KENWOOD

SERVICE MANUAL

TM-2550A/E,TM-2530A

MU-1, MB-10,TU-7, PG-2K,VS-1

144MHz FM TRANSCEIVER

Photo is TM-2550A.

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CIRCUIT DESECRIPTION

	TM-2550A (K1,M1,M3)	TM-2550E (T,W)	TM-2530A (K2,M2,M4)
FINAL UNIT	X45-1440-10	X45-1440-10	X45-1440-11
PLL UNIT	X50-2030-10	X50-2030-51	X50-2030-11
CONTROL UNIT	X53-1440-10 (K1,M1) X53-1440-21 (M3)	X53-1440-51 (T) X53-1440-61 (W)	X53-1440-10 (K2,M2) X53-1440-21 (M4)
DISPLAY UNIT	X54-1860-10	X54-1860-10	X54-1860-10
COMPOUND UNIT	X60-1280-10	X60-1280-51	X60-1280-10

Table 1 TM-2550A/E, TM-2530A PC board chart

RX SECTION

Signals from the antenna are applied to the FINAL unit (X60-1280-XX) transmit receive swithing circuit, D2 and D4. In receive, diodes D2 and D4 are reverse biased forcing the incoming receive signal down thru L3 to the RA (Receive Antenna) terminal. There the incoming receive signal is then coupled to the COMPOUND Unit (X60-1280-XX). The signal is filtered by a low pass filter and amplified by Q1 the first RF amplifier, a GaAs FET : 3SK129(S). The amplified RF signal is then mixed with the LR (Receiver Local Oscillator) signal in the first mixer Q2 : 3SK74(L) to obtain the First IF frequency of 10.695MHz. This IF signal is filtered by Helical Resonator, L4, and a two stage MCF (Monolithic Crystal Filter), L8, which combine to provide excellent two-signal characteristics and sensitivity.

The First IF signal from the MCF is then amplified by the First IF amplifier Q3 : 2SC2668(Y) and applied to the FM IF Amplifier/Mixer/Detector, IC2 : TA7761P. This signal IC mixes the IF signal with the 10.24MHz 2nd Local Oscillator signal (L14) to obtain the 2nd IF frequency of 455kHz, then amplifies, routes the signal thru external filter L16, and finally convertes it into the received audio signal with the internal quadrature detector. The 2nd Local Oscillator signal from L14 and IC2 is also used by the PLL unit as a Reference signal.

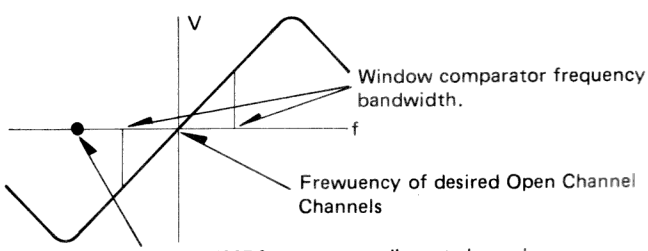
The detected audio output from IC2 is applied to the SQUELCH CONTROL (X59-1040-10), and to the de-emphasis circuit R56 and C99. The (de-emphasized) audio is amplified by Audio preamplifier Q9 : 2SC2458(Y) and then applied thru the AF GAIN control to the Audio Amplifier IC1 : μPC1241H which drives the speaker.

The noise component of the detected audio is filtered by a band-pass filter, in order to obtain a frequency of approximately 30kHz (which is well outside the normal voice bandwidth) and then amplified by the noise amplifiers contained inside IC2. This amplified noise is rectified by diodes D6 and D5 and applied to Q1 of the Squelch Switch. Q1 is used to control the conduction of Q2, which controls AF Preamp Q9.

A center-stop tuning circuit is provided to ensure that the incoming signal is actually on frequency before the squelch is opened. A portion of the 455kHz IF signal is coupled thru the secondary of L17 and applied to CENTER STOP unit (X59-1030-10) where Ceramic Discriminator L12, and Window comparator IC1 : NJM4558M are used to determine if the incoming signal is actually the channel center. When the detected signal applied to the window comparator reaches a predetermined level, Q5 of the Squelch Switch will be turned OFF or ON. The Squelch Switch determines if there is an incoming signal at the same time. If the incoming signal is at the proper level, and on frequency, the squelch will open and the C.TUNE indicator in the LCD display will turn ON. This indicator is controlled by IC2, the main microprocessor on the CONTROL unit (X53-1440-XX), thru inputs supplied from the COMPOUND unit via the BD line. During Open Channel Scanning of the DCL system Q3, Q1, and Q2 of the Squelch Switch are controlled by the main microprocessor via the SQS line. During DCL operations open channel search threshold levels are controlled by VR3 of the Compound ass'y. Transistor Q6 of the Squelch Switch, is used to prevent the Center Stop circuit from activating during Open Channel Scan Operation.

Note 1 :

The Center Stop circuit is not activated during Open Channel Scan.



Interference such as IMDfrom strong adjacent channels makes the use of the Center Stop function erratic during Open channel scan.

Fig. 1

Audio Preamplifier Q9 is controlled by Q1 of the Alert, Vacant CH. unit (X59-1020-10) during Alert, code Squelch and Open Channel operations.

CIRCUIT DESECRIPTION

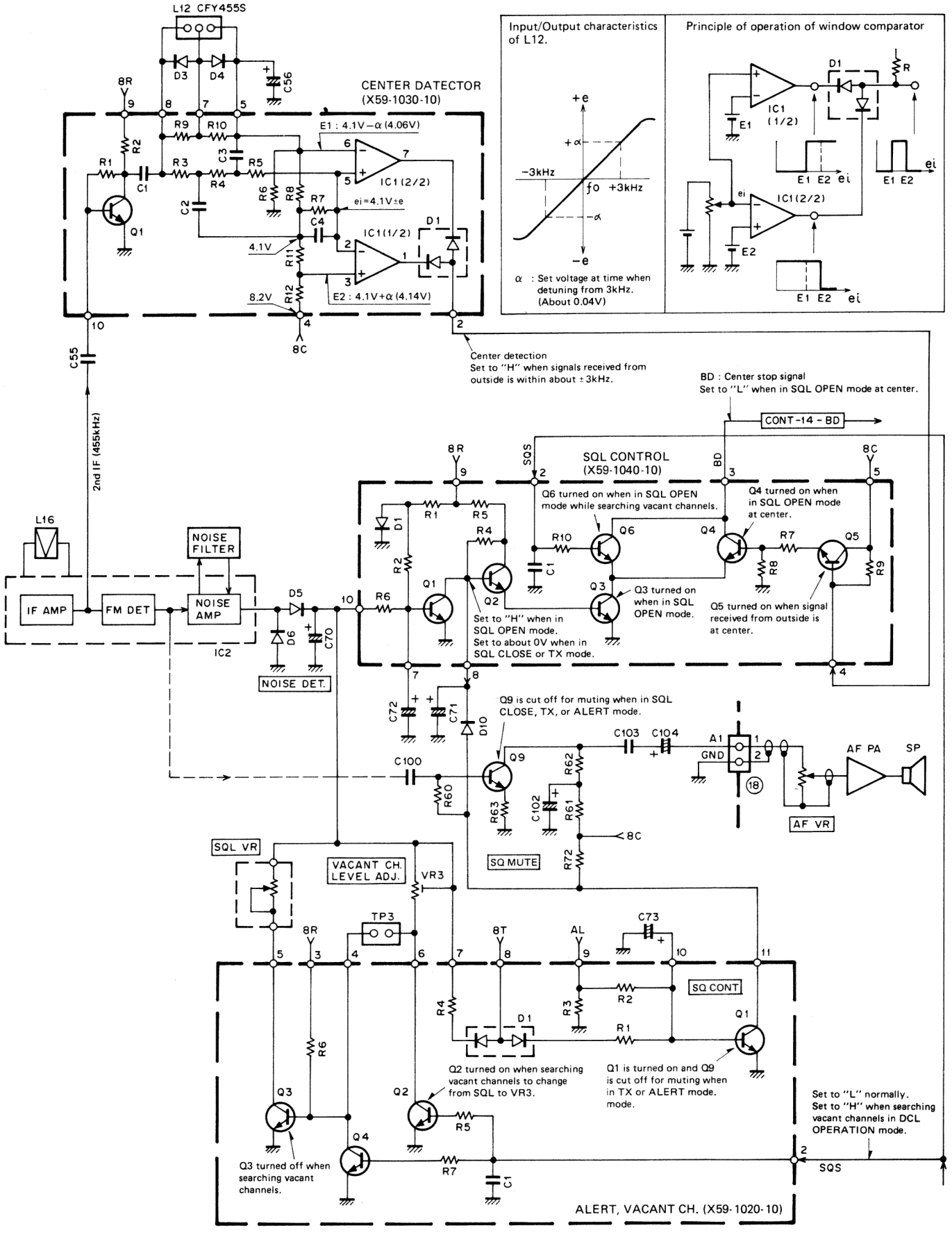


Fig. 2 Center datector, Alert, Vacant CH, SQL control circuit

CIRCUIT DESECRIPTION

Item	Rating
Nominal center frequency (fo)	10.695MHz
Pass bandwidth	±7.5kHz or more at 3dB
Attenuation bandwidth	±25kHz or less at 40dB ±45kHz or less at 60dB
Gurauranteed attenuation	1. 70dB or more within ±1MHz 2. Spurious level = 40dB or more at fo–fo + 500kHz 3. Spurious level = 80dB or more at fo–(910kHz±10kHz)
Ripple	1.0dB or less
Loss	1.5dB or less
Impedance	3kΩ/0pF

Table 2 MCF (L71-0216-05) COMP unit L8

Item	Rating
Nominal center frequency (fo)	455kHz
6dB bandwidth	±6kHz or more
50dB bandwidth	±12.5kHz or more
Ripple (within 455±5kHz)	3dB or less
Loss	6dB or less
Guaranteed attenuation (within 455±100kHz)	35dB or more
Input and output impedance	2.0kΩ

Table 3 Ceramic filter (L72-0315-05) COMP unit L16

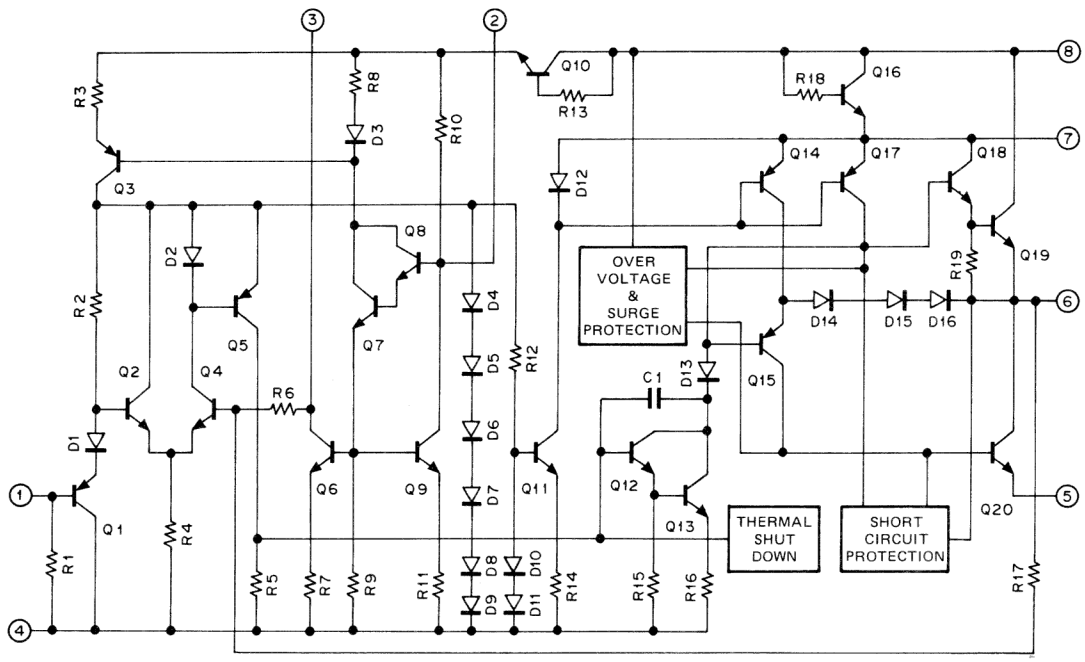


Fig. 3 μPC1241H Equivalent circuit (COMP unit IC1)

TX SECTION

Incoming microphone audio from the DISPLAY unit (X54-1860-10 C/3) is amplified by Q8 : 2SC1775(E). This amplified audio is then buffered by buffer amplifier Q7 : 2SC2458(Y) and applied to D2 : 1SS181 of the MIC AMP/S METER unit (X59-1010-10) for limiting. The signal is then amplified by a portion of IC1 : NJM4558M on the MIC AMP/S METER unit. D2 of the MIC AMP unit (X59-1000-10) provides additional limiting. The microphone audio is filtered by a 2 stage active LPF, IC1 : NJM4558M and applied to varactor diode D3 : 1S2208 in the PLL unit (X50-2030-XX) for phase modulation of the transmit VCO, Q8.

The phase-modulated FM signal is amplified by driver transistors Q10 : 2SC2688(Y), Q11 : 2SC2347 and Q12 : 2SC2538-22-A (TM-2530) or 2SC3019 (TM-2550) and applied to the FINAL unit (X45-1440-10 : TM-2550A/E or X45-1440-11 : TM-2530A).

This signal is amplified by the Hybrid Final Amplifier Module Q1 : M57737 (TM-2530A) or M57726 (TM-2550A/E) and applied to the antenna via the transmit/receive switching diode D2. During transmit, forward bias is applied to D2 allowing the transmit signal to pass. Diode D3 is also forward biased during transmit. The value of L3 was selected to present a high impedance to the transmitted signal. Any of the transmit signal that passes thru L3 is shunted to ground thru D3 to protect the receiver circuits and prevent feedback. Once the signal has been passed thru D2 it proceedes thru the LPF and to the antenna.

The APC (Automatic Protection Circuit) on the FINAL unit consists of two circuit, a negative feedback circuit that senses output power and an SWR protection circuit.

CIRCUIT DESECRIPTION

The negative feedback circuit samples the transmitted signal, rectifies this signal with D4, and applies the rectified signal to NF GAIN amplifier Q6 : 2SC2458(Y). This amplifier supplies a signal to Differential Amplifiers Q4 and Q5 : 2SC2458(Y) which control the bias applied to the PA module pin 2, and driver transistor Q12 of the PLL unit, via bias regulators Q2 : 2SD1406(Y) and Q3 : 2SA1015(Y). High/Low power swithing is accomplished by applying a ground to pin number 1 of connector (2) on the FINAL unit. This causes VR3 to act as a voltage divider that controls the condution of NF GAIN amplifier Q6.

Reflected power is coupled thru D5 on the FINAL unit and is used to control the conduction of Q7. This transistor function like Q6 to control differential amplifers Q4 and Q5, and thus the bias applied to the Power Amplifier.

Item	Symbol	Tc(°C)	Condition	Rating
Operating	Vcc	25		17V
DC current	Icc	25		7A
Operating case temp.	Tc (op)		−30~ + 110°C	
Storage temp.	Tstg		−40~ + 110°C	
Power input	Pin	25	Zg = ZI = 50Ω	0.4W
Power output	Po	25	Zg = ZI = 50Ω	40W

Table 4 M57737 Max. rating (TM-2530A Final unit Q1)

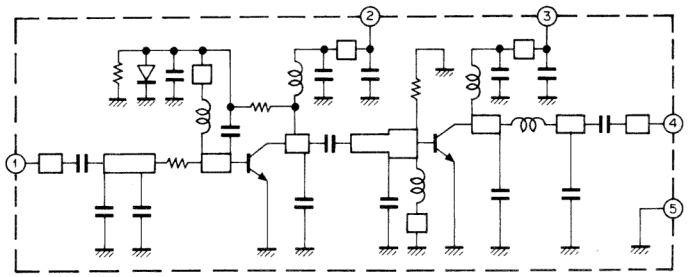


Fig. 4 M57737 Equivalent circuit

Item	Symbol	Tc (°C)	Rating
Operating voltage	Vcc	25	17V
DC current	Icc	25	14A
Operating case temp.	Tc (op)		−30~ + 110°C
Storage temp.	Tstg		−40~ + 110°C

Table 5 M57726 Max. rating (TM-2550A/E Final unit Q1)

Item	Symbol	Tc (°C)	Condition	Value	
				Min.	Typ.
Power output	Po	25	Vcc = 12.5V, F = 144~148MHz, PIN = 0.4W, ZL = ZG = 50Ω	43W	47W
Total efficiency	ηT	25	Vcc = 12.5V, F = 144~148MHz, PIN = 0.4W, ZL = ZG = 50Ω	50%	54%

Table 6 M57726 Electrical characteristic

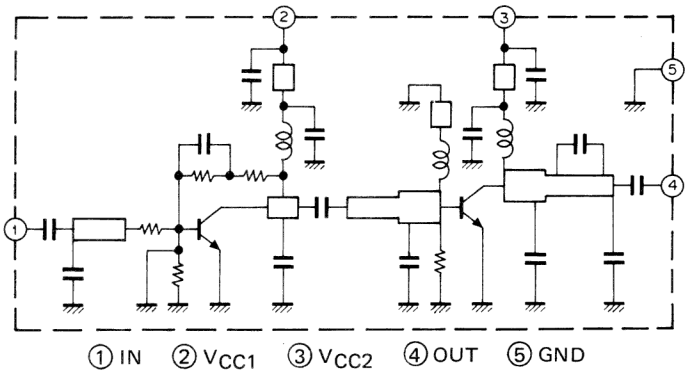


Fig. 5 M57726 Equivalent circuit

PLL CIRCUIT

The PLL circuit is divided into two main loops : transmit and receive.

Receive PLL Loop

The signal generated by the RX VCO (Voltage Controlled Oscillator) Q16 : 2SK192A(GR)*P is applied to buffer amplifier Q17 : 2SC2668(Y) and mixed with the HET (Heterodyne) signal by Q21 : 2SC2668(Y) where it becomes the PLL IF signal (**K,M** 13.015 to 15.010MHz, **T,W** 12.865 to 19.86MHz). This PLL IF signal is then amplified by Q20 : 2SC2668(Y) and applied to the Phase Detector IC2 : MC145155P*K where it is divided to obtain a 5kHz signal. The divide ratio is determined by Serial Data from the CONTROL unit. This 5kHz signal is compared with the 5kHz reference signal obtained by dividing the 10.240 MHz Reference signal.

The Phase Detector compares the phase of these two signals and transmits an error control signal to the VCO. The control signal is filtered by an Active Low-Pass filter composed of Q13 : 2SK30A(O) and Q14 : 2SC2458(Y) to remove any AC fluctuations to obtain a DC correction voltage. The correction voltage is used to change the capacitance of Varactor Diode D5 : 1SV50, which varies the output of the RX VCO to lock it on frequency.

If the phase difference is too great to be corrected by the control voltage applied to D5, an unlock signal is generated by the Phase Detector. This signal turns OFF Q15 : 2SC2458(Y) which turns OFF output amplifier Q18 : 2SC2668(Y) to prevent operation outside the authorized limits.

The PLL HET Oscillator, Q19 : 2SC2668(Y) oscillates at 39.48MHz. This signal is applied to frequency tripler Q22 : 2SC2688(Y) to obtain a signal of 118.44MHz which is applied to mixer Q21.

CIRCUIT DESECRIPTION

Transmit PLL Loop

The signal generated by the TX VCO Q8 : 2SK125 (**K,M** 142.00 to 148.995MHz, **T,W** 144.00 to 145.995MHz) is mixed with the RX PLL output, by Q7 : 2SC2688(Y) and applied to the Transmit Phase Detector IC1 : MC145151P. This signal and the 10.240MHz signal from IC2 are divided by 512, to obtain 20kHz. These two signals are compared and an error correction signal is applied to the Active Low Pass filter Q3, Q4 and Q5 : 2SC1775(E). Comparision at a frequency of 20kHz provides shorter response times, a real necessity in transmit. The DC correction voltage from the LPF is used to control varactor diode D2 : 1SV50.

The divide ratio is increased by 91 during transmit operations. This causes the TX VCO frequency to be locked at a frequency 455kHz higher than the RX VCO frequency which prevents internal mixing. When an error occurs that is greater than the correction voltage limits an unlock signal is generated by IC1. This signal controls the conduction of Q1 : 2SC2458(Y) which controls Q2 : 2SA1048(Y) to stop transmissions. Q2 interrupts the bias of the TX driver stage.

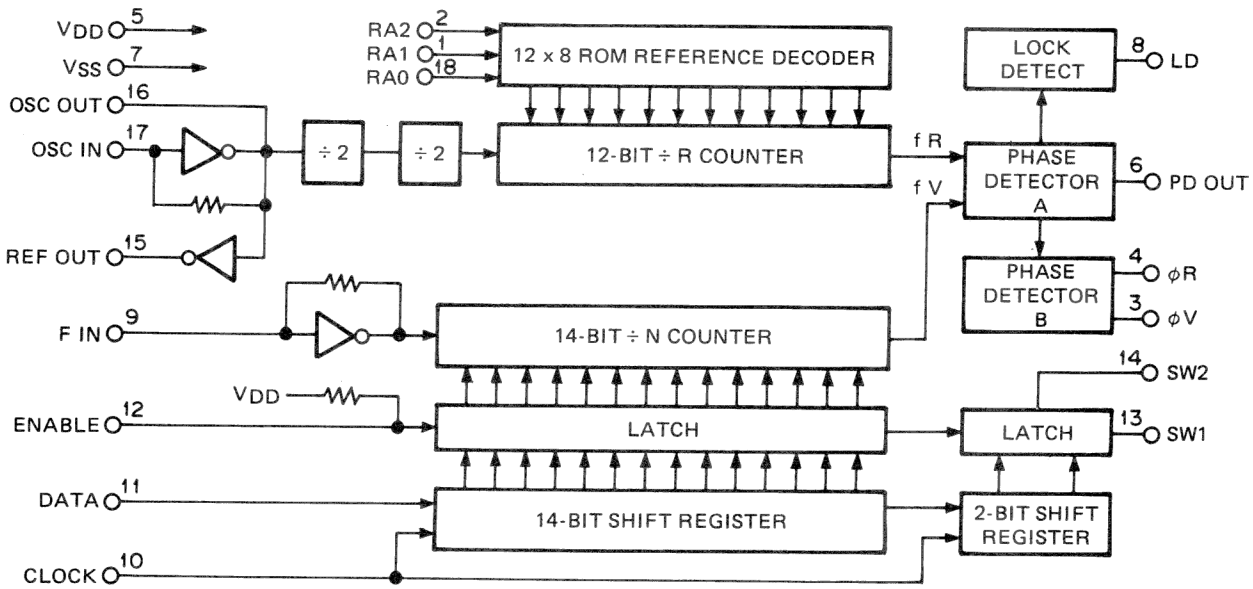


Fig. 6 MC145155P*K Block diagram (PLL unit IC2)

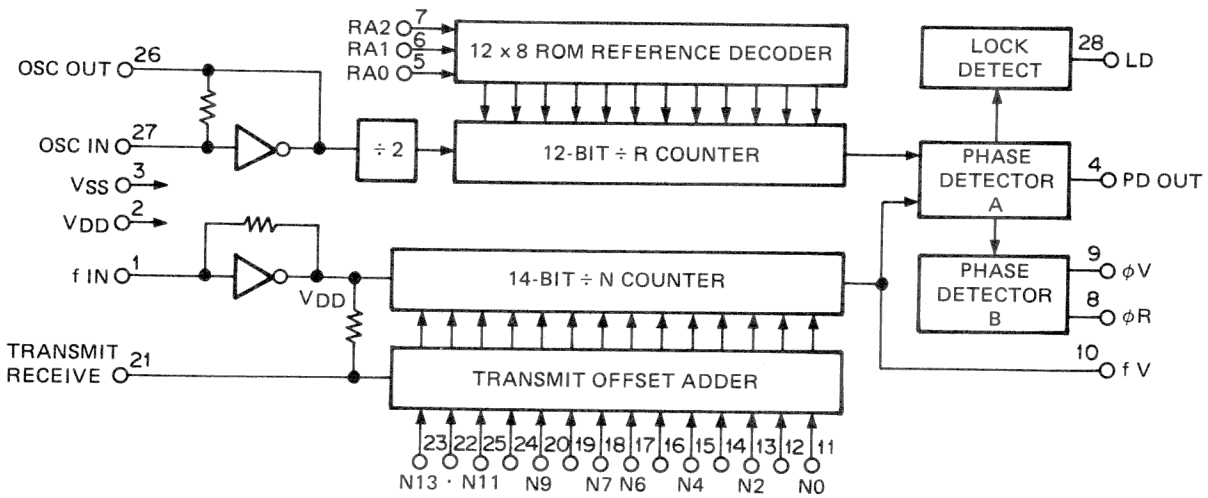


Fig. 7 MC145151P Block diagram (PLL unit IC1)

CIRCUIT DESECRIPTION

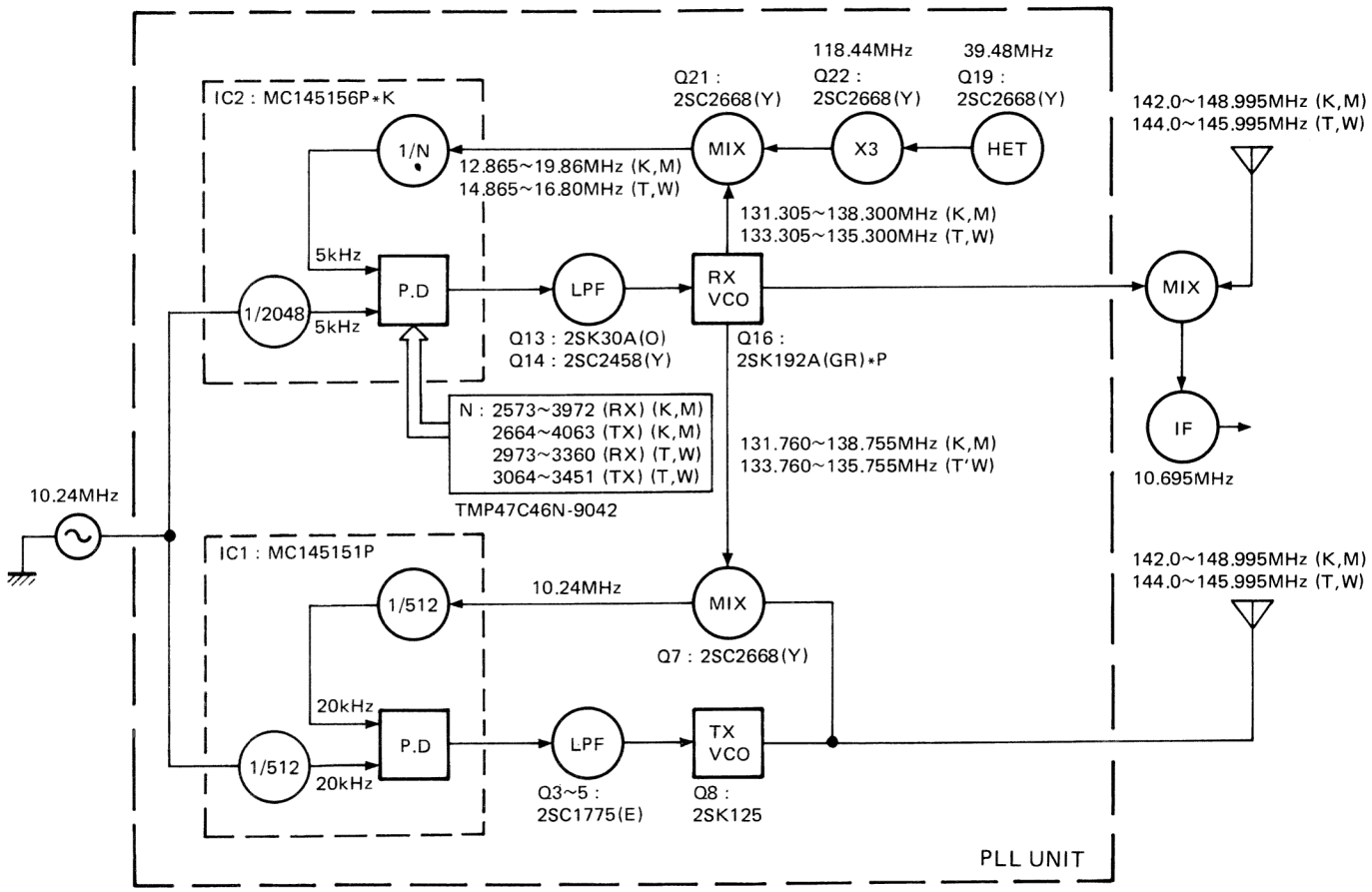
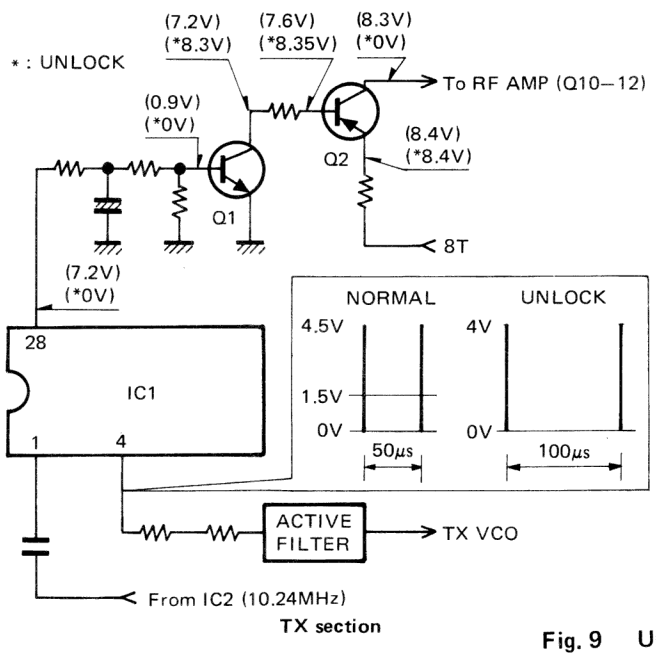
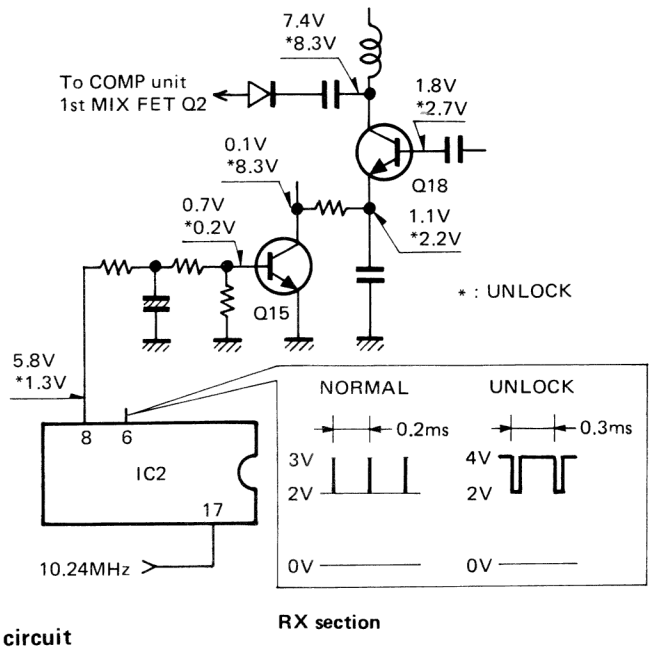


Fig. 8 Frequency-related block diagram



TX section



RX section

Fig. 9 Unlock circuit

CIRCUIT DESECRIPTION

CONTROL UNIT (X53-1440-XX)

The CONTROL unit uses two Microprocessors. the Main Microprocessor IC2 : TMP47C46N-9042 and Auxilliary Microprocessor IC3 : μPD75008HC-056. Both utilize 4 bit architecture and have 4K Bytes of ROM available.

The Main Microprocessor controls; frequency, offset, tone, memory frequency, key, switch, encoder, frequency display, DCL system and the Auxilliary Microprocessor. The Auxilliary Microprocessor controls; the voice synthesizer, display/contrl/and memory for telephone number functions, tone frequencies **(K,M)**, audio oscillator, and digital signal conversion and analysis processing for DCL system.

The Main Microprocessor utilizes a serial interface bus to the Auxilliary processor. A CMOS static RAM, IC6 : TC5047AP-1 with a capacity of 1K x 4 bits, is used for external memory storage of operator programmed data such as memory frequencies and telephone number data. It also functions as a data buffer when exchanging data between the Main and Auxilliary processors. Memory addressing is performed by IC5 : TC40H374P with read and write operations being handled by the Data Bus.

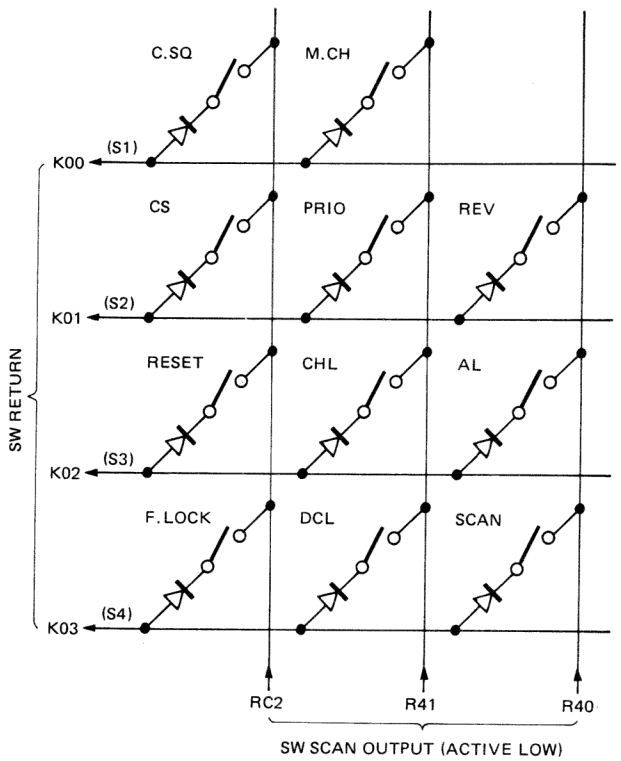


Fig. 10 Diode matrix

Switch Section

With a few exceptions most switch inputs on the front panel are arranged in a diode matrix. The Main Microprocessor reads the inputs via a keyboard status scan system. This system determines which key, if any, has been depressed.

The diode matrix is illustrated in Fig. 10.

The PHONE switch **(K,M)**, P.MR switch **(T,W)** TONE switch, PTT switch, UP switch and DOWN switch all supply inputs directly to the Main Microprocessor.

Keyboard section

Fig. 11 illustrates the keyboard section circuit diagram. The keyboard receives scan pulses from the Main Microprocessor ports P10 thru P13. The current keyboard status is returned via ports R70 thru R73. Pull-up resistors of P10 thru P13 are controlled by port R90. Keyboard status is scanned when R90 is pulled up from logic low by Q3 : DTA114YF.

Display section

Fig. 11 shows the layout of the LCD.

The LCD driver (Keyboard ass'y) is controlled via 8 data lines and 4 control lines on a parallel bus system by the Main and Auxilliary microprocessors.

Data transfer is possible only when the CS line is Low and in conjuction with the leading edge of the WE pulse. The DCL and CQS LED's are lit by transistors Q4 and Q5 which are controlled by the Main Microprocessor.

CIRCUIT DESECRIPTION

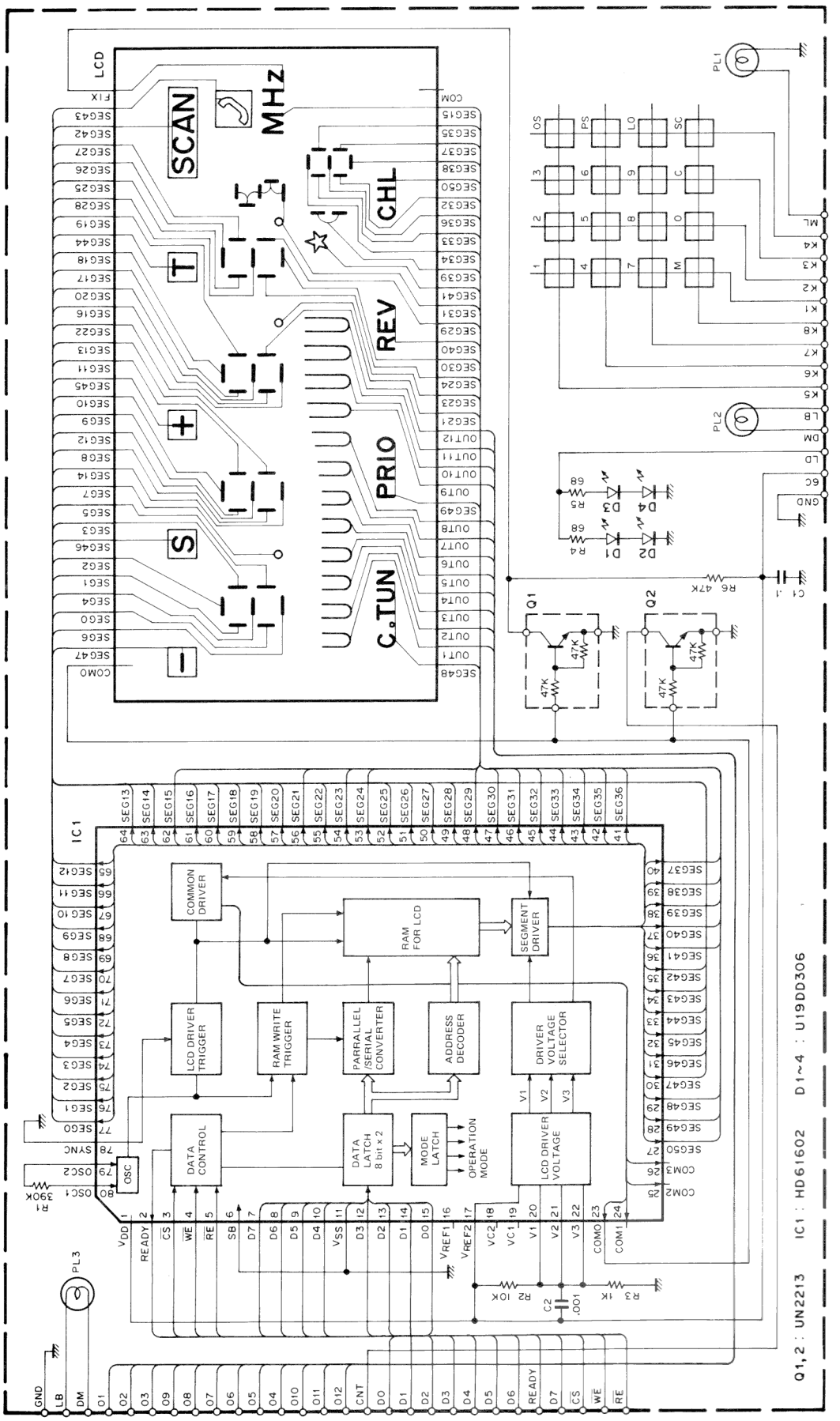


Fig. 11 Keyboard section circuit diagram

CIRCUIT DESECRIPTION

DTMF circuit (K,M Type)

The DTMF (Dual Tone Multiple Frequency) signal is generated by IC4 : LR4087 on the CONTROL unit. Power for the tone generator is obtained from the 8T (8 volts on transmit) line. During receive the IC is grounded preventing unwanted tone generation.

During transmit the non-exclusive port R90 is a logic High, causing pull-up resistors P10 thru P13 to open allowing the DTMF signals to be generated by pressing one of the keyboard keys.

During automatic transmission of telehphone number information port R90 is a logic Low, connecting pull-up resistors P10 thru P13. P10 thru P13 apply a logic High, and P70 thru P73 a logic low, so that the desired DTMF signals are generated. While the DTMF signal is being generated IC4 (CONTROL unit) mutes the normal transmitted audio.

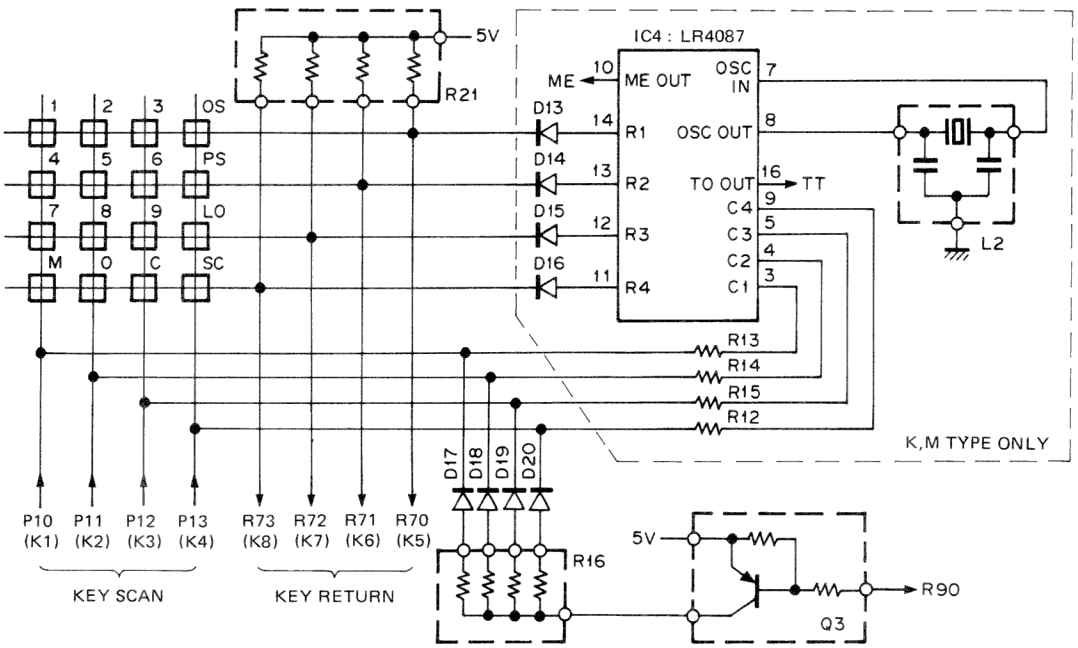


Fig. 12 DTMF circuit

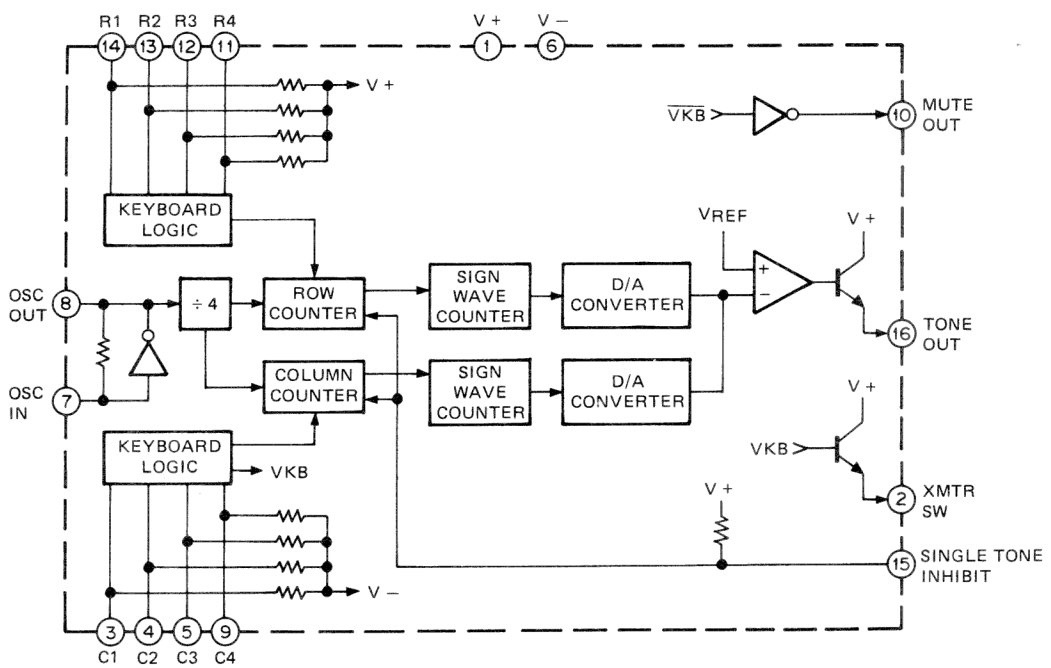


Fig.13 LR4087 Block diagram (Control unit IC4) K, M type only

CIRCUIT DESECRIPTION

PLL and Tone data (K,M type)

PLL and Tone data are sent from the Main Microprocessor on P30 and the Clock signal is on P33. Data and Clock signals are used concurrently. The Enable signal is transmitted on P21 for PLL data and on RC3 for tone data.

Audio Oscillator (CONTROL unit)

An audible confirmation of various keyboard inputs is provided by the TM-2530/50. This audio output is controlled via line P21 of the Auxilliary Microprocessor, IC3. The Oscillator is a portion of IC1 : MC14584BCP and its output is supplied to the COMPOUND unit via the BZ line.

Voice Synthesizer Control Section

The Main Microprocessor (IC2) analyzes inputs from the VOICE unit, and provides control information to the Auxilliary Microprocessor (IC3) necessary for processing the Voice data.

The Auxilliary Microprocessor provides control input and output via data lines PS0 thru PS4, SR and BY.

Rotary Encoder Section

Fig. 14 shows the encoder output waveforms. Waveform B is used as a reference. The phase of waveform A is compared with that of waveform B to determine if the dial base been turned clockwise or counterclockwise. A portion of IC1 is used as a Schmitt trigger to filter out any chattering of the encoder contacts. The inverted waveforms from IC1 are applied to the Main Microprocessor on pins RP0 and RP1, where the phase of the waveforms is compared. the number of input pulses is also counted by the microprocessor to detemine how much of a frequency change has been ordered.

Other Input and Output Sections

1) Standby or push-to-talk

PTT switch status is sent to the Main Microprocessor via the SS terminal on PS1. During manual or automatic transmission a logic Low is supplied on the RA2 line to the COMPOUND unit. This signal turns on the transmit voltage regulator and turns OFF the receive voltage regulator.

2) Microphone UP/DOWN switches

Any switch chattering (Keyboard) is filtered by C11 and C12 and the inputs from the UP and DOWN switch are applied to the Main Microprocessor on pins RB3 and RB2 for processing.

3) Busy indicator (BD)

A signal is supplied from the COMPOUND unit Center Tune circuit to the Main Microprocessor via pin RB2 to indicate when the radio has received an input and squelch has opened.

4) Microphone Muting

In order to prevent inteference to the Digital signals transmitted when using the DCL system the microphone must be muted. This function is controlled by Auxilliary Microprocessor via pin P61.

5) Squelch Switch (SC)

The Main Microprocessor provides a signal to control the Squelch threshold level during Digital Channel Linkage operations. Specifically this occurs when the radio is scanning for an open channel. When the SC terminal is a logic low, VR3 of the COMPOUND unit is used to control the Squelch Threshold.

6) RX Audio Muting (AL)

The Main Micorprocessor provides a logic High on P32 to mute the receive audio during Code Squelch operation, Open Channel search operations, and Priority channel scanning.

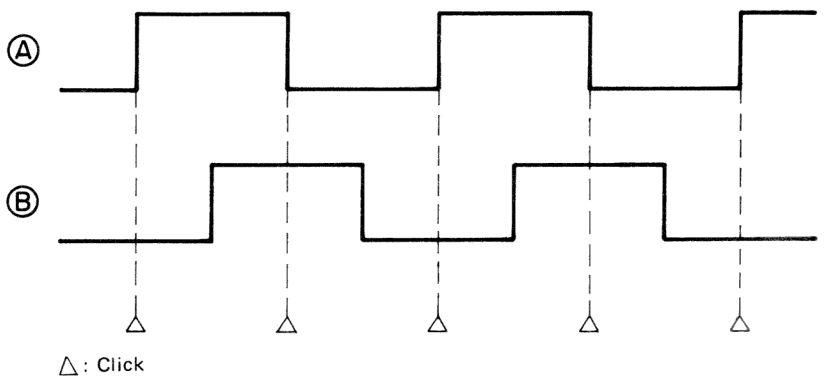


Fig. 14 Encoder output waveforms

CIRCUIT DESECRIPTION

Resetting the Microprocessor

To reset the Main Microprocessor (return to the default settings) ground pin number 49 of the Main Microprocessor. This should normally only be required when replacing the Lithium battery.

The Auxilliary microprocessor is reset by a reset pulse from IC7 : PST520D.

NOTE 2 : The operating system of this radio is in NON-ERASEABLE memory in the microprocessors. Replacing/removing the battery will not require reprogramming of Operating System paramaters. Operator programmed information (telephone numbers, memory frequencies, etc.) will require reentry.

Memory backup

Transistor Q2 : 2SC2458(Y) and zener diode D3 : MTZ7.5JA sense when the voltage supplied to the DC power connector drops below approximately 7.5 Vdc from its normal 13.8 Vdc. If the supply voltage falls below this minimum a control signal is supplied to the HOLD terminal (pin 52) of the Main Microprocessor via a Schmitt trigger. The microprocessor then enters the backup mode and draws power from the Lithium battery.

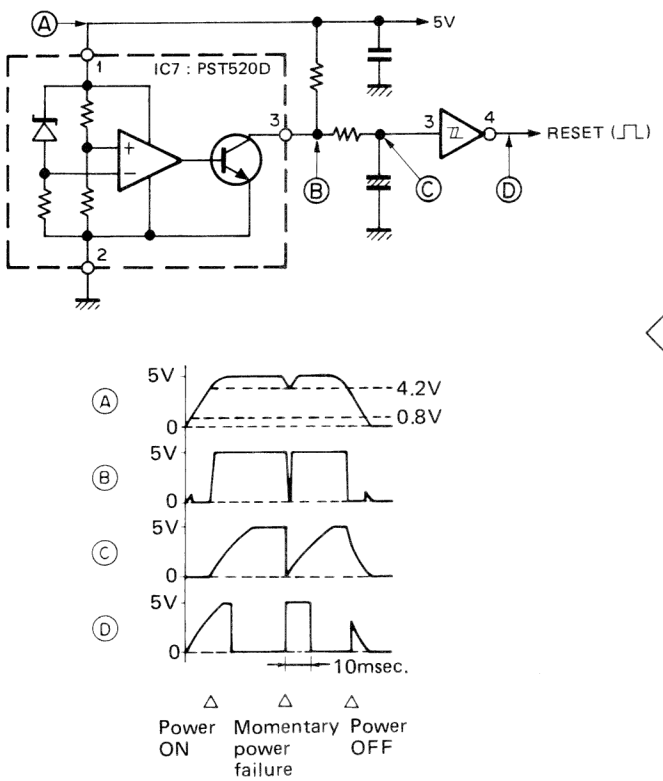


Fig. 15 Reset circuit and waveforms at respective points

DCL Contro System

A block diagram of the DCL control system is shown in Fig. 16

Control of Open Channel searching is performed by the Main Microprocessor. The microprocessor searches for an open channel by controlling the frequency of the receiver section. When an open channel is found the frequency data of that channel is stored into RAM and a control signal is applied to the Auxilliary microprocessor. The Auxilliary microprocessor takes this signal, reads the frequency data that was stored in the RAM, generates the Digital Control signal, and applies this data to the MODEM unit (X57-1140-20). The MODEM unit uses this incoming data to generate the MSK (Minimum Shift Keying) signal which is applied to the COMPOUND unit for transmission.

A portion of the incoming receive signal is applied to the RD terminal of the MODEM unit. The MODEM unit detects the prescence of any Digital Control signal and if present relays it to the Auxilliary Microprocessor.

The Auxilliary microprocessor compares the incoming DCL signal with the preprogrammed DCL data maintained in memory. If the signals are equal a request is made to transfer the incoming data into RAM. The Main microprocessor detects this transfer request and passes the data into RAM, and transmits a signal signifying data has been received, is sounds an audible alarm.

The Main microprocessor performs any frequency shifts or code squelch functions, determined by the incoming data.

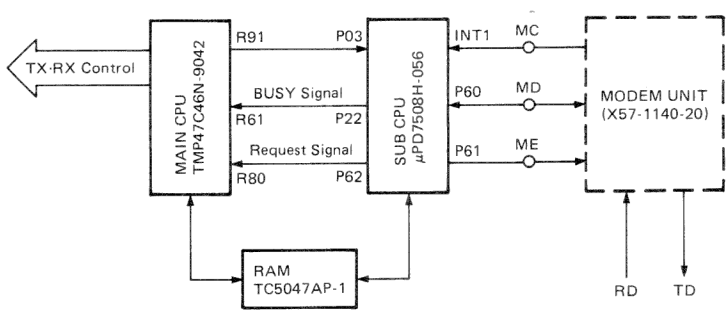


Fig. 16 DCL control system block diagram

CIRCUIT DESECRIPTION

Pin No.	Name	In/Out	Function	Logic	Pin No.	Name	In/Out	Function	Logic
1	RD0	I	Encoder E1		33	P20	O	1750Hz Tone Control **(T,W)**	
2	RD1	I	Encoder E2		34	P21	O	PLL Enable Signal	
3	R40	I/O	Data Bus (D0)		35	P22	O	HD61602 $\overline{RE}$ Signal	
4	R41	I/O	Data Bus (D1)		36	P23	O	HD61602 $\overline{WR}$ Signal	
5	R42	I/O	Data Bus (D2)		37	P30	O	PLL (Tone) Data Output	
6	R43	I/O	Data Bus (D3)		38	P31	O	Squelch Control Signal	
7	R50	I/O	Data Bus (D4)		39	P32	O	Audio Mute Signal	
8	R51	I/O	Data Bus (D5)		40	P33	O	PLL (Tone) Clock Output	
9	R52	I/O	Data Bus (D6)		41	RB0	I	VOICE SW Input	
10	R53	I/O	Data Bus (D7)		42	RB1	I	PHONE **(K,M)** SW input P.MR **(T,W)** SW input	
11	R60	I	HD61602 READY Signal						
12	R61	I	SUB CPU Busy Signal		43	RB2	I	MIC Down SW Input	
13	R62	I	Busy Signal		44	RB3	I	MIC Up SW Input	
14	R63	I	Tone SW Input		45	K00	I	SW Return (S1)	
15	R70	I	16 Key Return (K1)		46	K01	I	SW Return (S2)	
16	R71	I	16 Key Return (K2)		47	K02	I	SW Return (S3)	
17	R72	I	16 Key Return (K3)		48	K03	I	SW Return (S4)	
18	R73	I	16 Key Return (K4)		49	$\overline{RESET}$		Reset Input	
19	RA0	O	Memory Lamp		50	Xin		Clock	
20	RA1	O	RAM OD Signal Output		51	Xout		Clock	
21	RA2	O	Standby Signal Output		52	$\overline{HOLD}$		Back up Information Input	
22	RA3	O	RAM A8 Signal Output		53	R80	I	SUB CPU Request Signal	
23	P00	O	Address Latch		54	R81	I	PTT SW Input	
24	P01	O	RAM $\overline{CE1}$ Signal Output		55	R82	I	DCL Diode Matrix Input	
25	P02	O	HD61602 $\overline{CS}$ Signal Output		56	R83	I	SCAN Timer Trigger pulse	
26	P03	O	RAM CE2 Signal Output		57	R90	O	Keyboard select	
27	P10	O	16 Key Scan (K5)		58	R91	O	Serial Data Output	
28	P11	O	16 Key Scan (K6)		59	R92	O	Serial Clock Output	
29	P12	O	16 Key Scan (K7)		60	RC0	O	LED (DCL) Control	
30	P13	O	16 Key Scan (K8)		61	RC1	O	LED (C.SQ) Control	
31	TEST		GND		62	RC2	O	SW Scan	
32	Vss		GND		63	RC3	O	Tone DATA LOAD Signal	
					64	VDD		Power Supply	

Table 7 TMP47C46N-9042 Terminal functions (Control unit IC2)

Pin No.	Name	In/Out	Function	Logic	Pin No.	Name	In/Out	Function	Logic
1	0OUT		Open		21	CL2		Clock	
2	P20	O	VS-1 PS4		22	INT1	I	Modem Clock Input	
3	P21	O	"Beeper" Switching		23	P00	I	Backup Clock Input	
4	P22	O	MAIN CPU Busy Signal		24	P01	I	Serial Clock Input	
5	P23	O	VS-1 SR		25	P02		Open	
6	P10	O	Adress Latch		26	P03	I	Serial Data Input	
7	P11				27	P60	I/O	Modem Data Input/Output	
8	P12	I	HD61602 READY Signal		28	P61	O	Modem Me Signal Output	
9	P13	O	VS-1 BY		29	P62	O	MAIN CPU Request Signal	
10	P30	O	VS-1 PSO		30	P63	O	RAM A8 Signal Output	
11	P31	O	VS-1 PS1		31	P50	I/O	DATA BUS (D0)	
12	P32	O	VS-1 PS2		32	P51	I/O	DATA BUS (D1)	
13	P33	O	VS-1 PS3		33	P52	I/O	DATA BUS (D2)	
14	P70	O	RAM OD Signal Output		34	P53	I/O	DATA BUS (D3)	
15	P71	O	HD61602 $\overline{CS}$ Signal Output		35	P40	I/O	DATA BUS (D4)	
16	P72	O	RAM and HD61602 R/W		36	P41	I/O	DATA BUS (D5)	
17	P73	O	RAM $\overline{CS1}$ Signal Output		37	P42	I/O	DATA BUS (D6)	
18	RESET		Reset Input		38	P43	I/O	DATA BUS (D7)	
19	CL1		Clock		39	Vss		GND	
20	VDD		Power Supply		40	EVENT		GND	

Table 8 μPD7508H-056 Terminal functions (Control unit IC3)

CIRCUIT DESECRIPTION

TONE unit (X52-1330-20)

Incoming serial data from the Control unit is converted to parallel data by IC2 : MB88306. Serial data on the DT line, and the serial clock is on the CT line. When the ET terminal is high data is transferred, the tone output can be disabled by setting D1 to logic low. This can also be done by switching the ME terminal high.
IC1 : S7116A prevents the tone generator from oscillating outside the specified limits.

MODEM unit (X57-1140-20)

The modem Q3 : μPD65003C-20 uses a clock frequency of 3.6864MHz that is supplied across pins 18 and 19. Pin 13 is used to select transmit or receive operation of the modem. Transmit is selected when pin 13 is high, and receive when it is low. Pin 12 supplies the modem clock (1200Hz) to the MC terminal for transmit and receive clock timing purposes. Data transfers are based on this clock timing. When the transmit mode has been selected data is transferred to pins 1 thru 5 to produce the 1200 or 1800Hz MSK signal. This signal is then digital to analog converted by a ladder resistor network and applied to the TD terminal.
When the MODEM unit is in the receive mode it processes the signal applied to pin 9. This digitized Audio Frequency signal is received from the RD terminal after passing thru a band-pass filter and comparator circuit. This signal is converted by the MODEM unit and transferred thru pin 7, shaped by the LPF and comparator and applied again to pin 8.
The receive data and clock signal that are generated by the modem are based on the data applied to pins 12 and 14.

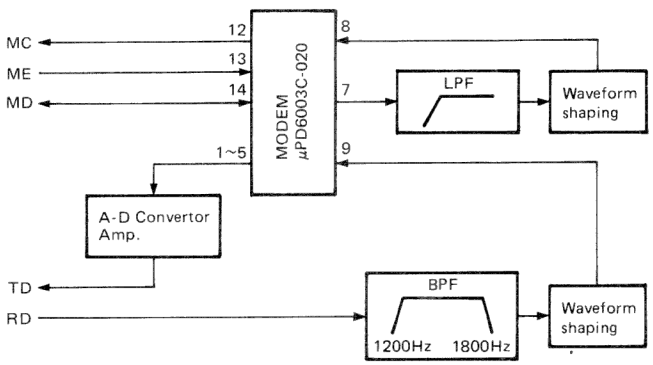


Fig. 17 MODEM unit (X57-1140-20) block diagram

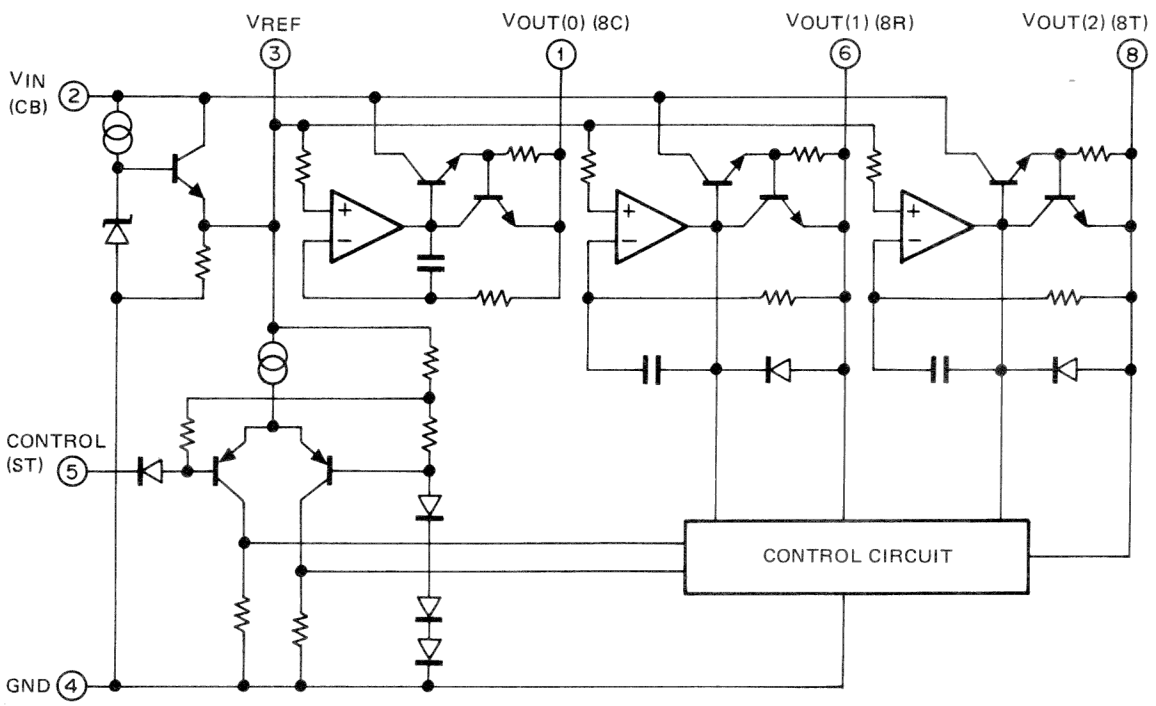


Fig. 18 MB3756 Equivalent circuit (COMP unit IC3)

CIRCUIT DESECRIPTION

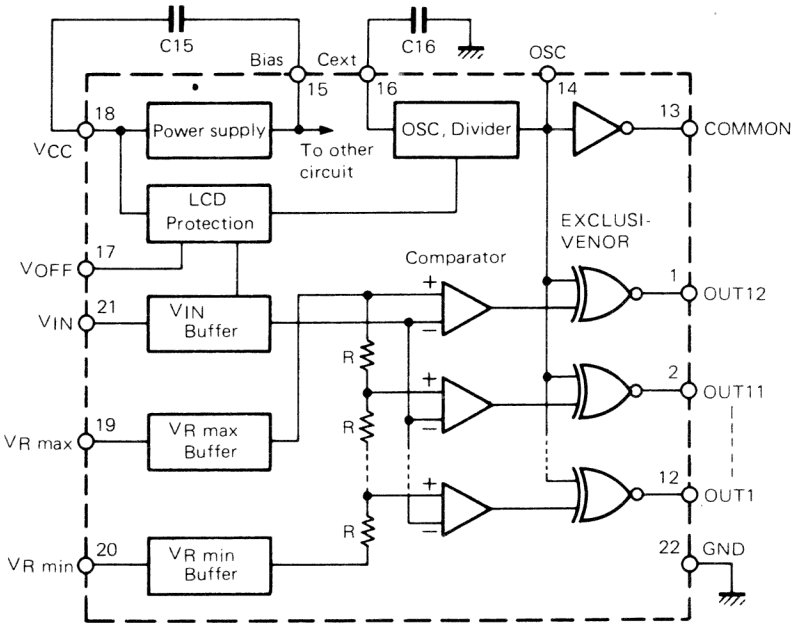


Fig. 19 IR2429 Block diagram (Display unit IC1)

Pin No.	Pin Name	I/O	Pull U/D	Part Name	Pin No.	Pin Name	I/O	Pull U/D	Remarks
3	S10	O	–	LCD		10			Level meter segment output
5	S8					8			
7	S6					6			
8	S5					5			
9	S4					4			
10	S3					3			
11	S2					2			
12	S1					1			
15	BIAS	I	–						Prevents C12 oscillation
16	C		–	GND					External clock is used; C is grounded.
18	VCC		–	Connector J6		8C2	I		8V power supply
19	VREF–MAX								Determines level 10 voltage value.
20	VREF–MIN			GND			I		Determines level 1 voltage value.
21	VIN		D R21	Connector J6		M	I		Meter input (DC)
22	GND	–	–	GND					GND pin

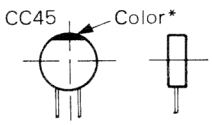
Note: Pins not specified must remain open.

Table 9 IR2429 Terminal functions

PARTS LIST

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

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



- **Capacitor value**

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

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

- **Temperature Coefficient**

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

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

Example CC45TH = −470±60 ppm/°C

- **Tolerance**

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

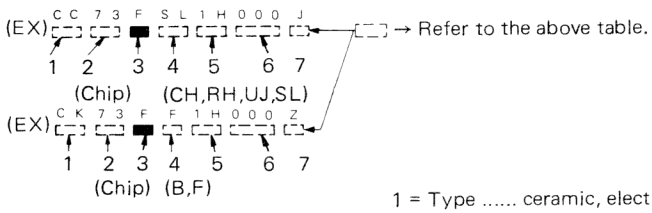
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

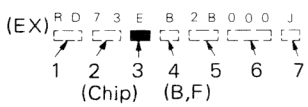
- **Rating voltage**

1st word \ 2nd word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	–
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	–
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	–

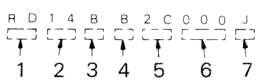
- **Chip capacitors**



- **Chip resistor (Carbon)**



- **Carbon resistor (Normal type)**



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

Dimension

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

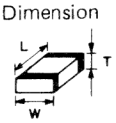
Dimension

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

Rating wattage

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

Dimension



PARTS LIST

SEMICONDUCTOR

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

Item	Re-marks	Part No.
Diode		1N60
		1N60A
		1N4448
		1S1555
		1S1587
		1S2208
		1SS106
		1SS133
		MA856
		MC911
		MC921
		MI308
		MI407
		U15B
		UM9401
Chip diode	N	1SS181
	N	1SS184
Vari-cap		1SV50
Zener diode		MTZ5.6JC
		MTZ6.2JA
		MTZ7.5JA
		MTZ11JC
LED	N	LN38GPL
		LN222RP
		LN322GP
		LN442YP
	N	U19DD306
LCD	N	FSS8066
Thermister		112-502-2
TR	N	2SA790(A)
		2SA1015(Y)
		2SA1048(Y)
		2SC496(Y)
		2SC1775(E)
		2SC2347
		2SC2458(Y)
		2SC2538-22-A
		2SC2668(Y)
		2SC3019

Item	Re-marks	Part No.
		2SD1406(Y)
Chip TR		2SC2712(BL)
		2SC2712(K)
		2SC2712(Y)
		2SC2714(Y)
Digital TR		2SC3295(B)
		DTA114YF
		DTC114ES
		DTC124EF
		DTC143TS
	N	UN2213
FET		2SK30A(O)
		2SK125
		2SK192A(GR)*P
		3SK74(L)
		3SK129(S)
Power module		M57726
		M57737
IC	N	HD61602
		IR2429
		LR4087
		MB3756
		MC14584BCP
		MC145151P
		MC145155P*K
		NE555P
		NJM78M06A
		NJM4558M
		PST520D
	N	TA7761P
		TC40H374P
		TC5047AP-1
		TMP47C46N-9042
	N	μPC1241H
		μPD7508HC-056

	TM-2550A (K1,M1,M3)	TM-2550E (T,W)	TM-2530A (K2,M2,M4)
FINAL UNIT	X45-1440-10	X45-1440-10	X45-1440-11
PLL UNIT	X50-2030-10	X50-2030-51	X50-2030-11
CONTROL UNIT	X53-1440-10 (K1,M1) X53-1440-21 (M3)	X53-1440-51 (T) X53-1440-61 (W)	X53-1440-10 (K2,M2) X53-1440-21 (M4)
DISPLAY UNIT	X54-1860-10	X54-1860-10	X54-1860-10
COMPOUND UNIT	X60-1280-10	X60-1280-51	X60-1280-10

PARTS LIST

* 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
			TM-2550A/E, TM-2530A GENERAL		
1	1G,2F	*	A01-0996-02	METALLIC CABINET (TOP)	
2	3G	*	A01-0997-02	METALLIC CABINET (BOTTOM)	
3	2B,3F	*	A20-2550-03	PANEL ASSY	K1,K2,M1-M4
3	2B	*	A20-2559-03	PANEL ASSY	T1,W1
4	2A	*	A21-0791-04	DRESSING PANEL (KEYBOARD)	
5	2A	*	A21-0795-04	DRESSING PANEL (DCL)	
-		*	A13-0666-02	MOUNTAIN BRACKET ASSY (R) ACSY	
-		*	A13-0667-02	MOUNTAIN BRACKET ASSY (L) ACSY	
-		*	A13-0668-04	MOUNTAIN HARDWARE	
		*	B11-0436-04	REFLECTION GLASS (DCS,CSQ)	
10	2F,2G	*	B01-0655-03	SIDE ESCUTCHEON	
11	1F	*	B04-0411-04	SP METAL	
12	1F		B05-0708-04	SP SARAN NET	
13	2F	*	B10-0675-04	FRONT GLASS	
14	3G	*	B40-3610-04	MODEL NAME PLATE	K1,M1,M3
14	3G	*	B40-3611-04	MODEL NAME PLATE	T1,W1
14	3G	*	B40-3619-04	MODEL NAME PLATE	K2,M2,M4
15	2A	*	B43-1057-04	BADGE	K1,M1,M3
15	2A	*	B43-1058-04	BADGE	T1
15	2A	*	B43-1059-04	BADGE	W1
15	2A	*	B43-1060-04	BADGE	K2,M2,M4
-		*	B11-0429-04	LIGHT GUIDING PLATE (AL)	
-		*	B11-0430-04	LIGHT GUIDING PLATE (P.MR)	T1,W1
-		*	B11-0431-04	LIGHT GUIDING PLATE (F.LOCK)	
-		*	B11-0432-04	LIGHT GUIDING PLATE (PHONE)	K1,K2,M1-M4
-		*	B11-0433-04	LIGHT GUIDING PLATE (MAIN)	
-		*	B11-0434-04	REFLECTION GLASS(ON AIR/F.LOCK	
-			B46-0410-00	WARRANTY CARD	K1,K2
-		*	B50-8039-00	INSTRUCTION MANUAL	K1,K2,M1-M4,W1
-		*	B50-8040-00	INSTRUCTION MANUAL	T1
-		*	E30-2022-15	DC CORD ASSY (ACSY)	
20	2G		F10-1206-04	GROUNDING SPRING	
21	1C		F15-0649-04	SHADE SHEET (KEYBOARD PCB)	
-			F05-1031-05	FUSE (10A) ACSY	K1,M1,M3,T1,W1
-			F05-8021-05	FUSE (8A) ACSY	K2,M2,M4
-			F20-0521-04	INSULATE PLATE (B)LITHIUM BTRY	
26			G01-0818-04	COMPRESSION SPRING (KNOB)	
27			G02-0505-05	KNOB FITTING SPRING (AF/SQ)	
28	1C	*	G10-0642-04	SHADE CLOTH	
-		*	G11-0616-04	SHADE SHEET (F. LOCK)	
-		*	G13-0823-04	CUSHION (MOUNTING BRACKET ACSY	
-		*	H01-4671-03	ITEM CARTON BOX (INSIDE)	K1,M1,M3
-		*	H01-4672-03	ITEM CARTON BOX (INSIDE)	T1
-		*	H01-4673-03	ITEM CARTON BOX (INSIDE)	W1
-		*	H01-4674-03	ITEM CARTON BOX (INSIDE)	K2,M2,M4
-			H03-2268-04	OUTER PACKING CASE	K1,M1,M3
-			H03-2269-04	OUTER PACKING CASE	T1,W1
-			H03-2270-04	OUTER PACKING CASE	K2,M2,M4
-			H10-2501-03	POLYSTYRENE FOAMED FIXTURE	
-		*	H10-2608-02	POLYSTYRENE FOAMED FIXTURE	K1,M1,M3,T1,W1
-		*	H10-2609-02	POLYSTYRENE FOAMED FIXTURE	K2,M2,M4

PARTS LIST

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

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向
-			H25-0029-04	PROTECTION BAG (SCREW,NUT ETC)	
-			H25-0103-04	PROTECTION BAG (MIC,MNT BRKT)	
-			H25-0106-04	PROTECTION BAG	
-			H25-0116-04	PROTECTION BAG (ACSY)	
-			H25-0117-04	PROTECTION BAG (DC CORD)	
33	1F		J21-1144-24	SP MOUNTING HARDWARE (KEY/PC)	
34	1C	*	J21-4182-04	MOUNTING HARDWARE	
35	1B,2B		J29-0409-04	SW KNOBS GUIDE (KNOB)	
-			J02-0439-05	FOOT (ACSY)	
-			J19-1346-04	MIC HOOK (ACSY)	
-			J61-0408-05	WIRE BAND	
40	3F	*	K21-0779-05	KNOB (MAIN)	
41	3F	*	K23-0779-04	KNOB (AF,SQ)	
42	2A	*	K29-3039-05	KNOB ASSY (PUSH SW)	
43	2A	*	K29-3044-05	KNOB ASSY (TACT SW)	
45			N14-0526-14	ROUND NUT (VOL)	
-			N09-0008-04	HEX HEAD SCREW (ACSY)	
-			N09-0632-05	TAPTITE SCREW (ACSY)	
-			N14-0510-04	FLANGE NUT (ACSY)	
-			N15-1040-45	FLAT WASHER	
-			N15-1060-46	FLAT WASHER (ACSY)	
-			N16-0060-46	SPRING WASHER (ACSY)	
-			N87-4008-41	BRAZIER TAPTITE SCREW (ACSY)	
-			N99-0304-04	SCREW WITH HEX HOLE (MNT BRKT)	
D			N09-0697-05	SEMUS SCREW (PANEL)	
K			N29-0301-04	STOPPER RING (TACT KNOB)	
-			S50-1406-05	TAKT SW FOR MICROHONE(UP/DOWN)	
48	1F	*	T07-0240-05	LOUDSPEAKER(FULLRANGE)	
-			T91-0331-05	MICROPHONE (ACSY)	K1,K2,M1-M4,W1
-			T91-0335-05	MICROPHONE (ACSY)	T1
50	1C	*	W02-0371-05	ROTARY ENCODER	
-			W01-0401-05	HEX WRENCH (ACSY)	
-			W09-0326-05	LITHIUM BATTERY(BR2032)	
55	2D,2G		X45-1440-10	FINAL UNIT (TM-2550A/E)	K1,M1,M3,T1,W1
55	2D,2G	*	X45-1440-11	FINAL UNIT (TM-2530A)	K2,M2,M4
56	2G	*	X50-2030-10	PLL UNIT (TM-2550A)	K1,M1,M3
56	2G	*	X50-2030-11	PLL UNIT (TM-2530A)	K2,M2,M4
56	2G	*	X50-2030-51	PLL UNIT (TM-2550E)	T1,W1
57	3F	*	X53-1440-10	CONTROL UNIT	K1,K2,M1,M2
57	3F	*	X53-1440-21	CONTROL UNIT	M3,M4
57	3F	*	X53-1440-51	CONTROL UNIT	T1
57	3F	*	X53-1440-61	CONTROL UNIT	W1
58	1B,1C	*	X54-1860-10	DISPLAY UNIT	
59	2G	*	X60-1280-10	COMPOUND UNIT	K1,K2,M1-M4
59	2G	*	X60-1280-51	COMPOUND UNIT	T1,W1
FINAL UNIT (X45-1440-XX) -10 : K1,M1,M3,T1,W1 -11 : K2,M2,M4					
C1			CC45SL2H080D	CERAMIC 8.0PF D	K2,M2,M4
C2			CC45SL2H150J	CERAMIC 15PF J	
C3			CC45SL2H050C	CERAMIC 5.0PF C	K1,M1,M3,T1,W1
C3			CC45SL2H060D	CERAMIC 6.0PF D	K2,M2,M4
C4			CK45B2H102K	CERAMIC 1000PF K	

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C5			CC45SL2H220J	CERAMIC 22PF J	
C6			CC45CH2H010C	CERAMIC 1.0PF C	
C7 -9			CC45SL2H220J	CERAMIC 22PF J	
C10			CC45CH1H010C	CERAMIC 1.0PF C	
C11 ,12			CC45SL2H100D	CERAMIC 10PF D	
C13			CE04W1C220M	ELECTRO 22UF 16WV	
C14			CK45B1H102K	CERAMIC 1000PF K	
C15			CE04W1C220M	ELECTRO 22UF 16WV	
C16 -19			CK45B1H102K	CERAMIC 1000PF K	
C21 -25			CK45B1H102K	CERAMIC 1000PF K	
C26			CS15E1C3R3M	TANTAL 3.3UF 16WV	
C27			C91-0667-05	CERAMIC 0.0047UF K	
C28			CK45B1H102K	CERAMIC 1000PF K	
C29			C91-0667-05	CERAMIC 0.0047UF K	
C30 -34			CK45B1H102K	CERAMIC 1000PF K	
100	3E		E04-0161-05	M TYPE RECEPTACLE	
101	2D		E11-0401-05	EAR PHONE JACK	
102	3D,2G		E30-2021-25	POWER SUPPLY CORD	
105	2E,1G	*	F01-0931-05	HEAT SINK	K1,M1,M3,T1,W1
105	2E,1G	*	F01-0935-05	HEAT SINK	K2,M2,M4
F1			F05-1031-05	FUSE (10A)	K1,M1,M3,T1,W1
F1			F05-8021-05	FUSE (8A)	K2,M2,M4
108	1D	*	J11-0409-05	WIRE CLAMPER	
109	3D		J41-0017-05	BUSHING (CORD)	
L1			L34-1020-05	COIL (ø3,3.5)	
L2			L34-0908-05	COIL (ø3,3.5T)	
L3			L34-0692-05	COIL (ø5,4T)	
L4			L34-0452-05	COIL (ø3,6T)	
L5			L34-0908-05	COIL (ø3,3.5T)	
L6			L34-0742-05	COIL (ø3,5T)	
L7			L34-0823-05	COIL (ø5,3T)	
L8 ,9			L40-1092-14	SMALL FIXED INDUCTOR (1UH)	
M			N09-0623-04	SCREW (SEMUSE)	
N			N09-0626-04	SCREW (SEMUSE)	
			R92-0150-05	JUMPER REST 0 OHM	
R2			RD14DB2H151J	SMALL-RD 150 J 1/2W	K1,M1,M3,T1,W1
R2			RD14DB2H181J	SMALL-RD 180 J 1/2W	K2,M2,M4
VR1			R12-0434-05	TRIMMING POT. (100OHM)	
VR2			R12-4417-05	TRIMMING POT. (50KOHM)	
VR3			R12-3455-05	TRIMMING POT. (10KOHM)	
VR4			R12-4417-05	TRIMMING POT. (50KOHM)	
D1			U15B	DIODE	
D2			MI407	DIODE	K2,M2,M4
D2			UM9401	DIODE	K1,M1,M3,T1,W1
D3			MI308	DIODE	
D4 ,5			1S1587	DIODE	
Q1			M57726	POWER MODULE	K1,M1,M3,T1,W1
Q1			M57737	POWER MODULE	K2,M2,M4
Q2			2SD1406(Y)	TRANSISTOR	
Q3			2SA1015(Y)	TRANSISTOR	
Q4 -7			2SC2458(Y)	TRANSISTOR	

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PLL UNIT (X50-2030-XX) -10 : K1,M1,M3 -11 : K2,M2,M4 -51 : T1,W1					
C1			C91-0117-05	CERAMIC 0.01UF K	
C2			CS15E1VR47M	TANTAL 0.47UF 35WV	
C4			CF92V1H683J	MF 0.068UF J	
C5			C91-1008-05	CERAMIC 0.011UF K	
C6 ,7			CS15E1C2R2M	TANTAL 2.2UF 16WV	
C8			CQ92M1H393K	MYLAR 0.039UF K	
C9 ,10			CS15E1E010M	TANTAL 1.0UF 25WV	
C11			CK45B1H102K	CERAMIC 1000PF K	
C12			CC45CH1H150J	CERAMIC 15PF J	
C13			CC45CH1H0R5C	CERAMIC 0.5PF C	
C14			CC45CH1H100D	CERAMIC 10PF D	
C15			CC45CH1H080D	CERAMIC 8.0PF D	
C16			CC45CH1H030C	CERAMIC 3.0PF C	
C17			CC45CH1H100D	CERAMIC 10PF D	
C18			C91-0117-05	CERAMIC 0.01UF K	
C19			CE04W1A470M	ELECTRO 47UF 10WV	
C20			CC45CH1H020C	CERAMIC 2.0PF C	
C21			CC45CH1H040C	CERAMIC 4.0PF C	
C22			CK45B1H102K	CERAMIC 1000PF K	
C23			CE04W1A470M	ELECTRO 47UF 10WV	
C24			CC45CH1H330J	CERAMIC 33PF J	
C25			CK45B1H102K	CERAMIC 1000PF K	
C26			CE04W1A470M	ELECTRO 47UF 10WV	
C27			C91-0117-05	CERAMIC 0.01UF K	
C28 ,29			CK45B1H102K	CERAMIC 1000PF K	
C30			C91-0117-05	CERAMIC 0.01UF K	
C31 ,32			CK45B1H102K	CERAMIC 1000PF K	
C33			C91-0117-05	CERAMIC 0.01UF K	
C35			CE04W1C100M	ELECTRO 10UF 16WV	
C36			C91-0117-05	CERAMIC 0.01UF K	
C37 ,38			CK45B1H102K	CERAMIC 1000PF K	
C39 ,40			C91-0117-05	CERAMIC 0.01UF K	
C41			CE04W1H4R7M	ELECTRO 4.7UF 50WV	
C42			C91-0667-05	CERAMIC 0.0047UF K	
C43			CK45B1H471K	CERAMIC 470PF K	
C44			CC45CH1H270J	CERAMIC 27PF J	
C46			CC45CH1H020C	CERAMIC 2.0PF C	
C47			C91-0765-05	CERAMIC 0.0047UF M	
C48			CK45B1H102K	CERAMIC 1000PF K	
C50			CQ92M1H223K	MYLAR 0.022UF K	
C51 ,52			CS15E1C2R2M	TANTAL 2.2UF 16WV	
C53			CE04W1A470M	ELECTRO 47UF 10WV	
C54			C91-0117-05	CERAMIC 0.01UF K	
C55			CK45B1H102K	CERAMIC 1000PF K	
C57			CE04W1A470M	ELECTRO 47UF 10WV	
C58			CK45B1H102K	CERAMIC 1000PF K	
C59			CC45CH1H020C	CERAMIC 2.0PF C	
C60			CC45CH1H120J	CERAMIC 12PF J	
C61			CC45CH1H100D	CERAMIC 10PF D	
C62			CC45CH1H070D	CERAMIC 7.0PF D	
C63			CE04W1A101M	ELECTRO 100UF 10WV	
C64			C91-0117-05	CERAMIC 0.01UF K	
C65			CC45CH1H030C	CERAMIC 3.0PF C	

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C66			CC45CH1H120J	CERAMIC 12PF J	
C67			CC45CH1H030C	CERAMIC 3.0PF C	
C68 ,69			CK45B1H102K	CERAMIC 1000PF K	
C70			CC45CH1H330J	CERAMIC 33PF J	
C71			CC45CH1H040C	CERAMIC 4.0PF C	
C72			CK45B1H102K	CERAMIC 1000PF K	
C73			CK45B1H471K	CERAMIC 470PF K	
C74			CS15E1E010M	TANTAL 1.0UF 25WV	
C75			C91-0757-05	CERAMIC 0.001UF K	
C76			CC45CH1H330J	CERAMIC 33PF J	
C77			CE04W1A470M	ELECTRO 47UF 10WV	
C78 ,79			C91-0117-05	CERAMIC 0.01UF K	
C80			CK45B1H471K	CERAMIC 470PF K	
C81 ,82			CC45CH1H270J	CERAMIC 27PF J	
C83			CK45B1H102K	CERAMIC 1000PF K	
C84			CC45CH1H030C	CERAMIC 3.0PF C	
C85			CC45CH1H0R5C	CERAMIC 0.5PF C	
C86			C91-0117-05	CERAMIC 0.01UF K	
C87			CC45CH1H040C	CERAMIC 4.0PF C	
C88			CC45CH1H180J	CERAMIC 18PF J	
C89			CC45CH1H220J	CERAMIC 22PF J	
C90 ,91			C91-0117-05	CERAMIC 0.01UF K	
C92			CC45CH1H070D	CERAMIC 7.0PF D	T1,W1
C92			CC45CH1H121J	CERAMIC 120PF J	K1,K2,M1–M4
C93			C91-0117-05	CERAMIC 0.01UF K	
C95			CK45B1H102K	CERAMIC 1000PF K	T1,W1
C96			CK45B1H102K	CERAMIC 1000PF K	
C97			C91-0117-05	CERAMIC 0.01UF K	
C99			CC45CH1H270J	CERAMIC 27PF J	
C100			CC45SL1H101J	CERAMIC 100PF J	
C101			CC45CH1H070D	CERAMIC 7.0PF D	
C102			CC45CH1H220J	CERAMIC 22PF J	K1,M1,M3,T1,W1
TC1			C05-0062-05	TRIMMING CAP (6PF)	
TC2 ,3			C05-0030-15	TRIMMING CAP (20PF)	
TC4			C05-0062-05	TRIMMING CAP (6PF)	
TC5			C05-0067-05	TRIMMING CAP (25PF)	T1,W1
			E04-0154-05	RF COAXIAL CABLE RECEPTACLE	
L1			L40-3391-03	SMALL FIXED INDUCTOR (3.3UH)	
L2		*	L32-0682-05	OSCILLATING COIL (3.5T)	
L3			L40-1021-03	SMALL FIXED INDUCTOR (1UH)	
L4			L34-0894-05	COIL (5T)	
L5			L34-0893-05	COIL (4T)	
L6			L34-0894-05	COIL (5T)	
L7			L34-0893-05	COIL (4T)	
L8			L40-3391-14	SMALL FIXED INDUCTOR (3.3UH)	
L9			L40-3391-03	SMALL FIXED INDUCTOR (3.3UH)	
L10			L32-0664-05	OSCILLATING COIL (4.5T)	
L11			L40-1092-14	SMALL FIXED INDUCTOR (1UH)	
L12			L34-1025-05	COIL (5.5T)	
L13			L40-3391-14	SMALL FIXED INDUCTOR (3.3UH)	
L14 ,15			L34-2035-05	COIL (TUNING)	
L16			L40-4701-14	SMALL FIXED INDUCTOR (47UH)	T1,W1
L17		*	L32-0681-05	OSCILLATING COIL	

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L18			L77-1290-05	CRYSTAL RESONATOR (39.48MHZ)	
R39			RD14DB2H220J	SMALL-RD 22 J 1/2W	K1,M1,M3,T1,W1
R39			RD14DB2H330J	SMALL-RD 33 J 1/2W	K2,M2,M4
R94		*	R90-0600-05	CAPACITOR BLOCK	
D1			1S1555	DIODE	
D2			1SV50	VARI CAP	
D3			1S2208	DIODE	
D4			1S1555	DIODE	
D5			1SV50	VARI CAP	
D6			MTZ6.2JA	ZENER DIODE	
D7			MA856	DIODE	T1,W1
IC1			MC145151P	IC	
IC2			MC145155P*K	IC	
Q1			2SC2458(Y)	TRANSISTOR	
Q2			2SA1048(Y)	TRANSISTOR	
Q3 -5			2SC1775(E)	TRANSISTOR	
Q6 ,7			2SC2668(Y)	TRANSISTOR	
Q8			2SK125	FET	
Q9			2SC2458(Y)	TRANSISTOR	
Q10			2SC2668(Y)	TRANSISTOR	
Q11			2SC2347	TRANSISTOR	
Q12			2SC2538-22-A	TRANSISTOR	K2,M2,M4
Q12			2SC3019	TRANSISTOR	K1,M1,M3,T1,W1
Q13			2SK30A(O)	FET	
Q14 ,15			2SC2458(Y)	TRANSISTOR	
Q16			2SK192A(GR)*P	FET	
Q17 -22			2SC2668(Y)	TRANSISTOR	
Q23			2SC2458(Y)	TRANSISTOR	T1,W1
CONTROL UNIT (X53-1440-XX) -10 : K1,K2,M1,M2 -21 : M3,M4 -51 : T1 -61 : W1					
C1			CK45B1H102K	CERAMIC 1000PF K	K1,K2,M1-M4
C2			CE04CW1A330M	ELECTRO 33UF 10WV	K1,K2,M1-M4
C3			CE04W1A101M	ELECTRO 100UF 10WV	
C4			C91-1008-05	CERAMIC 0.022PF	
C5			CE04W1A470M	ELECTRO 47UF 10WV	
C6			CS15E1A100M	TANTAL 10UF 10WV	
C7			CK45B1H681K	CERAMIC 680PF K	
C8			CK45B1H102K	CERAMIC 1000PF K	
C9			CK45B1H182K	CERAMIC 1800PF K	
C10 -16			C91-1008-05	CERAMIC 0.022PF	
C17			CE04W1E3R3M	ELECTRO 3.3UF 25WV	
C18			CE04W1H010M	ELECTRO 1.0UF 50WV	K1,K2,M1-M4
C19 ,20			C91-1008-05	CERAMIC 0.022PF	
C23 ,24			C91-1008-05	CERAMIC 0.022PF	
C25 -28			CK45B1H102K	CERAMIC 1000PF K	
L1			L78-0013-05	RESONATOR (4.19MHZ)	
L2			L78-0012-05	RESONATOR (3.58MHZ)	K1,K2,M1-M4
L3			L78-0013-05	RESONATOR (4.19MHZ)	
R8			R90-0202-05	MULTI-COMP 47KX4 J 1/6W	
R16			R90-0286-05	MULTI-COMP 4.7KX4 J 1/6W	
R19			R90-0233-05	MULTI-COMP 10KX4 J 1/6W	
R20			R90-0281-05	MULTI-COMP 10KX6 J 1/6W	
R21			R90-0291-05	MULTI-COMP 100KX4 J 1/6W	
R22			R90-0595-05	MULTI-COMP	

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R35			R90-0594-05	MULTI-COMP	
VR1			R12-7408-05	TRIMMING POT. (500KOHM)	
D1			MC911	DIODE	
D2			1N4448	DIODE	
D2			1S1555	DIODE	
D3			MTZ7.5JA	ZENER DIODE	
D4 -8			1N4448	DIODE	
D4 -8			1S1555	DIODE	
D9			1N4448	DIODE	K1,K2,M1,M2,W1
D9			1S1555	DIODE	K1,K2,M1,M2,W1
D10			1N4448	DIODE	T1,W1
D10			1S1555	DIODE	T1,W1
D11			1N4448	DIODE	
D11			1S1555	DIODE	
D12			1N4448	DIODE	T1,W1
D12			1S1555	DIODE	T1,W1
D13 -16			1N4448	DIODE	K1,K2,M1-M4
D13 -16			1S1555	DIODE	K1,K2,M1-M4
D17 -21			1N4448	DIODE	
D17 -21			1S1555	DIODE	
D22			1N4448	DIODE	K1,K2,M1-M4
D22			1S1555	DIODE	K1,K2,M1-M4
D23			MTZ5.6JC	ZENER DIODE	K1,K2,M1-M4
D24			1N4448	DIODE	
D24			1S1555	DIODE	
D25 ,26			1SS106	DIODE	
D27			1N4448	DIODE	
D27			1S1555	DIODE	
D28			1N4448	DIODE	K1,K2,M1-M4
D28			1S1555	DIODE	K1,K2,M1-M4
D29			1SS133	DIODE	
IC1			MC14584BCP	IC	
IC2			TMP47C46N-9042	IC(CPU)	
IC3			UPD7508HC-056	IC(CPU)	
IC4			LR4087	IC	K1,K2,M1-M4
IC5			TC40H374P	IC	
IC6			TC5047AP-1	IC	
IC7			PST520D	IC(LOW POWER RESET)	
Q1			DTC124EF	DIGITAL TRANSISTOR	K1,K2,M1-M4
Q2			2SC2458(Y)	TRANSISTOR	
Q3			DTA114YF	DIGITAL TRANSISTOR	K1,K2,M1-M4
Q4 ,5			DTA114YF	DIGITAL TRANSISTOR	
Q6			DTC143TY	DIGITAL TRANSISTOR	K1,K2,M1-M4
DISPLAY UNIT (X54-1860-10)					
C1 -7			CK45B1H102K	CERAMIC 1000PF K	
C8			CE04CW1C4R7M	ELECTRO 4.7UF 16WV	
C9 -11			CK45B1H102K	CERAMIC 1000PF K	
C12 -14			CK73FB1H102K	CHIP C 1000PF K	
			E06-0858-05	8P MIC CONNECTOR	
-			J61-0408-05	WIRE BAND	
			R92-0150-05	JUMPER REST 0 OHM	
VR1		*	R05-3436-05	POTENTIOMETER(10KOHM WITH SW)	

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VR2		*	R05-4415-05	POTENTIOMETER (50KB)SQ	
-		*	S59-0435-05	KEY BOARD ASSY	
S1 -3			S40-2443-05	PUSH SWITCH (LOCK)	
S4 ,5			S40-2444-05	PUSH SWITCH (NON-LOCK)	
S6 ,7			S40-2443-05	PUSH SWITCH (LOCK)	
S8			S40-2444-05	PUSH SWITCH (NON-LOCK)	
S9 -16			S50-1426-05	SENSITIVE SWITCH (TACT)	
-		*	FSS8066	LCD (KEYBOARD ASSY)	
-		*	HD61602	IC (KEYBOARD ASSY)	
-		*	UN2213	DIGITAL TR (KEYBOARD ASSY)	
-		*	U19DD306	LED (KEYBOARD ASSY)	
D1 -5			1N4448	DIODE	
D1 -5			1S1555	DIODE	
D6 ,7			MC921	LED	
D8 ,9			1N4448	DIODE	
D8 ,9			1S1555	DIODE	
D10 -13		*	LN38GPL	LED	
D14			LN222RP	LED (RED)	
D15			LN322GP	LED (GREEN)	
D16 ,17			LN442YP	LED (YELLOW)	
IC1			IR2429	IC	
Q1			DTC124EF	DIGITAL TRANSISTOR	
Q2		*	2SA790(A)	TRANSISTOR	
MIC AMP. (X59-1000-10)					
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W	
R2			RK73FB2A221J	CHIP R 220 J 1/10W	
R3			RK73FB2A104J	CHIP R 100K J 1/10W	
R4			RK73FB2A153J	CHIP R 15K J 1/10W	
R5			RK73FB2A333J	CHIP R 33K J 1/10W	
R6 -8			RK73FB2A224J	CHIP R 220K J 1/10W	
R9			RK73FB2A474J	CHIP R 470K J 1/10W	
R10			RK73FB2A153J	CHIP R 15K J 1/10W	
R11			RK73FB2A562J	CHIP R 5.6K J 1/10W	
R12			RK73FB2A184J	CHIP R 180K J 1/10W	
R13			RK73FB2A224J	CHIP R 220K J 1/10W	
R14			RK73FB2A474J	CHIP R 470K J 1/10W	
C1			CC73FSL1H390J	CHIP C 39PF	
C2			CK73FB1H152K	CHIP C 0.0015UF	
C3			CC73FSL1H331K	CHIP C 330PF	
C4			CC73FSL1H561K	CHIP C 560PF	
C5			CC73FSL1H331K	CHIP C 330PF	
D1		*	1SS184	CHIP DIODE	
D2		*	1SS181	CHIP DIODE	
IC1			NJM4558M	IC(OP AMP X2)	
Q1			2SC2712(Y)	CHIP TR	
MIC AMP., S-METER (X59-1010-10)					
R1			RK73FB2A473J	CHIP R 47K J 1/10W	
R2			RK73FB2A474J	CHIP R 470K J 1/10W	
R3			RK73FB2A473J	CHIP R 47K J 1/10W	
R4			RK73FB2A474J	CHIP R 470K J 1/10W	
R5			RK73FB2A224J	CHIP R 220K J 1/10W	
R6			RK73FB2A184J	CHIP R 180K J 1/10W	

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R7			RK73FB2A473J	CHIP R 47K J 1/10W	
R8			RK73FB2A472J	CHIP R 4.7K J 1/10W	
R9			RK73FB2A103J	CHIP R 10K J 1/10W	
R10			RK73FB2A822J	CHIP R 8.2K J 1/10W	
C1			CK45FB1H472K		
D1			1SS184	CHIP DIODE	
D2			1SS181	CHIP DIODE	
IC1			NJM4558M	IC(OP AMP X2)	
ALERT, VACANT CH. (X59-1020-10)					
R1			RK73FB2A103J	CHIP R 10K J 1/10W	
R2			RK73FB2A472J	CHIP R 4.7K J 1/10W	
R3			RK73FB2A223J	CHIP R 22K J 1/10W	
R4			RK73FB2A273J	CHIP R 27K J 1/10W	
R5 -7			RK73FB2A103J	CHIP R 10K J 1/10W	
C1			CK73FB1H102K	CHIP C 0.001UF	
D1			1SS181	CHIP DIODE	
Q1 -4			2SC2712(Y)	CHIP TRANSISTOR	
CENTER DETECTOR (X59-1030-10)					
R1			RK73FB2A224J	CHIP R 220K J 1/10W	
R2			RK73FB2A222J	CHIP R 2.2K J 1/10W	
R3			RK73FB2A332J	CHIP R 3.3K J 1/10W	
R4			RK73FB2A333J	CHIP R 33K J 1/10W	
R5 ,6			RK73FB2A104J	CHIP R 100K J 1/10W	
R7			RK73FB2A563J	CHIP R 56K J 1/10W	
R8			RK73FB2A102J	CHIP R 1.0K J 1/10W	
R9 ,10			RK73FB2A103J	CHIP R 10K J 1/10W	
R11			RK73FB2A102J	CHIP R 1.0K J 1/10W	
R12			RK73FB2A104J	CHIP R 100K J 1/10W	
R13 ,14			R92-0670-05	CHIP R 0 OHM	
C1 ,2			CK73FB1H102K	CHIP C 0.001UF	
C3 ,4			CK73FF1E473Z	CHIP C 0.047UF	
C5			CK73FB1H102K	CHIP C 0.001UF	
D1			1SS181	CHIP DIODE	
IC1			NJM4558M	IC(OP AMP X2)	
Q1			2SC2714(Y)	CHIP TRANSISTOR	
SQUELCH CONTROL (X59-1040-10)					
R1			RK73FB2A103J	CHIP R 10K J 1/10W	
R2			RK73FB2A223J	CHIP R 22K J 1/10W	
R3			RK73FB2A682J	CHIP R 6.8K J 1/10W	
R4			RK73FB2A474J	CHIP R 470K J 1/10W	
R5			RK73FB2A472J	CHIP R 4.7K J 1/10W	
R6			RK73FB2A332J	CHIP R 3.3K J 1/10W	
R7			RK73FB2A682J	CHIP R 6.8K J 1/10W	
R8			RK73FB2A332J	CHIP R 3.3K J 1/10W	
R9			RK73FB2A393J	CHIP R 39K J 1/10W	
R10			RK73FB2A472J	CHIP R 4.7K J 1/10W	
R11			R92-0670-05	CHIP R 0 OHM	
C1			CK73FB1H102K	CHIP C 0.001UF	
D1			1SS184	CHIP DIODE	
Q1			2SC2712(Y)	CHIP TRANSISTOR	
Q2 ,3			2SC3295(B)	CHIP TRANSISTOR	
Q4			2SC2712(BL)	CHIP TRANSISTOR	

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Q5			2SC2712(Y)	CHIP TRANSISTOR			
Q6			2SC2712(BL)	CHIP TRANSISTOR			
COMPOUND UNIT (X60-1280-XX) -10 : K1,K2,M1,M2,M3,M4 -51 : T1,W1							
C1			CC45CH1H330J	CERAMIC	33PF	J	
C2			CC45RH1H120J	CERAMIC	12PF	J	
C3			CC45CH1H030C	CERAMIC	3.0PF	C	
C4			CC45RH1H100D	CERAMIC	10PF	D	
C5			CC45CH1H220J	CERAMIC	22PF	J	
C6			CK45B1H102K	CERAMIC	1000PF	K	
C7			C91-0117-05	CERAMIC	0.01UF	K	
C8			CK45B1H102K	CERAMIC	1000PF	K	
C9			C91-0117-05	CERAMIC	0.01UF	K	
C10			CK45B1H102K	CERAMIC	1000PF	K	
C11			CC45CH1H010C	CERAMIC	1.0PF	C	
C12			CC45CH1H150J	CERAMIC	15PF	J	
C13			CC45CH1H020C	CERAMIC	2.0PF	C	
C14			CC45CH1H330J	CERAMIC	33PF	J	
C15 ,16			C91-0117-05	CERAMIC	0.01UF	K	
C17			CC45CH1H050C	CERAMIC	5.0PF	C	
C18			C91-0117-05	CERAMIC	0.01UF	K	
C19			CC45SL1H101J	CERAMIC	100PF	J	
C20 ,21			C91-0117-05	CERAMIC	0.01UF	K	
C22			C91-0757-05	CERAMIC	0.001UF	K	
C23			C91-0117-05	CERAMIC	0.01UF	K	
C24			CQ92M1H473K	MYLAR	0.047UF	K	
C25			CE04W1C102M	ELECTRO	1000UF	16WV	
C27			CE04W1H010M	ELECTRO	1.0UF	50WV	
C28 ,29			CE04W1A470M	ELECTRO	47UF	10WV	
C31			CQ92M1H104K	MYLAR	0.10UF	K	
C32			CE04W1A221M	ELECTRO	220UF	10WV	
C33			CE04W1A470M	ELECTRO	47UF	10WV	
C34 ,35			C91-0117-05	CERAMIC	0.01UF	K	
C36			CC45SL1H101J	CERAMIC	100PF	J	
C37			CC45CH1H040C	CERAMIC	4.0PF	C	
C38			CC45SL1H181J	CERAMIC	180PF	J	
C39			C91-0117-05	CERAMIC	0.01UF	K	
C40			CE04W1A470M	ELECTRO	47UF	10WV	
C41			CC45SL1H331J	CERAMIC	330PF	J	
C42			CK45B1H471K	CERAMIC	470PF	K	
C43			CK45B1H102K	CERAMIC	1000PF	K	
C44			CC45CH1H330J	CERAMIC	33PF	J	
C45			C91-0667-05	CERAMIC	0.0047UF	K	
C46			CC45CH1H330J	CERAMIC	33PF	J	
C47			C91-0117-05	CERAMIC	0.01UF	K	
C48			CC45SL1H121J	CERAMIC	120PF	J	
C49			CK45B1H102K	CERAMIC	1000PF	K	
C50 ,51			C91-0117-05	CERAMIC	0.01UF	K	
C52 -54			CF92V1H104J	MF	0.10UF	J	
C55			CK45B1H102K	CERAMIC	1000PF	K	
C56			CE04W1H010M	ELECTRO	1.0UF	50WV	
C58 ,59			C91-0117-05	CERAMIC	0.01UF	K	
C60			CE04W1C330M	ELECTRO	33UF	16WV	
C61			C91-0117-05	CERAMIC	0.01UF	K	
C62			CE04W1C100M	ELECTRO	10UF	16WV	

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C63			CE04W1C330M	ELECTRO 33UF 16WV	
C64			C91-0117-05	CERAMIC 0.01UF K	
C65			CE04W1C100M	ELECTRO 10UF 16WV	
C66			C91-0117-05	CERAMIC 0.01UF K	
C67			CE04W1C100M	ELECTRO 10UF 16WV	
C68			CE04W1A101M	ELECTRO 100UF 10WV	
C69			C91-0117-05	CERAMIC 0.01UF K	
C70			CS15E1C2R2M	TANTAL 2.2UF 16WV	
C71			CS15E1VR68M	TANTAL 0.68UF 35WV	
C72			CS15E1V010M	TANTAL 1.0UF 35WV	
C73			CE04W1A470M	ELECTRO 47UF 10WV	
C74			C91-0117-05	CERAMIC 0.01UF K	
C76			CK45B1H102K	CERAMIC 1000PF K	
C77			CE04W1HR47M	ELECTRO 0.47UF 50WV	
C79 ,80			C91-0117-05	CERAMIC 0.01UF K	
C81			CQ92M1H333K	MYLAR 0.033UF K	
C82 -85			CE04W1H010M	ELECTRO 1.0UF 50WV	
C86			CK45B1H102K	CERAMIC 1000PF K	
C87			CE04W1C470M	ELECTRO 47UF 16WV	
C88			CE04W1H010M	ELECTRO 1.0UF 50WV	
C89			CK45B1H152K	CERAMIC 1500PF K	
C90			CE04W1C100M	ELECTRO 10UF 16WV	
C93			CE04W1A470M	ELECTRO 47UF 10WV	
C94			CK45B1H102K	CERAMIC 1000PF K	
C95			CE04W1H0R1M	ELECTRO 0.1UF 50WV	
C96			CC45SL1H101J	CERAMIC 100PF J	
C97			CK45B1H102K	CERAMIC 1000PF K	
C98			C91-1008-05	CERAMIC 0.022UF K	
C99			CQ92M1H153K	MYLAR 0.015UF K	
C100			CQ92M1H183K	MYLAR 0.018UF K	
C101			CQ92M1H333K	MYLAR 0.033UF K	
C102			CE04W1A470M	ELECTRO 47UF 10WV	
C103			CQ92M1H473K	MYLAR 0.047UF K	
C105			CE04W1A470M	ELECTRO 47UF 10WV	T1,W1
C106			C91-0117-05	CERAMIC 0.01UF K	T1,W1
C107			C91-0433-05	CERAMIC 0.0039UF K	T1,W1
C108			CQ92M1H333K	MYLAR 0.033UF K	T1,W1
C109,110			CQ92M1H103K	MYLAR 0.010UF K	T1,W1
C115			CK45B1H102K	CERAMIC 1000PF K	
L1 ,2			L31-0267-05	COIL (ANT)	
L3			L15-0306-05	LOW-FREQUENCY CHOKE COIL	
L4			L79-0498-15	HELICAL RESONATOR	T1,W1
L4			L79-0499-05	HELICAL RESONATOR	K1,K2,M1–M4
L5			L34-0683-05	COIL (TUNING)PLL HET	
L6			L30-0281-15	IFT (10.24MHZ)	
L7			L30-0005-05	IFT (10.695MHZ)	
L8			L71-0216-05	MCF	
L9			L30-0005-05	IFT (10.695MHZ)	
L10 ,11			L40-1021-12	SMALL FIXED INDUCTOR (1UH)	
L12			L79-0446-05	CERAMIC DISCRI CFY455S	
L13			L40-1001-14	SMALL FIXED INDUCTOR (10UH)	
L14			L77-0858-15	CRYSTAL RESONATOR (10.24MHZ)	
L15		*	L30-0531-05	IFT (455KHZ)	
L16			L72-0315-05	CERAMIC FILTER (CFW455F)	

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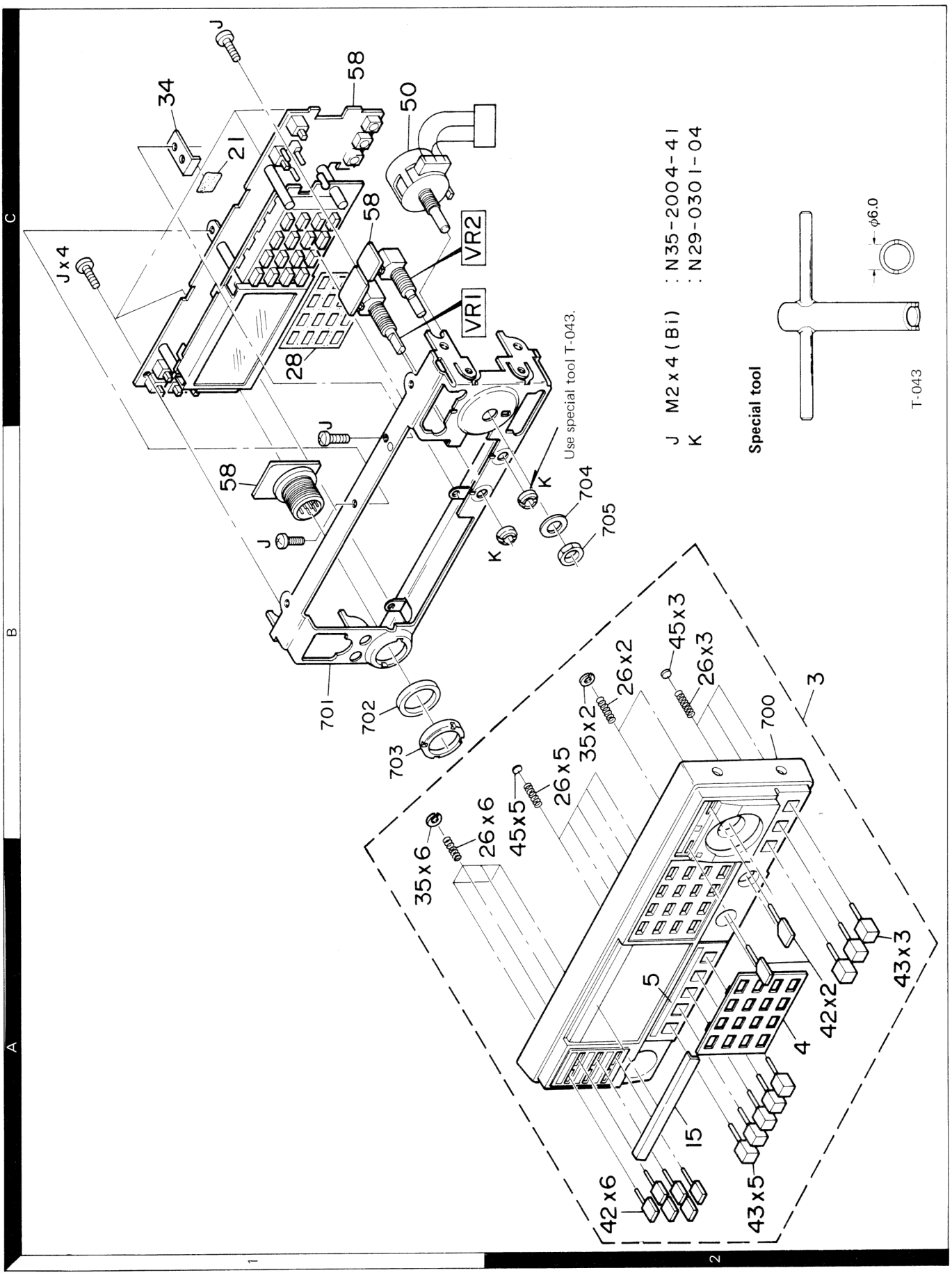
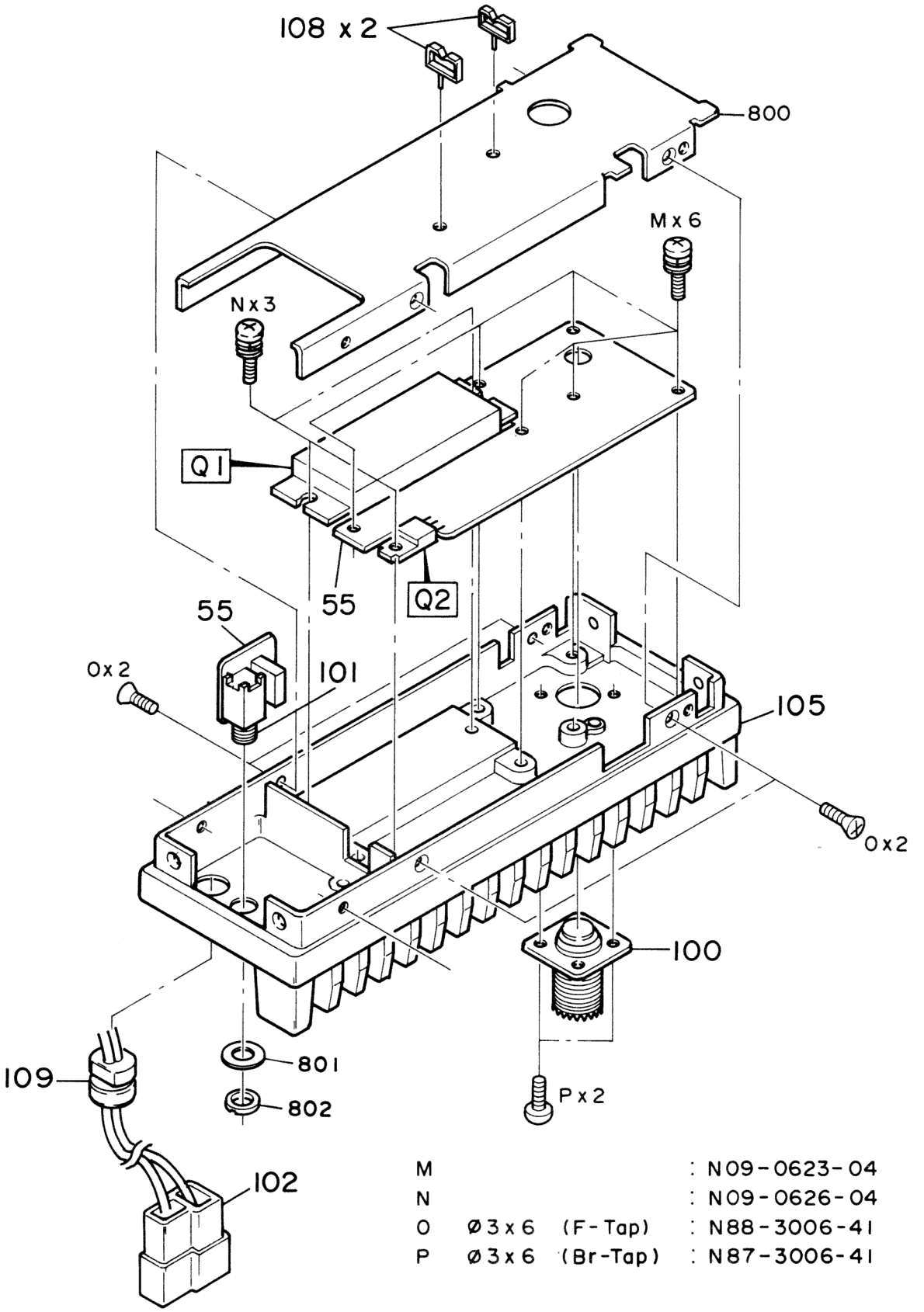
L17			L30-0503-05	IFT (455KHZ)	
R42		*	RS14KB3D330J	FL-PROOF RS 33 J 2W	
R66			RN14BK2B9102F	RN 91.0K F 1/8W	T1,W1
VR1			R12-2413-05	TRIMMING POT. (5K)	K1,K2,M1-M4
VR2 -4			R12-4413-05	TRIMMING POT. (50K)	
VR5			R12-3443-05	TRIMMING POT. (10K)	
VR6			R12-4413-05	TRIMMING POT. (50K)	
VR7			R12-2413-05	TRIMMING POT. (5K)	
VR8			R12-3521-05	TRIMMING POT. (20K)	T1,W1
D1 ,2			1N4448	DIODE	
D1 ,2			1S1555	DIODE	
D3 ,4			1N60	DIODE	
D5 ,6			1N4448	DIODE	
D5 ,6			1S1555	DIODE	
D7			MTZ11JC	ZENER DIODE	
D8			1N4448	DIODE	
D8			1S1555	DIODE	
D9			MTZ6.2JA	ZENER DIODE	T1,W1
D10			1N60A	DIODE	
IC1		*	UPC1241H	IC	
IC2		*	TA7761P	IC	
IC3			MB3756	IC	
IC4			NJM78M06A	IC	
IC5			NE555P	IC	T1,W1
Q1			3SK129(S)	FET	
Q2			3SK74(L)	FET	
Q3 ,4			2SC2668(Y)	TRANSISTOR	
Q5			2SC496(Y)	TRANSISTOR	
Q6 ,7			2SC2458(Y)	TRANSISTOR	
Q8			2SC1775(E)	TRANSISTOR	
Q9			2SC2458(Y)	TRANSISTOR	
Q10 ,11			DTC114ES	DIGITAL TRANSISTOR	
TH1			112-502-2	THERMISTER (5K OHM)	
		*	X59-1000-10	MIC AMP MODULE UNIT	
		*	X59-1010-10	MIC AMP,S-METER UNIT	
		*	X59-1020-10	ALERT,VACANT-CH UNIT	
		*	X59-1030-10	CENTER DETECTOR UNIT	
		*	X59-1040-10	SQUELCH CONTROL UNIT	

DISASSEMBLY



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

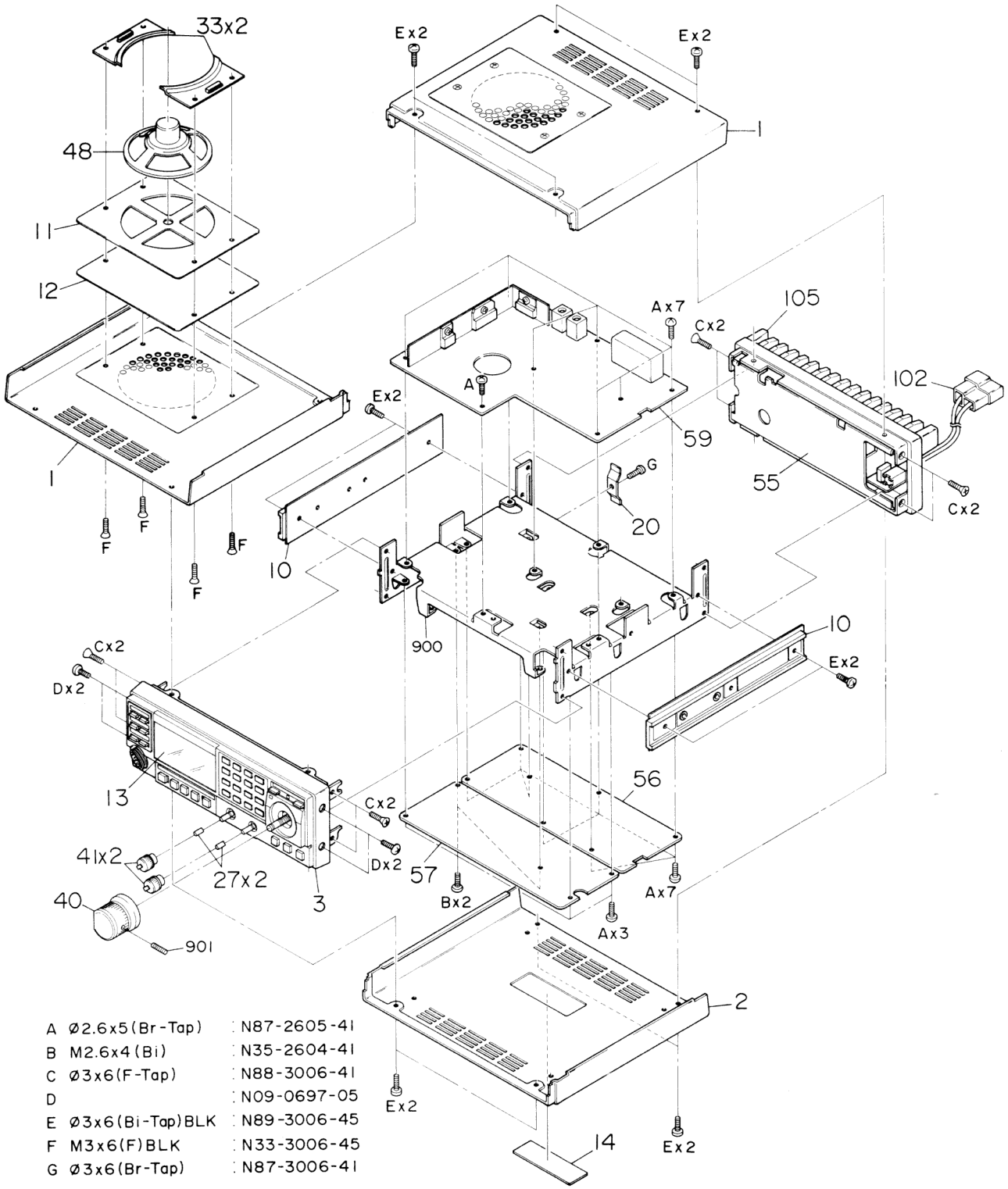
DISASSEMBLY



M		: N09-0623-04
N		: N09-0626-04
O	Ø3x6 (F-Tap)	: N88-3006-41
P	Ø3x6 (Br-Tap)	: N87-3006-41

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

DISASSEMBLY



A	Ø2.6x5(Br-Tap)	: N87-2605-41
B	M2.6x4(Bi)	: N35-2604-41
C	Ø3x6(F-Tap)	: N88-3006-41
D		: N09-0697-05
E	Ø3x6(Bi-Tap)BLK	: N89-3006-45
F	M3x6(F)BLK	: N33-3006-45
G	Ø3x6(Br-Tap)	: N87-3006-41

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

ADJUSTMENT

REQUIRED TEST EQUIPMENT

1. **DC V.M**
   1) High input impedance
2. **RF VTVM (RF V.M)**
   1) Input impedance : 1MΩ min., 2pF max.
   2) Voltage range : F.S = 10mV ~ 300V
   3) Frequency range : Up to 150MHz
3. **Frequency Counter (f. counter)**
   1) Input sensitivity : Approx. 50mV
   2) Frequency range : Up to 150MHz
4. **DC Power Supply**
   1) Voltage : 10V ~ 17V, variable
   2) Current : 8A min.
5. **RF Power Meter**
   1) Measurement range Approx. : 50W
   2) Input impedance : 50Ω
   3) Frequency range : 144MHz
6. **AF VTVM (AF V.M)**
   1) Input impedance : 1MΩ min.
   2) Voltage range : F.S = 1mV ~ 30V
   3) Frequency range : 50Hz ~ 10kHz
7. **AF Generator (AG)**
   1) Output frquency : 100Hz ~ 10kHz
   2) Output voltage : 0.5mV ~ 1V
8. **Linear Detector**
   1) Frequency range : 144MHz
9. **Field Strength Meter**
   1) Frequency range : 144MHz
10. **Directional Coupler**
11. **Oscilloscope**
    1) High sensitivity oscilloscope with horizontal input terminal
12. **SSG**
    1) Frequency range : 144~149MHz
    2) Modulation : AM and FM MOD.
    3) Output level : −20dB to 100dB
13. **Dummy Load**
    1) 8Ω, 5W (approx.)
14. **Noise Generator**
    1) Must generate ignition-like noise containing harmonics beyond 150MHz.
15. **Sweep Generator**
    1) Sweep range : 144~149MHz
16. **Tracking generator**

PREPARATION

1) Unless otherwise specified, knobs and switches should be set as follows **Table 10.**

POWER SW	ON	SQUELCH VR	MIN
AL. SW	OFF	AF GAIN VR	MIN
PRIO SW	OFF	PHONE SW	OFF
LAMP SW	OFF	TONE SW	OFF
REV SW	OFF	VOICE SW	OFF
SCAN SW	OFF	DCL SW	OFF
LOW SW	OFF	C. SQ SW	OFF
F. LOCK SW	OFF	CS SW	OFF

Table 10

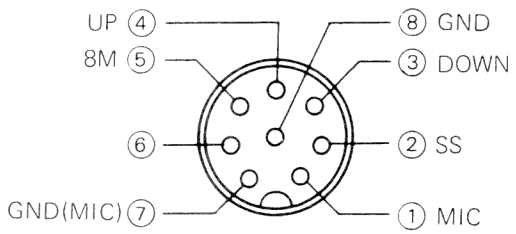


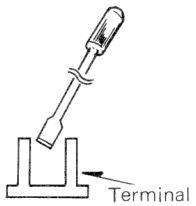
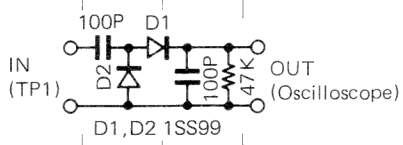
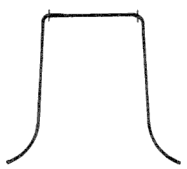
Fig. 20 MIC terminals (view from front panel side)

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.

ADJUSTMENT

RX ADJUSTMENT

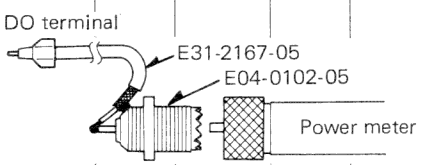
NOTE : COMP = COMPOUND UNIT (X60-1250-10,-51)

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reset	1) Set the power SW on, while depressing PS key. Then, release the PS key.	Display						Tone sounds.
	2) When the lithium battery is replaced, the microprocessor must be reset. Set the power SW on, while depressing PS key and terminal shorted (near Q6 position) on CONTROL unit by driver, etc. Then, release the PS key.							
2. Voltage check	1) Power supply : 13.8V DC SQL VR ↺ MIN (fully CCW)	DC VM	COMP.	8R		JP18		7.8V–8.6V
				8C		⑦-1		7.8V–8.6V
				6C		⑩-1		5.6V–6.4V
				8T		⑪-4		0.3V or less
	2) Transmit.			8T				7.8V–8.6V
				8R		JP18		0.3V or less
			PLL	DB				7V–13.5V
3. PLL	1) IF level Display : 6.000 **(K,M)** 5.000 **(W,T)**	SCOPE (10 : 1 probe)	PLL	TP1 (R74)	PLL	L14, L15	MAX When PLL leep is unlocked, ADJ TC4.	2.0Vp-p or more.
	2) RX VCO (RX) Display : 2.000 **(K,M)** 4.000 **(W,T)**	DC V.M		TP2 (C55)		TC4	6.0V **(K,M)** 5.0V **(W,T)**	±0.1V
	3) TX VCO Display : 2.000 **(K,M)** 4.000 **(W,T)**			TP3 (R17) (collector Q5)		TC1	2.5V **(K,M)** 3.0V **(W,T)** When PLL loop is unlocked, ADJ TC1.	(1.5V–2.9V) **(K,M)**
	4) Receive Display : 7.995 **(K,M)** 5.995 **(W,T)**			TP2 (C55)				4.0V–6.0V 3.5V–4.5V Confirm.
	5) Transmit Display : 7.995 **(K,M)** 5.995 **(W,T)**			TP3 (R17)				4.5V–5.5V Confirm.
	6) HET. Frequency Receive Display : 6.000 **(K,M)** 5.000 **(W,T)**	f.counter		LR (② -6)		L17	135.305MHz ADJ. 134.305MHz ADJ.	±100Hz ±100Hz
4. Helical	1) Connect the sweep gen. to ANT terminal. Output : 10dBμ Disconnect the No. ③ connector (SF, GND).	Detctor SCOPE	COMP.	TP1	COMP.	L1, L2, L4	Adjust to obtain the waveform as right fig.	144 148 **(K,M)** 144 146 **(T,W)**
							 D1,D2 1SS99	
5. SF level		RF V.M	COMP.	SF	COMP.	L6	MAX	0.2V or more
6. GAIN	1) Display : 6.060 **(K,M)** 5.060 **(T,M)** ANT : SSG Output : 5dBμ MOD. : 1kHz DEV. 3kHz f : 146.06MHz **(K,M)** 145.06MHz **(W,T)**	DC V.M (3.0V range)	COMP.	JP17	COMP.	L5, L7, L9, L15	Minimum voltage reading. Repeat 2 or 3 times.	Ref. 2.35V

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
7. DISCRI S/N	1) ANT 6.060 **(K,M)** 5.060 **(W,T)** ANT SSG MOD. : 1kHz, DEV. 3kHz Output : 60dBμ	AF V.M	Rear panel	SP	COMP.	L17	MAX	
	2) ANT SSG Output : −6dBμ (144.00–147.98MHz)							12dB SINAD or more.
8. S-Meter	1) MOD. 1kHz : DEV. 3kHz 6.060 **(K,M)** 5.060 **(W,T)** SSG output : 16dBμ	S-LCD	Front panel		COMP.	VR6	S-LCD should light.	
9. Vacant CH level	1) SSG output : −8dBμ MOD/DEV. OFF Short both TP3 terminals.				COMP.	VR3	Adjust threshold point.	
10. SQ SEN.	1) Threshold point : no signal		Front panel	SQL VR			Audio noise will disappear. C.TUNE indicator off.	8 : 30 – 12 : 00
	2) SSG output : −12dBμ						C.TUNE indicator lights.	SQ open.

TX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. DRIVE	1) Transmit. Display : 6.000 **(K,M)** 5.000 **(W,T)** Disconnect the coax. cable from the DO terminal in the COMP. unit. Connect the power meter to the DO terminal in the COMP. unit.	POWER (3W) 	PLL	DO	PLL	TC2,3	MAX In case of TM-2550A/E, reduce RF output from peak point to 0.04W down by TC3 (capacity of TC3 will decrease the position.)	0.5–0.7W 0.25–0.45W **(TM-2530A)**
2. POWER	1) Connect the coax. cable from the DO terminal in the COMP. unit. Display : 7.995 **(K,M)** 5.995 **(W,T)**	P.M Ammeter in the DC power supply.	Rear panel	ANT	FINAL	VR3	47W ADJ. **(K,M)** 28W ADJ. **(W,T)** RF LCD	47W±0.5W 28W±0.5W All RF-LED's should light.
	2) 4.000–7.995 **(K,M)** 4.000–5.995 **(W,T)**							43–54W or less. 9.5A or less **(K,M)** 24–33W or less. 6.5A or less **(W,T)**
3. LOW POWER	1) HI/LOW SW : LOW Display : 6.000 **(K,M)** 5.000 **(W,T)**	Power meter		ANT	FINAL	VR4	5W ADJ.	5W±0.5W
4. RF METER	1) Confirm, then, HI/LOW SW : HI	RF-LCD			COMP.	VR4	Adjust 5 LED's reading.	
5–1 PROTECTION (null)	1) FINAL unit				FINAL	VR2	MAX	
	2) Display : 6.000 **(K,M)** 5.000 **(W,T)** Transmit.	Power meter	Rear panel	ANT				45W or more **(K,M)** 25W or less **(W,T)**
		DC multimeter	FINAL	TP	FINAL	VR1	MIN	0.5V or less.

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
5–2. PROTECTION (Current)	1) ANT 45/25W : Open 45/25W short	DC supply V.M			FINAL	VR2	4A/3A ADJ.	6A or less **(K,M)** 5A or less **(W,T)**
	2) After adjusted, connect the power meter.							
6. MIC GAIN DEV.	1) Turn VR7 fully CCW. MIC 50mV/1kHz **(K,M)** 30mV/1kHz **(T,W)**	Linear detector			COMP.	VR7 VR5	±4.5kHz ADJ.	±100Hz–
	2) MIC 5mV/1kHz **(K,M)** 3mV/1kHz **(T,W)**					VR7	±3.0kHz ADJ.	±100Hz
7. FREQ. check	1) Display : 6.000 **(K,M)** 5.000 **(W,T)**	f.counter						146.000±500Hz **(K,M)** 145.000±500Hz **(W,T)**
8. TONE **(K,M)**	1) Install TU7 in the CONTROL Press TONE key then, turn the encoder dial to 88.5kHz transmit.	Linear detector f.counter						DEV. 0.6–0.9kHz FREQ. 88.5kHz Check output wave of linear detector output. display.
9. TONE **(W)**	1) Press TONE key. (Transmit after ADJ.)				COMP.	VR8	1.750Hz	±10Hz DEV. : 2.5kHz or more
10. TONE Burst **(T)**	1) Remove the TH/E connector, Connect 5V DC power supply to the TH/E connector (Transmit)				COMP.	VR8	1.750Hz	±10Hz DEV. : 2.5kHz or more
	2) Connect the TH/E connector. (Transmit) TONE SW : ON	Monitor radio						
11. Touch tone **(K,M)**	1) Transmit Press '3', '6' key at the same time.	Linear detector f.counter			COMP.	VR1	3kHz ADJ.	±0.2kHz 1471.9Hz±1%
12. SCAN	1) SCAN SW : T0 (Confirm VR1 at 12 o'clock.) SQL VR : ↶ MIN (CCW) Key board : Press "SC"				CONT.	VR1	Check scan time changed when VR1 turn.	
	2) After ADJ. Key board : Press "C"				CONT.	VR1	Centered.	

Microprocessor operation check

Item	Condition	Operation check
1. Keyboard	1) SQL : MIN (CCW) ↶ Power SW : ON Reset microprocessor. (See ADJ of "RESET".)	[S] 4.000 1
	2) KEY : 1. 9. PS. L0 **(K,M)** 1. 2. 3. 6. 7. 8. 9. 0. PS. L0 **(T,W)**	Display does not change. [S] 4.000 1
	3) KEY : 2. 2. 2. 2. 4. 2. 2. 2.	Tone sounds. [S] 2.220 1 [S] 4.220 1

Item	Condition	Operation check
1. Keyboard	4) KEY : 3. 3. 3. 3. 4. 3. 3. 3.	[S] 3.330 1 [S] 4.220 1
	5) KEY : 4. 4. 4. 4.	[S] 4.440 1
	6) KEY : 5. 5. 5. 5.	[S] 5.555 1

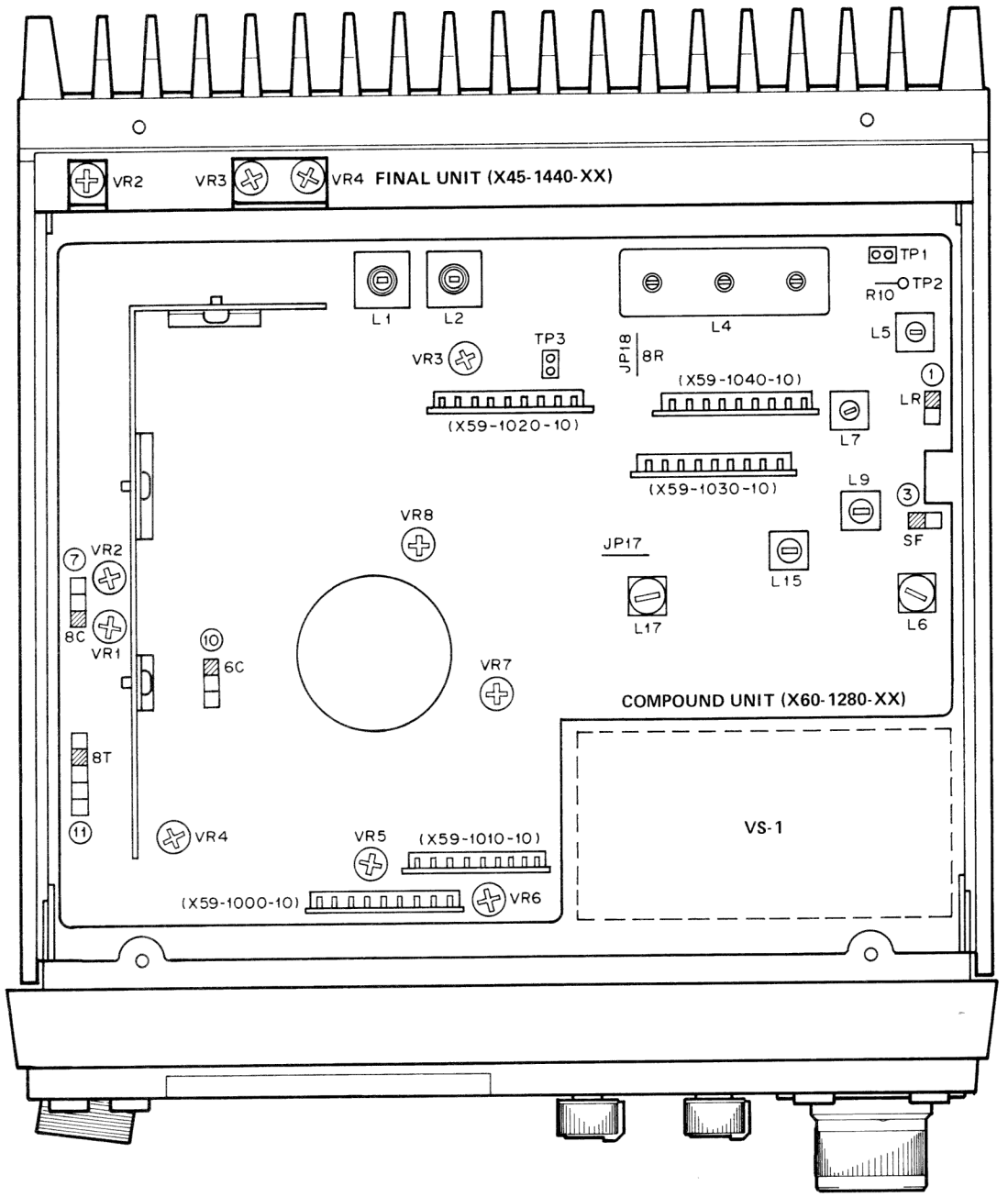
ADJUSTMENT

Item	Condition	Operation check
1. Keyboard	7) KEY : 6. 6. 6. 6. 5. 6. 6. 6.	[-] 6.665 1 [S] 5.665 1
	8) KEY : 7. 7. 7. 7. 5. 7. 7. 7.	[-] 7.775 1 [S] 5.775 1
	9) KEY : 8. 8. 8. 8. 5. 8. 8. 8.	[S] 8.885 1 [S] 5.885 1
	10) KEY : 8. 9. 9. 9. 5. 9. 9. 9.	[S] 8.995 1 [S] 5.995 1
	11) KEY : 5. 0. 0. 0.	[+] 5.000 1
	12) KEY : OS	Tone sounds. [+] 5.000 1
	13) Turn the M.CH dial to CCW 1 step.	[+] 5.000 2
	14) KEY : M	Tone sounds.
	15) Turn the M.CH dial to CCW. 2. 3. 4. . . . 19. A. b. d. 1. 2.	LCD Memory CH number should indicate. Tone sounds. U→1 (or 2→1)
2. M. CH SW	1) F. LOCK SW : ON	Display does not change when the M.CH dial turn to right and left. [+] 5.000 2
	2) M.CH key : Press	Lights on
	3) Turn the M.CH dial to the right 1 step.	Tone sounds. [S] 4.000 1
	4) KEY : L0	Tone sounds. [S] 4.000 ☆ 1
3. REV. PRIO SW	1) M.CH KEY : Press	Lights off
	2) REV SW : ON	[+] 5.000 1 5.600 1 REV LCD : Lights on
	3) REV SW : OFF PRIO SW : ON	[S] 4.000 ☆ 1 REV LCD : Lights off PRIO LCD : Lights on
4. AL SW	1) PRIO SW : OFF SQL VR : ↺ MIN (CCW) AL SW : ON VOL VR : 10:00	[+] 5.000 1 PRIO LCD : Lights off Noise should momentarily mute approx. 0.3 seconds every 6—7 seconds.

Item	Condition	Operation check
5. PS KEY	1)Turn the M.CH dial to b CH. KEY PS : ON	[+] 5.000 b Tone sounds.
	2) AL SW : OFF PRIO SW : ON	[S] 4.000 b PRIO LCD : Lights on
6. SCAN KEY	1) PRIO SW : OFF KEY SC : ON	PRIO LCD : Lights off [S] [SC] 4.005 b Tone sounds. The dispaly should step up in 5kHz approx. every 6 seconds.
7. Lamp SW	1) LAMP SW : ON	Key board illuminated.
	2) OFF after checked. KEY C : ON	
8. DCL function (Digital channel link)	1) Install MU-1 in the CONT. unit.	DCL LED : Lights on.
	2) Reset microprocessor. See ADJ of "RESET".	
	3) DCL KEY : Press	
	4) Memory write to channel "A".	
	5) Digital code setting • CS KEY : Press	00000
	• C.SQ KEY : Press	☆ lights.
	• RESET KEY : Press	1_00
	• CS KEY : Press again. KEY : Press 4. 9. 4. 0.	4940
	6) Check DCL operation. Set the monitor's radio. Condition : • Display : 4.940 • DCL KEY : Press • CHL KEY : Press	Both radio frequency changed display to "A" channel. Tone sounds.
9. DCS System (Digital code squelch)	1) C.SQ KEY : Press	C.SQ LED's light. Squelch closed.
	2) Monitor's radio Mic PTT : Press	C.SQ LED's light off Noise heard from SP.
10. VS-1 check	1) Install the VS-1 in the CONT. unit. VOICE KEY : Press	Speaks during display's condition. Confirm.
11. PHONE function	1) PHONE KEY : Press	Display shows A1—A15.
	2) Turn to encoder dial.	
	3) Set "A1" display PS KEY : Press	
	4) Input 7 digit for telephone number (ex. 6399000)	Telephone indicator light on.
	5) PHONE KEY : Press again	
	6) PHONE KEY : Press during transmit	Dial tone 7 digits are transmit automatically.
	7) Return to receive mode. PHONE KEY : Press again	
	8) C KEY : Press	A— —
	9) PHONE KEY : Press	Telephone indicator light off.

ADJUSTMENT

TOP VIEW



COMPOUND UNIT

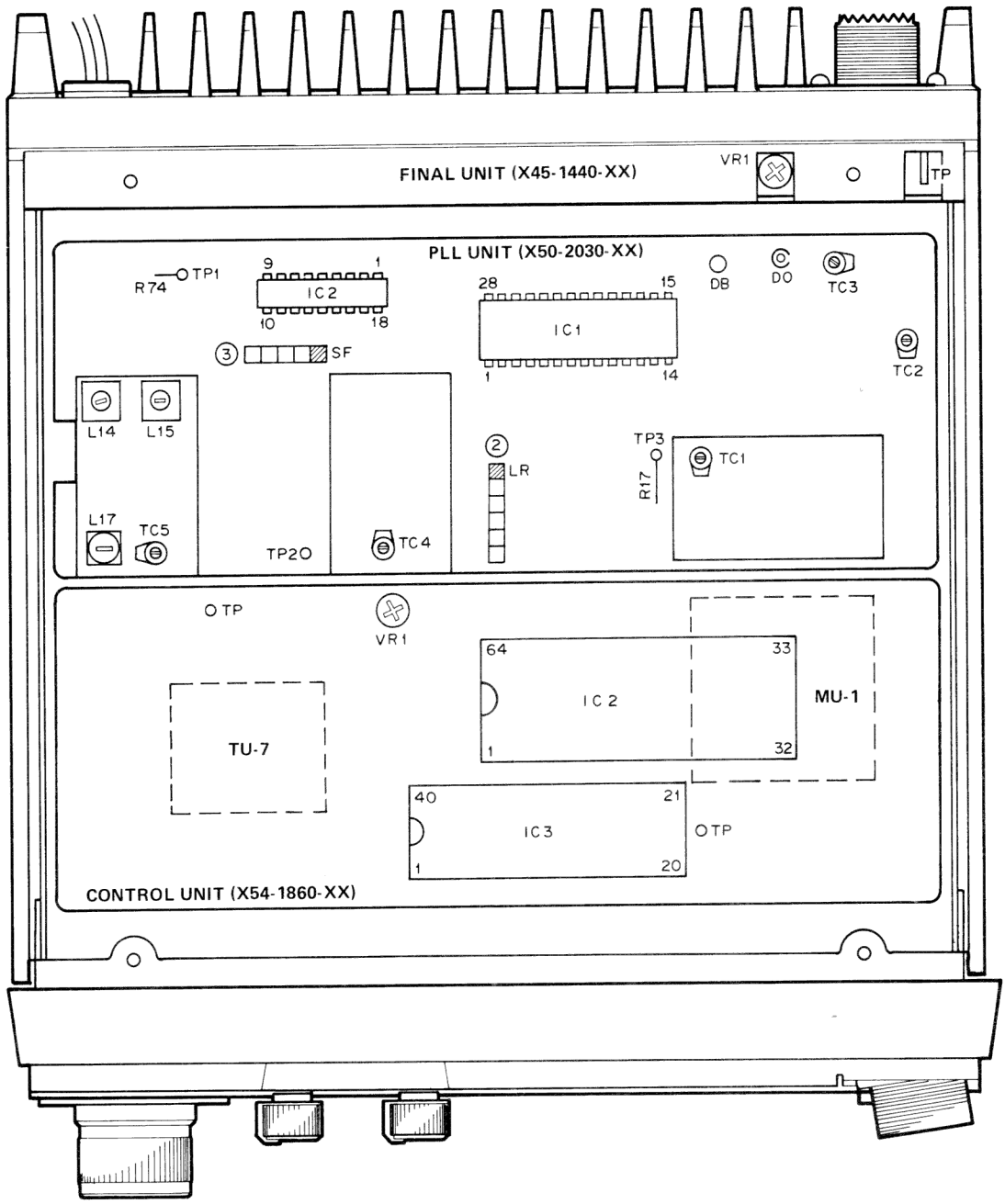
L5,7,9,15	: IF GAIN adj.
VR1	: TOUCH TONE adj. (K,M only)
VR2	: BEEP LEVEL adj.
VR3	: VACANT CH. LEVEL adj.
VR4	: RF-METER adj.
VR5	: DEV. adj. ±4.5kHz
VR6	: S-METER adj.
VR7	: MIC GAIN adj. ±3kHz
VR8	: TONE adj. (T,W only)

FINAL UNIT

VR2	: Protection current
VR3	: High power
VR4	: Low power

ADJUSTMENT

BOTTOM VIEW



FINAL UNIT

VR1 : NULL POINT

PLL UNIT

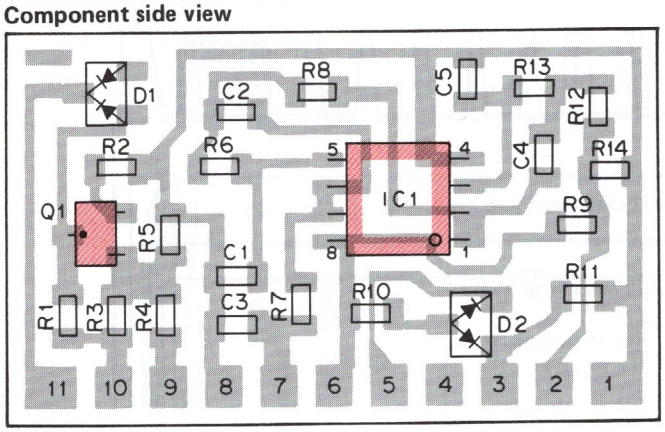
TC1 : TX VCO (2.0V)
TC4 : RX VCO (6.0V)
L14,15 : PLL IF
L17 : 135.305MHz adj. (K,M type)
134.305MHz adj. (T,W type)

CONTROL UNIT

VR1 : SCAN SPEED

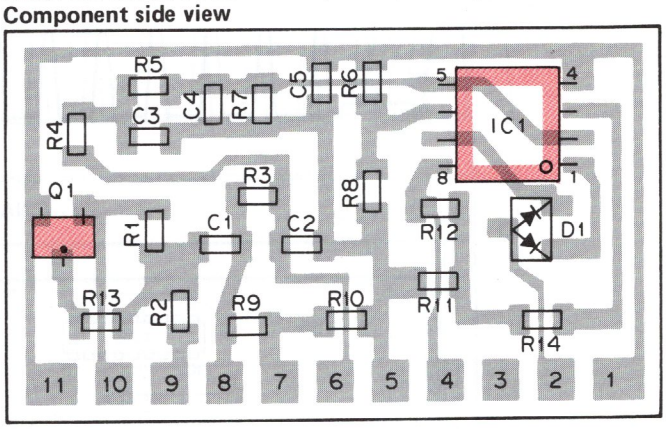
TM-2550A/E,2530A PC BOARD VIEWS

MIC AMP MODULE UNIT (X59-1000-10)
Component side view



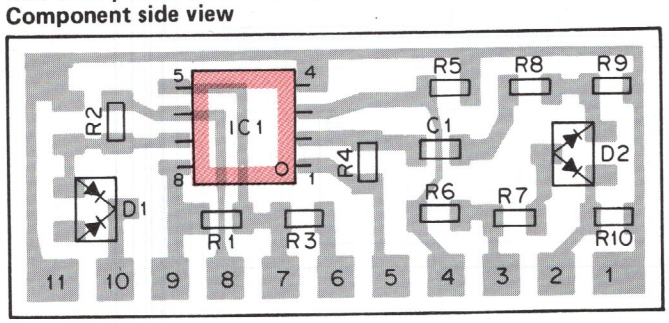
Q1 : 2SC2712(Y) IC1 : NJM4558M
D1 : 1SS184 D2 : 1SS181

CENTER-DETECTOR UNIT (X59-1030-10)
Component side view



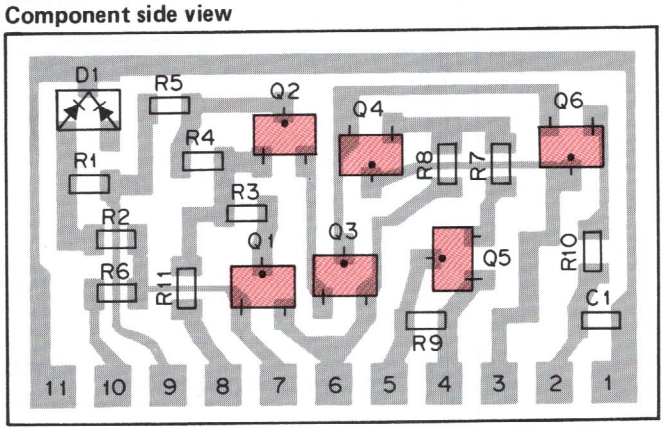
Q1 : 2SC2714(Y) IC1 : NJM4558M
D1 : 1SS181

MIC AMP, S-METER UNIT (X59-1010-10)
Component side view



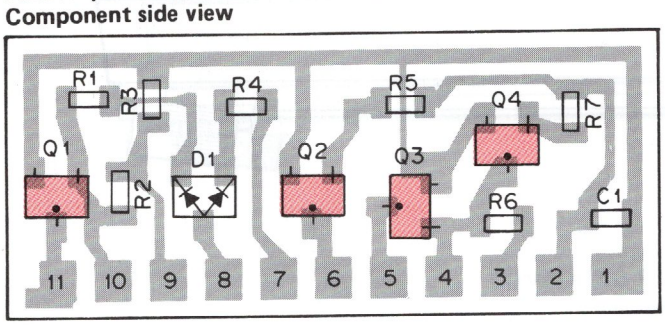
IC1 : NJM4558M
D1 : 1SS184 D2 : 1SS181

SQUELCH CONTROL UNIT (X59-1040-10)
Component side view



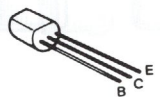
Q1,5 : 2SC2712(K) Q2,3 : 2SC3295(B) Q4,6 : 2SC2712(BL)
D1 : 1SS184

ALERT, VACANT-CH UNIT (X59-1020-10)
Component side view

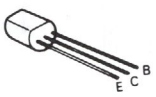


Q1–4 : 2SC2712(Y)
D1 : 1SS181

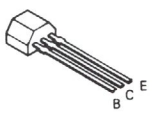
2SC2538-22-A



2SC1775

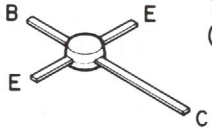


2SA1048 2SC2458
2SC2347 2SC2668

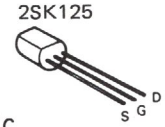


2SC2712
2SC2714
2SC3295

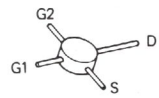
2SC3019



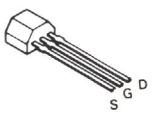
2SK30A
2SK125



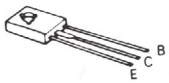
3SK74
3SK129



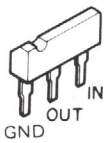
2SK192A



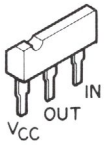
2SC496



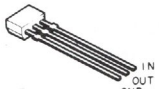
DTC124EF



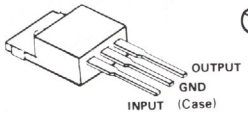
DTA114YF



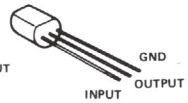
DTC114ES
DTC143TS



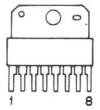
NJM78M06A



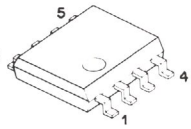
PST520D



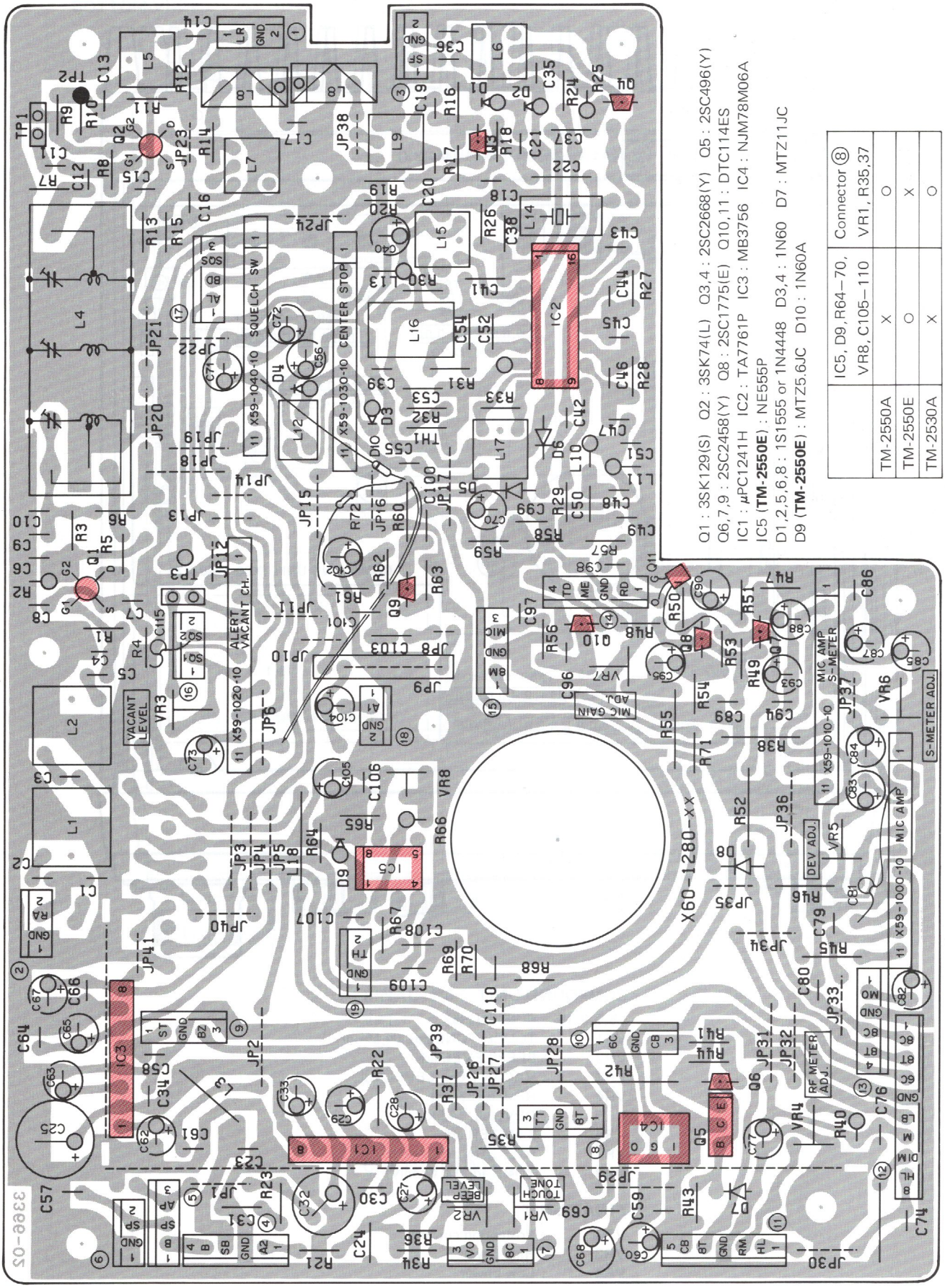
MB3756
μPC1243H



NJM4558M



COMPOUND UNIT (X60-1280-XX) Component side view
-10 : TM-2550A (K1,M1,M3), TM-2530A (K2,M2,M4)
-51 : TM-2550E (T,W)

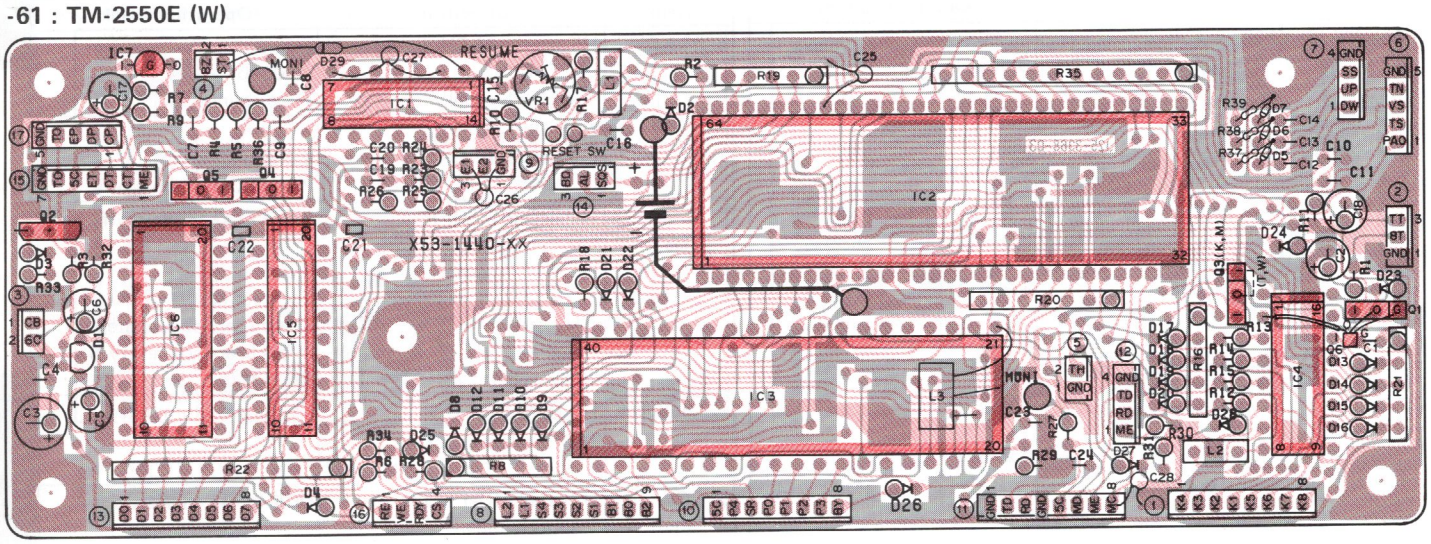


Q1 : 3SK129(S) Q2 : 3SK74(L) Q3,4 : 2SC2668(Y) Q5 : 2SC496(Y)
Q6,7,9 : 2SC2458(Y) Q8 : 2SC1775(E) Q10,11 : DTC114ES
IC1 : μPC1241H IC2 : TA7761P IC3 : MB3756 IC4 : NJM78M06A
IC5 (**TM-2550E**) : NE555P
D1,2,5,6,8 : 1S1555 or 1N4448 D3,4 : 1N60 D7 : MTZ11JC
D9 (**TM-2550E**) : MTZ5.6JC D10 : 1N60A

	IC5, D9, R64–70, VR8, C105–110	Connector ⑧ VR1, R35,37
TM-2550A	X	O
TM-2550E	O	X
TM-2530A	X	O

O : Used, X : Not used

CONTROL UNIT (X53-1440-XX) Component side view
-10 : TM-2550A (K1,M1), TM-2530A (K2,M2)
-21 : TM-2550A (M3), TM-2530A (M4)
-51 : TM-2550E (T)
-61 : TM-2550E (W)

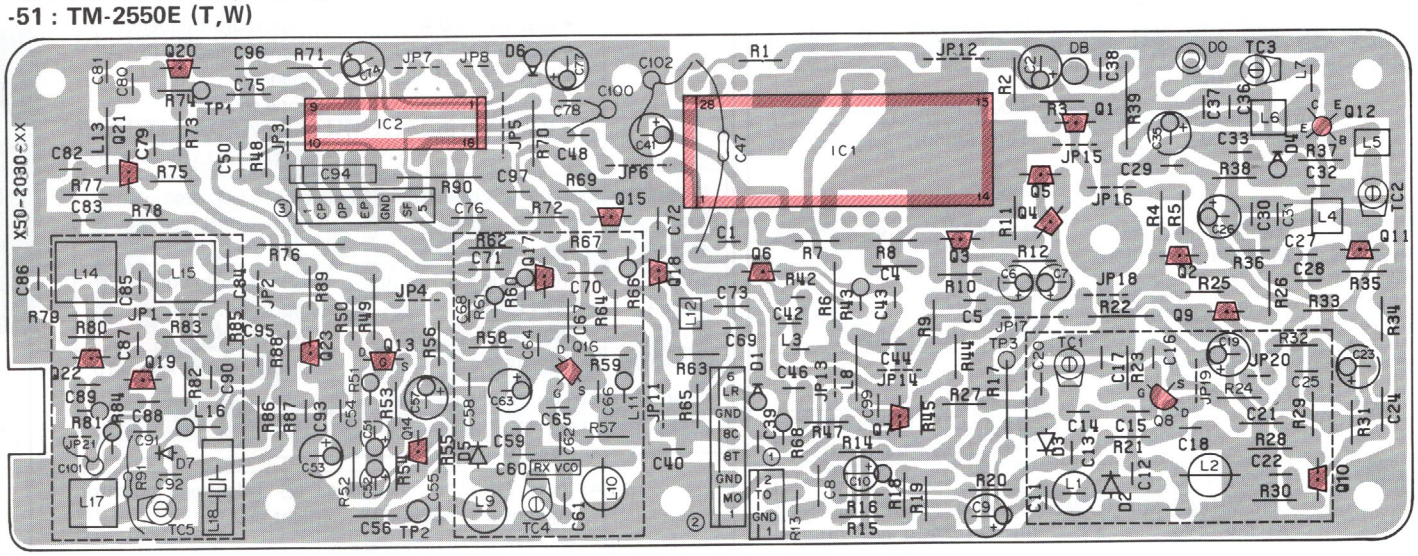


Q1 : DTC124EF Q2 : 2SC2458(Y) Q3 (**K1,K2,M1–M4**) : DTA114YF
Q4,5 : DTA114YF Q6 (**K1,K2,M1–M4**) : DTC143TS
IC1 : MC14584BCP IC2 : TMP47C46N-9042 IC3 : μPD7508HC-056
IC4 (**K1,K2,M1–M4**) : LR4087 IC5 : TC40H374P
IC6 : TC5047AP-1 IC7 : PST520D
D1 : MC911 D2,4–8,11,17–21,24,27 : 1S1555 or 1N4448
D9 (**K1,K2,M1,M2,W**) : 1S1555 or 1N4448
D10,12 (**T,W**) : 1S1555 or 1N4448
D13–16,22,28 (**K1,K2,M1–M4**) : 1S1555 or 1N4448
D23 (**K1,K2,M1–M4**) : MTZ5.6JC D25,26 : 1SS106 D29 : 1SS133

		Q1,3,6, D13–16,22,23,28, IC4, L2, C1,2,18, R1,11–15, Connector ②	D9	D10,12
TM-2550A	K1,M1	○	○	X
	M3	○	X	X
TM-2550E	T	X	X	○
	W	X	○	○
TM-2530A	K2,M2	○	○	X
	M4	○	X	X

○ : Used, X : Not used

PLL UNIT (X50-2030-XX) Component side view
-10 : TM-2550A (K1,M1,M3)
-11 : TM-2530A (K2,M2,M4)
-51 : TM-2550E (T,W)

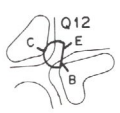


Q1,9,14,15 : 2SC2458(Y) Q2 : 2SA1048(Y) Q3–5 : 2SC1775(E)
Q6,7,10,17–22 : 2SC2668(Y) Q8 : 2SK125 Q11 : 2SC2347
Q12 (**TM-2550A/E**) : 2SC3019 Q12 (**TM-2530A**) : 2SC2538-22-A
Q13 : 2SK30A(O) Q16 : 2SK192A(GR)*P Q23 (**TM-2550E**) : 2SC2458(Y)
IC1 : MC145151P IC2 : MC145155P*K
D1,4 : 1S1555 D2,5 : 1SV50 D3 : 1S2208 D6 : MTZ6.2JA
D7 (**TM-2550E**) : MA856

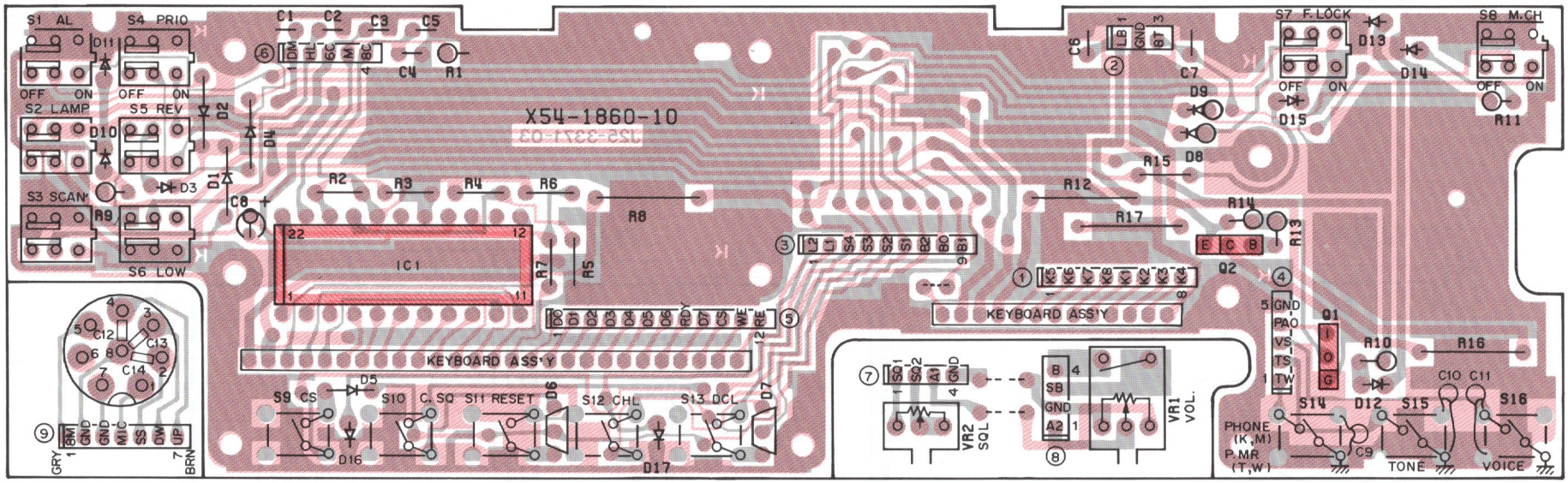
	Q23, D7, TC5, L16, C95, R85,86,88,89	C102
TM-2550A	X	○
TM-2550E	○	○
TM-2530A	X	X

○ : Used, X : Not used

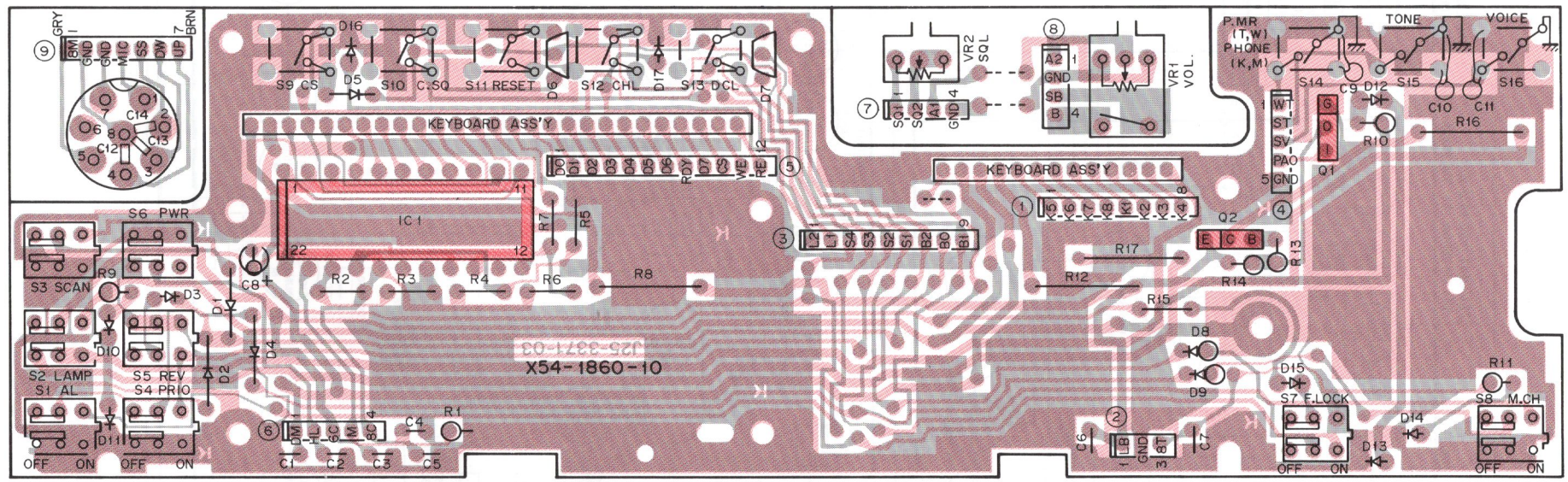
K1,K2, M1,M2,M3,M4



DISPLAY UNIT (X54-1860-10) Component side view

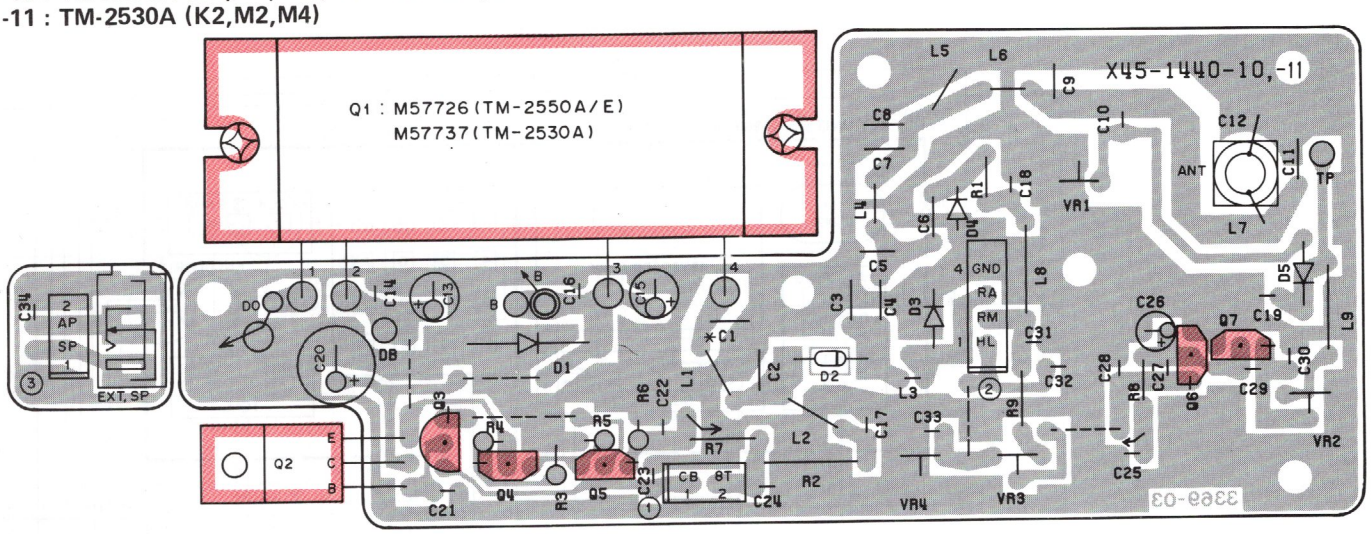


DISPLAY UNIT (X54-1860-10) Foil side view



Q1 : DTC124EF Q2 : 2SA790(A)
IC1 : IR2429
D1–5,8,9 : 1S1555 or 1N4448 D6,7 : MC921 D10–13 : LN38GPL D14 : LN222RP D15 : LN322GP D16,17 : LN442YP

FINAL UNIT (X45-1440-XX) Component side view
-10 : TM-2550A (K1,M1,M3), TM-2550E (T,W)
-11 : TM-2530A (K2,M2,M4)

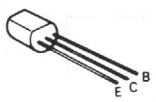


Q1 : M57726 (**TM-2550A/E**), M57737 (**TM-2530A**) Q2 : 2SD1406(Y) Q3 : 2SA1015(Y) Q4–7 : 2SC2458(Y)
D1 : U15B D2 : UM9401 (**TM-2550A/E**), MI407 (**TM-2530A**) D3 : MI308 D4,5 : 1S1587

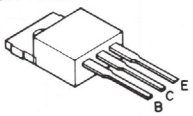
	C1
TM-2550A/E	X
TM-2530A	O

O : Used, X : Not used

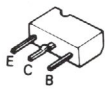
2SA1015



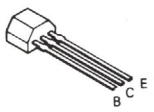
2SD1406



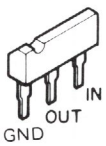
2SA790



2SC2458



DTC124EF

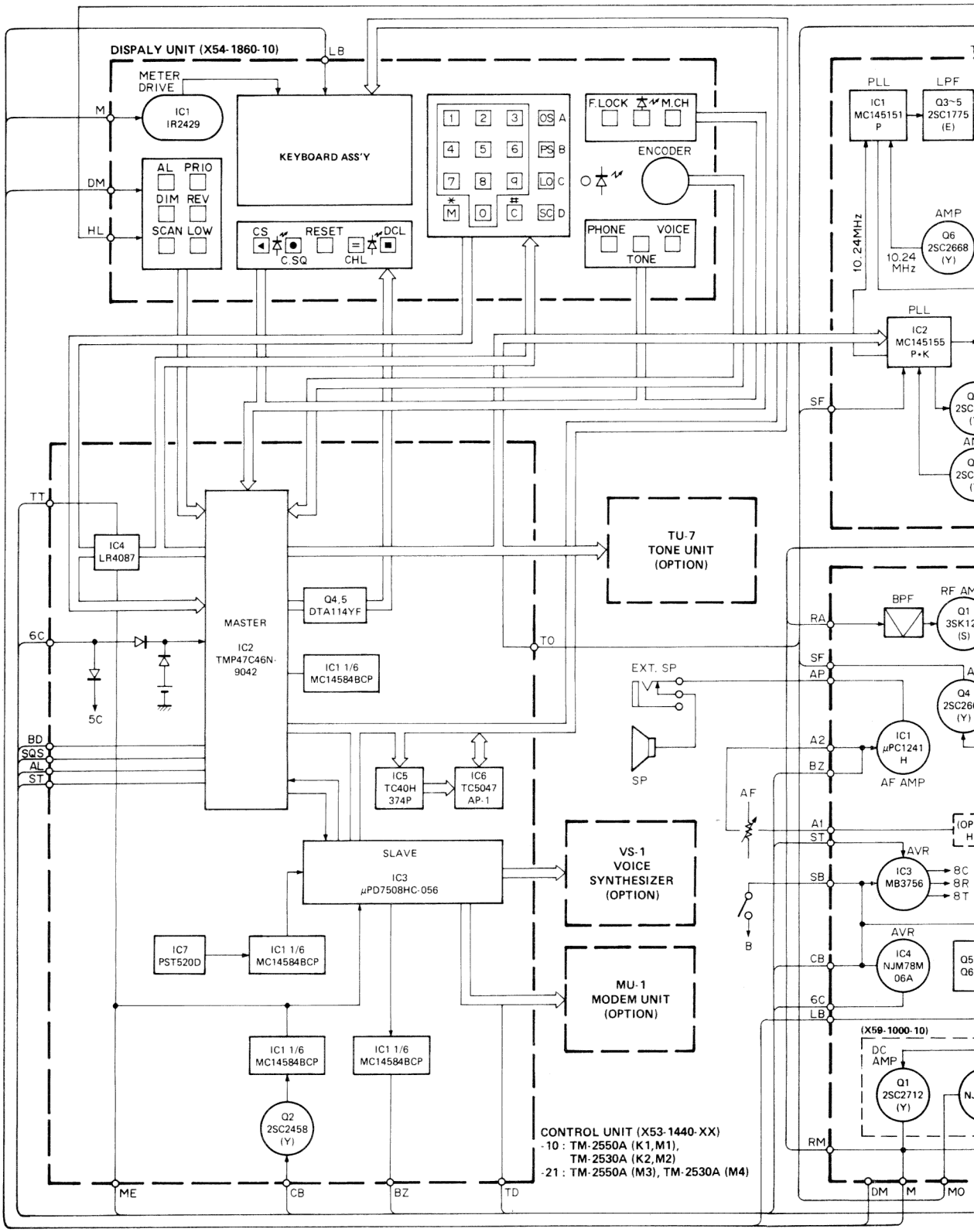


TERMINAL FUNCTION

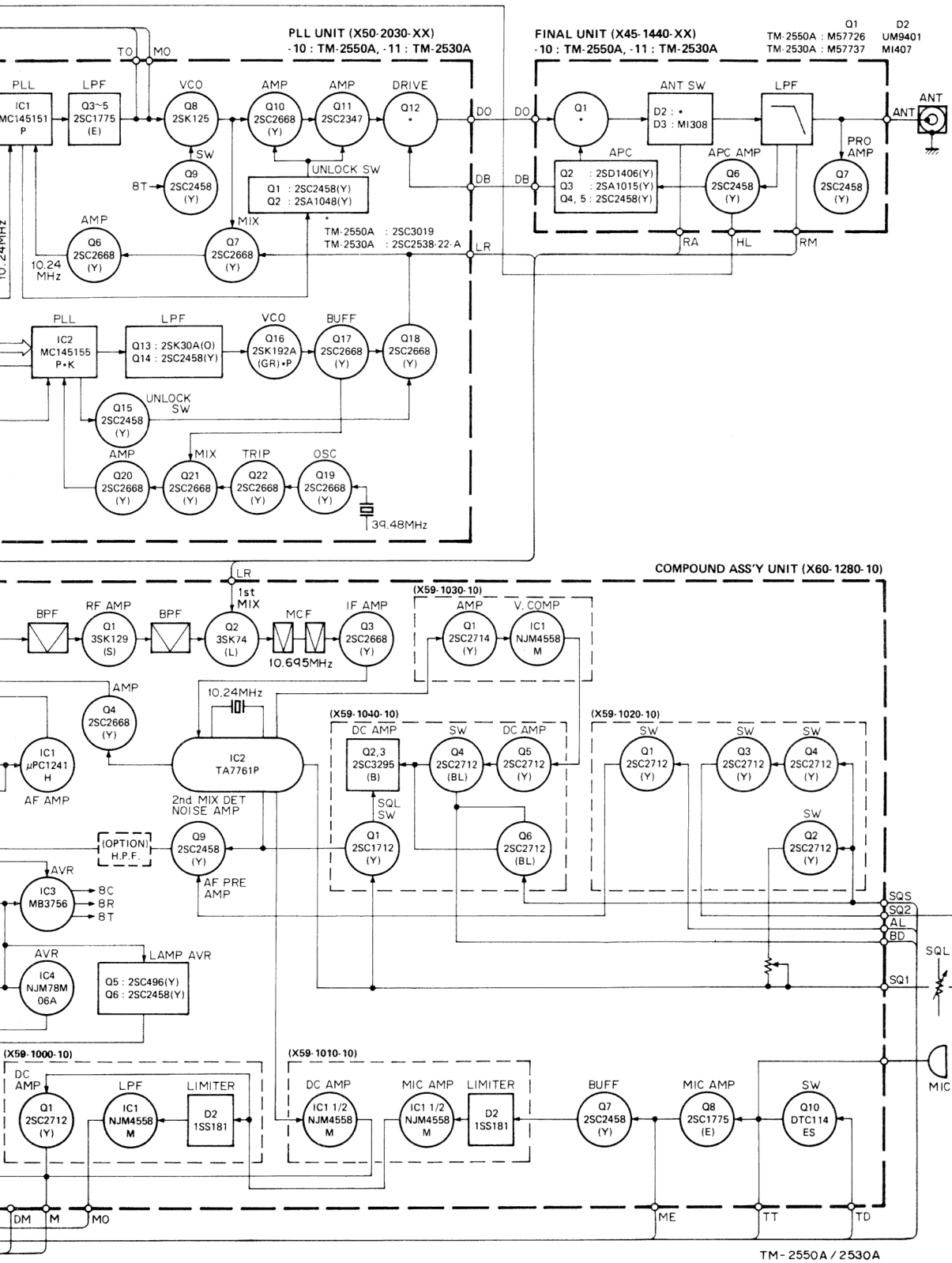
Terminal name	Terminal function
AL	ALERT
AP	Audio Power Output
A1	AF Output
A2	AF Input
B	+ 13.8V
BD	Busy Display
BZ	Buzzer
CB	Common + B
CT	Tone Clock
CP	PLL Clock
5C	+ 5V Common
6C	+ 6V Common
8C	+ 8V Common
DB	Drive + B
DT	Tone Data
DW	MIC Down SW
DP	PLL Data
DM	Dimmer
DO	Drive Out
ET	Tone Enable
EP	PLL Enable
E1	Encoder 1
E2	Encoder 2
HL	HI/LOW
G	GND
LB	Lamp + B
LR	RX Local

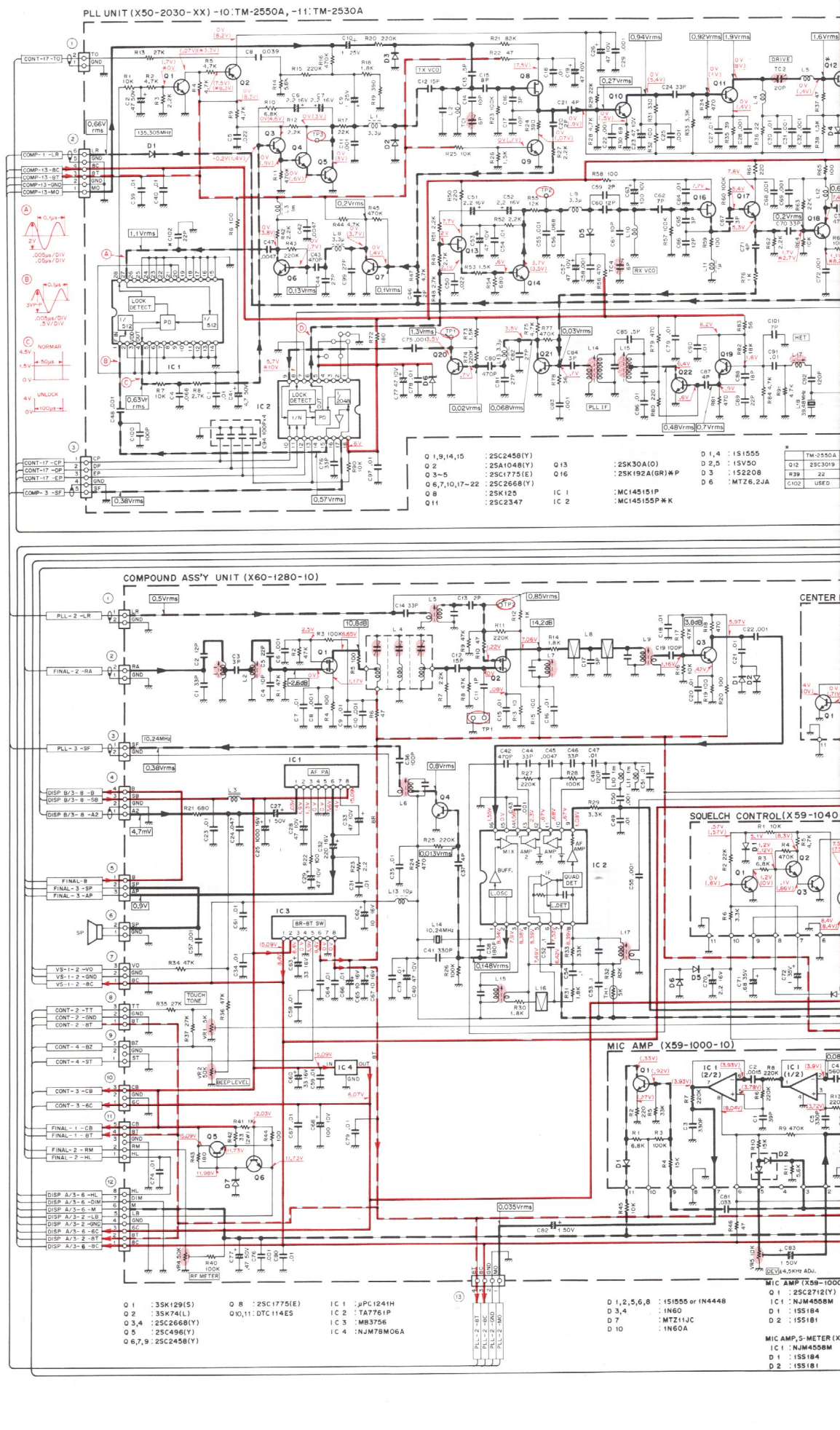
Terminal name	Terminal function
ME	Modem Enable
MD	Modem Data
MC	Modem Clock
M	Meter
MIC	MIC
MO	Modulator Out
8M	MIC 8V
NC	Non Connection
RD	RX Data
RA	RX Antenna
RM	RF Meter
SF	Standard Frequency
ST	Stand By
SS	Stand By SW
SQS	Squelch Select
SQ1	Squelch 1
SQ2	Squelch 2
SP	Speaker
SB	Switched + B
TO	Tone
TS	Tone SW
TH	Tone Hi
TD	TX Data
TT	Touch Tone Signal
8T	TX + 8V
8C	+ 8V Common
UP	MIC UP SW
VS	Voice SW

BLOCK DIAGRAM (K



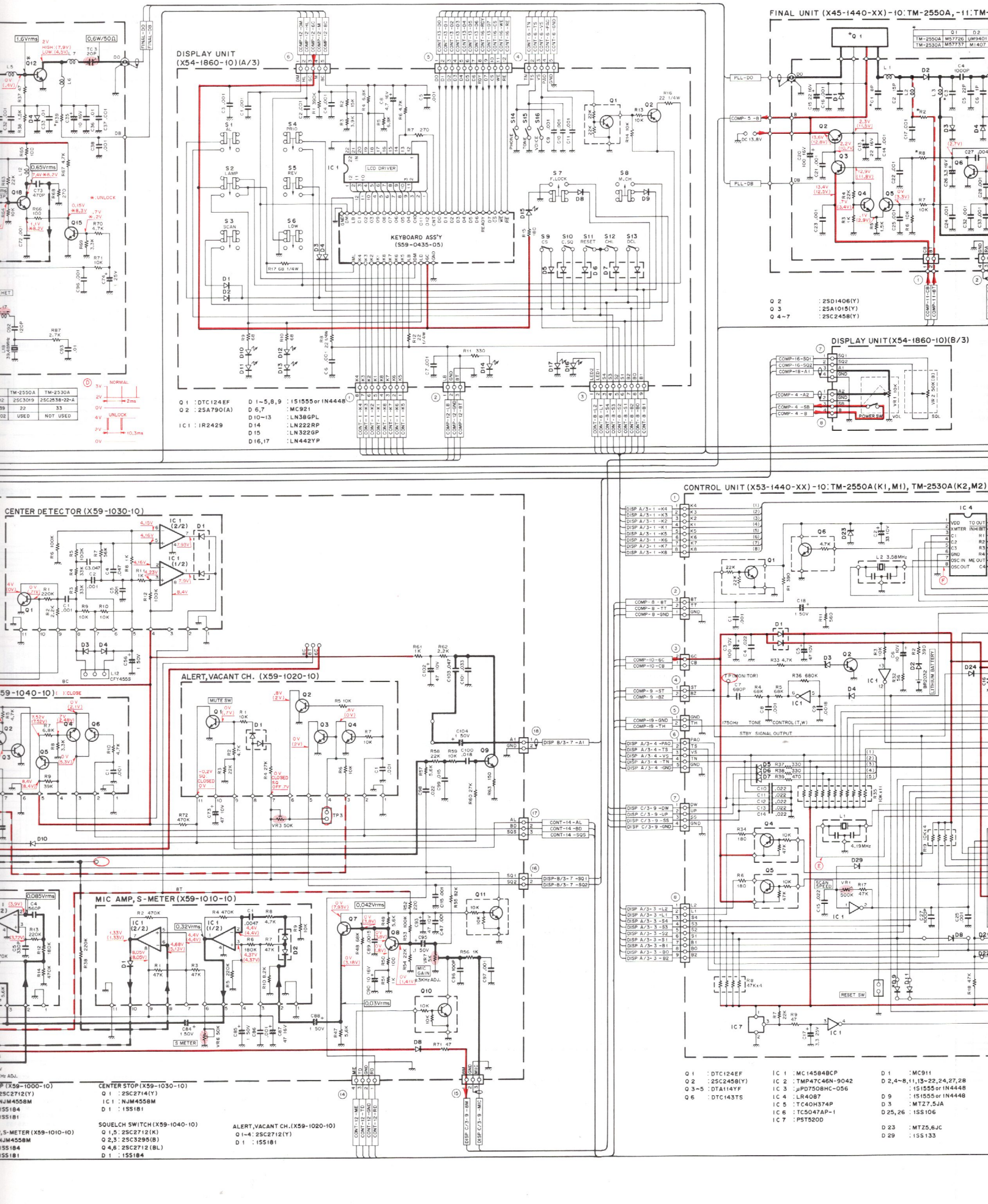
AGRAM (K,M TYPE)



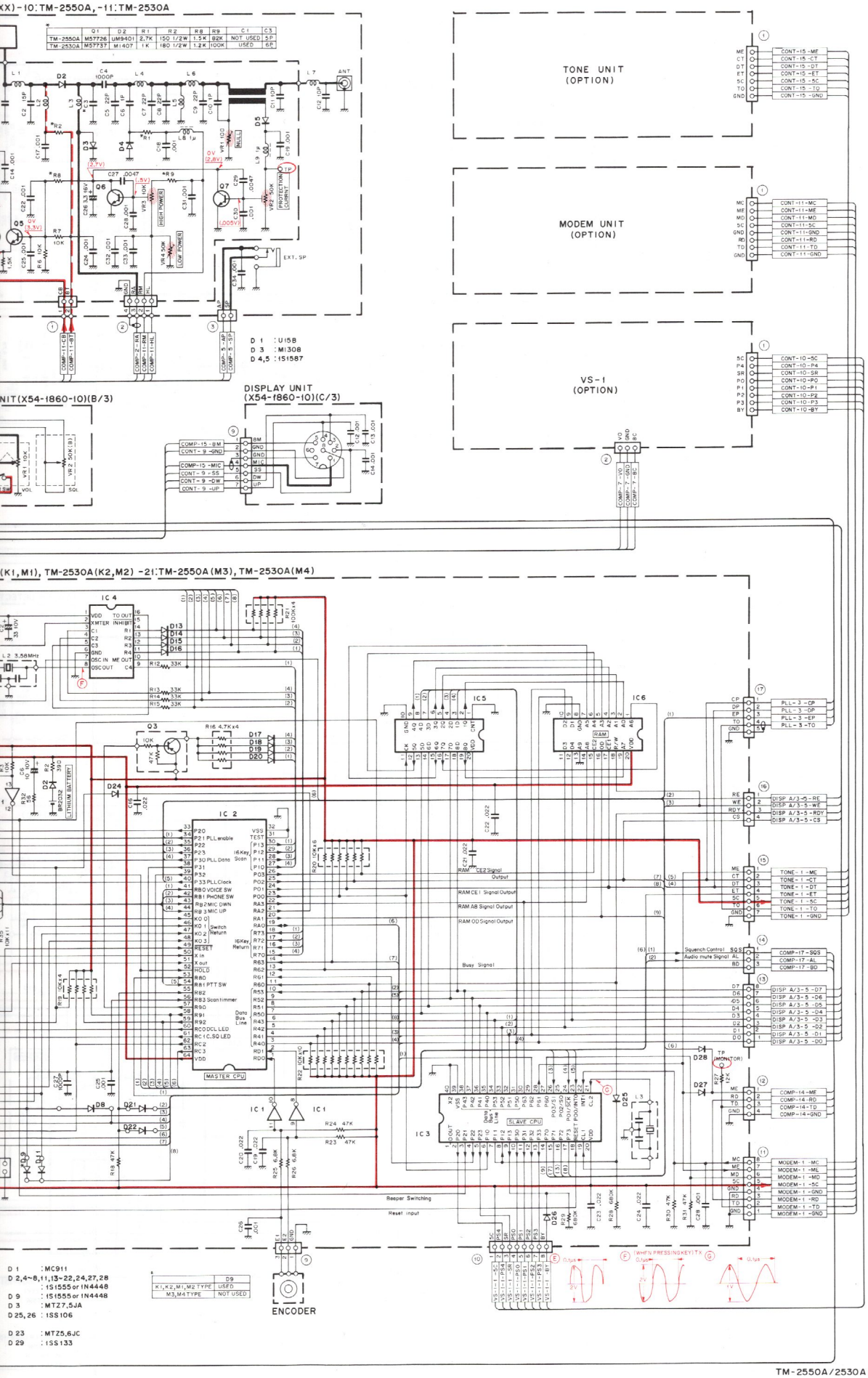

Signal line
Control line
Common DC line
8T L
PLL UNIT (X50-2030-XX) -10:TM-2550A, -11:TM-2530A
COMPOUND ASS'Y UNIT (X60-1280-10)
SQUELCH CONTROL(X59-1040
MIC AMP (X59-1000-10)
CENTER
MIC AMP (X59-1000
MIC AMP,S-METER (X
Q 1,9,14,15 : 2SC2458(Y)
Q 2 : 2SA1048(Y)
Q 3~5 : 2SC1775(E)
Q 6,7,10,17~22 : 2SC2668(Y)
Q 8 : 2SK125
Q 11 : 2SC2347
Q 13 : 2SK30A(O)
Q 16 : 2SK192A(GR)*P
IC 1 : MC145151P
IC 2 : MC145155P**K
D 1,4 : 1S1555
D 2,5 : 1SV50
D 3 : 1S2208
D 6 : MTZ6.2JA
TM-2550A
Q12 2SC3019
R39 22
C102 USED
Q 1 : 3SK129(S)
Q 2 : 3SK74(L)
Q 3,4 : 2SC2668(Y)
Q 5 : 2SC496(Y)
Q 6,7,9 : 2SC2458(Y)
Q 8 : 2SC1775(E)
Q10,11 : DTC114ES
IC 1 : μPC1241H
IC 2 : TA7761P
IC 3 : MB3756
IC 4 : NJM78M06A
D 1,2,5,6,8 : 1S1555 or 1N4448
D 3,4 : 1N60
D 7 : MTZ11JC
D 10 : 1N60A
IC 1 : NJM4558M
D 1 : 1SS184
D 2 : 1SS181

– 8T Line

Voltage measurement conditions f = 144.00MHz, RX no signal, ( ) : TX.



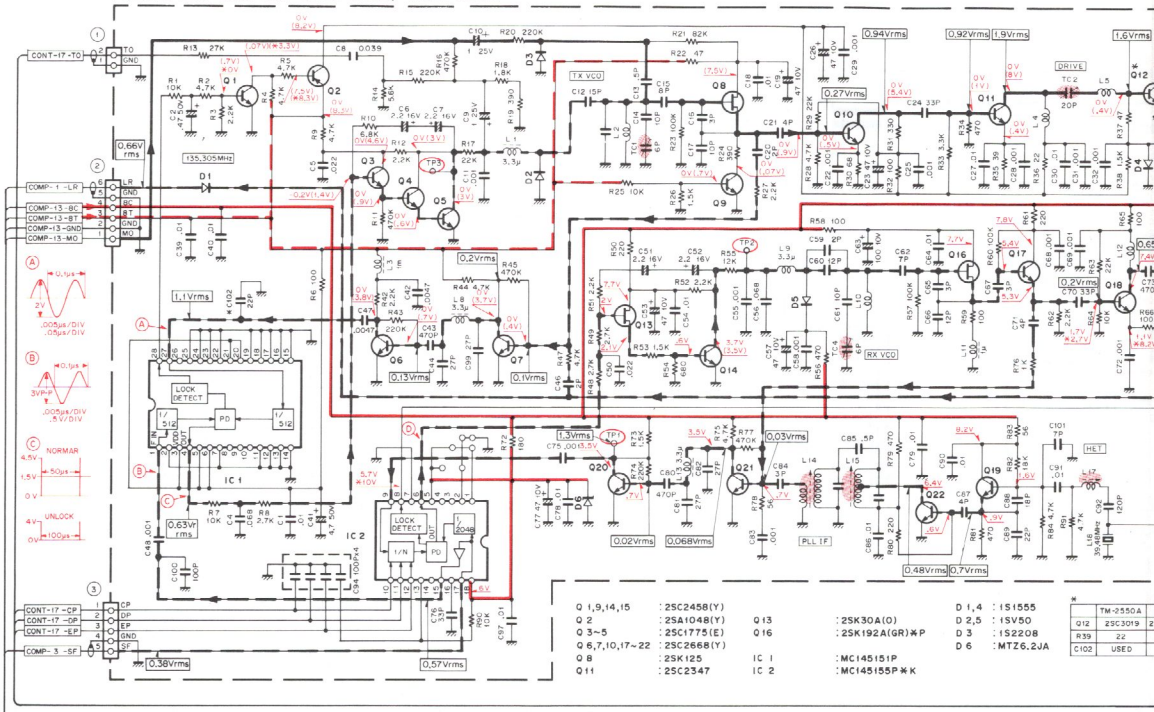
SCHEMATIC DIAGRAM (K,M TYPE) TM-2550A/E,2530A



TM-2550A/2530A(K,M)

Signal line — Control line — Common DC line — 8T L

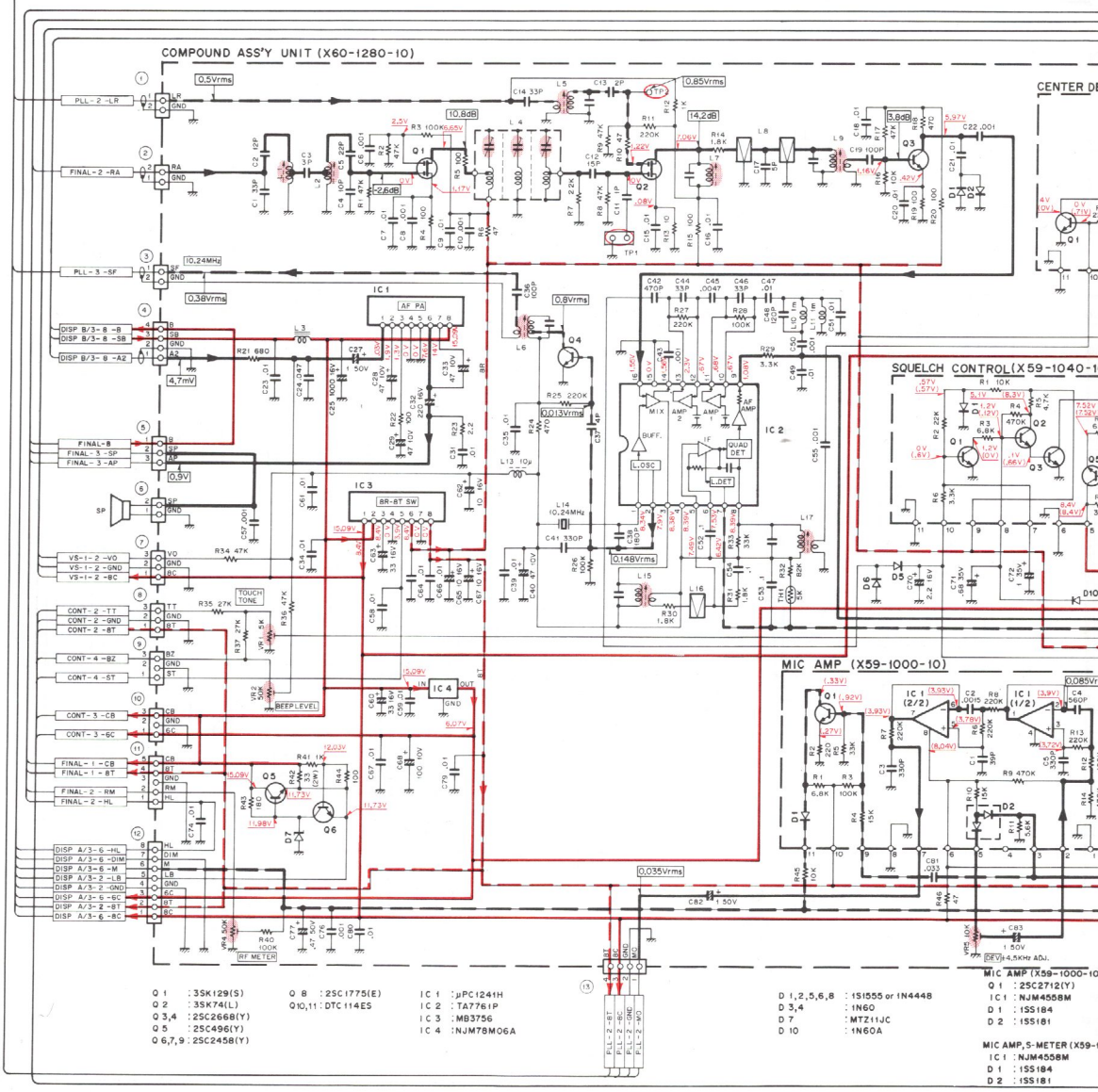
PLL UNIT (X50-2030-XX) -10:TM-2550A, -11:TM-2530A



Q 1,9,14,15 : 2SC2458(Y)
Q 2 : 2SA1048(Y)
Q 3~5 : 2SC1775(E)
Q 6,7,10,17~22 : 2SC2668(Y)
Q 8 : 2SK125
Q 11 : 2SC2347
Q 13 : 2SK30A(O)
Q 16 : 2SK192A(GR)*P
IC 1 : MC145151P
IC 2 : MC145155P*K
D 1,4 : 1S1555
D 2,5 : 1SV50
D 3 : 1S2208
D 6 : MTZ6.2JA

*	TM-2550A
Q12	2SC3019
R39	22
C102	USED

COMPOUND ASS'Y UNIT (X60-1280-10)



Q 1 : 3SK129(S)
Q 2 : 3SK74(L)
Q 3,4 : 2SC2668(Y)
Q 5 : 2SC496(Y)
Q 6,7,9 : 2SC2458(Y)
Q 8 : 2SC1775(E)
Q10,11 : DTC114ES
IC 1 : μPC1241H
IC 2 : TA7761P
IC 3 : MB3756
IC 4 : NJM78M06A
D 1,2,5,6,8 : 1S1555 or 1N4448
D 3,4 : 1N60
D 7 : MTZ11JC
D 10 : 1N60A

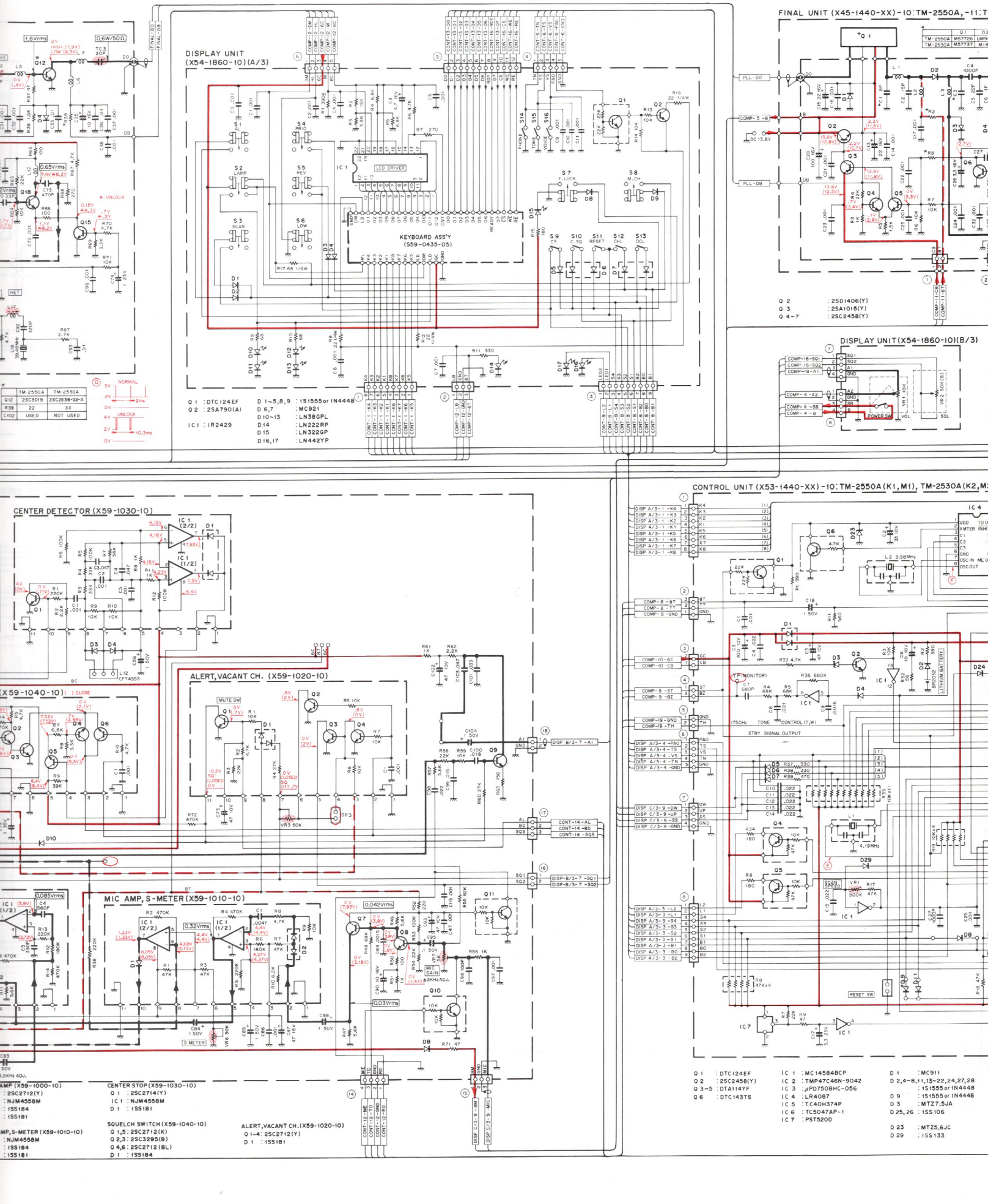
MIC AMP (X59-1000-10)

MIC AMP (X59-1000-10)
Q 1 : 2SC2712(Y)
IC 1 : NJM4558M
D 1 : 1SS184
D 2 : 1SS181

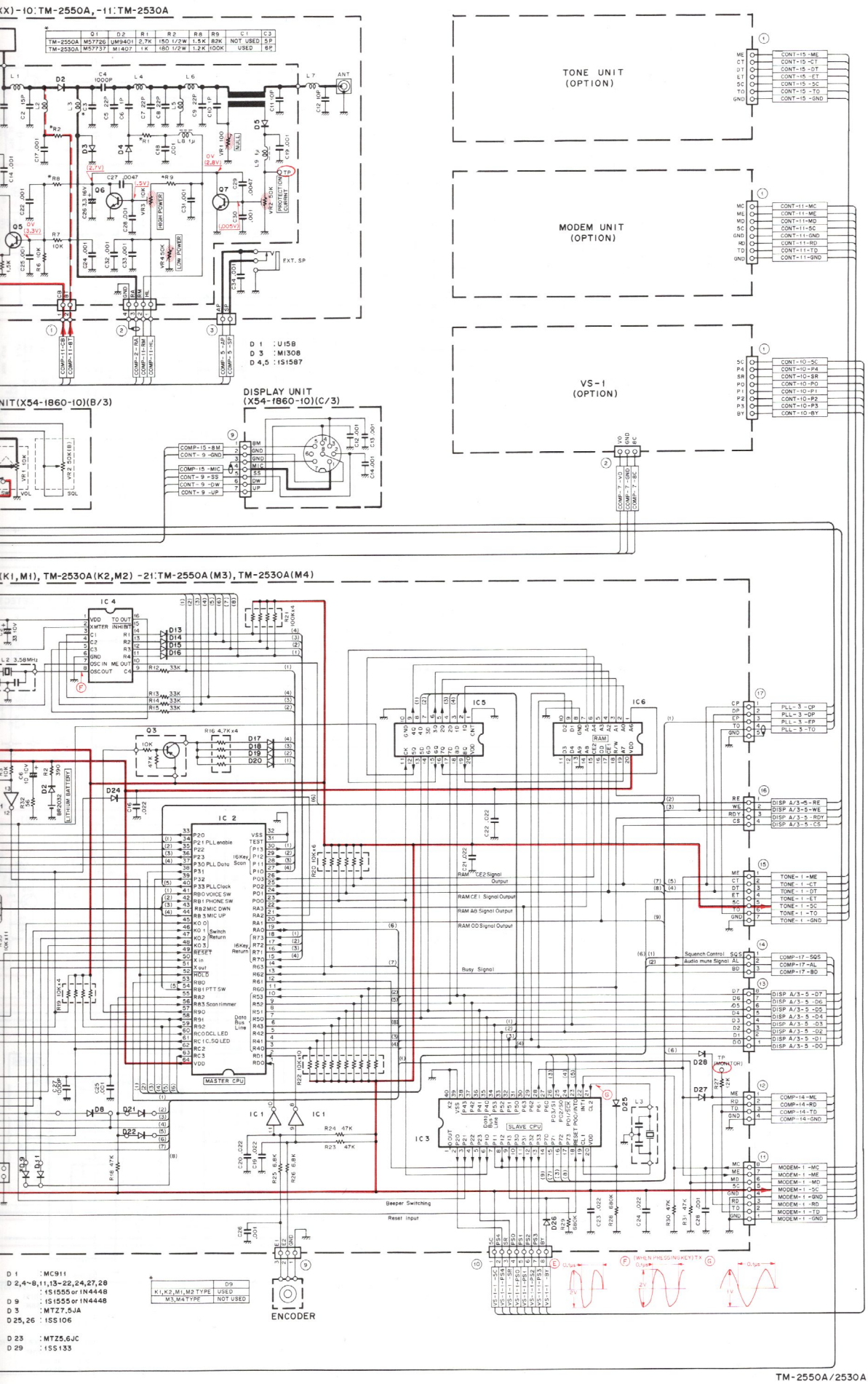
MIC AMP,S-METER (X59-
IC 1 : NJM4558M
D 1 : 1SS184
D 2 : 1SS181

— 8T Line

Voltage measurement conditions f = 144.00MHz, RX no signal, ( ) : TX.

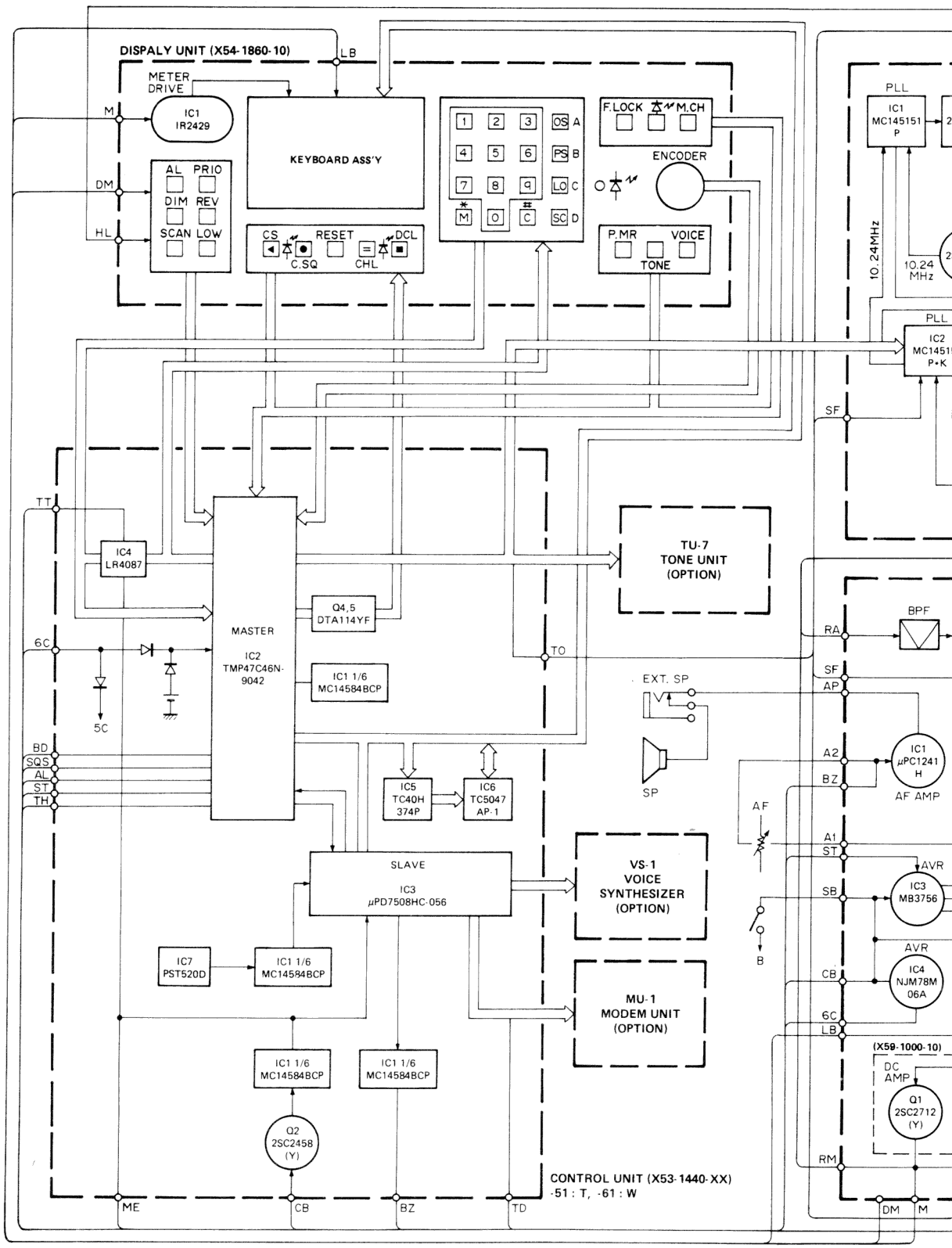


SCHEMATIC DIAGRAM (K,M TYPE) TM-2550A/E,2530A

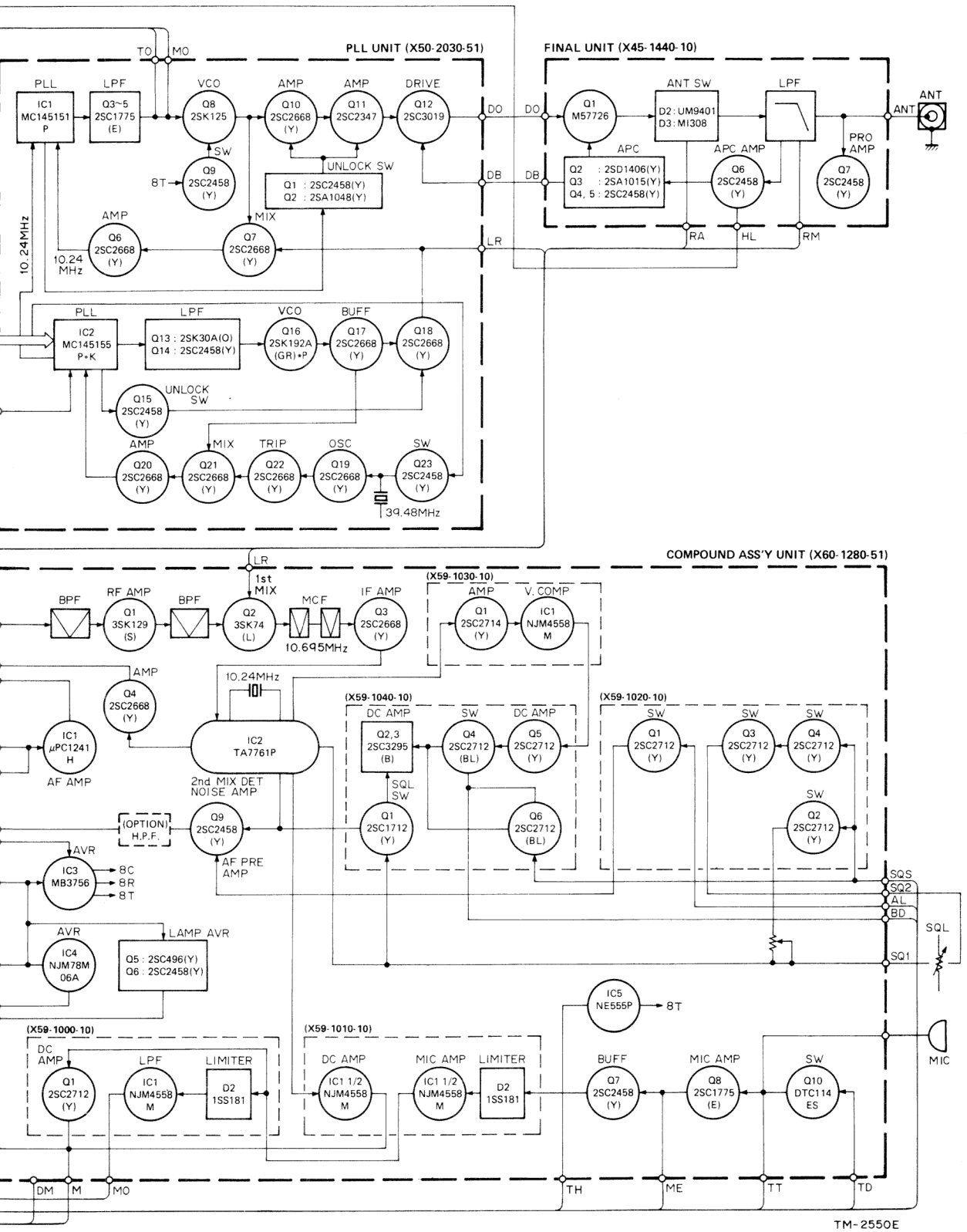


TM-2550A/2530A(K,M)

BLOCK DIAGRAM

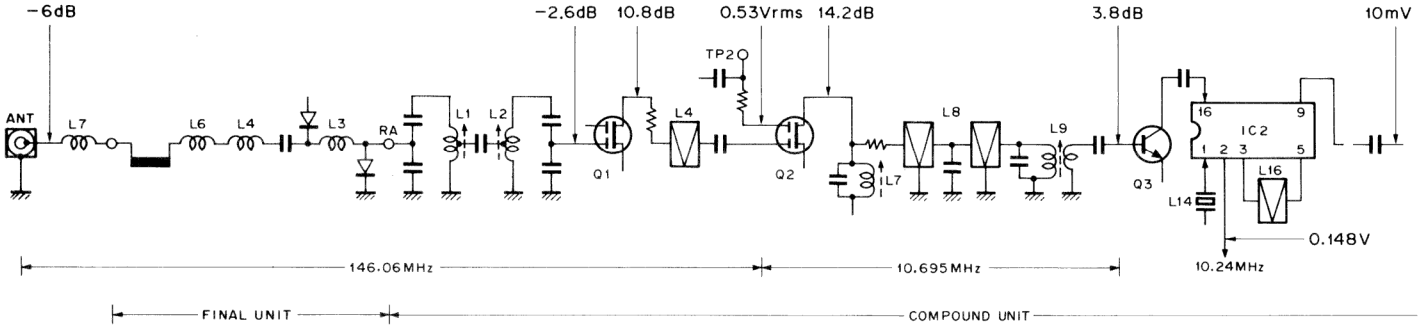


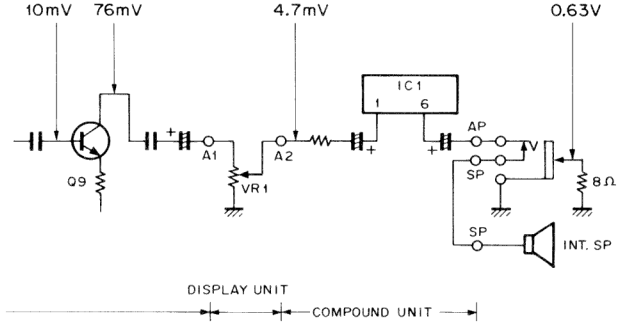
IAGRAM (T,W TYPE)



TM-2550E

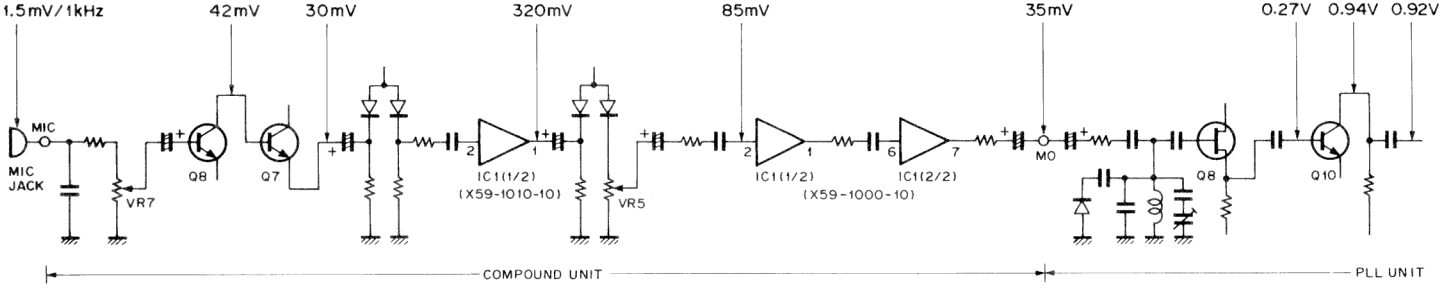
RX SECTION

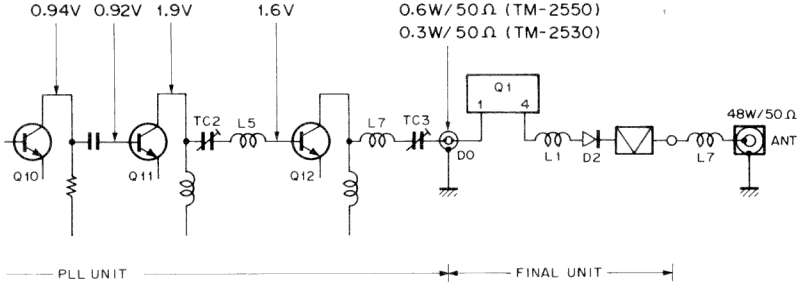




1) First, set the AF gain control for an audio output of 0.63V/8Ω for an SSG output signal at 146.06MHz/−6dBμ, applied to the antenna terminal, the AF gain control is now fixed. Thereafter, only the SSG signal level injected at each point is varied, as required to obtain the same 20dB NQ sesitivity as that at initial input of the reference −6dBμ is taken.
2) In the stages after the product delector, the AF output level is measured.
3) Level measurement is made with a 0.01μF ceramic capacitor connected to the SSG output.
   FREQ. : 146.06MHz, MOD : 1kHz, DEV : 3kHz

TX SEDTION

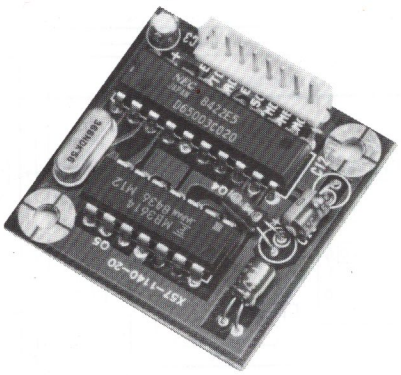




1) FREQ. : 146.06MHz
2) For level measurement before pin DO in the COMPOUND unit, coaxial cable connected to pin DO is disconnected.

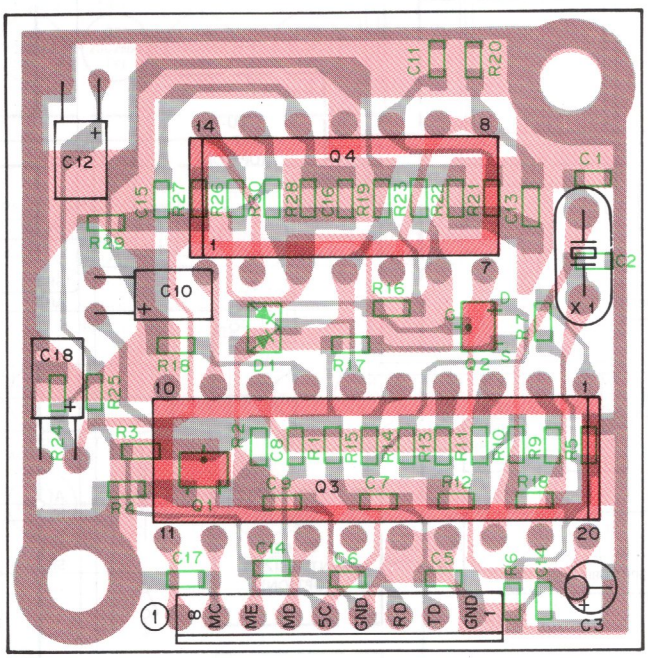
MU-1 (MODEM)

MU-1 OUTSIDE VIEW



MU-1 PD BOARD VIEW

(X57-1140-20) Component side view



2SC2712

2SK208

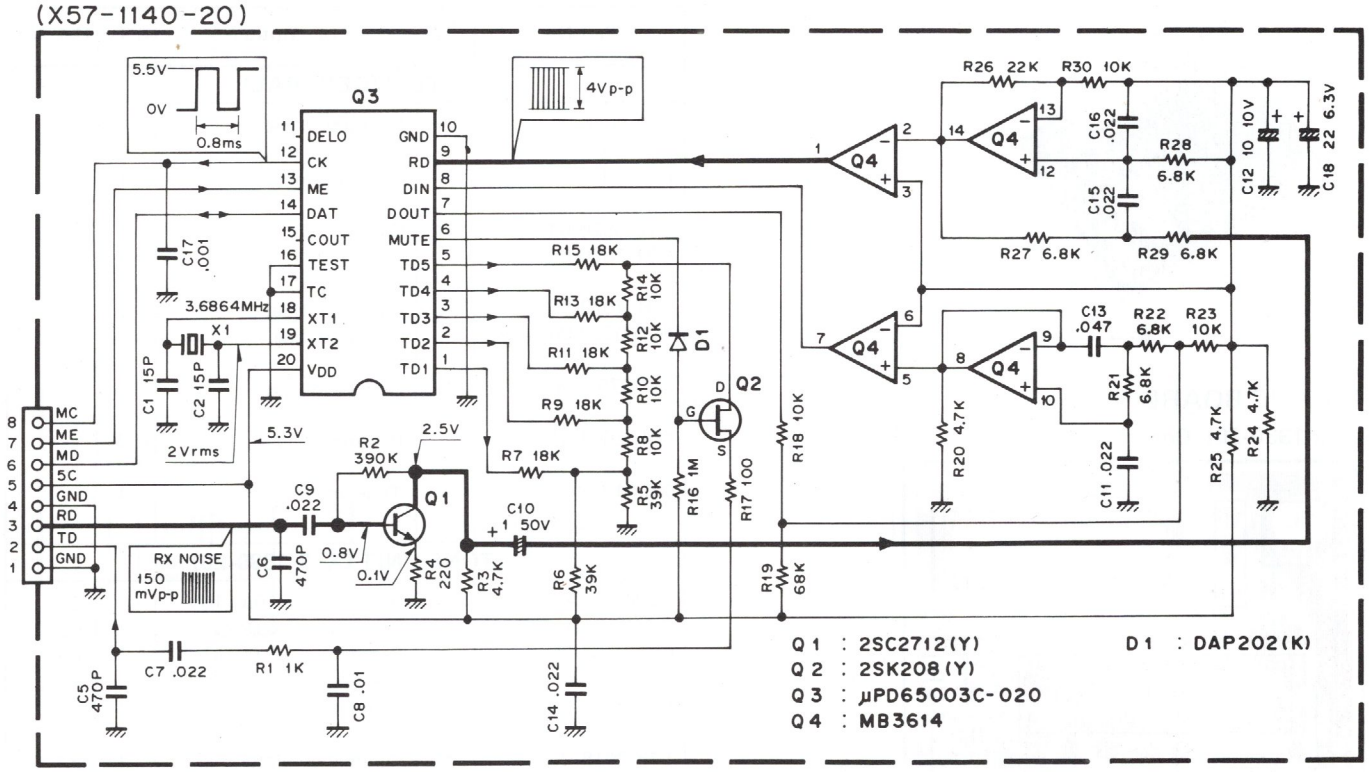
MU-1 PARTS LIST

Part No.	Re-marks	Description	Q'Ty	Ref. No.
MU-1 (GENERAL)				
B50-8046-00	N	Instruction manual	1	
G13-0826-04		Cushion	1	
H01-4680-03	N	Carton (Inside)	1	
H25-0029-04		Protective bag	2	
J32-0791-04		Hex. head boss	1	
N35-2604-41		Binding screw	2	
X57-1140-20	N	MODEM unit	1	
MODEM UNIT (X57-1140-20)				
CC73FCH1H150J		Chip cap. 15P	2	C1,2
CE04CW0J220M		Electro 22μ 6.3V	1	C18
CE04CW1A100M		Electro 10μ 10V	2	C3,12
CE04CW1H010M		Electro 1μ 50V	1	C10
CK73EB1E473K		Chip cap. 0.047μ	1	C13
CK73FB1H102K		Chip cap. 0.001μ	1	C17
CK73FB1H103K		Chip cap. 0.01μ	1	C8
CK73FB1H223K		Chip cap. 0.022μ	7	C4,7,9,11, 14–16
CK73FB1H471K		Chip cap. 470P	2	C5,6
E40-5022-05		Mini-connector 8P	1	
L77-1295-05	N	X'tal oscillator 3.6864MHz	1	X1
RK73FB2A101J		Chip res. 100Ω	1	R17
RK73FB2A102J		Chip res. 1kΩ	1	R1
RK73FB2A103J		Chip res. 10kΩ	7	R8,10,12,14, 18,23,30
RK73FB2A105J		Chip res. 1MΩ	1	R16
RK73FB2A183J		Chip res. 18kΩ	5	R7,9,11,13,15
RK73FB2A221J		Chip res. 220Ω	1	R4
RK73FB2A223J		Chip res. 22kΩ	1	R26
RK73FB2A393J		Chip res. 39kΩ	2	R5,6
RK73FB2A394J		Chip res. 390kΩ	1	R2
RK73FB2A472J		Chip res. 4.7kΩ	4	R3,20,24,25
RK73FB2A682J		Chip res. 6.8kΩ	5	R21,22,27–29
RK73FB2A683J		Chip res. 68kΩ	1	R19
2SC2712(Y)		Chip TR	1	Q1
2SK208(Y)		Chip FET	1	Q2
μPD65003C-020		IC	1	Q3
MB3614		IC	1	Q4
DAP202(K)		Chip diode	1	D1

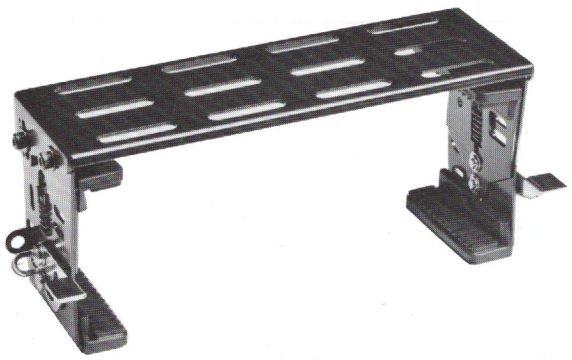
MU-1 (MODEM)/MB-10 (MOBILE MOUNT)

MU-1 SCHEMATIC DIAGRAM

(X57-1140-20)



MB-10 OUTSIDE VIEW

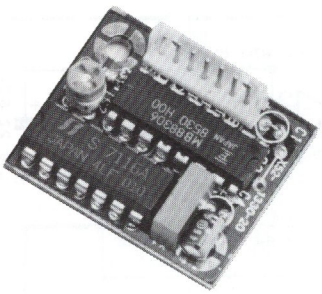


MB-10 PARTS LIST

Part No.	Re-marks	Description	Q'Ty	Ref. No.
A13-0666-02	N	Mount blacket ass'y	1	
A13-0667-02	N	Mount blacket ass'y	1	
A13-0668-04	N	Mount hardware	1	
B50-8063-00	N	Instruction manual	1	
G13-0823-04		Cushion	4	
H01-8006-03	N	Carton (Inside)	1	
H13-0803-03	N	Protective plate	1	
H13-0805-03	N	Protective plate	1	
H25-0029-04)		Protective bag (Screw etc.)	1	
H25-0036-04		Protective bag (Angle ass'y)	2	
H25-0116-04)		Protective bag (Accessary)	1	
N09-0008-04		Hex. head screw (Accessary)	4	
N09-0632-05		Taptite screw (A) (Accessary)	4	
N14-0510-04		Flange nut (Accessary)	4	
N15-1040-45		Flat washer (Accessary)	4	
N15-1060-46		Flat washer (Accessary)	4	
N16-0060-46		Spring washer (Accessary)	4	
N99-0304-04		Hex. hole screw (Accessary)	4	
W01-0401-05		Hex. wrench (Accessary)	1	

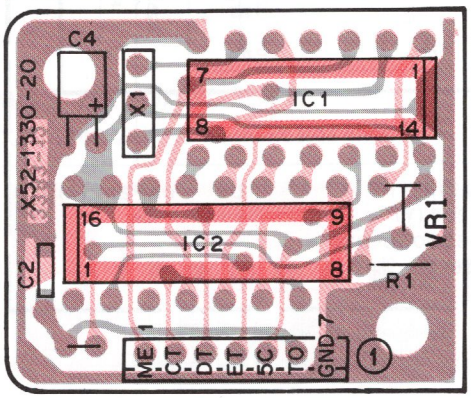
TU-7 (TONE) (K,M TYPE)

TU-7 OUTSIDE VIEW



TU-7 PC BOARD VIEW

(X52-1330-20) Component side view



TU-7 PARTS LIST

Part No.	Re-marks	Description	Q'Ty	Ref. No.
TU-7 (GENERAL)				
B50-8045-00	N	Instruction manual	1	
E31-3150-05	N	Cable assembly	1	
G13-0826-04	N	Cushion	1	
G31-0826-04		Foam spacer	1	
H01-4679-03	N	Carton (Inside)	1	
H25-0029-04		Protective bag	2	
J32-0791-04	N	Hex. head boss	1	
N35-2604-41		Binding screw	2	
X52-1330-20	N	Tone unit	1	
TONE UNIT (X52-1330-20)				
CE04CW1A100M		Electro 10μ 10V	1	C4
CK73EB1H473K		Chip cap. 0.047μ	1	C2
C91-0757-05		Ceramic 0.001μ	1	C3
E40-5021-05		Mini-connector 7P	1	
L78-0018-05	N	Ceramic oscillator	1	X1
R12-3445-05		Trimming pot. 47kΩ	1	VR1
MB88306	N	IC	1	IC2
S7116A	N	IC	1	IC1

TU-7 INSTALLATION AND TONE FREQUENCY SETTING PROCEDURE

Available CTSS tone frequencies

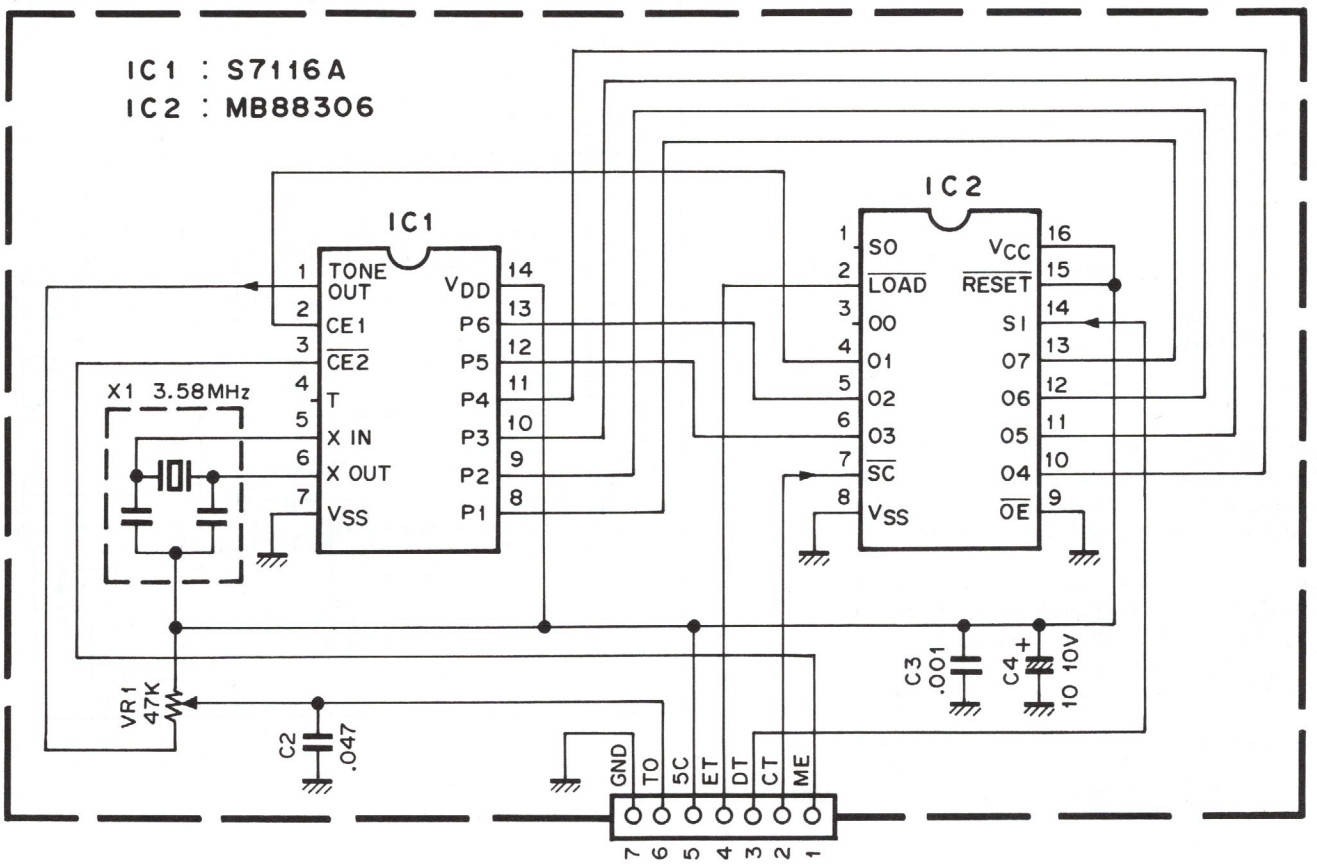
Hz	Hz	Hz
67.0	114.8	192.8
71.9	118.8	203.5
74.4	123.0	210.7
77.0	127.3	218.1
79.7	131.8	225.7
82.5	136.5	233.6
85.4	141.3	241.8
88.5	146.2	250.3
91.5	151.4	
94.8	156.7	
97.4	162.2	
100.0	167.9	
103.5	173.8	
107.2	179.9	
110.9	186.2	

Refer to the instruction manual provided with the transceiver.

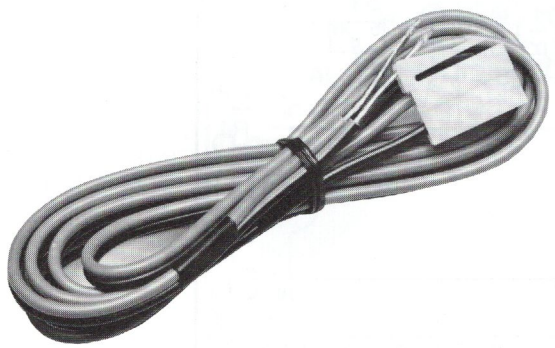
TU-7 (TONE) (K,M TYPE)/PG-2K (DC POWER CABLE)

TU-7 SCHEMATIC DIAGRAM

(X52-1330-20)



PG-2K OUTSIDE VIEW

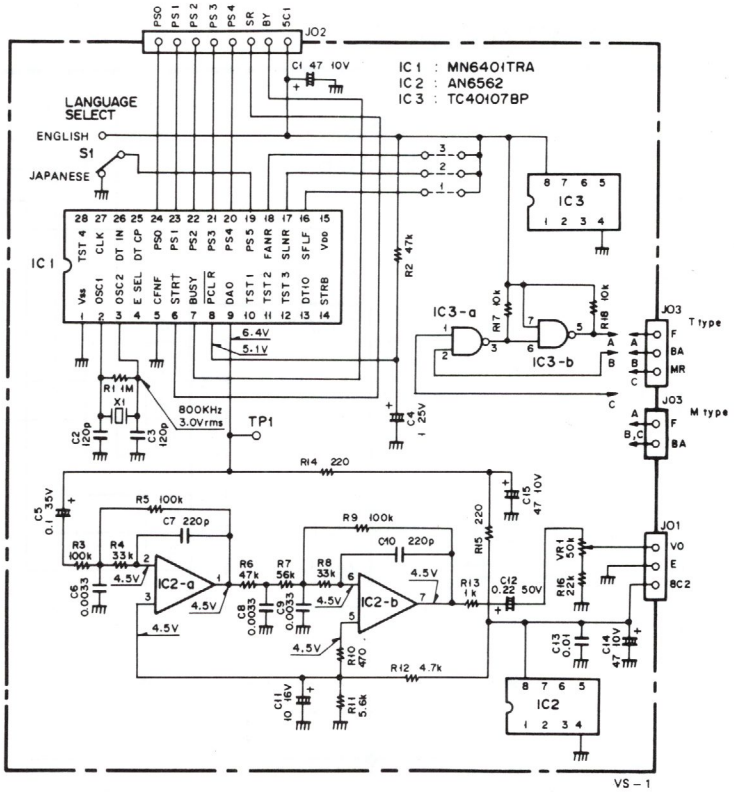


VS-1 (VOICE SYNTHESIZER)

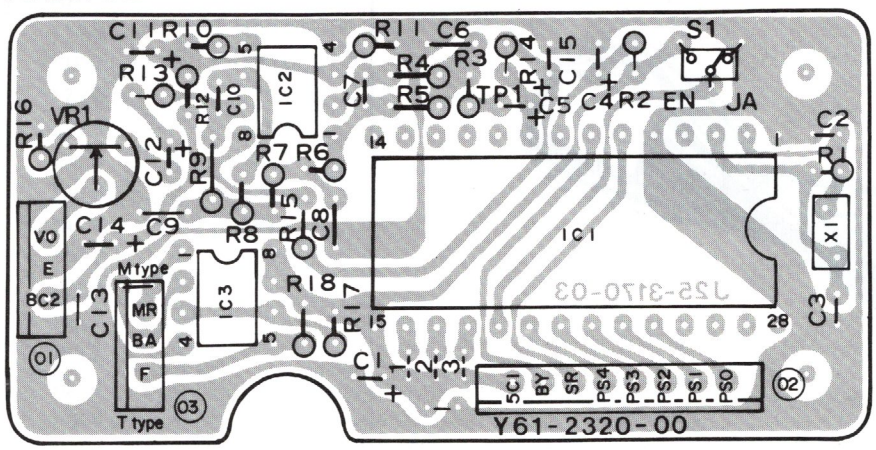
PARTS LIST

Part No.	Re-marks	Description	Ref. No.
B50-4035-00	N	Instruction manual	
CC45SL1H121J		C 120P x 2	C2,3
CE04W1A470M		E 47 10V	C1,14,15
CE04W1C100M		E 10 16V	C11
CE04W1HR22M		E 0.22 50V	C12
CK45B1H221K		C 220P x 2	C7,10
CQ92M1H332K		ML 0.0033 x 3	C6,8,9
CS15E1E010M		T 1 25V	C4
CS15E1V0R1M		T 0.1 35V	C5
C91-0131-05		C 0.01 (SP)	C13
E40-0273-05	△	Mini connector 2P **M**	
E40-0373-05	△	Mini connector 3P **M**	
E40-0373-05	△	Mini connector x 2 3P **T**	
E40-0873-05	△	Mini connector 8P	
H01-4481-03	N△	Packing carton (inside) **M**	
H01-4501-03	N△	Packing carton (inside) **T**	
H25-0029-04		Protective bag x 2	
L78-0006-05	N	Ceramic OSC	X1
N89-3006-46		Tapping screw x 4	
R12-4408-05		Trim. pot. 50kΩ	VR1
S31-1411-05	N	Slide switch	S1
AN6562	N	IC	IC2
MN6401TRA	N	IC	IC1
TC40107BP	N	IC	IC3

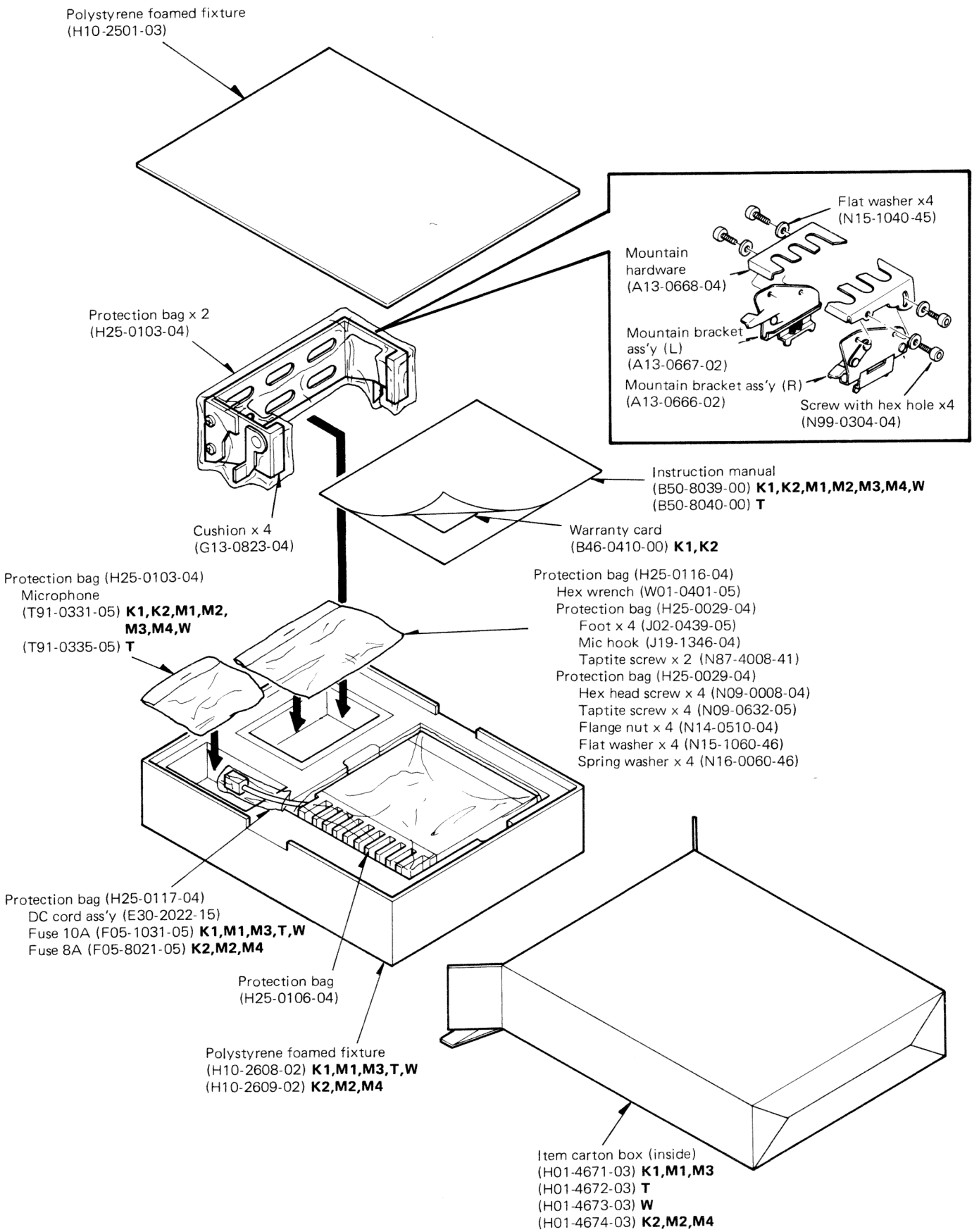
SCHEMATIC DIAGRAM



PC BOARD VIEW



PACKING


Polystyrene foamed fixture
(H10-2501-03)
Flat washer x4
(N15-1040-45)
Mountain
hardware
(A13-0668-04)
Protection bag x 2
(H25-0103-04)
Mountain bracket
ass'y (L)
(A13-0667-02)
Mountain bracket ass'y (R)
(A13-0666-02)
Screw with hex hole x4
(N99-0304-04)
Instruction manual
(B50-8039-00) K1,K2,M1,M2,M3,M4,W
(B50-8040-00) T
Cushion x 4
(G13-0823-04)
Warranty card
(B46-0410-00) K1,K2
Protection bag (H25-0103-04)
Microphone
(T91-0331-05) K1,K2,M1,M2,
M3,M4,W
(T91-0335-05) T
Protection bag (H25-0116-04)
Hex wrench (W01-0401-05)
Protection bag (H25-0029-04)
Foot x 4 (J02-0439-05)
Mic hook (J19-1346-04)
Taptite screw x 2 (N87-4008-41)
Protection bag (H25-0029-04)
Hex head screw x 4 (N09-0008-04)
Taptite screw x 4 (N09-0632-05)
Flange nut x 4 (N14-0510-04)
Flat washer x 4 (N15-1060-46)
Spring washer x 4 (N16-0060-46)
Protection bag (H25-0117-04)
DC cord ass'y (E30-2022-15)
Fuse 10A (F05-1031-05) K1,M1,M3,T,W
Fuse 8A (F05-8021-05) K2,M2,M4
Protection bag
(H25-0106-04)
Polystyrene foamed fixture
(H10-2608-02) K1,M1,M3,T,W
(H10-2609-02) K2,M2,M4
Item carton box (inside)
(H01-4671-03) K1,M1,M3
(H01-4672-03) T
(H01-4673-03) W
(H01-4674-03) K2,M2,M4

TM-2550A/E,2530A SPECIFICATIONS

[General]

Frequency range	144 MHz to 148 MHz (TM-2550A/2530A) 144 MHz to 146 MHz (TM-2550E)
Mode	FM F3 (F3E), F2 (F2D) (Control signal for DCL system)
Antenna impedance	50 ohms
Power requirement	13.8 VDC ±15%
Grounding	Negative
Operating temperature	−20°C to +50°C (−4°F to +122°F)
Current drain	0.6 A in receive mode with no input signal (TM-2550A/2550E) Approx. 9.5A in HI transmit mode Approx. 3A in LOW transmit mode (TM-2530A) Approx. 6.5A in HI transmit mode Approx. 2.5A in LOW transmit mode
Dimensions	180 mm wide, 60 mm high 215 mm deep (TM-2550A/2550E) 195 mm deep (TM-2530A) (Projection not included)
Weight	1.95 kg (4.3 lbs) : TM-2550A/2550E 1.8 kg (4 lbs) : TM-2530A

[Transmitter]

Output power (at 13.8 VDC, 50 ohms load)	HI: 45 W min. (TM-2550A/2550E) HI: 25 W min. (TM-2530A) LOW: 5 W approx. (Adjustable up to out 40 W ..... TM-2550A/2550E) (Adjustable up to out 20 W ..... TM-2530A) **Note:** Recommended duty cycle 1 minute : Transmission 3 minutes : Reception
Modulation	Reactance
Frequency stability	Less than ±15 PPM
Spurious radiation	Less than −60 dB
Maximum frequency deviation	±5 kHz
Audio distortion (at 60% modulation)	Less than 3% (300 Hz to 3000 Hz)

[Receiver]

Circuitry	Double conversion superheterodyne
Intermediate frequency	1st: 10.695 MHz, 2nd: 455 kHz
Sensitivity	SINAD 12 dB: Less than 0.25 μV S + N/N : More than 50 dB at 1 mV input
Selectivity	More than 12 kHz (−6 dB) Less than 24 kHz (−60 dB)
Spurious response	Better than 70 dB (except fd-IF/2)
Squelch sensitivity	Less than 0.125 μV (threshold)
Scan stop level	Less than 0.2 μV (threshold)
Output	More than 1.5 W across 8 ohms load (5% distortion)
External speaker impedance	8 ohms

[DCL control]

Code	NRZ equal-length code
Modulation	MSK modulation
Frequency deviation	±3.5 kHz reference
Mark frequency and deviation	1200 Hz ±200 PPM
Space frequency and deviation	1800 Hz ±200 PPM
Code transmission speed and deviation	1200 bits/second ±200 PPM

Note: Circuit and rating are subject to change without notice due to development in technology.

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