ORION™
POWER AMPLIFIER BOARD

*B19/CAH-505AL	60 WATTS	29-42 MHz
*B19/CAH-505BL	60 WATTS	35-50 MHz
B19/CAH-505AH Rev E	110 WATTS	29-42 MHz
B19/CAH-505BH Rev F	110 WATTS	35-50 MHz

*B19/CAH-505AL and B19/CAH-505BL are discontinued

TABLE OF CONTENTS

TABLE OF FIGURES

MANUAL REVISION HISTORY

REV	DATE	REASON FOR CHANGE
A	March 95	Initial Release
D	Dec 99	Discontinued P1 & P2 Models and updated drawings and parts lists
E	Oct. 2003	Added discontinued models B19/CAH-505AL, B19/CAH-505BL
F	June 2004	Modified Schematic Diagram

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Wireless Systems Business Unit
M/A-COM, Inc.
Technical Publications
221 Jefferson Ridge Parkway
Lynchburg VA, 24501
fax your comments to: (434) 455-6851
e-mail us at: techpubs@tycoelectronics.com

NOTICE!

Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations or substitution of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.

NOTICE!

1. DESCRIPTION

The RF Power Amplifier for the M/A-COM Orion low band mobile radio is available in two power levels and two frequency ranges, designated as:

- 29-42 MHz, 60 Watts
- 35-50 MHz, 60 Watts
- 29-42 MHz, 110 Watts
- 35-50 MHz, 110 Watts

The circuitry on the Power Amplifier board consists of an Exciter circuit, an RF Power Amplifier circuit, a Power Control circuit, an Antenna Switch and a Limiter circuit (see Figure 2-1). The Exciter circuit consists of two wide band amplifier stages operating over a frequency range of 29-50 MHz without any tuning. This circuit amplifies the one milliwatt input signal from the Voltage Controlled Oscillator, on the Synthesizer/IF board, to 300 milliwatts to drive the Power Amplifier.

The Power Amplifier circuit uses a driver and three RF power transistors to provide rated output power. The output power is adjustable over a range of 55 to 110 watts and 30 to 60 watts for the two power versions. Two transistors and three ICs are used in the Power Control circuit.

Supply voltage for the PA is provided by power leads from the power cable connector J1002 to J3 (A+) and (A-) on the Power Amplifier board.

2. CIRCUIT ANALYSIS

2.1 EXCITER

The 29-50 MHz TX injection input from the TX VCO is applied to **AMPLIFIER-1** transistor TR151 through an **ATTENUATOR** pad consisting of resistors R151, R152, and R153. Vcc voltage (+9 VDC) is applied through a Vcc feed network consisting of resistor R158 and transformer T151. Capacitor C156 is used to bypass the supply line. The +9 VDC is supplied by 3-terminal voltage regulator IC3.

The output of TR151 drives **AMPLIFIER-2** transistor TR152 through impedance-matching components consisting of transformers T151 and T152, and coupling capacitors C157 and C158. Resistors R152, R154, and diode CD151 set the bias voltage for TR152.

Collector voltage (+9 VDC) of TR152 is applied through collector feed network resistor R165 and inductor L152. Capacitors C160 and C161 are bypass capacitors.

The output of TR152 is coupled to **EX OUT** through the **LOW-PASS FILTER** consisting of capacitors C163 through C167 and inductors L153 and L154. Resistor R163 provides negative feedback for TR152 through capacitor C159. Transistor TR152 amplifies the 15 milliwatt input level to 300 milliwatts.

A+, supplied from the J1003 connector through transistor TR11 and the TX Power Switch, is regulated to 9 VDC by voltage regulator IC3. Vcc (+9 VDC) is applied to TR151 and TR152. When **TX ENBL** is high (receive mode), +9 VDC is not applied.

The Exciter is energized by pressing the PTT switch. Regulated +9 VDC is present on all Exciter stages when the radio is turned on.

2.2 POWER AMPLIFIER BOARD

The four power amplifiers that cover the frequency ranges of 29-42 MHz and 35-50 MHz and power levels of 60 watts and 110 watts are very similar in construction and operation. The differences are in the transistor types and component values. The descriptions presented in the following sections apply to all versions.

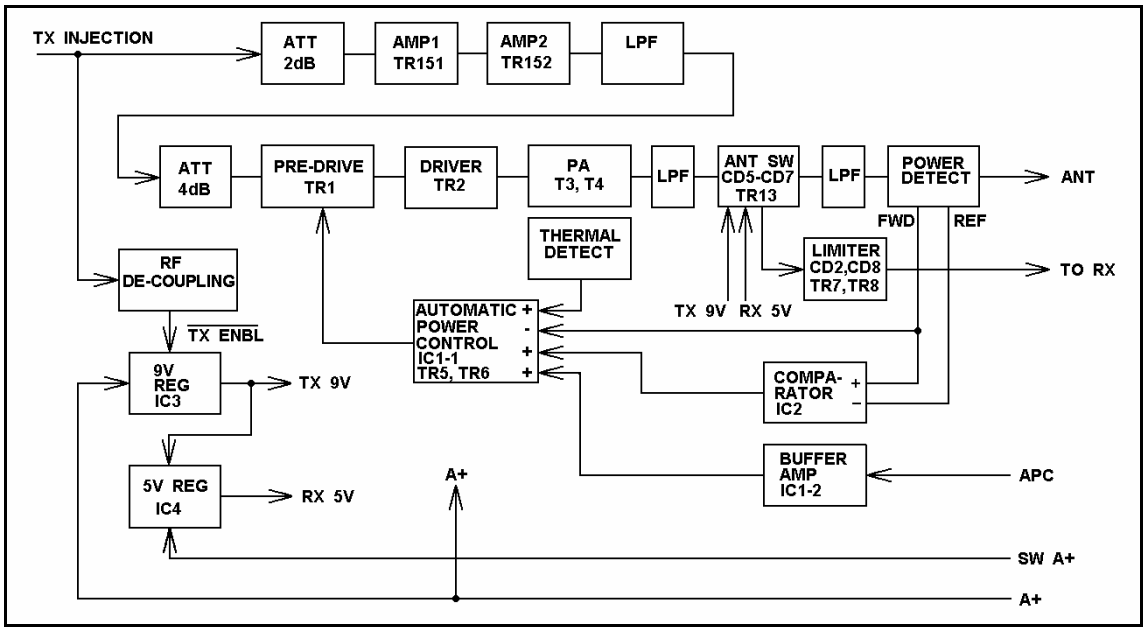


Figure 2-1: Block Diagram of Low Band Power Amplifier

2.2.1 RF Amplifiers

The Exciter RF output (EX OUT) is coupled to the PA input. The RF is then coupled through an **ATTENUATOR** pad consisting of resistors R1, R2, and R3, impedance matching transformer T1, and decoupling capacitor C1 to the base of **PRE-AMPLIFIER** transistor TR1. Inductor L1, diode CD1, and resistor R5 set the bias of TR1. Capacitor C4 and resistors R4 and R45 provide negative feedback to improve the stability of TR1. Collector voltage on TR1 is controlled by the Power Control circuit and is applied through a decoupling network consisting of capacitors C5, C6, and C7.

The output of TR1 is coupled to the base of **DRIVER AMPLIFIER** transistor TR2 through impedance matching transformer T2 and a frequency compensator consisting of capacitor C9 and resistor R6. Capacitor C8 provides matching between T2 and the base of TR2. Capacitor C10 and resistor R7 provide negative feedback and R8 and R46 maintain stability of TR2.

Collector voltage to driver amplifier TR2 is supplied through a decoupling network consisting of capacitors C12 to C14 and inductor L4.

The RF output from TR2 is coupled to **POWER AMPLIFIER** transistors TR3 and TR4 through impedance matching transformer T4 and capacitors C17 and C56.

2.2.2 Power Amplifier

The **POWER AMPLIFIER**, consisting of transistors TR3 and TR4, and transformers T4 and T5, is a class-c push-pull power amplifier. Transformer T4 provides impedance matching and power splitting to

the bases of TR3 and TR4. Capacitors C17 and C56 provide impedance-matching elements to T4. Resistors R10 and R11 provide the base loading to TR3 and TR4. Capacitors C19 and C21, and resistors R9 and R12 are negative feedback elements, which maintain the stability of TR3 and TR4. Transformer T5 provides impedance matching and power combining for the collectors of TR3 and TR4. Capacitors C16 and C23 provide matching elements to T5. Capacitors C20 and C22 provide impedance matching elements to the collector of TR3 and TR4.

Operating voltage for the power amplifier is supplied from the DC input through transformer T5 and a decoupling network consisting of capacitors C24 through C26 and inductor L5.

The output of the **POWER AMPLIFIER** passes through T5 to the **LOW-PASS FILTER** consisting of capacitors C72 though C76, and inductors L18 and L19.

The RF power passes through a 50 ohm microstrip and the **ANTENNA SWITCH** diode CD5 to the **LOW-PASS FILTER** and **POWER COUPLER**.

NOTE

This microstrip is a 50 ohm point and may be used for checking RF power levels.

2.2.3 Power Control

When high VSWR load conditions are sensed, the **POWER CONTROL** circuit provides closed-loop RF power leveling and power turndown.

When the transmitter is keyed, TX 9V turns on and supplies current to a **DC AMPLIFIER** consisting of transistors TR5, TR6, and IC1-1. This amplifier supplies voltage to the collector of TR1. The setting of RV1 determines the current supplied to the negative input of IC1-1. As the detected RF power increases, the current to the negative input of IC1-1 increases, causing IC1-1 to pull current away from the base of TR5. This cuts back the drive to TR5 and TR6, which reduces the voltage at the collector of TR1, decreasing RF output power.

RF power is sensed by directional **POWER COUPLER** T6 and associated elements. Forward power is sensed by diode CD9, and reflected power by diode CD10. Forward power is determined by the setting of RV1. Resistors R21 and R22 set the level of reflected RF power at which the control circuit reduces the RF output.

Thermal protection is provided by "**posistor**" R41 and associated elements. Posistor R41 is thermally connected to the body of transistor TR3. As the temperature of TR3 rises above 100°C, the resistance of R41 increases and TR9 turns on. This diverts output current of IC102 from R27 to TR9, which lowers the voltage at the collector of TR1, reducing the power output.

CAUTION

DO NOT operate the transmitter at levels higher than rated output. Operating at higher than rated output power will shorten the life of the RF power transistors.

2.2.4 Antenna Switch

The **ANTENNA SWITCH** consists of PIN diodes CD5, CD6, and CD7, and associated components. When the transmitter is keyed, TX 9V switch TR11 and the TX 9V regulator IC3 turn on. RX 5V (RX bias) turns off and TX 9V provides forward bias to CD5. This results in low impedance on CD5 and high impedance on CD6 and CD7, isolating the transmitted power from the receiver.

2.2.5 Limiter

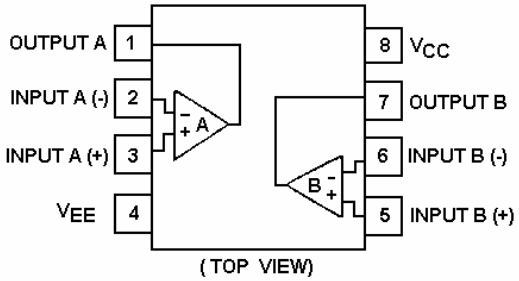
The **Limiter** on the PA board consists of diode CD2, transistors TR6 and TR7, and associated components. During receive mode, if the receive signal level exceeds +10 dBm, the rectified currents of the CD2 can provide the forward bias to TR6, TR7, and CD8 proportionally to the receive signal level. This causes a tap-down circuit (CD6, CD7, and CD8) to turn on when the receive signal exceeds +10 dBm, and protects the receiver from excessively high receive signal levels.

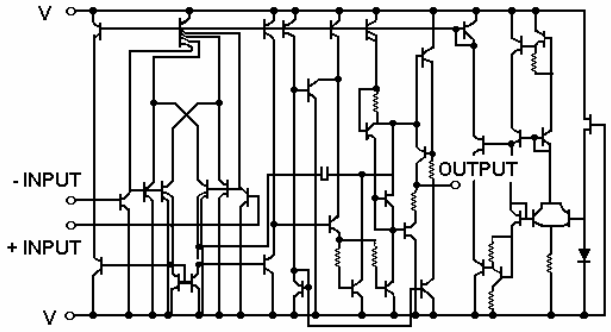
In the receive mode, signals from the antenna are coupled through this **Limiter** to the receiver input.

3. IC DATA

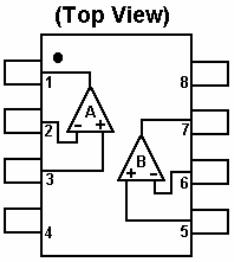
Linear, Dual Operational Amplifier IC1

(JRC NJM3404AM-T1)

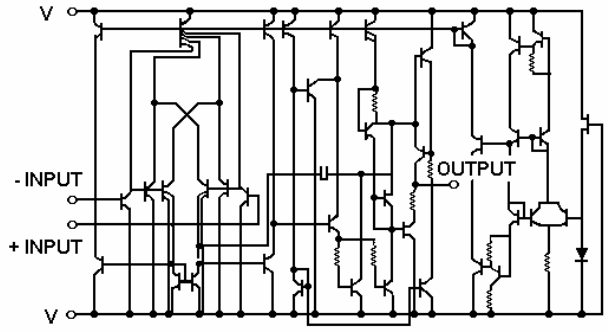




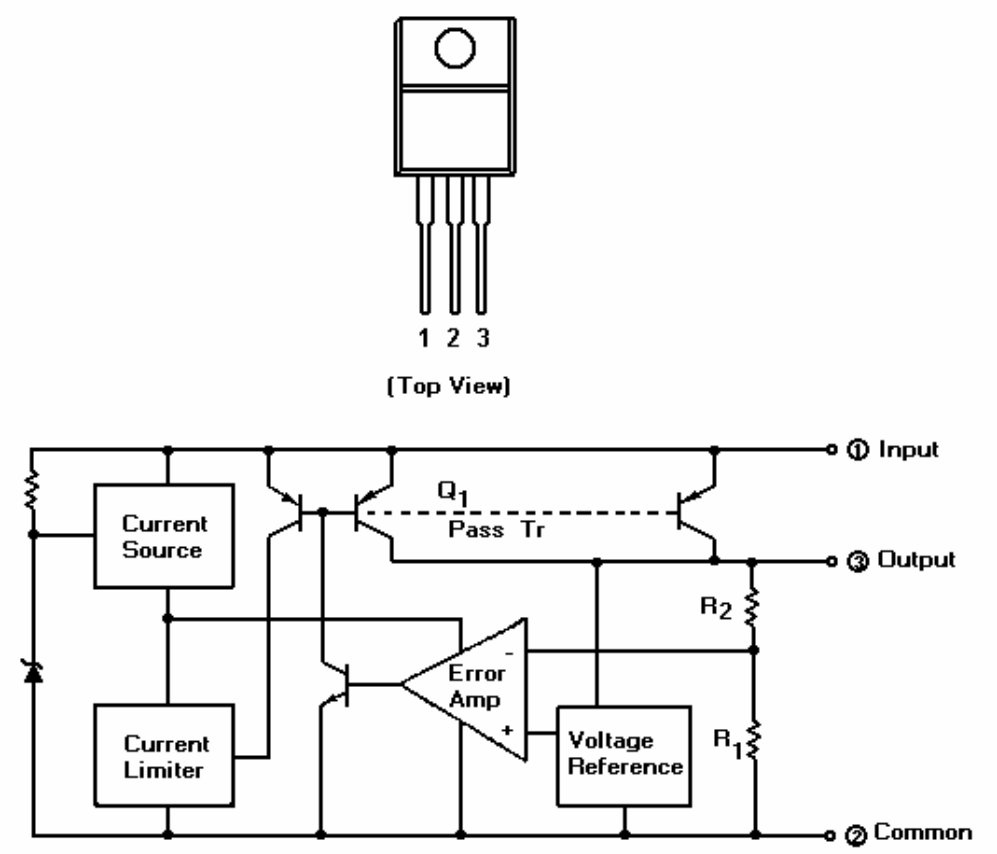
Comparator IC2



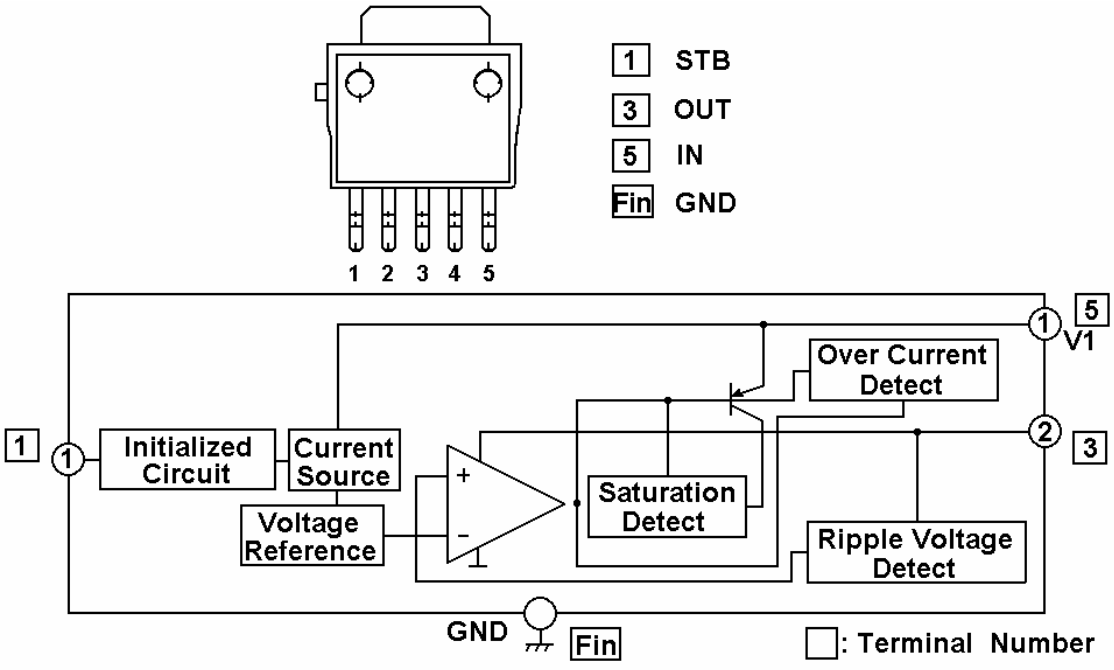
1. A OUTPUT
2. A- INPUT
3. A+INPUT
4. V-
5. B+INPUT
6. B- INPUT
7. B OUTPUT
8. V-



9 V Voltage Regulator IC3



Voltage Regulator IC4



4. PARTS LIST

POWER AMPLIFIER BOARD
CAH-505AL (Used in P1), CAH-505BL (Used in P2)
CAH-505AH (Used in P3), CAH-505BH (Used in P4)

SYMBOL	DESCRIPTION
	---------- CAPACITORS ----------
C1 And C2	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C3 And C4	Ceramic: 0.1 uF +80,-20% 25 VDCW, temp coef +30,-80%.
C5	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C6	Ceramic: 0.1 uF +80,-20% 25 VDCW, temp coef +30,-80%.
C7	Poli Film: 0.1 uF 50 VDCW, temp coef ±10%.
C8	Ceramic: 470 pF ±5% 50 VDCW, temp coef 0±30 PPM (used in AH, BH)
C8	Ceramic: 330 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in AL).
C8	Ceramic: 150 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in BL).
C9	Ceramic: 2200 pF ±10% 50 VDCW, temp coef ±10 % (used in AH, BH)
C10	Ceramic; 0.1 uF ±10% 50 VDCW temp coef ±10%.
C12	Electrolytic: 10 uF ±20% 50 VDCW.
C13	Ceramic: 0.1 uF +80,-20% 25 VDCW, temp coef +30,-80%.
C14	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C17	Dipped Mica: 1200 pF 100 VDCW (AH, BH)
C17	Ceramic: 1200 pF ±10% 50 VDCW, temp coef 0±15%. (Used in AL, BL).
C18	Mica: 390 pF ±1% 500 VDCW (Used in AH)
C18	Mica: 470 pF ±1% 500 VDCW (Used in BH)
C18	Mica: 330 pF ±1% 500 VDCW (Used in AL)
C18	Mica: 270 pF ±1% 500 VDCW (Used in BL)
C19	Ceramic: 0.1 uF ±10% 50 VDCW, temp coef ±15 %.
C20	Mica: 390 pF ±5% 500 VDCW. (Used in AL)
C20	Mica: 330 pF ±5% 500 VDCW. (Used in AH)
C20	Mica: 220 pF ±5% 500 VDCW. (Used in BL, BH)
C21	Ceramic: 0.1 uF ±10% 50 VDCW, temp coef ±15 %.
C22	Mica: 390 pF ±5% 500 VDCW. (Used in AL)
C22	Mica: 330 pF ±5% 500 VDCW. (Used in AH)
C22	Mica: 220 pF ±5% 500 VDCW. (Used in BH, BL)
C23	Mica: 390 pF ±1% 500 VDCW (Used in AH)
C23	Mica: 330 pF ±1% 500 VDCW (Used in BH)
C24	Electrolytic: 47 uF ±20% 25 VDCW.
C25	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C26	Ceramic: 1000 pF ±10% 50 VDCW, temp ±10%.
C27	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef 0±60 PPM.
C28 And C29	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C30	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef 0±60 PPM.
C31	Ceramic: 39 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in AL)
C31	Ceramic: 36 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in AH)
C31	Ceramic:27 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in BH, BL)
C32	Ceramic: 47 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in AL)
C32	Ceramic: 39 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in AH)
C32	Ceramic:33 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in BH, BL)
C33	Ceramic: 100 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in AL)
C33	Ceramic: 43 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in AH)
C33	Ceramic:39 pF ±5% 500 VDCW temp coef 0±60 PPM (Used in BH, BL)
C34	Ceramic: 36 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AL)
C34	Ceramic: 30 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C34	Ceramic: 24 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH, BL)
C35	Ceramic: 100 pF ±5% 500 VDCW, temp coef 0±60 PPM (used in AL)
C35	Ceramic: 47 pF ±5% 500 VDCW, temp coef 0±60 PPM (used in AH, BH, BL)
C36	Ceramic: 30 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH, AL)
C36	Ceramic: 24 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH, BL)
C37	Ceramic: 91 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH, AL)
C37	Ceramic: 82 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH, BL)
C38	Ceramic: 27 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C38	Ceramic: 24 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AL, BL, BH)
C40 Thru C46	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C47	Ceramic: 0.1 uF +80,-20% 25 VDCW, temp coef +30,-80%.
C48 And C52	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C53	Tantalum: 0.22 uF ±20% 35 VDCW.
C54	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C55	Ceramic: 0.1 uF +80,-20% 25 VDCW, temp coef +30,-80%.

SYMBOL	DESCRIPTION
C56	Tantalum: 4.7 uF ±20% 16 VDCW.
C57	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C59	Ceramic: 0.1 uF +80,-20% 25 VDCW, temp coef +30,-80%.
C60	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C61	Tantalum: 33 uF ±20% 16 VDCW.
C62	Tantalum: 10 uF ±20% 16 VDCW.
C63	Ceramic: 47 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C63	Ceramic: 39 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH, BL)
C64	Ceramic: 47 pF ±5% 500 VDCW, temp coef 0±60 PPM (used in AH, BH, BL)
C65	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C70 And C71	Ceramic: 1000 pF +200% 50 VDCW, temp coef +20,-55%.
C72	Ceramic: 30 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C72	Ceramic: 33 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH, BL)
C72	Ceramic: 15 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AL)
C73	Mica: 68 pF ±5% 500 VDCW (Used in AH)
C73	Mica: 43 pF ±5% 500 VDCW (Used in BH)
C73	Ceramic: 100 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AL)
C73	Ceramic: 43 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BL)
C74	Ceramic: 100 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C74	Ceramic: 82 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AL, BL, BH)
C75	Ceramic: 20 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C75	Ceramic: 22 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH, BL)
C76	Ceramic: 62 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C76	Ceramic: 47 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH, BL)
C76	Ceramic: 39 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AL)
C80 And C81	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C82	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%. (used in AL, BL)
C84	Ceramic: 82 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AH)
C84	Ceramic: 100 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BH)
C84	Ceramic: 120 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in BL)

SYMBOL	DESCRIPTION
C84	Ceramic: 200 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in AL)
C151 Thru C153	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C154	Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C155 Thru C158	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C159	Ceramic: 0.1 uF +80, -20% 25 VDCW, temp coef +30,-80%.
C160 Thru C162	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
C163	Ceramic: 56 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in AH, AL)
C163	Ceramic: 47 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in BH, BL)
C164	Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in AH, AL)
C164	Ceramic: 82 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in BH, BL)
C165	Ceramic: 27 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in AH, AL)
C165	Ceramic: 22 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in BH, BL)
C166	Ceramic: 68 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in AH, AL)
C166	Ceramic: 47 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in BH, BL)
C167	Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in AH, AL)
C167	Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in BH, BL)
C168	Ceramic: 0.01 uF ±10% 50 VDCW, temp coef ±10%.
	---------- DIODES ----------
CD1	Silicon: sim to TOSHIBA 1SS181 TE85L.
CD2	Silicon: sim to TOSHIBA 1SS226 TE85L.
CD3	SHOTKEY BARRIER: sim to NIHONINTER C30T04Q-TE24L. (used in AH, BH)
CD3	SHOTKEY BARRIER: sim to NIHONINTER C25T04Q-TE24L. (used in AL, BL)
CD4	VARISTOR: sim to PANASONIC ERZ-CF2MK220.
CD5	PIN DIODE.
CD6 Thru CD8	PIN DIODE: sim to MICROSEMI UM9401F/TR
CD9 And CD10	Silicon: sim to PANASONIC MA741-TX.
CD151	Silicon: sim to TOSHIBA 1SS184 TE85L.
	---------- INTEGRATED CIRCUIT ----------
IC1	Linear OP amplifier: sim to New JRC NJM3404AM-T1.
IC2	Comparator: sim to new JRC NJM2403M-T1 (used in AL, BL)

SYMBOL	DESCRIPTION
IC3	+9 V Voltage Regulator: sim to PANASONIC AN6541.
IC4	+5 V Voltage Regulator: sim to PANASONIC AN6545SP-E1.
	---------- CONNECTORS ----------
J2	Coaxial Connector.
J3 Thru J5	Connector.
J151	Coaxial Connector.
J1001	Coaxial Connector: TNC.
J1002	Connector for power cable.
J1002-1	Stud
J1002-2	Stud
	---------- INDUCTORS ----------
L1	Coil: 4.7 uH.
L4 And L5	Coil: RF.
L6 And L7	Coil: 4.7 uH.
L8	Coil: RF, 4.5T(R) (Used in AH, AL).
L8	Coil: RF, 3.5T(R) (Used in BH, BL).
L9 and L10	Coil: RF, 5.5T (R) (Used in AH, AL).
L9 and L10	Coil: RF 4.5T(R) (Used in BH, BL).
L11	Coil: RF 5.5T(L) (Used in AH, AL).
L11	Coil: RF 4.5T(L) (Used in BH, BL).
L12 And L17	Coil: 4.7 uH.
L18	Coil: RF, 2.5(R) (Used in AL).
L18	Coil: RF, 3.5(R) (Used in AH, BH, BL).
L19	Coil: RF 5.5(R) (Used in AL,AH).
L19	Coil: RF 4.5(R) (Used in BL, BH).
L151 And L152	Coil: 4.7 uH.
L153	Coil: RF 120 Nh (Used in AH, AL)
L153	Coil: RF 100 nH (Used in BH, BL)
L154	Coil: RF 180 nH (Used in AH, AL)
L154	Coil: RF 150 nH (Used in BH, BL)
	---------- PCB ----------
PD1	PCB: H-7PDDN0018
	---------- RESISTORS ----------
R1	Metal film: 270 ohms ±5% 200 VDCW 1/8W.
R2	Metal film: 22 ohms ±5% 200 VDCW 1/8W.
R3	Metal film: 270 ohms ±5% 200 VDCW 1/8W.
R4	Metal film: 390 ohms ±5% 200 VDCW 1/8W.
R5	Metal film: 1K ohms ±5% 200 VDCW 1/8W.
R6	Metal film: 2.2 ohms ±5% 200 VDCW 1/8W (used in AH, BH)
R6	Metal film: 4.7 ohms ±10% 200 VDCW 1/8W (used in AL, BL)
R7	Metal film: 47 ohms ±1% 500 VDCW 1.5W.

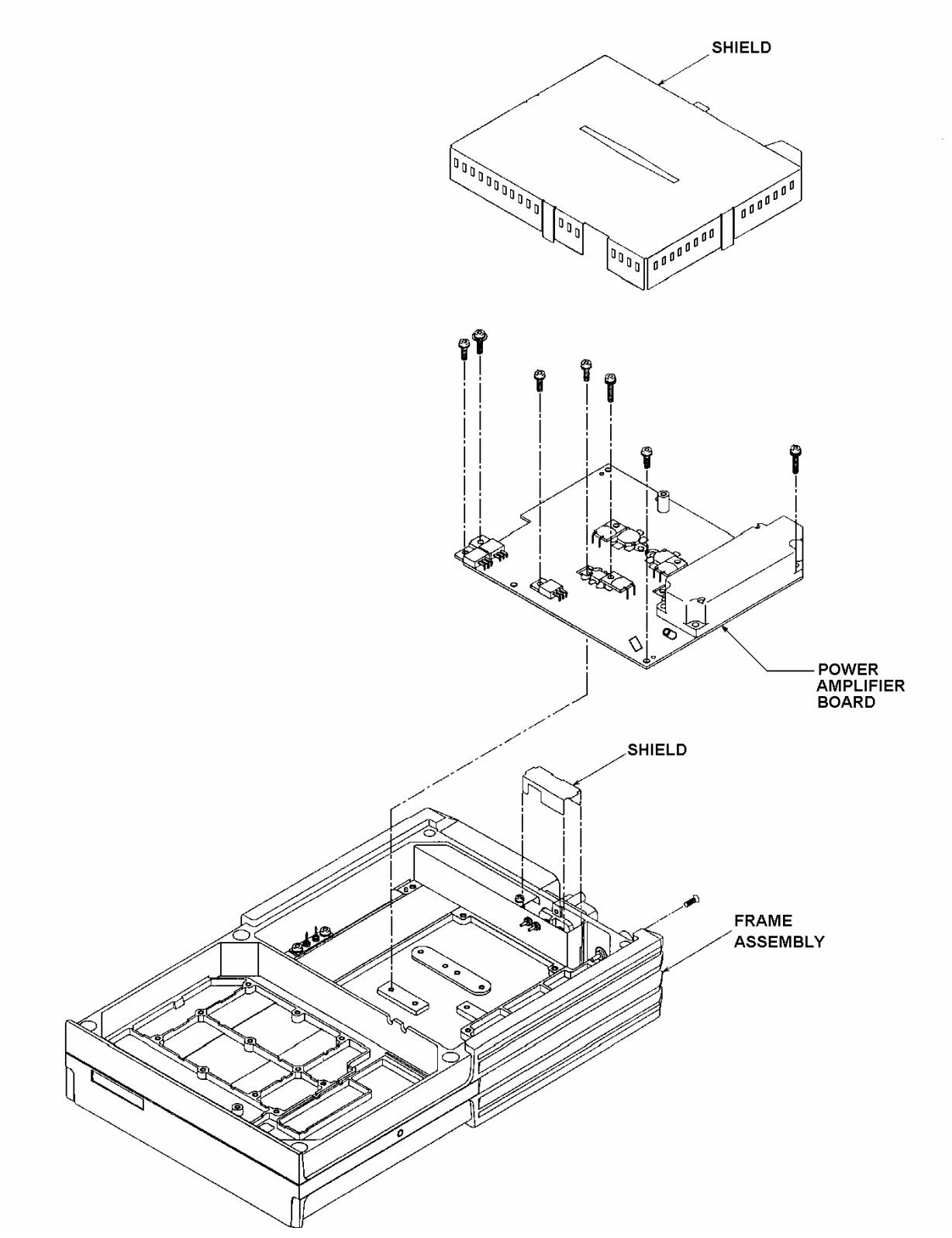
SYMBOL	DESCRIPTION
R8	Metal film: 22 ohms ±5% 200 VDCW 1/8W (used in AH, BH, BL)
R8	Metal film: 18 ohms ±5% 200 VDCW 1/8W (used in AL)
R9	Metal film: 47 ohms ±1% 500 VDCW 1.5W.
R10	Metal film: 2.2 ohms ±5% 250 VDCW 1W (Used in AH, AL)
R10	Metal film: 3.3 ohms ±5% 250 VDCW 1W (Used in BH)
R10	Metal film: 4.7 ohms ±10% 250 VDCW 1W (Used in BL)
R11	Metal film: 2.2 ohms ±5% 250 VDCW 1W (Used in AH, AL)
R11	Metal film: 3.3 ohms ±5% 250 VDCW 1W (Used in BH)
R11	Metal film: 4.7 ohms ±10% 250 VDCW 1W (Used in BL)
R12	Metal film: 47 ohms ±1% 500 VDCW 1.5W.
R13 And R14	Metal film: 47 ohms ±5% 250 VDCW 1W.
R15	Metal film: 47K ohms ±5% 200 VDCW 1/4W.
R16 And R17	Metal film: 47 ohms ±5% 200 VDCW 1/2W.
R18	Metal film: 10K ohms ±5% 100 VDCW 1/10W.
R19	Metal film: 100 ohms ±5% 250 VDCW 1W.
R20	Metal film: 47 ohms ±5% 250 VDCW 1W.
R21	Metal film: 22K ohms ±5% 100 VDCW 1/10W (used in AL, BL)
R22	Metal film: 15K ohms ±5% 100 VDCW 1/10W (used in AL, BL)
R23	Metal film: 220K ohms ±5% 100 VDCW 1/10W (used in AL, BL)
R24	Metal film: 220K ohms ±5% 100 VDCW 1/10W.
R25	Metal film: 2.2K ohms ±5% 100 VDCW 1/10W.
R26	Metal film: 2.2 ohms ±10% 250 VDCW 1W.
R27	Metal film: 12K ohms ±5% 100 VDCW 1/10W.
R28	Metal film: 3.3K ohms ±5% 100 VDCW 1/10W. (used in AL, BL)
R29 And R30	Metal film: 27K ohms ±5% 100 VDCW 1/10W.
R31 And R32	Metal film: 1K ohms ±5% 100 VDCW 1/10W.
R33	Metal film: 27K ohms ±5% 100 VDCW 1/10W.
R34	Metal film: 1K ohms ±5% 100 VDCW 1/10W.
R35	Metal film: 390 ohms ±5% 200 VDCW 1/4W.
R36	Metal film: 470 ohms ±5% 200 VDCW 1/4W.
R37	Metal film: 3.3K ohms ±5% 100 VDCW 1/10W.
R38	Metal film: 4.7K ohms ±10% 200 VDCW 1/8W.
R39 And R40	Metal film: 47K ohms ±5% 100 VDCW 1/10W.
R41	Posistor: sim to MURATA PTH9C32BB471Q-T.
R42	Metal film: 4.7 ohms ±5% 100 VDCW 1/10W. (used in AL, BL)
R44	Metal film: 10K ohms ±5% 100VDCW 1/10W (used in AH, BH)

SYMBOL	DESCRIPTION
R45	Metal film: 390 ohms ±5% 200 VDCW 1/8W.
R46	Metal film: 22 ohms ±5% 200 VDCW 1/8W (used in AH, BH, BL)
R46	Metal film: 15 ohms ±5% 200 VDCW 1/8W (used in AL)
R47	Metal film: 2.2 ohms ±10% 250 VDCW 1W.
R48	Metal film: 10K ohms ±5% 100 VDCW 1/10W.
R49	Metal film: 680 ohms ±0.5% 100 VDCW 1/10W. (Used in AH)
R49	Metal film: 560 ohms ±0.5% 100 VDCW 1/10W. (Used in BH)
R50	Metal film: 1K ohms ±1% 100 VDCW 1/10W. (Used in AH, BH)
R151	Metal film: 470 ohms ±5% 100 VDCW 1/10W.
R152	Metal film: 10 ohms ±5% 100 VDCW 1/10W.
R153	Metal film: 470 ohms ±5% 100 VDCW 1/10W.
R154	Metal film: 1K ohms ±5% 100 VDCW 1/10W.
R155	Metal film: 470 ohms ±5% 100 VDCW 1/10W.
R156	Metal film: 5.6K ohms ±5% 100 VDCW 1/10W.
R157	Metal film: 10 ohms ±5% 100 VDCW 1/10W.
R158	Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R159	Metal film: 270 ohms ±5% 100 VDCW 1/10W.
R160	Metal film: 18 ohms ±5% 100 VDCW 1/10W.
R161	Metal film: 270 ohms ±5% 100 VDCW 1/10W.
R162	Metal film: 120 ohms ±5% 100 VDCW 1/10W.
R163	Metal film: 150 ohms ±5% 100 VDCW 1/10W.
R164	Metal film: 1.2K ohms ±5% 100 VDCW 1/10W.
R165	Metal film: 10 ohms ±5% 200 VDCW 1/4W.
RV1	Variable: 10K ohms.
	---------- TRANSFORMERS ----------
T1	RF TRANSFORMER.
T2	RF TRANSFORMER.
T4	RF TRANSFORMER.
T5	RF TRANSFORMER:
T5-1	Ferrite core: 10-15-20 (used in AL, BL)
T5	RF TRANSFORMER:
T5-1	Ferrite core: 16-16-32 (used in AH, BH)
T6	RF TRANSFORMER FOR COUPLER.
T151 And T152	RF TRANSFORMER:
	---------- TERMINALS ----------
TB2	Terminal Plate.
	---------- TRANSISTORS ----------
TR1	Silicon,NPN: MITSUBISHI 2SC1971.
TR2	Silicon,NPN: MITSUBISHI 2SC1729.
TR3	RF POWER TRANSISTOR: 2SC2694 MITSUBISHI (used in AH, BH)
TR3	RF POWER TRANSISTOR: 2SC2540 MITSUBISHI (used in AL, BL)
TR4	RF POWER TRANSISTOR: 2SC2694 MITSUBISHI (used in AH, BH)
TR4	RF POWER TRANSISTOR: 2SC2540 MITSUBISHI (used in AL, BL)
TR5	Silicon,PNP: sim to PANASONIC 2SB953A.
TR6	Silicon,NPN: sim to NEC 2SD596-T1B DV3.

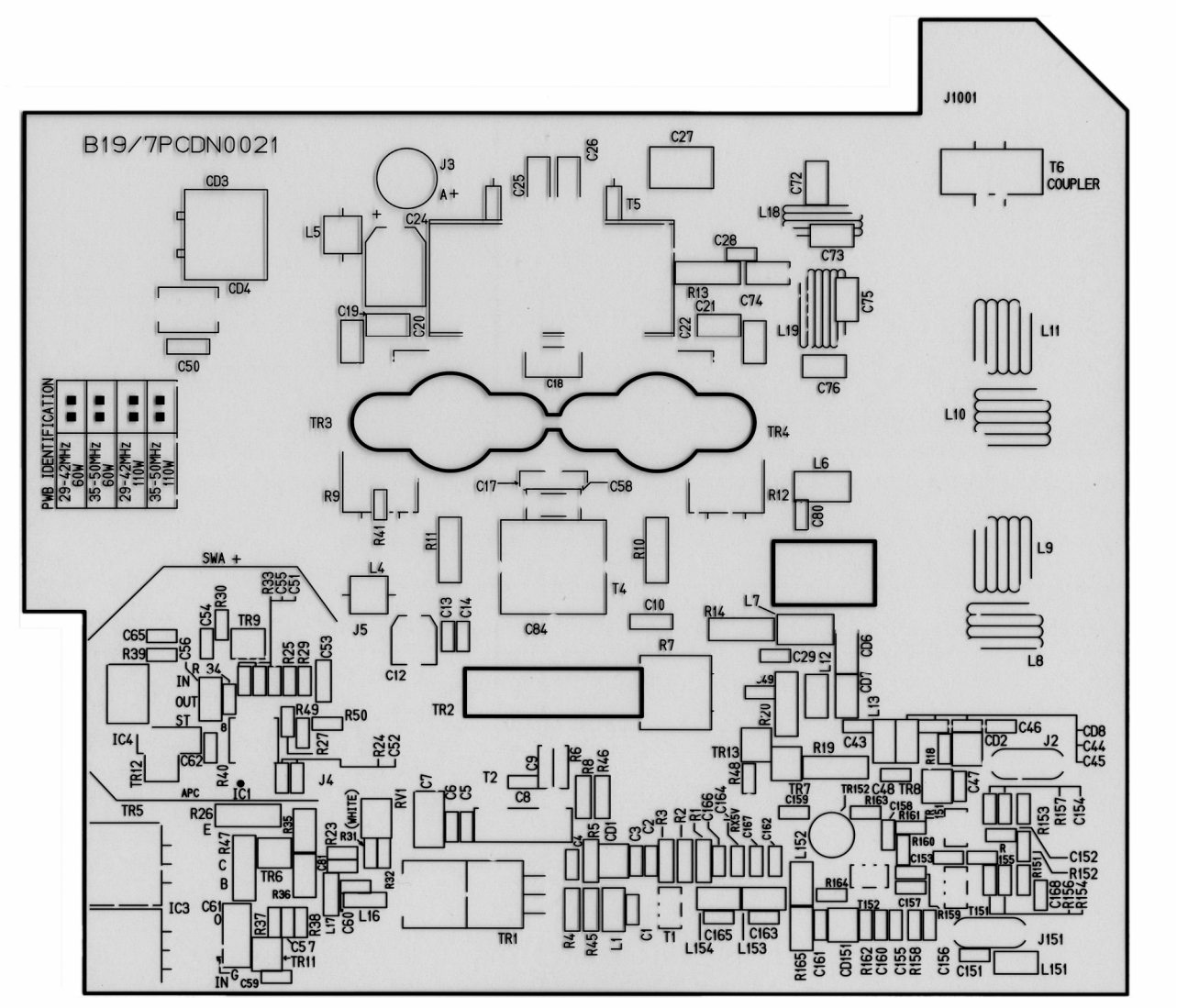
SYMBOL	DESCRIPTION
TR7	Silicon,PNP: sim to NEC 2SB624-T1B BV3.
TR8 And TR9	Silicon,NPN: sim to NEC 2SD596-T1B DV3.
TR11	Silicon,PNP: sim to NEC 2SB624-T1B BV3.
TR12	Silicon,NPN: sim to NEC 2SD596-T1B DV3.
TR13	Silicon,PNP: sim to NEC 2SB624-T1B BV3.
TR151	Silicon,NPN: sim to NEC 2SC3357-TI RF.
TR152	Silicon,NPN: sim to MOTOROLA MRF559.

4.1 COMPONENT IDENTIFICATION CHART

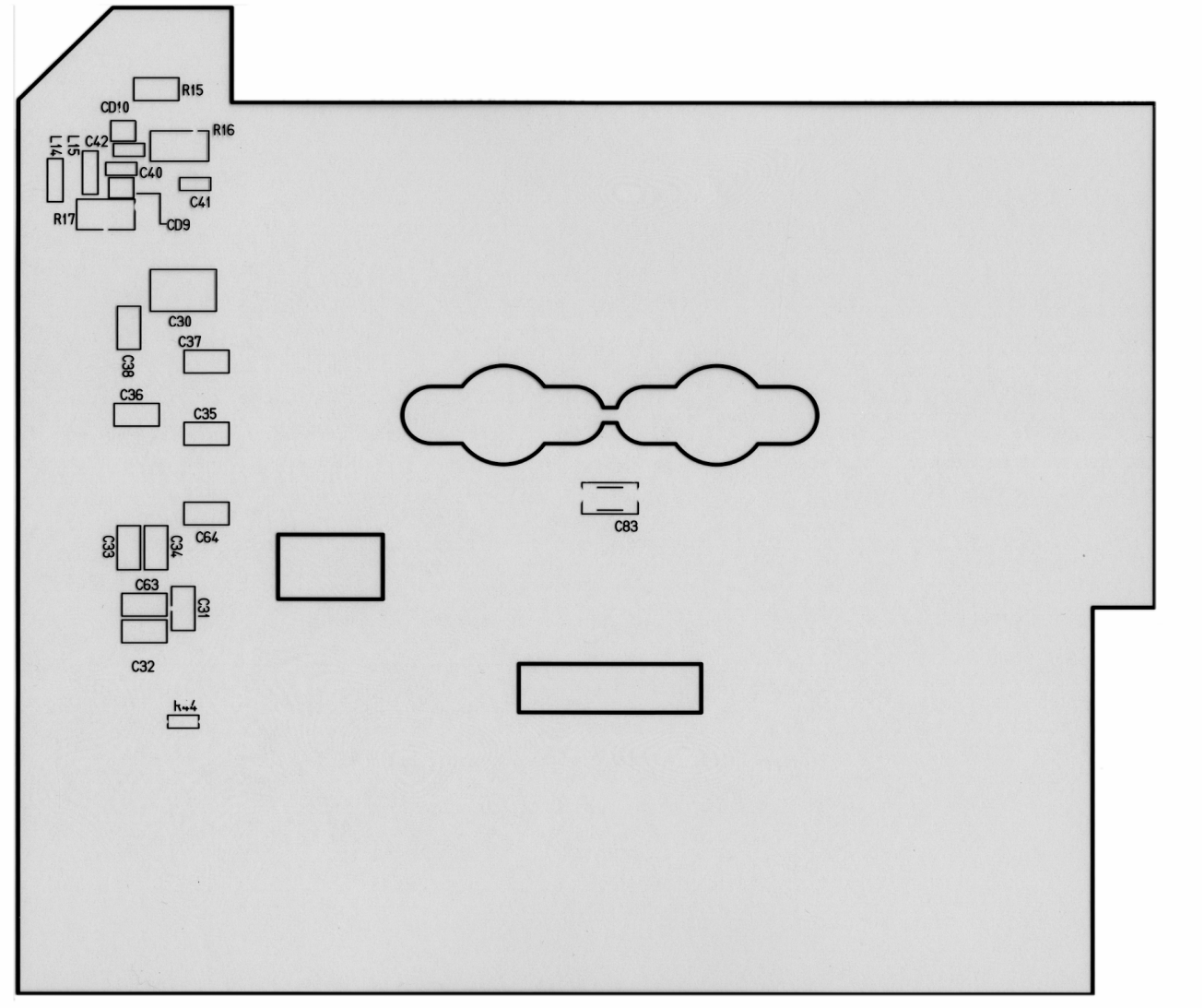
SYMBOL	CAH-505AL	CAH-505BL	CAH-505AH	CAH-505BH
C8	**330 pF**	150 pF	470 pF	470 pF
C9	----	----	2200 pF	2200 pF
C18	330 pF	270 pF	390 pF	470 pF
C20, C22	390 pF	220 pF	330 pF	220 pF
C23	----	----	390 pF	330 pF
C31	39 pF	27 pF	36 pF	27 Pf
C32	47 pF	33 pF	39 pF	33 pF
C33	100 pF	39 pF	43 pF	39 pF
C34	36 pF	24 pF	30 pF	24 pF
C35	100 pF	47 pF	47 pF	47 pF
C36	30 pF	24 pF	30 pF	24 pF
C37	91 pF	82 pF	91 pF	82 pF
C38	24 pF	24 pF	27 pF	24 pF
C63	----	39 pF	47 pF	39 pF
C64		47pF	47pF	47pF
C72	15 pF	33 pF	30 pF	33 pF
C73	100 pF	43 pF	68 pF	43 pF
C74	82 pF	82 pF	100 pF	82 pF
C75	----	22 pF	20 pF	22 pF
C76	39 pF	47 pF	62 pF	47 pF
C84	200 pF	120 pF	82 pF	100 pF
C163	56 pF	47 pF	56 pF	47 pF
C164	100 pF	82 pF	100 pF	82 pF
C165	27 pF	22 pF	27 pF	22 pF
C166	68 pF	47 pF	68 pF	47 pF
C167	39 pF	33 pF	39 pF	33 pF
CD3	C25T04Q-TE24L	C25T04Q-TE24L	C30T04Q-TE24L	C30T04Q-TE24L
IC2	HJM2403M-T1	HJM2403M-T1	----	----
L8	4.5T (R)	3.5T (R)	4.5T (R)	3.5T (R)
L9	5.5T (R)	4.5T (R)	5.5T (R)	4.5T (R)
L10	5.5T (R)	4.5T (R)	5.5T (R)	4.5T (R)
L11	5.5T (L)	4.5T (L)	5.5T (L)	4.5T (L)
L18	2.5T (R)	3.5T (R)	3.5T (R)	3.5T (R)
L19	5.5T (R)	4.5T (R)	5.5T (R)	4.5T (R)
L153	120 nH	100 nH	120 nH	100 nH
L154	180 nH	150 nH	180 nH	150 nH
R6	4.7 Ω	4.7 Ω	2.2 Ω	2.2 Ω
R8	18 Ω	22 Ω	22 Ω	22 Ω
R10, R11	2.2 Ω	4.7 Ω	2.2 Ω	3.3 Ω
R21	22 kΩ	22 k Ω	----	----
R22	15 kΩ	15 kΩ	----	----
R23	220 kΩ	220 kΩ	----	----
R28	3.3 kΩ	3.3 kΩ	----	----
R42	4.7 Ω	4.7 Ω	----	----
R44	----	----	10 kΩ	10 kΩ
R46	15 Ω	22 Ω	22 Ω	22 Ω
R49	----	----	680 Ω	560 Ω
R50	----	----	1 kΩ	1 kΩ
TR3, TR4	2SC2540	2SC2540	2SC2694	2SC2694



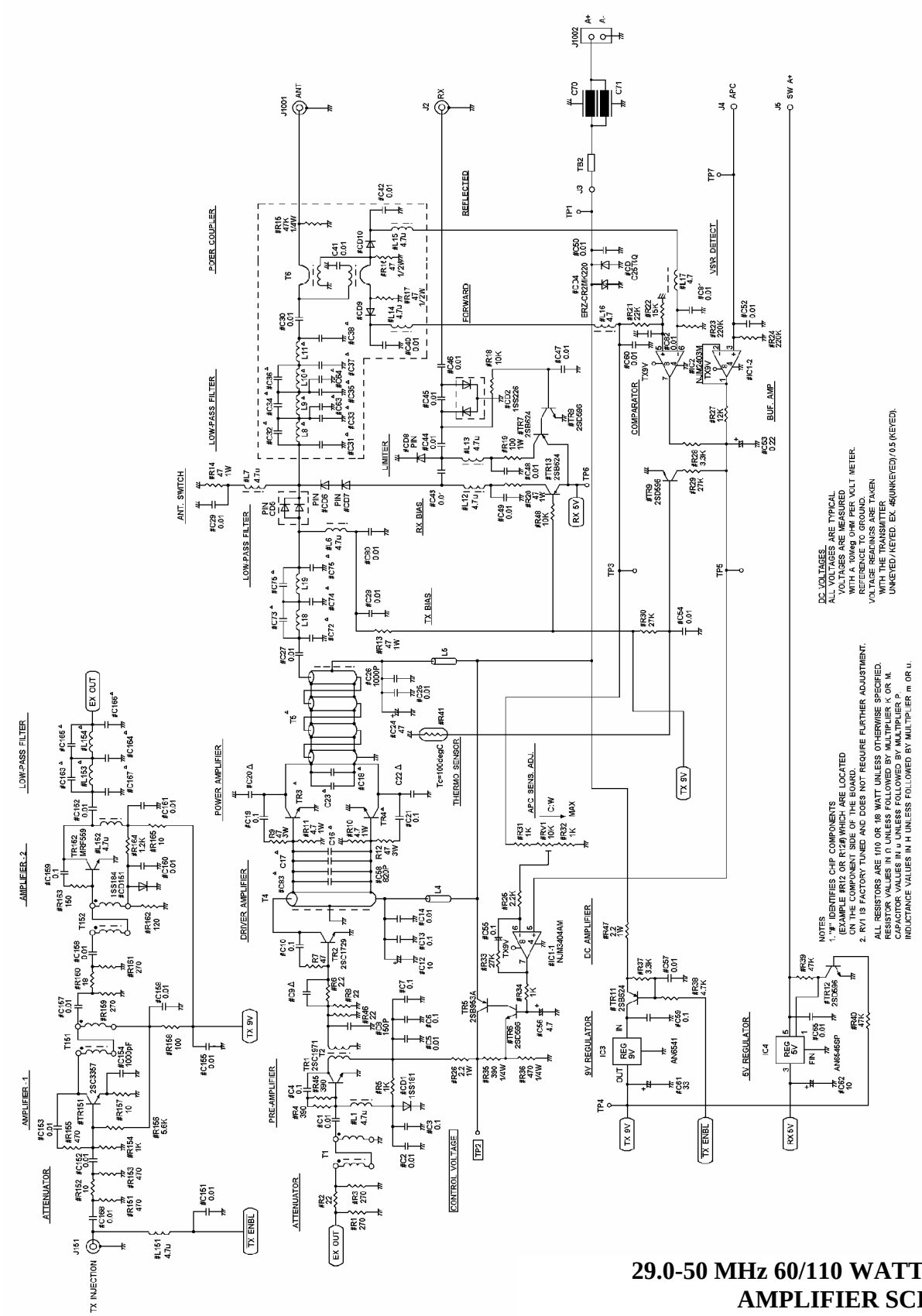
POWER AMPLIFIER ASSEMBLY DIAGRAM
29.0-50 MHz; 60/110 Watts



POWER AMPLIFIER BOARD LAYOUT
TOP VIEW
(6PCLD00277C)



POWER AMPLIFIER BOARD LAYOUT
BOTTOM VIEW
(CPCLD00277C)



29.0-50 MHz 60/110 WATTS POWER AMPLIFIER SCHEMATIC

(DDO2-CAH-505)

M/A-COM Wireless Systems
221 Jefferson Ridge Parkway
Lynchburg, Virginia 24501
(Outside USA, 434-385-2400) Toll Free 800-528-7711
www.macom-wireless.com

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