MOBILE RADIO

MAINTENANCE MANUAL

138—174 MHz, 35-WATT POWER AMPLIFIER
19C320414G1 AND G4 MOBILE AND INTERMITTENT DUTY STATION
19D417535G1 CONTINUOUS DUTY STATION

TABLE OF CONTENTS

DESCRIPTION

The PA assembly uses three RF power transistors and seven transistors in the Power Control circuitry to provide a power output of 35 Watts. The broadband PA has no adjustments other than Power Control potentiometer R219.

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 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 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. R203, L201 and C263 are a stabilizing network in the base circuit of Q201.

Part of the RF input is rectified by CR201 and applied to voltage divider R201, R202 and R228. This voltage is used 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 (L203, and R204) and collector feed network T202 and C215. The collector voltage of Q201 is metered through R214 at J205.

The output of Q201 is coupled to the base of Class C driver Q202 through a matching network consisting of C206, T202, T203, C212 and C213. Collector voltage to Q202 is applied through collector stabilizing network L204 and R226 and collector feed network L205 and C214.

Collector current for Q202 is metered across tapped manganin resistor R210 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.

The output of Q202 is applied to the base of Class C Power Amplifier Q203 through a lowpass filter matching network (L214, C218, C220 and C221). Collector voltage to Q203 is coupled through collector stabilizing network L207 and R227 and collector feed network L206 and C223.

Collector current for Q203 is metered across tapped manganin resistor R209. The reading is taken on the one-Volt scale with the High Sensitivity button pressed, and read as 30 amperes full scale.

Following Q203 is a matching network (L215, C228, T204 and C230) that matches the output of Q203 to the 50-ohm microstrip impedance (W204) to the input of low pass filter.

The PA output is coupled through the low-pass filter to the antenna through antenna switch K201.

Capacitors C270 through C287 provide ground isolation for ± ground operation.

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.

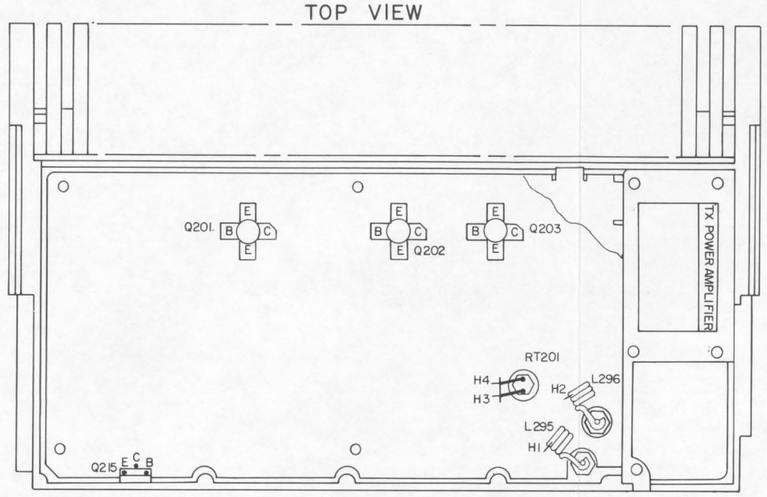
POWER CONTROL CIRCUIT

When the transmitter is keyed, rectified RF from CR201 is applied to the base of switch Q204, turning it on. Turning on Q204 turns on voltage regulator Q205, supplying a constant voltage to Power Adjust potentiometer R219.

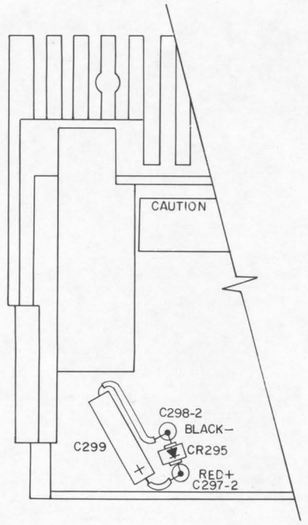
Q210, Q209, and Q215 operate as an amplifier chain to supply voltage to the collector of Q201 (Ampl-1). The setting of R219 determines the voltage applied to the base of Q210. The higher the voltage at the base of Q210, the harder the amplifiers conduct, supplying more collector voltage to Q201. The 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, thereby reducing the power output of the PA. The power output can be adjusted by R219 from approximately 10 to 35 Watts.

Temperature protection is provided by Q206, Q207 and thermistor RT201 which is mounted in the PA heatsink. Under normal operating conditions, the circuit is inactive (Q206 is on and Q207 is off). When the heatsink temperature reaches approximately 100°C, the resistance of RT201 decreases. This increases the base voltage applied to Q206 turning it off. Turning off Q206 allows Q207 to turn on, decreasing the voltage at Power Adjust potentiometer R219. This reduces the base voltage to Q210 which causes Q209 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.

PA ASSEMBLY
TOP VIEW



BOTTOM VIEW

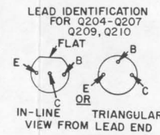


LEAD IDENTIFICATION
FOR Q101-Q109

VIEW FROM LEAD END

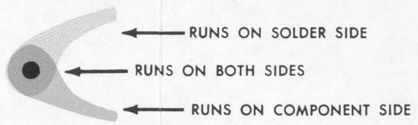
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION
FOR Q204-Q207
Q209, Q210

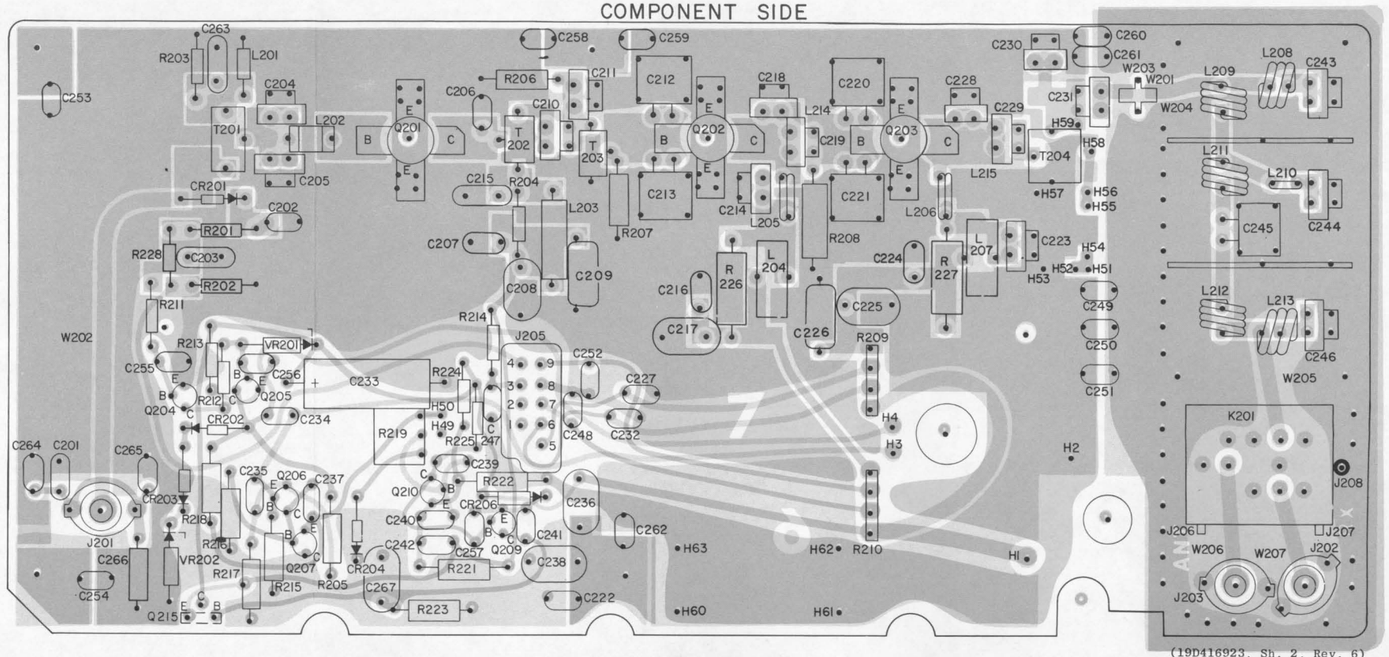


VIEW FROM LEAD END

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

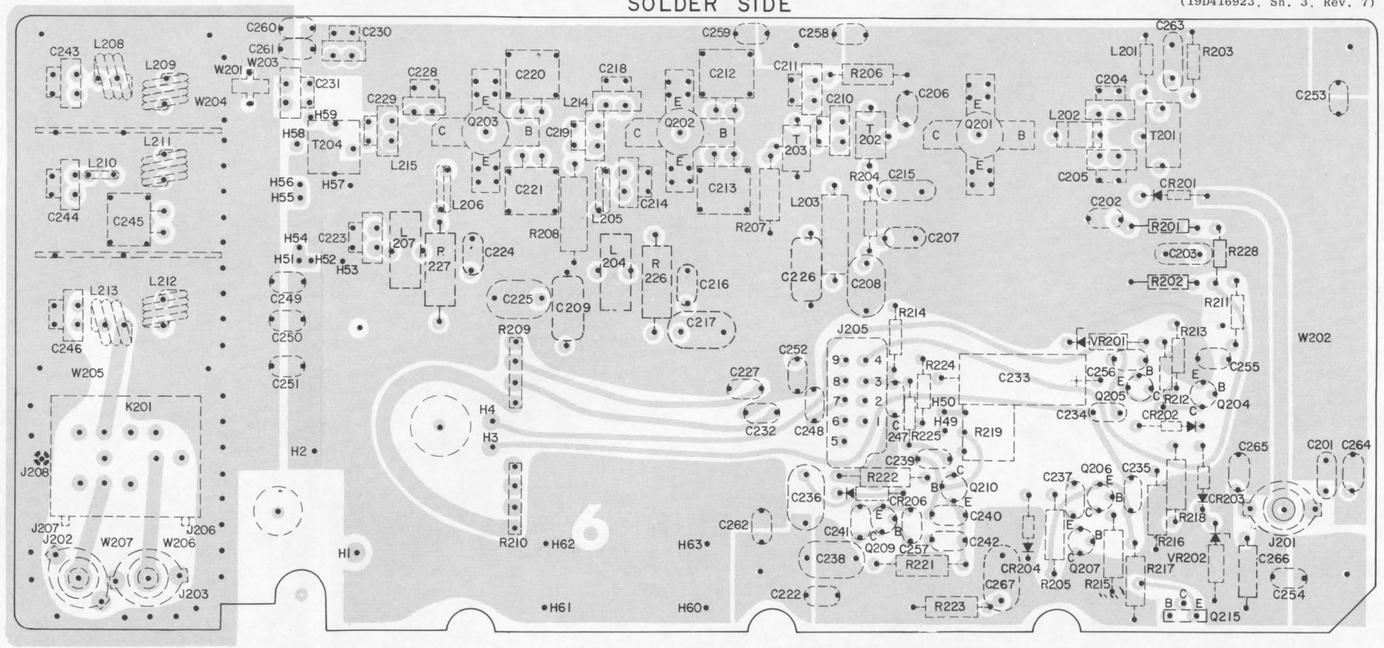


PA BOARD
COMPONENT SIDE



(19D416923, Sh. 2, Rev. 6)
(19D416923, Sh. 3, Rev. 7)

SOLDER SIDE

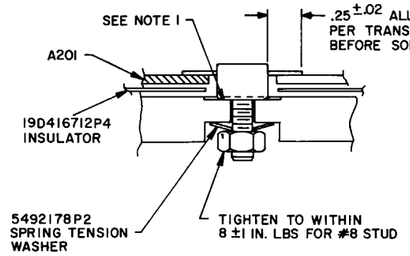


(19D416923, Sh. 2, Rev. 6)

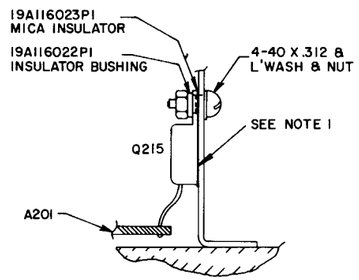
OUTLINE DIAGRAM

138—174 MHz, 35 WATT POWER AMPLIFIER
19C320414G1, G4
MOBILE AND INTERMITTENT DUTY STATION

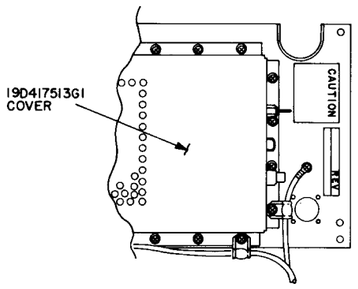
(19R622040, Rev. 12)



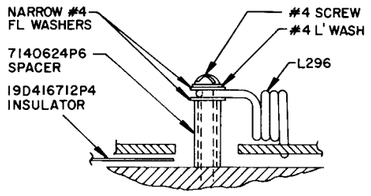
SECTION A-A
TYP MTG FOR Q201 THRU Q203



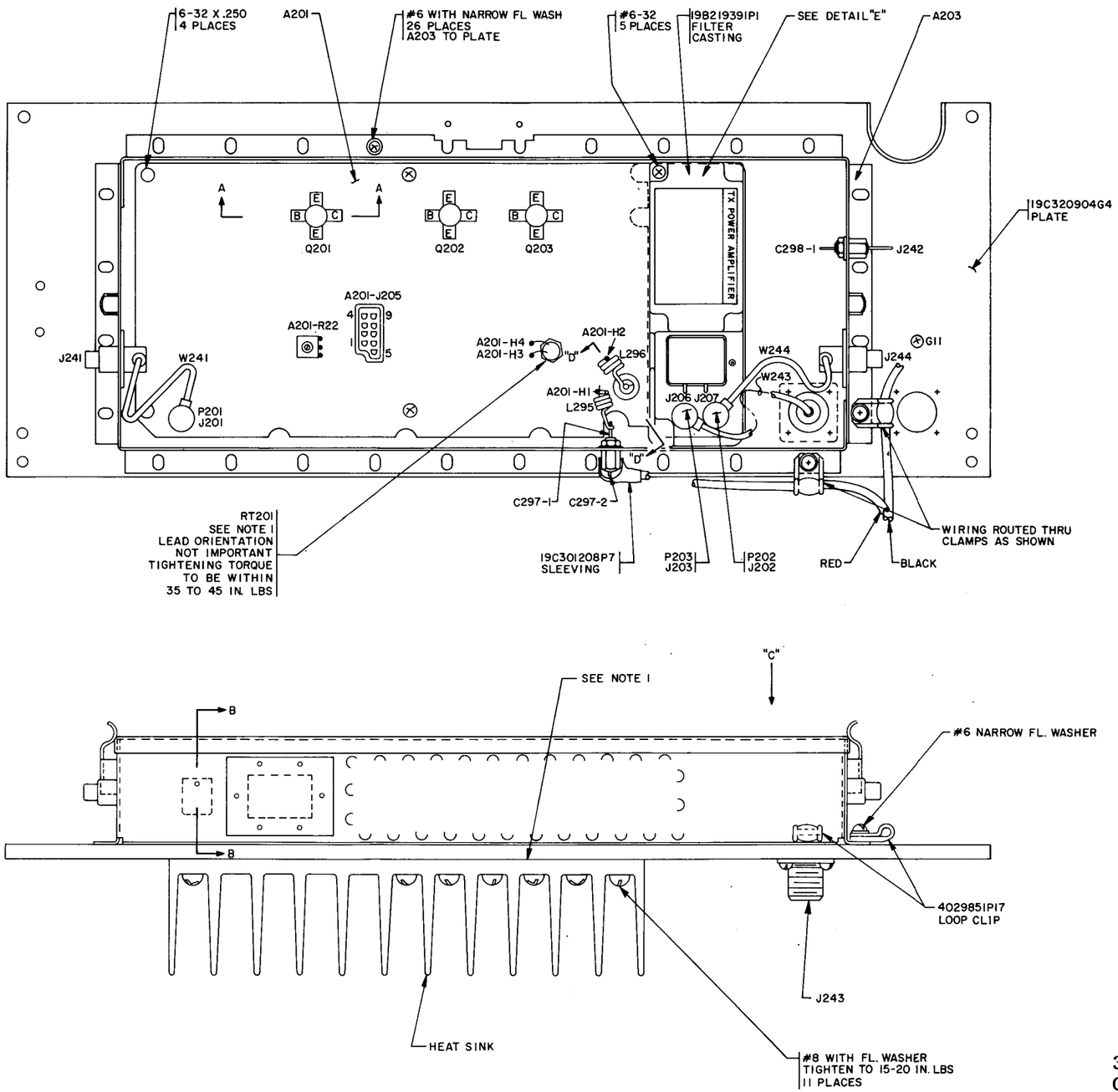
SECTION B-B

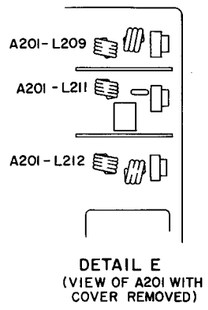


VIEW AT "C"



SECTION D-D





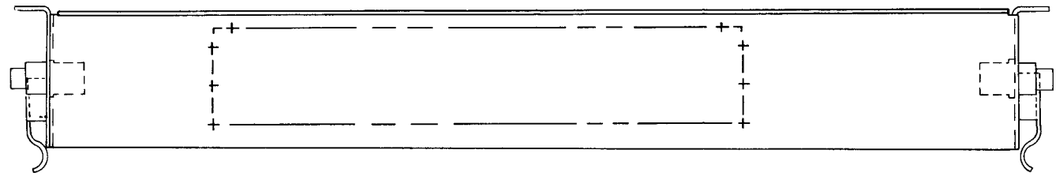
DETAIL E
(VIEW OF A201 WITH COVER REMOVED)

NOTES:
1. APPLY SILICONE GREASE TO BOTH SIDES OF MICA INSULATOR TO MOUNTING SURFACE OF Q201 THRU Q203 & RT201 AND UNPAINTED FLAT SURFACE OF HEAT SINK.
   NO GREASE ALLOWED ON THE THREADED PORTION OF THE MTG STUD.

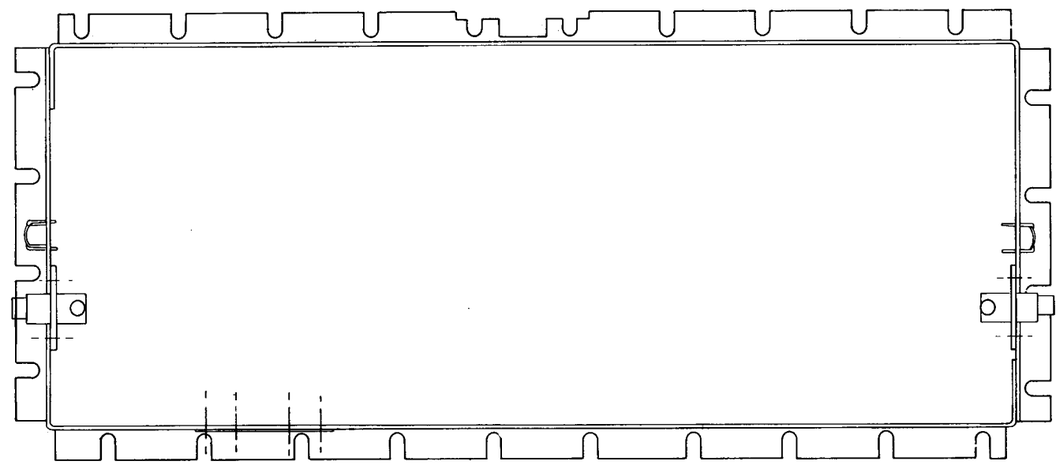
(19D423079, Rev. 0)

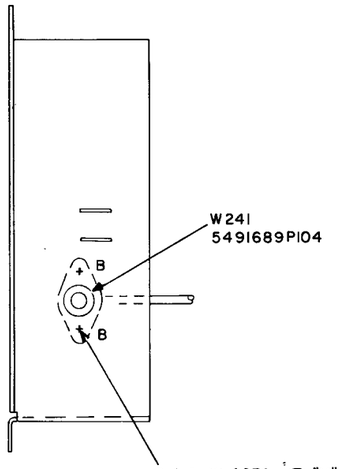
OUTLINE DIAGRAM

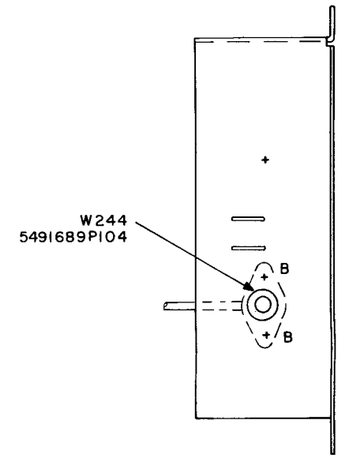
138—174 MHz,
35 WATT POWER AMPLIFIER
CONTINUOUS DUTY STATION
19D417535G1

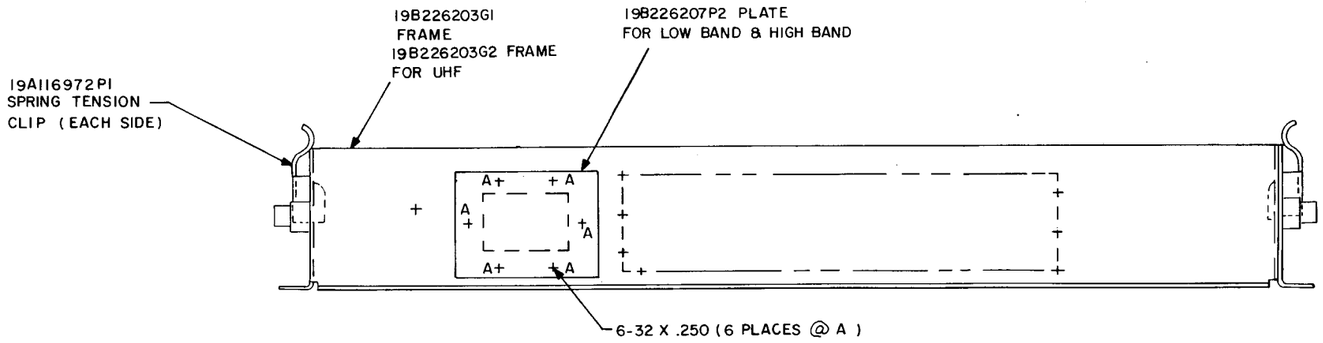


A203





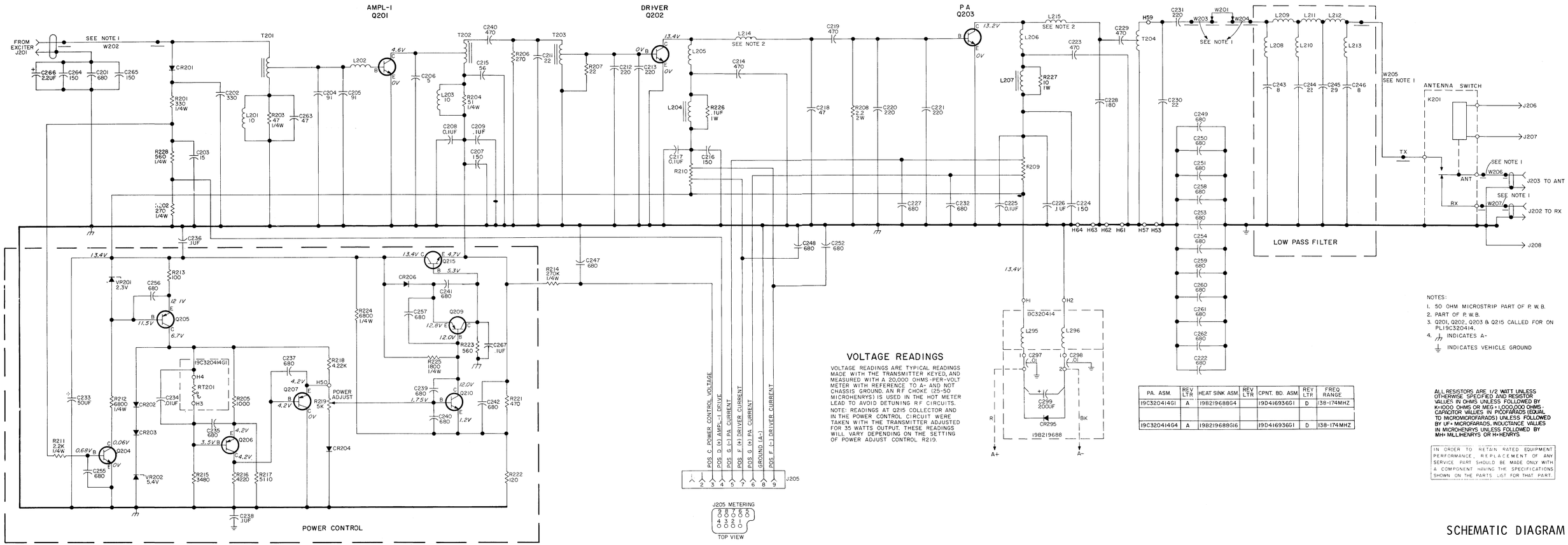




OUTLINE DIAGRAM

FRAME ASSEMBLY FOR INTERMITTENT AND CONTINUOUS DUTY STATION TRANSMITTERS

(19D423098, Rev. 0)



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 35 WATTS OUTPUT. THESE READINGS WILL VARY DEPENDING ON THE SETTING OF POWER ADJUST CONTROL R219.

NOTES:

1. 50 OHM MICROSTRIP PART OF P. W. B.
2. PART OF P. W. B.
3. Q201, Q202, Q203 & Q215 CALLED FOR ON PLI 9C320414.
4. ⏚ INDICATES A-
   ⏚ INDICATES VEHICLE GROUND

PA. ASM.	REV LTR	HEAT SINK ASM.	REV LTR	CPNT. BD. ASM.	REV LTR	FREQ RANGE
19C320414G1	A	19B219688G4		19D416936G1	D	138-174MHZ
19C320414G4	A	19B219688G16		19D416936G1	D	138-174MHZ

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.

(19B621932, Rev. 14)

SCHEMATIC DIAGRAM

138—174 MHz, 35 WATT POWER AMPLIFIER
MOBILE AND INTERMITTENT DUTY STATION
19C320414G1, G4

PARTS LIST

LBI-4556C

138-174 MHz, 35 WATT
POWER AMPLIFIER
19C320414G1, G4

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - 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.
Q203*	19A134060P3	Silicon, NPN.
		Earlier than REV A:
	19A129181P4	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT201	19A129379G1	Thermistor.
		POWER AMPLIFIER BOARD 19D416936G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C202	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C203	7489162P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C204 and C205	19A116679P91J	Silver mica: 91 pf ±5%, 250 VDCW.
C206	7489162P101	Silver mica: 5 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C207*	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		Earlier than REV A:
	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C208	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C209*	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.
C210	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C211	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C212 and C213	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C214	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C215	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C216*	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		Earlier than REV A:
	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C217	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C218	19A116679P47J	Metallized teflon: 47 pf ±5%, 250 VDCW.
C219	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C220 and C221	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C222	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C223	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C224*	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		Earlier than REV A:
	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C225	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C226*	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.
C227	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C228	19A116679P180J	Silver mica: 180 pf ±5%, 250 VDCW.
C229	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C230	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C231	19A116679P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C232	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C233	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C234	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C235	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C236	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C237	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C238	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C239 thru C242	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C243	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C244	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C245	19A116795P29J	Silver mica: 29 pf ±5%, 250 VDCW.
C246	19A116679P8D	Silver mica: 8 pf ±.5 pf, 250 VDCW.
C247 thru C262	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C263	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C264 and C265	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C266*	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Added by REV A.
C267*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW. Added by REV D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201*	19A116052P2	Silicon.
		In REV B and earlier:
	19A115250P1	Silicon.
CR202 thru CR204	19A115250P1	Silicon.
CR206	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.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L201	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
L202	19A129616P1	Strap.
L203	7488079P43	Choke, RF: 10.0 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4422-4.
L204*	19A129346G1	Coil. Added by REV A.
L205 and L206	19A129561P1	Coil.
L207*	19A129346G1	Coil. Added by REV A.
L208	19A129570P1	Coil.
L209	19A129569P1	Coil.
L210	19A129575P1	Coil.
L211 and L212	19A129569P1	Coil.
L213	19A129570P1	Coil.
L214 and L215		(Part of printed wiring board 19D416923P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q204*	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		Earlier than REV A:
	19A129184P1	Silicon, NPN.
Q205 thru Q207	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q209	19A129187P1	Silicon, PNP.
Q210*	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		Earlier than REV A:
	19A129184P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R202*	3R152P271J	Composition: 270 ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R152P821J	Composition: 820 ohms ±5%, 1/4 w.
R203	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R204	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R205	19A116278P201	Metal film: 1000 ohms ±2%, 1/2 w.
R206	3R77P271J	Composition: 270 ohms ±5%, 1/2 w.
R207	3R77P220J	Composition: 22 ohms ±5%, 1/2 w.
R208	19B209022P123	Wirewound: 2.2 ohms ±10%, 2 w; sim to IRC Type BWH.
R209 and R210	19C320212P2	Shunt resistor.
R211	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R212	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R213	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R214	3R152P274J	Composition: 0.27 megohm ±5%, 1/4 w.
R215	19A116278P253	Metal film: 3480 ohms ±2%, 1/2 w.
R216	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R217	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R218	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R219	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R221	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R222	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R223	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R224	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R225	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
R226* and R227*	3R78P100K	Composition: 10 ohms ±10%, 1 w. Added by REV A.
R228*	3R152P561J	Composition: 560 ohms ±5%, 1/4 w. Added by REV A.
		- - - - - - - - - - TRANSFORMERS - - - - - - -
T201 thru T203	19A129564G1	Transformer.
T204	19A129574G1	Transformer.
		- - - - - - - - VOLTAGE REGULATORS - - - - - -
VR201	4036887P1	Silicon, Zener.
VR202	4036887P5	Silicon, Zener.
		- - - - - - - - - - CABLES - - - - - - - - -
W201	19A129571P1	Strap.
W202 thru W207		(Part of printed wiring board 19D416923P1).
		- - - - - - - - - - FILTERS - - - - - - - - - -
Z201* and Z202*	19B219649G1	Filter. Deleted by REV A.
		HEAT SINK ASSEMBLY 19B219688G4 19B219688G16
		- - - - - - - - - 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 - - - - - - -
	19B219391G1	Filter Casting.
	19B201074P320	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1-1/4. (Secures Filter Casting).
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20. (Used with Q201-Q203).
	N207P15C6	Hexnut: No. 8-32. (Used with Q201-Q203).
	19A134016P1	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).
	19D416732G4	Heat sink. (Used with 19B219688G4).
	19D417105G4	Heat sink. (Used with 19B219688G16).
	19D416712P4	Insulator. (Located under component board).
	19A129661P1	Insulator. (Located by L295, L296).
	19A129361P2	Shield. (Located on component board).

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 19C320414G1

To improve performance. Changed Q201 through Q207.

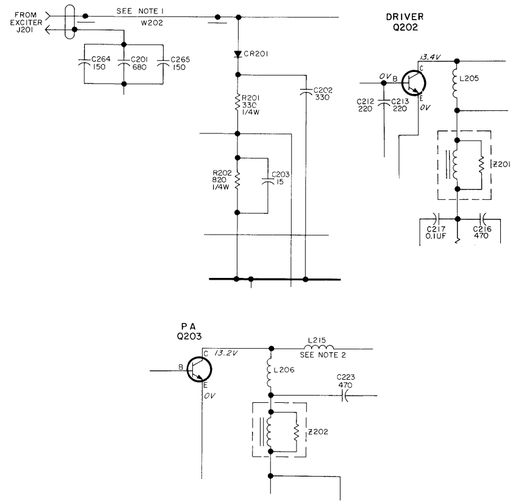
REV. A - Power Amplifier Board 19D416936G1

To improve operation. Changed C207, C216, C224, Q204, Q210 and R202. Added C266, L204, L207, and R226 thru R228. Deleted Z201 and Z202. Added holes H53, H57 and H61 thru H64 to permit incorporation of marine option.

REV. B - To incorporate new capacitors. Changed C209 and C226.

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

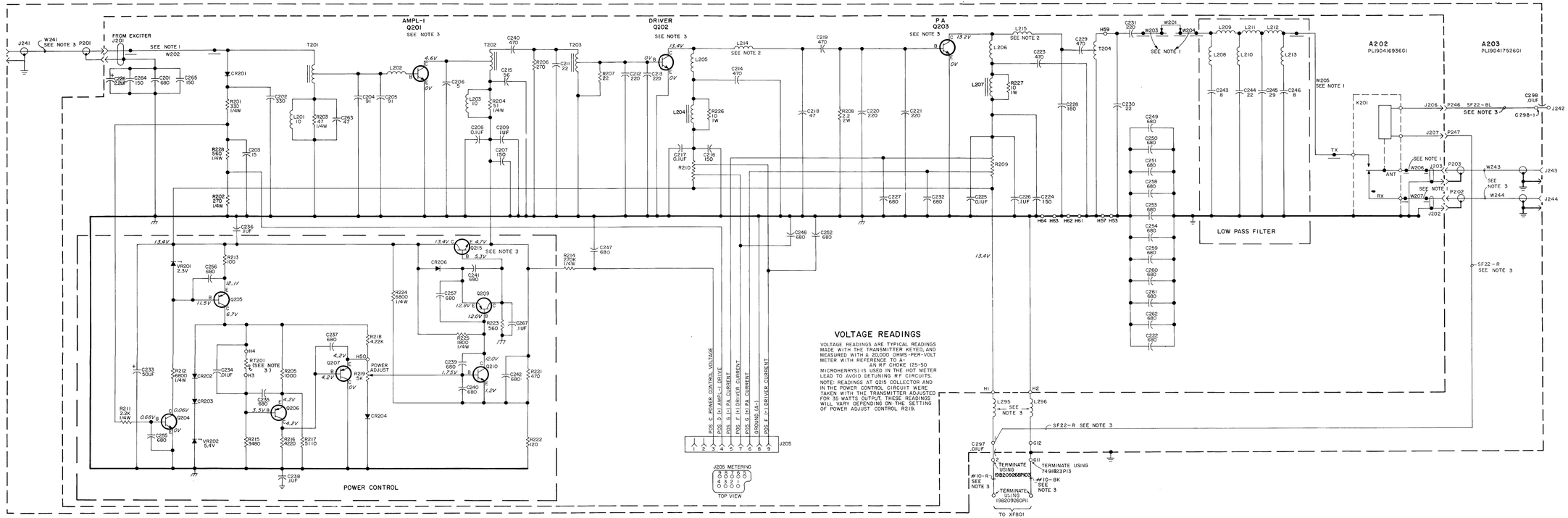
Old Schematic was:
(Prior to Revision A)



REV. D - Power Amplifier Board 19D416936G1

To improve operation when PA is used in a base station. Added C267.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



(19B622053, Rev. 6)

STANDARD PA ASSEMBLY	REV LTR	COMPONENT BOARD	REV LTR	FREQ. RANGE
19D417535		19D416936G1	D	

NOTES:
1. 50 OHM MICROSTRIP PART OF P.W.B.
2. PART OF P.W.B.
3. CALLED FOR ON PL19D417535
4. ⏚ INDICATES A-
   ⏚ INDICATES CHASSIS GROUND

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.

SCHEMATIC DIAGRAM

138—174 MHz, 35 WATT POWER AMPLIFIER
CONTINUOUS DUTY STATION 19D417535G1

PARTS LIST

LBI-4746B

138-174 MHz, 35 WATT
POWER AMPLIFIER
19D417535G1

SYMBOL	GE PART NO.	DESCRIPTION
A201		POWER AMPLIFIER BOARD 19D416936G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C202	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C203	7489162P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C204 and C205	19A116679P91J	Silver mica: 91 pf ±5%, 250 VDCW.
C206	7489162P101	Silver mica: 5 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C207	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C208	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C209*	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.
C210	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C211	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C212 and C213	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C214	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C215	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C216	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C217	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C218	19A116679P47J	Metallized teflon: 47 pf ±5%, 250 VDCW.
C219	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C220 and C221	19A116795P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C222	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C223	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C224	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C225	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C226*	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.
C227	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C228	19A116679P180J	Silver mica: 180 pf ±5%, 250 VDCW.
C229	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C230	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C231	19A116679P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C232	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C233	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C234	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C235	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C236	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C237	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C238	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C239 thru C242	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C243	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C244	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C245	19A116795P29J	Silver mica: 29 pf ±5%, 250 VDCW.
C246	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C247 thru C262	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C263	7489162P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C264 and C265	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C266	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C267*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW. Added by REV D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR201*	19A116052P2	Silicon.
		In REV B and earlier:
	19A115250P1	Silicon.
CR202 thru CR204	19A115250P1	Silicon.
CR206	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 4446-4.
L202	19A129616P1	Strap.
L203	7488079P43	Choke, RF: 10.0 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4422-4K.
L204	19A129346G1	Coil.
L205 and L206	19A129561P1	Coil.
L207	19A129346G1	Coil.
L208	19A129570P1	Coil.
L209	19A129569P1	Coil.
L210	19A129575P1	Coil.
L211 and L212	19A129569P1	Coil.
L213	19A129570P1	Coil.
L214 and L215		(Part of printed wiring board 19D416923P1).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q204	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q205 thru Q207	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q209	19A129187P1	Silicon, PNP.
Q210	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R202	3R152P271J	Composition: 270 ohms ±5%, 1/4 w.
R203	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R204	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R205	19A116278P201	Metal film: 1000 ohms ±2%, 1/2 w.
R206	3R77P271J	Composition: 270 ohms ±5%, 1/2 w.
R207	3R77P220J	Composition: 22 ohms ±5%, 1/2 w.
R208	19B209022P123	Wirewound: 2.2 ohms ±10%, 2 w; sim to IRC Type BWH.
R209 and R210	19C320212P2	Shunt resistor.
R211	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R212	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R213	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R214	3R152P274J	Composition: 0.27 megohm ±5%, 1/4 w.
R215	19A116278P253	Metal film: 3480 ohms ±2%, 1/2 w.
R216	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R217	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R218	19A116278P261	Metal film: 4220 ohms ±2%, 1/2 w.
R219	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R221	3R77P471J	Composition: 470 ohms ±5%, 1/2 w.
R222	3R77P121J	Composition: 120 ohms ±5%, 1/2 w.
R223	3R77P561J	Composition: 560 ohms ±5%, 1/2 w.
R224	3R152P682J	Composition: 6800 ohms ±5%, 1/2 w.
R225	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
R226 and R227	3R78P100K	Composition: 10 ohms ±10%, 1 w.
R228	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - -
T201 thru T203	19A129564G1	Transformer.
T204	19A129574G1	Transformer.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR201	4036887P1	Silicon, Zener.
VR202	4036887P5	Silicon, Zener.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	19A129571P1	Strap.
W202 thru W207		(Part of printed wiring board 19D416923P1).
A203		FRAME ASSEMBLY 19D417526G1
		- - - - - - - - - - CABLES - - - - - - - - - -
W241	5491689P104	RF: approx 3-5/8 inches long, 350 VRMS, 500 VDC operating voltage.
W244	5491689P104	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	19A134060P2	Silicon, NPN.
Q203	19A134060P3	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT201	19A129379G1	Thermistor.
		- - - - - - - - - - CABLES - - - - - - - - - -
W233	19A129312G6	Cable, antenna: approx 10 inches long.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219391G1	Filter Casting.
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20. (Used with Q201-Q203).
	N207P15C6	Hexnut: No. 8-32. (Used with Q201-Q203).
	19A134016P1	Insulator, bushing. (Used with Q215).
	19A116023P1	Insulator, plate. (Used with Q215).
	19C320896P1	Heat sink.
	19D416712P4	Insulator. (Located under component board).
	19A129361P2	Shield. (Located on component board).

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.

Component Board 19D416936G1

REV. A - Incorporated into initial shipment.

REV. B - To incorporate improved by-pass capacitors. Changed C209 and C226.

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

REV. D - To improve operation. Added C267.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES