N918
Semiconductor	1	4	2N2484
Semiconductor	1	4	2N4250
Semiconductor	1	2	2N3053
Semiconductor	1	2	CK1114
Semiconductor (Varactor 47PF)	1	4	MC105B
Semiconductor	1	4	2N3693
Semiconductor	1	2	FD600
Semiconductor	1	2	2N3646
Semiconductor	1	2	1N270
Semiconductor	1	2	FD300
Semiconductor	1	2	2N3114
semiconductor	1	3	2N3054
Semiconductor	1	2	2A100
Semiconductor	1	2	2N3638
Semiconductor (Varactor 235PF)	1	2	VS821
Semiconductor	1	2	1N752
Semiconductor	1	2	CER69C
Semiconductor	1	2	2N3440
Semiconductor	1	2	2N4888
Semiconductor	1	2	1N986B
Semiconductor	1	3	LAS18U
Semiconductor	1	3	LAS15U
Semiconductor	1	3	PMD-12K-80
Semiconductor	1	2	1N2976R
Semiconductor	1	2	1N2987
Semiconductor	1	2	2A400
Semiconductor	1	2	1N750A

TABLE 6.2 (Cont'd)

RECOMMENDED SPARE PARTS LIST
FOR
INTERFERENCE ANALYZERS MODEL EMC-25

Description	Recommended Quantity 1 set/10 sets		Part No.
Semiconductor	1	2	1N757
Semiconductor	1	2	1N965
Semiconductor	1	2	GEZD
Semiconductor	1	2	2N3819
Semiconductor	1	2	1N3022
Semiconductor	1	2	1N970
Semiconductor	1	3	2N1536
Semiconductor	1	2	2N3504
Semiconductor	1	2	1N4754
Semiconductor	1	2	EZ901
Semiconductor	1	2	1N759
Semiconductor (Matched Pair)	1	2	2N3564
IC	1	2	ua741HC
IC	1	2	Ca3028
IC	1	2	BB3521-H
IC	1	2	LM-1458
IC	1	2	Ca3020A
IC	1	2	ua709C
Relay	1	5	712D-12
Relay	1	5	2G2A126
To 18 Socket	4	10	SD18173
To 5 Socket	1	5	SD5173
To 58 Pin Socket	1	5	SD5178
Inline 8 Pin Socket	1	5	ICN-083-S2
Relay Socket 10 Pin	1	5	LP-51710-23
Pot 10K (Volume Control)	0	1	GAIG200S-103TA
Dual Pot (Fine Tune)	0	1	4142
Pot 500 Ω	1	2	100-1-500 Ω
Pot 2K	1	2	100-1-2K
Pot 10K	1	2	79PR-10K
Pot 50K	1	2	3009P-1-503
Pot 5K	1	2	3009P-1-502
Pot 500 Ω	1	2	3009P-1-501
Pot 500 Ω	1	2	275-1-501
Pot 10K	1	2	3282W-1-103

TABLE 6.2 (Cont'd)

RECOMMENDED SPARE PARTS LIST FOR INTERFERENCE ANALYZERS MODEL EMC-25

Description .	Recommended Quantity 1 set	Recommended Quantity 10 sets	Part No.
Pot 500K	1	3	3339W-1-504
Pot 50K	1	4	3339W-1-503
Pot 200 Ω	1	1	150-1200 Ω
Pot 5 K	1	1	100-1 5K
Pot 100K (Video Detector)	0	1	GS1N 156 P104UA
Pot 100K (Video Detector)	0	1	GA2N 156 P104UA
Pot 10K (Frequency Tuning)	0	1	Model 510
Pot 100K (Gain)	0	1	JA3G048P104UA
Crystal 1.425 MHz	1	2	CR-18/U
Choke 1 uh	1	4	MS90537-13
Choke 100 uh	1	4	MS90537-37
Choke 330 uh	1	2	MS90537-43
Choke 1 mh	1	4	MS90537-49
Capacitor 2.2 mFD/35V	1	4	196D225X9035A1
Capacitor 1000 PF Feed-Thru	2	5	FB-2B
Capacitor 15 mFD/20V	1	4	CS13AE150KLF
Capacitor 5-25 PF Trimmer	1	4	557000-COPO-39R
Circuit Breaker	2	4	MB316
Cell-Battery (Optional)	2	20	B3381
Clutch	0	1	B3175
Motor	0	1	C4850
Switch Toggle (Power)	0	1	MST205S
Switch Toggle (AM/FM Audio)	0	1	MST105D
Switch Toggle (Tune Manual/Sweep)	0	1	MST305D
Switch Toggle (AFC On/Off)	0	1	MST205N
Switch Pushbutton (Band Step)	0	2	P-8121
Switch Pushbutton (Bat. Test & Swp.)	0	2	P-8221
Switch Pushbutton (CAL)	0	1	P-8421
Microswitch	1	3	E61-10N
Switch (Detector Function)	0	1	C4872
Switch 3 Wafers (Cylindrical Scale)	o	1	B3246-1, 2, 3
Switch 2 Wafers (K Attenuator)	0	1	B4466
Transformer (Power)	0	1	C5214
22 Pin Connector PC Card	0	1	250-22-30-170
Subminiature Cable Connector, Male	2	20	27-9

TABLE 6.2 (Cont'd)

RECOMMENDED SPARE PARTS LIST FOR INTERFERENCE ANALYZERS MODEL EMC-25			
Description	Recommended Quantity 1 set	10 sets	Part No.
Subminiature Cable Connector, Female	2	20	27-10
Crimp Tool for 27 Connector	1	1	277-900
Coaxial Cable	5'	15'	RG/174
Set Screw 6-32 X 1/8	2	20	MS51021-21
Set Screw 8-32 X 3/16	5	50	MS51021-31
Set Screw 4-40 X 1/8	2	20	MS51021-9
Set Screw 2-56 X 1/8	2	20	MS51021-1
Fuse 2 Amp. Slo-Blo	2	5	3AG

TABLE 6.3

ACCESSORY LIST

Item	Description	Model
1	Interference Analyzer (AC Power Cord Model PCD-25, instruction manual, Adapter Brackets Model ABM-25, coaxial cable Model CAC-25) 10 kHz to 100 MHz	EMC-25
2.	Instrument Carrying Case	ICC-25
3	Remotely Switchable Loop Antenna, 10 kHz to 30 MHz	ALR-25
4	Remotely Switchable Vertical 41” Antenna, 10 kHz to 30 MHz	RVR-25
5	Broadband Dipole Antenna and Mount, 20 MHz to 200 MHz	BDA-25
6	Biconical Antenna, 20-200 MHz	BIA-25
7	Low Frequency Antenna Accessory Case (For transporting loop antenna, 41” Remote Antenna, Broadband Dipole and small accessories)	LVC-25
8	Log Conical Spiral Antenna, 200 MHz to 1000 MHz	LCA-25
9	Conical Antenna Carrying Case (For transporting LCA-25)	LCC-25
10	Clamp-on Probe, 10 kHz to 110 MHz (For maximum sensitivity 10 kHz to 11.5 MHz use PCL-10)	PCL-25
11	Magnetic Field Probe, 10 kHz to 520 kHz	MFA-25
12	Magnetic Field Probe, 480 kHz to 25 MHz	MFB-25
13	Magnetic Field Probe, 22 MHz to 230 MHz	MFC-25
14	Electro-Static Field Probe, 10 kHz to 1000 MHz	EFP-25
15	Counterpoise, 2’ x 2’ (for vertical antennas)	GPA-25
16	Carrying Cover with Handle	EAC-25
17	Earphones	EHF-25
18	Attenuator, Voltage Extension (20 DB, 4 watts)	FA-504-20T
19	Remote Meter with 25 ft. cable	RIM-252
20	Coaxial Cable, 25 foot	CAC-25
21	Extra Adapter Brackets (pr. for 19” rack mounting)	ABM-25
22	Extra Alignment Tool Kit	ATK-25
23	Extra AC Power Cord	PCD-25
24	DC Power Cord	PDD–25
25	Tripod (Ruggad) and Tripod Bag	TRP-25
26	Mast Sections (2)	MSA-25
27	Replacement Nickel Cadmium Battery Pack	BAT-25
28	Extra Instruction Manual	-
29	Tunable Rejection Filters	
	14kHz-220kHz	TRF-11
	220 kHz - 3500 kHz	TRF-12
	3.5 MHZ - 14 MHZ	TRF-13
	14 MHZ -110 MHZ	TRF-14
	110 MHZ - 1000 MHz	TRF-15

TABLE 6.3 (Cont'd)

ACCESSORY LIST

Item	Description	Model
30	Complete Set, Tunable Rejection Filters, 14 kHz - 1000 MHz	as above
31	Instrument Carrying Case (For one TRF filter)	ICC-15
32	Standard Accessory Kit, 10 kHz - 1000 MHz, consisting of:	AAK-25A
	(1) Remotely Switchable Loop Antenna, 10 kHz - 30 MHz ALR-25	ALR-25
	(2) Remotely Switchable Vertical 41" Antenna, 10 kHz - 30 MHz	RVR-25
	(3) Antenna Accessory Case	LVC-25
	(4) Broadband Dipole Antenna and Mount, 20 MHz - 200 MHz	BDA-25
	(5) Log Conical Spiral Antenna, 200 MHz to 1000 MHz	LCA-25
	(6) Conical Spiral Antenna Accessory Case	LCC-25
	(7) Coaxial Cable, 25 ft.	CAC-25
	(8) Clamp-on Probe, 10 kHz - 110 MHz	PCL-25
	(9) Magnetic Field Probe, 10 kHz - 520 kHz	MFA-25
	(10) Magnetic Field Probe, 480 kHz - 24 MHz	MFB-25
	(11) Magnetic Field Probe, 22 MHz - 230 MHz	MFC-25
	(12) Electro-Static Field Probe, 10 kHz to 1000 MHz	EFP-25
	(13) Tripod	TRP-25
	(14) Tripod Bag	TRB-25
	(15) Counterpoise, 2' x 2'	GPA-25
	(16) Instrument Carrying Case	ICC-25
	(17) Antenna Mount	AMT-25
	(18) Mast Section (2)	MSA-25
	(19) Antenna Control Cable	ACC-25B
33	Standard Accessory Kit, 10 kHz - 1 GHz, Contents same as AAK-25A except BIA-25 Biconical Antenna is substituted for the BDA-25 Dipole Antenna as required for MIL-STD-461 testing	AAK-25B
34	Electro-Scan Programmer for EMC-25R and EMC-10 with Antenna Switching Unit SU-125	ESC-125A
35	11" x 17" X-Y Plotter with choice of inter-connecting cable XYC-10 to EMC-10 or ESC-10A, or XYC-25 to EMC-25 or XYC-125 to ESC-125A	EXY-125B
36	11" x 17" Dual-Pen X-Y Plotter with interconnecting cable XYC-125 to ESC-125A	EXY-250C
37	Spectrum Analyzer Adapter including Oscilloscope, Time Base Plug-In and Plug-In Model PP-125	SPD-125
38	Spectrum Analyzer Plug-In (Plug-in Only)	PP-125
39	Extra X-Y Plotter Interconnecting Cable to EMC-25	XYC-252
40	Automated Spectrum Surveillance System including EMC-10, EMC-25, ESC-125A, EXY-125B and SPD-125 mounted together in 2-bay console, interconnected and tested as a system	FSS-250
41	Automated Spectrum Surveillance System including EMC-10, EMC-25, ESC-125A, EXY-250C and SPD-125 mounted together in 2-bay console, interconnected and tested as a system.	FSS-250D

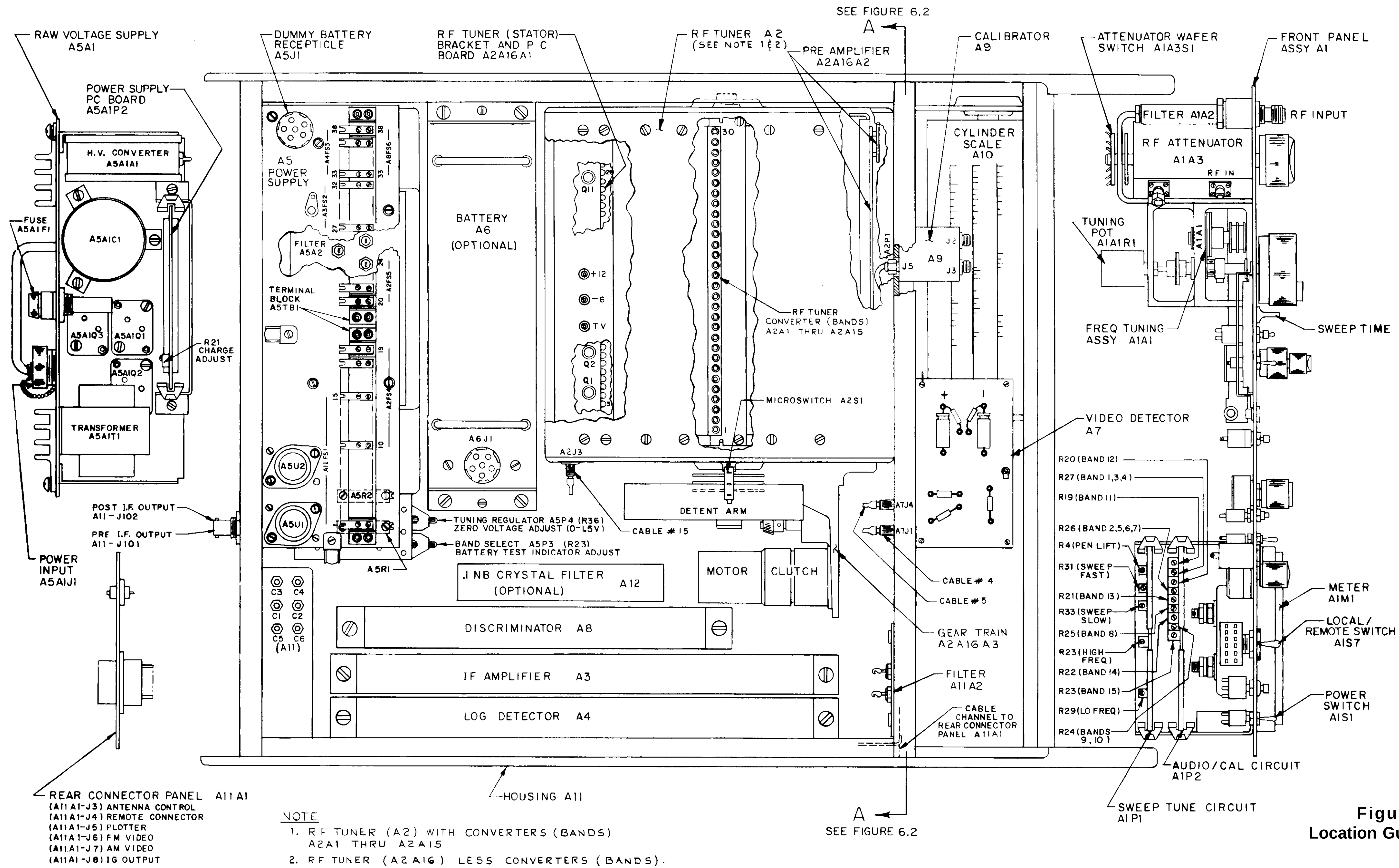


Figure 6.1
Location Guide Bottom View

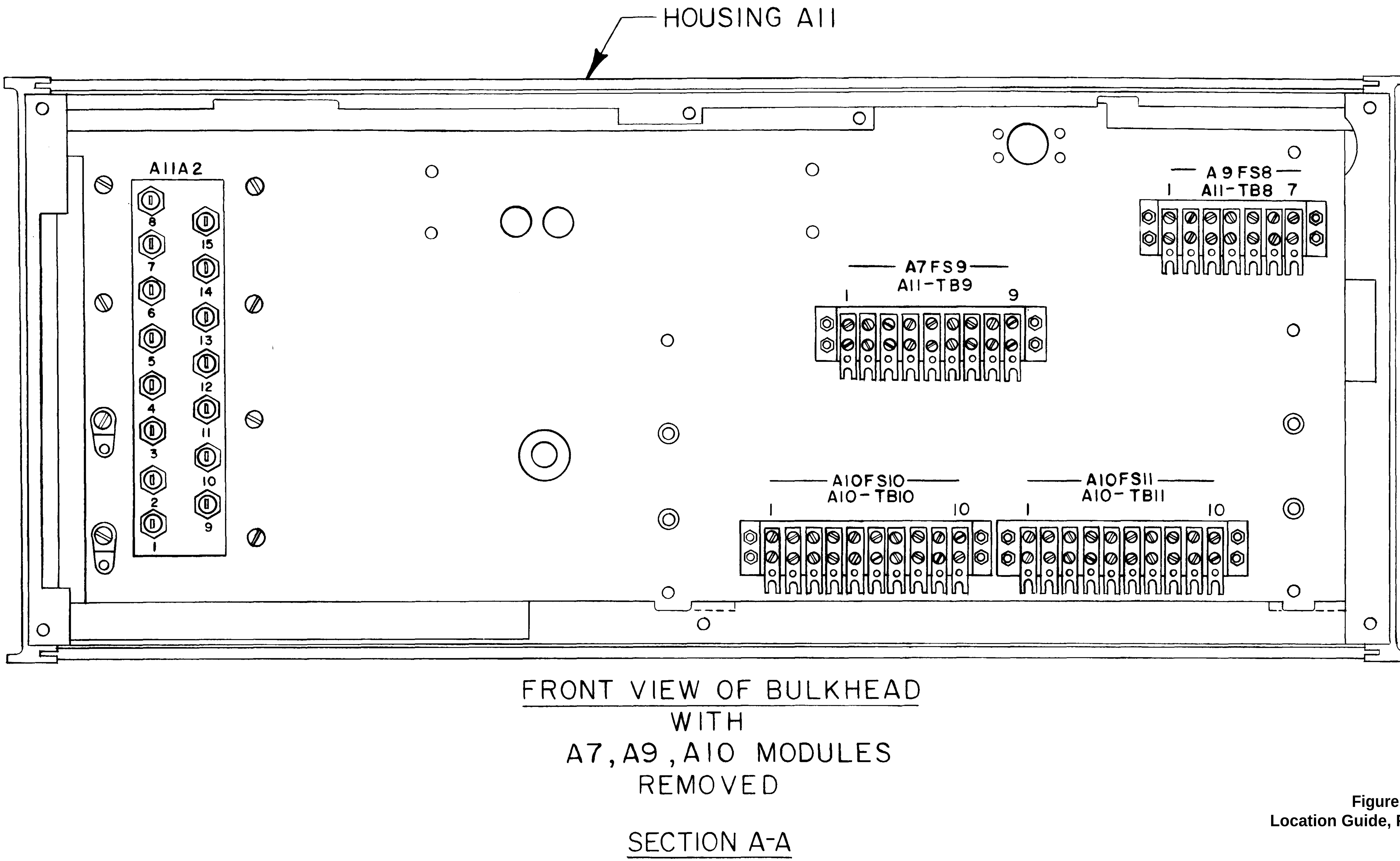


Figure 6.2
Location Guide, Front Bulkhead

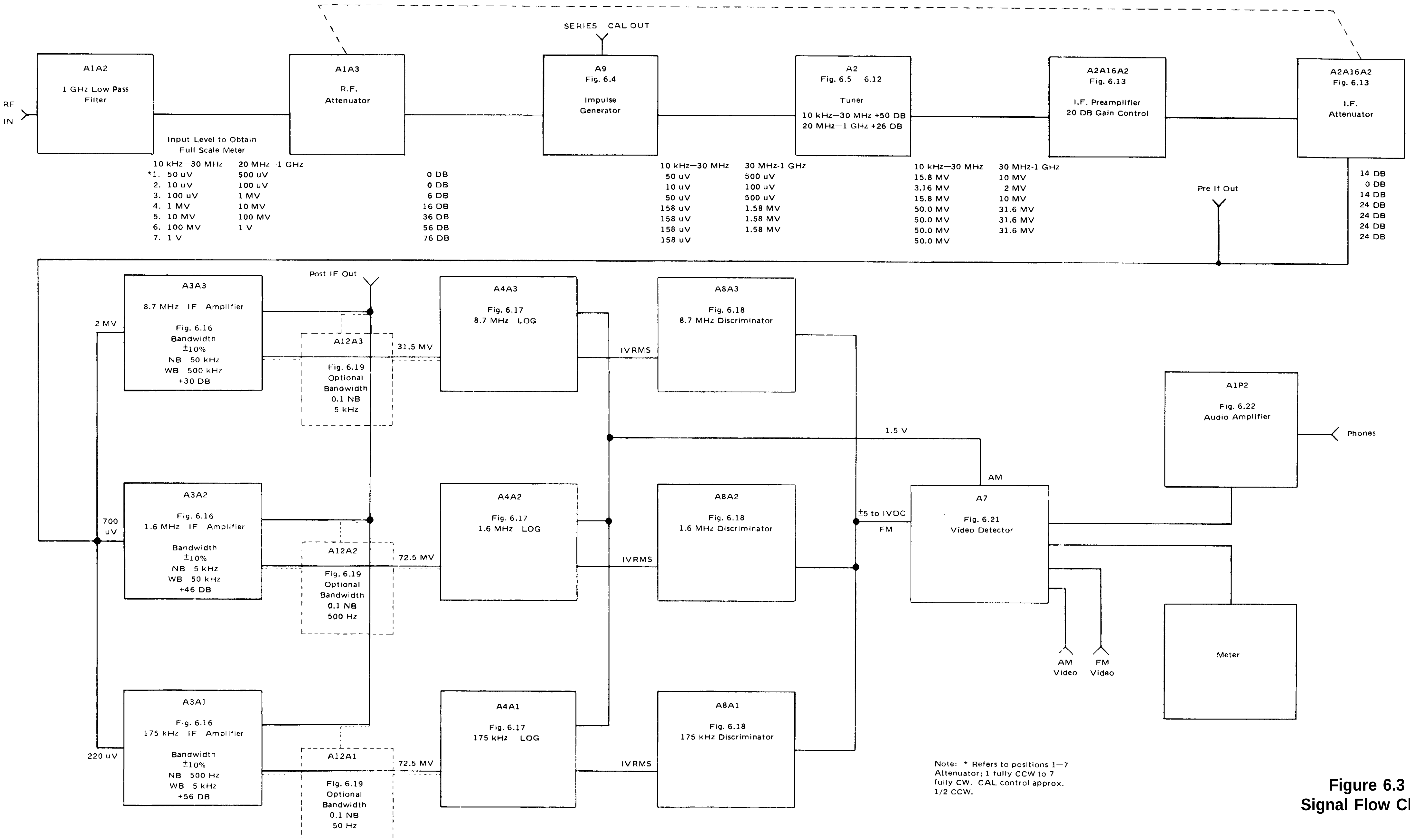
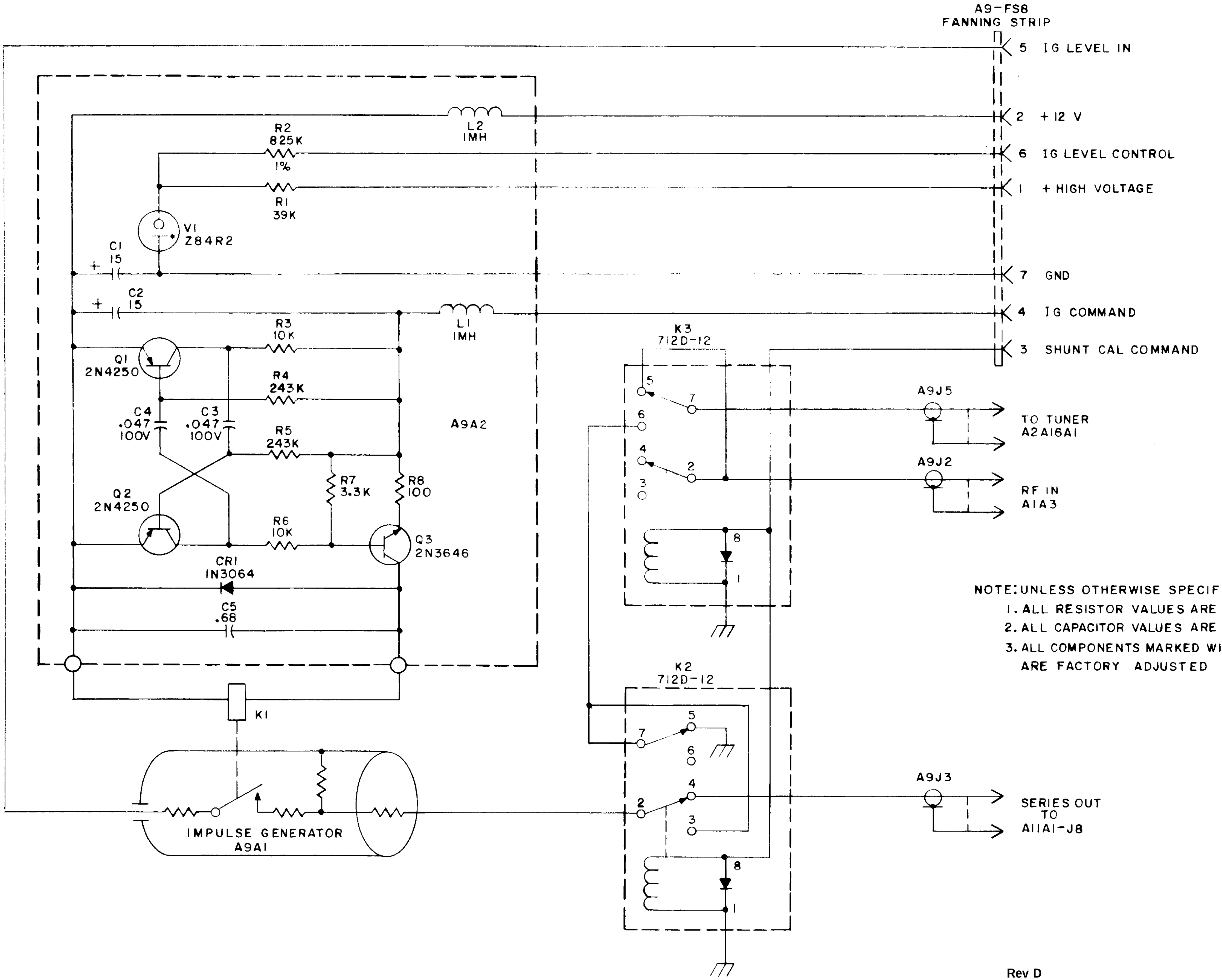
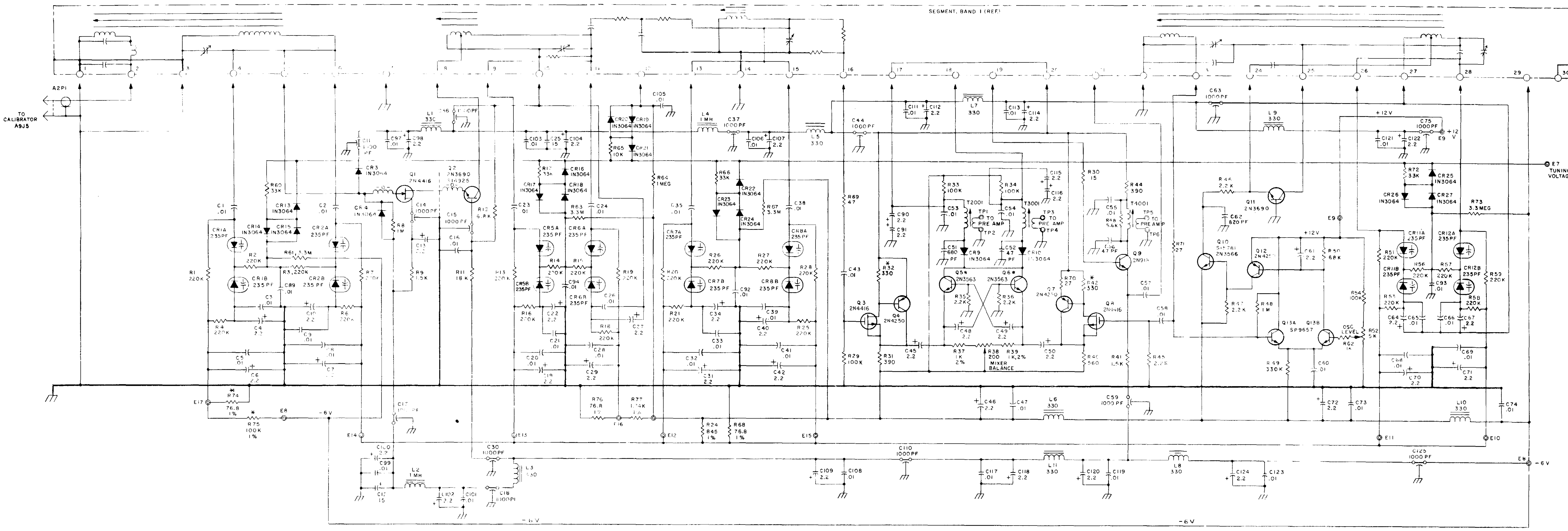


Figure 6.3
Signal Flow Chart



NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS ±10% ±1/4 W
2. ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%
3. ALL COMPONENTS MARKED WITH AN ASTERISK (*) ARE FACTORY ADJUSTED

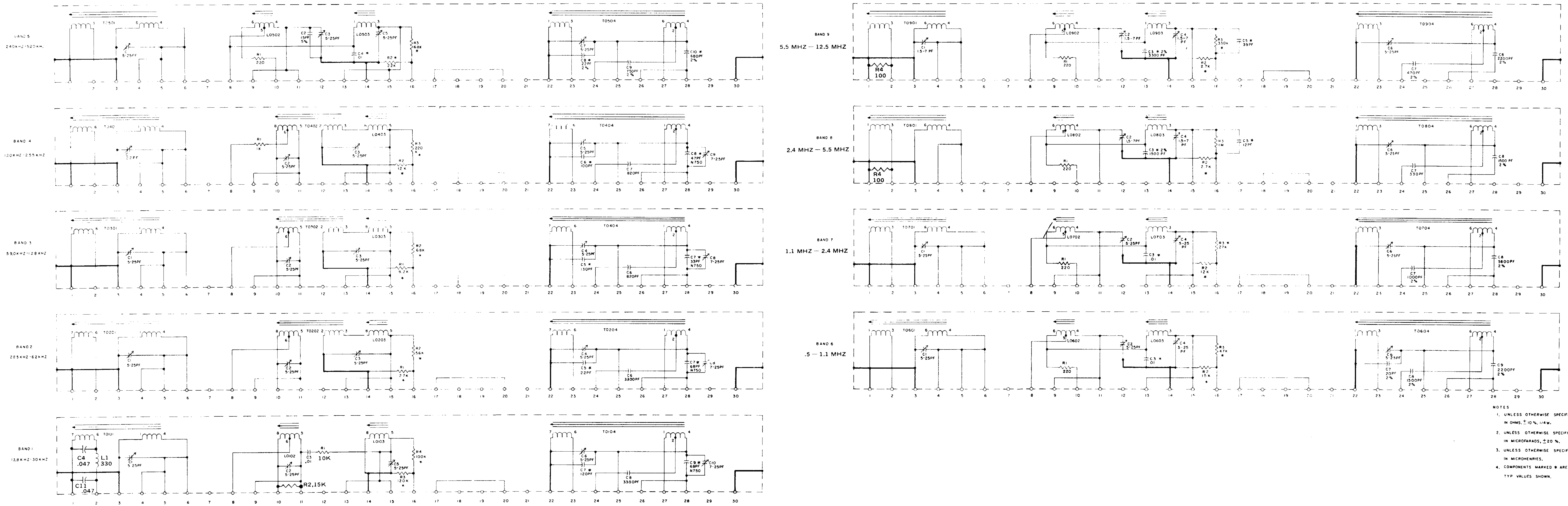
Figure 6.4
Calibrator (A9)



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, ±20%.
3. ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4. COMPONENTS MARKED * (ASTERISK) ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
5. COMPONENTS MARKED [ferrite bead symbol] ARE FERRITE BEADS.
6. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R9 ON ASSY A2A16A1, COMPLETE PART NUMBER IS A2A16A1 (R9).

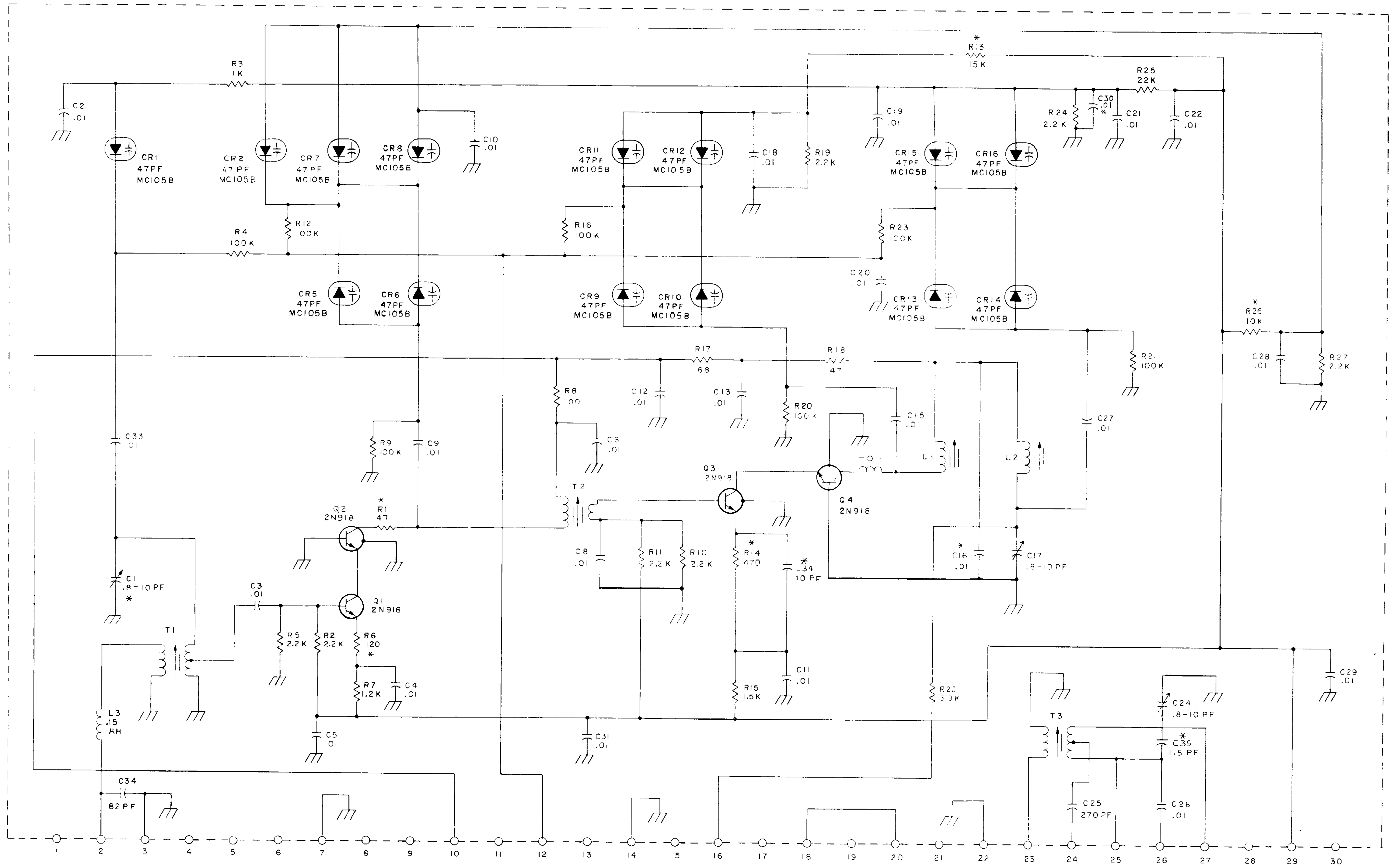
Figure 6.5
RF Tuner/Stator Board A2A16A1



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10 %, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 20 %.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED. TYP VALUES SHOWN.

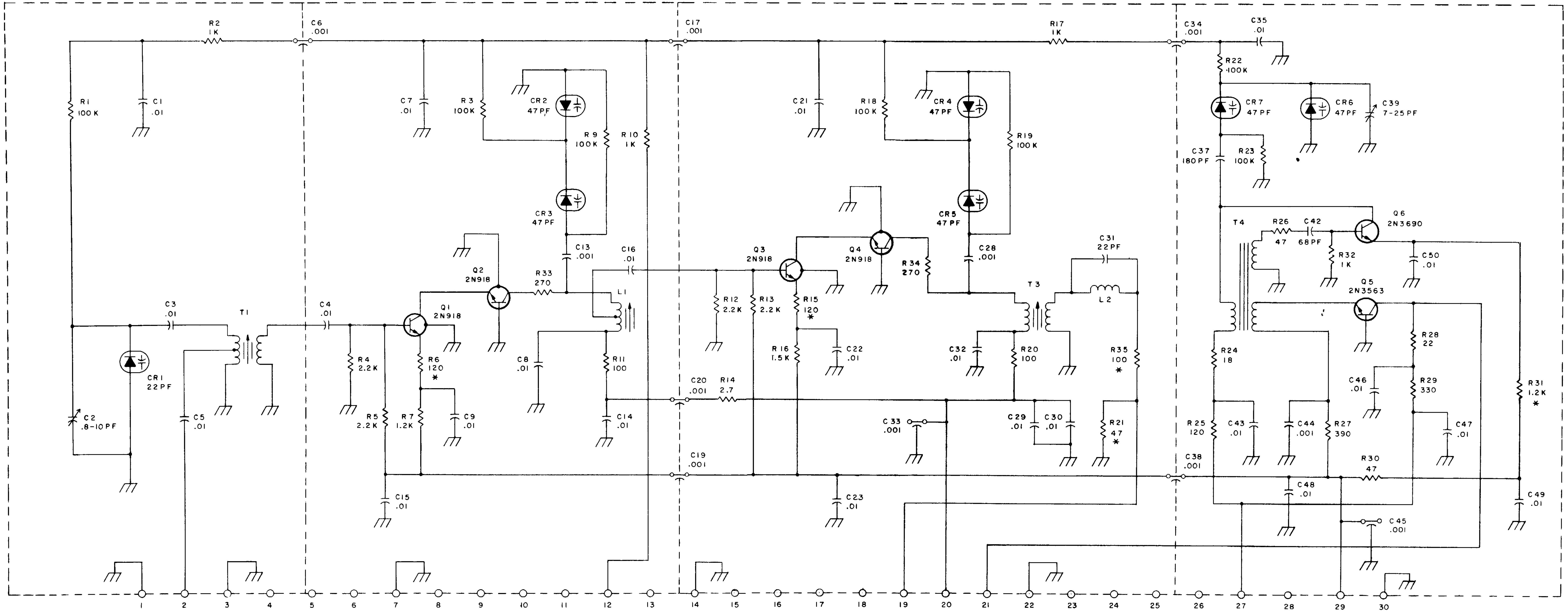
Figure 6.6
Bands 1-9 (A2A1 Thru A2A9)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10 %, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10 %.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ±10 %.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A2A10 COMPLETE PART NUMBER IS A2A10(R5).

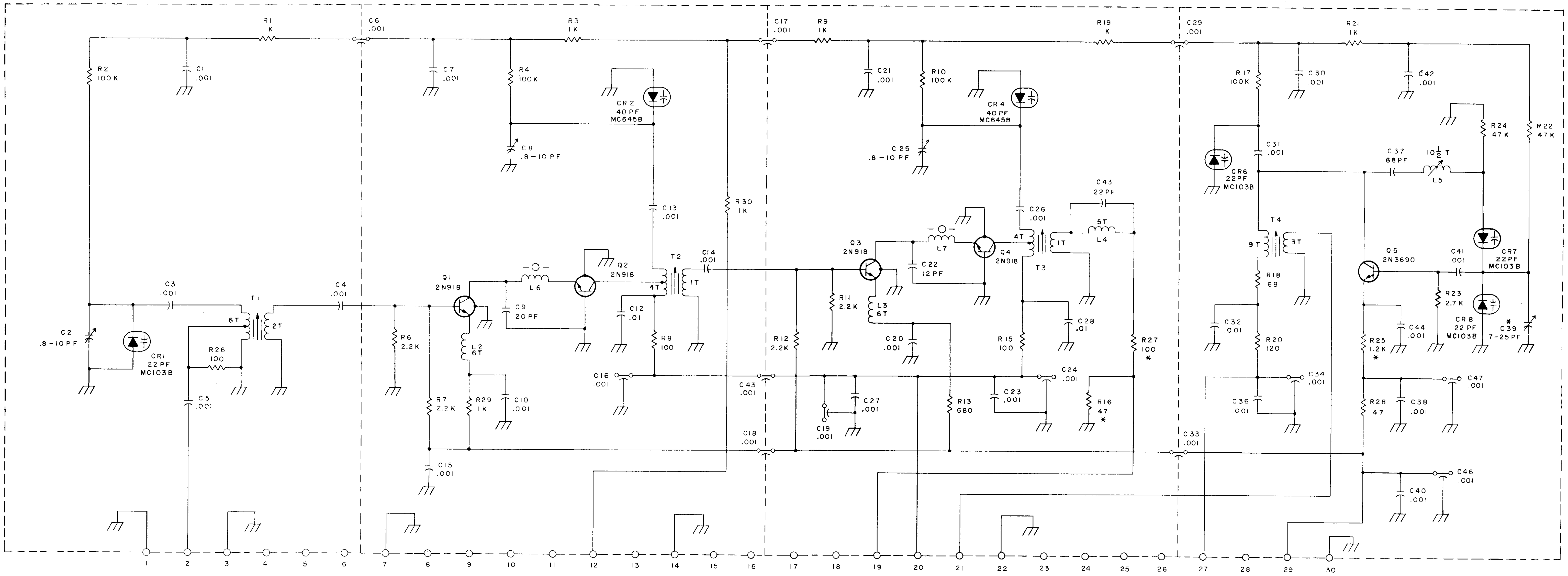
Figure 6.7
Band 10A2A10



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ±10%.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A1P2 COMPLETE PART NUMBER IS A1P2(R5).

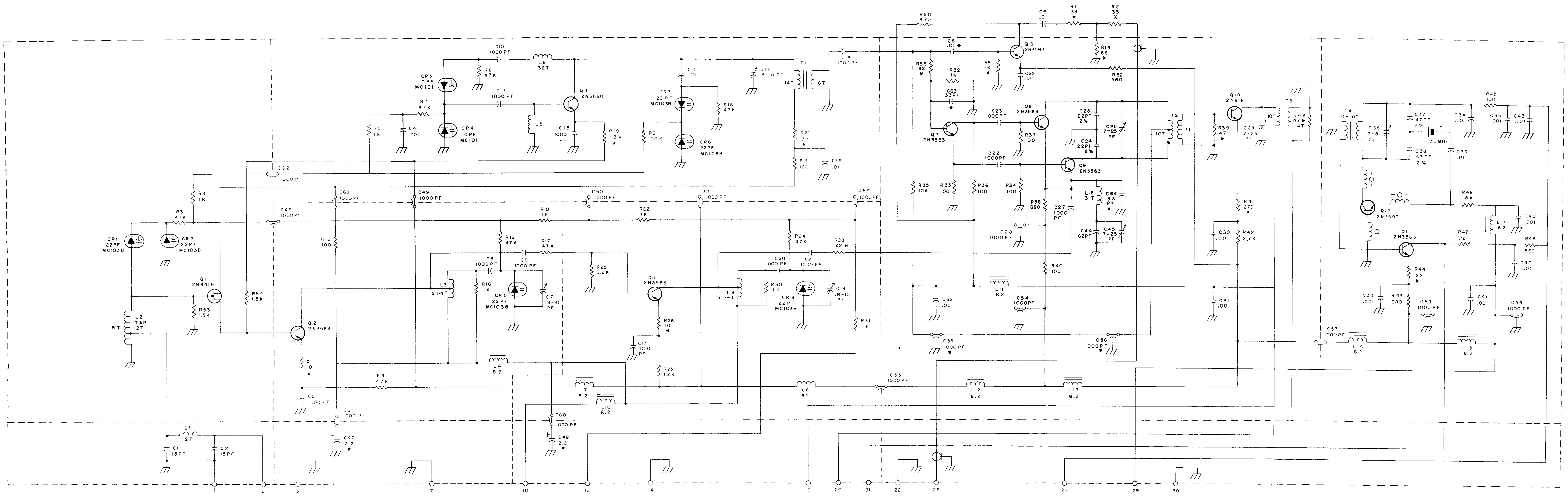
Figure 6.8
Band 11 A2A11



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10 %, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ± 10 %.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10 %.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A2A12 COMPLETE PART NUMBER IS A2A12(R5).
6. COMPONENTS MARKED -o- ARE FERRITE BEADS.

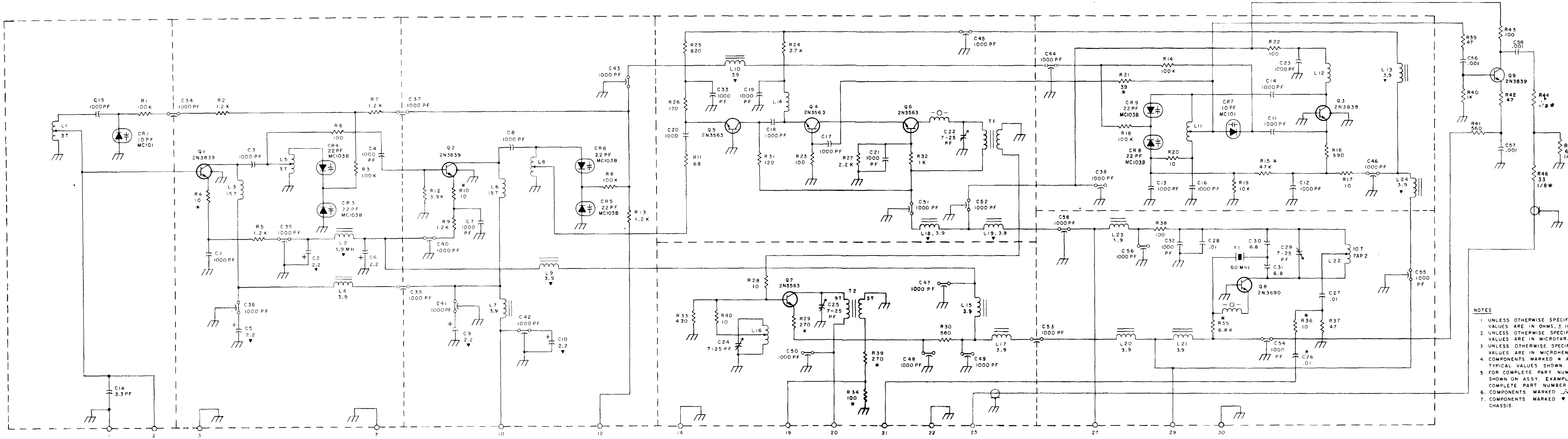
Figure 6.9
Band 12 A2A12



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 2%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES, ± 10%.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A2A13 COMPLETE PART NUMBER IS A2A13 (R5).
6. COMPONENTS MARKED -o- ARE FERRITE BEADS.
7. COMPONENTS MARKED ▼ ARE MOUNTED OUTSIDE OF CHASSIS.

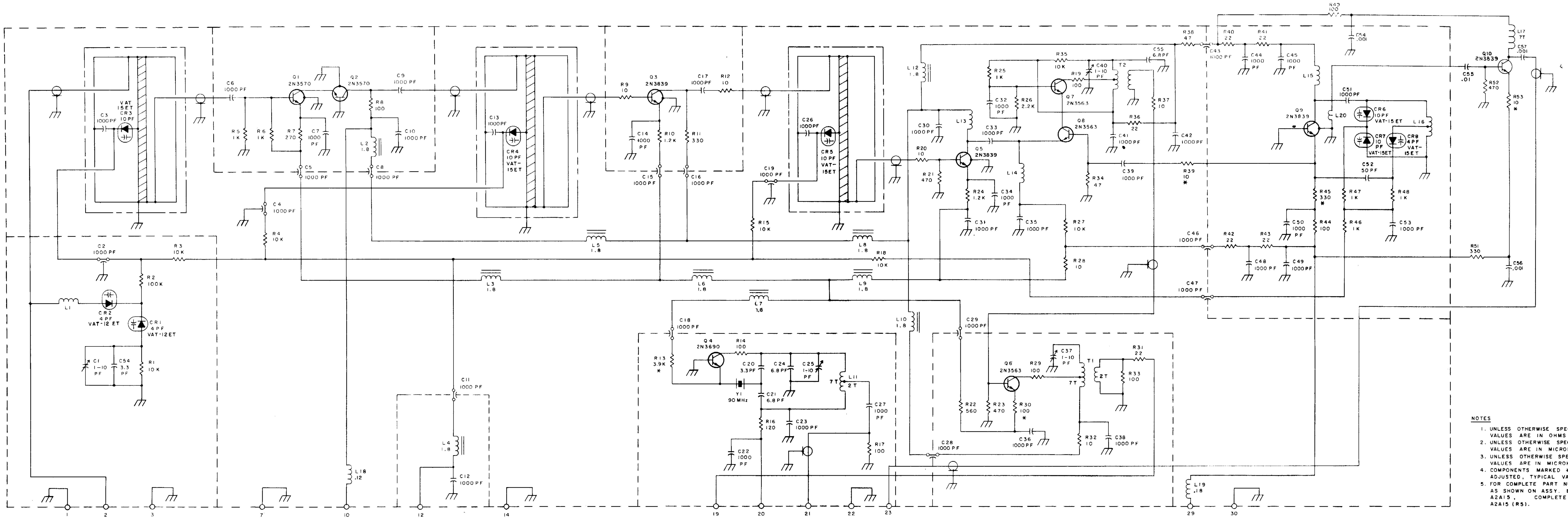
Figure 6.10
Band 13 A2A13



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10 %, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 10 %.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10 %
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED. TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A2A14 COMPLETE PART NUMBER IS A2A14 (R5).
6. COMPONENTS MARKED -o- ARE FERRITE BEADS.
7. COMPONENTS MARKED ▼ ARE MOUNTED OUTSIDE OF CHASSIS.

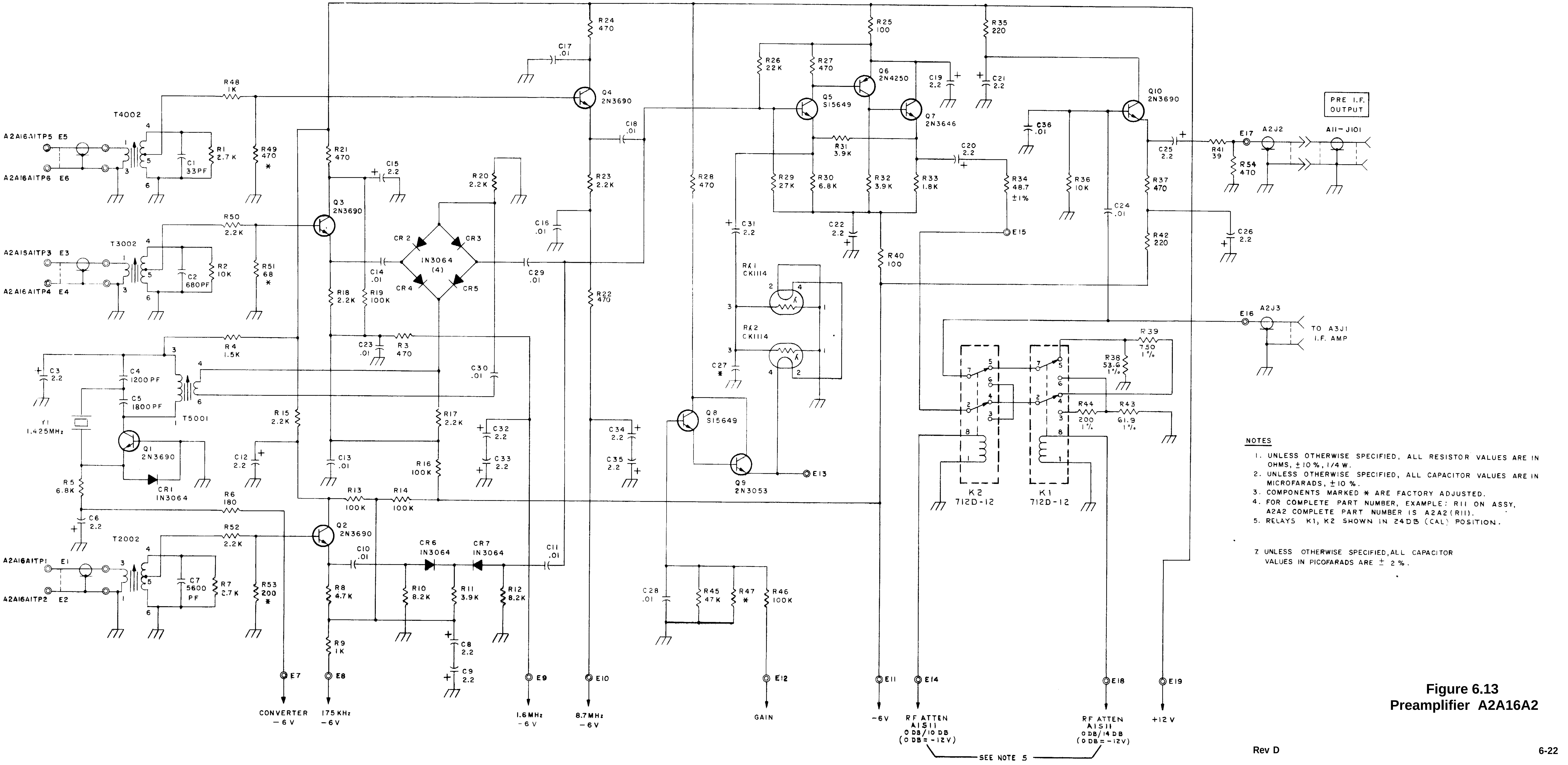
Figure 6.11
Band 14 A2A14



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10 %, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ± 10 %.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10 %.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A2A15, COMPLETE PART NUMBER IS A2A15 (R5).

Figure 6.12
Band 15 A2A15



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±10%.
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED.
4. FOR COMPLETE PART NUMBER, EXAMPLE: R11 ON ASSY, A2A2 COMPLETE PART NUMBER IS A2A2(R11).
5. RELAYS K1, K2 SHOWN IN 24DB (CAL) POSITION.

7. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES IN PICOFARADS ARE ± 2%.

Figure 6.13
Preamplifier A2A16A2

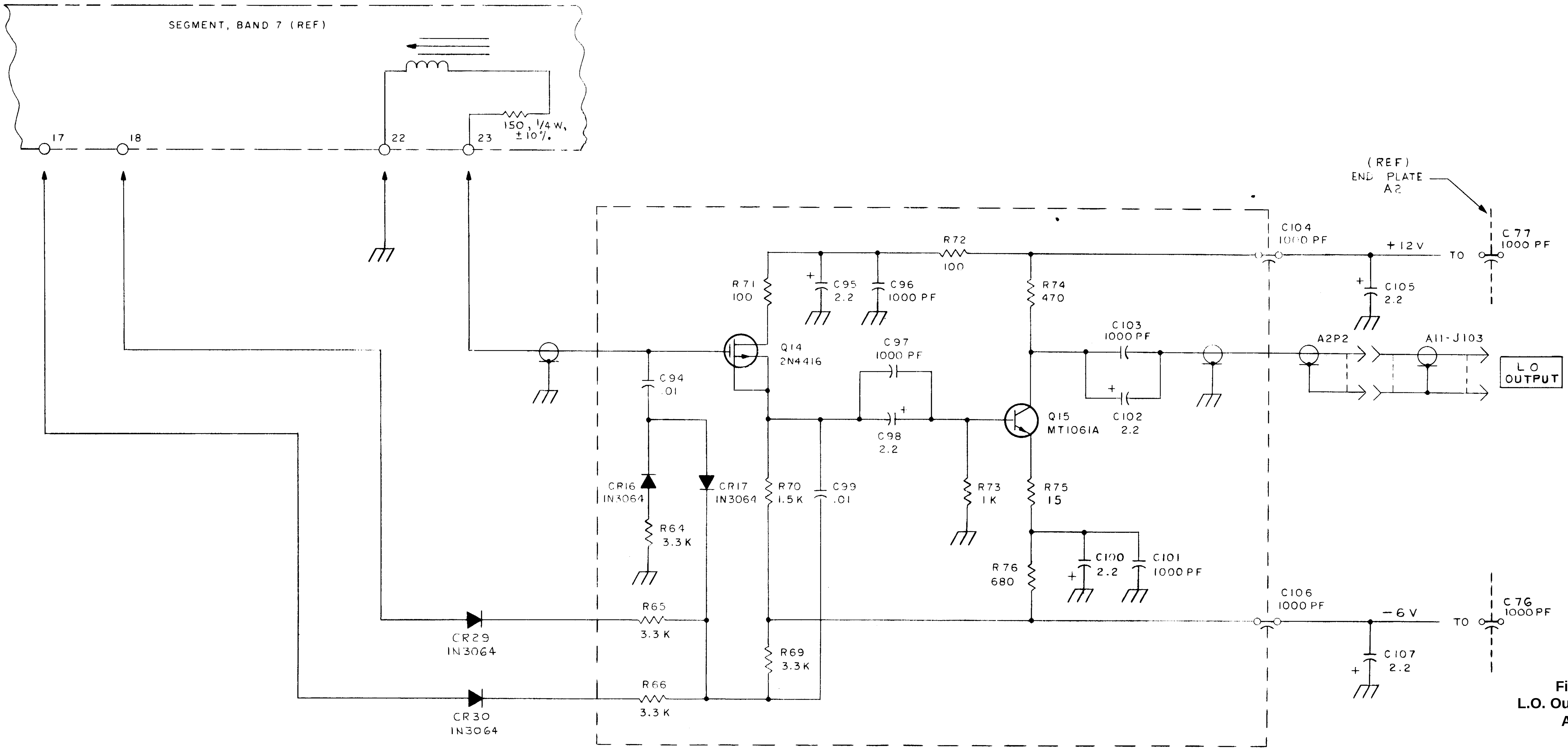


Figure 6.14
L.O. Output (Option L)
A2A16A4

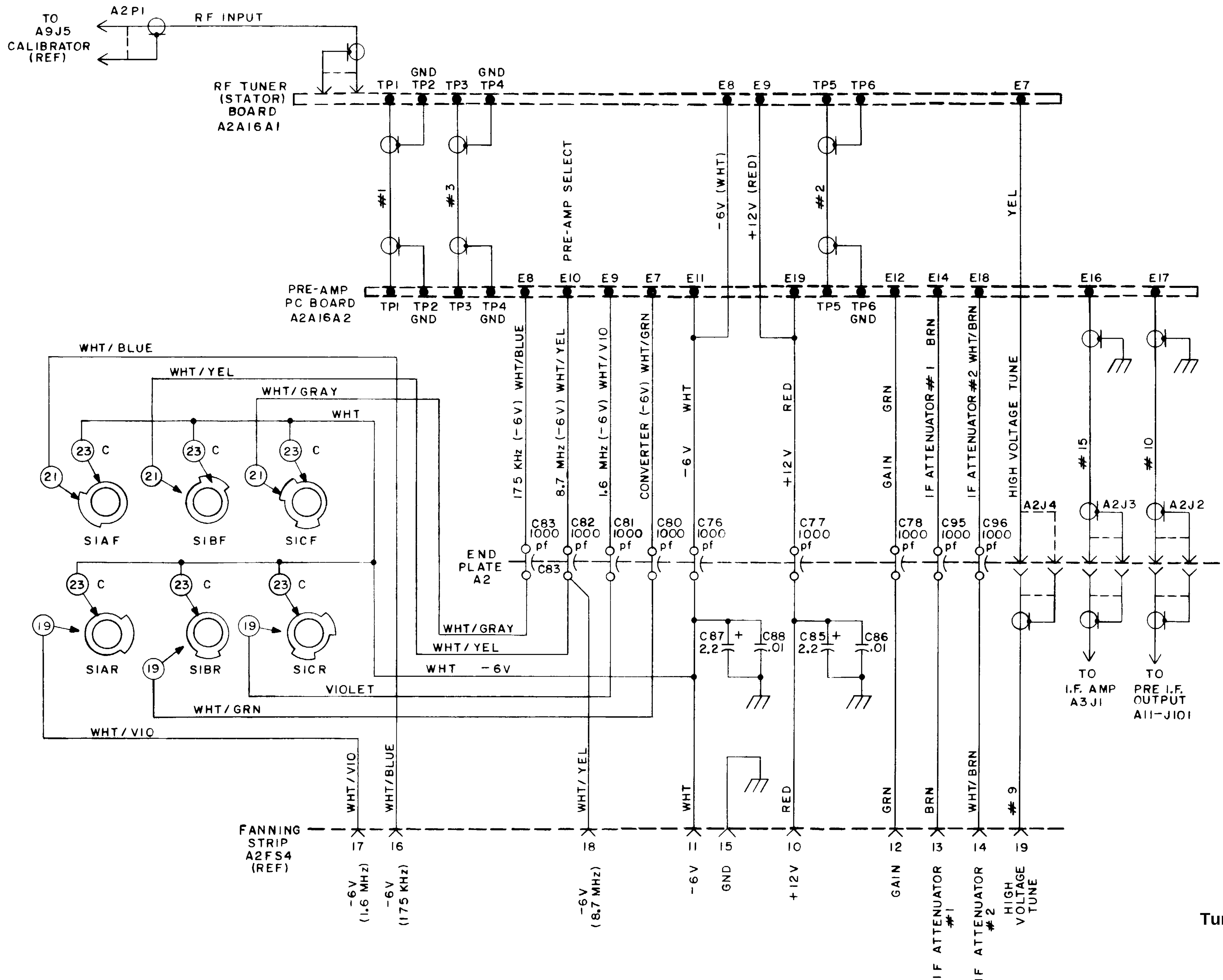
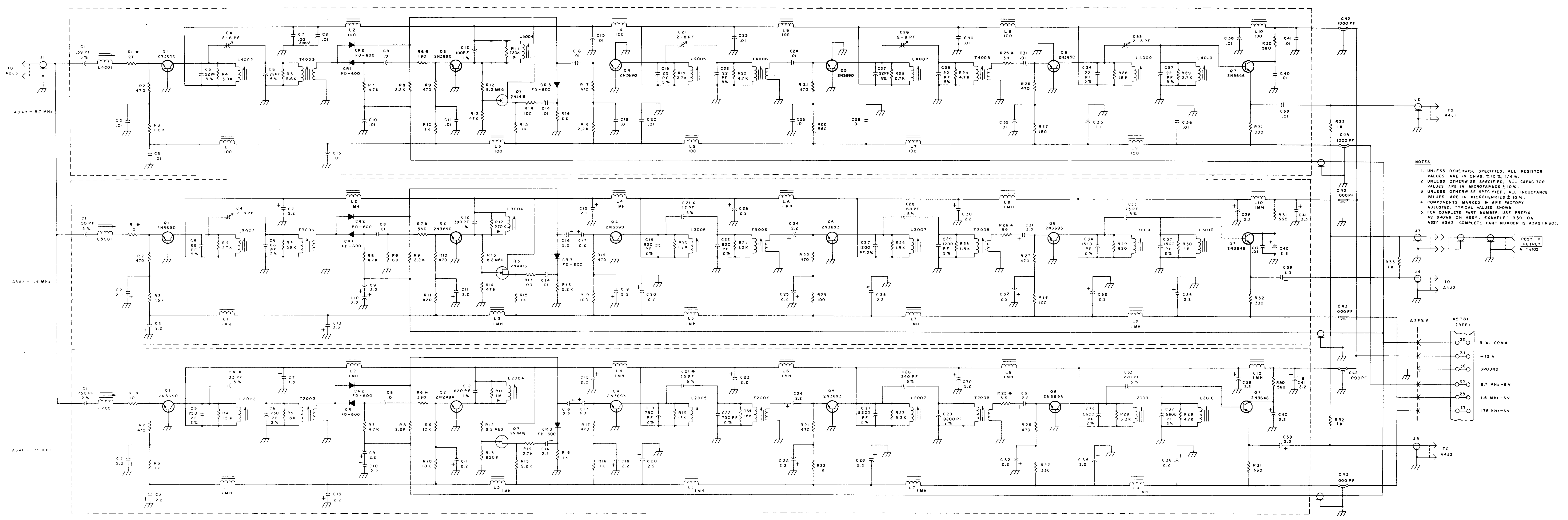


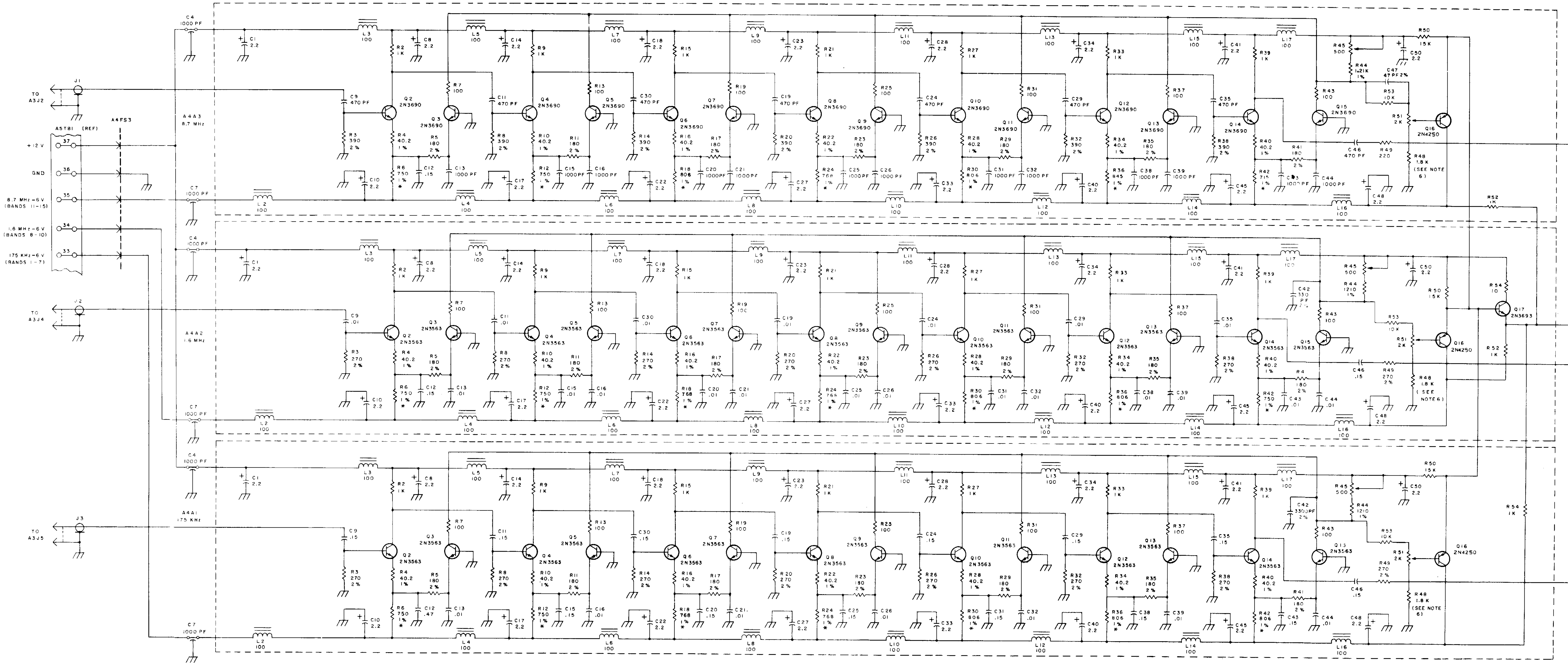
Figure 6.15
Tuner Interconnections A2



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ±10%.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R30 ON ASSY A3A2, COMPLETE PART NUMBER IS A3A2(R30).

Figure 6.16
IF Amplifiers A3

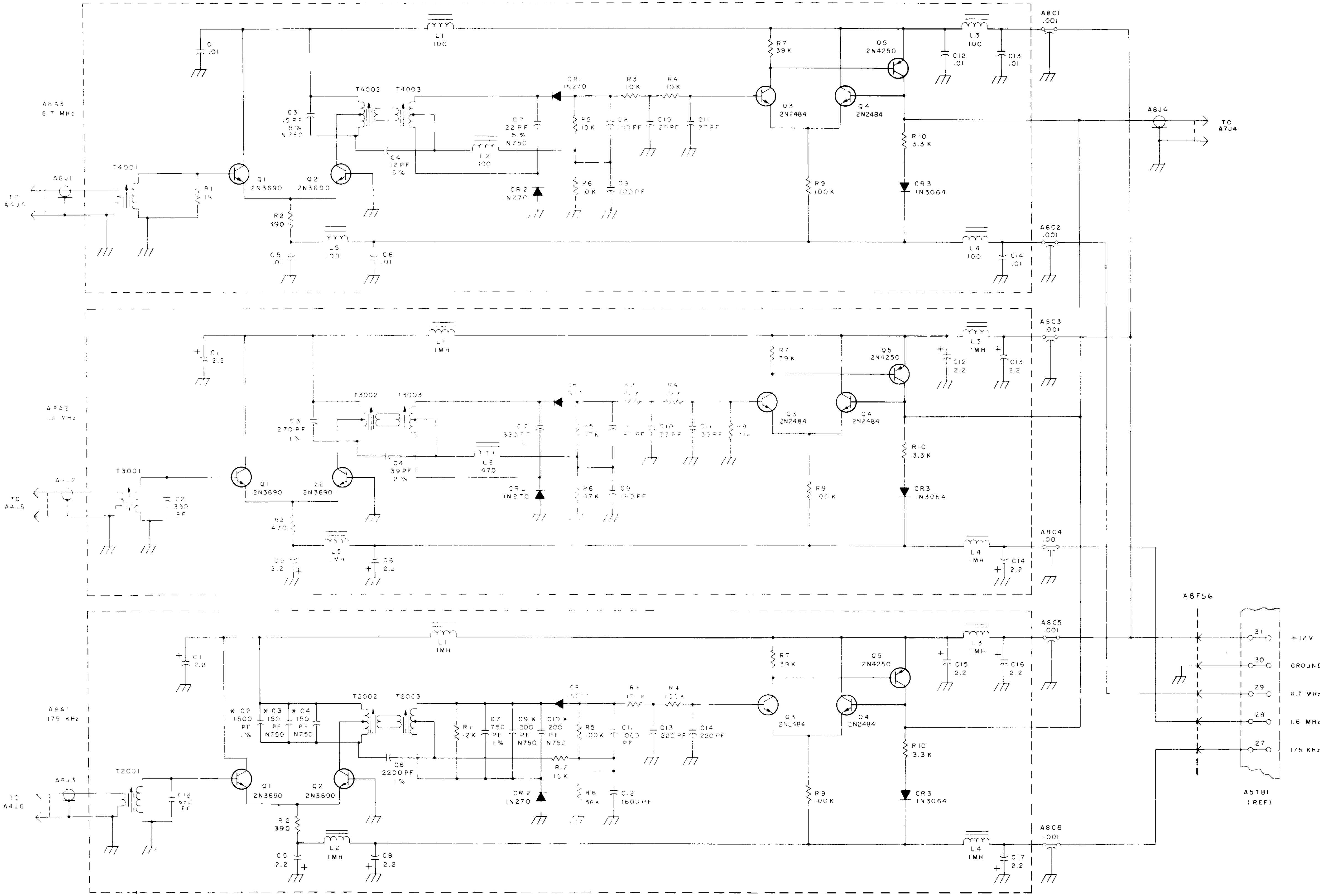


NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ± 10 %.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10 %.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A4, COMPLETE PART NUMBER IS A4 (R5)
6. WHEN USED WITH VIDEO DETECTOR "NO. 1" R48 IS 680.
7. Q2 AND Q3, Q4 AND 5, Q6 AND 7, Q8 AND 9, Q10 AND 11, Q12 AND 13, AND Q14 AND 15 USE MATCHED COMPONENTS PER STANDARD PROCEDURE.

FIGURE 6.17 LOG DETECTOR (A4)

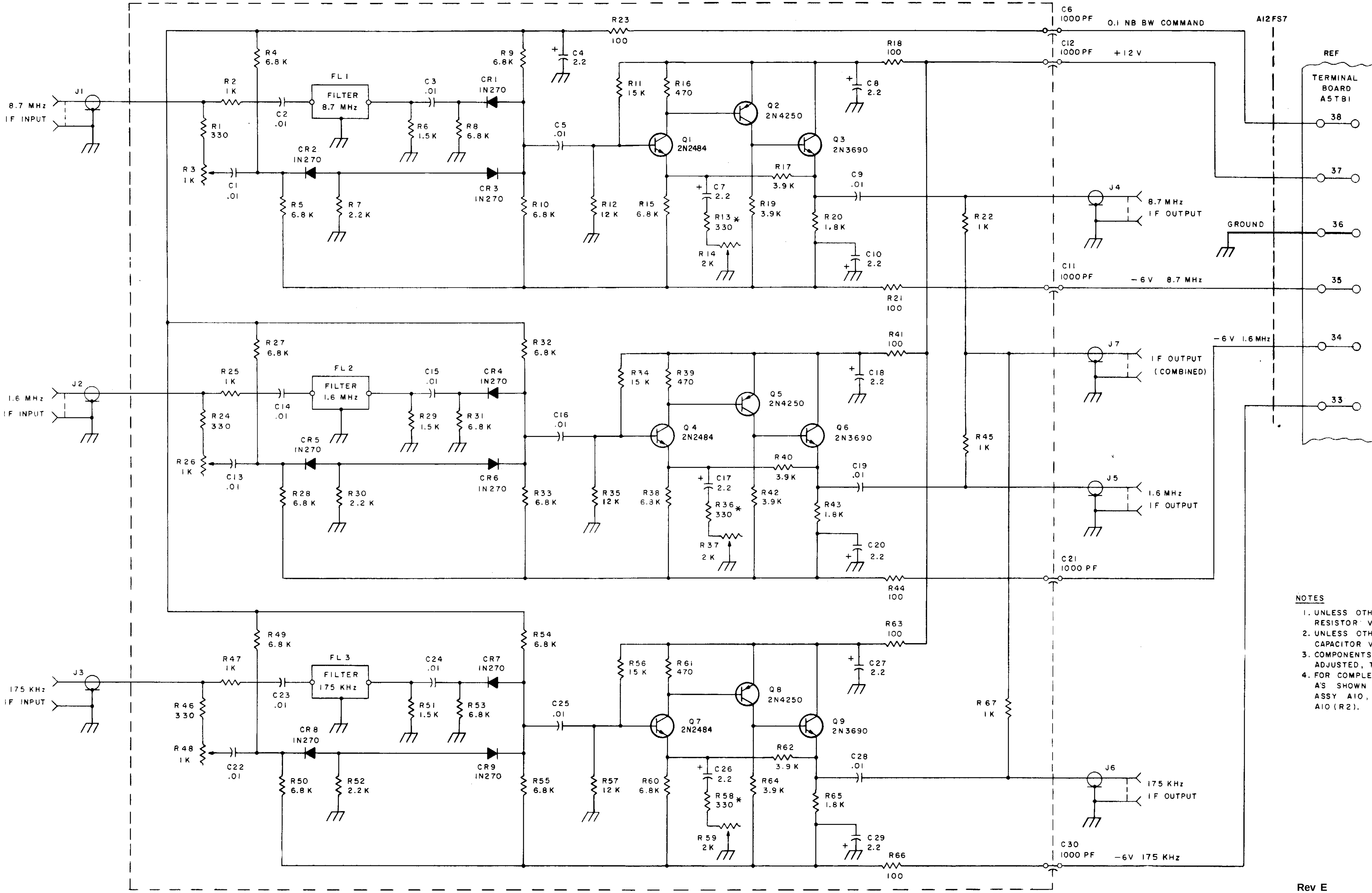
Figure 6.17
Log Detectors A4



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10 %, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ± 10 %.
3. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R5 ON ASSY A8, COMPLETE PART NUMBER A8 (R5).
4. COMPONENTS MARKED ✱ ARE FACTORY ADJUSTED.
5. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10 %.

Figure 6.18
Discriminators A8



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4 W
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±10%.
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
4. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSY. EXAMPLE: R2 ON ASSY A10, COMPLETE PART NUMBER IS A10(R2).

Figure 6.19
0.1 NB (Option N)
A12

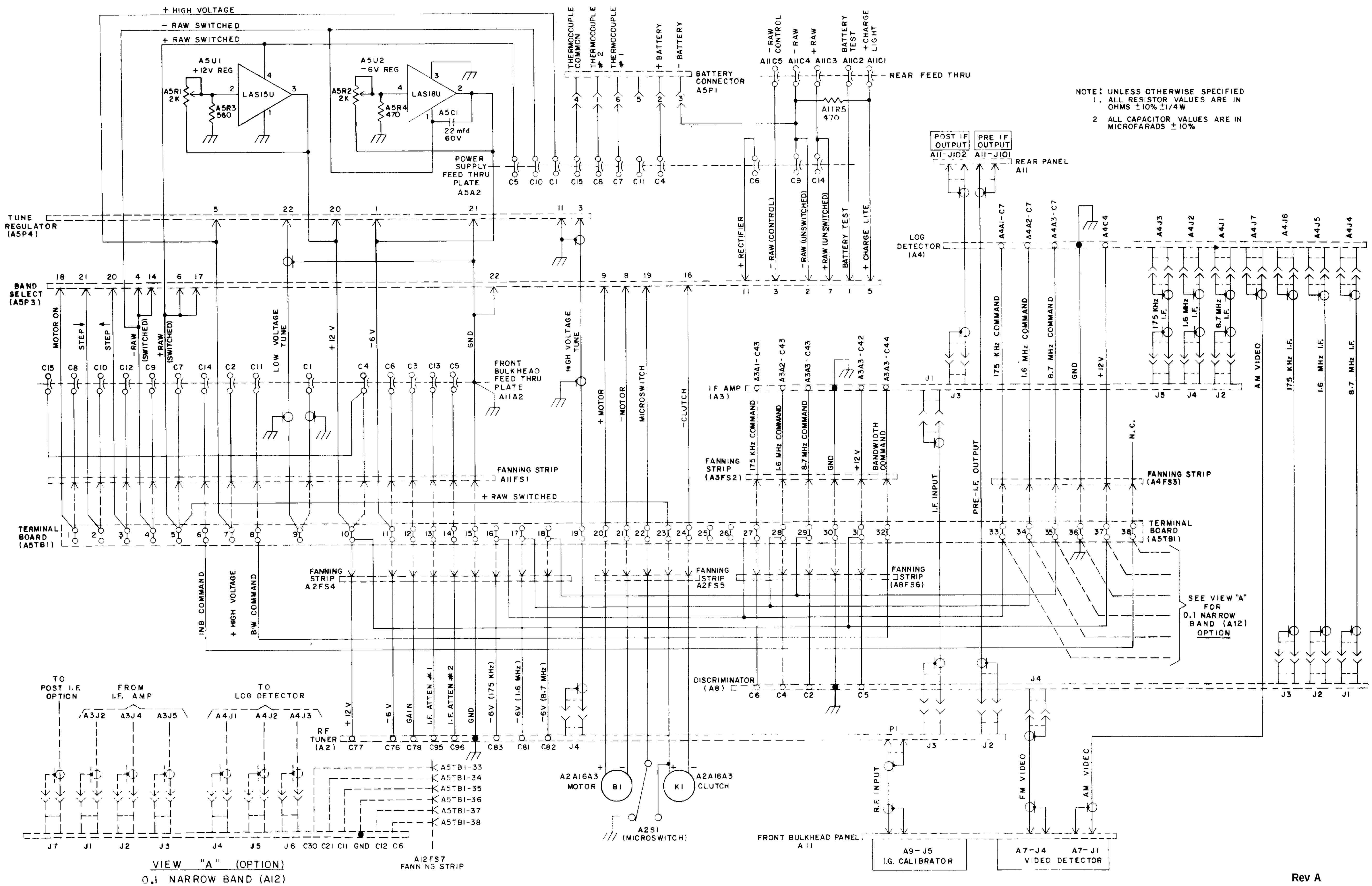
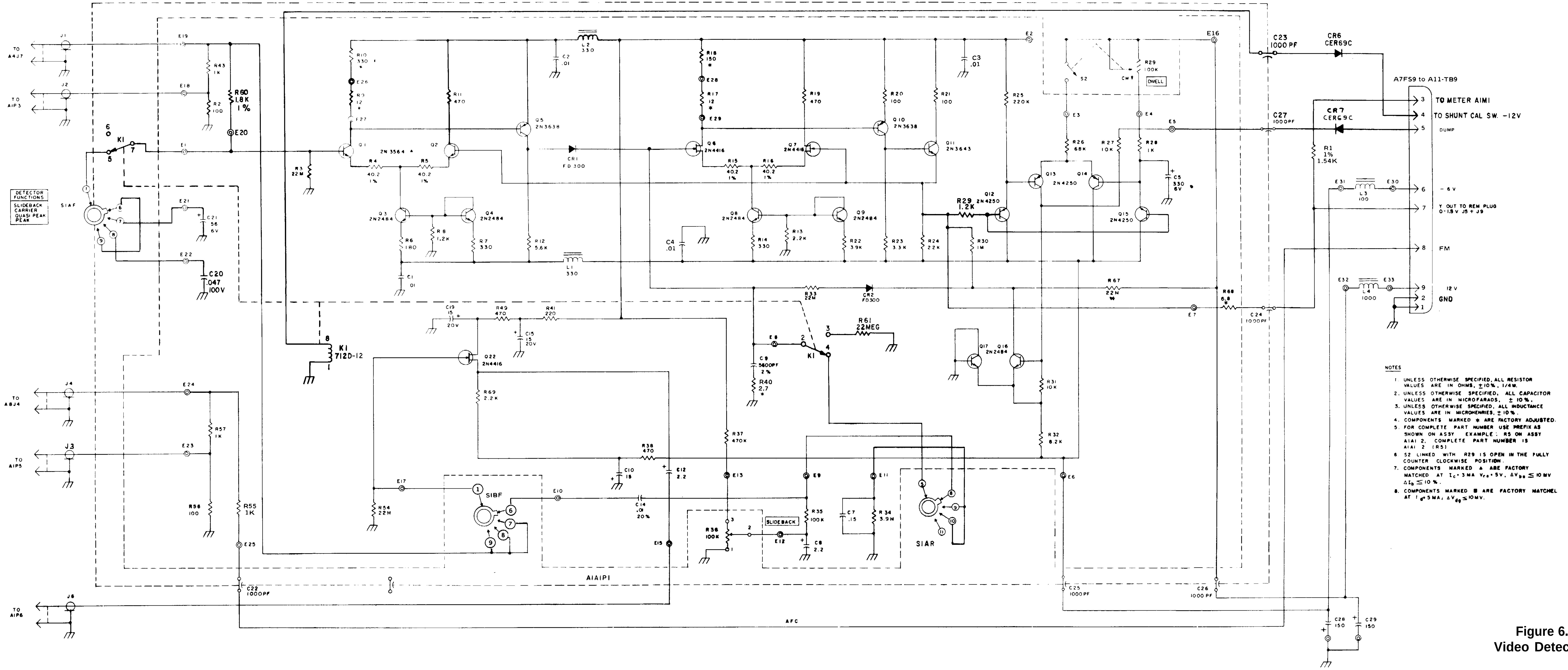


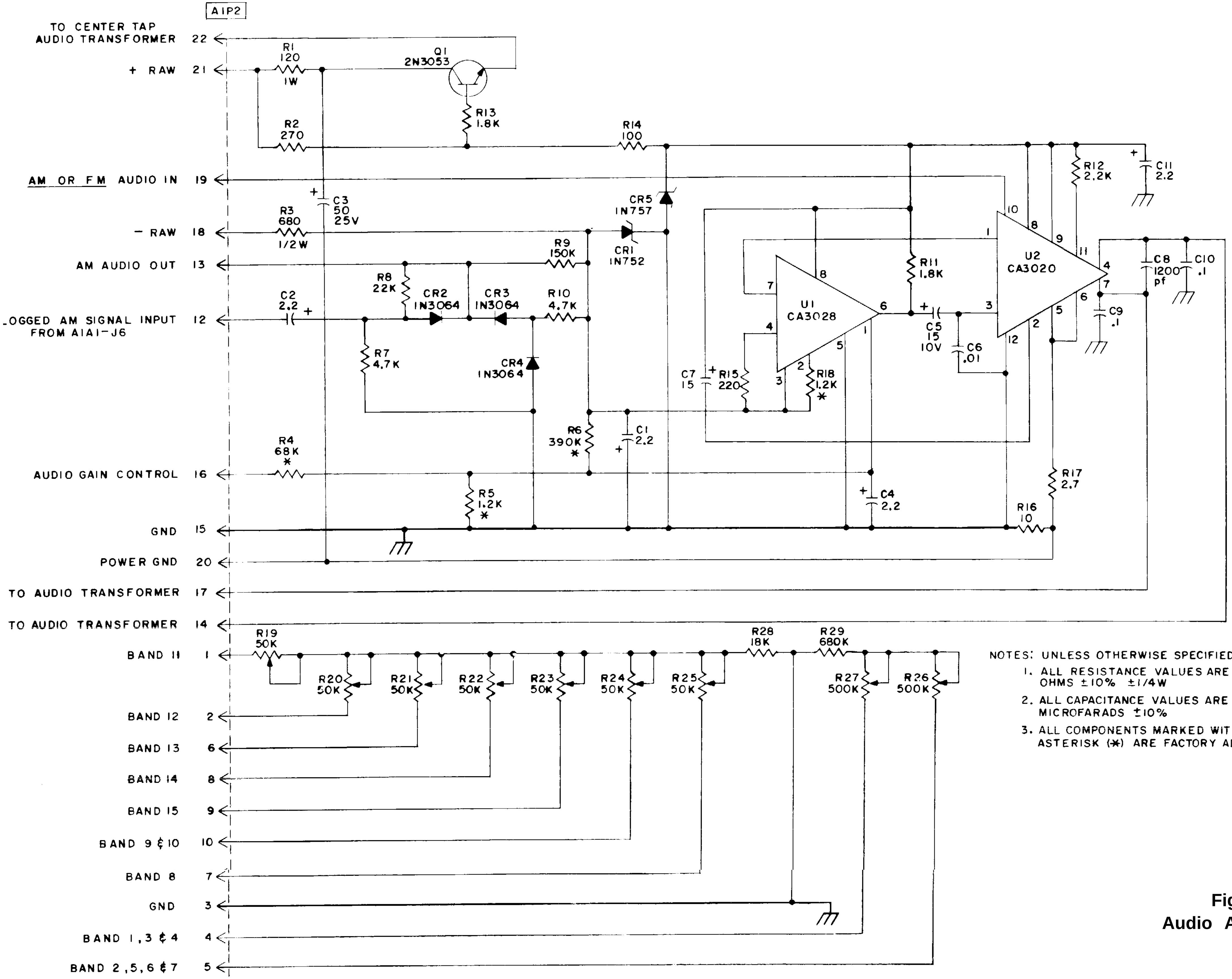
Figure 6.20
Interconnections
(Shielded Compartment)



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ±10%, 1/4W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 10%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES, ± 10%.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED.
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASSY EXAMPLE: R5 ON ASSY A1A1 2. COMPLETE PART NUMBER IS A1A1 2 (R5)
6. S2 LINKED WITH R29 IS OPEN IN THE FULLY COUNTER CLOCKWISE POSITION.
7. COMPONENTS MARKED ▲ ARE FACTORY MATCHED AT $I_c = 3$ MA $V_{ce} = 5$V, $\Delta V_{be} \leq 10$ MV $\Delta I_b \leq 10$ %.
8. COMPONENTS MARKED ■ ARE FACTORY MATCHEL AT $I_d = 5$ MA, $\Delta V_{dg} \leq 10$ MV.

Figure 6.21
Video Detector A7



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS ±10% ±1/4W
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS ±10%
3. ALL COMPONENTS MARKED WITH AN ASTERISK (*) ARE FACTORY ADJUSTED

Figure 6.22
Audio Amp/Cal Level
A1P2

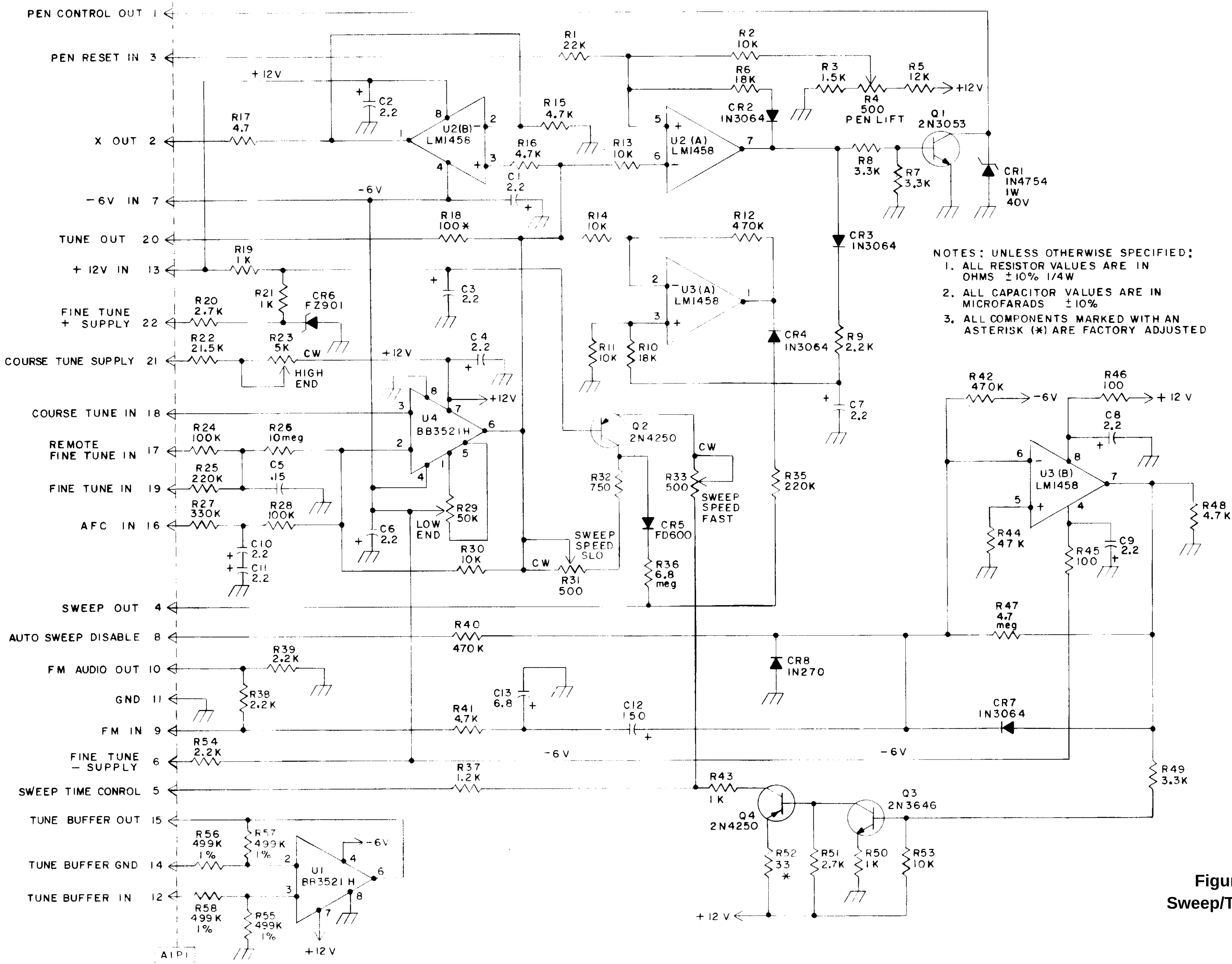
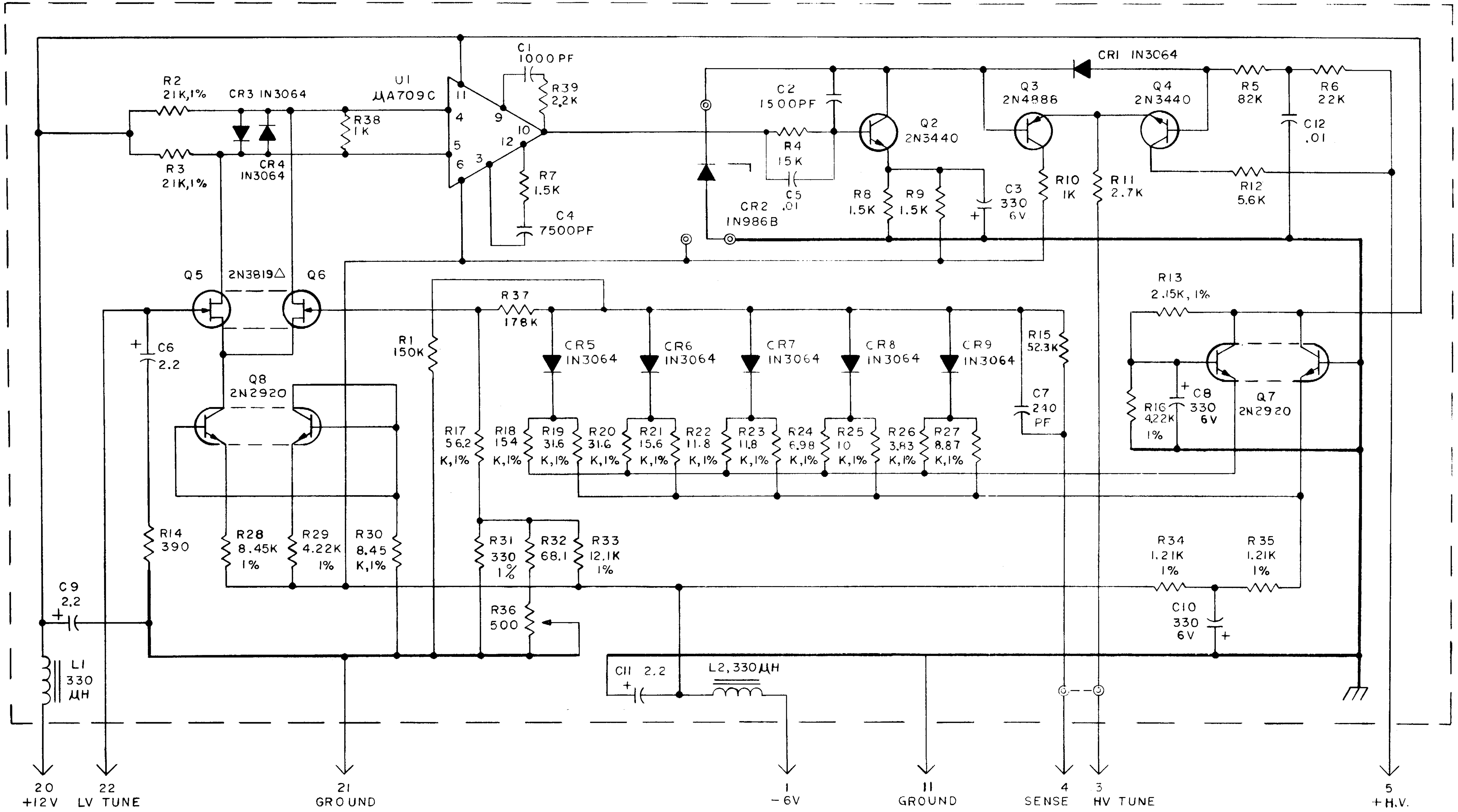


Figure 6.23
Sweep/Tune A1P1



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10%, 1/4 W.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ± 10%.
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES ± 10%.
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED, TYPICAL VALUES SHOWN.
5. FOR COMPLETE PART NUMBER USE PREFIX AS SHOWN ON ASS'Y. EXAMPLE: R5 ON ASS'Y A5P4, COMPLETE PART NUMBER IS A5P4 (R5).
6. Q3 IS NOT INSTALLED ON ALL ASSEMBLIES.
7. CR2 (IN986B) IS SELECTIVELY CONNECTED AS SHOWN.
8. △ DENOTES FACTORY MATCHED PAIR (TEXAS INSTRUMENT).

Figure 6.24. Tuning Regulator A5P4

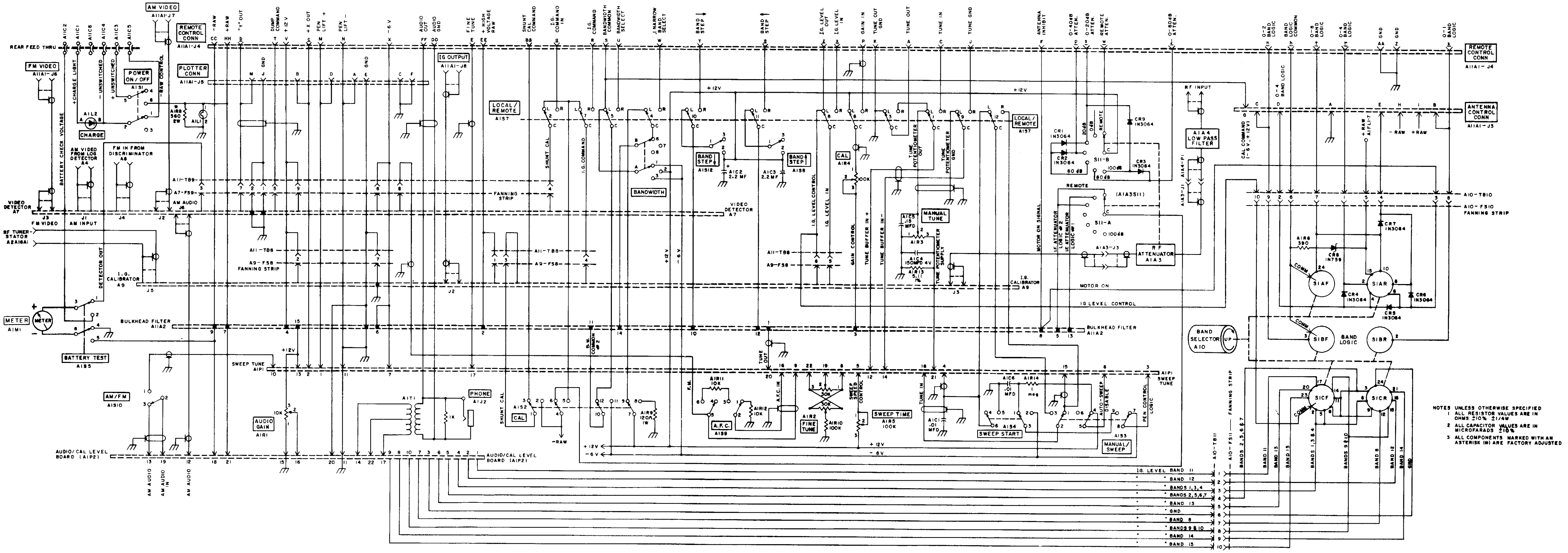


Figure 6.26
Control Section Interconnection

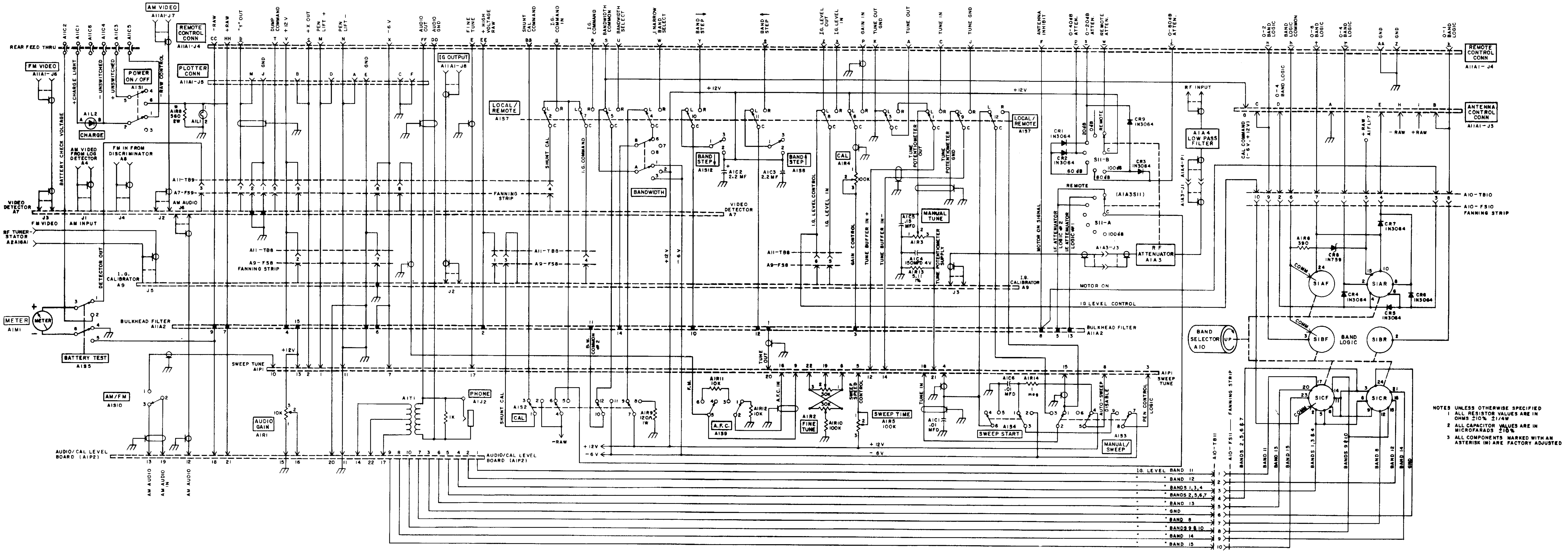
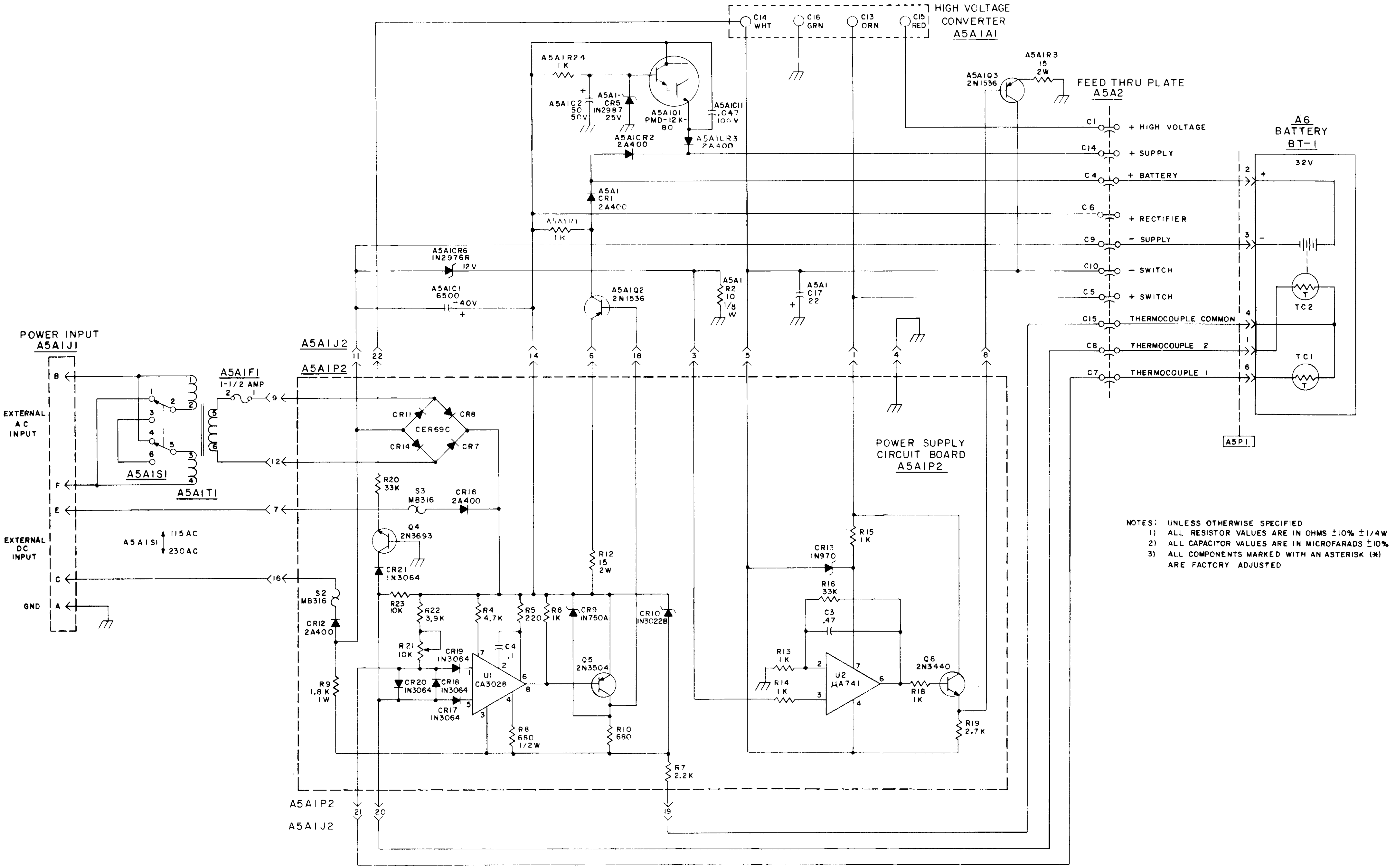
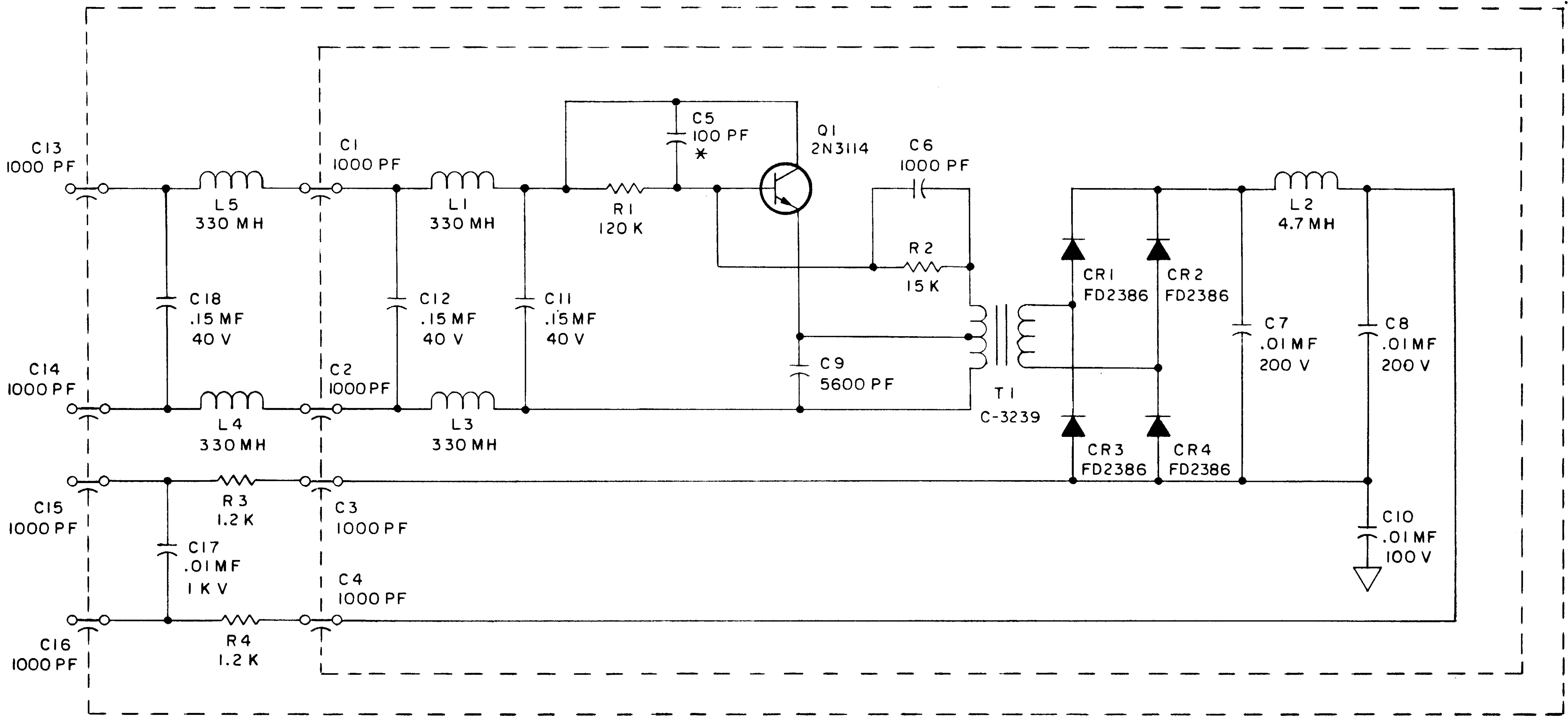


Figure 6.26
Control Section Interconnection



NOTES: UNLESS OTHERWISE SPECIFIED
1) ALL RESISTOR VALUES ARE IN OHMS ±10% ±1/4W
2) ALL CAPACITOR VALUES ARE IN MICROFARADS ±10%
3) ALL COMPONENTS MARKED WITH AN ASTERISK (*) ARE FACTORY ADJUSTED

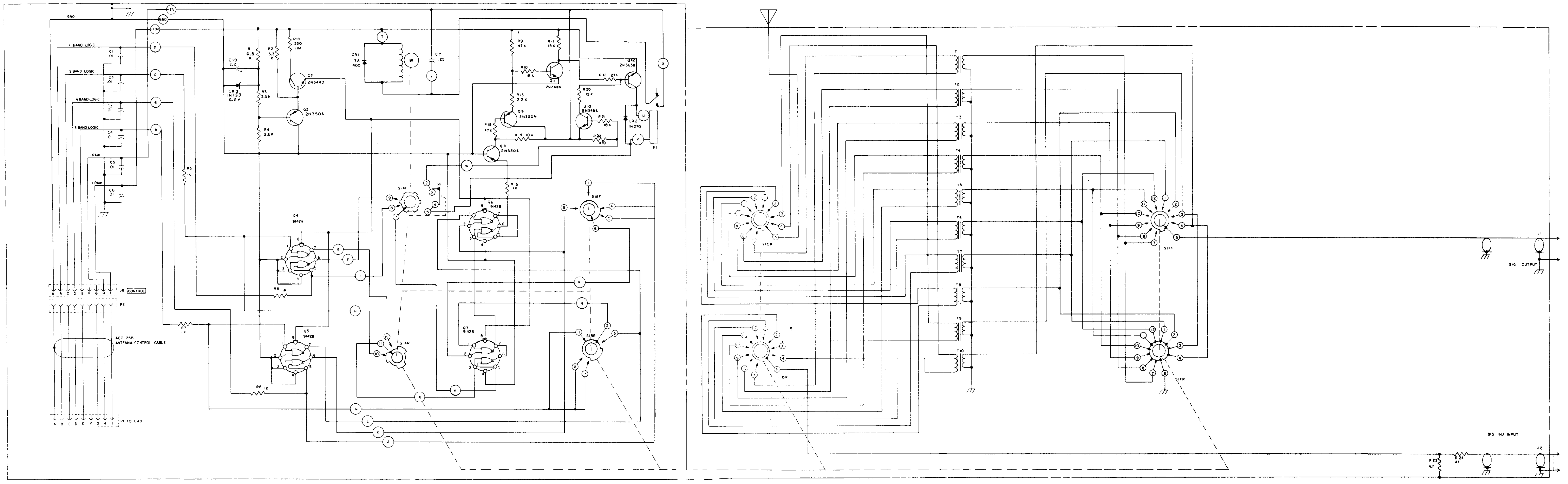
Figure 6.27
Power Supply A5A1



NOTE

UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, ± 10%, 1/4 W.

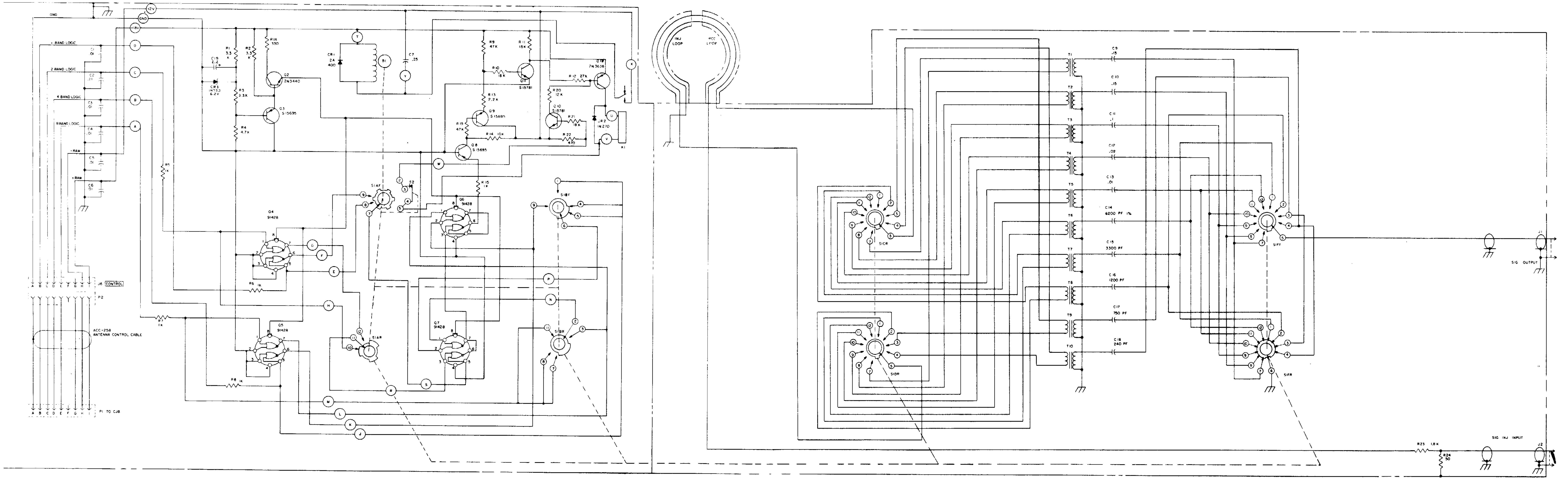
Figure 6.28
H.V. Converter A4A1A1



NOTES

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, ±10 %
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS ±20 %
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES
4. COMPONENTS MARKED * ARE FACTORY ADJUSTED
5. ALL SWITCHES ARE SHOWN IN BAND X POSITION, FIRST POSITION CLOCKWISE IS BAND I
6. (a) LAST C NO.– C8
   (b) LAST R NO.– R 24
   (c) LAST Q NO.– Q 12
   (d) LAST T NO.– T 10
   (e) LAST CR NO.– CR 2

Figure 6.29
RVR-25 Antenna



NOTES

1. UNLESS OTHERWISE SPECIFIED ALL RESISTOR VALUES ARE IN OHMS, 1/4, ± 10%.
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 20%
3. UNLESS OTHERWISE SPECIFIED, ALL INDUCTANCE VALUES ARE IN MICROHENRIES
4. COMPONENTS MARKED ✳ ARE FACTORY ADJUSTED
5. ALL SWITCHES ARE SHOWN IN BAND X POSITION. FIRST POSITION CLOCKWISE IS BAND I
6. (a) LAST C NO.-C18
   (b) LAST R NO.-R24
   (c) LAST Q NO.-Q12
   (d) LAST T NO.-T10
   (e) LAST CR NO.-CR2

Figure 6.30.
ALR-25 Antenna

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Publications, Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins and Lubrication Orders.
DA Pam 310-7	US Army Index of Modification Work Orders.
TM 11-6625-508-14-1	Operator's, Organizational, Direct Support and General Support Maintenance Manual: Signal Generator AN/USM-414B (NSN 6625-00-176-5708).
TM 11-6625-1515-15	Organizational, DS, GS and Depot Maintenance Manual: Frequency Converter, Hewlett-Packard Model 5253B.
TM 11-6625-1543-15	Organizational, DS, GS and Depot Maintenance Manual: Frequency Converter, Electronic CV-2003/U (Hewlett-Packard Model 5254A).
TM 11-6625-1548-15	Organizational, DS, GS and Depot Maintenance Manual: Counter, Electronic Digital CP-772/U (Hewlett-Packard Model 5245L).
TM 11-6625-2697-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual: Signal Generator AN/USM-44C (NSN 6625-00-138-7773).
TM 11-6625-2733-24P; NAVELEX 0967-LP-170-1060; TO 33D7-49-84-4	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Dual Time Base Plug-In Unit TD-1159/U (NSN 6625-00-261-5739).
TM 11-6625-2736-14 NAVELEX 0967-LP-170-1110 TO 33A1-13-499-11	Operator's, Organizational, Direct Support, and General Support Maintenance Manual: Oscilloscope OS-262(P)/U (NSN 6625-01-007-9416).
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).

APPENDIX B
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

B-1. General

This appendix provides a summary of the maintenance operations for AN/URM-200. 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.

B-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. Instill. 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.

B-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of task-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C-Operator/Crew
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.

B-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.

B-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.

SECTION II MAINTENANCE ALLOCATION CHART FOR AN/URM-200

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
00	AN/U RM-200	Inspect	1.0						
		Test				1.0		1 thru 8	
		Service				8.0		1 thru 14	
		Instal l				8.0			
		Repair					30.0	1 thru 14	
		Overhaul					120.0	1 thru 14	
01	RCVR, RADIO INTRF EMC-25	Inspect	1.0						
		Test				2.0		1 thru 6	
		Test					8.0	1 thru 14	
		Repair					16.0	1 thru 14	
		Replace				1.0			
0101	FRONT PANEL	Inspect				0.5		7 thru 12	
		Test				1.5			
		Test					2.0	7 thru 12, 14	
		Repair					4.0	14	
010101	FREQUENCY TUNING	Inspect				0.5			
		Test					1.0	1 thru 14	
		Repair					3.0	14	
		Replace				2.0		14	
010102	SWEEP TUNE P. C. BOARD	Inspect				0.5		7,8	
		Test					0.5	7 thru11, 14	
		Repair					2.0	14	
		Replace				0.30		7 thru 11, 14	
010103	AUDIO/CAL . LEVEL P.C. BOARD	Inspect				0.5		1,7,8	
		Test					0.5	1,7,8	
		Repair					1.0	14	
		Replace				1.0		1,7,8,14	
	RF INPUT ATTENUATOR	Inspect				0.5		7,8	B ,C
		Replace				0.5		7,8,14	
	LOW PASS FILTER	Inspect				0.5		7,8	B,C
		Repl ace				0.2		7,8,14	
0102	RF TUNER	Inspect				1.5		1 thru 6	
		Test					8.0	1 thru 14	
		Repair					20.0	14	
		Replace					30.0	1 thru 14	
010201	CONV. , RF #1	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Repl ace				1.0		1,7,8,14	
010202	CONV ., RF #2	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Replace				1.0		1,7,8,14	
010203	CONV. , RF #3	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Replace				1.0		1,7,8,14	
010204	CONV. , RF #4	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Replace				1.0		1,7,8,14	
010205	CONV. , RF #5	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Repl ace				1.0		1,7,8,14	

SECTION II MAINTENANCE ALLOCATION CHART FOR AN/URM-200

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
010206	CONV., RF #6	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Replace				1.0		1,7,8,14	
010207	CONV., RF #7	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Replace				1.0		1,7,8,14	
010208	CONV., RF #8	Inspect				0.1		1	A
		Test					0.2	1,7 thru 11	
		Repair					1.0	14	
		Replace				1.0		1,7,8,14	
010209	CONV., RF #9	Inspect				0.1		1,2	A
		Test					0.2	1,2,7 thru 11	
		Repair					1.0	14	
		Replace				1.0		1,2,7,8,14	
010210	CONV., RF #10	Inspect				0.1		2	A
		Test					0.5	2,7 thru 11	
		Repair					2.0	14	
		Replace				1.0		2,7,8,14	
	CONV., RF #11	Inspect				0.2		2	B,C
		Replace				0.5		2,14	
	CONV., RF #12	Inspect				0.2		2	B,C
		Replace				0.5		2,14	
	CONV., RF #13	Inspect				0.2		2	B,C
		Replace				0.5		2,14	
	CONV., RF #14	Inspect				0.2		2	B,C
		Replace				0.5		2,14	
	CONV., RF #15	Inspect				0.2		3	B,C
		Replace				0.5		3,14	
010211	RF TURRET	Inspect				1.0		1 thru 8	A
		Test					2.0	1 thru 13	
		Repair					4.0	14	
		Replace					8.0	1 thru 14	
01021101	STATOR	Inspect				1.0		1,7,8	A
		Test					2.0	1 thru 13	
		Repair					4.0	14	
		Replace					8.0	1 thru 14	
01021102	PREAMP	Inspect				1.0		1 thru 8	A
		Test					2.0	1 thru 13	
		Repair					4.0	14	
		Replace					8.0	1 thru 14	
01021103	GEAR TRAIN ASSEMBLY	Inspect				1.0		7,8	
		Test					1.0	7,8	
		Repair					1.0	14	
		Replace				2.0		7,8,14	
0103	IF AMPLIFIER MOD.	Inspect				0.5		1,14	
		Test				1.0		1,7 thru 11	
		Test					2.0	1,7 thru 11	
		Repair					6.0	14	
		Replace				4.0		1,7,8,14	

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AN/URM-200

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGC C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
010301	175 kHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thr 11	
		Repair					2.0	14	
		Replace				2.0		1,7,8,1	
010302	1.6 MHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thr 11	
		Repair					2.0	14	
		Replace				2.0		1,7,8,1	
010303	8.7 MHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thr 11	
		Repair					2.0	14	
		Replace				2.0		1,7,8,1	
0104	LOG DETECTOR MOD.	Inspect				0.5		1,14	
		Test				1.0		1,7 thr 11	
		Test					2.0	1,7 thr 11	
		Repair					6.0	14	
		Replace				4.0		1,7,8,1	
010401	175 kHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thr 11	
		Repair					2.0	14	
		Replace				2.0		1,7,8,14	
010402	1.6 MHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thr 11	
		Repair					2.0	14	
		Replace				2.0		1,7,8,14	
010403	8.7 MHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thru 11	
		Repair					2.0	14	
		Replace				2.0		1,7,8,14	
0105	POWER SUPPLY	Inspect				0.1		thru 11 4	
		Test				0.1			
		Test					0.2	thru 11	
		Repair					2.0	4	
		Replace				4.0		4	
010501	RAW VOLTAGE SUPPLY	Inspect				0.1		,8,14	
		Test					0.1	thru 11	
		Repair					0.5	4	
		Replace				1.5		thru 11 4	
01050101	POWER SUPPLY P.C. BOARD	Inspect				0.1		,8,14	
		Test					0.1	,8	
		Repair					1.0	4	
		Replace				0.5		4	
	H.V. CONV.	Inspect				0.1		thru 11	B,C
		Replace				1.0		thru 11 4	
010502	FEEDTHRU PLATE	Inspect				0.1		,8	
		Test					0.1	,8	
		Repair					0.5	,8,14	
		Replace				1.5		,8,14	

SECTION II MAINTENANCE ALLOCATION CHART FOR AN/URM-200

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
010503	BAND CONTROL P. C . BOARD	Inspect				0.1		7,8	
		Test					0.1	7,8	
		Repair					2.0	14	
		Replace				1.0		7,8,14	
010504	TUNE REG. P. C. BOARD	Inspect				0.1		7,8	
		Test					0.1	7 thru 11	
		Repair					2.0	14	
		Replace				2.0		7 thru 11, 14	
0106	BATTERY PACK	Inspect				0.1		7,8	
		Test				0.5		7,8	
		Repair				0.5		14	
		Replace				0.5		7,8,14	
0107	VIDEO DETECTOR	Inspect				0.5		7,8	
		Test				1.0		7 thru 12	
		Test					2.0	7 thru 12	
		Repair					4.0	14	
		Replace				2.0		7 thru 12, 14	
010701	P. C . BOARD , VIDEO DETECTOR	Inspect						7,8	
		Test				1.0		7 thru 12	
		Repair					3.0	14	
		Replace				2.0		7 thru 12, 14	
0108	DISCRIMINATOR MOD.	Inspect				0.5		1,7 thru 11	
		Test				0.5		1,7 thru 11	
		Test					2.0	1,7 thru 11	
		Repair					4.0	14	
		Replace				3.0		1,7,8,14	
010801	175 kHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thru 11	
		Repair					1.0	14	
		Replace				2.0		1,7,8,14	
010802	1.6 MHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thru 11	
		Repair					1.0	14	
		Replace				2.0		1,7,8,14	
010803	8.7 MHz P.C. BOARD	Inspect				0.5		1,14	
		Test					0.5	1,7 thru 11	
		Repair					1.0	14	
		Replace				2.0		1,7,8,14	
0109	IMPULSE CALIBRATOR	Inspect				0.2		7,8	
		Test				0.5		7 thru 12	
		Test					1.0	7 thru 12	
		Repair					1.0	14	
		Replace				0.3		14	
	IMPULSE GENERATOR	Inspect				0.2		7,8	B,C
		Replace				1.0		7 thru 12, 14	
010901	IMPULSE GENERATOR P.C. BOARD	Inspect				0.2		7,8	
		Test					0.5	7 thru 12	
		Repair					1.0	14	
		Replace				1.0		7 thru12, 14	

SECTION II MAINTENANCE ALLOCATION CHART FOR AN/URM-200

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
0110	CYLINDRICAL SCALE	Inspect				0.1			
		Test				0.5			
		Test					0.5		
		Repair					1.0	14	
		Replace				1.0		14	
0111	HOUSING	Inspect				0.1			
		Test				0.5		7 thru 11	
		Repair				0.5		14	
		Replace				20.0		14	
011101	REAR CONN . PLATE	Inspect				0.1			
		Test				0.2		7 thru 11	
		Repair				0.5		14	
		Replace				10.0		14	
011102	FEEDTHRU PLATE	Inspect				0.1		7,8	
		Test					0.1	7,8	
		Repair					0.5	14	
		Replace				1.5		7,8,14	
02	LINE CORD	Inspect	0.1						
		Test				0.1		7,8	
		Repair				0.5		14	
		Replace	0.1					7,8,14	
03	RACK MOUNT BRACKET	Inspect	0.1						
		Repair				0.1		14	
		Replace	0.1					14	
34	ANTENNA, LOOP ALR-25	Inspect	0.2						
		Test				0.2		1,2,3,7 thru 11	
		Repair				0.5		14	
		Replace				0.2			
3401	TRANSFORMER, P.C. BOARD	Inspect							
		Test				0.2		1,2,3,7 thru 11	
		Repair				0.5		14	
		Replace				1.0		14	
0402	SWITCHING, P.C. BOARD	Inspect				0.2		7 thru 11, 14	
		Test				0.2			
		Test					0.2	7 thru 11	
		Repair					0.5	14	
		Replace				1.0		14	
05	ANTENNA, ROD RVR-25	Inspect	0.2						
		Test				0.2		1,2,3,7 thru 11	
		Repair				0.5		14	
		Replace				0.2		14	
	SWITCHING, P.C. BOARD								E
1501	COIL, ASSEMBLY	Inspect				0.2			
		Test				0.2		1,2,3,7 thru 11	
		Test					0.2	1,2,3,7 thru 11	
		Repair					0.5	14	
		Replace				1.0		14	
06	METER, REMOTE RIM-25	Inspect	0.1						
		Test				0.1		7 thru 11	
		Repair				0.2		14	
		Replace				0.1			
07	CABLE , RF CAC-25	Inspect	0.1						
		Test				0.1		7 thru 11	
		Repair				0.2		14	
		Replace				0.1			

SECTION II MAINTENANCE ALLOCATION CHART FOR

AN/URM-200

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
08	CABLE , CONTROL ACC-25	Inspect Test Repair Replace	0.1			 0.1 0.4 0.1		 7 thru11 14	
	PROBE , MAGNETIC MFA-25								D
	PROBE , MAGNETIC MFB-25								D
	PROBE , MAGNETIC MFC-25								D
	PROBE, ELECTRIC EFP-25								D
	ADAPTER, ANTENNA MOUNT AMT-25								D
	MAST SECTION MSA-25								D
	PROBE , CURRENT PCL-25								D
	EARPHONES EHF-25								D
	CASE, TRANSIT LVC-25								D
	CASE,ANTENNA, LOOP LAC-25								D
	ANTENNA, LOG CONICAL LCA-25								D
	CASE , ANTENNA, LOG CONICAL LCC-25								D
	ANTENNA, BICONICAL BIA-25								D
	CASE, ANTENNA, BI CONICAL BCC-25								D
	TRIPOD, ANTENNA TRP-25								D
	BAG, TRIPOD TRB-25								D
	CASE, TRANSIT, EMC-25 ICC-25								D
	COUNTERPOISE GPA-25								D

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR AN/URM-200

'OOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TO(
1	H,D	OSCILLATOR, TEST SG-1128/U, HP-654A OR EQUIV.	6625 -00-4 50-7590	
2	H,D	GENERATOR, SIGNAL AN/USM-44B, HP608E02 OR EQUIV.	6625-00-176-5708	
3	H,D	GENERATOR, SIGNAL SG-340A/G, HP612A/G OR EQUIV.	6625-00-542-1292	
4	H,D	COUNTER ELECTRONIC DIGITAL CP-772A/U, HP5245L OR EQUIV.	6625-00-973-4837	
5	H,D	CONVERTER FREQUENCY ELECTRONIC CV-2002/U, HP5253B OR EQUIV.	6625-00-266-3483	
6	H,D	PLUG-IN COUNTER CV-2003B/U, HP5254C OR EQUIV.	6625-00-941-8474	
7	H,D	MULTIMETER ME-498/U, HP34702A OR EQUIV.	6625-00-538-9794	
8	H,D	INDICATOR, DIGITAL DISPLAY ID-2101/U, HP34750A OR EQUIV.	6625-00-538-9758	
9	H,D	OSCILLOSCOPE, MULTI-MODE STORAGE OS-262(P)/U TEK7623 OPT. 01,12 OR EQUIV.	6625-00-395-9416	
10	H,D	AMPLIFIER, DUAL TRACE AM-6880/U, TEK7A18 OR EQUIV.	6b25-00-185-7817	
11	H,D	TIME, BASE, DUAL PLUG-IN TD-1159/U, TEK7B53A OR EQUIV.	6625-00-261-5139	
12	H,D	VOLTMETER, ELECTRIC ME-459/U, HP400EL OR EQUIV.	6625-00-229-0457	
13	H,D	METER, POWER ME-441/U, HP432A OR EQUIV.	6625-00-436-4883	
14	H,D	MAINTENANCE KIT MK ( )/URM-200	*	
		*THE NATIONAL STOCK NUMBER THAT IS MISSING FROM THIS LIST HAS BEEN REQUESTED AND WILL BE ADDED BY A CHANGE TO THE LIST UPON RECEIPT.		

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	REPAIR NOT DONE ON THIS ITEM AS AN ENTITY, BUT IS DONE AS PART OF NEXT HIGHER ASSEMBLY.
B	THIS ITEM IS NOT REPAIRABLE BY PIECE PART REPLACEMENT AND IS NOT ASSIGNED AN FGC ALTHOUGH PART OF NEXT HIGHER ASSEMBLY.
C	THIS ITEM IS NOT REPAIRABLE BY PIECE PART REPLACEMENT AND IS A SEALED ASSEMBLY. THE PART SHOULD BE RETURNED TO CONTRACTOR FOR REPAIRS OR EXCHANGE.
D	THIS ITEM IS NOT REPAIRABLE BY PIECE PART REPLACEMENT AND IS NOT ASSIGNED AN FGC.
E	THIS ITEM IS IDENTICAL TO FGC 0402 AND HAS IDENTICAL MAINTENANCE FUNCTIONS AND IS THEREFORE, NOT ASSIGNED A SEPARATE FGC.

APPENDIX C
COMPONENTS OF END ITEM LIST

Section I. INTRODUCTION

C-1. Scope

This appendix lists integral components of and basic issue items for the AN/URM–200 to help you inventory items required for safe and efficient operation.

C-2. General

This Components of End Item List is divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the AN/URM-200 and must accompany it whenever it is transferred or turned in. The illustrations will help you identify these items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the AN/URM-200 in operation, to operate it, and to perform emergency repairs. Although shipped separately packed they must accompany the AN/URM–200 during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. Explanation of Columns

a. Illustration. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration on which the item is shown.

(2) *Item number.* The number used to identify item called out in the illustration.

b. National Stock Number. Indicates the National stock number assigned to the item and which will be used for requisitioning.

c. Description. Indicates the Federal item name and, if required, a minimum description to identify the item. The part number indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. Following the part number, the Federal Supply Code for Manufacturers (FSCM) is shown in parentheses.

d. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

e. Usable on Code. Not applicable.

f. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

g. Quantity. This column is left blank for use during an inventory. Under the Rcvd column, list the quantity you actually receive on your major item. The Date columns are for your use when you inventory the major item.

C-4. Special Information

National stock numbers (NSN's) that are missing from sections II and III have been applied for and will be added to this Technical Manual by future Change/Revision when they are entered in the Army Master Data File (AMDF). Until the NSN's are established and published, submit exception requisitions to: Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-MM, Fort Monmouth, NJ 07703 for the part required to support your equipment.

SECTION II INTEGRAL COMPONENTS OF END ITEM

(1) LLUSTRATION (A) FIG NO.	(B) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION PART NUMBER (FSCM)	(4) LOCATION	(5) SABLI ON CODE	(6) QTY REQD	QUANTITY RCVD	DATE
3.4			RECEIVER, RADIO INTERFERANCE EMC-25 (18581)	ICC-25		1		
			POWER CORD PCD-25 (18581)	ICC-25		1		
			RACK MOUNT BRACKETS ABM-25 (18581)	ICC-25		2		
3.10	8		ANTENNA, LOG CONICAL, 200-1000 MHz LCA-25 (18581)	LCC-25		1		
3.10	2		ANTENNA, LOOP, 0.01-30 MHz ALR-25 (18581)	LCA-25		1		
3.10	14		ANTENNA, BI CONICAL, 20-200 MHz BIA-25 (18581)	BCC-25		1		
3.10	14		ANTENNA ELEMENTS, BIA-25 ANTENNA BIA-25 ELEMENT (18581)	BCC-25		2		
3.10	7		TRIPOD-ANTENNA TRP-25 (18581)	TRB-25		1		
3.10	20		RF CURRENT PROBE PCL-25 (18581)	LVC-25		1		
3.10	10		MAGNETIC FIELD PROBE 10-520 kHz MFA-25 (18581)	LVC-25		1		
3.10	10		MAGNETIC FIELD PROBE 0.5-520 MHz MFB-25 (18581)	LVC-25		1		
3.10	10		MAGNETIC FIELD PROBE 22-230 MHz MFC-25 (18581)	LVC-25		1		
3.10	18		ELECTRO-STATIC PROBE EFP-25 (18581)	LVC-25		1		
3.10	15		TRIPOD ADAPTER AMT-25 (18581)	LVC-25		1		
3.10	3		ANTENNA, BASE, ROD 0.01-30 MHz RVR-25 (18581)	LVC-25		1		
3.10	3		ELEMENT, ROD ANTENNA RVR-25 ELEMENT (18581	LVC-25		1		
3.10	5		COUNTERPOISE, ROD ANTENNA GPA-25 (18581	LVC-25		1		
3.10	11		REMOTE METER RIM-25 (18581	LVC-25		1		
3.10	17		EARPHONES EHF-25 (18581)	LVC-25		1		
3.10	9		MAST SECTION-ANTENNA MSA-25 (18581)	LVC-25		2		
3.10	16		CABLE-RF (25 FT) CAC-25 (18581)	LVC-25		2		
3.10	6		CABLE, CONTROL ACC-25B (18581)	LVC-25		1		
3.10	22		BATTERY PACK BAT-25 (18581)	ICC-25		1		

SECTION III BASIC ISSUE ITEMS

(1) LUSTRATION (A) IG NO.	(B) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION PART NUMBER	(FSCM)	(4) LOCATION	(5) USABLE ON CODE	(6) QTY REQD	(7) QUANTITY RCVD	DATE
.11			TRANSIT CASE, RECEIVER ICC-25	(18581)			1		
.11			TRANSIT CASE, LCA-25 ANT. LCC-25	(18581)			1		
.11			TRANSIT CASE, BIA-25 ANT. BCC-25	(18581)			1		
.11			TRANSIT CASE, ALR-25 ANT. LAC-25	(18581)			1		
.11			TRANSIT CASE-ACCESSORIES LVC-25	(18581)			1		
.10	19		TRANSIT BAG, TRIPOD TRB-25	(18581)			1		
			OPERATOR'S MANUAL		LVC-25				
			ANTENNA FACTOR CHARTS		LVC-25				

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2949-14	31 Oct 79	

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

TEAR ALONG DOTTED LINE

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

U.S.MAIL

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2

TEAR ALONG DOTTED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2949-14	31 Oct 79	

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

U.S.MAIL

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2

TEAR ALONG DOTTED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2949-14	31 Oct 79	

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

U.S.MAIL

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

TEAR ALONG DOTTED LINE

FOLD BACK

TEAR ALONG DOTTED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2949-14	31 Oct 79	

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

U.S.MAIL

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

TEAR ALONG DOTTED LINE

FOLD BACK

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2949-14	31 Oct 79	

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG DOTTED LINE

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD—314

U.S. MAIL

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2949-14	31 Oct 79	

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

TEAR ALONG DOTTED LINE

DA FORM 1 AUG 74 2028-2

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

U.S.MAIL

Commander
US Army Communications and
Electronics Materiel Readiness Command
ATTN: DRSEL-ME-MQ
Fort Monmouth, New Jersey 07703

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Amy
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution
Active *Army:*
- TSG (1)
- USAARENBD (1)
- USAINSCOM (2)
- TRADOC (2)
- DARCOM (1)
- TECOM (2)
- OS Maj Cmd (2)
- USACC (2)
- HISA (Ft Monmouth) (21)
- Armies (1)
- USASIGS (10)
- Svc Colleges (1)
- Ft Richardson (CERCOM Ofc) (1)
- Ft Carson (5)
- Ft Gillem (10)
- WSMR (1)
- USAERDAA (1)
- USAERDAW (1)
- Army Dep (1) except:
  - LBAD (10)
  - SAAD (30)
  - TOAD (14)
  - SHAD (3)
- USA Dep (1)
- Sig Sec USA Dep (1)
- Units org under fol TOE:
  - 29-134 (1)
  - 29-136 (1)
  - 29-207 (2)
  - 29-610 (2)

NG: None.
USAR: None.
For explanation of abbreviations used see, AR 310-50.