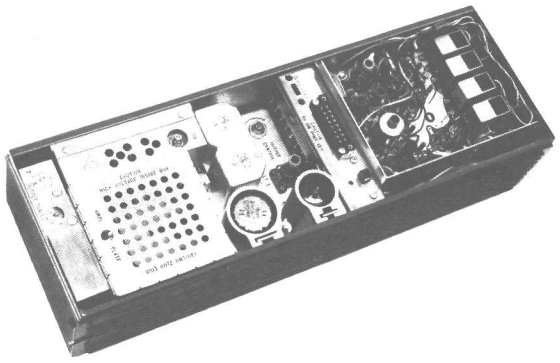
MOBILE RADIO

MASTR PROGRESS LINE

470-512 MHz, TRANSMITTER MODELS 4ET59G30-41, & 4ET60G30-41



SPECIFICATIONS *

FCC Filing Designation:

		ET-59-G	ET-60-G
Frequency Range:		470-512 MHz	470-512 MHz
Power Output:		30 Watts minimum (20 Watts minimum in 6-Volt systems)	60 Watts minimum
Crystal Multiplication Factor:		36	36
Frequency Stability:		±0.0002% (-30°C to +60°C)	
Modulation:		Adjustable from 0 to ±5 kHz (Narrow Band) and 0 to ±15 kHz (Wide Band) swing with instantaneous modulation limiting.	
Modulation Sensitivity		50 to 100 Millivolts	
Audio Frequency Characteristics		Within +1 dB to -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hertz per EIA standards. Post limiter filter per FCC and EIA.	
Distortion:		Less than 5%	
Tubes & Transistors:		Transmitter with no Options: 3 tubes 6 silicon transistors 4 diodes & 2 varactors 1 ICOM module	
Maximum Frequency Spacing:		0.2%	
Duty Cycle:	Mobile-	20% transmit (one minute transmit, four minutes off)	
	Station-	Continuous	

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

ET-59-G & ET-60-G

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

The MASTR Progress Line FM Transmitters Types ET-59-G and ET-60-G are crystal-controlled, phase-modulated transmitters designed for one-through four-frequency operation within the 470-512 megahertz band. The transmitters were designed for either narrow-band or wide-band operation, and consist of the following modules:

- Transistorized Exciter Board, with audio, modulator, amplifier, and multiplier stages.
- Integrated Circuit Oscillator Module (ICOM).
- Multipliers, IPA and power amplifier stages.
- Optional transistorized Channel Guard Low-Pass Filter.

All input leads to the transmitters are individually filtered by the 20-pin feed-through by-pass connector J101. The output passes through a two-section, band-pass filter, followed by a low-pass filter.

CIRCUIT ANALYSIS

Six silicon transistors and only three tubes are used in the transmitters. The frequency of the plug-in ICOM modules ranges from 13.05 - 14.2 megahertz. The oscillator frequency is multiplied 36 times.

A centralized metering jack (J102) is provided for use with General Electric Test Sets 4EX3A10 or 4EX8K11. The Test Set meters the multiplier, amplifier and PA stages as well as filament and regulated supply voltages. The metering jack also provides access to audio microphone and push-to-talk leads.

POWER INPUTS

The following supply voltages are connected from the power supply to the transmitter through the 20-pin by-pass connector J101:

- Pin 3: Filament
- Pin 4: +300 Volts MULT & IPA B+
- Pin 5: PA B+
- Pin 8: -45 Volts bias
- Pin 14: +10 Volts for Channel Guard option
- Pin 15: -20 Volts for Exciter Board and ICOM module

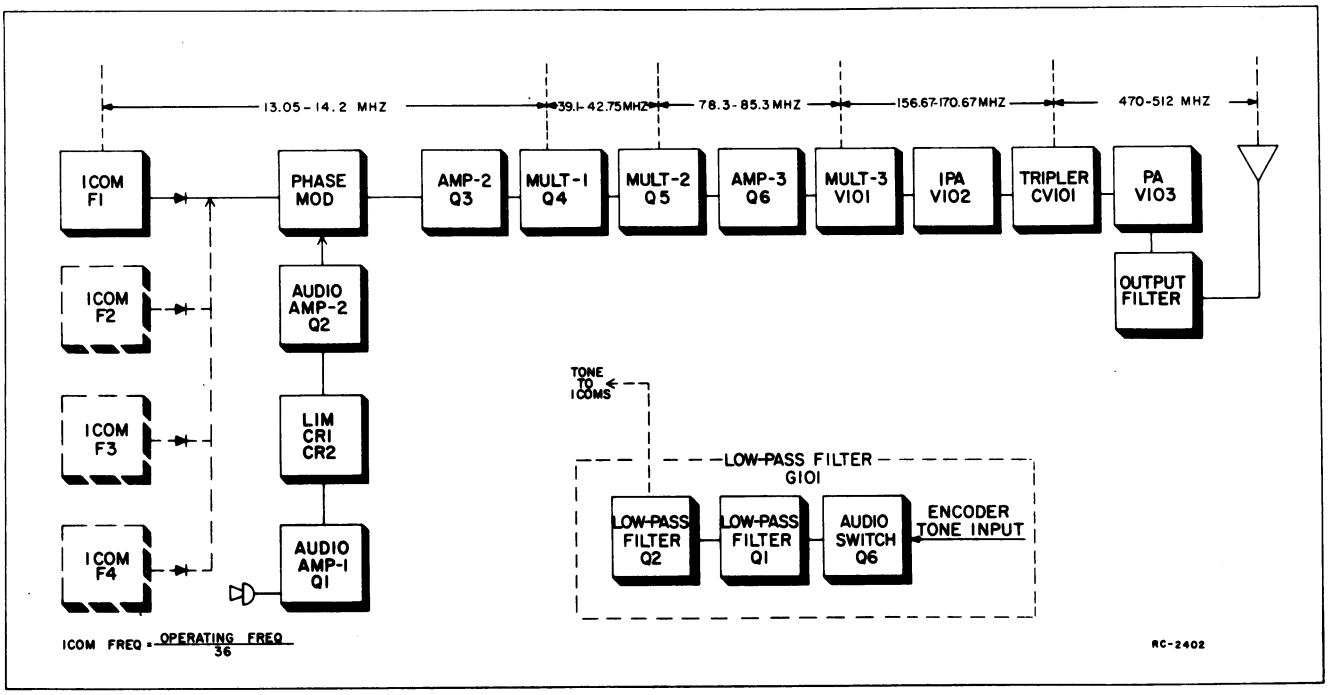


Figure 1 - Transmitter Block Diagram

NOTE

The PA B-plus voltage will vary due to the different power supplies used (both mobile and station), and due to the power input limitations of different services. Refer to the PA Plate Voltage Chart on the Transmitter Schematic Diagram for the different operating conditions.

ICOM MODULE

ICOM module Model 4EG25A10 consists of a crystal-controlled Colpitts oscillator, a voltage regulator, a Channel Guard tone modulator and a buffer output stage. The entire module (including crystal) is enclosed in a dust-proof aluminum can, with the ICOM frequency and the transmitter operating frequency printed on the top. Access to the oscillator trimmer is obtained by prying off the plastic GE decal on the top of the can.

The oscillator frequency is temperature-compensated at both ends of the temperature range to provide instant frequency compensation, with a frequency stability of ±.0002%.

In single-frequency transmitters, a keying jumper from H1 to H2 (on the exciter board) connects the ICOM to ground. This drops the -20 Volts exciter supply through voltage dividers R19 and R20 to provide -10 Volts to operate the ICOM. With the ICOM operating, diode CR3 is forward biased and the oscillator output is applied to the modulator stage.

In multi-frequency transmitters, up to three additional ICOM modules can be plugged into the exciter board. The single-frequency keying jumper is removed, and the proper frequency is selected by switching the ICOM keying lead to ground by means of a frequency selector switch on the control unit.

In Channel Guard applications, tone from the low-pass filter board is applied to the ICOM through Channel Guard Mod Adjust R1002. The oscillator output is frequency modulated by the Channel Guard tone.

CAUTION

All ICOM modules are individually compensated at the factory, and cannot be repaired in the field. Any attempt to remove the ICOM cover will void the warranty.

AUDIO AMPLIFIERS AND LIMITER

An audio signal from the microphone is coupled through C1 to the base of Class A audio amplifier Q1. The design of the microphone, in conjunction with C2 and R3, produces a 6-dB audio pre-emphasis. Rf decoupling is provided by C45.

The amplified audio signal is RC coupled to the diode limiters, CR1 and CR2. These diodes operate in series and are normally in a forward conducting state. An audio signal of sufficient amplitude to cause limiting takes the diodes out of conduction, so that one diode conducts only on positive cycles and the other conducts only on negative cycles.

Following the limiter stage is a second Class A amplifier, Q2. The output of Q2 is coupled through MOD ADJUST potentiometer R12 to a combined post-limiter filter and de-emphasis network. This network consists of C4, C7, C8, C9, R13, R14, R15 and R18. The output of the filter and de-emphasis network is applied directly to the phase modulator.

PHASE MODULATOR

The phase modulator uses varactor CV1 (voltage variable capacitor) in series with tunable coil L1. This network appears as a series-resonant circuit to the RF output of the oscillator. An audio signal applied to the modulator varies the bias of CV1, resulting in a phase-modulated output. The output of the modulator is coupled through blocking capacitor C14 to the base of the second amplifier.

AMPLIFIERS AND 1ST AND 2ND MULTIPLIERS

The second amplifier (Q3) isolates the modulator from the loading effects of the first multiplier and provides amplification. The output is coupled through T6 to the first multiplier.

Following Q3 are two inductively-coupled Class C, common-emitter multiplier stages (Q4 and Q5). Q4 is a tripler, with collector tank T1 tuned to three times the crystal frequency. Metering resistors R31 and R42 are for metering the MULT-1 stage at centralized metering jack J102.

Q5 operates as a doubler stage, with collector tank T3 tuned to six times the crystal frequency. Resistors R33 and R40 are for metering the MULT-2 stage at J102. The output of Q5 is inductively coupled through T3 and T4 to amplifier Q6. In 494-512 megahertz transmitters, capacitor C29 provides some high-side capacitive coupling.

Third amplifier Q6 is a neutralized straight-through amplifier. Feedback through C35 from the output link on T5 provides neutralization. This stage is metered at J102-3 across R37. The output is coupled to the grid tank of multiplier V101.

3RD MULTIPLIER

The output of the transistorized Exciter is coupled by a short length of RF cable to the grid tank (Z102) of beam pentode V101. This stage operates as a doubler with the plate tank tuned to twelve times the crystal frequency.

Bias voltage (approximately -18 Volts) is supplied to the grid of V101 through R108 to protect the tube against loss of drive. Grid voltage is metered by metering network R105 and R106 with a residual reading of approximately 0.18 Volts without any drive, caused by fixed bias voltage to the grid of V101. The plate tank is tuned by C104 with plate voltage supplied through L101.

IPA AND TRIPLER

The output of the MULT-3 stage is coupled by a pi-network consisting of C104, L103 and C107/C108 to the grid of the IPA, a compactron beam power amplifier.

Approximately 45 Volts of bias voltage is supplied to the grid of V102 through R112 and a tap on L103 to protect the stage against loss of drive. A residual reading of 0.28 Volt without any drive to the stage indicates the presence of fixed bias. Grid voltage and the tripler varactor bias voltage are metered simultaneously at J201-5.

The IPA plate tank is tuned by C115, and plate voltage is supplied through L105. The stage is neutralized by C110.

RF from the IPA is coupled through C120/C123 to a passive tripler stage. The tripler consists of three tuned stages (C115 & L109/L108, C121 & L114, and C122 & L113) which are coupled together through the common impedance of varactor CV101.

The IPA output is fed to the tripler, where the first tuned stage resonates at the fundamental frequency. The second tuned circuit (an "idler" circuit) is tuned to twice the input signal, and mixes with the input signal to produce the desired third harmonic (or operating frequency. The third tuned circuit is tuned to the operating frequency.

POWER AMPLIFIER

Drive from the tripler stage is link-coupled to the grid circuit of V103 through L115 and L116. V103 is a coaxial element, conduction-cooled beam power tetrode operating as a neutralized Class C amplifier.

The grid line L128 of V103 is series-tuned by C130 with 20 Volts of protective bias supplied through L117 and grid bias resistors R103 and R129. PA grid current is metered across resistor R103 at J102-6 and J102-14.

Neutralization is provided by a fixed series screen inductance (the fingers on the screen by-pass ring) and the screen by-pass capacitors C135, C136, C138 and C140.

The PA Plate tank circuit is comprised of C145 (the plate tank tuning flap), L120 (the copper-plated heat sink on the plate of V103), and mechanically constructed capacitor (with mica dielectric) C143. The plate voltage is supplied through choke L122, which is connected to feed-through capacitor C142.

The PA screen voltage is controlled by OUTPUT CONTROL potentiometer R124 which is in series with R123/R126 in the screen supply circuit. With the OUTPUT CONTROL fully counterclockwise, the plate dissipation of V103 is reduced below the rated tube limit for tuning the power amplifier stage.

Plate current is metered from J102-1 to J102-9 across metering resistor R102 in high-power units, transmitter Type ET-60-G. In Type ET-59-G transmitter, R101 is added in series with R102.

WARNING

The meter leads are at plate potential (high B-plus when metering the PA Plate.

The output of V103 is link-coupled to band-pass filter FL103/FL104 consisting of two inductively coupled helical resonators. C10/C11 and C12/C13 are the output tuning capacitors. L11 and C9 form an additional low-pass filter section. The RF output is fed through J103 to the antenna changeover relay located on the front of the system frame.

An RF sniffer circuit (CR1, C7, and R1) provides for measuring the relative power output at J102-11. When troubleshooting the transmitter, components of the low-pass filter and RF sniffer circuit can be checked by removing the plate on the bottom of the filter casing.

CHANNEL GUARD

Low-Pass Filter (G101)

In encode-decode combinations, low-pass filter G101 is assembled on a printed wiring board that mounts on the underside of the MASTR transmitters. The filter is supplied by a regulated +10 Volts and a regulated -20 Volts. The +10 Volts is applied continuously (even in the STANDBY position), and the -20 Volts is applied only when the transmitter is keyed.

Keying the transmitter applies the encoder tone (from the receiver) to low-pass

filter G101. Transistors Q1 and Q2 form a two-section, active low-pass filter that reduces tone distortion and power supply ripple. Q6 operates as a tone switch, applying the tone input to the filter whenever +10 Volts is applies to J1 (Q6 base). Thermistor RT1 keeps the output constant over wide variations in temperature. The filter output is coupled to the tone modulator on the transmitter exciter board through Channel Guard MOD ADJUST R34. Instructions for setting R34 are contained in the Modulation Adjustment section of the Transmitter Alignment Procedure.

The channel can be monitored before transmitting a message by moving the CG-OFF switch on the Control Unit to the OFF position, or by removing the microphone or handset from the operational hang-up bracket.

NOTE

When Channel Guard decode only is desired, remove the wire that connects to J6 on the Low-Pass filter (Encoder Tone Input).

Encoder Model 4EH17A10 (Optional)

In encode only combinations, or when different encode and decode frequencies are required, optional encoder Model 4EH17A10 mounts on the underside of the MASTR transmitter. The encoder is supplied by a regulated +10 Volts and a regulated -20 Volts. The +10 Volts is applied to Q3, Q4 and Q5 continuously (even in the STAND-BY position). The -20 Volts is applied to Q1 and Q2 only when the transmitter is keyed.

The encoder tone is provided by selective oscillators Q3 and Q4, which oscillate continuously at a frequency determined by the tone network (FL1). Negative feedback, applied through the tone network to the base of Q3, prevents any gain in the stage except at the desired encode frequency.

Thermistor-resistor combination R14 and RT2 provides temperature compensation for the oscillator output. Limiter diodes CR1 and CR2 keep the tone amplitude constant.

Keying the transmitter applied -20 Volts to the two-stage, active low-pass filter (Q1 and Q2) turning them on. The oscillator output is then coupled through emitter-follower Q5 to the low-pass filter. Thermistor RT1 keeps the filter output constant over wide variations in temperatures.

The output of the filter is applied to the tone modulator on the transmitter exciter board through Channel Guard MOD ADJUST R34. Instructions for setting R34 are contained in the Modulation Adjustment section of the Transmitter Alignment Procedure.

The channel can be monitored before transmitting a message by moving the CG-OFF switch on the Control Unit to the OFF position, or by removing the microphone or handset from the operational hand-up bracket.

MAINTENANCE

DISASSEMBLY

To service the transmitter from the top:

1. Pull locking handle down and pull radio about one inch out of mounting frame.
2. Pry up cover at rear of transmitter.
3. Slide cover back and lift off.

To service the transmitter from the bottom:

1. Pull locking handle down and pull radio out of mounting frame.
2. Remove the two screws in bottom cover, and pry up at back of transmitter.
3. Slide cover back and lift off.

To remove transmitter from system frame:

1. Loosen the two retaining screws in the front casting (see Figure 2) and pull away from the system frame.
2. Remove the four screws in the back cover.
3. Remove the two screws holding the transmitter at each end of the system frame.
4. Disconnect the antenna jack in front of the transmitter and the 20-pin feed-thru connector at the back of the transmitter, and slide the unit out of the system frame.

TUBE REPLACEMENT

WARNING

Before replacing tubes, remove all power from the unit so that the transmitter cannot be keyed. In mobile units, disconnect power plug P504. In stations, turn off the main line switch and discharge filter capacitors.

To replace 3rd Multiplier and IPA Tubes (V101 & V102)

Loosen the two screws holding tube shield to heatsink, and pull off tube shield. Then carefully work the tube out of its socket.

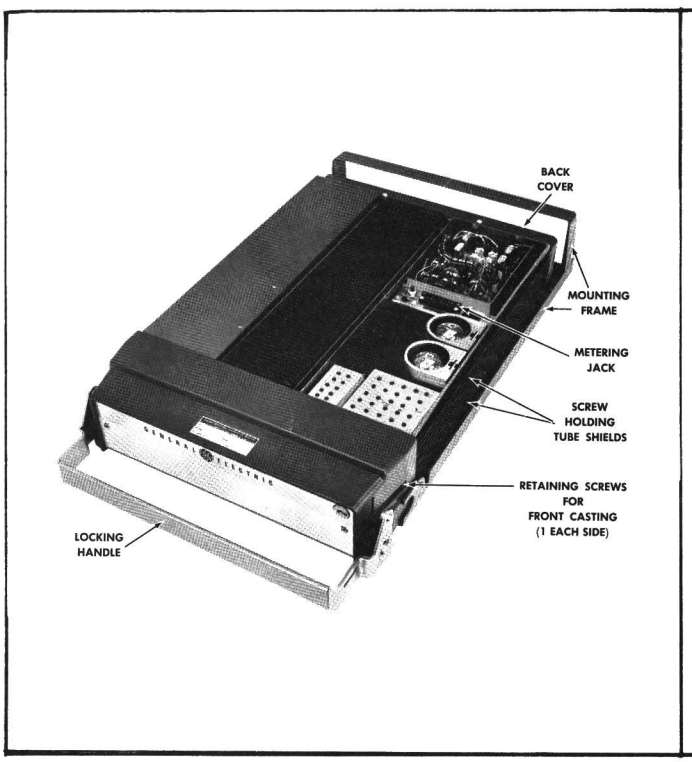


Figure 2 - Top Cover Removed

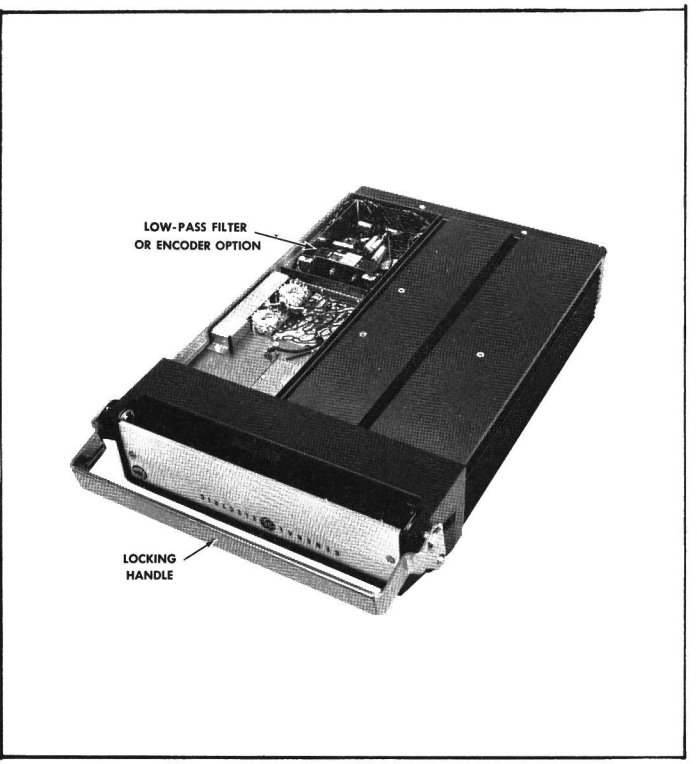


Figure 3 - Bottom Cover Removed

To replace Power Amplifier V103:

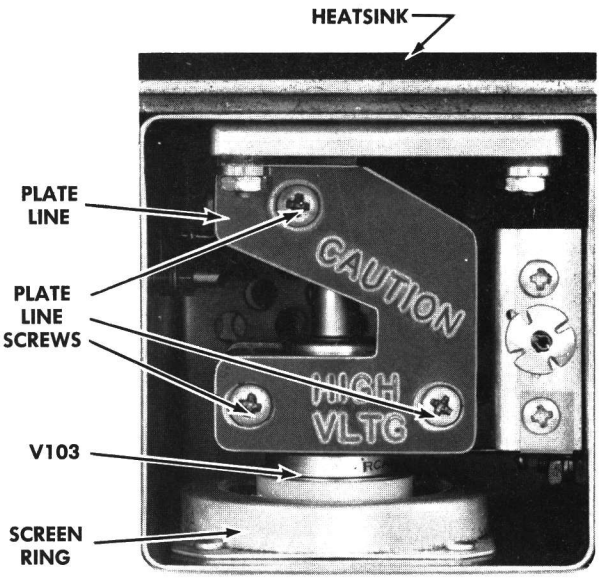


Figure 4 - PA Plate Box With Cover Removed

1. Make sure that all power is removed from the unit.

2. Remove the top cover on the AMPL PLATE box (figure 4). Allow the transmitter to cool if necessary.

3. Remove the three Phillips-head screws in the plate line, starting with the two screws nearest tube socket. Lift off the top section of the plate line. Next, slide the bottom section toward the AMPL PLATE tuning adjustment and lift it out ot the AMPL PLATE box.

4. Carefully work the tube out of its socket.

5. Use a screwdriver to bend the screen ring contacts out toward the center of the tube socket so that all contacts will touch the base of the tube.

CAUTION

Extreme care should be taken during PA tube replacement to avoid damaging the screen ring contacts.

6. Replac the tube by hand, making sure that it is fully seated in the socket and that all screen ring contacts are touching the tube.

7. Replace the plate lines, tightening the screw nearest the heat-sink first. Then replace the top cover of AMPL PLATE box.

8. Realign the transmitter.

ADDENDUM TO LBI-4430 AND LBI-4432

(470-512 MHz TRANSMITTER MODELS 4ET59G30-41, 4ET60G30-41, 4ET59H30-41 and 4ET60H30-41)

The following revision letter changes have been made to improve transmitter performance. The revision stamped on the assemblies includes all previous revisions.

REV. A - CHASSIS AND RF ASSEMBLY 19E500865G3

To optimize tuning range of C104. Deleted C107, 748916P7, and added C108, 748916P4.

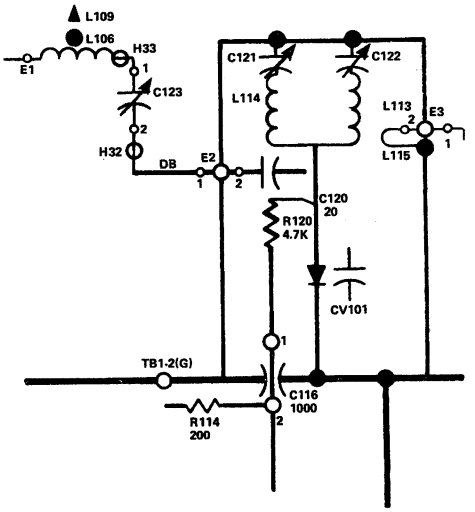
REV. B - To insure proper tuning.

Deleted C115, 19B209372P1, and L108, 19B205615P1. Changed C120 from 5496218P8 to 5496218P46 and C123 from 5496218P7 to 5491271P6. Added L106, 19B205615P4.

REV. A - CHASSIS AND RF ASSEMBLY 19E500865G4

To insure proper tuning. Deleted C115, 19B209372P1. Changed C120 from 5496218P8 to 5496218P46, C123 from 5496218P7 to 5491271P6, and L109 from 19B205615P3 to 19B205615P5.

Schematic Diagram Changed To:



Alignment Procedure Change:

8.	E (MULT-4)	Pin 5	C104 & C123	Maximum	Tune IPA GRID (C104) for maximum meter reading. Then tune C123 for maximum meter reading (not required unless changing frequency).
9.	E (MULT-4)	Pin 5	C121 & C122	See Procedure	Tune C121 clockwise until meter reading drops abruptly. Then turn C122 clockwise for a change in meter reading. This step is not required unless changing frequency.
10.	F PA GRID	Pin 14 (+) Pin 6 (-)	AMPL GRID (C130 & C123, C121 & C122	See Procedure	Tune AMPL GRID for maximum meter reading. Then retune C123, C121, C122 and AMPL GRID in that order until no further increase in meter reading is noted. NOTE If no reading is found, switch to test selector position "G" and alternately tune C123, C121, C122 and C130 for a peak in the reading at position "G". Then proceed with Step 10.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R12) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause overmodulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing overmodulation while preserving intelligiblity.

TEST EQUIPMENT

1. An audio oscillator
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Models 4EX3A10 or 4EX8K11

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J5 (Green-Hi) and J6 (Black-Lo) on GE Test Set or across J1 (Mike High) and J2 (Mike Low) on the Exciter Board.
2. Apply a 0.75-volt signal at 1000 Hz to Test Set or across J1 and J2 on Exciter Board.
3. For transmitters without Channel Guard, set the MOD ADJUST (R12) for a 4.5-kilohertz swing (13.5 kHz for wide band) with the deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.
4. For transmitters with Channel Guard, set the Channel Guard MOD ADJUST (R1002) for 0.75 kHz tone deviation. Remove the tone to the transmitter by unplugging leads to J7 and J8 on Exciter Board, or by switching to a non-Channel Guard frequency in multifrequency units. Next, apply a 0.75-volt signal at 1000 Hz and set MOD ADJUST (R12) for a 3.75 kHz deviation (4.5 kHz minus 0.75 kHz tone deviation).
5. For multi-frequency transmitters, set the deviation as described in Steps 3 or 4 on the channel producing the largest amount of deviation.

PA POWER INPUT

For FCC purposes, the PA power input can be determined by measuring the PA Plate voltage and the plate current indication, and using the following formula:

ET-59-G $P_i = \frac{\text{Plate Voltage x Plate Current Indication}}{3.5}$

ET-60-G $P_i = \frac{\text{Plate Voltage x Plate Current Indication}}{2.59}$

Where:
P_i is the power input in watts.

Plate voltage is measured with GE Test Set in position G, using the 1000-volt scale (or measured from J102-1 to -16 with multimeter).

Plate current indication is measured with GE Test Set in position G, using the TEST scale (or measured from J102-1 to -9 with multimeter).

3.5 or 2.59 is the value of the plate current metering resistor in ohms.

TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

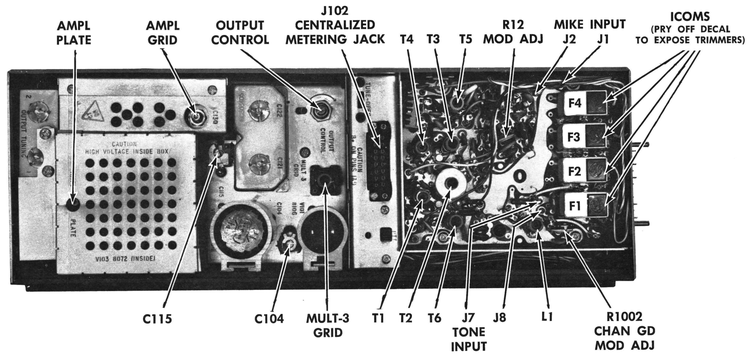
1. General Electric Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11, Station Test Meter Panel, or a 20,000 ohms-per-volt Multimeter with 1-volt scale.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOM(s) (operating frequency ÷ 30) in proper socket. Do not adjust ICOM trimmer. In multi-frequency units; tune the transmitter on the lowest frequency (except for Steps 15 and 16).
2. Turn OUTPUT CONTROL (R124) fully counterclockwise. This limits PA dissipation during initial tune-up.
3. Connect Test Set to the Transmitter Centralized Metering Jack J102. If using Multimeter, connect the positive lead to J102-16 (Ground), except where indicated.
4. For a large change in frequency or a badly misaligned transmitter, set the slugs in the Exciter coils at the bottom of the coil form, and the slug of Z102 (MULT-3 GRID) at the top of the coil form. Tune AMPL PLATE counterclockwise until the stud is even with the top of the case. Then turn C121, C122 and OUTPUT TUNING -1 and -2 fully counterclockwise.
5. All adjustments are made with the transmitter keyed.

ALIGNMENT PROCEDURE

Step	METERING POSITION 4EX3A10	METERING POSITION Multimeter - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A	Pin 10	T6 and L1	0.7 v (0.4 v Minimum)	Tuning the modulator is a critical adjustment. Carefully tune T6 and L1 alternately for maximum meter reading. If no peak is obtained when tuning T6, set the slug in L1 to a different position and re-tune T6.
2.	A (MULT-1)	Pin 10	T1	See Procedure	Tune T1 for a small dip in meter reading (not required unless changing frequency.
3.	B (MULT-2)	Pin 2	T2, T1 and T3	0.7 v (0.5 v Minimum)	Tune T2 and then T1 for a maximum meter reading. Then tune T3 for minimum meter reading (not required unless changing frequency).
4.	C (AMPL-3)	Pin 3	T4, T3 and T5	0.7 v (0.5 v Minimum)	Tune T4 and then T3 for a maximum meter reading. Then tune T5 for minimum meter reading (not required unless changing frequency).
			MULT-3, IPA AND POWER AMPLIFIER		
5.	D (MULT-3)	Pin 4	MULT-3 GRID (Z102)	0.7 v (0.5 v Minimum)	Tune MULT-3 GRID for maximum meter reading.
6.	C (AMPL-3)	Pin 3	T4	Maximum	Retune T4 for maximum meter reading.
7.	D (MULT-3)	Pin 4	MULT-3 GRID (Z102)	Maximum	Retune MULT-3 GRID for maximum meter reading.
8.	E (MULT-4)	Pin 5	C104 & C115	Maximum	Tune IPA GRID (C104) for maximum meter reading. Then tune C115 for maximum meter reading (not required unless changing frequency).
9.	E (MULT-4)	Pin 5	C121 & C122	See Procedure	Tune C121 clockwise until meter reading drops abruptly. Then turn C122 Clockwise for a change in meter reading. This step is not required unless changing frequency.
10.	F PA GRID	Pin 14 (+) Pin 6 (-)	AMPL GRID (C130) & C115, C121 & C122	See Procedure	Tune AMPL GRID for maximum meter reading. Then retune C115, C121, C122, and AMPL GRID in that order until no further increase in meter reading is noted. - NOTE - If no reading is found, switch to test selector position "G" and alternately tune C115, C121, C122 and C130 for a peak in the reading at position "G". Then proceed with Step 10.
11.	G PA PLATE	WARNING High B+ on Pins 1 & 9 Pin 1 (+) Pin 9 (-)	AMPL PLATE	Minimum	Tune AMPL PLATE for a dip in meter reading (not required unless changing frequency).
12.	H REL PWR OUT	Pin 11	OUTPUT TUNING -1 & -2 and AMPL PLATE	Maximum	Alternately tune OUTPUT TUNING -1 and -2 and AMPL PLATE in that order for maximum meter reading.
13.	G PA PLATE	Pin 1 (+) Pin 9 (-)	OUTPUT CONTROL (R124)	See Procedure	Adjust OUTPUT CONTROL for a meter reading of 0.64 volt (0.6) volt for continuous duty stations). - NOTE - Refer to REDUCED POWER OPERATION.
14.					Repeat Steps 12, 13 and 10 in that order.



TRANSMITTER ALIGNMENT (CONT'D)

STEP	METERING POSITION 4EX3A10	METERING POSITION Multimeter - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			FOR MULTI-FREQUENCY UNITS ONLY		
15.	F PA GRID	Pin 14 (+) Pin 6 (-)	AMPL GRID (C130)	See Procedure	After completing Steps 1 thru 14 using the lowest channel frequency, alternately switch from the highest to the lowest frequency and tune AMPL GRID for equal meter readings.
16.	H REL PWR OUT	Pin 11	OUTPUT TUNING-1 and AMPL PLATE	See Procedure	Alternately switch from the highest to the lowest frequency and tune OUTPUT TUNING-1 and AMPL PLATE for equal meter readings.

FREQUENCY ADJUSTMENT

First, check the transmitter frequency to determine if any adjustment is required. The frequency should be checked with a frequency meter or counter having an accuracy of 0.4 part-per-million (PPM), and with the ICOM module at 80°F (±4°F) or 26.5°C (±2°C) when possible. The ICOM temperature can be determined by taping a mercury thermometer to the side of the ICOM.

CAUTION

The ICOM case is at -20 volts DC. Be careful not to short the case to ground.

If an adjustment is required, use one of the following procedures:

If the ICOM is stabilized at 80° F, pry off the GE emblem and adjust the ICOM trimmer for correct transmitter operating frequency.

If the ICOM is not stabilized at 80°F, pry off the GE emblem and check for a color dot on the top of the can. This color dot indicates which correction curve to use in setting the unit on frequency (see Figure 5). Next, tape a thermometer to the ICOM and check the temperature when the thermometer is stabilized. Then proceed as shown in the following example:

1. Assume that the ICOM is marked with a green color dot and the temperature reading is 50°F. At that temperature, the green curve shows a correction factor of approximately +1.5 PPM. (At 470 MHz, 1 PPM is 470 Hz. At 512 MHz, 1 PPm is 512 Hz.)
2. With a transmitter operating a frequency of 470 MHz, adjust the ICOM trimmer for a reading of 705 Hz (+1.5 x 470) higher than the licensed operating frequency.
3. If a negative correction factor is obtained (at temperatures above 80°F), adjust the ICOM trimmer for the indicated PPM lower than the operating frequency.

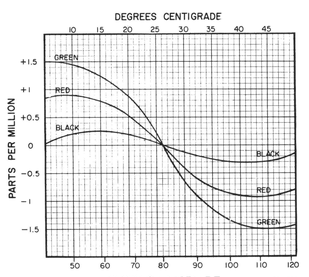


Figure 5 - ICOM Frequency Correction Curves

REDUCED POWER OPERATION

In some services, FCC regulations do not permit the use of full rated power input to the PA Plate circuit. In such cases:

1. In station applications, make sure that the power transformer taps are set for the PA Plate voltage shown in the Maintenance Manual for Power Supply Type EP-38-A.
2. In mobile applications, make sure that the transformer taps are set as shown in the Maintenance Manual for the 4EF37A10, 4EF37B10, 4EF37C10 or 4EF37D10.
3. Adjust the OUTPUT CONTROL for the meter reading shown in the following chart.

	XMTR TYPE	MEASURED PLATE VOLTAGE	METER READING
For 60-Watt Input	ET-59-G	275 to 305 VDC (see Note 1)	0.7 VDC
For 120-Watt Input	ET-60-G	460 to 510 VDC (see Note 2)	0.7 VDC MAX.

NOTE 1 - If the plate voltage is not within the 275 to 305-volt limit, find the OUTPUT CONTROL setting by dividing 210 by the measured plate voltage.

Meter reading in volts = $\frac{210}{\text{Measured Plate Voltage}}$

NOTE 2 - If the Plate Voltage is not within the 460 to 510-volt limit, find the OUTPUT CONTROL setting by dividing 311 by the measured plate voltage.

Meter reading in volts = $\frac{311}{\text{Measured Plate Voltage}}$

ALIGNMENT PROCEDURE

470—512 MHz, 30 & 60-WATT TRANSMITTER
MODELS 4ET59G30-41 & 4ET60G30-41

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating--but not properly. Problems encountered could be low power output, low B plus, tone and voice deviation, defective audio sensitivity and modulator adjust control set too high. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once a defect is pin-pointed, refer to the "Service Check" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

1. Wattmeter similar to: Bird #43, Jones #711N
2. VTVM similar to: Triplett #850, Heath #IM-21
3. Audio Generator similar to: GE Model 4EX6A10 or Heath #IG-72
4. Deviation Meter similar to: Measurements #140
5. Multimeter similar to:

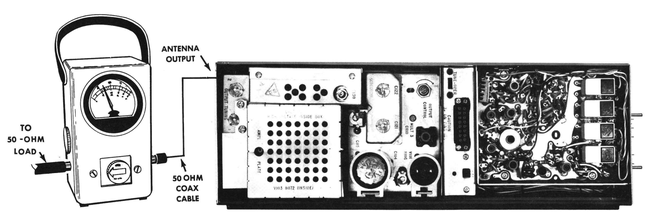
   GE METERING TEST SET MODELS 4EX3A10, 4EX8K10 or
   Triplett #631 or
   20,000 ohms-per-volt voltmeter

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output to wattmeter as shown below, using a low-loss coaxial cable between the antenna jack and wattmeter. RG-303/U is recommended for accurate power output readings.



2. Key transmitter and check wattmeter for minimum reading as shown in power output chart on Transmitter Schematic Diagram.

SERVICE CHECK

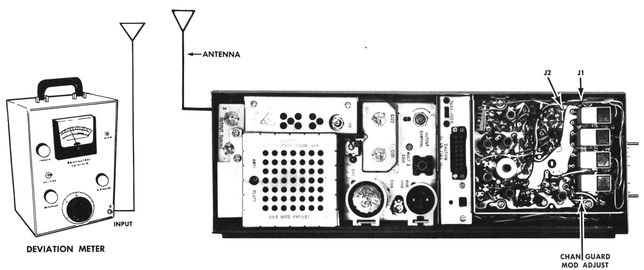
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

1. Setup Deviation Meter and monitor output of transmitter as shown below:



2. Unplug the MIC HI terminal from J1 on Transmitter Exciter Board.
3. Key transmitter and check for 0.75 kHz deviation (1.5 kHz wide-band). If reading is low or high, adjust Channel Guard MOD ADJUST (R1002) for a reading of 0.75 kHz (1.5 kHz wide-band).

DEVIATION METER

NOTES:

1. The Channel Guard MOD ADJUST (R1002) may be adjusted for deviations up to 1 kHz (narrow-band) or 3 kHz (wide-band) for Channel Guard frequencies.
2. The Tone Deviation Test Procedures should be repeated everytime the Tone Frequency is changed.

SERVICE CHECK

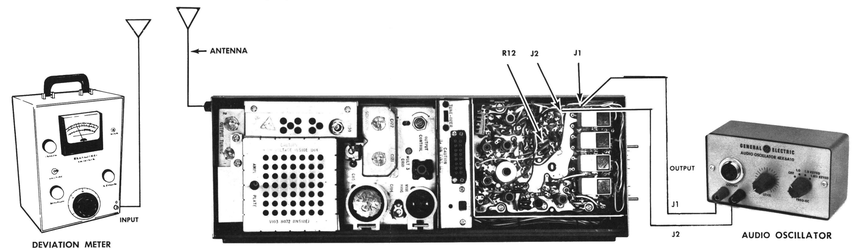
If the 0.75 kHz (1.5 kHz wide-band) deviation is not obtainable when adjusting R1002, replace the encoder tone network.

STEP 3

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

1. Unplug the High and Low Mike leads from the Exciter Board Jacks J1 and J2.
2. Connect test equipment to transmitter as shown below:



3. Set the generator output to 0.75 VOLTS RMS and frequency to 1 kHz.
4. Key the transmitter and adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz (±13 kHz wide-band).
6. Adjust "Modulation Adjust Control" R12 until deviation reads 4.5 kHz (13 kHz wide-band) on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.

DEVIATION METER

NOTES: MASTR transmitters are adjusted for 4.5 kHz (13 kHz wide-band) deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5 kHz (15 kHz wide-band) under the worst conditions of frequency, voltage and temperature.

If the deviation reading plus (+) and minus (-) differs by more than 0.5 kHz (1.5 kHz wide-band) check the following:

1. Recheck Step 1 as shown in the Transmitter Alignment Chart.
2. Check Audio Sensitivity by reducing generator output until deviation falls to 3.3 kHz (10 kHz wide-band).

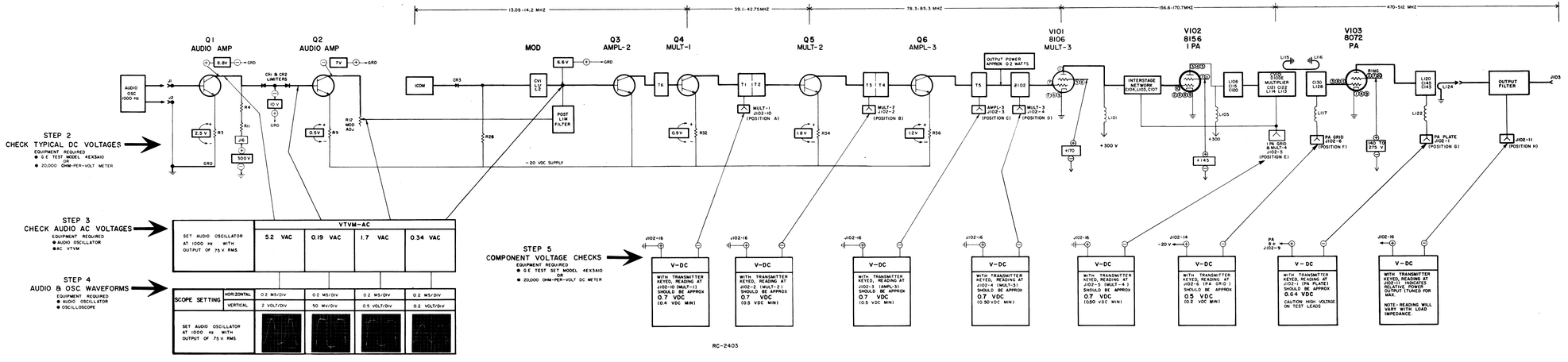
METER

STEP I - QUICK CHECKS

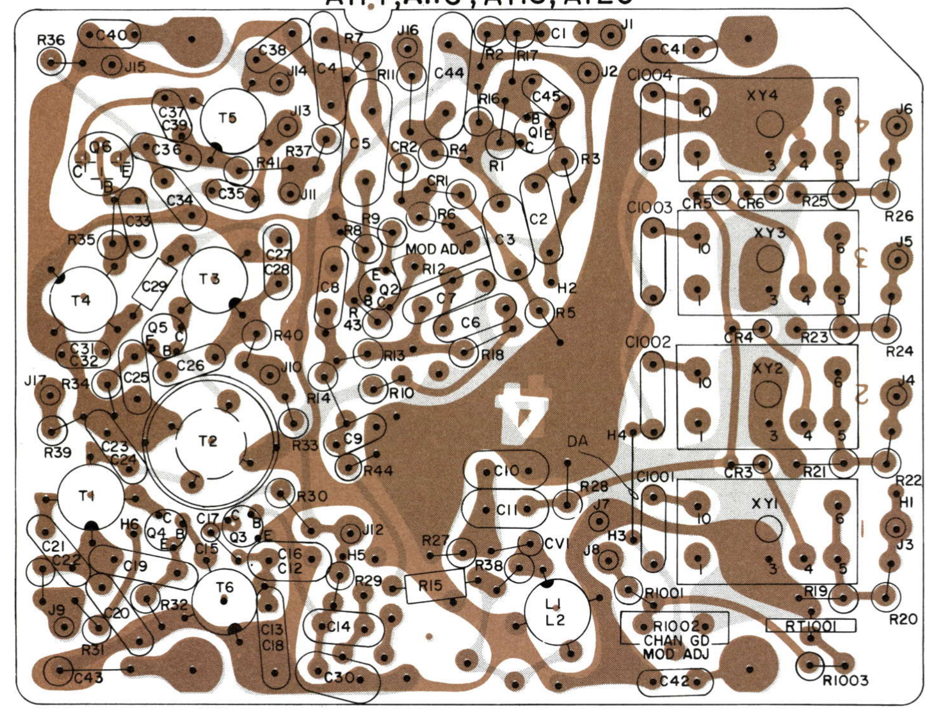
POWER OUTPUT	CHECK VOLTAGES AT CENTRALIZED METERING JACK J102 Multimeter - pin numbers GE Test Set - A-G positions							PROBABLE DEFECT
	Pins 10 & 16 A	Pins 2 & 16 B	Pins 3 & 16 C	Pins 4 & 16 D	Pins 5 & 16 E	Pins 6 & 14 F	Pins 1 & 9 G	
0	0	0	0	0.18 v	0.28 v	0	Low	Defective Q3, Q4 or Modulator (see Note A)
0	over 1.0 v	0	0	0.18 v	0.28 v	0	Low	Shorted Q4 or open Q3
0	NORMAL	0 or over 1.0 v	0	0.18 v	0.28 v	0	Low	Defective Q5
0	NORMAL	NORMAL	0 or over 1.0 v	0.18 v	0.28 v	0	Low	Defective Q6
0	NORMAL	NORMAL	Low	0.18 v	0.28 v	0	Low	Open filament on 8106, open coax, bad Q6
0	NORMAL	NORMAL	NORMAL	NORMAL	0.28 v	0	Low	Open filament on 8156
0	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	0	0	Open filament on 8072
0	NORMAL	NORMAL	NORMAL	NORMAL	0.5 v	0	0	If no peak at position "E" when tuning C115, bad multiplier diode or 8156
0	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	High	Very Low or 0	Bad R123/R126, bad R124, shorted 8072 screen
Low	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	Low	0.70 v	Weak 8156 or 8072
Erratic	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	Very High	0.70 v	Check contacts on screen by-pass ring

NOTE: Localize trouble by checking:

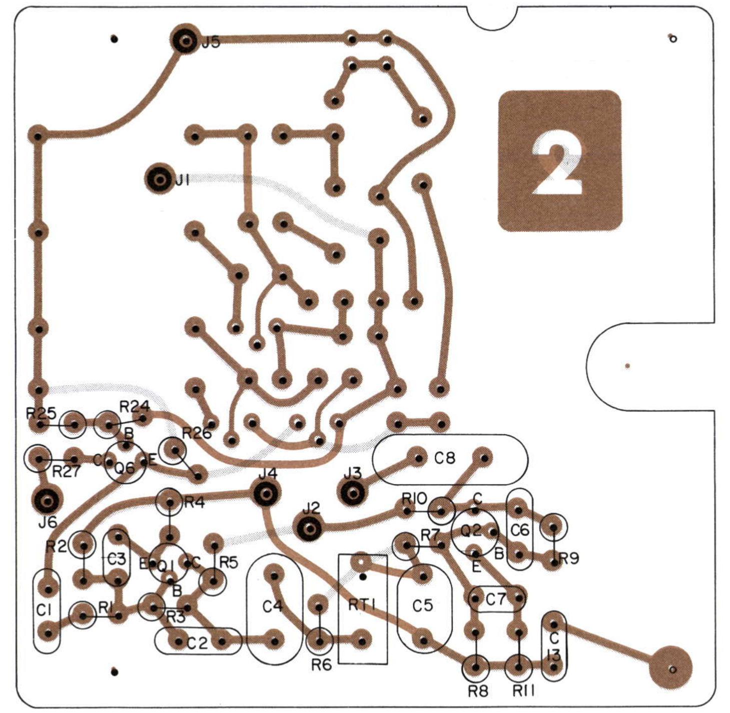
1. -20 volt DC supply at metering jack J102 pins 12 and 16
2. Measure 5.5 volts DC across ICOM load resistor R28 (2.7K ohms), then;
   (a) If no voltage is measured, check keying leads by measuring the voltage drop across resistors R19, R21, R23, and R25. Voltage should read 10 voltage when that channel is keyed and 0 volts when unkeyed.
   (b) If Step a indicates 10 volts and no voltage is measured across R28, suspect bad ICOM or socket.
   (c) With ICOMs removed, short Q3 base to emitter. A voltage reading above 1.0 volts at meter position A indicates Q3 and Q4 are good. If reading remains zero, check for shorted Q3 or open Q4.
   (d) If Step C is normal, defect is in modulator. Check voltage variable diode CV1.



EXCITER
A114,A116,A118,A120

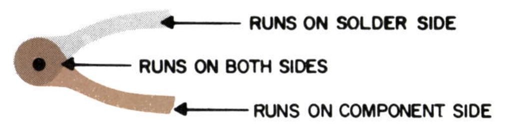


(19C311379, Sh. 1, Rev. 4)
(19C311379, Sh. 2, Rev. 4)



LOW-PASS FILTER
G101

(19C311800, Sh. 1, Rev. 2)
(19C311800, Sh. 2, Rev. 2)

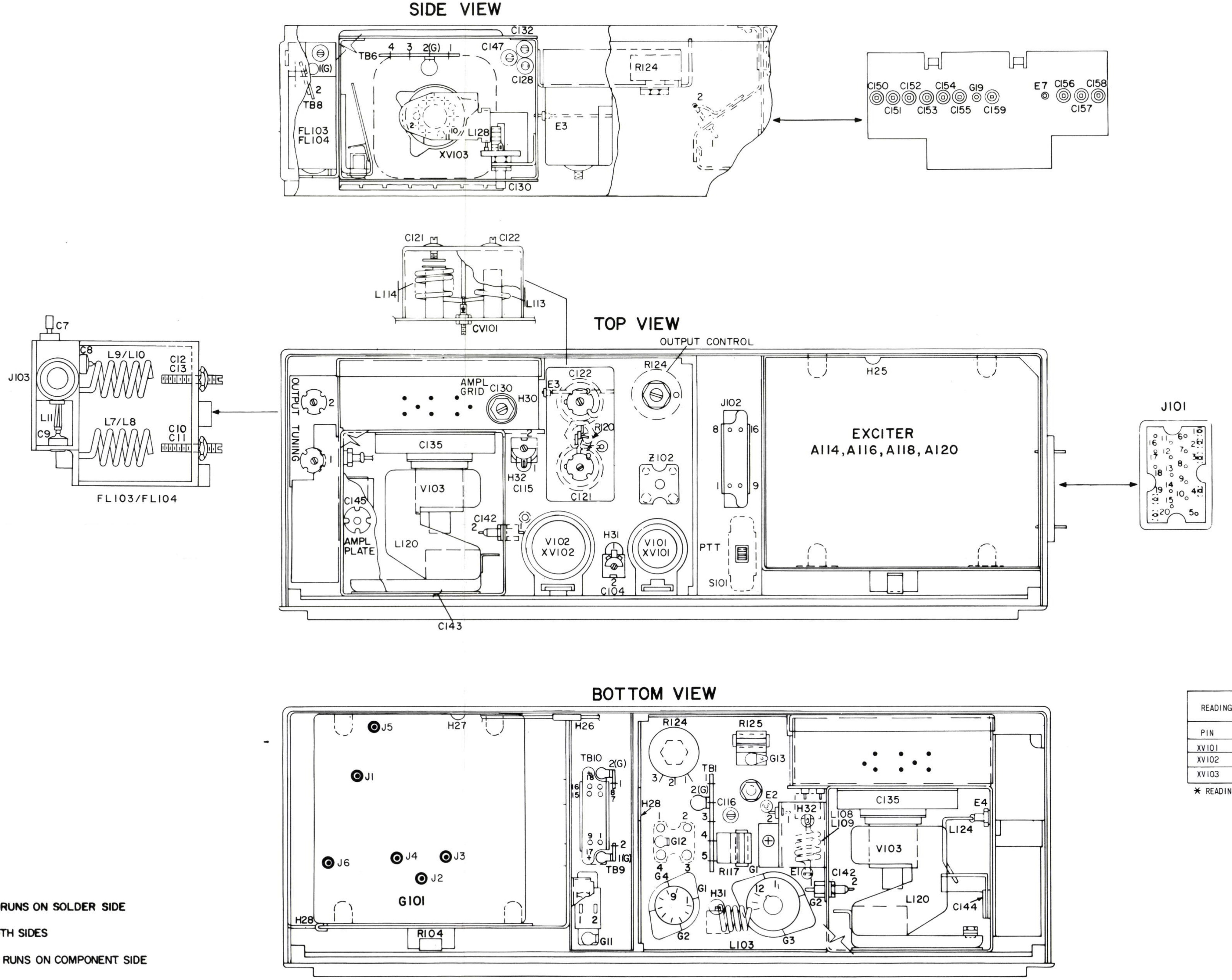


OUTLINE DIAGRAM

470—512 MHz, 30 & 60-WATT TRANSMITTER
MODELS 4ET59G30-41 & 4ET60G30-41

EXCITER READINGS TAKEN TO CHASSIS GROUND						
TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	5.8K	5.9K	140K	11K	60K	30K
Q2	4.1K	2.8K	70K	7.5K	8.7K	9.5K
Q3	3.4K	115	62K	5.7K	3.7K	3.8K
Q4	3.6K	2.3K	3.4K	2.1K	165	165
Q5	3.6K	2.3K	3.4K	115	200	210
Q6	3.5K	2.1K	3.5K	2.2K	70	70

EXCITER READINGS TAKEN TO 20 VOLT LINE (J15 BLUE LEAD)						
TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	9.5K	10K	145K	17.2K	63K	45K
Q2	450	450	68K	3.5K	11.5K	13.5K
Q3	0	0	68K	3.2K	7K	8K
Q4	13	120	0	0	2.2K	3.7K
Q5	54	120	0	0	52	3.7K
Q6	22	25	47	45	2.2K	3.5K



(19R621977, Rev. 0)

READINGS AT J101 TAKEN TO CHASSIS GROUND		
PIN	−	+
1	0	0
2	∞	∞
3	1Ω	1Ω
4	19K	19K
5	∞	∞
6	∞	∞
7	∞	∞
8	50K	50K
9	∞	∞
10	∞	∞
11	∞	∞
* 12	0/14K	0/9.5K
13	∞	∞
14	∞	∞
15	5.5K	2.5K
* 16	∞/14K	∞/9.5K
* 17	∞/14K	∞/9.5K
* 18	∞/14K	∞/9.5K
19	0	0
20	∞	∞

* 1ST READING FOR SINGLE FREQ.
2ND READING FOR MULTI-FREQ.

RESISTANCE READINGS

ALL READINGS ARE TYPICAL READINGS MEASURED WITH A 20,000 OHM-PER-VOLT METER AND J101 DISCONNECTED. + OR − SIGNS SHOW METER LEAD GROUNDED. OUTPUT CONTROL FULLY COUNTER-CLOCKWISE AND ALL TUBES IN THEIR SOCKETS.

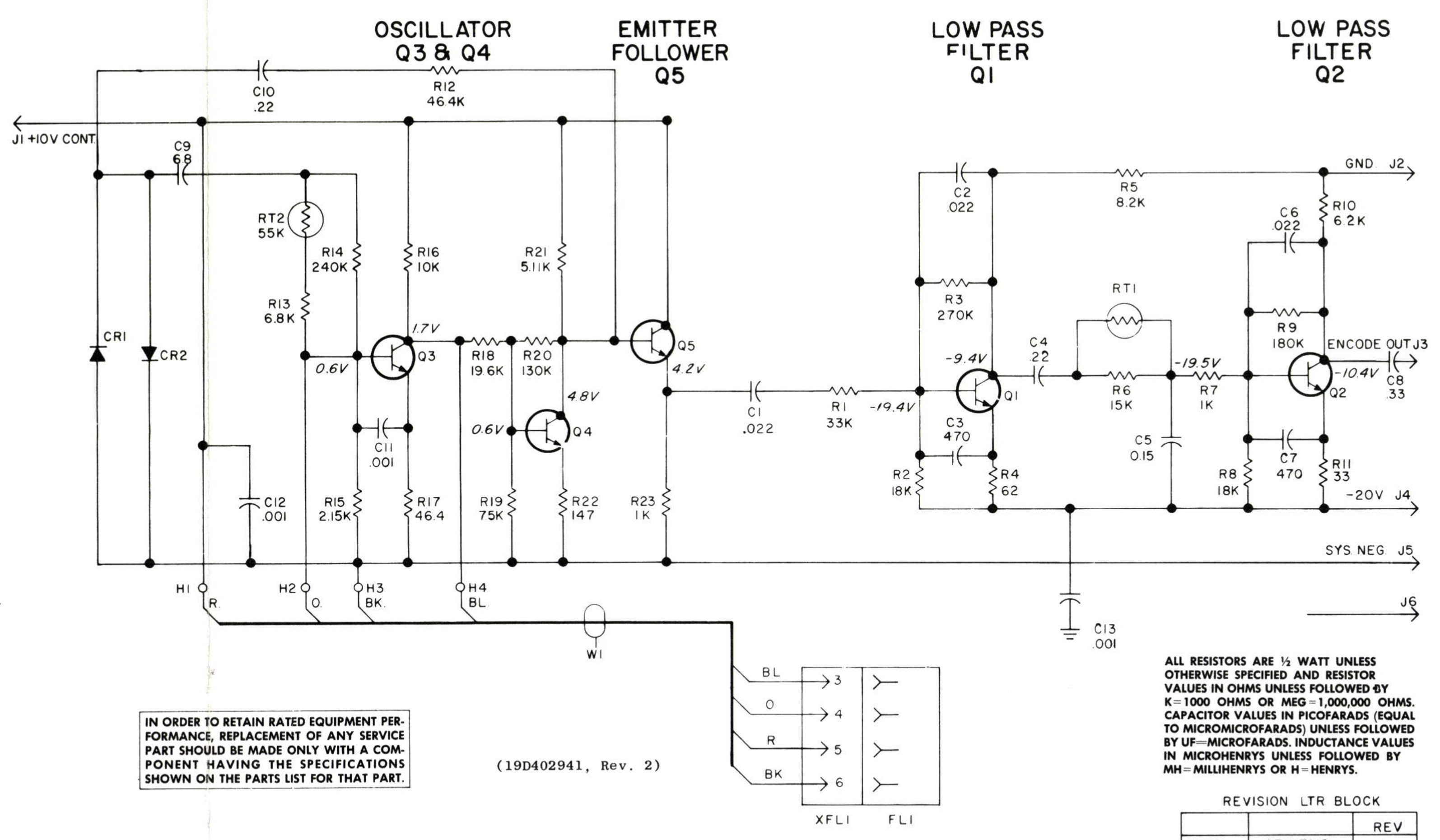
FOR READINGS OF:	USE SCALE:
1-100Ω	X 1
100-1KΩ	X 10
1K-50KΩ	X 1,000
50K-∞Ω	X 100,000

READINGS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND												
PIN	1	2	3	4	5	6	7	8	9	10	11	12
XV101	20K	0	46K	1Ω	0	0	32K	46K	0			
XV102	1	0	19K	19K	19K	0	24K	0	0	55K	24K	0
XV103	0	∞	2K/6K *	0	0	1Ω	12.5K	2K/6K *	0	∞	2K/6K *	

* READING DEPENDS ON METER POLARITY.

CHANNEL GUARD ENCODER MODEL 4EH17A10

SCHEMATIC DIAGRAM



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19D402941, Rev. 2)

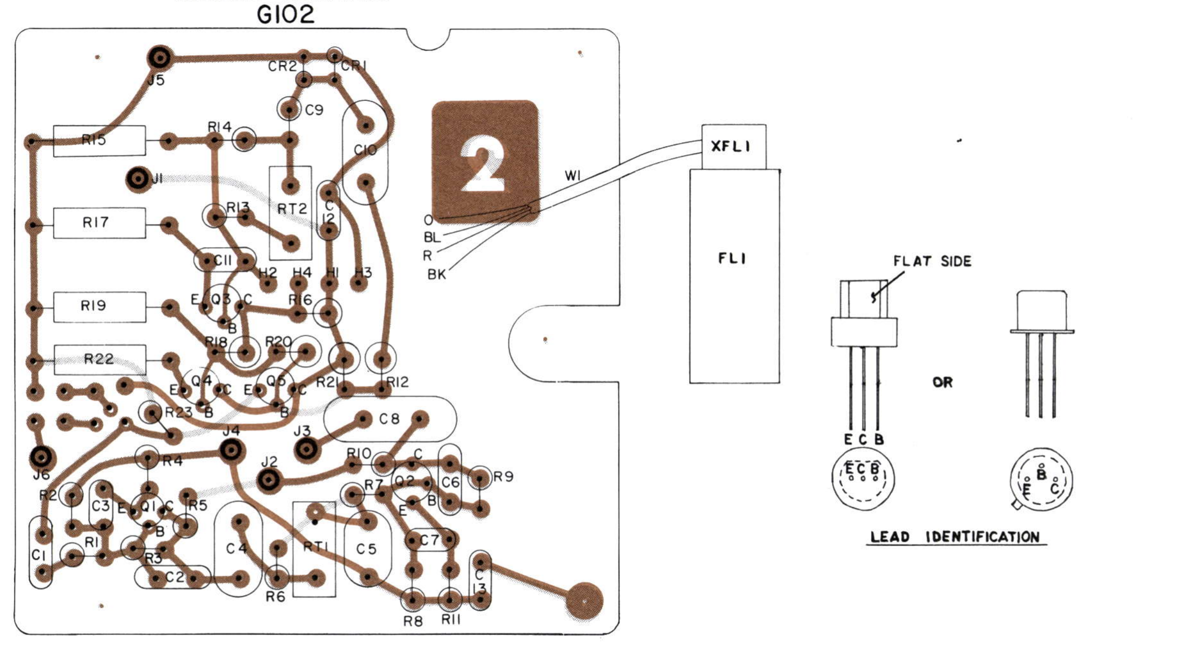
ALL RESISTORS ARE ½ WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

REVISION LTR BLOCK

		REV
G102	4EH17A10	A

OUTLINE DIAGRAM

ENCODER
MODEL 4EH17A10
G102



(19C311861, Rev. 3)
(19C311800, Sh. 1, Rev. 2)
(19C311800, Sh. 2, Rev. 2)

(19B621406, Rev. 3)

READING ARE TYPICAL VOLTAGES MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH THE TRANSMITTER KEYED. PA PLATE VOLTAGES WILL VARY AS SHOWN IN THE FOLLOWING CHART DUE TO THE DIFFERENT POWER SUPPLIES USED AND THE LOADING LIMITATIONS OF DIFFERENT SERVICES.

PA PLATE VOLTAGE		PA INPUT	RATED OUTPUT	APPLICATION	POWER SUPPLY USED
ET-59-G	ET-60-G				
290 VDC		60 WATTS	20 WATTS	P.A. EXCITER OR CLASS A, C B STATION OR MOBILE	4EP37B10 4EP38A12
420 VDC		90 WATTS	30 WATTS	12-VOLT MOBILE	4EP37B10
				28-VOLT MOBILE	4EP37D10
	520VDC	120 WATTS	40 WATTS	MOBILE	4EP37A10
	485 VDC	120 WATTS	40 WATTS	STATION	4EP38A12
	645 VDC	160 WATTS	60 WATTS	MOBILE	4EP37A10
		155 WATTS	60 WATTS	STATION	4EP38A12

READINGS SHOWN ON Q1 AND Q2 ON G101/G102 WERE MEASURED IN A NEGATIVE GROUND SYSTEM. FOR POSITIVE GROUND SYSTEMS, MEASURE Q1 AND Q2 READINGS TO J5 (SYSTEM NEGATIVE) ON G101/G102.

● USED WITH 470-494 MHZ UNITS ONLY.
▲ USED WITH 494-512 MHZ UNITS ONLY.
■ USED WITH CHAN. GD. UNITS ONLY.

NOTES

1. R101 USED IN 4ET59G MODELS ONLY. R101 IS REPLACED WITH DA WIRE ON 4ET60G MODELS.
2. ALL 22R WIRES ARE A4036780P3.
3. BEND TERMINAL BACK DOWN AGAINST SOCKET SADDLE, AND PRESS IT TIGHTLY AGAINST SADDLE WHILE SOLDERING.
4. PART OF CABLE 19B205480G2
5. ALL WIRES N22 EXCEPT AS OTHERWISE SHOWN.
6. R123 USED IN 4ET60G MODELS ONLY, R123 IS REPLACED WITH R126 ON 4ET59G MODELS.
7. CONNECTED TO PIN 6 ON MODELS 36 & 37. CONNECTED TO PIN 14 ON MODELS 40 & 41.
8. FOR CHANNEL GUARD ON F1 ONLY MOVE W-R WIRE FROM J101-6 TO J101-14.

SYM NO.	PARTS LIST	REV
	PL19E500865G3	
	PL19E500865G4	
A114	PL19D402884G2	
A116	PL19D402884G4	
A118	PL19D402884G6	
A120	PL19D402884G8	

MODEL NO			FREQ. RANGE (IN MHZ)	NO. OF FREQ	CHAN GD
30 WATT	60 WATT				
4ET59G30	4ET60G30		470-494 MHZ	1	
4ET59G31	4ET60G31		494-512 MHZ	1	
4ET59G34	4ET60G34		470-494 MHZ	4	
4ET59G35	4ET60G35		494-512 MHZ	4	
4ET59G36	4ET60G36		470-494 MHZ	1	X
4ET59G37	4ET60G37		494-512 MHZ	1	X
4ET59G40	4ET60G40		470-494 MHZ	4	X
4ET59G41	4ET60G41		494-512 MHZ	4	X

SCHEMATIC DIAGRAM

470—512 MHz, 30 & 60-WATT TRANSMITTER
MODELS 4ET59G30-41 & 4ET60G30-41

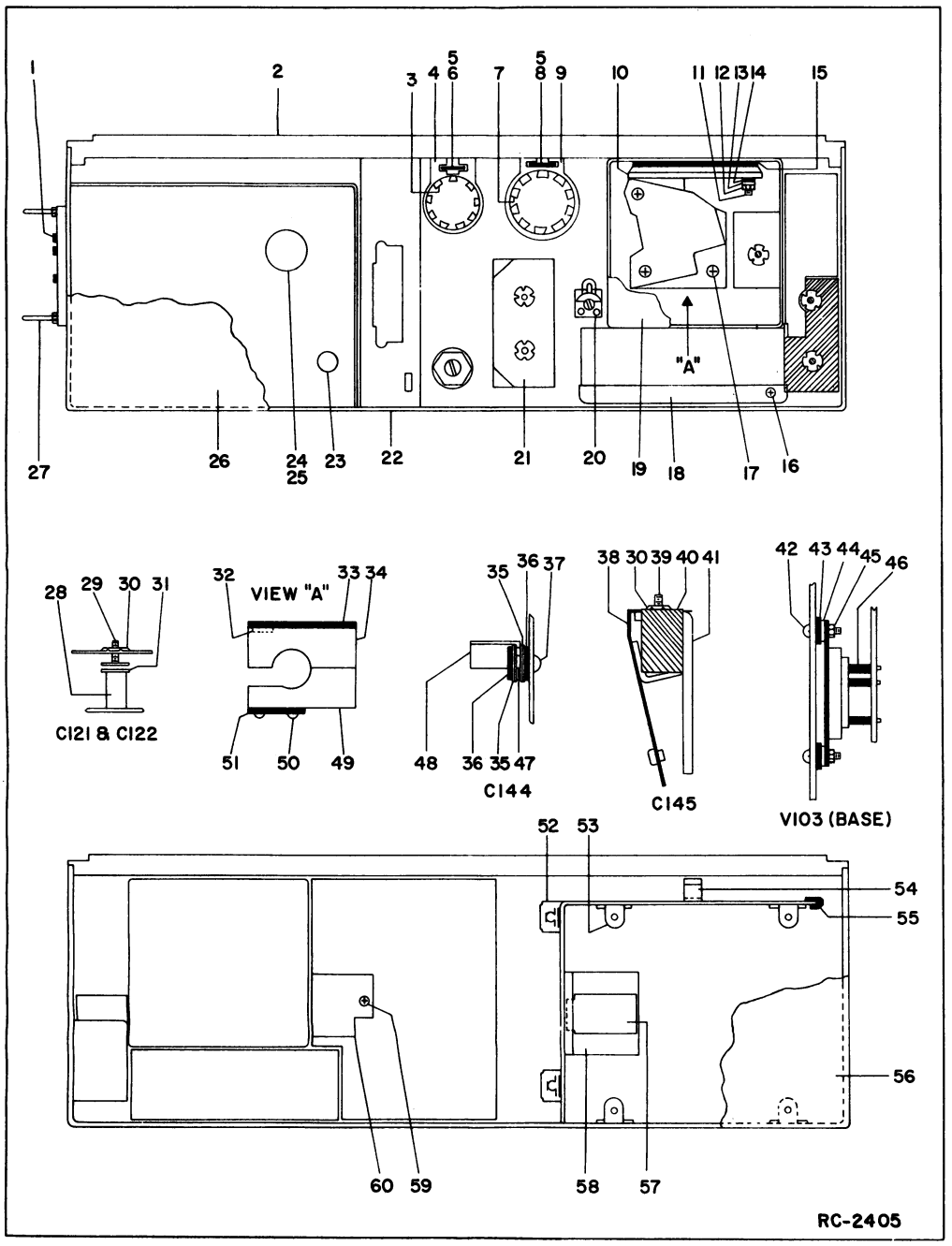
PARTS LIST

LBI-4429

470-512 MHz TRANSMITTER
MODELS 4ET59G30-41
MODELS 4ET60G30-41

SYMBOL	GE PART NO.	DESCRIPTION
A114, A116, A118, A120		EXCITER BOARD A114 19D402884G2 1 FREQ A116 19D402884G4 4 FREQ A118 19D402884G6 1 FREQ CHANNEL GUARD A120 19D402884G8 4 FREQ CHANNEL GUARD
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P3	Polyester: .022 µf ±20%, 50 VDCW.
C2	19A116080P4	Polyester: .033 µf ±20%, 50 VDCW.
C3	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C4	7491395P114	Ceramic disc: .0022 pf ±10%, 500 VDCW; sim to RMC Type JL.
C5	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C6	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C7	7491395P111	Ceramic disc: 1500 pf ±10%, 500 VDCW; sim to RMC Type JL.
C8 and C9	7491395P109	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JL.
C10	5496219P359	Ceramic disc: 68 pf ±5%, 500 VDCW, temp coef -150 PPM.
C11	5493366P100J	Mica: 100 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C14	593366P180K	Mica: 180 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C15	5491601P24	Phenolic: 1.8 pf ±10%, 500 VDCW.
C16	5493366P100J	Mica: 100 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C18	5496219P561	Ceramic disc: 82 pf ±5%, 500 VDCW, temp coef -330 PPM.
C19	•5494481P129	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C20	5494481P128	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C21	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C23	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C25 and C26	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C27	5496219P440	Ceramic disc: 9.0 pf ±5%, 500 VDCW, temp coef -220 PPM.
C29	5491601P35	Phenolic: 0.15 pf ±10%, 500 VDCW.
C30	5493366P330K	Mica: 330 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C31	5496219P241	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C33	5496219P51	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C34	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C35	5496219P35	Ceramic disc: 4.0 pf ±5%, 500 VDCW, temp coef 0 PPM.
C36	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C37	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C38	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C40 thru C42	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C43	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C44	19A115414P13	Polyester: 0.1 µf ±20%, 200 VDCW.
C45	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115331P1	Silicon.
CR3 thru CR6	19A115250P1	Silicon.
CV1	5495769P8	Silicon, capacitive.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J17	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B204526G2	Coil. Includes tuning slug 5491798P2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q3	19A115330P1	Silicon, NPN.
Q4 and Q5	19A115328P1	Silicon, NPN.
Q6	19A115329P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P334K	Composition: 0.33 megohm ±10%, 1/2 w.
R2	3R77P105K	Composition: 1 megohm ±10%, 1/2 w.
R3	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R4	3R77P224K	Composition: 0.22 megohm ±10%, 1/2 w.
R5	3R77P334K	Composition: 0.33 megohm ±10%, 1/2 w.
R6	3R77P684K	Composition: 0.68 megohm ±10%, 1/2 w.
R7	3R77P334K	Composition: 0.33 megohm ±10%, 1/2 w.
R8	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R9	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
R10	3R77P753J	Composition: 75,000 ohms ±5%, 1/2 w.
R11	3R77P274K	Composition: 0.27 megohm ±10%, 1/2 w.
R12	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R13	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R14	3R77P563K	Composition: 56,000 ohms ±10%, 1/2 w.
R15 and R16	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R17	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R18	3R77P433J	Composition: 43,000 ohms ±5%, 1/2 w.
R19	3R77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R20	3R77P162J	Composition: 1600 ohms ±5%, 1/2 w.
R21	3R77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R22	3R77P162J	Composition: 1600 ohms ±5%, 1/2 w.
R23	3R77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R24	3R77P162J	Composition: 1600 ohms ±5%, 1/2 w.
R25	3R77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R26	3R77P162J	Composition: 1600 ohms ±5%, 1/2 w.
R27	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R28	3R77P272K	Composition: 2700 ohms ±10%, 1/2 w.
R29	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R30	3R77P392K	Composition: 3900 ohms ±10%, 1/2 w.
R31	3R77P750J	Composition: 75 ohms ±5%, 1/2 w.
R32	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R33	3R77P620J	Composition: 62 ohms ±5%, 1/2 w.
R34	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R35	3R77P470K	Composition: 47 ohms ±10%, 1/2 w.
R36	3R77P270K	Composition: 27 ohms ±10%, 1/2 w.
R37	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
R38	3R77P363J	Composition: 36,000 ohms ±5%, 1/2 w.
R39	19A116278P474	Metal film: 0.576 megohm ±2%, 1/2 w.
R40	3R77P151K	Composition: 150 ohms ±10%, 1/2 w.
R41	3R77P470K	Composition: 47 ohms ±10%, 1/2 w.
R42	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R43	3R77P364J	Composition: 0.36 megohm ±5%, 1/2 w.
R44	3R77P184K	Composition: 0.18 megohm ±10%, 1/2 w.
		- - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19B204534G1	Coil. Includes tuning slug 5491798P4.
T2	19B204531G2	Coil. Includes tuning slug 5491798P4.
T3	19B204535G1	Coil. Includes tuning slug 5491798P4.
T4	19B204535G2	Coil. Includes tuning slug 5491798P4.
T5	19B204537G1	Coil. Includes tuning slug 5491798P4.
T6	19B216035G1	Coil. Includes tuning slug 5491798P4.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY1 thru XY4	19B216043G1	Socket: 6 contacts.
		OSCILLATORS
		When reordering, specify ICOM Frequency. ICOM Frequency = operating frequency ÷ 36.
Y1 thru Y4	4EG25A10	Integrated Circuit Oscillator Module (ICOM).
	19D413070P1	Cap, decorative.
		CHASSIS 19E500865G3 470-494 MHz 19E500865G4 494-512 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C101	5494481P12	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C104	5491271P6	Variable: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C105	5494481P12	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C106	19B209204P1	Ceramic disc: 220 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C107	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C108	7489162P4	Silver mica: 8 pf ±0.5 pf, 500 VDCW; sim to Electro Motive Type DM-15.
C109	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C110	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C111	19B209204P1	Ceramic disc: 220 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C113	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C115	19B209372P1	Variable: approx 2.3 to 24.3 pf; sim to EF Johnson Type V 193-0008-010.
C116	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C120	5496218P8	Ceramic disc: 8.0 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C121 and C122		Refer to Mechanical Parts (RC-2405), items 28 thru 31.
C123	5496218P7	Ceramic disc: 7.0 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C126	7489162P1	Silver mica: 5 pf ±0.5 pf, 500 VDCW; sim to Electro Motive Type DM-15.
C127	5494481P12	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C128	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C130	5490272P17	Variable: 2 to 7.83 pf, 1250 v peak; sim to Johnson Type M.
C132	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C135	19B209369P1	Mica: 2500 pf ±20%, 400 VDCW; sim to EF Johnson 124-113-18.
C136	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C138	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C140	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C142	7485975P17	Ceramic, feed-thru: 470 pf ±20%, 750 VDCW; sim to Erie Style 327.
C143		Refer to Mechanical Parts (RC-2405), items 10, and 15.
C144		Refer to Mechanical Parts (RC-2405), items 37, 47 and 48.
C145		Refer to Mechanical Parts (RC-2405), items 30, 38, 39, 40 and 41.
C147	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C148 and C149	5494481P12	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C150 thru C156	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C157	19B209282P1	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW; sim to Sprague Type 544C.
C158 and C159	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR101	4037822P1	Silicon.
CV101	19A115809P1	Silicon, capacitive.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	19B200535P3	Feed-thru: sim to Sealectro ST-1500SL-C3.
E2	4029309P1	Feed-thru: sim to Sealectro FT-SM-27.
E3	4036032P5	Feed-thru: sim to Sealectro FT-SM-10.
E7	4034512P2	Feed-thru: sim to Sealectro FT-SM-22-TUR.
		- - - - - - - - - - FILTERS - - - - - - - - - -
		BANDPASS FILTER
		NOTE: The bandpass filters are factory tuned. If a filter component (except as shown below) is found to be defective, it is recommended that the entire filter assembly be replaced to maintain rated power output and spurious attenuation.
FL103	19C303559G3	470-494 MHz.
FL104	19C303559G4	494-512 MHz.
G101		LOW PASS FILTER 19C311802G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P103	Polyester: 0.022 µf ±20%, 50 VDCW.
C2	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C3	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C5	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19A116080P3	Polyester: .022 µf ±20%, 50 VDCW.
C7	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8	19B209243P14	Polyester: 0.33 µf ±20%, 250 VDCW.
C13	5494481P111	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J6	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q6	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R2	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R3	3R77P274K	Composition: 0.27 megohm ±10%, 1/2 w.
R4	3R77P620J	Composition: 62 ohms ±5%, 1/2 w.
R5	3R77P822K	Composition: 8200 ohms ±10%, 1/2 w.
R6	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R7	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R8	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R9	3R77P184K	Composition: 0.18 megohm ±10%, 1/2 w.
R10	3R77P622J	Composition: 6200 ohms ±5%, 1/2 w.
R11	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R24	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R25	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R26	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R27	3R77P512K	Composition: 5100 ohms ±10%, 1/2 w.
		- - - - - - - - - - THERMISTORS - - - - - - - -
RT1	5490828P30	Rod: 0.33 megohm ±10% res, 1 w max; sim to Globar Type 783H-3.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J101	19C303426G1	Connector: 20 pin contacts.
J102	19B205689G1	Connector: 18 electrical contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L101	7488079P35	Choke, RF: 2.2 µh ±10%, 0.5 ohm DC res max; sim to Jeffers 4412-9K.
L103	19A122524G1	Coil.
L105	7488079P33	Choke, RF: 1 µh ±10%, 0.15 ohm DC res max; sim to Jeffers 4412-5K.
L108	19B205615P1	Coil.
L109	19B205615P3	Coil.
L113	19B205614P3	Coil.
L115		Not replaceable.
L116	4036032P5	Terminal, feed-thru: sim to Sealectro FT-SM-10.
L117	7772834P7	Choke, RF: 0.2 µh ±10%, .034 ohm ±15% DC res, 320 to 520 MHz freq range; sim to Ohmite Z-460.
L120		Refer to Mechanical Parts (RC-2405), items 32, 33, 34, 49, 50 and 51.
L122	7772834P7	Choke, RF: 0.2 µh ±10%, .034 ohm ±15% DC res, 320 to 520 MHz freq range; sim to Ohmite Z-460.
L124	19A121390P1	Coil.
L125 and L126	19B205616P1	Coil.
L128	19B204658P1	Grid line.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P101	4029840P2	Contact, electrical: sim to AMP 42827-2.
P102	4029840P1	Contact, electrical: sim to AMP 41854.
P103 thru P106	4029840P2	Contact, electrical: sim to AMP 42827-2.
P109 thru P111	4029840P2	Contact, electrical: sim to AMP 42827-2.
P113	4029840P2	Contact, electrical: sim to AMP 42827-2.
P114	4029840P1	Contact, electrical: sim to AMP 41854.
P115 thru P117	4029840P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R101	19A115416P1	Precision, wirewound: 0.91 ohm ±1%, 2 w; sim to Dale Type RS-2B.
R102	19A115416P3	Precision, wirewound: 2.59 ohms ±1%, 2 w; sim to Dale Type RS-2B.
R103	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
R104	5493035P11	Wirewound: 40 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
R105	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R106	3R77P431J	Composition: 430 ohms ±5%, 1/2 w.
R107	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R108	3R77P683J	Composition: 68,000 ohms ±5%, 1/2 w.
R109	3R79P273K	Composition: 27,000 ohms ±10%, 2 w.
R112	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R113	3R77P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R114	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R115	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R117	3R149P223J	Composition: 22,000 ohms ±5%, 4 w.
R118	3R78P473K	Composition: 47,000 ohms ±10%, 1 w.
R120	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R123	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R124	19B209381P1	Variable, composition: 10,000 ohms ±20%, 3 w; sim to Allen-Bradley Type K.
R125	3R149P153K	Composition: 15,000 ohms ±10%, 4 w.
R126	3R79P562K	Composition: 5600 ohms ±10%, 2 w.
R129	3R78P391J	Composition: 390 ohms ±5%, 1 w.
R130	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S101	4031922P1	Pushbutton: SPST, normally open, 1/2 amp at 12 VDC; sim to Stackpole Type SS-15.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P9	Phen: 5 terminals.
TB6	7775500P10	Phen: 4 terminals.
TB9	7487424P1	Miniature, phen: 1 terminal.
TB10	7487424P2	Miniature, phen: 1 terminal.
		- - - - - - - - - - - TUBES - - - - - - - - - -
V101		Type 8106.
V102		Type 8156.
V103		Type 8072.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XV101	7480532P8	Tube, phen: 9 pins; sim to Elco 04-903-84.
XV102	19C301007P5	Tube, plastic: 12 pins; sim to Alcon Metal Products 371G.
XV103	19B209160P1	Tube, plastic: 11 pins; sim to EF Johnson 124-311-100.
		- - - - - - - - - TUNED CIRCUITS - - - - - - -
Z102	19B204543G1	Coil. Includes tuning slug 5491798P4.
C1	5496203P468	Capacitor, ceramic disc: 510 pf ±5%, 500 VDCW, temp coef -5600 PPM.
		HARNESS ASSEMBLY 19E500865G5 (Includes J101, J102, P101-P106, P109-P111, P115-P117, R102, R103).
		CHANNEL GUARD MODIFICATION KIT 19A127078G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1001 thru C1004	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1001	3R77P242J	Composition: 2400 ohms ±5%, 1/2 w.
R1002	19B209358P107	Variable, carbon film: approx 75 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R1003	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1001	19C300048P8	Disc: 2500 ohms ±10%; sim to GE 4D403.
		MECHANICAL PARTS (SEE RC-2405)
1	19A115793P1	Contact, electrical: sim to Malco 2700. (Used with pins 1, 3, 4, 19 and 20 on J101).
2	19C311152P1	Heat sink.
3	7165167P5	Insert, tube shield: sim to Atlas Insert 106-332-5. (Used with V101).
4	19B204570P3	Heat sink. (Used with V101).
5	19A115332P1	Tap screw: No. 6-32 x 3/8. (Secures V101, V102 heat sinks).
6	19A122497P1	Support. (Used with V101).
7	7165167P9	Insert, tube shield: sim to Atlas Insert 106-332-21. (Used with V102).
8	19A122497P2	Support. (Used with V102).
9	19A122498P1	Heat sink. (Used with V102).
10	19C311166P2	Base line. (Part of C143).
11	N170P13010P	Cap screw: No. 6-32 x 5/8. (Used with Base line).
12	N210P13C13	Hex nut: No. 6-32. (Used with Base line).
13	19A115729P1	Flatwasher: No. 6. (Used with Base line).
14	19A115730P1	Bushing, insulated. (Used with Base line).
15	19A121350P1	Insulator. (Part of C143).
16	19B201074P205	Tap screw, Phillips Pozidriv: 4-40-5/16.
17	N80P15024C	Machine screw: No. 8-32 x 1-1/2. (Secures plate line).
18	19B204654P2	Cover.
19	19C303544P2	Cover. (Located over V103).
20	N539P108F22	Drive screw: No. 00 x 1/2. (Secures C115).
21	19C303405P2	Casting. (Consists C121, C122, and CV101).
22	19B204395G2	Chassis.
23	4036555P1	Insulator, washer: nylon. (Used with Q6 on A114-A120).
24	4034252P5	Can. (Used with T2 on A114-A120).
25	19A121688P4	Cap. (Used with T2 on A114-A120).
26	19C303396G1	Mobile Top Cover.
	19C303495G8	Station Top Cover. (Except Repeaters and VM).
	19C303673G3	Station Top Cover. (Repeaters and VM only).
27	19A121676P1	Guide pin: No. 4-40 thread. (Used with J101).
28	4036899P4	Insulator standoff: sim to Central Lab 3BX3778C. (Part of C121 and C122).
29	4036765G4	Screw. (Part of C121 and C122).
30	7137968P8	Stop nut: thd size No. 6-32; sim to Palnut T032005. (Part of C121, C122, and C145).
31	4036765G2	Screw. (Part of C121 and C122).
32	7142162P84	Spacer: 3/8 dia.
33	19C317637P1	Plate. (Located on top of plate line item 34).
34	19D402783P3	Plate line. (Part of L120).
35	4032084P1	Washer, insulated. (Part of C144).
36	4031593P1	Washer. (Part of C144).
37	N80P9008C6	Machine screw: No. 4-40 x 1/2. (Part of C144).
38	19A122518G1	Spring. (Part of C145).
39	19A122709P1	Set screw: sim to N174P1314. (Part of C145).
40	19A122516P1	Slide. (Part of C145).
41	19A122526G1	Support. (Part of C145).
42	N80P9010C6	Machine screw: No. 4-40 x 5/16.
43	N401P8C13	Flatwasher: No. 8.
44	N404P11C6	Lockwasher: No. 4.
45	7141225P2	Hex nut: No. 4-40.
46	19A115177P1	Contact, electrical: female, cad plated bronze, accepts 0.93 pin; sim to Component Mfg Service Inc C-6. (Used with terminals 3, 8, and 11 on XV103).
47	4031594P1	Insulator. (Part of C144).
48	5491229P1	Support. (Part of C144).
49	19B219139P1	Plate line. (Part of L120).
50	19B201074P705	Tap screw, Phillips Pozidriv: No. 6-32 x 5/16. (Secures Hi Split plate to plate line item 49).
51	19B219136P1	Hi Split Plate. (Used in 494-512 MHz split).
52	4036921P1	Bracket, angle: sim to Tinnerman C17609-8A-67.
53	19B204366P1	Support.
54	4038930P1	Clip. (Mounts R104).
55	4029030P10	Rubber channel.
56	19C303396G3	Mobile Bottom Cover.
	19C303396G7	Station Bottom Cover.
57	19A121065P1	Support. (Used with Channel Guard).
58	19A121257G1	Angle. (Used with Channel Guard).
59	19B201074P304	Tap screw: Phillips Pozidriv: No. 6-32 x 1/4.
60	19A122562G1	Support. (Used with L108, L109).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES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V103 (BASE)
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RC-2405

PARTS LIST

LBI-3936E

CHANNEL GUARD ENCODER G102
4EH17A10 19C311802-G2
REV A

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1*	19A116080-P103	Polyester: 0.022 µf ±10%, 50 VDCW.
		Earlier than REV A:
	19B209243-P2	Polyester: 0.015 µf ±20%, 50 VDCW.
C2	19A116080-P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C3	5494481-P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	19A116080-P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C5	19A116080-P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19A116080-P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C7	5494481-P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8	19B209243-P14	Polyester: 0.33 µf ±20%, 250 VDCW.
C9	5496267-P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C10	19A116080-P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C11 thru C13	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250-P1	Silicon.
		- - - - - - - - - TONE NETWORKS - - - - - - - -
FL1		TONE FREQUENCY NETWORK 19B205280
	19B205280-G1	71.9 Hz
	19B205280-G2	77.0 Hz
	19B205280-G3	82.5 Hz
	19B205280-G4	88.5 Hz
	19B205280-G5	94.8 Hz
	19B205280-G6	100.0 Hz
	19B205280-G7	103.5 Hz
	19B205280-G8	107.2 Hz
	19B205280-G9	110.9 Hz
	19B205280-G10	114.8 Hz
	19B205280-G11	118.8 Hz
	19B205280-G12	123.0 Hz
	19B205280-G13	127.3 Hz
	19B205280-G14	131.8 Hz
	19B205280-G15	136.5 Hz
	19B205280-G16	141.3 Hz
	19B205280-G17	146.2 Hz
	19B205280-G18	151.4 Hz
	19B205280-G19	156.7 Hz
	19B205280-G20	162.2 Hz
	19B205280-G21	167.9 Hz
	19B205280-G22	173.8 Hz
	19B205280-G23	179.9 Hz
	19B205280-G24	186.2 Hz
	19B205280-G25	192.8 Hz
	19B205280-G26	203.5 Hz
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J6	4033513-P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q3 thru Q5	19A115362-P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R2	3R77-P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R3	3R77-P274K	Composition: 0.27 megohms ±10%, 1/2 w.
R4	3R77-P620J	Composition: 62 ohms ±5%, 1/2 w.
R5	3R77-P822K	Composition: 8200 ohms ±10%, 1/2 w.
R6	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R7	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R8	3R77-P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R9	3R77-P184K	Composition: 0.18 megohms ±10%, 1/2 w.
R10	3R77-P622J	Composition: 6200 ohms ±5%, 1/2 w.
R11	3R77-P330K	Composition: 33 ohms ±10%, 1/2 w.
R12	5495948-P365	Deposited carbon: 46,400 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R13	3R77-P682J	Composition: 6800 ohms ±5%, 1/2 w.
R14	3R77-P244J	Composition: 0.24 megohms ±5%, 1/2 w.
R15	19A116278-P233	Metal film: 2150 ohms ±2%, 1/2 w.
R16	19A116278-P301	Metal film: 10,000 ohms ±2%, 1/2 w.
R17	19A116278-P65	Metal film: 46.4 ohms ±2%, 1/2 w.
R18	19A116278-P329	Metal film: 19,600 ohms ±2%, 1/2 w.
R19	19A116278-P285	Metal film: 7500 ohms ±2%, 1/2 w.
R20	19A116278-P412	Metal film: 130,000 ohms ±2%, 1/2 w.
R21	19A116278-P269	Metal film: 5110 ohms ±2%, 1/2 w.
R22	19A116278-P117	Metal film: 147 ohms ±2%, 1/2 w.
R23	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
		- - - - - - - - - THERMISTORS - - - - - - - -
RT1	5490828-P30	Thermistor: 330,000 ohms ±10%, color code black and gray; sim to Globar Type 783H-3.
RT2	5490828-P36	Thermistor: 55,000 ohms ±10%, color code black and red; sim to Globar Type 723B.
		- - - - - - - - - - - CABLES - - - - - - - - -
W1		(Part of XFL1).
		- - - - - - - - - - - SOCKETS - - - - - - - - -
XFL1	19A121920-G3	Reed, mica-filled phen: 7 pins rated at 1 amp at 500 VRMS with 4-1/4 inches of cable.
		ENCODER INSTALLATION KIT 19A127174-G1
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	N404P13C13	Lockwasher, no. 6.
	N80P13005C13	Machine screw, no. 6-32 x 5/16.
	19B201074-P304	Tap screw, no. 6-32 x 1/4.
	N210P13C13	Nut, no. 6-32.
	19B205480-G2	Harness. Includes:
P130 thru P135	4029840-P2	Contact, electrical; sim to Amp 42827-2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-4430

DF-3136

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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