GE MOBILE RADIO

MASTR II MAINTENANCE MANUAL

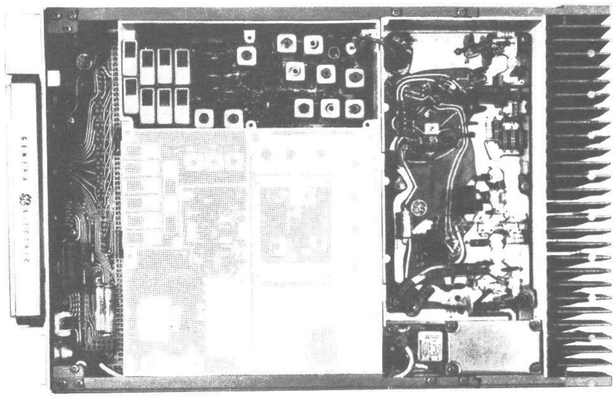
25-50 MHz, 50-WATT TRANSMITTER

Maintenance Manual LBI-4896 A

(Supercedes LBI-4487)

25-50 MHz EXCITER 19D416659G1-G8

50-WATT PA ASSEMBLY 19C321295G1-G4 AND G9-G12



SPECIFICATIONS *

Frequency Range	25-50 MHz
Power Output	50 Watts (Adjustable from 15 to 50 Watts)
Crystal Multiplication Factor	3
Frequency Stability	
5C-ICOM with EC-ICOM	±0.0005% (-40°C to +70°C)
5C-ICOM or EC-ICOM	±0.0002% (0°C to +55°C)
2C-ICOMS	±0.0002% (-40°C to +70°C)
Spurious and Harmonic Emission	At least 85 dB below full rated power output
Modulation	Adjustable from 0 to ±5 kHz swing with instantaneous modulation limiting.
Modulation Sensitivity	80 to 120 Millivolts
Audio Frequency Characteristics	Within +1 dB to -3 dB of a 6-dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA.
Distortion	Less than 2% (1000 Hz) Less than 3% (300 to 3000 Hz)
Deviation Symmetry	0.5 kHz maximum

Maximum Frequency Spread: (2 to 8 channels)	Full Specifications	1 dB Degradation
25-30 MHz	.160 MHz	.320 MHz
30-36 MHz	.200 MHz	.400 MHz
36-42 MHz	.240 MHz	.270 MHz
42-50 MHz	.280 MHz	.540 MHz

Duty Cycle	EIA 20% Intermittent
RF Output Impedance	50 Ohms

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

GENERAL ELECTRIC

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ILLUSTRATIONS

WARNING

Although the highest DC voltage in MASTR II Mobile Equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits! High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

DESCRIPTION

MASTR II transmitters are crystal-controlled, phase modulated and designed for one- through eight-frequency operation in the 25 to 50 megahertz band. The solid state transmitter utilizes both integrated circuits (ICs) and discrete components, and consists of the following assemblies:

- Exciter Board; with audio, modulator, amplifier and multiplier stages.
- Power Amplifier Assembly; with amplifier, driver, PA, power control, filter and antenna switch.

CIRCUIT ANALYSIS

EXCITER

The exciter uses nine transistors and two integrated circuits to drive the PA assembly. The exciter can be equipped with up to eight Integrated Circuit Oscillator Modules (ICOMs). The ICOM crystal frequency ranges from approximately 8.33 to 16.67 megahertz, and the crystal frequency is multiplied three times (divided by four and multiplied by 12 for a multiplication factor of three).

Audio, supply voltages and control functions are connected from the system board to the exciter board through P902.

Centralized metering jack J103 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The test set meters the modulator, multiplier and amplifier stages.

ICOMS

Three different types of ICOMs are available for use in the exciter. Each of the ICOMs contains a crystal-controlled Colpitts oscillator, and two of the ICOMs contain compensator ICs. The different ICOMs are:

- 5C-ICOM - contains an oscillator and a 5 part-per-million (±0.0005%) compensator IC. Provides compensation for EC-ICOMs.
- EC-ICOM - contains an oscillator only. Requires external compensation from a 5C-ICOM.
- 2C-ICOM - contains an oscillator and a 2 PPM (±0.0002%) compensator IC. Will not provide compensation for an EC-ICOM.

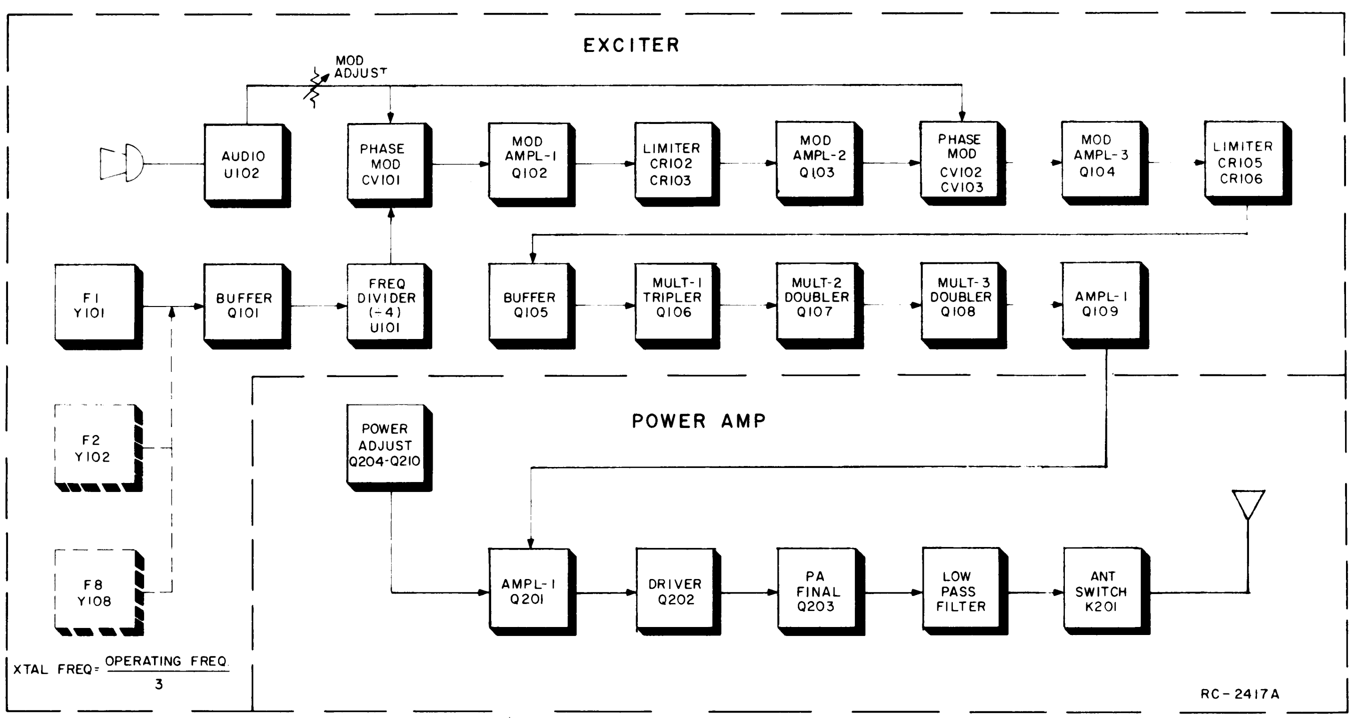


Figure 1 - Transmitter Block Diagram

The ICOMs are enclosed in a dust-proof, RF shielded can with the type ICOM (5C-ICOM, EC-ICOM, or 2C-ICOM) printed on the top of the can. Access to the oscillator trimmer is obtained by prying up the plastic tab on the top of the can. The tabs can also be used to pull the ICOMs out of the radio.

Frequency selection is accomplished by switching the ICOM keying lead (terminal 6) to A- by means of the frequency selector switch on the control unit. In single-frequency radios, a jumper from H9 to H10 in the control unit connects terminal 6 of the ICOM to A-. The oscillator is turned on by applying a keyed +10 Volts to the external oscillator load resistor. RF bypassing is provided for all unused keying leads on eight frequency radios. On two frequency radios, the six unused keying leads are shorted to ground.

CAUTION

All ICOMs are individually compensated at the factory and cannot be repaired in the field. Any attempt to repair or change an ICOM frequency will void the warranty.

In standard 5 PPM radios using EC-ICOMs, at least one 5C-ICOM must be used. The 5C-ICOM is normally used in the receiver F1 position, but can be used in any transmit or receive position. One 5C-ICOM can provide compensation for up to 15 EC-ICOMs in the transmit and receiver. Should the 5C-ICOM compensator fail in the open mode, the EC-ICOMs will still maintain 2 PPM frequency stability from 0°C to 55°C (+32°F to 131°F) due to the regulated compensation voltage (5 Volts) from the 10-Volt regulator IC. If desired, up to 16 5C-ICOMs may be used in the radio.

The 2C-ICOMs are self-compensated at 2 PPM and will not provide compensation for EC-ICOMs.

Oscillator Circuit

The quartz crystals used in ICOMs exhibit the traditional "S" curve characteristics of output frequency versus operating temperature.

At both the coldest and hottest temperatures, the frequency increases with increasing temperature. In the middle temperature range (approximately 0°C to +55°C), frequency decreases with increasing temperature.

Since the rate of change is nearly linear over the mid-temperature range, the output frequency change can be compensated by choosing a parallel compensation capacitor with a temperature coefficient approximately equal and opposite that of the crystal.

Figure 2 shows the typical performance of an uncompensated crystal as well as the typical performance of a crystal which has been matched with a properly chosen compensation capacitor.

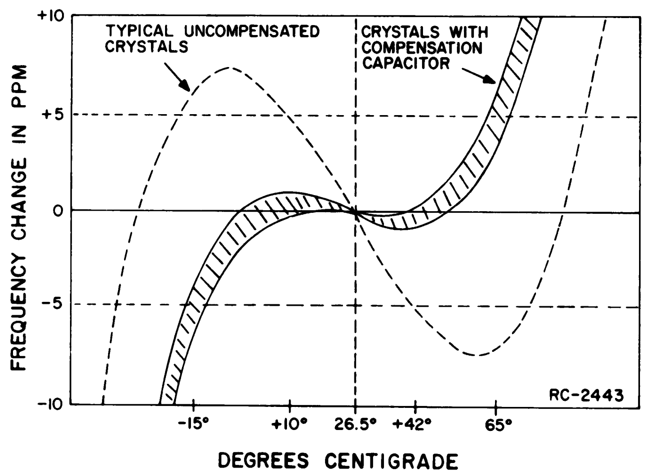


Figure 2 - Typical Crystal Characteristics

At temperatures above and below the mid-range, additional compensation must be introduced. An externally generated compensation voltage is applied to a varactor (voltage-variable capacitor) which is in parallel with the crystal.

A constant bias of 5 Volts (provided from Regulator IC U901 in parallel with the compensator) establishes the varactor capacity at a constant value over the entire mid-temperature range. With no additional compensation, all of the oscillators will provide 2 PPM frequency stability from 0°C to 55°C (32°F to 131°F).

Compensator Circuits

Both the 5C-ICOMs and 2C-ICOMs are temperature compensated at both ends of the temperature range to provide instant frequency compensation. An equivalent ICOM circuit is shown in Figure 3.

The cold end compensation circuit does not operate at temperatures above 0°C. When the temperature drops below 0°C, the circuit is activated. As the temperature decreases, the equivalent resistance decreases and the compensation voltage increases.

The increase in compensation voltage decreases the capacity of the varactor in the oscillator, increasing the output frequency of the ICOM.

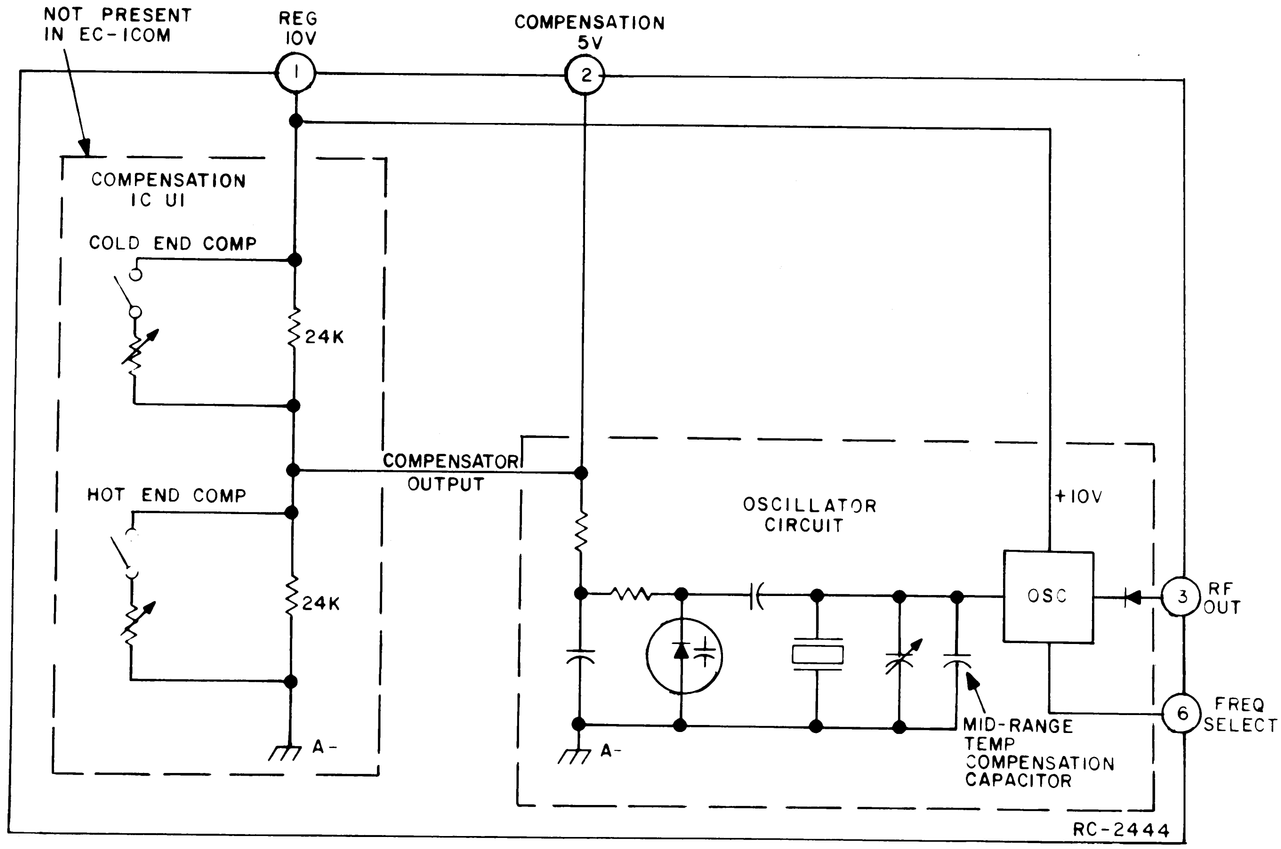


Figure 3 - Equivalent ICOM Circuit

The hot end compensation circuit does not operate at temperatures below +55°C. When the temperature rises above +55°C, the circuit is activated. As the temperature increases, the equivalent resistance decreases and the compensation voltage decreases. The decrease in compensation voltage increases the capacity of the varactor, decreasing the output frequency of the ICOM.

SERVICE NOTE: Proper ICOM operation is dependent on the closely-controlled input voltages from the 10-Volt regulator. Should all of the ICOMs shift off frequency, check the 10-Volt regulator module.

AUDIO IC

The transmitter audio circuitry is contained in audio IC U102. A simplified drawing of the audio IC is shown in Figure 4.

Audio from the microphone at pin 12 is coupled through pre-emphasis capacitor C1 to the base of Q1 in the operational amplifier-limiter circuit. Collector voltage for the transistorized microphone preamplifier is supplied from pin 11 through microphone collector load resistor R18 to pin 12.

The operational amplifier-limiter circuit consists of Q1, Q2 and Q3. Q3 provides limiting at high signal levels. The gain of the operational amplifier circuit is fixed by negative feedback through R19, R20 and R126.

The output of Q3 is coupled through a de-emphasis network (R10 and C3) to an active post-limiter filter consisting of C4, C5, C6, R11, R12, R13, R15, R17 and Q4.

Following the post-limiter filter is class A amplifier Q5. The output of Q5 is coupked through MOD ADJUST potentiometer R127 to the phase modulators.

SERVICE NOTE: If the DC voltages to the Audio IC are correct and no audio output can be obtained, replace U102.

For radios equipped with Channel Guard, tone from the encoder is applied to the phase modulators through CHANNEL GUARD MOD ADJUST potentiometer R128, and resistors R110, R121 and R124. Instructions for setting R128 are contained in the modulation adjustment section of the Transmitter Alignment Procedure.

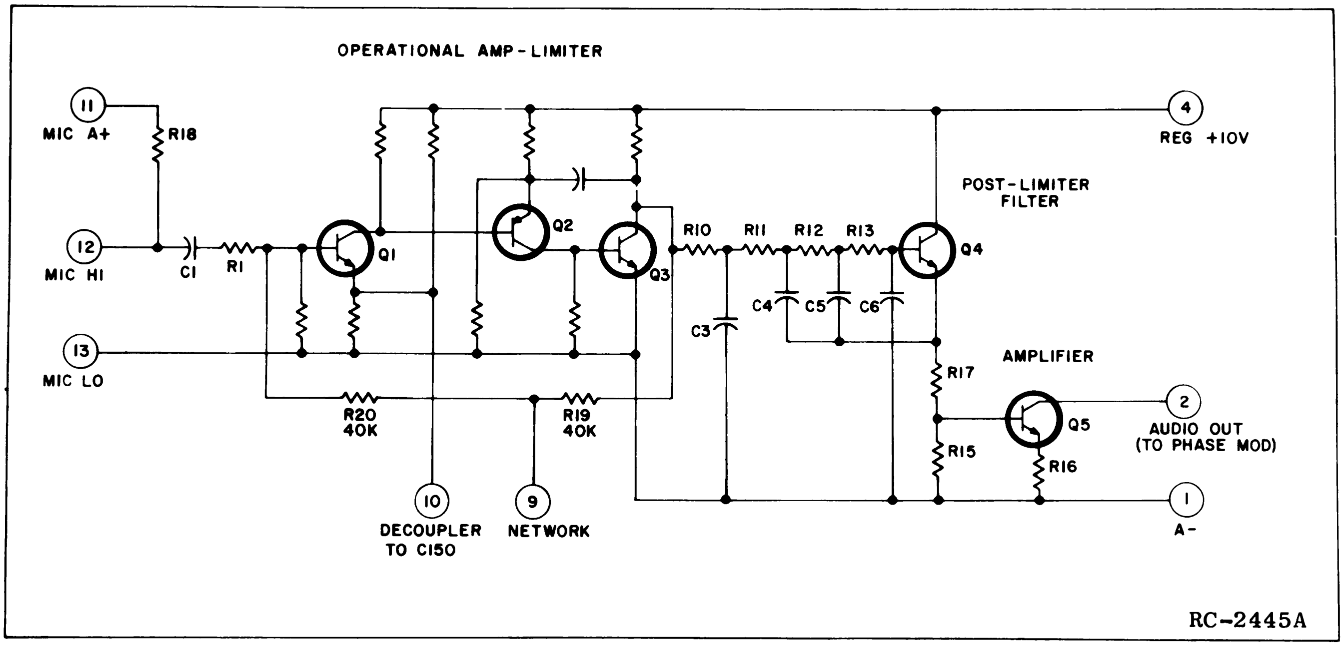


Figure 4 - Simplified Audio IC

FREQUENCY DIVIDER IC

The output at pin 3 of the selected ICOM is coupled through buffer amplifier Q101 to frequency divider U101, which divides the oscillator frequency by 4. The divider consists of two J-K flip-flops connected as a binary counter.

When the transmitter is not keyed (no ICOMs on), Q101 is saturated (turned on) with its collector voltage near zero. Keying the transmitter starts one of the ICOMs, and its output cuts Q101 on and off once each cycle. As Q101 turns off during each cycle, the drop in collector voltage causes the left flip-flop to change state. Assume the flip-flop was in the "0" state (the output at "Q" near A-). The first cycle of the oscillator output causes it to switch to the "1" stage (output at "Q" at approximately 5 Volts). The second cycle will cause the flip-flop to switch back to the "0" state. Therefore, it requires two oscillator cycles to switch the left flip-flop through one complete cycle from "0" to "1" and back to "0".

When the left flip-flop switches from "1" to "0", it causes the right flip-flop to change state. It requires two cycles of the left flip-flop to switch the right flip-flop from "0" to "1" and back to "0". Therefore, four cycles of the oscillator output are required for each cycle of output from pin 9 of U101.

If U101 was operating into a pure resistive load, its output would be a square wave. However, the modulator circuit presents a tuned load to the IC, so that harmonics are filtered out and the waveform at the junction of C102 and C103 (modulator input) is essentially a sine wave at one-fourth the oscillator frequency. The output of the frequency divider is coupled through DC blocking capacitor C102 to the first modulator stage.

PHASE MODULATORS, AMPLIFIERS AND MULTIPLIERS

The first phase modulator is varactor (voltage-variable capacitor) CV101 in series with tunable coil L101. This network appears as a series-resonant circuit to the RF output of the oscillator. An audio signal applied to the modulator circuit through blocking capacitor C115 varies the bias of CV101, resulting in a phase modulated output. A voltage divider network (R108 and R109) provides the proper bias for varactors CV101, CV102 and CV103.

The output of the first modulator is coupled through blocking capacitor C106 to the base of Class A amplifier Q102. The first modulator stage is metered through a metering network consisting of R115, R150, C107 and CR101. Diodes CR102 and CR103 remove any amplitude modulation in the modulator output.

Following Q102 is another Class A amplifier, Q103. The output of Q103 is applied to the second modulator stage. The second modulator consists of two cascaded modulator circuits consisting of CV102, L102, L103 and CV103. Following the second modulator is a Class A amplifier Q104. The output of the second modulator stage is metered through R133, R145, C117 and CR104, and is applied to the base of buffer Q105. Diodes CR105 and CR106 remove any amplitude modulation in the second modulator output.

Buffer Q105 is saturated when no RF signal is present. Applying an RF signal to Q105 provides a sawtooth waveform at its collector to drive the class C tripler, C106. The tripler stage is metered through R146. The output of Q106 is coupled through tuned circuits T101, T102 and T103 to the base of doubler Q107. T101, T102 and T103 are tuned to one-fourth of the operating frequency. The doubler stage is metered through R147.

The output of Q107 is coupled through tuned circuits T104 and T105 to the base of second doubler Q108. T104 and T105 are tuned to one-half the operating frequency. Q108 is metered through R148.

The output of Q108 is coupled through three tuned circuits (T106, T107 and T108) to the base of amplifier Q109. The circuits are tuned to the transmitter operating frequency.

Q109 is a class C amplifier with a collector feed network consisting of C139, C141, L104, L108 and R143. The stage is metered through R149. The amplifier collector circuit consists of C142, C143, C146 and L105, and matches the amplifier output to the input of the power amplifier assembly.

POWER AMPLIFIER

The PA assembly uses three RF power transistors and seven transistors in the Power Control circuitry to provide a power output of 50 Watts. The broadband PA has no adjustments other than Power Control potentiometer R216.

Supply voltage for the PA is connected through power leads from the system board to feedthrough capacitors C297 and C298 on the bottom of the PA assembly. C297, C298 and C299, L296 and L297 prevent RF from getting on the Power leads. Diode CR295 will cause the main fuse in the fuse assembly to blow if the polarity of the power leads is reversed.

Centralized metering jack J205 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), Ampl-1 power control, Driver and PA current.

RF AMPLIFIERS

The exciter output is coupled through an RF cable to PA input jack J203. The RF is coupled through DC blocking capacitor C202 to the base of Class C amplifier Q201 through a matching network. The network matches the 50-ohm input to the base of Q201, and consists of C205, C206, C235, L201, L202 and L203.

Part of the RF input is rectified by CR201 and used to activate the Power Control circuit. Another portion of the rectified RF is applied to voltage dividers R223 and R224 for metering the Ampl-1 drive at J205.

Collector voltage to Q201 (Ampl-1) is controlled by the Power Control circuit, and is applied through a collector stabilizing network consisting of L224 and R225 and collector feed network L204 and C207. The collector voltage of Q201 is metered through R235 at J205.

The output of Q201 is applied to the base of Class C driver Q202 through a low-pass filter matching network (C209, C210, L205 and L206). Resistors R202, R203 and R204 lower the gain of Q202. Collector voltage to Q202 is coupled through a collector stabilizing network consisting of L225 and R233 and collector feed network L208 and C213.

Collector current for Q202 is metered across tapped manganin resistor R230 at J205 (Driver Current). The reading is taken on the one-Volt scale with the High Sensitivity button pressed, and read as 10 amperes full scale.

Following Q202 is an interstage coupling network (C214 through C221, L209 through L211, R206 and R207.) The output is applied to the base of the class C PA stage, Q203. Supply voltage is coupled through a collector stabilizing network consisting of L226 and R234 and collector feed network C222 and L212.

Collector current for Q203 is metered across tapped manganin resistor R231 at J205. The reading is taken on the one-Volt scale with the High Sensitivity button pressed, and read as 10 amperes full scale.

The PA output is coupled through an output matching network (C224, C225, C226, L213 and L214,) to an M-derived, constant K low-pass filter. C230 through C233 provides ground isolation for ± ground operation. The filter output is applied to the antenna through antenna switch K201.

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.

POWER CONTROL CIRCUIT

When the transmitter is keyed, rectified RF from CR201 is applied to the base of switch Q204, turning it on. Turning on Q204 turns on voltage regulator Q206 which supplies a constant voltage to Power Adjust potentiometer R216.

Q208, Q209 and Q210 operate as an amplifier chain to supply voltage to the collector of Q201 (Ampl-1). The setting of R216 determines the voltage applied to the base of Q208. The higher the voltage at the base of Q208, the harder the amplifiers conduct, supplying more collector voltage to Q201. The lower the voltage at the base of Q208, the less collector voltage is supplied to Q201. Reducing the supply voltage to Q201 reduces the drive to Q202 and Q203, thereby reducing the power output of the PA. The power output can be adjusted by R216 from approximately 15 to 50 Watts.

Temperature protection is provided by Q205, Q207 and thermistor RT201 which is mounted in the PA heatsink. Under normal operating conditions, the circuit is inactive (Q205 is on and Q207 is off). When the heatsink temperature reaches approximately 100°C, the resistance of RT201 decreases. This increases the base voltage applied to Q205, turning it off. Turning off Q205 allows Q207 to turn on, decreasing the voltage at Power Adjust potentiometer R216. This reduces the base voltage to Q208 which causes Q209 and Q210 to conduct less, reducing the collector voltage to Q201 (Ampl-1). This reduces the transmitter output power, keeping the heatsink at a maximum of approximately 100°C. When the heatsink temperature decreases below 100°C, the temperature control circuit turns off, allowing the normal transmitter power output.

CARRIER CONTROL TIMER

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

The timing cycle (transmitter keyed time) is normally set at the factory for a duration of one minute. A potentiometer permits the timing cycle to be adjusted from approximately 15 seconds to 3 minutes.

MAINTENANCE

DISASSEMBLY

To service the transmitter from the top:

1. Pull the locking handle down, then pry up the top cover at the front notch and lift off the cover.

To service the transmitter from the bottom:

1. Pull the locking handle down and pull the radio out of the mounting frame.

2. Remove the top cover, then loosen the two bottom cover retaining screws and remove the bottom cover (see Figure 5).

3. To gain access to the bottom of the exciter board, remove the six screws (A) holding the exciter board and its bottom cover to the module mounting frame, and remove the bottom cover.

To remove the exciter board from the radio:

1. Unplug the exciter/PA cable (B) .

2. Remove the six screws (A) holding the exciter board and its bottom cover to the module mounting frame (see Figure 6).

3. Press straight down on the plug-in exciter from the top to avoid bending the pins when unplugging the board from the system board jack.

To remove the PA assembly:

1. Remove the PA top cover and unplug the exciter/PA cable (B) , the antenna, receiver and PTT cables (C) .

2. Remove the four side-rail screws (D) , and unsolder the power cables from the bottom of the PA assembly if desired.

To remove the PA board:

1. Remove the PA top cover and unplug the exciter/PA cable (B) .

2. Unsolder the two feedthrough coils (E) and the thermistor leads (F) .

3. Remove the PA transistor hold-down nuts and spring washers on the bottom of the PA assembly.

4. Remove the four PA board mounting screws (G) , the five screws in the filter casting (H) , and the retaining screw in Q210 (J) , and lift the board out

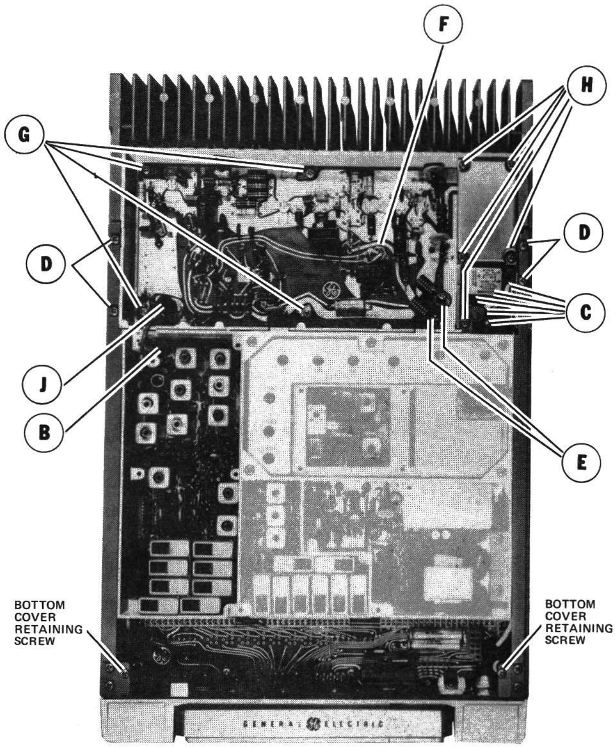


Figure 5 - Disassembly Procedure
Top View

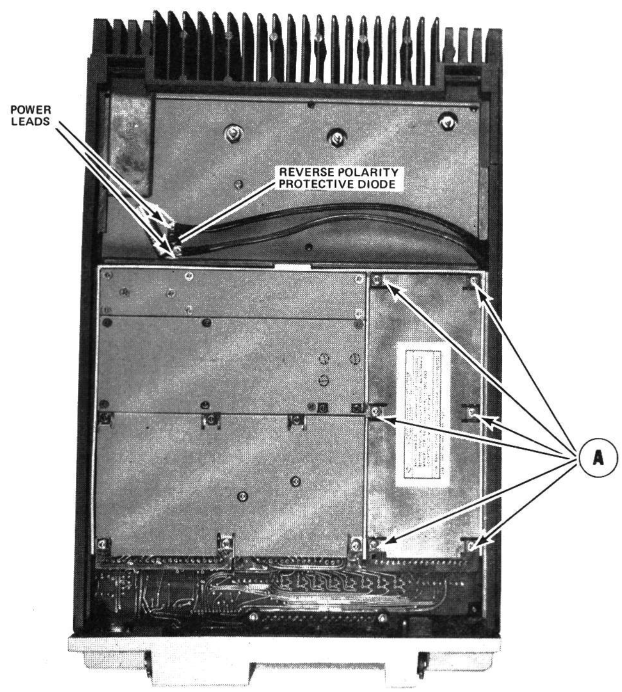


Figure 6 - Disassembly Procedure
Bottom View

PA TRANSISTOR REPLACEMENT

WARNING

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

To replace the PA RF transistors:

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

2. Turn the transmitter over.

3. Hold the body of the transistor to prevent it from turning. Remove the transistor hold-down nut and spring washer through the hole in the heatsink with an 11/32-inch nut-driver for Q201 and Q202, and a 3/8-inch nut-driver for Q203. Lift out the transistor, and remove the old solder from the printed circuit board with a de-soldering tool such as a SOLDA PULLT®. Special care should be taken to prevent damage to the printed circuit board runs.

4. Trim the new transistor leads (if required) to the lead length of the removed transistor. Cut the collector lead at a 45° angle for future identification (see Figure 7). 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 holding-down nut and spring-washer, using moderate torque (6.5 inch-pounds for Q201 and Q202, and 11 inch-pounds for Q203). A torque wrench must be used for this adjustment since transistor damage can result if too little or too much torque is used.

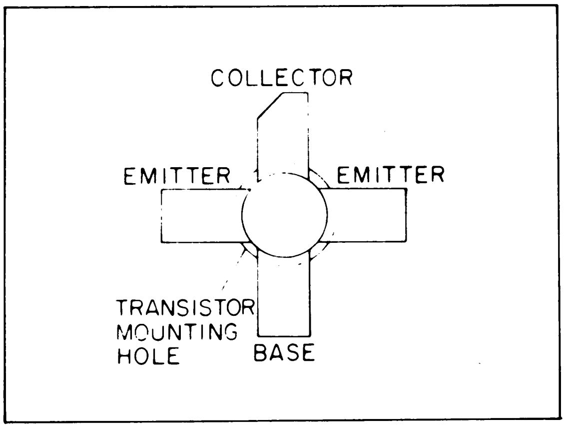


Figure 7 - Lead Identification

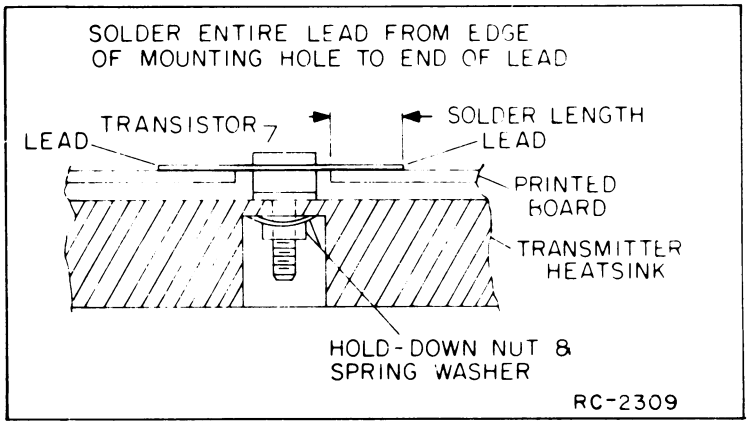


Figure 8 - Lead Forming

6. Make sure that the transistor leads are formed as shown in Figure 8 so that the leads can be soldered to the printed circuit pattern, starting from the inner edge of the mounting hole.

7. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board. Use care not to use excessive heat that causes the printed wire board runs to lift up from the board. Check for shorts and solder bridges before applying power.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor or may cause low power output.

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R127) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause overmodulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing overmodulation while preserving intelligibility.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Models 4EX3A11 or 4EX8K12

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J10 (Green-Hi) and J11 (Black-Lo) on GE Test Set, or across P902-6 (Mike High) through a 0.5 microfarad (or larger) DC blocking capacitor, and P902-5 (Mike-Low) on the System Board.
2. Adjust the audio oscillator for 1-Volt RMS at 1000 Hz.
3. For transmitters without Channel Guard, set MOD ADJUST R127 for a 4.5-kilohertz swing with the deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.
4. For transmitters with Channel Guard, set Channel Guard MOD ADJUST R128 for zero tone deviation. Next, with the 1-Volt signal at 1000 Hz applied, set MOD ADJUST R127 for a 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R128 for 0.75 kHz tone deviation.
5. For multi-frequency transmitters, set the deviation as described in Steps 3 or 4 on the channel producing the largest amount of deviation.

PA POWER INPUT

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

$$P_i = \text{PA voltage} \times \text{PA current}$$

where:

P_i is the power input in Watts,

PA voltage is measured with Test Set Model 4EX3A11 in Position G on the 15-Volt range (read as 15 Volts full scale), and with the polarity switch in the (-) position. With Test Set Model 4EX8K12, use the B+ position and the 1-Volt range (read as 15 Volts full scale), with the HIGH SENSITIVITY button pressed and the polarity switch in the (-) position.

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

Example:

P_i = 12.6 Volts x 5.0 amperes = 63 Watts

ICOM FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set with a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 26.5°C (79.8°F).

MASTR II ICOMs should be reset only when the frequency shows deviations in excess of the following limits:

A. ±0.5 PPM, when the radio is at 26.5°C (79.8°F).

B. ±2 PPM at any other temperature within the range of -5°C to +55°C (+23°F to +131°F).

C. The specification limit (±2 PPM or ±5 PPM) at any temperature within the ranges of -40°C to -5°C (-40°F to +23°F) or +55°C to +70°C (+131°F to +158°F).

If an adjustment is required, pry up the cover on the top of the ICOM to expose the trimmer, and use one of the following procedures:

If the radio is at an ambient temperature of 26.5°C (79.8°F), set the oscillator for the correct operating frequency.

If the radio is not at an ambient temperature of 26.5°C, setting errors can be minimized as follows:

A. To hold setting error to ±0.6 PPM (which is considered reasonable for 5 PPM ICOMS):

   1. Maintain the radio at 26.5°C (±5°C) and set the oscillator to desired frequency, or-

   2. Maintain the radio at 26.5°C (±10°C) and offset the oscillator, as a function of actual temperature, by the amount shown in Figure 9.

B. To hold setting error to ±0.35 PPM (which is considered reasonable for 2 PPM ICOMs): Maintain unit at 26.5°C (±5°C) and offset the oscillator, as a function of actual temperature, by the amount shown in Figure 9.

For example: Assume the ambient temperature of the radio is 18.5°C (65.4°F). At that temperature, the curve shows a correction factor of 0.3 PPM. (At 25 MHz, 1 PPM is 25 Hz. At 50 MHz, 1 PPM is 50 Hz).

With an operating frequency of 50 MHz, set the oscillator for a reading of 15 Hz (0.3 x 50 Hz) higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 26.5°C), set the oscillator for the indicated PPM lower than the licensed operating frequency.

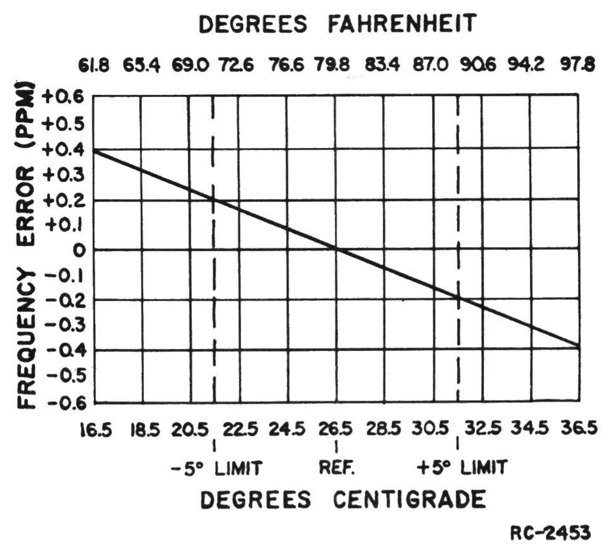
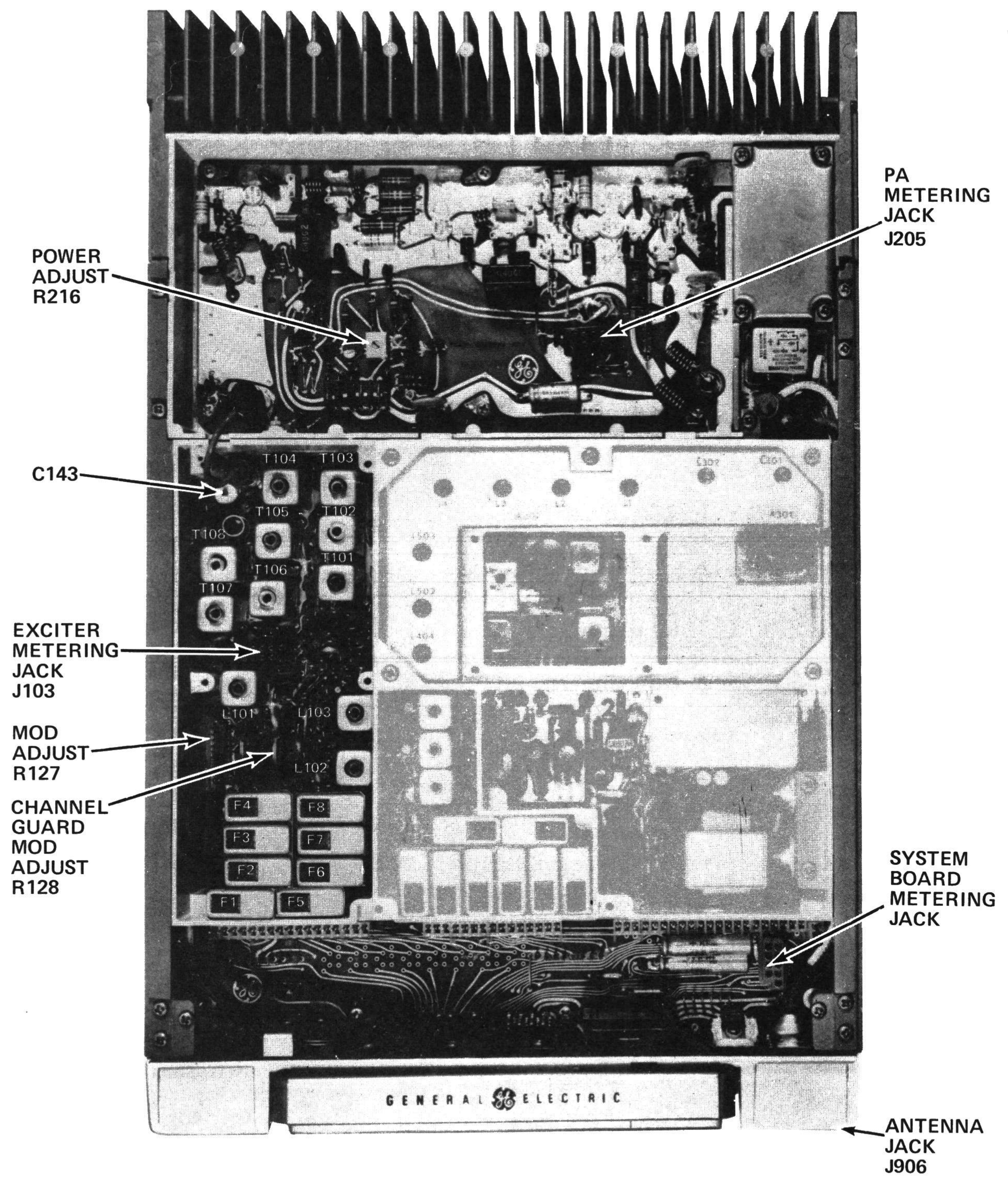


Figure 9 - Frequency Characteristics Vs. Temperature



TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
2. A 50-ohm wattmeter connected to antenna jack J906.
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOMs on Exciter Board (crystal frequency = operating frequency ÷ 3).
2. For a large change in frequency or a badly mis-aligned transmitter, pre-set the slugs in T101 through T108, and L101, L102 and L103 to the bottom of the coil form.

NOTE

The tuning frequency for multi-frequency transmitters is determined by the operating frequency and the frequency spread between transmitters. Refer to the table below for maximum frequency spread.

3. For multi-frequency transmitters with a frequency spread less than that specified in column (1), tune the transmitters to the lowest frequency.

   For frequency spread exceeding the limits specified in column (1), tune the transmitter using a center frequency tune up ICOM. Except the maximum frequency spread can be extended to the limits specified in column (3) with 1dB degradation.

   For tuning L101, L102, L103. Always tune L101, L102, L103 on the lowest frequency.

Multi-frequency Transmitter Tuning

Transmitter Frequency Range	MAXIMUM FREQUENCY SPREAD		
	(1) without center tuning	with center tuning	with center tuning (1dB degradation)
25-30 MHz	.080 MHz	.160 MHz	.320 MHz
30-36 MHz	.100 MHz	.200 MHz	.400 MHz
36-42 MHz	.120 MHz	.240 MHz	.470 MHz
42-50 MHz	.140 MHz	.280 MHz	.540 MHz

4. Connect the red plug on the GE Test Set to the System Board metering jack, and the black plug to the Exciter metering jack. Set the polarity to +, and set the range to the Test 1 position (1-Volt position for 4EX8K12) for all adjustments. NOTE: With the Test Set connected to the PA metering jack, the voltage reading at position "F" with the HIGH SENSITIVITY button pressed may be converted to driver collector current by reading the current as 10 amperes full scale. The voltage reading at position "G" with the HIGH SENSITIVITY button pressed may be converted to PA collector current by reading the current as 10 amperes full scale.
5. All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
1.	A MOD-1	L101	Maximum	Tune L101 for maximum meter reading.
2.	B	L102 & L103	Maximum	Tune L102 and then L103 for the maximum meter reading.
3.	C MULT-1	T101 & T102	See Procedure	Tune T101 for a dip in meter reading, and then tune T102 for maximum meter reading.
4.	D MULT-2	T103, T102, T101 & T104	See Procedure	Tune T103 for maximum meter reading and re-adjust T102 and T101 for maximum meter reading. Then tune T104 for a dip in meter reading.
5.	F MULT-3	T105, T104, T106 & T107	See Procedure	Tune T105 for maximum meter reading and re-adjust T104 for maximum meter reading. Then tune T106 for a dip in meter reading and T107 for maximum meter reading.
6.	G AMPL-1	T108, T107 & T106	Maximum	Tune T108 for maximum meter reading, and then re-adjust T107 and T106 for maximum meter reading.
7.	D AMPL-1 DRIVE (on PA)	C143, C156	Maximum	Move the black metering plug to the Power Amplifier metering jack and tune C143 and C156 for maximum meter reading.
8.		R216		With the battery voltage at 13.6 Volts or the PA collector voltage at 13.1 Volts, set Power Adjust potentiometer R216 on the PA board for the desired power output (from 15 to 50 Watts). If the battery voltage is not at 13.6 Volts or the collector voltage at 13.1 Volts and full rated output is desired (50 Watts at 13.6 Volts), set R216 for the output power according to the battery voltage or collector voltage shown in Figure 10. NOTE The PA collector voltage is measured as described in the PA POWER INPUT section.

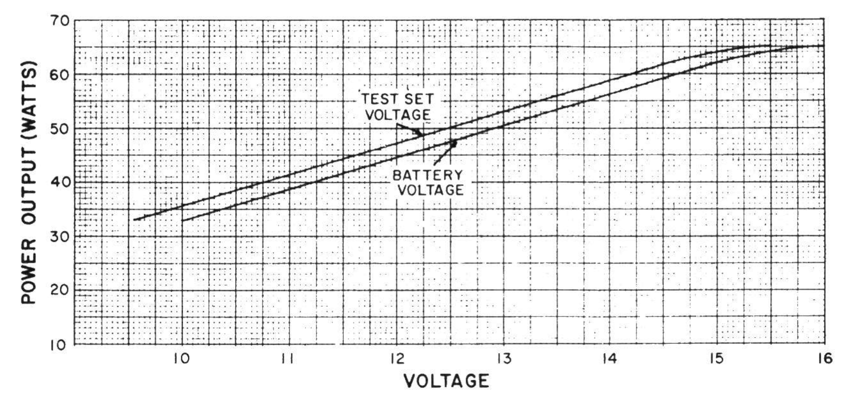


Figure 10 - Power Output Setting Chart

ALIGNMENT PROCEDURE

25—50 MHz, 50-WATT TRANSMITTER

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, tone and voice deviation, defective audio sensitivity, and modulator adjust control set too high. 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.

CAUTION

Before bench testing the MASTR II Mobile Radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed: 20 Volts
Transmitter keyed (50 ohm resistive load): 18 Volts
Transmitter keyed (no load or non-resistive load): 15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limit shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.6 VDC for loads of 6 to 16 amperes; 13.4 VDC for loads of 16 to 36 amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12-Volt automotive storage battery.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

1. Wattmeter similar to:
   Bird # 43
   Jones # 711N
2. VTVM similar to:
   Triplett # 850
   Heath # IM-21
3. Audio Generator similar to:
   GE Model 4EX6A10
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements # 720
5. Multimeter similar to:
   GE TEST SET MODEL 4EX3A11,
   MODEL 4EX8K12 or
   20,000 ohms-per-Volt voltmeter

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output from the antenna jack to the wattmeter through a 50-ohm coaxial cable. Make sure the wattmeter is terminated into a 50-ohm load.
2. Key the transmitter and check the wattmeter for the desired power output.

SERVICE CHECK

Check the setting of the Power Adjust Control (R216).

Refer to the QUICK CHECKS on the Transmitter Troubleshooting Procedure.

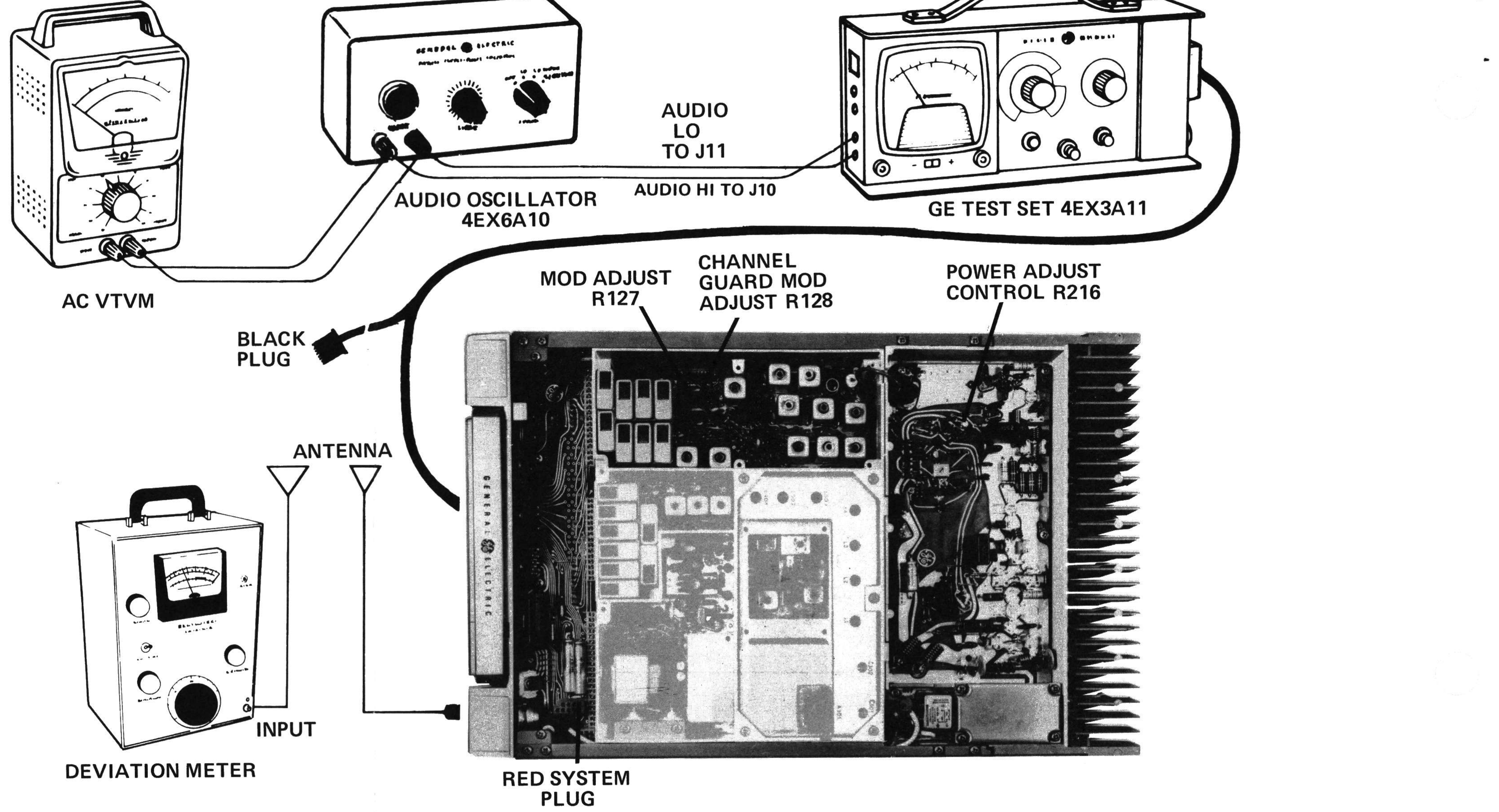
VOICE DEVIATION, SYMMETRY AND AUDIO SENSITIVITY

TEST PROCEDURE

1. Connect the test equipment to the transmitter as shown.
2. In radios with Channel Guard, set Channel Guard Mod Adjust R128 for zero tone deviation.
3. Set the Audio generator output to 1.0 VOLTS RMS and frequency to 1 kHz.
4. Key the transmitter and adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz in radios without Channel Guard, and ±3.75 kHz in radios with Channel Guard.
6. If necessary, adjust MOD ADJUST control R127 for the proper deviation on plus (+) or minus (-) deviation, whichever is greater.

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

7. If the deviation reading plus (+) or minus (-) differs by more than 0.5 kHz, recheck Steps 1 and 2 as shown in the Transmitter Alignment Chart.
8. Check Audio Sensitivity by reducing generator output until deviation falls to 3.0 kHz for radios without Channel Guard, or 2.25 kHz for radios with Channel Guard. Voltage should be LESS than 120 millivolts. If not, refer to the Transmitter Troubleshooting Procedure.



TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

1. Set up the Deviation Meter and monitor the output of the transmitter.
2. Remove the 1000 Hz signal from the audio generator.
3. Key the transmitter and check for 0.75 kHz deviation. If the reading is low or high, adjust Channel Guard MOD ADJUST R128 for a reading of 0.75 kHz.

NOTES:

1. On units supplied with Channel Guard, the Phase Modulator Tuning should be adjusted carefully to insure proper performance. (Refer to Steps 1 and 2 in the Transmitter Alignment Chart).
2. The Tone Deviation Test Procedures should be repeated every time the Tone Frequency is changed.

STEP I - QUICK CHECKS

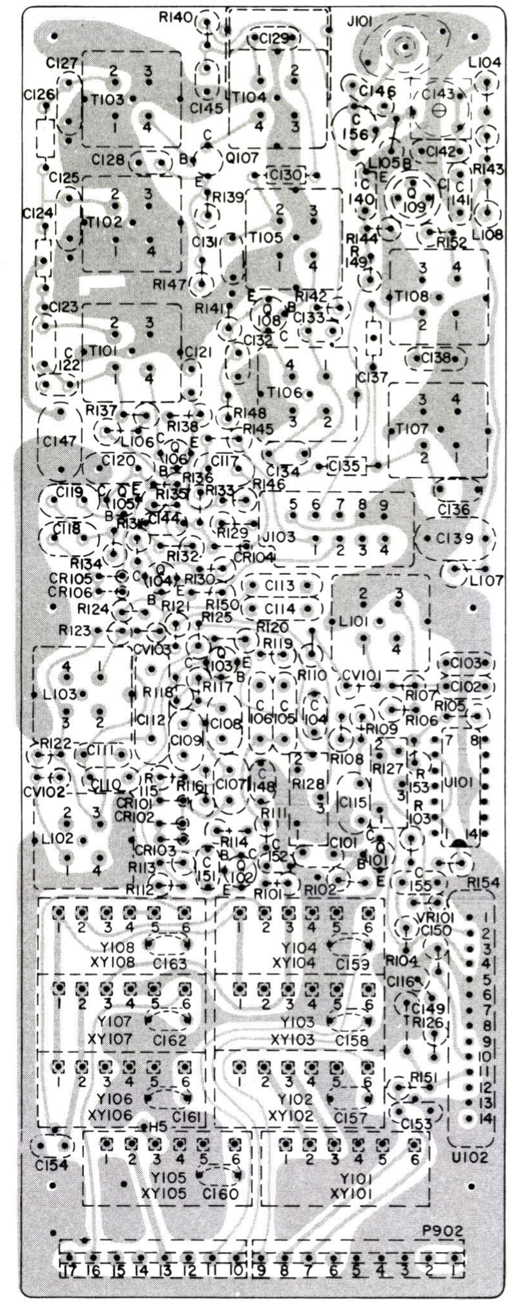
METER POSITION GE TEST SET	PROBABLE DEFECTIVE STAGE		
	HIGH METER READING	LOW METER READING	ZERO METER READING
		EXCITER	
A (MOD-1)	Q102, 10-Volt regulator	Q102, CV101, L101, 10-Volt regulator	ICOM, Q101, U101, L101, Q102, CR101, 10-Volt regulator or Channel Selector switch ground.
B (MOD-2)	Q104, 10-Volt regulator	Q103, L102, L103, CV102, CV103, Q104	Q103, L102, CV102, L103, CV103, CR104, Q104
C (MULT-1)	Q105, Q106 T101	Q105, Q106	Q105, Q106, T101
D (MULT-2)	Q107, T104	T101, T102, T103, Q107	T101, T102, T103, Q107, T104
F (MULT-3)	Q108, T106	T104, T105, Q108	T104, T105, Q108, T106
G (AMPL-1)	Q109, C146, R144	T106, T107, T108, Q109, L108	T106, T107, T108, Q109, L104, L107
		POWER AMPLIFIER	
"D" (AMPL-1 DRIVE)		Low Output from Exciter	No output from Exciter, CR201
"C" (AMPL-1 POWER CONTROL VOLTAGE)	Q210	Q210	No Exciter output, Q210, Q204, CR201
"F" (DRIVER CURRENT)	Q202	Q202, Low Output from Q201	Q202, Q201, Check Pos. D & C
"G" (PA CURRENT)	Q203	Q201, Q202, Q203	Q203, Q202, Q201, Q210

TROUBLESHOOTING PROCEDURE

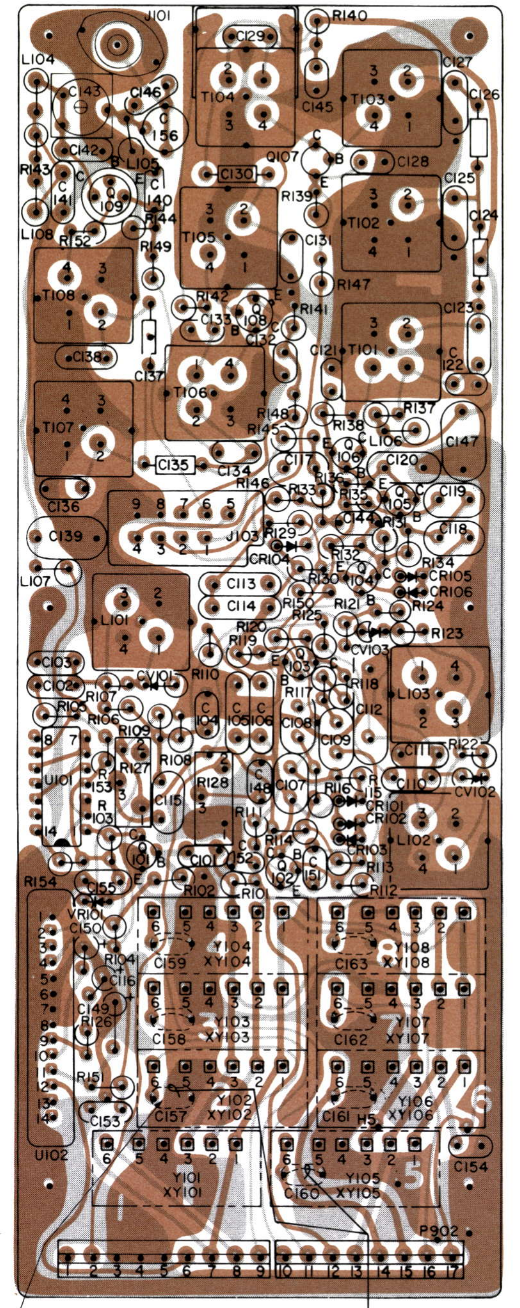
25—50 MHz, 50-WATT TRANSMITTER

EXCITER BOARD

SOLDER SIDE



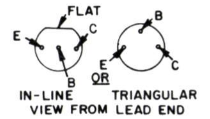
COMPONENT SIDE



(19D423167, Sh. 2, Rev. 1)

(19D423167, Sh. 2, Rev. 1)
(19D423167, Sh. 3, Rev. 1)

LEAD IDENTIFICATION FOR Q101-Q109



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

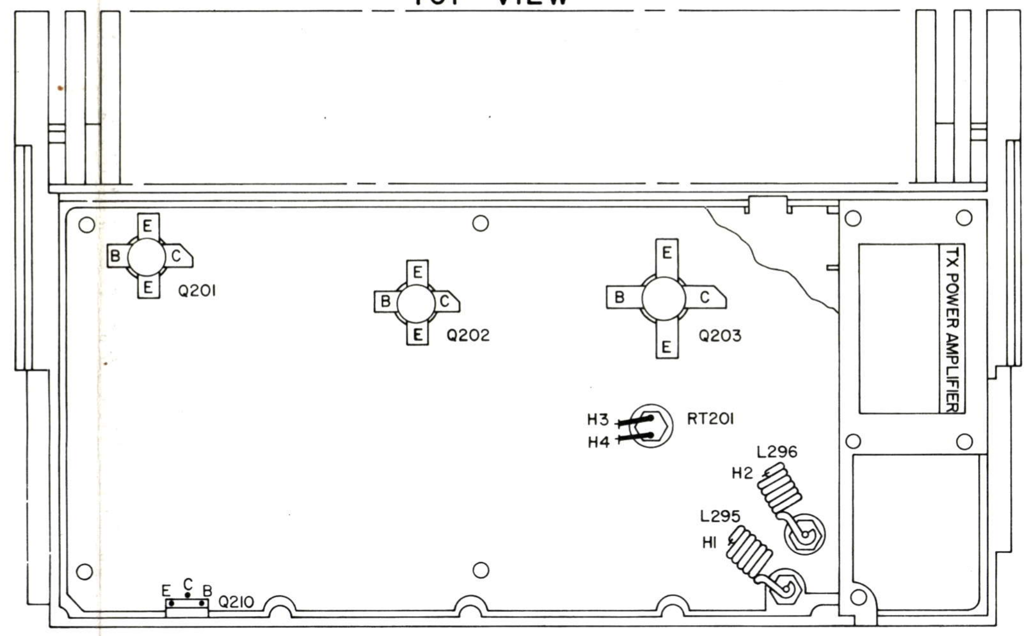
IN EIGHT-FREQUENCY EXCITERS (GROUPS 5-8), CAPACITORS C157-C163 ARE CLIPPED OUT AS REQUIRED TO MEET THE CUSTOMER REQUIREMENTS FOR FREQUENCIES. EXAMPLE; IF CUSTOMER WANTS ICOMS FOR F1, F2, F5, F7, THEN CAPACITORS C157, C160, AND C162 ARE CLIPPED OUT. C158, C159, C161, C163 ARE LEFT IN.

IN TWO-FREQUENCY EXCITERS (GROUPS 1-4) C157 IS CLIPPED OUT FOR COMBINATIONS WITH 2 TRANSMIT ICOMS. DA JUMPERS ARE PRESENT ON FREQUENCY SWITCHING LINES OF OTHER SIX ICOM CIRCUITS AS SHOWN.

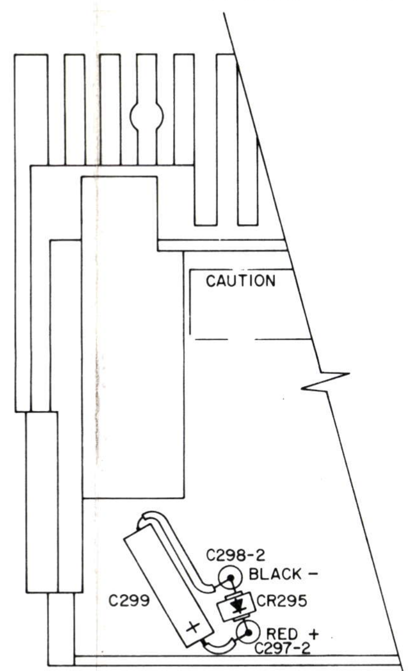
(19D423234, Rev. 1)

PA ASSEMBLY

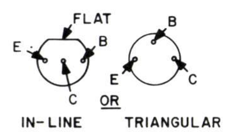
TOP VIEW



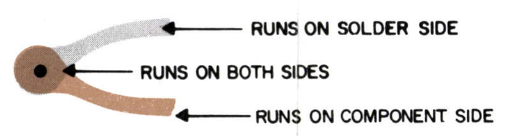
BOTTOM VIEW



LEAD IDENTIFICATION FOR Q204-Q209



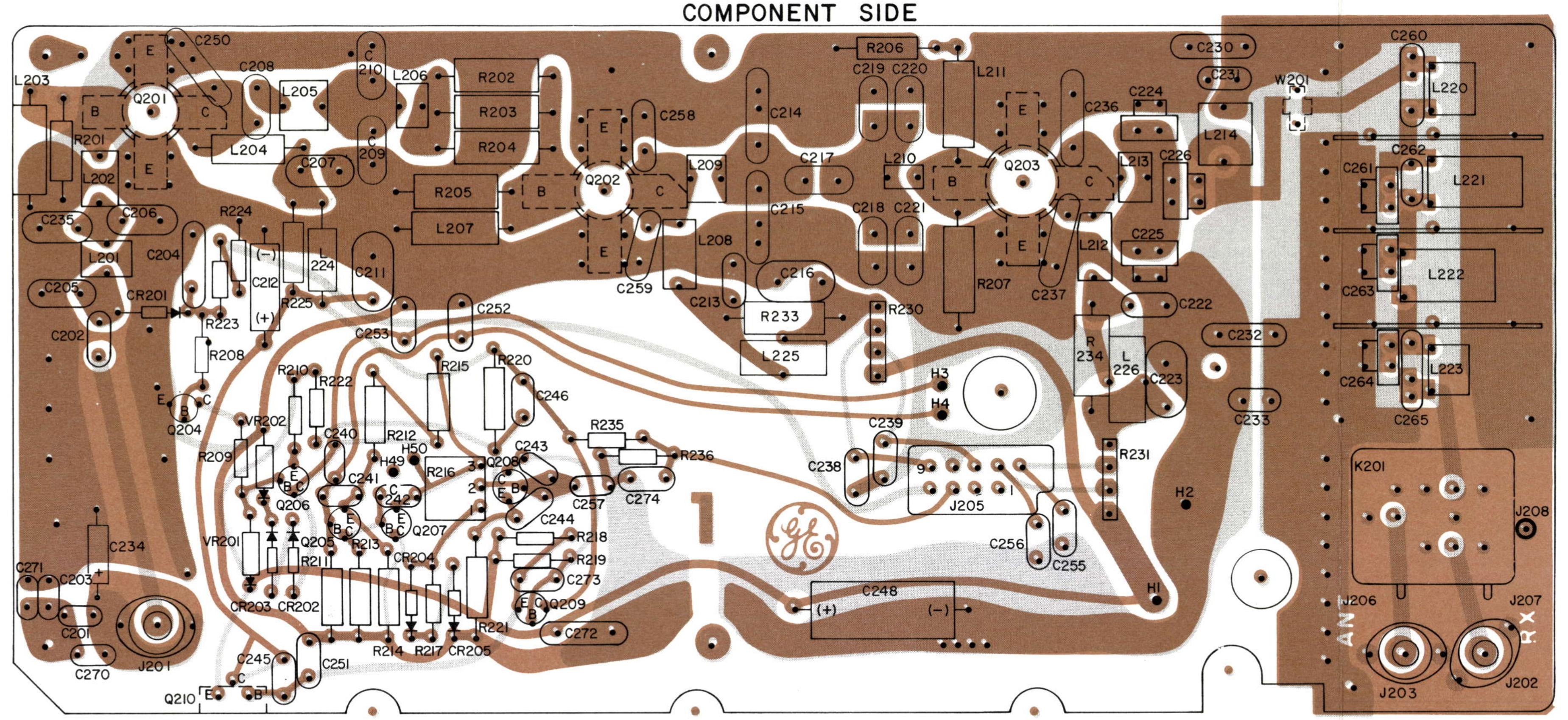
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION



(19R622111, Rev. 3)

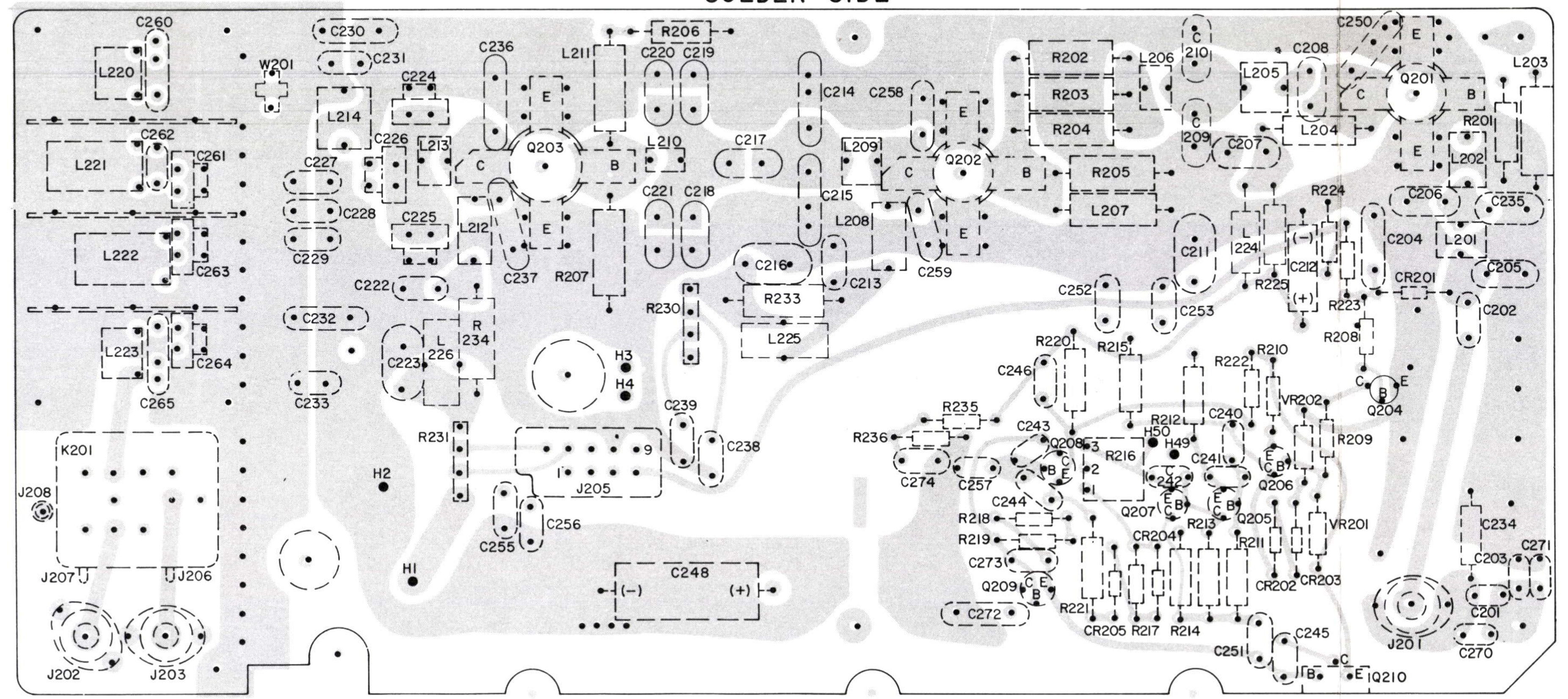
PA BOARD

COMPONENT SIDE



(19D417971, Sh. 2, Rev. 1)
(19D417971, Sh. 3, Rev. 1)

SOLDER SIDE



(19D417971, Sh. 2, Rev. 1)

OUTLINE DIAGRAM

25—50 MHz, 50-WATT TRANSMITTER

PARTS LIST

LBI-4440E

25-50 MHz EXCITER
19D416659G1-G8

SYMBOL	GE PART NO.	DESCRIPTION
		19D416659G1 2 FREQ 25-30 MHz (LL) 19D416659G2 2 FREQ 30-36 MHz (L) 19D416659G3 2 FREQ 36-42 MHz (M) 19D416659G4 2 FREQ 42-50 MHz (H) 19D416659G5 8 FREQ 25-30 MHz (LL) 19D416659G6 8 FREQ 30-36 MHz (L) 19D416659G7 8 FREQ 36-42 MHz (M) 19D416659G8 8 FREQ 42-50 MHz (H)
		- - - - - - - - - - - CAPACITORS - - - - - - - -
C101	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C102	19A116655P13	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C103	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C104	5494481P105	Ceramic disc: 330 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C105 and C106	19A116655P21	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C107 thru C109	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C110 and C111	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C112LL	4029003P104	Silver mica: 680 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-20.
C112L	4029003P104	Silver mica: 680 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-20.
C112M	5493367P1000K	Mica: 1000 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-20.
C112H	5493367P1000K	Mica: 1000 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-20.
C113 and C114	19A116655P21	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C115	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C116	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C117 thru C119	19116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C120	5490008P139	Mica: 330 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C121 and C122	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C123LL	5496219P262	Ceramic disc: 91 pf ±5%, 500 VDCW, temp coef -80 PPM.
C123L	5496219P258	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -80 PPM.
C123M	5496219P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C123H	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C124LL	5491601P123	Phenolic: 1.5 pf ±5%, 500 VDCW.
C124L	5491601P120	Phenolic: 1.0 pf ±5%, 500 VDCW.
C124M	5491601P120	Phenolic: 1.0 pf ±5%, 500 VDCW.
C124H	5491601P119	Phenolic: 0.82 pf ±5%, 500 VDCW.
C125LL	5496219P262	Ceramic disc: 91 pf ±5%, 500 VDCW, temp coef -80 PPM.
C125L	5496219P258	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -80 PPM.
C125M	5496219P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C125H	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C126LL	5491601P124	Phenolic: 1.8 pf ±5%, 500 VDCW.
C126L	5491601P124	Phenolic: 1.8 pf ±5%, 500 VDCW.
C126M	5491601P122	Phenolic: 1.2 pf ±5%, 500 VDCW.
C126H	5491601P122	Phenolic: 1.2 pf ±5%, 500 VDCW.
C127LL	5496219P262	Ceramic disc: 91 pf ±5%, 500 VDCW, temp coef -80 PPM.
C127L	5496219P258	Ceramic disc: 62 pf ±5%, 500 VDCW, temp coef -80 PPM.
C127M	5496219P257	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C127H	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C128	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C129LL*	5496219P255	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV F.
C129L*	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV F.
C129M*	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV F.
C129H*	5496219P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV F.
C130LL	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
C130L	5491601P110	Phenolic: 0.36 pf ±5%, 500 VDCW.
C130M	5491601P107	Phenolic: 0.27 pf ±5%, 500 VDCW.
C130H*	5491601P107	Phenolic: 0.27 pf ±5%, 500 VDCW.
		In REV F and earlier:
	5491601P105	Phenolic: 0.22 pf ±5%, 500 VDCW.
C131LL	5496219P255	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -80 PPM.
C131L	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM.
C131M	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C131H	5496219P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C132 and C133	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C134LL	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C134L	5496219P240	Ceramic disc: 9.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C134M	5496219P242	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -80 PPM.
C134H	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C135LL	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C135L	5491601P114	Phenolic: 0.51 pf ±5%, 500 VDCW.
C135M	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
C135H	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
C136LL	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C136L	5496219P240	Ceramic disc: 9.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C136M	5496219P242	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -80 PPM.
C136H	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C137LL	5491601P114	Phenolic: 0.51 pf ±5%, 500 VDCW.
C137L	5491601P114	Phenolic: 0.51 pf ±5%, 500 VDCW.
C137M	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
C137H	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
C138LL	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C138L	5496219P240	Ceramic disc: 9.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C138M	5496219P242	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -80 PPM.
C138H	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C139	19A116080P107	Polyester: 0.1 µf ±20%, 50 VDCW.
C140	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C141LL	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C141L	5490008P125	Silver mica: 82 pf ±10%, 500 VDCW; sim to Electro Motive type DM-15.
C141M	5490008P123	Silver mica: 68 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C141H	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C142LL	5490008P27	Silver mica: 100 pf ±50%, 50 VDCW; sim to Electro Motive Type DM-15.
C142L	5490008P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive type DM-15.
C142M	5490008P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C142H	5490008P24	Silver mica: 75 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C143	19A116163P5	Variable: approx 5 to 60 pf, 50 VDCW; sim to Amperex 2222-809-08003.
C144	5494481P105	Ceramic disc: 330 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C145	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C146*	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM. Added by REV B.
C146LL*	19A116656P12J8	Ceramic: 12 pf, ±5%, 0 PPM. Deleted by REV B.
C146L*	19A116656P12J8	Ceramic: 12 pf, ±5%, 0 PPM. Deleted by REV B.
C146M*	19A116656P13J8	Ceramic: 13 pf, ±5%, 0 PPM. Deleted by REV B.
C146H*	19A116656P12J8	Ceramic: 12 pf, ±5%, 0 PPM. Deleted by REV B.
C147	19A116080P107	Polyester: 0.1 µf ±20%, 50 VDCW.
C148	5494481P105	Ceramic disc: 330 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C149	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C150	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C151	5494481P105	Ceramic disc: 330 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C152 thru C155	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C156*	19A116867P1	Variable, ceramic: 2.5-6 pf, +50% -10%, 160 VDCW; sim to 7-S-TRIKO-02. Added by REV B.
C157* thru C163*	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW. Added by REV C.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR101 thru CR106	19A115250P1	Silicon.
CV101 thru CV103	5495769P12	Silicon, capacitive.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J101	19A116832P1	Connector, receptacles; sim to Cinch 14H11613.
J103	19B219374G1	Connector. Includes:
	19A116651P1	Contact, electrical: sim to Malco XO-2864.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
L101LL	19D416635G9	Coil.
L101L	19D416635G17	Coil.
L101M	19D416635G1	Coil.
L101H	19D416635G18	Coil.
L102LL	19D416635G9	Coil.
L102L	19D416635G17	Coil.
L102M	19D416635G1	Coil.
L102H	19D416635G18	Coil.
L103LL	19D416635G9	Coil.
L103L	19D416635G17	Coil.
L103M	19D416635G1	Coil.
L103H	19D416635G18	Coil.
L104LL	7488079P9	Choke, RF: 2.70 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4411-13.
L104L	7488079P8	Choke, RF: 2.20 µh ±10%, 1.00 ohms DC res max; sim to Jeffers 4411-12.
L104M	7488079P7	Choke, RF: 1.50 µh ±10%, 0.50 ohms DC res max; sim to Jeffers 4411-10.
L104H	7488079P7	Choke, RF: 1.50 µh ±10%, 0.50 ohms DC res max; sim to Jeffers 4411-10.
L105LL	7488079P6	Choke, RF: 1.00 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4411-8.
L105L	7488079P5	Choke, RF: 0.68 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4411-5.
L105M	7488079P4	Choke, RF: 0.47 µh ±10%, 0.09 ohms DC res max; sim to Jeffers 4411-4.
L105H	7488079P3	Choke, RF: 0.33 µh ±10%, 0.07 ohms DC res max; sim to Jeffers 4411-3.
L106 and L107	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7.
L108	7488079P50	Choke, RF: 39.0 µh ±10%, 2.00 ohms DC res max; sim to Jeffers 4422-11.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P902		Includes:
	19B219594P2	Contact strip: 8 pins.
	19B219594P3	Contact strip: 9 pins.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q101*	19A115330P1	Silicon, NPN.
		In REV C and earlier:
	19A115910P1	Silicon, NPN; sim to Type 2N3906.
Q102 thru Q106	19A115330P1	Silicon, NPN.
Q107*	19A115328P1	Silicon, NPN.
		Earlier than REV A:
	19A115330P1	Silicon, NPN.
Q108	19A115328P1	Silicon, NPN.
Q109	19A115329P2	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R101	3R77P561K	Composition: 560 ohms ±10%, 1/2 w.
R102*	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
		In REV C and earlier:
	3R77P393K	Composition: 39,000 ohms ±10%, 1/2 w.
R103	3R77P471K	Composition: 470 ohms ±10%, 1/2 w.
R104	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
R105	3R77P221K	Composition: 220 ohms ±10%, 1/2 w.
R106	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R107	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R108	3R77P474K	Composition: 470,000 ohms ±10%, 1/2 w.
R109	3R77P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R110	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R111	3R77P750J	Composition: 75 ohms ±5%, 1/2 w.
R112	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R113	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R114	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
R115	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R116	3R77P561K	Composition: 560 ohms ±10%, 1/2 w.
R117	3R77P821K	Composition: 820 ohms ±10%, 1/2 w.
R118	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R119	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R120	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
R121	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R122 and R123	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R124	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R125	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R126*	3R77P431J	Composition: 430 ohms ±5%, 1/2 w.
		In REV D and earlier:
	3R77P391K	Composition: 390 ohms ±10%, 1/2 w.
R127	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R128	19B209358P108	Variable, carbon film: approx 100 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R129	3R77P750J	Composition: 75 ohms ±5%, 1/2 w.
R130	3R77P681K	Composition: 680 ohms ±10%, 1/2 w.
R131	3R77P332K	Composition: 3300 ohms ±10%, 1/2 w.
R132	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
R133	3R77P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R134	3R77P561K	Composition: 560 ohms ±10%, 1/2 w.
R135	3R77P223K	Composition: 22,000 ohms ±10%, 1/2 w.
R136	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R137	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R138	3R77P181K	Composition: 180 ohms ±10%, 1/2 w.
R139	3R77P121K	Composition: 120 ohms ±10%, 1/2 w.
R140	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R141	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
R142	3R77P220K	Composition: 22 ohms ±10%, 1/2 w.
R143LL	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R143L	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R143M	3R77P820K	Composition: 82 ohms ±10%, 1/2 w.
R143H	3R77P820K	Composition: 82 ohms ±10%, 1/2 w.
R144LL	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
R144L	3R77P150K	Composition: 15 ohms ±10%, 1/2 w.
R144M	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
R144H	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
R145	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R146	3R77P683K	Composition: 68,000 ohms ±10%, 1/2 w.
R147 thru R150	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R151	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R152	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
R153 and R154	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
		- - - - - - - - - - TRANSFORMER - - - - - - - -
T101LL	19D416635G10	Coil. Includes:
	5493185P13	Tuning slug.
T101L	19D416635G10	Coil. Includes:
	5493185P13	Tuning slug.
T101M	19D416635G2	Coil. Includes:
	5493185P13	Tuning slug.
T101H	19D416635G2	Coil. Includes:
	5493185P13	Tuning slug.
T102LL	19D416635G11	Coil. Includes:
	5493185P13	Tuning slug.
T102L	19D416635G11	Coil. Includes:
	5493185P13	Tuning slug.
T102M	19D416635G3	Coil. Includes:
	5493185P13	Tuning slug.
T102H	19D416635G3	Coil. Includes:
	5493185P13	Tuning slug.
T103LL	19D416635G12	Coil. Includes:
	5493185P13	Tuning slug.
T103L	19D416635G12	Coil. Includes:
	5493185P13	Tuning slug.
T103M	19D416635G4	Coil. Includes:
	5493185P13	Tuning slug.
T103H	19D416635G4	Coil. Includes:
	5493185P13	Tuning slug.
T104LL*	19D416635G19	Coil.
		In REV E and earlier:
	19D416635G13	Coil. Includes:
	5493185P13	Tuning slug.
T104L*	19D416635G20	Coil.
		In REV E and earlier:
	19D416635G13	Coil. Includes:
	5493185P13	Tuning slug.
T104M*	19D416635G21	Coil.
		In REV E and earlier:
	19D416635G5	Coil. Includes:
	5493185P13	Tuning slug.
T104H*	19D416635G22	Coil.
		In REV E and earlier:
	19D416635G5	Coil. Includes:
	5493185P13	Tuning slug.
T105LL	19D416635G13	Coil. Includes:
	5493185P13	Tuning slug.
T105L	19D416635G13	Coil. Includes:
	5493185P13	Tuning slug.
T105M	19D416635G5	Coil. Includes:
	5493185P13	Tuning slug.
T105H	19D416635G5	Coil. Includes:
	5493185P13	Tuning slug.
T106LL	19D416635G14	Coil. Includes:
	5493185P13	Tuning slug.
T106L	19D416635G14	Coil. Includes:
	5493185P13	Tuning slug.
T106M	19D416635G6	Coil. Includes:
	5493185P13	Tuning slug.
T106H	19D416635G6	Coil. Includes:
	5493185P13	Tuning slug.
T107LL	19D416635G15	Coil. Includes:
	5493185P13	Tuning slug.
T107L	19D416635G15	Coil. Includes:
	5493185P13	Tuning slug.
T107M	19D416635G7	Coil. Includes:
	5493185P13	Tuning slug.
T107H	19D416635G7	Coil. Includes:
	5493185P13	Tuning slug.
T108LL	19D416635G16	Coil. Includes:
	5493185P13	Tuning slug.
T108L	19D416635G16	Coil. Includes:
	5493185P13	Tuning slug.
T108M	19D416635G8	Coil. Includes:
	5493185P13	Tuning slug.
T108H	19D416635G8	Coil. Includes:
	5493185P13	Tuning slug.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U101	19A116842P1	Frequency Divider: sim to Texas Instrument Type SN54H73N.
U102	19D416542G2	Transmitter, Audio.
		- - - - - - - VOLTAGE REGULATORS - - - - - - -
VR101	4036887P56	Silicon, Zener.
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
		NOTE: When reordering, specify quantity.
XY101 thru XY108	19A116779P1	Contact, electrical; sim to Molex 08-54-0404.
		- - - - - - - - - - - OSCILLATORS - - - - - - - -
		NOTE: When reordering specify ICOM Frequency. ICOM Freq = $\frac{\text{Operating Freq}}{3}$
Y101 thru Y108	19A129393G13	Compensated: 2 PPM, 25-50 MHz.
Y101 thru Y108	19A129393G16	Externally Compensated: 5 PPM, 25-50 MHz.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19A121252P1	Heat sink. (Used with Q109).
	19A129424G2	Can. (Used with T101-T108 and L101-L103).
	4036555P1	Insulator, washer: nylon. (Used with Q109).
	4029006P3	Clip, compression: 0.375 x 0.19 x .02 inches, sim to Tinnerman Products Inc. C5426-014-24. (Used with Q109).

*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 description of parts affected by these revisions.

REV. A - D: - Exciter Board 19D416659G1-8.
Incorporated in initial shipment

REV. E - To increase audio sensitivity. Changed R126.

REV. F - To eliminate possible shorting of shield to wire runs on printed wire board. Changed T104LL, T104L, T104M and T104H. Deleted shield (19B219619P1), C129LL, C129L, C129M and C129H.

Exciter Board 19D416659G4&8

REV. G - To improve multi-frequency spread performance in cold temperatures. Changed C 130H

■ NOTES:

1. IN TWO-FREQUENCY EXCITERS (GROUPS 1-4) C157 IS CLIPPED OUT FOR COMBINATIONS WITH 2 TRANSMIT ICOMS. DA JUMPERS ARE PRESENT ON FREQUENCY SWITCHING LINES OF OTHER SIX ICOM CIRCUITS.

2. IN EIGHT-FREQUENCY EXCITERS (GROUPS 5-8), CAPACITORS C157-C163 ARE CLIPPED OUT AS REQUIRED TO MEET THE CUSTOMER REQUIREMENTS FOR FREQUENCIES. EXAMPLE; IF CUSTOMER WANTS ICOMS FOR F1, F2, F5, F7, THEN CAPACITORS C157, C160, AND C162 ARE CLIPPED OUT. C158, C159, C161, C163 ARE LEFT IN.

*** COMPONENT VALUES AS FOLLOWS:**

COMPONENT IDENTIFICATION	LL 25-30 MHZ	L 30-36 MHZ	M 36-42 MHZ	H 42-50 MHZ
C112	680	680	1000	1000
C123	91	62	56	43
C124	1.5	1.0	1.0	0.82
C125	91	62	56	43
C126	1.8	1.8	1.2	1.2
C127	91	62	56	43
C129	47	33	22	15
C130	0.47	0.36	0.27	0.27
C131	47	33	22	15
C134	13	9	12	7
C135	0.68	0.51	0.56	0.47
C136	13	9	12	7
C137	0.51	0.51	0.39	0.39
C138	13	9	12	7
C141	100	82	68	100
C142	100	82	[illegible]	75
L104	2.7	2.2	1.5	1.5
L105	1.0	0.68	0.47	0.33
R143	100	100	82	82
R144	15	15	10	10

▲ THESE COMPONENTS NOT PRESENT ON 2ND EXCITER IN WIDE SPACE XMTR COMBINATIONS.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND.

AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS.

EXCITER BOARD	REV LETTER	FREQ RANGE	NO. FREQ
19D416659G1	F	25-30	2
19D416659G2	F	30-36	2
19D416659G3	F	36-42	2
19D416659G4	G	42-50	2
19D416659G5	F	25-30	8
19D416659G6	F	30-36	8
19D416659G7	F	36-42	8
19D416659G8	G	42-50	8

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

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

(19R621827, Rev. 15)

SCHEMATIC DIAGRAM

25—50 MHz, EXCITER BOARD 19D416659G1-8

 Issue 2

NOTE: CHANGES TO THIS DIAG. MAY AFFECT 19R622108.

* COMPONENT VALUES AS FOLLOWS:

COMP. IDENT.	LL 25-30 MHZ	L 30-36 MHZ	M 36-42 MHZ	H 42-50 MHZ
C207	390	330	270	220
C208	330	270	270	220
C209	390	270	270	270
C210	330	220	220	180
C213	1000	1000	680	680
C214	56	56	47	39
C215	56	56	47	39
C217	330	330	270	220
C218	390	330	270	270
C219	390	330	270	270
C220	330	270	270	180
C221	330	270	270	180
C222	1000	1000	680	680
C224	500	500	430	360
C225	500	500	430	360
C226	200	240	220	180
C235	270	270	220	180
C236	220	150	100	56
C237	220	150	100	56
C250	100	100	100	100
C258	100			
C259	100			
C260	91	68	56	51
C261	110	91	68	56
C262	15	13	12	10
C263	140	110	91	82
C264	120	100	82	75
C265	91	68	56	51
R201	10	10	20	20
R202	5.6	5.6	2.7	1.2
R203	5.6	5.6	2.7	1.2
R204	5.6	5.6	2.7	1.2
R207	10	10	20	20

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS AT Q201 COLLECTOR AND IN THE POWER CONTROL CIRCUIT WERE TAKEN WITH THE TRANSMITTER ADJUSTED FOR 50 WATTS OUTPUT. THESE READINGS WILL VARY DEPENDING ON THE SETTING OF POWER ADJUST CONTROL R216.

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

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

NOTES:

1. CALLED FOR ON PL19C321295.
2. 50Ω MICRO STRIP, PART OF PWB.
3. ⏚ - INDICATES A-
   ⏚ - INDICATES VEHICLE GROUND

	PA ASSEMBLY	REV LTR	HEAT SINK ASM	REV LTR	CPNT. BD. ASM	REV LTR	FREQ. RANGE
STANDARD PACKAGE	19C321295G1		19B219688G1		19D417968G1	B	25-30 MHZ
	19C321295G2				19D417968G2	A	30-36 MHZ
	19C321295G3				19D417968G3	A	36-42 MHZ
	19C321295G4				19D417968G4	A	42-50 MHZ
	19C321295G9		19B219688G13		19D417968G1	B	25-30 MHZ
	19C321295G10				19D417968G2	A	30-36 MHZ
	19C321295G11				19D417968G3	A	36-42 MHZ
	19C321295G12				19D417968G4	A	42-50 MHZ

SCHEMATIC DIAGRAM

25—50 MHz, 50-WATT POWER AMPLIFIER
19C321295G1-4 & G9-12

(19R622106, Rev. 3)

PARTS LIST

LBI-4897A

25-50 MHz, 50 WATT
POWER AMPLIFIER
19C321295G1-G4
19C321295G9-G12

SYMBOL	GE PART NO.	DESCRIPTION
		19C321295G1, G9 25-30 MHz (LL) 19C321295G2, G10 30-36 MHz (L) 19C321295G3, G11 36-42 MHz (M) 19C321295G4, G12 42-50 MHz (H)
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L295 and L296	19A129356P1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201	19A116839P1	Silicon, NPN.
Q202	19A116839P2	Silicon, NPN.
Q203	19A116839P3	Silicon, NPN.
Q210	19A116375P1	Silicon, PNP.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT201	19A129379G1	Thermistor.
		POWER AMPLIFIER BOARD 19D417968G1 25-30 MHz 19D417968G2 30-36 MHz 19D417968G3 36-42 MHz 19D417968G4 42-50 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C202	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C203	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C204	19116655P23	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C205	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C206	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C207LL	7489162P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C207L	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C207M	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C207H	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C208LL	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C208L and C208M	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C208H	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C209LL	7489162P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C209L	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C209M	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C209H	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C210LL	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C210L and C210M	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C210H	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C211	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C212	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C213LL and C213L	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C213M and C213H	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C214LL and C214L	19A116656P56J0	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef 0 PPM.
C214M	19A116656P47J0	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef 0 PPM.
C214H	19A116656P39J0	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef 0 PPM.
C215LL and C215L	19A116656P56J0	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef 0 PPM.
C215M	19A116656P47J0	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef 0 PPM.
C215H	19A116656P39J0	Ceramic disc: 39 pf ±5%, 500 VDCW, temp coef 0 PPM.
C216	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C217LL and C217L	7489162P39	Silver mica: 470 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C217M	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C217H	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C218LL	7489162P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C218L	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C218M and C218H	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C219LL	7489162P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C219L	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C219M and C219H	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C220LL	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C220L and C220M	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C220H	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C221LL	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C221L and C221M	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C221H	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C222LL and C222L	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C222M and C222H	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C223	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C224LL and C224L	19A116679P500J	Silver mica: 500 pf ±5%, 250 VDCW.
C224M	19A116679P430J	Silver mica: 430 pf ±5%, 250 VDCW.
C224H	19A116679P360J	Silver mica: 360 pf ±5%, 250 VDCW.
C225LL and C225L	19A116679P500J	Silver mica: 500 pf ±5%, 250 VDCW.
C225M	19A116679P430J	Silver mica: 430 pf ±5%, 250 VDCW.
C225H	19A116679P360J	Silver mica: 360 pf ±5%, 250 VDCW.
C226LL	19A116679P200J	Silver mica: 200 pf ±5%, 250 VDCW.
C226L	19A116679P240J	Silver mica: 240 pf ±5%, 250 VDCW.
C226M	19A116679P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C226H	19A116679P180J	Silver mica: 180 pf ±5%, 250 VDCW.
C230	19A116655P23	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C231	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C232	19A116655P23	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C233	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C234	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C235LL and C235L	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C235M	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C235H	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C236LL	19A116656P220J4	Ceramic disc: 220 pf ±5%, 500 VDCW, temp coef -470 PPM.
C236L	19A116656P150J1	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -150 PPM.
C236M	19A116656P100J1	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -150 PPM.
C236H	19A116656P56J0	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef 0 PPM.
C237LL	19A116656P220J4	Ceramic disc: 220 pf ±5%, 500 VDCW, temp coef -470 PPM.
C237L	19A116656P150J1	Ceramic disc: 150 pf ±5%, 500 VDCW, temp coef -150 PPM.
C237M	19A116656P100J1	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -150 PPM.
C237H	19A116656P56J0	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef 0 PPM.
C238 and C239	19A116655P19	Cermic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C240	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C241 and C242	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C243	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C244 thru C246	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C248	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C250	19A116656P100J1	Ceramic disc: 100 pf ±6%, 500 VDCW, temp coef -150 PPM.
C251 thru C253	19A116655P19	Cermic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C255 thru C257	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C258LL	19A116656P100K4	Ceramic disc: 100 pf ±10%, 500 VDCW, temp coef -470 PPM.
C259LL	19A116656P100K4	Ceramic disc: 100 pf ±10%, 500 VDCW, temp coef -470 PPM.
C260LL*	19A116656P91J2	Ceramic, disc: 91 pf ±5%, 500 VDCW, temp coef -220 PPM.
		In 19D417968G1 of REV A and earlier:
	19A116656P82J1	Ceramic, disc: 82 pf ±5%, 500 VDCW, temp coef -150 PPM.
C260L	19A116656P68J1	Ceramic, disc: 68 pf ±5%, 500 VDCW, temp coef -150 PPM.
C260M	19A116656P56J1	Ceramic, disc: 56 pf ±5%, 500 VDCW, temp coef -150 PPM.
C260H	19A116656P51J1	Ceramic, disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C261LL	19A116679P110J	Silver mica: 110 pf ±5%, 250 VDCW.
C261L	19A116679P91J	Silver mica: 91 pf ±5%, 250 VDCW.
C261M	19A116679P68J	Silver mica: 68 pf ±5%, 250 VDCW.
C261H	19A116679P56J	Silver mica: 56 pf ±5%, 250 VDCW.
C262LL	19A116656P15J1	Ceramic, disc: 15 pf ±5%, temp coef -150 PPM.
C262L	19A116656P13J1	Ceramic, disc: 13 pf ±5%, temp coef -150 PPM.
C262M	19A116656P12J1	Ceramic, disc: 12 pf ±5%, temp coef -150 PPM.
C262H	19A116656P10J1	Ceramic, disc: 10 pf ±0.5 pf, temp coef -50 PPM.
C263LL	19A116679P140J	Silver mica: 140 pf ±5%, 250 VDCW.
C263L	19A116679P110J	Silver mica: 110 pf ±5%, 250 VDCW.
C263M	19A116679P91J	Silver mica: 91 pf ±5%, 250 VDCW.
C263H	19A116679P82J	Silver mica: 82 pf ±5%, 250 VDCW.
C264LL	19A116679P120J	Silver mica: 120 pf ±5%, 250 VDCW.
C264L	19A116679P100J	Silver mica: 100 pf ±5%, 250 VDCW.
C264M	19A116679P82J	Silver mica: 82 pf ±5%, 250 VDCW.
C264H	19A116679P75J	Silver mica: 75 pf ±5%, 250 VDCW.
C265LL*	19A116656P91J2	Ceramic, disc: 91 pf ±5%, temp coef -220 PPM.
		In 19D417968G1 of REV A and earlier:
	19A116656P82J1	Ceramic, disc: 82 pf ±5%, temp coef -150 PPM.
C265L	19A116656P68J1	Ceramic, disc: 68 pf ±5%, temp coef -150 PPM.
C265M	19A116656P56J1	Ceramic, disc: 56 pf ±5%, temp coef -150 PPM.
C265H	19A116656P51J1	Ceramic, disc: 51 pf ±5%, temp coef -150 PPM.
C270 and C271	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C272	19A116655P23	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C273	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C274	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201*	19A116052P2	Silicon.
		Earlier than REV A:
	19A115250P1	Silicon.
CR202 thru CR205	19A115250P1	Silicon.
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J201 thru J203	19A130924G1	Receptacle, coaxial: jack type; sim to Cinch 14H11613.
J205	19B219374G1	Connector. Includes:
	19C317957P1	Shell.
	19A116651P1	Contact, electrical: sim to Malco XO-2864.
J206 and J207		(Part of K201).
J208	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - - - RELAYS - - - - - - - - - -
K201	19A116722P1	Relay, hermetic sealed: 13.6 VDC ±20%, 125 ohms coil res, 1 form C contact.
		- - - - - - - - - - - INDUCTORS - - - - - - - - - -
L201LL	19A129347P2	Coil.
L201L	19A129347P1	Coil.
L201M	19A129347P3	Coil.
L201H	19A129347P4	Coil.
L202LL	19A129352P9	Coil.
L202L	19A129354P4	Coil.
L202M	19A129352P8	Coil.
L202H	19A129352P7	Coil.
L203	7488079P42	Choke, RF: 8.20 µh ±10%, 0.25 ohms DC res max; sim to Jeffers 4422-3.
L204	7488079P3	Choke, RF: 0.33 µh ±20%, 0.07 ohms DC res max; sim to Jeffers 4411-3.
L205LL and L205L	19A129351P3	Coil.
L205M	19A129351P2	Coil.
L205H	19A129351P2	Coil.
L206LL	19A129352P1	Coil.
L206L	19A129352P1	Coil.
L206M	19A129352P3	Coil.
L206H	19A129348P2	Coil.
L207	7488079P42	Choke, RF: 8.20 µh ±10%, 0.25 ohms DC res max; sim to Jeffers 4422-3.
L208LL and L208L	19A129349P1	Coil.
L208M and L208H	19A129349P2	Coil.
L209LL	19A129355P1	Coil.
L209L and L209M	19A129352P4	Coil.
L209H	19A129352P2	Coil.
L210LL	19A129358P1	Coil.
L210L	19A129359P1	Coil.
L210M	19A129357P1	Coil.
L210H	19A129357P2	Coil.
L211	7488079P42	Choke, RF: 8.20 µh ±10%, 0.25 ohms DC res max; sim to Jeffers 4422-3.
L212LL and L212L	19A129349P1	Coil.
L212M and L212H	19A129349P2	Coil.
L213LL	19A129351P1	Coil.
L213L	19A129358P2	Coil.
L213M	19A129355P3	Coil.
L213H	19A129351P4	Coil.
L214LL	19A129353P3	Coil.
L214L	19A129355P5	Coil.
L214M	19A129355P4	Coil.
L214H	19A129352P10	Coil.
L220LL	19A129360P9	Coil.
L220L	19A129360P6	Coil.
L220M	19A129360P4	Coil.
L220H	19A129360P1	Coil.
L221LL	19A129360P10	Coil.
L221L	19A129360P7	Coil.
L221M	19A129360P3	Coil.
L221H	19A129360P2	Coil.
L222LL	19A129360P11	Coil.
L222L	19A129360P8	Coil.
L222M	19A129360P5	Coil.
L222H	19A129360P3	Coil.
L223LL	19A129360P9	Coil.
L223L	19A129360P6	Coil.
L223M	19A129360P4	Coil.
L223H	19A129360P1	Coil.
L224	7488079P10	Choke, RF: 3.30 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4421-1.
L225 and L226	19A129346G1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q204	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q205 thru Q207	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q208	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q209	19A129187P1	Silicon, PNP.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R201LL and R201L	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R201M and R201H	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
R202LL and R202L	5490205P6	Composition: 5.6 ohms ±5%, 1 w.
R202M	5490205P16	Composition: 2.7 ohms ±5%, 1 w.
R202H	7147161P22	Composition: 1.2 ohms ±5%, 1/2 w.
R203LL and R203L	5490205P6	Composition: 5.6 ohms ±5%, 1 w.
R203M	5490205P16	Composition: 2.7 ohms ±5%, 1 w.
R203H	7147161P22	Composition: 1.2 ohms ±5%, 1/2 w.
R204LL and R204L	5490205P6	Composition: 5.6 ohms ±5%, 1 w.
R204M	5490205P16	Composition: 2.7 ohms ±5%, 1 w.
R204H	7147161P22	Composition: 1.2 ohms ±5%, 1/2 w.
R205	3R78P200J	Composition: 20 ohms ±5%, 1 w.
R206	7147161P6	Composition: 2.7 ohms ±5%, 1/2 w.
R207LL and R207L	3R78P100J	Composition: 10 ohms ±5%, 1 w.
R207M and R207H	3R78P200J	Composition: 20 ohms ±5%, 1 w.
R208	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R209	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R210	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R211	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R212	19A116278P217	Metal film: 1470 ohms ±2%, 1/2 w.
R213	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R214	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R215	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R216	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R217	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
R218	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R219	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
R220	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R221	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R222	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R223	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R224	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
R225	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R230 and R231	19C320212P2	Shunt resistor.
R233 and R234	3R78P100K	Composition: 10 ohms ±10%, 1 w.
R235	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R236	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR201	4036887P1	Silicon, Zener.
VR202	4036887P5	Silicon, Zener.
		- - - - - - - - - - - - CABLES - - - - - - - - - -
W201	19A129571P1	Wire strap.
		HEAT SINK ASSEMBLY 19B219688G1 M MODEL AND INTERMITTANT DUTY STATION 19B219688G13 E MODEL
		- - - - - - - - - - - CAPACITORS - - - - - - - - -
C297 and C298	19A116708P1	Ceramic, feed-thru: 0.01 µf +100% -0%, 500 VDCW; sim to Erie Style 327.
C299	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR295	19A116783P1	Silicon.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B219391P1	Filter casting.
	19D416712P1	Insulator. (Located under printed wiring board).
	5492178P2	Washer, spring tension.
	N207P15C6	Hex nut: No. 8-32. (Used with Q201 and Q202).
	N207P16C6	Hex nut: No. 10-32. (Used with Q203).
	19A134016P1	Insulated bushing. (Used with Q210).
	19A116023P1	Insulated plate. (Used with Q210).
	19A129361P1	Shield. (Located between L221-L222 and L222-L223).
	19A129361P2	Shield. (Located between L220-L221).

*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 19D417968G1-4

To improve operation in cold temperature environments with wide frequency spacing. Changed CR201.

REV. B - PA Board 19D417968G1

To improve stopband attenuation in 25-30 MHz range. Changed C260 and C265.

ORDERING SERVICE PARTS

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

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

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

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

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

MAINTENANCE MANUAL

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MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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