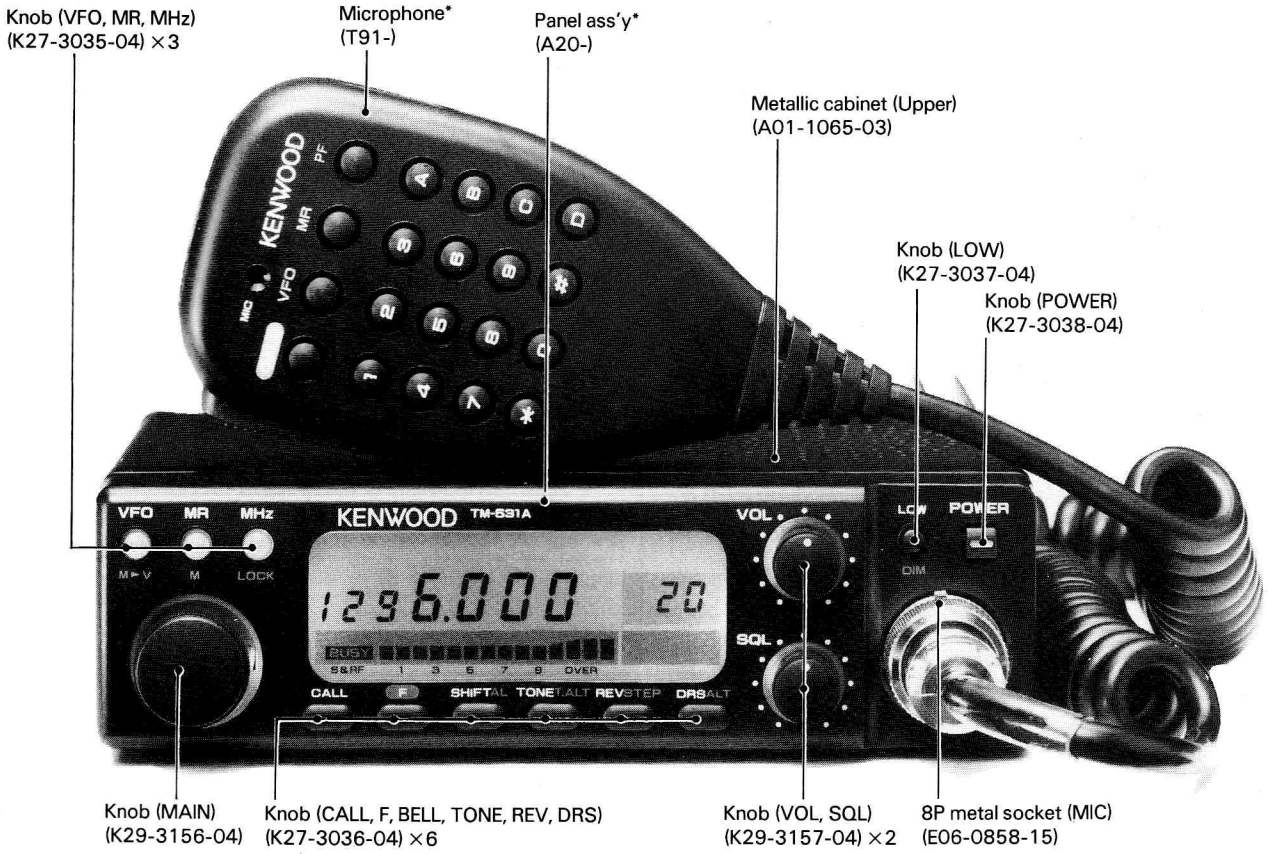
1200MHz FM TRANCEIVER

TM-531A/E

SERVICE MANUAL

KENWOOD

B51-8009-00(B)699



* Refer to parts list on page 15.

CONTENTS

CIRCUIT DESCRIPTION

MODEL / Unit Name	TM-531A	TM-531E
TX-RX Unit	X57-3340-11	X57-3340-61

Table 1

Frequency Configuration

The TM-531A/E utilizes a PLL synthesizer system and digital VFO. The VFO is capable of tuning in 10 kHz, 12.5 kHz, 20 kHz, and 25 kHz steps.

The receiver system configuration is based upon double superheterodyne principles with a first intermediate frequency (IF) of 59.7 MHz and a second intermediate frequency of 455 kHz. The transmit signal generated by the PLL (Phase Locked Loop) circuit, oscillating at one half the fundamental frequency is directly modulated, amplified and applied to the antenna.

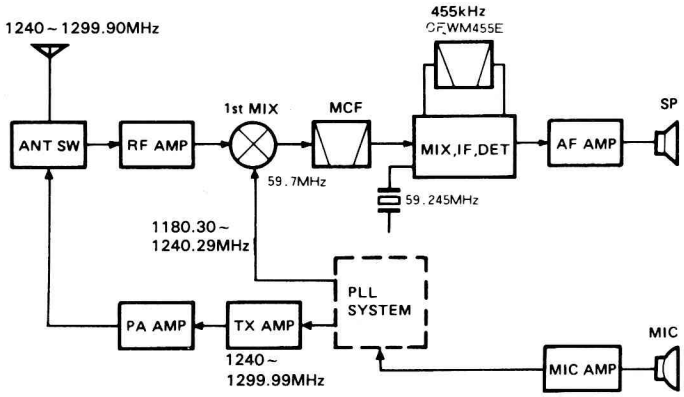


Fig. 1 Frequency configuration diagram

Receiver System

• General

Incoming signals from the antenna pass through a low pass filter circuit in the transmitters final stage, then through the transmit/receive switching diodes, and then to the front end of the receiver.

The incoming signals are amplified by a microwave GaAs (Gallium Arsenide) FET and enter a two-pole helical reasonator. The signals are then passed through an additional microwave GaAs FET and two-pole helical reasonator in order to remove any remaining undesirable components. The signal is then applied to the first mixer. The front end of this transceiver is matched thru the use of a microstrip line in order to obtain high sensitivity and reliability. The first mixer employs a GaAs FET that provides excellent two-signal characteristics. The incoming signal is combined with the first local oscillator signal from the PLL unit and converted into the first IF signal of 59.7 MHz. Undesirable harmonics are removed from the IF signal by a two stage MCF (Monolithic Crystal Filter).

The first IF signal is amplified and applied to the FM IF HIC (IC2: KCD01). The incoming IF signal is mixed with the second local oscillator frequency (59.245 MHz) to obtain the second IF frequency of 455 kHz. This signal is then applied to a six element ceramic filter (CFWM455E) to sharpen the signal quality and fed back into IC2 for additional amplification. The output signal from the IC2 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 IC2 (KCD01) in the FM IF HIC is fed into the control circuit. The CPU converts the voltage from an analog to a digital signal in order to operate the LCD bar meter.

Item	Standard
Center Frequency	59.700 MHz
Passband width	±12.5 kHz or more at 3 dB
Attenuation bandwidth	±35 kHz or less at 25 dB ±100 kHz or less at 60 dB
Guaranteed attenuation	70 dB or more within Fo±1 MHz 80 dB at Fo±(890~930) kHz
Spurious	40 dB or more within Fo~Fo+500 kHz
Ripple	2 dB or less. Minimum loss 4 dB or less
Impedance	Input/output 560 ohms±5% Input/output 1.5 pF±0.1 pF

Table 2 MCF (L71-0280-05) characteristics (TX-RX unit L5)

Item	Standard
Nominal center frequency	455 kHz
6 dB bandwidth	±75 kHz or more (at 455 kHz)
50 dB bandwidth	±15 kHz or less (at 455 kHz)
Ripple (within 455±kHz)	3 dB or less
Insertion loss (at the maximum output point)	6 dB or less
Guaranteed attenuation (within 455±100 kHz)	35 dB or more
Input/Output matching impedance	1.5 kΩ

Table 3 Ceramic filter CFWM455E (L72-0366-05) Characteristics (TX-RX unit CF1)

CIRCUIT DESCRIPTION

Transmitter System

• Outline

The basic configuration of the transmitter section is that of an oscillator circuit operating at 1/2 the desired operating frequency is directly modulated by using a varactor diode. This signal is then doubled, amplified and applied to the antenna circuits.

• Modulation Circuit

Voice signals from the microphone enter the transmitter via three op amps. These operational amplifiers perform pre-emphasis, amplification, limiting, and includes a splatter filter, which is used to reduce undesirable high-frequency components from the signal. A portion of the incoming audio signal is taken from the output of the amplifier and is applied to the microphone check circuit that is used in the low power setting of the radio. The FM modulation circuit applies this signal directly to the VCO via a varactor diode.

• PreAmplifier Circuit

The output signal from the VCO enters the pre-amplifier (HIC). The value of this circuit is that it provides high quality signal amplification since it is always operating in its linear range.

• Final Amplifier Circuit

The signals from the pre-amplifier stage and DRIVE HIC: KCB07 enter the final module where they are boosted to the desired final output level. This transceiver uses a large heat sink to prevent failure of the final amplifier due to temperature. It is designed to provide efficient radiation of the heat generated by the final amplifier.

• APC Circuit (Automatic Power Control)

The automatic power control circuit (APC) uses a diode to detect a portion of the output from the final module. It amplifies this signal and uses it as a control voltage. This control voltage is inversely proportional to the output so that a constant output is produced.

Item	Symbol	Tc (%)	Unit	Condition	Rating
Operating Voltage	V_{CC}	25	V		17
Base bias voltage	V_{BB}	25	V		10
Current Consumption	I_{CC}	25	A		8
Input voltage	Pin	25	W	$Z_G = Z_L = 50\ \Omega$, $V_{CC} = 12.5$ V, $V_{BB} = 9$ V	2
Output power	Po	25	W	$Z_G = Z_L = 50\ \Omega$	25
Operating case temperature	Tc(op)		°C		−30 ~ +110
Preservation temperature	Tstg		°C		−40 ~ +110

Table 4 Power module M67711, maximum rating (Final Unit IC401)

CIRCUIT DESCRIPTION

• Antenna Switching Circuit

The antenna switching circuit is shown in **Fig. 2**. The receive circuit consists of a two stage cutoff circuit that is formed by 1/4 wavelength striplines which provide low insertion loss and good isolation.

A PIN diode is used as a switching element because of its small junction capacitance, and because its high frequency capacitance is relatively independent of reverse bias voltages.

Fig. 3 shows the equivalent circuit for the transmit section.

The switching diodes are forward biased whenever the 8T (8 volts on transmit) is active. During transmit, the apparent impedance felt on the two 1/4 wavelength strip lines is very high (Point A) which prevents power from being coupled into the receiver section. This ensures maximum power is transferred to the antenna and protects the receiver front end from possible overloading.

The equivalent circuit for receive is shown in **Fig. 4**.

During receive the 8T line is held low which causes the PIN diodes to be reverse biased. This presents a high impedance to the incoming receive signals, effectively blocking them from the transmit section. The two 1/4 wavelength striplines present a low impedance to the small signal levels of the incoming receive signal and allow the signals to pass along to the receiver circuits.

In practice the junction capacitance of the PIN diodes will never reach zero so that the impedance of one circuit (Zout) might influence the other, to a small extent. Diodes D4 and D7 are provided to reduce this junction capacitance, and thus the effect of this interaction between circuits.

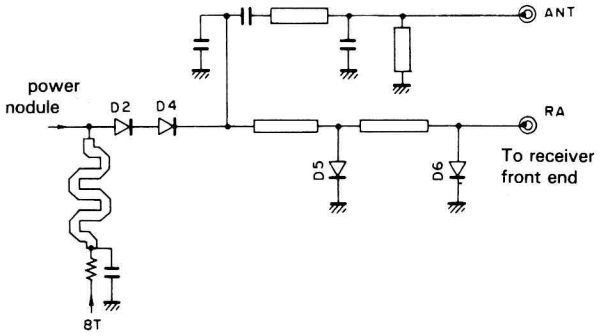


Fig. 2 Antenna Switching Circuit

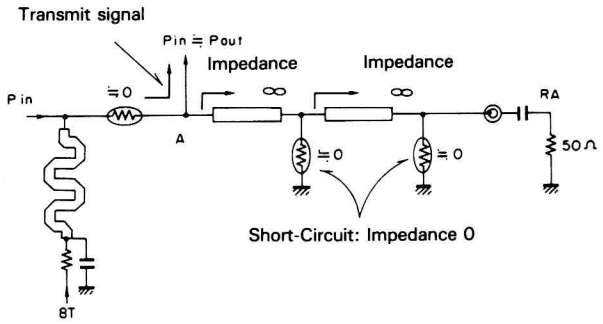


Fig. 3 Equivalent circuit for transmit

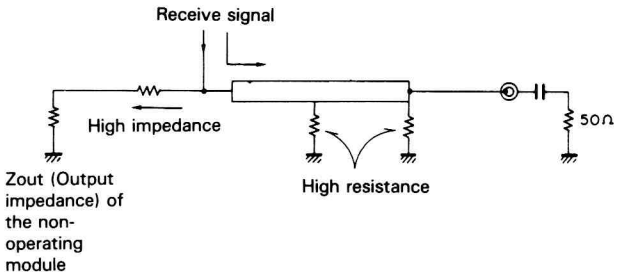


Fig. 4 Equivalent circuit for receive

CIRCUIT DESCRIPTION

PLL Synthesizer Unit

A block diagram of the PLL unit is provided in **Fig. 5**. The PLL unit of the TM-531A/E is constructed so that the VCO unit is contained in a separate shielded case that forms its own subassembly. This technique results in improved electrical and mechanical stability, which increases the overall frequency stability of the radio.

The VCO oscillates at a frequency of 600 MHz. Its second harmonic (1200 MHz) is amplified by transistor Q2 in order to obtain a useable 1200 MHz signal. This signal is then amplified by Q54. Here the signal is divided by 128 or 129. The resulting signal is applied to the phase comparator (MB1501PF) to obtain the correction voltage that is used to lock the VCO on frequency. A TCXO (Temperature Compensated Crystal Oscillator) reference oscillator operates at 12.8 MHz which helps to reduce frequency drift and offers high stability.

A frequency of 10 or 12.5 kHz is used to compare the signal obtained by dividing the 12.8 MHz TCXO frequency by 1/1280 or 1/1024 in order to provide the various tuning steps of 10, 12.5, 20, and 25 kHz.

The relationship between the fvco (RX) and the various division ratios is explained below:

- fvco (RX) = fRX − 59.7 = {(n × 128) + A} × fosc ÷ R
- fvco (RX): The output frequency (Q2 output) of the VCO during receive
- fRX: Receive frequency
- n: Set value of the binary 10 bit programmable counter

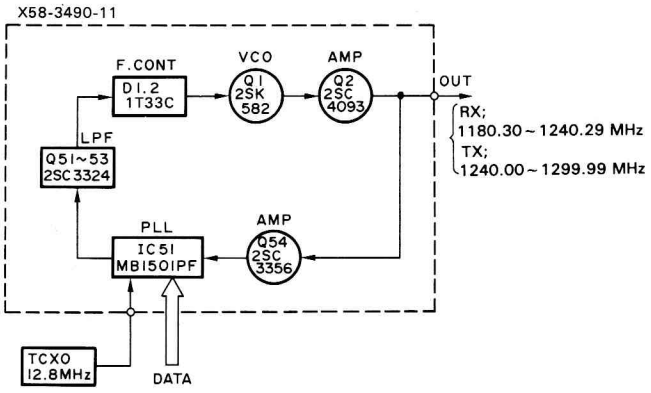


Fig. 5 Block diagram of the PLL unit

- fosc: Standard Oscillator Frequency 12.8 MHz (TCXO)
- R: Set value of the binary 14-bit programmable reference counter
- 1024 (for the 12.5 and 25 kHz steps)
- 1280 (for the 10 and 20 kHz steps)

In the case of 1260 MHz,

- fvco (RX) = 1260 − 59.7
  = {(n × 128) + A} × 12800 ÷ 1280
  = 1200.300 MHz

where n = 937 and A = 94.

For transmitting,

- fvco (TX) = 1260 = {(n × 128) + A} × 12800 ÷ 1280
  = 1260.000 MHz

where n = 984 and A = 48.

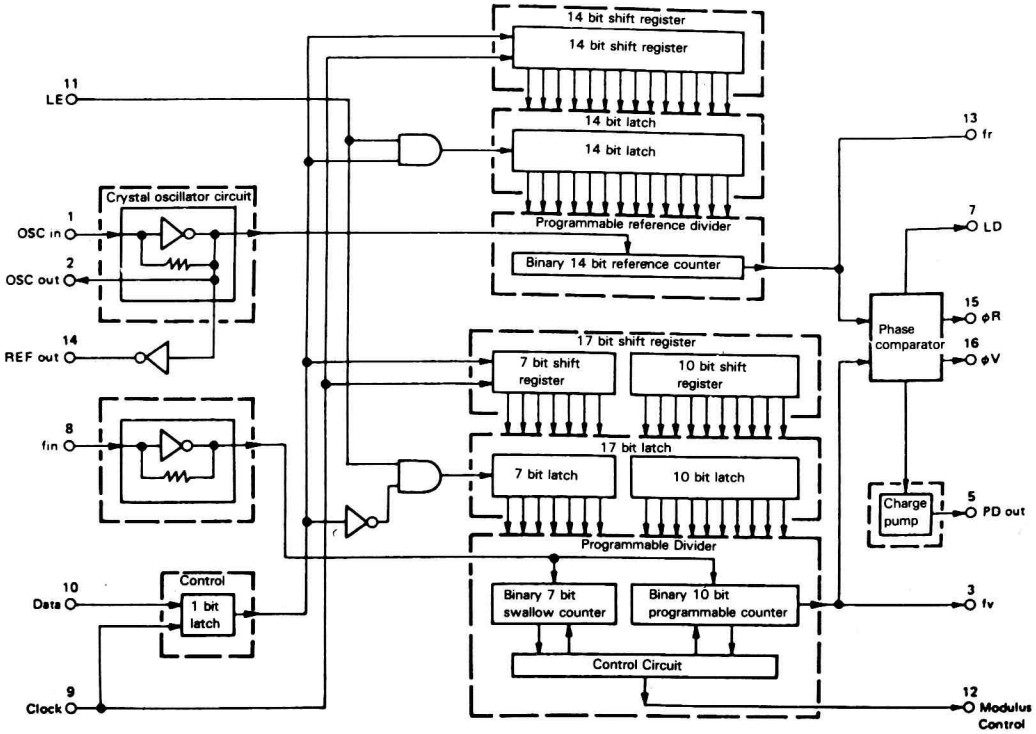


Fig. 6 Block diagram of MB1501PF (VCO unit IC 51)

CIRCUIT DESCRIPTION

• ALT (Automatic Frequency Locked Tuning) Circuit

The block diagram of the ALT unit is shown in **Fig. 7**.

The ALT system uses a portion of the second local oscillator signal, mixer, and the FM IF HIC: KCD01 module to form a feed-back circuit that is used to provide analog automatic frequency control.

When the first IF (59.7 MHz) changes due to a shift in the transmitter frequency a corresponding shift will occur in the second intermediate frequency. A portion of this second IF signal is detected. This correction voltage is amplified (NJM4558M) and is used to control D1 and D2 via analog switch MN4066BS. TP1 can be used to check the value of this control voltage. D1 and D2 are in series with the 59.245 MHz oscillator circuit and provide voltage control of this oscillator (VCXO, Voltage controlled oscillator). Therefore, fluctuations of the second IF cause a corresponding change in the second local oscillator circuit, which keeps the frequency of the second IF within the bandwidth of the IF filter. This system maintains close agreement between the transmit and receive frequency bandwidths. (In practice, the receiver frequency and transmit frequency are automatically maintained in close agreement.) The center voltage of the vari-cap diode is set by a voltage divider circuit. Stability of this voltage is maintained by a voltage follower circuit. When the ALT circuit is off, the control voltage applied to the vari-cap diode is switched to this fixed voltage divider circuit in order to set the second local oscillator frequency.

The control voltage for the vari-cap diode is subject to one additional voltage divider stage. During receive this DC signal is applied from the RM line to the microprocessor terminal PTH02 which turns on the tuning indicator light. Switching is performed by the 8R line.

The relationship between the input voltage on the PTH02 terminal and the tuning indicator, and the relationship between the RM voltage and the deviation during receive is shown in **Table 5** and **Fig. 8**.

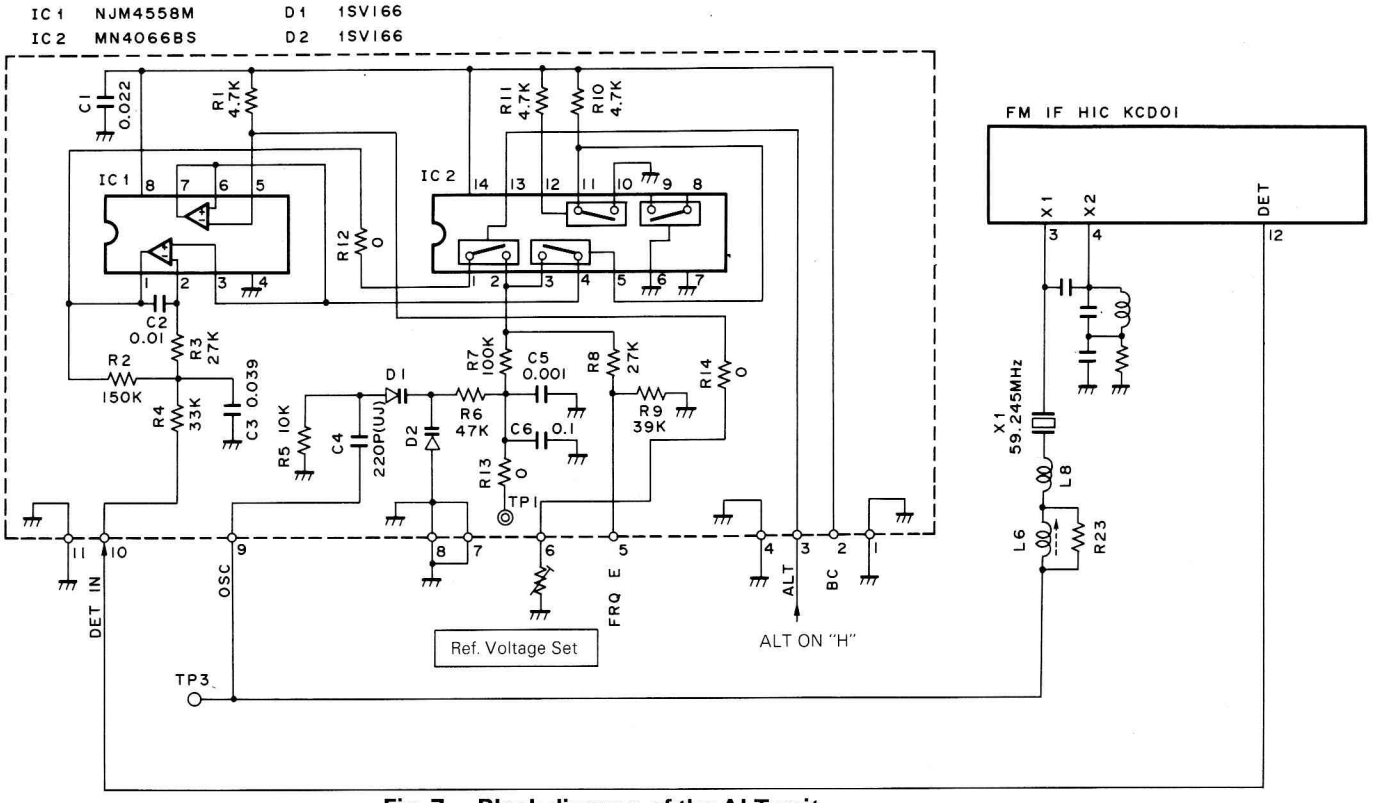


Fig. 7 Block diagram of the ALT unit

PTH01 input voltage	ALT indicator
0 ~ 1.48 V	Only ◁ turns ON
1.48 ~ 2.79 V	Both ◁ and ▷ turn OFF
2.79 ~ 5.0 V	Only ▷ turns ON

Table 5 Relationship between PTH01 input voltage and the T indicator

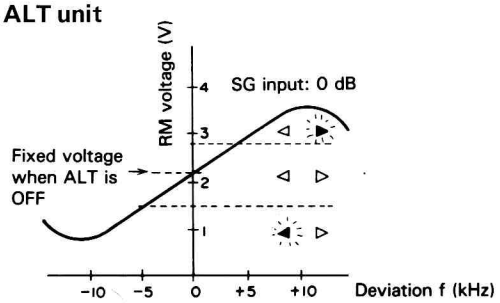


Fig. 8 Relationship between the RM voltage and deviation during receive

CIRCUIT DESCRIPTION

- **Unlock circuit**

When the PLL is unlocked, the base of Q16 is off with OV, turning Q16 off: As a result, the collector of Q16 becomes 8 V. This turns Q16 off and Q14 on, then turns Q12 off. Therefore, when the PLL is unlocked, Q12 is off removing bias voltage from the 8T line. Without the 8T voltage no transmit signal is generated.

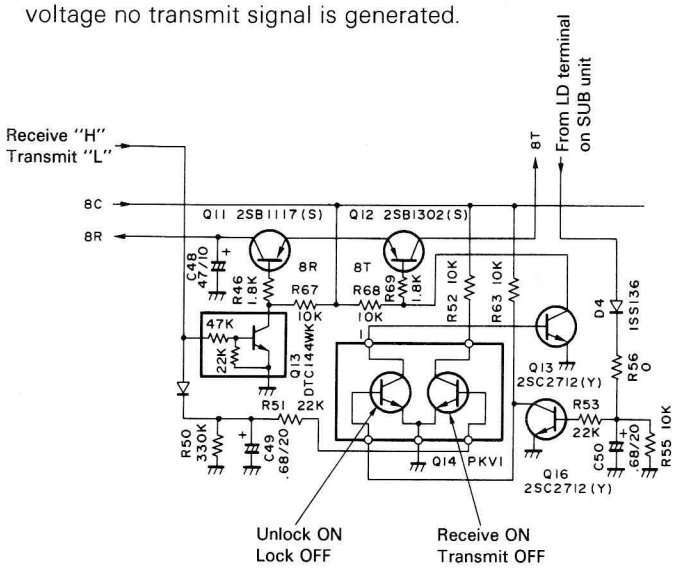


Fig. 9 Unlock circuit

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.

- **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.

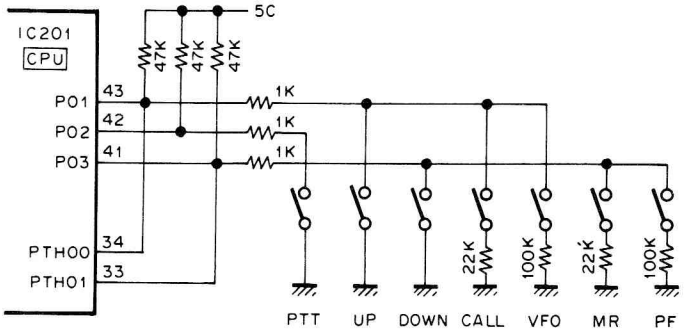


Fig. 10 Microphone key input circuit

CIRCUIT DESCRIPTION

• Reset and back-up circuits

When the TM-531A/E power is turned on, the reset circuit sends a "L" level pulse to the RESET pin of the CPU for approx. 3ms. This initiates the power-on reset sequence.

When the TM-531A/E power is turned off, the backup circuit detects a voltage drop in the 13.8V line and sets CPU INT4 to a "H" level. This causes the CPU to enter a back-up state.

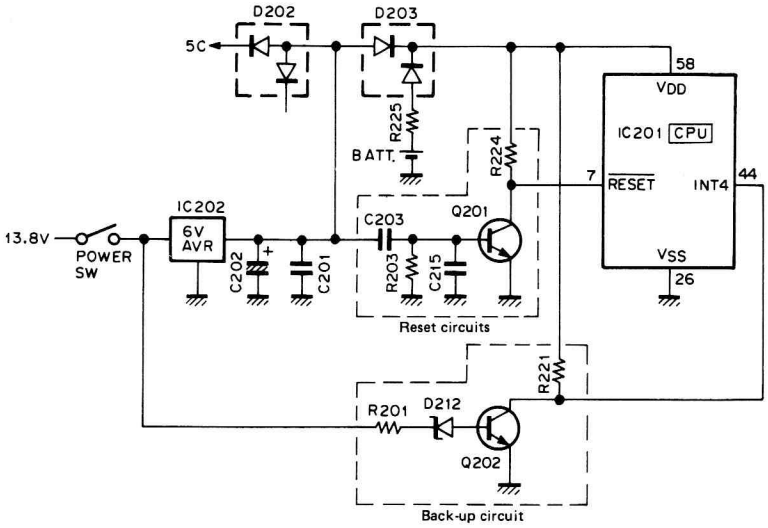


Fig. 11 Reset and back-up circuits

• 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 6

• 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, P141, and P140 of the CPU.

CIRCUIT DESCRIPTION

• PLL data output

PLL data is available from P21 (CK), P22 (DT), P61 (ACL), and P23 (EN1) of the CPU. Figure 9 is a timing chart for PLL data transfer, and Figure 10 shows the format of PLL data.

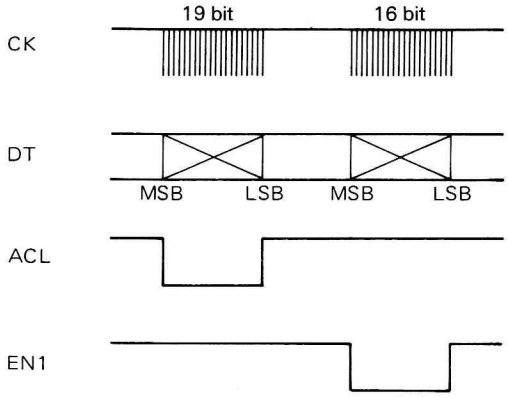


Fig. 12 Timing chart for PLL data transfer

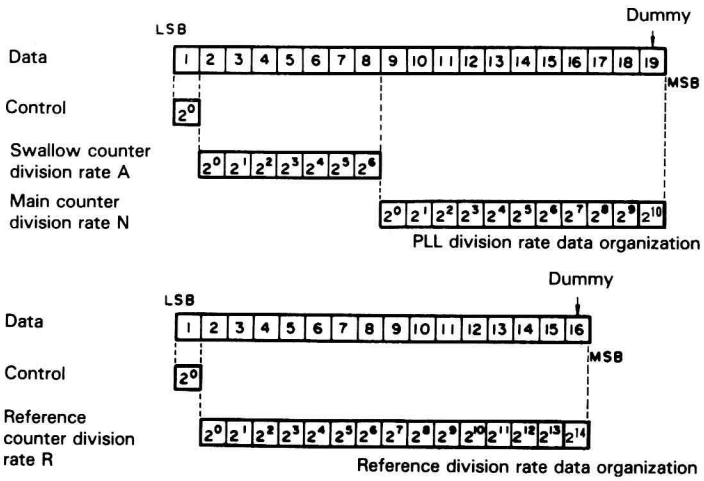


Fig. 13 Data format

• Input and output of CTCSS unit (option)

The optional CTCSS unit receives data from P21, P22, an P73 of the CPU. Figure 14 is a timing chart for CTCSS data transfer, and Figure 15 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 → $\overline{S2}$: Serial data output pin
P01 → $\overline{SCK}$: Serial clock I/O pin

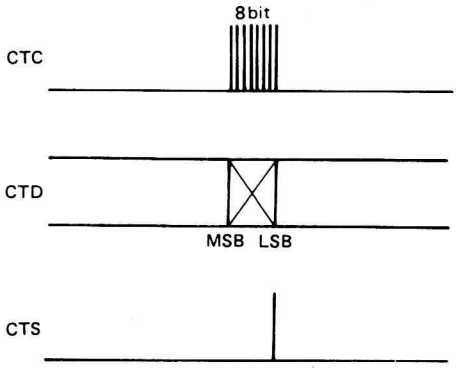


Fig. 14 Timing chart for CTCSS data transfer

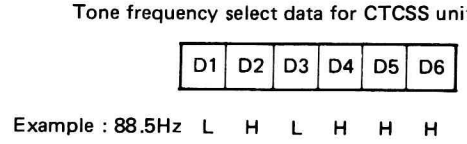


Fig. 15 CTCSS data format

CIRCUIT DESCRIPTION

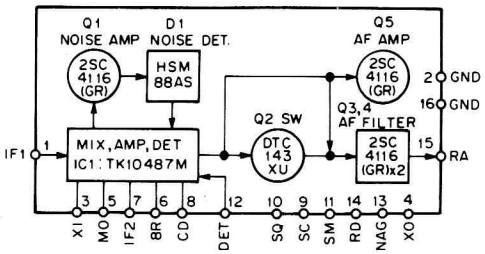
Pin No.	Pin name	I/O	Logic	Function	Pin No.	Pin name	I/O	Logic	Function
1	P41	O	–	D/A digital output (tone).	33	PTH01	I	–	Mic DOWN input.
2	P40	O	–		34	PTH00	I	–	Mic UP input.
3	P53	O	–		35	TI1	–	L	Not used.
4	P52	O	–		36	TI0	–	L	Not used.
5	P51	O	–		37	P23	O	L	PLL IC enable output.
6	P50	O	–		38	P22	O	–	PLL IC data output.
7	$\overline{\text{RESET}}$	I	L	Reset input.	39	P21	O	–	PLL IC clock output.
8	X2	–	–	4.194304MHz crystal oscillator.	40	P20	O	–	Beeper output.
9	X1	–	–		41	P03/SI	I/I	L/–	Mic DOWN/serial data input.
10	P63	I	H	CTCSS tone matching input.	42	P02/SO	I/O	L/–	Mic PTT input/serial data output.
11	P62	O	H	Power switch.	43	P01/$\overline{\text{SCK}}$	I/–	L/–	Mic UP input/serial clock I/O.
12	P61	O	–	Not used.	44	INT4	I	H	Back-up detect input.
13	P60	I	–	Not used.	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	–	Not used.	50	P132	I	L	LOW, DRS
19	P82	O	H	DRS unit STBY output.	51	P131	I	L	Transmit power select.
20	P81	O	L	DRS unit $\overline{\text{WR}}$ output.	52	P130	I	L	Busy input.
21	P80	O	L	DRS unit $\overline{\text{RD}}$ output.	53	P143	O	L	Squelch control.
22	P93	O	H	DRS unit data output.	54	P142	O	H	Dimmer control.
23	P92	O	H		55	P141	O	–	LCD driver clock output.
24	P91	O	H		56	P140	O	–	LCD driver data output.
25	P90	O	H		57	NC	–	–	Not used.
26	Vss	–	–	GND.	58	V_{DD}	–	–	Power supply pin.
27	INT3	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	INT0	I	H	Remote connect detect input.	62	P30	O	L	
31	PTH03	I	–	S-meter analog input.	63	P43	O	–	Not used.
32	PTH02	I	–	Not used.	64	P42	O	–	Tone freq. set output.

Destination, key input.

Table 7 75108G-E20-1B terminal functions (TX-RX unit IC201)

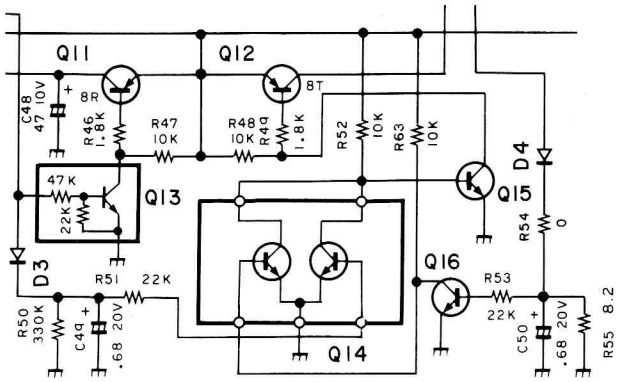
DESCRIPTION OF COMPONENTS

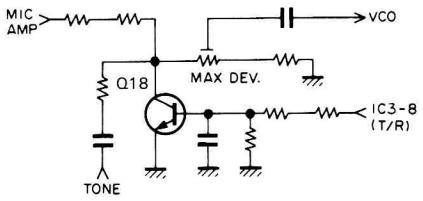
TX-RX UNIT (X57-3340-XX) —11: TM-531A (K, M) —61: TM-531E (T, W)

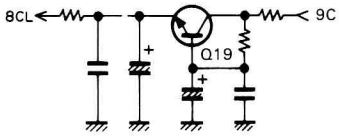
Component	Use/Function	Operation/Condition/Compatibility
IC1		
IC2	2nd local oscillator, Mixer IF amp, detection low-frequency amplification noise amplification noise detection Squelch switching	① 1st IF signal input (59.7 MHz) ③ 2nd local oscillator (59.245 MHz) ⑨ Busy output ⑩ Squelch control ⑪ S-meter output ⑭ RD output ⑮ Low-frequency output 
IC3	AF amplification	⑧ AF IN ① AF OUT
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	9V AVR	
IC8	Transmit pre-drive	
IC9	Transmit drive	
IC10	8V AVR	
IC201	Microprocessor	See circuit description
IC202	6V AVR	
IC301	Tone encoder	
Q1	RF amplification	
Q2	RF amplification	
Q4	1st mixer	Converts received 1200 MHz-range signals to 1st IF 59.7 MHz
Q6	IF amplification	Amplifies 1st IF signal
Q7 (1/2)	RD line mute	ON when DRS unit replays
Q7 (1/2)	AF line mute	
Q8 (1/2)	AF amplification	DRS unit
Q8 (1/2)	Reverse current prevention	Used a diode from transistor (base-emitter)
Q9	AF line mute	Operates when transmit mode, AL 1 ch receive mode, CTCSS, BELL is ON
Q10	RF amplification	Amplifies VCO output

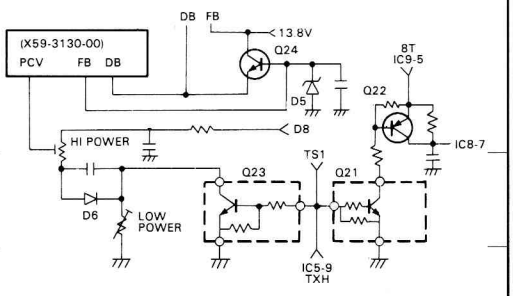
DESCRIPTION OF COMPONENTS

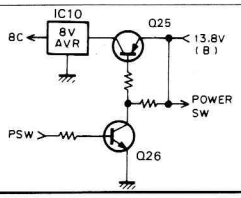
Component	Use/Function	Operation/Condition/Compatibility
Q11	8R switching	ON in receive mode
Q12	8T switching	ON in Transmit mode
Q13	8R switching control	ON in receive mode
Q14 (1/2)	8T switching control	OFF in transmit mode
Q14 (1/2)	8T switching control	OFF when PLL locked
Q15	8T switching control	ON when transmit
Q16	8T switching control	ON when PLL locked
Q18	Mic amp mute	On in receive mode
Q19	PLL 8V ripple filter	
Q20	RF amplification	VCO output amplification
Q21	Q22 switching control	"OFF" when Low power output "ON" when High power output
Q22	Switching	
Q23	Switching	"OFF" when Low power output "ON" when High power output
Q24	TX drive stage +B control	
Q25	Power switch	
Q26	Q25 control	ON when the power switch is turned on.





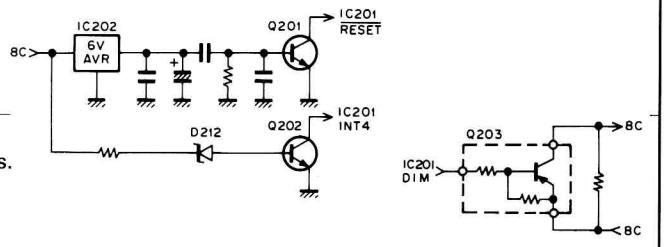






DESCRIPTION OF COMPONENTS

Component	Use/Function	Operation/Condition/Compatibility
Q201	Reset switch	ON for approx. 3 ms. when system power turned on. Usually OFF
Q202	Back-up switch	OFF when 13.8 V line becomes 7.5 V or less. Usually ON
Q203	Dimmer switch	"OFF" in dimmer
D1	Ref. voltage	Zenar diode for Q1
D3, D4	Reverse current prevention	
D5	Voltage setting	Decrease Tx drive +B voltage below 12 V
D6	Temperature compensation	APC circuit
D7	Temperature compensation	IC9 idling
D8	RF output voltage detection	Detect RF output then control APC circuit
D9~D11	TX/RX switch	ON in transmit mode
D12	Reverse power protection	
D13	Limiter	Protect the FM IF IC mulfunction when receiving (heavy reception)
D14	TX/RX switch	ON in transmit mode
D201	Reverse current protection	
D202		
D203		
D204, D205	Microprocessor protection	
D206~D211	Destination diode	
D212	Back-up Voltage Setting	



PLL (X58-3490-11)

Component	Use/Function	Operation/Condition/Compatibility
IC51	PLL	
Q1	VCO	590.15~620.145 MHz
Q2	RF amplification	Amplifies VCO output to ref. level
Q3	TX/RX switch	ON when receiving
Q51~Q53	Loop filter	
Q54	RF amplification	Amplifies VCO output to PLL IC input level
Q101	VCO	Oscillates 454.85~504.845 MHz
Q102	RF amplification	Amplifies VCO output to ref. level
D1, D2	Frequency control	
D3	Modulation	Make a modulation to VCO when transmit
D4	TX/RX switch	
D5	VCO output switch	
D51	UNLOCK detection	
D52	Voltage drop	PLL IC voltage supply 5.0 V→4.5 V
D101	Frequency control	

DESCRIPTION OF COMPONENTS

ALT (X59-3510)

Component	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	DC amplification	Amplifies DC voltage of FM · IF IC detection output
IC1 (1/2)	Voltage controller	Protect against load variation of ref. voltage
IC2	Double side switch four switch circuit	①—② ON when ALT ON ③—④ ON when ALT OFF ⑩—⑪ ON when ALT ON
D1, D2	Variable 2nd OSC freq.	Variable 2nd OSC freq. from control voltage of ALT circuit.

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			TM-531 A/E			
1	1B		A01-1065-03	METALLIC CABINET(UPPER)		
2	2C		A01-1066-03	METALLIC CABINET(BOTTOM)		
3	1C		A10-1292-01	CHASSIS CALKED ASSY		
4	2A	*	A20-2691-02	PANEL ASSY	KM	
4	2A	*	A20-2692-02	PANEL ASSY	TW	
6	2A		B10-1114-04	FRONT GLASS		
7	2B		B11-0462-08	FILTER		
8	2B		B30-0869-05	LAMP		
9	2B		B38-0311-05	LCD ASSY		
-		*	B40-3884-04	MODEL NAME PLATE	KM	
-		*	B40-3885-04	MODEL NAME PLATE	TW	
-			B42-2454-04	SERIAL NO.LABEL (PACKING)		
11	1B,1C		B42-2455-04	LABEL (M4X8 MAX)		
-			B42-3343-04	SERIAL NO.LABEL (NAME PLATE)		
-			B42-3356-04	LABEL (EXT.SP)		
-			B46-0410-20	WARRANTY CARD	K	
-			B46-0419-00	WARRANTY CARD	W	
-			B50-8286-00	INSTRUCTION MANUAL		
16	1C		E30-2108-05	ANT CABLE (N TYPE)		
			E30-2111-05	DC POWER CORD		
15	1C	*	E30-2154-05	DC POWER CORD		
			E31-3197-05	CONNECTING WIRE (SP)		
		*	E31-6014-15	CONNECTING WIRE		
			F05-2036-05	FUSE (20A)		
17	1C		F05-8021-05	FUSE (8A)		
		*	F10-1400-04	SHIELDING PLATE		
			F11-1136-04	SHIELDING COVER		
19	2B		F20-0521-04	INSULATING BOARD(LITHIUM BATT)		
20	2B		F20-0587-04	INSULATING BOARD(LITHIUM BATT)		
			G02-0551-14	FLAT SPRING		
			G02-0565-04	FLAT SPRING		
22	1B		G02-0576-04	FLAT SPRING		
		*	G02-0579-04	FLAT SPRING		
		*	G02-0583-04	FLAT SPRING		
23	2A		G09-0405-05	KNOB FIXD SPRING		
			G10-0651-04	NON-WOVEN FABRIC		
25	1B,2C		G10-0681-04	NON-WOVEN FABRIC		
26	2A		G13-0906-04	CUSHION (3KEY)		
27	2B		G13-0907-04	CUSHION (6KEY)		
		*	G13-0916-04	CUSHION (TONE)		
			H11-0822-04	POLYSTYRENE PLATE		
			H13-0814-04	POLYSTYRENE PLATE		
-		*	H01-8229-04	ITEM CARTON BOX	KM	
-		*	H01-8230-04	ITEM CARTON BOX	TW	
-		*	H03-2752-04	OUTER PACKING CASE	KM	
-		*	H03-2753-04	OUTER PACKING CASE	TW	
-			H10-2658-02	POLYSTYRENE FOAMED FIXTURE		
-			H25-0029-04	PROTECTION BAG (MIC HOOK)	K	
-			H25-0049-03	PROTECTION BAG (DC CORD)		
-			H25-0720-04	PROTECTION BAG (TM-531A/E)		
30	1C		J19-1434-04	HOLDER (SP)		

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			J20-0319-24	MIC HOOK	K	
			J21-4147-14	MOUNTING HARDWARE		
			J21-4256-08	MOUNTING HARDWARE (LCD ASSY)		
31	2A		J29-0436-03	BRACKET		
32	2B		K27-3035-04	KNOB (VFO,MR,MHZ)		
33	2A		K27-3036-04	KNOB (CALL,ETC)		
34	2B		K27-3037-04	KNOB (LOW)		
35	2B		K27-3038-04	KNOB (POWER)		
36	2A		K29-3156-04	KNOB (MAIN)		
37	2A		K29-3157-04	KNOB (VOL,SQL)		
A			N09-0626-04	SCREW		
B			N09-0650-05	SCREW		
C			N33-2606-45	OVAL HEAD MACHINE SCREW		
			N46-3010-46	PAN HEAD TAPPING SCREW	K	
D			N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
E			N88-2606-46	FLAT HEAD TAPTITE SCREW		
-			N99-0331-05	SCREW SET		
TS1		*	S59-0438-05	SWITCH		
40	1C		T07-0246-05	LOUDSPEAKER(FULLRANGE)		
			T91-0379-05	MICROPHONE	M	
			T91-0380-05	MICROPHONE	K	
			T91-0382-05	MICROPHONE	TW	
IC1			LC7582	IC(LCD DRIVER)		
			W01-0414-04	WRENCH		
41	2B		W09-0326-05	LITHIUM BATTERY		
		*	X57-3340-11	TX-RX UNIT	KM	
		*	X57-3340-61	TX-RX UNIT	TW	
TX-RX UNIT (X57-3340-11: K, M, 0-61 T, W)						
C107			C90-0840-05	ELECTRO 10UF 16WV		
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			CC73FCH1H1R5C	CHIP C 1.5PF C		
C3			CC73FCH1H010C	CHIP C 1.0PF C		
C4			CC73FSL1H470J	CHIP C 47PF J		
C5			CK73FB1H102K	CHIP C 1000PF K		
C6			CC73FSL1H470J	CHIP C 47PF J		
C7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73FCH1H020C	CHIP C 2.0PF C		
C9			CC73FSL1H470J	CHIP C 47PF J		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			CC73FSL1H101J	CHIP C 100PF J		
C12			CC73FCH1H020C	CHIP C 2.0PF C		
C13			CC73FSL1H101J	CHIP C 100PF J		
C14			CK73FB1H103K	CHIP C 0.010UF K		
C15			CE04EW1A470M	ELECTRO 47UF 10WV		
C16			CK73FB1H103K	CHIP C 0.010UF K		
C17			CC73FCH1H030C	CHIP C 3.0PF C		
C18			CC73FCH1H020C	CHIP C 2.0PF C		
C20			CC73FSL1H101J	CHIP C 100PF J		
C21 ,22			CK73FB1H102K	CHIP C 1000PF K		
C23			CC73FCH1H080D	CHIP C 8.0PF D		
C24 ,25			CK73FB1H102K	CHIP C 1000PF K		

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C26			CC73FCH1H150J	CHIP C 15PF J		
C27			CC73FCH1H220J	CHIP C 22PF J		
C28 ,29			CK73FB1H103K	CHIP C 0.010UF K		
C30			CE04EW1A470M	ELECTRO 47UF 10WV		
C32			CK73EB1E104K	CHIP C 0.10UF K		
C33			CK73EF1C105Z	CHIP C 1.0UF Z		
C34			CK73EB1E104K	CHIP C 0.10UF K		
C35			CE04EW1A471M	ELECTRO 470UF 10WV		
C36			CE04EW1A470M	ELECTRO 47UF 10WV		
C37			CE04EW1C470M	ELECTRO 47UF 16WV		
C38			CK73FB1H103K	CHIP C 0.010UF K		
C39 ,40			CE04EW1A470M	ELECTRO 47UF 10WV		
C41			CK73FB1H333K	CHIP C 0.033UF K		
C42			CC73FSL1H101J	CHIP C 100PF J		
C43			CE04EW1E4R7M	ELECTRO 4.7UF 25WV		
C44 ,45			CK73EF1C105Z	CHIP C 1.0UF Z		
C46			CC73FSL1H101J	CHIP C 100PF J		
C47			CC73FCH1H030C	CHIP C 3.0PF C		
C48			CE04EW1A470M	ELECTRO 47UF 10WV		
C49 ,50			C92-0504-05	CHIP-TAN 0.68UF 20WV		
C51 ,52			CK73FB1H102K	CHIP C 1000PF K		
C53			CC73FSL1H101J	CHIP C 100PF J		
C54			CE04EW1C470M	ELECTRO 47UF 16WV		
C55			CK73EF1C105Z	CHIP C 1.0UF Z		
C56			CC73FSL1H101J	CHIP C 100PF J		
C57			CK73FB1H103K	CHIP C 0.010UF K		
C58 ,59			CC73FSL1H101J	CHIP C 100PF J		
C60			CC73FSL1H470J	CHIP C 47PF J		
C61			CE04EW1A101M	ELECTRO 100UF 10WV		
C62 ,63			CK73FB1H103K	CHIP C 0.010UF K		
C64 ,65			CE04EW1A101M	ELECTRO 100UF 10WV		
C66			CK73FB1H103K	CHIP C 0.010UF K		
C67			CE04EW1A101M	ELECTRO 100UF 10WV		
C68 ,69			CK73FB1H103K	CHIP C 0.010UF K		
C70			CC73FSL1H101J	CHIP C 100PF J		
C71			CK73FB1H102K	CHIP C 1000PF K		
C72			CC73FCH1H080D	CHIP C 8.0PF D		
C73			CC73FCH1H030C	CHIP C 3.0PF C		
C74			CK73FB1H103K	CHIP C 0.010UF K		
C75			CC73FSL1H101J	CHIP C 100PF J		
C76			CC73FCH1H030C	CHIP C 3.0PF C		
C77			CC73FCH1H020C	CHIP C 2.0PF C		
C78			CK73FB1H103K	CHIP C 0.010UF K		
C79			CC73FCH1H040C	CHIP C 4.0PF C		
C80			CC73FCH1H020C	CHIP C 2.0PF C		
C81			CK73FB1H102K	CHIP C 1000PF K		
C82			CE04EW1C100M	ELECTRO 10UF 16WV		
C83 -85			CK73FB1H102K	CHIP C 1000PF K		
C86			CC73FSL1H101J	CHIP C 100PF J		
C87 ,88			CK73FB1H102K	CHIP C 1000PF K		
C89			CE04EW1C100M	ELECTRO 10UF 16WV		
C90 ,91			CK73FB1H102K	CHIP C 1000PF K		
C92 ,93			CK73EF1C105Z	CHIP C 1.0UF Z		
C95			CE04EW1C101M	ELECTRO 100UF 16WV		
C96			CC73FCH1H010C	CHIP C 1.0PF C		

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C97			CC73FCH1H100D	CHIP C 10PF D		
C98 ,99			CK73FB1H471K	CHIP C 470PF K		
C100			CC73FCH1H010C	CHIP C 1.0PF C		
C101			CM73F2H470J	CHIP C 47PF J		
C102			CM73F2H010C	CHIP C 1.0PF C		
C103			CK73FB1H471K	CHIP C 470PF K		
C104			CE04EW1A470M	ELECTRO 47UF 10WV		
C105,106			CK73FB1H103K	CHIP C 0.010UF K		
C107			CE04EW1C100M	ELECTRO 10UF 16WV		
C108,109			CK73FB1H103K	CHIP C 0.010UF K		
C110		*	C90-2092-05	ELECTRO 1800UF 16WV		
C111			CK73FB1H102K	CHIP C 1000PF K		
C113			CC73FSL1H101J	CHIP C 100PF J		
C114			CK73FB1H102K	CHIP C 1000PF K		
C116			CK73EF1C105Z	CHIP C 1.0UF Z		
C117			CK73FB1H472K	CHIP C 4700PF K		
C118			CK73EB1E104K	CHIP C 0.10UF K		
C120			CK73EF1C105Z	CHIP C 1.0UF Z		
C121		*	C90-2092-05	ELECTRO 1800UF 16WV		
C201			CK73FB1H103K	CHIP C 0.010UF K		
C202			CE04CW1C100M	ELECTRO 10UF 16WV		
C203			CK73FB1H223K	CHIP C 0.022UF K		
C204,205			CK73FB1H102K	CHIP C 1000PF K		
C206,207			CC73FCH1H330J	CHIP C 33PF J		
C210-215			CK73FB1H102K	CHIP C 1000PF K		
C301			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C302			CK73FB1H102K	CHIP C 1000PF K		
C303			CK73FB1E393K	CHIP C 0.039UF K		
W202			E31-6003-15	CONNECTING WIRE(CTCSS)		
CN1			E40-3237-05	PIN CONNECTOR (SP)		
CN2		*	E40-5182-05	PIN CONNECTOR (VOICE)		
CN3 ,4		*	E40-5202-05	PIN CONNECTOR (CONT)		
CN201,202		*	E40-5203-05	PIN CONNECTOR (TX-RX)		
CN203		*	E40-5185-05	PIN CONNECTOR (VOICE 8P)		
CN204		*	E40-5187-05	PIN CONNECTOR (VOICE10P)		
CN205,206		*	E40-5204-05	PIN CONNECTOR (LCD)		
J1			E11-0425-05	PHONE JACK		
J2 ,3			E04-0154-05	RF COAXIAL CABLE RECEPTACLE		
J101			E06-0858-15	8P METAL SOCKET(MIC)		
TP1 -3			E23-0465-05	TERMINAL(S-METER)		
W203		*	E31-6004-05	CONNECTING WIRE		
CD1			L79-0855-05	CERAMIC DISCR.CDB455C7		
CF1			L72-0366-05	CERAMIC FILTER		
L1 ,2			L79-0827-05	LC FILTER		
L4			L34-4087-05	COIL (BOX)		
L5			L71-0280-05	CRYSTAL FILTER		
L6			L34-2034-05	COIL		
L7 ,8			L40-5682-19	SMALL FIXED INDUCTOR		
L9			L40-1001-19	SMALL FIXED INDUCTOR		
L301			L78-0018-05	CRYSTAL RESONATOR 3.58MHZ		
X1			L77-1375-05	CRYSTAL RESONATOR 59.245MHZ		
X2		*	L77-1376-15	TCXO 12.8MHZ		
X201		*	L77-1397-05	CRYSTAL RESONATOR 4.194304MHZ		

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R1			RK73FB2A820J	CHIP R 82 J 1/10W		
R2			RK73FB2A221J	CHIP R 220 J 1/10W		
R3			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R4			RK73FB2A153J	CHIP R 15K J 1/10W		
R5			RK73FB2A4R7J	CHIP R 4.7 J 1/10W		
R6			RK73FB2A471J	CHIP R 470 J 1/10W		
R11			RK73FB2A471J	CHIP R 470 J 1/10W		
R12			RK73FB2A560J	CHIP R 56 J 1/10W		
R15			RK73FB2A471J	CHIP R 470 J 1/10W		
R16			RK73FB2A103J	CHIP R 10K J 1/10W		
R17			RK73FB2A151J	CHIP R 150 J 1/10W		
R18			R92-0670-05	CHIP R 0 ΩHM	TW	
R18			R92-0670-05	CHIP R 0 ΩHM	KM	
R19			RK73FB2A101J	CHIP R 100 J 1/10W		
R20			R92-0670-05	CHIP R 0 ΩHM	TW	
R20			R92-0670-05	CHIP R 0 ΩHM	KM	
R21			RK73FB2A331J	CHIP R 330 J 1/10W		
R22			RK73FB2A334J	CHIP R 330K J 1/10W		
R23			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R24			RK73FB2A471J	CHIP R 470 J 1/10W		
R25			RK73FB2A103J	CHIP R 10K J 1/10W		
R26			R92-0670-05	CHIP R 0 ΩHM	TW	
R26			R92-0670-05	CHIP R 0 ΩHM	KM	
R27 ,28			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R29			RK73FB2A334J	CHIP R 330K J 1/10W		
R30			R92-0670-05	CHIP R 0 ΩHM	TW	
R30			R92-0670-05	CHIP R 0 ΩHM	KM	
R31			RK73FB2A331J	CHIP R 330 J 1/10W		
R32			R92-0670-05	CHIP R 0 ΩHM	TW	
R32			R92-0670-05	CHIP R 0 ΩHM	KM	
R33			RK73FB2A101J	CHIP R 100 J 1/10W		
R34			R92-0670-05	CHIP R 0 ΩHM	TW	
R34			R92-0670-05	CHIP R 0 ΩHM	KM	
R35			RK73FB2A473J	CHIP R 47K J 1/10W		
R36			RK73FB2A333J	CHIP R 33K J 1/10W		
R37			RK73FB2A473J	CHIP R 47K J 1/10W		
R38			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R39			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R40			RK73FB2A223J	CHIP R 22K J 1/10W		
R41			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R42			RK73FB2A101J	CHIP R 100 J 1/10W		
R44			RK73FB2A473J	CHIP R 47K J 1/10W		
R45			RK73FB2A223J	CHIP R 22K J 1/10W		
R46			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R47 ,48			RK73FB2A103J	CHIP R 10K J 1/10W		
R49			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R50			RK73FB2A334J	CHIP R 330K J 1/10W		
R51			RK73FB2A223J	CHIP R 22K J 1/10W		
R52			RK73FB2A103J	CHIP R 10K J 1/10W		
R53			RK73FB2A223J	CHIP R 22K J 1/10W		
R54			R92-0670-05	CHIP R 0 ΩHM	TW	
R54			R92-0670-05	CHIP R 0 ΩHM	KM	
R55			RK73FB2A103J	CHIP R 10K J 1/10W		
R56 -58			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R59			RK73FB2A102J	CHIP R 1.0K J 1/10W		

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R60			RK73FB2A392J	CHIP R 3.9K J 1/10W	KM	
R61			RK73FB2A222J	CHIP R 2.2K J 1/10W	KM	
R61 ,62			R92-0670-05	CHIP R 0 ΩHM	TW	
R62			R92-0670-05	CHIP R 0 ΩHM	KM	
R63			RK73FB2A103J	CHIP R 10K J 1/10W		
R64			RK73FB2A473J	CHIP R 47K J 1/10W		
R65			RK73FB2A223J	CHIP R 22K J 1/10W		
R66			RK73FB2A103J	CHIP R 10K J 1/10W		
R67			RK73FB2A331J	CHIP R 330 J 1/10W		
R68 -70			RK73FB2A221J	CHIP R 220 J 1/10W		
R71			RK73FB2A220J	CHIP R 22 J 1/10W		
R72			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R73			RK73FB2A100J	CHIP R 10 J 1/10W		
R74			RK73FB2A220J	CHIP R 22 J 1/10W		
R75			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R76			RK73FB2A180J	CHIP R 18 J 1/10W		
R77			RK73FB2A331J	CHIP R 330 J 1/10W		
R78			RK73FB2A180J	CHIP R 18 J 1/10W		
R79			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R80			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R81			RK73FB2A151J	CHIP R 150 J 1/10W		
R82 ,83			RK73FB2A101J	CHIP R 100 J 1/10W		
R84			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R85			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R86			RK73FB2A100J	CHIP R 10 J 1/10W		
R87			RK73FB2A104J	CHIP R 100K J 1/10W		
R88			R92-1201-05	SILID 220 1/2W		
R89			R92-0670-05	CHIP R 0 ΩHM	TW	
R89			R92-0670-05	CHIP R 0 ΩHM	KM	
R90		*	R92-1211-05	SΩRID R 5.6 J 1/2W		
R91			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R92			RK73FB2A470J	CHIP R 47 J 1/10W		
R93			R92-0700-05	SΩLID 180 1/2W		
R94		*	R92-1215-05	SΩRID R 470 J 1/2W		
R95 ,96			RK73FB2A103J	CHIP R 10K J 1/10W		
R97			RK73FB2A331J	CHIP R 330 J 1/10W		
R98		*	RK73FB2A3R3J	CHIP R 3.3 J 1/10W		
R99			RK73FB2A561J	CHIP R 560 J 1/10W		
R100,101			R92-0670-05	CHIP R 0 ΩHM	TW	
R100,101			R92-0670-05	CHIP R 0 ΩHM	KM	
R201			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R202			RK73FB2A104J	CHIP R 100K J 1/10W		
R203			RK73FB2A563J	CHIP R 56K J 1/10W		
R204,205			R92-0670-05	CHIP R 0 ΩHM	TW	
R204,205			R92-0670-05	CHIP R 0 ΩHM	KM	
R206			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R207			R92-0670-05	CHIP R 0 ΩHM	TW	
R207			R92-0670-05	CHIP R 0 ΩHM	KM	
R208-210			RK73FB2A473J	CHIP R 47K J 1/10W		
R211-213			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R214			R92-0670-05	CHIP R 0 ΩHM	TW	
R214			R92-0670-05	CHIP R 0 ΩHM	KM	
R215			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R216,217			RK73FB2A104J	CHIP R 100K J 1/10W		
R218			RK73FB2A102J	CHIP R 1.0K J 1/10W		

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R219			RK73FB2A473J	CHIP R 47K J 1/10W		
R220			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R221			RK73FB2A474J	CHIP R 470K J 1/10W		
R222			RK73FB2A473J	CHIP R 47K J 1/10W		
R223		*	R92-1212-05	CHIP R 0 ΩHM		
R224			RK73FB2A474J	CHIP R 470K J 1/10W		
R225			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R226-229			R92-0670-05	CHIP R 0 ΩHM	TW	
R226-230			R92-0670-05	CHIP R 0 ΩHM	KM	
R230,231			R92-0670-05	CHIP R 0 ΩHM	TW	
R231			R92-0670-05	CHIP R 0 ΩHM	KM	
R232,233			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R234			R92-0670-05	CHIP R 0 ΩHM	TW	
R234			R92-0670-05	CHIP R 0 ΩHM	KM	
TH1		*	R92-1216-05	THERMISTER 10K J 1/10W		
VR1			R12-3132-05	TRIMMING PΩT. 100K		
VR2		*	R12-6421-05	TRIMMING PΩT. 4.7K		
VR3			R12-3132-05	TRIMMING PΩT. 47K		
VR4		*	R12-6423-05	TRIMMING PΩT. 10K		
VR5		*	R12-6427-05	TRIMMING PΩT. 47K		
VR201			R05-3441-05	PΩTENTIΩMETER		
VR202			R05-4420-05	PΩTENTIΩMETER		
VR301		*	R12-6427-05	TRIMMING PΩT. 47K		
S201			S40-2458-05	PUSH SWITCH (PΩWER)		
S202-211			S40-1086-05	PUSH SWITCH (CALL,F,SHIFT,TΩN)		
Q7			FMG2	TRANSISTΩR		
			FTD8608	LCD		
			KCC03	IC		
D1			02CZ3.6(Y,Z)	ZENER DIΩDE		
D3 ,4			1SS184	DIΩDE		
D5		*	02CZ12(X,Y)	ZENER DIΩDE		
D6 ,7			1SS187	DIΩDE		
D8			HSK151	DIΩDE		
D9 -11		*	MI308	DIΩDE		
D12			DSA3A1	DIΩDE		
D13		*	MA716	DIΩDE		
D14		*	MI308	DIΩDE		
D201			DLS1585	DIΩDE		
D202			1SS181	DIΩDE		
D203			1SS184	DIΩDE		
D204			1SS187	DIΩDE	TW	
D204			1SS187	DIΩDE	KM	
D205			1SS193	DIΩDE		
D206-208			1SS187	DIΩDE	TW	
D206-208			1SS187	DIΩDE	KM	
D209,210		*	MA141A			
D211			1SS187	DIΩDE	TW	
D212			02CZ7.5(X,Y)	DIΩDE		
IC2		*	KCD01	IC(FM IF)		
IC3			UPC1241H	IC(AF PA)		
IC4		*	KCC02	IC(ELE VΩL)		
IC5		*	TC9174F	IC(CMΩS I/O)		
IC6			NJM78L05UA	IC(VΩLTAGE REGULATΩR/ +5V)		
IC7			LA5009M	IC(AVR)		

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IC8			KCB01	IC(DRIVE AMP)		
IC9		*	KCB07	IC		
IC10		*	MC7808CT	IC(VOLTAGE REGULATORS/ +8V)		
IC201		*	75108G-E20-1B	IC(MICROPROCESSOR)		
IC202			NJM78L06UA	IC(VOLTAGE REGULATOR/ +6V)		
IC301			S7116A	IC(TONE ENCODER)		
IC401			M67711	IC(POWER MODULE)		
Q1			MGF1502	IC		
Q2			2SC4095(R47.6)	TRANSISTOR		
Q4			3SK184(R)	FET		
Q6			2SC2714(Y)	TRANSISTOR		
Q8		*	IMX1	TRANSISTOR		
Q9			2SD1757(K)	TRANSISTOR		
Q10			2SC3356	TRANSISTOR		
Q11			2SB1119S	TRANSISTOR		
Q12		*	2SB1302S	TRANSISTOR		
Q13			DTC144WK	DIGITAL TRANSISTOR		
Q14			FMW1	TRANSISTOR		
Q15 ,16			2SC2712(Y)	TRANSISTOR		
Q18			2SD1757(K)	TRANSISTOR		
Q19			2SC2712(Y)	TRANSISTOR		
Q20			2SC3356	TRANSISTOR		
Q21			DTC124EK	DIGITAL TRANSISTOR		
Q22			2SA1162(Y)	TRANSISTOR		
Q23			DTC114EK	DIGITAL TRANSISTOR		
Q24			2SD1406(Y)	TRANSISTOR		
Q25		*	2SB1302S	TRANSISTOR		
Q26			2SC2712(Y)	TRANSISTOR		
Q201,202			2SC2712(Y)	TRANSISTOR		
Q203		*	2SA1519	TRANSISTOR		
S212			W02-0388-05	FRONT END UNIT,ELECTRIC UNIT		
VCO PLL module.			X58-3490-11	SUB UNIT (PLL)		
			X59-3130-00	MODULE UNIT (APC)		
			X59-3510-00	MODULE UNIT (ALT)		
			X59-3610-00	MODULE UNIT (MIC)		
SUB UNIT (PLL)(X58-3490-11)						
			CC73FCH1H030C	CHIP C 3.0PF C		
			CC73FCH1H070D	CHIP C 7.0PF D		
			CC73GCH1H010C	CHIP C 1.0PF C		
			CC73GCH1H060D	CHIP C 6.0PF D		
			CK73GB1E103K	CHIP C 0.010UF K		
C1			CK73GB1H102K	CHIP C 1000PF K		
C2 -4			CC73GSL1H101J	CHIP C 100PF J		
C5			CK73GB1H102K	CHIP C 1000PF K		
C6		*	CC73GCH1H1R5C	CHIP C 1.5PF C		
C7			CC73GCH1H0R5C	CHIP C 0.5PF C		
C8			CC73GCH1H040C	CHIP C 4.0PF C		
C9			CK73GB1H102K	CHIP C 1000PF K		
C10			CC73GSL1H101J	CHIP C 100PF J		
C11			C92-0001-05	CHIP TAN 0.1UF 35WV		
C12		*	CC73GCH1H070D	CHIP C 7.0PF D		
C13		*	CC73GCH1H1R5C	CHIP C 1.5PF C		
C14			CC73GCH1H040C	CHIP C 4.0PF C		
C16 ,17			CC73GCH1H040C	CHIP C 4.0PF C		

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C18			CC73GCH1H030C	CHIP C 3.0PF C		
C51			CK73GB1H102K	CHIP C 1000PF K		
C52			CC73GSL1H101J	CHIP C 100PF J		
C53 ,54			CK73GB1H102K	CHIP C 1000PF K		
C56 ,57			C92-0501-05	CHIP TAN 1.5UF 6.3WV		
C58			CC73GCH1H030C	CHIP C 3.0PF C		
C59			CC73GCH1H040C	CHIP C 4.0PF C		
C60			CC73GSL1H101J	CHIP C 100PF J		
C61			CC73GCH1H020C	CHIP C 2.0PF C		
C62			CC73GCH1H120J	CHIP C 12PF J		
C63 -65			CC73GSL1H101J	CHIP C 100PF J		
TC1			C05-0346-05	TRIMMING CAP		
CN1			E40-5161-05	PIN CONNECTOR (3P)		
CN2			E40-5158-05	PIN CONNECTOR (4P)		
CN3		*	E40-5211-05	PIN CONNECTOR (8P)		
			F11-1122-04	SHIELDING COVER		
L1 ,2		*	L40-3382-19	SMALL FIXED INDUCTOR(0.33UH)		
L3			L40-8272-80	SMALL FIXED INDUCTOR(82NH)		
L4			L40-1582-19	SMALL FIXED INDUCTOR(150UH)		
			RK73GB1J224J	CHIP R 220K J 1/16W		
			RK73GB1J331J	CHIP R 330 J 1/16W		
			RK73GB1J822J	CHIP R 8.2K J 1/16W		
R1 ,2		*	RK73GB1J000J	CHIP R 0.0 J 1/16W		
R3			RK73GB1J104J	CHIP R 100K J 1/16W		
R4			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R5			RK73GB1J682J	CHIP R 6.8K J 1/16W		
R6		*	RK73GB1J220J	CHIP R 22 J 1/16W		
R7			RK73GB1J470J	CHIP R 47 J 1/16W		
R9			RK73GB1J103J	CHIP R 10K J 1/16W		
R10			RK73GB1J101J	CHIP R 100 J 1/16W		
R11			RK73GB1J223J	CHIP R 22K J 1/16W		
R12			RK73GB1J103J	CHIP R 10K J 1/16W		
R13			RK73GB1J101J	CHIP R 100 J 1/16W		
R14		*	RK73GB1J000J	CHIP R 0.0 J 1/16W		
R51			RK73GB1J223J	CHIP R 22K J 1/16W		
R52			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R53			RK73GB1J103J	CHIP R 10K J 1/16W		
R54		*	RK73GB1J221J	CHIP R 220 J 1/16W		
R55			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R56			RK73GB1J103J	CHIP R 10K J 1/16W		
R57		*	RK73GB1J000J	CHIP R 0.0 J 1/16W		
R58 ,59			RK73GB1J101J	CHIP R 100 J 1/16W		
R60		*	RK73GB1J152J	CHIP R 1.5K J 1/16W		
R61			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R62		*	RK73GB1J180J	CHIP R 18 J 1/16W		
R64		*	RK73GB1J180J	CHIP R 18 J 1/16W		
R65		*	RK73GB1J474J	CHIP R 470K J 1/16W		
R66		*	RK73GB1J000J	CHIP R 0.0 J 1/16W		
R67			RK73GB1J101J	CHIP R 100 J 1/16W		
D1 ,2			1T33C	DIODE		
D52			1SS184	DIODE		
D3			MA360	DIODE		
D4			MA77	DIODE		

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D51			DLS1585	DIODE		
IC51		*	MB1501PF	IC		
Q1			2SK582	FET		
Q2			2SC4093	TRANSISTOR		
Q3			DTC114YU	DIGITAL TRANSISTOR		
Q51 -53			2SC3324(B)	TRANSISTOR		
Q54			2SC3356	TRANSISTOR		
MODULE UNIT (APC)(X59-3130-00)						
C1			CK73FB1H102K	CHIP C 1000PF K		
C4			CK73FB1H102K	CHIP C 1000PF K		
C6			CK73FB1H102K	CHIP C 1000PF K		
C3			CK73FB1H472K	CHIP C 4700PF K		
C5			CK73FB1H472K	CHIP C 4700PF K		
C2			C92-0501-05	CHIP TAN 1.5UF 6.3WV		
			E23-0471-05	TERMINAL		
R2			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R4 ,5			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R6			RD41FB2B122J	CYLND CHIP R 1.2K J 1/8W		
R3			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R1			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
Q1 ,2			FMW1	TRANSISTOR		
Q3			2SA1162(Y)	TRANSISTOR		
MODULE UNIT (ALT)(X59-3510-00)						
C1			CK73FB1H223K	CHIP C 0.022UF K		
C2			CK73FB1H103K	CHIP C 0.010UF K		
C3			CK73FB1E393K	CHIP C 0.039UF K		
C4			CC73FUJ1H221J	CHIP C 220PF J		
C5			CK73FB1H102K	CHIP C 1000PF K		
C6			CK73FF1E104Z	CHIP C 0.10UF Z		
			E23-0471-05	TERMINAL		
TP1		*	E23-0619-05	TERMINAL		
R1			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R2			RK73FB2A154J	CHIP R 150K J 1/10W		
R3			RK73FB2A273J	CHIP R 27K J 1/10W		
R4			RK73FB2A333J	CHIP R 33K J 1/10W		
R5			RK73FB2A103J	CHIP R 10K J 1/10W		
R6			RK73FB2A473J	CHIP R 47K J 1/10W		
R7			RK73FB2A104J	CHIP R 100K J 1/10W		
R8			RK73FB2A273J	CHIP R 27K J 1/10W		
R9			RK73FB2A393J	CHIP R 39K J 1/10W		
R10 ,11			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R12			R92-0670-05	CHIP R 0 OHM		
D1 ,2			1SV166	DIODE		
IC1			NJM4558M	IC(OP AMP X2)		
IC2			MN4066BS	IC(QUAD ANALOG SWITCH)		
MODULE UNIT (MIC)(X59-3610-00)						
			CK73FF1E104Z	CHIP C 0.10UF Z		
			CK73GB1H102K	CHIP C 1000PF K		
			CK73GB1H681K	CHIP C 680PF K		
C1			CK73FB1E333K	CHIP C 0.033UF K		
C3			CK73FB1E333K	CHIP C 0.033UF K		

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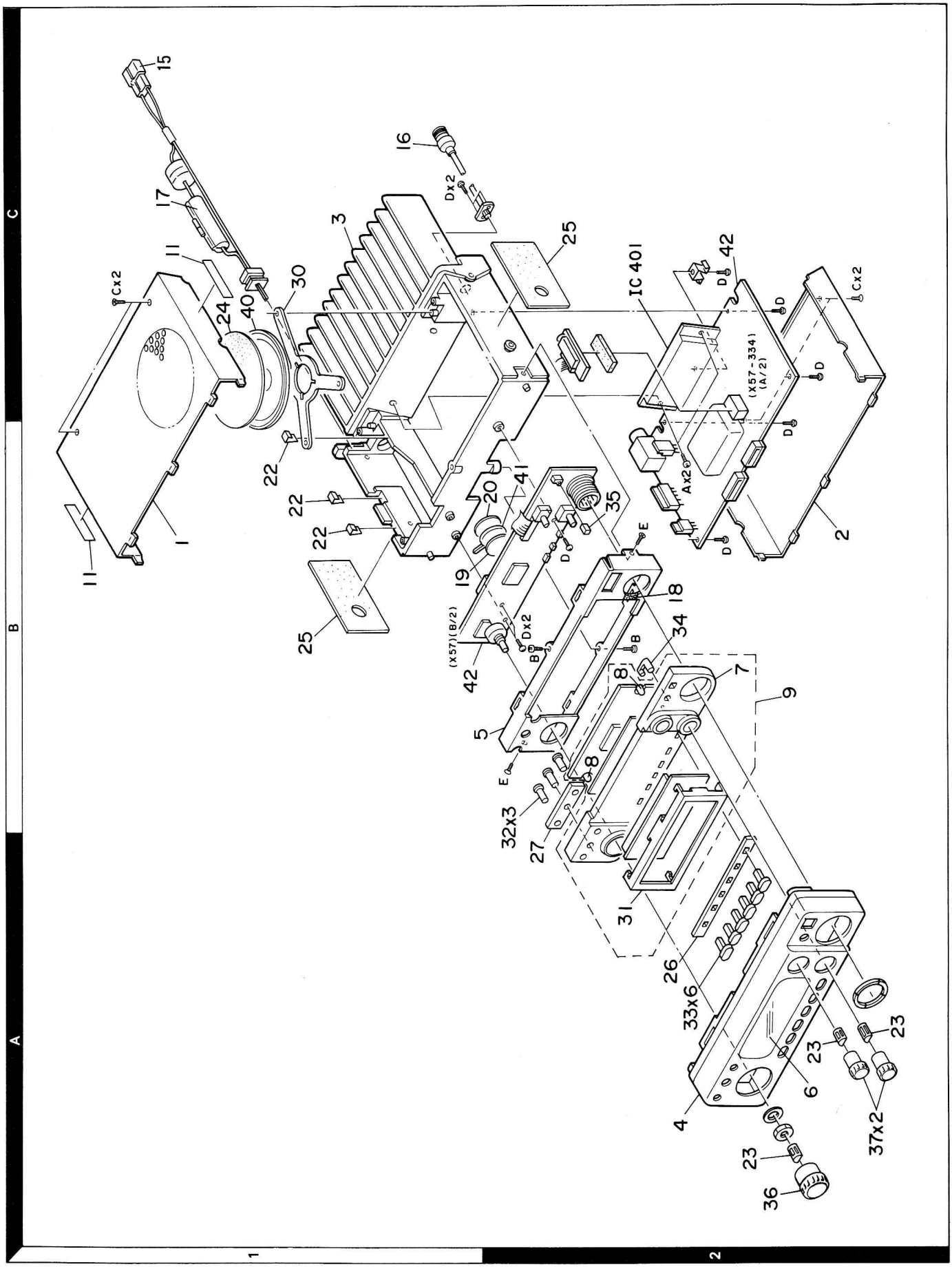
C4			CC73GCH1H270J	CHIP C 27PF J		
C5			C92-0004-05	CHIP TAN 1UF 16WV		
C6			CK73FB1E333K	CHIP C 0.033UF K		
C9		*	CC73GCH1H820J	CHIP C 82PF J		
C10		*	CC73GCH1H101J	CHIP C 100PF J		
			E23-0471-05	TERMINAL		
			RK73FB2A473J	CHIP R 47K J 1/10W		
			RK73GB1J394J	CHIP R 390K J 1/16W		
R1			RK73GB1J223J	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		*	RK73GB1J000J	CHIP R 0.0 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		
R12		*	RK73GB1J224J	CHIP R 220K J 1/16W		
R13 -15		*	RK73GB1J823J	CHIP R 82K J 1/16W		
R16		*	RK73GB1J000J	CHIP R 0.0 J 1/16W		
IC1			NJM4558M	IC(OP AMP X2)		
Q1		*	2SC4116(Y)	TRANSISTOR		

E: Scandinavia & Europe **K**: USA **P**: Canada **W**:Europe
U: PX(Far East, Hawaii) **T**: England **M**: Other Areas
UE: AAFES(Europe) **X**: Australia

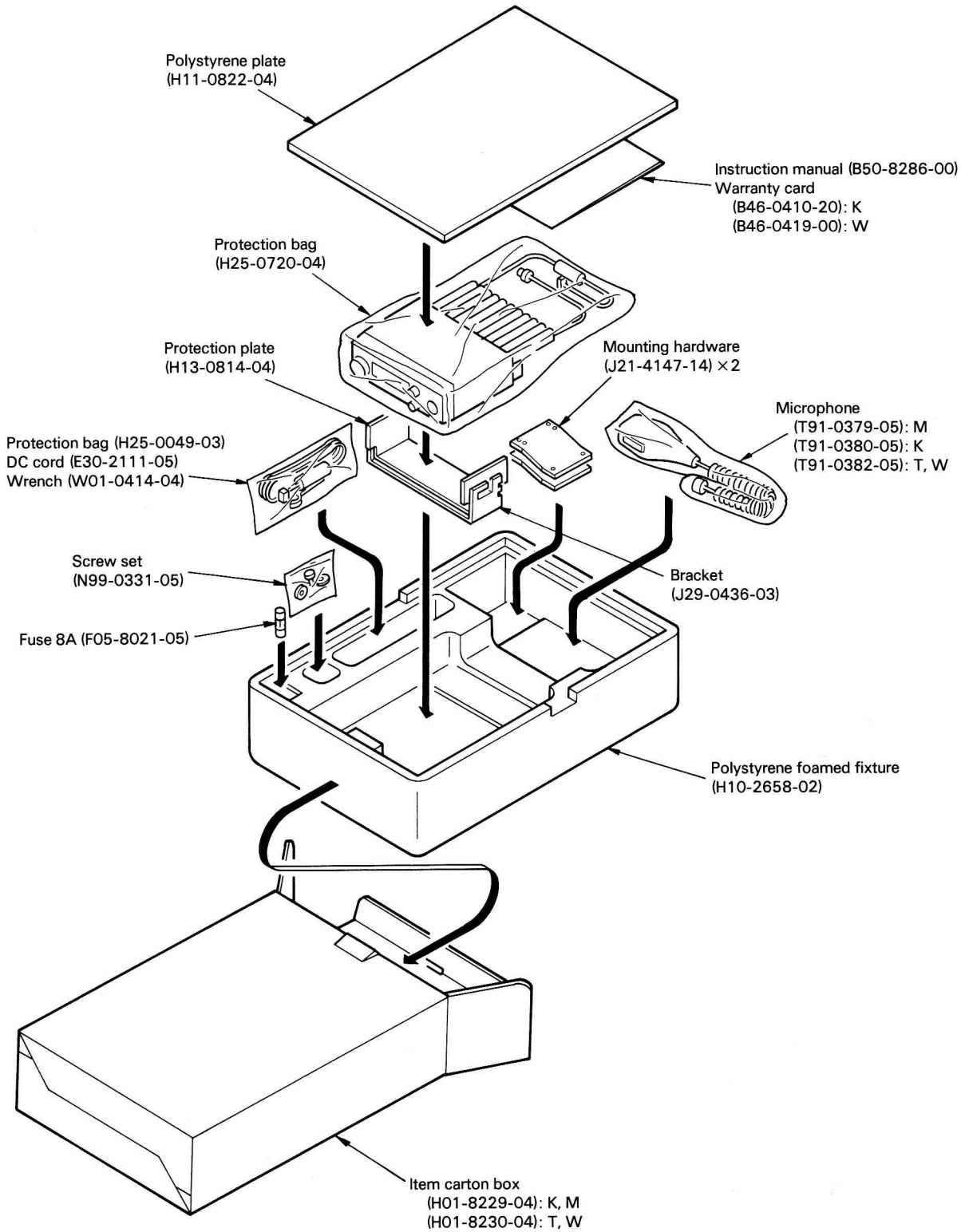
⚠ indicates safety critical components.

EXPLODED VIEW



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

PACKING


Polystyrene plate
(H11-0822-04)
Instruction manual (B50-8286-00)
Warranty card
(B46-0410-20): K
(B46-0419-00): W
Protection bag
(H25-0720-04)
Protection plate
(H13-0814-04)
Mounting hardware
(J21-4147-14) ×2
Microphone
(T91-0379-05): M
(T91-0380-05): K
(T91-0382-05): T, W
Protection bag (H25-0049-03)
DC cord (E30-2111-05)
Wrench (W01-0414-04)
Screw set
(N99-0331-05)
Bracket
(J29-0436-03)
Fuse 8A (F05-8021-05)
Polystyrene foamed fixture
(H10-2658-02)
Item carton box
(H01-8229-04): K, M
(H01-8230-04): T, W

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 1200 MHz
4. **DC Power Supply**
   1) Voltage : 10V to 17V, variable
   2) Current : 15A min.
5. **Power Meter**
   1) Measurement range : Approx. 30W, 3W, 1W
   2) Input impedance : 50Ω
   3) Frequency range: 1200 MHz
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: 1200 MHz
9. **Spectrum Analyzer**
   1) Frequency range: 1200 MHz
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 1200 MHz
15. **Sweep Generator**
    1) Sweep range: 1200 MHz bands
16. **Tracking Generator**

PREPARATION

1) Unless otherwise specified, knobs and switches should be set as follows **Table 8.**

POWER SW	ON	CALL	OFF
AF VOL VR	MIN	BELL/ALERT	OFF
SQL VOL VR	MIN	TONE/T. SHIFT	OFF
VFO	VFO	REV/STEP	OFF
MR	OFF	DRS	OFF

Table 8

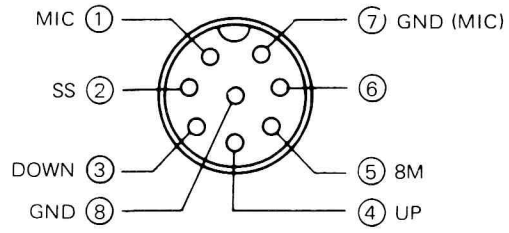


Fig. 16 MIC terminals (view from front panel side)

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) SSG output levels are those at the time the output terminal is open.
6) Meter and display section should be set as follows **Fig. 17.**

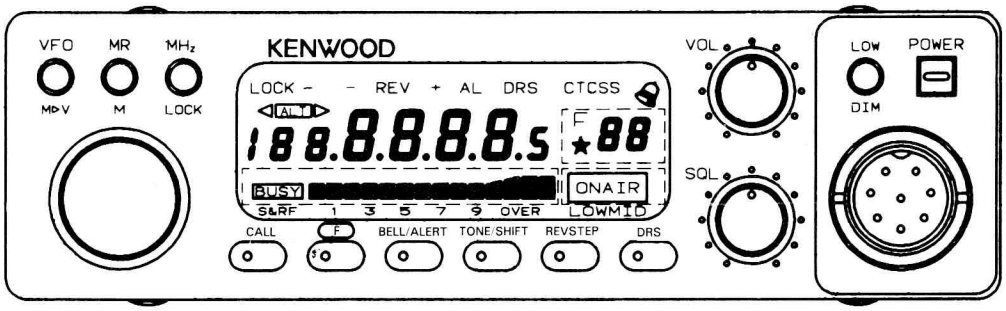


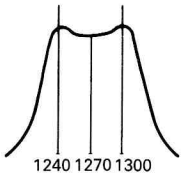
Fig. 17

ADJUSTMENT

COMMON SECTION ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method	
1. Setting	1) Source voltage: DC 13.8 V POWER SW: ON VOL VR: Full counter-clockwise (CCW) SQL VR: Full counter-clockwise (CCW) TX-RX unit VR4: CCW LOW SW: ON							
2. Reset	1) Turn POWER SW ON while holding down MR/M POWER SW: ON							1240.000 MHz
3. PLL	1) RX VCO FREQ.: 1299.975 MHz Receive	DVM	TX-RX	TP2			Check	6.3~7.3 V
		Power-meter	Rear panel	ANT	VCO SUB Unit	TC1	6.5 V	±0.5 V
	2) TX VCO FREQ.: 1240.000 MHz Transmit						Check	1.5 V or more
4. Transmit freq. adjust-ment	1) FREQ.: 1240.000 MHz Transmit	Freq. counter Power-meter	Rear panel	ANT			Check 1240.000 MHz ±1 kHz	

RECEIVER SECTION ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method	
1. Helical	1) FREQ.: 1270.100 MHz Connect the TP2 to GND. 2) Connect the tracking generator to ANT terminal (−40 dBm)	Spectrum analyzer Tracking generator	TX-RX Rear panel	J3 ANT	TX-RX	L1, 2	Check whether required band obtained at max. gain.	
2. GAIN	1) FREQ.: 1270.100 MHz SSG Output: −108 dBm (0.9 μV) MOD: OFF	Tester (DC V)	TX-RX	TP1	TX-RX	L4	Adjust the L4 to max.	
3. Sensi-tivity	1) FREQ.: 1270.100 MHz SSG Output: −122 dBm (0.18 μV) MOD: 1 kHz DEV: ±3 kHz	AF. VM Oscillo-scope Distortion meter	Rear panel	EXT. SP				SINAD 12 dB or more
	2) FREQ.: 1240.100 MHz							
	3) FREQ.: 1299.900 MHz							

ADJUSTMENT

RECEIVER SECTION ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method	
4. S-meter	1) FREQ.: 1270.100 MHz SSG Output: −95 dBm (4 μV) MOD: 1 kHz DEV: ±3 kHz	LCD (S-meter)			TX-RX	VR1	All S-meter segments on (adjust VR1 so that last segment just turns off.)	
	2) SSG Output: −93 dBm (5 μV)						Check	All S-meter segments on.
	3) SSG Output: OFF							S-meter segments off.
5. ALT. ref. voltage	1) FREQ.: 1270.100 MHz No signal condition	Digital voltmeter	TX-RX ALT module	TP3 TP1	TX-RX	VR2	Adjust same voltage to TP1 and TP2	±0.05 V (ref. voltage 3.0~3.5 V)
6. ALT	1) FREQ.: 1270.100 MHz SSG FREQ.: 1270.105 MHz Output: −113 dBm (0.5 μV) MOD: 1 kHz DEV: ±3 kHz ALT SW: ON	Oscillo-scope	Rear panel	EXT. SP			Check	ALT ▷ lights on. Wave is correct.
	2) SSG FREQ.: 1270.095 MHz ALT SW: OFF							◁ ALT lights on.
7. f (2nd L.OSC)	1) FREQ.: 1270.100 MHz SSG Output: −123 dBm (0.16 μV) MOD: 1 kHz DEV: ±3 kHz	AF. VM Oscillo-scope Distortion meter	Rear panel	EXT. SP	TX-RX	L6 6	MAX. (12 dB SINAD)	
	2) MOD: OFF ALT SW: ON (F PUSH, ALT PUSH)	Digital voltmeter	ALT module	TP1	TX-RX	L6	Check that same voltage between ALT ON and ALT OFF when off voltage, adjust L6	±0.1 V

TRANSMITTER SECTION ADJUSTMENT

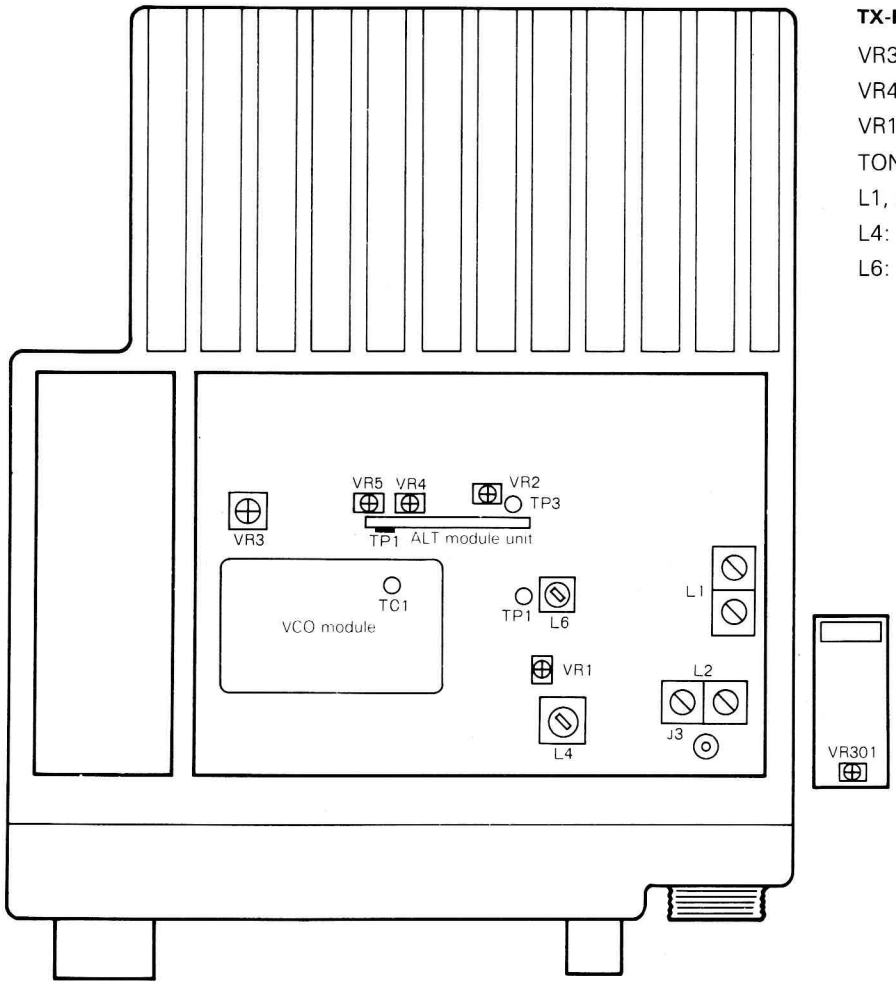
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method	
1. POWER	1) FREQ.: 1270.000 MHz Transmit	Power meter Ammeter	Rear panel	ANT	TX-RX	VR4	MAX	13 W or more All RF-meter segments on ON AIR indicator on
						VR4	11 W	±1 W 5.5 A or less
	2) LOW SW: ON Transmit					VR5	1 W	±0.2 W, 2.5 A or less 6 digits lights on
	3) FREQ.: 1240.000 MHz LOW SW: OFF Transmit				TX-RX		Check	9~14 W 5.5 A or less
	4) FREQ.: 1299.980 MHz Transmit							

ADJUSTMENT

TRANSMITTER SECTION ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method	
2. DEV.	1) FREQ.: 1270.000 MHz AG: 1 kHz, 50 mV LOW SW: ON Transmit	Linear detector Oscillo-scope Power meter	Rear panel	ANT	TX-RX	VR3	±4.6 kHz	±200 Hz Check for detected wave form
	2) AG: 1 kHz, 2.8 mV						Check	±2.2~3.6 kHz
3-1. TONE (K, M)	1) FREQ.: 1282.200 MHz TONE SW: ON LOW SW: ON Transmit	Linear detector Oscillo-scope Power meter	Rear panel	ANT	TX-RX	VR301	DEV. ±800 Hz	±50 Hz
3-2. TONE (W, T)	FREQ: 1270.000 MHz LOW SW: ON Transmit						DEV. ±2.5 kHz or more	
4. Protection	1) ANT: Opened FREQ.: 1270.000 MHz FREQ.: 1240.000 MHz FREQ.: 1299.975 MHz Transmit	Ammeter					Check	8 A or less

Adjustment points (Top View)



TX-RX Unit (X57-3340-XX)

VR3: DEV. 1 kHz, 50 mV ±4.4 kHz
VR4: APC
VR1: S-meter
TONE SW (MIC): ON
L1, 2: Helical
L4: GAIN
L6: f (2nd OSC)

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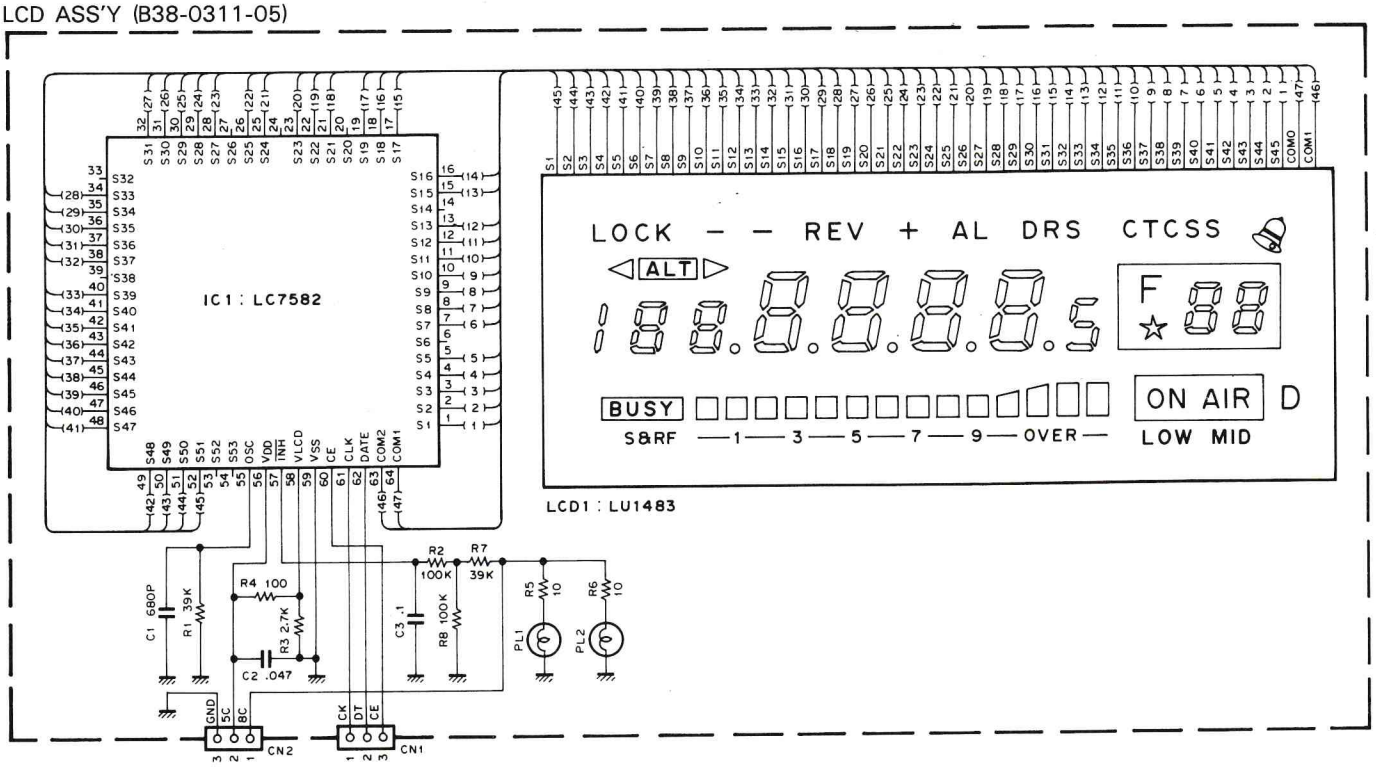
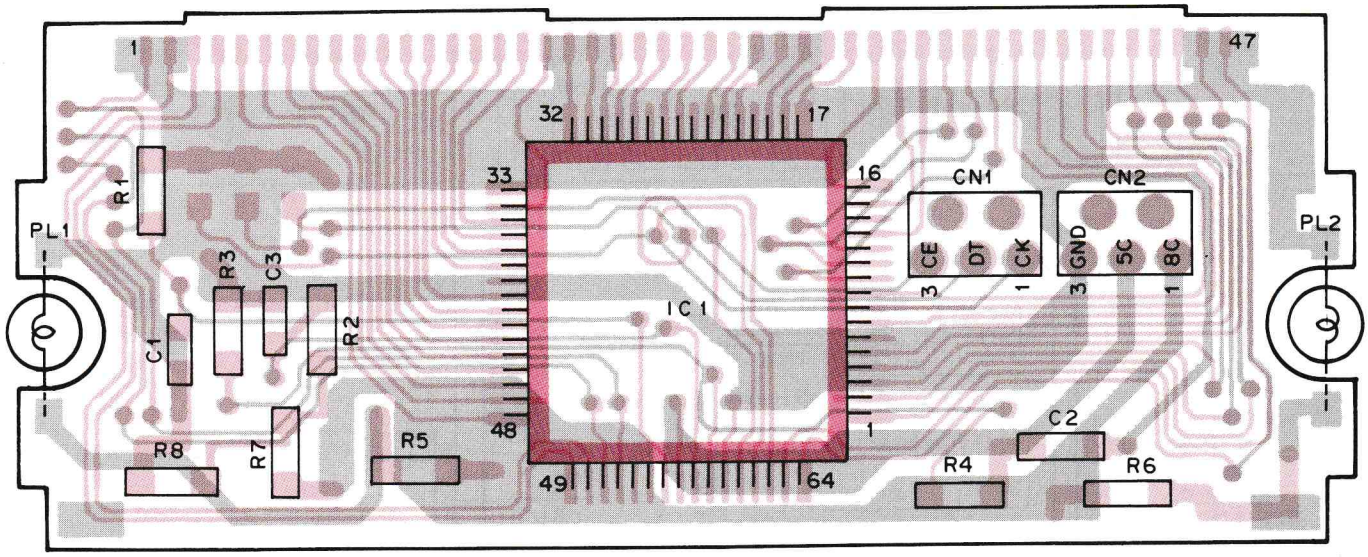
PC BOARD VIEWS/CIRCUIT DIAGRAMS

LCD ASS'Y (B38-0311-05)

LCD ASS'Y (B38-0311-05)

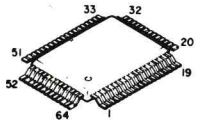


LCD ASS'Y (B38-0311-05) Component side view



IC1 : LC7582 LCD1 : LU1483

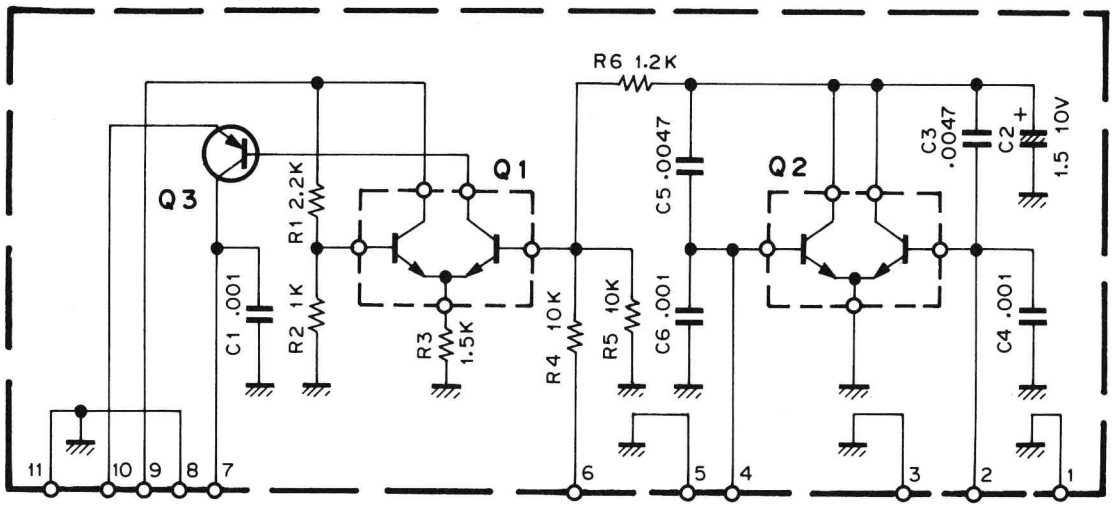
LC7582



PC BOARD VIEWS/CIRCUIT DIAGRAMS

▼APC (X59-3130-00)

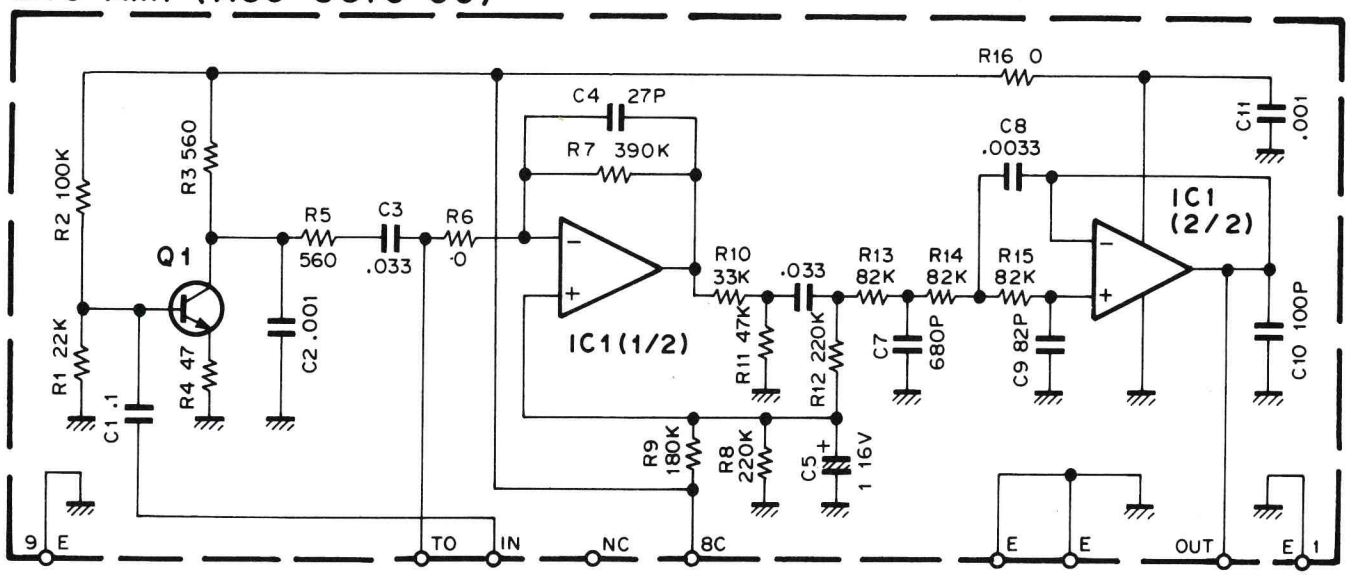
APC (X59-3130-00)



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

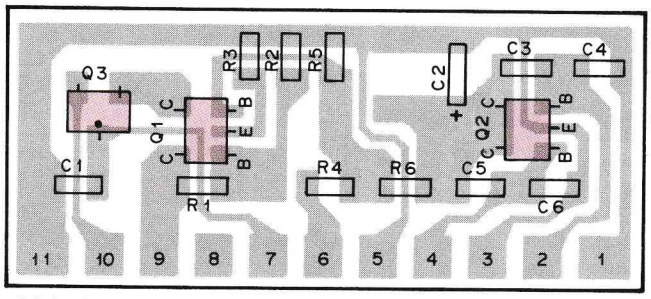
▼MIC AMP (X59-3610-00)

MIC AMP (X59-3610-00)



Q1 : 2SC4116(Y) IC1 : NJM4558M

▼APC (X59-3130-00) **Foil side view**

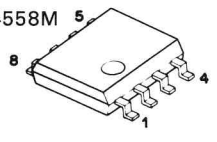


Q1,2 : FMW-1 Q3 : 2SA1162(GR)

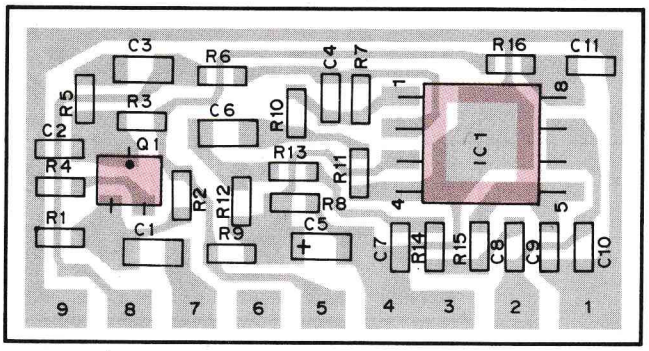
2SA1162

FMW1

NJM4558M



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

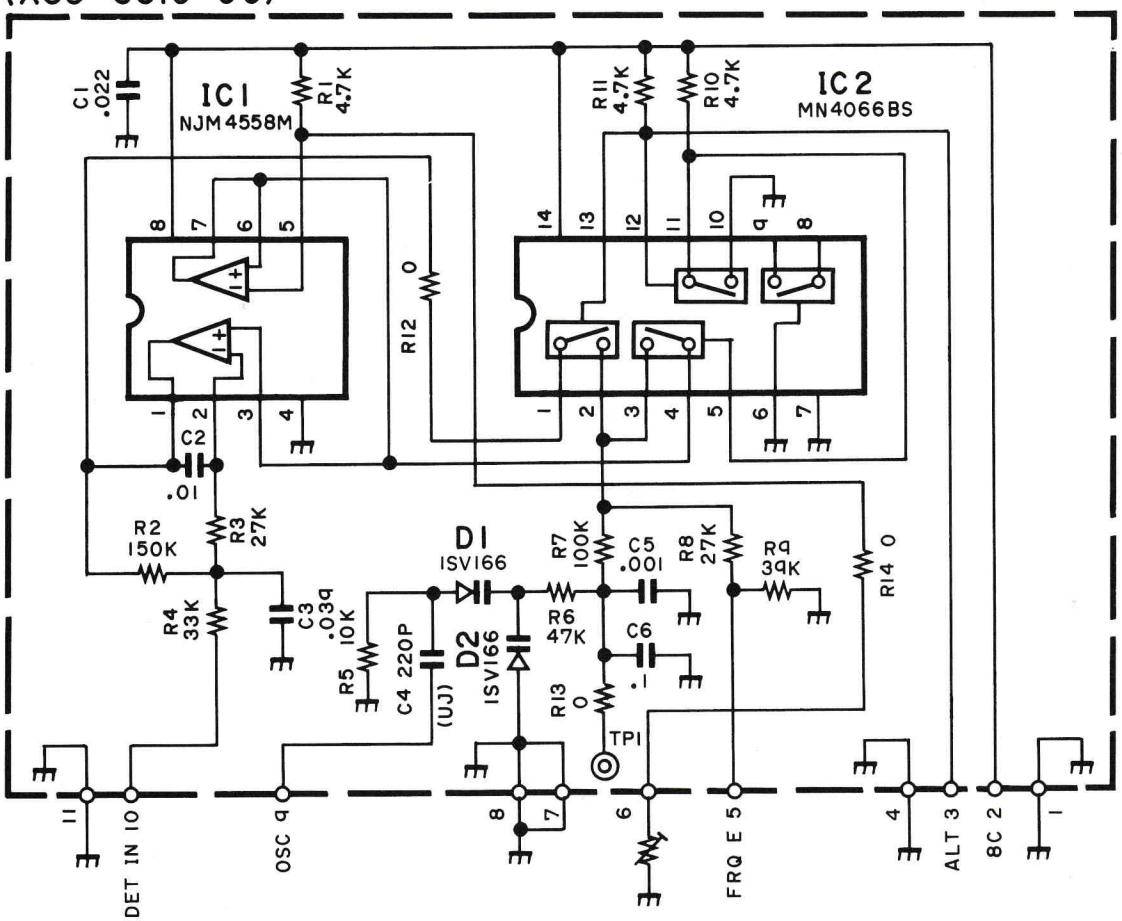


Q1 : 2SC4116(Y) IC1 : NJM4558M

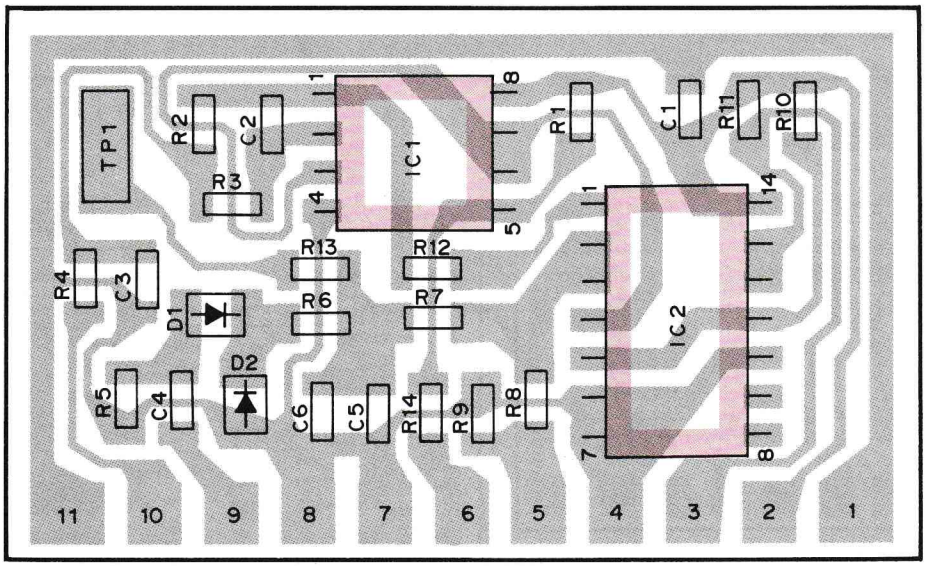
PC BOARD VIEWS/CIRCUIT DIAGRAMS

▼ALT (X59-3510-00)

(X59-3510-00)

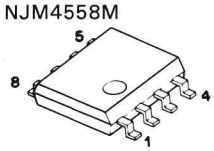


▼ALT (X59-3510-00) **Foil side view**

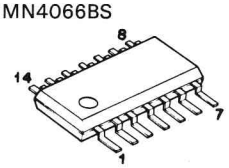


IC1:NJM4558M IC2:MN4066BS

NJM4558M

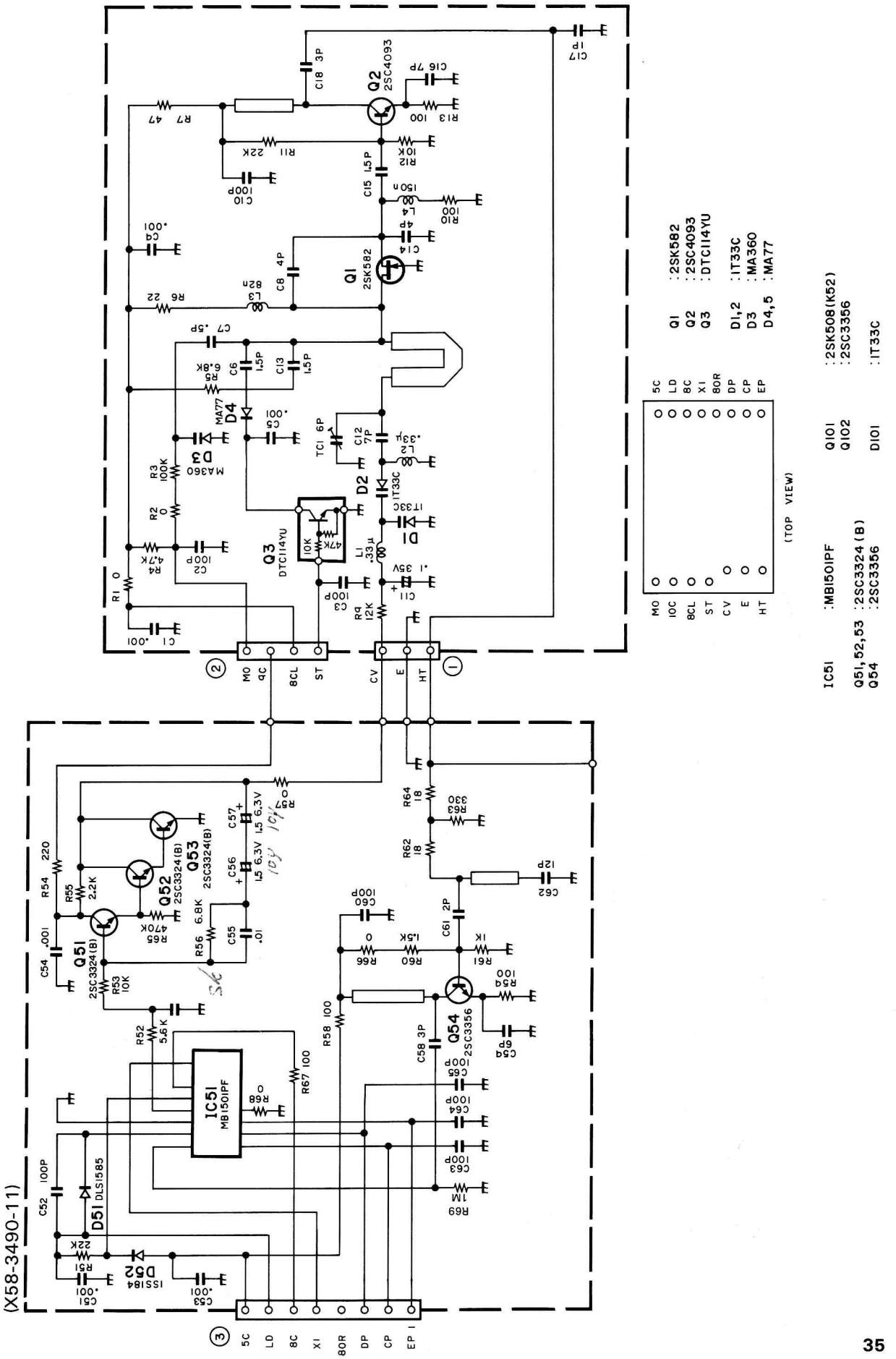


MN4066BS

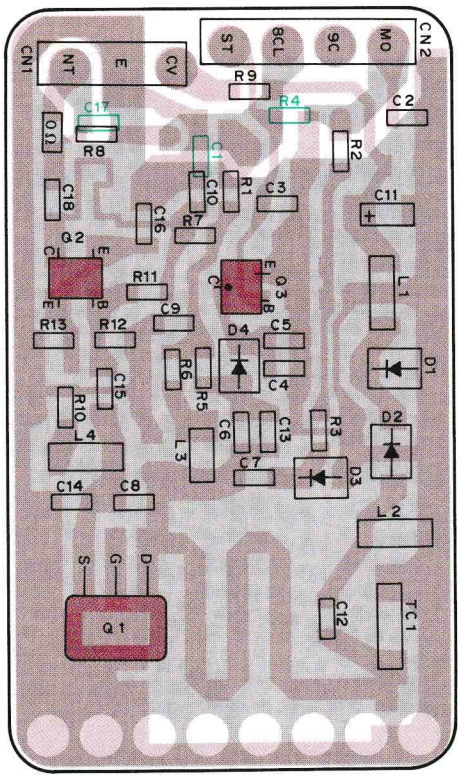


CIRCUIT DIAGRAM

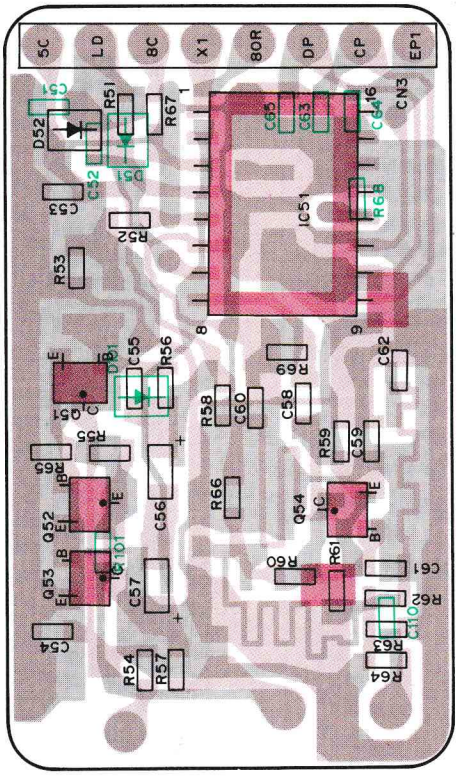
▼PLL (X58-3490-11)



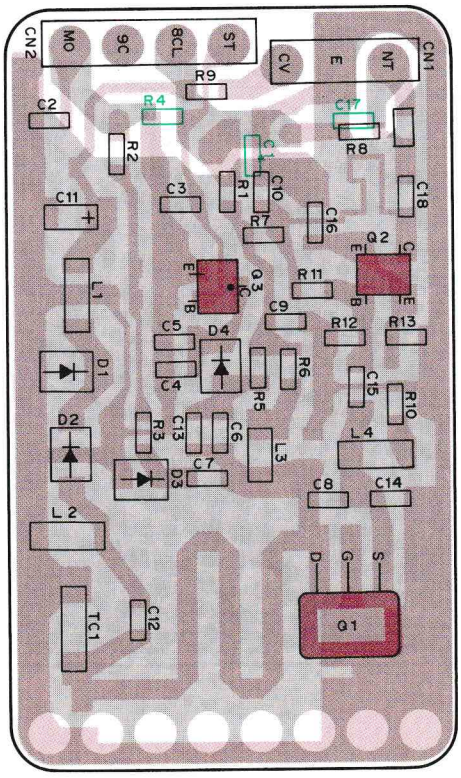
▼PLL(X58-3490-11)(A/2)
Component side view



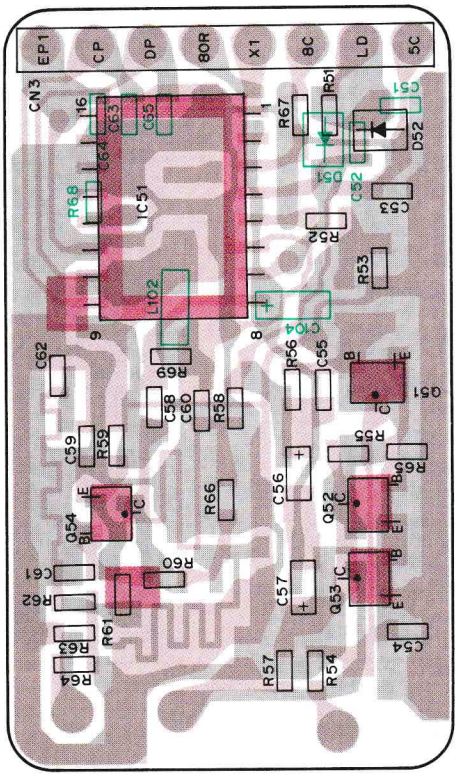
▼PLL(X58-3490-11)(B/2)
Component side view



▼PLL(X58-3490-11)(A/2)
Foil side view



▼PLL(X58-3490-11)(B/2)
Foil side view



IC51:MB1501PF Q1:2SK582 Q2:2SC4093 Q3:DTC114YU Q51～53:2SC3324(B)
Q54:2SC3356

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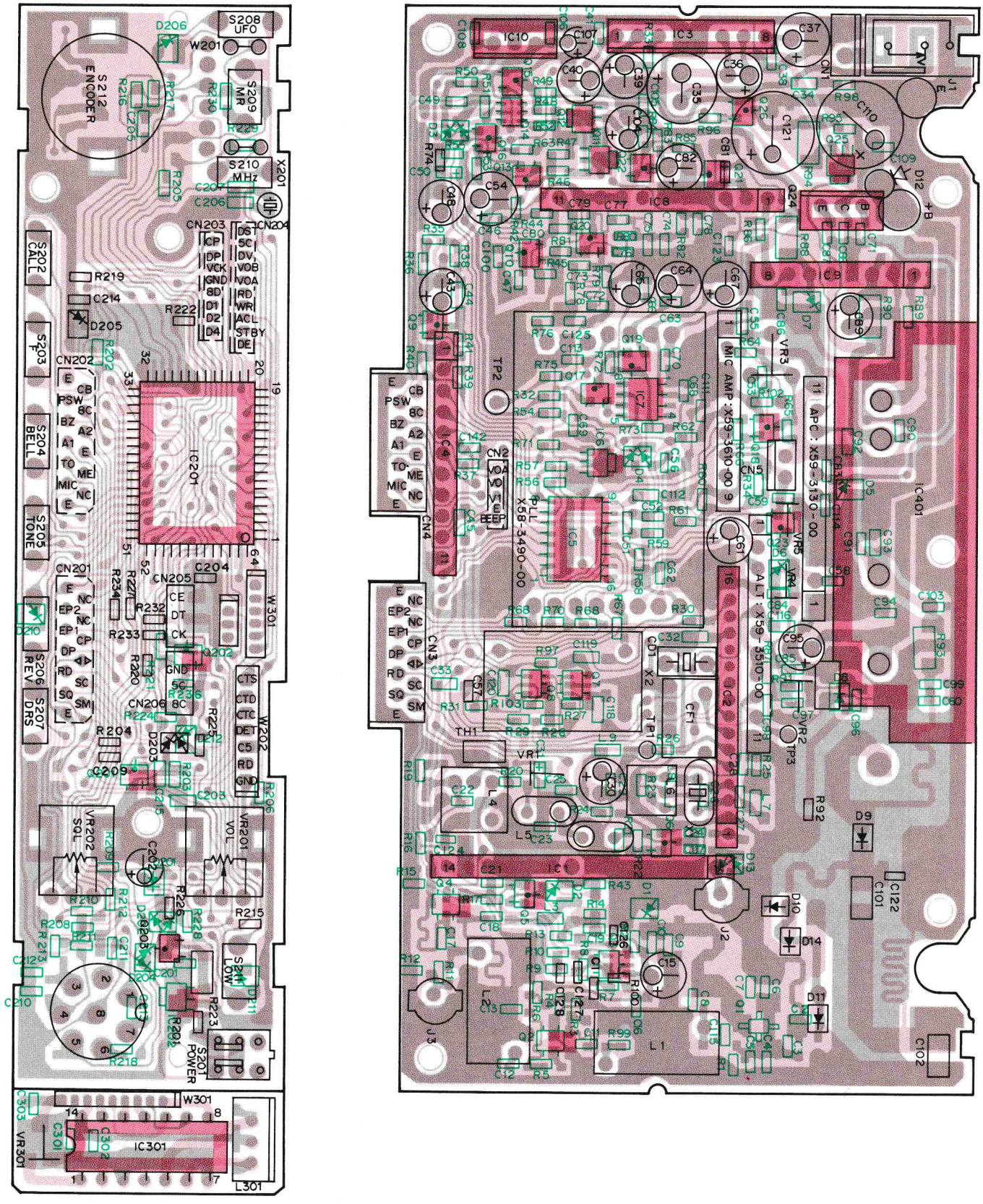
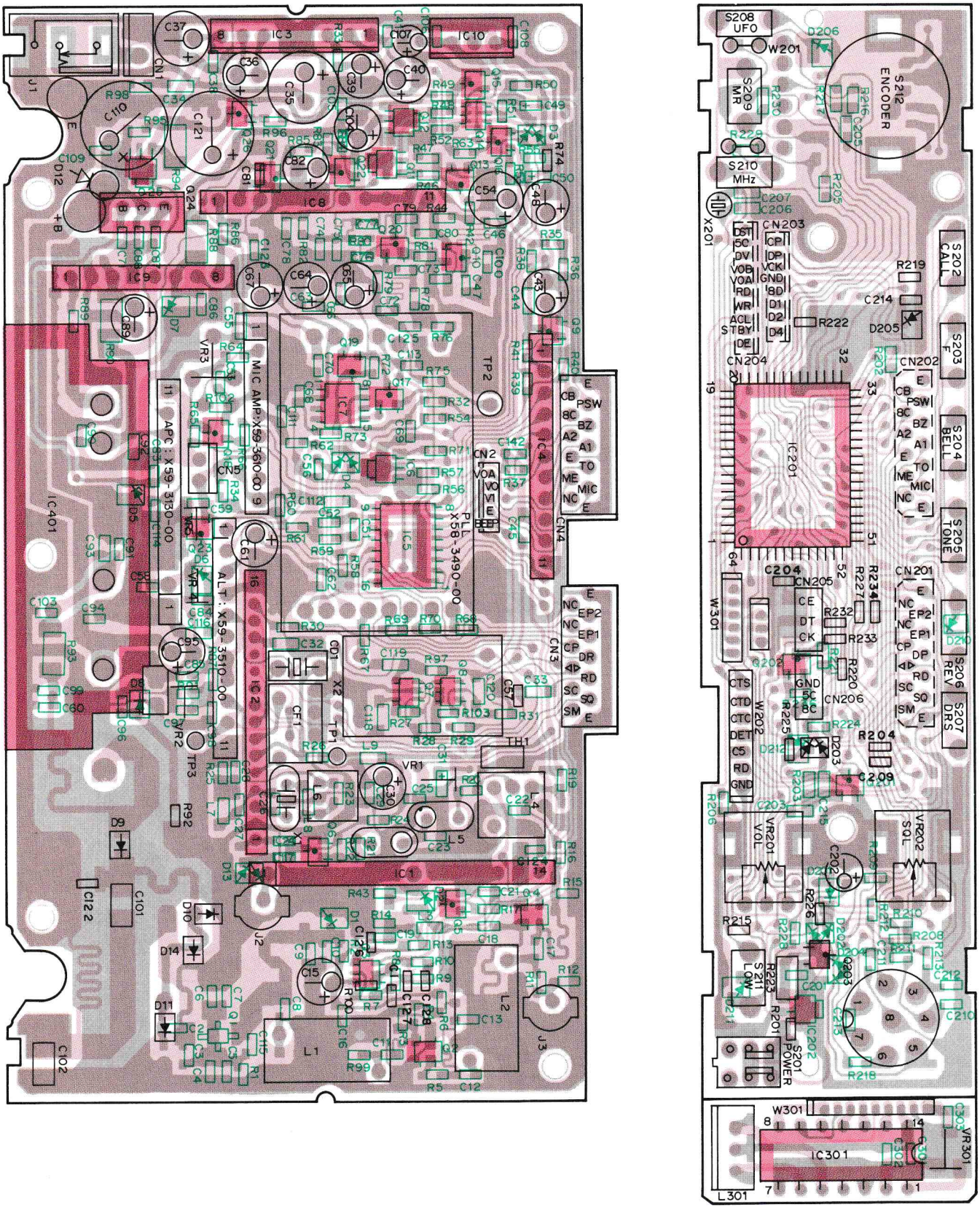
PC BOARD

▼ TX-RX UNIT (X57-3340-XX) Component side view



IC2:KCD01 IC3:UPC1241H IC4:KCC02 IC5:IC9174F IC6:NJM78L05UA IC7:LA5009M IC8:KCB01 IC9:KCB07 IC10:MC7808CT IC201:75108G-IC202:NJM78L06UA IC301:S7116A IC401:M67711 Q1:MGF1502 Q2:2SC4095(R47.6) Q3:IMT2 Q4:3SK184(R) Q6:2SC2714(Y) Q7:FMG2 Q8:IMX1 Q9:2SD1757(K) Q10:2SC3356 Q11:2SB1119S Q12:2SB1302S Q13:DTC144WK Q14:FMW1 Q15,16:2SC2712(Y)

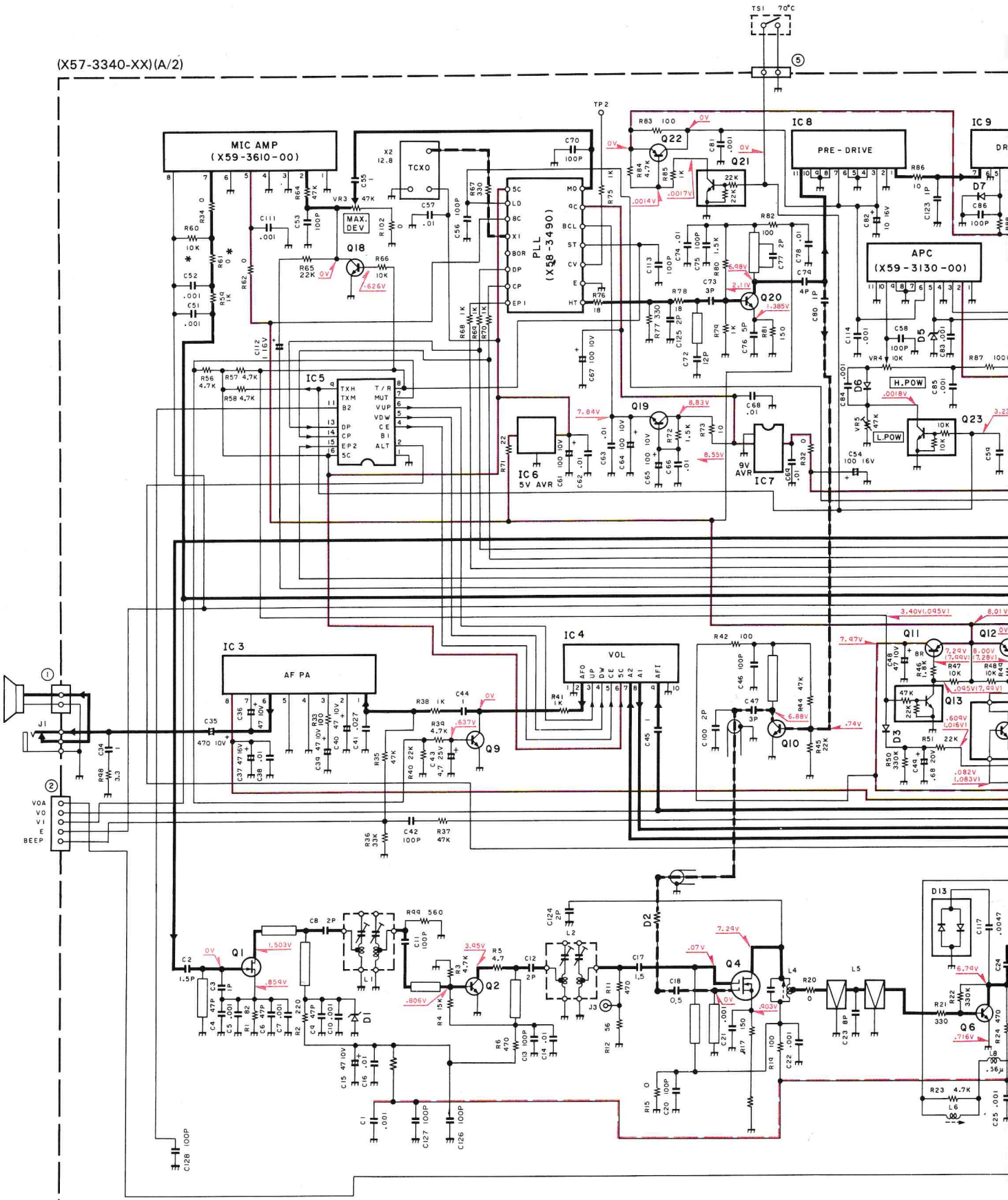
▼ TX-RX UNIT (X57-3340-XX) Foil side view



E20-1B

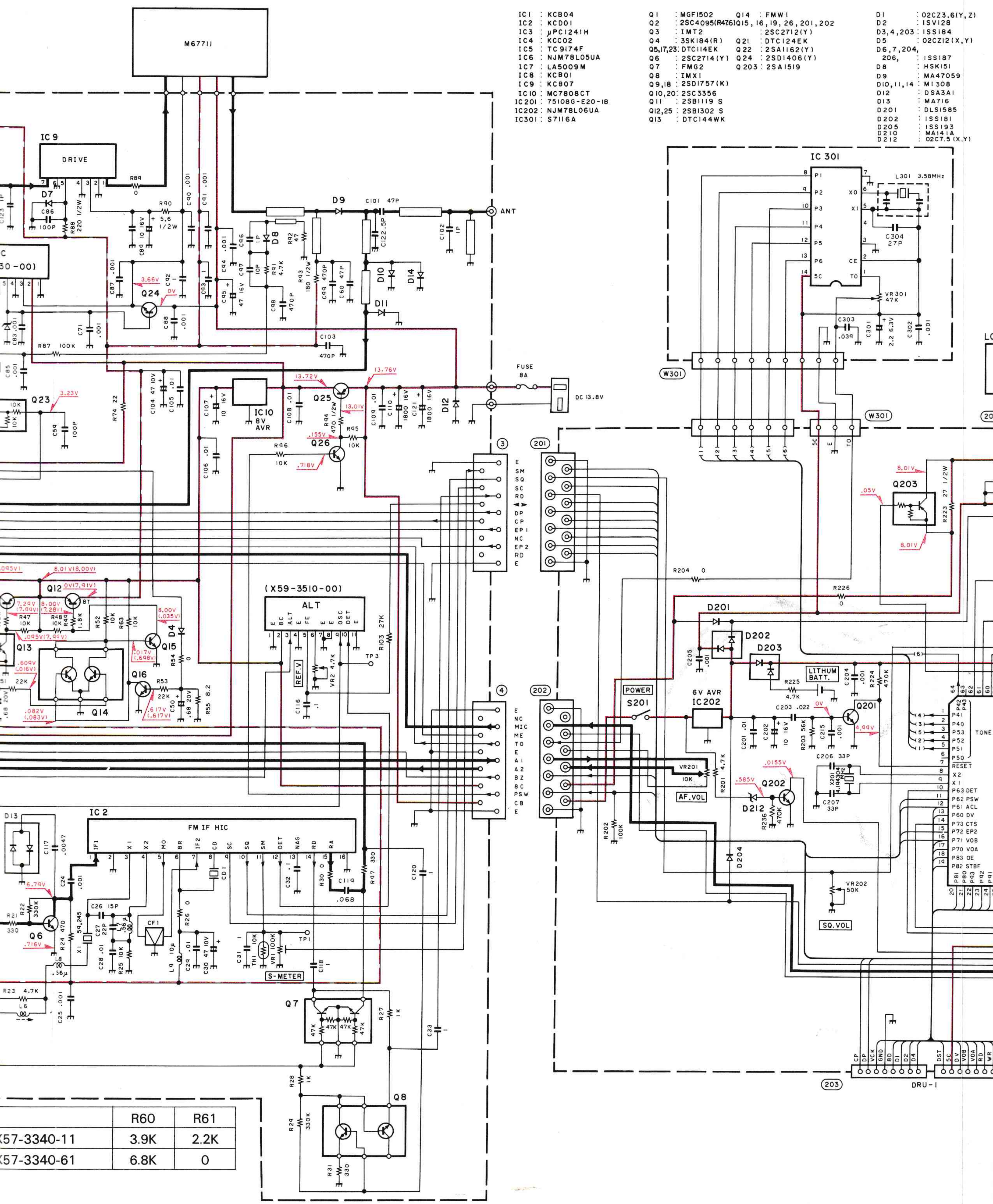
Q18:2SD1757(K) Q19:2SC2712(Y) Q20:2SC3356 Q21:DTC124EK Q22:2SA1162(Y) Q23:DTC114EK Q24:2SD1406(Y)
Q25:2SB1302S Q26:2SC2712(Y) Q201,202:2SC2712(Y) Q203:2SA1519

(X57-3340-XX)(A/2)



X57-3340-1
X57-3340-6

F G H I J



IC1 : KCB04
IC2 : KCD01
IC3 : μPC1241H
IC4 : KCC02
IC5 : TC9174F
IC6 : NJM78L05UA
IC7 : LA5009M
IC8 : KCB01
IC9 : KCB07
IC10 : MC7808CT
IC201 : 75108G-E20-1B
IC202 : NJM78L06UA
IC301 : S7116A

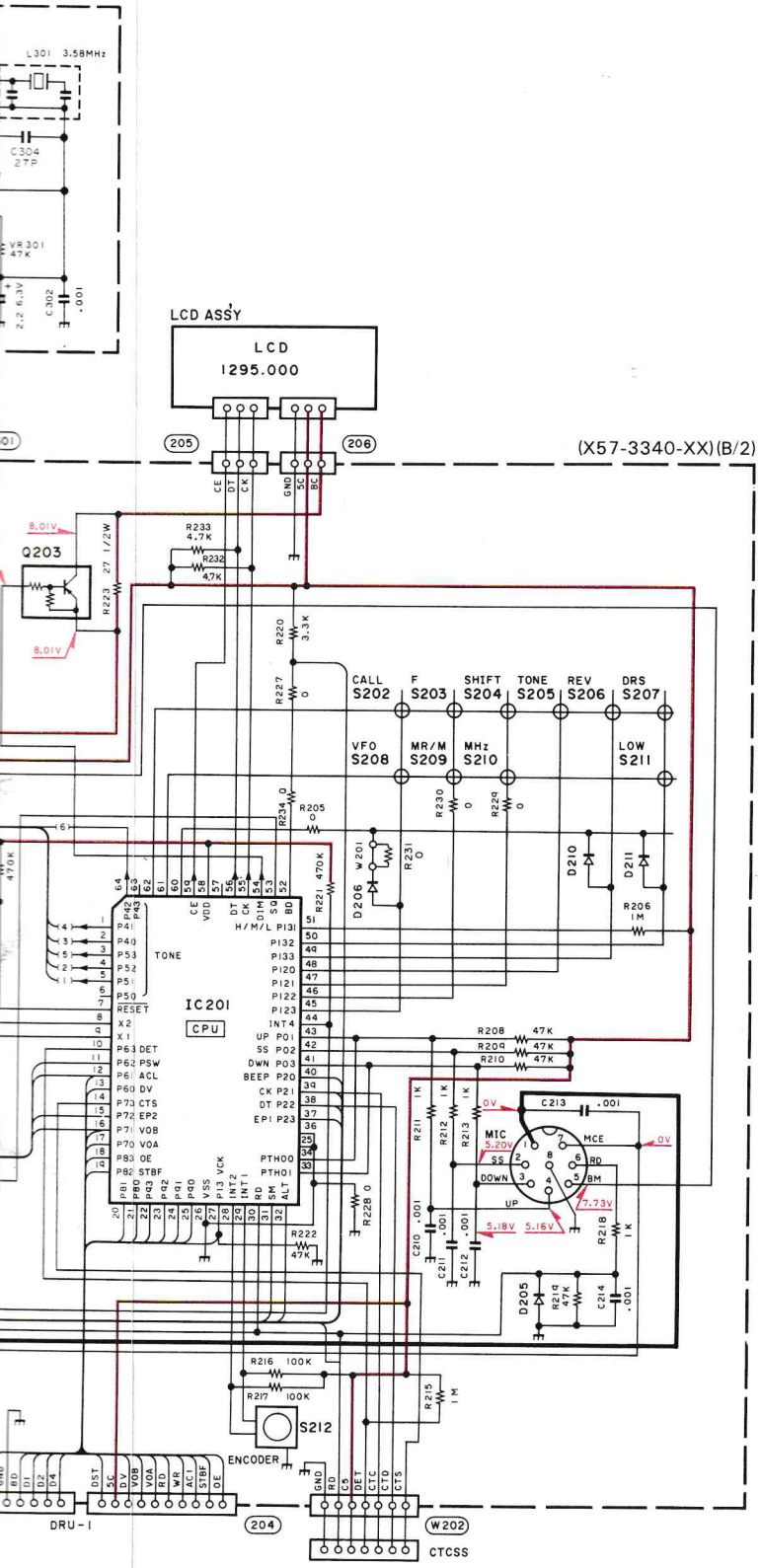
Q1 : MGF1502
Q2 : 2SC4095(R47.6)
Q3 : IMT2
Q4 : 3SK184(R)
Q5,17,23 : DTC114EK
Q6 : 2SC2714(Y)
Q7 : FMG2
Q8 : IMX1
Q9,18 : 2SD1757(K)
Q10,20 : 2SC3356
Q11 : 2SB1119 S
Q12,25 : 2SB1302 S
Q13 : DTC144WK
Q14 : FMW1
Q15,16,19,26,201,202 : 2SC2712(Y)
Q21 : DTC124EK
Q22 : 2SA1162(Y)
Q24 : 2SD1406(Y)
Q203 : 2SA1519

D1 : 02CZ3.6(Y,Z)
D2 : 1SV128
D3,4,203 : 1SS184
D5 : 02CZ12(X,Y)
D6,7,204,206, : 1SS187
D8 : HSK151
D9 : MA47059
D10,11,14 : M1308
D12 : DSA3A1
D13 : MA716
D201 : DLS1585
D202 : 1SS181
D205 : 1SS193
D210 : MA141A
D212 : 02C7.5(X,Y)

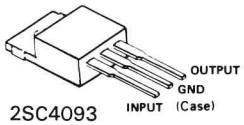
	R60	R61
X57-3340-11	3.9K	2.2K
X57-3340-61	6.8K	0

SCHEMATIC DIAGRAM TM-531A/E

01	: 02CZ3.6(Y,Z)
02	: ISV128
03,4,203	: ISS184
05	: 02CZ12(X,Y)
06,7,204,	
206,	: ISS187
08	: HSK151
09	: MA47059
010,11,14	: MI308
012	: DSA3A1
013	: MA716
D201	: DLS1585
D202	: ISS181
D205	: ISS193
D210	: MA141A
D212	: 02CZ7.5(X,Y)



MC7808CT



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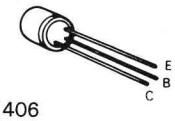

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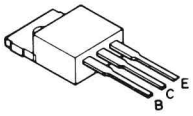
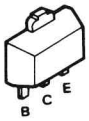


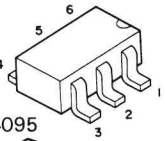
DTC114EK
DTC114YU
DTC124EK
DTC144WK
2SA1162
2SC2712
2SC2714
2SC3324
2SC3356
2SC4116
2SD1757

2SB1119S



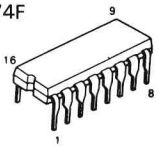
FMG2
FMW1

IMX1

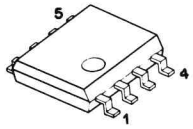


2SC4095

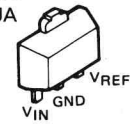
TC9174F



NJM4558M



NJM78L05UA
NJM78L06UA



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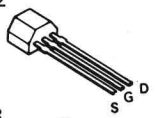
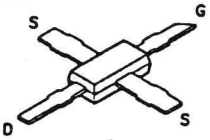


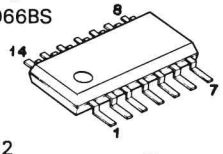
2SK508

3SK184

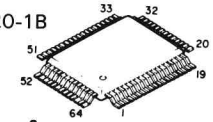
MGF1502



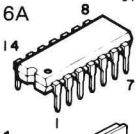
MN4066BS



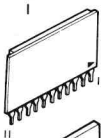
LC7582
75108G-E20-1B



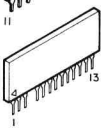
S7116A



KCB01



KCB04

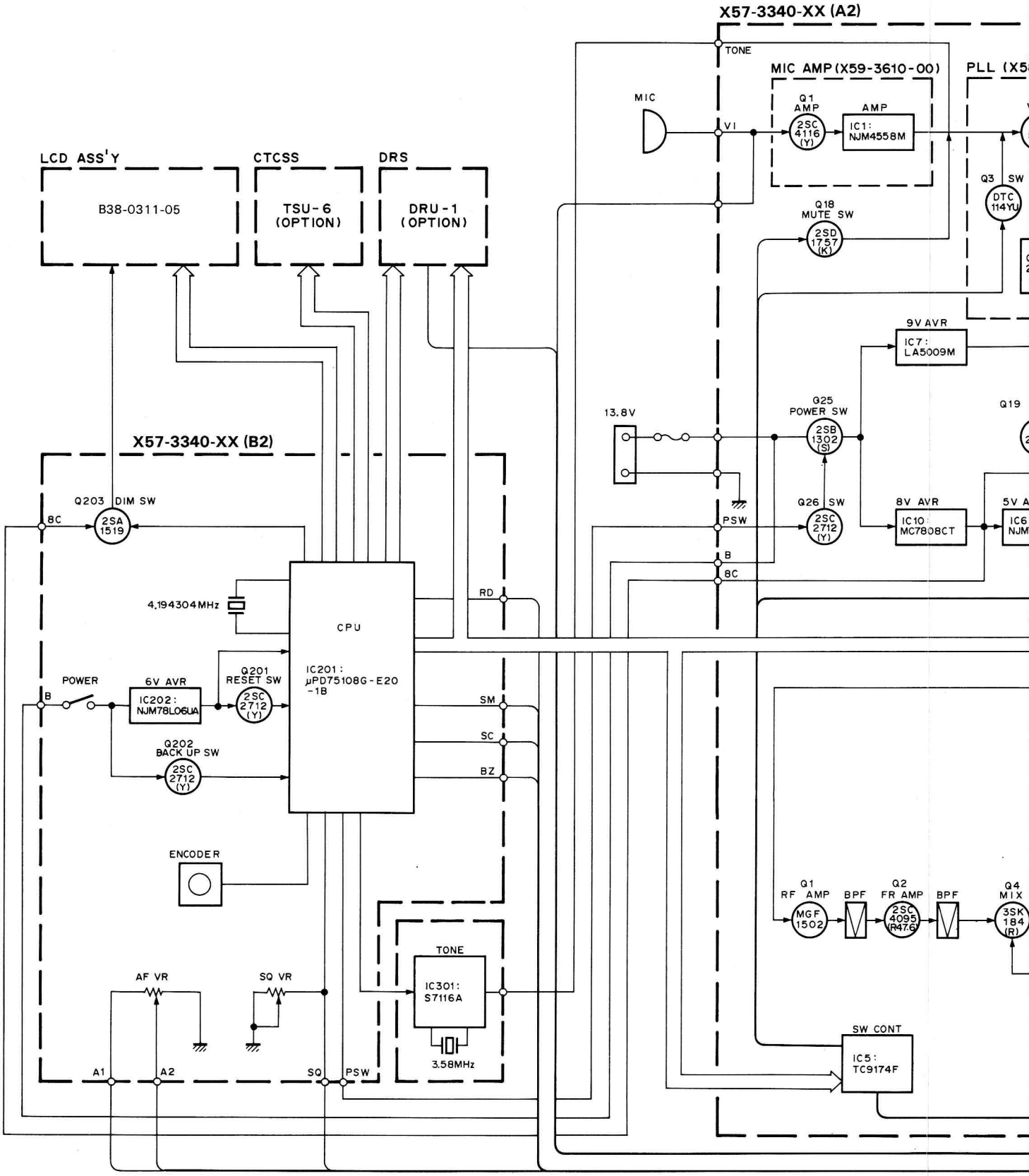


TERMINAL FUNCTIONS

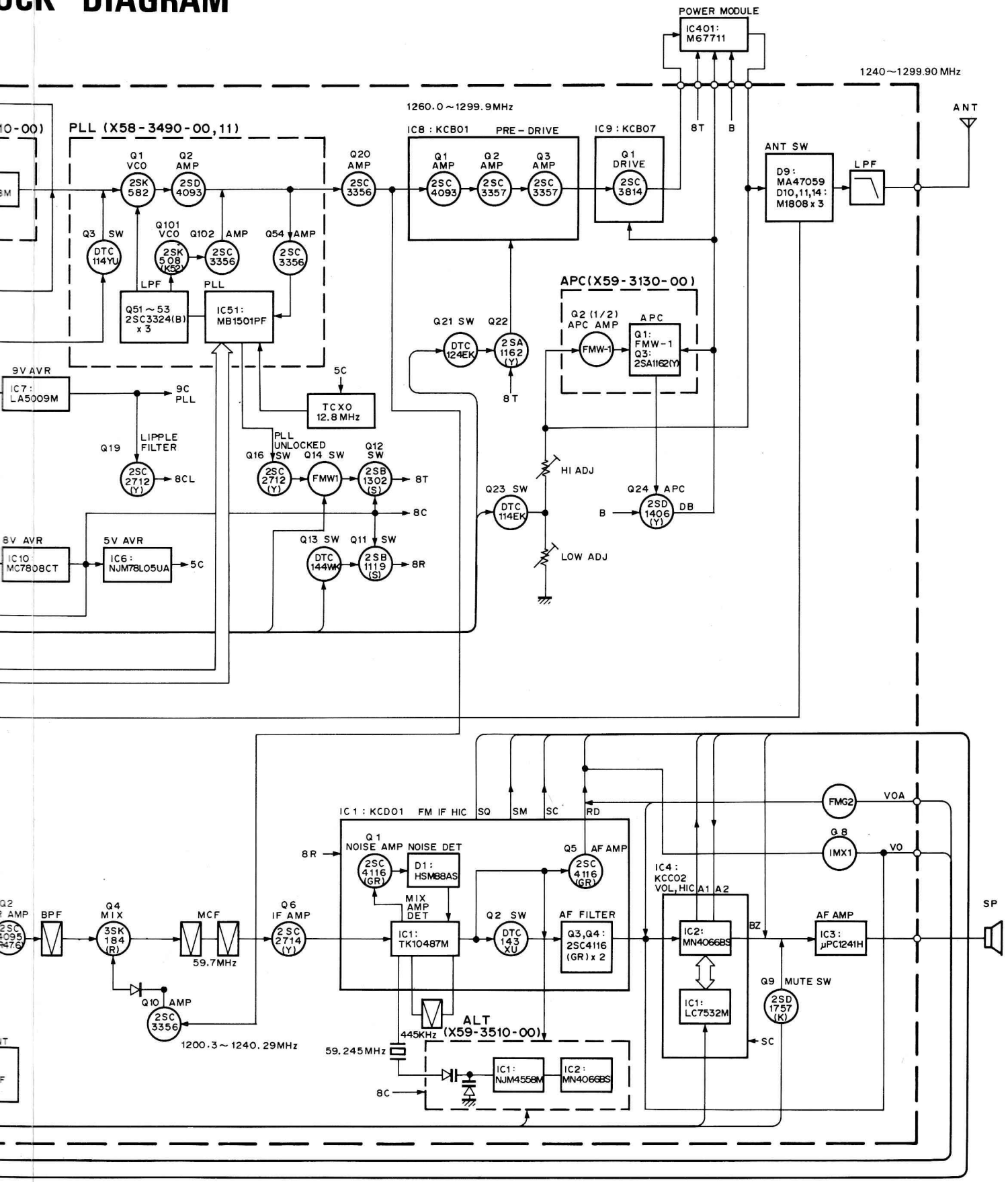
Connector No.	Terminal No.	Terminal Name	Terminal Function
TX-RX UNIT (X57-3340-11)(A/2)			
CN1	1	SP	Speaker input.
	2	E	GND.
CN2	1	VOA	Power supply for voice memory.
	2	VO	Voice memory output.
	3	VI	Voice memory input.
	4	E	GND.
	5	BZZ	
CN3	1	E	GND.
	2	SM	S-meter output.
	3	SQ	Squelch output.
	4	SC	Squelch busy control output.
	5	RD	Audio output.
	6	DET	
	7	DT	PLL data.
	8	CK	PLL clock.
	9	EN1	PLL enable.
	10	NC	
	11	EN2	Shift register (IC5) enable.
	12	NC	
	13	E	GND.
CN4	1	E	GND.
	2	NC	
	3	MIC	Mic input (To MIC AMP unit).
	4	ME	MIC GND.
	5	TO	Tone input.
	6	E	GND.
	7	A1	Audio output (To AF VOL).
	8	A2	Audio input (To electronic volume from AF VOL).
	9	BZ	Beep input (To AF IC from CPU).
	10	8C	Common +8V.
	11	PSW	Power switch control input.
	12	B	+13.8V.
	13	E	GND.
TX-RX UNIT (X57-3340-11)(B/2)			
CN201	1	E	GND.
	2	SM	S-meter input (To CPU IC201).
	3	SQ	Squelch input (To CPU IC201).
	4	SC	Squelch busy control input (To CPU IC201).
	5	RD	Audio input (CPU IC201).
	6	DET	
	7	DT	PLL data (From CPU IC201).
	8	CK	PLL clock (From CPU IC201).
	9	EN1	PLL enable (From CPU IC201).
	10	NC	
	11	EN2	Shift register enable (From CPU IC201).
	12	NC	
	13	E	GND.

Connector No.	Terminal No.	Terminal Name	Terminal Function
CN202	1	E	GND.
	2	NC	
	3	MIC	Mic output (From mic jack).
	4	ME	MIC GND.
	5	TO	Tone output (From IC203).
	6	E	GND.
	7	A1	Audio input (To AF VOL).
	8	A2	Audio output (To electronic volume from AF VOL).
	9	BZ	Beep output (From CPU).
	10	8C	Common +8V.
	11	PSW	Power switch control output (From CPU).
	12	B	+13.8V.
	13	E	GND.
CN203	1	CK	PLL IC clock output (From CPU P21).
	2	DT	PLL IC data output (From CPU P22).
	3	VCK	
	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	
	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.
	9	STBY	DRS unit STBY output
	10	OE	
CN205	1	CE	LCD driver enable output.
	2	DT	LCD driver data output.
	3	CK	LCD driver clock output.
CN206	1	GND	GND.
	2	5C	Common +5V.
	3	8C	Common +8V.
W202	1	GND	GND.
	2	RD	CTCSS unit voice de-modulation input.
	3	C5	Common +5V.
	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.

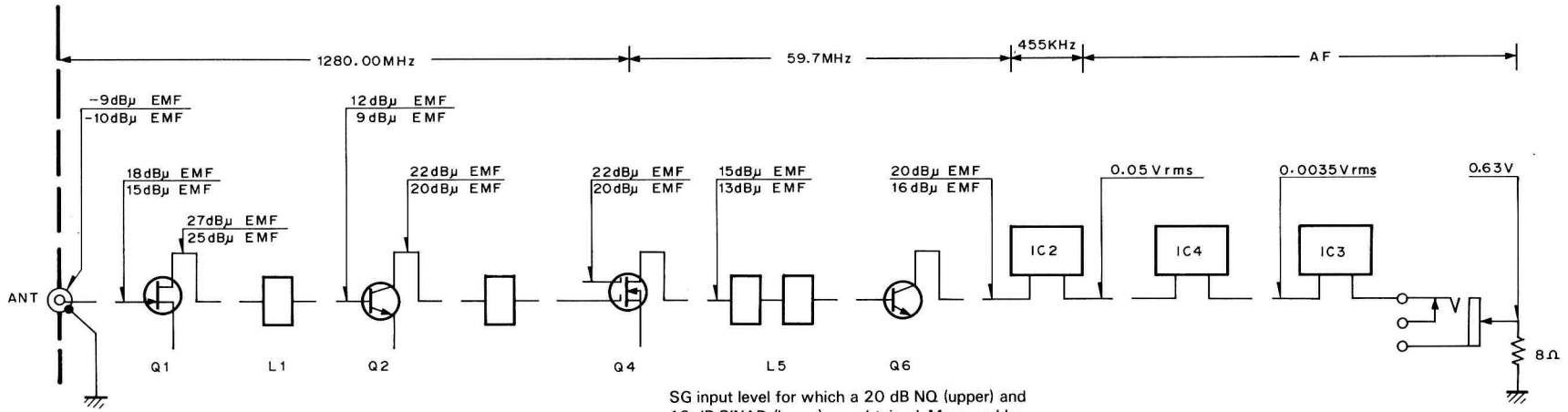
BLOCK DIA


X57-3340-XX (A2)
TONE
MIC AMP (X59-3610-00)
MIC
Q1 AMP
2SC 4116 (Y)
AMP
IC1: NJM4558M
VI
LCD ASS'Y
B38-0311-05
CTCSS
TSU-6 (OPTION)
DRS
DRU-1 (OPTION)
Q3 SW
DTC 114YU
Q18 MUTE SW
2SD 1757 (K)
9V AVR
IC7: LA5009M
13.8V
Q25 POWER SW
2SB 1302 (S)
Q19
X57-3340-XX (B2)
Q203 DIM SW
2SA 1519
8C
Q26 SW
2SC 2712 (Y)
PSW
8V AVR
IC10: MC7808CT
B
8C
4.194304MHz
CPU
RD
IC201: μPD75108G-E20 -1B
POWER
6V AVR
IC202: NJM78L06UA
Q201 RESET SW
2SC 2712 (Y)
SM
SC
BZ
Q202 BACK UP SW
2SC 2712 (Y)
ENCODER
Q1 RF AMP
MGF 1502
BPF
Q2 FR AMP
2SC 4095 (R47G)
BPF
Q4 MIX
3SK 184 (R)
TONE
IC301: S7116A
3.58MHz
AF VR
SQ VR
SW CONT
IC5: TC9174F
A1
A2
SQ
PSW

OCK DIAGRAM


POWER MODULE
IC401: M67711
1240~1299.90 MHz
1260.0~1299.9MHz
ANT
PLL (X58-3490-00,11)
IC8 : KCB01 PRE-DRIVE
IC9 : KCB07
8T
B
ANT SW
D9: MA47059 D10,11,14: M1808 x 3
LPF
Q1 VCO 2SK 582
Q2 AMP 2SD 4093
Q20 AMP 2SC 3356
Q1 AMP 2SC 4093
Q2 AMP 2SC 3357
Q3 AMP 2SC 3357
Q1 DRIVE 2SC 3814
Q3 SW DTC 114YU
Q101 VCO 2SK 508 (K52)
Q102 AMP 2SC 3356
Q54 AMP 2SC 3356
LPF
PLL
Q51~53 2SC3324(B) x 3
IC51: MB1501PF
APC(X59-3130-00)
Q21 SW DTC 124EK
Q22 2SA 1162 (Y)
Q2 (1/2) APC AMP FMW-1
APC Q1: FMW-1 Q3: 2SA1162(Y)
9V AVR
IC7: LA5009M
9C PLL
5C
TCXO 12.8 MHz
Q19 LIPPLE FILTER
2SC 2712 (Y)
8CL
PLL UNLOCKED SW
Q16 SW 2SC 2712 (Y)
Q14 SW FMW1
Q12 SW 2SB 1302 (S)
8T
8C
HI ADJ
Q23 SW DTC 114EK
Q24 APC 2SD 1406 (Y)
DB
LOW ADJ
8V AVR
IC10 MC7808CT
5V AVR
IC6: NJM78L05UA
5C
Q13 SW DTC 144WK
Q11 SW 2SB 1119 (S)
8R
IC1 : KCD01 FM IF HIC
SQ
SM
SC
RD
FMG2
VOA
Q8 IMX1
VO
Q1 NOISE AMP 2SC 4116 (GR)
NOISE DET D1: HSM88AS
Q5 AF AMP 2SC 4116 (GR)
IC4: KCC02 VOL, HIC
A1 A2
SP
BPF
Q4 MIX 3SK 184 (R)
MCF
59.7MHz
Q6 IF AMP 2SC 2714 (Y)
MIX AMP DET
IC1: TK10487M
Q2 SW DTC 143 XU
AF FILTER Q3,Q4: 2SC4116 (GR) x 2
IC2: MN4066BS
BZ
AF AMP IC3: μPC1241H
Q9 MUTE SW 2SD 1757 (K)
IC1: LC7532M
SC
Q10 AMP 2SC 3356
1200.3~1240.29MHz
ALT (X59-3510-00)
445KHz
59.245MHz
IC1: NJM4558M
IC2: MN4066BS
8C

Receiver Section

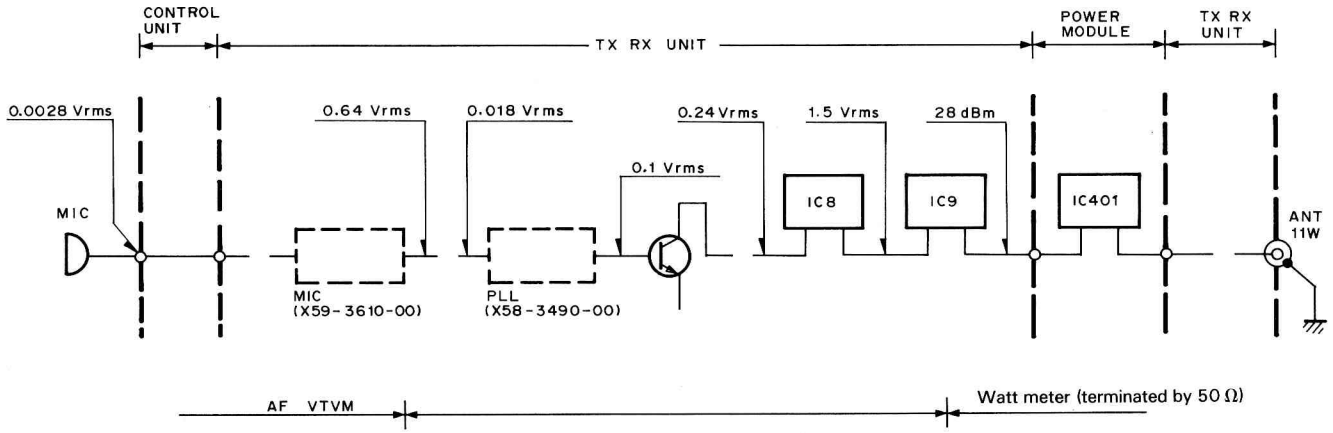


SG input level for which a 20 dB NQ (upper) and 12 dB SINAD (lower) are obtained. Measured by connecting the SG to each point via a 0.01 μF capacitor.

AF VTVM

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

Transmitter Section



1. AG is set so that MIC input becomes 3 kHz DEV at 1 kHz MOD.
2. Transmitting frequency: 1280.00 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-531A/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

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

DRU-1 DESCRIPTION OF COMPONENTS

ACCESSORY UNIT (X42-3010-00)

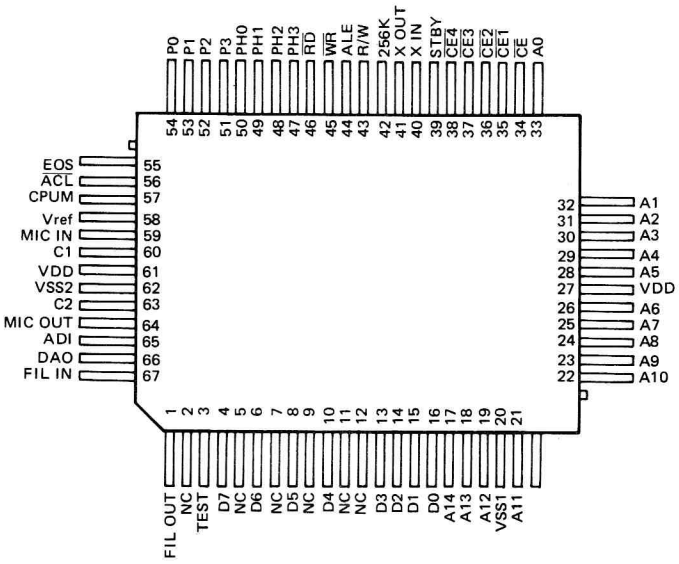
Component	Use/Function	Description
IC1	Multiplexer	See DRU-1 circuit description.
IC3	Audio recording and playback	See DRU-1 semiconductor data.
IC4~7	S-RAM	
Q5	AF amplification	Mic input amplification.
Q6	AF amplification	Playback sound amplification.
D1	Reverse current prevention	
D2	Reverse current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

DRU-1 (DIGITAL RECORDING UNIT)

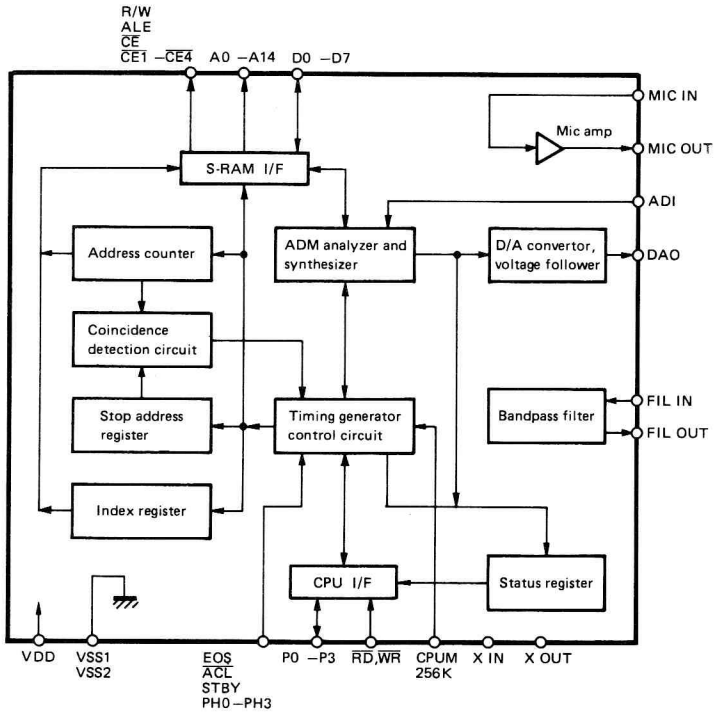
DRU-1 SEMICONDUCTOR DATA

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.				
4	D7	I/O	RAM data I/O.	43	R/W	O	RAM read/write output.
5	NC	–	Not connected.	44	ALE	–	Not used.
6	D6	I/O	RAM data I/O.	45	$\overline{WR}$	I	Write pulse input.
7	NC	–	Not connected.	46	$\overline{RD}$	I	Read pulse input.
8	D5	I/O	RAM data I/O.	47~50	PH3~PH0	–	Not used.
9	NC	–	Not connected.	51~54	P3~P0	I/O	Data bus.
10	D4	I/O	RAM data I/O.	55	EOS	–	Not used.
11,12	NC	–	Not connected.	56	ACL	I	Reset signal input.
13~16	D3~D0	I/O	RAM data I/O.	57	CPUM	I	"H" when CPU control enabled.
17~19	A14~A12	O	RAM address output.	58	Vref	O	Analog circuit reference voltage output.
20	V_{SS1}	–	GND.	59	MIC IN	I	Mic amp. 1 input.
21~26	A11~A6	O	RAM address output.	60	C1	O	Mic amp. 1 output.
27	V_{DD}	–	Power supply.	61	V_{DD}	–	Power supply.
28~33	A5~A0	O	RAM address output.	62	V_{SS2}	–	GND.
34	$\overline{CE}$	–	Not used.	63	C2	I	Mic amp. 2 input.
35~38	$\overline{CE1}$~$\overline{CE4}$	O	RAM chip enable.	64	MIC OUT	O	Mic amp. 2 output.
39	STBY	I	Minimum current standby when standby input is "H".	65	ADI	I	Audio analysis circuit input.
				66	DAO	O	D/A convertor output.
40	X IN	I	512kHz oscillation circuit.	67	FIL IN	I	Not used.

DRU-1 (DIGITAL RECORDING UNIT)

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

DRU-1 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
DRU-1						
			B42-3317-04	LABEL		
-			B50-8290-00	INSTRUCTION MANUAL		
			G10-0666-04	NON-WOVEN FABRIC		
			G10-0679-04	NON-WOVEN FABRIC		
			G13-0913-04	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		
			N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
			X42-3010-00	ACCESSORY UNIT		
ACCESSORY UNIT (X42-3010-00)						
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 mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R6			R92-0670-05	CHIP R 0 ΩHM		
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 ΩHM		
R11			RK73FB2A223J	CHIP R 22K J 1/10W		
R12			R92-0670-05	CHIP R 0 ΩHM		
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 ΩHM		
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		
Q1 -3			2SC2712(BL)	TRANSISTOR		
Q4			DTC144EK	DIGITAL TRANSISTOR		
Q5 ,6			2SC2712(BL)	TRANSISTOR		
			W09-0326-05	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

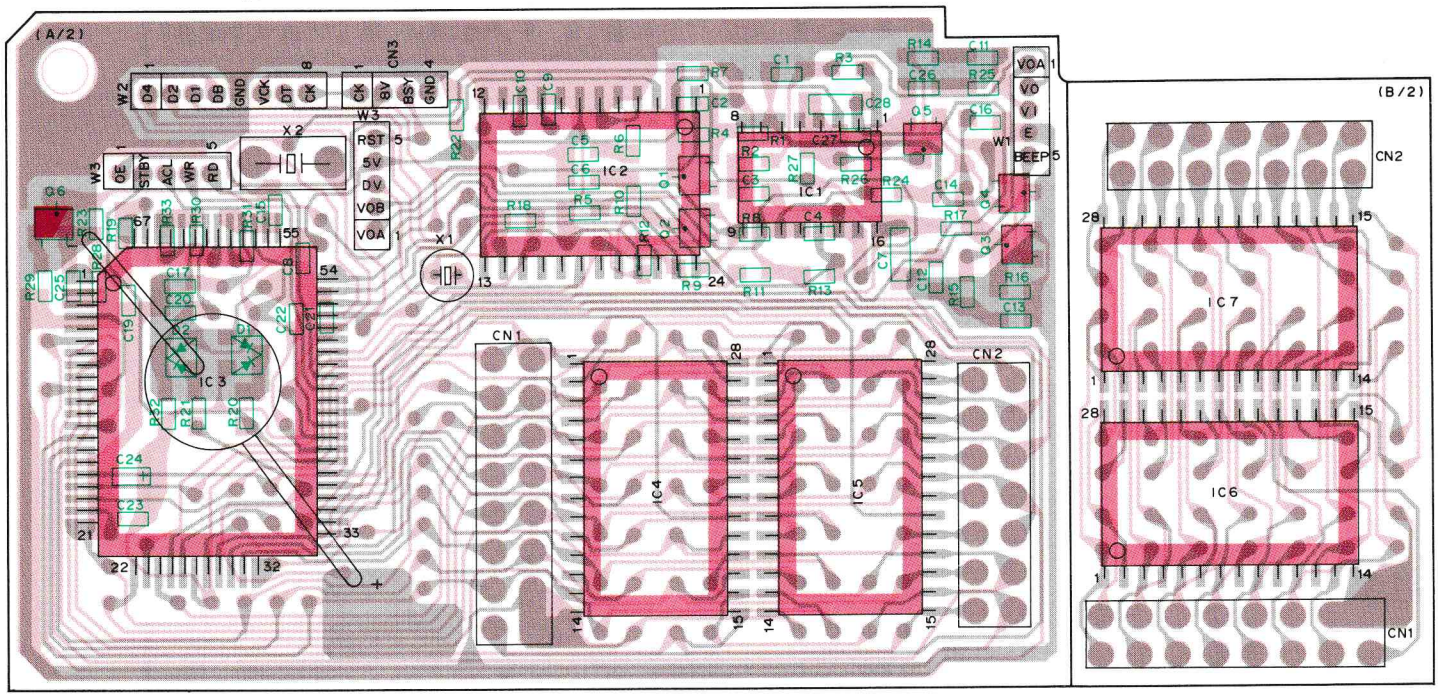
⚠ indicates safety critical components.

TM-531A/E

DRU-1 DIGITAL RECORDING UNIT

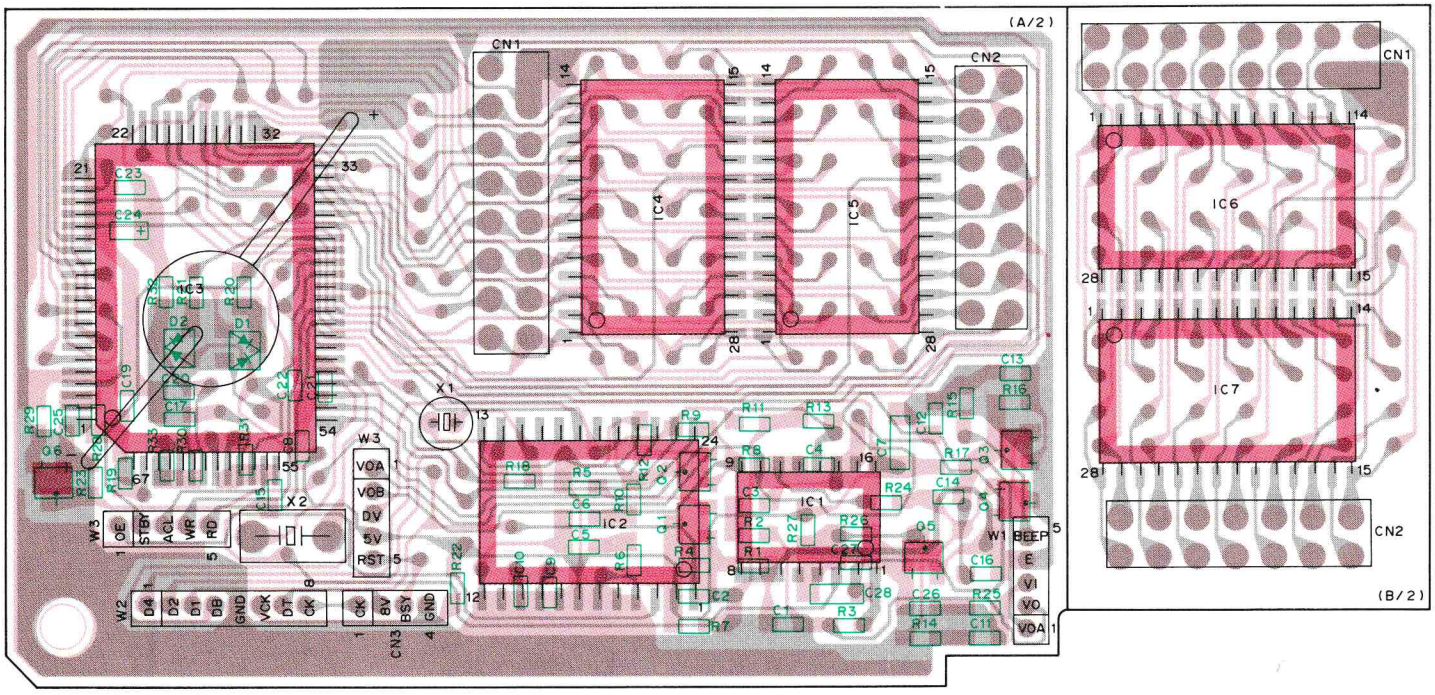
DRU-1 PC BOARD VIEW

▼ACCESSORY UNIT (X42-3010-00) FOIL SIDE VIEW



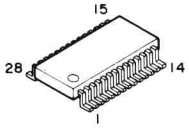
IC1:TC4052BF IC2:LR4102N IC3:TC8830F IC4~7:HM62256LFP-15T Q5,6:2SC2712(BL) D1,2:ISS184

▼ACCESSORY UNIT (X42-3010-00) COMPONENT SIDE VIEW

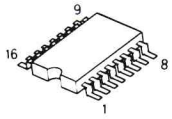


DTC144EK
2SC2712(BL)

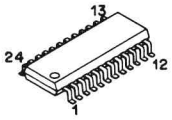
HM62256LFP-15T



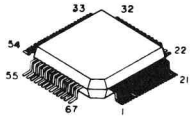
TC4052BF



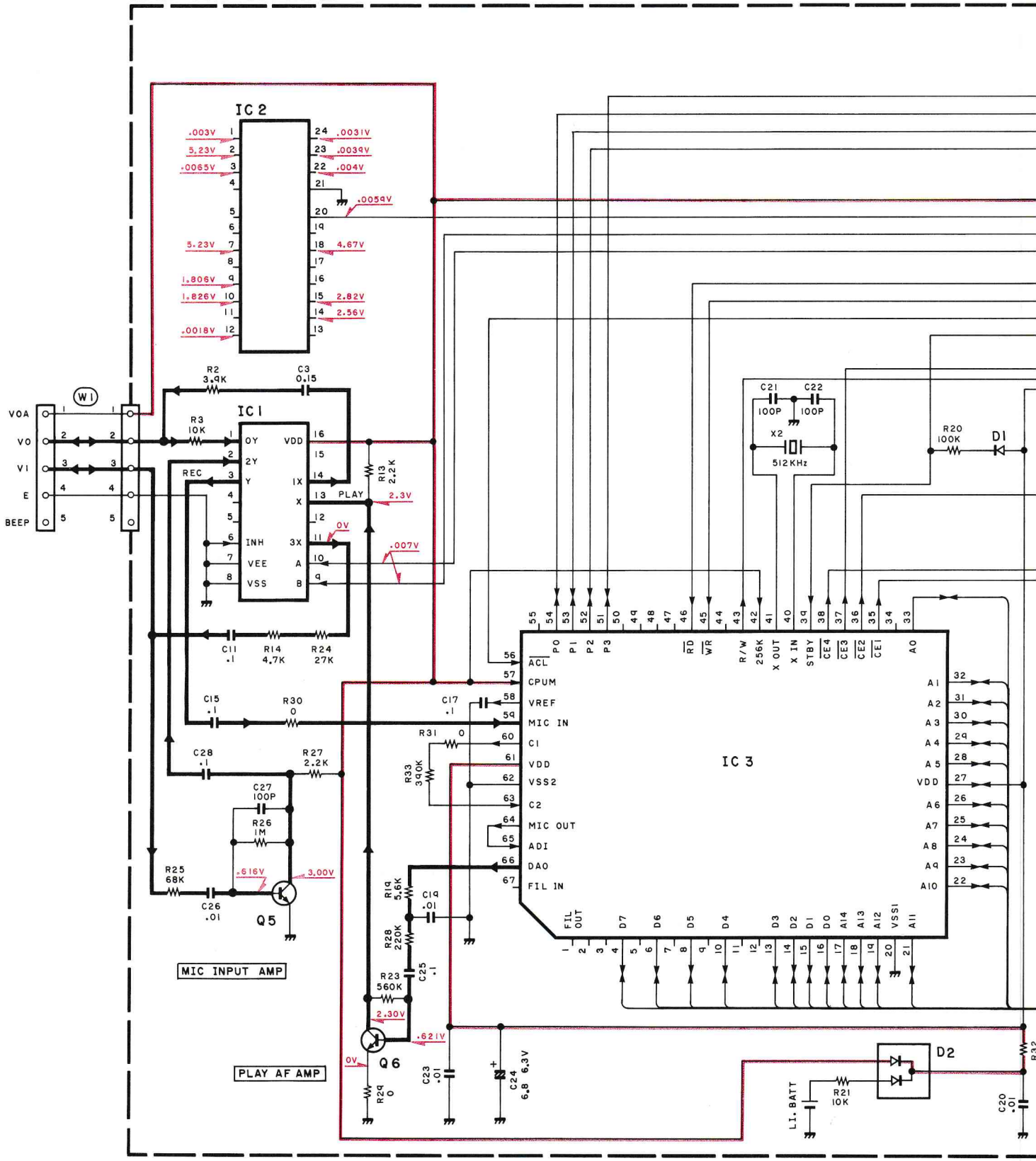
TC8830F



LR4102N

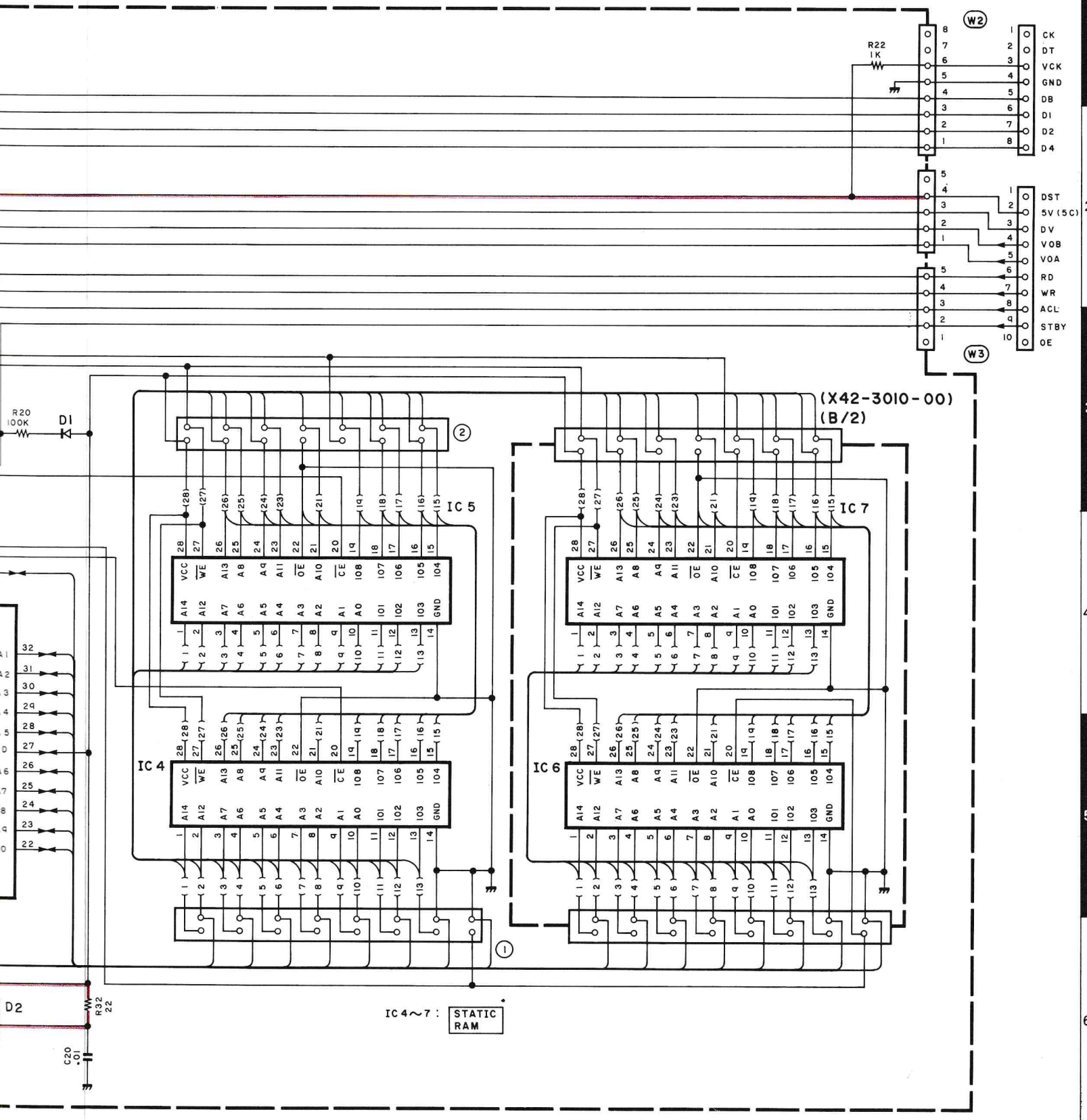


(X42-3010-00)(A/2)



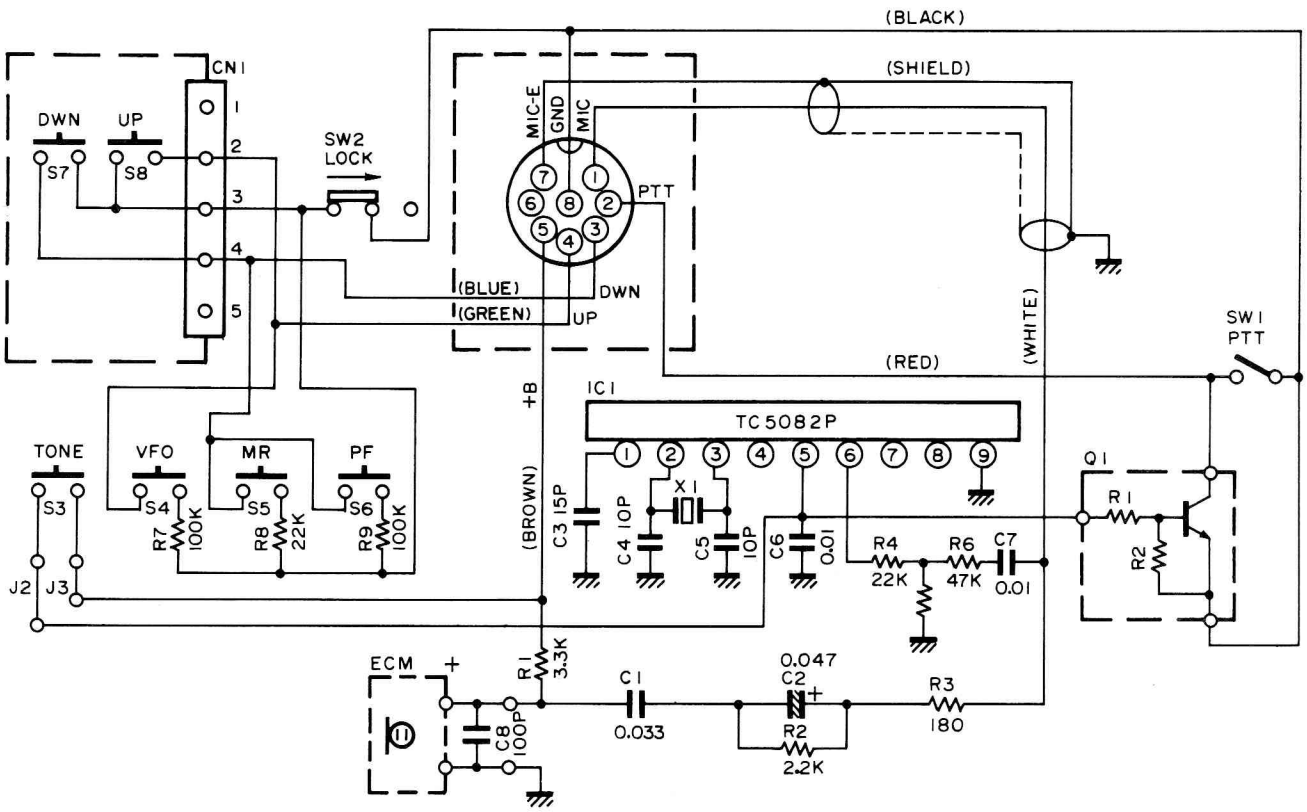
(X42-3010-00)(A/2)

IC 1	: TC4052BF	Q5, 6	: 2SC2712(BL)
IC 2	: LR4102N		
IC 3	: TC8830F	D1, 2	: 1SS184
IC 4~7	: HM62256LFP-15T		


W2
W3
R22 1K
CK
DT
VCK
GND
DB
DI
D2
D4
DST
5V (5C)
DV
VOB
VOA
RD
WR
ACL
STBY
OE
R20 100K
D1
D2
R32 22
C20 .01
(X42-3010-00) (B/2)
IC 4
IC 5
IC 6
IC 7
IC4~7 : STATIC RAM

MC-44E (MULTI FUNCTION MICROPHONE)

MC-44E SCHEMATIC DIAGRAM

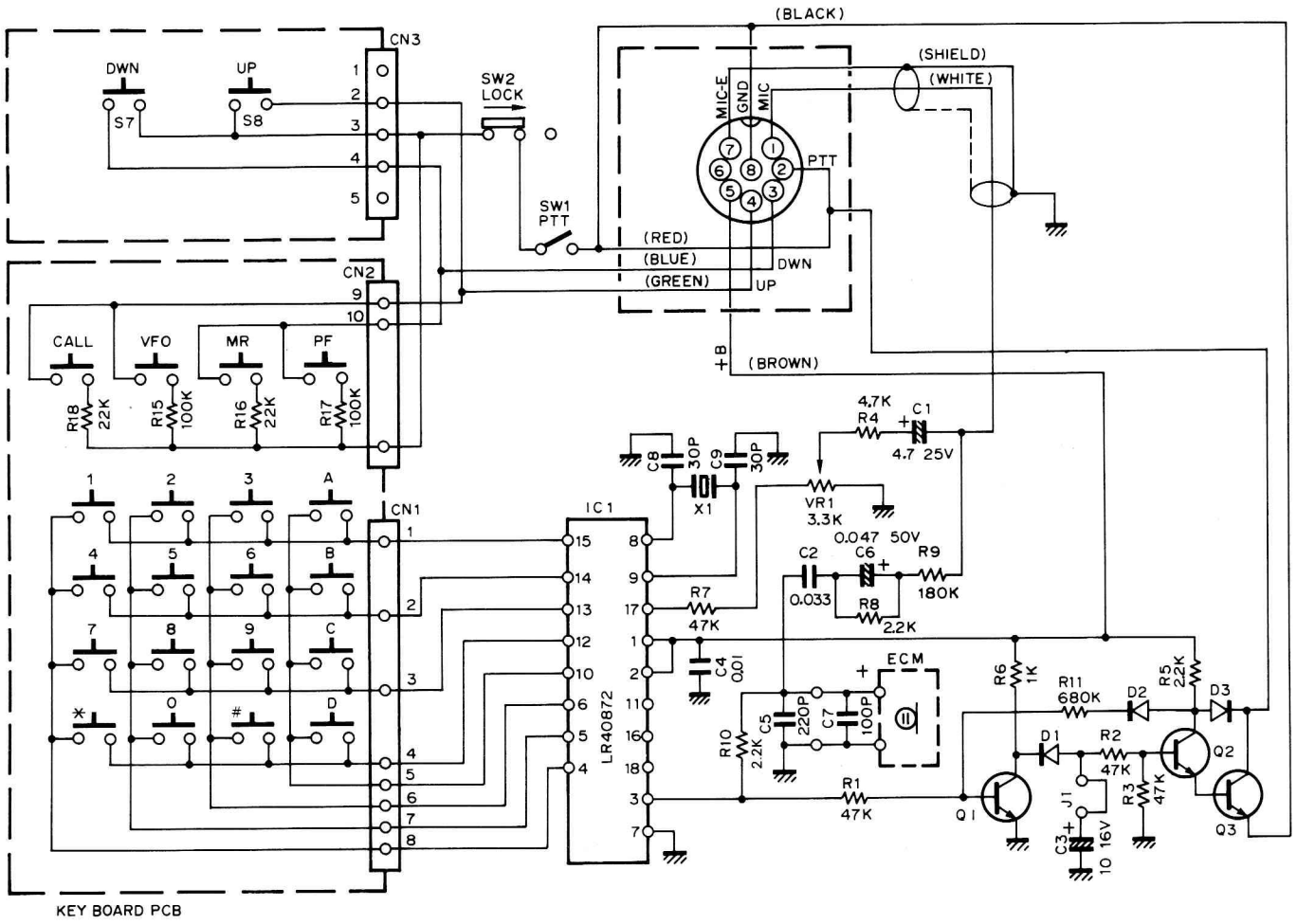


MC-44E PARTS LIST

Ref. No.	New parts	Parts No.	Description
		A02-0897-08	Case (Front) With TONE
		A02-0900-08	Case (Rear)
		B50-8293-08	Instruction manual
		E30-2149-08	Curl cord
		K29-3165-08	Knob PTT
		K29-3168-08	Knob UP
		K29-3169-08	Knob DOWN
		K29-3170-08	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 UP, DOWN
		T91-0383-08	Microphone element (Condenser microphone)

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

MC-44DM/MC-44DME SCHEMATIC DIAGRAM

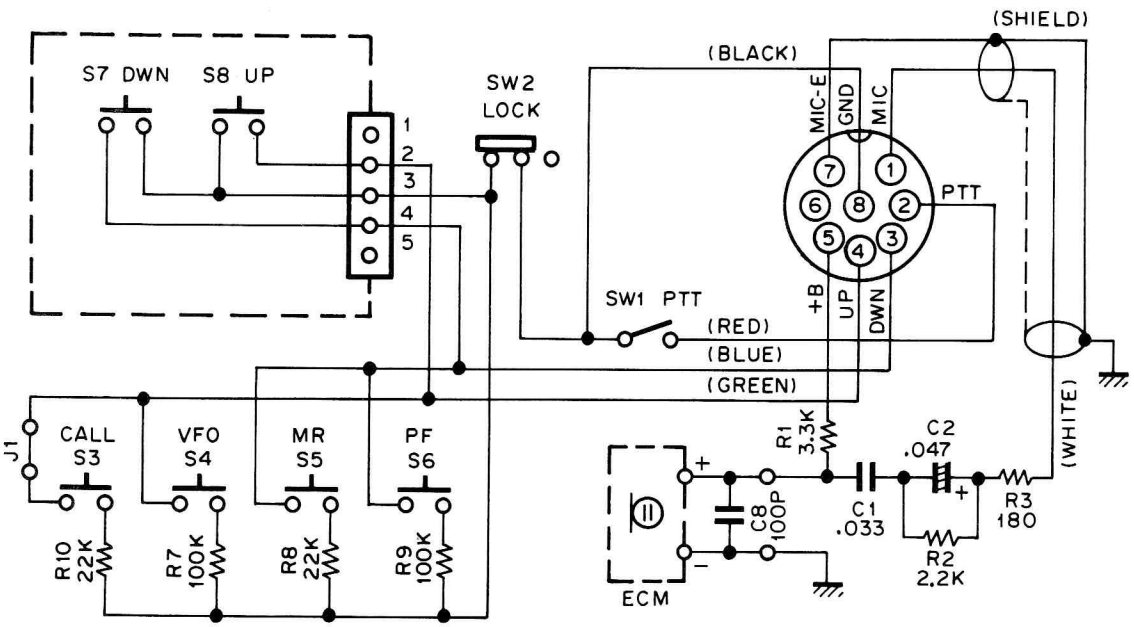


MC-44DM/MC-44DME PARTS LIST

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

MC-44 (MULTI FUNCTION MICROPHONE)

MC-44 SCHEMATIC DIAGRAM

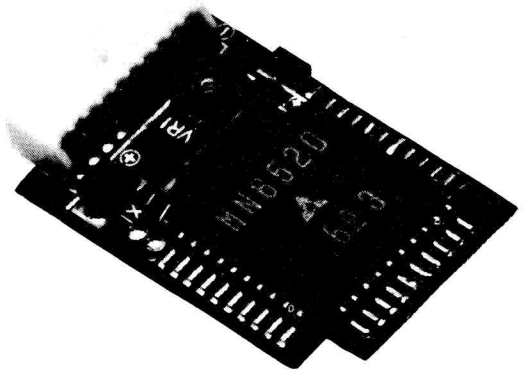


MC-44 PARTS LIST

Ref. No.	New parts	Parts No.	Description
		A02-0896-08	Case (Front)
		A02-0900-08	Case (Rear)
		B50-8293-08	Instruction manual
		E30-2149-08	Curl cord
		K29-3165-08	Knob PTT
		K29-3168-08	Knob UP
		K29-3169-08	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		S59-1409-08	Switch 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
		CTCSS UNIT (X52-3100-00)	
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		RK73FB2A○○○J	Chip resistor
R12–14		RK73FB2A○○○J	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%	O	X
+1.0%	X	O
+1.5%	O	O

O : 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

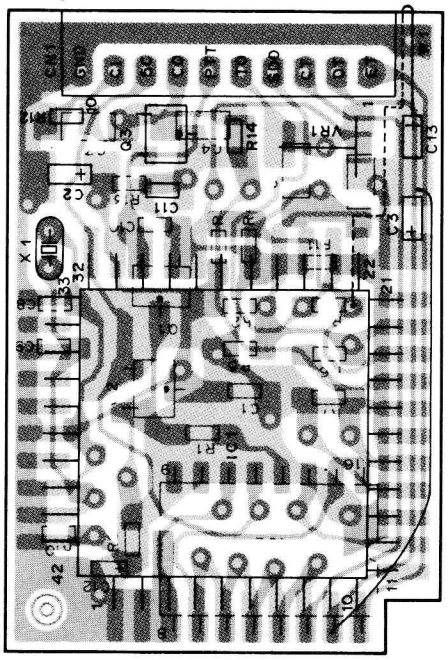
Tone frequency (Hz)	MN6520 terminal					
	$\overline{S6}$	$\overline{S5}$	$\overline{S4}$	$\overline{S3}$	$\overline{S2}$	$\overline{S1}$
	MN4094BS terminal					
	Q1	Q2	Q3	Q4	Q7	Q8
67.0	L	H	H	H	L	H
71.9	L	H	H	H	L	L
74.4	L	H	H	L	H	H
77.0	L	H	H	L	H	L
79.7	L	H	H	L	L	H
82.5	L	H	H	L	L	L
85.4	L	H	L	H	H	H
88.5	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

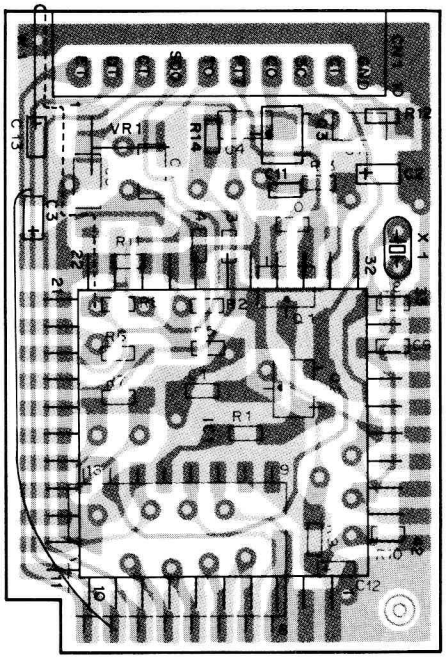
TSU-6 (CTCSS UNIT)

TSU-6 PC BOARD VIEWS

Component side view



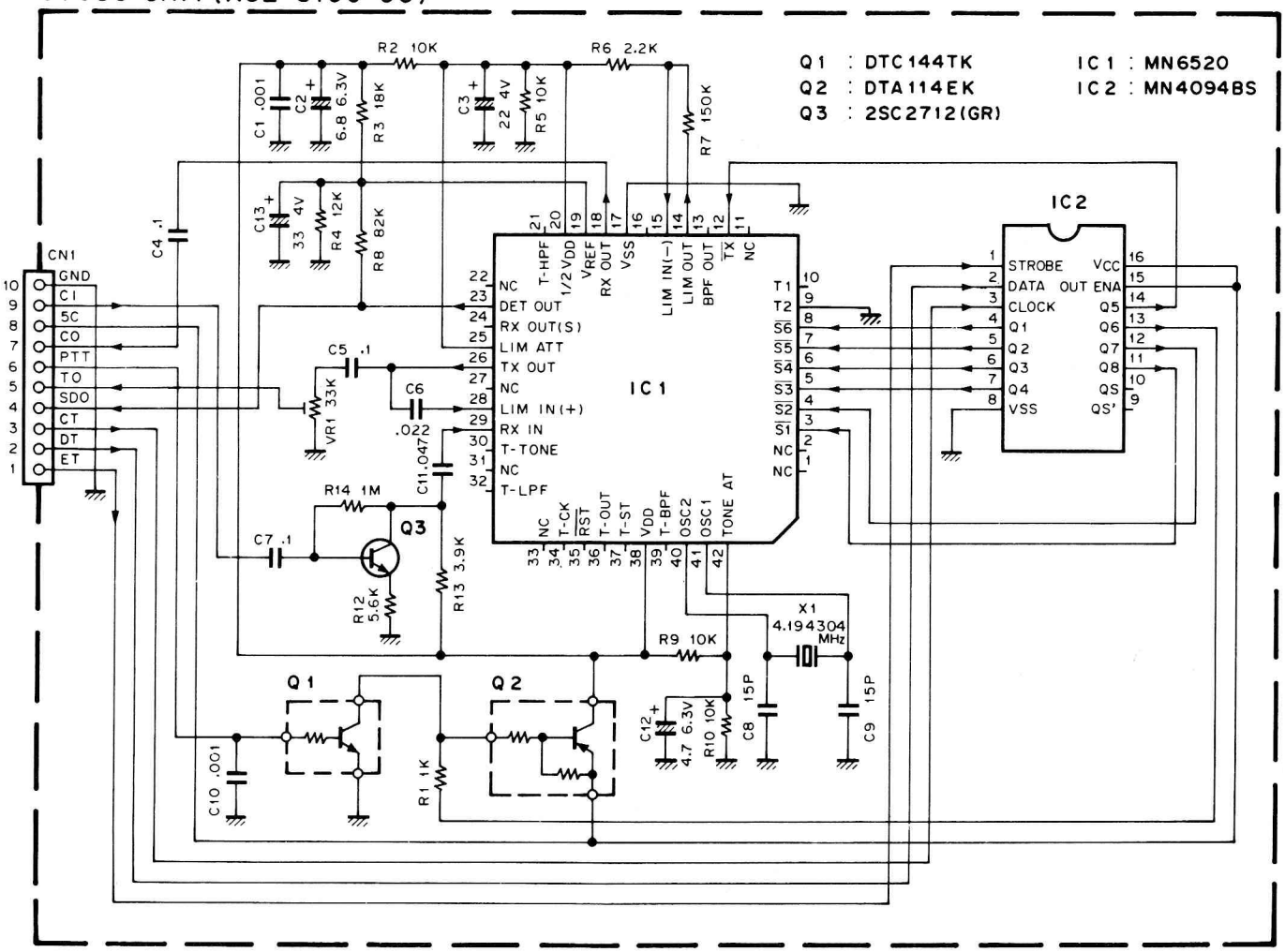
Foil side view



: Component side
: Foil side

TSU-6 CIRCUIT DIAGRAM

CTCSS UNIT(X52-3100-00)



TM-531A/E

SPECIFICATIONS

TM-531A/TM-531E

General

Frequency range	1240 to 1300 MHz
Mode	F3E (FM)
Antenna impedance	50 ohms
Operating temperature	−20°C to +60°C (−4°F to +140°F)
Power requirement	13.8 VDC ± 15% (11.7 to 15.8)
Grounding	Negative
Current drain	
Transmit mode (Max.)	Less than 5.5A
Receive mode with no input signal	Less than 0.6A
Frequency stability	Less than $\pm 3 \times 10^{-6}$
Dimensions	
Wide	141 mm (5-9/16")
High	42 mm (1-21/32")
Deep	171 mm (6-47/64")
Weight	1.2 kg (2.65 lbs)

Transmitter

*Output power	
HI	10 W
LOW	1 W
Modulation	Reactance modulation
Spurious radiation	Less than −50 dB
Max. frequency deviation	±5 kHz
Audio distortion (at 60% modulation)	Less than 3% (300 to 3000 Hz)
Microphone impedance	500 to 600 ohms

Receiver

Circuitry	Double conversion superheterodyne
Intermediate frequency	
1st	59.7 MHz
2nd	455 kHz
Sensitivity(12 dB SINAD)	Less than 0.16 μV
Selectivity	
−6 dB	More than 12 kHz
−60 dB	Less than 36 kHz
Spurious response	Better than 40 dB
Squelch sensitivity	Less than 0.1 μV
Output (5% distortion)	More than 2 W across 8 ohms load
External speaker impedance	8 ohms

Notes:

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

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