MOBILE RADIO

MAINTENANCE MANUAL

806—825 MHz, 10-WATT POWER AMPLIFIER ASSEMBLY 19D42482IG1

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DESCRIPTION

The power amplifier assembly for the Custom MVP radio uses four RF power transistors to provide a maximum of 10-Watts output power.

The power adjust circuit, consisting of R16, VR1, Q1 and Q215, controls the output power. R16 is used to set the output power to 10-Watts with a battery voltage of 13.8 VDC.

SUPPLY VOLTAGE AND METERING

Supply voltage (A+) for the PA is connected from J1 on the back of the radio through FL210-C5 on the side of the radio. C211, C212, and A202-C2 prevent RF from getting on the power leads. Diode CR201 will cause the main fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J5 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), power adjust voltage, and PA voltage.

CIRCUIT ANALYSIS

PA ASSEMBLY

The exciter output is coupled through a 50-ohm RF cable to the PA input connector P201. The RF input is coupled through a matching network composed of C2, C3, L1, L2 and L3 to the base of power amplifier Q201.

Part of the RF input is rectified by CR1 and metered at J5 through resistor R1 and R18.

A+ is applied to the collector of Q201 through contacts 3 and 8 of antenna relay K1, R20, R21 and through collector stabilizing network L5 and R4 and collector feed network L4 and C201.

The output of Q201 is coupled to the base of the second power amplifier Q202 through coupling capacitor C5, and a matching network consisting of C6, C7, L6, L7, L8 and L9.

Collector voltage to Q202 is applied direct from the A+ input to the PA through collector stabilizing network L11 and R7 and collector feed network C202 and L10.

The output of Q202 is coupled to the base of power amplifier Q203 through C9 and the matching network of C203, C204, C10, L13, L4 and L15.

The collector voltage to Q203 is coupled directly from power control transistor Q215E through collector stabilizing network L7 and R9 and collector feed network L16 and C11.

The output of Q203 is coupled through an impedance matching network (C206, C13, C207, C208, L18, L19, L20 and L21) and a 50-ohm microstrip W4 that matches the output impedance of Q203 to the input impedance of PA Q204.

The collector voltage of Q204 is applied direct from the A+ input through R20, collector stabilizing network L23 and R11, and collector feed network L22 and C15.

Collector current for Q204 is metered across tapped manganin resistor R20. The meter reading, taken in position "F" on the 10-Volt scale of the Test Set with the High Sensitivity button pressed, should be approximately 2.5 Amperes.

WARNING

The 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.

The output of Q204 is coupled through an impedance matching network (C209, C210, C16 and L24) and a 50-ohm microstrip, W5, to the low pass filter. The output of the low pass filter is coupled to antenna connector J3 through closed contacts 4 and 7 of integral antenna relay K1 and a 50-ohm microstrip W9.

CAUTION

The placement of monolithic capacitors on the PA board is very critical; therefore, it is not recommended that the PA board be serviced in the field. When a malfunction occurs with the PA board the entire radio should be returned to the factory for service.

POWER CONTROL CIRCUIT

The Power Control Circuit is a regulated power supply consisting of voltage regulator VR1 and Q1 and pass transistor Q215. VRI sets the bias for Q1 at a level of 4.4 VDC above the reference point established by &16-- nominally 10-11 VDC. Q1, functioning as a variable resistor, controls the base voltage of pass transistor Q215. When R16 is set for 10-watts output, the base voltage of Q215 should be approximately 6.4 VDC and the emitter at 7.0 VDC.

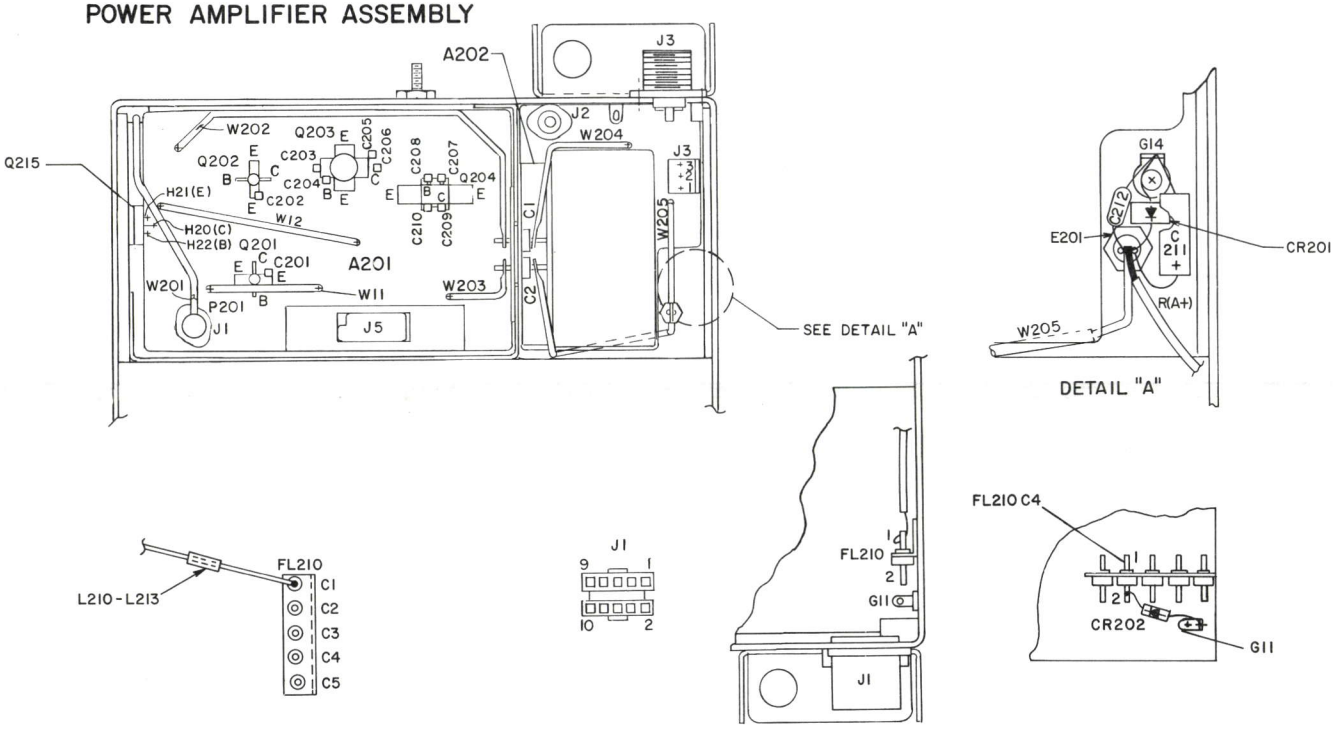
As the battery voltage increases or decreases the voltage across R16 and therefore the bias level of Q1 varies in direct proportion. With an increase in battery voltage, Q1 will conduct more, lowering the base voltage of Q215. Q215 now conducts less, lowering the output voltage to compensate for the increase in battery voltage.

The output voltage of Q215 is applied to the collector of Q203, thereby controlling the drive to power amplifier Q204 and the output power.

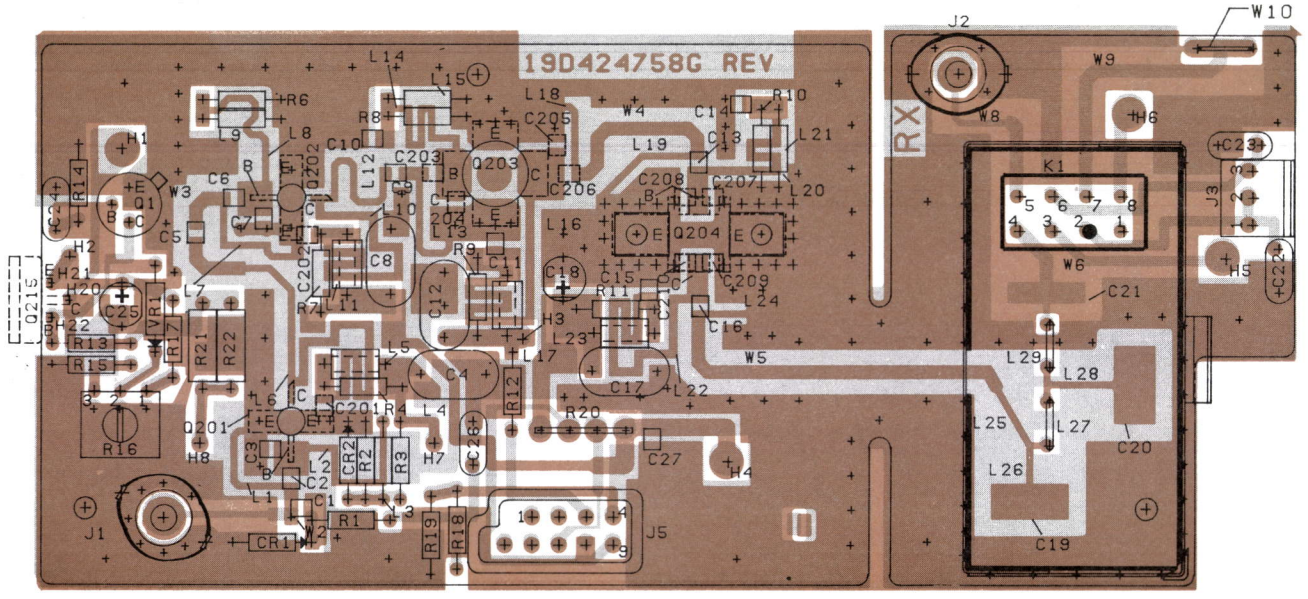
MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

POWER AMPLIFIER ASSEMBLY

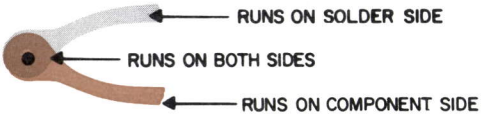


(19C328152, Rev. 0)



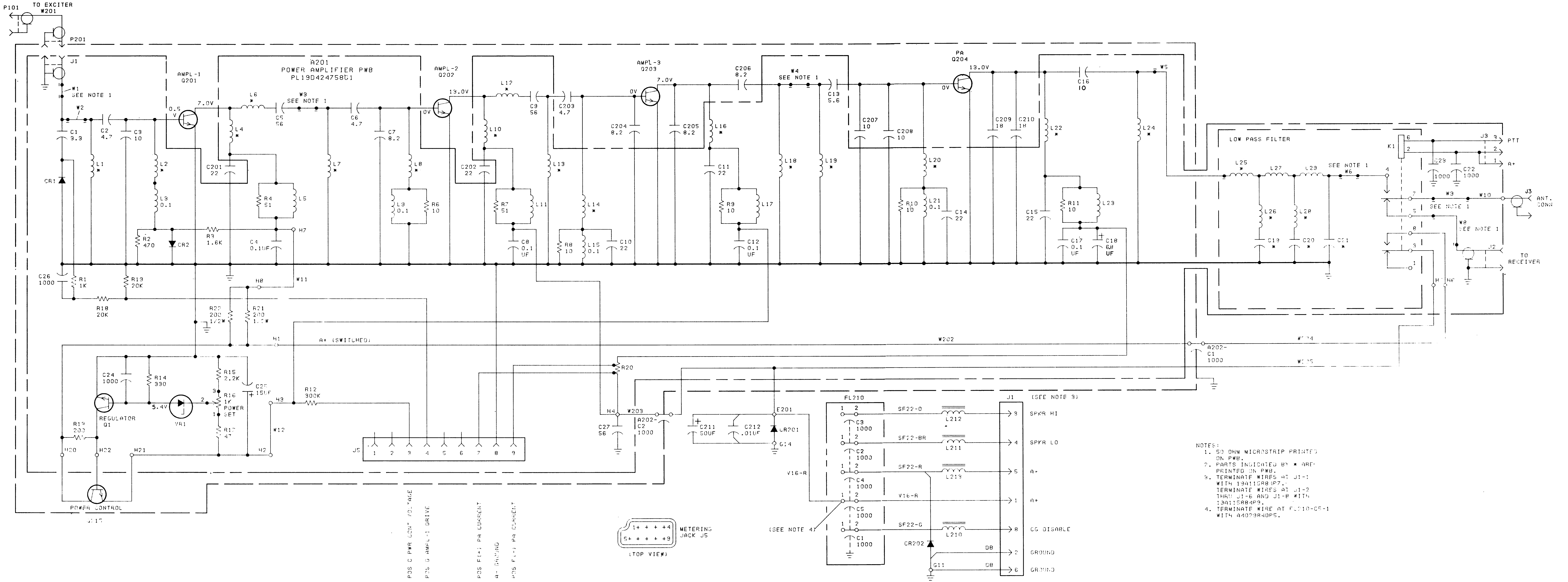
CONNECTIONS CHART		
FROM	TO	USING
H2	H3	W12
H7	H8	W11

(19D424760, Rev. 0)
(19B227954, Sh. 1, Rev. 0)
(19B227954, Sh. 2, Rev. 0)



OUTLINE DIAGRAMS

806—825 MHz, PA ASSEMBLY



NOTES:
1. 50 OHM MICROSTRIP PRINTED ON PWB.
2. PARTS INDICATED BY * ARE PRINTED ON PWB.
3. TERMINATE WIRES AT J1-1 WITH 19A115884P7. TERMINATE WIRES AT J1-2 THRU J1-6 AND J1-8 WITH 13A115884P9.
4. TERMINATE WIRE AT FL210-C5-1 WITH A4029840P5.

ALL RESISTORS ARE 1/4 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.

MODEL NO	REV LETTER
PL19D424758G1	A
PL19D424821G1	

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS ARE TAKEN WITH TRANSMITTER ADJUSTED TO RATED POWER OUTPUT.

(19R622212, Rev. 3)

SCHEMATIC DIAGRAM

806—825 MHz, PA ASSEMBLY

Issue 2

PARTS LIST

LBI30598A

806-825 MHz, PA ASSEMBLY
19D424821G1

SYMBOL	GE PART NO.	DESCRIPTION
A201		POWER AMPLIFIER BOARD 19D424758G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A134419P1	Ceramic: 3.3 pf ±.25 pf, 50 VDCW.
C2	19A134419P5	Ceramic: 4.7 pf ±.25 pf, 50 VDCW.
C3	19A134419P13	Ceramic: 10 pf ±5% pf, 50 VDCW.
C4	19A116030P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C5	19A134419P31	Ceramic: 56 pf ±5% pf, 50 VDCW.
C6	19A134419P5	Ceramic: 4.7 pf ±.25 pf, 50 VDCW.
C7	19A134419P11	Ceramic: 8.2 pf ±5% pf, 50 VDCW.
C8	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C9	19A134419P31	Ceramic: 56 pf ±5% pf, 50 VDCW.
C10 and C11	19A134419P21	Ceramic: 22 pf ±5% pf, 50 VDCW.
C12	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C13	19A134419P7	Ceramic: 5.6 pf ±5% pf, 50 VDCW.
C14 and C15	19A134419P21	Ceramic: 22 pf ±5% pf, 50 VDCW.
C16*	19A134418P13	Ceramic: 10 pf ±5% pf, 50 VDCW.
		Earlier than REV A:
	19A134418P11	Ceramic: 8.2 pf ±5% pf, 50 VDCW.
C17	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C18	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C19 thru C21		(Part of printed board 19D424759P1).
C22 thru C24	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW: sim to RMC Type JF Discap.
C25	19A134202P8	Tantalum: 15 µf ±20%, 20 VDCW.
C26	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C27	19A134419P31	Ceramic: 56 pf ±5% pf, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A116052P1	Hot carrier: Fwd drop .350 volts max.
CR2	19A115775P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E201	7143206P1	Terminal, stud.
G11	7135118P2	Terminal, solder: 90° bend.
G14	7135118P2	Terminal, solder: 90° bend.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 and J2	19A116832P1	Receptacle, coaxial: jack type; sim to Cinch 14H11613.
J3	19A116659P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
J5	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19B209558P1	Hermetic sealed: 180 to 341 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC; sim to GE 3SAV1760A2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1 and L2		(Part of 19D424759P1 printed board).
L3	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L4		(Part of 19D424759P1 printed board).
L5	19A129773G1	Coil.
L6 thru L8		(Part of 19D424759P1 printed board).
L9	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L10		(Part of 19D424759P1 printed board).
L11	19A129773G1	Coil.
L12 thru L14		(Part of 19D424759P1 printed board).
L15	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L16		(Part of 19D424759P1 printed board).
L17	19A129773G1	Coil.
L18 thru L20		(Part of 19D424759P1 printed board).
L21	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L22		(Part of 19D424759P1 printed board).
L23	19A129773G1	Coil.
L24 thru L26		(Part of 19D424759P1 printed board).
L27	19A136863P1	Coil.
L28		(Part of 19D424759P1).
L29	19A136863P1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A115300P2	Silicon, NPN; sim to Type 2N3053.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R2	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R3	3R152P162J	Composition: 1.6K ohms ±5%, 1/4 w.
R4	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R6	3R152P100J	Composition: 10 ohms ±5%, 1/4 w.
R7	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R8 thru R11	3R152P100J	Composition: 10 ohms ±5%, 1/4 w.
R12	3R152P304J	Composition: 300K ohms ±5%, 1/4 w.
R13	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R14	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R15	3R152P222J	Composition: 2.2K ohms ±5%, 1/4 w.
R16	19A116559P101	Variable, cermet: 1K ohms ±20%, .5 w; sim to CTS Series 360.
R17	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R18 and R19	3R152P203J	Composition: 20K ohms ±5%, 1/4 w.
R20	19C320213P2	Shunt resistor.
R21	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
R22	3R77P201J	Composition: 200 ohms ±5%, 1/2 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P5	Zener: 500 mW, 5.4 v. nominal.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 thru W9		(Part of 19D424759P1 printed board).
W10	19A137057P1	Strap.
W11	19B227659P6	Jumper.
W12	19B227659P7	Jumper.
A202		SHIELD ASSEMBLY 19B227977G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19B209488P2	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Style FA5M.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201 and C202	19A134419P21	Ceramic: 22 pf ±5%, 50 VDCW.
C203	19A134419P5	Ceramic: 4.7 pf ±.25 pf, 50 VDCW.
C204 thru C206	19A134419P11	Ceramic: 8.2 pf ±5%, 50 VDCW.
C207 and C208	19A134419P13	Ceramic: 10 pf ±5%, 50 VDCW.
C209 and C210	19A134418P19	Ceramic: 18 pf ±5%, 50 VDCW.
C211	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TYA.
C212	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201	19A116783P1	Silicon.
CR202	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL210		FILTER ASSEMBLY 19A136680G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		Connector. Includes:
	19A115884P12	Shell: sim to AMP 1-480286-0.
	19A115884P7	Contact, male: sim to AMP 60328-4.
	19A115884P9	Contact, male: sim to AMP 60910-4.
J2	7777145P5	Connector, plug: 1 female contact; sim to Amphenol 82-97 or Military UG-58A/U. (STATION).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L210 thru L213	19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P101		(Part of W201).
P201		(Part of W201).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q201	19A134430P1	Silicon, NPN.
Q202	19A134430P2	Silicon, NPN.
Q203	19A134431P1	Silicon, NPN.

SYMBOL	GE PART NO.	DESCRIPTION
Q204	19A134432P1	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	5491689P91	Cable, RF: approx 7-1/2 inches long.
W202	19C327785P1	Jumper.
W203	19C327785P6	Jumper.
W204	19C327785P5	Jumper.
W205	19C327785P2	Jumper.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A134016P1	Insulator, bushing. (Used with Q215).
	19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Used with Q215).
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20. (Used with Q201-Q203).
	19A121006P14	Washer. (Used with Q203 and Q204).
	N207P15C6	Nut, hex: No 8-32. (Used with Q201-Q203).
	19C327746P1	Insulator. (Used with Q201-Q203).
	19D424364P2	Support. (Used with Q201-Q203).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Used with J2).
	19A137056P1	Terminal. (Used with J2).
	19B219076G2	Support. (Mounts J5 of A201).
	19B201074P312	Tap screw, Phillips POZIDRIV®: No. 6-32 x 3/4. (Secures J5 to support).
	19B227962P1	Insulator. (Located under A201).
	19B227351G1	Cover, PA.
	19B201074P205	Tap screw, Phillips POZIDRIV®: No. 4-40 x 5/16. (Secures terminal on J2).
	4033714P11	Solderless terminal: sim to Zierick 349. (Used with J2).

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 Board 19D424758G1
To improve operation. Changed VR1 and C16.