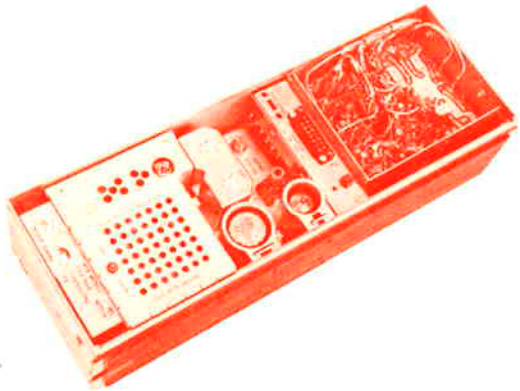
MOBILE RADIO

MASTR Progress Line

406—470 MHz, 35 & 70-WATT TRANSMITTER MODELS 4ET59D30-41 & 4ET60D30-41

Maintenance Manual LBI-3998D

ET-59-D & ET-60-D



SPECIFICATIONS *

	ET-59-D-5	ET-60-D-5
FCC Filing Designation:		
Frequency Range:	406-420 & 450-470 MHz	406-420 & 450-470 MHz
Power Output:	35 watts minimum (20 watts minimum in 6-volt systems)	70 watts minimum
Crystal Multiplication Factor:	36	36
Frequency Stability:	±0.0005% (-35°C to +60°C)	
Modulation:	Adjustable from 0 to ±5 kHz (Narrow Band) and 0 to ±15 kHz (Wide Band) swing with instantaneous modulation limiting.	
Audio Frequency Characteristics	Within +1 dB to -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hertz per EIA standards. Post limiter filter per FCC and EIA.	
Distortion:	Less than 5%	
Tubes & Transistors:	Transmitter with no Options: 3 tubes 8 silicon transistors 4 diodes & 2 varactors	
Maximum Frequency Spacing:	0.2%	
Duty Cycle: Mobile-	20% transmit (one minute transmit, four minutes off)	
Station-	Continuous	

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

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

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

DESCRIPTION

The MASTR Progress Line FM Transmitters Types ET-59-D and ET-60-D are crystal-controlled, phase-modulated transmitters designed for one-, two-, or four-frequency operation within the 406-420 and 450-470 megahertz bands. The transmitters consist of the following modules:

- Transistorized Exciter Board, with audio, oscillator, modulator, amplifier and multiplier stages,
- Multipliers, IPA and power amplifier stages,
- Optional transistorized Channel Guard Low-Pass filter.

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

CIRCUIT ANALYSIS

Eight silicon transistors and only three tubes are used in the transmitters. The frequency of the crystals used ranges from 11.25 to 11.67 and 12.5 to 13.05 megahertz , and the crystal frequency is multiplied 36 times.

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

POWER INPUTS

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

- Pin 3 - Filament voltage
- Pin 4 - +300 volts MULT & IPA B+
- Pin 5 - -45 volts bias
- Pin 14- +10 volts for Channel Guard option
- Pin 15- -20 volts for Exciter Board

NOTE

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

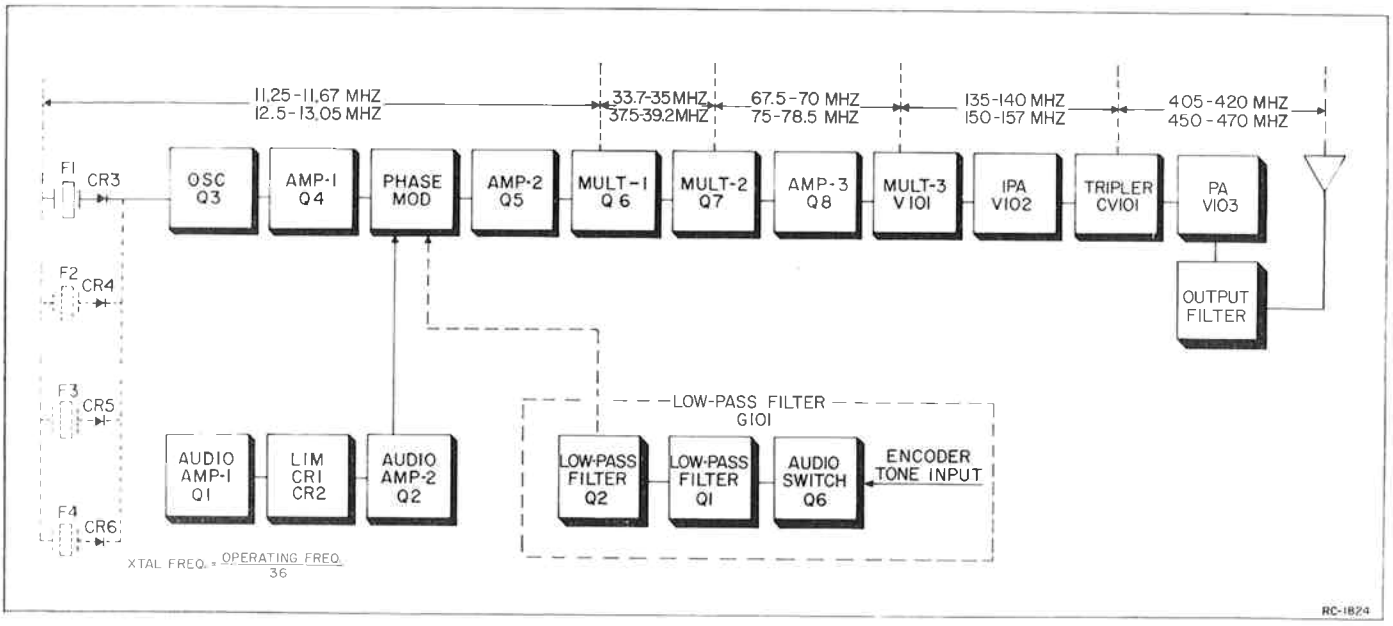


Figure 1 - Transmitter Block Diagram

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 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 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 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 CV1 (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 CV1, 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 transmitters, a second modulator stage (L3/L4 and CV2) is cascaded with the first modulator. The output of the Channel Guard encoder is fed through CHANNEL GUARD MOD ADJUST R34 to the tone modulator stage.

AMPLIFIERS AND 1ST AND 2ND MULTIPLIERS

The second amplifier (Q5) isolates the modulator from the loading effects of the first amplifier 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 tuned 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 450-470 megahertz 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.

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

IPA AND TRIPLER

The output of the MULT-3 stage is coupled by a pi-network consisting of C104, L102/L103 and C107/C108 to the grid of the IPA, a compactron beam power amplifier.

Approximately 45 volts of bias voltage is supplied to the grid of V102 through R112 and a tap on L102/L103 to protect the stage

against loss of drive. A residual reading of 0.28 volt without any drive to the stage indicates the presence of fixed bias. Grid voltage and the tripler varactor bias voltage are metered simultaneously at J201-5.

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

RF from the IPA is coupled through C118/C119 to a passive tripler stage. The tripler consists of three tuned stages (C115 & L107/L108, C121 & L110/L111, and C122 & L112/L113) which are coupled together through the common impedance of varactor CV101.

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

POWER AMPLIFIER

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

The grid line L127/L128 of V103 is series-tuned by C130 with 20 volts of protective bias supplied through L117 and grid bias resistors R103 and R129. PA grid current is metered across resistor R103 at J102-6 and J102-14.

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

The PA Plate tank circuit is comprised of C145 (the plate tank tuning flap), L119/L120 (the copper-plated heat sink on the plate of V103), and mechanically constructed capacitor (with mica dielectric) C143. The plate voltage is supplied through choke L122, which is connected to feed-through capacitor C142.

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

Plate current is metered from J102-1 to J102-9 across metering resistor R102 in high-power units. In medium-power units, R101 is added in series with R102.

WARNING

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

The output of V103 is link-coupled to band-pass filter FL101/FL102 consisting of two inductively coupled helical resonators. C1/C2 and C3/C4 are the output tuning capacitors. L5/L6, C5 and C6 form an additional low-pass filter section. The RF output is fed through J103 to the antenna changeover relay located on the front of the system frame.

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

CHANNEL GUARD

Low Pass Filter (G101)

In encode-decode combinations, low-pass filter G101 is assembled on a printed wiring board that mounts on the underside of the MASTR transmitters. The filter is supplied by a regulated +10 volts and a regulated -20 volts. The +10 volts is applied 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

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

Encoder Model 4EH17A10 (Optional)

In encode only combinations, or when different encode and decode frequencies are required, optional encoder Model 4EH17A10

mounts on the underside of the MASTR transmitter. The encoder is supplied by a regulated +10 volts and a regulated -20 volts. The +10 volts is applied to Q3, Q4 and Q5 continuously (even in the 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 applied -20 volts to the two-stage, active low-pass filter (Q1 and Q2) turning them on. The oscillator output is then coupled through emitter-follower Q5 to the low-pass filter. Thermistor RT1 keeps the filter output constant over wide variations in temperatures.

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

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

To service the transmitter from the bottom--

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

To remove transmitter from system frame--

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

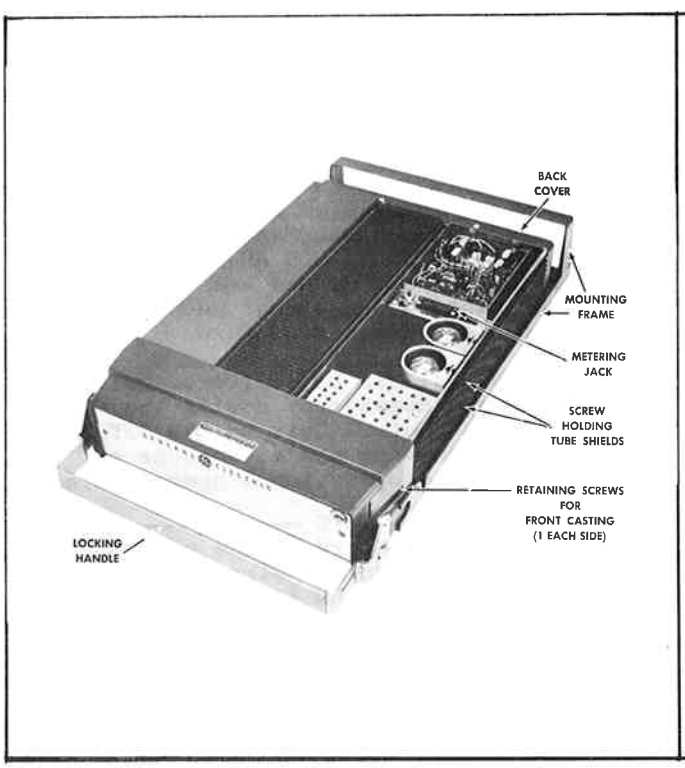


Figure 2 - Top Cover Removed

Figure 3 - Bottom Cover Removed

4. Disconnect the antenna jack in front of the transmitter and the 20-pin feed-thru connector at the back of the transmitter, and slide the unit out of the system frame.

TUBE REPLACEMENT

WARNING

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

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

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

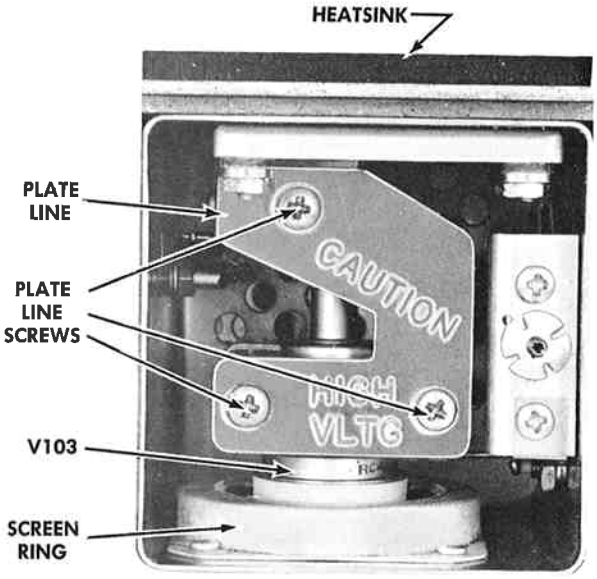


Figure 4 - PA Plate Box With Cover Removed

To replace Power Amplifier V103:

1. Make sure that all power is removed from the unit.
2. Remove the top cover on the AMPL PLATE box (fig. 4). Allow the transmitter to cool if necessary.
3. Remove the three Phillips-head screws in the plate line, starting with the two screws nearest tube socket. Lift off the top section of the plate line. Next, slide the bottom section toward the AMPL PLATE tuning adjustment and lift it out of the AMPL PLATE box.
4. Carefully work the tube out of its socket.
5. Use a screwdriver to bend the screen ring contacts out toward the center of the tube socket so that all contacts will touch the base of the tube.

CAUTION

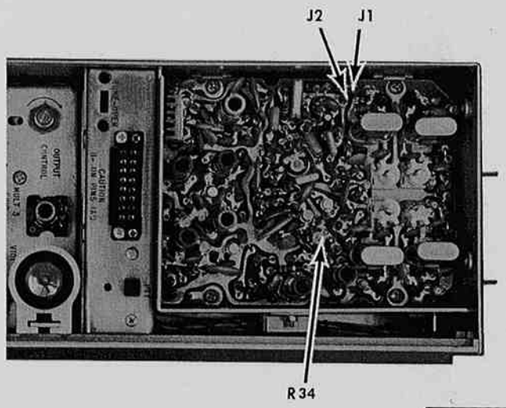
Extreme care should be taken during PA tube replacement to avoid damaging the screen ring contacts.

6. Replace the tube by hand, making sure that it is fully seated in the socket and that all screen ring contacts are touching the tube.
7. Replace the plate lines, tightening the screw nearest the heatsink first. Then replace the top cover of AMPL PLATE box.
8. Realign the transmitter.

.mum reading as shown in power output chart

ting Procedure.

ransmitter as shown below:



.tter Exciter

ion (1.5 kHz
t Channel Guard

DEVIATION METER

for deviations up to 2.4 kHz for tone
s up to 3.0 kHz for all tone frequencies

se Modulator Tuning should be peaked care-
o Steps 1 and 2 in the Transmitter Align-

repeated everytime the Tone Frequency is

SERVICE CHECK

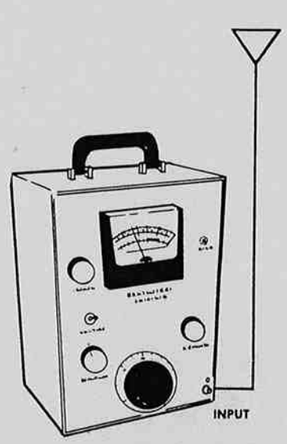
If the 0.75 kHz (1.5 kHz wide-band) deviation is not obtainable when adjusting R34, replace the encoder tone network.

STEP 3

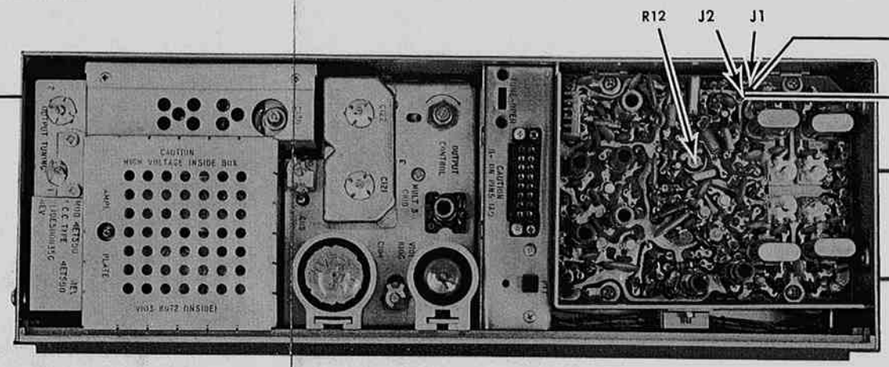
VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

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



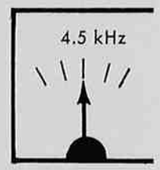
DEVIATION METER



AUDIO OSCILLATOR

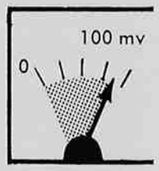
3. Set the generator output to 0.75 VOLTS RMS and frequency to 1 kHz.
4. Key the transmitter and adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz (±13 kHz wide-band).
6. Adjust "Modulation Adjust Control" R12 until deviation reads 4.5 kHz (13 kHz wide-band) on plus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

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



DEVIATION METER

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



METER

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-bar Voltage should be LESS than 100 millivolts.

TEST PROCEDURES

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

TEST EQUIPMENT REQUIRED

for test hookup as shown:

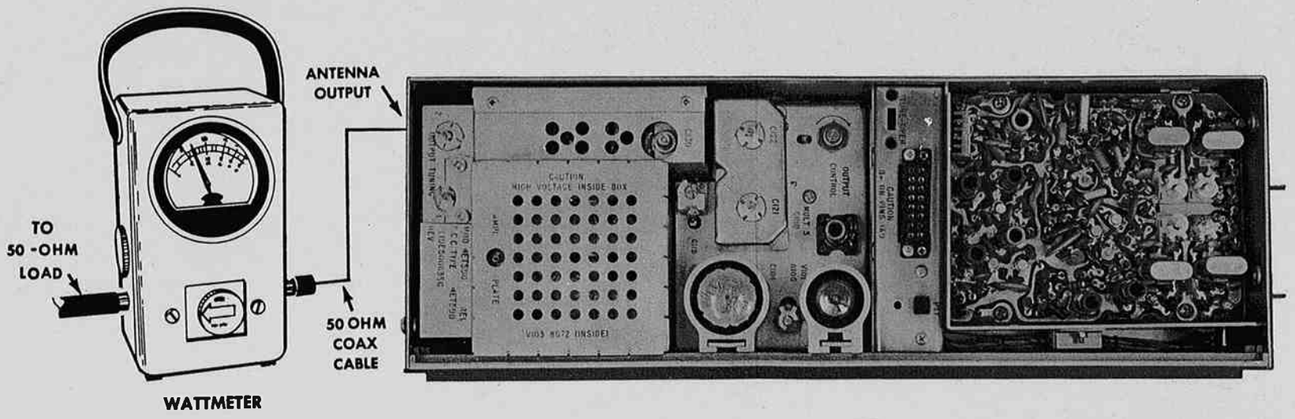
1. Wattmeter similar to: Bird #43
2. VTVM similar to: Triplett #850
3. Audio Generator similar to: GE Model 4EX6A10 or Heath #1G-72
4. Deviation Meter similar to: Measurements #140
5. Multimeter similar to: GE METERING TEST SET MODEL 4EX3A10, 4EX8K11, Triplett #631 or 20,000 ohms-per-volt voltmeter

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

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



2. Key transmitter and check wattmeter for minimum re on Transmitter Schematic Diagram.

SERVICE CHECK

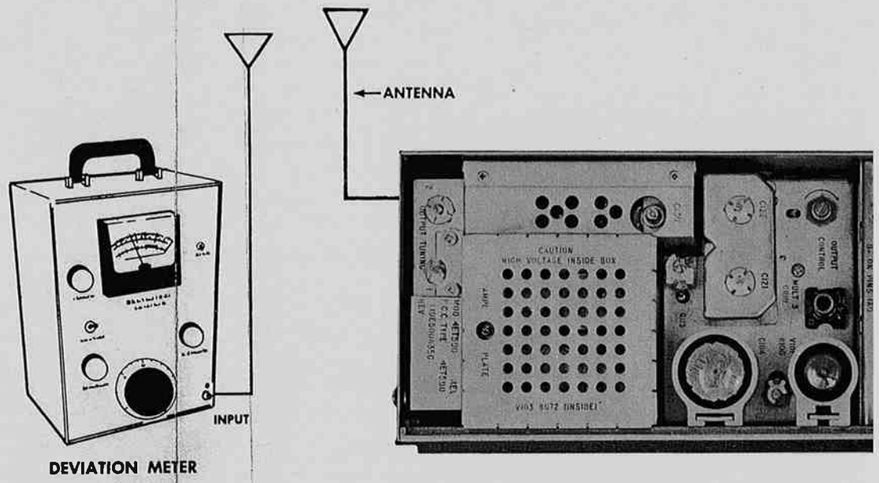
Refer to Service Hints on Transmitter Troubleshooting Pr

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

1. Setup Deviation Meter and monitor output of transmi



2. Unplug the MIC HI terminal from J1 on Transmitter I Board.
3. Key transmitter and check for 0.75 kHz deviation (J wide-band). If reading is low or high, adjust Char MOD ADJUST (R34) for a reading of 0.75 kHz.

NOTES:

The Channel Guard MOD ADJUST (R34) may be adjusted for d frequencies from 71.9 Hz to 82.5 Hz, and deviations up t above 82.5 Hz.

1. On units supplied with Channel Guard, the Phase Mod fully to insure proper performance. (Refer to Step ment Chart).
2. The Tone Deviation Test Procedures should be repeat changed.

TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

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

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal (operating frequency ÷ 36) in crystal socket XY1.
2. For a badly mis-aligned transmitter or a large change in frequency, set crystal trimmer C10 to mid-capacity. If multi-frequency transmitter, set all trimmers to mid-capacity and tune transmitter on channel with the lowest frequency (except for Steps 15 and 16).
3. Turn OUTPUT CONTROL (R124) fully counterclockwise. This limits PA dissipation during initial tune-up.
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 where indicated.
5. 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 Z101/Z102 (MULT-3 GRID) at the top of the coil form. Tune AMPL PLATE counterclockwise until the stud is even with the top of the case. Then turn C121, C122 and OUTPUT TUNING -1 and -2 fully counterclockwise
6. All adjustments are made with the transmitter keyed.

ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	METERING POSITION Multimeter - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A (MULT-1)	Pin 10	L1/L2 (and L3/L4 with Channel Guard)	0.8 v (0.5 v Minimum)	Tuning the modulator is a critical adjustment. Carefully tune L1/L2 for maximum meter reading. For transmitters with Channel Guard, 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 meter reading (not required unless changing frequency).
4.	C (AMPL-3)	Pin 3	T4, T3 and T5	0.60 v (0.5 v Minimum)	Tune T4 and then T3 for a maximum meter reading. Then tune T5 for minimum meter reading (not required unless changing frequency).
			MULT-3, IPA AND POWER AMPLIFIER		
5.	D (MULT-3)	Pin 4	MULT-3 GRID (Z101/Z102)	0.6 v (0.5 v Minimum)	Tune MULT-3 GRID for maximum meter reading.
6.	C (AMPL-3)	Pin 3	T4	Maximum	Retune T4 for maximum meter reading.
7.	D (MULT-3)	Pin 4	MULT-3 GRID (Z101/Z102)	Maximum	Retune MULT-3 Grid for maximum meter reading.
8.	E (MULT-4)	Pin 5	IPA GRID (C104) & C115	Maximum	Tune IPA GRID for maximum meter reading. Then tune C115 for maximum meter reading (not required unless changing frequency).
9.	E (MULT-4)	Pin 5	C121 & C122	See Procedure	Tune C121 clockwise until meter reading drops abruptly. Then turn C122 clockwise for a change in meter reading. This step is not required unless changing frequency.
10.	F PA GRID	Pin 14 (+) Pin 6 (-)	AMPL GRID (C130) & C115, C121 & C122	See Procedure	Tune AMPL GRID for maximum meter reading. Then retune C115, C121, C122 and AMPL GRID in that order until no further increase in meter reading is noted.
11.	G PA PLATE	WARNING High B+ on Pins 1 & 9 Pin 1 (+) Pin 9 (-)	AMPL PLATE	Minimum	Tune AMPL PLATE for a dip in meter reading (not required unless changing frequency).
12.	H REL PWR OUT	Pin 11	OUTPUT TUNING -1 & -2 and AMPL PLATE	Maximum	Alternately tune OUTPUT TUNING -1 and -2 and AMPL PLATE in that order for maximum meter reading.
13.	G PA PLATE	Pin 1 (+) Pin 9 (-)	OUTPUT CONTROL (R124)	See Procedure (See note 1)	Adjust OUTPUT CONTROL for a meter reading of 0.7 volt (0.6 volt for continuous duty stations).
14.					Repeat Steps 12, 13 and 10 in that order
			FOR MULTI-FREQUENCY UNITS ONLY		
15.	F PA GRID	Pin 14 (+) Pin 6 (-)	AMPL GRID (C130)	See Procedure	After completing Steps 1 thru 14 using the lowest channel frequency, alternately switch from the highest to the lowest frequency and tune AMPL GRID for equal meter readings.
16.	H REL PWR OUT	Pin 11	OUTPUT TUNING-1 and AMPL PLATE	See Procedure	Alternately switch from the highest to the lowest frequency and tune OUTPUT TUNING-1 and AMPL PLATE for equal meter readings.
			FREQUENCY ADJUSTMENT		
17.					With no modulation, adjust crystal trimmers C10, C16, C22 or C28 as required. Next, refer to the MODULATION ADJUSTMENT.

REDUCED POWER OPERATION

NOTE 1 - In some services, FCC regulations do not permit the use of full rated power input to the PA Plate circuit. In such cases:

1. In station applications, make sure that the power transformer taps are set for the PA Plate voltage shown in the Maintenance Manual for Power Supply Type EP-38-A.
2. In mobile applications, make sure that the transformer taps are set as shown in the Maintenance Manual for the 4EP37A10, 4EP37B10, 4EP37C10 or 4EP37D10.
3. Adjust the OUTPUT CONTROL for the meter reading shown in the following chart.

	XMTR TYPE	MEASURED PLATE VOLTAGE	METER READING
For 60-Watt Input	ET-59-D	275 to 305 VDC (see Note 2)	0.7 VDC
For 120-Watt Input	ET-60-D	460 to 510 VDC (see Note 3)	0.7 VDC MAX.

NOTE 2 - If the plate voltage is not within the 275 to 305-volt limit, find the OUTPUT CONTROL setting by dividing 210 by the measured plate voltage.

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

NOTE 3 - If the Plate Voltage is not within the 460 to 510-volt limit, find the OUTPUT CONTROL setting by dividing 311 by the measured plate voltage.

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

ALIGNMENT PROCED

406—470 MHz, 35 & 60-WATT
TRANSMITTER MODELS 4ET59D30
MODELS 4ET60D

Issue 2

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
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Model 4EX3A10

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J5 (Green-Hi) and J6 (Black-Lo) on GE Test Set or across J1 (Mike High) and J2 (Mike Low) on the Exciter Board.
2. Apply a 0.75-volt signal at 1000 Hz to Test Set or across J1 and J2 on Exciter Board.
3. For transmitters without Channel Guard, set the MOD ADJUST (R12) for a 13 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 (R34) for 1.5 kHz tone deviation. Then repeak L1/L2 and L3/L4 as shown in Step 1 of Transmitter Alignment Procedure. Reset tone deviation to 1.5 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 11.5 kHz deviation (13 kHz minus 1.5 kHz tone deviation).
5. For multifrequency transmitters, set the deviation as described in Steps 3 or 4 on the channel producing the largest amount of deviation.

PA POWER INPUT

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

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

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

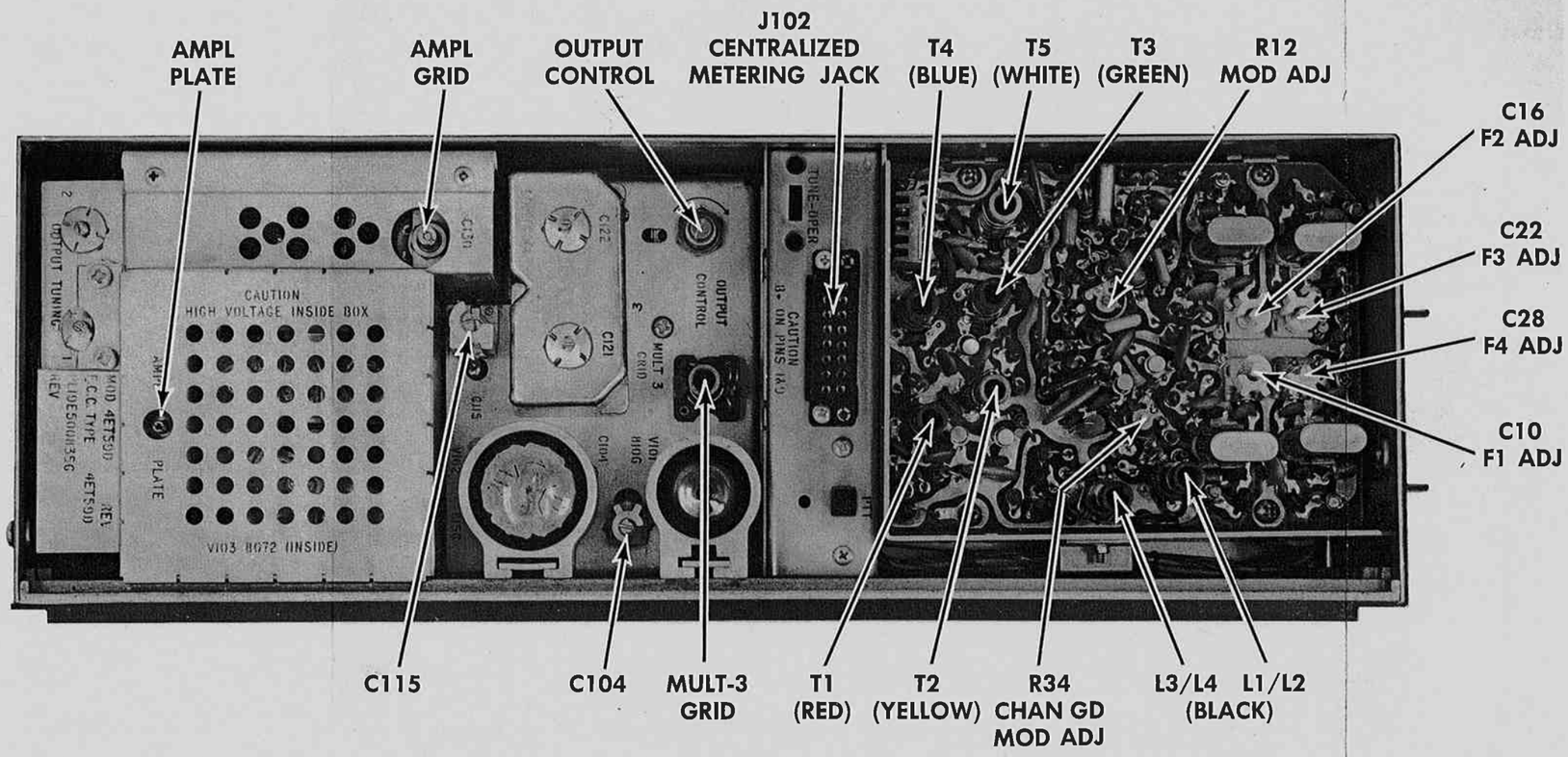
Where:

P_i is the power input in watts.

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

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

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

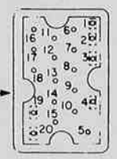


C158
57

READINGS AT J101 TAKEN TO CHASSIS GROUND.		
PIN	−	+
1	0	0
2	∞	∞
3	1Ω	1Ω
4	19K	19K
5	∞	∞
6	∞	∞
7	∞	∞
8	50K	50K
9	∞	∞
10	∞	∞
11	∞	∞
* 12		
13	∞	∞
14	∞	∞
15	5.5K	2.5K
* 16	∞/30K	∞/15K
* 17	∞/30K	∞/15K
* 18	∞/30K	∞/15K
19	0	0
20	∞	∞

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

J101



RESISTANCE READINGS

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

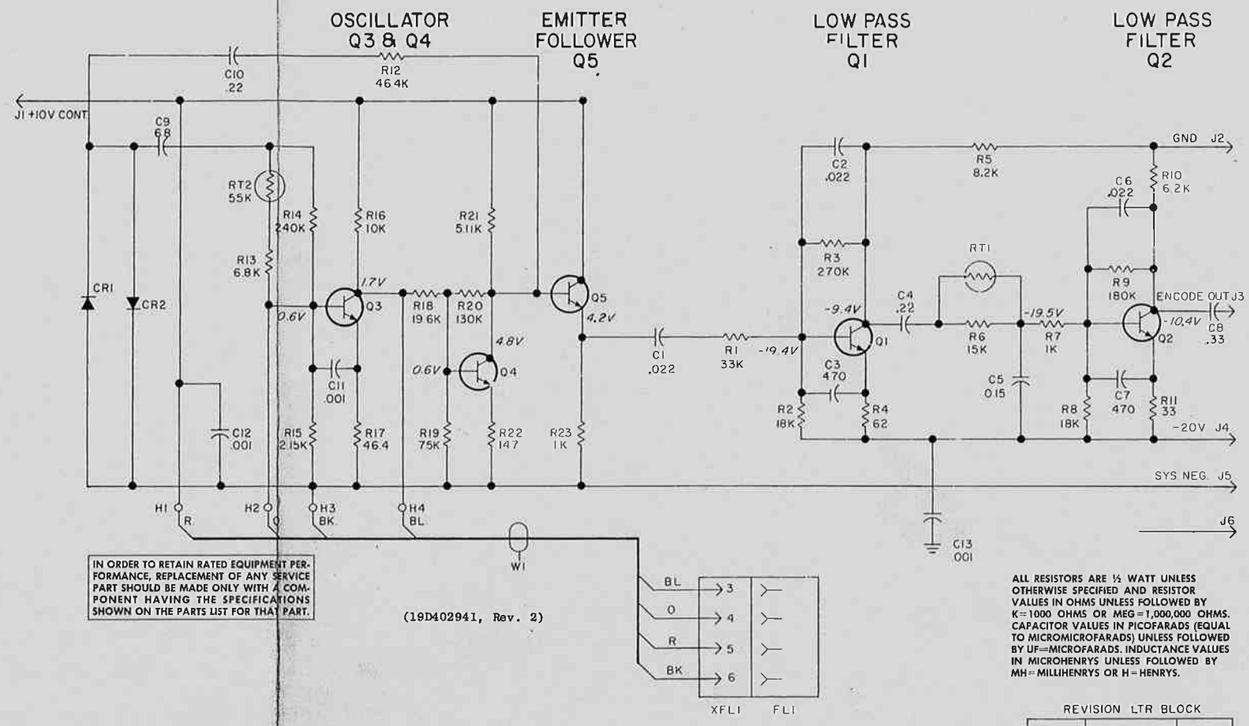
FOR READINGS OF:	USE SCALE:
1-100Ω	X 1
100-1KΩ	X 10
1K-50KΩ	X 1,000
50K-∞Ω	X 100,000

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

* READING DEPENDS ON METER POLARITY.

CHANNEL GUARD ENCODER MODEL 4EH17A10

SCHEMATIC DIAGRAM



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

(19D402941, Rev. 2)

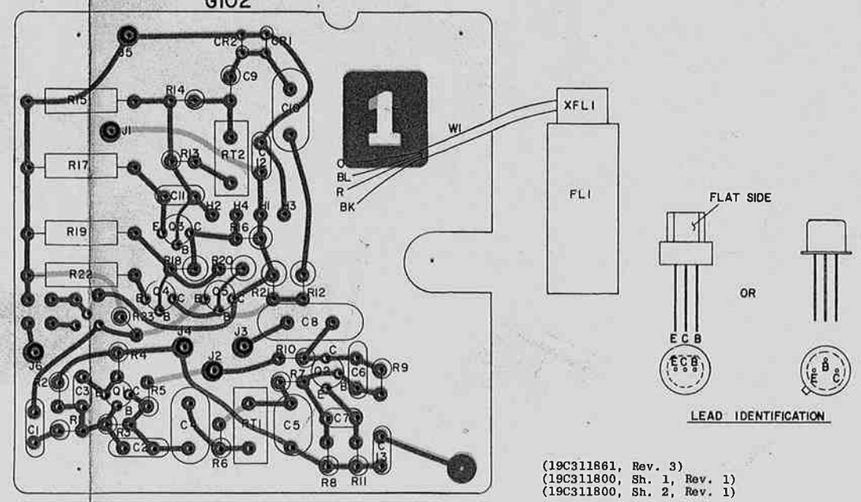
ALL RESISTORS ARE ½ WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

REVISION LTR BLOCK

		REV
G102	4EH17A10	A

OUTLINE DIAGRAM

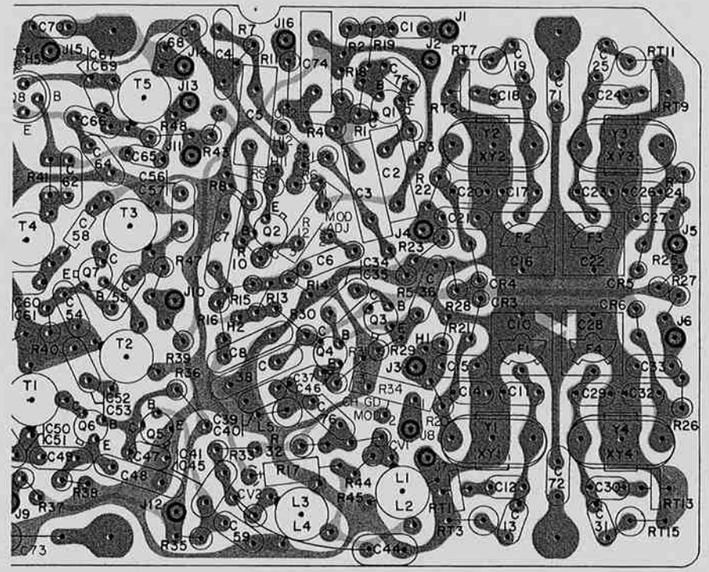
ENCODER
MODEL 4EH17A10
G102



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

I-3998

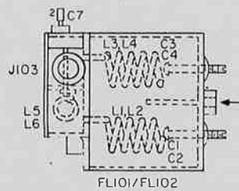
EXCITER
A101 - A112



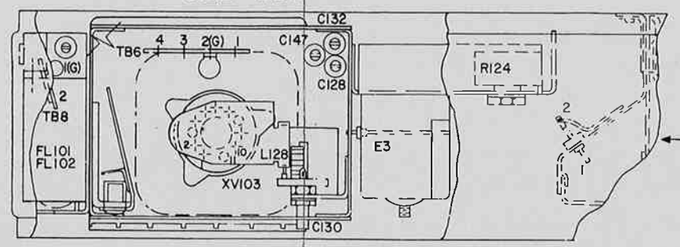
303483, Sh. 1, Rev. 7)
303483, Sh. 2, Rev. 7)

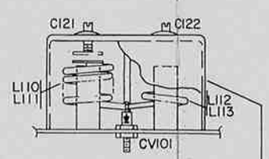
EXCITER READINGS TAKEN TO CHASSIS GROUND						
TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	6.5K	6.8K	240K	12K	50K	20K
Q2	6.2K	4K	70K	10K	9.8K	10K
Q3	9K	2.7K	9K	2.7K	100	100
Q4	7K	5K	9K	2.7K	100	100
Q5	5K	2.7K	70K	6.8K	3.7K	2.3K
Q6	4K	3.2K	3.7K	2.3K	175	175
Q7	5.2K	2.9K	5K	2.7K	465	465
Q8	5K	2.7K	5K	2.7K	67	67

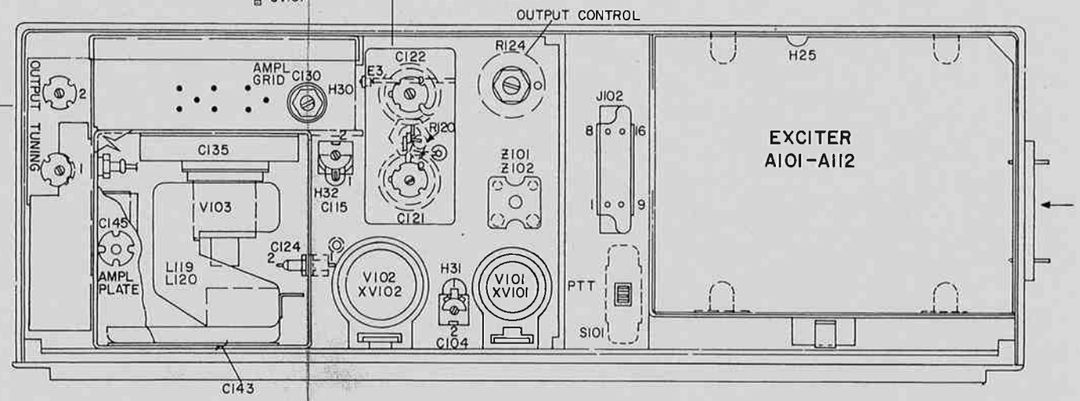
EXCITER READINGS TAKEN TO 20 VOLT LINE J15 BLUE LEAD.						
TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	11K	14K	240K	30K	60K	35K
Q2	1K	1K	70K	4.3K	14K	18K
Q3	2.6K	2.5K	10K	5.5K	2.7K	5.1K
Q4	1.5K	1.5K	2.6K	2.5K	2.7K	5.1K
Q5	0	0	70K	3.2K	8.2K	3.8K
Q6	340	360	8K	3.8K	3K	5.1K
Q7	60	180	0	0	2.3K	5.5K
Q8	27	27	47	47	2.6K	5K

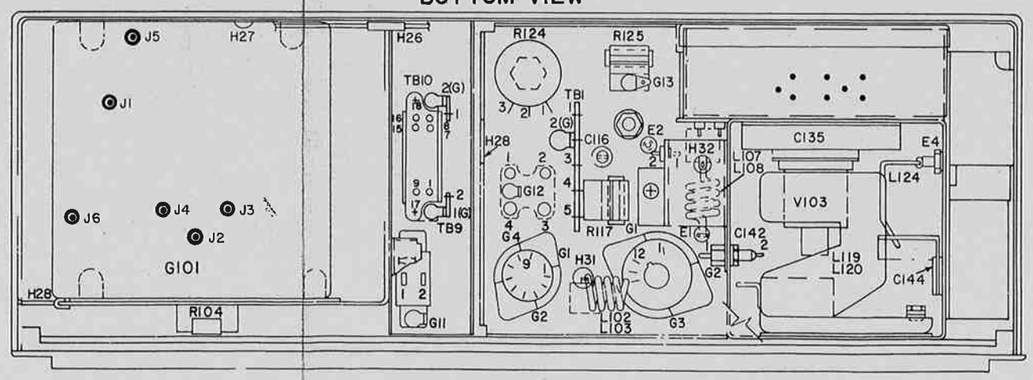


FL101/FL102

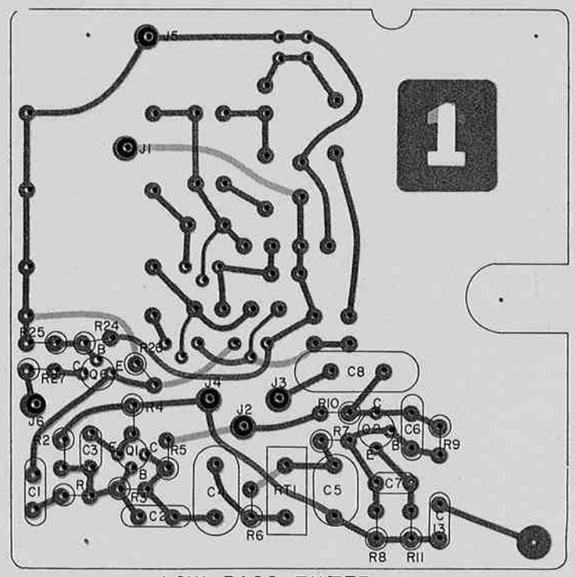






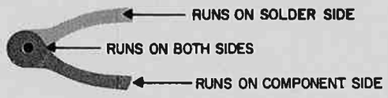


(19R621286, Rev. 3)



LOW-PASS FILTER
G101

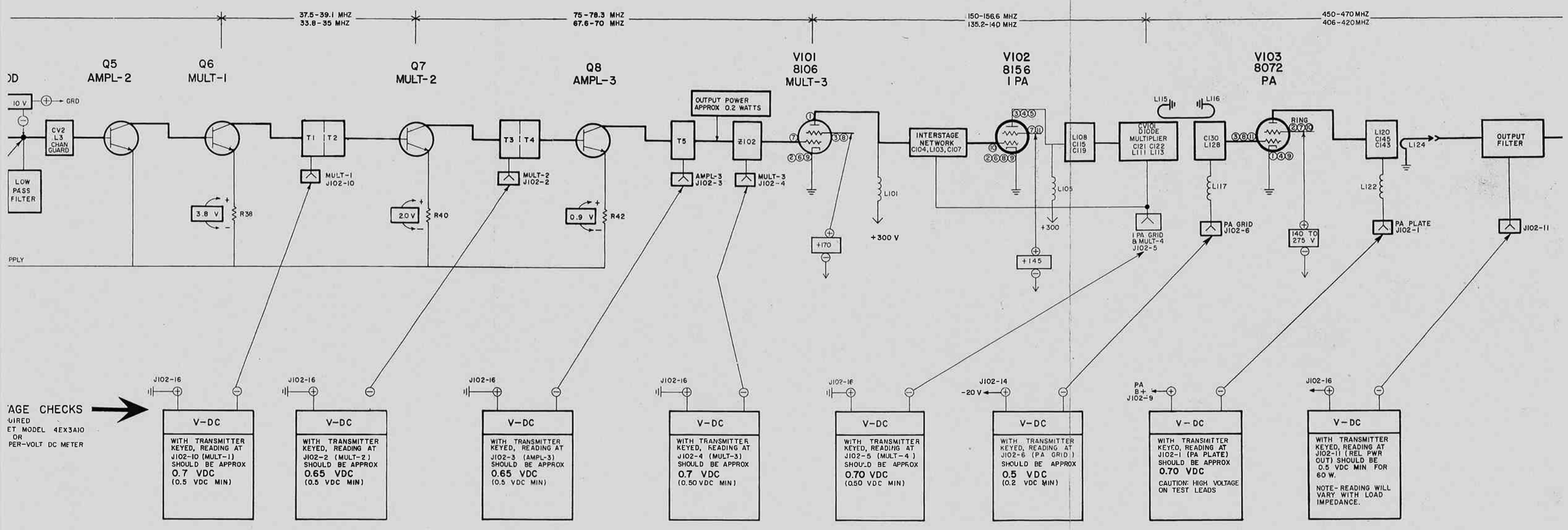
(19C311800, Sh. 1, Rev. 1)
(19C311800, Sh. 2, Rev. 1)



JTLINE DIAGRAM

6—470 MHz, 35 & 60-WATT TRANSMITTER
DELS 4ET59D30-41 & 4ET60D30-41

Issue 3



RC-1462A

TROUBLESHOOTING PROCEDU

406—470 MHz, 35 & 60-WATT TRANSMI
MODELS 4ET59D30-41 & 4ET60D3

Issue 1

STEP I - QUICK CHECKS

POWER OUTPUT	CHECK VOLTAGES AT CENTRALIZED METERING JACK J102 Multimeter = pin numbers GE Test Set = A-G positions							PROBABLE DEFECT
	Pins 10 & 16 A	Pins 2 & 16 B	Pins 3 & 16 C	Pins 4 & 16 D	Pins 5 & 16 E	Pins 6 & 14 F	Pins 1 & 9 G	
0	0	0	0	0.18 v	0.28 v	0	Low	Defective Q3-Q6 or Modulator (see Note A)
0	over 1.0 v	0	0	0.18 v	0.28 v	0	Low	Shorted Q5 or open Q6
0	0.70 v	0 or over 1.0 v	0	0.18 v	0.28 v	0	Low	Defective Q7
0	0.70 v	0.65 v	0 or over 1.0 v	0.18 v	0.28 v	0	Low	Defective Q8
0	0.70 v	0.65 v	low	0.18 v	0.28 v	0	Low	Open filament on 8106, open coax
0	0.70 v	0.65 v	0.7 v	0.75 v	0.28 v	0	Low	Open filament on 8156
0	0.70 v	0.65 v	0.7 v	0.75 v	0.75 v	0	0	Open filament on 8072
0	0.70 v	0.65 v	0.7 v	0.75 v	0.5 v	0	0	If no peak at position "E" when tuning C115, bad multiplier diode or 8156
0	0.72 v	0.65 v	0.7 v	0.75 v	0.75 v	high	Very Low or 0	Bad R123/R126, bad R124, shorted 8072 screen
Low	0.72 v	0.65 v	0.7 v	0.75 v	0.75 v	Low	0.70 v	Weak 8156 or 8072
Erratic	0.72 v	0.65 v	0.7 v	0.75 v	0.75 v	Very high	0.70 v	Check contacts on screen bypass ring

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

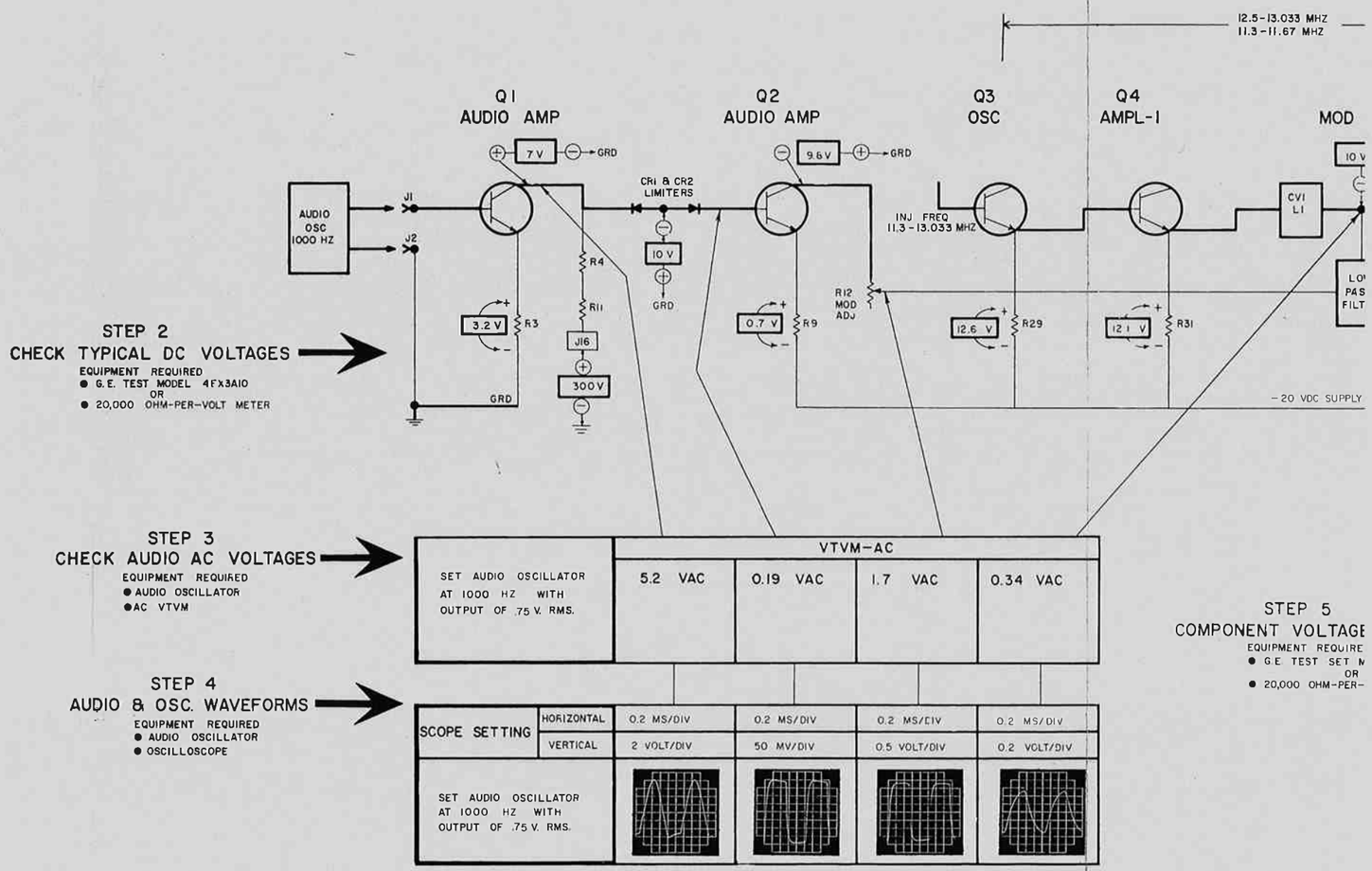
1. -20 volt DC supply at J102-12-16.
2. Measure 12.1 VDC across Q4 emitter resistor R31 (1500 ohms), then:

(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.



PARTS LIST

LBI-4025D

405-470 MHz TRANSMITTER

MODELS 4ET59D30-35 STANDARD
MODELS 4ET59D36-41 CHANNEL GUARD
MODELS 4ET60D30-35 STANDARD
MODELS 4ET60D36-41 CHANNEL GUARD

SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD
A101 thru A112		A101 19D402308G1 4ET59D30, 4ET60D30 1 Freq A102 19D402308G2 4ET59D31, 4ET60D31 1 Freq A103 19D402308G3 4ET59D32, 4ET60D32 2 Freq A104 19D402308G4 4ET59D33, 4ET60D33 2 Freq A105 19D402308G5 4ET59D34, 4ET60D34 4 Freq A106 19D402308G6 4ET59D35, 4ET60D35 4 Freq A107 19D402308G7 4ET59D36, 4ET60D36 1 Freq A108 19D402308G8 4ET59D37, 4ET60D37 1 Freq A109 19D402308G9 4ET59D38, 4ET60D38 2 Freq A110 19D402308G10 4ET59D39, 4ET60D39 2 Freq A111 19D402308G11 4ET59D40, 4ET60D40 4 Freq A112 19D402308G12 4ET59D41, 4ET60D41 4 Freq
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C2	19A116080P4	Polyester: .033 µf ±20%, 50 VDCW.
C3	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C4	7491395P114	Ceramic disc: 0.0022 pf ±10%, 500 VDCW; sim to RMC Type JL.
C5	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C6	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C7	7491395P111	Ceramic disc: 0.0015 pf ±10%, 500 VDCW; sim to RMC Type JL.
C8	5493367P1000K	Silver mica: .001 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-20.
C10	5491271P106	Variable: approx 2.1 to 12.7 pf, 750 v peak; sim to EF Johnson 189.
C11	5496219P7	Ceramic disc: 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C12 and C13	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C14	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C15	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C16	5491271P106	Variable: approx 2.1 to 12.7 pf, 750 v peak; sim to EF Johnson 189.
C17	5496219P7	Ceramic disc: 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C18 and C19	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C20	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C21	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C22	5491271P106	Variable: approx 2.1 to 12.7 pf, 750 v peak; sim to EF Johnson 189.
C23	5496219P7	Ceramic disc: 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C24 and C25	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C26	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C27	5494481P111	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C28	5491271P106	Variable: approx 2.1 to 12.7 pf, 750 v peak; sim to EF Johnson 189-6-5.
C29	5496219P7	Ceramic disc: 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C30 and C31	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C32	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C33	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C34	5496372P50	Ceramic disc: 220 pf ±5%, 500 VDCW, temp coef -2200 PPM.
C35	5496372P54	Ceramic disc: 270 pf ±5%, 500 VDCW, temp coef -2200 PPM.
C36	5496219P467	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -220 PPM.
C37	5496372P327	Ceramic disc: 75 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C38	5494481P131	Ceramic disc: .0068 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C39	5496372P145	Ceramic disc: 180 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C40	5496372P345	Ceramic disc: 180 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C41	5493366P180K	Silver mica: 180 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C44	5493366P470J	Silver mica: 470 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C45	5496372P45	Ceramic disc: 180 pf ±10%, 500 VDCW, temp coef -2200 PPM.
C46	5496372P347	Ceramic disc: 200 pf ±10%, 500 VDCW, temp coef -4700 PPM.
C47	5496219P749	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -750 PPM.
C48	5494481P129	Ceramic disc: .0039 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C49	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C50	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C51	5496219P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C52	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C53	5496219P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C54 and C55	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C56	5496219P440	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef -220 PPM.
C57	5496219P343	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -150 PPM.
C58	5491601P35	Phenolic: 0.15 pf ±10%, 500 VDCW.
C59	5493366P220K	Silver mica: 220 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C60	5496219P241	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C61	5496219P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C62	5496219P51	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C64	5494481P111	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C65	5496219P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C66	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C67	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C68	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C69	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C70 thru C72	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C73	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C74	19A115414P13	Polyester: 0.1 µf ±20%, 200 VDCW.
C75	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C76	5493366P470K	Silver mica: 470 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
C77	5493366P270K	Silver mica: 270 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3 thru CR6	19A115603P1	Silicon.
CV1 and CV2	5495769P8	Varactor, silicon: 33 pf ±20% at 4 VDC; sim to Pacific Semiconductors Varicap Type V-595.
		- - - - - - - 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.
L3	19B204526G4	Coil. Includes tuning slug 5491798P2.
R1	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
L4	19B204526G3	Coil. Includes tuning slug 5491798P2.
R1	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
L5	7488079P48	Choke, RF: 27 µh ±10%, 1.4 ohms DC res max; sim to Jeffers 4422-9K.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q3 thru Q5	19A115330P1	Silicon, NPN.
Q6 and Q7	19A115328P1	Silicon, NPN.
Q8	19A115329P2	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P334K	Composition: 0.33 megohm ±10%, 1/2 w.
R2	3R77P105K	Composition: 1 megohm ±10%, 1/2 w.
R3	3R77P472K	Composition: 4700 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	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R10 and 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. In Exciter 19D402308G1 thru G6 earlier than REV D; 19D402308G7 thru G12 earlier than REV E:
	19B201969P6	Variable, carbon film: .01 megohm ±20%, 0.1 w; sim to Centralab Series 4.
R13 and R14	3R77P224K	Composition: 0.22 megohm ±10%, 1/2 w.
R15	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R16	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R17	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R18	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R19	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R20	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R21	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R22	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R23	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R24	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R25	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R26	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R27 and R28	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R29	3R77P272K	Composition: 2700 ohms ±10%, 1/2 w.
R30	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R31	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R32 and R33	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R34*	19B209358P107	Variable, carbon film: approx 75 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201. In Exciter 19D402308G1 thru G6 earlier than REV D; 19D402308G7 thru G12 earlier than REV E:
	19B201969P7	Variable, carbon film: .025 megohm ±20%, 0.1 w; sim to Centralab Series 4.
R35	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R36	3R77P392K	Composition: 3900 ohms ±10%, 1/2 w.
R37	3R77P750J	Composition: 75 ohms ±5%, 1/2 w.
R38	3R77P391K	Composition: 390 ohms ±10%, 1/2 w.
R39	3R77P620J	Composition: 62 ohms ±5%, 1/2 w.
R40	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R41	3R77P470K	Composition: 47 ohms ±10%, 1/2 w.
R42	3R77P270K	Composition: 27 ohms ±10%, 1/2 w.
R43	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
R44	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R45	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R46	19A116278P474	Metal film: 0.576 megohm ±2%, 1/2 w.
R47	3R77P391K	Composition: 390 ohms ±10%, 1/2 w.
R48	3R77P470K	Composition: 47 ohms ±10%, 1/2 w.
R50	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R53	3R152P472K	Composition: 4700 ohms ±10%, 1/4 w.
		- - - - - - - - - THERMISTORS - - - - - - - -
RT1	19B209284P6	Disc: 75 ohms, color code blue.
RT3	19B209284P2	Rod: 2140 ohms, color code red.
RT5	19B209284P6	Disc: 75 ohms, color code blue.
RT7	19B209284P2	Rod: 2140 ohms, color code red.
RT9	19B209284P6	Disc: 75 ohms, color code blue.
RT11	19B209284P2	Rod: 2140 ohms, color code red.
RT13	19B209284P6	Disc: 75 ohms, color code blue.
RT15	19B209284P2	Rod: 2140 ohms, color code red.
		- - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19B204534G1	Coil. Includes tuning slug 5491798P4.
T2	19B204531G1	Coil. Includes tuning slug 5491798P4.
T3	19B204535G1	Coil. Includes tuning slug 5491798P4.
T4	19B204535G2	Coil. Includes tuning slug 5491798P4.
T5	19B204537G1	Coil
XY1 thru XY4		Refe
Y1 thru Y4	19B206175P6	Quar rang
Y1 thru Y4	19B206175P7	Quar rang
C101	5494481P12	Cera RMC
C104	5491271P6	Vari to 1
C105	5494481P12	Cera RMC
C106	19B209204P1	Cera -47(
C107	7489162P7	Sili Elec
C108	7489162P4	Sili Elec
C109	7489162P27	Sil Elec
C110	7489162P31	Sil Elec
C111	19B209204P1	Cer -47(
C113	5493392P7	Cer VDC
C115	19B209372P1	Var EF
C116	5493392P7	Cer VDC
C118	7489162P8	Sil Elec
C119	7489162P6	Sil Elec
C121 and C122		Ref 33,
C125	7489162P2	Sil Elec
C126	7489162P1	Sil Elec
C127	5494481P12	Cer RMC
C128	5493392P7	Cer VDC
C130	5490272P17	Var Joh
C132	5493392P7	Cer VDC
C135	19B209369P1	Mic 124
C136	7489162P27	Sil Elec
C138	7489162P27	Sil Elec
C140	7489162P27	Sil Elec

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

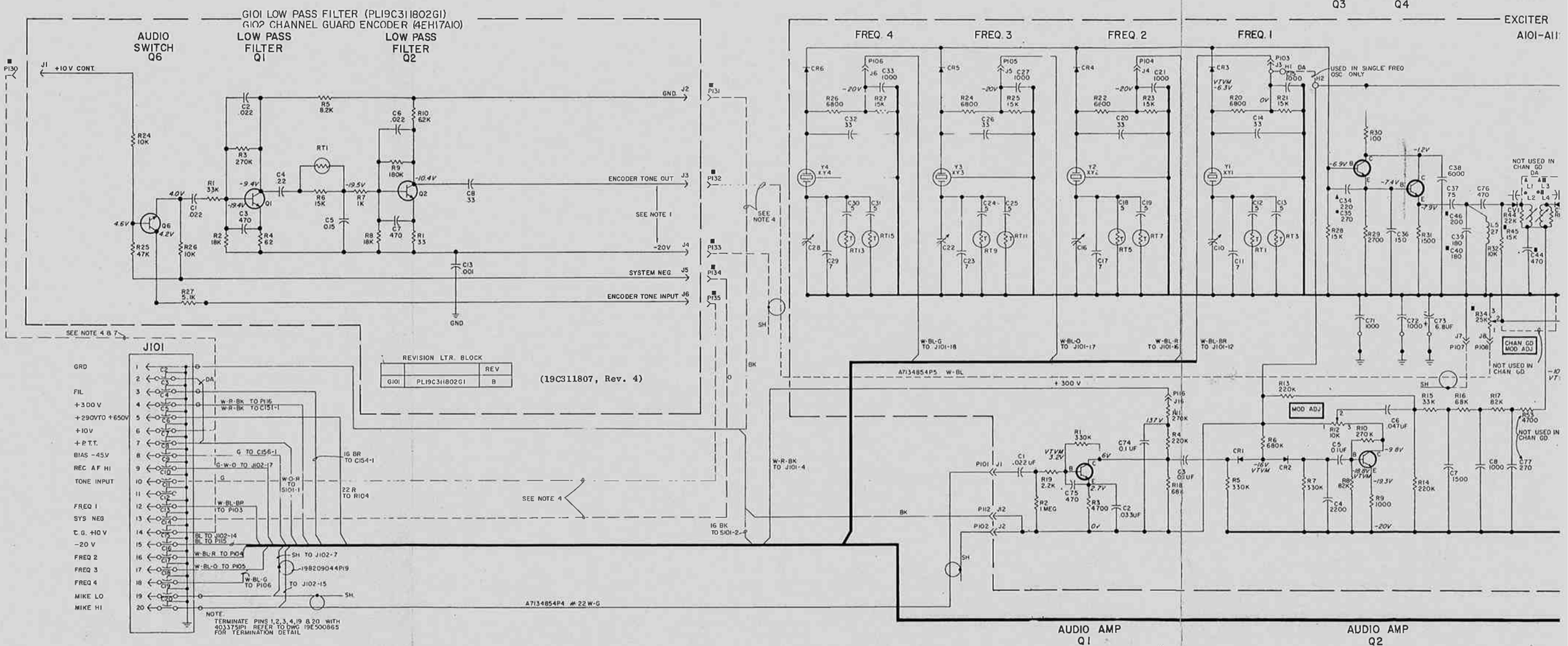
DESCRIPTION
ncludes tuning slug 5491798P4.
- - - - - - SOCKETS - - - - - - - - - -
Mechanical Parts (RC-1465, items 1-4).
- - - - - - CRYSTALS - - - - - - - - - -
rdering give GE Part Number and specify equency needed.
frequency = (OF ÷ 36).
freq range 11,000 to 12,566 KHz, temp 0°C to +85°C. (406-420 MHz Transmitter)
freq range 12,500 to 14,500 KHz, temp 0°C to +85°C. (450-470 MHz Transmitter)
CHASSIS AND PA ASSEMBLY 19E500865G1, G2
- - - - - CAPACITORS - - - - - - - - -
disc: .001 pf ±10%, 1000 VDCW; sim to JF Discap.
: approx 2.1-12.7 pf, 750 v peak; sim hnson 189.
disc: .001 pf ±10%, 1000 VDCW; sim to JF Discap.
disc: 220 pf ±10%, 500 VDCW, temp coef M.
ica: 12 pf ±5%, 500 VDCW; sim to Motive Type DM-15.
ica: 8 pf ±0.5 pf, 500 VDCW; sim to Motive Type DM-15.
ica: 100 pf ±5%, 500 VDCW; sim to Motive Type DM-15.
ica: 150 pf ±5%, 500 VDCW; sim to Motive Type DM-15.
disc: 220 pf ±10%, 500 VDCW, temp coef M.
, feed-thru: .001 pf +100% -0%, 500 lm to Allen-Bradley Type FA5C.
: approx 2.3 to 24.3 pf; sim to on Type V 193-0008-010.
, feed-thru: .001 pf +100% -0%, 500 lm to Allen-Bradley Type FA5C.
ica: 15 pf ±5%, 500 VDCW; sim to Motive Type DM-15.
ica: 10 pf ±0.5 pf, 500 VDCW; sim to Motive Type DM-15.
Mechanical Parts (RC-1465 items 19, 31,
ica: 6 pf ±0.5 pf, 500 VDCW; sim to Motive Type DM-15.
ica: 5 pf ±0.5 pf, 500 VDCW; sim to Motive Type DM-15.
disc: .001 pf ±10%, 1000 VDCW; sim to JF Discap.
, feed-thru: .001 pf +100% -0%, 500 lm to Allen-Bradley Type FA5C.
e: 2 to 7.83 pf, 1250 v peak; sim to Type M.
, feed-thru: .001 pf +100% -0%, 500 lm to Allen-Bradley Type FA5C.
2650 pf ±20%, 400 VDCW; sim to EF Johnson -18.
mica: 100 pf ±5%, 500 VDCW; sim to Motive Type DM-15.
mica: 100 pf ±5%, 500 VDCW; sim to Motive Type DM-15.
mica: 100 pf ±5%, 500 VDCW; sim to Motive Type DM-15.

SYMBOL	GE PART NO.	DESCRIPTION
C142	7485975P17	Ceramic, feed-thru: 470 pf ±20%, 750 VDCW; sim to Erie Style 327.
C143		Refer to Mechanical Parts (RC-1465 items 14,15).
C144		Refer to Mechanical Parts (RC-1465 items 25,26, 35).
C145		Refer to Mechanical Parts (RC-1465 items 16-20).
C147	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C148 and C149	5494481P12	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C150 thru C156	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C157	19B209282P1	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW; sim to Sprague Type 544C.
C158 and C159	5493392P7	Ceramic, feed-thru: .001 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR101	4037822P1	Silicon.
CV101	19A115809P1	Silicon, capacitive.
		- - - - - - - - - TERMINALS - - - - - - - - -
E1	19B200535P3	Feed-thru: sim to Sealectro ST-1500SL-C3.
E2	4029309P1	Feed-thru: sim to Sealectro FT-SM-27.
E3	4036032P5	Feed-thru: sim to Sealectro FT-SM-10.
E7	4034512P2	Feed-thru: sim to Sealectro FT-SM-22-TUR.
		- - - - - - - - - - FILTERS - - - - - - - - - -
		BANDPASS FILTER
		NOTE: The bandpass filters are factory tuned. If a filter component (except as shown below) is found to be defective, it is recommended that the entire filter assembly be replaced to maintain rated power output and spurious attenuation.
FL101	19C303559G1	405-420 KHz.
FL102	19C303559G2	450-470 MHz.
G101		LOW PASS FILTER ASSEMBLY 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%, 250 VDCW.
C13	5494481P111	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - JACKS AND RECEPTACLES - - - - -
J1 thru J6	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q6	19A115123P1	Silicon, NPN; sim to Type 2N2712.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R2	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R3	3R77P274K	Composition: 0.27 megohm ±10%, 1/2 w.
R4	3R77P620J	Composition: 62 ohms ±5%, 1/2 w.
R5	3R77P822K	Composition: 8200 ohms ±10%, 1/2 w.
R6	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R7	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R8	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R9	3R77P184K	Composition: 0.18 megohm ±10%, 1/2 w.
R10	3R77P622J	Composition: 6200 ohms ±5%, 1/2 w.
R11	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R24	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R25	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R26	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R27	3R77P512K	Composition: 5100 ohms ±10%, 1/2 w.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1	5490828P30	Rod: 0.33 megohm ±10% res, 1 w max; sim to Globar Type 783H-3.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J101	19C303426G1	Connector: 20 pin contacts.
J102	19B205689G1	Connector: 18 electrical contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L101	7488079P35	Choke, RF: 2.2 µh ±10%, 0.5 ohm DC res max; sim to Jeffers 4412-9K.
L102	19A122524G2	Coil.
L103	19A122524G1	Coil.
L105	7488079P33	Choke, RF: 1 µh ±10%, 0.15 ohm DC res max; sim to Jeffers 4412-5K.
L107	19B205615P2	Coil.
L108	19B205615P1	Coil.
L110	19B205614P2	Coil.
L111	19B205614P5	Coil.
L112	19B205614P4	Coil.
L113	19B205614P3	Coil.
L115	4036032P5	Feed-thru: sim to Sealectro FT-SM-10.
L116		Part of can assembly 19B205625G1. Not recommended as a replaceable item.
L117	7772834P7	Choke, RF: 0.2 µh ±10%, .034 ohm ±15% DC res, 320 to 520 MHz freq range; sim to Ohmite Z-460.
L119 and L120		(Part of Mechanical Assembly, items 12, 13, 22 and 23).
L122	7772834P7	Choke, RF: 0.2 µh ±10%, .034 ohm ±15% DC res, 320 to 520 MHz freq range; sim to Ohmite Z-460.
L124	19A121390P1	Coil.
L125 and L126	19B205616P1	Coil.
L127	19B204658P3	Grid line.
L128	19B204658P1	Grid line.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P101	4029840P2	Contact, electrical: sim to AMP 42827-2.
P102	4029840P1	Contact, electrical: sim to AMP 41854.
P103 thru P106	4029840P2	Contact, electrical: sim to AMP 42827-2.

SYMBOL	GE PART NO.	DESCRIPTION
P109 thru P113	4029840P2	Contact, electrical: sim to AMP 42827-2.
P114	4029840P1	Contact, electrical: sim to AMP 41854.
P115 thru P117	4029840P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R101	19A115416P1	Precision, wirewound: 0.91 ohm ±1%, 2 w; sim to Dale Type RS-2B.
R102	19A115416P3	Precision, wirewound: 2.59 ohms ±1%, 2 w; sim to Dale Type RS-2B.
R103	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
R104	5493035P11	Wirewound: 40 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
R105	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R106	3R77P431J	Composition: 430 ohms ±5%, 1/2 w.
R107	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R108	3R77P683J	Composition: 68,000 ohms ±5%, 1/2 w.
R109	3R79P273K	Composition: 27,000 ohms ±10%, 2 w.
R112	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R113	3R77P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R114	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R115	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R117	3R149P223J	Composition: 22,000 ohms ±5%, 4 w.
R118	3R78P473K	Composition: 47,000 ohms ±10%, 1 w.
R120	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R123	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R124	19B209381P1	Variable, composition: 10,000 ohms ±20%, 3 w; sim to Allen-Bradley Type K.
R125	3R149P153K	Composition: 15,000 ohms ±10%, 4 w.
R126	3R79P562K	Composition: 5600 ohms ±10%, 2 w.
R129	3R78P391J	Composition: 390 ohms ±5%, 1 w.
R130	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - -
S101	4031922P1	Pushbutton: SPST, normally open, 1/2 amp at 12 VDC; sim to Stackpole Type SS-15.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P9	Phen: 5 terminals.
TB6	7775500P10	Phen: 4 terminals.
TB9	7487424P1	Miniature, phen: 1 terminal.
TB10	7487424P2	Miniature, phen: 1 terminal.
		- - - - - - - - - - TUBES - - - - - - - - - -
V101		Type 8106.
V102		Type 8156.
V103		Type 8072.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XV101	7480532P8	Tube, phen: 9 pins; sim to Elco 04-903-84.
XV102	19C301007P5	Tube, plastic: 12 pins; sim to Alcon Metal Products 371G.
XV103	19B209160P1	Tube, plastic: 11 pins; sim to EF Johnson 124-311-100.
		- - - - - - - - TUNED CIRCUITS - - - - - - - -
Z101 C1	19B204543G2 5496203P468	Coil. Includes tuning slug 5491798P4. Capacitor, ceramic disc: 510 pf ±5%, 500 VDCW, temp coef -5600 PPM.
Z102 C1	19B204543G1 5496203P468	Coil. Includes tuning slug 5491798P4. Capacitor, ceramic disc: 510 pf ±5%, 500 VDCW, temp coef -5600 PPM.

SYMBOL	GE PART NO.	DESCRIPTION
		MECHANICAL PARTS (SEE RC-1465)
1	19B200525P9	Rivet. (Part of XY1-4 in A101-112).
2	19A115793P1	Contact, electrical: sim to Malco 2700. (Part of XY1-4 in A101-112).
3	19C311172P2	Socket. (Part of XY1-4 in A101-112).
4	4033089P1	Clip. (Part of XY1-4 in A101-112).
5	19C311152P1	Heat sink.
6	7165167P5	Insert, tube shield: sim to Atlas Insert 106-332-5. (Used with V101).
7	19B204570P3	Heat sink. (Used with V101).
8	19A122497P1	Support. (Used with V101).
9	7165167P9	Insert, tube shield: sim to Atlas Insert 106-332-21. (Used with V102).
10	19A122497P2	Support. (Used with V102).
11	19A122498P1	Heat sink. (Used with V102).
12	19C311164P4	Plate line. (Used with L119).
13	19C311164P5	Plate line. (Used with L119).
14	19C311166P2	Base line. (Mounts L119, 120, Part of C143).
15	19A121350P1	Insulator. (Part of C143).
16	19A122526G1	Support. (Part of C145).
17	19A122516P1	Slide. (Part of C145).
18	19A122709P1	Set screw. 6-32. (Part of C145).
19	7117825P1	Washer, spring tension; sim to Tinnerman C4578B-632-24. (Part of C121, C122, C145).
20	19A122518G1	Spring. (Part of C145).
21	19C303544P2	Cover. (Used with V103).
22	19D402783P5	Plate line. (Used with L120).
23	19C311164P6	Plate line. (Used with L120).
24	19C303405P2	Casting. (Part of C121, C122).
25	4031593P1	Washer. (Part of C144).
26	4032084P1	Washer, insulated. (Part of C144).
27	19B204395G2	Chassis.
28*	19B204393P1	Heat sink. (Used with Q8 in A101-A112). (Deleted from Exciter 19D402308G1 thru G6 by REV E, 19D402308G7 thru G12 by REV F.
29*	19B204394P1	Support. (Used with Q8 in A101-A112). Deleted from Exciter 19D402308G1 thru G6 by REV E, 19D402308G7 thru G12 by REV F.
30	19C303495G8	Station Top Cover. (Except Repeaters and VM).
	19C303673G3	Station Top Cover. (Repeaters and VM only).
	19C303396G1	Mobile Top Cover.
31	4036765G4	Set Screw. (Part of C121, C122).
32	19A121676P1	Guide pin: 4-40 thread. (Used with J101).
33	4036899P4	Insulator, standoff: sim to Centralab 3BX3778C. (Part of C121, C122).
34	4036765G2	Screw. (Part of C121, C122).
35	4031594P1	Insulator. (Part of C144).
36	4036921P1	Bracket, angle: sim to Tinnerman C17609-8A-67.
37	19B204366P1	Support.
38	4038930P1	Clip. (Mounts R104).
39	4029030P10	Rubber Channel.
40	19C303495G7	Station Bottom Cover.
	19C303396G3	Mobile Bottom Cover.
41	19A121065P1	(Not Used).
42	19A127257G1	(Not Used).
43*	4038555P1	Insulator, disc: nylon. (Added to Exciter 19D402308G1 thru G6 by REV E, 19D402308G7 thru G12 by REV F.



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

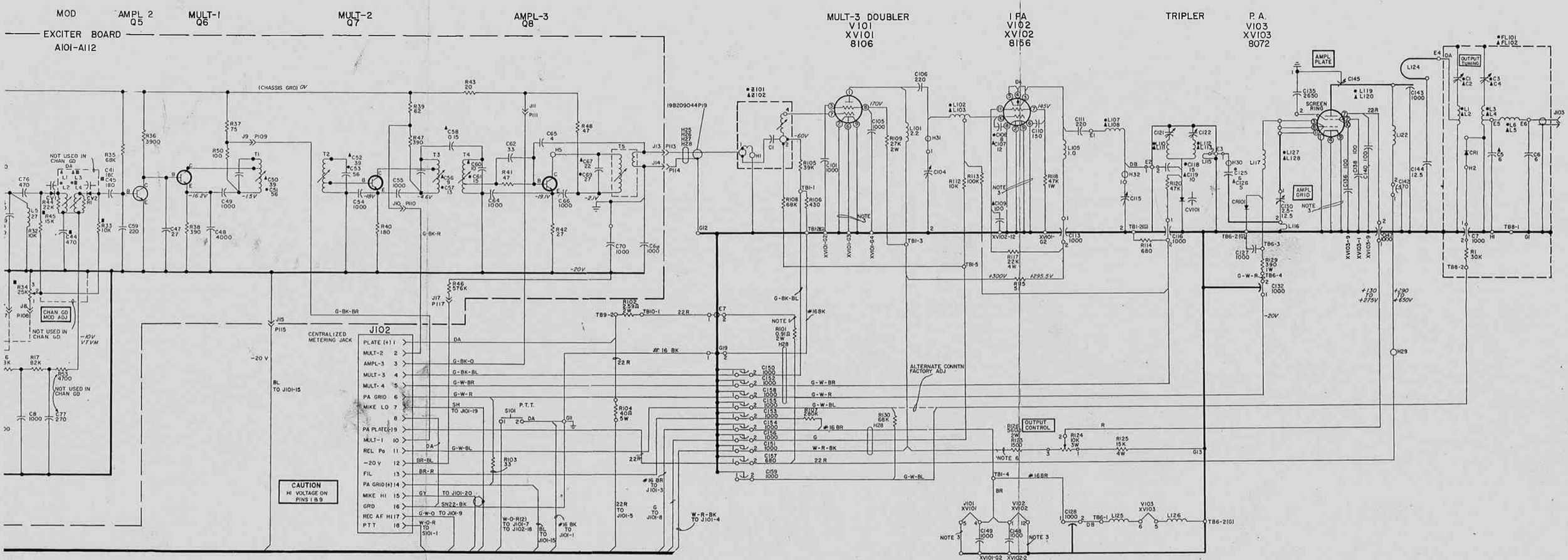
PA PLATE VOLTAGE		PA INPUT	RATED OUTPUT	APPLICATION	POWER SUPPLY USED
ET-59-D	ET-60-D				
290 VDC		60 WATTS	20 WATTS	PA EXCITER OR CLASS A,C,B STATION OR MOBILE	4EP37A10 4EP38A10
380 VDC		70 WATTS	20 WATTS	6-VOLT MOBILE	4EP37C10
435 VDC		90 WATTS	35 WATTS	12-VOLT MOBILE	4EP37B10
				28-VOLT MOBILE	4EP37D10
	485 VDC	120 WATTS	40 WATTS	STATION	4EP38A10
	660 VDC	180 WATTS	70 WATTS	MOBILE	4EP37A10
		150 WATTS	60 WATTS	STATION	4EP38A10

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

● USED WITH 405-420MHZ
▲ USED WITH 450-470MHZ
■ USED WITH CHAN GD UN

NOTES

1. R101 USED IN 4ET59D MO WITH DA WIRE ON 4ET
2. ALL 22R WIRES ARE #40
3. BEND TERMINAL BACK D AND PRESS IT TIGHTLY A
4. PART OF CABLE 19B20548
5. ALL WIRES N22 EXCEPT
6. R123 USED IN 4ET60D M WITH R126 ON 4ET59D
7. CONNECTED TO PIN 6 ON CONNECTED TO PIN 14 ON



USED WITH 405-420MHZ UNITS ONLY.
USED WITH 450-470MHZ UNITS ONLY.
USED WITH CHAN. GD. UNITS ONLY.

NOTES

1. R101 USED IN 4ET59D MODELS ONLY. R101 IS REPLACED WITH DA WIRE ON 4ET60D MODELS.
2. ALL 22R WIRES ARE A403678OP3.
3. BEND TERMINAL BACK DOWN AGAINST SOCKET SADDLE, AND PRESS IT TIGHTLY AGAINST SADDLE WHILE SOLDERING.
4. PART OF CABLE 19B205480G2.
5. ALL WIRES N22 EXCEPT AS OTHERWISE SHOWN.
6. R123 USED IN 4ET60D MODELS ONLY. @123 IS REPLACED WITH R126 ON 4ET59D MODELS.
7. CONNECTED TO PIN 6 ON MODELS 36 & 37. CONNECTED TO PIN 14 ON MODELS 38,39,40 & 41.

SYM NO	PARTS LIST	REV LETTER
	PL19E500865G1	
	PL19E500865G2	
A101	PL19040230801	E
A102	PL19040230802	E
A103	PL19040230803	E
A104	PL19040230804	E
A105	PL19040230805	E
A106	PL19040230806	E
A107	PL19040230807	F
A108	PL19040230808	F
A109	PL19040230809	F
A110	PL19040230810	F
A111	PL19040230811	F
A112	PL19040230812	F

MODEL NO		FREQ RANGE (IN MHZ)	NO. OF FREQ	CHAN GD
35 WATT	60 WATT			
4ET59030	4ET60030	405-420	1	
4ET59031	4ET60031	450-470	1	
4ET59032	4ET60032	405-420	2	
4ET59033	4ET60033	450-470	2	
4ET59034	4ET60034	405-420	4	
4ET59035	4ET60035	450-470	4	
4ET59036	4ET60036	405-420	1	X
4ET59037	4ET60037	450-470	1	X
4ET59038	4ET60038	405-420	2	X
4ET59039	4ET60039	450-470	2	X
4ET59040	4ET60040	405-420	4	X
4ET59041	4ET60041	450-470	4	X

SCHEMATIC DIAGRAM

406—470 MHz, 35 & 60-WATT MASTR TRANSMITTER MODELS 4ET59D30-41 & MODELS 4ET60D30-41

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.

CHANNEL GUARD LOW PASS FILTER G101

Rev. A & B - Incorporated into initial shipment

EXCITER BOARD A101-A112 (19D412308G1 thru G12)

Rev. A thru C - 19D402308G1 thru G6
Rev. A thru D - 19D402308G7 thru G12

Incorporated into initial shipments.

Rev. D - 19D402308G1 thru G6
Rev. E - 19D402308G7 thru G12

To improve stability and facilitate adjustment of modulation limiting and Channel Guard levels. Changed R12 and R34.

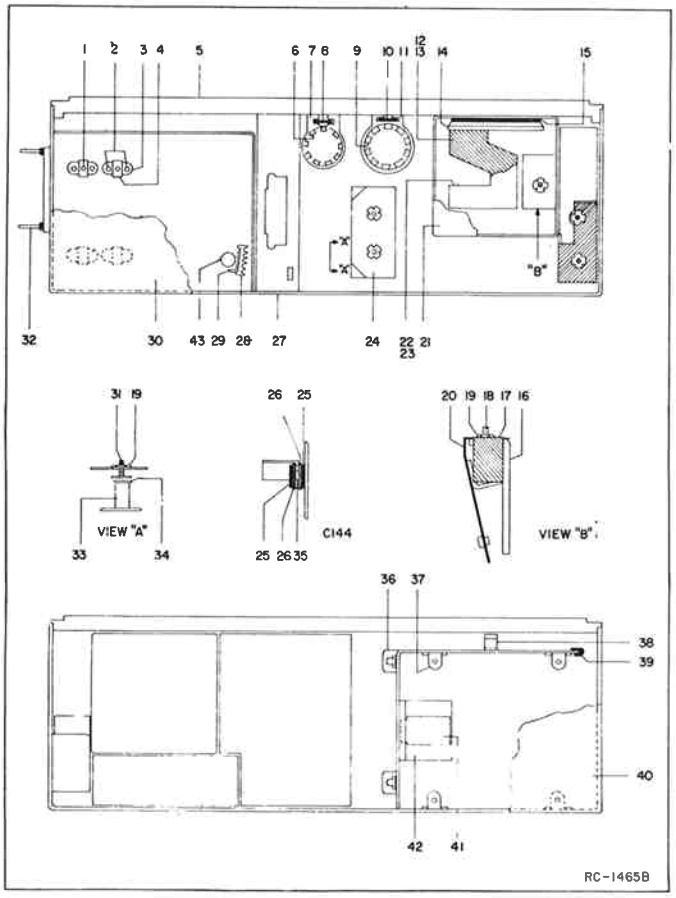
Rev. E - 19D402308G1 thru G6
Rev. F - 19D402308G7 thru G12

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

CHASSIS & PA ASSEMBLY

Rev. A - 19E500865G1 & G2

To improve assembly. Changed items 12,13,14,22 and 23 of mechanical Parts List.



4ET59D10-41
4ET60D10-41

(DF-3126)

PARTS LIST

LBI-3936D

CHANNEL GUARD ENCODER G102
4EH17A10 19C311802-G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1*	19B209243-P103	Polyester: 0.022 µf ±10%, 50 VDCW.
		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-P117	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 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 variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

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

MAINTENANCE MANUAL

LBI-3998

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

PRINTED IN U.S.A.

DF-3126