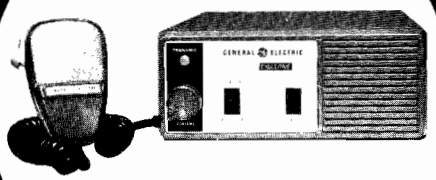
MOBILE RADIO

MASTR PROGRESS LINE

CUSTOM EXECUTIVE

MAINTENANCE MANUAL



MOBILE RADIO

150.8-174 MHz

TWO-WAY FM
MOBILE COMBINATIONS

LBI-4343A

GENERAL ELECTRIC

TABLE OF CONTENTS

ILLUSTRATIONS

WARNING

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

EQUIPMENT INDEX

EQUIPMENT	MODEL OR TYPE NUMBER
FM TRANSMITTER	KT-25-A
FM RECEIVER	ER-48-C
CHANNEL GUARD BOARD	4EK14B11
POWER CABLE	19A129305G1
MOUNTING HARDWARE	19A129302G1
CONTROLLED RELUCTANCE MICROPHONE	4EM25L10
Microphone Bracket	7141414G2
ALIGNMENT TOOLS	
Hex Slug Type	4038831P1
Slotted Screw Type	4033530G2
150.8-174 MHz ANTENNA	4EY12A13

OPTIONAL EQUIPMENT

10-WATT SPEAKER (Option 8427)	4EZ18A14
CHANNEL GUARD HOOKSWITCH (Option 8428)	19C303571G4
ALTERNATOR FILTER (Option 8426)	19C320174G1
GUTTER-MOUNT ANTENNA (Option 5982)	4EY20A10

SPECIFICATIONS*

GENERAL

FREQUENCY RANGE	150.8-174 MHz
DIMENSIONS (H x W x D)	3-3/8" x 8-3/8" x 13-1/4"
WEIGHT (less accessories)	15 pounds
BATTERY DRAIN	
Receiver (at 13.8 VDC)	
Standby (squelched)	120 milliamps
Standby (unsquelched)	400 milliamps
Transmitter	
Transmit (at 13.8 VDC)	5.5 amperes
OPERABLE TEMPERATURE RANGE	-30°C to +60°C (-22°F to 140°F)
DUTY CAPABILITY	Transmit: 20% Receive: Continuous
MAXIMUM FREQUENCY SPACING	0.4%

TRANSMITTER

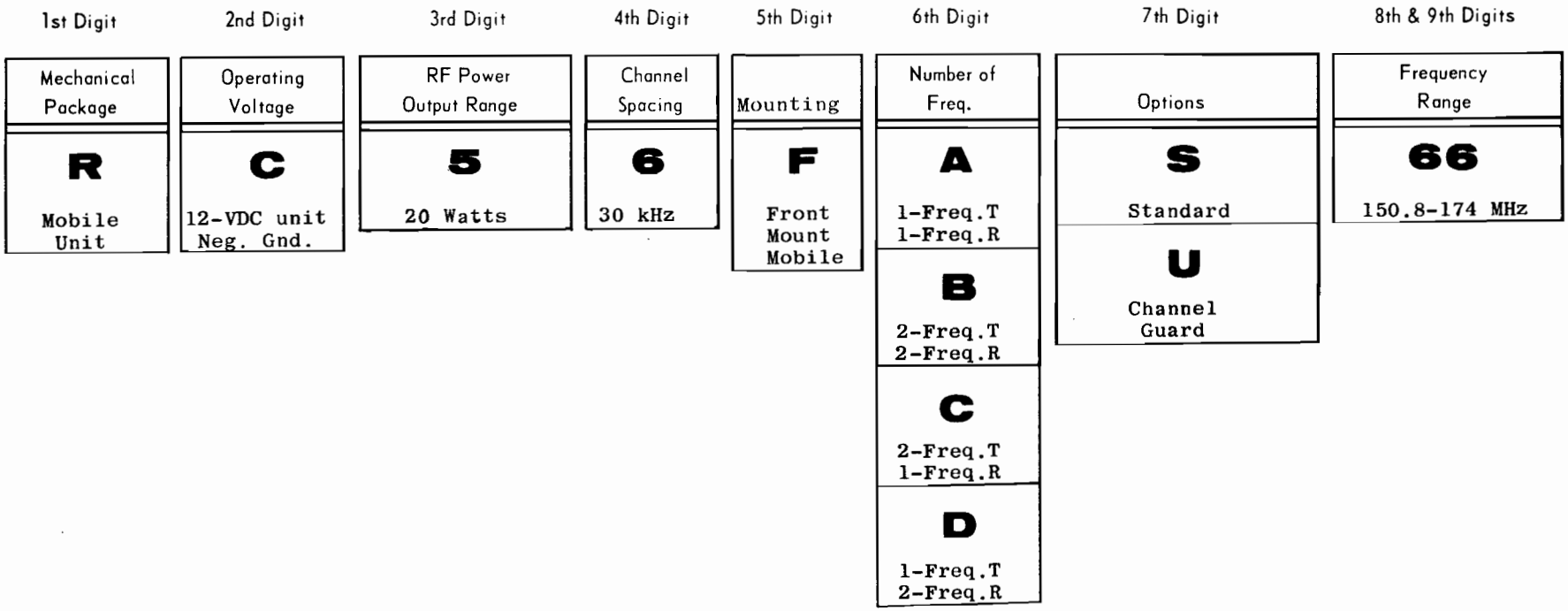
POWER OUTPUT	20 Watts
FREQUENCY STABILITY	±.0005% (-30°C to +60°C, 25°C reference)
SPURIOUS AND HARMONIC RADIATION	At least 56 dB below rated power output
MODULATION	Adjustable from 0 to ±5 kHz swing with instantaneous modulation limiting
AUDIO FREQUENCY	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards
DISTORTION	Less than 5% @ 1 kHz
DEVIATION SYMMETRY	0.6 kHz maximum (narrow band)
CRYSTAL MULTIPLICATION FACTOR	24

RECEIVER

AUDIO OUTPUT	1.5 Watts at less than 10% distortion
SENSITIVITY	
12-dB SINAD (EIA Method)	0.3 µv
20-dB Quieting Method	0.4 µv
SELECTIVITY	
EIA Two-Signal Method	-40 dB (adjacent channel, 30 kHz channels)
20-dB Quieting Method	-100 dB at ±20 kHz
SPURIOUS RESPONSE	-90 dB
FIRST OSCILLATOR STABILITY	±.001% (-30°C to +60°C, 25°C reference)
MODULATION ACCEPTANCE	±7 kHz
INTERMODULATION	-70 dB
FREQUENCY RESPONSE	+1 and -8 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz
SQUELCH SENSITIVITY	
Critical Squelch	4 dB SINAD (0.1 µv typical)
Maximum Squelch	Greater than 20 dB quieting

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

COMBINATION NOMENCLATURE



DESCRIPTION

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

No high-voltage power supply is required as the highest voltage in the radio is supplied by the vehicle battery.

Centralized metering jacks for the transmitter and receiver permit simplified alignment and troubleshooting.

TRANSMITTER

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

- One or two frequencies
- Channel Guard (tone squelch)

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 or two frequencies
- Channel Guard (tone squelch)

CONTROL UNIT

The control unit is attached to the front of the two-way radio. The control panel contains all operating controls and a loudspeaker.

INITIAL ADJUSTMENT

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

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

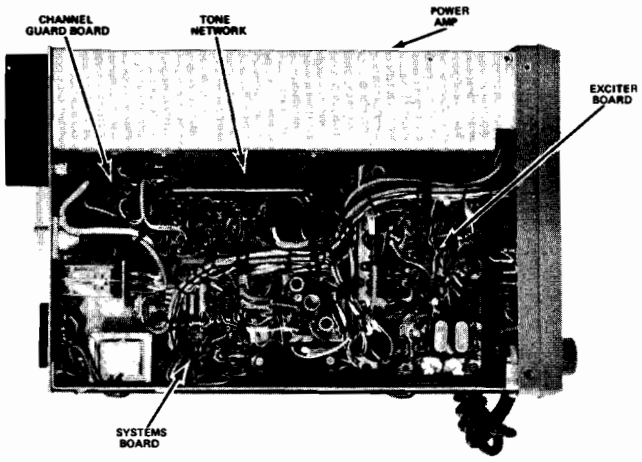
TRANSMITTER ADJUSTMENT

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

RECEIVER ADJUSTMENT

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

TOP VIEW



BOTTOM VIEW

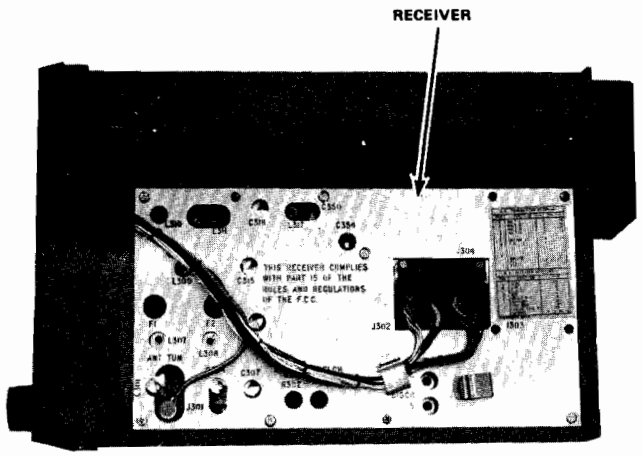


Figure 1 - Module Layout

OPERATION

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

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the OFF-VOLUME control halfway to the right.

2. Place the MONITOR-SQUELCH button in the MONITOR position and adjust the VOLUME control for a comfortable listening level. Then place the switch in the SQUELCH position.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Apply power to the transmitter by turning the OFF-VOLUME control to the ON position.

2. Press the push-to-talk button on the microphone and speak across the face of the microphone in a normal (or softer) voice. Release the button as soon as the message has been given. The red signal light on the control panel will glow each time the microphone button is pressed, indicating that the transmitter is keyed.

MAINTENANCE

PREVENTIVE MAINTENANCE

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

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 and receiver (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 transmitter or receiver for servicing, remove the 4 screws on each side of the radio. Then lift off the top cover, and slide off the bottom cover.

To remove the PA Assembly for servicing:

1. Remove the 8 screws in the PA cover.

2. Remove the uncolored screws holding the receiver to the chassis and lift out the receiver.

3. Remove the 4 flat-head screws holding the control unit to the chassis.

4. Remove the 2 screws holding the cover mounting bracket.

5. Remove the mounting bracket screws for the PA feed-through capacitors and move it out of the way.

6. Remove the 5 mounting screws in the bottom of the PA Assembly and lift out the board.

NOTE

Before reassembling the PA, make sure there is an adequate amount of silicon grease between the PA heatsink and the chassis.

MAINTENANCE CHECKS	INTERVAL	
	6 Months	As Required
CONNECTIONS - Check power and ground connections periodically for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation.	X	
ELECTRICAL SYSTEM - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. If the alternator or generator voltage is excessive, indicator lights, etc., may burn out periodically. This condition is indicated when the battery 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	
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

CIRCUIT ANALYSIS

TRANSMITTER

Transmitter Type KT-25-A is a crystal controlled, frequency modulated transmitter designed for one- or two-frequency operation in the 150.8 to 174 megahertz band. The transmitter consists of the following assemblies:

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

The transmitter uses 12 transistors to provide an RF power output of 20 Watts. The crystals used range from 6.28 to 7.25 megahertz, and the crystal frequency is multiplied 24 times.

A centralized metering jack (J33) on Systems Board A501 is provided for use with GE Test Set Models 4EX3A10 or 4EX8K11. The test set meters the phase modulator, multipliers, PA amplifiers, and PA supply voltages. The metering jack also provides access to microphone and push-to-talk leads.

All input leads to the transmitter PA board are individually filtered by feed-through capacitators. Supply voltage, metering and control functions for the exciter board are connected from the Systems Control Unit through a 9-pin miniature connector (P105). Supply voltages for the transmitter are shown in the following chart.

Voltage	Use
+12.5 VDC	Amplifiers and PA supply
+12.5 V (Battery)	Relay
Keyed +10VDC	Exciter Board & 2nd doubler

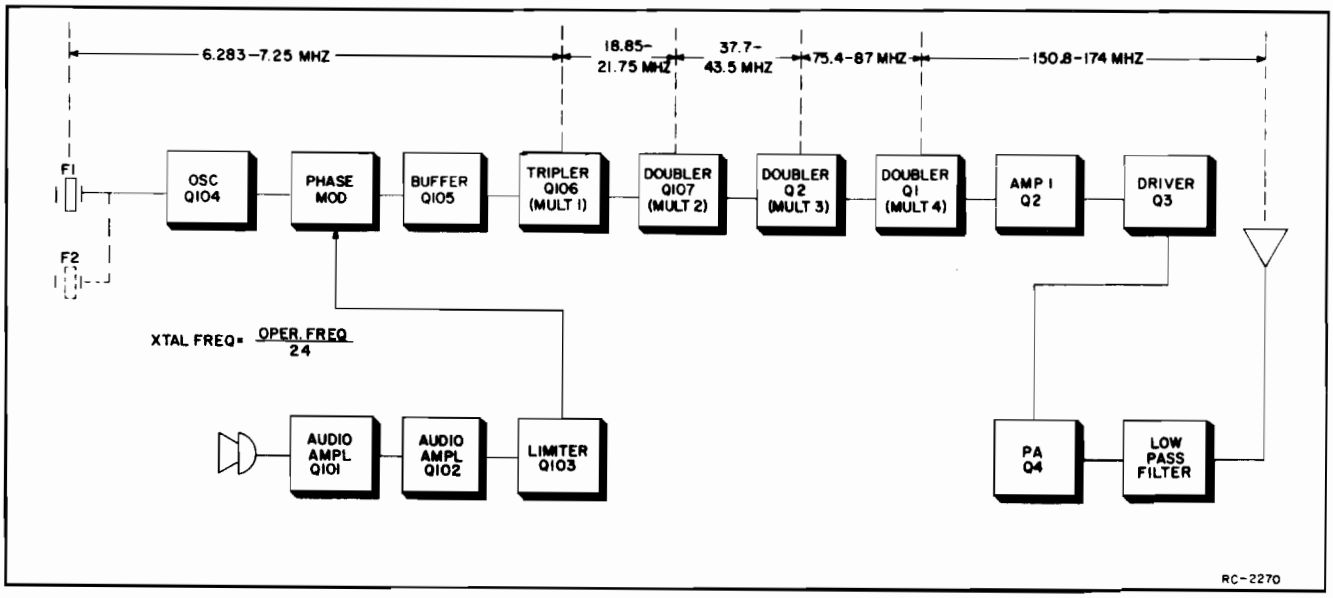


Figure 2 - Transmitter Block Diagram

EXCITER BOARD

OSCILLATOR

A transistorized Colpitts oscillator (Q104) is used in the transmitter. The oscillator crystal is thermistor-compensated at both ends of the temperature range to provide instant frequency compensation with a frequency stability of +.0005% without crystal ovens or warmers. Feedback for the oscillator is developed across C113.

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

In two-frequency transmitters, the single oscillator transistor is used, and an additional crystal circuit and two switching diodes (CR101 and CR102) are added. The keying jumper is removed, and the proper crystal frequency is selected by switching the crystal keying lead to ground by means of a frequency selector switch on the control unit. This forward biases the diode in the crystal circuit, reducing its impedance, so that the selected crystal frequency is applied to the base of oscillator Q104.

AUDIO AMPLIFIER AND LIMITER

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

The output of limiter Q103 is connected through modulation adjust potentiometer R110 to a de-emphasis network for 6-dB/octave de-emphasis and post limiter roll-off. The network consists of C136, C137, C138, R165 and R166. Modulation Adjust R110 determines the maximum signal level applied to the modulation circuit, and is normally set for ±4.3 kHz (narrow band).

PHASE MODULATOR

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

In Channel Guard applications, tone from Channel Guard board Model 4EK14B11 is fed to the modulator circuit through J103 (tone high) and J104 (ground).

BUFFER AND MULTIPLIERS

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

Following Q105 are two L-C coupled Class C multiplier stages (Q106 and Q107), Q106 is a tripler stage (MULT-1) with the collector tank tuned to six times the crystal frequency. Resistors R134 and R135 are for metering the doubler stage at centralized metering jack J33.

PA ASSEMBLY

MULTIPLIERS

The exciter output is link-coupled to the base of 2nd doubler Q2 on Systems Board A501. This stage operates as a common emitter doubler and is metered at J33 (MULT-3). The 2nd doubler output is coupled through a series-tuned circuit (tuned to 12 times the crystal frequency) and then through matching network A202 to the base of 3rd doubler Q1 on PA Board A201. This stage is metered at J33 (MULT-4) across A201-R4. The 3rd doubler output is coupled through a series-tuned circuit (tuned to 24 times the crystal frequency) to the base of amplifier Q2.

WARNING

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

AMPLIFIERS, DRIVER & PA

Q2 operates as a common emitter, series-tuned RF amplifier stage. Base voltage for Q2 is metered at J33 through metering network CR1, R3 and R4.

Driver Q3 follows the amplifier stage. Collector current for Q3 is metered at J33 across resistor R6 on Systems Board A501 (DRIVER Ic). The reading is taken on the 1-Volt scale (the actual current reading is 10 amperes full scale) with the GE Test Set in Position F. The driver output is coupled through a series-tuned circuit to the base of power amplifier Q4.

The power amplifier (Q4) is a common-emitter amplifier providing a minimum RF power output of 20 Watts. Collector current for the PA transistor is measured at J33 (PA Ic) across metering resistor R5 on the Systems Board. The reading is taken on the 1-Volt scale (the current reading is 10 amperes full scale), with the GE Test Set in Position G.

Potentiometer R2 on the Systems Board controls the RF power output of the transmitter by varying the supply voltage to amplifier Q2.

CAUTION

Be careful when servicing the PA board as supply voltage is applied continuously to Q1 through Q4.

The power amplifier output is coupled through a series-tuned circuit to low-pass filter FL201, and then through relay K701 to the antenna.

RECEIVER

Receiver Type ER-48-C is a double conversion, superheterodyne FM narrowband receiver designed for one- or two-frequency operation on the 150.8-174 megahertz band.

The receiver is of single-unit construction and is housed in a copper-plated casting for maximum shielding and rigidity. The unit is completely transistorized, using a total of 20 silicon transistors.

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 system frame.

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, multipliers 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 gate of 2nd RF amplifier Q302.

The Second RF Amplifier uses a Field-Effect Transistor (FET) as the active device. The FET may be considered a semiconductor current path (or channel) whose resistance is varied by a voltage applied to the control element (gate). Lead identification for the FET is shown in Figure 4.

The FET has several advantages over a conventional transistor, including a high input impedance, high power gain, and an

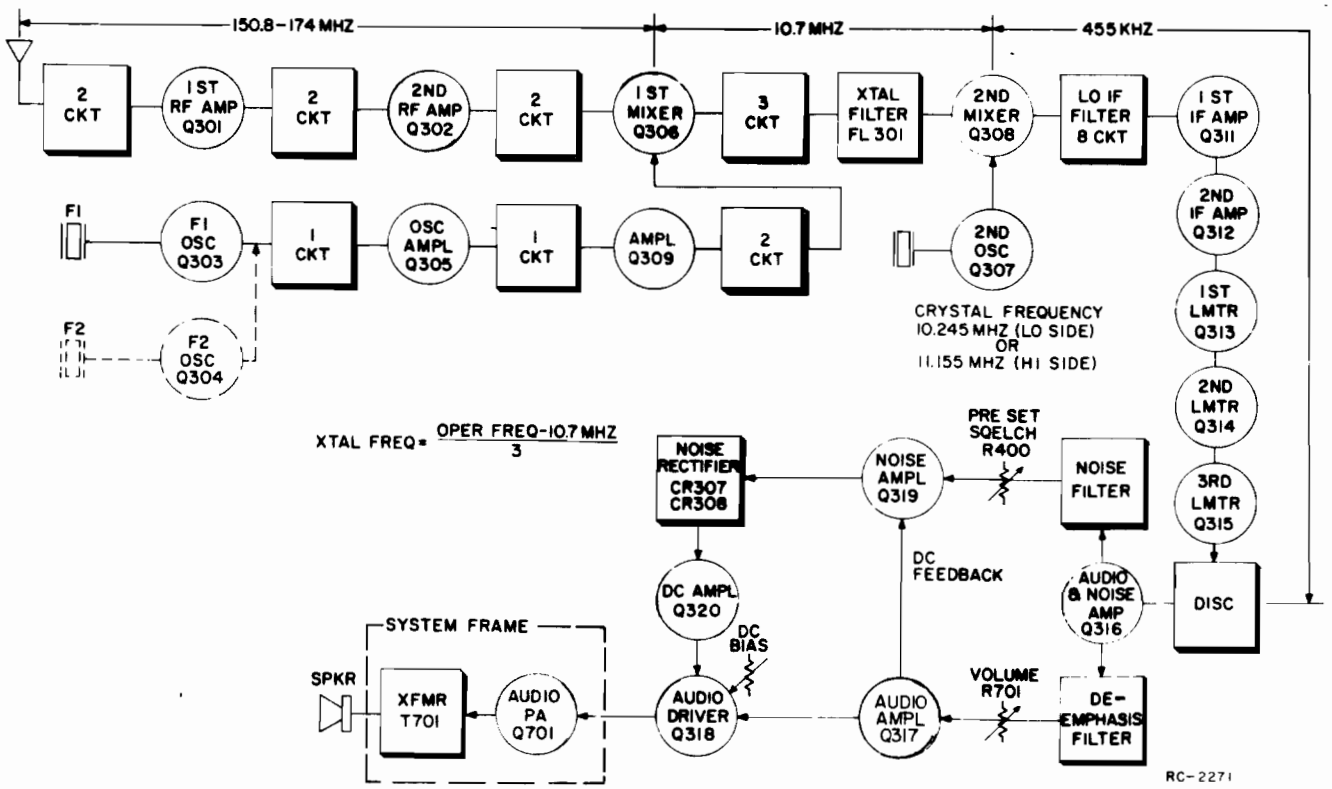


Figure 3 - Receiver Block Diagram

output that is relatively free of harmonics (low in intermodulation products). The FET also has voltage-controlled characteristics, and may be compared to a vacuum tube in operation (see Figure 4B).

Q302 operates as a grounded-gate amplifier. This method of operation provides a low impedance input to the amplifier. The amplified output is taken from the drain terminal and coupled through a tuned circuit (L305, C315 and C316) to the input of the first mixer.

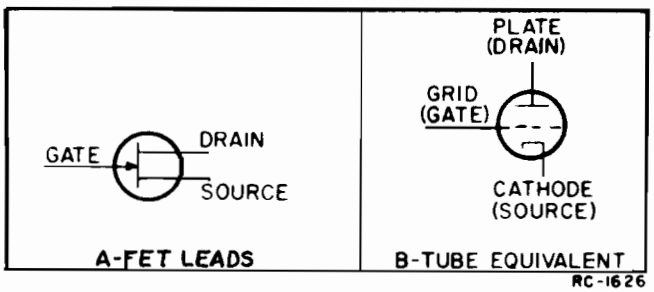


Figure 4 - FET Nomenclature

OSCILLATOR

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

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

1ST MIXER AND CRYSTAL FILTER

The RF signal from the 2nd RF amplifier and the low-side injection voltage from oscillator-amplified Q309 are applied to 1st Mixer Q306.

The 1st Mixer uses a Field-Effect Transistor (FET) as the active device (Figure 4).

RF is applied to the gate of Q306, and injection voltage from the oscillator amplifier is applied to the source. The mixer output is taken from the drain with the output tuned to the 10.7 MHz high IF frequency.

The 10.7 megahertz High IF output is coupled through three tuned circuits (L312 and C350, L313 and C354, L314 and C357) which provide High IF selectivity and impedance matching to the crystal filter.

The Hi-IF crystal filter (FL 301) 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 product 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 overdriver amplifiers. The 1st and 2nd limiter stages are metered at centralized metering jack J304 thru metering diodes CR302 and CR303.

DISCRIMINATOR

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

AUDIO AMPLIFIER AND DRIVER

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

After the de-emphasis network, the audio signal is fed to the base of audio amplifier Q317 through the VOLUME control mounted on the control unit. The VOLUME control is used to set the amount of drive to audio amplifier Q317, audio driver Q318, and audio PA Q701 on the system frame. DC BIAS trimmer R392 sets the bias on Q318 and Q701, and is adjusted for a 250 millivolt (250 milliamps) reading at metering jack J304-9. The output of Q701 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 C435, C436, C437, and L331. The noise level fed to the noise amplifier is set by SQUELCH control R400. The output of noise amplifier Q319 is rectified by diodes CR307 and CR308, and filtered by C441 and C461 to produce a positive DC voltage. This DC voltage turns on DC amplifier Q320, causing it to conduct. When conducting, the collector voltage of the DC amplifier drops to near ground potential, which lowers the bias on audio stages Q317 and Q318, turning them off.

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

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

SYSTEM BOARD

System Board A501 contains the 10-Volt regulator, Audio PA stage, Power Level Control stage, the transmitter 2nd doubler circuit (MULT-3), and the transmitter centralized metering jack. The board also provides connection points for all supply voltages for the Two-Way radio. The supply voltages include:

- A continuous, regulated +10 Volts for the receiver and Channel Guard board.
- A keyed, regulated +10 Volts for the transmitter exciter, 2nd doubler (MULT-3), Channel Guard board and receiver muting.
- A continuous +12 Volts for the transmitter, PA board, receiver, and system relay.
- A keyed 12 Volts for the TRANSMIT light.

A simplified power distribution and switching diagram is shown in Figure 5.

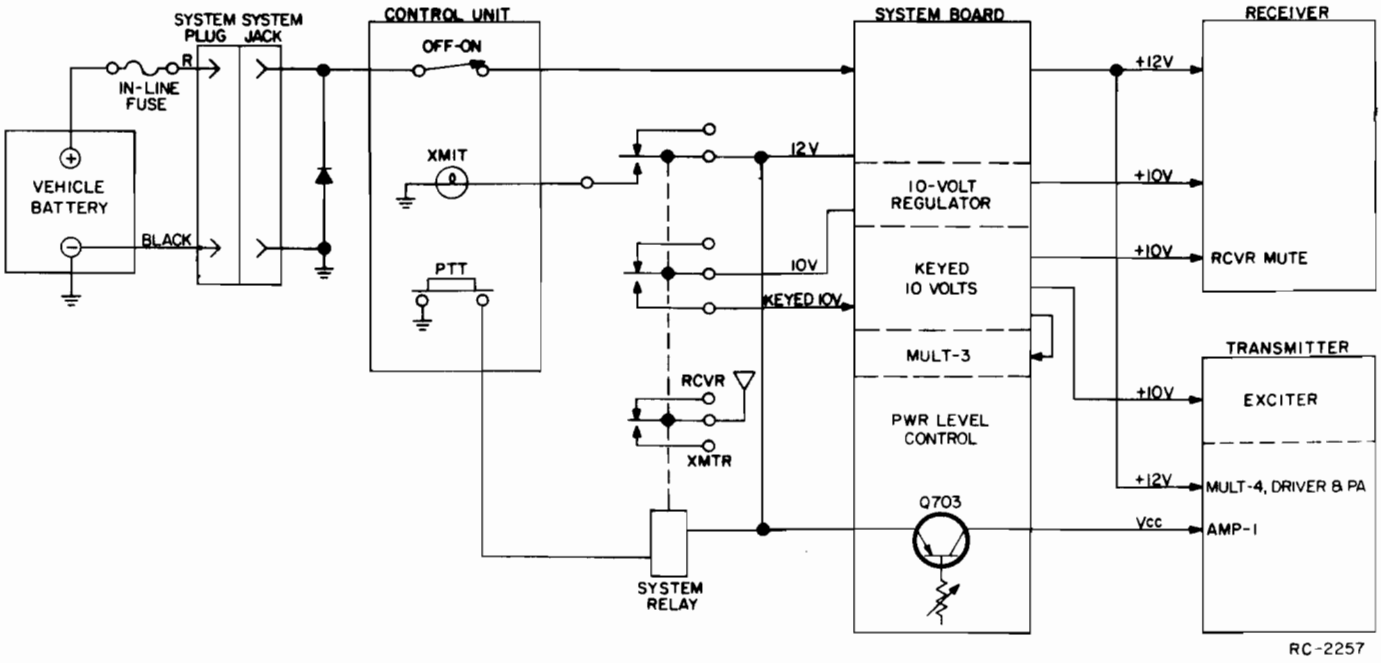


Figure 5 - Power Distribution Diagram

The audio PA, 10-Volt regulator and power level control transistors are mounted on the system frame which acts as a heatsink for these stages.

+10-VOLT REGULATOR

Turning the radio on applies +12 Volts to the collector of regulator transistor Q702, turning it on. The regulated +10 Volts is taken from the emitter of Q702.

When the supply voltage (or output) starts to increase, the voltage at the base of Q1 also increases. This causes Q1 to conduct more, providing less base current for Q702. The voltage drop across Q702 becomes larger and the output remains constant.

When the input voltage starts to drop, the output voltage also tends to drop and Q1 will conduct less. This increases the forward bias on Q702 and reduces the voltage drop across Q702 to keep the output constant.

Potentiometer R10 is used to set the emitter-base voltage of Q1 for the desired 10-Volt output. R7 and R9 limit the maximum current through Q1. R8 provides bias current for Zener diode VR1, and lamp DS1 provides bias for Q702. C2 and C5 prevent high frequency oscillation. The output voltage is metered at receiver centralized metering jack J304.

AUDIO PA

The output of Q318 on the receiver chassis is applied to the base of the class A, audio PA (Q701). Bias to Q701 is set by DC bias trimmer R392 on the receiver. The trimmer is set for 0.25 Volt at receiver metering jack J304-9 (Position G on GE Test Set). The audio output is coupled through audio transformer T701 and applied to the loudspeaker.

POWER LEVEL CONTROL

Applying power to the radio causes Power Level Control Transistor Q703 to conduct. The output voltage at the collector of Q701 is applied to amplifier Q2 on the PA board. Changing the setting of potentiometer R2 changes the supply voltage to Amplifier Q2, which varies the transmitter power output. Instructions for setting R2 are contained in the transmitter Alignment Procedure.

CONTROL UNIT

The control unit has an OFF-VOLUME control, a MONITOR-SQUELCH switch, a two-frequency switch, a red TRANSMIT light, and a self-contained loudspeaker. Terminal board TB701 is provided for microphone connections.

OFF - VOLUME CONTROL (S701/R701)

The OFF-VOLUME control determines whether the radio is operative or not. Turning S701 On applies supply voltage to the System Board and receiver, and activates the push-to-talk (PTT) circuit.

Pressing the PTT button on the microphone energizes system relay K701. Energizing the relay applies +10 Volts to the exciter board and Channel Guard board, switches the antenna, and mutes the receiver. Energizing the relay also applies +12 Volts to the red TRANSMIT light.

Volume Control R701 is a variable resistor used to control the audio output of speaker LS701.

MONITOR/SQUELCH (S702)

Placing S702 in the MONITOR position disables the noise squelch circuit in the receiver. In radios equipped with Channel Guard, the MONITOR position also disables the receiver Channel Guard.

Placing the switch in the SQUELCH position permits normal operation of the noise squelch and Channel Guard circuits.

TWO-FREQUENCY SWITCHES (S703)

In two-frequency applications, the frequency-selector switch selects the channel desired for both transmit and receive. 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 two-frequency radios, the transmitter and receiver Channel Guard operate on all frequencies.

CHANNEL GUARD

Channel Guard Board Model 4EK14B11 is a fully transistorized encoder-decoder for use with Custom Executive Mobile combinations.

The tone frequencies are controlled by plug-in tone networks that are made with precision components for excellent stability and reliability. The tone frequencies range from 71.9 to 203.5 Hz.

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

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MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R110) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause over-modulation are clipped by the modulation limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing over-modulation while preserving intelligibility.

TEST EQUIPMENT

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

PROCEDURE

Transmitters without CHANNEL GUARD

1. Connect the audio signal generator and the meter across audio input terminals J5 (Green-Hi) and J6 (Black Lo) on GE Test Set, or across J33-15 (Mike Hi) and J33-7 (Mike Lo) on the Centralized Metering Jack.
2. Apply a 0.75 Volt RMS signal at 1000 Hz to Test Set or across J33-15 and J33-7 on the Centralized Metering Jack.
3. Set MOD ADJUST (R110) for a 4.3-kHz swing with deviation polarity that 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.

Two-frequency Transmitters

Check both channels for deviation as described in Steps above.

PA POWER INPUT

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

P_i + PA voltage x PA current

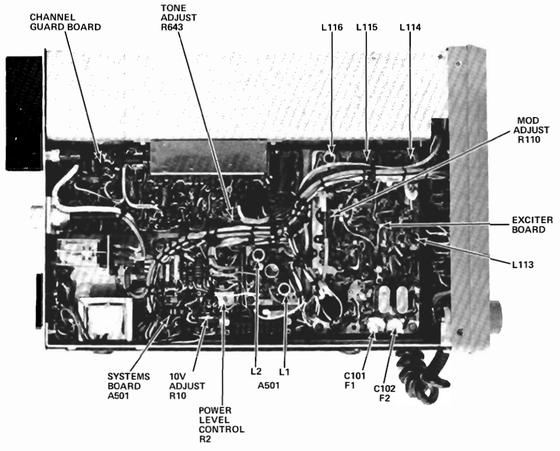
where

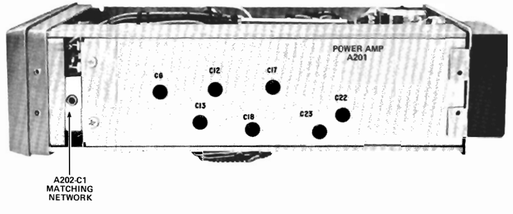
P_i is the power input in Watts,

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

PA current is measured with the Test Set in Position G in the Test 1 position, and is read as 10 amperes full scale.

Example: P_i = 12.5 Volts x 1.5 amperes = 18.7 Watts





TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A10 (Revision A or later), or Model 4EX8K11.
2. A 50-ohm wattmeter connected to Antenna Jack J702.
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal(s) in crystal socket (crystal frequency = operating frequency ÷ 24).
2. For a large change in frequency or a badly misaligned transmitter, set crystal trimmer C101 to mid-capacity. In two-frequency transmitters, also set C102 to mid-capacity and set the channel selector switch to the highest frequency.
3. For a large change in frequency or a badly misaligned transmitter, turn the slugs in the Exciter coils (L113, L114, L115, L116) to the bottom of the coil. Set A501-L1 and -L2 (on System Board) so that the top of the slug is approximately even with the bottom of the coil winding. Adjust C6, C12, C13, C18, C22 and C23 on the PA board 1/2 turn out from the tight position. Adjust C17 1/4 turn out from the tight position.
4. Rotate Power Level Control R2 fully clockwise, and adjust A202-C1 1 turn out from the tight position.

NOTE

No adjustments should be made on Systems Board A50, Matching Network A202 or PA Board A201 unless Power Control Adjust R2 is in the fully clockwise (maximum power) position.

5. Connect the GE Test Set to Receiver Metering jack J302 and check for +10 Volts at Position J. If reading is not 10 Volts, refer to the System Board Outline Diagram and set R10 for +10 Volts.
6. Connect GE Test Set to metering jack J33 on Systems Board A501. Set the test polarity to (+) and set the range to the Test 1 (or 1-Volt position for 4EX8K11).
7. All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.

TRANSMITTER ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
				EXCITER BOARD
1.	A (MULT-1)	L113 & L114	See Procedure	Carefully adjust L113 for maximum meter reading. Then adjust L114 for a small dip in meter reading.
2.	B (MULT-2)	L115, L114 & L116	See Procedure	Adjust L115 for maximum meter reading. Re-adjust L114 for maximum meter reading. Then adjust L116 for a dip in meter reading.
				MULT-3, MATCHING NETWORK & PA BOARD
3.	C (MULT-3 INPUT)	A501-L1, L116 & A501-L2	See Procedure	Adjust A501-L1 for maximum meter reading. Next, re-adjust L116 for maximum meter reading. Then adjust A501-L2 for a dip in meter reading.
4.	D (MULT-3 OUTPUT)	A201-C6	Maximum	Adjust A201-C6 for maximum meter reading.
5.	F (DRIVER Ic)	A201-C12, C13 & C6	Maximum	Alternately adjust C12 and C13 several times for maximum meter reading. Then re-adjust C6 for maximum meter reading.
6.	F (DRIVER Ic)	A201-C12 & C13	Maximum	Alternately re-adjust C12 and C13 for maximum meter reading.
7.	G (PA Ic)	A201-C17 & -C18	Maximum	Alternately adjust C17 and C18 several times for maximum meter reading.
8.	G (PA Ic)	A201-C22 & -C23	Maximum power out; minimum G reading	Alternately adjust C22 and C23 several times for maximum RF power output and minimum PA collector current (Position "G" reading). With meter in Position "G," repeat Steps 8, 7 and 5 in that order for maximum power output.
9.	D (MULT-3 OUTPUT)	A501-L2 & A202-C1	Maximum	Adjust A501-L2 and A202-C1 for maximum meter reading.
10.		A501-R2	20 Watts	Adjust Power Level Control R2 for 20 Watts output maximum.
				FREQUENCY ADJUSTMENT
11.		C101(C102 in 2-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.) 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.

TEST PROCEDURES

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

TEST EQUIPMENT REQUIRED

for test hookup as shown:

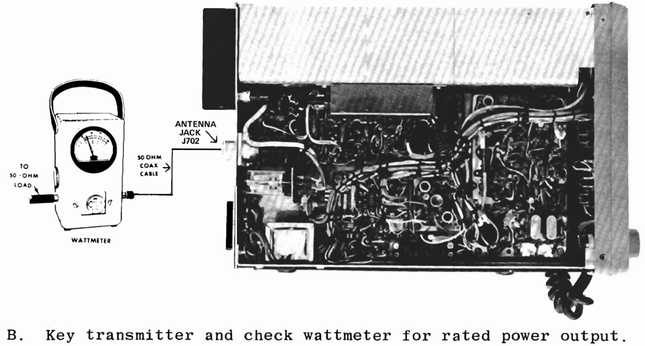
1. Watt meter similar to:
   Bird #43
   Jones #711N
2. VTVM similar to:
   Triplett #850
   Heath #IM-21
3. Audio Generator
   GE MODEL 4EX6A10
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements #140
   Lampkin #205A
5. Multimeter similar to:
   GE TEST SET
   MODEL 4EX3A10 or 4EX8K11

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

A. Connect transmitter output to wattmeter as shown below:



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

SERVICE CHECK

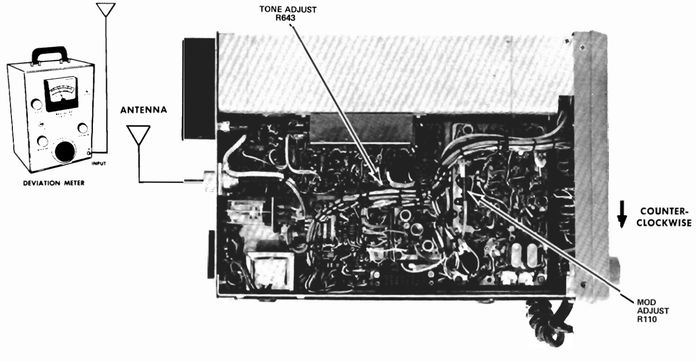
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

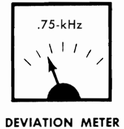
TEST PROCEDURE

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



B. Set MOD ADJUST control R110 fully counterclockwise.

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



DEVIATION METER

NOTES:

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

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

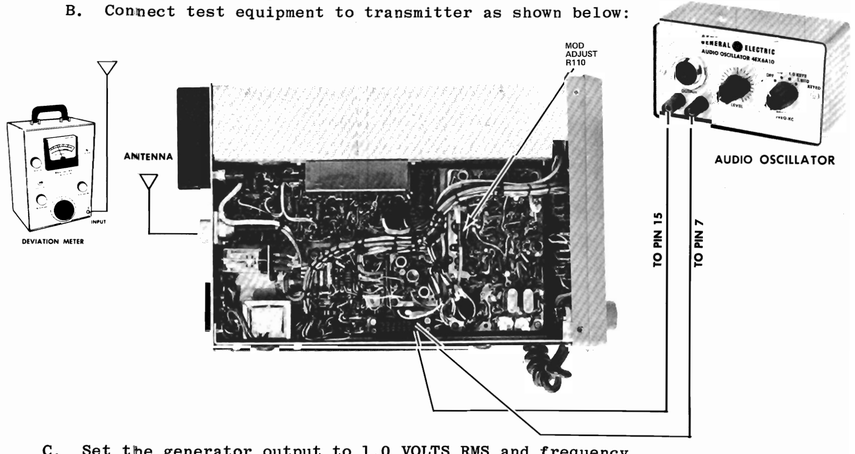
STEP 3

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

A. Unplug the microphone.

B. Connect test equipment to transmitter as shown below:

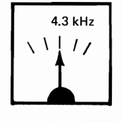


C. Set the generator output to 1.0 VOLTS RMS and frequency to 1 kHz.

D. Key the transmitter by connecting a jumper from TB701-3 to TB701-4 (GRD).

E. Deviation reading should be ±4.3 kHz.

F. Adjust MOD ADJUST Control R110 until deviations reads 4.3 kHz on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.



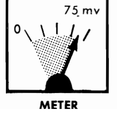
DEVIATION METER

NOTES: --These transmitters are adjusted for 4.3 kHz deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz under the worst conditions of frequency, voltage and temperature.

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

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

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



METER

FRONT END ALIGNMENT

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

EQUIPMENT REQUIRED

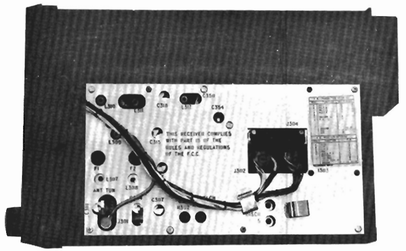
1. GE Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11 or 20,000 ohms-per-Volt Multimeter.
2. 150.8-174 MHz signal source (keep signal level below saturation).

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 set PA Bias R392 for a reading of 0.25 Volt (250 milli-amperes).

ALIGNMENT PROCEDURES

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 (.06 - .25)	Apply an on-frequency signal to J301 and adjust L309 and L307 for a maximum meter reading (.06 - .25 Volts).
3.	E OSC	pin 4	L310, L317 & L311	Maximum	Adjust L310, L317 & L311 for maximum.
4.	D OSC	pin 4	L308 (2-freq. only)	Maximum	For 2-frequency receivers, switch to F2, insert F2 crystal and adjust L308 for maximum.
5.					Preset RF capacitors C301, C304, C307, C311, C315, and C318 to approximate-frequency. (Capacitors tune from 130 MC (max. capacitance) to 174 MC (min. capacitance)).
6.	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, and C318 for maximum meter reading. Keep signal below saturation at each stage 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.)



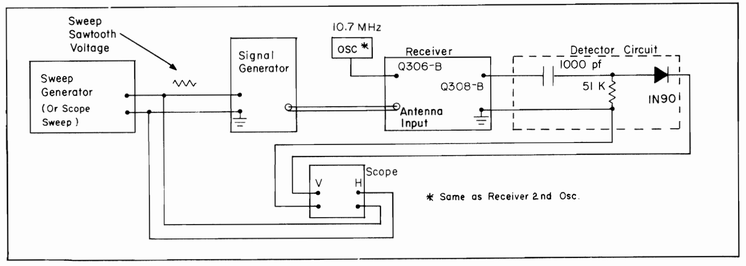


Figure 1 - High and Low IF FILTER TEST Circuit

COMPLETE RECEIVER ALIGNMENT

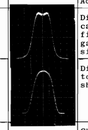
EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10 (TM11 or TM12), 4EX8K11 or 20,000 ohms-per-Volt Multimeter.
2. A 10.7 MHz (±200 Hz) and 150.8-174 MHz signal source. Couple the 10.7 MHz signal through a 0.01 µf capacitor. Keep signal levels below saturation.
3. For Alignment steps 4 thru 8 - Oscilloscope, sweep generator, 10.7 MHz marker generator and construct a detector circuit (see Figure 1 for circuitry).

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Plug Test Set into the receiver centralized metering jack J304. Set meter polarity switch on + and meter sensitivity switch to TEST 1. If using multimeter, connect the negative lead to J304-13 (ground).
2. Switch Test Set to Position "I" (or measure at collector of Q318 with multimeter). Reading should be a nominal 13.8 Volts.
3. Switch to Position "J" (or measure at top of C443 with multimeter), and check for a reading of 10 Volts. If reading is not correct, refer to Systems Board Outline Diagram and set R10 for +10 Volts.
4. Turn SQUELCH control fully clockwise and VOLUME control to minimum. Switch to Position "G" (or measure at J304-9 with multimeter) and set PA bias R392 for reading of 0.25 Volts (250 milliamperes).

ALIGNMENT PROCEDURE

STEP	METERING POSITION TEST SET	METERING POSITION MULTIMETER + at J304	TUNING CONTROL	METER READING	PROCEDURE
DISCRIMINATOR					
1.					Remove 1st oscillator crystal and apply a 10.7 MHz signal to the base of Q308.
2.	A DISC	pin 10	L329	See Procedure	Adjust L329 (discriminator primary) 1/2 turn up from bottom of range.
3.	A DISC	pin 10	L330	Zero	Tune L330 (discriminator secondary) for zero meter reading.
HIGH and LOW IF FILTER (SEE NOTE 1)					
4.	B LIM	pin 2	L321 thru L328	Maximum	Adjust L321 thru L328 for maximum meter reading.
5.	B LIM	pin 2	C357, C354, C350	See Procedure	Adjust C357 for minimum meter reading. Adjust C354 for maximum meter reading. Adjust C350 for minimum meter reading.
6.			C357 & C360		Disable the 2nd oscillator by grounding base of Q307 through a .01 µf capacitor. Connect scope, signal generator and detector as shown in figure 1. Sweep RF ±50 kHz at 20 Hz. Connect 10.7 MHz marker to gate 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			Check to see that discriminator idling voltage is within 0.05 Volts of zero with no signals applied and the modulation acceptance band width is greater than ±8 kHz (narrow 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 (.06-.25 V)	Adjust L309 and L307 for maximum meter reading (.06-.25 Volts).
11.	E OSC	pin 4	L310, L317 L311	Maximum	Adjust L310, L317 and L311 for maximum.
12.	D OSC	pin 4	L308 (2-freq)	Maximum	For 2-frequency receiver, insert F2 crystal and adjust L308 for maximum meter reading.
RF					
13.	C LIM 2	pin 3	L321, L322, L323, L324, L325, L326, L327, L328	Maximum	Inject 10.7 MHz crystal-controlled marker on base of 2nd Mixer Q308. Adjust L321, L322, L323, L324, L325, L326, L327, L328, for maximum meter reading. Keep signal below saturation at each stage and on discriminator zero. Remove 10.7 MHz marker.
14.	C LIM 2	pin 3	C350, C354, C357, C360	Maximum	Inject 10.7 MHz crystal-controlled marker to gate of Q306. Adjust C350, C354, C357 and C360 for maximum meter reading. Adjust C350 for dip on "B" position of test meter.
15.			C301, C304		While receiving a weak on-frequency signal from the antenna, tune C301 and C304 for best quieting.
16.	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 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.
17.				≤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 realign unless there is positive evidence of a defective filter. For location of components, refer to the Receiver Outline Diagram.

ALIGNMENT PROCEDURE

RECEIVER MODELS 4ER48C10-15
FOR MOBILE COMBINATIONS

TEST PROCEDURES

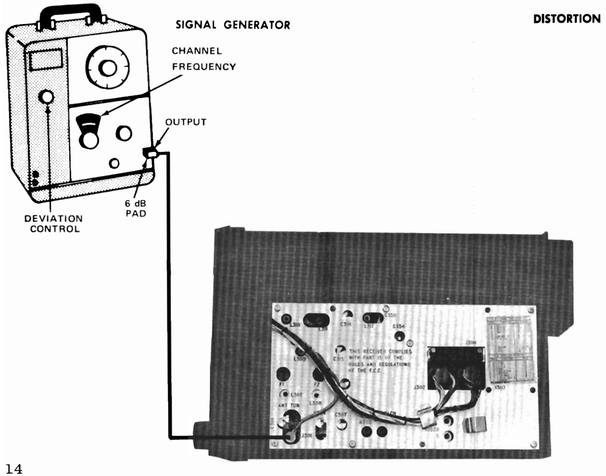
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect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

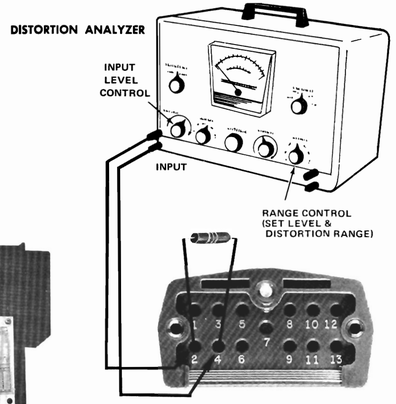
TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-800
- 6-dB attenuation pad, and 3.2 ohm, 10-Watt resistor

PRELIMINARY ADJUSTMENTS

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





REMOVE JUMPER BETWEEN P701-2 AND P702-3 AND CONNECT A 312-OHM, 10 WATT RESISTOR BETWEEN P701-2 AND P701-4

STEP 1

AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

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

B. When speaker is used, disconnect speaker (and handset if present). Hook up a 3.2-ohm load resistor on P701 as shown.

C. Set VOLUME Control for one-Watt output (1.77 VRMS).

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

SERVICE CHECK

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

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

F. Set SQUELCH control R400 fully counterclockwise and volume control to minimum. Switch to position G on test set and check to see if Bias is set at 0.25 Volt (250 mA).

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

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

STEP 2
USABLE SENSITIVITY (12-dB SINAD)

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

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

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

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

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

E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least one Watt (1.77 Volts RMS across the 3.2-ohm receiver load using the Distortion Analyzer as a VTVM).

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

SERVICE CHECK

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

STEP 3
MODULATION ACCEPTANCE BANDWITH (IF BANDWITH)

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

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

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

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

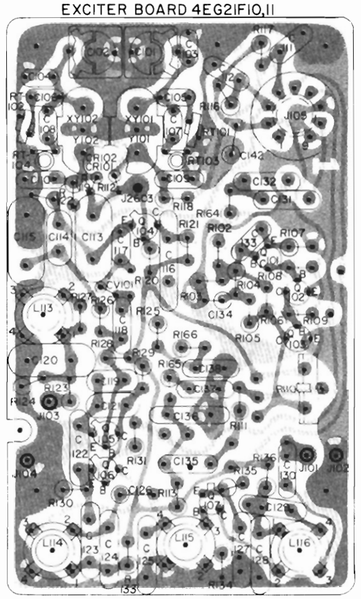
D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±8 kHz (but less than ±10 kHz).

SERVICE CHECK

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

OUTLINE DIAGRAM

EXCITER BOARD 4EG21F10,11



(19E500954, Rev. 5)
(19B205178, Sh. 1, Rev. 1)
(19B205178, Sh. 2, Rev. 1)

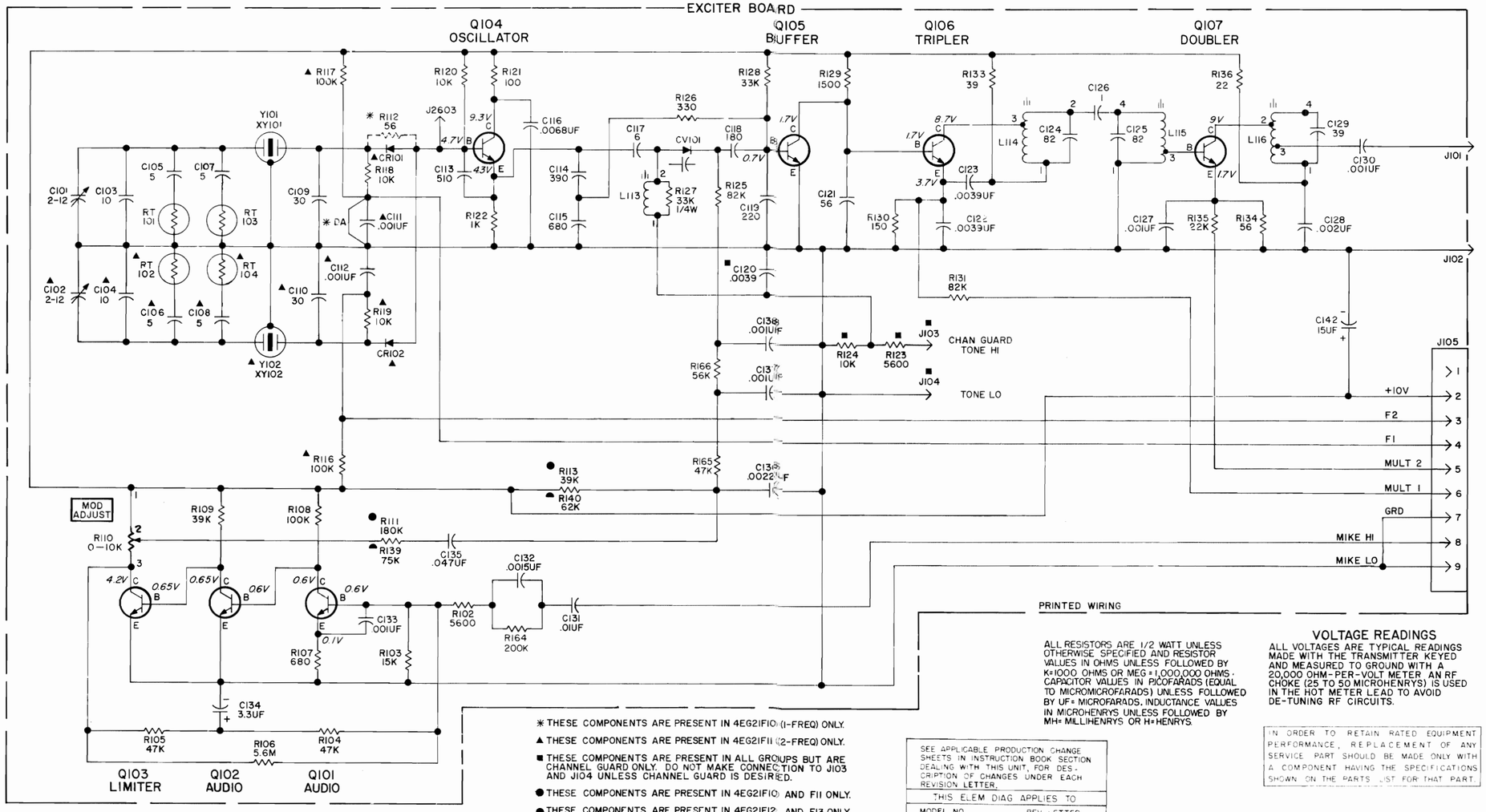
RESISTANCE READINGS

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

EXCITER BOARD

TRANSISTOR SYMBOL #	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q101	650	650	13,200	3,650	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

SCHEMATIC DIAGRAM



✱ THESE COMPONENTS ARE PRESENT IN 4EG21F10 (1-FREQ) ONLY.

▲ THESE COMPONENTS ARE PRESENT IN 4EG21F11 (2-FREQ) ONLY.

■ THESE COMPONENTS ARE PRESENT IN ALL GROUPS BUT ARE CHANNEL GUARD ONLY. DO NOT MAKE CONNECTION TO J103 AND J104 UNLESS CHANNEL GUARD IS DESIRED.

● THESE COMPONENTS ARE PRESENT IN 4EG21F10 AND F11 ONLY.

◓ THESE COMPONENTS ARE PRESENT IN 4EG21F12 AND F13 ONLY.

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

(19D402586, Rev. 5)

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.

VOLTAGE READINGS

ALL VOLTAGES ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED AND MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER. AN RF CHOKE (25 TO 50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DE-TUNING RF CIRCUITS.

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

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EG21F10	B
4EG21F11	B

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.

SCHEMATIC & OUTLINE DIAGRAM

EXCITER BOARD
MODELS 4EG21F10 & 4EG21F11

PARTS LIST

LBI-4349

EXCITER BOARD
MODEL 4EG21F10 1 FREQ NARROW BAND
MODEL 4EG21F11 2 FREQ NARROW BAND
Rev B

SYMBOL	GE PART NO.	DESCRIPTION
		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: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C113	5496372P167	Ceramic disc: 510 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C114	5493366P390J	Silver mica: 390 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C115	5493367P680J	Silver mica: 680 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-20.
C116	5494481P131	Ceramic disc: .0068 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C117	5496219P37	Ceramic disc: 6 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C118	5496372P46	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -2200 PPM.
C119	5490008P135	Silver mica: 220 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C120	5494481P129	Ceramic disc: .0039 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C121	5496219P218	Ceramic disc: 56 pf ±10%, 500 VDCW, temp coef -80 PPM.
C122 and C123	5494481P129	Ceramic disc: .0039 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C124 and C125	5496219P261	Ceramic disc: 82 pf ±5%, 500 VDCW, temp coef -80 PPM.
C126	7130348P3	Molded: 1 pf ±.05 pf, 500 VDCW, temp coef approx 0 PPM; sim to Jeffers Type JM-5/32.
C127	5494481P112	Ceramic disc: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C128	5494481P113	Ceramic disc: .002 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: .001 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C131	19B209243P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C132	7491395P111	Ceramic disc: .0015 pf ±10%, 500 VDCW; sim to RMC Type JL.
C133	5494481P111	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C134	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C135	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C136	7491395P114	Ceramic disc: .0022 pf ±10%, 500 VDCW; sim to RMC Type JL.
C137 and C138	7491395P109	Ceramic disc: .001 pf ±10%, 500 VDCW; sim to RMC Type JL.
C142	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		DIODES AND RECTIFIERS
CR101 and CR102	19A115603P1	Silicon.
CV101	5495769P9	Varactor, silicon: 33 µf ±10% at 4 VDC; sim to Pacific Semiconductor Varicap Type V-596.
		JACKS AND RECEPTACLES
J101 thru J104	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J105	19B209303P1	Connector, phen: 9 pins.
J2603		(Part of Exciter Board 19C303835P1).
		INDUCTORS
L113	19C303883G13	Coil. Includes tuning slug 5491798P2.
L114	19C303883G14	Coil. Includes tuning slug 5491798P2.
L115	19C303883G15	Coil. Includes tuning slug 5491798P2.
L116	19C303883G17	Coil. Includes tuning slug 5491798P2.
		TRANSISTORS
Q101	19A115889P1	Silicon, NPN.
Q102 and Q103	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q104	19C300114P1	Silicon, NPN; sim to Type 2N706.
Q105	19A115330P1	Silicon, NPN.
Q106 and Q107	19A115328P1	Silicon, NPN.
		RESISTORS
R102	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R103	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R104 and R105	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R106	3R77P565J	Composition: 5.6 megohms ±5%, 1/2 w.
R107	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R108	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R109	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R110	19B209358P106	Variable, carbon film: 75 to 10,000 ohms ±10%, 1/4 w; sim to CTS Type X-201.
R111	3R77P184J	Composition: 0.18 megohm ±5%, 1/2 w.
R112	3R152P560J	Composition: 56 ohms ±5%, 1/4 w.
R113	3R77P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R116 and R117	3R77P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R118 thru R120	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R121	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R122	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R123	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R124	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R125	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R126	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R127	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R128	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R129	3R77P152K	Composition: 1500 ohms ±10%, 1/2 w.
R130	3R77P151K	Composition: 150 ohms ±10%, 1/2 w.
R131	3R77P823K	Composition: 82,000 ohms ±10%, 1/2 w.
R133	3R77P390K	Composition: 39 ohms ±10%, 1/2 w.
R134	3R77P560K	Composition: 56 ohms ±10%, 1/2 w.
R135	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R136	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R164	3R77P204J	Composition: 0.20 megohm ±5%, 1/2 w.
R165	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R166	3R77P563J	Composition: 56,000 ohms ±5%, 1/2 w.
		THERMISTORS
RT101 and RT102	19B209353P2	Disc: 460 ohms max; sim to GE 16D-3121.
RT103 and RT104	19B209353P1	Rod: 10,200 ohms min; sim to GE 1R-1544.
		SOCKETS
XY101 and XY102		Includes:
	4033089P1	Clip. (Part of XY101, 102).
	19A115793P1	Contact, electrical: sim to Malco 2700. (Part of XY101, 102).
	19C311172P1	Socket, crystal. (Part of XY101, 102).
	19B200525P9	Rivet. (Part of XY101, 102).
		CRYSTALS
		When reordering give GE Part Number and specify exact frequency needed.
		Crystal freq = (OF ÷ 24).
Y101 and Y102	19B206204P1	Quartz: freq range 5400-7250 KHz, temp range -30°C to +85°C.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

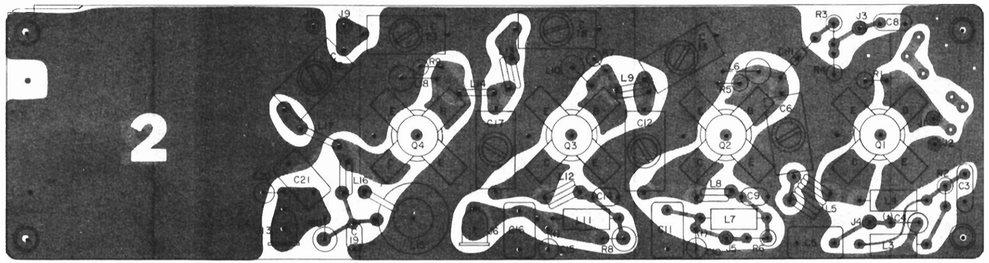
PRODUCTION CHANGES

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

REV. A & B - Incorporated into initial shipment.

OUTLINE DIAGRAM

PA BOARD



RESISTANCE READINGS

ALL READINGS ARE TYPICAL READINGS MEASURED FROM TRANSISTOR PINS TO GROUND WITH ALL POWER TURNED OFF. READINGS ON THE EXCITER BOARD OVER A 1,000 OHMS READ ON THE X 1,000 SCALE. + OR − S16N SHOW METER LEAD GROUNDED.

(19E500954, Rev. 5)
(19D416266, Sh. 1, Rev. 2)
(19D416266, Sh. 2, Rev. 2)

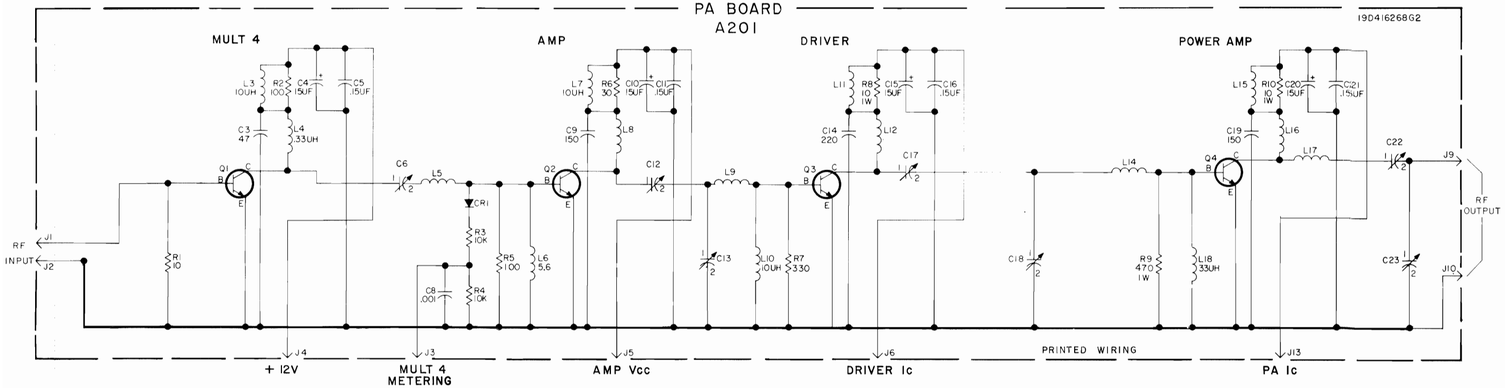
PA ASSEMBLY

SYMBOL #	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1(2ND DOUBLER A201)	9.5	10.2	0.6	12.5	40	200
Q1(2ND DOUBLER A202)	GND	GND	1.1	1.1	3.15	
Q2 1ST AMP	GND	GND	0.4	0.4	5.1K	5.2K
Q3 DRIVER	GND	GND	0.2	0.2	9.6K	11.5K
Q4 PA	GND	GND	8.6	8.4	3K	5.4K
	GND	GND				
	GND	GND				

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION BEARING NO. WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM. DIAG. APPLIES TO	
MODEL NO.	REV. LETTER
19D416268G2	A

SCHEMATIC DIAGRAM

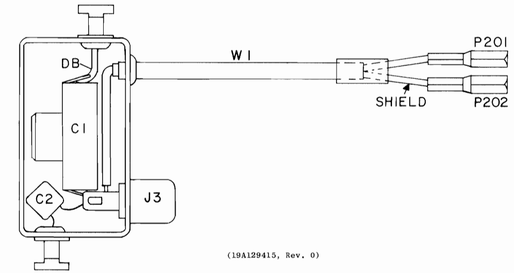


IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

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.

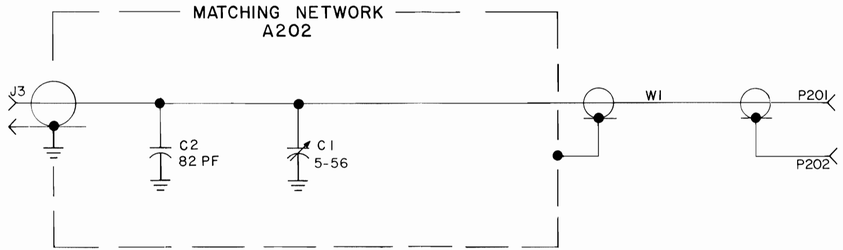
(19D416570, Rev. 3)

OUTLINE DIAGRAM



(19A129415, Rev. 0)

SCHEMATIC DIAGRAM



(19B219575, Rev. 3)

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

SCHEMATIC & OUTLINE DIAGRAMS

PA BOARD 19D416268G2 AND
MATCHING NETWORK 19C320162G1

PARTS LIST

LBI-4350A

PA BOARD 19D416268G2 WITH MATCHING NETWORK 19C320162G1

SYMBOL	GE PART NO.	DESCRIPTION
A201		**PA BOARD 19D416268G2**
		- - - - - - - - - **CAPACITORS** - - - - - - - - -
C3	7489162P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C4	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C5	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19B209408P2	Variable, mica: 4-25 pf, 400 VDCW.
C8	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C10	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C11	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C12	19B209408P2	Variable, mica: 4-25 pf, 400 VDCW.
C13	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C14	19A116655P10	Ceramic disc: 220 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C15	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C16	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C17 and C18	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
C19	19A116655P14	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C20	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C21	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C22	19B209408P6	Variable, mica: 37-140 pf, 400 VDCW.
C23	19B209408P3	Variable, mica: 7-50 pf, 400 VDCW.
		- - - - - - - **DIODES & RECTIFIERS** - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - **JACKS & RECEPTACLES** - - - - - -
J1 thru J5	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J6	4033284P2	Terminal; sim to Alcon 3-1215.
J9 and J10	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J13	4033284P2	Terminal; sim to Alcon 3-1215.
J14 and J15	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - **INDUCTORS** - - - - - - - -
L3	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L4	7488079P3	Choke, RF: 0.33 µh ±20%, 0.07 ohms DC res max; sim to Jeffers 4411-3M.
L5	19B216275P5	Coil.
L6	7488079P13	Choke, RF: 5.60 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4421-4K.
L7	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L8	19A129167P1	Coil.
L9	19B219376P1	Coil.
L10	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L11	7488079P40	Choke, RF: 5.60 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4422-1K.
L12	19B219376P2	Coil.
L14	19A129281P1	Coil.
L15	19B216365G1	Coil.
L16	19B219376P1	Coil.
L17	19A129166P1	Coil.
L18	7488079P49	Choke, RF: 33.0 µh ±10%, 1.90 ohms DC res max; sim to Jeffers 4422-10K.
L19	19A129282P1	Coil.
		- - - - - - - - - **TRANSISTORS** - - - - - - - -
Q1 and Q2	19A129181P1	Silicon, NPN.
Q3	19A129181P3	Silicon, NPN.
Q4	19A129181P4	Silicon, NPN.
		- - - - - - - - - - **RESISTORS** - - - - - - - - -
R1	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
R2	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R3 and R4	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R5	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R6	3R77P300J	Composition: 30 ohms ±5%, 1/2 w.
R7*	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
		Earlier than REV A:
	3R77P910K	Composition: 91 ohms ±10%, 1/2 w.
R8	3R78P100K	Composition: 10 ohms ±10%, 1 w.
R9*	3R78P471K	Composition: 470 ohms ±10%, 1 w.
		Earlier than REV A:
	3R78P101K	Composition: 100 ohms ±10%, 1 w.
R10	3R78P100K	Composition: 10 ohms ±10%, 1 w.
A202		**MATCHING NETWORK 19C320162G1**
		- - - - - - - - - **CAPACITORS** - - - - - - - - -
C1	19B209408P3	Variable, mica: 7 to 50 pf, 400 VDCW.
C2	19A116288P11	Ceramic: 82 pf ±5%, 100 VDCW; sim to Erie 8121-100-COG-820J.
		- - - - - - - **JACKS & RECEPTACLES** - - - - - -
J3	7104941P20	Receptacle, coaxial: sim to National Tel.
		- - - - - - - - - - **PLUGS** - - - - - - - - - -
P201	4029840P2	Contact, electrical: sim to Amp 42827-2.
P202	4029840P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - - **CABLES** - - - - - - - - - -
W1	19B209044P13	RF: approx 3 inches long; sim to Amphenol 421-105.
		- - - - - - - - **MISCELLANEOUS** - - - - - - - -
	19C317960P1	Heat sink.
	7147306P2	Washer, shoulder: No. 6, black pressed fiber; sim to H.H. Smith Inc 2150. (Used with L15).
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20. (Used with Q1-Q4).

*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 - PA Board (19D416268G2)

To improve power output. Changed R7 and R9

PARTS LIST

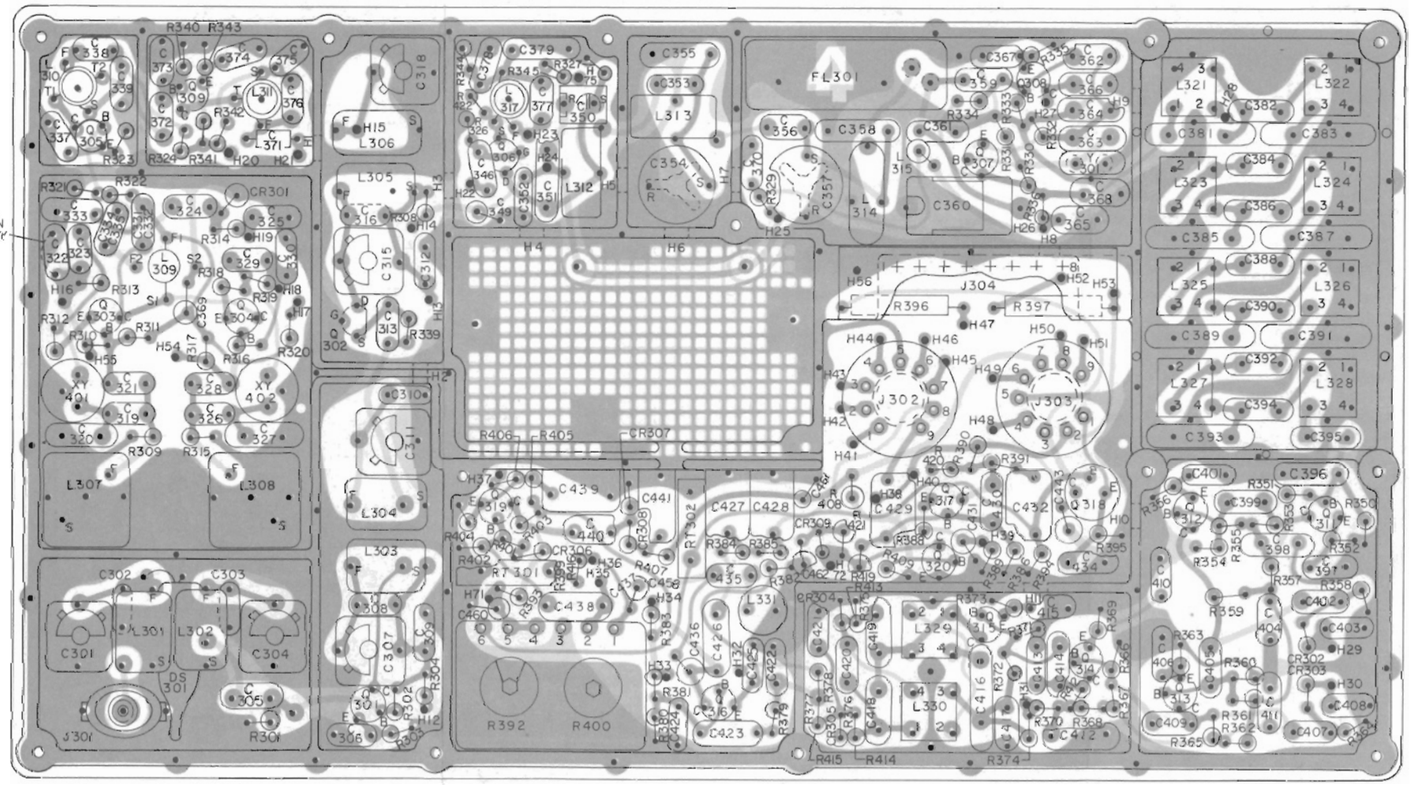
LBI-4257C

132-174 MHz RECEIVER
MODELS 4ER48C10-15

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C301	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C302	19A116656P5J8	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C303	19A116656P5J2	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -220 PPM.
C304	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C305	5490008P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C306	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C307	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C308	19A116656P5J2	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -220 PPM.
C309	7491827P102	Ceramic disc: .01 µf +80%-30%, 50 VDCW; sim to Sprague 19C180.
C310	19A116656P5J3	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -330 PPM.
C311	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C312	7491827P102	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C313	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C315	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C316	19A116656P5J2	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef -220 PPM.
C318	5491271P106	Variable, air: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C319A	5496219P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM.
C319B	5496219P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM.
C320A	5496219P357	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C320B	5496219P356	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C321A and C321B	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C322	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C323	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C324	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C325	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C326A	5496219P447	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -220 PPM.
C326B	5496219P444	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -220 PPM.
C327A	5496219P357	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -150 PPM.
C327B	5496219P356	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C328A and C328B	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C329	5496219P34	Ceramic disc: 3 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C330	19A116655P19	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C331A	5496219P744	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -750 PPM.
C331B*	5496219P740	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
		In REV A and earlier:
	5496219P741	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
C332A	5496219P744	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -750 PPM.
C332B*	5496219P740	Ceramic disc: 9 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
		In REV A and earlier:
	5496219P741	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -750 PPM.
C333	19A116655P19	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C334	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C335	5496219P38	Ceramic disc: 7 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C337	19A116655P19	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C338A	5496219P241	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C338B	5496219P238	Ceramic disc: 7 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C339	19A116655P19	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C346	19A116655P19	Ceramic disc: .001 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C349	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C350	19A116462P3	Variable: less than 2 pf to more than 20 pf, 100 VDCW, -320 PPM/°C.
C351*	19C300685P248	Ceramic disc: 62 pf ±2%, 500 VDCW, temp coef -80 PPM.
		Earlier than REV A:
	5496219P259	Ceramic disc: 68 pf ±5%, 500 VDCW, temp coef -80 PPM.
C352	7491827P102	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C353	5496219P35	Ceramic disc: 4 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C354	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie 557-36.
C355	5496219P158	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -30 PPM.
C356	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C357	5490446P2	Variable, ceramic: approx 5-25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie 557-36.
C358	5496219P158	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -30 PPM.
C359	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C360	19A115659P1	Variable: approx 16-141 pf, 150 VDCW; sim to El Menco Type 42.
C361	5496219P54	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef 0 PPM.
C362	5496219P13	Ceramic disc: 22 pf ±10%, 500 VDCW, temp coef 0 PPM.
C363	5490008P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C364	5490008P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C365	19A116080P6	Polyester: .068 µf ±20%, 50 VDCW.
C366	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C367	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C368	19A116080P6	Polyester: .068 µf ±20%, 50 VDCW.
C369	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C370	7491827P2	Ceramic disc: .01 µf +80%-30%, 50 VDCW; sim to Sprague 19C180.
C371A	5491601P116	Phenolic: 0.62 pf ±5%, 500 VDCW.
C371B	5491601P108	Phenolic: 0.30 pf ±5%, 500 VDCW.
C372	5496219P38	Ceramic disc: 7 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C373	5496219P36	Ceramic disc: 5 pf ±0.25 pf, 500 VDCW, temp coef 0 PPM.
C374	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C375	19A116655P13	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C376A	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C376B and C377A	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C377B	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C378	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C379	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C381	19A116656P160J1	Ceramic disc: 160 pf ±5%, 500 VDCW, temp coef -150 PPM.
C382	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C383	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C384	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C385	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C386	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C387	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C388	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C389	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C390	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C391	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C392	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C393	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C394	5496219P42	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C395	5490008P34	Silver mica: 200 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C396	5494481P128	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C397	19A116080P1	Polyester: .01 µf ±20%, 50 VDCW.
C398	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C399	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C401	19A116080P1	Polyester: .01 µf ±20%, 50 VDCW.
C402	5490008P119	Silver mica: 47 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C403	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

JUMPER USED IN SINGLE FREQ ONLY

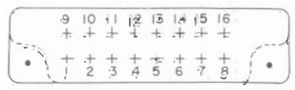


(19D415259, Rev. 2)
(19D413909, Sh. 1, Rev. 4)
(19D413909, Sh. 2, Rev. 4)

RESISTANCE READINGS

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

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

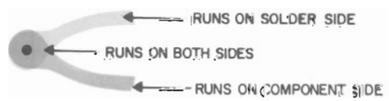


TERMINAL NUMBERING FOR J304

LEAD IDENTIFICATION FOR Q301, Q303, Q305, Q307, Q309, Q311 & Q321

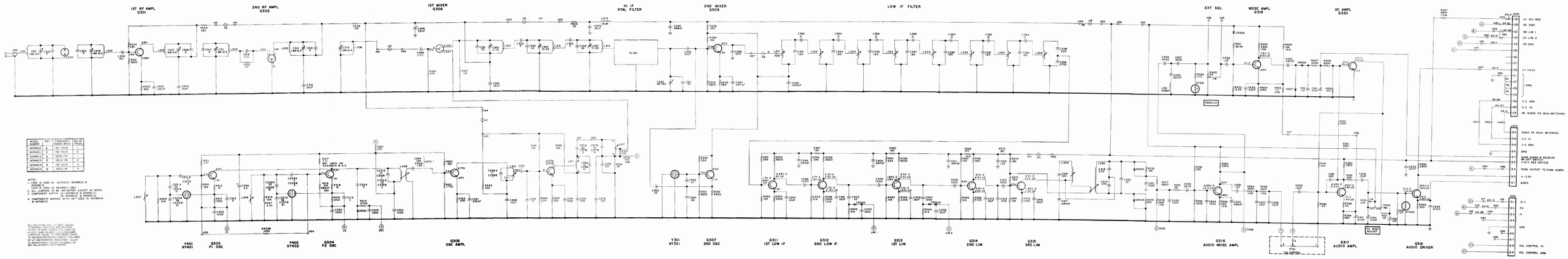
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR Q302, Q306



OUTLINE DIAGRAM

132—174 MHz RECEIVER
MODELS 4ER48C10-15



MODEL NUMBER	REV.	FREQUENCY RANGE (MHz)	MAX. IF FREQ.
4ER48C10	E	132-150.8	1
4ER48C11	E	132-150.8	2
4ER48C14	E	150.8-174	1
4ER48C15	E	150.8-174	2
4ER48C16	E	132-150.8	4
4ER48C18	E	150.8-174	4

NOTES:
1. C334-15 USED IN 4ER48C10, 4ER48C12 & 4ER48C16.
   C334-16 USED IN 4ER48C11, 4ER48C13, 4ER48C15 & 4ER48C18.
2. ALL COMPONENTS SHOWN EXCEPT AS NOTED.
3. ALL COMPONENTS SUFFIX (A) 4ER48C10 & 4ER48C11
   (B) 4ER48C12 & 4ER48C13
4. COMPONENTS MARKED WITH (A*) USED IN 4ER48C14 & 4ER48C15.

ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE INDICATED. RESISTANCE VALUES IN OHMS UNLESS FOLLOWED BY K=KILOHMS, M=MEGOHMS. ALL CAPACITORS ARE IN MICROFARADS UNLESS FOLLOWED BY P=PICOFARADS, PF=PICOFARADS. INDUCTANCE VALUES ARE IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

(19R621420, Rev. 9)

SCHEMATIC DIAGRAM

132—174 MHz RECEIVER
MODELS 4ER48C10-15

SYMBOL	GE PART NO.	DESCRIPTION
C404	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C405	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C406	19A116080P1	Polyester: .01 µf ±20%, 50 VDCW.
C407	7491393P1	Ceramic disc: .001 µf +100% -0%, 500 VDCW; sim to Sprague 1219C4.
C408	7491827P2	Ceramic disc: .01 µf +80% -30%, 50 VDCW; sim to Sprague 19C180.
C409	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C410	19A116080P1	Polyester: .01 µf ±20%, 50 VDCW.
C411	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C412	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C413	5494481P108	Ceramic disc: 470 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C414	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C415	19A116080P1	Polyester: .01 µf ±20%, 50 VDCW.
C416	19A116656P180J1	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -150 PPM.
C417	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C418 and C419	5490008P137	Silver mica: 270 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C420	5496219P656	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -470 PPM.
C421 and C422	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C423	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C424	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C425	19A116080P6	Polyester: .068 µf ±20%, 50 VDCW.
C426	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C427 and C428	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C429	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C430	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C431	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C432	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C434	5494481P14	Ceramic disc: 2000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C435	19A116080P203	Polyester: .002 µf ±5%, 50 VDCW.
C436	19C300075P47000J	Polyester: 4700 pf ±5%, 100 VDCW; sim to GE Type 61F.
C437	19C300075P33000J	Polyester: 3300 pf ±5%, 100 VDCW; sim to GE Type 61F.
C438	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C439	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C440	19A116080P5	Polyester: .047 µf ±20%, 50 VDCW.
C441	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C443	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C460	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C461	5496267P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C462	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR301	7777146P3	Germanium; sim to Type 1N90.
CR302 and CR303	4038056P1	Germanium.
CR304 and CR305	19A115250P1	Silicon.
CR306	5494922P1	Silicon; sim to Type 1N456.
CR307 thru CR309	19A115250P1	Silicon.
		- - - - - - - - INDICATING DEVICES - - - - - - -
DS301	19B209067P1	Lamp, glow: 0.3 ma; sim to GE NE-2T.
		- - - - - - - - - - FILTERS - - - - - - - - -
FL301	19C304219G1	Bandpass, 10.7 MHz.
		- - - - - - JACKS AND RECEPTACLES - - - - - -
J301	7104941P9	Jack, phono type: phen; sim to Cinch 14H20958.
J302 and J303	19B209303P1	Connector, phen: 9 pins.
J304	19B205689G2	Connector: 16 contacts.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L301	19B205530G1	Coil.
L302	19B205530G2	Coil.
L303*	19B205530G2	Coil.
		In REV A and earlier:
	19B205530G6	Coil.
L304	19B205530G2	Coil.
L305	19A128122P1	Coil.
L306	19A128122P2	Coil.
L307 and L308	19A121085G1	Coil. Includes tuning slug 19B200497P2.
L309	19B205236G1	Coil. Includes tuning slug 19B200497P2.
L310	19B219057G1	Coil. Includes tuning slug 19B200497P2.
L311	19B219059G1	Coil. Includes tuning slug 19B200497P2.
L312 and L313	19B205224G2	Coil.
L314	19B205224G3	Coil.
L315	7488079P18	Choke, RF: 15 µh ±10%, 1.2 ohms DC res max; sim to Jeffers 4421-9K.
L317	19B219059G2	Coil. Includes tuning slug 19B200497P2.
L321 and L322	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
L323	19A115711P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12671.
L324	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
L325	19A115711P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12671.
L326	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
L327	19A115711P2	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12671.
L328	19A115711P1	Transformer, freq: 455 KHz; sim to Automatic Mfg EX12670.
L329	19A115711P6	Transformer, freq: 455 KHz; sim to TOKO PEFCN-14733-CX12.
L330	19A115711P7	Transformer, freq: 455 KHz; sim to TOKO PEFCN-14734-BNL2.
L331	19B209405P1	Reactor, audio freq: 142 mh ±5% at 0.1 v thru 0.27 v; sim to Aladdin 405-101.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q301*	19A116859P1	Silicon, NPN; sim to Type 2N5032 or 2N3570.
		In REV B, C, D:
	19A115666P1	Silicon, NPN.
		In REV A and earlier:
	19A115342P1	Silicon, NPN.
Q302	19A115953P1	N channel, field effect.
Q303 and Q304	19A115925P1	Silicon, NPN.
Q305	19A115342P1	Silicon, NPN.
Q306*	19A116154P1	N channel, field effect.
		In REV A and earlier:
	19A115953P1	N channel, field effect.
Q307	19A115889P1	Silicon, NPN.
Q308	19A115245P1	Silicon, NPN.
Q309A* and Q309B*	19A115440P1	Silicon, NPN.
		In REV B, C, D:
	19A115666P1	Silicon, NPN.
		In REV A and earlier:
	19A115342P1	Silicon.
Q311 thru Q315	19A115889P1	Silicon, NPN.
Q316	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q317*	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		In REV C and earlier:
	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q318*	19A115300P4	Silicon, NPN; sim to Type 2N3053.
		In REV C and earlier:
	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q319	19A115889P1	Silicon, NPN.
Q320	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - -
R301	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R302	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R303	3R77P561K	Composition: 560 ohms ±10%, 1/2 w.
R304	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R308	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R309 and R310	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R311	3R77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R312	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
R313	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R314	3R77P472K	Composition: 4700 ohms ±10%, 1/2 w.
R315 and R316	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R317	3R77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R318	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
R319	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R320	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R321*	3R77P272K	Composition: 2700 ohms ±10%, 1/2 w.
		In REV A and earlier:
	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R322	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R323	3R77P431J	Composition: 430 ohms ±5%, 1/2 w.
R324	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R326	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R327	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R329	3R152P330K	Composition: 33 ohms ±10%, 1/4 w.
R330	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R331	3R77P822K	Composition: 8200 ohms ±10%, 1/2 w.
R332	3R77P392K	Composition: 3900 ohms ±10%, 1/2 w.
R333	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R334	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R335	3R77P561K	Composition: 560 ohms ±10%, 1/2 w.
R336	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R337	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R338	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R339	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R340*	3R77P272K	Composition: 2700 ohms ±10%, 1/2 w.
		In REV A and earlier:
	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R341	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R342	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R343	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R344	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
R345	3R152P623K	Composition: 62,000 ohms ±10%, 1/4 w.
R350	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R351	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R352	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R353	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R354	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R355	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R356	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R357	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R358	3R77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R359	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R360	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R361	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R362	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R363	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R364	3R77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R365	3R77P562K	Composition: 5600 ohms ±10%, 1/2 w.
R366	3R77P123K	Composition: 12,000 ohms ±10%, 1/2 w.
R367	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R368	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R369	3R77P512J	Composition: 5100 ohms ±5%, 1/2 w.
R370	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R371	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R372	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R373	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R374	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R375 and R376	3R77P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R377	3R77P682K	Composition: 6800 ohms ±10%, 1/2 w.
R378	3R152P104K	Composition: 0.1 megohm ±10%, 1/4 w.
R379	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R380	3R77P332J	Composition: 3300 ohms ±5%, 1/2 w.
R381	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R382	3R152P221J	Composition: 220 ohms ±5%, 1/4 w.
R383	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R384	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R385	3R152P152K	Composition: 1500 ohms ±10%, 1/4 w.
R386*	3R77P163J	Composition: 16,000 ohms ±5%, 1/2 w.
		In REV C and earlier:
	3R77P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R388	3R77P300J	Composition: 30 ohms ±5%, 1/2 w.
R389	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R390	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R391	3R77P431K	Composition: 430 ohms ±10%, 1/2 w.
R392(R400	19B209320P1	Resistor assembly. Variable, carbon film, includes: (R392) 20,000 ohms ±20%, 0.25 w; (R400) 5000 ohms ±20%, 0.25 w; sim to Centralab Series 5 (Type 71-2).
R393	3R77P392K	Composition: 3900 ohms ±10%, 1/2 w.
R394	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R395	3R77P331K	Composition: 330 ohms ±10%, 1/2 w.
R396 and R397	19A116278P444	Metal film: 0.28 megohm ±2%, 1/2 w.
R399	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R400		(See R392).
R401	19A116278P357	Metal film: 38,300 ohms ±2%, 1/2 w.
R402	19A116278P313	Metal film: 13,300 ohms ±2%, 1/2 w.
R403	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R404	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R405	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R406*	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
		In REV B and earlier:
	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R407	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R408	3R77P822J	Composition: 8200 ohms ±5%, 1/2 w.
R409	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R412	3R77P561K	Composition: 560 ohms ±10%, 1/2 w.
R417	3R152P432J	Composition: 4300 ohms ±5%, 1/4 w.
R419	3R77P433J	Composition: 43,000 ohms ±5%, 1/2 w.
R420	3R77P564J	Composition: 0.56 megohm ±5%, 1/2 w.
R421	3R77P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R442*	3R152P331K	Composition: 330 ohms ±10%, 1/4 w. Added by REV E.
		- - - - - - - - - THERMISTORS - - - - - - -
RT301	5490828P38	Rod: 1400 ohms ±5%, 1 w max; sim to Globar Type 492H.
RT302	5490828P35	Rod: 3800 ohms ±5%, 1 w max; sim to Globar Type 723B-H.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY401 and XY402	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		- - - - - - - - - - CRYSTALS - - - - - - - - -
Y301	19A110215G1	Quartz: freq 10245 KHz, temp range -30°C to +90°C.
Y401 and Y402	19B206221P1	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 - - - - - - -
	19A122139P1	Cover.
	19B205369G1	Top cover.
	19A121088P1	Can. (Used with L307 and L308).
	4035306P62	Washer, fiber. (Used with Y301, FL301).
	4036555P1	Insulator, washer: nylon. (Used with QS18).

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 4ER48C10-15

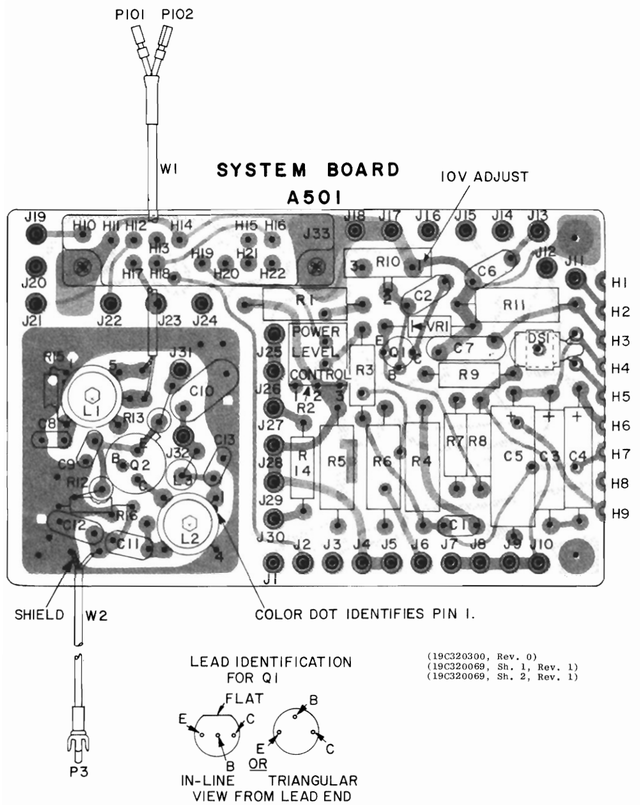
REV. B - Incorporated into initial shipment.

REV. C - To improve squelch action. Changed R406.

REV. D - To improve audio at -30°C. Changed Q317, Q318 and R386.

REV. E - To prevent oscillation. Changed Q301 and Q309. Added R422.

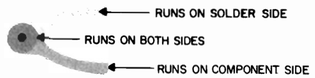
OUTLINE DIAGRAM



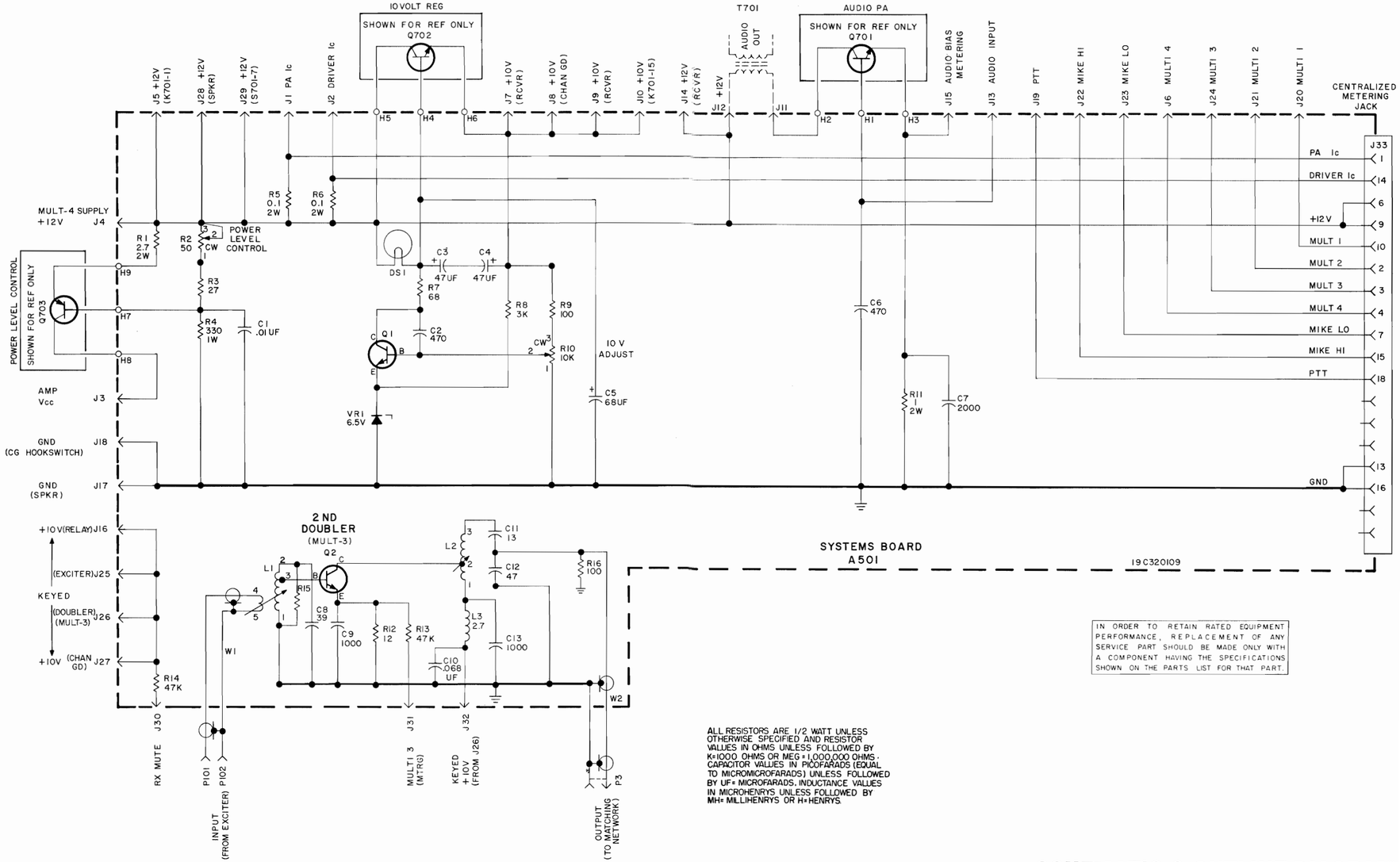
LEAD IDENTIFICATION FOR Q1

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

(19C320300, Rev. 0)
(19C320069, Sh. 1, Rev. 1)
(19C320069, Sh. 2, Rev. 1)



SCHEMATIC DIAGRAM



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

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

(19D416517, Rev. 3)

SCHEMATIC & OUTLINE DIAGRAM

SYSTEM BOARD 19C320109G1

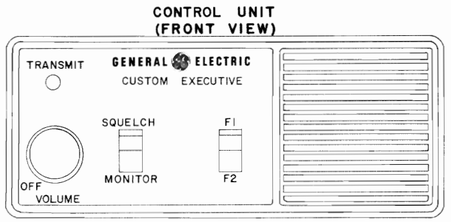
PARTS LIST

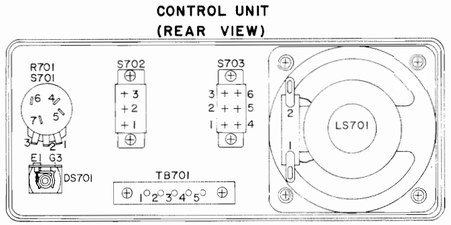
LBI-4351

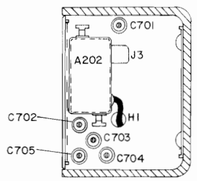
SYSTEMS BOARD
19C320109G1

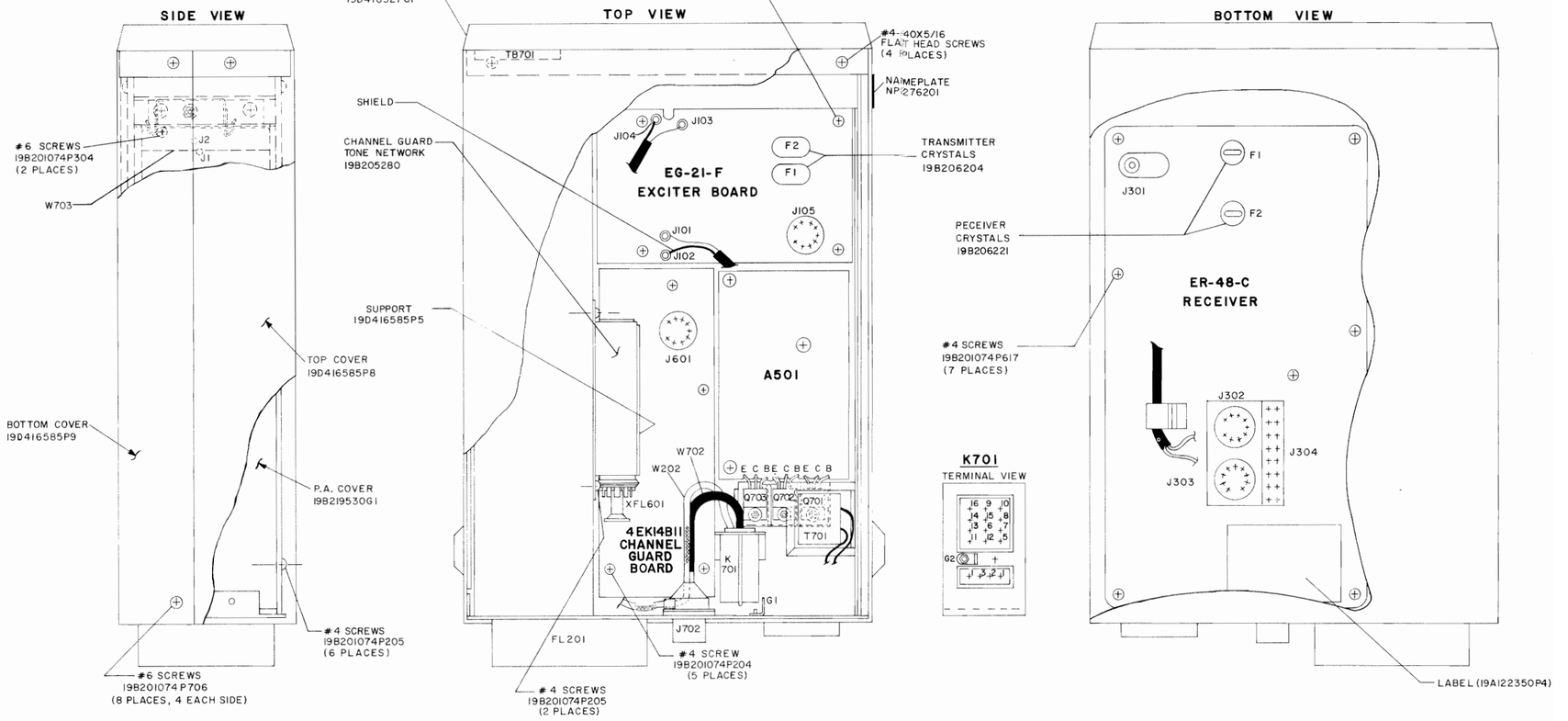
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - **CAPACITORS** - - - - - - - - -
C1	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C2	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C3 and C4	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C5	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C6	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C7	5494481P114	Ceramic disc: 2000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C8	19A116114P50	Ceramic: 39 pf ±5%, 100 VDCW; temp coef -150 PPM.
C9	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
C10	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C11	5496219P43	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef 0 PPM.
C12	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C13	5495323P12	Ceramic: .001 µf +100% -20%, 75 VDCW.
		- - - - - - - **INDICATING DEVICES** - - - - - - -
DS1	4034664P1	Lamp, incandescent: 28 v; sim to GE2148.
		- - - - - - - **JACKS & RECEPTACLES** - - - - -
J1 thru J32	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J33	19B205689G1	Connector: 16 contacts, includes (16) 19A115853P1 contacts.
		- - - - - - - - - **INDUCTORS** - - - - - - - - -
L1	19D402808G37	Coil. Includes:
R15	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
	5491798P2	Tuning slug.
L2	19D402808G35	Coil.
L3	7488079P9	Choke, RF: 2.70 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4411-13.
		- - - - - - - - - - **PLUGS** - - - - - - - - - -
P3		(Part of W2).
P101	4029840P2	Contact, electrical: sim to Amp 42827-2.
P102	4029840P1	Contact, electrical: sim to AMP 41854.
		- - - - - - - - - **TRANSISTORS** - - - - - - - -
Q1	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q2	19A116016P1	Silicon, NPN.
		- - - - - - - - - **RESISTORS** - - - - - - - -
R1	19B209022P25	Wirewound: 2.7 ohms ±5%, 2 w; sim to IRC Type BWH.
R2	19A116559P110	Variable, cermet: 50 ohms ±20%, 1/2 w; sim to CTS Series 360.
R3	3R77P270J	Composition: 27 ohms ±5%, 1/2 w.
R4	3R78P331J	Composition: 330 ohms ±5%, 1 w.
R5 and R6	19B209022P89	Wirewound: 0.1 ohms ±5%, 2 w; sim to IRC Type BWH.
R7	3R77P680J	Composition: 68 ohms ±5%, 1/2 w.
R8	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
R9	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R10	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R11	19B209022P15	Wirewound: 1.0 ohms ±5%, 2 w; sim to IRC Type BWH.
R12	3R77P120J	Composition: 12 ohms ±5%, 1/2 w.
R13 and R14	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R16	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - **VOLTAGE REGULATORS** - - - - - -
VR1	4036887P6	Silicon, Zener.
		- - - - - - - - - - **CABLES** - - - - - - - - -
W1	19B209044P19	RF: approx 6 inches; sim to Times M1-5280.
W2	19B219584G1	RF: approx 11 inches long.
		- - - - - - - - **MISCELLANEOUS** - - - - - - - -
	19A121252P1	Heat sink. (Used with Q2).
	4029006P3	Clip, compression: 0.375 x 0.19 x .02 inches; sim to Tinnerman C5426-014-24. (Used with Q2).
	4036555P1	Insulator, washer: nylon. (Used with Q2).
	4035711P4	Clip, spring tension: sim to Augat Bros. 6007-8-CT. (Used with DS1).
	19B201074P216	Screw, tap: No. 6-32. (Secures J33).

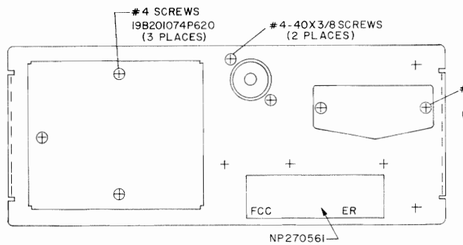
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



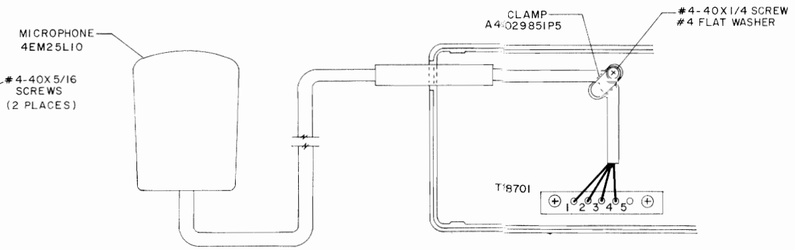








VIEW AT "A"



MICROPHONE CONNECTIONS	
WIRE COLOR	CONNECTION TO
MIKE-SHIELD	TB701-1
MIKE-R	TB701-2
MIKE-W	TB701-3
MIKE-BK	TB701-4

NOTES:

1. PART OF HARDWARE KIT FURNISHED WITH PL19D416527G1.
2. PART OF HARDWARE KIT FURNISHED WITH 4EK14B11.
3. TONE NETWORK TO BE ORIENTED SO MARKING APPEARS ON THIS SURFACE.
4. SPOT TIE P601 TO HARNESS IF CHANNEL GUARD OPTION NOT REQ'D.

OUTLINE DIAGRAM

CONTROL UNIT AND
ASSOCIATED ASSEMBLIES

(19R621860, Rev. 2)

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

CPD 310A

NOTES:

1. USE SF 24 WIRE UNLESS OTHERWISE NOTED.
2. CONNECT JUMPER BETWEEN P701-2 AND P701-5 IF 10 WATT SPKR IS USED. REMOVE JUMPER BETWEEN P701-2 AND P701-3.
3. FOR 2-FREQ XMIT & 1-FREQ RECEIVE, REMOVE JUMPER BETWEEN S703-5 AND S703-6.
   FOR 2-FREQ XMIT & 2-FREQ RECEIVE, REMOVE JUMPER BETWEEN S703-5 AND S703-6 AND S703-2 AND S703-3.
   FOR 1-FREQ XMIT & 2-FREQ RECEIVE, REMOVE JUMPER BETWEEN S703-2 AND S703-3.

(19R621784, Rev. 6)

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
19D416527G1	A

SCHEMATIC DIAGRAM

CONTROL UNIT AND ASSOCIATED ASSEMBLIES

PARTS LIST

LBI-4352B

CONTROL UNIT/SYSTEM
19D416527G1
AND
ASSOCIATED ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
		CONTROL UNIT 19C320132G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C706	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR701	19A115823P1	Silicon.
CR702	4037822P2	Silicon.
		- - - - - - - - INDICATING DEVICES - - - - - - -
DS701	4034664P1	Lamp, incandescent: 28 v; sim to GE2148.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J701	19C303576P1	Socket, phen: 13 contacts rated at amps max.
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS701	19A116701P1	Permanent magnet: 3 inch, 3.2 ohms ±10% voice coil imp, freq range to 1000 Hz; sim to Oaktron 3A3C.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P103	4029840P2	Contact, electrical: sim to Amp 42827-2.
P104	4029840P1	Contact, electrical: sim to AMP 41854.
P105	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
P302 and P303	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
P505	4029840P2	Contact, electrical: sim to Amp 42827-2.
P507 thru P510	4029840P2	Contact, electrical: sim to Amp 42827-2.
P513 thru P518	4029840P2	Contact, electrical: sim to Amp 42827-2.
P519	4029840P1	Contact, electrical: sim to AMP 41854.
P520 thru P522	4029840P2	Contact, electrical: sim to Amp 42827-2.
P523	4029840P1	Contact, electrical: sim to AMP 41854.
P524 thru P527	4029840P2	Contact, electrical: sim to Amp 42827-2.
P528 and P529	4029840P3	Contact, electrical: sim to AMP 42101-2.
P530 thru P532	4029840P2	Contact, electrical: sim to Amp 42827-2.
P601	19B209341P2	Socket, tube: 9 pins; sim to Elco 04-920-XX.
		- - - - - - - - - RESISTORS - - - - - - - - -
R701	5496870P13	Resistor/Switch: variable, carbon film: 5000 ohms ±20%; switch: DPST, 6 amps at 125 VAC; sim to Mallory LC(5K)OAC-2.
		- - - - - - - - - SWITCHES - - - - - - - - -
S701		(Part of R701).

SYMBOL	GE PART NO.	DESCRIPTION
S702	19A116622P3	Push: DPDT, .5 amp at 125 VDC/VAC, 2 amps at 14 VDC res max; sim to Switchcraft 51206LH.
S703	19A116622P2	Push: DPDT, .5 amp at 125 VDC/VAC, 2 amps at 14 VDC res max; sim to Switchcraft 51206LH.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB701	19A129242G1	Terminal board: 5 contacts.
		- - - - - - - - - - CABLES - - - - - - - - - -
W202	19A129265P1	RF: approx 6 inches long.
W301	19A129262P1	RF: approx 21 inches long.
W701	19B219518G1	System Cable. Includes C706, CR701, CR702, J701, P103-P105, P302, P303, P505, P507-P510, P513-P532, P601, R701, R702, S701-S703, TB701, W202, W301, W702, and XK701.
W702	19A122133G14	Antenna jack: approx 5 inches long. Includes (J702).
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK701	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A129240G1	Support. (Used with DS701).
	4031053P7	Nut, sheet spring; sim to Tinnerman C12046-012-87. (Used to secure LS701).
	N402P5C6	Flatwasher: No. 4. (Used to secure LS701).
	19A122138P1	Knob. (Used with P105, P302, P303, and P601).
	N197P408C6	Wood screw: steel, No. 4, 1/2" long. (Used with P105, P302, P303, and P601).
	7115130P9	Lockwasher: sim to Shakeproof 1220-2. (Used with R701-S701).
	7165075P2	Hex nut, brass: No. 3/8-32. (Used with R701-S701).
	19B201074P205	Screw, Phillips Pozidriv: 4-40-5/16. (Secures TB701).
	19A129260P1	Support. (Used with XK701).
	5491595P10	Retainer: spring; sim to Allied Control 30052-1. (Used with XK701).
	19D416585P1	Control head case.
	NP270664	Nameplate.
	19A129244G1	Knob. (VOLUME).
	19B204949P1	Jewel: red plastic lens. (TRANSMIT).
		SYSTEM
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL201	19C311460G5	Lowpass.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K701	19C307010P18	Armature: 12 VDC nominal, 1.5 w max operating, 130 ohms ±10% coil res, 4 form C contacts; sim to Allied Control 7154-X-976A.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P511 and P512	4029840P2	Contact, electrical: sim to Amp 42827-2.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q701	19A116742P1	Silicon, NPN.
Q702	19A116118P1	Silicon, NPN.
Q703	19A116375P1	Silicon, PNP.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T701	19B209079P1	Audio freq: 0.3-3 KHz freq range, Pri: 55 ohms ±10% imp, 0.895 ohm ±10% DC res, Sec: 3.2 ohms imp, 0.168 ohm DC res.

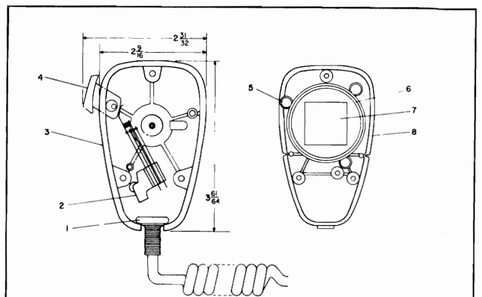
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W201		CABLE ASSEMBLY 19A129263G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P209	4029840P2	Contact, electrical: sim to Amp 42827-2.
P210	4029840P1	Contact, electrical: sim to AMP 41854.
W703		CABLE ASSEMBLY 19A129238G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C701 thru C705	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P203	4029840P2	Contact, electrical: sim to Amp 42827-2.
P204 and P205	4029840P3	Contact, electrical: sim to Amp 42101-2.
P206	19B209151P1	Terminal, solderless: sim to Amp 42284-5.
P213	19B209151P1	Terminal, solderless: sim to Amp 42284-5.
P501 thru P504	4029840P3	Contact, electrical: sim to Amp 42101-2.
P506	4029840P2	Contact, electrical: sim to Amp 42827-2.
		ASSOCIATED ASSEMBLIES
		POWER CABLE ASSEMBLY 19A129305G1
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A121322G1	Lead: approx 9 feet long.
	19A121314G4	Fused lead.
	7484390P4	Fuse, quick blowing: 8 amp 250 v; sim to Littelfuse 31408 or Bussmann ABC-08.
	19A121324G2	Jumper.
	19A121441G1	Vehicle Systems Plug.
	19C303574P1	Cover.
	4033204P5	Pad.
	N44P9006C13	Screw: No. 4 x 1/32. (Secures Vehicle Systems Plug to cover).
	19A121167P1	Screw: .750 dia. (Secures connector to radio).
		ANTENNA-4EY12A13 150.8-174 MHz
		- - - - - - - **MISCELLANEOUS** - - - - - - -
	19B201074P204	Tap screw, Phillips Pozidriv: No. 4-40 x 1/4. (Secures A501).
	19D416585P4	Backplate. (Locates FL201 and J701).
	19B219474P1	Cover. (Used with FL201).
	19A127181P1	Plate. (Used with FL201).
	19B201074P620	Tap screw: No. 4-40 x 1-1/4. (Secures cover to FL201).
	7878455P2	Solderless terminal. (Used with J701).
	5491595P9	Retainer: spring; sim to Allied Control 30040-2. (Used with K701).
	19A116023P1	Insulator plate. (Used with Q701-Q703).
	N402P55P6	Washer: No. 6. (Used with Q701-Q703).
	19A129318P1	Plate. (Used with Q701-Q703).

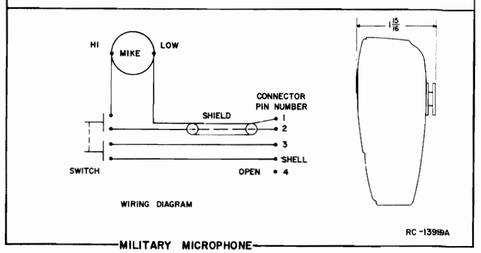
SYMBOL	GE PART NO.	DESCRIPTION
	7160861P27	Nut, sheet spring: sim to Tinnerman. (Secures T701).
	7878455P1	Solderless terminal. (Used with W202).
	19B209209P205	Tap screw: N. 4-40 x 5/16. (Secures Control Head to Chassis).
	19B201074P305	Screw, tap: No. 6-32 x 5/16. (Secures Backplate to frame).
	4038050P4	Cap screw: thread size 10-32 UNF2A. (Secures PA Board to channel).

PARTS LIST

MILITARY MICROPHONE
MODEL 4EM25L10

SYMBOL	GE PART NO.	DESCRIPTION
1		Cable clamp, front and back case. Shure Brothers RP897.
2		Switch. Shure Brothers RP26.
3		Case, back. (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		Case, front. (See item 1).
9		Cable: approx 6 feet long, includes (4) 4029840P1 female terminals. Shure Brothers RP786.





MILITARY MICROPHONE

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PA TRANSISTOR REPLACEMENT

WARNING

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

To replace the PA transistors (Q1 through Q4):

1. Unsolder one lead at a time with a 50-Watt soldering iron. Use a scribe to hold the lead away from the printed circuit board until the solder cools.
2. Remove the PA Assembly as directed in the Disassembly Procedure (see Table of Contents).
3. Hold the body of the transistor to prevent it from turning. Next, remove the transistor hold-down nut and springwasher through the hole in the heatsink with an 11/32-inch nut-driver. Lift out the transistor, and remove the old solder from the printed circuit board.
4. Trim the new transistor leads (if required) to approximately 3/8-inch lengths. Cut the collector lead at a 45° angle for future identification (see Figure 1). The letter "C" on the top of the transistor indicates the collector.
5. Apply a coating of silicon grease around the transistor mounting surface, and place the transistor in the mounting hole. Align the leads as shown in the Outline Diagram. Then hold the body of the transistor and replace the hold-down nut and spring washer, using moderate torque (6.5 inch-pounds for 150.8 to 470 MHz transmitters).
6. Make sure that the transistor is mounted as shown in Figure 2 so that the leads can be soldered to the printed curcuit pattern, starting from the inner edge of the mounting hole.
7. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board.

CAUTION

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

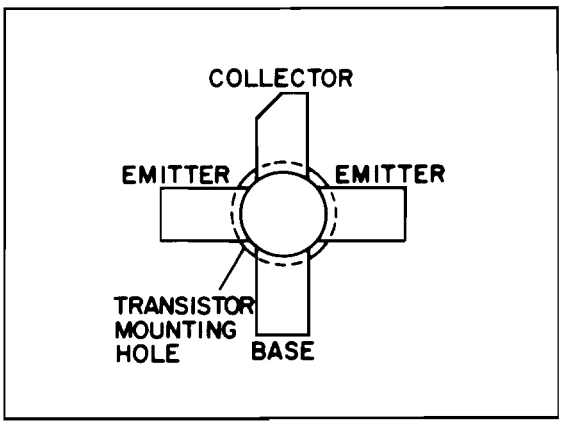


Figure 1 - Lead Identification

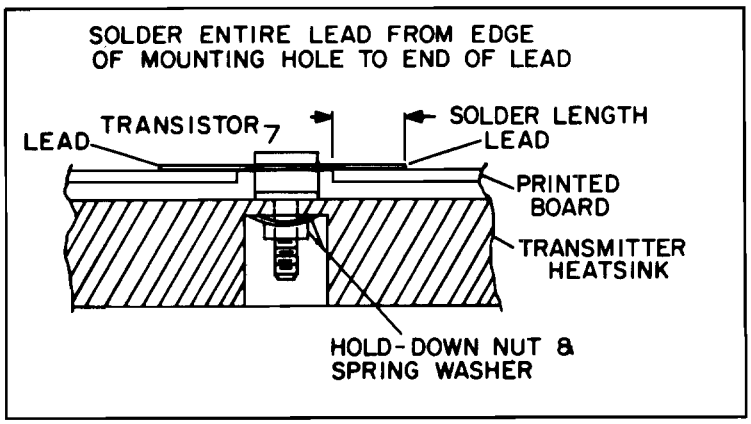


Figure 2 - Transistor Mounting

STEP 1 - QUICK CHECKS

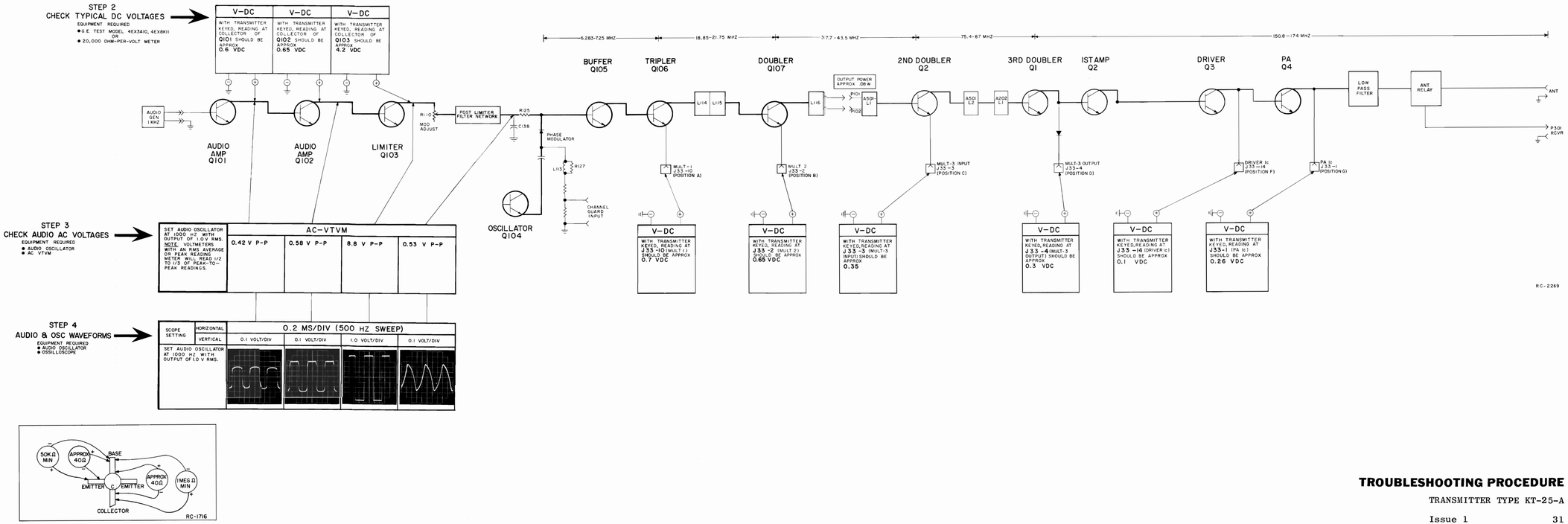
Meter Position	Probable Defective Stage		
	High Meter Reading	Low Meter Reading	Zero Meter Reading
A (MULT-1)	Q105 or Q106	Q105 or open L113	10-Volt regulator, osc. crystal or Q104, Q105, Q106
B (MULT-2)	Q107, A201-Q1	Q107	Q107
C (MULT-3) INPUT	A201-Q1	10-Volt regulator, A201-Q1	10-Volt regulator, A201-Q1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

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

PA TRANSISTOR CHECKS

PA transistors Q1 thru Q4 can be checked to determine if they are defective by measuring the junction resistances with an ohmmeter according to the following procedure:

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



STEP I - 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 and Q702 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 Front End 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).
NO AUDIO	Check jumper connections on power cable.
LOW AUDIO	Check Audio PA (Q701) output current at J304-9. If reading is low -- a. Check BIAS ADJ for 0.25 VDC at J304-9. If incorrect, set for 0.25 V with R392 (Position G 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.
DISCRIMINATOR IDLING TOO FAR OFF ZERO	See if discriminator zero is in the center of IF bandpass.

TROUBLESHOOTING PROCEDURE

RECEIVER MODELS 4ER48C10-15

STEP 3- GAIN-PER-STAGE READINGS-

EQUIPMENT REQUIRED:

1. RF VOLTMETER (SIMILIAR TO BOONTON MODEL 91-CA OR MILLIVAC TYPE MV-16 C.
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION) CORRECT FREQUENCY CAN BE DETERMINED BY ZEROING THE DISCRIMINATOR.

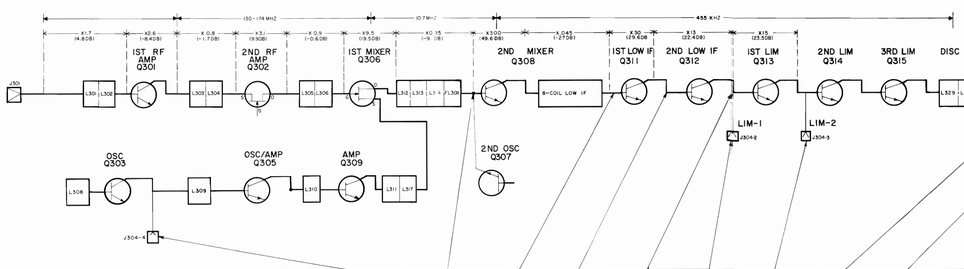
PROCEDURE

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE, BASE OF RF AMP). PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (E1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (1ST MIXER). REPEAK FIRST RESONANT CIRCUIT THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (E2).
3. CONVERT READINGS (BY SUBTRACTING E1 FROM E2 ON THE DB SCALE OF RF VOLTMETER, OR) BY MEANS OF THE FOLLOWING FORMULA:

$$\text{AMP FACTOR } \frac{E2}{E1}$$

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-ACDC
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 OUTPUT SETTING AT MAINTAIN DISCRIMINATOR ZERO		UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED	10 MICROVOLTS UNMODULATED	1 MICROVOLT UNMODULATED	STANDARD SIGNAL (1 KHZ AT RCVR FREQ MOD BY 1 KHZ WITH 3.5 KHZ DEVIATION)	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL	NO SIGNAL	STANDARD SIGNAL	STANDARD SIGNAL
PROCEDURE		INCREASE GENERATOR OUTPUT UNTIL VTVM READING IS ONE SCALE DECREASES BY 50 MV	INCREASE SIGNAL GENERATOR OUTPUT (FROM STEP UNTIL VTVM READING DECREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM STEP UNTIL VTVM READING DECREASES BY 5%	INCREASE SIGNAL GENERATOR OUTPUT FROM STEP UNTIL VTVM READING DECREASES BY 5%												ADJUST VOLUME FOR RATED 1 WATT OUTPUT.	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 MULTIMTR 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 MULTIMTR 0.4 VDC	1.6 VDC EX-3-A 0.4 VDC MULTIMTR 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	.185 VAC	0.25 VDC EX-3-A 0.25 VDC MULTIMTR 0.25 VDC	8.2 VAC	1.77 VAC

STEP 2B-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:

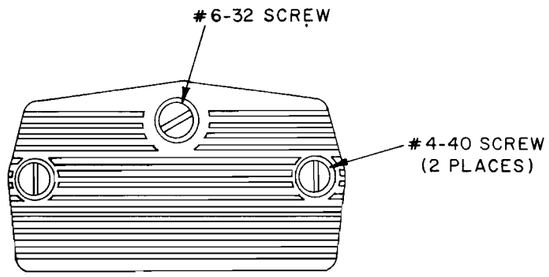
1. OSCILLOSCOPE
2. SIGNAL GENERATOR (MEASUREMENTS M560 OR EQUIVALENT)

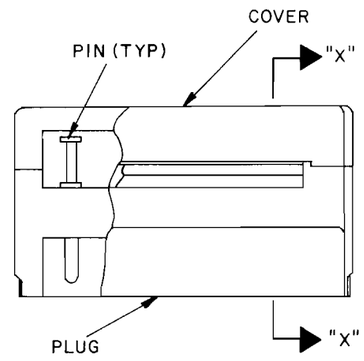
SCOPE SETTING												
HORIZONTAL	0.5 MS/DIV (APPROX 200 CPS)	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV		0.5 MS/DIV	0.5 MS/DIV
VERTICAL	0.5 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV	1 VOLT/DIV	100 MILLIVOLTS/DIV		200 MILLIVOLTS/DIV	200 MILLIVOLTS/DIV		5 VOLTS/DIV	1 VOLT/DIV
PEAK-TO-PEAK VOLTAGE	2.2 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		24 V P-P	5.2 V P-P

NOISE WAVE FORM

STANDARD SIGNAL (1 MILLIVOLT AT RECEIVER FREQ MODULATED BY 1KHZ WITH 3.5 KHZ DEVIATION, WIDE BAND) 2.5 VAC RMS

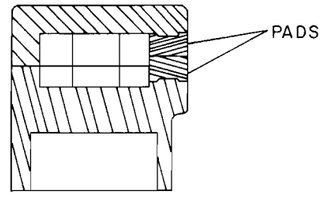
RC-2258





INSTALLATION INSTRUCTIONS

1. ASSEMBLE PINS IN PROPER HOLES.
2. ASSEMBLE COVER TO PLUG MAKING SURE LEADS LAY IN A SINGLE ROW AT CABLE ACCESS SLOT.
3. WHEN SOLDERING AN ADDITIONAL WIRE TO AN EXISTING PIN (AS IN HANDSET HOOKSWITCH) HOLD WIRE AND SOLDER BUILDUP TO A MINIMUM TO PREVENT SHORT CIRCUITS.
4. ASSEMBLE PADS IN APPROXIMATE POSITIONS SHOWN.

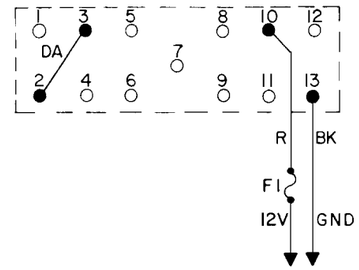


SECTION "X - X"

12V NEGATIVE GROUND

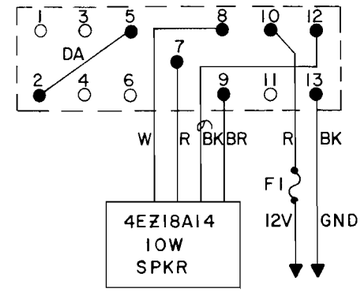
STANDARD CABLE

FIGURE 1



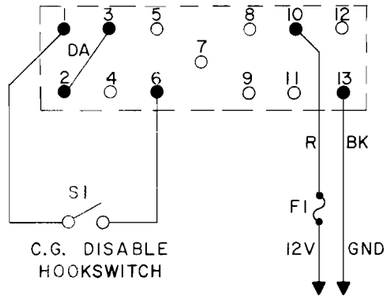
STANDARD CABLE WITH 10W SPEAKER OPTION

FIGURE 3



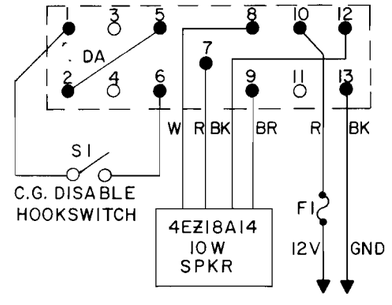
STANDARD CABLE WITH C.G. HOOKSWITCH OPTION

FIGURE 2



STANDARD CABLE WITH 10W SPEAKER OPTION AND C.G., HOOKSWITCH OPTION

FIGURE 4



(19C320195, Rev. 3)

This modification for 132-174 MHz receivers Type ER-48-C reduces the susceptibility of the receiver to intermodulation interference by decreasing the receiver sensitivity.

PROCEDURE

1. Remove the top cover from the receiver.
2. Unsolder the lead of capacitor C305 (see Figure 1) and solder one lead of a 39-ohm, 5%, 1/4-watt resistor (GE Part No. 3R152P390J) into the hole from which the capacitor lead was removed.
3. Solder the other lead of the resistor and capacitor together as shown in View "A".
4. Replace the top cover.

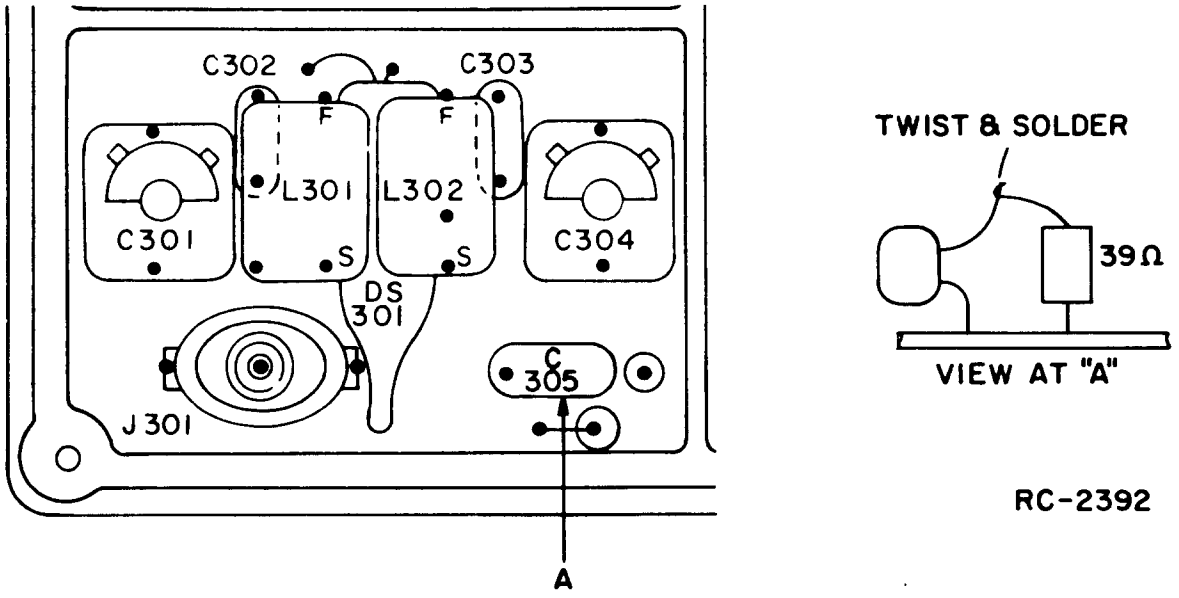


Figure 1 - Installation Diagram

TEST SPECIFICATIONS

1. Receiver specification changes are as follows:

20-dB Quieting	0.6 microvolts
12-dB SINAD	0.4 microvolts
EIA Intermodulation	unchanged (-70 dB)
Critical Squelch	less than 12-dB SINAD

2. More receiver sensitivity degradation can be obtained by increasing the value of the 39-ohm resistor in small increments.

MODIFICATION INSTRUCTIONS

REDUCTION OF INTERMODULATION INTERFERENCE
(OPTION 8302)