ERICSSON

LBI-38155C

MAINTENANCE MANUAL
TRANSMITTER B19/CAH-334 L/H

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DESCRIPTION

Transmitter board CAH-334L/H for the EDACS™ FMD 800 MHz mobile radio provides 12/30 watts of rf power in the 806 to 825 MHz and 851 to 870 MHz frequency ranges. The board mounts at the bottom rear of the radio frame assembly as shown in Figure 1. The Transmitter board consists of a power amplifier circuit, power control circuit, and antenna switch circuit (Figure 2).

The power amplifier circuit (see Figure 2 and the schematic diagram) consists of an input attenuator circuit connected to P1, pre-driver circuit HC-1 (M57775), Driver circuit HC2 (M57792), PA transistor TR1 (30 W radio only), and a low-pass filter on the output. The output of the PA connects through the antenna switch to the input of the low-pass filter.

The power control circuitry consists of IC1, thermal detector transistor TR5, dc amplifier transistor TR2, Power Control transistor TR3, and filter transistor TR4.

Antenna Switching consists of switching diodes (CD3 thru CD6), quarter-wave, 50-ohm microstrips Z11 and Z12, and associated components.

CIRCUIT ANALYSIS

30-WATT PA

The 30-watt radio uses pre-driver module HC1, driver module HC2, and PA transistor TR1 to provide 30 watts of rf power output. The Driver module (HC1) contains three broadband amplifiers.

The auto-power control circuit supplies voltage to the driver. Continuous 13.6 volts (TX A+) source voltage is applied to transistor TR1 through inductors L4 and L5. The output of the Driver module (HC2) is coupled through a 50-ohm impedance-matching network consisting of capacitors C12 thru C14, and a 50-ohm stripline made up of Z3 and Z4 (printed circuit pattern) to the emitter of Class C final PA amplifier transistor TR1.

The output of TR1 is taken from the collector and coupled to a low-pass filter through a 50-ohm impedance-matching network consisting of capacitors C16 and C17, and 16-ohm stripline Z5. The output of the matching network is coupled to the power detector circuit composed of Z6 thru Z8 and diodes CD1 and CD2. From the power detector, output is coupled to the antenna connector (ZC1) through antenna switch diode CD4 and the low-pass filter consisting of capacitors C22 and C30 thru C38 and Z10.

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LBI-38155

12-WATT PA

The 12-watt PA circuit is the same as the 30-watt PA circuit with the exception of the PA and thermal detection circuit. The 50-ohm output of HC2 (Driver module) is fed directly to the Power Detector (Z6) through rf coaxial cable (W2).

ANTENNA SWITCHING

The antenna switch circuit is controlled by the TX 8V output of the Receiver board. When TX 8V output goes high, bias current flows to switching diodes CD4-CD7 through R27, Z6, Z8, and Z9. Antenna switching diode CD4 couples rf output from the power detector through the low-pass filter and to antenna connector ZC1.

APC CIRCUITS

The auto-power control (APC) circuit protects the transmitter PA from damage due to excessive output power, reflected power, or excessive case temperature (30W PA). The POWER ADJ resistor RV1 sets the power control circuit for the desired output power level.

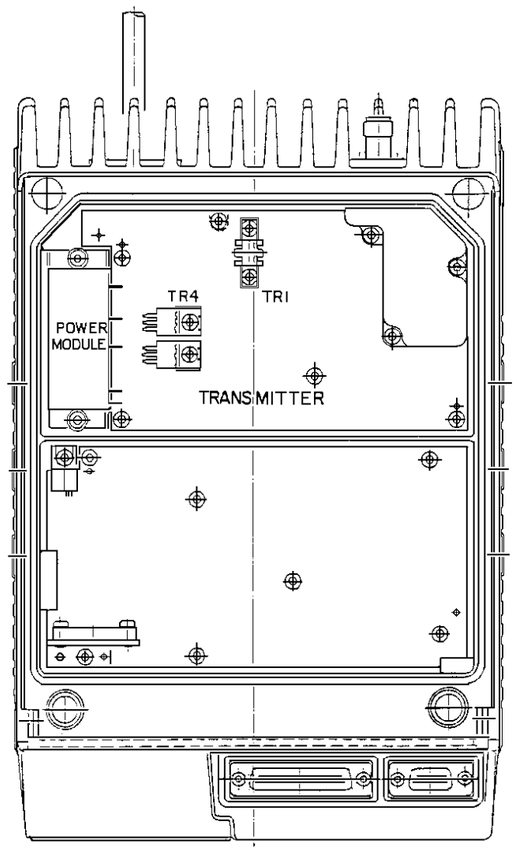


Figure 1 - Transmitter Board Location (Bottom View)

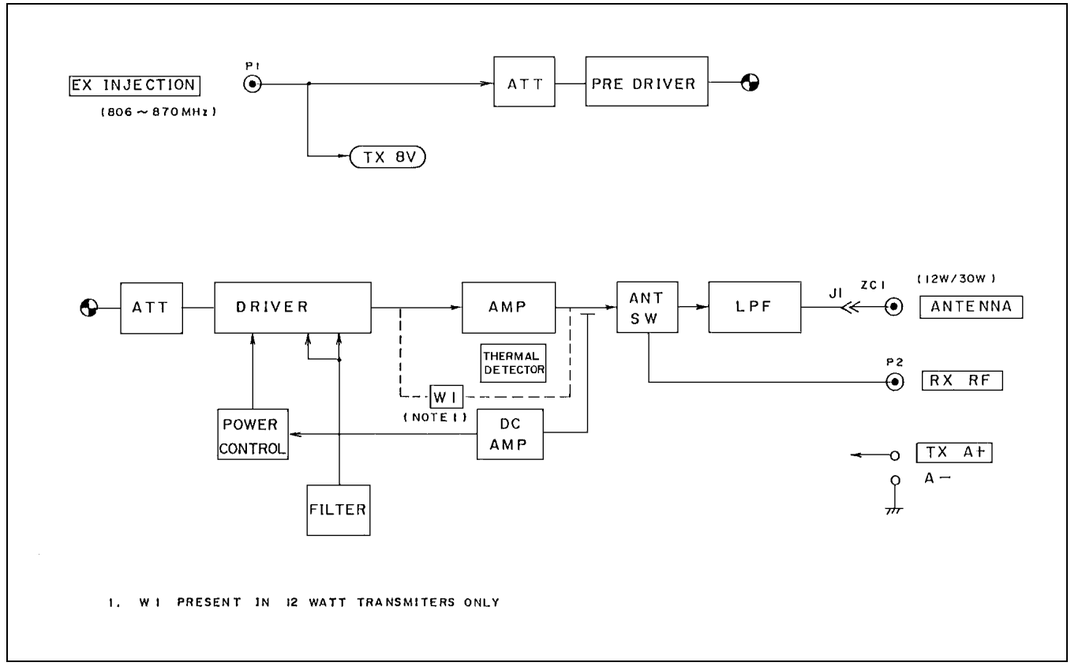


Figure 2 - Transmitter Block Diagram

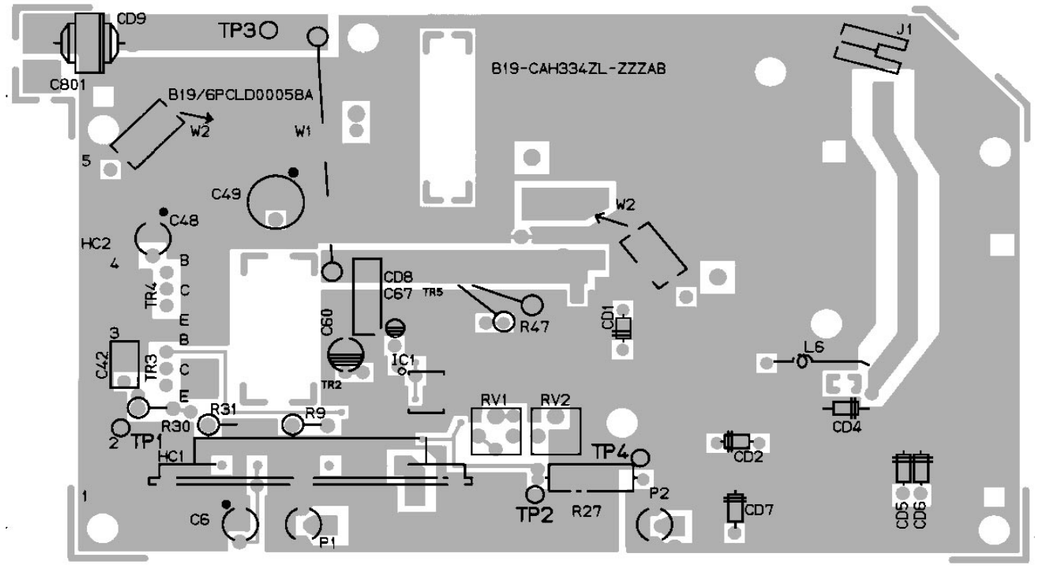
If output power increases, the detected voltage (forward or reflected) coming from the power detector circuit also increases. This causes the voltage at IC1-2 to increase and the output at IC1-1 to decrease. The resulting decrease in output causes transistor TR2 to conduct less.

When transistor TR2 conducts less, the base voltage on PNP pass transistor TR3 increases, causing it to conduct less. This results in less voltage being applied to the first amplifier stage in the Driver module (HC2), reducing the power output of the Transmitter in proportion to the increase in output power detected by the circuit.

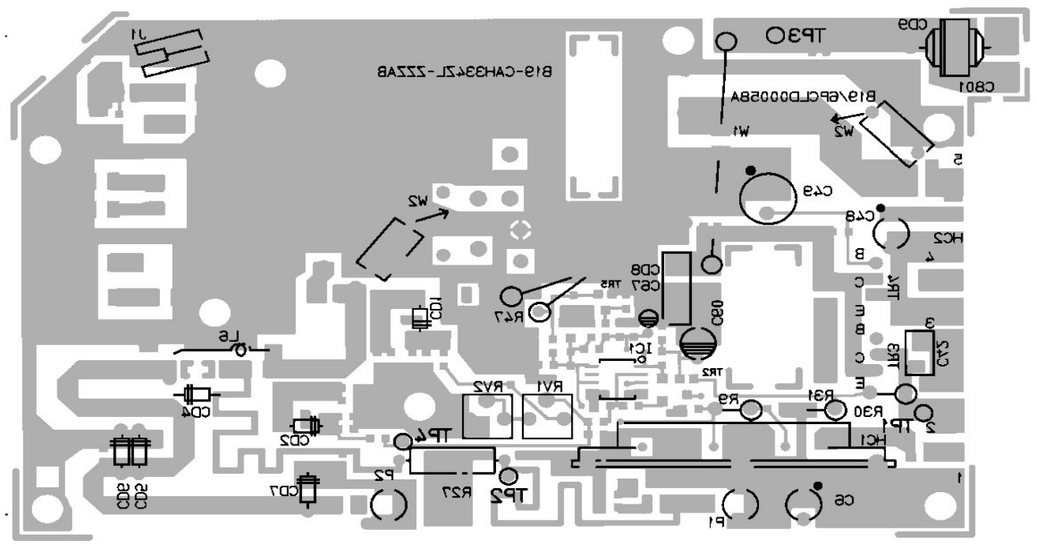
To protect the PA (30W only) against badly mismatched loads, a reverse power (VSWR) detector circuit is incorporated. The circuit consists of CD2, IC1, TR2, and pass transistor TR3. When sufficient power is detected by CD2 to cause IC1 to conduct, the voltage at the output of IC1 decreases, causing the Driver module to lower the output power, protecting the PA. The reverse power level is set by resistor R25 connected in series with diode CD2.

The PA is protected against temperature increases by a thermal detector circuit consisting of R47, TR2, TR3, TR5, and IC1. As case temperature increases, the resistance to ground of thermal detector R47 increases. This causes IC1 to conduct less, causing a decrease in the PA output until the temperature level is reduced. The temperature level is set by resistor R46.

COMPONENT SIDE



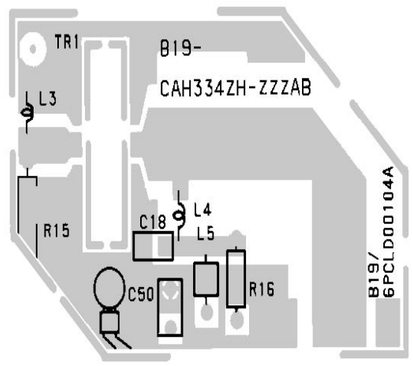
SOLDER SIDE



TRANSMITTER BOARD

(PCL0000588, 11-88)

COMPONENT SIDE



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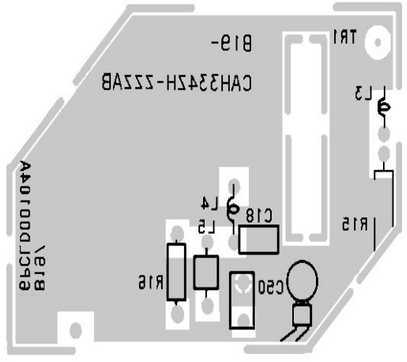

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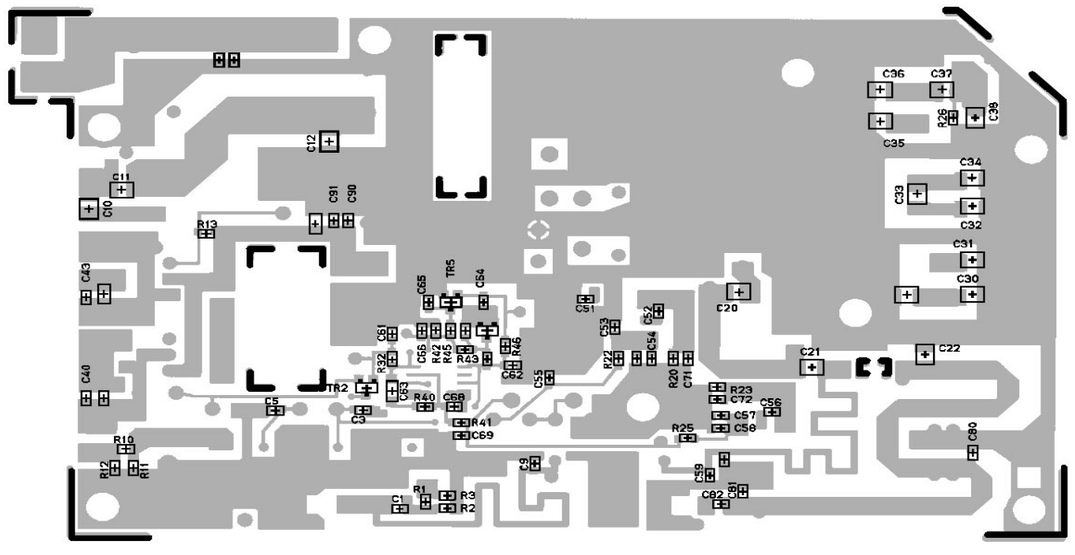

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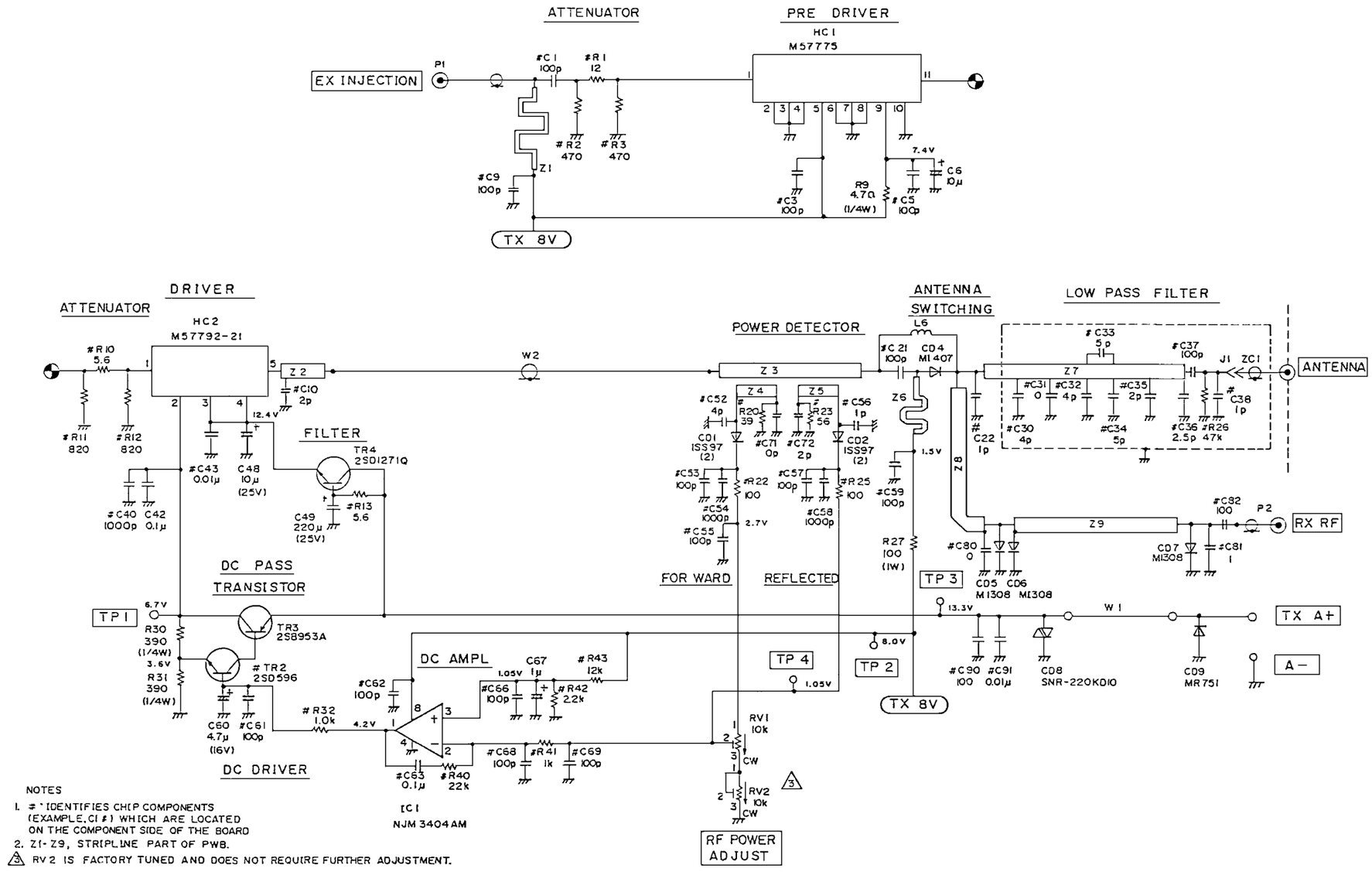
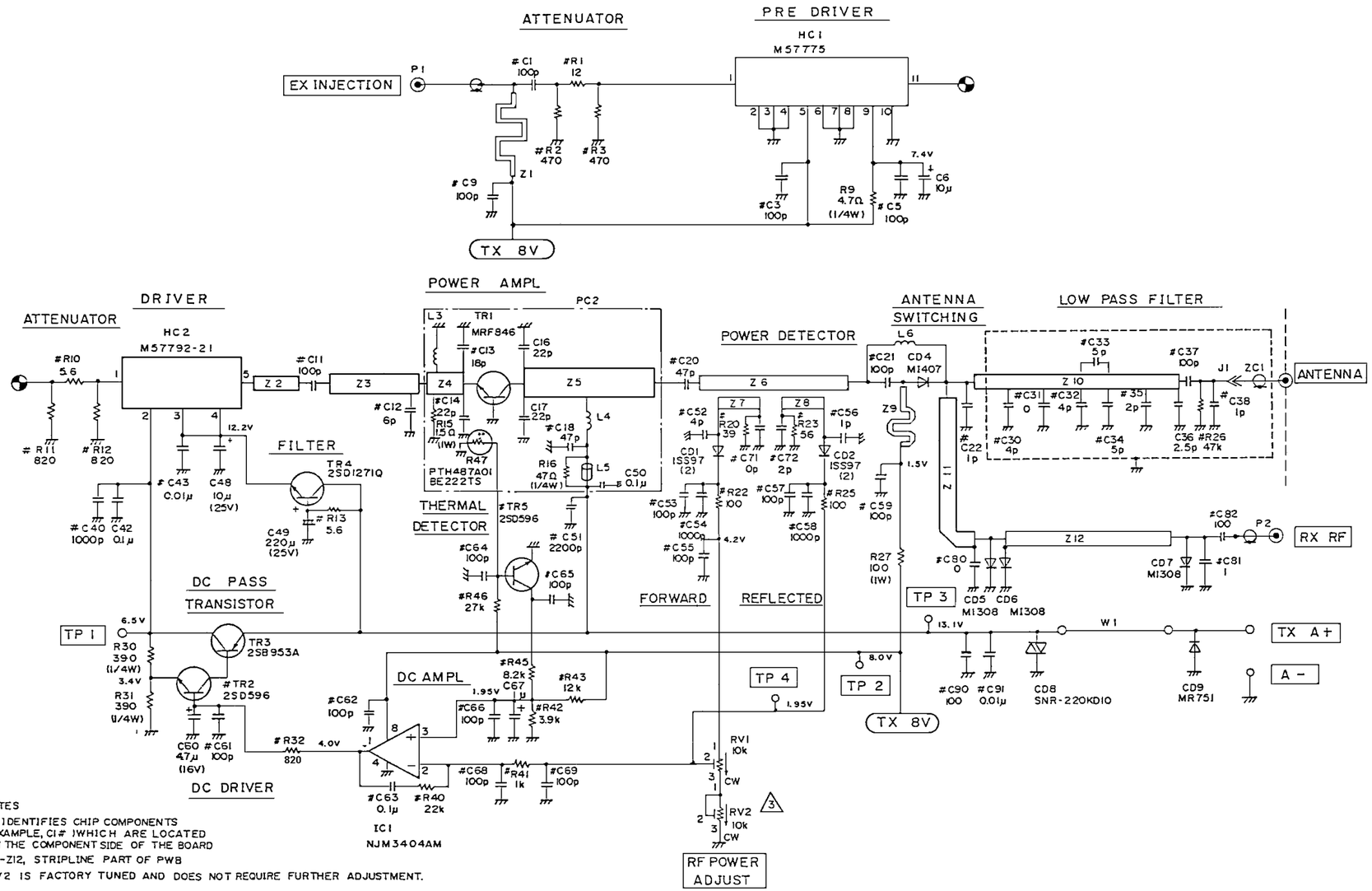


NOTES

1. # IDENTIFIES CHIP COMPONENTS (EXAMPLE, C1 #) WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD
2. Z1 - Z9, STRIPLINE PART OF PWB.
3. RV2 IS FACTORY TUNED AND DOES NOT REQUIRE FURTHER ADJUSTMENT.

ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER µ, n.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR µ.

LOW POWER



NOTES

1. "#" IDENTIFIES CHIP COMPONENTS (EXAMPLE, C1#) WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD
2. Z1-Z12, STRIPLINE PART OF PWB
3. RV2 IS FACTORY TUNED AND DOES NOT REQUIRE FURTHER ADJUSTMENT.

ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER µ, n.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR µ.

HIGH POWER

PARTS LIST

FMD TRANSMITTER
B19/CAH.334L/H
ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
		---------- CAPACITORS ----------
C1	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C3	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C5	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C6	B19/5CEAA01864	Electrolytic: 10 uF ± 20%, 25 VDCW.
C9	B19/5CAAD00239	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C10	B19/5CMAB01170	Mica: 2 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM. (Used in CAH-334L).
C11	B19/5CAAA03010	Ceramic: 100 pF ±5%, 500 VDCW, temp coef 0 ± 60 PPM. (Used in CAH-334H).
C12	B19/5CMAB01171	Mica: 6 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM. (Used in CAH-334H).
C13	B19/5CMAB01171	Mica: 18 pF ±5%, 50 VDCW, temp coef 0 ± 100 PPM. (Used in CAH-334H).
C14	B19/5CMAB01206	Mica: 22 pF ±5%, 50 VDCW, temp coef 0 ± 100 PPM. (Used in CAH-334H).
C16 and C17	B19/5CAAH00024	Mica: 22 pF ±5%, 100 VDCW. (Used in CAH-334H).
C18 and C20	B19/5CAAA01252	Mica: 47 pF ±5%, 500 VDCW, temp coef 0 ± 60 PPM. (Used in CAH-334H).
C21	B19/5CAAA0310	Ceramic: 100 pF ±5%, 500 VDCW.
C22	B19/5CMAB01169	Mica: 1 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM.
C30	B19/5CMAB01397	Mica: 4 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM.
C32	B19/5CMAB01397	Mica: 4 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM.
C33 and C34	B19/5CMAB01113	Mica: 5 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM.
C35	B19/5CMAB01170	Mica: 2 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM.
C36	B19/5CMAB01473	Mica: 2.5 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM.
C37	B19/5CAAA03010	Ceramic: 100 pF ±5%, 500 VDCW, temp coef 0 ± 100 PPM.
C38	B19/5CMAB01169	Mica: 1 pF ± 0.25 pF, 500 VDCW, temp coef 0 ± 100 PPM.
C40	B19/5CAAD01154	Ceramic: 100 pF ±5%, 500 VDCW, temp coef 0 ± 100 PPM.
C42	B19/5CRAA00617	Metallized plastic: 0.1 uF ± 5%, 50 VDCW.
C43	B19/5CAAD01115	Ceramic: 0.01 uF + 10%, 50 VDCW, temp coef 0 ± 100 PPM.
C48	B19/5CEAA01864	Electrolytic: 10 uF ± 20%, 25 VDCW, temp coef 0 ± 100 PPM.
C49	B19/5CEAA01786	Electrolytic: 220 uF ± 20%, 25 VDCW, temp coef 0 ± 100 PPM.
C50	B19/5CEAA00617	Metallized plastic: 0.1 uF ± 5%, 50 VDCW. (Used in CAH-334H).
C51	B19/5CAAD00946	Ceramic: 2200 pF ± 10%, 50 VDCW, temp coef 0 ± 15%. (Used in CAH-334H).
C52	B19/5CAAD00961	Ceramic: 4 pF ± 0.25 pF, 50 VDCW, temp coef 0 ± 30 PPM.
C53	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C54	B19/5CAAD01154	Ceramic: 1000 pF ± 10%, 50 VDCW, temp coef 0 ± 350 - 1000 PPM.
C55	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C56	B19/5CAAD00852	Ceramic: 1 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C57	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C58	B19/5CAAD01154	Ceramic: 1000 pF ± 10%, 50 VDCW, temp coef 0 ± 350 - 1000 PPM.
C59	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C60	B19/5CSAC01409	Tantalum: 4.7 uF ± 10%, 16 VDCW.
C61 and C62	B19/5CAAD00839	Ceramic: 100 pF ±5%, 500 VDCW, temp coef 0 ± 30 PPM.
C63	B19/5CAAD01237	Ceramic: 0.01 uF + 10%, 50 VDCW, temp coef ± 15%.
C64 and C65	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM. (Used in CAH-334H).
C66	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C67	B19/5CSAC00982	Tantalum: 1 uF ± 10%, 35 VDCW.
C68 and C69	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C72	B19/5CAAD00949	Ceramic: 2 pF ± 0.25 pF, 50 VDCW, temp coef 0 ± 30 PPM.
C81	B19/5CAAD00852	Ceramic: 1 pF ± 0.25 pF, 50 VDCW, temp coef 0 ± 30 PPM.
C82	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C90	B19/5CAAD00839	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ± 30 PPM.
C91	B19/5CAAD01115	Ceramic: 0.01 uF + 10%, 50 VDCW.
		---------- DIODES ----------
CD1 and CD2	B19/5TXAA00313	Silicon (Schottky Barrier): sim to NEC 1SS97 (2).
CD4	B19/5TXAR00051	Silicon, fast recovery (RF Switch): sim to MITSUBISHI MI407.
CD5 thru CD7	B19/5TXAR00041	Silicon, fast recovery (RF Switch): sim to MITSUBISHI MI308.
CD8	B19/5TZAA00104	Ceramic, varistor: sim to SANKEN SNR-220KD10.
CD9	B19/5TXAM00019	Silicon, fwd current 3A 200 PIV; sim to MOTOROLA MR751.
		---------- HYBRID CIRCUITS ----------
HC1	B19/5DHAA00020	RF Power Amplifier; sim to MITSUBISHI M5775.
HC2	B19/5DDAB00273	RF Power Amplifier; sim to MITSUBISHI M57792-21.
		---------- INTEGRATED CIRCUITS ----------
IC1	B19/5DAAN00202	Linear, Dual OP AMP; sim to NJRC NJM3404AM.
		---------- CONNECTORS ----------
J1	B19/5JWFR00004	Connector, RF.
		---------- COILS ----------
L3 and L4	B19/6LALD00053	Coil, RF. (Used in CAH-334H).
L5	B19/6LALD00043	Coil, RF. (Used in CAH-334H).
L6	B19/6LALD00055	Coil, RF.
		---------- PIN & CABLES ----------
P1	B19/6JJLD00018	Co-axial cable.
P2	B19/6JJLD00011	Co-axial cable.
P3	B19/6LALD00081	Pin. (Used in CAH-334H).
		---------- RESISTORS ----------
R1	B19/5RDAC02612	Metal film: 12 ohms ±5%, 100 VDCW, 1/10W.
R2 and R3	B19/5RDAC02471	Metal film: 470 ohms ± 5%, 100 VDCW, 1/10W.
R9	B19/5RDAA01550	Metal film: 47 ohms ± 5%, 300 VDCW, 1/4W.
R10	B19/5RDAC02616	Metal film: 5.6 ohms ± 5%, 100 VDCW, 1/10W.
R11 and R12	B19/5RDAC02542	Metal film: 820 ohms ± 5%, 100 VDCW, 1/10W.
R13	B19/5RDAC02616	Metal film: 5.6 ohms ± 5%, 100 VDCW, 1/10W.
R15	B19/5REAG02567	Metal film: 1.5 ohms ± 5%, 350 VDCW, 1W. (Used in CAH-334H).
R16	B19/5RDAA01946	Metal film: 47 ohms ± 5%, 200 VDCW, 1/10W. (Used in CAH-334H).
R20	B19/5RDAC02624	Metal film: 39 ohms ± 5%, 100 VDCW, 1/10W.
R22	B19/5RDAC02447	Metal film: 100 ohms ± 5%, 100 VDCW, 1/10W.
R23	B19/5RDAC02579	Metal film: 56 ohms ± 5%, 100 VDCW, 1/10W.
R25	B19/5RDAC02447	Metal film: 100 ohms ± 5%, 100 VDCW, 1/10W.
R26	B19/5RDAC02439	Metal film: 47K ohms ± 5%, 100 VDCW, 1/10W.
R27	B19/5REAG02230	Metal film: 100 ohms ± 5%, 350 VDCW, 1W.
R30 and R31	B19/5RDAA01625	Metal film: 390 ohms ± 5%, 300 VDCW, 1/4W.
R32	B19/5RDAC02446	Metal film: 1K ohms ± 5%, 100 VDCW, 1/10W. (Used in CAH-334L).
R32*	B19/5RDAC02542	Metal film: 820 ohms ± 5%, 100 VDCW, 1/10W. (Used in CAH-334H).
R40	B19/5RDAC02454	Metal film: 22K ohms ± 5%, 100 VDCW, 1/10W.
R41	B19/5RDAC02446	Metal film: 1K ohms ± 5%, 100 VDCW, 1/10W. (Used in CAH-334L).
R42	B19/5RDAC02451	Metal film: 22K ohms ± 5%, 200 VDCW, 1/10W.
R42	B19/5RDAC02477	Metal film: 3.9 ohms ± 5%, 100 VDCW, 1/10W. (Used in CAH-334H).
R43	B19/5RDAC02480	Metal film: 12K ohms ± 5%, 100 VDCW, 1/10W.
R45	B19/5RDAC02479	Metal film: 8.2K ohms ± 5%, 100 VDCW, 1/10W. (Used in CAH-334H).
R46	B19/5RDAC02457	Metal film: 27K ohms ± 5%, 100 VDCW, 1/10W. (Used in CAH-334H).
R47	B19/5RXAE00028	Posistor: 2.2k ohms. (Used in CAH-334H).
RV1 and RV2	B19/5RVAB00399	Variable: 10k ohms ± 30%, 0.1W.
		---------- TRANSISTORS ----------
TR1	B19/5TZAR00014	Silicon, NPN, Power Amplifier: sim to MOTOROLA MRF 846. (Used in CAH-334H).
TR2	B19/5TDAB00055	Silicon, NPN: sim to NEC 2SD596-T2 DV3.
TR3	B19/5TBAR00002	Silicon, PNP: sim to MATSUSHITA 2SB953AG.
TR4	B19/5TDAR00012	Silicon, NPN: sim to MATSUSHITA 2SD1217Q.
TR5	B19/5TDAB00055	Silicon, NPN: sim to NEC 2SD596-T2 DV3. (Used in CAH-334H).
		---------- WIRE & CABLES ----------
W1	B19/6LALD00045	Wire.
W2	B19/6JJLD00006	Co-axial cable. (Used in CAH-334L).
ZCI	B19/6ZCLD00047	Co-axial cable.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

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 the descriptions of parts affected by these revisions.

REV A - TRANSMITTER BOARD B19/CAH-334
To improve reliability, changed printed wire boards.