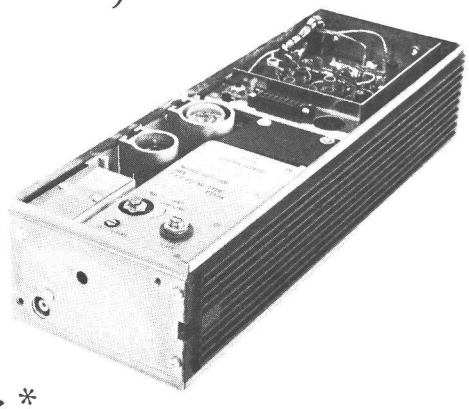
MOBILE RADIO

MASTR Progress Line

132—174 MHz, 80-WATT TRANSMITTER MODEL 4ET58C30—41 (ICOM OPTIONS 7301—7316)



SPECIFICATIONS *

FCC Filing Designation: **ET-58-C (Narrow Band)**

Frequency Range:	132—174 MHz
Power Output:	80 watts minimum
Crystal Multiplication Factor:	12
Frequency Stability:	±0.0002% (-30°C to +60°C)
Spurious & Harmonic Radiation:	At least 85 dB below rated power output
Modulation:	Adjustable from 0 to ±5 kHz (Narrow Band) swing with instantaneous modulation limiting
Audio Frequency Characteristics:	Within +1 dB to -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA
Distortion:	Less than 5%
Deviation Symmetry:	0.5 kHz maximum
Tubes & Transistors:	80-watt Transmitter with no Options: 3 tubes 6 transistors 4 diodes
Maximum Frequency Spacing	0.4%
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.

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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 Transmitter Type ET-58-C is a crystal-controlled, phase-modulated transmitter designed for one-,two-, or four-frequency operation within the 132-174 megahertz band. The transmitter consists of the following modules:

- Transistorized Exciter Board, with audio, oscillator, modulator, amplifier and multiplier stages,
- Integrated Circuit Oscillator Module (ICOM),
- Tubed multipliers and power amplifier stages,
- Optional transistorized Channel Guard Board.

All input leads to the transmitter are individually filtered by the 20-pin feed-through by-pass connector J101. The output passes through a four-section, low-pass filter that features good shielding between sections, and Teflon® capacitors for fail-free operation with an open or shorted antenna.

CIRCUIT ANALYSIS

Eight silicon transistors and only three tubes are used in the transmitter. The frequency of the plug-in ICOM modules ranges from 11 to 14.5 megahertz, and the crystal frequency is multiplied twelve times.

A centralized metering jack (J102) is provided for use with General Electric Test Set 4EX3A10 or 4EX8K10, 11. 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 receiver 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 voltage
- Pin 4 — +300 volts MULT B+
- Pin 5 — +650 volts PA B+
- Pin 8 — -45 volts bias

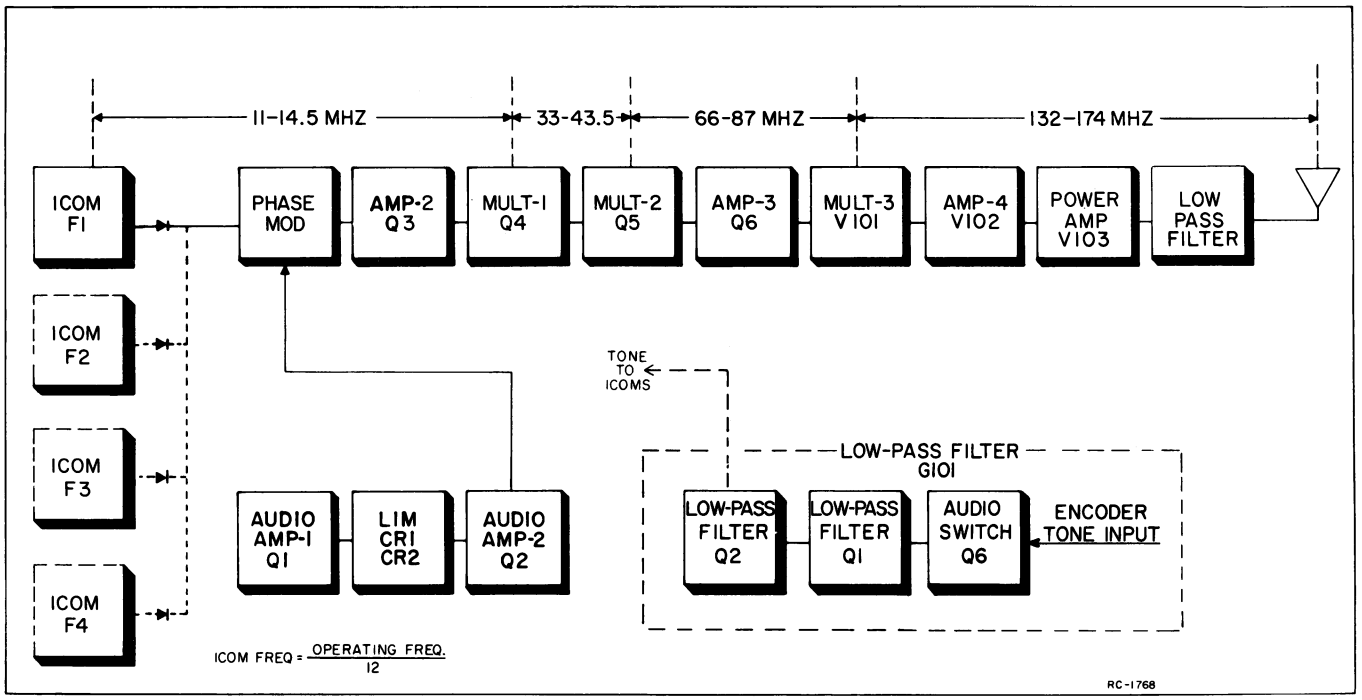


Figure 1 - Transmitter Block Diagram

- Pin 14 -- +10 volts for Channel Guard option
- Pin 15 -- -20 volts for Exciter Board and ICOM module

ICOM MODULE

ICOM module Model 4EG25A11 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 ±0.0002%.

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.

For transmitters equipped with Channel Guard, tone from the encoder 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/L2. 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 450-470 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 (Z101/Z102) of beam pentode V101. This stage operates as a doubler with the plate tank tuned to twelve times the crystal frequency. The plate tank is tuned by C106.

The grid of V101 is metered through metering resistor R102 at J102-4. R101 drops the bias voltage to approximately -18 volts to protect V101 against loss of drive. Plate voltage is supplied through L101.

When measuring grid current to V101, there will be a residual reading of approximately 0.18 volts without any drive. This is caused by the presence of fixed bias voltage to the grid of the tube.

AMPLIFIER 4

The output of the MULT-3 stage is coupled to the grid of the compactron beam power amplifier (V102) by a pi-network consisting of C106, L102/L103 and C107. The grid is metered at J102-5 through metering resistor R106. Bias voltage is supplied through R105 and L114.

When measuring the grid voltage, there will be a residual reading of approximately 0.45 volt without any drive to the stage. Neutralization is provided by C121. The plate tank is series-tuned by C111.

POWER AMPLIFIER

Drive from 4th amplifier V102 is inductively coupled to the grid of power amplifier V103 through L104/L105 and L106/L107. For large changes in frequency (over ±0.2%), the physical spacing between the two coils must be adjusted by bending L104/L105. The coil should be adjusted for maximum coupling for the high end of the frequency range, and for minimum coupling for the low end of the frequency range.

The PA grid is metered at J102-6 through metering resistors R3 and R5. Bias voltage is applied to the control grids through R3 and R4.

Power amplifier V103 is a dual tetrode operating in a push-pull circuit. The PA plate is parallel-tuned by "butterfly" capacitor C112. High B-plus is applied through L113 to a center tap on the plate tank coil, L108/L109. C113 is a mechanical high-voltage by-pass capacitor.

The screen grid dropping resistors are R7 and R8. Plate current is metered from J102-1 to J102-9 across metering resistor R108.

WARNING

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

Placing the TUNE-OPERATE switch (S102) in the OPERATE position applies 300 volts to A119-J8 and -J10. The 300 volts appearing on each side of R8 effectively shorts the resistor out of the circuit, and the screen voltage is applied through R7 for normal operation of V102. With S102 in the TUNE position, the screen voltage is applied to A119-J8 only. Now, dropping resistors R7 and R8 are in series, to reduce the screen voltage. This reduces the plate dissipation of V103 while tuning the power amplifier stage.

Antenna coupling is achieved by varying the coupling between L108/L109 and L110/L111. C114 tunes the antenna circuit.

The RF output from the antenna coil is fed to low-pass filter FL101. This filter has a low insertion loss and a harmonic attenuation of at least -50 dB through all harmonics. The filter output is fed to the antenna changeover relay located on the front of the system frame.

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 applied 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

If Channel Guard decode only is desired, disconnect the Encoder Tone Input from J6 on the low-pass filter.

Encoder Model 4EH17A10 (Optional)

In encode only combinations, 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 STANDBY 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 applies -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 hang-up bracket.

REDUCED POWER OPERATION

STATION APPLICATIONS

Station power supply Model 4EP38A10 may be modified to operate at reduced power. Select one of the modifications ("A" thru "D") shown in the chart at the bottom of the page that meets the desired power limitations.

Transmitter Alignment Procedure

Tune the transmitter according to the standard Alignment procedure, but adjust the ANT COUPLING control by one of the two following methods:

CAUTION -- Do not allow the PA PLATE reading to exceed 0.7 volts.

Method 1 - Measure the power output directly using an RF wattmeter, and adjust the ANT COUPLING control for the required power output.

Method 2 - The efficiency of the power amplifier in the modified transmitter will vary from about 47% to 60%. Use the highest anticipated efficiency (60%) and adjust the ANT COUPLING control for the following PA PLATE reading:

$$\text{"PA PLATE" reading} = \frac{3 \times \text{desired power output}}{\text{efficiency} \times \text{PA plate voltage}}$$

Follow the standard transmitter Alignment Procedure for measuring the PA PLATE voltage.

	PA POWER OUTPUT LIMIT	MODIFICATION OF POWER SUPPLY	TYPICAL PA PLATE VOLTAGE	MAX. PA PLATE POWER INPUT	MAX. EFFICIENCY
A*	65 watts	Interchange white wire at TB8-3 and green wire at H4 (on board A501).	467 VDC	109 watts	60%
B	40-58 watts	a) Remove jumper from TB8-4 to TB8-5. b) Add jumper from TB8-3 to TB8-5. c) Remove jumper from TB7-3 to TB7-4. d) Add jumper from TB7-2 to TB7-3.	415-435 VDC	101 watts	60%
C	35-40 watts	Remove fuse F502.	297-300	70 watts	60%
D	30-38 watts	a) Remove fuse F502 b) Remove jumper from TB7-3 to TB7-4. c) Add jumper from TB7-2 to TB7-3.	275-280 VDC	65 watts	60%

*Modification "A" is required for operation under Part 93 (Land Transportation Radio Services) of FCC rules. If Option 7044 is ordered, the power supply will be modified before shipment from the factory.

MOBILE APPLICATIONS

The mobile transmitter with power supply Model 4EP37A10 may be operated at reduced power (120-watt plate input limitation) as required by Part 93 (Land Transportation Radio Services) and Part 21 (Domestic Public Radio Services) of FCC rules by using the following procedure.

Power Supply Modification*

Move the jumper in the secondary of transformer T501 from T501-23 to T501-22. This modification provides a nominal plate voltage of 550 volts.

Transmitter Alignment Procedure

Tune the transmitter according to the standard Alignment Procedure for maximum power output while maintaining 120 watts input to the PA. Refer to the PA POWER INPUT instructions on the transmitter Alignment Procedure to determine the PA input.

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.

NOTE

The tube shields for the 80-watt transmitter are spring-loaded, and can be pulled off of the tube.

To remove transmitter from system frame--

1. Loosen the two retaining screws in the front casting (see Figure 2) and pull casting 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.

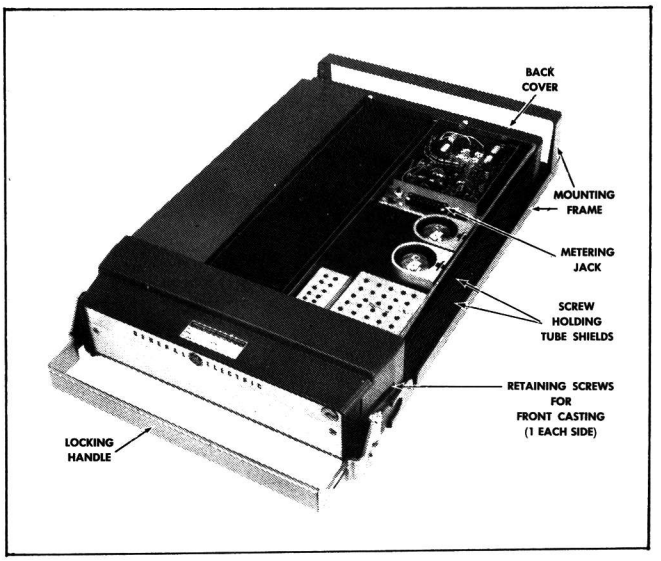


Figure 2 - Top Cover Removed

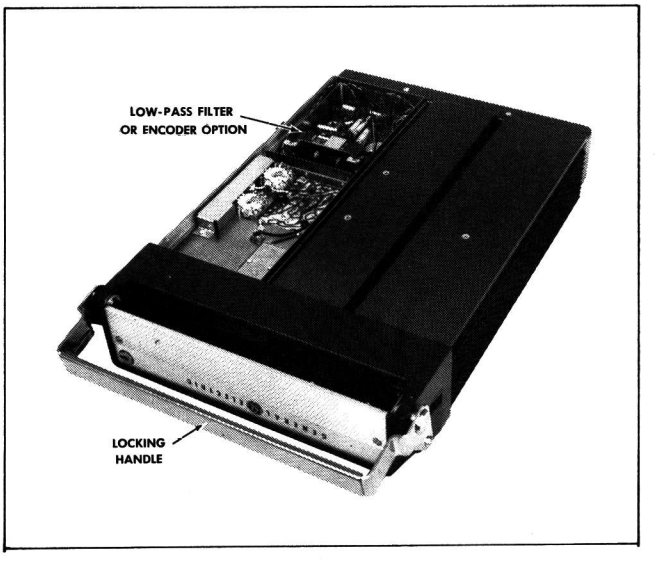


Figure 3 - Bottom Cover Removed

*If Option 7040 is ordered, the power supply will be modified before shipment from the factory.

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 intelligibility.

TEST EQUIPMENT

1. An audio oscillator Model 4EX6A10
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Models 4EX3A10 or 4EX8K10, 11

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 1.0-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 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. Then repeak L1/L2 and L3/L4 as shown in Step 1 of Transmitter Alignment Procedure. Reset tone deviation to 0.75 KHz 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 1.0 volt signal at 1000 Hz and set MOD ADJUST (R12) for 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 PLATE POWER INPUT

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

$$P_i = \frac{\text{Plate Voltage} \times \text{Plate Current Indication}}{3.0}$$

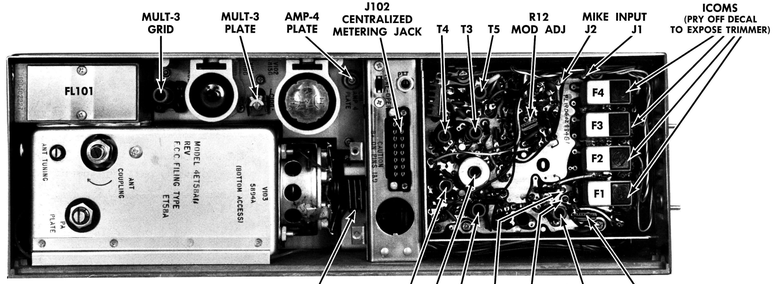
Where:

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 1 scale (or measured from J102-1 to -9 with multimeter).

3.0 is the value of the plate current metering resistor in ohms.



ICOM 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 (34°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.

NOTE

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 4). 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 132 MHz, 1 PPM is 132 Hz. At 174 MHz, 1 PPM is 174 Hz.)
2. With a transmitter operating frequency of 150 MHz, adjust the ICOM trimmer for a reading of +225 Hz (+1.5 x 150) 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.

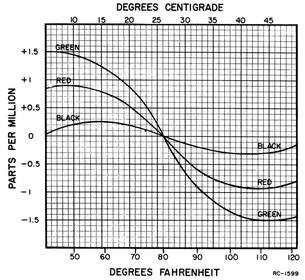


Figure 4 - ICOM Frequency Correction Curve

TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10, 4EX8K10 or 11, Station Metering Panel, or a 20,000 ohms-per-volt Multimeter with a 1-volt scale.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOM (s) (operating frequency ÷ 12) into proper socket. Do not adjust ICOM trimmer. If multi-frequency transmitter, tune transmitter on channel with the highest frequency (except for Step 12 thru 16).
2. Place the TUNE-OPERATE switch (S102) in the TUNE position.
3. Connect GE Test Set to the Transmitter Centralized Metering Jack J102. If using Multimeter, connect the positive lead to J102-16 (Ground) except for Steps 7 through 16.
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 MULT-3 GRID (Z101/Z102) at the top of the coil form.
5. All adjustments are made with the transmitter keyed.

STEP	METERING POSITION GE TEST SET	METERING POSITION Multimeter - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A (MULT-1)	Pin 10	T6 and L1/L2	0.55 v (0.4 v Minimum)	Tuning the modulator is a critical adjustment. Carefully tune T6 and L1/L2 alternately for maximum meter reading. If no peak is obtained when tuning T6, set the slug in L1/L2 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	0.65 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	0.6 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 AND POWER AMPLIFIER		
5.	D (MULT-3)	Pin 4	MULT-3 GRID (Z101/Z102)	0.6 v (0.45 v Minimum)	Tune MULT-3 GRID for maximum meter reading.
6.	E (AMPL-4)	Pin 5	MULT-3 PLATE (C106)	0.55 v (0.45 v Minimum)	Tune MULT-3 PLATE for maximum meter reading.
7.	F (PA GRID)	Pin 14(+) and Pin 6 (-)	AMPL-4 PLATE (C111) and L104/L105	1.0 v Maximum (0.65 v Minimum)	Alternately tune AMPL-4 PLATE and adjust interstage coupling (L104/L105) for maximum meter reading (not over 1 volt). NOTE: Adjusting L104/L105 may not be required if there is no change in frequency. If adjustment is required, bend the mounting leads on L104/L105 to pivot the coil.
8.					Rotate ANT COUPLING fully counterclockwise.
9.	G (PA PLATE)	WARNING: High B-plus on Pins 1 and 9. Pin 1(+) and Pin 9(-)	PA PLATE (C112)	Minimum	Carefully tune PA PLATE for minimum meter reading.
10.					Place S102 (TUNE-OPERATE) switch in OPERATE position.
11.	G (PA PLATE)	Pin 1(+) and Pin 9(-)	ANT COUPLING	Minimum	Adjust ANT COUPLING clockwise for minimum meter reading.

FOR SINGLE-FREQUENCY TRANSMITTERS

STEP	METERING POSITION GE TEST SET	METERING POSITION Multimeter - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
12.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)	PA PLATE (C112)	Minimum	Tune C112 (PA PLATE) for minimum meter reading.
13.	"	"	ANT TUNING and ANT COUPLING	0.55 v	Alternately tune ANT TUNING for maximum meter reading, and adjust ANT COUPLING clockwise for a meter reading of 0.55 volts.
14.	"	"	PA PLATE (C112)	Minimum	Retune PA PLATE for a minimum meter reading.
15.	"	"	ANT COUPLING	0.7 v	Adjust ANT COUPLING for a meter reading of 0.7 volts.
16.	F (PA GRID)	"	AMP-4 PLATE (C111)	Maximum	Retune AMP-4 PLATE for maximum meter reading.

FOR MULTI-FREQUENCY TRANSMITTERS

STEP	METERING POSITION GE TEST SET	METERING POSITION Multimeter - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
12.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)	PA PLATE (C112)	Minimum	Switch to the lowest frequency and tune PA PLATE for minimum meter reading.
13.	"	"	ANT TUNING (C114) and ANT COUPLING	0.7 v	Switch back to the highest frequency. Alternately tune ANT TUNING and adjust ANT COUPLING clockwise for a meter reading of 0.7 volts.
14.	E (AMPL-4)	Pin 5	MULT-3 PLATE (C106)	Maximum	Tune MULT-3 PLATE for maximum meter reading.
15.	F (PA GRID)	Pin 14 (+) and Pin 6 (-)	AMP-4 PLATE (C111)	Maximum	Tune AMP-4 PLATE for maximum meter reading.
16.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)		0.7 v Minimum	The PA PLATE reading should be approximately 0.7 volts on both frequencies. AMP-4 PLATE may be retuned slightly until this reading is obtained.

ALIGNMENT PROCEDURE

132—174 MHz, 80-WATT MASTR TRANSMITTER
MODELS 4ET58C30-41

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 modulation 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 #1M-21
3. Audio Generator similar to:
   - GE Model 4EX6A10 or
   - Heath #1G-72
4. Deviation Meter (with a .75 KHz scale) similar to:
   - Measurements #140
   - Lampkin #205A
5. Multipmeter similar to:

   GE METERING TEST SET MODEL 4EX3A10 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:

2. Key transmitter and check wattmeter for minimum reading of 80 watts.

SERVICE CHECK

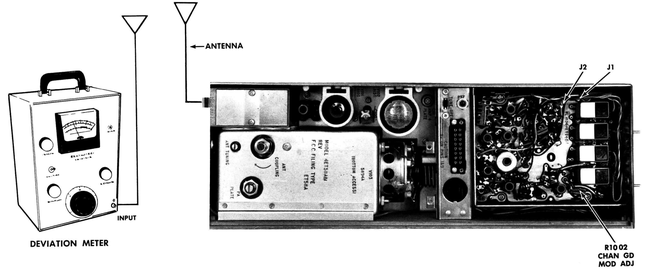
Refer to Service Hints on Transmitter Troubleshooting Procedure.

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. If reading is low or high, adjust Channel Guard MOD ADJUST (R1002) for a reading of 0.75 kHz.

NOTES:

The Channel Guard MOD ADJUST (R1002) may be adjusted for deviations up to 0.80 kHz for tone frequencies from 71.9 Hz to 82.5 Hz and deviations up to 1.0 kHz for all tone frequencies above 82.5 Hz.

1. On units supplied with Channel Guard, the Phase Modulator Tuning should be peaked carefully to insure proper performance. (Refer to Steps 1 and 2 in the Transmitter Alignment Chart).
2. The tone Deviation Test Procedures should be repeated everytime the Tone Frequency is changed.

DEVIATION METER

SERVICE CHECK

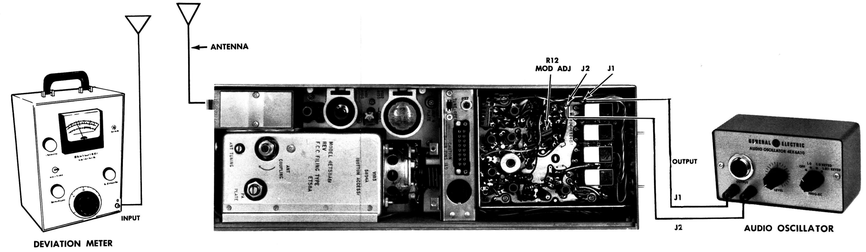
If the 0.75 kHz deviation is not obtainable when adjusting R1002, replace the tone network.

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 1.0 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.
6. Adjust "Modulation Adjust Control" R12 until deviation reads 4.5 kHz 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 deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz under the worst conditions of frequency, voltage and temperature.

If the deviation reading plus (+) and minus (-) differs by more than 0.5 kHz, 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. Voltage should be LESS than 90 millivolts.

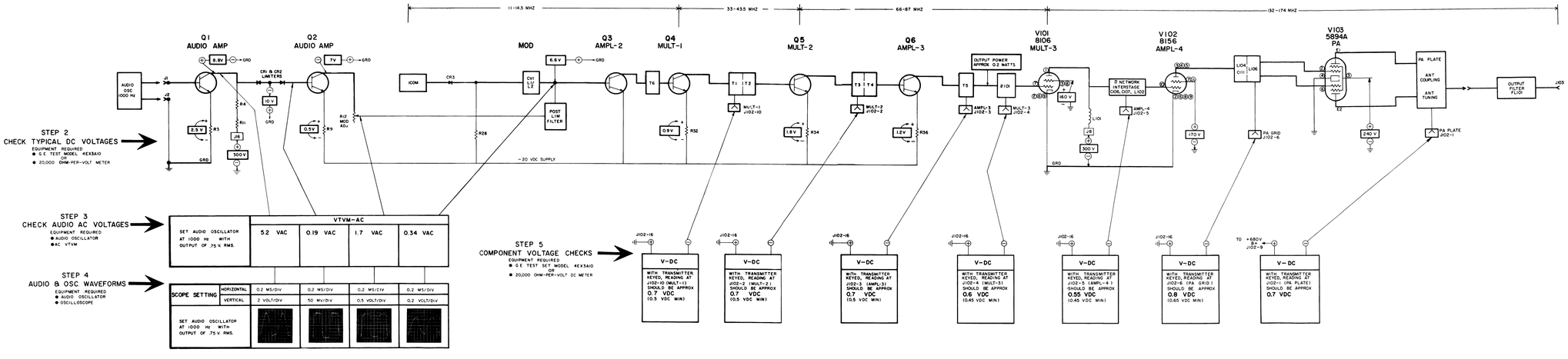
METER

STEP I - QUICK CHECKS

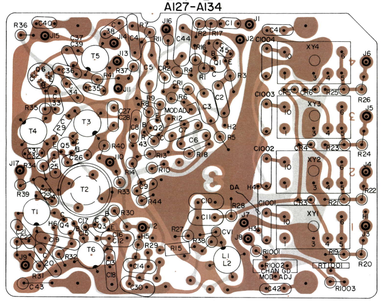
POWER OUTPUT	CHECK VOLTAGES AT CENTRALIZED METERING JACK J102 Multimeter- pin numbers GE Test Set- A-G positions							PROBABLE DEFECT
	Pins 10 & 16 A	Pins 2 & 16 B	Pins 3 & 16 C	Pins 4 & 16 D	Pins 5 & 16 E	Pins 6 & 14 F	Pins 1 & 9 G	
Low	0.8 V	0.65 V	0.6 V	0.6 V	0.55 V	Low	0.7 V	Weak 5894A or Loose Hardware in output tank circuit, or bad filter.
0	0.8 V	0.65 V	0.6 V	0.6 V	0.55 V	.37 V	0	Open 5894A
Low	0.8 V	0.65 V	0.6 V	0.6 V	0.55 V	Low	0.7 V	Weak 8156
0	0.8 V	0.65 V	0.6 V	0.6 V	.37 V	.37 V	0	Open Filament on 8156
0	0.8 V	0.65 V	Low	.18 V	.37 V	.37 V	0	Open Filament on 8106
0	0.8 V	0.65 V	0 or over 1.0 V	.18 V	.37 V	.37 V	0	Defective Q8
0	0.8 V	0 or over 1.0 V	0	.18 V	.77 V	.37 V	0	Defective Q7
0	over 1.2 V	0	0	.18 V	.37 V	.37 V	0	Shorted Q6 or Open Q5
0	0	0	0	.18 V	.37 V	.37 V	0	Defective Q3-Q6 or Modulator (see Note A)

NOTE A --- Localize trouble by checking: --

1.	-20 volt DC supply at J102-12-16.
2.	Measure 12.1 VDC across Q4 emitter resistor R31 (1500 ohms), then:
(a)	Remove crystal- a slight variation in R31 voltage reading indicates Q3 and Q4 stages operating properly.
(b)	If no voltage is measured, check keying leads CR3-CR6, Q3, Q4.
(c)	With crystal removed, short Q5 base to emitter. A voltage reading above 1.0 volt indicates Q5 and Q6 are operating properly. Defect may be in Modulator.
(d)	If modulator is defective, check voltage variable diodes CV1 and CV2.



EXCITER
A127-A134

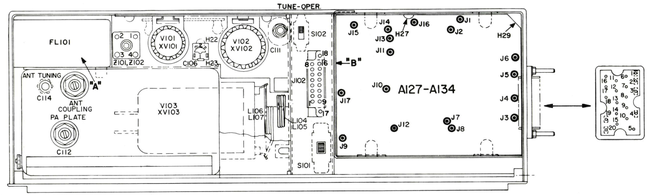


(19C311379, Sh. 1, Rev. 3)
(19C311379, Sh. 2, Rev. 3)

EXCITER READINGS TAKEN TO CHASSIS GROUND						
TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	5.8K	5.9K	140K	11K	60K	30K
Q2	9.1K	2.6K	70K	7.5K	8.7K	6.5K
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	97	45	2.2K	3.5K

TOP VIEW

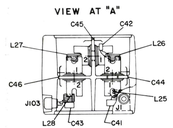


READINGS AT J101 TAKEN TO CHASSIS GROUND.

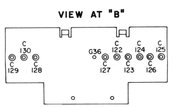
PIN	−	+
1	0	0
2	○○	○○
3	1.4Ω	1.4Ω
4	550K	500K
5	○○	○○
6	○○	○○
7	○○	○○
8	50K	50K
9	○○	○○
10	○○	○○
11	○○	○○
* 12	0/14K	0/9.5K
13	○○	○○
14	○○	○○
15	4.9K	2.7K
* 16	○○/14K	○○/9.5K
* 17	○○/16K	○○/9.5K
* 18	○○/14K	○○/9.5K
19	0	0
20	○○	○○

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

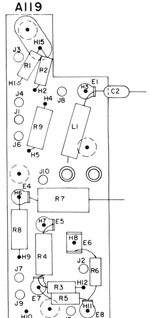
VIEW AT "A"



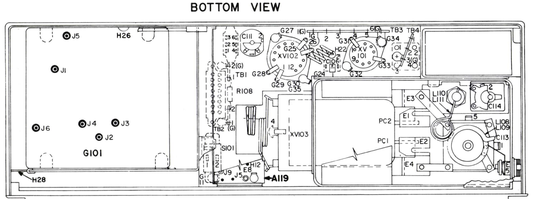
VIEW AT "B"



A119



BOTTOM VIEW



READINGS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND												
PIN	1	2	3	4	5	6	7	8	9	10	11	12
XV101	550K	0	545K	0	1.4Ω	0	30K	583K	0	60K	83K	1.4Ω
XV102	0	0	550K	550K	550K	0	83K	0	0			
XV103	1.4Ω	50K	500K	0	0.9Ω	50K	0	-				

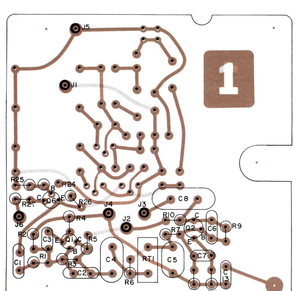
(19B621266, Rev. 4)

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.

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

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE



LOW-PASS FILTER
G101

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

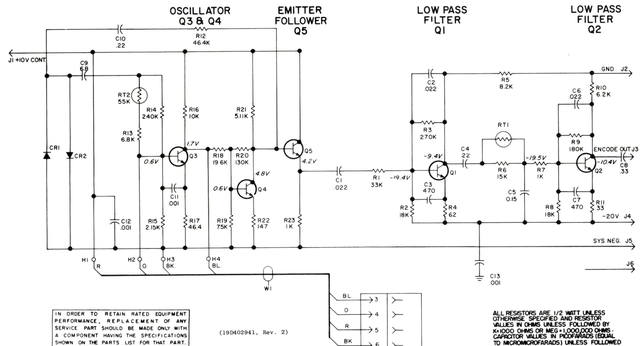
LEAD IDENTIFICATION

OUTLINE DIAGRAM

132—174 MHz, 80-WATT MASTR TRANSMITTER
MODELS 4ET58C30-41

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.

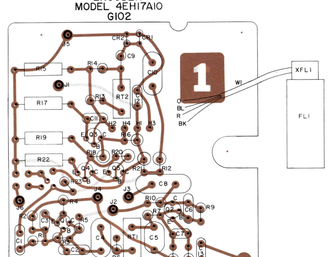
(19D402941, Rev. 2)

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED. RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY: K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY: UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

OUTLINE DIAGRAM

REVISION LTR BLOCK	
G102	4EH17A10
	REV. A

ENCODER
MODEL 4EH17A10
G102



FLAT SIDE
OR
LEAD IDENTIFICATION

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

(19R621234, Rev. 5)

NOTE:
1. ALL WIRES N22 UNLESS OTHERWISE SPECIFIED.
2. PART OF CABLE 19B205480G2
3. ALL 22-R WIRES ARE A403678P3.
4. CONNECT TO PIN 6 ON MODELS 36 & 37. CONNECT TO PIN 14 ON MODELS 40 & 41.

VOLTAGE READINGS ARE TYPICAL VOLTAGES MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT VOLTMETER, WITH TRANSMITTER KEYED.

EXCEPTION— VOLTAGES FOLLOWED BY VTVM WERE MEASURED WITH A HIGH IMPEDANCE VTVM USING A 470K SERIES RESISTOR. READINGS SHOWN ON Q1 AND Q2 ON G101/G102 WERE MEASURED IN A NEGATIVE GROUND SYSTEM. FOR POSITIVE GROUND SYSTEMS, MEASURE READINGS AT Q1 AND Q2 TO J5 ON G101/G102.

ALL RESISTORS ARE 1/2 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.

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.

MODEL NO.		FREQ. RANGE	NO. OF FREQ.	CHAN. GD.	
4ET58C30		132-150.8MHZ	1		
4ET58C31		150.8-174MHZ	1		
4ET58C34		132-150.8MHZ	4		
4ET58C35		150.8-174MHZ	4		
4ET58C36		132-150.8MHZ	1	X	
4ET58C37		150.8-174MHZ	1	X	
4ET58C40		132-150.8MHZ	4	X	
4ET58C41		150.8-174MHZ	4	X	

MC=MHZ
KC=KHZ
CPS=HZ

■ USED WITH CHAN GD ONLY
● USED WITH 132-150.8 MHZ ONLY
▲ USED WITH 150.8-174 MHZ ONLY

		REV.
	PL19E500858G1	B
	PL19E500858G2	B
A127	PL19D402884G1	
A128	PL19D402884G2	
A129	PL19D402884G3	
A130	PL19D402884G4	
A131	PL19D402884G5	
A132	PL19D402884G6	
A133	PL19D402884G7	
A134	PL19D402884G8	

SCHEMATIC DIAGRAM

132—174 MHz, 80-WATT MASTR TRANSMITTER
MODELS 4ET58C30-41

PARTS LIST

LBI-3978A

132-174 MHz TRANSMITTER
MODELS 4ET58C30-4ET58C41

SYMBOL	GE PART NO.	DESCRIPTION
A119		COMPONENT BOARD 19C303615G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C2	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - JACKS AND RECEPTACLES - - - - -
J1 thru J10	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - - INDUCTORS - - - - - - - - -
L1	7488079P34	Choke, RF: 1.5 µh ±10%, 0.28 ohm DC res; sim to Jeffers 4412-7K.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P431J	Composition: 430 ohms ±5%, 1/2 w.
R2	3R77P182K	Composition: 1800 ohms ±10%, 1/2 w.
R3	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R4	3R78P512J	Composition: 5100 ohms ±5%, 1 w.
R5	3R77P184K	Composition: 0.18 megohm ±10%, 1/2 w.
R6	3R77P182K	Composition: 1800 ohms ±10%, 1/2 w.
R7	3R79P822K	Composition: 8200 ohms ±10%, 1/2 w.
R8	3R78P473K	Composition: 47,000 ohms ±10%, 1 w.
R9	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R10	3R79P822K	Composition: 8200 ohms ±10%, 2 w.
A127 thru A134		EXCITER BOARD A127 19D402884G1 4ET58C30 A128 19D402884G2 4ET58C31 A129 19D402884G3 4ET58C32 A130 19D402884G4 4ET58C33 A131 19D402884G5 4ET58C36 A132 19D402884G6 4ET58C37 A133 19D402884G7 4ET58C40 A134 19D402884G8 4ET58C41
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C2	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C3	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C4	7491395P114	Ceramic disc: 0.0022 pf ±10%, 500 VDCW; sim to RMC Type JL.
C5	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C6	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C7	7491395P111	Ceramic disc: 1500 pf ±10%, 500 VDCW; sim to RMC Type JL.
C8 and C9	7491395P109	Ceramic disc: 1000 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.
C12	5493366P150J	Mica: 150 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C13	5496219P564	Ceramic disc: 110 pf ±5%, 500 VDCW, temp coef -330 PPM.
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.
C17	5491601P32	Phenolic: 4.7 pf ±10%, 500 VDCW.
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.
C22	5496219P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C23	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C24	5496219P257	Ceramic disc: 56 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.
C28	5496219P343	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -150 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.
C32	5496219P244	Ceramic disc: 15 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.
C39	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
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.
L2	19B204526G1	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	Comosition: 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 assembly. Includes:
	19D413071P1	Socket cavity.
	19A115834P2	Contact, electrical: sim to AMP 2-380598-2.
		OSCILLATORS
		When reordering, specify ICOM Frequency. ICOM Frequency = operating frequency ÷ 12.
Y1 thru Y4	4EG25A1	Integrated Circuit Oscillator Module (ICOM).
	19D413070P1	Cap, decorative.
		CHANNEL GUARD MODIFICATION KIT 19A127078G1 (Used with A131-A134)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1001 thru C1004	19B209243P7	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.
G101		LOW PASS FILTER 19C311802G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P103	Polyester: 0.022 µf ±10%, 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%, 50 VDCW.
C13	5494481P111	Ceramic disc: 1000 pf ±20%, 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 megohms ±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.
		- - - - - - - - - THERMISTOR - - - - - - - - -
RT1	5490828P30	Thermistor: 0.33 megohm ±10%, color code black and gray; sim to Globar Type 783-3.
		CHASSIS 19E500858G1 4ET58C30, 34, 36, 40 19E500858G2 4ET58C31, 35, 37, 41
		- - - - - - - - - CAPACITORS - - - - - - - - -
C102 and C103	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C104	5496203P446	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -5600 PPM.
C105	5494481P7	Ceramic disc: 470 pf ±20%, 500 VDCW; sim to RMC Type JF Discap.
C106	5491271P6	Variable, subminiature: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C107	5490008P107	Silver mica: 12 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C109 and C110	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C111	7481115P3	Variable: approx 2.53-12.78 pf, 1250 v peak; sim to EF Johnson 160.
C112	19B200391P2	Variable: approx 3-7 pf, 2100 v peak.
C113		Refer to Mechanical Parts (RC-1776).
C114	7491398P4	Variable: 4-17 pf; sim to Teleradio T-9974.
C115 thru C119	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C121	7130348P6	Tubular: 2 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM; sim to Jeffers JM-5/32.
C122 thru C129	5493392P7	Ceramic, feed-thru: .001 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FA5C.
C130	19B209282P1	Ceramic, feed thru: 680 pf ±20%, 1000 VDCW; sim to Sprague Type 544C.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL101*		LOW PASS FILTER ASSEMBLY 19D402233G9 The low pass filter is factory tuned. If it is found to be defective it is recommended that the entire filter assembly be replaced to maintain rated power output and spurious attenuation.
		In REV A and earlier:
FL101*		LOW PASS FILTER ASSEMBLY 19D402233G5 The low pass filter is factory tuned. If it is found to be defective it is recommended that the entire filter assembly be replaced to maintain rated power output and spurious attenuation.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J101	19C303426G1	Connector: 20 pin contacts.
J102	19B205689G1	Connector: 18 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L101	7488079P8	Choke, RF: 2.2 µh ±10%, 1 ohm DC res; sim to Jeffers 4411-12K.
L102	19B204814P1	Coil.
L103	19B204814P2	Coil.
L104	19B204364P2	Coil.
L105	19B204364P5	Coil.
L106	19B204523P1	Coil.
L107	19B204813P1	Coil.
L108	19B204718G2	Coil.
L109	19B204718G1	Coil.
L110	19B204797G2	Coil.
L111	19B204797G1	Coil.
L112	7488079P7	Choke, RF: 1.5 µh ±10%, 0.5 ohm DC res; sim to Jeffers 4411-10K.
L113	7488079P34	Choke, RF: 1.5 µh ±10%, 0.28 ohm DC res; sim to Jeffers 4412-7K.
L114	7488079P8	Choke, RF: 2.2 µh ±10%, 1 ohm DC res; sim to Jeffers 4411-12K.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P101	4029840P2	Contact, electrical; sim to Amp 42827-2.
P102	4029840P1	Contact, electrical; simto Amp 41854.
P103 thru P106	4029840P2	Contact, electrical; sim to Amp 42827-2.
P109 thru P113	4029840P2	Contact, electrical; sim to Amp 42827-2.
P114	4029840P1	Contact, electrical; sim to Amp 41854.
P115 thru P118	4029840P2	Contact, electrical; sim to Amp 42827-2.
P119	4029840P1	Contact, electrical; sim to Amp 41854.
P120 thru P122	4029840P2	Contact, electrical; sim to Amp 42827-2.
P123	4033513P17	Contact, electrical; sim to Bead Chain R125-19.
P125	4029840P1	Contact, electrical; sim to Amp 41854.
P126 thru P135	4029840P2	Contact, electrical; sim to Amp 42827-2.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R101	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R102	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R103	3R79P333K	Composition: 33,000 ohms ±10%, 2 w.
R104	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R105	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R106	3R77P184J	Composition: 0.18 megohm ±5%, 1/2 w.
R107	3R79P333K	Composition: 33,000 ohms ±10%, 2 w.
R108	19A115416P7	Precision, wirewound: 3 ohms ±1%, 2 w; sim to Dale Type RS-2B.
		- - - - - - - - - - SWITCHES - - - - - - - - -
S101	4031922P1	Push: single pole, single throw, normally open, 1/2 amp at 12 VDC; sim to Stackpole Type SS-15.
S102	19B209040P1	Slide: DPDT, 0.5 amp at 125 v; sim to Continental Wirt Type 126.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7487424P2	Miniature, phen: 1 terminal.
TB2	7487424P1	Miniature, phen: 1 terminal.
TB3	7775500P16	Phen: 6 terminals.
TB4	7487424P4	Miniature, phen: 2 terminals.
		- - - - - - - - - - - TUBES - - - - - - - - - -
V101		Type 8106.
V102		Type 8156.
V103		Type 5894A.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XV101	7480532P11	Tube, mica-filled phen: 9 pins rated at 1 amp at 500 VRMS; sim to Elco 04-902-27.
XV102	19C301007P5	Tube, plastic: 12 pins rated at 5 amps max; sim to Alcon Metal Products 371G bottom mount.
XV103	7489471P3	Tube, ceramic or steatite: 7 pins.
		- - - - - - - - - - COILS - - - - - - - - - -
Z101	19B204543G1	Coil. Includes tuning slug 5491798P4.
C1	5496203P468	Ceramic disc: 510 pf ±5%, 500 VDCW, temp coef -5600 PPM.
Z102	19B204543G2	Coil. Includes tuning slug 5491798P4.
C1	5496203P468	Ceramic disc: 510 pf ±5%, 500 VDCW, temp coef -5600 PPM.
		MECHANICAL PARTS (SEE RC-1776)
1	19C303395G4	Chassis heat sink.
2	19C303602P1	Shield. (Used with shield assembly 19A121570G1).
3	19A121571P1	Insulator.
4	19C303613G1	Tuning chassis.
5	19A121527P1	Plate.
6	7120754P1	Fiber washer. (Used with C112 and C113).
7	7165075P2	Hex nut: 3/8-32. (Used with C112).
8	7115130P9	Lockwasher. (Part of post assembly and C112).
9	19A121516P1	Insulator. (Used with C112 and C113).
10	19A121520P1	Plate. (Used with C112 and C113).
11	19C303599P1	Heat sink.
12	19A121523P1	Heat sink. (Used with V101).
13	19B205622P1	Spring. (Used with V101 and V102).
14	7165167P5	Tube shield insert. (Used with V101).
15	7165167P9	Tube shield insert. (Used with V102).
16	4031532P1	Cup washer. (Part of post assembly).
17	4031530P1	Bearing: No. 32. (Part of post assembly).
18	7893938P1	Nut: No. 32. (Part of post assembly).
19	N910P18C13	Retaining ring. (Part of post assembly).
20	4031527P2	Collar. (Part of post assembly).
21	4031531P1	Locknut: No. 32. (Part of post assembly).
22	19C303605P1	Tuning cover.
23	19B204792P1	Heat sink. (Used with V103).
24	7165167P3	Tube shield insert. (Used with V103).
25	19B204791P1	Post assembly bracket. (Used with C114).
26	19A121189P3	Post. (Part of post assembly).
27	19A121523P2	Heat sink. (Used with V102).
28	19B204395G3	Chassis.
29		(Not Used).
30		(Not Used).
31	19C303495G8	Station top cover (except Repeaters and VM).
	19C303673G3	Station top cover (Repeaters and VM only).
	19C303396G1	Mobile top cover.
32	19B204793P1	Heat sink. (Used with V103).
33	19A121529P1	Contact. (Used with V103).
34	19B204435P2	Plate line. (Used with V103).
35	19A121676P1	Pin guide: 4-40 thread. (Used with J101).
36	5493361P5	Spring washer.
37	N509P608C13	Dowel pin, spring.
38	19A122724P1	Post.
39	N402P39C13	Washer, No. 10.
40	19B204756P1	Insulator, ceramic. (Part of post assembly).
41	19B204776P1	Angle support. (Part of post assembly).
42	19A121547P1	Plate. (Part of post assembly).
43	19B204435P1	Plate line. (Used with V103).
44	4032591P26	Pad, rubber.
45	19A121257G1	Angle. (Used with FL1 and XFL1).
46	19A121065P1	Support. (Used with FL1 and XFL1).
47	19C303495G7	Station bottom cover.
	19C303396G3	Mobile bottom cover.
48	4029030P10	Channel, rubber.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

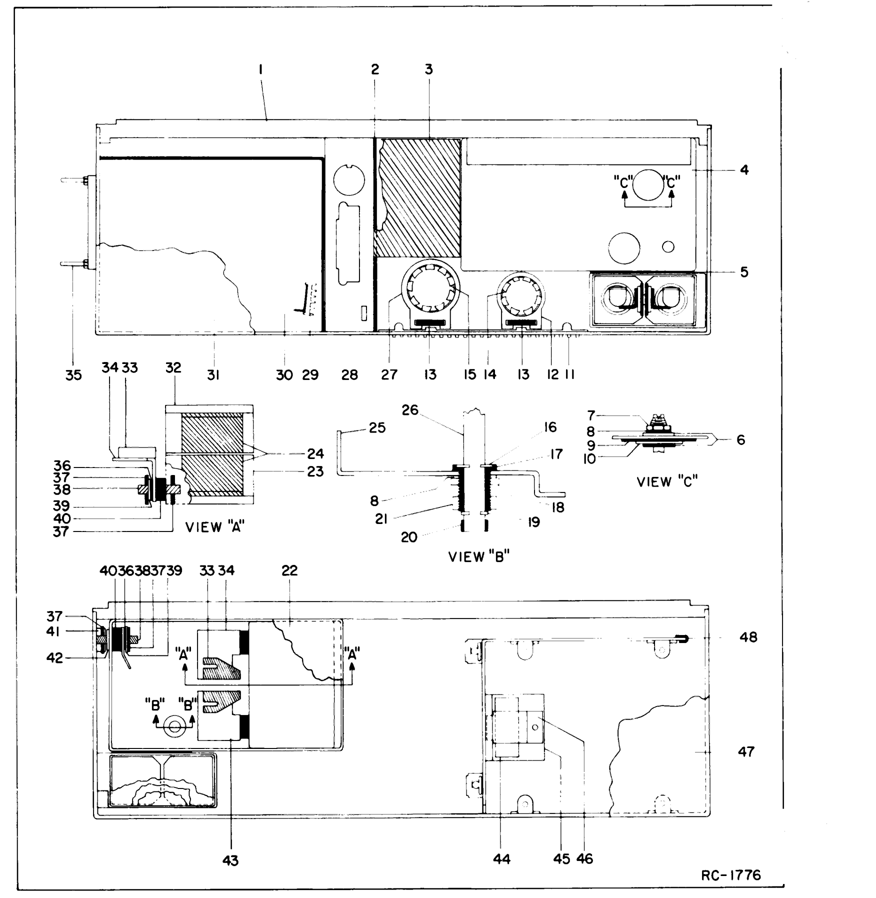
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

(Chassis & PA Assembly 19E500858-G1 & G2)

REV. A - To eliminate FM noise caused by mechanical vibration of the driver output and PA grid coils. Changed L104/L105.

REV. B - To improve performance of transmitter. Changed FL101.



PARTS LIST

LBI-3936B

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

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1*	19B209243-P103	Polyester: 0.022 µf ±10%, 50 VDCW.
		In Models earlier than Rev A:
	19B209243-P2	Polyester: 0.015 µf ±20%, 50 VDCW.
C2	19B209243-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	19B209243-P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C5	19B209243-P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19B209243-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	19B209243-P115	Polyester: 0.22 µf ±10%, 250 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	127.3 Hz
	19B205280-G15	131.8 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	5495948-P233	Deposited carbon: 2150 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R16	5495948-P301	Deposited carbon: 10,000 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R17	5495948-P65	Deposited carbon: 46.4 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R18	5495948-P329	Deposited carbon: 19,600 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R19	5495948-P285	Deposited carbon: 7500 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R20	5495948-P412	Deposited carbon: 130,000 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R21	5495948-P269	Deposited carbon: 5110 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
R22	5495948-P117	Deposited carbon: 147 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2MR.
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.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To improve Channel Guard low pass filter. Changed C1.

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 variation 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

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MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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