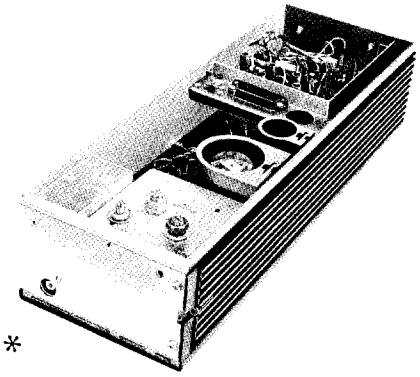
MOBILE RADIO

MASTR Progress Line

132—174 MHz 30-WATT TRANSMITTER MODELS 4ET57A30—41 & 4ET57B10—15



SPECIFICATIONS *

FCC Filing Designation	**ET-57-A (Narrow Band)** **ET-57-B (Wide Band)**
Frequency Range	132-174 MHz
Power Output:	
Mobile Power Supply	30 watts minimum (20% duty cycle)
Station Power Supply	10 watts minimum (continuous duty)
Crystal Multiplication Factor	12
Frequency Stability	±.0005% (-30°C to +60°C)
Spurious and Harmonic Radiation	At least 85 dB below rated power output
Modulation	Adjustable from 0 to ±5 kHz (Narrow Band) and 0 to ±15 kHz (Wide 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:	
Narrow Band	0.5 kHz maximum
Wide Band	1.5 kHz maximum
Tubes and Transistors	30-Watt Transmitter with no Options: 2 tubes 8 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.

ET-57-A & B

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

MASTR Progress Line FM Transmitter Types ET-57-A and B are crystal-controlled, phase modulated transmitters 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 mulfiplier stages.
- Tubed multiplier and power amplifier stages.
- Optional Channel Guard Low-Pass Filter (ET-57-A only).

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 two tubes are used in the transmitter. When used with the mobile power supplies, the transmitter has a minimum power output of 30 watts. When used as an exciter with high power stations, the minimum power output is 10 watts. The frequency of the crystals used ranges from 11 to 14.5 megahertz, and the crystal frequency is multiplied 12 times.

A centralized metering jack (J102) is provided for use with GE Test Sets 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 for 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 - +450 volts PA B+ with mobile supplies (+300 volts PA B+ for driver use with station supplies)
- Pin 8 - -45 volts bias

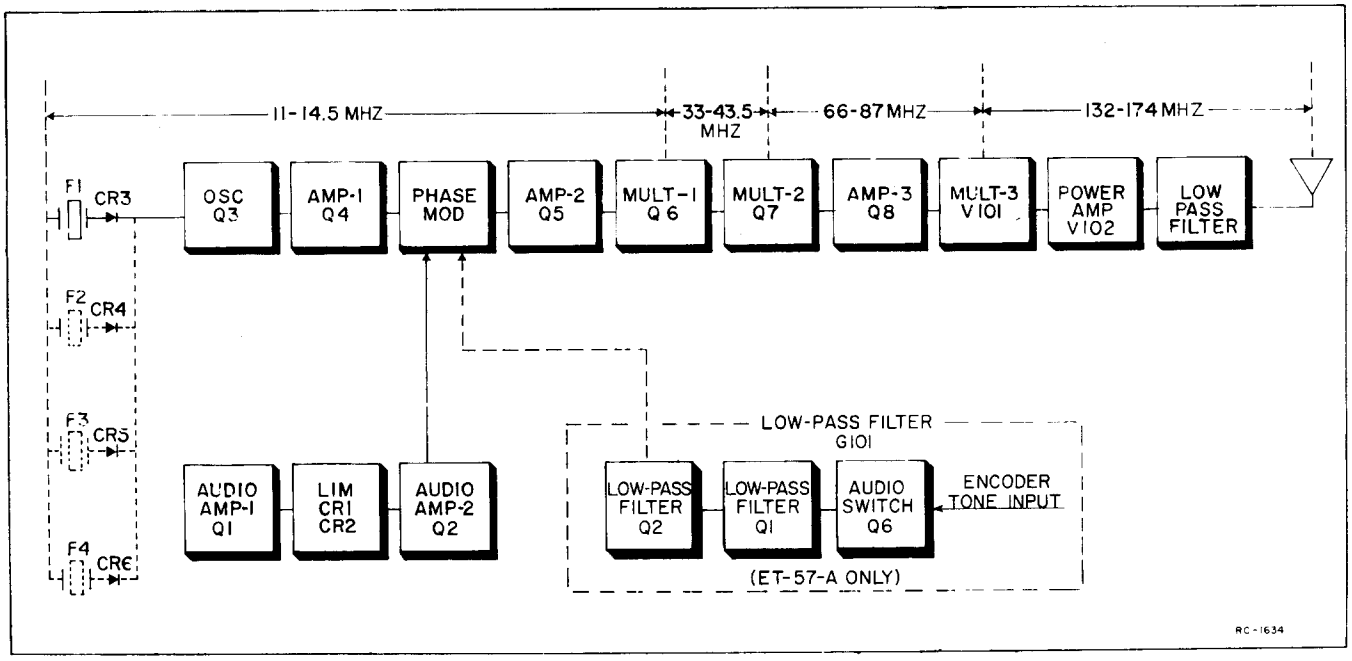


Figure 1 - Transmitter Block Diagram

- Pin 14 - +10 volts for Channel Guard option (ET-57-A only)
- Pin 15 - -20 volts for Exciter Board

OSCILLATOR

A transistorized Colpitts oscillator (Q3) is used in the transmitter. The oscillator crystal is thermistor compensated at both ends of the temperature range to provide instant frequency compensation with a frequency stability of ±.0005% without crystal ovens or warmers.

In single-frequency transmitters, a jumper (from H1 to H2) connects the F1 crystal keying lead to ground to forward bias diode CR3. Forward biasing the diode reduces its impedance, and the crystal frequency is applied to the base of oscillator Q3. Feedback for the oscillator is developed across C34/C35. The oscillator output is coupled through an impedance matching emitter-follower amplifier stage (Q4) to the phase modulator.

In multi-frequency transmitters, the single oscillator transistor is used, and up to three additional crystal circuits, identical to the F1 crystal circuit, can be added. The keying jumper is removed and the proper crystal frequency is selected by switching the crystal keying lead to ground by means of a frequency selector switch on the Control Unit.

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 R19 and C75.

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 to 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 R15, R16, R17, C4, C7 and C8/C9. The output of the filter and de-emphasis network is applied directly to the phase modulator.

PHASE MODULATOR

The phase modulator uses varactor CV-1 (voltage variable capacitor) in series with tuneable 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 CV-1, resulting in a phase-modulated output. The output of the modulator is coupled through blocking capacitor C41/C45 to the base of the second amplifier. For Channel Guard and wide band transmitters, a second modulator stage (L3/L4 and CV-2) is cascaded with the first modulator. The output of the Channel Guard enclosed is fed through CHANNEL GUARD MOD ADJUST R34 to the modulator stages. The voice audio is also applied to both modulator stages.

AMPLIFIERS AND 1ST AND 2ND MULTPLIERS

The second amplifier (Q5) isolates the modulator from the loading effects of the first multiplier and provides amplification. The output is DC coupled to the first multiplier.

Following Q5 are two inductively-coupled Class C, common-emitter multiplier stages (Q6 and Q7). Q6 is a tripler, with collector tank T1 tuned to three times the crystal frequency. Metering resistor R37 is for metering the MULT-1 stage at centralized metering jack J102.

Q7 operates as a doubler stage, with collector tank T3 turned to six times the crystal frequency. Resistor R39 is for metering the MULT-2 stage at J102. The output of Q7 is inductively coupled through T3 and T4 to amplifier Q8. In 150.8-174 megacycle transmitters, capacitor C58 provides some high-side capacitive coupling.

Third amplifier Q8 is a neutralized straight-through amplifier. Feedback through C65 from the output link on T5 provides neutralization. This stage is metered at J102-3 across R43. 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 grid of V101 is metered through metering resistors R1 and R2 at J102-5. The combination of R1, R2 and R3 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.

POWER AMPLIFIER

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 C104, L107/L108 and C118. The grid tank is tuned by C118 (PA GRID), and current is metered at J102-6 and J102-14 by measuring the voltage drop across R11. Bias voltage (-45 volts) is applied to the PA grid through R10, R11 and L102/L103. There is no residual reading on the PA.

WARNING

The meter leads are at plate potential (high B+) when metering the PA plate at J102-1 and J102-9.

Placing the TUNE-OPERATE switch (S102) in the OPERATE position applies 300 volts to A117-J3 and -J7. The 300 volts appearing on each side of R13 effectively shorts the resistor out of the circuit, and R14 and R15 are in series for normal operation of V102. When S102 is in the TUNE position, the screen voltage is applied to A117-J3 only. Now, dropping resistors R13, R14 and R15 are in series, to reduce the screen voltage. This reduces the plate dissipation of V102 while tuning the power amplifier stage. Capacitors C107, C108 and C109 neutralize the PA stage.

Antenna coupling is achieved by varying the coupling between L102/L110 and L111/L112. The antenna circuit is tuned by C112.

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 chargeover 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 varistions 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 optional 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 optional hang-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. Pull radio out of mounting frame.
2. Remove two screws in bottom cover. Pry up at back of transmitter.
3. Slide cover back and lift off.

NOTE

To replace tubes, loosen screws holding tube shields and slide shields off.

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.

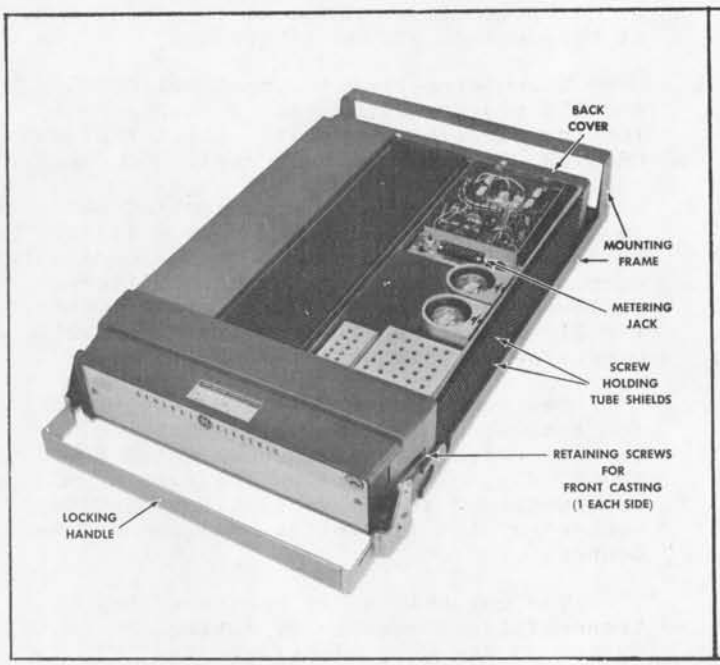


Figure 2 - Top Cover Removed

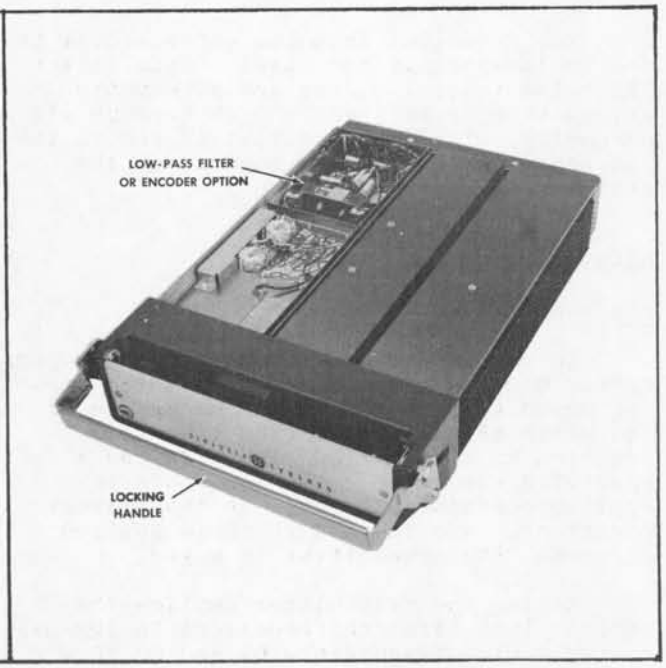


Figure 3 - Bottom Cover Removed

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 over-modulation 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. Audio oscillator Model 4EX6A10
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Model 4EX3A10 (TM11 or TM12)

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 (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 (R34) 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 power input can be determined by measuring the PA Plate voltage and the plate current indication, and using the following formula:

$$P_i = \frac{\text{Plate Voltage} \times \text{Plate Current Indication}}{4.38}$$

where:

P_i is the power input in watts.

Plate voltage is measured with G-E 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 G-E Test Set in Position G, using the TEST 1 scale (or measured from J102-1 to -9 with multimeter).

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

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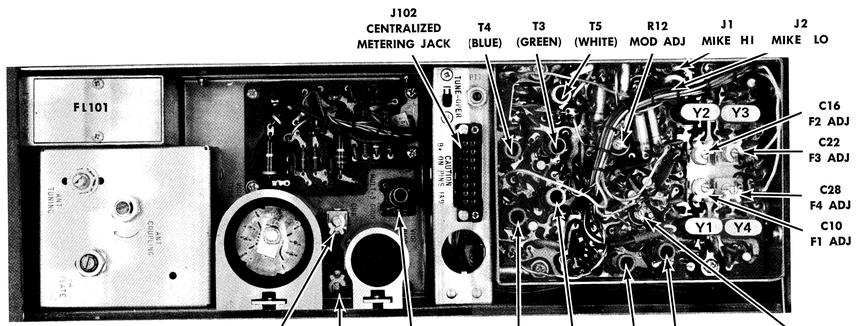


TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. General Electric Test Set Model 4EX3A10, Station Meter Switching Panel, or a 20,000 ohm-per-volt Multimeter with a 1-volt scale.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal (operating frequency + 12) in crystal socket XY1.
2. For a large change in frequency or a badly mis-aligned transmitter, set crystal trimmer C10 to mid-capacity. If mult-frequency transmitter, set all trimmers to mid-capacity and tune transmitter on channel with the highest frequency.
3. Place the TUNE-OPERATE switch (S102) in the TUNE position.
4. Connect Test Set Model 4EX3A10 to the Transmitter Centralized Metering Jack J102. If using Multimeter, connect the positive lead to J102-16 (Ground) except for Steps 6 through 15.
5. For a large change in frequency or a badly mis-aligned transmitter, set the slugs in the Exciter coils at the bottom of the coil form (closed to the printed board), and the slug of MULT-3 GRID (Z101/Z102) at the top of the coil form.
6. All adjustments are made with the transmitter keyed.

NOTE

Do not exceed a maximum meter reading of 1 volt on any adjustment while aligning the transmitter.

STEP	METERING POSITION 4EX3A10	METERING POSITION Multimeter - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A (MULT-1)	Pin 10	L1/L2 (and L3/L4 with Channel Guard)	0.7 v (0.5 v Minimum)	Tuning the modulator is a critical adjustment. Carefully tune L1/L2 for maximum meter reading. For channel guard or wide band transmitters, alternately tune L1/L2 and L3/L4 for maximum meter reading.
2.	A (MULT-1)	Pin 10	T1	See Procedure	Tune T1 for a small peak 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 maximum meter reading. Then tune T3 for minimum in meter reading (not required unless changing frequency).
4.	C (AMPL-3)	Pin 3	T4, T3 and T5	0.65 v (0.5 v Minimum	Tune T4 and then T3 for maximum meter reading. Then tune T5 for minimum in 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 (0.5 v Minimum)	Tune MULT-3 GRID for maximum meter reading.
6.	F (PA GRID)	Pin 14 (+) and Pin 6 (-)	C118 and C104	0.4 v (0.2 v Minimum)	Alternately tune C118 and C104 for maximum meter reading. Peak C104 as small changes in C118 reading are made.
7.					Rotate ANT COUPLING fully counterclockwise.
8.	G (PA PLATE)	High B-plus on Pin 1 (+) and Pin 9 (-)	WARNING Pins 1 and 9 PA PLATE (C110)	Minimum	Carefully tune PA PLATE for minimum meter reading. Then for multi-frequency transmitters, alternately switch from the highest to the lowest frequency and adjust PA PLATE to an intermediate frequency so that readings are approximately equal on both frequencies.
9.					Place S102 in the OPERATE position.
10.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)	ANT COUPLING	See Procedure	Rotite ANT COUPLING clockwise until meter reading rises slightly. In multi-frequency transmitters, switch to the lowest frequency before making this adjustment.
11.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)	ANT TUNING (C112)	Maximum	Adjust ANT TUNING for maximum meter reading.
12.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)	ANT COUPLING	0.7 v	Adjust ANT COUPLING for meter reading of 0.7 volt.
13.	G	Pin 1 (+) and Pin 9 (-)	ANT TUNING (C112)	Maximum	Tune ANT TUNING for maximum meter reading.
14.	F (PA GRID)	Pin 14(+) and Pin 6 (-)	C118 and C104	Maximum	For single-frequency transmitters, alternately tune C118 and C104 for maximum meter reading. For multi-frequency transmitters: Tune C104 for equal grid currents on the highest and lowest frequencies.
15.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)			When properly aligned, the reading on the highest channel should be equal to, or slightly lower than reading on lowest frequency (-.05 volt maximum).
			FREQUENCY ADJUSTMENT		
16.			C10 (C16, C22 and C28 in multi-freq. units		With no modulation, adjust crystal trimmer C10 for proper oscillator frequency. In multi-frequency units, adjust C16, C22 and C28 as required. For Channel Guard transmitters, refer to MODULATION ADJUSTMENT. NOTE For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temperature of approx. 75°F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90°F.

ALIGNMENT PROCEDURE

132—174 MHZ, 30-WATT TRANSMITTER
MODELS 4ET57A30-41 & 4ET57B10-15

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 sequency 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:

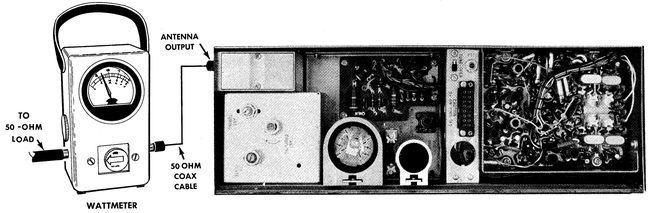
1. Wattmeter similar to:
   Bird # 43
   Jones # 711N
2. VTVM similar to:
   Triplett # 850
   Heath # 1M-21
3. Audio Generator similar to:
   GE Model 4EX6A10 or
   Heath # 1G-72
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements # 140
   Lampkin # 205A
5. Multimeter similar to:
   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 30 watts.

SERVICE CHECK

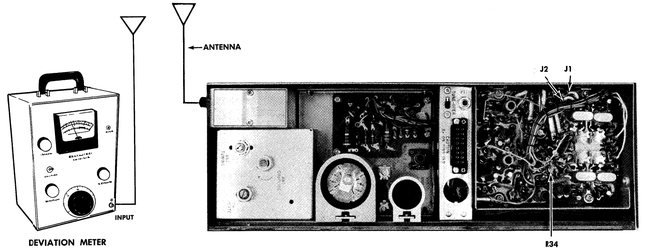
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

1. Set up 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 MODADJUST (R34) for a reading of 0.75-kHz.

NOTES: --The Channel Guard MOD ADJUST (R34) 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

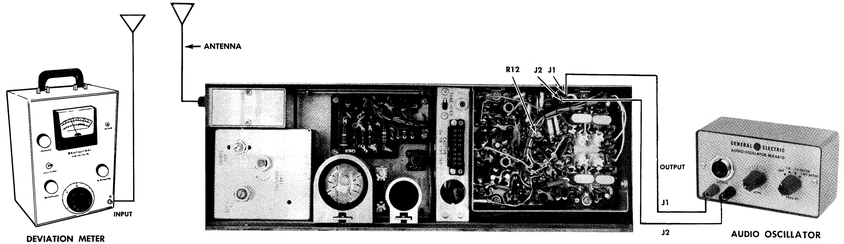
If the 0.75-kHz deviation is not obtainable when adjusting R34, adjust R12 until 0.75 kHz is obtained.

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 (±13.5 kHz wide band).
6. Adjust "Modulation Adjust Control" R12 until deviation reads 4.5 kHz (13.5 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 (13.5 kHz wide band) deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 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:

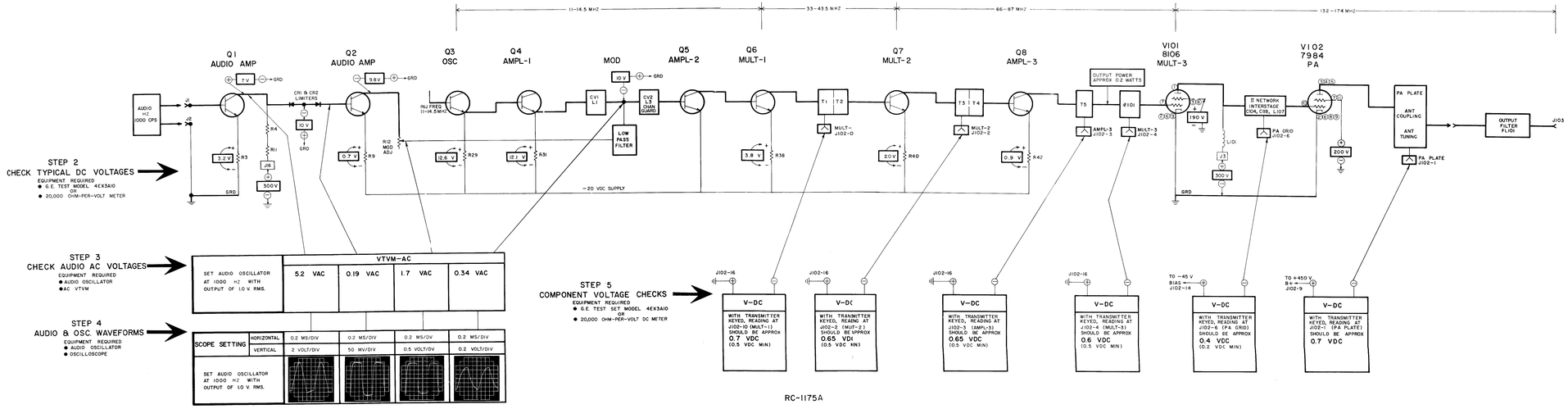
1. Recheck Step 1 as shown in the Transmitter Alignment Chart.
2. Check Audio Sensitivity by reducing generator output until deviation falls to 3.3 kHz (10 kHz wide band). Voltage should be LESS than 100 millivolts.

METER

STEP 1 – QUICK CHECKS

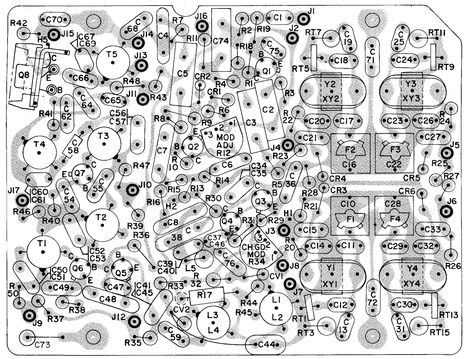
	CHECK VOLTAGES AT CENTRALIZED METERING JACK J102 Multimeter - pin numbers GE Test Set - A-G positions						
POWER OUTPUT	Pins 10 & 16 A	Pins 2 & 16 B	Pins 3 & 16 C	Pins 4 & 16 D	Pins 6 & 14 F	Pins 1 & 9 G	PROBABLE DEFECT
Low	0.7 v	0.65 v	0.65 v	0.6 v	0.4 v	0.7 v	Weak 7984
0	0.7 v	0.65 v	0.65 v	0.6 v	0	0	Open 7984
Low	0.7 v	0.65 v	0.65 v	Low or 0.6 v	Low or neg.	--	Weak 8106
0	0.7 v	0.65 v	0.65 v	0.15 v	0	0.4 v	8106 Fil. open
0	0.7 v	0.65 v	0.65 v	0.15 v	0	0	Open Fil. Fuse
0	0.7 v	0.65 v	0 or over 1.0 v	0.15 v	0	0.4 v	Defective Q8
0	0.7 v	0 or over 1.0 v	0	0.15 v	0	0.4 v	Defective Q7
0	Over 1.0 v	0	0	0.15 v	0	0.4 v	Shorted Q6 or Open Q5
0	0	0	0	0.15 v	0	0.4 v	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.



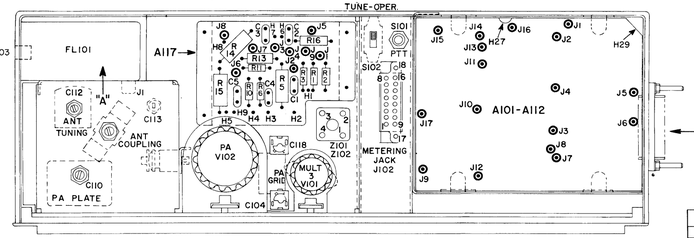
(DF-3124)

EXCITER
A101 - A112

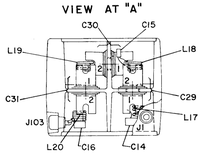


(19C303483, Sh. 1, Rev. 7)
(19C303483, Sh. 2, Rev. 7)

TOP VIEW



VIEW AT "A"



EXCITER READINGS TAKEN TO CHASSIS GROUND

TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	6.5K	6.8K	2K2K	12K	50K	20K
Q2	6.29	4K	70K	10K	9.3K	10K
Q3	91	2.7K	5K	2.7K	100	100
Q4	71	5K	9K	2.7K	100	100
Q5	59	2.7K	70K	6.8K	3.7K	2.3K
Q6	48	3.2K	2.7K	2.3K	175	175
Q7	5.3	2.9K	5K	2.7K	165	165
Q8	51	2.7K	5K	2.7K	67	67

EXCITER READINGS TAKEN TO −20 VOLT LINE (J15 BLUE LEAD)

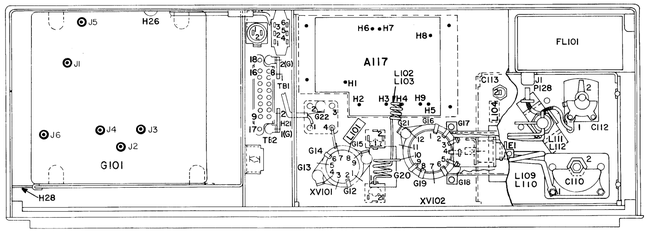
TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	11K	11K	240K	30K	60K	95K
Q2	11K	1K	70K	4.3K	1MK	18K
Q3	2.6K	2.5K	10K	5.5K	2.7K	5.1K
Q4	1.5K	1.5K	2.6K	2.5K	2.7K	5.1K
Q5	0	0	10K	3.2K	3.2K	3.9K
Q6	340	360	88	3.8K	31	5.1K
Q7	60	180	0	0	9.3K	5.5K
Q8	27	27	47	47	2.6K	5K

READINGS AT J101 TAKEN TO CHASSIS GROUND.

PIN	−	+
1	0	0
2	∞	∞
3	2.1Ω	2.1Ω
4	550K	500K
5	∞	∞
6	∞	∞
7	∞	∞
8	110K	110K
9	∞	∞
10	∞	∞
11	∞	∞
* 12	0/30K	0/15K
13	∞	∞
14	∞	∞
15	5K	2.7K
* 16	∞/30K	∞/15K
X 17	∞/30K	∞/15K
* 18	∞/30K	∞/15K
19	0	0
20	∞	∞

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

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	550K	0	2.1Ω	0	39K	50K	0			
XV102	0	0	∞	∞	∞	0	550K	0	0	110K	550K	2.1Ω

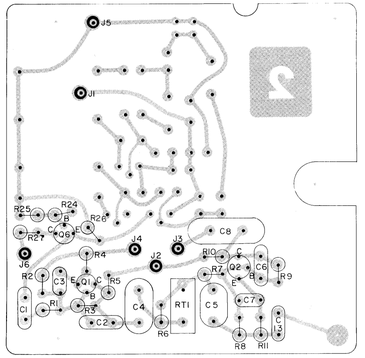
(19D413164, Rev. 2)

RESISTANCE READINGS

ALL READINGS ARE TYPICAL READINGS MEASURED WITH A 20,000 OHMS-PER-VOLT METER AND J101 DISCONNECTED. + OR − SIGNS SHOW METER LEAD GROUNDED.

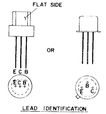
FOR READINGS OF:	USE SCALE:
1-100Ω	X 1
100-1KΩ	X 10
1K-50KΩ	X 1,000
50-∞Ω	X 100,000

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



LOW-PASS FILTER
G101

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

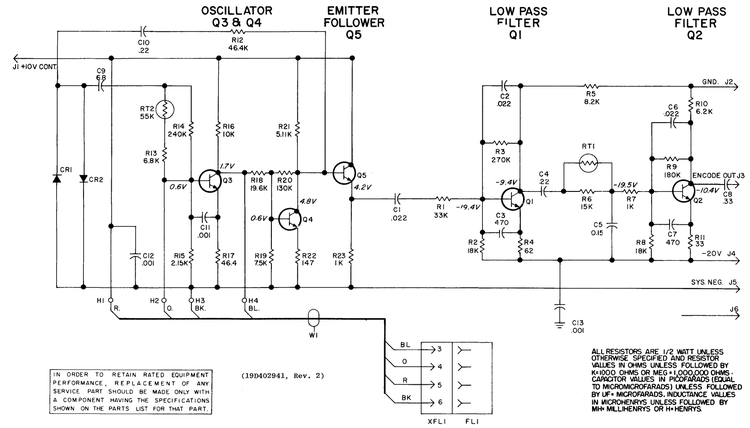


OUTLINE DIAGRAM

132—174 MHZ, 30-WATT TRANSMITTER
MODELS 4ET57A30-41 & 4ET57B10-15

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)

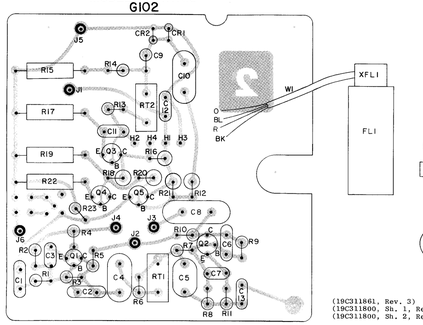
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR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

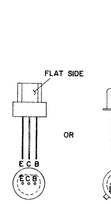
REVISION LTR BLOCK

		REV
G102	4EH17A10	A

OUTLINE DIAGRAM

ENCODER
MODEL 4EH17A10
G102





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

(DF-3124)

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.

		REV.
	PL19E500855G1	A
	PL19E500855G2	A
A101	PL19D402308G1	E
A102	PL19D402308G2	E
A103	PL19D402308G3	E
A104	PL19D402308G4	E
A105	PL19D402308G5	E
A106	PL19D402308G6	E
A107	PL19D402308G7	F
A108	PL19D402308G8	F
A109	PL19D402308G9	F
A110	PL19D402308G10	F
A111	PL19D402308G11	F
A112	PL19D402308G12	F
A121	PL19D402308G13	E
A122	PL19D402308G14	E
A123	PL19D402308G15	E
A124	PL19D402308G16	E
A125	PL19D402308G17	E
A126	PL19D402308G18	E

MODEL NO.	FREQ. RANGE	NO. OF FREQ.	CHAN. GD.	
4ET57A30	132-150.8 MC	1		
4ET57A31	150.8-174 MC	1		
4ET57A32	132-150.8 MC	2		
4ET57A33	150.8-174 MC	2		
4ET57A34	132-150.8 MC	4		
4ET57A35	150.8-174 MC	4		
4ET57A36	132-150.8 MC	1	X	
4ET57A37	150.8-174 MC	1	X	
4ET57A38	132-150.8 MC	2	X	
4ET57A39	150.8-174 MC	2	X	
4ET57A40	132-150.8 MC	4	X	
4ET57A41	150.8-174 MC	4	X	
4ET57B10	132-150.8 MC	1		
4ET57B11	150.8-174 MC	1		
4ET57B12	132-150.8 MC	2		
4ET57B13	150.8-174 MC	2		
4ET57B14	132-150.8 MC	4		
4ET57B15	150.8-174 MC	4		

● USED WITH 132-150.8 MC ONLY
▲ USED WITH 150.8-174 MC ONLY
■ USED WITH CHAN. GD ONLY
◓ USED WITH WIDE BAND ONLY

NOTE
1. ALL WIRES N22 UNLESS OTHERWISE SPECIFIED.
2. PART OF CABLE 19B205480G2.
3. FOR CHANNEL GUARD ON F1 ONLY MOVE W-R WIRE FROM J101-6 TO J101-14.

(19R621222, Rev. 8)

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 GROUNDED SYSTEM. FOR POSTIVE GROUND SYSTEMS, MEASURE READINGS AT Q1 AND Q2 TO J5 ON G101/G102.

● USED WITH 132-150.8 MC ONLY
▲ USED WITH 150.8-174 MC ONLY

SCHEMATIC DIAGRAM

132—174 MHZ, 30-WATT MASTR TRANSMITTER
MODELS 4ET57A30-41 & 4ET57B10-15

PARTS LIST

LBI-3870C

132-174 MHz TRANSMITTER
MODELS 4ET57A30 - 4ET57A41
MODELS 4ET57B10 - 4ET57B10

SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD ASSEMBLY
A101 thru A112		A101 Model 4ET57A30 19D602308-G1 REV E A102 Model 4ET57A31 19D602308-G2 REV E A103 Model 4ET57A32 19D602308-G3 REV E A104 Model 4ET57A33 19D602308-G4 REV E A105 Model 4ET57A34 19D602308-G5 REV E A106 Model 4ET57A35 19D602308-G6 REV E A107 Model 4ET57A36 19D602308-G7 REV E A108 Model 4ET57A37 19D602308-G8 REV E A109 Model 4ET57A38 19D602308-G9 REV E A110 Model 4ET57A39 19D602308-G10 REV E A111 Model 4ET57A40 19D602308-G11 REV F A112 Model 4ET57A41 19D602308-G12 REV E
A121 thru A136		A121 Model 4ET57B30 19D602308-G13 REV E A122 Model 4ET57B31 19D602308-G14 REV E A123 Model 4ET57B32 19D602308-G15 REV E A124 Model 4ET57B33 19D602308-G16 REV E A135 Model 4ET57B14 19D602308-G17 REV E A126 Model 4ET57B15 19D602308-G18 REV E
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080-P3	Polyester; .022 pf ±20%, 50 VDCW.
C2	19A116080-P4	Polyester; .033 pf ±20%, 50 VDCW.
C3	19A116080-P7	Polyester; 0.1 pf ±20%, 50 VDCW.
C4	7491395-P114	Ceramic disc; .0022 pf ±10%, 500 VDCW.
C5	19A116080-P7	Polyester; 0.1 pf ±20%, 50 VDCW.
C6	19A116080-P5	Polyester; .047 pf ±20%, 50 VDCW.
C7	7491395-P111	Ceramic disc; .0015 pf ±10%, 500 VDCW.
C8	5493367-P1000K	Silver mica; .001 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-20.
C10	5491271-P106	Variable, subminiature; approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C11	5496219-P7	Ceramic disc; 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C12 and C13	19C300685-P93	Ceramic disc; 5 pf ±0.1 pf, 500 VDCW, temp coef -750 PPM.
C14	5496219-P751	Ceramic disc; 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C15	5496481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C16	5491271-P106	Variable, subminiature; approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189-6-5.
C17	5496219-P7	Ceramic disc; 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C18 and C19	19C300685-P93	Ceramic disc; 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C20	5496219-P751	Ceramic disc; 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C21	5496481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C22	5491271-P106	Variable, subminiature; approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189-6-5.
C23	5496219-P7	Ceramic disc; 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C24 and C25	19C300685-P93	Ceramic disc; 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C26	5496219-P751	Ceramic disc; 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C27	5496481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C28	5491271-P106	Variable, subminiature; approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.

SYMBOL	GE PART NO.	DESCRIPTION
C29	5496219-P7	Ceramic disc; 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C30 and C31	19C300685-P93	Ceramic disc; 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C32	5496219-P751	Ceramic disc; 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C33	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C34	5496372-P50	Ceramic disc; 200 pf ±5%, 500 VDCW, temp coef -2200 PPM.
C35	5496372-P54	Ceramic disc; 270 pf ±5%, 500 VDCW, temp coef -1700 PPM.
C36	5496219-P467	Ceramic disc; 150 pf ±5%, 500 VDCW, temp coef -220 PPM.
C37	5496372-P327	Ceramic disc; 75 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C38	5494481-P131	Ceramic disc; 6800 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C39	5496372-P145	Ceramic disc; 180 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C40	5496372-P345	Ceramic disc; 180 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C41	5493366-P180K	Mica; 180 pf ±10%, 100 VDCW; sim to Electro Motive Type DM15.
C44	5493366-P470J	Silver mica; 470 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C45	5496372-P45	Ceramic disc; 180 pf ±10%, 500 VDCW, temp coef -2200 PPM.
C46	5496372-P347	Ceramic disc; 200 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C47	5496219-P749	Ceramic disc; 27 pf ±5%, 500 VDCW, temp coef -750 PPM.
C48	5494481-P129	Ceramic disc; 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C49	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
L5	7488079-P48	Choke, RF; 27 uh ±10%, 1.4 ohms DC res; sim to Jeffers 4422-5K.
Q1 and Q2	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q3 thru Q5	19A115330-P1	Silicon, NPN.
C54 and C55	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
Q6 and Q7	19A115328-P1	Silicon, NPN.
C56	5496219-P440	Ceramic disc; 9 pf ±0.25 pf, 500 VDCW, temp coef -220 PPM.
C57	5496219-P343	Ceramic disc; 13 pf ±5%, 500 VDCW, temp coef -160 PPM.
Q9	19A115392-P1	Silicon, NPN; sim to Type 2N2925.
C58	5491601-P25	Tubular; 0.15 pf ±10%, 500 VDCW; sim to Quality Components Type MC.
C59	5493366-P220K	Silver mica; 220 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C60	5496219-P241	Ceramic disc; 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C61	5496219-P244	Ceramic disc; 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C62	5496219-P51	Ceramic disc; 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C63	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C64	5496219-P35	Ceramic disc; 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C66	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C67	5496219-P247	Ceramic disc; 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C68	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

SYMBOL	GE PART NO.	DESCRIPTION
C69	5496219-P249	Ceramic disc; 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C70 thru C72	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C73	5496267-P18	Tubular; 6.8 pf ±20%, 35 VDCW.
C74	19A115414-P13	Tubular, polyester; 0.1 pf ±20%, 200 VDCW.
C75	5494481-P107	Ceramic disc; 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C76	5493366-P470K	Mica; 470 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C77	5493366-P270K	Mica; 270 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 thru CR2	19A115350-P1	Silicon.
CR3 thru CR6	19A115603-P1	Silicon.
CY1 and CY2	5495769-P6	Silicon, capacitive.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J17	4033513-P4	Contact, electrical; sim to Bead Chain L83-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B204526-G2	Coil. Includes tuning slug 5491798-P2.
L2	19B204526-G1	Coil. Includes tuning slug 5491798-P2.
L3	19B204526-G4	Coil. Includes tuning slug 5491798-P2.
R1	3R152-P333J	Composition: 33,000 ohms ±5%, 1/4 w.
L4	19B204526-G3	Coil. Includes tuning slug 5491798-P2.
R1	3R152-P333J	Composition: 33,000 ohms ±5%, 1/4 w.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q3 thru Q5	19A115330-P1	Silicon, NPN.
Q6 and Q7	19A115328-P1	Silicon, NPN.
Q8	19A115329-P1	Silicon, NPN.
Q9	19A115392-P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77-P334K	Composition: 0.33 megohm ±10%, 1/2 w.
R2	3R77-P105K	Composition: 1 megohm ±10%, 1/2 w.
R3	3R77-P472K	Composition: 10 pf ±5%, 1/2 w.
R4	3R77-P224K	Composition: 0.22 megohm ±10%, 1/2 w.
R5	3R77-P334K	Composition: 0.33 megohm ±10%, 1/2 w.
R6	3R77-P684K	Composition: 0.68 megohm ±10%, 1/2 w.
R7	3R77-P334K	Composition: 0.33 megohm ±10%, 1/2 w.
R8	3R77-P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R9	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R10 and R11	3R77-P274K	Composition: 0.27 megohm ±10%, 1/2 w.
R12*	19B209358-P106	Variable, carbon film; approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201. Earlier than REV D in Models 4ER57A30-35, M10-15; Earlier than REV E in Models 4ER57A36-41;
	19B201969-P6	Variable, carbon film; .03 megohm ±20%, 0.1 w, sim to Centralab Series 4.

SYMBOL	GE PART NO.	DESCRIPTION
R13 and R14	3R77-P224K	Composition: 0.22 megohm ±10%, 1/2 w.
R15	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R16	3R77-P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R17	3R77-P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R18	3R77-P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R19	3R77-P222K	Composition: 2200 ohms ±10%, 1/2 w.
R20	3R77-P682K	Composition: 6800 ohms ±10%, 1/2 w.
R21	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R22	3R77-P682K	Composition: 6800 ohms ±10%, 1/2 w.
R23	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R24	3R77-P682K	Composition: 6800 ohms ±10%, 1/2 w.
R25	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R26	3R77-P682K	Composition: 6800 ohms ±10%, 1/2 w.
R27 and CR3	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R28		
R29	3R77-P272K	Composition: 2700 ohms ±10%, 1/2 w.
R30	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
R31	3R77-P152K	Composition: 1500 ohms ±10%, 1/2 w.
R32 and R33	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R34*	19B209358-P107	Variable, carbon film; approx 75 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201. Earlier than REV E in Models 4ER57A36-41;
	19B201969-P7	Variable, carbon film; 25,000 ohms ±20%, 0.1 w.
R35	3R77-P553K	Composition: 55,000 ohms ±10%, 1/2 w.
C3	3R77-P392K	Composition: 3900 ohms ±10%, 1/2 w.
R37	3R77-P750J	Composition: 75 ohms ±5%, 1/2 w.
R38	3R77-P391K	Composition: 390 ohms ±10%, 1/2 w.
R39	3R77-P620J	Composition: 62 ohms ±5%, 1/2 w.
R40	3R77-P181K	Composition: 180 ohms ±10%, 1/2 w.
R41	3R77-P470K	Composition: 47 ohms ±10%, 1/2 w.
R42	3R77-P270K	Composition: 27 ohms ±10%, 1/2 w.
R43	3R77-P200J	Composition: 20 ohms ±5%, 1/2 w.
R44	3R77-P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R45	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R46	19A116278-P474	Metal film: 578,000 ohms ±2%, 1/2 w.
R47	3R77-P391K	Composition: 390 ohms ±10%, 1/2 w.
R48	3R77-P470K	Composition: 47 ohms ±10%, 1/2 w.
R50	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
R51	3R77-P511J	Composition: 510 ohms ±5%, 1/2 w.
R52	3R77-P364J	Composition: 0.36 megohm ±5%, 1/2 w.
R53	3R152-P472K	Composition: 4700 ohms ±10%, 1/4 w.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1	19B209284-P6	Disc; 75 ohms res nominal at 25°C, color code red blue.
RT3	19B209284-P2	Rod; 21,400 ohms res nominal at 25°C, color code red.
RT5	19B209284-P6	Disc; 75 ohms res nominal at 25°C, color code blue.
RT7	19B209284-P2	Rod; 21,400 ohms res nominal at 25°C, color code red.
RT9	19B209284-P6	Disc; 75 ohms res nominal at 25°C, color code blue.
RT11	19B209284-P2	Rod; 21,400 ohms res nominal at 25°C, color code red.

SYMBOL	GE PART NO.	DESCRIPTION
RT13	19B209284-P6	Disc; 75 ohms res nominal at 25°C, color code blue.
RT15	19B209284-P2	Rod; 21,400 ohms res nominal at 25°C, color code red.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	19B204534-G1	Coil. Includes tuning slug 5491798-P4.
T2	19B204531-G1	Coil. Includes tuning slug 5491798-P4.
T3	19B204535-G1	Coil. Includes tuning slug 5491798-P4.
T4	19B204535-G2	Coil. Includes tuning slug 5491798-P4.
T5	19B204537-G1	Coil. Includes tuning slug 5491798-P4.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY1 thru XY4		Refer to Mechanical Parts (RC-1165).
		- - - - - - - - - CRYSTALS - - - - - - - - -
		When reordering give GE Part No. and specify exact freq needed.
Y1 thru Y4	19B206175-P6	Quartz; freq range 11.000 to 12.566 KHz, temp range -30°C to +85°C. (132-150.8 MHz Transmitter)
Y1 thru Y4	19B206175-P7	Quartz; freq range 12.566 to 14.500 KHz, temp range -30°C to +85°C. (150.8-174 MHz Transmitter)
A117		COMPONENT BOARD ASSEMBLY 19B204539-G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1 thru C3	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	5490068-P119	Silver mica; 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C5	5490068-P121	Silver mica; 56 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
J1 thru J9	4033513-P4	Contact, electrical; sim to Bead Chain L83-3.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77-P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R2	3R77-P431J	Composition: 430 ohms ±5%, 1/2 w.
R3	3R77-P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R5	3R77-P182J	Composition: 1800 ohms ±5%, 1/2 w.
R6	3R77-P221K	Composition: 220 ohms ±10%, 1/2 w.
R10	3R77-P562K	Composition: 5600 ohms ±10%, 1/2 w.
R11	3R77-P331J	Composition: 330 ohms ±5%, 1/2 w.
R13	3R77-P683K	Composition: 68,000 ohms ±10%, 1 w.
R14	3R70-P472J	Composition: 4700 ohms ±5%, 2 w.
P130 thru P135	4029840-P2	Contact, electrical; sim to Amp 42827-2.
R16	19A116278-P444	Metal film: 0.38 megohm ±2%, 1/2 w.
G101		- - - - - - - - - OSCILLATORS - - - - - - - - - LOW PASS FILTER ASSEMBLY 19C311803-G1 REV B
C1*	19A116080-P103	Polyester: 0.022 pf ±20%, 50 VDCW.
	19B209304-P1	Is Models earlier than REV A:
	19B209243-P2	Polyester: 0.015 pf ±20%, 50 VDCW.

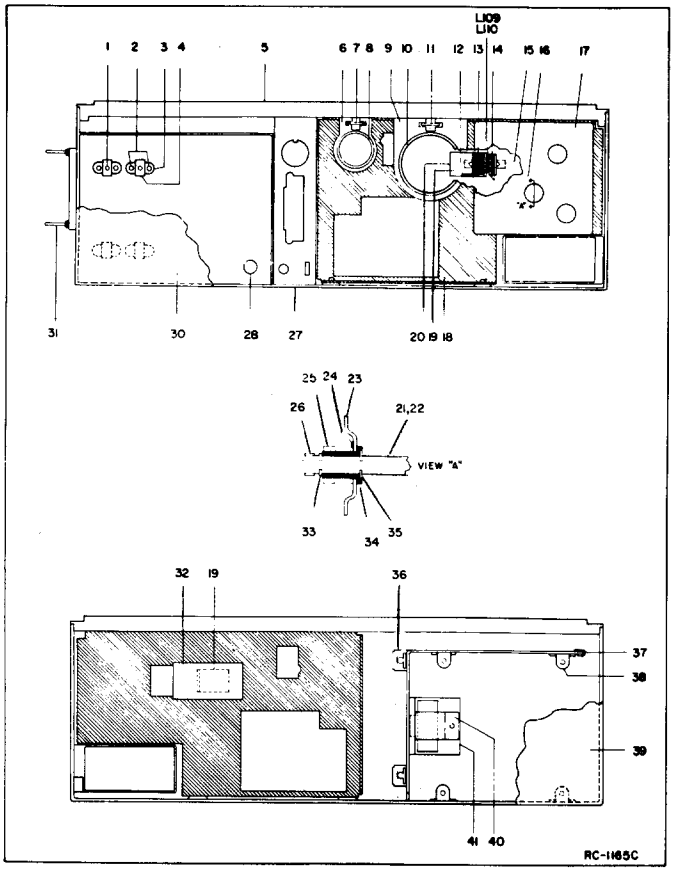
SYMBOL	GE PART NO.	DESCRIPTION
C2	19A116080-P3	Polyester; 0.022 pf ±20%, 50 VDCW.
C3	5494481-P107	Ceramic disc; 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	19A116080-P6	Polyester; 0.33 pf ±20%, 50 VDCW.
C5	19A116080-P8	Polyester; 0.15 pf ±20%, 50 VDCW.
C6	19A116080-P3	Polyester; .022 pf ±20%, 50 VDCW.
C7	5494481-P107	Ceramic disc; 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8	19B209243-P14	Polyester; 0.33 pf ±20%, 250 VDCW.
C13	5494481-P111	Ceramic disc; .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C116 and C117	5494481-P11	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C118	5491271-P6	Variable, subminiature; approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
		LOW PASS FILTER ASSEMBLY
		The output filters are factory tuned. If a filter is found to be defective, it is recommended that the entire filter assembly be replaced to attain rated power output and spurious attenuation.
FL101*	19D602233-G8	132-174 MHz.
	19D602233-G5	Earlier than REV A:
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 megohm ±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 megohm ±10%, 1/2 w.
R10	3R77-P622J	Composition: 6200 ohms ±5%, 1/2 w.
R11	3R77-P330K	Composition: 33 ohms ±10%, 1/2 w.
R24	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R25	3R77-P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R26	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R27*	3R77-P512K	Composition: 5100 ohms ±10%, 1/2 w. Added by REV B.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1	5490828-P30	Rod; 0.33 megohm ±10% res, 1 w max; sim to Global Type 7838-3.
		CHANNEL GUARD INSTALLATION KIT 19A127714-G2
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B201074-P304	Tap screw, 6-32 x 1/4. (4)
	19D602480-G2	Harness, Includes:
P130 thru P135	4029840-P2	Contact, electrical; sim to Amp 42827-2.
		CHASSIS AND PA ASSEMBLY 19E500650-G1 and G2 REV A
		- - - - - - - - - CAPACITORS - - - - - - - - -
C101 and C102	5494481-P11	Ceramic disc; .001 pf ±20% 1000 VDCW; sim to RMC Type JF Discap.
C103	19B209304-P1	Ceramic disc; 220 pf ±10%, 500 VDCW, temp coef -3600 PPM.
C104	5491271-P6	Variable, subminiature; approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189-5.

SYMBOL	GE PART NO.	DESCRIPTION
C106	7488162-P107	Silver mica; 12 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C107 thru C109	5494481-P111	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C110	5491498-P3	Variable,; approx 2.8-50 pf, 1700 v peak.
C111	5494481-P11	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C112	7491398-P1	Variable; approx 3.6-12 pf; sim to Teleradio T-9476.
C113	7485975-P17	Ceramic feed-thru; 470 pf ±30%, 750 VDCW; sim to Erie Style 327.
C114 and C115	5494481-P11	Ceramic disc; .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7487424-P2	Miniature, phen: 1 terminal.
TB2	7487424-P1	Miniature, phen: 1 terminal.
		- - - - - - - - - TUBES - - - - - - - - -
V101		Type 8106.
V102		Type 7984.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY101	7480332-P11	Tube, mica-filled phen: 9 pins rated at 1 amp at 500 VRMS; sim to CTS Type 133-1.
XY102	19C301007-P5	Tube, plastic: 12 pins rated at 5 amps max; sim to Alcon Metal Products 3712 bottom mount.
		- - - - - - - - - COILS - - - - - - - - -
Z101	19B204543-G1	Coil. Includes tuning slug 5491798-P4.
C1	5496203-P468	Ceramic disc: 510 pf ±5%, 500 VDCW, temp coef -3600 PPM.
Z102	19B204543-G2	Coil. Includes tuning slug 5491798-P4.
C1	5496203-P468	Ceramic disc: 510 pf ±5%, 500 VDCW, temp coef -3600 PPM.
		MECHANICAL PARTS (SEE FIG 1163)
1	4033089-P1	Clip. (Part of XY1-XY4).
2	19B200525-P9	Rivet. (Part of XY1-XY4).
3	19A115793-P1	Contact, electrical; sim to Malco 2700. (Part of XY1-XY4).
4	19C311173-P2	Socket, crystal. (Part of XY1-XY4).
5	19C303395-G2	Heat sink.
6	19B204570-P1	Heat sink, tube. (Used with V101).
7	19A121195-P1	Support, (Used with V101 heat sink).
8	7161107-P5	Insert, tube shield; sim to Atlas 106-333-5. (Used with V101).
9	19B204571-P1	Heat sink, tube. (Used with V102).
10	7161107-P7	Insert, tube shield; sim to Atlas 106-332-18. (Used with V102).
11	19A121195-P2	Support. (Used with V102 heat sink).
12	N309P609C13	Panel pin, spring.
13	19B204756-P1	Insulation, ceramic.
14	5493361-P5	Spring washer; sim to Shakeproof 3502-10-58.
15	19A122724-P1	Post.
16	8402239C13	Washer, no. 10.
17	19B204490-G1	Can.
18	19B204579-G1	Chassis.
19	19B204770-P1	Support.
20	19A121198-P1	Plate line.
21	19A121189-P1	Post. (Used in Models 4ET57A11, 13, 15, 17, 19, 21, 31, 33, 35, 37, 39, 41, 4ET57B11, 13 and 15).
22	19A121189-P2	Post. (Used in Models 4ET57A10, 12, 14, 16, 18, 20, 30, 32, 34, 36, 38, 40, 4ET57B10, 12 and 14).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

SYMBOL	GE PART NO.	DESCRIPTION
23	19B205023-P1	Support.
24	7115130-P9	Lockwasher; sim to Shakeproof 1220-2.
25	4031531-P1	Locknut, no. 32.
26	4031527-P2	Collar.
27	19B204395-G1	Chassis.
28	4036555-P1	Insulator, washer: nylon.
29	19B204394-P1	(Not Used).
30	19C303396-G1	Mobile top cover.
	19C303673-G3	Station top cover. (Repeaters and VM only).
	19C303495-G8	Station top cover. (Except Repeaters and VM).
31	19A121676-P1	Guide pin.
32	19B204497-P1	Shield.
33	N910P18C	Retaining ring.
34	4031530-P1	Bearing, no. 32.
35	4031532-P1	Washer, spring tension.
36	4036921-P1	Mounting support, bottom cover; sim to Tinnerman C17609-8A-67.
37	4029030-P10	Channel, rubber.
38	19B204366-P1	Support.
39	19C303396-G3	Mobile bottom cover.
	19C303495-G2	Station bottom cover.
40	19A121065-P1	Support. (Used with FL1).
41	19A121257-G1	Angle. (Used with FL1).



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 thru C - (Exciter Board A101-A106 & A121-A126)
REV. A thru D - (Exciter Board A107-A112)

Incorporated into initial shipment.

REV. A - (Channel Guard Low Pass Filter G101)

To improve operation. Changed C1.

REV. B - (Channel Guard Low Pass Filter G101)

To reduce input to filter to prevent a square wave output. Added R27.

REV. D - (Exciter Board A101-A106 & A121-A126)
REV. E - (Exciter Board A107-A112)

To improve stability and ease of adjustment. Changed MOD ADJUST potentiometer R12 and Channel Guard MOD ADJUST potentiometer R34.

(Chassis & PA Assembly 19E500855-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 to transmitter. Changed FL101.

REV. E - (Exciter Board A101-A106 & A121-A126)
REV. F - (Exciter Board A107-A112)

To facilitate manufacturing. Deleted the heat sink and mechanical parts to mount Q8. Added parts to mount Q8 on the board.

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

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 the Channel Guard low pass filter.
Changed C1.