

KENWOOD

SERVICE MANUAL

TM-211A/E OPTION TU-3A

VHF FM TRANSCEIVER



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CIRCUIT DESCRIPTION

RX SECTION

The input signal from the antenna passes through the LPF (Low Pass Filter) of the final unit (X45-1360-01), the transmit/receive diode switch D3 M1308, and goes into the front end on the A-unit (X44-1590-11). The front end consists of an RF amplifier comprising of a gallium arsenide FET RF amplifier Q1 : 3SK97 (Q2) *J, ANTENNA coils L1 and L2 and a 2 MHz band width helical resonator L3.

After obtaining both good sensitivity and 2-signal characteristics through the front end, the signal is applied to the first mixer Q2 : 3SK74 (L), where it is mixed with the PLL output 133.305 ~ 135.295 MHz (T,W), 131.305 ~ 138.300 MHz (K,M), and the output becomes the first IF signal at 10.695 MHz. After passing through the 2-stage MCF (Monolithic Crystal Filter), the first IF signal is amplified by Q3 : 2SK192A (GR) * N, mixed with the local oscillator (10.24 MHz) Q25 : 2SC2668 (Y), and becomes the second IF signal at 455 kHz. The 10.240 MHz second local oscillator frequency is also used by the PLL (Phase locked loop) for the comparator reference signal. The second IF signal passes through the ceramic filter (CFV455F), IF amplified by (Q5, 6 : 2SC2787 (L), Q7 : 2SC2668 (Y)) and IC1 : μ PC577H, and detected by ceramic discriminator (CFY-455S).

The detected output from the discriminator is divided into the audio frequency component and a noise component. The audio frequency component is de-emphasised and preamplified by Q32 : 2SC2458 (Y) before delivery to be amplified by IC3 : MB3712 which drives the speaker.

The noise component is extracted through (Band Pass Filter), amplified by noise amplifier Q27, 28 : 2SC3113 (B), and rectified by D10, 11 to achieve the squelch signal. The squelch control signal is then used to control SQUELCH SWITCH Q29 : 2SC2458 (Y), which in turn controls AF preamplifier Q32. Q30,31 : 2SC3113 (B) are DC amplifier for the busy indicator. Q33 : 2SC2458 (Y) prevents transient "clicks" when the priority watch function operates and also mute the receiver audio during DCS system code squelch operation.

Item	Rating
Nominal center frequency	455 kHz
3 dB band-width	± 4.2 kHz or more (from 455 kHz)
6 dB band-width	± 6 kHz or more (from 455 kHz)
60 dB band-width	± 12 kHz or less (from 455 kHz)
Ripple (within 455 $\pm$ 4.2 kHz)	3 dB less
Loss	6 dB or less
Guaranteed attenuation	50 dB or more (within 455 $\pm$ 100kHz)
Input/output impedance	1.5 k Ω

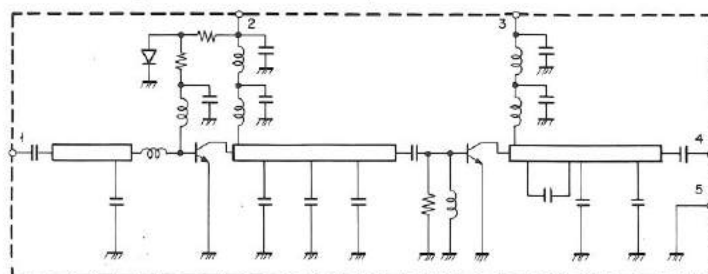
Table 1 Characteristics of Ceramic Filter (L72-0342-05) CFV455 (A-unit : L7)

TX SECTION

The signal from the microphone is amplified by microphone limiting amplifier Q9 : 2SC1775 (E) and Q40 : 2SO2458 (Y) IC4 (1/2) : μ PC4558C on the B-unit (X53-1380-11). Then LPF (low-pass filter) IC4 (1/2) : μ PC4558C filters the higher audio frequencies to phase modulates the transmitting PLL loop of the A unit (X44-1590-11). Q12 : 2SC2458(Y) is used to cut the microphone input at transmission of the F2 control signal which is generated at both PTT (Push to talk) DCS system is used. Q11 : 2SC2458 amplifies a part of the microphone output and forms a microphone visual check function circuit. The phase modulated FM signal is amplified by the VCO buffer Q14 : 2SC2668 (Y) on the A-unit (X44-1590-00) before being amplified by drivers Q1 : 2SC2347 and Q2 : 2SC2538-22-A, on the B-unit (X53-1380-11) to yield the output for the final unit (X45-1360-01). The signal fed to the Final unit is amplified by the power hybrid Q1 : M57737. The signal is then passed through the transmit/receive diode D1 and before going through a 3-stage LPF and then fed to the antenna.

The APC (Automatic Power Control) circuit performs HI/LOW power control section and SWR protection. The output from the detected by power amplifier is sampled through C8 detected by D4, and applied to differential amplifier Q5, 6 : 2SC2458 (Y). The protection circuit detects the reflected wave from the antenna terminal, and the detected signal is applied to the differential amplifier Q5, 6 through the B-unit DC amplifier Q8 : 2SC2458 (Y).

The differential amplifier controls Q4 : 2SA1015 (Y) and Q3 : 2SD880 (Y), which varies the voltages to Q1 pin 2 on the final unit and Q2 collector voltage on B-unit, thereby controlling the transmission output.



1 : Input
2 : Vcc 1
3 : Vcc 2
4 : Output
5 : GND

Power Module M57737 Equivalent Circuit (Final Unit Q1)

Item	Symbol	Tc(°)	Condition	Rating	Unit
Operating	Vcc	25		17	V
DC current	Icc	25		7	A
Power input	Pin (max)	25	Zg=Zl=50 Ω , Vcc1 $\leq$ 12.5V	0.4	W
Power output	Po (max)	25	Zg=Zl=50 Ω	20	W
Operating case temp.	To (op)		-30 ~ +110	°C	
Storage temp.	Tstg		-40 ~ +110	°C	

Power Module M57737 Maximum Ratings

CIRCUIT DESCRIPTION

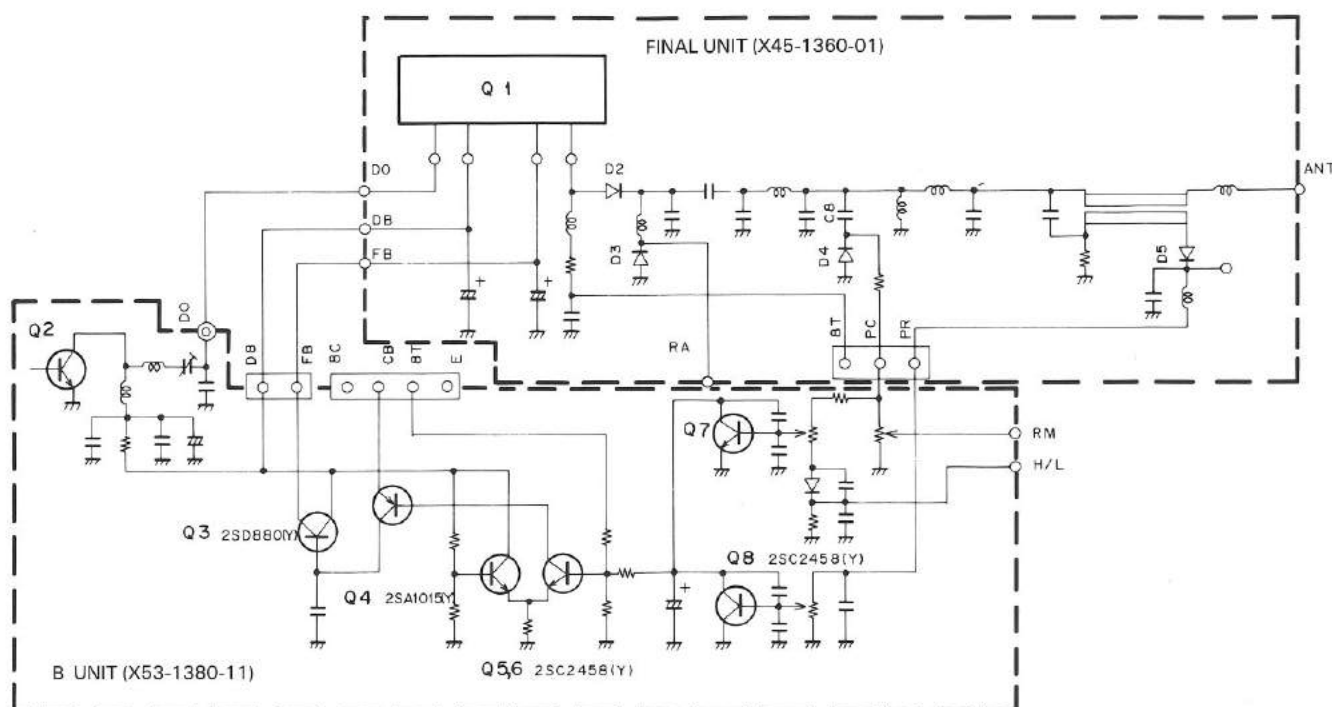


Fig. 1 APC, Protection Circuit

PLL SECTION

The PLL block diagram is given in Fig. 2. The PLL circuit uses two VCO within one PLL system for an independent RX VCO and TX VCO.

- **OSC circuit**

Receiving and transmitting oscillators are selected by supplying 8R and 8T voltages at reception and transmission. The multiplier Q22: 2SC2668 (Y) (T,W) is common to both oscillators. A 40.8267 MHz (T,W), 59.740 MHz (K,M) heterodyne signal is generated by Q24: 2SC2688 (Y) for reception. A 44.3917 MHz (T,W), 43.3917 MHz (K,M) heterodyne signal is generated by Q23: 2SC2668 (Y) for transmission. For either transmission or reception, this frequency is tripled [to 122.48 MHz for reception, 133.175 MHz for transmission (T,W)] before being input to the mixer Q21: 2SC2668 (Y). Also this frequency is doubled [to 119.48 MHz for reception and tripled to 130.175 MHz (K,M)] before being input to the mixer Q21: 2SC2668 (Y).

- **VCO circuit**

The VCO circuit oscillates 133.305 - 135.295 MHz (T,W), 131.305 ~ 138.300 MHz (K,M) by Q8: 2SK192A (GR)*N for reception, and 144.00 - 145.995 MHz (T,W), 142.00 ~ 148.995 MHz (K,M) by Q12: 2SK192A (GR)*N for transmission. These frequencies are applied to mixer Q21 through buffer amplifier Q13: 2SC2668 (Y), which is common to transmission and reception. Q9: 2SC2458 (Y) connected to Q8 source works to stop Q8 oscillation momentarily when changing from receiving mode to transmitting mode.

The RX VCO signal is amplified by Q11: 2SC2668 (Y)

through buffer amplifier Q10: 2SC2668 (Y) and is applied to the first IF mixer. The TX VCO signal is amplified by Q14: 2SC2668 (Y) and applied to the drive circuit on the B-unit. The local oscillator signals are tripled in RX: 122.48 MHz, TX: 133.175 MHz (T,W), also local oscillator signal are doubled in RX: 119.48 MHz, tripled in TX 130.175 MHz and the VCO outputs RX: 133.305 - 135.300 MHz (T,W), 131.305 ~ 138.300 MHz (K,M), TX: 144.00 - 145.995 MHz (T,W), 142.00 ~ 148.995 MHz (K,M) output by the RX VCO and TX VCO are mixed by Q21, to become PLL IF signal 10.825 - 12.815 MHz (T,W), 11.825 ~ 18.82 MHz (K,M). This is amplified by Q20: 2SC2668 (Y) and input to the Phase Detector IC: MC145155P*J(IC2).

IC2 amplifies the second IF local oscillator signal (10.24 MHz) from Q26: 2SC2668 (Y) and divides this by 1/2048. This yields a 5 kHz reference comparison signal. Simultaneously, the PLL IF signal 10.825 - 12.815 MHz (T,W), 11.825 ~ 18.82 MHz (K,M) is divided down to 5 kHz comparison signal by a ratio of $N = 2165 - 2563$ (T,W), $N = 2365 \sim 3764$ (K,M) from the control data supplied by the microprocessor (μ PD7508G-620-00). Finally the PLL IF signal phase is compared with the reference signal for VCO control. The phase compared output signal is passed through LPF Q17, 18: 2SC2458 (Y) and Q19: 2SC2458 (L) (L), and is applied as the VCO control voltage to voltage variable diode D5: 1SV50 during reception, and D6: 1SV50 during transmission, to control the oscillator frequency of each VCO.

CIRCUIT DESCRIPTION

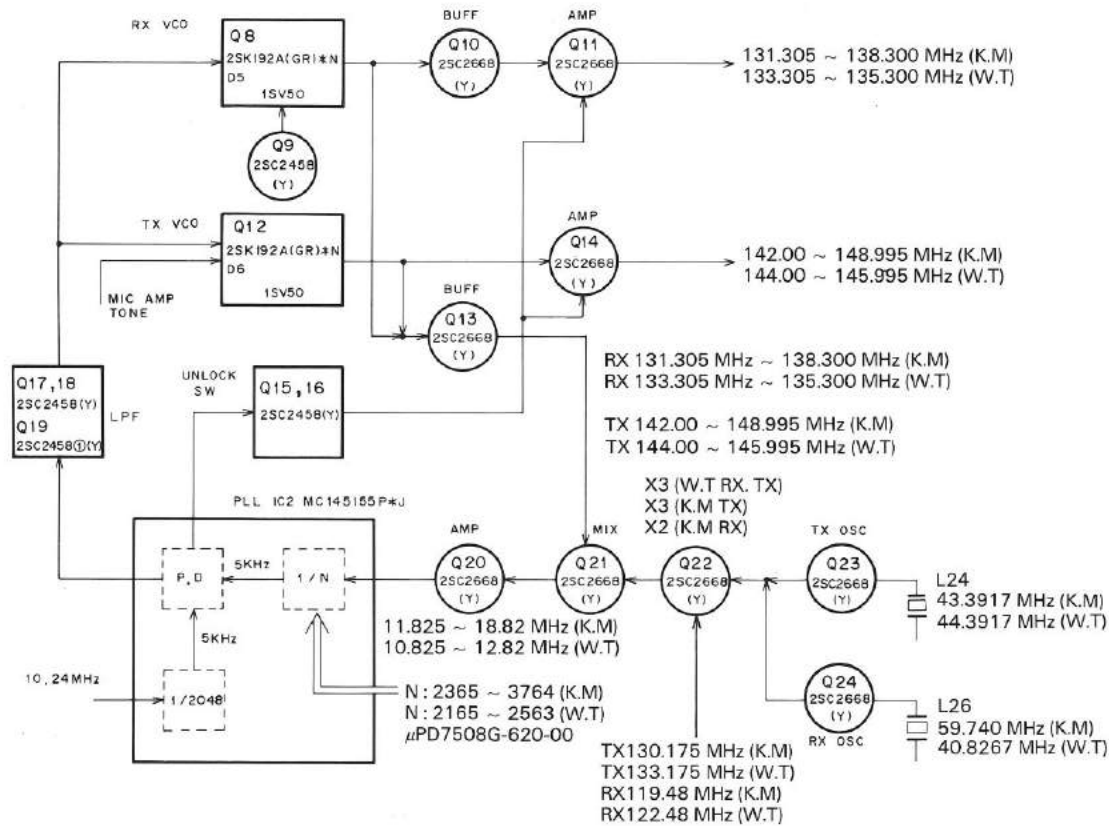
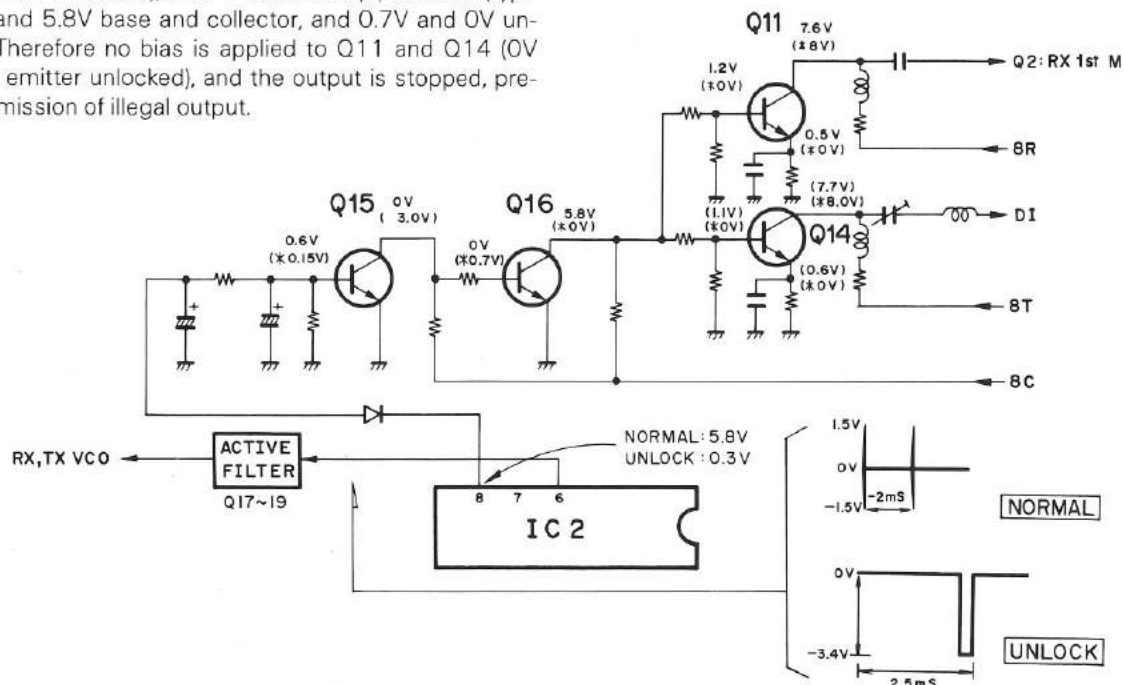


Fig. 2 PLL circuit block diagram

UNLOCK CIRCUIT

If the PLL loop unlocks, IC2 pin 8 becomes, low level (typically 5.8V locked and 0.3V unlocked), Q15 : 2SC2458 (Y) turns off (typically 0.6V and 0V base and collector, and 0.15V and 3V unlocked), Q16 : 2SC2458 (Y) turns on (typically 0V and 5.8V base and collector, and 0.7V and 0V unlocked). Therefore no bias is applied to Q11 and Q14 (0V base and emitter unlocked), and the output is stopped, preventing emission of illegal output.



CIRCUIT DESCRIPTION

CONTROL CIRCUIT

● Display

The display system consists of 5 LED digit dynamically driven. The LED segment drive signals are output as a "L" at ports P40 ~ P43, P50 ~ P53 of (μ PD7508G-620-00) of B-unit (X53-1380-11). This drives digital transistor Q1 - 8: DTA143X on the display unit. The digit signal is output as a "L" at ports P30 ~ P33 and P60, and drives Q9 - Q13: 2SA1150 (Y) on the display unit. Displays of over range, the MHz decimal, PR.W, C.AL and standby are also made by dynamically lighted.

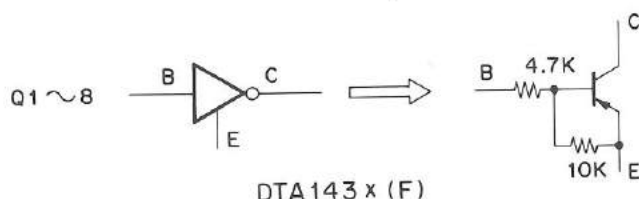


Fig. 3 Digital TR DTA143X(F)

● Encoder

The mechanical encoder is outputs 25 pulses with 50 clicks to one cycle. Any chatter in the encoder output is eliminated by Schmitt trigger circuit IC5: (M-C14069UBCP or TC4069UBP) on the B-unit (X53-1380-11). This output is directly applied to microprocessor ports P10 and P11. The direction UP or DOWN of encoder is internally judged by microprocessor software.

● Switch signal

Scanned key scan output pulses are applied to the input port extending IC1: LC7800 on the display unit (X54-1810-11). The output data is generated from $Q_0 \sim Q_3$ and is applied to IC1: μ PD7508G-620-00 P70 ~ P73 on the B-unit (X53-1380-11).

● Beep Tone

The tone sound is generated by a stable multivibrator IC6: TC4001BP (1/2) on the B-unit. The switching signal is generated from P22. The tone frequency is determined by R47 and C62.

● Memory Back-up circuit

The back-up circuit detects voltage drop at the INTO terminal of microprocessor IC1: μ PD7508G-620-00 on the B-unit, and goes into back-up mode. In the back-up mode, system clock oscillation is stopped, the output port goes low and the input/output port goes into the input/output state. When the INTO terminal voltage increases, back-up mode is reset, the normal operational state is regained, and PLL data is once again output.

● Reset circuit

After supplying V_{DD} voltage to microprocessor IC1: μ PD7508G-620-00, apply V_{DD} to the RESET terminal for approximately 0.5 second to reset that IC. For resetting the DCS system microprocessor IC2: μ PD7507G-575-00, IC1 P30 and P32 are applied to IC2 RESET terminal via IC6 NOR gate.

● TU-3A (Option)

IC2 P23 goes high and enables the first tone with the COM switch ON, and IC2 P22 goes high to enable the second tone with the shift switch ON.

CIRCUIT DESCRIPTION

DCS system key

All four system operating keys (DCS, DSQ, CS and R) are input to IC1 (LC7000) ports on the display unit.

The outputs (O₀ ~ O₃) are connected to IC1 on the display unit. By operating these four keys, a Low is output from IC2 P50 ~ P53 on the B-unit (based on the microprocessor software), and these signals are driven by Q14 ~ Q16 and Q20 to light on the display unit LEDs D5 ~ D8.

Digital squelch operation

(A) : A-unit, (B) : unit

Transmission

With the microphone PTT switch ON, data (call sign, digital code and information) is sent from IC1 (B) to IC2 (B) and from IC2 (B) to IC3 (B). As a result, ST becomes "L" and after about 150m sec., ME IC3 (B) pin 21 becomes "H" (simultaneously microphone amplifier input is cut) and MSK signals of 1.2 kHz and 1.8 kHz are applied to the microphone amplifier, thereby modulating the transmitting carrier.

Reception

When the D.SQ key is pressed to on, AC (audio cut) becomes "H". When the collect MSK signal is received, the signal runs through the receiving circuit at (A), and goes to IC3 (B) after being sent from the discrete output (RX terminal) through IC7 (B) active filter. The data (call sign, digital code and information) modulation from IC3 is sent to IC2 (B). The data is further sent from IC2 (B) to IC1 (B) and when the digital codes coincide, AC goes "L" and the squelch opens. If the code alert state is being set then, the beep sounds continuously in addition to the squelch opening.

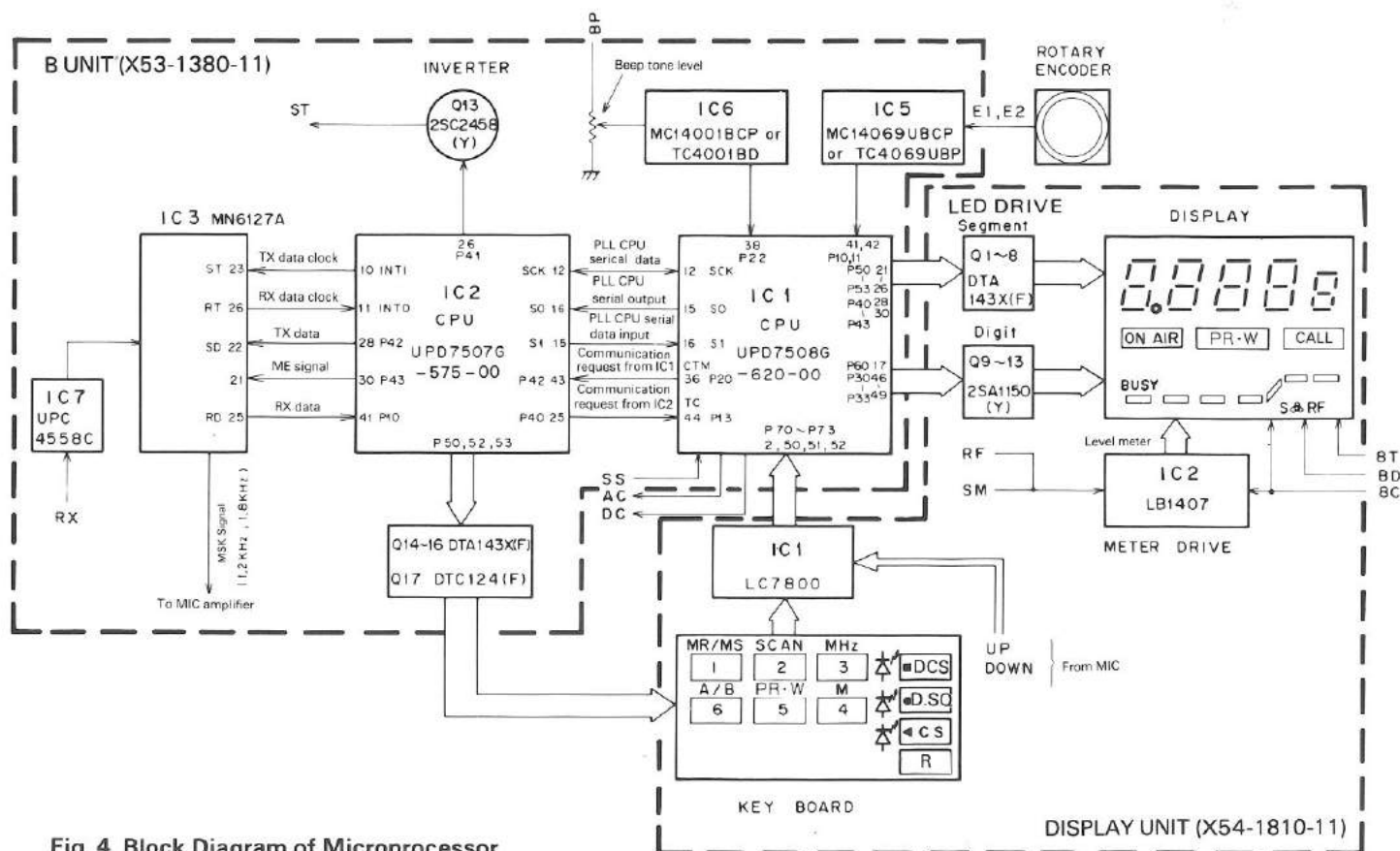


Fig. 4 Block Diagram of Microprocessor

CIRCUIT DESCRIPTION

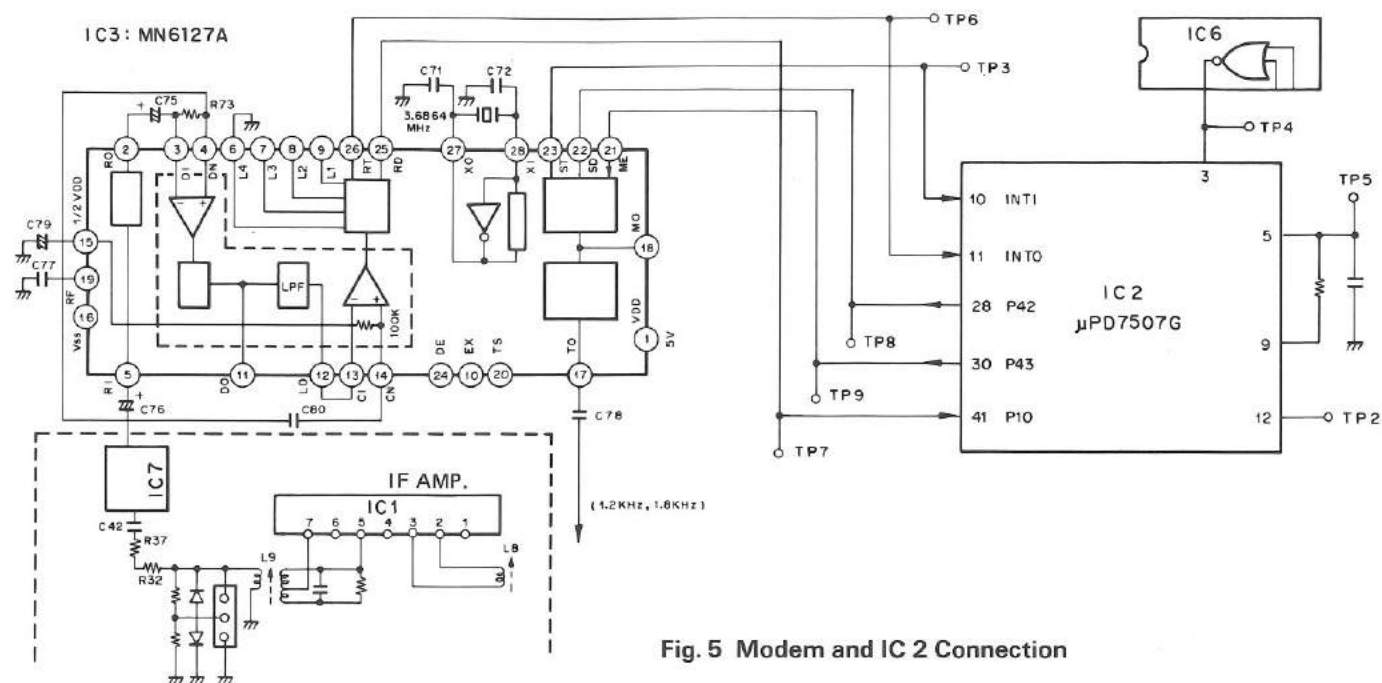
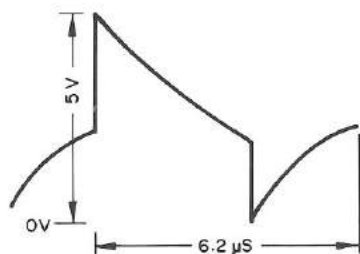


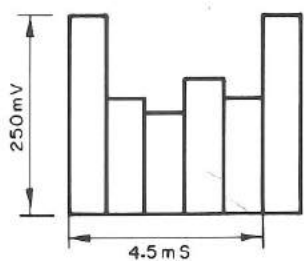
Fig. 5 Modem and IC 2 Connection

Table 2 Test Point Wave's (B unit)

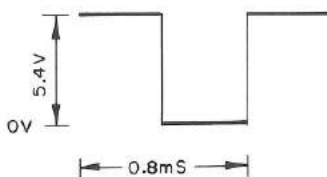


TP 1 : IC 1 system clock

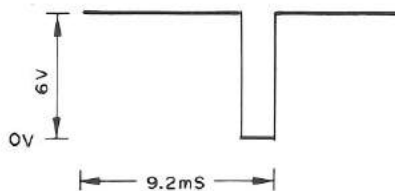
(IC 1 : 5pin)



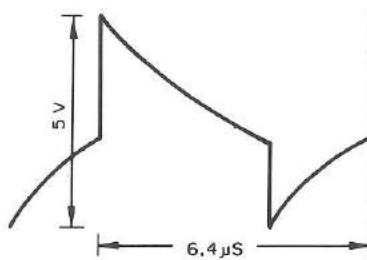
TP 2 : PLL, CPU serial data clock



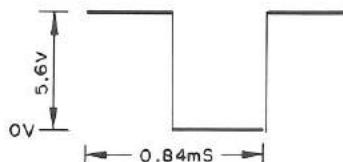
TP 3 : TX data clock



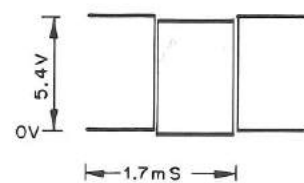
TP 4 : IC 2 reset input



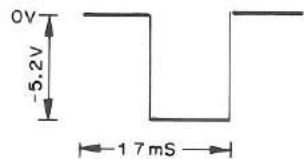
TP 5 : IC 2 system clock



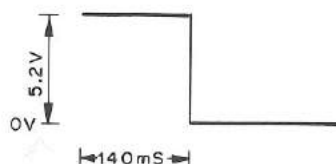
TP 6 : RX data clock



TP 7 : RX data



TP 8 : TX data



TP 9 : ME Signal

CIRCUIT DESCRIPTION

Terminal No.	Name	In-put	Out-put	Functions	Terminal No.	Name	In-put	Out-put	Functions
1	NC				27	NC			
2	P73	○		LC7800 output signal (O ₃) input	28	P42		○	LED Segment output (b)
3	RESET	○		Reset input	29	NC			
4	NC				30	P43		○	LED Segment output (a)
5	CL 1			Clock OSC C,R connection terminal	31	Vss			GND
6	NC				32	X 1			GND
7	V DD			Lithium battery connection terminal	33	V DD			+B power terminal (+5 V)
8	NC				34	X 2			
9	CL 2			Clock OSC C,R connection terminal	35	NC			
10	INT1			GND	36	P20		○	IC 2 to communication require CTM output
11	P00/INT0	○		Back Up detected input	37	P21		○	PLL serial data output
12	P01/SCK		○	PLL,CPU Serial data	38	P22		○	BEEP signal output
13	NC				39	P23		○	AUDIO CUT signal output
14	NC				40	NC			
15	P02/S0		○	PLL,CPU, Serial data output	41	P10	○		Encoder E1 input
16	P03/S1	○		PLL, CPU, Serial data input	42	P11	○		Encoder E2 input
17	P60		○	LED digit output (1K)	43	P12	○		STBY sinal input
18	P61			ATX Signal output	44	P13	○		IC 2 from communication require MTC input
19	P62	○		BUSY signal input	45	NC			
20	P63		○	BUSY CONTOROL signal output	46	P30		○	LC7800 select (SD) and LED digit output (CH)
21	P50		○	LED segment output (P)	47	P31		○	LC7800 select (SC) and LED digit output (IM)
22	P51		○	LED segment output (g)	48	P32		○	LC7800 select (SB) and LED digit output (100K)
23	P52		○	LED segment output (f)	49	P33		○	LC7800 select (SA) and LED digit output (10K)
24	P53		○	LED segment output (e)	50	P70	○		LC7800 output signal (O ₀) input
25	P40		○	LED segment output (d)	51	P71	○		LC7800 output signal (O ₁) input
26	P41		○	LED segment output (c)	52	P72	○		LC7800 output signal (O ₂) input

Table 3 μ PD-71508G-620-00 terminal functions

Terminal No.	Name	In-put	Out-put	Functions	Terminal No.	Name	In-put	Out-put	Functions
1	NC				27	NC			
2	P73			(H)	28	P42		○	TX data output
3	RESET	○		Reset input	29	NC			
4	NC				30	P43		○	ME signal output
5	CL 1			Clock OSC CR connection terminal	31	Vss			GND
6	NC				32	X 1			GND
7	V DD				33	V DD			+B power terminal (+5 V)
8	NC				34	X 2			
9	CL 2			Clock OSC CR connection terminal	35	NC			
10	INT 1	○		TX data clock signal input	36	P20			
11	P00/INT0	○		RX data clock input (RT)	37	P21			
12	P01/SCK		○	PLL,CPU Serial data	38	P22			
13	NC				39	P23			
14	NC				40	NC			
15	P02/S0		○	PLL,CPU, Serial data output	41	P10	○		RX data input (RD)
16	P03/S1	○		PLL, CPU, Serial data input	42	P11			(H)
17	P60			(H)	43	P12	○		IC1 from communication require MTC input
18	P61			(H)	44	P13			GND
19	P62			TIME SCAN(N), CARRIER SCAN(H)	45	NC			
20	P63			ALERT (L), PRIORITY WATCH(H)	46	P30			
21	P50		○	DCL LED output	47	P31			
22	P51				48	P32			
23	P52		○	CSQ LED output	49	P33			
24	P53		○	CS LED output	50	P70			(H)
25	P40		○	IC1 to communication require MTC output	51	P71			(H)
26	P41		○	STBY signal output	52	P72			(H)

Table 4 μ PD7507G-575-00 terminal functions

CIRCUIT DESCRIPTION

Terminal name	Function	Terminal name	Function	Terminal name	Function
AC	AF Cut	LCM	C SQ Light	UP	MIC UP Swich
AI	AF Input	LCS	CS Light	a	LED Segment a Data
AO	AF Output	MI	MIC	b	LED Segment b Data
ANT	Antenna	MO	Modulation	c	LED Segment c Data
ATX	Anti-TX	MR	MIC MR Switch	d	LED Segment d Data
B	+ 13.8V	P	LED Dott a Data	e	LED Segment e Data
BD	Busy Drive	PC	Power Control	f	LED Segment f Data
BP	Beep Tone Output	PRO	Protection	g	LED Segment g Data
CB	Common + B	P70	μ -Proc port 70	1K	LED Digit 1K Data
CK	PLL Clock	P71	μ -Proc port 71	10K	LED Digit 10K Data
DA	PLL Data	P72	μ -Proc port 72	100K	LED Digit 100K Data
DB	Drive + B	P73	μ -Proc port 73	1M	LED Digit 1M Data
DI	Drive Input	P74	μ -Proc port 74	CH	LED Digit CH Data
DO	Drive Output	RA	RF Antenna	5C	+ 5V Common
DW	MIC Down Switch	RM	RF Meter	5L	+ 5V LED
E	GND	RX	Discri Output	8C	+ 8V Common
E1	Encoder 1	SB	Switched + B	8M	+ 8V at MIC
E2	Encoder 2	SM	Signal Meter	8R	+ 8V in RX
EN	PLL enable	SP	Speaker	8T	+ 8V in TX
FB	Final + B	SQ1	Squelch 1	RT	Repeater Tone +B
H/L	High/Low	SQ2	Squelch 2	TB	Tone +B
LAS	DCL Light	SS	Stand by Switch	TO	Tone out
LRE	RESET Light	ST	Stand by		

Table 5 Terminal functions

A : 65	B : 66	C : 67	D : 68
E : 69	F : 70	G : 71	H : 72
I : 73	J : 74	K : 75	L : 76
M : 77	N : 78	O : 79	P : 80
Q : 81	R : 82	S : 83	T : 84
U : 85	V : 86	W : 87	X : 88
Y : 89	Z : 90	/ : 47	Space : 32
0 : 48	1 : 49	2 : 50	3 : 51
4 : 52	5 : 53	6 : 54	7 : 55
8 : 56	9 : 57		

Table 6 ASCII chart

ASCII (American Standard Code for Information Interchange)

	b1	b16	b32	b48	b64	b80		
	000	001	010	011	100	101	110	111
b0	0000	NULL	$\textcircled{1}DC_0$	b	0	@	P	
b1	0001	SOM	DC_1	!	1	A	Q	
b2	0010	EOA	DC_2	"	2	B	R	
b3	0011	EOM	DC_3	#	3	C	S	
b4	0100	EOT	DC_4 (S100)	\$	4	D	T	
b5	0101	WRU	ERR	%	5	E	U	
b6	0110	RU	SYNC	&	6	F	V	
b7	0111	BELL	LEM	.	7	G	W	
b8	1000	FE_0	S_0	(	8	H	X	
b9	1001	HT_{SK}	S_1	)	9	I	Y	
b10	1010	LF	S_2	*	:	J	Z	
b11	1011	V_{TAB}	S_3	+	;	K	[	
b12	1100	FF	S_4	(Comma)	<	L	/	
b13	1101	CR	S_5	-	=	M	]	
b14	1110	SO	S_6	*	>	N	↑	
b15	1111	SI	S_7	/	?	O	←	
Unassigned								ACK
								$\textcircled{2}$
								ESC
								DEL

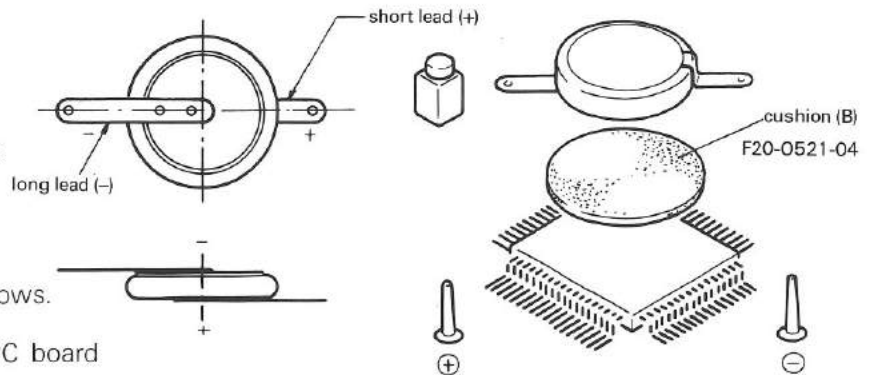
Example: $b64 + b1 = A$

CIRCUIT DESCRIPTION

Lithium Battery (W09-0323-05)

Specifications

Model	CR2032
Nominal Voltage	3V
Nominal capacitor	170mAh
Discharge Stop Voltage	2.0V
Dimensions	Diameter 20.0 mm Height 3.2 mm
Weight	3 g



Replacement procedure

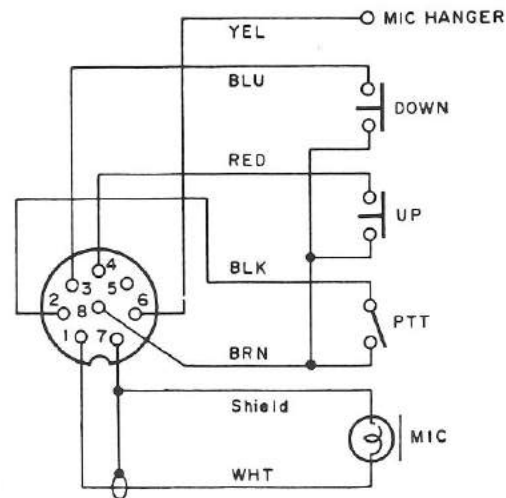
When replace the back-up battery read as follows.

1. Remove the lower case.
2. Take care not to damage parts on the PC board since they are soldered battery.
3. Remount cell again (conform to cell pole)
4. After power switch is on, push the reset switches on.

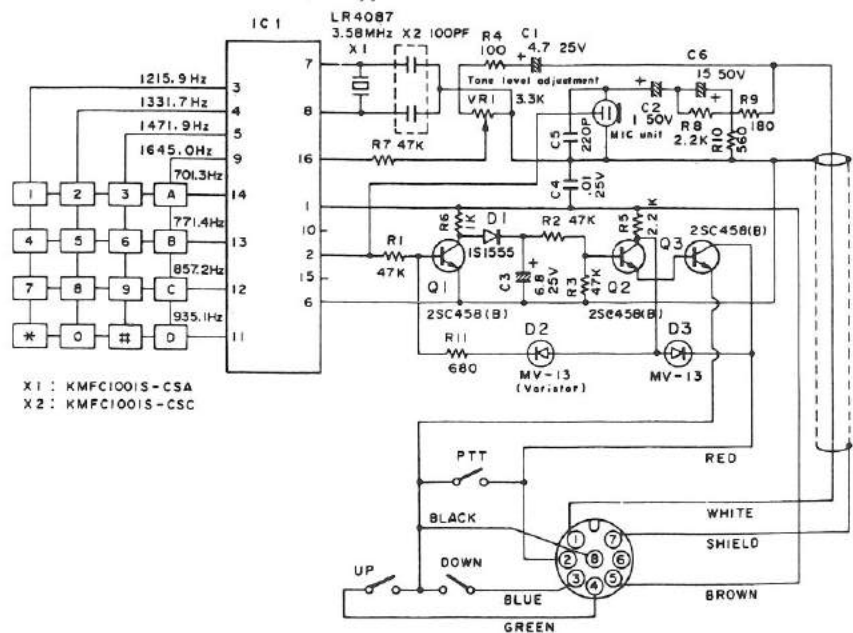
ACCESSORY MICROPHONE

(T91-0331-05) M, W type

(T91-0335-05) T type



(T91-0332-05) K type



PARTS LIST

CAPACITORS

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

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

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

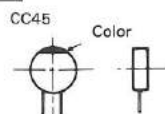
Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 -20	+60 -20	+100 -0	More than 10μF-10 ~ +50 Less than 4.7μF-10 ~ +75

Less than 10pF

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

Abbreviation		Abbreviation	
Cap	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		



Resistors not listed in this parts list are standard, fixed carbon composition 1/4W or 1/8W. The resistance values, in ohms, are indicated on the schematic diagram.

Chip capacitor

ex.	CC	73	F	SL	1H	000	J
	1	2	3	4	5	6	7

ex.	CK	73	F	F	1H	000	Z
	1	2	3	4	5	6	7

1 = Type ceramic, electrolytic
2 = Shape round, square
73: chip type
3 = Dimension
4 = Temp. coefficient
5 = Voltage rating
6 = Value
7 = Tolerance



Chip resistor (Carbon)

ex.	RD	73	E	B	2B	000	J
	1	2	3	4	5	6	7

Carbon resistor (Normal type)

ex.	RD	14	B	B	2C	000	J
	1	2	3	4	5	6	7

Rating voltage

2nd word 1st 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	-

Capacitor value

0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF
1 0 3 = 0.01μF
2 2 0 = 22pF

Symbol	Destination
K	U.S.A.
W	Europe
T	Britain
M	General market

Dimension

Code	L	W	T
No Code	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

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

Code	Wattage	Code	Wattage	Code	Wattage
2A	110W	2E	14W	3A	1W
2B	18W	2H	12W	3D	2W
2C	16W				

* Please note that parts are sometimes not in stock and it takes much time to deliver.

N: New Parts

SEMICONDUCTOR

Item	Re- marks	Parts No.
Diode		1N60 1S1555 or 1N4448 1S1587 1SS99 MI308 MI407 UI5B 1SV50
Vari-cap diode		MTZ10JC MTZ6.2JA
Zener diode		
TR	N	2SA1015(Y) 2SA1150(Y) 2SC1775(E) 2SC2347 2SC2458(Y)or 2SC2603(E)

Item	Re- marks	Parts No.
	N	2SC2458(L) 2SC2668(Y) 2SC2710(Y) 2SC2787(L) 2CS3113(B) 2SC2538-22-A 2SD880(Y)
FET		2SK192A(GR)*N 3SK74(L) 3SK97(Qz)*or 3SK97(Qi)*J DTA143X(F) DTC124(F)
Digital TR		
Power module		M57737

Item	Re- marks	Parts No.
IC		LB1407 LC7800 MB3712 MC145155P*J MC1400BCP or TC4001BP MC14069UBCP or TC4069UBP MN6127A NJM78L06A NJM78M06A μPC577H(E,F) μPC78M08H μPC4558C
Micro- processor	N N	μPD7507G-575-00 μPD7508G-620-00

TM-211A/E GENERAL

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY				
			011	021	051	061	
A01-0982-03	N	CASE(UPPER)	1	1			
A01-0983-03	N	CASE(UPPER)			1	1	
A01-0977-03	N	CASE(UPPER)					
A02-0637-08	N	CASE(LOWER)	1	1	1	1	
A02-0642-08	*	SPEAKER'S CASE(UPPER) K,M,W	1	1			
A02-0637-08	*	SPEAKER'S ASS'Y			1		
A02-0638-08	*	SPEAKER'S CASE(UPPER) K,M,W	1	1	1	1	
A02-0638-08	*	SPEAKER'S CASE(LOWER) K,M,W	1	1	1	1	
A13-0640-22	*	MOUNTING BRACKET ASS'Y	1	1	1	1	
A13-0654-05	N*	FRAME					
A13-0655-04	N*	SUB FRAME(A)					
A13-0656-14	N*	SUB FRAME(B)					
A20-2512-03	N	PANEL ASS'Y K,M	1	1			
A20-2513-03	N	PANEL ASS'Y T			1		
A20-2514-03	N	PANEL ASS'Y W					
A20-2527-04	N*	PANEL	1	1			
A20-2528-04	N*	PANEL	1	1			
A21-0765-13	*	ORNAMENTAL PANEL	1	1	1	1	
B07-0649-04	N	SIDE ESCUTCHEON(L&R)	2	2	2	2	
B10-0669-04	N*	FRONT GLASS	1	1	1	1	
B40-3505-04	N*	MODEL NAME PLATE TM-211A	1	1			
B40-3546-04	N*	MODEL NAME PLATE TM-211E			1		
B43-1009-04	N	BADGE TM-211A	1	1			
B43-1010-04	N	BADGE TM-211E(TRIO)			1		
B43-1011-04	N	BADGE TM-211E	1	1	1	1	
B43-1012-04	N	BADGE(B)	1	1	1	1	
B46-0410-00	N	WARRANTY CARD	1	1			
B50-4117-00	N	INSTRUCTION MANUAL TM-211A	1	1			
B50-4118-00	N	INSTRUCTION MANUAL TM-211E			1		
B50-4117-00	N	INSTRUCTION MANUAL TM-211A	1	1	1	1	
B58-0662-00	N	CAUTION CARD					
D19-0402-05	N	BALL	4	4	4	4	
D29-0301-05	N	MOVING BEARING	2	2	2	2	
D29-0302-04	N	BALL STOPPER	2	2	2	2	
E30-1788-05	N	DC CABLE ASS'Y	1	1	1	1	
E30-1729-08	N	CABLE WITH PLUG	1	1	1	1	
F05-7025-05	N	FUSE	1	1	1	1	
F07-0853-02	N	PLASTIC COVER	2	2	2	2	
F11-0859-04	N*	SHIELDING COVER	1	1	1	1	
F19-0639-04	N*	SHIELDING MATERIAL	1	1	1	1	
F20-0521-04	N	INSULATING PLATE	1	1	1	1	
G01-0831-04	N*	COILED SPRING (DCS SW ETC.)	4	4	4	4	
G01-0818-04	*	COILED SPRING	9	9	9	9	
G02-0505-05	N	KNOB FITTING SPRING	2	2	2	2	
G02-0542-04	N	GND SPRING (VCO CASE RIGHT)	1	1	1	1	
G09-0420-04	N	FITTING SPRING	2	2	2	2	
G11-0615-04	N	CUSHION	1	1	1	1	
G13-0680-04	N	CUSHION ACS SP	1	1	1	1	
G13-0683-04	N	CUSHION(MOUNTING ANGLE)	1	1	1	1	
G13-0804-04	N	CUSHION(MOUNTING BLACKET)	2	2	2	2	
G13-0809-04	N	CUSHION	1	1	1	1	

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY				
			011	021	051	061	
H01-4550-03	N*	CARTON(INSIDE) TM-211A	1	1			
H01-4551-03	N*	CARTON(INSIDE) TM-211E			1		
H01-4591-03	N*	CARTON(INSIDE) TM-211E					
H10-2572-04	*	PACKING FIXTURE(TOP)	1	1	1	1	
H10-2590-02	*	PACKING FIXTURE	1	1	1	1	
H12-1338-04	*	CUSHION(C)	2	2	2	2	
H12-1360-04	N*	CUSHION					
H25-0029-04	*	BAG(ACS)	2	2	2	2	
H25-0049-03	*	PROTECTIVE BAG 60X200	1	1	1	1	
H25-0103-04	*	BAG	1	1	1	1	
H25-0116-04	*	PROTECTIVE BAG 125X250	1	1	1	1	
H25-0708-04	*	BAG	1	1	1	1	
H25-0104-04	*	BAG	1	1	1	1	
J19-1402-04	N	CABLE FITTING HARDWARE	1	1	1	1	
J21-2799-13	N*	HARDWARE FIXTURE	1	1	1	1	
J21-4132-03	N*	JOINT HARD WARE	1	1	1	1	
J21-4149-04	N*	WIRE HOLDER	1	1	1	1	
J29-0407-04	N	SW GUIDE A (TACT KNOB)	10	10	10	10	
J29-0409-04	N	SW GUIDE X3	3	3	3	3	
J32-0775-04	N	MOUNTING BOSS X4	4	4	4	4	
J32-0772-14	N*	STUD & BOSS (STICK TYPE)	1	1	1	1	
J32-0783-04	N*	ROUND BOSS(A UNIT)	1	1	1	1	
J32-0784-04	N*	ROUND BOSS(B UNIT)	1	1	1	1	
J39-0418-08	*	SPACER(ACS SP)	1	1	1	1	
J61-0408-05	*	VINYL TIE	4	4	4	4	
K21-0771-15	N	MAIN KNOB	1	1	1	1	
K23-0769-05	N	KNOB(RIT,AF,SQL	2	2	2	2	
K29-3010-05	N	KNOB(B) OFFSET	1	1	1	1	
K29-3003-05	N	PUSH KNOB(A)	3	3	3	3	
K29-3004-05	N	PUSH KNOB(B)	1	1	1	1	
K29-3005-05	N	PUSH KNOB(C)	1	1	1	1	
K29-3006-05	N	PUSH KNOB(D)	1	1	1	1	
K29-3007-05	N	PUSH KNOB(E)	1	1	1	1	
K29-3008-05	N	PUSH KNOB(F)	1	1	1	1	
K29-3009-05	N	PUSH KNOB(G)	1	1	1	1	
K29-3033-03	N	KNOB(M)	1	1	1	1	
K29-3034-03	N	KNOB(N)	1	1	1	1	
K29-3020-03	N	PUSH KNOB(J)	1	1	1	1	
K29-3022-03	N	KNOB(L)	1	1	1	1	
LR4087		IC	1				
N09-0008-04		SCREW (ACS. MOUNTING BRACKET)	4	4	4	4	
N09-0632-05		SCREW (ACS. MOUNTING BRACKET)	4	4	4	4	
N10-2040-41	N	HEX NUT(ACS SP)	2	2	2	2	
N14-0526-04	N	ROUND NUT(VOLUME)	2	2	2	2	
N14-0510-04	N	NUT (ACS. MOUNTING BRACKET)	4	4	4	4	
N15-1030-46	N	FLAT WASHER	1	1	1	1	
N15-1050-46	N	WASHER(ACS.MOUNTING BRACKET)	4	4	4	4	
N15-1060-46	N	WASHER(ACS.MOUNTING BRACKET)	4	4	4	4	
N16-0026-46	N	SPRING WASHER	2	2	2	2	
N16-0060-46	N	SPRING WASHER	4	4	4	4	
N19-0631-05	N	FLAT WASHER	4	4	4	4	
N30-4010-41	N	PAN HD SCREW	2	2	2	2	
N32-2604-46	N	FLAT HD SCREW	6	6	6	6	

A UNIT (X44-1590-xx) (-11: K, M -51: T, W)

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE. NO
			011	051									
CC45CH1H150J		CERAMIC 15P 50V	1	3									C , 20
CC45CH1H150J		CERAMIC 15P 50V	1	3									C , 20, 107, 111
CC45CH1H05C		CERAMIC 0.5P 50V	1	1									C , 101
CC45CH1H220J		CERAMIC 22P 50V	1	1									C , 80
CC45CH1H270J		CERAMIC 27P 50V	1	1									C , 96
CC45CH1H010C		CERAMIC 1P 50V	2	2									C , 14, 76
CC45CH1H270J		CERAMIC 27P 50V	1	1									C , 97
CC45CH1H330J		CERAMIC 33P 50V	2	2									C , 2, 19
CC45CH1H020C		CERAMIC 2P 50V	1	1									C , 102
CC45TH1H100D		CERAMIC 10P 50V	1	1									C , 48
CC45CH1H05C		CERAMIC 0.5P 50V	1	1									C , 55
CC45RH1H120J		CERAMIC 12P 50V	1	1									C , 1
CC45CH1H030C		CERAMIC 3P 50V	2	2									C , 50, 54
CC45RH1H180J		CERAMIC 18P 50V	2	2									C , 4, 5
CC45CH1H05C		CERAMIC 0.5P 50V	1	1									C , 55
CC45UJ1H060D		CERAMIC 6P 50V	1	1									C , 111
CC45CH1H040C		CERAMIC 4P 50V	1	1									C , 58
CC45TH1H100D		CERAMIC 10P 50V	1	1									C , 69
CC45CH1H030C		CERAMIC 3P 50V	3	6									C , 71, 99, 100
CC45CH1H030C		CERAMIC 3P 50V	1	1									C , 3, 71, 99, 100, 105, 109
CC45CH1H050C		CERAMIC 5P 50V	2	2									C , 17
CC45CH1H050C		CERAMIC 5P 50V	2	2									C , 75, 117
CC45CH1H040C		CERAMIC 4P 50V	1	1									C , 3
CC45SL1H470J		CERAMIC 47P 50V	2	2									C , 13, 144
CC45SL1H101J		CERAMIC 100P 50V	5	5									C , 18, 90, 91, 118, 119
CC45SL1H101J		CERAMIC 100P 50V	1	1									C , 89
CC45CH1H070D		CERAMIC 7P 50V	3	3									C , 49, 108, 113
CC45SL1H121J		CERAMIC 120P 50V	1	1									C , 130
CC45CH1H060D		CERAMIC 6P 50V	2	2									C , 105, 109
CC45CH1H100D		CERAMIC 10P 50V	2	2									C , 12, 72
CC45CH1H070D		CERAMIC 7P 50V	1	1									C , 70
CC45CH1H080D		CERAMIC 8P 50V	1	1									C , 57
CC45CH1H100D		CERAMIC 10P 50V	2	2									C , 121, 124
CC45CH1H100D		CERAMIC 10P 50V	3	3									C , 68, 121, 124
CC45SL1H181J		CERAMIC 180P 50V	1	1									C , 115
CC45CH1H120J		CERAMIC 12P 50V	3	3									C , 46, 51, 106
CC45CH1H120J		CERAMIC 12P 50V	1	1									C , 68
CC45CH1H090D		CERAMIC 9P 50V	1	1									C , 112
CC45CH1H180J		CERAMIC 18P 50V	1	1									C , 112
CC73FCH1H020C		CHIP CAP. 2P 50V	1	1									C , 160
CC73FCH1H1R5C		CHIP CAP. 1.5P 50V	3	3									C , 160
CE04W1A470M		ELECTRO 47 10V	3	3									C , 53, 122, 141
CE04W1A101M		ELECTRO 100 10V	3	3									C , 35, 74, 153
CE04W1A221M		ELECTRO 220 10V	1	1									C , 147
CE04W1E100M		ELECTRO 10 25V	1	1									C , 139
CE04CW0J470M		ELECTRO 47 6.3V	1	1									C , 137
CE04CW1A330M		ELECTRO 33 10V	3	3									C , 62, 88, 94
CE04CW1A470M		ELECTRO 47 10V	1	1									C , 134
CE04CW1C100M		ELECTRO 10 16V	1	1									C , 152
CE04CW1HR33M		ELECTRO 0.33 50V	1	1									C , 138
CE04CW1HR47M		ELECTRO 0.47 50V	1	1									C , 26
CE04CW1H010M		ELECTRO 1 50V	2	2									C , 142, 143
CE04CW1H2R2M		ELECTRO 2.2 50V	1	1									C , 85
CF92V1H473J	N	POLYESTER 0.047 50V	1	1									C , 136
CF92V1H683J		POLYESTER 0.068 50V	1	1									C , 43
CK45B1H102K		CERAMIC 1000P 50V	5	5									C , 11, 59, 64, 92, 161
CK45B1H102K		CERAMIC 1000P 50V	4	4									C , 11, 59, 64, 92

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE. NO
			O11	051									
CK4581H471K		CERAMIC 470P 50V	3	3									C , 114, 149, 151
CK4581H102K		CERAMIC 1000P 50V	13	13									C , 6, 9, 27, 40, 41, 45, 60 C , 63, 78, 81, 148, 150, 156
CK4581H471K		CERAMIC 470P 50V	4	4									C , 30, 32, 95, 125
CQ92M1H152K		MYLAR 1500P 50V	1	1									C , 145
CQ92M1H222K		MYLAR 2200P 50V	1	1									C , 140
CQ92M1H223K		MYLAR 0.022 50V	2	2									C , 133, 135
CQ92M1H333K		MYLAR 0.033 50V	1	1									C , 132
CQ92M1H104K		MYLAR 0.1 50V	1	1									C , 146
CS15E1C2R2M		TANTALUM 2.2 16V	2	2									C , 86, 127
CS15E1E010M		TANTALUM 1 25V	2	2									C , 66, 128
CS15E1V0R1M		TANTALUM 0.1 35V	2	2									C , 65, 83
CS15E1VR22M		TANTALUM 0.22 35V	2	2									C , 84, 87
CS15E1VR68M		TANTALUM 0.68 35V	1	1									C , 129
C05-0030-15		TRIMMER 20P	2	2									TC , 2, 4
C05-0062-05		TRIMMER 6P	2	2									TC , 1, 3
C05-0067-05		TRIMMER 25P	2	2									TC , 5, 6
C90-0897-05	N	ELECTRO 470 10V	1	1									C , 159
C91-0667-05		CERAMIC 0.0047	1	1									C , 123
C91-0117-05		CERAMIC 0.01	6	6									C , 8, 16, 23, 44, 67, 79
C91-1008-05		CERAMIC 0.022	1	1									C , 42
C91-0667-05		CERAMIC 0.0047	2	2									C , 120, 131
C91-0117-05		CERAMIC 0.01	20	20									C , 10, 15, 25, 29, 52, 56, 61 C , 73, 77, 82, 93, 103, 104, 110
C91-1008-05		CERAMIC 0.022	11	11									C , 116, 126, 154, 155, 157, 158 C , 21, 22, 28, 31, 33, 34, 36 C , 37, 38, 39, 98
E04-0154-05	*	RF COAXIAL CABLE CONNECTOR RA											
E31-2108-05		INSIDE CONNECTING WIRE(A)	1	1									TP , 1
E40-0211-05	*	MINI CONNECTOR 2P	1	1									
E40-0273-05	*	MINI CONNECTOR 2P	1	1									
E40-0473-05	*	MINI CONNECTOR 4P	1	1									
E40-5016-05	N*	MINI CONNECTOR 2P	3	3									
E40-5017-05	N*	MINI CONNECTOR 3P	2	2									
E40-5018-05	N*	MINI CONNECTOR 4P	2	2									
E40-5020-05	N*	MINI CONNECTOR 6P	1	1									
F11-0862-04	N	SHIELDING CASE(A)	1	1									
J31-0503-05		BEADS	1	1									
L15-0306-05	N	LOW-FREQUENCY CHOKE COIL	1	1									L , 30
L19-0352-15	N	TOROIDAL COIL 30.5T	2	2									L , 11, 15
L30-0005-05		IFT	2	2									L , 4, 6
L30-0503-05	N	IFT	1	1									L , 9
L30-0530-05		TUNING COIL 455KHZ	1	1									L , 8
L31-0267-05		TUNING COIL	2	2									L , 1, 2
L32-0664-05	N	OSCILLATING COI	2	2									L , 12, 16
L34-0683-05		TUNING COIL	2	2									L , 21, 22
L34-1025-05		COIL 3 5.5T	3	3									L , 14, 18, 19
L40-1092-14		INDUCTOR 1 UH	4	4									L , 13, 17, 23, 25
L40-3391-14		INDUCTOR 3.3 UH	1	1									L , 20
L40-1021-12		INDUCTOR 1 MH	1	1									L , 29
L40-1025-25		INDUCTOR 1 MH	1	1									L , 28
L71-0216-05		MCF 10.695MHZ	1	1									L , 5
L72-0342-05		CERAMIC FILTER CFV455F	1	1									L , 7

[illegible]

FINAL UNIT (X45-1360-01)

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE. NO
			001										
CC45CH10010C		CERAMIC 1P 50V	2										C , 8, 10
CC45SL2H180J		CERAMIC 18P 500V	1										C , 3
CC45SL2H150J		CERAMIC 15P 500V	2										C , 4, 6
CC45SL2H330J		CERAMIC 33P 500V	1										C , 9
CC45SL2H390J		CERAMIC 39P 500V	1										C , 7
CC45SL2H101J		CERAMIC 100P 500V	1										C , 5
CE04CW1C100M		ELECTRO 10 16V	2										C , 1, 2
CK45B1H102K		CERAMIC 1000P 50V	6										C , 12, 13, 14, 15, 16, 17
CM73F2H220J		CHIP MICA 22P 500V	1										C , 11
E11-0401-05		EARPHONE JACK EXT.SP	1										
E23-0512-05		TERMINAL 1P	1										
E30-1780-05		POWER CABLE	1										
E30-1782-15		8P MIC CABLE ASS'Y	1										
E31-2172-15		COAXIAL CABLE CONNECTOR M	1										
E31-2089-05		INSIDE CONNECTIRA	1										
E31-3028-05		CABLE WITH TERMDO	1										
F01-0910-05	N*	HEAT SINK	1										
F05-7025-05		FUSE 7A	1										
J19-1375-04		HOLDER	1										
J41-0024-15		BUSHING (PLASTIC)	2										
J61-0408-05		VINYL TIE	1										
L34-0499-05		VHF COIL 3 4T	3										L , 3, 5, 6
L34-0895-05		COIL 3 6T	1										L , 2
L34-0908-05		COIL 3 9.5T	2										L , 1, 4
L40-1091-03		INDUCTOR 1 UH	1										L , 7
M1308		DIODE	1										D , 3
M1407		DIODE	1										D , 2
M57737		POWER MODULE	1										Q , 1
N09-0626-04		SCREW (OTHERS)	2										
N87-2606-41		TAPPING SCREW	6										
RD14DB2H181J		RES. CARBON 180 OHM 1/2W	1										R , 1
RD14B2C223J		RES. CARBON 22K OHM 1/6W	1										R , 2
R12-0541-05		TRIM.POT. 100 OHM	1										VR , 1
U158		DIODE	1										D , 1
1S1587		DIODE	2										D , 4, 5

[illegible]

B UNIT (X53-1380-xx) -11:K,M -51:T -61:W

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY					REFERENCE. NO
			011	051	061			
F11-0860-04	N*	SHIELDING CASE(B)	1	1	1			
F11-0861-04	N*	SHIELDING COVER(B)	1	1	1			
F20-0516-05		INSULATING BOARD	1	1	1			
F29-0014-05		INSULATING WASHER	1	1	1			
G10-0628-04	N	CLOTH	1	1	1			
L34-0893-05		COIL 3 4T	2	2	2			L 2, 4
L34-0894-05		COIL 3 5T	2	2	2			L 1, 3
L77-1206-05	N	XTAL 3.6864MHZ	1	1	1			L 5
L78M06		IC	1	1	1			IC 8
MC140018CP		IC OR TC4001BP	1	1	1			IC 6
MC14069UBCP		IC	1	1	1			IC 5
MN6127A		IC	1	1	1			IC 3
NJM78M06A	N	IC OR L78M06	1	1	1			IC 8
NJM78L06A		IC	1	1	1			IC 9
N09-0623-04		SCREW (OTHERS)	1	1	1			
RS14AB3A100J		METAL FILM 10 OHM 1W	1	1	1			R 43
R12-1430-05		TRIM.POT. 3K OHM	1	1	1			VR 2
R12-2413-05		TRIM.POT.(5K)	1	1	1			VR 5
R12-3443-05		TRIM.POT. 10K OHM	1	1	1			VR 6
R12-3446-05	N	TRIM.POT.(30K)	1	1	1			VR 3
R12-4413-05		TRIM.POT. 50K OHM	3	3	3			VR 1, 4, 7
R90-0515-05		RESISTOR BLOCK 10K	2	2	2			R 62, 65
S31-1411-05		SLIDE SWITCH(MONITOR SW)	1	1	1			S 2
S59-0415-05		KEYBOARD SWITCHRESET SW	1	1	1			S 1
TC4001BP		IC						IC 6
TC4069UBP		IC						IC 5
UPC4558C		IC	2	2	2			IC 4, 7
UPD7508G-620-00	N	MICRO-PROCESSOR	1	1	1			IC 1
UPD7507G-575-00	N	MICRO-PROCESSOR FOR DCS	1	1	1			IC 2
1N4448		DIODE						D 1, 2, 3, 4, 5, 6, 7
1S1555		DIODE	12	12	12			D 8, 10, 11, 12, 13
2SA1015(Y)		TR	1	1	1			D 1, 2, 3, 4, 5, 6, 7
2SA1115(E)		TR	1	1	1			D 8, 10, 11, 12, 13
2SC2347		TR	1	1	1			D 1, 2, 3, 4, 5, 6, 7
2SC2538-22-A		TR	1	1	1			D 8, 10, 11, 12, 13
2SC2458(Y)		TR	4	5	4			D 1, 2, 3, 4, 5, 6, 7
2SC2458(Y)		TR						D 8, 10, 11, 12, 13
2SC2603(E)		TR						D 1, 2, 3, 4, 5, 6, 7
2SC2603(E)		TR						D 8, 10, 11, 12, 13
2SC2603(E)		TR						D 1, 2, 3, 4, 5, 6, 7
2SC2603(E)		TR						D 8, 10, 11, 12, 13
2SC2458(Y)		TR	4	4	4			D 1, 2, 3, 4, 5, 6, 7
2SC1775(E)		TR	1	1	1			D 8, 10, 11, 12, 13
2SD880(Y)		TR	1	1	1			D 1, 2, 3, 4, 5, 6, 7

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE. NO
			011	051	061								
CC45CH1H150J		CERAMIC 15P 50V	2	2	2								C , 71, 72
CC45CH1H220J		CERAMIC 22P 50V	1	1	1								C , 10
CC45SL1H121J		CERAMIC 120P 50V	1	1	1								C , 81
CC45SL1H101J		CERAMIC 100P 50V	1	1	1								C , 57
CC45CH1H330J		CERAMIC 33P 50V	2	2	2								C , 67, 69
CC45SL1H101J		CERAMIC 100P 50V	3	3	3								C , 56, 58, 59
CE04CW1HR22M		ELECTRO 0.22 50V	1	1	1								C , 46
CE04CW1HR47M		ELECTRO 0.47 50V	1	1	1								C , 41
CE04CW1HOR1M		ELECTRO 0.1 50V	2	2	2								C , 76, 84
CE04CW1C4R7M		ELECTRO 4.7 16V	1	1	1								C , 38
CE04CW1C100M		ELECTRO 10 16V	4	4	4								C , 9, 34, 37, 82
CE04CW1A330M		ELECTRO 33 10V	1	1	1								C , 79
CF92V1H104J		POLYESTER 0.1 50V	2	2	2								C , 77, 80
CK45B1H152K		CERAMIC 1500P 50V	1	1	1								C , 32
CK45B1H471K		CERAMIC 470P 50V	3	3	3								C , 44, 65, 66
CK45B1H681K		CERAMIC 680P 50V	1	1	1								C , 64
CK45B1H102K		CERAMIC 1000P 50V	20	20	20								C , 2, 3, 5, 7, 13, 14, 18, 20, 21, 22, 23, 24, 25, 29, 31, 54, 55, 86, 90, 91, 11, 15, 27, 30, 85, 113, 35
CK45B1H102K		CERAMIC 1000P 50V	6	6	6								C , 100, 101, 102, 103, 104, 105, 106
CK45B1H152K		CERAMIC 1500P 50V	1	1	1								C , 107, 108, 109
CK73EB1H103K		CHIP CAP. 0.01 50V	10	10	10								C , 39, 62, 83
CG92M1H102K		MYLAR 1000P 50V	3	3	3								C , 63
CG92M1H222K		MYLAR 2200P 50V	1	1	1								C , 42
CG92M1H822K		MYLAR 8200P 50V	1	1	1								C , 45, 78
CG92M1H223K		MYLAR 0.022 50V	2	2	2								C , 40
CG92M1H273K		MYLAR 0.027 50V	1	1	1								C , 36
CG92M1H333K		MYLAR 0.033 50V	1	1	1								C , 43
CS15E1VR33M		TANTALUM 0.33 35V	1	1	1								C , 33
CS15E1VR01M		TANTALUM 0.1 35V	1	1	1								C , 16
CS15E1C3R3M		TANTALUM 3.3 16V	1	1	1								C , 88
CS15E1A100M		TANTALUM 10 10V	1	1	1								TC , 1, 2
C05-0030-15		TRIMMER 20P	2	2	2								C , 48, 49
C90-0871-05		ELECTRO 220 16V	2	2	2								C , 53, 74, 75
C90-0872-05		ELECTRO 33 16V	3	3	3								C , 26, 28
C90-0873-05		ELECTRO 47 10V	2	2	2								C , 12, 51, 89
C90-0875-05		ELECTRO 100 16V	3	3	3								C , 1, 4, 6, 8, 47, 52, 70
C91-0117-05		CERAMIC 0.01	8	8	8								C , 73
C91-0117-05		CERAMIC 0.01	5	5	5								C , 60, 61, 99, 110, 111
C91-0667-05		CERAMIC 0.0047	2	2	2								C , 17, 19
C91-1008-05		CERAMIC 0.022	2	2	2								C , 50, 68
DTA143XF		DIGITAL TR	4	4	4								Q , 14, 15, 16, 20
DTC124EF		DIGITAL TR	1	1	1								Q , 17
E04-0159-05	N	MINI-PIN JACK(A) DI,DO											
E31-3083-05	N*	CONNECTOR WITH WIRE	1										
E31-3084-05	N*	CONNECTOR WITH WIRE	1	1	1								
E40-3007-05	*	MINI CONNECTOR 2P	1	1	1								
E40-5015-05	N*	MINI CONNECTOR 8P	2	2	2								
E40-5016-05	*	MINI CONNECTOR 2P	2	2	2								
E40-5016-05	*	MINI CONNECTOR 2P	2	2	2								
E40-5017-05	*	MINI CONNECTOR 3P	5	5	5								
E40-5018-05	*	MINI CONNECTOR 4P	5	5	5								
E40-5019-05	N*	MINI CONNECTOR 5P	1	1	1								

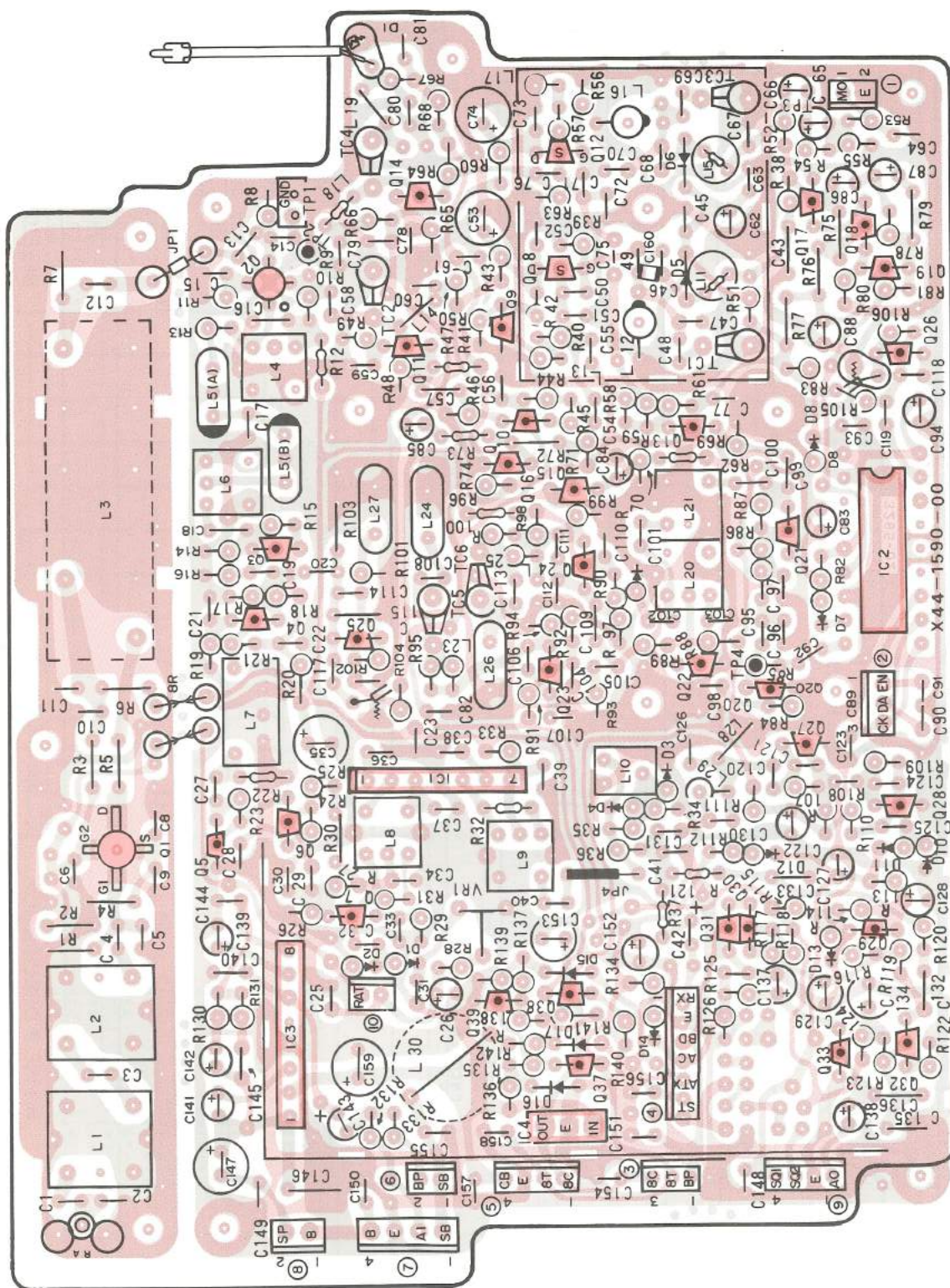
DISPLAY UNIT (X54-1810-xx) - 11:K,M -51:T -61:W

PARTS. NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY						REFERENCE. NO
			011	021	051	061			
CK45B1H471K		CERAMIC 470P 50V	1	1	1	1			C , 4
CK45B1H102K		CERAMIC 1000P 50V	6	6	6	6			C , 1, 3, 5, 6, 7, 8
CS15E1E010M		TANTALUM 1 25V	1	1	1	1			C , 2
DTA143XF		DIGITAL TR	8	8	8	8			Q , 1, 2, 3, 4, 5, 6, 7
E23-0427-05		GND TERMINAL	2	2	2	2			
E23-0455-14		PLATE FOR GND	1	1	1	1			
E40-5016-05		MINI CONNECTOR 2P	1	1	1	1			
F15-0654-04	N*	LED MASK	4	4	4	4			
LB1407	N	IC	1	1	1	1			IC , 2
LC7800	N	IC	1	1	1	1			IC , 1
N15-1020-46		FLAT WASHER	1	1	1	1			
N89-2005-46		BIND TAPPING SCREW	1	1	1	1			
R05-3424-05	N	POT. 10K OHM WITH SWITCH	1	1	1	1			VR , 1
R29-4401-05	N	POT. WITH SW.	1	1	1	1			VR , 2
SLP444	N	LED	4	4	4	4			D , 5, 6, 7, 8
S40-2443-05		PUSH SW	2	2	2	2			S , 11, 12
S40-2443-05		PUSH SW	1	1	1	1			S , 11, 13
S40-2443-05		PUSH SW	1	1	1	1			S , 11
S40-2444-05		PUSH SW	1	1	1	1			S , 13
S40-2444-05		PUSH SW	1	1	1	1			S , 12
S40-2444-05		PUSH SW	1	1	1	1			S , 12, 13
S50-1412-05		TACT SWITCH	6	6	6	6			S , 1, 2, 3, 4, 5, 6
S50-1427-05	N	TACT SWITCH	4	4	4	4			S , 7, 8, 9, 10
W02-0360-05	N	ROTARY ENCODER	1	1	1	1			
W02-0361-05	N	LED ASS'Y	1	1	1	1			
1N4448		DIODE							D , 1, 4
1N4448		DIODE							D , 2, 4
1N4448		DIODE							D , 3, 4
1S1555		DIODE	2	2	2	2			D , 1, 4
1S1555		DIODE							D , 2, 4
1S1555		DIODE							D , 3, 4
2SA1150(Y,O)	N	TR	5	5	5	5			Q , 9, 10, 11, 12, 13

PC BOARD VIEW

▼ A UNIT (X44-1590-11, -51) Component side view

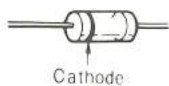
-11: K,M -51: T,W



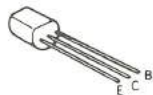
A UNIT (X44-1590-11)

IC1: μ PC577H(E or F) IC2: MC145155 P*J IC3: MB3712 IC4: μ 78M08H Q1: 3SK97(Q2)*J Q2: 3SK74(L) Q3,12: 2SK192A(GR)*N
Q4,5,6: 2SC2787(L) Q7,10,11,13,14,20,21~26: 2SC688(Y) Q9,15~18,29,32~33,39: 2SC2458(Y) or 2SC2603(E) Q19: 2SC2458 (L)
Q27,28,30,31: 2SC3113(B) Q37,38: 2SC2710(Y) D1,2,9~15: 1S1555 D3,4: 1SS99 D5,6: 1SV50 D7: IN60
D8: MTZ6.2JA D16,17: MTZ10JC

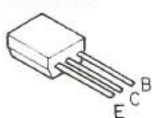
1S1555



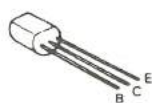
2SA1015
2SC1775
2SC2347



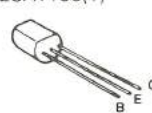
2SC2458
2SC2668
2SC2710
2SC3113
2SC2603



2SC2538



2SA1150(Y)

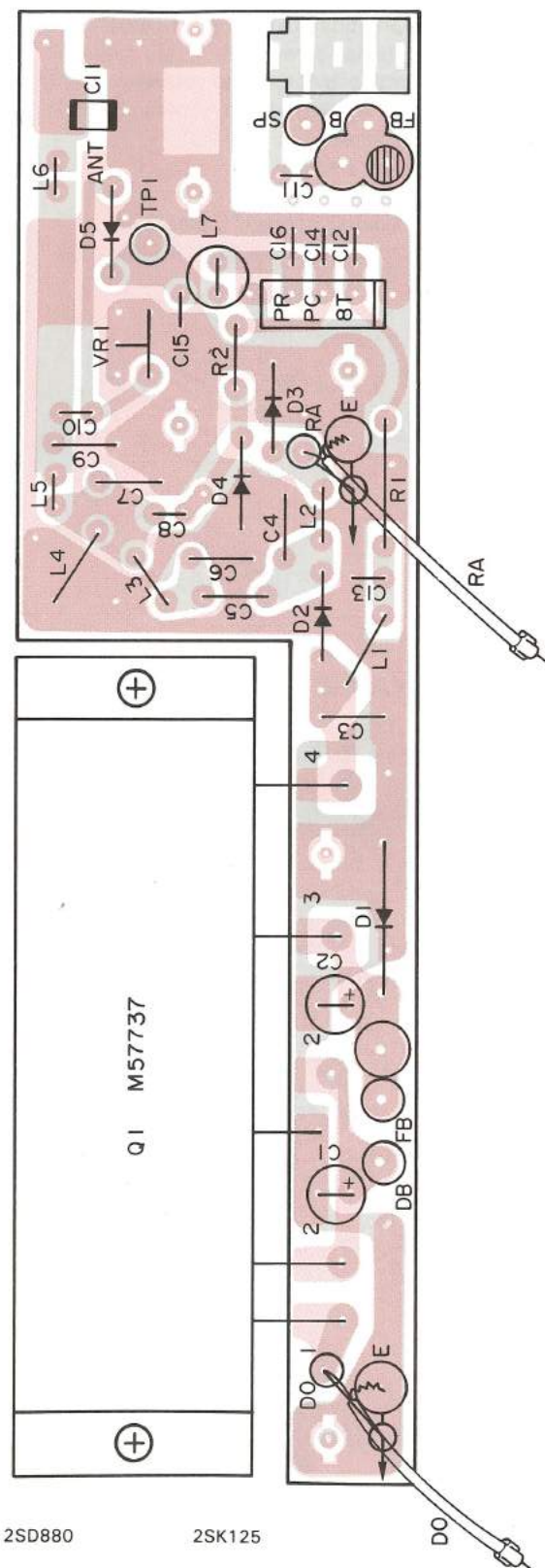


2SC2787



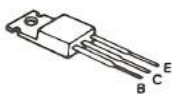
▼ FINAL UNIT (X45-1360-01)

Component side view

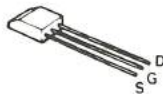


2SD880

2SK125



2SK192A



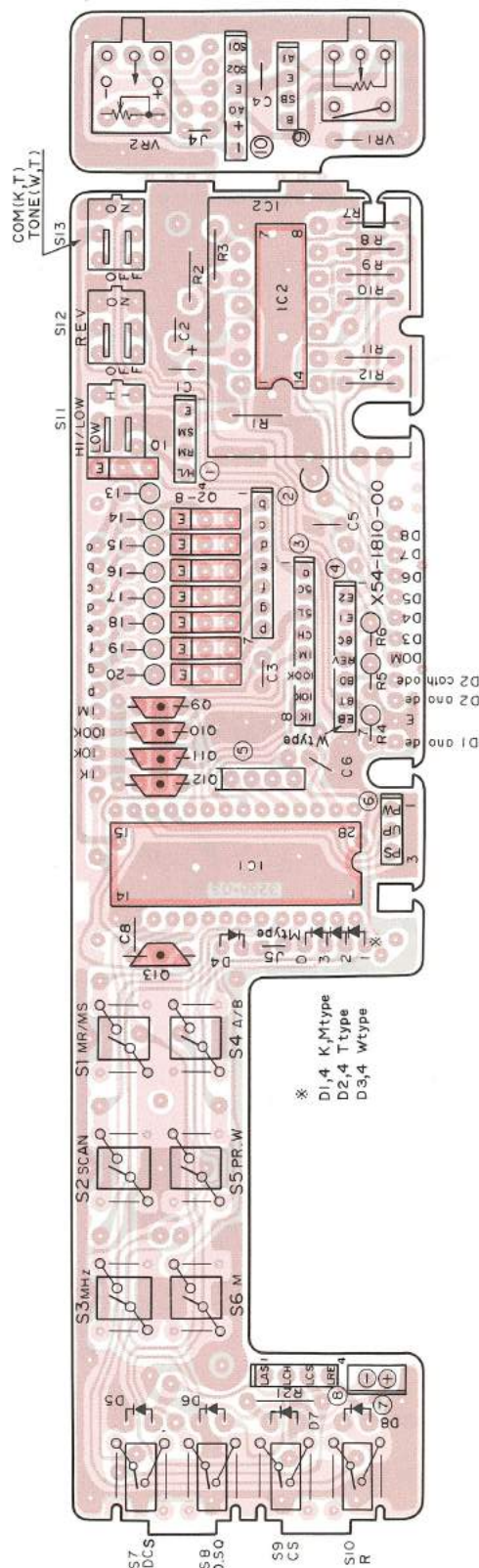
FINAL UNIT (X45-1360-01)

Q1: M57737, D1: U15B, D2: M1407, D3: M1308, D4,5: 1SS1587

▼ DISPLAY UNIT (X54-1810-11)

Foil side view

-11: K,M -51: T -61: W



DISPLAY UNIT (X54-1810-11)

IC1: LC7800, IC2: LB1407, Q1 ~ 8: DTA143x(F), Q9 ~ 13 2SC1150(Y), D4: 1S1555 or 1N4448B, D5: 7: SLP444

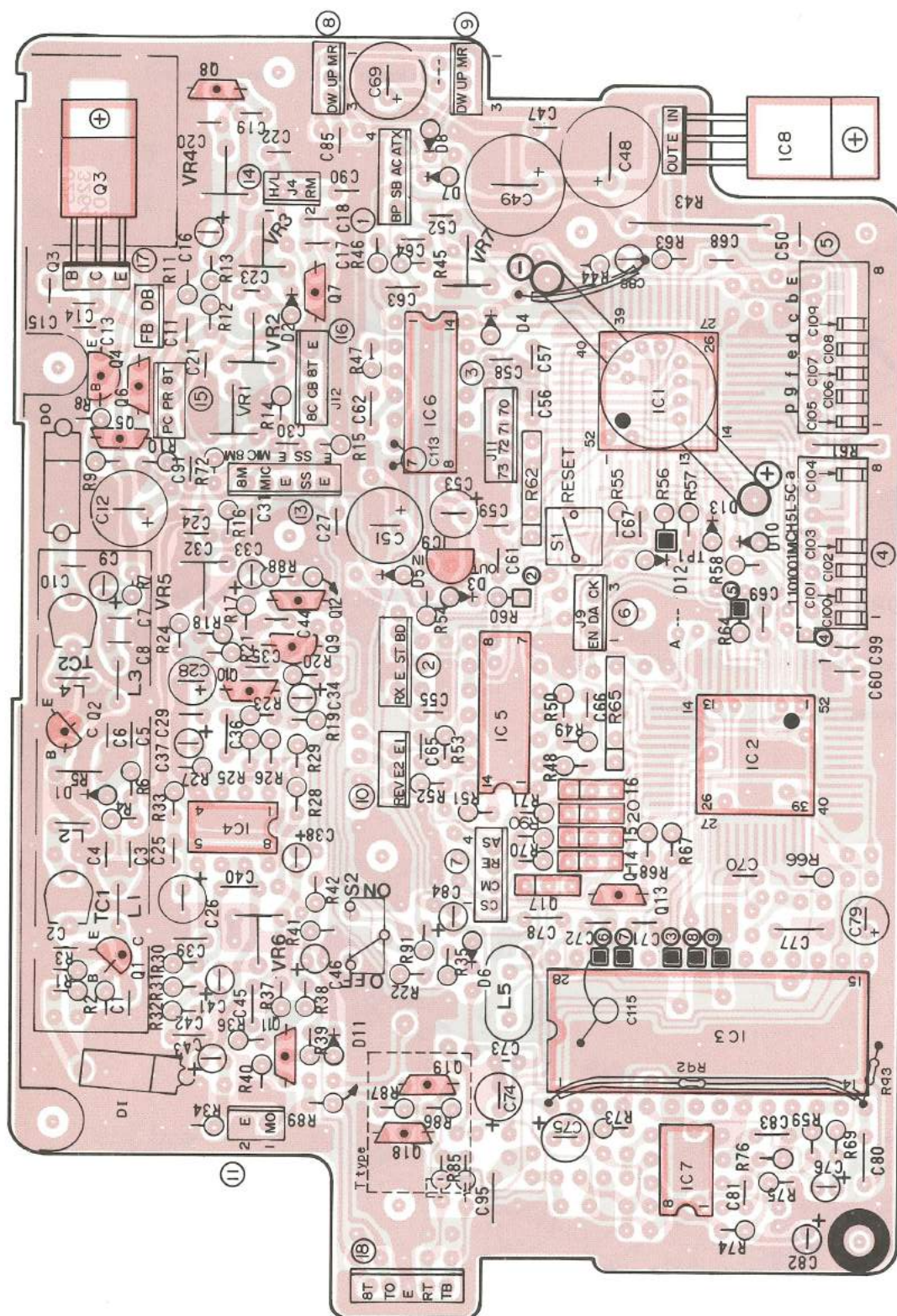
▼ B UNIT (X53-1380-11,-51,-61)

Component side view

-11 : K,M

-51 : T

-61 : W



B UNIT (X53-1380-11)

IC1: μ PD7508G-611-00, IC2: μ PD7507G-575-00, IC3: MN-6127A, IC4: μ PC4558C, IC5: MC14069U or TC4069UBP
 IC6: MC1400BCP or TC4001BP, IC8: NJM78M06 or L78M06, IC9: NJM78L06A, Q1: 2SC2026, Q2: 2SC2407(1), Q3: 2SD880(y)
 Q4: 2SA1015(y), Q5,10 ~ 12,18: 2SC2458(y) or 2SC2603(E), Q6 ~ 9,13: 2SC1775(E), Q14 ~ 16: DTA143X(F), Q17: DTC124(F)
 Q19: 2SA1115(E), D1 ~ 8,10 ~ 13: 1S1555 or 1N4448

3SK74
3SK97

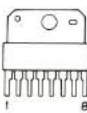
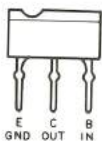
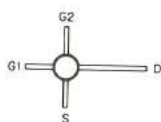
DTC124
DTA143X

MB3712

μ PC5777

μ PC78M08H

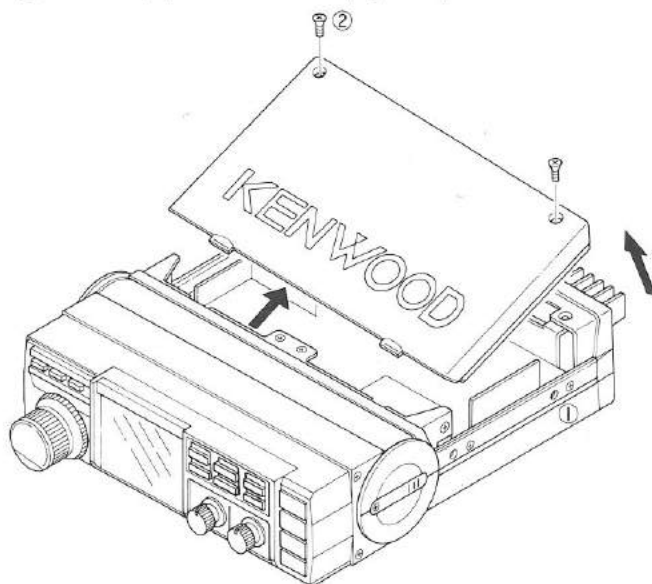
NJM78M06A
or L78M06
NJM78ML06A



DISASSEMBLY

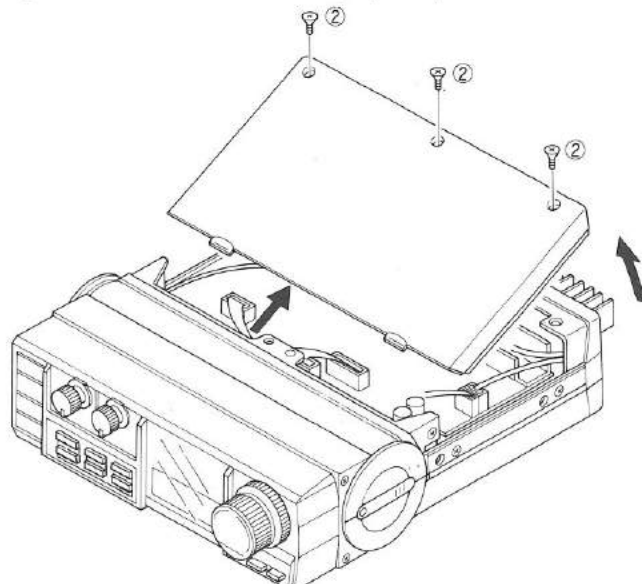
DISASSEMBLY FOR UPPER CASE

- ① To loosen the side escutcheon's (L & R) screw (black 4 pieces).
- ② Remove upper case's screw (2 pieces).



DISASSEMBLY FOR LOWER CASE

- ① To loosen the side escutcheon's (L & R) screw (black 4 pieces).
- ② Remove lower case's screw (3 pieces).

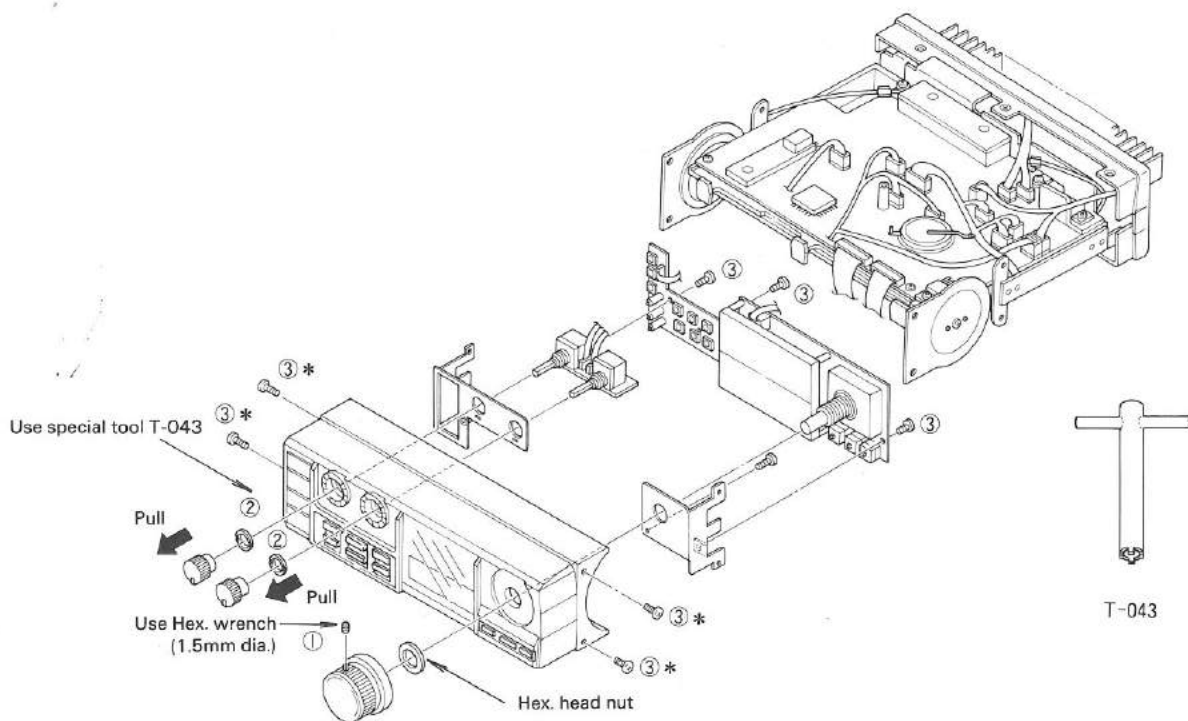


DISASSEMBLY FOR DISPLAY UNIT

- ① Remove main dial by Hex. wrench, remove 1 1mm nut.
- ② To remove AF, SQ knob from front panel, remove nut by special tool (T-043).
- ③ Remove screw (3 pieces) on the DISPLAY UNIT.

DISASSEMBLY FOR FRONT PANEL

- ① Remove side escutcheon's screw and knobs.
- ② Remove plastic cover's (upper and lower) screw.
- ③ Remove front panel's screw (4 pieces).



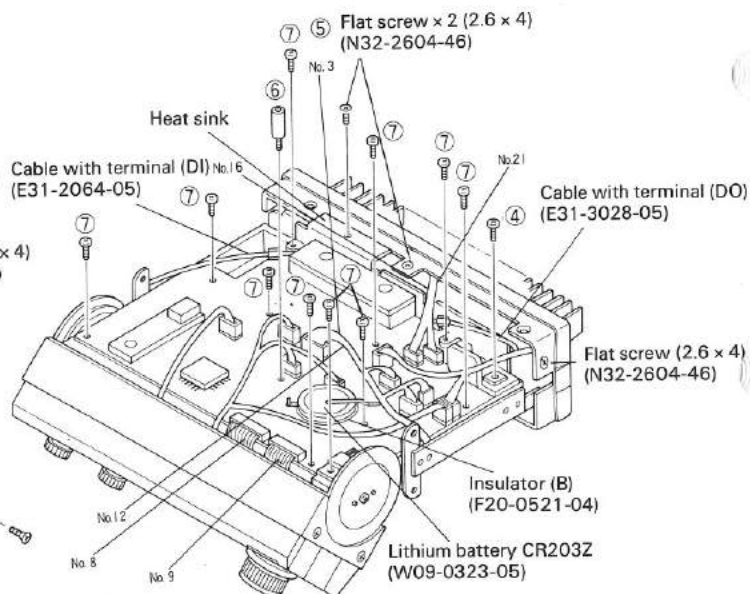
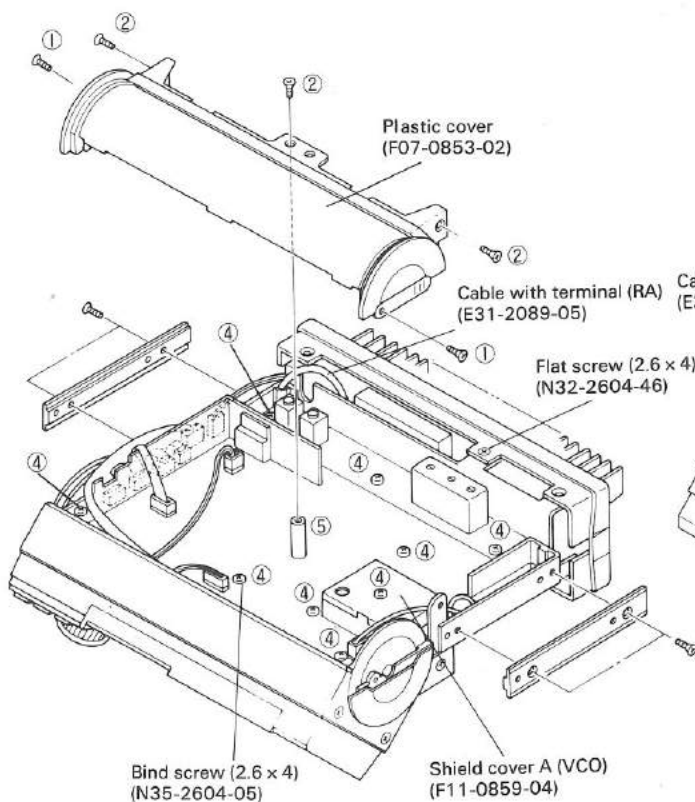
DISASSEMBLY

REMOVING THE "A" UNIT (x44-1590-11)

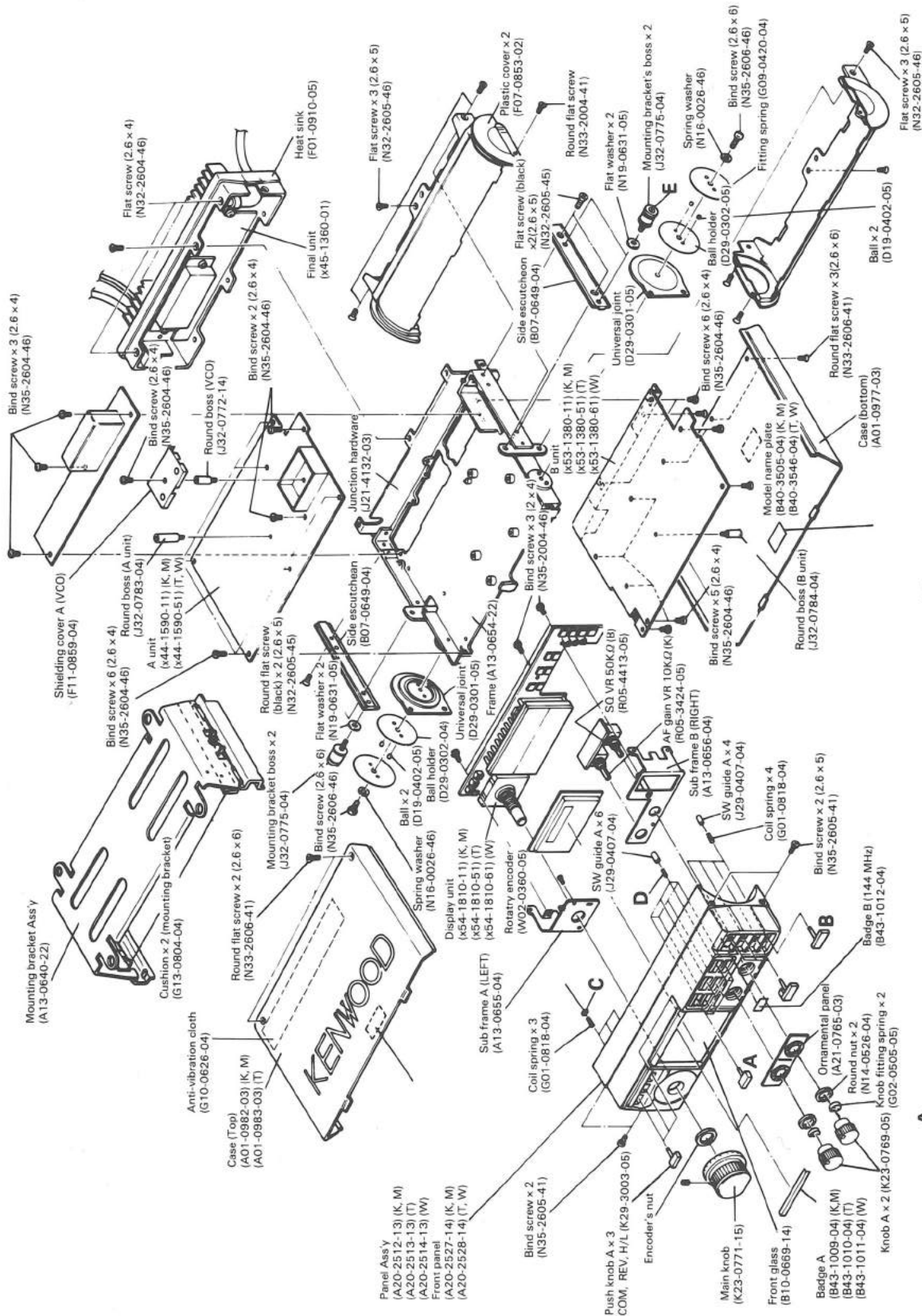
- ① Remove the plastic cover's (F07-0853-02) screw (N33-2004-41) (small screw x 2).
- ② Remove plastic cover's screw (flat screw).
- ③ Incline at a prastic angle of down (show to below).
- ④ Remove "A" PC board's screw (12 pieces).
- ⑤ Remove 2 round boss (one of boss is located in VCO case).
- ⑥ Remove connector and coaxial cable (RA, DI) at final unit.

REMOVING THE "B" UNIT (P x53-1380-11)

- ① Remove the plastic cover's (F07-0853-02) screw (N33-2004-41) (small screw x 2).
- ② Remove plastic cover's screw (flat screw).
- ③ Incline at a prastic angle of down (show to below).
- ④ Remove Q3 TR's screw.
- ⑤ Remove heat sinker's screw.
- ⑥ Remove round boss.
- ⑦ Remove "B" PC board's screw (10 pieces).
- ⑧ Remove connector and coaxial cable (DI, DO etc.).



DISASSEMBLY



- A**

MR/MS	SCAN	MHz
1	2	3
A/B	AL	M
	5	4
- B**

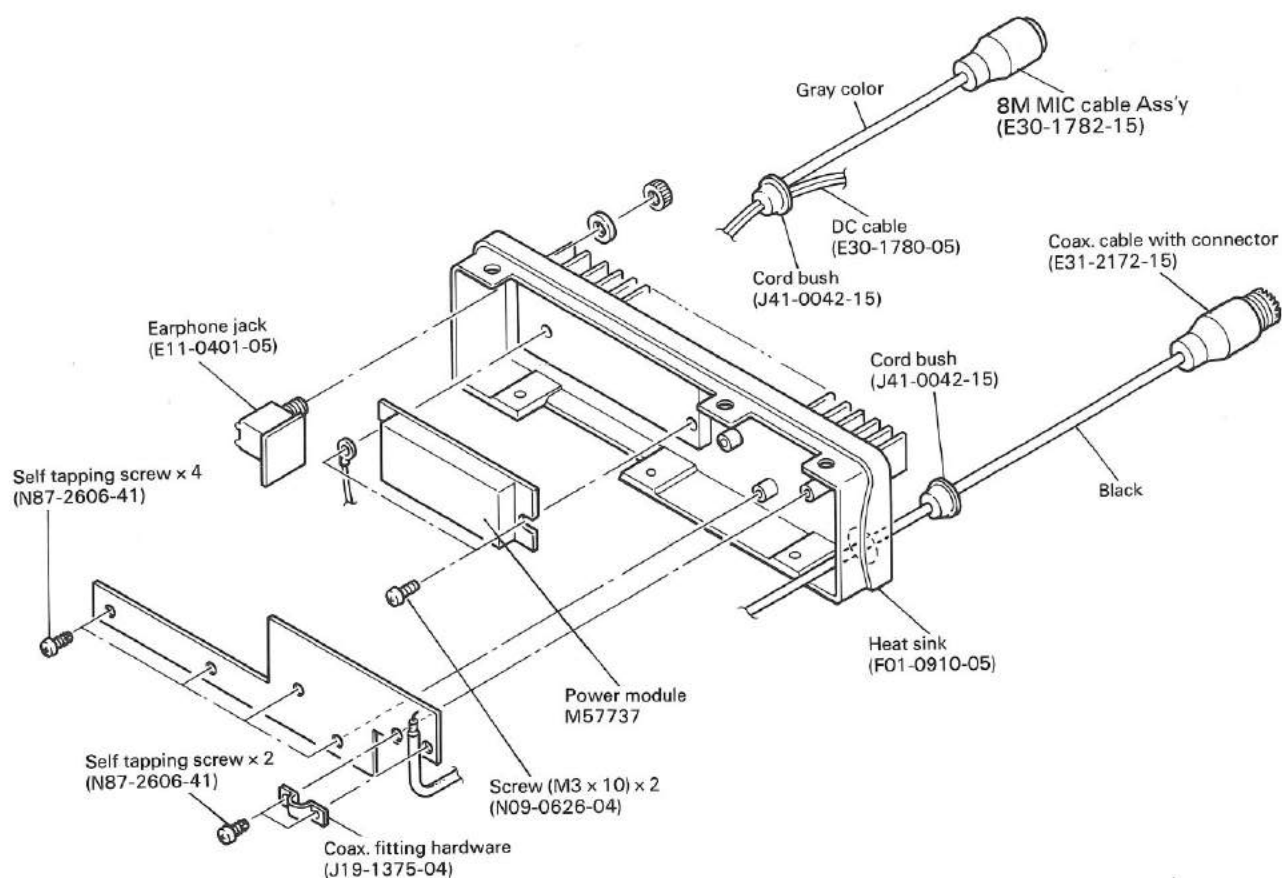
☐ DCS	Push knob M (DCS) (K29-3033-03)
☐ DSQ	Push knob N (D.SQ) (K29-3034-03)
☐ CS	Push knob J (CS) (K29-3020-03)
☐ R	Push knob L (R) (K29-3022-03)
- C**

SW guide x 3 (J29-0409-04)
- D**

Coil spring x 6 (G01-0818-04)
- E**

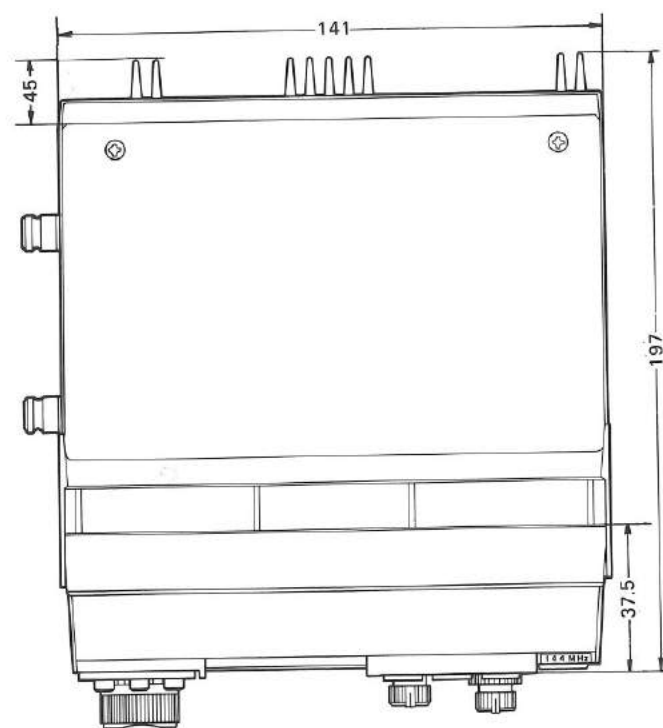
Flat screw x 2 (3 x 4) (N32-3014-41)

DISASSEMBLY/DIMENSIONS

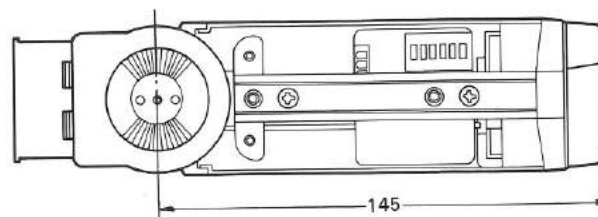


DIMENSION (: mm)

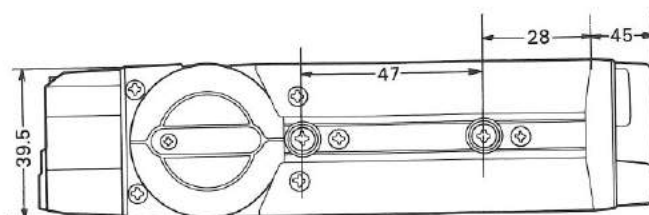
View from top



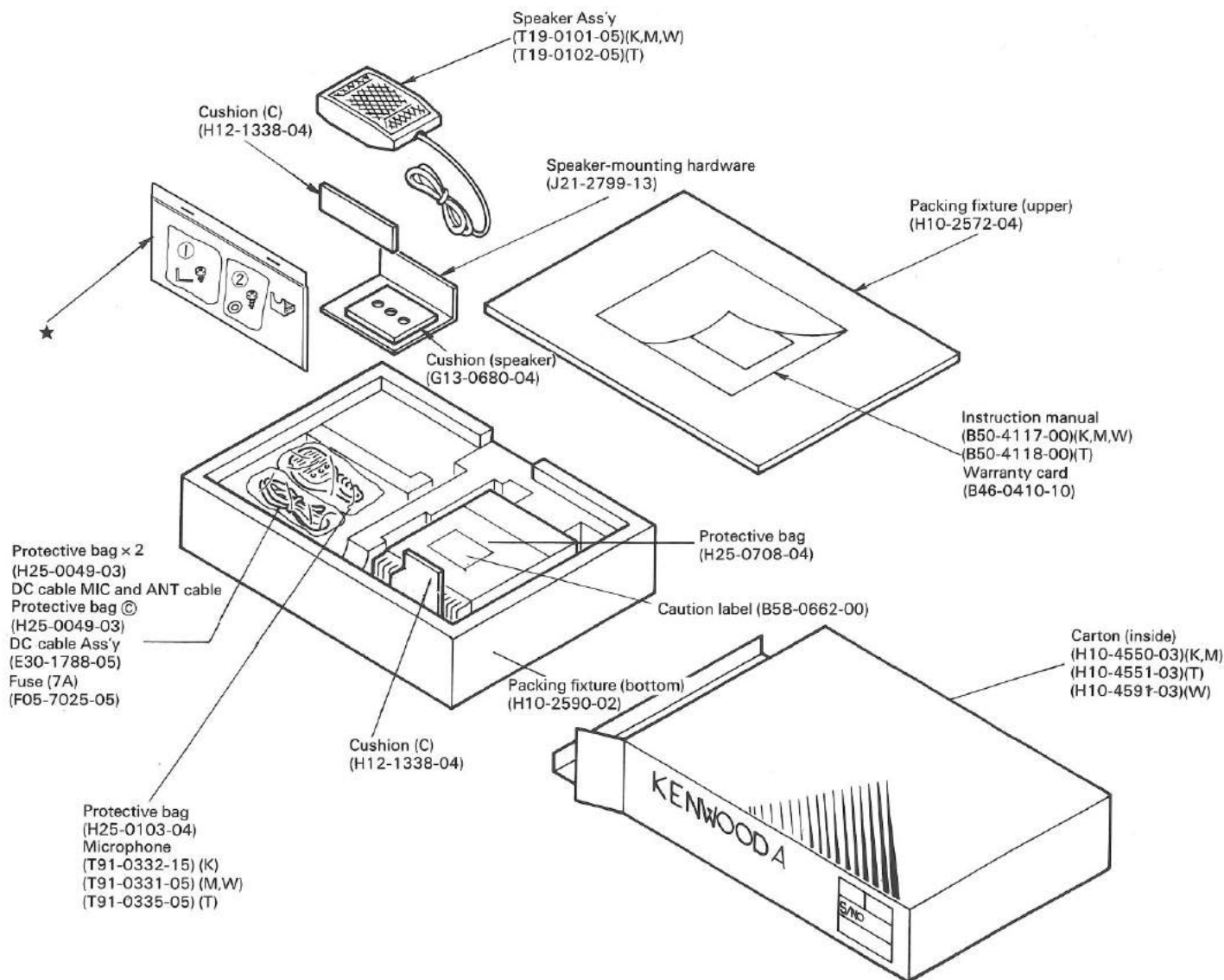
Right side view



Left side view



PACKING



★

Protective bag D
(H25-0116-04)
Cable fitting hardware (J19-1402-04)

① Protective bag ①

Hex. head nut (N10-2040-41)
Screw (4 × 10) × 2 (N10-2040-41)
Self tapping screw (4 × 8) × 4 (N87-4008-41)
Flat tapping screw (4 × 8) × 2 (N88-4008-41)

② Protective bag ② (H25-0029-04)

Screw (mounting bracket) × 4 (N09-0632-05)
Self tapping screw (mounting bracket) × 4 (N09-0632-05)
Flange nut C (mounting bracket) × 4 (N14-0510-04)
Flat washer C (mounting bracket) × 4 (N15-1050-46)
Flat washer C (mounting bracket) × 4 (N15-1060-46)
Spring washer (mounting bracket) × 4 (N16-0060-46)
Bind tapping screw (cable fitting hardware) × 2 (N89-2606-45)

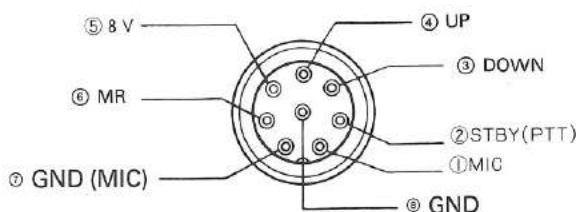
ADJUSTMENT

PREPARATION

Unless otherwise specified.
Set the control as follows.

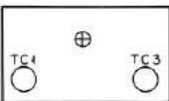
POWER SW ON
VOL (AFGAIN) MIN
SQL VOL MIN
HI/LOW SW HI
COM SW OFF
REV OFF
OFF SET S

- When adjusting the trimmer or coils, use a non-induced adjusting rod of bakelite, etc.
- When adjusting the RX Section never transmit to prevent SSG damage.
- The output level of SSG is indicated as SSG "S" open circuit.
- Connect MIC connector as shown in bellow.

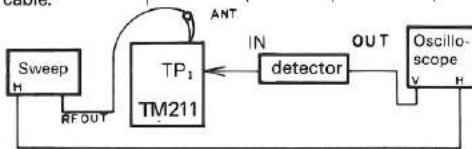
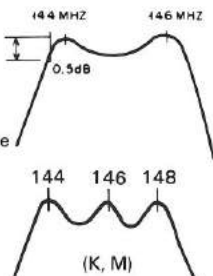


MIC terminal (view from 8P MIC cable)

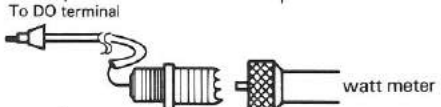
RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reset	Reset switch S1 push on (B unit)	DISPLAY					Check	5.000A (T, W) 6.000A (K, M) Tone sounds
2. Voltage check.	1) DC POWER SUPPLY: 13.8V POWER SW: ON (Receive)		A	8C		Connector No. 5 (1 pin)		7.7V ~ 8.3V
				8R		JP-2 Jumper lead*		7.6 ~ 8.2V
				8T		Connector No. 5 (2 pin)*		0.1V or less
				6C		IC2 (1 pin)		5.75 ~ 6.2V
	2) Transmit (ON AIR LED indicated) (Return to RX)		B	5L		Connector No. 4 (4 pin)		5.75 ~ 6.25V
				5C		Connector No. 4 (7 pin)		5.0 ~ 5.6V
				8T		*		7.6 ~ 8.2V
3. PLL	3) Push MR SW 1 second more.	DISPLAY					Check	Decimal point is flashed.
	1) PLL IF level Frequency: 5.000 (T, W) 6.000 (K, M) Adjust when PLL locked condition, please adjust to TC1, TC3 when PLL unlocked.	Oscillo scope (100 MHz or more) with 10:1 probe	A	TP4 (R85) near Q20	A	L21	a) Adjust level to max. when RX.	
						L22	b) Adjust level to max. when TX.	
						L21 L22	c) Repeat adjust (a) and (b) 2 or 3 times then, adjust same level by L21. 3V p-p or more (T, W)	
	2) VCO voltage Freq. 4.000 (T, W) 8.995 (K, M) 	DC volt meter	A	TP3 (R52)	A	TC1	a) When RX 6.5V ± 0.1V (T, W) 2.7V ± 0.1V (K, M)	
						TC3	b) When TX 6.5V ± 0.1V (T, W) 2.7V ± 0.1V (K, M)	
							Check	5.0 ~ 5.7V (T, W) 5.5 ~ 6.5V (K, M) (RX & TX)
	3) RX VCO output Freq. 5.000 (T, W) 6.000 (K, M)	RFVM	A	TP2 (R9)	A	TC2	When RX MAX	more than 0.75V (r.m.s)
							TP4 shorted to ground when RX	TP2's level should be down.

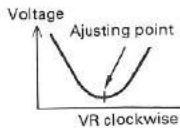
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
	4) Freq. adjustment Freq. 5.000 (T, W) 6.000 (K, M)	Freq counter	A	TP2	A	TC6	a) When RX 134.3050 MHz $\pm$ 100 Hz (T, W) 135.3050 MHz $\pm$ 100 Hz (K, M)	
				DI	A	TC5	b) When TX 145.0000 MHz $\pm$ 100 Hz (T, W) 146.0000 MHz $\pm$ 100 Hz (K, M)	
	3) Return to RX							
4. Herical	1) Freq. 5.00 (T, W) 6.00 (K, M) 2) Connect the sweep generator to ANT. 3) TP4 shorted to ground. 4) Do not across the VCO area from detector's cable.	Oscilloscope detector	A	TP1	A	L1 L2 L3		
5. IF gain	1) Freq. 5.050 (T, W) 6.050 (K, M) 2) Connect the SSG to ANT. MOD : 1 kHz DEV : 5 kHz OUT : 10 dB μ } SSG conditions	SSG AFVM 8 Ω Oscilloscope	Final	SP	A	TC2 L4 L6 L8	MAX.	Repeat 2 ~ 3 times
6. Discriminator	1) Freq. 5.050 (T, W) 6.050 (K, M) 2) SSG MOD : 1 kHz DEV : 5 kHz OUT : 60 dB μ	SSG AFVM 8 Ω Oscilloscope	Final	SP	A	L9	MAX.	
7. Sensitivity	SSG OUT : -9 dB μ	SSG AFVM 8 Ω Oscilloscope	Final	SP	A	L6	MAX. (Signal to noise ratio)	S/N: 21 dB or more
8. S-meter	1) Freq. 5.050 (T, M) 6.050 (K, M) SSG OUT : 20 dB μ 2) SSG OUT : 5 dB μ	S-LED	LED		A	VR1	All LED's light S-1 LED's light (Check)	
9. S/N	Freq. 5.050 (T, W) 6.050 (K, M)	AFVM Oscilloscope 8 Ω	Final	SP				S/N 20 dB or more

TX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. DRIVE	1) Disconnect D0 cable on B unit. 2) Connect 0.6W Power meter to D0 terminal on B unit.	Power meter (Max x 0.6W)	B	D0				
	3) VR1, VR3				B	VR1 VR3	Centered	
	4) VR2, VR4				B	VR2 VR4	Fullcounterclockwise position.	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
	5) Freq. 5,000 (T, W) 6,000 (K, M) Transmit	Power meter (MA×0.6W)			A	TC4		MAX.
					B	TC1 TC2		
					A	TC4		0.6W power meter Reduce RF output by TC4  1) Max (TC1, TC2, TC4) then 2) Reduce RF output by TC4
					B	TC2		0.6W power meter 0.02W down 
								0.25 ~ 0.5W 0.25 ~ 0.5W check.
	6) Freq. 4,000							
	7) Freq. 5.995 (T, W) 8.000 (K, M)							
2. POWER	1) Disconnect the .6W power meter from D0 terminal. then connect D0 cable. Freq. 5.000 (T, W) 6.000 (K, M)	Power meter						30W or more
	2) Power adj.				B	VR2	28W	28W ± 0.5W less than 5.3A
	3) Freq. 4.000							25 ~ 33W less than 5.6A
	4) Freq. 5.995 (T, W) 8.000 (K, M)							
3. LOW POWER	1) Freq. 5.000 (T, W) 6.000 (K, M)	Power meter			B	VR3	5W	5W ± 0.5W Less than 2.6A
	2) LOW SW : ON Transmit							
	3) Freq. 4,000							3 ~ 7.5W Less than 2.6A
	4) Freq. 5.995 (T, W) 8.000 (K, M)							
4. RF METER	1) LOW SW : ON (LOW POWER POSITION) 2) Freq. 5.000 (T, W) 6.000 (K, M)	RF power meter RF LED			B	VR1	Adjust VR1 for S-5	(S-7 LED's should off.)
5. PROTECTION	1) Freq. 5.000 (T, W) 6.000 (K, M) Transmit	DC volt meter	Final	TP1	Final	VR1	a) Set full power output. b) Adjust VR1 (clockwise) for dip point. 	
	2) Freq. 5.000 (T, W) 5.000 (K, M) LOW SW : OFF Shorted ANT Transmit	DC power supply with DC current meter			B	VR4	3.5A	3.5A ± 0.2A

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. DEV	1) VR5: counterclockwise 2) Connect the AG to MIC. AG: 1 kHz 28 mV (T, W) 52 mV (K, M) 3) Freq. 5.000 (T, W) 6.000 (K, M) Transmit	Linear detector			B	VR6	{ DE-EMPHASIS : OFF } { FILTER : OFF } 4.5 kHz	4.5 kHz $\pm$ 100 Hz
	4) MIC GAIN AG : 1 kHz 2.8 mV (T, W)	AG			B	VR5	3 kHz	3 kHz $\pm$ 100 Hz
7. TONE	1) Freq. 5.000 (T, W) 6.000 (K, M)							
	2) "T type" a) Install TONE unit b) R86 shorted to ground on B unit. c) Shorted between R2 and R7 on TONE unit. d) TONE SW : ON e) Transmit (Return to RX when adjust TONE freq.)	Linear detector Freq. counter	Connect the freq. to output of linear detector			VR1	1750 Hz	Freq. 1750 Hz DEV: 2.5 kHz or more
	3) "W" type a) Install TONE unit b) TONE SW : push					VR1	1750 Hz	Freq. 1750 Hz DEV: 2.5 kHz or more
	4) "K, M" type a) Install TU-3A b) OFF SET SW : - c) Transmit	Linear detector				VR1	0.65 kHz	0.65 kHz $\pm$ 0.1 kHz

OPERATIONAL CHECKS

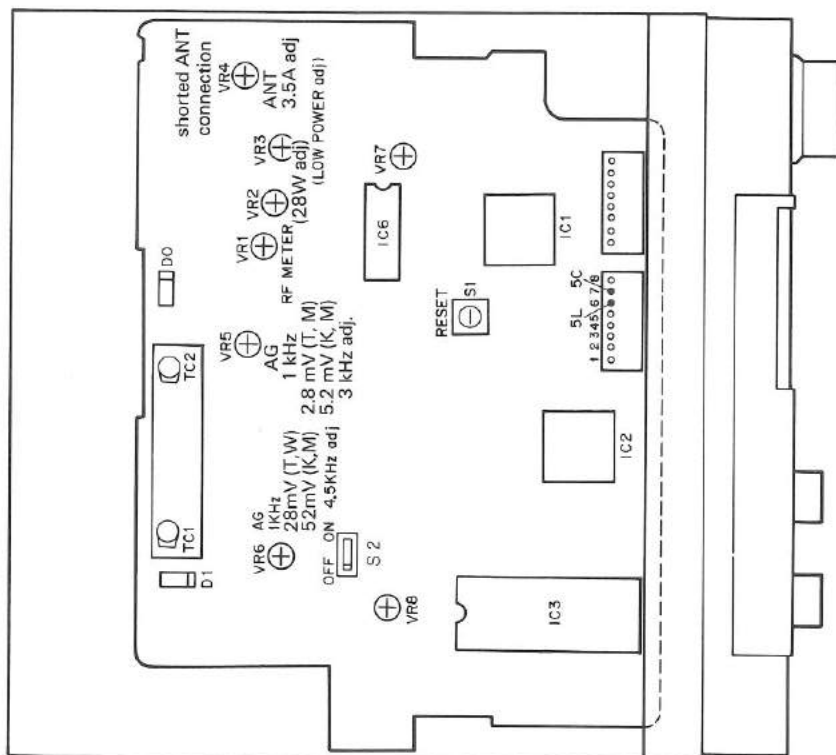
Item	Condition	Check of movement
1. Reset	1) Reset SW S1 : ON AF GAIN VOL : Centered SQ VOL : MIN.	Tone sounds 5.000A displayed (T, W) 6.000A displayed (K, M)
2. Main dial	1) Main dial : turn to clockwise	Display increases by 5 kHz (K, M) Display increases by 25 kHz (T, W)
	2) Main dial : turn to counterclockwise	Display decreases by 5 kHz (K, M) Display decreases by 25 kHz (T, W)
3. VFO A/B	1) A/B : push on	Tone sounds 4.000 b displayed (T, W), (K, M)
	2) Main dial : turn to clockwise and counterclockwise	Display increase and decrease by 5 kHz (T, W), (K, M)
	3) A/B : push on again	Tone sounds 5.000A displayed (T, W) 6.000A displayed (K, M)
4. COM SW (K, M only)	1) COM SW : ON	Tone sounds 6.000C displayed (K, M only)
	2) COM SW : OFF	Tone sounds 5.000A displayed
5. Memory write	1) M knob is depressed make a continuous beep sound. MR/MS SCAN MHz 1 2 3 A/B PRW M 4 5 4 1 ~ 3 knob is depressed during beep sounds.	Tone sounds Memory wrote already. < ex > 5.000 CH1 Memory write 5.100 CH2 Memory write 5.200 CH3 Memory write
6. Memory check	1) MR/MS : ON 1	Tone sounds 5.000 1 displayed
	2) SCAN : ON 2	Tone sounds 5.100 2 displayed
	3) MHz : ON 3	Tone sounds 5.200 3 displayed
7. SCAN	1) Connect the SSG to ANT connector f = 145.300 MHz MOD: 1 kHz DEV: 5 kHz SCAN : ON 2 SQ: MAX. 2) SQ: 3) MIC PTT: 1 push	Tone sounds MHz dot is flashed Scan will start increase by 25 kHz (T, W) and 5 kHz (K, M). Then scan stopped (freq. 5.300) After about 6 seconds, scan will start again. Scan operation stopped
8. OFFSET	1) Tune to main dial then set freq 5.100A	5.100A displayed
	2) OFFSET SW: (-) (+) Transmitt	ON AIR LED's light. 4.500A displayed OFFSET (-) 5.700A displayed OFFSET (+)
	3) REV SW: ON	5.100A displayed
9. MHz	4) Return to RX OFFSET SW: (S)	
	1) MHz : ON 3	Tone sounds MHz digit increases by 1 MHz ex. 4.100 → 5.100
10. Memory scan	1) MR/MS : depressed over 1 second	1) Decimal point is flashed memory scan will start between ex. M1 → M2 → M3 → M1 5.000 → 5.100 → 5.200 → 5.000
11. PR.W (Priority-watch)	1) PR.W : ON 4 SQ VOL: MIN	Tones sounds PR.W LED's light. Busy LED's light. After 6 seconds, 5.100 displayed. (2 seconds hold)
	2) PR.W : ON again 4	PR.W LED's OFF.

DCS FUNCTION OPERATIONAL CHECKS

Item	Condition	Check of movement
1. Digital cord setting (Digital cord will program 5.)	1) Freq. 5.000 LOW SW: ON <CS> (Front panel): ON (push)	Tone sounds 0000 displayed <CS> LED's light
	2) Digital cord setting 1 2 3 4 5 4 If push 1 ~ 5 knob, display will change numbers (0 ~ 9).	ex. Incase of digital cord 1 push 1 time 2 push 2 time 3 push 3 time 4 push 4 time 5 push 5 time Also, tone sounds if push each times.
	3) Another digital cord setting OC.SQ : ON	Tone sounds 0000 displayed again Then repeat item (2) again. 5 kind of digital cord wrote already
2. Call sign setting	1) Freq. 5.000 CS : ON	Tone sounds 1 2 3 4 5 displayed
	2) R : ON	Tone sounds 1 0 0 displayed 1st digit 3rd digit 4th digit then, set a number of ASCII cord (call sign) (See a service manual page 9)
	3) C.SQ : ON Call sign will make a 6 digit.	Tone sounds 2 0 0 displayed then, set a number of ASCII cord (call sign)
3. Digital card Squelch operation	4) R : ON	Tone sounds 5.000 displayed
	1) Freq. 4.900 DCS : ON AF GAIN VR: Centered *Also monitor radio's condition Freq. 4.9000 DCS : ON	Tone sounds DCS LED's light Noise heard from speaker.
	2) DSQ : ON	Tone sounds Noise stopped.
	3) <Monitor radio condition> MIC PTT: 1 push	DSQ LED's OFF Noise heard from speaker. C. AL LED's light.
	4) R : ON	Tone sounds CALL LED's OFF
	5) DSQ : ON R : ON	Tone sounds DSQ LED's light. R LED's light Noise stopped
	6) <Monitor radio condition> MIC PTT: 1 push	Tone sounds DSQ LED's OFF. CALL LED's light Noise heard from speaker and piping sound (continuous sounds)
	7) R : ON	Tone sounds piping sound stopped. CALL LED's OFF
	8) <Monitor radio condition> DSQ : ON	<Monitor radio condition> DSQ LED's light
	9) MIC PTT: 1 push	<Monitor radio condition> DSQ LED's OFF Noise heard from speaker

BOTTOM VIEW

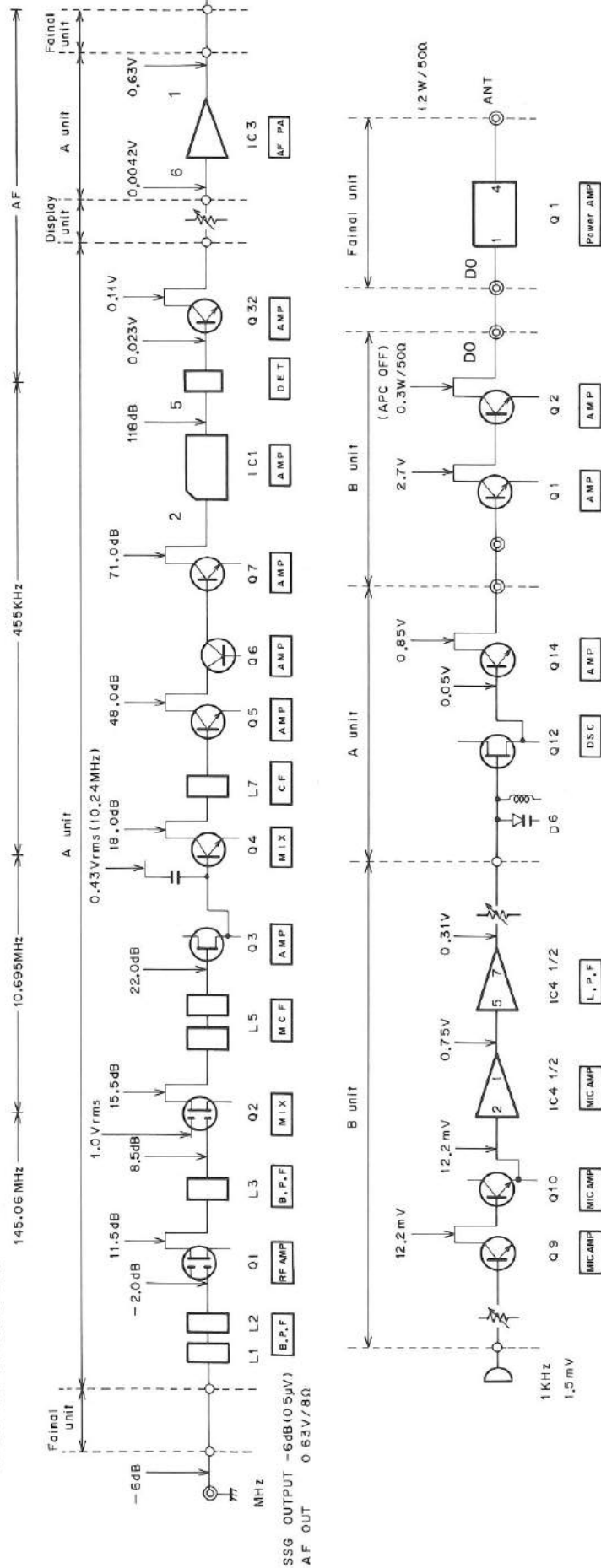
B UNIT (view from bottom case side)



LEVEL DIAGRAM

Note:

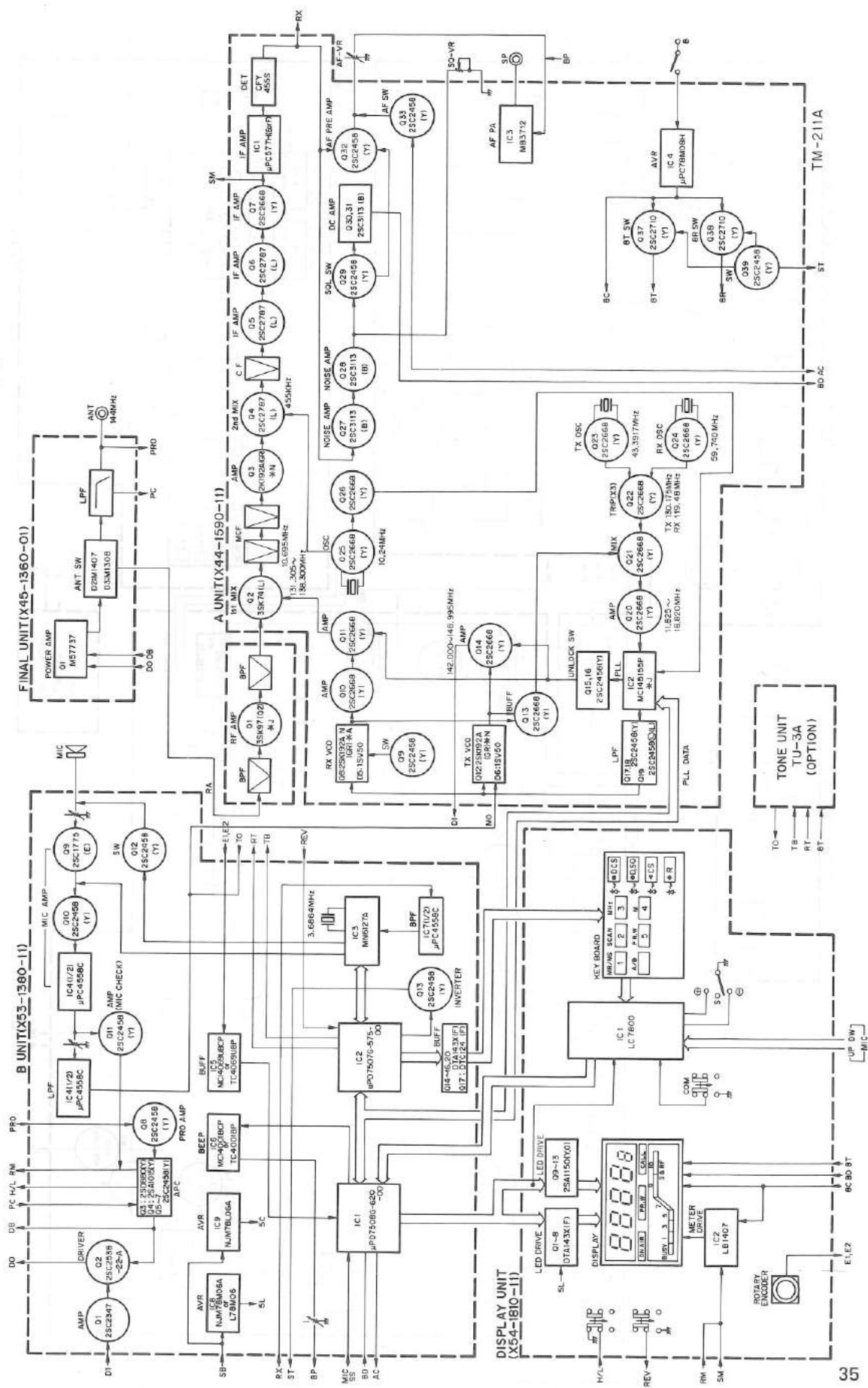
1. In measuring the circuit from the ANT terminal to the spin of IC1 an unmodulated signal of 145.06 MHz, -6 dBμ from an SSG was applied to the ANT terminal to obtain a reference NQ sensitivity. Then, the SSG output was measured when the NQ sensitivity at each SSG signal input point became equal to the reference NQ sensitivity. The SSG output was measured through a 0.01μF capacitor.
2. In measuring the circuit from the base of Q32 to the SP terminal, an SSG signal of 145.06 MHz, -6 dBμ, 1 kHz MOD, 5 kHz DEV was applied to the ANT terminal and the AF VR was adjusted to obtain an AF output of 0.63V/8Ω. The signal voltage at each point was measured with an audio V.V.



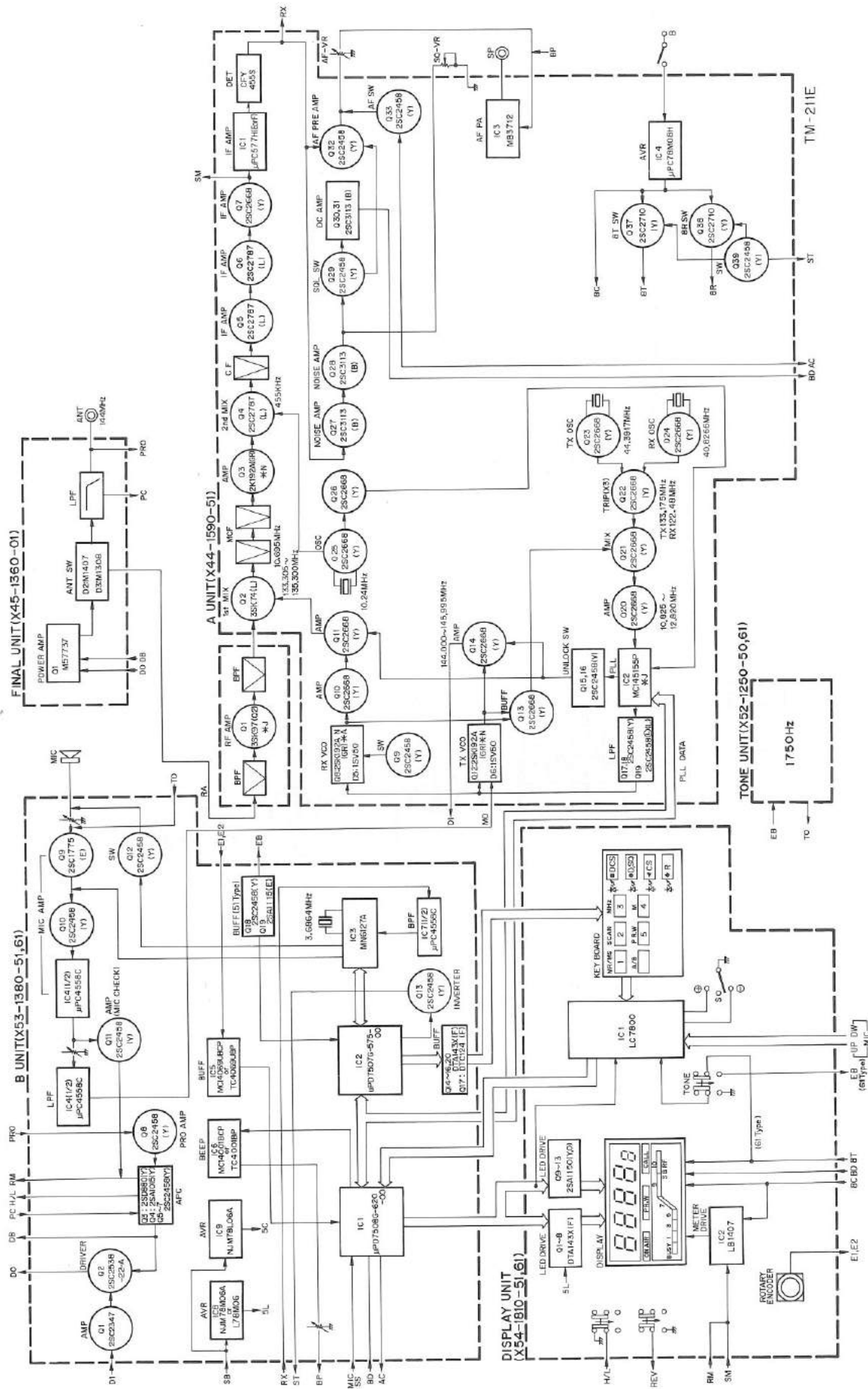
Note:

1. The signal level before DO was measured with the coaxial cable disconnected from DO and the final unit. The signal level after the DO terminal was the level under normal operating conditions.
2. The B unit (Q9 ~ IC4) was measured using audio V.V. and A unit (Q12 ~ Q14), B unit (Q1 ~ Q2) was measured using an RF V.V. (1/100 attenuator used for levels of more than 3V).

BLOCK DIAGRAM (K Type)

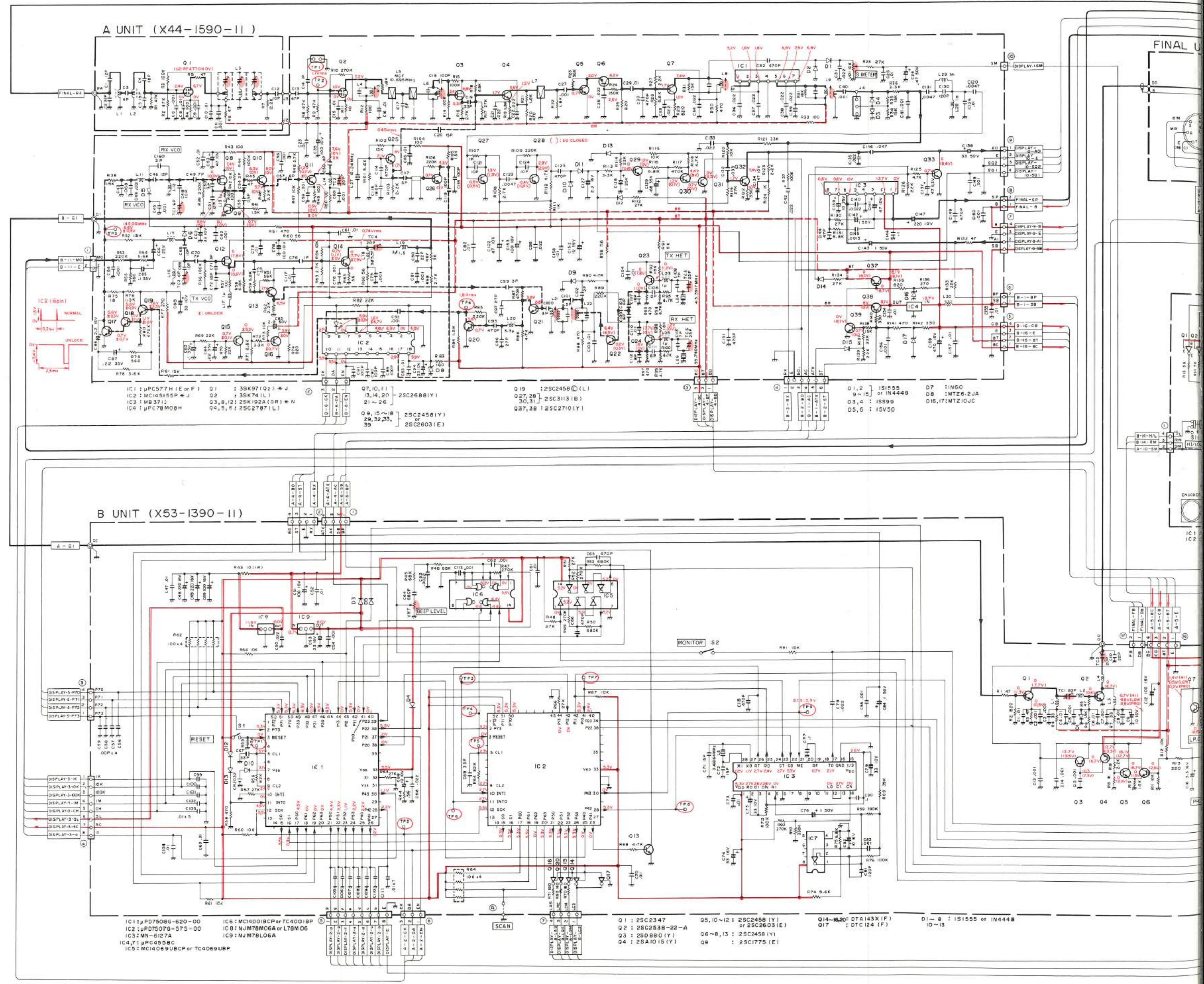
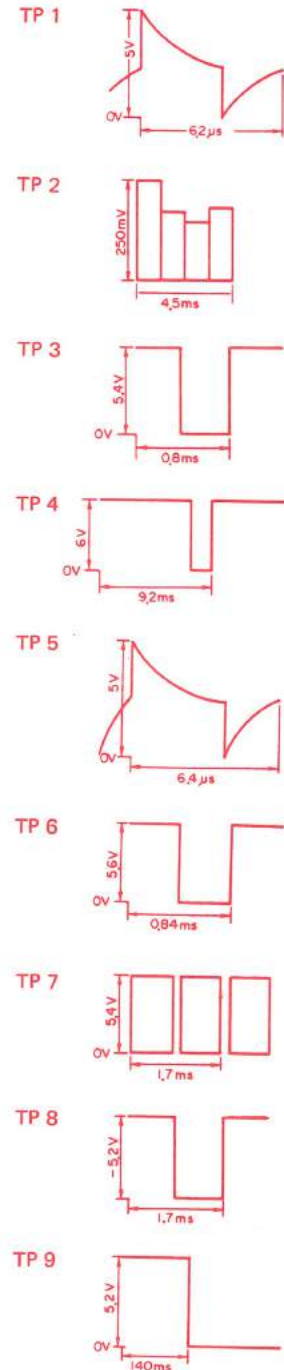


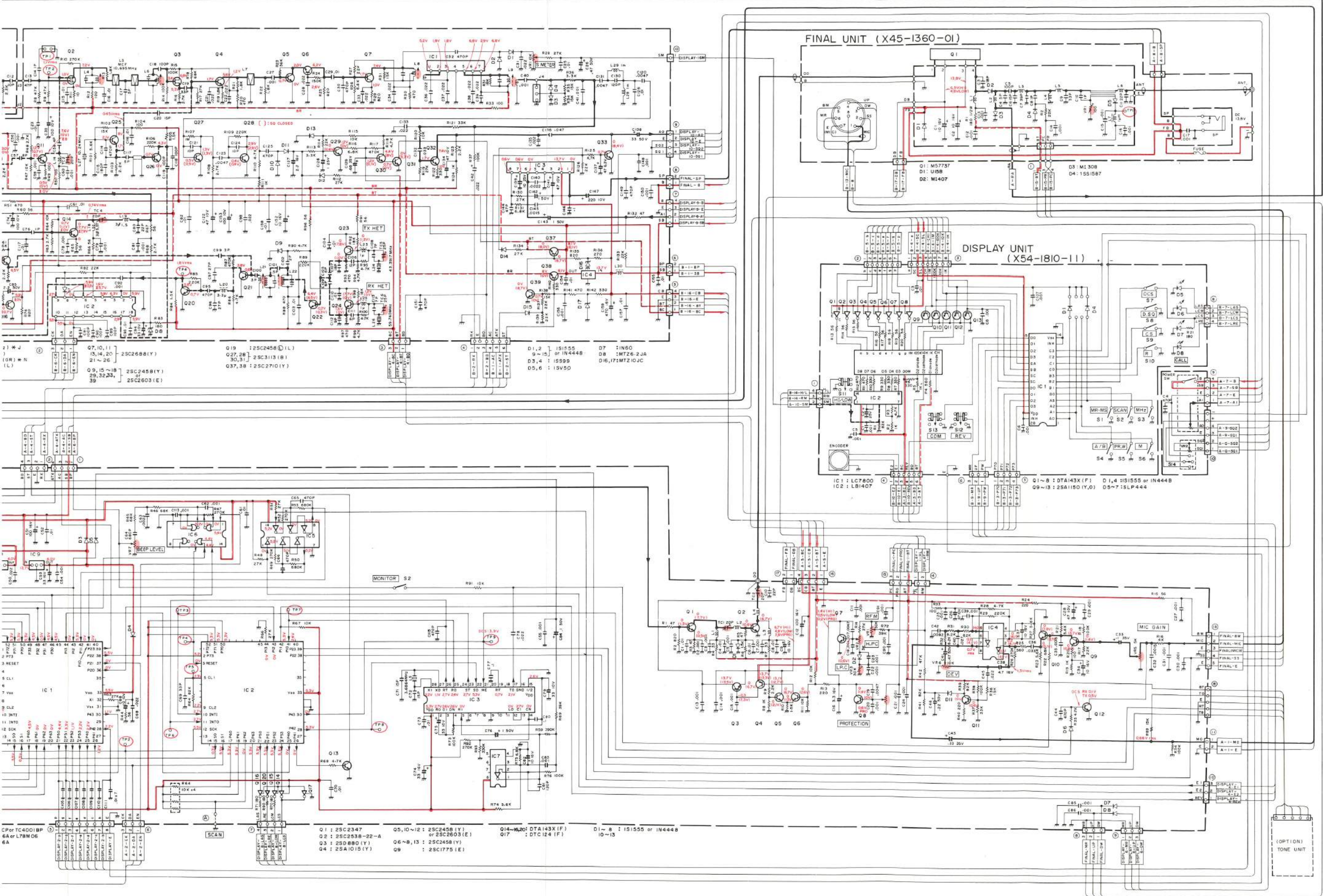
BLOCK DIAGRAM (T Type)

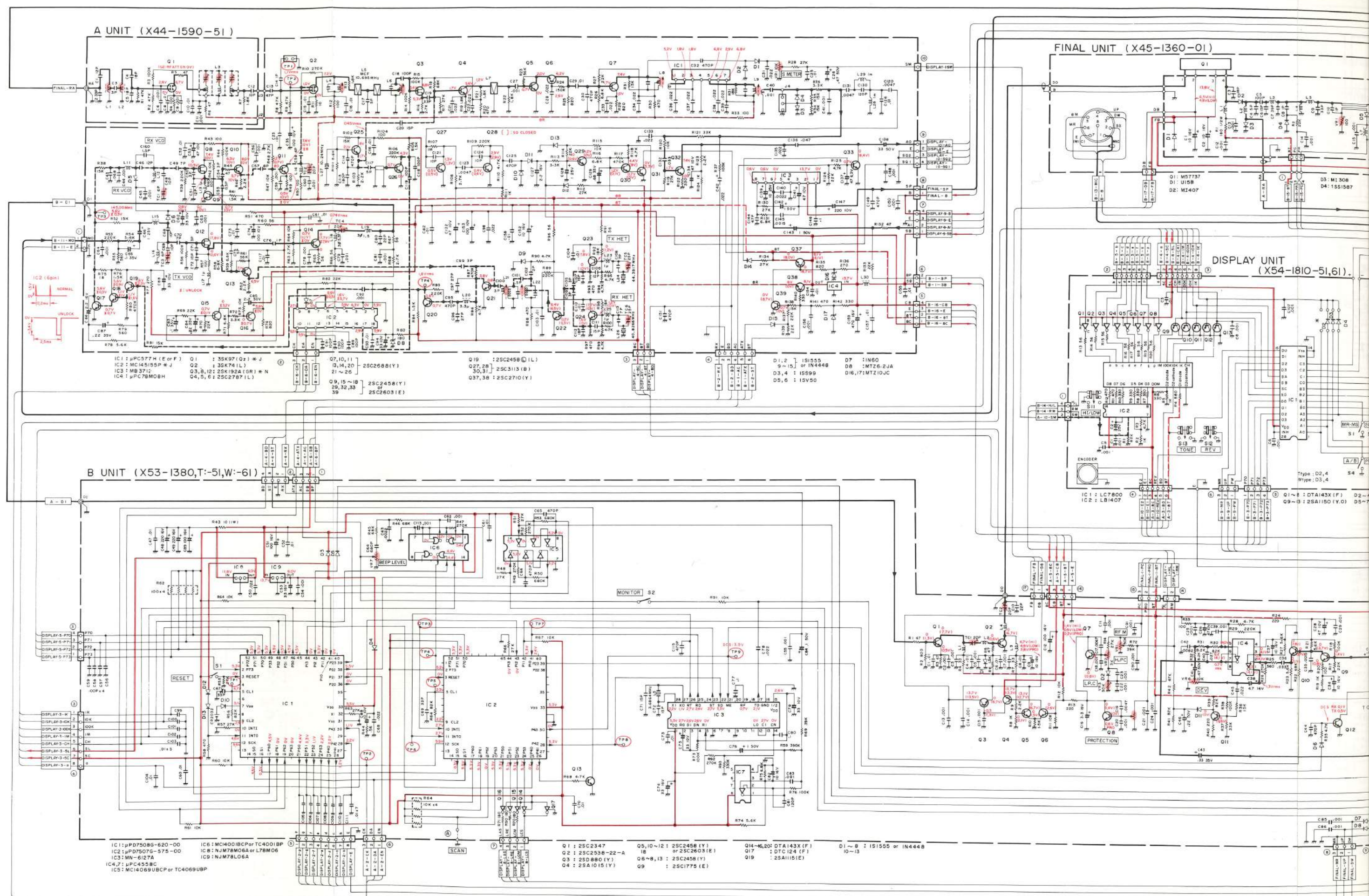


— Signal Line
 - - - Control Line
 — Common DC Line

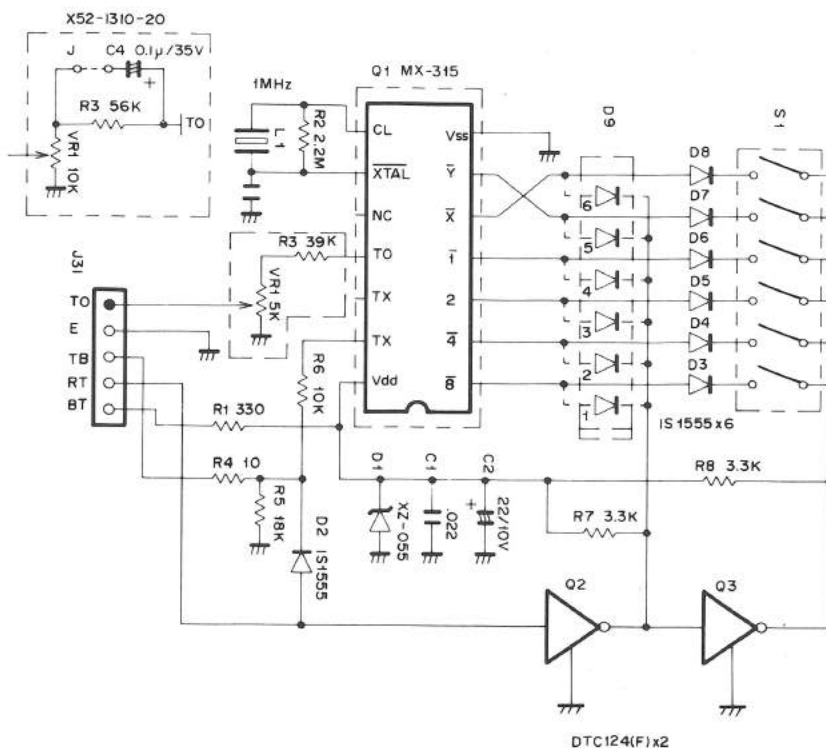
● The voltages measured when receiving
 145 MHz
 () : in TX



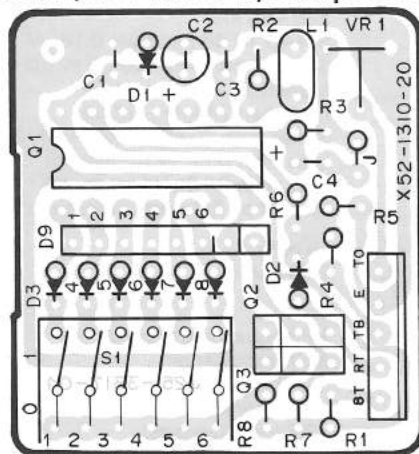




OPTION TU-3A



▼ TONE UNIT (X52-1310-20) Component side view



Q1 MX-315
Q2,3 DTC124(F)
D1: MTZ 5.6JB
D2 8: 1S1555 or 1N4448
L1 L77-0982-05
S1 S31-6401-05

Destination	Frame A
011	Q1: Not provided IC socket: provided
021 020	Q1: provided IC socket: Not provided

EIA Specification Group

1 denotes that the diode must be cut.

#	EIA		Program Lines						#	EIA		Program Lines					
	Specification	Group	Hz	1	2	3	4	5		6	1	2	3	4	5	6	
1	A	67.0	1	1	1	1	1	1	21	A	141.3	1	0	0	0	0	
2	B	71.9	1	1	1	1	0	1	22	B	146.2	0	1	1	1	0	
3	C	74.4	1	1	1	0	1	1	23	A	151.4	0	1	1	1	0	
4	A	77.0	1	1	1	1	0	0	24	B	156.7	0	1	1	0	0	
5	C	79.7	1	1	0	1	1	1	25	A	162.2	0	1	1	0	0	
6	B	82.5	1	1	1	0	0	1	26	B	167.9	0	1	0	1	0	
7	C	85.4	1	1	0	0	1	1	27	A	173.8	0	1	0	1	0	
8	A	88.5	1	1	1	0	0	0	28	B	179.9	0	1	0	0	0	
9	C	91.5	1	0	1	1	1	1	29	A	186.2	0	1	0	0	0	
10	B	94.8	1	1	0	1	0	1	30	B	192.8	0	0	1	1	0	
11	A	100.0	1	1	0	1	0	0	31	A	203.5	0	0	1	1	0	
12	B	103.5	1	1	0	0	0	1	32	B	210.7	0	0	1	0	0	
13	A	107.2	1	1	0	0	0	0	33	A	218.1	0	0	1	0	0	
14	B	110.9	1	0	1	1	0	1	34	B	225.7	0	0	0	1	0	
15	A	114.8	1	0	1	1	0	0	35	A	233.6	0	0	0	1	0	
16	B	118.8	1	0	1	0	0	1	36	B	241.8	0	0	0	0	1	
17	A	123.0	1	0	1	0	0	0	37	A	250.3	0	0	0	0	0	
18	B	127.3	1	0	0	1	0	1									
19	A	131.8	1	0	0	1	0	0									
20	B	136.5	1	0	0	0	0	1									

Tone Frequency Table

SPECIFICATIONS

[General]	
Frequency range	144.000 to 147.995 MHz (TM-211A) 144.000 to 145.995 MHz (TM-211E)
Mode	FM F3, F2 (Control signal for DCS system)
Antenna impedance	50 ohms
Power requirement	13.8V DC $\pm$ 15%
Grounding	Negative
Operating temperature	-20°C to +60°C (-4°F to +140°F)
External speaker impedance	8 ohms
Current drain	0.5 A in receive mode with no input signal Max. 5.6 A in HI transmit mode 2.5 A in LOW transmit mode (Approx.)
Dimensions	140 mm wide 40 mm high 197 mm deep (projections not included)
Weight	1.25 kg (2.75 lbs)
[Transmitter]	
RF output power (at 13.8V DC, 50 Ω load)	HI 25 Watts min. Low 5 Watts approx. (adjustable up to about 15 W) TX duty cycle: 1 minute ON 3 minutes OFF RX duty cycle: Continuous (100%)
Modulation	Reactance
Frequency tolerance (-10°C ~ +60°C)	Less than $\pm 15 \times 10^{-6}$
Spurious radiation	HI Less than -70 dB LOW Less than -60 dB
Maximum frequency deviation (FM)	± 5 kHz
Audio distortion (at 60% modulation)	3% max. (300 Hz ~ 3000 Hz)
[Receiver]	
Circuitry	Double superheterodyne
Intermediate frequency	1st 10.695 MHz 2nd 455 kHz
Receiver sensitivity	SINAD 12 dB less than 0.18 μ V S + N/N more than 50 dB at 1.0 mV input
Receiver selectivity	More than 12 kHz (-6 dB) Less than 24 kHz (-60 dB)
Spurious response	Better than 70 dB (except f_d -IF/2)
Squelch sensitivity	Less than 0.15 μ V (threshold)
Auto scan stop level	Less than 0.18 μ V (threshold)
Audio output	More than 2.0 watts across 8 ohms load (5% dist.)
[Auto patch microphone (MC-48) supplied] - For U.S.A. version only	
Impedance	500 ohms
[DCS control]	
Code	NRZ equal-length code
Modulation	MSK modulation
Frequency deviation	± 2.5 kHz or more ± 5 kHz or less ± 3.5 kHz standard
Mark frequency and deviation	1200 Hz $\pm$ 200 PPM
Space frequency and deviation	1800 Hz $\pm$ 200 PPM
Code transmission speed and deviation	1200 bits/second $\pm$ 200 PPM

Note: Circuit and ratings are subject to change without notice due to developments in technology.

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