ICOM

SERVICE MANUAL

HF+50 MHz AUTOMATIC ANTENNA TUNER

AH-4

Icom Inc.

INTRODUCTION

This service manual describes the latest service information for the **AH-4** HF+50 MHz AUTOMATIC ANTENNA TUNER at the time of publication.

To upgrade quality, any electrical or mechanical parts and internal circuits are subject to change without notice or obligation.

DANGER

NEVER connect the antenna tuner to an AC outlet or to a DC power supply that uses more than 16 V. This will ruin the antenna tuner.

DO NOT expose the antenna tuner to rain, snow or any liquids.

DO NOT reverse the polarities of the power supply when connecting the antenna tuner.

ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:

1. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

<SAMPLE ORDER>

1110001590	IC	TA 75393F	AH-4	TUNER	1 pieces
8810003160	Screw	M3 x 8	AH-4	TUNER	10 pieces

Addresses are provided on the inside back cover for your convenience.

REPAIR NOTES

1. Make sure a problem is internal before disassembling the antenna tuner.
2. **DO NOT** open the antenna tuner until the antenna tuner is disconnected from its power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated tuning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the antenna tuner is defective.
6. **READ** the instructions of test equipment thoroughly before connecting equipment to the antenna tuner.

TABLE OF CONTENTS

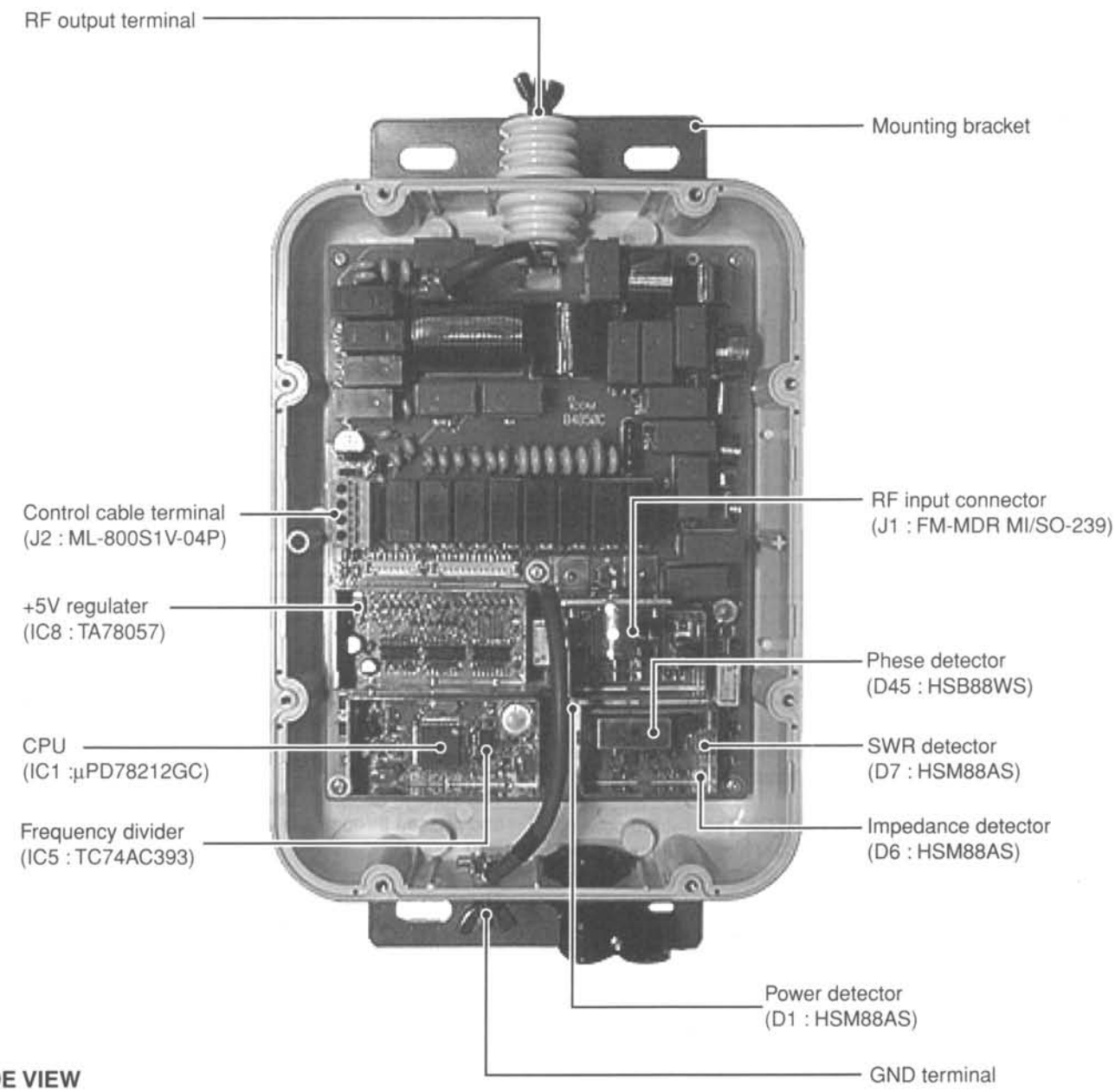
SECTION 1 SPECIFICATIONS

• Number of memory channels	: 45
• Frequency range	: 3.5 MHz to 54 MHz (with a 7 m; 23 ft or longer wire antenna) 7.0 MHz to 54 MHz (with an optional AH-2b)
• Maximum input power	: 120 W PEP
• Input impedance	: 50 Ω
• Automatic tuning power	: 10 W (5 to 15 W)
• Automatic tuning time	:
General	Approx. 2 to 3 sec. (max. 15 sec.)
Returning to a memorized frequency	Approx. 1 sec.
• Automatic tuning accuracy (VSWR)	: Less than 2.0 : 1 (after tuning; except for multiples of ½ λ antenna length)
• Antenna required	: Marconi-type with suitable RF ground (More than 7 m (23 ft) is suggested)
• Power supply required	: DC 13.8 V ± 15 % (negative ground)
• Current drain	: Less than 1 A
• Usable temperature range	: –10°C to +60°C; –14°F to +140°F
• Dimensions (projections not included)	: 172(W) × 71(H) × 230(D) mm 6 25/32(W) × 2 25/32(H) × 9 1/16(D) in
• Case construction	: Weatherproof
• Weight	: 1.2 kg; 2 lb 10 oz

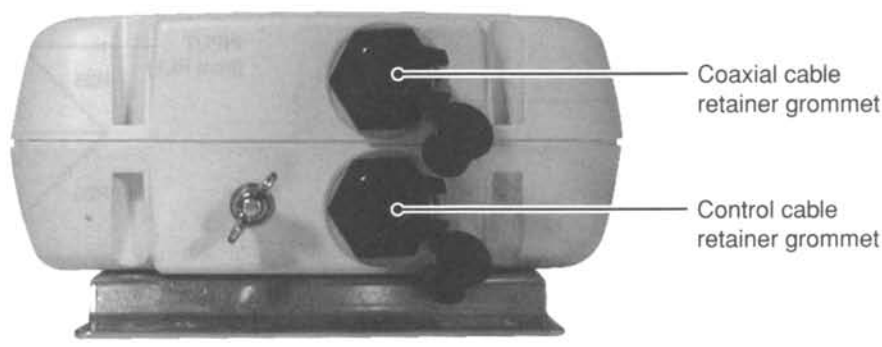
All stated specifications are subject to change without notice or obligation.

SECTION 2 INSIDE VIEWS

• TOP VIEW



• SIDE VIEW



SECTION 3 CIRCUIT DESCRIPTION

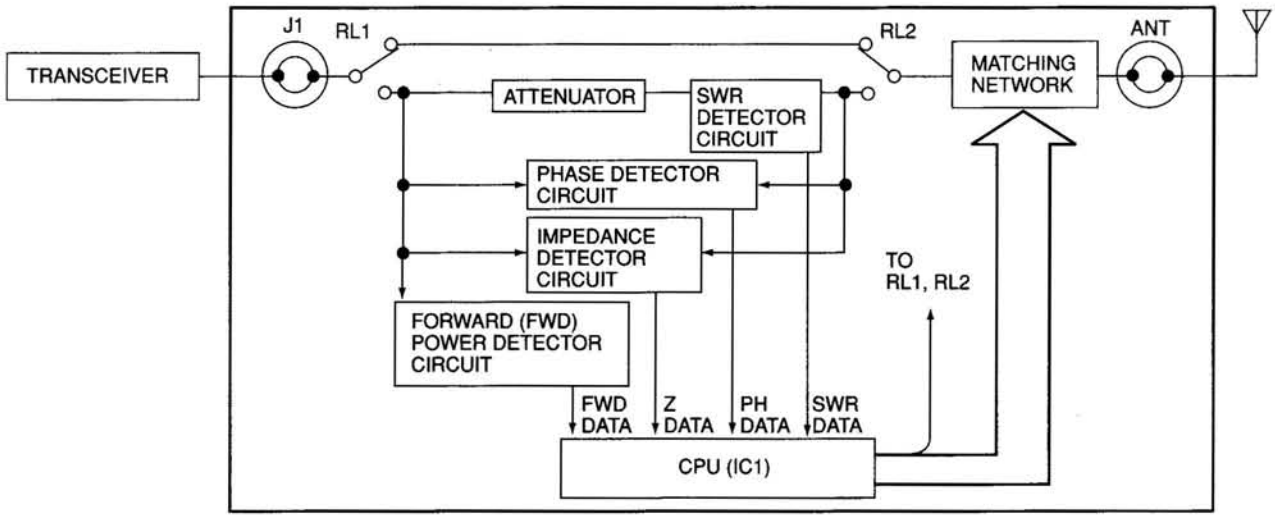
3-1 GENERAL

An 8-bit microprocessor controls the AH-4. The tuner matches the antenna system to the transceiver by using four kinds of detector circuits. These circuits are:

(1) FORWARD POWER DETECTOR
(2) SWR DETECTOR
(3) PHASE DETECTOR
(4) IMPEDANCE DETECTOR

Detailed descriptions of each circuit follows.

• General



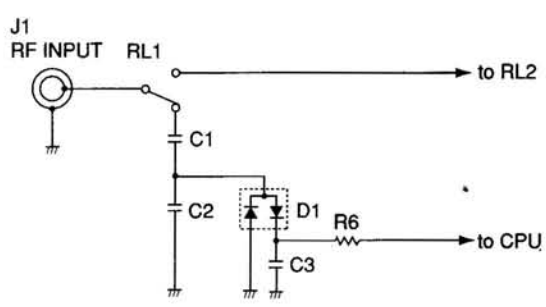
3-2 FORWARD (FWD) POWER DETECTOR CIRCUIT

This circuit ensures the input power from the transceiver is low enough to be handled by the attenuator within the tuner.

The input power is divided by C1 and C2. The divided power is detected at FWD power detector (D1) as the RF input current. The detected voltage is applied to an analog input port of the CPU (IC1, pin 49)

When the input power is an appropriate power (about 10 W or less), the CPU allows tuning function, otherwise the CPU does not respond.

• Forward power detector circuit



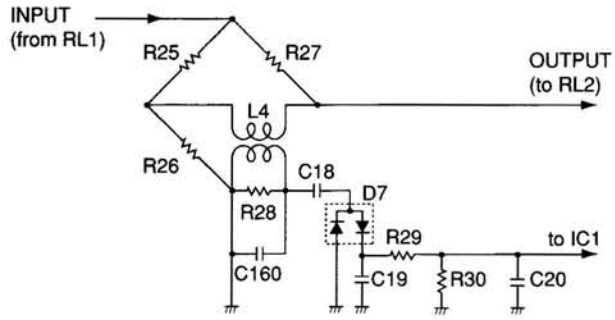
3-3 SWR DETECTOR CIRCUIT

The reflected power from the antenna system provides a detection voltage.

The voltage doubler, consisting of D7, rectifies this voltage and passes through the voltage divider formed by R29 and R30.

These SWR data from voltage divider feed into the CPU (IC1). The CPU controls the setting of the coils and capacitors in the matching network.

• SWR detector circuit

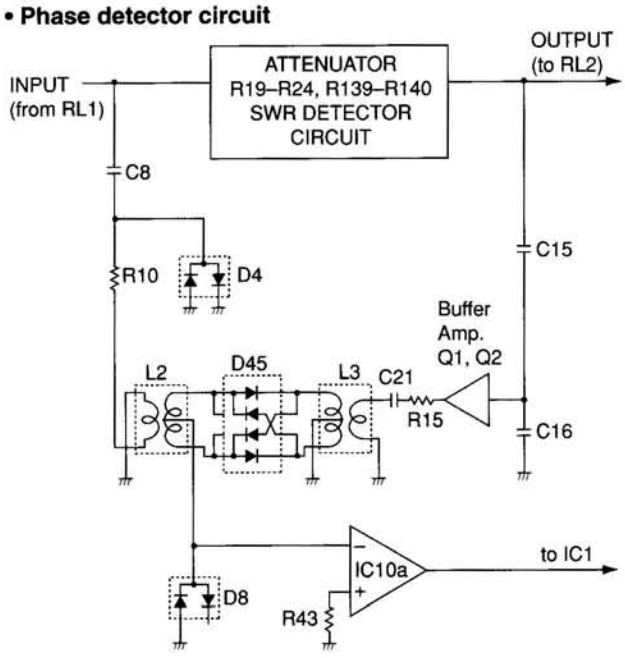


3-4 PHASE DETECTOR CIRCUIT

This circuit consists of L2, L3 and D45. The phase detector's purpose is to detect reactance components and provide a pure resistance.

The output of D45 is a reference voltage of approximately 4 V when the load of L3 is a pure resistance with no reactance. An inductive load produces an output voltage from D45 which is lower than the reference voltage, whereas, a capacitive load produces an output voltage higher than the reference voltage. The output voltage is applied to the comparator (IC10a).

• Phase detector circuit



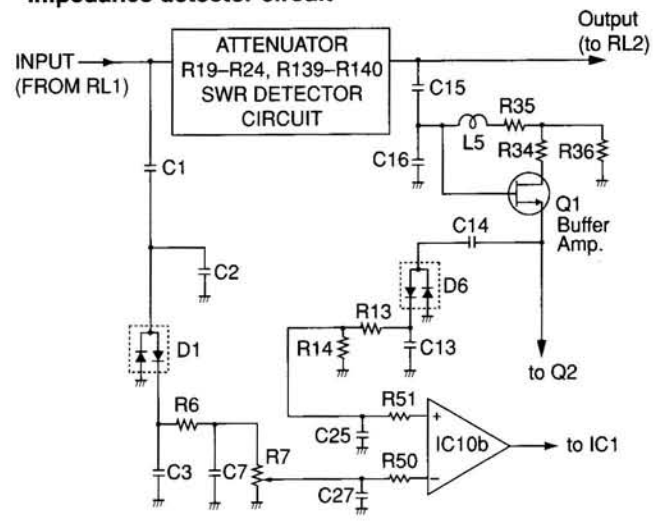
3-5 IMPEDANCE DETECTOR CIRCUIT

The tuner uses an attenuator to reduce the transmit power to a very low level. The low power minimizes the risk of interference to other stations while matching an antenna to the transmitter.

The VSWR at the input terminal is usually close to 1:1 even with a large change of impedance at the attenuator output due to the 16 dB of isolation between the input and the matching network.

The circuit uses the constant voltage from voltage divider (D7) on the TUNER unit as a reference. If the impedance of the attenuator output is higher than 50 Ω, the voltage which is detected at impedance detector (D6) via the buffer amplifier (Q1) is HIGH level. If the impedance is lower than 50 Ω, the voltage is LOW level. Both the reference and detected voltages feed to the comparator (IC10b).

• Impedance detector circuit



3-6 LOGIC CIRCUIT

IC1, the CPU, controls the antenna matching network. The CPU receives +5V through the CPU controller (Q4) when DC power is applied to the tuner. This voltage initializes the CPU. The stored program in the CPU (IC1) sets each relay to the initial condition.

The tuning program begins only if the START line is at LOW level. RL1 and RL2 activate when RF power at the input antenna connector from the transceiver is present at an appropriate level (See Section 3-1).

The data from the previously described detectors (input RF power, reflected RF power, phase difference, impedance difference) feed into the CPU. The coil data is then applied to IC4, the capacitor data to IC3 and the control data to IC2 according to the tuning program.

The CPU halts when all of the above procedures are complete. The CPU oscillator also stops to avoid causing interference to the receiver.

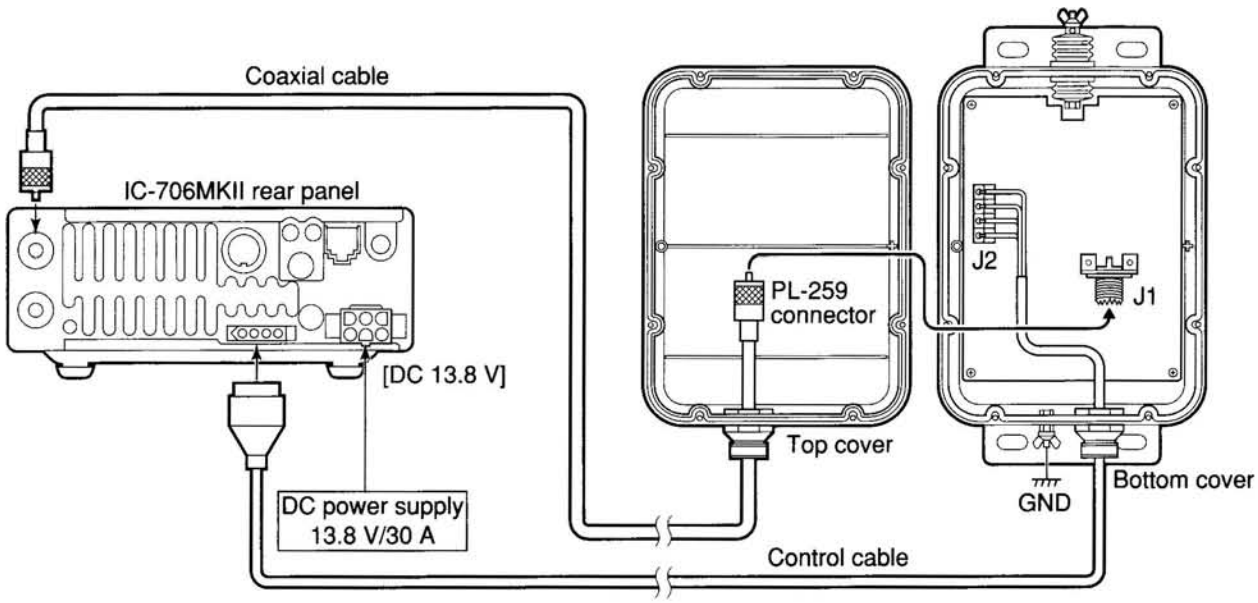
SECTION 4 ADJUSTMENT PROCEDURES

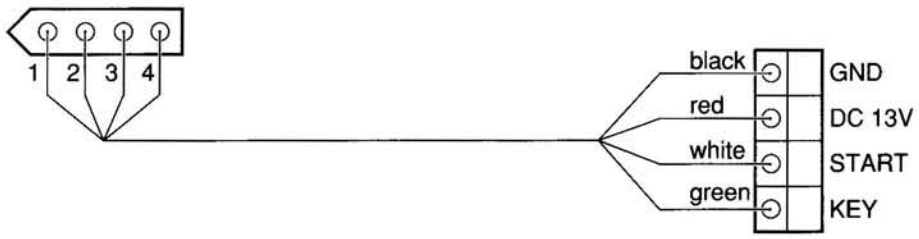
4-1 PREPARATION

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.8 V DC Current capacity : 30 A or more	Frequency counter	Frequency range : 0.1–100 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better
DC voltmeter	Measuring range : 50 kΩ/V DC or better	Transceiver	: IC-706MKII, IC-746 or IC-756
Oscilloscope	Frequency range : DC–20 MHz Measuring range : 0.01–10 V		

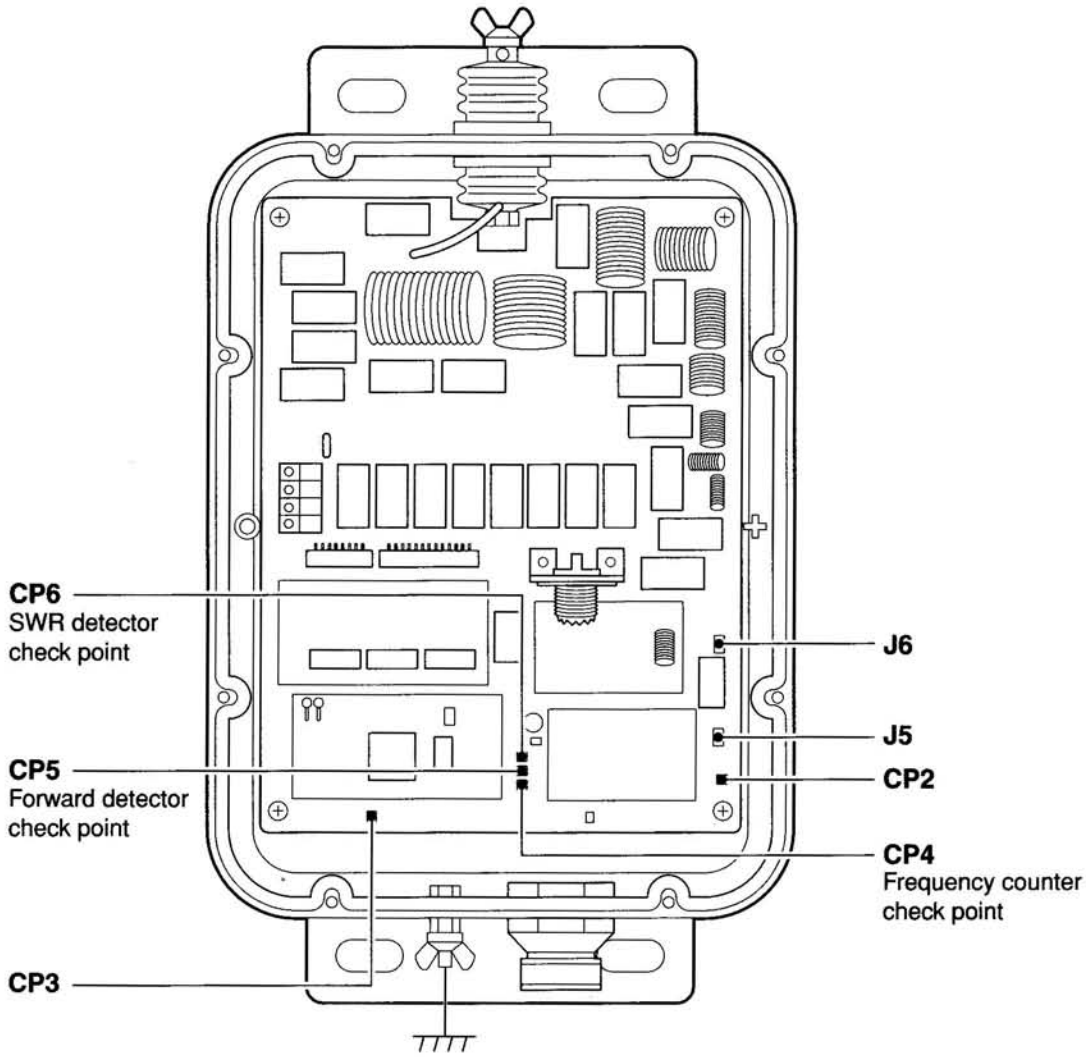
■ CONNECTIONS





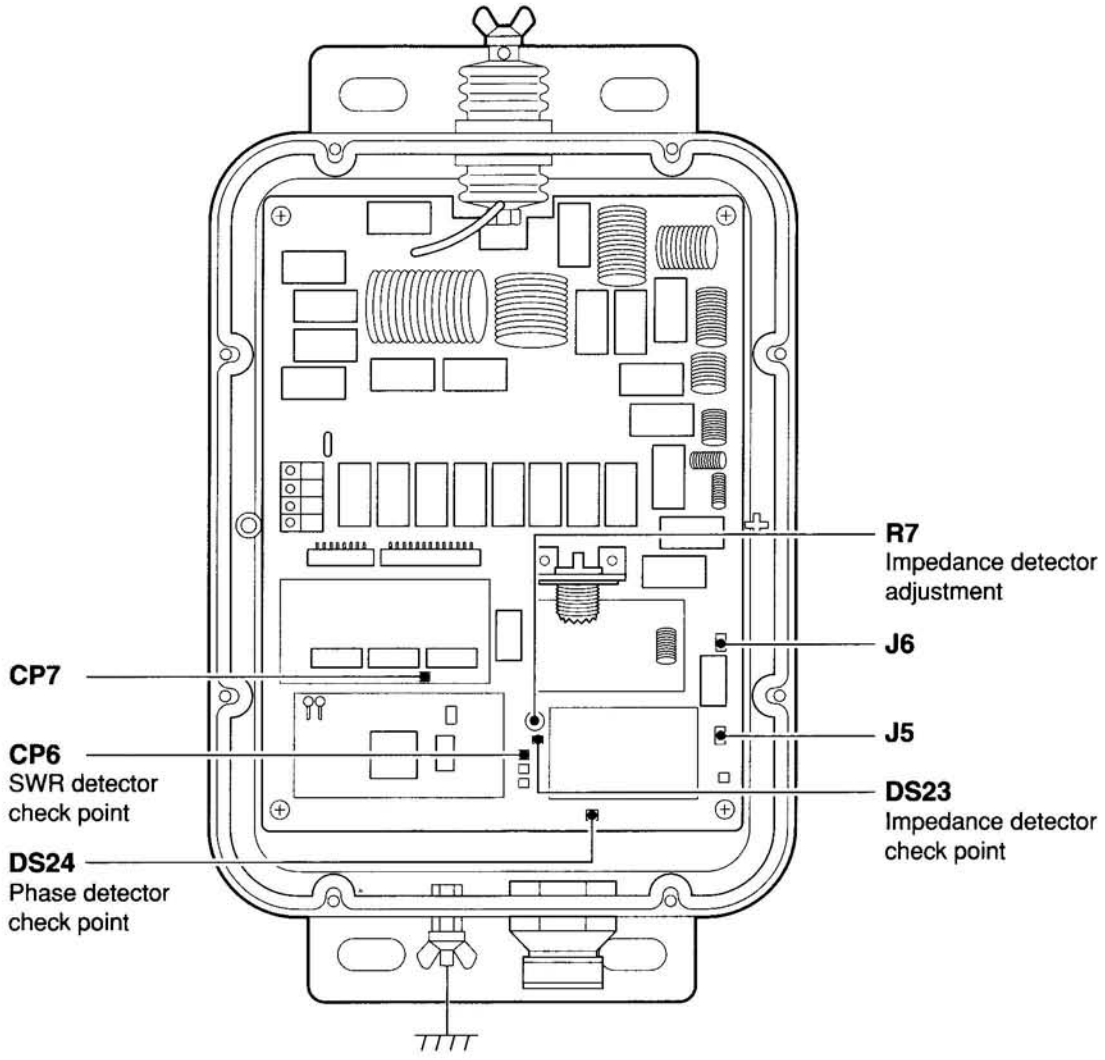
4-2 ANTENNA TUNER ADJUSTMENT

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
FREQUENCY DETECTOR CIRCUIT	1	• Disconnect P5 from J5. • Short pins of J6 with P5. • Ground CP2, CP3 with jumper wires. • TRANSCEIVER Display freq. : 14.08 MHz Mode : RTTY Output power : 10 W • Transmitting	TUNER	Connect a frequency counter to the check point CP4.	55.0 kHz	TUNER	Verify
		After adjustment, remove jumper wire from CP3.					
FORWARD DETECTOR CIRCUIT	2	• Same as above	TUNER	Connect a digital multi-meter or oscilloscope to check point CP5.	1.4 – 2.4 V	TUNER	Verify
SWR DETECTOR CIRCUIT (1)	3	• Same as above		Connect a digital multi-meter or oscilloscope to check point CP6.	less than 0.1 V		Verify



ANTENNA TUNER ADJUSTMENT (continued)

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
IMPEDANCE DETECTOR CIRCUIT	4	• TRANSCEIVER Display freq. : 52.0 MHz Mode : RTTY Output power : 10 W • Transmitting	TUNER	DS23	At the point where DS23 just before turns OFF.	TUNER	R7
		After adjustment, disconnect P5 from J6 and reconnect P5 to J5.					
SWR DETECTOR CIRCUIT (2)	5	• Connect a 50 Ω resistor and 1000 pF capacitor in parallel to the antenna tunner's output terminal. • TRANSCEIVER Display freq. : 3.56 MHz Mode : RTTY Output power : 10 W • Transmitting	TUNER	Connect a digital multi-meter or oscilloscope to check point CP6.	more than 0.35 V	TUNER	Verify
PHASE DETECTOR CIRCUIT	6	• Same as above		DS24	Turns ON		Verify
	7	• Ground CP7 with a jumper wire. • Transmitting			Turns OFF		
		After adjustment, remove jumper wires from CP2 and CP7.					



SECTION 5 PARTS LIST

[TUNER UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
IC1	1140007180	S.IC	μPD78212GC-536-AB8
IC2	1130006980	S.IC	TC74HC574AF
IC3	1130006980	S.IC	TC74HC574AF
IC4	1130006980	S.IC	TC74HC574AF
IC5	1130008410	S.IC	TC74AC393F (EL)
IC6	1130007260	S.IC	TC7W74FU (TE12L)
IC7	1110004300	S.IC	S-80741AL-A5-T1
IC8	1180001590	S.IC	TA78057F (TE16L)
IC10	1110001590	S.IC	TA75393F (TP1)
IC15	1130007110	S.IC	TC7W04FU (TE12L)
Q1	1560000330	S.FET	2SK210-GR (TE85R)
Q2	1560000330	S.FET	2SK210-GR (TE85R)
Q4	1510000510	S.TRANSISTOR	2SA1576A T106R
Q5	1530002060	S.TRANSISTOR	2SC4081 T107 R
Q6	1530002060	S.TRANSISTOR	2SC4081 T107 R
Q8	1590000720	S.TRANSISTOR	DTA144EUA T106
Q9	1590000430	S.TRANSISTOR	DTC144EUA T106
Q10	1590001330	S.TRANSISTOR	DTA114EUA T106
Q11	1590000680	S.TRANSISTOR	DTC114EUA T106
Q12	1590000680	S.TRANSISTOR	DTC114EUA T106
Q13	1590000680	S.TRANSISTOR	DTC114EUA T106
Q14	1590000680	S.TRANSISTOR	DTC114EUA T106
Q15	1590000680	S.TRANSISTOR	DTC114EUA T106
Q16	1590000680	S.TRANSISTOR	DTC114EUA T106
Q17	1590000680	S.TRANSISTOR	DTC114EUA T106
Q18	1590000680	S.TRANSISTOR	DTC114EUA T106
Q19	1590000680	S.TRANSISTOR	DTC114EUA T106
Q20	1590000680	S.TRANSISTOR	DTC114EUA T106
Q21	1590000680	S.TRANSISTOR	DTC114EUA T106
Q22	1590000680	S.TRANSISTOR	DTC114EUA T106
Q23	1590000680	S.TRANSISTOR	DTC114EUA T106
Q24	1590000680	S.TRANSISTOR	DTC114EUA T106
Q25	1590000680	S.TRANSISTOR	DTC114EUA T106
Q26	1590000680	S.TRANSISTOR	DTC114EUA T106
Q27	1590000680	S.TRANSISTOR	DTC114EUA T106
Q28	1590000680	S.TRANSISTOR	DTC114EUA T106
Q29	1590000680	S.TRANSISTOR	DTC114EUA T106
Q30	1590000680	S.TRANSISTOR	DTC114EUA T106
Q31	1590000680	S.TRANSISTOR	DTC114EUA T106
Q32	1590000680	S.TRANSISTOR	DTC114EUA T106
Q33	1530002060	S.TRANSISTOR	2SC4081 T107 R
Q34	1590000720	S.TRANSISTOR	DTA144EUA T106
D1	1790000490	S.DIODE	HSM88AS-TR
D2	1790000450	S.DIODE	MA862 (TX)
D3	1160000060	S.DIODE	DAN202U T107
D4	1790000490	S.DIODE	HSM88AS-TR
D6	1790000490	S.DIODE	HSM88AS-TR
D7	1790000490	S.DIODE	HSM88AS-TR
D8	1790000490	S.DIODE	HSM88AS-TR
D9	1160000060	S.DIODE	DAN202U T107
D10	1160000060	S.DIODE	DAN202U T107
D11	1160000060	S.DIODE	DAN202U T107
D12	1710000350	DIODE	1N4002
D13	1710000350	DIODE	1N4002
D14	1790000490	S.DIODE	HSM88AS-TR
D15	1160000060	S.DIODE	DAN202U T107
D16	1750000270	S.DIODE	1SS301 (TE85R)
D17	1160000060	S.DIODE	DAN202U T107
D18	1160000060	S.DIODE	DAN202U T107
D19	1160000060	S.DIODE	DAN202U T107
D20	1160000060	S.DIODE	DAN202U T107
D21	1160000060	S.DIODE	DAN202U T107
D22	1160000060	S.DIODE	DAN202U T107
D23	1160000060	S.DIODE	DAN202U T107
D24	1160000060	S.DIODE	DAN202U T107
D25	1160000060	S.DIODE	DAN202U T107
D26	1160000060	S.DIODE	DAN202U T107
D27	1160000060	S.DIODE	DAN202U T107
D28	1160000060	S.DIODE	DAN202U T107
D29	1160000060	S.DIODE	DAN202U T107
D30	1160000060	S.DIODE	DAN202U T107

[TUNER UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
D31	1160000060	S.DIODE	DAN202U T107
D32	1160000060	S.DIODE	DAN202U T107
D33	1160000060	S.DIODE	DAN202U T107
D34	1160000060	S.DIODE	DAN202U T107
D35	1160000060	S.DIODE	DAN202U T107
D36	1160000060	S.DIODE	DAN202U T107
D37	1160000060	S.DIODE	DAN202U T107
D38	1160000060	S.DIODE	DAN202U T107
D39	1160000060	S.DIODE	DAN202U T107
D40	1160000060	S.DIODE	DAN202U T107
D42	1160000060	S.DIODE	DAN202U T107
D43	1160000060	S.DIODE	DAN202U T107
D44	1160000060	S.DIODE	DAN202U T107
D45	1750000430	S.DIODE	HSB88WSTR
D46	1160000060	S.DIODE	DAN202U T107
X1	6050009870	S.XTAL	CR-567 (9.8304 MHz)
L2	6140002810	S.COIL	LR-317
L3	6140002810	S.COIL	LR-317
L4	6140003400	COIL	LR-382
L5	6180000450	COIL	RFC L6 222K
L6	6110002750	COIL	LA-459
L7	6110002760	COIL	LA-460
L8	6110002770	COIL	LA-461
L9	6110002780	COIL	LA-462
L10	6110002790	COIL	LA-463
L11	6110002800	COIL	LA-464
L12	6110002810	COIL	LA-465
L13	6110002820	COIL	LA-466
L14	6110002830	COIL	LA-467
L16	6200003260	S.COIL	NL 322522T-101J
L17	2040000490	COIL	EXC-ELDR25C
L18	2040000490	COIL	EXC-ELDR25C
L19	2040000490	COIL	EXC-ELDR25C
L20	2040000490	COIL	EXC-ELDR25C
L21	6200003260	S.COIL	NL 322522T-101J
L22	6200003260	S.COIL	NL 322522T-101J
L23	6200001830	S.COIL	NL 322522T-100J
L27	6200003240	S.COIL	NL 322522T-221J
L28	6200003240	S.COIL	NL 322522T-221J
L29	6200003880	S.COIL	NL 252018T-022J
R3	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R6	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R7	7310002600	S.TRIMMER	RV-110 (RH03A3AS4X0AA) 473
R8	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R9	7030003530	S.RESISTOR	ERJ3GEYJ 562 V (5.6 kΩ)
R10	7030003200	S.RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R13	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R14	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R15	7030003280	S.RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R16	7030009240	S.RESISTOR	ERJ1WYJ151H (150 Ω)
R17	7030009240	S.RESISTOR	ERJ1WYJ151H (150 Ω)
R18	7030009240	S.RESISTOR	ERJ1WYJ151H (150 Ω)
R19	7030009230	S.RESISTOR	ERJ1WYJ121H (120 Ω)
R20	7030009230	S.RESISTOR	ERJ1WYJ121H (120 Ω)
R21	7030009230	S.RESISTOR	ERJ1WYJ121H (120 Ω)
R22	7030009250	S.RESISTOR	ERJ1WYJ331H (330 Ω)
R23	7030006150	S.RESISTOR	ERJ1WYJ271H (270 Ω)
R24	7030009250	S.RESISTOR	ERJ1WYJ331H (330 Ω)
R25	7030006220	S.RESISTOR	ERJ12YJ470H (47 Ω)
R26	7030006220	S.RESISTOR	ERJ12YJ470H (47 Ω)
R27	7030006220	S.RESISTOR	ERJ12YJ470H (47 Ω)
R28	7030006220	S.RESISTOR	ERJ12YJ470H (47 Ω)
R29	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R30	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R31	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R32	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R33	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R34	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R35	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)

S.=Surface mount

[TUNER UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
R36	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R37	7030006070	S.RESISTOR	ERJ12YJ101H (100 Ω)
R38	7030006070	S.RESISTOR	ERJ12YJ101H (100 Ω)
R39	7540000100	ABSORBER	SRYH-350L
R40	7030007980	S.RESISTOR	ERJ12YJ473H (47 kΩ)
R41	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R42	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R43	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R45	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R46	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R47	7030003520	S.RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R48	7030003480	S.RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R49	7030003550	S.RESISTOR	ERJ3GEYJ 822 V (8.2 kΩ)
R50	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R51	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R53	7030005520	S.RESISTOR	RR0816R-334-D (330 kΩ)
R54	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R55	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R56	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R57	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R58	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R59	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R60	7030007360	S.RESISTOR	ERJ1WYJ470H (47 Ω)
R61	7030003600	S.RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R62	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R63	7030003650	S.RESISTOR	ERJ3GEYJ 563 V (56 kΩ)
R64	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R65	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R66	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R67	7030003500	S.RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R68	7030003580	S.RESISTOR	ERJ3GEYJ 153 V (15 kΩ)
R69	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R70	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R71	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R72	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R73	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R74	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R75	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R76	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R77	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R78	7030003440	S.RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R79	7030005520	S.RESISTOR	RR0816R-334-D (330 kΩ)
R80	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R81	7030003720	S.RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R82	7030003360	S.RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R83	7030003680	S.RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R84	7030003560	S.RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R85	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R86	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R87	7030007490	S.RESISTOR	MCR03EZHJ 10 M Ω (106)
R88	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R89	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R90	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R91	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R92	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R93	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R94	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R95	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R96	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R97	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R98	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R99	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R100	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R101	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R102	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R103	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R104	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R105	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R106	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R107	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R108	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R109	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R110	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R111	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R112	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R113	7030007910	S.RESISTOR	RR0816R-563-D (56 kΩ)
R114	7030005630	S.RESISTOR	RR0816R-154-D (150 kΩ)
R135	7030009240	S.RESISTOR	ERJ1WYJ151H (150 Ω)
R136	7030009240	S.RESISTOR	ERJ1WYJ151H (150 Ω)
R137	7030009240	S.RESISTOR	ERJ1WYJ151H (150 Ω)
R138	7030006180	S.RESISTOR	ERJ1WYJ101H (100 Ω)
R139	7030006180	S.RESISTOR	ERJ1WYJ101H (100 Ω)

[TUNER UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
R140	7030006180	S.RESISTOR	ERJ1WYJ101H (100 Ω)
R141	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R143	7030007360	S.RESISTOR	ERJ1WYJ470H (47 Ω)
R154	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R155	7030003400	S.RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R157	7030003640	S.RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R158	7030003370	S.RESISTOR	ERJ3GEYJ 271 V (270 Ω)
C1	4010005570	CERAMIC	HM60SJ SL 060D 500V
C2	4030007140	S.CERAMIC	C1608 CH 1H 121J-T-A
C3	4030010760	S.CERAMIC	C1608 CH 1H 331J-T-A
C4	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C5	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C6	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C7	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C8	4010005560	CERAMIC	HM60SJ SL 050C 500V
C13	4030010760	S.CERAMIC	C1608 CH 1H 331J-T-A
C14	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C15	4030007010	S.CERAMIC	C1608 CH 1H 100D-T-A
C16	4030008560	S.CERAMIC	C1608 CH 1H 300J-T-A
C17	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C18	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C19	4030010760	S.CERAMIC	C1608 CH 1H 331J-T-A
C20	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C21	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C22	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C23	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C24	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C25	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C26	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C27	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C29	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C30	4310000520	MYLAR	50 F2D 224J
C31	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C32	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C33	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C34	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C35	4510005310	S.ELECTROLYTIC	ECEV1CA220SR
C36	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C37	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C38	4510004640	S.ELECTROLYTIC	ECEV1CA470SP
C39	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C40	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C41	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C42	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C43	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C45	4030008920	S.CERAMIC	C1608 JB 1C 473K-T-A
C46	4510006670	S.ELECTROLYTIC	ECEV 1CA 471P
C47	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C48	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C49	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C50	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C51	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C52	4510004630	S.ELECTROLYTIC	ECEV1CA100SR
C53	4310000520	MYLAR	50 F2D 224J
C54	4510006700	ELECTROLYTIC	FYD0H 104Z
C55	4030006860	S.CERAMIC	C1608 JB 1H 102K-T-A
C56	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C57	4030008560	S.CERAMIC	C1608 CH 1H 300J-T-A
C58	4030008560	S.CERAMIC	C1608 CH 1H 300J-T-A
C59	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C60	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C61	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C62	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C63	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C64	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C65	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C66	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C67	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C68	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C69	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C70	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C71	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C72	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C73	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C74	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C75	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C76	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C77	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C78	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C79	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A

S.=Surface mount

[TUNER UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
C80	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C81	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C82	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C83	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C84	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C85	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C86	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C87	4320000660	DIP MICA	KD20C 122J5
C88	4010004740	CERAMIC	DE1207 SL 271J 2KV
C89	4010004750	CERAMIC	DE1510 SL 331J 2KV
C90	4010004280	CERAMIC	DE1207 SL 151J 3KV
C91	4010004280	CERAMIC	DE1207 SL 151J 3KV
C92	4010004280	CERAMIC	DE1207 SL 151J 3KV
C93	4010004280	CERAMIC	DE1207 SL 151J 3KV
C94	4010004280	CERAMIC	DE1207 SL 151J 3KV
C95	4010004260	CERAMIC	DE0907 SL 820J 3KV
C96	4010005100	CERAMIC	DE0807 SL 680J 3KV
C97	4010005070	CERAMIC	DE0707 SL 390J 3KV
C98	4010005070	CERAMIC	DE0707 SL 390J 3KV
C99	4010005040	CERAMIC	DE0707 SL 180J 3KV
C100	4010005040	CERAMIC	DE0707 SL 180J 3KV
C101	4010005050	CERAMIC	DE0707 SL 270J 3KV
C102	4010005050	CERAMIC	DE0707 SL 270J 3KV
C105	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C106	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C107	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C108	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C109	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C110	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C112	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C113	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C114	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C115	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C116	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C117	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C118	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C119	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C120	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C121	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C123	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C124	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C125	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C126	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C127	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C128	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C129	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C130	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C132	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C133	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C134	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C135	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C136	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C137	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C138	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C139	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C140	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C141	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C142	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C143	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C144	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C145	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C146	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C147	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C148	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C149	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C150	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C151	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C152	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C153	4010005550	CERAMIC	HM60SJ SL 040C 500V
C154	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C155	4030006900	S.CERAMIC	C1608 JB 1E 103K-T-A
C159	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C160	4030007010	S.CERAMIC	C1608 CH 1H 100D-T-A
C161	4010004250	CERAMIC	DE1007 SL 101J 3KV
C162	4010004250	CERAMIC	DE1007 SL 101J 3KV
C163	4010004250	CERAMIC	DE1007 SL 101J 3KV
C164	4010004250	CERAMIC	DE1007 SL 101J 3KV
C165	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C166	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C167	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C168	4030011600	S.CERAMIC	C1608 JB 1C 104KT-N
C169	4010005030	CERAMIC	DE0707 SL 120J 3KV

[TUNER UNIT]

REF NO.	ORDER NO.	DESCRIPTION	
C170	4010005030	CERAMIC	DE0707 SL 120J 3KV
C171	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
C172	4030006880	S.CERAMIC	C1608 JB 1H 472K-T-A
RL1	6330001430	RELAY	NA-12W-K
RL2	6330001430	RELAY	NA-12W-K
RL3	6330001060	RELAY	APQ 3311
RL4	6330001060	RELAY	APQ 3311
RL5	6330001060	RELAY	APQ 3311
RL6	6330001060	RELAY	APQ 3311
RL7	6330001060	RELAY	APQ 3311
RL8	6330001060	RELAY	APQ 3311
RL9	6330001060	RELAY	APQ 3311
RL10	6330001060	RELAY	APQ 3311
RL11	6330001060	RELAY	APQ 3311
RL12	6330001060	RELAY	APQ 3311
RL13	6330001060	RELAY	APQ 3311
RL14	6330001060	RELAY	APQ 3311
RL15	6330001060	RELAY	APQ 3311
RL16	6330001060	RELAY	APQ 3311
RL17	6330001520	RELAY	VE-12HM-K
RL18	6330001520	RELAY	VE-12HM-K
RL19	6330001520	RELAY	VE-12HM-K
RL20	6330001520	RELAY	VE-12HM-K
RL21	6330001520	RELAY	VE-12HM-K
RL22	6330001520	RELAY	VE-12HM-K
RL23	6330001520	RELAY	VE-12HM-K
RL24	6330001520	RELAY	VE-12HM-K
RL25	6330001520	RELAY	VE-12HM-K
RL26	6330001520	RELAY	VE-12HM-K
CP1	6910009670	S.CHECK P	HK3-S-T
CP2	6910009670	S.CHECK P	HK3-S-T
CP3	6910009670	S.CHECK P	HK3-S-T
CP7	6910009670	S.CHECK P	HK3-S-T
J1	6510000130	CONNECTOR	FM MDR MI
J2	6510019960	CONNECTOR	ML-800S1V-4P
J4	6910003140	CONNECTOR	IMSA-9202B-1-02T
J5	6910003140	CONNECTOR	IMSA-9202B-1-02T
J6	6910003140	CONNECTOR	IMSA-9202B-1-02T
J8	6510003100	CONNECTOR	RT01T-1.3B
J11	6510018940	S.CONNECTOR	B13B-PH-SM3-TB
J12	6510018920	S.CONNECTOR	B8B-PH-SM3-TB
P4	6910003120	CONNECTOR	IMSA-9206H-T
P5	6910003120	CONNECTOR	IMSA-9206H-T
DS1	5040002020	S.LED	CL-170UR-CD-T
DS23	5040002010	S.LED	CL-170PG-CD-T
DS24	5040002010	S.LED	CL-170PG-CD-T
W11	7030003860	S.JUMPER	ERJ3GE JPW V
W12	7030003860	S.JUMPER	ERJ3GE JPW V
WS1	8970023131	CABLE	LEAD SET (2)/TU
EP1	0910050003	PCB	B 4850C

S.=Surface mount

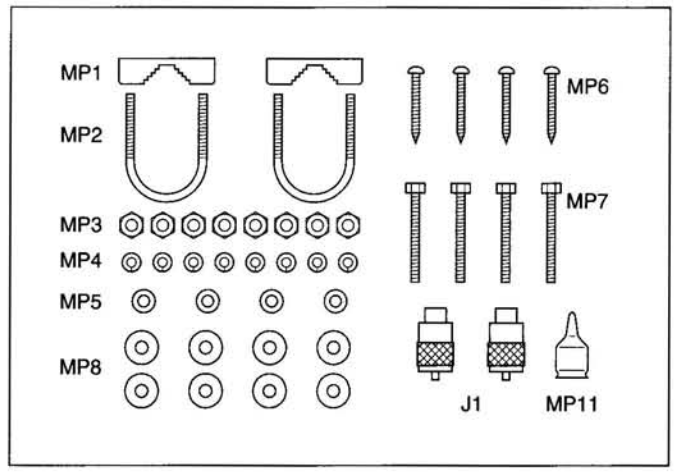
SECTION 6 MECHANICAL PARTS AND DISASSEMBLY

[CHASSIS PARTS]

REF.NO	ORDER NO	DESCRIPTION	QTY
EP1	6910000880	Sheet NC-1	1
EP2	6910000880	Sheet NC-1	1
MP1	8010017160	1869 U-case	1
MP2	8010017170	1869 L-case	1
MP3	8930044600	1896 Main seal	1
MP4	8930044590	1869 Angle	2
MP7	8810000620	Screw M3 x 16 SUS	1
MP8	8810000620	Screw M3 x 16 SUS	1
MP9	8830000230	Nut M3 SUS	1
MP10	8830000230	Nut M3 SUS	1
MP11	8930044610	Sealing washer (N)	1
MP12	8930044610	Sealing washer (N)	1
MP13	8810005560	Screw M3 x 8 SUS ZK	8
MP14	8810006440	Set screw M5 x 12 SUS	4
MP15	6910000470	High voltage insulator	1
MP16	8930044620	Sealing washer (O)	1
MP18	8810003480	Hexagon bolt M5 x 60 SUS	1
MP19	8930045520	1869 Screw plate	1
MP20	8850000500	S washer M5 SUS	1
MP21	8830000180	Flat washer M5 SUS	1
MP22	8850000250	Nut M5 SUS	1
MP23	8860000190	Earth RUG D5 (M5) BS AG	1
MP24	8850000600	Star washer M5 SUS	1
MP25	8830000370	Wing nut M5 SUS	1
MP26	8810008230	Hexagon bolt (+) M5 x 20 SUS	1
MP27	8930045520	1869 Screw plate	1
MP28	8850000500	S washer M5 SUS	1
MP30	8850000180	Flat washer M5 SUS	1
MP31	8830000250	Nut M5 SUS	1
MP32	8860000190	Earth RUG D5 (M5) BS AG	1
MP33	8850000600	Star washer M5 SUS	1
MP34	8830000370	Wing nut M5 SUS	1
MP38	8810008660	Screw B0 M3 x 8 NI-ZU (BT)	5
MP39	8930039000	1757 Sheet	3
MP41	8930047350	Insulation sheet (FK)	1
MP42	8850000180	Flat washer M5 SUS	1
MP43	8850000180	Flat washer M5 SUS	1
MP44	8930006570	Sealing washer (D)	1
MP45	8930006570	Sealing washer (D)	1
MP46	8850000180	Flat washer M5 SUS	1

[ACCESSORIES]

REF.NO	ORDER NO	DESCRIPTION	QTY
W1	8900001420	Cable OPC-136	1
W2	9040496001	Coaxial cable 5D-2V(5m)	1
MP1	8010000010	U bolt plate	2
MP2	8820000440	U bolt (A) SUS	2
MP3	8830000260	Nut M6 SUS	8
MP4	8850000510	S washer M6 SUS	8
MP5	8850000190	Flat washer M6 6 x 13 x 1.0 SUS	4
MP6	8810001500	Screw A0 M6 x 30 SUS	4
MP7	8810003500	Hexagon bolt M6 x 50 SUS	4
MP8	8850000200	Flat washer M6 6 x 20 x 1.5 SUS	8
MP11	6950000010	Weatherproof cap	1

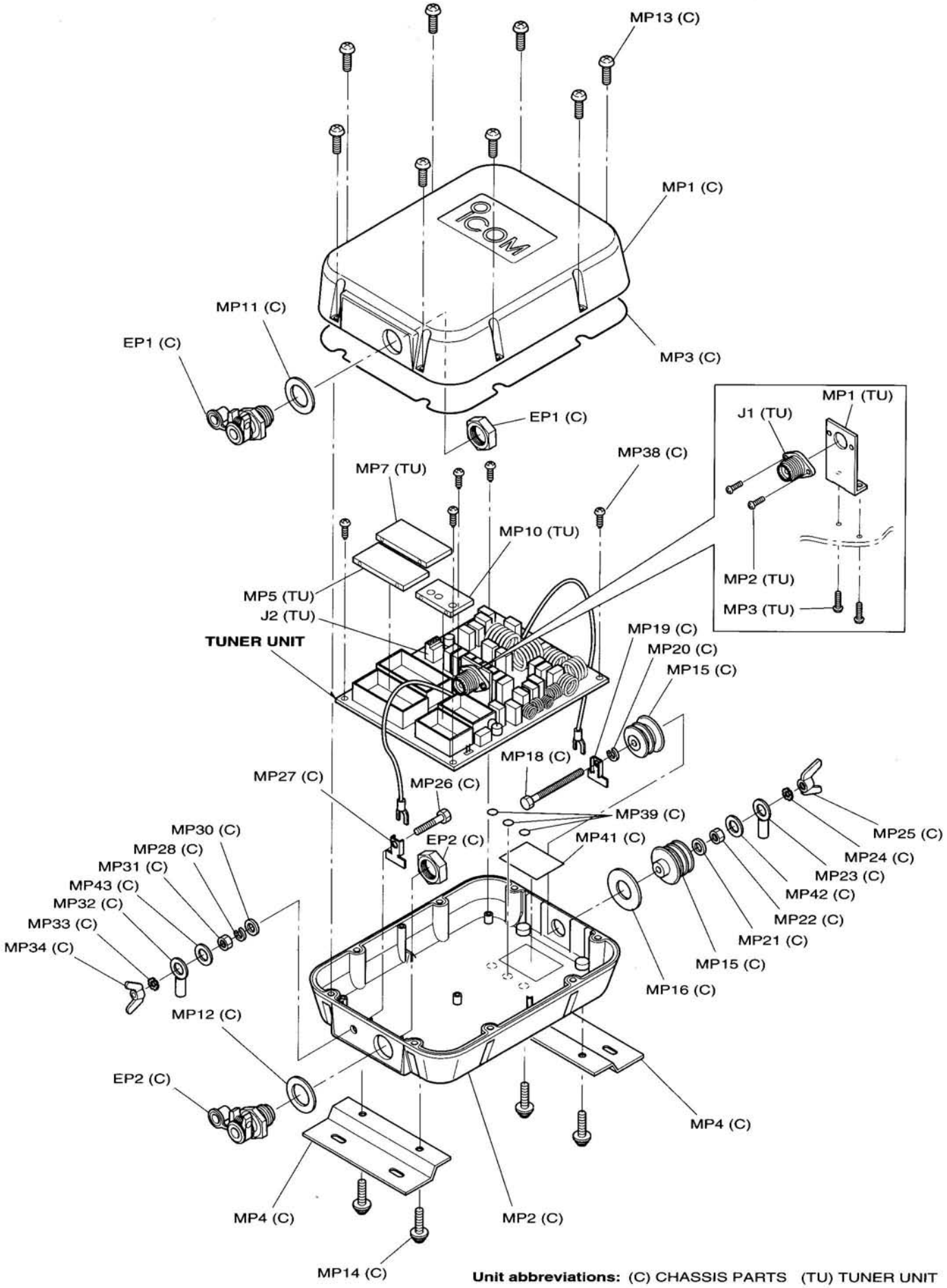


[TUNER UNIT]

REF.NO	ORDER NO	DESCRIPTION	QTY
J1	6510000130	FM-MDR MI	1
MP1	8930006910	Connector angle	1
MP2	8810003160	Set screw (A) M3 x 6	2
MP3	8810003160	Set screw (A) M3 x 6	2
MP4	8510003500	406 Shield case	1
MP5	8510003510	406 Shield cover	1
MP6	8510003500	406 Shield case	1
MP7	8510003510	406 Shield cover	1
MP8	8510002020	MIX Shield case	1
MP9	8510002420	368 Shield case (A)	1
MP10	8510002430	368 Shield cover (A)	1
MP11	8510002420	368 Shield case (A)	1

Screw abbreviations

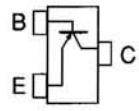
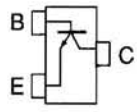
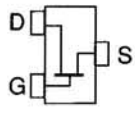
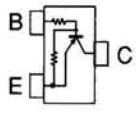
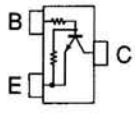
A, BO, BT	: Self-tapping
PH	: Pan head
FH	: Flat head
BiH	: Bind head
BS	: Brass-Argent
NI	: Nickel
NI-ZU	: Nickel-Zinc
SUS	: Stainless
ZK	: Black



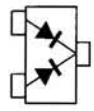
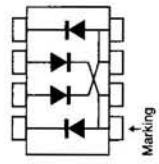
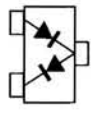
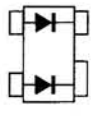
Unit abbreviations: (C) CHASSIS PARTS (TU) TUNER UNIT

SECTION 7 SEMI-CONDUCTOR INFORMATION

7-1 TRANSISTOR AND FET'S

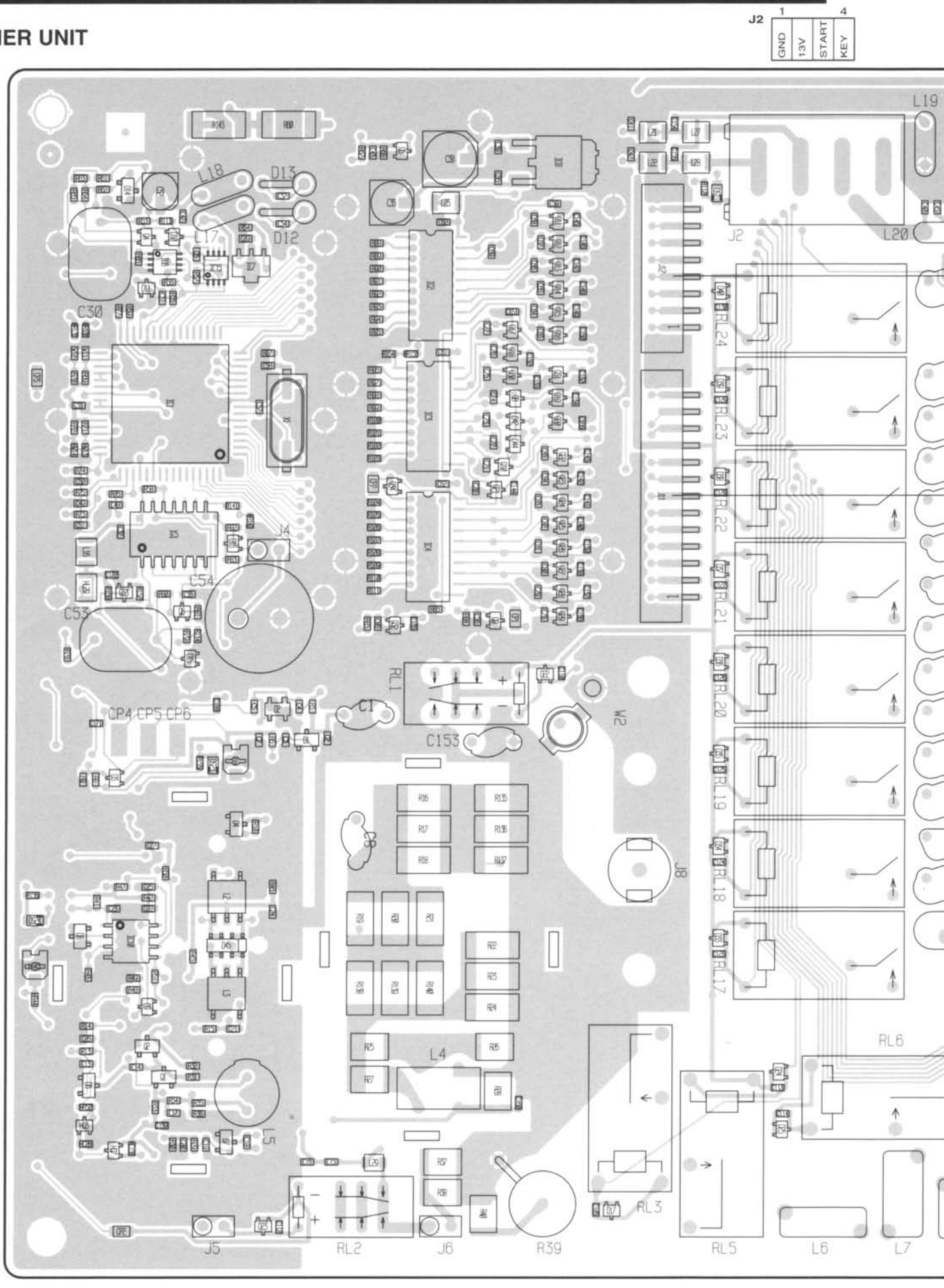
NAME	SYMBOL	INSIDE VIEW
2SA1576R	FR	
2SC4081R	BR	
2SK1204R	YG	
DTA144EU	14	
DTC144EU	24	

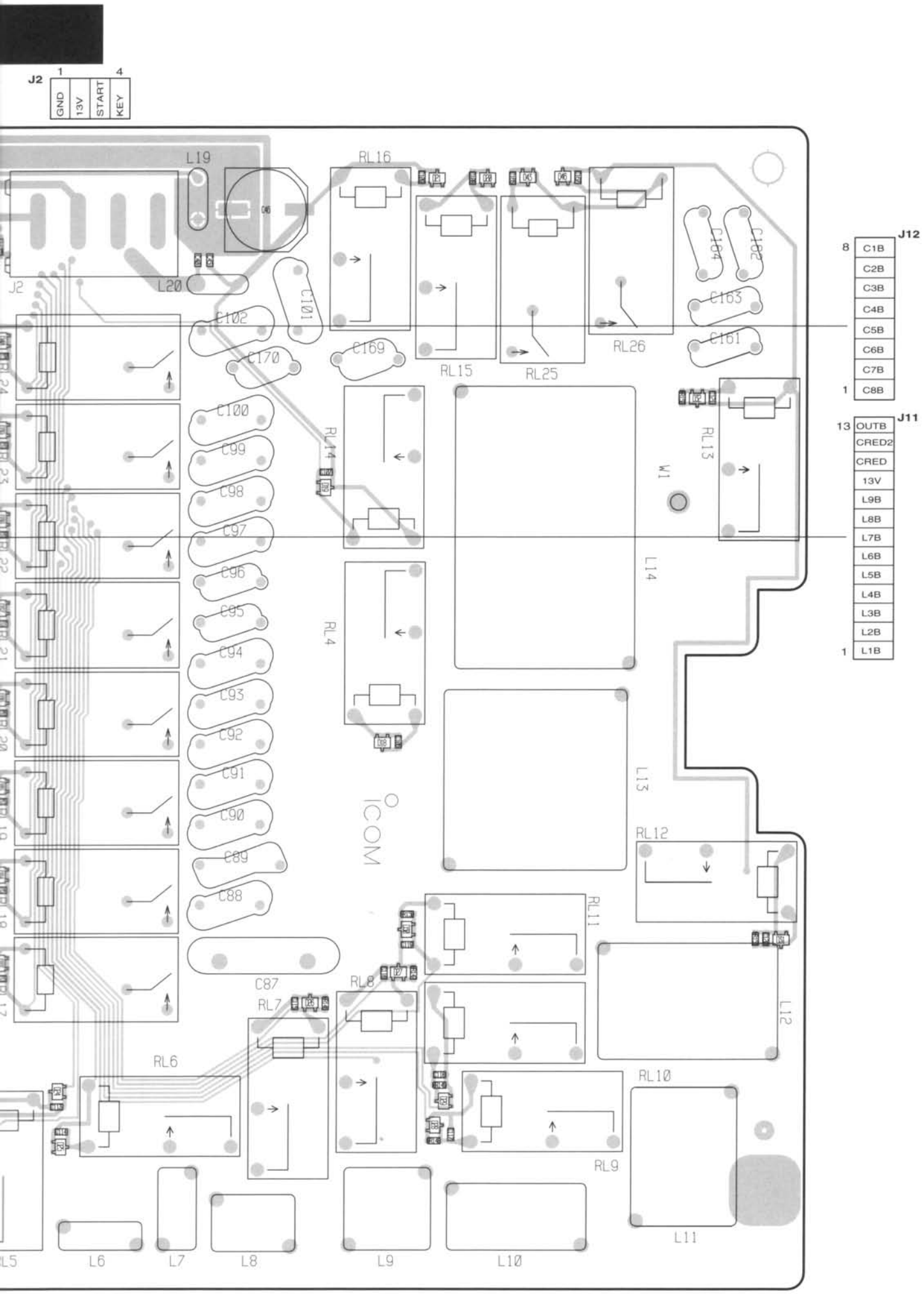
7-2 DIODES

NAME	SYMBOL	INSIDE VIEW
DAN202U	N	
HSB88WS	No Symbol	
HSM88AS	C1	
MA862	M1I	

SECTION 8 BOARD LAYOUT

8-1 TUNER UNIT




J2
1
4
GND
13V
START
KEY
J12
8
C1B
C2B
C3B
C4B
C5B
C6B
C7B
1
C8B
J11
13
OUTB
CRED2
CRED
13V
L9B
L8B
L7B
L6B
L5B
L4B
L3B
L2B
1
L1B
L19
L20
J2
RL16
RL15
RL25
RL26
RL14
RL13
RL4
W1
L14
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RL12
RL11
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RL7
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RL10
RL9
L12
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L5
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L8
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L10
C87
C88
C89
C90
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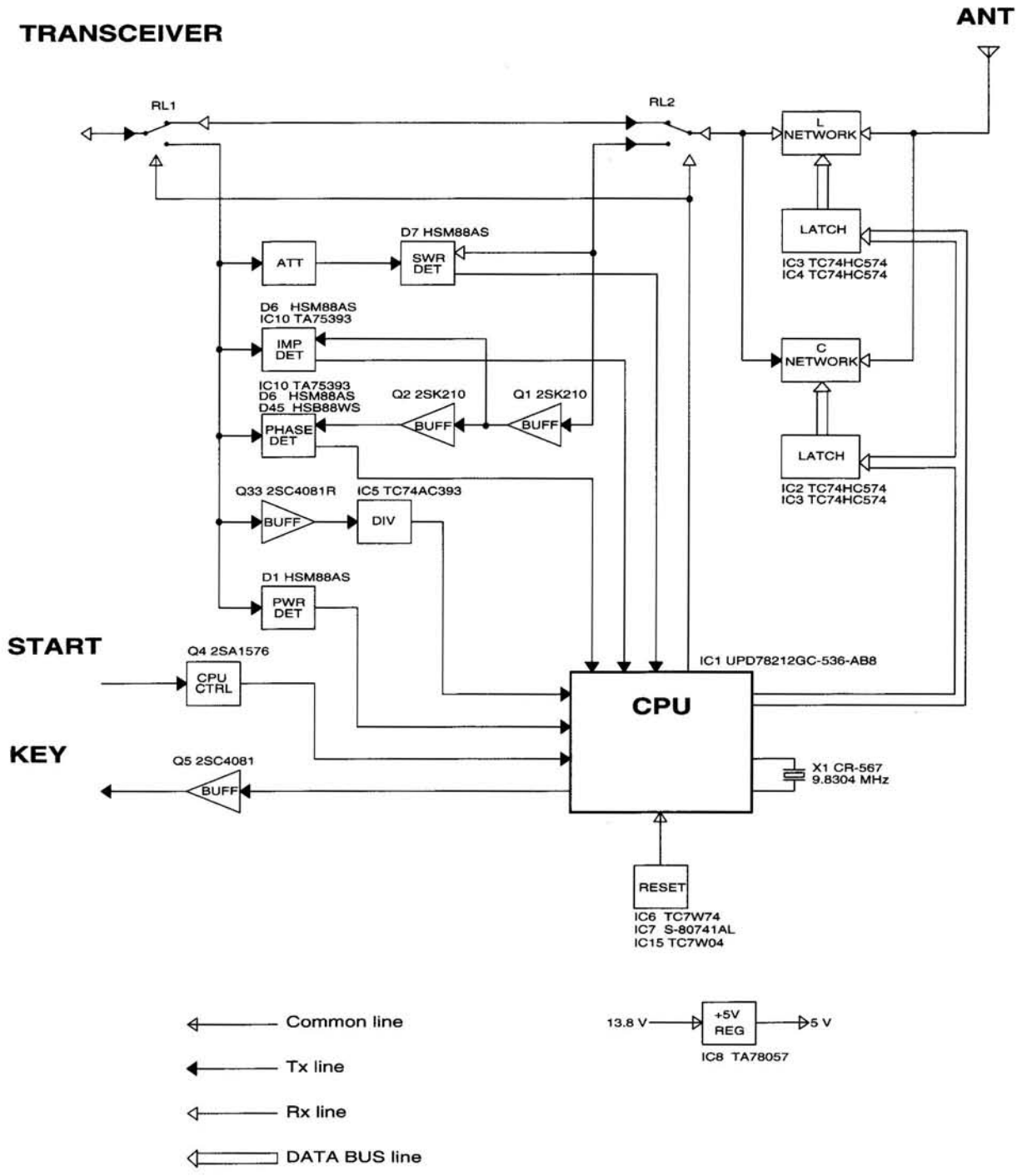
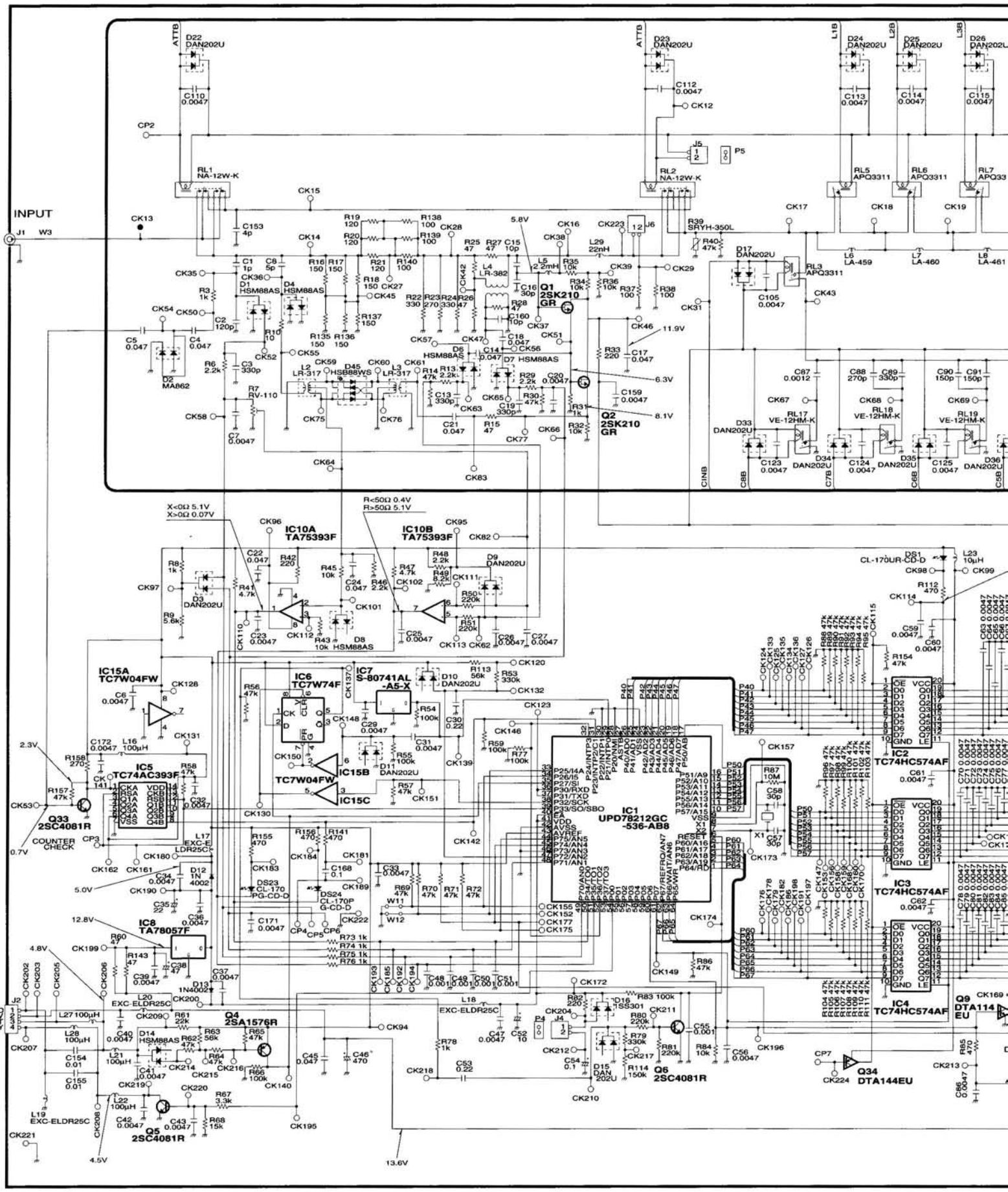
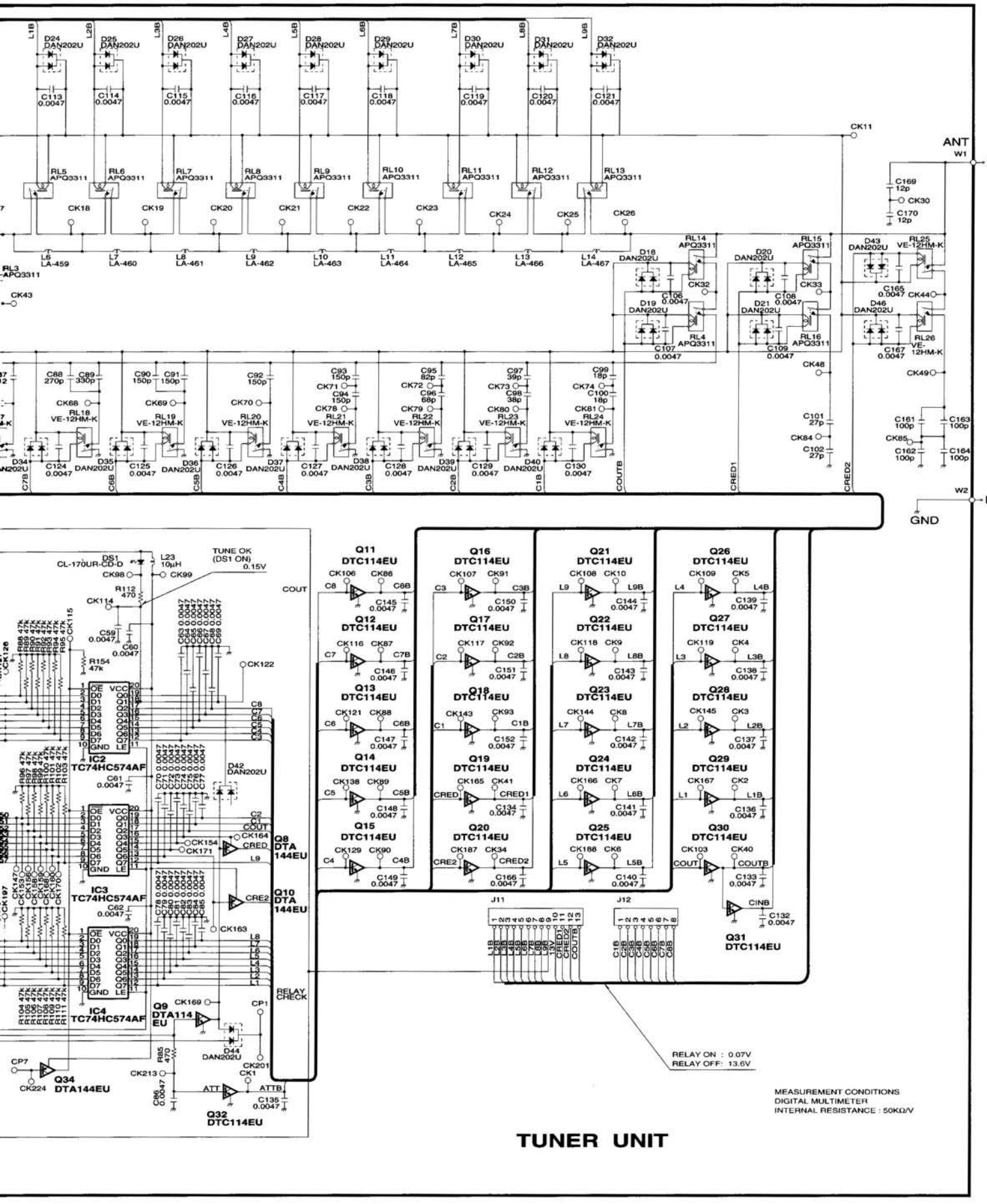
C164
C169
C170
ICOM

SECTION 9 BLOCK DIAGRAM



SECTION 10 VOLTAGE DIAGRAM




ANT
W1
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EP5
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CK19
CK20
CK21
CK22
CK23
CK24
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CK26
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CK201
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CK224
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L2B
L3B
L4B
L5B
L6B
L7B
L8B
L9B
L23
10µH
DS1
CL-170UR-CD-D
TUNE OK
(DS1 ON)
0.15V
R112
470
R154
47k
R85
470
C59
0.0047
C60
0.0047
C61
0.0047
C62
0.0047
IC2
TC74HC574AF
IC3
TC74HC574AF
IC4
TC74HC574AF
D42
DAN202U
D44
DAN202U
Q8
DTA
144EU
Q10
DTA
144EU
Q9
DTA114
EU
Q34
DTA144EU
Q32
DTC114EU
Q11
DTC114EU
Q12
DTC114EU
Q13
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Q14
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Q29
DTC114EU
Q30
DTC114EU
Q31
DTC114EU
J11
J12
COUT
CRED
CRE2
L8
L9
RELAY
CHECK
CP1
CP7
ATT
ATTB
RELAY ON : 0.07V
RELAY OFF: 13.6V
MEASUREMENT CONDITIONS
DIGITAL MULTIMETER
INTERNAL RESISTANCE : 50KΩ/V

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