MOBILE RADIO

MAINTENANCE MANUAL

138—174 MHz, 65-WATT POWER AMPLIFIER
19C320414G2 MOBILE "M" 138—174 MHz
19C320414G2 STATION INTERMITTENT DUTY, 138—155 MHz
19C320414G5 MOBILE "E" 138—174 MHz
19C320414G7 STATION INTERMITTENT DUTY, 150.8—174 MHz
19D417524G1 STATION CONTINUOUS DUTY, 138—155 MHz
19D417524G3 STATION CONTINUOUS DUTY, 150.8—174 MHz

TABLE OF CONTENTS

DESCRIPTION

The PA assembly uses five RF power transistors and seven transistors in the Power Control circuitry to provide a power output of 65 Watts. The broadband PA has no adjustments other than Power Control potentiometer R222.

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 from 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 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.

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, C204, C205 and L202. R201, L201 and C206 comprise a stabilizing network in the base circuit of Q201.

Part of the RF input is rectified by CR201 and used to activate the Power Control circuit. Another portion of the rectified RF is applied to voltage dividers R203 and R231 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 (L203, R204 and C209) and collector feed network T202 and C286. 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 T203, C214 and C215. Collector voltage to Q202 is applied through collector stabilizing network Z201 and collector feed network L204 and C218.

The output of Q202 is applied to the base of Class C driver Q203 through a low-pass filter matching network (L216, C219, C221 and C222). Collector voltage to Q203 is coupled through collector stabilizing network Z202 and collector feed network L205 and C226.

Collector current for Q203 is metered across tapped manganin resistor R213 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 (L217, C228, T204 and C229) that matches the output of Q203 to the 50-ohm microstrip impedance (W206) to the input of power divider Z205.

The power amplifier stages consist of two identical paralleled Class C PA circuits (Q204 and Q205). One output of Z205 is applied to the base of Q204 through an impedance matching network (T206, C233 and C237). C234, L207 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 L208 and C252.

Collector current for Q204 and Q205 is metered across paralleled tapped manganin resistors R210 and R211. 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 (L218, C242 and T208), and added to the output of Q205 in power combiner Z206. Following Z206 is impedance matching transformer T210 that matches the combiner output to the 50-ohm microstrip (W207). Capacitors C270 through C287 provides ground isolation for ± ground operation. The PA output is coupled through a low-pass filter to the antenna through antenna switch K201.

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 Q206, turning it on. Turning on Q206 turns on voltage regulator Q207, supplying a constant voltage to Power Adjust potentiometer R222.

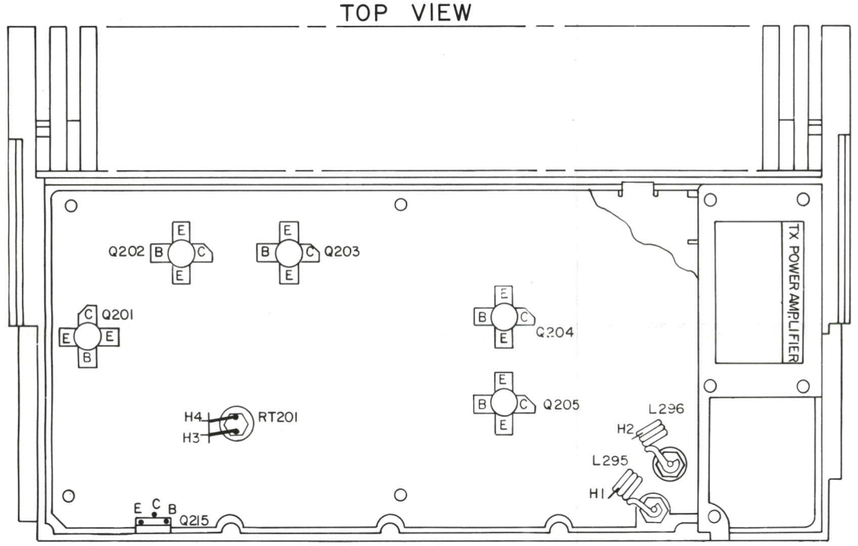
Q210, Q211 and Q215 operate as an amplifier chain to supply voltage to the collector of Q201 (Ampl-1). The setting of R222 determines the voltage applied to the base of Q210. The higher the voltage at the base of Q210, the harder the amplifiers conduct, supplying more collector voltage to Q201. The lower the voltage at the base of Q210, 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 R222 from approximately 20 to 65 Watts.

Temperature protection is provided by Q208, Q209, and thermistor RT201 which is mounted in the PA heatsink. Under normal operating conditions, the circuit is inactive (Q208 is on and Q209 is off). When the heatsink temperature reaches approximately 100°C, the resistance of RT201 decreases. This increases the base voltage applied to Q208, turning it off. Turning off Q208 allows Q209 to turn on, decreasing the voltage at Power Adjust potentiometer R222. This reduces the base voltage to Q210 which causes Q211 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, providing normal transmitter power output.

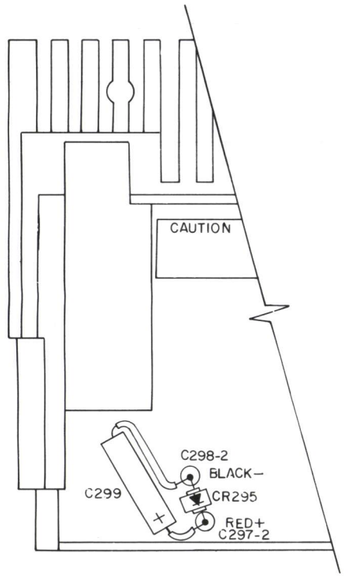
MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

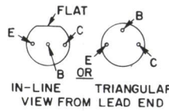
PA ASSEMBLY
TOP VIEW



BOTTOM VIEW



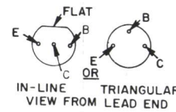
LEAD IDENTIFICATION
FOR Q101-Q109, Q206, Q210, Q211



IN-LINE TRIANGULAR
VIEW FROM LEAD END

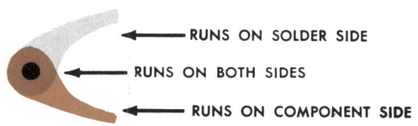
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION
FOR Q201-Q205, Q207, Q208, Q209

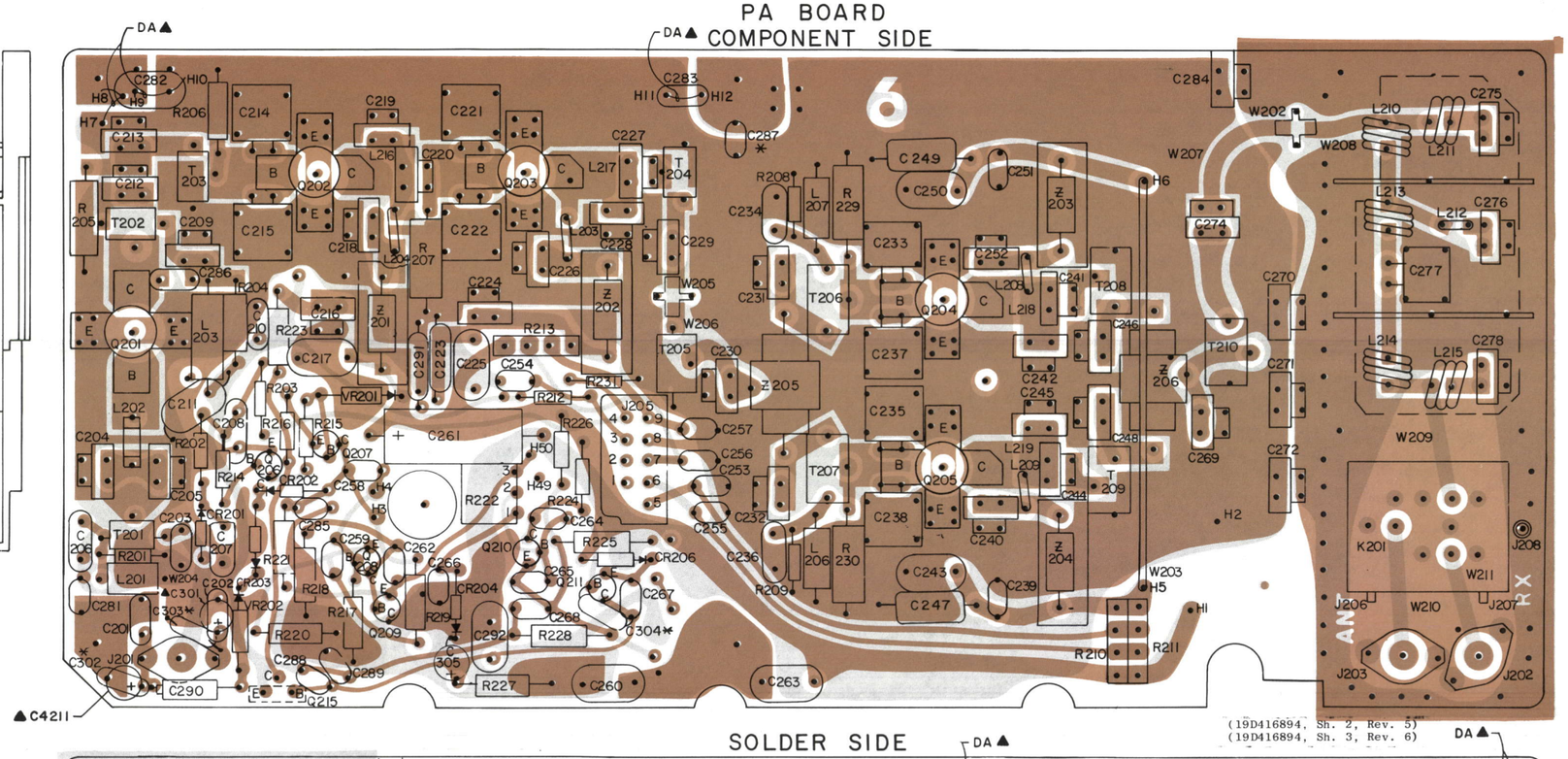


IN-LINE TRIANGULAR
VIEW FROM LEAD END

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

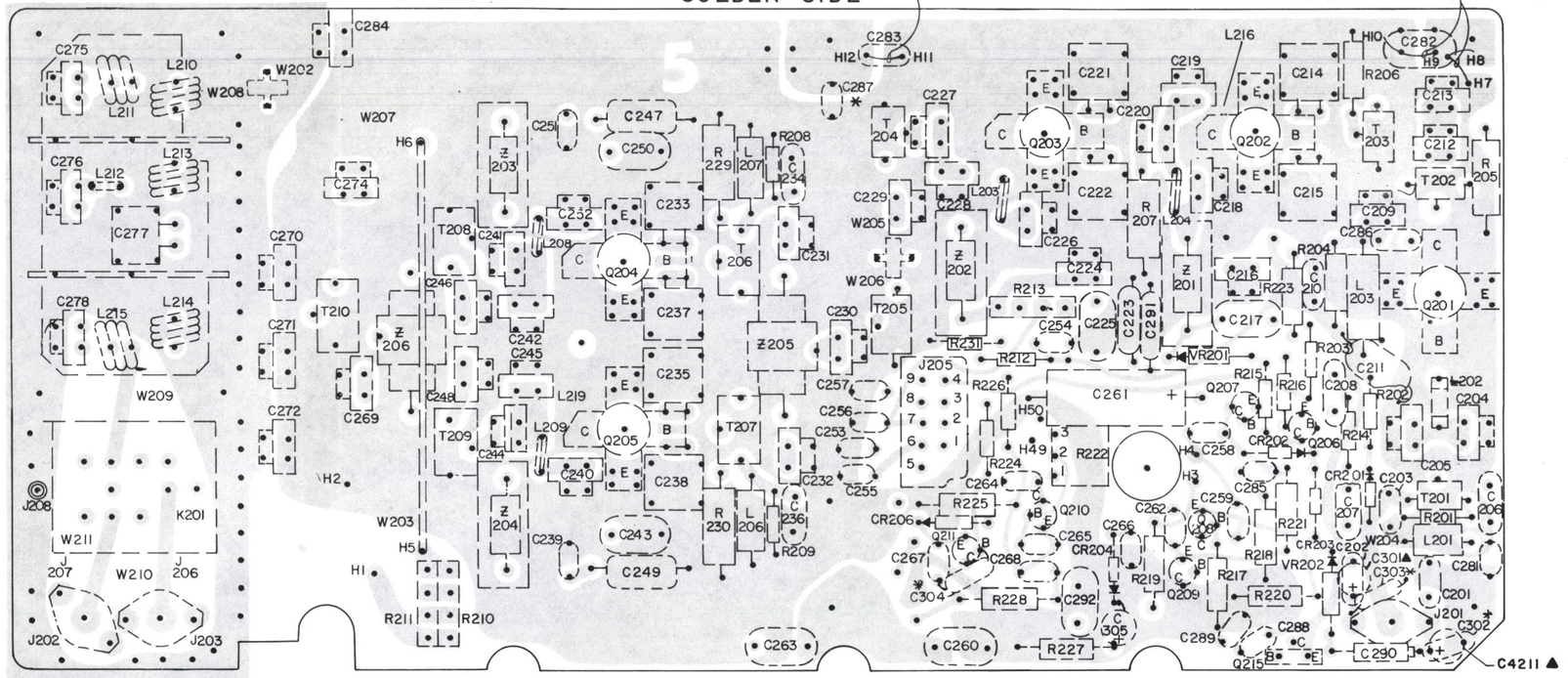


PA BOARD
COMPONENT SIDE



(19D416894, Sh. 2, Rev. 5)
(19D416894, Sh. 3, Rev. 6)

SOLDER SIDE



(19R622039, Rev. 14)

(19D416894, Sh. 2, Rev. 5)

OUTLINE DIAGRAM

138—174 MHz, 65-WATT TRANSMITTER

▲ 19D416886G2
* 19D416886G1

(19B621923, Rev. 20)

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS.

NOTE: READINGS AT Q215 COLLECTOR AND IN THE POWER CONTROL CIRCUIT WERE TAKEN WITH THE TRANSMITTER ADJUSTED FOR 65 WATTS OUTPUT. THESE READINGS WILL VARY DEPENDING ON THE SETTING OF POWER ADJUST CONTROL R222.

PA. ASM.	REV LTR	HEAT SINK ASM.	REV LTR	CPNT. BD. ASM.	REV LTR	FREQ RANGE	APPLICATION
19C320414G2	A	19B219688G3		19D416886G1	E	138-174 MHZ	"M" MOBILES
19C320414G2	A	19B219688G3		19D416886G1	E	138-155 MHZ	INTERMITENT STA.
19C320414G5	A	19B219688G15		19D416886G1	E	138-174 MHZ	"E" MOBILES
19C320414G7		19B219688G3		19D416886G2		150.8-174MH	INTERMITENT STATIONS

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

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

NOTES:
1. 50 OHM MICROSTRIP PART OF PWB
2. PART OF PWB
3. Q201 THRU Q205 & Q215 ARE CALLED FOR ON PL19C320414.
4. (chassis symbol) INDICATES A-
   (ground symbol) INDICATES VEHICLE GROUND
5. COMPONENTS USED IN CERTAIN GROUPS ONLY AS FOLLOWS:
   * USED IN 19D416886G1
   △ USED IN 19D416886G2

SCHEMATIC DIAGRAM

138—174 MHz, 65-WATT POWER AMPLIFIER
MOBILE & INTERMITTENT DUTY STATION
(19C320414G2, G5, G7)

PARTS LIST

LBI4555D

POWER AMPLIFIER
138-174 MHz, 65 WATT
19C320414G2, G5, G7

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - CAPACITORS - - - - - - - - - -
C4214*	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV B.
		- - - - - - - - - - - INDUCTORS - - - - - - - - - -
L295 and L296	19A129562P1	Coil.
		- - - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201*	19A134060P1	Silicon, NPN.
		Earlier than REV A:
	19A129181P1	Silicon, NPN.
Q202*	19A134060P2	Silicon, NPN.
		Earlier than REV A:
	19A129181P3	Silicon, NPN.
Q203A*	19A134060P3	Silicon, NPN.
		Earlier than REV A:
	19A129181P4	Silicon, NPN.
Q204* and Q205*	19A134060P3	Silicon, NPN.
		Earlier than REV A:
	19A129181P4	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - - THERMISTORS - - - - - - - - - -
RT201	19A129379G1	Thermistor: 40K ohms ±20%, color code white; sim to Carborundum Type M0806J-5.
		POWER AMPLIFIER BOARD 19D416886G1, G2
		- - - - - - - - - - - CAPACITORS - - - - - - - - - -
C201 and C202	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C203	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C204 and C205	19A116679P75J	Silver mica: 75 pf ±5%, 250 VDCW.
C206	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C207 and C208	7489162P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C209	19A116679P47K	Metallized teflon: 47 pf ±10%, 250 VDCW.
C210	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C211	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C212	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C213	19A116679P27J	Metallized teflon: 27 pf ±5%, 250 VDCW.
C214 and C215	19A116795P180J	Silver mica: 180 pf ±5%, 250 VDCW.
C216	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C217	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C218	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C219	19A116679P47J	Metallized teflon: 47 pf ±5%, 250 VDCW.
C220	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C221 and C222	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C223*	19A116966P107	Metallized polyester: .1 µf ±10%, 50 VDCW.
		In REV A and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C224	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C225	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C226 and C227	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C228	19A116679P150J	Silver mica: 150 pf ±5%, 250 VDDCW.
C229 thru C232	19A116679P24J	Metallized teflon: 24 pf ±5%, 250 VDCW.
C233	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C234	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C235	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C236	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C237 and C238	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C239	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C240 and C241	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C242	19A116679P150J	Silver mica: 150 pf ±5%, 250 VDCW.
C243	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C244	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C245	19A116679P150J	Silver mica: 150 pf ±5%, 250 VDCW.
C246	19A116679P27J	Metallized teflon: 27 pf ±5%, 250 VDCW.
C247*	19A116966P107	Metallized polyester: .1 µf ±10%, 50 VDCW.
		In REV A and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C248	19A116679P27J	Metallized teflon: 27 pf ±5%, 250 VDCW.
C249*	19A116966P107	Metallized polyester: .1 µf ±10%, 50 VDCW.
		In REV A and earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C250	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C251	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C252	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C253 thru C257	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C258 and C259	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C260	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C261	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C262	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C263	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C264 thru C267	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C268	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C269	19A116679P27J	Mica: 27 pf ±5%, 250 VDCW.
C270 thru C272	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C274	19A116679P220K	Silver mica: 220 pf ±10%, 250 VDCW.
C275	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C276	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C277	19A116795P29J	Metallized teflon: 29 pf ±5%, 250 VDCW.
C278	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C281	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C282	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C283	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C284	19A116679P470K	Silver mica: 470 pf ±10%, 250 VDCW.
C285	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C286	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C287	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C288 and C289	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C290	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C291*	19A116966P107	Metallized polyester: 0.1 µf ±10%, 50 VDCW.
		In REV A:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV A.
C292*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW. Added by REV A.
C300 and C301	19A134202P14	Tantalum: 1 µf ±20%, 35 VDCW.
C302*	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV D.
C303*	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV D.
C304*	5494481P9	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV D.
C305*	19A134202P115	Tantalum: 6.8 µf ±10%, 35 VDCW. Added by REV E.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201*	19A116052P2	Silicon, hot carrier: Fwd. drop .410 volts max.
		In REV B & earlier:
	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR202 thru CR204	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR206	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J201 thru J203	19A130924G1	Connector, receptacle: coaxial, jack type; sim to Cinch 14H11613.
J205	19B219374G1	Connector, includes (9) 19A116651P1 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	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L202	19A129616P1	Strap.
L203	7488079P43	Choke, RF: 10.0 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4422-4K.
L204 and L205	19A129561P1	Coil.
L206 and L207	7488079P16	Choke, RF: 10.0 µh ±10%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L208 and L209	19A129561P1	Coil.
L210	19A129569P1	Coil.
L211	19A129570P1	Coil.
L212	19A129575P1	Coil.
L213 and L214	19A129569P1	Coil.
L215	19A129570P1	Coil.
L216 thru L219		(Part of printed wiring board, 19D416894P1).
		- - - - - - - - - - - TRANSISTORS - - - - - - - -
Q206	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q207 thru Q209	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q210	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q211	19A115779P1	Silicon, PNP; sim to Type 2N3251.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R201	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R202	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R203	3R152P221J	Composition: 220 ohms ±5%, 1/4 w.
R204	3R77P510J	Composition: 51 ohms ±5%, 1/2 w.
R205	3R78P101J	Composition: 100 ohms ±5%, 1 w.
R206	3R77P220J	Composition: 22 ohms ±5%, 1/2 w.
R207	19B209022P137	Wirewound: 8.2 ohms ±10%, 2 w; sim to IRC Type BWH.
R208 and R209	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R210 and R211	19C320212P1	Shunt.
R212	3R152P274J	Composition: 270K ohms ±5%, 1/4 w.
R213	19C320212P2	Shunt.
R214	3R152P222J	Composition: 2.2K ohms ±5%, 1/4 w.
R215	3R152P682J	Composition: 6.8K ohms ±5%, 1/4 w.
R216	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R217	19A116278P253	Metal film: 3.48K ohms ±2%, 1/2 w.
R218	19A116278P261	Metal film: 4.22K ohms ±2%, 1/2 w.
R219	19A116278P201	Metal film: 1K ohms ±2%, 1/2 w.
R220	19A116278P269	Metal film: 5.1K ohms ±2%, 1/2 w.
R221	19A116278P261	Metal film: 4.22K ohms ±2%, 1/2 w.
R222	19A116559P102	Variable, cermet: 5K ohms ±20%, .5 w; sim to CTS Series 360.
R223	7147161P19	Composition: 1.0 ohms ±5%, 1/2 w.
R224	3R152P182J	Composition: 1.8K ohms ±5%, 1/4 w.
R225	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R226	3R152P682J	Composition: 6.8K ohms ±5%, 1/4 w.
R227	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R228	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R229 and R230	19B209022P131	Wirewound: 4.7 ohms ±10%, 2 w; sim to IRC Type BWH.
R231	3R152P111J	Composition: 110 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T201 thru T203	19A129564G1	Coil.
T204	19A129574G1	Coil.
T205	19A129566G1	Coil.
T206 and T207	19A129564G1	Coil.
T208 and T209	19A129574G1	Coil.
T210	19A129566G1	Coil.
		- - - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR201	4036887P1	Zener: 500 mW, 2.3 v. nominal.
VR202	4036887P5	Zener: 500 mW, 5.4 v. nominal.
		- - - - - - - - - - - - CABLES - - - - - - - - - -
W201 and W202	19A129571P1	Cable, strap.
W203	19B219851P1	Jumper.
W204 thru W211		(Part of printed wiring board, 19D416894P1).
		- - - - - - - - - - - - FILTERS - - - - - - - - - -
Z201 thru Z204	19B219649G1	Filter.
		- - - - - - - - - - - TRANSFORMERS - - - - - - - - -
Z205 and Z206	19A129563G1	Hybrid Transformer.
		HEAT SINK CASTING 19B219688G3, STANDARD 19B219688G15 SYSTEM
		- - - - - - - - - - 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.
		- - - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4035306P59	Washer, fiber. (Used with T204, T208, T209, Z205, Z206).
	19A129361P2	Shield. (Located on each side of C276 on component board).
	19B219767P1	Solder mask. (Used on component board).
	19D416732G3	Heat sink, casting. (Used in 19B219688G3).
	19D417105G3	Heat sink, casting. (Used in 19B219688G15).
	19D416712P3	Insulator. (Located under component board).
	5492178P2	Washer, spring tension. (Used with Q201-Q205).
	N207P15C6	Nut, hex: No. 8-32. (Used with Q201-Q205).
	19A134016P1	Insulator, bushing. (Used with Q215).
	19A116023P1	Insulator, plate. (Used with Q215).
	19A129661P1	Insulator. (Located under component board at L295 & L296).
	19A129434P1	Washer, fiber. (Located on terminals of C297 & C298).
	19A129639P1	Cover. (Part of System heat sink).
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16. (Secures heat sink 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.

REV. A: Power Amplifier Assembly 19C320414G2, G5
Improve Performance. Replace Q201-Q205.

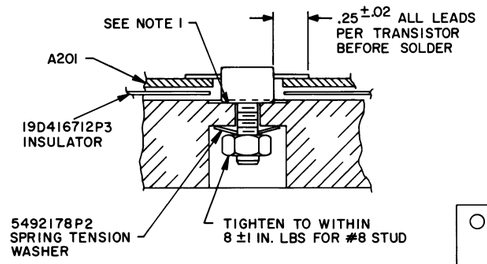
REV. A: Power Amplifier Board 19D416886G1
To improve performance. Added C291 and C292.

REV. B: To incorporate new capacitors. Changed C223, C247, C249 and C291.

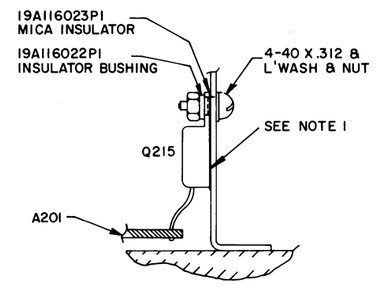
REV. C: To improve transmitter operation in cold temperature and wide frequency spacing applications. Changed CR201.

REV. D - To improve operation. Added C302, C303 and C304.

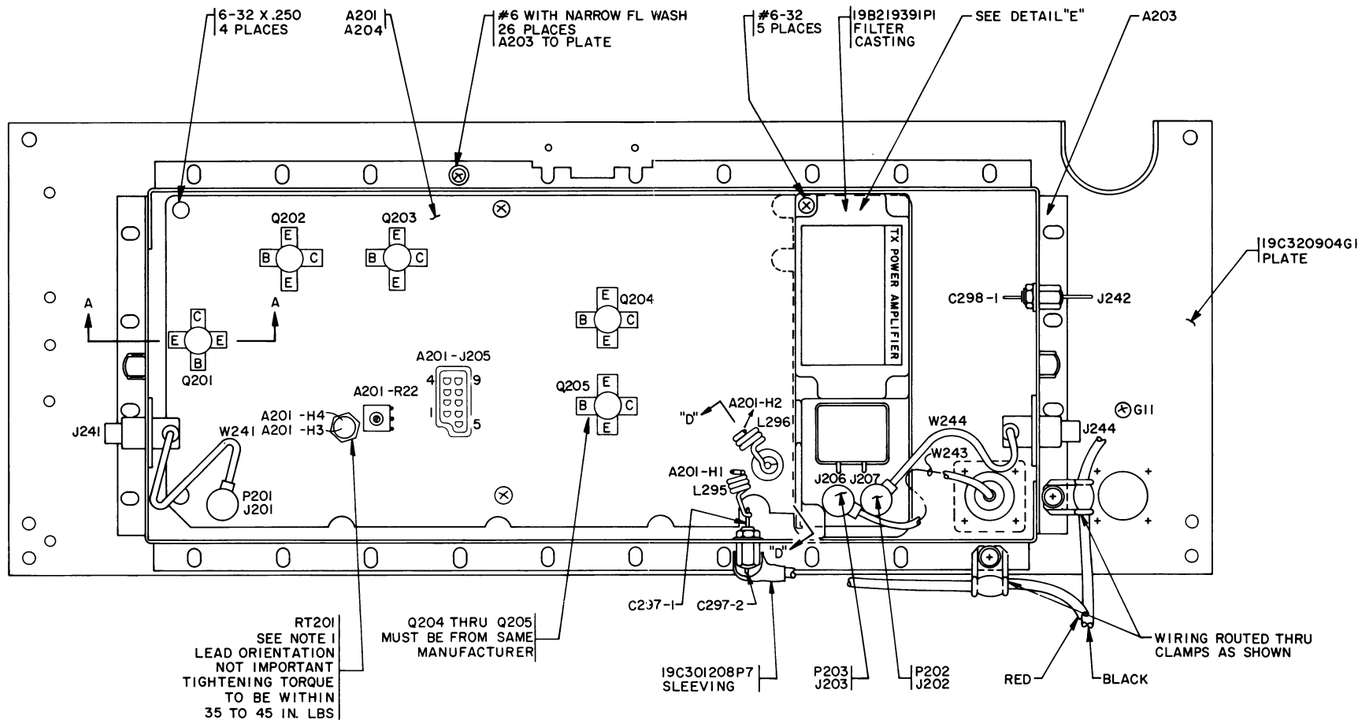
REV. E - To improve operation. Added C305.

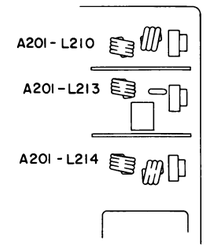


SECTION A-A
TYP MTG FOR Q201 THRU Q205

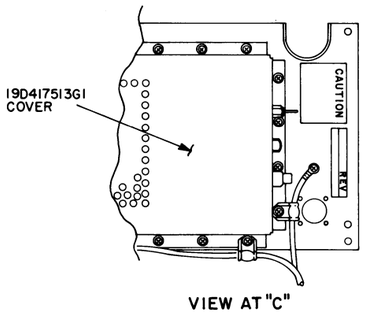


SECTION B-B

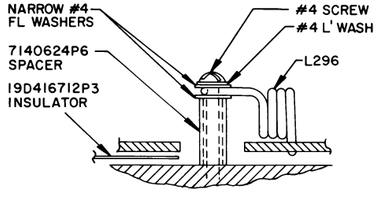




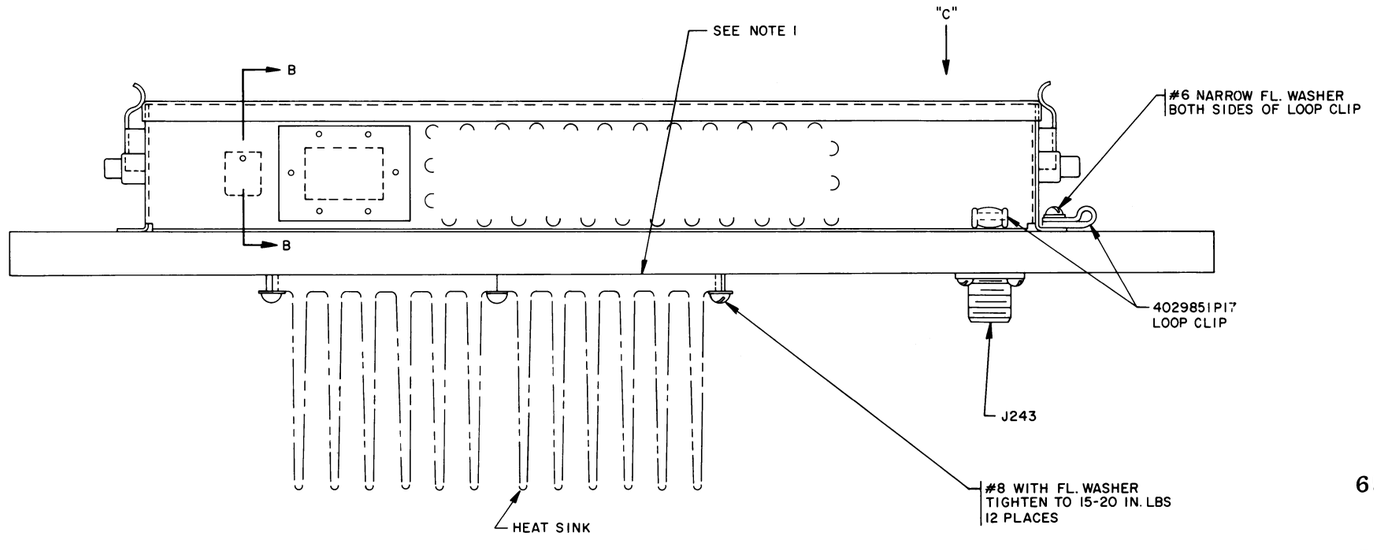
DETAIL "E"
(VIEW OF A201 WITH COVER REMOVED)



VIEW AT "C"



SECTION D-D



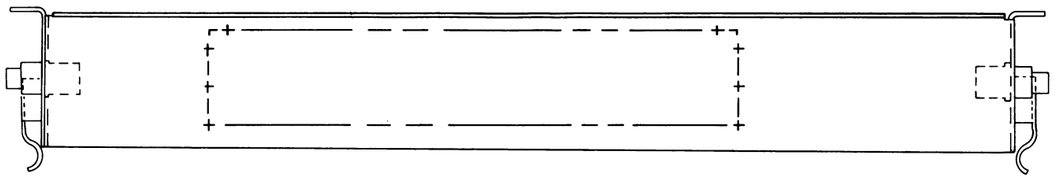
NOTES:

1. APPLY SILICONE GREASE TO BOTH SIDES OF MICA INSULATOR TO MOUNTING SURFACE OF Q201 THRU Q205 & RT201 AND UNPAINTED FLAT SURFACE OF HEAT SINKS.
   NO GREASE ALLOWED ON THE THREADED PORTION OF THE MTG STUD.

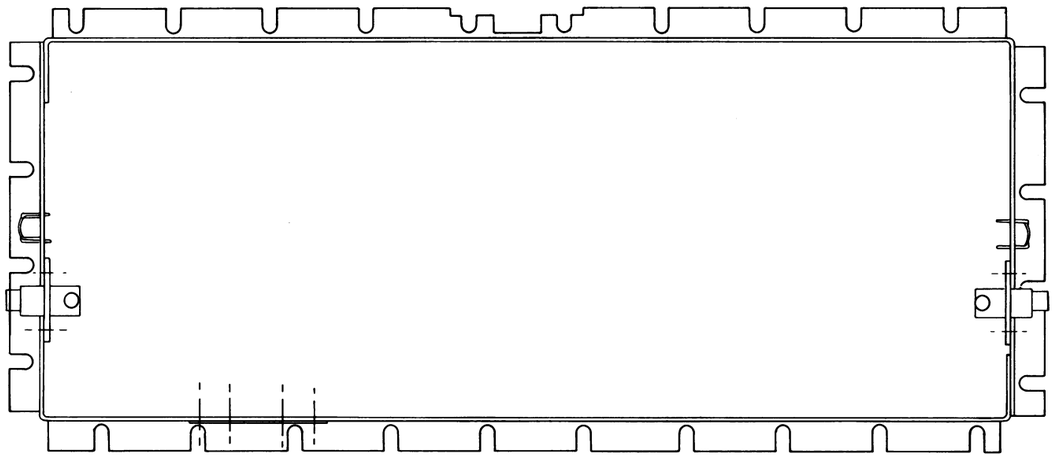
(19D423086, Rev. 1)

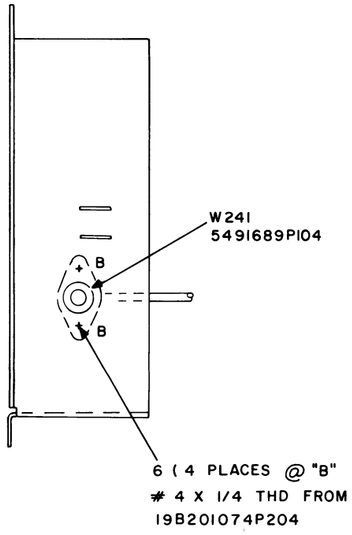
OUTLINE DIAGRAM

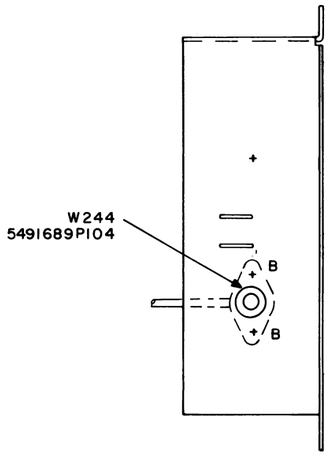
138—174 MHz,
65-WATT STATION TRANSMITTER
CONTINUOUS DUTY PA

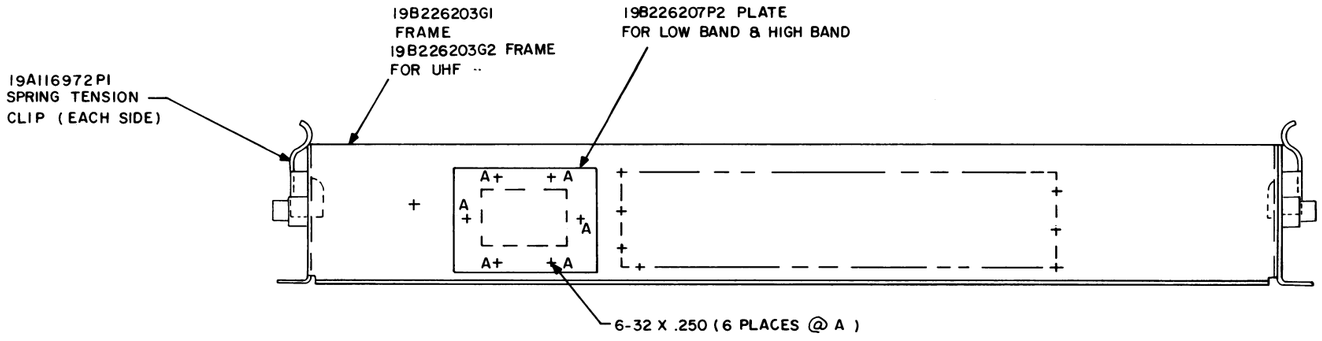


A203





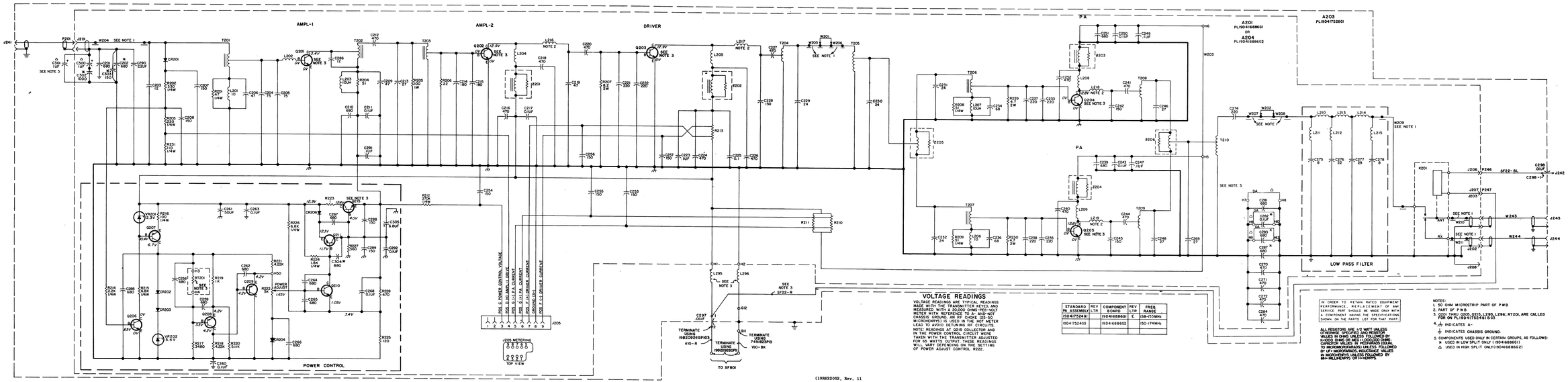




OUTLINE DIAGRAM

FRAME ASSEMBLY FOR INTERMITTENT & CONTINUOUS DUTY STATION TRANSMITTERS

(19D423098, Rev. 0)



(19B622052, Rev. 11

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 B- AND NOT CHASSIS GROUND. AN RF CHOKE (25-150 MHz) SHOULD BE USED AT THE METER PROBE LEAD TO AVOID DETUNING RF CIRCUITS.
NOTE: READINGS AT Q215 COLLECTOR AND IN THE POWER CONTROL CIRCUIT WERE TAKEN WITH THE TRANSMITTER ADJUSTED FOR 65 WATTS OUTPUT. THESE READINGS WILL VARY DEPENDING ON THE SETTING OF POWER ADJUST CONTROL R222.

STANDARD PA ASSEMBLY	REV LTR	COMPONENT BOARD	REV LTR	FREQ RANGE
19D417524G1		19D416886G1	E	138-155MHz
19D417524G3		19D416886G2		150-174MHz

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

ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K (KILOHMS) OR M (MEGOHMS). CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

NOTES:
1. 50 OHM MICROSTRIP PART OF P WB
2. PART OF P WB
3. Q201 THRU Q205, Q215, L295, L296; RT201, ARE CALLED FOR ON PL19041752401&03

* INDICATES A-
INDICATES CHASSIS GROUND.
5. COMPONENTS USED ONLY IN CERTAIN GROUPS, AS FOLLOWS:
* USED IN LOW SPLIT ONLY (19D416886G1)
△ USED IN HIGH SPLIT ONLY(19D416886G2)

SCHEMATIC DIAGRAM

138—174 MHz,
65-WATT STATION POWER AMPLIFIER
19D417524G1, G3 CONTINUOUS DUTY

PARTS LIST

LBI4781C

POWER AMPLIFIER
135-174 MHz, 65 WATT
CONTINUOUS DUTY
19D417526G01, G3

SYMBOL	GE PART NO.	DESCRIPTION
A201, A304		POWER AMPLIFIER BOARD A201 19D416886G1 A304 19D416886G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201 and C202	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C203	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C204 and C205	19A116678P75J	Silver mica: 75 pf ±5%, 250 VDCW.
C206	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C207 and C208	7489162P131	Silver mica: 150 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C209	19A116678P47K	Metallized teflon: 47 pf ±10%, 250 VDCW.
C210	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C211	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C212	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C213	19A116678P27J	Metallized teflon: 27 pf ±5%, 250 VDCW.
C214 and C215	19A116785P180J	Silver mica: 180 pf ±5%, 250 VDCW.
C216	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C217	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C218	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C219	19A116678P47J	Metallized teflon: 47 pf ±5%, 250 VDCW.
C220	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C221 and C222	19A116785P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C223*	19A116966P107	Metallized polyester: 0.1 µf ±10%, 50 VDCW. In REV A & earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C224	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C225	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C226 and C227	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C228	19A116678P150J	Silver mica: 150 pf ±5%, 250 VDCW.
C229 thru C232	19A116678P24J	Metallized teflon: 24 pf ±5%, 250 VDCW.
C233	19A116785P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C234	7489162P03	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C235	19A116785P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C236	7489162P03	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C237 and C238	19A116785P220J	Silver mica: 220 pf 5%, 250 VDCW.
C239	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C240 and C241	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C242	19A116678P150J	Silver mica: 150 pf ±5%, 250 VDCW.
C243	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C244	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C245	19A116678P150J	Silver mica: 150 pf ±5%, 250 VDCW.
C246	19A116678P27J	Metallized teflon: 27 pf ±5%, 250 VDCW.
C247*	19A116966P107	Metallized polyester: 0.1 µf ±10%, 50 VDCW. In REV A & earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C248	19A116678P27J	Metallized teflon: 27 pf ±5%, 250 VDCW.
C249*	19A116966P107	Metallized polyester: 0.1 µf ±10%, 50 VDCW. In REV A & earlier:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C250	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C251	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C252	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C253 thru C257	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C258 thru C259	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C260	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C261	19A116580P4	Electrolytic: 50 µf -150% -10%, 25 VDCW; sim to Mallory Type TTX.
C262	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C263	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C264 thru C267	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C268	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C269	19A116678P27J	Metallized teflon: 27 pf ±5%, 250 VDCW.
C270 thru C272	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C274	19A116678P220K	Silver mica: 220 pf ±10%, 250 VDCW.
C275	19A116678P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C276	19A116678P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C277	19A116785P29J	Metallized teflon: 29 pf ±5%, 250 VDCW.
C278	19A116678P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C281	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C282	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C283	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C284	19A116678P47K	Silver mica: 470 pf ±10%, 250 VDCW.
C285	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C286	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C287	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C288 and C289	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C290	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C291*	19A116966P107	Metallized polyester: 0.1 µf ±10%, 50 VDCW. In REV A:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV A.
C292*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW. Added by REV A.
C300 and C301	19A134202P24	Tantalum: 1 µf ±20%, 35 VDCW.
C302*	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV D.
C303*	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV D.
C304*	5494481P9	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV D.
C305*	19A134202P115	Tantalum: 6.8 µf ±10%, 35 VDCW. Added by REV E.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR201*	19A116052P2	Silicon, hot carrier: Fwd. drop .410 volts max. In REV B & earlier:
	19A115250P1	Silicon, fast recovery, 225 nA, 50 PIV.
CR202 thru CR204	19A115250P1	Silicon, fast recovery, 225 nA, 50 PIV.
CR206	19A115250P1	Silicon, fast recovery, 225 nA, 50 PIV.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J201 thru J203	19A130924G1	Connector, receptacle: coaxial, jack type; sim to Cinch 14S11613
J205	19B219374G1	Connector, includes (9) 19A116651P1 contacts.
J206 and J207		(Part of K301).
J208	4033513P4	Contact, electrical: sim to Bead Chain LS3-3.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K201	19A116722P1	Relay, hermetic sealed: 125 ohms ±20%, 1 form C contact, 9.6 to 15.8 VDC (over the temp range indicated).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L201	7488079P16	Choke, RF: 10.0 µh ±5%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L202	19A129616P1	Strap.
L203	7488079P43	Choke, RF: 10.0 µh ±5%, 0.30 ohms DC res max; sim to Jeffers 4422-4K.
L204 and L205	19A129561P1	Coil.
L206 and L207	7488079P16	Choke, RF: 10.0 µh ±5%, 0.60 ohms DC res max; sim to Jeffers 4421-7K.
L208 and L209	19A129561P1	Coil.
L210	19A129569P1	Coil.
L211	19A129570P1	Coil.
L212	19A129571P1	Coil.
L213 and L214	19A129569P1	Coil.
L215	19A129570P1	Coil. (Part of printed wiring board, 19D416894P1).
L216 thru L219		
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q206	19A115910P1	Silicon, NPN; sim to Type 2N3906.
Q207 thru Q209	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q210	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q211	19A115779P1	Silicon, PNP; sim to Type 2N3251.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	3B1529470J	Composition: 47 ohms ±5%, 1/4 w.
R202	3B15293331J	Composition: 330 ohms ±5%, 1/4 w.
R203	3B15292221J	Composition: 220 ohms ±5%, 1/4 w.
R204	3B77951OJ	Composition: 51 ohms ±5%, 1/2 w.
R205	3B7891O1J	Composition: 100 ohms ±5%, 1 w.
R206	3B77922OJ	Composition: 22 ohms ±5%, 1/2 w.
R207	19B209022P137	Wirewound: 6.2 ohms ±10%, 2 w; sim to IRC Type BWH.
R208 and R209	3B15291OJ	Composition: 51 ohms ±5%, 1/4 w.
R210 and R211	19C320212P1	Shunt resistor.
R213	3B15297S4J	Composition: 270K ohms ±5%, 1/4 w.
R213	19C320312P2	Shunt resistor.
R214	3B15292232J	Composition: 2.2K ohms ±5%, 1/4 w.
R215	3B15296S2J	Composition: 6.8K ohms ±5%, 1/4 w.
R216	3B15291O1J	Composition: 100 ohms ±5%, 1/4 w.
R217	19A116278P253	Metal film: 3.48K ohms ±2%, 1/2 w.
R218	19A116278P281	Metal film: 4.32K ohms ±2%, 1/2 w.
R219	19A116278P501	Metal film: 1K ohms ±2%, 1/2 w.
R220	19A116278P269	Metal film: 5.11K ohms ±2%, 1/2 w.
R221	19A116278P261	Metal film: 4.22K ohms ±2%, 1/2 w.
R222	19A116559P102	Variable, cermet: 5K ohms ±20%, .5 w; sim to CTS Series 360.
R223	7147161P19	Composition: 1.0 ohms ±5%, 1/2 w.
R224	3B15291S2J	Composition: 1.8K ohms ±5%, 1/4 w.
R225	3R77P131J	Composition: 130 ohms ±5%, 1/2 w.
R226	3B15296S2J	Composition: 6.8K ohms ±5%, 1/4 w.
R227	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R228	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R229 and R230	19B209032P131	Wirewound: 4.7 ohms ±10%, 2 w; sim to IRC Type BWH.
R231	3B1529111J	Composition: 110 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T201 thru T203	19A129564G1	Coil.
T204	19A129574G1	Coil.
T205	19A129566G1	Coil.
T206 and T207	19A129564G1	Coil.
T208 and T209	19A129574G1	Coil.
T210	19A129566G1	Coil.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR201	4036687P1	Silicon, Zener.
VR202	4036688P5	Silicon, Zener.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201 and W202	19A129571P1	Cable, strap.
W203	19B219851P1	Jumper. (Part of printed wiring board, 19D416894P1).
W204 thru W211		
		- - - - - - - - - - FILTERS - - - - - - - - - -
Z201 thru Z204	19B219649G1	Filter.
		- - - - - - - - - - TRANSFORMERS - - - - - - -
Z205 and Z206	19A129563G1	Hybrid Transformer.
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 pf +100% -0%, 500 VDCW; sim to Erie Style 327.
L295	19A129563P9	Coil.
L296	19A129561P1	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P246 and P247	4036634P1	Contact, electrical; sim to AMP 42428-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201	19A134606P1	Silicon, NPN.
Q202	19A134606P2	Silicon, NPN.
Q203A	19A134606P3	Silicon, NPN.
Q204 and Q205	19A134606P3	Silicon, NPN.
Q215	19A116743P1	Silicon, NPN.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT201	19A129379G1	Thermistor.
		- - - - - - - - - - CABLES - - - - - - - - - -
W243		CABLE ASSEMBLY 19A129312G6
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J243		Connector. Includes:
	4029493P1	Connector: sim to Amphenol 83-798.
	4029082P2	Cover.
	19C301208P6	Insulated sleeving.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P203	5491689P108	Plug: sim to Component Mfg. 5203 RCX.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A129361P2	Shield. (Located on each side of C276 on component board).
	4033306P59	Sandwich, fiber. (Used with T204, T208, T209, E305, E306).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J243, K241, W244).
	19D417531G1	PA cover.
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures frame assembly to plate).
	19B201074P306	Tap screw, Phillips POZIDRIV®: No. 6-32 x 3/8. (Secures cable clamps).
	4029851P17	Cable clamp: sim to Heckeseer Co. 3/16-6.
	714084296	Spacer. (Used with L296).
	19B201074P314	Tap screw, Phillips POZIDRIV®: No. 6-40 x 7/8. (Secures L296 to spacer).
	19B218391G1	Filter casting.
	N80P130626	Machine screw: No. 6-32 x 1-1/2. (Secures filter casting).
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-50. (Used with Q201-Q205).
	N207P15C6	Nut, hex: No. 8-32. (Used with Q201-Q205).
	19D416721P2	Insulator. (Located under A201).
	19A116023P5	Insulator, plate. (Used with Q215).
	19A116022P1	Insulator, bushing. (Used with Q215).
	19B226213G1	Heat sink casting. (Quantity 2).
	19B209103P410	Tap screw, hex head: No. 8-32 x 5/8. (Secures heat sink castings).
	7139889P5	Hex nut, brass. (Secures C297 and C298).

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 19D416886G1

REV. A - Incorporated into initial shipment.

REV. B - To incorporate new capacitors. Changed C202, C247, C249 and C291.

REV. C - To improve transmitter operation in cold temperature and wide frequency spacing applications. Changed CR201.

REV. D - To improve operation. Added C302, C303 and C304.

REV. E - To improve operation. Added C305.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES