KENWOOD

SERVICE MANUAL

TR-3500 BT-1, MS-1, PB-25, SC-4, ST-2 SMC-25, TU-35A/TU-35B, TU-1

70 CM FM SYNTHESIZED HAND-HELD TRANSCEIVER

SPECIFICATIONS

[GENERAL]

Frequency Range	440.000 – 449.995 MHz (K, M1, M3) 430.000 – 439.995 MHz (M2, M4, T, W, X)
Frequency Step	5 kHz
Memory Channels	10 CH
Mode	FM (F3)
Operating voltage	8.4 V DC ± 25%
Power Requirement	8.4 V, 400 mAH (Ni-Cd battery pack) 9V AA manganese or alkaline (not Ni-Cd) 6 pcs. (battery case optional)
Back-up Power Requirement	CR2032 Lithium battery (supplied)
Current Drain	Approx 35 mA in receive mode with no input signal Approx 700 mA in HI transmit mode (at 8.4 V) Approx. 350 mA in Low transmit mode (at 8.4 V) Approx 1 μA for memory back-up
Grounding	Negative
Operating Temperature	–20°C to +50°C
Antenna Impedance	50 Ω
Semiconductors	Microcomputer 1 ICs 6 Transistors 49 (K, M, X), 52(T), 51(W) Diodes 45 (K, M, X), 43 (T), 41(W) LCD 1 LED 1
Dimensions	With Ni-Cd battery: 66 (2.6) W × 168 (6.7)H × 40 (1.6) D mm (inch) With manganese battery: 66 (2.6)W × 176 (7.0)H × 40 (1.6) D mm(inch)
Weight	With Ni-Cd battery: 540 g (1.2 lbs.) With manganese battery: 530 g (1.2 lbs.)

[TRANSMITTER]

RF Output Power	HI = 1.5 W LOW = 0.3 W approx.
Modulation	Variable reactance direct shift
Frequency Tolerance	Less than $\pm 20 \times 10^{-6}$ (– 10°C ~ +50°C)
Maximum Frequency Deviation	± 5 kHz
Spurious Radiation	Less than –60 dB

[RECEIVER]

Circuitry	Double conversion superheterodyne
Intermediate Frequency	1st IF = 21.6 MHz 2nd IF = 455 kHz
Sensitivity	Better than 1 μV for S/N 30 dB Less than 0.25 μV for 12 dB SINAD
Pass-Band Width	12 kHz (More than –6 dB)
Selectivity	24 kHz (Better than –45 dB)
Spurious Response	Better than 50dB
Squelch Sensitivity	Less than 0.25 μV (threshold)
Audio Output Power	More than 400mW (at 10% distortion and 8 Ω load)

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

SC-4: Except USA market

TU-1: Available only for USA

CONTENTS

CIRCUIT DESCRIPTION

RECEIVER SECTION

★ : K, M1, M3 ★ : M2, M4, T, W, X

The receiver is DUAL Conversion, Superheterodyne with a 1st IF frequency of 21.6 MHz and 2nd IF frequency of 455 kHz.
The received signal is amplified by 2-stage RF amplifier Q1 and Q2 (2SC2026s), then mixed with the local oscillator signal (408.4 –418.4 MHz for types M2, M4, T, W and X [★] and 418.4 – 428.4 MHz for types K, M1 and M3 [*]) by Q3. The 1st IF signal is filtered by a two element MCF (Monolithic crystal filter) and is then amplified by Q4 (2SC2668(Y)). The Signal is then applied to Q14 (MC3359P), which includes the second local oscillator, mixer, limiter, discriminator and squelch. The demodulated audio signal is amplified by Q26 (TA7313AP) to drive the speaker.

Item	Rating
Nominal center frequency (f_o)	21,600 kHz
Pass bandwidth	$f_o \pm 7.5$ kHz or more at 3 dB
Attenuation bandwidth	$f_o \pm 25$ kHz or more at 40 dB $f_o \pm 45$ kHz or more at 60 dB
Guaranteed attenuation	70 dB or more within f_o f ± 1 MHz, Spurious: 35 dB or more at $f_o \sim f_o$ +500 kHz, 80 dB or more at $f_o \pm (910 \pm 20$ kHz)
Ripple	1.0 dB or less
Insertion loss	2.0 dB or less
Terminal impedance	1 kΩ/1 pF

Table 1. MCF L71-0240-05 (TX, RX UNIT L7)

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

Table 2. Ceramic filter L72-0335-05 (TX, RX UNIT L27)

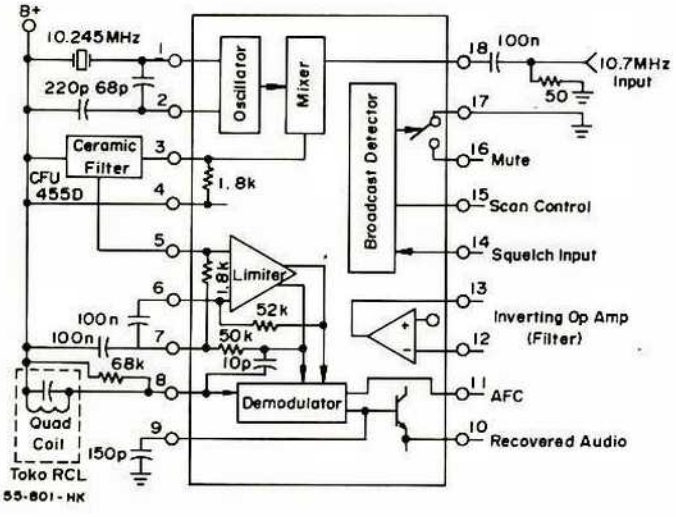


Fig. 1 MC3359P BLOCK DIAGRAM (TX, RX UNIT Q14)

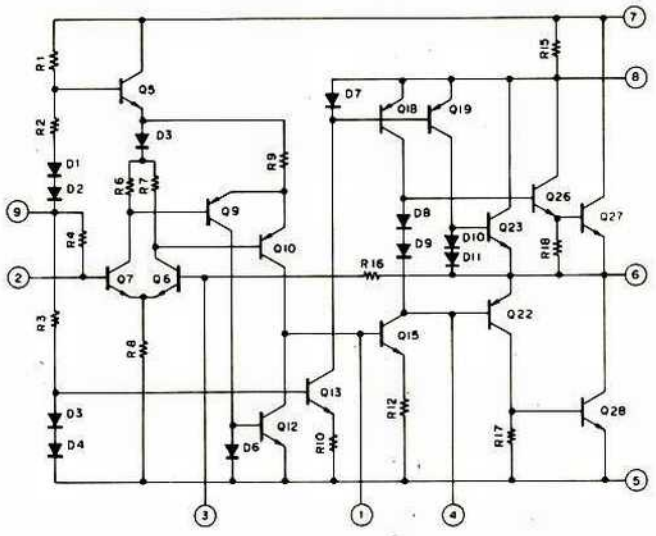


Fig. 2 TA7313AP (TX, RX UNIT Q26)

Squelch Circuit

The squelch is closed by turning the squelch control to the right. When closed, the level at Q14 (MC3359P) Pin 16 goes "L", and Q23 and Q24 are OFF. This causes Vcc applied to Q26 (TA7313AP) to switch OFF and Q26 stops operating. When a signal is received, the level at Q14 pin 16 goes "H", causing Q23 and Q24 to turn ON. Therefore, Vcc is applied to Q26 to operate the amplifier. During transmission, Q22 is ON. Therefore, Q23 and Q24 are OFF and Q26 is off.

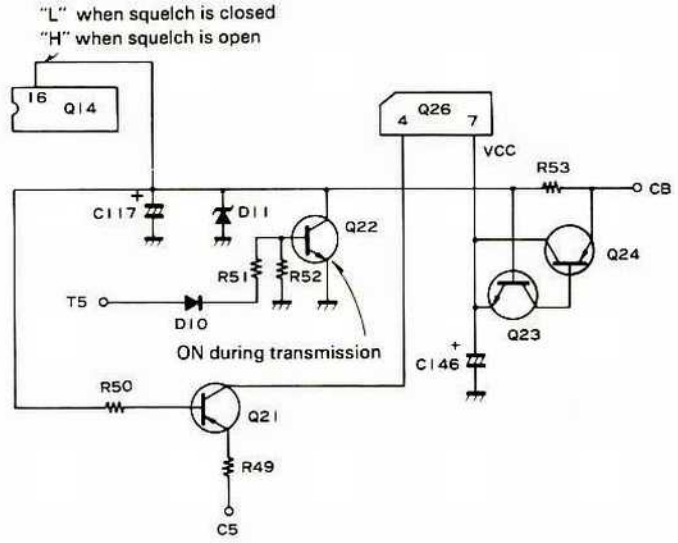


Fig. 3 Squelch circuit

Key-input tone oscillator circuit

A pulse of approximately 1 kHz is output by the microcomputer during keypad input, applied to Q25 through terminal BZO. The speaker is driven by Q25 when the squelch is closed or when the AF volume is set to minimum. When the squelch is open or the AF volume is set to other than minimum, the signal is applied to the AF volume control through C121 and the speaker is driven with a signal whose level corresponds to the setting of the AF volume control.

CIRCUIT DESCRIPTION

TRANSMITTER SECTION

The signal from the microphone is amplified by the PLL unit MIC amplifier Q12, then is applied to varactor diode D3: 1SV50 for direct modulation of the VCO (voltage controlled oscillator). The VCO output is amplified by Q9, and Q10, then by Q13, Q8, and Q7 in the TX, RX unit, after which the signal is applied to Q6: 2SC2283M for power amplification.

	VCBO	VCEO	VEBO	IC	Rth(J-C)	PT	Tj	Tstg
Test Conditions						Tc = 25°C		
Maximum Rating	38V	18V	3V	0.75A	15°C/W	10W	+175°C	−65 ~ +150°C

Table 3. 2SC2283M (TX, RX UNIT Q6)

PLL SECTION

A grounded-base Colpitts oscillator Q7 (2SC2212) is employed in the VCO. During reception, D4 turns ON to connect C32 into the oscillator circuit, causing the oscillation frequency of the VCO to drop.

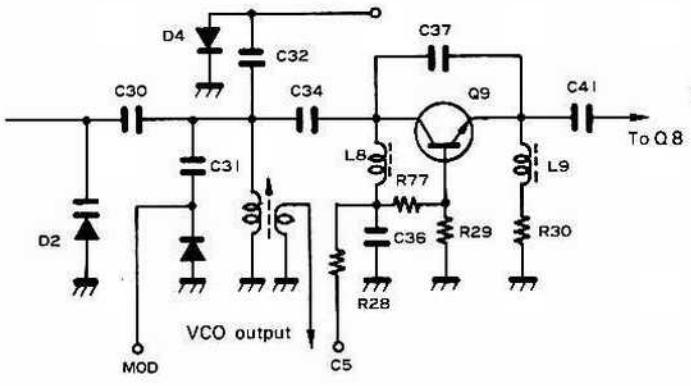


Fig.4 VCO circuit

The heterodyne oscillator consists of X1: 49.675 MHz (M2, M4, T, W, X [★]), 50.925 MHz (K, M1, M3 [∗]) and Q1. This operates at the crystal 4th harmonic to produce an output frequency of 198.7 MHz [★] or 203.7 MHz [∗].

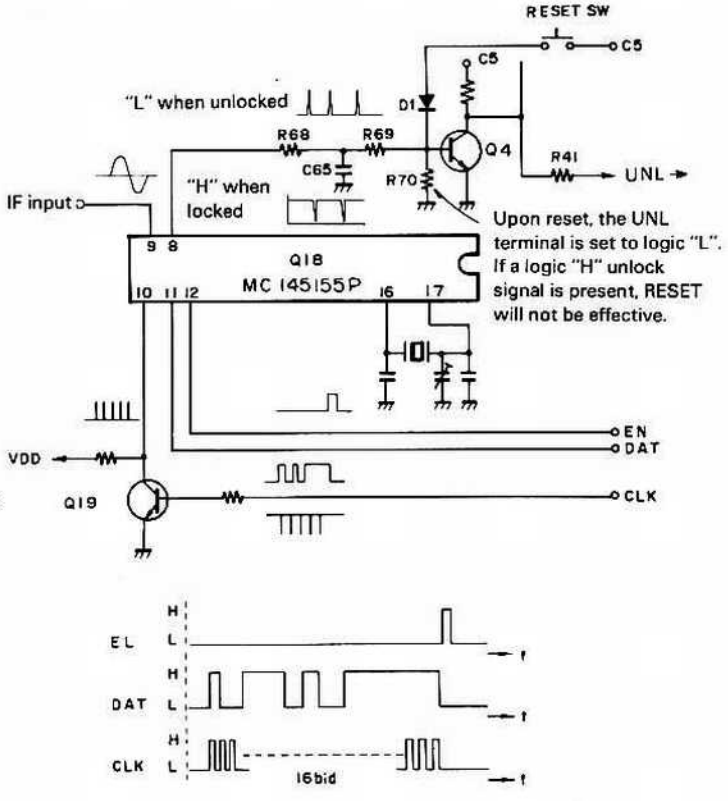
The IF signal produced after mixing in Q2 is 5.5 – 10.5 MHz during reception and 16.3 – 21.3 MHz during transmission.

L6 and 16 operate as a peaking circuit in the Q3 collector circuit to extend frequency characteristics.

The signal, applied to the emitter circuit of Q3 through R11 and C14 is switched on to raise the gain of Q3 during transmission and off to lower it during reception.

Q18: MC145155 pin 8 is normally "H" during phaselock, but is "L" if the PLL is unlocked, causing transistor Q17, and Q9 (emitter circuit) to stop transmission.

MC145155P is a PLL IC which includes a reference oscillator, frequency divider and phase comparator, as well as a latch circuit and program counter. In this unit, it operates as shown is Figure 6.



Relationship between wave forms.....one cycle is output after key input ends (about 5-10 ms).

Fig. 5 MC145155P operation

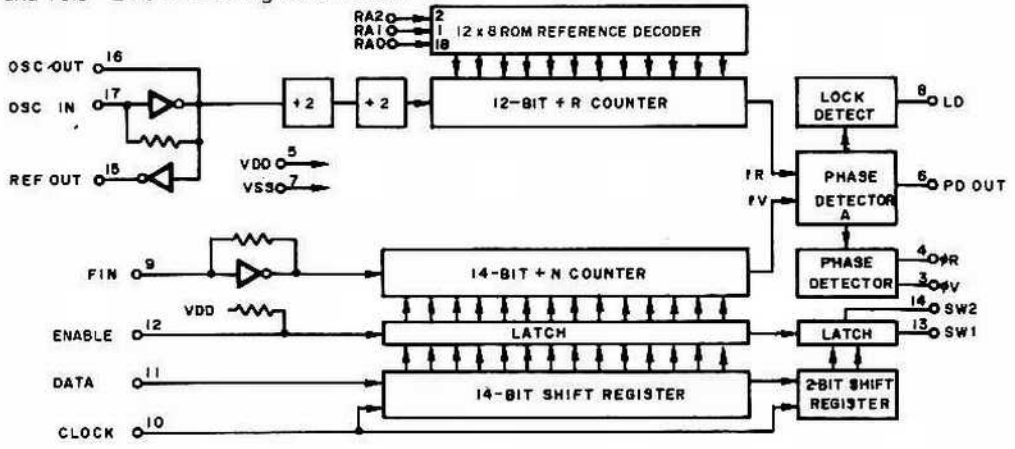


Fig. 6 MC145155P (PLL UNIT Q18)

CIRCUIT DESCRIPTION

5 kHz local oscillator frequency shift.

The signal applied to the 5k terminal is output from the microprocessor. The level of this signal is "L" and Q21 is OFF when the least significant display digit is 5 kHz. Therefore trimmer capacitor TC6 at the emitter of Q1 is off and the oscillation frequency is 203.7025 MHz [*], 198. 7025 MHz [★]. When the 5k terminal goes "H". Q21 turns ON and TC6 capacitance appears at Q1 emitter to shift the oscillator's frequency down to 203.7000 MHz [*], 198.7000 MHz [★].

5k terminal

5k terminal	K, M1, M3	M2, M4, T, W, X
L	203.7025 MHz	198.7025 MHz
H	203.7000 MHz	198.7000 MHz

Table 4

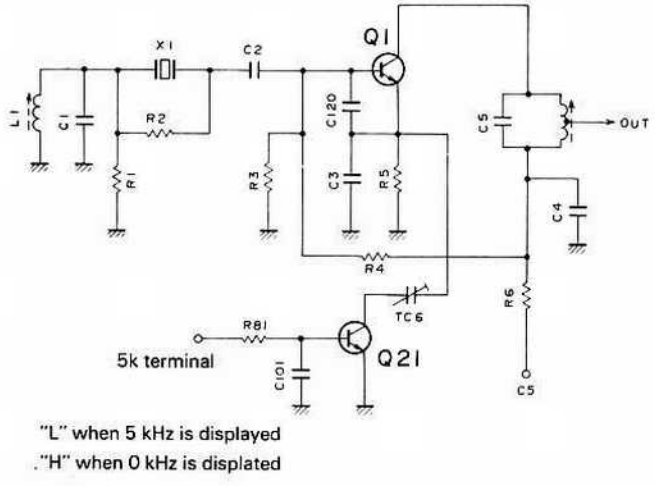


Fig. 7 5 kHz frequency shift circuit

TRANSMITTER B+ (T5) AND RECEIVER B+ (R6) GENERATION CIRCUIT

During reception, regulated C5 voltage (constant 5V) is applied to the base of Q16 through Q17. Therefore, B+ (R6) is supplied to the receiver through Q15. Simultaneously, Q29 and Q30 are both OFF so that T6 (B+) is not supplied to the transmitter.

When the PTT switch is depressed to transmit, Q11, in the PLL unit is turned ON and Q17 (TX-RX unit) is turned OFF. This causes Q16 and Q17 to go OFF and R6 voltage goes "L". On the other hand, Q29 and Q30 are turned ON, supplying T5 voltage to the transmitter.

When TX STOP is ON, the TXS terminal level goes "H" and Q29 and Q28 go ON. This causes Q17 to remain ON and Q29 to remain OFF even if the PTT switch is depressed. Therefore, R6 is supplied to the receiver but T5 is not supplied to the transmitter.

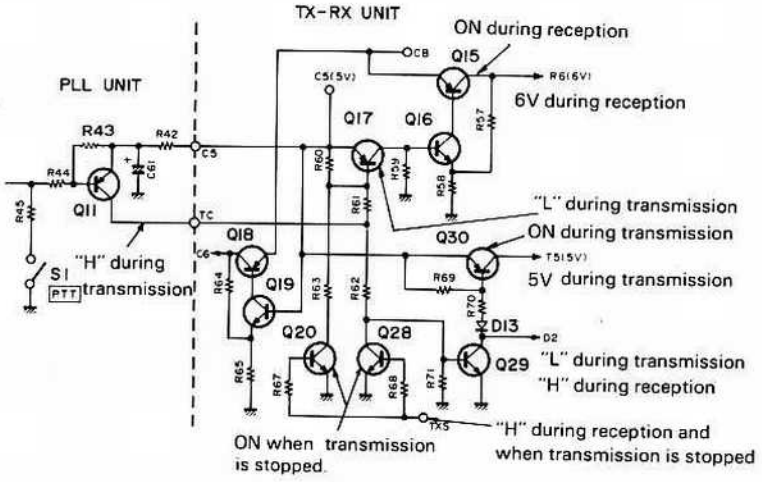


Fig. 8 Transmitter B + (T5) and Receiver B + (R6) generation circuit (TX, RX UNIT)

ON AIR AND BATTERY WARNING INDICATOR CIRCUIT

Since Q10 goes ON if the battery voltage above 7V during reception, pins 12and 13 of IC-d become "L" and pin 11 becomes "H" causing Q9 to turn OFF and LED: D4 to turn off.

During transmission, Q10 goes OFF if the battery voltage above 6V so that pins 12 and 13 of IC-d become "L", Q9 turns ON and the LED lights.

If the battery voltage drops during reception, pin 1 of IC-a becomes "L" so that the oscillator circuit IC-a and -b operate and a square wave is output from IC-b pin 4. After this signal passes through IC-c, it is applied to pin 12 of IC-d, which cycles Q9 ON and OFF, thus flashing the LED (D4). During transmission, pin 13 of IC-d remains "H", but the voltage applied to pin 12 of IC-d drops along with the battery voltage, so that the square wave from pin 13 of IC-c causes pin 12 of IC-d to alternate between "L"and "H", causing LED (D5) to flash.

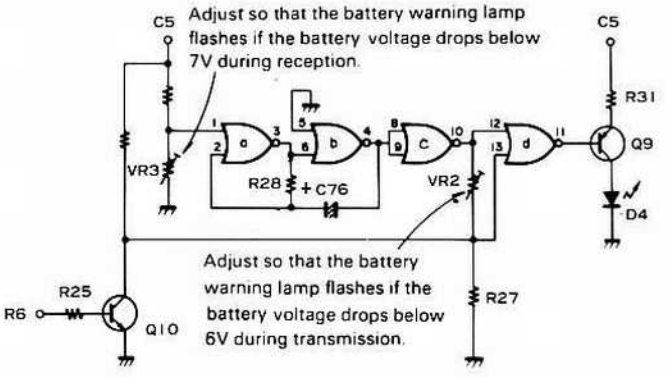


Fig. 9 ON AIR and battery warning indicator circuit

CIRCUIT DESCRIPTION

Table 5 FUNCTION OF μPD7502G-73-12

Terminal No.	Description	Input signal	Output signal	Function	Mate terminal
1	NC				
2	P32		○	Pulse output at reception	RP
3	P31		○	Pulse output at reception	NC1
4	P30		○	Pulse output at reception	TYP
5	SI			GND	
6	SO		○	PLL dividing data output	DAT
7	SCK		○	PLL clock output	CLK
8	P63	○		Key input	C4
9	P62	○		Key input	C3
10	P61	○		Key input	C2
11	P60	○		Key input	C1
12	P53		○	Key board output, scan pulse output	R4
13	P52		○	Key board output, scan pulse output	R3
14	P51		○	Key board output, scan pulse output	R2
15	P50		○	Key board output, scan pulse output	R1
16	P43		○	"L" at 5 kHz step	5K
17	P42		○	Pulse output for peep sound	BZO
18	P41		○	"H" at TX STOP	TXS
19	P40			LCD power supply	
20	X2			Vacant terminal	
21	X1			GND	
22	VSS			GND	
23	VLC3			LCD power supply	
24	VLC2			LCD power supply	
25	VLC1			LCD power supply	
26	VDD			5 V Power supply	
27	COM3			Vacant terminal	
28	COM2		○	LCD common signal	
29	COM1		○	LCD common signal	
30	COM0		○	LCD common signal	
31	S23			Vacant terminal	
32	S22			Vacant terminal	
33	S21			Vacant terminal	
34	S20			Vacant terminal	
35	S19		○	LCD segment signal	
36	S18			Vacant terminal	
37	S17		○	LCD segment signal	
38	S16		○	LCD segment signal	
39	S15		○	LCD segment signal	
40	S14		○	LCD segment signal	
41	S13		○	LCD segment signal	
42	S12		○	LCD segment signal	
43	S11			Vacant terminal	
44	S10		○	LCD segment signal	
45	S9			Vacant terminal	
46	S8		○	LCD segment signal	
47	S7		○	LCD segment signal	
48	S6		○	LCD segment signal	
49	S5		○	LCD segment signal	
50	S4		○	LCD segment signal	
51	S3		○	LCD segment signal	
52	S2			Vacant terminal	
53	S1		○	LCD segment signal	
54	S0			Vacant terminal	
55	INT1			GND	
56	RESET	○		"H" at reset	RES
57	CL1	○		Clock oscillation	
58	VDD			Vacant terminal	
59	CL2			Clock oscillation	
60	P13	○		"H" at non-signal reception	BSY
61	P12	○		"H" at transmission	TX
62	P11	○		"H" at unlock	UNL
63	P10	○		"L" at back up	BU
64	P33		○	Pulse output when the dividing data changes	EN

LITHIUM BATTERY SPECIFICATIONS

Model and Efficiency

Model CR2032

Nominal Voltage 3V

Nominal Capacity..... 170m Ah

Discharge Stop Voltage..... 2.0V

Dimensions { Diameter ..... 20.0 mm
High..... 3.2 mm

Weight 3g

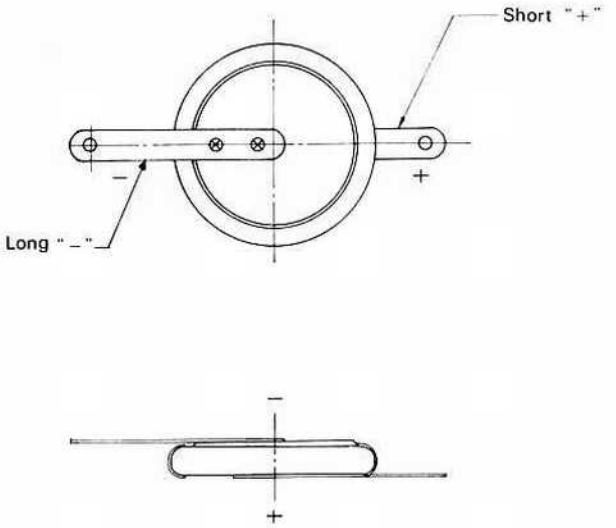


Fig. 10 An outward form of Lithium Battery

CIRCUIT DESCRIPTION

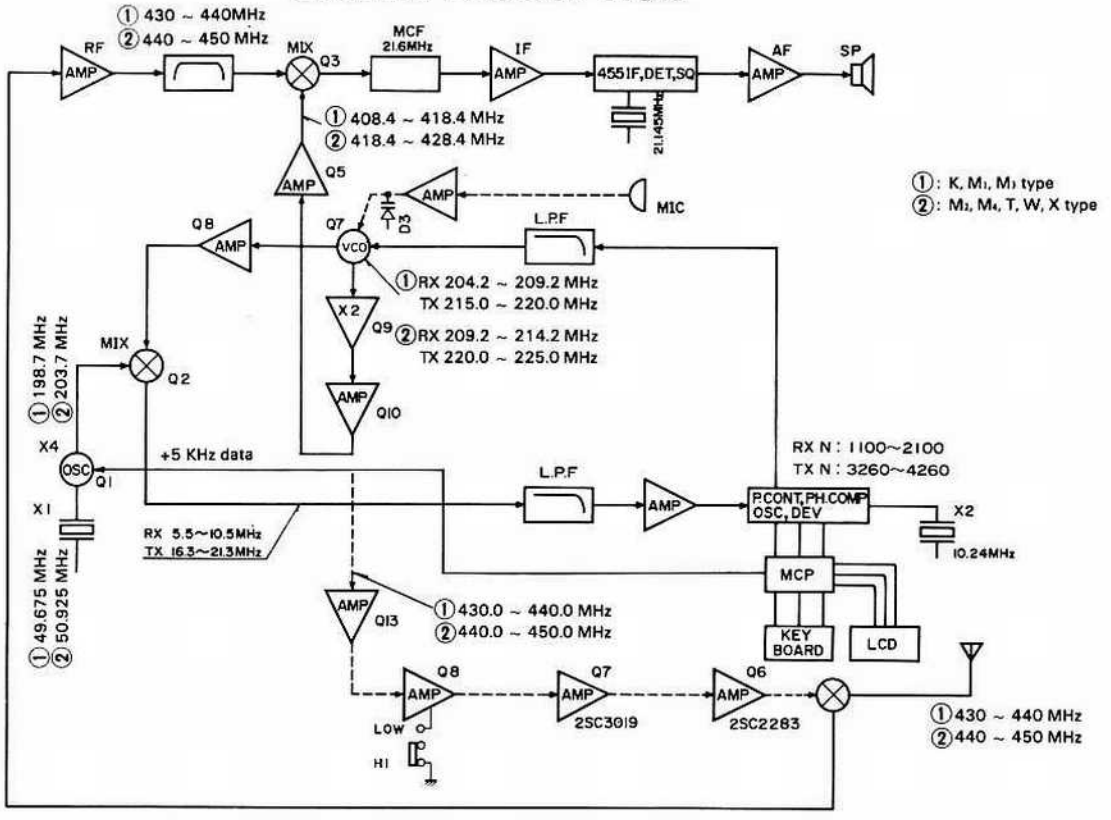


Fig. 11 Frequency configuration

Part No.	W09-0315-05	W09-0317-05
Rating	Primary side: AC 120V 60 Hz Secondary side: DC 10.15V DC 42.5 mA	Primary side: AC 220V 50/60 Hz Secondary side: DC 10.15V DC 42.5 mA
Output voltage (resistance loaded)	At 0 mA: DC 14.9V ±5% At 42.5 mA: DC 6.2V ±5%	At 0 mA: DC12.5V ±5% At 42.5 mA: DC 5.5V ±5%
Weight	About 130g	About 240g
Consumed power	4W or less with 60 Hz at rated input and battery loaded.	4W or less with 50 Hz at rated input and battery loaded.
Destination	U.S.A./GENE, M1, 2	Europe/GENE, M3, 4

Part No.	W09-0318-05	W09-0319-05
Rating	Primary side: AC 240V 50 Hz Secondary side: DC 10:15V DC 42.5 mA	Primary side: AC 240V 50/60 Hz Secondary side: DC 10.15V DC 42.5 mA
Output voltage (resistance loaded)	At 0 mA: DC 12.6V ±5% At 42.5 mA: DC 5.6V ±5%	At 0 mA: DC12.6V ±5% At 42.5 mA: DC 5.6V ±5%
Weight	About 220g	About 240g
Consumed power	4W or less with 50 Hz at rated input and battery loaded.	4W or less with 50 Hz at rated input and battery loaded.
Destination	England	Australia & New Zealand

Table 6. Charger specifications

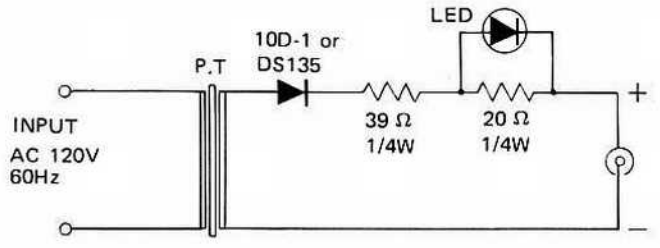


Fig. 12 W09-0315-05 Schematic diagram

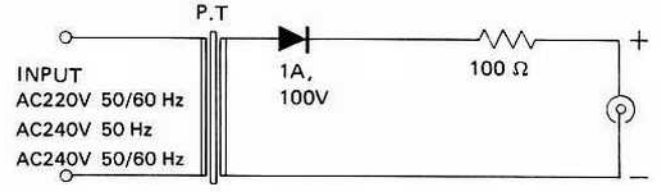


Fig. 13 W09-0317-05, W09-0318-05 W09-0319-05 Schematic diagram

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

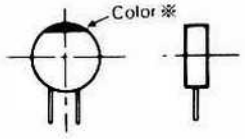
● **Temperature coefficient**

1st Word	C	L	P	R	S	T	U
Color ※	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm ℃	0	−80	−150	−220	−330	−470	−750

2nd Word	G	H	J	K	L
ppm ℃	±30	±60	±120	±250	±500

Example CC45TH = −470 ± 60ppm ℃

CC45



● **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**

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

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

● **Tolerance**

Cord	C	D	G	J	K	M	X	Z	P	No cord
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 −20	+80 −20	+100 −0	More than 10μF −10~+50 Less than 4.7μF −10~+75

Less than 10 pF

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

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

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

Symbol	Destination
K	U.S.A
W	Europa
T	Britain
X	Australia & New Zealand
M	General market

SEMICONDUCTOR

Item	Name	Remarks
Diode	1N60	
	1S1555	
	1S2208	
	1S2588	
	1SV50	
	MI301	
Zener Diode	05Z5.1-Y	
	WZ-081	
Thermistor	32D27	
LED	SR-538D	

Item	Name	Remarks
TR	2SA1115 (E)	
	2SB698	
	2SC2026	
	2SC2212	
	2SC2283M	N
	2SC2347	
	2SC2407	
	2SC2549	
	2SC2603 (E)	
	2SC2668 (Y)	
	2SC2669 (Y)	
	2SC3019	

Item	Name	Remarks
IC	AFG05F1750A2 T,W	
	AN6551	N
	MC145155P	
	MC3359P	
	MK5087N K,M1,2,3,4,X	
	TA7313AP	
	TC4001BP	
LCD	F2179-30	
Miro-Processor	μPD7502G-73-12	N

PARTS LIST

Part No.	Re-marks	Description
GENERAL		
A02-0616-12	N	Case (upper)
A02-0618-03		Ni-cd battery case (upper)
A02-0619-03		Ni-cd battery case (lower)
A02-0634-12	N	Case (lower)
A21-0749-03	N	Ornamental panel
B03-0521-14		Slide switch mask (A)
B03-0522-04		SP jack mask
B03-0523-14		Slide switch mask (B)
B05-0724-04	N	SP grill cloth
B06-0502-14		MIC Grill
B10-0647-08		Front glass
B11-0411-05		LCD Reflector
B30-0823-08		Pilot lamp
B40-2619-04	N	Name plate T
B40-2626-04	N	Name plate K, M1,M2,M3,M4,W,X
B42-0473-24		Serial name plate, (package) × 2
B42-1711-08		Name plate, LCD
B42-1715-04		Name plate (A), Ni-cd batt. Assy
B42-1716-04		Name plate (B), Ni-cd batt. Assy
B42-1719-04		Tape (A), PLL unit-key board
B42-1745-04	N	Serial name plate
B42-1746-08	N	Name plate, key board T, W
B42-1764-04	N	Name plate, FCC K,M1,M2,M3,M4,W,X
B42-1765-08	N	Name plate, Key board K,M1,M2,M3,M4,X
B43-0678-04	N	Badge T
B43-0679-04	N	Badge, (B)
B43-0682-04	N	Badge K,M1,M2,M3,M4,W,X
B46-0058-10		Warranty card K
B50-3999-00	N	Instruction manual K
B50-4000-00	N	Instruction manual W
B50-4001-00	N	Instruction manual T
B50-4002-00	N	Instruction manual M1,M2,M3,M4,X
CC45SL1H560J		C 56PF C200
E12-0001-15		Phone plug
E12-0401-15		Stand-by plug
E23-0432-04		Lug terminal,Ni-cd Batt. Assy × 2
E29-0426-04		LCD Connecter
E29-0428-04		Terminal, Ni-cd Batt, Assy × 4
E31-2111-05		Connecter with lead, SP, MIC
F07-0836-04		SP cover, MIC
F07-0837-04		Terminal cover (A), Ni-cd Batt. Assy
F11-0822-04	*N	Shield cover (B), PLL
F20-0520-04	*	Insulating plate, Lithium Batt. × 3
F29-0419-14	*	Insulating sheet (B), Key board
G10-0624-04	N	Anti-vibration sheet (PTT)
G13-0625-04		Neo-Sponge (A), SP
G13-0626-04		Neo-Sponge (B), MIC
G13-0670-04	N	Neo-Sponge, lower case
H01-4441-04	N	Packing carton K,M1,M2,M3,M4,W,X

Parts No.	Re-marks	Description
H01-4442-04	N	Packing carton T
H10-2552-02		Packing fixture (A), upper
H10-2553-02		Packing fixture (B), lower
H25-0029-04		Protective bag (Accessory)
H25-0077-03		Protective bag (Ni-cd batt) × 2
H25-0103-04		Protective bag (TR-3500)
H25-0120-04		Protective bag (Charger)
J21-2774-04	*N	Speaker metal fittings
J25-3053-04		Flexible PC board (A), key board-PLL
J25-3054-04		Flexible PC board (B), TX·RX unit-PLL
J39-0409-14	*	Spacer, MIC
J39-0412-14	*	Spacer (A) K,M1,M2,M3,M4,X
J39-0416-04	*N	Spacer (B) T,W
J69-0303-04		Hand strap Assy M1,M2,M3,M4,T,W,X
K23-0748-04		Knob × 2, VOL, SQL
K27-0427-04		Push knob (A) × 2, TONE
K27-0428-04		Push knob (B), HI/LOW
K29-0751-14		Lever, PTT
K29-0752-04		Slide knob
N08-0506-04		Ornamental screw M1,M2,M3,M4,T,W,X
N08-0506-04		Ornamental screw × 2 K
N09-0616-04		Flat head screw, Key board
N09-0636-05		Round screw × 2, Panel
N09-0637-05		Round flat screw × 4, Ni-cd batt.
N09-0638-05		Round screw × 2, Ni-cd batt.
N30-2012-45		Round screw × 3, Ni-cd Case
N32-2004-41		Flat head screw × 4, Frame
N32-2604-41		Flat head screw × 4, Case, Frame
N87-2005-41		Bind tapping screw, SP
S59-0413-05	N	Key board Assy K,M1,M2,M3,M4,X
S59-0414-05	N	Key board Assy T,W
T07-0223-05	N	speaker
T18-0054-05		Earphone (Accessory) M1,M2,M3,M4,X
T90-0330-05	N	Rubber flex antenna (Accessory)
T91-0312-15		Condenser microphone
W09-0315-05		Battery charger K,M1,M2
W09-0317-05		Battery charger M3,M4,W
W09-0318-05		Battery charger T
W09-0319-05		Battery charger X
W09-0320-05		Ni-cd Battery Assy
W09-0322-08		Ni-cd Battery
W09-0323-05	N	Lithium Battery (CR2032)
X44-1500-00	N	TX-RX unit M2,M4,T,X
X44-1500-11	N	TX-RX unit K,M1,M3
X44-1500-61	N	TX-RX unit W
X50-1890-11	N	PLL unit K,M1,M3
X50-1890-51	N	PLL unit T
X50-1890-61	N	PLL unit W
X50-1890-71	N	PLL unit M2,M4,X

PARTS LIST

Part No.	Re-marks	Description	Ref. No.	Q'ty
TX-RX UNIT (X44-1500-○○)		**-00 M2, 4, T, X -11 K, M1, 3, -61W**		
A13-0634-03	*N	TX Frame		1
C05-0030-15		Ceramic trimmer 20p	TC8	1
C05-0031-15		Ceramic trimmer 10p	TC9	1
C05-0062-05		Ceramic trimmer 6p	TC10	1
C05-0318-05	N	Ceramic trimmer 6p	TC1,2,4,5	4
		K,M1, M3,	11	1
C05-0319-05	N	Ceramic trimmer 10p	TC3,6,7,12	4
		M2,M4,T,W,X	11	1
CC45CH1H010C		C, 1p, ±0.25pF	C15,18	2
CC45CH1H030C		C, 3p, ±0.25pF	C46,47,57	3
CC45CH1H040C		C,4p, ±0.25pF	C1,45	2
CC45CH1H050C		C,5p, ±0.25pF	C31	1
CC45CH1H0R5C		C, 0.5p, ±0.25pF	C37	1
CC45CH1H060D		C, 6p, ±0.5pF	C40,48,97	3
CC45CH1H080D		C, 8p, ±0.5pF	C44	1
CC45CH1H090D		C, 9p, ±0.5pF	C20,49	2
CC45CH1H100D		C, 10p, ±0.5pF	C98	1
CC45CH1H120J		C, 12p	C71	1
CC45CH1H150J		C, 15p	C2,9,41,92	4
CC45CH1H180J		C, 18p	C56	1
CC45CH1H220J		C, 22p	C60	1
CC45CH1H270J		C, 27p	C51	1
CC45CH1H330J		C, 33p	C24, 109	2
CC45TH1H030C		C, 3p, ±0.25pF	C7, 16	2
CC45TH1H050C		C, 5p, ±0.25pF	C4	1
CC45TH1H060D		C, 6p, ±0.5pF	C13,36,67	3
CC45SL1H101J		C, 100p	C17,104,110	3
CC45SL1H470J		C, 47p	C52,64	2
CC45SL1H560J		C, 56p	C43,157	2
CK45B1H102K		C, 0.001	C3,5,8,10-14, 19,22,23, 25-28,32-34, 38,39,42,50, 54,55,58,59, 61-63,65,66, 68,69,70,73, 75,79-82, 85-91,93-96 99,100,105, 106,108,115, 118,120, 122-129,134 136,147,148, 152,153,155 156,159-162	78
CK45B1H471K		C, 470p	C72,74,121	3
CS15E1A150M		T, 15, 10V	C144	1
CS15E1ER68M		T, 0.68, 25V	C76	1
CS15E1VR47M		T, 0.47, 35V	C53	1
C90-0837-05		E, 0.1,50V	C132	1
C90-0838-05		E, 1,50V	C77,101, 116	3
C90-0839-05		E, 4, 7, 25V	C131,149	2
C90-0840-05		E, 10, 16V	C117, 135, 140	3
C90-0842-05		E, 100, 6.3V	C119	1
C90-0843-05		E, 47, 10V	C138	1
C90-0844-05		E, 3.3, 50V	C84, 102	2
C90-0845-05		E, 22, 10V	C133	1
C90-0847-05		E, 47, 10V	C78,83,142,	3

Part No.	Re-marks	Description	Ref. No.	Q'ty
C90-0848-05		E, 47, 16V	C154	1
C90-0853-05		E, 330, 10V	C146	1
C90-0854-05		E, 100, 25V	C145	1
C91-0426-05		Layer-built cap., 0.022	C107,150	2
C91-0430-05		Layer-built cap., 0.047	C103,114	2
C91-0460-05		Layer-built cap., 0.068	C141	1
C91-0462-05		Semi-conductor cap., 0.0047	C21,151	2
C91-0475-05		ML, 0.022	C29, 143	2
C91-0478-05		ML, 0.0047	C137	1
C91-0479-05		Layer-built cap., 150p	C113	1
C91-0487-05		Layer-built cap., 0.082	C139	1
C91-0488-05		Semi-conductor cap., 0.1	C111,112	2
C91-0498-05		C, 0.35p	C6	1
D32-0405-05		Stopper		1
E04-0251-05		BNC receptacle		1
E19-0451-05		Mini-connector, 4p		1
E23-0431-14		Spring terminal		2
E23-0432-04		Lug terminal		1
F10-1299-04	*N	TX shield plate		1
F20-0530-04	*N	TX insulating sheet		1
F29-0416-04		Insulating sheet, LED		1
G01-0814-04		Spring, stopper		1
J09-0403-14		Plate, terminal		1
J25-3068-04		Flexible PC board		3
J39-0410-04		Spacer, terminal		2
J39-0411-04		LED spacer		1
L33-0002-05		Choke coil	L15	1
L33-0632-05		Choke coil	L29	1
L34-1051-05	N	Coil	L2,3,26	3
		K,M1,M3	L4,5	2
L34-1052-05	N	Coil, 3ø2T	L10,11,12,14, 16,17,21,22, 25,30,31	11
L34-1053-05	N	Coil, 2ø4T	L13	1
L34-1054-05	N	Coil	L1	1
L34-1055-05	N	Coil	L8,9	2
		M2,M4,T,W,X	L4,5	2
L34-2032-05		Tuning coil, 455 kHz	L28	1
L34-2135-05	N	Tuning coil, 21.6 MHz	L6	1
L71-0240-05	N	Monolithicfilter, 21.6 MHz	L7	1
L72-0335-05	N	Ceramic filter, CFU455E	L27	1
L77-0971-05	N	Crystal, 21.145 MHz	X1	1
L92-0110-05		Ferrite bead core	L18,19,20,23	4
N30-2004-41		Round screw, Heat sink		2
N30-2005-41		Round screw,	for J09-0403-14	1
N30-2008-41		Round screw,	for J09-0403-14	1
N30-2604-41		Round screw,	for J09-0403-14	2
R05-3414-05	N	Pot, 10K W/switch AF	VR5	1
R05-3416-05	N	Pot, 10K (B) W/switch SQ	VR4	1
R12-0420-05		Trim. pot, 500 (B)	VR1	1

PARTS LIST

Part No.	Re-marks	Description	Ref. No.	Q'ty
R12-3430-05		Trim. pot 10K (B)	VR6	1
R12-4408-05		Trim. pot, 50K (B)	VR2,3	1
R92-0150-05		Jumper wire		13
S40-1403-15		Push switch W	S2	1
S40-1404-15		Push switch K,M1-4,T,X	S1,2	2
S40-1404-15		Push swithc W	S1	1
PLL UNIT (X50-1890-○○)		**-11 K, M1, 3, -51 T -61 W, -71 M2, 4, X**		
C05-0319-05		Ceramic trimmer, 10p	TC2,3,5	3
C05-0320-05	N	Ceramic trimmer, 10p	TC4	1
C05-0321-05	N	Ceramic trimmer, 20p	TC6	1
CC45CH1H030C		C, 3p, ±0.25pF	C6,54	2
CC45CH1H050C		C, 5p, ±0.25pF	C8,9,50,55	4
CC45CH1H0R5C		C, 0.5p, ±0.25pF	C31	1
CC45CH1H060D		C, 6p, ±0.5pF	C90	
CC45CH1H100D		C, 10p, ±0.5pF	C38,41	2
CC45CH1H120J		C, 12p,	C3	1
CC45CH1H150J		C, 15p,	C30	1
CC45CH1H220J		C, 22p,	C11,34	2
CC45CH1H330J		C, 33p,	C59	1
CC45TH1H060D		C, 6p, ±0.5pF	C5,7,37,44	4
CC45TH1H070D		C, 7p, ±0.5pF	C1,32	2
CC45TH1H080D		C, 8p, ±0.5pF	C43	1
CC45TH1H150J		C, 15p	C40	1
CC45SL1H101J		C, 100p	C2,63-65,119 128-130, 132	9
CC45SL1H330J		C, 33p	C36,39	2
CC45SL1H470J		C, 47p	C16,49,	2
		T,W	C111	1
CC45SL1H560J		C, 56p	C56	1
CK45B1H102K		C, 0.001	C4,10,12,18 19,24-27,29 33,35,42, 45-48,52,53 57,58,62,72 76,80-82,85 88,89,91-93 96, 133, 135	36
CK45B1H102K		C,0.001 K,M1-4,X	C104 - 107	4
CK45B1H471K		C, 470p	C13-15,69,70, 84,87,101	8
		T	C114, 117	2
		W	C117	1
CS15E1A100M		T, 10, 10V	C21,94	2
CS15E1C2R2M		T, 2.2,16V	C115	1
CS15E1E010M		T, 1, 25V	C22	1
C90-0837-05		E, 0.1, 50V	C67,102	2
C90-0838-05		E, 1, 50V	C60,71	2
		T,W	C112	1
C90-0839-05		E, 4.7, 25V	C51,83	2
C90-0840-05		E, 10, 16V	C61,66,75	3
		T,W	C109,110	2
C90-0847-05		E, 47, 10V	C28	1
		K,M1-4,X	C103	1
		T	C113	1
C91-0462-05		Semi-conductor cap., 0.0047	C17,20	2
C91-0500-05	N	Chip cap., 47p	C97,98	2
C91-1003-05	N	Chip cap., 0.5p	C120	1

Part No.	Re-marks	Description	Ref. No.	Q'ty
E11-0407-05		Earphone jack	J3	1
E11-0407-05		Earphone Jack	J3	1
E11-0408-05		Microphone jack	J2	1
E40-3007-05	*	Pin connector 2p	J1	1
F10-1300-04	*N	PLL shield plate		1
F11-0815-04	*N	VCO shield cover		1
F11-0816-04	*N	PLL shield cover		1
F20-0531-04	*N	PLL insulating sheet		1
J25-3068-04		Flexible PC board		1
J31-0524-04	N	Spacer Tone unit		2
L34-1051-05		Coil	L13,14	2
L34-1052-05		Coil, 3φ 2T	L12	1
L34-1053-05		Coil 2φ 4T	L10	1
L34-2034-05	N	VXO, coil M2,4 T,W,X	L1	1
L34-2136-05	N	Tuning coil	L3,11	2
L34-2137-05	N	VCO coil	L7	1
L34-2138-05	N	Tuning coil	L2	1
L34-2139-05		VXO Coil K,M1,3	L1	1
L40-1001-01		Ferri-inductor, 10μH	L8,9,16	3
L40-1021-03		Ferri-inductor, 1 mH	L15,17	2
L40-1092-01		Ferri-inductor, 1μH	L5,6	2
L40-3392-01		Ferri-inductor, 3.3μH	L4	1
L77-0972-05	N	Crystal, 49.675 MHz M2, 4, T, W, X	X1	1
L77-0977-05	N	Crystal, 10.240 MHz	X2	1
L77-0977-05		Crystal, 50.925 MHz K, M1, 3	X1	1
R12-2409-05		Trim Pot, 5K (B) K,M1 ~4, X	VR3	1
R12-4408-05		Trim pot, 50K (B)	VR1	1
R12-3430-05		Trim pot, 10K (B)	VR2	1
R12-3432-05		Trim pot, 20K (B) T, W	VR4	1
R92-0150-05		Jumper wire		4
S31-1405-05		Slide switch	S2	1
S40-1403-15		Push switch, CALL	S3	
S50-1405-05		Micro switch, PTT	S1	1
S59-1405-05		Tact switch, RESET	S4	1

DISASSEMBLY

*** Installing knobs**
Install the knob so that the cut surface is aligned as shown in the figure.

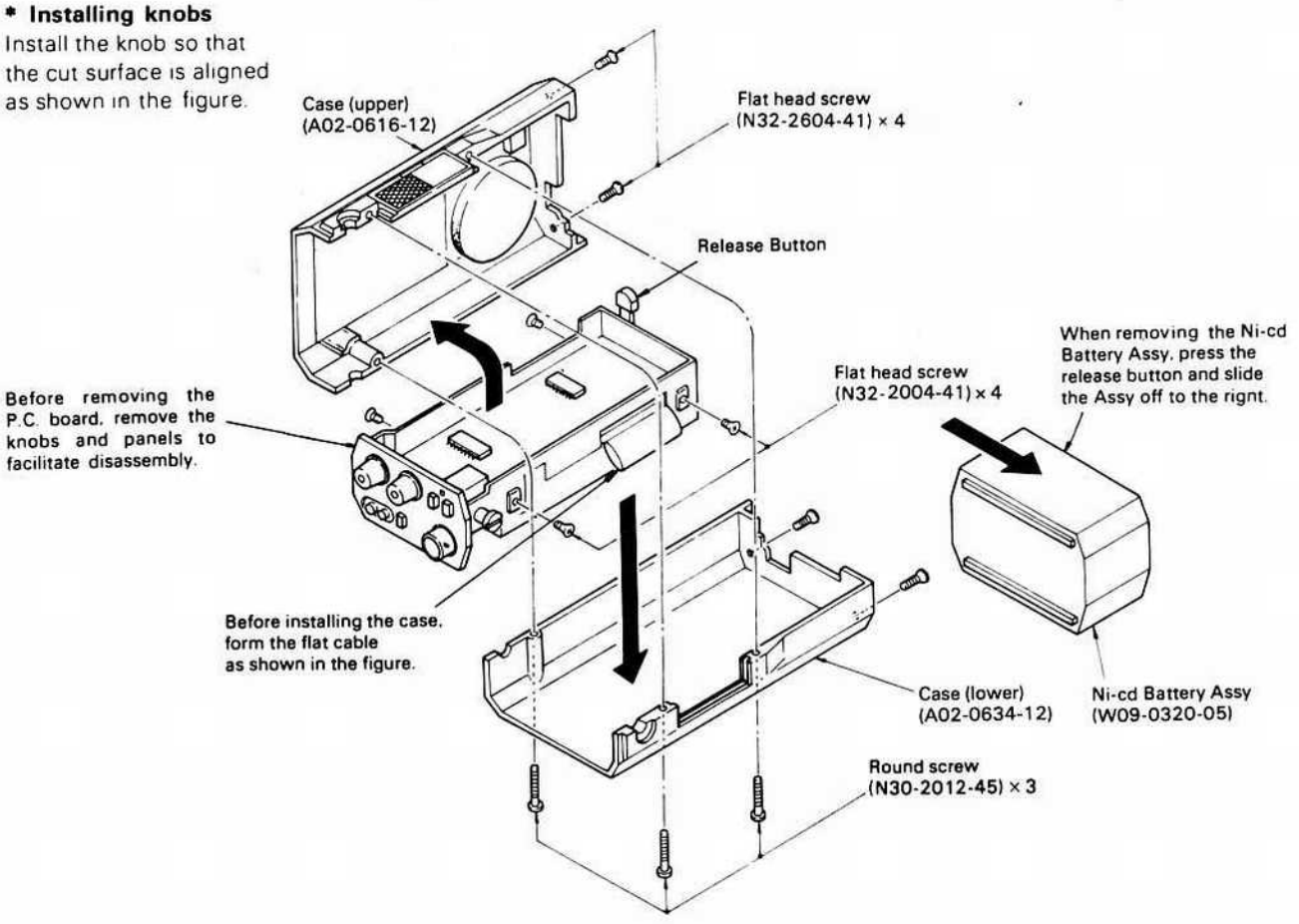


Fig. 14 Case Removal

DISASSEMBLY

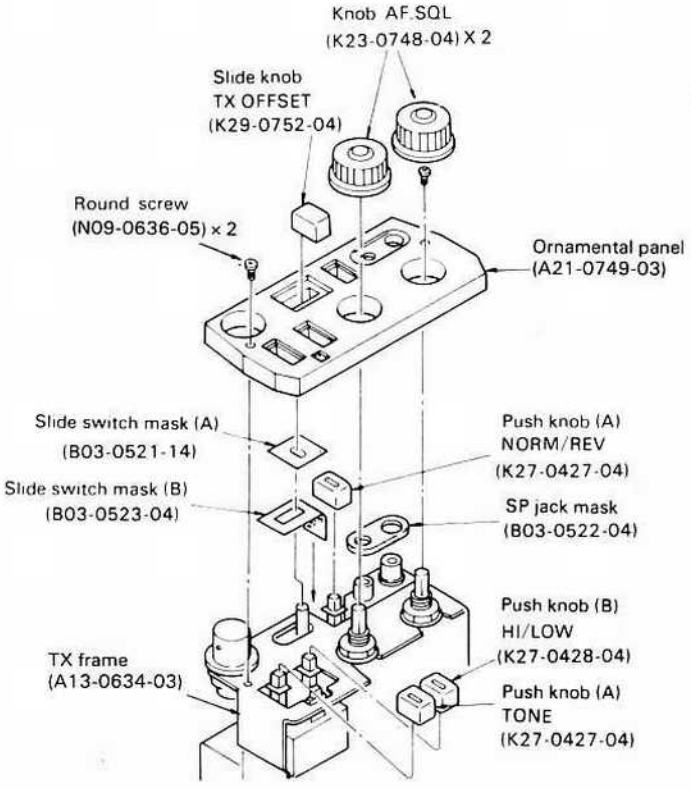


Fig. 15 Assembling the panel

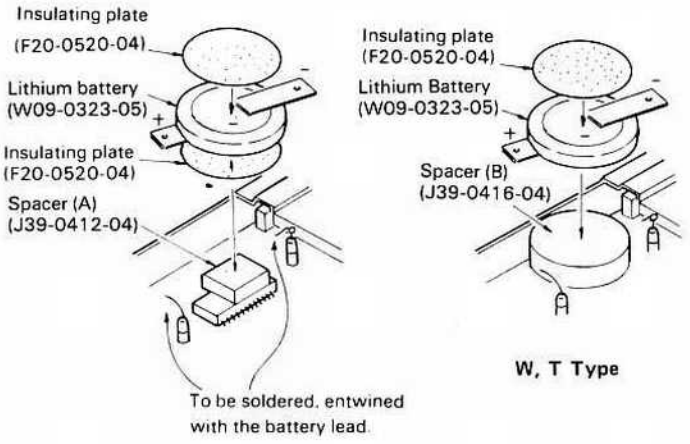


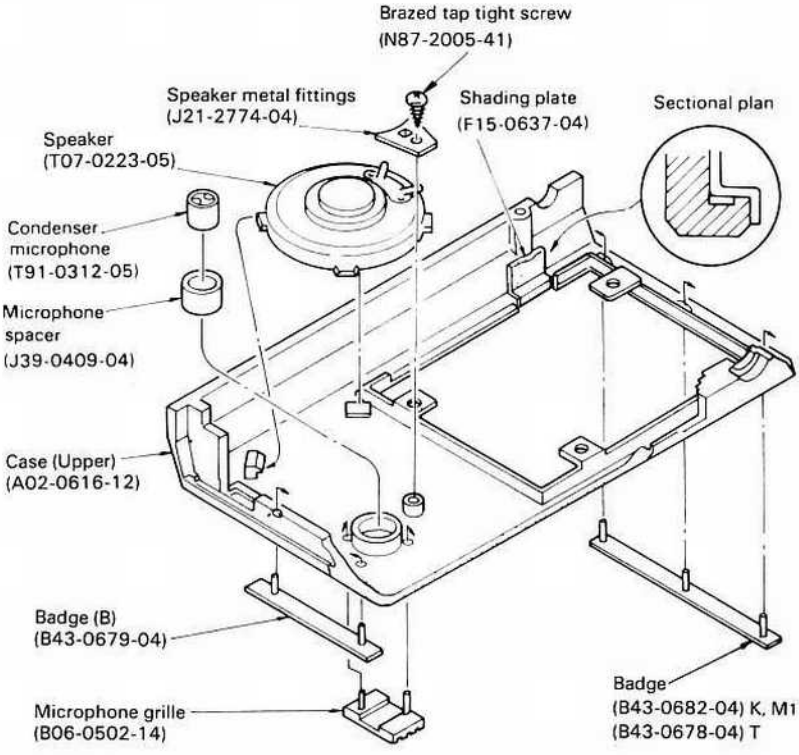
Fig. 17 Installing the Lithium Battery

HOW TO INSTALL LITHIUM BATTERY

When the lithium battery is removed for servicing, install the battery as follows.

1. Connect an external power supply (8.4V) to TR-3500 and turn the power ON.
2. Set the reste switch of the PLL unit (X50-1890-XX) to ON.
3. Solder the (+) side of lithium battery to teh terminal.
4. Solder the (–) side of lithium battery to the terminal.

When performing above procedures, take care not to short circuit the lithium battery.



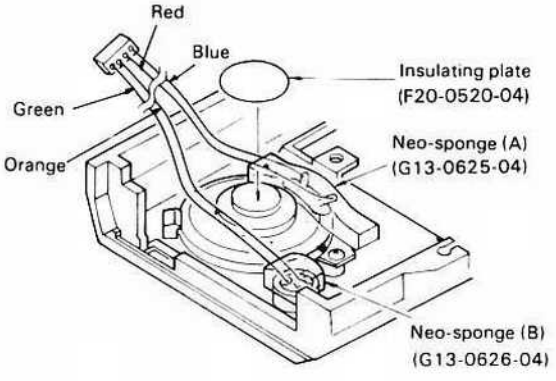


Fig. 16 Assembling the Upper case

PACKING

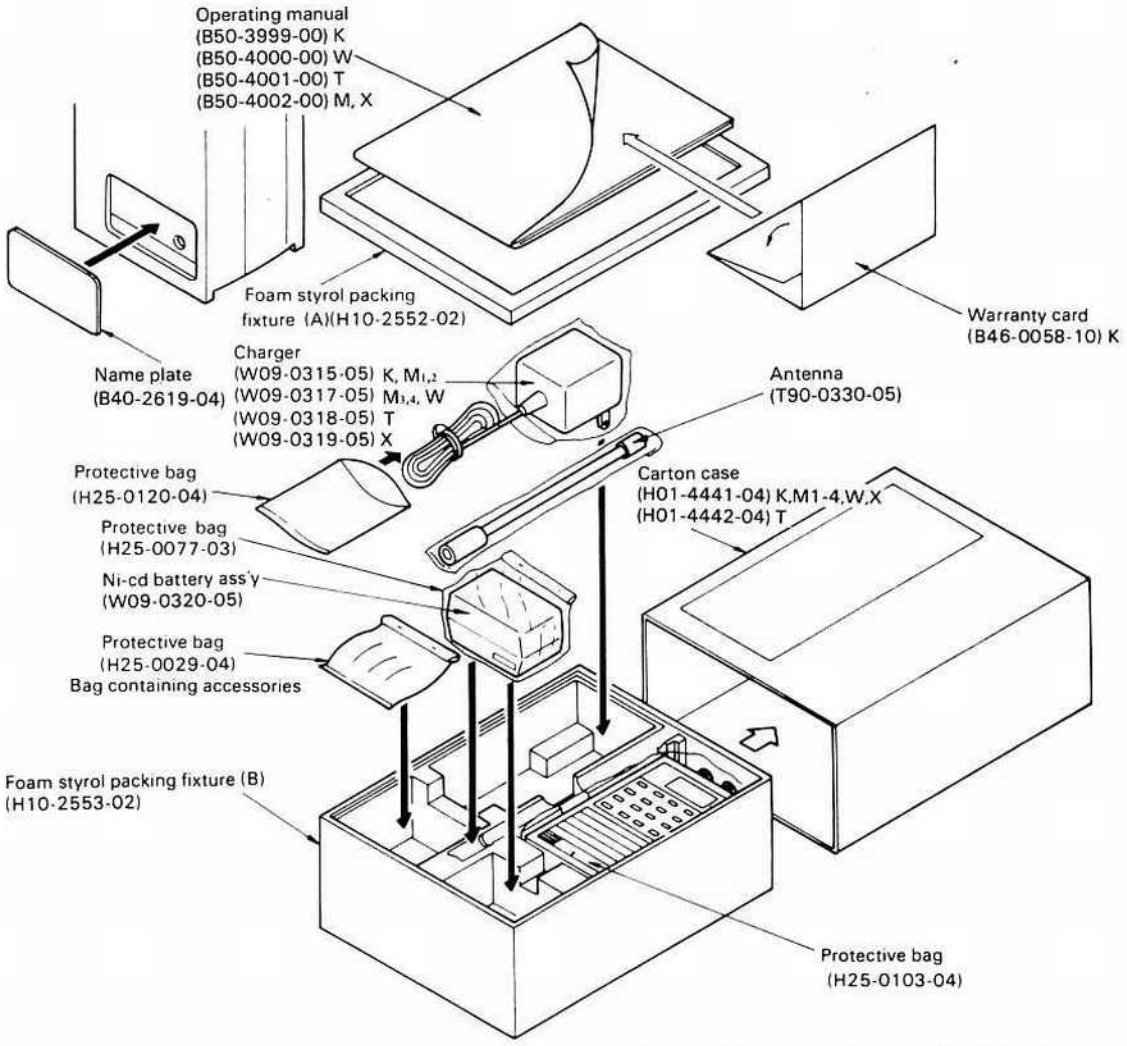
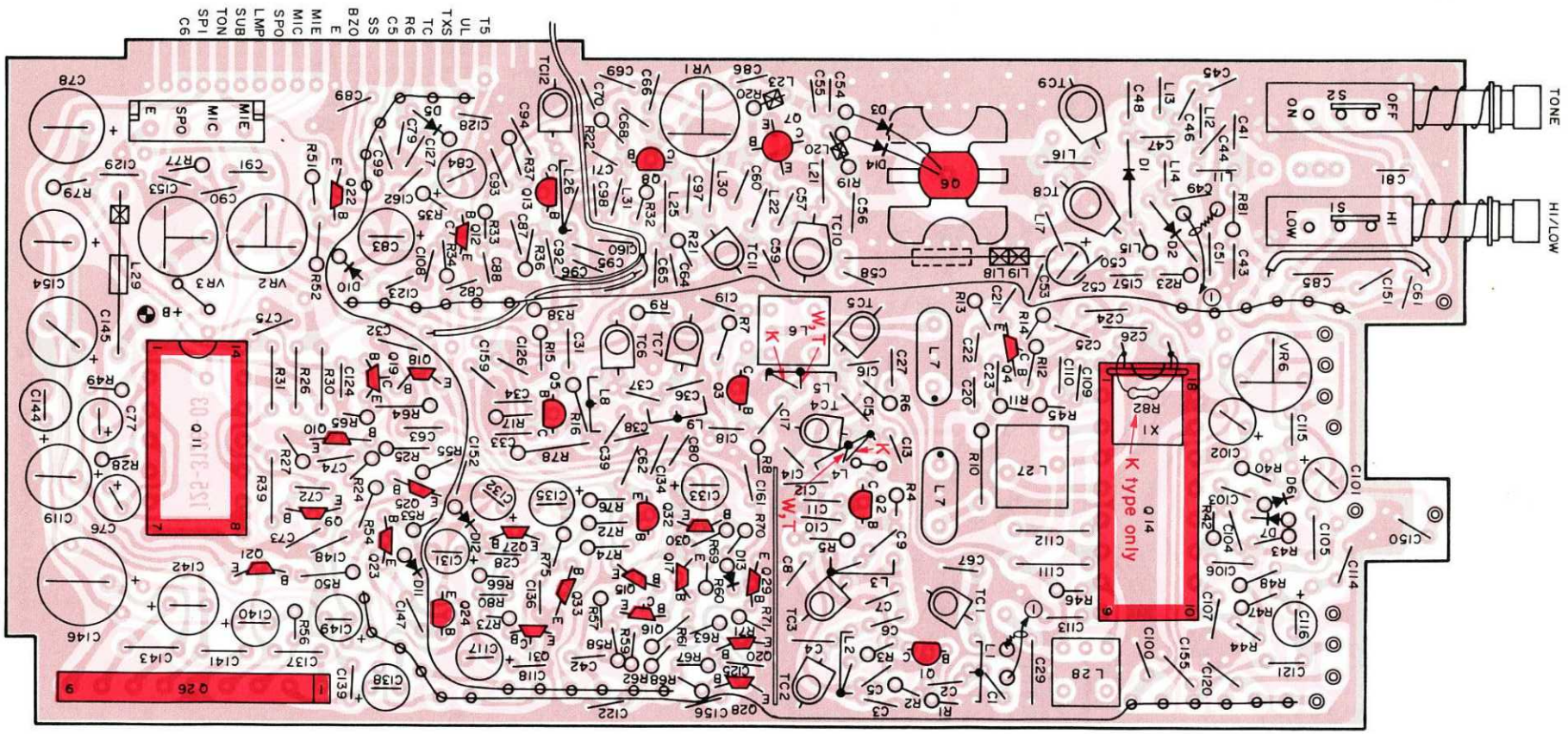


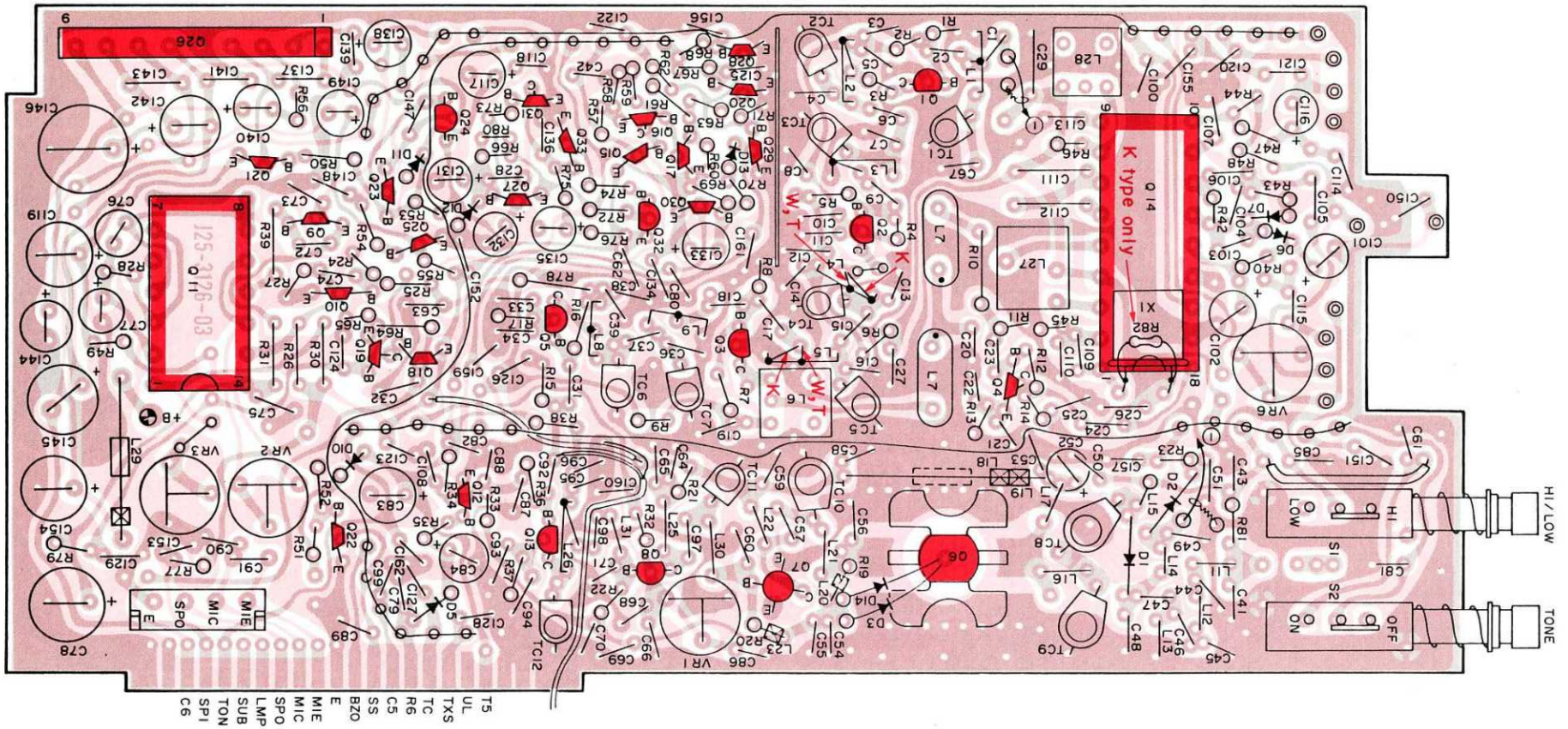
Fig. 18 PACKING

* The illustration above is for K type.

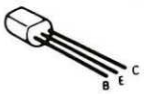
PC BOARD VIEW TX · RX UNIT (X44-1500-○○) Component side view



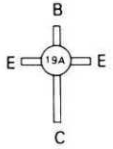
Q1,2,3,5: 2SC2026 Q4: 2SC2668 (Y) Q6: 2SC2283M Q7: 2SC3019 Q8: 2SC2407
Q9,15,17,18,21,27,30: 2SA1115 (E) Q10,12,16,19,20,22,23,25,28,29,31,33: 2SC2603 (E)
Q11: TC4001BP Q13: 2SC2549 Q14: MC3359P Q24,32: 2SB698 Q26: TA7313AP
D1,2: MI301 D3,5,10,13,14: 1S1555 D4: SR-538D D6,7: IN60 D11: WZ-081 D12: 05Z5,1 – Y



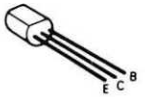
2SC2026
2SC2407
2SC2549



2SC3019

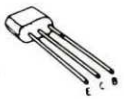


2SB698

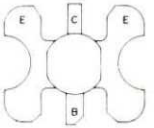


SR-538D

2SA1115
2SC2603
2SC2668
2SC2669

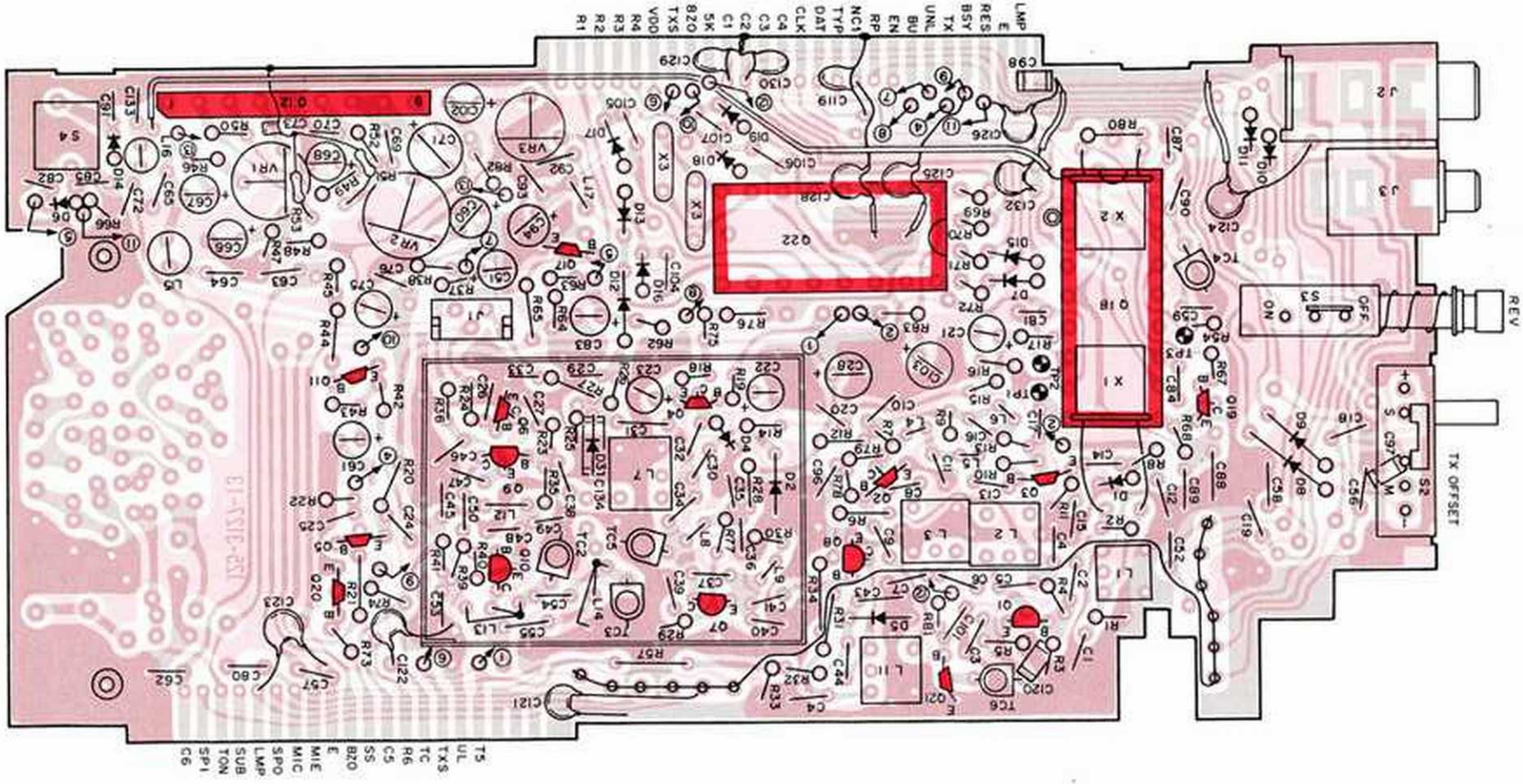


2SC2283M

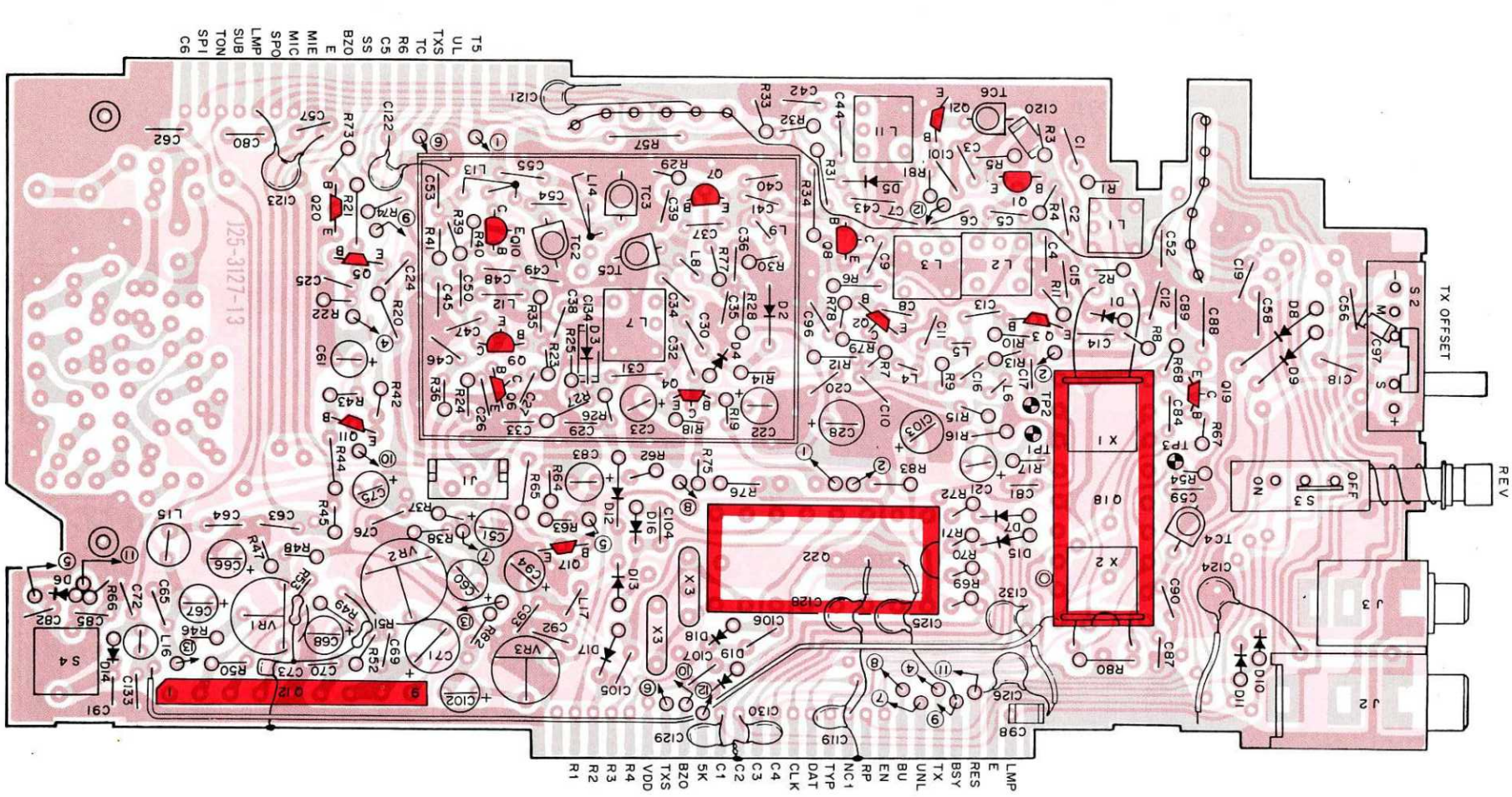


PC BOARD VIEW TX · RX UNIT (X44-1500-○○) Foil side view

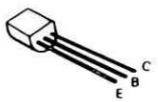
PC BOARD VIEW PLL UNIT (X50-1890-○○) Component side view



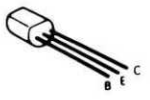
Q1,8: 2SC2347 Q2,21: 2SC2669 (Y) Q3,6: 2SC2669(Y) Q4,5,11: 2SA1115 (E) Q7: 2SC2212
Q9,10: 2SC2026 Q12: AN6551 Q17,19,20: 2SC2603 (E) Q18: MC145155P Q22: MK5087N (K,M,X)
D1,4: 1S2588 D2,3: 1SV50 D5: 1S2208 D6,7,10 ~ 14: 1S1555 D8,9: 1N60 (K, M, X)



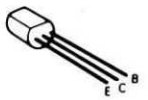
2SC2212



2SC2026



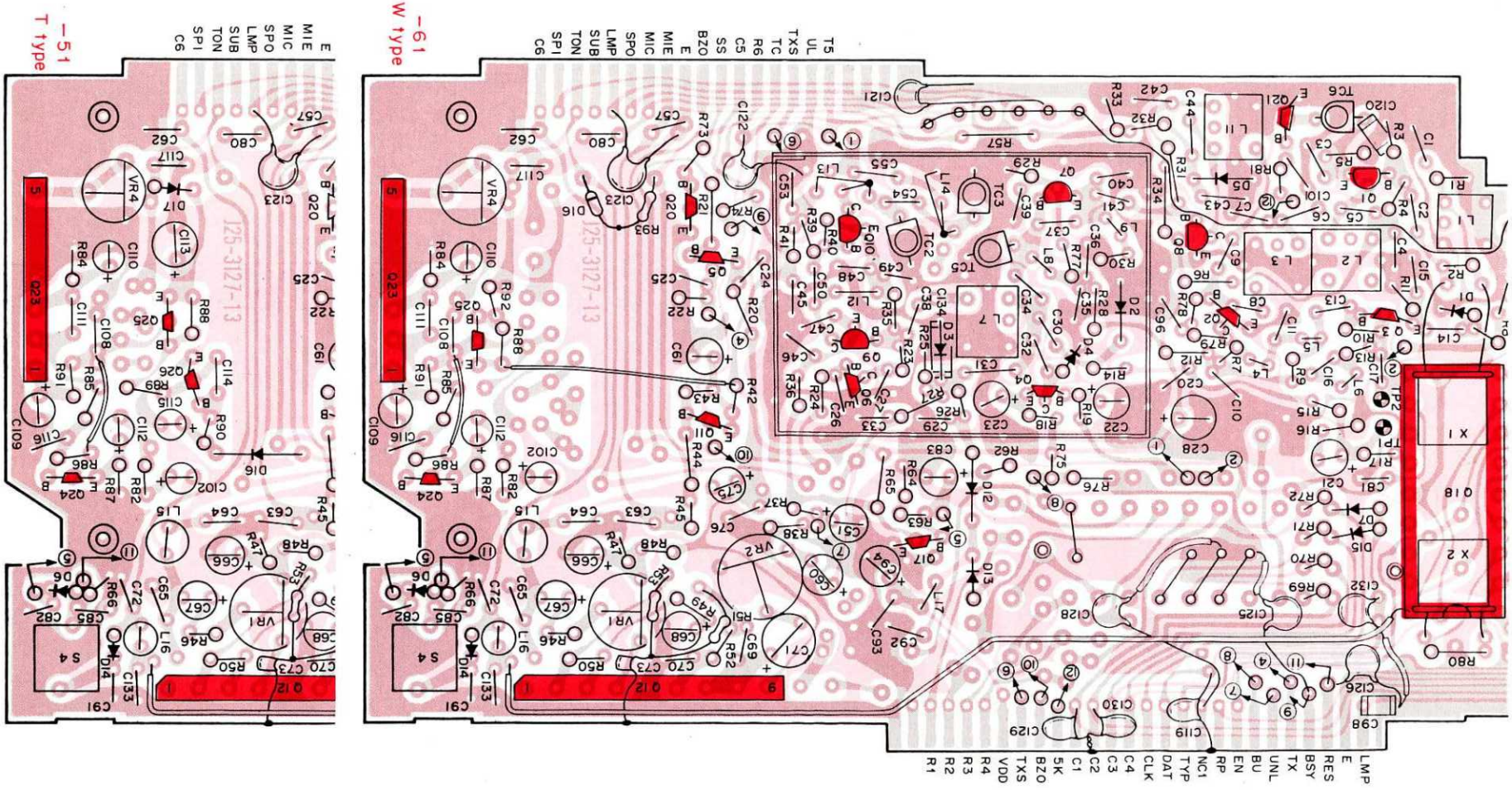
2SC2347



2SA1115
2SC2603
2SC2668
2SC2669

PC BOARD VIEW PLL UNIT (X50-1890-○○) Foil side view

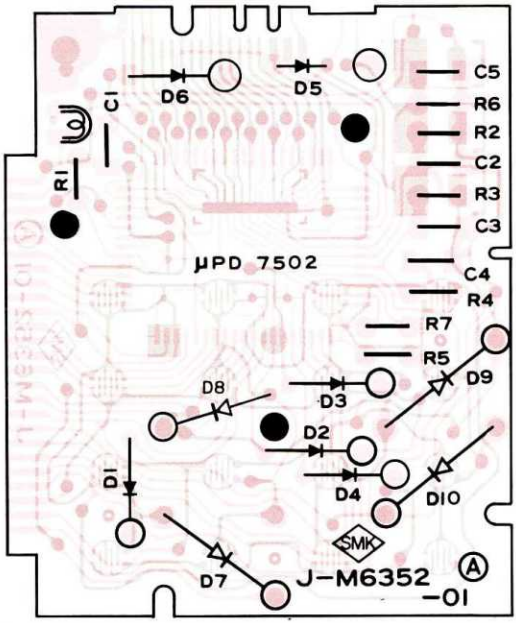
PC BOARD VIEW PLL UNIT (X50-1890-61,-51) Foil side view



Q1,8: 2SC2347 Q2,21: 2SC2668 (Y) Q3,6: 2SC2669 (Y) Q4,5,11,25: 2SA1115 (E) Q7: 2SC2212
Q9,10: 2SC2026 Q12: AN6551 Q17,19,20,24,26 (T): 2SC2603 (E) Q18: MC145155P Q23: AFG05F1750A2
D1,4: 1S2588 D2,3: 1SV50 D5: 1S2208 D6,7,10 ~ 16, 17 (T): 1S1555 D8,9: 1N60

PC BOARD VIEW

▼ KEY BOARD (S59-0413-05) K,M,X
(S59-0414-05) T,W

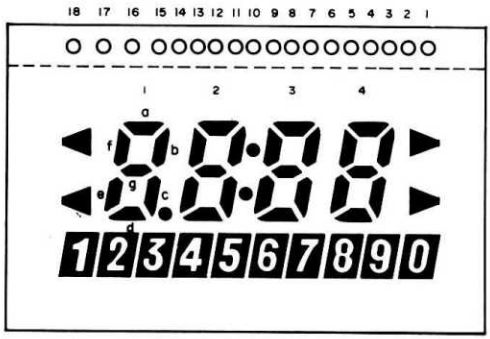


Q1: μPD750G-73-12
D1 ~ 6: 1S1555
D7 ~ 10: 1N60
V1: F2179-30

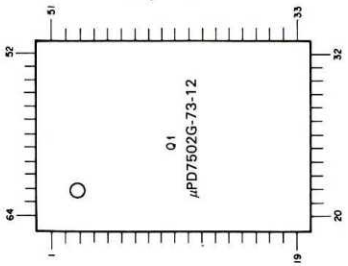
LCD PIN CONNECTION

Pin No.	Segment	Pin No.	Segment
1	▷, ▷, 0	12	1bcp
2	4bc, 9	13	1agd
3	4agd	14	1fe, 2
4	4fe, 8	15	◁, ◁, 1
5	3bc, 7	16	◁ (Upper) 1fab, 2 fab, COL (Upper) 3fab, 4fab, ▷ (Upper)
6	3agd		
7	3fe, 6	17	◁ (Lower) 1egc, 2egc, COL (Lower) 3egc, 4egc, ▷ (Lower)
8	COL, 5		
9	2bc, 4	18	1, 2, 1dp, 3, 2d, 4, 5, 6, 3d, 7, 8, 4d, 9, 0
10	2agd		
11	2fe, 3		

Pin connection



Top View



LCD F2179-30 (Display unit V1)

Max rating (Absolute max. rating)

Item	Symbol	Min.	Max.	Unit
Storage temperature	Tstg	−20	60	°C
Operation temperature	Top	−20	40	°C
Applied voltage			10	V
Allowable DC voltage			0.5	V

Recommendable operating condition

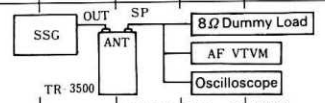
Item	Symbol	Min.	Norm.	Max.	Unit
Operating voltage	Vop	2.95	3.1	3.25	V
Operating frequency	fop	80	100	200	Hz
Operating temperature	Top	0	25	40	°C

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Voltage check	1) DC power supply: 8.4V	DC V. M	Key-Board	Q1, pin 26				4.2 ~ 4.7V
	2) R6		TX-RX	Q18 collector				6.0V
	3) T5 Transmit.			Q30 collector				4.7V
	4) Receive							
2. Battery warning indicator	1) DC power supply: 7V	BATT LED (Top Panel) DC V.M			TX, RX	VR3	Adjust to BATT LED flash threshold.	
	2) DC power supply: 6V Transmit					VR2	Adjust to BATT LED flash threshold.	
	3) DC power supply: more than 7V, Receive						Check	BATT LED goes off.
	4) DC power supply: more than 7V, Transmit						Check	BATT LED lights
	5) DC power supply: less than 6V, Transmit						Check	BATT LED flashes
	6) Repeat adjustment if checks are not satisfactory.							
	7) Receive							

<PLL section>

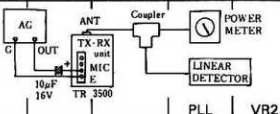
Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. PLL	1) f: 0.000	RF VTVM	PLL	TPI	PLL	L2, 3, L11	MAX. (Repeat Till No Change)	Reference value (1.35Vrms)
2. VCV	1) f: 0.000	DC V.M	PLL	TP2	PLL	TC5	1.0V	
	2) f: 9.990						Check	4V or less (Reference value 3.6V)
	3) f: 9.990 Transmit						Check	Reference the above voltage. Less than ±1V.
	4) f: 0.000 Transmit						Check	4V +1V −0.4V
3. PLL output	1) f: 9.990 Transmit	RF VTVM	PLL	PL	PLL	L11	MAX.	Reference value (0.45V rms)
4. Frequency adjustment	1) Any frequency	f counter	PLL	TP3	PLL	TC4	10.2400 MHz	
	2) f: 0.005 Transmit					L1	430.005 MHz (M2, M4, T, W, X type) 440.005 MHz (K, M1, M3 type)	
	3) f: 0.000 Transmit					TC6	430.000 MHz (M2, M4, T, W, X type) 440.000 MHz (K, M1, M3 type)	
	4) Repeat adjustment 2, 3 several times.							

<RX section>

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Sensitivity	1) ANT: SSG f: 435.000 MHz (M2, M4, T, X type) f: 445.000 MHZ (K, M1, M3 type) Output: 3 dBμ DEV: 5 kHz TX SW: STOP	SSG AF VTVM Oscilloscope 8 Ω Dummy-Load			TX, RX	TC1 ~ 7 L28	MAX. TC5: There are two peaks. Use the point of least capacitance.	
	2) f: 9.990					TC5, 6	MAX	
	3) f: 0.000					TC4, 7	MAX	
2. S/N	1) f: 0.000 ~ 9.990 SSG: 0 dBμ						Check	S/N: 27 dB or more
3. Auto squelch	1) f: 5.000 SSG: −3 dBμ				TX, RX	VR6	Adjust to squelch open threshold.	

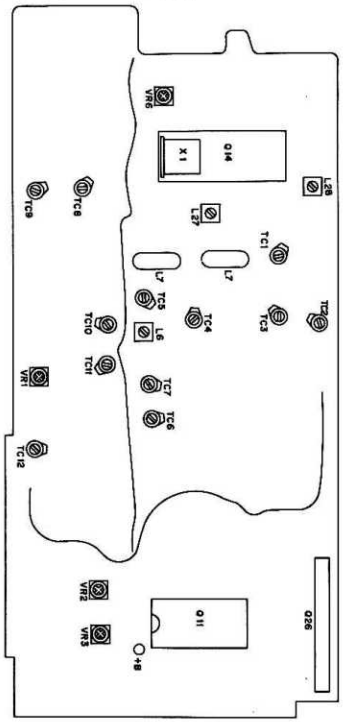
ADJUSTMENT

<TX section>

Item	Condition	Measurement			Adjustment			Specifications
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Power output adjustment	1) f: 5.000 ANT: Connect power meter HI/LOW: HI Power supply: 8.40V (with 1A Anmeter) Transmit	Power metter DC A.M			TX, RX	TC12 ~ 9	MAX.	1.7W or more
						TC8	Output: 1.7W or more and current, within 600 ~ 700 mA.	
	2) f: 0.000 or 9.990 HI/LOW: HI	Power meter					Check	1.5W or more
	3) f: 5.000 HI/LOW: LOW				TX, RX	VR1	0.3W	
	4) f: 5.000 HI/LOW: HI						Check	1.7W or more
	5) HI/LOW: LOW						Check	Approx. 0.3W (0.2 ~ 0.6W) (Current: 400 mA or less)
2. Deviation	1) ANT: Power meter and linear detector. Use 10 μF/16V capacitor between AG output and MIC input. f: 9.990 AG output: 1 kHz, 55 mV Transmit				PLL	VR2	5 kHz	
	2) AG output: 1 kHz, 5.5 mV					VR1	3.8 kHz	
	3) AG output: 1 kHz, 55 mV					VR2	If not 5 kHz, readjust to 5 kHz.	

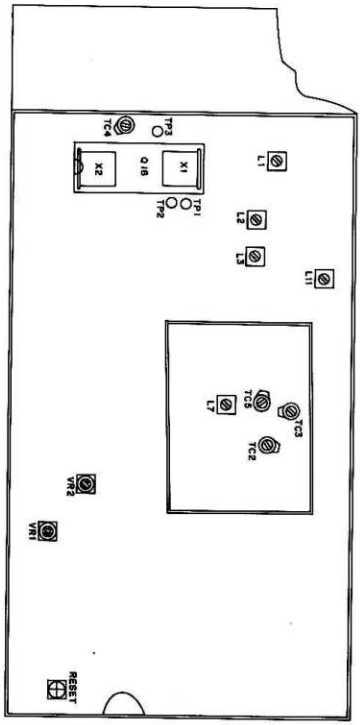
<ADJUSTMENT POINT>

TX-RX Unit (X44-1500-○○)



Front View

PLL Unit (X50-1890-○○)



Rear View

ADJUSTMENT

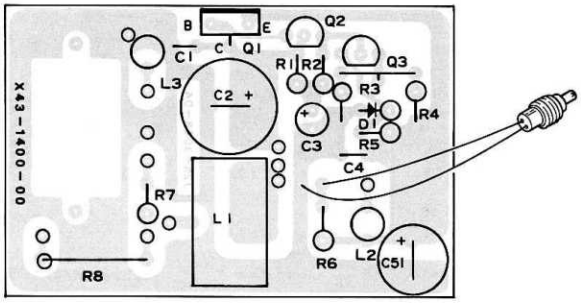
<Micro-processor operational check>

Item	Condition	Specifications
1. Reset check	1) Power SW: ON Press Reset	Display 3,000
2. Set frequencies	1) MHz indication	Indicate as entered by the numeral keys.
	2) 100 kHz	Indicate as entered by the numeral keys.
	3) 10 kHz	Indicate as entered by the numeral keys.
	4) 1 kHz	Indicate "0" when keys 0, 1, 2, 3, 4 pressed. Indicate "5" when keys 5, 6, 7, 8, 9 pressed.
3. "C" key	1) Press "C" key.	Indicate 3,000
4. ▲ key	1) Press the ▲ key.	Display should advance 5 kHz at each key-press.
	2) Press the ▲ key continuously	Count up from 0.000 ~ 9.995. Next step past 9.995, restarts again from 0.000.
5. ▼ key	1) Press the ▼key.	Display should step down 5 kHz at each key-press
	2) Press the ▼ key continuously.	Count down from 9,995 ~ 0.000. Next step past 0.000, restarts again frmo 9.995
6. Memory write	1) (e.g.) 5,110 MHz. Press the "F" and "MR(M)" keys. Then press channel number key (e.g.)"1".	Display 5,110 [1] The tone does not sound when "F" and "MR(M)" keys are pressed.
	2) Enter memory in all the channels (M1 ~ M0)(same method as1).	Frequency is stored in each selected channel, when the "F" and "MR" keys, are pressed, all the occupied channel munbers display.
7. Memory recall	1) Press the "MR"key.	Display all stored frequencies in channels in 1 ~ 10 oder.
	2) Press the desired channel key (e.g.) M1	Display 5,110 [1]
8. Memory scan check	1) Press the "MS" key. SQ: MAX No scan if squelch is opened. If stopped on signal, press the "MS" key to resume scan.	Frequencies stored in memory are scanned. The scan speed is about 8 second through 10 channels. (e.g.) 5,110 ▶ MS [1] ↓ 5,220 ▶ MS [2] ↓ 5,330 ▶ MS [3]
9. Program scan	(e.g.) Scan in 25 kHz steps 3,000 ~ 5,000 MHz. 1) f: 3,000 Press "F" and "▲(SCAN W)" keys.	Display 3,000
	2) f: 3,025 (3,000 kHz + 25 kHz) Press "F" and "▲(SCAN W)" keys.	Display 3,025
	3) f: 5,000 Press "F" and "▲(SCAN W)" keys.	Display 5,000 The tone sounds. If the tone does not sound, program is not entered. Repeat from 1).
	4) Press "F" and "▼" PROGS keys.	Scan starts from 3,000 ~ 5,000 MHz in 25 kHz step. The scan stops when signal is present. Scan resumes approx. 2 seconds after signal drops. To restart when stopped on signal, press the ▼ key (e.g.) 3,000 ▶ ↓ 3,025 ▶ ↓ 3,050 ▶ ↓ 5,000 ▶
	5) Press "C" key	Scan stops
10. F. Lock	1) F. Lock SW: ON	Key operation is not possible. "F. Lock ◀" indicator lights.
11. TX PTT/ STOP	1) TX PTT/STOP: STOP	TX not possible. PTT SW has no effect.
12. Lamp	1) Lamp: ON	Lamp for LCD lights.
13. Rev.	1) Rev. SW: ON	Displays "REV ◀" and frequency shows selected offset.

MS-1

MS-1 MOBILE STAND CHARGER

PC BOARD
Component side view



MS-1 Specifications

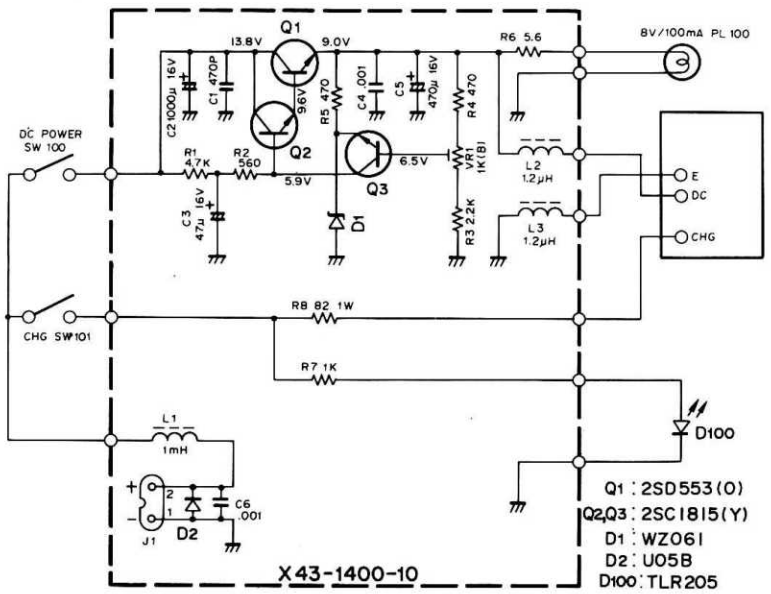
General

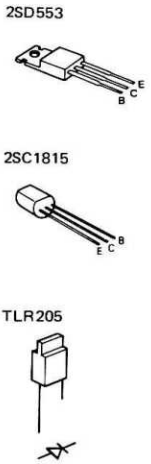
Dimensions 79(W) × 180(H) × 53(D) mm
Weight 350g

Rating

Input source voltage ..... DC13.8V±15%
Output voltage DC9.0V
Charging current About 45mA (DC 13.8V)
Charging time ..... About 15 hrs

MS-1 SCHEMATIC DIAGRAM





Q1 : 2SD553(O)
Q2,Q3 : 2SC1815(Y)
D1 : WZ061
D2 : U05B
D100 : TLR205

MS-1

MS-1, TU-1

Part No.	Remarks	Description	
MS-1, (KMT) GENERAL			
A02-0624-02	N	Mobile case (front)	
A02-0625-02	N	Mobile case (front)	M
A02-0626-02	N	Mobile case (rear)	
A40-0607-04			
B10-0649-04	N	Front glass	
B11-0412-04	* N	Reflector	
B40-2590-04	N	Name plate	
B46-0007-00		Warranty card	
B50-3936-00	N	Operating manual	
E23-0426-05		Earth lug, LED	
E29-0429-04		Pin connector x 3	
E30-1696-05	N	Cigarette plug with cord	
G01-0815-04	N	Spring, switch	
G01-0816-04	N	Spring, connector x 3	
G10-0618-04	N	Protective cloth (A)	
G10-0619-14	N	Protective cloth (B) x 2	
G13-0626-04	*N	Neo sponge	
G13-0659-04	*N	Cushion (A)	
G13-0660-04	*N	Cushion (B)	
H01-2788-03	N	Carton case	M
H12-0489-13	N	Packing fixture	
H25-0029-04		Protective bag (Screw, tape)	
H25-0103-04		Protective bag (MS-1)	
J11-0406-14		Fixed stopper	
J12-0404-04		Pin (switch) x 2	
J19-1317-04		Diode holder	
J19-1359-04	N	Metal hook	
J61-0401-05		Nylon band	
J69-0304-04	N	Viscous tape	
N24-3015-45		E-ring x 4	
N30-2010-45		Panhead screw, Case	x 4
N35-3005-45		Bind screw, Hook metal fitting	x 4
N87-2005-46		Tap tight screw, Switch, LED	x 5
N89-3010-41		Tap tight screw, Fixed stopper	x 2
S36-1405-05		See saw switch, S100, S101	x 2
TLR205		LED. D100	
X43-1400-00		Power unit	

Part No.	Remarks	Description	Ref. No.	Q'ty
POWER UNIT, X43-1400-00				
B30-0825-05	N	Lamp		1
CE04W1C470M		E, 47μF, 16V	C3	1
CK45B1H102K		C, 0.001μF	C4,6	2
C90-0820-05		E470μF, 16V	C5	1
C90-0850-05	N	E, 1000μF, 16V	C2	1
E08-0203-25		2P connector		1
F20-0078-05		Insulating plate		1
F29-0014-05		Insulating washer		1
L15-0302-05	N	Troidal coil, 1mH	L1	1
L34-0438-05		Choke coil, 1.2μH	L2,3	2
N10-2026-46		Hexagon nut		2
N10-2030-46		Hexagon nut		1
N30-2604-46		Panhead screw		1
N30-2610-41		Panhead screw		2
N30-3008-46		Panhead screw		1
R12-1020-05		Trim. Pot, 1kΩ	VR1	1
RS14AB3A820J		MF, 82Ω, ±5%, 1W	R8	1
2SC1815 (Y)		TR	Q2,3	2
2SD553 (O)		TR	Q1	1
WZ-061		Zener diode	D1	1
U05B		Diode	D2	1

TU-1 TONE UNIT (AVAILABLE ONLY FOR USA)

TU-1 PARTS LIST

Part No.	Remarks	Description	
A02-0622-03	N	Sub-tone case (Upper)	
A02-0623-03	N	Sub-tone case (Lower)	
D32-0404-04	N	Stopper knob	
E23-0431-04		Spring terminal x 4	
E23-0432-04		Lug plate x 6	
H01-2794-03	N	Carton case	
H25-0077-03		Protective bag	
J39-0410-04		Spacer, Terminal	x 4
N09-0638-05		Round screw	
N30-2004-41		Panhead screw, Spring terminal	x 4
N30-2020-45		Panhead screw, Case	x 2
N87-2006-46		Tap tight screw, PC board	x 2

ST-2

ST-2 BASE STAND CHARGER

ST-2 SPECIFICATIONS

Power Source Voltage

K TYPE	120V	60Hz
W TYPE	220V	50/60Hz
T TYPE	240V	50/60Hz
X TYPE	240V	50/60Hz
M TYPE	120/220V	50/60Hz

Dimensions ..... 185 (W) × 72 (H) × 115 (D) mm
Weight ..... 1.5 kg
DC Power Source Unit
Output Voltage 9.0V
Output current 0.8A
Charging Power Source Unit
Type ..... Boosting charge type
Charging current ..... Boosting charge about 600mA
Trickle charge about 20mA
Charging time ..... Boosting charge about 1 hr
Trickle charge about 20 hrs

ST-2 PARTS LIST

Part No.	Re-marks	Description		
A02-0628-11	N	Case		K,M,W,X
A02-0629-11	N	Case		T
B40-2592-04	N	Name plate		K
B40-2593-04	N	Name plate		W
B40-2594-04	N	Name plate		T,X
B40-2596-04	N	Name plate		M
B42-1697-04		Voltage selector		M
B46-0404-00		Warranty card		K
B50-3938-00	N	Operating manual		K,T,W,X
B50-3947-00	N	Operating manual		M
D32-0075-04		Switch stopper, Slide switch		M
E29-0429-04	N	Pin, connector		
E30-0181-05		AC cord with plug		K,M
E30-0185-05		AC cord		X
E30-0585-05		AC cord with plug		W
E30-0602-05		AC cord with plug		T
F06-1022-05		Fuse 1A		
G01-0815-04	N	Switch spring		
G01-0816-04	N	Spring connector terminal	× 4	
G02-0533-04		Spring plate	× 2	
G10-0620-14	N	Cushion cloth (A), Case	× 2	
H01-2791-04	N	Carton case		K,M,W,X
H01-2792-04	N	Carton case		T
H12-0489-03	N	Packing fixture		
H25-0029-04		Protective bag , Fuse		
H25-0106-04		Protective bag		
J02-0070-05		Foot	× 4	
J11-0406-14	N	Fixed stopper	× 2	
J12-0404-04	N	Pin, switch		
J19-1317-04		Diode holder	× 2	
J41-0024-15		Cord bushing		T,W,X
J42-0430-05	N	Cord bushing	× 3	K,M
J61-0401-05		Nylon belt		

Part No.	Re-marks	Description		
L01-8146-05	N	Power transformer		
N09-0256-05		Earth screw		T,W,X
N16-0040-41		Spring washer, Transformer	× 2	
N24-3015-45		E-ring	× 5	
N30-3004-41		Panhead screw, Slide switch	× 2	M
N30-3006-41		Panhead screw, Power unit	× 5	
N30-4006-41		Panhead screw, Transformer	× 2	
N35-3006-45		Bind screw, Case	× 4	
N87-2006-46		Tap tite screw LED, Micro Sw PC board	× 5	
N87-3008-41		Tap tite screw Foot	× 4	
N89-3010-41		Tap tite screw stopper	× 2	
S31-2027-05		Slide switch, voltage selector		M
S36-1407-05	N	See saw switch, Power, charge	S_1,S_2	× 2
X43-1410-10	N	Power unit		

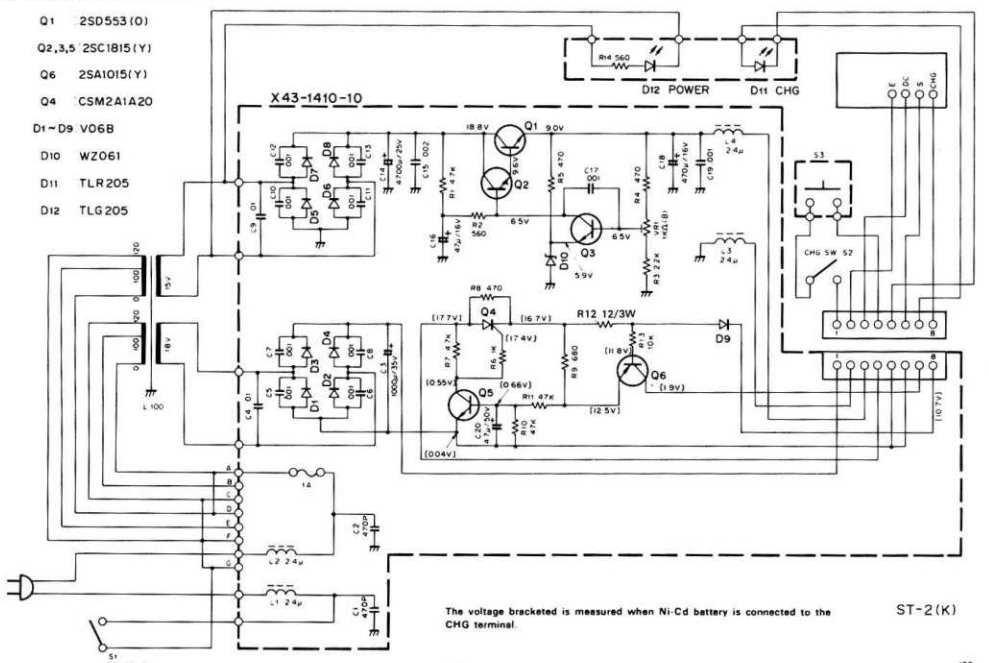
Part No.	Re-marks	Description	Ref. No.	Q'ty
Power Unit (X43-1410-10)				
CE04W1C470M		E, 47μF, 16V	C16	1
CE04W1H4R7M		E, 4.7μF, 50V	C20	1
CK45B1H102K		C, 0.001μF	C5,6,7,8,10,11, 12,13,17,19	10
CK45B2H471K		C, 470pF	C1,2	2
CK45F1H103Z		C, 0.01μF	C4,9	2
CK45F1H223Z		C, 0.022μF	C15	1
C90-0814-05		E, 4700μF, 25V	C14	1
C90-0820-05		E, 470μF, 16V	C18	1
C90-0851-05	N	E, 1000μF, 35V	C3	1
E23-0047-04		Square terminal		14
F06-1022-05		Fuse, 1A		1
F20-0078-05		Insulating plate		2
F29-0014-05		Insulating washer		2

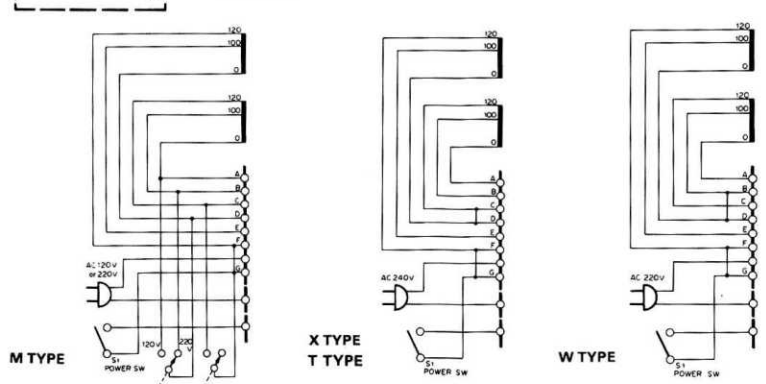
ST-2

Part No.	Re-marks	Description	Ref. No.	Q'ty
J13-0039-05		Fuse holder		2
L33-0624-05		Choke coil, 2.4μH	L1,2,3,4	4
N09-0641-05		Screw		2
N10-2030-46		Hexagon Nut		1
N30-3008-46		Panhead screw		2
R12-1414-05		Trim. pot., 1kΩ	VR1	1
R92-0661-05	N	Cement resistor, 12Ω, 5W	R12	1
R92-0150-05		Jumper resistor		1

Part No.	Re-marks	Description	Ref. No.	Q'ty
S50-1410-05	N	Micro switch	S3	1
2SA1015 (Y)	N	TR	Q6	1
2SC1815 (Y)		TR	Q2,3,5	3
2SD553 (O)	N	TR	Q1	1
V06B		Diode	D1～9	9
WZ-061		Zener diode	D10	1
CSM2A1A20	N	Thryistor	Q4	1
TLG205		LED	D12	1
TLR205		LED	D11	1

ST-2 SCHEMATIC DIAGRAM



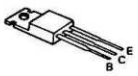


ST-2, SMC-25

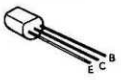
ST-2 PC BOARD (X43-1410-10)

Component Side View

2SD553

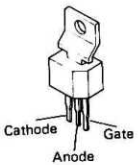


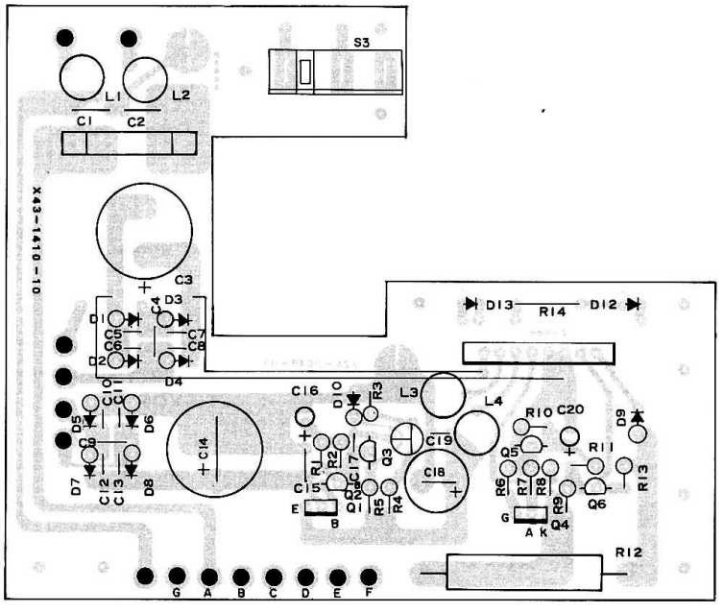
2SC1815
2SA1015(Y)



TLR205

CSM2A1A20





SMC-25 SPEAKER MICROPHONE

SMC-25 SPECIFICATIONS

General

Cord length	About 30 cm (curl type)
Dimensions	50 (W) × 73(H) × 35(D)mm (Projections excluded)
Weight	About 130 g (Cord included)

Microphone Unit

Type	Electret type
Sensitivity	−67 dB
Impedance	2.2kΩ
Frequency characteristic	200Hz ~ 5kHz

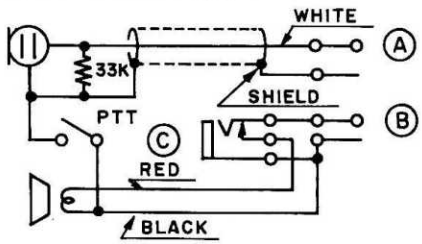
Speaker Section

Normal max. input	0.5W
Impedance	8 Ω
Frequency range	400 Hz ~ 4kHz

SMC-25 PARTS LIST

Part No.	Re-marks	Description
E30-1695-08	N	Curled cord ass'y (with plug)
J19-1360-08	N	Clip metal fitting
K29-0748-08		PTT knob
S50-1408-08		Micro switch
T07-0219-08	N	Speaker
T97-1024-08		Electret MIC

SMC-25 SCHEMATIC DIAGRAM



BT-1, PB-25, SC-4

PB-25 NI-CD BATTERY PACK

PB-25 SPECIFICATIONS

General

Dimensions	65 (W) × 41(H) × 39(D) mm.
Weight	180g

Rating

Output voltage	8.4V (N-425 × 7pcs.)
Charging current	42.5mA (Ordinary charging for 15 hrs.) 650mA (Boosting charging for 1 hr)
Capacity	400mA
Thermostat operating temperature	45°C±5°C

PB-25 PARTS LIST

Part No.	Re-marks	Description
A02-0618-03		Case (upper)
A02-0619-03		Case (lower)
B42-1715-04		Name plate (A)
B42-1716-04		Name plate (B)
B50-3929-08	N	Operating manual
E08-0271-05		Power connector
E23-0432-04		Lug plate × 2
E29-0428-04		Terminal ×4
F07-0837-04		Terminal cover (A)
H01-2793-08	* N	Carton case
N09-0637-08		Round flat screw, M2 × 4 ×4
N09-0638-05		Round screw, M2 × 4
N87-2006-46		Panhead screw M2 × 6 ×2
S50-1405-05		Micro switch
W09-0320-05		Ni-cd battery ass'y

SC-4 CARRYING CASE (EXCEPT USA MARKET)

SC-4 PARTS LIST

Part No.	Re-marks	Description
J31-0521-04	N	Collar (A) right
J31-0522-04	N	Collar (B) left
J61-0405-13	N	Belt hook ass'y
N08-0507-04	N	Ornamental screw (A) right
N08-0508-04	N	Ornamental screw (B) left
N30-3005-41		Ornamental screw × 2 Belt hook

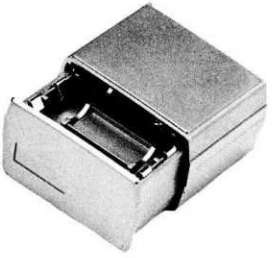
BT-1

Dimensions

39.5 mm wide
52.0 mm high
66.0 mm deep

Weight

60g



BT-1 PARTS LIST

Ref. No.	Part No.	Description	Re-marks
	A02-0620-03	Manganese case (inner)	
	A02-0621-03	Case (B) Lower	
	E23-0432-04	Ellipse lug	
	E29-0427-04	Battery connector	
	F07-0838-04	Terminal cover (B)	
	N09-0638-05	Small round head screw	
	H01-4417-03	Packing case (unit packing)	
	H25-0077-03	Protection bag	

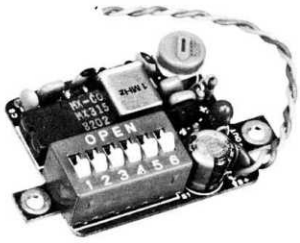
TU-35A, TU-35B (REPEATER TONE UNIT)

TU-35A VARIABLE TONE ENCODER

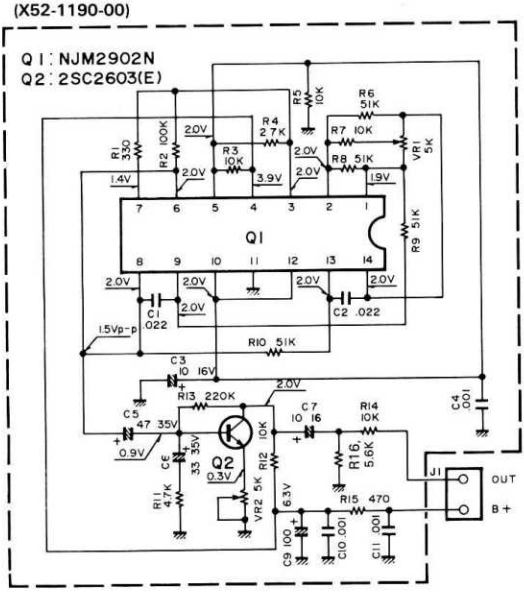
Specifications: Oscillator frequency..... 88.5 Hz (±0.2 Hz) at normal temperature
Frequency adjustment range... 60 ~ 260 Hz
Weight ..... 8 grams

TU-35B PROGRAMMABLE TONE ENCODER

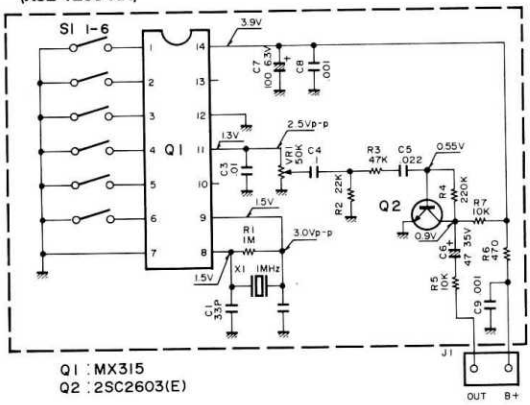
Specifications: Oscillator frequency..... 1 MHz ±0.1%
Usable frequency range..... 37 EIA Specification Group Frequencies (67.0 ~ 250.3 Hz)
Weight ..... 8 grams



TU-35A
(X52-1190-00)

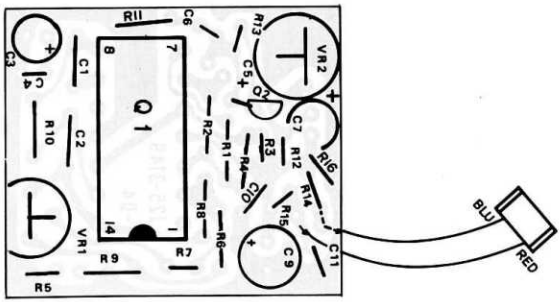


TU-35B
(X52-1200-XX)

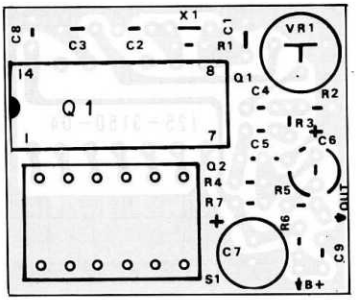


Q1 : MX315
Q2 : 2SC2603(E)

TU-35A
(X52-1190-00)



TU-35B
(X52-1200-XX)

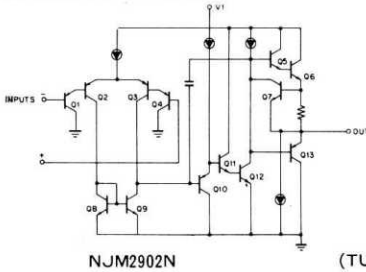


Part No.	Re-marks	Description	Q'ty
TU-35A			
B40-2637-04	N	Name plate	1
B50-4019-00	N	Instruction manual	1
F19-0617-04		Rubber cap	1
J39-0417-04	N	Spacer	1
N35-2004-41		Bind screw	2
X52-1190-00	N	Tone unit	1
Tone Unit (X52-1190-00)			
CK45B1H102K		C 0.001 μF	C4, 10, 11 3
CS15E1VR33M		T 0.33μF 35V	C6 1
CS15E1VR47M		T 0.47μF 35V	C5 1
C90-0840-05		E 10 μF 16V	C3, 7 2
C90-0842-05		E 100 μF 6.3V	C9 1
C91-1001-05		Cap 0.022 μF	C1, 2 2
R12-2405-05		Trim. Pot. 5 kΩ (B)	VR2 1
R12-2412-05		Pot. 5 kΩ	VR1 1
2SC2603 (E)		Tr	Q2 1
NJM2902N		IC	Q1

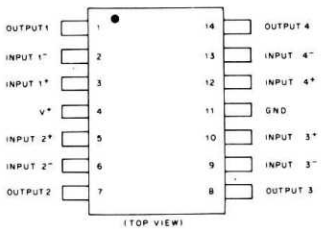
Part No.	Re-marks	Description	Q'ty
TU-35B			
B40-2638-04	N	Name plate	1
B42-1771-04	N	Frequenccy name plate	1
B50-4019-00	N	Instruction manual	1
J39-0417-04		Spacer	1
N35-2004-41		Bind screw	2
X52-1200-00	N	Tone unit M	1
X52-1200-11	N	Tone unit K	1
Tone Unit (X52-1200-XX)			
CC45CH1H330J		C 33PF	C1,2 2
CK45B1H102K		C 0.001 μF	C8, 9 2
CS15E1VR47M		T 0.47μF 35V	C6 1
C90-0842-05		E 100 μF 6.3V	C7 1
C91-0422-05		Cap 0.01 μF	C3 1
C91-0426-05		Cap 0.022 μF	C5 1
C91-0431-05		Cap 0.1 μF	C4 1
L77-0982-05	N	Crystal 1MHz	X1 1
R12-4505-05		Trim. Pot. 50 KΩ (B)	VR1 1
S31-6401-05	N	Dip switch	S1 1
2SC2603 (E)		Tr	Q2 1
MX315	N	IC	Q1 1

TU-35B Tone Frequency Data

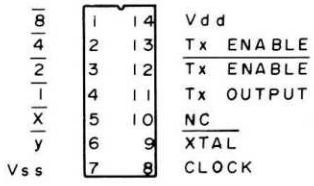
#	EIA Specification Groop	Hz	Program Lines (ON···1, OFF···0) 1	2	3	4	5	6
1	C	67.0	1	1	1	1	1	1
2	B	71.9	1	1	1	1	1	0
3	C	74.4	1	1	1	0	1	1
4	A	77.0	1	1	1	1	0	0
5	C	79.7	1	1	0	1	1	1
6	B	82.5	1	1	1	0	1	0
7	C	85.4	1	1	0	0	1	1
8	A	88.5	1	1	1	0	0	0
9	C	91.5	1	0	1	1	1	1
10	B	94.8	1	1	0	1	1	0
11	A	100.0	1	1	0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



NJM2902N (TU-35A)



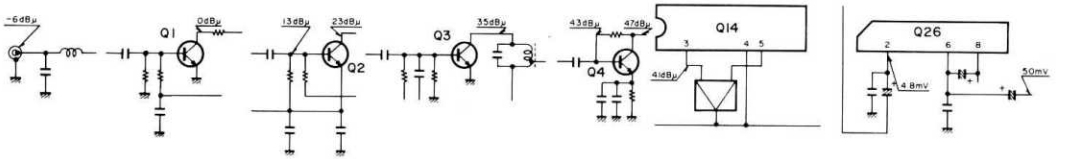
NJM2902N



MX315 (TU-35B)

LEVEL DIAGRAM

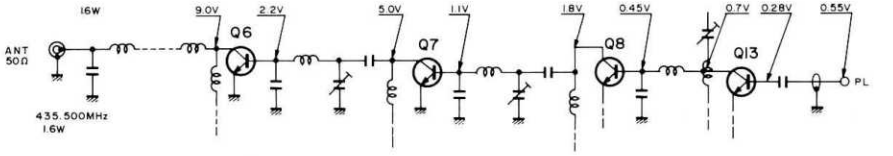
Receiver Section



Measurement conditions

1. C
   C=0.01μF (1μF for AF circuit)
2. f = 435.500MHz
   MOD = 1KHz DEV = 5KHz
   AG f = 1KHz
3. OUTPUT = 50mW/8Ω

Transmitter Section

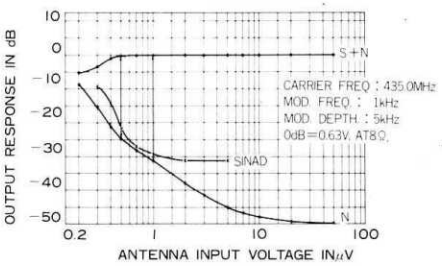


Measurement conditions

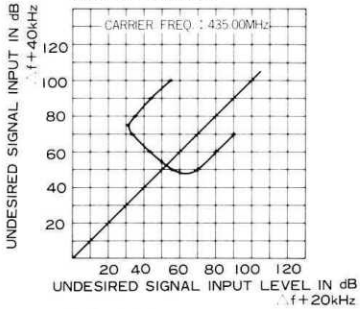
1. f = 435.500MHz
2. OUTPUT POWER = 16W

REFERENCE DATA (W TYPE)

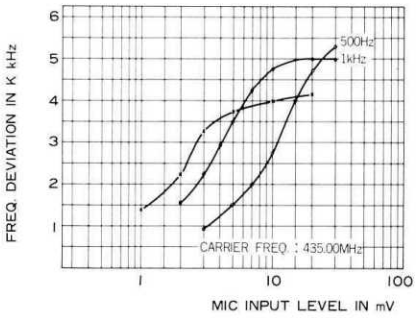
Reception sensitivity



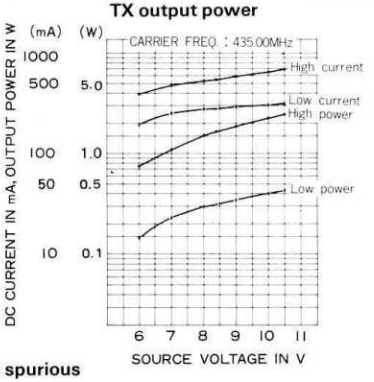
Inter modulation



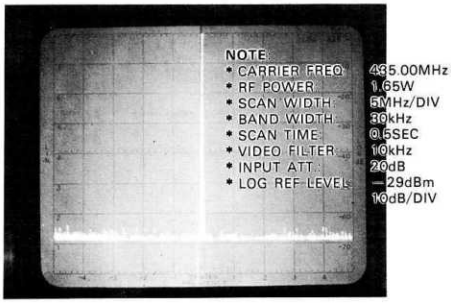
Frequency deviation



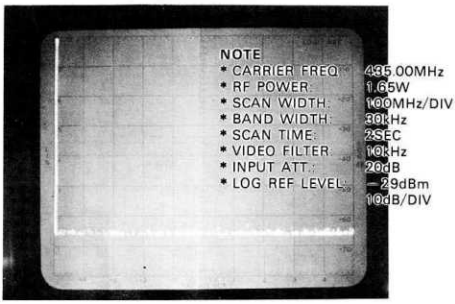
TX output power



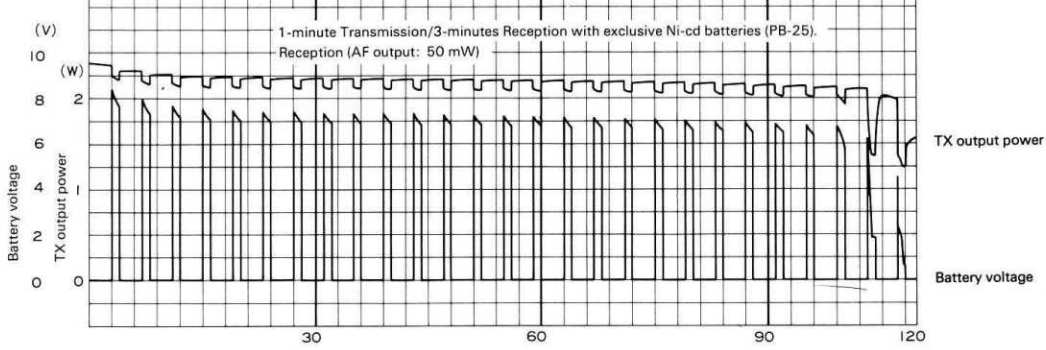
Adjacent spurious response



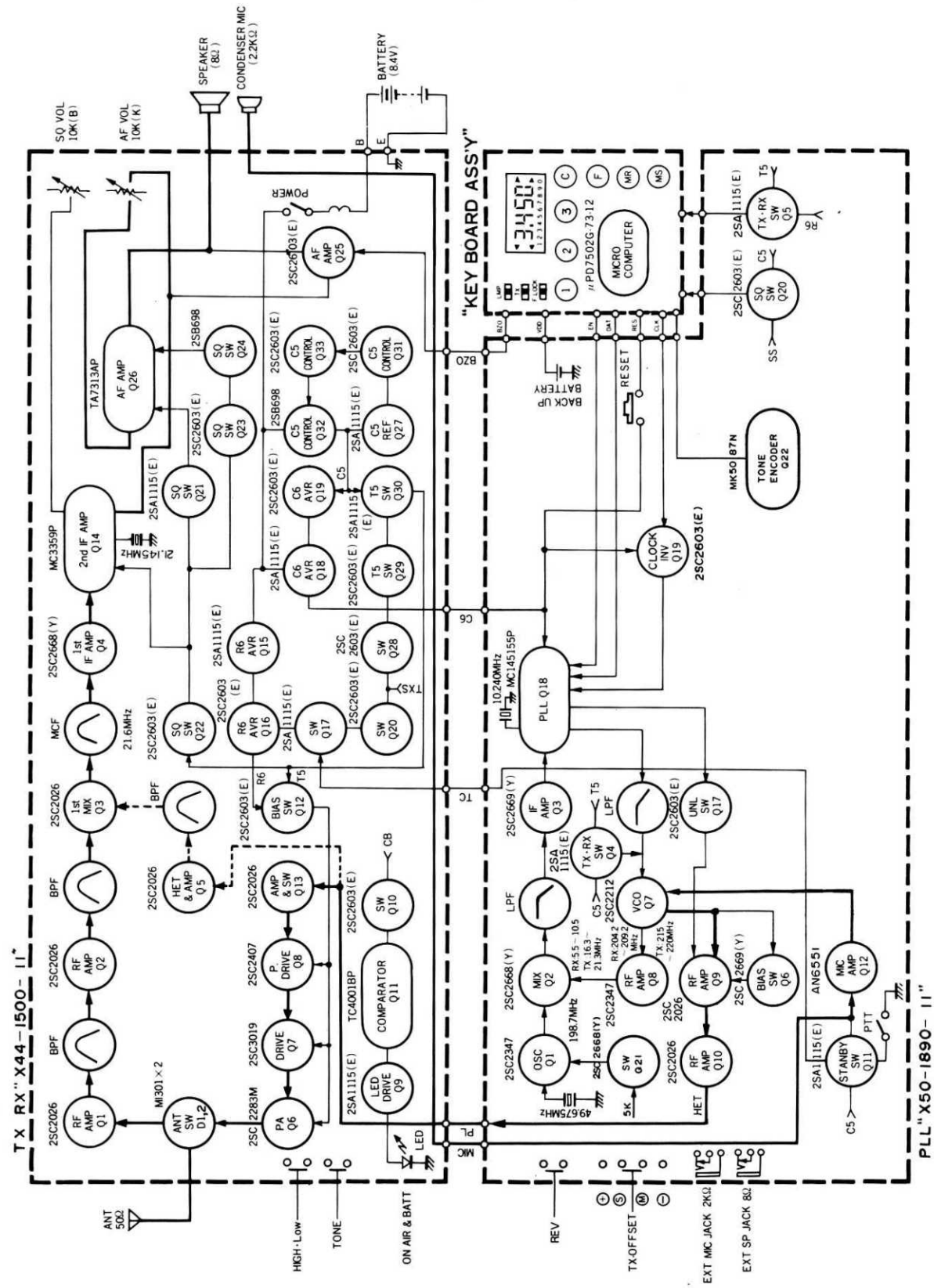
Harmonic spurious

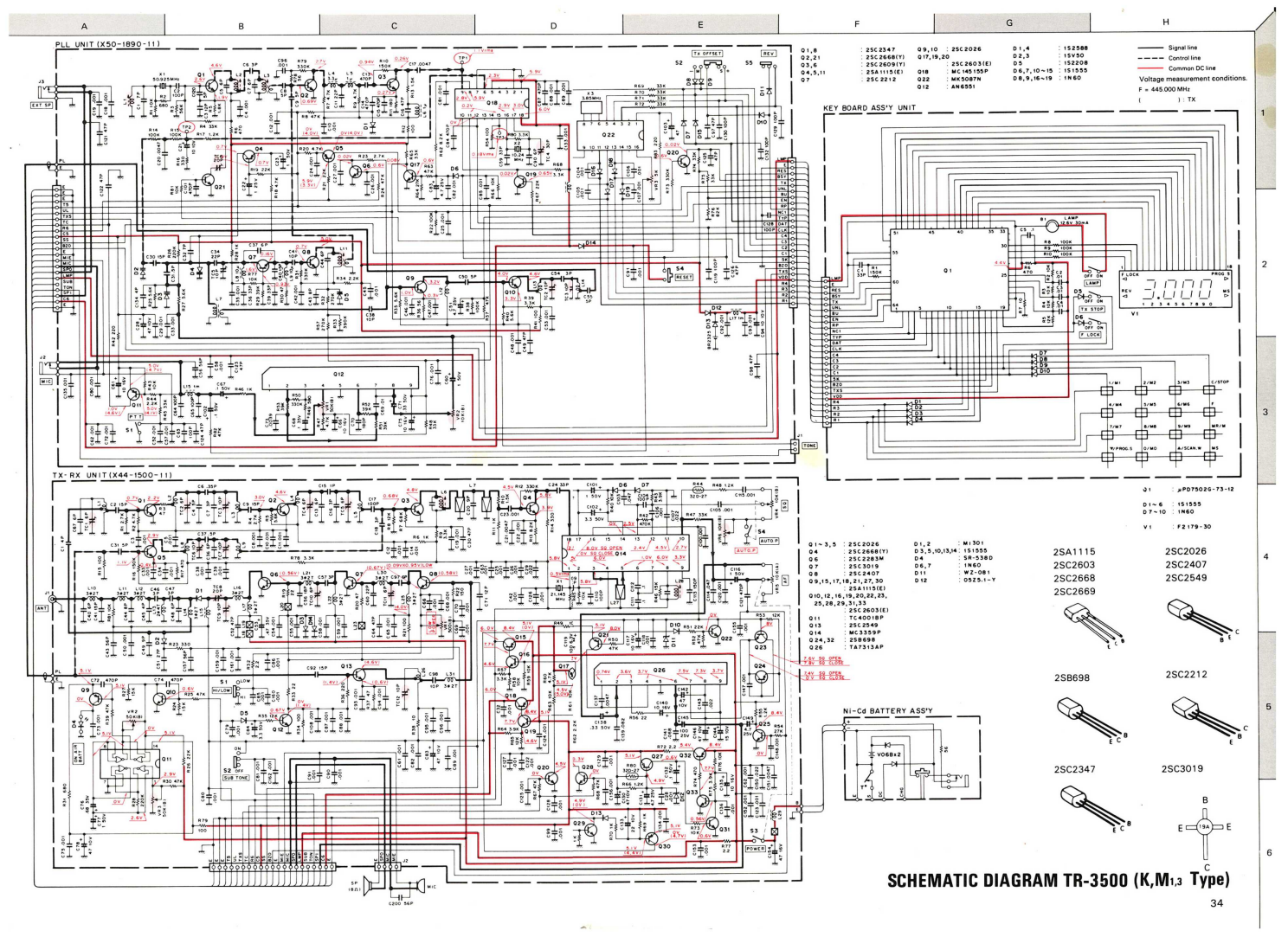


Battery voltage and output power charateristics in continuous operation.

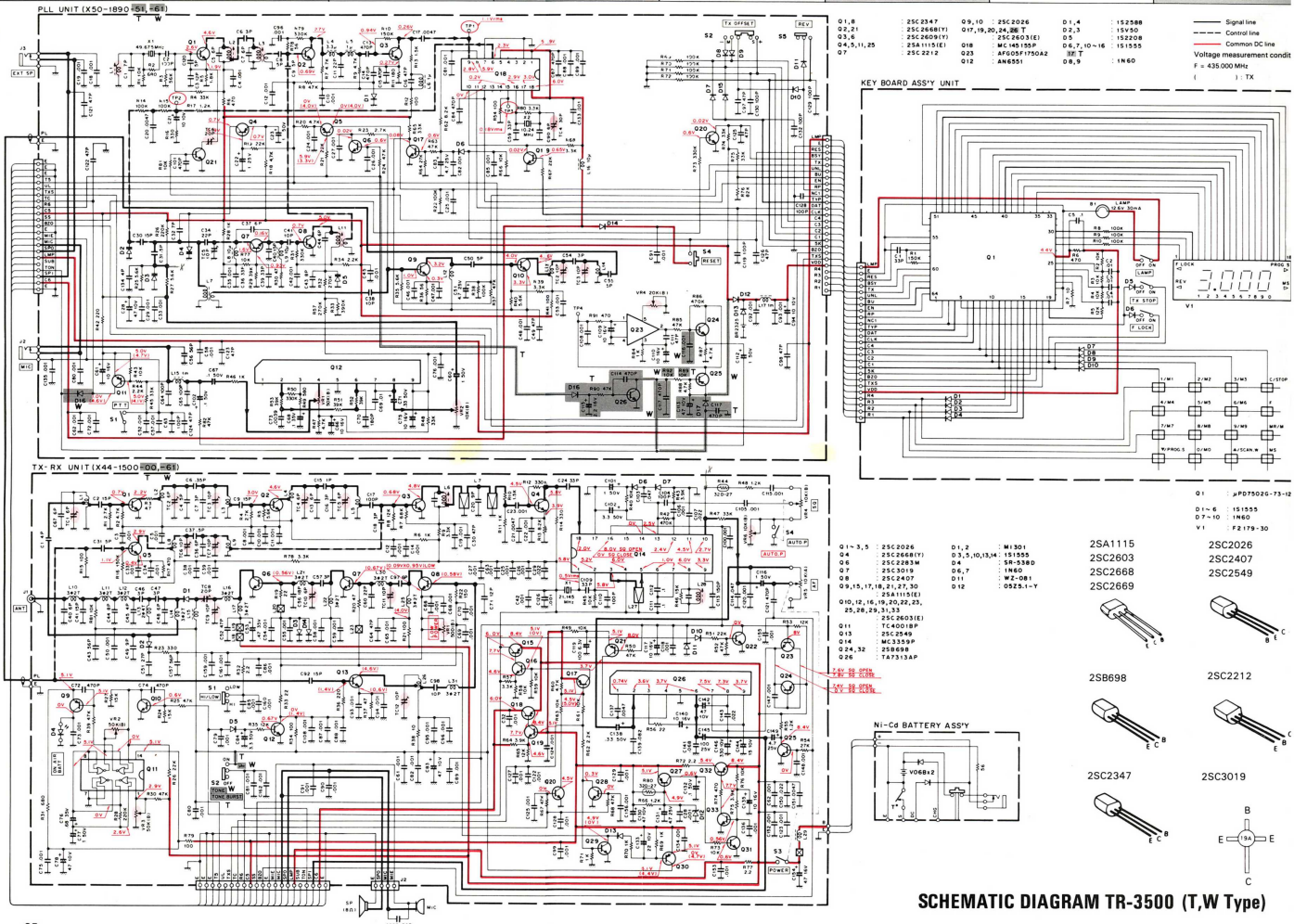


BLOCK DIAGRAM (K TYPE)





SCHEMATIC DIAGRAM TR-3500 (K,M1,3 Type)


PLL UNIT (X50-1890-51, -61)
TX-RX UNIT (X44-1500-00, -61)
KEY BOARD ASS'Y UNIT
Ni-Cd BATTERY ASS'Y
Q1,8 : 2SC2347
Q2,21 : 2SC2668(Y)
Q3,6 : 2SC2609(Y)
Q4,5,11,25 : 2SA1115(E)
Q7 : 2SC2212
Q9,10 : 2SC2026
Q17,19,20,24,26 T : 2SC2603(E)
Q18 : MC145155P
Q23 : AF605F1750A2
Q12 : AN6551
D1,4 : 1S2588
D2,3 : 1SV50
D5 : 1S2208
D6,7,10~16 : 1S1555
D8,9 : 1N60
Signal line
Control line
Common DC line
Voltage measurement condit
F = 435.000MHz
( ) : TX
Q1 : μPD7502G-73-12
D1~6 : 1S1555
D7~10 : 1N60
V1 : FZ179-30
Q1~3,5 : 2SC2026
Q4 : 2SC2668(Y)
Q6 : 2SC2283M
Q7 : 2SC3019
Q8 : 2SC2407
Q9,15,17,18,21,27,30 : 2SA1115(E)
Q10,12,16,19,20,22,23,25,28,29,31,33 : 2SC2603(E)
Q11 : TC4001BP
Q13 : 2SC2549
Q14 : MC3359P
Q24,32 : 2SB698
Q26 : TA7313AP
D1,2 : MI301
D3,5,10,13,14 : 1S1555
D4 : SR-538D
D6,7 : 1N60
D11 : WZ-081
D12 : 0525.1-Y
2SA1115
2SC2603
2SC2668
2SC2669
2SC2026
2SC2407
2SC2549
2SB698
2SC2212
2SC2347
2SC3019
SCHEMATIC DIAGRAM TR-3500 (T,W Type)

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