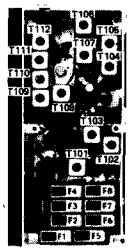
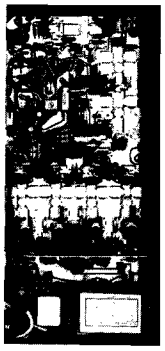
MOBILE RADIO

MASTR II MAINTENANCE MANUAL

138-174 MHz, 110-WATT STATION TRANSMITTER



EXCITER ASSEMBLY



PA ASSEMBLY

Maintenance Manual LBI-4737B

138-174 MHz EXCITER 19D416859G1-4
INTERMITTENT DUTY 110-WATT PA ASSEMBLY 19C320414G3
CONTINUOUS DUTY 110-WATT PA ASSEMBLY 19D417524G2

SPECIFICATIONS *

FCC Filing Designation	KT-43-A, C Extended Local Control KT-46-A, C Extended Local/DC & Tone Remote KT-49-A, C DC Remote/Tone Remote all Controls
Power Output	110 Watts (Adjustable from 20 to 110 Watts)
Frequency Stability (-30°C to +60°C) (0°C to +55°C) (-30°C to +60°C)	 ±0.0005% (KT-43-A, KT-46-A, KT-49-A) ±0.0002% (KT-43-A, KT-46-A, KT-49-A) ±0.0002% (KT-43-C, KT-46-C, KT-49-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.
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 4 Channels)	Full Specification	1 dB Degradation
138 -155 MHz	1.8 MHz	2.75 MHz
150.8-174 MHz	2.0 MHz	3.0 MHz

Duty Cycle	EIA 20% Intermittent (KT-43-A, C & KT-46-A, C) Continuous (KT-49-A, C)
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 the MASTR II Station Transmitter is the 12 VDC Supply Voltage, 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

Transmitter Types, KT-43-A, C; KT-46-A, C and KT-49-A, C are crystal-controlled, phase modulated transmitters designed for one through four-frequency operation in the 138 to 174 megahertz band. The solid state transmitter utilizes both integrated circuits (ICs) and discrete components, and consists of following assemblies:

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

CIRCUIT ANALYSIS

EXCITER

The exciter uses nine transistors and one integrated circuit to drive the PA assembly. The exciter can be equipped with up to four Integrated Circuit Oscillator Modules (ICOMs). The ICOM crystal frequency ranges from approximately 11.5 to 14.5 megahertz, and the crystal frequency is multiplied 12 times.

Audio, supply voltages and control functions are connected 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, and the regulated 10-Volts.

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.

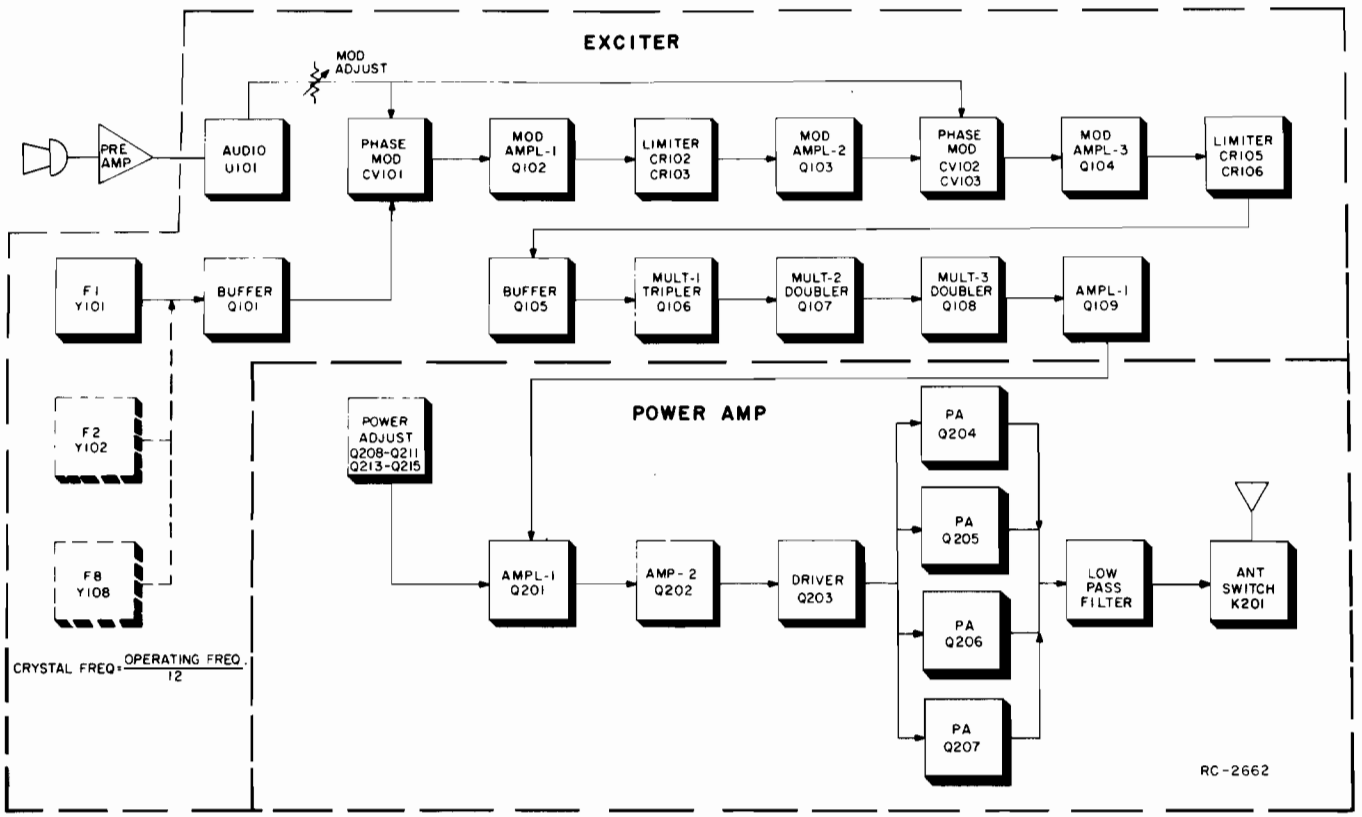


Figure 1 - Transmitter Block Diagram

The ICOMs are enclosed in an 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-. The oscillator is turned on by applying a keyed +10 Volts to the external oscillator load resistor.

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 transmitter types KT-43-A, C 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 8 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. In transmitter types KT-46-A, C and KT-99-A, C at least one 5C-ICOM is required for the transmitter and at least one 5C-ICOM is required for the receiver. If desired, up to 8 5C-ICOMs may be used in the station.

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 temperatures. 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.

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.

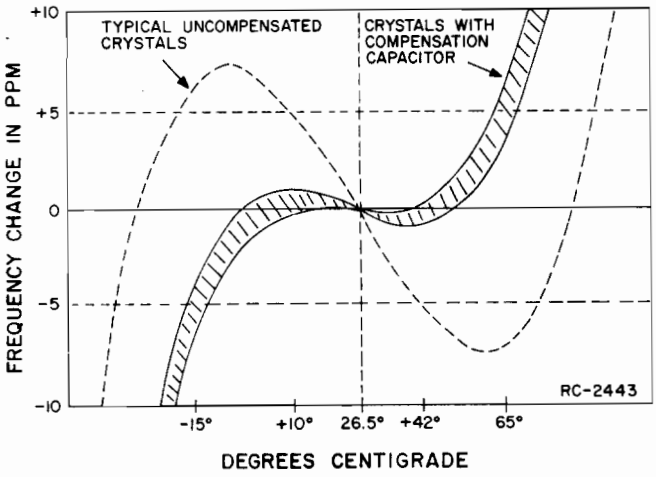


Figure 2 - Typical Crystal Characteristics

In transmitter types KT-42-A, C 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.

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

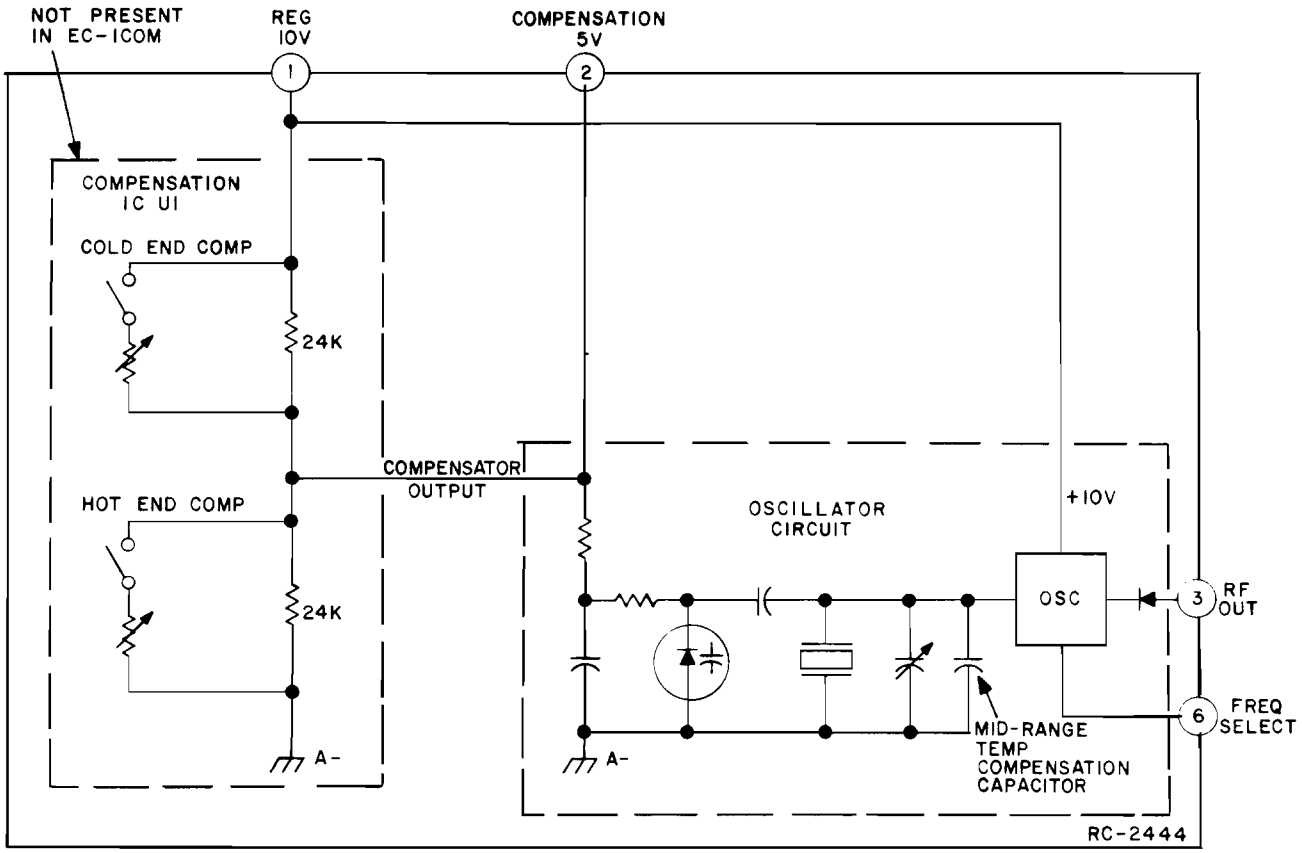


Figure 3 - Equivalent ICOM Circuit

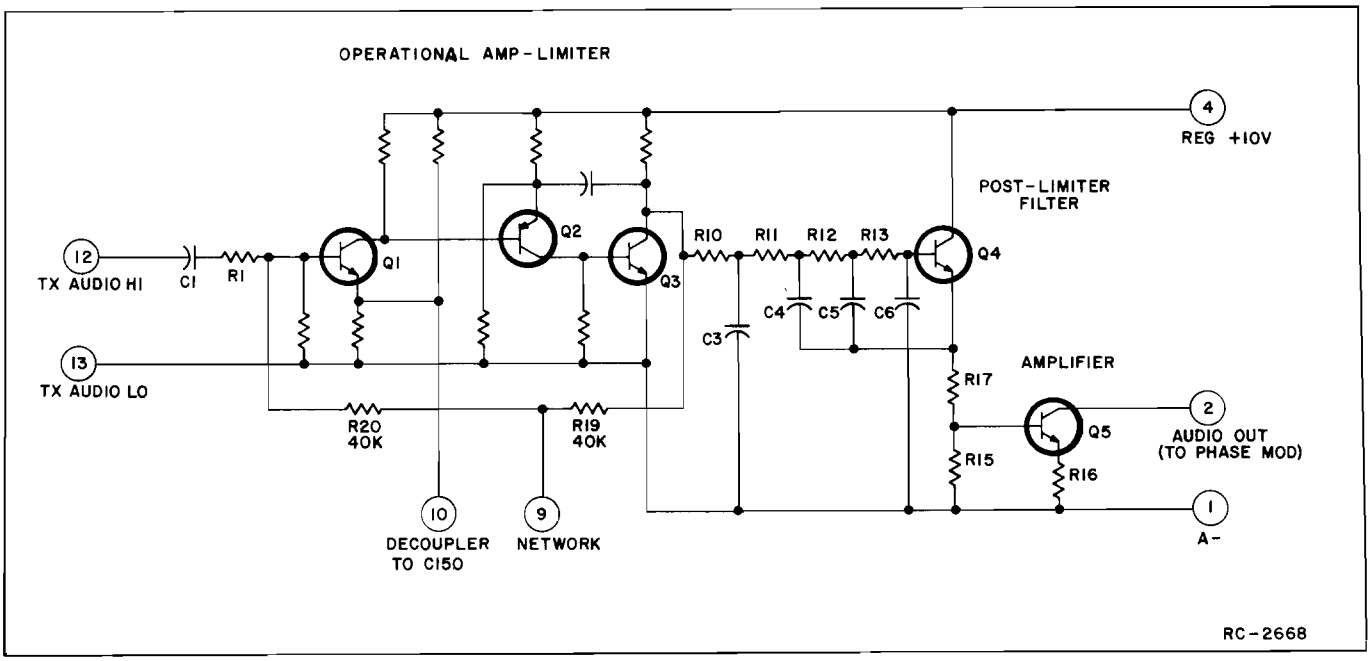


Figure 4 - Simplified Audio IC

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 or check output of 5C-ICOM.

AUDIO IC

The transmitter audio circuitry is contained in audio IC U101. A simplified drawing of the audio IC is shown in Figure 4.

Audio from the station pre-amplifier at pin 12 is coupled through pre-emphasis capacitor C1 to the base of Q1 in the operational amplifier-limiter circuit.

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 the resistance in the network (Pin 9).

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 coupled through MOD ADJUST potentiometer R104 and resistors R108 and R125 to the phase modulators.

SERVICE NOTE: If the DC voltages to the Audio IC are correct and no audio output can be obtained, replace U101.

For radios equipped with Channel Guard, tone from the encoder is applied to the phase modulators through CHANNEL GUARD MOD ADJUST potentiometer R105, and resistors R112, R105 and R127. Instructions for setting R128 are contained in the modulation adjustment section of the Transmitter Alignment Procedure.

BUFFER, PHASE MODULATORS & AMPLIFIERS

The output at pin 3 of the selected ICOM is coupled through buffer-amplifier Q101 to the first modulator stage. The first phase modulator is varactor (voltage-variable capacitor) CV101 in series with tunable coil T101. 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 C107 varies the bias of CV101, resulting in a phase modulated output. A voltage divider network (R110 and R111) provides the proper bias for varactors CV101, CV102 and CV103.

The output of the first modulator is coupled through blocking capacitor C113 to the base of Class A amplifier Q102. The first modulator stage is metered through a metering network consisting of C115, C118 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, T102, T103 and CV103. Following the second modulator is a Class A amplifier, Q104. The output of the second modulator stage is metered through C123, R132 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, MULTIPLIERS & AMPLIFIER

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, Q106. The tripler stage is metered through R138. The output of Q106 is coupled through tuned circuits T104 and T105 to the base of doubler Q107. T104 and T105 are tuned to one-fourth of the operating frequency. The doubler stage is metered through R141.

The output of Q107 is coupled through tuned circuits T106 and T107 to the base of second doubler Q108. T106 and T107 are tuned to one-half the operating frequency. Q108 is metered through R146.

The output of Q108 is coupled through three tuned circuits (T108, T109 and T110) to the base of amplifier Q109. The circuits are tuned to the transmitter operating frequency.

Q109 is a class C amplifier, and is metered through R148. The amplifier collector circuit consists of T111, C154, C155, T112 and C157, and matches the amplifier output to the input of the power amplifier assembly.

POWER AMPLIFIER

The PA assembly uses seven RF power transistors and seven transistors in the Power Control circuitry to provide a power output of 110 Watts. The broadband PA has no adjustments other than Power Control potentiometer R222.

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, C299, L295 and L296 prevent RF from getting on the Power leads. Diode CR295 (on the intermittent duty PA only) will cause the main fuse in the fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

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 J201. The RF is coupled through a matching network to the base of Class C amplifier Q201. The network matches the 50-ohm input to the base of Q201, and consists of T201, C203, C204 and L202. R201, L201 and C275 are a stabilizing network in the base circuit of Q201.

Part of the RF input is rectified by CR201 and is applied to voltage dividers R202 and R203. The voltage is divided to activate the Power Control circuit and 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 (L213 and R213) and collector feed network T202 and C276. The collector voltage of Q201 is metered through R212 at J205.

The output of Q201 is coupled to the base of the second class C amplifier (Q202) through a matching network consisting of T202, C210, T203, C211 and C212. Collector voltage to Q202 is applied through collector stabilizing network Z201 and collector feed network L203 and C217.

The output of Q202 is applied to the base of Class C driver Q203 through a low-pass filter matching network (L220, C218, C220 and C221). Collector voltage to Q203 is coupled through collector stabilizing network Z202 and collector feed network L204 and C225.

Collector current for Q203 is metered across tapped manganin resistor R215 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 Q203 is a matching network (L221, C227, C4209, T204 and C229) that matches the output of Q203 to the 50-ohm microstrip impedance (W207) to the input of power divider Z207.

The power amplifier stages consist of four identical paralleled Class C PA circuits (Q204 through Q207). The output of Z207 is coupled through impedance-matching networks T205-C230 and T206-C231 to additional power dividers Z208 and Z209. Z208 provides drive for PA transistors Q204 and Q205, while Z209 provides drive for Q206 and Q207.

One output of Z208 is applied to the base of Q204 through an impedance matching network (T207, C236, C240 and C241). C265, L214 and R208 are a stabilizing network in the base of Q204. Supply voltage for Q204 is coupled through collector stabilizing network Z203, and collector feed network L205 and C248.

Collector current for Q204 through Q207 is metered across paralleled tapped manganin resistors R207 and R216. The reading is taken on the one-Volt scale with the High Sensitivity button pressed, and read as 30 amperes full scale.

The output of Q204 is coupled through a matching network (L222, C256, T211 and C260) and added to the output of Q205 in power combiner Z210. The outputs of Q206 and Q207 are coupled through matching networks to power combiner Z211. Following Z210 and Z211 are impedance-matching networks (T215-C268 and T216-C269) that match the outputs of Z210 and Z211 to power combiner Z212. The combined PA output is applied to 50-ohm microstrip W209, and is coupled through a low-pass filter to the antenna through antenna switch K201. Capacitors C278, C279, C280, C223, C232, C226, C223 and C4208 provide isolation.

WARNING

The stud mount 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 Q208, turning it on. Turning on Q208 turns on voltage regulator Q209, supplying a constant voltage to Power Adjust potentiometer R223.

Q213, Q214 and Q215 operate as an amplifier chain to supply voltage to the collector of Q201 (Ampl-1). The setting of R223 determines the voltage applied to the base of Q214. The higher the voltage at the base of Q214, the harder the amplifiers conduct, supplying more collector voltage to Q201. The lower the voltage at the base of Q214, 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 R223 from approximately 35 to 110 Watts.

Temperature protection is provided by Q210, Q211, and thermistor RT201 which is mounted in the PA heatsink. Under normal operating conditions, the circuit is inactive (Q210 is on and Q211 is off). When the heatsink temperature reaches approximately 100°C, the resistance of RT201 decreases. This increases the base voltage applied to Q210, turning it off. Turning off Q210 allows Q211 to turn on, decreasing the voltage at Power Adjust potentiometer R223. This reduces the base voltage to Q214 which causes Q213 and Q215 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.

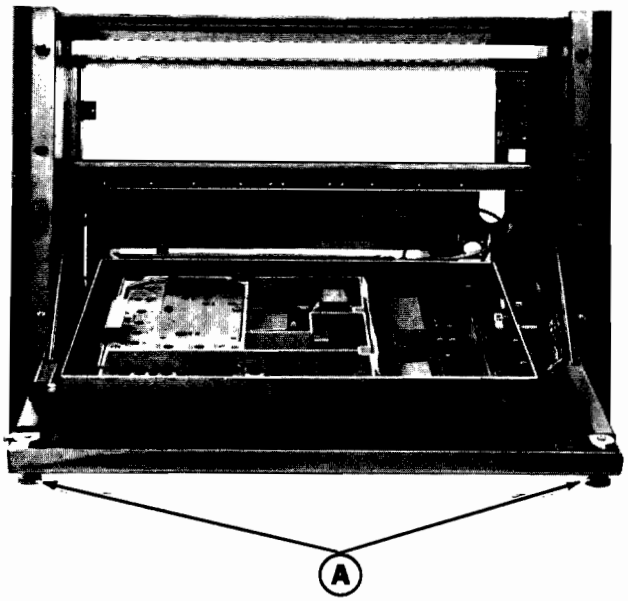


Figure 5 - Access to Exciter Front View

MAINTENANCE

DISASSEMBLY

For a more complete mechanical parts breakdown refer to the station manual. To service the transmitter exciter from the front:

1. Turn the two latching knobs (A) counterclockwise to unlatch the Radio Panel Front Door. Refer to Figure 5.
2. Swing the Radio Panel Front Door down as shown.
3. Remove covers.

To service the transmitter Power Amplifier from the rear:

1. Remove the top two screws (B) on the Intermittent or Continuous Duty Power Amplifier. Refer to Figure 6.
2. Swing the Power Amplifier down as shown. Remove the top cover of the Power Amplifier.

NOTE

If the heatsink blower option is present, this blower must be removed before the Power Amplifier can be lowered.

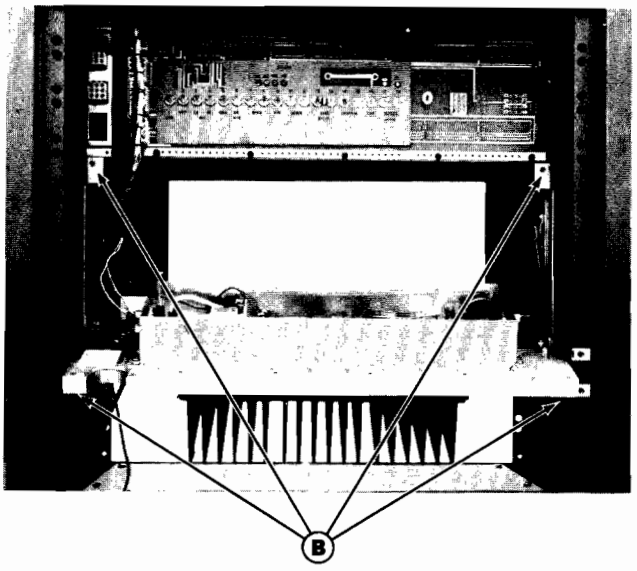


Figure 6 - Access to Power Amplifier Rear View

To remove the PA board: Refer to Figure 7.

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. In continuous Duty stations only, remove all heatsink sections from the heat dissipator plate.
4. Remove the PA transistor hold-down nuts and spring washers on the bottom of the PA assembly.
5. 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.

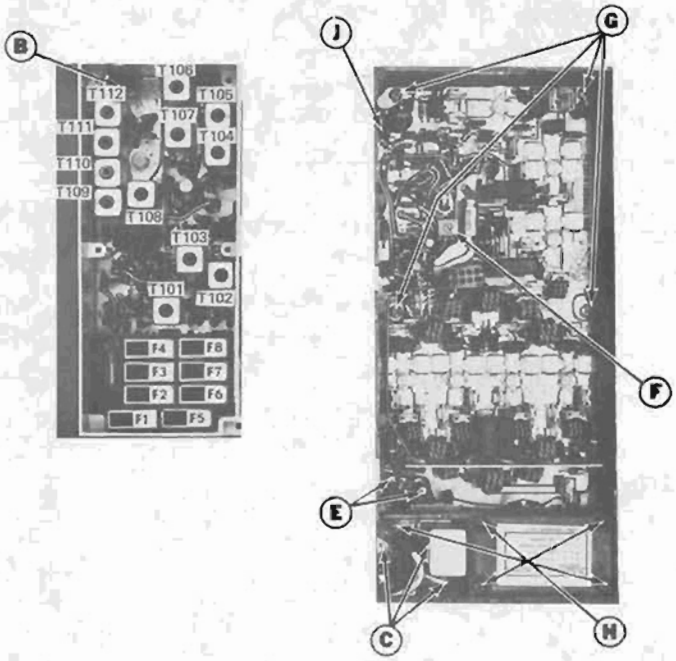


Figure 7 - PA Board Removal

PA TRANSISTOR REPLACEMENT

When replacing a power transistor where more than one are in parallel, make sure all the paralleled transistors are from the same manufacturer for proper operation.

WARNING

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

To replace the PA 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.

NOTE

If the transmitter has a continuous Duty Power Amplifier a section of Heat Sink may have to be removed to get to the transistor hold-down nuts. Apply a light coat of silicon grease when replacing the removed section of Heat Sink.

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. Lift out 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. Applying 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 (8 inch-pounds). A torque wrench must be used for this adjustment since transistor damage can result if too little or too much torque is used.

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.

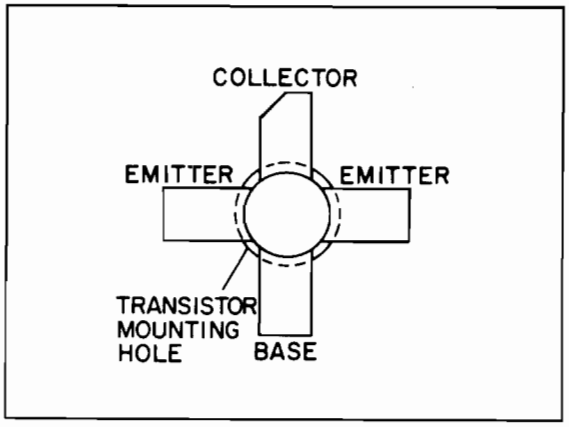


Figure 8 - Lead Identification

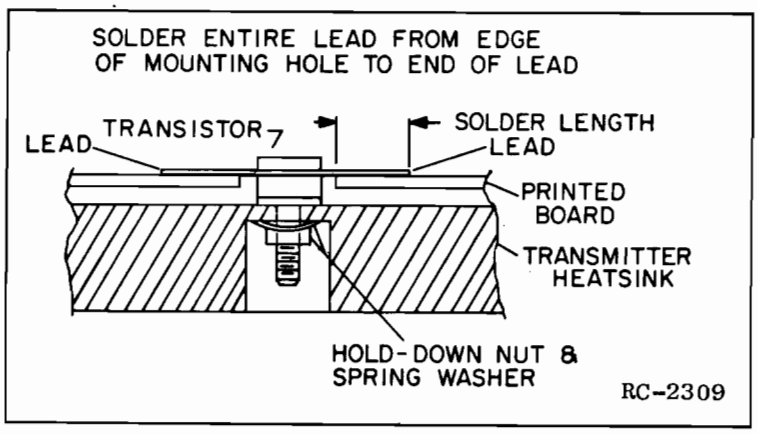


Figure 9 - Lead Forming

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R104) 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 Model 4EX3A11 or 4EX8K12.

PROCEDURE

1. Set the station gain control R14 to the full clockwise position.
2. Connect the audio oscillator and the meter across audio input terminals J10 (Green-Hi) and J11 (Black-Lo) on GE Test Set, or across J952-13 (Mike High) through a 0.5 microfarad (or larger) DC blocking capacitor, and J952-14 (Mike-Low) on the System Board.
3. Adjust the audio oscillator for 30 Millivolts RMS at 1000 Hz.
4. For transmitters without Channel Guard, set MOD ADJUST R104 for a 4.5-kHz swing with the deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.
5. For transmitters with Channel Guard, set Channel Guard MOD ADJUST R105 for zero tone deviation. Next, with the 30 Millivolts signal at 1000 Hz applied, set MOD ADJUST R104 for 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R105 for 0.75 kHz tone deviation.
6. For multi-frequency transmitters, set the deviation as described in Steps 4 or 5 on the channel producing the largest amount of deviation.
7. Remove the Audio Oscillator and Key the Mike. While talking in a normal voice at a distance of four to six inches from the station microphone, adjust the gain control R14 for a deviation of 3 kHz as measured on the deviation monitor.

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 (30 amperes full scale).

Example:

P_i = 12.4 Volts x 9.0 amperes = 111.6 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 deviation 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 the 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 10.

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 10.

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 138 MHz, 1 PPM is 138 Hz. At 174 MHz, 1 PPM is 174 Hz).

With an operating frequency of 150 MHz, set the oscillator for a reading of 45 Hz (0.3 x 150 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.

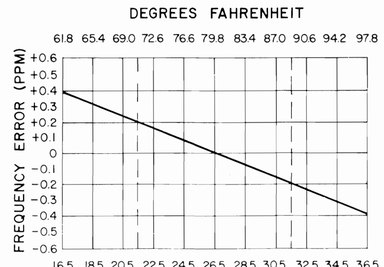
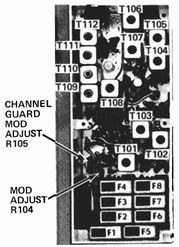
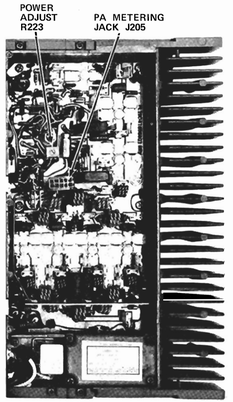


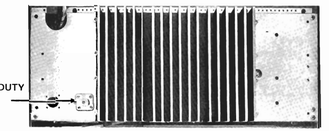
Figure 10 - Frequency Characteristics Vs. Temperature

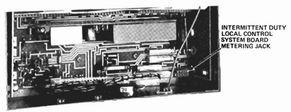


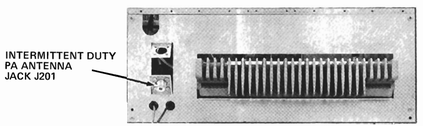
EXCITER ASSEMBLY



PA ASSEMBLY







TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
2. A 50-ohm wattmeter connected to antenna jack J201 or J243.
3. A frequency counter.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place ICOMs on Exciter Board (crystal frequency = operating frequency ÷ 12).
2. For a large change in frequency or a badly mis-aligned transmitter, pre-set the slugs in T104 and T105 to the bottom of the coil form. Pre-set all of the other slugs to the top of the coil form.
3. For multi-frequency transmitters with a frequency spacing less than .900 MHz for frequencies between 138-155 MHz or less than 1.00 MHz for frequencies between 150.8-174 MHz tune the transmitter on the lowest frequency.

   For multi-frequency transmitters with a frequency spacing up to 1.8 MHz for frequencies between 138-155 MHz or 2.0 MHz for frequencies, tune the transmitter using a center frequency tune-up ICOM. These limits can be extended to 2.75 MHz and 3.0 MHz respectively with 1 dB degradation in power output.
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 30 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)	T101	Maximum	Tune T101 for maximum meter reading on the lowest frequency.
2.	B (MOD-2)	T102 & T103	Maximum	Tune T102 and then T103 for the maximum meter reading on the lowest frequency.
3.	C (MULT-1)	T104	Minimum	Tune T104 for a dip in meter reading.
4.	D (MULT-2)	T105, T104 & T106	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.
5.	F (MULT-3)	T107, T106, T108 & T109	See Procedure	Tune T107 for maximum meter reading and re-adjust T106 for maximum meter reading. Then tune T108 for a dip in meter reading and T109 for maximum meter reading.
6.	G (AMPL-1)	T110, T108 & T109	Maximum	Tune T110 for maximum meter reading, and then re-adjust T108 and T109 for maximum meter reading.
7.	D (AMPL-1 DRIVE on PA)	T111 & T112	Maximum	Move the black metering plug to the Power Amplifier metering jack and tune T111 and then T112 for maximum meter reading. Alternately tune T111 and T112 for maximum meter reading.
8.	G (AMPL-1)	T108, T109 & T110	Maximum	Move the black metering plug back to the exciter metering jack and re-adjust T108, T109 and T110 for maximum meter reading.
9.	D (AMPL-1 DRIVE on PA)	T111 & T112	Maximum	Move the black metering plug back to the Power Amplifier metering jack and re-adjust T111 and T112 for maximum meter reading.
10.		R219		Set Power Adjust potentiometer R223 on the PA board for the desired power output (from 35 to 110 Watts).
	ADDITIONAL STEPS FOR TRANSMITTERS USING CENTER FREQUENCY TUNE-UP ICOM			
11.	D (MULT-2)	T105	See Procedure	Move the black metering plug to the exciter metering jack and re-adjust T105 for equal drive on the highest and lowest frequency.
12.	G (AMPL-1)	T110 & T108	Maximum	Re-adjust T110 and then T108 for maximum meter reading on the lowest frequency.

ALIGNMENT PROCEDURE

138—174 MHz, 110-WATT STATION 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, 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.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

1. Wattmeter similar to:
   Bird # 43
   Jones # 711N
2. VTVM similar to:
   Triplett # 850
   Health # 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 (R223).

Refer to the QUICK CHECKS on the Transmitter Troubleshooting Procedure.

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

1. Connect the test equipment to the transmitter as shown.
2. In radios with Channel Guard, set Channel Guard Mod Adjust R105 for zero tone deviation.
3. Set the Audio generator output to 30 Millivolts 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 R104 for the proper deviation on plus (+) or minus (-) deviation, whichever is greater.

NOTES: MASTR II STATION 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.

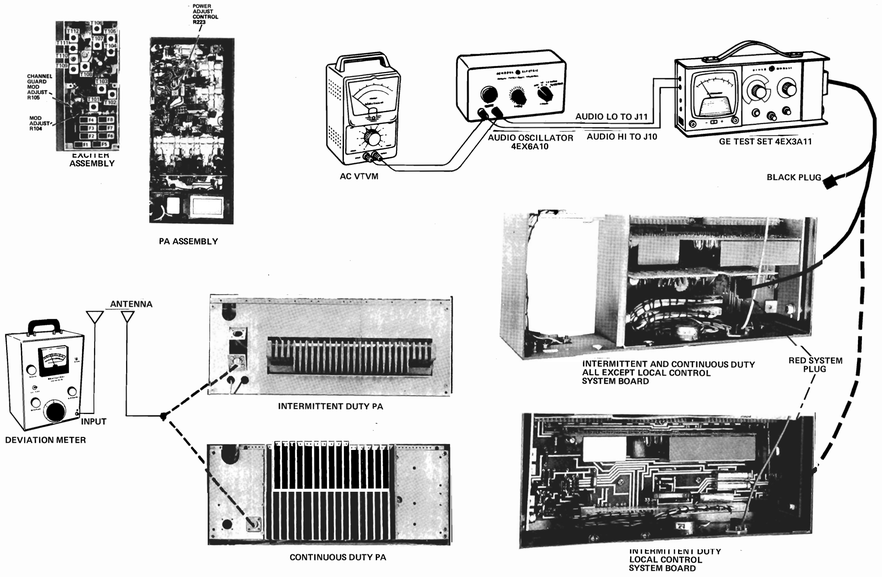
TONE DEVIATION WITH CHANNEL GUARD

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 R105 for a reading of 0.75 kHz.

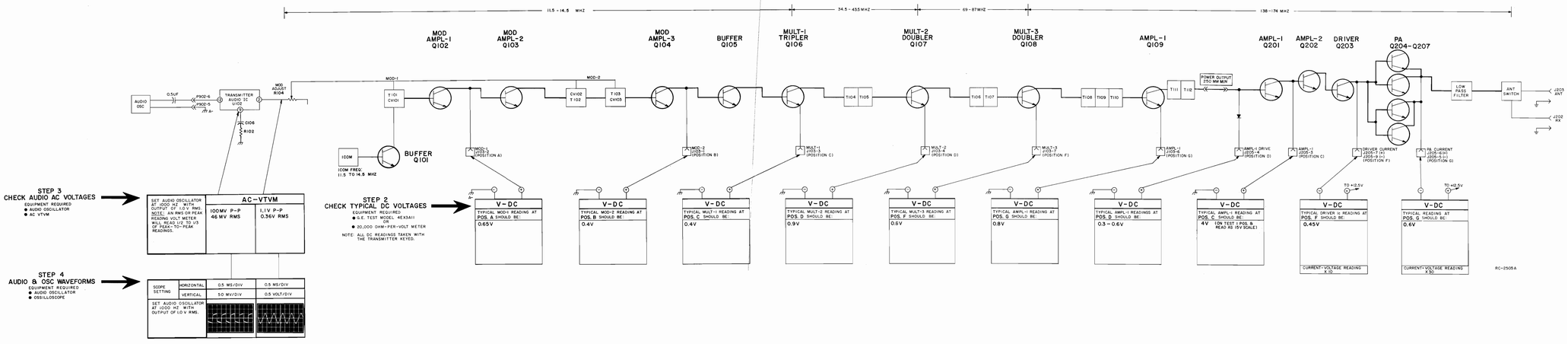
NOTES:

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.



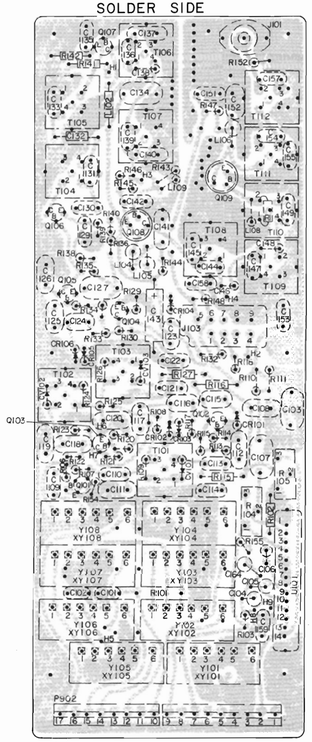
STEP I - QUICK CHECKS

METER POSITION GE TEST SET	PROBABLY DEFECTIVE STAGE		
	HIGH METER READING	LOW METER READING	ZERO METER READING
EXCITER			
A (MOD-1)	Q102, 10-Volt Regulator	Q102, CV101, T101, 10-Volt Regulator	ICOM, Q101, Q102, CR101, 10-Volt regulator or Channel Selector switch ground.
B (MOD-2)	Q104, 10-Volt regulator	Q103, T102, CV102, T103, CV103, Q104	Q103, T102, CV102, T103, CV103, CR104, Q104
C (MULT-1)	Q105, Q106 T104	Q105, Q106	Q105, Q106, T104
D (MULT-2)	Q107, T106	T104, T105, Q107	T104, T105, Q107, T106
F (MULT-3)	Q108, T108	T106, T107, Q108	T106, T107, Q108, T108
G (AMPL-1)	Q109, C157	T108, T109, T110, Q109, L106	T108, T109, T110, Q109, L106
POWER AMPLIFIER			
"D" (AMPL-1 DRIVE)		Low Output from Exciter, CR201	No output from Exciter, CR201
"C" (AMPL-1 POWER CONTROL VOLTAGE)	Q215	Q215	No Exciter output, Q215, Q206, CR201
"P" (DRIVER CURRENT)	Q203	Q203, Low Output from Q201, Q202	Q203, Q202, Q201. Check Pos. D & C
"G" (PA CURRENT)	Q204, Q205, Q206, Q207	Q201, Q202, Q203, Q204, Q205, Q206, Q207	Q207, Q206, Q205, Q204, Q203, Q202, Q201, Q215



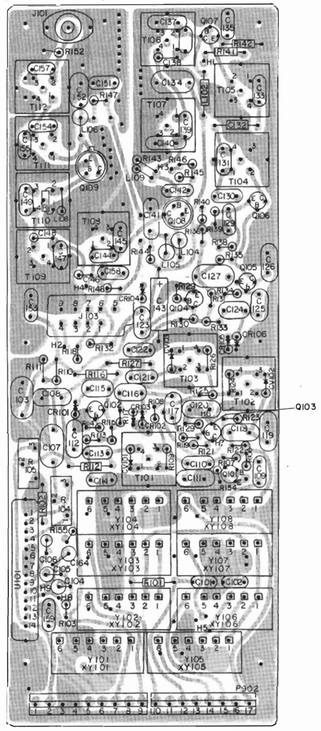
EXCITER BOARD

SOLDER SIDE



(19D416850, Sh. 2, Rev. 3)

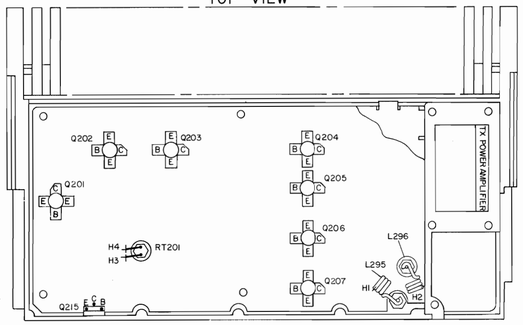
COMPONENT SIDE



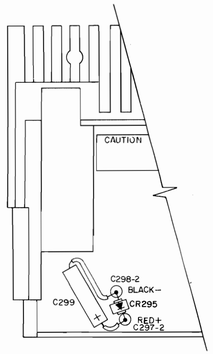
(19D416850, Sh. 2, Rev. 3)
(19D416850, Sh. 3, Rev. 3)

PA ASSEMBLY

TOP VIEW

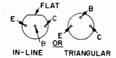


BOTTOM VIEW



(19B622041, Rev. 11)

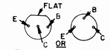
LEAD IDENTIFICATION
FOR Q101 - Q109, Q208, Q213, Q214



IN-LINE TRIANGULAR
VIEW FROM LEAD END

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

LEAD IDENTIFICATION
FOR Q201 - Q207, Q209, Q210, &Q211



IN-LINE TRIANGULAR
VIEW FROM LEAD END

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

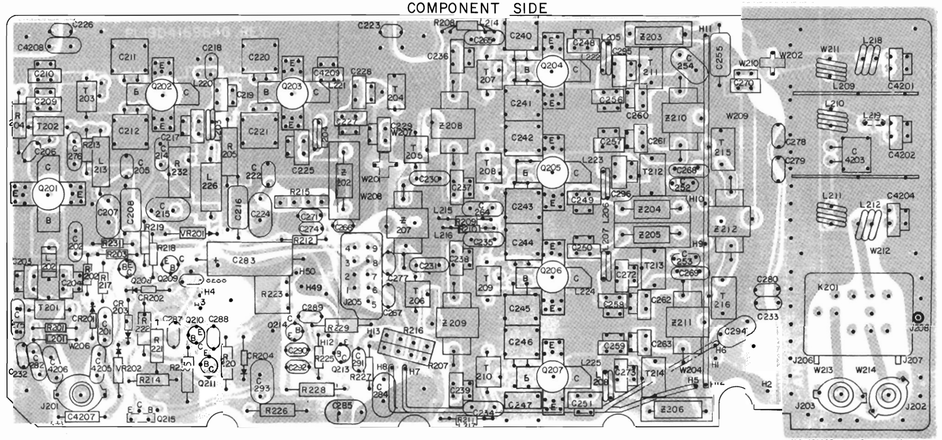
RUNS ON SOLDER SIDE

RUNS ON BOTH SIDES

RUNS ON COMPONENT SIDE

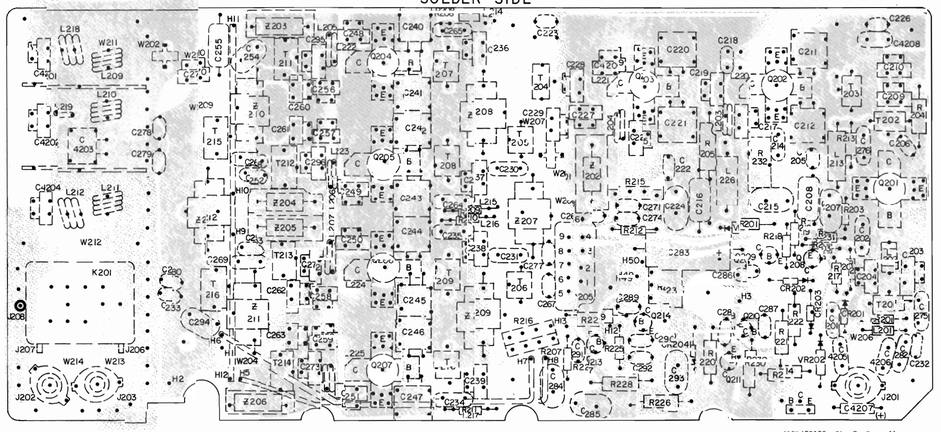
PA BOARD

COMPONENT SIDE



(19D423195, Sh. 3, Rev. 1)

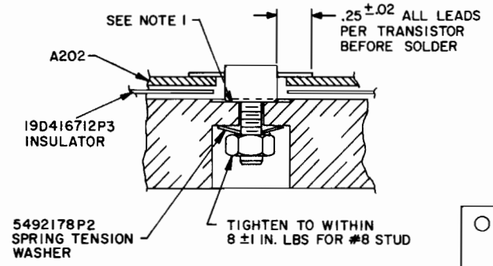
SOLDER SIDE



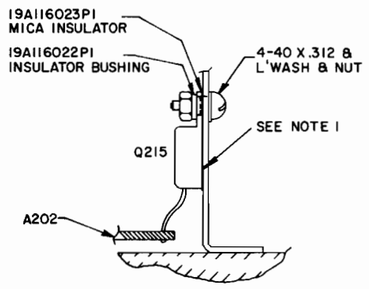
(19D423195, Sh. 2, Rev. 1)

OUTLINE DIAGRAM

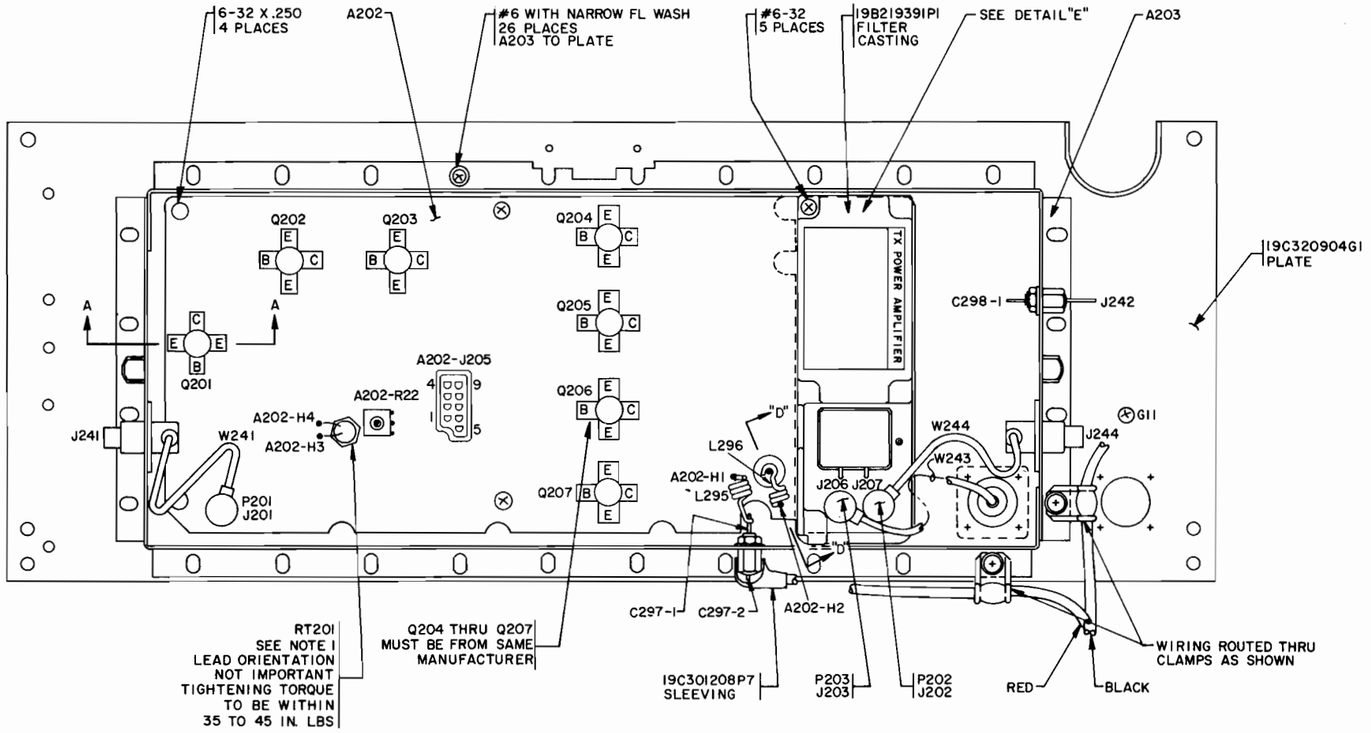
138—174 MHz, 110-WATT STATION TRANSMITTER INTERMITTENT & CONTINUOUS DUTY EXCITER AND PA BOARDS; INTERMITTENT DUTY PA ASSEMBLY

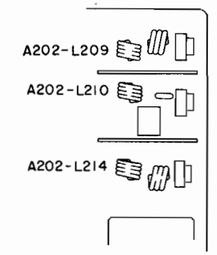


SECTION A-A
TYP MTG FOR Q201 THRU Q207

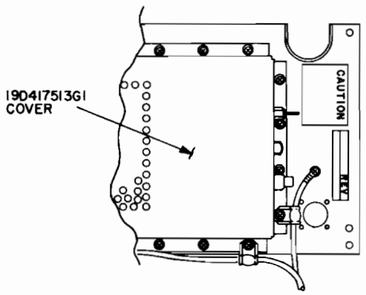


SECTION B-B

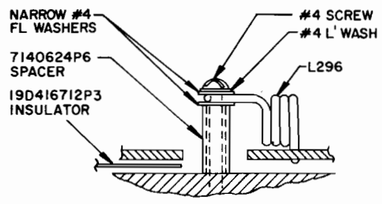




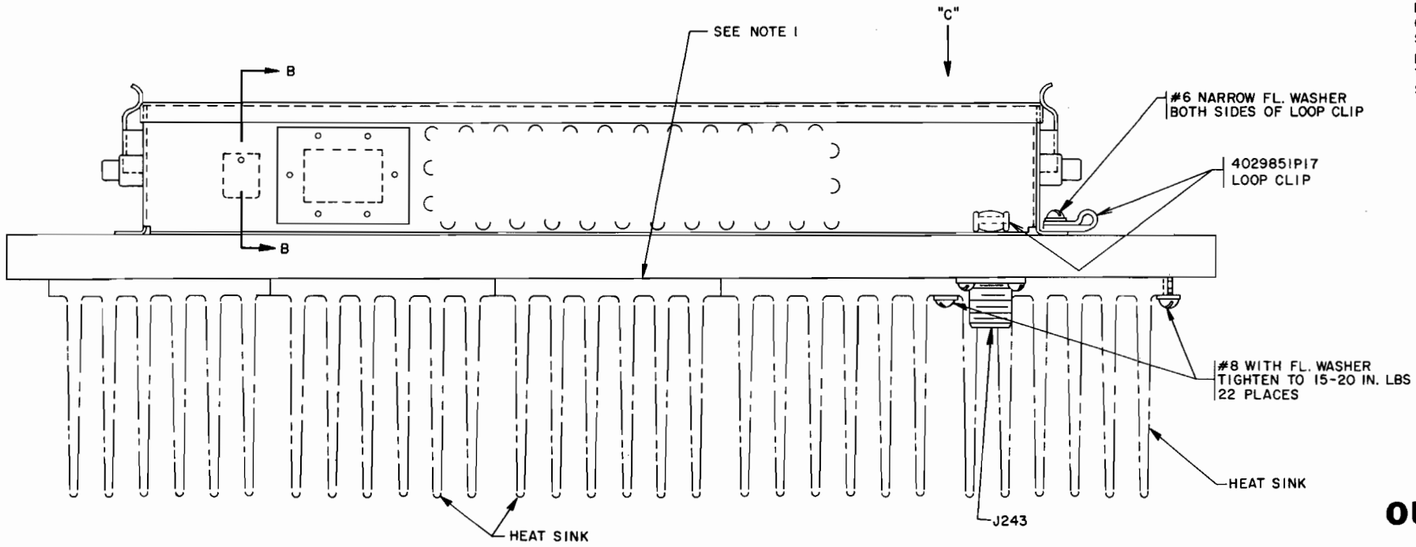
DETAIL "E"
(VIEW OF A202 WITH COVER REMOVED)



VIEW AT "C"



SECTION D-D



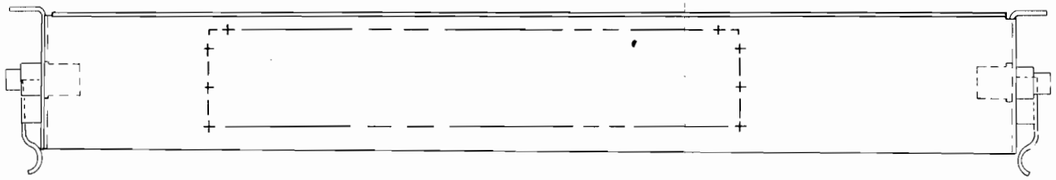
NOTES:

1. APPLY SILICONE GREASE TO BOTH SIDES OF MICA INSULATOR TO MOUNTING SURFACE OF Q201 THRU Q207 & RT201 AND UNPAINTED FLAT SURFACE OF HEAT SINKS.
   NO GREASE ALLOWED ON THE THREADED PORTION OF THE MTG STUD.

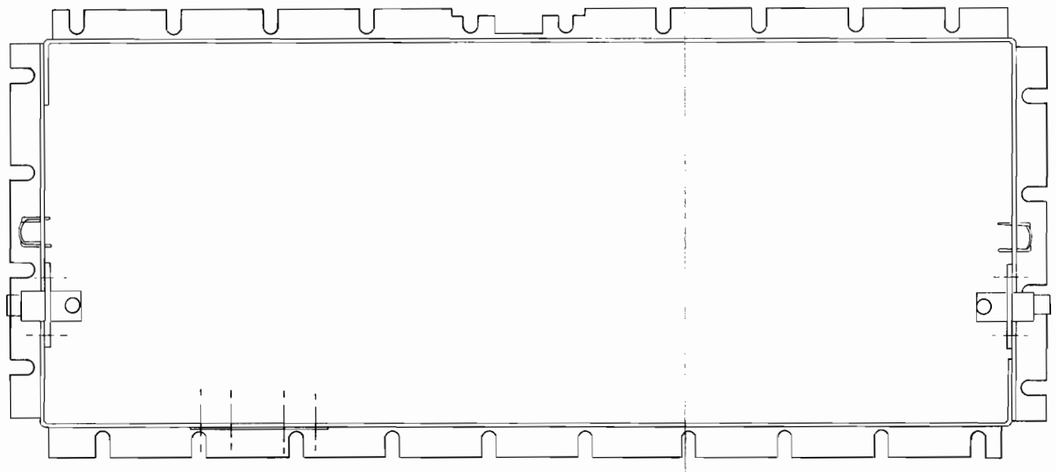
(19D423087, Rev. 0)

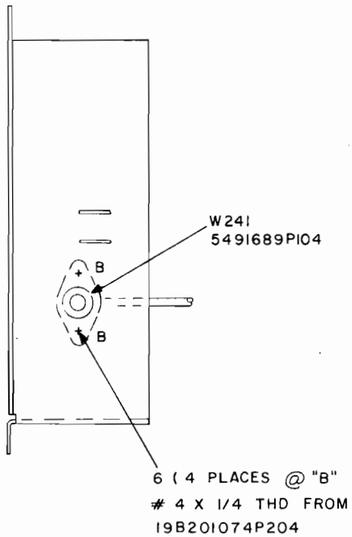
OUTLINE DIAGRAM

138—174 MHz, 110-WATT TRANSMITTER
19D417524G2 CONTINUOUS DUTY PA

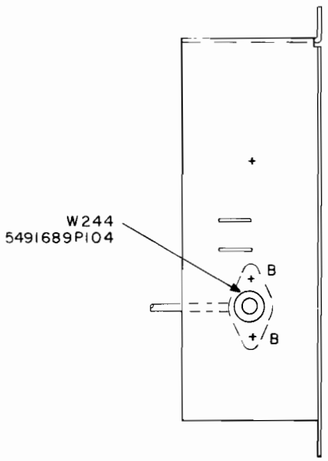


A203





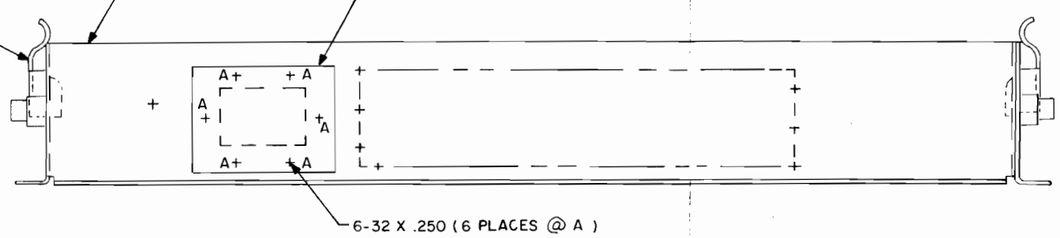
6 (4 PLACES @ "B"
4 X 1/4 THD FROM
19B201074P204



19B226203G1
FRAME
19B226203G2 FRAME
FOR UHF

19B226207P2 PLATE
FOR LOW BAND & HIGH BAND

19A116972P1
SPRING TENSION
CLIP (EACH SIDE)



6-32 X .250 (6 PLACES @ A)

(19D423098, Rev. 0)

OUTLINE DIAGRAM

FRAME ASSEMBLY FOR INTERMITTENT
AND CONTINUOUS DUTY TRANSMITTERS

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 - Exciter Board 19D416859G1, G4

To improve operation. Changed C139, C137, C138, C141, C145, C148, R134, R139, R144, R145, Q108, Q109, and added L109.

REV. B - Exciter Board 19D416859G1, G3

To improve operation. Deleted C136L. Changed C136S, C137, C144L, C145, C146, CV103 and added C137L, C145L, C146L, C103L, L108 and R152.

REV. C - Exciter Board 19D416859G1, G3

To improve drive to modulator stage. Changed Q101 and R106.

REV. D - To Exciter Board 19D416859G1, G3

To reduce transmitter noise. Changed C109.

REV. B - Exciter Board 19D416859G2, G4

To improve drive to modulator stage. Changed Q101 and R106.

REV. C - Exciter Board 19D416859G2, G4

To reduce transmitter noise. Changed C109.

REV. D - Exciter Board 19D416859G2,4

REV. E - Exciter Board 19D416859G13

To improve operation. Changed CV101, CV102, CV103, C159, and R105. Added R154.

REV. E - Exciter Board 19D416859G2,4

REV. F - Exciter Board 19D416859G1,3

To reduce attenuation noise and improve operation. Changed R107. Added C164 and R155.

REV. F - Exciter Board 19D416859G2, 4

REV. G - Exciter Board 19D416859G1, 3

To increase audio sensitivity. Changed R102.

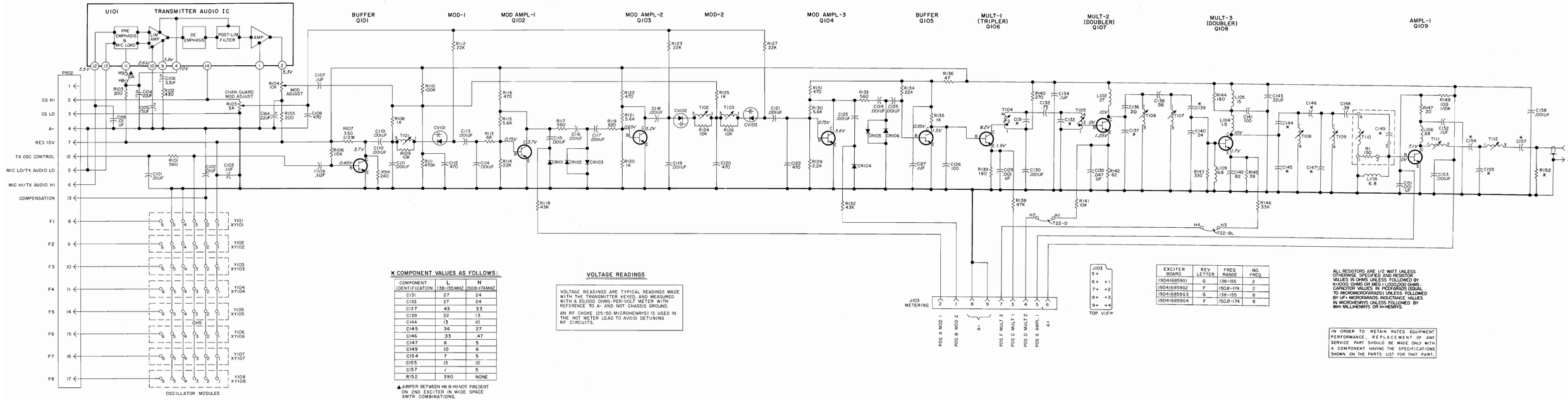
PARTS LIST

LBI-4554E

138-174 MHz EXCITER BOARD
19D416859G1-G4

SYMBOL	GE PART NO.	DESCRIPTION
		19D416859G1 2 FREQ 138-155 MHz (L) 19D416859G2 2 FREQ 150.8-174 MHz (H) 19D416859G3 8 FREQ 138-155 MHz (L) 19D416859G4 8 FREQ 150.8-174 MHz (H)
		- - - - - - - - - CAPACITORS - - - - - - - - -
C101 and C102	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C103	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C104	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C105	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C106	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C107	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C108	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C109*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
	5494481P111	In G1, G3 of REV C and earlier: In G2, G4 of REV B and earlier: Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C110	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C111	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C112	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C113 thru C117	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C118 and C119	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C120	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type IM-15.
C121	5494481P112	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C122	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C123 thru C125	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C126	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C127	19A116080P107	Polyester: 10 µf ±10%, 50 VDCW.
C129 and C130	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C131L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C131N	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C132*	5491601P118	Phenolic: 0.75 pf ±5%, 500 VDCW.
		Earlier than REV A:
	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C133L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C133N	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C134	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C135	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C136*	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C136L*	5496219P348	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -150 PPM. Deleted by REV B.
C136N*	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV B.
C137*	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV B.
		Earlier than REV A:
	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C137L*	5496219P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C137N*	5496219P251	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C138*	5491601P115	Phenolic: 33 pf ±5%, 500 VDCW.
		Earlier than REV A:
	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
C139L	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C139N	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C140	5496219P348	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C141*	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type IM-15.
		Earlier than REV A:
	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C142	7489162P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C143	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C144L*	5496219P243	Ceramic disc: 13 pf ±1%, 500 VDCW, temp coef -80 PPM.
		In REV A and earlier:
	5496219P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
C144N	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C145*	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM. Deleted by REV B.
		Earlier than REV A:
	5496219P246	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -80 PPM.
C145L*	5496219P252	Ceramic disc: 36 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C145N*	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM. Added by REV B.
C146*	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW. Deleted by REV B.
		Earlier than REV A:
	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C146L*	5491601P109	Phenolic: 0.33 pf ±5%, 500 VDCW. Added by REV B.
C146N*	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW. Added by REV B.
C147L	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C147N	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C148*	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
		Earlier than REV A:
	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW.
C149L	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C149N	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C151	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C152	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C153	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C154L	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C154N	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C155N	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C155L	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C157L	5496219P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C157N	5496219P236	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C158	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C159*	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW. In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C164*	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Added to 19D416859G1, G3 by REV F. Added to 19D416859G2, G4 by REV E.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR101 thru CR106	19A115250P1	Silicon.
CV101* and CV102*	5495769P9	Silicon, capacitive: 33 pf ±10%, at 4 VDC. In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 VDC.
CV103*	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 VDC. Deleted by REV B. Added by REV D.
CV103L*	5495769P9	Silicon, capacitive: 33 pf ±10%, at 4 VDC. Added by REV B. Deleted by REV D.
CV103N*	5495769P8	Silicon, capacitive: 33 pf ±20%, at 4 VDC. Added by REV B. Deleted by REV D.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J101	19A116832P1	Receptacle, coaxial: sim to Cinch 14W11613.
J103	19B219374G1	Connector. Includes:
	19A116651P1	Contacts. (9).
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L102	19B209420P130	Coil, RF: 27.0 µh ±10%, 3.60 ohms DC res max; sim to Jeffers 4413L-3.
L104	7488079P7	Choke, RF: 1.50 µh ±10%, 0.50 ohms DC res max; sim to Jeffers 4411-10K.
L105	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9K.
L106	7488079P5	Choke, RF: 0.68 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4411-5K.
L108*	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2. Added to low split by REV B.
L109*	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2. Added by REV A.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P902		Includes:
	19B218594P2	Contact strip: 8 pins.
	19B219594P3	Contact strip: 9 pins.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q101*	19A115330P1	Silicon, NPN. In G1, G3 of REV B and earlier: In G2, G4 of REV A and earlier:
	19A115010P1	Silicon, NPN; sim to Type 2N3904.
Q102 thru Q106	19A115330P1	Silicon, NPN.
Q107	19A115328P1	Silicon, NPN.
Q108* and Q109*	19A115328P2	Silicon, NPN.
		Earlier than REV A:
	19A115328P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R102*	3R152P431K	Composition: 430 ohms ±10%, 1/4 w. In 19D416859G1, G3 of REV F and earlier: In 19D416859G2, G4 of REV E and earlier:
	3R152P391K	Composition: 390 ohms ±10%, 1/4 w.
R103*	3R152P200J	Composition: 200 ohms ±5%, 1/4 w. In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R104	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R105*	19B209358P105	Variable, carbon film: approx 200 to 5000 ohms ±10%, 0.25 w; sim to CTS Type X-201. In 19D416859G1, G3 of REV D and earlier: In 19D416859G2, G4 of REV C and earlier:
	19B209358P108	Variable, carbon film: approx 100 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R106*	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w. In G1, G3 of REV B and earlier: In G2, G4 of REV A and earlier:
	3R152P393K	Composition: 39,000 ohms ±10%, 1/4 w.
R107*	3R77P331K	Composition: 330 ohms ±10%, 1/2 w. In 19D416859G1, G3 of REV E and earlier: In 19D416859G2, G4 of REV D and earlier:
	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R108	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R109	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R110	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R111	3R152P474K	Composition: 0.47 megohm ±10%, 1/4 w.
R112	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R113	3R152P680K	Composition: 68 ohms ±10%, 1/4 w.
R114	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R115	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R116	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R117	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R118	3R152P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R119	3R152P821K	Composition: 820 ohms ±10%, 1/4 w.
R120	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R121	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R122	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R123	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R124	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R125	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R126	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R127	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R129	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R130	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R131	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R132	3R152P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R133	3R152P561K	Composition: 560 ohms ±10%, 1/4 w.
R134*	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w. Earlier than REV A:
	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R135	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R136	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R138	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w.
R139*	3R152P181K	Composition: 180 ohms ±10%, 1/4 w. Earlier than REV A:
	3R152P301J	Composition: 300 ohms ±5%, 1/4 w.
R140	3R152P271K	Composition: 270 ohms ±10%, 1/4 w.
R141	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R142	3R152P620J	Composition: 62 ohms ±5%, 1/4 w.
R143	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R144*	3R152P181K	Composition: 180 ohms ±10%, 1/4 w. Earlier than REV A:
	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R145*	3R152P390K	Composition: 39 ohms ±10%, 1/4 w. Earlier than REV A:
	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R146	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R147	3R152P200J	Composition: 20 ohms ±5%, 1/4 w.
R148	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R152*	3R152P391K	Composition: 390 ohms ±10%, 1/4 w. Added by REV B.
R154*	3R152P241J	Composition: 240 ohms ±5%, 1/4 w. Added to 19D416859G1, G3 by REV E. Added to 19D416859G2, G4 by REV D.
R155*	3R152P301J	Composition: 300 ohms ±5%, 1/4 w. Added to 19D416859G1, G3 by REV F. Added to 19D416859G2, G4 by REV E.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T101	19D416843G9	Coil. Includes:
	5493185P12	Tuning slug.
T102 and T103	19D416843G1	Coil. Includes:
	5493185P12	Tuning slug.
T104	19D416843G3	Coil. Includes:
	5493185P12	Tuning slug.
T105	19D416843G2	Coil. Includes:
	5493185P12	Tuning slug.
T106 and T107	19D416843G7	Coil. Includes:
	5493185P12	Tuning slug.
T108 and T109	19D416843G5	Coil. Includes:
	5493185P13	Tuning slug.
T110		COIL ASSEMBLY 19D416843G8
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P151K	Composition: 150 ohms ±10%, 1/4 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	5493185P13	Tuning slug.
T111	19D416843G4	Coil. Includes:
	5493185P12	Tuning slug.
T112	19D416843G6	Coil. Includes:
	5493185P12	Tuning slug.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U101	19D416542G2	Audio Transmitter.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY101 thru XY108		Socket. Part of Mechanical Construction. Includes:
	19A116779P1	Contact, electrical: sim to Molex 08-54-0404. Quantity (6) with each.
		- - - - - - - - - - OSCILLATORS - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency.
		ICOM Freq = Operating Frequency / 12
Y101 thru Y108	19A129393G17	Externally compensated, ±5 PPM, 138-174 MHz.
Y101 thru Y108	19A129393G14	Internally compensated, ±2 PPM, 138-174 MHz.
		MECHANICAL PARTS
	19A129424G2	Can. (Used with T101-T112).
	4036655P1	Insulator, washer: nylon. (Used with Q108, Q109).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SCHEMATIC DIAGRAM

138—174 MHz, EXCITER BOARD
19D416859G1-G4

EXCITER BOARD	REV LETTER	FREQ RANGE	NO. FREQ.
19D416859G1	G	138-155	2
19D416859G2	F	150.8-174	2
19D416859G3	G	138-155	8
19D416859G4	F	150.8-174	8

✱ COMPONENT VALUES AS FOLLOWS:

COMPONENT IDENTIFICATION	L 138-155 MHZ	H 150.8-174MHZ
C131	27	24
C133	27	24
C137	43	33
C139	22	13
C144	13	10
C145	36	27
C146	33	47
C147	8	5
C149	10	6
C154	7	5
C155	13	10
C157	7	5
R152	390	NONE

▲JUMPER BETWEEN H8 & H9 NOT PRESENT ON 2ND EXCITER IN WIDE SPACE XMTR COMBINATIONS.

VOLTAGE READINGS

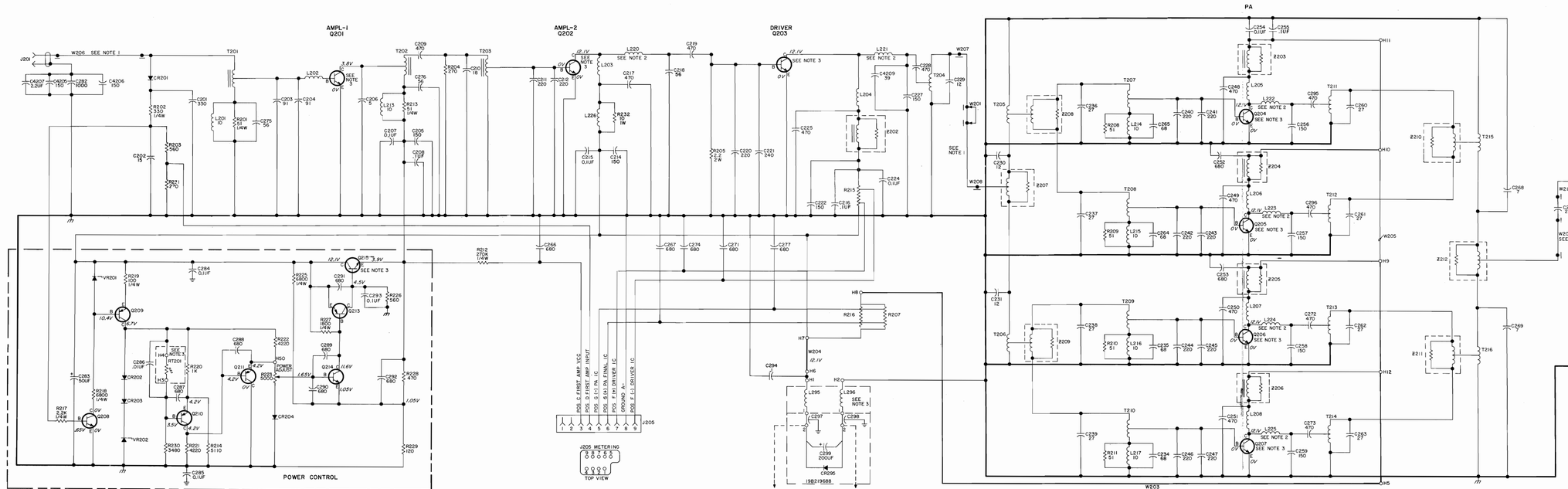
VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND.

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

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.

(19B621902, Rev. 14)



STANDARD PA ASSEMBLY	REV LTR	HEAT SINK ASM	REV LTR	CPNT. BD. ASM	REV LTR	FREQ RANGE
19C320414G3	A	19B219688G3		19D416964G1	F	138-174 MHZ
19C320414G6	A	19B219688G15		19D416964G1	F	138-174 MHZ

SCHEMATIC DIAGRAM

138—174 MHz, 110-WATT STATION
POWER AMPLIFIER 19C320414G3
INTERMITTENT DUTY

PARTS LIST

LBI-4557C

138-174 MHz, 110 WATT
POWER AMPLIFIER
19C320414G3, G6

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L295 and L296	19A129562P1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201	19A134060P1	Silicon, NPN.
Q202	19A134060P2	Silicon, NPN.
Q203B	19A134060P4	Silicon, NPN.
Q204 thru Q207	19A134060P3	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT201	19A129379G1	Thermistor.
		POWER AMPLIFIER BOARD 19D416964G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201*	7489162P39C	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
		In REV B and earlier:
	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C202	7489162P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C203 and C204	19A116679P91J	Mica: 91 pf ±5%, 250 VDCW.
C205*	19A116655P8	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		In REV B and earlier:
	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C206	7489162P1	Silver mica: 5 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C207	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C208*	19A116966P107	Metallized polyester: .1 µf, ±10%, 50 VDCW.
		In REV C and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C209	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C210	19A116679P18J	Metallized teflon: 18 pf ±5%, 250 VDCW.
C211 and C212	19A116795P220J	Mica: 220 pf ±5%, 250 VDCW.
C214*	19A116655P8	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		In REV B and earlier:
	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C215	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C216*	19A116966P107	Metallized polyester: .1 µf, ±10%, 50 VDCW.
		In REV C and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C217	19A116679P200J	Mica: 200 pf ±5%, 250 VDCW.
C218*	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
		In REV B and earlier:
	19A116679P68J	Mica: 68 pf ±5%, 250 VDCW.
C219	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C220	19A116795P220J	Mica: 220 pf ±5%, 250 VDCW.
C221	19A116795P240J	Mica: 240 pf ±5%, 250 VDCW.
C222*	19A116655P8	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		In REV B and earlier:
	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C223	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C224	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C225	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C226	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C227	19A116679P150J	Mica: 150 pf ±5%, 250 VDCW.
C228	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C229	19A116679P12J	Mica: 12 pf ±5%, 250 VDCW.
C230 and C231	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C232 and C233	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C234 and C235	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C236 thru C239	19A116679P27J	Mica: 27 pf ±5%, 250 VDCW.
C240 thru C247	19A116795P220J	Mica: 220 ohms ±5%, 250 VDCW.
C248 thru C251	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C252 and C253	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C254	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C255*	19A116966P107	Metallized polyester: .1 µf, ±10%, 50 VDCW.
		In REV C and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C256 thru C259	19A116679P150J	Mica: 150 pf ±5%, 250 VDCW.
C260 thru C263	19A116679P27J	Mica: 27 pf ±5%, 250 VDCW.
C264 and C265	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C266 and C267	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C268 and C269	7489162P3	Silver mica: 7 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C270	19A116679P220J	Mica: 220 pf ±5%, 250 VDCW.
C271	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C272 and C273	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C274	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C275 and C276	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C277 thru C280	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C282*	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		In REV B and earlier:
	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C283	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C284 and C285	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C286	19A116080P101	Polyester: 0.01 µf ±20%, 50 VDCW.
C288 thru C292	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C293	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C294*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW. Added by REV C.
C295 and C296	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C4201	19A116679P8D	Mica: 8 pf ±.5 pf, 250 VDCW.
C4202	19A116679P22J	Mica: 22 pf ±5%, 250 VDCW.
C4203	19A116795P29J	Mica: 29 pf ±5%, 250 VDCW.
C4204	19A116679P8D	Mica: 8 pf ±.5 pf, 250 VDCW.
C4205 and C4206	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C4207	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C4208	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C4209	19A116679P39J	Mica: 39 pf ±5%, 250 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR201*	19A116052P2	Silicon.
		In REV D and earlier:
	19A115250P1	Silicon.
CR202 thru CR204	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J201 thru J203	19A116832P1	Receptacle, coaxial: sim to Cinch 14H11313.
J205	19B219374G1	Connector: 9 contacts.
J206 and J207		(Part of K201).
J208	4033513P4	Contact, electrical: sim to Bead Chain L03-3.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K201	19A116722P1	Hermetic sealed: 125 ohms ±20%, 1 form C contact, 9.6 to 15.8 VDC (over the temp range indicated).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L201	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
L202	19A129616P1	Strap.
L203 thru L208	19A129561P1	Coil.
L209 thru L211	19A129569P1	Coil.
L212	19A129570P1	Coil.
L213	7488079P43	Choke, RF: 10.0 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4422-4K.
L214 thru L217	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4K.
L218	19A129570P1	Coil.
L219	19A129575P1	Coil.
L220 thru L225		(Part of 19D423195P1 printed wiring board).
L226*	19A129346G1	Coil. Added by REV C.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q208	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q209 thru Q211	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q213	19A129187P1	Silicon, PNP.
Q214	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R202	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R203*	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		In REV B and earlier:
	3R152P821J	Composition: 820 ohms ±5%, 1/4 w.
R204	3R77P271J	Composition: 270 ohms ±5%, 1/2 w.
R205	19B209022P123	Wirewound: 2.2 ohms ±10%, 2 w; sim to IRC Type BWH.
R207	19C320212P1	Shunt resistor.
R208 thru R211	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R212	3R152P274J	Composition: 0.27 megohm ±5%, 1/4 w.
R213	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R214	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R215	19C320212P2	Shunt resistor.
R216	19C320212P1	Shunt resistor.
R217	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R218	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R219	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R220	19A116278P201	Metal film: 1000 ohms ±2%, 1/2 w.
R221 and R222	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R223	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R225	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R226	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R227	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
R228	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R229	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R230	19A116278P253	Metal film: 3480 ohms ±2%, 1/2 w.
R231*	3R152P271J	Composition: 270 ohms ±5%, 1/4 w. Added by REV C.
R232*	3R78P100K	Composition: 10 ohms ±10%, 1 w. Added by REV C.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T201 thru T203	19A129564G1	Coil.
T204	19A129574G1	Coil.
T205 and T206	19A129633G1	Coil.
T207 thru T210	19A129564G1	Coil.
T211 thru T214	19A129574G1	Coil.
T215* and T216*	19A129574G1	Coil.
		In REV E and earlier:
	19A129633G1	Coil.
		- - - - - - - - - - VOLTAGE REGULATORS - - - - - - - - - -
VR201	4036887P1	Silicon, Zener.
VR202	4036887P5	Silicon, Zener.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201 and W202	19A129571P1	Strap.
W203	19B219885P2	Jumper.
W204	19B219930P1	Jumper.
W205	19C320288P1	Strap, connector.
W206 thru W214		(Part of 19D423195P1 printed wiring board).
		- - - - - - - - - - FILTERS - - - - - - - - - -
Z201*	19B219649G1	Filter. Deleted by REV C.
Z202 thru Z206	19B219649G1	Filter.
Z207	19A129563G4	Hybrid filter.
Z208 thru Z211	19A129563G3	Hybrid filter.
Z212	19A129563G4	Hybrid filter.
		HEAT SINK ASSEMBLY 19B219688G3
		- - - - - - - - - - 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 TTX.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR295	19A116783P1	Silicon, NPN.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19D416732G3	Heat sink, casting.
	19B219391P1	Filter casting.
	19D416712P3	Insulator. (Located under Power Amplifier Board).
	19B201074P320	Tap screw: No. 6-32 x 1-1/4. (Secures Filter Casting).
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20. (Used with Q201-Q207).
	N207P15C6	Hexnut: No. 8-32. (Used with Q201-Q207).
	19A134016P1	Insulator, bushing. (Used with Q215).
	19A116023P1	Insulator, plate. (Used with Q215).
	19A129361P2	Shield. (Located between L209 and L210, L211).

PRODUCTION CHANGES

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

REV. A - POWER AMPLIFIER 19C320414G3,G6

REV. A,B&C - POWER AMPLIFIER BOARD 19D416964G1

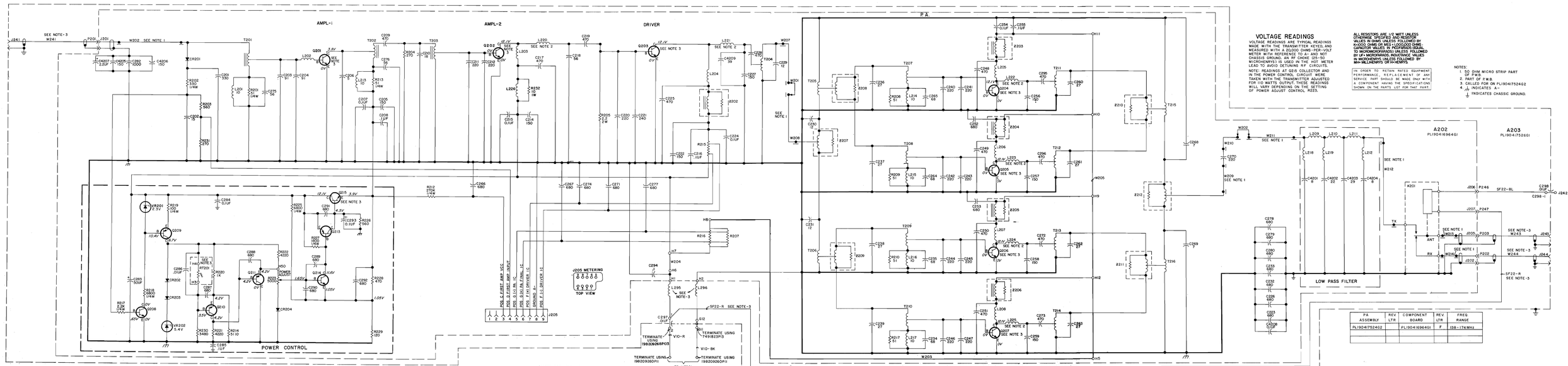
Incorporated into Initial Shipment.

REV. D: To incorporate new capacitors. Changed C208, C216 and C255.

REV. E: To improve operation in cold temperature and wide frequency spacing applications. Changed CR201.

REV. F: To increase power output efficiency at the low end of the band. Changed T215 and T216.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



PA ASSEMBLY	REV LTR	COMPONENT BOARD	REV LTR	FREQ RANGE
PL19041752G2		PL19041696G1	F	138-174 MHz

SCHEMATIC DIAGRAM

138—174 MHz, 110-WATT STATION
POWER AMPLIFIER 19D41752G2
CONTINUOUS DUTY

PARTS LIST

LBI-4747B
138-174 MHz, 110 WATT
POWER AMPLIFIER
CONTINUOUS DUTY
19D417524G2

SYMBOL	GE PART NO.	DESCRIPTION
A202		POWER AMPLIFIER BOARD 19D416964G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	7489162P39C	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C202	7489162P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C203 and C204	19A116679P91J	Mica: 91 pf ±5%, 250 VDCW.
C205*	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		In REV B and earlier:
	19A116655P3	Ceramic disc: 100 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C206	7489162P1	Silver mica: 5 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C207	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C208*	19A116966P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		In REV C and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C209	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C210	19A116679P18J	Metallized teflon: 18 pf ±5%, 250 VDCW.
C211 and C212	19A116795P220J	Mica: 220 pf ±5%, 250 VDCW.
C214*	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		In REV B and earlier:
	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C215	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C216*	19A116966P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		In REV C and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C217	19A116679P200J	Mica: 200 pf ±5%, 250 VDCW.
C218	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C219	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C220	19A116795P220J	Mica: 220 pf ±5%, 250 VDCW.
C221	19A116795P240J	Mica: 240 pf ±5%, 250 VDCW.
C222*	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		In REV B and earlier:
	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C223	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C224	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C225	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C226	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C227	19A116679P150J	Mica: 150 pf ±5%, 250 VDCW.
C228	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C229	19A116679P12J	Mica: 12 pf ±5%, 250 VDCW.
C230 and C231	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C232 and C233	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C234 and C235	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C236 thru C239	19A116679P27J	Mica: 27 pf ±5%, 250 VDCW.
C240 thru C247	19A116795P220J	Mica: 220 ohms ±5%, 250 VDCW.
C248 thru C251	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C252 and C253	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C254	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C255*	19A116966P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		In REV C and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C256 thru C259	19A116679P150J	Mica: 150 pf ±5%, 250 VDCW.
C260 thru C263	19A116679P27J	Mica: 27 pf ±5%, 250 VDCW.
C264 and C265	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C266 and C267	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C268 and C269	7489162P3	Silver mica: 7 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C270	19A116679P220J	Mica: 220 pf ±5%, 250 VDCW.
C271	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C272 and C273	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C274	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C275 and C276	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C277 thru C280	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C282	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C283	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C284 and C285	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C286	19A116080P101	Polyester: 0.01 µf ±20%, 50 VDCW.
C287 thru C292	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C293 and C294	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C295 and C296	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C4201	19A116679P8D	Mica: 8 pf ±.5 pf, 250 VDCW.
C4202	19A116679P22J	Mica: 22 pf ±5%, 250 VDCW.
C4203	19A116795P29J	Mica: 29 pf ±5%, 250 VDCW.
C4204	19A116679P8D	Mica: 8 pf ±.5 pf, 250 VDCW.
C4205 and C4206	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C4207	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C4208	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C4209	19A116679P39J	Mica: 39 pf ±5%, 250 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR201*	19A116052P2	Silicon.
		In REV D and earlier:
	19A115250P1	Silicon.
CR202 thru CR204	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J201 thru J203	19A130924G1	Receptacle, coaxial: sim to Cinch 14H11613.
J205	19B219374G1	Connector: 9 contacts.
J206 and J207		(Part of K201).
J208	4033513P4	Contact, electrical: sim to Bead Chain 103-3.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K201	19A116722P1	Hermetic sealed: 125 ohms ±20%, 1 form C contact, 9.6 to 15.8 VDC (over the temp range indicated).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L201	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
L202	19A129616P1	Strap.
L203 thru L208	19A129561P1	Coil.
L209 thru L211	19A129569P1	Coil.
L212	19A129570P1	Coil.
L213	7488079P43	Choke, RF: 10.0 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4423-4K.
L214 thru L217	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4K.
L218	19A129570P1	Coil.
L219	19A129575P1	Coil.
L220 thru L225		(Part of 19D423195P1 printed wiring board).
L226	19A129346G1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q208	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q209 thru Q211	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q213	19A129187P1	Silicon, PNP.
Q214	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R202	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R203	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R204	3R77P271J	Composition: 270 ohms ±5%, 1/2 w.
R205	19B209022P123	Wirewound: 2.2 ohms ±10%, 2 w; sim to IRC Type BWH.
R207	19C320212P1	Shunt resistor.
R208 thru R211	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R212	3R152P274J	Composition: 0.27 megohm ±5%, 1/4 w.
R213	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R214	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R215	19C320212P2	Shunt resistor.
R216	19C320212P1	Shunt resistor.
R217	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R218	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R219	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R220	19A116278P201	Metal film: 1000 ohms ±2%, 1/2 w.
R221 and R222	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R223	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R225	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R226	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R227	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
R228	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R229	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R230	19A116278P253	Metal film: 3480 ohms ±2%, 1/2 w.
R231	3R152P271J	Composition: 270 ohms ±5%, 1/4 w.
R232	3R78P100K	Composition: 10 ohms ±10%, 1 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T201 thru T203	19A129564G1	Coil.
T204	19A129574G1	Coil.
T205 and T206	19A129633G1	Coil.
T207 thru T210	19A129564G1	Coil.
T211 thru T214	19A129574G1	Coil.
T215* and T216*	19A129574G1	Coil.
		In REV E and earlier:
	19A129633G1	Coil.
		- - - - - - - - - - VOLTAGE REGULATORS - - - - - - - - - -
VR201	4036887P1	Silicon, Zener.
VR202	4036887P5	Silicon, Zener.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201 and W202	19A129571P1	Strap.
W203	19B219885P2	Jumper.
W204	19B219930P1	Jumper.
W205	19C320288P1	Strap, connector.
W206 thru W214		(Part of 19D423195P1 printed wiring board).
		- - - - - - - - - - FILTERS - - - - - - - - - -
Z202 thru Z206	19B219649G1	Filter.
Z207	19A129563G4	Hybrid filter.
Z208 thru Z211	19A129563G3	Hybrid filter.
Z212	19A129563G4	Hybrid filter.
A203		FRAME ASSEMBLY 19D417526G1
		- - - - - - - - - - CABLES - - - - - - - - - -
W241	5491689P104	Cable, RF: approx 3-5/8 inches long, 350 VRMS, 500 VDC operating voltage.
W244	5491689P104	Cable, RF: approx 3-5/8 inches long, 350 VRMS, 500 VDC operating voltage.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C297 and C298	19A116708P1	Ceramic, feed-thru: 0.01 µf +100% -0%, 500 VDCW; sim to Erie Style 327.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L295	19A129562P3	Coil.
L296	19A129562P1	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P246 and P247	4036634P1	Contact, electrical: sim to AMP 42428-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201	19A134060P1	Silicon, NPN.
Q202	19A134050P2	Silicon, NPN.
Q203B	19A134060P4	Silicon, NPN.
Q204 thru Q207	19A134060P3	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT201	19A129379G1	Thermistor.
		- - - - - - - - - - CABLES - - - - - - - - - -
W243	19A129312G6	Cable, antenna: approx 10 inches long.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19B226212G1	Heat sink, casting. (Quantity 4).
	19B226212G2	Heat sink, casting. (Quantity 1).
	19B219391P1	Filter casting.
	19D416712P3	Insulator. (Located under Power Amplifier Board).
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20. (Used with Q201-Q207).
	19A116022P1	Insulator, bushing. (Used with Q215).
	19A116023P1	Insulator, plate. (Used with Q215).
	N5602P015	"O" Ring. (Used with Q215).
	N402P7C6	Washer: No. 6. (Used with Q215).
	19A129888P1	Insulator. (Used with Q215).
	19D417513G1	Cover.

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.

POWER AMPLIFIER BOARD 19D416964G1

REV. A,B&C - Incorporated into Initial Shipment.

REV. D - To incorporate improved by-pass capacitors. Changed C208, C216 & C255.

REV. E - To improve performance in cold temperature and wide frequency spacing. Changed CR201.

REV. F - To increase power output efficiency at the low end of the band. Changed T215 and T216.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.