MOBILE RADIO

# MAINTENANCE MANUAL

# 138—174 MHz POWER AMPLIFIER BOARD 19D423319G1, G2

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## DESCRIPTION

The PA Assembly for MASTR® EXECUTIVE II uses three RF power transistors to provide a power output of 35 Watts. The output power is adjustabe using power control potentiometer R11 over a range of 10 to 35 Watts. A single transistor is used in the power control circuit.

Supply voltage for the PA is connected through power leads from the system-audio-squelch board (SAS) to feedthrough capacitors C297 and C298 on the side 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.

The hinged PA heat sink pivots 90° to provide access to the power amplifier board, low pass filter and central metering jack J205.

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 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 T1, C5, C6 and L2. L1, R3 and C4 comprise a stabilizing network in the base circuit of Q201.

Part of the RF input is rectified by CR1 and applied to voltage divider R1 and R2. This voltage is used to meter the AMPL-1 drive at J205.

Collector voltage to Q201 (Ampl-1) is controlled by power control transistor Q204 and is applied through collector stabilizing network (L3 and R4) and collector feed network T2 and C9. The collector voltage of Q201 is metered through R7 at J205.

The output of Q201 is coupled to the base of Class C driver Q202 through a matching network consisting of C7, T2, C8, T3, C14 and C15. Collector voltage to Q202 is applied through collector stabilizing network Z1 and collector feed network L4 and C16.

Collector current for Q202 is metered across tapped manganin resistor R9 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 C20 and a lowpass filter matching network (L5, C21, C22 and C23). Collector voltage to Q203 is coupled through collector stabilizing network Z2 and collector feed network L6 and C29.

Collector current for Q203 is metered across tapped manganin resistor R10. 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 (L7, C31, T4 and C35) that matches the output of Q203 to the 50-ohm microstrip impedance (W2) to the input of low pass filter. C30 acts as a DC blocking capacitor.

The PA output is coupled through the low-pass filter to the antenna through antenna transfer relay K1901.

Capacitors C36 through C45 provide ground isolation for positive and negative ground operation. C34 provides DC isolation between the transmitter and the antenna.

**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.

## POWER CONTROL CIRCUIT

The power control circuit consists of R11 and Q204. R11 controls the base voltage and conduction of Q204. Q204 is connected in series with the collector feed network for Q201, thereby controlling the drive to driver Q202 and the output power. R11 is adjusted to provide the desired output power.

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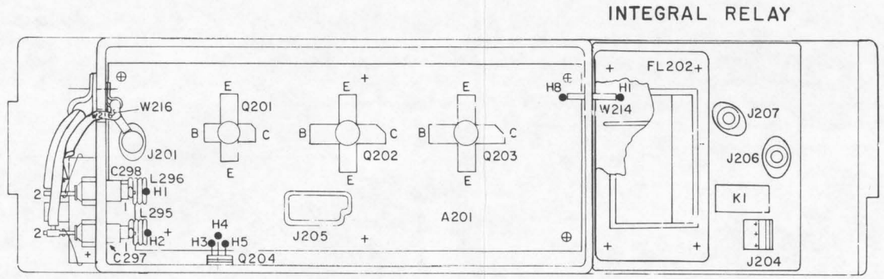
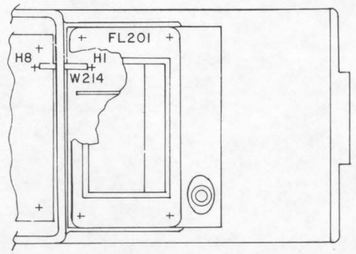
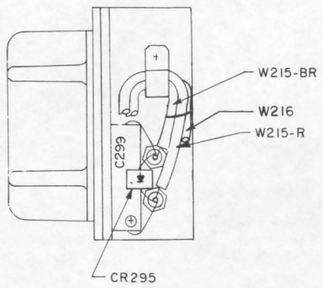
PA ASSEMBLY



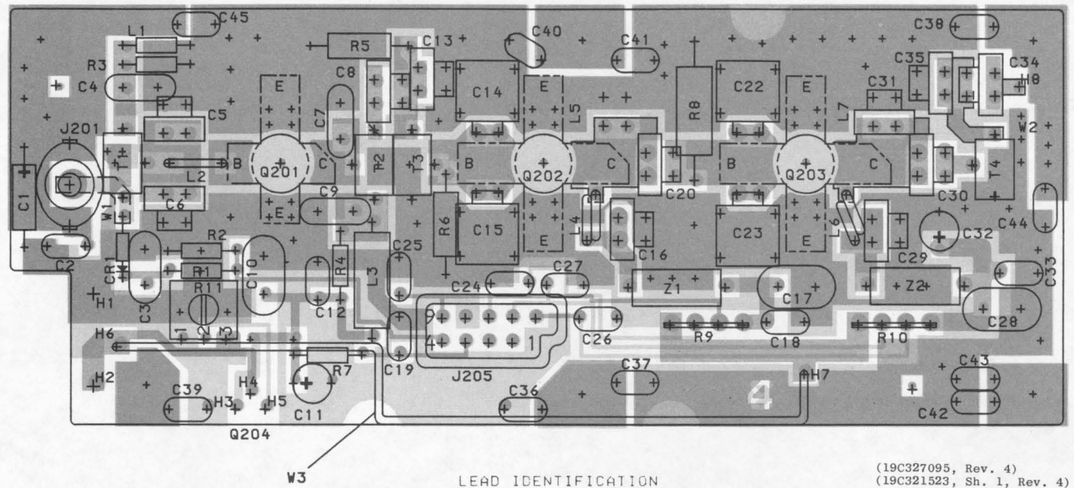



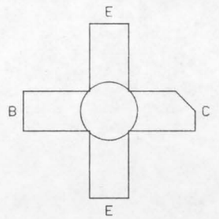

END VIEW

(19C327098, Rev. 6)

COMPONENT BOARD
A201



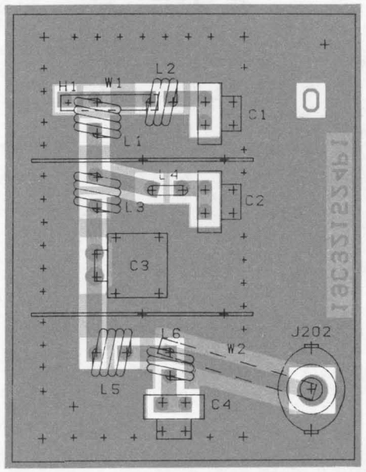

LEAD IDENTIFICATION
FOR Q201 - Q203




VIEW FROM CASE END

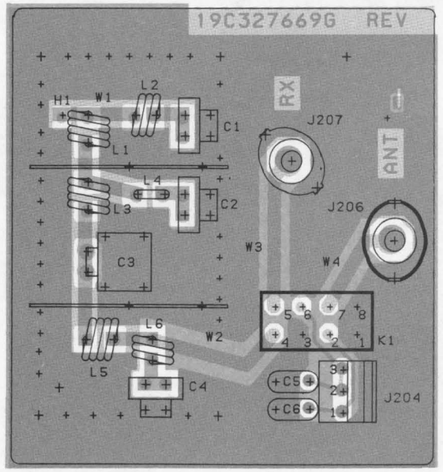
(19C327095, Rev. 4)
(19C321523, Sh. 1, Rev. 4)
(19C321523, Sh. 2, Rev. 3)

LOW PASS FILTER FL201
(EXTERNAL RELAY)




(19B227367, Rev. 0)
(19B226795, Sh. 2, Rev. 0)
(19B226795, Sh. 3, Rev. 0)

LOW PASS FILTER FL202 (INTEGRAL RELAY)

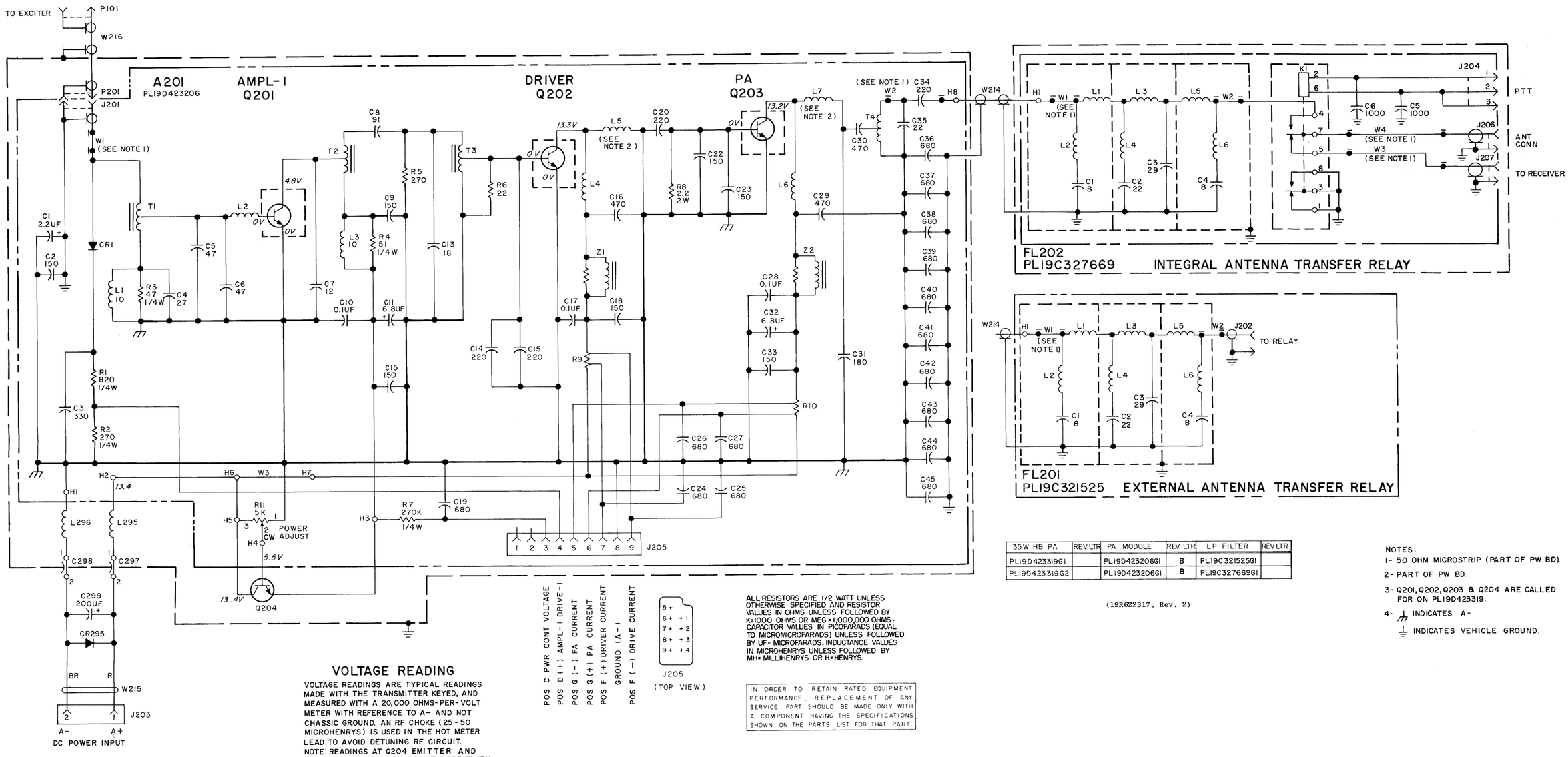



(19C327916, Rev. 0)
(19B227884, Sh. 1, Rev. 1)
(19B227884, Sh. 2, Rev. 0)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

## OUTLINE DIAGRAM

138—174 MHz, 35 WATT POWER AMPLIFIER




## VOLTAGE READING

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 CHASSIC GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUIT.
NOTE: READINGS AT Q204 EMITTER 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 R11.

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.

| 35W HB PA | REV LTR | PA MODULE | REV LTR | LP FILTER | REV LTR |
|---|---|---|---|---|---|
| PLI9D423319G1 | | PLI9D423206G1 | B | PLI9C321525G1 | |
| PLI9D423319G2 | | PLI9D423206G1 | B | PLI9C327669G1 | |

(19R622317, Rev. 2)

NOTES:
1- 50 OHM MICROSTRIP (PART OF PW BD).
2- PART OF PW BD.
3- Q201, Q202, Q203 & Q204 ARE CALLED FOR ON PLI9D423319.
4- ⏚ INDICATES A-
⏚ INDICATES VEHICLE GROUND.

# SCHEMATIC DIAGRAM

138—174 MHz, 35 WATT POWER AMPLIFIER

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## PARTS LIST

LBI30066D

138-174 MHz POWER AMPLIFIER
19D423319G1, G2

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| A201 | | P.A. BOARD 19D423206G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 5496267P13 | Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D. |
| C2 | 19A116655P8 | Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| C3 | 7489162P39 | Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15. |
| C4* | 19A116656P27J0 | Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef 0 PPM. |
| | | Earlier than REV A: |
| | 7489162P19 | Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15. |
| C5 and C6 | 19A700015P21 | Metallized teflon: 47 pf ±5%, 250 VDCW. |
| C7 | 19A700105P8 | Mica: 12 pf ±5%, 500 VDCW. |
| C8 | 19A700015P28 | Metallized teflon: 91 pf ±5%, 250 VDCW. |
| C9* | 19A116655P8 | Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| | | In REV A & earlier: |
| | 19A700105P28 | Mica: 56 pf ±5%, 500 VDCW. |
| C10 | 19A116080P107 | Polyester: 0.1 µf ±10%, 50 VDCW. |
| C11 | 19A134202P15 | Tantalum: 6.8 µf ±20%, 35 VDCW. |
| C12 | 19A116655P8 | Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| C13 | 19A700015P10 | Metallized teflon: 18 pf ±5%, 250 VDCW. |
| C14 and C15 | 19A116795P220J | Silver mica: 220 pf ±5%, 250 VDCW; sim to Underwood Type J1HF. |
| C16 | 19A116679P470K | Mica: 470 pf ±10%, 250 VDCW. |
| C17 | 19A116080P107 | Polyester: 0.1 µf ±10%, 50 VDCW. |
| C18 | 19A116655P8 | Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| C19 | 19A116655P18 | Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| C20* | 19A116679P220K | Mica: 220 pf ±10%, 250 VDCW. |
| | | In REV A & earlier: |
| | 19A116679P470K | Mica: 470 pf ±10%, 250 VDCW. |
| C21* | 19A116679P56J | Mica: 56 pf ±5%, 250 VDCW. Deleted by REV B. |
| C22* and C23* | 19A116795P150J | Silver mica: 150 pf ±5%, 250 VDCW; sim to Underwood Type J1HF. |
| | | Earlier than REV A: |
| | 19A116795P220J | Silver mica: 220 pf ±5%, 250 VDCW; sim to Underwood Type J1HF. |
| C24 thru C27 | 19A116655P18 | Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| C28 | 19A116080P107 | Polyester: 0.1 µf ±10%, 50 VDCW. |
| C29 and C30 | 19A116679P470K | Mica: 470 pf ±10%, 250 VDCW. |
| C31 | 19A700015P35 | Metallized teflon: 180 pf ±5%, 250 VDCW. |
| C32 | 19A134202P15 | Tantalum: 6.8 µf ±20%, 35 VDCW. |
| C33 | 19A116655P8 | Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| C34 | 19A700015P37 | Metallized teflon: 220 pf ±5%, 250 VDCW. |
| C35 | 19A700015P12 | Metallized teflon: 22 pf ±5%, 250 VDCW. |
| C36 thru C45 | 19A116655P18 | Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| | | - - - - - - - DIODES AND RECTIFIERS - - - - - - |
| CR1 | 19A115250P1 | Silicon, fast recovery, 225 mA, 50 PIV. |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J201 | 19A130924G1 | Connector: jack type; sim to Cinch 14H11613. |
| J205 | 19B219374G1 | Connector: 9 contacts. |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - |
| L1 | 19A700024P25 | Coil, RF: 10.0 µh ±10%, 3.70 ohms DC res max. |
| L2 | 19A130609G1 | Coil. |
| L3 | 19A700000P123 | Coil, RF: 10.0 µh ±10%, 0.26 ohms DC res max. |
| L4* | 19A136531P1 | Coil. |
| | | In REV A & earlier: |
| | 19A129561P1 | Coil. |
| L5 | | (Part of printed board 19D423205P1). |
| L6 | 19A129561P1 | Coil. |
| L7 | | (Part of printed board 19D423205P1). |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - |
| R1 | 19A700106P61 | Composition: 820 ohms ±5%, 1/4 w. |
| R2 | 19A700106P49 | Composition: 270 ohms ±5%, 1/4 w. |
| R3 | 19A700106P31 | Composition: 47 ohms ±5%, 1/4 w. |
| R4 | 19A700106P32 | Composition: 51 ohms ±5%, 1/4 w. |
| R5 | 19A700113P39 | Composition: 100 ohms ±5%, 1/2 w. |
| R6 | 19A700113P23 | Composition: 22 ohms ±5%, 1/2 w. |
| R7 | 3R152P274J | Composition: 270K ohms ±5%, 1/4 w. |
| R8 | 19A700050P17 | Wirewound: 2.2 ohms ±10%, 2 w. |
| R9 and R10 | 19C320212P2 | Shunt resistor. |
| R11 | 19A116559P102 | Variable, cermet: 5K ohms ±20%, 0.5 w; sim to CTS Series 360. |
| | | - - - - - - - - - - TRANSFORMERS - - - - - - - - - |
| T1 thru T3 | 19A129564G1 | Transformer. |
| T4 | 19A129574G1 | Transformer. |
| | | - - - - - - - - - - - - CABLES - - - - - - - - - - - |
| W1 and W2 | | (Part of printed board 19D423205P1). |
| W3 | 19B226909G1 | Jumper. |
| | | - - - - - - - - - - NETWORKS - - - - - - - - - - |
| Z1 and Z2 | | FILTER ASSEMBLY 19B219649G1 |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - - |
| L1 | 19A129346G2 | Coil. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - |
| R1 | 3R78P100K | Composition: 10 ohms ±10%, 1 w. |
| | | - - - - - - - - - - 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 | Rectifier, silicon: 100 VDC blocking, 6 amps. |
| | | - - - - - - - - - - - FILTERS - - - - - - - - - |
| FL201 | | LOW PASS FILTER (EXTERNAL RELAY) 19C321525G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 19A116679P8D | Metallized teflon: 8 pf ±.5 pf, 250 VDCW. |
| C2 | 19A700015P12 | Metallized teflon: 22 pf ±5%, 250 VDCW. |
| C3 | 19A116795P29J | Silver mica: 29 pf ±5%, 250 VDCW; sim to Underwood Type J1HF. |
| C4 | 19A116679P8D | Metallized teflon: 8 pf ±.5 pf, 250 VDCW. |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J202 | 19A130924G1 | Connector: jack type; sim to Cinch 14H11613. |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - |
| L1 | 19A129569P1 | Coil. |
| L2 | 19A129570P1 | Coil. |
| L3 | 19A129569P1 | Coil. |
| L4 | 19A129575P1 | Coil. |
| L5 | 19A129569P1 | Coil. |
| L6 | 19A129570P1 | Coil. |
| | | - - - - - - - - - - CABLES - - - - - - - - - - |
| W1 and W2 | | (Part of printed board 19C321524P1). |
| FL202 | | LOW PASS FILTER (INTEGRAL RELAY) 19C327669G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 19A116679P8D | Metallized teflon: 8 pf ±.5 pf, 250 VDCW. |
| C2 | 19A700015P12 | Metallized teflon: 22 pf ±5%, 250 VDCW. |
| C3 | 19A116795P29J | Silver mica: 29 pf ±5%, 250 VDCW; sim to Underwood Type J1HF. |
| C4 | 19A116679P8D | Metallized teflon: 8 pf ±.5 pf, 250 VDCW. |
| C5 and C6 | 19A116655P20 | Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap. |
| | | - - - - - - - JACKS AND RECEPTACLES - - - - - - |
| J204 | 19A116659P55 | Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031. |
| J206 and J207 | 19A130924G1 | Connector, receptacle: jack type; sim to Cinch 14H11613. |
| | | - - - - - - - - - - - RELAYS - - - - - - - - - - |
| K1 | 19A700061P1 | Hermetic sealed: 180-341 ohms coil res, 8-16.3 VDC; sim to GE 3SAV1760A2, CP Clare HFW-1201558, or Potter-Brumfield HCM6160. |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - |
| L1 | 19A129569P1 | Coil. |
| L2 | 19A129570P1 | Coil. |
| L3 | 19A129569P1 | Coil. |
| L4 | 19A129575P1 | Coil. |
| L5 | 19A129569P1 | Coil. |
| L6 | 19A129570P1 | Coil. |
| | | - - - - - - - - - - CABLES - - - - - - - - - - |
| W1 thru W4 | | (Part of printed board 19C327670P1). |
| | | - - - - - - - - - - INDUCTORS - - - - - - - - - |
| L295 and L296 | 19A130608G1 | Coil. |
| | | - - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q201 | 19A134060P1 | Silicon, NPN. |
| Q202 | 19A134060P2 | Silicon, NPN. |
| Q203 | 19A134060P3 | Silicon, NPN. |
| Q204 | 19A116742P1 | Silicon, NPN. |
| | | - - - - - - - - - - CABLES - - - - - - - - - - |
| W214 | 19A130607G1 | Cable, RF: approx 1 foot long. |
| W215 | 19B227058G1 | Cable: approx 1 foot long. |
| W216 | 19A130909G1 | Cable, RF: approx 7-1/2 inches long. |
| | | - - - - - - - - - MISCELLANEOUS - - - - - - - - |
| | 19C321591G2 | Heat sink. (Used with Q201-Q203). |
| | 19C321595P1 | Insulator. (Used with Q201-Q203). |
| | 5492178P2 | Washer, spring tension; sim to Wallace Barnes 375-20. (Used with Q201-Q203). |
| | N207P15C6 | Nut, hex: No. 8-32. (Used with Q201-Q203). |
| | 19A134016P1 | Insulator, bushing. (Used with Q204). |
| | 19A116023P1 | Insulator, plate. (Used with Q204). |
| | 19D416275P3 | Filter housing. (FL201). |
| | 19B201074P312 | Tap screw, Phillips POZIDRIV®: No. 6-32 x 3/4. (Secures FL201 can). |
| | 19B201074P305 | Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16. (Secures A201 board). |
| | 19A129434P1 | Washer. (Used with L295, L296). |
| | 4029851P6 | Clip loop: sim to Weckesser Co. 5/16-4-128. (Used with W215). |
| | 19B226952G1 | P.A. cover. |

## 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 19D423206G1
To improve operation. Changed C4.

REV. B - Power Amplifier Board 19D423206G1
To increase output in 174 MHz (high end) range. Changed C9, C20, C22, C23 and L4. Deleted C21.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.