

2-m FM HANDHELD TRANSCEIVER

# TH-215A/E

## SERVICE MANUAL

# KENWOOD

© 1987-1 PRINTED IN JAPAN  
B51-3117-00 (O) 1501



Photo is TH-215A.

## CONTENTS

CIRCUIT DESCRIPTION .....	2
SEMICONDUCTOR DATA .....	5
DESCRIPTION OF COMPONENTS .....	10
PARTS LIST .....	11
EXPLODED VIEW .....	24
PACKING .....	25
LEVEL DIAGRAM .....	26
ADJUSTMENT .....	27
TERMINAL FUNCTIONS .....	31
PC BOARD VIEWS	
VCO (X58-3010-10) .....	31
MIC AMP (X59-3090-10) .....	31
CASE ASS'Y (A02-076X-05) .....	32
RF UNIT (X44-3000-10) .....	33
IF UNIT (X48-3020-XX) .....	35
SCHEMATIC DIAGRAM .....	37
BLOCK DIAGRAM .....	40
TSU-4 (TONE SQUELCH UNIT) .....	41
BC-8 (COMPACT CHARGER) .....	43
SPECIFICATIONS .....	BACK COVER

## CIRCUIT DESCRIPTION

### Receiver section

The basic construction of the receiver section is of the double-superheterodyne system using the first IF of 16.3 MHz and second IF of 455kHz.

The signal input to the antenna is HF amplified by Q6 : 2SC3356 and Q7 : 2SC2714 which are connected in cascade, and supplied to the BPF of L15 to L17. The output from the BPF is supplied to first mixer Q8 : 2SK210(GR) to be mixed with the first local oscillator (PLL) output signal. The first mixer output is supplied through a 16.3 MHz MCF, amplified by Q9 : 2SC2714(O), and input to IC1 : TA7761P of the IF unit as the first IF signal. The first IF signal is mixed with the 16.755MHz signal from the second local oscillator, and covered into the 455kHz second IF signal. The 455kHz second IF signal is supplied through ceramic filter CF1, amplified by an internal amp, and detected.

The detected signal is sent through the AF VOL, amplified by IC2 : BA526, and sent to the speaker.

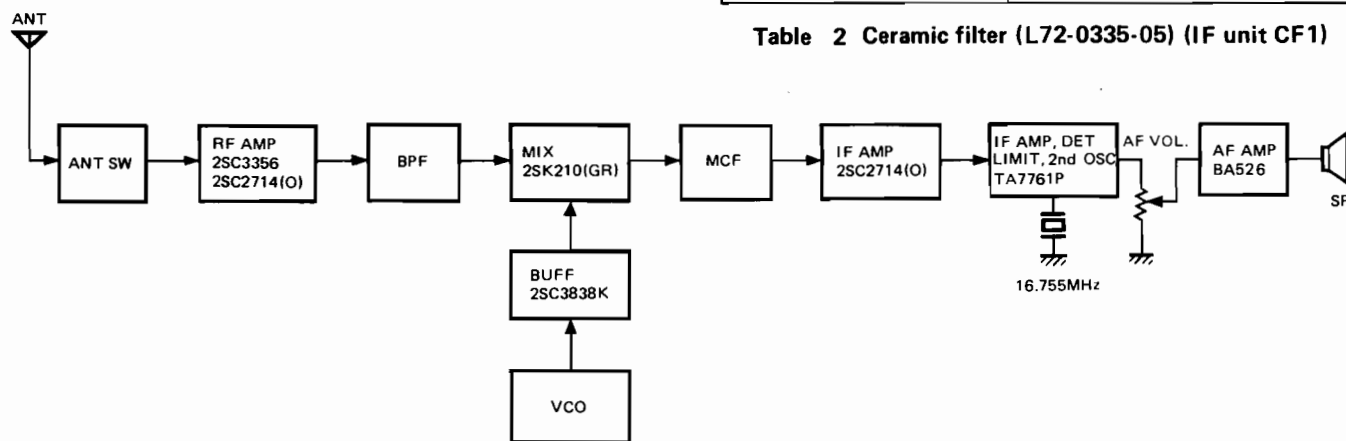


Fig. 1 RX section block diagram

Item	Rating
Noninal center frequency (fo)	16.3MHz
Pass bandwidth	fo ± 7.5kHz or more at 3dB
Attenuation bandwidth	fo ± 25kHz or more at 40dB
Guaranteed attenuation	70dB or more within fo ± 1MHz Spurious : 40dB or more at fo ~ fo + 500kHz.
Ripple	1dB or less
Insertion loss	2dB or less
Terminal impedance	1.8kΩ//0pF

Table 1 MCF (L71-0265-05) (RF unit XF1,2)

Item	Rating
Center frequency of 6dB bandwidth (fo)	455kHz ± 1.5kHz
6dB bandwidth	± 7.5kHz or more
40dB bandwidth	± 15kHz or less
Ripple	1.5dB or less (455 ± 5kHz)
Guaranteed attenuation	27dB or more within fo ± 100kHz
Insertion loss	6dB or less at 455kHz
Terminal impedance	1.5kΩ

Table 2 Ceramic filter (L72-0335-05) (IF unit CF1)

### Transmitter section

The audio signal from the MIC is amplified at sub-unit (X59-3090-10) (microphone amp) of the IF unit, then sent to sub-unit (X59-3010-10) (VCO) of the RF unit in order to apply direct modulation to the VCO utilizing the capacitance between the electrodes of D1 : 1SV153.

The VCO output is amplified by Q2 : 2SC3838K(N,P) and Q3 : 2SC2407, supplied through power-controller pin diode D3 : 1SV172, and power-amplified by final IC1 : M57732L.

The transmission output from IC1 is sent through low pass filter LB and transmission/reception switching diode D5 : M1303, and supplied to the ANT terminal.

A part of the output is detected by D8 and D9 : HSM88AS. It is used by Q4 : 2SA1313(Y) and Q5 : FMW1 to control the current flowing to D3 and to apply APC by varying the power driving IC1. The power adjustment is performed by VR1 and VR2 on the IF unit.

## CIRCUIT DESCRIPTION

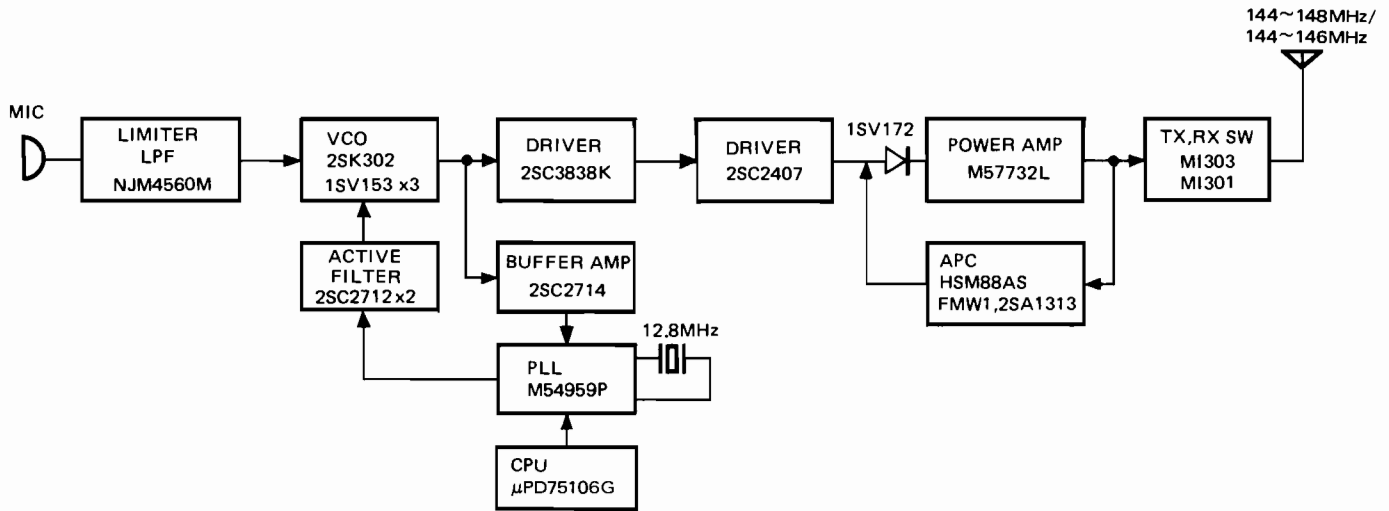


Fig. 2 TX section block diagram

### PLL unit

The VCOs are provided independently for transmission and reception, and use Colpitts oscillator circuits of Q1 and Q2 : 2SK302(GR). The two VCOs are switched by switching Q11 using the serial data sent from the microprocessor PLL control IC2 : M54959P.

The VCO output is distributed to the transmitter, receiver and PLL. The signal supplied to the PLL circuit is input to IC2 via the buffer circuit of Q1 : 2SC2714(O). The VCO output, which is input to IC2, is divided with the dividing ratio set by the serial data from the microprocessor. On the other hand, its phase is compared with that of a 5kHz signal obtained by dividing X1 : 12.8MHz, and the result is output from pin 9 of IC2. The phase comparison output passes through the active filter of Q12 of Q13 : 2SC2712(GR) and controls the VCO.

If the PLL is unlocked during transmission and the UL line from the RF unit goes high (HI), the microprocessor turns the TX line to low (LO) and returns to the transmission mode preventing abnormal reception.

### Power supply circuit

The TH-215 provides the following regulated/unregulated voltages;

- T5 . . . . . 5V DC in transmit
- R5 . . . . . 5V DC in receive
- C5 . . . . . 5V DC constant
- M5 . . . . . 5V DC for the microphone
- VDD . . . . . 5V DC for microprocessor bias
- KEY . . . . . Key matrix voltage
- CB . . . . . Battery voltage

The C5 constant voltage circuit utilizes three-pin regulators IC5 : LVC550C, Q14 : 2SA1358Y and Q15 : FMW1.

The T5 circuit consisting of Q13 : 2SA1313(Y) and Q16 : DTC114YK is controlled by the TX line from the microprocessor.

The R5 circuit, Q11 : DTA114YK and Q12 : DTA144EK is controlled by the output of the T5 circuit.

The M5 and KEY lines are directly controlled by three-pin regulator IC5.

VDD utilizes the output of the three-pin regulator IC4 : LVC550C to provide microprocessor power. When IC4 is OFF, D6 : 1SS184 causes the microprocessor to be powered from the backup battery, B1.

Since the microprocessor must synthesize TTP information and sub audible tone information the clock frequency is higher than the clock in the TH-205. Therefore, 5V is about 0.7V DC higher in the TH-215, by putting the GND terminal of IC4 higher at D7 : 1SS226.

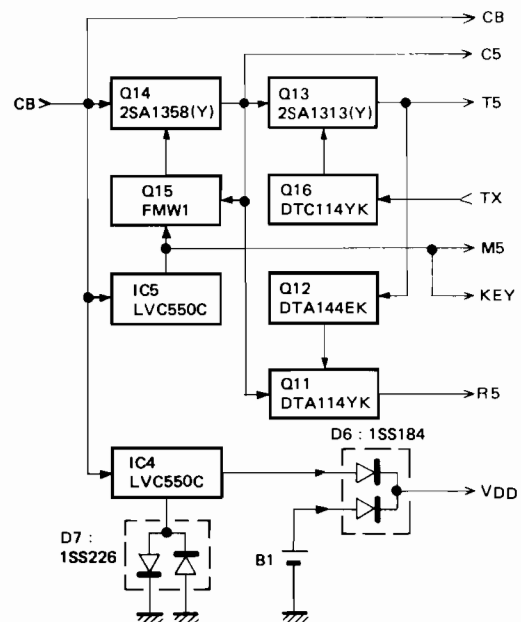


Fig. 3 Power supply circuit

## CIRCUIT DESCRIPTION

### Microprocessor and its peripheral circuits

The TH-215 is designed for multiple functions and has low power consumption, thanks to its 4 bit single-chip microprocessor (IC1 :  $\mu$ PD75106G-514-1B in the control section) and LCD driver (IC2, a  $\mu$ PD7225G in the Case ass'y).

#### • Backup circuits

If the CB voltage drops to approximately 5V, pin 1 of IC3 : S-8045HN in the IF unit goes "L" and pin 44 of the microprocessor goes "L". This places the microprocessor in the backup mode. If the CB voltage returns to normal, pin 44 of the microprocessor goes "H" and places the microprocessor back in the normal operating mode. This causes a differentiating circuit to apply a reset pulse to pin 7 of the microprocessor.

Normally, the microprocessor can be reset by grounding pin 7 or pin 44. However, when the microprocessor lithium backup battery fails or when a new battery is installed the microprocessor must be reset by applying a pulse to pin 7.

Pin 44 is used to reset the microprocessor when normal

reset is impossible, due to low input voltage or a short power outage. If this happens the microprocessors RAM contents will be maintained by the lithium battery.

#### • Squelch circuit

Incoming signals are detected by IC1 : TA7761P (in the IF section) then amplified, rectified, and smoothed by the filter formed by IC1 and Q2 : 2SC2712(GR). The squelch control (SQL VOL.) sets the control voltage on Q1 : 2SC2712(GR). When Q1 is ON, the incoming receive signal is applied to the SQ port (pin 36) of the microprocessor.

When a signal is received, port SQ goes "H" and the BUSY indicator turns ON, in the LCD. At the same time, port AFC (pin 39 of the microprocessor) become "L" and Q6 thru Q8 (Q6 : FMG2, Q7 : 2SC2712(GR), Q8 : 2SA1241Y) of the IF unit, apply power to IC2 and Q6. When power is supplied to IC2, squelch is disabled. Pushing the MONITOR button places the SQ line "H" and the AFC line "L", this also opens squelch.

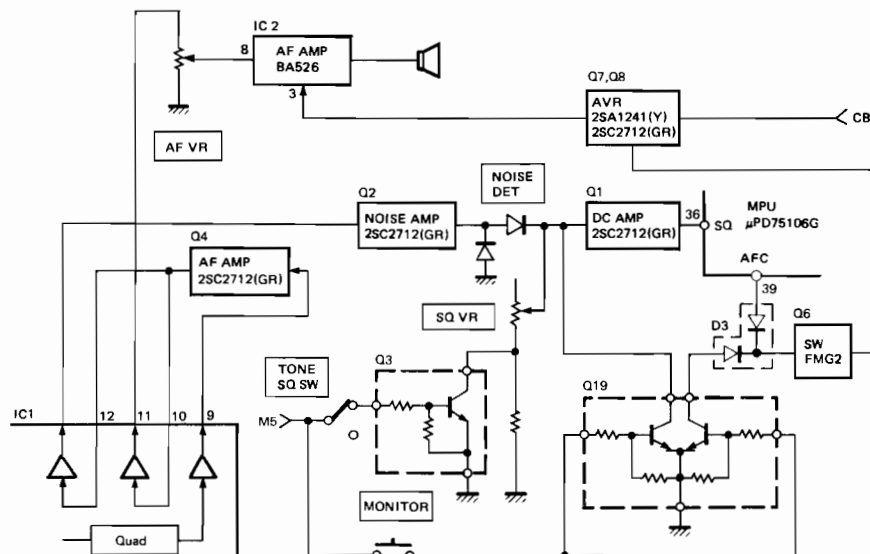


Fig. 4 Squelch circuit

#### • Sub-tone and touch tone signals.

Sub audible tone frequencies and Touch Tone Pad frequencies are generated by the microprocessor in the TH-215. Since sub audible tones are a single tone the sine wave is produced from 7-bit digital data supplied by the microprocessor. Digital to analog conversion (D/A) is performed

by weighted resistor array R18.

Touch tone signals are a two frequency signal produced by combining two 7-bit sine waves to an 8-bit signal. Digital to analog conversion is performed by weighted resistor array R10 for this function.

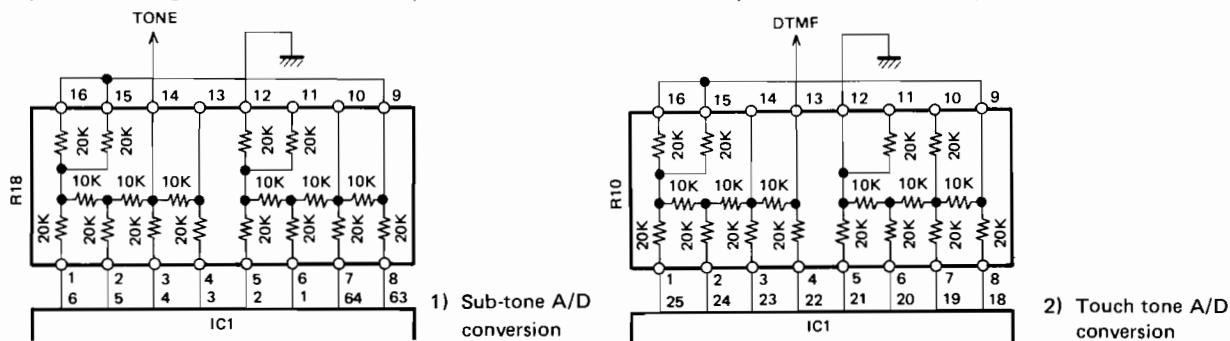


Fig. 5 Sub-tone and touch-tone signals

## CIRCUIT DESCRIPTION/SEMICONDUCTOR DATA

### ● Battery power save circuit

The TH-215 provides several battery saver modes to conserve on battery power. These modes function during the receive mode and not the transmit mode.

#### 1) Save mode

In this mode the radio will activate the battery power save circuit 2 seconds after the squelch closes.

#### 2) Auto save mode

In this mode the radio will activate the battery power save circuit 1 minute after the last key operation during the receive mode.

To select the desired battery saver mode press the **[SAVE]** key. Each time the key is depressed you will step thru the various modes, i.e. for SAVE to AUTO SAVE to OFF and back to SAVE etc. The appropriate indicator will light in the display to remind you which circuit is

active. When no indicator is on the battery power save circuit is OFF.

#### 3) Power save ratio selection

In addition to the two different activation modes the TH-215 allows you to specify the actual length of time the receiver section shuts down. To alter this rate press the **[F]** and then the **[SAVE]** key. The display will show the time the radio will be operating at reduced power levels.

During battery saver operation the SAVE line (pin 37) of the microprocessor repeatedly cycles between a logic "H" : High and "L" : Low which turns C5 and R5 ON and OFF. The VDD, KEY and M5 lines are not affected by these circuits and remain active. The ON/OFF interval is adjustable between 1 and 9 units, with each unit equalling about 200msec.

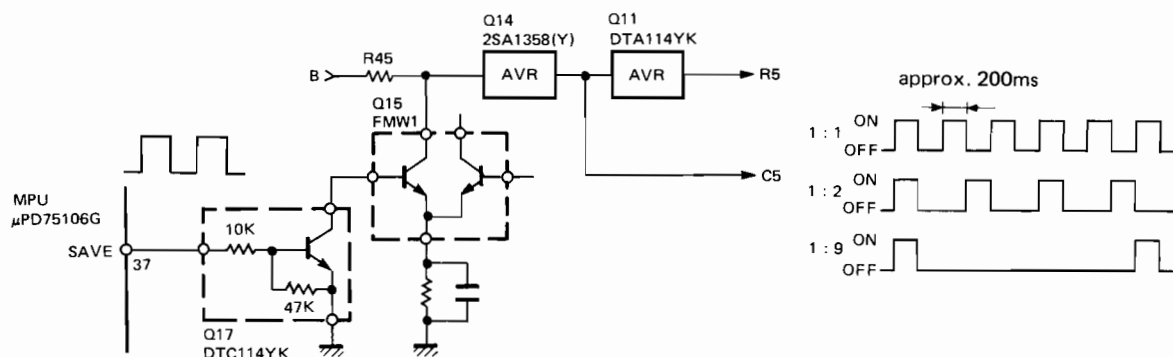
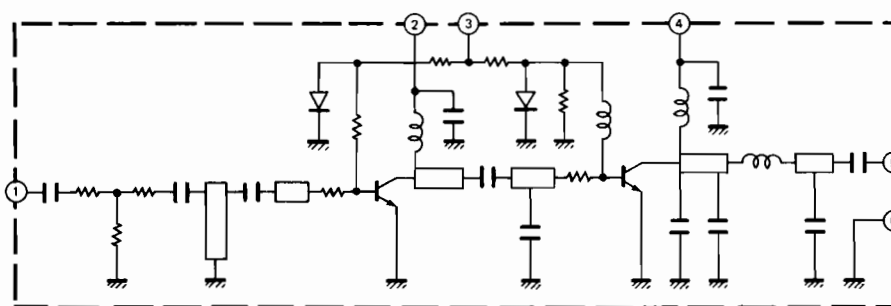


Fig. 6 Battery power save circuit

### RF POWER AMP M57732L(RF UNIT IC1)

#### ● Equivalent circuit



#### ● Electrical characteristic

Item	Symbol	Rating			Unit	Condition
		Min	Max	Typ		
Output power	$P_{01}$	7	8	—	W	$V_{cc} = 12.5V$
Total efficiency	$\eta_T$	40	45	—	%	$V_{cc} = 12.5V$
2nd spurious		—	—	-20	dB	$V_{cc} = 12.5V$
Spurious after 3rd		—	—	-30	dB	$V_{cc} = 12.5V$
Input SWR	$\delta_{in}$	—	1.5	2.5	—	$V_{cc} = 12.5V$
Output SWR	$\delta_{out}$	—	1.5	—	—	$V_{cc} = 12.5V$
Output power	$P_{02}$	5	6	—	W	$V_{cc} = 10.8V$
Output power	$P_{03}$	3.5	4	—	W	$V_{cc} = 8.4V$
Output power	$P_{04}$	1.5	2	—	W	$V_{cc} = 7.2V$

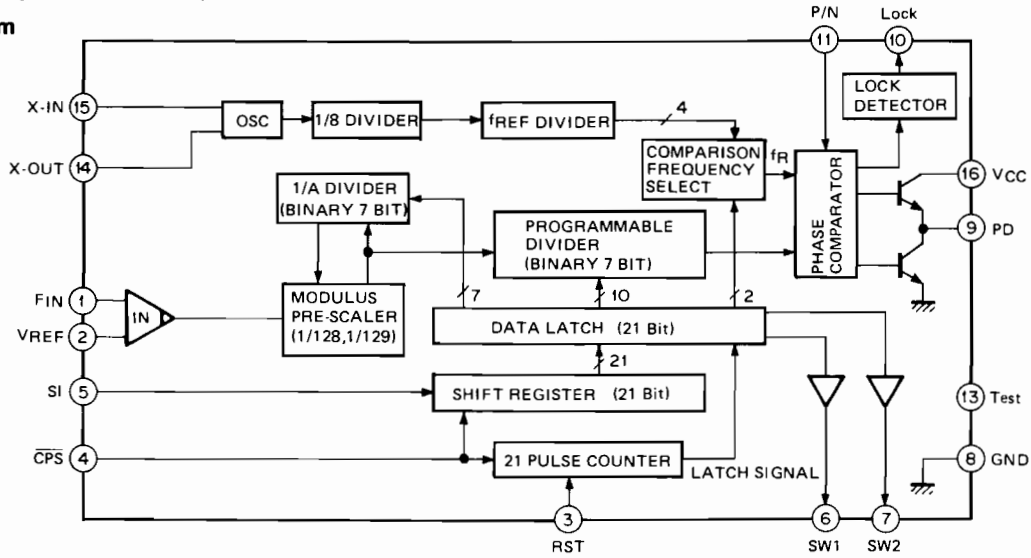
- 1:INPUT
- 2:PRE-DRIVE+B
- 3:BIAS+B
- 4:FINAL+B
- 5:OUTPUT
- 6:GND

( $T_a = 25^\circ C$ ,  $V_{BB} = 5V$ ,  $f = 135 \sim 160MHz$ ,  $P_{in} = 20mW$ ,  $Z_G = Z_L = 50 \Omega$ )

## SEMICONDUCTOR DATA

### PLL M54959P(RF UNIT IC2)

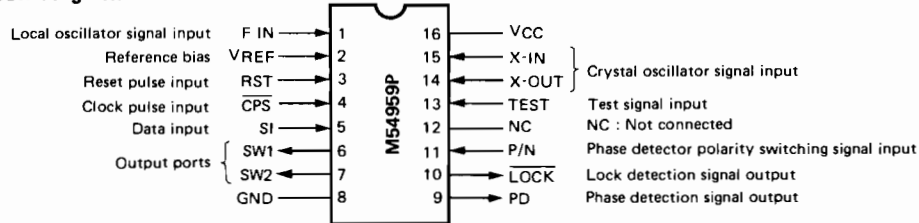
#### ● Block diagram



#### ● Description of terminals

No.	Symbol	Pin name	Description
1	FIN	Local oscillator signal input	Local oscillator frequency (VCO input; $f_{MAX} = 500\text{MHz}$ ).
2	VREF	Reference bias	Grounded by a 1000pF capacitor.
3	RST	Reset pulse input	Reset pulse input for 21-pulse counter.
4	CPS	Clock pulse input	Clock pulse input for shift register.
5	SI	Data input	Data input for shift register.
6	SW1	Output ports	Output ports whose status is determined by the data sent from the controller.
7	SW2		Open collector.
8	GND	Ground	0V.
9	PD	Phase detection signal output	Tristate.
10	LOCK	Lock detection signal output	"L" when the PLL unit is locked; "H" when it is unlocked. Open collector.
11	P/N	Phase detector polarity switching	When this pin is "H", the PD pin is "H" for phase lead and "L" for phase delay. When this pin is "L", the PD pin is "L" for phase lead and "H" for phase delay.
12	NC	Not connected	Used open or as ground.
13	Test	Test signal input	Usually "L". When this pin is "H", $f_R$ (comparison frequency) and $f_{IN}/N$ (programmable divider) are output from SW1 (pin 6) and SW2 (pin 7), respectively.
14	X-OUT	Liquid crystal oscillator signal input	Inputs signals sent from the 12.8MHz basic oscillator to X-IN.
15	X-IN		Oscillation is possible even when an external crystal resonator is used.
16	Vcc	Power supply	4.5~5.5V.

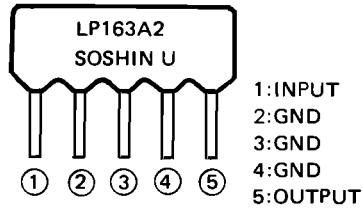
#### ● Terminal connection diagram



## SEMICONDUCTOR DATA

### LPF LP163A2(RF UNIT L8)

#### ● Outside view



#### ● Electrical characteristic

Item	Rating
Input and output impedance	50Ω
Pass bandwidth	142–163MHz
Loss	0.7dB or less
V.S.W.R.	1.5 or less
Attenuation	35dB or more (284–500MHz)

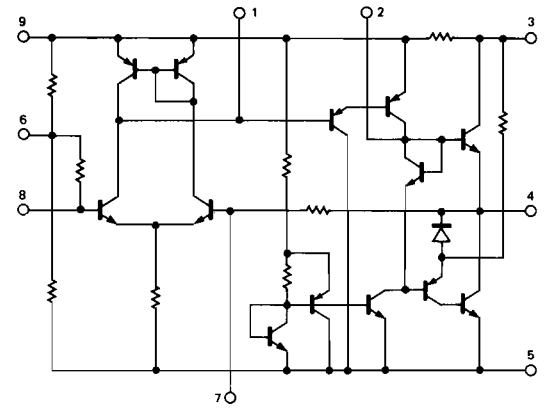
### AF POWER AMP BA526(IF UNIT IC2)

#### ● Electrical characteristic

Item	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
DC current	$I_{cc}$	–	12	24	mA	$V_{IN} = 0V$
Voltage gain	$G_{vc}$	48	52	54	dB	$R_{NF} = 47\Omega, V_{IN} = 2.5mV$
Max. output power	$P_o$ MAX	600	700	–	mW	$V_{IN} = 25mV$
Spec. output power	$P_o$	350	430	–	mW	T.H.D. = 10%
Noise output voltage	$V_{NO}$	–	0.25	0.7	mV	$R_g = 0\Omega$
Distortion	T.H.D.	–	0.4	2	%	$P_o = 50mW$
Input resistance	$Z_{IN}$	–	22	–	kΩ	1kHz $P_o = 50mW$

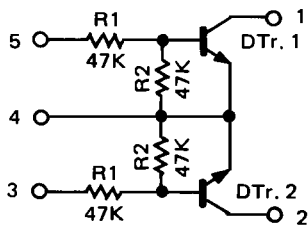
( $T_a = 25^\circ C, V_{CC} = 6V, R_L = 8\Omega, f = 1kHz$ )

#### ● Equivalent circuit



### FMG2 (IF UNIT Q6,10,19)

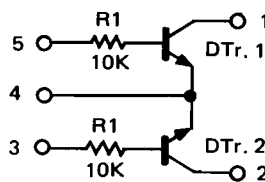
#### ● Equivalent circuit



1: Tr1 OUT  
2: Tr2 OUT  
3: Tr2 IN  
4: GND  
5: Tr1 IN

### FMG4 (RF UNIT Q11,14)

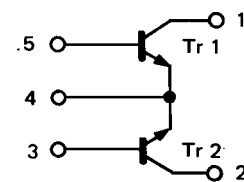
#### ● Equivalent circuit



1: Tr1 OUT  
2: Tr2 OUT  
3: Tr2 IN  
4: GND  
5: Tr1 IN

### FMW1 (IF UNIT Q15, RF UNIT Q5)

#### ● Equivalent circuit



1: Tr1 Collector  
2: Tr2 Collector  
3: Tr2 Base  
4: Tr1, 2 Emitter  
5: Tr1 Base

## SEMICONDUCTOR DATA

μPD75106G-514-1B (Case ass'y IC1)

● Terminal functions

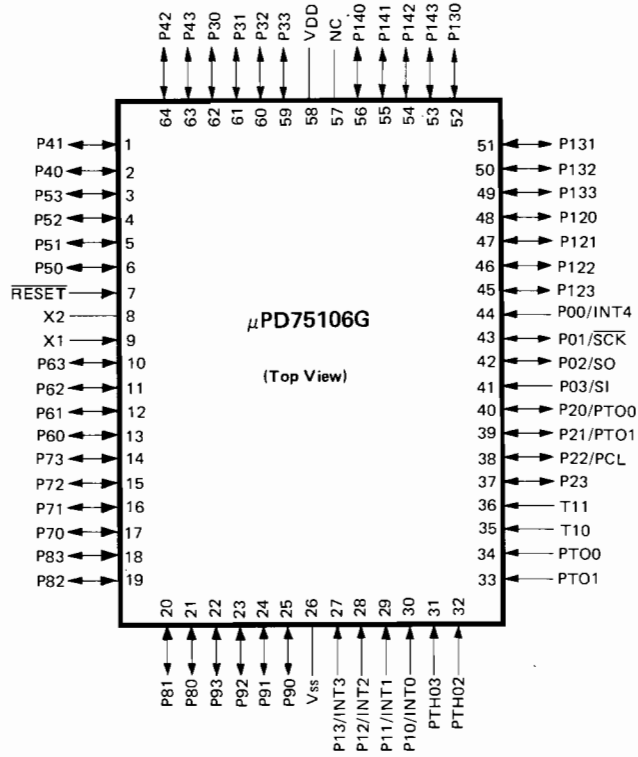
Pin No.	Port name	I/O	Name	Function
1	P41	O		TONE bit 5, 1750 (T,W only)
2	P40	O		TONE bit 4, 1750 (T,W only)
3	P53	O		TONE bit 3, 1750 (T,W only)
4	P52	O		TONE bit 2, 1750 (T,W only)
5	P51	O		TONE bit 1.
6	P50	O		TONE bit 0.
7	RESET	I		Reset.
8	X2	O		X'tal oscillator.
9	X1	I		X'tal oscillator.
10	P63	—		Not used.
11	P62	O	TRS	Power supply for TONE SQL unit, "H" : Power ON, "L" : Power OFF.
12	P61	I		μPD7225G RESET.
13	P60	O		μPD7225G BUSY.
14	P73	O		μPD7225G C/D.
15	P72	O		μPD7225G CS.
16	P71	O		μPD7225G SI.
17	P70	O		μPD7225G SCK.
18	P83	O		DTMF bit 7.
19	P82	O		DTMF bit 6.
20	P81	O		DTMF bit 5.
21	P80	O		DTMF bit 4.
22	P93	O		DTMF bit 3.
23	P92	O		DTMF bit 2.
24	P91	O		DTMF bit 1.
25	P90	O		DTMF bit 0.
26	Vss	—		GND.
27	P13/INT3	I	J4	Customer's pin.
28	P12/INT2	I	J3	Customer's pin.
29	P11/INT1	I	J2	Customer's pin.
30	P10/INT0	I	J1	Customer's pin.
31	PTH03	—		Not used.
32	PTH02	—		Not used.
33	PTH01	I		Battery warning, analog input.
34	PTH00	I	SM	S meter, analog input.
35	TI0	I	UL	"H" : PLL Unlocked, "L" : PLL Locked.
36	TI1	I	SQ	"H" : SQ Close.
37	P23	O	SAVE	OPEN : Power Save operation, "L" : NORMAL operation.
38	P22/PCL	O	TX	"H" : TX, "L" : RX, OPEN Power Save operation.
39	P21/PT01	O	BEEP	BEEP sound output.
40	P20/PT00	O	AFC	"H" : SP OFF, "L" : SP ON, OPEN Power Save operation.
41	P03/SI	—		Not used.
42	P02/SO	O	TD	DATA for TONE SQL unit.
43	P01/SCK	O	TCK	CLOCK for TONE SQL unit.
44	P00/INT4	I	BU	"H" : Normal operation, "L" : Backup operation switching.
45	P123	—		Not used.
46	P122	I	TS	"H" : TONE OFF, "L" : TONE ON.
47	P121	I	ST	"H" : PTT OFF, "L" : PTT ON.
48	P120	I		Key matrix (DOWN, 0, UP, SCAN).
49	P133	I		Key matrix (7, 8, 9, ENTER).
50	P132	I		Key matrix (4, 5, 6, M).
51	P131	I		Key matrix (1, 2, 3, F).
52	P130	I		Key matrix (OFFSET, REV, SAVE).
53	P143	O		Key matrix (SAVE, M, F, ENTER, SCAN).
54	P142	O		Key matrix (REV, 3, 6, 9, UP).
55	P141	O		Key matrix (OFFSET, 2, 5, 8, 0).
56	P140	O		Key matrix (1, 4, 7, DOWN).
57	NC	—		Not used.
58	VDD	—	VDD	Power supply (+ 5V).
59	P33	—		Not used.
60	P32	O	CPS	CLOCK for PLL IC.
61	P31	O	SI	DATA for PLL IC.
62	P30	O	RST	RESET for PLL IC.
63	P43	O		Tone bit 7, 1750 (T,W only)
64	P42	O		Tone bit 6, 1750 (T,W only)



## SEMICONDUCTOR DATA

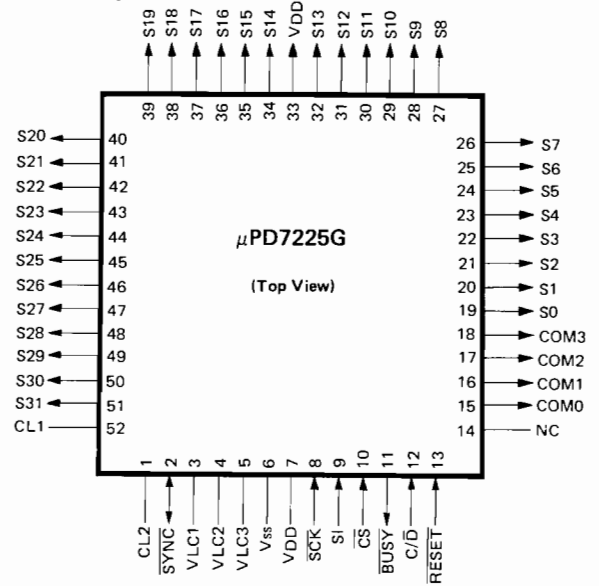
### μPD75106G-514-1B (Case ass'y IC1)

● Terminal connection diagram



### μPD7225G (Case ass'y IC2)

● Terminal connection diagram



### μPD7225G (Case ass'y IC2)

● Terminal functions

Pin No.	Pin name	Function
1	CL2	R connection for CLOCK signal generation.
2	SYNC	Not used.
3	VLC1	LCD driver power supply.
4	VLC2	LCD driver power supply.
5	VLC3	LCD driver power supply.
6	Vss	GND.
7	VDD	Power supply.
8	SCK	Serial clock input.
9	SI	Serial data output.
10	CS	Chip select input.
11	BUSY	BUSY output.
12	C/D	Command/Data select input.
13	RESET	Reset input.
14	NC	Not used.
15	COM0	Common signal output
16	COM1	Common signal output.
17	COM2	Common signal output.
18	COM3	Common signal output.
19~32	S0~S13	Segment signal output.
33	VDD	Not used.
34~51	S14~S31	Segment signal output.
52	CL1	R connection for CLOCK signal generation.

## DESCRIPTION OF COMPONENTS

### RF UNIT (X44-3000-10)

Component	Name	Function
IC1	M57732L	Transmission power amplification.
IC2	M54959P	PLL.
Q1	2SC2714(O)	VCO output amplifier.
Q2	2SC3838K(N,P)	Transmission amplifier.
Q3	2SC2407	Transmission amplifier.
Q4	2SA1313(Y)	Current control for D3.
Q5	FMW1	APC.
Q6	2SC3356	RF amplifier for reception.
Q7	2SC2714(O)	RF amplifier for reception.
Q8	2SK210(GR)	1st mixer for reception.
Q9	2SC2714(O)	1st IF amplifier for reception.
Q10	2SC3838K(N,P)	HFT (VCO) amplifier.
Q11	FMG4	Varicap tuning voltage control.
Q12,Q13	2SC2712(GR)	Active filter.
Q14	FMG4	VCO power supply switching for transmission and reception.
D1	HSM2693	Transmission/reception switching.
D2	DA204K	Q3 bias setting.
D3	1SV172	Control on RF signal input to final module.
D4	DA204K	Q5 bias setting.
D5	MI303	Transmission/reception switching (Transmission : ON).
D6	MI301	Transmission/reception switching (Transmission : ON).
D7	1SS277	Protection of receiving unit against excessive input.
D8,D9	HSM88AS	APC detection.
D10~D13	1SV153	Varicap tuning.
D14	ERB83-004	Protection against reverse connection.
D15	UZP-22B	Protection against over-voltage.
D16	ERB83-004	Battery protection for the external DC power supply operation.

### IF UNIT (X48-3020-XX)

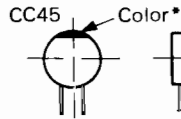
-10 : K,M1,M2,X (TH-215A), -51 : T,W (TH-215E)

Component	Name	Function
IC1	TA7761P	1st IF amplifier receiver, 2nd OSC, 2nd MIX, 2nd IF amplifier, DISC. ⑦S meter output, ⑨Detection signal output, ⑩AF amplifier output, ⑬Noise amplifier output, ⑭IF signal input.
IC2	BA526	AF power amplifier ④output, ⑧input.
IC3	S-8054HN	Backup reset ① output ("H" → "L" Backup).
IC4	LVC550C	Microprocessor power supply ①input, ③output.
IC5	LVC550C	KEY, 5V AVR for M5, ① input, ③ output.
Q1	2SC2712(GR)	SQL SW, BUSY : OFF.
Q2	2SC2712(GR)	SQL noise amplifier.
Q3	DTC144EK	SQL AUTO/MANUAL SW.
Q4	2SC2712(GR)	AF amplifier.
Q5	2SJ106(GR)	Hysteresis characteristic switching for SQL circuit, BUSY : ON.
Q6	FMG2	SW : ① Turns OFF the MIC input when sound is generated from SP while transmitting (when DTMF, BEEP, etc., output). ② Turns OFF the AF amplifier power supply when AFC is "H".
Q7	2SC2712(GR)	AF amplifier power supply.
Q8	2SA1241(Y)	AF amplifier power supply.
Q9	DTC143XK	BEEP sound amplifier.
Q10	FMG2	SW : ① Turns SPL "L" when using DTMF while transmitting with TONE SQL unit. ② Turns the line for MOD pin "L" to cut the microprocessor noise while receiving.
Q11	DTA114YK	R5 power supply SW.
Q12	DTA144EK	R5 power supply SW.
Q13	2SA1313(Y)	T5 power supply SW.
Q14	2SA1358(Y)	C5 power supply.
Q15	FMW1	C5 power supply.
Q16	DTC114YK	T5 power supply SW.
Q17	DTC114YK	SW : Turns C5 ON/OFF in SAVE mode.
Q18	DTC114YK	SW : Turns SQ pin "L" in SAVE (C5 OFF) mode.
Q19	FMG2	SW : Forces SQL open when monitoring.
Q20	DTC144EK	SW : Turns MIC input OFF when transmitting DTMF. <b>K,M1,M2,X only</b>
D1	HSM88AS	SQL noise rectification.
D3	1SS184	SW : Power supply for, AF amplifier, AFC, OR circuit for SPO.
D4	02CZ8.2	AVR
D5	02CZ8.2	AVR
D6	1SS184	SW : Switching for microprocessor power supply.
D7	1SS226	AVR voltage shift (approx. 0.6V).

## PARTS LIST

### CAPACITORS

CC 45 TH 1H 220 J  
 1 2 3 4 5 6



#### Capacitor value

1 0 3 = 0.01 μF

- 1 = Type ..... ceramic, electrolytic, etc.
- 2 = Shape ..... round, square, etc.
- 3 = Temp. coefficient
- 4 = Voltage rating
- 5 = Value
- 6 = Tolerance

- 0 1 0 = 1pF
- 1 0 0 = 10pF
- 1 0 1 = 100pF
- 1 0 2 = 1000pF = 0.001 μF

2 2 0 = 22pF  
 ↑ ↑ ↑  
 1st number Multiplier  
 2nd number

#### Temperature Coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	-80	-150	-220	-330	-470	-750

2nd Word	G	H	J	K	L
ppm/°C	± 30	± 60	± 120	± 250	± 500

Example CC45TH = -470 ± 60 ppm/°C

#### Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+ 40 - 20	+ 80 - 20	+ 100 - 0	10 μF - 10 ~ + 50 4.7 μF - 10 ~ + 75

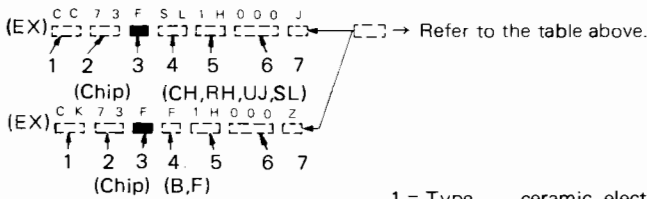
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

#### Rating voltage

1st word	2nd word										
	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	-
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	-
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	-

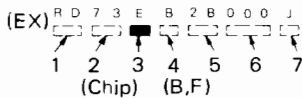
#### Chip capacitors



- 1 = Type ..... ceramic, electrolytic, etc.
- 2 = Shape ..... round, square, etc.
- 3 = Dimension
- 4 = Temp. coefficient
- 5 = Voltage rating
- 6 = Value
- 7 = Tolerance.

### RESISTORS

#### Chip resistor (Carbon)



#### Carbon resistor (Normal type)



#### Dimension

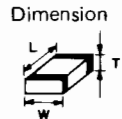
Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

#### Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

#### Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1/10W	2E	1/4W	3A	1W
2B	1/8W	2H	1/2W	3D	2W
2C	1/6W				



## PARTS LIST

### SEMICONDUCTOR

N : New parts

Item	Re- marks	Parts No.
<b>Diode</b>	N	1SS277
		ERB83-004
		MI301 MI303
<b>Vari-cap</b>		1SV153
<b>Chip Diode</b>	N	1SS184 1SS226 1SV172
		DA204K
		HSM88AS HSM2693
<b>Zener Diode</b>		UZP-22B
<b>Chip Zener Diode</b>	N	02CZ8.2
<b>Thermister</b>		112-101-2 112-202-2
<b>Posistor</b>		PTH59T103M
<b>TR</b>	N	2SA1241(Y) 2SA1358(Y) 2SB1182F5(Q) 2SC2407

Item	Re- marks	Parts No.	
<b>Chip TR</b>	N	2SA1313(Y) 2SC2412K 2SC2712(GR) 2SC2714(O) 2SC3356 2SC3838K(N,P)	
		<b>Digital TR</b>	DTA114YK DTA144EK DTC114YK DTC144EK DTC143XK
			<b>Chip FET</b>
<b>IC</b>	2SK210(GR) 2SK302(GR) 2SJ106(GR)		
	BA526 LVC550C		
	N N	M54959P M57732L	
N	NJM4560M S-8054HN TA7761P $\mu$ PD75106G-514-1B $\mu$ PD7225G		

## PARTS LIST

\* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
<b>TH-215A/E</b>						
1	3B	*	A01-1018-15	CASE		
2	3D		A02-0728-13	BATTERY CASE ASSY	M1M2	
5	1A	*	A02-0761-05	CASE ASSY	K	
5	1A	*	A02-0762-05	CASE ASSY	M1X	
5	1A	*	A02-0763-05	CASE ASSY	M2	
5	1A	*	A02-0765-05	CASE ASSY	TW	
7	3A	*	A20-2612-14	PANEL ASSY	KM1M2X	
7	3A	*	A20-2613-14	PANEL ASSY	TW	
8	2A		A22-0749-13	SUB PANEL		
10	3B		A40-0620-13	BOTTOM PLATE		
14	3C		B09-0307-14	CAP (ACSY)		
17	3A		B40-3687-04	MODEL NAME PLATE	KM1M2X	
17	3A	*	B40-3689-04	MODEL NAME PLATE	TW	
18	1D	*	B50-8120-10	INSTRUCTION MANUAL		
19	1D		B46-0410-10	WARRANTY CARD	K	
20	1D		B58-0682-04	CAUTION CARD	M1M2	
-		*	B42-2437-04	LABEL		
-		*	B42-2454-04	LABEL		
C42			CC45SL1H180J	CERAMIC 18PF J		
20	3B		D10-0602-04	LEVER (BATTERY RELEASE)		
22	2B		E23-0474-14	TERMINAL (BATT)		
23	3B		E23-0432-04	TERMINAL		
29	2A	*	E31-3209-05	CONNECTING WIRE(DC LINE)		
30	2A		E40-5089-05	PIN CONNECTOR (24P)		
-			E31-3207-08	FLAT CABLE (15P)		
-		*	E31-3210-05	CONNECTING WIRE(JIG FOR ADJ)		
-			E31-3211-08	FLAT CABLE (10P)		
J1	2A		E11-0420-15	MIC JACK		
J2	2A		E11-0421-05	PHONE JACK		
J3	2A		E03-0165-05	DC IN JACK		
J4	2A		E04-0160-05	BNC RECEPTACLE		
32	2B		F19-0646-04	BLIND PLATE		
34	1A		F20-0521-04	INSULATING SHEET(BATT,-)		
35	3A		F20-0574-04	INSULATING SHEET(CASE)		
36	1A		F20-0520-04	INSULATING BOARD(BATT,+)		
37	2B		F20-0575-04	INSULATING SHEET(VCO)		
40	3B		G01-0833-04	COIL SPRING		
41	3A		G01-0834-04	COIL SPRING		
43	2A		G10-0644-04	FELT (AF,SQL VR)		
44	2B		G11-0617-04	CUSHION (FOR BATT TERMINAL)		
46	3A		G13-0846-04	CUSHION (FOR BLIND PLATE)		
47	2A		G13-0814-04	CUSHION		
48	2C	*	H01-8051-02	ITEM CARTON BOX(TH-215A)	KM1M2X	
48	2C	*	H01-8053-02	ITEM CARTON BOX(TH-215E)	W	
49	1D		H21-0713-04	PROTECTION SHEET		
50	1D		H11-0808-14	BUFFER(TOP) 215X153X13		
51	3D		H11-0809-04	BUFFER (20X68X10)		
52	1C,3C		H13-0801-04	BUFFER		
53	2D		H25-0103-04	BAG (125X250)		
54	3D		H10-2618-02	POLYSTYRENE FOAMED FIXTURE		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

△ indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
55	2D		H25-0116-04	BAG (80X180)	K	
56	1C, 2C		H25-0120-04	BAG (150X150)	KXTW	
57	3C		H25-0076-03	BAG (60X50)		
58	2D		J29-0417-14 J21-4217-04	BELT HOOK MOUNTING HARDWARE	K	
62	1A		K01-0414-04	HANDLE		
63	2A	*	K23-0787-04	KNØB (AF VØL, SQL)		
64	3A		K27-0494-04	KNØB (TØNE, LØW)		
76	3D		N16-0030-41	SPRING WASHER (FOR BELT HOOK)	K	
77	2D		N35-3005-41	BINDING HEAD MACHINE SCREW	K	
78	3A		N19-0638-04	FLAT WASHER		
-			N09-2015-05	SCREW (BATTERY CASE)	M1M2	
A	3A, 3B		N09-2002-05	SCREW (2X20)		
B	2A		N09-2008-05	SCREW (2.6X8)		
C	3A, 3B		N09-2009-05	SCREW (2X4.5)		
D	2B		N09-2010-05	SCREW (2X6)		
F	2A		N09-2016-05	SCREW (2X4)		
G	2B		N35-2005-41	BINDING HEAD MACHINE SCREW		
H	1A, 1B		N35-2608-41	BINDING HEAD MACHINE SCREW		
K	2A		N87-2605-46	BRAZIER HEAD TAPTITE SCREW		
VR3	1A		R05-4419-05	SQL VØL (50KB)		
VR4	1A		R05-3440-05	AF VØL (10KA)		
S3	1A		S40-1401-05	PUSH SWITCH (SELF LØCK)	KM1M2X	
S3	1A		S40-1401-05	PUSH SWITCH (SELF LØCK)	T	
S3	1A		S40-1402-05	PUSH SWITCH (NØN LØCK)	W	
S4	1A		S40-1401-05	PUSH SWITCH (SELF LØCK)		
92	3D	*	T90-0352-05	ANTENNA		
95	2C		W09-0315-15	BATTERY CHARGER(120V)	K	
95	1C		W09-0317-15	BATTERY CHARGER(220V)	W	
95	1C		W09-0318-15	BATTERY CHARGER(240V)	T	
95	1C		W09-0319-15	BATTERY CHARGER(240V)	X	
103	2D		W09-0361-05	BATTERY PACK	KTW	
103	2D		W09-0361-05	BATTERY PACK	X	
B1	1B		W09-0326-05	LITHIUM BATTERY		
106	2B		X44-3000-10	RF PC BOARD ASSY		
107	2A		X48-3020-10	IF PC BOARD ASSY	KM1M2	
107	2A		X48-3020-10	IF PC BOARD ASSY	X	
107	2A		X48-3020-51	IF PC BOARD ASSY	TW	
<b>CASE ASS'Y (A02-076X-05)</b>						
200	2B	*	A02-0767-08	CASE	KM1M2X	
200	2B	*	A02-0769-08	CASE	TW	
201	1B	*	A33-0407-08	REFLECTØR		
202	1B	*	B10-0693-08	FRONT GLASS		
-		*	B03-0542-08	DRESSING PLATE		
-		*	B30-0849-05	LAMP (3V, 60MA)		
203	1B	*	E29-0476-08	LCD CONNECTØR (15P)		
204	2B		G01-0837-05	COMPRESSION SPRING		
205	2B		J31-0526-04	MIC SPACER		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

## PARTS LIST

※ New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnes dans le Parts No. ne sont pas fournis.


Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
206	2B		K29-3054-05	KN0B (PTT)		
207	2B		K29-3055-05	KN0B (MONITOR)		
209	1B		T07-0244-08	SPEAKER		
210	1B		T91-0312-15	MICROPHONE		
211		*	FTD8391	LCD		
D1			02CZ8.2	CHIP ZENER DIODE		
D2			DA204K	CHIP DIODE		
IC1			75106G-514-1B	MPU		
IC2			UPD7225G	LCD DRIVER		
Q1			2SC2412K	CHIP TRANSISTOR		
Q2			2SB1182	TRANSISTOR		
R10 ,18		*	KRR-C001	HIC		
<b>RF UNIT (X44-3000-10)</b>						
C1 ,2			CK73FB1H103K	CHIP C 0.010UF K		
C3 ,4			CK73FB1H102K	CHIP C 1000PF K		
C5 -7			CK73FB1H103K	CHIP C 0.010UF K		
C8			CC73FCH1H070D	CHIP C 7.0PF D		
C9			CC73FCH1H220J	CHIP C 22PF J		
C10 -12			CK73FB1H103K	CHIP C 0.010UF K		
C13			CC73FCH1H150J	CHIP C 15PF J		
C14			CC73FCH1H060D	CHIP C 6.0PF D		
C15 -19			CK73FB1H103K	CHIP C 0.010UF K		
C20			C90-2039-05	ELECTRO 15UF 16WV		
C21			C90-2048-05	ELECTRO 6.8UF 6.3WV		
C22			C90-2039-05	ELECTRO 15UF 16WV		
C23			CK73EB1E104K	CHIP C 0.10UF K		
C24			C90-2053-05	ELECTRO 47UF 6.3WV		
C25			C90-0478-05	ELECTRO 10UF 16WV		
C26 -29			CK73FB1H103K	CHIP C 0.010UF K		
C30			C90-0484-05	ELECTRO 0.47UF 50WV		
C31 ,32			CK73FB1H103K	CHIP C 0.010UF K		
C33			CC73FCH1H390J	CHIP C 39PF J		
C34 ,35			CC73FCH1H010C	CHIP C 1.0PF C		
C36			CK73FB1H102K	CHIP C 1000PF K		
C37 ,38			CC73FCH1H010C	CHIP C 1.0PF C		
C39			CC73FCH1H390J	CHIP C 39PF J		
C40 ,41			CK73FB1H103K	CHIP C 0.010UF K		
C43			C91-0769-05	CERAMIC 0.01UF M		
C44			CC73FCH1H270J	CHIP C 27PF J		
C45 ,46			CC73FCH1H040C	CHIP C 4.0PF C		
C47			CC73FCH1H070D	CHIP C 7.0PF D		
C48			CC73FCH1H101J	CHIP C 100PF J		
C49 ,50			CK73FB1H102K	CHIP C 1000PF K		
C51			CC73FCH1H070D	CHIP C 7.0PF D		
C52			CC73FCH1H020C	CHIP C 2.0PF C		
C53			CK73FB1H103K	CHIP C 0.010UF K		
C54			CC73FCH1HOR5C	CHIP C 0.5PF C		
C55			CC73FCH1H070D	CHIP C 7.0PF D		
C56			CC73FCH1H030C	CHIP C 3.0PF C		
C57			CK73FB1H103K	CHIP C 0.010UF K		
C58			CC73FCH1HOR5C	CHIP C 0.5PF C		
C59			CC73FCH1H070D	CHIP C 7.0PF D		
C60 ,61			CK73FB1H103K	CHIP C 0.010UF K		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

 indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.


Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
C62			CC73FCH1H180J	CHIP C 18PF J		
C63 -65			CK73FB1H103K	CHIP C 0.010UF K		
C66			CC73FCH1H080D	CHIP C 8.0PF D		
C67			CC73FCH1H330J	CHIP C 33PF J		
C68 ,69			CK73FB1H103K	CHIP C 0.010UF K		
C70			CC73FCH1H070D	CHIP C 7.0PF D		
C71			CC73FCH1H180J	CHIP C 18PF J		
C72			C90-2053-05	ELECTRØ 47UF 6.3WV		
C73			CK73FB1H103K	CHIP C 0.010UF K		
C74			CC73FCH1H560J	CHIP C 56PF J		
C75			CC73FCH1H150J	CHIP C 15PF J		
C76			CK73FB1H103K	CHIP C 0.010UF K		
C77			C90-0478-05	ELECTRØ 10UF 16WV		
C78			CK73FB1H102K	CHIP C 1000PF K		
C79			CK73FB1E223K	CHIP C 0.022UF K		
C80			CK73FB1H182K	CHIP C 1800PF K		
C81			CC73FCH1H101J	CHIP C 100PF J		
C82			CC73FSL1H471J	CHIP C 470PF J		
C83			CK73FB1H103K	CHIP C 0.010UF K		
C84			CS15E1C010M	TANTAL 1.0UF 16WV		
C85			CS15E1VR47M	TANTAL 0.47UF 35WV		
C86 ,87			CK73FB1H103K	CHIP C 0.010UF K		
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CK73EB1E104K	CHIP C 0.10UF K		
C90			C90-1408-05	ELECTRØ 220UF 6.3WV		
TC1			C05-0326-05	CERAMIC TRIMMER(10P)		
-		*	E29-0472-04	TERMINAL (GND)		
CN1		*	E40-5090-05	PIN CONNECTOR		
CN2		*	E40-3237-05	MINI CONNECTOR (2P)		
TP1 ,2			E23-0443-05	TERMINAL (TEST)		
-		*	F02-0427-14	HEAT SINK(CAP/ADDITION TYPE)		
-		*	F11-1038-14	SHIELDING COVER		
-		*	J30-0545-05	SPACER (FOR MCF)		
-			J31-0503-05	BEAD		
-			J39-0425-14	SPACER		
L1		*	L40-1581-80	SMALL FIXED INDUCTOR(CHIP,150N)		
L2		*	L40-3372-80	SMALL FIXED INDUCTOR(CHIP,33N)		
L3		*	L40-8272-80	SMALL FIXED INDUCTOR(CHIP,82N)		
L4		*	L40-5672-80	SMALL FIXED INDUCTOR(CHIP,56N)		
L5 -7			L33-0680-05	CHØKE CØIL		
L8		*	L79-0700-05	FILTER MØDULE (LP163A2)		
L9			L40-1092-14	SMALL FIXED INDUCTOR(10H)		
L10 ,11			L34-0892-05	CØIL		
L12			L34-0894-05	CØIL		
L13		*	L34-3159-05	CØIL		
L14		*	L34-4016-05	CØIL (RF)		
L15 -17			L34-2216-05	CØIL (RF)		
L18			L40-1001-14	SMALL FIXED INDUCTOR(100H)		
L19		*	L34-4017-05	CØIL (1ST IF)		
L20		*	L40-2281-80	SMALL FIXED INDUCTOR(CHIP,220N)		
L21		*	L40-8272-80	SMALL FIXED INDUCTOR(CHIP,82N)		
L22			L33-0680-05	CHØKE CØIL		
L23			L92-0110-05	BEAD CØRE		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

 indicates safety critical components.



## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnes dans le Parts No. ne sont pas fournis.


Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
C62			CC73FCH1H180J	CHIP C 18PF J		
C63 -65			CK73FB1H103K	CHIP C 0.010UF K		
C66			CC73FCH1H080D	CHIP C 8.0PF D		
C67			CC73FCH1H330J	CHIP C 33PF J		
C68 ,69			CK73FB1H103K	CHIP C 0.010UF K		
C70			CC73FCH1H070D	CHIP C 7.0PF D		
C71			CC73FCH1H180J	CHIP C 18PF J		
C72			C90-2053-05	ELECTRØ 47UF 6.3WV		
C73			CK73FB1H103K	CHIP C 0.010UF K		
C74			CC73FCH1H560J	CHIP C 56PF J		
C75			CC73FCH1H150J	CHIP C 15PF J		
C76			CK73FB1H103K	CHIP C 0.010UF K		
C77			C90-0478-05	ELECTRØ 10UF 16WV		
C78			CK73FB1H102K	CHIP C 1000PF K		
C79			CK73FB1E223K	CHIP C 0.022UF K		
C80			CK73FB1H182K	CHIP C 1800PF K		
C81			CC73FCH1H101J	CHIP C 100PF J		
C82			CC73FSL1H471J	CHIP C 470PF J		
C83			CK73FB1H103K	CHIP C 0.010UF K		
C84			CS15E1C010M	TANTAL 1.0UF 16WV		
C85			CS15E1VR47M	TANTAL 0.47UF 35WV		
C86 ,87			CK73FB1H103K	CHIP C 0.010UF K		
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CK73EB1E104K	CHIP C 0.10UF K		
C90			C90-1408-05	ELECTRØ 220UF 6.3WV		
TC1			C05-0326-05	CERAMIC TRIMMER(10P)		
-		*	E29-0472-04	TERMINAL (GND)		
CN1		*	E40-5090-05	PIN CONNECTØR		
CN2		*	E40-3237-05	MINI CONNECTØR (2P)		
TP1 ,2		*	E23-0443-05	TERMINAL (TEST)		
-		*	F02-0427-14	HEAT SINK(CAP/ADDITION TYPE)		
-		*	F11-1038-14	SHIELDING COVER		
-		*	J30-0545-05	SPACER (FOR MCF)		
-		*	J31-0503-05	BEAD		
-		*	J39-0425-14	SPACER		
L1		*	L40-1581-80	SMALL FIXED INDUCTØR(CHIP,150N)		
L2		*	L40-3372-80	SMALL FIXED INDUCTØR(CHIP,33N)		
L3		*	L40-8272-80	SMALL FIXED INDUCTØR(CHIP,82N)		
L4		*	L40-5672-80	SMALL FIXED INDUCTØR(CHIP,56N)		
L5 -7		*	L33-0680-05	CHØKE COIL		
L8		*	L79-0700-05	FILTER MØDULE (LP163A2)		
L9		*	L40-1092-14	SMALL FIXED INDUCTØR(10H)		
L10 ,11		*	L34-0892-05	COIL		
L12		*	L34-0894-05	COIL		
L13		*	L34-3159-05	COIL		
L14		*	L34-4016-05	COIL (RF)		
L15 -17		*	L34-2216-05	COIL (RF)		
L18		*	L40-1001-14	SMALL FIXED INDUCTØR(10UH)		
L19		*	L34-4017-05	COIL (1ST IF)		
L20		*	L40-2281-80	SMALL FIXED INDUCTØR(CHIP,220N)		
L21		*	L40-8272-80	SMALL FIXED INDUCTØR(CHIP,82N)		
L22		*	L33-0680-05	CHØKE COIL		
L23		*	L92-0110-05	BEAD CORE		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

 indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnes dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 向	Re- marks 備考
L24 ,25 L26 X1 XF1 ,2			L40-1021-14 L40-1092-14 L77-1325-05 L71-0265-05	SMALL FIXED INDUCTOR(1MH) SMALL FIXED INDUCTOR(1UH) CRYSTAL RESONATOR (12.8MHZ) MCF (16.3MHZ)		
-			N09-2017-05	TAPTYTE SCREW (Ø1.7X2.8)		
JP1			R92-0150-05	JUMPER REST 0 ØHM		
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R2			RK73FB2A153J	CHIP R 15K J 1/10W		
R3			RK73FB2A471J	CHIP R 470 J 1/10W		
R4			RK73FB2A821J	CHIP R 820 J 1/10W		
R5			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			RK73FB2A101J	CHIP R 100 J 1/10W		
R8			RK73FB2A331J	CHIP R 330 J 1/10W		
R9			RK73FB2A560J	CHIP R 56 J 1/10W		
R10			RK73FB2A470J	CHIP R 47 J 1/10W		
R11			RK73FB2A220J	CHIP R 22 J 1/10W		
R12			RK73FB2A103J	CHIP R 10K J 1/10W		
R13			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R14			RK73FB2A681J	CHIP R 680 J 1/10W		
R15			RK73FB2A120J	CHIP R 12 J 1/10W		
R16 ,17			RK73FB2A331J	CHIP R 330 J 1/10W		
R18			RK73FB2A221J	CHIP R 220 J 1/10W		
R19			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R20			RK73FB2A333J	CHIP R 33K J 1/10W		
R21			RK73FB2A103J	CHIP R 10K J 1/10W		
R22			RK73FB2A221J	CHIP R 220 J 1/10W		
R23 ,24			RK73FB2A820J	CHIP R 82 J 1/10W		
R25			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R29			RK73FB2A104J	CHIP R 100K J 1/10W		
R30			RD14BB2C103J	RD 10K J 1/6W		
R31			RK73FB2A271J	CHIP R 270 J 1/10W		
R32 ,33			RK73FB2A103J	CHIP R 10K J 1/10W		
R34			RK73FB2A104J	CHIP R 100K J 1/10W		
R35			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R36			RD14BB2C470J	RD 47 J 1/6W		
R37 -39			RK73FB2A104J	CHIP R 100K J 1/10W		
R40			RK73FB2A470J	CHIP R 47 J 1/10W		
R41			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R42			RK73FB2A470J	CHIP R 47 J 1/10W		
R43			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R44			RK73FB2A103J	CHIP R 10K J 1/10W		
R45			RD14BB2C471J	RD 470 J 1/6W		
R46			RD14BB2C470J	RD 47 J 1/6W		
R47			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R48			RD14BB2C101J	RD 100 J 1/6W		
R49			RD14BB2C334J	RD 330K J 1/6W		
R50			RK73FB2A271J	CHIP R 270 J 1/10W		
R51			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R52			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A104J	CHIP R 100K J 1/10W		
R54			RK73FB2A223J	CHIP R 22K J 1/10W		
R55 -57			RK73FB2A104J	CHIP R 100K J 1/10W		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R58 ,59			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R60			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R61			RK73FB2A103J	CHIP R 10K J 1/10W		
R62			RK73FB2A183J	CHIP R 18K J 1/10W		
R63			RK73FB2A394J	CHIP R 390K J 1/10W		
R64			RK73FB2A104J	CHIP R 100K J 1/10W		
R65			RK73FB2A473J	CHIP R 47K J 1/10W		
R66			RD14BB2C823J	RD 82K J 1/6W		
D1		*	HSM2693	CHIP DIODE		
D2			DA204K	CHIP DIODE		
D3		*	1SV172	CHIP DIODE		
D4			DA204K	CHIP DIODE		
D5			MI303	DIODE		
D6			MI301	DIODE		
D7		*	1SS277	DIODE		
D8 ,9			HSM88AS	VARICAP DIODE		
D10 -13			1SV153	DIODE		
D14			ERB83-004	DIODE		
D15		*	UZP-22B	ZENER DIODE		
D16			ERB83-004	DIODE		
IC1		*	M57732L	IC(POWER MODULE/ 135-160MHZ,5W		
IC2		*	M54959P	IC(FREQ SYNTHESIZER PLL)		
Q1			2SC2714(Ø)	CHIP TRANSISTOR		
Q2			2SC3838K(N,P)	CHIP TRANSISTOR		
Q3			2SC2407	TRANSISTOR		
Q4			2SA1313(Y)	CHIP TRANSISTOR		
Q5			FMW1	DIGITAL TRANSISTOR		
Q6			2SC3356	CHIP TRANSISTOR		
Q7			2SC2714(Ø)	CHIP TRANSISTOR		
Q8			2SK210(GR)	CHIP FET		
Q9			2SC2714(Ø)	CHIP TRANSISTOR		
Q10			2SC3838K(N,P)	CHIP		
Q11		*	FMG4	DIGITAL TRANSISTOR		
Q12 ,13			2SC2712(GR)	TRANSISTOR		
Q14		*	FMG4	DIGITAL TRANSISTOR		
131	2B		X58-3010-10	SUB UNIT (VCO)		
<b>IF UNIT (X48-3020-XX) -10 : TH-215A, -51 : TH-215E</b>						
C1			CE04CW1H010M	ELECTRO 1.0UF 50WV		
C2			CK73FB1H471K	CHIP C 470PF K		
C3 ,4			CK73FB1H102K	CHIP C 1000PF K		
C5 ,6			C90-0890-05	CHIP TAN 1UF 16WV		
C7			C91-0769-05	CERAMIC 0.01UF M		
C8			CK73FB1H103K	CHIP C 0.010UF K		
C9			C90-0888-05	CHIP TAN 0.1UF 16WV		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			CC73FCH1H390J	CHIP C 39PF J		
C12			CK73FB1H102K	CHIP C 1000PF K		
C13			CK73FB1H123K	CHIP C 0.012UF K		
C14			CK73FB1H122K	CHIP C 1200PF K		
C15			CK73FB1H102K	CHIP C 1000PF K		
C16			CK73FB1H123K	CHIP C 0.012UF K		
C17			CK73FB1H103K	CHIP C 0.010UF K		
C19			CK73FB1E223K	CHIP C 0.022UF K		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

▲ indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.


Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
C20			CK73FB1H102K	CHIP C 1000PF K		
C23			CC73FCH1H820J	CHIP C 82PF J		
C24			CC73FCH1H330J	CHIP C 33PF J		
C25 -27			CK73EB1E104K	CHIP C 0.10UF K		
C28			C90-2050-05	ELECTRØ 33UF 6.3WV		
C29			CK73EB1E104K	CHIP C 0.10UF K		
C30			C90-1248-05	ELECTRØ 1UF 50WV		
C31			C90-0890-05	CHIP TAN 1UF 16WV		
C32			CK73FB1H102K	CHIP C 1000PF K		
C33			CK73FB1H222K	CHIP C 2200PF K		
C34			CK73FB1H102K	CHIP C 1000PF K		
C35			CK73FB1H681K	CHIP C 680PF K		
C36			CE04CW1A470M	ELECTRØ 47UF 10WV		
C37 ,38			C90-2012-05	ELECTRØ 100UF 10WV		
C39			C91-1015-05	FILM 0.18UF		
C40 ,41			C90-0885-05	TANTAL 10UF 6.3WV		
C42			CK73FB1H103K	CHIP C 0.010UF K		
C43			CE04CW1A330M	ELECTRØ 33UF 10WV		
C44			C90-1248-05	ELECTRØ 1UF 50WV		
C45			CK73FB1H102K	CHIP C 1000PF K		
C46			C90-1248-05	ELECTRØ 1UF 50WV		
C47			CE04CW1C220M	ELECTRØ 22UF 16WV		
C48			CE04CW1C470M	ELECTRØ 47UF 16WV		
C49			CK73FF1E104Z	CHIP C 0.10UF Z		
C50			CK73FB1H471K	CHIP C 470PF K		
C51			CE04CW1C4R7M	ELECTRØ 4.7UF 16WV		
C52			CK73FB1H152K	CHIP C 1500PF K		
C53			CK73FB1H103K	CHIP C 0.010UF K		
C54			C90-0891-05	TANTAL 4.7UF 16WV		
C56 ,57			CK73FB1H103K	CHIP C 0.010UF K		
C58			CE04CW1HR22M	ELECTRØ 0.22UF 50WV		
C59			CK73FB1H102K	CHIP C 1000PF K		
C60			C90-0868-05	ELECTRØ 10UF 16WV		
C61 ,62			CK73FB1H471K	CHIP C 470PF K		
C63			C90-0868-05	ELECTRØ 10UF 16WV		
C64			CK73FB1H102K	CHIP C 1000PF K		KM1M2X
C65			CK73FB1H471K	CHIP C 470PF K		KM1M2X
C68			C90-2011-05	ELECTRØ 4.7UF 25WV		
C69			C90-1248-05	ELECTRØ 1UF 50WV		
C70			CK73FB1H471K	CHIP C 470PF K		
C70			CK73FB1H471K	CHIP C 470PF K		
C71			CE04CW0J220M	ELECTRØ 22UF 6.3WV		
C72 -74			CK73FB1H471K	CHIP C 470PF K		
C75			C90-1248-05	ELECTRØ 1UF 50WV		
C76			C90-2048-05	ELECTRØ 6.8UF 6.3WV		
C77 ,78			CK73FB1H102K	CHIP C 1000PF K		
C83			CE04CW1C470M	ELECTRØ 47UF 16WV		
C84			CK73FB1H471K	CHIP C 470PF K		
C85			C90-2049-05	ELECTRØ 15UF 6.3WV		
C86			CK73FB1H471K	CHIP C 470PF K		
C87			C90-2048-05	ELECTRØ 6.8UF 6.3WV		
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CK73FB1H471K	CHIP C 470PF K		
C90			CK73FB1H102K	CHIP C 1000PF K		
C91			CK73FB1H471K	CHIP C 470PF K		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

 indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
C92 C93 -96 C97 C98 C99			C90-2073-05 CK73FB1H102K CK73FB1H471K C90-2049-05 CK73FB1H102K	ELECTRO CAPACITOR(AL) CHIP C 1000PF K CHIP C 470PF K ELECTRO 15UF 6.3WV CHIP C 1000PF K		
C100 C101 C102 C103			CK73FB1H471K CK73FB1H102K CE04CW1C220M CK73FB1H471K	CHIP C 470PF K CHIP C 1000PF K ELECTRO 22UF 16WV CHIP C 470PF K		
CN2 CN3 CN4			E40-5039-05 E40-5021-05 E40-5034-05	PIN CONNECTOR (5597-15CPB) PIN CONNECTOR (7P) PIN CONNECTOR (5597-10CPB)	KM1M2X	
CF1 L2 ,3 L4 X1			L72-0335-05 L30-0538-05 L40-4791-14 L77-1323-05	CERAMIC FILTER (CFU45SE2) IFT (455KHZ) SMALL FIXED INDUCTOR(4.7KHZ) CRYSTAL RESONATOR(16.722MHZ)		
Q13			2SA1313(Y)	CHIP TRANSISTOR		
- CJ1 ,2 CJ3 JP1 ,2 JP3			R92-0150-05 R92-0670-05 R92-0670-05 R92-1061-05 R92-1061-05	JUMPER REST 0 OHM CHIP R 0 OHM CHIP R 0 OHM JUMPER REST 0 OHM JUMPER REST 0 OHM	KM1MX TW TW	
R1 R2 R3 R4 R6			RK73FB2A152J RK73FB2A271J RK73FB2A332J RK73FB2A271J RK73FB2A105J	CHIP R 1.5K J 1/10W CHIP R 270 J 1/10W CHIP R 3.3K J 1/10W CHIP R 270 J 1/10W CHIP R 1.0M J 1/10W		
R7 R9 R10 R11 R12			RK73FB2A564J RK73FB2A153J RK73FB2A333J RK73FB2A223J RK73FB2A472J	CHIP R 560K J 1/10W CHIP R 15K J 1/10W CHIP R 33K J 1/10W CHIP R 22K J 1/10W CHIP R 4.7K J 1/10W		
R14 R15 ,16 R17 R18 R19			RK73FB2A103J RK73FB2A152J RK73FB2A823J RK73FB2A333J RK73FB2A223J	CHIP R 10K J 1/10W CHIP R 1.5K J 1/10W CHIP R 82K J 1/10W CHIP R 33K J 1/10W CHIP R 22K J 1/10W		
R20 R21 R23 R24 R25			RK73FB2A103J RK73FB2A473J RK73FB2A103J RK73FB2A222J RK73FB2A473J	CHIP R 10K J 1/10W CHIP R 47K J 1/10W CHIP R 10K J 1/10W CHIP R 2.2K J 1/10W CHIP R 47K J 1/10W		
R26 R28 R29 ,30 R31 R32			RD14CB2C123J RK73FB2A471J RK73FB2A103J RK73FB2A333J RD14BB2C822J	RD 12K J 1/6W CHIP R 470 J 1/10W CHIP R 10K J 1/10W CHIP R 33K J 1/10W RD 8.2K J 1/6W		
R33 R34 R35 R36 R37			RK73FB2A122J RK73FB2A333J RK73FB2A103J RK73FB2A473J RK73FB2A100J	CHIP R 1.2K J 1/10W CHIP R 33K J 1/10W CHIP R 10K J 1/10W CHIP R 47K J 1/10W CHIP R 10 J 1/10W		
R38			RD14BB2C272J	RD 2.7K J 1/6W		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

▲ indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
R39			RK73FB2A273J	CHIP R 27K J 1/10W		
R40			RK73FB2A223J	CHIP R 22K J 1/10W		
R41			RK73FB2A103J	CHIP R 10K J 1/10W		
R42			RK73FB2A151J	CHIP R 150 J 1/10W		
R43			RK73FB2A224J	CHIP R 220K J 1/10W	KM1M2X	
R44			RK73FB2A474J	CHIP R 470K J 1/10W	KM1M2X	
R45			RD14BB2C472J	RD 4.7K J 1/6W		
R46			RK73FB2A473J	CHIP R 47K J 1/10W		
R47			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R48			RD14BB2C272J	RD 2.7K J 1/6W		
R49			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R51			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R52			RK73FB2A124J	CHIP R 120K J 1/10W		
R53			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R54			RK73FB2A473J	CHIP R 47K J 1/10W		
R55			RK73FB2A223J	CHIP R 22K J 1/10W		
R56			RK73FB2A473J	CHIP R 47K J 1/10W		
R57			RK73FB2A223J	CHIP R 22K J 1/10W		
R58			RK73FB2A822J	CHIP R 8.2K J 1/10W		
VR1			R12-3447-05	TRIMMING PØT. (10K)		
VR2			R12-1431-05	TRIMMING PØT. (1K)		
VR5			R12-6406-05	TRIMMING PØT. (470K)		
VR6			R12-1437-05	TRIMMING PØT. (3.3K)		
VR7		*	R12-1436-05	TRIMMING PØT. (1K)		
VR8			R12-5422-05	TRIMMING PØT. (100K)	KM1M2X	
S1	,2	2B	S40-1412-05	TACT SWITCH (EVQ-QSH03B)		
D1			HSM88AS	CHIP DIØDE		
D3			1SS184	CHIP DIØDE		
D4	,5		Ø2C28.2	CHIP ZENER DIØDE		
D6			1SS184	CHIP DIØDE		
D7			1SS226	CHIP DIØDE		
IC1			TA7761P	IC(FM IF)		
IC2			BA526	IC(AF POWER AMP/ 700MW)		
IC3			S-8Ø54HN	IC(VØLTAGE DETECTOR)		
IC4	,5		LVC55ØC	IC(VØLTAGE REGULATOR/ +5V)		
Q1	,2		2SC2712(GR)	CHIP TRANSISTØR		
Q3			DTC144EK	DIGITAL TRANSISTØR		
Q4			2SC2712(GR)	CHIP TRANSISTØR		
Q5			2SJ1Ø6(GR)	CHIP FET		
Q6			FMG2	DIGITAL TRANSISTØR		
Q7			2SC2712(GR)	CHIP TRANSISTØR		
Q8			2SA1241(Y)	TRANSISTØR		
Q9			DTC143XK	DIGITAL TRANSISTØR		
Q10			FMG2	DIGITAL TRANSISTØR	KM1M2X	
Q11			DTA114YK	DIGITAL TRANSISTØR(10K,47K)		
Q12			DTA144EK	DIGITAL TRANSISTØR(47K,47K)		
Q14			2SA1358(Y)	TRANSISTØR		
Q15			FMW1	DIGITAL TRANSISTØR		
Q16	-18		DTC114YK	DIGITAL TRANSISTØR(47K,47K)		
Q19			FMG2	DIGITAL TRANSISTØR		
Q20			DTC144EK	DIGITAL TRANSISTØR	KM1M2X	
TH1			PTH59T1Ø3M	PØSISTØR		
TH2			112-2Ø2-2	THERMISTØR		
TH3			112-1Ø1-2	THERMISTØR		

E: Scandinavia &amp; Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnes dans le Parts No. ne sont pas fournis.


Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
B1	1B	*	W09-0371-05	LITHIUM BATTERY (CR2032-T12)		
-			X59-3090-10	MODULE UNIT (MIC AMP)		
<b>VCO (X58-3010-10)</b>						
C1			CC73FCH1H030C	CHIP C 3.0PF C		
C2			CK73FF1E104Z	CHIP C 0.10UF Z		
C3			CC73FRH1H680J	CHIP C 68PF J		
C4			CC73FCH1H060D	CHIP C 6.0PF D		
C5			CK73EB1E104K	CHIP C 0.10UF K		
C6			CK73FB1H103K	CHIP C 0.010UF K		
C7			CC73FCH1H030C	CHIP C 3.0PF C		
C8			CK73FB1H102K	CHIP C 1000PF K		
C9			CC73FRH1H680J	CHIP C 68PF J		
C10			CC73FCH1H060D	CHIP C 6.0PF D		
C11			CC73FCH1H030C	CHIP C 3.0PF C		
C12			CK73FB1H102K	CHIP C 1000PF K		
TC1 ,2			C05-0329-05	TRIMMING CAP (6P)		
-			E23-0465-05	TEST PIN		
-		*	E40-5092-05	TERMINAL		
-			F11-1039-04	SHIELDING CASE		
L1		*	L34-4013-05	COIL		
L2			L40-1892-81	SMALL FIXED INDUCTOR(1.8UH)		
L3		*	L34-4014-05	COIL		
L4			L40-1892-81	SMALL FIXED INDUCTOR(1.8UH)		
R1			RK73FB2A104J	CHIP R 100K J 1/10W		
R2			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R3			RK73FB2A104J	CHIP R 100K J 1/10W		
R4			RK73FB2A151J	CHIP R 150 J 1/10W		
R5 ,6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R8			RK73FB2A104J	CHIP R 100K J 1/10W		
R9			RK73FB2A181J	CHIP R 180 J 1/10W		
D1			1SV153	VARI CAP		
D2			1SS277	DIODE		
D3 ,4			1SV153	VARI CAP		
D5			1SS277	DIODE		
D6 ,7			1SV153	VARI CAP		
Q1 ,2			2SK302(GR)	CHIP FET		
<b>MIC AMP (X59-3090-10)</b>						
C1			CK73FB1E223K	CHIP C 0.022UF K		
C2			CK73FB1H471K	CHIP C 470PF K		
C3			C92-0005-05	CHIP TAN 2.2UF 6.3WV		
C4			CK73FB1H182K	CHIP C 1800PF K		
C5			CC73FCH1H151J	CHIP C 150PF J		
C6			CK73FB1H103K	CHIP C 0.010UF K		
C7			CK73FB1H471K	CHIP C 470PF K		
-			E23-0471-05	TERMINAL		
R1			RK73FB2A104J	CHIP R 100K J 1/10W		
R2			RK73FB2A103J	CHIP R 10K J 1/10W		
R3 ,4			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R5			RK73FB2A391J	CHIP R 390 J 1/10W		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

 indicates safety critical components.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.


Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R6			RK73FB2A823J	CHIP R 82K J 1/10W		
R7 ,8			RK73FB2A104J	CHIP R 100K J 1/10W		
R9			RK73FB2A472J	CHIP R 4.7K J 1/10W		
IC1		*	NJM4560M	IC(OP AMP X2)		

E: Scandinavia & Europe K: USA P: Canada W: Europe

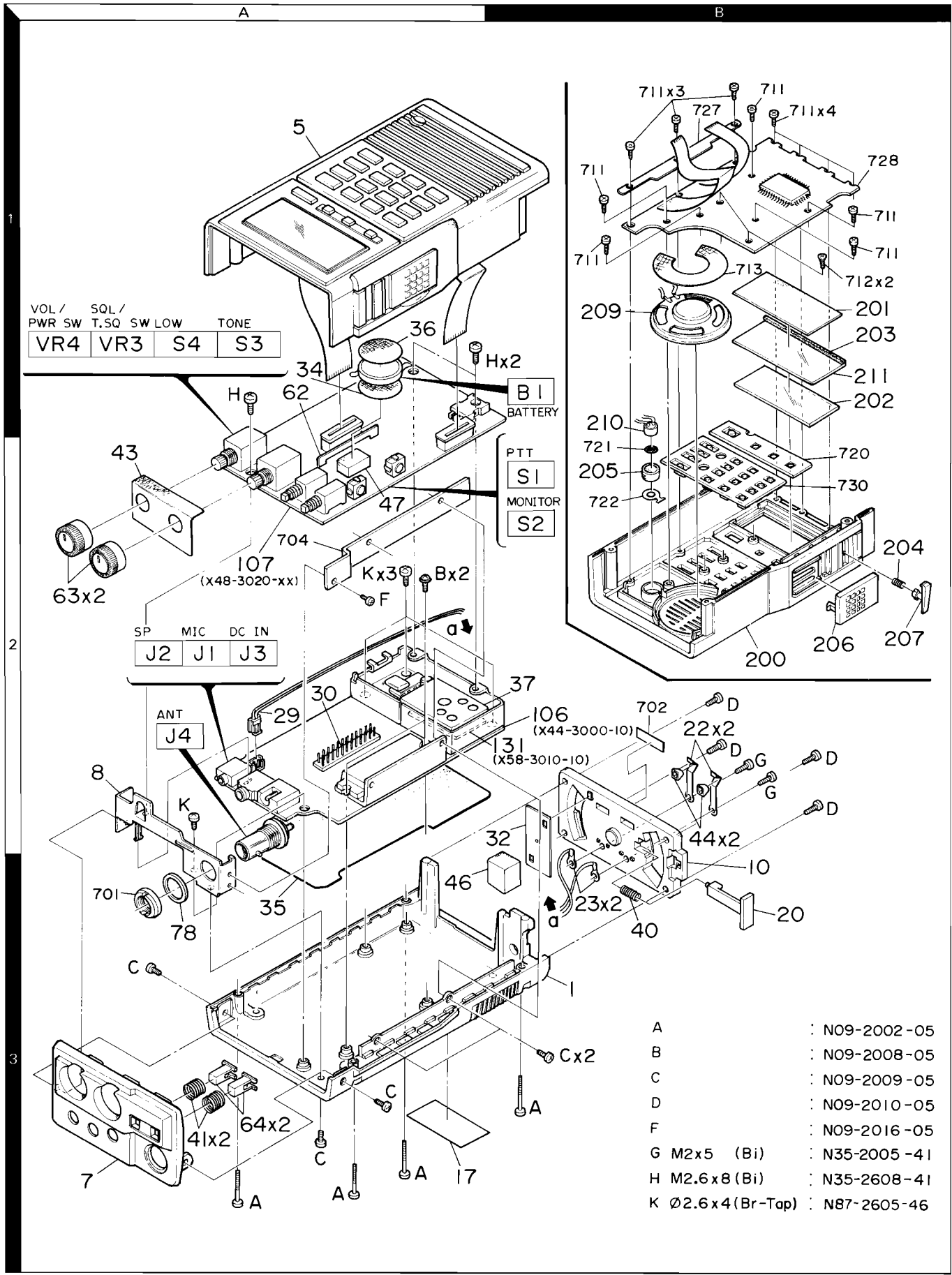
U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

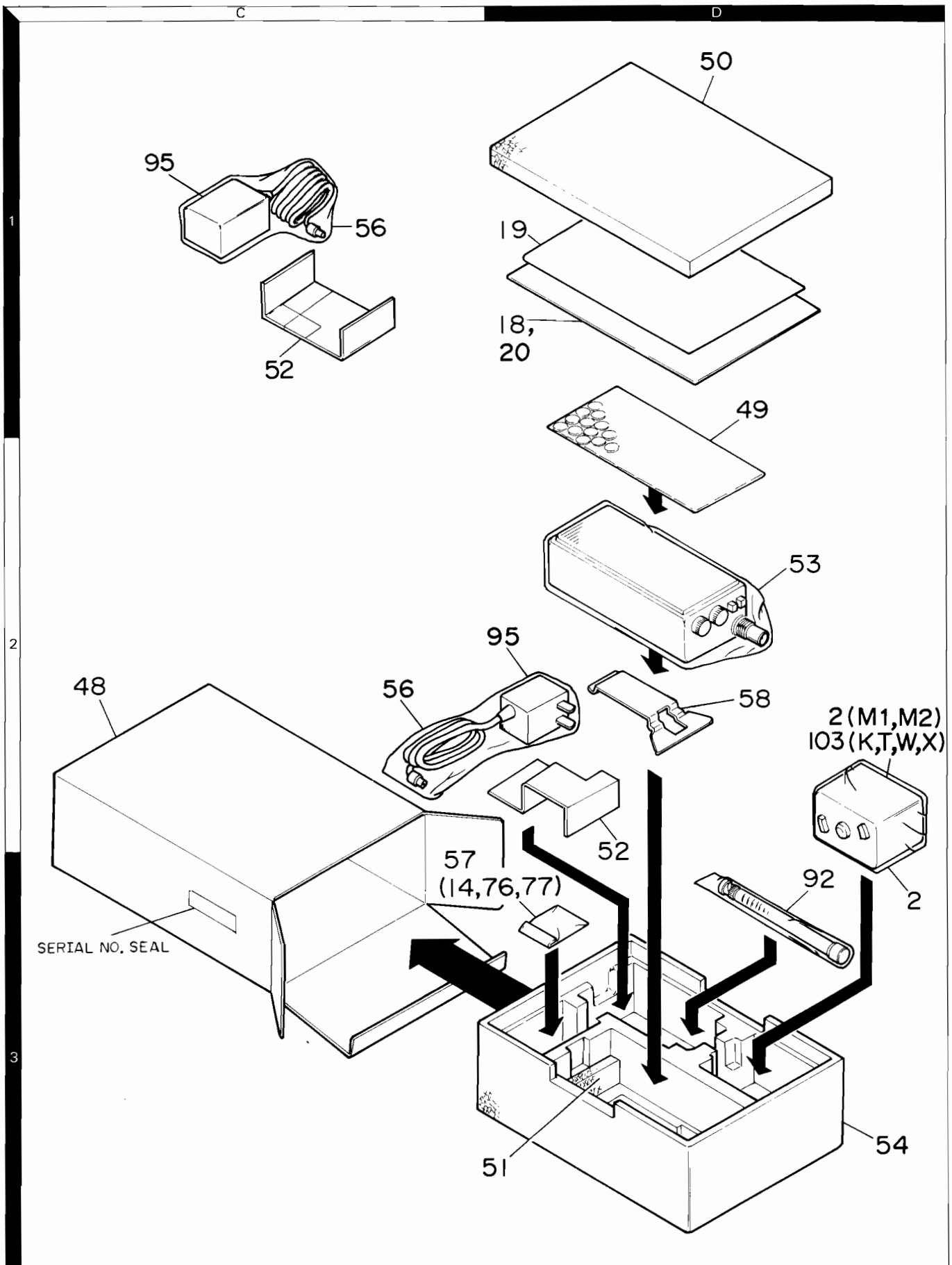
 indicates safety critical components.



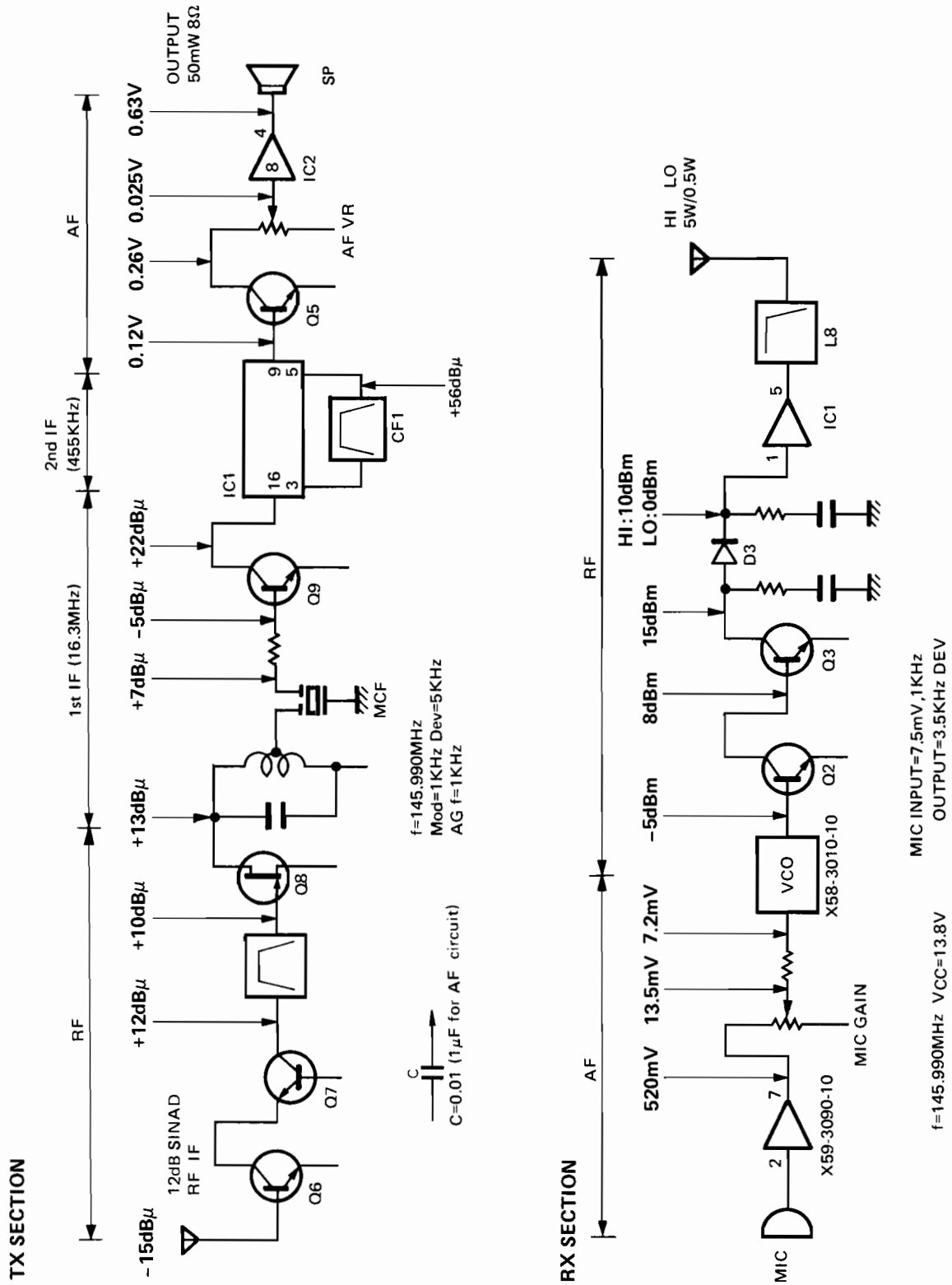
## EXPLODED VIEW



## PACKING



## LEVEL DIAGRAM



## ADJUSTMENT

### REQUIRED TEST EQUIPMENT

#### 1. Stabilized Power Supply

- 1) The supply voltage can be changed between 5V and 18V, and the current is 3A or more.
- 2) The standard voltage is 13.8V.

#### 2. DC Ammeter

- 1) Class 1 ammeter (17 ranges and other features)
- 2) The full scale can be set to either 300mA or 10A.
- 3) A cable of less internal loss must be used.

#### 3. Frequency Counter (f. counter)

- 1) Frequencies of up to 1GHz or so can be measured.
- 2) The sensitivity can be changed to 250MHz or below, and measurements are highly stable and accurate (0.2 ppm or so).

#### 4. Power Meter

- 1) Measurable frequency : Up to 500MHz
- 2) Impedance :  $50\Omega$ , unbalanced
- 3) Measuring range : Full scal of 10W or so
- 4) A standard cable (5D2W 1m) must be used.

#### 5. RF VTVM (RF V.M)

- 1) Measurable frequency : Up to 500MHz or so

#### 6. Linear Detector

- 1) Measurable frequency : Up to 500MHz
- 2) Characteristics are flat, and CN is 60dB or more.

#### 7. Digital Voltmeter

- 1) Voltage range : FS = 18V or so
- 2) Input resistance :  $1M\Omega$  or more

#### 8. Oscilloscope

- 1) Measuring range : DC to 30MHz
- 2) Provides highly accurate measurements for 5 to 25 MHz.

#### 9. AF Voltmeter (AF VTVM)

- 1) Measurable frequency : 50Hz to 1MHz
- 2) Maximum sensitivity : 1mV or more

#### 10. Spectrum Analyzer

- 1) Measuring range : DC to 1GHz or more

#### 11. Standard Signal Generator (SSG)

- 1) Maximum frequency : 500MHz or more
- 2) Output :  $-20\text{dB}/0.1\mu\text{V}$  to  $120\text{dB}/1\text{V}$
- 3) Output impedance :  $50\Omega$

#### 12. Tracking Generator

- 1) Center frequency : 50kHz to 200MHz
- 2) Frequency deviation :  $\pm 35\text{MHz}$
- 3) Output voltage : 100mV or more

#### 13. Dummy Load

- 1)  $8\Omega$ , 3W or more

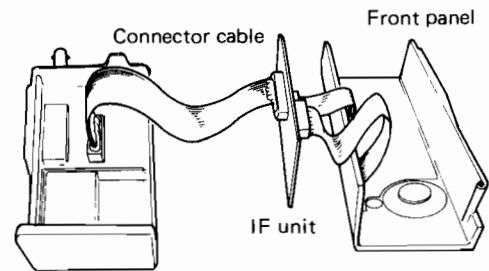
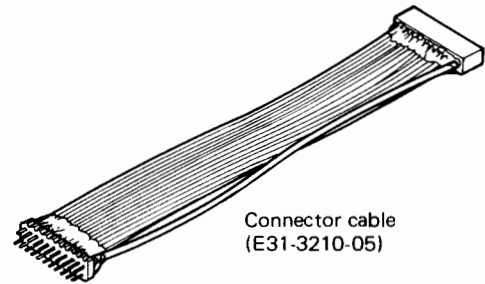
### PREPARATION

- Set the unit in the receiving mode and set the controls as follows, unless otherwise specified.

POWER/VOL ..... ON  
 SQL VR ..... MIN  
 F.LOCK ..... OFF  
 HI/LOW ..... HI

- Use a non-conductive rod such as a Bakelite rod for adjustment (especially of trimmers and coils).
- To protect the SSG, do not send out signals while adjusting the receiving unit.
- The indicated SSG output levels are for maximum output.

### Measuring Jigs

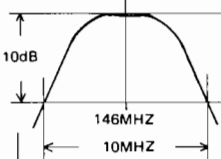


Be careful with the inserting direction when connecting the cables.



## ADJUSTMENT

### RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reception sensitivity	1) Connect a tracking generator to the ANT terminal. Connect a spectrum analyzer to the TP1 terminal of the RF unit.	Tracking generator Spectrum analyzer	RF	ANT TP1	RF	L14 L15~ L17	146MHz MAX. 	The gain and band are MAX. A gain of -10dB is obtained over at least 146MHz±5MHz.
	2) Connect a SSG to the ANT FREQ. : 144.90MHz SSG output : 60dBμ MOD : 1kHz DEV. : ±3kHz	SSG AF VTVM Oscilloscope	ANT terminal SP terminal	SP	IF	L3	AF output : MAX	
	3) SSG output : -8dBμ	DC V.M Distortion meter Oscilloscope AF VTVM	ANT SP	IC7 7P SP	IF RF	L2 L19	MIN. Check	
2. S meter	1) FREQ. : 145.98MHz SSG output : -7dBμ	S meter			IF	VR5	Adjust VR5 to the "S-1" reading.	
	2) SSG output : -10dBμ						Check.	Lights OFF.
	3) SSG output : 23dBμ						Check.	All segments light ON.

### Microprocessor operation check

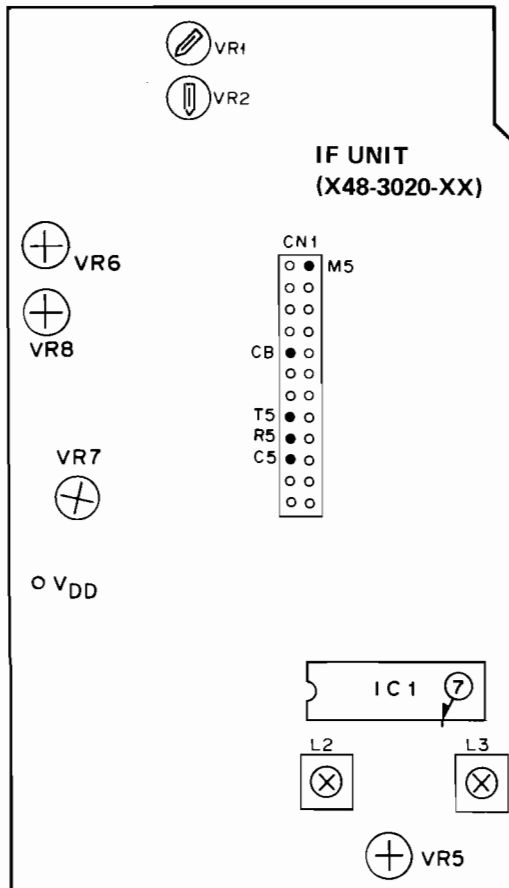
Item	Condition	Operation check	Item	Condition	Operation check
1. FREQ. setting	1) <b>[ENTER]</b> push <b>[1] [2] [3] [4] [5]</b> push	14 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> FREQ. indication : 142.345 ( <b>K,M2</b> ) 144.345 ( <b>T,M1,W,X</b> )	2. Function key operation (Pressing <b>[F]</b> key and numeral key activates the indicated function).	2) <b>[F] [2]</b> /BEEP <b>[F] [2]</b> /BEEP	BEEP ON (except LAMP). BEEP OFF
	2) <b>[ENTER]</b> push <b>[6] [7] [8] [9] [0]</b> push	14 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> FREQ. indication : 162.890 ( <b>K,M2</b> ) 147.890 ( <b>M1,X</b> ) 145.890 ( <b>T,W</b> )		3) <b>[F] [3]</b> /STEP	Switching of F.STEP.
	3) <b>[▼]</b> push	5kHz DOWN (when 5kHz steps)		4) <b>[F] [4]</b> /BAND	<b>[BAND]</b> indicator turns on. Push <b>[SCAN]</b> key to start unit scanning on all receivable frequencies.
	4) <b>[▲]</b> push	5kHz UP (when 5kHz steps)		5) <b>[F] [5]</b> /MEMORY	<b>[MEMO]</b> indicator turns on. Push <b>[SCAN]</b> key to start scan on only the memorized channel.
2. Function key operation (Pressing <b>[F]</b> key and numeral key activates the indicated function).	1) <b>[F] [1]</b> /PRIORITY	<b>[PRIO]</b> indicator turns on. Memory channel <b>[1]</b> is monitored every 5 seconds <b>[PRIO]</b> indicator blinks if frequency is in use.	6) <b>[F] [6]</b> /PROGRAM	<b>[PROG]</b> indicator turns on. Push <b>[SCAN]</b> key to start scan between memory 8 and 9.	
	<b>[F] [1]</b> /PRIORITY	<b>[PRIO]</b> indicator turns off.	7) <b>[F] [7]</b> /SEEK	<b>[SEEK]</b> indicator turns on. Push <b>[SCAN]</b> key to start scanning. If a signal is detected stops scanning and the scanning operation is released.	
			8) <b>[F] [8]</b> /TIME	<b>[TIME]</b> indicator turns on. Push <b>[SCAN]</b> key to start scanning. Scanning stops if signal detected, and scanning restarts after 5 seconds.	

## ADJUSTMENT

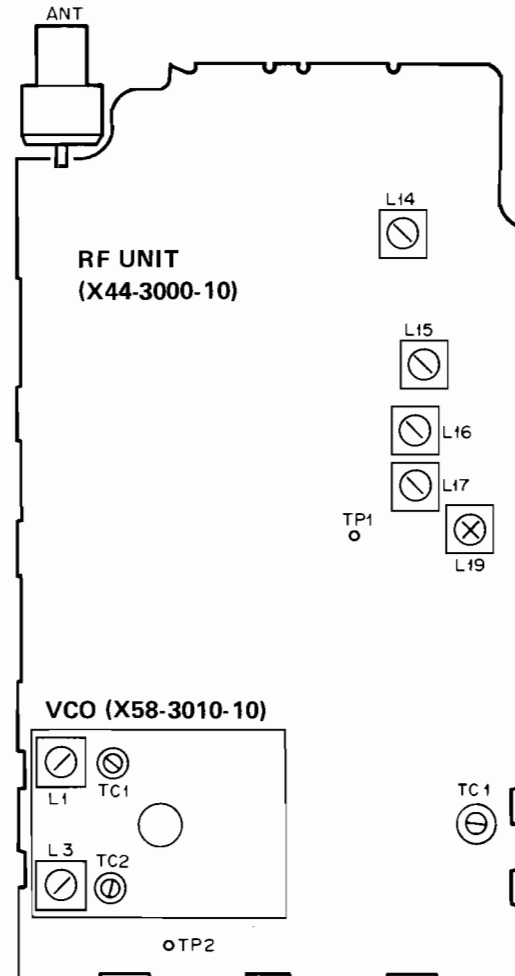
Item	Condition	Operation check
2. Function key operation (Pressing [F] key and numeral key activates the indicated function).	9) [F] [9]/CARRIER	[CAR] indicator turns on. Push [SCAN] key to start scanning. Scanning stops if signal detected, and scanning restarts 2 seconds after the signal ends.
	10) [F] [▲] or [▼]	High speed operation of [▼] or [▲] mode.
	11) [F] [M]/TX STOP [F] [M]/TX STOP	[TX STOP] indicator turns on. PTT and TONE key are disabled. [TX STOP] indicator turns off.
	12) [F] [ENTER]/KEY LOCK [F] [ENTER]/KEY LOCK	[KEY LOCK] indicator turns on. Disables all keys except KEY LOCK and LAMP. [KEY LOCK] indicator turns off.
3. OFFSET	1) [OFFSET/F]	← → + → -
4. Memory	1) FREQ. indication : 145.020 [M] [T] push	[M] [T] indicator turns on.
	2) FREQ. indication : Any value [L] push	[L] indicator turns on. FREQ. indication : 145.020

Item	Condition	Operation check
5. BATT SAVE	1) [SQ] : ON	The SAVE circuit begins operation after about 2 seconds. A rate from 1 to 9 can be selected.
	2) [SAVE] push 3) [F] [SAVE] [▲] or [▼] [ENTER]	
6. BATT Warning	1) Unit monitors 7V from BATT pin.	[BATT] indicator remains off.
	2) Unit monitors 5.5V from BATT pin.	[BATT] indicator turns on.
7. R/TONE.F	1) [R/TONE.F] push push	R indicator turns on. R indicator turns off.
	2) [F] [R/TONE.F]	
	3) Set frequency with [▲] or [▼].	
	4) [ENTER] push	Complete TONE frequency setting.
8. RESET	1) POWER : OFF	Unit is reset. FREQ. indication : 144.000
	2) Hold down [F] [ENTER] POWER : ON	

### Adjusting points



(TOP SIDE VIEW)



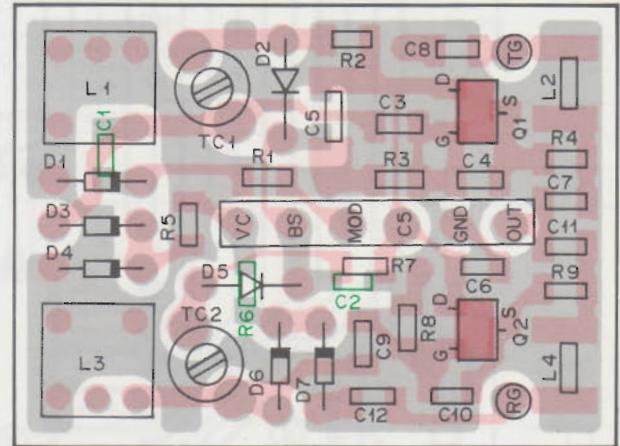
(BOTTOM SIDE VIEW)

# TERMINAL FUNCTIONS/PC BOARD VIEWS TH-215A/E

## Terminal functions

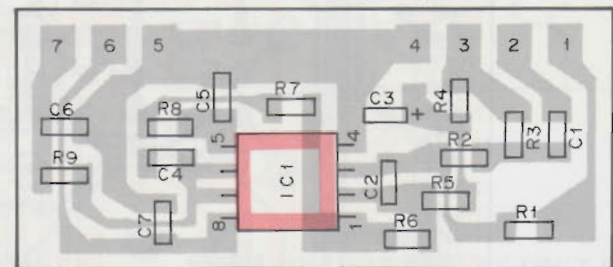
Terminal		Terminal function	
No.	Name		
<b>IF/RF UNIT COMMON</b>			
1	B	Power supply before Power switch ON.	
2	B	Power supply before Power switch ON.	
3	GND	Ground	
4	CB	Power supply after Power switch ON.	
5	CB	Power supply after Power switch ON.	
6	AFO	AF output line	
7	H/L	transmission/reception output control line	
8	T5	5V for transmission	
9	R5	5V for reception	
10	C5	5V for transmission/reception common	
11	GND	Ground	
12	MOD	Modulation signal line	
13	IF	Reception IF signal	
14	GND	Ground	
15	RST	PLL IC reset pulse	
16	SI	PLL IC serial data pulse	
17	CPS	PLL IC clock pulse	
18	UL	Unlock line, "L" : LOCK, "H" : UNLOCK	
19	SP	Signal line to internal speaker	
20	AFG	AF output line ground	
21	MIC	Signal line from Microphone	
22	IM	Signal line from internal microphone	
23	ST	Standby switch, "H" : transmission, "L" : reception	
24	M5	5V for Microphone	
<b>RF UNIT (X44-3000-10)</b>			
1	-	Battery (-)	
2	+	Battery (+)	
<b>IF UNIT (X48-3020-XX)</b>			
CN2	1	TS	Tone SW ON "L"
	2	BEEP	BEEP input
	3	ST	Standby SW "L" : transmission
	4	IM	Signal line from internal MIC
	5	AFG	AF output GND
	6	SP	Signal line to internal SP
	7	UL	Unlock line, "L" : LOCK, "H" : UNLOCK
	8	CPS	PLL IC clock pulse
	9	SI	PLL IC serial data pulse
	10	RST	PLL IC reset pulse
	11	TRS	Tone IC clock pulse
	12	TDA	Tone IC data pulse
	13	TCK	Tone IC clock pulse
	14	GND	Ground
	15	SM	S meter data output
CN3	1	TCK	Tone IC clock pulse
	2	TDA	Tone IC data pulse
	3	TRS	Tone IC reset pulse
	4	TB	Power supply for external Tone unit
	5	SPO	AF output control line
	6	TI	Tone input line
	7	GND	Ground
CN4	1	SAVE	Battery save control line
	2	KEY	Power supply for key matrix
	3	VDD	Power supply for MPU
	4	TX	T5/R5 select line, "H" : transmission
	5	SQ	BUSY detect line, "H" : BUSY
	6	CB	Power supply after Power SW ON
	7	BU	Backup control line
	8	AFC	AF output control line "H" : BUSY
	9	TONE	SUB Tone signal input line
	10	DTMF	DTMF signal input line

## ▼ VCO (X58-3010-10) Component side view



Q1,2 : 2SK302(GR)  
D1,3,4,6,7 : 1SV153 D2,5 : 1SS277

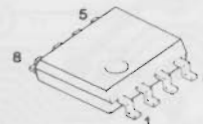
## ▼ MIC AMP (X59-3090-10) Component side view



IC1 : NJM4560M

NJM4560M

2SK2412K



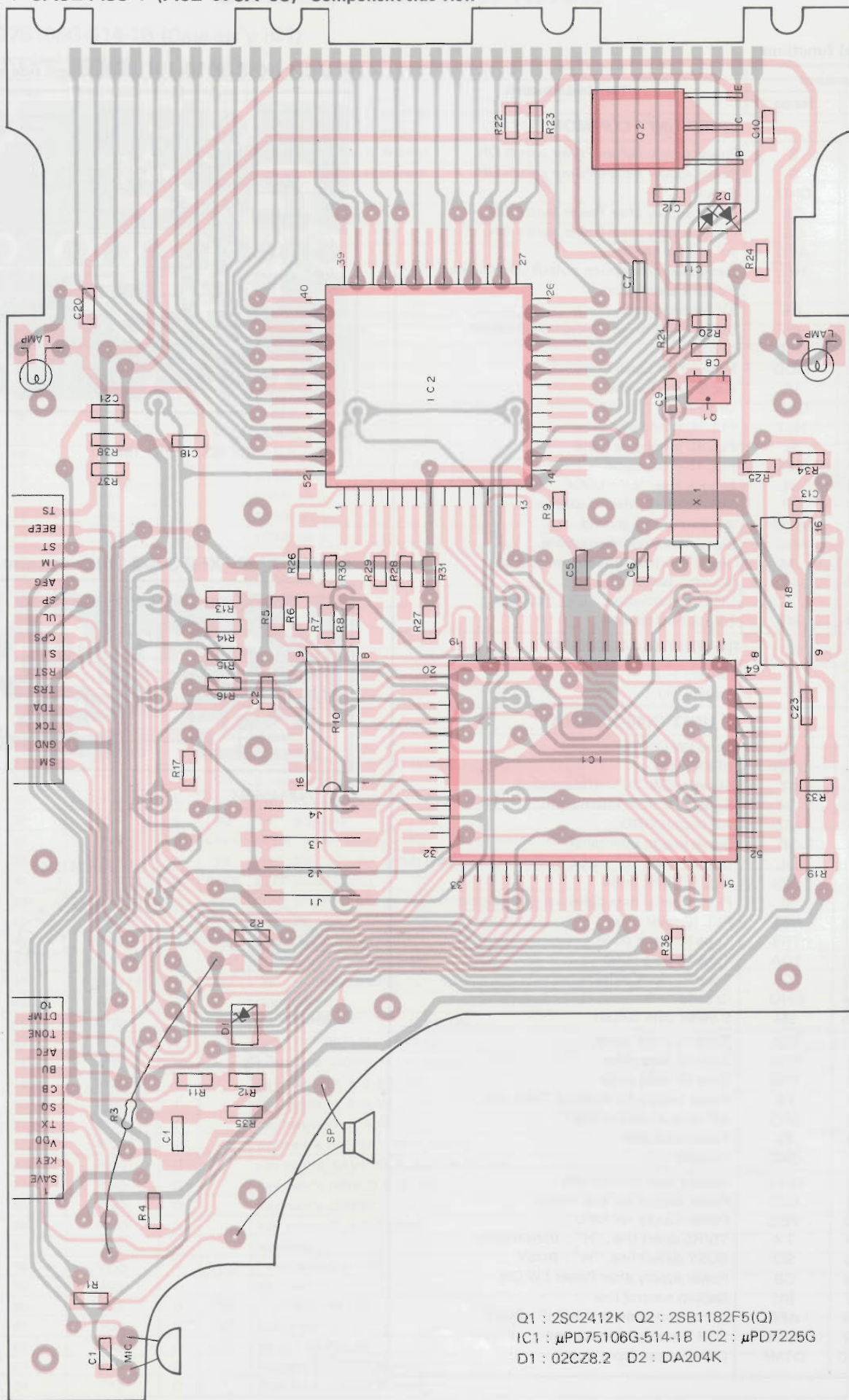
2SK302





# TH-215A/E PC BOARD VIEW

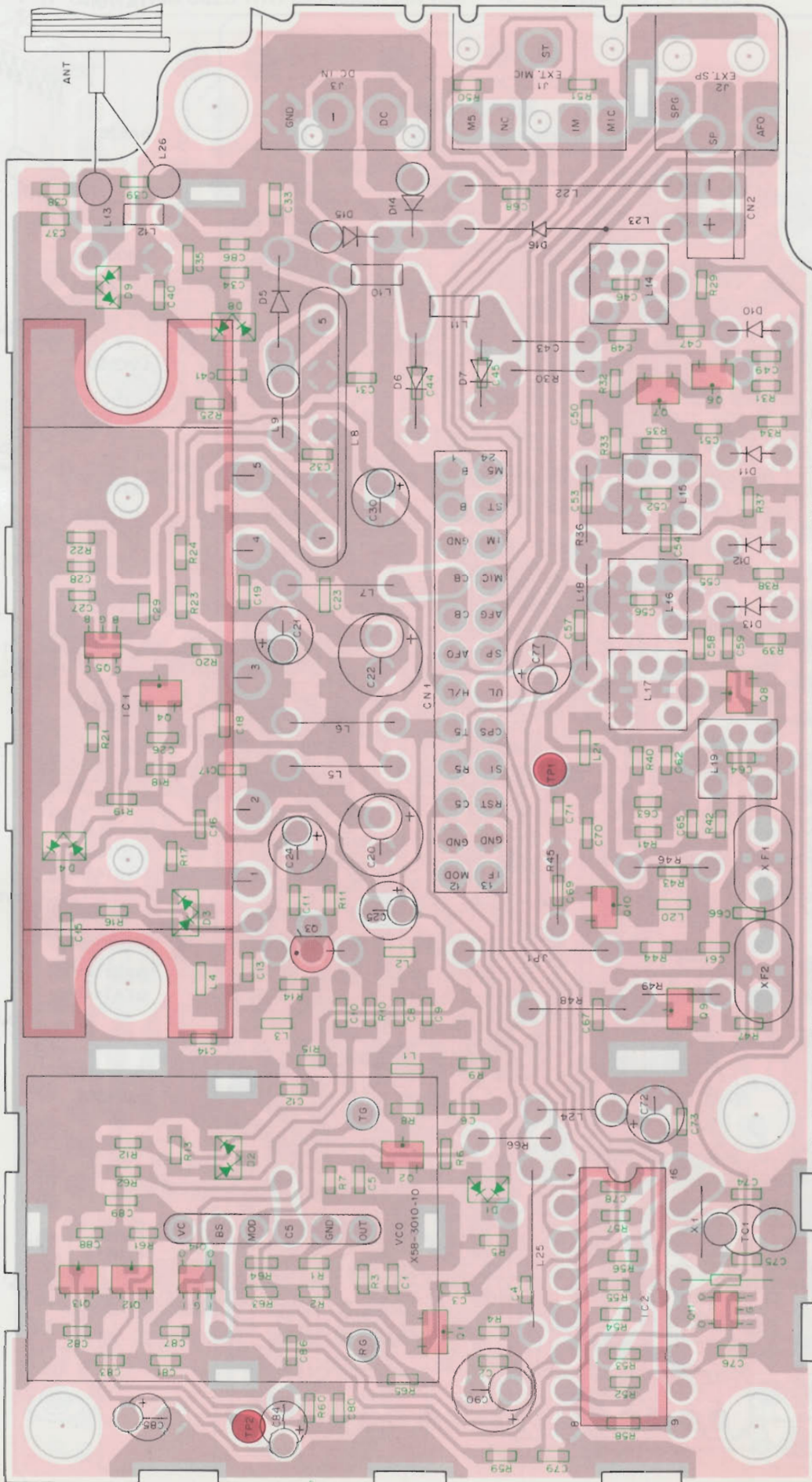
▼ CASE ASS'Y (A02-076X-05) Component side view



Q1 : 2SC2412K Q2 : 2SB1182F5(Q)  
 IC1 :  $\mu$ PD75106G-514-18 IC2 :  $\mu$ PD7225G  
 D1 : 02CZ8.2 D2 : DA204K



▼ RF UNIT (X44-3000-10) Component side view



Q1,7,9 : 2SC2714(O) Q2,10 : 2SC3838K(N,P) Q3 : 2SC2407 Q4 : 2SA1313(Y) Q5 : FMW1 Q6 : 2SC3356 Q8 : 2SK210(GR) Q11,14 : FMG4 Q12,13 : 2SC2712(GR)  
 IC1 : M57732L IC2 : M54959P  
 D1 : HSM2693 D2,4 : DA204K D3 : 1SV172 D5 : MI303 D6 : MI301 D7 : 1SS277 D8,9 : HSM88AS D10-13 : 1SV153 D14,16 : ERB83-004 D15 : UZP-228

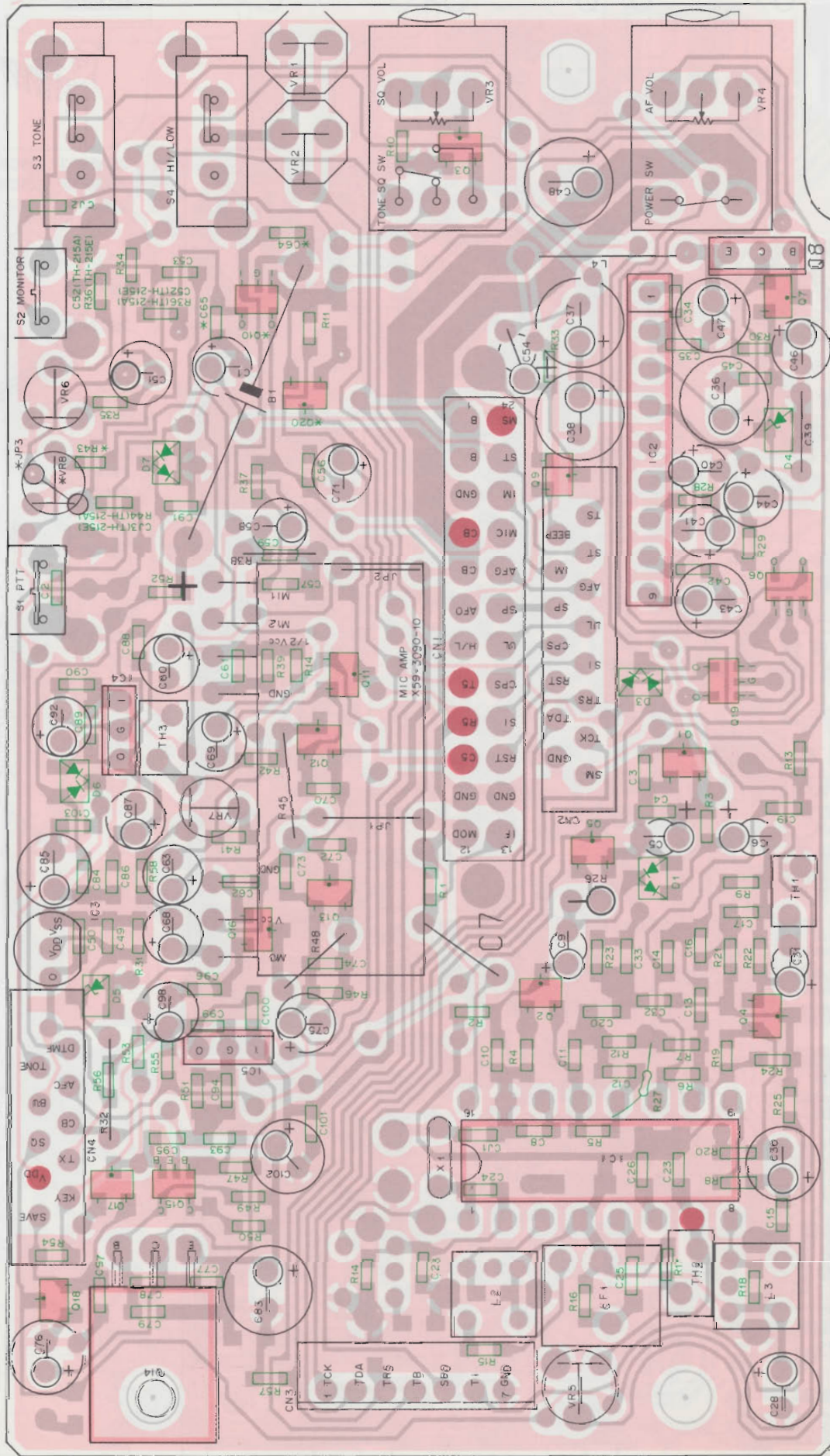






# TH-215A/E PC BOARD VIEWS

▼ IF UNIT (X48-3020-XX) Component side view -10 : TH-215A, -51 : TH-215E



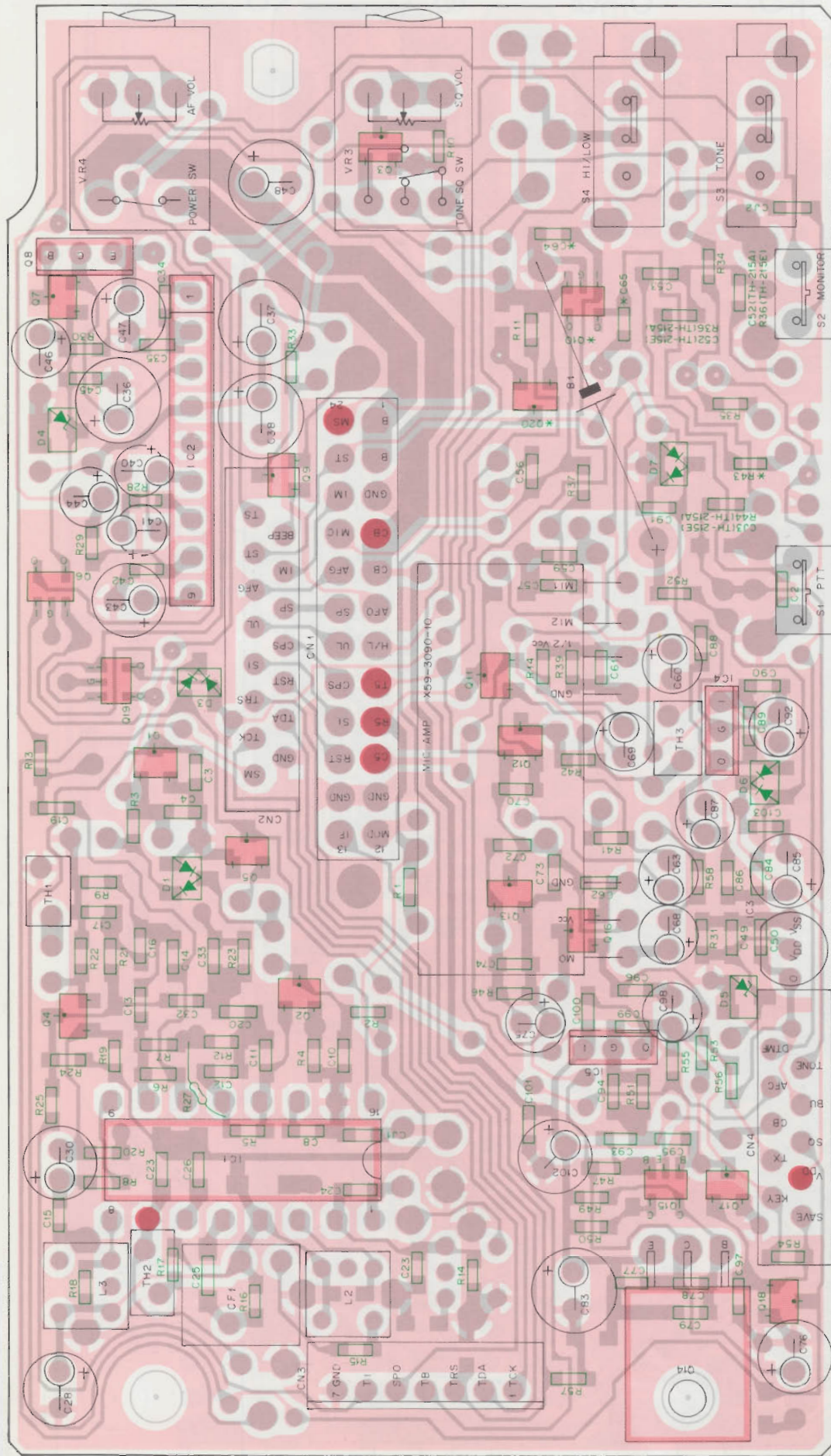
Q1,2,4,7 : 2SC2712(IGR) Q3,20 : DTC144EK Q5 : 2SJ106(IGR) Q6,10,19 : FMG2 Q8 : 2SA1241(Y) Q9 : DTC143XK Q11 : DTA114YK Q12 : DTA144EK  
 Q15 : FMW1 Q16-18 : DTC114YK Q19 : FMG2  
 IC1 : TA7761P IC2 : BA526 IC3 : S-8054HN IC4,5 : LVC550C  
 D1 : HSM88AS D3,6 : 1SS184 D4,5 : 02C28,2 D7 : 1SS226  
 TH1 : PTH59T103M TH2 : 112-202-2 TH3 : 112-101-2

	Q10	Q20	Q64	C65	R43	R44	JP3	CJ3	VR8
TH-215A (-10)	○	○	○	○	○	○	○	○	○
TH-215E (-51)	X	X	X	X	X	X	○	○	X

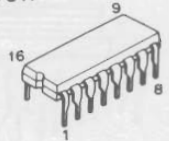
○ : Used, X : Not used.



▼ IF UNIT (X48-3020-XX) Foil side view -10 : TH-215A, -51 : TH-215E



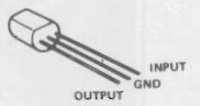
TA7761P



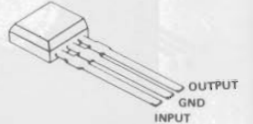
BA526



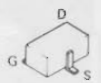
S-8054HN



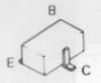
LVC550C



2S106



2SC2712  
2SA1313



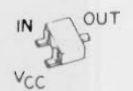
2SA1241



DTC114YK  
DTC144EK  
DTC143XK



DTA114YK  
DTA144EK



2SA1358

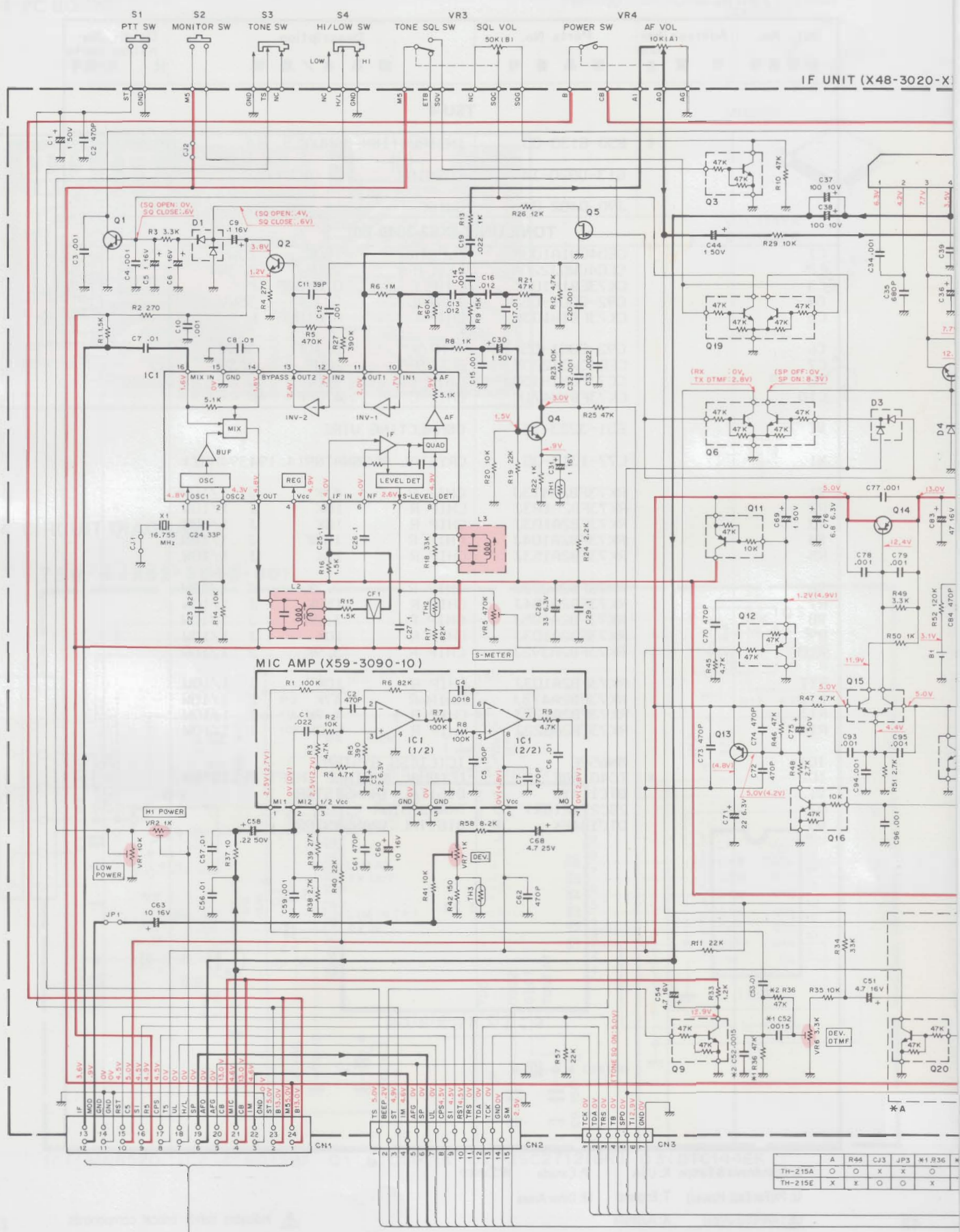


FMG2  
FMW1





Signal line    Control line    Common DC line



IF UNIT (X48-3020-X)

MIC AMP (X59-3090-10)

	A	R44	CJ3	JP3	M1	R36
TH-215A	O	O	X	X	O	X
TH-215E	X	X	O	O	X	X

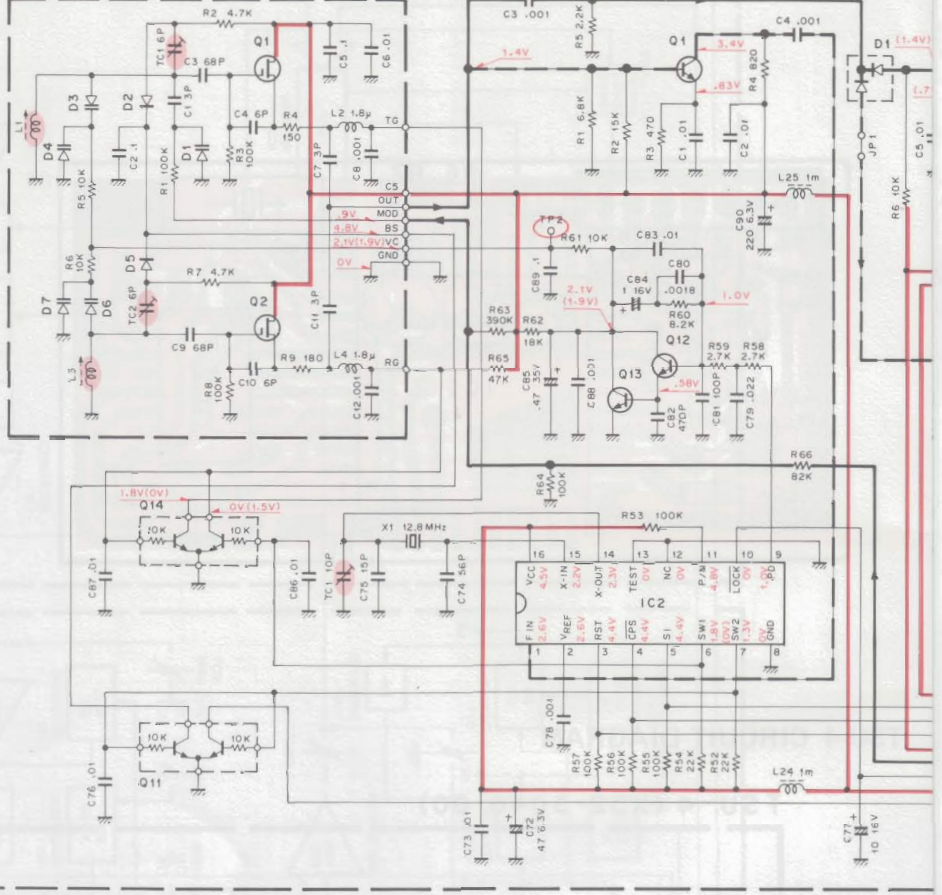


# SCHEMATIC DIAGRAM

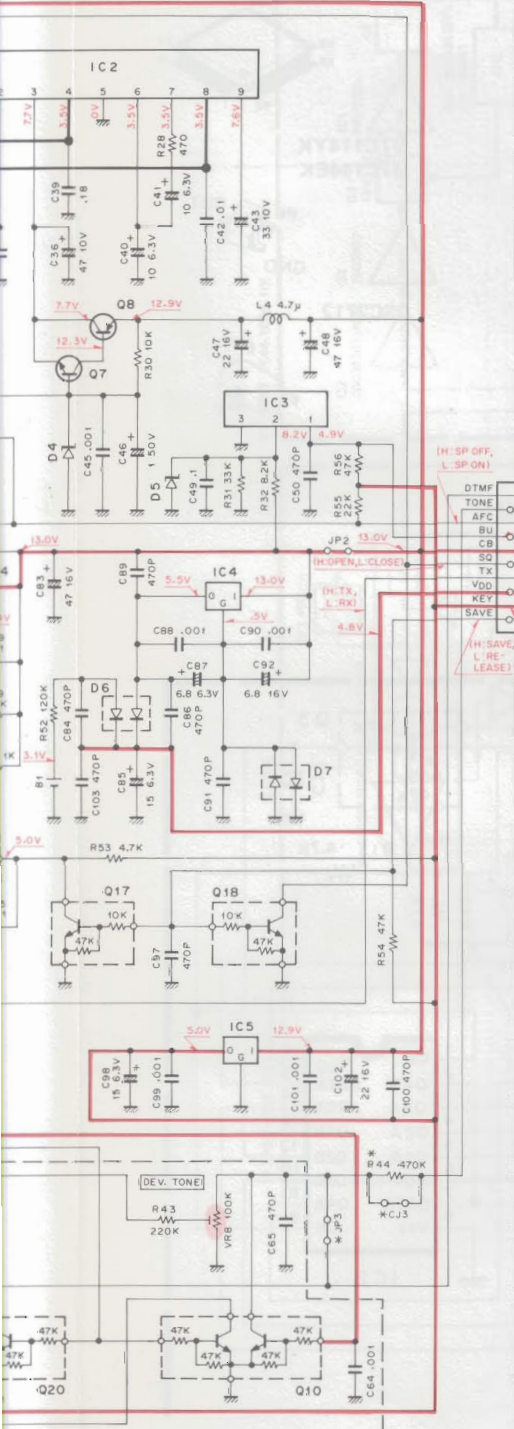
VCO (X58-3010-10)  
 Q1,2 : 2SK302(GR)  
 D1,3,4,6,7 : 1SV153  
 D2,5 : 1SS277

## RF UNIT (X44-3000-10)

VCO (X58-3010-10)



3020-XX) -10 : TH-215A (K,M1,M2,X) -51 : TH-215E (T,W)



#1 R36	#2 R36	#1 C52	#2 C52
O	X	O	X
X	O	X	O

MIC AMP (X59-3090-10)  
 IC1 : NJM 4560M

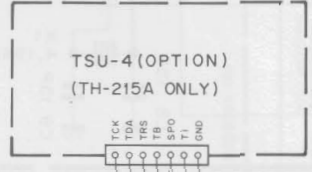
## IF UNIT (X48-3020-XX)

- Q1,2,4,7 : 2SC2712 (GR)
- Q3,20 : DTC144EK
- Q5 : 2SJ106 (GR)
- Q6,10,19 : FMG2
- Q8 : 2SA1241 (Y)
- Q9 : DTC143 XK
- Q11 : DTA114 YK
- Q12 : DTA144 EK
- Q13 : 2SA1313 (Y)
- Q14 : 2SA1358 (Y)
- Q15 : FMW1
- Q16 ~ 18 : DTC114 YK

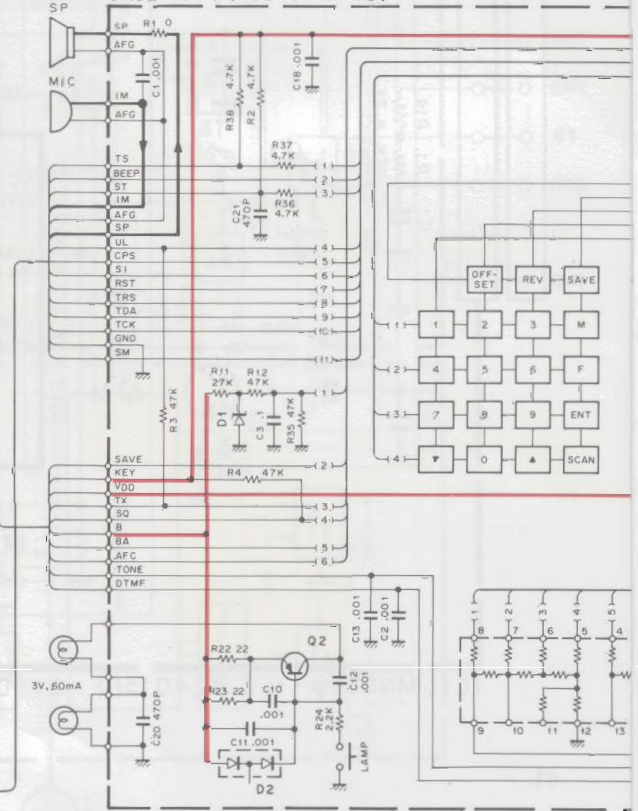
- IC1 : TA7761P
- IC2 : BA526
- IC3 : S-8054HN
- IC4,5 : LVC550C

- D1 : HSM88AS
- D3,6 : 1SS184
- D4,5 : 02C28.2 or STZJ8.2 or RDB.2M-B2,B3
- D7 : 1SS226

- TH1 : PTH59T103M
- TH2 : 112-202-2
- TH3 : 112-101-2



## CASE ASS'Y (A02-076X-05)

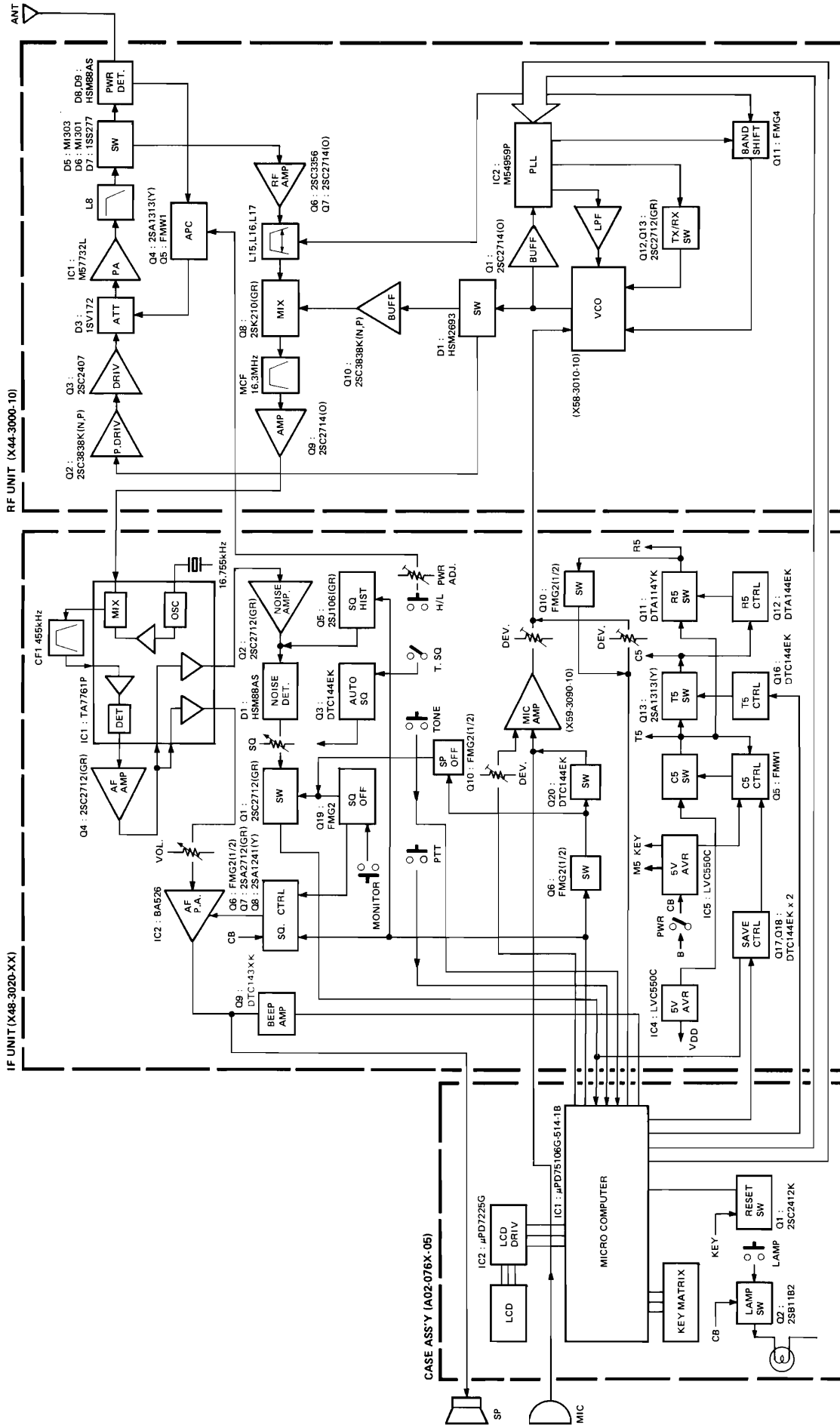






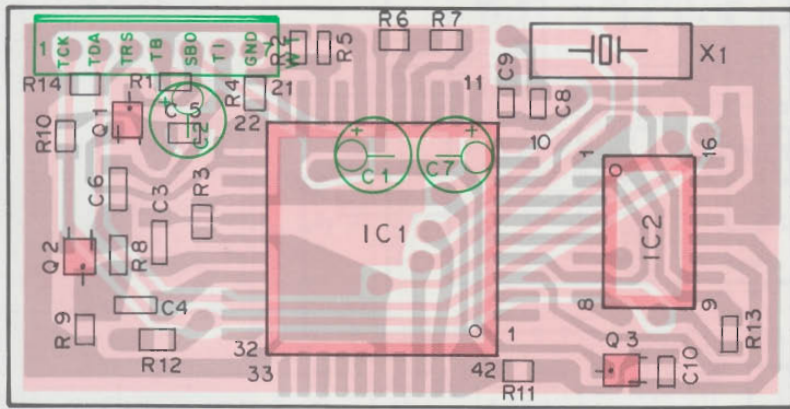


## BLOCK DIAGRAM

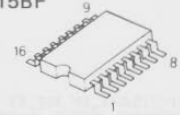


## TSU-4 (TONE SQUELCH : TH-215A ONLY)

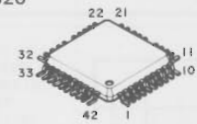
TSU-4 PC BOARD VIEW



TC4015BF



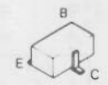
MN6520



DTC114YK  
DTC144EK

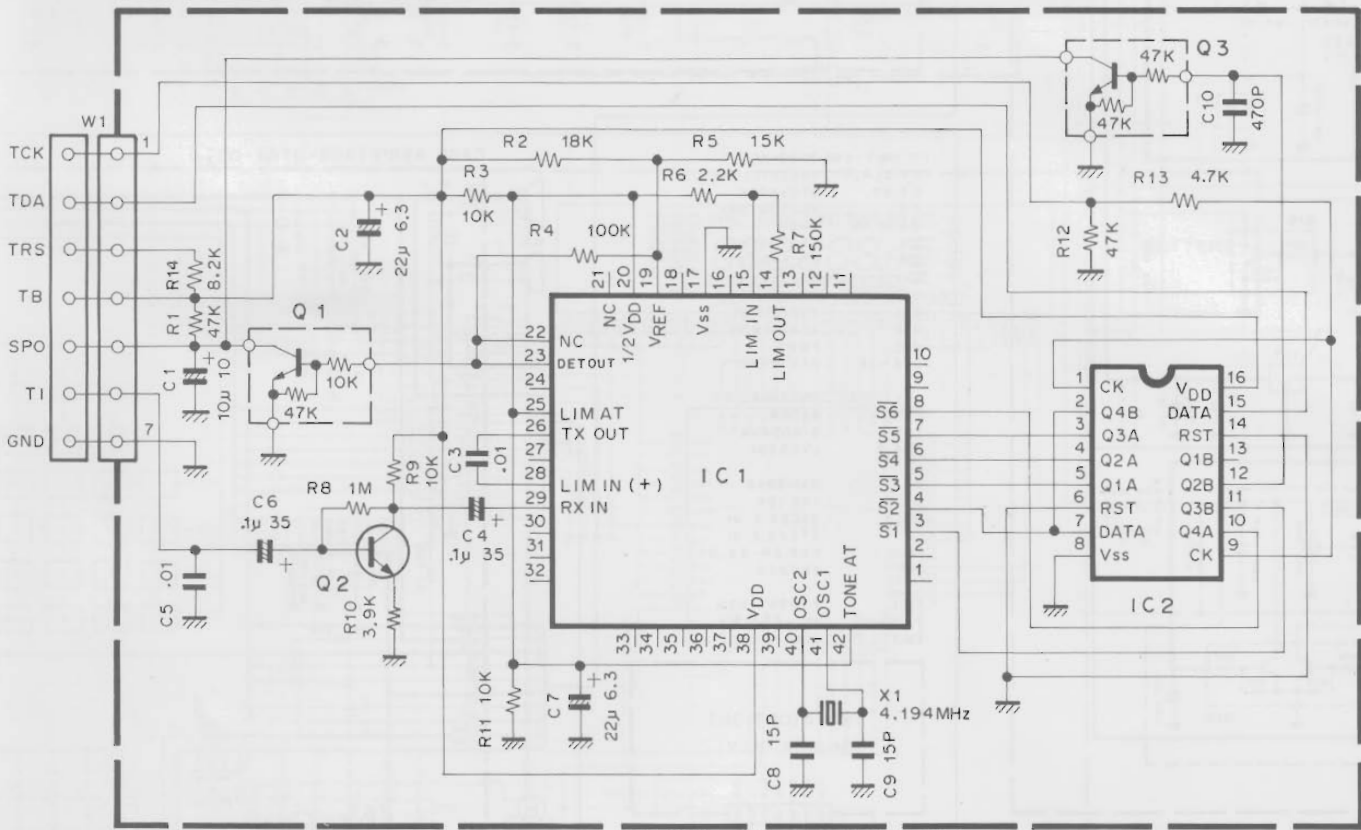


2SC2712



TSU-4 CIRCUIT DIAGRAM

TSU-4 (X52-3040-00)



IC1: MN6520 IC2: TC4015BF Q1: DTC114YK Q2: 2SC2712(GR) Q3: DTC144EK

## TSU-4 (TONE SQUELCH : TH-215A ONLY)

※ New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

### TSU-4 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
<b>TSU-4</b>						
-		*	B50-8130-00	INSTRUCTION MANUAL		
-			G13-0820-14	CUSHION (ACSY)		
-			J90-0402-04	GUIDE		
<b>TONE UNIT (X52-3040-00)</b>						
C1			CE04CW1A100M	ELECTRO 10UF 10WV		
C2			CE04CW0J220M	ELECTRO 22UF 6.3WV		
C3			CK73EB1H103K	CHIP C 0.010UF K		
C4			C92-0001-05	TANTAL 0.1UF 35WV		
C5			CK73FB1H103K	CHIP C 0.010UF K		
C6			C92-0001-05	TANTAL 0.1UF 35WV		
C7			CE04CW0J220M	ELECTRO 22UF 6.3WV		
C8 ,9			CC73FCH1H150J	CHIP C 15PF J		
C10			CK73FB1H471K	CHIP C 470PF K		
W1			E31-3223-15	CONNECTING WIRE		
X1			L77-1313-05	CRYSTAL RESONATOR(4.194394MHZ)		
R1			RK73FB2A473J	CHIP R 47K J 1/10W		
R2			RK73FB2A183J	CHIP R 18K J 1/10W		
R3			RK73FB2A103J	CHIP R 10K J 1/10W		
R4			RK73FB2A104J	CHIP R 100K J 1/10W		
R5			RK73FB2A153J	CHIP R 15K J 1/10W		
R6			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R7			RK73FB2A154J	CHIP R 150K J 1/10W		
R8			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R9			RK73FB2A103J	CHIP R 10K J 1/10W		
R10			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R11			RK73FB2A103J	CHIP R 10K J 1/10W		
R12			RK73FB2A473J	CHIP R 47K J 1/10W		
R13			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R14			RK73FB2A822J	CHIP R 8.2K J 1/10W		
IC1			MN6520	IC(CTCSS SYSTEM)		
IC2		*	TC4015BF	IC(DUAL 4-STAGE SHIFT RESISTOR)		
Q1			DTC114YK	DIGITAL TRANSISTOR		
Q2			2SC2712(GR)	TRANSISTOR		
Q3			DTC144EK	DIGITAL TRANSISTOR		

E: Scandinavia & Europe K: USA P: Canada W: Europe

U: PX(Far East, Hawaii) T: England M: Other Areas

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

## BC-8 (COMPACT CHARGER)

### BC-8 EXTERNAL VIEW

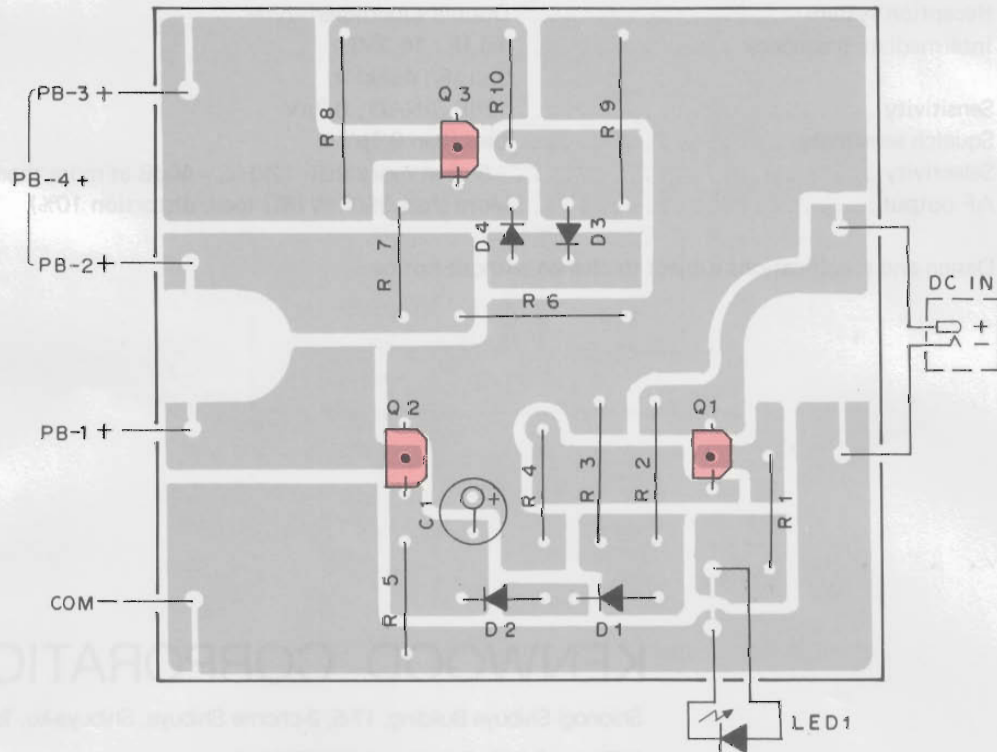


### BC-8 PARTS LIST

N : New parts

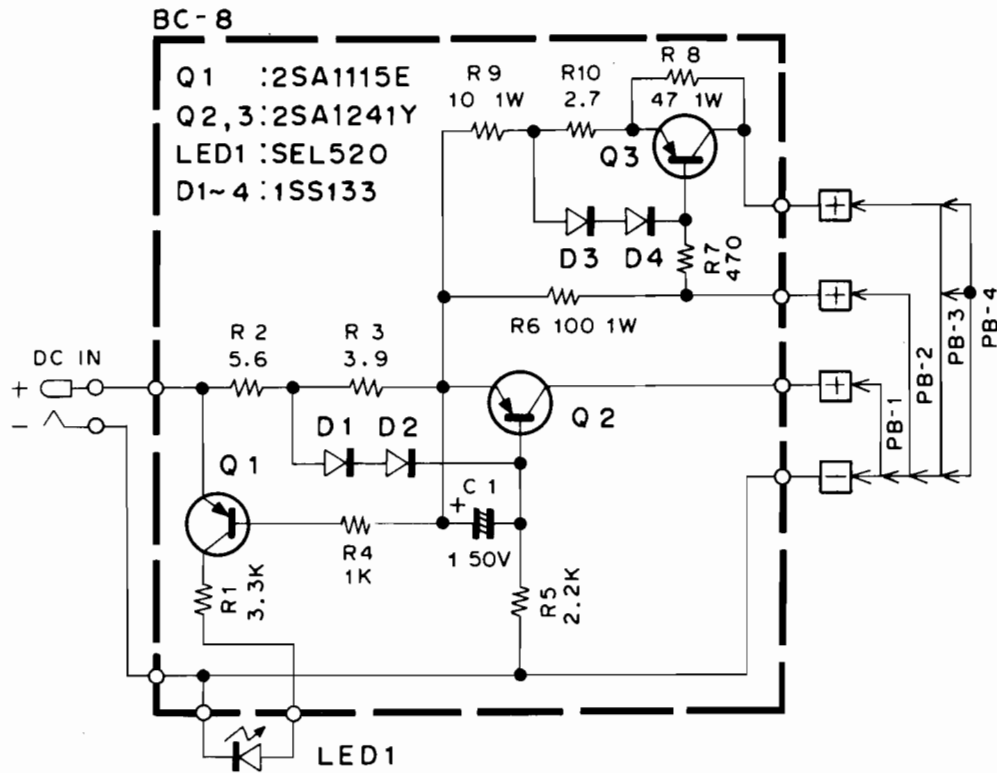
Parts No.	Re- marks	Description	Ref.No.
A02-0778-05	N	Case	
B50-8137-18	N	Instruction manual	
W09-0391-08	N	PC board ass'y	
2SA1115E		TR	Q1
2SA1241Y		TR	Q2,3
1SS133		Diode	D1~4
SEL520		LED	LED1

### BC-8 PC BOARD VIEW

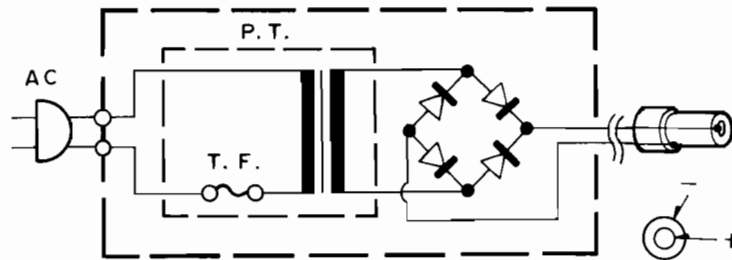


## BC-8 (COMPACT CHARGER)

### BC-8 CIRCUIT DIAGRAM



The unspecified resistors have the value of 1/4W.



## SPECIFICATIONS

### General

Frequency range	144.00MHz – 148.00MHz (TH-215A) 144.00MHz – 146.00MHz (TH-215E)
Signal type	F3 (F3E)
Power supply voltage	DC 6.3V – 15V (Battery terminal) DC 7.2V – 16V (DC IN jack)
Power consumption	At reception standby ; Approx. 50mA At battery power save ; Approx. 11mA At transmission (5W) ; Less than 1.7A At transmission (0.5W) ; Less than 0.7A
Antenna impedance	50 $\Omega$
EXT. MIC impedance	2k $\Omega$
Operating temperature	-20°C – +50°C
Dimensions	67 (69.5) W x 173 (180.7) H x 37 (40) D mm The numbers in the parenthesis include projections parts.
Weight	540g (including antenna and Ni-Cd batteries)

### Transmitter section

Output power	Hi ; 5W, Low ; 0.5W
Modulation system	Reactance modulation
Max. frequency deviation	$\pm 5$ kHz
Unwanted reflection	Less than -60dB
Frequency tolerance	Less than $\pm 20 \times 10^{-6}$ (-10°C ~ +50°C)

### Receiver section

Reception system	Double superheterodyne
Intermediate frequency	1st IF ; 16.3MHz 2nd IF ; 455kHz
Sensitivity	12dB SINAD ; 0.2 $\mu$ V
Squelch sensitivity	Less than 0.1 $\mu$ V
Selectivity	-6dB at more than 12kHz, -40dB at more than 24kHz
AF output	More than 350mW (8 $\Omega$ load, distortion 10%)

Design and specifications subject to change without notice.

## KENWOOD CORPORATION

Shionogi Shibuya Building, 17-5, 2-chome Shibuya, Shibuya-ku, Tokyo 150, Japan

KENWOOD COMMUNICATIONS

Post Office Box 7065, Compton, California 90224, U.S.A.

KENWOOD COMMUNICATIONS

DIVISION OF KENWOOD ELECTRONICS, DEUTSCHLAND GMBH

Rembrücker Str. 15, 6056 Heusenstamm, West Germany

KENWOOD ELECTRONICS, BENELUX N.V.

Mechelsesteenweg 418 B-1930 Zaventem, Belgium

KENWOOD ELECTRONICS, AUSTRALIA PTY. LTD.

4E. Woodcock Place, Lane Cove, N.S.W. 2066, Australia