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# MAINTENANCE MANUAL **ORION**<sup>TM</sup> **VHF POWER AMPLIFIER UNITS**

344A4572P1	JHM-271PEA	25 WATT	136 - 153 MHz
344A4572P2	JHM-271PEB	25 WATT	150 - 174 MHz
344A4572P3	JHM-271PLA	50 WATT	136 - 153 MHz
344A4572P4	JHM-271PLB	50 WATT	150 - 174 MHz
344A4572P5	JHM-271PHA	110 WATT	136 - 153 MHz
344A4572P6	JHM-271PHB	110 WATT	150 - 174 MHz

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### **DESCRIPTION**

RF Power Amplifiers for the Ericsson GE VHF ORIONTM mobile radio are provided in three different power levels designated as follows:

- 344A4572P1, P2 136-174 MHz, 25 WATT used in low power applications
- 344A4572P3, P4 136-174 MHz, 50 WATT Used in mid power applications
- 344A4572P5, P6 136-174 MHz, 110 WATT used in high power applications

The exciter for each of the three power amplifiers is located on Synthesizer/Receiver/Exciter board CMN-352-1. This exciter circuit provides approximately 500 milliwatt input to the PA (refer to Maintenance Manual *LBI-38910*). The PA utilizes a single power amplifier module (HC1) as the driver unit. In the case of the 25 watt amplifier the power module is the only power amplifying unit. With the other two power levels the power module drives other power transistors to provide the power output required. Each power amplifier is provided with an antenna switch and limiter circuit to isolate the receive circuit from the transmit circuit, limiting the receiver input from being over driven due to large RF signals. Each power amplifier has a power detect circuit which controls an Automatic Power Control (APC) circuit to keep the power output constant. A low-pass filter is provided in the antenna circuit to reduce harmonic emissions. A keyed **Tx 9V** regulator is provided to power the APC circuits.

### **CIRCUIT ANALYSIS**

#### **25 WATT**

The 25 Watt PA assembly uses one power module (HC1) to provide the output power.

Supply voltage for the power amplifier is connected from power leads on the System Interface Board to J3 (A+) and G (A-) on the PA Board. Capacitors C1001 and C1002 on the flexible interface printed wire board, prevent RF from getting on the power leads. Diode CD8 will cause the fuse to blow if the polarity of the power leads is reversed. Diode CD7 is a surge protector to suppress pulses on the power leads.

The Exciter output is coupled through connector J2 on the Synthesizer/Receiver/Exciter Board to input connector J1 on the PA board. The 500 milliwatt RF input at J1 is coupled to power module HC1 through an attenuator pad consisting of resistors R1-R3. This pad attenuates the power to about 300 milliwatt and provides isolation between Exciter and PA. The

power module (HC1) amplifies the 300 milliwatt input to 30 Watts.

The power module consists of a two-stage RF amplifier (Refer to IC DATA). The first stage power supply voltage is supplied by the power control circuit. The second stage power supply voltage is supplied by SMOOTHING FILTER transistor TR1. The second RF amplifier operates in class C.

The 25 Watts output of HC1 is coupled to the ANTENNA and ANTENNA SWITCH & LIMITER circuits through 50 ohm stripline Z1.

#### Antenna Switch & Limiter

The Antenna Switch circuit consists of two PIN diodes, CD3 and CD4, and a quarter-wave circuit with "lumped" constants capacitor C25 and inductor L8. Capacitor C25 and inductor L8 and take the place of a quarter-wave micro strip line. When the transmit circuit is keyed and **TX9V** output goes high, bias current flows through switching diodes CD3 and CD4. A low impedance now exists at the anode of CD4 and a high impedance exists at the node connection of C25 and L8. This isolates the transmitter power from the receiver. Diode CD3 is now an RF short and, along with capacitor C12, couples the power to the low pass filter and on to the antenna.

The limiter circuit consists of transistors TR7, TR8, diode package CD13 and other associated components. While receiving, if the received signal level exceeds +10 dBm, the rectified currents of CD13 provide forward bias to TR7, TR8 and PIN diode CD4 proportional to the received signal level. This causes the quarter-wave circuit (lumped constants C25 and L8) to turn on when the received 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 filter and limiter to the receiver input.

### Tx 9V Switch

When the TX EN lead, located on the Synthesizer/Receiver/Exciter board, goes low, the DC voltage on J102 goes low. On the PA board, the DC voltage on J1 also goes low completing the circuit for diode CD9. With CD9 conducting **TX 9V** Switch transistor TR6 conducts applying A+ (13.32 V) to the input of +9 Volt Regulator IC1. The regulated +9 volts applies bias to IC2, TR2 and the switching diodes CD3 and CD4.



Figure 1 - Block Diagram For 25-Watt Power Amplifier

### **Power Control**

The Auto Power Control (APC) circuit protects the transmitter PA from damage due to:

- a. excessive output power
- b. excessive reflected power
- or
- c. excessive temperature

The output power control circuit allows the RF output power to be set at rated power by the APC voltage from the Logic/IF/Audio Board. If the output power of the PA increases, the detected voltage and the input to operational amplifier IC2-2 increases. The output voltage of operational amplifier IC2-2 decreases. This causes **DC DRIVER** transistor TR5 to conduct less. This increases the base voltage on PNP **DC PASS** transistor TR4, causing it to conduct less. This results in less voltage being applied to the first amplifier stage in RF Power Module HC1, reducing the output power of the PA in proportion to the increases in output power detected by the circuit.

To protect the PA against badly mismatched loads, a reverse power detector circuit (**VSWR**) consisting of diode CD11, operational amplifier IC2-2, transistor TR5 and pass transistor TR4 detects reverse (reflected) power. When sufficient power is detected by CD11 to cause IC2-2 to conduct, the voltage at the output of IC2-2 decreases, causing the Power Module to lower the output power, protecting the PA.

The PA is protected against temperature increases by a thermal detector circuit. This circuit consists of resistor R28, **THERMAL DETECT** transistor TR2, **DC DRIVER** transistor TR5 and DC AMPL operational amplifier IC2-2. As temperature increases, the resistance to ground through thermal detector resistor R28 increases. This causes IC2-2 to conduct less, causing a decrease in PA output until the temperature level is reduced. The temperature level is set by resistor R28. When the heat sink temperature rises above 90\*C, the resistance of R28 increases and the power output is reduced.

#### **50 WATT**

The 50 Watt PA assembly uses one power module (HC1) and one RF power transistor (TR1) to provide the output power.

Supply voltage for the power amplifier is connected from power leads on the System Interface Board to J3 (A+) and G (A-) on the PA Board. Diode CD11 is a surge protector to suppress pulses on the power leads. (Diode CD1001 in the PA Interconnection will cause a fuse to blow if the voltage polarity is reversed. Refer to the PA INTERCONNECTION DIAGRAM)

Test Points (TP) are the printed board terminals for measuring control voltage as follows:

- TP1 A+ (13.42V)
- TP2 Control Voltage (4.72V)
- TP3 Forward Power Detect (2.64V)
- TP4 Tx 9V (9.12V)
- TP5 APC Voltage on output of DC AMPL IC2-1 (2.64V)
- TP6 Voltage to HC1, pins 3 &4 (12.5V)
- TP7 APC Voltage (3.5V)

The Exciter output is coupled through connector J102 on the Synthesizer/Receiver/Exciter Board to input Jack P1 on the PA board. The 500 milliwatt RF input at P1 is coupled to power module HC1 through an attenuator pad consisting of resistors R1-R4. This pad attenuates the 500 milliwatt to about 300 milliwatt and provides isolation between Exciter and PA. The power module (HC1) amplifies the 300 milliwatt input to 14 Watts.

The power module consists of a two-stage RF amplifier (Refer to IC DATA). The first stage power supply voltage is supplied by the power control circuit. The second stage power supply voltage is supplied by **SMOOTHING FIL-TER** transistor TR7. The second RF amplifier operates in class C.

The 14 Watts output of HC1 is coupled to **POWER AMPL** transistor TR1 through impedance matching components consisting of capacitors C4 through C9, inductors L1 and L2 and stripline Z1. Transistor TR1 amplifies the 14 Watt level to 60 Watts. The output of TR1 is coupled to the **ANTENNA** and **ANTENNA SWITCH** through impedance matching components consisting of capacitors C13 through C15, C159, C166, C168, C173, inductors L3 and L4, and impedance matching network Z2 through coupling capacitor C16 and 50 ohm stripline Z7.

#### <u>Antenna Switch</u>

The Antenna Switch circuit consists of capacitor C57 and inductor L24 and takes the place of a quarter-wave micro strip line. When TX9V output goes high, bias current flows through switching diodes CD1, CD3 and CD5. A low impedance now exists at the anode of CD3 and a high impedance exists at the node connection of C57 and L24. This isolates the transmitter power from the receiver. Diode CD1 is now an RF short and, along with capacitor C48, couples the power to the low pass filter and on to the antenna.



Figure 2 - Block Diagram For 50-Watt Power Amplifier





#### Tx 9V Switch

When the **TX EN** lead goes low, **TX 9V** switching transistor TR8 conducts, applying A+ (13.32 V) to the input of +9 Volt Regulator IC1. The regulated +9 volts (**TX 9V**) applies bias to IC2, TR4, forward and reverse detector diodes CD6 and CD7 and switching diodes CD1, CD3 and CD5.

#### **Power Control**

The Auto Power Control (APC) circuit protects the transmitter PA from damage due to:

- a. excessive output power
- b. excessive reflected power
- or
- c. excessive temperature

The output power control circuit allows the RF output power to be set at rated power by the APC voltage from the Logic/IF/Audio Board. If the output power of the PA increases, the detected voltage and the input of operational amplifier IC2-2 increases. The output voltage of IC2-2 decreases. This causes **DC DRIVER** transistor TR6 to conduct less. This increases the base voltage on PNP **DC PASS** transistor TR5, causing it to conduct less. This results in less voltage being applied to the first amplifier stage, in driver module (HC1), reducing the output power of the PA in proportion to the increases in output power detected by the circuit.

To protect the PA against badly mismatched loads, a reverse power detector circuit (**VSWR**) consisting of diode CD7, transistor TR6, operational amplifier IC2-2 and pass transistor TR5 detects reverse (reflected) power. When sufficient power is detected by CD7 to cause it to conduct, the voltage at the output of IC2-2 decreases, causing the driver module to lower the output power, protecting the PA. The reverse power level is set by resistor R19 connected in series with diode CD7.

The PA is protected against temperature increases by a thermal detector circuit. This circuit consists of resistor R31, transistors TR4, TR5, TR6 and operational amplifier IC2-2. As temperature increases, the resistance to ground through thermal detector resistor R31 increases. This causes IC2-2 to conduct less, causing a decrease in PA output until the temperature level is reduced. The temperature level is set by resistor R31. When the heat sink temperature rises above 90\*C, the resistance of R31 increases and the power output is reduced.

### **110 WATT**

The 110 Watt PA assembly uses one power module (HC1) and three RF power transistors (TR1, TR2 and TR3) to provide the output power.

Supply voltage for the power amplifier is connected from power leads on the System Interface Board to J3 (A+) and G (A-) on the PA Board. Capacitors C87 and C88 prevent RF from getting on the power leads. Diode CD10 causes a fuse to blow if the polarity of the power leads is reversed. Diode CD11 is a surge protector to suppress pulses on the power leads.

Test Points (TP) are the printed board terminals for measuring control voltage as follows:

- TP1 A+ (13.32V)
- TP2 Control Voltage (4.27V)
- TP3 Forward Power Detect (3.2V)
- TP4 Tx 9V (9.2V)
- TP5 APC Voltage on output of DC AMPL IC2-1 (2.66V)
- TP6 Voltage to HC1, pins 3 & 4 (12.8V)
- TP7 APC Voltage (3.5V)

The exciter output is coupled through connector J102 on the Synthesizer/Receiver/Exciter Board to input Jack P1 on the PA board. The 500 milliwatt RF input at P1 is coupled to power module HC1 through an attenuator pad consisting of resistors R1 through R4. This pad attenuates the 500 milliwatt input to 300 milliwatt and provides isolation between the Exciter and PA. Power Module HC1 amplifies the 300 milliwatt input to 40 Watts.

The power module (HC1) consists of a two stage RF amplifier. The first stage of the module is controlled by the voltage from the power control circuit. The amplifier consist of two Class C driver amplifiers.

The 40 watt output from HC1 is coupled to a power **SPLITTER** circuit through a 50 ohm stripline. The power **SPLITTER** circuit consists of capacitors C15, C17 and C29 and inductors L7, L8 and L32. Resistor R8 absorbs any unbalance in the drive to **DRIVER AMPL-1/AMPL-2** transistors TR2 and TR3. The power amplifier stages (TR2 and TR3) are two identical paralleled class-C amplifiers. The output of the power SPLITTER circuit is coupled to transistors TR2 and TR3 through coupling capacitors C19, C20 and impedance matching components consisting of capacitors C21 through C28, inductors L9 and L10 and impedance matching networks Z3 and Z5.

The output of TR2 and TR3 is coupled to a power **COM-BINER** through impedance matching components consisting of capacitors C33 through C42, C169 through C172, C174 and

C175, inductors L11 and L12 and impedance matching networks Z4 and Z6. The power **COMBINER** consists of capacitors C43 through C46 and inductors L13, L14 and L19. Resistor R9 absorbs the difference in the output power of TR2 and TR3. Transistors TR2 and TR3 each amplify the input level from 20 watts to 80 watts. The output of the **COM-BINER** is coupled to the **ANTENNA SWITCH** through 50-ohm stripline Z7.

#### Antenna Switch

The antenna switch circuit consists of capacitor C57 and inductor L24 and takes the place of a quarter-wave micro strip line. When **TX9V** output goes high, bias current flows through switching diodes CD2 through CD5. A low impedance now exists at the anode of CD3 and CD4 and a high impedance exists at the node connection of C57 and L24. This isolates the transmitter power from the receiver. Diode CD2 is now an RF short and, along with capacitor C48, couples the power to the low pass filter and on to the antenna.

#### Tx 9V Switch

When the **TX EN** lead goes low, **TX 9V** switch transistor TR8 conducts applying A+ (13.32 V) to the input of +9 Volt Regulator IC1. The regulated +9 volts (**TX 9V**) applies bias to IC2, TR4, forward and reverse detector diodes CD6 and CD7 and switching diodes CD2 through CD5.

#### **Power Control**

The Automatic Power Control (APC) circuit protects the transmitter PA from damage due to:

- a. excessive output power
- b. excessive reflected power

or

c. excessive temperature

The output power control circuit allows the RF output power to be set at rated power by the APC voltage from the LOGIC/IF/AUDIO Board. If the output power of the PA increases, the detected voltage and the input of operational amplifier IC2-2 increases. The output voltage of operational amplifier IC2-2 decreases. This causes transistor TR6 to conduct less. This increases the base voltage on PNP pass transistor TR5, causing it to conduct less. This results in less voltage being applied to the first amplifier stage in driver module (HC1), reducing the output power of the exciter/ PA in proportion to the increases in output power detected by the circuit. The PA is protected against temperature increases by a thermal detector circuit. This circuit consists of resistor R31, transistors TR4, TR5, TR6 and operational amplifier IC2-2. As temperature increases, the resistance to ground through thermal detector resistor R31 increases. This causes IC2-2 to conduct less, causing a decrease in PA output until the temperature level is reduced. The temperature level is set by resistor R31. When the heat sink temperature rises above 90 C, the resistance of R31 increases and the power output is reduced.

### LBI-39002

To protect the PA against badly mismatched loads, a reverse power detector circuit (**VSWR**) consisting of diode CD7, transistor TR6, operational amplifier IC2-2 and pass transistor TR5 detect reverse (reflected) power. When sufficient power is detected by CD7 to cause IC2-2 to conduct, the voltage at the output of IC2-2 decreases, causing the driver module to lower the output power, protecting the PA. The reverse power level is set by resistor R19 connected in series with diode CD7.





150-174 MHz 25-WATT POWER MODULE HC1 B19/5DHA00050 (M67781H-38) (Used in EB)





Figure 3 - Block Diagram For 110-Watt Power Amplifier

# LBI-39002

- 1. INPUT 2. VCC 1 3. VCC 2 4. OUTPUT
- 5.GND



1. INPUT 2. VCC 1 3. VCC 2 4. OUTPUT 5. GND





# 150-174 MHz 14-WATT POWER MODULE HC1 B19/5DHAA00052 (M57719-38)(Used in LB)



**9 VOLT REGULATOR IC1** B19/5DAAR00021 (AN6541)



**OPERATIONAL AMPLIFIER IC2** B19/5DAAN00368 (NJM3404AM)



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



.



# PARTS LIST

	PA UNIT (EUROPEAN MODEL) 344A4572P1/JHM-271PEA 344A4572P2/JHM271PEB			POWER AMPLIFIERS CAH-515EA (Used in 344A4572P1) CAH-515EB (Used in 344A4572P2)		
SYMBOL	EGE PART NO.	DESCRIPTION	SYMBOL	EGE PART NO.	DESCRIPTION	(
A1	B19/CAH-515EA	PA CIRCUIT CAH-515EA (Used in 344A4572P1)			CAPACITORS	
A1	B19/CAH-515EB	PA CIRCUIT CAH-515EB (Used in 344A4572P2)	C1	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef	
A2	B19/CMH-1231E	INTERFACE CMH-1231E	and C2		±15%.	(
		010107000	C3	B19/5CBAA00184	Electrolytic: 33 µF 20% 25 VDCW, temp coef +20%.	
<b>0</b> 4 9 9 4		CAPACITORS	C4	B19/5CRAA01230	Film: 0.1 µE +5% 50 VDCW.	
and	B19/5NLAN00046	±15%.	C6	B19/5CAAD01844	Ceramic: 0.022 $\mu$ F ±10% 50 VDCW, temp coef	(
C1002		CONNECTORS	C12	B19/5CAAA03082	±10%. Ceramic: 1000 pF ±10% 500 VDCW, temp coef	0
J1001	B19/6JALD00005	H-6JALD00005	C21	B19/5CEAA01844	±13%. Electrolytic: 220 μF ±20% 25 VDCW, temp coef	r
TB1001	B19/5JTGH00002	ALB-01A	C22	B19/5CAAD00838	<sup>±</sup> 20%. Ceramic: 1000 pF ±10% 50 VDCW, temp coef	ſ
W1001	B19/2265100234	WIRE 250V-HV-19/0.18-(2).	C25	B19/5CAAA03094	±15%. Ceramic: 10 pF ±0.5 pF 500 VDCW, temp coef 060	
		COAXIAL CABLES	C26	B19/5CAAD00840	PPM. Ceramic: 22 pF ±5% 50 VDCW, temp coef 0±30	1
ZC1002	B19/6JJLD17125A	H-6JJLD17125A			PPM.	
ZC1003	B19/6JJLD17060A	H-6JJLD17060A	C27	B19/5CAAD00953	Ceramic: 10 pF $\pm 0.5$ pF 50 VDCW, temp coef 0±30 PPM.	
ZC1004	B19/6ZCLD41060	H-62CLD41060	C28	B19/5CAAD00838	Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$	
			C30	B19/5CSAC01224	Tantalum: 4.7 µF ±20% 25 VDCW.	
	PA 344	A UNIT (USA MODEL) A4572P3/JHM-271PLA	C31	B19/5CEAA02877	Electrolytic: 10 $\mu$ F ±20% 25 VDCW, temp coef	
	344 344 344	A4572P4/JHM-271PLB A4572P5/JHM-271PHA A4572P6/JHM-271PHP	C32	B19/5CAAD01267	±20%. Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±10%	
0/4/201	544		C33	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef	
SYMBOL	EGE PART NO.	DESCRIPTION	C34	B19/5CSAC01416	10 μF +20% 16 VDCW.	
A1001	B19/CAH-515LA	PA CIRCUIT CAH-515LA (Used in 344A4572P3)	C35	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef	
A1001	B19/CAH-515LB	PA CIRCUIT CAH-515LB (Used in 344A4572P4)			±15%.	
A1001	B19/CAH-515HA	PA CIRCUIT CAH-515HA (Used in 344A4572P5)	C36	B19/5CSAC01050	Tantalum: 1 $\mu F$ ±20% 16 VDCW.	
A1001	B19/CAH-515HB	PA CIRCUIT CAH-515HB (Used in 344A4572P6)	C37	B19/5CAAD00838	Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef	
A1002	B19/CMH-1231UL	INTERFACE (Used in 344A4572P3.P4)			±15%.	
A1002	B19/CMH-1231UH	INTERFACE (Used in 344A4572P5,P6)	C38	B19/5CAAD01078	Ceramic: 0.1 F +80-20% 25 VDCW, temp coef, +30%,-80%.	
		CAPACITORS	C39	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef	
C1001	B19/5CBAB02902	Ceramic: 1000 pF +200%,-0%, 50 VDCW temp	and C40		±15%.	
C1002	B19/5CBAB02902	coef +20%,-55%. Ceramic: 1000 pF +200%,-0%, 50 VDCW temp	C45	B19/5CAAA03089	Ceramic: 12 pF $\pm$ 5% 500 VDCW, temp coef 060 PPM.	
C1004	B19/5NLAN00046	coef +20%,-55%. ( Used in 344A4572P5,P6) Ceramic: 1000 pF +50-20% 50 VDCW.	C46	B19/5CAAA03087	Ceramic: 5 pF 0.25 pF 500 VDCW, temp coef 060 PPM.	
		DIODE	C47	B19/5CAAA03103	Ceramic: 8 pF $\pm$ 0.5 pF 500 VDCW, temp coef 060 PPM.	
CD1001	B19/5TXAM00019	Silicon fwd current 3A, 200 PIV ;sim to MOTOROLA MR751, Used in 344A4572P3, P4)	C48	B19/5CAAA03086	Ceramic: 22 pF ±5% 500 VDCW, temp coef 060 PPM.	
		JACKS	C49	B19/5CAAA03089	Ceramic: 12 pF $\pm$ 5% 500 VDCW, temp coef 060 PPM	
J1001	B19/5JAAE01064	Connector: TNC-R888.	C50	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef	
J1002	B19/5JWAV00159	CCT9402-0501R.	thru		±15%.	
J1004	B19/5JWHA01075	2-171822-4.	C53			
J1004-1	B19/5JWHA01087	170204-4.	C54	B19/5CAAA03089	Ceramic: 12 pF ±5% 500 VDCW, temp coef 060	
thru J1004			C55	B19/5CAAA03087	Ceramic: 5 pF 0.25 pF 500 VDCW, temp coef 060	
		WIRES	C56	B19/5CAAA03415	Ceramic: 9 pF ±0.5 pF 500 VDCW, temp coef 060	
W1001	B19/2265100134	250V-HV-19/0.18-(1).	C57	B19/5CAAA03086	PPM.	
W1002	B19/2265100931	250V-HV-19/0.18-(9).	057	D13/30AA03080	PPM.	
W1003	B19/2265100234	250V-HV-19/0.18-(2).	C58	B19/5CAAA03093	Ceramic: 20 pF $\pm$ 5% 500 VDCW, temp coef 060	
W1004	B19/2265100034	250V-HV-19/0.18-(0).	C59	B19/5CAAA03139	PPM. Ceramic: 3 pF 0.25 pF 500 VDCW. temp coef 0120	
		COAXIAL CABLE	500	_ 10,00,00,00,00	PPM.	
ZC1002	B19/6ZCLD41060	H-6ZCLD41060			210250	
ZC1003	B19/6ZCLD40111	H-6ZCLD40111 (Used in 344A4572P5, P6)	000			
ZC1003	B19/6ZCLD40009	H-6ZCLD40009 (Used in 344A4572P3, P4)	thru C62	БТ9/30AAD00838	±15%.	

SYMBOL	EGE PART NO.	DESCRIPTION		SYMBOL	EGE PART NO.	DESCRIPTION
CD3	B19/6TXLD00001	PIN DIODE		R33	B19/5REAG03813	Metal film: 100 ohms ±5%, 250 VDCW 1W.
and				R34	B19/5RDAC02134	Metal film: 47K ohms ±5%, 200 VDCW 1/8W.
CD4	D40/5T74T00004			R35	B19/5REAG03813	Metal film: 100 ohms ±5%, 250 VDCW 1W.
CD7	B19/51ZA100084	BARISTOR: SIIII IO PANASONIC ERZ-CF2WR220		R36	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW 1/10W.
CDo	B19/51 XAM00019	Silicon: fast receivery (2 diades in asthede common):		RV1	B19/5RMAG00053	Variable: 10K ohms
CD9	B19/31XAD00290	sim to TOSHIBA 1SS184.				
CD10	B19/5TZAT00135	Silicon: Sim to PANASONIC MA741-TX.				
and				TR1	B19/5TDAR00027	Silicon, NPN: sim to PANASONIC 2SD1445A.
CD12	B10/5TYAD00320	Silicon: fact recovery - sim to TOSHIBA 188226		TR2	B19/5TDAB00054	Silicon, NPN sim to NEC 2SD596-11B DV3.
0015	D13/31777D00320			TR4	B19/51BAR00001	Silicon, PNP: SIM to PANASONIC 258953A.
		HYBRID CIRCUIT		TRO	B19/51DAB00054	Silicon, NPN: Sim to NEC 2SD596-11B DV3.
HC1	B19/5DHAA00049	RF Power Amplifier : sim to MITSUBISHI M67781L-38		TP7	B19/5TDAB00053	Silicon, NPN: sim to NEC 2SD506-T1B DV3.
HC1	B19/5DHAA00050	(Used in EA) RF Power Amplifier : sim to MITSUBISHI M67781H-38 (Used in EB)		TR8	B19/5TBAB00055	Silicon, PNP: sim to NEC 250590-115 DV3.
				<b>-</b> .		TRANSFORMER
101	B10/5DAAB00021	INTEGRATED CIRCUITS		11	B19/6LHLD00009	RF Trans.
101	B19/5DAAR00021	AN6541.				
IC2	B19/5DAAN00368	Linear: Positive Voltage Regulator; sim to NEW JRC NJM3404AM-T1.			CAH- CAH-	POWER CIRCUIT 515LA (Used in 344A4572P3) 515LB (Used in 344A4572P4)
		CONNECTORS			CAH-	515HA (Used in 344A4572P5) 515HP (Used in 344A4572P6)
J1	B19/5JAAA01450	Connector			CAII-	51511B (Useu ili 544A457210)
and J2			ΙC	SYMBOL	EGE PART NO	DESCRIPTION
J3	B19/5ZZPU00004	Connector		OTMBOL	LOET ANT NO.	
J4	B19/5JTCD00197	Connector				CAPACITORS
				C1	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef 015%.
		INDUCTORS		C2	B19/5CEAA01816	Electrolytic: 47 $\mu F$ $\pm 20\%~$ 25 VDCW, temp coef $\pm 20\%.$
L1	B19/5LAHA00023	Coil: 0.68 μH.		C3	B19/5CAAD01268	Ceramic: 0.1 µF +80,-20% 50 VDCW, temp coef +30,-
L2	B19/5LCAP00211	Coil: 1 μH.				80%.
L3	B19/6LLAD12029	RF Coll:		C4	B19/5CAAA03078	Ceramic: 120 pF ±5% 500 VDCW, temp coef 0±60 PPM (Used in LA LB)
L4	B19/6LLAD12039			C5	B19/5CAAA03131	Ceramic: 36 pE $\pm$ 5% 500 VDCW temp coef 0 $\pm$ 60 PPM
LO	B19/6LLAD12029	RF Coll:		00	210,00111100101	Used in LA)
17	B19/6LLAD12039	RF Coll:		C5	B19/5CAAA03081	Ceramic: 30 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM.
1.9	B19/6LLAD12029					Used in LB)
19	B19/5LCAP00231			C6	B19/5CAAA03123	Ceramic: 75 pF ±5% 500 VDCW, temp coet 0±60 PPM. Used in LA)
L10	B19/5LAHA00023	Coil: 0.68 µH		C6	B19/5CAAA03095	Ceramic: 56 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in LB)
		RESISTORS		C7	B19/5CAAA03959	Ceramic: 150 pF ±5% 500 VDCW, temp coef 0±60
R1	B19/5RDAC02471	Metal film: 470 ohms ±5%, 100 VDCW 1/10W.		C7	B10/5CAAA03078	Coromic: 120 pE $\pm$ 5% 500 VDCW/ tomp coof 0 $\pm$ 60
R2	B19/5REAG04134	Metal film: 12 ohms ±5%, 200 VDCW 1/4W.		07	B19/3CAA03070	PPM. (Used in LB)
R3 R4 and	B19/5RDAC02471 B19/5REAG04028	Metal film: 470 ohms ±5%, 100 VDCW 1/10W. Metal film: 22 ohms ±5%, 200 VDCW 1/2W.		C8	B19/5CAAA03092	Ceramic: 270 pF $\pm 5\%$ 500 VDCW, temp coef 0 $\pm 60$ PPM. (Used in LA)
R5				C8	B19/5CAAA03097	Ceramic: 220 pF ±5% 500 VDCW, temp coef 0±60 PPM. (Used in LB)
R14	B19/5RDAC02457	Metal film: 27K ohms $\pm$ 5%, 100 VDCW 1/10W.		C9	B19/5CAAA03092	Ceramic: 270 pF ±5% 500 VDCW. temp coef 0±60
R15	B19/5RDAC02476	Metal film: 2.7K ohms ±5%, 100 VDCW 1/10W.				PPM. (Used in LA)
R16	B19/5REAG03488	Metal film: 390 ohms $\pm$ 5%, 200 VDCW 1/4W.		C9	B19/5CAAA03097	Ceramic: 220 pF ±5% 500 VDCW, temp coef 0±60
R17	B19/5REAG03113	Metal film: 470 ohms ±5%, 200 VDCW 1/4W.		C10	D40/EOMADO4004	
R18	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW 1/10W.		010	B19/5CMAB01994	Mica; 1000 pF ±5% 500 VDCW. (Used in LA, LB)
R19 thru	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 200 VDCW 1/10W.		CII	B19/5CAAA03083	(Used in LA, LB) (Used in LA, LB)
R21				C12	B19/5CEAA00451	Electrolytic: 22 $\mu\text{F}$ ±20% 40 VDCW. (Used in LA, LB)
R22	B19/5RDAC02449	Metal film: 100k ohms $\pm$ 5%, 100 VDCW 1/10W.		C13	B19/5CAHA00046	Metal mica: 180 pF ±5% 100 VDCW. (Used in LA)
R23	B19/5RDAC02462	Metal film: 3.3K ohms $\pm$ 5%, 100 VDCW 1/10W.		C14	B19/5CAAA03095	Ceramic: 56 pF ±5% 500 VDCW, temp coef 0±60 PPM.
R24	B19/5RDAC02478	Metal film: 4.7K ohms $\pm$ 5%, 100 VDCW 1/10W.		a		(Used in LA, LB)
R25	B19/5RDAC02451	Metal film: 2.2K ohms $\pm$ 5%, 100 VDCW 1/10W.		C15	B19/5CAAA03140	Ceramic: 33 pF ±5% 500 VDCW, temp coef 0±60 PPM.
R26	B19/5RDAC02439	Metal film: 47K ohms ±5%, 100 VDCW 1/10W.		C15	B19/5CAAA03100	Ceramic: 39 pF ±5% 500 VDCW. temp coef 0+60 PPM
R27	B19/5RDAC02446	Metal film: 1K ohms $\pm$ 5%, 100 VDCW 1/10W.				(Used in HA).
R28	B19/5RXAE00094	Posistor: sim to MURATA PTH9M04BC222TS2F333.		C15	B19/5CAAA03079	Ceramic: 27 pF ±5% 500 VDCW, temp coef 0±60 PPM.
R29	B19/5RDAC02447	Metal film: 100 ohms ±5%, 100 VDCW 1/10W.		046	DANGOANAG	(Used in HB).
R32				C16	вт9/5СААА03078	Ceramic: 120 pF ±5% 500 VDCW, temp coet 0±60 PPM. (Used in LA, LB).

SYMBOL	EGE PART NO.	DESCRIPTION
C17	B19/5CAAA03095	Ceramic: 56 pF ±5% 500 VDCW, temp coef 0±60 PPM. (Used in HA).
C17	B19/5CAAA03090	Ceramic: 68 pF ±5% 500 VDCW, temp coef 0±60 PPM. (Used in HB).
C19	B19/5CAAA03961	Ceramic: 200 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA)
C19	B19/5CAAA04055	Ceramic: 180 pF $\pm 5\%$ 500 VDCW, temp coef 0 $\pm 60$ PPM. (Used in HB).
C20	B19/5CAAA03961	Ceramic: 200 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA)
C20	B19/5CAAA04055	Ceramic: 180 pF $\pm 5\%$ 500 VDCW, temp coef 0 $\pm 60$ PPM. (Used in HB)
C21 and C22	B19/5CAAA03090	Ceramic: 68 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA)
C21 and C22	B19/5CAAA03100	Ceramic: 39 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB).
C23 and C24	B19/5CAAA03091	Ceramic: 100 pF $\pm 5\%$ 500 VDCW, temp coef 0 $\pm 60$ PPM. (Used in HA)
C23 and C24	B19/5CAAA03258	Ceramic: 91 pF $\pm 5\%$ 500 VDCW, temp coef 0 $\pm 60$ PPM. (Used in HB)
C25 thru C28	B19/5CAAA03092	Ceramic: 270 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA)
C25	B19/5CAAA03097	Ceramic: 220 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HB)
C26 and C27	B19/5CAAA03961	Ceramic: 200 pF $\pm 5\%$ 500 VDCW, temp coef 0 $\pm 60$ PPM. (Used in HB)
C28	B19/5CAAA03097	Ceramic: 220 pF $\pm 5\%$ 500 VDCW, temp coef 0 $\pm 60$ PPM. (Used in HB)
C29	B19/5CAAA03131	Ceramic: 36 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA)
C29	B19/5CAAA03079	Ceramic: 27 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB)
C30	B19/5CEAA00451	Electrolytic: 22 $\mu F$ ±20% 40 VDCW. (Used in HA, HB)
C31	B19/5CAAA03083	Ceramic: 0.1 $\mu F$ $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$ (Used in HA, HB)
C32	B19/5CMAB01994	Mica: 1000 pF ±5% 500 VDCW. (Used in HA, HB)
C33 and C34	B19/5CMAB01252	Mica: 47 pF $\pm 5\%$ 500 VDCW. (Used in HA, HB)
C35 thru C38	B19/5CAHA00046	Metal mica: 180 pF $\pm 5\%$ 100 VDCW. (Used in HA)
C39 and C40	B19/5CAAA03140	Ceramic: 33 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA)
C39 and C40	B19/5CAAA03128	Ceramic: 4 pF 0.25 pF 500 VDCW, temp coef $0\pm60$ PPM. (Used in HB)
C41 and	B19/5CMAB01499	Mica: 270 pF $\pm 5\%$ 500 VDCW. (Used in HA)
C42 C41 and	B19/5CMAB01439	Mica: 120 pF $\pm 5\%$ 500 VDCW. (Used in HB)
C42 C43	B19/5CAAA03095	Ceramic: 56 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA)
C43	B19/5CAAA03100	Ceramic: 39 pF ±5% 500 VDCW, temp coef 0±60 PPM. (Used in HB)
C44	B19/5CAAA03140	Ceramic: 33 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA)
C44	B19/5CAAA03088	Ceramic: 24 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HB)
C45	B19/5CAAA03095	Ceramic: 56 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA)
C45	B19/5CAAA03100	Ceramic: 39 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB).
C46 C46	B19/5CMAB01475 B19/5CMAB01155	Mica: 33 pF ±5% 500 VDCW. (Used in HA). Mica: 27 pF ±5% 500 VDCW. (Used in HB)

SYMBOL	EGE PART NO.	DESCRIPTION
C47	B19/5CMAB01450	Mica: 220 pF ±5% 500 VDCW. (Used in HA, HB)
C48	B19/5CAAA03961	Ceramic: 200 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM.
C49	B19/5CAAA03084	Ceramic: 6 pF $\pm$ 0.5 pF 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA, HB)
C49	B19/5CAAA03087	Ceramic: 5 pF 2.5 pF 500 VDCW, temp coef 0±60 PPM. (Used in LA, LB)
C50	B19/5CAAA03101	Ceramic: 15 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA, LA)
C50	B19/5CAAA03089	Ceramic: 12 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HB, LB)
C51	B19/5CAAA03086	Ceramic: 22 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA, LA).
C51	B19/5CAAA03093	Ceramic: 20 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB, LB)
C52	B19/5CAAA03087	Ceramic: 5 pF 0.25 pF 500 VDCW, temp coef 0±60 PPM (Used in HA, LA)
C52	B19/5CAAA03128	Ceramic: 4 pF 0.25 pF 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HB, LB)
C53	B19/5CAAA03088	Ceramic: 24 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA, LA)
C53	B19/5CAAA03093	Ceramic: 20 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB, LB)
C54	B19/5CAAA03087	Ceramic: 5 pF 0.25 pF 500 VDCW, temp coef 0 $\pm$ 60 PPM. (Used in HA, LA)
C54	B19/5CAAA03128	Ceramic: 4 pF 0.25 pF 500 VDCW, temp coef $0\pm60$ PPM. (Used in HB, LB).
C55	B19/5CAAA03088	Ceramic: 24 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA, LA).
C55	B19/5CAAA03093	Ceramic: 20 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB, LB).
C56	B19/5CAAA03094	Ceramic: 10 pF $\pm 0.5$ pF 500 VDCW, temp coef 0±60 PPM. (Used in HA, LA).
C56	B19/5CAAA03103	Ceramic: 8 pF $\pm 0.5$ pF 500 VDCW, temp coef 0±60 PPM. (Used in HB, LB).
C57	B19/5CAAA03093	Ceramic: 20 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA).
C57	B19/5CAAA03085	Ceramic: 18 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in LA).
C57	B19/5CAAA03101	Ceramic: 15 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB, LB)
C58	B19/5CAAA03080	Ceramic: 47 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HA).
C58	B19/5CAAA03140	Ceramic: 33 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in HB, LA).
C58	B19/5CAAA03079	Ceramic: 27 pF $\pm 5\%$ 500 VDCW, temp coef 0±60 PPM. (Used in LB).
C59	B19/5CAAD00840	Ceramic: 22 pF $\pm 5\%$ 50 VDCW, temp coef 0±30 PPM. (Used in HA)
C59	B19/5CAAD00950	Ceramic: 15 pF $\pm 5\%$ 50 VDCW, temp coef 0±30 PPM. (Used in LA, HB).
C59	B19/5CAAD00968	Ceramic: 12 pF $\pm 5\%$ 50 VDCW, temp coef 0±30 PPM. (Used in ,LB).
C60 C61	B19/5CAAD00838 B19/5CAAD00964	Ceramic: 1000 pF $\pm$ 10% 50 VDCW, temp coef 015%. Ceramic: 8 pF $\pm$ 0.5 pF 50 VDCW, temp coef 30 PPM.
C61	B19/5CAAD00840	(Used in HB) Ceramic: 22 pF ±5% 500 VDCW, temp coef 0±30 PPM.
C62	B19/5CAAD00948	(Used in LA, LB). Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C62	B19/5CAAD00840	(Used in HA). Ceramic: 22 pF ±5% 500 VDCW, temp coef 0±30 PPM.
and C63		
C63	B19/5CAAD00952	Ceramic: 27 pF ±5% 50 VDCW, temp coef 0±30 PPM. (Used in HA, LA). C63
	B19/5CAAD00948	Ceramic: 33 pF $\pm$ 5% 50 VDCW, temp coef 0 $\pm$ 30 PPM. (Used in LB).
C65	B19/5CAAD00838	Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef 015%.
C66	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef 015%.
		(2004 11 1 11 1, 1 12).
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# PARTS LIST

SYMBOL	EGE PART NO.	DESCRIPTION
C67	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef
C68 and C69	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef 015%. (Used in HA, HB).
C68	B19/5CAAD00838	Ceramic: 1000 pF $\pm$ 10% 50 VDCW, temp coef 015%. (Used in LA, LB).
C70	B19/5CAAA03082	Ceramic: 1000 pF ±10% 500 VDCW, temp coef ±15%. (Used in HA, HB).
C70	B19/5CAAD00838	Ceramic: 1000 pF $\pm$ 10% 50 VDCW, temp coef 015%. (Used in LA, LB).
C71 and C72	B19/5CAAD00838	Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef 015%.
C73	B19/5CAAD01078	Ceramic: 0.1 µF +80,-20% 25 VDCW, temp coef +30,-80%.
C74	B19/5CAAD00838	Ceramic: 1000 pF $\pm$ 10% 50 VDCW, temp coef 015%.
C75	B19/5CEAA02249	Electrolytic: 1 µF ±20% 16 VDCW.
C76	B19/5CAAD00838	Ceramic: 1000 pF ±10% 50 VDCW, temp coef
C77	B19/5CEAA01786	015%. Electrolytic: 220 $\mu$ F ±20% 25 VDCW, temp coef
C77	B19/5CEAA01816	$\pm$ 20%. (Used in HA, HB). Electrolytic: 47 µF $\pm$ 20% 25 VDCW, temp coef
C78	B19/5CSAC01409	$\pm 20\%$ . (Used in LA, LB). Tantalum: 4.7 $\mu F \pm 10\%$ 16 VDCW.
C79	B19/5CAAD01268	Ceramic: 0.1 µF +80,-20% 50 VDCW, temp coef +30,-80%.
C80	B19/5CEAA02283	Electrolytic: 33 µF ±20% 25 VDCW.
C86	B19/5CAAA03082	Ceramic: 1000 pF $\pm$ 10% 500 VDCW, temp coef $\pm$ 15%. (Used in HA, HB).
C87	B19/5CEAA02283	Electrolytic: 33 $\mu F$ $\pm 20\%$ 25 VDCW. (Used in HA, HB).
C88	B19/5CAAA03082	Ceramic: 1000 pF $\pm 10\%$ 500 VDCW, temp coef $\pm 15\%$ (Used in HA, HB).
C89	B19/5CEAA01816	Electrolytic: 47 $\mu\text{F}$ ±20% 25 VDCW.
C90	B19/5CSAC00932	Tantalum: 10 $\mu F$ ±10% 16 VDCW.
C91 and C94	B19/5CAAD00838	Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef 015%.
C95	B19/5CAAA03137	Ceramic: 1 pF 0.25 pF 500 VDCW, temp coef 0250 PPM. (Used in HA, HB).
C95	B19/5CAAA03139	Ceramic: 3 pF 0.25 pF 500 VDCW, temp coef 0120 PPM. (Used in LA, LB).
C158	B19/5CAAD00957	Ceramic: 4700 pF $\pm 10\%$ 50 VDCW, temp coef 015%.
C159	B19/5CMAB01252	Mica: 47 pF $\pm 5\%$ 500 VDCW. (Used in LA, LB).
C160 and C161	B19/5CAAD00838	Ceramic: 1000 pF $\pm$ 10% 50 VDCW, temp coef 015%. (Used in LA, LB).
C165	B19/5CAAD00838	Ceramic: 1000 pF $\pm$ 10% 50 VDCW, temp coef 015%. (Used in LA, LB).
C166 and	B19/5CAHA00046	Metal mica: 180 pF $\pm 5\%$ 100 VDCW. (Used in LA).
C168 C166 and	B19/5CAHA00047	Metal mica: 150 pF $\pm 5\%$ 100 VDCW. (Used in LB).
C168 C169 thru C172	B19/5CAHA00047	Metal mica: 150 pF $\pm 5\%$ 100 VDCW. (Used in HB).
C172 C173	B19/5CAAA03101	Ceramic: 15 pF ±5% 500 VDCW, temp coef 0±60
C174 and C175	B19/5CAAA03140	Ceramic: 33 pF ±5% 500 VDCW, temp coef 0±60 PPM. (Used in HB).
C177	B19/5CAAA03961	Ceramic: 200 pF $\pm$ 5% 500 VDCW, temp coef 0 $\pm$ 60 PPM.
C178	B19/5CAAD00838	Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef 015%. (Used in HA, HB).
0.01		DIODES
CD1	B19/61XLD00001	Pin Diode. (Used in LA, LB).

SYMBOL	EGE PART NO.	DESCRIPTION
CD2	B19/6AZLD00001	Pin Diode. (Used in HA, HB).
CD3	B19/6TXLD00001	Pin Diode
CD4	B19/6TXLD00001	Pin Diode (Used in HA, HB).
CD5	B19/6TXLD00001	Pin Diode
CD6	B19/5TXAD00319	Diode: optoelectronic, red sim to TOSHIBA 1SS154.
and		(Used in LA, LB)
CD7		
and	B19/51XAD00137	Diode: optoelectronic, red sim to PANASONIC MA741WK. (Used in HA. HB).
CD7		
CD9	B19/5TXAD00290	Silicon: fast recovery (2 diodes in cathode com-
0040		mon); sim to TOSHIBA 155184.
CD10	B19/51XAM00019	Didde: sim to MR751 (Used in HA, HB).
CD12	B19/512DL00012	Ceramic valision, sim to HORORIKO 222R-10D.
and	B19/31XAR00004	SUBISHI MI301.
CD13		
		INTEGRATED CIRCUITS
IC1	B19/5DAAR00021	Linear: Positive Voltage Regulator: sim to PANA-
101	B10/0B/04/00021	SONIC AN6541.
IC2	B19/5DAAN00368	Linear: OP AMP
		0010/0707020
10		CONNECTORS
J3	B19/5JTCW00060	Connector.
J4	B19/511CD00197	Connector.
		POWER MODULES
HC1	B19/5DHAA00049	M67781L-38. (Used in HA).
HC1	B19/5DHAA00050	M67781H-38. (Used in HB).
HC1	B19/5DHAA00051	M57719M-38. (Used in LA).
HC1	B19/5DHAA00052	M57719-38. (Used in LB).
		NELIOTOPO
14	D40/011 AD42024	INDUCTORS
	B19/6LLAD12024	Coll: RF (Used in LA, LB).
	B19/6LLAD20630	Coll: RF (Used in LA).
1.2	B19/6LLAD20640	Coll: RF (Used in LB).
13	B19/6LLAD20000	Coil: RF (Used in LR).
14	B19/6LLAD20040	Coil: RF (Used in LA)
14	B19/6LLAD12023	Coil: RF (Used in LR)
15	B19/6LLAD16016	Coil: RF (Used in LA LB)
L6	B19/6LLAD12016	Coil: RF (Used in LA, LB).
 L7	B19/6LLAD13013	Coil: RF (Used in HA, HB).
L8	B19/6LLAD12013	Coil: RF (Used in HA, HB).
L9	B19/6LLAD20640	Coil: RF (Used in HA).
thru		
L12		
L9 and	B19/6LLAD20630	Coll: RF (Used In HB).
L10		
L11	B19/6LLAD20670	Coil: RF (Used in HB).
and L12		
L13	B19/6LLAD12014	Coil: RF (Used in HA).
L13	B19/6LLAD12013	Coil: RF (Used in HB).
L14	B19/6LLAD13014	Coil: RF (Used in HA).
L14	B19/6LLAD13013	Coil: RF (Used in HB).
L15	B19/6LLAD16116	Coil: RF (Used in HA, HB).
L16	B19/6LLAD16016	Coil: RF (Used in HA, HB).
L17	B19/6LLAD12016	Coil: RF (Used in HA, HB).
L18	B19/6LLAD13016	Coil: RF (Used in HA, HB).
L19	B19/6LLAD21115	Coil: RF(Used in HA).
L19	B19/6LLAD21112	Coil: RF
L20	B19/6LLAD13127	Coil: RF

# PARTS LIST

SYMBOL	EGE PART NO.	DESCRIPTION
L21	B19/6LLAD13138	Coil: RF
and		
L22	Diala LADIANA	0.11.05
L23	B19/6LLAD13139	
L24	B19/6LLAD13047	
L25	B19/6LLAD12047	Coll: RF (Used in HA, HB).
L20	B19/6LLAD13047	Coll: R (Used in LA, LB).F
and	B19/0LLAD15051	
L27		
L26	B19/5LCAP00315	Coil: RF (Used in LA).
L26	B19/5LCAP00298	Coil: RF (Used in LB).
L28	B19/6LLAD14096	Coil: RF (Used in HA, HB).
L28	B19/5LCAC01411	Coil: RF 1H ±10%. (Used in LA, LB).
L29	B19/5LAHA00023	
L30	B19/5LCAC01413	Coil: RF 0.68 H ±10%. (Used in HA, HB).
L30	B19/5LCAC01412	Coll: RF 1.2 H $\pm$ 10%. (Used in LA, LB).
L32	B19/6LLAD12025	Coll: RF (Used in HA).
LJZ	B19/0LLAD12020	Coll. RF (Osed III HB).
		COAXIAL CABLES
P1	B19/6JJLD16150	Coaxial cable with connector. (Used in HA, HB).
P1	B19/6JJLD16120	Coaxial cable with connector. (Used in LA, LB).
P2	B19/6JJLD19150	Coaxial cable with connector. (Used in HA, HB).
P2	B19/6JJLD19120	Coaxial cable with connector. (Used in LA, LB).
		PESISTOPS
R1	B19/5RDAC02/65	Metal film: 22 obms +5% 100 VDCW 1/10W
R2	B19/5RDAC02546	Metal film: 22 ohms ±5%, 100 VDCW 1/10W
R3	B19/5RDAC02491	Metal film: 390 ohms ±5% 100 VDCW 1/10W
and	210,0102101	
R4		
K5	B19/5REAG03811	LA, LB).
R6	B19/5REAG03811	Metal film: 1.5 ohms ±5%, 250 VDCW 1W. (Used
and		in HA, HB).
	B10/5PEAC03762	Motal film: 24 abms +5% 250 VDCW 2W (Used in
IX0	B19/31(EAG03702	HA, HB).
R9	B19/5REAG03207	Metal film: 18 ohms $\pm$ 5%, 350 VDCW 3W. (Used in
		HA).
R9	B19/5REAG02318	Metal film: 22 ohms ±5%, 350 VDCW 3W. (Used in HB)
R11	B19/5RDAC02554	Metal film: 120 ohms ±5%, 100 VDCW 1/10W.
thru		(Used in HA, HB).
R14		
R11	B19/5RDAC02547	Metal film: 51 onms ±5%, 100 VDCW 1/10W. (Used in LA, LB).
R13	B19/5RDAC02579	Metal film: 56 ohms ±5%, 100 VDCW 1/10W. (Use
		in LA, LB).
R15	B19/5REAG03812	Metal film: 120 ohms ±5%, 250 VDCW 1W. (Used in HA HB)
R16		ппа, пр).
R15	B19/5REAG03418	Metal film: 180 ohms $\pm$ 5%, 250 VDCW 1W. (Used
and R16		in LA, LB).
R18	B19/5REAG03760	Metal film: 47K ohms ±5% 200 VDCW 1/4W
R19	B19/5RDAC02447	Metal film: 100 ohms ±5%. 100 VDCW 1/10W
R20	B19/5RDAC02458	Metal film: 6.8K ohms ±5%, 100 VDCW 1/10W.
		(Used in HA, HB).
R20	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW 1/10W.
R20		(USEU III LA). Metal film: 2 7K ohms +5% 100 \/DC\// 1/10\//
RZU	D19/3RDAG02476	(Used in LB).
R21	B19/5RDAC02478	Metal film: 4.7K ohms ±5%, 100 VDCW 1/10W.
R22	B19/5RDAC02454	Metal film: 22K ohms ±5%, 100 VDCW 1/10W.
R23	B19/5RDAC02439	Metal film: 47K ohms $\pm$ 5%, 100 VDCW 1/10W.
R24	B19/5RDAC02446	Metal film: 1K ohms $\pm$ 5%, 100 VDCW 1/10W.
I		

SYMBOL	EGE PART NO.	DESCRIPTION
R25	B19/5RDAC02482	Metal film: 18K ohms $\pm$ 5%, 100 VDCW 1/10W. Used in HA, HB).
R25	B19/5RDAC02454	Metal film: 22K ohms $\pm$ 5%, 100 VDCW 1/10W. (Used in LA, LB).
R26	B19/5RDAC02457	Metal film: 27K ohms $\pm$ 5%, 100 VDCW 1/10W.
R27	B19/5RDAC02451	Metal film: 2.2K ohms ±5%, 100 VDCW 1/10W.
and R28		(Used in HA, HB).
R27	B19/5RDAC02452	Metal film: 5.6K ohms $\pm$ 5%, 100 VDCW 1/10W. (Used in LA, LB).
R28	B19/5RDAC02474	Metal film: 1.5K ohms $\pm$ 5%, 100 VDCW 1/10W. (Used in LA, LB).
R29	B19/5RDAC02474	Metal film: 1.5K ohms $\pm$ 5%, 200 VDCW 1/10W. (Used in HA, HB).
R29	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW 1/10W. (Used in LA, LB).
R30	B19/5RDAC02445	Metal film: 10K ohms ±5%, 100 VDCW 1/10W.
R31	B19/5RXAE00087	Posistor: PTH9M04BE222TS2F333.
R32 and R33	B19/5RDAC02542	Metal film: 820 ohms $\pm 5\%,100$ VDCW 1/10W.
R34 and R35	B19/5RDAC02471	Metal film: 470 ohms $\pm$ 5%, 100 VDCW 1/10W. (Used in HA, HB).
R34 and R35	B19/5RDAC02542	Metal film: 820 ohms $\pm 5\%,$ 100 VDCW 1/10W. (Used in LA, LB).
R36	B19/5RDAC02204	Metal film: 5.6 ohms $\pm 5\%$ , 100 VDCW 1/8W. (Used in HA, HB).
R36	B19/5RDAC02146	Metal film: 18 ohms $\pm 5\%$ , 100 VDCW 1/8W. (Used in LA, LB).
R50	B19/5RDAC02462	Metal film: 3.3K ohms ±5%, 100 VDCW 1/10W.
R51	B19/5REAG04144	Metal film: 750 ohms ±5%, 200 VDCW 1/4W.
R52	B19/5RDAC02479	Metal film: 8.2K ohms ±5%, 100 VDCW 1/10W. (Used in LA, LB).
R53	B19/5RDAC02446	Metal film: 1K ohms ±5%, 100 VDCW 1/10W. (Used in LA, LB).
R55	B19/5RDAC02449	Metal film: 100K ohms $\pm 5\%,100$ VDCW 1/10W.
RV2	B19/5RVAB00421	Variable: 10K ohms.
		TRANSISTORS
TR1	B19/5TCAF00510	Silicon, NPN: TOSHIBA 2SC2782. (Used in LA, LB).
TR2	B19/5TCAF00510	Silicon, NPN: TOSHIBA 2SC2782. (Used in HA,
and		HB).
TR3		
TR4	B19/51DAB00054	Silicon, PNP: sim to NEC 25B/D596-11B BV3.
TR5	B19/51BAR00001	Silicon PNP: sim to PANASONIC 2SB953A.
	B19/51DAB00054	Silicon, PNP: sim to NEC 25B/D596-11B BV3.
IR7	B19/51DAR00028	Silicon NPN: sim to PANASONIC 2SD1445A-Q. (Used in HA, HB)
TR7	B19/5TDAR00012	Silicon NPN: sim to PANASONIC 2SD1271-A. (Used in LA, LB).
TR8	B19/5TBAB00055	Silicon PNP: sim to NEC 2SB624-T1B BV3.
TR5-1 and TR7-1	B19/5JTGH00003	Accessory (Used in HA, HB).
		WIRE
W1	B19/6LLAD18733	Jumper wire: (Used in HA, HB).

# $\Delta$ COMPONENT IDENTIFICATION CHART

### 50 Watt Power Amplifier

PART	CAH-515LA 136 - 153 MHz	CAH-515LB 150 - 173 MHz	PART
PART C5 C6 C7 C8 C9 C13 C50 C51 C52 C53 C54 C55 C56 C55 C56 C57 C58 C59 C63 C166 C168 C168 C173 L2	CAH-515LA 136 - 153 MHz 36 pF 75 pF 150 pF 270 pF 270 pF 180 pF 22 pF 5 pF 24 pF 24 pF 24 pF 10 pF 18 pF 33 pF 15 pF 27 pF 180 pF 180 pF 180 pF 180 pF	CAH-515LB 150 - 173 MHz 30 pF 56 pF 120 pF 220 pF 220 pF 20 pF 4 pF 20 pF 4 pF 20 pF 4 pF 20 pF 8 pF 15 pF 27 pF 12 pF 15 pF 27 pF 15 pF 27 pF 15 pF	PART C15 C17 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C35 C36 C37 C38 C39 C40 C41 C42
C173 L2 L3 L4 L26 R20 HC1	15 pF 6LALD20630 6LALD20680 6LALD12025 64 nH 3.3 k Ω M57719M-38	- 6LALD20640 6LALD20640 5LALD12024 56 nH 2.7 k Ω M57719M-38	C41 C42 C43 C44 C45 C46 C51

#### (MADE FROM DD00-CAH-515L 2/2)

# $\Delta$ COMPONENT IDENTIFICATION CHART

# 110 Watt Power Amplifier

CAH-515HA	CAH-515HB
136 - 153 MHz	150 - 173 MHz
39 pF         56 pF         200 pF         200 pF         200 pF         200 pF         68 pF         100 pF         270 pF         33 pF         20 pF         5 pF         24 pF         10 pF         20 pF         33 pF         37 pF         20 pF         37 pF         20 pF         33 pF         27 pF         -         -         -         -         -         -         -         -	27 pF 68 pF 180 pF 180 pF 39 pF 39 pF 91 pF 220 pF 220 pF 220 pF 220 pF 27 pF 7 4 pF 4 pF 120 pF 120 pF 120 pF 120 pF 24 pF 20 pF 20 pF 20 pF 25 pF 20 pF 33 pF 15 pF 33 pF 15 pF 33 pF 15 pF 33 pF 15 0 pF 150 pF 150 pF 150 pF 150 pF 150 pF 150 pF 150 pF 150 pF 150 pF 150

(MADE FROM DD00-CAH-515H 2/2)

#### INTERCONNECTION DIAGRAM





EUROPEAN VHF PA UNIT (DD00-JHM-271PE)

### LBI-39002

### VHF PA UNIT (DD00-JHM-271PL/H)

**COMPONENT SIDE** 



SOLDER SIDE



# 25 Watt Power Amplifier CAH-515E

(B19/6PCLD00287B, Component Side Layout) (B19/6PCLD00287B, Chip Components) (B19/6PCLD00287B, Component Side) (B19/6PCLD00287B, Solder Side)

### **OUTLINE DIAGRAM**





**COMPONENT SIDE** 



# LBI-39002

### **50 Watt Power Amplifier CAH-515L**

(B19/6PCLD00325A, Component Side Layout) (B19/6PCLD00325A, Chip Components) (B19/6PCLD00325A, Component Side) (B19/6PCLD00325A, Solder Side)





# 110 Watt Power Amplifier CAH-515H

(B19/6PCLD00279C, Component Side Layout) (B19/6PCLD00279C, Chip Components) (B19/6PCLD00279C, Component Side) (B19/6PCLD00279C, Solder Side)



NOTES 1. "#"IDENTIFIES CHIP COMPONENTS (EXAMPLE #A12 OF R12#)WHICH ARE LOCATED ON THE COMPONENT SIDE OF THE BOARD 2. Z1. Z2 AND Z3 ARE STRIPLINE PART OF PWB. 3. RV1 IS FACTORY TUNED AND DOES NOT REQUIRE FURTHER ADJUSTMENT. ALL RESISTORS ARE 1/10 OR 1/9 WATT UNLESS OTHERWISE SPECIFIED. RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M. CAPACITOR VALUES IN P UNLESS FOLLOWED BY MULTIPLIER M ORM . INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER M ORM .

DC VOLTAGE READINGS

<u>JC VOLTAGES ARE TYPICAL</u>, VOLTAGES ARE MEASURED WITH A 10Meg OHM PER VOLT METER, REFEAENCE TO GROUND. VOLTAGE READINGS ARE TAKEN WITH THE TRANSMITTER UNKEYED/KEYED, EX .45 (UNKEYED) / .05 (KEYED).

#### LBI-39002

**25 Watt Power Amplifier CAH-515E** (DD00-CAH-515E)



CAPACITOR VALUES IN P UNLESS FOLLWED BY MULTIPLIER N

INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OF u .

**50 Watt Power Amplifier CAH-515L** (DD00-CAH-515L 1/2)



**110 Watt Power Amplifier CAH-515H** (DD00-CAH-515H 1/2)