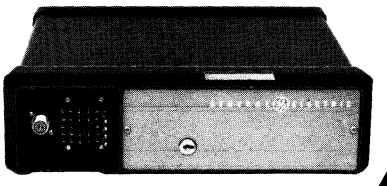
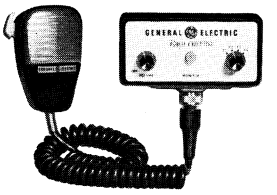
MOBILE RADIO

MASTR
PROGRESS LINE
ROYAL EXECUTIVE

MAINTENANCE MANUAL



Mobile Radio



Control Unit

132—174 MHz

TWO-WAY FM MOBILE COMBINATIONS

LBI-3900D

* * * * * *

Speaker

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

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

EQUIPMENT INDEX

EQUIPMENT	MODEL OR TYPE NUMBER
FM TRANSMITTER	ET-83-A
FM RECEIVER	ER-48-A
CONTROL UNITS	
Trunk-Mount	EC-67-A
Front-Mount	EC-68-B
POWER REGULATOR	4EP57A10
4-FREQ. OSCILLATOR BOARD	4EG22F10 or 11
CHANNEL GUARD BOARD	4EK14B10
FIVE-WATT SPEAKER	4EZ16A18
TRUNK-MOUNT POWER/CONTROL CABLE	
1- or 2-Frequency	19C303910-G2
3- or 4-Frequency	19C303910-G4
FRONT-MOUNT POWER CABLE	19C303982-G2
MOUNTING HARDWARE	
Trunk-Mount	19A122244-G2
Front-Mount	19A122244-G1
CONTROLLED RELUCTANCE MICROPHONE	19B209102-P2
Microphone Bracket	7141414-G2
LOCK ASSEMBLY	
Key	5491682-P8
Lock	5491682-P14
ALIGNMENT TOOLS	
Hex Slug Type	4038831-P1
Slotted Screw Type	4033530-G2
132-174 MHz ANTENNA	4EY12A13
FUSE ASSEMBLY	19B216021-G1

OPTIONAL EQUIPMENT

CARRIER CONTROL TIMER BOARD (Option 8307)	19A127875-G4
SPEAKER WINDOW MOUNTING KIT (Option 8009)	19A121879-G4
WEATHERPROOF BOX (Option 8013)	
Box	19D402674-G1
Cable Entry Kit	19A122244-G4
Hardware	19A122244-G3
HANDSET (Option 8093)	4EM26A10
Hookswitch	19B204867-G4

SPECIFICATIONS *

GENERAL

FREQUENCY RANGE	132-174 MHz
DIMENSIONS (H x W x D)	
Truck-Mount	3-7/8" x 13-1/2" x 12-1/4"
Front-Mount	3-7/8" x 13-3/4" x 13
WEIGHT (less accessories)	25 pounds
BATTERY DRAIN	
Receiver (at 13.8 VDC)	
Standby (squelched)	200 milliamps
Standby (unsquelched)	1.25 amps
Transmitter	
Transmit (at 13.6 VDC)	11.5 amps
OPERABLE TEMPERATURE RANGE	-30°C to +60°C (-22°F to 140°F)
DUTY CAPABILITY	Continuous
MAXIMUM FREQUENCY SPACING	0.4%

TRANSMITTER

POWER OUTPUT	35 watts (132-162 MHz) 30 watts (162-174 MHz)
FREQUENCY STABILITY	±.0005% (-30°C to +60° C, 25°C reference)
SPURIOUS AND HARMONIC RADIATION	At least 60 db below power output
MODULATION	Adjustable from 0 to ±5 KHz swing with instantaneous modulation limiting
AUDIO FREQUENCY	Within +1 and -3 db of a 6 db/octave pre-emphasis from 300 to 3000 Hz per EIA standards.
DISTORTION	Less than 5%
DEVIATION SYMMETRY	0.6 kHz maximum (narrow band)
CRYSTAL MULTIPLICATION FACTOR	24

RECEIVER

AUDIO OUTPUT	5 watts at less than 5% distortion
SENSITIVITY	
12-db SINAD (EIA Method)	0.25 µv
20-db Quieting Method	0.35 µv
SELECTIVITY	
EIA Two-Signal Method	-90 db (adjacent channel, 30 kHz channels)
20-db Quieting Method	-100 db at ±20 kHz
SPURIOUS RESPONSE	-90 db
FIRST OSCILLATOR STABILITY	±.001% (-30°C to +60°C, 25°C reference)
MODULATION ACCEPTANCE	±7 kHz
INTERMODULATION	-65 db
FREQUENCY RESPONSE	+1 and -8 db of a standard 6-db per octave de-emphasis curve from 300 to 3000 Hz
SQUELCH SENSITIVITY	
Critical Squelch	4 db SINAD (0.1 µv typical)
Maximum Squelch	Greater than 20 db quieting

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

DESCRIPTION

MASTR Progress Line Royal Executive mobile radio combinations are highly reliable, ruggedly constructed units that are designed to meet the most stringent requirements in the field of two-way radio. The radios are fully transistorized — using silicon transistors for added reliability. Since no tubes are used, the Royal Executive is ready to transmit at full power the instant the radio is turned on.

No high-voltage power supply is required as the highest voltage in the radio is supplied by the vehicle battery. A power regulator assembly provides regulated voltages for the transmitter exciter and receiver, and contains sensing and control circuitry for protection of the transmitter output transistors.

All major modules and tuning adjustments are accessible from the top of the radio (see Figure 1). Centralized metering jacks in the transmitter and receiver permit simplified alignment and troubleshooting.

TRANSMITTER

The transmitter assembly consists of a transistorized exciter and power amplifier assembly. The standard transmitter may be equipped with:

- One through four frequencies.
- Channel Guard (tone squelch).
- Carrier Control Timer Option.

RECEIVER

The fully transistorized receiver is mounted on a single printed wiring board for increased reliability. A copper-plated housing and metal cover that completely enclose the receiver provides excellent shielding. The standard receiver may be equipped with:

- One through four frequencies
- Channel Guard (tone squelch)

POWER REGULATOR

The transistorized mobile power regulator was designed for operation in a 12-volt, negative-ground vehicle system only and provides regulated supply voltages for the transmitter exciter and receiver. The power regulator also contains circuitry to protect the transmitter PA stages against sudden increases in battery voltages, excessively high temperatures or a shorted or open antenna.

CONTROL UNITS

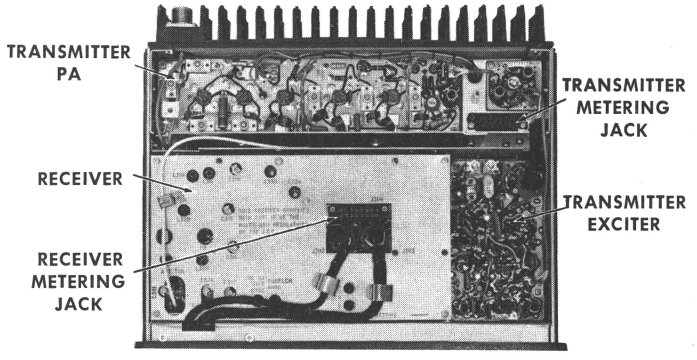
Two different control units are available for use with the radio. In front-mount applications, the control unit is attached to the front panel of the two-way radio. In trunk-mount applications, the control unit is normally mounted on the underside of the instrument panel near the operator.

INITIAL ADJUSTMENT

After the two-way radio has been installed (as described in the INSTALLATION Manual), the following adjustments should be made by an electronics technician who holds a 1st or 2nd Class FCC Radiotelephone license. Alignment tools are provided with the radio.

Make sure that a RADIO TRANSMITTER IDENTIFICATION form (FCC Form 452-C or General Electric Form ECP-82) has been filled out and attached to the transmitter.

TOP VIEW



BOTTOM VIEW

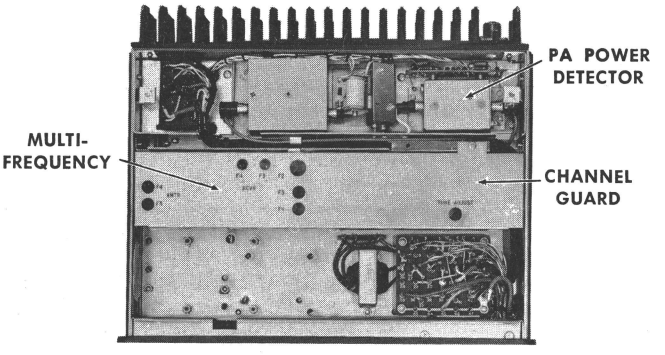


Figure 1 - Royal Executive Module Layout

TRANSMITTER ADJUSTMENT

The initial adjustment for the transmitter includes loading the power amplifier into the antenna, and checking the frequency and modulation. For the Initial Adjustment procedure, refer to the transmitter ALIGNMENT PROCEDURE (see Table of Contents).

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes zeroing the receiver to the system operating frequency, and matching the antenna transformer to the antenna. For the initial adjustment procedure, refer to the FRONT END ALIGNMENT PROCEDURE (see Table of Contents).

OPERATION

Complete operating instructions for the two-way radio are provided in the separate OPERATOR'S MANUAL. The basic procedures for receiving and transmitting messages follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the OFF-VOLUME control halfway to the right.
2. Press the MONITOR button and adjust the VOLUME control for a comfortable listening level.
3. The radio is nor ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Apply power to the transmitter by turning the OFF-VOLUME control to the ON position.
2. Press the push-to-talk button on the microphone and speak across the face of the microphone in a normal (or softer) voice. Release the button as soon as the message has been given. The red GE signal light on the control panel will glow each time the microphone button is pressed, indicating that transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

Table 1 - Preventive Maintenance Checks

MAINTENANCE CHECKS	INTERVAL	
	6 Months	As Required
CONNECTIONS - Check power and ground connections periodically for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation.	X	
ELECTRICAL SYSTEM - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. If the alternator or generator voltage is excessive, indicator lights, etc., may burn out periodically. This condition is indicated when the battery looses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation.		X
MECHANICAL INSPECTION - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws, and parts to make sure that nothing is working loose.	X	
ANTENNA - Keep the antenna, antenna base and all contacts clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result.	X	
ALIGNMENT - Check the transmitter and receiver meter readings periodically, and "touch-up" the alignment when necessary. Refer to the applicable ALIGNMENT PROCEDURE and Trouble-shooting Sheet for typical voltage readings.		X
FREQUENCY CHECK - Check transmitter frequency and deviation as required by FCC. Normally, these checks are made when the unit is first put into operation, after the first six months, and once a year thereafter.		X

MAINTENANCE

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This preventive maintenance should include the maintenance checks listed in Table 1.

TEST AND TROUBLESHOOTING PROCEDURES

Whenever difficult servicing problems occur, the test procedure for transmitter and receiver can be used by the serviceman to compare the actual preformance of the unit against the specifications met by the unit when shipped from the factory. The test procedures are located on the back of the applicable Alignment Procedure.

In addition, specific troubleshooting procedures are available for the transmitter, receiver and power regulator (refer to the Table of Contents). For best results, the test procedures should be used in conjunction with the troubleshooting procedures.

DISASSEMBLY

To gain access to the unit for servicing:

1. Unlock the radio (see Figure 2).
2. Loosen the two captive screws shown in Figure 2.
3. Pull the radio forward about two inches out of mounting frame, and lift off top cover.
4. To gain access to the bottom side, pull the radio all the way out of mounting frame.

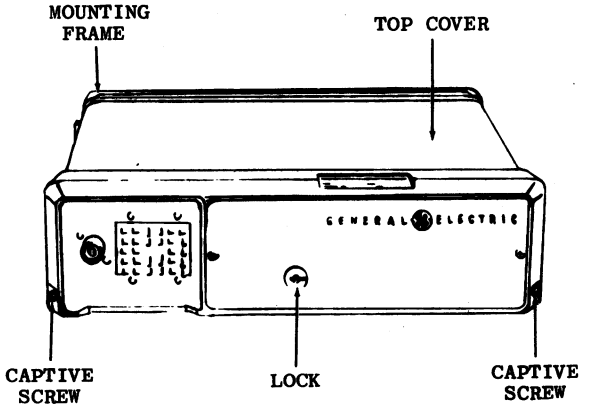


Figure 2 - Disassembly

CIRCUIT ANALYSIS

TRANSMITTER

Transmitter Type ET-83-A is a crystal controlled, frequency modulated transmitter designed for one-, two- or four-frequency operation in the 132-174 megahertz band. The transmitter consists of the following assemblies:

- Transistorized Exciter Board
  Audio, oscillator, modulator and multiplier stages.
- Transistorized PA Assembly Multipliers, amplifiers, driver, power amplifier, power detector, lowpass filter and antenna switch or relay.

The model number and application of each assembly is shown in the following chart.

PA Assembly With Antenna Relay	
130—150.8 MHz	150.8—174 MHz
4EF33F10	4EF33F11

PA Assembly With Antenna Switch	
130—150.8 MHz	150.8—174 MHz
4EF33F20	4EF33F21

EXCITER BOARD	
1-Frequency	2-Frequency
4EG21F10	4EG21F11

The transmitter uses a total of 16 transistors to provide a minimum power output of 35 watts in the 132 to 162 MHz range, and 30 watts in the 162 to 174 MHz range. The crystal frequency is multiplied 24 times.

A centralized metering jack (J202) is provided for use with GE Test Set Models 4EX3A10 (Rev. A or later) or 4EX8K11. The test set meters the phase modulator, multipliers, driver and PA stage, as well as the relative power output, reflected power and PA supply voltages. The metering jack also provides access to receiver audio, microphone and push-to-talk leads.

All input leads to the transmitter are individually filtered by the 20-pin feedthrough by-pass connector J201. Supply voltage, metering and control functions for the exciter board are connected from the PA assembly through a 9-pin miniature connector (P105). Supply voltages for the transmitter are shown in the following chart.

Connection	Voltage	Use
J201-8 and J201-15	+12.5 VDC	Multiplier, amplifiers and PA supply (Vcc)
J201-3	+12 VDC (Battery)	Relay
J201-11	Keyed +10 VDC	Exciter board, 2nd doubler and differential amplifier supply.

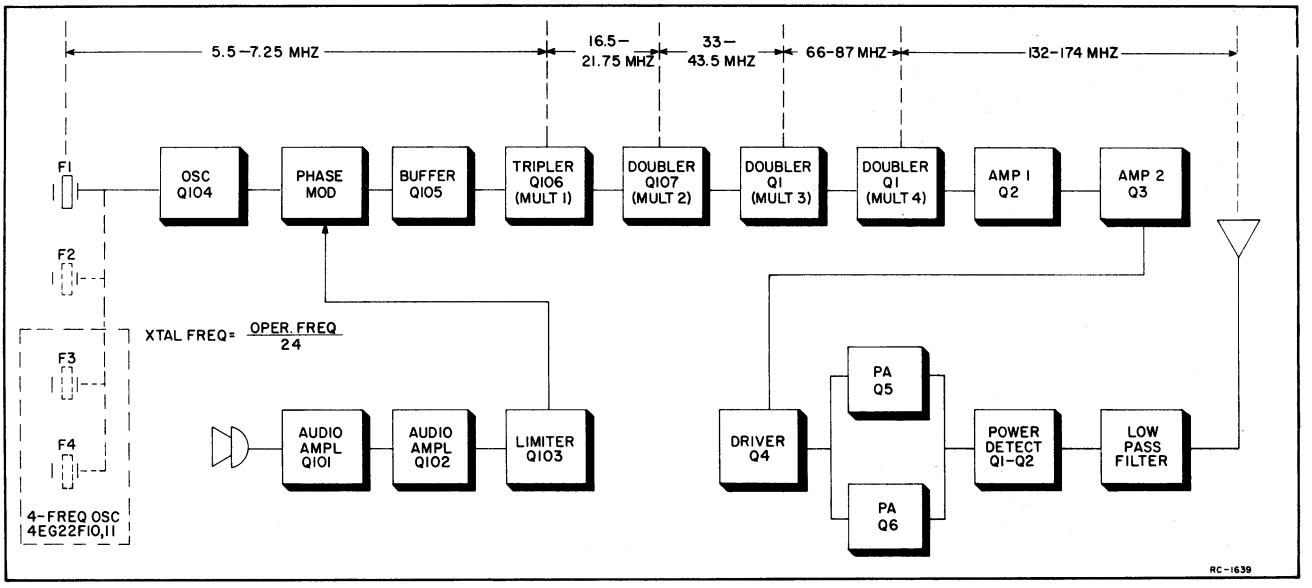


Figure 3 - Transmitter Block Diagram

EXCITER BOARD

OSCILLATOR

A transistorized Colpitts oscillator (Q104) 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. Feedback for the oscillator is developed across C113.

In single-frequency transmitters, a jumper connects the F1 crystal keying lead to ground and the crystal frequency is applied to the base of oscillator A104. The oscillator frequency is adjusted by trimmer C101. The oscillator output is applied to the enode of phase modulator CV101.

In two-frequency transmitters, the single oscillator transistor is used, and an additional crystal circuit and two switching diodes (CR101 and CR102) are 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. This forward biases the diode in the crystal circuit, reducing its impedance, so that the selected crystal frequency is applied to the base of oscillator Q104.

For four-frequency transmitters, oscillator board Model 4EG22F10 or 11 is added. The oscillator board contains two crystal circuits (F3 and F4) identical to the F1 and F2 circuits. In four-frequency transmitters, F3 and F4 crystals are also switched by means of diode biasing. The output of the oscillator board is connected through J2603 to the base of Q104.

AUDIO AMPLIFIERS AND LIMITER

The audio section of the transmitter consists of direct-coupled feedback amplifiers Q101, Q102 and Q103. Q103 also acts as a limiter at high audio input levels. Audio from the microphone is coupled through an input network (C132 and R164) to the audio stages. The input network, in conjunction with the feedback circuit, provides the audio gain and a 6-db/octave pre-emphasis.

The output of limiter Q103 is connected through modulation adjust potentiometer R110 to a de-emphasis network for 6-db/octave de-emphasis and post limiter roll-off. The network consists of C136, C137, C138, R165 and R166. Modulation adjust R110 determines the maximum set for ±4.5 kHz (narrow band).

PHASE MODULATOR

The phase modulator uses varactor CV101 (a voltage-variable capacitor) in an R-L-C network that includes R126 and L113. An audio signal applied to the modulator through L113 varies the capacitance of CV101 resulting in a phase modulated output. The modulator output is fed to the base of buffer Q105.

In Channel Guard applications, tone from Channel Guard board Model 4EK14A10 is fed to the modulator circuit through J103 (tone high) and J104 (ground).

BUFFER AND MULTIPLIERS

Buffer stage Q105 isolates the modulator from the loading effects of the tripler stage, and provides some amplification. The output is direct-coupled to the tripler.

Following Q105 are two L-C coupled Class C multiplier stages (Q106 and Q107), Q106 is a tripler stage (MULT-1) with the collector tank tuned to six times the crystal frequency. Resistors R134 and R135 are for metering the doubler stage at centralized metering jack J202.

PA ASSEMBLY

MULTIPLIERS

The exciter output is link-coupled through A201-L1 to the base of 2nd doubler A201-Q1. This stage operates as a common emitter doubler (MULT-3), and is metered at J202 across A201-R1. The 2nd doubler output is coupled through a series-tuned circuit (tuned to 12 times the crystal frequency) to the base of 3rd doubler A202-Q1 (MULT-4). This stage is metered at J202 across A202-R1. The 3rd doubler output is coupled through a series-tuned circuit (tuned 24 times the crystal frequency) to the base of amplifier Q2.

AMPLIFIERS, DRIVER AND PA

Following the doubler are two common-emitter, series-tuned RF amplifier stages, Q2 and Q3. Q2 base voltage is metered at J202 through metering network CR1, R3 and R8. Q3 is metered at J202 through metering network CR2, R5 and R8.

Driver Q4 follows the two amplifier stages. Collector current for Q4 is metered across metering resistor R201 at J202 (DRIVER Ic). The reading is taken on the one volt scale (10 amperes full scale) with the GE Test Set in Position G, and with the HIGH SENSITIVITY button pressed.

Thermistor RT1 is mounted on the PA board between Q5 and Q6. The thermistor, in conjunction with a control circuit on the power board, protects the PA stages against excessively high temperatures. If the temperature of the PA heat sink starts to rise excessively, RT1 activates the temperature control circuit, which reduces the supply voltage to the PA board. The control circuit keeps the supply voltage reduced until the temperature returns to normal.

The PA output is coupled through a series-tuned circuit to power detector assembly A203.

POWER DETECTOR

Power detector A203 consists of the detector circuitry enclosed in a shielded casting, and a differential amplifier mounted on a printed wiring board. The detector circuit samples both the forward and reflected power on the antenna line, and applies the outputs to the bases of differential amplifier transistors Q1 and Q2. The output of the differential amplifier is proportional to the net power output (forward power minus reflected power). The differential amplifier is connected to a control circuit on the power regulator board which controls the supply voltage applied to the transmitter PA board (see Figure 4).

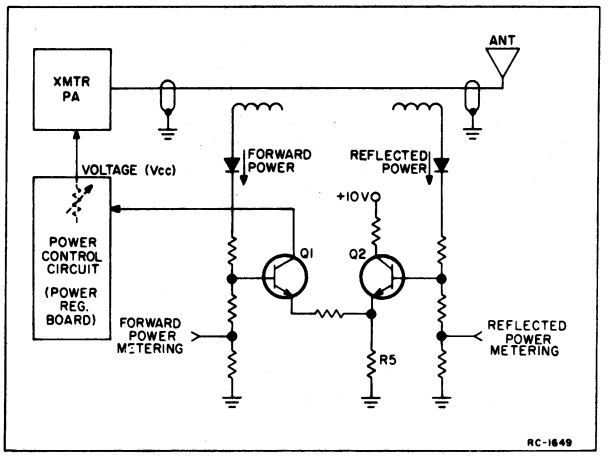


Figure 4 - Power Detector Circuit

With normal power output into a 50-ohm load, Q1 conducts and Q2 is turned off. This keeps the power control circuit on the power regulator board turned off. A drop in power output reduces the drive to Q1, which activates the power control circuit and reduces the supply voltage to the transmitter (Vcc).

An increase in the VSWR increases the input to the base of Q2, causing Q2 to start conducting. This causes Q1 to conduct less due to the emitter bias developed by Q2 across R5. Q1 conducting less activates the power control circuit on the power regulator board, reducing the Vcc.

The output of the power detector is coupled through the antenna switch (or changeover relay K201) to low-pass filter FL201, and then to the antenna.

SOLID STATE ANTENNA SWITCH

The solid state antenna switch automatically provides antenna changeover for transmitter and receiver.

During the receive mode of operation, the switch isolates the transmitter from the antenna. Application of RF from the transmitter causes the switch to operate, connecting the antenna to the transmitter and isolating the receiver. A continuous external bias voltage (+10 volts) is applied to the switch to prevent spurious antenna power from operating the switch during the receive mode.

When the transmitter is off, signals picked up by the antenna are connected to the receiver through Low Pass Filter FL201 and the filter network in the antenna switch. A parallel LC circuit (collector to base capacitance of Q1 and L2/L3) which is resonant near the receiver frequency provides isolation from transmitter loading.

When the transmitter is keyed and the peak RF voltage exceeds the +10 volt bias voltage, Q1 conducts. This connects RF voltage from the transmitter through Low Pass Filter FL201 to the antenna. Q2 and CR1 are biased on during transmit to isolate the receiver from the transmitter output. While Q2 is conducting, its collector is near ground potential. This places L4/L5 in parallel with C5/C6 forming a parallel resonant circuit near the transmitter frequency to isolate the receiver. CR1 provides additional isolation.

RECEIVER

Receiver Type ER-48-A is a double conversion, superheterodyne FM receiver designed for one-, two- or four-frequency operation on the 132-174 megahertz band.

The receiver is of single-unit construction and is housed in a copper-plated casting for maximum shielding and rigidity. The unit is completely transistorized, using silicon transistors for added reliability.

Frequency ranges and the number of frequencies for each receiver model are shown in the following chart.

RECEIVER MODEL	FREQUENCY RANGE	NUMBER OF FREQUENCIES
4ER48A10	132—150.8 MHz	One-Frequency
4ER48A11	132—150.8 MHz	Two-Frequency
4ER48A12	150.8—174 MHz	One-Frequency
4ER48A13	150.8—174 MHz	Two-Frequency
4ER48A14	132—150.8 MHz	Four-Frequency
4ER48A15	150.8—174 MHz	Four-Frequency

A regulated +10 volts is used for all receiver stages except the audio drivers and audio PA stage, which operate from the 12-volt system supply.

Centralized metering jack J304 is provided for use with GE Test Set Models 4EX3A10 or 4EX8K11. The test set meters the oscillator, 1st and 2nd limiters, discriminator and audio driver bias as well as the voice coil, regulated 10-volts and 12-volt supply.

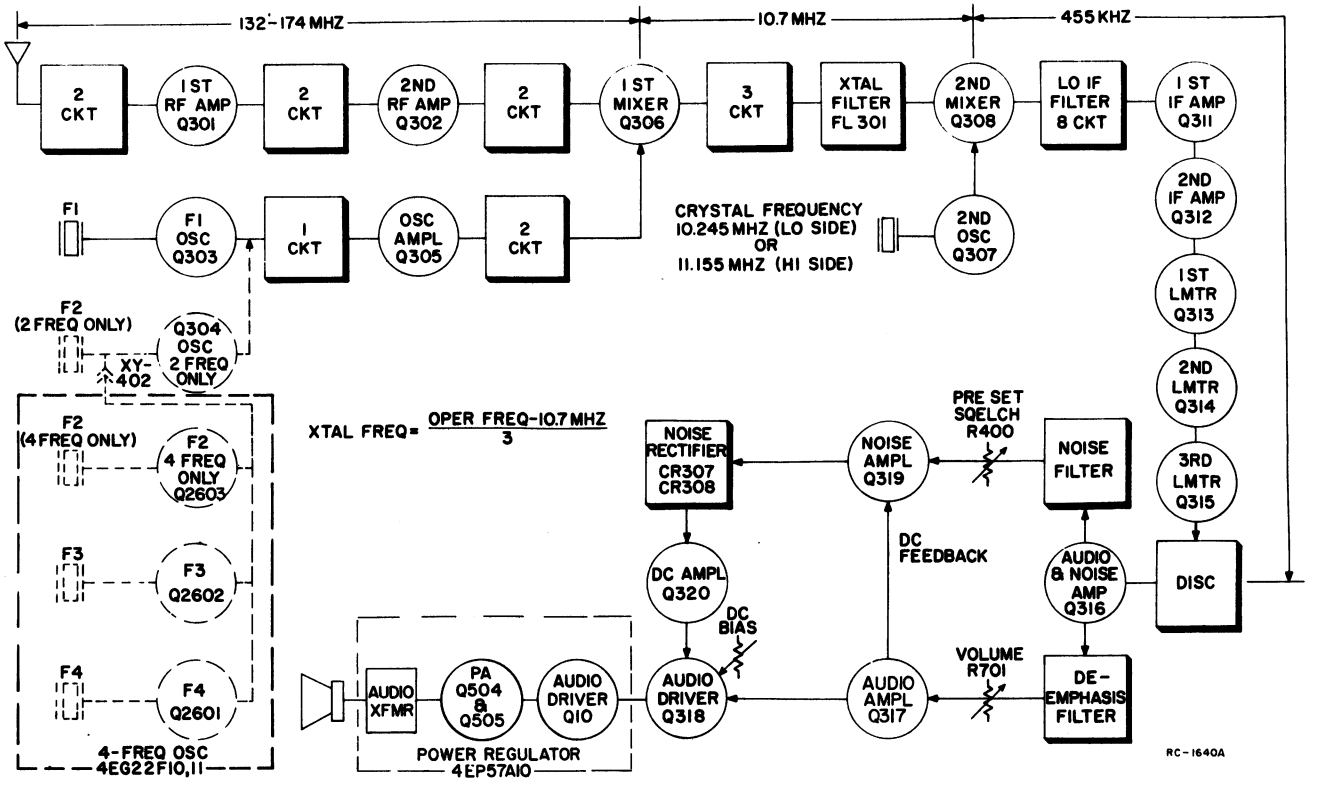


Figure 5 - Receiver Block Diagram

RF AMPLIFIERS

RF signals from the antenna are fed to the base of 1st RF amplifier Q301 through two tuned pre-selector circuits. The output of Q302 is inductively coupled through two tuned circuits to the base of 1st mixer Q306.

OSCILLATOR

Q303 is a third mode oscillator that operates in the 40 to 55 megahertz region. The crystal is connected in the oscillator feedback path to permit oscillation only at the crystal frequency. L307, C319 and C320 make up the mode-selective resonant circuit. Adjustable coil L307 permits the oscillator frequency to be shifted slightly for setting the receiver on the system operating frequency. The collector tank of Q303 is tuned to three times the crystal frequency.

For two-frequency operation, a second oscillator stage is added. Channels are selected by grounding the emitter of the desired oscillator by means of a two-frequency switch on the control unit.

For four-frequency operation, four-frequency oscillator board Model 4EG22F10 is added. The oscillator board contains three oscillator circuits (F2, F3 and F4) that are similar to the F1 oscillator circuit. The output lead of the oscillator board is plugged into crystal socket XY402, and F2 oscillator board is modified so that Q304 can be used as an amplifier stage. Channels are selected by grounding the emitter of the desired oscillator by means of a four-frequency switch on the Control Unit.

1ST MIXER AND CRYSTAL FILTER

The RF signal from the 2nd RF amplifier and the low-side injection voltage from oscillator-amplifier Q305 are applied to the base of 1st mixer Q306. The 10.7-megahertz high IF output is coupled through three tuned circuits (L312 and C350, L313 and C354, L314 and C357) which provide Hi-IF selectivity and impedance matching to the crystal filter.

The Hi-IF crystal filter (FL301) has ample selectivity to prevent adjacent channel signals from overloading the 2nd mixer, and to reduce intermodulation spurious responses.

2ND OSCILLATOR AND MIXER

Hi-IF from the crystal filter is applied to the base of 2nd mixer Q308 with the 10.245 MHz (or 11.155 MHz) 2nd oscillator output to produce the 455-kHz Lo-IF.

The 455-kHz Lo-IF is coupled to an eight-coil Lo-IF filter which provides the main receiver selectivity.

LO-IF AMPLIFIERS AND LIMITERS

Following the Lo-IF filter are two R-C coupled Lo-IF amplifiers (Q311 and Q312). The amplified output is fed to three R-C coupled limiter stages consisting of Q313, Q314 and Q315, operating as over-driven amplifiers. The 1st and 2nd limiter stages are metered at centralized metering jack J304 thru metering diodes CR302 and CR303.

DISCRIMINATOR

The 3rd limiter output is applied to the Foster-Seely type discriminator, where the audio voltages are recovered from the 455-kHz Lo-IF. A low-pass filter, made up of C422, C423, C424, R377, R379 and R380, removes any 455-kHz signal from the discriminator output.

AUDIO AMPLIFIER AND DRIVER

The audio signal is fed to the base of audio-noise amplifier Q316. Following Q316 is an audio de-emphasis network consisting of C426, C427, C428, R383, R384 and R385.

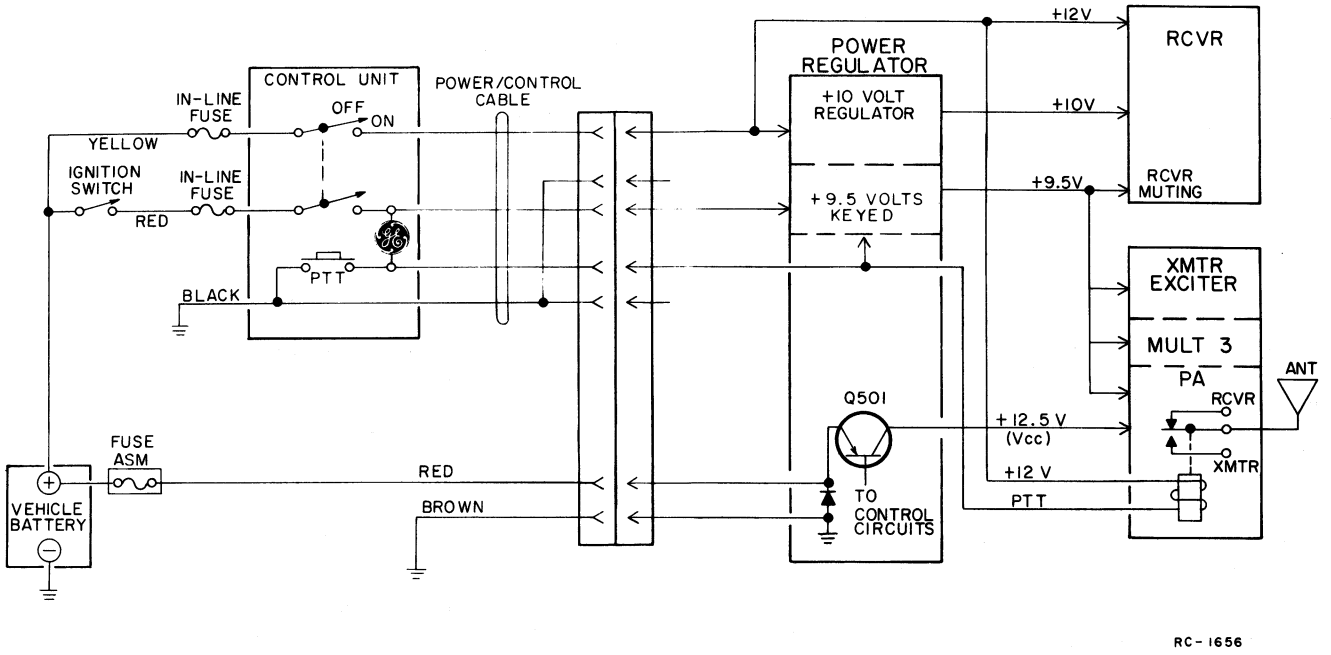
After the de-emphasis network, the audio signal is fed to the base of audio amplifier Q317 through the VOLUME control mounted on the control unit. The VOLUME control is used to set the amount of drive to audio amplifier Q317 and audio driver Q318. DC BIAS trimmer R392 sets the bias on Q318 and audio driver Q10 on the power regulator assembly, and is applied to audio driver Q10 on the power regulator assembly.

SQUELCH

Noise from audio-noise amplifier Q316 is used to operate the squelch circuit. When no carrier is present in the receiver, this noise is coupled through a noise filter (which attenuates any audio frequencies) to the base of noise amplifier Q319. The noise filter consists of C435, C436, C437 and L331. The noise level fed to the amplifier Q319 is rectified by diodes CR307 and CR308, and filtered by C441 and C442 to produce a positive DC voltage. This DC voltage turns on DC amplifier Q320, causing it to conduct. When conducting, the collector voltage of the DC amplifier drops to near ground potential, which lowers the bias on audio stages Q317 and Q318, turning them off.

As audio amplifier Q317 is being turned off, its emitter potential decreases. This results in a positive DC feedback through R406 to the emitter of noise amplifier Q319 which causes an increase in the gain. As the gain of Q319 increases, the positive DC voltage to the DC amplifiers increases, quickly turning the audio stages off.

TRUNK MOUNT



FRONT MOUNT

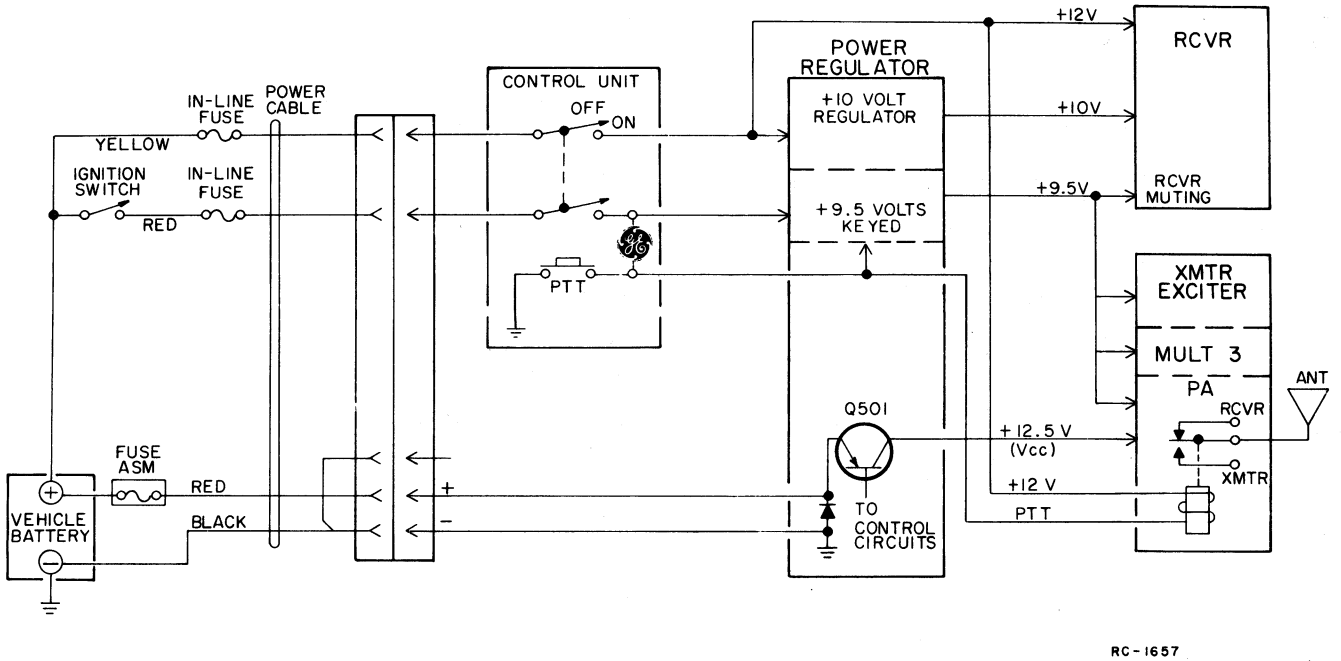


Figure 6 - 12-Volt, Negative Ground Power Distribution Diagram

When the receiver is quieted by a signal, less noise is present in the circuit and the DC amplifiers turn off. The audio stages are allowed to conduct, and audio is heard from the speaker. When audio amplifier Q317 is conducting, a positive voltage appears across R406 which helps reduce the gain of noise amplifier Q319. This positive feedback causes a quick, positive switching action in the squelch circuit.

POWER REGULATOR

Transistorized Power Regulator Model 4EP57A10 contains the receiver audio PA stages, the protective circuits for the transmitter PA stages, and provides all the regulated supply voltages for the two-way radio. Regulation of critical supply voltages provides improved performance of the wide range of input voltages encountered in mobile communications. The power regulator operates in 12-Volt, negative ground systems only, and provides the following supply voltages:

- A continuous, regulated +10 Volts for the transmitter PA power detector, receiver, and multi-frequency board.
- A keyed, regulated +10 Volts for the transmitter exciter, power regulator protective circuitry, channel guard and multi-frequency boards, and the carrier control timer option.
- A keyed, controlled +12.5 Volts for the transmitter PA supply

Supply voltage (+12 Volts) for the receiver audio stages, transmitter PA regulator, the 10-Volt regulator and antenna switching relay is taken directly from the vehicle battery. A simplified power distribution and switching diagram is shown in Figure 6.

The 10-Volt keying circuit, two stages of the 10-Volt regulator, the short circuit protector, voltage limiter and temperature-power driver are mounted on regulator board A501. The regulator board is mounted on the main chassis.

PA regulator transistors Q501 and Q502, 10-Volt regulator Q503, and audio PA transistors Q504 and Q505 mount on the front casting which acts as a heat sink for these stages.

AUDIO PA

The output of Q318 on the receiver chassis is applied to the base of audio driver Q10 on the power regulator board. Bias to Q10 is set by DC bias trimmer R392 on the receiver. The trimmer is set for 0.7 Volt at receiver metering jack J304-9 (Position G on GE Test Set). Audio from Q10 is coupled through phase-inverting transformer T502 to the class AB, push-pull audio PA stage (Q504 and Q505). A bias network consisting of R30, R32, R34 and thermistor RT1 (mounted on the power regulator board) keeps the audio PA bias constant over wide variations in temperature. The PA output is coupled through audio transformer T501 to the loudspeaker.

A feedback network consisting of R506 and thermistor RT501 provides improved frequency response and reduced distortion. Resistor R505 provides a constant load on audio transformer T501 when the speaker is disconnected.

+10 VOLT REGULATOR

The +10-Volt regulator provides a closely-controlled supply voltage for the transmitter, receiver, protective circuitry on the power regulator, channel guard and multi-frequency boards, and Carrier Control Timer option.

Supply voltage from the vehicle battery is applied to the collector of regulator

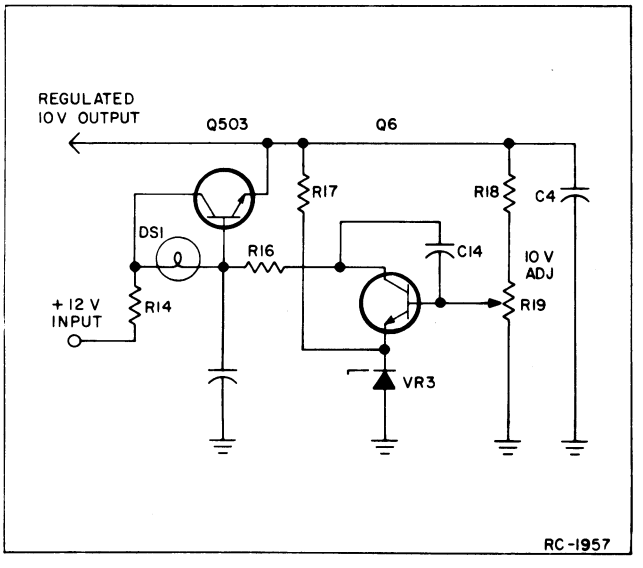


Figure 7 - +10 Volt Regulator Circuit

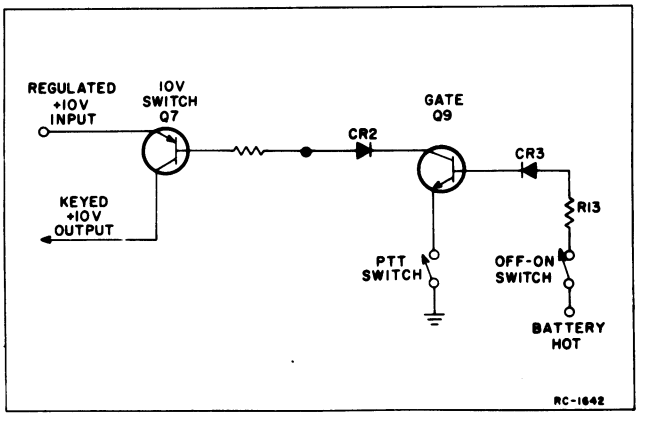


Figure 8 - +10 Volt Keying Circuit

transistor Q503, causing the transistor to conduct (see Figure 7). When the output voltage at the collector of Q503 tends to increase, the voltage at the base of Q6 tends to become more positive, causing Q6 to conduct harder. With Q6 conducting harder, the voltage at the base of transistor Q503 becomes less positive and Q503 conducts less. This increases the voltage drop across Q503, keeping the output voltage constant.

When the output voltage tends to decrease, Q6 conducts less, causing Q503 to conduct harder. This reduces the voltage drop across Q503, keeping the output constant.

Potentiometer R19 is used to set the emitter-base voltage of Q6 for the desired 10-Volt output. R16 and R18 limit maximum current through Q6. R17 provides bias current for Zener diode VR3, and lamp DS1 provides bias for Q503. C4 and C14 prevent high frequency oscillation. The output voltage is metered at receiver centralized metering jack J304.

KEYED +10 VOLTS

The keyed +10 Volts is used to activate the transmitter and squelch the receiver. Turning the OFF-ON switch on the control unit to the ON position applies the vehicle battery voltage to the anode of diode CR3. This forward biases the diode so that the battery voltage is applied to the base of gating transistor Q9 (see Figure 8).

With the battery voltage applied to the base of Q9, keying the microphone grounds the emitter, causing it to conduct. When conducting, the collector voltage of Q9 drops to ground potential which forward biases CR2 and turns on switching transistor Q7. The nominal +10-Volt collector output voltage is applied to the transmitter exciter board, and to the transmitter PA voltage regulator and protective circuitry to key the transmitter.

The keyed 10 Volts is also connected through dropping resistor R503 (on TB3) to the base of receiver DC amplifiers Q320 and Q321. The resultant voltage causes the DC amplifiers to conduct, which turns off the receiver audio amplifiers and squelches the receiver.

Diode CR3 is connected in series with Q9 to provide polarity protection for the 10-Volt switching circuit.

PROTECTIVE CIRCUITS

The protective circuits in the power regulator prevent any damage to the transmitter PA transistors that might result from an excessive PA transistor temperature, an excessive output VSWR, or a high input battery voltage. All of the protective circuits affect the action of transmitter PA supply regulator transistor Q501. The transistor acts as a variable resistance in series with the PA supply voltage, and increases or decreases the supply voltage (Vcc) as required. A circuit is also provided to protect Q501 from a short circuit in the PA supply lead.

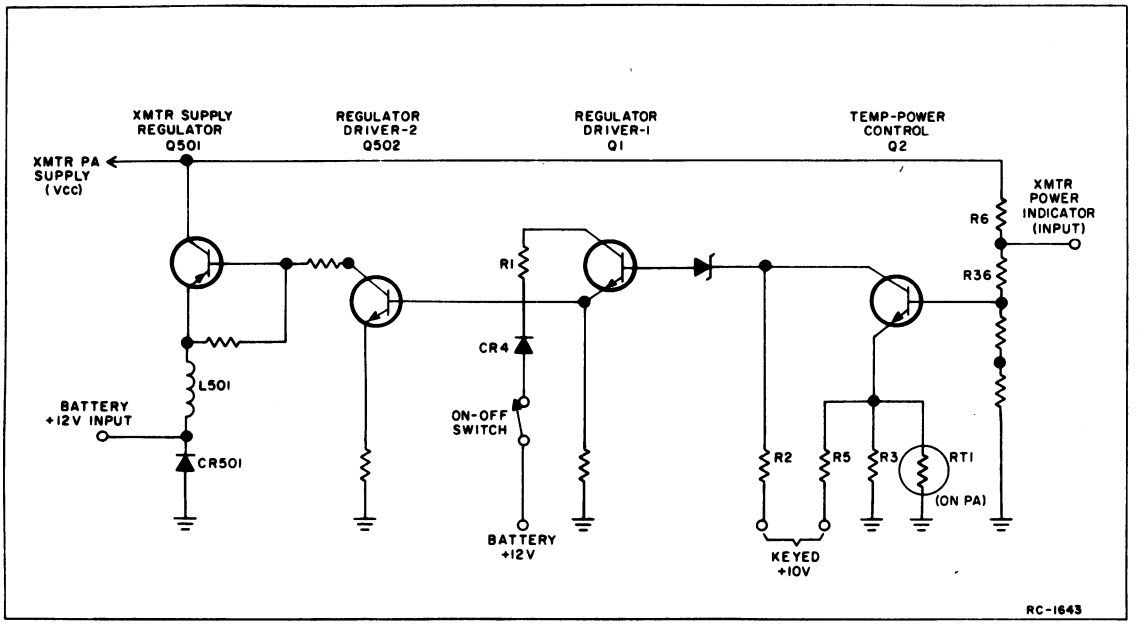


Figure 9 - Temperature Control Circuit

Temperature Control

Temperature control is provided by thermistor RT1 which is mounted in the heat sink near the transmitter PA transistors. The thermistor is in the emitter biasing circuit of temperature and power control transistor Q2 (see Figure 9).

Under normal operating conditions, Q2 is biased so that it is just below conduction (turned off). When the temperature of the PA heat sink rises, the resistance of thermistor RT1 decreases, decreasing the emitter bias on Q2. If the temperature rises sufficiently, Q2 begins to conduct. When conducting, the collector potential of Q2 becomes more negative, which causes drivers Q1 and Q502 to conduct less.

Power Control

The power control circuit protects the transmitter PA transistors from the effects of de-tuned amplifier stages, an antenna mismatch or shorted antenna. The circuit is controlled by the differential amplifier in the transmitter power detector assembly.

With normal transmitter power output into a 50-ohm load, Q1 on the differential amplifier conducts and Q2 is turned off. This results in a voltage drop across R6 which reduces the base bias on temperature-power control transistor Q2, keeping it turned off. This causes regulator drivers Q1 and Q502 to conduct heavily (see Figure 10).

A drop in power output reduces the drive to Q1 so that it conducts less, reducing the voltage drop across R6. This increases the forward bias on the base of temperature-power control transistor Q2 so that it starts to conduct. With Q2 conducting, regulator drivers Q1 and Q502 conduct less, lowering the degree of saturation of Q501 and reducing the Vcc.

An increase in the VSWR increases the reflected power input to the base of Q2 in the differential amplifier so that it starts to conduct. This causes Q1 to conduct less due to the emitter bias developed across R5. With Q1 conducting less, the voltage drop across R6 on the power regulator board decreases. This causes the temperature-power control transistor (Q2) to start conducting, reducing the Vcc.

Temperature-power control transistor Q2 also provides some limiting of the Vcc. Under normal power output and temperature conditions, PA supply transistor Q501 operates fully saturated. In this condition, an increase in the vehicle battery voltage will cause an increase in the Vcc. Since the Vcc is connected to the base of control transistor Q2 through a voltage divider network, an increase in the Vcc increases the forward bias on control transistor Q2, causing it to conduct, reducing the Vcc.

This limiting effect does not work in very low temperatures due to the increase in resistance of the thermistor in the emitter of control transistor Q2. At very low temperatures, the Vcc is limited by top voltage limiter Q3.

Diode CR501 provides reverse polarity protection for the circuit. Inadvertently connecting the battery cables to the wrong polarity will cause the shunt diode to conduct, blowing the main fuse.

Short Circuit Protector

A short circuit protector is provided to protect Q501 from being damaged by a short in the PA supply line. Keying the transmitter applies +10 volt to the circuit,

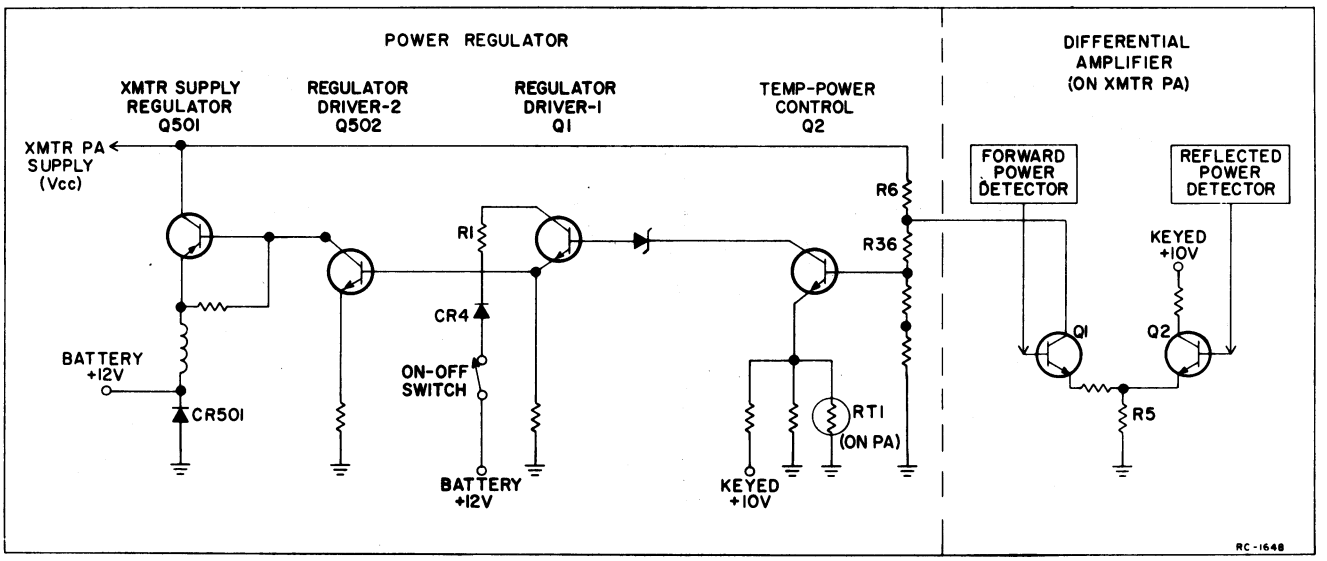


Figure 10 - Power Control Circuit

turning on the regulator drivers and Q501 (see Figure 11). The +10 volts is also applied to the collector and base of Q8. However, Q8 does not turn on immediately. Before Q8 can conduct, its base voltage must exceed its emitter voltage by approximately 0.5 volt. In order for this to occur, C7 must charge, which takes approximately eight milliseconds. This time delay permits regulator drivers Q1 and Q502 to turn on, and Q501 to become fully saturated. The supply voltage (Vcc) is then applied through a voltage divider network (R28 and R25) to the emitter of Q8, keeping the transistor turned off.

If the supply voltage does not appear at the emitter of Q8, the transistor will turn on as soon as C7 is charged. When conducting, the collector of Q8 drops to near ground potential, removing the breakdown voltage on zener diode VR1. This switches off the regulator drivers and Q501 and removes all power to the transmitter PA. A short in the supply line while the transmitter PA. A short in the supply line while the transmitter is keyed also turns on Q8, which switches off Q501 and removes all power to the transmitter PA.

Top Voltage Limiter

With normal power output and moderate ambient temperatures, PA supply transistor Q501 operates fully saturaged, so that an increase in battery voltage causes an increase in battery voltage causes an increase in Vcc. When the Vcc is not high enough for power dissipation to endanger the PA transistors, the power and temperature control circuits will not reduce the Vcc. However, at very low ambient temperature, a high value of Vcc that would not result in excessive power dissipation might permit RF voltages to rise enough to cause secondary breakdown in the PA transistors. Therefore, the voltage limiter places a top limit on the amount that the Vcc can rise under any condition (see Figure 12).

Keying the transmitter applies the output of Q501 to the base of Q3 through a voltage divider network (R8, R9 and R10). With the voltage at a safe operating level, VR4 prevents voltage limiter Q3 from turning on. If the voltage rises higher than the safe operating limit, the voltage will break down VR4, and Q3 will begin to conduct. This causes regulator drivers Q1 and Q502 to conduct less, reducing the output of Q501. The maximum voltage is set at the factory for approximately 13 volts.

HEAT SINK SERVICING

Since the metal envelopes of Q501 through Q505 are at collector potential, they must be electrically isolated from ground. However, there must be a good path for heat from the transistors to reach the cast aluminum radiator (heat sink) in which they are mounted, so that the heat will dissipated by the heat sink. The insulators used between the transistors and the heat sink not only isolate the transistors electrically, but also act as a good thermal conductor to conduct heat away from them.

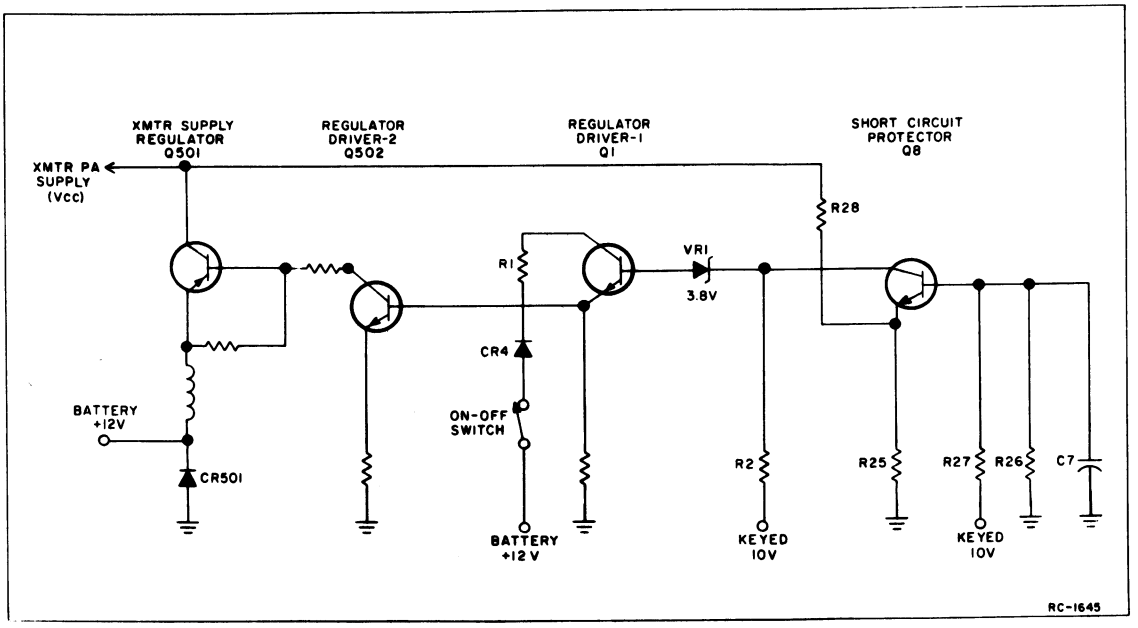


Figure 11 - Short Circuit Protector Circuit

Silicone grease is used on each side of the transistor insulators to improve the thermal contact, and allow the heat to be transferred more readily to the heat sink. Always make sure that there is a coating of silicone grease on each side of the insulator whenever one of the transistors is replaced.

CAUTION

The Royal Executive mobile combinations will operate in 12-volt, negative ground vehicle systems only. If the radio is ever moved to a different vehicle, always check the battery polarity and voltage of the new system before using the radio.

CONTROL UNITS

Six different models of control units are available for use with Executive Series mobile combinations. Three of the models are used with Trunk-Mount radios, and three with Front-Mount radios.

All Models of the control unit have an OFF-VOLUME control, a MONITOR pushbutton and a red transmit light. In addition, control units in multi-frequency combinations are equipped with a frequency-selector switch. The application of the different model control units is shown in the following chart.

TRUNK-MOUNT MODELS	FRONT-MOUNT MODELS	NO. OF FREQUENCIES
4EC67A10	4EC68B10	One
4EC67A11	4EC68B11	Two
4EC67A12	4EC68B12	Three or Four

CONTROLS

The OFF-VOLUME control normally determines whether or not the transmitter and receiver and receiver are operative. (Refer to section on Ignition Switch connections). Turning the switch ON enables the push-to-talk (PTT) circuit, and applies +12 volts to the receiver and power regulator.

Pushing the PTT button on the microphone lights the red pilot light, energizes the antenna changeover relay, and applies a keyed voltage to the transmitter and power regulator. The keyed voltage also mutes the receiver audio stages.

Monitor Pushbutton (S702)

Pressing in the MONITOR button disables the noise squelch circuit in the receiver. In radios equipped with Channel Guard, pressing the MONITOR button also disables the receiver Channel Guard.

Multi-Frequency Switches (S703 and S704)

In multi-frequency applications, a frequency-selector switch selects the channel desired for both transmit and receive. S703 is used in two-frequency control units, and

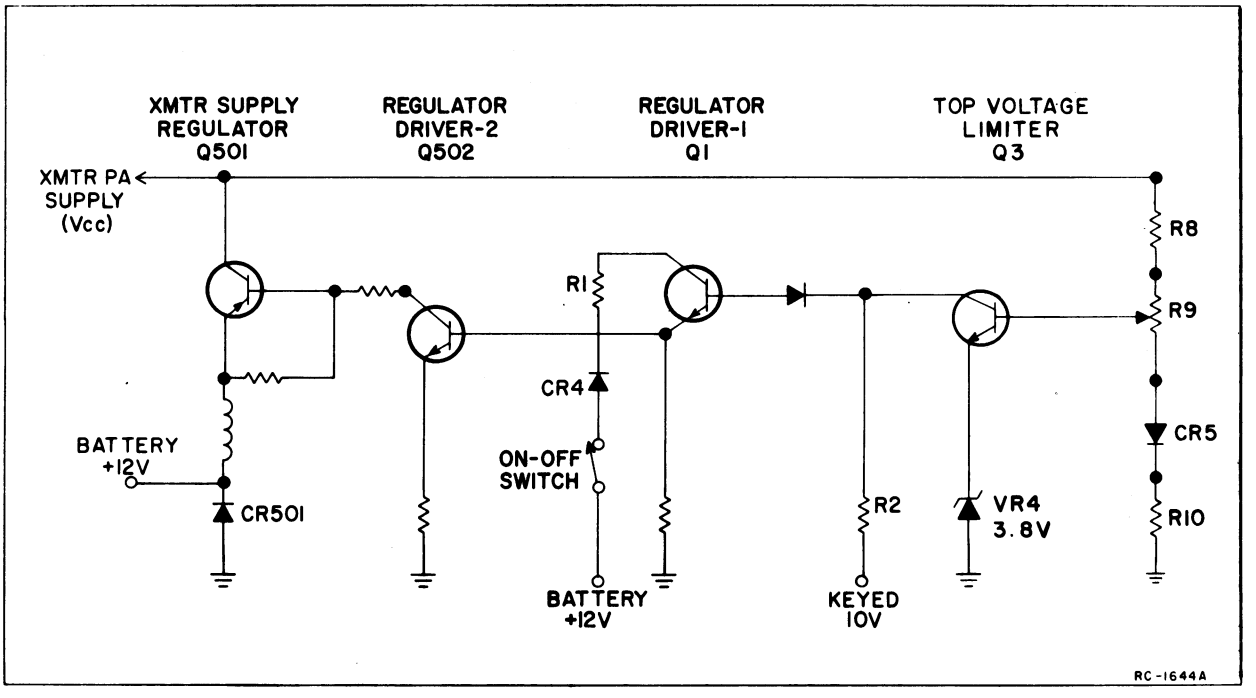


Figure 12 - Top Voltage Limiter Circuit

S704 is used in three- or four-frequency control units.

The switch connects the emitter of the receiver first oscillator and the transmitter oscillator-switching diode to ground, so that the radio will operate on the frequency determined by the selected crystal-controlled oscillators. In multi-frequency radios, the transmitter and receiver Channel Guard operates on all frequencies.

IGNITION SWITCH CABLE CONNECTIONS

The ignition switch cables may be connected for three different modes of operation, depending on the way the cables are connected in the vehicle system. The black ignition switch cable (in Trunk-Mount control units only) provides the receiver ground connection. The red fused lead provides the switched +12 volts (from the vehicle ignition switch) for the power regulator. The three types of operation are:

1. Ignition Switch Standby

   For this type of operation, the red fused lead (power regulator voltage) is connected to the ACCESSORY or ON terminal of the ignition switch. The yellow fused lead (receiver hot) is connected to the hot side of the ignition switch, and the black lead connects to vehicle ground.

   With the ignition switch OFF, the receiver automatically reverts to STBY, ready to receive messages. Turning the ignition switch to the ON or ACCESSORY position supplies power regulator voltage. Turning the OFF-VOLUME switch to OFF removes all power to the Two-Way Radio.

2. Ignition Switch Control

   For ignition switch control, the yellow and red fuse leads are connected to the ACCESSORY or ON terminal of the ignition switch. The transmitter and receiver will operate only when the ignition switch is in the ACCESSORY or ON position. Turning the ignition switch OFF removes all power to the radio.

3. Ignition Switch Bypass

   For ignition switch bypass, the yellow and red fused leads connect to the "hot" side of the ignition switch or the vehicle fuse block assembly. Both the transmitter and receiver operate independently of the ignition switch and can be turned on and off only by the OFF-VOLUME switch on the control unit.

CHANNEL GUARD

Channel Guard Board Model 4EK14B10 is fully transistorized encoder-decoder for use with MASTR Royal Executive mobile combinations. The tone-frequencies are controlled by plug-in tone networks that are made with precision components for excellent stability and reliability. The tone frequencies range from 71.9 to 203.5 Hz.

Cable W601 connects the supply voltage, encoder keying voltage and decoder functions from the Channel Guard board to the system terminal board (TB3). The encoder tone output is connected by a white-black shielded lead to the transmitter exciter board.

Complete instructions for the encoder-decoder are contained in Maintenance Manual LBI-4143.

CARRIER CONTROL TIMER
(Option 8307)

The Carrier Control Timer option shuts off the transmitter on each transmission after a one-minute timing cycle, and alerts the operator that the transmitter is off by means of an alarm tone in the speaker. The transmitter can be turned on again by releasing and rekeying the push-to-talk switch on the microphone. The timer option is assembled on a printed wiring board that mounts on the underside of the main chassis.

The timing cycle (transmitter keyed time) is normally set at the factory for a duration of one minute. An optional potentiometer is available that permits the timing cycle to be adjusted from 15 seconds to 5 minutes. Complete instructions for the Carrier Control Timer are contained in Maintenance Manual LBI-4138.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R110) 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, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing over-modulation while preserving intelligibility.

TEST EQUIPMENT

1. Audio Signal Generator Model 4EX6A10
2. Frequency Modulation Monitor
3. AC VTVM or output meter
4. GE Test Set Model 4EX3A10 (TM11 or TM12)

PROCEDURE

Transmitters without CHANNEL GUARD

1. Connect the audio signal generator and the meter across audio input terminals J5 (green-hi) and J6 (black-lo) on GE Test Set, or across J202-15 (mike hi) and J202-7 (mike lo) on the Centralized Metering Jack.
2. Apply a 1.0 volt signal at 1000 Hz to Test Set or across J202-15 and J202-7 on the Centralized Metering Jack.
3. Set MOD ADJUST (R110) for a 4.5-kHz swing with deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.

Transmitters with CHANNEL GUARD

1. Set the Channel Guard TONE ADJUST (R643) for 0.75-kHz tone deviation.
2. Follow Steps 1 thru 3 described above.

Multi-frequency Transmitters

Check all channels for deviation as described in Steps above.

PA POWER INPUT

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

P_i = PA voltage x PA current

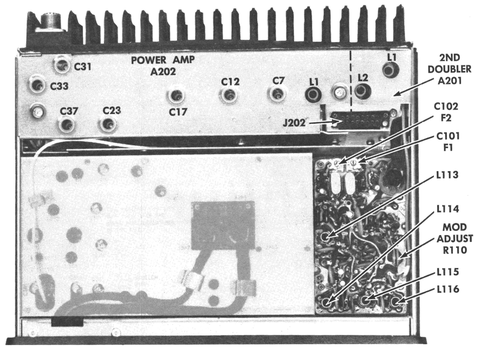
where

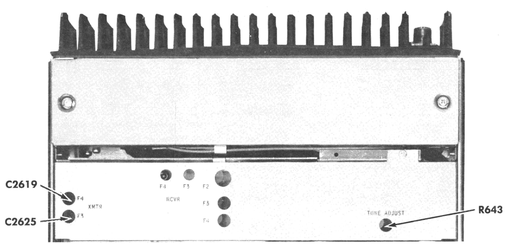
P_i is the power input in watts,

PA voltage is measured with the GE Test Set in Position G on the 15 volt scale, and the polarity switch in (-) position,

PA current is measured with the Test Set in Position G in the Test 1 position, and with the HIGH SENSITIVITY button pressed (10 amperes full scale).

Example: P_i = 12.5 volts x 5.5 amperes = 68.75 watts





TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A10 (Revision A or later), or Model 4EX8K11.
2. A 50-ohm wattmeter connected to J204.
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal(s) in crystal socket (crystal frequency= operating frequency ÷ 24).
2. For a large change in frequency or a badly misaligned transmitter, set crystal trimmer C101 to mid-capacity. In multi-frequency transmitters, set all trimmers to mid-capacity and set the channel selector switch to the highest frequency.
3. For a large change in frequency or a badly mis-aligned transmitter above 150 MHz, turn the slugs in the Exciter coils (L113, L114, L115, L116) to the bottom of the coil. For transmitters below 150 MHz, set the slugs in the center of the coils. Set A201-L1 and -L2 (on 2nd Multiplier Board) so that the top of the slug is approximately even with the bottom of the coil winding. Next, turn mica compression capacitors C7, C12, C17, C33, C31, C33 and C37 (on PA Board) all the way to the right (clockwise). Then set C7, C12, C17 and C33 1-1/2 turns counterclockwise, and C31 and C37 1/4-turn counterclockwise.
4. Connect the GE Test Set to Receiver Metering jack J302 and check for +10 volts at Position J. If reading is not 10 volts, refer to the Power Regulator Outline Diagram and set R19 for +10 volts.
5. Connect GE Test Set to metering jack J202. Set the test polarity to + and set the range to the Test 1 (or 1-volt position for 4EX8K11).
6. All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.

TRANSMITTER ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
			EXCITER BOARD	
1.	A MULT-1	L113 & L114	See Procedure	Carefully tune L113 for maximum meter reading. Then tune L114 for a small dip in meter reading.
2.	B MULT-2	L115, L114, and L116	See Procedure	Tune L115 for full scale meter reading (or maximum reading if full scale cannot be obtained). Next, tune L116 for a dip in meter reading. Then re-tune L114 and L115 for maximum meter reading.
			MULT-3 AND POWER AMPLIFIER	
3.	C MULT-3	A201-L1, -L2 (MULT-3) & L116	See Procedure	Adjust A201-L1 for maximum meter reading. Re-adjust L116 for maximum meter reading. Then adjust A201-L2 for minimum meter reading.
4.	D MULT-4	A202-L1 (PA) & 201-L2 (MULT-3)	Maximum	Adjust A202-L1 for maximum meter reading. Then re-adjust A201-L2 and A202-L1 for maximum meter reading.
5.	E Amp 1 & 2	A202-C7	Maximum	Increase the capacity (clockwise) of C7 to the first indication. Then tune this response for maximum meter reading.
6.	E DRIVER Ic	A202-C12	Maximum	Adjust C12 clockwise for maximum meter reading.
7.	F	A202-C17	Maximum	Adjust C17 for maximum meter reading.
8.	G PA Ic	A202-C23 & C37	5 amps MAX.	With the HIGH SENSITIVITY button on the GE Test Set pressed, turn C23 counterclockwise for maximum meter reading. Do not exceed a meter reading of 5 amperes (10 amperes full scale). If necessary, turn C37 clockwise to keep maximum reading of C23 at 5 amperes.
9.	G	A202-C12 & C17	Maximum	With the HIGH SENSITIVITY BUTTON pressed, adjust C12 and C17 for maximum meter reading.
10.	G	A202-C23 & C37	See Procedure	If the meter reading exceeds 5 amperes after adjusting C12 and C17, repeat Step 8.
11.	I Rel. Power Out	A202-C31 & C33	See Procedure	Adjust C31 for maximum RF power output (this may be fully clockwise), and then turn C31 slightly counterclockwise from maximum. Next, turn C33 clockwise for maximum meter reading, and then turn C33 slightly clockwise from maximum meter reading. Repeat these adjustments until maximum power output is obtained. NOTE Meter Position "I" indicates relative power output. Either the test meter (in Position "I") or wattmeter may be used to tune for maximum power output.
12.	G	A202-C23 & C37	4.6 amps	With the HIGH SENSITIVITY button pressed, check for a meter reading of 5 amperes. If reading exceeds 5 amperes, repeat Step 8 to get meter reading as close as possible to 5 amperes. If the reading is less than 5 amperes, adjust both C23 and C37 for maximum meter reading.
			FREQUENCY ADJUSTMENT	
13.		C101 (C102 in 2-freq. units, and C2625) or C2619 in multi-freq. units.		Loosely couple frequency counter to output and adjust C101 for proper frequency output. (Switch to F2 and adjust C102 on 2-frequency units.) In 3- or 4-frequency units, adjust C2625 or C2619 as required. NOTE For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90° F.

ALIGNMENT PROCEDURE

TRANSMITTER TYPE ET-83-A

RC-1673E

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 supply voltage, tone and voice deviation, defective audio sensitivity and modulator adjust control set too high. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once a defect is pin-pointed, refer to the "Service Check" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

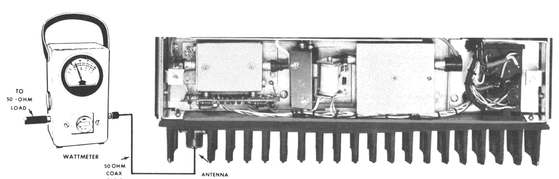
1. Wattmeter similar to:
   Bird #43
   Jones #711N
2. VTVM similar to:
   Triplett #850
   Heath #1M-21
3. Audio Generator
   G-E MODEL 4EX6A10
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements #140
   Lampkin #205A
5. Multimeter similar to:
   G-E TEST SET
   MODEL 4EX3A10 or 4EX8K11

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

A. Connect transmitter output to wattmeter as shown below:



B. Key transmitter and check wattmeter for minimum reading of 35 watts (132-162 MHz) or 30 watts (162-174 MHz).

SERVICE CHECK

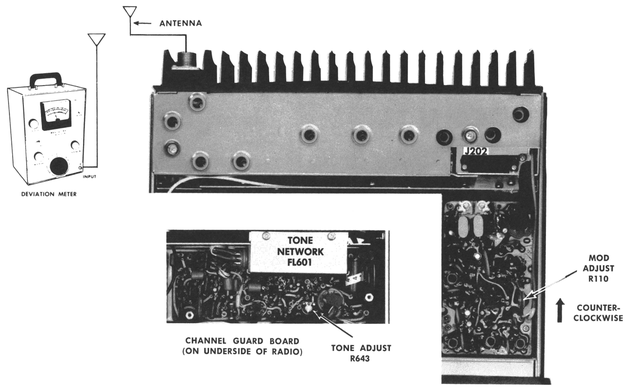
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

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



B. Set MOD ADJUST control R110 fully counterclockwise.

C. Key transmitter and check for 0.75 kHz deviation. If reading is low or high, adjust Channel Guard TONE ADJUST (R643 on Channel Guard Board) for a reading of 0.75 kHz.

DEVIATION METER

NOTES:

D. On units supplied with Channel Guard, the Phase Modulator Tuning should be peaked carefully to insure proper performance. (Refer to Step 1 in the Transmitter Alignment Procedure).

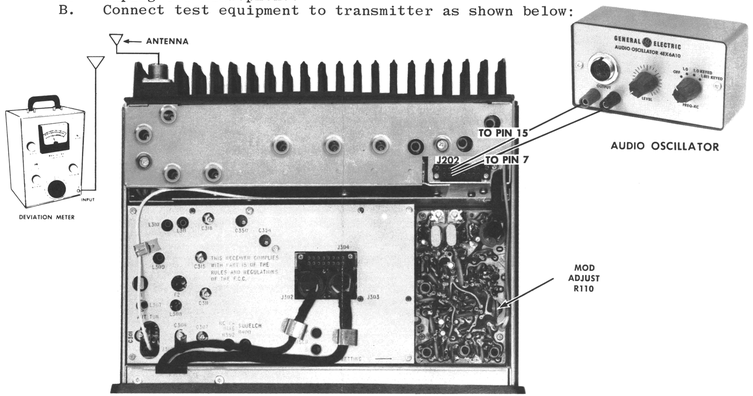
E. The Tone Deviation Test Procedures should be repeated every time the Tone Frequency is changed.

STEP 3

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

A. Unplug the microphone.
B. Connect test equipment to transmitter as shown below:

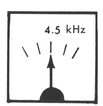


C. Set the generator output to 1.0 VOLTS RMS and frequency to 1 kHz.

D. Key the transmitter by connecting a jumper from J202-18 to J202-16 (GRD).

E. Deviation reading should be ±4.5 kHz.

F. Adjust MOD ADJUST Control R110 until deviation reads 4.5 kHz on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.



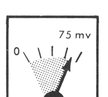
DEVIATION METER

NOTES: --These transmitters are adjusted for 4.5 kHz deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz under the worst conditions of frequency, voltage and temperature.

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

G. Recheck Step 1 as shown in the Transmitter Alignment Procedure.

H. Check Audio Sensitivity by reducing generator output until deviation falls to 3.3 kHz. Voltage should be LESS than 90 millivolts (typically 75 mv).



METER

FRONT END ALIGNMENT

These instructions are for tuning the oscillator and RF stages of the receiver and may be used when changing the receiver crystal or frequency. When necessary to realign the entire receiver, refer to the COMPLETE RECEIVER ALIGNMENT.

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11 or 20,000 ohms-per-volt Multimeter.

2. 132-174 MHz signal source (keep signal level below saturation).

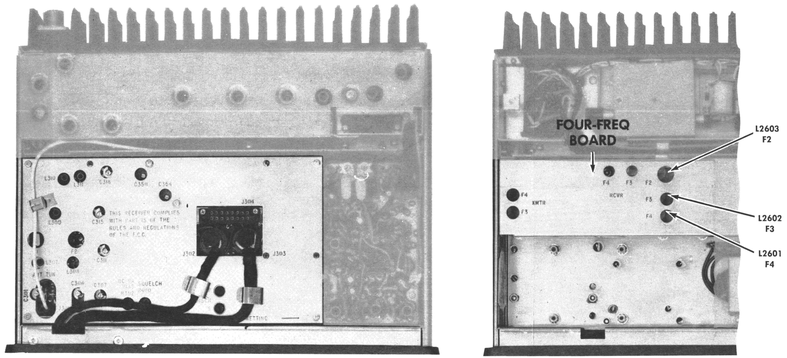
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set 4EX3A10 into receiver contralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to 1. If using Multimeter, connect the negative lead to J304-13 (ground).

2. **Turn SQUELCH control (R400) fully clockwise and VOLUME control to minimum. Switch to position "G" or measure at J304-9 with Multimeter. In combinations with Power Regulator Model 4EP57A10 in Rev. G or later, set PA bias R392 for reading of 1.3 volts. For Power Regulator in Rev. F or earlier set PA bias R392 for a reading of 0.7 volt.**

ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	METERING POSITION Multimeter + at J304	TUNING CONTROL	METER READING	PROCEDURE
1.	D OSC	pin 4	L307	See Procedure	Switch to F1, put in F1 crystal and tune L307 for maximum meter reading.
2.	D OSC	pin 4	L309 & L307	Maximum (0.17-0.5V)	Apply an on-frequency signal to J301 and adjust L309 and L307 for a maximum meter reading (0.17-0.5 volts).
3.	D OSC	pin 4	L310 & L311	See Procedure	Adjust slugs to same depth as in L309 in Step 2.
4.	D OSC	pin 4	L308 (2-freq. only)	Maximum	For 2-frequency receivers, switch to F2, insert F2 crystal and adjust L308 for maximum.
5.					Preset RF capacitors C301, C304, C307, C311, C315, and C318 to approximate-frequency. (Capacitors tune from 130 MC (max. capacitance) to 174 MC (min. capacitance).
6.	B LIM 1	pin 3	L310, L311 C301, C304 C307, C315 C318	Maximum	Apply on-frequency signal to J301. Tune L310, L311, C301, C304, C307, C315, and C318 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero.
7.	A DISC	pin 4	L307 (L308 for 2-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L307 (L308 for 2-frequency) for zero discriminator reading. - NOTE - For proper freq control of the receiver, it is recommended that all freq adjustments be made when the equipment is at a temp of approx 75°F. In no case should freq adjustments be made when the equipment is outside the temp range of 50° to 90°F.
8.			C301, C304		While receiving a weak on-frequency signal from the antenna, tune C301 and C304 for best quieting.
			SQUELCH ADJUSTMENT		
9.				30°	Set SQUELCH Control (R400) to open with a 4 db SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)



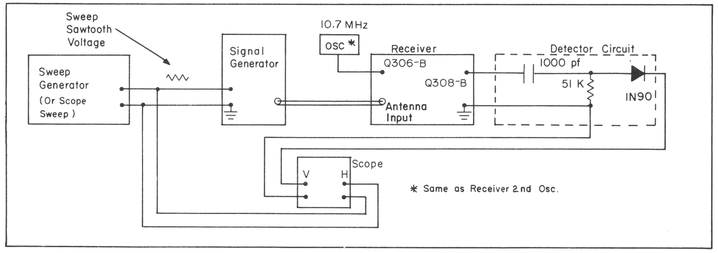


Figure 1 - High and Low IF FILTER TEST Circuit

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11 or 20,000 ohms-per-volt Multimeter.

2. A 10.7 MHz (±200 Hz) and 132-174 MHz signal source. Couple the 10.7 MHz signal through a 0.01 µf capacitor. Keep signal levels below saturation.

3. For Alignment steps 4 thru 8 - Oscilloscope, sweep generator, 10.7 MHz marker generator and construct a detector circuit (see Figure 1 for circuitry).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set into the receiver centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to TEST 1. If using multimeter, connect the negative lead to J304-13 (ground).

2. Switch Test Set to Position "I" (or measure at collector of Q318 with multimeter). Reading should be a nominal 13.8 volts.

3. Switch to Position "J" (or measure at top of C443 with multimeter), and check for a reading of 10 volts. If reading is not correct, refer to power regulator Outline Diagram and set R19 for + 10 volts.

4. **Turn SQUELCH control fully clockwise and VOLUME control to minimum. Switch to Position "G" or measure at J304-9 with multimeter. In combinations with Power Regulator Model 4EP57A10 in Rev. G or later, set PA bias R392 for reading of 1.3 volts. For Power Regulator in Rev. F or earlier set PA bias R392 for a reading of 0.7 volt.**

ALIGNMENT PROCEDURE

STEP	METERING POSITION TEST SET	METERING POSITION MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
			DISCRIMINATOR		
1.					Remove 1st oscillator crystal and apply a 10.7 MHz signal to the base of Q308.
2.	A DISC	pin 10	L329	See Procedure	Adjust L329 (discriminator primary) 1/2 turn up from bottom of range.
3.	A DISC	pin 10	L330	Zero	Tune L330 (discriminator secondary) for zero meter reading.
			HIGH and LOW IF FILTER (SEE NOTE 1)		
4.	B LIM	pin 2	L321 thru L328	Maximum	Adjust L321 thru L328 for maximum meter reading.
5.	B LIM	pin 2	C357, C354, C350	See Procedure	Adjust C357 for minimum meter reading. Adjust C354 for maximum meter reading. Adjust C350 for minimum meter reading.
6.			C357 & C360		Disable the 2nd oscillator by grounding base of Q307 through a .01 µf capacitor. Connect scope, signal generator and detector as shown in figure 1. Sweep RF ±50 kHz at 20 Hz. Connect 10.7 MHz marker to base of Q306. Tune C357 and C360 for scope pattern shown. Keep marker signal centered between humps and signal level below saturation.
7.			L321 thru L328		Disconnect detector, remove short from base of Q307 and connect scope to 1st LIM test point. Adjust L321 thru L328 for symetrical wave form shown, with marker in center.
8.	A DISC	pin 10			Check to see that discriminator idling voltage is within 0.05 volts of zero with no signals applied and the modulation acceptance bandwidth is between ±8 and ±9 kHz.
			OSC/MULT & AMPLIFIER		
9.	D OSC	pin 4	L307	Maximum	Remove short from base of Q307, if present, then insert 1st oscillator crystal and adjust L307 for maximum meter reading.
10.	D OSC	pin 4	L309 & L307	Maximum (0.17-0.5v)	Adjust L309 and L307 for maximum meter reading (0.17-0.5 volts).
11.	D OSC	pin 4	L310 & L311	See Procedure	Set L310 and L311 slugs to same depth as L309.
12.	D OSC	pin 4	L308 (2-freq)	Maximum	For 2-frequency receiver, insert F2 crystal and adjust L308 for maximum meter reading.
			RF		
13.	B LIM 1	pin 3	L310, L311 C301, C304 C307, C311 C315, C318	Maximum	Apply on-frequency signal to J301, then turn L310, L311, C301, C304, C307, C211, C315 and C318 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero.
14.			C301, C304		While receiving a weak on-frequency signal from the antenna, tune C301 and C304 for best quieting.
			FREQUENCY ADJUSTMENT		
15.	A DISC	pin 4	L307 (L308 for 2-freq. or L2603, L2602 or L2601 on 4-freq. board for 3- or 4-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L307 (L308 for 2-frequency) for zero discriminator reading. In 3- or 4-frequency units, tune L2603, L2602 or L2601 as required. NOTE 2 For proper frequency control of the receiver, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approx. 75°F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90°F.
16.				30°	Set SQUELCH Control (R400) to open with a 4 db SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)

NOTE 1 -- High and Low IF coils and capacitors have been set at the factory and will normally require no further adjustment. Do not re-align unless there is positive evidence of a defective filter. For location of components, refer to the Receiver Outline Diagram.

ALIGNMENT PROCEDURE

RECEIVER MODELS 4ER48A10-15
FOR MOBILE COMBINATIONS

RC-1988
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TEST PROCEDURES

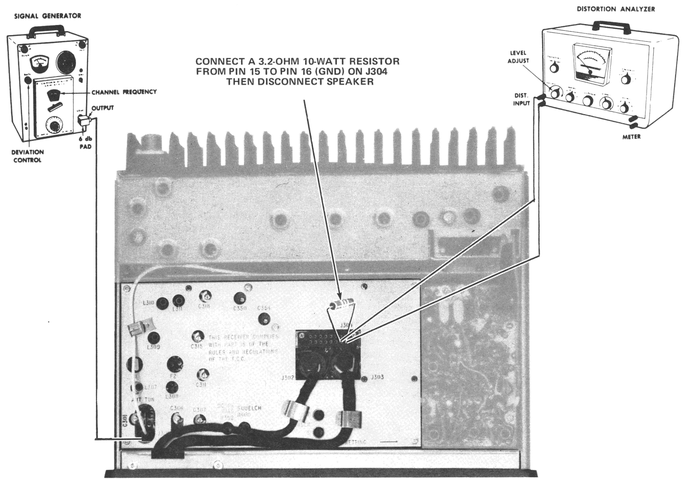
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequency of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup shown:

1. Distortion Analyzer similar to: Heath #1M-12
2. Signal Generator similar to: Measurements #M-560
3. 6 db attenuation pad

The test equipment is hooked to the receiver as shown for all Receiver Test Procedures.



STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

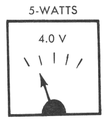
Measure Audio Power Output as follows:

A. Connect a 1,000-microvolt test signal modulated by 1,000 hertz with +3.3 kHz deviation to the antenna jack J301.

B. When speaker is used, disconnect speaker (and handset if present). Hook up a 3.2-ohm load resistor from J304-15 to J304-16 as shown.

C. Set VOLUME Control for five-watt output (4.0 VRMS).

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%.



VOLTMETER SCALE ON DISTORTION ANALYZER

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than five watts, make the following checks:

E. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

F. Set SQUELCH control R400 fully clockwise and the VOLUME control to minimum. Then connect a milliammeter in series with the red lead at TB5-1 and adjust R4 on the Audio PA board for a reading of 20 milliamperes. This adjustment should not be necessary unless one of the Audio PA transistors has been replaced

G. Audio Gain (Refer to Receiver Troubleshooting Procedure).

H. Discriminator Alignment (Refer to Receiver Alignment on reverse side of page).

STEP 2

USABLE SENSITIVITY (12 db SINAD)

TEST PROCEDURE

Measure sensitivity of the receiver modulated at the standard test modulation as follows:

A. Be sure TEST STEP 1 checks out properly.

B. Reduce the Signal Generator output from setting in TEST STEP 1.

C. Adjust Distortion Analyzer LEVEL control for a +2 db reading.

D. Set CONTROL from LEVEL to DISTORTION reading. Repeat Steps 2A, 2B and 2C until difference in reading is 12 db (+2 db to -10 db).

E. The 12-db difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. Reading should be less than 0.25 microvolts with audio output at least 2.5 watts (2.85 volts RMS across the 3.2-ohm receiver load).

SERVICE CHECK

If the sensitivity level is more than 0.25 microvolts, make the following checks:

F. Alignment of RF stages (Refer to RF Alignment in Receiver Alignment on reverse side of page.)

G. Gain measurements as shown on the Receiver Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

TEST PROCEDURE

A. Be sure TEST STEPS 1 and 2 check out properly.

B. Set Signal Generator output for twice the microvolt reading obtained in TEST STEP 2D.

C. Increase Signal Generator frequency deviation.

D. Adjust LEVEL Control for +2 db.

E. Set CONTROL from LEVEL to DISTORTION reading. Repeat Steps 3C, 3D and 3E until difference between readings becomes 12 db (from +2 db to -10 db).

F. Deviation control reading for the 12-db difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±8 kHz (but less than ±10 kHz).

DB SCALE ON DISTORTION ANALYZER

LEVEL DISTORTION ON DISTORTION ANALYZER

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

PARTS LIST

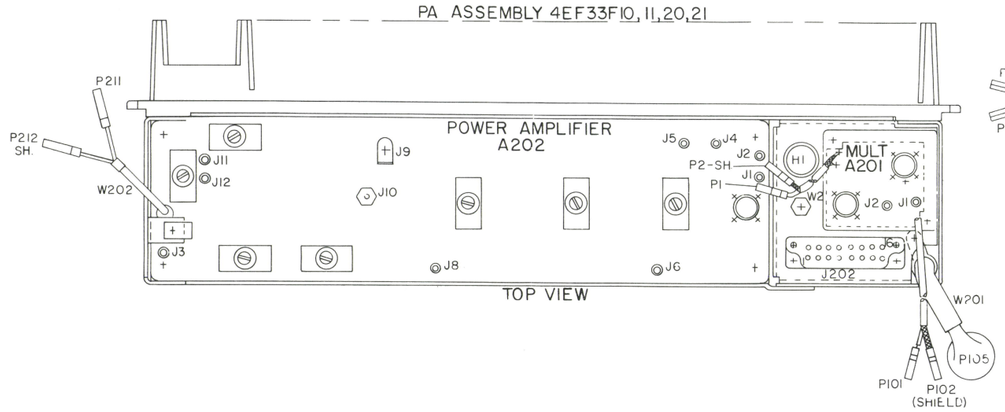
LBI-3893E

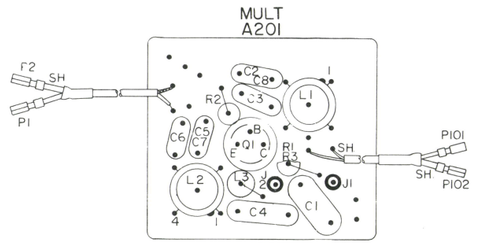
132-174 MHz TRANSMITTER
TYPE ET-83-A

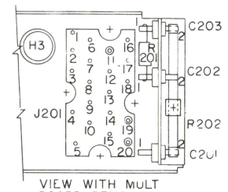
SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD MODEL 4EG21F10 1 FREQ NARROW BAND MODEL 4EG21F11 2 FREQ NARROW BAND
		- - - - - - - - - CAPACITORS - - - - - - - - -
C101 and C102	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C103 and C104	5496219P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C105 thru C108	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C109 and C110	5496219P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C111 and C112	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C113	5496372P167	Ceramic disc: 510 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C114	5490008P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C115	4029003P4	Silver mica: 680 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-20.
C116	5494481P131	Ceramic disc: 6800 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C117	5496219P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C118	5496372P45	Ceramic disc: 180 pf ±10%, 500 VDCW, temp coef -2200 PPM.
C119	5490008P135	Silver mica: 220 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C120	5494481P129	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C121	5496219P218	Ceramic disc: 56 pf ±10%, 500 VDCW, temp coef -80 PPM.
C122* and C123*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		In REV B and earlier:
	5494481P129	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C124 and C125	5496219P261	Ceramic disc: 82 pf ±5%, 500 VDCW, temp coef -80 PPM.
C126	7130348P3	Molded: 1 pf ±.05 pf, 500 VDCW, temp coef approx 0 PPM; sim to Jeffers Type JM-5/32.
C127	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C128	5494481P113	Ceramic disc: 2000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C129	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C130	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C131	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C132	7491395P111	Ceramic disc: 1500 pf ±10%, 500 VDCW; sim to RMC Type JL.
C133	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C134	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C135	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C136	7491395P114	Ceramic disc: .0022 pf ±10%, 500 VDCW; sim to RMC Type JL.
C137 and C138	7491395P109	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JL.
C142*	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV A.
		- - - - - - **DIODES AND RECTIFIERS** - - - - - -
CR101 and CR102	19A115603P1	Silicon.
CV101	5495769P9	Varactor, silicon: 33 µf ±10% at 4 VDC; sim to Pacific Semiconductor Varicap Type V-596.
		- - - - - - **JACKS AND RECEPTACLES** - - - - - -
J101 thru J104	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J105	19B209303P1	Connector, phen: 9 pins.
J2603		(Part of Exciter Board 19C303835P1).
		- - - - - - - - - **INDUCTORS** - - - - - - - - -
L113	19C303883G13	Coil. Includes tuning slug 5491798P2.
L114	19C303883G14	Coil. Includes tuning slug 5491798P2.
L115	19C303883G15	Coil. Includes tuning slug 5491798P2.
L116*	19C303883G17	Coil. Includes tuning slug 5491798P2.
		In Models earlier than REV A:
	19C303883G16	Coil. Includes tuning slug 5491798P2.
		- - - - - - - - **TRANSISTORS** - - - - - - - -
Q101	19A115889P1	Silicon, NPN.
Q102 and Q103	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q104	19C300114P1	Silicon, NPN; sim to Type 2N706.
Q105	19A115330P1	Silicon, NPN.
Q106 and Q107	19A115328P1	Silicon, NPN.
		- - - - - - - - - **RESISTORS** - - - - - - - - -
R101*	3R77P154K	Composition: 0.15 megohm ±10%, 1/2 w. Deleted by REV B.
R102	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R103	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R104 and R105	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R106	3R77P565J	Composition: 5.6 megohms ±5%, 1/2 w.
R107	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R108	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R109	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R110	19B209358P106	Variable, carbon film: 75 to 10,000 ohms ±10%, 1/4 w; sim to CTS Type X-201.
R111	3R77P184J	Composition: 0.18 megohm ±5%, 1/2 w.
R112	3R152P560J	Composition: 56 ohms ±5%, 1/4 w.
R113	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R114*	3R77P333J	Composition: 33,000 ohms ±5%, 1/2 w. Deleted by REV B.
R115*	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w. Deleted by REV B.
R116 and R117	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R118 thru R120	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R121	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R122	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R123	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R124	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R125*	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
		In Models of REV A and earlier:
	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R126	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R127	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R128	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R129	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R130*	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
		In REV B and earlier:
	3R77P151K	Composition: 150 ohms ±10%, 1/2 w.
R131	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R133	3R77P390K	Composition: 39 ohms ±10%, 1/2 w.
R134*	3R77P430J	Composition: 43 ohms ±5%, 1/2 w.
		In REV B and earlier:
	3R77P560K	Composition: 56 ohms ±10%, 1/2 w.
R135	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R136	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R164*	3R77P204J	Composition: 0.20 megohm ±5%, 1/2 w. Added by REV B.
R165*	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w. Added by REV B.
R166*	3R77P563J	Composition: 56,000 ohms ±5%, 1/2 w. Added by REV B.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT101 and RT102	19B209353P2	Disc: 460 ohms max; sim to GE 16D-3121.
RT103 and RT104	19B209353P1	Rod: 10,200 ohms min; sim to GE 1R-1544.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY101 and XY102	4033089P1	Clip.
	19A115793P1	Contact, electrical: sim to Malco 2700.
	19C311172P1	Socket, crystal.
	19B200525P9	Rivet.
		- - - - - - - - - CRYSTALS - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
		Crystal freq = OF / 24
Y101 and Y102	19B206204P1	Quartz: freq range 5400-7250 KHz, temp range -30°C to +85°C.
		POWER AMPLIFIER ASSEMBLY MODEL 4EF33F10 130-150.8 MHz MODEL 4EF33F11 150.8-174 MHz MODEL 4EF33F20 130-150.8 MHz MODEL 4EF33F21 150.8-174 MHz
A201A and A201B		MULTIPLIER BOARD A201A 19B205919G1 A201B 19B205919G2
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C2	5496219P316	Ceramic disc: 39 pf ±10%, 500 VDCW, temp coef -150 PPM.
C3	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

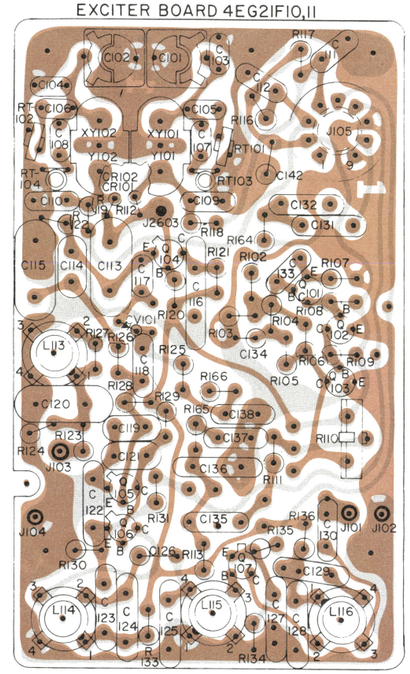
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

(Cont'd on back of RE-1676)

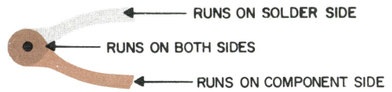


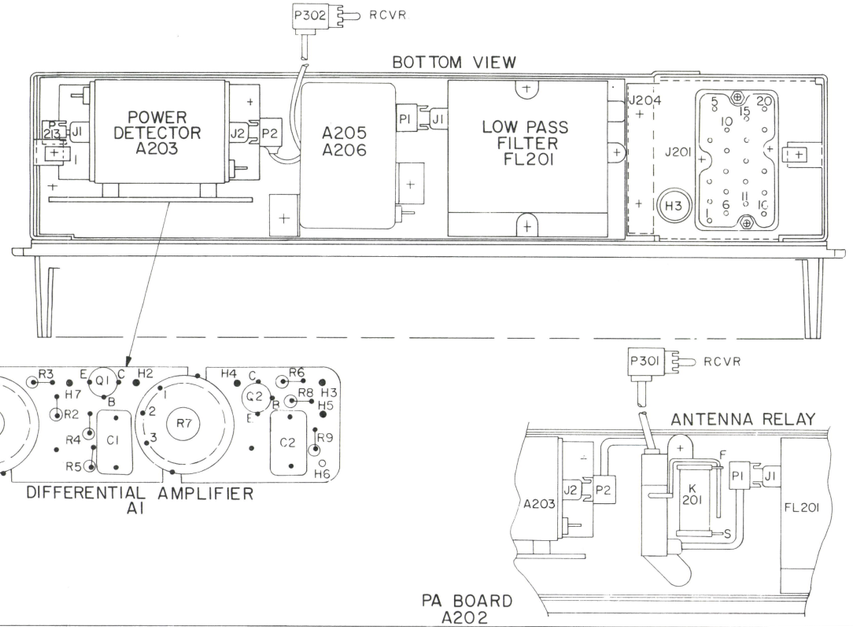


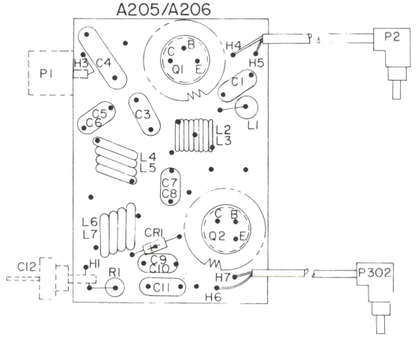


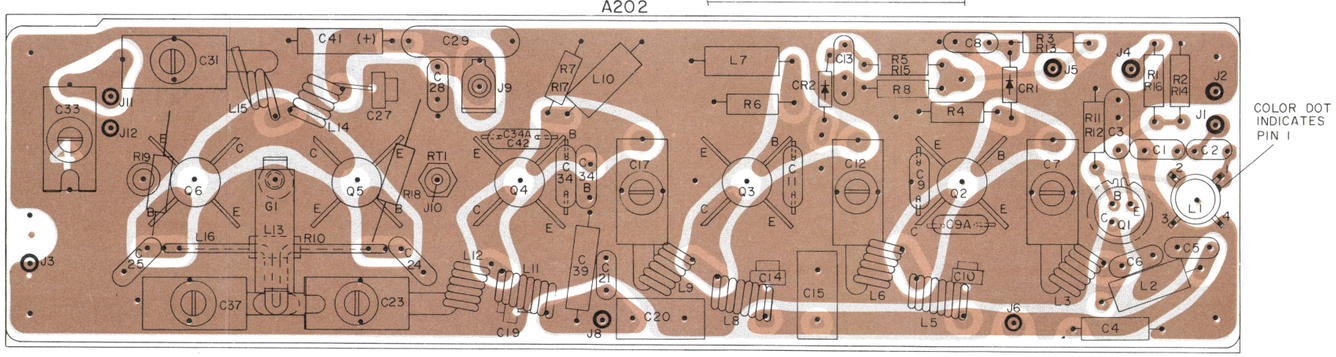


(19B205178, Sh. 1, Rev. 1)
(19B205178, Sh. 2, Rev. 1)









RESISTANCE READINGS

ALL READINGS ARE APPROX. READINGS MEASURED FROM TRANSISTOR PINS TO GROUND WITH ALL POWER TURNED OFF. READINGS ON THE EXCITER BOARD OVER 1,000 OHMS READ ON THE X 1,000 SCALE. + OR – SIGN SHOW METER LEAD GROUNDED

EXCITER BOARD

TRANSISTOR SYMBOL #	EMITTER		BASE		COLLECTOR	
	–	+	–	+	–	+
Q101	650	650	13,200	3,650	8600	2800
Q102			8,600	2,800	12,000	2800
Q103			12,000	3,800	10,000	11,500
Q104	1000	4000	14,000	3,500	2500	3000
Q105			35,000	3,300	4300	3300
Q106	150	150	4,300		2900	2900
Q107	50	50			2600	2900

PA ASSEMBLY

SYMBOL #	EMITTER		BASE		COLLECTOR	
	–	+	–	+	–	+
Q1 (MULT A201)	30	30	GND	GND	40	200
Q1 (P.A. A202)	33	33	220	85	33	165
Q2	GND	GND	22	22	30	165
Q3	GND	GND	GND	GND	30	165
Q4	GND	GND	GND	GND	30	165
Q5	GND	GND	2	2	30	165
Q6	GND	GND	2	2	30	165

(19E500878, Rev. 9)

OUTLINE DIAGRAM

132—174 MHZ TRANSMITTER
TYPE ET-83-A

RC-1675E
****

(19C311397, Sh. 1, Rev. 4)
(19C311397, Sh. 2, Rev. 4)

(19D402586, Rev. 5)

(19R621204, Rev. 22)

SCHEMATIC DIAGRAM

132—174 MHZ TRANSMITTER
TYPE ET-83-A

RC-1676G
****

(Cont'd from front of RC-1675)

SYMBOL	GE PART NO.	DESCRIPTION
C4	5494481P127	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C5	5496219P305	Ceramic disc: 5.0 pf ±10%, 500 VDCW, temp coef -150 PPM.
C6	19A116565P6X1	Ceramic disc: 5 pf ±1 pf, 500 VDCW, temp coef -150 PPM.
C7	5496219P309	Ceramic disc: 9.0 pf ±0.5 pf ±10%, 500 VDCW, temp coef -150 PPM.
C8	5496219P317	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -150 PPM.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 and J2	6033513P4	Contact, electrical: sim to Bead Chain L93-3.
	7484398P4	Silver mica: 500 pf ±10%, 500 VDCW; sim to Underwood Type J-1-HF.
		- - - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19D402808G22	Coil. Includes:
	5491798P2	Tuning slug.
L2	19D402808G23	Coil. Includes:
	5491798P2	Tuning slug.
L3	7488079P9	Choke, RF: 2.7 µh ±10%, 1.2 ohms DC res max; sim to Jeffers 4411-13K.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1 and P2	4029840P1	Contact, electrical: sim to AMP 41854.
P101	4029840P2	Contact, electrical: sim to Amp 42827-2.
P102	4029840P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A116016P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R2	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R3	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
A202A and A202B		PA BOARD A202A 19D413047G1 A202B 19D413047G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116656P562J1	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2	19A116656P9K1	Ceramic disc: 9.0 pf ±1 pf, 500 VDCW, temp coef -150 PPM.
C3	7489162P135	Silver mica: 220 pf ±2%, 500 VDCW; sim to Electro Motive Type DM-15.
C4	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C5	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C6	19A116656P47K1	Ceramic disc: 47 pf ±10%, 500 VDCW, temp coef -150 PPM.
C7	19SD904089P103	Variable, mica: 4 to 35 pf, 400 VDCW.
C8	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9 and C9A	19A116656P39K1	Ceramic disc: 39 pf ±10%, 500 VDCW, temp coef -150 PPM.
C10*	5493392P107	Ceramic, stand-off: 1000 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type 535A. In Models 4EF33F10, 11 of REV B and earlier: In Model 4EF32F20 earlier than REV A; In Model 4EF33F21 of REV A and earlier:
	7484398P4	Silver mica: 500 pf ±10%, 500 VDCW; sim to Underwood Type J-1-HF.
C11	19A116656P56K1	Ceramic disc: 56 pf ±10%, 500 VDCW, temp coef -150 PPM.
C12	19SD904089P102	Variable, mica: 4 to 35 pf, 400 VDCW.
C13	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

SYMBOL	GE PART NO.	DESCRIPTION
C14*	5493392P107	Ceramic, stand-off: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type 535A. In Models 4EF33F10, 11 of REV B and earlier: In Model 4EF32F20 earlier than REV A; In Model 4EF33F21 of REV A and earlier:
	7484398P4	Silver mica: 500 pf ±10%, 500 VDCW; sim to Underwood Type J-1-HF.
C20	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C21	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C23*	19SD904089P204	Variable, mica: 16 to 90 pf, 400 VDCW. In 4EF33F10, 11 of REV C and earlier; In 4EF33F20 of REV A and earlier; In 4EF33F21 of REV B and earlier:
	19SD904089P203	Variable, mica: 7 to 50 pf, 400 VDCW.
C24 and C25	19A116656P30J1	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -150 PPM.
C26*	5493392P107	Ceramic, stand-off: .001 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type 535A. In Models 4EF33F10, 11 of REV B and earlier: In Model 4EF33F20 earlier than REV A; In Model 4EF33F21 of REV A and earlier:
	7484398P4	Silver mica: 500 pf ±10%, 500 VDCW; sim to Underwood Type J-1-HF.
C28	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C29	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C31	19SD904089P105	Variable, mica: 24 to 110 pf, 400 VDCW.
C33	19SD209409P6	Variable, mica: 37 to 140 pf, 400 VDCW.
C34 and C34A	19A116656P47K1	Ceramic disc: 47 pf ±10%, 500 VDCW, temp coef -150 PPM.
C34B*	19A116656P47K1	Ceramic disc: 47 pf ±10%, 500 VDCW, temp coef -150 PPM. Added to Model 4EF33F11 by REV B, and 4EF33F21 by REV A.
C37	19SD904089P103	Variable, mica: 7 to 50 pf, 400 VDCW.
C39	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C41	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C42	19A116656P82K1	Ceramic disc: 82 pf ±10%, 500 VDCW, temp coef -150 PPM.
		- - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J6	6033513P4	Contact, electrical: sim to Bead Chain L93-3.
J8	6033513P4	Contact, electrical: sim to Bead Chain L93-3.
J9	6033284P2	Contact, electrical: sim to Alcoa 3-1215.
J10		(Part of RT1).
J11 and J12	6033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19D402808G21	Coil. Includes tuning slug 5491798P2.
L2	7488079P33	Choke, RF: 1 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4413-2K.
L3	19B216275P1	Coil.

SYMBOL	GE PART NO.	DESCRIPTION
L5	19B216275P2	Coil.
L6	19B216275P1	Coil.
L7	7488079P8	Choke, RF: 2.20 µh ±10%, 1.00 ohms DC res max; sim to Jeffers 4411-12K.
L8	19B216275P2	Coil.
L9	19B216275P1	Coil.
L10	7488079P43	Choke, RF: 10.0 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4422-4K.
L11	19B216275P2	Coil.
L12	19B216275P1	Coil.
L13	7488079P61	Choke, RF: 10 µh ±10%, 2 ohms DC res max; sim to Jeffers 4414-12K.
L14	19B216275P3	Coil.
L15	19B216275P4	Coil.
L16	19A122864P1	Coil.
		- - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A116016P1	Silicon, NPN.
Q2	19A116029P1	Silicon, NPN.
Q3	19A116029P2	Silicon, NPN.
Q4	19A116029P4	Silicon, NPN.
Q5 and Q6	19A116029P3	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R2	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R3	3R77P183J	Composition: 18,000 ohms ±5%, 1/2 w.
R4	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R5	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R6	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R7	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R8	3R77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R10	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
R11	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R12	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
R13	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R14	3R77P390K	Composition: 39 ohms ±10%, 1/2 w.
R15	3R77P273K	Composition: 27,000 ohms ±10%, 1/2 w.
R16	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R17	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R18* and R19*	3R78P470K	Composition: 47 ohms ±10%, 1 w. Added by REV B.
		- - - - - - - - THERMISTORS - - - - - - - - -
RT1	19A123944G1	Thermistor assembly. Includes (2)10) 6033513P14 electrical contact.
A203		POWER DETECTOR 19C311680G1
A1		COMPONENT BOARD 19B216032G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19A115681P2	Variable, wirewound: 5000 ohms ±20%, 3 w; sim to CTS Series 115.
R2	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R3	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R4	3R152P202J	Composition: 2000 ohms 5%, 1/4 w.
R5	3R152P221J	Composition: 220 ohms ±5%, 1/4 w.
R6	3R152P221K	Composition: 220 ohms ±10%, 1/4 w.
R7	19A115681P2	Variable, wirewound: 5000 ohms ±20%, 3 w; sim to CTS Series 115.
R8	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R9	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
A205 and A206		ANTENNA SWITCH A205 19C317068G2 150-174 MHz A206 19C317068G4 132-150 MHz
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19C301468P233	Ceramic disc: 2.0 pf ±5%, 200 VDCW, temp coef -80 PPM.
C3	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C4	19A116655P22	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C5	19C300685P213	Ceramic disc: 13 pf ±2%, 500 VDCW; temp coef -80 PPM.
C6	19C300685P214	Ceramic disc: 15 pf ±2%, 500 VDCW; temp coef -80 PPM.
C7	19C300685P316	Ceramic disc: 18 pf ±2%, 500 VDCW; temp coef -150 PPM.
C8	19C300685P318	Ceramic disc: 20 pf ±2%, 500 VDCW; temp coef -150 PPM.
C9	19C300685P212	Ceramic disc: 13 pf ±2%, 500 VDCW; temp coef -80 PPM.
C10	19C300685P214	Ceramic disc: 15 pf ±2%, 500 VDCW; temp coef -80 PPM.
C11	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C12	5493392P210	Ceramic, feed-thru: 470 pf ±20%, 500 VDCW; sim to Allen Bradley Type FASC.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	7488079P10	Coil, RF: 3.30 µh ±10%; sim to Jeffers 4421-1K.
L2*	19B216005P2	Coil.
		In REV B and earlier:
	19B216005P14	Coil.
L3	19B216005P13	Coil.
L4	19B216005P8	Coil.
L5	19B216005P7	Coil.
L6	19B216005P8	Coil.
L7	19B216005P7	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	7104941P17	Plug, phono.
P2	5491689P56	RF: 500 VDC. Includes 12 inch cable (19B209044P19).
P302	5491689P56	RF: 500 VDC. Includes 12 inch cable (19B209044P19).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1* and Q2*	19A116179P1	Silicon, NPN. Deleted in 19C311707G4 by REV C.
Q3* and Q4*	19A116179P2	Silicon, NPN. Added to 19C311707G4 by REV C.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C201 thru C203	5493392P7	Ceramic, feed-thru: .001 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FASC.
		- - - - - - DIODES AND RECTIFIERS - - - - - -
CR301	4037832P1	Silicon.
		- - - - - - - - - FILTERS - - - - - - - - -
FL201	19C311460G1	Filter.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J201	19C303426G1	Connector: 20 pin contacts.
J302	19B205689G1	Connector: 18 pin contacts.
J304		(Part of FL201).
		- - - - - - - - - - RELAYS - - - - - - - - - -
K201	19SD904121P1	Armature, coaxial: 100 ohms ±10% coil res, 13.6 VDC ±20% operating, 2.2 w, 1 form C contact; sim to Magnecraft 1233-3.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P105		(Part of W201).
P202 and P303		(Part of W201).
P205	4029840P2	Contact, electrical: sim to Amp 42827-2.
P206	4029840P1	Contact, electrical: sim to AMP 41854.
P207	4029840P2	Contact, electrical: sim to Amp 42827-2.
P208	4029840P1	Contact, electrical: sim to AMP 41854.
P209	19SD901152P1	Terminal, solderless: sim to AMP 42386-5.
P210	4029840P6	Contact, electrical: sim to Malco 12080-0.
P211 thru P213		(Part of W202).
P301		(Part of K201).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	19SD909223P89	Wirewound: 0.1 ohms ±5%, 2 w; sim to IRC Type BWH.
R202	19A127071P1	Slide.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201		CABLE ASSEMBLY 19B205268G2
		- - - - - - - - - - PLUGS - - - - - - - - - -
P105	19SD209341P2	Socket, tube: 9 pins; sim to Elco 04-720.
P202 and P203	4029840P2	Contact, electrical; sim to Amp 42827-2.
	19A122138P1	Knob.
W202		CABLE ASSEMBLY 19A121948G4
		- - - - - - - - - - PLUGS - - - - - - - - - -
P211	4029840P2	Contact, electrical: sim to Amp 42827-2.
P212	4029840P1	Contact, electrical: sim to Amp 41854.
P213	5491689P56	RF Cable assembly: approx 12 inches long with plug molded on one end.
		MECHANICAL PARTS (SEE RC-1654)
1	7147223P2	Clip, loop. (Located by J302).
2	7160861P16	Nut, sheet spring. (Secures covers).
3	4036555P1	Insulator, disc. (Used with Q1 on A201, Q1 on A202, Q1 and Q2 on A205 and A206).

SYMBOL	GE PART NO.	DESCRIPTION
4	19A121252P1	Heat sink. (Used with Q1 on A201).
5	19A121676P1	Guide pin.
6	40290049P3	Retainer strap. (Used with Q1 on A201).
7	19B216016G1	Frame.
8	5491541P305	Spacer, hex. (Secures top cover).
9	19B216305G1	Plate. (Antenna relay).
	19B216305G2	Plate. (Antenna switch).
10	403543P1	Heat sink. (Used with Q1 on A202).
11	19A127181P1	Plate (Located between FL201 and item 9).
12	19C311665G1	Frame.
13	19B216017G1	Top cover.
14	19C311281G1	Bottom cover.
15	19C311277P1	Heat sink.
16	19C311279P1	Heat sink. (Used with A202).

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 - Models 4EG21F10, F11

To permit use of this exciter with High Band Royal Executive Systems. Changed L116 and added C142.

REV. B - Models 4EG21F10, F11

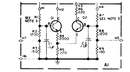
To permit use of this exciter with 25 kHz channel spacing.

Changed R125; deleted R101, R114 & R115; and added R164, R165 & R166

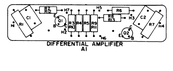
REV. A - Models 4EF33F10, 11

To incorporate new differential amplifier board. Changed A203-A1.

Schematic Diagram Was:



Outline Diagram Was:



REV. B - Model 4EF33F10

To improve stability added R18 and R19.

REV. A - Model 4EF33F21

REV. B - Model 4EF33F11

To improve impedance matching with multiple vendors. Added C34B.

REV. A - Model 4EF33F20

REV. B - Model 4EF33F21

REV. C - Models 4EF33F10, 11

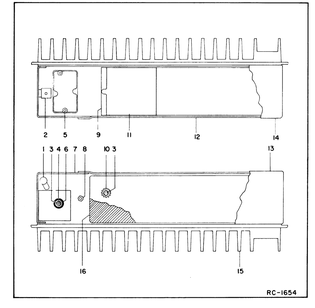
To facilitate manufacturing. Changed C10, C14, C19, and C27.

REV. B - Model 4EF33F20

REV. C - Model 4EF33F21

REV. D - Models 4EF33F10, 11

To prevent the capacitor from arcing. Changed C23.



RC-1654

PARTS LIST

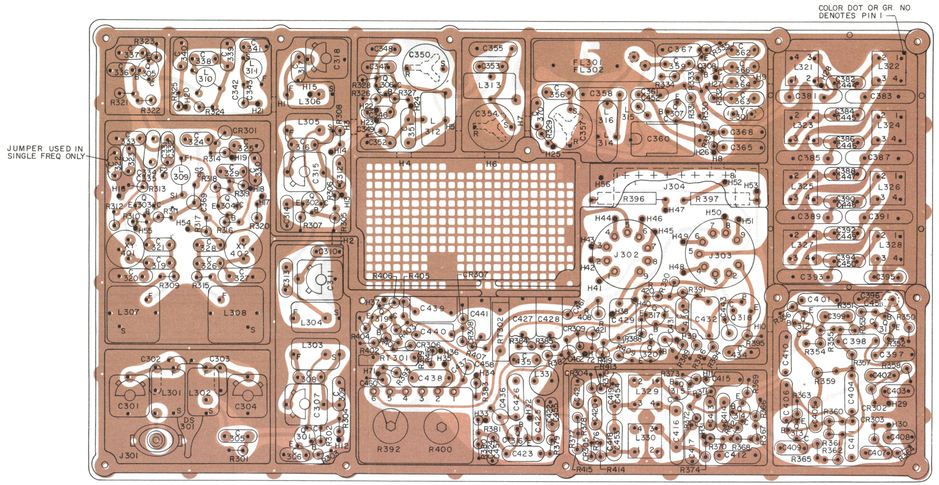
LBI-3718E

132-174 MHz RECEIVER
MODELS 4ER48A10, 11, 13; B10, 11, 13
MODELS 4ER48A12, 14, 15; B12, 14, 15

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C301	5491271-P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C302	5496219-P236	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C303	5496219-P436	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -220 PPM.
C304	5491271-P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C305	5490008-P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C306	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C307	5491271-P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C308	5496219-P436	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -220 PPM.
C309	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C310	5496219-P536	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -330 PPM.
C311	5491271-P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C312	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C313	5490008-P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C314	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C315	5491271-P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C316	5496219-P436	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -220 PPM.
C317	5496219-P236	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C318	5491271-P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C319A*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM.
		In Models earlier than REV A:
	5496219-P347	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -150 PPM.
C319B*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM.
		In Models earlier than REV A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C320A*	5496219-P357	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
		In Models earlier than REV A:
	5496219-P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C320B*	5496219-P356	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
		In Models earlier than REV A:
	5496219-P256	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -80 PPM.
C321A*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		In Models earlier than REV A:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C321B*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		In Models earlier than REV A:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C322	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C323 and C324	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C325	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C326A*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM.
		In Models earlier than REV A:
	5496219-P347	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -150 PPM.
C326B*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM.
		In Models earlier than REV A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C327A*	5496219-P357	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -150 PPM.
		In Models earlier than REV A:
	5496219-P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C327B	5496219-P356	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C328A*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		In Models earlier than REV A:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C328B*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		In Models earlier than REV A:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C329	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C330	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C331A	5496219-P744	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -750 PPM.
C331B*	5496219-P741	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
		In Models 4ER48A12 and B12 of REV E and earlier:
	5496219-P742	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -750 PPM.
C332A	5496219-P744	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -750 PPM.
C332B	5496219-P741	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
C333	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C334*	5496219-P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		In Models earlier than REV A:
	5491601-P127	Molded phenolic: 2.4 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C335*	5496219-P38	Ceramic disc: 7 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		In Models earlier than REV A:
	5491601-P128	Molded phenolic: 2.7 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C336	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C337	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C338A	5496219-P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C338B	5496219-P240	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C339 and C340	7491827-P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C341A	5496219-P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C341B	5496219-P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C342	5491601-P120	Molded phenolic: 1 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C343	5491601-P123	Molded phenolic: 1.5 pf ±5%, 500 VDCW; sim to Quality Components Type MC.
C346	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C347	5490008-P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C348	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C349	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C350	5490446-P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0; sim to Erie 557-36.
C351	5496219-P56	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef 0 PPM.
C352	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C353	5496219-P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C354	5490446-P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0; sim to Erie 557-36.
C355	5496219-P158	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -30 PPM.
C356	5496219-P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C357	5490446-P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0; sim to Erie 557-36.
C358	5496219-P158	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -30 PPM.
C359	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C360	19A115659-P1	Variable: approx 16-141 pf, 150 VDCW; sim to Hi Mencro Type 42.
C361	5496219-P54	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef 0 PPM.
C362	5496219-P13	Ceramic disc: 22 pf ±10%, 500 VDCW, temp coef 0 PPM.
C363	5490008-P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C364	5490008-P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C365	19B209243-P6	Polyester: .068 µf ±20%, 50 VDCW.
C366	5490008-P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C367	19B209243-P5	Polyester: .047 µf ±20%, 50 VDCW.
C368	19B209243-P6	Polyester: .068 µf ±20%, 50 VDCW.
C369	5496267-P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C370	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C381	5496219-P368	Ceramic disc: 160 pf ±5%, 500 VDCW, temp coef -150 PPM.
C382	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C383	5496219-P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C384	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C385	5496219-P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C386	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C387	5496219-P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C388	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C389	5496219-P369	Ceramic disc: 180 pf ±5%, 5DO VDCW, temp coef -150 PPM.
C390	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C391	5496219-P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C392	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C393	5496219-P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C394	5496219-P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C395	5490008-P34	Silver mica: 200 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C396	5494481-P128	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C397	19A116080-P1	Polyester: .01 µf ±20%, 50 VDCW.
C398	19A116080-P5	Polyester: .047 µf ±20%, 50 VDCW.
C399	5494481-P112	Ceramic disc: .001 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C401	19A116080-P1	Polyester: .01 µf ±20%, 50 VDCW.
C402	5490008-P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C403	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C404	19A116080-P5	Polyester: .047 µf ±20%, 50 VDCW.
C405	5494481-P112	Ceramic disc: .001 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C406	19A116080-P1	Polyester: .01 µf ±20%, 50 VDCW.
C407	7491393-P1	Ceramic disc: .001 pf +100% -0%, 500 VDCW; sim to Sprague 1219C4.
C408	7491827-P2	Ceramic disc: .01 pf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C409	5494481-P112	Ceramic disc: .001 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C410	19A116080-P1	Polyester: .01 µf ±20%, 50 VDCW.
C411	19A116080-P5	Polyester: .047 µf ±20%, 50 VDCW.
C412	19A116080-P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C413	5494481-P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C414	5494481-P112	Ceramic disc: .001 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C415	19A116080-P1	Polyester: .01 µf ±20%, 50 VDCW.
C416	5496219-P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C417	19A116080-P5	Polyester: .047 µf ±20%, 50 VDCW.
C418 and C419	5490008-P137	Silver mica: 270 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C420	5496219-P636	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C421 and C422	5494481-P112	Ceramic disc: .001 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C423*	5492638-P108	Ceramic disc: 0.22 pf +80% -20%, 12 VDCW; sim to Sprague 44C70. Added in Models 4ER48B10-13 by REV C. Added in Models 4ER48B14, 15 by REV D.
C424	5494481-P112	Ceramic disc: .001 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C425*	19A116080-P6	Polyester: .068 µf ±20%, 50 VDCW.
		In Models 4ER48A10-13 of REV B and earlier: In Models 4ER48A14,15 of REV C and earlier:
	19B209243-P5	Polyester: .047 µf ±20%, 50 VDCW.
C426	19A116080-P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C427 and C428	19A116080-P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C429	19A116080-P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C430	5494481-P112	Ceramic disc: .001 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C431	5496267-P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C432	19A116080-P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C433*	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Deleted in Models 4ER48A10, 11, 13 by REV H. Deleted in Models 4ER48A12, 14, 15 by REV J. Deleted in Models 4ER48B10, 11, 13 by REV H. Deleted in Models 4ER48B12, 14, 15 by REV J.
C434*	5494481-P14	Ceramic disc: .002 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		In Models 4ER48A10-13 of REV C and earlier: In Models 4ER48B10-13 of REV C and earlier: In Models 4ER48A14,15 of REV D and earlier: In Models 4ER48B14,15 of REV D and earlier:
	5490008-P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C435	19A116080-P203	Polyester: .022 µf ±5%, 50 VDCW.
C436	19C300075-P 4700J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C437	19C300075-P 3300J	Polyester: 3300 pf ±5%, 100 VDCW; sim to GE Type 61F.
C438	19A116080-P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C439	19A116080-P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C440	19A116080-P5	Polyester: .047 µf ±20%, 50 VDCW.
C441	19A116080-P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C442*	5496267-P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Deleted in Models 4ER48A10, 11, 13, by REV H. Deleted in Models 4ER48A12, 14, 15, by REV J. Deleted in Models 4ER48B10, 11, 13, by REV H. Deleted in Models 4ER48B12, 14, 15, by REV J.
		In Models 4ER48A10-13 of REV D and earlier: In Models 4ER48B10-13 of REV D and earlier: In Models 4ER48A14,15 of REV E and earlier: In Models 4ER48B14,15 of REV E and earlier:
	5496267-P5	Tantalum: 4.7 µf ±20%, 10 VDCW; sim to Sprague Type 150D.
		In Models 4ER48A10-13 of REV B and earlier: In Models 4ER48B10-13 of REV B and earlier: In Models 4ER48A14,15 of REV C and earlier: In Models 4ER48B14,15 of REV C and earlier:
	5496267-P13	Tantalum: 2.2 µf ±20%, 10 VDCW; sim to Sprague Type 150D.
C443	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C444	5496219-P48	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C445 thru C449	5496219-P47	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef 0 PPM.
C450	5496219-P48	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C451	19C300075-P 4700J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C452	5496219-P55	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef 0 PPM.
C453 and C454	5490008-P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C455	7774750-P1	Ceramic disc: .00047 µf +100% -0%, 500 VDCW.
C457	7491393-P1	Ceramic disc: .001 pf +100%, -0%, 500 VDCW; sim to Sprague 1219C4.
C458	19C300075-P 4700J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C459*	5496267-P5	Tantalum: 4.7 µf ±20%, 10 VDCW; sim to Sprague Type 150D. Deleted in Models 4ER48A10, 11, 13, by REV H. Deleted in Models 4ER48A12, 14, 15, by REV J. Deleted in Models 4ER48B10, 11, 13, by REV H. Deleted in Models 4ER48B12, 14, 15, by REV J.
		Added in Models 4ER48A10-13 by REV E. Added in Models 4ER48B10-13 by REV E. Added in Models 4ER48A14,15 by REV F. Added in Models 4ER48B14,15 by REV F.
C460*	5496267-P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Added to Models 4ER48A10, 11, 13 by REV H. Added to Models 4ER48A12, 14, 15 by REV J. Added to Models 4ER48B10, 11, 13 by REV H. Added to Models 4ER48B12, 14, 15 by REV J.
C461*	5496267-P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D. Added to Models 4ER48A10, 11, 13 by REV H. Added to Models 4ER48A12, 14, 15 by REV J. Added to Models 4ER48B10, 11, 13 by REV H. Added to Models 4ER48B12, 14, 15 by REV J.
C462*	5496267-P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Added to Models 4ER48A10, 11, 13 by REV H. Added to Models 4ER48A12, 14, 15 by REV J. Added to Models 4ER48B10, 11, 13 by REV H. Added to Models 4ER48B12, 14, 15 by REV J.
		- - - - - - DIODES AND RECTIFIERS - - - - - -
CR301	7777146-P3	Germanium; sim to Type 1N90.
CR302 and CR303	4038056-P1	Germanium.
CR304 and CR305	19A115250-P1	Silicon.
CR306	5494922-P1	Silicon; sim to Type 1N456.
CR307 and CR308	19A115250-P1	Silicon.
CR309*	19A115250-P1	Silicon. Added to Models 4ER48A10, 11, 13 by REV H. Added to Models 4ER48A12, 14, 15 by REV J. Added to Models 4ER48B10, 11, 13 by REV H. Added to Models 4ER48B12, 14, 15 by REV J.
		- - - - - - - INDICATING DEVICES - - - - - - -
DS301	19B209067-P1	Lamp, glow: 0.3 ma; sim to GE NE-2T.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL301	19C304219-G1	Bandpass. 10.7 MHz.
FL302	19C304219-G3	Bandpass. 10.7 MHz.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J301	7104941-P9	Jack, phono type: phen; sim to Cinch 14H20958.
J302 and J303	19B209303-P1	Connector, phen: 9 pins.
J304	19B205689-G2	Connector: 16 contacts.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L301	19B205530-G1	Coil.
L302 thru L305	19B205530-G2	Coil.
L306	19B205530-G3	Coil.
L307 and L308	19A121085-G1	Coil. Includes tuning slug 19B200497-P2.
L309	19B205236-G1	Coil. Includes tuning slug 19B200497-P2.

(Cont'd on back of 19B620752)

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



(19D402810, Rev. 7)
(19D402627, Sh. 1, Rev. 5)
(19D402627, Sh. 2, Rev. 4)

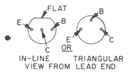
RESISTANCE READINGS

ALL READINGS ARE MEASURED FROM JACK PINS TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH ALL EXTERNAL CONNECTIONS REMOVED. + OR − SIGNS SHOW METER LEAD GROUNDED.

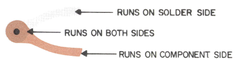
PIN NUMBER	J302			J303			
	+	−	METER SCALE	+	METER SCALE	−	METER SCALE
1	INF	INF	X100Ω	300Ω	X10Ω	325Ω	X10Ω
2	INF	INF	X100Ω	1.7KΩ	X1Ω	1.7K	X1Ω
3	INF	INF	X100Ω	3KΩ	X1Ω	INF	X100Ω
4	INF	INF	X100Ω	3.3KΩ	X1Ω	5K	X1Ω
5	0	0	X1Ω	0	X1Ω	0	X1Ω
6	INF	INF	X100Ω	INF	X100Ω	INF	X100Ω
7	INF	INF	X100Ω	12K	X1Ω	6.5K	X1Ω
8	INF	INF	X100Ω	INF	X100Ω	INF	X100Ω
9	INF	INF	X100Ω	0	X1Ω	0	X1Ω

TERMINAL NUMBERING FOR J304

LEAD IDENTIFICATION FOR Q307, Q311-Q317, Q319 & Q320



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



OUTLINE DIAGRAM

132—174 MHZ RECEIVER
MODELS 4ER48A10-15 & B10-15

RC-1415G

MODEL NUMBER	REV	FREQUENCY RANGE (MHZ)	NO OF FREQ'S
4ER48A10	H	132-150.8	1
4ER48A11	H	132-150 8	2
4ER48A12	J	150.8-174	1
4ER48A13	H	150 8-174	2
4ER48A14	J	132-150.8	4
4ER48A15	J	150.8-174	4
4ER48B10	H	132-150.8	1
4ER48B11	H	132-150.8	2
4ER48B12	J	150.8-174	1
4ER48B13	H	150.8-174	2
4ER48B14	J	132-150.8	4
4ER48B15	J	150 8-174	4

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO GROUND WITH TEST SET MODEL 4EX3A10 OR A 20,000 OHM-PER-VOLT METER, AND WITH SQUELCH CONTROL R400 FULLY COUNTERCLOCKWISE. READINGS TAKEN WITH F1 OPERATING.

S= NO SIGNAL (SQUELCHED)

US= WITH A 1 MILLIVOLT UNMODULATED ON-FREQUENCY SIGNAL (UNSQUELCHED).

NOTES:

1. C334 IS USED IN 4ER48A10, 4ER48A12, 4ER48A13, 4ER48B10, 4ER48B12 & 4ER48B13. C335 IS USED IN 4ER48A11 & 4ER48B11.
2. C342 IS USED IN 4ER48A10, 4ER48A12, 4ER48B10, & 4ER48B12. C343 IS USED IN 4ER48A11, 4ER48A13, 4ER48B11, & 4ER48B13.
3. ALL JUMPERS TO BE 19A115075P1 EXCEPT AS NOTED.
4. COMPONENT SUFFIX (A=4ER48A10, 4ER48A11, 4ER48B10 & 4ER48B11) (B=4ER48A12, 4ER48A13, 4ER48B12 & 4ER48B13)
5. COMPONENTS MARKED WITH A * USED IN 4ER48A14, 4ER48A15, 4ER48B14 & 4ER48B15.
6. COMPONENTS MARKED WITH A ▲ USED IN 4ER48B10, 4ER48B11, 4ER48B12, 4ER48B13, 4ER48B14 & 4ER48B15 (WIDE BAND)
7. COMPONENTS MARKED WITH A ● USED IN 4ER48A10, 4ER48A11, 4ER48A12, 4ER48A13, 4ER48A14 & 4ER48A15 (NARROW BAND)
8. ALL RESISTORS ARE 1/2 WATTS EXCEPT AS NOTED.

SCHEMATIC DIAGRAM

132—174 MHZ RECEIVER
MODELS 4ER48A10-15 & 4ER48B10-15

19R620752, Rev. 21

(Cont'd from front of RC-1415)

SYMBOL	GE PART NO.	DESCRIPTION
L310	19B205239-G1	Coil. Includes tuning slug 19B200497-P2.
L311	19B205240-G1	Coil. Includes tuning slug 19B200497-P2.
L312 and L313	19B205224-G2	Coil.
L314	19B205224-G3	Coil.
L315	7488079-P18	Choke, RF: 15 µh ±10%, 1.2 ohms DC res max; sim to Jeffers 4421-9K.
L316	19B205224-G4	Coil.
L321* and L322*	19A115711-P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L323*	19A115711-P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12671.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L324*	19A115711-P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L325*	19A115711-P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12671.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L326*	19A115711-P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L327*	19A115711-P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12671.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L328*	19A115711-P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L329*	19A115711-P6	Transformer, freq: 455 KHz; sim to TOKO PEFCN-14733-CX12.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G4	Coil. Includes tuning slug 4038368-P1.
L330*	19A115711-P7	Transformer, freq: 455 KHz; sim to TOKO PEFCN-14734-BNL2.
		In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier:
	19C303062-G5	Coil. Includes tuning slug 4038368-P1.
L331	19B209405-P1	Reactor, audio freq: 142 mh ±5% at 0.1 v thru 0.27 v; sim to Aladdin 405-101.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q301 and Q302	19A115342-P1	Silicon, NPN.
Q303* and Q304*	19A115925-P1	Silicon, NPN.
		In Models 4ER48A10-13, 4ER48B10-13 of REV A and earlier: In Models 4ER48A14,15, 4ER48B14,15 of REV B and earlier:
	19A115342-P1	Silicon, NPN.
Q305 and Q306	19A115342-P1	Silicon, NPN.
Q307	19A115889-P1	Silicon, NPN.
Q308	19A115245-P1	Silicon, NPN.
Q311 thru Q315	19A115889-P1	Silicon, NPN.
Q316 and Q317	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q318	19A115300-P2	Silicon, NPN; sim to Type 2N3053.
Q319	19A115889-P1	Silicon, NPN.
Q320 and Q321	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - RESISTORS - - - - - - - - -
R301	3R77-P562K	Composition: 5600 ohms ±10%, 1/2 w.
R302	3R77-P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R303	3R77-P561K	Composition: 560 ohms ±10%, 1/2 w.
R304	3R77-P331K	Composition: 330 ohms ±10%, 1/2 w.
R305	3R77-P562K	Composition: 5600 ohms ±10%, 1/2 w.
R306	3R77-P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R307	3R77-P331K	Composition: 330 ohms ±10%, 1/2 w.
R308	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
R309 and R310	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R311*	3R77-P243J	Composition: 24,000 ±5%, 1/2 w.
		In Models 4ER48A10,11,13 of REV G and earlier: In Models 4ER48A12,14,15 of REV H and earlier: In Models 4ER48B10,11,13 of REV G and earlier: In Models 4ER48B12,14,15 of REV H and earlier:
	3R152-P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R312	3R77-P150K	Composition: 15 ohms ±10%, 1/2 w.
R313	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R314	3R77-P472K	Composition: 4700 ohms ±10%, 1/2 w.
R315 and R316	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R317*	3R77-P243J	Composition: 24,000 ±5%, 1/2 w.
		In Models 4ER48A10,11,13 of REV G and earlier: In Models 4ER48A12,14,15 of REV H and earlier: In Models 4ER48B10,11,13 of REV G and earlier: In Models 4ER48B12,14,15 of REV H and earlier:
	3R152-P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R318	3R77-P150K	Composition: 15 ohms ±10%, 1/2 w.
R319	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R320	3R77-P221K	Composition: 220 ohms ±10%, 1/2 w.
R321	3R77-P392K	Composition: 3900 ohms ±10%, 1/2 w.
R322	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R323	3R77-P431K	Composition: 430 ohms ±10%, 1/2 w.
R324 and R325	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
R326	3R77-P562K	Composition: 5600 ohms ±10%, 1/2 w.
R327	3R77-P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R328	3R77-P391K	Composition: 390 ohms ±10%, 1/2 w.
R329	3R152-P330K	Composition: 33 ohms ±10%, 1/4 w.
R330	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R331	3R77-P822K	Commposition: 8200 ohms ±10%, 1/2 w.
R332	3R77-P392K	Composition: 3900 ohms ±10%, 1/2 w.
R333	3R77-P682K	Composition: 6800 ohms ±10%, 1/2 w.
R334	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R335	3R77-P561K	Composition: 560 ohms ±10%, 1/2 w.
R336	3R77-P331K	Composition: 330 ohms ±10%, 1/2 w.
R337	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R338	3R77-P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R350	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R351	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R352	3R77-P222K	Composition: 2200 ohms ±10%, 1/2 w.
R353	3R77-P562K	Composition: 5600 ohms ±10%, 1/2 w.
R354	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R355	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R356	3R77-P222K	Composition: 2200 ohms ±10%, 1/2 w.
R357	3R77-P181K	Composition: 180 ohms ±10%, 1/2 w.
R358	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R359	3R77-P562K	Composition: 5600 ohms ±10%, 1/2 w.
R360	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R361	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R362	3R77-P181K	Composition: 180 ohms ±10%, 1/2 w.
R363	3R77-P222K	Composition: 2200 ohms ±10%, 1/2 w.
R364	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R365	3R77-P562K	Composition: 5600 ohms ±10%, 1/2 w.
R366	3R77-P123K	Composition: 12,000 ohms ±10%, 1/2 w.
R367	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R368	3R152-P181K	Composition: 180 ohms ±10%, 1/4 w.
R369	3R77-P512J	Composition: 5100 ohms ±5%, 1/2 w.
R370	3R77-P181K	Composition: 180 ohms ±10%, 1/2 w.
R371	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R372	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R373	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R374	3R77-P181K	Composition: 180 ohms ±10%, 1/2 w.
R375 and R376	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R377	3R77-P682K	Composition: 6800 ohms ±10%, 1/2 w.
R378	3R152-P104K	Composition: 0.1 megohm ±10%, 1/4 w.
R379	3R77-P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R380	3R77-P332J	Composition: 3300 ohms ±5%, 1/2 w.
R381	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R382	3R152-P221J	Composition: 220 ohms ±5%, 1/4 w.
R383	3R77-P332K	Composition: 3300 ohms ±10%, 1/2 w.
R384	3R152-P332K	Composition: 3300 ohms ±10%, 1/4 w.
R385	3R152-P152K	Composition: 1500 ohms ±10%, 1/4 w.
R386	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R387	3R77-P753J	Composition: 75,000 ohms ±5%, 1/2 w.
R388	3R77-P300J	Composition: 30 ohms ±5%, 1/2 w.
R389	3R77-P681J	Composition: 680 ohms ±5%, 1/2 w.
R390	3R77-P332K	Composition: 3300 ohms ±10%, 1/2 w.
R391	3R77-P431K	Composition: 430 ohms ±10%, 1/2 w.
R392(R400)	19B209320-P1	Resistor assembly. Variable, carbon film, includes: (R392) 20,000 ohms ±20%, 0.25 w; (R400) 5000 ohms ±20%, 0.25 w; sim to Centralab Series 5 (Type 71-2).
R393	3R77-P392K	Composition: 3900 ohms ±10%, 1/2 w.
R394	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R395	3R77-P331K	Composition: 330 ohms ±10%, 1/2 w.
R396 and R397	19A116278-P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R399*	3R77-P821J	Composition: 820 ohms ±5%, 1/2 w.
		In Models 4ER48A10-13 of REV D and earlier: In Models 4ER48B10-13 of REV D and earlier: In Models 4ER48A14,15 of REV E and earlier: In Models 4ER48B14,15 of REV E and earlier:
	3R152-P511J	Composition: 510 ohms ±5%, 1/4 w.
R400		(See R392).
R401	19A116278-P357	Metal film: 38,300 ohms ±2%, 1/2 w.
R402	19A116278-P313	Metal film: 13,300 ohms ±2%, 1/2 w.
R403	3R152-P332J	Composition: 3300 ohms ±5%, 1/4 w.
R404	19A116278-P233	Metal film: 2150 ohms ±2%, 1/2 w.
R405	3R152-P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R406	3R152-P332J	Composition: 3300 ohms ±5%, 1/4 w.
R407	3R77-P222K	Composition: 2200 ohms ±10%, 1/2 w.
R408	3R77-P822J	Composition: 8200 ohms ±5%, 1/2 w.
R409	3R77-P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R410*	3R77-P182J	Composition: 1800 ohms ±5%, 1/2 w.
		Deleted in Models 4ER48A10, 11, 13, by REV H. Deleted in Models 4ER48A12, 14, 15, by REV J. Deleted in Models 4ER48B10, 11, 13, by REV H. Deleted in Models 4ER48B12, 14, 15, by REV J.
		In Models 4ER48A10-13 of REV D and earlier: In Models 4ER48B10-13 of REV D and earlier: In Models 4ER48A14,15 of REV E and earlier: In Models 4ER48B14,15 of REV E and earlier:
	3R152-P362J	Composition: 3600 ohms ±5%, 1/4 w.
R411*	3R77-P473J	Composition: 47,000 ohms ±5%, 1/2 w. Deleted in Models 4ER48A10, 11, 13, by REV H. Deleted in Models 4ER48A12, 14, 15, by REV J. Deleted in Models 4ER48B10, 11, 13, by REV H. Deleted in Models 4ER48B12, 14, 15, by REV J.
R413 and R414	3R77-P273K	Composition: 27,000 ohms ±10%, 1/2 w.
R415	3R77-P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R416*	3R77-P132J	Composition: 1300 ohms ±5%, 1/2 w.
		In Models 4ER48A10-13 of REV D and earlier: In Models 4ER48B10-13 of REV D and earlier: In Models 4ER48A14,15 of REV E and earlier: In Models 4ER48B14,15 of REV E and earlier:
	3R152-P911J	Composition: 910 ohms ±5%, 1/4 w.
R417*	3R152-P432J	Composition: 4300 ohms ±5%, 1/4 w. Added in Models 4ER48A14,15 by REV B. Added in Models 4ER48B14,15 by REV B.
R418*	3R152-P152J	Composition: 1500 ohms ±5%, 1/4 w. Deleted in Models 4ER48A10, 11, 13, by REV H. Deleted in Models 4ER48A12, 14, 15, by REV J. Deleted in Models 4ER48B10, 11, 13, by REV H. Deleted in Models 4ER48B12, 14, 15, by REV J.
		Added in Models 4ER48A10-13 by REV E. Added in Models 4ER48B10-13 by REV E. Added in Models 4ER48A14,15 by REV F. Added in Models 4ER48B14,15 by REV F.
R419*	3R77-P433J	Composition: 43,000 ohms ±5%, 1/2 w. Added to Models 4ER48A10, 11, 13 by REV H. Added to Models 4ER48A12, 14, 15 by REV J. Added to Models 4ER48B10, 11, 13 by REV H. Added to Models 4ER48B12, 14, 15 by REV J.
R420*	3R77-P564J	Composition: 0.56 megohm ±5%, 1/2 w. Added to Models 4ER48A10, 11, 13 by REV H. Added to Models 4ER48A12, 14, 15 by REV J. Added to Models 4ER48B10, 11, 13 by REV H. Added to Models 4ER48B12, 14, 15 by REV J.
R421*	3R77-P153J	Composition: 15,000 ohms ±5%, 1/2 w. Added to Models 4ER48A10, 11, 13 by REV H. Added to Models 4ER48A12, 14, 15 by REV J. Added to Models 4ER48B10, 11, 13 by REV H. Added to Models 4ER48B12, 14, 15 by REV J.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT301*	5490828-P38	Rod: 1400 ohms ±5%, 1 w max; sim to Globar Type 492H.
		In Models 4ER48A10-13 of REV D and earlier: In Models 4ER48B10-13 of REV D and earlier: In Models 4ER48A14,15 of REV E and earlier: In Models 4ER48B14,15 of REV E and earlier:
	5490828-P34	Rod: 1810 ohms ±5%, 1 w max; sim to Globar Type 723H-3.
RT302	5490828-P35	Rod: 3800 ohms ±5%, 1 w max; sim to Globar Type 723B-H.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY401 and XY402	5490277-P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		- - - - - - - - - CRYSTALS - - - - - - - - -
Y301	19A110215-P1	Quartz: freq 10245 KHz, temp range -30°C to +90°C.
Y401 and Y402	19B206221-P1	Quartz: freq range 38.3 to 62 MHz, temp range -30°C to +80°C. (When reordering give GE Part Number and specify exact frequency needed). (Crystal frequency = (OF -10.7) ÷ 3).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B205369-G1	Top cover.
	19A121088-P1	Can.
	4036555-P1	Insulator, washer: nylon. (Used with Q318).
	4035306-P62	Washer, fiber. (Used with Y301, FL301).

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 frequency stability of the oscillator.
Changed: C319A, C319B, C320A, C320B, C321A, C321B, C326A, C326B, C327A, C328A, C328B, C334, and C335.

REV. B - Models 4ER48A14, 15 & 4ER48B14, 15
To improve oscillator operation. Deleted R315 and added R417.

REV. B - Models 4ER48A10 - 13 & 4ER48B10 - 13
REV. C - Models 4ER48A14, 15 & 4ER48B14, 15
To incorporate improved transistors. Changed Q303 and Q304.

REV. C - Models 4ER48A10 - 13 & 4ER48B10 - 13
REV. D - Models 4ER48A14, 15 & 4ER48B14, 15
To increase maximum squelch sensitivity. Changed C442. In Models 4ER48A10 - 15, C425 was also changed.

REV. D - Models 4ER48A10-13 & 4ER48B10-13
REV. E - Models 4ER48A14,15 & 4ER48B14,15
To eliminate high frequency oscillations in the receiver PA caused by use of a higher gain PA transistor. Changed C434.

REV. E - Models 4ER48A10-13 & 4ER48B10-13
REV. F - Models 4ER48A14,15 & 4ER48B14,15
To eliminate undesirable squelch thump that occurs when carrier is received. Changed C442 and R410. Added C459 and R418.

To incorporate new squelch thermister. Changed RT301, R399 and R416.

REV. F - Models 4ER48A12 & 4ER48B12
To assure oscillator band-end tuning at 174 MHz. Changed C331B.

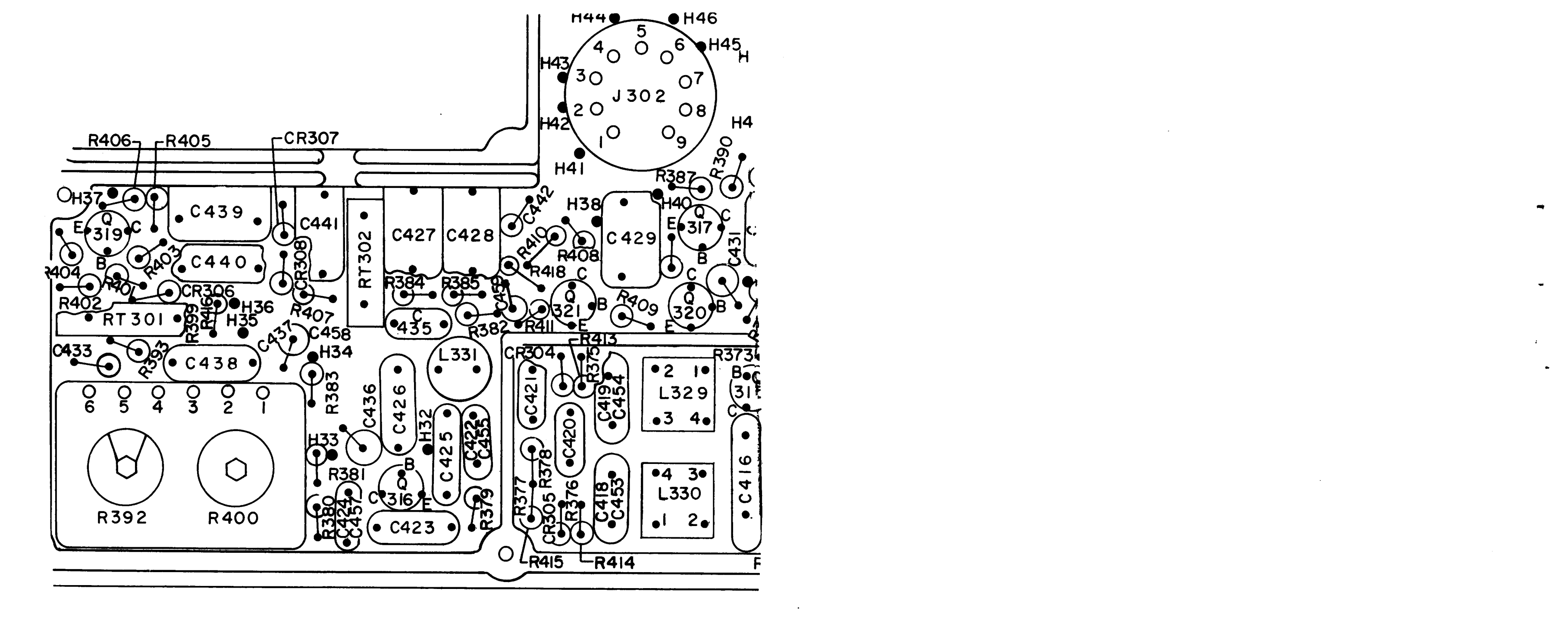
REV. F - Models 4ER48A10,11,13 & 4ER48B10,11,13

REV. G - Models 4ER48A12,14,15 & 4ER48B12,14,15
To permit use of different IF coils. Changed printed wiring board and L321 thru L330.

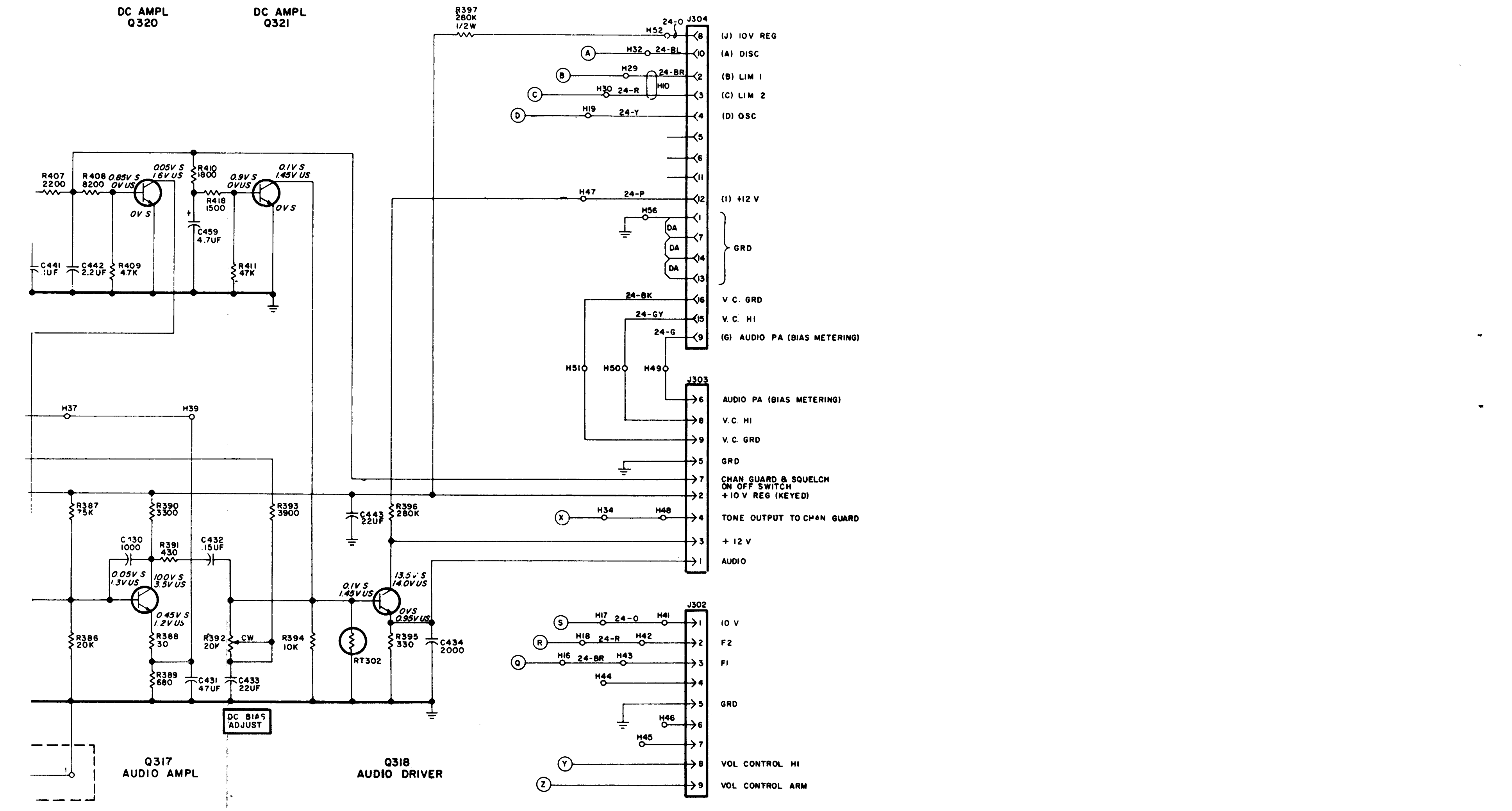
REV. G - Models 4ER48A10, 11, 13 & 4ER48B10, 11, 13
REV. H - Models 4ER48A12, 14, 15 & 4ER48B12, 14, 15
To provide adequate 1st oscillator injection voltage. Changed R311.

REV. H - Models 4ER48A10, 11, 13 & 4ER48B10, 11, 13
REV. J - Models 4ER48A12, 14, 15 & 4ER48B12, 14, 15
To eliminate objectionable squelch thump. Deleted R387, R410, R411, C433, C442, R418, C459 and Q321. Added CR309, R419, R420, R421, C460, C461 and C462.

Outline Diagram Was:



Schematic Diagram Was:



ADJUSTMENT PROCEDURE

If it is necessary to replace power regulator board A501, or either Sensitivity control R29 or Top Limiter control R9 on the power regulator board, follow the procedure listed below. If the power regulator board is replaced, both R29 and R9 (in that order) must be adjusted as directed. If only R29 or R9 is replaced, only the new control must be adjusted as directed.

EQUIPMENT REQUIRED

1. VOM with at least 3% accuracy (Triplett 630 or equivalent).
2. Milliammeter with at least 3% accuracy, and a 0 to 5 milliamp range.
3. Variable resistor, 0 to 5000 ohms.
4. Fixed resistor, 300 ohms ±5%.
5. Variable power source (from 13.6 to 16.3 volts under a 12-ampere load). In mobile applications, connect the power source to the vehicle battery cables. In station applications, connect the power source to the External Battery connector (TB502).
6. Cement for securing R9 or R29 after adjustment (Loctite R404 or equivalent).

NOTE

The transmitter must be properly aligned and drawing at least 7 amperes of load current before making these adjustments.

ADJUSTMENT OF R29

1. Turn R29 fully counterclockwise (in direction of arrow).
2. Disconnect the Orange lead from A501-J9 and the White lead from A501-J11. Connect the 300-ohm fixed resistor from J9 to ground as shown in Figure 1.
3. Adjust the power source for 13.6 volts. Then key the transmitter and re-adjust the power source for 13.6 volts if necessary.
4. Connect the VOM across P201-8 and P201-13 (ground). Then key the transmitter and adjust R29 according to the applicable procedure as follows:
   - For Revision B and earlier of Model 4EP57A10: carefully adjust R29 for a VOM reading of 9.9 volts.
   - For Revision C or later of Model 4EP57A10 and all Revisions of Model 4EP59A10: carefully adjust R29 for a VOM reading of 8.5 volts.

CAUTION

This is a critical adjustment. Failure to adjust R29 correctly may result in damage to the transmitter PA transistors.

5. Apply sufficient cement to secure R29. Then disconnect the 300-ohm resistor from J9, and re-connect the Orange and White leads.

ADJUSTMENT OF R9

1. Turn R9 fully clockwise (in direction of arrow).
2. Disconnect the Orange lead from A501-J9 and the White lead from A501-J11. Connect the 5000-ohm variable resistor in series with the milliammeter, and connect one end of the circuit to J11 and the other end to ground as shown in Figure 1.

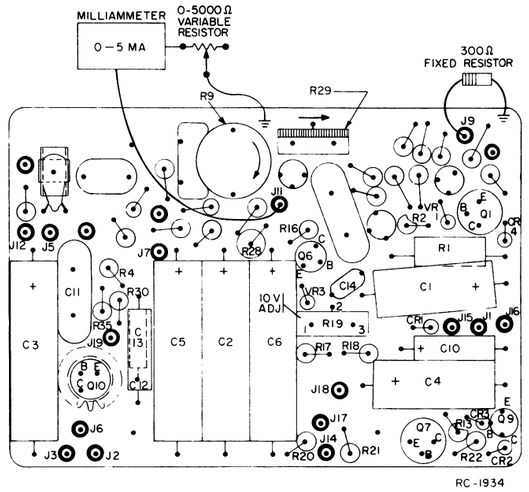


Figure 1 — Power Regulator Board Set-Up

3. Adjust the power source for 16.3 volts. Then key the transmitter and re-adjust the power source for 16.3 volts if necessary.
4. Key the transmitter and adjust the variable resistor for a milliammeter reading of 2.0 milliamps.
5. Key the transmitter and carefully adjust R9 for a VOM reading of 13.0 volts as measured from P201-8 to P201-13 (ground) as shown in Figure 2.

CAUTION

This is a critical adjustment. Failure to adjust R9 correctly may result in damage to the transmitter PA transistors.

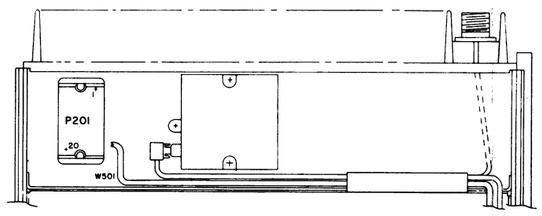


Figure 2 — Location of P201

QUICK CHECKS

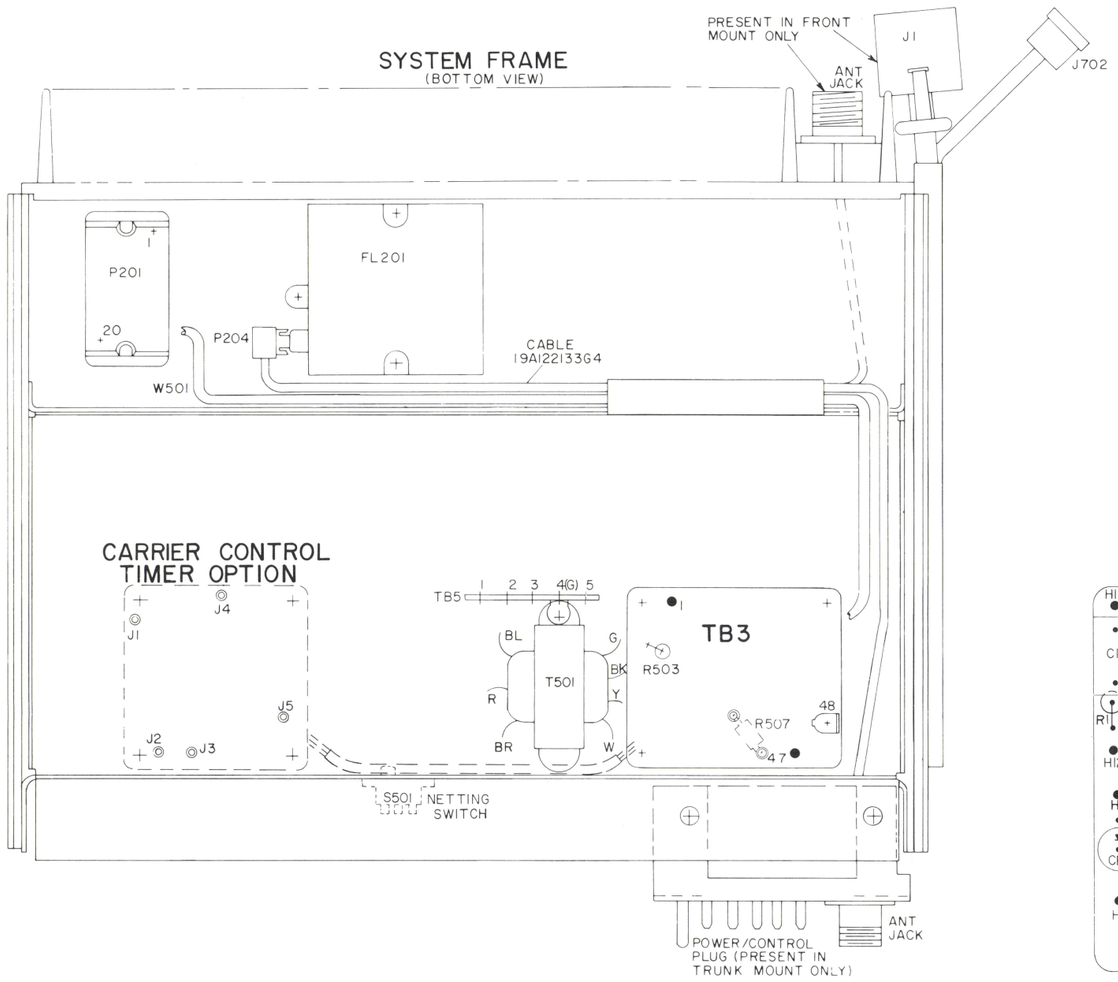
This procedure should be used in conjunction with voltage readings on the power regulator schematic diagram (see Table of Contents).

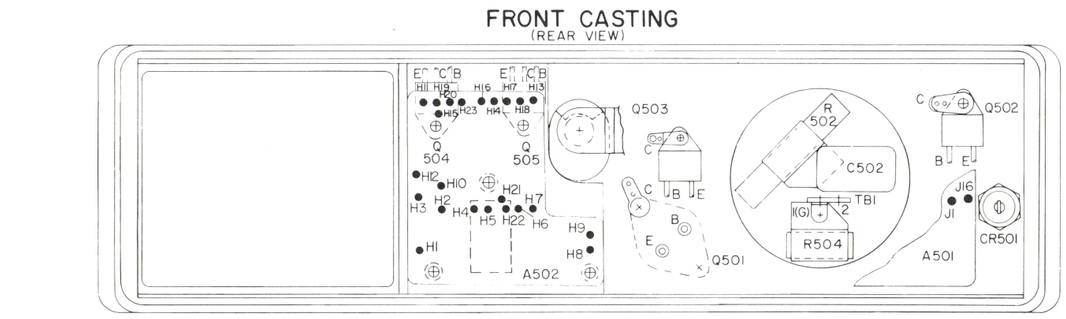
SYMPTOM	PROCEDURE
No PA supply voltage (Vcc) when transmitter is keyed. (Measure with 4EX3A10 in Position G, polarity switch in (-) position and read on 15-volt scale).	1. Check the 15-amp input fuse in the red battery cable. 2. Check for keyed 9.5 volts at J15 on power regulator board A501. If voltage is present, check for approximately 3.5 volts at A501-J8. If voltage is present on J8, check Q501 and Q502. **NOTE** This reading may vary from 1.8 to 3.5 volts when protective circuits are activated by low power output or high PA heatsink temperature. The base-to-emitter voltage of Q2, Q3 and Q8 should be less than 0.6 volts when the circuits are not activated. 3. Check to see if a continuous 9.5 volts (instead of keyed voltage) is present at J15. A continuous voltage will activate short circuit protector Q8.
No regulated +10 volts.	1. Check input fuse. Check setting of R19. 2. Check for approximately +12 volts at emitter of Q503. If voltage is present, check for shorted Q5.
Vcc applied continuously (transmitter keyed or unkeyed).	1. Check for 9 volts at the collector of Q9. a. If voltage is present, check for shorted Q7. b. If the voltage is not present, check the Push-To-Talk circuit for a short to ground.
Vcc too low.	1. Check for 3.5 volts at A501-J8. If reading is less than 3.5 volts, check to see that protective circuits are not activated (base-to-emitter voltage of Q2, Q3 and Q8 should be less than 0.6 volt if not activated). 2. If voltage at A401-J8 is greater than 3.5 volts, check Q501, Q502 and associated circuitry.
Vcc too high (greater than 13.0 volts).	1. Check for shorted Q501.
No keyed 9.5 volts. (Vcc present)	1. Check wiring from A501-J15.
No keyed 9.5 volts or Vcc	1. Check for a voltage drop of from 12 volts to approximately zero volts on the collector of Q9 when the transmitter is keyed. a. If no voltage drop, check the wiring from A501-J16 through the PTT circuit. b. If the voltage drop is present, check the base circuit of Q7.

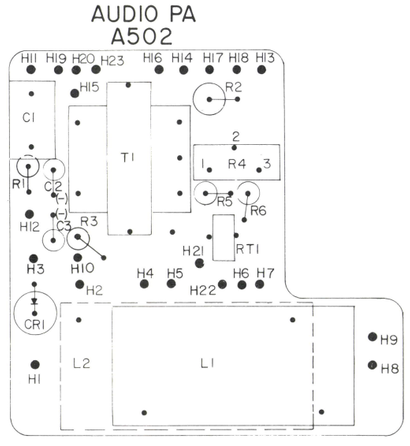
ADJUSTMENT & TROUBLESHOOTING PROCEDURE

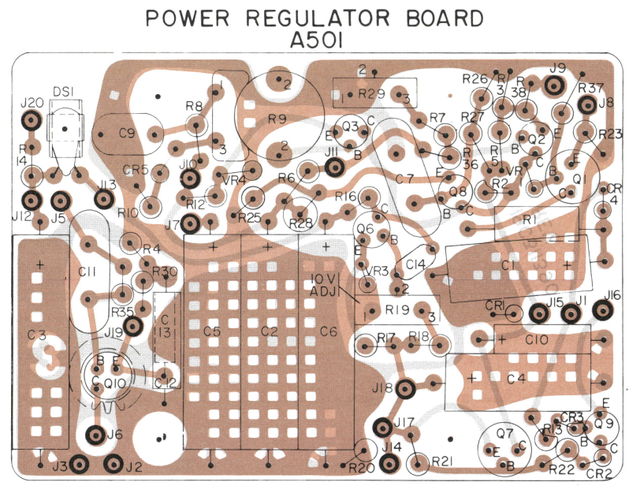
POWER REGULATOR MODEL 4EP57A10

RC-1682B

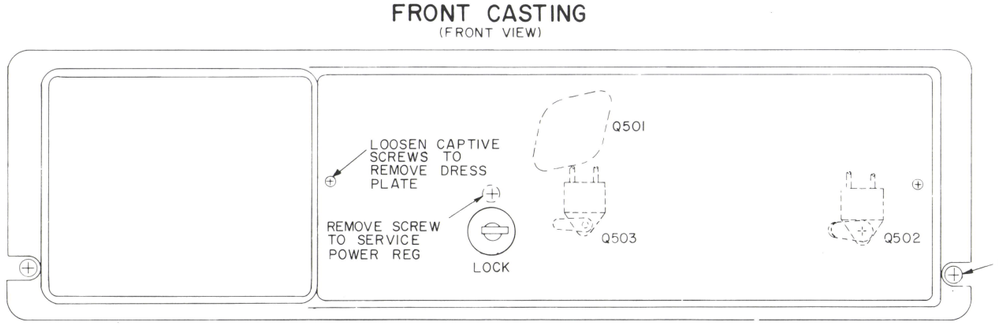


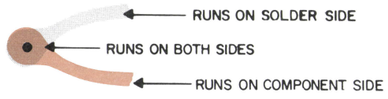






(19D413171, Rev. 7)
(19B205923, Sh. 1, Rev. 3)
(19B205923, Sh. 2, Rev. 3)





OUTLINE DIAGRAM

POWER REGULATOR MODEL 4EP57A10

RC-1677G
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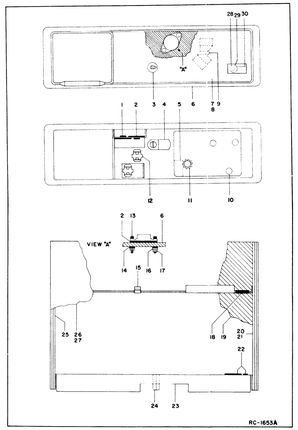
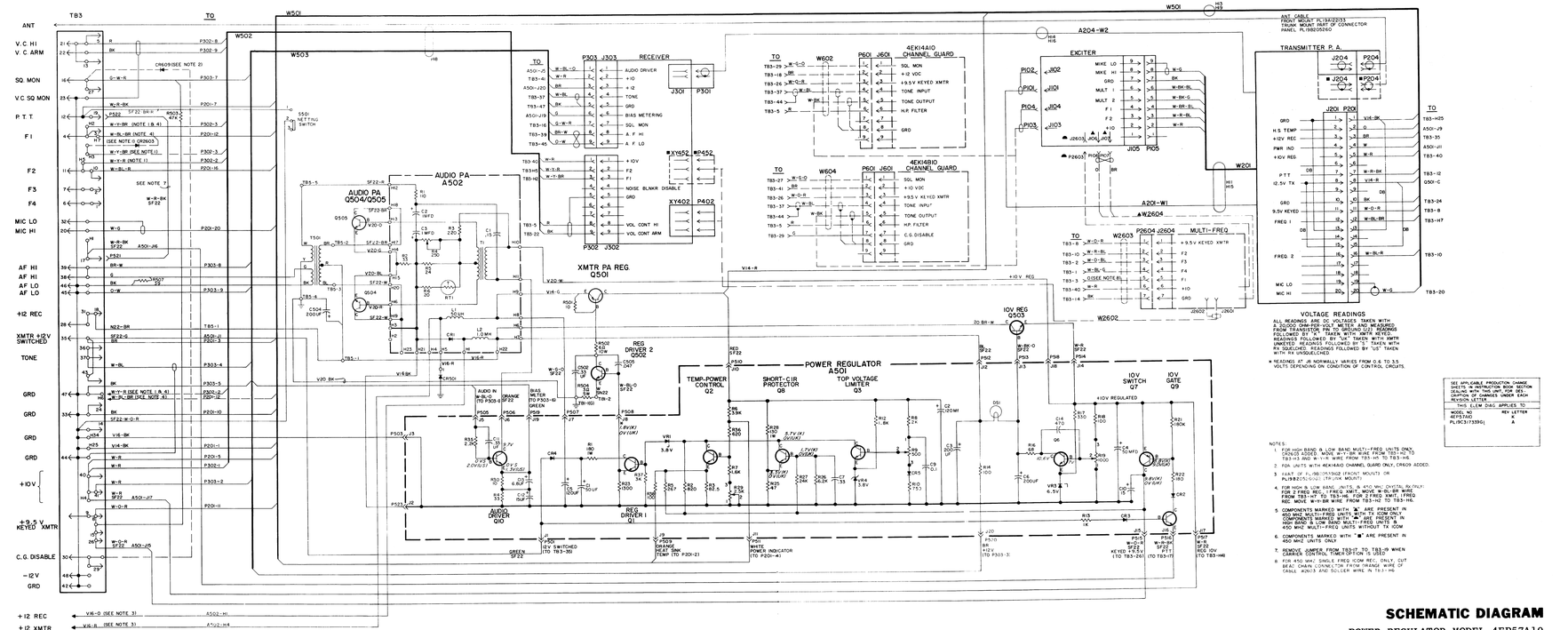
SYMBOL	GE PART NO.	DESCRIPTION
		HARNESS ASSEMBLY 19D413056G2 (Includes P201, P202, P303, P501, P503, P505-P508, P510, P512-P523, R503, W501-W503).
		MECHANICAL PARTS (SEE MC-1653A)
1	7147306P2	Washer, shield.
2	602897 4P1	Insulator plate.
3	5491682P11	Lock: Yale and Towne.
4	5491682P12	Cam. (Used with lock).
5	19A132059P9	Pad.
6	19C303919P2	Casting.
7	19B205282G1	Dress plate (Front Mount).
8	19B205282G2	Dress plate (Trunk Mount).
9	6038930P1	Clip. (Used with R502 and R504).
10	6036555P1	Insulator disc. (Used with Q1, Q7 and Q10).
11	6035436P1	Heat sink. (Used with Q10).
12	7118719P4	Retainer. (Used with L501 and L502). (Not Used).
13	#1791P36H0C13	Cap screw: 6-32 x 1/2. (Used with Q501).
14	19A121882P1	Washer, shield: No. 6. (Used with Q501).
15	6031529P1	Clip, spring tension. (Used with W501).
16	#403913C13	Lockwasher: No. 6. (Used with Q501).
17	#21091 3C13	Nut: 6-32. (Used with Q501).
18	19A132059P7	Pad. (Used with W501-W503).
19	19D403826P1	Top cover.
20	19B205391G2	Side rail (Front Mount).
21	19C303899P3	Side rail (Trunk Mount).
22	19D602660G2	Frame.
23	5491541P345	Spacer, hex. (Mounts casting to frame).
24	19C303899P1	Side rail.
25	19C303911G1	Bottom cover. (Front mount).
26	19C303911G2	Bottom cover. (Trunk mount).
28	19A116023P2	Insulator, mica. (Used with Q502 and Q503).
29	19A115522P1	Insulator, bushing; sim to Nylomatic Corp N5228, (Used with Q502 and Q503).
30	403683P9	Terminal, solderless (Used with Q502 and Q503).



RC-1653A

DF-0065)



SCHEMATIC DIAGRAM

POWER REGULATOR MODEL 4EP57A10

19R640717, Rev. 20

PARTS LIST

LBI-38947

POWER REGULATOR
MODEL 4EP57A10

SYMBOL	GE PART NO.	DESCRIPTION
		POWER REGULATOR ASSEMBLY 19D413036G1
A501		**POWER REGULATOR BOARD** 19C311392G1
		- - - - - - - - - - **CAPACITORS** - - - - - - - - - -
C1*	19A115840P4	Electrolytic: 50 mf +150% -10%, 25 VDCV; sim to Mallory Type TT.
		Earlier than REV G:
	5496267P20	Tantalum: 47 mf ±20%, 35 VDCV; sim to Sprague Type 150D.
C2	19A115840P9	Electrolytic: 120 mf +150% -10%, 26 VDCV; sim to Mallory Type TT.
C3	19A115840P10	Electrolytic: 200 mf +150% -10%, 18 VDCV; sim to Mallory Type TT.
C4*	19A115840P4	Electrolytic: 50 mf +150% -10%, 25 VDCV; sim to Mallory Type TT.
		Earlier than REV G:
	19A115840P5	Electrolytic: 100 mf +150% -10%, 25 VDCV; sim to Mallory Type TT.
C5	19A115840P9	Electrolytic: 120 mf +150% -10%, 26 VDCV; sim to Mallory Type TT.
C6	19A115840P10	Electrolytic: 200 mf +150% -10%, 18 VDCV; sim to Mallory Type TT.
C7	19B209243P14	Polyester: 0.33 mf ±20%, 250 VDCV.
C9	19A116080P7	Polyester: 0.1 mf ±20%, 50 VDCV.
C10	5496267P14	Tantalum: 15 mf ±20%, 20 VDCV; sim to Sprague Type 150D.
C11*	19B209243P14	Polyester: 0.33 mf ±20%, 250 VDCV.
		Earlier than REV G:
	19B209243P5	Polyester: 0.047 mf ±20%, 50 VDCV.
C12*	5496267P14	Tantalum: 15 mf ±20% 20 VDCV; sim to Sprague Type 150D.
		Earlier than REV G:
	19B209243P7	Polyester: 0.1 mf ±20%, 50 VDCV.
C13*	5496267P1	Tantalum: 6.8 mf ±20%, 6 VDCV; sim to Sprague Type 150D. Added by REV G.
C14*	7774750P1	Ceramic disc: .00047 mf +100% -0%, 500 VDCV. Added by REV G.
		- - - - - - - - **DIODES & RECTIFIERS** - - - - - - - -
CR1*	19A115250P1	Silicon. Deleted by REV G.
CR2	4037822P1	Silicon.
CR3	19A115250P1	Silicon.
CR4	4037822P1	Silicon.
CR5*	19A115250P1	Silicon. Added by REV B.
		- - - - - - - - **INDICATING DEVICES** - - - - - - - -
DS1*	4034664P1	Lamp, incandescent: 28 v; sim to GE 3148. Added by REV G.
		- - - - - - - **JACKS & RECEPTACLES** - - - - - - -
J1 thru J3	4033513P4	Contact, electrical: sim t Bead Chain L93-3.
J4*	4033513P4	Contact, electrical: sim to Bead Chain L93-3. Deleted by REV G.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	GE PART NO.	DESCRIPTION
J5 thru J30	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - **TRANSISTORS** - - - - - - - -
Q1	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q2 and Q3	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q4		Earlier than REV G:
	3877P681J	Composition: 680 ohms ±5%, 1/2 w.
Q5*	19A115706P1	Silicon, PNP; sim to Type 2N3638. Deleted by REV G.
Q6	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q7	19A115976P1	Silicon, PNP.
Q8 and Q9	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q10	19A115300P4	Silicon, NPN; sim to Type 2N3053.
		- - - - - - - - - - **RESISTORS** - - - - - - - - - -
R1	3R78P181K	Composition: 180 ohms ±10%, 1 w.
R2	3R77P821K	Composition: 820 ohms ±10%, 1/2 w.
R3*	5495948P69	Deposited carbon: 82.5 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2RB.
		In Models of REV A and earlier:
	3R77P830J	Composition: 82 ohms ±5%, 1/2 w.
R4*	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
		Earlier than REV G:
	3R77P006J	Composition: 30 ohms ±5%, 1/2 w.
R5*	5495948P142	Deposited carbon: 267 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2RB.
		In Models of REV A and earlier:
	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R6*	3R77P39KJ	Composition: 39K ohms ±5%, 1/2 w.
		In Models earlier than REV C:
	3R77P272J	Composition: 2700 ohms ±5%, 1/2 w.
R7*	3R77P162J	Composition: 1600 ohms ±5%, 1/2 w.
		In Models of REV A and earlier:
	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R8*	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
		In Models of REV C, D, and E:
	3R77P162J	Composition: 1600 ohms ±5%, 1/2 w.
		In Models of REV A and earlier:
	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R9	19B209358P3	Variable, carbon film: approx 25 to 500 ohms ±20%, 0.2 w; sim to CTS Type U-201.
R10*	3R77P75LJ	Composition: 750 ohms ±5%, 1/2 w.
		In Models of REV C, D, and E:
	3R77P911J	Composition: 910 ohms ±5%, 1/2 w.
		In Models of REV A and earlier:
	3R77P112J	Composition: 1100 ohms ±5%, 1/2 w.
R11*	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w. Deleted by REV B.
R12*	3R77P182J	Composition: 1800 ohms ±5%, 1/2 w.
		In Models of REV A and earlier:
	3R77P133J	Composition: 130 ohms ±5%, 1/2 w.
R13	3R77P102K	Composition: 1003 ohms ±10%, 1/2 w.
R14	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R15*	3R78P271K	Composition: 270 ohms ±10%, 1 w. Deleted by REV G.
R16*	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
		Earlier than REV G:
	3R77P471K	Composition: 470 ohms ±10%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R17*	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
		Earlier than REV G:
	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R18*	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
		Earlier than REV G:
	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R19*	19B209358P103	Variable, carbon film: approx 25 to 1000 ohms ±10%, 0.2 w; sim to CTS Type X-201.
		Earlier than REV G:
	19B209358P102	Variable, carbon film: approx 25 to 500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R20*	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w. Deleted by REV G.
R21	3R77P184K	Composition: 0.18 megohm ±10%, 1/2 w.
R22	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R23	3R77P133J	Composition: 1300 ohms ±5%, 1/2 w.
R25	3R77P470K	Composition: 47 ohms ±10%, 1/2 w.
R26	3R77P623J	Composition: 6200 ohms ±5%, 1/2 w.
R27	3R77P943J	Composition: 94,000 ohms ±5%, 1/2 w.
R28	3R78P133J	Composition: 130 ohms ±5%, 1 w.
R29*	19B209358P104	Variable, carbon film: approx 50 to 2500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
		In Models earlier than REV G:
	19B209358P103	Variable, carbon film: approx 25 to 1000 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R30*	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
		Earlier than REV G:
	5495946P127	Deposited carbon: 187 ohms ±1%, 1/2 w; sim to Texas Instrument CD1/2RB.
R31*	19B209022P101	Wirewound: .27 ohms ±10%, 2 w; sim to IRC Type BWH. Deleted by REV G.
R32*	3R77P160J	Composition: 16 ohms ±5%, 1/2 w. Deleted by REV G.
R34*	3R77P240J	Composition: 24 ohms ±5%, 1/2 w. Deleted by REV G.
R35*	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
		Earlier than REV G:
	19B209243P7	Polyester: 0.1 mf ±20%, 50 VDCV.
C505*	19A116080P105	Polyester: 0.047 mf ±10%, 50 VDCV. Added by REV B.
		- - - - - - - - **DIODES & RECTIFIERS** - - - - - - - -
CR501	19A115617P2	Silicon.
CR502*	19A115823P1	Silicon. Deleted by REV G.
		- - - - - - - - - - **INDICATORS** - - - - - - - - - -
L501*	19A115339P1	Choke, RF: 50 µh ±10%, .02 ohm DC res max. Deleted by REV G.
L502*	19A115894P1	Audio frequency reactor. Deleted by REV G.
		- - - - - - - - - - **PLUGS** - - - - - - - - - -
P201		Part of W501.
P302		Part of W502.
P303		Part of W503.
P501	4029840P2	Contact, electrical: sim to Amp 42827-2.
P503	4029840P3	Contact, electrical: sim to AMP 42101-2.
P504*	4029840P2	Contact, electrical: sim to Amp 42827-2. Deleted by REV G.
P505		Part of W503.
P506 thru P508	4029840P2	Contact, electrical: sim to Amp 42827-2.
P509		Part of W501.
P510	4029840P2	Contact, electrical: sim to Amp 42827-2.

SYMBOL	GE PART NO.	DESCRIPTION
C2 and C3	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCV; sim to Sprague Type 150D.
		- - - - - - - - **DIODES & RECTIFIERS** - - - - - - - -
CR1	19A115823P1	Silicon.
		- - - - - - - - - - **INDUCTORS** - - - - - - - - - -
L1	19A115392P1	Choke, RF: 50 µh ±10%, .02 ohm DC res max.
L2	19A115894P1	Audio frequency reactor.
		- - - - - - - - - - **RESISTORS** - - - - - - - - - -
R1	3R77P111J	Composition: 110 ohms ±5%, 1/2 w.
R2	19B209022P103	Wirewound: .33 ohms ±10%, 2 w; sim to IRC Type BWH.
R3*	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
		Earlier than REV A:
	3R77P241J	Composition: 240 ohms ±5%, 1/2 w.
R4	19B209358P101	Variable, carbon film: approx 25 to 250 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R5	3R77P240J	Composition: 24 ohms ±5%, 1/2 w.
R6	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
		- - - - - - - - **THERMISTORS** - - - - - - - -
RT1	5490828P41	Thermistor: 30 ohms ±10%, color code black/white; sim to Global Type B13118-4.
		- - - - - - - - **TRANSFORMERS** - - - - - - - -
T1	19A116040P1	Audio freq: 300-4000 Hz. Pri: 18.2 ohms ±10% DC res. Sec: 23.5 ohms ±10% DC res.
		- - - - - - - - - - **CAPACITORS** - - - - - - - - - -
C502	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCV.
C503*	19B209243P6	Polyester: 0.068 µf ±20%, 50 VDCV. Deleted by REV G.
C504*	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCV; sim to Mallory Type TT.
		Earlier than REV G:
	19B209243P7	Polyester: 0.1 µf ±20%, 50 VDCV.
C505*	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCV. Added by REV B.
		- - - - - - - - **DIODES & RECTIFIERS** - - - - - - - -
CR501	19A115617P2	Silicon.
CR502*	19A115823P1	Silicon. Deleted by REV G.
		- - - - - - - - - - **INDUCTORS** - - - - - - - - - -
L501*	19A115339P1	Choke, RF: 50 µh ±10%, .02 ohm DC res max. Deleted by REV G.
L502*	19A115894P1	Audio frequency reactor. Deleted by REV G.
		- - - - - - - - - - **PLUGS** - - - - - - - - - -
P201		Part of W501.
P302		Part of W502.
P303		Part of W503.
P501	4029840P2	Contact, electrical: sim to Amp 42827-2.
P503	4029840P3	Contact, electrical: sim to AMP 42101-2.
P504*	4029840P2	Contact, electrical: sim to Amp 42827-2. Deleted by REV G.
P505		Part of W503.
P506 thru P508	4029840P2	Contact, electrical: sim to Amp 42827-2.
P509		Part of W501.
P510	4029840P2	Contact, electrical: sim to Amp 42827-2.

SYMBOL	GE PART NO.	DESCRIPTION
		Part of W501.
P512 thru P516	4029840P2	Contact, electrical: sim to Amp 42827-2.
P519 and P520		Part of W503.
P521 and P522	4029840P2	Contact, electrical: sim to Amp 42827-2.
P523*	4029840P3	Contact, electrical: sim to Amp 42101-2. Added by REV G.
		- - - - - - - - **TRANSISTORS** - - - - - - - -
Q501	19A115977P1	Silicon, PNP.
Q502*	19A116203P3	Silicon, NPN.
		In Models of REV E, F, G, and H:
	19A116118P1	Silicon, NPN.
		In Models of REV D and earlier:
	19A115527P1	Silicon, NPN.
Q503*	19A116303P3	Silicon, NPN.
		In Models of REV G and E:
	19A116118P1	Silicon, NPN.
		In Models of REV F and earlier:
	19A115822P1	Silicon.
Q504* and Q505*	19A116203P2	Silicon, NPN.
		Earlier than REV G:
	19A116017P1	Silicon, NPN.
		- - - - - - - - - - **RESISTORS** - - - - - - - - - -
R501	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
R502	5493035P33	Wirewound: 6 ohms ±5%, 10 w; sim to Hamilton Hall Type HH.
R503	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R504	5493035P6	Wirewound: 3 ohms ±5%, 5 w; sim to Hamilton Hall Type HH.
R505*	3R77P75LJ	Composition: 750 ohms ±5%, 1/2 w. Deleted by REV G.
R506*	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w. Deleted by REV G.
R507*	3R78P390K	Composition: 39 ohms ±10%, 1 w. Added by REV G.
		- - - - - - - - **THERMISTORS** - - - - - - - -
RT501*	5490828P42	Thermistor: 300 ohms ±20%, color code yellow and yellow; sim to Global Type C0800H-14. Deleted by REV G.
		- - - - - - - - **SWITCHES** - - - - - - - -
S501*	19B209046P7	Slide: SPDT, 0.5 amp at 125 v; sim to Continental-Wirt Type G132. Added by REV G.
		- - - - - - - - **TRANSFORMERS** - - - - - - - -
T501*	19A116041P2	Audio freq: 300-4000 Hz. Pri: 1.00 ohm ±15% DC res. Sec No. 1: .23 ohm ±10% DC res. Sec No. 2: 10.0 ohms ±15% DC res.
		Earlier than REV G:
	19A116003P1	Audio: freq range 300 to 4000 Hz. Pri: 23.3 ohms ±5% imp, 1.00 ohms ±15% DC res. Sec: 3.5 ohms imp, 0.32 ohms ±10% DC res.
T502*	19A116004P1	Audio: freq range 300 to 4000 Hz. Pri: 70 ohms ±15% DC res. Sec: 9 ohms ±10% DC res. Deleted by REV G.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - **TERMINAL BOARDS** - - - - - - - -
TB1	748742AP2	Miniature, phen: 1 terminal.
TB2*	7775500P11	Phen: 5 terminals. Deleted by REV G.
TB3	19B209512G1	Terminal board.
TB5*	7775500P12	Phen: 5 terminals. Earlier than REV G:
	7775500P10	Phen: 4 terminals.
		- - - - - - - - - - **CABLES** - - - - - - - - - -
		CABLE ASSEMBLY 19D413097G1
		- - - - - - - - - - **PLUGS** - - - - - - - - - -
W501		
P201	19C303506P2	Connector, phen: 20 contacts.
P509	4029840P2	Contact, electrical: sim to Amp 42827-2.
P511	4029840P2	Contact, electrical: sim to Amp 42827-2.
		CABLE ASSEMBLY 19B205365G2
W502		
P302	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
	19A122138P1	Knob.
	8197408C13	Screw.
		CABLE ASSEMBLY 19B210526G1
W503		
P303	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
P505	4029840P2	Contact, electrical: sim to Amp 42827-2.
P519 and P520	4029840P2	Contact, electrical: sim to Amp 42827-2.
	19A122138P1	Knob.
	8197408C13	Screw.
		CABLE ASSEMBLY (CHANNEL GUARD) 19B210490G1
W602		
P601	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
P103 and P104	4029840P1	Contact, electrical: sim to Amp 41854.
	4029840P2	Contact, electrical: sim to Amp 42827-2. (6)
	19A122138P1	Knob.
	8197408C13	Screw.
		CABLE ASSEMBLY (MULTI-FREQUENCY) 19B205375G2
W2603		
P2004	19B209341P1	Socket, tube: 7 pins; sim to Elco 04-720-XX.
	4029840P2	Contact, electrical: sim to Amp 42827-2. (6)
	19A122138P1	Knob.
	8197408C13	Screw.
		ANTENNA CABLE ASSEMBLY FRONT MOUNT 19A122133G4
		- - - - - - - - - - **PLUGS** - - - - - - - - - -
P204	4029493P1	Receptacle: coaxial, 1 contact: sim to Amphenol 83-794.
	4029082P1	Hood, UHF connector: coaxial; sim to Amphenol 83-765.
	5491688P70	RF cable assembly: approx 18.50 inches long.

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 - Power Regulator Model 4EP57A10

To eliminate low voltage being applied to the receiver through antenna relay when receiver fuse is blown. Moved brown wire from TB3-D1 to TB3-D3.

REV. B - To improve temperature compensation of Vcc: changed R3, R5, R7, R36 and added R38.

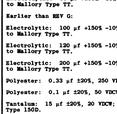
To reduce interaction of type voltage limiter and control stages; deleted R11, changed R8, R10, R12, VR4, and added CR5.

Schematic Diagram was:

REV. C - To make the power regulator compatible with Low Band transmitter. Changed R6, P29 and R36.

REV. D - To provide connections for carrier control timer option 19B205924-G1 Revision A or later. Connected +12 volts to TB3-J43, and in Channel Guard applications, changed connection of W602-shield from TB3-E3 to TB3-44.

Schematic Diagram was:



REV. E - To incorporate new transistor and mounting assembly. Changed Q502.

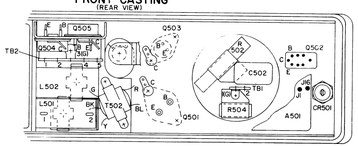
REV. F - To re-center adjustment range of Top Limiter R8 and R10.

REV. G - To incorporate a new Audio PA circuit and a notting switch, and to improve operation of the 10-volt regulator circuit.

On Power Regulator Board A501 (19C311392-G1): Changes C1, C4, C11, C12, C504, Q502, Q504, Q505, and T501. Deleted CR4, R15, R20, R31, R32, R34, R71 and Q3. Added C13, C14 and C505.

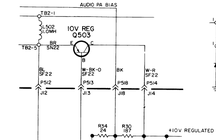
On Power Regulator Board 19D413056-G1: Changed C504, Q502, Q504, Q505 and T501. Deleted C503, C5502, L501, L502, R505, R506, RT501 and T502. Added Audio PA board A502, R507 and notting switch S501.

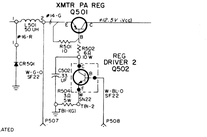
Outline Diagram was:



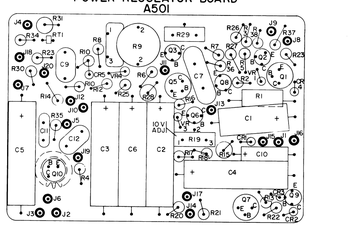
PRODUCTION CHANGES (CONT'D)

Schematic Diagram was:





POWER REGULATOR BOARD A501



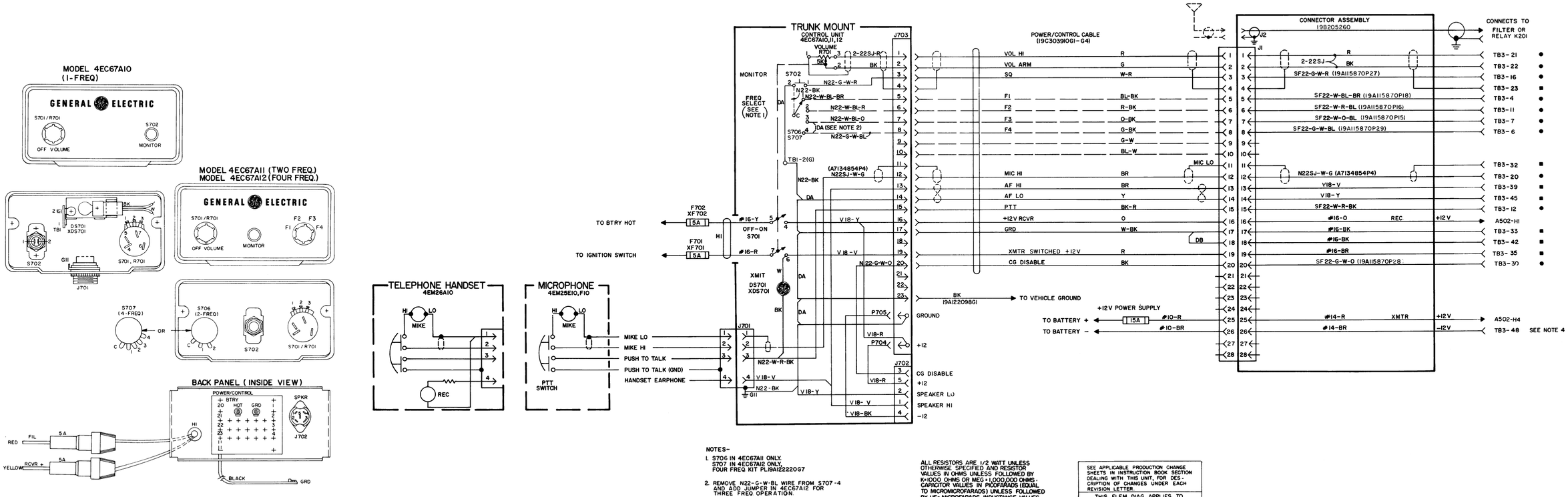
REV. H - To provide a ground between front casting and chassis. Added a black-white wire from TB1-1(G) to TB5-4(G) and changed TB1.

REV. J - To provide a better mechanical package. Changed Q502 and Q503. Added C505.

REV. K - To improve performance with changing transistor parameters. Added C505.

REV. A - Audio PA Board A502 (19C311339G1)

To allow PA bias to be set to proper Current. Changed R3.



(19C311222, Rev. 3)

NOTES-

1. S706 IN 4EC67A11 ONLY.
   S707 IN 4EC67A12 ONLY.
   FOUR FREQ KIT PL19A122206G7
2. REMOVE N22-G-W-BL WIRE FROM S707-4 AND ADD JUMPER IN 4EC67A12 FOR THREE FREQ OPERATION.
3. TERMINATE WIRES MARKED BY ■ WITH A4029840P1 AND WIRES MARKED BY ● WITH A4029840P2.
4. TERMINATE WITH 19B209151P1

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.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EC67A10	F
4EC67A11	F
4EC67A12	F

(19R620794, Rev. 12)

SCHEMATIC & OUTLINE DIAGRAMS

TRUNK MOUNT CONTROL UNIT
MODEL 4EC67A10-12

RC-1678H
****

PARTS LIST

LBI-3901F

TRUNK MOUNT CONTROL UNIT

MODEL 4EC67A10 (19C303901G1) (1 FREQUENCY)
MODEL 4EC67A11 (19C303901G2) (2 FREQUENCY)
MODEL 4EC67A12 (19C303901G2) (4 FREQUENCY)
(19A122220G7)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - **INDICATING DEVICES** - - - - - -
DS701	19C307037P14	Lamp, incandescent: 18 v; sim to GE 1445.
		- - - - - - - - - - **FUSES** - - - - - - - - -
F701 and F702	1R16P8	Quick blowing: 5 amps at 250 v; sim to Littelfuse 312005 or Bussman MTH-5.
		- - - - - - - - **JACKS AND RECEPTACLES** - - - - -
J701*		Connector. Includes:
	19A116061P2	Receptacle: 4 female contacts; sim to Amphenol Type 91-PN4F-1000.
	19A116061P4	Lockwasher.
	19A116061P5	Nut, knurled.
		In Models of REV C and earlier:
	7117934P5	Connector, chassis: 4 female contacts; sim to Amphenol 91-PC4F.
J702*	5493018P1	Connector, 5 contacts; sim to Cinch 203-41-05-081.
		In Models earlier than REV A:
	19B209340P5	Receptacle: 4 female contacts; sim to Alcon MS120.
J703	19A122095G1	Board: 27 contacts.
		- - - - - - - - - - **PLUGS** - - - - - - - - -
P704 and P705	4029840P3	Contact, electrical: sim to AMP 42101-2.
		- - - - - - - - - - **RESISTORS** - - - - - - - - -
R701		(Part of S701).
		- - - - - - - - - - **SWITCHES** - - - - - - - - -
S701	5496870P13	Resistor/switch: includes Resistor (R701), variable, carbon film: 5000 ohms ±20%, 0.5 w; Switch, rotary, DPST, 6 amps at 125 VAC; sim to Mallory LC(5K)OAC-2.
S702	19B209165P4	Pushbutton: SPST, momentary contact, normally open, 1 amp at 115 VAC; sim to Grayhill 30-17B.
S706	19B200394P7	Rotary: 1 pole, 2 positions, non-shorting contacts, 1 amp at 115 VAC or 28 VDC; sim to Grayhill Series 24.
		- - - - - - - - **TERMINAL BOARDS** - - - - -
TB1	7775500P4	Phen: 2 terminals.
		- - - - - - - - - - **SOCKETS** - - - - - - - - -
XDS701	4032220P1	Lampholder, miniature: sim to Drake N517.
XF701		**FUSE LEAD** 19A122111G1
	19A115776P2	Fuseholder, phen: sim to Bussman Type HHJ.
XF702		**FUSE LEAD** 19A122111G2
	19A115776P2	Fuseholder, phen: sim to Bussman Type HHJ.
		MODIFICATION KIT 19A122220G7 (Used in Model 4EC67A12)
		- - - - - - - - - - **SWITCHES** - - - - - - - - -
S707	19B204441G1	Rotary: 1 pole, 4 positions, non-shorting contacts, 1 amp at 115 VDC; sim to Grayhill Series 24 (modified).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		ASSOCIATED ASSEMBLIES **POWER CONTROL CABLE** **19C303910G2 (2 Freq.) Negative Ground** **19C303910G4 (4 Freq.) Negative Ground**
		- - - - - - - - **MISCELLANEOUS** - - - - - -
	19C311409P1	Socket, phen: 28 contacts.
	19D413039P1	Connector Cover.
	7142878G1	Cable hook.
	19C311411G1	Screw. (Used with connector cover).
		FUSE MOUNTING **19B216021G4**
	19D413045P1	Base.
	19D413046P1	Cover.
	19B205950P1	Fuse clip.
		FUSE
	1R11P4	Quick blowing: 15 amps at 250 v; sim to Bussman NON15.
		CONNECTOR PANEL **25-50 MHz** **19B205260G8**
		- - - - - - - - **JACKS AND RECEPTACLES** - - - - -
J1	19C303775P1	Connector, phen: 28 contacts.
		- - - - - - - - **MISCELLANEOUS** - - - - - -
	19A122133G13	Antenna Cable: Includes J2.
		CONNECTOR PANEL **150.8-174 MHz** **19B205260G2**
		- - - - - - - - **JACKS AND RECEPTACLES** - - - - -
J1	19C303775P1	Connector, phen: 28 contacts.
		- - - - - - - - **MISCELLANEOUS** - - - - - -
	19A122133G5	Antenna Cable: Includes J2.
		CONNECTOR PANEL **450 MHz** **19B205260G3**
		- - - - - - - - **JACKS AND RECEPTACLES** - - - - -
J1	19C303775P1	Connector, phen: 28 contacts.
		- - - - - - - - **MISCELLANEOUS** - - - - - -
	19A122133G6	Antenna Cable: Includes J2 and P204.
		MILITARY MICROPHONE **MODEL 4EM25E10** **(19B209102P2)** **(See RC-1399)**
1		Cable clamp, front and back case. Shure Brothers RP96.
2		Switch. Shure Brothers RP26.
3		(See item 1).
4		Switch button. Shure Brothers RP97. (Quantity 5 only).
5		Spring and internal hardware. Shure Brothers RP16.
6		Shield. Shure Brothers RP23. (Quantity 5 only).
7		Magnetic controlled cartridge, grille cloth, screen and resonator. Shure Brothers RP13.
8		(See item 1).
9		Cable and plug: approx 6 feet long. Shure Brothers RP14.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - **MISCELLANEOUS** - - - - - - - -
	19B209340P6	Retainer, ring. (Used with J702 in 19C303901G1, G2).
	19B205216P1	Jewel: red. (Used with DS701 in 19C303901G1,2).
	4039182G3	Knob. (Used with S701 in 19C303901G1, G2). (Used with S703 in 19C303901G2).
	19A121521G1	Mounting support. (Used in 19C303901G1, G2).
	4032248P1	Clip: spring tension; sim to Augat Brothers 6185-1A. (Mounts DS701 in 19C303901G1, G2).
	NP248987	Nameplate. (Used in Model 4EC67A10).
	NP248988	Nameplate. (Used in Model 4EC67A11, 12).
	19D413010P2	Housing.
	19A116773P106	Tap screw, Phillips POZIDRIV®: No. 7-19 x 3/8. (Secures back plate).

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 - Models 4EC67A10,11 & 12
To incorporate improved speaker jack. Changed J702.

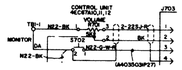
REV. A - Collector Assembly 19B205260-G1
To permit the addition of Channel Guard hookswitch option, added a green-white-orange wire from J1-20 to TB3-17.

REV. B - Models 4EC67A10, 11 & 12
To permit the addition of Channel Guard hookswitch option, added a green-white-orange wire from J702-3 to J703-20.

REV. B - Connector Assembly 19B205260-G1
To reduce alternate noise, removed #14 Black wire from J1-27.

REV. C - Models 4EC67A10,11 & 12
To make control head compatible with Royal Executive Systems. Changed wiring of R701.

Schematic was:

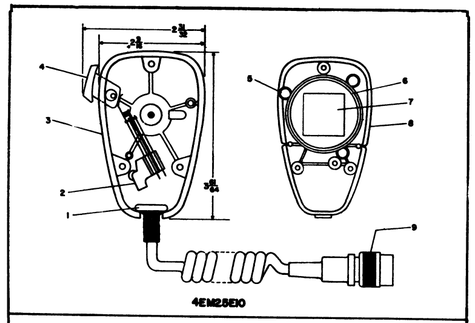


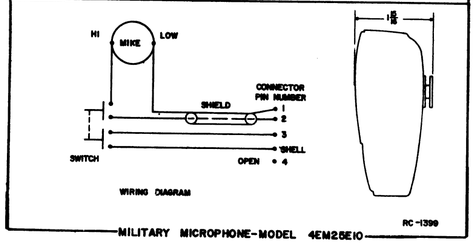
REV. D - Models 4EC67A10, 11 & 12
To ground microphone jack. Added black-white wire from J703 ground to G11.

REV. E - Models 4EC67A10, 11 & 12
To incoporate a new control unit housing. Changed housing from metal to Lexan®.

REV. C - Connector Assembly 19B205260-G1
To reduce transmitter noise to the region of 30-150 kHz from carrier. Added #14 BK wire between J1-27 and TB3-8, 22, 27. Added jumper from pin 26 to 27 on power cable plug in negative ground applications. Added jumper from pin 25 to 27 on power cable plug in positive ground applications.

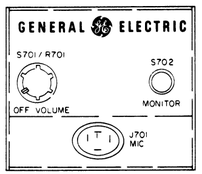
REV. F - Models 4EC67A10, 11 & 12
To incorporate new housing. Changed housing from 19B217271G2 to 19D413010P2. Changed back plate retaining screw to 19A116773P106.





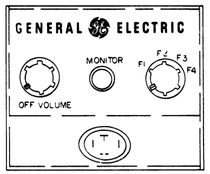
MILITARY MICROPHONE-MODEL 4EM25E10

MODEL 4EC68B10(1-FREQ.)

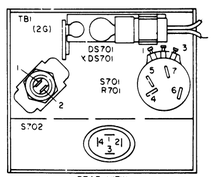


FRONT VIEW

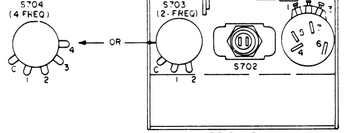
MODEL 4EC68B11 (2-FREQ)
MODEL 4EC68B12 (4-FREQ)



FRONT VIEW

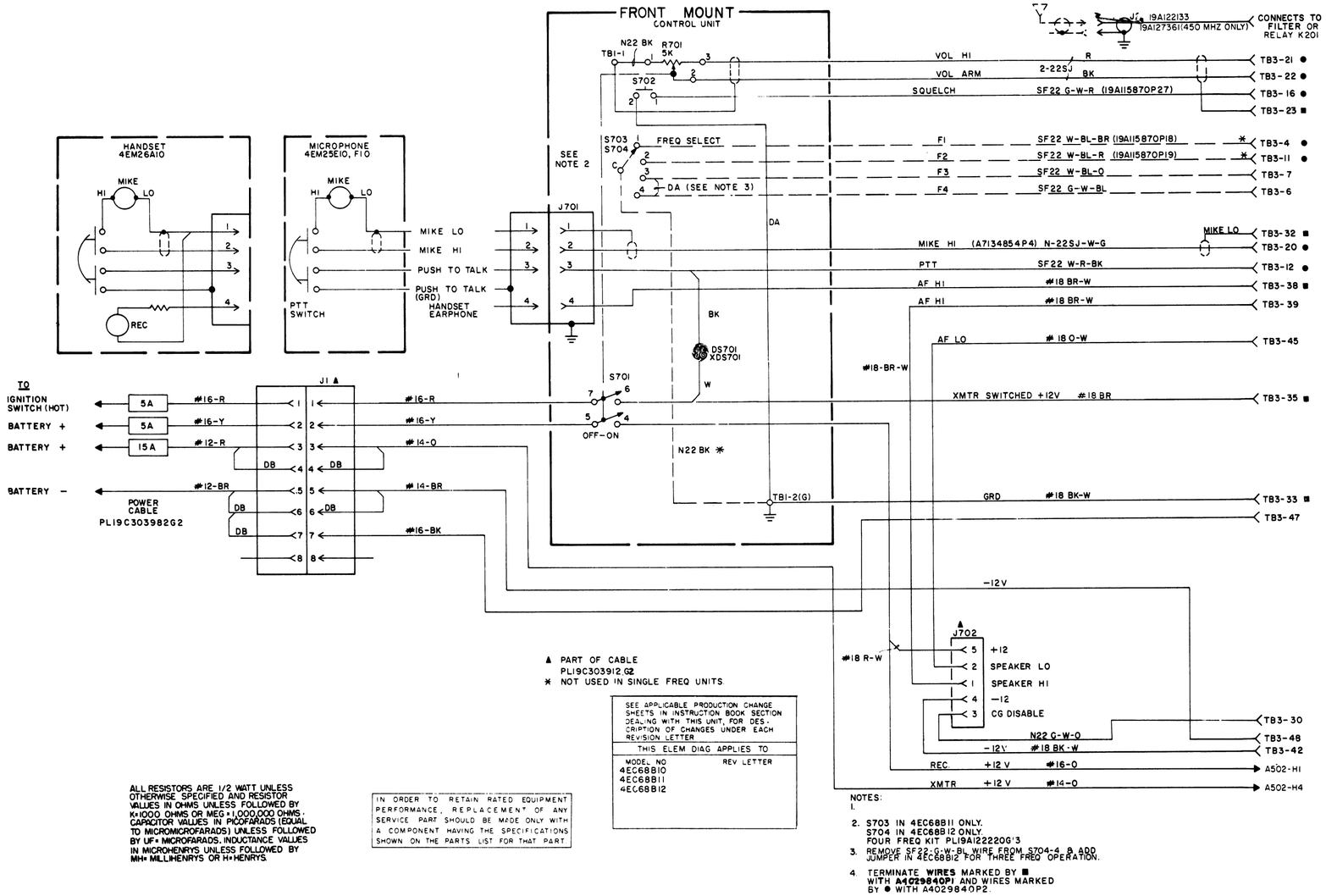


REAR VIEW



REAR VIEW

(19C311890, Rev. 0)



▲ PART OF CABLE PLI9C30391 2G2.
* NOT USED IN SINGLE FREQ UNITS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER	
THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EC68B10 4EC68B11 4EC68B12	

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.

(19D413136, Rev. 6)

NOTES:
1.
2. S703 IN 4EC68B11 ONLY.
   S704 IN 4EC68B12 ONLY.
   FOUR FREQ KIT PLI9A122206G3
3. REMOVE SF22-G-W-BL WIRE FROM S704-4 & ADD JUMPER IN 4EC68B12 FOR THREE FREQ OPERATION.
4. TERMINATE WIRES MARKED BY ■ WITH A4029840P1 AND WIRES MARKED BY ● WITH A4029840P2.

SCHEMATIC & OUTLINE DIAGRAMS

FRONT MOUNT CONTROL UNIT
MODEL 4EC68B10-12
RC-1679C
****

PARTS LIST

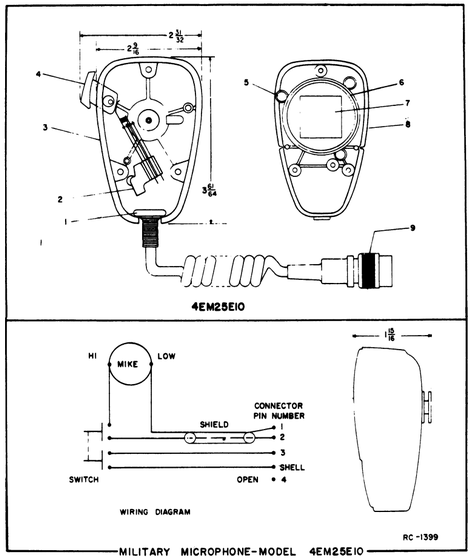
LBI-3899A

TRUNK MOUNT CONTROL UNIT
MODEL 4EC68B10 (19C303907G3) (1 FREQUENCY)
MODEL 4EC68B11 (19C303907G4) (2 FREQUENCY)
MODEL 4EC68B12 (19C303907G4) (4 FREQUENCY)
(19A122206G13)

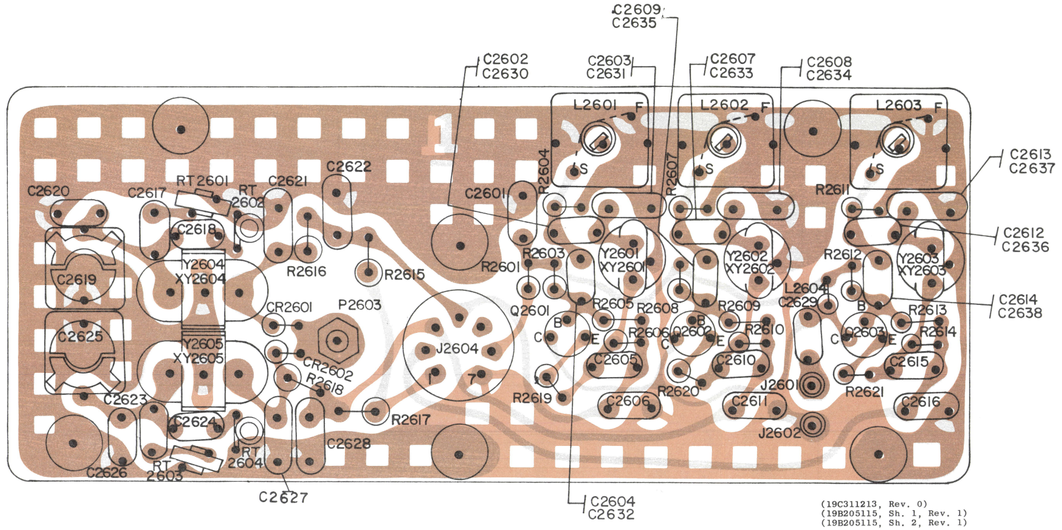
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INDICATING DEVICES - - - - - - - -
DS701	19C307037P14	Lamp, incandescent: 18 v; sim to GE 1445.
		- - - - - - JACKS AND RECEPTACLES - - - - -
J701	19A116061P1	Receptacle: 4 female contacts; sim to Amphenol 91-PN4E-1000.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R701		(Part of S701).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701	5496870P13	Resistor/switch: includes Resistor (R701), variable, carbon film: 5000 ohms ±20%, 0.5 w; Switch, rotary, DPST, 6 amps at 125 VAC; sim to Mallory LC(5K)OAC-2.
S702	19B209165P4	Pushbutton: SPST, momentary contact, normally open, 1 amp at 115 VAC; sim to Grayhill 30-17B.
S703	19B200394P3	Rotary: 1 pole, 2 positions, non-shorting contacts, 1 amp at 115 VAC or 28 VDC; sim to Grayhill Series 24.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P4	Phen: 2 terminals.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XDS701	4032220P2	Lampholder, miniature: sim to Drake N517.
		MODIFICATION KIT 19A122206G13 (Used in Model 4EC68B12)
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S704	19B204441G6	Rotary: 1 pole, 4 positions, non-shorting contacts, 1 amp at 115 VDC; sim to Grayhill Series 24 (modified).
		ASSOCIATED ASSEMBLIES
		POWER CABLE 19C303982G2
	7473192P35	Receptacle: phen, 8 contacts; sim to HB Jones 261-32-08-033 (S-308-CCT-K).
	1R16P8	Fuse: quick blowing, 5 amps at 250 v; sim to Littelfuse 312005 or Bussman MTH-5.
	19A122111G1	Fuseholder: with red wire; sim to Bussman Type HHJ.
	19A122111G2	Fuseholder: with yellow wire; sim to Bussman Type HHJ.
		FUSE MOUNTING 19B216021G4
	19D413045P1	Base.
	19D413046P1	Cover.
	19B205950P1	Fuse clip.
		FUSE
	1R11P4	Quick blowing: 15 amps at 250 v; sim to Bussman NON15.
		CABLE ASSEMBLY 19C303912G1
J1	7473192P34	Plug: phen, 8 contacts; sim to HB Jones 261-31-08-032 (P-308-CCT-L).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
J702	5493018P5	Receptacle: 5 female contacts; sim to Cinch 203-31-05-031.
	5491563P3	Cap: (Used with J702); sim to Methode C850-LV.
		ANTENNA CABLES
	19A122133G13	25-50 MHz: approx 19 inches long. Includes J2.
	19A122133G4	150.8-174 MHz: approx 19 inches long. Includes J2.
	19A127361G1	450 MHz: approx 18 inches long. Includes J2 and P204.
		MILITARY MICROPHONE MODEL 4EM25E10 (19B209102P2) (See RC-1399)
1		Cable clamp, front and back case. Shure Brothers RP96.
2		Switch. Shure Brothers RP26.
3		(See item 1).
4		Switch button. Shure Brothers RP97. (Quantity 5 only).
5		Spring and internal hardware. Shure Brothers RP16.
6		Shield. Shure Brothers RP23. (Quantity 5 only).
7		Magnetic controlled cartridge, grille cloth, screen and resonator. Shure Brothers RP13.
8		(See item 1).
9		Cable and plug: approx 6 feet long. Shure Brothers RP14.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	NP257782	Nameplate. (Used in Model 4EC68B10).
	NP257783	Nameplate. (Used in Models 4EC68B11, 12).
	19B205216P1	Jewel: red. (Used with DS701).
	4039182G3	Knob. (Used with S701 and S703).
	4032248P1	Clip: spring tension; sim to Augat Brothers 6185-1A. (Mounts DS701).



MILITARY MICROPHONE-MODEL 4EM25E10

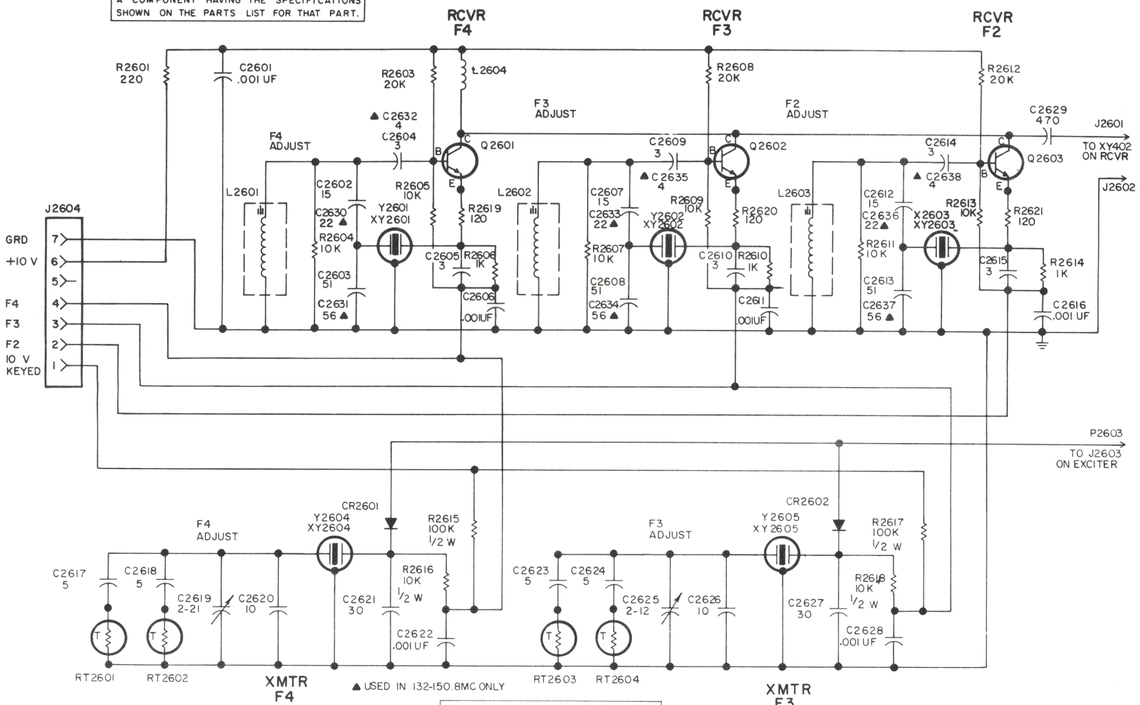


(19C311213, Rev. 0)
(19B205115, Sh. 1, Rev. 1)
(19B205115, Sh. 2, Rev. 1)

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

(DF-8407)

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.



ALL RESISTORS ARE 1/4 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.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EG22F10	C
4EG22F11	C

ECP-321

(19C303926, Rev.-6)

SCHEMATIC & OUTLINE DIAGRAM

FOUR-FREQUENCY OSCILLATOR BOARD
MODEL 4EG22F10, 11

RC-1418E

****

PARTS LIST

LBI-3715C

132-174 MHz FOUR FREQUENCY OSCILLATOR BOARD
MODELS 4EG22F10, 11
(19C303924-G1, 2)

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2601	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2602*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2603	5496219-P456	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2604*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2605	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2606	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2607*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2608	5496219-P456	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2609*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2610	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2611	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2612*	5496219-P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P644	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P344	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2613	5496219-P456	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2614*	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2615	5496219-P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2616	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2617 and C2618	5496219-P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2619	5491271-P106	Variable, air: approx 1.98-12.4 µf, 750 v peak; sim to EF Johnson 189-6-5.
C2620	5496219-P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C2621	5496219-P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C2622	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2623 and C2624	5496219-P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2625	5491271-P106	Variable, air: approx 1.98-12.4 pf, 750 v peak; sim to EF Johnson 189-6-5.
C2626	5496219-P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C2627	5496219-P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C2628	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2629	5494481-P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2630*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P647	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2631	5496219-P457	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2632*	5496219-P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2633*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P647	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2634	5496219-P457	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2635*	5496219-P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2636*	5496219-P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM. In Models earlier than Rev B:
	5496219-P647	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -470 PPM. In Models earlier than Rev A:
	5496219-P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2637	5496219-P457	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -220 PPM.
C2638*	5496219-P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM. In Models earlier than Rev B:
	5496219-P39	Ceramic disc: 8 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR2601 and CR2602	19A115371-P1	Silicon; sim to Type 1N676.
CR603	4037822-P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J2601 and J2602	4033513-P4	Contact, electrical: sim to Bead Chain L93-3.
J2604	19B209303-P2	Connector, phen: 7 pins.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2601 thru L2603	19A121085-G1	Coil. Includes tuning slug 19B200497-P2.
L2604	7488079-P1	Choke, RF: 0.15 µh ±20%, .03 ohm DC res max; sim to Jeffers 4411-1.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P2603	4029093-P1	Plug, banana type: sim to Ucinite 155296.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q2601* thru Q2603*	19A115925-P1	Silicon, NPN.
	19A115342-P2	In Models earlier than Rev C: Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2601	3R152-P221K	Composition: 220 ohms ±10%, 1/4 w.
R2603	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R2604 and R2605	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2606	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R2607	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2608	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R2609	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2610	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R2611	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2612	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R2613	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R2614	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R2615	3R77-P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R2616	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R2617	3R77-P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R2618	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R2619* thru R2621*	3R152-P121J	Composition: 120 ohms ±5%, 1/4 w.
	3R152-P150J	In Models earlier than Rev B: Composition: 15 ohms ±5%, 1/4 w.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT2601	19B209353-P2	Disc: 1250 ohms ±5%, color code red; sim to GE 16D-3121.
RT2602	19B209353-P1	Rod: 3350 ohms ±5%, color code brown; sim to GE 1R-1544.
RT2603	19B209353-P2	Disc: 1250 ohms ±5%, color code red; sim to GE 16D-3121.
RT2604	19B209353-P1	Rod: 3350 ohms ±5%, color code brown; sim to GE 1R-1544.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2601		CABLE 19B205275-G1
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B209341-P1	Socket: 7 contacts; sim to Elco 04-720-XX.
W2602		CABLE 19B205263-G1
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4029840-P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY2601 thru XY2603	5490277-P1	Transistor, phen: 4 contacts; sim to Elco 3303.
XY2604 and XY2605		(See Miscellaneous).
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		When reordering give GE Part Number and specify exact frequency needed.
		Receiver Crystal freq = (OF -10.7 MHz) ÷ 3.
Y2601 thru Y2605	19B206221-P1	Quartz: freq range 39 to 62 MHz, temp range -30°C to +80°C. (Receiver).
		Transmitter Crystal freq = (OF) ÷ 24.
Y2601 thru Y2605	19B206204-P1	Quartz: freq range 5400 to 7250 KHz, temp range -30°C to +85°C. (Transmitter).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4033089-P1	Clip. (Part of XY2604, 2605).
	19A115793-P1	Contact, electrical: sim to Malco 2700. (Part of XY2604, 2605).
	19C311172-P1	Socket: 4 contacts. (Part of XY2604, 2605).
	19A121088-P1	Can. (Used with L2601-2603).

*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 receiver oscillator frequency stability. Changed C2602, C2607, C2612, C2630, C2633 and C2636.

REV. B - To improve the frequency stability of the receiver oscillators. Changed C2602, C2604, C2607, C2609, C2612, C2614, C2630, C2632, C2633, C2635, C2636, C2638, R2619, R2620 and R2621.

REV. C - To incorporate new transistors. Changed Q2601, Q2602 & Q2603.

PARTS LIST

LBI-4273A

HANDSET MODEL 4EM26A10
HANDSET MODEL 4EM26C10
AND
HOOKSWITCH 19B204867G4
(Refer to RC-1398)

SYMBOL	GE PART NO.	DESCRIPTION
		HANDSET MODEL 4EM26A10 19B209100P2 **HANDSET MODEL 4EM26C10 19B209100P3**
1		Self tap screw, bind head: No. 4 x 5/16. Shure Brothers 30C640C.
2		Cable clamp. Shure Brothers 53A532.
3		Shield. Shure Brothers RP19.
4		Switch. Shure Brothers RP81.
5		Case. Shure Brothers RP49. (Used in 4EM26A10).
		Case. Shure Brothers 21RP899F. (Used in 4EM26C10).
6		Adapter. Shure Brothers 65A230.
7		Magnetic controled cartridge. Shure Brothers RP41.
8	3R77P222K	Resistor, composition: 2200 ohms ±10%, 1/2 w.
9		Receiver cap. (Part of item 5).
10		Washer. Shure Brothers 34A321.
11		Escutcheon. Shure Brothers 53A536A.
12		Actuator. Shure Brothers 53A556.
13		Spring. Shure Brothers 44A140.
14		Plunger bar. Shure Brothers RP82.
15		Flat head screw, socket cap: No. 4-40 x 1/4. Shure Brothers 30C557B.
16		Transmitter cap. (Part of item 5).
17		Washer. Shure Brothers 34A309.
18		Magnetic controled cartridge, Transmitter. Shure Brothers RP13.
19		Cable and plug. Shure Brothers RP48. (Used in 4EM26A10).
		Cable and plug. Shure Brothers 21RP738F. (Used in 4EM26C10).
		HOOKSWITCH ASSEMBLY **19B204867G4**
20	4029851P5	Cable clamp; sim to Weckesser 2/16-4.
21	19A121612P1	Holder and switch: thermoplastic case, contact rating 1 amp at 125 v.
22	19B205661G1	Cable: approx 8-1/2 feet long.
23	5493035P10	Resistor, wirewound, ceramic: 3.5 ohms ±5%, 5 w; sim to Tru-Ohn Type X-50.
24	7775500P55	Terminal board, phen: 5 terminals.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

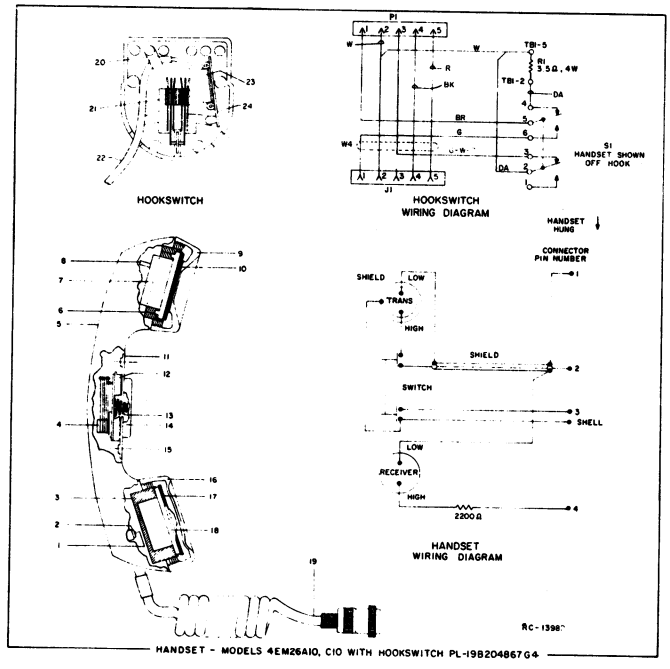
PARTS LIST

LBI-3739D

SPEAKER
MODEL 4EZ20A11
19C320302G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - **LOUDSPEAKERS** - - - - -
LS2	19A116910P1	Permanent magnet, 5 inch, 3.2 ohms ±15 imp, 5 w max operating; sim to Pioneer 002009.
		- - - - - - - - - - **CABLES** - - - - - - - - - -
W2		**CABLE** 19A122167G1
		- - - - - - - - - - **PLUGS** - - - - - - - - - -
P702	5493018P2	Connector, phenolic: 5 contacts; sim to Cinch 204-31-05-010.
		- - - - - - - - - **MISCELLANEOUS** - - - - - - - - -
	19D416396P2	Housing.
	19B219692G2	Grille Assembly.
	19C320016P2	Mounting bracket.
	19A116986P108	Screw, thread forming assembled washer: Phillips Pozidriv®, HI-LO® thread, No. 7-19 x 1/2. (Secures LS2).
	19A116986P112	Screw, thread forming assembled washer: Phillips Pozidriv®, HI-LO® thread, No. 7-19 x 3/4. (Secures grille to housing).
	19A116985P1	Screw, hexhead: No. 1/4-20 x 5/8. (Secures housing to mounting bracket).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SCHEMATIC & OUTLINE DIAGRAM

HANDSET MODEL 4EM26A10
HANDSET MODEL 4EM26C10
HOOKSWITCH 19B204867G4
SPEAKER MODEL 4EZ20A11

RC-1681E
****

PA TRANSISTOR REPLACEMENT

WARNING

The stud mounted RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

To replace the PA transistors (Q2 through Q6):

1. Unsolder one lead at a time with a 50-watt soldering iron. Use a scribe to hold the lead away from the printed circuit board until the solder cools.

2. Turn the transmitter over and remove the unpainted Phillips-head screws holding the multiplier-filter, power detector, and output filter mounting assembly to the transmitter heatsink. Then swing the entire assembly away from the heatsink to expose transistor mounting holes.

3. Hold the body of the transistor to prevent it from turning. Next, remove the transistor hold-down nut and springwasher through the hole in the heatsink with an 11/32-inch nut-driver. Lift out the transistor, and remove the old solder from the printed circuit board.

4. Trim the new transistor leads (if required) to approximately 3/8-inch lengths (3/16 - inch lengths for Q3, Q4 and Q5 on 25-50 MHz transmitters). Cut the collector lead at a 45° angle for future identification (see Fig. 1). The letter "C" on the top of the transistor indicates the collector.

5. Apply a coating of silicone grease around the transistor mounting surface, and place the transistor in the mounting hole. Align the leads as shown in the Outline Diagram. Then hold the body of the transistor and replace the hold-down nut and spring washer, using moderate torque (7 to 9 inch-pounds maximum).

6. Make sure that the transistor is mounted as shown in Figure 2 so that the leads can be soldered to the printed circuit pattern, starting from the inner edge of the mounting hole.

7. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor.

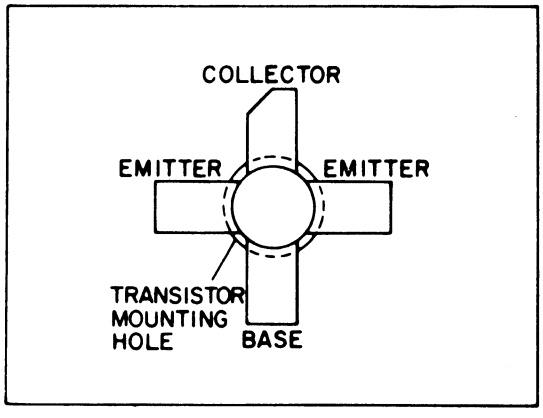


Figure 1 - Lead Identification

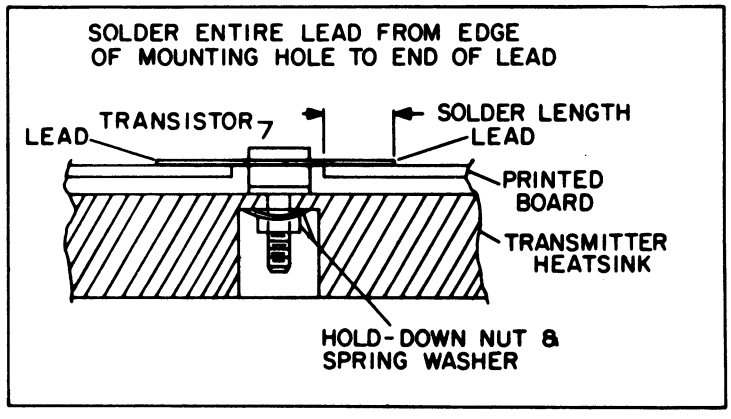


Figure 2 - Transistor Mounting

STEP 1 - QUICK CHECKS

Meter Position	Probable Defective Stage		
	High Meter Reading	Low Meter Reading	Zero Meter Reading
A (MULT-1)	Q105 or Q106	Q105 or open L113	10-volt regulator, osc. crystal or Q104, Q105, Q106
B (MULT-2)	Q107, A201-Q1	Q107	Q107
C (MULT-3)	A201-Q1	10-volt regulator, A201-Q1	10-volt regulator, A201-Q1
D (MULT-4)	A202-Q1	Keyed 12.5 volts, A202-Q1	Keyed 12.5 volts, A202-Q1
E (AMP 1/2)	Q4	Q2, Q3, or protective circuits activated*	Keyed 12.5 volts, short circuit protector, A202-Q1
F (DRIVER Ic)	Top Voltage limiter	Q4, or protective circuits activated*	Keyed 12.5 volts, short circuit protector, Q4
G (PA Ic)	Mis-aligned PA. Check Step 14 of Alignment Procedure.	Q5 or Q6, or protective circuits activated*	Keyed 12.5 volts, short circuit protector, Q5 or Q6
I (Forward Power)	High power output. Check Step 14 of Alignment Procedure.	Mis-aligned PA	NO POWER OUTPUT
J (Reflected Power)	High VSWR-check antenna system and relay	LOW VSWR (Normal)	

* Refer to the power regulator Troubleshooting Procedure for check of protective circuits.

PA TRANSISTOR CHECKS

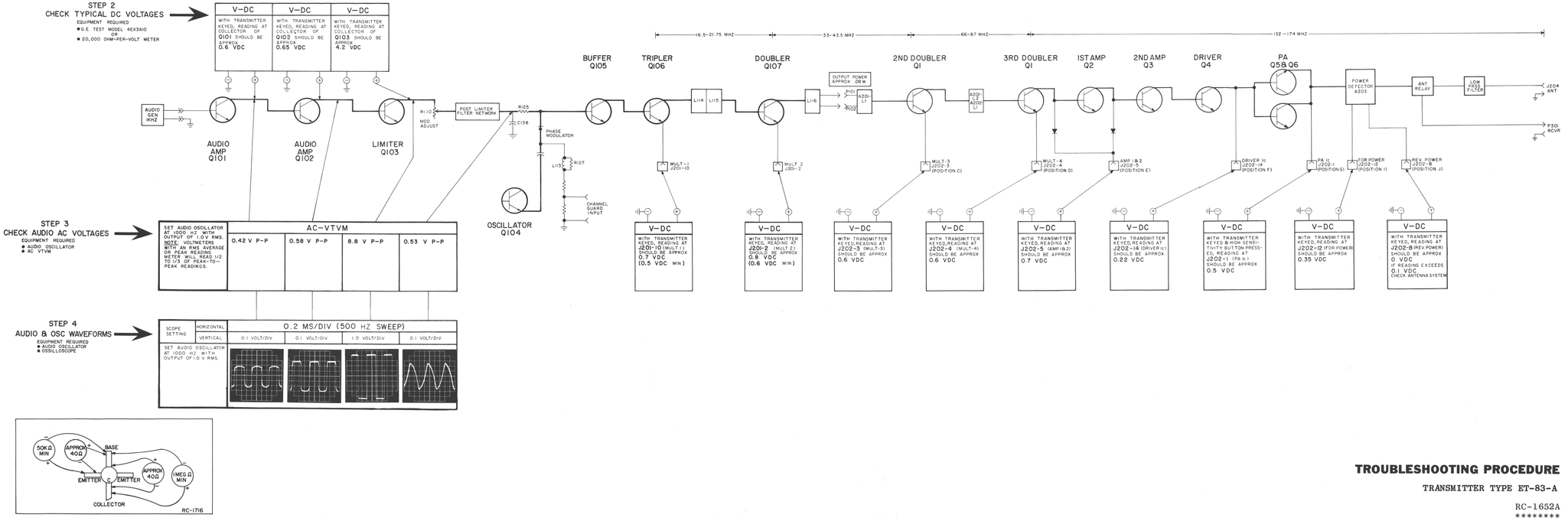
PA transistors Q2 thru Q6 can be checked to determine if they are defective by measuring the junction resistances with an ohmmeter according to the following procedure:

1. Unsolder the base and collector leads with a 50-watt soldering iron. Use a scribe to hold each lead off the printed circuit board until the solder cools.
2. Slip a piece of paper under each unsoldered lead to insulate it from the printed circuit board.
3. Measure the base-to-emitter and base-to-collector resistances, and check with the "good" resistance readings as shown in RC-1716. Always take two different readings for each junction by reversing the meter leads.

NOTE

If either Q5 or Q6 is defective, always replace both transistors. Both replacement transistors should be made by the same manufacturer. The defective transistor may have failed due to an out-of-specification characteristic of the "good" transistor. The "good" transistor may be used in the Driver stage (Q4), or both transistors returned to the factory for replacement if in warranty.

4. If replacement of a transistor is necessary, refer to the replacement procedure on the preceding page.



TROUBLESHOOTING PROCEDURE

TRANSMITTER TYPE ET-83-A

RC-1652A
****

STEP 1 - QUICK CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	Check power connections and continuity of supply leads, and check fuses. If fuse is blown, check for short circuits by disconnecting all plugs in the unit. Reconnect plugs one at a time until a fuse blows.
NO REGULATED 10 VOLTS	Check the 12-volt supply. Then check Q503 in 10-volt regulator and regulator circuit. Disconnect all plugs from the receiver, exciter board and option boards, and take resistance readings from jack pins to ground (Refer to Outline Diagrams).
LOW 2ND LIM READING	Check supply voltages and then check oscillator reading at J304-4 as shown in STEP 2A. Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 2nd Limiter stages as shown in STEP 2A. Check receiver RF alignment (refer to Receiver Alignment Procedure).
LOW OSCILLATOR READING	Check alignment of Oscillator (Refer to Front End Alignment Procedure). Check voltage readings of Q304 and Q305. Check resistance readings on J302-1, -2 and -3. Check crystal Y401.
LOW RECEIVER SENSITIVITY	Check Front End Alignment (Refer to Receiver Alignment Procedure). Check input signal required for 0.2-volt reading at LIM-1. Reading should be less than 20 uv. Check antenna connections, cable and relay. Check voltage readings of 1st and 2nd RF Amps and 1st and 2nd Mixers. Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	Check Audio PA (Q504 and Q505) output current at J304-9. If reading is low -- a. Check BIAS ADJ for 1.3 VDC at J304-9. If incorrect, set for 1.3 v with R392. (Position 0 on Test Set). b. If correct, check for a minimum bias current reading of 14 milliamps at J4. Make SIMPLIFIED GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch Stages. Check unsquelched DC voltage readings in Audio section (Refer to Receiver Service Sheet). Check voltage readings on Channel Guard receiver.
IMPROPER SQUELCH OPERATIONS	Check setting of SQUELCH control R400 (Refer to Receiver Alignment Procedure). Make GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch stages. Check voltage readings of Squelch circuit (Refer to Receiver Alignment Procedure).
DISCRIMINATOR IDLING TOO FAR OFF ZERO	See if discriminator zero is in the center of IF bandpass.

STEP 3- GAIN-PER-STAGE READINGS-

EQUIPMENT REQUIRED:

1. RF VOLTMETER (SIMILIAR TO BOONTON MODEL 91-CA OR MILLIVAC TYPE MV-18 C)
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION). CORRECT FREQUENCY CAN BE DETERMINED BY ZEROING THE DISCRIMINATOR.

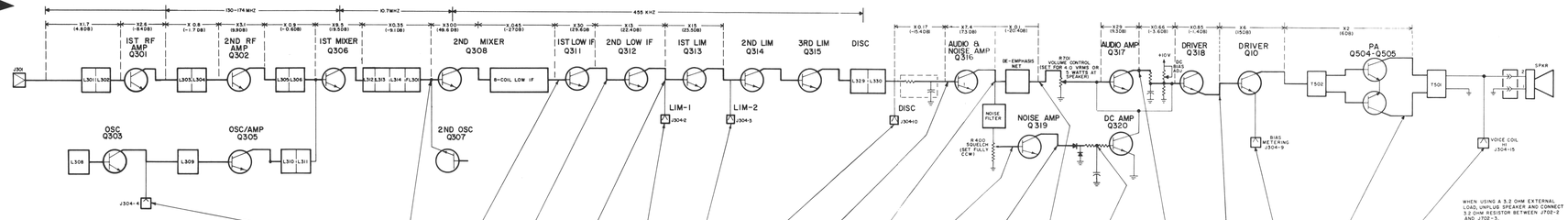
PROCEDURE

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, BASE OF RF AMP). PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E$_i$).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (1ST MIXER*, REPEAK FIRST RESONANT CIRCUIT THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E$_f$).
3. CONVERT READINGS (BY SUBTRACTING E$_f$ FROM E$_i$ ON THE DB SCALE OF RF VOLTMETER, OR) BY MEANS OF THE FOLLOWING FORMULA:

   AMP FACTOR = $\frac{E_f}{E_i}$

4. CHECK RESULTS WITH TYPICAL GAINS SHOWN ON DIAGRAM BELOW.
5. USE PROCEDURE LISTED ABOVE TO FIND GAIN OF EACH STAGE.

* NOTE: REMOVE CRYSTAL OR SHORT OUT OSC. BASE BEFORE MEASURING MIXER STAGES TO ELIMINATE INJECTION VOLTAGE.



WHEN USING A 3.2 OHM EXTERNAL LOAD, UNPLUG SPEAKER AND CONNECT 3.2 OHM RESISTOR BETWEEN J702-2 AND J702-3.
IN DESK TOP STATIONS, DISCONNECT JUMPER FROM T850-1 AND-2 AND CONNECT 3.2 OHM LOAD TO T850-1 AND -2.

STEP 2A- SIMPLIFIED VTVM GAIN CHECKS

EQUIPMENT REQUIRED:

1. VTVM-AC&DC
2. SIGNAL GENERATOR (MEASUREMENTS M56O EQUIV.)

PRELIMINARY STEPS:

1. SET VOLUME CONTROL FULLY CLOCKWISE.
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE.
3. RECEIVER SHOULD BE PROPERLY ALIGNED.

SIGNAL GENERATOR INPUT AT J301 (OR ANTENNA JACK) MEASURED WITH RF DISCRIMINATOR PROBE		UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED	10 MICROVOLTS UNMODULATED	1 MICROVOLT UNMODULATED	STANDARD SIGNAL-(1 MV AT RCVR FREQ MOD BY 1 KHZ WITH 3.3 KHZ DEVIATION)	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL
PROCEDURE		INCREASE GENERATOR OUTPUT UNTIL VTVM READING ON 10 VOLT SCALE INCREASES BY 50 MV	INCREASE SIGNAL GENERATOR OUTPUT FROM STEP ABOVE UNTIL VTVM READING INCREASES BY 5 %	INCREASE SIGNAL GENERATOR OUTPUT FROM STEP ABOVE UNTIL VTVM READING INCREASES BY 5 %	INCREASE SIGNAL GENERATOR OUTPUT FROM STEP ABOVE UNTIL VTVM READING INCREASES BY 5 %													AFTER CHECKING WAVEFORMS SET VOLUME CONTROL FOR RATED 1 WATT OUTPUT ACROSS 3.2 Ω LOAD	
READING	0.41 VDC MIN EX-J-4 0.9 VDC MIN MULTMTR 0.25 VDC MIN	GENERATOR OUTPUT SHOULD BE APPROX 5 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 400 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 70 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 5 MICROVOLTS	0.82 VDC EX-J-4 0.2 VDC MULTMTR 0.4 VDC	1.6 VDC EX-J-4 0.4 VDC MULTMTR 0.8 VDC	0.57 VAC	0.05 VAC	0.89 VAC	0.045 VAC	1.2 VAC	.03 VAC	0.56 VDC	0.34 VAC	0.5 VAC	1.3 VDC	5.8 VAC (COLLECTOR TO GROUND)	4.0 VAC

STEP 2B-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:
1. OSCILLOSCOPE
2. SIGNAL GENERATOR (MEASUREMENTS M560 OR EQUIVALENT).

SCOPE SETTING	HORIZONTAL	0.5 MS/DIV (APPROX 200 CPS)	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV
	VERTICAL	0.5 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV		200 MILLIVOLTS/DIV	500 MILLIVOLTS/DIV		5 V/DIV	2 VOLT/DIV
PEAK-TO-PEAK VOLTAGE		2.1 V P-P	340 MV P-P	2.6 V P-P	0.4 V P-P(NOISE)	3.0 V P-P (NOISE)	0.24 V P-P		1.2 V P-P	1.4V P-P		15 V P-P	11 V P-P
NOISE WAVE FORM													
STANDARD SIGNAL 1 MILLIVOLT AT RECEIVER FREQ MILLIVOLTS AT 1KHZ WITH 3.3 KHZ TOKING WIDE BAND DEVIATION													

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

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GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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