MOBILE RADIO

MASTR
PROGRESS LINE
ROYAL EXECUTIVE

MAINTENANCE MANUAL

Mobile Radio

Control Unit

450 – 470 MHz

TWO-WAY FM MOBILE COMBINATIONS

LBI-4345B

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	KT-14-A
FM RECEIVER 450-470 MHz	ER-50-A
CONTROL UNITS	
Trunk-Mount	EC-67-A
Front-Mount	EC-68-B
POWER REGULATOR	4EP76A10
4-FREQ. OSCILLATOR BOARD	4EG22H10
CHANNEL GUARD BOARD	4EK14B10
FIVE-WATT SPEAKER	4EZ16A18
TRUNK-MOUNT POWER/CONTROL CABLE	
1- or 2-Frequency	19C303910G2
3- or 4-Frequency	19C303910G4
FRONT-MOUNT POWER CABLE	19C303982G2
MOUNTING HARDWARE	
Trunk-Mount	19A122244G2
Front-Mount	19A122244G1
CONTROLLED RELUCTANCE MICROPHONE	19B209102P2
Microphone Bracket	7141414G2
LOCK ASSEMBLY	
Key	5491682P8
Lock (with key)	5491682P14
ALIGNMENT TOOLS	
Hex Slug Type	4038831P3
Slotted Screw Type	4033530G2
450-470 MHz ANTENNA	4EY12A13
FUSE ASSEMBLY	19B216021G1

OPTIONAL EQUIPMENT

CARRIER CONTROL TIMER KIT (Option 8307)	19A127875G4
SPEAKER WINDOW MOUNTING KIT (Option 8009)	19A121879G4
WEATHERPROOF BOX (Option 8013)	
Box	19D402674G1
Cable Entry Kit	19A122244G4
Hardware	19A122244G3
HANDSET (Option 8093)	4EM26C10
Hookswitch	19B204867G4

SPECIFICATIONS*

GENERAL

FREQUENCY RANGE	450-470 MHz
DIMENSIONS (Hx W x D)	
Trunk-Mount	3-7/8" x 13-1/2" x 12-1/2"
Front-Mount	3-7/8" x 13-3/4" x 12-3/4"
WEIGHT (less accessories)	25 pounds
BATTERY DRAIN	
Receiver (at 13.8 VDC)	
Standby (squelched)	120 milliamps
Standby (unsquelched)	1.25 amps
Transmitter	
Transmit (at 13.6 VDC)	8.0 amps
OPERABLE TEMPERATURE RANGE	-30°C to +60°C (-22°F to 140°F)
DUTY CAPABILITY	Transmit: 20% Receive: 100%
MAXIMUM FREQUENCY SPACING	0.4%

TRANSMITTER

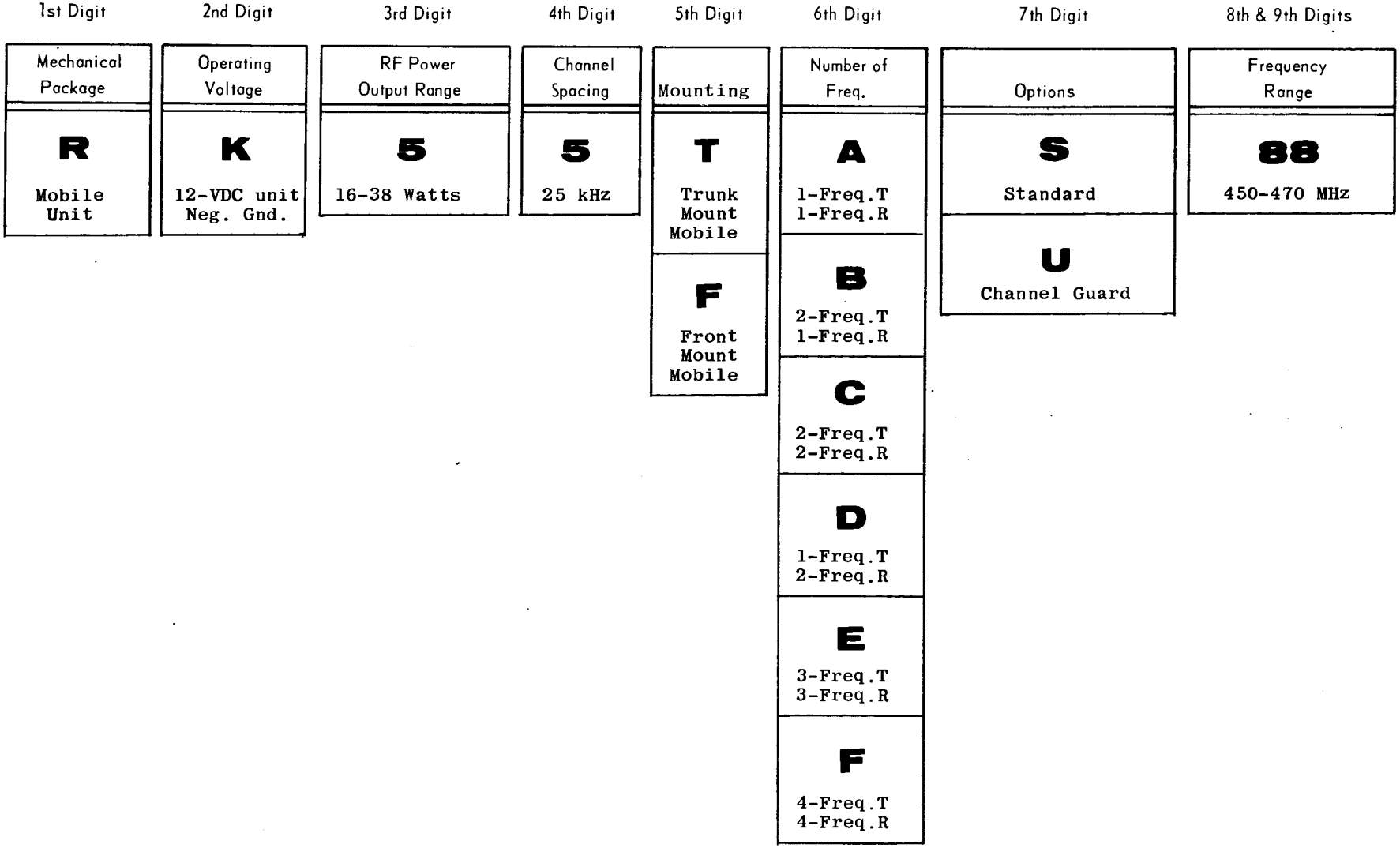
POWER OUTPUT	6-18 Watts Adjustable
FREQUENCY STABILITY	±.0005% (-30°C to +60°C, 25°C reference)
SPURIOUS AND HARMONIC RADIATION	At least 56 dB below power output
MODULATION	Adjustable from 0 to ±5 kHz swing with instantaneous modulation limiting.
AUDIO FREQUENCY	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards.
DISTORTION	Less than 5% @ 1 kHz
DEVIATION SYMMETRY	0.6 kHz maximum (narrow band)
CRYSTAL MULTIPLICATION FACTOR	72

RECEIVER

AUDIO OUTPUT	5 Watts at less than 5% distortion
SENSITIVITY	
12-dB SINAD (EIA Method)	0.4 µv
20-dB Quieting Method	0.6 µv
SELECTIVITY	
EIA Two-Signal Method	-75 dB (adjacent channel, 25 kHz channels)
20-dB Quieting Method	-120 dB at ±25 kHz
SPURIOUS RESPONSE	-85 dB
FIRST OSCILLATOR STABILITY	±.0005% (-30°C to +60°C, 25°C reference)
MODULATION ACCEPTANCE	±8 kHz
INTERMODULATION	-60 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 (0.25 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.

COMBINATION NOMENCLATURE



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 control circuitry for protection of the transmitter output transistors.

All major modules and tuning adjustments are easily accessible (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, power amplifier and multiplier-filter 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 encloses 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 control circuitry to protect the transmitter PA stages against sudden increases in battery voltage, high collector current resulting from transmitter detuning, or an open or shorted 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.

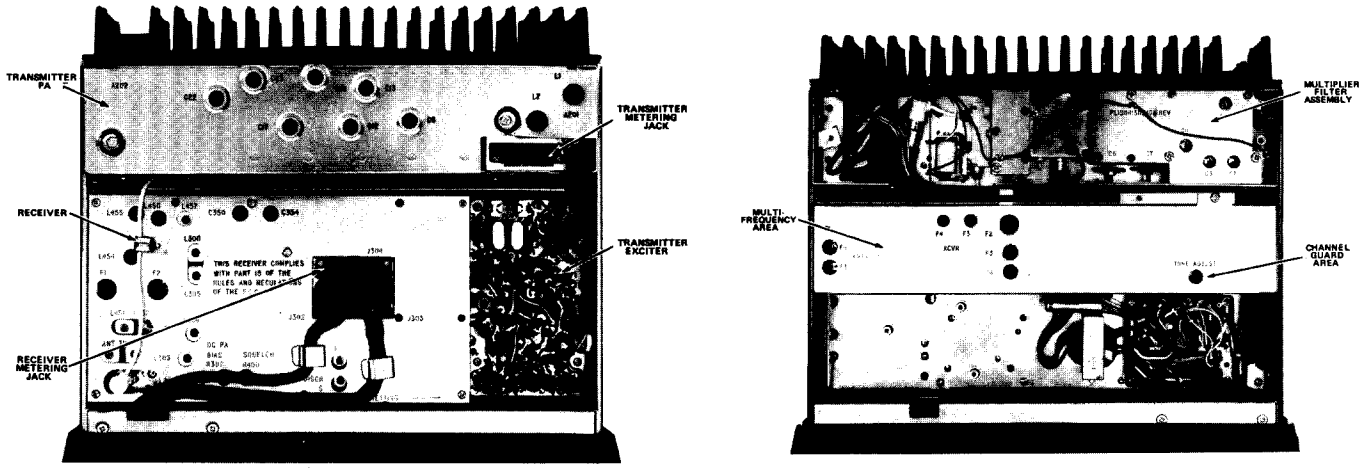


Figure 1 - Royal Executive Module Layout

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 lst 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 NP270303) has been filled out and attached to the transmitter.

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 in the MONITOR button and adjust the VOLUME control for a comfortable listening level.

The radio is now 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 the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

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 the table at the top of page 3.

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 performance 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, power regulator, and noise blanker (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.

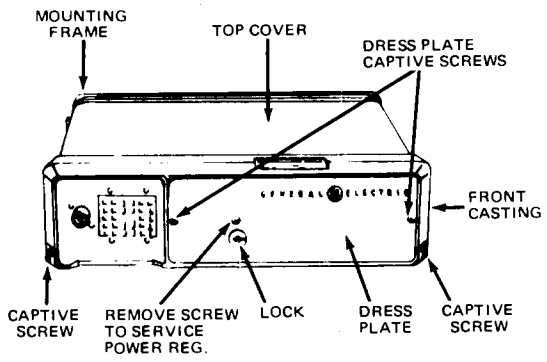


Figure 2 - Disassembly

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 Troubleshooting 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

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.

5. To gain access to the Power Regulator, remove the two dress plate captive screws, remove the screw above the lock, and tilt the front casing down.

INTERMODULATION IMPROVEMENT KIT OPTION 8302

This modification kit is used to improve the intermodulation performance of the receiver with some loss of receiver sensitivity. The installation of this kit consists of changing R301 from a 10K-ohm resistor to a 1500-ohm resistor. R301 is located in the base circuit of Q301. Then tune L302 for the best quieting sensitivity. The 12-dB SINAD sensitivity is changed from 0.4 microvolt to 0.8 microvolt, and the Intermodulation spurious response is changed from -60 dB to -65 dB.

CIRCUIT ANALYSIS

TRANSMITTER

Transmitter Type KT-14-A is crystal controlled, frequency modulated transmitter designed for one-, two-, or four-frequency operation in the 450-470 megahertz band. The transmitter consists of the following assemblies:

- Transistorized Exciter Board -Audio, oscillator, modulator and multiplier stages.
- Transistorized PA Assembly - Multipliers, amplifier, power amplifier, multiplier-filter, antenna relay, and low-pass filter.

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

FREQ. RANGE	PA ASSEMBLY	EXCITER BOARD	NO. OF FREQS.
450 - 470 MHz	4EF44A11	4EG21F10 4EG21F11	1-Freq. 2-Freq.

The transmitter uses 12 transistors to provide adjustable RF power output of 6-18 Watts from 450-470 MHz. The crystals used range from 5.64-6.52 megahertz, and the crystal frequency is multiplied 72 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, multiplier, PA amplifiers, varactor tripler, 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 feed-through 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	Amplifiers and PA supply (Vcc)
J201-3	+12.5 V (Battery)	Relay
J201-11	Keyed +9.5 VDC	Exciter board & 2nd doubler
J201-4	Keyed +12.5V adjustable	Pre Driver (Amp 1) Vcc

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 anode 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 switch-

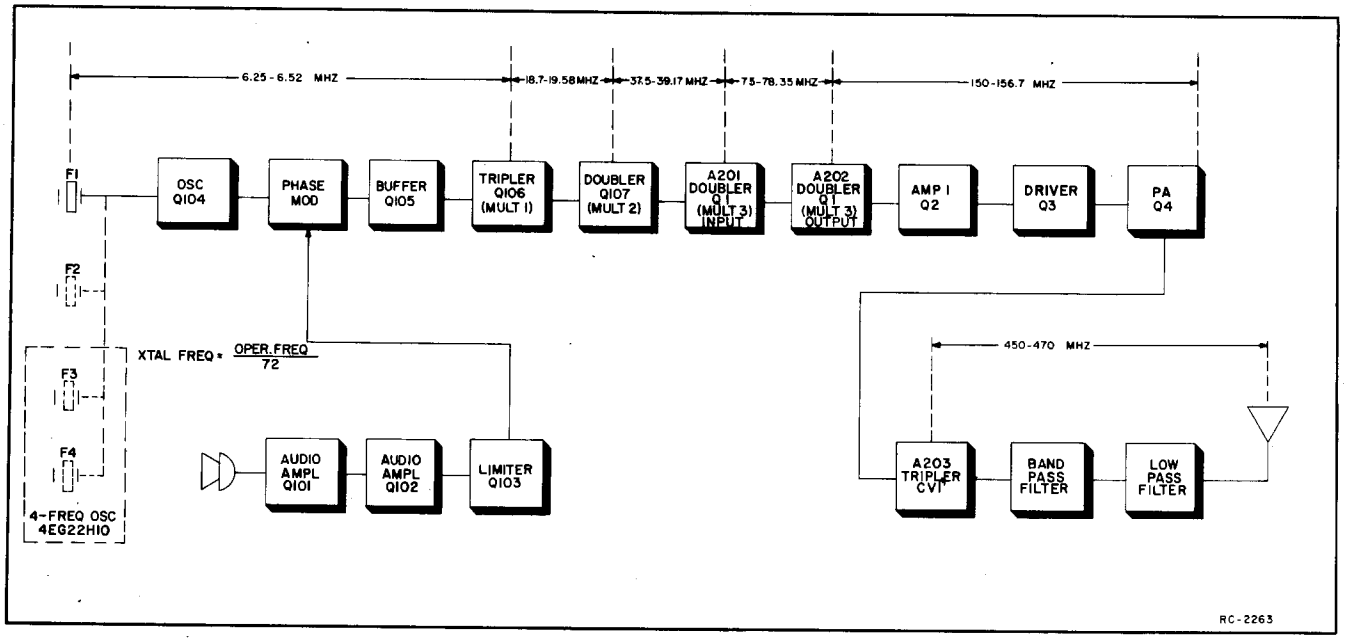


Figure 3 - Transmitter Block Diagram

ed 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 signal level applied to the modulator circuit and is normally 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 R113. 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 4EK14B10 is fed to the modulator circuit through J103 (tone high) and J104 (ground).

BUFFERS 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-L5 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-R2. The 2nd doubler output is coupled through series-tuned circuit L4 (tuned to 12 times the crystal frequency) to the base of 3rd doubler A202-Q1 (MULT-3 OUTPUT). This stage is metered at J202 across A202-R4. The 3rd doubler output is coupled through a series-tuned circuit (tuned 24 times the crystal frequency) to the base of 1st amplifier Q2.

AMPLIFIERS, DRIVER AND PA

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.

Following the doubler is a common-emitter, series-tuned RF amplifier stage, Q2. Q2 base voltage is metered at J202 through metering network CR1, R3 and R4.

Driver Q3 follows the amplifier stage. Collector current for Q3 is metered across metering resistor R201 at J202-14 (Driver Ic). The reading is taken on the 1-Volt scale (the actual current reading is 10 amperes full scale) with the GE Test Set in Position F. The Driver output is coupled through a series-tuned circuit to base of the power amplifier Q4.

Q4 operates as a common-emitter power amplifier to provide variable RF power output of 10-35 Watts. Collector current for the PA transistor is metered across metering resistor R202 at J202-1 (PA Ic). The reading is taken on the 1-Volt scale (the actual current reading is 10 amperes full scale) with the GE Test Set in Position G, and with the HIGH SENSITIVITY button pressed.

Meter shunt R202 also serves a a voltage and current sensing element in conjunction with the Power Regulator to provide protection for the PA transistors by reducing the supply voltage of the pre-driver amplifier Q2 when the collector current or the supply voltage of the PA amplifier Q4 rises. Reducing the supply voltage of Q1 causes the RF drive to the PA transistor Q4 to be reduced thus limiting the DC input power and holding the RF output power approximately constant.

The adjustable RF power output feature is accomplished by controlling the supply voltage of the pre-driver amplifier Q2. Potentiometer R13 on the Power Regulator board controls the RF power output by varying the supply voltage to the pre-driver amplifier Q2.

CAUTION

Supply Voltage for the 3rd doubler Q1, driver Q3 and the PA stage Q4 is on continuously.

The output of the PA is coupled through a series-tuned circuit to the multiplier-filter assembly.

MULTIPLIER-FILTER ASSEMBLY

Multiplier-Filter assembly A203 consists of a varactor tripler, bandpass filter, low-pass filter and antenna switching relay.

RF signals from the PA are applied to a passive tripler circuit. The tripler consists of three tuned stages (C1-L1-C2, C3-L3, and C4-L4) which are coupled together through the common impedance of varactor CV1. The first tuned circuit is tuned to the fundamental frequency. The second tuned circuit is tuned to twice the input signal, and provides a harmonic which mixes with the input signal to produce the desired output (or operating frequency). The third tuned circuit is tuned to the operating frequency. Metering for the tripler is across metering network R1 and R2 at metering jack J202.

Following the tripler is a bandpass filter consisting of two inductively coupled helical resonators (C7-L5 and C8-L6). The filter is tuned to select only the third harmonic, and removes any even harmonics in the tripler output.

The filter output is coupled through a short length of RF cable to the low-pass filter which further attenuates any harmonics in the transmitter output. The RF output of the transmitter is then connected through the antenna switching relay K1 to the antenna.

RECEIVER

Receiver Type ER-50-A (450-470 MHz) is a double conversion, superheterodyne FM receiver designed for one-, two-, or four-frequency operation. 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.

A regulated +10 Volts is used for all receiver stages except the audio drivers and audio PA stages, 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

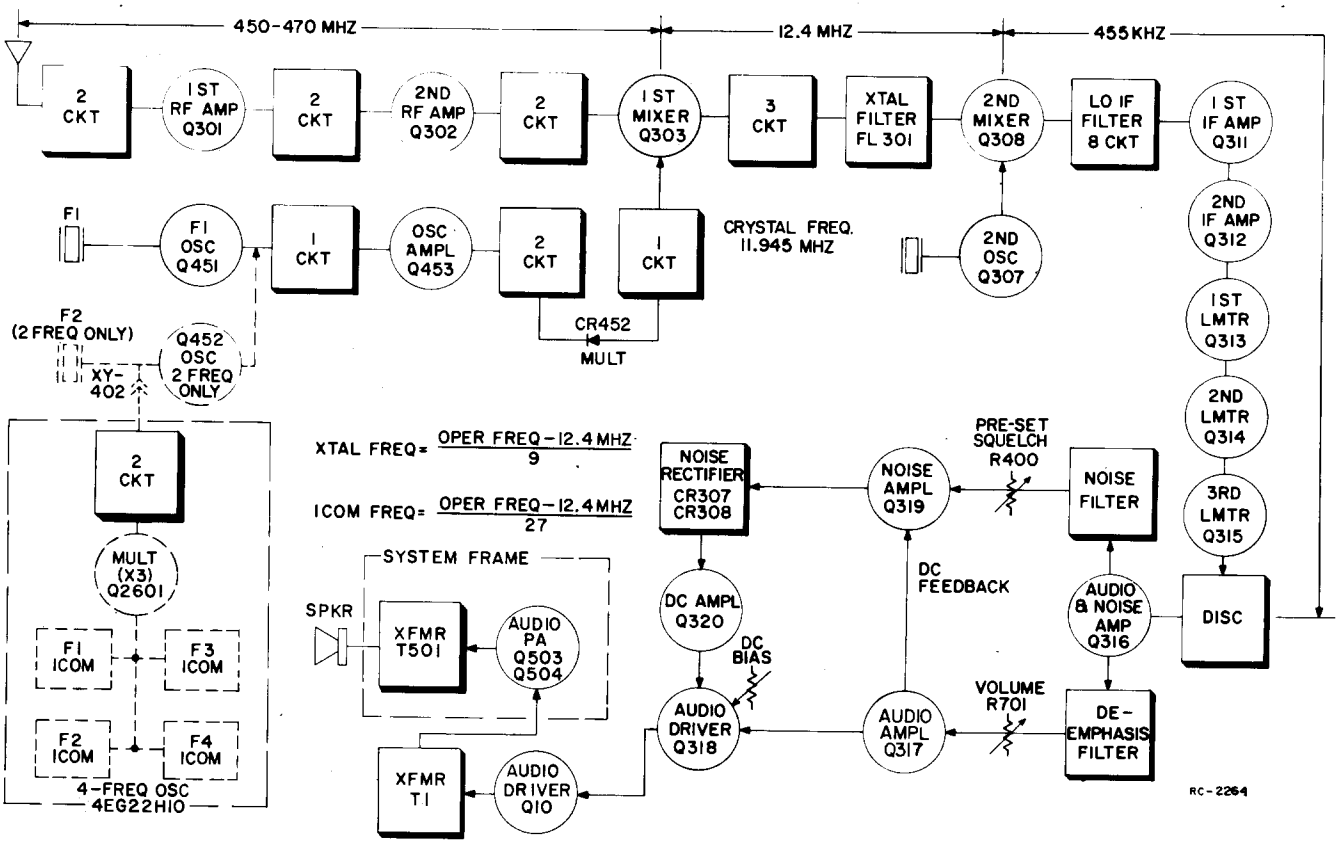


Figure 4 - Receiver Block Diagram

+10 Volts and the 12-Volt supply.

RF AMPLIFIERS

RF signals from the antenna are link-coupled through helical resonators L301 and L302 to the base of 1st RF amplifier Q301. The output of Q301 is link-coupled through helical resonators L303 and L304 to the base of the 2nd RF amplifier Q302. The output of Q302 is link-coupled through L305 and L306 to the base of 1st mixer Q303.

STANDARD OSCILLATOR

The F1 oscillator is a third mode oscillator operating in the 48 to 50 megahertz region. The crystal is connected in the oscillator feedback path to permit oscillation only at the crystal frequency. L451, C451 and C452 make up the mode selective circuit. L451 is adjustable to permit the oscillator frequency to be shifted slightly for setting the receiver on the system operating frequency.

The oscillator is frequency compensated over the temperature range by thermistor network RT451, RT452, and varactor CV401. The network provides instant frequency compensation without crystal ovens or heaters.

For two-frequency operation, an F2 oscillator stage (similar to the F1 oscillator stage) is added. The proper channel is selected by grounding the emitter of the desired oscillator through a two-frequency switch on the Control Unit.

ICOM OSCILLATOR

For four-frequency operation, oscillator board Model 4EG22H10 is added. The oscillator board is designed for use with the GE Integrated Circuit Oscillator Module (ICOM) Model 4EG26A13. The ICOM module consists of a crystal-controlled Colpitts oscillator, a voltage regulator, and a buffer output stage.

The entire module (including crystal) is enclosed in a dust-proof aluminum can, with the ICOM frequency and the receiver operating frequency printed on the top. Access to the oscillator trimmer is obtained by prying off the plastic GE decal on the top of the can. The oscillator frequency is temperature-compensated at both ends of the temperature range to provide instant frequency compensation without crystal ovens or warmers.

The ICOM output is applied to the base of tripler Q2601 on oscillator board Model 4EG22H10. The tripler output is coupled through two tuned circuits (L2601 and L2602) to crystal socket XY402 on the receiver. In four-frequency radios, the F2 oscillator stage on the receiver is modified so that Q452 operates as a tripler. The proper channel is selected by grounding pin 3 of the desired ICOM by means of a four-frequency switch on the Control Unit. The tripler stage on the receiver is metered at J2605.

CAUTION

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

OSCILLATOR AMPLIFIER AND MULTIPLIER

The oscillator output is coupled through L454 to the base of the oscillator amplifier Q453. L454 is tuned to three times the oscillator frequency. The output of Q453 is coupled through two tuned circuits (L455 and L456) to the cathode of multiplier diode CR452. The anode of CR452 is connected to helical resonator L457, which is tuned to nine times the oscillator frequency.

1ST MIXER AND CRYSTAL FILTER

RF from Q302 is applied to the base of 1st mixer Q303, and the low-side injection voltage from the multiplier is applied to the emitter of the 1st mixer. The 12.4 megahertz high IF output is coupled through three tuned circuits (L312-C350, L313-C354 and L314-C357) to provide high IF selectivity and impedance matching to the crystal filter.

High IF crystal filter FL301 has the required selectivity to prevent adjacent channel signals from overloading the 2nd mixer, and to reduce intermodulation spurious responses.

2ND OSCILLATOR AND MIXER

High IF from the crystal filter is applied to the base of the 2nd mixer Q308 with the 11.945 MHz 2nd oscillator output to produce the 455-kHz low IF.

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

LO-IF AMPLIFIERS AND LIMITERS

Following the low IF filter are two R-C coupled low 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 overdriven 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 (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, audio driver Q318 and audio PA Q504 and Q505. DC BIAS trimmer R392 sets the bias on Q318 and audio driver Q10 on the power regulator assembly, and is adjusted for a reading of 0.9 Volt at metering jack J304-9. The output of Q318 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 noise amplifier is set by SQUELCH control R400. The output of noise 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 amplifier increases, quickly turning the audio stages off.

When the receiver is quieted by a signal, less noise is present in the circuit and the DC amplifier turns 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 4EP76A10 contains the receiver audio PA stages, the protective circuit 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 receiver and multi-frequency board.
- A keyed +10 Volts for the transmitter exciter, multiplier board, 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 pre-driver Amp. 1 supply.

Supply voltage (+12 Volts) for the receiver audio stages, transmitter PA and driver, 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 5.

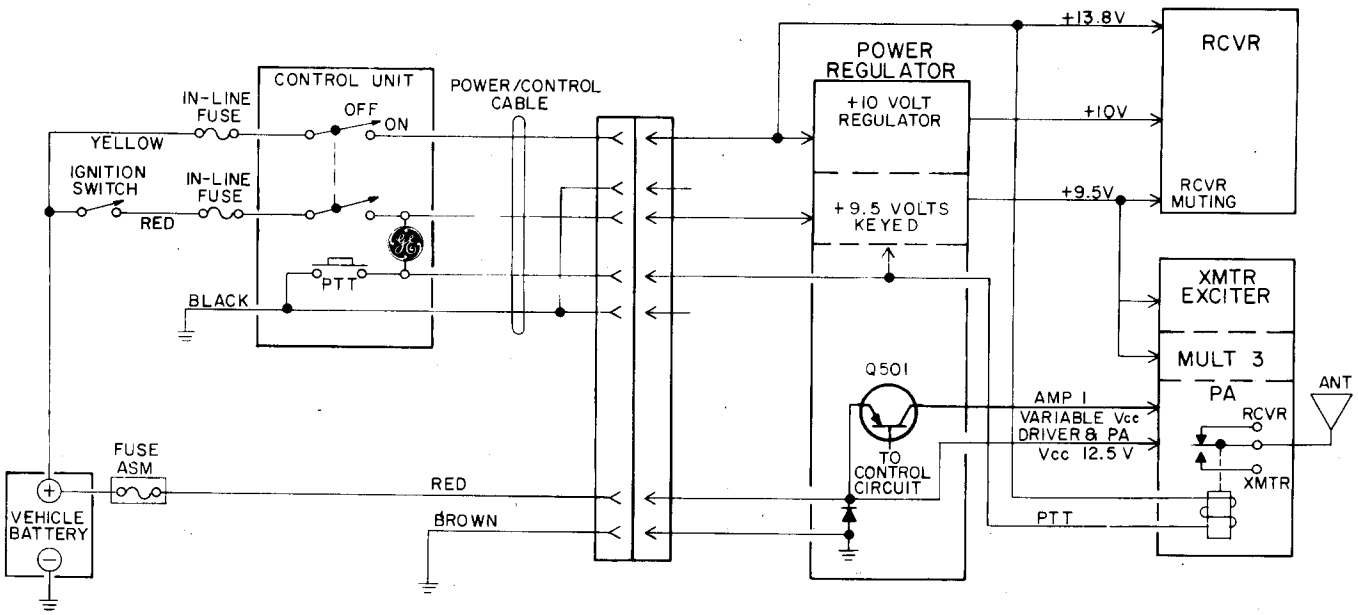
The 10-Volt keying circuit, one stage of the 10-Volt regulator, two DC amplifier stages, one RF power control stage, one constant current stage, two reference stages (integrated circuit), a differential amplifier comprising two stages, and the audio PA driver are mounted on printed wiring board A501. The regulator board is mounted in the front casing.

PA pre-driver regulator transistor Q501, 10-Volt regulator Q502, and audio PA transistors Q503 and Q504 mount on the front casing which acts as a heatsink for these stages.

AUDIO PA

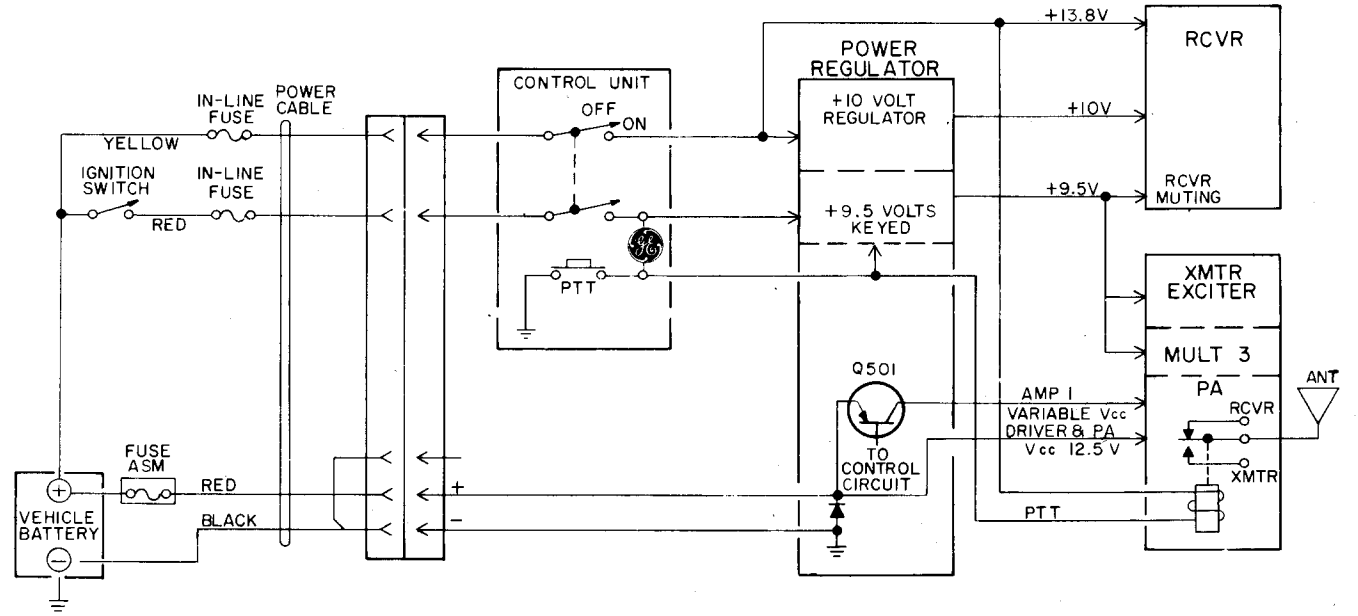
The output of Q318 on the receiver chassis is applied to the base of audio driver Q9 on the power regulator board. Bias to Q9 is set by DC bias potentiometer R392 on the receiver. The potentiometer is set for 0.9 Volts at receiver metering jack J304-9 (position G on GE Test Set). Audio from Q9 is coupled through transformer T1 on Audio PA board A502 to provide phase inversion for the push-pull audio PA stage.

TRUNK MOUNT



RC-2204

FRONT MOUNT



RC-2205

Figure 5 - 12-Volt, Negative Ground Power Distribution Diagram

Q503 and Q504 operate as a push-pull, class AB audio PA stage. The PA output is coupled through audio transformer T501 to the loudspeaker. The yellow and white tertiary windings of T501 supply balanced feedback to the collector of Q9. The feedback winding minimizes distortion and prevents the pick-up of external electrical noise.

The PA stage provides a 5-Watt output at less than 5% distortion into a 3.5-ohm load at the receiver output terminals (3.2-ohms at the Control Unit). Base bias for the PA stage and the elimination of cross-over distortion is controlled by potentiometer R4 on the Audio PA board. The potentiometer is set at the factory as shown in STEP 1 of the receiver Test Procedure.

NOTE

Do not adjust potentiometer R4 unless PA transistors Q503 and Q504 have been replaced.

Audio high and low are also present at centralized metering jack J304, and can be used as shown in STEP 1 of the Test Procedure.

A bias network consisting of R3, R4, R5, R6 and thermistor RT1 keeps the audio PA bias constant over wide variations in temperature. The PA output is coupled through audio transformer T501 to the loudspeaker.

+10 VOLT REGULATOR

The +10-Volt regulator provides a closely-controlled supply voltage for the transmitter, receiver, Channel Guard and multi-frequency boards, and Carrier Control Timer.

Supply voltage from the vehicle battery is applied to the collector of regulator transistor Q502, causing the transistor to conduct (see Figure 6). When the output voltage at the collector of Q502 tries to increase, the voltage at the base of Q10 tends to become more positive, causing Q10 to conduct harder. With Q10 conducting harder, the voltage at the base of transistor Q502 becomes less positive and Q502 conducts less. This increases the voltage drop across Q502, keeping the output constant.

Potentiometer R28 is used to set the emitter-base voltage of Q10 for the desired 10-Volt output. R26 and R27 limit maximum current through Q10. R39 provides bias current for Zener diode VR3, and lamp DS1 provides bias for Q502. The output voltage is metered at receiver centralized metering jack J304.

Diode CR1 provides reversed polarity protection for regulator transistor Q502. Inadvertently connecting the battery cables to the wrong polarity will cause the shunt diode to conduct, blowing the main fuse.

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 CR1. This forward biases the diode so that the battery voltage is applied to the base of gating transistor Q8 (see Figure 7).

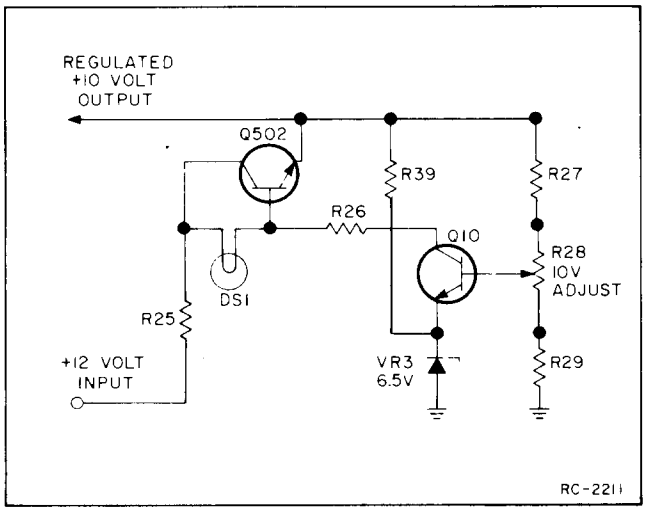


Figure 6 - +10 Volt Regulator Circuit

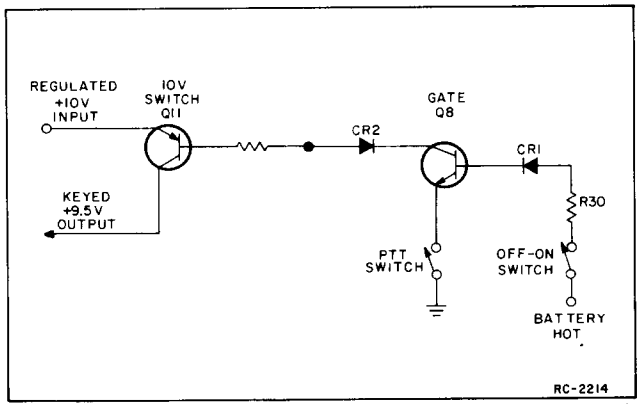


Figure 7 - +10-Volt Keying Circuit

With the battery voltage applied to the base of Q8, keying the microphone grounds the emitter, causing it to conduct. When conducting, the collector voltage of Q8 drops to ground potential which forward biases CR2 and turns on switching transistor Q11. The nominal +9.5-Volt collector output voltage is applied to the transmitter exciter board to the multiplier board, and protective circuitry to key the transmitter.

The keyed 9.5 Volts is also connected through dropping resistor R501 (on TB3) to the base of receiver DC amplifier Q320. The resultant voltage causes the DC amplifiers to conduct, which turns off the receiver audio amplifiers and squelches the receiver.

Diode CR1 is connected in series with Q8 to provide polarity protection for the 10-Volt switching circuit.

PA PROTECTIVE CIRCUITS

The power regulator board, A501, senses the PA collector current and the input supply voltage and uses these parameters to control the collector voltage of the transmitter pre-driver (Amp. 1) stage. A differential amplifier (Q1 & Q3) is used to control a 2-stage DC amplifier (Q6 & Q7) which in turn controls the emitter-base bias of the pre-driver pass transistor Q501 (see Figure 8). An integrated circuit (Q4A & Q4B) is used as the reference transistor for the PA collector sensing voltage and the DC input voltage. Q5 is used in conjunction with potentiometer R13 to provide a means of adjusting the RF power output by controlling the pre-driver collector voltage.

The voltage drop (approximately 100 MV) across the PA Collector metering resistor R202 (and R203 if used), is used to sense the current changes as a result of detuning or an antenna mismatch. This voltage appears between J1 and J2 of the power regulator board A501. Bias for Q4B is determined by precision resistors R1, R2, and R3 in addition to the voltage drop across the metering resistor R202 (and R203 if used). When the PA collector current increases, Q4B conducts harder causing the base voltage of Q1 to rise and reduces Q1 conduction. This lowers the Q1 collector voltage which reduces Q6 & Q7 conduction. Reduced conduction of Q7 causes Q501 to conduct less increasing the voltage drop from emitter to collector of Q501 which lowers the collector voltage supplied to the pre-driver (Amp 1) stage. This reduces the RF driver power to the driver and PA stages and causes the collector current to drop which completes the regulation loop.

In a similar fashion an increase in input supply voltage causes the collector voltage of Q5 to rise. This results in a lower emitter-base voltage on Q4A causing Q4A to conduct less. Q3 emitter-base voltage is increased and Q3 conducts more resulting in Q1 conducting less. The collector voltage of Q1 then drops and the regulation loop is completed as before.

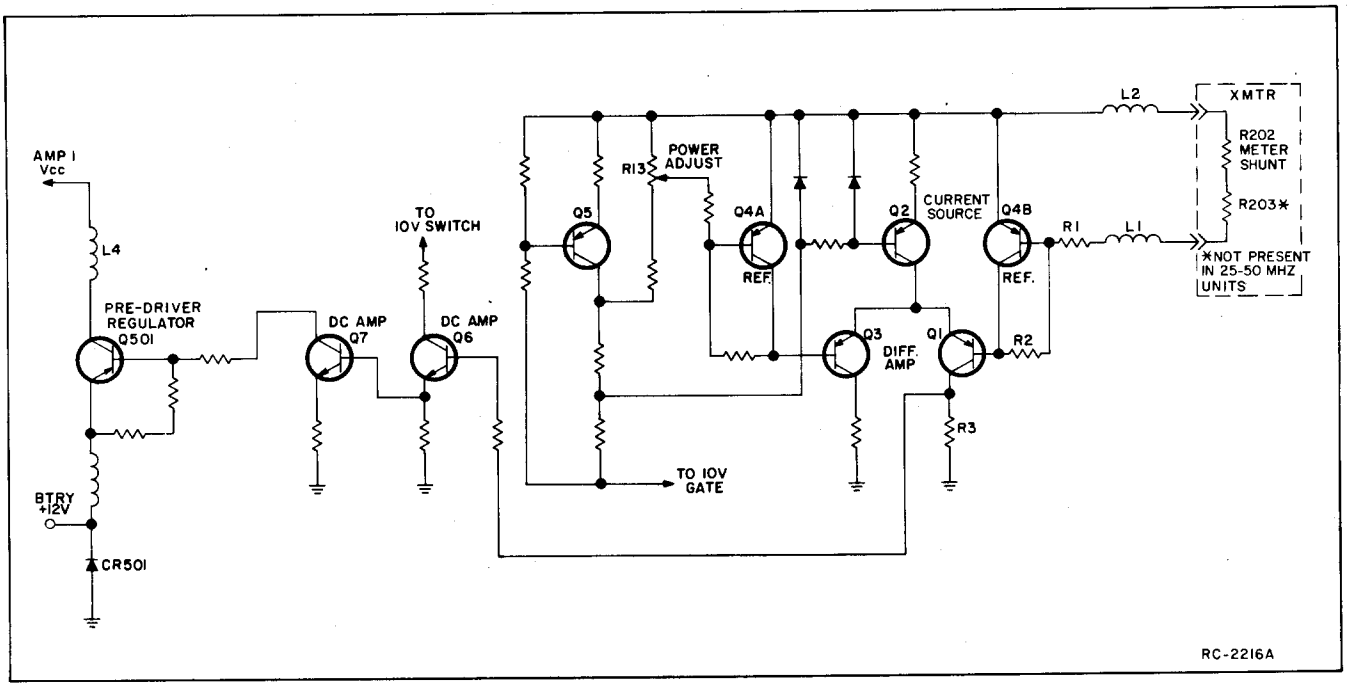


Figure 8 - PA Protective Circuits

Q2 serves as a constant current source of approximately 4 MA for the differential amplifier.

HEAT SINK SERVICING

Since the metal envelopes of Q501 through Q504 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 be 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.

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

Off-Volume Control (S701/R701)

The OFF-VOLUME control normally determines whether or not the transmitter 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 10 Volts to the transmitter exciter and multiplier. 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.

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 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 positive. 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 the 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 fused 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 by-pass, 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 a fully transistorized encoder-decoder for use with MASTR Executive Series 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.

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

CARRIER CONTROL TIMER

The Carrier Control Timer option shuts off the transmitter on each transmission after a one-minute time 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 chasis.

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.

FOR REDUCED POWER APPLICATIONS ONLY

Through the square hole in the chassis, adjust R13 on the Power Regulator board to the desired RF power output level from 6-18 Watts.

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 4EX6A1G
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) and 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

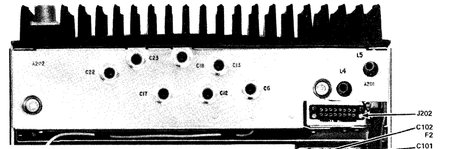
where

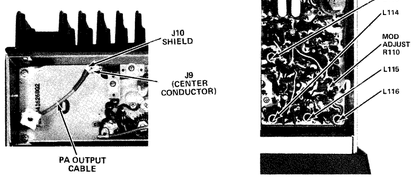
P_i is the power input in Watts.

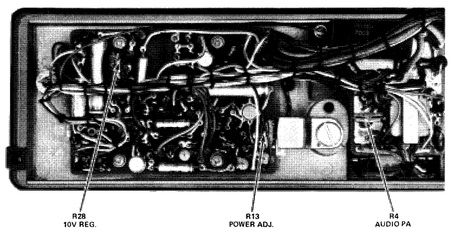
PA voltage is measured with the GE Test Set in Position G on the 15 Volt scale, and the polarity switch in (-) position.

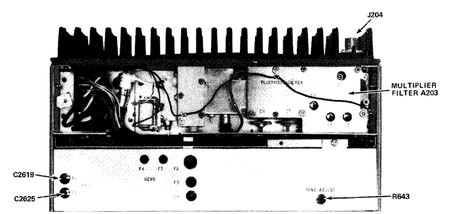
PA current is measured with the Test Set in Position G in the Test 1 position, and with the HIGH SENSITIVITY button pressed (10 Amperes full scale).

Example: P_i = 12.5 Volts x 4 Amperes = 50 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 Ant. Jack J204 (See Step 4 of Preliminary Checks and Adjustments).
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal(s) in crystal socket (crystal frequency = operating frequency ÷ 72).
2. For large change in frequency (2 MHz or over) or a badly misaligned transmitter, set crystal trimmer C101 to mid-capacity. In multi-frequency transmitters, set all crystal trimmers to mid-capacity and set the channel selector switch to the highest frequency.
3. Turn the slugs in the Exciter coils (L113, L114 L115, L116) to the bottom of the coil. Set A201-L5 and L4 (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 C6, C12, C13, C18, C22, and C23 (on PA Board) 1/2 turn out from the tight position. Turn C17 1/4 turn out from the tight position.
4. For large changes in frequency (2 MHz or over) or in a badly misaligned transmitter, remove the PA cover and disconnect the PA output cable from J9 and J10 on the PA board. Then connect the wattmeter to J9 and J10 using the adaptor cable as shown in Figure 14.
5. For large changes in frequency or badly mis-aligned transmitter, turn mica compression capacitor C1 on the Multiplier-Filter assembly all the way to the right (clockwise). Then set the capacitor one-quarter turn counterclockwise. Then set C2, C3 and C4 for maximum capacity (plates fully meshed). Next, set C7 and C8 for minimum capacity with thumb-wheels approximately 3/8-inch away from the filter wall. Use a non-metallic screwdriver to adjust C1 thru C4.
6. Connect the GE Test Set to Receiver Metering Jack J304 and check for +10 volts at Position J. If reading is not 10 volts, refer to the Power Regulator Outline Diagram and set R28 for +10 volts.
7. 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).
8. All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.
9. Adjust R13 on the Power Regulator board fully clockwise (maximum power output position).

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 maximum reading. 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 INPUT)	A201-L5, L4 (MULT-3) & L116	See Procedure	Adjust A201-L5 for maximum meter reading. Re-adjust L116 for maximum meter reading. Then adjust A201-L4 for minimum meter reading.
4.	D (MULT-3 OUTPUT)	A202-C6 (PA) A201-L4 (MULT-3)	Maximum	Adjust A202-C6 for maximum meter reading. Then re-adjust A201-L4 for maximum meter reading.
5.	F (DRIVER Ic)	A202-C6, C12 & C13	Maximum	Adjust A202-C12, C13 & C6 for maximum meter reading. Re-adjust C12 C13 several times for maximum meter reading.
6.	G (PA Ic)	A202-C17 & C18	Maximum	With the High Sensitivity button pressed, alternately adjust C17 and C18 several times for maximum meter reading.
7.	G	A202-C22 & C23	Minimum "G" reading Maximum power out	With the High Sensitivity button pressed, alternately adjust C22 and C23 several times for maximum RF power output and minimum PA collector current (Position "G" reading). Repeat steps 4 thru 7 if necessary to obtain maximum RF power output.
8.		A201-L4 A202-C6, C12, C13, C17, C18, C22, C23	Maximum	After performing the above steps, adjust A201-L4, C6, C12, C13, C17, C18, C22 & C23 for maximum Power Output.

TRANSMITTER ALIGNMENT (CONT'D)

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
				MULTIPLIER-FILTER ASSEMBLY
9.				If connected, remove the wattmeter from J9 and J10, and connect it to antenna jack J204. Re-connect the PA output cable to J9 and J10. Then switch the Test Set polarity to (-).
10.	H Varactor	C2 & C1 (Multi-filter)	Maximum	Adjust C2 and then C1 for maximum meter reading. (Use a non-metallic screwdriver to adjust C2, C3 and C4).
11.	H Varactor	C3 & C4 (Multi-filter)	Minimum	Adjust C3 and then C4 for minimum meter reading.
12.	H Varactor	C7 & C8 (Multi-filter)	Maximum	Adjust C7 and C8 for maximum power output. NOTE Always tune C7 and C8 so that thumb-wheels remain relatively even.
13.	H Varactor	C2, C3, C4 & C1, C7, C8 (Multi-filter)	Maximum	Re-adjust C2, C3, C4 and then C1, C7 and C8 for maximum power output. Repeat Steps 9 thru 13 until rated power output is obtained. If more than rated power output is obtained, adjust R13 for rated power output.
				1- AND 2-FREQUENCY ADJUSTMENT
14.		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.

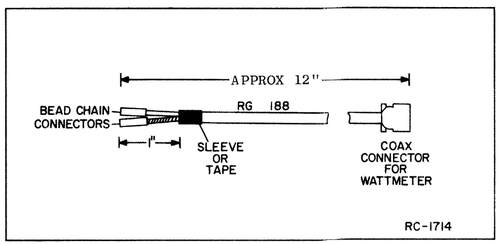


Figure 14 - PA Adapter Cable

ALIGNMENT PROCEDURE

TRANSMITTER TYPE KT-14-A

RC-2266B

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:

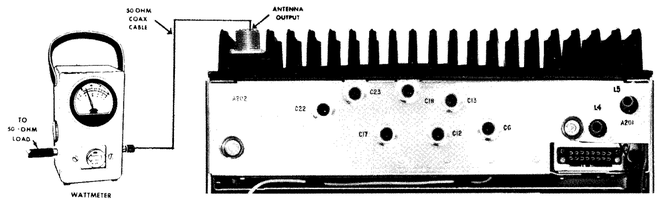
1. Wattmeter similar to:
   Bird #43
   Jones #711N
2. VTVM similar to:
   Triplett #850
   Heath #IM-21
3. Audio Generator
   GE MODEL 4EX6A10
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements #140
   Lampkin #205A
5. Multimeter similar to:
   GE TEST SET
   MODEL 4EX3A10 or 4EX8K11

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

A. Connect transmitter output to wattmeter as shown below:



B. Key transmitter and check wattmeter for rated power output.

SERVICE CHECK

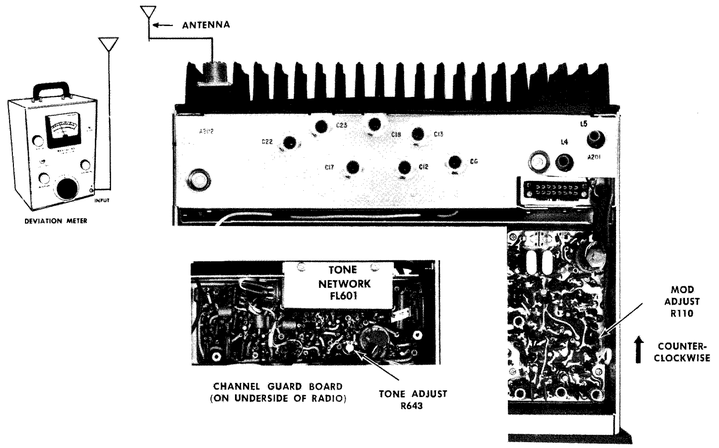
Refer to Service Hints on Transmitter Troubleshooting Procedure.

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.

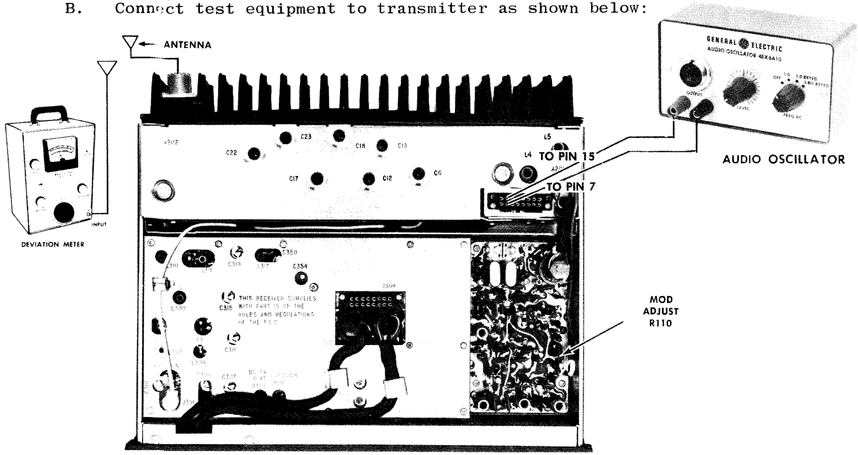
STEP 3

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.

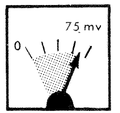
DEVIATION METER

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 3.0 kHz. Voltage should be LESS than 90 millivolts (typically 75 mv).



METER

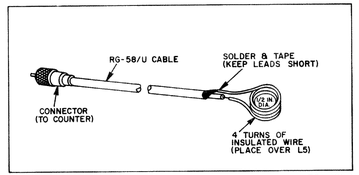


Figure 15 - Coaxial Cable and Test Loop

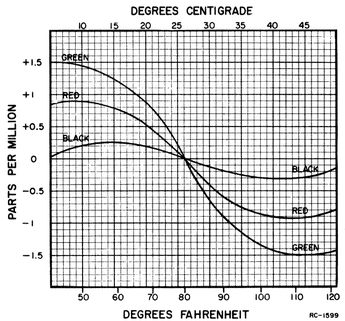


Figure 16 - ICOM Correction Curves

(DF-1091)

FREQUENCY ADJUSTMENT

STANDARD OSCILLATOR

METERING POSITION		TUNING CONTROL	METER READING	PROCEDURE
TEST SET	MULTIMETER + at J304			
A	pin 10	L451 (L452 for 2-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L451 (L452 for 2-frequency) for zero discriminator reading. In 3- or 4-frequency units, refer to the ICOM alignment Procedure.

—— NOTE ——

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.

ICOM OSCILLATOR:

Due to the high stability of the ICOM module, it is not recommended that zero discriminator be used as the indication for setting the oscillator frequency. Instead, measure the ICOM frequency as described in the following procedure.

EQUIPMENT REQUIRED:

1. Frequency Counter capable of measuring the 42-52 MHz frequency range. The counter should have an accuracy of 0.4 part-per million (PPM).
2. Coaxial cable with test loop as described in Figure 15.
3. Mercury thermometer.

PROCEDURE:

1. Check the ICOM temperature by taping the mercury thermometer to the side of the ICOM.
2. Connect the frequency counter to L2602 on multi-frequency board 4EG22H10, using the 4-turn test loop and cable shown in Figure 15.
3. If the ICOM temperature is 80°F (±4°F) or 26.5°C (±2°C), the frequency indication on the counter should be 3 times the frequency stenciled on the ICOM case. Adjust the ICOM trimmer (if necessary) to obtain this frequency.
4. If the temperature is not within the 80°F (±4°F) or 26.5°C (±2°C) range, use the correction curves of Figure 16 for setting the ICOM frequency as follows:
   a. Check the color dot beneath the GE emblem and select the matching curve to determine the correction factor in parts-per-million (PPM).
   b. Multiply the frequency stenciled on the ICOM by 3 and then multiply this figure by the correction factor (from Figure 16) observing the sign (±) given to the correction factor.
   c. The frequency measured at L2602 should be 3 times the ICOM frequency ± the correction factor. Adjust the ICOM trimmer (if required) to obtain this frequency.

FOR EXAMPLE

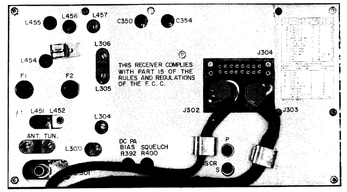
ICOM Frequency	-	16.948,148 MHz
ICOM Color Dot	-	Green
Ambient Temperature	-	35°C (95°F)
Correction Factor (From Figure 16)	-	-1.15 PPM

Multiply ICOM Frequency by 3;
(16.948,148 MHz x 3 = 50.844,444 MHz)

Multiply preceding figure by correction factor;
(50.844 MHz x -1.15 PPM = -58.47 hertz (or -58 hertz)

Set the frequency measured at L2602 for 50.844,386 MHz;

50.844,444
- 58
50.844,386



MULT-FREQ BOARD ALIGNMENT

Remove cover from the multi-frequency board.

1. Place ICOM's ($\frac{Fo - 12.4}{27}$) in proper socket. Do not adjust ICOM trimmer.
2. Connect test set probes to J2605 (+) and J2606 (GND) on multi-frequency board.
3. Tune L2601 for maximum meter reading. Then tune L2602 for minimum meter reading.
4. Tune L452 on receiver board for maximum meter reading. Next, complete the receiver alignment procedure.

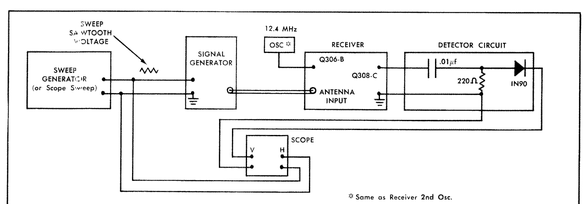


Figure 17 - High and Low IF Filter TEST Circuit

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED:

1. GE Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11 or 20,000 ohms-per-Volt.
2. A 12.4 MHz (±200 Hz) and 406-470 MHz signal source. Couple the 12.4 MHz signal through a 0.01 µF capacitor. Keep signal levels below saturation.
3. For Alignment steps 4 thru 8 - Oscilloscope, sweep generator, 21.4 MHz marker generator and construct a detector circuit (see Figure 17 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 regulation Outline Diagram and set R39 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 combination with Power Regulator Model 4EP57A10 in Rev. G or later, set PA Bias R392 for a reading of 1.3 Volts. For Power Regulator Model 4EP57A10 in Rev. F or earlier, set R392 for a reading of 0.7 Volts. In combination with Power Regulator Model 4EP76A10, set R392 for a reading of 1.3 Volts. In combinations with Power Regulator Model 4EP78A10, set R392 for a reading of 0.9 Volts.
5. For multi-frequency receivers with ICOM oscillators, refer to the MULTI-FREQUENCY BOARD ALIGNMENT.

ALIGNMENT PROCEDURE:

STEP	METERING POSITION: TEST SET	MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
			DISCRIMINATOR		
1.					Remove 1st oscillator crystal and apply a 12.4 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	Turn 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	Maximum	Adjust C357, C354 and C350 for maximum 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 17. Sweep RF ±50 kHz at 60 Hz. Connect 12.4 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 waveform 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 28 and 30 kHz.
			OSC MULT & AMPLIFIER		
9.	D OSC	pin 4	L451	Maximum	Remove short from base of Q307, if present, then insert 1st oscillator crystal and adjust L451 for maximum meter reading.
10.	D OSC	pin 4	L454 & L451	Maximum (0.17 - 0.5v)	Adjust L454 and L451 for maximum meter reading (0.17-0.5v).
11.	E OSC	pin 5	L455 & L456	See Procedure	Adjust L455 and L456 for maximum meter reading (.06-0.5 volts). Then adjust L457 for a small dip in meter reading.
12.	E OSC	pin 5	L452	Maximum	For 2-frequency receivers with crystal oscillators, insert F2 crystal and adjust L452 for maximum meter reading.
			RF		
13.	C LIN 2	pin 3	L457 & L301 thru L306	Maximum	Apply on-frequency signal to J301, then adjust L457 and L301 thru L306 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero.
14.	C LIN 2	pin 3	L301 thru L306		While receiving a weak on-frequency signal from the antenna, tune L301 thru L306 for best quieting while maintaining the highest limiter reading possible.
			SQUELCH ADJUSTMENT		
15.				 130°	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.

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. 406-470 MHz signal source (keep signal level below saturation).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug GE Test Set into 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. 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 a reading of 1.3 Volts. For Power Regulator Model 4EP57A10 in Rev. F or earlier, set R392 for a reading of 0.7 Volts. In combinations with Power Regulator Model 4EP76A10, set R392 for a reading of 1.3 Volts. In combinations with Power Regulator Model 4EP78A10, set R392 for a reading of 0.9 Volt.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: TEST SET	MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
1.	D OSC	pin 4	L451	See Procedure	Switch to F1, put in F1 crystal and tune L451 for maximum meter reading.
2.	D OSC	pin 4	L454 & L451	Maximum (0.17 - 0.5 V)	Apply an on-frequency signal to J301 adjust L454 and L451 for a maximum reading (0.17 - 0.5 volts).
3.	E OSC	pin 5	L455, L456 & L457	See Procedure	Apply an on-frequency signal and adjust L455 and L456 for maximum meter reading (.06 - 0.5 volts). Then adjust L457 for a slight dip in meter reading.
4.	E OSC	pin 5	L452 (2-freq. only)	Maximum	For 2-frequency receivers, switch to F2, insert F2 crystal and adjust for maximum.
5.					Preset RF coils L201 thru L206 to approximately the same positions as L457.
6.	C LIN 2	pin 3	L457 & L301 thru L306	Maximum	Apply on-frequency signal to J301. Tune L457 and L301 thru L306 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero.
7.	A DISC	pin 10	L451 (L452 for 2-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L451 (L452 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.	C LIN 2	Pin 3	L301 thru L306		While receiving a weak on-frequency signal from the antenna, tune L301 thru L306 for best quieting while maintaining the highest limiter reading possible.
			SQUELCH ADJUSTMENT		
9.				130°	Set SQUELCH Control (R400) to open with a 4 dB SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)

ALIGNMENT PROCEDURE

RECEIVER TYPES ER-49-A & ER-50-A
FOR MOBILE COMBINATIONS

RC-1729E

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 sequence 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

- Distortion Analyzer similar to:

  Heath IM-12

- Signal Generator similar to:

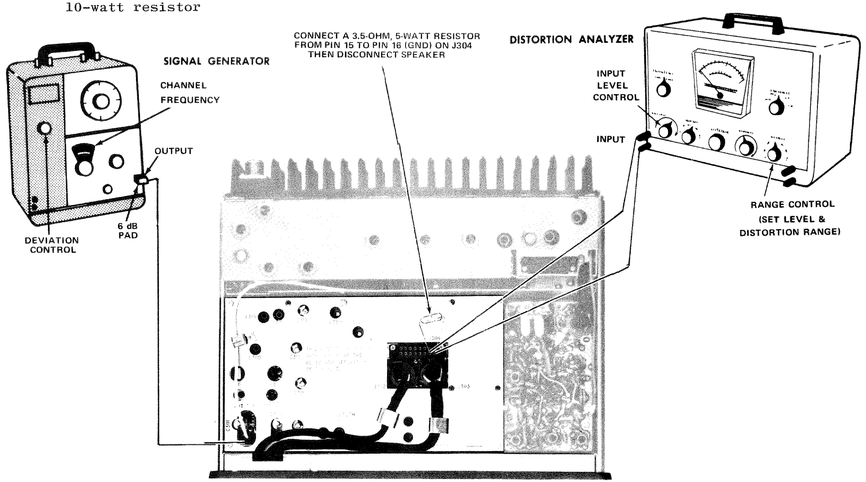
  Measurements M-800

- 6-dB attenuation pad, and 3.2 ohm,

  10-watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure
3. Turn on all of the test equipment and let it warm up 20 minutes.



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%.

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 counterclockwise. Then connect a milliammeter in series with the red lead at TB5-1. With no signal in, 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).

USABLE SENSITIVITY (12-dB SINAD)

STEP 2

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

STEP 2 (Cont'd)

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.3-kHz deviation to J301.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal Plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least 2.5 watts 2.85 volts RMS across the 3.2-ohm receiver load using the Distortion Analyzer as a VTVM).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD specification, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz (but less than ±9 kHz).

SERVICE CHECK

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

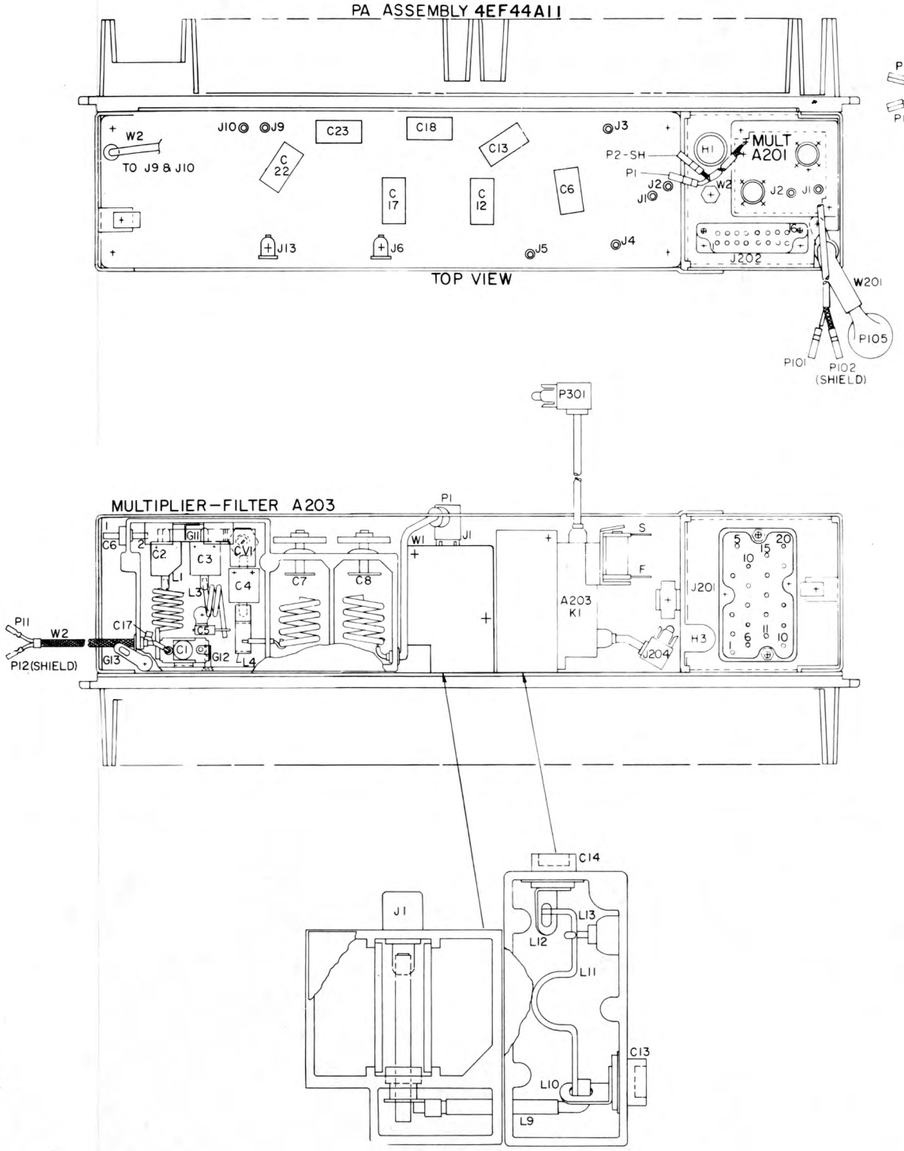
PARTS LIST

LBI-4346B

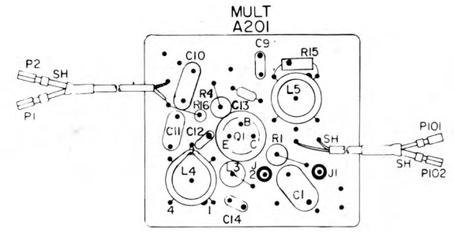
450-470 MHz TRANSMITTER
TYPE KT-14-A

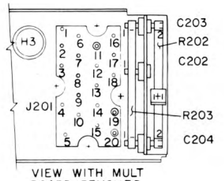
SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD **MODEL 4EG21F10 1 FREQ NARROW BAND** **MODEL 4EG21F11 2 FREQ NARROW BAND**
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C101 and C102	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C103 and C104	5496219P10	Ceramic 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	5493366P390J	Silver mica: 390 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C115	5493367P680J	Silver mica: 680 pf ±5%, 100 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	5496372P46	Ceramic disc: 180 pf ±5%, 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	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	19B209243P1	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: 2200 pf ±10%, 500 VDCW; sim to RMC Type JL.
C137 and C138	7491395P109	Ceramic disc: 1000 pf ±10%, 500 VDCW; sim to RMC Type JL.
C142	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		- - - - - - 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.
		- - - - - - - - - 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 - - - - - - - - -
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.
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.
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	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	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.
R165	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R166	3R77P563J	Composition: 56,000 ohms ±5%, 1/2 w.
		- - - - - - - - - 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		Includes:
	4033089P1	Clip. (Part of XY101, 102).
	19A115793P1	Contact, electrical: sim to Malco 2700. (Part of XY101, 102).
	19C311172P1	Socket, crystal. (Part of XY101, 102).
	19B200525P9	Rivet. (Part of XY101, 102).
		- - - - - - - - - CRYSTALS - - - - - - - - -
		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 4EF44A11 450-470 MHz** **MULTIPLIER BOARD** 19B205919G3
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C3*	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Deleted by REV A.
C4*	5494481P127	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Deleted by REV A.
C9*	19A116114P50	Ceramic: 39 pf ±5%, 100 VDCW; temp coef 0 PPM.
		Earlier than REV A:
	5496219P316	Ceramic disc: 39 pf ±10%, 500 VDCW, temp coef -150 PPM.
C10	7489162P17	Silver mica: 39 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C11	19A116656P12J0	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C12*	19A116114P2053	Ceramic: 47 pf ±5%, 100 VDCW; temp coef -80 PPM. Added by REV A.
C13* and C14*	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW. Added by REV A.
		- - - - - - JACKS AND RECEPTACLES - - - -
J1 and J2	4033513P4	Contact, electrical: sim to Bead Chain L93-3.

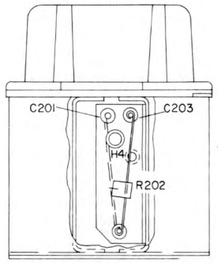
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

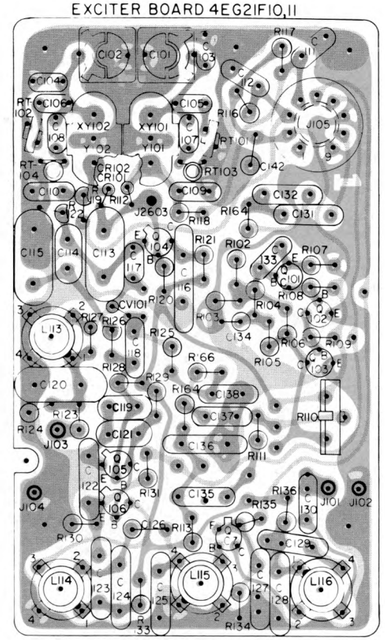


(19D416266, Sh. 1, Rev. 3)
(19D416266, Sh. 2, Rev. 3)









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

OUTLINE DIAGRAM

450—470 MHZ TRANSMITTER
TYPE KT-14-A

RC-2261B

RESISTANCE READINGS

ALL READINGS ARE TYPICAL 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.

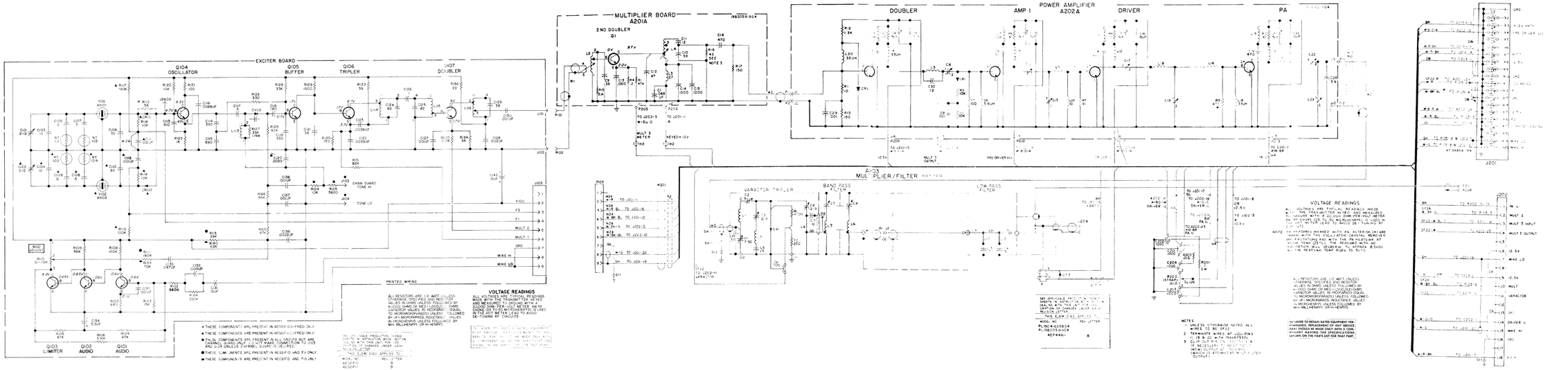
EXCITER BOARD

TRANSISTOR SYMBOL #	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q101	650	650	13,200	3,650	8,600	2,800
Q102			8,600	2,800	12,000	2,800
Q103			12,000	3,800	10,000	11,500
Q104	1000	1000	14,000	3,500	2,500	3,000
Q105			35,000	3,300	4,300	3,300
Q106	150	150	4,300		2,900	2,900
Q107	50	50			2,600	2,900

PA ASSEMBLY

SYMBOL #	EMITTER		BASE		COLLECTOR	
	−	+		+	−	+
Q1 (MULT A201)	9.5	10.2	9.6	10.5	5.1K	6.6K
Q1 (MULT A202)	GND	GND	1.1	1.1	3.1K	5.4K
Q2 AMP 1	GND	GND	0.4	0.4	3.1K	5.4K
Q3 DRIVER	GND	GND	0.2	0.2	5.6K	11.3K
Q4 PA	GND	GND	8.6	8.4	3K	5.4K

(19E500965, Rev. 3)



(DF - 351)

SCHEMATIC DIAGRAM

450—470 MHZ TRANSMITTER
TYPE KT-14-A

RC-2262C, Sheet 1

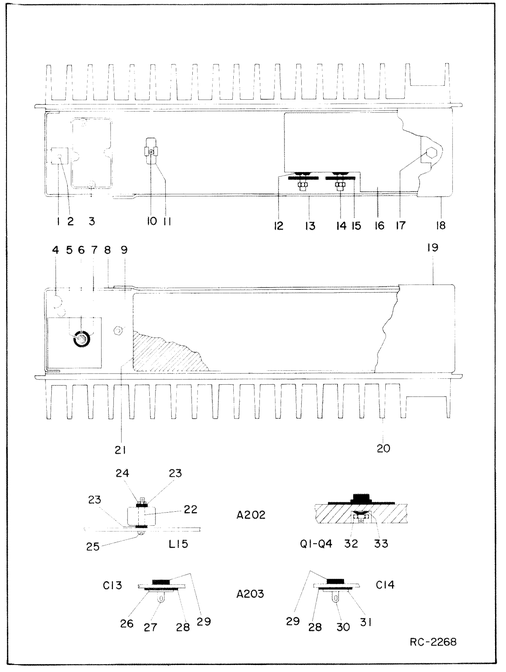
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2	4029840P1	Contact, electrical: sim to AMP 41854.
P101	4029840P2	Contact, electrical: sim to Amp 42827-2.
P102	4029840P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A116016P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3B77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R4	3B77P120K	Composition: 12 ohms ±10%, 1/2 w.
R15		(Part of L5).
R16	3B152P430J	Composition: 43 ohms ±5%, 1/4 w.
R17	3B152P151J	Composition: 150 ohms ±5%, 1/4 w.
A202A		**PA BOARD** 19D410284G4
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C3	7489102P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C4	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C5	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19B209408P2	Variable, mica: 4-25 pf, 400 VDCW.
C8	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C10	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C11	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C12	19B209408P2	Variable, mica: 4-25 pf, 400 VDCW.
C13	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C14	19A116655P10	Ceramic disc: 220 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C15	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C16	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C17 and C18	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C19	19A116655P14	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C20	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C21	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C22	19B209408P6	Variable, mica: 37-140 pf, 400 VDCW.
C23	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C28	19A116114P141	Ceramic: 22 pf ±5%, 100 VDCW; temp coef -30 PPM.
C29	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C30	19A116656P1,2,8	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -80 PPM.
		- - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115256P1	Silicon.
CR2	19A115775P1	Silicon.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J5	4035513P4	Contact, electrical: sim to Bead Chain 183-3.
J6	4033284P2	Contact, electrical: sim to Alcon 3-1215.
J9 and J10	4035513P4	Contact, electrical: sim to Bead Chain 183-31.

SYMBOL	GE PART NO.	DESCRIPTION
J13	4033284P2	Contact, electrical: sim to Alcon 3-1215.
J14 and J15	4035513P4	Contact, electrical: sim to Bead Chain 183-31.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L3	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L4	7488079P3	Choke, RF: 0.33 µh ±20%, 0.07 ohms DC res max; sim to Jeffers 4411-3M.
L5	19B216275P5	Coil.
L6	7488079P13	Choke, RF: 5.60 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4421-4K.
L7	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L8	19A129167P1	Coil.
L9	19B219376P1	Coil.
L10	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L11	7488079P40	Choke, RF: 5.60 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4422-1K.
L12	19B219376P2	Coil.
L14	19A129281P1	Coil.
L15	19B216365G3	Coil.
L16	19B219376P1	Coil.
L17	19A129166P1	Coil.
L18	7488079P46	Choke, RF: 33.0 µh ±10%, 1.90 ohms DC res max; sim to Jeffers 4422-10K.
L19	19A129282P1	Coil.
L20	7488079P40	Choke, RF: 33.0 µh ±10%, 1.90 ohms DC res max; sim to Jeffers 4422-10K.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q3 and Q4	19A129181P1	Silicon, NPN.
Q3	19A129181P3	Silicon, NPN.
Q4	19A129181P4	Silicon, NPN.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3B77P100K	Composition: 10 ohms ±10%, 1/2 w.
R2	3B77P101K	Composition: 100 ohms ±10%, 1/2 w.
R3 and R4	3B77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R5	3B77P101K	Composition: 100 ohms ±10%, 1/2 w.
R6	3B77P300J	Composition: 30 ohms ±5%, 1/2 w.
R7	3B77P910J	Composition: 91 ohms ±5%, 1/2 w.
R8	3B76P100K	Composition: 10 ohms ±10%, 1 w.
R9	3B76P471K	Composition: 470 ohms ±10%, 1 w.
R10	3B76P100K	Composition: 10 ohms ±10%, 1 w.
R12	3B77P133J	Composition: 1300 ohms ±5%, 1/2 w.
R13	3B77P151J	Composition: 150 ohms ±5%, 1/2 w.
A203		**MULTIPLIER/FILTER** 19D413634G4
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A115282P5	Variable, mica: approx 7-50 pf, 400 VDCW; sim to El-Menco Type 42.
C2 thru C4	19B209418P1	Variable, air: 1.75 to 7.65 pf; sim to EF Johnson Type Y.
C5	7146331G5	Silver mica: 15 pf ±10%, 500 VDCW; sim to Underwood Type J1HF.
C6	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.

SYMBOL	GE PART NO.	DESCRIPTION
C7 and C8		(Refer to Mechanical Parts RC-2268).
C13 and C14		(Refer to Mechanical Parts RC-2268).
C17	19A116114P141	Ceramic: 22 pf ±5%, 100 VDCW; temp coef -30 PPM.
		- - - - - DIODES AND RECTIFIERS - - - - -
CR3	4037822P1	Silicon.
CV1	19A115809P2	Silicon, capacitive.
		- - - - - JACKS AND RECEPTACLES - - - - -
J1	7104941P16	Jack, phono: sim to National Tel.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19B209419P1	Armature, coaxial: 100 ohms ±10% coil res, 1 form C contacts, 13.6 VDC ±20%; sim to Magnecraft Electric 120X-70. (Includes L13 and P301).
		- - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216133P1	Coil.
L3	19B216144P1	Coil.
L4	19B205982P1	Coil.
L5	19B216448G3	Coil.
L6	19B216448G1	Coil.
L9	19A137261P1	Coil.
L10	7878455P2	Terminal, lug.
L11	19A127445P1	Coil. (Includes L12).
L12		(Part of L11).
L13		(Part of K1).
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1		(Part of W1).
P11	4029840P2	Contact, electrical: sim to Amp 42827-2.
P12	4029840P1	Contact, electrical: sim to AMP 41854.
P301		(Part of K1).
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3B77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R2	3B77P201J	Composition: 200 ohms ±5%, 1/2 w.
		- - - - - - - - - CABLES - - - - - - - - -
W1	54916B9P56	Cable assembly: includes black RG-58-U cable with short phono plug (P1).
W2	19B209044P13	Cable, RF: approx 7 inches.
		- - - - - - - - - CAPACITORS - - - - - - - - -
C201	5493392P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FA5C.
C202	5493392P107	Ceramic, stand off: 1000 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type 585D.
C203 and C204	5493392P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FA5C.
		- - - - - JACKS AND RECEPTACLES - - - - -
J201	19C303426G1	Connector: 20 pin contacts.
J202	19B205688G1	Connector: 18 pin contacts.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P105		(Part of W201).
P202 and P203		(Part of W201).

SYMBOL	GE PART NO.	DESCRIPTION
P205	19B209151P1	Terminal, solderless: sim to AMP 42284-5.
P209	4029840P2	Contact, electrical: sim to Amp 42827-2.
P210	4029840P1	Contact, electrical: sim to AMP 41854.
P212	4029840P1	Contact, electrical: sim to AMP 41854.
P213	19B209151P1	Terminal, solderless: sim to AMP 42284-5.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	19B209032P80	Wirewound: 0.1 ohms ±5%, 2 w; sim to IRC Type BWG.
R202		Includes:
	19A127073P1	Strap.
	19A127071P1	Slide.
R203	19A137071P1	Slide.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201		**CABLE ASSEMBLY** 19B209369G2
		- - - - - - - - - - PLUGS - - - - - - - - - -
P105	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-720.
P202 and P203	4029840P2	Contact, electrical: sim to Amp 42827-2.
	19A122138P1	Knob.
	19A134048P1	Screw.
W202		**CABLE ASSEMBLY** 19A123848G3
		- - - - - - - - - - PLUGS - - - - - - - - - -
P211	4029840P2	Contact, electrical: sim to Amp 42827-2.
P212	4029840P1	Contact, electrical: sim to Amp 41854.
P213	54916B9P56	RF cable assembly: approx 10 inches long with plug molded on one end.
W203	19A123848G6	Cable assembly: approx 2 inches long. Includes (P204).
W204	19A123848G8	Cable assembly: approx 12 inches long.
		HARNESS ASSEMBLY 19D416297G2 (Includes C201-C204, J201, J202, P205, P209, P210, P212, P213, R201, W201)
		MECHANICAL PARTS (SEE RC-2268)
1	7160801P16	Nut, sheet spring. (Used to secure bottom cover).
2	X115P1508C13	Screw, flathead: No. 8 x 1/2. (Used to secure bottom cover).
3	19A121676P1	Guide pin.
4	714723P2	Clip, loop. (Located by J202).
5	403655SP1	Insulator, washer: nylon. (Used with Q1 on A201).
6	19A121252P1	Heat sink. (Used with Q1 on A201).
7	402B006P3	Retainer strap. (Used with Q1 on A201).
8	19B216016G1	Frame.
9	5491541P305	Spacer, hex. (Used to secure top cover).
10	19B201074P304	Tap screw, Phillips POZIDRIV: No. 4-40 x 1/4. (Used to secure J204 retainer).
11	7118219P1	Retainer. (Used to secure J204).
12	7137958P8	Nut, stamped: No. 6-32 thread; sim to Palnut 10532005. (Part of C7 and C8 on A203).
13	19B216138G1	Frame.
14	403676SG7	Screw. (Part of C7 and C8 on A203).

SYMBOL	GE PART NO.	DESCRIPTION
15	19A127161P1	Nut. (Part of C7 and C8 on A203).
16	19C311432P1	Cover. (A203).
17	19A127357P1	Spacer, hex. (Used to secure bottom cover).
18	19B210342G1	Bottom cover.
19	19B216017G3	Top cover.
20	19C311277P1	Heat sink.
21	19C311960P1	Heat sink. (Used with A2023).
22	7150727P14	Tubing, vinyl. (Specify length).
23	7147306P2	Bushing, insulator: sim to H.H. Smith 2150.
24	7141223P3	Nut, hex: No. 6-32.
25	380P130314C6	Screw, phillips: No. 6-32 x 7/8.
26	19A121006P13	Washer.
27	7878455P2	Solderless terminal.
28	19A127163P1	Washer.
29	19A127064P1	Insulator.
30	4035338P2	Solderless terminal: sim to Zierick 401.
31	19A121006P12	Washer.
32	X20P15C6	Nut, hex: No. 8-32.
33	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20.



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 Amplifier Model 4EF48A11
Incorporated in initial shipment.

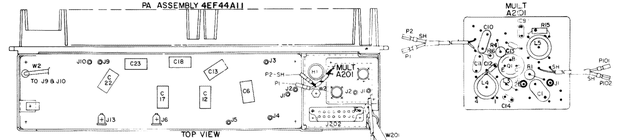
REV. B - Power Amplifier Model 4EF48A11
To reduce spurious output and improve stability and tuning. Changed multiplier board from 19D205099G3 to 19D205099G4 and PA board from 19D416286G2 to 19D416286G4.

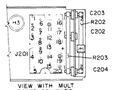
— NOTE —

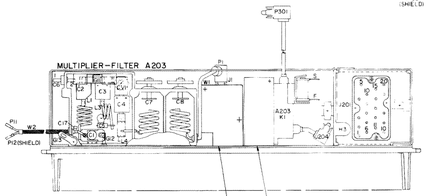
Multiplier Board 19D205099G3 must be used with PA Board 19D416286G1 only.

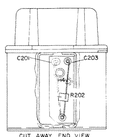
Multiplier Board 19D205099G4 must be used with PA Board 19D416286G2 only.

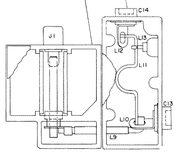
(DF - 3151)



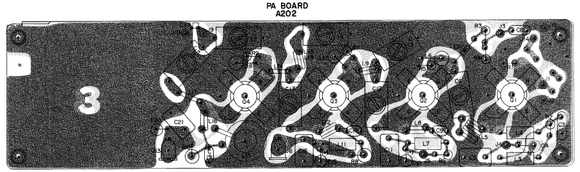






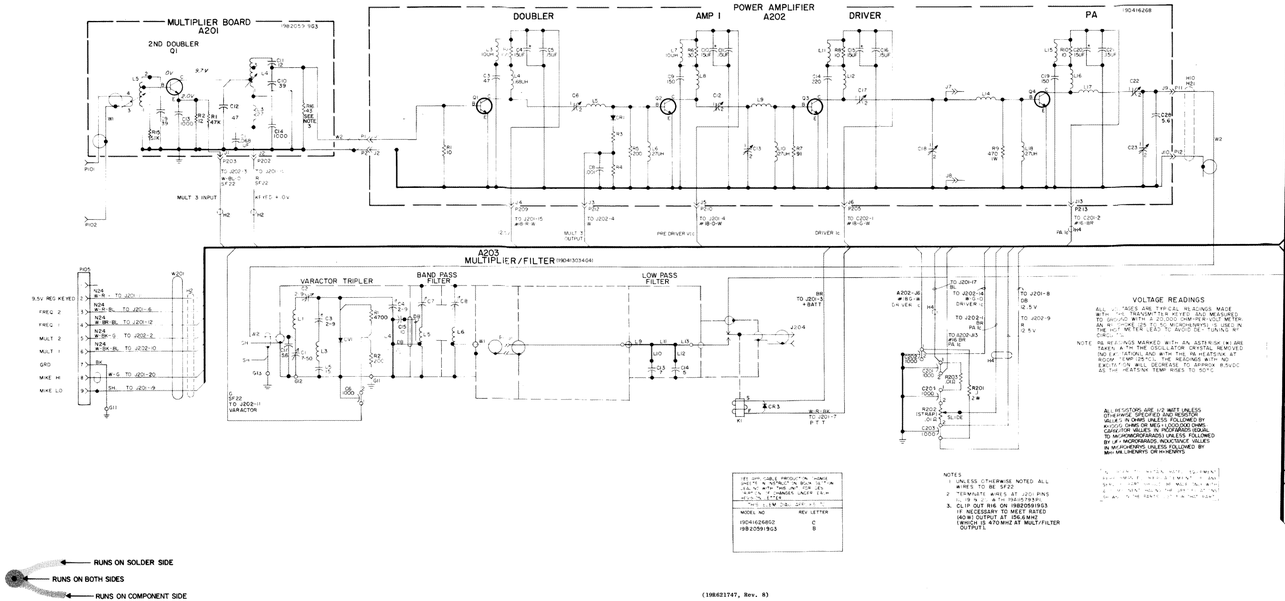


PA BOARD
A202



(193500965, Rev. 3)
(190416266, Sh. 1, Rev. 3)
(190416266, Sh. 2, Rev. 3)

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



(198621747, Rev. B)

SCHEMATIC & OUTLINE DIAGRAM

450—470 MHz POWER AMPLIFIER ASSEMBLY
MODEL 4EF44A11 (REV. A AND EARLIER)
USED WITH TRANSMITTER TYPE KT-14-A

RC-2262C, Sheet 2

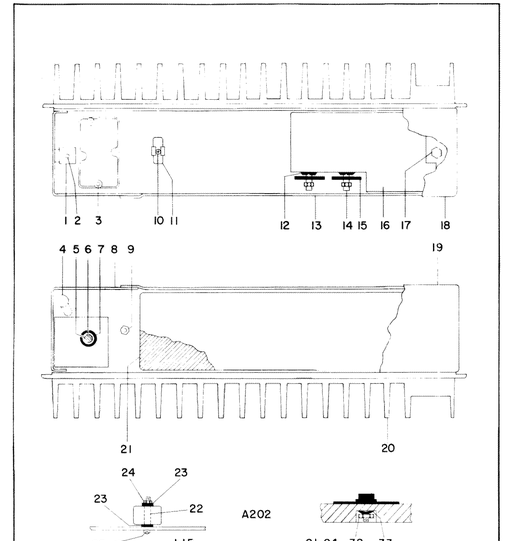
PARTS LIST

LBI-4863

POWER AMPLIFIER
MODEL 4EF44A11 450-470 MHz

SYMBOL	GE PART NO.	DESCRIPTION
A201		**MULTIPLIER BOARD** 19B205919G3
		---------- CAPACITORS ----------
C1	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C9	19A116114P50	Ceramic: 39 pf ±5%, 100 VDCW; temp coef 0 PPM.
C10	7489162P17	Silver mica: 39 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C11	19A116656P1SJ0	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C12	19A116114P2053	Ceramic: 47 pf ±5%, 100 VDCW; temp coef -80 PPM.
C13 and C14	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
		------ JACKS AND RECEPTACLES ------
J1 and J2	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		---------- INDUCTORS ----------
L3	7488079P9	Choke, RF: 2.7 µh ±10%, 1.2 ohms DC res max; sim to Jeffers 4411-12K.
L4	19D402808G35	Coil. Includes tuning slug 5491798P2.
L5	19D402808G37	Coil. Includes tuning slug 5491798P2.
R15	3R152P513J	Composition: 5100 ohms ±5%, 1/4 w.
		---------- 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.
R4	3R77P120K	Composition: 12 ohms ±10%, 1/2 w.
R15		(Part of L5).
R16*	3R152P430J	Composition: 43 ohms ±5%, 1/4 w. Added by REV B.
A202		**PA BOARD** 19D416268G2
		---------- CAPACITORS ----------
C3	7489162P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C4	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C5	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19B209408P2	Variable, mica: 4-25 pf, 400 VDCW.
C8	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C10	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C11	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C12	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C13 and C18	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C19	19A116655P14	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C20	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C21	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C22	19B209408P6	Variable, mica: 37-140 pf, 400 VDCW.
C23	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C28*	19A116114P141	Ceramic: 5.6 pf ±5%, 100 VDCW; temp coef 0 PPM. In REV A and earlier:
	19A116114P41	Ceramic: 22 pf ±5%, 100 VDCW; temp coef 0 PPM.
CR1	19A115250P1	Silicon.
		------ DIODES AND RECTIFIERS ------
		------ JACKS AND RECEPTACLES ------
J1 thru J5	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J6	4033284P2	Contact, electrical: sim to Alcon 3-1215.
J9 and J10	4033513P4	Contact, electrical: sim to Bead Chain L93-31.
J13	4033284P2	Contact, electrical: sim to Alcon 3-1215.
J14 and J15	4033513P4	Contact, electrical: sim to Bead Chain L93-31.
		---------- INDUCTORS ----------
L3	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L4	7488079P3	Choke, RF: 0.33 µh ±20%, 0.07 ohms DC res max; sim to Jeffers 4411-3K.
L5	19B216275P5	Coil.
L6	7488079P13	Choke, RF: 5.60 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4421-4K.
L7	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L8	19A129167P1	Coil.
L9	19B219376P1	Coil.
L10	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L11	7488079P40	Choke, RF: 5.60 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4422-1K.
L12	19B219376P2	Coil.
L14	19A129281P1	Coil.
L15	19B216363G1	Coil.
L16	19B219376P1	Coil.
L17	19A129166P1	Coil.
L18	7488079P49	Choke, RF: 33.0 µh ±10%, 1.90 ohms DC res max; sim to Jeffers 4422-10K.
L19	19A129282P1	Coil.
		---------- TRANSISTORS ----------
Q1 and Q2	19A129181P1	Silicon, NPN.
Q3	19A129181P3	Silicon, NPN.
Q4	19A129181P4	Silicon, NPN.
		---------- RESISTORS ----------
R1	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
R2	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R3 and R4	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R5	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R6	3R77P300J	Composition: 30 ohms ±5%, 1/2 w.
R7*	3R77P910J	Composition: 91 ohms ±5%, 1/2 w. In REV B and earlier:
	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R8	3R78P100K	Composition: 10 ohms ±10%, 1 w.
R9	3R78P471K	Composition: 470 ohms ±10%, 1 w.
R10	3R78P100K	Composition: 10 ohms ±10%, 1 w.
A203		**MULTIPLIER/FILTER** 19D413034G4
		---------- CAPACITORS ----------
C1	19A115282P5	Variable, mica: approx 7-50 pf, 400 VDCW; sim to Elmenco Type 42.
C2 thru C4	19B209418P1	Variable, air: 1.75 to 7.65 pf; sim to EF Johnson Type V.
C5	7146331G5	Silver mica: 15 pf ±10%, 500 VDCW; sim to Underwood Type J18F.
C6	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C7 and C8		(Refer to Mechanical Parts MC-2268).
C13 and C14		(Refer to Mechanical Parts MC-2268).
C17*	19A116114P141	Ceramic: 5.6 pf ±5%, 100 VDCW; temp coef -30 PPM. Earlier than REV A:
	19A116114P41	Ceramic: 22 pf ±5%, 100 VDCW; temp coef 0 PPM.
		------ DIODES AND RECTIFIERS ------
CR3	4037822P1	Silicon.
CY1	19A115809P2	Silicon, capacitive.
		------ JACKS AND RECEPTACLES ------
J1	7104941P16	Jack, phono: sim to National Tel.
J204		(Part of K1).
		---------- RELAYS ----------
K1	19B209419P1	Armature, coaxial: 100 ohms ±10% coil res, 1 form C contacts, 13.6 VDC ±20%; sim to Magnecraft Electric 120X-70. (Includes J204, L13 and P301).
		---------- INDUCTORS ----------
L1	19B216153P1	Coil.
L3	19B216164P1	Coil.
L4	19B205982P1	Coil.
L5	19B216448G3	Coil.
L6	19B216448G1	Coil.
L9	19A127261P1	Coil.
L10	7878455P2	Terminal, lug.
L11	19A127445P1	Coil. (Includes L12).
L12		(Part of L11).
L13		(Part of K1).
		---------- PLUGS ----------
P1		(Part of W1).
P11	4029840P2	Contact, electrical: sim to Amp 42827-2.
P12	4029840P1	Contact, electrical: sim to AMP 41854.
P301		(Part of K1).
		---------- RESISTORS ----------
R1	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R2	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
		---------- CABLES ----------
W1	5491689P56	Cable assembly: includes black RG-58-U cable with short phono plug (P1).
W2	19B209044P13	Cable, RF: approx 7 inches.
		---------- CAPACITORS ----------
C201	5493392P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FA5C.
C202	5493392P107	Ceramic, stand off: 1000 pf +100%-0%, 500 VDCW; sim to Allen-Bradley Type 585D.
C203 and C204	5493392P7	Ceramic, feed-thru: 1000 pf +100%-0%, 500 VDCW; sim to Allen Bradley Type FA5C.
		------ JACKS AND RECEPTACLES ------
J201	19C303426G1	Connector: 20 pin contacts.
J202	19B205689G1	Connector: 18 pin contacts.
		---------- PLUGS ----------
P105		(Part of W201).
P202 and P203		(Part of W201).
P205	19B209151P1	Terminal, solderless: sim to AMP 42284-5.
P209	4029840P2	Contact, electrical: sim to Amp 42827-2.
P210	4029840P1	Contact, electrical: sim to AMP 41854.
P212	4029840P1	Contact, electrical: sim to AMP 41854.
P213	19B209151P1	Terminal, solderless: sim to AMP 42284-5.
		---------- RESISTORS ----------
R201	19B209022P89	Wirewound: 0.1 ohms ±5%, 2 w; sim to IRC Type BWH.
R202		Includes:
	19A127071P1	Strap.
	19A127073P1	Slide.
R203	19A127071P1	Strap.
		---------- CABLES ----------
		CABLE ASSEMBLY 19B209268G2
W201		---------- PLUGS ----------
P105	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-720.
P202 and P203	4029840P2	Contact, electrical: sim to Amp 42827-2.
		CABLE ASSEMBLY 19A121948G3
W202		---------- PLUGS ----------
P211	4029840P2	Contact, electrical: sim to Amp 42827-2.
P212	4029840P1	Contact, electrical: sim to Amp 41854.
P213	5491689P56	RF Cable assembly: approx 10 inches long with plug molded on one end.
W203	19A121948G6	Cable assembly: approx 2 inches long. Includes (P204).
W204	19A121948G8	Cable assembly: approx 12 inches long.
		HARNESS ASSEMBLY 19D413297G2 (Includes C201-C204, J201, J202, P205, P209, P210, P212, P213, K201, W201)
		MECHANICAL PARTS (SEE MC-2268)
1	7160861P16	Nut, sheet spring. (Used to secure bottom cover).
2	N115P1508C13	Screw, flathead: No. 8 x 1/2. (Used to secure bottom cover).
3	19A121676P1	Guide pin.
4	7147223P2	Clip, loop. (Located by J202).
5	4036555P1	Insulator, washer: nylon. (Used with Q1 on A201).
6	19A121232P1	Heat sink. (Used with Q1 on A201).
7	4029006P3	Retainer strap. (Used with Q1 on A201).
8	19B216016G1	Frame.
9	5491541P305	Spacer, hex. (Used to secure top cover).
10	19B201074P204	Tap screw: No. 4-40 x 1/4. (Used to secure J204 retainer).
11	7118719P1	Retainer. (Used to secure J204).
12	7137968P8	Nut, stamped: No. 6-32 thread; sim to Pallnut T0632005. (Part of C7 and C8 on A203).
13	19B216158G1	Frame.
14	4036765G7	Screw. (Part of C7 and C8 on A203).
15	19A127161P1	Nut. (Part of C7 and C8 on A203).
16	19C311432P1	Cover. (A203).
17	19A127357P1	Spacer, hex. (Used to secure bottom cover).
18	19B216342G1	Bottom cover.
19	19B216017G3	Top cover.
20	19C311277P1	Heat sink.
21	19C317960P1	Heat sink. (Used with A202).
22	7150727P14	Tubing, vinyl. (Specify length).
23	7147306P2	Bushing, insulator: sim to H.H. Smith 2150.
24	7141225P3	Nut, hex: No. 6-32.
25	N80P13014C6	Screw, phillips: No. 6-32 x 7/8.
26	19A121006P13	Washer.
27	7878455P2	Solderless terminal.
28	19A127163P1	Washer.
29	19A127064P1	Insulator.
30	4035338P2	Solderless terminal: sim to Zierick 401.
31	19A121006P12	Washer.
32	K207P15C6	Nut, hex: No. 8-32.
33	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified with 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 - Multiplier Board 19B205919G3
To improve stability. Deleted L1, C3 and C4. Added L5, C13, C14 and C15.

REV. B - To prevent Q1 on P.A. Board from being overdriven. Add R16.

REV. A - PA Board 19D416268G2
To improve power output of transmitter. Changed R7 and R9.

REV. B - To improve radiated spurious emissions. Added C28.

REV. C - To improve stability and power output of transmitter. Changed R7.

PARTS LIST

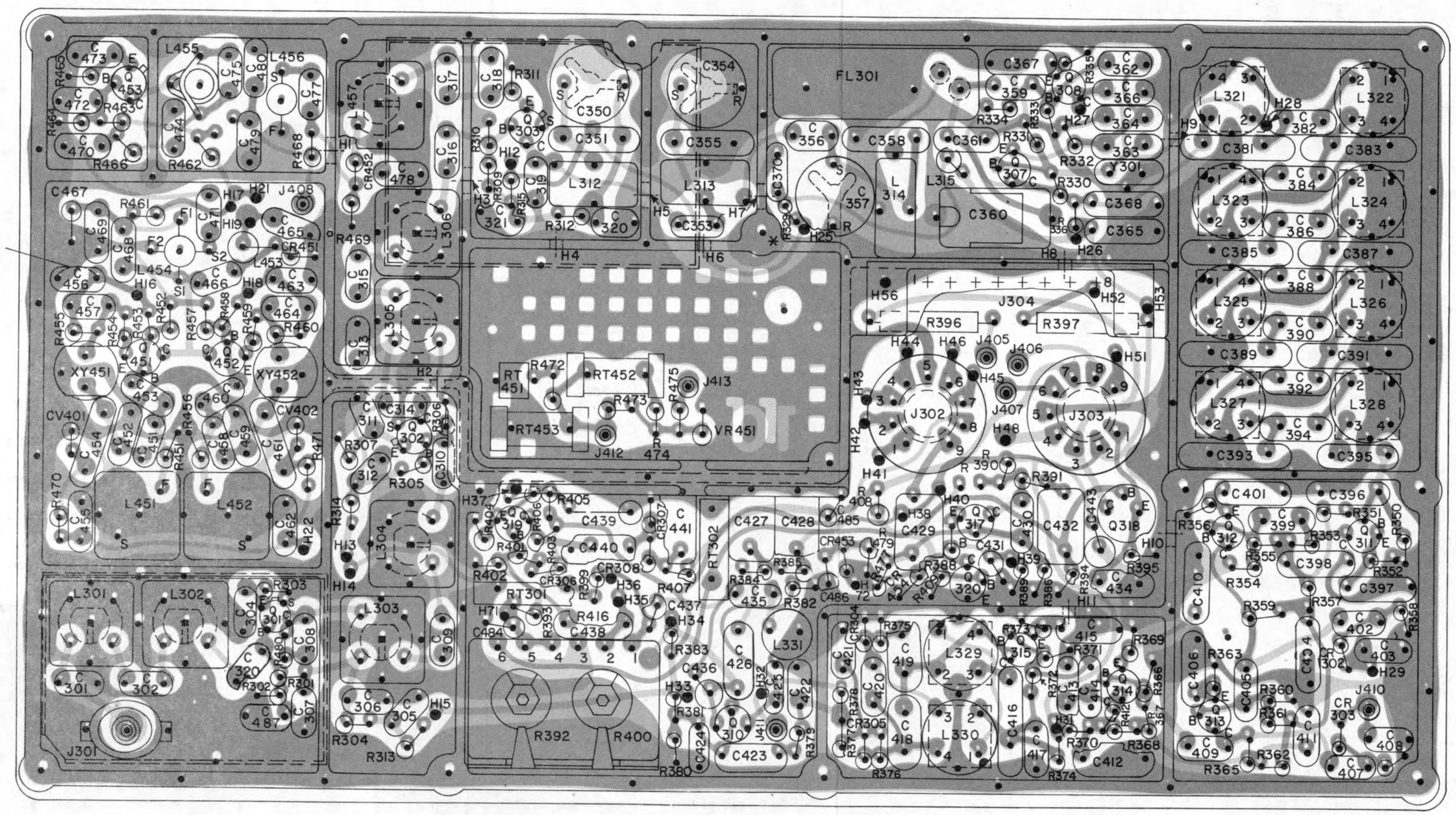
LBI-3912H

406--470 MHz RECEIVER
MODELS 4ER49A10-12 406--420 MHz
MODELS 4ER50A10-12 450--470 MHz

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - **CAPACITORS** - - - - - - - - -
C301	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C302*	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C303	19A116656P18J1	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C304*	19A116656P14	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		Earlier than REV D:
	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C305	19A116656P18J1	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C306	19A116656P4J2	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef -220 PPM.
C307	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C308*	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
		In REV F and earlier:
	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C309*	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
		In REV G and earlier:
	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C310*	19A116656P33J1	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -150 PPM.
		Earlier than REV E:
	5496219P345	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C311 and C312	19A116656P18J1	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C313	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C314	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C315*	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
		In REV G and earlier:
	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C316	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C317	19A116656P18J1	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C318	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C319	19A116656P18J1	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -150 PPM.
C320 and C321	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C350	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C351	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C353	5496219P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C354	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C355	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C356	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C357	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36.
C358	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C359	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C360	19A115659P1	Variable, compression mica: approx 16-141 pf, 150 VDCW; sim to El-Menco Type 42.
C361	5496219P54	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef 0 PPM.
C362	5496219P13	Ceramic disc: 22 pf ±10%, 500 VDCW, temp coef 0 PPM.
C363 and C364	5490008P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C365	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C366	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C367	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C368	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C370	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C381	19A116656P160J1	Ceramic disc: 160 pf ±5%, 500 VDCW, temp coef -150 PPM.
C382*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV J and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C383	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C384*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV J and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C385	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C386*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV J and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C387	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C388*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV J and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C389	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C390*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV J and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C391	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C392*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV J and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C393	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C394*	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
		In REV J and earlier:
	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C395	19A116656P200J1	Ceramic disc: 200 pf ±5%, 500 VDCW, temp coef -150 PPM.
C396	5494481P128	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C397	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C398	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C399	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C401	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C402	5490008P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C403	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C404	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C405	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C406	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C407	7491393P1	Ceramic disc: .001 µf +100% -0%, 500 VDCW; sim to Sprague 1219C4.
C408	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C409	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C410	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C411	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C412	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C413	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C414	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C415	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C416	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C417	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C418 and C419	5490008P137	Silver mica: 270 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C420	5496219P656	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C421 and C422	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C423	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C424	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C425	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C426	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C427 and C428	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C429	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C430	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C431	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C432	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C433*	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Deleted by REV C:
C434	5490008P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C435	19A116080P203	Polyester: 0.022 µf ±5%, 50 VDCW.
C436	19C300075P 47000J	Polyester: 4700 µf ±5%, 100 VDCW; sim to GE Type 61F.
C437	19C300075P 33000J	Polyester: 3300 µf ±5%, 100 VDCW; sim to GE Type 61F.
C438	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C439*	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
		In REV K and earlier:
	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C440	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C441	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C442*	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Deleted by REV C.
C443	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C451	5496219P544	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -330 PPM.
C452	5496219P545	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -330 PPM.
C453	5496219P35	Ceramic disc: 4 pf ±5%, 500 VDCW, temp coef 0 PPM.
C454	5496219P667	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -470 PPM.
C455 and C456	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C457	5496219P3	Ceramic disc: 3 pf ±10%, 500 VDCW, temp coef 0 PPM.
C458	5496219P544	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -330 PPM.
C459	5496219P545	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -330 PPM.
C460	5496219P35	Ceramic disc: 4 pf ±5%, 500 VDCW, temp coef 0 PPM.
C461	5496219P667	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -470 PPM.
C462 and C463	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C464	5496219P3	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C465	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C466	5496219P3	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C467	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C468	5496219P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C469	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C470	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C471 and C472	5496219P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C473	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C474	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C.
C475	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.

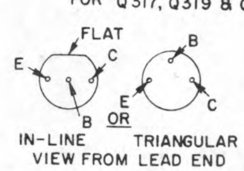
(Cont'd on 19R621221)

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



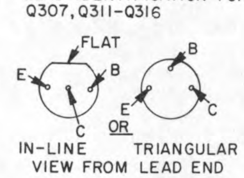
(19D413179, Rev. 8)
(19C311420, Sh. 1, Rev. 11)
(19C311420, Sh. 2, Rev. 10)

LEAD IDENTIFICATION
FOR Q317, Q319 & Q320

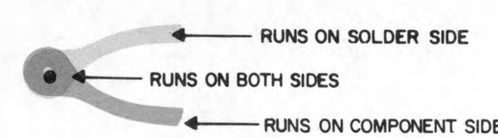


NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR
Q307, Q311-Q316



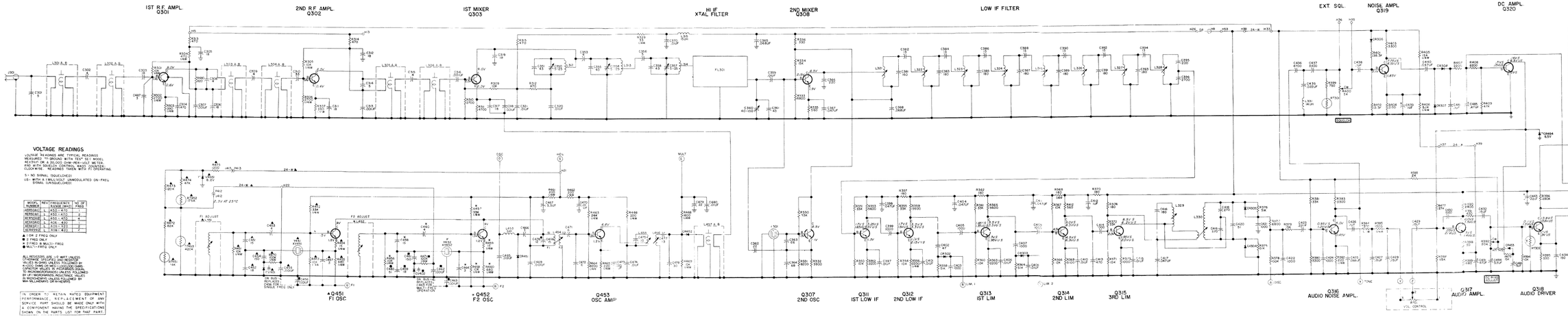
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



OUTLINE DIAGRAM

406—470 MHZ RECEIVER
MODELS 4ER49A10-12 &
4ER50A10-12

RC-1732J



(DF-1091)

SCHEMATIC DIAGRAM

406—470 MHZ RECEIVER
MODELS 4ER49A10-12 & 4ER50A10-12

19R621221, Rev. 16

(Cont'd from RC-1723)

SYMBOL	G-E PART NO	DESCRIPTION
C476	54962199242	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -80 PPM,
C477	54962199243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C478	19A116656P0028	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C479	54962199247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -150 PPM.
C480	19A116080P1	Polystyrene: 0.01 µf ±20%, 50 VDCW.
C481	54962679S	Tantalum: 4.7 µf ±20%, 10 VDCW; sim to Sprague Type 150D.
C482	54962199256	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -80 PPM.
C483*	54962199256	Ceramic disc: 5 pf ±5%, 500 VDCW, temp coef 0 PPM. Added by REV A.
C484*	54962679P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Added by REV C.
C485*	54962679Z28	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D. Added by REV C.
C486*	54962679Z14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV C.
C487*	19A116656P9J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM. Added by REV G.
		- - - - - - DIODES AND RECTIFIERS - - - - - -
CR301*	19A115250P1	Silicon. Deleted by REV D.
CR302 and CR303	4038056P1	Germanium.
CR304 and CR305	19A115250P1	Silicon.
CR306	54946022P1	Silicon.
CR307 and CR308	19A115250P1	Silicon.
CR451*	19A116052P1	Silicon.
		In KEY H and earlier:
	19A115250P1	Silicon.
CR452	19A116081P1	Silicon.
CR453*	19A115250P1	Silicon. Added by REV C.
CR454*	4036887P6	Silicon, Zener. Added by REV L.
CY401 and CY402	19A116034P1	Silicon.
		- - - - - - - - - FILTERS - - - - - - - - -
FL301	19C304319G5	Bandpass.
		- - - - - - JACKS & RECEPTACLES - - - - - -
J301	7104841P9	Jack, phono type: phen; sim to Cinch 14S.
J302 and J303	19B209303P1	Connector, phen: 9 pins.
J304	19B205699G2	Connector: 16 contacts,
J405* thru J409*	40335113P4	Contact, electrical: sim to Head Chain L83-3, Added by REV G.
J410* thru J413*	40335113P4	Contact, electrical: sim to Head Chain L83-3. Added by REV G.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L301A	19D413078G1	Coil: frequency range 438-483 MHz.
L301B	19D413078G3	Coil: frequency range 394-433 MHz.
L302A	19D413078G1	Coil: frequency range 438-483 MHz.
L302B	19D413078G3	Coil: frequency range 394-433 MHz.
L303A	19D413078G5	Coil: frequency range 343-478 MHz.

SYMBOL	G-E PART NO	DESCRIPTION
L303B	19D413078G3	Coil: frequency range 394-433 MHz.
L304A	19D413078G1	Coil: frequency range 438-483 MHz.
L304B	19D413078G3	Coil: frequency range 394-433 MHz.
L305A	19D413078G1	Coil: frequency range 438-483 MHz.
L305B	19D413078G3	Coil: frequency range 394-433 MHz.
L306A	19D413078G1	Coil: frequency range 438-483 MHz.
L306B	19D413078G3	Coil: frequency range 394-433 MHz.
L312	19B205224G5	Coil,
L313	19B205224G2	Coil,
L314	19B205224G6	Coil,
L315	7488079P18	Choke, RF: 15 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-8K.
L321 and L322	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EX13670.
L323	19A115711P2	Freq: 455 KHz; sim to Automatic Mfg EX13671.
L324	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EX13670.
L325	19A115711P2	Freq: 455 KHz; sim to Automatic Mfg EX13671.
L326	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EX13670.
L327	19A115711P2	Freq: 455 KHz; sim to Automatic Mfg EX13671.
L328	19A115711P1	Freq: 455 KHz; sim to Automatic Mfg EX13670.
L329	19A115711P6	Freq: 455 KHz; sim to Toko PEFCN-14733 CX12.
L330	19A115711P7	Freq: 455 KHz; sim to Toko PEFCN-14734 BM12.
L331	19B209605P1	Reactor, audio freq: 142 mh ±5, at 0.1 v thru 0.27 v; sim to Aladdin 605-101.
L451 and L452	19B205917G1	Coil. Includes tuning slug 19B200497P2.
L453	7488079P6	Choke, RF: 1 µh ±10%, .30 ohms DC res max; sim to Jeffers 4411-6K.
L454	19B203236G1	Coil, Includes tuning slug 19B200497P2.
L455	19B203239G1	Coil. Includes tuning slug 19B200497P2.
L456	19B203240G2	Coil. Includes tuning slug 19B200497P2.
L457A	19D413076G2	Coil: frequency range 419-464 MHz.
L457B	19D413078G4	Coil: frequency range 374-414 MHz.
		- - - - - - - - - PLUGS - - - - - - - - -
P400* thru P408*	4029840P2	Contact, electrical: sim to Amp 42827-2. Added by REV G.
P410* thru P413*	4029840P2	Contact, electrical: sim to Amp 42827-2. Added by REV G.
		- - - - - - - - TRANSISTORS - - - - - - - -
Q301*	19A116059P1	Silicon, NPN; sim to Type 2N5032 or 2N5570.
		In KEY D-F:
	19A115991P1	Silicon, NPN.
		Earlier than KEY D:
	19A115440P5	Silicon, NPN.
Q302*	19A115440P2	Silicon, NPN.
		Earlier than KEY D:
	19A115440P1	Silicon, NPN.
Q303*	19A115991P1	Silicon, NPN.
		Earlier than KEY D:
	19A115440P5	Silicon, NPN.
Q307 and Q308	19A115245P1	Silicon, NPN.
Q311 thru Q313	19A115133P1	Silicon, NPN; sim to Type 2N2712.

SYMBOL	G-E PART NO	DESCRIPTION
Q314 thru Q316	19A115888P1	Silicon, NPN; sim to Type 2N2712.
Q317*	19A116774P1	Silicon, NPN.
		In KEY K and earlier:
	19A115888P1	Silicon, NPN; sim to Type 2N2712.
Q318*	19A115300P4	Silicon, NPN; sim to Type 2N3053.
		In KEY K and earlier:
	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q319* and Q320*	19A116774P1	Silicon, NPN.
		In KEY K and earlier:
	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q321*	19A115888P1	Silicon, NPN; sim to Type 2N2712. Deleted by REV C.
Q431 thru Q433	19A115925P1	Silicon, NPN.
		- - - - - - - - - RESISTORS - - - - - - - - -
R301	3A152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R302	3A152P273J	Composition: 2700 ohms ±5%, 1/4 w.
R303	3A152P393J	Composition: 390 ohms ±5%, 1/4 w.
R304	3A152P471J	Composition: 470 ohms ±5%, 1/4 w.
R305	3A152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R306	3A152P273J	Composition: 2700 ohms ±5%, 1/4 w.
R307	3A152P391J	Composition: 390 ohms ±5%, 1/4 w.
R309	3A77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R310	3A77P273J	Composition: 2700 ohms ±5%, 1/2 w.
R311	3A77P475J	Composition: 4700 ohms ±5%, 1/2 w.
R312 thru R315	3A77P471J	Composition: 470 ohms ±5%, 1/2 w.
R329	3A152P330K	Composition: 33 ohms ±10%, 1/4 w.
R330	3A77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R331	3A77P823K	Composition: 8200 ohms ±10%, 1/2 w.
R332	3A77P390K	Composition: 3900 ohms ±10%, 1/2 w.
R333	3A77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R334	3A77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R335	3A77P561K	Composition: 560 ohms ±10%, 1/2 w.
R336	3A77P331K	Composition: 330 ohms ±10%, 1/2 w.
R350	3A77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R351	3A77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R352	3A77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R353	3A77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R354	3A77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R355	3A77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R356	3A152P223K	Composition: 2200 ohms ±10%, 1/4 w.
R357	3A77P181K	Composition: 180 ohms ±10%, 1/2 w.
R358	3A77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R359	3A77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R360	3A77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R361	3A77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R362	3A77P181K	Composition: 180 ohms ±10%, 1/2 w.
R363	3A77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R364	3A77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R365	3A77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R366	3A77P123K	Composition: 12,000 ohms ±10%, 1/2 w.
R367	3A77P103K	Composition: 10,000 ohms ±10%, 1/2 w.

SYMBOL	G-E PART NO	DESCRIPTION
R368	3A152P181K	Composition: 180 ohms ±10%, 1/4 w.
R369	3A77P513J	Composition: 5100 ohms ±5%, 1/2 w.
R370	3A77P181K	Composition: 180 ohms ±10%, 1/2 w.
R371	3A77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R372	3A77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R373	3A77P103K	Composition: 1000 ohms ±10%, 1/2 w.
R374	3A77P181K	Composition: 180 ohms ±10%, 1/2 w.
R375 and R376	3A77P513J	In KEY K and earlier: Composition: 51,000 ohms ±5%, 1/2 w.
R377	3A77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R378	3A77P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R379	3A77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R380	3A77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R381	3A77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R382	3A152P221J	Composition: 220 ohms ±5%, 1/4 w.
R383	3A77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R384	3A152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R385	3A152P152K	Composition: 1500 ohms ±10%, 1/4 w.
R386*	3A77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
		In KEY K and earlier:
	3A77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R387*	3A152P753J	Composition: 75,000 ohms ±5%, 1/4 w. Deleted by REV C.
R388	3A77P300J	Composition: 30 ohms ±5%, 1/2 w.
R389	3A77P681J	Composition: 680 ohms ±5%, 1/2 w.
R390*	3A77P242J	Composition: 2400 ohms ±5%, 1/2 w.
		In KEY K and earlier:
	3A77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R391	3A77P431J	Composition: 430 ohms ±5%, 1/2 w.
R392(R400	19B209320P1	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 3 (Type 71-2).
R393*	3A77P303K	Composition: 2000 ohms ±10%, 1/2 w.
		In KEY K and earlier:
	3A77P393K	Composition: 3900 ohms ±10%, 1/2 w.
R394	3A77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R395	3A77P331K	Composition: 330 ohms ±10%, 1/2 w.
R396 and R397	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R399	3A152P751J	Composition: 750 ohms ±5%, 1/4 w, (Part of R392).
R400		
R401	19A116278P357	Metal film: 38,300 ohms ±2%, 1/2 w.
R402	19A116278P313	Metal film: 19,300 ohms ±2%, 1/2 w.
R403	3A77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R404	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R405	3A152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R406*	3A152P513J	Composition: 5100 ohms ±5%, 1/4 w.
		In KEY F-K:
	3A152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
		In KEY K and earlier:
	3A152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R407	3A77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R408	3A77P473J	Composition: 47,000 ohms ±5%, 1/2 w.

SYMBOL	G-E PART NO	DESCRIPTION
R410*	3A152P182J	Composition: 1800 ohms ±5%, 1/4 w. Deleted by REV C.
R411*	3A152P473J	Composition: 47,000 ohms ±5%, 1/4 w. Deleted by REV C.
R412	3A77P561J	Composition: 560 ohms ±5%, 1/2 w.
R451 and XY451	3A152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R452*	3A152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
		Earlier than REV B:
	3A152P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R453	3A152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R454	3A152P150K	Composition: 15 ohms ±10%, 1/4 w.
R455	3A152P681J	Composition: 680 ohms ±5%, 1/4 w.
R456	3A152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R457*	3A152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
		Earlier than REV B:
	3A152P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R458	3A152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R459	3A152P150K	Composition: 15 ohms ±10%, 1/4 w.
R460	3A152P681J	Composition: 680 ohms ±5%, 1/4 w.
R461 and R462	3A152P201J	Composition: 200 ohms ±5%, 1/4 w.
R463*	3A152P243J	Composition: 24,000 ohms ±5%, 1/4 w.
		Earlier than REV B:
	3A152P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R464	3A152P823J	Composition: 8200 ohms ±5%, 1/4 w.
R465	3A152P221K	Composition: 220 ohms ±10%, 1/4 w.
R466	3A152P201J	Composition: 200 ohms ±5%, 1/4 w.
R468	3A152P162J	Composition: 1600 ohms ±5%, 1/4 w.
R469	3A152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R470 and R471	3A152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R472	3A77P823J	Composition: 82,000 ohms ±5%, 1/2 w.
R473	3A77P124J	Composition: 0.12 megohm ±5%, 1/2 w.
R474	3A77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R475	3A77P122J	Composition: 1200 ohms ±5%, 1/2 w.
R476*	3A152P152J	Composition: 1500 ohms ±5%, 1/4 w. Deleted by REV C.
R477*	3A77P273J	Composition: 27,000 ohms ±5%, 1/2 w.
		In KEY G-K:
	3A77P433J	Composition: 43,000 ohms ±5%, 1/2 w. Added by REV C.
R478*	3A77P564J	Composition: 0.56 megohm ±5%, 1/2 w. Added by REV C. Deleted by REV L.
R479*	3A77P153J	Composition: 15,000 ohms ±5%, 1/2 w. Added by REV C.
R480*	3A152P821J	Composition: 820 ohms ±5%, 1/4 w. Added by REV G.
		- - - - - - - - THERMISTORS - - - - - - - -
RT301	5490828P38	Thermistor: 1400 ohms ±5%, color code green and white; sim to Global Type 4R2B.
RT302	5490828P35	Thermistor: 3900 ohms ±5%, color code green and green; sim to Global Type 7238-4.
RT451	5490828P44	Thermistor: 14,000 ohms ±5%, color code black and yellow; sim to Global Type 416K.
RT452	19C300048P12	Disc: .175 megohm ±10%; sim to GE 36D.
RT453	5490828P45	Thermistor: 0.42 megohm ±5%, color code black and blue; sim to Global Type 0550M.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - VOLTAGE REGULATORS - - - - - -
VR451	4036887P40	Silicon, Zener.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY451 and XY452	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.
Y301	19B213403G1	Crystal: frequency 11945 KHz, temp range -30°C to +60°C. NOTE: When reordering, give GE Part Number and specify exact frequency needed. ICOM Frequency = Operating Freq -12.4 / 23. Crystal Frequency = Operating Freq -12.4 / 9.
Y451 and Y452	19B206890P1	Quartz: freq range 42-55 MHz, temp range -30°C to +85°C.
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	4030555P1	Insulator, disc: nylon. (Used with Q318).
	19A127000P2	Can. (Used with L301-L306 and L457).
	19B216165G1	Plate,
	19A121069P1	Can. (Used with L451 and L452).
	19E500824P1	Chassis,
	4033306P62	Washer, fiber. (Used with FL301).

PRODUCTION CHANGES

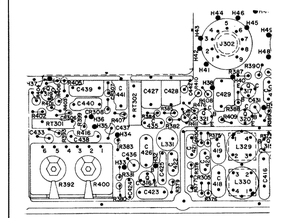
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for description of parts affected by these revisions.

REV. A - To improve performance of 1st RF Amplifier. Added C483.

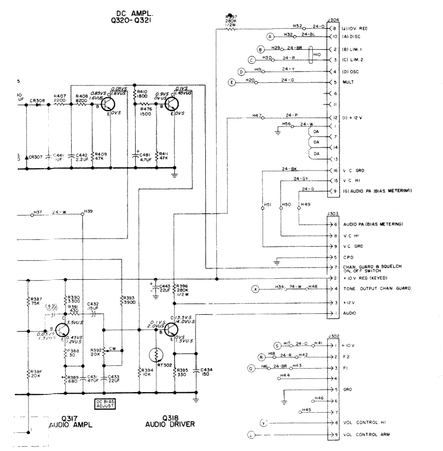
REV. B - To provide adequate 1st oscillator injection voltage. Changed R452, R457, and R463.

REV. C - To eliminate objectionable squelch thump. Deleted R287, R410, R411, C433, C448, R476, C481, and Q321. Added C8453, R477, R478, R479, C484, C485, and C486.

Outline Diagram was:



Schematic Diagram was:



REV. D - To replace transistor no longer available and improve receiver front end stability. Deleted C483 and CR301. Changed C304, Q301, Q302 and Q303.

REV. E - To stabilize the 2nd R.F. Amplifier. Changed C310 and applied a solder bead along the copper plated frame and printed wiring board in the area where the first oscillator thermistors are mounted, on the opposite side of the frame from L305 and Q302.

REV. F - To improve critical squelch. Changed R406.

REV. G - To improve performance change jumpers from H12 to H25, H15 to H14, H23 to H40, and H24 to H27 to printed wire run on printed wire board. Added R480 and C487, Changed C702, C308 and Q301. Added J405, J406, J407, J408, J411, J412, and J413. Added P405, P406, P407, P408, P411, P412 and P413.

REV. H - To improve coupling in front end. Changed C309 and C315.

REV. J - To increase "S" reading on Test Set. Changed CR451.

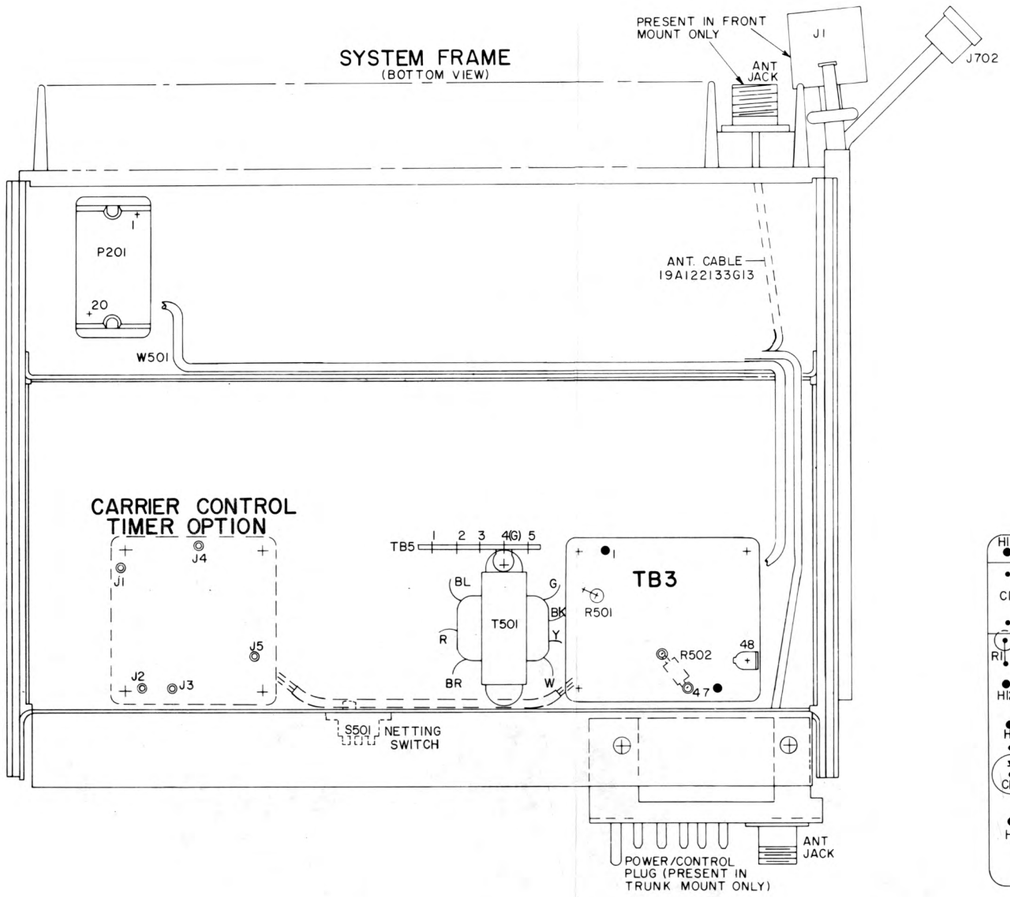
REV. K - To improve modulation acceptance and squelch clipping performance. Changed C382,C384, C386, C388, C390 C393 and C394.

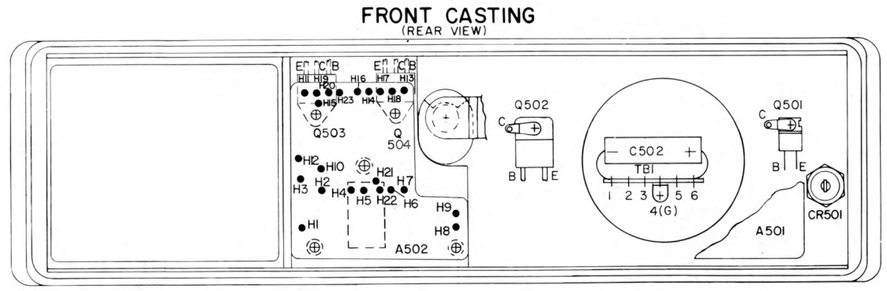
REV. L - To improve distortion and squelch action. Changed C439, R386, R393, R406, R477, R390, Q317, Q318, Q319 and Q320. Deleted R478 and added CR454.

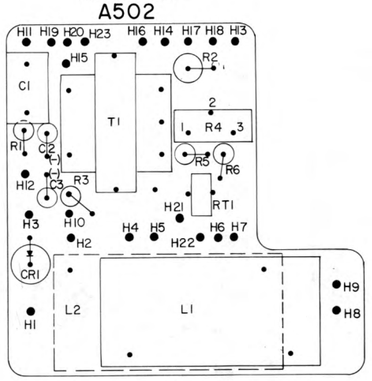
QUICK CHECKS

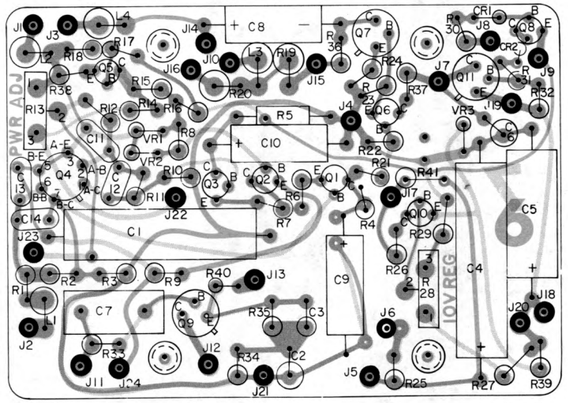
This procedure should be used in conjunction with voltage readings on the power regulator schematic diagram (see Table of Contents).

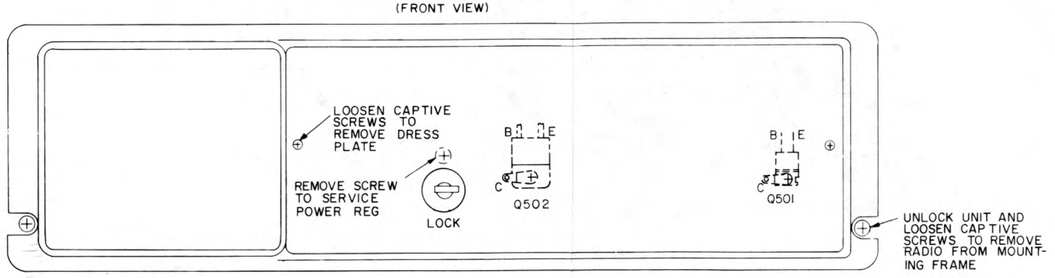
SYMPTOM	PROCEDURE
No PA supply voltage VCC (Measure with 4EX3A10 in Position G, polarity switch in (-) position and read on 15-Volt scale.)	1. Check the 15-Amp input fuse in the red battery cable. 2. Check for open coil L1 on A502. 3. Check for loose connections at A502-H9 and P201-8.
No regulated +10 Volts	1. Check input fuse. Check setting of R28. 2. Check for approximately +12 Volts at collector of Q502. If voltage is present, check for defective Q10.
Vcc too low.	1. Check voltage at A502-H4, H8 and P201-8
Vcc too high (greater than 13.0 Volts).	1. Check for shorted Q501 2. Check for defective coil L1 on A502.
No keyed 9.5 (Vcc present)	1. Check for defective Q8 or Q11 on A501. 2. Check for 10V at emitter of Q11 on A501. 3. Check for 9.5V at collector of Q8 on A501. 4. Check for 12V at J8 on A501. 5. Check for Gnd. at J9 on A501 when the transmitter is keyed.
No Pre-driver (AMP 1) Voltage at P201-4	1. Check Voltage at A501-J3 2. Check Voltages on Q501 per wiring diagram. 3. Check Voltages on Q1-Q7 per wiring diagram.
Power Output cannot be adjusted with R13	1. Check Voltage at A501-J3. It should vary as the Power Adjust Pot is varied. 2. Check for proper Voltages on Q1-Q7. 3. Check voltages on Q501. 4. Check voltage at P201-4.

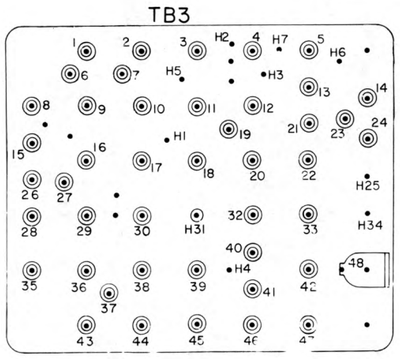


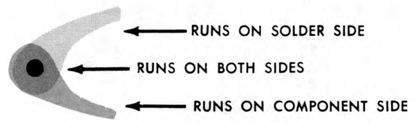










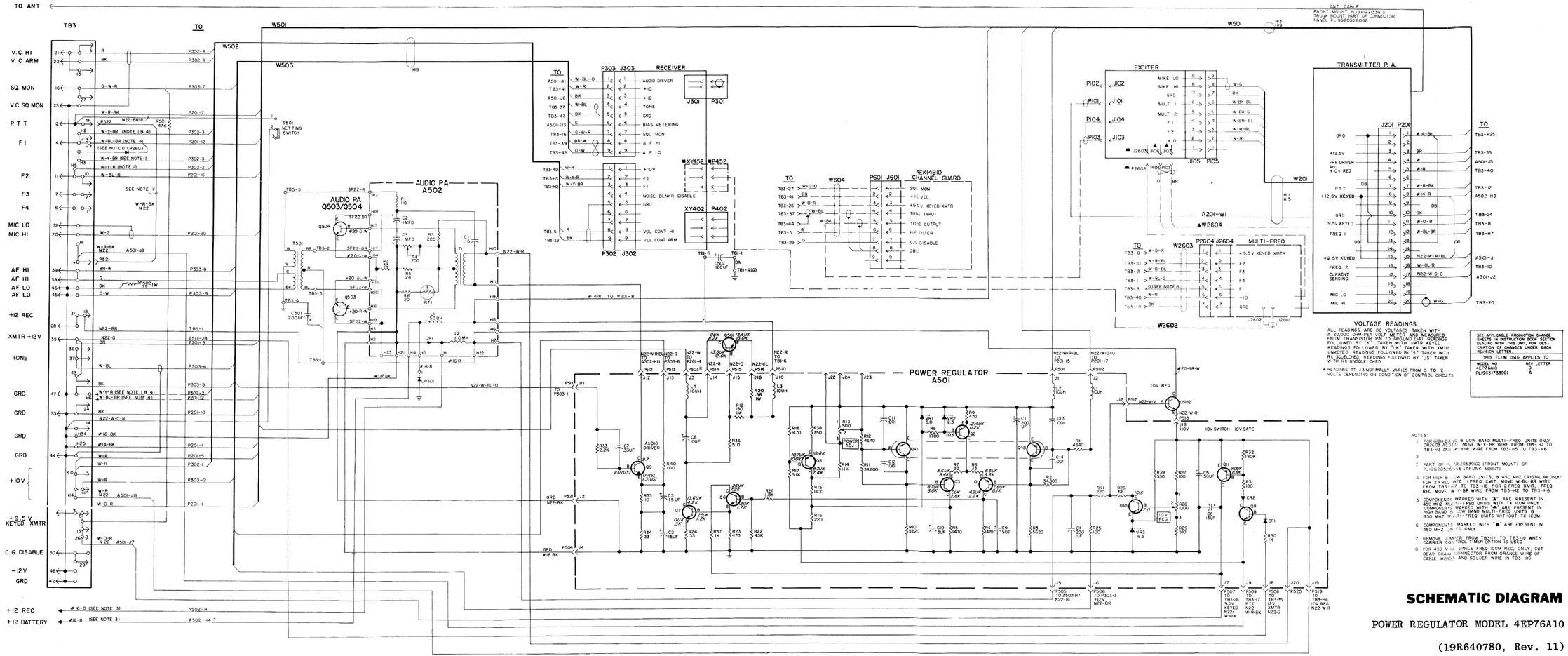


OUTLINE DIAGRAM

POWER REGULATOR MODEL 4EP76A10

RC-2199C

(19D416135, Rev. 6)
(19C317878, Sh. 1, Rev. 6)
(19C317878, Sh. 2, Rev. 7)



VOLTAGE READINGS

ALL READINGS ARE DC VOLTAGES TAKEN WITH A 20,000 OHM PER-VOLT METER AND MEASURED FROM TRANSISTOR PIN TO GROUND. (V#) READINGS FOLLOWED BY "K" TAKEN WITH XMTR KEYED. READINGS FOLLOWED BY "UK" TAKEN WITH XMTR UNKEYED. READINGS FOLLOWED BY "S" TAKEN WITH RX SQUELCHED. READINGS FOLLOWED BY "US" TAKEN WITH RX UNSQUELCHED.

* READINGS AT J3 NORMALLY VARIES FROM 5 TO 12 VOLTS DEPENDING ON CONDITION OF CONTROL CIRCUITS

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
4EP76A10	D
PLN9C3733G1	A

NOTES:

1. FOR HIGH BAND & LOW BAND MULTI-FREQ UNITS ONLY. CROSS ADD'D MOVE W-Y- BR WIRE FROM TB3-H2 TO TB3-H3 AND W-Y-R WIRE FROM TB3-H3 TO TB3-H2.
2.
3. PART OF P. 9B20539G2 (FRONT MOUNT) OR P. 9B20539G6/G8 (TRUNK MOUNT).
4. FOR HIGH & LOW BAND UNITS, & 450 MHZ CRYSTAL RX ONLY: FOR 2 FREQ REC, (FREQ XMIT, MOVE W-BL-BR WIRE FROM TB3-H7 TO TB3-H6 FOR 2 FREQ XMIT, (FREQ REC MOVE W-Y-BR WIRE FROM TB3-H2 TO TB3-H6.
5. COMPONENTS MARKED WITH "A" ARE PRESENT IN 450 MHZ MULTI-FREQ UNITS WITH TX CONFIGURATION ONLY. COMPONENTS MARKED WITH "B" ARE PRESENT IN HIGH BAND & LOW BAND MULTI-FREQ UNITS & 450 MHZ MULTI-FREQ UNITS WITHOUT TX ICOM.
6. COMPONENTS MARKED WITH "■" ARE PRESENT IN 450 MHZ UNITS ONLY.
7. REMOVE JUMPER FROM TB3-J7 TO TB3-J9 WHEN CARRIER CONTROL TIMER OPTION IS USED.
8. FOR 450 MHZ SINGLE FREQ ICOM REC. ONLY, CUT BEAD CHAIN CONNECTOR FROM ORANGE WIRE OF CABLE W2601 AND SOLDER WIRE IN TB3-H6.

SCHEMATIC DIAGRAM

POWER REGULATOR MODEL 4EP76A10

(19R640780, Rev. 11)

(DF-0070)

PARTS LIST

L81-4272C

POWER REGULATOR
MODEL 4EP76A10

SYMBOL	GE PART NO.	DESCRIPTION
		POWER REGULATOR ASSEMBLY 19D416100G1
A501		**POWER REGULATOR BOARD 19C317880G1**
		- - - - - - - - - **CAPACITORS** - - - - - - - - -
C1	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT.
C2	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C3*	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		In REV C and earlier:
	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C4	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT.
C5	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C6	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C7	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C8	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C9 and C10	19A115680P2	Electrolytic: 5 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C11* thru C14*	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV A.
		- - - - - **DIODES AND RECTIFIERS** - - - - -
CR1 and CR2	19A115250P1	Silicon.
		- - - - - - - - **INDICATING DEVICES** - - - - -
DS1*	4034664P1	Lamp, incandescent: 28 v; sim to GE 2148. Deleted by REV C.
		- - - - - - **JACKS AND RECEPTACLES** - - - - - -
J1 thru J24	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - **INDUCTORS** - - - - - - - - -
L1 thru L4	7488079P43	Choke, RF: 10.0 mh ±10%, 0.30 ohms DC res max; sim to Jeffers 4422-4K.
		- - - - - - - - **TRANSISTORS** - - - - - - - -
Q1 thru Q3	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q4	19A116597P1	Silicon, Dual, PNP: sim to Type 2N4939.
Q5	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q6	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q7	19A115300P1	Silicon, NPN; sim to Type 2N3053.
Q8	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q9	19A115300P4	Silicon, NPN; sim to Type 2N3053.
Q10	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q11	19A115970P1	Silicon, PNP; sim to Type 2N4356.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - **RESISTORS** - - - - - - - - -
R1	19A116278P265	Metal film: 4640 ohms ±2%, 1/2 w.
R2	19A116278P353	Metal film: 34,800 ohms ±2%, 1/2 w.
R3	19A116278P273	Metal film: 5620 ohms ±2%, 1/2 w.
R4 and R5	19A116278P217	Metal film: 1470 ohms ±2%, 1/2 w.
R6 and R7	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
R8	19A116278P225	Metal film: 1780 ohms ±2%, 1/2 w.
R9	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R10	19A116278P273	Metal film: 5620 ohms ±2%, 1/2 w.
R11	19A116278P353	Metal film: 34,800 ohms ±2%, 1/2 w.
R12	19A116278P265	Metal film: 4640 ohms ±2%, 1/2 w.
R13	19B209358P102	Variable, carbon film: approx 25 to 500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R14	3R77P113J	Composition: 11,000 ohms ±5%, 1/2 w.
R15	3R77P112J	Composition: 1100 ohms ±5%, 1/2 w.
R16	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
R17	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
R18	19A116278P217	Metal film: 1470 ohms ±2%, 1/2 w.
R19	3R78P181J	Composition: 180 ohms ±5%, 1 w.
R20	19B209022P109	Wirewound: 0.56 ohms ±10%, 2 w; sim to IRC Type BWH.
R21	3R77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R22	3R77P433J	Composition: 43,000 ohms ±5%, 1/2 w.
R23	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R24	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
R25	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R26	3R77P680J	Composition: 68 ohms ±5%, 1/2 w.
R27	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R28	19B209358P103	Variable, carbon film: approx 25 to 1000 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R29	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
R30	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R31	3R77P181J	Composition: 180 ohms ±5%, 1/2 w.
R32	3R77P184J	Composition: 0.18 megohm ±5%, 1/2 w.
R33	3R77P222J	Composition: 2200 ohms ±5%, 1/2 w.
R34	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
R35	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R36	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
R37	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R38	3R77P751J	Composition: 750 ohms ±5%, 1/2 w.
R39	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R40*	3R152P101K	Composition: 100 ohms ±10%, 1/4 w. Added by REV B.
R41*	3R152P221K	Composition: 220 ohms ±10%, 1/4 w. Added by REV C.
		- - - - **VOLTAGE REGULATORS** - - - - -
VR1	4036887P7	Silicon, Zener.
VR2	4036887P1	Silicon, Zener.
VR3	4036887P6	Silicon, Zener.
A502		**AUDIO PA BOARD 19C317339G1**
		- - - - - - - - - **CAPACITORS** - - - - - - - - -
C1	19A116080P6	Polyester: 0.15 µf ±20%, 50 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C2 and C3	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; 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 and white; sim to Globar Type B1211H-4.
		- - - - - - - **TRANSFORMERS** - - - - - - -
T1	19A116040P1	Audio freq: 300 to 4000 Hz. Pri: 19.3 ohms ±10% DC res. Sec: 23.8 ohms ±10% DC res.
		- - - - - - - - - **CAPACITORS** - - - - - - - - -
C2501	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C2502	19A115680P9	Electrolytic: 120 µf +150% -10%, 26 VDC#; sim to Mallory Type TT.
		- - - - - - **DIODES AND RECTIFIERS** - - - - - -
CR2501	19A115617P2	Silicon.
		- - - - - - - - - **PLUGS** - - - - - - - - -
P201		Part of W501.
P302		Part of W502.
P303		Part of W503.
P501	4029840P2	Contact, electrical: sim to Amp 42827-2.
P502		Part of W501.
P503		Part of W501.
P504	4029840P1	Contact, electrical: sim to Amp 41854.
P505	4029840P2	Contact, electrical: sim to Amp 42827-2.
P506		Part of W503.
P507 thru P510	4029840P2	Contact, electrical: sim to Amp 42827-2.
P511		Part of W503.
P512	4029840P2	Contact, electrical: sim to Amp 42827-2.
P513		Part of W503.
P514 thru P521	4029840P2	Contact, electrical: sim to Amp 42827-2.
		- - - - - - - - **TRANSISTORS** - - - - - - - -
Q501	19A116375P1	Silicon, PNP.
Q502	19A116203P3	Silicon, NPN.
Q503 and Q504	19A116203P2	Silicon, NPN.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - **RESISTORS** - - - - - - - - -
R501	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R502	3R78P390K	Composition: 39 ohms ±10%, 1 w.
		- - - - - - - - - **SWITCHES** - - - - - - - - -
S501	19B209040P7	Slide: SPDT, 0.5 amp at 125 v; sim to Continental-Wirt Type G135.
		- - - - - - - - **TRANSFORMERS** - - - - - - - -
T501	19A116041P2	Audio: 300 to 4000 Hz. Pri: 1.00 ohm ±15% DC res. Sec No. 1: .23 ohm ±10% DC res. Sec No. 2: 10.5 ohms ±15% DC res.
		- - - - - - - **TERMINAL BOARDS** - - - - - - -
TB1	7487424P25	Miniature, phen: 5 terminals.
TB3	19B205912G1	Terminal board.
TB5	7775500P12	Phen: 5 terminals.
		- - - - - - - - - - **CABLES** - - - - - - - - - -
W501		**CABLE ASSEMBLY 19C311697G3**
		- - - - - - - - - **PLUGS** - - - - - - - - -
P201	19C303506P2	Connector, phen: 20 contacts.
P501 thru P503	4029840P2	Contact, electrical: sim to Amp 42827-2.
W502		**CABLE ASSEMBLY 19B205265G2**
		- - - - - - - - - **PLUGS** - - - - - - - - -
P302	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
	19A122138P1	Knob.
	19A134048P1	Wood screw.
		CABLE ASSEMBLY 19B216024G3
		- - - - - - - - - **PLUGS** - - - - - - - - -
P303	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
P506	4029840P2	Contact, electrical: sim to Amp 42827-2.
P511	4029840P2	Contact, electrical: sim to Amp 42827-2.
P513	4029840P2	Contact, electrical: sim to Amp 42827-2.
	19A122138P1	Knob.
	19A134048P1	Wood screw.
		HARNESS ASSEMBLY 19D418100G2 (Includes P201, P302, P303, P501-P521, TB3, W501-W503)
		MECHANICAL PARTS (See RC-2226)
1	5491682P11	Lock: Yale and Towne.
2	5491682P12	Cam. (Used with lock).
3	19C303919P2	Casting.
4	19B205282G1	Dress plate (Front Mount).
5	19B205282G2	Dress plate (Trunk Mount).
6	4036555P1	Insulator disc. (Used with Q7, Q8 and Q11 on A501).
7	4035711P4	(Not Used).

SYMBOL	GE PART NO.	DESCRIPTION
8	19B200525P52	(Not Used).
9	19D402629P1	Top cover.
10	19B205391G2	Side rail (Front Mount).
11	19C303899P3	Side rail (Trunk Mount).
12	19A122059P7	Pad. (Used with W501-W503).
13	7763541P2	Clip, spring tension.
14	19B209030P203	Tap screw: 4-40 x 3/16.
15	19D402660G2	Frame.
16	5491541P345	Spacer, hex. (Mounts casting to frame).
17	19C303899P1	Side rail.
18	19C303911G1	Bottom cover. (Front mount).
19	19C303911G2	Bottom cover. (Trunk mount).
20	N80P9010C6	Screw: 4-40 x 5/8. (Used with Q503 and Q504).
21	19A116023P2	Insulator, mica. (Used with Q501 thru Q504).
22	19A115222P3	Insulator, bushing. (Used with Q503 and Q504).
23	N404P11C6	Lockwasher: No. 4. (Used with Q501-Q504).
24	7141225P2	Hexnut: 4-40. (Used with Q501-Q504).
25	4031529P1	Clip, spring tension. (Used with W501).
26	N80P9007C6	Screw: 4-40 x 7/16. (Used with Q501 and Q502).
27	19A115222P1	Insulator, bushing: sim to Nylomatic Corp N5228. (Used with Q501 and Q502).
28	4036835P9	Terminal, solderless. (Used with Q501 and Q502).
29	19A121252P1	Heat sink. (Used with Q9 on A501).

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 prevent stray feedback from causing improper regulation. Added C11, C12, C13 and C14.

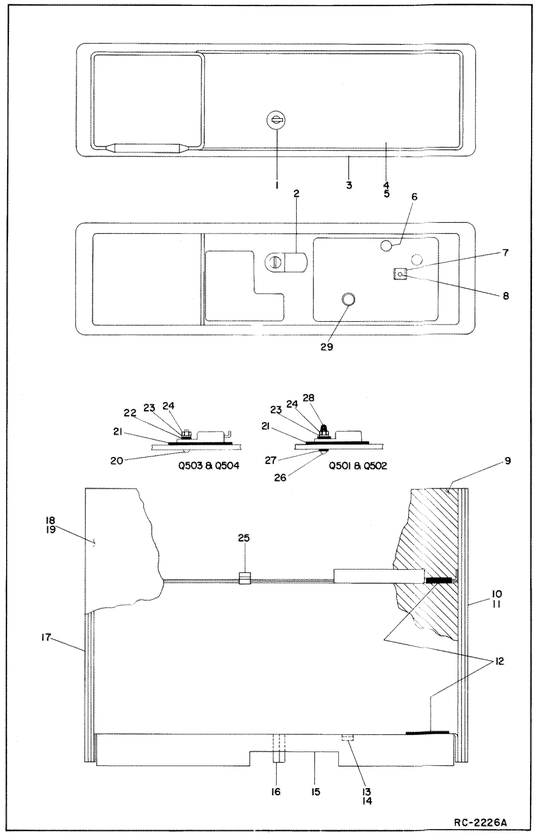
REV. B - To prevent oscillation in the Audio Driver circuit. Added R40.

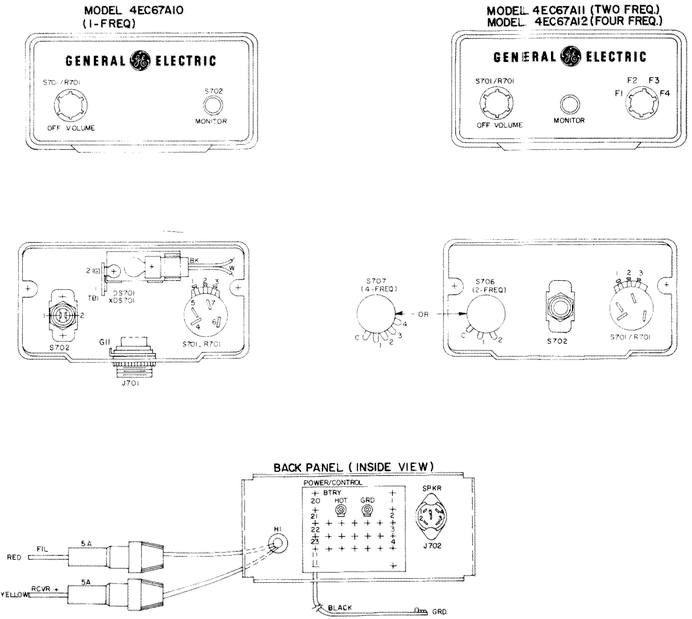
REV. A - Audio PA, A502 (19C317339G1)

To allow PA bias to set to proper current. Changed R3.

REV. C - To improve reliability. Delete DS1 Add R41

REV. D - To improve performance. Change value of C3





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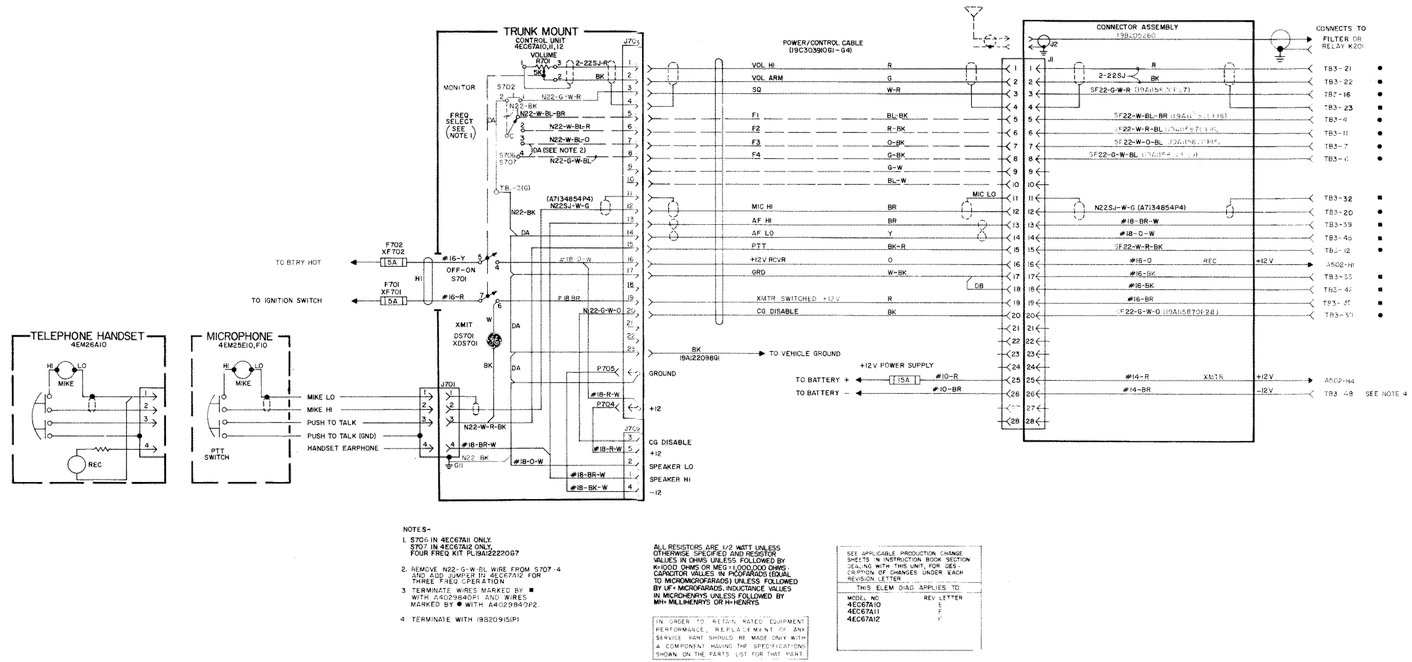


NOTES-

1. S705 IN 4EC67A11 ONLY.
   S707 IN 4EC67A12 ONLY.
   FOUR FREQ KIT PL19A122206G1
2. REMOVE N22-G-W-BL WIRE FROM S707-4 AND ADD JUMPER TO 4EC67A12 FOR THREE FREQ OPERATION
3. TERMINATE WIRES MARKED BY ■ WITH A402984OP1 AND WIRES MARKED BY ● WITH A402984OP2.
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 DESIGN AND PART CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

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

(19R620794, Rev. 10)

(DF-4075)

SCHEMATIC & OUTLINE DIAGRAMS

TRUNK MOUNT CONTROL UNIT
MODEL 4EC67A10-12

RC-1678G

PARTS LIST

LBI-3901E

TRUNK MOUNT CONTROL UNIT

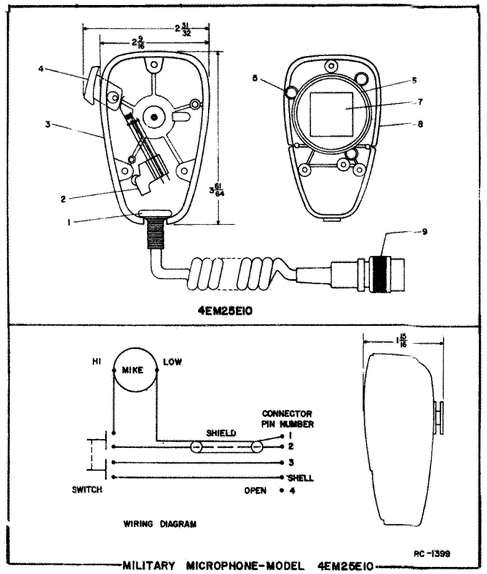
MODEL 4EC67A10 (19C303901G1) (1 FREQUENCY)
MODEL 4EC67A11 (19C303901G2) (2 FREQUENCY)
MODEL 4EC67A12 (19C303901G2) (4 FREQUENCY)
(19A122220G7)

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	19B209185P4	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).
	403918203	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).
	19B216271G2	Housing.



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.

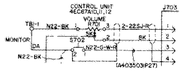
REV. A - Collector Assembly 19B205260-G1
To permit the addition of Channel Guard hookswitch option, added a green-white-orange wire from J1-20 to TB3-17.

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:

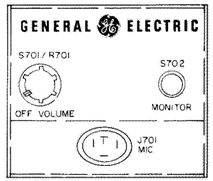


REV. D - Models 4EC67A10, 11 & 12
To ground microphone jack. Added black-white wire from J703 ground to G11.

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

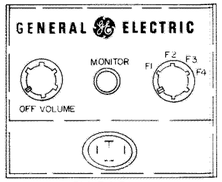
REV. C - Connector Assembly 19B205260-G1
To reduce transmitter noise to the region of 30-150 kHz from carrier. Added #14 BK wire between J1-27 and TB3-8, 22, 27. Added jumper from pin 26 to 27 on power cable plug in negative ground applications. Added jumper from pin 25 to 27 on power cable plug in positive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

MODEL 4EC68B10(1-FREQ.)

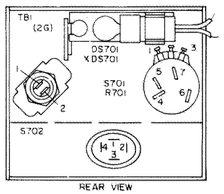


FRONT VIEW

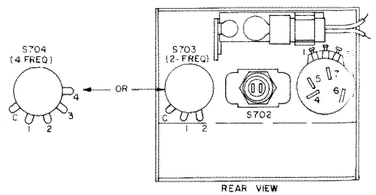
MODEL 4EC68B11 (2-FREQ)
MODEL 4EC68B12 (4-FREQ)



FRONT VIEW

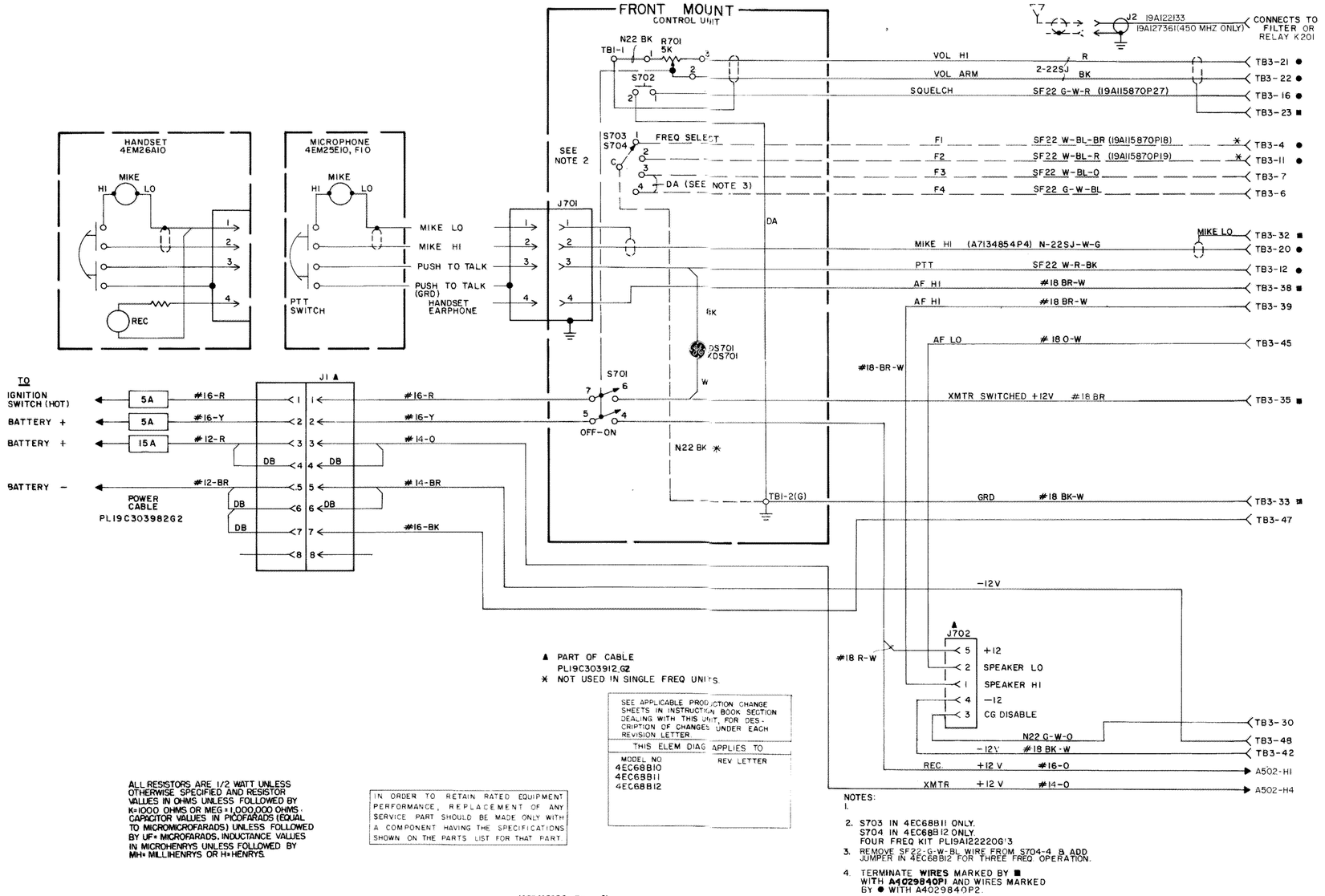


REAR VIEW



REAR VIEW

(19C311890, Rev. 0)



▲ PART OF CABLE PL19C303912,G2

✱ 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.

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(19D413136, Rev. 6)

NOTES:
1.
2. S703 IN 4EC68B11 ONLY.
   S704 IN 4EC68B12 ONLY.
   FOUR FREQ KIT PL19A122206G13
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

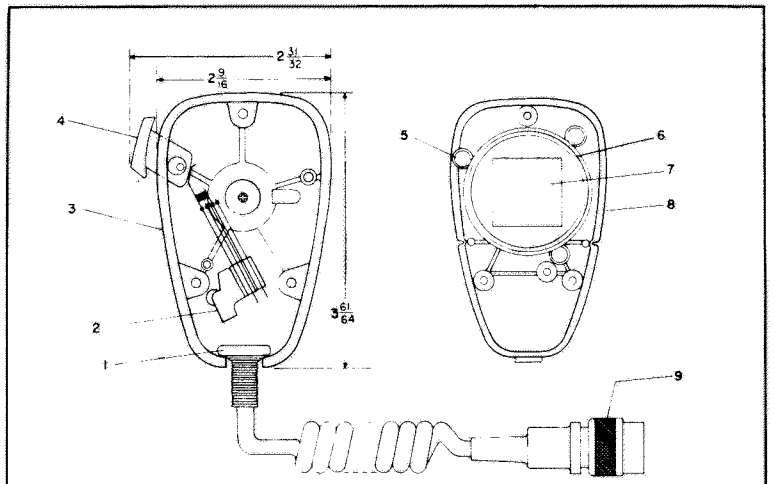
PARTS LIST

LBI-3899A

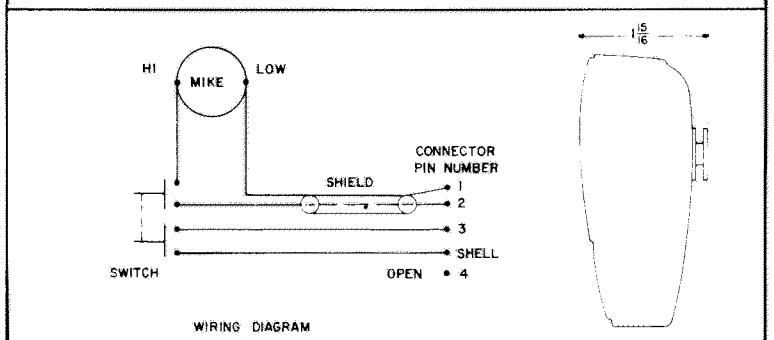
TRUNK MOUNT CONTROL UNIT
MODEL 4EC68B10 (19C303907G3) (1 FREQUENCY)
MODEL 4EC68B11 (19C303907G4) (2 FREQUENCY)
MODEL 4EC68B12 (19C303907G4) (4 FREQUENCY)
(19A12220G13)

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	7775560P4	Phen: 2 terminals.
		- - - - - - - - - SOCKETS - - - - - - - - -
XDS701	4032220P2	Lampholder, miniature: sim to Drake N517.
		MODIFICATION KIT 19A12220G13 (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).
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).

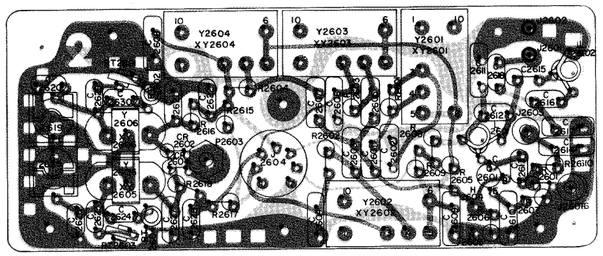
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



4EM25E10

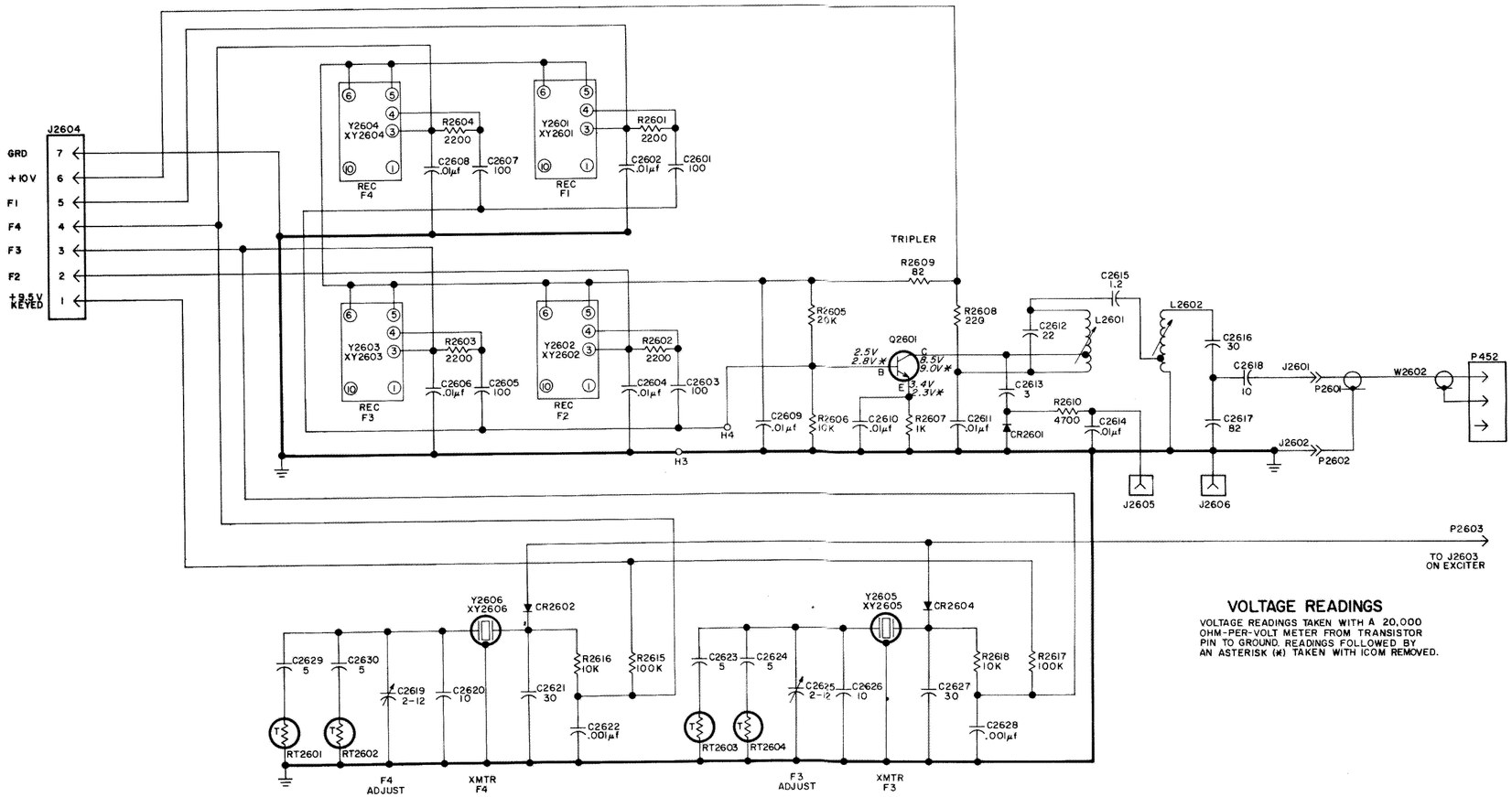


MILITARY MICROPHONE-MODEL 4EM25E10



(19C311983, Rev. 0)
(19B216315, Sh. 1, Rev. 2)
(19B216315, Sh. 2, Rev. 2)

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



VOLTAGE READINGS

VOLTAGE READINGS TAKEN WITH A 20,000 OHM-PER-VOLT METER FROM TRANSISTOR PIN TO GROUND. READINGS FOLLOWED BY AN ASTERISK (*) TAKEN WITH ICOM REMOVED.

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(19D413173, Rev. 1)

SCHEMATIC & OUTLINE DIAGRAMS

FOUR-FREQUENCY OSCILLATOR BOARD
MODEL 4EG22H10

RC-1733B

(DF-8407)

PARTS LIST

LBI-3913A

406–470 MHz MULTI-FREQUENCY OSCILLATOR BOARD MODEL 4EG22H10

SYMBOL	GE PART NO.	DESCRIPTION
		CAPACITORS
C2601	5490008P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2602	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2603	5490008P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2604	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2605	5490008P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2606	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2607	5490008P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2608 thru C2611	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2612	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2613	5496219P34	Ceramic disc: 3.0 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2614	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C2615	7130348P5	Molded, phen: 1.20 pf ±0.06 pf, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32.
C2616	5496219P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C2617	5490008P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2618	5496219P41	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2619	5491271P106	Variable, sub-miniature: approx 2.1-12 pf, 750 v peak; sim to EF Johnson 189.
C2620	5496219P10	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2621	5496219P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C2622	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2623 and C2624	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp 0 PPM.
C2625	5491271P106	Variable, sub-miniature: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C2626	5496219P10	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C2627	5496219P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C2628	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2629 and C2630	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
		DIODES AND RECTIFIERS
CR2601	7777146P3	Germanium.
CR2602	19A115603P1	Silicon.
CR2604	19A115603P1	Silicon.
		JACKS AND RECEPTACLES
J2601 and J2602	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J2604	19B209303P2	Plug, phen: 7 pins.
J2605 and J2606	4037265P1	Jack, tip: black plastic body; sim to Component Mfg Service A-11128.
		INDUCTORS
L2601 and L2602	19C303960G3	Coil.
		PLUGS
P452		(Part of W2602).
P2601 and P2602		(Part of W2602).
P2603	4029093P1	Plug, banana type; sim to Ucinite 155296.
P2604		(Part of W2603).
		TRANSISTORS
Q2601	19A115330P1	Silicon, NPN.
		RESISTORS
R2601 thru R2604	3R77P222J	Composition: 2200 ohms ±5%, 1/2 w.
R2605	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R2606	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R2607	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
R2608	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R2609	3R77P820K	Composition: 82 ohms ±10%, 1/2 w.
R2610	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R2615	3R77P104K	Composition: 0.10 megohms ±10%, 1/2 w.
R2616	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R2617	3R77P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R2618	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
		THERMISTORS
RT2601	19B209353P2	Disc, thermistor: 1250 ohms ±5%, color code red; sim to GE 16D-3121.
RT2602	19B209353P1	Rod, thermistor: 3350 ohms ±5%, color code brown; sim to GE 1R-1544.
RT2603	19B209353P2	Disc, thermistor: 1250 ohms ±5%, color code red; sim to GE 16D-3121.
RT2604	19B209353P1	Rod, thermistor: 3350 ohms ±5%, color code brown; sim to GE 1R-1544.
		CABLES
W2602	19B205263G1	Cable, RF: approx 14 inches long. Includes P452, P2601 and P2602.
W2603	19B205275G2	Cable assembly, (Multi-Freq). Includes P2604.
		SOCKETS
XY2601 thru XY2604	19B216043G1	Socket assembly. Includes:
	19D413071P1	Socket cavity.
	19A115834P2	Electrical contacts. (6)
XY2605 and XY2606		(See Miscellaneous).
		OSCILLATORS
		NOTE: When reordering, specify ICOM Frequency.
		ICOM Frequency = (OF -12.4) ÷ 27.
Y2601 thru Y2604	4EG26A13	Integrated Circuit Oscillator Module (1COM).
	19D413070P1	Cap, decorative.
		NOTE: When reordering, give GE Part Number and specify exact frequency needed.
		Crystal frequency = (OF ÷ 72).
Y2605 and Y2606	19B206204P1	Quartz: freq range 5400 to 7250 KHz, temp range -30°C to +85°C.
		MISCELLANEOUS
	4033089P1	Clip, spring tension. (Part of XY2605 and XY2606).
	19A115793P1	Contact, electrical. (Part of XY2605 and XY2606).
	19C311172P1	Socket. (Part of XY2605 and XY2606).
	19B200525P8	Rivet. (Part of XY2605 and XY2606).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

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 2/18-4.
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.

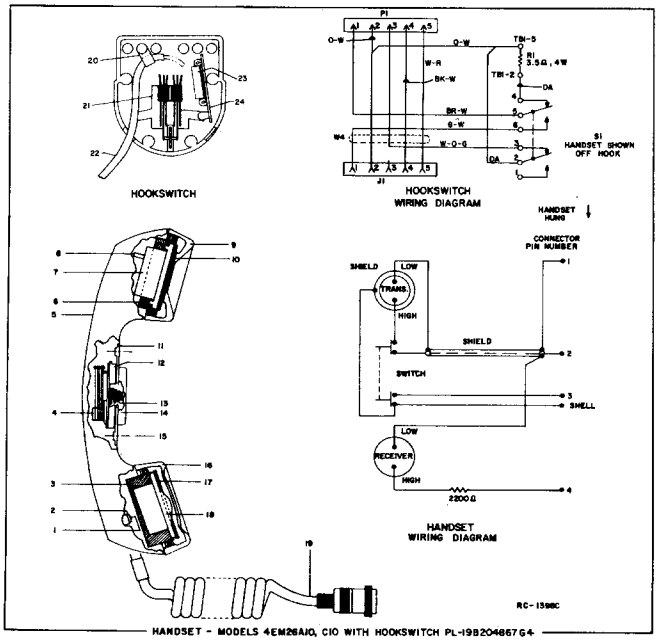
PARTS LIST

LBI-4866

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 - - - - - - - - -
	19A116986P108	Screw, thread forming, assembled washer: Phillips Pozidriv®, HI-LO® thread, No. 7-19 x 1/2. (Mount speaker).
	19A116986P112	Screw, thread forming, assembled washer: Phillips Pozidriv®, HI-LO® thread, No. 7-19 x 3/4. (Housing to grille).
	N130P1710C13	Tap screw. (Secures housing to wall).
	19A116985P1	Screw, hex head-slotted: double lead thread, with internal tooth washer, No. 13-16 x 3/4. (Mounts bracket to housing).
	19C320016P2	Mounting bracket.
	19D416396P2	Housing.
	19B219692G2	Grille.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



HANDSET - MODELS 4EM26A10, C10 WITH HOOKSWITCH PL-19B204867G4

SCHEMATIC & OUTLINE DIAGRAM

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

RC-2203D

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 (Q1 through Q4):

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 antenna relay 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. Cut the collector lead at a 45° angle for future identification (see Figure 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 (8 to 10 inch-pounds maximum in 25-50 MHz transmitters, and 6.5 inch-pounds for 150.8 to 470 MHz transmitters).

6. Make sure that the transistor leads are formed 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.

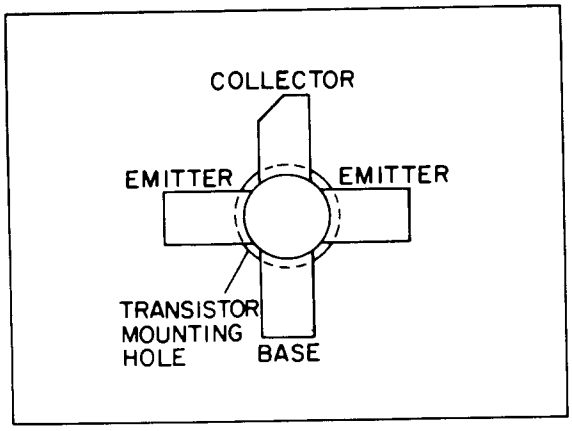


Figure 1 - Lead Identification

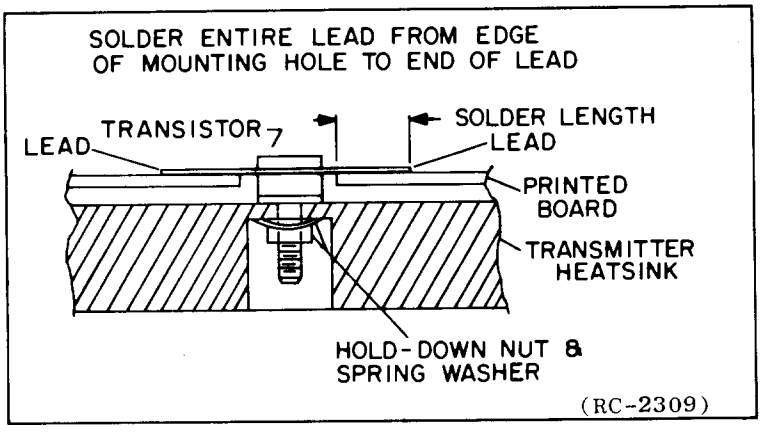


Figure 2 - Lead Forming

STEP I - QUICK CHECKS

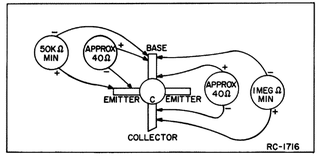
Meter Position	Probable Defective Stage		
	High Meter Reading	Low Meter Reading	Zero Meter Reading
A (MULT-1)	Q105 or Q106	Q105 or open L113	10-Volt regulator, osc. crystal or Q104, Q105, Q106
B (MULT-2)	Q107, A201-Q1	Q107	Q107
C (MULT-3) INPUT	A201-Q1	10-Volt regulator, A201-Q1	10-Volt regulator, A201-Q1
D (MULT-3) OUTPUT	A202-Q2	13.1 Volts A202-Q1	13.1 Volts A202-Q1
F (DRIVER Ic)	A202-Q4	Q3, or protective circuits activated*	Keyed 12 Volts, A202-Q2, Q3
G (PA Ic)	Mis-aligned PA. Check Step 7 of Alignment Procedure.	Q4 or protective circuits activated*	Keyed 12 Volts, A202-Q4
H (Varactor Voltage)	Check PA and Varactor Alignment	Check PA and Varactor Alignment and CV1	PA, CV1

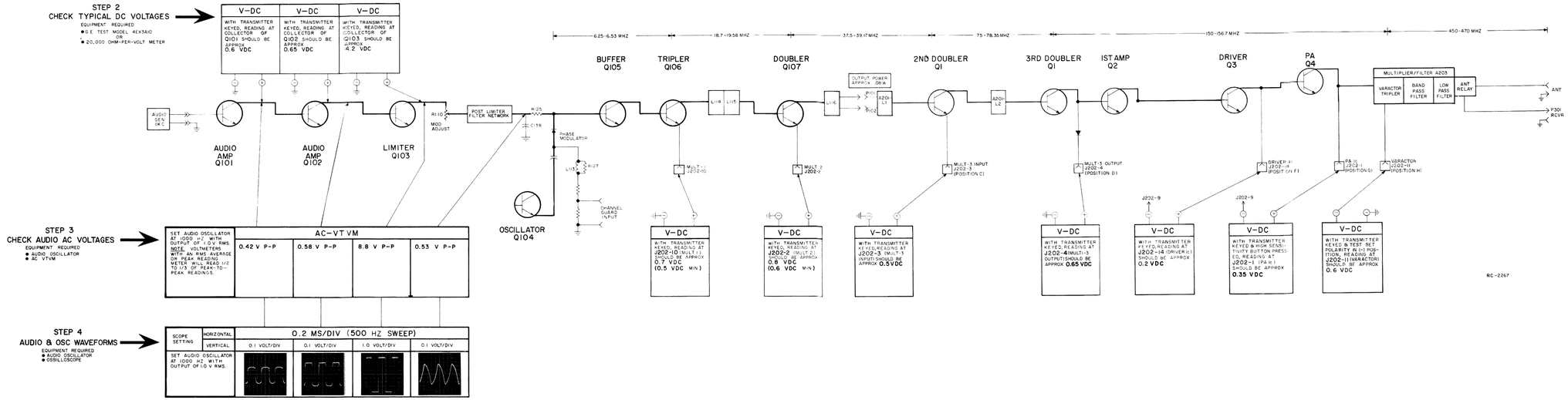
* Refer to the power regulator Troubleshooting Procedure for check of protective circuit.

PA TRANSISTOR CHECKS

PA transistors Q1 thru Q4 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.
4. If replacement of a transistor is necessary, refer to the replacement procedure listed in the Table of Contents.





(DF-3151)

TROUBLESHOOTING PROCEDURE

TRANSMITTER TYPE KT-14-A

RC-2267A

STEP 1 - QUICK CHECKS

TEST SET CHECKS

These readings are typical readings measured with GE Test Set Model 4EX2A10 in the Test 1 position, or with Model 4EX8K10 or 11 in the 1 volt position.

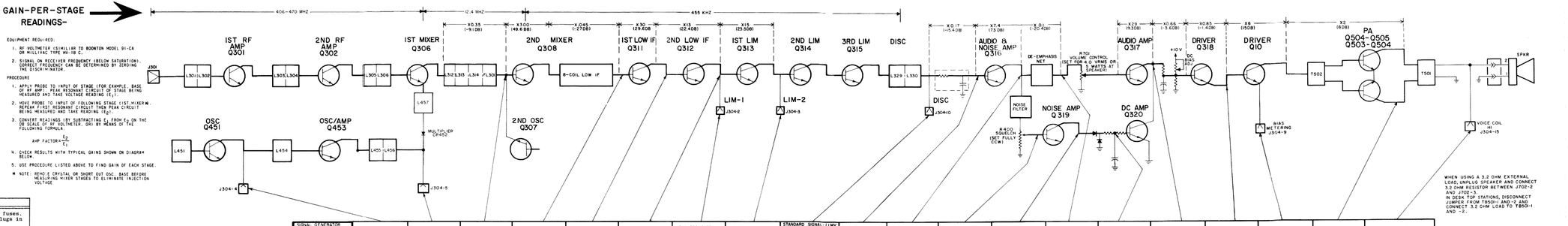
Metering Position	Reading With No Signal In	Reading With 10 Microvolts
A (Disc)	0 VDC	0 VDC
B (Lim 1)	0 VDC	0.1 VDC
C (Lim 2)	0.1 VDC	0.45 VDC
D (Osc.)	0.15 VDC	
E (Osc.)	0.1 VDC	
G (Audio Bias)	0.9 VDC	
I (Supply Voltage)	Approx. 13 VDC (15 volts full scale)	
J (Reg 10V)	+ 10 VDC (15 volts full scale)	

SYMPTOM 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 on 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 Q451 and Q453. Check resistance readings on J302-1, -2 and -3. Check crystal Y451.
LOW RECEIVER SENSITIVITY	Check Front End Alignment (Refer to Receiver Alignment Procedure). Check input signal required for 0.2-volt reading at LIN-1. Reading should be less than 20 uv. Check antenna connections, cable and relay. Check voltage readings of 1st and 2nd IF Amps and 1st and 2nd Mixers. Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	Check Audio PA Transistors output current at J304-9. If reading is low -- Check BIAS ADJ for 0.9 VDC at J304-9. If incorrect, set for 0.9 V with R392. (Position G on Test Set). 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. Check setting of SQUELCH control R400 (Refer to Receiver Alignment Procedure).
IMPROPER SQUELCH OPERATIONS	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.

(DF-3134)

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). RELATIVE VOLTAGES CAN BE DETERMINED BY TERMINATING 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_1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (1ST MIXER IN THIS CASE). PEAK RESONANT CIRCUIT OF PEAK CIRCUIT BEING MEASURED AND TAKE READING (E_2).
3. CONVERT READINGS (BY SUBTRACTING E_1 FROM E_2 ON THE DB SCALE OF RF VOLTMETER, OR) BY MEANS OF THE FOLLOWING FORMULA:

   AMP FACTOR = $\frac{E_2}{E_1}$

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.

SIGNAL GENERATOR INPUT TO J301 FOR SETTING AT DISCRIMINATOR ZERO			UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED	10 MICROVOLTS UNMODULATED	1 MICROVOLT UNMODULATED	STANDARD SIGNAL-1 MV AT NO.1 PIN FROM M10 BY 1 KHZ WITH 33 KHZ DEV. (WIDE DEV.)	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 ACROSS R 50 MV	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING INCREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING INCREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING INCREASES BY 5%														AFTER CHECKING WAVEFORMS AT J304-15 SET FOR RATED 5 WATT OUTPUT ACROSS 3.2 Ω LOAD.	
READING	0.4 VDC MIN EX-3-A 0.1 VDC MIN MULTMTR 0.15 VDC MIN	0.08 VDC MIN EX-3-A 0.07 VDC MIN MULTMTR 0.07 VDC MIN	GENERATOR OUTPUT SHOULD BE APPROX 20 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 500 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 250 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 10 MICROVOLTS	0.4 VDC EX-3-A 0.1 VDC MULTMTR 0.2 VDC	1.2 VDC EX-3-A 0.3 VDC MULTMTR 0.6 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	0.9 VDC	5.8 VAC (COLLECTOR TO GROUND)	4.0 VAC

STEP 2A- SIMPLIFIED VTVM GAIN CHECKS

EQUIPMENT REQUIRED:

1. VTVM-ACADC
2. SIGNAL GENERATOR (MEASUREMENTS M560 EQUIV.)

PRELIMINARY STEPS:

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

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 VP-P (NOISE)	0.24 V P-P		1.2 V P-P	1.4V P-P		16V P-P	11.3V P-P
NOISE WAVE FORM													
STANDARD SIGNAL 1 MILLIVOLT AT RECEIVER FREQ MODULATED BY 1KHZ WITH 3.3 KHZ (10KHZ, WIDE BAND) DEVIATION													

TROUBLESHOOTING PROCEDURE

RECEIVER MODELS 4ER49A10-12 & 4ER50A10-12

RC-1711A