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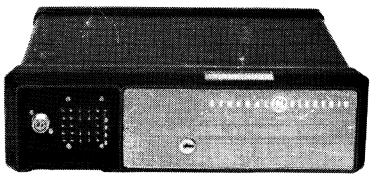
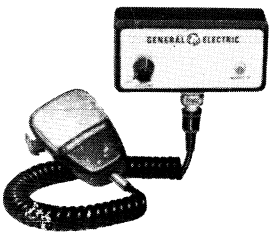
COMMUNICATIONS

MASTR
PROGRESS LINE
Executive Series

MAINTENANCE MANUAL

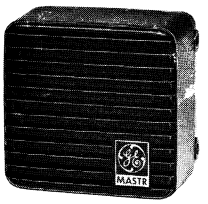


Mobile Radio



Control Unit

132—174 MHz
TWO-WAY FM
MOBILE COMBINATIONS
LBI-3712C



Speaker

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

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

EQUIPMENT INDEX

EQUIPMENT	MODEL OR TYPE NUMBER
FM TRANSMITTER	ET-74-A , B
FM RECEIVER	ER-48-A , B
CONTROL UNITS	
Trunk-Mount	EC-67-A
Front-Mount	EC-68-A
POWER SUPPLY	4EP50A10
4-FREQ. OSCILLATOR BOARD	4EG22F10 or 11
CHANNEL GUARD BOARD	4EK14A10
SPEAKER	4EZ16A18
TRUNK-MOUNT POWER/CONTROL CABLE	
1- or 2-Frequency	19C303910-G2
3- or 4-Frequency	19C303910-G4
FRONT-MOUNT POWER CABLE	19C303982-G2
MOUNTING HARDWARE	
Trunk-Mount	19A122244-G2
Front-Mount	19A122244-G1
CONTROLLED RELUCTANCE MICROPHONE	19B209102-P2
Microphone Bracket	7141414-G2
KEY	5491682-P8
ALIGNMENT TOOLS	
Hex Slug Type	4038831-P2
Slotted Screw Type	4033530-G2
132-174 MHZ ANTENNA	4EY12A13

OPTIONAL EQUIPMENT

10-WATT SPEAKER (Option 8003)	4EZ18A11
WINDOW MOUNTING KIT (Option 8011)	19A121879-G3
WEATHERPROOF BOX (Option 8013)	
Box	19D402674-G1
Cable Entry Kit	19A122244-G4
Hardware	19A122244-G3
HANDSET (Option 8093)	4EM26A10
Hookswitch	19B204867-G4

SPECIFICATIONS *

GENERAL

FREQUENCY RANGE	132 - 174 MHz
DIMENSIONS (H x W x D)	
Trunk-Mount	4" x 12 3/4" x 12 1/4"
Front-Mount	4" x 12 3/4" x 12 1/2"
WEIGHT (including accessories)	33 pounds
BATTERY DRAIN	
Receiver (at 13.8 VDC)	
Standby (squelched)	55 mA
Standby (unsquelched)	0.6 amp
Transmitter	
Transmitter Filaments On (receiver squelched)	1.15 amps
Transmit (at 13.6 VDC)	12 amps
OPERABLE TEMPERATURE RANGE	-30°C to +60°C (-22°F to 140°F)
DUTY CYCLE	Transmit: 20% Receive: 100%
MAXIMUM FREQUENCY SPACING	0.4%

TRANSMITTER

TYPE NUMBER	ET-74-A (Narrow Band) ET-74-B (Wide Band)
POWER OUTPUT	35 watts (132-162 MHz) 30 watts (162-174 MHz)
FREQUENCY STABILITY	±.0005% (-30°C to +60°C, +25°C reference)
SPURIOUS AND HARMONIC RADIATION	At least 60 dB below rated power output
MODULATION	Adjustment from 0 to ±5 kHz (Narrow Band) and 0 to ±15 kHz (Wide Band) swing with instantaneous modulation limiting.
AUDIO FREQUENCY CHARACTERISTICS	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards.
DISTORTION	Less than 5%
DEVIATION SYMMETRY	0.6 kHz maximum (Narrow Band) 2.0 kHz maximum (Wide Band)
CRYSTAL MULTIPLICATION FACTOR	24

RECEIVER

TYPE NUMBER	ER-48-A (Narrow Band) ER-48-B (Wide Band)
AUDIO OUTPUT	2 watts at less than 6% distortion 3 watts at less than 15% distortion
SENSITIVITY	
12-dB SINAD (EIA Method)	0.25 µV (NB; 0.30 µV (WB)
20-dB Quieting Method	0.35 µV (NB); 0.45 µV (WB)
SELECTIVITY	
EIA Two-Signal Method	-85 dB - adjacent channel 30 kHz channels (NB) -90 dB - adjacent channel 60 kHz channel (WB)
20-dB Quieting Method	-100 dB at ±20 kHz (NB) -120 dB at ±40 kHz (WB)
SPURIOUS RESPONSE	-90 dB
FIRST OSCILLATOR STABILITY	±.001% (-30°C to +60°C), +25°C reference
MODULATION ACCEPTANCE	±7 kHz (NB) ±16 kHz (WB)
INTERMODULATION	-60 dB (NB); -65 dB (WB)
FREQUENCY RESPONSE	+1 and -8 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz
SQUELCH SENSITIVITY	
Critical Squelch	4 dB SINAD (0.1 µV typical)
Maximum Squelch	Greater than 20 dB quieting

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

DESCRIPTION

MASTR Progress Line Executive Series Mobile Radio Combinations are attractively styled, ruggedly constructed units that are designed to meet the most stringent requirements in the field of two-way FM radio.

The combination is contained in a "slide-rail" mounting frame and is designed for either Front-Mount or Trunk-Mount installations. The radio is tamperproof when locked in the mounting frame. When unlocked, the unit can be easily pulled out of its frame for servicing.

Both the transmitter exciter board and the receiver are fully transistorized. Silicon transistors are used for added reliability.

Battery drain in standby operation is so low (only 55 milliamps) that the radio never has to be turned off.

All major modules and tuning adjustments are accessible from the top of the unit (Figure 1). Both the transmitter and receiver are equipped with centralized metering jacks for simplified alignment and troubleshooting.

The transmitter and receiver may be used interchangeably in mobile and station installations. No modifications are required when transferring the units from one type of operation to another.

TRANSMITTER

The transmitter assembly consists of the transistorized exciter board and the power amplifier section. The transmitter uses only three tubes in the power amplifier. The standard transmitter may be equipped with:

- One through four frequencies
- Channel Guard

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

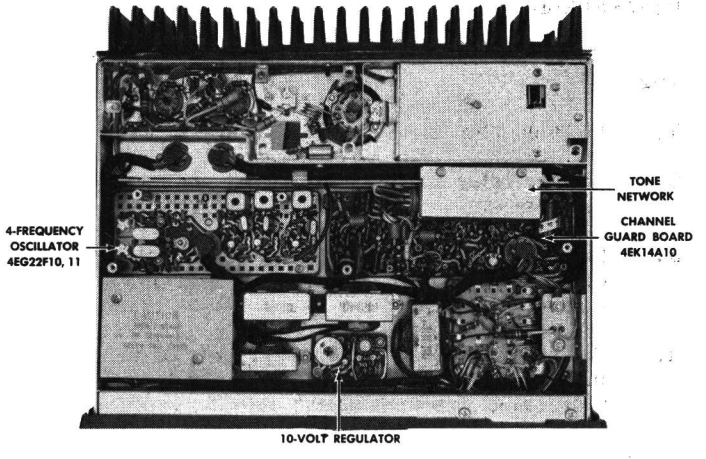
POWER SUPPLY

The transistorized mobile power supply was designed for operation in 12-volt, negative-ground vehicle systems. An optional polarity converter is required to operate the radio in positive-ground vehicle systems.

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.

BOTTOM VIEW



TOP VIEW

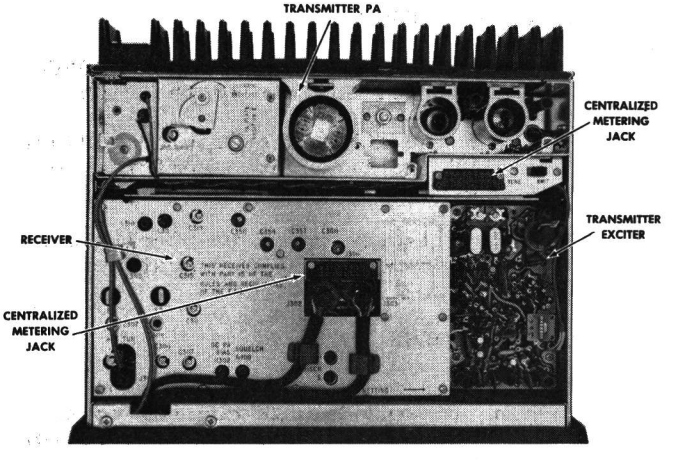


Figure 1 - Module Layout

INITIAL ADJUSTMENT

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

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

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.

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.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in the separate OPERATOR'S MANUAL (LBI-3731). 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. Let the unit warm up for 30 seconds.
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 on the following page.

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

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	
GENERATOR AND REGULATOR - Check the generator and voltage regulator periodically to keep the generating system within safe and economical operating limits. If generator voltage is excessive, tubes, lights, etc., may burn out periodically. This condition is indicated when the battery loses 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	
RELAY CONTACTS - Examine the relay contacts. Where contacts carry little or no current, the contacts do not clean themselves and an insulating coating is apt to form. When contacts become coated, remove the film with a suitable solvent applied with a non-metalic brush, such as a toothbrush. Current-carrying contacts are subject to pitting and should be burnished from time to time. Dust and particles should be removed by a clean, dry, non-metallic brush.	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

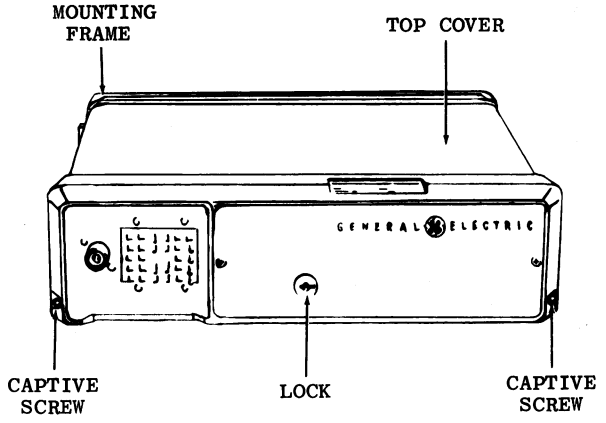


Figure 2 - Disassembly

CIRCUIT ANALYSIS

TRANSMITTER

Transmitter Types ET-74-A and ET-74-B are crystal-controlled, phase modulated transmitters designed for one-, two- or four-frequency operation in the 132-174 megahertz band in mobile or station applications. The transmitter consists of the following modules:

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

The model number and number of frequencies of each module is shown in the chart on the following page.

The transmitter uses a total of 7 transistors and 3 tubes to provide a minimum power output of 35 watts in the 132-162 MHz range, and 30 watts in the 162-174 MHz range. The crystals used range from 5.5 to 7.25 megahertz, and the crystal frequency is multiplied 24 times.

A centralized metering jack (J201) is provided for use with GE Test Set Model 4EX3A10. The test set meters the phase modulator, multipliers, driver and PA stage, as well as the B-plus and regulated supply

PA ASSEMBLY	EXCITER BOARD	NO. OF FREQUENCIES
4EF32F10 (132-150.8 MHz) 4EF32F11 (150.8-174 MHz)	4EG21F10 (Narrow Band) 4EG21F12 (Wide Band)	One-Frequency
4EF32F10 (132-150.8 MHz) 4EF32F11 (150.8-174 MHz)	4EG21F11 (Narrow Band) 4EG21F13 (Wide Band)	Two-Frequency

voltages. The metering jack also provides access to receiver audio, microphone and push-to-talk leads.

POWER INPUTS

All supply voltages are connected from the power supply to the transmitter through two 7-pin miniature connectors (J202 and J203). Voltages for the PA assembly are connected through J202, and are filtered by feed-through capacitors C222 through C229. Supply voltage, metering and control functions for the exciter board are connected from the PA assembly through a 9-pin miniature connector (J105). Supply voltages for the transmitter are shown in the following chart.

Connection	Voltage	Use
J202-1	+450 VDC	PA B-plus
J202-2	+300 VDC	multiplier B-plus
J202-3	ground	
J202-4	-55 VDC	PA bias
J202-5	+12 VDC	relay supply
J202-6 & -7		filament
J105-2	+10 VDC reg.	Exciter supply

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 Q104. 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 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.

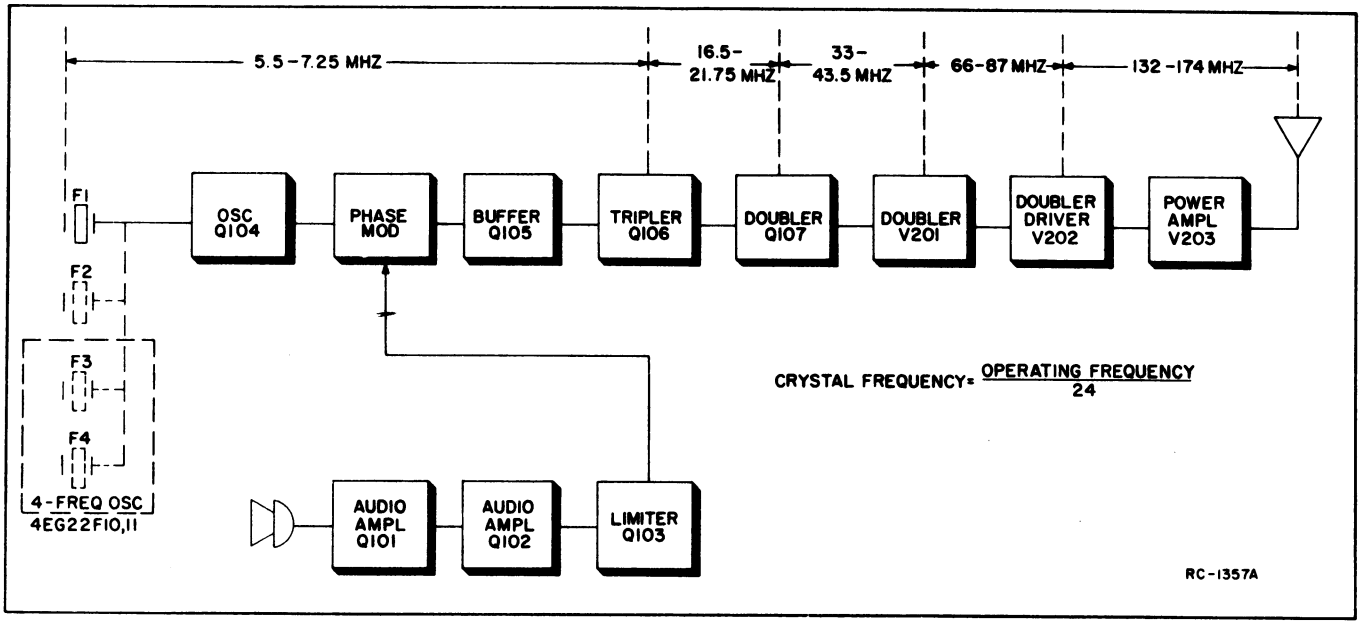


Figure 3 - Transmitter Block Diagram

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

AUDIO AMPLIFIERS AND LIMITERS

The audio section of the transmitter consists of DC-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) or ±13.5 KHz (wide band).

PHASE MODULATOR

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

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

BUFFER AND MULTIPLIERS

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

Following Q105 are two L-C coupled Class C multiplier stages (Q106 and Q107). Q106 is a tripler stage with the collector tank tuned to three times the crystal frequency. The stage is metered at J201 through metering resistor R131.

Q107 operates as a doubler stage, 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 J201.

PA ASSEMBLY

MULTIPLIERS

The output of the transistorized exciter is link-coupled through T201 to the grid of beam pentode V201. This stage operates as a doubler with T202 tuned to 12 times the crystal frequency. The grid of V201 is metered across R201 at J201.

The output of V201 is transformer-coupled to the grid of beam pentode V202. This stage operates as a doubler-driver with the output tuned to 24 times the crystal frequency. The grid of V202 is metered through metering network R207 and R208.

POWER AMPLIFIER

The output of V202 is coupled to the grid of compactron beam power amplifier (V203) by a pi-network consisting of C209, L205 and C236/C210. The grid is tuned by C209 (PA GRID), and current is metered at J201-6 and J201-14 by measuring the voltage drop across R210. Bias voltage (-55 volts) is applied to the PA grid through R210, L209 and L205.

Plate current is metered from J201-1 to J201-9 across metering resistor R214. Plate voltage is supplied through L206, and the PA plate tank is series-tuned by capacitor C214. The screen grid dropping resistor is R213.

WARNING

The meter leads are at plate potential (high B+) when metering the PA plate at J201-1 and J201-9.

Placing TUNE-OPERATE switch S201 in the OPERATE position effectively shorts R212 out of the circuit, and applies 300 volts to grid dropping resistor R213 for normal operation of the stage. Placing the switch in the TUNE position applies the screen voltage to dropping resistor R212 and shunt resistor R211 to drop the screen voltage. This reduces the plate dissipation while tuning the transmitter.

PA loading is achieved by varying the coupling between L207 and L208. The antenna circuit is tuned by C215.

RF from the antenna coil is fed through antenna changeover relay K201 to the low-pass filter, and then to the antenna.

RECEIVER

Receiver Types ER-48-A and ER-48-B are double conversion, superheterodyne FM receivers designed for one-, two- or four-frequency operation on the 132-174 megahertz

CIRCUIT ANALYSIS

band in mobile or station applications.

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 a total of 20 silicon transistors. Frequency ranges and the number of frequencies for each receiver model are shown in the following chart.

RECEIVER MODEL	FREQUENCY RANGE	NO. OF FREQ.
4ER48A10 (NB) 4ER48B10 (WB)	132—150.8 MHz	One-Freq
4ER48A11 (NB) 4ER48B11 (WB)	132—150.8 MHz	Two-Freq
4ER48A12 (NB) 4ER48B12 (WB)	150.8—174 MHz	One-Freq
4ER48A13 (NB) 4ER48B13 (WB)	150.8—174 MHz	Two-Freq
4ER48A14 (NB) 4ER48B14 (WB)	132—150.8 MHz	Four-Freq
4ER48A15 (NB) 4ER48B15 (WB)	150.8—174 MHz	Four-Freq

A regulated +10 volts is used for all receiver stages except the audio driver and audio PA stages, which operate from the 12-volt system supply. The audio PA stage and output transformer are mounted on the underside of the system frame behind the power supply.

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

RF AMPLIFIERS

RF signals from the antenna are fed to the base of 1st RF amplifier Q301 through two tuned pre-selector circuits. The output signal is inductively coupled through two tuned circuits to the base of 2nd RF amplifier Q302. The output of Q302 is inductively coupled through two tuned circuits to the base of 1st mixer Q306.

OSCILLATOR

Q303 is a third mode oscillator that operates in the 40 to 55 megahertz region. The crystal is connected in the oscillator feedback path to permit oscillation only at the crystal frequency. L307, C319 and C320 make up the mode-selective resonant circuit. Adjustable coil L307 permits the oscillator

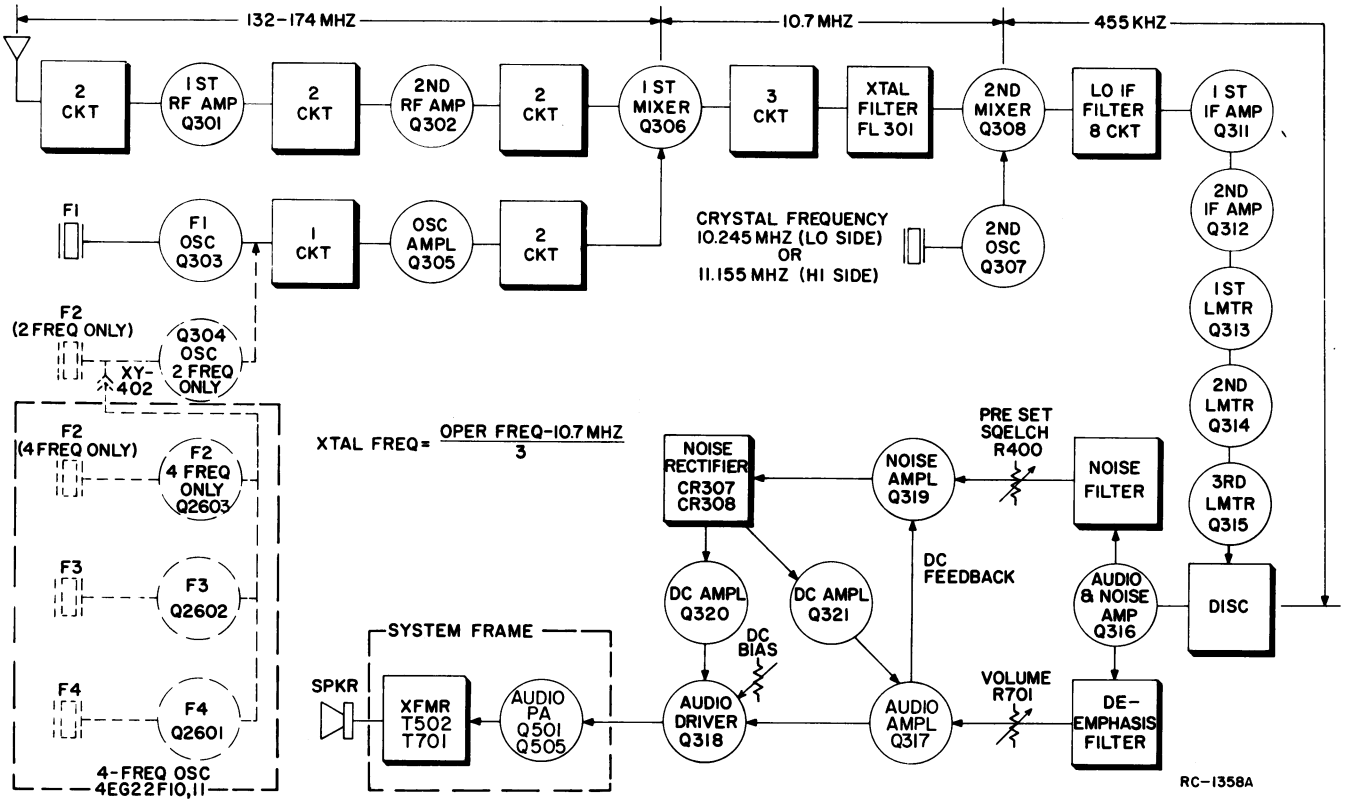


Figure 4 - Receiver Block Diagram

frequency to be shifted slightly for setting the receiver on the system operating frequency. The collector tank of Q303 is tuned to three times the crystal frequency.

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

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

1ST MIXER AND CRYSTAL FILTER

The RF signal from the 2nd RF amplifier and the low-side injection voltage from oscillator-amplifier Q305 are applied to the base of 1st Mixer Q306. The 10.7-megahertz High IF output is coupled through three tuned circuits (L312 and C350, L313 and C354, L314/L316 and C357) which provide Hi-IF selectivity and impedance matching to the crystal filter.

The Hi-IF crystal filter (FL301/FL302) has ample selectivity to prevent adjacent channel signals from overloading the 2nd Mixer, and to reduce intermodulation spurious responses.

2ND OSCILLATOR AND MIXER

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

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

LO-IF AMPLIFIERS AND LIMITERS

Following the Lo-IF filter are two R-C coupled Lo-IF amplifiers (Q311 and Q312). The amplified output is fed to three R-C coupled limiter stages consisting of Q313, Q314 and Q315, operating as 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, made up of C422/C455, C423, C424/C457, R377/R415, 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 Q505. DC BIAS trimmer R392 sets the bias on Q318 and Q505, and is adjusted for a 280 millivolt (500 milliamps) reading at metering jack J304-9. The output of Q505 drives the loudspeaker.

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 C345, C346, C347 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 amplifiers Q320 and Q321, causing them to conduct. When conducting, the collector voltage of the DC amplifiers drops to near ground potential, which lowers the bias on audio stages Q317 and Q318, turning them off.

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

When the receiver is quieted by a signal, less noise is present in the circuit and the DC amplifiers stay 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 SUPPLY

Transistorized Power Supply Model 4EP50A10 is used with MASTR Progress Line Executive Series mobile combinations. The power supply is mounted in the front casting which acts as a heat sink for the power transistors. Output filters and the 10-volt regulator are mounted on the main chassis.

The fully transistorized power supply uses highly efficient silicon rectifiers for reliable operation. Polyester capacitors in the output filters provide additional reliability with good performance at low temperatures. Regulation of critical transmitter and receiver supply voltages provides improved operation over the wide range of input voltages encountered in mobile communications. The power supply provides:

- Plate, screen and bias voltage for the transmitter multiplier and power-amplifier stages,
- Regulated +10 volts for the transistorized transmitter exciter board,
- Regulated +10 volts for the receiver and for the four-frequency board.

Low voltage for the transmitter filaments, push-to-talk and antenna relays, receiver audio amplifiers and the 10-volt regulator is taken directly from the vehicle battery.

The power supply is designed for operation in 12-volt, negative-ground systems. For positive-ground systems, a DC-to-DC converter (Model 4EP54A10) must be used with a mobile combination. Figure 5 is a simplified power distribution and switching diagram.

MULTIVIBRATOR CIRCUIT

The power supply uses transistors Q501 and Q502 as switches in an inductively-coupled multivibrator circuit. These switches connect the battery voltage across alternate halves of the transformer primary, resulting in alternating square waves. The output of the multivibrator circuit (square wave generator) is stepped up by power transformer T501, then rectified and filtered to supply B-plus and bias voltage for the transmitter. The two transistors conduct alternately at a frequency of approximately 2,000 hertz.

RECTIFIER AND FILTER CIRCUITS

Negative Bias Supply

The AC voltage developed across secondary windings 13 and 15 of transformer T501 is rectified by full-wave rectifiers CR501 and CR502. It is then filtered by C505, L501 and C506 to supply a negative 55 volts for the control grid of the transmitter power amplifier. The bias voltage is present as a protective measure to limit cathode current in the PA tube while the PA is untuned, or in the case of loss of drive to the PA. R504 is a bleeder resistor.

Multiplier B-Plus (Figure 6)

The AC voltage developed across the high voltage secondary windings of T501 is rectified by a full-wave bridge rectifier circuit.

During one-half of each AC cycle, the voltage across TB501-2 and -3 of the high voltage output winding is rectified by CR507 and CR509. During the second half of the cycle, the voltage is rectified by CR508 and CR510.

Filtering is provided by L-C filter C501, L503 and C502. Relatively small values of L and C are required because of the high frequency and the square wave characteristics of the AC voltage.

Power Amplifier B-Plus (Figure 6)

High B-Plus for the power amplifier is provided by the PA rectifier circuit and the multiplier rectifier circuit connected in series.

In high band mobile combinations, a jumper is connected from TB4-8 to TB4-10, and the AC voltage developed across TB501-5 and -6 is rectified by CR504 and CR505. This output, in series with the multiplier output, supplies 450 volts DC high B-plus.

In low band mobile combinations, the jumper is connected from TB4-8 to TB4-11, and the AC voltage is rectified by a bridge rectifier circuit consisting of CR503, CR504, CR505 and CR506. This output, in series with the multiplier output, supplies 600 volts DC high B-plus.

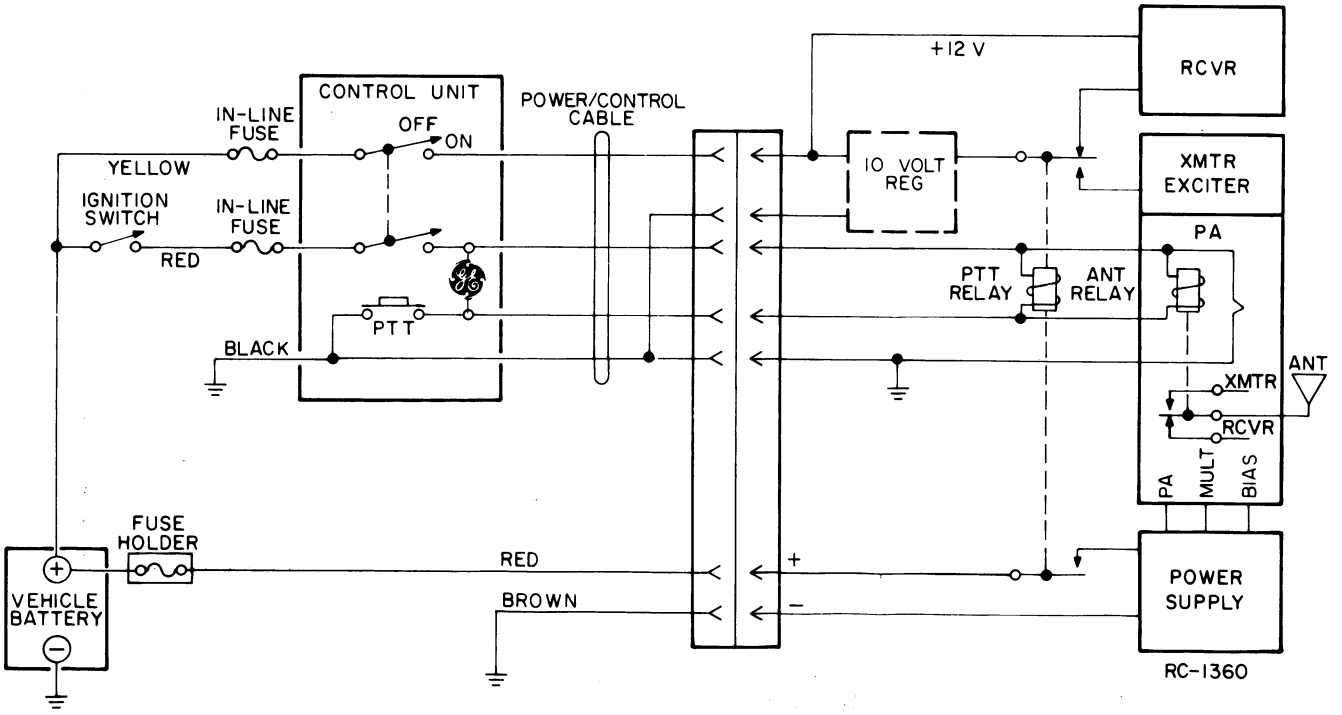
The PA filter consists of C503, L502 and C504. R503 is a bleeder resistor.

+10 VOLT REGULATOR (A501)

The 10-volt regulator provides a closely controlled supply voltage for the transmitter exciter, receiver and four-frequency oscillator board.

When the output voltage at the emitter of Q1 tries to increase, the voltage at the base of Q2 tends to become more positive. This makes Q2 conduct more heavily, causing the voltage at the base of Q1 to become more negative. With less base bias, Q1 conducts

TRUNK-MOUNT



FRONT MOUNT

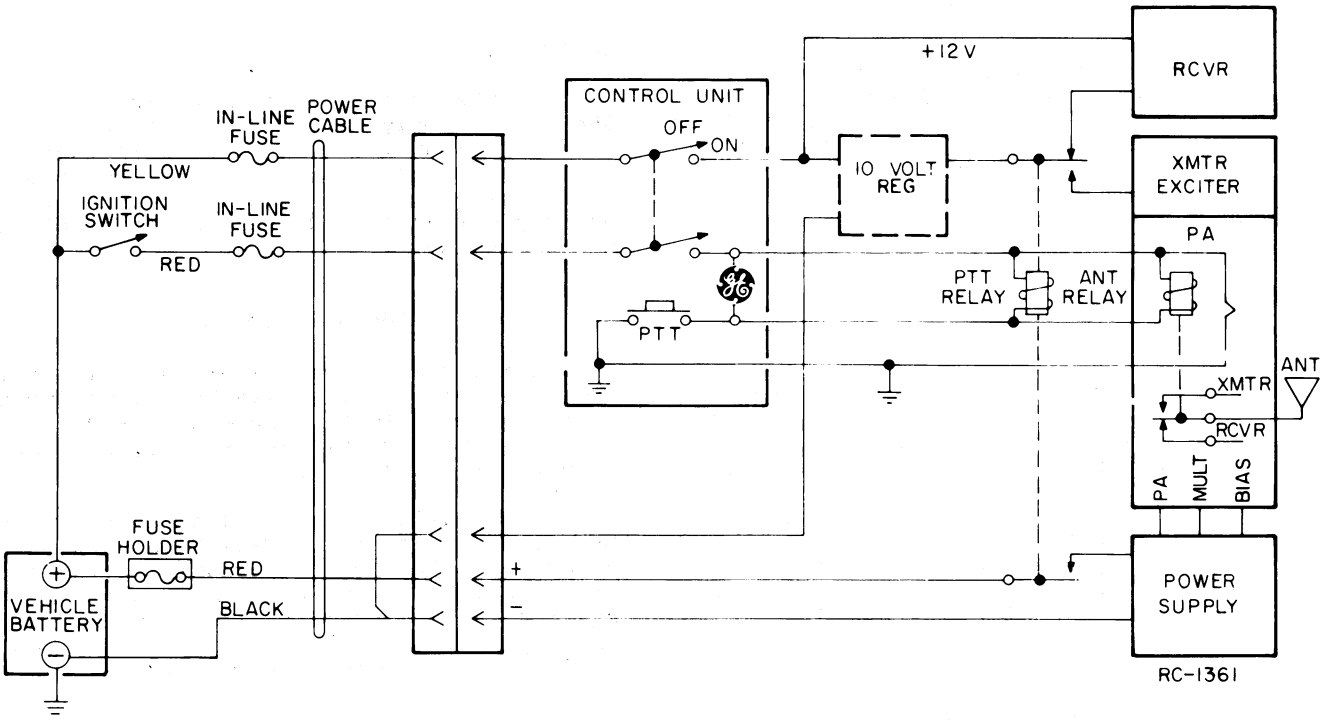


Figure 5 - 12-Volt, Negative-Ground Power Distribution Diagrams

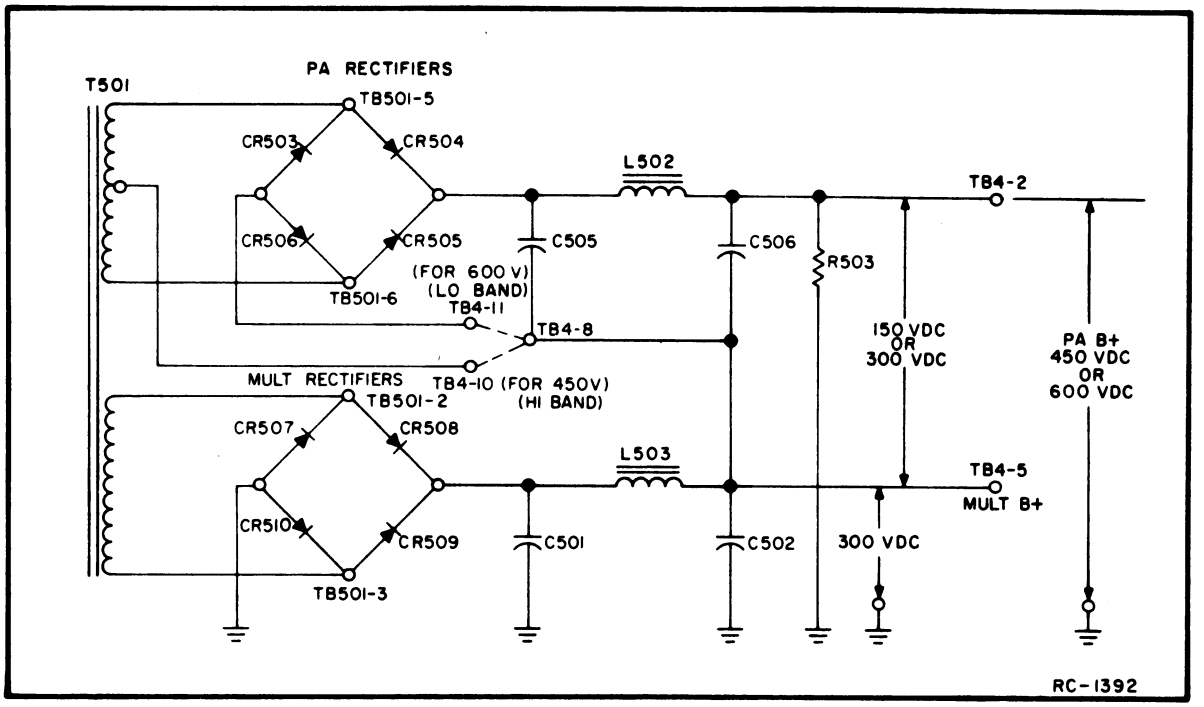


Figure 6 - Multiplier and PA B-Plus Circuits

less and the voltage drop across the transistor is larger, keeping the output voltage constant.

When the output voltage tries to decrease, Q2 conducts less and the base bias on Q1 increases. This causes Q1 to conduct more heavily, reducing the voltage drop across the transistor and keeping the output constant.

Potentiometer R3 and resistor R4 form a voltage divider so that R3 can be adjusted for a +10 volt output. Zener diode VR1 provides a voltage reference for the regulator. The output can be metered at the transmitter and receiver centralized metering jacks.

HEAT SINK SERVICING

Since the metal envelopes of the transistors 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 anodized aluminum spacers used between the transistors and their mounting plate not only isolate the transistors electrically, but also provide a good thermal conductor to conduct heat away from them.

Silicon grease is used between the metal parts in the heat sink to improve the thermal contact between them and allow the heat to be transferred more readily.

NOTE

Always make sure that there is sufficient silicon grease on each side of the anodized aluminum washer whenever one of the power transistors is removed and replaced.

RE-INSTALLATION

If the mobile combination in which the power supply is mounted is ever moved to a different vehicle, be sure to check the battery polarity of the new system and, if necessary, install the DC-to-DC converter in positive-ground vehicles to maintain current polarity.

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	4EC68A10	One
4EC67A11	4EC68A11	Two
4EC67A12	4EC68A12	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 applies filament voltage to the transmitter, activates the push-to-talk (PTT) circuit, and applies +12 volts to the receiver.

Pushing the PTT button on the microphone energizes the system relay and the antenna changeover relay. The system relay starts the power supply; and the antenna relay switches the antenna and mutes the receiver. Keying the transmitter also lights the red pilot light.

Monitor Pushbutton (S702)

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

Multi-Frequency Switches (S703 and S704)

In multi-frequency applications, a frequency-selector switch selects the channel desired for both transmit and receive. S703 is used in two-frequency control units, and S704 is used in three- or four-frequency control units.

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

IGNITION SWITCH CABLE CONNECTIONS

The ignition switch cables may be connected for three different modes of operation, depending on the way the cables are connected in the vehicle system. The black ignition switch cable (in Trunk-Mount control units only) provides the receiver ground connection. The yellow fused lead provides the receiver positive. The red fused lead provides the hot connection for the transmitter filaments. The three types of operation are:

1. Ignition Switch Standby-For this type of operation, the red fused lead (transmitter filament voltage) is connected to the ACCESSORY or ON terminal of the ignition switch. The yellow fused lead (receiver hot) is connected to the hot side of the ignition switch, and the black lead connects to vehicle ground.

   With the ignition switch OFF, the receiver automatically reverts to STBY, ready to receive messages. Turning the ignition switch to the ON or ACCESSORY position supplies transmitter filament 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 bypass, the yellow and red fused leads connect to the "hot" side of the ignition switch or the vehicle fuse block assembly. Both the transmitter and receiver operate independently of the ignition switch and can be turned on and off only by the OFF-VOLUME switch on the Control Unit.

CHANNEL GUARD

Channel Guard Board Model 4EK14A10 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.

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

ENCODER (Fig. 7)

The encoder tone is provided by Q604 and Q605 which oscillate at a frequency determined by the tone network. Negative feedback, applied thru the tone network to the base of Q604, prevents any gain in the

stage except at the operating frequency.

Keying the transmitter applies +10 volts to the anode of feedback control diode CR605, causing it to conduct. When conducting, the diode shunts R635 which reduces the impedance of the positive feedback loop (R635, R633 and C617). This provides the necessary gain to the base of Q604 to permit oscillation, and the oscillator locks in on the Channel Guard frequency.

An extremely fast starting time for the encoder tone is provided by a starting network consisting of R641, C618, C619 and CR606. This network utilizes a positive pulse from the +10 volts keying voltage to provide the positive feedback required to start oscillation.

Thermistor-resistor combination R627-RT601 provides temperature compensation for the oscillator output, and limiter diodes CR603 and CR604 keep the amplitude of the tone constant.

The oscillator output is fed to emitter-follower Q606, and then to TONE ADJUST potentiometer R643. This control is normally set for a ±0.75 kHz deviation as outlined in the Transmitter Modulation Adjustment Procedure.

The encoder tone is applied to the modulator stage on the transmitter exciter board.

DECODER (Fig. 7)

The decoder function is designed to eliminate all calls that are not tone coded for the Channel Guard frequency. As long as the MONITOR switch is not depressed, all signals are locked out except those from transmitters that are continuously tone-coded for positive identification by the receiver. Pressing the MONITOR switch instantly disables the Channel Guard and noise squelch circuits so that all calls on the channel can be heard.

Audio, tone and noise are taken from the collector of audio-noise amplifier Q316 and is fed thru J601-4 to three tone amplifier and bandpass filter circuits. The filters remove the audio and high-frequency noise from the signal, and the tone amplifiers provide sufficient gain to insure clipping by limiter diodes CR601 and CR602. The clipping action eliminates variation in the squelch performance due to changes in tone deviation.

The signal is then applied to selective amplifiers Q604 and Q605, which amplify only the tone determined by the tone network.

The output of the selective amplifier is applied through emitter-follower Q606 to the high gain, broad-band tone amplifiers Q607 and Q608. The output of Q608 is rectified by detector diodes CR607 and CR608, and the resulting negative DC voltage controls the squelch gate. Q607 is normally biased for low gain. When the tone is detected by CR607 and CR608, feedback is provided through R635 to quickly change the bias on Q607 for full gain. This ensures a more positive "unsquelching" action.

Squelch gate diode CR609 (on power supply) is normally forward biased by a positive DC voltage (approximately 1.5 volts)

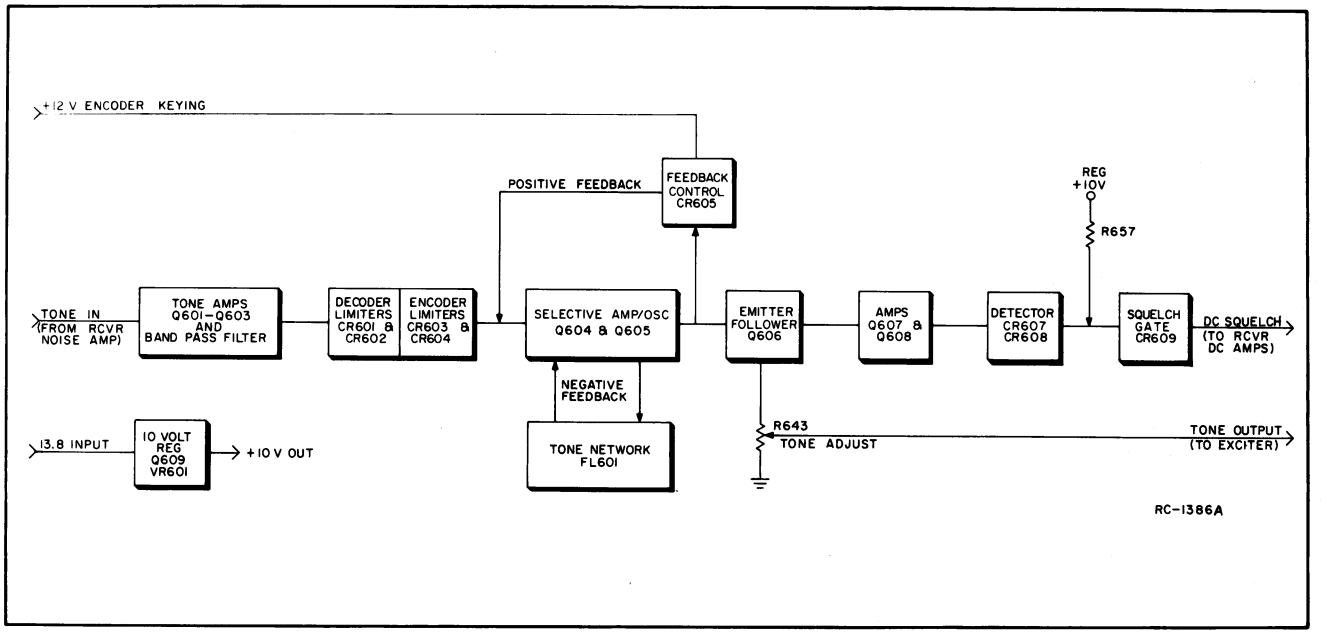


Figure 7 - Channel Guard Block Diagram

fed through R657. The forward bias causes CR609 to conduct, feeding a DC voltage to the base of noise amplifiers Q320 and Q321 in the receiver. This removes the bias on the receiver audio stages and holds them off.

When the proper tone is applied to the decoder, the negative DC voltage from the detector diodes back-biases squelch gate diode CR609, and cuts off the positive bias to the DC amplifiers. However, the receiver noise squelch circuit continues to operate until a carrier quiets the receiver.

Pressing the MONITOR switch on the control unit grounds the base biasing circuit of the DC amplifiers and disables both the Channel Guard and noise squelch circuits. If the optional hookswitch is provided, removing the microphone from its hanger automatically disables Channel Guard while maintaining normal noise squelch operation.

A tone rejection filter connected in parallel with the VOLUME control bypasses the tone to ground, thereby attenuating the tone level reaching the audio circuits. The filter is composed of L601, C624, C625, C626 and R659.

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

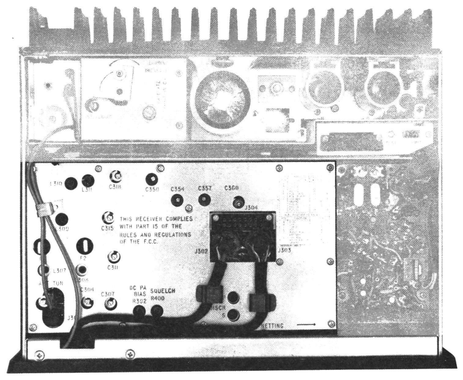
1. G-E Test Set TM11 or TM12 (or 20,000 ohms-per-volt Multimeter).
2. 130-174 MHz signal source (keep signal level below saturation).

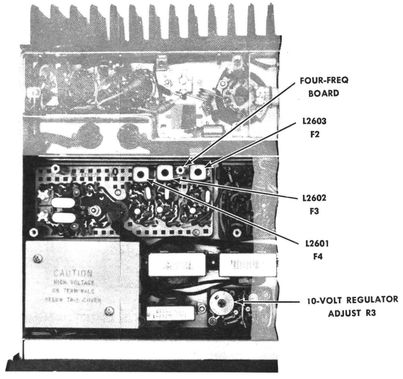
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set 4EX3A10 into receiver centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to 1. If using Multimeter, connect the negative lead to J304-13 (ground).
2. Turn SQUELCH control (R400) fully clockwise and VOLUME control to minimum. Switch to position "G" (or measure at J304-9 with Multimeter) and adjust PA Bias R392 for a reading of 0.28 volts (500 milliamps).

ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	METERING POSITION MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
1.	D OSC	pin 4	L307	See Procedure	Switch to F1, put in F1 crystal and tune L307 for maximum meter reading.
2.	D OSC	pin 4	L309 & L307	Maximum (0.17-0.5V)	Apply an on-frequency signal to J301 and adjust L309 and L307 for a maximum meter reading (0.17-0.5 volts).
3.	D OSC	pin 4	L310 & L311	See Procedure	Adjust slugs to same depth as in L209 in Step 2.
4.	D OSC	pin 4	L308 (2-freq. only)	Maximum	For 2-frequency receivers, switch to F2, insert F2 crystal and adjust L308 for maximum.
5.					Preset RF capacitors C301, C304, C307, C311, C315, and C318 to approximate-frequency. (Capacitors tune from 130 MHz. (max. capacitance) to 174 MHz (min. capacitance).
6.	C LIM 2	pin 3	L310, L311 C301, C304 C307, C311 C315, C318	Maximum	Apply on-frequency signal to J301. Tune L310, L311, C301, C304, C307, C311, C315, C318 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero.
7.	A DISC	pin 10	L307 (L308 for 2-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L307 (L308 for 2-frequency) for zero discriminator reading. ——NOTE—— For proper freq control of the receiver, it is recommended that all freq adjustments be made when the equipment is at a temp of approx 75° F. In no case should freq adjustments be made when the equipment is outside the temp range of 50° to 90° F.
8.			C301, C304		While receiving a weak on-frequency signal from the antenna, tune C301 and C304 for best quieting.
			SQUELCH ADJUSTMENT		
9.				30°	Set SQUELCH Control (R400) to open with a 4 db SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)





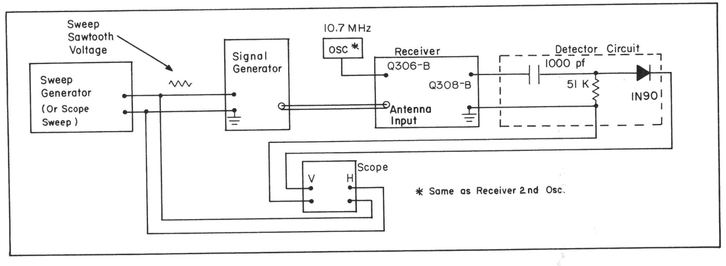


Figure 1 - High and Low IF FILTER TEST Circuit

COMPLETE RECEIVER ALIGNMENT

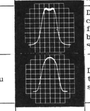
EQUIPMENT REQUIRED

1. G-E Test Set TM11 or TM12 (or 20,000 ohms-per-volt Multimeter).
2. A 10.7MHz (±200 Hz) and 130-174MHz signal source. Couple the 10.7MHz signal through a 0.01 uf capacitor. Keep signal levels below saturation.
3. For Alignment steps 4 thru 8 - Oscilloscope, sweep generator, 10.7 MHz marker generator and construct a detector circuit (see Figure 1 for circuitry).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set into the receiver centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to TEST 1. If using multimeter, connect the negative lead to J304-13 (ground).
2. Switch Test Set to Position "1" (or measure at collector of Q318 with multimeter). Reading should be a nominal 13.8 volts.
3. Switch to Postion "J" (or measure at top of C443 with multimeter), and check for a reading of 10 volts. If reading is not correct, refer to STEP 8 of the Transmitter Preliminary Checks and Adjustment Procedure.
4. Turn SQUELCH control fully clockwise and VOLUME control to minimum. Switch to Position "G" (or measure at J304-9 with multimeter) and adjust PA Bias potentiometer R392 for a reading of 0.28 volts (500 milliamps).

ALIGNMENT PROCEDURE

STEP	METERING POSITION TEST SET 4EX3A10	METERING POSITION MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
			DISCRIMINATOR		
1.					Remove 1st oscillator crystal and apply a 10.7 MHz signal to the base of Q308.
2.	A DISC	pin 10	L329	See Procedure	Adjust L329 (discriminator primary) 1/2 turn up from bottom of range.
3.	A DISC	pin 10	L330	Zero	Tune L330 (discriminator secondary) for zero meter reading.
			HIGH and LOW IF FILTER (SEE NOTE 1)		
4.	B LIM	pin 2	L321 thru L328	Maximum	Adjust L321 thru L328 for maximum meter reading.
5.	B LIM	pin 2	C357, C354, C350	See Procedure	Adjust C357 for minimum meter reading. Adjust C354 for maximum meter reading. Adjust C350 for minimum meter reading.
6.			C357 & C360		Disable the 2nd oscillator by grounding base of Q307 through a .01 pf capacitor. Connect scope, signal generator and detector as shown in figure 1. Sweep RF ±50KHz/s at 20 Hz, Connect 10.7 MHz marker to base of Q306. Tune C357 and C360 for scope pattern shown. Keep marker signal centered between humps and signal level below saturation.
7.			L321 thru L328		Disconnect detector, remove short from base of Q307 and connect scope to 1st LIM test point. Adjust L321 thru L328 for symetrical wave form shown, with marker in center.
8.	A DISC	pin 10			Check to see that discriminator idling voltage is within 0.05 volts of zero with no signals applied and the modulation acceptance bandwidth is greater than ±8 KHz(narrow Band) or ±16 KHz (Wide Band).
			OSC/MULT & AMPLIFIER		
9.	D OSC	pin 4	L307	Maximum	Remove short from base of Q307, if present, then insert 1st oscillator crystal and adjust L307 for maximum meter reading.
10.	D OSC	pin 4	L309 & L307	Maximum (0.17-0.5v)	Adjust L309 and L307 for maximum meter reading (0.17-0.5 volts).
11.	D OSC	pin 4	L310 & L311	See Procedure	Set L310 and L311 slugs to same depth as L309.
12.	D OSC	pin 4	L308 (2-freq)	Maximum	For 2-frequency receivers, insert F2 crystal and adjust L308 for maximum meter reading.
			RF		
13.	C LIM 2	pin 3	L310,L311 C301, C304 C307,C311 C315,C318	Maximum	Apply on-frequency signal to J301, then tune L310, L311, C301, C304, C307, C311, C315 and C318 for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero.
14.			C301, C304		While receiving a weak on-frequency signal from the antenna, tune C301 and C304 for best quieting.
			FREQUENCY ADJUSTMENT		
15.	A DISC	pin 10	L307 (L308 for 2-freq, or L2603, L2602 or L2601 on 4-freq. board for 3- or 4-freq.)	Zero	Apply the exact channel frequency signal to J301 and tune L307 (L308 for 2-frequency) for zero discriminator reading. In 3- or 4-frequency units, tune L2603, L2602 or L2601 as required. ——NOTE 2—— For proper frequency control of the receiver, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approx. 75° F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90° F.
16.				30°	Set SQUELCH Control (R400) to open with a 4 db SINAD signal. (Approximately 30° counterclockwise of critical squelch position.)

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

ALIGNMENT PROCEDURE

RECEIVER MODELS 4ER48A10-15
AND 4ER48B10-15

(RC-1412D)

TEST PROCEDURES

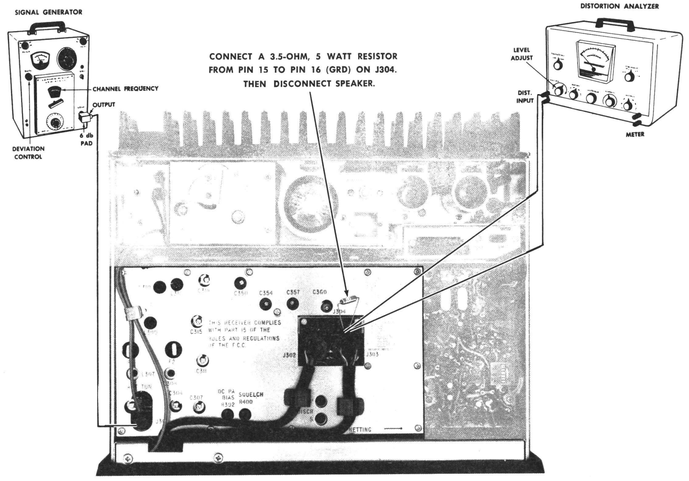
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequency of test steps starting with Step 1, the defect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

TEST EQUIPMENT REQUIRED

for test hookup shown:

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

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



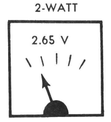
STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

1. Connect a 1,000-microvolt test signal modulated by 1,000 Hertz ±3.3 kHz (±10 kHz Wide Band) deviation to the antenna jack J301.
2. When speaker is used, disconnect speaker (and handset if present). Hook up a 3.5-ohm load resistor from J304-15 to J304-16 as shown.
3. Set VOLUME Control for two-watt output (2.65 VRMS).
4. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5% (3% is typical).



VOLTMETER SCALE ON DISTORTION ANALYZER

SERVICE CHECK

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

1. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)
2. DC Bias Adjust R392 (Position "G" on Test Set)--- should be adjusted for 0.28 volts (500 milliamps). (Refer to Receiver Alignment on reverse side of page).
3. Audio Gain (Refer to Receiver Troubleshooting Procedure).
4. Discriminator Alignment (Refer to Receiver Alignment on reverse side of page).

STEP 2

USABLE SENSITIVITY (12 db SINAD)

TEST PROCEDURE

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

1. Be sure Test Step 1 checks out properly.
2. Reduce the Signal Generator output from setting in Test Step 1.
3. Adjust Distortion Analyzer LEVEL control for a +2 db reading.
4. Set CONTROL from LEVEL to DISTORTION reading. Repeat Steps 1, 2 and 3 until difference in reading is 12 db (+2 db to -10 db).
5. The 12-db difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. Reading should be less than 0.25 microvolts with audio output at least one watt (1.87 volts RMS across the 3.5-ohm receiver load).

SERVICE CHECK

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

1. Alignment of RF stages (Refer to RF Alignment in Receiver Alignment on reverse side of page.)
2. Gain measurements as shown on the Receiver Troubleshooting Procedure.

STEP 3

MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

TEST PROCEDURE

1. Be sure Test Steps 1 and 2 check out properly.
2. Set Signal Generator output for twice the microvolt reading obtained in Test Step 2 - 4.
3. Increase Signal Generator frequency deviation.
4. Adjust LEVEL Control for +2 db.
5. Set CONTROL from LEVEL to DISTORTION reading. Repeat Steps 3, 4 and 5 until difference between readings becomes 12 db (from +2 db to -10 db).
6. Deviation control reading for the 12-db difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±8 kHz but less than ±10 kHz (Narrow Band) or more than ±16 kHz but less than ±20 kHz (Wide Band).

DB SCALE ON DISTORTION ANALYZER

LEVEL DISTORTION ON DISTORTION ANALYZER

SERVICE CHECK

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

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 Oscillator Model 4EX6A10
2. Frequency Modulation Monitor
3. AC VTVM or output meter
4. G-E Test Set Model 4EX3A10 (TM11 or TM12)

PROCEDURE

Transmitters without CHANNEL GUARD

1. Connect the audio signal generator and the meter across audio input terminals J5 (green-hi) and J6 (black-lo) on G-E Test Set, or across J201-15 (mike hi) and J201-7 (mike lo) on the Centralized Metering Jack.
2. Apply a 1.0 volt signal at 1000 Hz to Test Set or across J201-15 and J201-7 on the Centralized Metering Jack.
3. Set MOD ADJUST (R110) for a 4.5 KHz (Narrow Band) or 13.5 KHz (Wide Band) 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.

ALIGNMENT PROCEDURE CHANGES FOR 10-WATT RADIO COMMON CARRIER DISPATCH STATIONS WITH TRANSMITTER TYPE ET-74-C (Option 8450)

In this service, FCC regulations restrict the transmitter power output to 10 watts. Whenever MASTR Desk Top Stations are used in such services, make the following changes in the transmitter Alignment Procedure (RC-1411 in LBI-3737):

In Steps 9, 11, 13 and 14 of the Alignment Procedure, adjust the PA LOADING for a watt meter output of 10 watts and note the Test Meter reading. This reading will indicate the correct PA loading. If a watt meter is not available, adjust the PA LOADING for a meter reading of 0.32 volt (instead of 0.7 volt).

——— NOTE ———

The following changes were made in the station for 10-watt operation:

- In the PA assembly, the PA screen grid resistor (R213) was changed from 8.2K to 22K.
- In the power supply, the jumpers between TB4-14 and -18, and TB4-12 and -15 were removed. The jumpers between TB4-14 and -19, and TB4-8 and -15 were added.
- Changed transmitter type number to ET-74-C.

PA POWER INPUT

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

$$P_i = \frac{\text{Plate Voltage} \times \text{Plate Current Indication}}{4.3}$$

where

P_i is the power input in watts.

Plate voltage is measured with G-E Test Set in Position G, using the 1000-volt scale (or measured from J201-1 to -16 with multimeter).

Plate current indication is measured with G-E Test Set in Position G, using the TEST 1 scale (or measured from J201-1 to -9 with multimeter).

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

FOR OPERATING AT REDUCED POWER

In some services, FCC regulations do not permit the use of full rated power input to the final amplifier plate circuit (ET-74-A or ET-74-B). In such cases, the PA LOADING control must not be adjusted for a meter reading of 0.79 at J201 as shown in Step 13 of the Alignment Procedure.

To find the maximum permissible meter reading at J201, measure the PA plate voltage under load and derive the meter reading from the following formula:

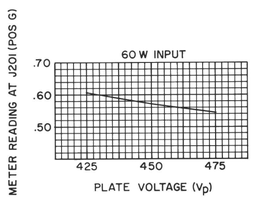
$$V_{meter} = \frac{4.3 \times P}{V_p}$$

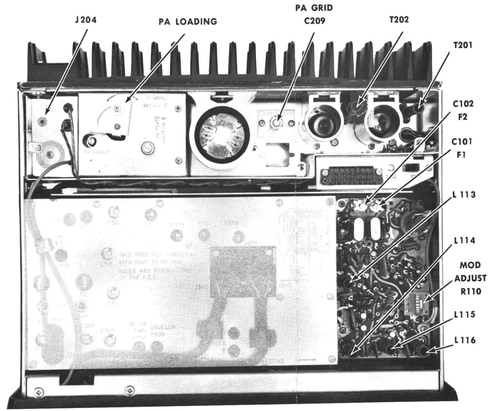
Where V_{meter} is the maximum permissible test set reading (position G for G-E Test set, or J201-1 and -9 with multimeter):

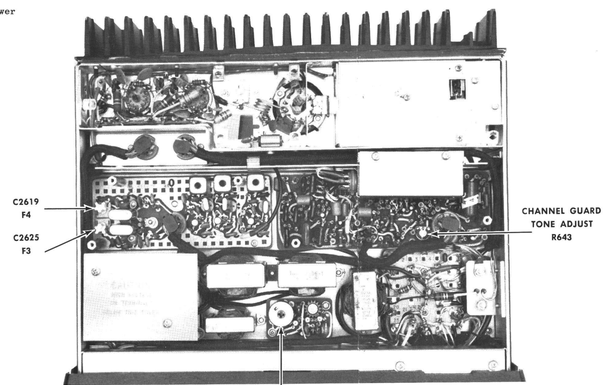
P is the maximum permissible power input

V_p is the measured plate voltage under load

The maximum permissible J201 reading vs plate voltage for a power input of 60 watts is shown in the following chart.







TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. General Electric Test Set TM11 or TM12, or a 20,000 ohms-per-volt Multimeter with a 1-volt scale, 50-ohm wattmeter, and a frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal(s) in crystal socket(s). (Crystal frequency = operating frequency ÷ 24).
2. Turn PA LOADING to minimum loading position, set crystal trimmer C101 to mid-capacity.
3. For multi-frequency transmitters, set all trimmers to mid-capacity and set the Control Unit CHANNEL SELECTOR Switch to the highest frequency channel.
4. Place the TUNE-OPERATE Switch (S201) in the TUNE position.
5. For a large change in frequency or a badly mis-aligned trasmitter, above 150 MHz, turn the slugs in the Exciter coils (L113, L114, L115, L116) to the bottom of the coil. (For transmitters below 150 MHz, set the slugs in the center of the coils.) Set the T201 slug to the top of the coil. Set the T202 top slug to the top of the coil and the bottom slug to the bottom of the coil.
6. Connect TEST SET to the Transmitter Centralized Metering Jack J201. Turn the test set polarity switch to (+). If using a multimeter, connect the leads as shown below.
7. Connect wattmeter to J204.
8. With TEST SET in position I, key the transmitter and check for a regulated 10 volts (read on 15-volt scale). If voltage is not correct, adjust 10-volt regulator potentiometer R3 for 10-volts. Then move TEST SET plug to receiver metering jack and check 10-volts at Position J. If reading is not approximately 10 volts, refer to the Power Supply Troubleshooting Diagram.
9. All adjustments are made with the transmitter keyed and the TEST SET on the 1-volt TEST scale.

TRANSMITTER ALIGNMENT PROCEDURE

STEP	METERING POSITION 4EX3A10	METERING POSITION MULTIMETER AT J201	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A MULT-1	pin 10 (+) pin 16 (-)	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	pin 2 (+) pin 16 (-)	L115, L114 and L116	See Procedure	Tune L115 and re-tune L114 for maximum meter reading, then tune L116 for a dip in meter reading.
			MULT-3 AND POWER AMPLIFIER		
3.	D MULT-3	pin 16 (+) pin 4 (-)	T201 & L116	Maximum	Adjust T201 for maximum meter reading, then re-adjust L116 maximum meter reading.
4.	E MULT-4	pin 16 (+) pin 5 (-)	T202	Maximum	Adjust top slug of T202 for maximum meter reading. Adjust bottom slug of T202 for maximum meter reading, then re-adjust top slug for maximum meter reading.
5.	F PA GRID	pin 14 (+) pin 6 (-)	PA GRID C209	Maximum	Tune C209 for maximum meter reading.
6.	G PA PLATE	WARNING High B+ on pins 1 & 9 pin 1 (+) pin 9 (-)	PA PLATE (C214)	See Procedure	Carefully tune PA Plate for minimum meter reading. Adjustment is quite sharp and will be only a small dip in meter reading.
7.			Place TUNE/OPERATE Switch S201 in the OPERATE position.		
8.	G PA PLATE	pin 1 (+) pin 9 (-)	PA PLATE		Carefully re-tune PA Plate for minimum meter reading.
9.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING	0.7 volts	Adjust PA LOADING for meter reading of 0.7 volts.
10.	G PA PLATE	pin 1 (+) pin 9 (-)	ANT TUNING C215	Maximum	Adjust ANT TUNING for maximum meter reading.
11.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING AND ANT TUNING	See Procedure	Re-adjust PA LOADING for 0.7 volts. Re-adjust ANT TUNING for maximum meter reading.
12.	F PA GRID	pin 14 (+) pin 6 (-)	PA GRID	Maximum	Repeak PA GRID for maximum meter reading.
13.	G PA PLATE	pin 1 (+) pin 9 (-)	PA LOADING	0.79 volts	Increase PA LOADING until meter reads 0.79 volts.
14.	G PA PLATE	pin 1 (+) pin 9 (-)	ANT TUNING	Maximum	Repeak ANT TUNING, then repeat Step 13 and repeak ANT TUNING.
			FREQUENCY ADJUSTMENT		
15.			C101 (C102 in 2-freq. units, and C2625 or C2619 in multi-freq. units.		Loosely couple frequency counter to output and adjust C101 for proper frequency output. (Switch to F2 and adjust C102 on 2-frequency units. In 3- or 4-frequency units, adjust C2625 or C2619 as required. ———NOTE——— For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temp. of approximately 75° F. In no case should frequency adjustments be made when the equipment is outside the temp. range of 50° to 90° F.

ALIGNMENT PROCEDURE

TRANSMITTER TYPES ET-74-A, B & C

RC-1411F

TEST PROCEDURES

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

TEST EQUIPMENT REQUIRED

for test hookup as shown:

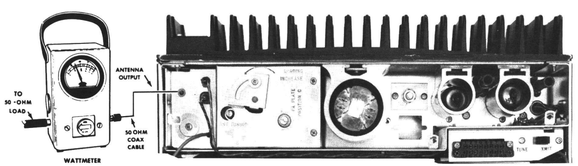
1. Wattmeter similar to:
   Bird #43
   Jones #711N
2. VTVM similar to:
   Triplett #850
   Heath #1M-21
3. Audio Generator similar to:
   GE Model 4EX6A10
   Heath #1G-72
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements #140
   Lampkin #205A
5. Multimeter similar to:
   GE METERING TEST SET MODEL 4EX3A10 or Triplett #631 or 20,000 ohms-per-volt voltmeter

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output to wattmeter as shown below:



2. Key transmitter and check wattmeter for minimum reading of 35 watts (132-162 MHz) or 30 watts (162-174 MHz) in ET-74-A & B, or 10 watts in ET-74-C.

SERVICE CHECK

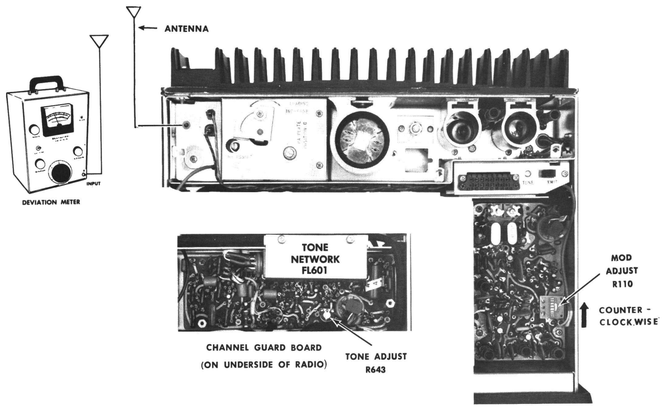
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

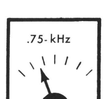
TEST PROCEDURE

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



2. Set MOD ADJUST control R110 fully counterclockwise.

3. 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:

1. 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 Chart).

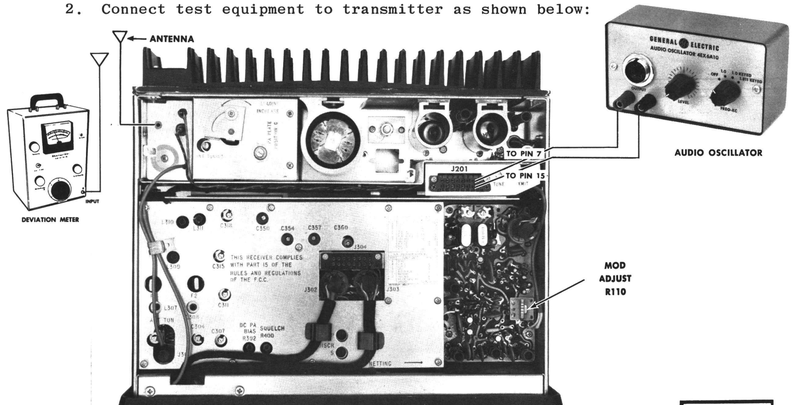
2. The Tone Deviation Test Procedures should be repeated every time the Tone Frequency is changed.

STEP 3

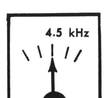
VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

1. Unplug the microphone.
2. Connect test equipment to transmitter as shown below:



3. Set the generator output to 1.0 VOLTS RMS and frequency to 1 kHz.
4. Key the transmitter by connecting a jumper from J201-18 to J201-16 (GRD). Then adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz (Narrow Band) or 13.5 kHz (Wide Band).
6. Adjust MOD ADJUST Control R110 until deviation reads 4.5 kHz (Narrow Band) or 13.5 kHz (Wide Band) on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.

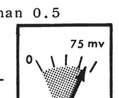


DEVIATION METER

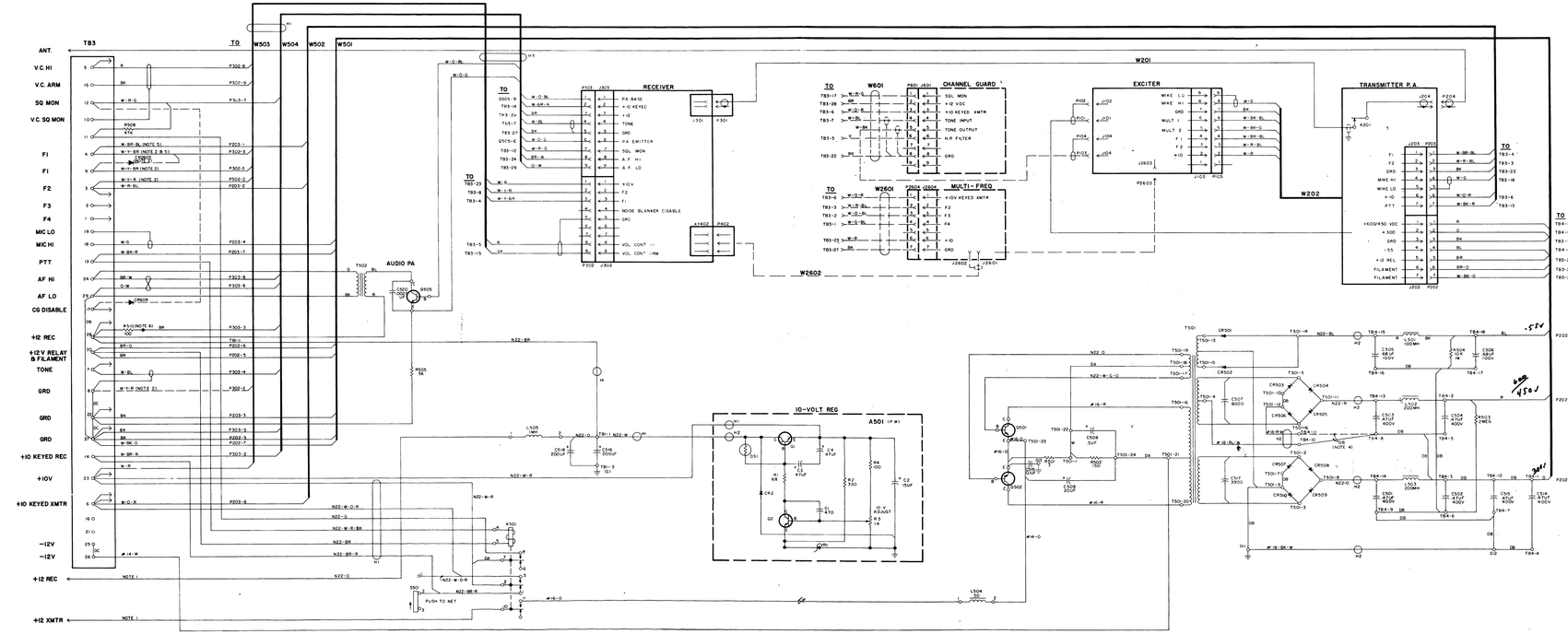
NOTES: --These transmitters are adjusted for 4.5 kHz (13.5 kHz Wide Band) deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz (15 kHz Wide Band) under the worst conditions of frequency, voltage and temperature.

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

1. Recheck Step 1 as shown in the Transmitter Alignment Chart.
2. Check Audio Sensitivity by reducing generator output until deviation falls to 3.3 kHz (10 kHz Wide Band). Voltage should be LESS than 90 millivolts (typically 75 mv).



METER



SCHEMATIC DIAGRAM

POWER SUPPLY MODEL 4EP50A10

19R640707, Rev. 22

PARTS LIST

LBI-3717E

MOBILE POWER SUPPLY
MODEL 4EP50A10
19D402638-G1

SYMBOL	G-E PART NO.	DESCRIPTION
A501		**10 VOLT REGULATOR 19B205255-G1**
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481-P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5496267-P14	Tantalum: 33 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C3 and C4	5496267-P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1*	4037822-P1	Silicon. (Deleted by Rev F).
CR2*	4037822-P1	Silicon. (Added by Rev F).
		- - - - - - - - INDICATING DEVICES - - - - - - - -
DS1	4034664-P1	Lamp, incandescent: 28 v; sim to GE 2148.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115300-P2	Silicon, NPN; sim to Type 2N3053.
Q2	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1*	3R77-P68*K	Composition: 68 ohms ±10%, 1/2 w.
	3R77-P161J	In Models earlier than Rev C: Composition: 160 ohms ±5%, 1/2 w.
R2	3R77-P331J	Composition: 330 ohms ±5%, 1/2 w.
R3	19A115681-P1	Variable, wirewound: 1000 ohms ±20%, 3 w; sim to CTS Series 115.
R4	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
		- - - - - VOLTAGE REGULATORS - - - - - -
VR1	4036887-P6	Silicon, Zener.
		- - - - - - - - - CAPACITORS - - - - - - - - -
C501 thru C504	19A115028-P59	Polyester: 0.47 µf ±20%, 400 VDCW.
C505* and C506*	19A115028-P20	Polyester: 0.68 µf ±20%, 100 VDCW.
	19A115028-P19	In Models earlier than Rev B: Polyester: 0.47 µf ±20%, 100 VDCW.
C507	5490825-P2	Ceramic disc: .008 µf ±10%, 2000 VDCW; sim to RMC Type JF Discap.
C508	19A115680-P2	Electrolytic: 5 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C509	19A115680-P3	Electrolytic: 20 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C514 and C515	19A115028-P59	Polyester: 0.47 µf ±20%, 400 VDCW.
C516*	19A115680-P10	Electrolytic: 200 µf +150% -10%, 25 VDCW.
	19A115680-P5	In Models earlier than Rev A: Electrolytic: 100 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C517	5494481-P29	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C518*	19A115680-P10	Electrolytic: 200 µf +150% -10%, 25 VDCW. Added by Rev A.
C519*	19A115028-P14	Polyester: 0.1 µf ±20%, 200 VDCW. Added by Rev D.
C520*	5494481-P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by Rev E.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	G-E PART NO	DESCRIPTION
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR501 thru CR510	4037822-P2	Silicon.
CR609	5494922-P1	Silicon; sim to Type 1N456.
CR2603	4037822-P1	Silicon.
		- - - - - - - - - - - RELAYS - - - - - - - - - - -
K501	19B209240-P5	Armature, open: 12 VDC nominal, 2 w max operating, 100 ohms ±10% coil res, 3 form C contacts; sim to Magnecraft 88X-156.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L501	19B200777-P1	Reactor: 0.1 h min, 12 ohms ±10% DC res, 200 VDC operating.
L502 and L503	19B209236-P1	Reactor: 200 mh min, 16 ohms DC res max, 700 VDC operating.
L504	19A115392-P1	Choke, RF: 50 µh ±10%, .02 ohm DC res max.
L505*	19A115894-P1	Choke, RF: 1 mh min, 0.35 ohms DC res max.
	7488079-P43	In Models earlier than Rev A: Choke, RF: 10 µh ±10%, 0.3 ohm DC res max; sim to Jeffers 4422-4.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q501 and Q502	5490810-P1	Germanium, PNP.
Q505	19A115327-P1	Silicon, NPN.
		- - - - - - - - - RESISTORS- - - - - - - - -
R501	5493035-P6	Wirewound: 3 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
R502	5493035-P21	Wirewound: 150 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
R503	3R77-P205J	Composition: 2 megohms ±5%, 1/2 w.
R504	3R78-P103K	Composition: 10,000 ohms ±10%, 1 w.
R505	19B209022-P109	Wirewound: 0.56 ohm ±10%, 2 w; sim to IRC Type BWH.
R508	3R77-P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R510*	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w. Added by Rev A.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S501	19B209040-P7	Slide: SPDT, 0.5 amp at 125 v; sim to Continental-Wirt Type G-232.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T501	19C303893-G1	Transformer.
T502	19A115612-P1	Audio frequency: 0.3-3 KHz freq range, Pri: 24.0 ohms ±5% imp, 1.28 ohm DC res, Sec: 3.3 ohms imp, 0.18 ohm DC res.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500-P2	Phen: 3 terminals.
TB3	19B205258-G1	Board: 27 terminals.
TB4	19B205237-G1	Board: 18 terminals.
		- - - - - - - - - - CABLES - - - - - - - - - -
W501		**CABLE 19B205266-G1** (Used in Transmitter)
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P202	19B209341-P1	Socket: 7 contacts; sim to Elco 04-720-XX.
W502		**CABLE 19B205267-G1** (Used in Transmitter)
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P203	19B209341-P1	Socket: 7 contacts; sim to Elco 04-720-XX.

SYMBOL	G-E PART NO	DESCRIPTION
W503		**CABLE 19B205265-G1** (Used in Receiver)
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P302	19B209341-P2	Socket: 9 contacts; sim to Elco 04-920-XX.
W504		**CABLE 19B205264-G1** (Used in Receiver)
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P303	19B209341-P2	Socket: 9 contacts; sim to Elco 04-920-XX.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4035439-P1	Heat sink, transistor: sim to Birtcher 3AL-63L-3R. (Used with Q1 in 19B205255-G1).
	4035711-P4	Clip, spring tension: sim to Augat Brothers 6007-A-CT. (Used with DS1 in 19B205255-G1).
	4036555-P1	Insulator, washer: nylon. (Used with Q1 in 19B205255-G1).
	19C303871-P1	Cover. (Used with K501 in 19D402638-G1).
	4038930-P1	Clip. (Used with R501, 502 in 19D402638-G1).
	5491682-P11	Lock: sim to Yale and Towne Lock P6701, (Used in 19D402638-G1).
	5491682-P12	Can: sim to Yale and Towne Lock 18, (Used in 19D402638-G1).
	4031529-P1	Clip: sim to Tinnerman C20213-017. (Used with W502 in 19D402638-G1).
	4039387-P2	Nut: sim to Tinnerman C410-632-3. (Mounts L502, L503 in 19D402638-G1).
	19A122251-P1	Clip, cable. (Located by T501 in 19D402638-G1).

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 provide additional filtering for alternator noise and voltage spikes on incoming power leads, changed C516 and L505, and added C518 and R510.

REV. B - To improve filtering of bias supply, changed C505, and C506.

REV. C - To improve operation of 10-volt regulator, changed R1 on A501.

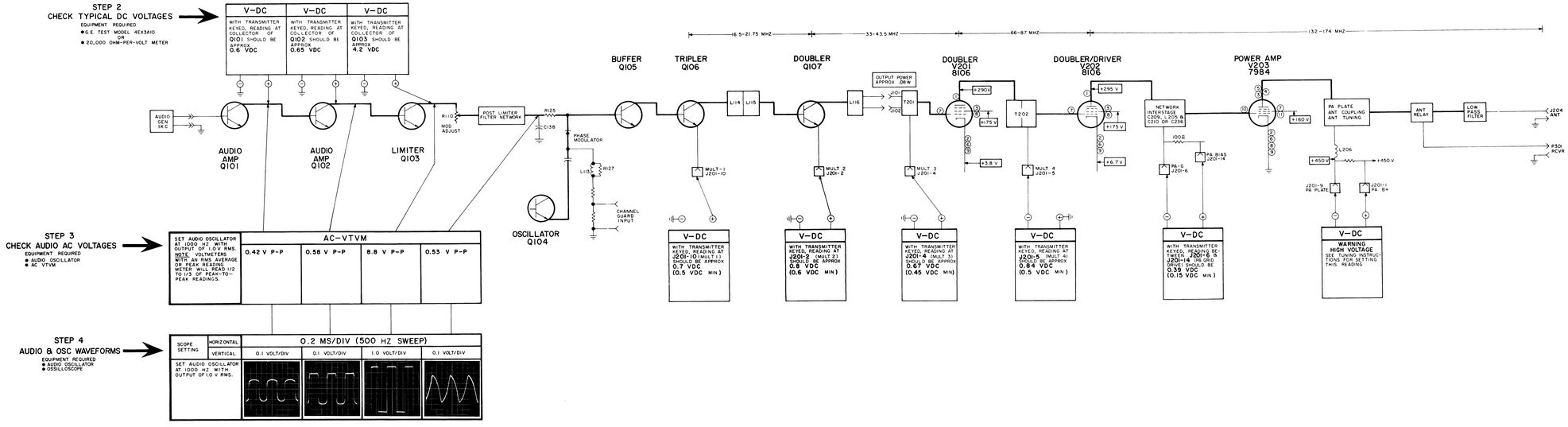
REV. D - To reduce transistor switching noise. Add C519.

REV. E - To eliminate receiver PA instability. Added C520 between the collector and emitter of Q505.

REV. F - To provide reverse polarity protection. Added CR2 and deleted CR1 in the collector circuit of Q2 on 10-volt regulator A501.

STEP 1 - QUICK CHECKS

Power Out	A	B	D	E	F	G	I	Probable Defect
low	0.7	0.8	0.7	0.8	0.3	0.7	10	weak 7984
low	0.7	0.8	0.7	0.8	0.1	0.7	10	weak 8106 V202
low	0.7	0.8	0.7	0.3	0.1	0.7	10	weak 8106 V201
0	0.7	0.8	0.7	0.8	0.3	0	10	defective 7984
0	0.7	0.8	0.7	0.8	0	0	10	defective 7984
0	0.7	0.8	0.7	0.8	0	0.8	10	defective bias supply
0	0.7	0.8	0.7	0	0	0	10	V202 failure
0	0.7	0.8	0	0	0	0	10	V201 failure, open coax to exciter board or Q107 defective
0	0.7	0	0	0	0	0	10	Q107 defective
0	0	0	0	0	0	0	0	10 v regulator defective



TROUBLESHOOTING PROCEDURES

TRANSMITTER TYPES ET-74-A & B

RC-1389A

STEP 1 - QUICK CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	Check power connections and continuity of supply leads, and check fuses. If fuse is blown, check for short circuits by disconnecting all plugs in the unit. Reconnect plugs one at a time until a fuse blows.
NO REGULATED 10 VOLTS	Check the 12-volt supply. Then check Q1 in 10-volt regulator and regulator circuit. Disconnect all plugs from the receiver, exciter board and option boards, and take resistance readings from jack pins to ground (Refer to Outline Diagrams).
LOW 2ND LIM READING	Check supply voltages and then check oscillator reading at J304-4 as shown in STEP 2A. Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 2nd Limiter stages as shown in STEP 2A. Check receiver RF alignment (refer to Receiver Alignment Procedure).
LOW OSCILLATOR READING	Check alignment of Oscillator (Refer to Front End Alignment Procedure). Check voltage readings of Q304 and Q305. Check resistance readings on J302-1, -2 and -3. Check crystal Y401.
LOW RECEIVER SENSITIVITY	Check Front End Alignment (Refer to Receiver Alignment Procedure). Check input signal required for 0.2-volt reading at LIM-1. Reading should be less than 20 uv. Check antenna connections, cable and relay. Check voltage readings of 1st and 2nd RF Amps and 1st and 2nd Mixers. Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	Check Audio PA (Q505) output current at J304-9. If reading is low -- a. Check BIAS ADJ for 0.28 VDC at J304-9. If incorrect, set for 0.28 v with R401 (Position on Test Set). b. If correct, check Audio Amp Q317. Make SIMPLIFIED GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch Stages. Check unsquelched D-C 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 OPERATION	Make GAIN and WAVEFORM CHECKS (STEPS 2A and 2B) of Audio and Squelch stages. Check voltage readings of Squelch circuit (Refer to Receiver Service Sheet).
DISCRIMINATOR IDLING TOO FAR OFF ZERO	See if discriminator zero is in the center of IF bandpass.

STEP 3- GAIN-PER-STAGE READINGS-

EQUIPMENT REQUIRED:

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

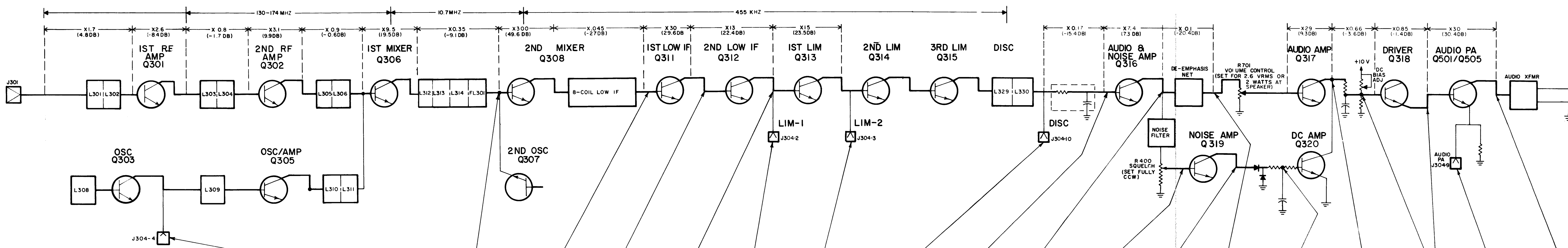
PROCEDURE

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, BASE OF RF AMP). PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E_1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (1ST.MIXER*). REPEAK FIRST RESONANT CIRCUIT THEN 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



STEP 2A- SIMPLIFIED VTVM GAIN CHECKS

EQUIPMENT REQUIRED:

1. VTVM-AC&DC
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.

SIGNAL GENERATOR INPUT AT J301 MAINTAIN SETTING AT DISCRIMINATOR ZERO		UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED	10 MICROVOLTS UNMODULATED	1 MICROVOLT UNMODULATED	STANDARD SIGNAL-(1MV AT RCVR FREQ MOD BY 1KHZ WITH 3.3 KHZ (10 KHZ WB) 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 GENERA-OUTPUT UNTIL VTVM READING ON 1.5 V SCALE DECREASES BY 50 MV	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DE-CREASES BY 5 %	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DE-CREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM ZERO UNTIL VTVM READING DE-CREASES BY 5%														AFTER CHECKING WAVEFORMS ADJUST VOLUME CONTROL FOR RATED 1 WATT OUTPUT ACROSS 3.2 Ω LOAD.
READING	0.41 VDC MIN EX-3-A 0.19 VDC MIN MULTMTR 0.25 VDC MIN	GENERATOR OUTPUT SHOULD BE APPROX 3 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 400 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 70 MICROVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 5 MICROVOLTS	0.82 VDC EX-3-A 0.2 VDC MULTMTR 0.4 VDC	1.6 VDC EX-3-A 0.4 VDC MULTMTR 0.8 VDC	0.57 VAC	0.05 VAC	0.89 VAC	0.045 VAC	1.2 VAC	.03 VAC	0.56 VDC	0.34 VAC	0.2 VAC	0.28 VDC EX-3-A 0.28 VDC MULTMTR 0.28 VDC	8 VAC	2.6 VAC

STEP 2B-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:

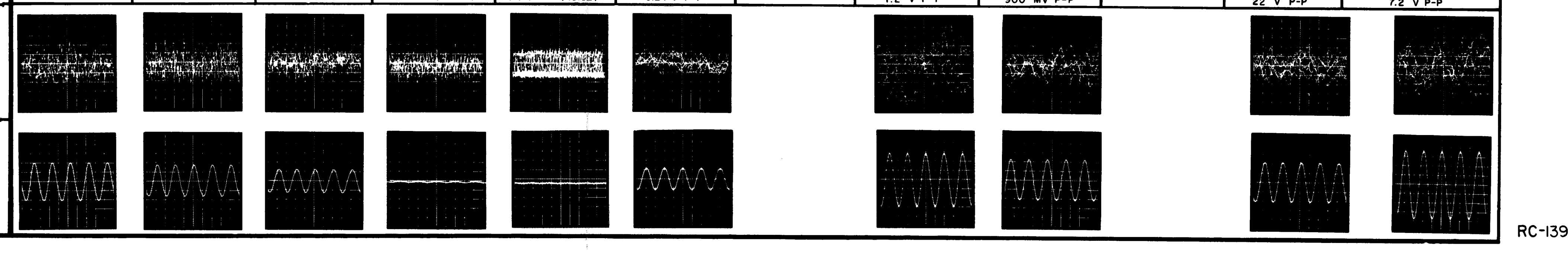
1. OSCILLOSCOPE
2. SIGNAL GENERATOR (MEASUREMENTS M560 OR EQUIVALENT).

SCOPE SETTING												
HORIZONTAL	0.5 MS/DIV (APPROX 200 CPS)	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV
VERTICAL	0.5 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV		200 MILLIVOLTS/DIV	200 MILLIVOLTS/DIV		5 VOLTS/DIV	1 VOLT/DIV
PEAK-TO-PEAK VOLTAGE	2.1 V P-P	340 MV P-P	2.6 V P-P	0.4 V P-P (NOISE)	3.0 V P-P (NOISE)	0.24 V P-P		1.2 V P-P	900 MV P-P		22 V P-P	7.2 V P-P

NOISE WAVE FORM

STANDARD SIGNAL

1 MILLIVOLT AT RECEIVER FREQ MODULATED BY 1KHZ WITH 3.3 KHZ (10KHZ, WIDE BAND) DEVIATION

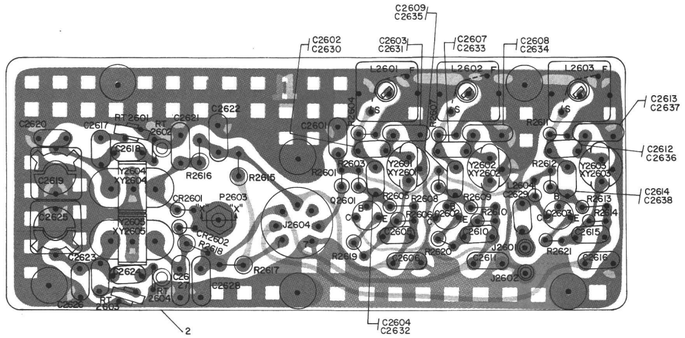


RC-1390A

TROUBLESHOOTING PROCEDURES

RECEIVER MODELS 4ER48A10-15 & B10-15

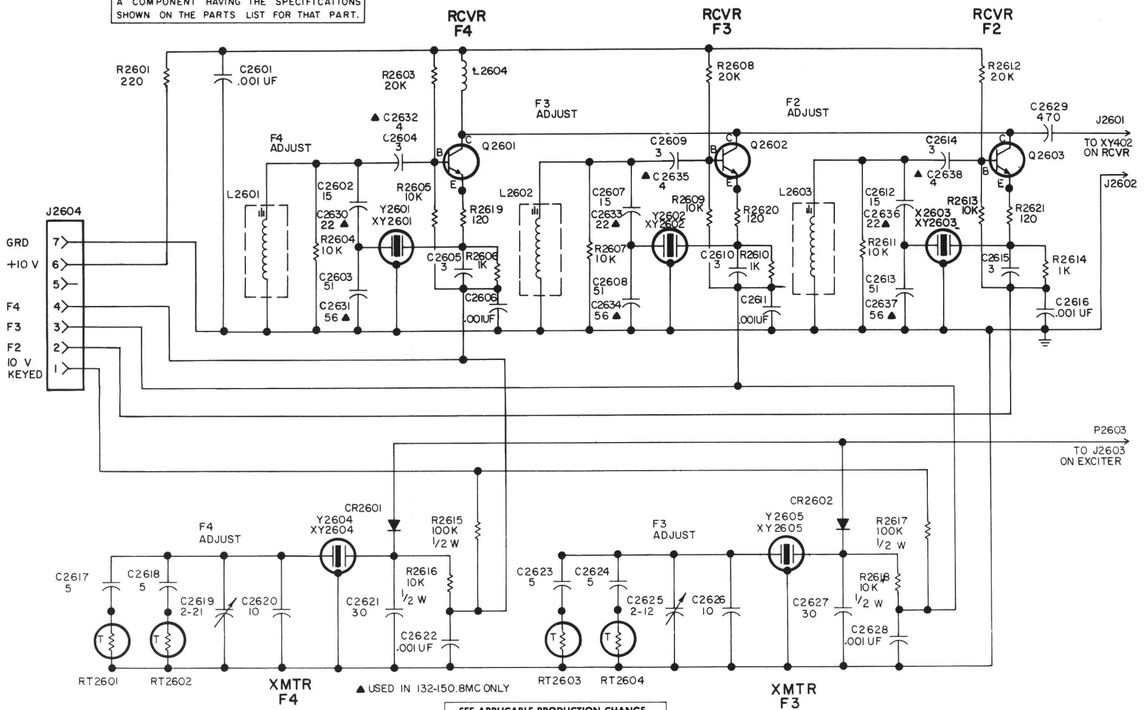
(RC-1390A)



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

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

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



ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

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

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EG22F10	C
4EG22F11	C

ECP-221

(19C303926, Rev.-6)

SCHEMATIC & OUTLINE DIAGRAM

FOUR-FREQUENCY OSCILLATOR BOARD
MODEL 4EG22F10, 11

RC-1418D

PARTS LIST

LBI-3715C

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

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

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

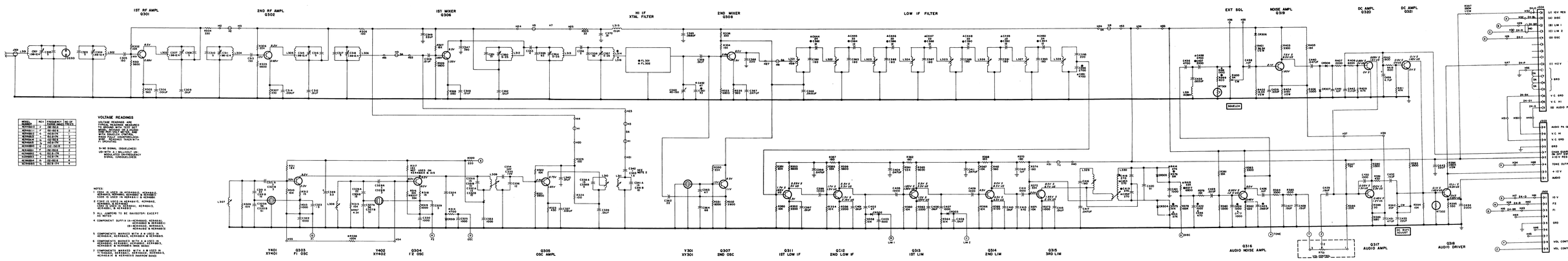
PRODUCTION CHANGES

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

REV. A - To improve receiver oscillator frequency stability. Changed C2602, C2607, C2612, C2630, C2633 and C2636.

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

REV. C - To facilitate manufactoring. Changed Q2601, Q2602 & Q2603.



SCHEMATIC DIAGRAM

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

19R620752, Rev. 17

(Cont'd from front of RC-1415)

SYMBOL	G-E PART NO	DESCRIPTION
C395	5490008-P34	Silver mica: 200 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C396	5494481-P128	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C397	19B209243-P1	Polyester: .01 μf ±20%, 50 VDCW.
C398	19B209243-P5	Polyester: .047 μf ±20%, 50 VDCW.
C399	5494481-P112	Ceramic disc: .001 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C401	19B209243-P1	Polyester: .01 μf ±20%, 50 VDCW.
C402	5490008-P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C403	5494481-P111	Ceramic disc: .001 μf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C404	19B209243-P5	Polyester: .047 μf ±20%, 50 VDCW.
C405	5494481-P112	Ceramic disc: .001 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C406	19B209243-P1	Polyester: .01 μf ±20%, 50 VDCW.
C407	7491393-P1	Ceramic disc: .001 μf +100% -0%, 500 VDCW; sim to Sprague 1219C4.
C408	7491827-P2	Ceramic disc: .01 μf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C409	5494481-P112	Ceramic disc: .001 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C410	19B209243-P1	Polyester: .01 μf ±20%, 50 VDCW.
C411	19B209243-P5	Polyester: .047 μf ±20%, 50 VDCW.
C412	19B209243-P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C413	5494481-P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C414	5494481-P112	Ceramic disc: .001 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C415	19B209243-P1	Polyester: .01 μf ±20%, 50 VDCW.
C416	5496219-P369	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C417	19B209243-P5	Polyester: .047 μf ±20%, 50 VDCW.
C418 and C419	5490008-P137	Silver mica: 270 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C420	5496219-P656	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C421 and C422	5494481-P112	Ceramic disc: .001 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C423*	5492638-P108	Ceramic disc: 0.22 μf +80% -20%, 12 VDCW; sim to Sprague 44C70. Added in Models 4ER48B10-13 by Rev C. Added in Models 4ER48B14, 15 by Rev D.
C424	5494481-P112	Ceramic disc: .001 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C425*	19B209243-P6	Polyester: .068 μf ±20%, 50 VDCW.
	19B209243-P5	In Models 4ER48A10-13 of Rev B and earlier: In Models 4ER48A14, 15 of Rev C and earlier: Polyester: .047 μf ±20%, 50 VDCW.
C426	19B209243-P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C427 and C428	19B209243-P108	Polyester: 0.15 μf ±10%, 50 VDCW.
C429	19B209243-P8	Polyester: 0.15 μf ±20%, 50 VDCW.
C430	5494481-P112	Ceramic disc: .001 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C431	5496267-P2	Tantalum: 47 μf ±20%, 6 VDCW; sim to Sprague Type 150D.
C432	19B209243-P8	Polyester: 0.15 μf ±20%, 40 VDCW.
C433	5496267-P10	Tantalum: 22 μf ±20%, 15 VDCW; sim to Sprague Type 150D.
C434*	5494481-P14	Ceramic disc: .002 μf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
	5490008-P131	In Models 4ER48A10-13 of Rev C and earlier: In Models 4ER48B10-13 of Rev C and earlier: In Models 4ER48A14,15 of Rev D and earlier: In Models 4ER48B14,15 of Rev D and earlier: Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C435	5491189-P202	Polyester: .022 μf ±5%, 50 VDCW.
C436	19C300075-P 47000J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C437	19C300075-P 33000J	Polyester: 3300 pf ±5%, 100 VDCW; sim to GE Type 61F.
C438	19B209243-P7	Pplyester: 0.1 μf ±20%, 50 VDCW.
C439	19B209243-P9	Polyester: 0.22 μf ±20%, 50 VDCW.
C440	19B209243-P5	Polyester: .047 μf ±20%, 50 VDCW.
C441	19B209243-P7	Polyester: 0.1 μf ±20%, 50 VDCW.
C442*	5496267-P13	Tantalum: 2.2 μf ±20%, 20 VDCW; sim to Sprague Type 150D.
	5496267-P13	In Models 4ER48A10-13 of Rev D and earlier: In Models 4ER48B10-13 of Rev D and earlier: In Models 4ER48A14,15 of Rev E and earlier: In Models 4ER48B14,15 of Rev E and earlier: Tantalum: 4.7 μf ±20%, 10 VDCW; sim to Sprague Type 150D.
	5496267-P13	In Models 4ER48A10-13 of Rev B and earlier: In Models 4ER48B10-13 of Rev B and earlier: In Models 4ER48A14,15 of Rev C and earlier: In Models 4ER48B14,15 of Rev C and earlier: Tantalum: 2.2 μf ±20%, 10 VDCW; sim to Sprague Type 150D.
C443	5496267-P10	Tantalum: 22 μf ±20%, 15 VDCW; sim to Sprague Type 150D.
C444	5496219-P48	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C445 thru C449	5496219-P47	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef 0 PPM.
C450	5496219-P48	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C451	19C300075-P 47000J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C452	5496219-P55	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef 0 PPM.
C453 and C454	5490008-P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C455	7774750-P1	Ceramic disc: .00047 μf +100% -0%, 500 VDCW.
C457	7491393-P1	Ceramic disc: .001 μf +100%, -0%, 500 VDCW; sim to Sprague 1219C4.
C458	19C300075-P 47000J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C459*	5496267-P5	Tantalum: 4.7 μf ±20%, 10 VDCW; sim to Sprague Type 150D. Added in Models 4ER48A10-13 by Rev E. Added in Models 4ER48B10-13 by Rev E. Added in Models 4ER48A14,15 by Rev F. Added in Models 4ER48B14,15 by Rev F.
		DIODES AND RECTIFIERS
CR301	7777146-P3	Germanium; sim to Type 1N90.
CR302 and CR303	4038056-P1	Germanium.
CR304 and CR305	19A115250-P1	Silicon.
CR306	5494922-P1	Silicon; sim to Type 1N456.
CR307 and CR308	19A115250-P1	Silicon.
		INDICATING DEVICES
DS301	19B209067-P1	Lamp, glow: 0.3 ma; sim to GE NE-2T.
		FILTERS
FL301	19C304219-G1	Bandpass. 10.7 MHz.
FL302	19C304219-G3	Bandpass. 10.7 MHz.
		JACKS AND RECEPTACLES
J301	7104941-P9	Jack, phono type: phen; sim to Cinch 14H20958.
J302 and J303	19B209303-P1	Connector, phen: 9 pins.
J304	19B205689-G2	Connector: 16 contacts.
		INDUCTORS
L301	19B205530-G1	Coil.
L302 thru L305	19B205530-G2	Coil.
L306	19B205530-G3	Coil.
L307 and L308	19A121085-G1	Coil. Includes tuning slug 19B200497-P2.
L309	19B205236-G1	Coil. Includes tuning slug 19B200497-P2.
L310	19B205239-G1	Coil. Includes tuning slug 19B200497-P2.
L311	19B205240-G1	Coil. Includes tuning slug 19B200497-P2.
L312 and L313	19B205224-G2	Coil.
L314	19B205224-G3	Coil.
L315	7488079-P18	Choke, RF: 15 μh ±10%, 1.2 ohms DC res max; sim to Jeffers 4421-9.
L316	19B205224-G4	Coil.
L321 * and L322 *	19C311181G3	Coil: Includes tuning slug 4038368-P1.
	19C303062-G6	In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier. Coil. Includes tuning slug 4038368-P1.
L323 *	19C311181-G4	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L324 *	19C311181-G3	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L325 *	19C311181-G4	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L326 *	19C311181-G3	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L327 *	19C311181-G4	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L328 *	19C311181-G3	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G6	Coil. Includes tuning slug 4038368-P1.
L329 *	19C311181-G1	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G4	Coil. Includes tuning slug 4038368-P1.
L330 *	19C311181-G2	Coil. Includes tuning slug 4038368-P1. In Models 4ER48A10, 11, 13, B10, 11, 13 of REV E and Models 4ER48A12, 14, 15, B12, 14, 15 of REV F and earlier.
	19C303062-G5	Coil. Includes tuning slug 4038368-P1.
L331	19B209405-P1	Reactor, audio freq: 142 mh ±5% at 0.1 v thru 0.27 v; sim to Aladdin 405-101.
		TRANSISTORS
Q301 and Q302	19A115342-P1	Silicon, NPN.
Q303* and Q304*	19A115925-P1	Silicon, NPN.
	19A115342-P1	In Models 4ER48A10-13, 4ER48B10-13 of Rev A and earlier: In Models 4ER48A14, 15, 4ER48B14, 15 of Rev B and earlier: Silicon, NPN.
Q305 and Q306	19A115342-P1	Silicon, NPN.
Q307	19A115889-P1	Silicon, NPN.
Q308	19A115245-P1	Silicon, NPN.
Q311 thru Q315	19A115889-P1	Silicon, NPN.
Q316 and Q317	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q318	19A115300-P2	Silicon, NPN; sim to Type 2N3053.
Q319	19A115889-P1	Silicon, NPN.
Q320 and Q321	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		RESISTORS
R301	3R152-P562K	Composition: 5600 ohms ±10%, 1/4 w.
R302	3R152-P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R303	3R152-P561K	Composition: 560 ohms ±10%, 1/4 w.
R304	3R152-P331K	Composition: 330 ohms ±10%, 1/4 w.
R305	3R152-P562K	Composition: 5600 ohms ±10%, 1/4 w.
R306	3R152-P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R307	3R152-P331K	Composition: 330 ohms ±10%, 1/4 w.
R308	3R152-P101K	Composition: 100 ohms ±10%, 1/4 w.
R309 and R310	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R311	3R152-P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R312	3R152-P150K	Composition: 15 ohms ±10%, 1/4 w.
R313	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R314	3R152-P472K	Composition: 4700 ohms ±10%, 1/4 w.
R315 and R316	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R317	3R152-P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R318	3R152-P150K	Composition: 15 ohms ±10%, 1/4 w.
R319	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R320	3R152-P221K	Composition: 220 ohms ±10%, 1/4 w.
R321	3R152-P392K	Composition: 3900 ohms ±10%, 1/4 w.
R322	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R323	3R152-P431K	Composition: 430 ohms ±10%, 1/4 w.
R324 and R325	3R152-P101K	Composition: 100 ohms ±10%, 1/4 w.
R326	3R152-P562K	Composition: 5600 ohms ±10%, 1/4 w.
R327	3R152-P183K	Composition: 18,000 ohms ±10%, 1/4 w.
R328	3R152-P391K	Composition: 390 ohms ±10%, 1/4 w.
R329	3R152-P330K	Composition: 33 ohms ±10%, 1/4 w.
R330	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R331	3R152-P822K	Composition: 8200 ohms ±10%, 1/4 w.
R332	3R152-P392K	Composition: 3900 ohms ±10%, 1/4 w.
R333	3R152-P682K	Composition: 6800 ohms ±10%, 1/4 w.
R334	3R152-P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R335	3R152-P561K	Composition: 560 ohms ±10%, 1/4 w.
R336	3R152-P331K	Composition: 330 ohms ±10%, 1/4 w.
R337	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R338	3R152-P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R350	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R351	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R352	3R152-P222K	Composition: 2200 ohms ±10%, 1/4 w.
R353	3R152-P562K	Composition: 5600 ohms ±10%, 1/4 w.
R354	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R355	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R356	3R152-P222K	Composition: 2200 ohms ±10%, 1/4 w.
R357	3R152-P181K	Composition: 180 ohms ±10%, 1/4 w.
R358	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R359	3R152-P562K	Composition: 5600 ohms ±10%, 1/4 w.
R360	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R361	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R362	3R152-P181K	Composition: 180 ohms ±10%, 1/4 w.
R363	3R152-P222K	Composition: 2200 ohms ±10%, 1/4 w.
R364	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R365	3R152-P562K	Composition: 5600 ohms ±10%, 1/4 w.
R366	3R152-P123K	Composition: 12,000 ohms ±10%, 1/4 w.
R367	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R368	3R152-P181K	Composition: 180 ohms ±10%, 1/4 w.
R369	3R152-P512J	Composition: 5100 ohms ±5%, 1/4 w.
R370	3R152-P181K	Composition: 180 ohms ±10%, 1/4 w.
R371	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R372	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R373	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R374	3R152-P181K	Composition: 180 ohms ±10%, 1/4 w.
R375 and R376	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R377	3R152-P682K	Composition: 6800 ohms ±10%, 1/4 w.
R378	3R152-P104K	Composition: 0.1 megohm ±10%, 1/4 w.
R379	3R152-P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R380	3R152-P332J	Composition: 3300 ohms ±5%, 1/4 w.
R381	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R382	3R152-P221J	Composition: 220 ohms ±5%, 1/4 w.
R383 and R384	3R152-P332K	Composition: 3300 ohms ±10%, 1/4 w.
R385	3R152-P152K	Composition: 1500 ohms ±10%, 1/4 w.
R386	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R387	3R152-P753J	Composition: 75,000 ohms ±5%, 1/4 w.
R388	3R152-P300J	Composition: 30 ohms ±5%, 1/4 w.
R389	3R152-P681J	Composition: 680 ohms ±5%, 1/4 w.
R390	3R152-P332K	Composition: 3300 ohms ±10%, 1/4 w.
R391	3R152-P431K	Composition: 430 ohms ±10%, 1/4 w.
R392(R400)	19B209320-P1	Resistor assembly. Variable, carbon film, includes: (R392) 20,000 ohms ±20%, 0.25 w; (R400) 5000 ohms ±20%, 0.25 w; sim to Centralab Series 5 (Type 71-2).
R393	3R152-P392K	Composition: 3900 ohms ±10%, 1/4 w.
R394	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R395	3R152-P331K	Composition: 330 ohms ±10%, 1/4 w.
R396 and R397	5495948-P444	Deposited carbon: 0.28 megohm ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R399*	3R152-P821J	Composition: 820 ohms ±5%, 1/4 w.
	3R152-P511J	In Models 4ER48A10-13 of Rev D and earlier: In Models 4ER48B10-13 of Rev D and earlier: In Models 4ER48A14,15 of Rev E and earlier: In Models 4ER48B14,15 of Rev E and earlier: Composition: 510 ohms ±5%, 1/4 w.
R400		(See R392).
R401	5495948-P357	Deposited carbon: 38,300 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R402	5495948-P313	Deposited carbon: 13,300 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R403	3R152-P332J	Composition: 3300 ohms ±5%, 1/4 w.
R404	5495948-P233	Deposited carbon: 2150 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R405	3R152-P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R406	3R152-P332J	Composition: 3300 ohms ±5%, 1/4 w.
R407	3R152-P222K	Composition: 2200 ohms ±10%, 1/4 w.
R408	3R152-P822J	Composition: 8200 ohms ±5%, 1/4 w.
R409	3R152-P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R410*	3R152-P182J	Composition: 1800 ohms ±5%, 1/4 w.
	3R152-P362J	In Models 4ER48A10-13 of Rev D and earlier: In Models 4ER48B10-13 of Rev D and earlier: In Models 4ER48A14,15 of Rev E and earlier: In Models 4ER48B14,15 of Rev E and earlier: Composition: 3600 ohms ±5%, 1/4 w.
R411	3R152-P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R412	3R152-P561K	Composition: 560 ohms ±10%, 1/4 w.
R413 and R414	3R152-P273K	Composition: 27,000 ohms ±10%, 1/4 w.
R415	3R152-P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R416*	3R152-P132J	Composition: 1300 ohms ±5%, 1/4 w.
	3R152-P911J	In Models 4ER48A10-13 of Rev D and earlier: In Models 4ER48B10-13 of Rev D and earlier: In Models 4ER48A14,15 of Rev E and earlier: In Models 4ER48B14,15 of Rev E and earlier: Composition: 910 ohms ±5%, 1/4 w.
R417*	3R152-P432J	Composition: 4300 ohms ±5%, 1/4 w. Added in Models 4ER48A14,15 by Rev B. Added in Models 4ER48B14,15 by Rev B.
R418*	3R152-P152J	Composition: 1500 ohms ±5%, 1/4 w. Added in Models 4ER48A10-13 by Rev E. Added in Models 4ER48B10-13 by Rev E. Added in Models 4ER48A14,15 by Rev F. Added in Models 4ER48B14,15 by Rev F.
		THERMISTORS
RT301*	5490828-P38	Rod: 1400 ohms ±5%, 1 w max; sim to Globar Type 492H.
	5490828-P34	In Models 4ER48A10-13 of Rev D and earlier: In Models 4ER48B10-13 of Rev D and earlier: In Models 4ER48A14,15 of Rev E and earlier: In Models 4ER48B14,15 of Rev E and earlier: Rod: 1810 ohms ±5%, 1 w max; sim to Globar Type 723H-3.
RT302	5490828-P35	Rod: 3800 ohms ±5%, 1 w max; sim to Globar Type 723B-H.
		SOCKETS
XY401 and XY402	5490277-P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		CRYSTALS
y301	19A110215-P1	Quartz: freq 10245 KHz, temp range -30°C to +90°C.
Y401 and Y402	19B206221-P1	Quartz: freq range 38.3 to 62 MHz, temp range -30°C to +80°C. (When reordering give GE Part Number and specify exact frequency needed). (Crystal frequency = (OF -10.7) ÷ 3).
		MISCELLANEOUS
	19B205369-G1	Top cover.
	19A121088-P1	Can.
	4038844-G1	Can. (Used with L321-330).
	4036555-P1	Insulator, washer: nylon. (Used with Q318).
	4035306-P62	Washer, fiber. (Used with Y301, FL301).

PRODUCTION CHANGES

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

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

REV. B - Models 4ER48A14, 15 & 4ER48B14, 15

To improve oscillator operation. Deleted R315 and added R417.

REV. B - Models 4ER48A10 - 13 & 4ER48B10 - 13
REV. C - Models 4ER48A14, 15 & 4ER48B14, 15

To incorporate improved transistors. Changed Q303 and Q304.

REV. C - Models 4ER48A10 - 13 & 4ER48B10 - 13
REV. D - Models 4ER48A14, 15 & 4ER48B14, 15

To increase maximum squelch sensitivity. Changed C442. In Models 4ER48A10 - 15, C425 was also changed.

REV. D - Models 4ER48A10-13 & 4ER48B10-13
REV. E - Models 4ER48A14,15 & 4ER48B14,15

To eliminate high frequency oscillations in the receiver PA caused by use of a higher gain PA transistor. Changed CR34.

REV. E - Models 4ER48A10-13 & 4ER48B10-13
REV. F - Models 4ER48A14,15 & 4ER48B14,15

To eliminate undesirable squelch thump that occurs when carrier is received. Changed C442 and R410. Added C459 and R418.

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

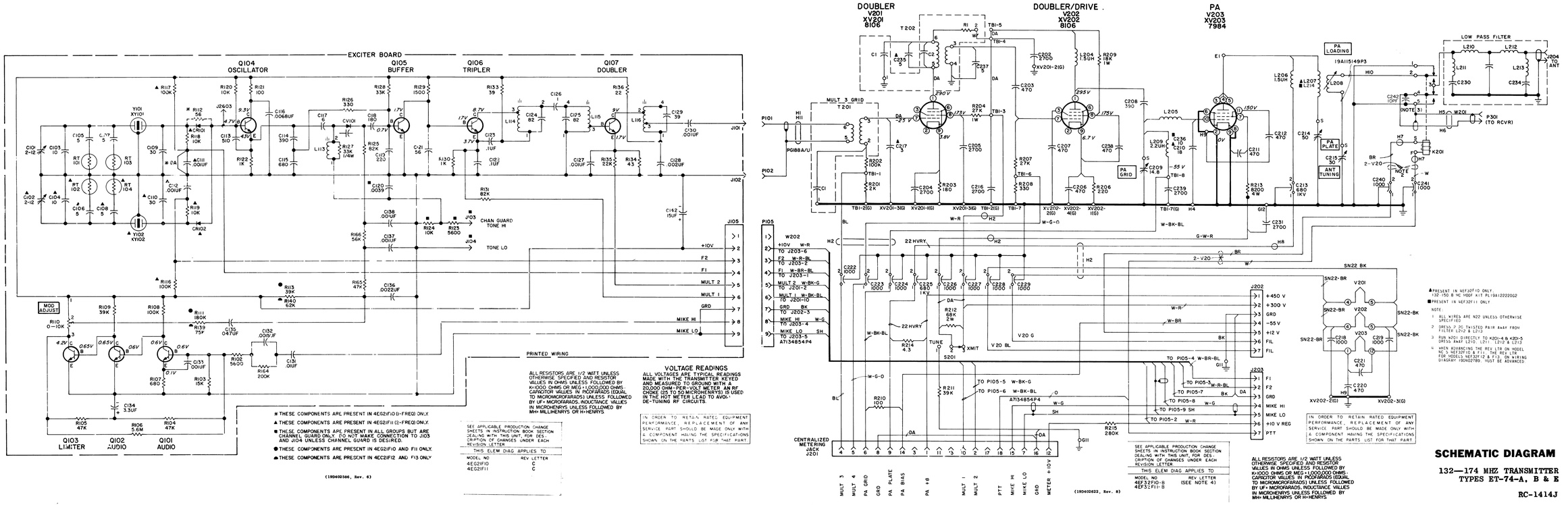
REV. F - Models 4ER48A12 & 4ER48B12

To assure oscillator band-end tuning at 174 MHz. Changed C331B.

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

REV. G - Models 4ER48A12,14,15 & 4ER48B12,14,15

To permit use of different IF coils. Changed printed wiring board and L321 thru L330.



(DF-3133)

SCHEMATIC DIAGRAM

132—174 MHZ TRANSMITTER
TYPES ET-74-A, B & E

RC-1414J

(Cont'd from front of RC-1413)

SYMBOL	GE PART NO.	DESCRIPTION
C203	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C204 and C205	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C206 and C207	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C208*	7489162P141	Silver mica: 390 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
		In Models earlier than REV A:
	7489162P143	Silver mica: 470 pf ±10%, 300 VDCW; sim to Electro Motive Type DM-15.
C209	19B209328P5	Variable, air: approx 1.85 to 14.8 pf, 650 v peak; sim to EF Johnson 193-5-2.
C210	5496218P612	Ceramic disc: 18 pf ±10%, 500 VDCW, temp coef -470 PPM.
C211 and C212	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C213	19A116470P1	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW; sim to Erie 2432-019-X5RO-681M.
C214	19B209329P1	Variable, air: approx 5.1 to 50 pf, 1700 v peak; sim to Star Products Model APL.
C215	19B209328P10	Variable, air: approx 2.62 to 30.6 pf, 650 v peak; sim to EF Johnson 193-10-2.
C216	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C217	5496218P203	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C218 and C219	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C220 and C221	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C222 thru C224	7160807P1	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW.
C225	19B209282P1	Ceramic, feed-thru: 680 pf ±20%, 1000 VDCW; sim to Sprague Type 544C.
C226 thru C229	7160807P1	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW.
C230		Includes:
	19A121018P1	Washer (inner). Quantity (4).
	4031594P2	Insulator. Quantity (1).
	19A121006P1	Washer (outer). Quantity (2).
	4036835P4	Terminal, solder: sim to Shakeproof 2177-04-000. Quantity (1).
	N80P9007C6	Screw, panhead, Phillips: No. 4-40 x 7/16.
C231	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C232		Includes:
	19A121018P1	Washer (inner). Quantity (2).
	4031594P2	Insulator. Quantity (1).
	7878455P2	Terminal, lug. Quantity (1).
	19A121006P7	Washer (outer). Quantity (2).
	4036835P4	Terminal, solder: sim to Shakeproof 2177-04-000. Quantity (1).
	N80P9008C6	Screw, panhead, Phillips: No. 4-40 x 1/2.
C234		Includes:
	19A121018P1	Washer (inner). Quantity (4).
	4031594P2	Insulator. Quantity (1).
	19A121006P1	Washer (outer). Quantity (2).
	4036835P4	Terminal, solder: sim to Shakeproof 2177-04-000. Quantity (1).
	N80P9007C6	Screw, panhead, Phillips: No. 4-40 x 7/16.

SYMBOL	GE PART NO.	DESCRIPTION
C235	5496218P205	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C236	5496218P610	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef -470 PPM.
C237	5496218P205	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C238	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C239	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C240 and C241	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
C242*	5496219P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM. Added by REV B.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	7135118P1	Solder.
		- - - - - - - JACKS AND RECEPTACLES - - - - -
J201	19B205689G1	Connector: 18 contacts.
J202 and J203	19B205219P1	Connector: 7 pins.
J204	7104941P16	Jack, phono type: coaxial.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K201	19C307020P5	Armature: 12 VDC nominal, 2.5 w max operating, 80 ohms ±15% coil res, 2 form C contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L204	7488079P34	Choke, RF: 1.5 μh ±10%, 0.28 ohm DC res max; sim to Jeffers 4412-7K.
L205	19A122076P1	Coil.
L206	7772834P5	Choke, RF: 1.8 μh ±10%, 0.33 ohm DC res; sim to Ohmite Z-144.
L207*	19B205220P1	Coil. Deleted by REV A in Models 4EF32F11.
L208	19B205222P1	Coil.
L209	7488079P35	Choke, RF; 2.2 μh ±10%, 0.5 ohm DC res max; sim to Jeffers 4412-9K.
L210	19A122072P1	Coil.
L211	19A122073P1	Coil.
L212	19A122072P1	Coil.
L213	19A122074P1	Coil.
L214*	19B205220P2	Coil. Added by REV A.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P101	4029840P2	Contact, electrical: sim to AMP 42827-2.
P102	4029840P1	Contact, electrical: sim to AMP 41854.
P105		(Part of W202).
P301		(Part of W201).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	3R77P202J	Composition: 2000 ohms ±5%, 1/2 w.
R202	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R203	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R204	3R78P273K	Composition: 27,000 ohms ±10%, 1 w.
R206	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R207	3R77P273K	Composition: 27,000 ohms ±10%, 1/2 w.
R208	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R209	3R78P183K	Composition: 18,000 ohms ±10%, 1 w.
R210	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R211	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R212	3R79P683K	Composition: 68,000 ohms ±10%, 2 w.
R213	3R149P822K	Composition: 8200 ohms ±10%, 4 w.
R214	19B209022P30	Wirewound: 4.3 ohms ±5%, 2 w; sim to IRC Type BWH.
R215	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S201	7145098P3	Slide: SPDT, 0.75 amp at 125 VAC or 0.5 amp at 125 VDC; sim to Stackpole SS-32.
		- - - - - - - - TRANSFORMERS - - - - - - - -
T201		**COIL** 19B205215G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
	5491798P4	Tuning slug.
T202		**COIL** 19B205213G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5491238P10	Ceramic disc: 2 pf ±0.5 pf, 500 VDCW, temp coef -470 ±250 PPM.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P221J	Composition: 220 ohms ±5%, 1/2 w.
	5493185P5	Tuning slug.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P124	Phen: 8 terminals.
		- - - - - - - - - - TUBES - - - - - - - - - -
V201 and V202		Type 8106.
V203		Type 7984.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	5491689P56	RF: approx 12 inches, includes short, phono type plug (P301).
W202		**CABLE** 19B205268G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P105	19B209341P2	Socket: 9 contacts; sim to Elco 04-920-XX.
	19A122138P1	Knob.
	19A134048P1	Wood screw, phillips head: No. 4, 1/2 inch long.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XV201 and XV202	7480532P8	Tube, phen: 9 pins; sim to Elco 04-903-84.
XV203	19C301007P5	Tube: 12 pins; sim to Alcon Metal Products 371G.
		MECHANICAL PARTS (SEE RC-1396)
1	19A121195P2	Support. (Used with V203).
2	7165167P5	Insert, tube shield: sim to Atlas 106-332-5. (Used with V202).
3	19B205622P1	Spring. (Used with V201, 202).
4	19A121523P3	Heat sink. (Used with V201, 202).
5	7147223P3	Clip, loop: sim to Patton-Macguyer 40. (Used with W202).

SYMBOL	GE PART NO.	DESCRIPTION
6	19B205211P1	Support.
7	4035017P4	Support, angle: sim to Tinnerman C-19185-020-24.
8	7165167P7	Insert, tube shield: sim to Atlas 106-332-22. (Used with V203).
9	19B204571P1	Heat sink. (Used with V203).
10	19C303875G1	Chassis.
11	7763541P2	Strap, retaining.
12	19B205475G1	Cover, top.
13	19B205476G1	Cover, bottom.
14	19D402623P1	Casting.

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 efficiency and bandwidth of final amplifier stage.

In Model 4EF32F10:
Changed C208.

In Model 4EF32F11:
Changed C208, deleted L207
and added L214.

REV. A - Models 4EF32F10, F11

To improve efficiency and bandwidth of final amplifier stage.

In Model 4EF32F10:
Changed C208.

In Model 4EF32F11:
Changed C208, deleted L207
and added L214.

REV. A - Models 4EG21F10, F11

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

REV. B - Models 4EG21F10, F11

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

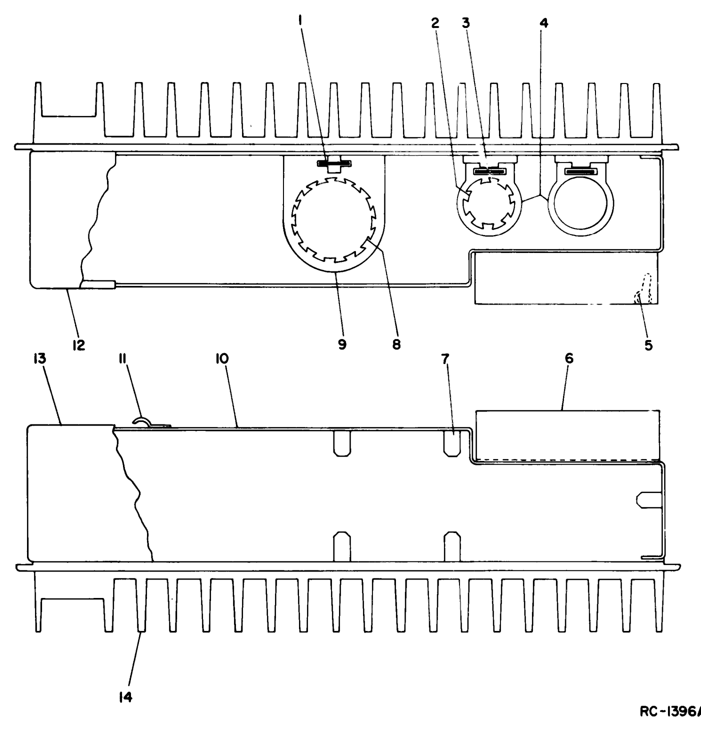
Changed R125; deleted R101, R114 & R115; and added R164, R165 & R166.

REV. B - Models 4EF32F10, F11

To reduce system losses in antenna circuit of receiver. Added C242, deleted G13.

REV. C - Models 4EG21F10, F11

To improve operation. Changed C122, C123, R130 and R134.



132-174 MHZ TRANSMITTER-TYPE ET-74-A,B

PARTS LIST

LBI-3719E

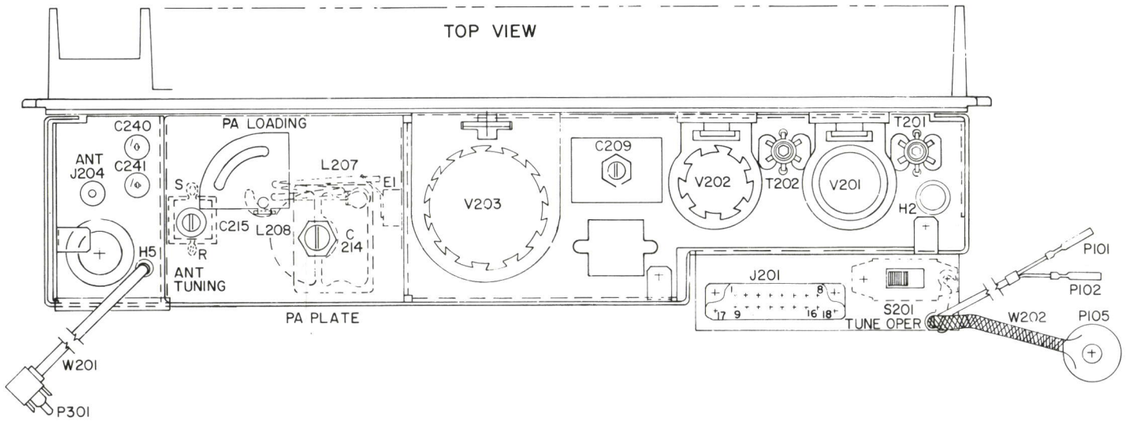
132-174 MHz TRANSMITTER
TYPE ET-74-A NARROW BAND
TYPE ET-74-B WIDE BAND
TYPE ET-74-E 8-FREQ.

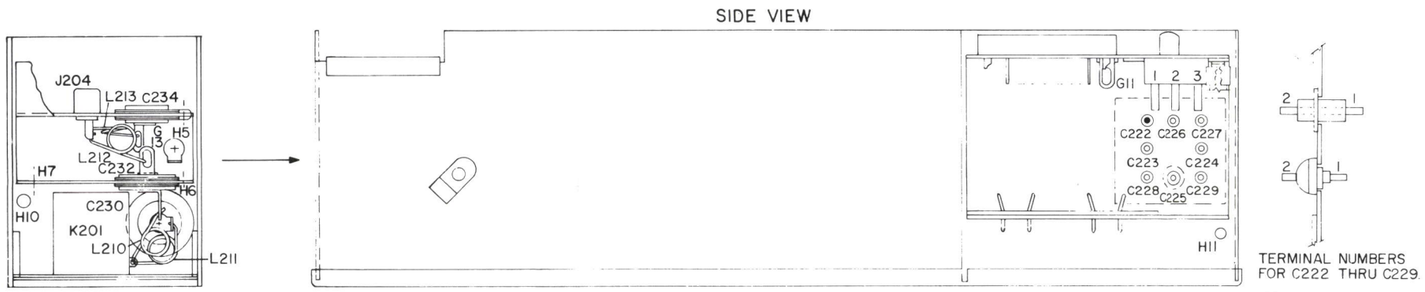
SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD WITH CHANNEL GUARD
		MODEL 4EG21F10 1 FREQ NARROW BAND REV B MODEL 4EG21F11 2 FREQ NARROW BAND REV B MODEL 4EG21F12 1 FREQ WIDE BAND REV B MODEL 4EG21F13 2 FREQ WIDE BAND REV B
		- - - - - - - - - CAPACITORS - - - - - - - - -
C101 and C102	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C103 and C104	5496219P10	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C105 thru C108	19C300685P93	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C109 and C110	5496219P50	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef 0 PPM.
C111 and C112	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C113	5496372P167	Ceramic disc: 510 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C114	5490008P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C115	4029003P4	Silver mica: 680 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-20.
C116	5494481P131	Ceramic disc: 6800 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C117	5496219P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C118	5496372P45	Ceramic disc: 180 pf ±10%, 500 VDCW, temp coef -2200 PPM.
C119	5490008P135	Silver mica: 220 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C120	5494481P129	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C121	5496219P218	Ceramic disc: 56 pf ±10%, 500 VDCW, temp coef -80 PPM.
C122* and C123*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		In REV B and earlier:
	5494481P129	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C124 and C125	5496219P261	Ceramic disc: 82 pf ±5%, 500 VDCW, temp coef -80 PPM.
C126	7130348P3	Molded, phen: 1 pf ±.05 pf, 500 VDCW, temp coef 0 PPM; sim to Jeffers Type JM-5/32.
C127	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C128	5494481P113	Ceramic disc: 2000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C129	5496219P253	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef -80 PPM.
C130	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C131	19A116080P1	Polyester: .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: .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. Added by REV A.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR101 and CR102	19A115603P1	Silicon.
CV101	5495769P9	Silicon, capacitive.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J101 thru J104	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J105	19B209303P1	Connector, phen: 9 pins.
J2603		(Part of printed board 19C303835P1).
		- - - - - - - - - INDUCTORS - - - - - - - - -
L113	19C303883G13	Coil. Includes tuning slug 5491798P2.
L114	19C303883G14	Coil. Includes tuning slug 5491798P2.
L115	19C303883G15	Coil. Includes tuning slug 5491798P2.
L116	19C303883G17	Coil. Includes tuning slug 5491798P2.
		In Models earlier than REV A:
	19C303883G16	Coil. Includes tuning slug 5491798P2.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q101	19A115889P1	Silicon, NPN.
Q102 and Q103	19A115123P1	Silicon, NPN.
Q104	19C300114P1	Silicon, NPN; sim to Type 2N706.
Q105	19A115330P1	Silicon, NPN.
Q106 and Q107	19A115328P1	Silicon, NPN.
		- - - - - - - - - RESISTORS - - - - - - - - -
R101*	3R77P154K	Composition: 0.15 megohm ±10%, 1/2 w. Deleted by REV B.
R102	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R103	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R104 and R105	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R106	3R77P565J	Composition: 5.6 megohms ±5%, 1/2 w.
R107	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R108	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R109	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R110	19B209358P106	Variable, carbon film: 75 to 10,000 ohms ±10%, 1/4 w; sim to CTS Type X-201.
R111	3R77P184J	Composition: 0.18 megohm ±5%, 1/2 w.
R112	3R152P560J	Composition: 56 ohms ±5%, 1/4 w.
R113	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R114*	3R77P333J	Composition: 33,000 ohms ±5%, 1/2 w. Deleted by REV B.
R115*	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w. Deleted by REV B.
R116 and R117	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R118 thru R120	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R121	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R122	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R123	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R124	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R125*	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
		In Models of REV A and earlier:
	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R126	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R127	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R128	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R129	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R130*	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
		In REV B and earlier:
	3R77P151K	Composition: 150 ohms ±10%, 1/2 w.
R131	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R133	3R77P390K	Composition: 39 ohms ±10%, 1/2 w.
R134*	3R77P430J	Composition: 43 ohms ±5%, 1/2 w.
		In REV B and earlier:
	3R77P560K	Composition: 56 ohms ±10%, 1/2 w.
R135	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R136	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R139	3R77P753J	Composition: 75,000 ohms ±5%, 1/2 w.
R140	3R77P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R164*	3R77P204J	Composition: 0.20 megohm ±5%, 1/2 w. Added by REV B.
R165*	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w. Added by REV B.
R166*	3R77P563J	Composition: 56,000 ohms ±5%, 1/2 w. Added by REV B.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT101 and RT102	19B209353P2	Disc: 460 ohms max; sim to GE 16D-3121.
RT103 and RT104	19B209353P1	Rod: 10,200 ohms min; sim to GE 1R-1544.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY101 and XY102		Refer to Miscellaneous Parts.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
		Crystal freq = Operating Freq. / 24
Y101 and Y102	19B206204P1	Quartz: freq range 5400-7250 KHz, temp range -30°C to +85°C.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	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).
		POWER AMPLIFIER MODEL 4EF32F10 132-150.8 MHz REV B MODEL 4EF32F11 150.8-174 MHz REV B
		- - - - - - - - - CAPACITORS - - - - - - - - -
C202	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

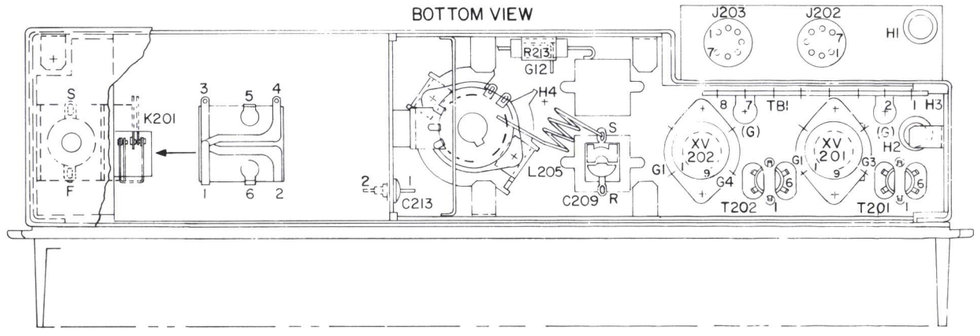
(Cont'd on back of RC-1414)

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

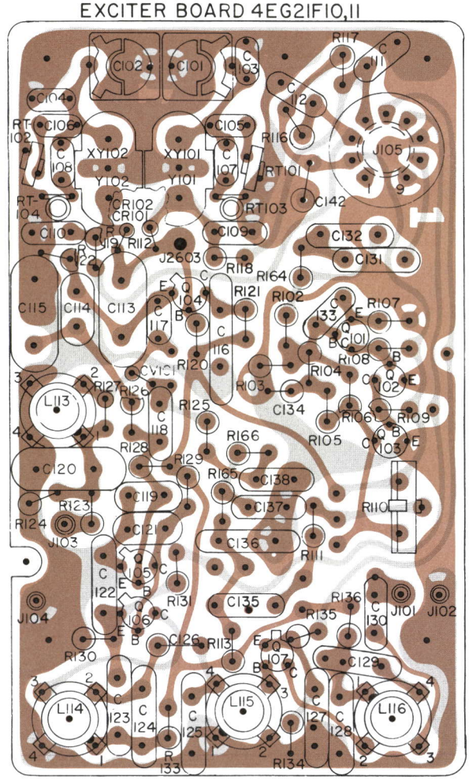
PA ASSEMBLY 4EF32F10







EXCITER BOARD 4EG21F10,11



RESISTANCE READINGS

ALL READINGS ARE TYPICAL READINGS MEASURED FROM TRANSISTOR OR TUBE PINS TO GROUND WITH A 20,000 OHM PER VOLT METER, AND WITH ALL POWER TURNED OFF READINGS ON THE EXCITER BOARD OVER 1,000 OHMS READ ON THE X 1,000 SCALE + OR − SIGNS SHOW METER LEAD GROUNDED

EXCITER BOARD

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

PA ASSEMBLY

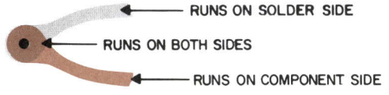
SYMBOL NO.	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12
V201	6.3K	180	47K	FIL	FIL	180	100K	47K	100			
V202	6K	220	47K	FIL	FIL	220	27K	47K	220			
V203	FIL	0	20K	20K	20K	0	22K	0	0	6K	22K	-11

(19D402815, Rev. 5)
(19B205178, Sh. 1, Rev. 1)
(19B205178, Sh. 2, Rev. 1)

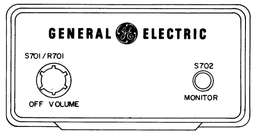
OUTLINE DIAGRAM

132—174 MHZ TRANSMITTER
TYPES ET-74-A, B & E

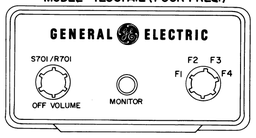
RC-1413H

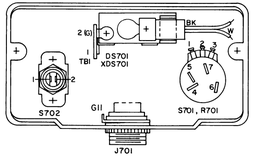


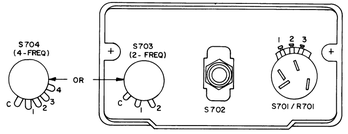
MODEL 4EC67A10
(1-FREQ)



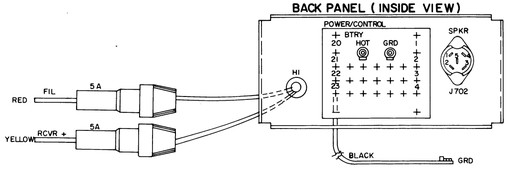
MODEL 4EC67A11 (TWO FREQ)
MODEL 4EC67A12 (FOUR FREQ.)





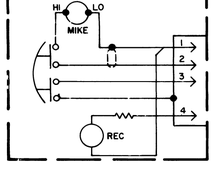


BACK PANEL (INSIDE VIEW)

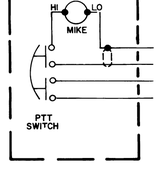


(19C311222, Rev. 2)

TELEPHONE HANDSET
4EM26A10



MICROPHONE
4EM25E10, F10



NOTES-

1. S703 IN 4EC67A11 ONLY.
   S704 IN 4EC67A12 ONLY,
   FOUR FREQ KIT PL19A122220G7
2. JUMPER ADDED IN 4EC67A12 FOR THREE FREQ. OPERATION.

(19B620756, Rev. 13)

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

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

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

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EC67A10	E
4EC67A11	E
4EC67A12	E
PL19B205260G1	C

SCHEMATIC & OUTLINE DIAGRAM

TRUNK MOUNT CONTROL UNIT
MODEL 4EC67A10-12

RC-1416E

PARTS LIST

LBI-3713B

TRUNK MOUNT CONTROL UNIT

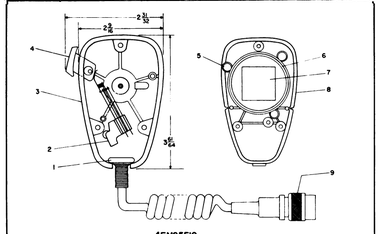
MODEL 4EC67A10 (PL-19C303901-G1) (1 Frequency)
MODEL 4EC67A11 (PL-19C303901-G2) (2 Frequency)
MODEL 4EC67A12 (PL-19C303901-G2) (4 Frequency)
(PL-19A122220-G7)

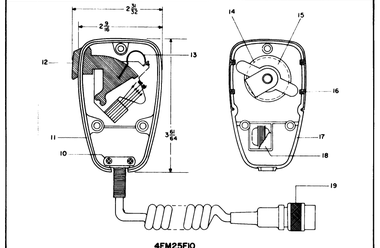
SYMBOL	G-E PART NO.	DESCRIPTION
		INDICATING DEVICES
DS701	19C307037-P14	Lamp, incandescent: 18 v; sim to G-E 1445.
		FUSES
F701 and F702	1R16-P8	Quick blowing: 5 amps at 250 v; sim to Littelfuse 312005 or Bussmann MTH-5.
		JACKS AND RECEPTACLES
J701*	19A116061-P1	Connector, chassis: 4-female contacts. In models earlier than REV. D:
	7117934-P5	Connector, chassis: 4 female contacts; sim to Amphenol 91-PC4F.
J702*	5493018-P1	Connector, 5 contacts; sim to Cinch 203-41-05-081. In Models earlier than REV. A:
	19B209340-P5	Connector, phen: 4 contacts, sim to Alcon Metal MS101.
J703	PL-19A122095-G1	Board: 27 contacts.
		PLUGS
P704 and P705	4029840-P3	Contact, electrical: sim to AMP 42101-2.
		RESISTORS
R701		(Part of S701).
		SWITCHES
S701	5496870-P13	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 LCSX10AC-2.
S702	19B209165-P4	Pushbutton, white: SPST, momentary contact, normally open, 1 amp at 115 VAC: sim to Grayhill 30-17B.
S703	19B200394-P3	Rotary: 1 pole, 2 positions, non-shorting contacts, 1 amp at 115 VAC or 28 VDC; sim to Grayhill Series 24. (Used in Model 4EC67A11).
		TERMINAL BOARDS
TB1	7775500-P4	Phen: 2 terminals.
		SOCKETS
XDS701	4032220-P1	Lampholder, miniature: sim to Drake N517.
XF701		**FUSE LEAD PL-19A122111-G1**
		MISCELLANEOUS
	19A115776-P2	Fuseholder, phenolic: sim to Bussmann Type HHJ.
XF702		**FUSE LEAD PL-19A122111-G2**
		MISCELLANEOUS
	19A115776-P2	Fuseholder, phenolic: sim to Bussmann Type HHJ.
		MODIFICATION KIT PL-19A122220-G7 (Used in Model 4EC67A12)
		SWITCHES
S704	PL-19B204441-G1	Rotary: 1 pole, 4 positions, non-shorting contacts, 1 amp at 115 VDC; sim to Grayhill Series 24 (modified).

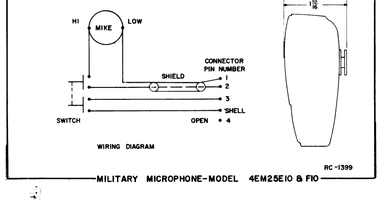
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	G-E PART NO	DESCRIPTION
		ASSOCIATED ASSEMBLIES
		POWER/CONTROL CABLE
		PL-19C303910-G1 (2 Freq) Positive Ground PL-19C303910-G2 (2 Freq) Negative Ground PL-19C303910-G3 (4 Freq) Positive Ground PL-19C303910-G4 (4 Freq) Negative Ground
		MISCELLANEOUS
	7102673-P2	Fuse, quick blowing: 15 amps at 32 v; sim to Littelfuse 311015 or Bussmann AGC-15.
	7007522-P1	Fuseholder: 15 amps; sim to Littelfuse 356001.
	19C303780-P1	Socket, phen: 28 contacts; sim to Beauchaine and Sons 3308-81.
	19C303782-P1	Shell, connector: sim to Beauchaine 3308-93.
	PL-7142878-G1	Cable hook.
		POWER/ANTENNA CONNECTOR PL-19B205260-G1
		JACKS AND RECEPTACLES
J1	19C303775-P1	Connector, phen: 28 contacts.
		CABLES
W1		**CABLE PL-19A122133-G1**
		JACKS AND RECEPTACLES
J2	2R22-P3	Receptacle, panel, coaxial. Signal Corps SO-239 or sim to Amphenol 83-1R.
		PLUGS
P204	7104941-P6	Phono type, phen: sim to Cinch 15M20175.
		MILITARY MICROPHONE MODELS 4EM25E10, F10 (19B209102-P2) (See RC-1399)
		MODEL 4EM25E10 - SHURE BROTHERS
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.
		MODEL 4EM25F10 - ELECTRO VOICE
10		(See item 11).
11		Case (front and back): includes switch, screen and mounting hardware.
12		(See item 11).
13		Internal hardware (button spring, gasket). Electro Voice 83870.
14		(See item 13).
15		Magnetic controlled cartridge. Electro Voice 83876.
16		(See item 11).
17		(See item 11).
18		Transformer. Electro Voice 83871.

SYMBOL	G-E PART NO	DESCRIPTION
		MILITARY MICROPHONES (Cont'd)
19		Cable and plug: approx 6 feet long. Electro Voice 8378.
		MISCELLANEOUS
	19B209340-P6	Retainer, ring: sim to Alcon Metal Products 21-1488. (Used with J702 in PL-19C303901-G1, 2).
	19B205216-P1	Jewel: red. (Used with DS701 in PL-19C303901-G1, 2).
	PL-4039182-G3	Knob. (Used with S701 in PL-19C303901-G1, 2). (Used with S703 in PL-19C303901-G2).
	PL-19A121521-G1	Mounting support. (Used in PL-19C303901-G1, 2).
	4032248-P1	Clip: spring tension; sim to Augat Brothers 6185-1A. (Mounts DS701 in PL-19C303901-G1, 2).
	NP248987	Nameplate. (Used in Model 4EC67A10).
	NP248988	Nameplate. (Used in Model 4EC67A11, 12).







MILITARY MICROPHONE-MODEL 4EM25E10 & F10

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.

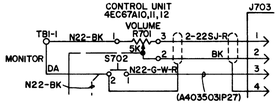
REV. A - Connector Assembly 19B205260-G1
To permit the addition of Channel Guard hookswitch option, added a green-white-orange wire from J1-20 to TB3-17.

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:

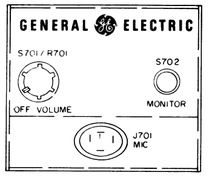


REV. C - Connector Assembly 19B205260-G1
To reduce transmitter noise in the region of 30-150 kHz from carrier. Added #14 BK wire between J1-27 and TB3-8, 22, 27. Added jumper from pin 26 to 27 on power cable plug in negative ground applications. Added jumper from pin 25 to 27 on power cable plug in positive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

REV. D - Models 4EC67A10, 11, 12
To ground microphone jack. Changed J701. Added #18 BK-W wire from J703 (ground) to G11.

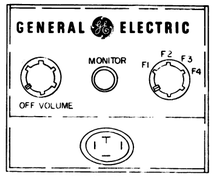
REV. E - Models 4EC67A10, 11, 12
Changed control unit housing from metal to Lexans.

MODEL 4EC68A10(1-FREQ.)

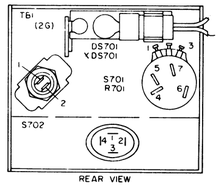


FRONT VIEW

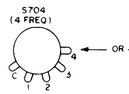
MODEL 4EC68A11 (2-FREQ)
MODEL 4EC68A12 (4-FREQ)



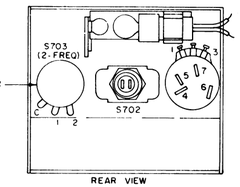
FRONT VIEW



REAR VIEW

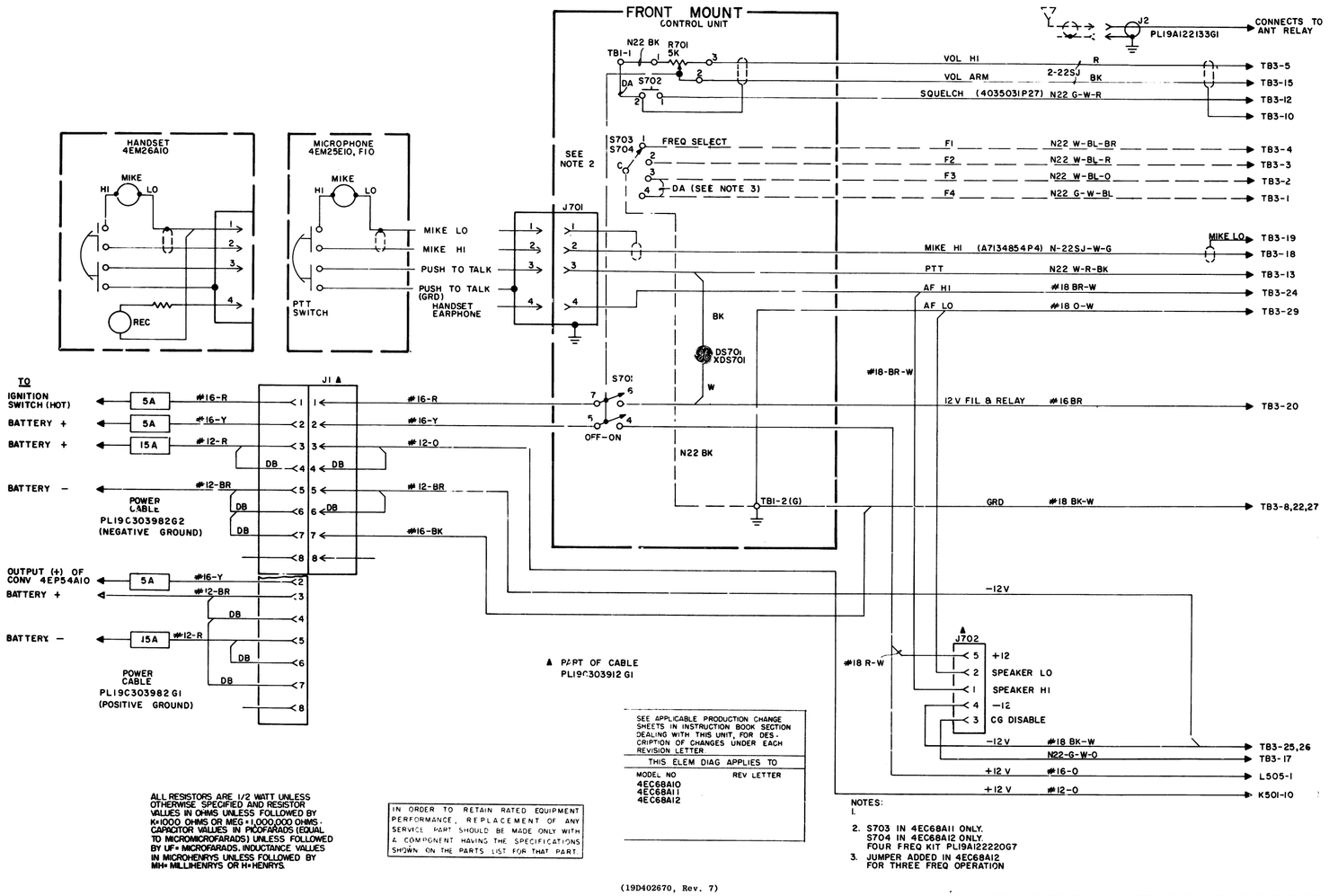


OR



REAR VIEW

(19C311221, Rev. 0)



▲ PART OF CABLE PLI9C303912G1

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

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

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

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EC68A10	
4EC68A11	
4EC68A12	

NOTES:
1.
2. S703 IN 4EC68A11 ONLY.
   S704 IN 4EC68A12 ONLY.
   FOUR FREQ KIT PLI9A122220G7
3. JUMPER ADDED IN 4EC68A12 FOR THREE FREQ OPERATION

(19D402670, Rev. 7)

SCHEMATIC & OUTLINE DIAGRAM

FRONT MOUNT CONTROL UNIT MODEL 4EC68A10-12

RC-1417D

PARTS LIST

LBI-3714A

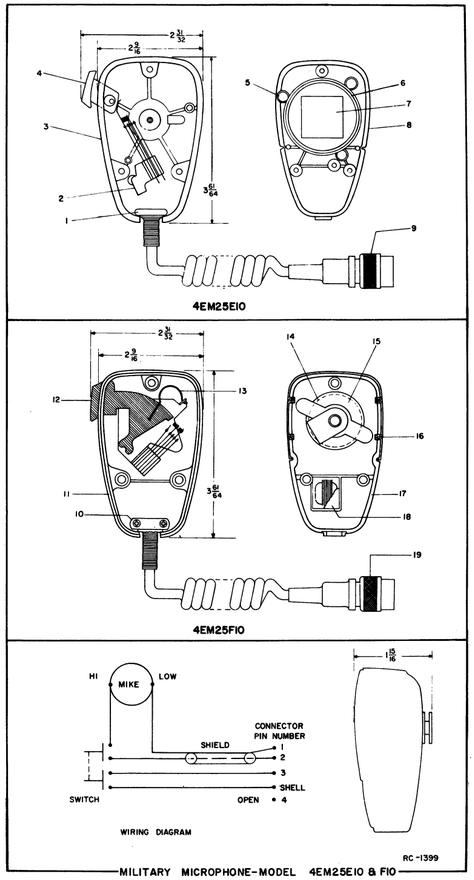
FRONT MOUNT CONTROL UNIT

MODEL 4EC68A10 (PL-19C303907-G1) (1 Frequency)
MODEL 4EC68A11 (PL-19C303907-G2) (2 Frequency)
MODEL 4EC68A12 (PL-19C303907-G2) (4 Frequency)
(PL-19A122220-G7)

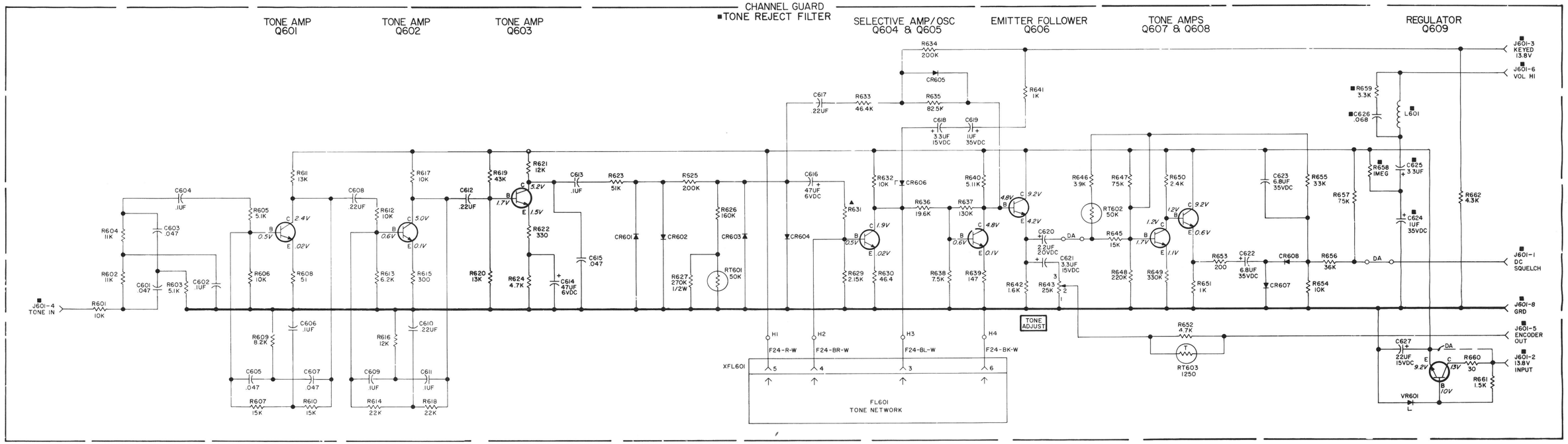
SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - INDICATING DEVICES - - - - - - - -
DS701	19C307037-P14	Lamp, incandescent: 18 v; sim to G-E 1445.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J701	7117934-P5	Connector, chassis: 4 female contacts; sim to Amphenol 91-PC4F.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701		(Part of S701).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701	5496870-P13	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	19B209165-P4	Pushbutton, white: SPST, momentary contact, normally open, 1 amp at 115 VAC; sim to Grayhill 30-17B.
S703	19B200394-P3	Rotary: 1 pole, 2 positions, non-shorting contacts, 1 amp at 115 VAC or 28 VDC; sim to Grayhill Series 24. (Used in Model 4EC68A11).
		- - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500-P4	Phen: 2 terminals.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XDS701	4032220-P2	Lampholder, miniature: sim to Drake N517.
		MODIFICATION KIT PL-19A122220-G7 (Used in Model 4EC68A12)
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S704	PL-19B204441-G1	Rotary: 1 pole, 4 positions, non-shorting contacts, 1 amp at 115 VDC; sim to Grayhill Series 24 (modified).
		ASSOCIATED ASSEMBLIES
		POWER CABLE PL-19C303982-G2 (Negative Ground)
	7473192-P35	Receptacle: Phenolic, 8 contacts; sim to H. B. Jones 261-32-08-033 (S-308-CCT-K).
	1R16-P8	Fuse: Quick blowing, 5 amps @ 250 volts; sim to Littelfuse 312005 or Bussmann MTH-5.
	PL-19A122111-G1	Fuseholder: With red wire; sim to Bussman Type HHJ.
	PL-19A122111-G2	Fuseholder: with yellow wire; sim to Bussmann Type HHJ.
	7102673-P2	Fuse, cartridge: 15 amps @ 32 volts; sim to Littelfuse 311015.
	7007522-P1	Fuseholder: 15 amps; sim to Littelfuse 356001.
		POWER CABLE PL-19C303982-G1 (Positive Ground)
	PL-19A122111-G1	Fuseholder, with red wire: sim to Bussmann Type HHJ.
	PL-19A122111-G2	Fuseholder, with yellow wire: sim to Bussmann Type HHJ.
	7473192-P35	Connector, phenolic: 8 female contacts; sim to HB Jones 261-32-08-033 (S-308-CCT-K).
	1R16-P8	Fuse, quick blowing: 5 amps at 250 v; sim to Littelfuse 312005 or Bussmann MTH-5. (Used with PL-19A122111-G1, 2).
	7007522-P1	Fuseholder: 15 amps; sim to Littelfuse 35601.
	7102673-P2	Fuse, quick blowing: 15 amps at 32 v; sim to Littelfuse 311015 or Bussmann AGC-15.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	G-E PART NO	DESCRIPTION
		CABLE ASSEMBLY (PL-19C303912-G1)
J1	7473192-P34	Plug: Phenolic, 8 contacts; sim to H. B. Jones 261-31-08-032 (P-308-CCT-L).
J702	5493018-P2	Plug: Phenolic, 5 contacts; sim to Cinch 204-31-05-010.
	5491563-P3	Cap: (Used with J702); sim to Methode C850-1V.
		MILITARY MICROPHONE MODELS 4EM25E10, F10 (19B209102-P2) (See RC-1399)
		MODEL 4EM25E10 - SHURE BROTHERS
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.
		MODEL 4EM25F10 - ELECTRO VOICE
10		(See item 11).
11		Case (front and back): includes switch, screen and mounting hardware.
12		(See item 11).
13		Internal hardware (button spring, gasket). Electro Voice 83870.
14		(See item 13).
15		Magnetic controlled cartridge. Electro Voice 83876.
16		(See item 11).
17		(See item 11).
18		Transformer. Electro Voice 83871.
19		Cable and plug: approx 6 feet long. Electro Voice 8378.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	NP248936	Nameplate. (Used in Model 4EC68A10).
	NP248938	Nameplate. (Used in Model 4EC68A11, 12).
	19B205216-P1	Jewel: red. (Used with DS701 in PL-19C303907-G1, 2).
	PL-4039182-G3	Knob. (Used with S701 in PL-19C303907-G1, 2). (Used with S703 in PL-19C303907-G2).
	4032248-P1	Clip: spring tension; sim to Augat Brothers 6185-1A. (Mounts DS701 in PL-19C303907-G1, 2).



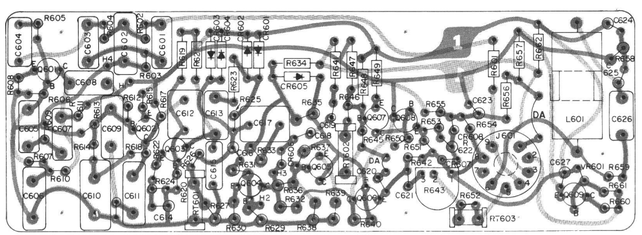
MILITARY MICROPHONE-MODEL 4EM25E10 & F10



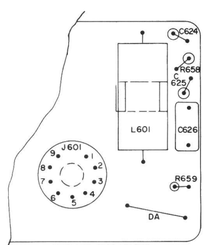
RESISTANCE READING

RESISTANCE READINGS ARE TYPICAL READINGS MEASURED FROM JACK PINS TO GROUND (PIN 8) WITH A 20,000 OHMS-PER-VOLT METER, AND WITH ALL LEADS UNPLUGGED

J601 PIN NO	1	2	3	4	5	6	7	8	9
RESISTANCE	∞	10K	4.3K	∞	25K	1 MEG		GRD	∞



(19C311219, Rev. 3)
(19B205398, Sh. 1, Rev. 1)
(19B205398, Sh. 2, Rev. 1)



TONE REJECT FILTER OPTION

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
4EK14A10	C
19C303989G2	

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED FROM TRANSISTOR PIN TO GROUND WITH A 20,000 OHM-PER-VOLT METER, AND WITH NO TONE INPUT AND THE ENCODER NOT KEYED.

(19R620757, Rev. 7)

▲ VALUE OF R631 IS DETERMINED BY FREQUENCY (SEE TEST SPECS)

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

SCHEMATIC & OUTLINE DIAGRAM

CHANNEL GUARD BOARD
MODEL 4EK14A10

RC-1419H

PARTS LIST

CHANNEL GUARD BOARD
MODEL 4EK14A10
(19C303989-G1)

SYMBOL	G-E PART NO.	DESCRIPTION
		---------- CAPACITORS ----------
C601	5491189-P204	Polyester: .047 µf ±5%, 50 VDCW.
C602	5491189-P206	Polyester: 0.1 µf ±5%, 50 VDCW.
C603	5491189-P204	Polyester: .047 µf ±5%, 50 VDCW.
C604	19B209243-P7	Polyester: 0.1 µf ±20%, 40 VDCW.
C605	5491189-P204	Polyester: .047 µf ±5%, 50 VDCW.
C606	5491189-P206	Polyester: 0.1 µf ±5%, 50 VDCW.
C607	5491189-P204	Polyester: .047 µf ±5%, 50 VDCW.
C608	19B209243-P9	Polyester: 0.22 µf ±20%, 40 VDCW.
C609	5491189-P206	Polyester: 0.1 µf ±5%, 50 VDCW.
C610	5491189-P208	Polyester: 0.22 µf ±5%, 50 VDCW.
C611	5491189-P206	Polyester: 0.1 µf ±5%, 50 VDCW.
C612	19B209243-P9	Polyester: 0.22 µf ±20%, 40 VDCW.
C613	19B209243-P7	Polyester: 0.1 µf ±20%, 40 VDCW.
C614	5496267-P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C615	19B209243-P5	Polyester: .047 µf ±20%, 40 VDCW.
C616	5496267-P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C617	19B209243-P9	Polyester: 0.22 µf ±20%, 40 VDCW.
C618	5496267-P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C619	5496267-P17	Tantalum: 1 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C620	5496267-P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C621	5496267-P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C622 and C623	5496267-P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C624	5496267-P417	Tantalum: 1 µf ±5%, 35 VDCW; sim to Sprague Type 150D.
C625	5496267-P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C626	5491189-P205	Polyester: .068 µf ±5%, 50 VDCW.
C627	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		---------- DIODES AND RECTIFIERS ----------
CR601 thru CR605	5494922-P1	Silicon; sim to Type 1N456.
CR606	4036887-P3	Silicon, Zener.
CR607 thru CR609	5494922-P1	Silicon; sim to Type 1N456.
		---------- FILTERS ----------
FL601		TONE FREQUENCY NETWORK 19B205280
	19B205280-G1	71.9 Hz
	19B205280-G2	77.0 Hz
	19B205280-G3	82.5 Hz
	19B205280-G4	88.5 Hz
	19B205280-G5	94.8 Hz
	19B205280-G6	100.0 Hz
	19B205280-G7	103.5 Hz
	19B205280-G8	107.2 Hz
	19B205280-G9	110.9 Hz
	19B205280-G10	114.8 Hz
	19B205280-G11	118.8 Hz
	19B205280-G12	123.0 Hz
	19B205280-G13	127.3 Hz
	19B205280-G14	131.8 Hz
	19B205280-G15	136.5 Hz
	19B205280-G16	141.3 Hz
	19B205280-G17	146.2 Hz
	19B205280-G18	151.4 Hz
	19B205280-G19	156.7 Hz
	19B205280-G20	162.2 Hz
	19B205280-G21	167.9 Hz
	19B205280-G22	173.8 Hz
	19B205280-G23	179.9 Hz
	19B205280-G24	186.2 Hz
	19B205280-G25	192.8 Hz
	19B205280-G26	203.5 Hz
		---------- JACKS AND RECEPTACLES ----------
J601	19B209303-P1	Connector, phen: 9 pins.
		---------- INDUCTORS ----------
L601	19A115690-P1	Coil, RF: 880 mh ±5%, 120 ohms ±15% DC res; sim to Artted AC5672.
		---------- TRANSISTORS ----------
Q601	19A115362-P1	Silicon, NPN; sim to Type 2N2925.
Q602 and Q603	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q604 thru Q606	19A115362-P1	Silicon, NPN; sim to Type 2N2925.
Q607*	19A115362-P1	Silicon, NPN.
	19A115123-P1	In Models earlier than Rev A: Silicon, NPN; sim to Type 2N2712.
Q608	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q609	19A115720-P1	Silicon, NPN.
		---------- RESISTORS ----------
R601	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R602	3R152-P113J	Composition: 11,000 ohms ±5%, 1/4 w.
R603	3R152-P512J	Composition: 5100 ohms ±5%, 1/4 w.
R604	3R152-P113J	Composition: 11,000 ohms ±5%, 1/4 w.
R605	3R152-P512J	Composition: 5100 ohms ±5%, 1/4 w.
R606	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R607	3R152-P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R608	3R152-P510J	Composition: 51 ohms ±5%, 1/4 w.
R609	3R152-P822J	Composition: 8200 ohms ±5%, 1/4 w.
R610	3R152-P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R611	3R152-P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R612	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R613	3R152-P622J	Composition: 6200 ohms ±5%, 1/4 w.
R614	3R152-P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R615	3R152-P301J	Composition: 300 ohms ±5%, 1/4 w.
R616	3R152-P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R617	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R618	3R152-P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R619	3R152-P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R620	3R152-P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R621	3R152-P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R622	3R152-P331J	Composition: 330 ohms ±5%, 1/4 w.
R623	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R624	3R152-P472J	Composition: 4700 ohms ±5%, 1/4 w.
R625	3R152-P204J	Composition: 0.2 megohm ±5%, 1/4 w.
R626	3R152-P164J	Composition: 0.16 megohm ±5%, 1/4 w.
R627	3R77-P274J	Composition: 0.27 megohm ±5%, 1/2 w.
R629	5495948-P233	Deposited carbon: 2150 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R630	5495948-P65	Deposited carbon: 46.4 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR. NOTE The value of Resistor R631 must be obtained from the component, then find corresponding value in parts list for the correct part number.
R631	5495948-P345	Deposited carbon: 28,700 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P346	Deposited carbon: 29,400 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P347	Deposited carbon: 30,100 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P348	Deposited carbon: 30,900 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P349	Deposited carbon: 31,600 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P350	Deposited carbon: 32,400 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P351	Deposited carbon: 33,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P352	Deposited carbon: 34,000 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P353	Deposited carbon: 34,800 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P354	Deposited carbon: 35,700 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P355	Deposited carbon: 36,500 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P356	Deposited carbon: 37,400 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P357	Deposited carbon: 38,300 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P358	Deposited carbon: 39,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P359	Deposited carbon: 39,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P360	Deposited carbon: 41,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P361	Deposited carbon: 42,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P362	Deposited carbon: 43,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P363	Deposited carbon: 44,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P364	Deposited carbon: 45,300 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P365	Deposited carbon: 46,400 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P366	Deposited carbon: 47,500 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P367	Deposited carbon: 48,700 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P368	Deposited carbon: 49,900 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R631	5495948-P369	Deposited carbon: 51,100 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R632	5495948-P301	Deposited carbon: 10,000 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R633	5495948-P365	Deposited carbon: 46,400 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R634	3R152-P204J	Composition: 0.2 megohm ±5%, 1/4 w.
R635	5495948-P389	Deposited carbon: 82,500 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R636	5495948-P329	Deposited carbon: 19,600 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R637	5495948-P412	Deposited carbon: 130,000 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R638	5495948-P285	Deposited carbon: 7500 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R639	5495948-P117	Deposited carbon: 147 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R640	5495948-P269	Deposited carbon: 5110 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R641	3R152-P102J	Composition: 1000 ohms ±5%, 1/4 w.
R642	3R152-P162J	Composition: 1600 ohms ±5%, 1/4 w.
R643	19B201969-P7	Variable, carbon film: 25,000 ohms ±20%, 0.1 w; sim to Centralab Series 4.
R644*	3R152-P202J	Composition: 2000 ohms ±5%, 1/4 w. Deleted by Rev A.
R645*	3R152-P153J	Composition: 15,000 ohms ±5%, 1/4 w.
	3R152-P752J	In Models earlier than Rev A: Composition: 7500 ohms ±5%, 1/4 w.
R646	3R152-P392J	Composition: 3900 ohms ±5%, 1/4 w.
R647*	3R152-P753J	Composition: 75,000 ohms ±5%, 1/4 w.
	3R152-P563J	In Models earlier than Rev A: Composition: 56,000 ohms ±5%, 1/4 w.
R648	3R152-P224J	Composition: 0.24 megohm ±5%, 1/4 w.
R649	3R152-P331J	Composition: 330 ohms ±5%, 1/4 w.
R650	3R152-P242J	Composition: 2400 ohms ±5%, 1/4 w.
R651	3R152-P102J	Composition: 1000 ohms ±5%, 1/4 w.
R652	3R152-P472J	Composition: 4700 ohms ±5%, 1/4 w.
R653	3R152-P201J	Composition: 200 ohms ±5%, 1/4 w.
R654	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R655	3R152-P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R656	3R152-P363J	Composition: 36,000 ohms ±5%, 1/4 w.
R657*	3R152-P753J	Composition: 75,000 ohms ±5%, 1/4 w.
	3R152-P104J	In Models earlier than Rev C: Composition: 0.1 megohm ±5%, 1/4 w.
R658	3R152-P105J	Composition: 1 megohm ±5%, 1/4 w.
R659	3R152-P332J	Composition: 3300 ohms ±5%, 1/4 w.
R660	3R152-P300J	Composition: 30 ohms ±5%, 1/4 w.
R661	3R152-P152J	Composition: 1500 ohms ±5%, 1/4 w.
R662	3R152-P432J	Composition: 4300 ohms ±5%, 1/4 w.
		---------- THERMISTORS ----------
RT601 and RT602	5490828-P11	Rod: 50,000 ohms ±10%, 1 w max; sim to Globar 783H-1.
RT603	5490828-P21	Rod: 1250 ohms ±10%, 0.38 w max; sim to Globar 492H-11.
		---------- VOLTAGE REGULATORS ----------
VR601	4036887-P11	Silicon, Zener.
		---------- CABLES ----------
W601		CABLE 19B205345-G1
		---------- MISCELLANEOUS ----------
	19B209341-P2	Socket: 9 contacts; sim to Elco 04-920-XX.
		---------- SOCKETS ----------
XFL601	19B209341-P1	Tube: 7 pins; sim to Elco 04-720-XX.
		---------- MISCELLANEOUS ----------
	19A122138-P1	Knob. (For removal of XFL601).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

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

REV. A - To incorporate a higher gain transistor to improve bandwidth setting accuracy. Changed R647, R645 and Q607; deleted R644 and added R631.

REV. B - To facilitate the addition of a Channel Guard disable function. Deleted CR609.

REV. C - To make Channel Guard compatible with Royal Executive systems. Changed R657.

PARTS LIST

HANDSET
MODEL 4EM26A10
(PL-19B209100-G4)

SYMBOL	G-E PART NO.	DESCRIPTION
		---------- MISCELLANEOUS ----------
		(REFER TO RC-1398)
1		Self tap screw, bind head: No. 4 x 5/16. Shure Brothers 30C640C.
2		Cable clamp. Shure Brothers 53A532.
3		Shield. Shure Brothers 53A341.
4		Switch. Shure Brothers 90A925.
5		Handle. Shure Brothers 90A971.
6		Adapter. Shure Brothers 65A230.
7		Magnetic controlled cartridge. Shure Brothers 99A562.
8	3R77-P222K	Resistor, composition: 2200 ohms ±10%, 1/2 w.
9		Receiver cap. Shure Brothers 65A199A.
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 65B206A.
15		Flat head screw, socket cap: No. 4-40 x 1/4. Shure Brothers 30C557B.
16		Transmitter cap. Shure Brothers 65A197A.
17		Washer. Shure Brothers 34A309.
18		Magnetic controlled cartridge. Shure Brothers 99A86.
19		Cable and plug. Shure Brothers 90AB619.
		HOOKSWITCH ASSEMBLY PL-19B204867-G4
		---------- MISCELLANEOUS ----------
20	4029851-P4	Cable clamp; sim to WEC Kesser 3/16-4.
21	19A121612-P1	Holder and switch: thermoplastic case, contact rating 1 amp at 125 v.
22	19B205661-G1	Cable, W4: approx 8-1/2 feet long.
23	5493035-P10	Resistor, wirewound, ceramic: 3.5 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
24	7775500-P55	Terminal board, phen: 5 terminals.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

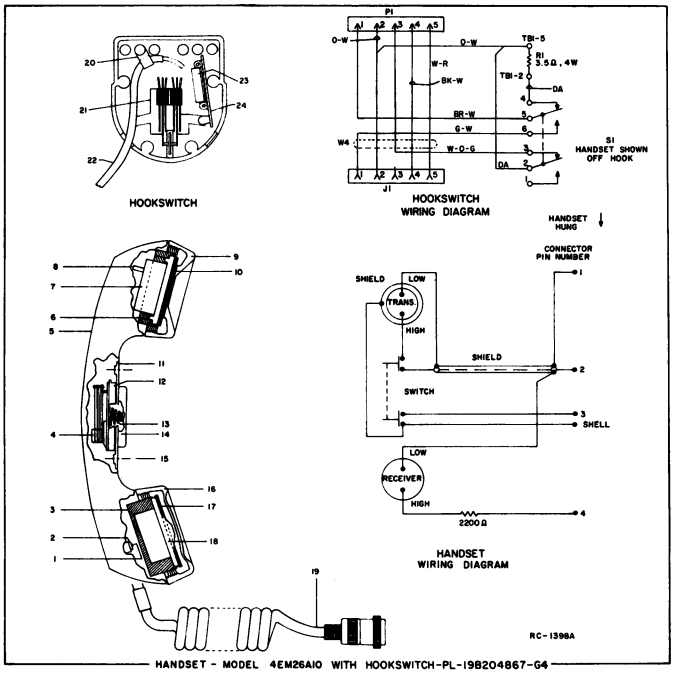
PARTS LIST

LBI-3739A

TWO-WATT SPEAKER
MODEL 4EZ16A13
(PL-19D402499-G6)

SYMBOL	G-E PART NO.	DESCRIPTION
		---------- CAPACITORS: ----------
C1	19B209233-P1	Electrolytic: 25 µf ±20%, 25 VDCW; sim to Sprague D37461.
		---------- LOUDSPEAKERS ----------
LS1	19B209101-P1	Permanent magnet, 5-inch: 2-1/4 w voice input operating; sim to Cletron X10271.
		---------- CABLES ----------
W5		**CABLE PL-19A122167-G1**
		---------- PLUGS ----------
P702	5493018-P2	Connector, phenolic: 5 contacts; sim to Cinch 204-31-05-010.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



HANDSET - MODEL 4EM26A10 WITH HOOKSWITCH-PL-19B204867-G4

SCHEMATIC & OUTLINE DIAGRAM

HANDSET MODEL 4EM26A10
HOOKSWITCH PL-19B204867-G4
SPEAKER MODEL 4EZ16A13

RC-1420A

QUICK CHECKS

MULTIVIBRATOR CIRCUIT	
SYMPTOM	PROCEDURE
POWER SUPPLY WON'T START	1. Check following: A. All fuses B. For collector-to-emitter short in Q501 and Q502.
	2. Check the following voltages: A. Supply voltage. B. Collector-to-emitter voltages of Q501 and Q502 with transmitter keyed. Readings should be approximately equal to supply voltage.
	3. Check starting network R501 and R502 for opens or shorts.
	4. Make continuity check of primary and feedback circuits.
	5. Check for shorted turns or shorts between windings of T501. To check, disconnect all secondary windings from their loads. Key the transmitter. If unit starts, go to step 6. If unit does not start, T501 is probably defective.
	6. Check for excessive load in secondary. A. Check for shorted capacitors or diodes. B. Check for shorts to ground of wiring to the transmitter.
OUTPUT VOLTAGES BELOW NORMAL - SUPPLY VOLTAGES NORMAL	7. Check for excessive load in secondary. A. Check for shorted capacitors or diodes. B. Check continuity of L501, L502, and L503.
10-VOLT REGULATOR	
NO OUTPUT	Check: A. For 12 V at input of regulator. B. For C to E open circuit in Q1. C. For open DS1. D. For short between emitter of Q1 and ground.
OUTPUT TOO HIGH - CANNOT ADJUST WITH R3	Check for: A. Open in VR1 or Q2. B. Defective R3.
OUTPUT EQUALS INPUT	Q1 is shorted.
REGULATION POOR BUT OUTPUT IS ADJUSTABLE WITH R3	Q1 is probably defective and should be replaced.

TROUBLESHOOTING PROCEDURE

POWER SUPPLY MODEL 4EP50A10

RC-1425

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

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

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COMMUNICATION PRODUCTS DEPARTMENT, LYNCHBURG, VIRGINIA
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