MAINTENANCE MANUAL

POWER AMPLIFIER ASSEMBLY (UHF)
N29/85154001240 440-470 MHz
N29/85154001260 470-512 MHz

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DESCRIPTION

The Power Amplifier Board is mounted on an aluminum diecast heatsink at the rear of the radio. A brass shield plate covers the heatsink to prevent RF leakage. The entire assembly may be disassembled by loosening two screws.

The PA board amplifies the output from the main board (approximately 1.5 watts) to a level of approximately 40-45 watts over the frequency range of 440-512 MHz. There are no tuning adjustments on the board.

The board consists of a two stage bipolar RF power amplifier, a TX/RX PIN diode switch, a power detection circuit and a low pass filter for harmonics suppression. A diode/overvoltage transient suppressor is also included on the board for reverse voltage and transient protection, as well as a multi-pin connector used to distribute non amplifier related signals to the main board. A 2-pin connector provides 8 volts to bias the PIN diodes, a detector diode, and feeds the detected DC voltage back to the power control circuit on the main board. All connector pins are decoupled with feed-thru capacitors. One coaxial cable supplies drive to the power amplifier and the other feeds received signal back to the receiver. The 440-512 MHz range of UHF frequencies is covered by two PA boards:

N29/85154001240	440-470 MHz
N29/85154001260	470-512 MHz

CIRCUIT ANALYSIS

The exciter output from the main board (1.5 watts, 50 ohm impedance) is matched to the base of Q1 by C6, C7, C8 ,C9 and a microstrip line. L5 provides a bias return for class "C" operation. A network consisting of L6 and R12 enhances low frequency stability. The interstage matching is comprised of C10, C11, C12, C13, C14, C15 and two microstrip lines. L8 forms a bias return for Q2. L9 and R13 serve to enhance stability. Once the drive is amplified to 40 watts by Q2, the output is matched back to 50 ohms by C16, C17, C18, C19 and two microstrip lines.

A+ is supplied to the collector of Q1 and Q2 through a network consisting of C1, C2, L1, L2, L3,

R11, L7, C36, C3, C4, C5, C38, L4, R10 and L10. In addition to enhancing stability, these components also suppress the leakage of RF onto the A + line.

The amplifier output feeds transmit PIN diode switch D2. During transmit, switched 8 volts is applied through R1, R2, L11, L16 and L13 turning on PIN diodes D2 and D3 with bias current set at 40 mA. D3 provides an RF path to ground to protect the receiver during transmit. L16, C20 and C25 form a lumped quarter-wave line providing isolation between the switches. L12 and C23 improve the insertion loss during receive.

The low pass filter formed by L14, L15, C21, C22 and a microstrip line reduces the harmonic output from the transmitter. The low pass filter then feeds a directional coupler which provides a sample of transmitter power to Schottky diode D4 which develops a DC voltage proportional to the transmitter power and feeds the power control circuit. The diode is biased by R5 and R6. C30 is a blocking capacitor which prevents DC from appearing at the antenna.

Diode D1 provides reverse voltage protection. If voltage is accidentally reversed, this diode will conduct causing the A + fuse in the power cable to blow thereby removing power from the radio and preventing serious damage.

The power amplifier is powered by A + which runs directly from the car battery. It is decoupled by a feedthru capacitor to prevent RF interference from leaking into the supply line. Other non amplifier related signals are routed through the PA board for distribution to the Main Board. These include **IGN A +**, **EXT_ALARM**, **EXT_SPKR** and **SPKR_LO**. They are decoupled by a set of feedthru capacitors on J10 to prevent RF interference from leaking out of the Power Amplifier and into the Main Board. A wiring harness plugs into J10.

SERVICE NOTES

1. Remove all power from the radio before servicing the PA board. The power switch does not remove **A +** from the board.

2. To remove the Power Amplifier assembly, loosen the two retaining screws on the rear of the heat sink. Unplug the 2 coax cables from the Main printed wire board and the two connectors on the PA.

3. The chip mica capacitors are easily damaged and should be replaced with new parts if removed. Solder them in the exact positions shown in outline diagram as defined by the solder mask. Failure to do so will have adverse effects on the performance.

TROUBLESHOOTING GUIDELINES

1. Check for 13 volts at the **A +** supply line.

2. Check the PA for open loop functioning by first grounding **DET_PWR**. Check that input drive from the Exciter is at least 1.5 Watts.

3. Check for proper current consumption. It should be around 8-10 Amps.

4. Check for approximately 6.5 volts across resistors R1 or R2. If not present, check PIN diodes D2 and D3 and the DC path from **8V_SW** to L13.

5. With the transmitter unkeyed, check for approximately 4 volts across R5. If not present, check bias path R5, D4 and R6.

PA TRANSISTOR REPLACEMENT

1. Remove the two retaining screws securing the PA transistor to the heatsink.

2. Unsolder the six leads of the transistor, and remove it from the PC board. Take care not to damage the board or the adjacent capacitors.

3. Remove all excess solder from the board near the transistor and clean the board to allow new transistor to be positioned properly. Trim the new transistor leads (if required) to the lead length of the removed transistor.

4. Apply a thin layer of thermal compound to the back of the transistor and place it in the mounting cutout. Make sure that the base and collector are not reversed.

5. Tighten the transistor mounting screws using a moderate torque of 0.5 Newton-metre (4.5 inch-pounds).

6. Solder the transistor leads to the printed board. Again take care not to damage the adjacent capacitors.

7. Remove any residue flux.

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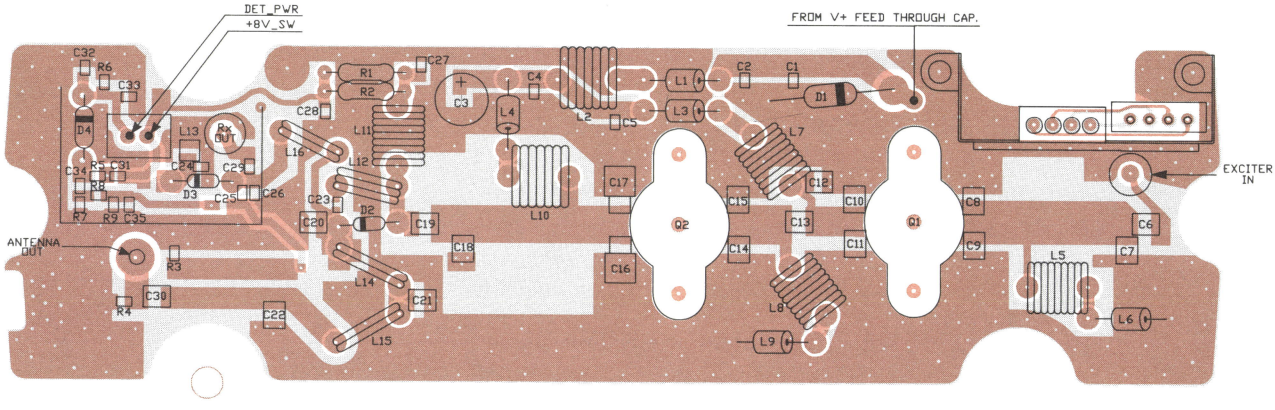


view from component side

RUNS ON SOLDER SIDE

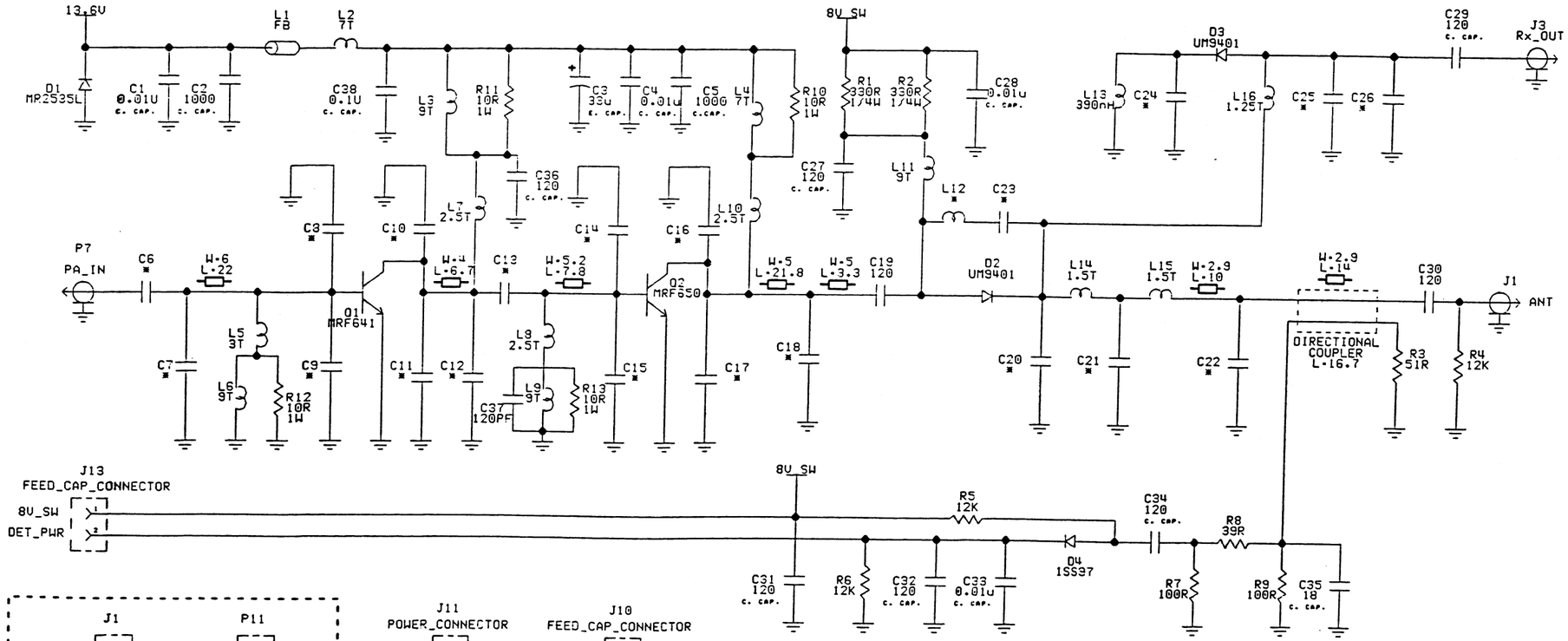
RUNS ON BOTH SIDES

RUNS ON COMPONENT SIDE

POWER AMPLIFIER BOARD
N29/85154001240 440-470 MHz
N29/85154001260 470-512 MHz

TABLE 1.

REF	L.S.	H.S.	TYPE
C6	12	12	CHIP MICA CAP.
C7	8	6	CHIP MICA CAP.
C8	22	20	CHIP MICA CAP.
C9	27	20	CHIP MICA CAP.
C10	27	24	CHIP MICA CAP.
C11	27	24	CHIP MICA CAP.
C12	24	24	CHIP MICA CAP.
C13	22	20	CHIP MICA CAP.
C14	24	15	CHIP MICA CAP.
C15	24	18	CHIP MICA CAP.
C16	33	33	UNCASED MICA CAP.
C17	33	27	UNCASED MICA CAP.
C18	12	10	CHIP MICA CAP.
C20	8	6	CHIP MICA CAP.
C21	8	6	CHIP MICA CAP.
C22	3	3	CHIP MICA CAP.
C23	NIL	NIL	CHIP CER. CAP.
C24	24	20	CHIP CER. CAP.
C25	1	1	CHIP CER. CAP.
C26	1.5	2	CHIP CER. CAP.
L12	NIL	NIL	AIR COIL



NOTES:

1. ALL RESISTORS ARE 1/10W. 5%, CHIP UNLESS OTHERWISE SPECIFIED.
2. RESISTOR VALUES ARE IN OHMS.
3. CAPACITOR VALUES ARE IN PICOFARADS, UNLESS OTHERWISE SPECIFIED.
4. CAPACITOR TYPE ARE MICA CAPACITOR UNLESS OTHERWISE SPECIFIED.
5. * INDICATES PART VALUE DETERMINED BY LOW OR HIGH SPLIT. REFER TO TABLE 1.
6. ALL DIMENSIONS ARE IN mm.

POWER AMPLIFIER BOARD
N29/85154001240 440-470 MHz
N29/85154001260 470-512 MHz

MDS CONVENTIONAL RADIO (UHF)
POWER AMPLIFIER ASSEMBLY
N29/85154001240 (440-470 MHz)
N29/85154001260 (470-512 MHz)
ISSUE 1

SYMBOL	PART NO.	DESCRIPTION
		---------- CAPACITORS ----------
C1		Surface Mount: .01 uF, 50 V.
C2		Surface Mount: 1000 pF, 50 V.
C3		Surface mount: 33 uF, 25 V.
C4		Surface Mount: .01 uF, 50 V.
C5		Surface Mount: 1000 pF, 50 V.
C6		Surface Mount: 12 pF, 500 V.
C7		Surface Mount: 8.0 pF, 500 V. (Used in 440-470 MHz PA).
C7		Surface Mount: 5.0 pF, 500 V. (Used in 470-512 MHz PA).
C8		Surface Mount: 22 pF, 500 V. (Used in 440-470 MHz PA).
C8		Surface Mount: 20 pF, 500 V. (Used in 470-512 MHz PA).
C9		Surface Mount: 27 pF, 500 V. (Used in 440-470 MHz PA).
C9		Surface Mount: 20 pF, 500 V. (Used in 470-512 MHz PA).
C10		Surface Mount: 27 pF, 500 V. (Used in 440-470 MHz PA).
C10		Surface Mount: 24 pF, 500 V. (Used in 470-512 MHz PA).
C11		Surface Mount: 27 pF, 500 V. (Used in 440-470 MHz PA).
C11		Surface Mount: 24 pF, 500 V. (Used in 470-512 MHz PA).
C12		Surface Mount: 24 pF, 500 V.
C13		Surface Mount: 22 pF, 500V.
C14		Surface Mount: 24 pF, 500 V. (Used in 440-470 MHz PA).
C14		Surface Mount: 15 pF, 500 V. (Used in 470-512 MHz PA).
C15		Surface Mount: 24 pF, 500 V. (Used in 440-470 MHz PA).
C15		Surface Mount: 18 pF, 500 V. (Used in 470-512 MHz PA).
C16		Surface Mount: 33 pF, 500 V.
C17		Surface Mount: 33 pF, 500 V. (Used in 440-470 MHz PA).
C17		Surface Mount: 27 pF, 500 V. (Used in 470-512 MHz PA).
C18		Surface Mount: 12 pF, 500 V. (Used in 440-470 MHz PA).
C18		Surface Mount: 10 pF, 500 V. (Used in 470-512 MHz PA).
C19		Surface Mount: 120 pF, 100 V.
C20		Surface Mount: 8.0 pF, 500 V. (Used in 440-470 MHz PA).
C20		Surface Mount: 3.0 pF, 500 V. (Used in 470-512 MHz PA).
C21		Surface Mount: 8.0 pF, 500 V. (Used in 440-470 MHz PA).
C21		Surface Mount: 6.0 pF, 500 V. (Used in 470-512 MHz PA).
C22		Surface Mount: 3.0 pF, 500 V.
C23		Surface Mount: 10 pF, 50 V.
C24		Surface Mount: 24 pF, 50 V. (Used in 440-470 MHz PA).
C24		Surface Mount: 22 pF, 50 V. (Used in 470-512 MHz PA).
C25		Surface Mount: 2.0 pF, 50 V. (Used in 440-470 MHz PA).
C25		Surface Mount: 1.5 pF, 50 V. (Used in 470-512 MHz PA).
C27		Surrface Mount: 120 pF, 50 V.
C28		Surface Mount: .01 uF, 50 V.
C29		Surface Mount: 120 pF, 50 V.
C30		Surface Mount: 120 pF, 100 V.
C31		Surface Mount: 120 pF, 100 V. (Used in 470-512 MHz PA).
C32		Surface Mount: 120 pF, 50 V.
C33		Surface Mount: .01 uF, 50 V.
C34		Surface Mount: 120 pF, 50 V.
C35		Surface Mount: 18 pF, 50 V.
C36 and C37		Surrface Mount: 120 pF, 50 V.
C39		Surrface Mount: 120 pF, 50 V.
		---------- DIODE ----------
D1		Transorb MR2535L.
D2 and D3		Silicon: 1.5 watt, 50V, UM9401.
D4		Diode: SCK 1SS97.
		---------- COILS ----------
L1		Bead, 4.2, 6mm.
L2		Coil: #1, 9x7Tx5, gold.
L3		Bead, 4.2, 6mm.
L4		Coil: #1, 9x4Tx5. (Used in 440-470 MHz PA).
L4		Bead, 4.2, 6mm. (Used in 470-512 MHz PA).
L5		Coil: 9T, ID=4mm.
L7		Coil: 9T, ID=4mm.
L8		Coil: 9T, ID=4mm. (Used in 470-512 MHz PA).
L9		Bead, 4.2, 6mm.
L10		Coil: #1, 8x2.5Tx5, gold. (Used in 440-470 MHz PA).
L10		Coil: #1, 9x7Tx5, gold. (Used in 470-512 MHz PA).
L11		Coil: 9T, ID=4mm.
L12		Coil: #1, 8x2.5Tx5, gold. (Used in 440-470 MHz PA).
L12		Coil: #1, 8x1Tx6, gold. (Used in 470-512 MHz PA).
L13		Inductor: .39 uH, 1008CS-XK2.
L14 and L15		Coil: #1, 8x1.5Tx5, gold.
L16		Coil: #1, 8x1Tx6, gold. (Used in 440-470 MHz PA).
L16		Coil: #1, 8x2.5Tx5, gold. (Used in 470-512 MHz PA).
		---------- TRANSISTORS ----------
Q1	N29/20954000080	NPN: 3A, 16 V, MRF641.
Q2	N29/20954000060	NPN: 12A, 16.5 V, MRF650.
		---------- RESISTORS ----------
R1 and R2		Carbon film: 330 ohms, 1/10 w.
R3		Surface Mount: 51 ohms, 1/10 w.
R4 thru R6		Surface Mount: 12K ohms, 1/10 w.
R7		Surface Mount: 100 ohms, 1/10 w.
R8		Surface Mount: 39 ohms, 1/10 w.
R9		Surface Mount: 100 ohms, 1/10 w.
		---------- CABLES ----------
W1	N29/85154002210	Coax cable, 100 mm.
W2	N29/85154000702	Coax cable, 80 mm.
W3	N29/85154001671	2-wire cable assembly.
		-------- MISCELLANEOUS ----------
	N29/14900900021	Antenna connector, TNC, female.
	N29/18454000020	Bushing, strain relief.
		Crystal pin insulator.
		Shelid, shell.
		Partition.
		Screw: M2.6 x 8. (Quantity 12).
		Screw: M2.6 x 10. (Used with transistors Quantity 4).
		Heat sink.
		Grounding plate.

POWER AMPLIFIER ASSEMBLY