MOBILE RADIO

MAINTENANCE MANUAL

138—174 MHz, 100/110-WATT POWER AMPLIFIER
19C320414G3 MOBILE "M" 138—174 MHz
19C320414G6 MOBILE "E" 138—174 MHz
19C320414G8 STATION INTERMITTENT DUTY, 150.8—174 MHz
19C320414G9 STATION INTERMITTENT DUTY, 138—155 MHz
19D417524G2 STATION CONTINUOUS DUTY, 138—155 MHz
19D417524G4 STATION CONTINUOUS DUTY, 150.8—174 MHz

TABLE OF CONTENTS

DESCRIPTION

The PA assembly uses seven RF power transistors to provide 100 watts output power for MASTR™ Executive II and 110 watts output power for MASTR™ II. The output power is adjustable over a range of 30 to 100 watts for MASTR Executive II and 35 to 110 watts for MASTR II. Seven transistors are used in the power control circuit.

CAUTION

Mobile and Station Power Amplifiers ARE NOT interchangeable due to different chassis grounding requirements.

In Station applications, the chassis ground and PA board ground are common.

In Mobile applications, the PA board is isolated from vehicle ground.

Supply voltage for the PA is connected through power leads (from the system-audio-squelch board (SAS) on MASTR Executive II and from the system board on MASTR II) 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 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.

The PA assembly is insulated from vehicle ground to permit operation in positive or negative ground vehicles.

NOTE

In positive ground vehicles, A- is "hot" with respect to vehicle ground. Shorting the transmitter PA printed wiring board ground pattern to the radio case may cause one of the in-line fuses to blow.

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 voltage, driver current, PA current and PA voltage.

CIRCUIT ANALYSIS

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, R231 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 L226 and R232 and collector feed network L203 and C17.

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 for ± ground operation.

WARNING

The RF Power Transistors used in the transmitter contain Beryilium 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 30 to 100 watts for MASTR Executive II and 35 to 110 watts for MASTR II.

CAUTION

Due to the reduced heat dissipation capability of the MASTR Executive II heat sink assembly, the MASTR Executive II transmitter should not be adjusted above 100 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 approximately 100°C. When the heatsink temperature decreases below 100°C, the temperature control circuit turns off, allowing the normal transmitter power output.

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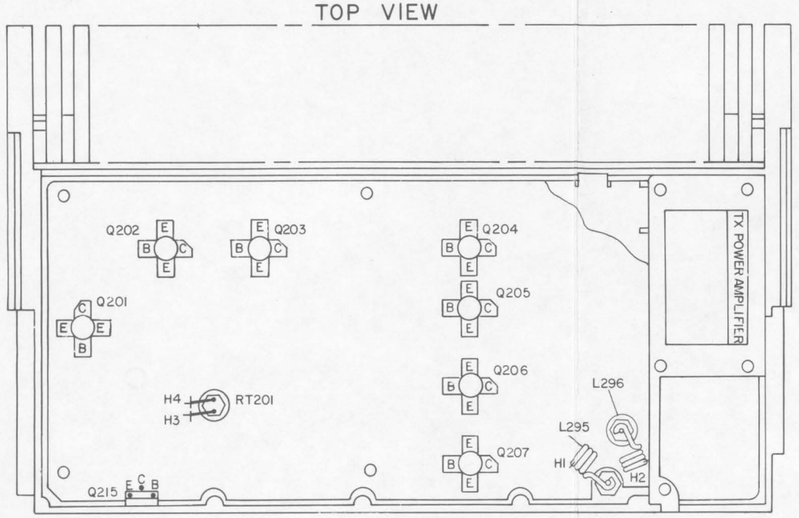
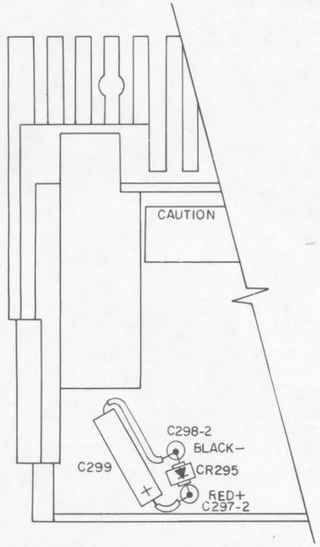
PA ASSEMBLY
TOP VIEW

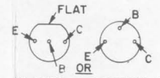


BOTTOM VIEW



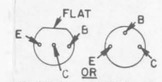
▲ 19D416964G2 & G3
✱ 19D416964G3

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

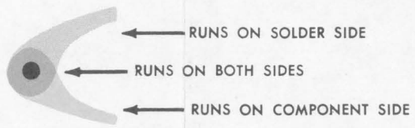


NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

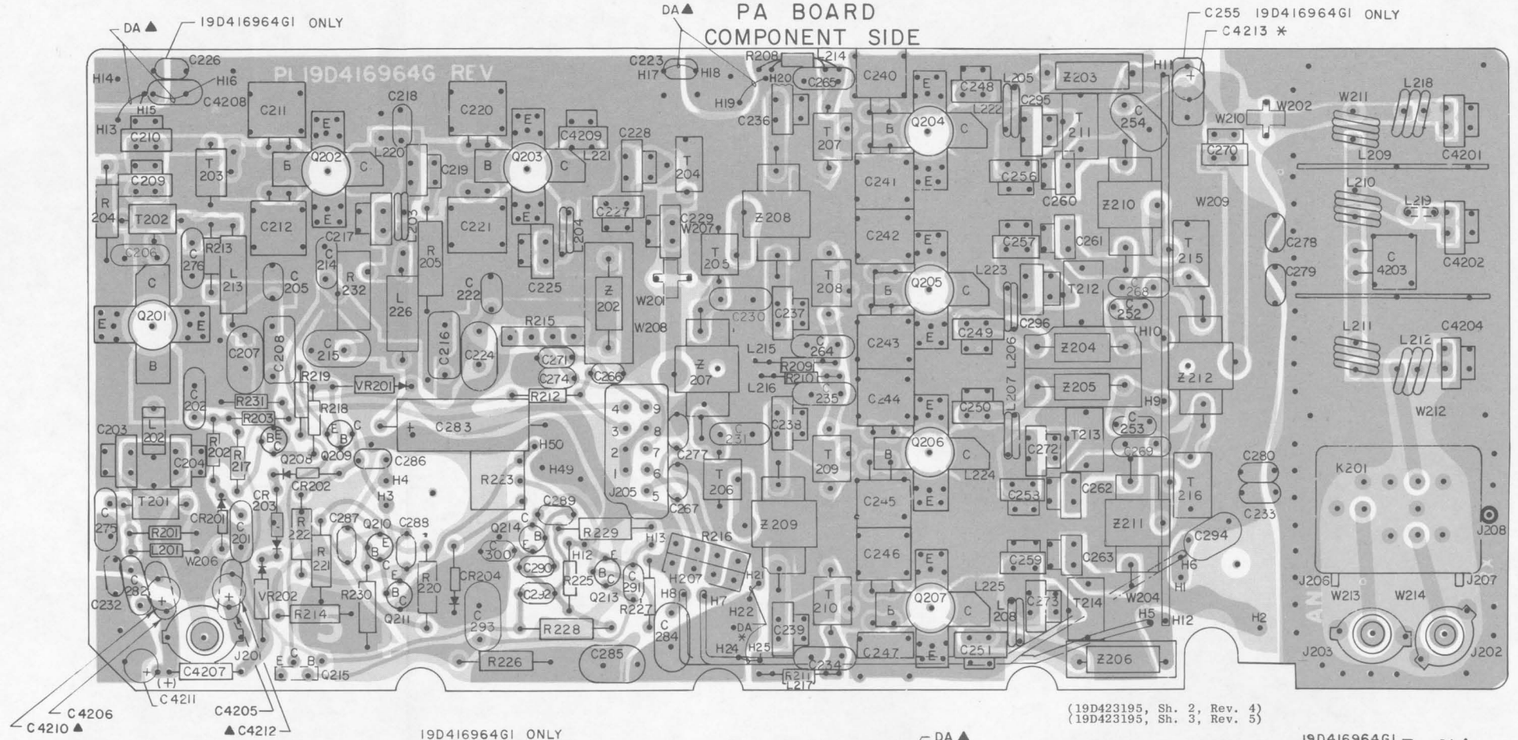
LEAD IDENTIFICATION
FOR Q201 - Q207, Q209, Q210, &Q211



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

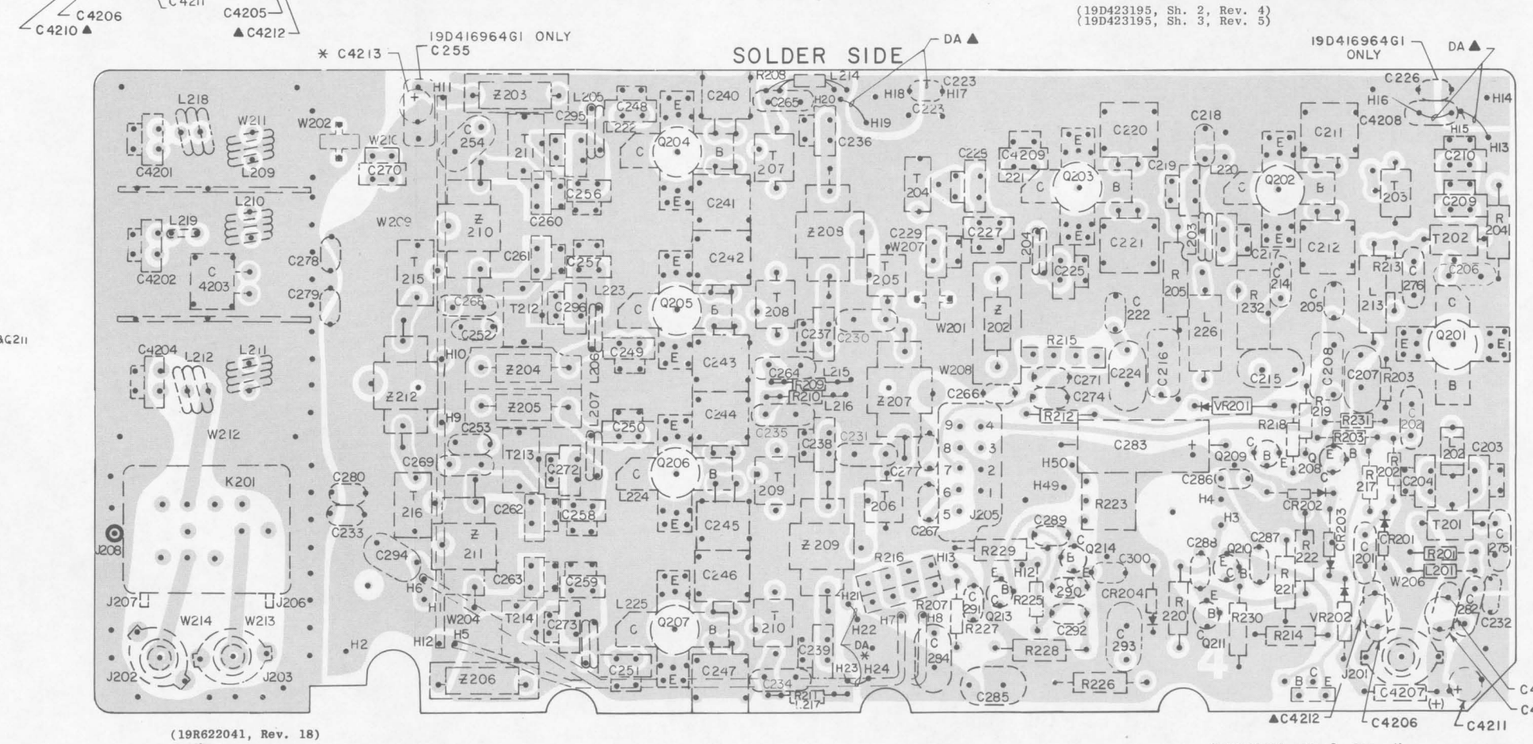


PA BOARD
COMPONENT SIDE



(19D423195, Sh. 2, Rev. 4)
(19D423195, Sh. 3, Rev. 5)

SOLDER SIDE

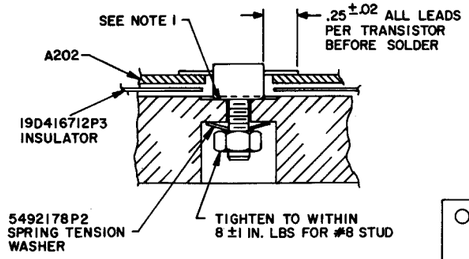


(19R622041, Rev. 18)

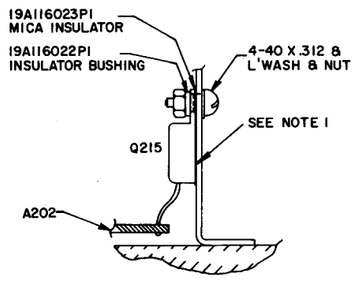
(19D423195, Sh. 2, Rev. 4)

OUTLINE DIAGRAM

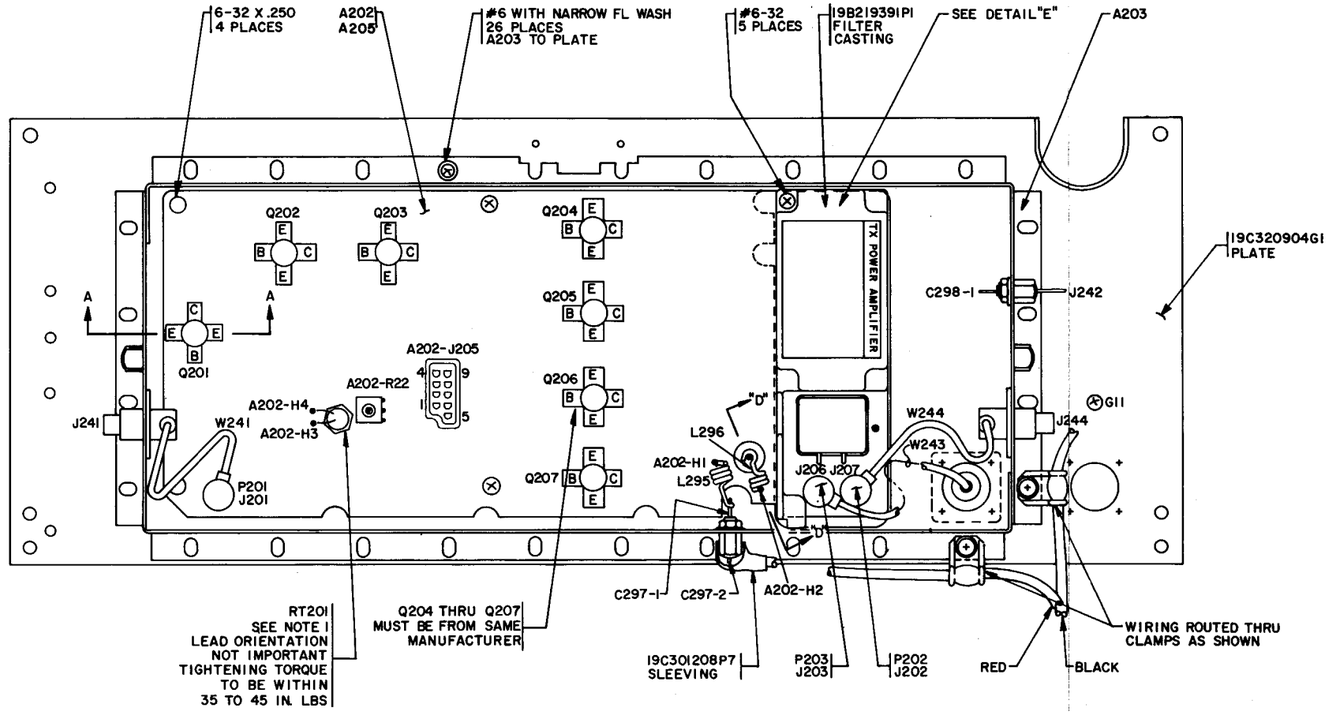
138—174 MHz, 100/110 WATT
POWER AMPLIFIER 19C320414G3, G6, G8 & G9
MOBILE AND INTERMITTENT DUTY STATION

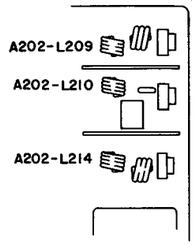


SECTION A-A
TYP MTG FOR Q201 THRU Q207

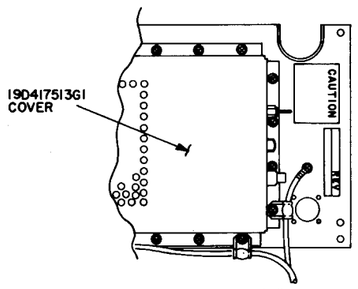


SECTION B-B

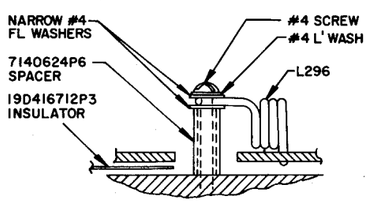




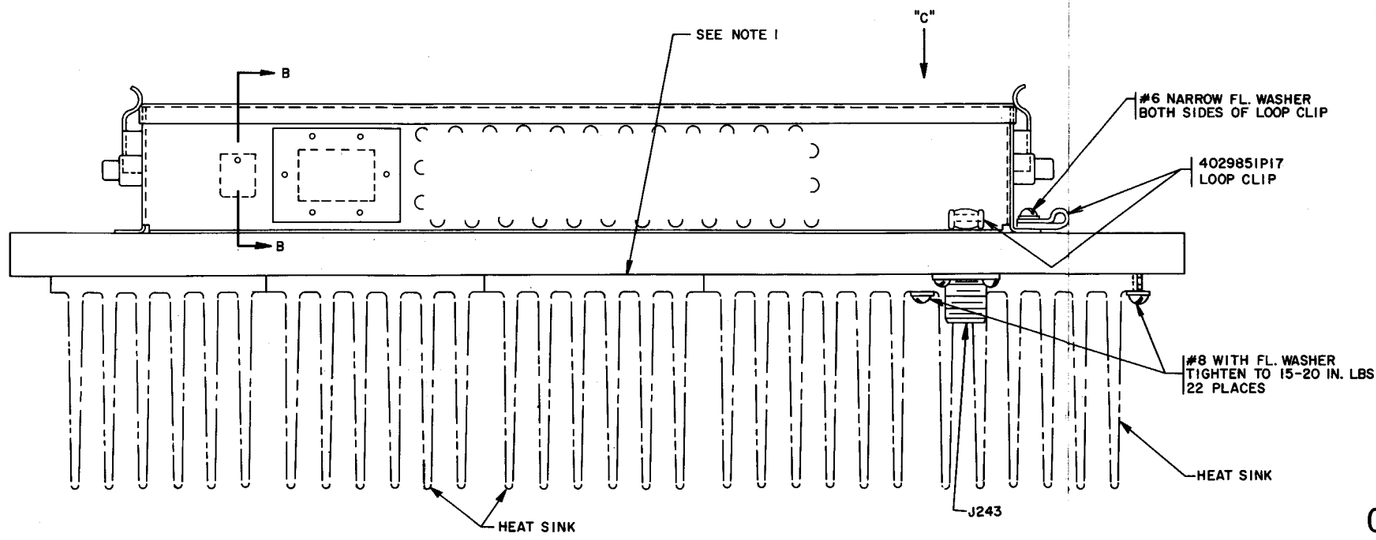
DETAIL "E"
(VIEW OF A202 WITH COVER REMOVED)



VIEW AT "C"



SECTION D-D

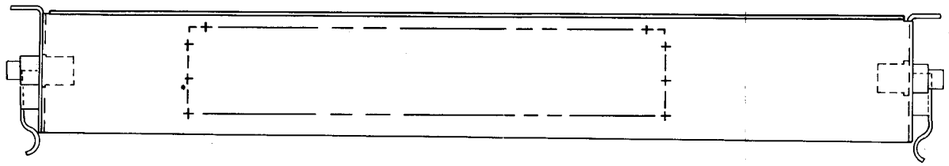


NOTES:
1. APPLY SILICONE GREASE TO BOTH SIDES OF MICA INSULATOR TO MOUNTING SURFACE OF Q201 THRU Q207 & RT201 AND UNPAINTED FLAT SURFACE OF HEAT SINKS.
   NO GREASE ALLOWED ON THE THREADED PORTION OF THE MTG STUD.

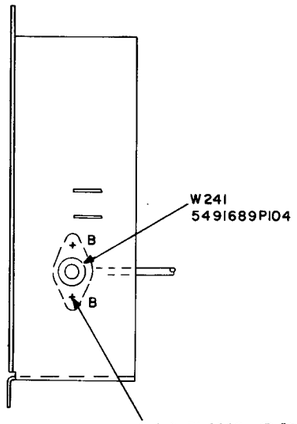
(19D423087, Rev. 1)

OUTLINE DIAGRAM

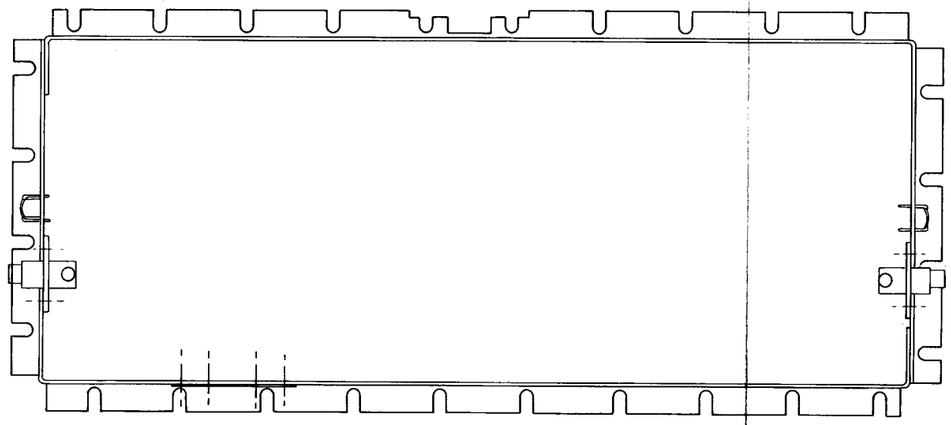
138—174 MHz, 110 WATT POWER AMPLIFIER
19D417524G2 & G4 CONTINUOUS DUTY STATION

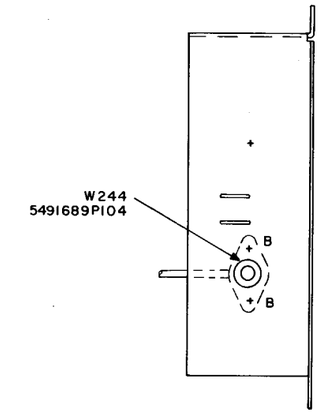


A203



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

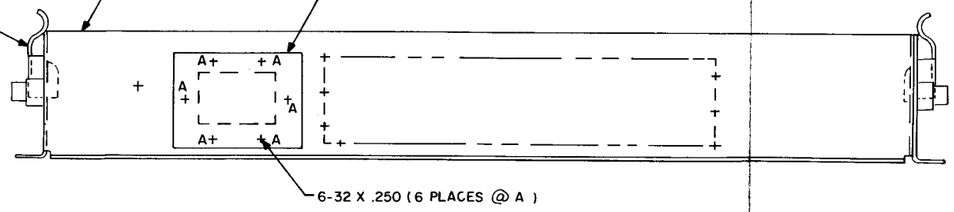




19B226203G1
FRAME
19B226203G2 FRAME
FOR UHF

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

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 Q215 COLLECTOR AND IN THE POWER CONTROL CIRCUIT WERE TAKEN WITH THE TRANSMITTER ADJUSTED FOR 110 WATTS OUTPUT. THESE READINGS WILL VARY DEPENDING ON THE SETTING OF POWER ADJUST CONTROL R223.

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. 50 OHM MICROSTRIP PART OF PWB.
2. PART OF PWB.
3. CALLED FOR ON PL19C320414G3.
4. ⏚ INDICATES A-
   ⏚ INDICATES VEHICLE GROUND
5. COMPONENT USED ONLY IN CERTAIN GROUPS AS FOLLOWS:
   * USED IN 19D416964G3
   △ USED IN 19D416964G2 & G3
   □ USED IN 19D416964G1
   ○ USED IN 19D416964G1 & G2

STANDARD PA ASSEMBLY	REV LTR	HEAT SINK ASM.	REV LTR	CPNT. BD. ASM.	REV LTR	FREQ RANGE	APPLICATION
19C320414G3	A	19B219688G3		19D416964G1	G	138-174 MHz	"M" MOBILES
19C320414G6	A	19B219688G5		19D416964G1	G	138-174 MHz	"E" MOBILES
19C320414G8		19B219688G3		19D416964G2		150.8-174MHz	STATIONS
19C320414G9		19B219688G3		19D416964G3		138-155 MHz	STATIONS

(19R621940, Rev. 18)

SCHEMATIC DIAGRAM

138—174 MHz, 100/110 WATT POWER AMPLIFIER
19C320414G3, G6, G8 & G9
MOBILE AND INTERMITTENT DUTY STATION

PARTS LIST

LBI-4557F

138-174 MHz, 110 WATT POWER AMPLIFIER
19C320414G3 STD PKG 138-174 MHz
19C320414G5 STD PKG 138-174 MHz
19C320414G6 STATION INTER. DUTY 138-155 MHz
19C320414G9 STATION INTER. DUTY 150.8-174 MHz

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2995 and L2996	19A129552P1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201	19A136406P1	Silicon, NPN.
Q202	19A136406P2	Silicon, NPN.
Q203A	19A136406P4	Silicon, NPN.
Q204 thru Q207	19A136406P3	Silicon, NPN.
Q215	19A116743P1	Silicon, NPN.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT201	19A129379G1	Thermistor.
		POWER AMPLIFIER BOARD 19D416964G1 19D416964G2 19D416964G3
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	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	7489162P101	Silver mica: 5 pf ±10%, 500 VDCW; sim to Electro Motive Type IM-15.
C207	19A116040P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C208*	19A116666P107	Metallized 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	19A116679P1BJ	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	19A116040P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C216*	19A116966P107	Metallized 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 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	19A116040P107	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	19A116679P13J	Metallized teflon: 13 pf ±.5 pf, 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	19A116679P75J	Metallized teflon: 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	19A116040P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C255*	19A116666P107	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	19A116679P75J	Metallized teflon: 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 TTH.
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.
C300*	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV C.
C4201	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C4202	19A116679P32J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C4203	19A116795P29J	Metallized teflon: 29 pf ±5%, 250 VDCW.
C4204	19A116679P8D	Metallized teflon: 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	Metallized teflon: 39 pf ±5%, 250 VDCW.
C4210 thru C4212	19A134203P14	Tantalum: 1 µf ±20%, 35 VDCW.
C4213	19A134203P8	Tantalum: 15 µf ±20%, 20 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR201*	19A116053P2	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	19A119337A61	Connector: 9 contacts. (Part of K201).
J206 and J207		
J208	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K201	19A116722P1	Hermetic sealed: 125 ohms ±20%, 1 form C contact, 5.6 to 15.8 VDC (over the temp range indicated).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L201	19A130942G9125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4K.
L202	19A129616P1	Strap.
L203 thru L208	19A129561P1	Coil.
L209 thru L211	19A129569P1	Coil.
L212	19A129570P1	Coil.
L213	7488078P43	Choke, RF: 10.0 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4422-4K.
L214 thru L217	19A130942G9125	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	3R77P27J	Composition: 270 ohms ±5%, 1/2 w.
R205	19A209022P123	Wirewound: 2.2 ohms ±10%, 2 w; sim to IRC Type BW6.
R207	19C330213P1	Shunt resistor.
R208 thru R211	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R212	3R152P274J	Composition: 0.27 megohm ±5%, 1/4 w.
R213	3R152P51J	Composition: 51 ohms ±5%, 1/4 w.
R214	19A116278P259	Metal film: 5110 ohms ±2%, 1/2 w.
R215	19C330213P2	Shunt resistor.
R216	19C330213P1	Shunt resistor.
R217	3R152P223J	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	19A116569P102	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 thru T206	19A129633G1	Coil.
T207 thru T210	19A129564G1	Coil.
T211 thru T214	19A129574G1	Coil.
T215* thru T216*	19A129574G1	Coil. In REV E and earlier:
	19A129633G1	Coil.
VR201	4036887P1	Silicon, Zener.
VR202	4036887P5	Silicon, Zener.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201 and W202	19A129571P1	Strap.
W203	19B219885P2	Jumper.
W204	19B219830P1	Jumper.
W205	19C320288P1	Strap, connector. (Part of 19D423195P1 printed wiring board).
W206 thru W214		
		- - - - - - - - - - FILTERS - - - - - - - - - -
Z201*	19D219649G1	Filter. Deleted by REV C.
Z202 thru Z206	19D219649G1	Filter.
Z207	19A129563G4	Hybrid filter.
Z208 thru Z211	19A129563G3	Hybrid filter.
Z212	19A129563G4	Hybrid filter. HEAT SINK ASSEMBLY 19D219648G15 STD PKG 19D219648G115 STS PKG
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C297 and C298	19A116704P1	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 TTH.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR295	19A116783P1	Silicon, NPN.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19D416733G3	Heat sink, casting. (STD PKG).
	19D417105G3	Heat sink, casting. (STS PKG).
	19B219391G1	Filter casting.
	19D416713P3	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).
	X20TP15C6	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).
	19A129633P21	Cover, heat sink. (STSTTER PACKAGE).

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.

REV. G - To prevent the RF Power output level from changing when the cover is put on the PA. Added C300.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.


AMPL-1
AMPL-2
DRIVER
P.A.
POWER CONTROL
LOW PASS FILTER
J205 METERING
TOP VIEW
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 Q215 COLLECTOR AND IN THE POWER CONTROL CIRCUIT WERE TAKEN WITH THE TRANSMITTER ADJUSTED FOR 110 WATTS OUTPUT. THESE READINGS WILL VARY DEPENDING ON THE SETTING OF POWER ADJUST CONTROL R223.
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. 50 OHM MICRO STRIP PART OF P.W.B.
2. PART OF P.W.B.
3. CALLED FOR ON PL19D417524G2 & G4
4. INDICATES A-
INDICATES CHASSIC GROUND.
5. COMPONENTS USED ONLY IN CERTAIN GROUPS, AS FOLLOWS:
* USED IN LOW SPLIT ONLY (19D416964G1)
△ USED IN HIGH SPLIT ONLY (19D416964G2)
A202
PL19D416964G1
OR
A205
PL19D416964G2
A203
PL19D417526G1

PA ASSEMBLY	REV. LTR	COMPONENT BOARD	REV. LTR	FREQ. RANGE
PL19D417524G2		PL19D416964G1	G	138-155 MHz
PL19D417524G4		PL19D416964G2		150.5-174 MHz

(19B622051, Rev. 12)

SCHEMATIC DIAGRAM

138—174 MHz, 110 WATT POWER AMPLIFIER
19D417524G2 & G4 CONTINUOUS DUTY STATION

PARTS LIST

LBI-4747C

138-174 MHz, 110 WATT
POWER AMPLIFIER
CONTINUOUS DUTY
19D417524G2 138-155 MHz
19D417524G4 150.8-174 MHz

SYMBOL	GE PART NO.	DESCRIPTION
A202, A205		POWER AMPLIFIER BOARD A202 19D416964G1 138-155 MHz A205 19D416964G2 150.8-174 MHz
		- - - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	7489162P39	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	7489162P101	Silver mica: 5 pf ±10%, 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	Metallized teflon: 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	Metallized teflon: 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	Metallized teflon: 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.
C300*	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV G.
C4201	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C4202	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C4203	19A116795P29J	Mica: 29 pf ±5%, 250 VDCW.
C4204	19A116679P8D	Metallized teflon: 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	Metallized teflon: 39 pf ±5%, 250 VDCW.
C4210 thru C4212	19A134202P14	Tantalum: 1 µf ±20%, 35 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 L93-3.
		- - - - - - - - - - - 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 4446-4K.
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.
		- - - - - - - - - - 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: 270K ohms ±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: 2.2K ohms ±5%, 1/4 w.
R218	3R152P682J	Composition: 6.8K ohms ±5%, 1/4 w.
R219	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R220	19A116278P201	Metal film: 1K ohms ±2%, 1/2 w.
R221 and R222	19A116278P261	Metal film: 4.22K ohms ±2%, 1/2 w.
R223	19A116559P102	Variable, cermet: 5K ohms ±20%, .5 w; sim to CTS Series 360.
R225	3R152P682J	Composition: 6.8K ohms ±5%, 1/4 w.
R226	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R227	3R152P182J	Composition: 1.8K 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: 3.48K 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.
A205		(See A202).
		- - - - - - - - - - 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	19A134060P2	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).
	19B219391G1	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.

*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.

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.

19D416964G1 POWER AMPLIFIER BOARD

REV. G - Added capacitor C300 to improve power output level stability.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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