

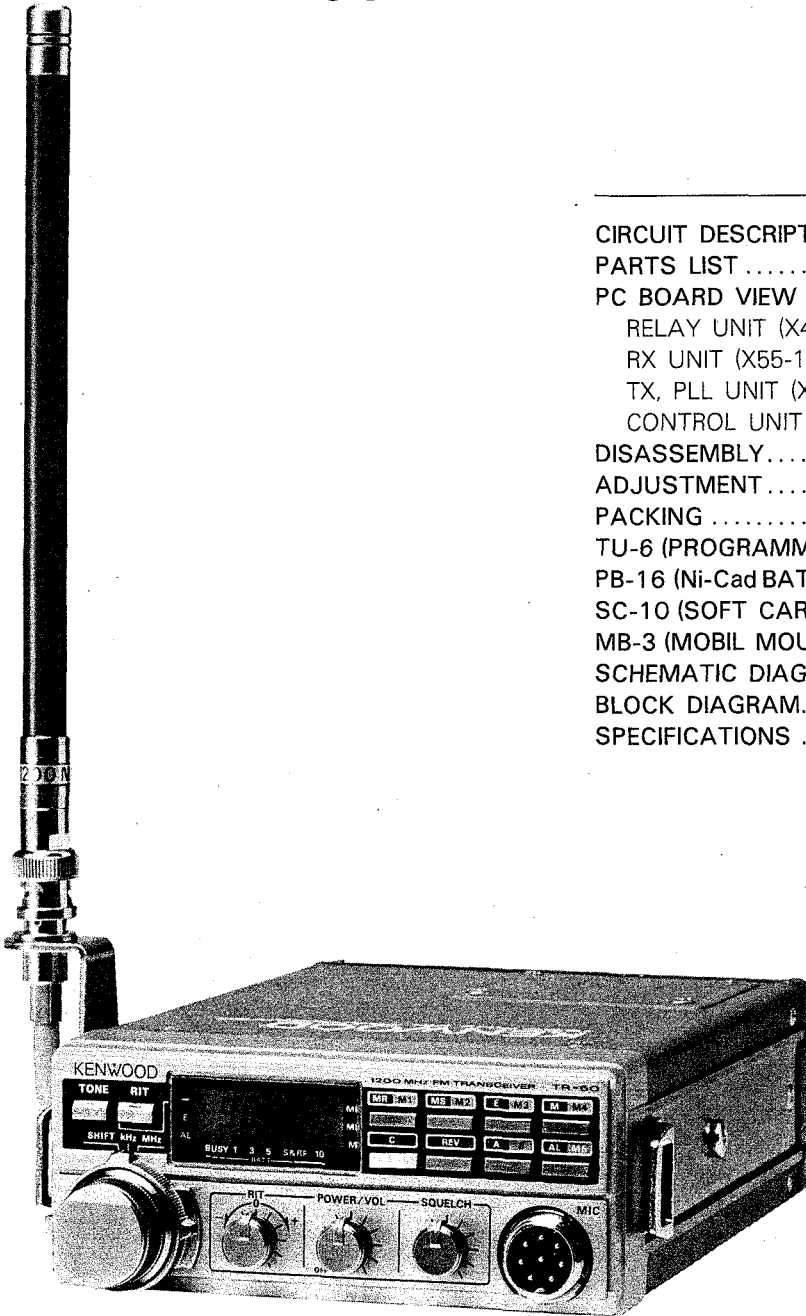
KENWOOD

SERVICE MANUAL

TR-50

MB-3 SC-10
PB-16 TU-6

1200MHz FM TRANSCEIVER



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CIRCUIT DESCRIPTION

Model	Destination	TONE	SHIFT Control
TR-50	K.	Option (TU-6)	-20 MHz TX offset
	W.	1750 Hz TONE Burst	+35 MHz TX offset

K: U.S.A. W: Europe

Table 1 Destination chart

Overall Frequency configuration

The 1.2 GHz amateur band has a 40 MHz wide bandwidth. Normally, a frequency band this wide is usually divided into several band segments, for which PLL (Phase locked Loop) VCO's (Voltage Controlled Oscillators) are Micro-processor Selected. However, in the TR-50, in view of its compact size, this amateur band is fully covered by a highly stable PLL system using only a single VCO operating at a 10 kHz step rate. This frequency configuration is shown in Fig. 1.

The received signal is mixed with the first local oscillator signal (lower heterodyne) to become the 139 MHz first IF (intermediate frequency), then further mixed with the 118.065 MHz second local oscillator signal to produce the 20.935 MHz second IF. This 118.065 MHz second local oscillator signal can be varied by ± 5 kHz or more using the RIT (Receiver Incremental Tuning) control. The 20.935 MHz second IF is mixed with the 20.48 MHz third local oscillator signal (shared in common with the PLL reference oscillator IC) to produce the 455 kHz third IF.

In the transmitter, the reactance-modulated 19.857 MHz signal is amplified and multiplied 7 times to become the 139 MHz FM-modulated RF signal, then mixed with the first local oscillator signal which is used in common with the receiver to produce output within the 1.2 GHz band. The target frequency is amplified up to the required power by a 6-stage microstrip amplifier, then passed through the receiver/transmitter switching relay to be fed to the antenna.

The first local oscillator is PLL synthesized and is common to both the receiver and transmitter. The 20.48 MHz reference oscillator is divided down by 1/4096 to become the 5 kHz comparison signal. The 280.25 MHz to 290.245 MHz VCO oscillator frequency is mixed with the 271.75 MHz local oscillator frequency to yield an 8.5 MHz to 18.495 MHz intermediate PLL frequency, which is further counted down by 1N (where N equals 1700 to 3700) to produce a 5 kHz signal. This 5 kHz signal is compared with the reference 5 kHz signal in the phase comparator, and the comparator output voltage is used to control the VCO oscillator.

The VCO frequency is multiplied by a factor of 4 up to the target frequency and level. At the same time, this circuit controls the level for both transmission and reception.

Circuit configuration

The overall configuration is given in page 32, the block diagram.

The Transceiver can be divided into four basic components, consisting of the Control unit, Relay unit, TX-PLL unit and RX unit. All units are glass epoxy double-sided printed circuit boards, using microstrip techniques, and newly-developed ultra miniaturized parts to increase component mounting density, yielding a compact and high performance radio.

(1) Control unit

This unit uses an 80-pin flat pack 4-bit CMOS microprocessor Q2 (μ PD7514G), which also directly drives the LCD (Liquid Cristal Display). Using its large 4K Bytes of program area effectively, its sophisticated programming permits diversified operating modes and contains all frequency controls.

To make the most of various holding functions, the microprocessor backup mode (data retention function) is used to afford long term data memory. The data for setting the PLL frequency is 16-bit serial output.

Other circuits include Q1 (TC40H004F), which prevents chatter during rotary encoder operation, Q3 (IR2429), which is an A/D converter for displaying the TX RF, RX "S" meter level and BATT levels, and Q4 (TC40H000F), which generates the function "beep" tones.

CIRCUIT DESCRIPTION

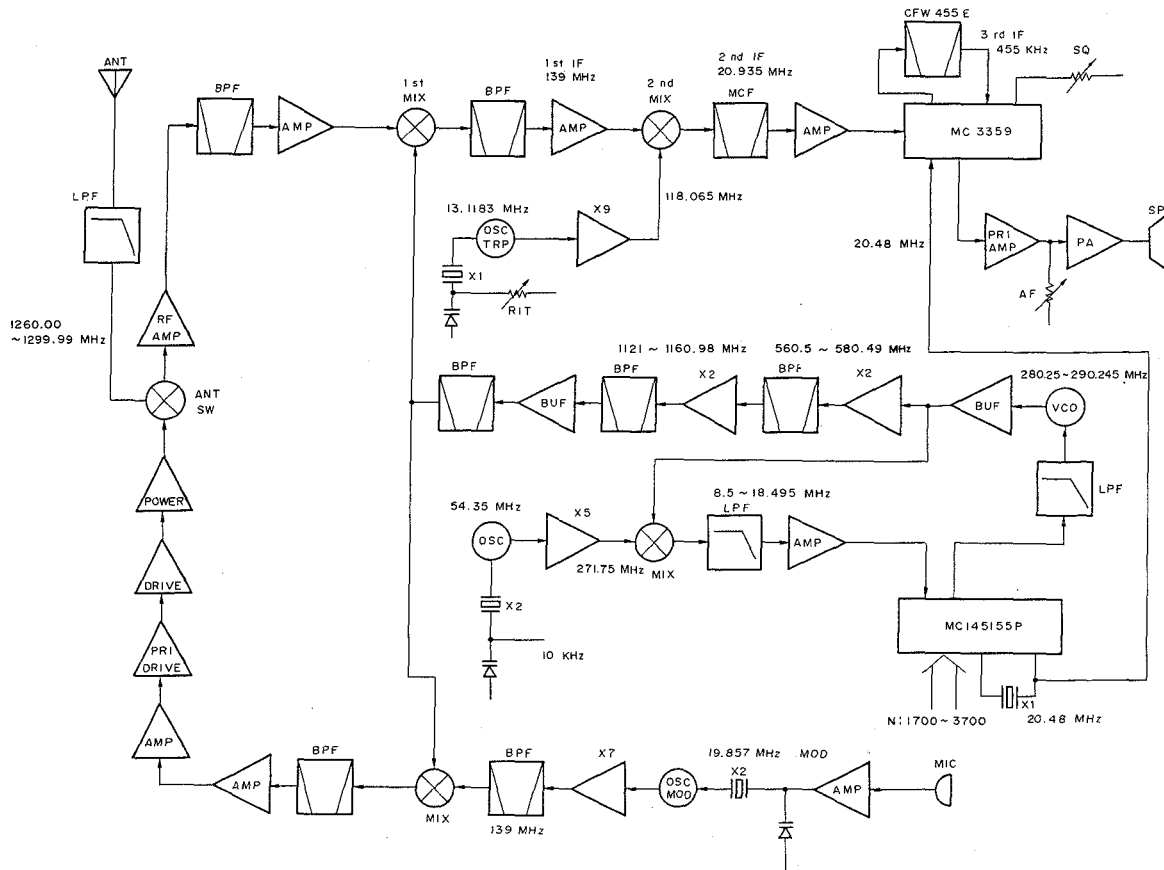


Fig. 1 Frequency-related block diagram

TC40H004F 1/6

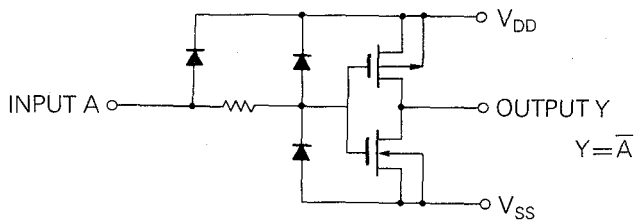


Fig. 2 TC40H004F Equivalent circuit (CONTROL unit Q1)

TC40H000F 1/4

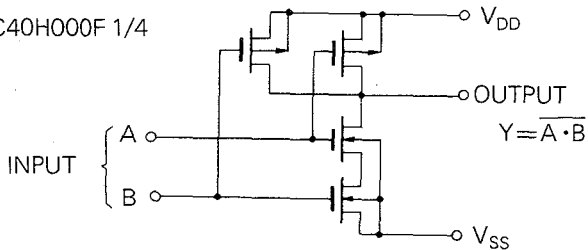


Fig. 3 TC40H000F Equivalent circuit (CONTROL unit Q4)

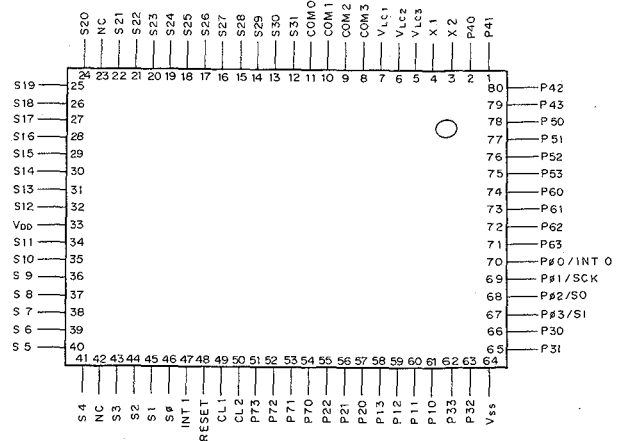


Fig. 4 μPD7514G-030-12 (CONTROL unit Q2)

CIRCUIT DESCRIPTION

PIN No.	PIN NAME	I/O	FUNCTION	PIN No.	PIN NAME	I/O	FUNCTION
1	P41	I	Type return	41	S4	O	LED segment, 10 kHz
2	P40	I	Type return	42	NC	—	
3	X2	—	Crystal oscillator connection pin	43	S3	O	LED segment, 10 kHz
4	X1	—	Crystal oscillator connection pin	44			Open
5	VCL3	I	LED power supply set up pin	45	S1	O	LED segment, MR, MS, M ▶
6	VCL2	I	LED power supply set up pin	46			Open
7	VCL1	I	LED power supply set up pin	47	INT 1	I	External input → R17 → GND
8			Open	48	RESET	I	RESET input. H: active
9	COM2	O	LED common signal output pin	49	CL1	—	System clock oscillator CR pin
10	COM1	O	LED common signal output pin	50	CL2	—	System clock oscillator CR pin
11	COM φ	O	LED common signal output pin	51	P73	I	→ R17 → GND
12			Open	52	P72	I	KEY return RPT.C
13			Open	53	P71	I	KEY return C, REV, A—B, M/M4
14			Open	54	P70	I	KEY return MR/M1, MS/M2, E/M3, AL/MS
15			Open	55	P22	O	Type SCAN, AF TX STOP
16			Open	56	P21	O	Type SCAN, external tone SW
17			Open	57	P20	O	1 MHz step, shift SW scan
18			Open	58	P13	I	BUSY detect
19			Open	59	P12	I	PTT detector
20	S23	O	LED segment, CH (1—5), VFO (A, B), RPT·C (0)	60	P11	I	UN LOCK detector
21	S22	O	LED segment, CH (1—5), VFO (A, B), RPT·C (0)	61	P10	I	OPEN SCAN, BUSYSCAN change detect
22	S21	O	LED segment, CH (1—5), VFO (A, B), RPT·C (0)	62	P33	O	PLL enable. H: active
23	NC	—		63	P32	O	LED ON-OFF. L: ON, H: OFF
24			Open	64	VSS	—	GND
25	S19	O	LED segment, RIT, E, AL ◀	65	P31	O	BZ ON-OFF. H: ON, L: OFF
26	S18	O	LED segment, BUSY	66	P30	O	10 k data. H: +0, L: +10 K
27	S17	O	LED segment, 10 MHz	67	Pφ3/S1	I	RIT ON-OFF detector, H: ON
28	S16	O	LED segment, 10 MHz	68	Pφ2/S0	O	Serial data output
29	S15	O	LED segment, 10 MHz	69	Pφ1/SCK	O	Serial clock output
30	S14	O	LED segment, 1 MHz	70	Pφφ/INTφ	I	Power ON-OFF detector H: ON
31	S13	O	LED segment, 1 MHz	71	P63	O	Type SCAN, 88.5 Hz TONE
32	S12	O	LED segment, 1 MHz	72	P62	I	88.5 Hz TONE SW. L: ON, H: OFF
33	VDD	—	Power supply	73	P61	I	UP Key (Mic) detector. L: active
34			Open	74	P60	I	DOWN Key (Mic) detector. L: active
35			Open	75	P53	O	Key scan M/M4, AL/M5
36			Open	76	P52	O	Key scan MR/M2, REV
37	S8	O	LED segment, 100 kHz	77	P51	O	Key scan MS/M2, C
38	S7	O	LED segment, 100 kHz	78	P50	O	Key scan E/M3, A—B
39	S6	O	LED segment, 100 kHz	79	P43	I	Encoder pulse input E1
40	S5	O	LED segment, 10 kHz	80	P42	I	Encoder pulse input E2.

Table 2 μPD7514G-030-12 Terminal function (CONTROL unit Q2)

(2) Relay unit

This unit is composed of a low-loss 50-ohm coaxial relay for switching between transmission and reception, a printed circuit pattern low pass filter and a low noise microstrip receiver preamplifier Q1

(2SC3358). This pre-amplifier has been especially designed for this wide band application and has superb characteristics, with a noise figure of 3.2 dB within the band and a gain of 8 dB.

CIRCUIT DESCRIPTION

(3) RX unit

The received signal from the Relay unit is fed to a 3-pole helical resonator which attenuates the out of band signal component and the target signal alone is amplified by low-noise amplifier Q1 (2SC3358) before being fed to the first mixer Q2 (2SC3356).

The first local oscillator signal (1121 MHz to 1160.99 MHz) produced by the TX-PLL unit is delivered to J4 of the RX unit, passed through the wide band filter circuit, and is then applied to mixer Q2, to produce the 139 MHz first IF signal. This IF signal is passed through the band-pass filter (BPF) consisting of L2 and L3, and is amplified by low-noise GaAs FET Q3 (3SK97). This signal is passed through BPF L4 to L6, and is then applied to gate 1 of the second mixer amplifier Q4 (3SK97).

The second local oscillator circuit is made up of Q10 (2SC2347) and Q11 (2SC2668), and is provided with a voltage follower RIT circuit. This circuit can track a station whose frequency has drifted since the reception frequency will be 118.065 MHz after multiplication by a factor of 9. This second local oscillator signal is input to gate two of Q4 (3SK97), where the signal is mixed with the first IF (139 MHz) to produce the second IF signal (20.937 MHz), then passed through a 2-stage MCF (monolithic crystal filter) (L8). This is amplified by Q5 (2SC2669) before being input to Q7 pin 18 (MC3359P).

The 20.48 MHz reference oscillator frequency from Q17 (MC145155P) on the TX-PLL unit is amplified by Q12 (3SK73GR) as the third local oscillator frequency, then wave-shaped before being fed to Q7 pin 1 (MC3359P) where the incoming IF signal is mixed with the second injection signal (20.937 MHz) to produce the third IF signal (455 kHz). Amplification and other operations (Squelch, Limiting, Quadrature Detection, etc.) for the 455 kHz third IF signal are basically those used in our other current FM transceivers, and employ field-proven circuitry into which minor improvements have been incorporated. The transmitter uses a microphone amplifier circuit with excellent limiter characteristics consisting of Q13 and Q14 (NJM4558S), a crystal oscillator Q15 (2SC2347) (operating at 19.857 MHz), for direct FM modulation and an amplifier and multiplier with a multiplication factor of 7, consisting of Q15 (2SC2347), Q16 and Q17 (2SC2668).

Item	Rating
Nominal center frequency (fo)	20,935 MHz
Pass bandwidth	fo ±7.5 kHz or more at 3 dB
Attenuation bandwidth	fo ±25 kHz or less at 40 dB fo ±45 kHz or less at 60 dB
Guaranteed attenuation	70 dB or more within fo ±1 MHz spurious level=35 dB or more at fo-fo+500 kHz 80 dB or more at fo ±(890~930 kHz)
Ripple	1.0 dB or less
Loss	2.0 dB or less
Input and output impedance	1.1 kΩ // 0.5 pF

Table 3 MCF (L71-0251-05) (RX unit L8)

Item	Rating
Center frequency of 6 dB bandwidth	Within 455 kHz ±1.5 kHz
6 dB bandwidth	±9 kHz or more
50 dB bandwidth	±18 kHz or less
Ripple (within 455 kHz ±8 kHz)	2 dB or less
Guaranteed attenuation (within ±100 kHz)	40 dB or more
Loss	6 dB or less (455 kHz)
Input and output impedance	1.5 kΩ
Weight	1.5 g

Table 4 Ceramic discriminator (L72-0347-05) CFW455D (RX unit L14)

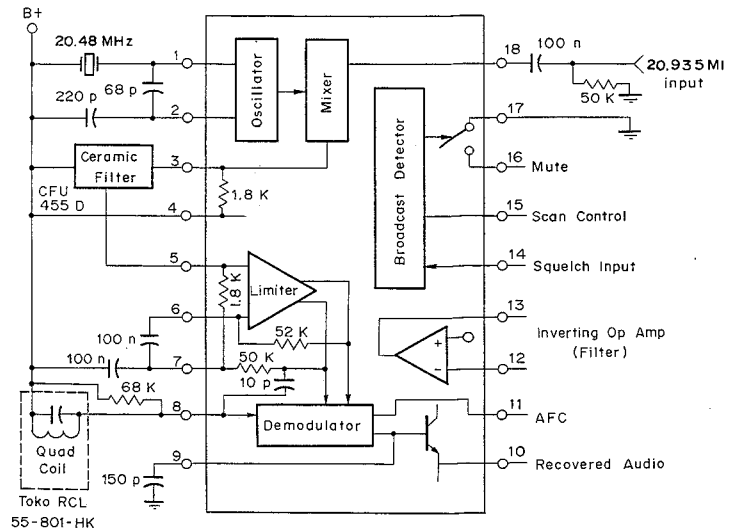


Fig. 5 MC3359 Block diagram (RX unit Q7)

CIRCUIT DESCRIPTION

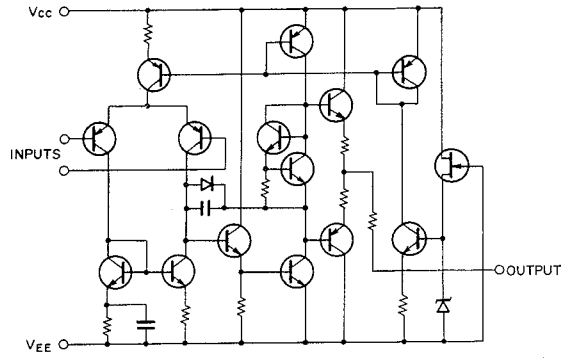
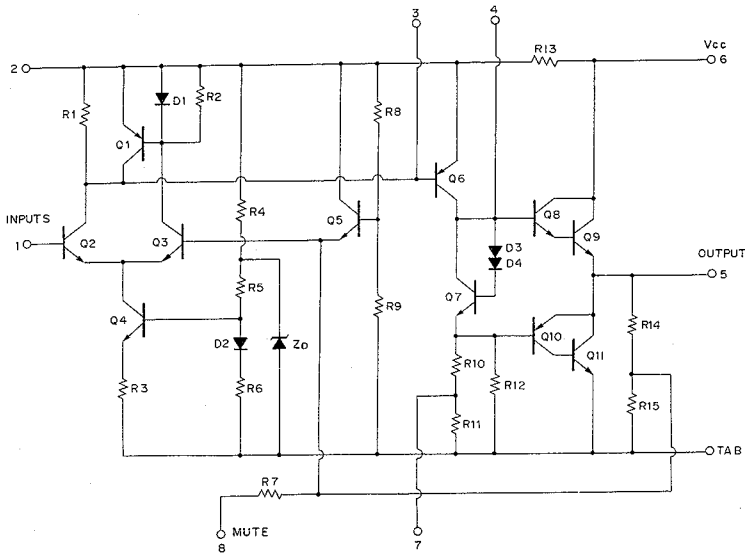


Fig. 6 μPC575C2 Equivalent circuit (RX unit Q19)

Fig. 7 NJM4558S Equivalent circuit (RX unit Q13,14)

	VCBO	VEBO	ICBO	Ic	Pc	Po	Tj	Ta
Condition				Ic	Tc=25°C	f=860MHz VCC=13.5V Pi=0.1W		25°C
Rating	35V	3V	50 μA	250mA	8.3W	1.25W	200°C	

Table 4 2SC2558 Max. rating (TX, PLL unit Q1)

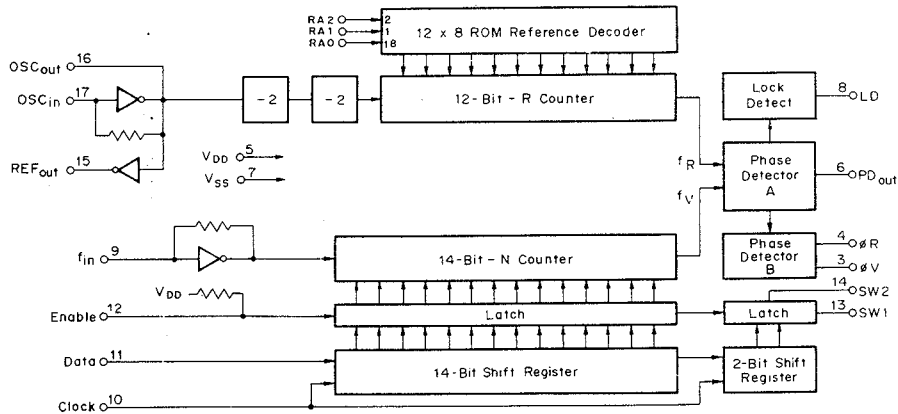


Fig. 8 MC145155P Block diagram (TX, PLL unit Q17)

CIRCUIT DESCRIPTION

(4) TX-PLL unit

As can be seen in Fig. 1 frequency configuration, the PLL circuit is used in common for both the transmitter and receiver. The VCO uses Q11 (2SK125) in a highly stable Colpitts oscillator circuit operating at output frequency of from 280.25 to 290.245 MHz.

The local oscillator is composed of Q20 (2SC2347), two third-overtone crystals (X2: 54.350 MHz) and Q19 (DTC114Y) switching transistor for switching in 10 kHz steps. This switching operation is controlled by the microprocessor on the Control unit. If the displayed (target) frequency is odd, a local oscillator frequency (multiplied by a factor of 5) of 271.725 MHz is used, whereas if it is even, a frequency of 271.75 MHz is used. This VCO frequency signal is mixed with the local oscillator frequency signal at mixer Q15 (2SC2026) to produce the 8.5 MHz to 18.495 MHz IF signal, which in turn is passed through a low-pass filter, then amplified by Q16 (2SC2347) up to a level sufficient to drive PLL IC Q17 (MC145155P) at the next stage before being input to Q17 pin 9.

The VCO oscillator signal is buffer amplified by Q10 (2SC2026), then multiplies by Q9 (2SC2026) by a factor of 2, and further doubled by Q8 (2SC3355) to produce

the first local oscillator frequency of 1121 MHz to 1160.99 MHz. Q7 (2SC3355) amplifies the signal up to the transmission level. During reception, Q7 is off. Q9 (2SC2026) stops PLL operation to prevent illegal transmission output if the PLL unlocks, and Q14 (2SC2603) turns off. L6 and L7 are a 2-pole helical resonator and serve as a band-pass filter which eliminates unnecessary signals. The transmitter is made up of a 2 DBM (Double Balanced Mixer) circuit consisting of Schottky diodes D5~D8 (1SS99) and their matching transformer. The FM modulated 139 MHz IF signal from the RX unit and the 1121 MHz to 1160.99 MHz first local oscillator frequency signal are input to the DBM circuit and mixed there to produce the final 1260 MHz to 1299.99 MHz output frequency. Unwanted spurious signal components are then eliminated by helical resonator band-pass filter L3. The desired signal is amplified by Q6, Q5, Q4 (2SC3358), Q3 (2SC3357), Q2 (MRF559) and Q1 (2SC2558) up to the final output level before being fed to the Relay unit. All stages of this circuit use microstrip line construction and operate in either Class-A and Class-AB mode. This is a linear, distortion free mode.

LITHIUM BATTERY (W09-0323-05)

SPECIFICATIONS

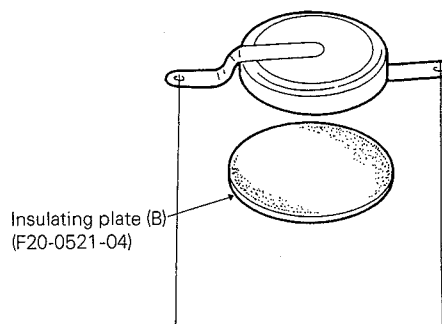
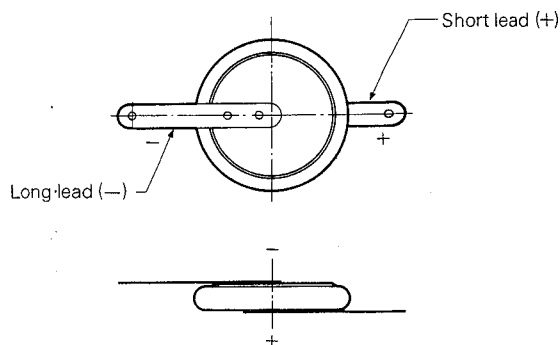
Model and Efficiency

Model	CR2032
Nominal Voltage	3V
Nominal Capacity	170 m Ah
Discharge Stop Voltage	2.0 V
Dimensions	Diameter 20.2 mm
	High 3.2 mm
Weight	3 g

Replacement procedure

When replace the back-up battery read as follows.

1. Remove the upper and lower cases, then pull out the panel.
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 switch is on.

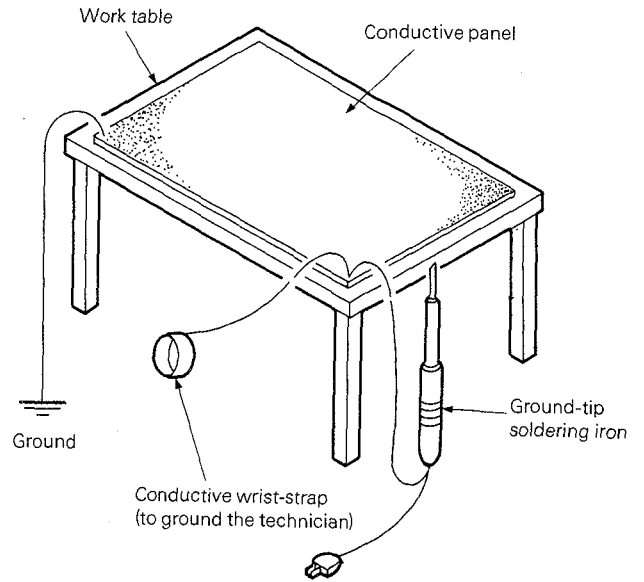


CIRCUIT DESCRIPTION

PRECAUTIONS FOR HANDLING GALLIUM ARSENIDE FET'S

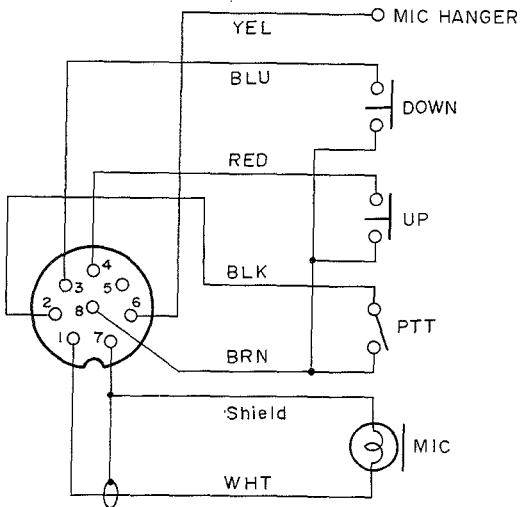
The gallium arsenide FET (3SK97) used in this device is easily damaged by static electricity. Take careful note of the following points when soldering and handling this device.

1. When handling this FET separated from the radio, make sure to first discharge yourself to ground.
2. Use a grounded-tip soldering iron.
3. Ground the FET while soldering-in.
4. Cover the work table with a conductive, grounded panel to insure an adequate static discharge path.

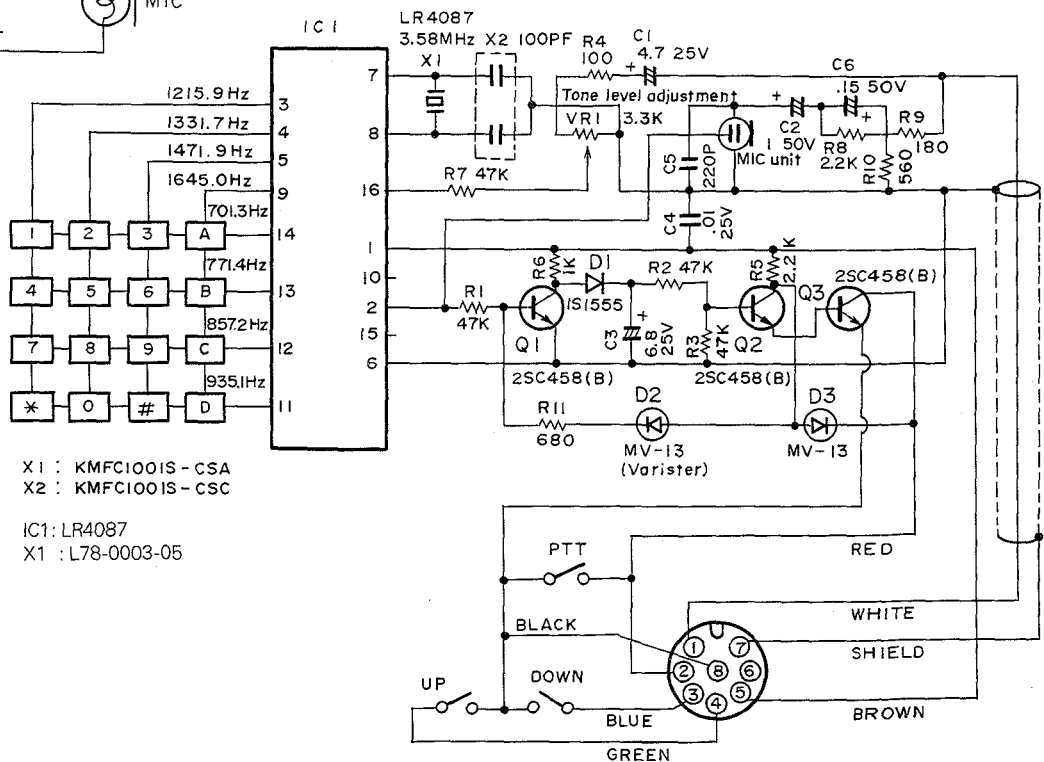


ACCESSORY MICROPHONE

(T91-0349-05) W type



(T91-0332-05) K type

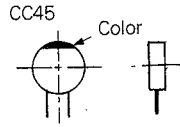


PARTS LIST

CAPACITORS

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

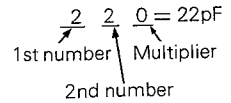
- 1=Type..... ceramic, electrolytic, etc.
- 2=Shape..... round, square, etc.
- 3=Temp. coefficient
- 4=Voltage rating
- 5=Value
- 6=Tolerance



• Capacitor value

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

1 0 3 = 0.01 μF



• Temperature Coefficient

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

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

Example CC45TH = -470 ± 60 ppm/°C

• Tolerance

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

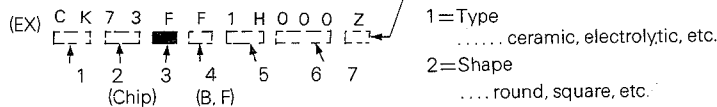
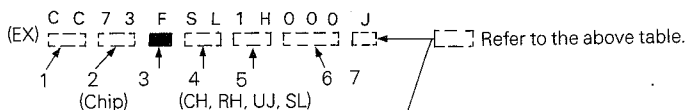
Code	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

Less than 10 pt

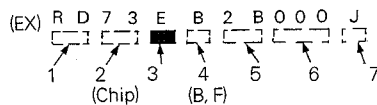
• Rating voltage

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	—	

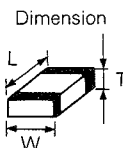
• Chip capacitors



• Chip resistor (Carbon)



• Carbon resistor (Normal type)



Dimension

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

Dimension

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

Rating wattage

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

Model	Destination	RELAY unit	CONTROL unit	RX unit	TX, PLL unit
TR-50	K.	X41-1560-11	X53-1400-11	X55-1390-11	X-56-1480-00
	W.	X41-1560-61	X53-1400-61	X55-1390-61	

PARTS LIST

N: New parts

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

TR-50 GENERAL

PART NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE NO		
			011	061											
A01-0984-03	N*	CASE(TOP)	1	1											
A01-0985-03	N*	CASE(BOTTOM)	1	1											
A20-2533-03	N*	PANEL ASS'Y	1	1											
A21-0787-04	N*	ORNAMENTAL PANEL(A)	1	1											
A21-0786-04	N*	ORNAMENTAL PANEL(B)	1	1											
A23-1483-03	N*	REAR PANEL ASS'Y	1	1											
A23-1484-05	N*	REAR PANEL	1	1											
B05-0706-14	N*	SP GRILE CLOTH	1	1											
B05-0736-04	N*		1	1											
B07-0652-03	N	SIDE ESCUTCHEON(L)	1	1											
B07-0653-03	N	SIDE ESCUTCHEON(R)	1	1											
B10-0670-04	N*	FRONT GLASS	1	1											
B40-3553-04	N*	MODEL NAME PLATE	1	1											
B41-0450-04	N*	CAUTION LABEL	1	1											
B41-0649-04	N*	CAUTION LABEL	1	1											
B42-2374-04	N*	LABEL(CASE TOP)	1	1											
B46-0410-00	*	WARRANTY CARD	1	1											
B50-4177-00	N	INSTRUCTION MANUAL (K/W)	1	1											
D21-0806-04	*	SHAFT	1	1											
D23-0706-04	N	FLANGE COLOR	1	1											
D40-0628-02	N	ANTENNA MECHANISM ASS'Y	1	1											
E20-0381-03	N*	TERMINAL PLATE	1	1											
E30-1794-05	N	DC CABLE ASS'Y	1	1											
F07-0854-05	N*	BATTERY COVER	1	1											
F20-0521-04	*	INSULATING PLATE	1	1											
F20-0510-04	*	INSULATING PLATE	2	2											
G01-0821-04		COIL SPRING	10	10											
G02-0505-05		KNOB FITTING SPRING	3	3											
G02-0504-04		PLATE SPRING	1	1											
G02-0547-04	N	END SPRING	2	2											
G13-0630-14	*	CUSHION	1	1											
G13-0635-04	*	CUSHION(UNDER LED)	1	1											
G53-0511-04	*	PACKING	2	2											
G53-0523-04	*	PACKING	1	1											
H01-4616-03	N*	PACKING	1	1											
H10-2600-02	N*	PACKING FIXTURE(BOTTOM)	1	1											
H10-2572-06	*	PACKING FIXTURE(TOP)	1	1											
H12-1369-04	*	CUSHION(A)	1	1											
H12-1370-04	*	CUSHION(B)	1	1											
H25-0705-04	*	BAG 200X300	1	1											
H25-0077-03	*	BAG	1	1											
J19-1409-04	N*	CABLE FITTING HARDWARE	1	1											
J19-1311-04		FITTING HARDWARE(BATT CASE)	1	1											
J19-1410-04	N*	BELT HARDWARE	1	1											
J19-0715-04	N*	BELT HARDWARE	1	1											
J19-0461-05		BATTERY CASE(6P)	1	1											
J19-0462-05		BATTERY CASE(4P)	1	1											
J21-2566-04	*	SPEAKER MOUNTING PLATE	1	1											

PART NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE NO		
			011	061											
J29-0409-04		SW GUIDE	2	2											
J61-0412-05	N	SHOULDER BAND	1	1											
K21-0776-05	N	KNOB MAIN	1	1											
K21-0775-05	N	KNOB SHIF	1	1											
K23-0749-05		KNOB RIT,AF,SQL	3	3											
K27-0445-05		SQUARE KNOB RIT	1	1											
K27-0446-05		SQUARE KNOB TONE	1	1											
K27-0444-05		KEY KNOB(SILVER)	7	7											
K27-0443-05		KEY KNOB(ORANGE)	1	1											
LR4087		IC	1	1											
N08-0501-14		DRESSED SCREW	1	1											
N09-0687-04	N	ROUND FLAT SCREW	16	16											
N09-0688-04	N	ROUND FLAT SCREW	3	3											
N09-0689-04	N	BIND SCREW	1	1											
N13-0310-04		DRESSED NUT AF,SQL	3	3											
N19-0604-04		SPACER	1	1											
N19-0634-04		SPRING WASHER	1	1											
N24-3015-41	*	E-RING	2	2											
N29-0301-04		STOPER-LING	8	8											
N30-2605-45		PAN HD SCREW	2	2											
N30-2604-46		PAN HD SCREW	2	2											
N30-2004-46		PAN HD SCREW	2	2											
N32-2604-46		FLAT HD SCREW	1	1											
N32-3005-46		FLAT HD SCREW	6	6											
N35-2605-45		ROUND FLAT SCREW	17	17											
N35-2605-46		BIND SCREW(JDINT HARDWARE)	1	1											
N35-2004-45		BIND SCREW	5	5											
N35-2004-45		BIND SCREW	3	3											
N35-3004-46		BIND SCREW	2	2											
N35-3006-46		BIND SCREW	1	1											
T07-0237-05		SPEAKER	1	1											
T90-0344-05	N	ANTENNA	1	1											
T91-0332-05		MICROPHONE MC-48	1	1											
T91-0349-05	N	MICROPHONE	1	1											
W02-0367-05	N	ROTARY ENCODER	1	1											
W09-0002-05	N	DUMMY BATTERY	1	1											
W09-0342-05	N	BATTERY CHARGER	1	1											
W09-0344-05	N	BATTERY CHARGER	1	1											
W09-0343-05	N	NI-CD BATTERY ASS'Y (PB-16)	1	1											
W09-0326-05	N	LITHIUM BATTERY	1	1											
X41-1560-11	N*	RELAY UNIT	1	1											
X41-1560-61	N*	RELAY UNIT	1	1											
X53-1400-11	N*	CONTROL UNIT	1	1											
X53-1400-61	N*	CONTROL UNIT	1	1											
X55-1390-11	N*	RX UNIT	1	1											
X55-1390-61	N*	RX UNIT	1	1											
X56-1480-00	N*	TX/PLL UNIT	1	1											

PARTS LIST

RELAY UNIT (X41-1560-XX) -11:K, -61:W

PART NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE NO
			011	061	
AFG05F1750A2		IC		1	Q / 2
CC45CH1H020C		CERAMIC 2P 50V	1	1	C / 1
CC45SL1H470J		CERAMIC 47P 50V	1	1	C / 22
CC73ECH1H0R5C		CHIP CAP. 0.5P 50V	2	2	C / 5, 7
CC73ECH1H1R5C		CHIP CAP. 1.5P 50V	1	1	C / 2
CC73ECH1H020C		CHIP CAP. 2P 50V	1	1	C / 3
CC73ECH1H100D		CHIP CAP. 10P 50V	1	1	C / 4
CC73ECH1H101J		CHIP CAP. 100P 50V	1	1	C / 6
CK73EB1H102K		CHIP CAP. 1000P 50V	9	9	C / 8, 9, 10, 11, 13, 14, 15
CK73EB1H103K		CHIP CAP. 0.01 50V	1	1	C / 16, 17
C05-0334-05	N	MICRO WAVE TRIMMER	1	1	TC / 2
C05-0062-05		TRIM.CAP. 6P	2	2	TC / 1, 3
C90-1248-05		ELECTRO 1 50V	1	1	C / 20
C90-0868-05		ELECTRO 10 16V	1	3	C / 19, 23, 24
E04-0154-05		RF COAX. CONNECTOR	2	2	J / 1, 2
E06-0858-05		8P METAL SOCKET	1	1	J / 3
E11-0401-05		EARPHONE JACK EXT.SP	1	1	J / 4
E18-0352-05	N	POWER JACK	1	1	J / 5
E40-3007-05	*	MINI CONNECTOR 2P	1	1	J / 6
E40-3010-05		MINI CONNECTOR 3P	1	1	J / 9
F29-0428-04	N	INSULATING WASHER	1	1	
L33-0683-05	N	CHOKE COIL	1	1	L / 3
L34-1083-09		COIL 1.25T	2	2	L / 1, 2
R073FB2A470J		CHIP RES. 47 OHM 1/10W	1	1	R / 3
R073FB2A101J		CHIP RES. 100 OHM 1/10W	1	1	R / 2
R073FB2A563J		CHIP RES. 56K OHM 1/10W	1	1	R / 1
R05-3429-05	N	POTENTIOMETER 10K(K)	1	1	VR / 1
R05-3430-05	N	POTENTIOMETER 10K(B)	2	2	VR / 2, 3
R12-3451-05		TRIM.POT. 22 OHM	1	1	VR / 4
R12-1433-05		TRIM.POT. 4.7K(B)	1	1	VR / 5
R92-1061-05		JUMPER WIRE	2	2	R / 7, 8
S31-2411-05	N	SLIDE SWITCH	1	1	S / 1
S51-1419-05		RELAY	1	1	RL / 1
U05B		DIODE	1	1	D / 8
1S8133		DIODE	5	5	D / 1, 2, 3, 4, 7
2SA1115(E)	TR	TR	1	1	Q / 4
2SC3358K	TR	TR	1	1	Q / 1
2SC2603(E)	TR	TR	1	1	Q / 3

RX UNIT (X55-1390-XX) -11:K, -61:W

PART NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY		REFERENCE NO
			011	061	
CC45CH1H0R5C		CERAMIC 0.5P 50V	5	5	C / 15, 23, 24, 71, 73
CC45RH1H040C		CERAMIC 4P 50V	1	1	C / 16
CC45CH1H010C		CERAMIC 1P 50V	3	3	C / 68, 80, 119
CC45RH1H050C		CERAMIC 5P 50V	1	1	C / 27
CC45CH1H020C		CERAMIC 2P 50V	2	2	C / 114, 117
CC45RH1H060D		CERAMIC 6P 50V	1	1	C / 109
CC45CH1H040C		CERAMIC 4P 50V	1	1	C / 25
CC45RH1H070D		CERAMIC 7P 50V	6	6	C / 14, 26, 112, 115, 118, 120
CC45CH1H050C		CERAMIC 5P 50V	2	2	C / 18, 81
CC45RH1H080D		CERAMIC 8P 50V	1	1	C / 21
CC45CH1H060D		CERAMIC 6P 50V	1	1	C / 28
CC45RH1H090D		CERAMIC 9P 50V	1	1	C / 74
CC45RH1H100D		CERAMIC 10P 50V	3	3	C / 66, 70, 72
CC45CH1M100D		CERAMIC 10P 50V	4	4	C / 31, 62, 75, 111
CC45CH1H120J		CERAMIC 12P 50V	1	1	C / 104
CC45CH1H220J		CERAMIC 22P 50V	1	1	C / 76
CC45SL1H101J		CERAMIC 100P 50V	1	1	C / 40
CC45CH1H470J		CERAMIC 47P 50V	2	2	C / 107, 108
CC73ECH1H010C		CHIP CAP. 1P 50V	1	1	C / 10
CC73ECH1H020C		CHIP CAP. 2P 50V	3	3	C / 7, 8, 11
CC73ECH1H040C		CHIP CAP. 4P 50V	1	1	C / 9
CE04M1E220M		ELECTRO 22 25V	2	2	C / 105, 168
CK73EB1H102K		CHIP CAP. 1000P 50V	10	10	C / 1, 2, 3, 4, 5, 6, 12
C092M1H102K		MYLAR 1000P 50V	1	1	C / 102
C092M1H152K		MYLAR 1500P 50V	1	1	C / 94
C092M1H222K		MYLAR 2200P 50V	1	1	C / 103
C092M1H472K		MYLAR 4700P 50V	1	1	C / 87
C092M1H153K		MYLAR 0.015 50V	1	1	C / 129
C092M1H223K		MYLAR 0.022 50V	2	2	C / 42, 97
C092M1H333K		MYLAR 0.033 50V	4	4	C / 46, 47, 149, 150
C092M1H104K		MYLAR 0.1 50V	1	1	C / 135
CS15E1VR47M		TANTALUM 0.47 35V	1	1	C / 85
CS15E1E01M		TANTALUM 1 25V	1	1	C / 101
C05-0062-05		TRIM.CAP. 6P	2	2	TC / 1, 2
C90-0837-05		ELECTRO 0.1 50V	2	2	C / 128, 147
C90-0843-05		ELECTRO 0.33 50V	1	1	C / 58
C90-0838-05		ELECTRO 1 50V	10	10	C / 39, 86, 88, 89, 90, 98, 130
C90-0508-05		ELECTRO 2.2 50V	1	1	C / 38
C90-0840-05		ELECTRO 10 16V	4	4	C / 122, 125, 131, 160
C90-0873-05		ELECTRO 4.7 10V	3	3	C / 95, 132, 146
C90-0896-05		ELECTRO 4.60 16V	3	3	C / 50, 138, 143
C90-0854-05		ELECTRO 100 25V	1	1	C / 134
C90-2008-05		ELECTRO 220 16V	1	1	C / 145
C90-2009-05	N	ELECTRO 470 16V	1	1	C / 139
C91-0462-05		CERAMIC 0.0047 50V	11	11	C / 35, 36, 51, 52, 54, 55, 57
C91-0488-05		CERAMIC 0.1 50V	2	2	C / 59, 77, 78, 82
E04-0154-05		RF COAX. CONNECTOR	3	3	J / 48, 49
E29-0455-04		GND TERMINAL	1	1	J / 3, 4, 5
E40-3007-05	*	MINI CONNECTOR 2P	1	1	J / 10
E40-3008-05	*	MINI CONNECTOR 3P	1	1	J / 8
E40-3010-05	*	MINI CONNECTOR 5P	2	2	J / 9, 12
E40-3011-05	*	MINI CONNECTOR 6P	1	1	J / 7
E40-3012-05	*	MINI CONNECTOR 7P	2	2	J / 6, 11

PARTS LIST

PART NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE NO			
			011	061												
E40-3018-05	*	MINI CONNECTOR 13P	1	1											J	13
F10-1323-04	N*	SHIELDING PLATE	1	1												
F11-0875-04	N*	SHIELDING CASE	1	1												
L33-0666-05		CHOKE COIL	3	3											L	11, 12, 13
L34-2034-05		VXO COIL	1	1											L	17
L34-0890-05		TUNING COIL	14	14											L	2, 3, 4, 5, 6, 18, 19, 20, 21, 26, 27, 28, 29, 30
L34-2032-05		TUNING COIL	1	1											L	15
L34-2233-05	N	TUNING COIL	2	2											L	7, 10
L34-2234-05	N	TUNING COIL	3	3											L	22, 23, 24
L34-2135-05		TUNING COIL	1	1											L	25
L40-1021-03		INDUCTOR 1 MH	1	1											L	16
L71-0251-05	N	MCF 20.955MHZ	1	1											L	8
L72-0347-05	N	CERAMIC FILTER 435KHZ	1	1											L	14
L77-1238-05	N	XTAL 13.1183MHZ	1	1											X	1
L77-1239-05	N	XTAL 19.857MHZ	1	1											X	2
L79-0646-05	N	HELICAL BLOCK	1	1											L	1
MC3399P		IC	1	1											Q	7
MC911		DIODE	2	2											D	8, 9
NJM4558S		IC	2	2											Q	13, 14
RD73FB2A470J		CHIP RES. 47 OHM 1/10W	1	1											R	3
RD73FB2A332J		CHIP RES. 3.3KOHM 1/10W	1	1											R	8
RD73FB2A392J		CHIP RES. 3.9KOHM 1/10W	1	1											R	7
RD73FB2A472J		CHIP RES. 4.7KOHM 1/10W	2	2											R	1, 2
RD73FB2A473J		CHIP RES. 47K OHM 1/10W	3	1											R	122
RD73FB2A105J		CHIP RES. 1M OHM 1/10W	1	1											R	123
R12-3444-05		TRIM.POT. 10K OHM	1	1											VR	3
R12-3451-05		TRIM.POT. 22 OHM	2	2											VR	2, 6
R12-3445-05		TRIM.POT. 47K OHM	3	3											VR	1, 4, 5
UPC7808H		IC	1	1											Q	20
UPC575C2		IC	1	1											Q	19
1SV50E		VOLTAGE VARIABLE	2	2											D	7, 10
1S1555		DIODE	8	8											D	3, 4, 11, 16, 17, 18, 19, 20
1S1588		DIODE	4	4											D	1, 2, 5, 6
2SA1115(E)		TR	2	2											Q	6, 8
2SB873(R)	N	TR	2	2											Q	21, 23
2SC2347		TR	2	2											Q	10, 15
2SC2668(Y)		TR	3	3											Q	11, 16, 17
2SC2669(Y)		TR	3	3											Q	5
2SC3356		TR	1	1											Q	2
2SC3358K		TR	1	1											Q	1
2SC2603(E)		TR	6	6											Q	9, 18, 22, 24, 25, 26
3SK73(GR)		FET	1	1											Q	12
3SK97(R2)		FET	2	2											Q	3, 4
3ZD27		THERMISTOR	1	1											R	31

TX, PLL UNIT (X56-1480-00)

PART NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE NO			
			000													
CC45CH1H0R5C		CERAMIC 0.5P 50V	2												C	111, 112
CC45CH1H010C		CERAMIC 1P 50V	2												C	38, 49
CC45SL1H101J		CERAMIC 100P 50V	2												C	66, 67
CC45CH1H020C		CERAMIC 2P 50V	1												C	105
CC45SL1H221J		CERAMIC 220P 50V	1												C	97
CC45CH1H030C		CERAMIC 3P 50V	1												C	45
CC45CH1H050C		CERAMIC 5P 50V	3												C	32, 33, 37
CC45CH1H060D		CERAMIC 6P 50V	2												C	78, 98
CC45CH1H100D		CERAMIC 10P 50V	2												C	43, 44
CC45CH1H150J		CERAMIC 15P 50V	1												C	71
CC45CH1H200J		CERAMIC 22P 50V	3												C	70, 81, 84
CC45CH1H330J		CERAMIC 33P 50V	1												C	101
CC45CH1H560J		CERAMIC 56P 50V	1												C	100
CC45RH1H030C		CERAMIC 3P 50V	2												C	104, 109
CC45RH1H040C		CERAMIC 4P 50V	2												C	108, 110
CC45RH1H080D		CERAMIC 8P 50V	1												C	50
CC45RH1H100D		CERAMIC 10P 50V	2												C	48, 55
CC45RH1H120J		CERAMIC 12P 50V	1												C	122
CC73ECH1H05C		CHIP CAP. 1.5P 50V	2												C	2, 135
CC73ECH1H020C		CHIP CAP. 2P 50V	2												C	20, 26
CC73ECH1H030C		CHIP CAP. 3P 50V	3												C	12, 16, 25
CC73ECH1H080D		CHIP CAP. 8P 50V	1												C	134
CC73ECH1H060D		CHIP CAP. 6P 50V	2												C	22, 23
CC73ECH1H470J		CHIP CAP. 47P 50V	1												C	1
CC73ECH1H101J		CHIP CAP. 100P 50V	3												C	127, 128, 130
CK73EB1H102K		CHIP CAP. 1000P 50V	16												C	3, 6, 9, 11, 13, 15, 17, 19, 21, 24, 27, 34, 36, 42
CM73F2H030C		CHIP MICA 3P 500V	1												C	7
CQ92M1H225K		MYLAR 0.022 50V	1												C	64
CS15E1V0R1M		TANTALUM 0.1 35V	1												C	56
CS15E1C2R2M		TANTALUM 2.2 16V	2												C	58, 118
CS15E1C4R7M		TANTALUM 4.7 16V	3												C	53, 60, 61
C05-0062-05		TRIM.CAP. 6P	5												TC	2, 3, 4, 6, 7
C05-0030-15		TRIM.CAP. 20P	1												TC	8
C05-0031-15		TRIM.CAP. 10P	1												TC	5
C05-0335-05		TRIM.CAP. 4P	1												TC	1
C90-0844-05		ELECTRO 3.3 50V	4												C	5, 10, 14, 18
C90-0840-05		ELECTRO 10 16V	3												C	74, 90, 119
C90-0873-05		ELECTRO 47 10V	8												C	28, 41, 62, 65, 87, 88, 131
C90-2008-05		ELECTRO 220 16V	1												C	94
C90-2010-05		ELECTRO 1000 10V	1												C	52
C91-0462-05		CERAMIC 0.0047 50V	1												C	80
DTC114YF		DIGITAL TR	1												Q	19
E04-0154-05		RF COAX. CONNECTOR	4												J	1, 2, 3, 8
E39-0155-04	*	GND TERMINAL	8													
E40-3007-05	*	MINI CONNECTOR 2P	2												J	7, 9
E40-3008-05	*	MINI CONNECTOR 3P	1												J	6
E40-3010-05	*	MINI CONNECTOR 5P	2												J	4, 5
F11-0877-04	N*	PLI SHIELD COVER	1													
F20-0550-04	N*	INSULATING BOARD	1													
L19-0349-05		TOROIDAL COIL	2												L	4, 5

PARTS LIST

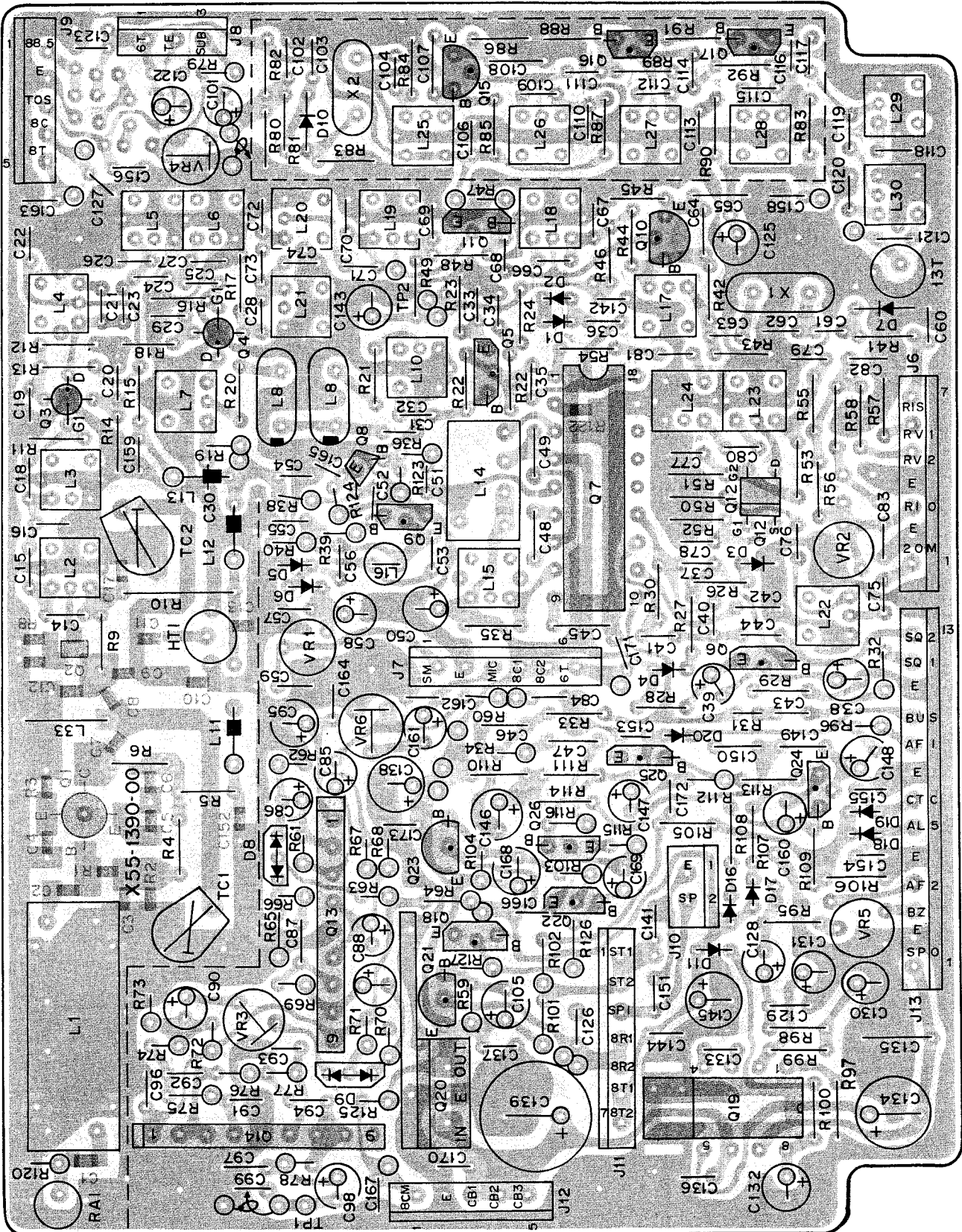
PART_NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE_NO		
			000	001	002	003	004	005	006	007	008	009			
L32-0673-05	N	VCO COIL	1												L / 14
L33-0680-05	N	CHOKE COIL 1 UH	1												L / 26
L34-1115-05	N	TUNING COIL	2												L / 8, 9
L34-1115-05	N	TUNING COIL	2												L / 2
L34-1108-05	N	TUNING COIL	1												L / 11
L34-1109-05	N	TUNING COIL	1												L / 10
L34-1110-05	N	TUNING COIL	1												L / 1
L34-2235-05	N	TUNING COIL	3												L / 22, 23, 24
L34-2236-05	N	TUNING COIL	1												L / 25
L34-2139-05	N	VVO COIL	1												L / 20
L40-2282-01		INDUCTOR 2.2 UH	1												L / 18
L40-4782-14		INDUCTOR 0.47UH	1												L / 12
L40-1092-14		INDUCTOR 1 UH	2												L / 21, 27
L40-1091-03		INDUCTOR 1 UH	1												L / 17
L40-3391-03		INDUCTOR 3.3 UH	2												L / 15, 16
L40-1001-01		INDUCTOR 10 UH	1												L / 19
L40-3391-14		INDUCTOR 3.3 UH	1												L / 13
L77-1260-05	N	XTAL 20.480MHZ	1												X / 1
L77-1261-05	N	XTAL 54.350MHZ	2												X / 2
L79-0648-05	N	HELICAL BLOCK	1												L / 6, 7
L79-0647-05	N	HELICAL BLOCK	1												L / 3
MC145155P* MRF559	N	IC	1												Q / 17
MT26.2J(A,B)		ZENER DIODE 6.2V	1												D / 2
RD73FB2A100J		CHIP RES. 10 OHM 1/10W	2												R / 11, 22
RD73FB2A101J		CHIP RES. 100 OHM 1/10W	1												R / 14
RD73FB2A471J		CHIP RES. 470 OHM 1/10W	2												R / 12, 13
R12-3431-05		TRIM.POT. 22 OHM	1												VR / 2
R12-3445-05		TRIM.POT. 47K OHM	1												VR / 1
S59-1405-05		TACT SW RESET	1												S / 1
OS25.1-Y		ZENAR DIODE	1												D / 10
1SS99		DIODE	4												D / 5, 6, 7, 8
1SS101		DIODE	1												D / 1
1SS133		DIODE	6												D / 2, 3, 4, 11, 12, 14
1SV123		VOLTAGE VARIABLE	1												D / 9
1SV50E		VOLTAGE VARIABLE	1												D / 13
2SA1115(E)		TR	1												Q / 24
2S8498		TR	1												Q / 18
2SC1815(Y)		TR	1												Q / 23
2SC2558KA	N	TR	1												Q / 1
2SC3357	N	TR	1												Q / 3
2SC3358K	N	TR	2												Q / 4, 5, 6
2SC2024	N	TR	2												Q / 7, 8
2SC2603(E)		TR	2												Q / 9, 10, 15
2SC2668(Y)		TR	1												Q / 14, 22
2SC2347		TR	2												Q / 21
2SC1775(E)		TR	1												Q / 16, 20
2SK125		FET	1												Q / 12
2SK30A(O)		FET	1												Q / 11
		FET	1												Q / 13

CONTROL UNIT (X53-1400-XX) -11:K, -61:W

PART_NO	NOTE	NAME & DESCRIPTION	DISTINCTION & QUANTITY										REFERENCE_NO		
			011	061											
B11-0423-04	N*	LIGHT GUIDING PLATE	1	1											
B11-0424-04	N*	REFLECTING SHEET	1	1											
B30-0832-05	N	LAMP 8V 40MA	2	2											
CC73FCH1H200J		CHIP.CAP. 20P 50V	1	1											C / 6
CC73FCH1H300J		CHIP.CAP. 30P 50V	1	1											C / 5
CC73FCH1H350J		CHIP.CAP. 35P 50V	1	1											C / 11
CE04CW1A330M		ELECTRO 33 10V	2	2											C / 18, 21
CK73FF1H223Z		CHIP.CAP. 0.022 50V	2	2											C / 3, 2
CK73FF1E104Z		CHIP.CAP. 0.1 25V	1	1											C / 10
CK73FB1H471K		CHIP.CAP. 470P 50V	2	2											C / 3, 4
CK73FB1H102K		CHIP.CAP. 1000P 50V	6	6											C / 13, 14, 15, 20, 26, 27
CK73FF1H103Z		CHIP.CAP. 0.01 50V	3	3											C / 7, 8, 9
CS15E1C3R3M		TANTALUM 3.3 16V	1	1											C / 17
CS15E1C4R7M		TANTALUM 4.7 16V	1	1											C / 12
C90-0885-05		ELECTRO 10 25V	1	1											C / 28
C90-2011-05	N	ELECTRO 4.7 25V	1	1											C / 16
C90-0868-05		ELECTRO 10 16V	1	1											C / 29
E29-0456-04	N*	LCD CONNECTOR(A)	1	1											J / 15
E29-0457-04	N*	LCD CONNECTOR(B)	1	1											J / 16
FTD1613	N	LED	1	1											V / 1
IR2429		IC	1	1											Q / 3
J19-1412-04	N*	LCD HOLDER	1	1											
J30-0533-04	N	SWITCH SPACER	2	2											
J32-0788-04	N	ROUND BOSS	3	3											
L77-1256-05		XTAL 32.758KHZ	1	1											X / 1
NJM78L06A		IC	1	1											Q / 8
N35-2004-46		BIND SCREW	6	6											
RD73FB2A104J		CHIP RES. 100KOHM 1/10W	11	11											R / 13, 14, 15, 19, 20, 21, 23
RD73FB2A154J		CHIP RES. 150KOHM 1/10W	2	2											R / 30, 46, 47, 48
RD73FB2A274J		CHIP RES. 270KOHM 1/10W	4	4											R / 12, 31
RD73FB2A684J		CHIP RES. 680KOHM 1/10W	1	1											R / 3, 6, 29, 34
RD73FB2A100J		CHIP RES. 10 OHM 1/10W	1	1											R / 17
RD73FB2A471J		CHIP RES. 470 OHM 1/10W	1	1											R / 16
RD73FB2A332J		CHIP RES. 3.3KOHM 1/10W	2	2											R / 1, 2
RD73FB2A472J		CHIP RES. 4.7KOHM 1/10W	1	1											R / 28
RD73FB2A273J		CHIP RES. 27K OHM 1/10W	2	2											R / 3, 4
RD73FB2A473J		CHIP RES. 47K OHM 1/10W	9	9											R / 9, 10, 11, 22, 25, 26, 27
RD73FB2A823J		CHIP RES. 82K OHM 1/10W	1	1											R / 36, 42
R92-1061-05		JUMPER WIRE	2	2											R / 10, 12
R92-0150-05		JUMPER WIRE	1	1											R / 19
S31-2410-05	N	SLIDE SWITCH SHIFT	1	1											S / 11
S40-2443-05		PUSH SWITCH RIT.TONE	2	2											S / 9, 10
S40-2443-05		PUSH SWITCH RIT	1	1											S / 10
S40-2444-05		PUSH SWITCH TONE	1	1											S / 9
S50-1412-05		TACT SWITCH	8	8											S / 1, 2, 3, 4, 5, 6, 7
															R / 8

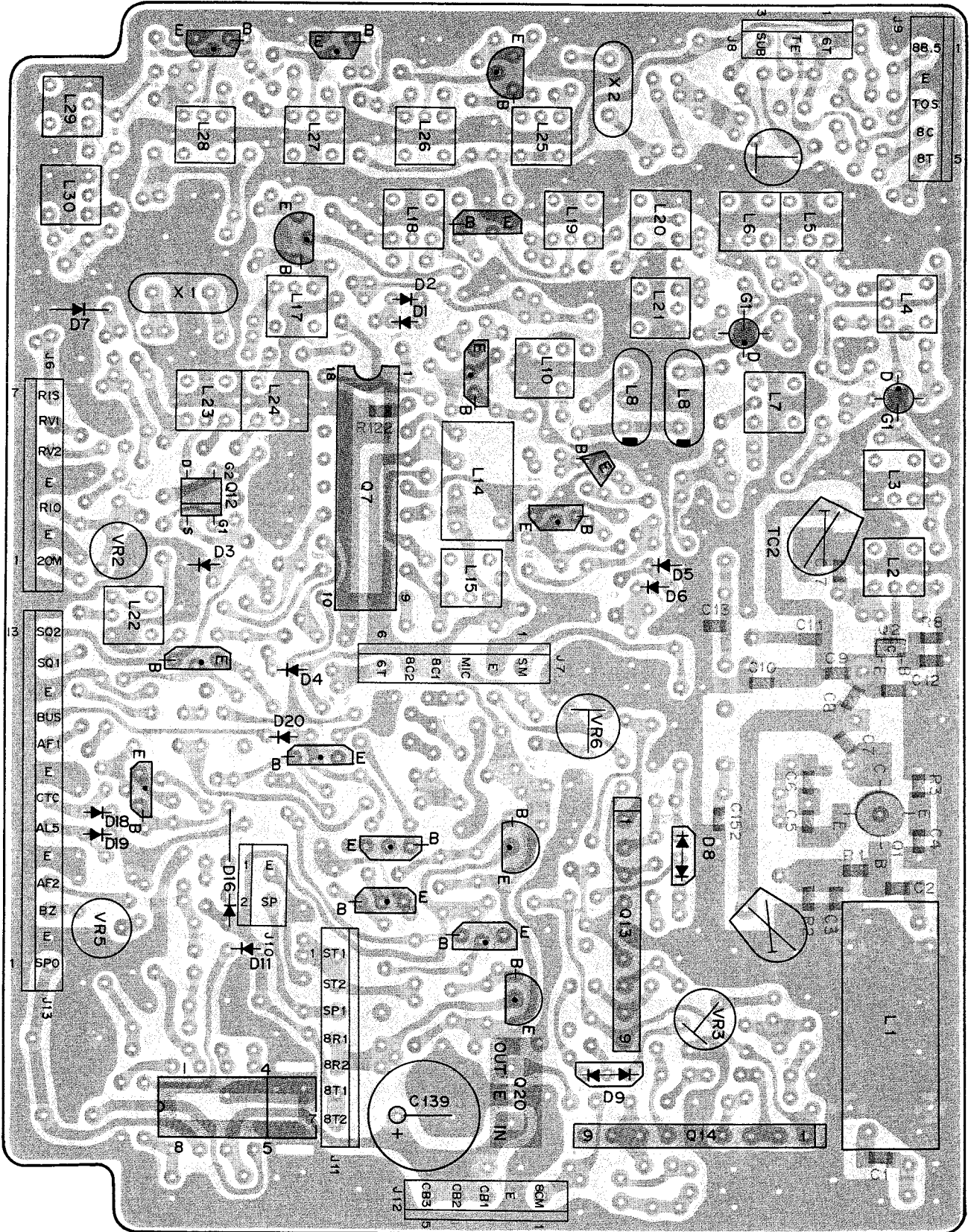
TR-50 PC BOARD VIEW

▼ RX UNIT [X55-1390-XX] [-11:K, -61:W] [Component side view]



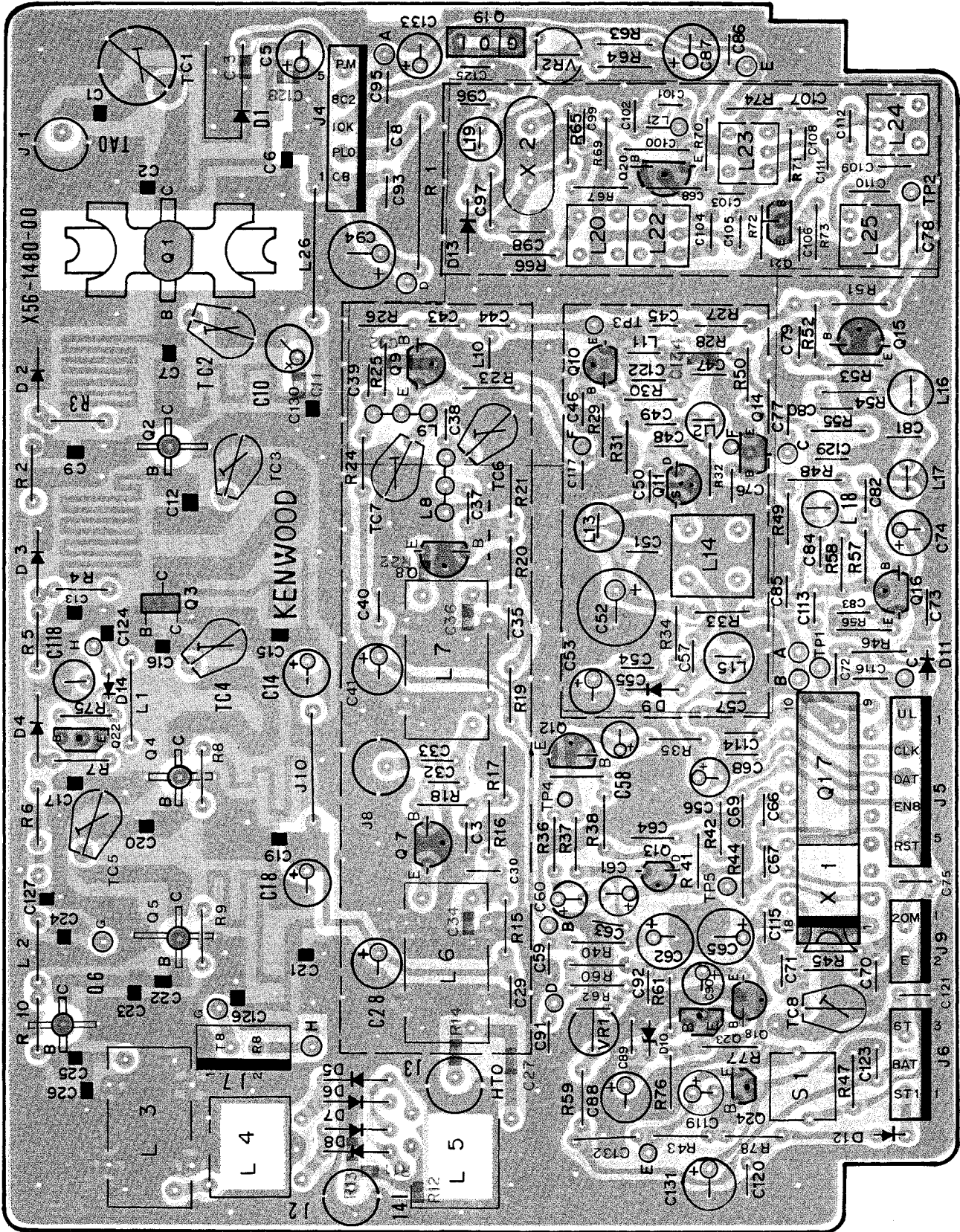
Q1: 2SC3358K Q2: 2SC3356 Q3, 4: 3SK97Q2 Q5: 2SC2669Y Q6, 8: 2SA1115E Q7: MC3359 Q10, 15: 2SC2347
 Q11, 16, 17: 2SC2668 Q12: 3SK73GR Q13, 14: NJM4558S Q19: μ PC575C2 Q20: μ PC7808H Q21, 23: 2SB873
 Q18, 22, 9, 24-26: 2SC2603E D1, 2, 5, 6: 1S1588 D3, 4, 11, 16-20: 1S1555 D7, 10: 1SV50E D8, 9: MC911

RX UNIT [X55-1390-XX] [-11:K, -61:W] [Foil side view]



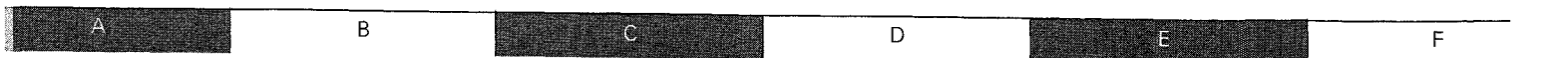
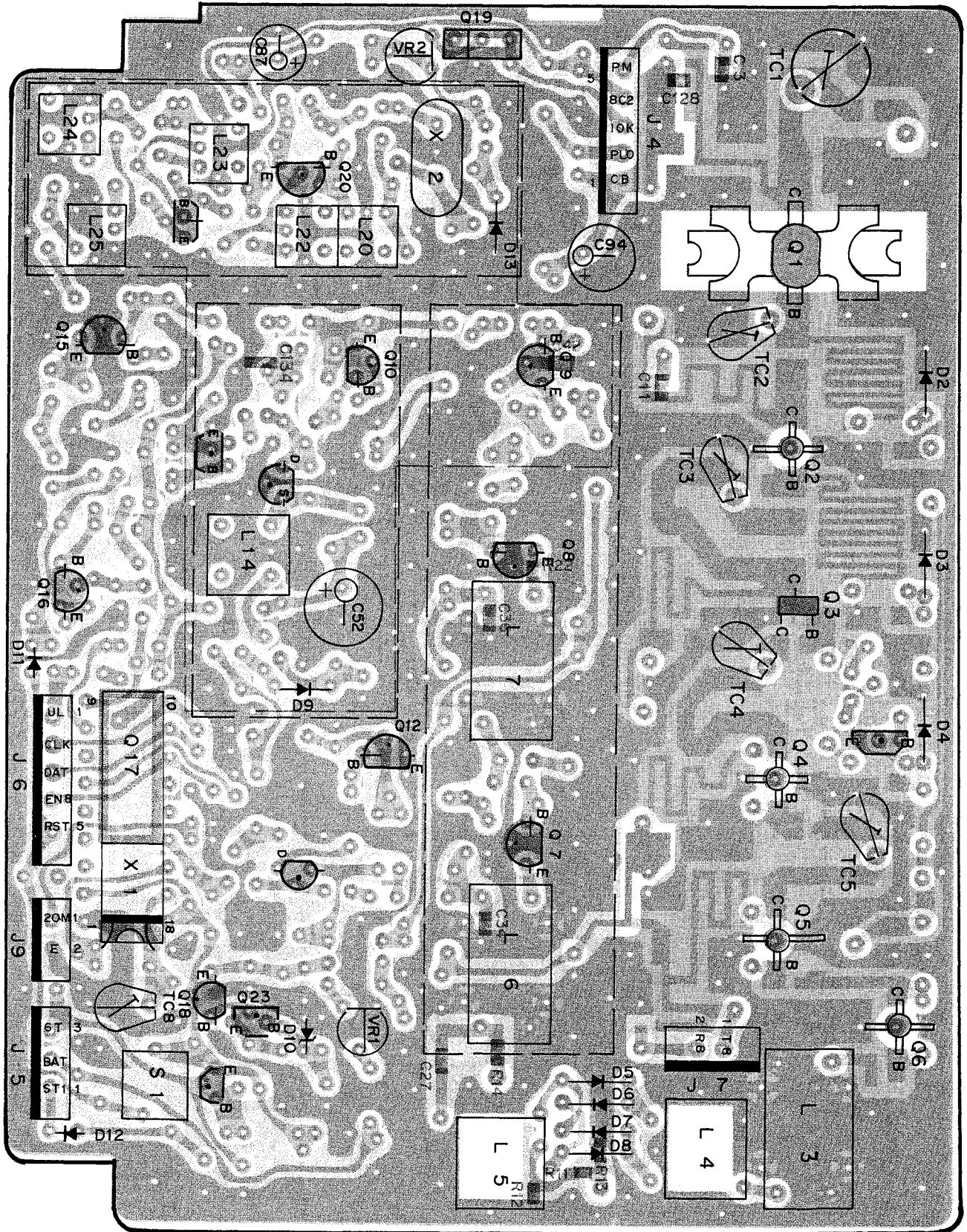
TR-50 PC BOARD VIEW

▼ TX, PLL UNIT [X56-1480-00] [Component side view]

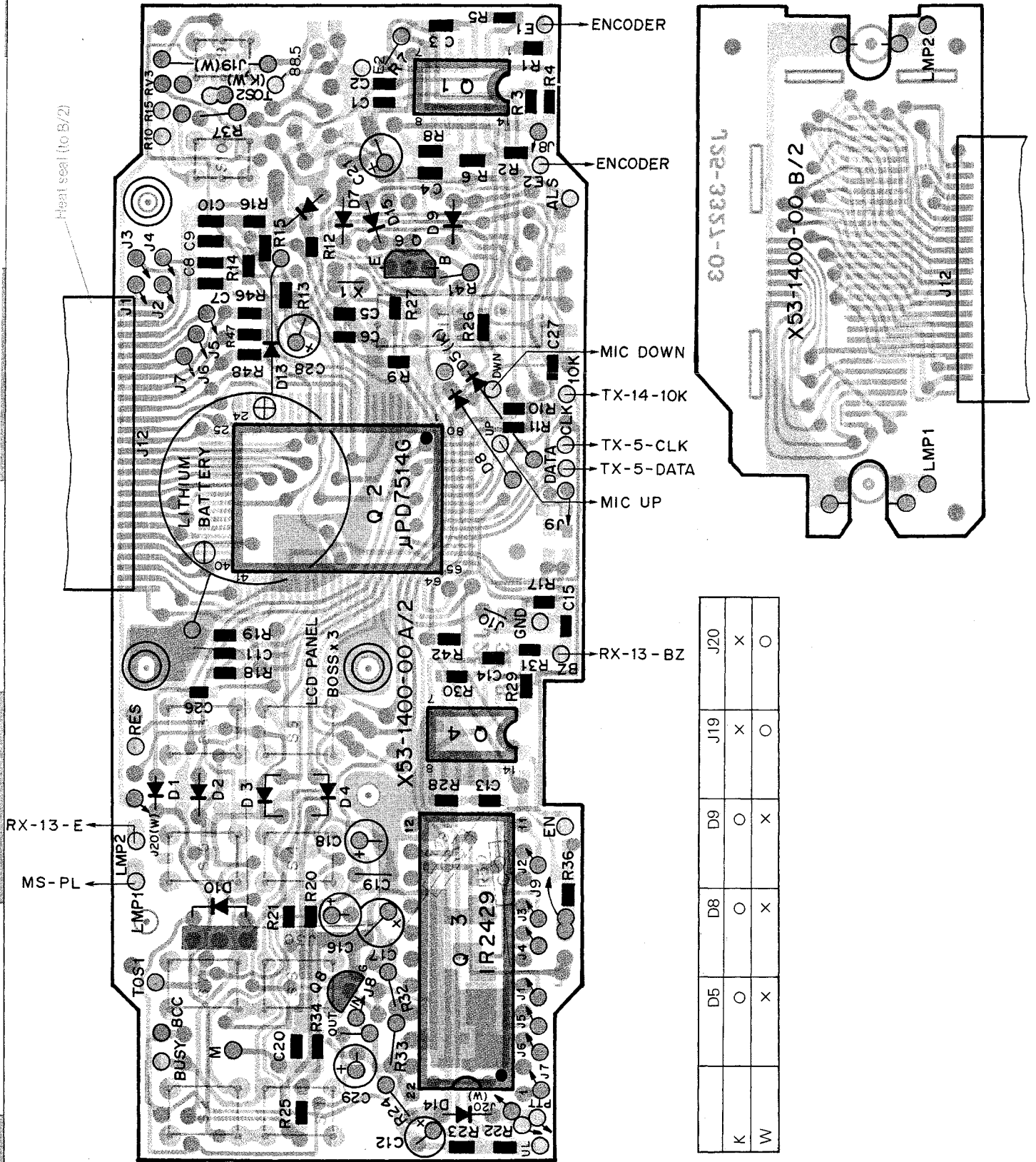


- Q1: 2SC2558KA Q2: MRF559 Q3: 2SC3357 Q4, 5, 6: 2SC3358K Q7, 8: 2SC3355K Q9, 10, 15: 2SC2026 Q11: 2SK125
 Q12: 2SC1775 Q13: 2SK30A(O) Q14, 22, 23: 2SC2603E Q16, 20: 2SC2347 Q17: MC145155P Q18: 2SB698 Q19: DTC114Y
 Q21: 2SC2668Y Q24: 2SA1115E D1: ISS101 D2, 3, 4, 11, 12, 14: ISS133 D5, 6, 7, 8: ISS99 D9: ISV123 D10: 05Z5.1-Y
 D13: ISV50E D15: MTZ6.2J (A,B)

▼ TX, PLL UNIT [X56-1480-00] [Foil side view]



▼ CONTROL UNIT [X53-1400-XX] [-11:K, -61:W] A/2 [Component side view]



	D5	D8	D9	J19	J20
K	○	○	○	X	X
W	X	X	X	○	○

- Q1: TC40H004F Q2: μPD7514G-030-12 Q3: IR2429
- Q4: TC40H000F Q6: 2SA1115E
- O8: NJM78L06A D1~D10, D12~D15: ISS133

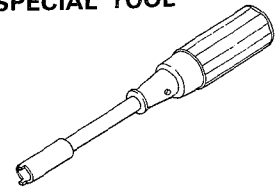
DISASSEMBLY

Front Panel Disassembly

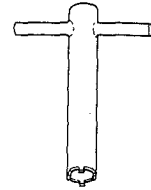
NOTES

1. When assembling ❶, align the Slider switch knob with the notch on ❷.
2. Use the special tool (T-009-01) to assemble/disassemble ❸.
- Use the special tool (T-004) to assemble/disassemble ❹.

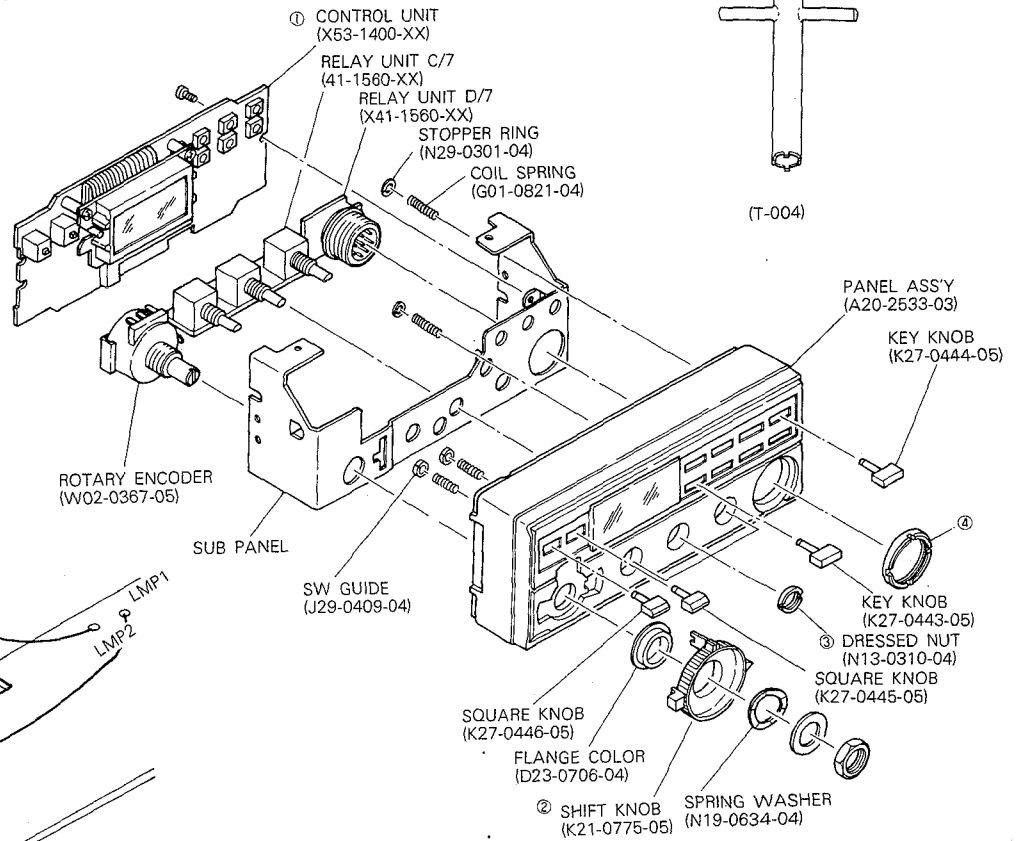
SPECIAL TOOL



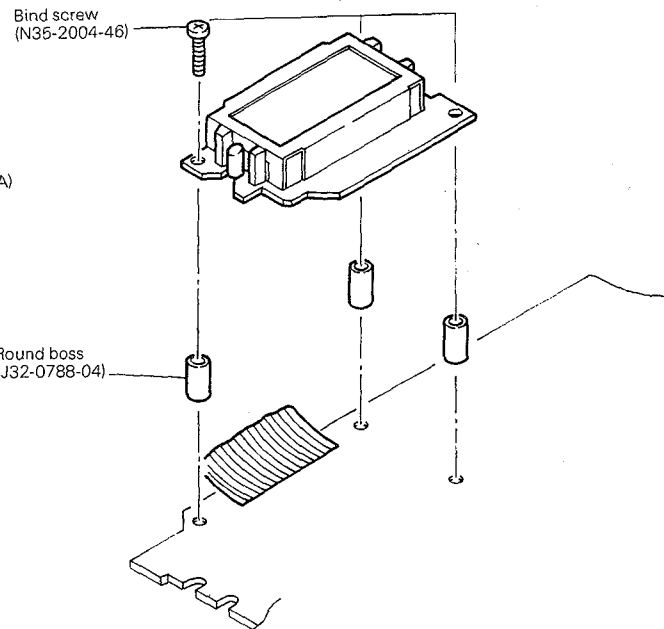
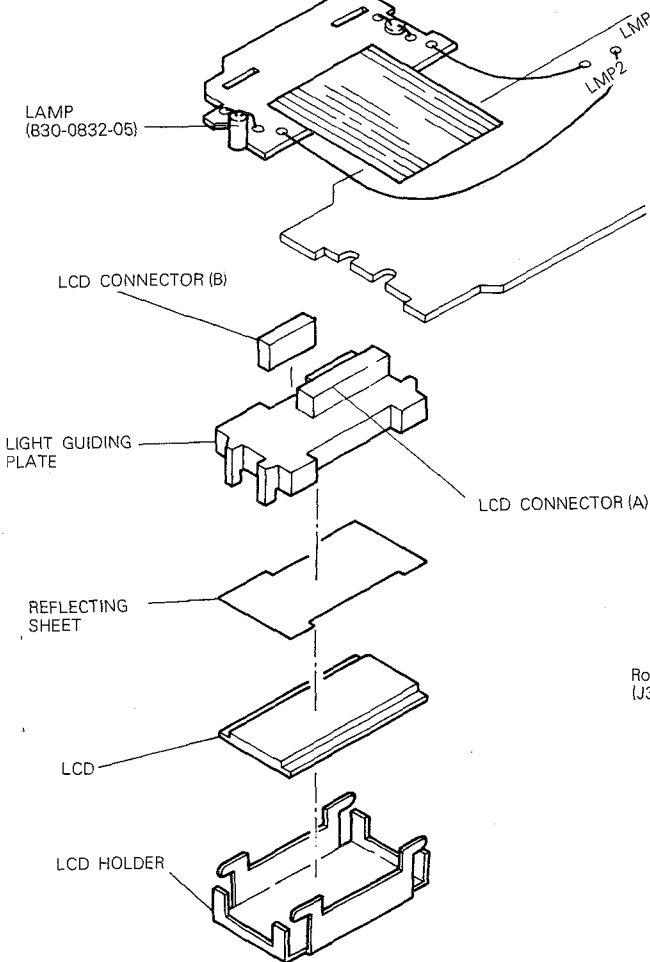
T-009-01



(T-004)



DISASSEMBLY FOR LCD



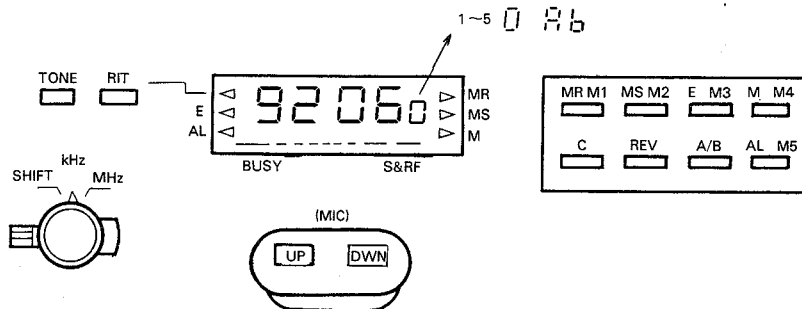
ADJUSTMENT

A. Necessary specification of test-equipment

No.	Test-equipment	Specification
1	AVR DC power supply	Current capacity; over 1 [A] Voltage; variable 8~18 [V] (standard; 13.8 [V])
2	Current metter with low loss cable	Full scall 0.3 [A] and 1.0 [A] analog type.
3	f. counter	Upper frequency rponsece; 1.5 [GHz] approx. 0.2 [ppm] stability
4	Power metter with cable (5D2W, 1m)	Upper frequency rponsece; 1.5 [GHz] Impedance; unbalanced 50 Ω Full scale; 3 [W]
5	Dummy resistor	Impedance; 8 [Ω], more than 3 [W]
6	RF VTVM	Upper frequency rponsece; 1.5 [GHz]
7	Linear detector	Upper frequency rponsece; 1~1.5 [GHz] C/N; better than 60 dB
8	DVM	DC input impedance; more than 1 [M Ω] Full scall; approx. 18 [Volt]
9	Oscilloscope	Frequency rponsece; DC~30 [MHz]
10	AF VTVM	Frequency rponsece; 50 Hz~1 [MHz] Minimum lenge; more than 1 [mV]
11	Spectrum analyzer	Frequency rponsece; DC~4 [GHz]
12	SSG	Upper frequency; more than 1.3 [GHz] Output level; -120 dBm~+20 dBm (0.1 μ V) (1 V) Output impedance; 50 [Ω]

B. Control

Arrangement figure and control function



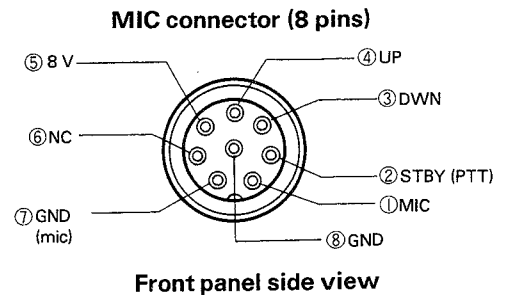
C. Preoperation

Initial setting for check or adjustment

- Power SW ON
- AF VOL MIN
- SQ VOL MIN
- TONE OFF
- SHIFT SW kHz
- RIT OFF

ADJUSTMENT

- When adjusting the trimmers or coils, use non-induced adjusting rod.
- When adjusting the RX section, never transmit to prevent SSG damage.
- Connect MIC connector as shown in right Figure.
- Output level of SSG is indicated as SSG's open circuit.



ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification
		Equipment	Unit	Terminal	Unit	Part	Method	
1. TX IF section (139 MHz)	JP-5 (13T) terminates in 50 Ω load.	RF VTVM	RX	JP-5 (13T)	RX	L26, 27 28, 29 30	Max	Better than 0 dBm
	Transmittes	F.counter				L25	139.000 MHz	±100 Hz
2. Sensitivity in Pre.Amp.	Connect SSG (649.75 MHz, 100 dB). RAO terminates in 50 Ω load	RF VTVM	Relay	RAO	Relay	TC-1	Center position	
						TC-3	Minimum.	
3. Battery indicator	DC power supply voltage sets to 10.3 [V]. LAMP/BATT SW; BATT					POT.1	Sets max. bar indicate to 8th bar.	
4. PLL part a) Input level to PLL IC	Display f.: 1299.98 [MHz]	Oscilloscope	TX	TP-1	TX	L22, 23 24, 25	Maximum «caution» L25 adjustment direction; corror move down	Reference 0.3 [Vrms]
	Display f.: 1260.00 [MHz]					L10	Vary pitch-width	0.35 ~ 1.15 [Vrms]
b) Reference oscillator		F. counter	TX	TP-5	TX	TC-8	20, 480 [MHz]	±100 [Hz]
c) VCO part	Display f.: 1260.00 [MHz]	DVM				TP-4	TX	
	Display f.: 1299.98 [MHz]				Confirm 1.2 ~ 1.8 [V]			
	Display f.: 1280.00 [MHz]	RF VTVM	TP-3				Confirm 0.6 [Vrms]	
Display f.: 1260.00 [MHz]	F.counter						Confirm approx. 280.25 [MHz]	
d) Multiply part	HTO terminates in 50 Ω load. TX at 1260.00 [MHz]	Spectrum analyzer	TX	HTO	TX	TC-6 output side L6, 7	Max.	-3 ~ +5 dBm
	TX at 1299.98 [MHz]					TC-7 input side L6, 7	Max.	-3 ~ +5 dBm
	TX at 1299.98 [MHz]	F. counter	TX	HTO			Confirm 1160.98 [MHz]	
	TX at 1260.00 [MHz]						Confirm 1121.00 [MHz]	
5. Drive/final stage	Transmits at following f.: 1260 [MHz]	RF Power metter			TX	Output side L6, 3 TC-5, 4, 3	Max.	
	1299.98 [MHz]					Input side L6, 3	Max.	
	1280.00 [MHz]					TC-2,1	Max.	
						Relay	TC-2	Max.

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification
		Equipment	Unit	Terminal	Unit	Part	Method	
	1299.98 [MHz]	RF Power meter					Confirm RF output power	Over 1 [W] with less than 0.9 [A] operation 9 current
	1260.00 [MHz]						Confirm RF output power	
6. TX frequency	Pick up TX radio-wave with F. counter. 1260.00 [MHz]	F. counter			TX	VR-2	1260.00 [MHz]	±300 [Hz]
	1260.01 [MHz]					L20	1260.01 [MHz]	
7. RF indicator	Transmits at following f.: 1280.00 [MHz]				TX	D1	Cuppling capacitance by stripline and D1 lead	Full scale
	Both band edge							
8. Modulation	Connect AG (1 kHz, 2 mV) to MIC jack, and transmute at 1299.98 [MHz].							
a) Mic gain					RX	VR-6	±3 [kHz]	
b) Dev.	Increase AG output +20 dB				RX	VR-3	±4.5 [kHz dev]	
	Decrease AG output to privious level.						Confirm ±2.5~3.5 [kHz]	
c) Tone circuit	Tone ON, (W type)				Key board (1/2)	VR-4	Tone frequency 1750 [Hz]	
		Key board (1/2)	VR-5	±3.5 [kHz dev.]				
9. RIT	RIT ON	RF VTVM	RX	TP-2	RX	L18	Max.	
	RIT knob, center	F. counter				L17	118.065 [MHz]	
	RIT OFF					VR-2	118.065 [MHz]	
	RIT knob turn						Confirm ±5 [kHz] variable	
10. Sensitivity	Set f. and output level in following step	SSG oscillo-scope						
	1280 [MHz], 30 dBμ				RX	L15	AF Max.	
	Decrease output level to EX Smetter starting point.		RX	J7-1	RX	TC-1,2 L2~7 L10, 19 L20, 21	Max. *TC-2, L20~21 adjust circlely.	
	1280 [MHz], -4 dBμ		RX	J7-1	RX	L22~24	Max.	
	1260 [MHz], -4 dBμ		RX	J7-1	RX	Center L1	EX Smetter, Max	More than S/N 20 dB
	1299.98 [MHz], -4 dBμ		RX	J7-1	RX	Output side L1		
			RX	J7-1	RX	Input side L1		
11. LCD Bar graph S metter	1280 [MHz], 0 dBμ						Confirm no LCD bar graph. In case still LCD bar graph indicates, adjuste L24 in RX unit (adjust mentdirection — corror moves out).	
	1280 [MHz], 17 dBμ				RX	VR-1	LCD bar graph, full scale	±3 dB
	1280 [MHz], 6 dBμ						Confirm that max. Bar graph points over 2nd Bar.	
	Output level vary 40 to 100 dBμ						All Bar graph indicates.	

ADJUSTMENT

OPERATION CHECKS

Item	Condition	Operation Checks	Specification
1. Operation check	POWER: ON, SQ: ON RESET: ON (TX unit S1)		Display: 60.000 A
	STEP knob; kHz Turn Main knob clockwise: UP counter clockwise: DOWN		in 20 kHz step step up/down
	[A/B] ON Turn Main dial		Display: 95.00 b Step up/down in 10 kHz step
	Connect Mic: Push UP/DOWN botton		Change in 1 step each
	Keep pushing UP/DOWN botton		Change continuously
	Release UP/DOWN botton		Scan start
	Push both botton at same time		Scan stop
	Start scan with UP/DOWN botton Key PTT		Scan stop
2. Memory	display: 60.00	One beep [M/M4] → display: ▶ M → beeps with Morse "R" [MR/M1] → Memorized	
	display: 99.98	One beep [M/M4] → display: ▶ M → beeps with Morse "R" [E/M3] → Memorized	
	display: 80.00	One beep [M/M4] → display: ▶ M → beeps with Morse "R" [MS/M2] → Memorized	
		One beep [M/M4] → display: ▶ M → beeps with Morse "R" [M/M4] → Memorized	
	display: 82.00	One beep [M/M4] → display: ▶ M → beeps with Morse "R", and beeps [AL/M5] → Memorized beeps with Morse "R" [AL/M5] → Memorized One beep	
3. Memory recall		One beep [MR/M1] → Display; ▶ [MR/M1] → Display; 60.00 ₁	
		One beep [MS/M2] → Display; 80.00 ₂	
		One beep [E/M3] → Display; 99.98 ₃	
		One beep [M/M4] → Display; 80.00 ₄	
		One beep [AL/M5] → Display; 80.00 ₅ Display; 82.00 ₅	
	TX	[C]	
4. Memory scan		One beep [MS/M2] → Scan CH1 to CH5	
5. Memory erase		One beep One beep One beep [C] → [C] → [E/M3] → Display; E ◀	
		One beep beeps with Morse "R" One beep [M/M4] → [E/M3] → [MS/M2] → Scan CH1 to CH5.	

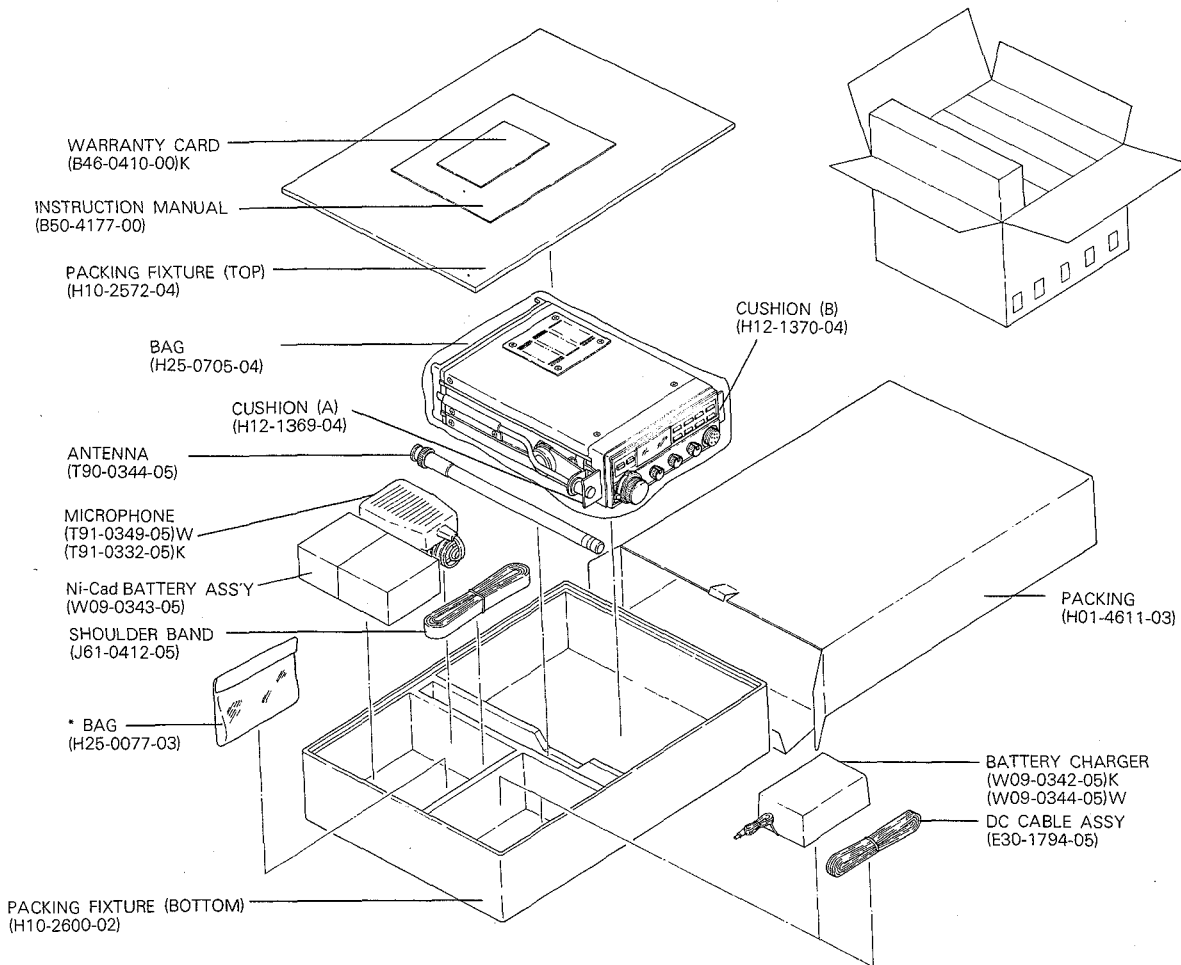
ADJUSTMENT /PACKING

6. Memory erase	SQ OFF		Busy light. Step next CH, after holding for approx. 5 minutes.
	SQ ON PTT ON		Scan-stop
7. Program Scan	Push UP button	One beep One beep One beep [C] → [MR/M1] → [AL/M5] → Display; 80.00	Scan from 80.00 to 82.00. Scan stop
	PTT ON		Scan stop
8. Alert	SQ OFF	One beep [AL/M5] → Display: AL ◀ → Beep tone sounds every 7 minute [AL/M5] → Alert Operation stops.	

PACKING

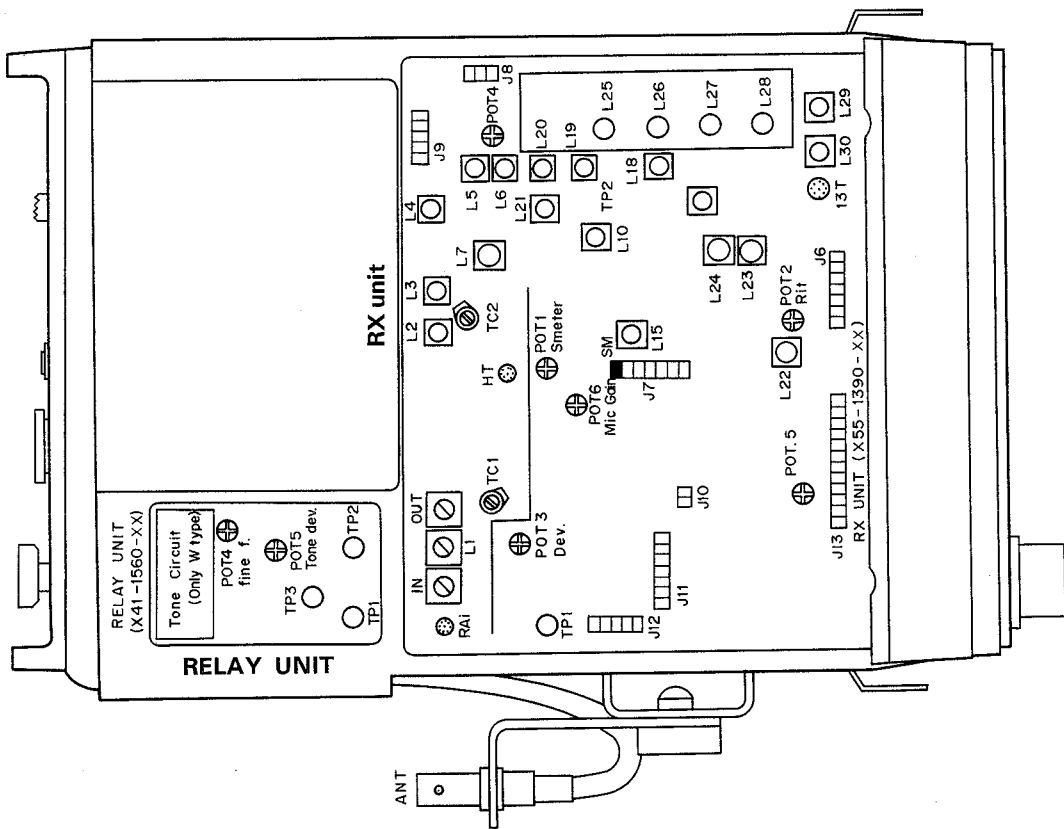
* PART. CONTENTS

NAME	PART. NO.	QUANTITY
DUMMY BATTERY	W 09-0002-05	1

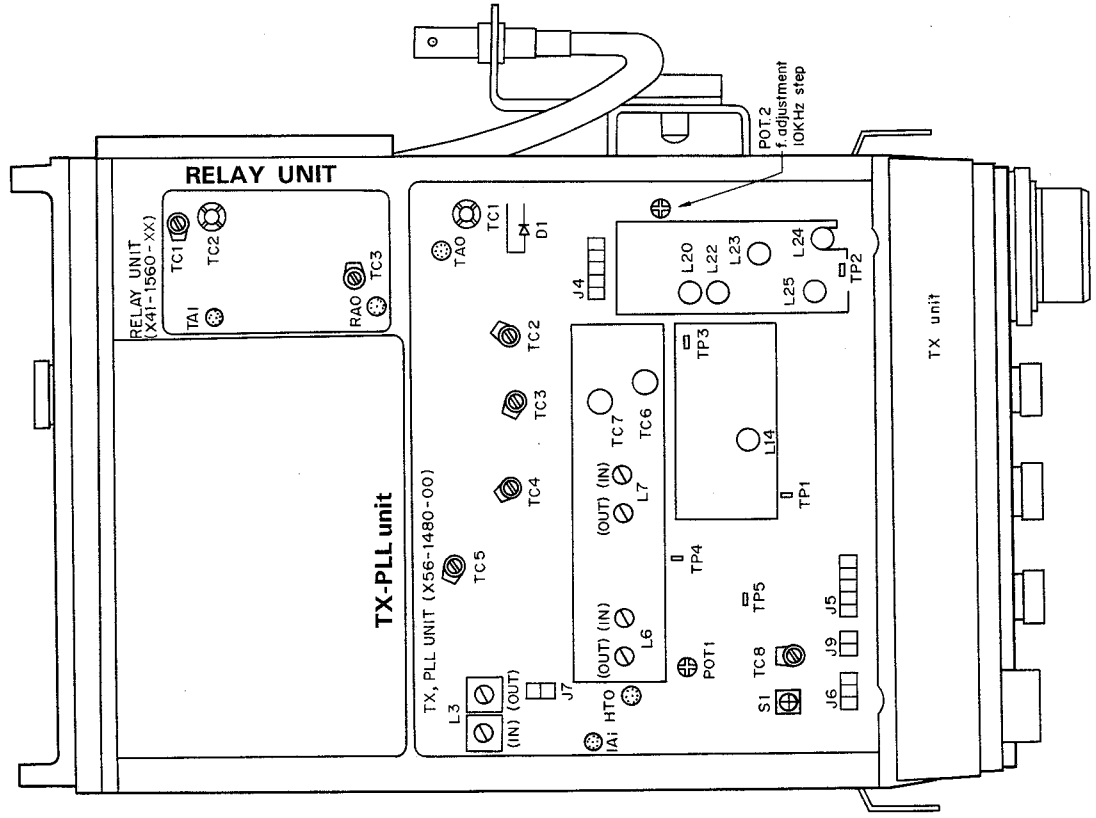


ADJUSTMENT

TOP VIEW



BOTTOM VIEW



TU-6 (PROGRAMMABLE TONE ENCODER)

TU-6 SPECIFICATIONS

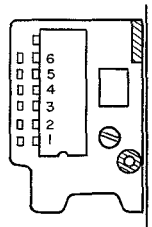
Oscillator frequency 1 MHz ± 0.1%
 Usable frequency range 37 EIA
 Specification Group Frequencies
 (67.0—250.3 Hz)
 Weight 3 g

TU-6 TONE FREQUENCY CHART

Setting the frequency

Cut and connect pins 1—6 of the IC to the PC board pattern by soldering to set the frequency.

- "0" in the table indicates the connection.
- "1" in the table indicates the disconnection.



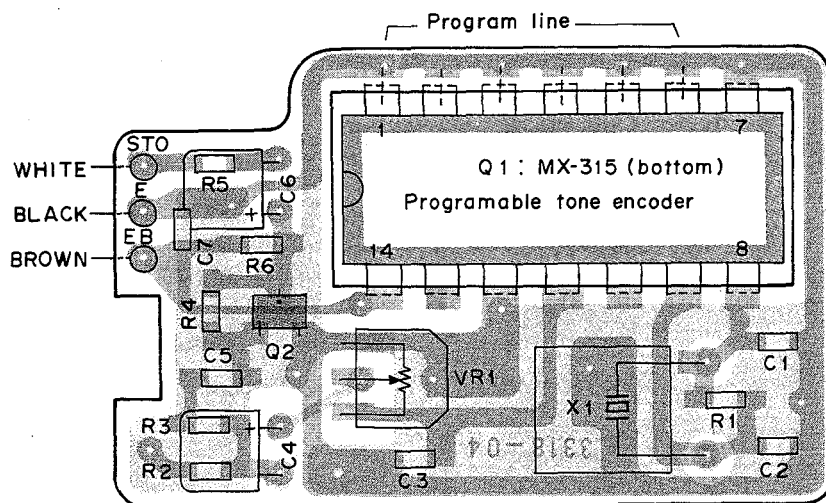
#	EIA Specification Group	Hz	Program Lines (ON...1, OFF...0)						#	EIA Specification Group	Hz	Program Lines (ON...1, OFF...0)					
			1	2	3	4	5	6				1	2	3	4	5	6
1	A	67.0	1	1	1	1	1	1	21	A	141.3	1	0	0	0	0	0
2	B	71.9	1	1	1	1	0	1	22	B	146.2	0	1	1	1	0	1
3	C	74.4	1	1	1	0	1	1	23	A	151.4	0	1	1	1	0	0
4	A	77.0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

TU-6 PARTS LIST

Parts No.	Re- marks	Description	Ref. No.	Q'ty
TU-6 GENERAL				
B50-4178-00	N	Instruction manual		1
G13-0806-04	N	Cushion		1
H25-0029-04		Protective bag		1
X52-1320-10	N	Tone unit		1
TONE UNIT (X52-1320-10)				
CC73FCH1H330J		Chip cap. 33P	C1, 2	2
CE04CW1A100M		Electro 10 10 V	C6	1
CK73FB1E103K		Chip cap. 0.01	C3	1
CK73FB1E223K		Chip cap. 0.022	C5	1
CK73FB1H102K		Chip cap. 0.001	C7	1
C90-0888-05		Tantalum 0.1 16 V	C4	1
L77-0982-05		Crystal 1 MHz	X1	1
RD73FB2A103J		Chip resistor 10 kΩ	R6	1
RD73FB2A105J		Chip resistor 1 MΩ	R1	1
RD73FB2A223J		Chip resistor 22 kΩ	R2	1
RD73FB2A224J		Chip resistor 220 kΩ	R4	1
RD73FB2A473J		Chip resistor 47 kΩ	R3	1
R12-3449-05		Trim. pot. 10 kΩ(B)	VR1	1
R92-0670-05		Chip resistor 0 Ω	R5	1
MX315		IC	Q1	1
2SC1412K(Q) or 2SC2712(Y)		TR	Q2	1

TU-6 PC BOARD VIEW

TONE UNIT (X52-1320-10) Foil side view



MX-315

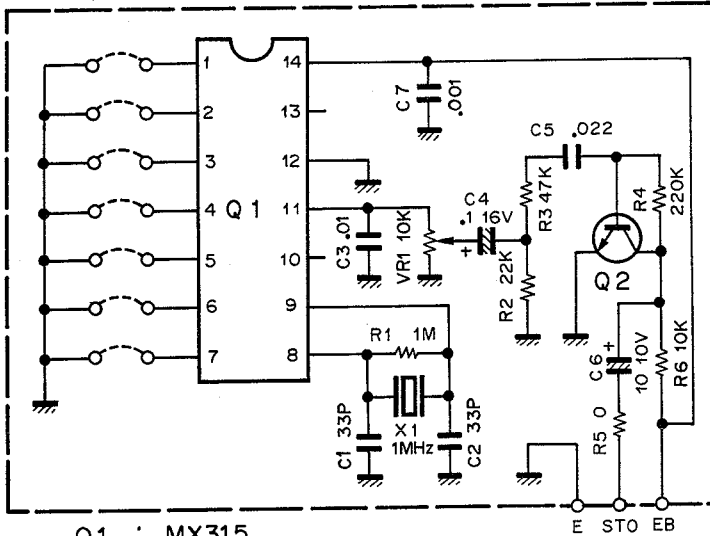
8	1	14	Vdd
4	2	13	Tx ENABLE
2	3	12	Tx ENABLE
T	4	11	Tx OUTPUT
X	5	10	NC
y	6	9	XTAL
Vss	7	8	CLOCK

Q1: MX315 Q2: 2SC2412K(Q) or 2SC2712(Y)

TU-6 (PROGRAMMABLE TONE ENCODER)/PB-16 (Ni-Cad BATTERY)
SC-10 (SOFT CARRYING BAG)/MB-3 (MOBIL MOUNT KIT)

TU-6 SCHEMATIC DIAGRAM

TU-6 (X52-1320-10)



Q1 : MX315
 Q2 : 2SC2412K(Q) or 2SC2712(Y)

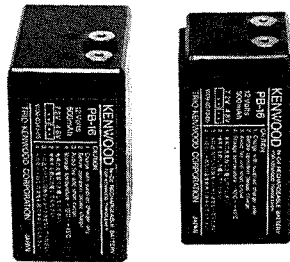
2SC2412K
 2SC2714



PB-16 (Ni-Cad BATTERY)

PB-16 SPECIFICATION

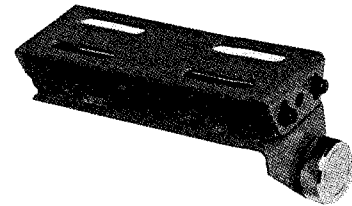
Nominal voltage ... 12 V, 500 mA
 Charging voltage ... 15.5 V
 Charging current ... 125 mA



PARTS LIST

Parts No.	Re- marks	Description
B50-4187-08	N*	Instruction manual
H01-4630-08	N*	Packing carton (inside)
W09-0343-05		PB-16

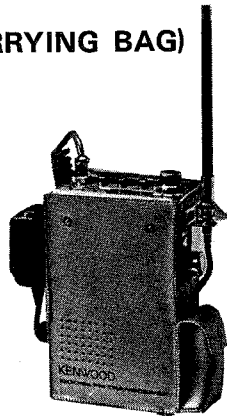
MB-3 (MOBIL MOUNT KIT)



PARTS LIST

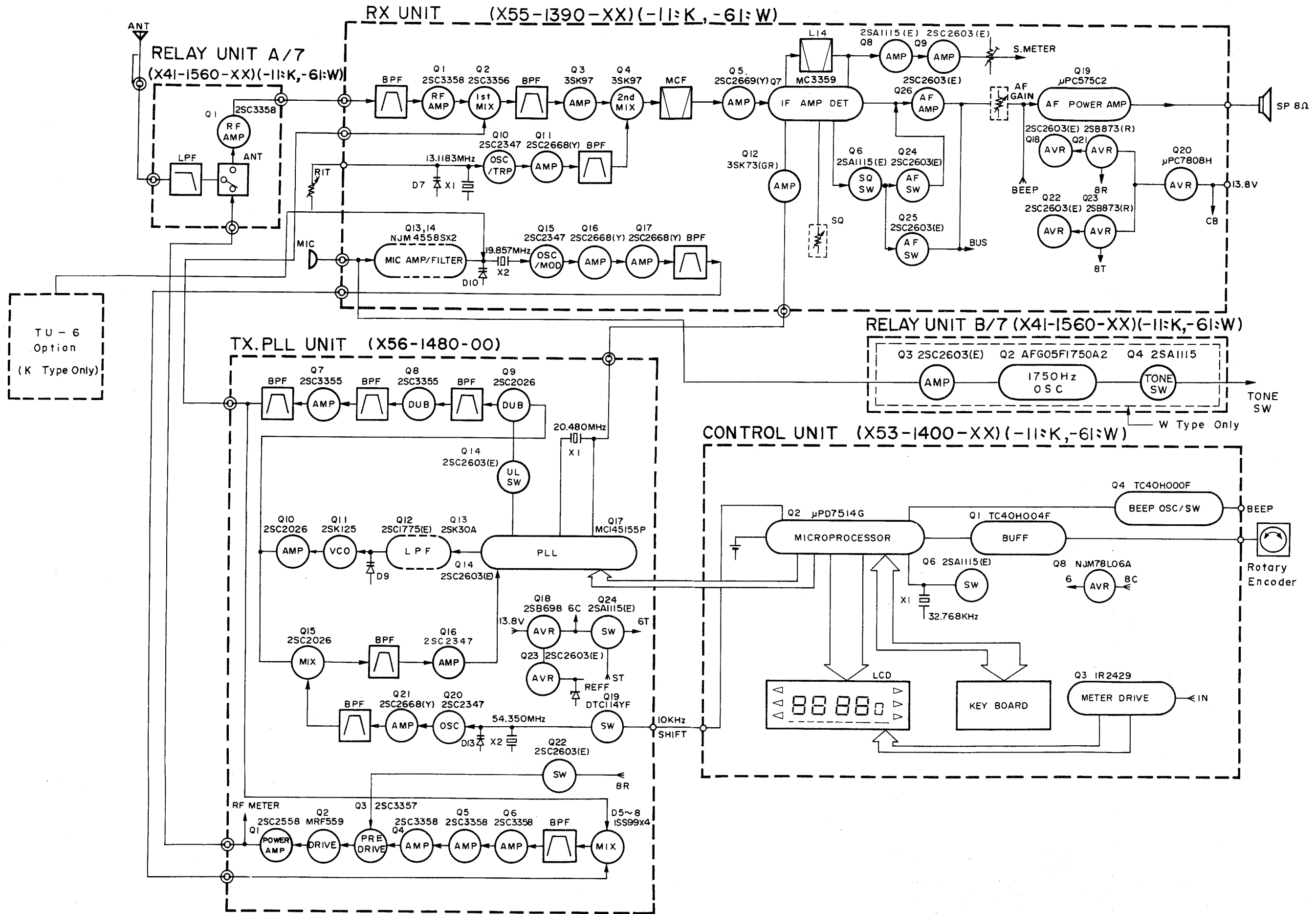
Parts No.	Re- marks	Description
A13-0663-02	N	Mounting bracket ass'y
A13-0664-03	N	Bracket
A19-1414-04	N	Backing metal fitting
G13-0807-04	N	Cushion ×2
J19-1413-03	N	Fix metal fitting
N09-0691-04	N	Taping screw ×4
N14-0527-04	N	Flange nut ×4
N15-1040-45		Flat washer ×4
N33-3006-45		Round flat screw ×4
N35-3006-45		Bind screw ×4
N99-0303-04		Bolt ×4
B50-4189-00		Instruction manual
H01-4632-03	N	Packing carton (inside)
H12-1373-03	N	Cushion
H25-0103-04		Protective bag (main body)
H25-0116-04		Protective bag (accessory)
N09-0008-04		Mounting boss M4
N09-0632-05		Tapping screw M5
N09-0692-04	N	Bolt
N14-0009-04		Nut
N15-1060-41		Washer
N16-0060-46		Spring washer
W01-0401-04		Hex. bar wrench
		M6 ×20
		M6
		for M6 bolt
		for M6 bolt

SC-10 (SOFT CARRYING BAG)



PARTS LIST

Parts No.	Re- marks	Description
B50-4190-08	N*	Instruction manual
H01-4633-08	N*	Packing carton (inside)
H90-0318-08	N*	SOFT CARRYING BAG



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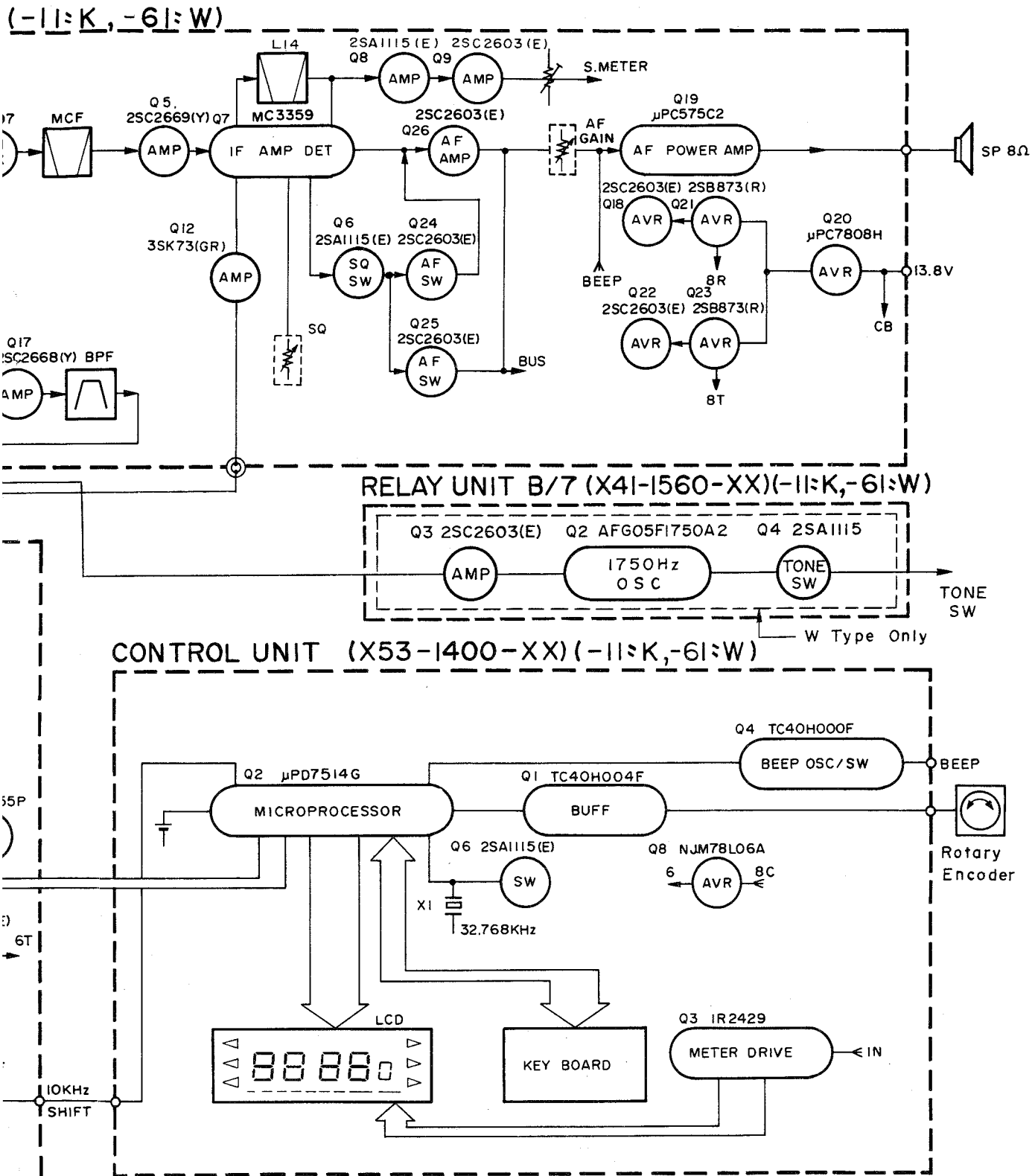
Squelc
Pass b

RIT var
Audio

Note: C

BLOCK DIAGRAM TR-50 TR-50

SPECIFICATIONS



[GENERAL]

Frequency range.....	1260.00 — 1299.99 MHz
Mode.....	F3
Operating temperature.....	-20°C to +50°C
Antenna impedance.....	50 Ω
Supply voltage.....	13.8 V +15%, -25%
Current drain (13.8 V, lamp OFF).....	Approx. 180 mA at standby Approx. 850 mA at transmission (1 W)

Dimensions

(Maximum dimensions including projections).....	123 (157.5) W x 192 (210) D x 51 (51.5) H mm (inch)
Weight.....	Approx. 1,200 g (including antenna and battery)

[TRANSMITTER]

Output power.....	1 W
Modulation.....	Reactance
Maximum frequency deviation.....	\pm 5 kHz
Spurious radiation.....	-40 dB
Microphone impedance.....	500~600 Ω

[RECEIVER]

Circuitry.....	Triple superheterodyne
Intermediate frequency.....	1st IF: 139 MHz 2nd IF: 20.935 MHz 3rd IF: 455 kHz
Receiver sensitivity.....	SINAD 12 dB: -10 dB μ (0.3 μ V) or less S/N ratio: 30 dB or more at 1 μ V input
Squelch sensitivity.....	0.25 μ V or more
Pass band width.....	15 kHz or more (-6 dB) 30 kHz or less (-60 dB)
RIT variable range.....	\pm 5 kHz or more
Audio output.....	1 W or more (10% distortion, 8 Ω load)

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

TRIO-KENWOOD CORPORATION

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

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut Street, Compton, California 90220, U.S.A.

TRIO-KENWOOD COMMUNICATIONS
DIVISION OF TRIO-KENWOOD ELECTRONICS GmbH
Rembrücker Str. 15, 6056 Heusenstamm, West Germany

TRIO-KENWOOD ELECTRONICS, N.V.
Leuvensesteenweg 504, B-1930 Zaventem Belgium

TRIO-KENWOOD (AUSTRALIA) PTY. LTD. (INCORPORATED IN N.S.W.)
4E, Woodcock Place, Lane Cove, N.S.W. 2066, Australia