

# TM-241A/E

## SERVICE MANUAL

# KENWOOD

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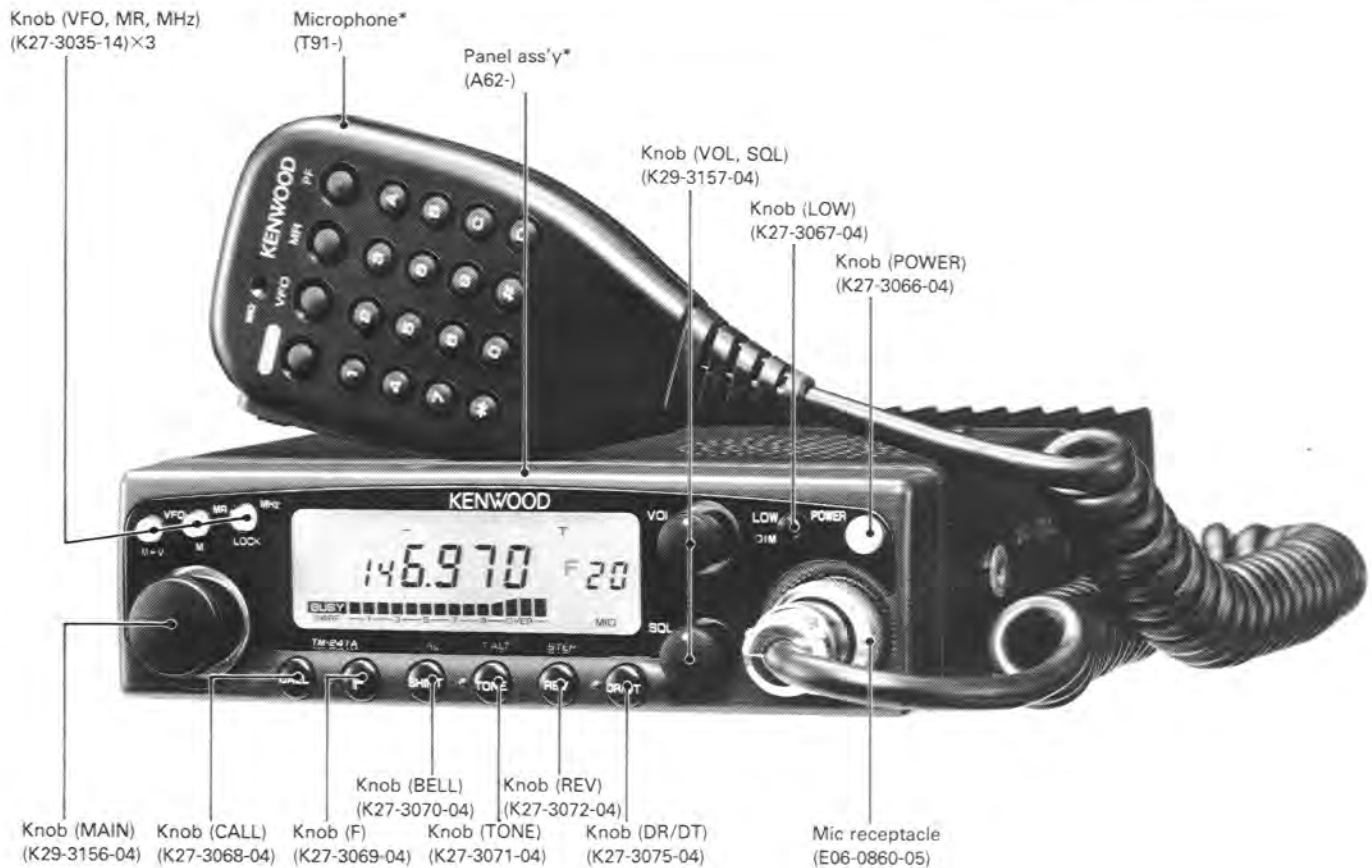


Photo is TM-241A.

\* Refer to parts list on page 12.

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## CIRCUIT DESCRIPTION

	TM-241A			TM-241E	
	K,P	M	M2	E	E2
TX-RX UNIT (X57-369X-XX)	0-11	0-21	0-22	2-71	2-72

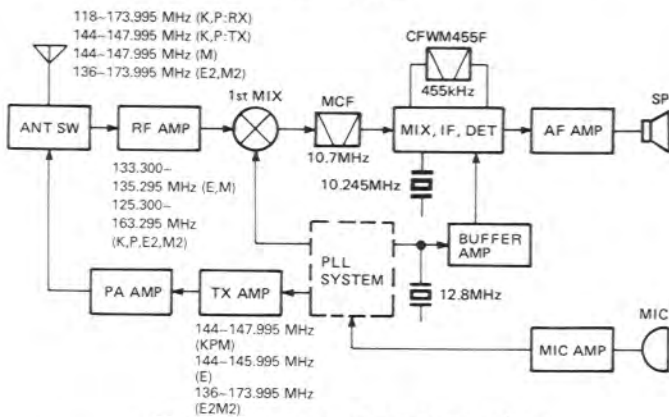
**Table 1**

### Circuit Configuration By Frequency

The TM-241A/E incorporates a PLL synthesizer which uses a digital VFO to allow any channel step of 5, 10, 12.5, 15, 20, or 25 kHz to be selected (See Figure 1).

The receiving system utilizes double-conversion techniques. That is, an incoming signal is mixed down to the 1st intermediate frequency (IF) of 10.7 MHz, using a 1st local oscillator frequency of from 133.300 to 135.295 MHz (E,M), 125.300 to 163.295 MHz (K,P,E2,M2). The 1st IF signal is then mixed with the 2nd local oscillator frequency of 12.8 MHz to generate the 2nd IF of 455 kHz.

The transmitting system consists of a PLL circuit which allows direct modulation and direct frequency division. Signals from the PLL circuit are amplified by a linear amplifier for transmission.



**Fig. 1 Frequency configuration**

### Receiving System

#### • Overview

Incoming signals from the antenna pass through a low-pass filter in the final block of the transmitter system, and are switched to the front-end of the receiver system via a receive/transmit switching diode.

The signals are then passed through an antenna matching coil, where the high-frequency components are amplified by a GaAs FET. The signals are then fed into a three-stage bandpass filter that uses vari-cap tuning to reject unwanted signal components, and is fed

to the 1st mixer. The 1st mixer uses the N-channel MOS FET that are used in the RF stage to obtain better two-signal characteristics. The 1st mixer mixes the signal with the 1st local oscillator frequency and converts it to the 1st IF (10.7MHz). The signal then passes through two monolithic crystal filters (MCFs) to remove unnecessary near-by frequency components. The signal from the MCFs is used as the 1st IF signal.

The 1st IF signal is amplified and fed into IC1 (KCD04) in the FM IF HIC. The IF signal is then mixed with the 2nd local oscillator frequency of 10.245 MHz to generate the 2nd IF of 455 kHz. The 455 kHz signal is then passed through a six element ceramic filter (CFWM455F), and fed back into IC1 for additional amplification. The output signal from the IC1 is then fed into a power amplifier via the audio volume control for application to the speaker.

#### • S-meter circuit

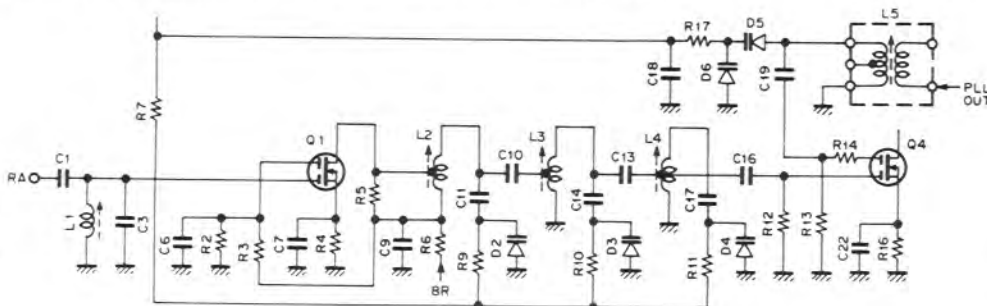
S-meter control voltage from IC1 (KCD04) in the FM IF HIC is fed into the control unit. The CPU converts the voltage from an analog to digital signal in order to operate the LCD bar meter.

Item	Rating
Nominal center frequency (fo)	10.7MHz
Pass band width	±7.5kHz or less at 3dB
Attenuation band width	±25kHz or less at 40dB ±45kHz or less at 60dB
Ripple	1.0dB or less
Insertion loss	1.5dB or less
Guaranteed attenuation	70dB or more within ±1MHz (Spurious : 40dB or more at fo - fo + 500kHz) 80dB or more at fo - (900 - 920kHz)
Terminating impedance	3kΩ/OpF

**Table 2 MCF (L71-0228-05) (TX-RX unit XF1)**

Item	Rating
Nominal center frequency	455kHz ± 1kHz
6dB bandwidth	±6kHz or more (from 455kHz)
50dB bandwidth	±12.5kHz or less (from 455kHz)
Ripple (within ±4kHz of 455kHz)	3dB or less
Insertion loss	6dB or less
Guaranteed attenuation (within ±100kHz of 455kHz)	35dB or more
I/O matching impedance	2.0kΩ

**Table 3 Ceramic filter CFWM455F (L72-0372-05) (TX-RX unit CF1)**



**Fig. 2 Front-end section (vari-cap tuning)**

## CIRCUIT DESCRIPTION

### Transmitting System

#### • Overview

The transmitter produces the target frequency through the use of direct FM-modulation via a varactor diode.

#### • Modulation circuit

Audio signals from the microphone are fed into the mic amplifier unit for amplification by the first transistor amplifier, and then into two operational amplifiers. The operational amplifiers form a splatter filter for pre-emphasis, amplification, limiting, and removal of unnecessary high-frequency components.

The FM modulation circuit directly FM-modulates the VCO signals, using a varactor diode.

#### • Pre-amplifier stage circuit

Signals from the VCO are applied to the drive HIC IC8 (KCB05). The amplifier always operates in a linear mode so that signals can be amplified without degradation. Additionally, the amplifier is designed to cover a wide range of frequencies and can produce stable output without adjustment. The APC (Automatic Power Control) controls collector voltage from the last stage of the pre-amplifier.

#### • Power amplifier circuit

The drive signal is amplified to the required level by the power module. The TM-241 A/E uses a large heat sink for efficient heat dissipation.

#### • APC circuit

The APC circuit for automatic transmit output control detects part of the power module output, and amplifies it to provide a control voltage for output control. The output control voltage is in inverse proportion to the output from the power module, so it is maintained at the same level.

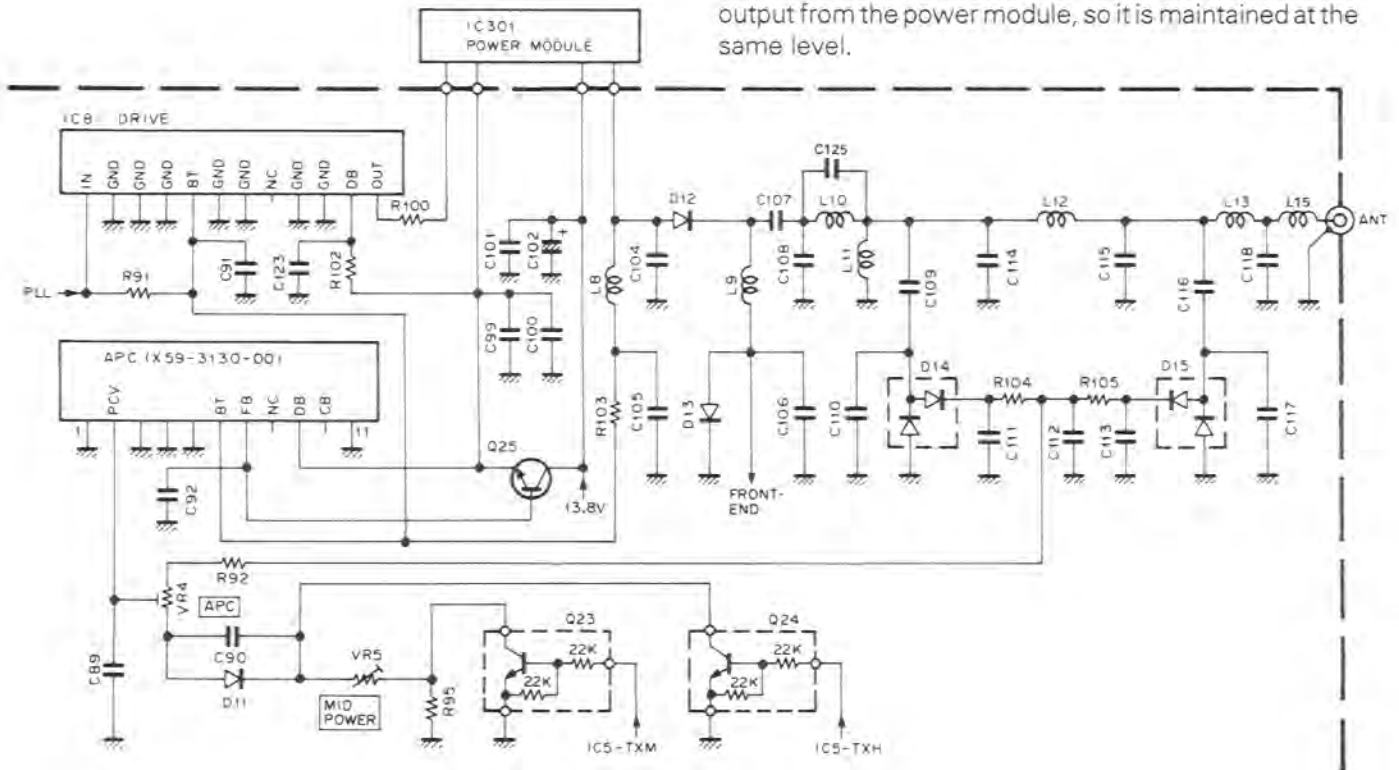


Fig. 3 Pre-amplifier stage, power amplifier, and APC circuits

(T<sub>c</sub> = 25°C)

Item	Symbol	Condition	Rating	Unit
Operating voltage	V <sub>cc</sub>		16	V
Control voltage	V <sub>con</sub>		16	V
Current consumption	I <sub>T</sub>		14	A
Input power	P <sub>i</sub>		600	mW
Output power	P <sub>o</sub>	12.5V < V <sub>cc</sub> ≤ 16V, V <sub>con</sub> ≤ 12.5V P <sub>i</sub> = 0 ~ 500mW, Z <sub>G</sub> = Z <sub>L</sub> = 50Ω	65	W
Operating case temperature	T <sub>c(opr)</sub>		-30 ~ +100	°C
Storage temperature	T <sub>stg</sub>		-40 ~ +110	°C

Table 4 Power module S-AV17 maximum ratings (IC301)

## CIRCUIT DESCRIPTION

### PLL Synthesizer Unit

Figure 4 is the PLL and VCO block diagram. In the TM-241 A/E, the PLL system is implemented as a sub-unit which is divided into the upper VCO and lower PLL blocks. The sub-unit is shielded to prevent external interference.

There are two reference frequencies, 6.25kHz and 5 kHz, available to allow 5, 10, 12.5, 15, or 25 kHz-step operation. The 6.25kHz is obtained by dividing the reference oscillator frequency of 12.8MHz by 2048, and the 5kHz is obtained by dividing it by 2560. The VCO directly generates the dial frequency. This dial frequency is amplified once and then fed into a pulse swallow-type PLL IC for frequency division and phase comparison, in order to lock the frequency.

The PLL system is locked without switching between transmit mode and receive mode. By using a signal ("H" in transmit mode) from pin 11 of the PLL IC (M54959FP), the LPF is deactivated-activated by Q52 and Q53 only for the moment when the TM-241 A/E enters transmit mode. This helps produce lock more rapidly than previous methods.

In 144MHz mode,  $f_{VCO}$  (RX) is calculated by the following formula:

$$f_{VCO} = (144 - 10.7) = \{(n \times 128) + A\} \times f_{osc} / R$$

where,

$f_{VCO}$  : VCO output frequency

$n$  : Binary value of the 10-bit programmable counter

$A$  : Binary value of the 7-bit programmable counter

$f_{osc}$  : 12.8MHz reference frequency

$R$  : Binary value of the 14-bit programmable counter

2560 (5, 10, 15, 20, or 25kHz step mode)

2048 (12.5kHz step mode)

In 5, 10, 15, 20, or 25kHz step mode,

$n = 208$  and  $A = 36$ .

Therefore,  $f_{VCO}$  is calculated as follows:

$$f_{VCO} = \{(208 \times 128) + 36\} \times 12800 / 2560$$

$$= \{26624 + 36\} \times 5$$

$$= 133300 = 133.300\text{MHz}$$

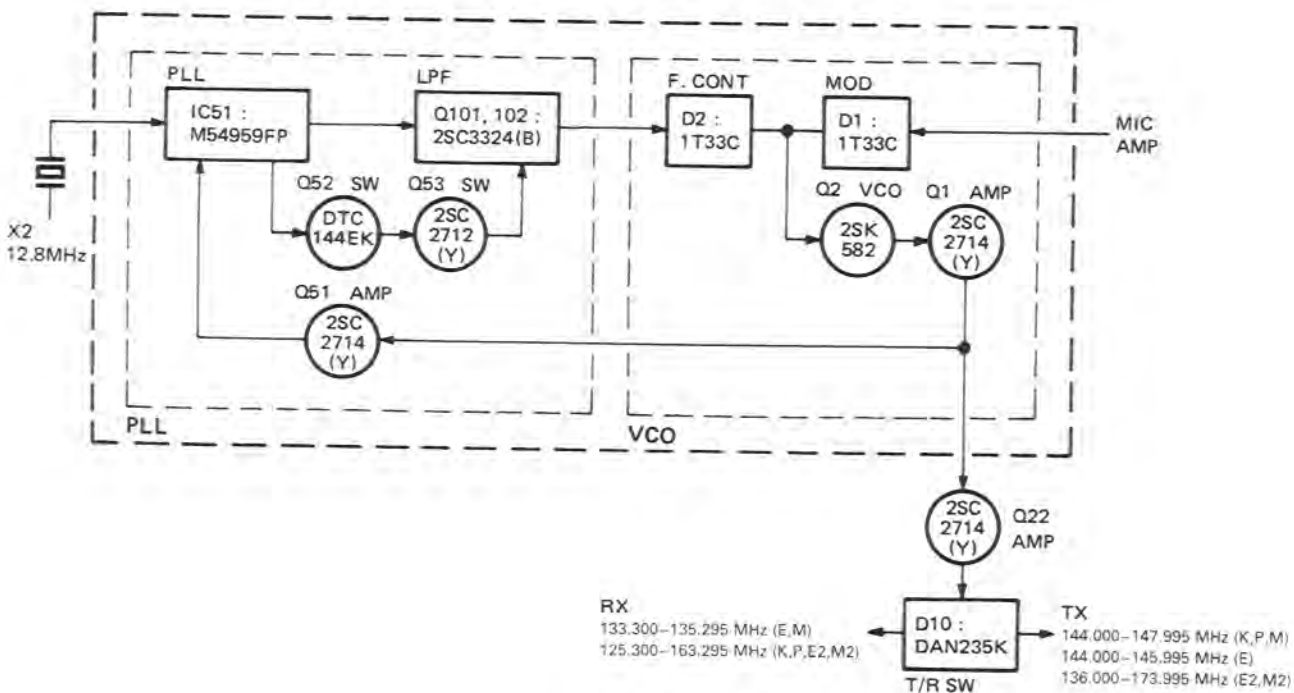


Fig. 4 PLL block diagram

## CIRCUIT DESCRIPTION

### • 8T (8V in transmit mode) and unlock circuits

In receive mode, the base of Q17 has 0.7V. As a result, Q17 is on, and Q16 and Q14 are off, and the collector of Q14 (8T) provides no voltage.

The CPU outputs serial data to the shift register IC5 when the PTT switch is depressed. As a result, pin 8 of IC5 becomes "L", turning Q17 off, and Q16 and Q14 on. The 8T line is therefore supplied with 8V.

The unlock circuit operates only in transmit mode. Q18 is a PLL unlocking switching transistor. Usually, the base of Q18 is supplied with 0V ("L"), and the collector is supplied with 8V ("H").

When the PLL is unlocked, the base of Q18 is supplied with 0.7V, turning Q18 on. As a result, the collector of Q18 becomes "L" (0V). This turns Q16 off and the collector of Q14 becomes 8V, turning it off. Therefore, when the PLL is unlocked, Q14 is off removing bias voltage from the 8T line. Without the 8T voltage no transmit signal is generated.

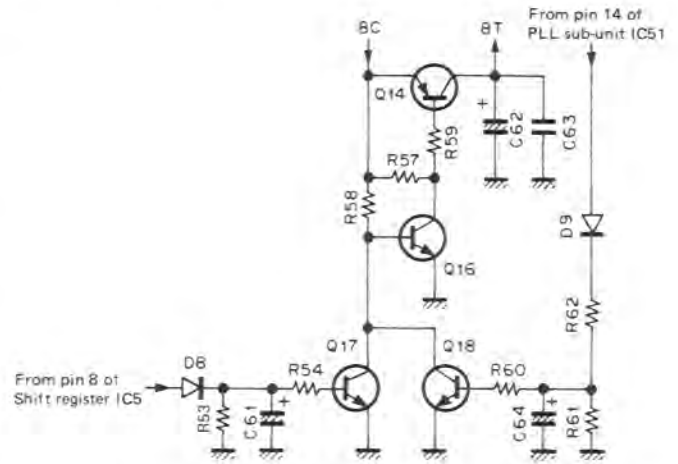


Fig. 5 8T and unlock circuits

## Digital Control Unit

### • Overview

The digital control unit consists of a several keys, a rotary encoder input, a display, a reset circuit, a back-up circuit, and a tone output circuit. These circuits are controlled by a single microcomputer (CPU).

### • Key and rotary encoder input circuits

The keys on the panel are arranged in matrix. Key input is fed into the CPU, using a key scan technique. Output from the rotary encoder is fed directly into the CPU.

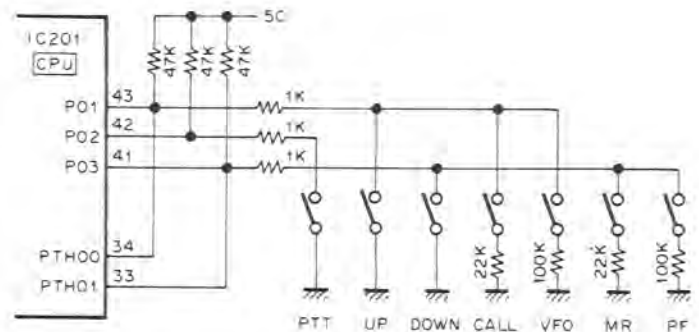


Fig. 6 Microphone key input circuit

### • Microphone key input circuit

The UP, DOWN, and other function keys of the microphone are directly connected to their corresponding analog input pins of the CPU. Each of the functions is activated by a voltage generated when the corresponding key is pressed.

### • Reset and back-up circuits

When the TM-241 A/E power is turned on, the reset circuit sends a "L" level pulse to the RESET pint of the CPU for approx. 3 ms. This initiates the power-on reset sequence.

When the TM-241 A/E power is turned off, the back-up circuit detects a voltage drop in the 5 C line and sets CPU INT4 to a "H" level. This causes the CPU to enter a back-up state.

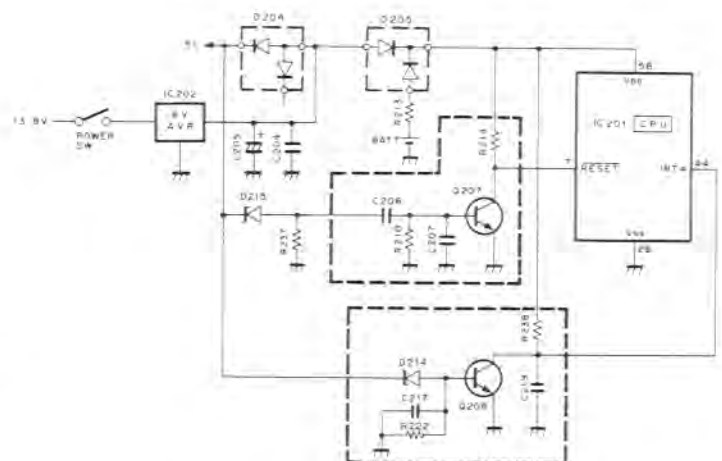


Fig. 7 Reset and back-up circuits

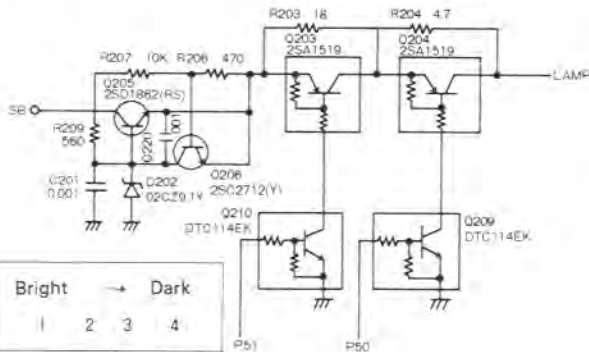
## CIRCUIT DESCRIPTION

### • Display circuit

The display circuit is contained in the LCD assembly. It consists of a LCD driver, its peripheral circuits, and an LCD. The LCD is dynamically operated at a 50% duty cycle. The LCD driver receives LCD data from P33, P140, and P141 of the CPU.

### Dimmer circuit

The lamp circuit generates a constant voltage of about 8.8 V with SB, Q205, and D202. The lamp circuit resistance is changed by turning Q203 and Q204 on and off to control the dimmer. If the lamp is shorted, Q206 decreases the Q205  $V_{BE}$  to prevent an overcurrent from flowing through Q205.



Brightness	Bright → Dark			
	1	2	3	4
P50	H	L	H	L
P51	H	H	L	L

Fig.10 Dimmer circuit

### • Shift register circuit

The shift register circuit consists of IC5 (TC9174F). The IC5 receives serial data from the microcomputer to perform the controls listed below.

Pin No.	Pin name	Function
1	GND	
2	B1	Usually "H".
3	B2	Open.
4	CE	Electronic VOL select : "H" when electronic VOL selected, "L" when panel VOL selected or interface connected.
5	VOLD	Electronic VOL DOWN : "L" when DOWN key ON.
6	VOLU	Electronic VOL UP : "L" when UP key ON.
7	MUTE	AF MUTE : "H" when TX mode, AL 1ch receive mode, CTCSS, bell, or squelch is ON.
8	T/R	Transmit/receive select : "H" in RX mode, "L" in TX mode.
9	TXM	TX power select : "H" in HI or MID mode, "L" in LOW mode.
10	TXH	TX power select : "H" in HI mode, "L" in MID or LOW mode.
11	-	Open.
12	-	Open.
13	DATA	Serial data input.
14	CLOCK	Clock input.
15	EN	Enable input.
16	VDD	

Table 5

### • Tone output circuit

R246 (ladder resistor) receives signals from P40 to P43 and P50 to P53 of the CPU and converts them from digital to analog to produce 38 different waveforms from 67.0 Hz to 250.3 Hz. Figure 8 shows the internal configuration of R246.

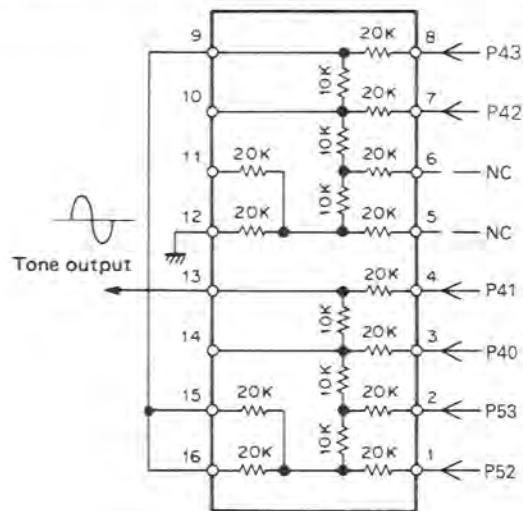


Fig.8 Internal configuration of ladder resistor (TX-RX unit B/2 R246)

## CIRCUIT DESCRIPTION

### • PLL data output

PLL data is available from P21 (CK), P22 (DT), and P23 (EP1) of the CPU. Figure 9 is a timing chart for PLL data transfer, and Figure 10 shows the format of PLL data.

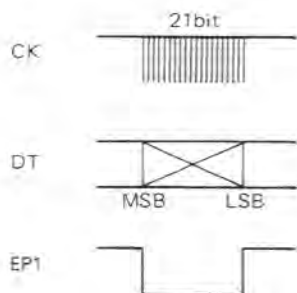
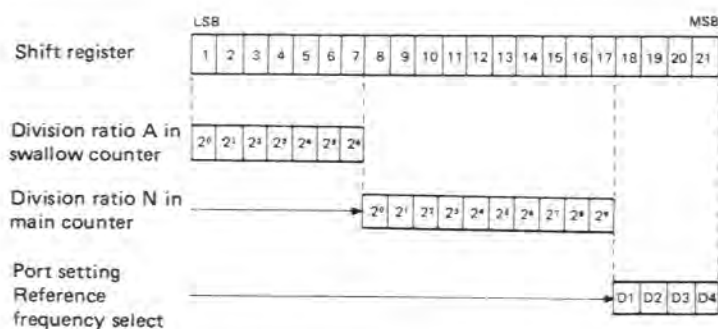


Fig. 9 timing chart for PLL data transfer



The 21-bit data is made up of the following:

#### 1. Division ratio data A and N (17 bits)

$F$  (display - 10.7MHz in RX mode)

$$= ((N \times 128) + A) \times 12.8\text{MHz} / \text{ref}$$

N : Division ratio set in 10-bit main counter (binary)

A : Division ratio set in 7-bit swallow counter (binary)

#### 2. Reference frequency (ref) select (2 bits)

Data		Phase reference frequency	
D1	D2		
L	L	5kHz	5, 10, 15, 20, 25kHz step mode
H	L	6.25kHz	12.5kHz step mode

#### 3. Switch select (2 bits)

Data		Output port		
D3	D4	SW1	SW2	
L	H	L	H	RX mode
H	L	H	L	TX mode

Fig. 10 PLL data format

### • Input and output of CTCSS unit (option)

The optional CTCSS unit receives data from P21, P22, an P73 of the CPU. Figure 11 is a timing chart for CTCSS data transfer, and Figure 12 shows the format of CTCSS data. When a tone from the CTCSS unit is detected, a "H" level signal is sent to P63 of the CPU, opening the squelch.

### • Input and output of the remote control unit (option)

When the optional remote control unit is connected, a "H" level signal is applied to INT0 of the CPU, and the following pins have different functions:

P03 → S1 : Serial data input pin

P02 → S2 : Serial data output pin

P01 → SCK : Serial clock I/O pin

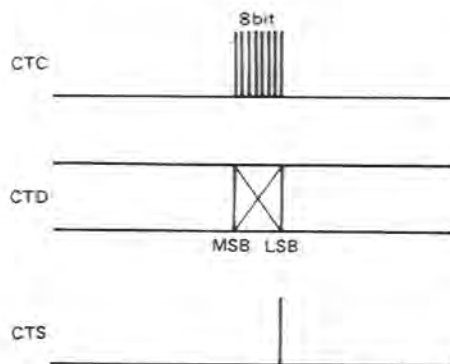
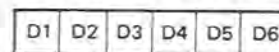


Fig. 11 Timing chart for CTCSS data transfer

Tone frequency select data for CTCSS unit



Example : 88.5Hz L H L H H H

Fig. 12 CTCSS data format

## CIRCUIT DESCRIPTION

Pin No.	Pin name	I/O	Logic	Function	Pin No.	Pin name	I/O	Logic	Function
1	P41	O	-	D/A digital output (tone).	33	PTH01	I	-	Mic DOWN/MR/PF input
2	P40	O	-		34	PTH00	I	-	Mic UP/CALL/VFO input
3	P53	O	-		35	T10	I	H	CTCSS DET
4	P52	O	-		36	T11	I	L	Not used. (GND)
5	P51	O	-	Dimmer select	37	P23	O	L	PLL IC enable output.
6	P50	O	-		38	P22	O	-	Serial data output.
7	RESET	I	L	Reset input.	39	P21	O	-	Serial clock output.
8	X2	-	-	4.194304MHz crystal oscillator.	40	P20	O	-	Beeper output.
9	X1	-	-		41	P03/SI	I/I	L/-	Serial data input. (KENWOOD BUS)
10	P63	I	H	Function display	42	P02/SO	I/O	L/-	Serial data output. (KENWOOD BUS)
11	P62	O	H	DRS remote control ST	43	P01/SCK	I/-	L/-	Serial clock I/O. (KENWOOD BUS)
12	P61	O	-	DRS unit Reset ACL	44	INT4	I	H	Back-up detect input. (Back-up: HI)
13	P60	I	H	DTMF Signal detect	45	P123	I	L	CALL, VFO
14	P73	O	H	CTCSS unit enable output.	46	P122	I	L	F, MR/M
15	P72	O	H	Shift register enable output.	47	P121	I	L	SHIFT, MHz
16	P71	O	H	DRS unit VOB output.	48	P120	I	L	TONE
17	P70	O	H	DRS unit VOA output.	49	P133	I	L	REV
18	P83	O	H	DRS OE,DTSS EN	50	P132	I	L	LOW, DRS/DTSS
19	P82	O	H	DRS unit STBY output.	51	P131	I	L	Not used (GND)
20	P81	O	L	DTSS DTSEL output · DRS unit WR output	52	P130	I	L	Busy input.
21	P80	O	L	DRS unit RD output.	53	P143	O	L	Squelch control.
22	P93	O	H	DRS unit data output. D8/D3	54	P142	O	H	Power SW.
23	P92	O	H	DRS unit data output. D4/D2	55	P141	O	-	LCD driver clock output.
24	P91	O	H	DRS unit data output. D2/D1	56	P140	O	-	LCD driver data output.
25	P90	O	H	DRS unit data output. D1/D0	57	NC	-	-	Not used. (V <sub>DD</sub> )
26	Vss	-	-	GND.	58	V <sub>DD</sub>	-	-	Power supply pin.
27	P13	I	H	DRS unit connect check.	59	P33	O	-	LCD driver enable output.
28	INT2	I	-	Encoder input.	60	P32	O	L	Distination output.
29	INT1	I	-		61	P31	O	L	Key output.
30	P10	I	H	Remote connect detect input.	62	P30	O	L	
31	PTH03	I	-	S-meter analog input.	63	P43	O	-	D/A digital output (tone).
32	PTH02	I	-	Not used. (GND)	64	P42	O	-	

Table 6 75116GF-728-3BE terminal functions (TX-RX unit IC201)

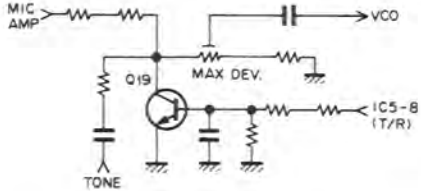
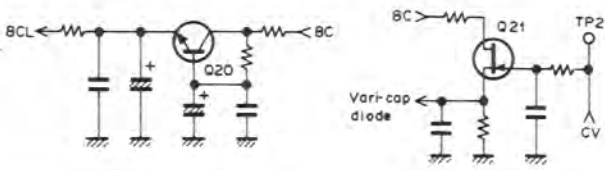
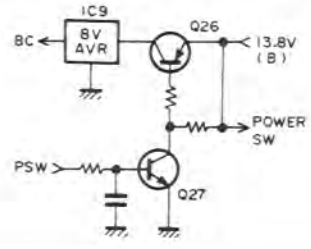
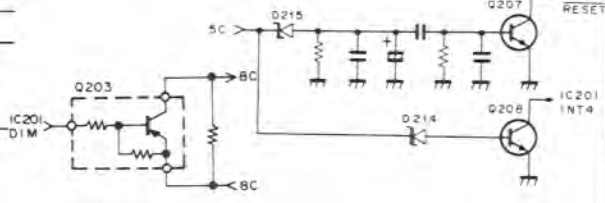
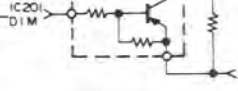


## DESCRIPTION OF COMPONENTS

**TX-RX UNIT (X57-369X-XX)** 0-11: TM-241A (K, P), 0-21: TM-241A (M), 0-22: TM-241A (M2) 2-71: TM-241E (E) 2-72: TM-241E (E2)

Component	Use/Function	Operation/Condition/Compatibility
IC1	2nd local oscillator, IF amplification, detection, low-frequency amplification, noise amplification, noise detection, squelch switching	① 1st IF signal input (10.7MHz). ③ ④ 2nd local oscillator (10.245MHz). ⑨ Busy output. ⑩ Squelch control. ⑪ S-meter output. ⑭ RD output. ⑮ Low-frequency output.
IC2	AM detector	
IC3	AF amplification	① AF input, ⑧ AF output.
IC4	Electronic volume control, AF switch	② AF output. ③ "L" during step-up. ④ "L" during step-down. ⑤ "H" when electronic volume selected.
		⑦ Panel volume input. ⑧ Panel volume output. ⑩ AF input.
IC5	Shift register	See circuit description.
IC6	5V AVR	
IC7	10V AVR	For PLL.
IC8	Transmit drive	
IC9	8V AVR	
IC201	Microprocessor	See circuit description.
IC202	6V AVR	
Q1	High-frequency amplification	Operates in receive mode.
Q2	11R switching	On when the aircraft band is selected.
Q3	BPF switching	On when the aircraft band is selected.
Q4	1st mixer	Converts received 144 MHz-range signals to 1st IF 10.7 MHz.
Q5	High-frequency amplification	Amplifies 1st IF signal.
Q6	Q5 Gain control	
Q7	Detector output switch	When the aircraft band is selected, the FM detection switch is turned off.
Q8	AF amplifier	When the aircraft band is selected, the output signal from the AM detector is amplified.
Q9 (1/2)	RD line mute	ON when DRS unit replays.
Q9 (2/2)	AF line mute	
Q10	Low-frequency amplification	Operates when DRS unit replays.
Q11	2nd local oscillator buffer	
Q12	AF line mute	Operates when transmit mode, AL 1ch receive mode, CTCSS, bell or squelch is ON.
Q13	8R switching	ON in receive mode.
Q14	8T switching	ON in transmit mode.
Q15	8R switching control	ON in receive mode.
Q16	8T switching control	ON in transmit mode.
Q17	8T switching control	OFF in transmit mode.
Q18	8T switching control	OFF when PLL locked.

## DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility															
Q19	Mic line mute	ON in receive mode. 															
Q20	PLL 8V ripple filter																
Q21	CV line buffer																
Q22	VCO output amplification																
Q23	TX power select	ON in HI or MID mode.															
Q24	TX power select	ON in HI mode.															
Q25	TX drive stage +B control																
Q26	Power switch																
Q27	Power switch control	ON when power switch is ON. 															
Q28	Squelch hysteresis	On when the squelch is on.															
Q201, 202	Function dimmer switch	Refer to circuit description.															
Q203, 204	Lamp dimmer switch																
Q207	Reset switch	ON for approx. 3ms when system power turned on, usually OFF. 															
Q208	Back-up switch	OFF when 13.8 V line becomes 7.5 V or less, usually ON. 															
Q209, 210	Dimmer switch ON/OFF	Turn Q201~Q204 on or OFF <table border="1" data-bbox="941 1646 1372 1736"> <thead> <tr> <th>dimmer</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>Q209</td> <td>ON</td> <td>OFF</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>Q210</td> <td>ON</td> <td>ON</td> <td>OFF</td> <td>OFF</td> </tr> </tbody> </table>	dimmer	1	2	3	4	Q209	ON	OFF	ON	OFF	Q210	ON	ON	OFF	OFF
dimmer	1	2	3	4													
Q209	ON	OFF	ON	OFF													
Q210	ON	ON	OFF	OFF													
Q211	Function drive switch																
Q212	Mic mute	On when DTSS and paging codes are sent.															
D1	Band select switch. (AM/FM)	On when the aircraft band is selected.															
D2~6	Vari-cap tuning																
D7~9	Reverse current prevention																
D10	VCO output switch																
D11	Temperature compensation	For APC.															
D12,13	Transmit/receive switching.																

## DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility
D14,15	Power detection	For APC.
D16	Reverse power protection	
D202	Lamp standard voltage	
D203	Dimmer switch	
D204, 205		D205 switches in the lithium battery when the power is off.
D206~211	Used for destination setting.	
D212	CPU protector.	
D213	Reverse current prevention	
D214	Back-up detection voltage	
D215	Reset detection voltage	
D216	Function LED	

### PLL (X58-3470-00)

Component	Use/Function	Operation/Condition/Compatibility
IC51	PLL	① VCO input 133.300~135.295MHz (E,M), 125.300~163.295 MHz (K,P,E <sub>2</sub> ,M <sub>2</sub> ) in receive mode, 144.000~145.995MHz (E), 144.000~147.995 MHz (K,P,M) 136.000~173.995 MHz (E <sub>2</sub> ,M <sub>2</sub> ) in transmit mode. ② "L" in transmit mode.      ③ "H" when PLL unlocked.
Q51	VCO output buffer	
Q52	Transmit switch	OFF in transmit mode.
Q53	Transmit switch	ON for moment when transmission starts.
Q101,102	LPF	
Q1	VCO output buffer	
Q2	VCO	133.300~135.295MHz (E,M), 125.300~163.295MHz (K,P,E <sub>2</sub> ,M <sub>2</sub> ) in receive mode, 144.000~145.995MHz (E), 144.000~147.995MHz (K,P,M) 136.000~173.995 MHz (E <sub>2</sub> ,M <sub>2</sub> ) in transmit mode.
D1	For modulation in TX mode	
D2	VCO voltage control	

### APC (X59-3130-00)

Component	Use/Function	Operation/Condition/Compatibility
Q1	Differential amplification	
Q2 (2/2)	APC control	
Q3	Drive stage +B AVR	

### MIC AMP (X59-3610-00)

Component	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	Limited amplification	
IC1 (2/2)	LPF	
Q1	Low-frequency amplification	

# TM-241A/E

## PARTS LIST

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<b>TM-241</b>						
1	1B		A01-1065-03	METALLIC CABINET(TOP)		
2	2B		A01-1066-03	METALLIC CABINET(BOTTOM)		
3	1C		A10-1292-01	CHASSIS CALKED ASSY		
4	2B		A22-0770-03	SUB PANEL		
5	2A	*	A62-0007-23	PANEL ASSY	KMM2P	
5	2A	*	A62-0008-23	PANEL ASSY	EE2	
6	2B		B11-0484-08	FILTER(LCD)		
7	2B		B30-0869-05	LAMP		
8	2B	*	B38-0330-05	LCD ASSY		
9	1B, 1C		B42-2455-04	LABEL(M4X8 MAX)		
			B42-3343-04	S/NO LABEL(NAME PLATE)		
			B42-3356-04	LABEL(EXT SP)		
			B42-3394-04	FCC LABEL	K	
11A		*	B62-0031-00	INSTRUCTION MANUAL	K	
11B		*	B62-0032-00	INSTRUCTION MANUAL	MM2P	
11B		*	B62-0032-00	INSTRUCTION MANUAL	EE2	
12		*	B62-0033-00	INSTRUCTION MANUAL	EE2	
		*	B72-0093-04	MODEL NAME PLATE	KP	
		*	B72-0094-04	MODEL NAME PLATE	MM2	
		*	B72-0095-04	MODEL NAME PLATE	EE2	
10			B46-0410-20	WARRANTY CARD	K	
10			B46-0419-00	WARRANTY CARD	E	
10			B46-0422-00	WARRANTY CARD	P	
13			E30-2111-05	DC CABLE		
14	1C		E30-2137-15	DC CABLE		
15	1C		E30-2145-05	ANT CABLE		
			E31-3197-15	CONNECTING WIRE(SP)		
16			F05-1531-05	FUSE 15A		
17	1C		F05-2036-05	FUSE 20A		
		*	F15-0670-04	SHADE		
19	1B		F20-0587-04	INSULATING BOARD(LITHIUM BATT)		
20	1B		F20-1059-04	INSULATING BOARD(LITHIUM BATT)		
21	1B, 1C		G02-0565-04	FLAT SPRING	KP	
22	2A		G02-0576-14	FLAT SPRING		
23			G09-0405-05	SPRING (KNOB)		
24	1B, 2C		G10-0651-04	NON-WOVEN FABRIC(SP)		
			G10-0681-04	NON-WOVEN FABRIC(CHASSIS)		
25	1B, 2B		G10-0686-04	NON-WOVEN FABRIC(CASE)		
26	2B		G13-0906-04	CUSHION (3KEY)		
			G13-0926-04	CUSHION (CONT)		
27	2A		G13-0960-04	CUSHION (6KEY)		
28	2B		G13-0961-04	CUSHION (LOW)		
29			H10-2658-02	POLYSTYRENE FOAMED FIXTURE		
30A			H11-0822-04	POLYSTYRENE PLATE	K	
30B			H11-0823-04	POLYSTYRENE PLATE	MM2P	
30B			H11-0823-04	POLYSTYRENE PLATE	EE2	
31			H13-0814-04	PROTECTION SHEET		
32			H13-0825-04	PROTECTION SHEET	MM2P	
32			H13-0825-04	PROTECTION SHEET	EE2	
36		*	H52-0054-04	ITEM CARTON BOX	KMM2P	
36		*	H52-0055-04	ITEM CARTON BOX	EE2	

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-			H10-2658-02	POLYSTYRENE FOAMED FIXTURE		
33			H25-0029-04	PROTECTION BAG(MIC HOOK)	KP	
34			H25-0117-04	PROTECTION BAG(DC CABLE)		
35			H25-0720-04	PROTECTION BAG(RADIO)		
37	1C		J19-1434-04	HOLDER(SP)		
38			J20-0319-24	MIC HOOK	KP	
40	2A		J21-4303-08	MOUNTING HARDWARE(LCD ASSY)		
41			J29-0436-03	BRACKET		
42	2B		K27-3035-14	KNØB(ENCODER)		
43	2B		K27-3066-04	KNØB(POWER SW)		
44	2B		K27-3067-04	KNØB(LOW)		
45	2A		K27-3068-04	KNØB(CALL)		
46	2A		K27-3069-04	KNØB(FUNC)		
47	2A		K27-3071-04	KNØB(TONE)		
48	2A		K27-3072-04	KNØB(REVERSE)		
49	2A		K27-3074-04	KNØB(SHIFT)		
50	2A	*	K27-3075-04	KNØB(DR/DT)		
51	2A		K29-3156-04	KNØB(MAIN)		
52	2A		K29-3157-04	KNØB(VOL)		
A	2B		N09-0626-04	SCREW(POWER MODULE 3X10)		
B	2B		N09-0650-05	SCREW(SUB PANEL)		
C	1C, 2C		N33-2606-45	OVAL HEAD MACHINE SCREW(CASE)		
G			N46-3010-46	PAN HEAD TAPPING SCREW	KP	
D	1C, 2C		N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
E	2B		N87-2610-46	BRAZIER HEAD TAPTITE SCREW		
F	2B		N88-2606-46	FLAT HEAD TAPTITE SCREW		
53			N99-0331-05	SCREW SET		
SP	1C		T07-0246-05	LOUDSPEAKER		
54			T91-0379-25	MICROPHONE	MM2	
54			T91-0380-35	MICROPHONE(DTMF)	KP	
54			T91-0382-25	MICROPHONE(1750Hz TONE)	EE2	
IC1			LC7582	IC(LCD DRIVER)		
IC301			S-AV17	IC(POWER MODULE FOR 144MHZ)		
55			W01-0414-04	WRNCH		
56	2B		W09-0326-05	LITHIUM BATTERY		
57	2B, 2C	*	X57-3690-11	TX-RX UNIT	KP	
57	2B, 2C	*	X57-3690-21	TX-RX UNIT	M	
57	2B, 2C	*	X57-3690-22	TX-RX UNIT	M2	
57	2B, 2C	*	X57-3692-71	TX-RX UNIT	E	
57	2B, 2C	*	X57-3692-72	TX-RX UNIT	E2	
<b>TX-RX UNIT (X57-369X-XX)</b>						
0-11: TM-241A (K, P), 0-21: TM-241A (M), 0-22: TM-241A (M2) 2-71: TM-241E (E), 2-72: TM-241E (E2)						
C1			CC73FCH1H040C	CHIP C 4PF C		
C2			CC73FCH1H060D	CHIP C 6PF D	KP	
C3			CC73FCH1H040C	CHIP C 4PF C	KP	
C3			CC73FCH1H070D	CHIP C 7PF D	MM2	
C3			CC73FCH1H070D	CHIP C 7PF D	EE2	
C4	,5		CK73FB1H102K	CHIP C 1000PF K	KP	
C6	,7		CK73FB1H102K	CHIP C 1000PF K		
C8			CK73FB1H103K	CHIP C 0.010UF K		
C9			CK73FB1H102K	CHIP C 1000PF K		
C10			CC73FCH1H0R5C	CHIP C 0.5PF C		
C11			CC73FCH1H470J	CHIP C 47PF J		

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TX-RX UNIT (X57-369X-XX)

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C12			CK73FB1H103K	CHIP C 0.010UF K		
C13			CC73FCH1H0R5C	CHIP C 0.5PF C		
C14			CC73FCH1H470J	CHIP C 47PF J		
C15			CK73FB1H102K	CHIP C 1000PF K		
C16			CC73FCH1H150J	CHIP C 15PF J		
C17			CC73FCH1H470J	CHIP C 47PF J		
C18			CK73FB1H103K	CHIP C 0.010UF K		
C19			CC73FCH1H030C	CHIP C 3PF C		
C20			CK73FB1H102K	CHIP C 1000PF K		
C21			CK73FB1H103K	CHIP C 0.010UF K		
C22			CK73FB1H102K	CHIP C 1000PF K		
C23			CC73FCH1H050C	CHIP C 5PF C		
C24			CK73FB1H102K	CHIP C 1000PF K		
C25			CK73FB1H103K	CHIP C 0.010UF K		
C26			CC73FCH1H220J	CHIP C 22PF J		
C27			CK73FB1H102K	CHIP C 1000PF K		
C28			CC73FCH1H330J	CHIP C 33PF J		
C29			CC73FCH1H151J	CHIP C 150PF J		
C30			CK73FB1H102K	CHIP C 1000PF K	KP	
C31			CC73FSL1H101J	CHIP C 100PF J	KP	
C32			CK73EF1C105Z	CHIP C 1.0UF Z	KP	
C33			CK73FB1H223K	CHIP C 0.022UF K	KP	
C34			CK73FB1H333K	CHIP C 0.033UF K	KP	
C35			C92-0004-05	CHIP TAN 1.0UF 16WV	KP	
C36 ,37			CK73FB1H103K	CHIP C 0.010UF K	KP	
C38			C92-0002-05	CHIP TAN 0.22UF 35WV		
C39 -41			CK73EF1C105Z	CHIP C 1.0UF Z		
C43			CE04EW1A470M	ELECTRØ 47UF 10WV		
C44			CK73FB1H103K	CHIP C 0.010UF K		
C47			CK73EB1H104K	CHIP C 0.10UF K		
C48			CE04EW1A471M	ELECTRØ 470UF 10WV		
C49			CK73FB1H103K	CHIP C 0.010UF K		
C50			CE04EW1C470M	ELECTRØ 47UF 16WV		
C51 -53			CE04EW1A470M	ELECTRØ 47UF 10WV		
C54			CK73FB1H273K	CHIP C 0.027UF K		
C55			CC73FSL1H101J	CHIP C 100PF J		
C56			CE04EW1E477M	ELECTRØ 4.7UF 25WV		
C57 ,58			CK73EF1C105Z	CHIP C 1.0UF Z		
C59			CK73FB1H103K	CHIP C 0.010UF K		
C60			CE04EW1A470M	ELECTRØ 47UF 10WV		
C61			C92-0504-05	CHIP TAN 0.68UF 20WV		
C62			CE04EW1A470M	ELECTRØ 47UF 10WV		
C63			CK73FB1H103K	CHIP C 0.010UF K		
C64			C92-0504-05	CHIP TAN 0.68UF 20WV		
C65 ,66			CK73FB1H102K	CHIP C 1000PF K		
C67			CC73FCH1H050C	CHIP C 5PF C		
C68			C92-0501-05	CHIP-TAN 1.5UF 6.3WV		
C69			CK73FB1H103K	CHIP C 0.010UF K		
C71			CK73FB1H102K	CHIP C 1000PF K		
C72			CK73EB1H473K	CHIP C 0.047UF K		
C73			CK73FB1H102K	CHIP C 1000PF K		
C74			CK73EF1C105Z	CHIP C 1.0UF Z		
C75 ,76			CK73FB1H102K	CHIP C 1000PF K		
C78			CK73FB1H102K	CHIP C 1000PF K		
C79			CC73FCH1H330J	CHIP C 33PF J		

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C80			CK73FB1H102K	CHIP C 1000PF K		
C81			CC73FCH1H220J	CHIP C 22PF J		
C82			CK73FB1H103K	CHIP C 0.010UF K		
C83			CE04EW1A470M	ELECTRØ 47UF 10WV		
C84			CK73FB1H103K	CHIP C 0.010UF K		
C85			CE04EW1A221M	ELECTRØ 220UF 10WV		
C86			CE04EW1C100M	ELECTRØ 10UF 16WV		
C87 ,88			CK73FB1H103K	CHIP C 0.010UF K		
C89 -92			CK73FB1H102K	CHIP C 1000PF K		
C93			CK73FB1H103K	CHIP C 0.010UF K		
C94			CE04EW1A470M	ELECTRØ 47UF 10WV		
C95 ,96			CK73FB1H103K	CHIP C 0.010UF K		
C97			CE04EW1C102M	ELECTRØ 1000UF 16WV		
C99			CK73FB1H102K	CHIP C 1000PF K		
C100			CK73EF1C10SZ	CHIP C 1.0UF Z		
C101			CK73FB1H102K	CHIP C 1000PF K		
C102			CE04EW1C100M	ELECTRØ 10UF 16WV		
C104			CC73FCH1H150J	CHIP C 15PF J		
C105			CK73FB1H102K	CHIP C 1000PF K		
C106			CC73FCH1H220J	CHIP C 22PF J		
C107			CK45B2H102K	CERAMIC 1000PF K		
C108			CM73F2H330J	CHIP C 33PF J		
C109			CC73FCH1H0R5C	CHIP C 0.5PF C		
C110			CC73FCH1H020C	CHIP C 2.0PF C		
C111-113			CK73FB1H102K	CHIP C 1000PF K		
C114			CC45SL2H560J	CERAMIC 56PF J		
C115			CC45SL2H470J	CERAMIC 47PF J		
C116			CC73FCH1H0R5C	CHIP C 0.5PF C		
C117			CC73FCH1H020C	CHIP C 2.0PF C		
C118			CM73F2H270J	CHIP C 27PF J		
C119			CK73FB1H102K	CHIP C 1000PF K		
C120			C92-0511-05	CHIP TAN 0.15UF 35WV		
C121			CK73EF1C10SZ	CHIP C 1.0UF Z		
C122			CK73FB1H102K	CHIP C 1000PF K		
C123			CK73EF1C10SZ	CHIP C 1.0UF Z		
C125			CM73F2H060D	CHIP C 6.0PF D		
C126			CC73FSL1H101J	CHIP C 100PF J		
C127			CK73FB1H332K	CHIP C 3300PF K		
C201			CK73FB1H102K	CHIP C 1000PF K		
C202			CK73FB1H103K	CHIP C 0.010UF K		
C203			CK73FB1H102K	CHIP C 1000PF K		
C204			CK73FB1H103K	CHIP C 0.010UF K		
C205			CE04NW0J221M	ELECTRØ 220UF 6.3WV		
C206			CK73FB1E223K	CHIP C 0.022UF K		
C207			CK73FB1H102K	CHIP C 1000PF K		
C208,209			CC73FCH1H330J	CHIP C 33PF J		
C210,211			CK73FB1H103K	CHIP C 0.010UF K		
C212-214			CC73FSL1H101J	CHIP C 100PF J		
C215-217			CK73FB1H102K	CHIP C 1000PF K		
C219,220			CK73FB1H103K	CHIP C 0.010UF K		
TC1			C05-0349-05	TRIMMING 10PF		
CN1			E40-3237-05	PIN CONNECTOR(INT.SP)		
CN2			E40-5182-05	PIN CONNECTOR(DRU)		
CN3 ,4			E40-5202-05	PIN CONNECTOR(TR)		

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CN5			E40-5183-05	PIN CONNECTOR(DTM)		
CN201, 202			E40-5203-05	PIN CONNECTOR(CONT)		
CN203			E40-5185-05	PIN CONNECTOR(DRU)		
CN204			E40-5187-05	PIN CONNECTOR(DRU)		
CN205			E40-5341-05	PIN CONNECTOR		
J1			E11-0425-05	EXT SP JACK		
J201			E06-0860-05	MIC RECEPTACLE		
TP1 ,2			E23-0465-05	TEST TERMINAL		
W1			E33-1902-05	FINISHED WIRE SET(HET)		
W201			E31-6003-15	CONNECTING WIRE(CTCSS)		
W202			E33-1871-15	FINISHED WIRE SET	KPME	
			J31-0534-05	COLLAR (LED)		
CD1			L79-1013-05	CERAMIC DISCRI(CDBM455C16)		
CF1			L72-0372-05	CERAMIC FILTER(CFWM455F)		
L1 -4			L34-4080-05	COIL		
L5			L34-0956-05	COIL		
L6			L30-0005-05	IFT		
L7			L40-1001-48	SMALL FIXED INDUCTOR(10UH)		
L8			L34-1239-05	COIL		
L9			L34-0895-05	COIL		
L10			L34-0742-05	COIL		
L11			L34-0908-05	COIL		
L12 ,13			L34-0499-05	COIL		
L14			L40-3392-48	SMALL FIXED INDUCTOR(3.3UH)		
L15			L34-0499-05	COIL		
X1			L77-0946-15	CRYSTAL RESONATOR(10.245MHz)		
X2			L77-1405-05	CRYSTAL RESONATOR(12.8MHz)		
X201			L77-1397-05	CRYSTAL RESONATOR(4.194304MHz)		
XF1			L71-0228-05	CRYSTAL FILTER(10.7MHz)		
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W	KP	
R2			RK73FB2A223J	CHIP R 22K J 1/10W		
R3			RK73FB2A274J	CHIP R 270K J 1/10W		
R4			RK73FB2A101J	CHIP R 100 J 1/10W		
R5			RK73FB2A103J	CHIP R 10K J 1/10W		
R6			RK73FB2A101J	CHIP R 100 J 1/10W		
R7			RK73FB2A104J	CHIP R 100K J 1/10W		
R8			RK73FB2A333J	CHIP R 33K J 1/10W	KP	
R9 -11			RK73FB2A103J	CHIP R 10K J 1/10W		
R12 ,13			RK73FB2A473J	CHIP R 47K J 1/10W		
R14			RK73FB2A470J	CHIP R 47 J 1/10W		
R15			RK73FB2A274J	CHIP R 270K J 1/10W		
R16			RK73FB2A470J	CHIP R 47 J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R18			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R19			R92-0670-05	CHIP R 0 OHM		
R20			RK73FB2A101J	CHIP R 100 J 1/10W		
R21			RK73FB2A471J	CHIP R 470 J 1/10W		
R22			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R23			RK73FB2A471J	CHIP R 470 J 1/10W		
R24			RK73FB2A101J	CHIP R 100 J 1/10W		
R25			RK73FB2A103J	CHIP R 10K J 1/10W		
R26			RK73FB2A473J	CHIP R 47K J 1/10W		
R27			RK73FB2A272J	CHIP R 2.7K J 1/10W	KP	

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## PARTS LIST

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TX-RX UNIT (X57-369X-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名/規格	Desti- nation 仕向	Re- marks 備考
R28			RK73FB2A103J	CHIP R 10K J 1/10W		
R29			RK73FB2A681J	CHIP R 680 J 1/10W	KP	
R30			RK73FB2A153J	CHIP R 15K J 1/10W		
R31			RK73FB2A274J	CHIP R 270K J 1/10W	KP	
R32			RK73FB2A332J	CHIP R 3.3K J 1/10W	KP	
R33			RK73FB2A102J	CHIP R 1.0K J 1/10W	KP	
R35 ,36			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R37			RK73FB2A334J	CHIP R 330K J 1/10W		
R38			RK73FB2A331J	CHIP R 330 J 1/10W		
R40			RK73FB2A331J	CHIP R 330 J 1/10W		
R43			R92-1220-05	CHIP R 1 J 1/10W		
R44			RK73FB2A101J	CHIP R 100 J 1/10W		
R45			R92-0670-05	CHIP R 0 ΩHM		
R46			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R47			RK73FB2A473J	CHIP R 47K J 1/10W		
R48			RK73FB2A333J	CHIP R 33K J 1/10W		
R49			RK73FB2A473J	CHIP R 47K J 1/10W		
R50			RK73FB2A223J	CHIP R 22K J 1/10W		
R51			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R52			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R53			RK73FB2A334J	CHIP R 330K J 1/10W		
R54			RK73FB2A223J	CHIP R 22K J 1/10W		
R55			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R56 -58			RK73FB2A103J	CHIP R 10K J 1/10W		
R59			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R60			RK73FB2A223J	CHIP R 22K J 1/10W		
R61			RK73FB2A473J	CHIP R 47K J 1/10W		
R62			R92-0670-05	CHIP R 0 ΩHM		
R63			RK73FB2A102J	CHIP R 1.0K J 1/10W	EE2	
R63			RK73FB2A332J	CHIP R 3.3K J 1/10W	KPMM2	
R64			RK73FB2A392J	CHIP R 3.9K J 1/10W	KPMM2	
R64			RK73FB2A563J	CHIP R 56K J 1/10W	EE2	
R65 ,66			R92-0670-05	CHIP R 0 ΩHM		
R67			RK73FB2A220J	CHIP R 22 J 1/10W		
R68			R92-0670-05	CHIP R 0 ΩHM		
R69			RK73FB2A184J	CHIP R 180K J 1/10W		
R70 ,71			RK73FB2A103J	CHIP R 10K J 1/10W		
R72			R92-0670-05	CHIP R 0 ΩHM		
R73			RK73FB2A223J	CHIP R 22K J 1/10W		
R74			R92-0670-05	CHIP R 0 ΩHM		
R75 -78			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R79			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R80			RK73FB2A104J	CHIP R 100K J 1/10W		
R81			RK73FB2A471J	CHIP R 470 J 1/10W		
R82			RK73FB2A220J	CHIP R 22 J 1/10W		
R84			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R85			RK73FB2A220J	CHIP R 22 J 1/10W		
R86			RK73FB2A223J	CHIP R 22K J 1/10W		
R87			RK73FB2A103J	CHIP R 10K J 1/10W		
R88 ,89			RK73FB2A101J	CHIP R 100 J 1/10W		
R90			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R91			RK73FB2A470J	CHIP R 47 J 1/10W		
R92			RK73FB2A104J	CHIP R 100K J 1/10W		
R94			RK73FB2A220J	CHIP R 22 J 1/10W		
R95			RK73FB2A472J	CHIP R 4.7K J 1/10W		

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TX-RX UNIT (X57-369X-XX)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名/規格	Desti- nation 仕向	Re- marks 備考
R96			RK73FB2A103J	CHIP R 10K J 1/10W		
R97			R92-1215-05	CHIP R 470 J 1/2W		
R98			RK73FB2A103J	CHIP R 10K J 1/10W		
R100			R92-0670-05	CHIP R 0 OHM		
R102			R92-0685-05	CHIP R 22 J 1/2W		
R103			R92-1213-05	CARBON 100 J 1/2W		
R104, 105			RK73FB2A223J	CHIP R 22K J 1/10W		
R106			RK73FB2A274J	CHIP R 270K J 1/10W		
R107			R92-0670-05	CHIP R 0 OHM		
R108			RK73FB2A273J	CHIP R 27K J 1/10W		
R109			RK73FB2A103J	CHIP R 10K J 1/10W		
R110, 111			RK73FB2A273J	CHIP R 27K J 1/10W		
R112			RK73FB2A104J	CHIP R 100K J 1/10W		
R113			RK73FB2A273J	CHIP R 27K J 1/10W		
R114			RK73FB2A221J	CHIP R 220 J 1/10W		
R201			RK73EB2B220J	CHIP R 22 J 1/8W		
R202			R92-0685-05	CHIP R 22 J 1/2W		
R203			R92-1259-05	FIXED RESISTOR(18 OHM)		
R204			R92-1262-05	FIXED RESISTOR(4.7 OHM)		
R205			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R207			RK73FB2A103J	CHIP R 10K J 1/10W		
R208			RK73FB2A471J	CHIP R 470 J 1/10W		
R209			RK73FB2A561J	CHIP R 560 J 1/10W		
R210			RK73FB2A563J	CHIP R 56K J 1/10W		
R211			RK73FB2A103J	CHIP R 10K J 1/10W		
R213			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R214			RK73FB2A474J	CHIP R 470K J 1/10W		
R215			R92-0670-05	CHIP R 0 OHM		
R216, 217			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R218			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R219			R92-0670-05	CHIP R 0 OHM		
R220			R92-0670-05	CHIP R 0 OHM		M2E2
R222			RK73FB2A151J	CHIP R 150 J 1/10W		
R223-225			RK73FB2A473J	CHIP R 47K J 1/10W		
R226-229			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R230			RK73FB2A473J	CHIP R 47K J 1/10W		
R231, 232			RK73FB2A104J	CHIP R 100K J 1/10W		
R233			R92-0670-05	CHIP R 0 OHM		
R234			RK73FB2A104J	CHIP R 100K J 1/10W		
R235			RK73FB2A474J	CHIP R 470K J 1/10W		
R236, 237			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R238			RK73FB2A474J	CHIP R 470K J 1/10W		
R239			RK73FB2A473J	CHIP R 47K J 1/10W		
R240			R92-0670-05	CHIP R 0 OHM		
R241			RK73FB2A473J	CHIP R 47K J 1/10W		
R242			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R243			RK73FB2A474J	CHIP R 470K J 1/10W		
R244			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R245			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R246			R90-0711-05	MULTI-COMP		
R247			RK73EB2B180J	CHIP R 18 J 1/8W		
VR1			R12-5058-05	TRIM POT. 100K		
VR3			R12-3132-05	TRIM POT. 47K		
VR4, 5			R12-3126-05	TRIMMING POT.(10K)		
VR201			R05-3441-05	POTENTIOMETER(10KA)		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
VR202			R05-4420-05	POTENTIOMETER(50KB)		
S201			S40-2458-05	PUSH SWITCH(POWER)		
S202-211			S40-1086-05	TACT SWITCH		
D1			DAN235K	DIODE	KP	
D2 -6			1SV164	DIODE		
D7			LFB01	DIODE		
D8 ,9			1SS184	DIODE		
D10			DAN235K	DIODE		
D11			1SS181	DIODE		
D12			M1407	DIODE		
D13			M1308	DIODE		
D14 ,15			1SS226	DIODE		
D16			DSA3A1	DIODE		
D202			02CZ9.1(Y)	CHIP ZENER DIODE		
D203			1SS184	DIODE		
D204			1SS181	DIODE		
D205			1SS184	DIODE		
D206			1SS184	DIODE	KPMEM2	
D207			1SS184	DIODE		
D209			MA141A	CHIP DIODE	MM2EE2	
D210			MA141A	CHIP DIODE	MM2EE2	
D211			MA141A	CHIP DIODE	EE2	
D212			1SS226	DIODE		
D213			LFB01	DIODE		
D214			02CZ3.9(Z)	CHIP ZENER DIODE		
D215			02CZ3.0(Z)	CHIP ZENER DIODE		
D216			B30-0852-05	LED(LOW)		
D217			1SS184	DIODE		
IC1			KCD04	HIC(FM IF)		
IC2			TA7787AF	IC(FM/AM IF/3V)	KP	
IC3			UPC1241H	IC(AF PA)		
IC4			KCC02	HIC(EL,VOL)		
IC5			TC9174F	IC(CMOS I/O)		
IC6			NJM78L05UA	IC(VOLTAGE REGULATOR/ +5V)		
IC7			LA5010M	IC(LOW SATURATION REGULATOR)		
IC8			KCB05	HIC(DRIVE)		
IC9			MC7808CT	IC(VOLTAGE REGULATORS/ +8V)		
IC201		*	75116GF-728-3BE	IC(CPU)		
IC202			NJM78L06UA	IC(VOLTAGE REGULATOR/ +6V)		
Q1			3SK184(S)	FET		
Q2			DTA114YK	DIGITAL TRANSISTOR	KP	
Q3			DTC123JK	DIGITAL TRANSISTOR	KP	
Q4			3SK131(V12)	FET		
Q5			2SC2714(Y)	TRANSISTOR		
Q6			2SK208(Y)	FET	KP	
Q7			DTC143EK	DIGITAL TRANSISTOR	KP	
Q8			2SC2712(Y)	TRANSISTOR	KP	
Q9			FMG2	TRANSISTOR		
Q10			2SC2712(Y)	TRANSISTOR		
Q12			2SD1757K	TRANSISTOR		
Q13 ,14			2SB1119S	TRANSISTOR		
Q15			DTC144WK	DIGITAL TRANSISTOR		
Q16 -18			2SC2712(Y)	TRANSISTOR		

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TX-RX UNIT (X57-369X-XX)

PLL UNIT (X58-3470-00)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕 向	Re- marks 備考
Q19			2SD1757K	TRANSISTOR		
Q20			2SC2712(Y)	TRANSISTOR		
Q21			2SK208(Y)	FET		
Q22			2SC2714(Y)	TRANSISTOR		
Q23, 24			DTC124EK	DIGITAL TRANSISTOR		
Q25			2SD1406(Y)	TRANSISTOR		
Q26			2SB1302S	TRANSISTOR		
Q27			2SC2712(Y)	TRANSISTOR		
Q28			2SJ106(GR)	FET		
Q201-204			2SA1519	TRANSISTOR		
Q205			2SD1682(R, S)	TRANSISTOR		
Q206-208			2SC2712(Y)	TRANSISTOR		
Q209, 210			DTC114EK	DIGITAL TRANSISTOR		
Q211			DTD143EK	DIGITAL TRANSISTOR		
Q212			FMG2	TRANSISTOR		
S212			W02-0388-05	ROTARY ENCODER		
			X58-3470-00	SUB UNIT(PLL)		
			X59-3130-00	MODULE UNIT(APC)		
			X59-3610-00	MODULE UNIT(MIC AMP)		
<b>PLL UNIT (X58-3470-00)</b>						
C1			CC73FCH1H220J	CHIP C 22PF J		
C2			CK73FB1H102K	CHIP C 1000PF K		
C3			CC73FCH1H020C	CHIP C 2.0PF C		
C4, 5			CK73FB1H472K	CHIP C 4700PF K		
C6			CC73FCH1H010C	CHIP C 1PF C		
C7 -9			CK73FB1H102K	CHIP C 1000PF K		
C10			CK73FB1H472K	CHIP C 4700PF K		
C11			CK73FB1H102K	CHIP C 1000PF K		
C51			CC73FCH1H100D	CHIP C 10PF D		
C52			CK73FB1H102K	CHIP C 1000PF K		
C53			CC73FCH1H100D	CHIP C 10PF D		
C54			CK73FB1H102K	CHIP C 1000PF K		
C55			CK73EB1H223K	CHIP C 0.022UF K		
C56			CK73FB1E393K	CHIP C 0.039UF K		
C101			CK73EB1H223K	CHIP C 0.022UF K		
C102			CK73EB1H223K	CHIP C 0.022UF K		
C102, 103			C92-0009-05	CHIP TAN 4.7UF 10WV		
C104			CK73FB1H102K	CHIP C 1000PF K		
C105			C92-0003-05	CHIP TAN 0.47UF 25WV		
C106			CK73EB1H223K	CHIP C 0.022UF K		
C107			CC73FCH1H100D	CHIP C 10PF D		
C108			CC73FCH1H220J	CHIP C 22PF J		
C109, 110			CK73FB1H102K	CHIP C 1000PF K		
CN1			E40-0311-05	PIN CONNECTOR(3P)		
CN2			E40-0411-05	PIN CONNECTOR(4P)		
CN3			E40-5201-05	PIN CONNECTOR(7P)		
			F11-1122-14	SHIELDING COVER		
L1			L40-1581-80	SMALL FIXED INDUCTOR(150NH)		
L2 -4			L40-3391-19	SMALL FIXED INDUCTOR(3.3UH)		
L5			L34-2336-05	COIL		
L51			L40-3392-81	SMALL FIXED INDUCTOR(3.3UH)		
			RK73FB2A392J	CHIP R 3.9K J 1/10W		

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PLL UNIT (X58-3470-00)

APC UNIT (X59-3130-00)

MIC AMP UNIT (X59-3610-00)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名/規格	Desti- nation 仕向	Re- marks 備考
R1			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R2			RK73FB2A561J	CHIP R 560 J 1/10W		
R3			RK73FB2A101J	CHIP R 100 J 1/10W		
R4			RK73FB2A121J	CHIP R 120 J 1/10W		
R5			RK73FB2A470J	CHIP R 47 J 1/10W		
R6 ,7			R92-0670-05	CHIP R 0 OHM		
R8			RK73FB2A101J	CHIP R 100 J 1/10W		
R9			RK73FB2A470J	CHIP R 47 J 1/10W		
R10			RK73FB2A103J	CHIP R 10K J 1/10W		
R51			RK73FB2A103J	CHIP R 10K J 1/10W		
R52			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A221J	CHIP R 220 J 1/10W		
R54			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R55			RK73FB2A473J	CHIP R 47K J 1/10W		
R101			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R102			R92-0670-05	CHIP R 0 OHM		
R103			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R104			R92-0670-05	CHIP R 0 OHM		
R105			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R106			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R107-111			RK73FB2A473J	CHIP R 47K J 1/10W		
R112			RK73FB2A223J	CHIP R 22K J 1/10W		
R113			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R114			R92-0670-05	CHIP R 0 OHM		
D1 ,2			1T33C			
IC51			M54959FP	IC(FREQ SYNTHESIZER PLL)		
Q1			2SC2714(Y)	TRANSISTOR		
Q2			2SK582	FET		
Q51			2SC2714(Y)	TRANSISTOR		
Q52			DTC144EK	DIGITAL TRANSISTOR		
Q53			2SC2712(Y)	TRANSISTOR		
Q101,102			2SC3324(B)	TRANSISTOR		
<b>APC UNIT (X59-3130-00)</b>						
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			C92-0501-05	CHIP-TAN 1.5UF 6.3WV		
C3			CK73FB1H472K	CHIP C 4700PF K		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			CK73FB1H472K	CHIP C 4700PF K		
C6			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R1			RD41FB2B222J	CARBON 2.2K J 1/8W		
R2			RD41FB2B102J	CARBON 1K J 1/8W		
R3			RD41FB2B152J	CARBON 1.5K J 1/8W		
R4 ,5			RD41FB2B103J	CARBON 10K J 1/8W		
R6			RD41FB2B122J	CARBON 1.2K J 1/8W		
Q1 ,2			FMW1	TRANSISTOR		
Q3			2SA1162(Y)	TRANSISTOR		
<b>MIC AMP UNIT (X59-3610-00)</b>						
C1			CK73FF1E104Z	CHIP C 0.1UF Z		
C2			CK73GB1H102K	CHIP C 1000PF K		
C3			CK73FB1E333K	CHIP C 0.033UF K		
C4			CC73GCH1H270J	CHIP C 27PF J		
C5			C92-0004-05	CHIP TAN 1.0UF 16WV		

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MIC AMP UNIT (X59-3610-00)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名/規格	Desti- nation 仕向	Re- marks 備考
C6			CK73FB1E333K	CHIP C 0.033UF K		
C7			CK73GB1H681K	CHIP C 680PF K		
C8			CK73GB1H332K	CHIP C 3300PF K		
C9			CC73GCH1H820J	CHIP C 82PF J		
C10			CC73GCH1H101J	CHIP C 100PF J		
C11			CK73GB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R1			RK73GB1J223J	CHIP R 22K J 1/16W		
R2			RK73GB1J104J	CHIP R 100K J 1/16W		
R3			RK73GB1J561J	CHIP R 560 J 1/16W		
R4			RK73GB1J470J	CHIP R 47 J 1/16W		
R5			RK73GB1J561J	CHIP R 560 J 1/16W		
R6			R92-1252-05	CHIP R 0 OHM		
R7			RK73GB1J394J	CHIP R 390K J 1/16W		
R8			RK73GB1J224J	CHIP R 220K J 1/16W		
R9			RK73GB1J184J	CHIP R 180K J 1/16W		
R10			RK73GB1J333J	CHIP R 33K J 1/16W		
R11			RK73FB2A473J	CHIP R 47K J 1/10W		
R12			RK73GB1J224J	CHIP R 220K J 1/16W		
R13 -15			RK73GB1J823J	CHIP R 82K J 1/16W		
R16			R92-1252-05	CHIP R 0 OHM		
IC1			NJM4558M	IC(OP AMP X2)		
Q1			2SC4116(GR)	TRANSISTOR		

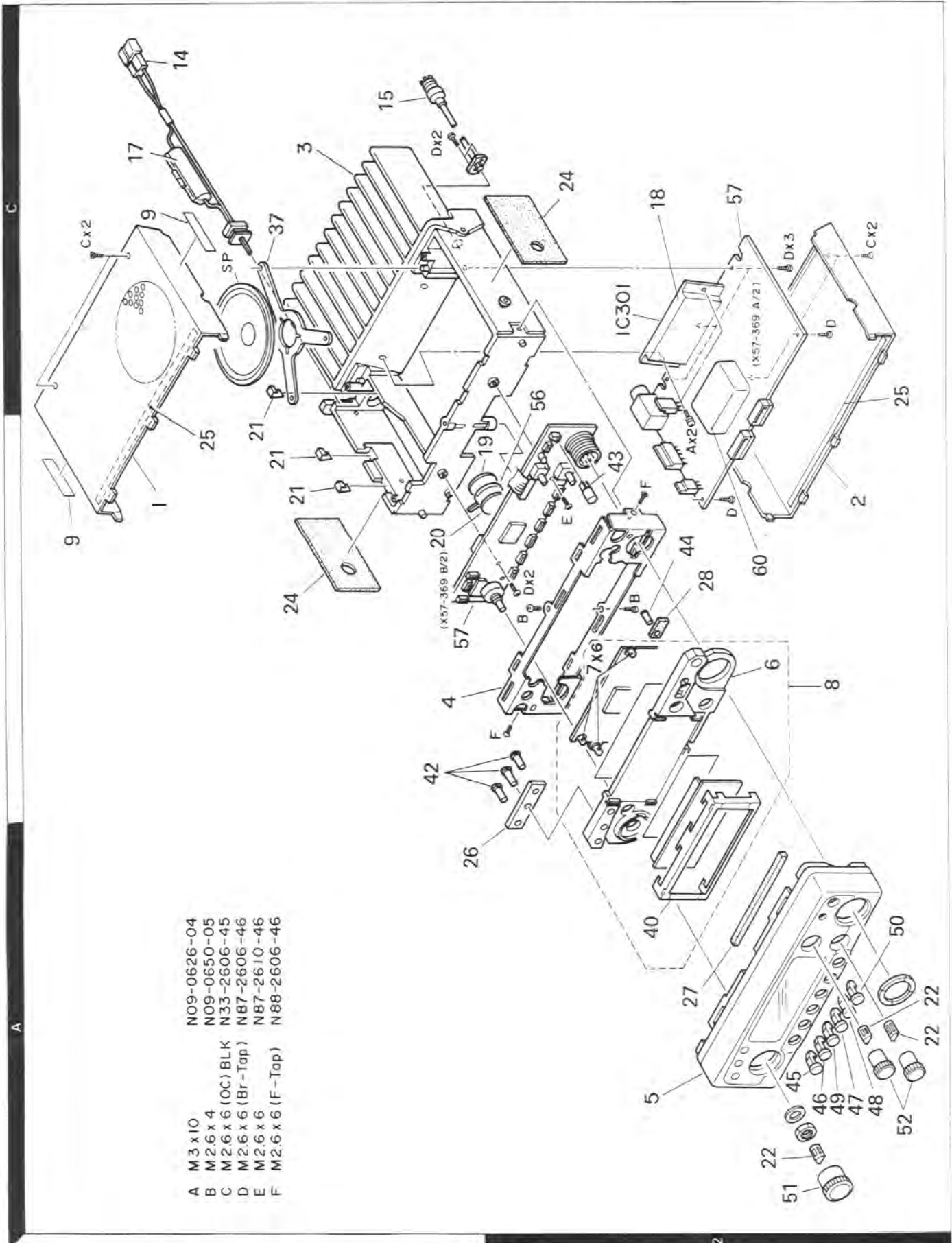
E: Scandinavia & Europe K: USA P: Canada W: Europe

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

UE: AAFES(Europe) X: Australia

TM-241A: K, P, M, M2  
TM-241E: E, E2

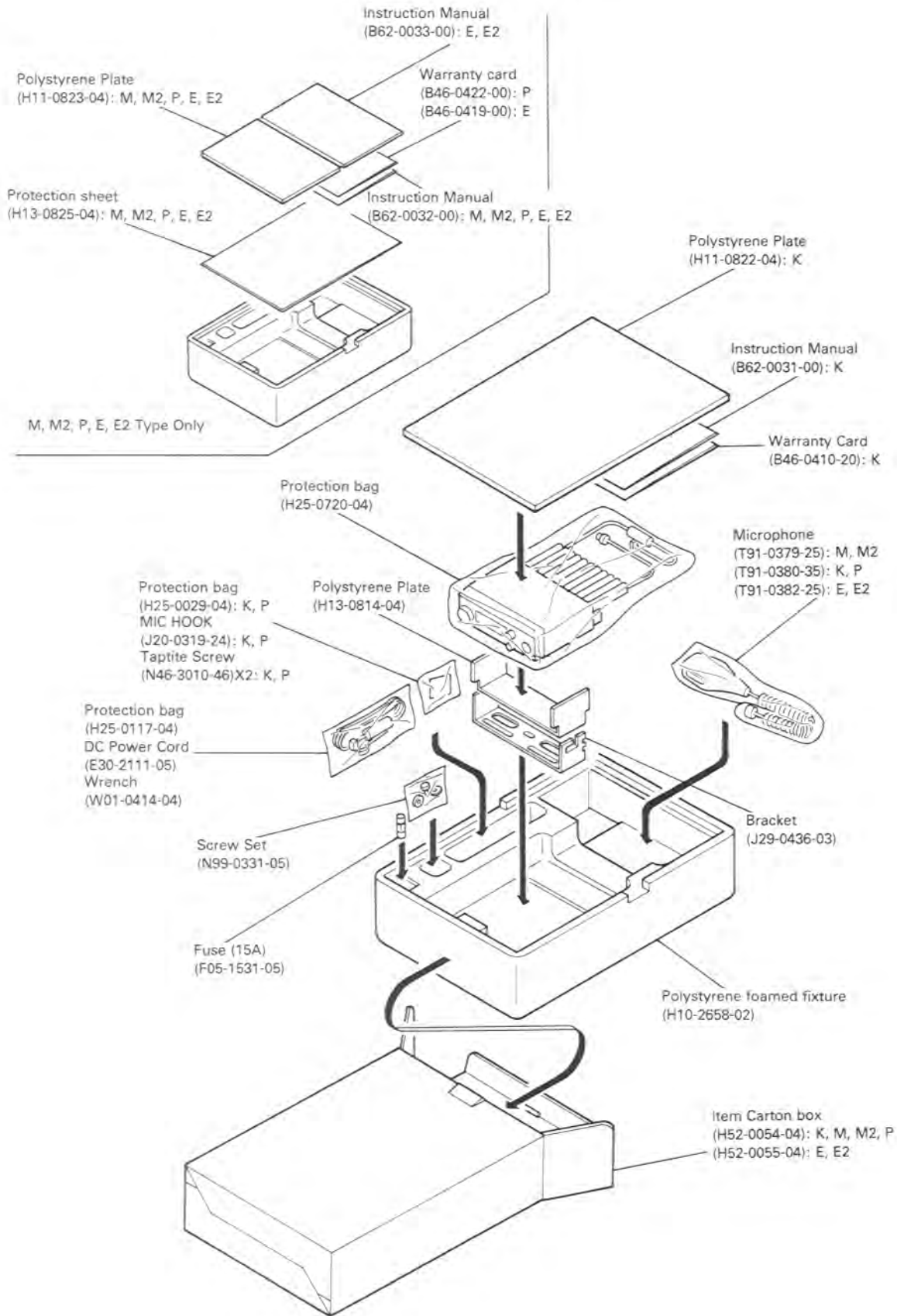
## EXPLODED VIEW



- A M3 x 10
  - B M2.6 x 4
  - C M2.6 x 6 (OC) BLK
  - D M2.6 x 6 (Br-Top)
  - E M2.6 x 6
  - F M2.6 x 6 (F-Top)
- N09-0626-04
  - N09-0650-05
  - N33-2606-45
  - N87-2606-46
  - N87-2610-46
  - N88-2606-46

Parts with the exploded numbers larger than 700 are not supplied.

## PACKING





## ADJUSTMENT

### REQUIRED TEST EQUIPMENT

#### 1. DC V.M and Tester

- 1) High input impedance

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

- 1) Input impedance : 1MΩ min., 2pF max.
- 2) Voltage range : F.S = 10mV to 300V
- 3) Frequency range : Up to 450MHz

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

- 1) Input sensitivity : Approx. 50mV
- 2) Frequency range : Up to 450MHz

#### 4. DC Power Supply

- 1) Voltage : 10V to 17V, variable
- 2) Current: 11A min.

#### 5. Power Meter

- 1) Measurement range: Approx. 60W, 3W, 1W
- 2) Input impedance : 50Ω
- 3) Frequency range : 450MHz

#### 6. AF VTVM (AF V.M)

- 1) Input impedance : 1MΩ min.
- 2) Voltage range : F.S = 1mV to 30V
- 3) Frequency range : 50Hz to 10kHz

#### 7. AF Generator (AG)

- 1) Output frequency : 100Hz to 10kHz
- 2) Output voltage : 0.5mV to 1V

#### 8. Linear Detector

- 1) Frequency range : 450MHz

#### 9. Spectrum Analyzer

- 1) Frequency range : 450MHz

#### 10. Directional Coupler

#### 11. Oscilloscope

- 1) High sensitivity oscilloscope with horizontal input terminal

#### 12. SSG

- 1) Frequency range : 144MHz band
- 2) Modulation: AM and FM MOD.
- 3) Output level : 0.1μV to 100mV.

#### 13. Dummy Load

- 1) 8Ω, 5W (approx.)

#### 14. Noise Generator

- 1) Must generate ignition-like noise containing harmonics beyond 450MHz.

#### 15. Sweep Generator

- 1) Sweep range : 144MHz bands

#### 16. Tracking Generator

### PREPARATION

- 1) Unless otherwise specified, knobs and switches should be set as follows **Table 7**.

POWER SW	ON	CALL	OFF
AF VOL VR	MIN	SHIFT/AL	OFF
SQL VOL VR	MIN	TONE/T. ALT	OFF
VFO	VFO	REV/STEP	OFF
MR	OFF	DR/DT	OFF

Table 7

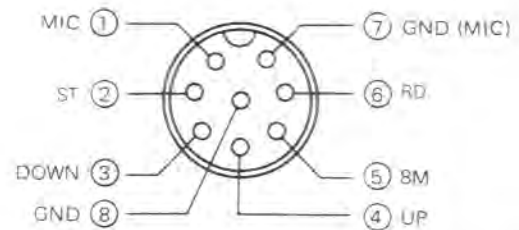


Fig. 13 MIC terminals (view from front panel side)

- 2) Use an insulated adjusting rod to adjust trimmers and coils.
- 3) To prevent damaging SSG, never set the stand by switch to SEND while adjusting the receiver section.
- 4) Be sure to turn the power switch OFF, before connecting the power cable to a power source.
- 5) Meter and display section should be set as follows **Fig. 14**.

Fig. 14.

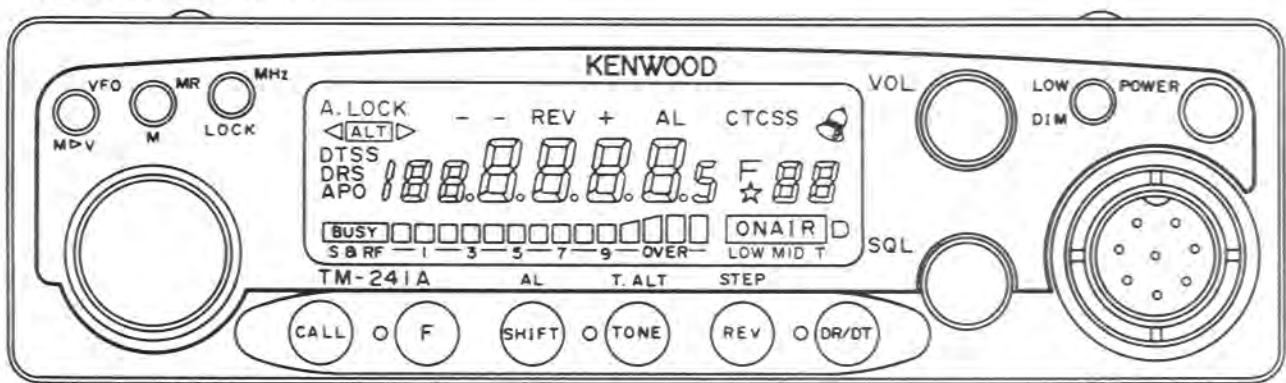


Fig. 14

## ADJUSTMENT

### COMMON SECTION ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Setting	1) Source voltage : DC 13.8V POWER SW : OFF VOL VR : Full counter-clockwise (CCW) SQL VR : CCW TX-RX unit VR3, 4 : CCW VR1 : Center							
2. Reset	1) Turn POWER SW ON while holding down MR/M.							Display 144.000
3. PLL	1) RX VCO FREQ. : 144.975 <b>E,E<sub>2</sub></b> FREQ. : 146.000 <b>K,P,M,M<sub>2</sub></b> Receive.	DVM Dummy	TX-RX Rear panel	TP2 ANT			Check	1.7 ~ 2.4V
	2) FREQ. : 136.000 <b>K,P,M,M<sub>2</sub></b> Receive.							1.0V or more.
	3) TX VCO FREQ. : 144.975 <b>E,E<sub>2</sub></b> FREQ. : 146.000 <b>K,P,M,M<sub>2</sub></b> Transmit.							3.2 ~ 3.8V
	4) FREQ. : 173.995 <b>M<sub>2</sub>,E<sub>2</sub></b> Transmit.							10V or less.
4. Transmit frequency adjustment	1) FREQ. : 144.975 <b>E,E<sub>2</sub></b> FREQ. : 146.000 <b>K,P,M,M<sub>2</sub></b> Transmit.	f.counter Power meter	Rear panel	ANT	TX-RX	TC1	144.975MHz <b>E,E<sub>2</sub></b> 146.000MHz <b>K,P,M,M<sub>2</sub></b>	±100Hz

### RECEIVER SECTION ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. BPF	1) FREQ. : 145.050 <b>E,E<sub>2</sub></b> FREQ. : 146.040 <b>K,P,M,M<sub>2</sub></b>  TX-RX unit VR1 : Center Connect the SSG to ANT. Connect the DC V.M to TP1, SSG output : -113dBm (0.5μV) SSG MOD : 1kHz SSG DEV : 3kHz	DC V.M SSG	TX-RX	TP1	TX-RX	L1~5	Repeat for MAX.	
2. Distortion	1) FREQ. : 145.050 <b>E,E<sub>2</sub></b> FREQ. : 146.040 <b>K,P,M,M<sub>2</sub></b>  SSG output: -113dBm (0.5μV) SSG MOD : 1kHz SSG DEV : 3kHz	Distortion meter Oscilloscope	Rear panel	SP	TX-RX	L6	Repeat for MIN.	Turn L6 core CCW until best SINAD point obtained.

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks		
		Test-equipment	Unit	Terminal	Unit	Parts	Method			
3. Receiving sensitivity	1) FREQ. : 145.050 E,E <sub>2</sub> FREQ. : 146.040 K,P,M,M2  SSG output : -123dBm (0.16μV) SSG MOD : 1kHz SSG DEV : 3kHz	AF V.M Oscilloscope	Rear panel	SP	TX-RX		Check	SINAD 12dB or more.		
	2) FREQ. : 144.040 K,P,M,M2 FREQ. : 144.050 E,E <sub>2</sub>									
	3) FREQ. : 145.950 E,E <sub>2</sub> FREQ. : 147.940 K,P,M,M2									
4. S-meter	1) FREQ. : 145.050 E,E <sub>2</sub> FREQ. : 146.040 K,P,M,M2  SSG output: -96dBm (3.6μV) SSG MOD : 1kHz SSG DEV : 3kHz	LCD (S-meter)			TX-RX	VR1	Adjust so that all the signal-strength segments go on, then the last segment goes off.			
	2) SSG output: -95 dBm (4μV)								Check	All S-meter segments on.
	3) SSG: OFF								Check	S-meter off.

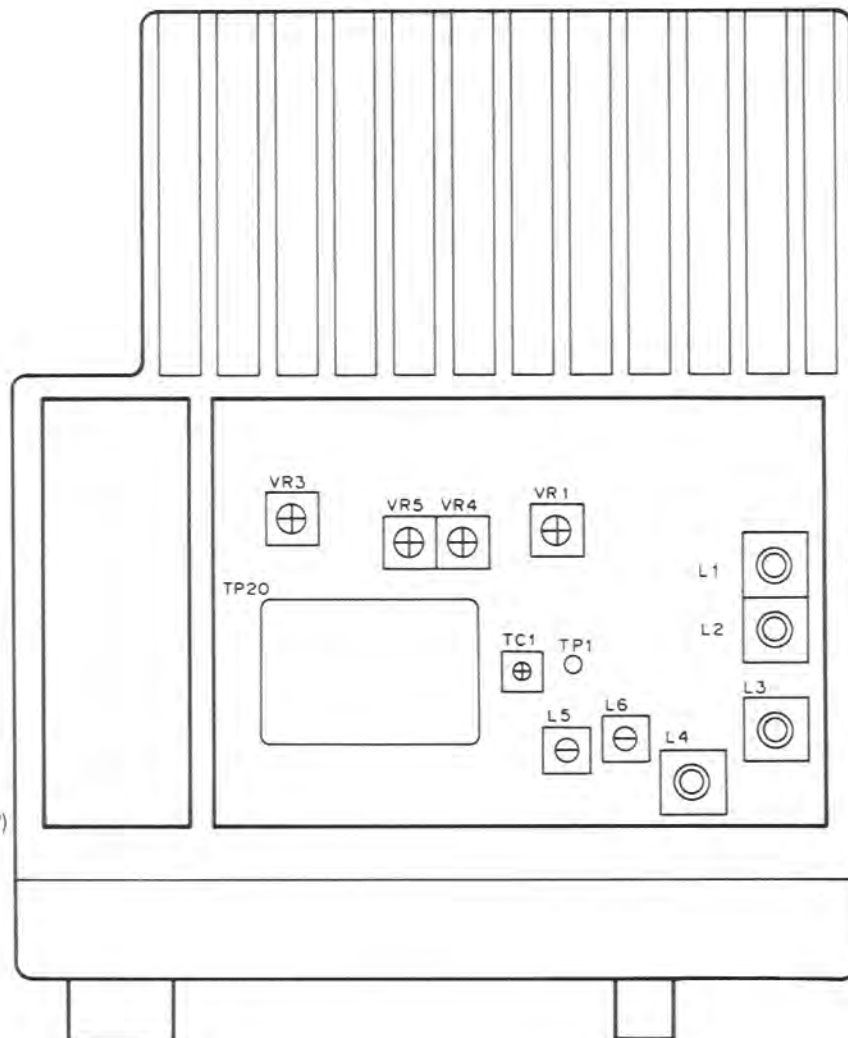
### TRANSMITTER SECTION ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks			
		Test-equipment	Unit	Terminal	Unit	Parts	Method				
1-1. APC	1) FREQ. : 144.975 E,E <sub>2</sub> FREQ. : 146.000 K,P,M,M2  Transmit.	Power meter Ammeter	Rear panel	ANT			Check	57W or more.			
	2) FREQ. : 145.975 E,E <sub>2</sub> FREQ. : 147.995 K,P,M,M2  Transmit.							TX-RX	VR4	54W	ON AIR LED on. ±1W, 11A or less.
	3) FREQ. : 144.000 Transmit.									Check	49 - 59W 11A or less.
	4) FREQ. : 144.975 E,E <sub>2</sub> FREQ. : 146.000 K,P,M,M2  Transmit.									Read RF meter	All RF meter LEDs on.
1-2. MID power	1) FREQ. : 144.975 E,E <sub>2</sub> FREQ. : 146.000 K,P,M,M2  LOW SW: PUSH Transmit.				TX-RX	VR5	12W Read RF meter	±1W 10 RF meter LEDs on.			
1-3. LOW power	1) FREQ. : 144.975 E,E <sub>2</sub> FREQ. : 146.000 K,P,M,M2  LOW SW: PUSH Transmit.						Check Read RF meter	3.0 - 8.0W 6 RF meter LEDs on.			

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
2. DEV.	1) FREQ. : 144.975 E,E <sub>2</sub> FREQ. : 146.000 K,P,M,M2 AG : 1kHz, 28mV E,E <sub>2</sub> AG : 1kHz, 50mV K,P,M,M2 Transmit.	Linear detector Oscilloscope Power meter	Rear panel	ANT	TX-RX	VR3	±4.4kHz (Read higher absolute value of + or - value)	±200Hz Check for detected waveform.
	2) AG : 1kHz, 2.8mV E,E <sub>2</sub> AG : 1kHz, 5.0mV K,P,M,M2						Check	±2.2 ~ 3.6kHz
	3) DTSS AG : 1.6 kHz 175 mV (CN5 INPUT)						Check	±2.5 kHz or more
3. Protection	1) FREQ. : 145.975 E,E <sub>2</sub> FREQ. : 147.995 K,P,M,M2  ANT : OPEN Transmit.	Ammeter					Check	11A or less.
4-1. TONE	1) FREQ. : 145.250 TONE : ON Transmit.	Linear detector Oscilloscope	Rear panel	ANT			Check	DEV. : ±0.5 ~ 1.0kHz
4-2. TONE	1) FREQ. : 144.975 E,E <sub>2</sub> Transmit.	Power meter					TONE SW of MIC : ON.	DEV. : ±2.5 ~ 5.0kHz

### Adjustment Points (Top View)

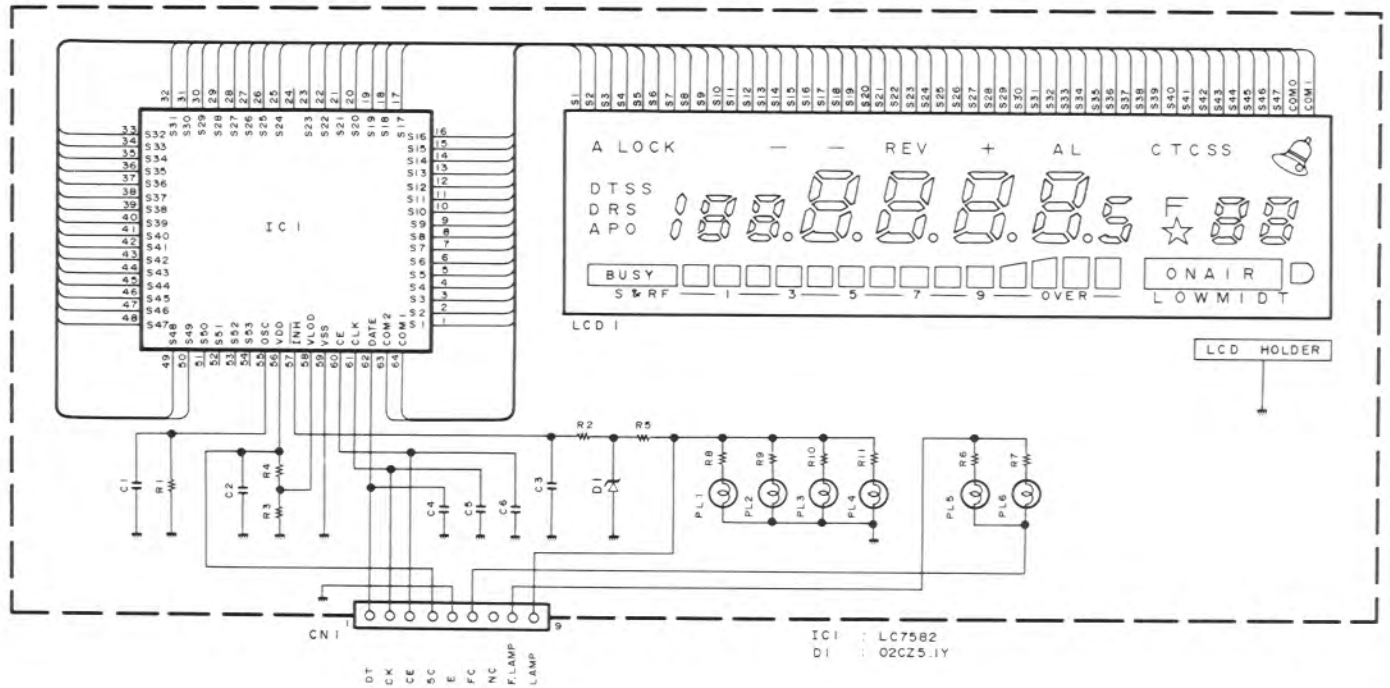


#### TX-RX unit (X57-369X-XX)

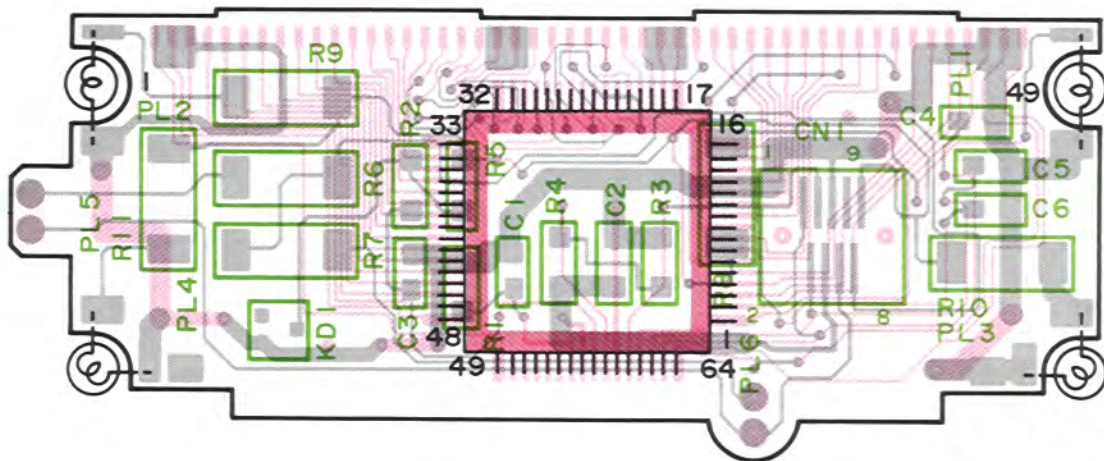
- VR1: S-meter
- VR3: ±4.4 kHz at 1 kHz, 28 mV (E,E<sub>2</sub>)
- VR3: ±4.4 kHz at 1 kHz, 50 mV (K, M, M2, P)
- VR4: APC
- VR5: MIC POWER
- L1-5: BPF, RX sensitivity
- L6: Distortion, RX sensitivity
- TC1: TX frequency

# PC BOARD VIEWS/CIRCUIT DIAGRAMS TM-241A/E

## LCD ASS'Y (B38-0330-05)



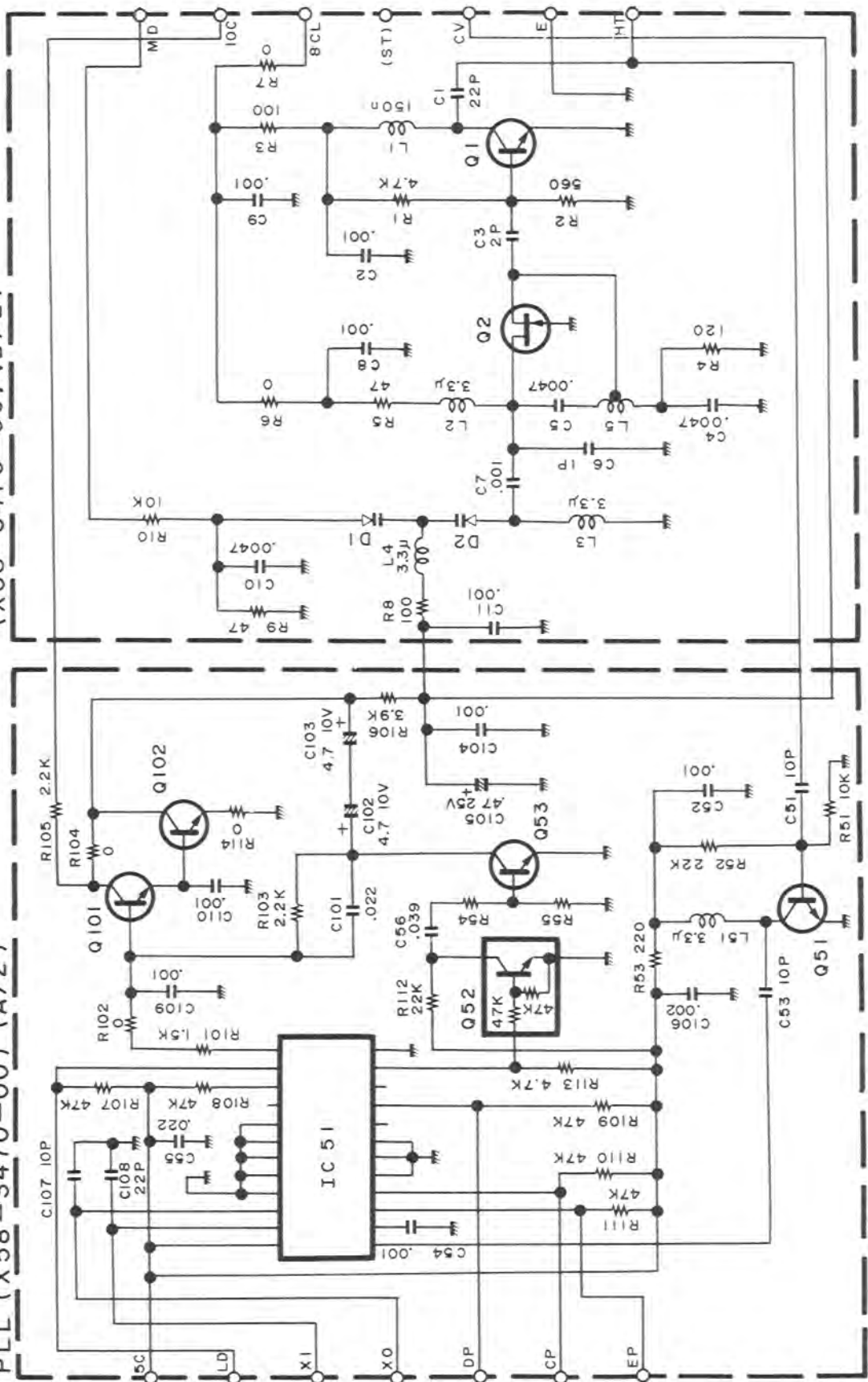
## LCD ASS'Y (B38-0330-05) Component side view



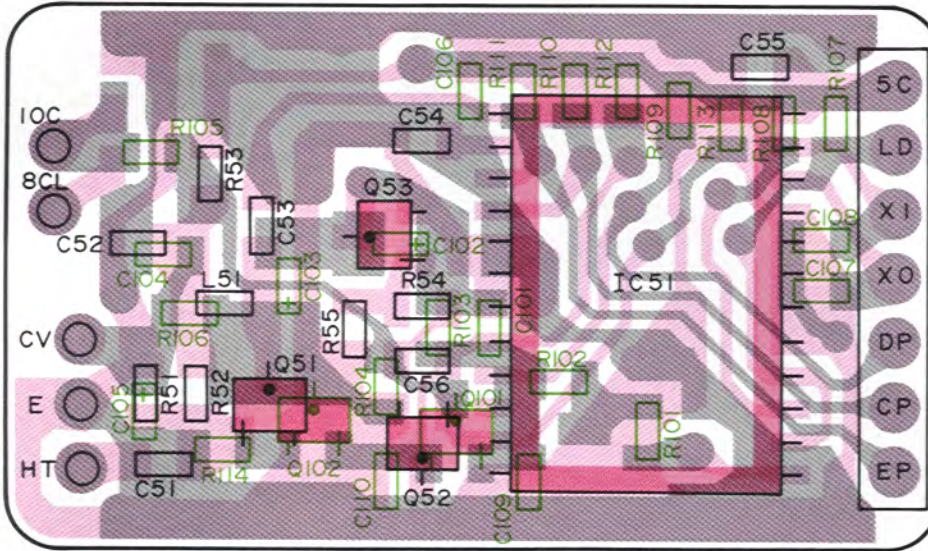
# TM-241A/E CIRCUIT DIAGRAM

(X58-3470-00) (B/2)

PLL (X58-3470-00) (A/2)

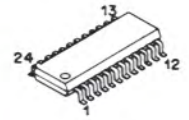


**PLL (X58-3470-00) (A/2) Component side view**

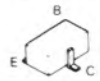


IC51:M54949FP Q51:2SC2714(Y) Q52:DTC144EK Q53:2SC2714Y  
Q101,102:2SC3324(B)

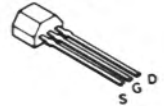
M54949FP



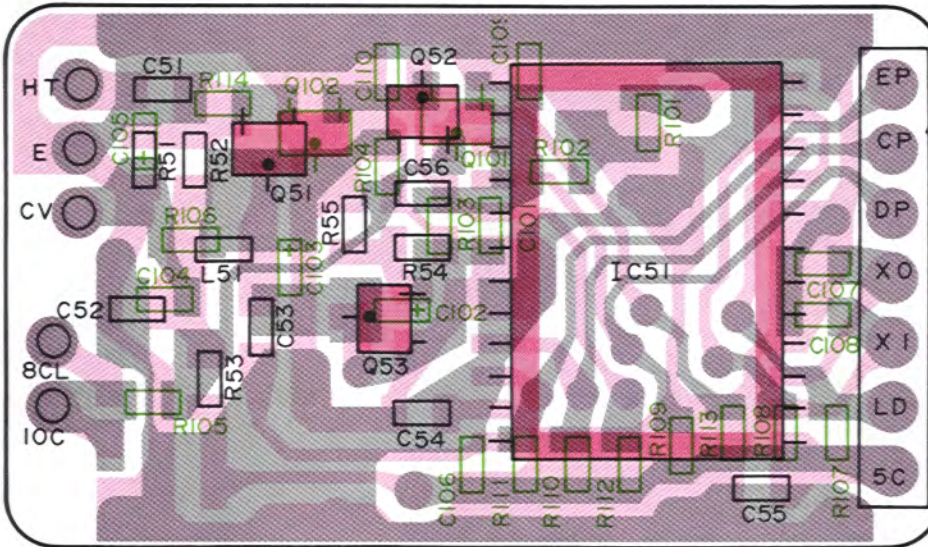
2SC2714  
DTC144EK  
2SC2712Y  
2SC3324



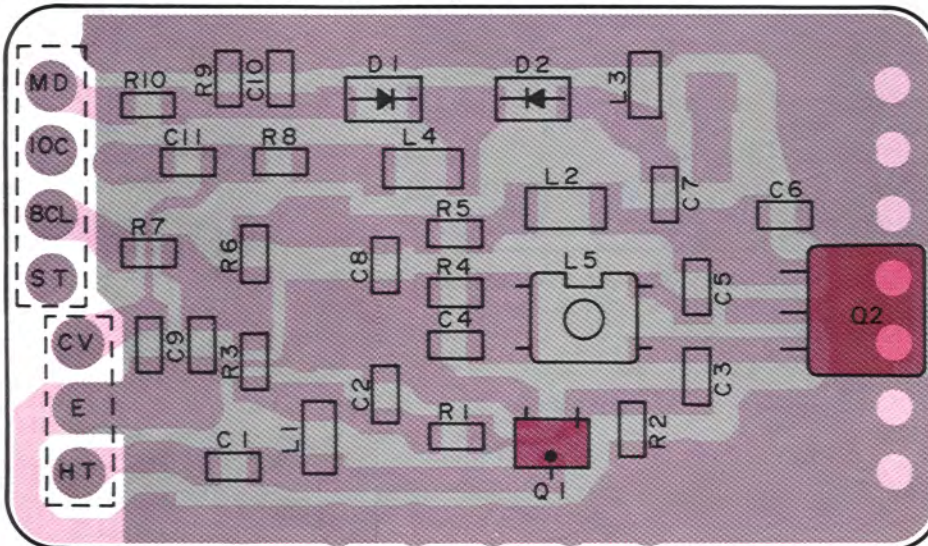
2SK582



**PLL (X58-3470-00) (A/2) Foil side view**



**PLL (X58-3470-00) (B/2) Component side view**



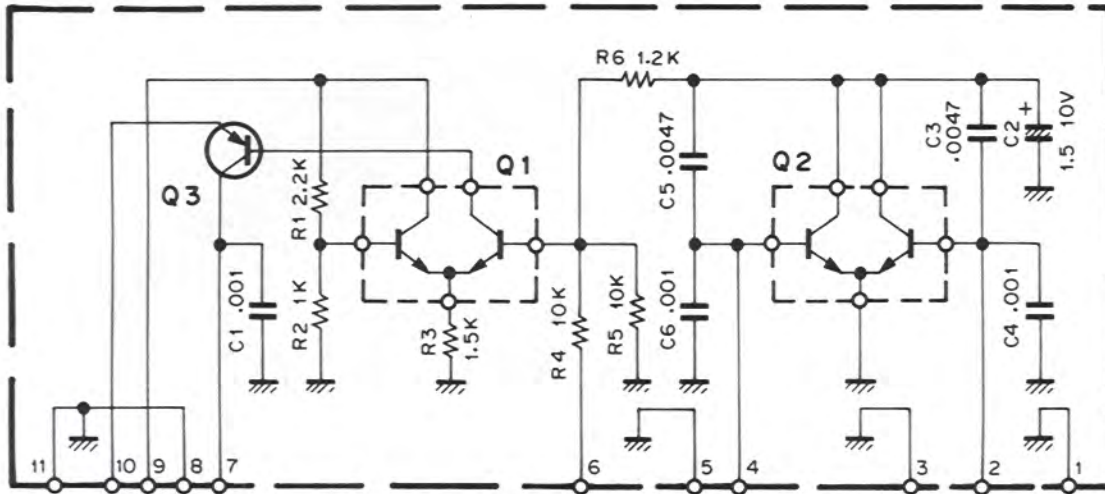
Q1:2SC2714(Y) Q2:2SK582

# PC BOARD VIEW/CIRCUIT DIAGRAM

# TM-241A/E

APC (X59-3130-00)

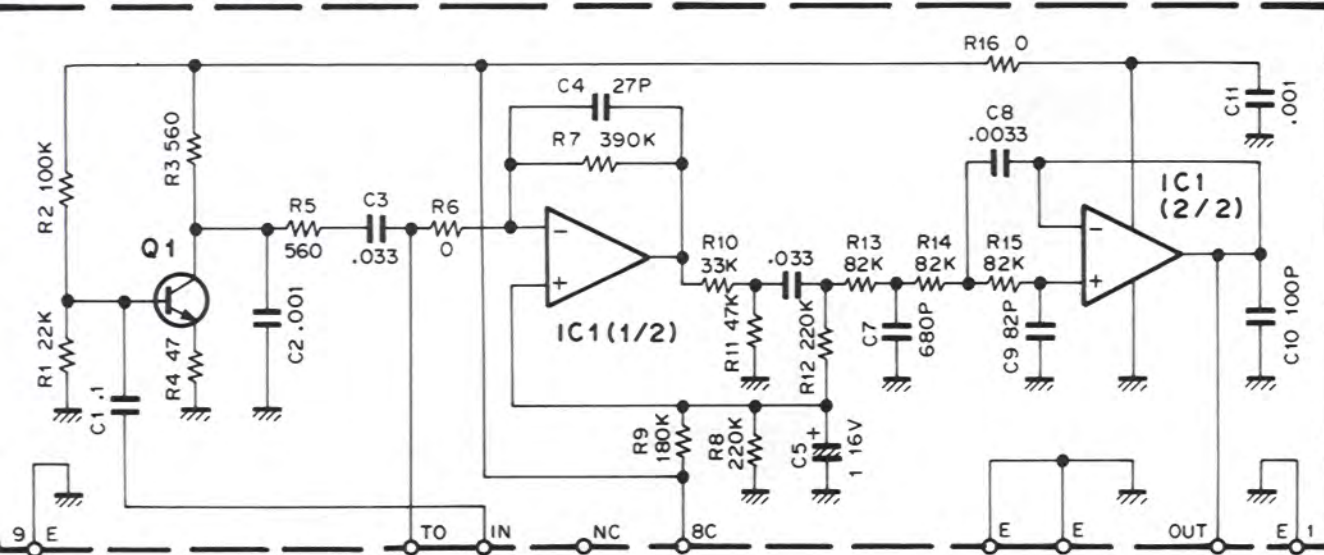
APC (X59-3130-00)



Q1,2 : FMW-1    Q3 : 2SA1162 (GR)

MIC AMP (X59-3610-00)

MIC AMP (X59-3610-00)

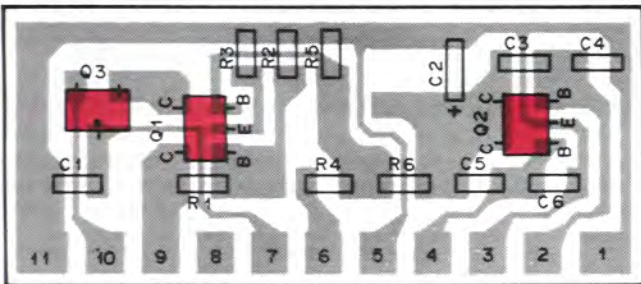


Q1 : 2SC4116 (Y)

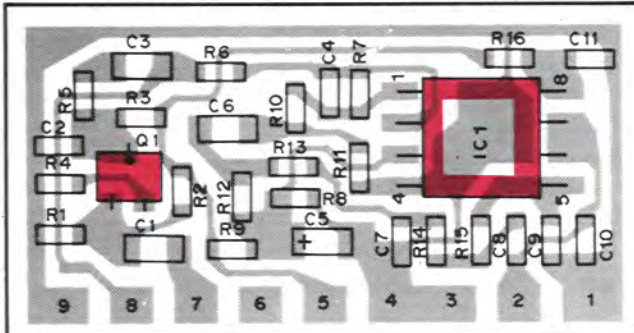
IC1 : NJM4558M

APC (X59-3130-00) Component side view

MIC AMP (X59-3610-00) Foil side view



Q1,2 : FMW-1    Q3 : 2SA1162 (GR)



Q1 : 2SC4116 (Y)    IC1 : NJM4558M

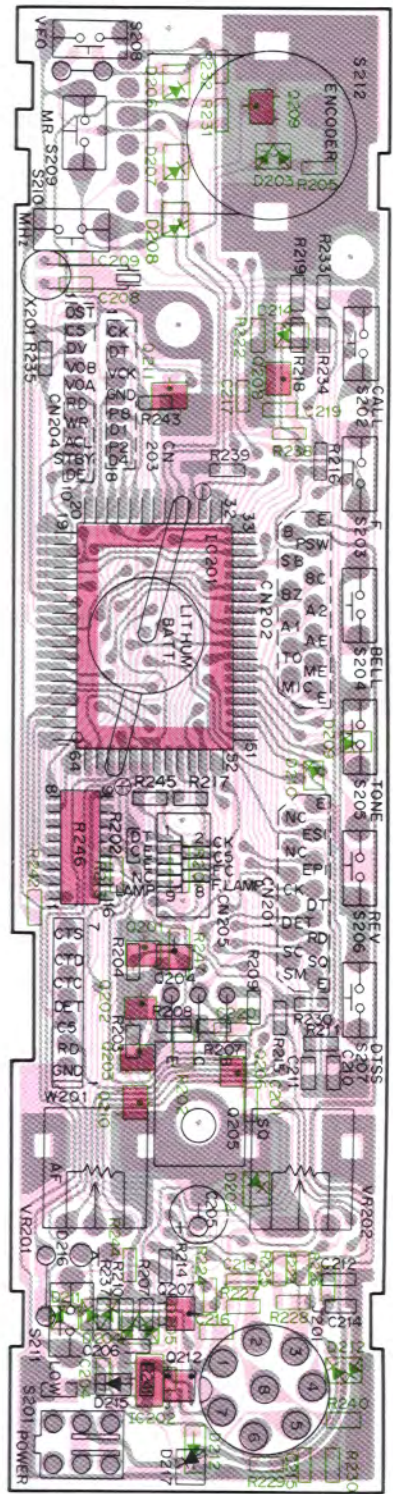
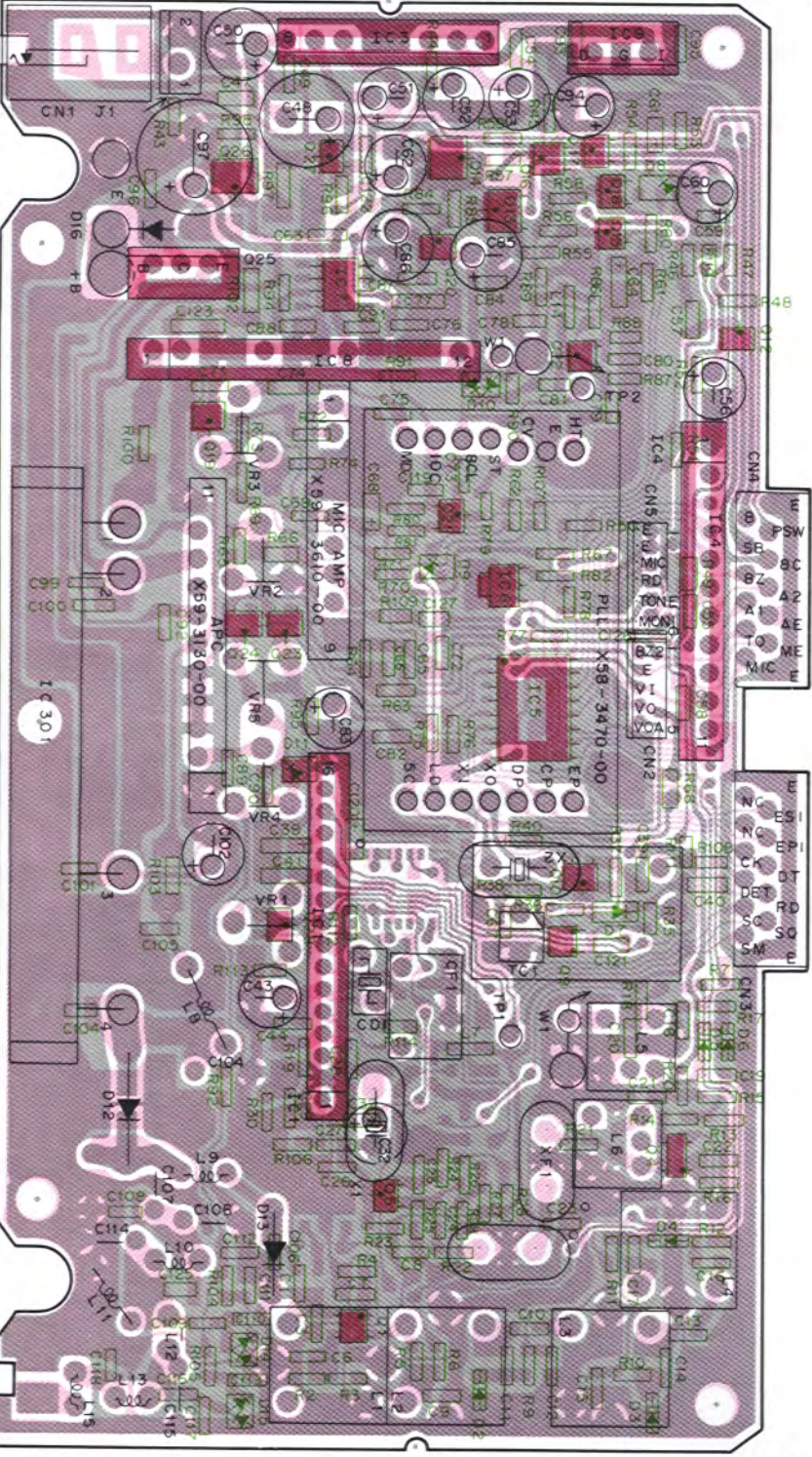
Refer to the schematic diagram for the values of resistors and capacitors.



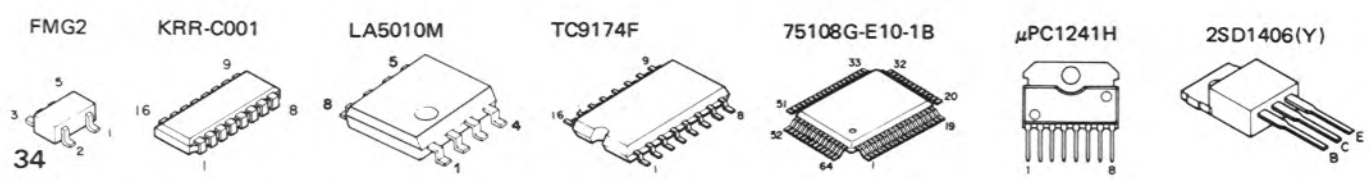


**TX-RX UNIT (X57-3310-XX) Foil side view**

0-11: TM-241A (K,P) 0-21: TM-241A (M) 0-22: TM-241A (M2) 2-71: TM-241E (T,E) 2-72: TM-241E (E2)

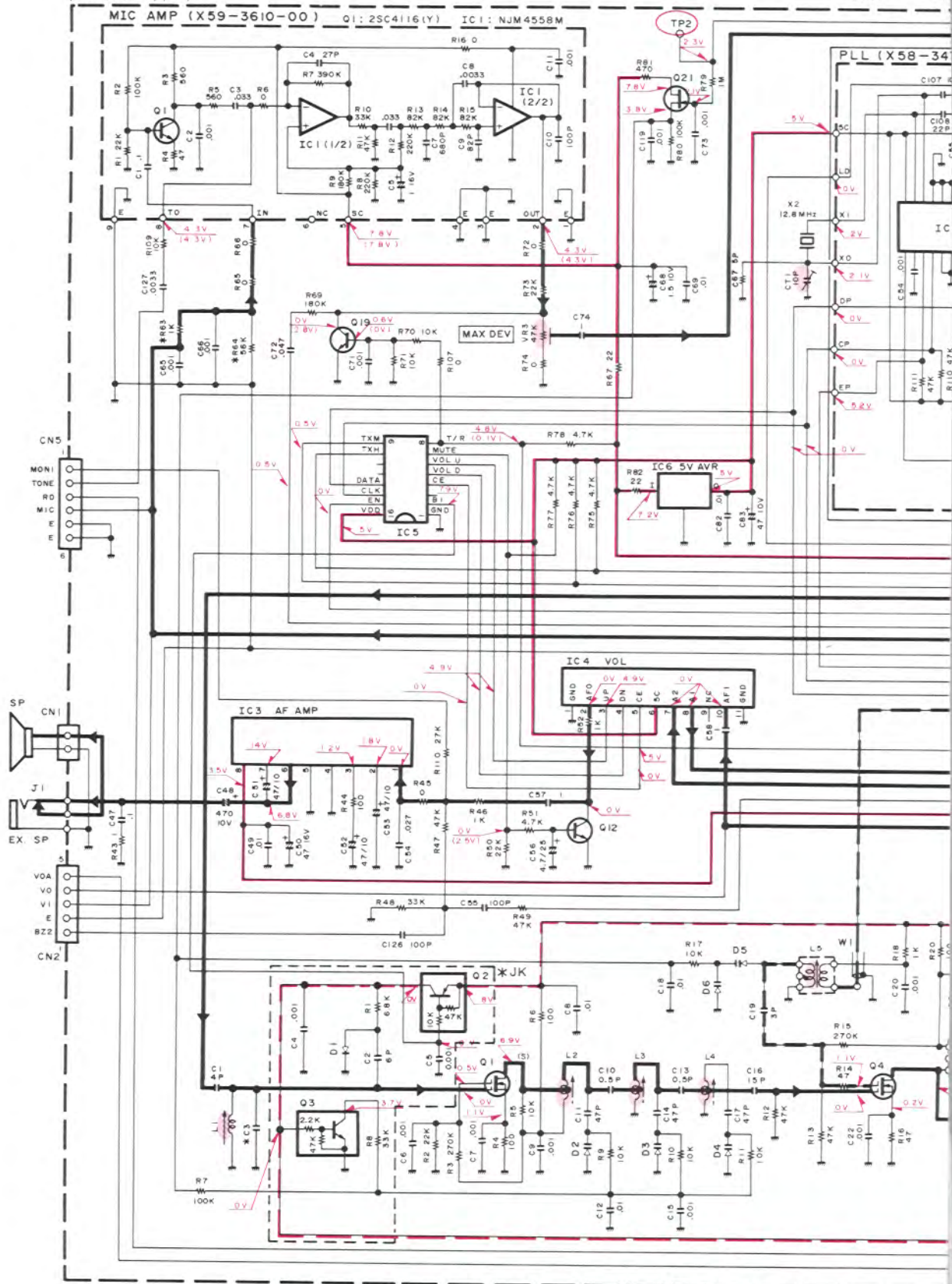


75116GF-728-3BE IC202 : NJM78L06UA IC301 : S-AV17 Q1 : 3SK184(S) Q4 : 3SK131(V12) Q5,22 : 2SC2714(Y)  
 Q4 : DTC124EK Q25 : 2SD1406 (Y) Q26 : 2SB1302S Q201 ~ 204 : 2SA1519  
 D209,210 : MA141A D212 : 02CZ7.5(X,Y)



34

(X57-369\*\*\*) (A/2)



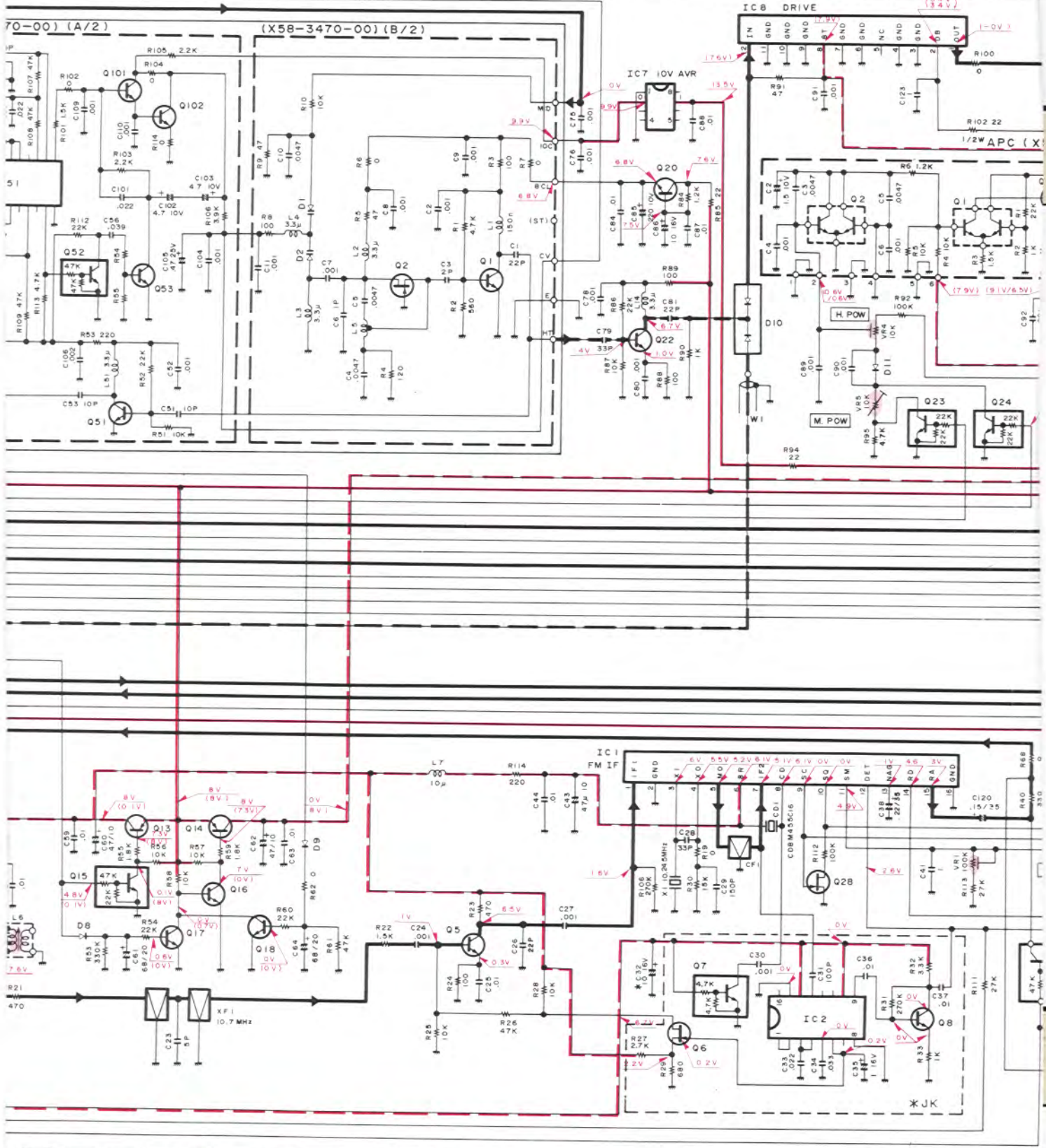
	X57-369***)	IC301	R63	R64	C3	C32	* JK	R220	W2
TM-241A	K, P	0 - 11	S-AV17	3.3K	3.9K	4P	I	O	O
TM-241A	M	0 - 21	S-AV17	3.3K	3.9K	7P	-	-	O
TM-241A	M2	0 - 22	S-AV17	3.3K	3.9K	7P	-	-	O
TM-241E	E	2 - 71	S-AV17	1K	56K	7P	-	O	O
TM-241E	E2	2 - 72	S-AV17	1K	56K	7P	-	O	O

1  
2  
3  
4  
5  
6  
7

1/2) Q51 : 2SC2714 (Y)  
 Q52 : DTC144EK  
 Q53 : 2SC2712 (Y)  
 1959FP Q101, 102 : 2SC3324 (B)

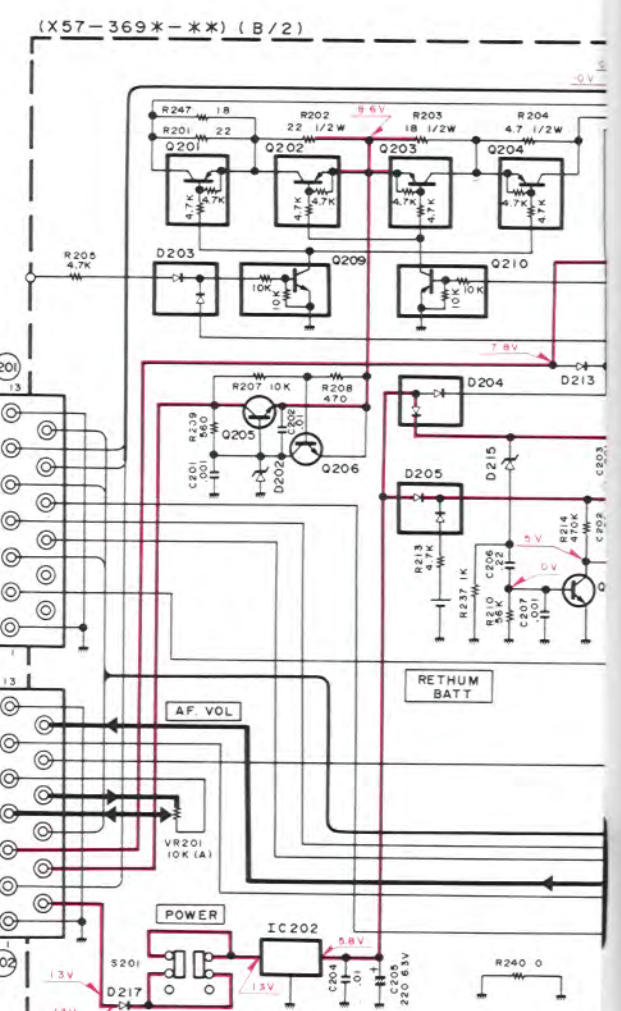
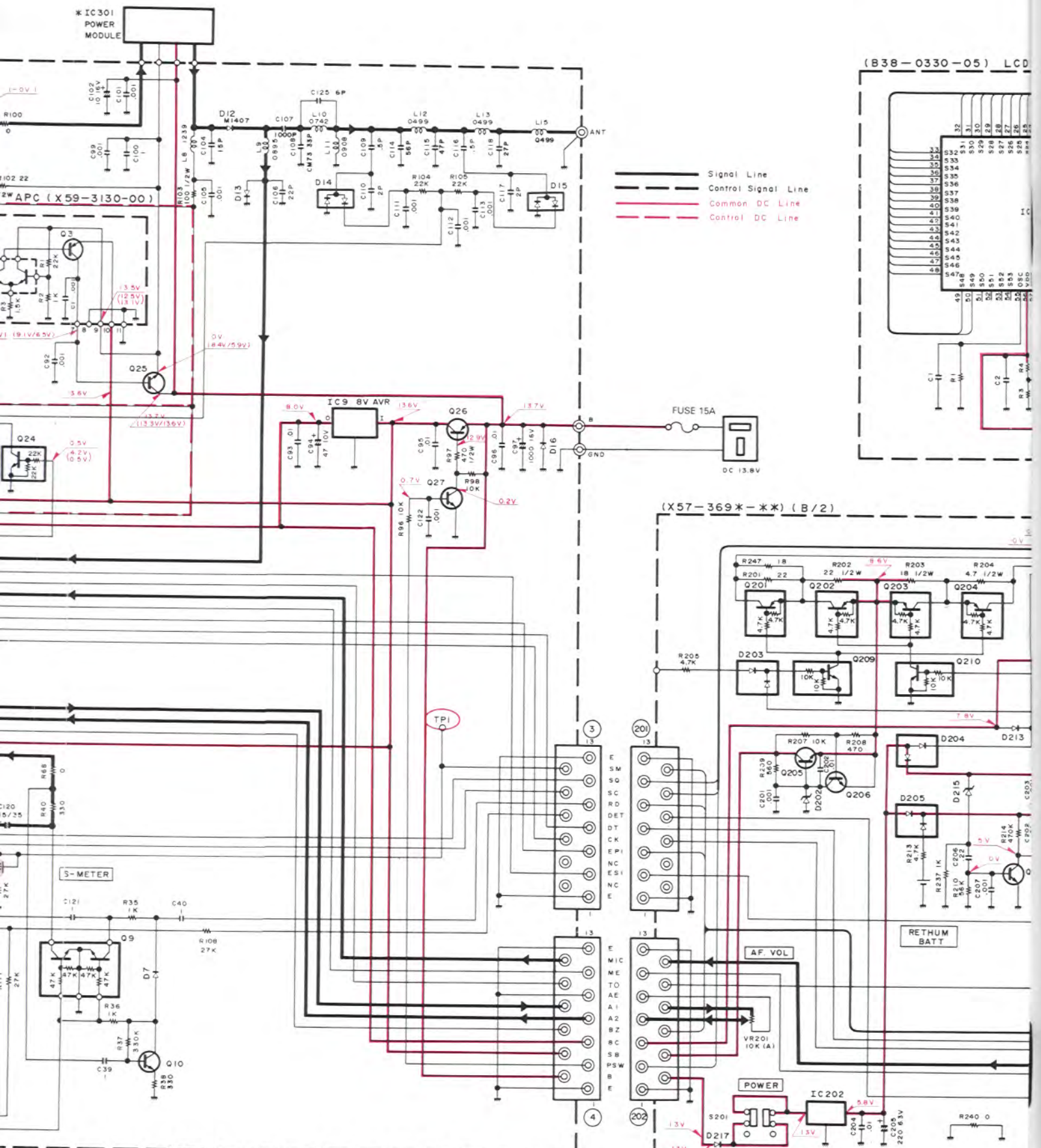
(X58-3470-00) (B/2)  
 Q1 : 2SC2714 (Y)  
 Q2 : 2SK582  
 D1, 2 : 1T33C

(X59-3130-00)  
 Q1, 2 : FMW-1  
 Q3 : 2SA1162 (GR)



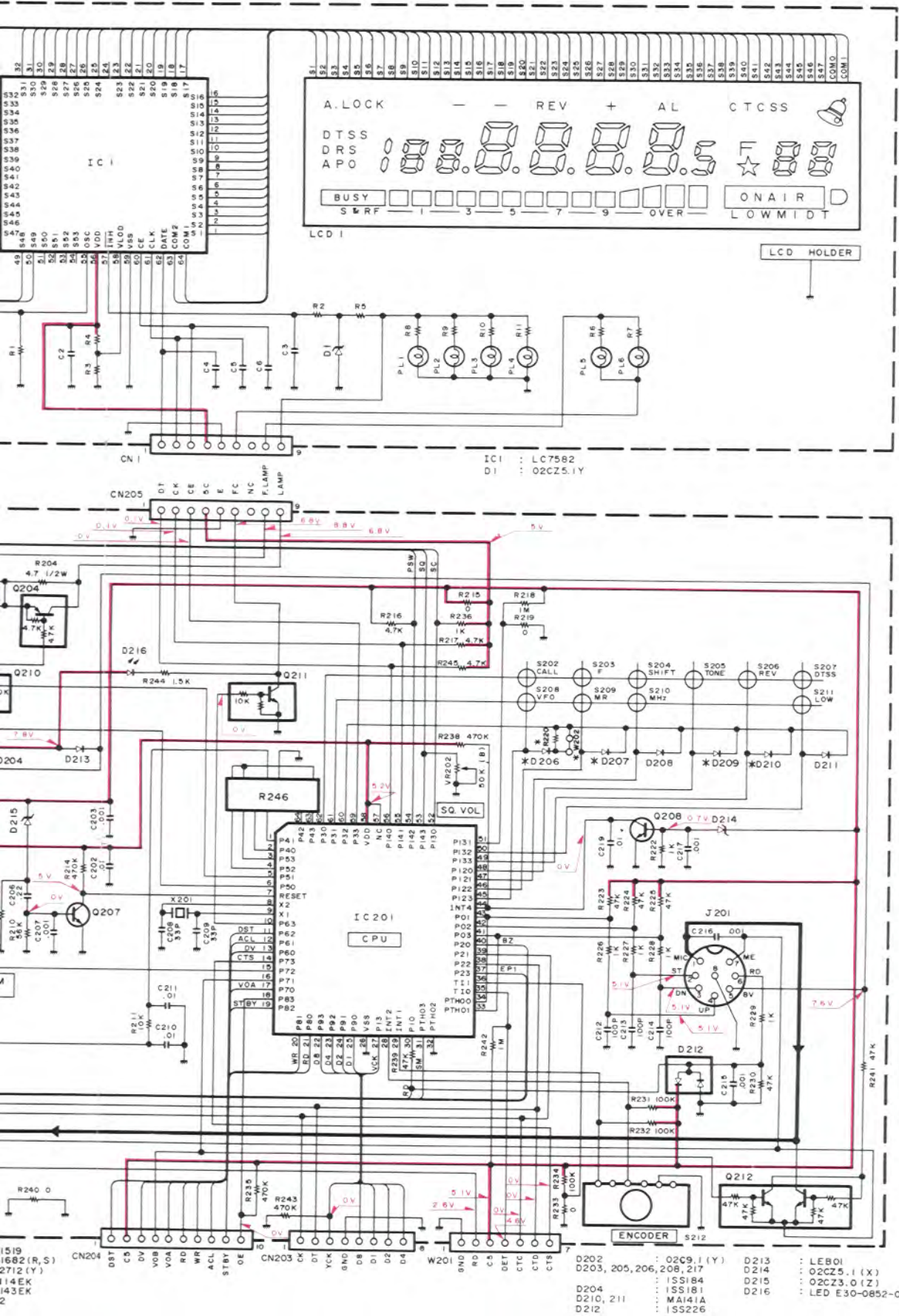
2	D206	D207	D209	D210
	○	○	○	○
	○	○	○	○
	○	○	○	○
	○	○	○	○

- |      |                  |       |                |          |                    |          |                             |          |
|------|------------------|-------|----------------|----------|--------------------|----------|-----------------------------|----------|
| IC 1 | ..... KCD04      | IC 7  | ..... LA5010M  | Q 01     | ..... 3SK184 (S)   | Q 07     | ..... 08, 10, 16-18, 20, 27 | Q 23, 24 |
| IC 2 | ..... TA7787AF   | IC 8  | ..... KCB05    | Q 02     | ..... DTA114YK     | Q 08     | ..... DTC143EK              | Q 25     |
| IC 3 | ..... UPC1241H   | IC 9  | ..... MC7808CT | Q 03     | ..... DTC123JK     | Q 09     | ..... FMG2                  | Q 26     |
| IC 4 | ..... KCC02      | IC 30 | ..... *        | Q 04     | ..... 3SK131 (V12) | Q 12, 19 | ..... 2SD1757K              | Q 28     |
| IC 5 | ..... TC9174F    |       |                | Q 05, 22 | ..... 2SC2714 (Y)  | Q 13, 14 | ..... 25B1119S              |          |
| IC 6 | ..... NJM78L05UA |       |                | Q 06, 21 | ..... 2SK208 (Y)   |          |                             |          |



- |                    |                  |                     |
|--------------------|------------------|---------------------|
| Q23, 24 : DTC124EK | D1, 10 : DAN235K | D14, 15 : ISS226    |
| Q25 : 2SD1406(Y)   | D2 ~ 6 : ISV164  | D16 : DSA3A1        |
| Q26 : 2SB1302S     | D7 : LFR01       | D209 ~ 211 : MA141A |
| Q28 : 2SJ106(GR)   | D8, 9 : ISS184   |                     |
|                    | D11 : ISS181     |                     |
|                    | D13 : M1308      |                     |
- 
- |                         |                         |
|-------------------------|-------------------------|
| IC201 : 75116GF-728-3BE | Q201 ~ 204 : 2SA1519    |
| IC202 : NJM78L06UA      | Q205 : 2SD1682(R,S)     |
|                         | Q206 ~ 208 : 2SC2712(Y) |
|                         | Q209, 210 : DTC114EK    |
|                         | Q211 : DTD143EK         |
|                         | Q212 : FMG2             |

0-05) LCD ASS'Y



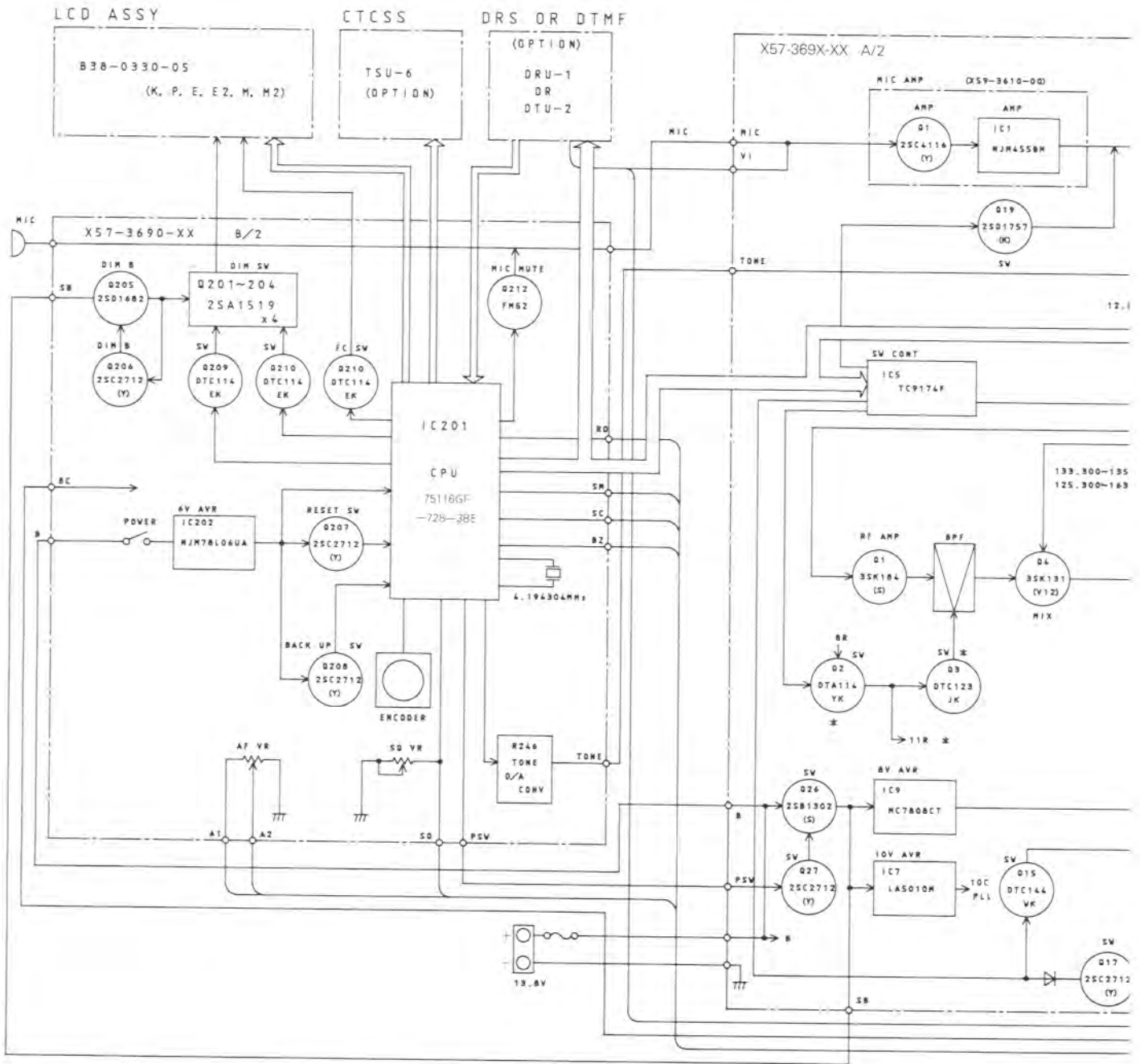
- D202 : 02C9.1(Y)
- D203, 205, 206, 208, 217 : 02CZ5.1(X)
- D204 : ISS184
- D210, 211 : MA141A
- D212 : ISS226
- D213 : LEB01
- D214 : 02CZ5.1(X)
- D215 : 02CZ3.0(Z)
- D216 : LED E30-0852-05

## TERMINAL FUNCTIONS

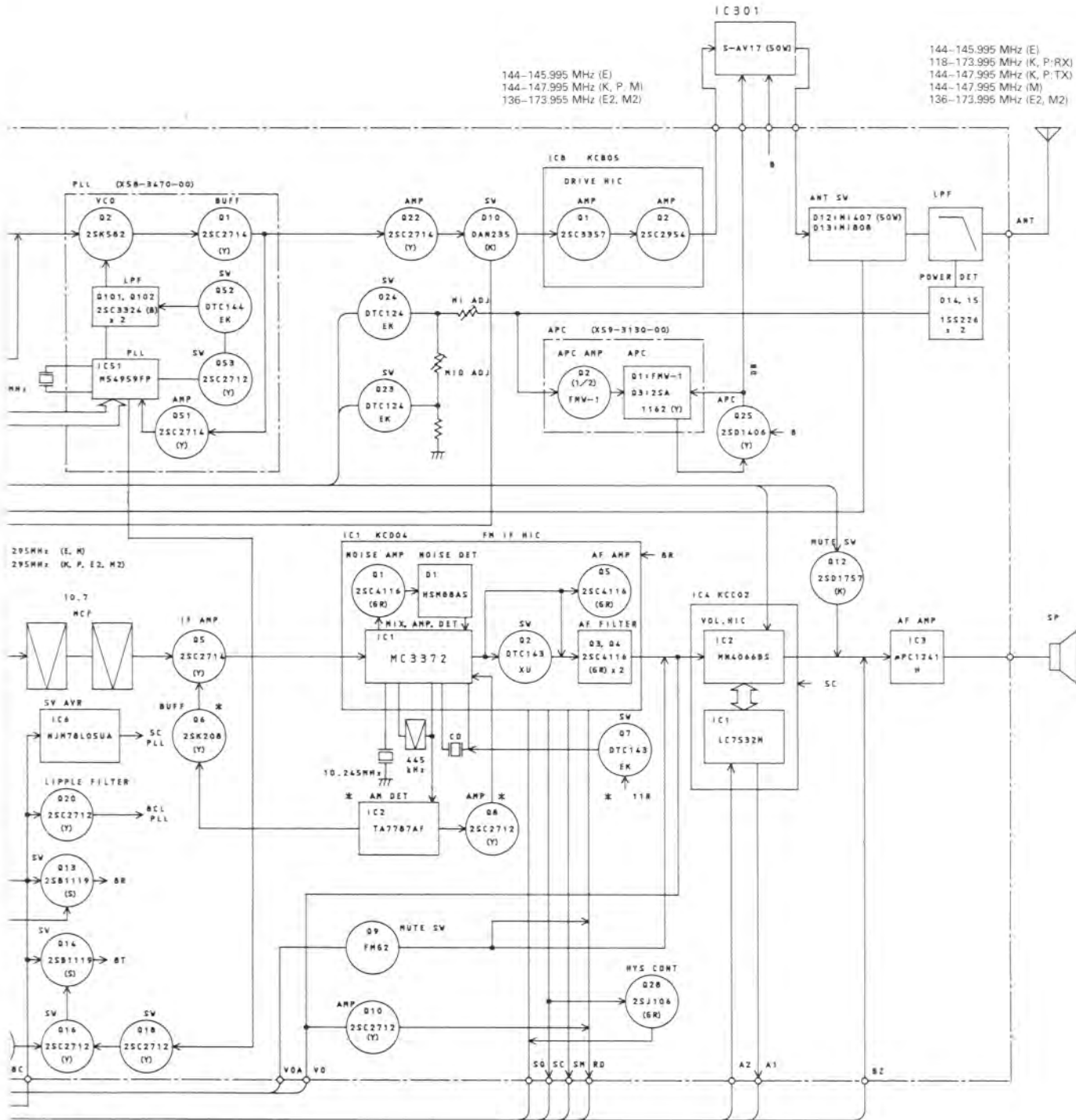
Connector No.	Terminal No.	Terminal Name	Terminal Function
<b>TX-RX UNIT (X57-369X-XX) (A/2)</b>			
CN1	1	E	GND.
	2	SP	Speaker input.
CN2	1	BZZ	GND.
	2	E	GND.
	3	VI	Voice memory input.
	4	VO	Voice memory output.
	5	VOA	Power supply for voice memory.
CN3	1	E	GND.
	2	NC	
	3	ES1	Shift register (IC5) enable.
	4	NC	
	5	EP1	PLL enable.
	6	CK	PLL clock.
	7	DT	PLL data.
	8	DET	CTCSS detector output.
	9	RD	Audio output.
	10	SC	Squelch busy control output.
	11	SQ	Squelch output.
	12	SM	S-meter output.
	13	E	GND.
CN4	1	E	GND.
	2	B	+13.8 V.
	3	PSW	Power switch control input.
	4	SB	Switched B.
	5	8C	Common +8V.
	6	BZ	Beep input (To AF IC from CPU).
	7	A2	Audio input (To electronic volume from AF VOL).
	8	A1	Audio output (To AF VOL).
	9	E	GND.
	10	TO	Tone input.
	11	ME	MIC GND.
	12	MIC	Mic input (To MIC AMP unit).
	13	E	GND.
<b>TX-RX UNIT (X57-369X-XX) (B/2)</b>			
CN201	1	E	GND.
	2	NC	
	3	ES1	Shift register enable (From CPU IC201).
	4	NC	
	5	EP1	PLL enable (From CPU IC201).
	6	CK	PLL clock (From CPU IC201).
	7	DT	PLL data (From CPU IC201).
	8	DET	CTCSS detector output.
	9	RD	Audio input (CPU IC201).
	10	SC	Squelch busy control input. (To CPU IC201).
	11	SQ	Squelch input (To CPU IC201).
	12	SM	S-meter input (To CPU IC201).
	13	E	GND.

Connector No.	Terminal No.	Terminal Name	Terminal Function
CN202	1	E	GND.
	2	B	+13.8V.
	3	PSW	Power switch control output (From CPU).
	4	SB	Switched B.
	5	8C	Common +8V.
	6	BZ	Beep output (From CPU).
	7	A2	Audio output (To electronic volume from AF VOL).
	8	A1	Audio input (to AF VOL).
	9	E	GND.
	10	TO	Tone output (From IC203).
	11	ME	MIC GND.
	12	MIC	Mic output (From mic jack).
	13	E	GND.
CN203	1	CK	Serial clock output (From CPU P21).
	2	DT	Serial data output (From CPU P22).
	3	VCK	DRS unit connect check.
	4	GND	GND.
	5	D8	DRS unit data.
	6	D1	DRS unit data.
	7	D2	DRS unit data.
	8	D4	DRS unit data.
CN204	1	DST	
	2	5C	Common +5V.
	3	DV	DTMF signal detector.
	4	VOB	DRS unit VOB output.
	5	VOA	DRS unit VOA output.
	6	RD	DRS unit RD output.
	7	WR	DRS unit WR output.
	8	ACL	DRS unit RESET output. ( $\overline{ACL}$ )
	9	STBY	DRS unit STBY output.
	10	OE	DRS OE, DTSS EN
CN205	1	DT	LCD driver data output.
	2	CK	LCD driver clock output.
	3	CE	LCD driver enable output.
	4	C5	+5V.
	5	E	GND.
	6	FC	Function control.
	7	NC	
	8	F.LAMP	Function lamp B.
	9	LAMP	Lamp B.
W201	1	GND	GND.
	2	RD	CTCSS unit voice de-modulation input.
	3	C5	Common +5 V.
	4	DET	CTCSS unit tone matching input.
	5	CTC	CTCSS unit clock output.
	6	CTD	CTCSS unit data output.
	7	CTS	CTCSS unit enable output.

TM-241A/241E



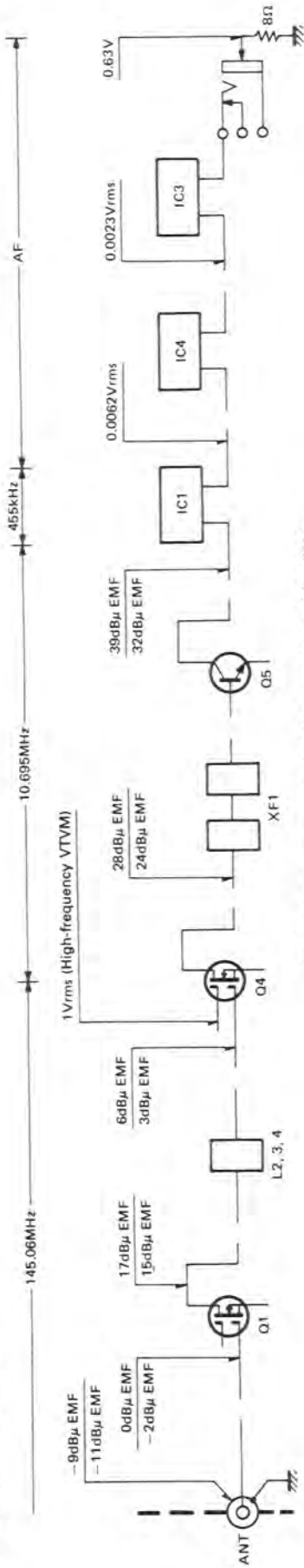




\* K, P only

## LEVEL DIAGRAM

### Receiver section

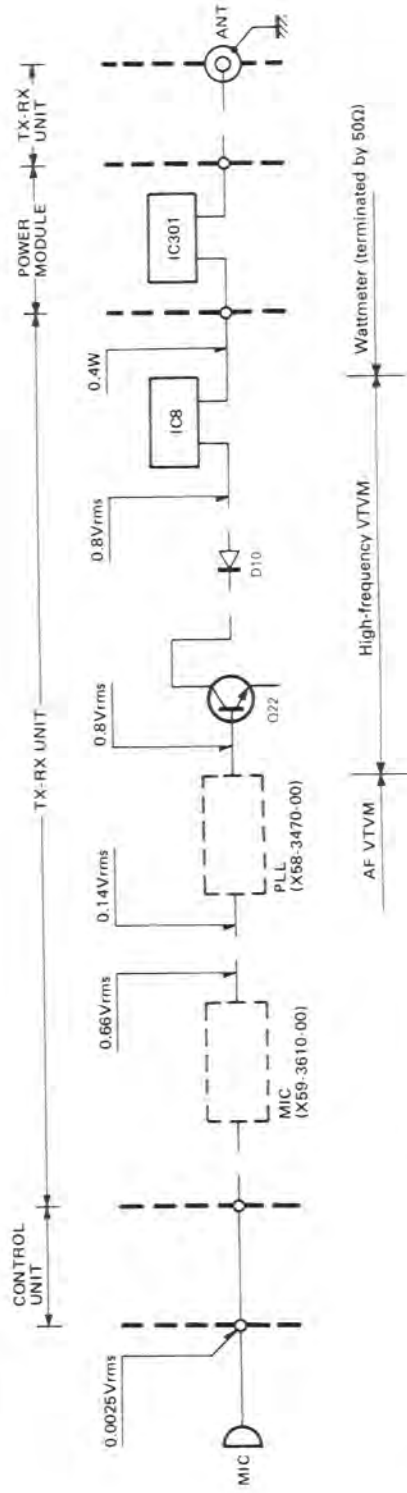


SG input level for which a 20dB NO (upper) and 12dB SINAD (lower) are obtained. Measured by connecting the SG to each point via a  $0.01\mu\text{F}$  capacitor.

AF VTVM

AF level obtained when the AF output level is adjusted for  $0.63\text{V}/8\Omega$  with the front panel AF VOL control. Measured with AF voltmeter connected to the external speaker jack, receiving a 40dB EMF SSG signal modulated at 1kHz, DEV 3kHz.

### Transmitter section



1. AG is set so that MIC input becomes 3kHz DEV at 1kHz MOD.
2. Transmitting frequency : 145.06 MHz

## DRU-1 (DIGITAL RECORDING UNIT)

### DRU-1 CIRCUIT DESCRIPTION

#### 1. Overview

The DRU-1 is a digital recording and playback unit designed to be installed inside the TM-241 A/E series. This unit has the following features:

- Recording received audio (for output to the internal speaker) or transmit audio (microphone input)
- Outputting recorded audio to the internal speaker or outputting recorded audio as modulating signals during transmission
- Built-in lithium battery back-up for maintaining DRU-1 contents
- DTSS and paging code reception.

#### 2. Operations

##### • Recording received audio (for output to the internal speaker)

A received signal from the VO pin is fed into pin 1 (0Y) of the multiplexer IC1 (TC4052BF). It is then fed into pin 59 (MIC IN) of IC3 (TC8830F) via pin 3 (Y). The signal is amplified approx. 26dB by a mic amplifier in IC3, and output via pin 60 (C1). The signal from pin 60 is fed into pin 63 (C2) and amplified approx. 20dB. The amplified signal is applied to pin 64 (MIC OUT) and pin 65 (ADI).

##### • Recording transmit audio (microphone input)

Microphone input from the VI pin is amplified by Q5, and fed into pin 2 (2Y) of the multiplexer IC1 (TC4052BF). It is then supplied to IC3 (TC8830F) via pin 3 (Y) and recorded in the same way as in recording received sound.

##### • Outputting recorded audio to the internal speaker

D/A convertor output from pin 66 (DAO) of IC3 (TC8830F) is passed through a CR filter, and amplified by Q6. The amplified signal is then fed into pin 13 (X) of the multiplexer IC1 (TC4052BF), and output to the VO pin via pin 14 (1X).

##### • Outputting recorded audio as modulating signals during transmission

When sound recorded in the DRU-1 is played during transmission, the same operations as written above in outputting recorded audio to the internal speaker occur. That is, D/A convertor output from pin 66 (DAO) of IC3 (TC8830F) is passed through a CR filter, amplified by Q6, and fed into pin 13 (X) of the multiplexer IC1 (TC4052BF). The sound, however, is output via pin 11 (3X).

	VOA (pin 10)	VOB (pin 9)	On channel
Output to speaker	H	L	1X (pin 14)
Output during transmission	H	H	3X (pin 11)
Received audio recording	L	L	0Y (pin 1)
Transmit aidop recording	L	H	2Y (pin 2)

Table 1 IC1 : TC4052BF operations

##### • DTSS and paging code reception

The DTMF signal input from the VO pin is amplified by Q1 and input to pin 12 of DTMF decoder IC2 (LR4102N). When the DTMF signal is input to IC2, pin 20 (DV pin) is made high. A DTMF code is then output to pins 1 (D1), 24 (D2), 23 (D4), and 22 (D8) of IC2. The CPU can receive the DTMF signal by detecting the DTMF signal input from the DV pin and reading D1, D2, D3, and D4 data.

### DRU-1 DESCRIPTION OF COMPONENTS

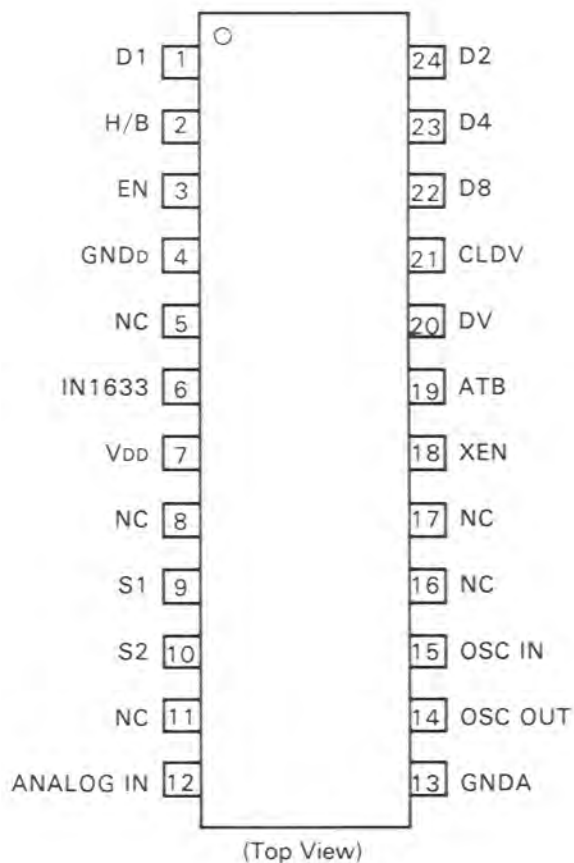
#### ACCESSORY UNIT (X42-3010-00)

Component	Use/Function	Description
IC1	Multiplexer	See DRU-1 circuit description.
IC2	DTMF decode	
IC3	Audio recording and playback	See DRU-1 semiconductor data.
IC4~7	S-RAM	
Q5	AF amplification	Mic input amplification.
Q6	AF amplification	Playback sound amplification.
D1	Reverse current prevention	
D2	Reverse current prevention	Back-up.

## DRU-1 (DIGITAL RECORDING UNIT)

### 2. DTMF DECODER: LR4102N (IC2)

#### ● Pin connection



#### ● Pin description

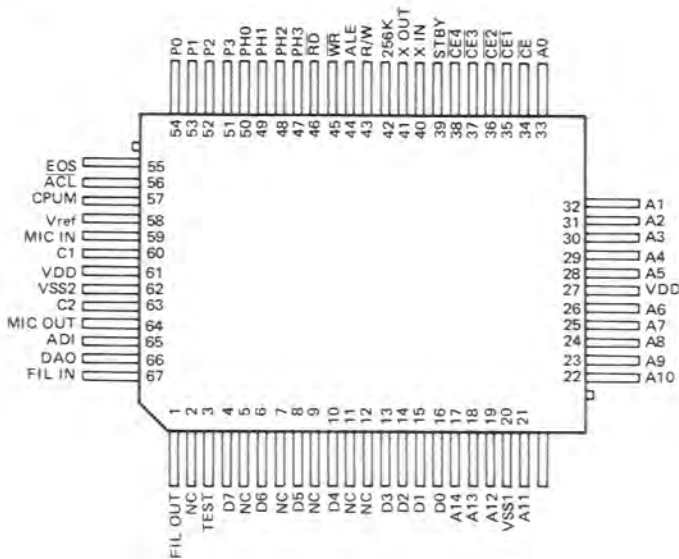
Pin No.	Name	I/O	Function	Pin No.	Name	I/O	Function
1	D1	O	DTMF data output	13	GNDA	—	Analog GND
2	H/B	I	16 digit cord setting	14	OSC <sub>OUT</sub>	O	X-tal output
3	EN	I	Output enable	15	OSC <sub>IN</sub>	I	X-tal input
4	GND <sub>D</sub>	—	Digital GND (GND)	16	NC	—	NC
5	NC	—	NC	17	NC	—	NC
6	IN1633	I	Valid 1633 Hz (GND)	18	XEN	I	X-tal enable
7	V <sub>DD</sub>	—	Power supply	19	ATB	O	NC
8	NC	—	NC	20	DV	O	Data varied
9	S1	—	Bypass (Connected to ground by a 0.01 μF capacitor.)	21	CLDV	I	Data varied clear
10	S2	—	Bypass (Connected to ground by a 0.01 μF capacitor.)	22	D8	O	DTMF data output
11	NC	—	NC	23	D4	O	DTMF data output
12	ANALOG IN	I	DTMF signal input	24	D2	O	DTMF data output

## DRU-1 (DIGITAL RECORDING UNIT)

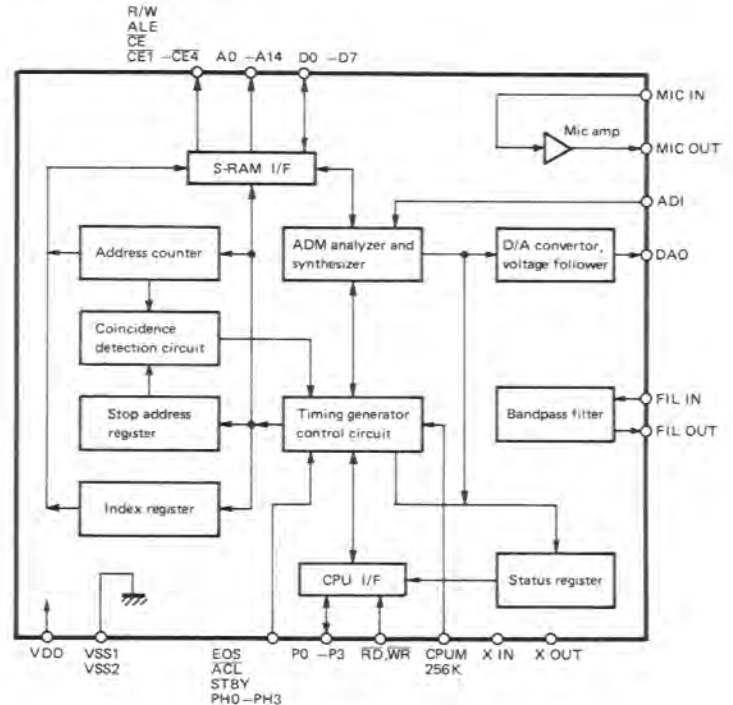
### DRU-1 SEMICONDUCTOR DATA

#### 1. Audio recording and playback : TC8830F (IC3)

##### • Terminal connection diagram



##### • Block diagram



##### • Terminal functions

Pin No.	Pin name	I/O	Function	Pin No.	Pin name	I/O	Function
1	FIL OUT	O	Not used.	41	X OUT	O	512kHz oscillation circuit.
2	NC	-	Not connected.	42	256K	I	64K/256K RAM select, "H" when 256K used.
3	TEST	-	Not used.	43	R/W	O	RAM read/write output.
4	D7	I/O	RAM data I/O.	44	ALE	-	Not used.
5	NC	-	Not connected.	45	WR	I	Write pulse input.
6	D6	I/O	RAM data I/O.	46	RD	I	Read pulse input.
7	NC	-	Not connected.	47-50	PH3-PH0	-	Not used.
8	D5	I/O	RAM data I/O.	51-54	P3-P0	I/O	Data bus.
9	NC	-	Not connected.	55	EOS	-	Not used.
10	D4	I/O	RAM data I/O.	56	ACL	I	Reset signal input.
11,12	NC	-	Not connected.	57	CPUM	I	"H" when CPU control enabled.
13-16	D3-D0	I/O	RAM data I/O.	58	Vref	O	Analog circuit reference voltage output.
17-19	A14-A12	O	RAM address output.	59	MIC IN	I	Mic amp. 1 input.
20	Vss1	-	GND.	60	C1	O	Mic amp. 1 output.
21-26	A11-A6	O	RAM address output.	61	VDD	-	Power supply.
27	VDD	-	Power supply.	62	Vss2	-	GND.
28-33	A5-A0	O	RAM address output.	63	C2	I	Mic amp. 2 input.
34	CE	-	Not used.	64	MIC OUT	O	Mic amp. 2 output.
35-38	CE1-CE4	O	RAM chip enable.	65	ADI	I	Audio analysis circuit input.
39	STBY	I	Minimum current standby when standby input is "H".	66	DAO	O	D/A convertor output.
40	X IN	I	512kHz oscillation circuit.	67	FIL IN	I	Not used.

# TM-241A/E

## DRU-1 (DIGITAL RECORDING UNIT)

### DRU-1 PARTS LIST

\* New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名/規格	Desti- nation 仕向	Re- marks 備考
<b>DRU-1</b>						
-			B42-3317-04 B50-8290-00	LABEL INSTRUCTION MANUAL		
			G10-0666-04 G10-0679-04 G13-0913-04	NON-WOVEN FABRIC NON-WOVEN FABRIC FORMED PLATE		
-			H01-8249-03	ITEM CARTON BOX		
-			H03-2772-04	OUTER PACKING CASE		
-			H21-0704-04	PROTECTION SHEET		
-			H25-0029-04	PROTECTION BAG		
-			H25-0710-04	PROTECTION BAG		
			NB7-2606-46	BRAZIER HEAD TAPTITE SCREW		
			X42-3010-00	ACCESSORY UNIT		
<b>ACCESSORY UNIT (X42-3010-00)</b>						
C1			CK73FB1H103K	CHIP C 0.010UF K		
C2			CK73FB1H102K	CHIP C 1000PF K		
C3			CK73FF1E154Z	CHIP C 0.15UF Z		
C4 -6			CK73FB1H103K	CHIP C 0.010UF K		
C7			CK73EF1C105Z	CHIP C 1.0UF Z		
C8 -10			CK73FB1H103K	CHIP C 0.010UF K		
C11			CK73FF1E104Z	CHIP C 0.10UF Z		
C12			CK73FB1H103K	CHIP C 0.010UF K		
C13 +14			CK73FB1H102K	CHIP C 1000PF K		
C15			CK73FF1E104Z	CHIP C 0.10UF Z		
C16			CK73FB1H103K	CHIP C 0.010UF K		
C17			CK73FF1E104Z	CHIP C 0.10UF Z		
C19			CK73FB1H103K	CHIP C 0.010UF K		
C20			CK73FB1H102K	CHIP C 1000PF K		
C21 +22			CC73FSL1H101J	CHIP C 100PF J		
C23			CK73FB1H103K	CHIP C 0.010UF K		
C24			C92-0010-05	CHIP TAN 6.8UF 6.3WV		
C25			CK73EB1H104K	CHIP C 0.10UF K		
C26			CK73FB1H103K	CHIP C 0.010UF K		
C27			CC73FSL1H101J	CHIP C 100PF J		
C28			CK73FF1E104Z	CHIP C 0.10UF Z		
CN1		*	E40-5207-05	PIN CONNECTOR		
CN2		*	E40-5206-05	PIN CONNECTOR		
CN3		*	E40-5181-05	PIN CONNECTOR		
W1		*	E31-6005-05	CONNECTING WIRE		
W2		*	E31-6006-05	CONNECTING WIRE		
W3		*	E31-6007-05	CONNECTING WIRE		
			F20-0520-04	INSULATING BOARD		
			F20-0521-04	INSULATING BOARD		
X1		*	L77-1398-05	CRYSTAL RESONATOR 3.579545MHZ		
X2		*	L78-0050-05	RESONATOR 512KHZ		
R1			RK73FB2A103J	CHIP R 10K J 1/10W		
R2			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R3			RK73FB2A103J	CHIP R 10K J 1/10W		
R4			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R5			RK73FB2A102J	CHIP R 1.0K J 1/10W		

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

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

UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components

## DRU-1 (DIGITAL RECORDING UNIT)

\* New Parts

Parts without Parts No. are not supplied.

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


Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R6			R92-0670-05	CHIP R 0 0HM		
R7			RK73FB2A223J	CHIP R 22K J 1/10W		
R8			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R9			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R10			R92-0670-05	CHIP R 0 0HM		
R11			RK73FB2A223J	CHIP R 22K J 1/10W		
R12			R92-0670-05	CHIP R 0 0HM		
R13			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R14			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R15			RK73FB2A104J	CHIP R 100K J 1/10W		
R16			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R18			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R19			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R20			RK73FB2A104J	CHIP R 100K J 1/10W		
R21			RK73FB2A103J	CHIP R 10K J 1/10W		
R22			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R23			RK73FB2A564J	CHIP R 560K J 1/10W		
R24			RK73FB2A273J	CHIP R 27K J 1/10W		
R25			RK73FB2A683J	CHIP R 68K J 1/10W		
R26			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R27			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R28			RK73FB2A224J	CHIP R 220K J 1/10W		
R29 -31			R92-0670-05	CHIP R 0 0HM		
R32			RK73FB2A220J	CHIP R 22 J 1/10W		
R33			RK73FB2A394J	CHIP R 390K J 1/10W		
D1 +2			1SS184	DIODE		
IC1		*	TC4052BF	IC (4CH MPX/DE-MPX)		
IC2		*	LR4102N	IC		
IC3		*	TC8830F	IC		
IC4 -7			HM62256LFP-15T	IC		
O1 -3			2SC2712(BL)	TRANSISTOR		
O4			DTC144EK	DIGITAL TRANSISTOR		
O5 +6			2SC2712(BL)	TRANSISTOR		
			WD9-0326-05	LITHIUM BATTERY		

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

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

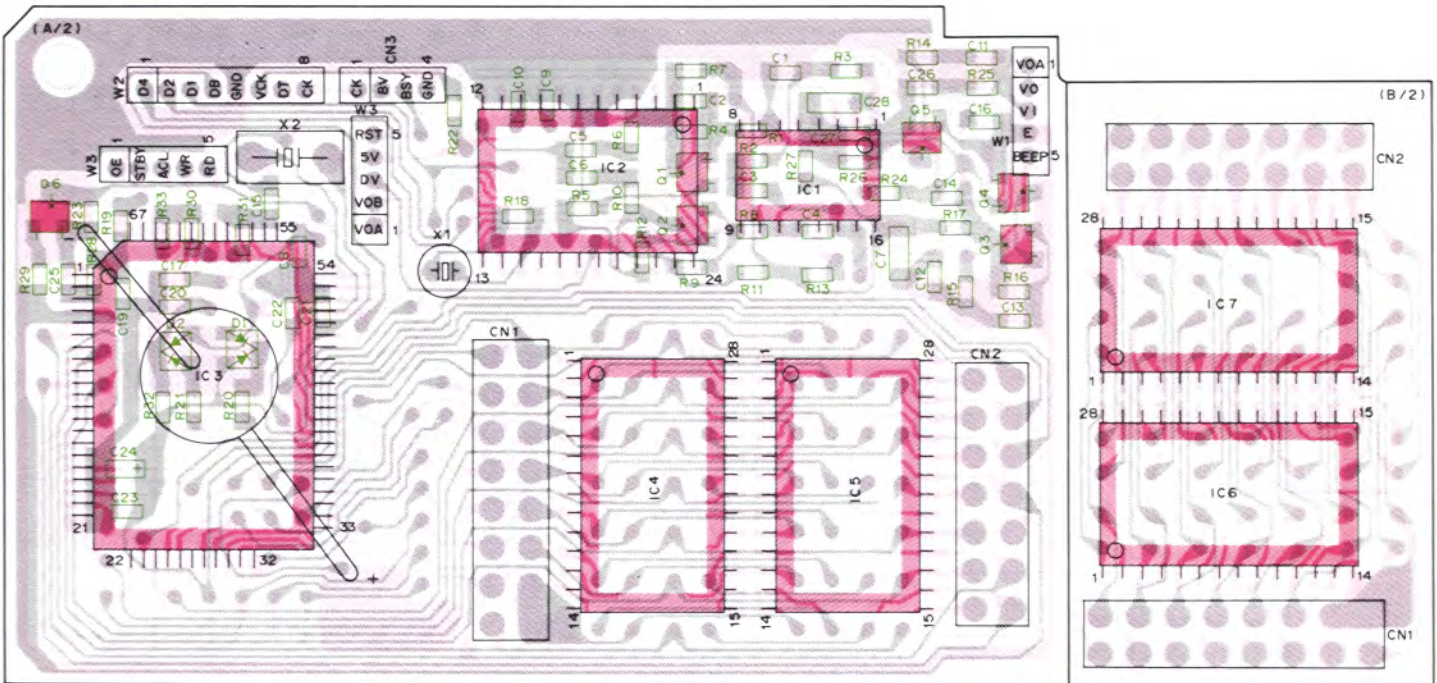
UE: AAFES(Europe) X: Australia

 indicates safety critical components.

# TM-241A/E DRU-1 (DIGITAL RECORDING UNIT)

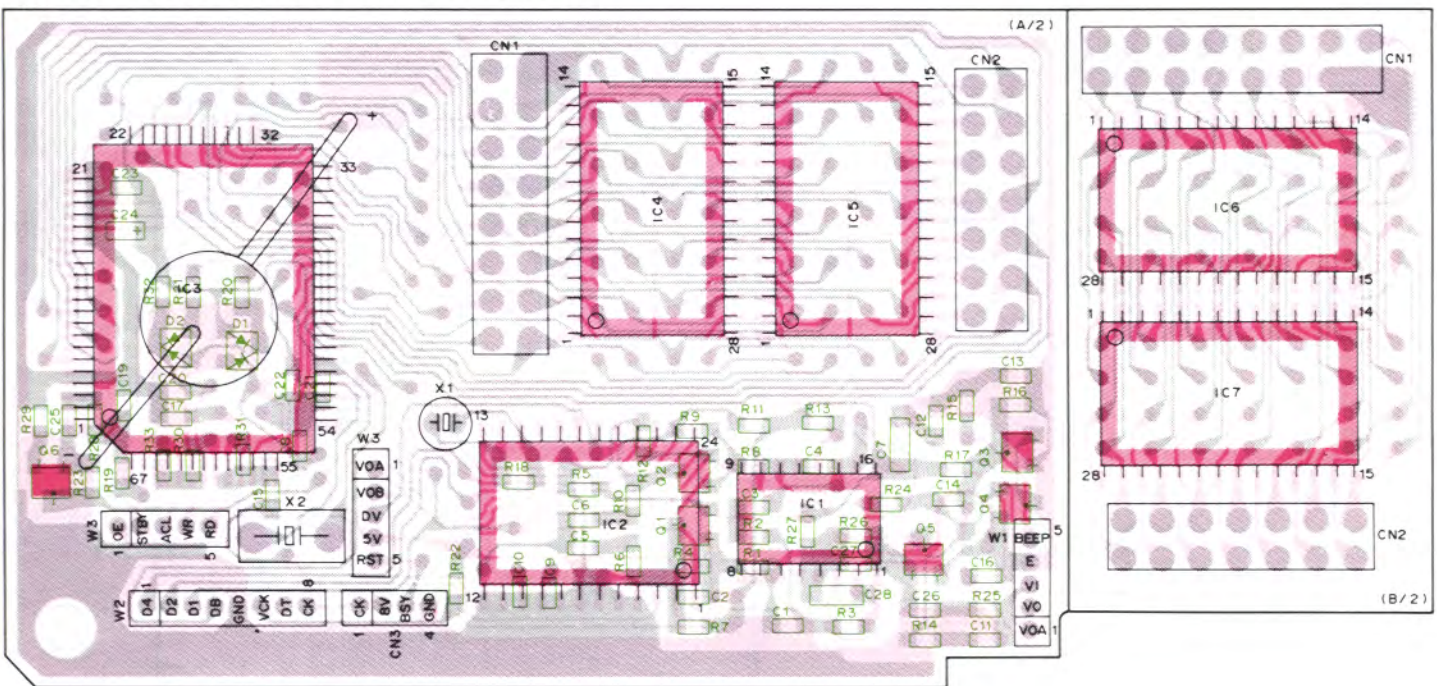
## DRU-1 PC BOARD VIEWS

### ACCESSORY UNIT (X42-3010-00) Component side view



IC1 : TC4052BF IC2 : LR4102N IC3 : TC8830F IC4~7 : HM62256LFP-15T Q5,6 : 2SC2712(BL) D1,2 : 1SS184

### ACCESSORY UNIT (X42-3010-00) Foil side view



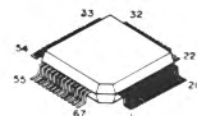
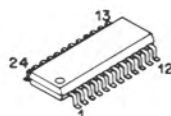
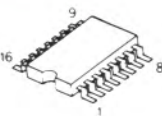
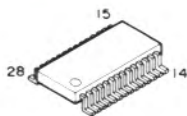
DTC144EK  
2SC2712(BL)

HM62256LFP-15T

TC4052BF

LR4102N

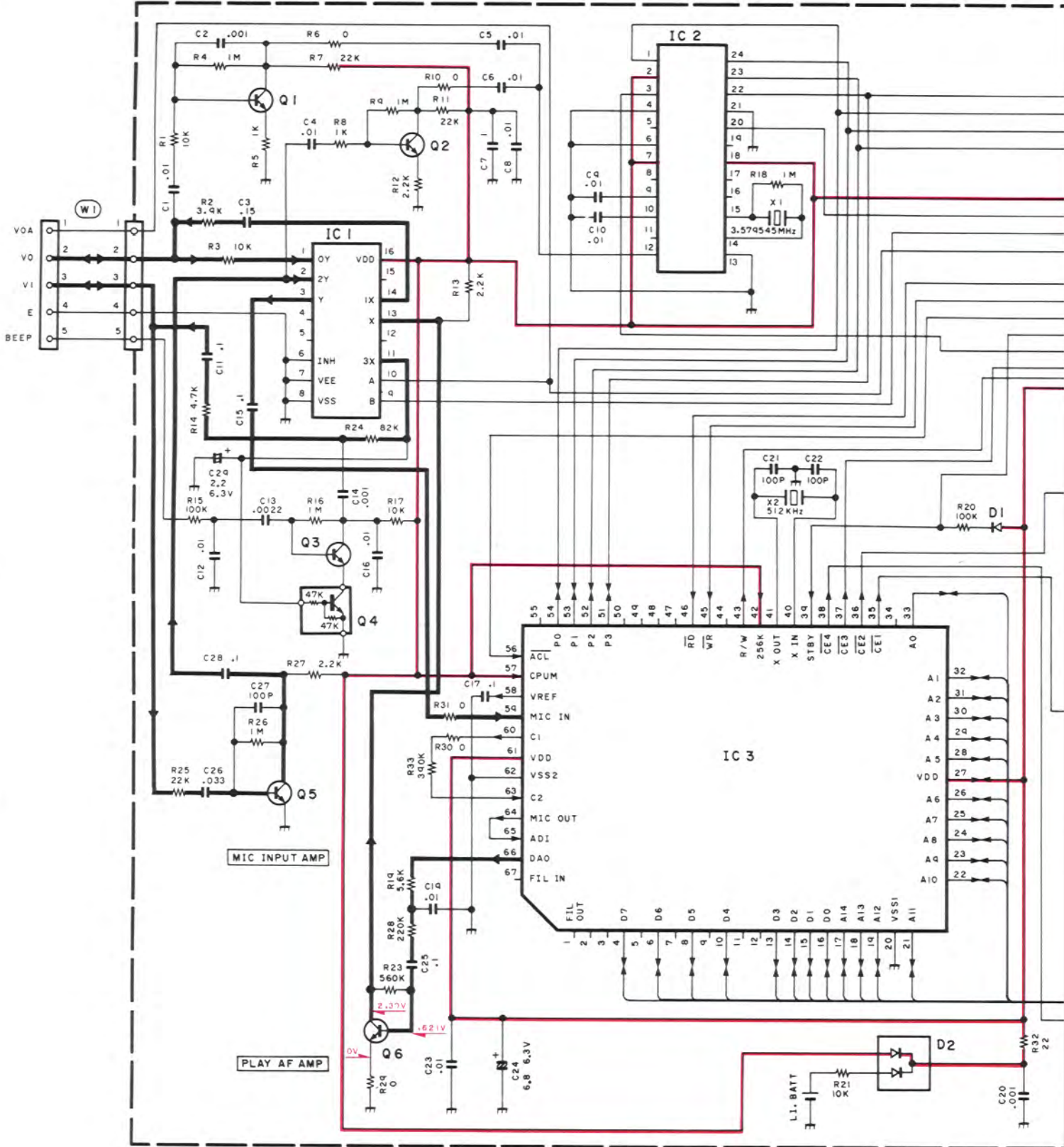
TC8830F





# DRU-1 SCHEMATIC DIAGRAM

(X42-3010-00) (A/2)

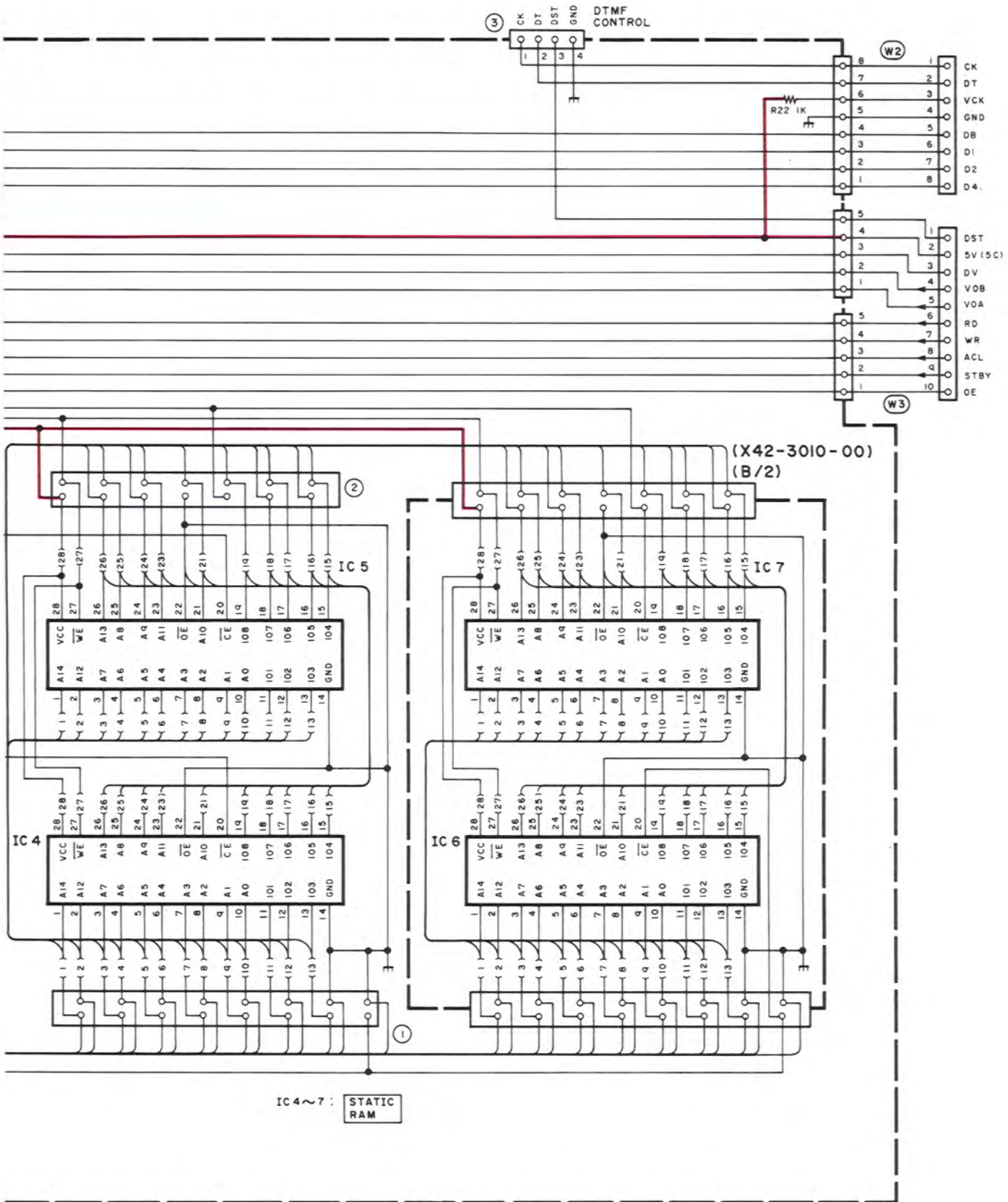


(X42-3010-00) (A/2)

IC 1 : TC4052BF  
 IC 2 : LR4102N  
 IC 3 : TC8830F  
 IC 4 ~ 7 : HM62256LFP-15T

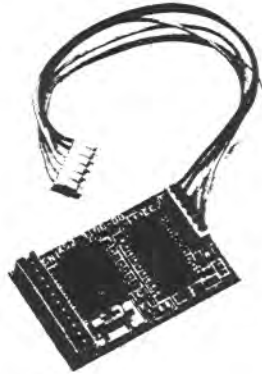
Q1 ~ 3, 5, 6 : 2SC2712 (BL)  
 Q4 : DTC144EK  
 D1, 2 : 1SS184

## DRU-1 SCHEMATIC DIAGRAM



DTU-2 (DTMF UNIT)

DTU-2 EXTERNAL VIEW



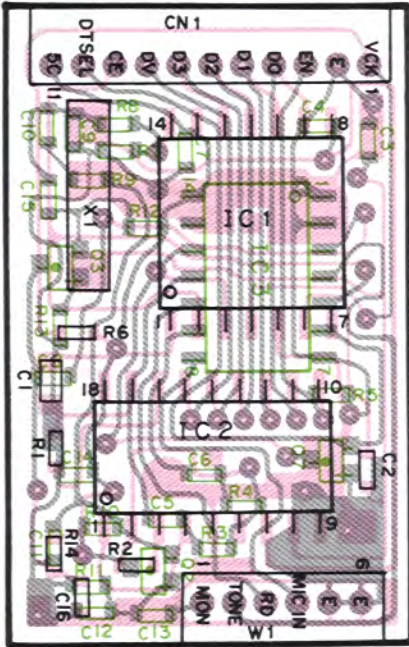
DTU-2 PARTS LIST

Re 5 No.	New Parts	Parts No.	Description
C1		CK73FB1E104K	Chip C 0.1 $\mu$ F K
C2		CC73GCH1H100D	Chip C 10 pF D
C3,4		CC73GCH1H330J	Chip C 33 pF J
C5~8, 10		CK73GB1E103K	Chip C 0.01 $\mu$ F K
C13~16		CK73GL1E103K	Chip C 0.01 $\mu$ F K
C9		CK73GB1E822K	Chip C 0.0082 $\mu$ F K
C10		CK73GB1E322K	Chip C 0.0033 $\mu$ F K
C11		CC73GSL1H101J	Chip C 100 pF J
		E37-0033-05	Connecting cable (6P)
		E40-5188-05	Pin ass'y socket (11P)
X1		L78-0061-05	CERAMIC RESONATOR (3.58 MHz)
R1~14		RK73GB1JxxxJ	Chip R
Q1		DTC114EU	Digital transistor
Q2,3		2SC4116 (Y)	Digital transistor
IC1		TP5088WM	IC
IC2		LC7385M	IC
IC3		BU4066BF	IC

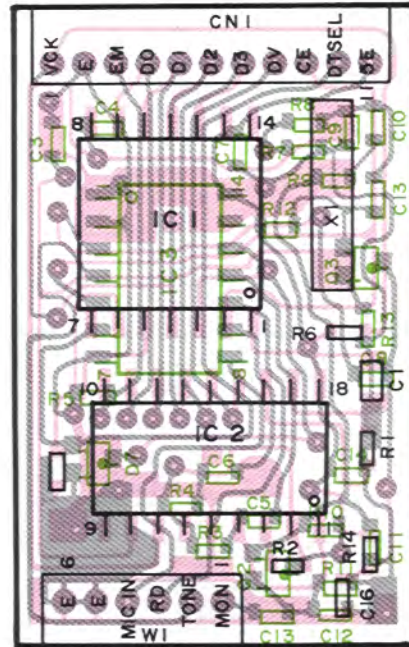
## DTU-2 (DTMF UNIT)

### DTU-2 PC BOARD

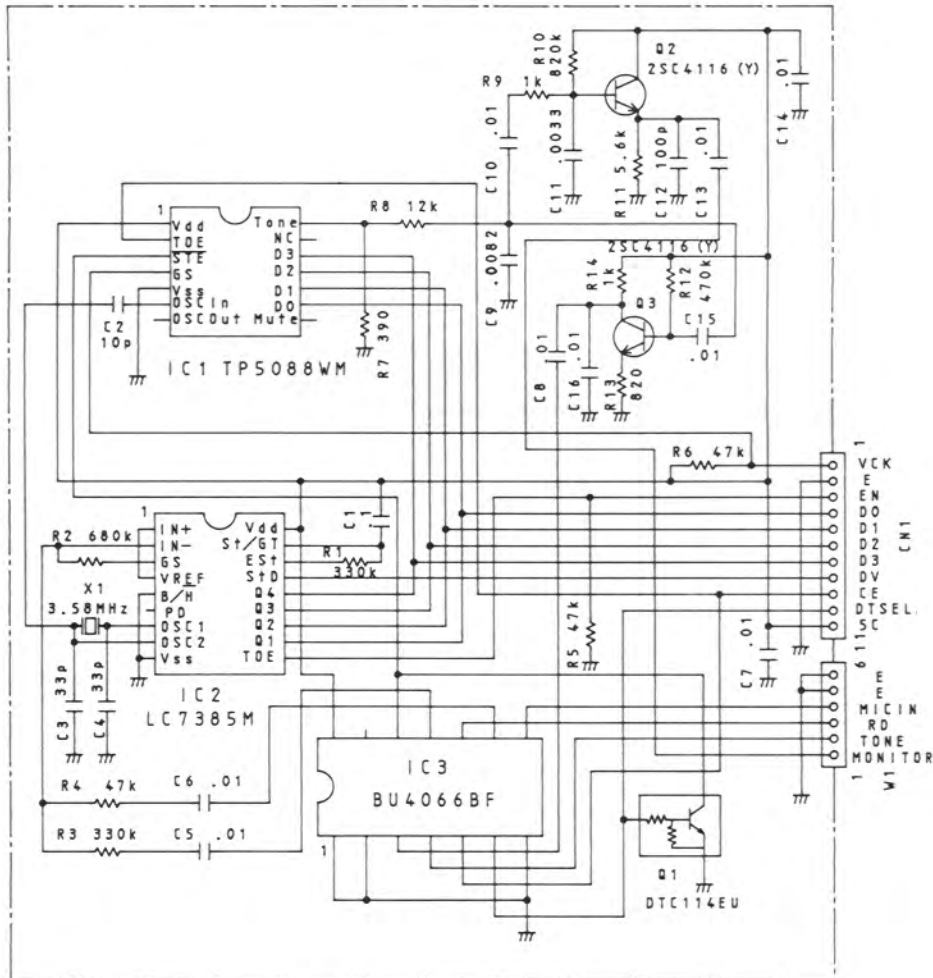
Component side view



Foil side view

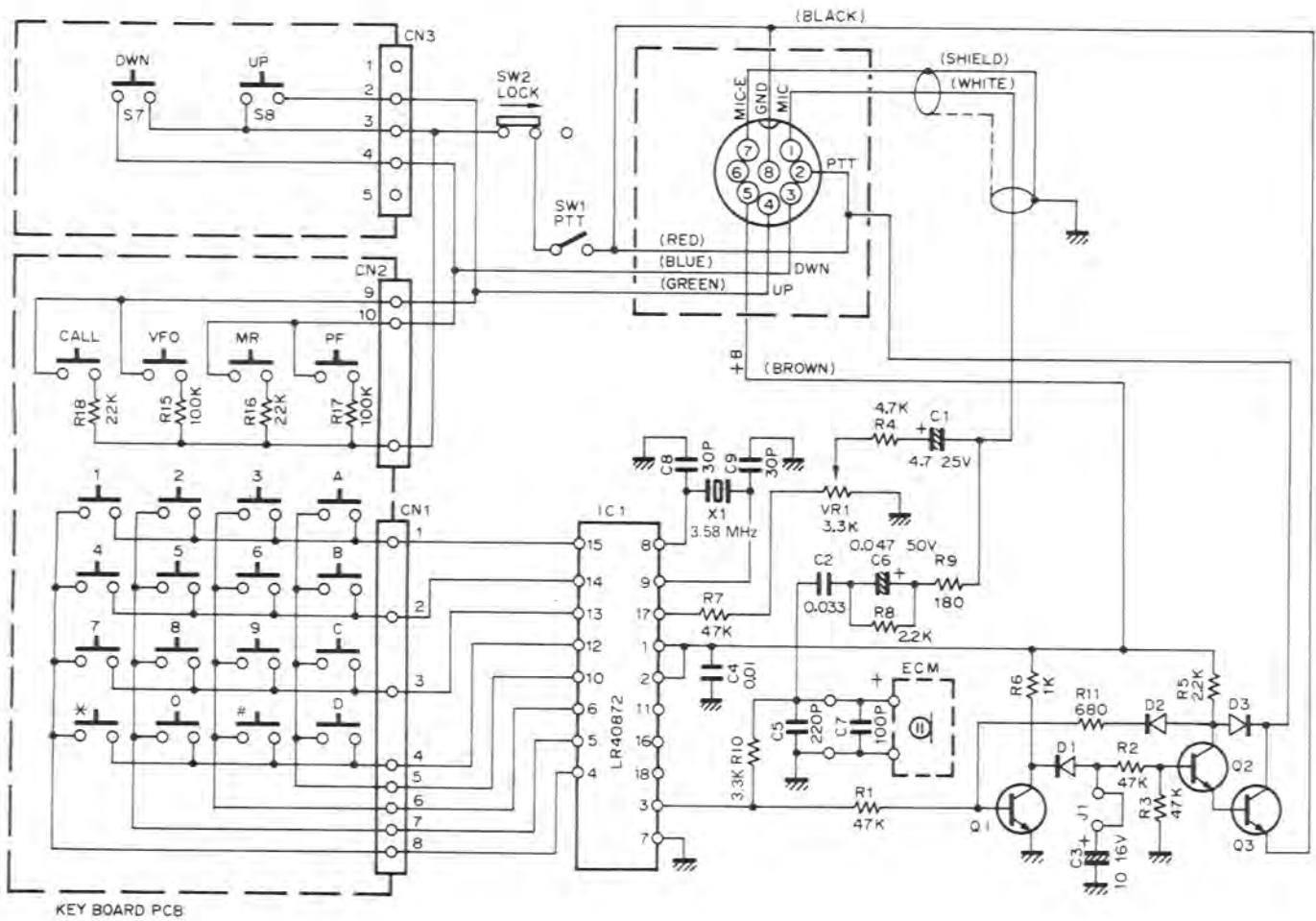


### SCHEMATIC DIAGRAM



## MC-44DM/MC-44DME (MULTI FUNCTION MICROPHONE WITH AUTOPATCH)

### MC-44DM/MC-44DME SCHEMATIC DIAGRAM



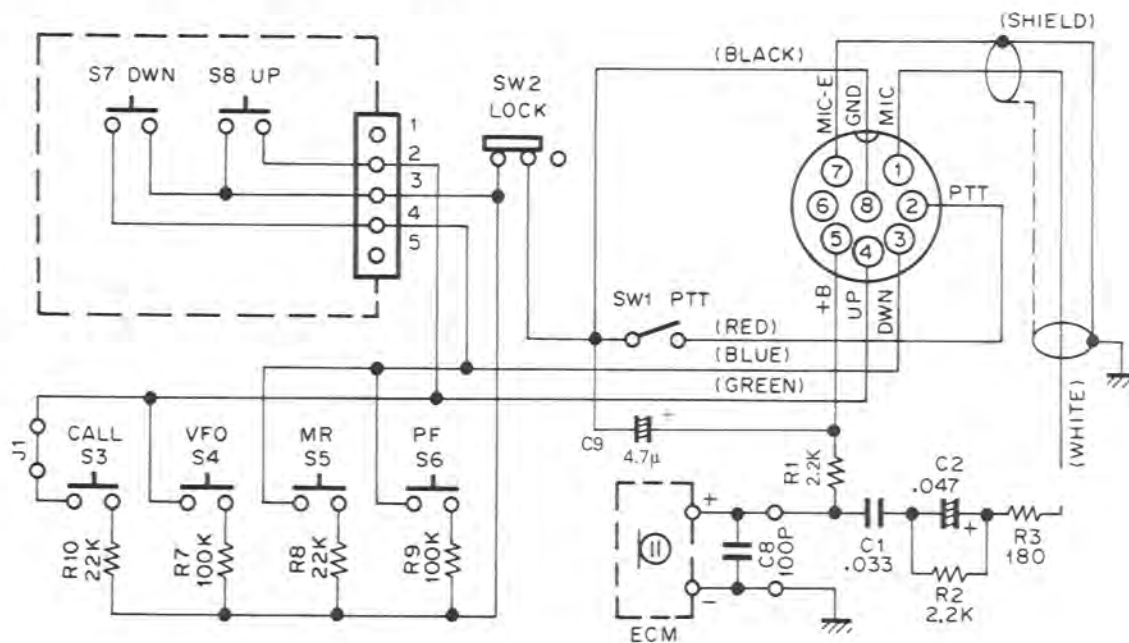
### MC-44DM/MC-44DME PARTS LIST

Ref. No.	New parts	Parts No.	Description		
	*	A02-0898-18	Case (Front)	DTMF	M
	*	A20-0899-18	Case (Front)	DTMF (With TONE)	W
		A02-0901-08	Case (Rear)	DTMF	
	*	B50-8293-18	Instruction manual		
		E30-2149-08	Curl cord		
		G13-0933-08	Cushion		
		K29-3165-08	Knob	PTT	
		K29-3167-08	Key top	DTMF	
	*	K29-3168-18	Knob	UP	
	*	K29-3169-18	Knob	DOWN	
SW2		S31-1422-08	Slide switch	LOCK	
SW1		S50-1431-08	Micro switch	PTT	
S7, 8	*	S59-1409-28	Switch Ass'y	UP, DOWN	
		T91-0383-08	Microphone element (Condenser microphone)		

# TM-241A/E

## MC-44 (MULTI FUNCTION MICROPHONE)

### MC-44 SCHEMATIC DIAGRAM

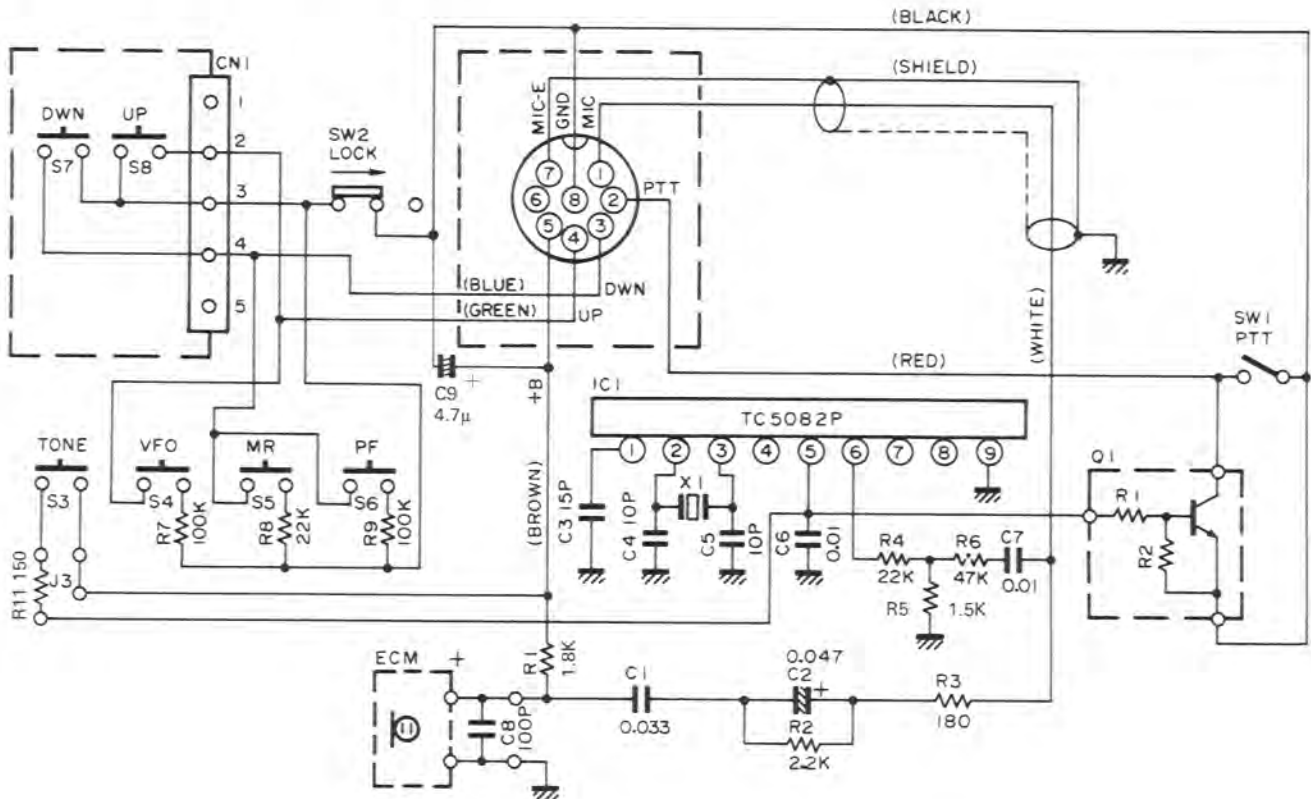


### MC-44 PARTS LIST

Ref. No.	New parts	Parts No.	Description
	*	A02-0896-18	Case (Front)
		A02-0900-08	Case (Rear)
	*	B50-8293-18	Instruction manual
	*	E30-2149-08	Curl cord
		G13-0933-08	Cushion
		K29-3165-08	Knob PTT
	*	K29-3168-18	Knob UP
	*	K29-3169-18	Knob DOWN
		K29-3170-08	Knob CALL, VFO, MR, PF
SW2		S31-1422-08	Slide switch LOCK
SW1		S50-1431-08	Micro switch PTT
S7, 8	*	S59-1409-28	Switch Ass'y UP, DOWN
		T91-0383-08	Microphone element (Condenser microphone)

## MC-44E (MULTI FUNCTION MICROPHONE)

### MC-44E SCHEMATIC DIAGRAM



### MC-44E PARTS LIST

Ref. No.	New parts	Parts No.	Description
	•	A02-0897-18 A02-0900-08	Case (Front) With TONE Case (Rear)
	•	B50-8293-18	Instruction manual
	•	E30-2149-08 G13-0933-08 K29-3165-08 K29-3168-18 K29-3169-18 K29-3170-08	Curl cord Cushion Knob PTT Knob UP Knob DOWN Knob 1750, VFO, MR, PF
SW2		S31-1422-08	Slide switch LOCK
SW1		S50-1431-08	Micro switch PTT
S7, 8		S59-1409-08	Switch Ass'y UP, DOWN
	•	T91-0383-08	Microphone element (Condenser microphone)

## TSU-6 (CTCSS UNIT)

### TSU-6 EXTERNAL VIEW



### TSU-6 PARTS LIST

\* : New Parts

Ref. No.	New Parts	Parts No.	Description
<b>CTCSS UNIT (X52-3100-00)</b>			
C1		CK73FB1H102K	Chip C 1000pF K
C2		C92-0010-05	Tantal 6.8μF 6.3WV
C3	*	C92-0006-05	Tantal 3.3μF 4.0WV
C4, 5		CK73EB1E104K	Chip C 0.1μF K
C6		CK73EB1H223K	Chip C 0.022μF K
C7		CK73EB1E104K	Chip C 0.1μF K
C8, 9		CC73FCH1H150J	Chip C 15pF J
C10		CK73FB1H102K	Chip C 1000pF K
C11		CK73EB1E104K	Chip C 0.1μF K
C12		C92-0507-05	Chip tan. 4.7μF 6.3WV
C13	*	C92-0510-05	Chip tan. 3.3μF 4.0WV
	*	E40-5121-05	Pin connector (10P)
X1		L77-1313-05	X'tal resonator 4.194304MHz
R1-10		RK73FB2A000J	Chip resistor
R12-14		RK73FB2A000J	Chip resistor
VR1	*	R12-3460-05	Trimming pot. 33kΩ
Q1		DTC144TK	Digital transistor
Q2		DTA114EK	Digital transistor
Q3		2SC2712(GR)	Chip transistor
IC1		MN6520	IC
IC2		MN4094BS	IC

### TSU-6 FINE ADJUSTMENT OF TONE FREQUENCY

The tone frequency can be fine adjusted with an interval of 0.5% step over the range of 0 to +1.5%. Ground the T1 (pin 10) and T2 (pin 9) of IC1 to obtain the desired frequency.

	T1	T2
0%	X	X
+0.5%	○	X
+1.0%	X	○
+1.5%	○	○

○ : GND, X : OPEN

Table 3

### TSU-6 REFERENCE DATA

#### TH-25's condition and MN4094BS (IC2) relationship

CTCSS switch	TONE switch	TX/RX	MN4094BS terminal		
			Q5	Q6	Q1 ~ 4, 7, 8
OFF	OFF	TX	L	H	L
		RX	L	H	L
	ON	TX	L	L	See table 2
		RX	L	H	L
ON	OFF	TX	L	L	See table 2
		RX	H	L	
	ON	TX	L	L	
		RX	H	L	

Q1 ~ 4, 7, 8 : Tone frequency setting

Q5 : TX/RX switch for MN6520 (IC1). "H" : RX, "L" : TX

Q6 : Power switch for MN6520 (IC1). "H" : OFF, "L" : ON

Table 1

#### Tone frequency and MN6520 (IC1) relationship

Tone frequency (Hz)	MN6520 terminal					
	S6	S5	S4	S3	S2	S1
	MN4094BS terminal					
	Q1	Q2	Q3	Q4	Q7	Q8
67.0	L	H	H	H	L	H
71.9	L	H	H	H	L	L
74.4	L	H	H	L	H	H
77.0	L	H	H	L	H	L
79.7	L	H	H	L	L	H
82.5	L	H	H	L	L	L
85.4	L	H	L	H	H	H
88.5	L	H	L	H	H	L
91.5	L	H	L	H	L	H
94.8	H	H	H	L	L	H
100.0	H	H	H	L	L	L
103.5	H	H	L	H	H	H
107.2	H	H	L	H	H	L
110.9	H	H	L	H	L	H
114.8	H	H	L	H	L	L
118.8	H	H	L	L	H	H
123.0	H	H	L	L	H	L
127.3	H	H	L	L	L	H
131.8	H	H	L	L	L	L
136.5	H	L	H	H	H	H
141.3	H	L	H	H	H	L
146.2	H	L	H	H	L	H
151.4	H	L	H	H	L	L
156.7	H	L	H	L	H	H
162.2	H	L	H	L	H	L
167.9	H	L	H	L	L	H
173.8	H	L	H	L	L	L
179.9	H	L	L	H	H	H
186.2	H	L	L	H	H	L
192.8	H	L	L	H	L	H
203.5	H	L	L	H	L	L
210.7	H	L	L	L	H	H
218.1	H	L	L	L	H	L
225.7	H	L	L	L	L	H
233.6	H	L	L	L	L	L
241.8	L	H	H	H	H	H
250.3	L	H	H	H	H	L

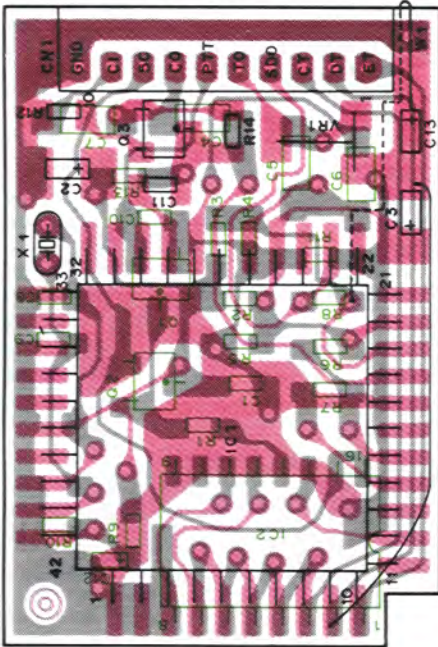
Table 2



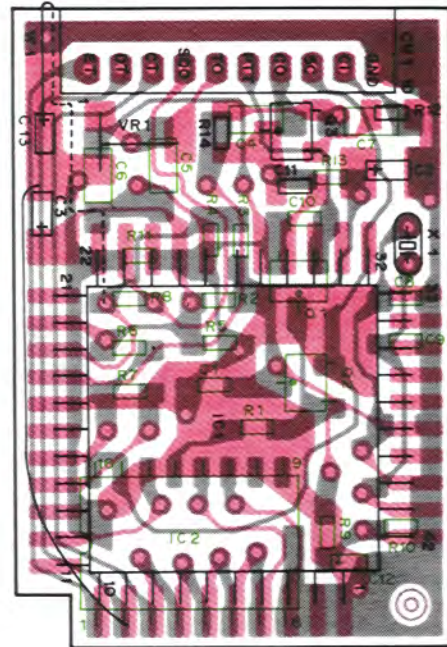
## TSU-6 (CTCSS UNIT)

### TSU-6 PC BOARD VIEWS

Component side view



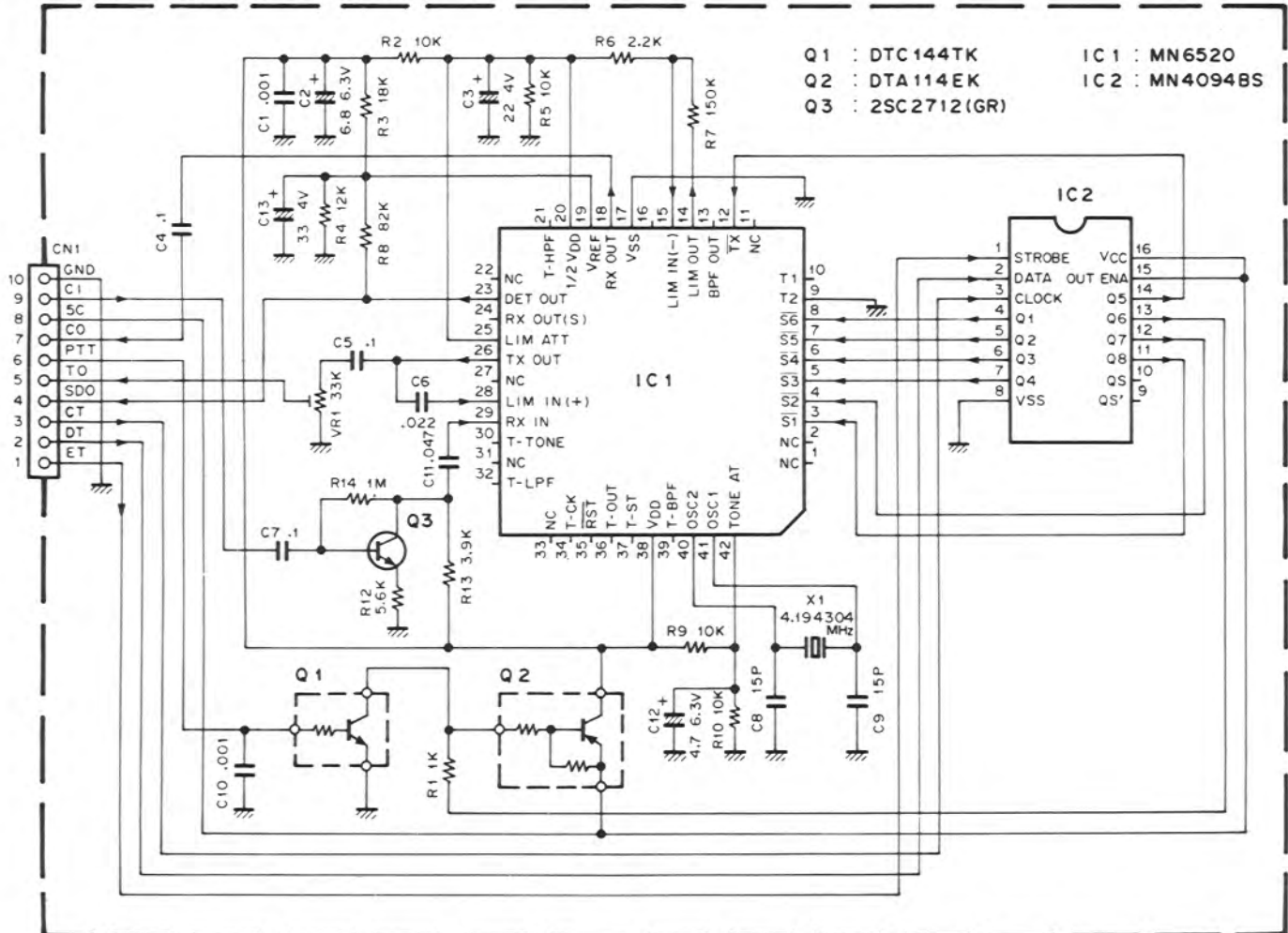
Foil side view



■ : Component side  
 ■ : Foil side

### TSU-6 CIRCUIT DIAGRAM

CTCSS UNIT (X52-3100-00)



## SPECIFICATIONS

### General

Frequency range.....	136 to 174 MHz: TM-241A (M2), TM-241E (E <sub>2</sub> ) 144 to 148 MHz: TM-241A (K,P,M) 144 to 146 MHz: TM-241E (E)
Mode .....	F3E (FM)
Antenna impedance .....	50Ω
Power requirements.....	13.8 V DC ±15% (11.7 to 15.8)
Ground.....	Negative
Frequency stability .....	Less than ±10ppm
Current drain	
Transmit mode .....	Less than 11A
Receiver mode with no signal .....	Less than 0.6A
Operating temperature .....	-20°C to +60°C (-4°F to +140°F)
Dimensions (W x H x D) .....	140 x 40 x 160 mm (5-1/2" x 1-37/64" x 6-19/64")
(Projection included).....	140 x 40 x 172 mm (5-1/2" x 1-37/64" x 6-25/32")
Weight .....	1.2kg (2.65lbs)

### Transmitter

Output power*	
HI .....	50W
MID .....	Approx. 10 W
LOW .....	Approx. 5W
Modulation .....	Reactance modulation
Spurious radiation .....	Less than -60dB
Maximum frequency deviation .....	±5kHz
Audio distortion (at 60% modulation) .....	Less than 3% (300 to 3000Hz)
Microphone impedance .....	500 to 600Ω

### Receiver

Circuitry .....	Double conversion superheterodyne
Intermediate frequency (1st/2nd) .....	10.7MHz/455kHz
Sensitivity (12dB SINAD) .....	Less than 0.16μV
Selectivity	
-6dB .....	More than 12kHz
-60dB .....	Less than 24kHz
Squelch sensitivity .....	Less than 0.1μV
Output (5% distortion) .....	More than 2W across 8Ω loads
External speaker impedance .....	8Ω

### Notes :

1. Circuit and ratings are subject to change without notice due to advancements in technology.
2. \* Recommended duty cycle : 1 minute Transmit, 3 minutes Reception.

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## Extending TM-241 frequency ranges

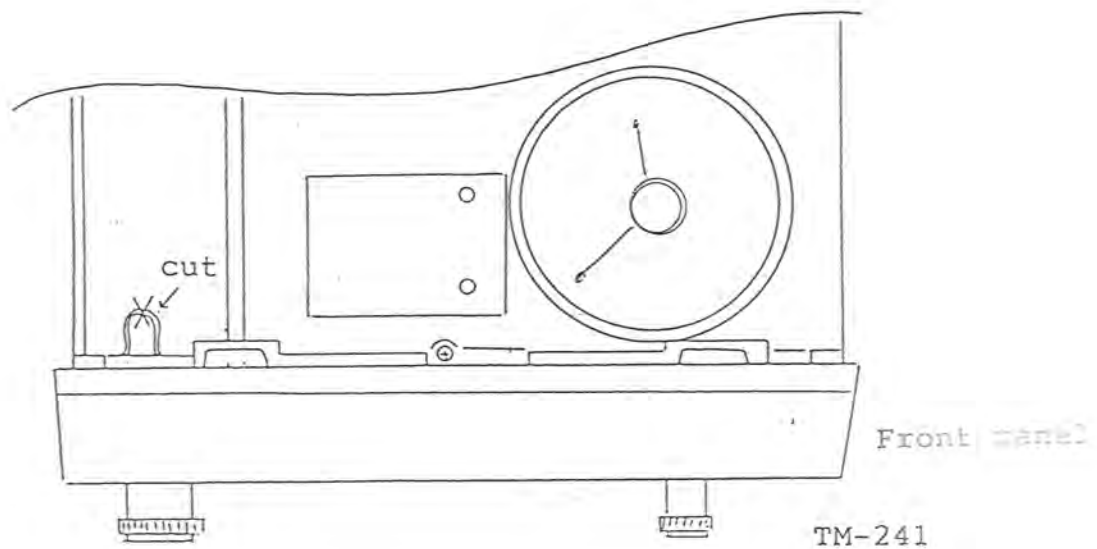
There are two methods of reconfiguring the TM-241.

One is to cut a jumper wire ; the other is to replace chip diodes.  
(If both methods are used, cutting the jumper wire has priority.)

### 1. Cutting a jumper wire

- 1 ) Turn the power off, remove the top of the radio, and cut the green wire on the left of the front panel.

Tape the wire so that it cannot contact other parts.



### 2 ) Frequency ranges after extension

#### Destination

K , P	TX : 142,000 ~ 151,995 MHz
E	RX/TX : 136,000 ~ 173,995 MHz
M	RX : 118,000 ~ 173,995 MHz ( FM )
	TX : 136,000 ~ 135,995 MHz

## 2. Replacing chip diodes

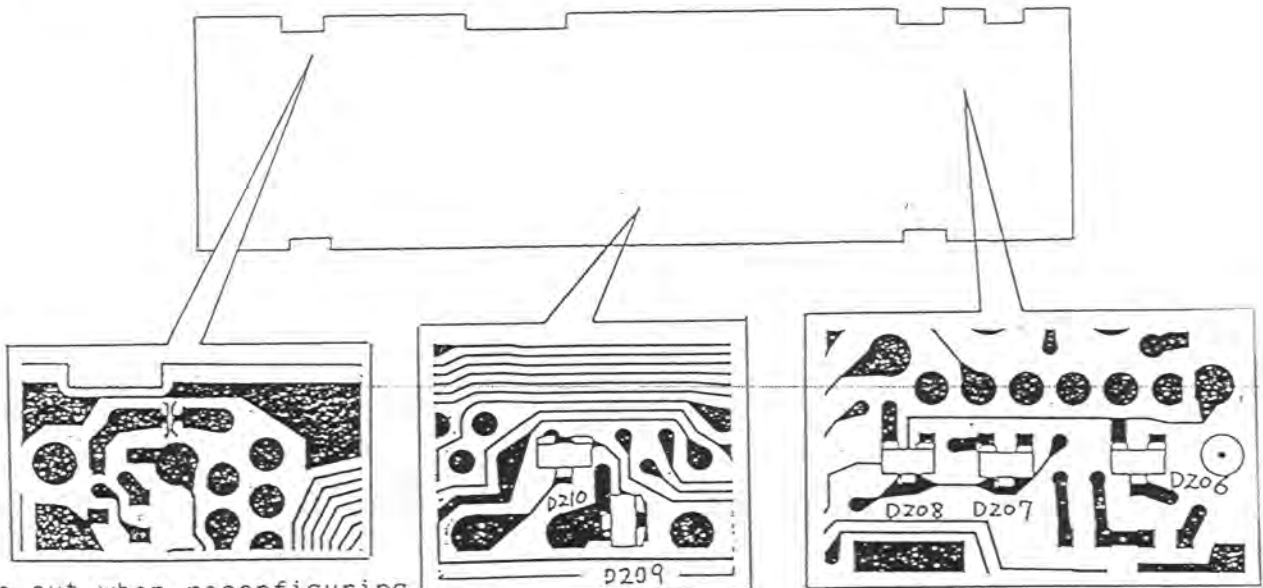
- 1 ) Frequencing can be changed by replacig the diodes for the destination set bits ( a0 - a4 ) as shown below.

Destination set bit a4a3a2a1a0	Destination	Transait frequency		Receive frequency		Initial value	A.S.	SHIFT	STEP ( ◎ : Initial value )					
		MIN	MAX	MIN	MAX				5	10	15	20	12.5	25
00010	E1	144	146	144	146	144		± 0.6	○	○	○	○	◎	○
00011	C1	136	174	136	174	144		± 5.7	○	○	○	○	◎	○
01000	E3	144	146	136	174	144		± 0.6	○	○	○	○	◎	○
01010	E2	136	174	136	174	144		± 0.6	○	○	○	○	◎	○
10010	M2	136	174	136	174	144		± 0.6	○	○	○	○	◎	○
10110	M1	144	148	144	148	144		± 0.6	○	○	○	○	◎	○
10111	K1	144	148	118	174	144	○	± 0.6	◎	○	○	○	○	○
11110	K3	136	174	118	174	144		± 0.6	◎	○	○	○	○	◎
11111	K2	142	152	118	174	144	○	± 0.6	◎	○	○	○	○	◎

0: With diode      1: Without diode

## 2 ) Changing parts

Printed circuit of X57-3690-00 ( CONT B/2 ) unit



Pattern cut when reconfiguring DRS transmission

Bit	a4	a3	a2	a1	a0
Ref.	D210	D206	D207	D208	D209
Part name	MA141A	1SS184	1SS184	1SS184	MA141A