MOBILE RADIO

MAINTENANCE MANUAL

806—825 MHz, 35-WATT POWER AMPLIFIER ASSEMBLY 19D424356G1, G5
806—825 MHz, 25-WATT POWER AMPLIFIER ASSEMBLY 19D424356G3, G6

TABLE OF CONTENTS

DESCRIPTION

The power amplifier assembly uses six RF power transistors to provide a maximum of 35 Watts output power (Mobile) or 25 Watts output power (Station), R24, located on the PA module, is used to adjust the output power to any level from 10 Watts to rated RF power output. The power control circuit consists of R24, Q207, Power Control IC (U1), and a directional coupler.

SUPPLY VOLTAGE AND METERING

Supply voltage is connected through power leads from the system board to feed-through capacitor C219. C219 and C220 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 PA.

Centralized metering jack J205 is provided for use with GE Test Model 4EX3A11 or Test Kit 4EX8K12. The test set meters the AMPL-1 DRIVE (exciter output), the POWER CONTROL voltage, and the DRIVER AND PA CURRENT.

CIRCUIT ANALYSIS

PA ASSEMBLY

The exciter output is coupled through a 50 ohm RF cable to the PA input connector P101. 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 J205-4 through resistor R21. The rectified RF is also applied to the power control IC (U1).

Collector voltage to Q201 is applied from the power controller 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 and L7.

Collector voltage to Q202 is controlled by power control IC (U1), and Q207 and is applied through a 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, L14 and L15.

The collector voltage to Q203 is coupled directly from the supply voltage through collector stabilizing network L17 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 driver Q204.

The collector voltage of Q204 is coupled through R26 from the supply voltage, through collector stabilizing network L23 and R11, through collector feed network L22 and C15.

Collector current for Q204 is metered across tapped manganin resistor R26. The reading, taken in position "F" on the 10-Volt scale of the Test Set with the High Sensitivity button pressed, should be approximately 2.1 Amperes.

GENERAL ELECTRIC

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. Be extremely careful to avoid damaging transistors when working with the PA assembly.

The output of Q204 is coupled through an impedance matching network (C209, C210, C16 and L24) and a 50 ohm microstrip, W5, to a power splitter consisting of microstrip transmission line W6-W9 and R12.

RF output power from Q204 (approximately 12 Watts) is split evenly between two identical class C power amplifiers Q205 and Q206 via their respective identical impedance matching networks. The impedance matching networks consist of C19, C211, C213, L27, L25, and C20, C212, C214, L26 and L27.

Collector voltage for Q205 and Q206 is supplied from the A+ line at J203-1 through identical collector stabilizing networks consisting of R13, L31, and C23, and L32, R14 and C24 respectively.

Collector current for Q205 and Q206 is metered across tapped manganin resistor R27. The reading taken in position G on the 10 Volt scale with the HIGH SENS button on the test set pressed. The meter reading should be 7.9 Amperes.

The output of Q205 and Q206 is coupled through identical impedance matching and RF power combining networks. The RF power combiner consists of microstrip transmission lines W12 and W13 and resistor 15. The combiner adds the outputs of Q205 and Q206 and applies the combined RF output to the low pass filter through 50 ohm microstrip W14.

The RF power output is applied to antenna connector J202 through 50 ohm microstrip W1 in the low pass filter, to the antenna relay in control station and to J202 in mobile PA.

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.

POWER CONTROL CIRCUIT

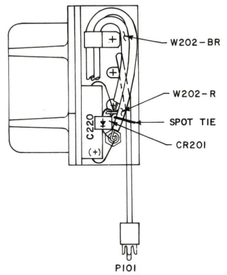
The Power Control Circuit, consists of CR1, U1, Q207 and the directional coupler (C30, C31, CR3, R16 and W15).

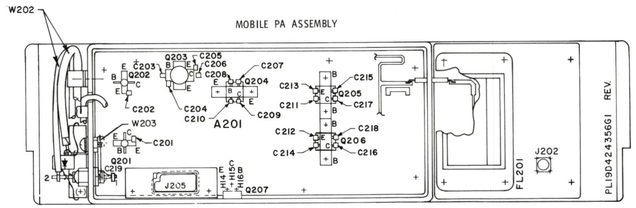
When the transmitter is keyed, rectified RF from CR1 is applied to a transistorized switch in the Power Control IC (U1), turning on the switch. The switch operates a voltage regulator. The directional coupler senses the forward power at the output of the power amplifier and feeds voltage back to the Power Control IC, resulting in feedback control of the voltage regulator output. A constant voltage is fed via Pin 4 of U1 to Power Adjust potentiometer R24. The setting of R24 determines the voltage fed to the base and collector of Q201 and the collector of Q202. Reducing the supply voltage to these stages reduces the drive to the remaining stages of the power amplifier, thereby reducing the power output of the PA.

Overvoltage sensing of the supply voltage via Pin 11 of U1 shuts down the driver when this comdition occurs, thus protecting the driver and PA stages. The feedback power control performs the function of power leveling of the amplifier output over a range of varying input conditions such as drive level, DC voltage and load variations.

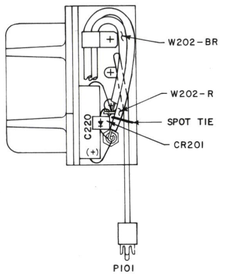
GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

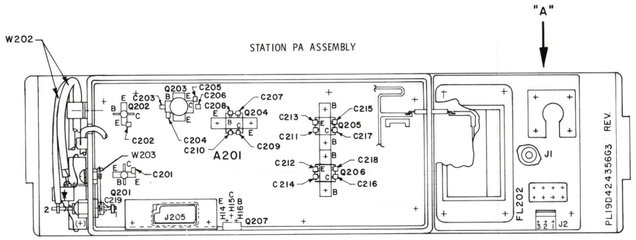
GENERAL ELECTRIC*
U.S.A.



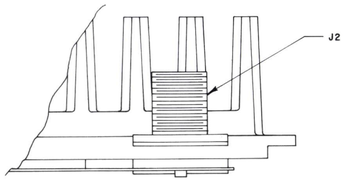


(19C327934, Rev. 0)



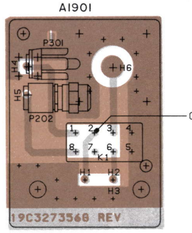


(19C327935, Rev. 0)



VIEW "A" (ENLARGED)

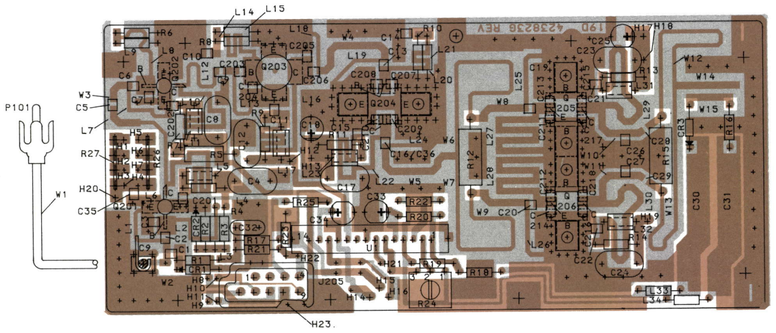
ANTENNA RELAY (MOBILE)



CONNECTION CHART			
FROM	TO	WIRE	REMARKS
H1	LET HANG	W3-BK	
H2	↑	W3-R	
H3	|	W3-SHLD	
H4	↓	W1	
H5	LET HANG	W2	

(19C327489, Rev. 1)
(19B227558, Sh. 1, Rev. 1)
(19B227558, Sh. 2, Rev. 0)

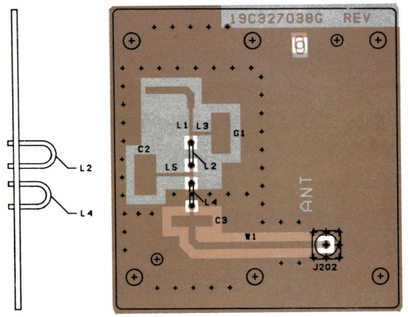
PA BOARD



CONNECTIONS CHART		
FROM	TO	USING
H1	H17	W18
H2	H9	ST22-BR
H3	H8	ST22-R
H4	H12	W17
H5	H13	W20
H6	H10	ST22-G
H7	H11	ST22-W
H18	H19	W19

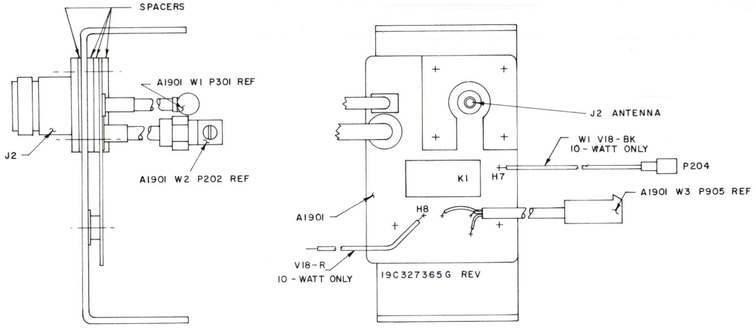
(19D424590, Rev. 4)
(19B227301, Sh. 1, Rev. 1)
(19B227301, Sh. 2, Rev. 1)

LOW PASS FILTER FL201 (MOBILE)

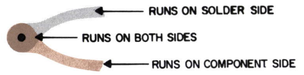


(19C327585, Rev. 0)
(19B227304, Sh. 1, Rev. 0)
(19B227304, Sh. 2, Rev. 0)

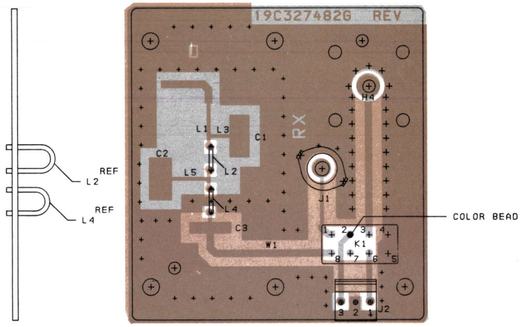
ANTENNA RELAY ASSEMBLY



(19C327924, Rev. 1)



LOW PASS FILTER FL202 (STATION)

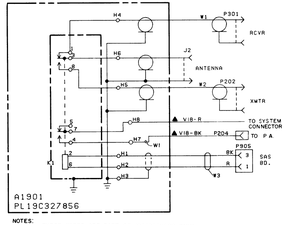


(19C327521, Rev. 0)
(19B227657, Sh. 1, Rev. 1)
(19B227657, Sh. 2, Rev. 0)

OUTLINE DIAGRAMS

806—825 MHz, PA ASSEMBLY
35-WATT MOBILE TRANSMITTER
25-WATT STATION TRANSMITTER

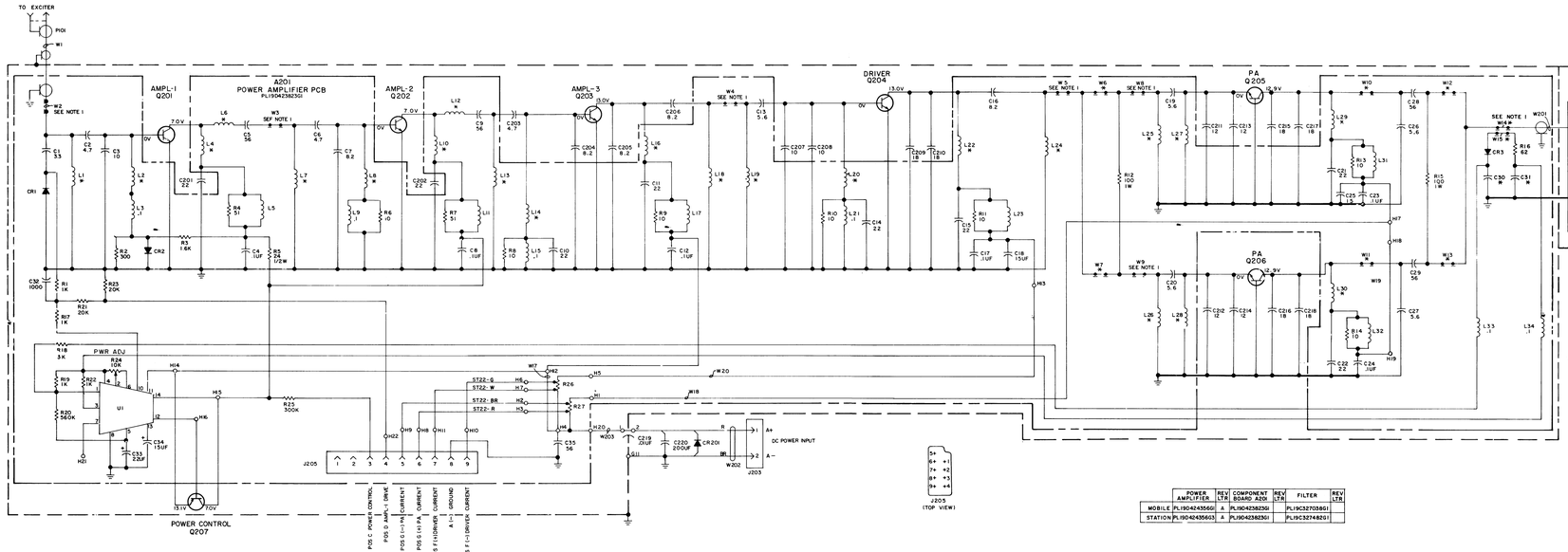
ANTENNA RELAY (MOBILE)



NOTES:
1. ▲ THESE WIRES ARE PART OF 19C327365G2 ONLY

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.
THIS ELEM DIAG APPLIES TO
MODEL NO — REV LETTER
PL19C327365G1 PL19C327365G2 PL19C327856G1

(19B227557, Rev. 2)



POWER AMPLIFIER	REV LTR	COMPONENT BOARD A201	REV LTR	FILTER	REV LTR
MOBILE PL19042435G6	A	PL19042362G2		PL19C327038G1	
STATION PL19042435G63	A	PL19042362G1		PL19C327482G1	

(19B227242, Rev. 6)

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH TRANSMITTER KEYED AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER IN HF CAVITY. USE HIGH IMPEDANCE METER (10 MEGOHMS) OR METER LEAD TO AVOID DETUNING RF CIRCUITS.
NOTE: READINGS AT Q201, Q202 COLLECTOR AND IN THE POWER CONTROL CIRCUIT WERE TAKEN WITH THE TRANSMITTER ADJUSTED FOR 35 WATTS OUTPUT. THESE READINGS MAY VARY ACCORDING TO THE SETTING OF POWER ADJUST CONTROL R24.

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 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1,000 OHMS OR M=1,000,000 OHMS. CAPACITOR VALUES NON-POLARIZED ARE IN MICROFARADS UNLESS OTHERWISE NOTED IN UF= MICROFARADS, PICOFARAD VALUES IN MICROFARADS UNLESS FOLLOWED BY MMF=MILLIMICROFARADS OR PICOFARADS.

NOTES:
1. 50 OHM MICROSTRIP (PART OF PWB)
2. PARTS INDICATED BY ✱ ARE PART OF PCB

SCHEMATIC DIAGRAM

806—825 MHz, PA ASSEMBLY
35-WATT MOBILE TRANSMITTER
25-WATT STATION TRANSMITTER

PARTS LIST

LBI30470E

806-825 MHz, PA ASSEMBLY
19D424359G1 MOBILE
19D424359G2 STATION
19D424359G3 MOBILE SYNTHESIZED
19D424359G6 STATION SYNTHESIZED

SYMBOL	GE PART NO.	DESCRIPTION
A201		POWER AMPLIFIER BOARD 19D423823G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A134418P1	Ceramic: 3.3 pf ±.25 pf, 50 VDCW.
C2	19A134418P5	Ceramic: 4.7 pf ±.25 pf, 50 VDCW.
C3	19A134418P13	Ceramic: 10 pf ±5% pf, 50 VDCW.
C4	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C5	19A134418P31	Ceramic: 56 pf ±5% pf, 50 VDCW.
C6	19A134418P5	Ceramic: 4.7 pf ±.25 pf, 50 VDCW.
C7	19A134418P11	Ceramic: 8.2 pf ±5% pf, 50 VDCW.
C8	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C9	19A134418P31	Ceramic: 56 pf ±5% pf, 50 VDCW.
C10 and C11	19A134418P21	Ceramic: 22 pf ±5% pf, 50 VDCW.
C12	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C13	19A134418P7	Ceramic: 5.6 pf ±5% pf, 50 VDCW.
C14 and C15	19A134418P21	Ceramic: 22 pf ±5% pf, 50 VDCW.
C16	19A134418P11	Ceramic: 8.2 pf ±5% pf, 50 VDCW.
C17	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C18	19A134302P8	Tantalum: 15 µf ±20%, 20 VDCW.
C19 and C20	19A134418P7	Ceramic: 5.6 pf ±5% pf, 50 VDCW.
C21 and C22	19A134418P21	Ceramic: 22 pf ±5% pf, 50 VDCW.
C23 and C24	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C25	19A134302P8	Tantalum: 15 µf ±20%, 20 VDCW.
C26 and C27	19A134418P7	Ceramic: 5.6 pf ±5% pf, 50 VDCW.
C28 and C29	19A134418P31	Ceramic: 56 pf ±5% pf, 50 VDCW.
C30 and C31		(Part of 19D423824P1 printed board).
C32	19A116855P18	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C33	19A134302P6	Tantalum: 22 µf ±20%, 15 VDCW.
C34	19A134302P8	Tantalum: 15 µf ±20%, 20 VDCW.
C35	19A134418P31	Ceramic: 56 pf ±5% pf, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A116052P1	Silicon, hot carrier: Fwd. drop .350 volts max.
CR2	19A115775P1	Silicon.
CR3	19A116052P2	Silicon, hot carrier: Fwd. drop .410 volts max.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J205	19B219376G1	Connector: 9 contacts.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - INDUCTORS - - - - - - - - -
L1 and L2		(Part of 19D423824P1 printed board).
L3	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L4		(Part of 19D423824P1 printed board).
L5	19A129773G1	Coil.
L6 thru L8		(Part of 19D423824P1 printed board).
L9	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L10		(Part of 19D423824P1 printed board).
L11	19A129773G1	Coil.
L12 thru L14		(Part of 19D423824P1 printed board).
L15	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L16		(Part of 19D423824P1 printed board).
L17	19A129773G1	Coil.
L18 thru L20		(Part of 19D423824P1 printed board).
L21	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
L22		(Part of 19D423824P1 printed board).
L23	19A129773G1	Coil.
L24 thru L30		(Part of 19D423824P1 printed board).
L31 and L32	19A129773G1	Coil.
L33 and L34	19B209420P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1K.
		- - - - - - - - - PLUGS - - - - - - - - -
P101		(Part of W1).
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R2	3B152P301J	Composition: 300 ohms ±5%, 1/4 w.
R3	3B152P162J	Composition: 1.6K ohms ±5%, 1/4 w.
R4	19A700106P32	Composition: 51 ohms ±5%, 1/4 w.
R5	3B77P240J	Composition: 24 ohms ±5%, 1/2 w.
R6	19A700106P15	Composition: 10 ohms ±5%, 1/4 w.
R7	19A700106P32	Composition: 51 ohms ±5%, 1/4 w.
R8 thru R11	19A700106P15	Composition: 10 ohms ±5%, 1/4 w.
R12	19A700112P39	Composition: 100 ohms ±5%, 1 w.
R13 and R14	19A700106P15	Composition: 10 ohms ±5%, 1/4 w.
R15	19A700112P39	Composition: 100 ohms ±5%, 1 w.
R16	3B152P620J	Composition: 62 ohms ±5%, 1/4 w.
R17	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R18	3B152P302J	Composition: 3K ohms ±5%, 1/4 w.
R19	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R20	3B152P564J	Composition: 560K ohms ±5%, 1/4 w.
R21	3B152P203J	Composition: 20K ohms ±5%, 1/4 w.
R22	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R23	3B152P203J	Composition: 20K ohms ±5%, 1/4 w.
R24	19A116559P106	Variable, cermet: 10K ohms ±20%, .5 w; sim to CTS Series 360.

SYMBOL	GE PART NO.	DESCRIPTION
R25	3B152P304J	Composition: 300K ohms ±5%, 1/4 w.
R26 and R27	19C320212P2	Shunt resistor.
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - -
U1	19D429709G4	Power Control.
		- - - - - - - - - CABLES - - - - - - - - -
W1	19A136858G1	Cable. Includes (P101).
W2 thru W5		(Part of 19D424824P1 printed board).
W17	19B227765P4	Jumper.
W18	19B227765P2	Jumper.
W19	19B227765P1	Jumper.
W20	19B227765P3	Jumper.
		- - - - - - - - - CAPACITORS - - - - - - - - -
C201 and C202	19A134418P21	Ceramic: 22 pf ±5% pf, 50 VDCW.
C203	19A134418P5	Ceramic: 4.7 pf ±.25 pf, 50 VDCW.
C204 thru C206	19A134418P11	Ceramic: 8.2 pf ±5% pf, 50 VDCW.
C207 and C208	19A134418P13	Ceramic: 10 pf ±5% pf, 50 VDCW.
C209 and C210	19A134418P19	Ceramic: 18 pf ±5% pf, 50 VDCW.
C211 thru C214	19A134418P15	Ceramic: 12 pf ±5% pf, 50 VDCW.
C215 thru C218	19A134418P18	Ceramic: 18 pf ±5% pf, 50 VDCW.
C219	19A116708P1	Ceramic, feed-thru: 0.01 pf +100% -0%, 500 VDCW; sim to Erie 3270508-0401032.
C220*	19A115680P10	Electrolytic: 200 µf -150% -10%, 18 VDCW; sim to Mallory Type TTX.
	19A115680P5	Earlier than REV A: Electrolytic: 100 µf -150% -10%, 25 VDCW; sim to Mallory Type TTX.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201	19A116783P1	Rectifier, silicon: 100 VDC blocking, 6 amps.
		- - - - - - - - - FILTERS - - - - - - - - -
FL201	19C327038G1	Lowpass Filter. (MOBILE).
FL202		STATION 800 MHz FILTER/RELAY ASSEMBLY 19C327482G1
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19A130924G1	Receptacle, coaxial: jack type; sim to Cinch 14B11613.
J2	19A116659P53	Connector, printed wiring: 3 contacts; sim to Molex 09-48-1031.
		- - - - - - - - - RELAYS - - - - - - - - -
K1	19A700081P1	Hermetic sealed: 180-241 ohms coil res, 8-16.3 VDC; sim to GE 3SAY176042, CP Clare HPF-1201558, or Potter-Brumfield HCM6160.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L2	19A136863P1	Coil.
L4	19A136863P1	Coil.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - JACKS AND RECEPTACLES - - - - -
J2	7777145P5	Connector, plug: 1 female contact; sim to Amphenol 82-97 or Military UG-58A/U. (STATION).
J202		(Part ofFL201).
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P101		(Part of W202).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q201	19A134430P1	Silicon, NPN.
Q202	19A134430P2	Silicon, NPN.
Q203	19A134431P1	Silicon, NPN.
Q204	19A134432P1	Silicon, NPN.
Q205 and Q206	19A134433P1	Silicon, NPN.
Q207	19A116894P1	Silicon, PNP.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W201	19A136859G1	Cable, RF.
W202A	19B227058G1	Cable: approx 1 foot long.
W202B	19B227058G2	Cable: approx 1 foot long.
W203	19B227659P5	Jumper.
		ASSOCIATED ASSEMBLIES
		MOBILE ANTENNA RELAY 19C327356G1
A1901		COMPONENT BOARD 19C327856G1
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19A700081P1	Hermetic sealed: 180-241 ohms coil res, 8-16.3 VDC; sim to GE 3SAY176042, CP Clare HPF-1201558, or Potter-Brumfield HCM6160.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P202		(Part of W2).
P301		(Part of W1).
P905		(Part of W3).
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W1	19A136861G1	Cable, RF: approx 5-1/2 inches long. Includes (P301) 7104841P21.
W2	19B227567G1	Cable, RF: approx 14-1/4 inches long. Includes (P202) 18A134413P4.
W3	19A136804G1	Cable: approx 22 inches long. Includes (P905) 18A116659P14.
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J2	7777145P5	Connector, plug: 1 female contact; sim to Amphenol 82-97 or Military UG-58A/U. (MOBILE).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B226952G3	PA Cover.
	19A136788G1	Support. (J2).
	19B227679P1	Spacer. (MOBILE- Quantity 3- Used with Antenna Relay).
	19B227679P2	Spacer. (MOBILE- Quantity 1- Used with Antenna Relay).
	19B227679P1	Spacer. (STATION- TOP - Used with antenna relay jack J2).

SYMBOL	GE PART NO.	DESCRIPTION
	19B227679P2	Spacer. (STATION- BOTTOM - Used with antenna relay jack J2).
	19B227679P3	Spacer. (STATION- CENTER - Used with antenna relay jack J2).
	4035306P59	Washer, fiber. (Part of L5,L11,L17,L23,L31,L32). (Not Used).
	19C321591G5	Heat sink. (Used with Q201-Q203). (MOBILE).
	19C321591G7	Heat sink. (Used with Q201-Q203). (STATION).
	7139898P3	Hex nut, brass: 1/4-28. (Secures C219).
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16, (Secures L201).
	19A134016P1	Insulator, bushing. (Used with Q207).
	19A116023P1	Insulator, plate. (Used with Q207).
	5492178P2	Washer. (Used with Q201-Q205).
	19A121006P14	Washer. (Used with Q201 & Q202).
	N3079150S6	Nut, hex: No 8-32. (Used with Q201-Q203).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ADDENDUM TO LBI30469E

This addendum describes Revision Letter changes that are not yet included in the publication.

REV.A- 19D423823G1-3 POWER AMPLIFIER BOARD.

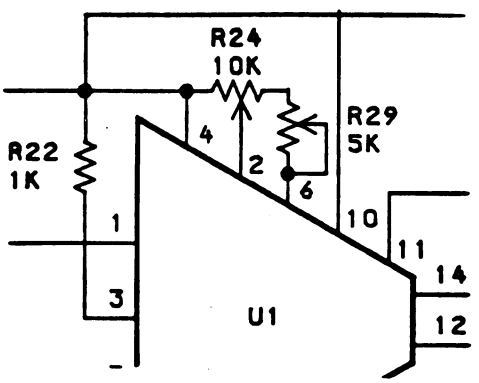
TO REDUCE THE PROBABILITY OF P.A. BURN-UP DUE TO MISADJUSTMENT FO EXCESSIVE POWER. ADDED R29. PART NUMBER FOR R29 IS 19A700016P3. VARAIBLE RESISTOR, 5000 OHMS + OR - 10%, 1/2 WATT.

ADJUSTMENT PROCEDURE

1. TURN POWER ADJUST CONTROL R24 AND POWER LIMIT CONTROL R29 FULLY CLOCKWISE. NOTE THAT POWER OUTPUT EXCEEDS RATED POWER OUTPUT FOR ALL CHANNELS.

2. SET LIMIT CONTROL TO PROVIDE A POWER OUTPUT 1 DB GREATER THAN RATED POWER.

NEW SCHEMATIC IS



NOTE: THE NEW PRINTED WIRE PATTERN IS INCORPORATED IN THIS CHANGE.