144/430(440)MHz FM DUAL BANDER

TW-4100A/E

SERVICE MANUAL

KENWOOD

B51-3228-00 (O) 851

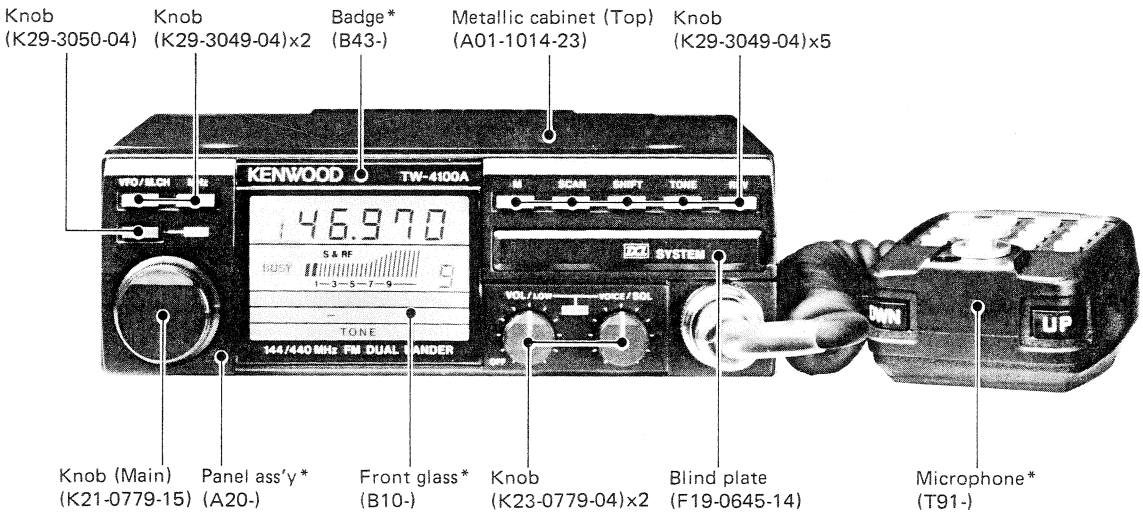


Photo is TW-4100A.
***Refer to parts list on page 19.**

CONTENTS

CIRCUIT DESCRIPTION

Unit name \ Model	TW-4100A (K,M1,M2)	TW-4100E (T,W)
Control unit	X53-3000-11 **(K)** X53-3000-21 **(M1)** X53-3000-22 **(M2)**	X53-3000-51 **(T)** X53-3000-61 **(W)**
Composite unit (RX-TX)	X60-3000-11	X60-3000-51
Composite unit (PLL-TX)	X60-3010-01 **(M1)** X60-3010-11 **(K,M2)**	X60-3010-01

Table 1 TW-4100A/E PC board chart

Frequency configuration

The TW-4100A/E utilizes a PLL synthesizer system with a digital VFO, which covers each band in 5, 10, 12.5, 20, 25, and 50kHz steps (See **Figure 1**).

The receiver operates as a double conversion system. Received signals are mixed with a signal from the first local oscillator (113.175 to 115.17MHz for the 144MHz band : **M1,T,W**, 113.175 to 117.17MHz for the 144MHz band : **K,M2**, 399.175 to 409.17MHz for the 430MHz band : **M1,T,W**, and 409.175 to 419.17MHz for the 440MHz band : **K,M2**) to produce the first intermediate frequency (IF) of 30.825MHz. The first IF is mixed with a signal from the second local oscillator (30.370MHz) to produce the second IF of 455kHz.

For transmission, signals are produced by a PLL circuit consisting of a direct-drive oscillator and frequency divider for each band. Gain is added to the output for each band by a linear amplifier for transmission.

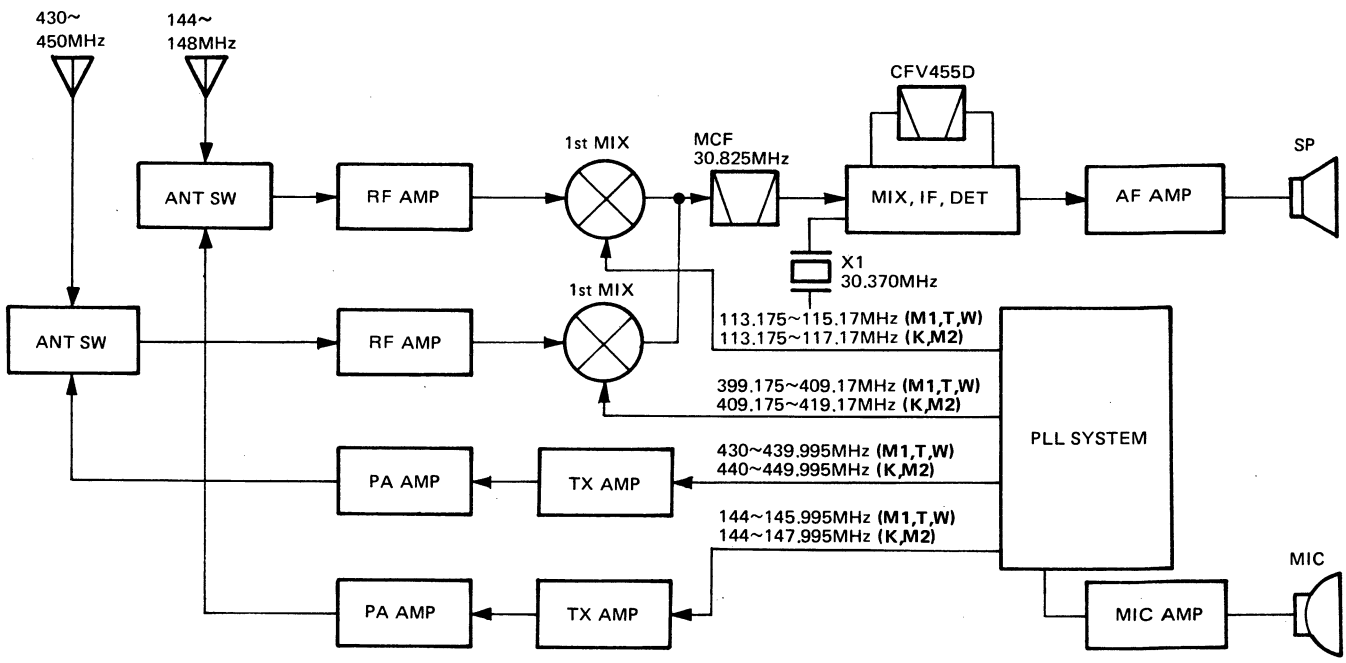


Fig. 1 Block diagram showing frequencies

CIRCUIT DESCRIPTION

Receiver system

- **General**

Incoming recieved signals for the 2 meter band are amplified by the 2 meter GaAs FET RF amplifier, Q1 : 3SK184(S), filtered by a 3 pole helical resonator, L24, and are then applied to mixer Q2 : 3SK184(R).

70 centimeter signals are applied to L6 for impedance matching and are then amplified by the 70 centimeter GaAs FET 1st RF amplifier, Q6 : 3SK184(S), filtered by a two pole helical resonator, L25, applied to the 2nd GaAs FET amplifier Q7 : 2SK125, and are then applied to mixer Q8 : 3SK184(R).

The first mixer of each band utlizes the same GaAs FET as the RF amplifier in order to improve the two signal characteristics of the radio. These mixers combine the respective first local oscillator signal, from the PLL unit, with the incoming receive signal, in order to obtain a common IF signal of 30.825MHz. Undesirable adjacent channel signals are removed from the first IF signal by a two-stage monolithic cyrstal filter (MCF) L27.

The signal is then applied to a cascade amplifier circuit consisting of Q3 and Q4 : 2SC2714(Y) and then to the narrow-band FM IC : TA7661P. The incoming IF signal is mixed with the second local oscillator signal of 30.370 MHz to yield the second IF frequency of 455kHz. This signal is then filtered by a six element cerramic filter (CFV455E), amplified, limited and quadrature detected by Q10. Any remaining high frequency components of the incoming signal are removed by an active low-pass filter. The signal is next applied to the front panel volume control and is then amplified by the AF power amplifier. Q16 : μPC1242H in order to drive the speaker.

- **Center detector circuit (X59-1030-10)**

A portion of the amplified 455kHz second IF signal is coupled thru the 455kHz tuning coil, L12, amplified and then detected by the ceramic discriminator L29 (CFY455S) The detected output is applied to a low pass filter and then to the center-detector IC1. The signal is then sent to the switching circuit on X59-3200-00 which controls the input to the scan stop instruction circuit on the Control unit.

- **Squelch circuit**

The noise components of the detected audio signal are filtered and then amplified by noise amplifier Q34 : 2SC2712(Y) and applied to a rectifier circuit composed of diodes D3 and D4 : 1S1587. This rectified voltage is used to control the audio muting switch, Q1 : 2SC2712(Y), of the Squelch control board (X59-3200-00). Q1 is used to control the conduction of audio preamplifier Q11 : 2SC2712(Y).

- **S-meter circuit**

The S-meter output signal of Q10 is inverted and amplified by IC1 of X59-1010-10, and then applied to the Control unit (X53-3000-XX). The microprocessor converts this analog signal into a digital signal that is used to drive the LCD bar graph.

Item	Rating
Nominal center frequency	30.825MHz
Pass bandwidth	±7.5kHz or more at 3dB
Attenuation bandwidth	±32kHz or less at 40dB
Ripple	1.5dB or less
Insertion loss	3dB or less
Guaranteed attenuation	60dB or more within ±1MHz 40dB or more spurious
Terminating impedance	1.4kΩ±10%/1pF±10%

Table 2 MCF (L71-0263-05) characteristics (Composite unit (RX-TX) L27)

Item	Rating
Nominal center frequency	455kHz
6dB bandwidth	±8kHz or more (from 455kHz)
60dB bandwidth	±16kHz or less (from 455kHz)
Ripple (within ±4kHz from 455kHz)	3dB or less
Insertion loss	6dB or less (minimum loss input)
Guaranteed attenuation (within ±100kHz from 455kHz)	50dB or more
I/O impedance	1.5kΩ

Table 3 Ceramic filter CFV455E (L72-0359-05) characteristics (Composite unit (RX-TX) L28)

Item	Rating
Center frequency (fo) and deviation	Within ±1kHz from 455kHz
Peak separation	15kHz or more
Voltage sensitivity	15±3mV/kHz
Hump	Not within ±5kHz from fo
Linearity	Within ±3kHz from 455kHz
Temperature characteristics (−30°C~+ 60°C)	Within ±0.3% (center frequency)

Table 4 Ceramic discriminator CFY455S (L79-0446-05) characteristics (Composite unit (RX-TX) L29)

CIRCUIT DESCRIPTION

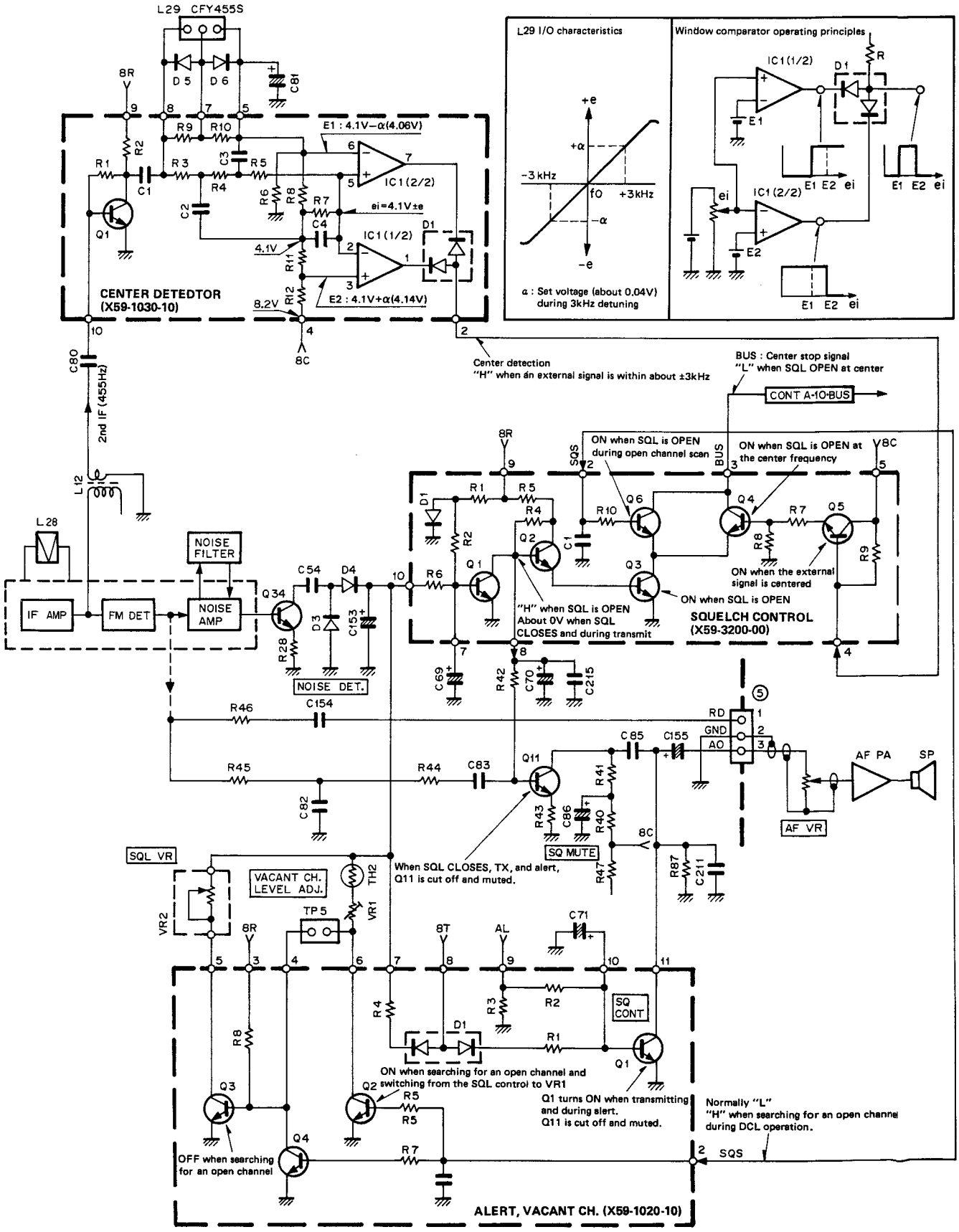


Fig. 2 Center detection, alert, open channel, SQL control circuit

CIRCUIT DESCRIPTION

Transmitter sytem

- **General**

The transmitter unit generates the desired frequencies in both bands directly and provides FM modulation using varactor diodes.

- **Modulation circuit**

Audio signals from the microphone pass microphone gain control VR2 and are amplified by a low-noise pre-amplifier Q13 : 2SC1775(E) and Q14 : 2SC2712(Y). The amplified signal is then applied to op amps on daughter boards X59-1010-10, and X59-3190-00, for pre-emphasis, amplification, limiting and filtering.

This signal is then applied to the varactor diodes in the 2 meter and 70 centimeter VCO circuits. The use of direct modulation provides a signal characterized by a flat frequency response (with a ripple approximately 2dB or less from ultra low thru ultra high audio frequencies). The FM signal therefore has excellent modulation characteristics with good linear response from subaudible thru audible frequency ranges.

- **Preamplifier stage circuit**

The signal from each VCO enters a linear amplifier (characterized by outstanding signal amplification). The APC (Automatic Transmit Output Control Circuit) controls the collector voltage at the preamplifier last step in both bands. To provide proper power module drive levels, there are three preamplifier stages for the TW-4100A/E.

- **Power amplifier circuit**

Each drive signal is applied to the appropriate power module and amplified to the desired output level. The power module has been designed with efficient duplex operation and thermal diffusion in mind. The TW-4100A/E utilizes a large heat sink, which is free of mechanical trouble, and a thermal guide, which operates to prevent thermal runaway and assure circuit safety.

- **APC and SWR protection circuits**

Figure 3 shows the basic APC and SWR protection circuits. The APC and protection circuits are independent of each other in both bands. The SWR protection circuit detects and amplifies reflected power due to antenna mismatching with a CM coupler. Signals from the SWR protection circuit lower the ALC reference voltge which reduces the gain of the power module. The Automatic Transmit Output Control Circuit (APC) detects and amplifies part of the signal from the power module by a diode, and controls the output control voltage. The control voltage is inversely proportional to the output, so the output is kept constant.

Item	Symbol	Tc (°C)	Unit	Condition	Rating	
					M57726	M57788M
Operating voltage	Vcc	25	V		17	17
Current consumption	Icc	25	A		14	14
Input power	Pin	25	W	$Z_G=Z_L=50\Omega$	0.6	0.6 ($V_{cc1} \leqq 13.8V$)
Output power	Po	25	W	$Z_G=Z_L=50\Omega$	55	55
Operating case temperature	Tc (op)		°C		−30~+110	−30~+110
Storage temperature	Tstg		°C		−40~+110	−40~+110

Table 5 Power module maximum rating

CIRCUIT DESCRIPTION

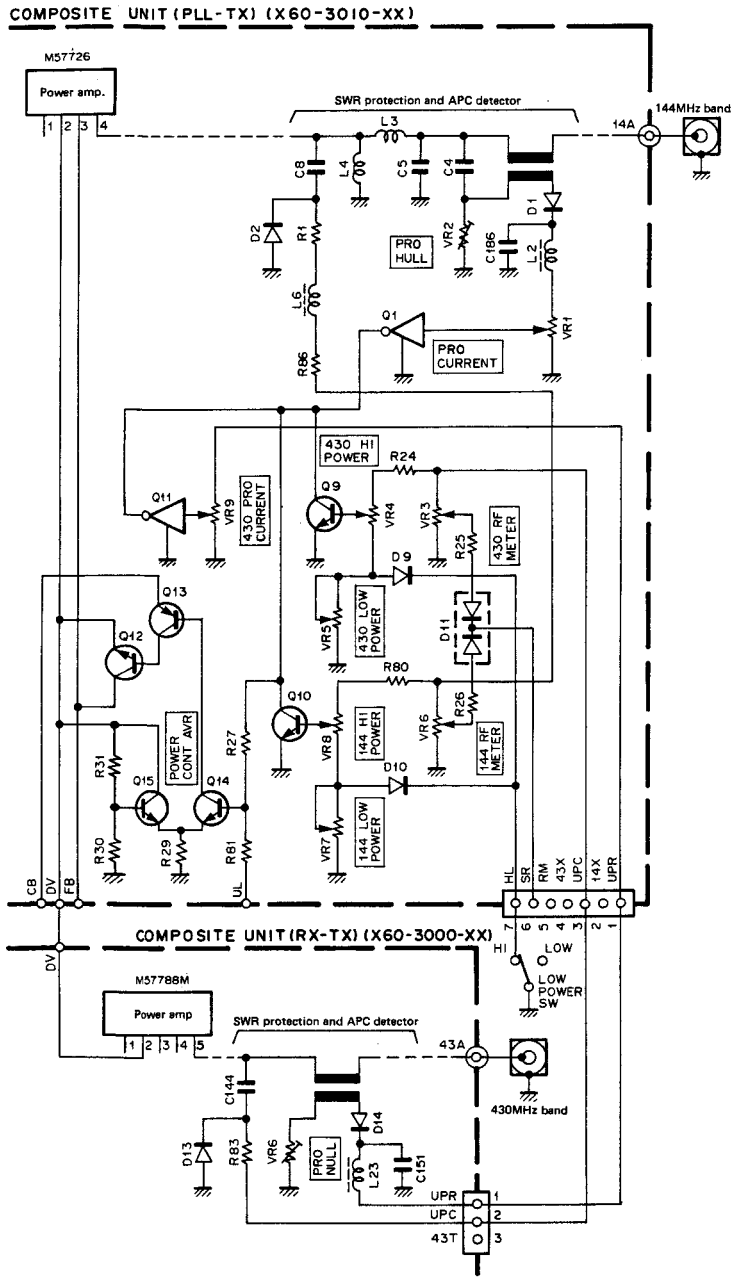


Fig. 3 APC and SWR protection circuits

PLL synthesizer

Figure 4 is a block diagram of the PLL system. The most important feature of the TW-4100A/E PLL system is that it is composed of VCO and PLL system in which the bands and transmit/receive sections are independent, which allows full duplex operation. The four VCOs are designed as independent subunits so that they limit outside influences in order to improve frequency stability.

The comparison frequencies of 6.25kHz and 5kHz, are obtained by dividing the 12.8MHz reference oscillator signal by 2048 and 2560. The frequency of each VCO is applied to the pulse swallow PLL circuit where the phase and frequencies are compared.

Serial data from the Control unit are used to set the reference and division ratios for PLL IC's Q20 and Q26 : MB87006. Q20 and Q26 have modulus control over pulse swallow counters Q19 : MB504P and Q25 : MB501P with an external prescaler. **Figure 5** shows the pulse swallow counter circuit.

The 12.8MHz reference signal is applied to Q20 from the reference generation circuit through buffer amplifier Q21 : 2SC2712(Y). The signal is internally divided by 2560 or 2048 according to the selected step width, to produce the 5kHz and 6.25kHz comparison frequencies.

The signal from the VCO passes through an amplifier and enters the pulse swallow counter. The 144MHz band is divided by 64, and the 430MHz band is divided by 128. The phase is compared with the 5kHz and 6.25kHz reference signals by the phase comparator. The phase comparator supplies a dc correction voltage that is applied to a varactor diode, which controls the frequency of the VCO.

fvco (RX) for 144.000MHz

fvco = (144.00–30.825) = [(n x M) + A] x fosc/R

fvco : VCO output frequency

n : Binary 10-bit programmable counter set value ND

M : Externally connected dual modulus prescaler (Q19 or 25) module set value : 64 (144MHz band), 128 (430MHz band)

A : Binary 7-bit swallow counter set value NA

fosc : Reference oscillator frequency 12.8MHz (128000kHz)

R : Binary 14-bit programmable reference counter set value : 2560 (5, 10, 20, 25, and 50kHz steps), 2048 (12.5kHz step)

=

∴ fvco = [(353 x 64) + 43] x 12800/2560

= [22592 + 43] x 5

= 113.175MHz

CIRCUIT DESCRIPTION

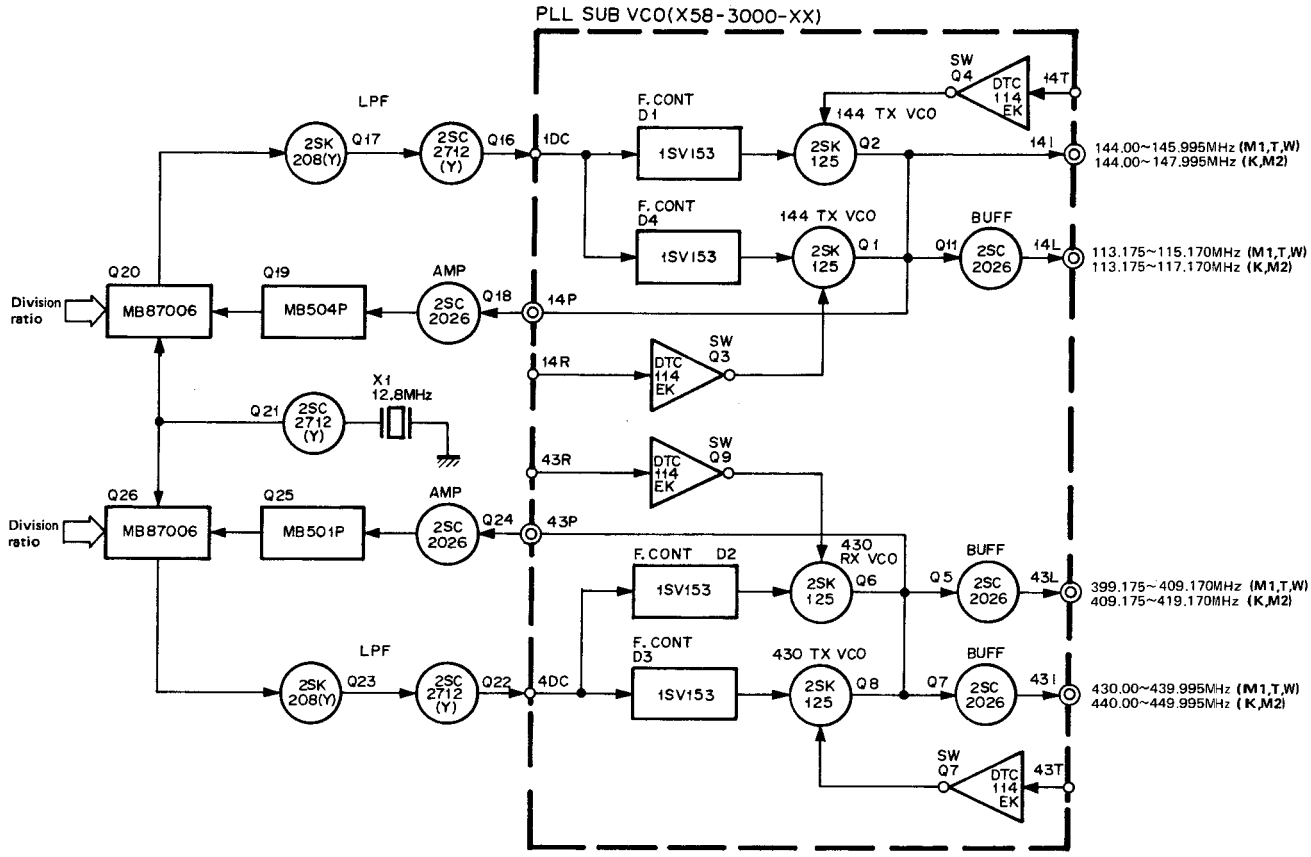


Fig. 4 PLL system block diagram

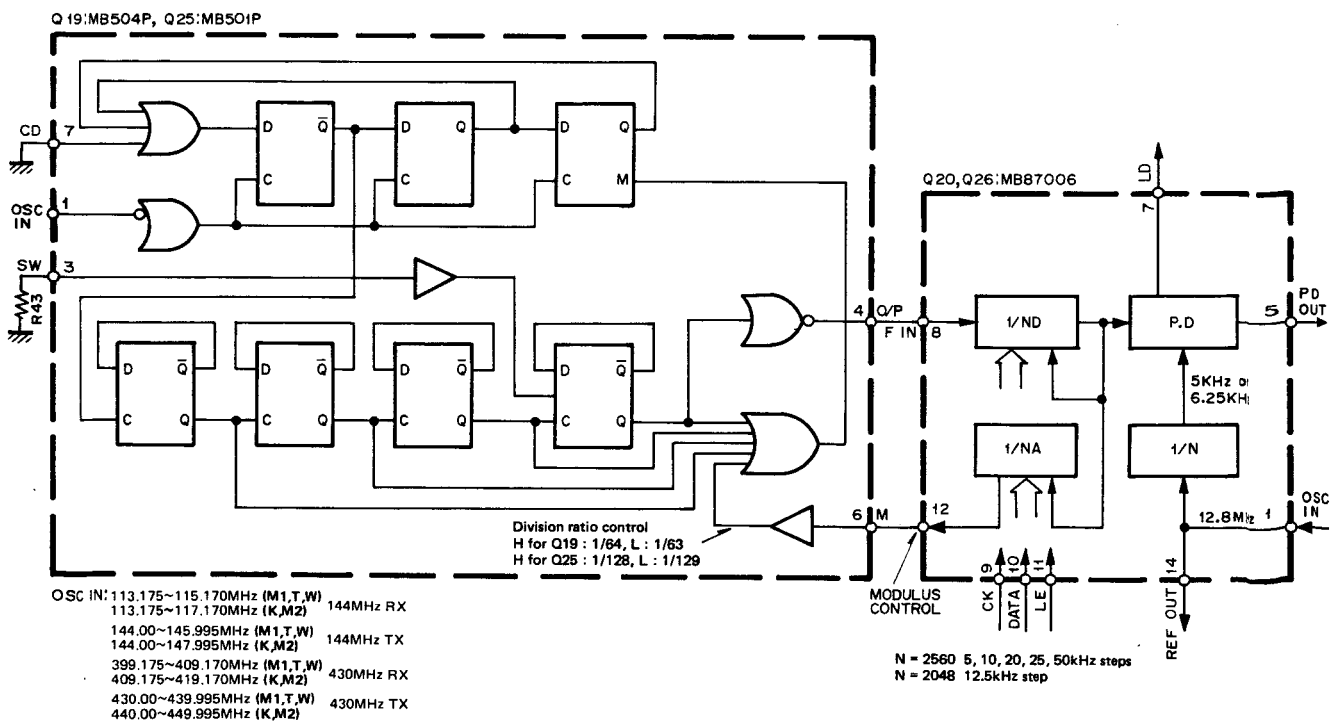


Fig. 5 Pulse swallow counter circuit

CIRCUIT DESCRIPTION

Digital control unit

- **General**

The Control unit consists of two PC boards: one on the front panel and the other on the main chassis. The processing is controlled by two microprocessors.

Figure 6 is a block diagram of the Control unit. The Control unit includes two microprocessors, their interface circuits, an input circuit (consisting of keys, switches, and a rotary encoder), a reset backup circuit, a beeper circuit, and a display circuit.

- **Microprocessor interface circuits**

Figure 7 shows how the two microprocessors are interfaced. To exchange data, three clock and data I/O lines (SCK, SI, and SO) and two pairs of control lines DCS, (DCL microprocessor chip select) and DRQ (DCL microprocessor request) are provided.

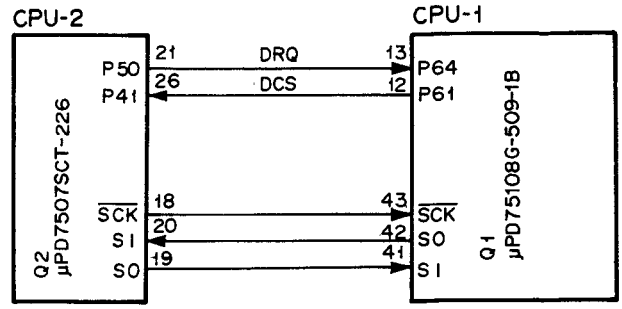


Fig. 7 Interfacing of microprocessors

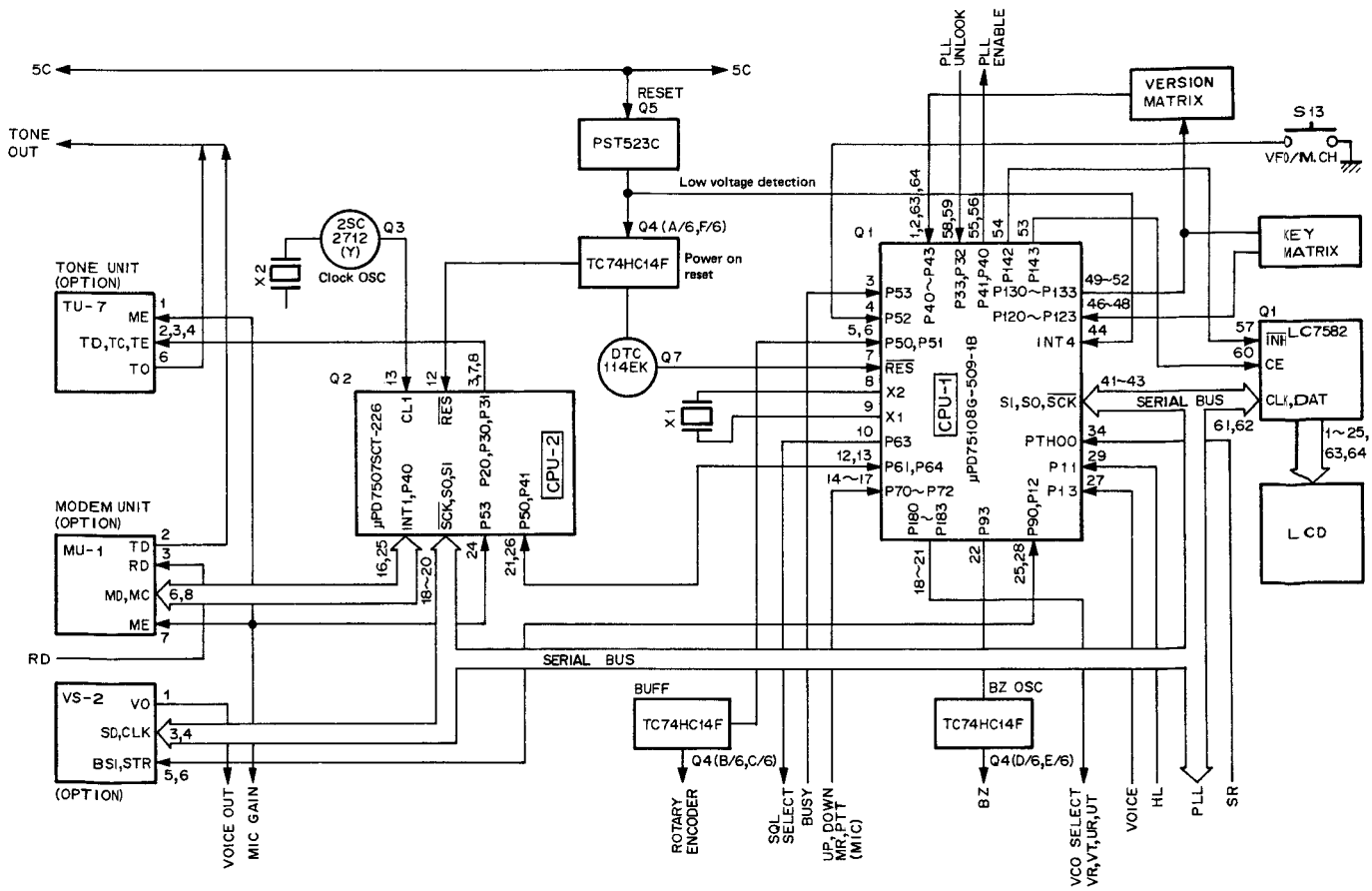
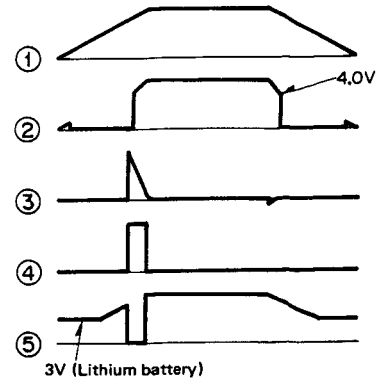


Fig. 6 Control unit block diagram

CIRCUIT DESCRIPTION

- **Reset backup circuit**

Figure 8 shows the reset backup circuit. When the transceiver power is turned on, the reset IC Q5 emits a reset pulse. When the power is turned off, the IC recognizes when the voltage of the 5C line falls to 4.0V or less, and sets Q1 INT4 pin low ("L"). When INT4 goes to "L", Q1 enters the backup mode.



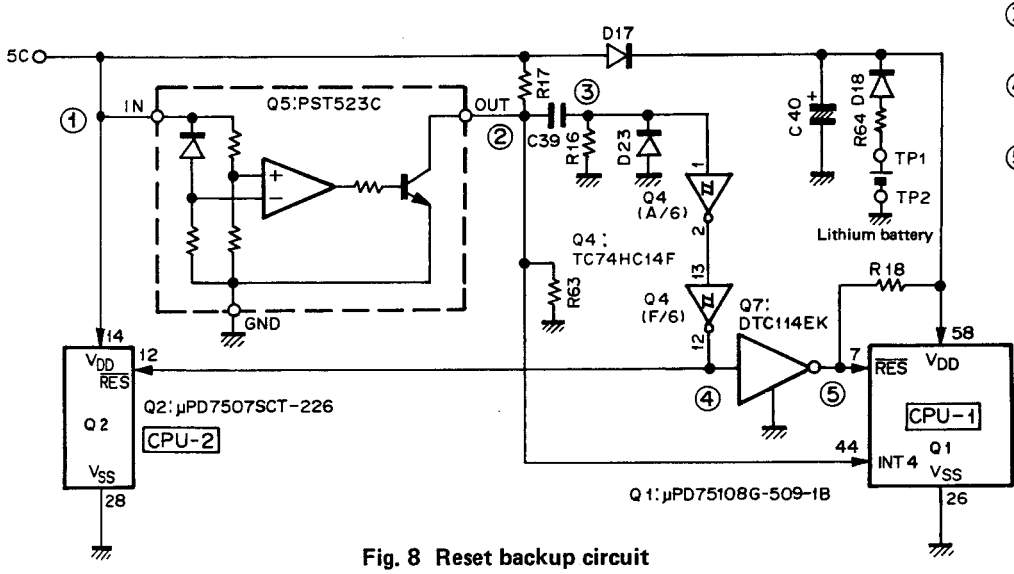


Fig. 8 Reset backup circuit

- **Beep circuit**

The beep circuit consists of an oscillator using P93, a 1.2kHz oscillation circuit using a Schmitt trigger inverter, Q4 (D/6), and a filter which filters the output pulse waveforms.

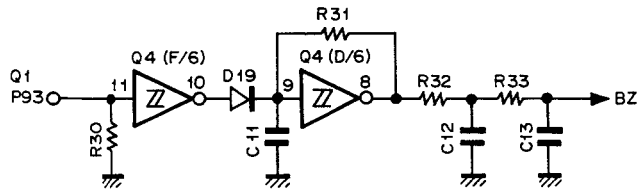


Fig. 9 Beep circuit

- **Display circuit**

The display circuit, on the display and switch PC board consists of a LCD driver, its peripheral circuits, and an LCD. The LCD is turned on dynamically with a 1 : 2 duty cycle. Data is sent from the microprocessor to the LCD driver serially. **Figure 10** shows the LCD driver common outputs, and segment output signals.

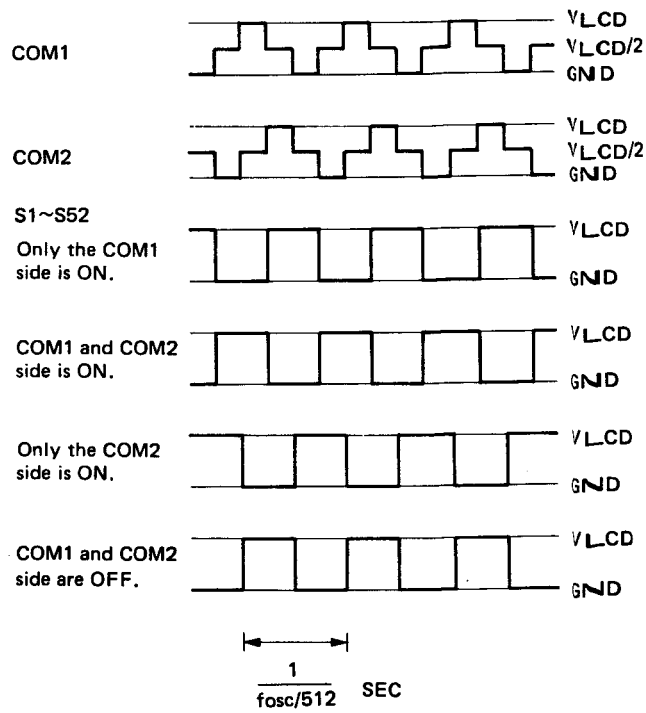


Fig. 10 LCD driver common and segment output signals

CIRCUIT DESCRIPTION

- **Key, switch and rotary encoder circuits**

Figure 11 shows the key, switch, and rotary encoder input circuits. The front panel keys are arranged in a matrix utilizing control lines P130 to P133 and P120 to P122 and inputs from the VFO/M.CH, VOICE, and HI/LOW switches.

The microphone switch lines (PTT, MR, UP and DOWN) are connected to control lines P70 to P73 through protection diodes. The rotary encoder is connected to control lines P50 and P5 through the inverter of the Schmitt trigger inputs.

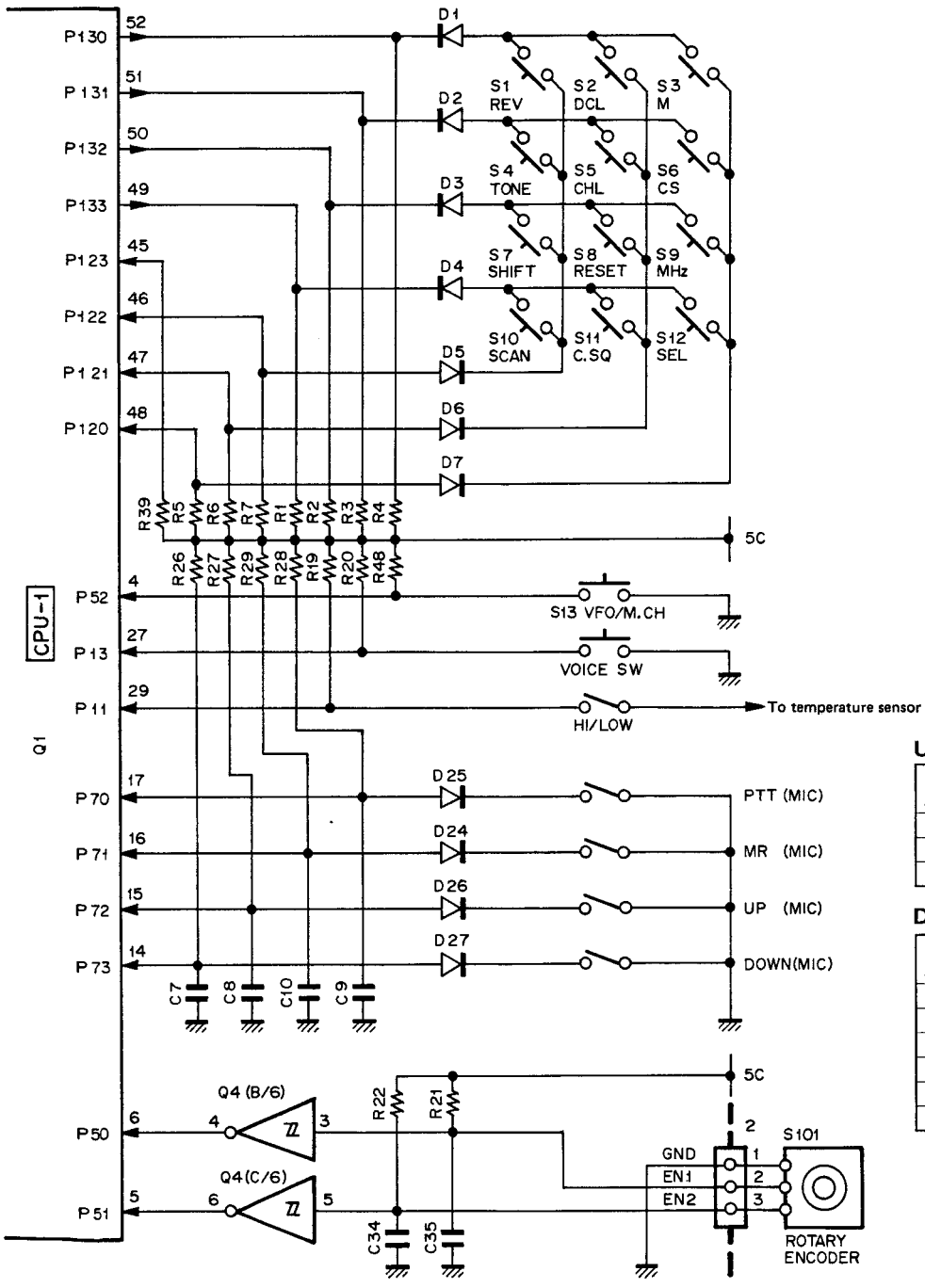


Fig. 11 Key, switch, and rotary encoder input circuits

UP/DOWN microphone

Pin / SW	PTT	MR	UP	DOWN
PTT	0	1	1	1
UP	1	1	0	1
DOWN	1	1	1	0

DCL microphone (MC-56)

Pin / SW	PTT	MR	UP	DOWN
PTT	0	1	1	1
UP	1	0	0	1
DOWN	1	0	1	0
MR	1	1	0	1
CHL	1	1	1	0
RES	1	0	1	1

Table 6 Microphone input logic

CIRCUIT DESCRIPTION

- **Other I/O circuits**

1) PLL data output and unlock input

PLL data is output through serial buses SCK (clock), SO (data output), P140 (144MHz band enable), and P141 (430MHz band enable). **Figure 12** shows the data transfer format.

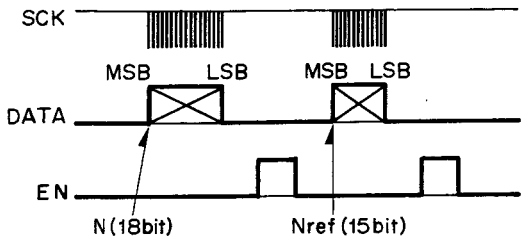
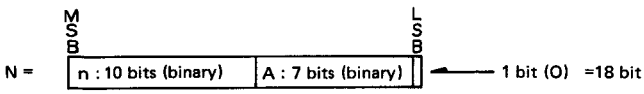


Fig. 12 Data transfer format

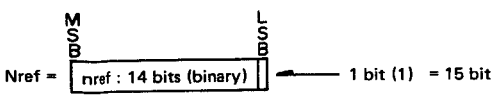
N (18 bits) and Nref (15 bits) are produced by converting frequencies as follows.

F (indicated value – 30.825MHz for RX) =
[(n x M) + A] x fosc/nref
n : Binary 10-bit division ratio
M : Prescaler division ratio : 64 for 144MHz, 128 for 430MHz
A : Binary 7-bit swallow counter setting
fosc : Reference frequency (12.8MHz)
nref : Binary 14-bit reference counter
2560 (decimal) for 5, 10, 20, 25, and 50kHz steps
2048 (decimal) for 12.5kHz

N is data consisting of the 17-bit sum of n and A calculated by the avobe expression plus control bit 0.



Nref is obtained by converting nref calculated by the above expression into a binary format, and adding A1 control bit to it.



When the PLL is unlocked in each band, P32 (144MHz band unlock) and P33 (430 to 440MHz band unlock) are set to a "H" level to cause the frequency display to blink off and on.

2) Audio muting output (AM)

When performing code squelch operation or searching for an open channel, port P22 is set to "H", to mute audio output.

3) S and RF meter input (SR)

The analog voltages for the S and RF meters are applied to the programmable threshold port (PTHOO), and are converted in 16 stages into 4-bit digital signals internally and sent to the display.

4) Microphone mute output (MM)

The signal which mutes audio inputs from the microphone when a DCL signal is sent from P53 of Q2 : μPD7507SCT. This is also used with modem enable, and subtones are also muted when audio inputs from the microphone are muted.

5) Tone output (TO)

The internal subtone signal, external tone signal, and modem unit audio signal levels are combined then sent to the VCO modulation input.

6) RD

Demodulated audio signals are applied to the modem unit audio input.

7) Squelch select output (SQS)

The squelch select output circuit is used to switch from the squelch control on the panel to the internal semi-fixed squelch control, by SQS, when the DCL system searches for an open channel. Normally, at "H", when the squelch control on the panel is active.

8) Busy input (BUS)

When an incoming signal is present, the receive unit center detector circuit switches to a "H" level. Even when squelch is applied or open, the input is "H" and the BUSY indication will be turned off.

9) VOICE strobe (SR)

After one word of data is transferred through the serial bus during VS-2 operations a "H" pulse is output.

10) VOICE BUSY (V BUSY)

During the time the VS-2 is operating and a voice is generated, the input goes "H" to prepare for the next voice data.

CIRCUIT DESCRIPTION

- **Other circuits**

1) 349kHz oscillator

This circuit supplies sytem clock pulses for Q2 : μPD7507SCT using a ceramic oscillator.

- **Voltage switching circuit**

1) UR, VR, UT, and VT (VCO select output)

The UR, VR, UT, and VT outputs are transferred from ports P80 to P83, using negative logic. For example, the UR port (P81) is "L" when the 430MHz-band is displayed (actually, signals are $\overline{UR}$, $\overline{VR}$, $\overline{UT}$ and $\overline{VT}$). When UR goes "L", Q27 goes "H", Q33 (A/6) goes "H", and Q31 goes "L" (43X becomes "L").

This is done to forcibly stop PLL IC Q26 during 144 MHz operations and to stop Q20 during 440MHz operations. Pin 1 of Q20 and Q26 are set "H" to prevent malfunction of one while the other is operating.

Note :

14X is "L" (+ 8V) for 144MHz and "H" for 430MHz.

43X is "H" (+ 8V) for 144MHz and "L" for 430MHz.

2) 8R, 8T, 14R, 14T, 43R, 43T

The $\overline{UR}$, $\overline{VR}$, $\overline{UT}$, and $\overline{VT}$ outputs from the microprocessor are inverted by Q27 to Q30, inverted again by Q23 (voltage switching) normally "H". The inputs to Q1 thru Q2 go "L" when $\overline{UR}$, $\overline{VR}$, $\overline{UT}$, and $\overline{VT}$ information is applied from the microprocessor ports. The outputs of Q17 to Q22 are used supply + 8V for various transmit receive circuits (8T thru 43R).

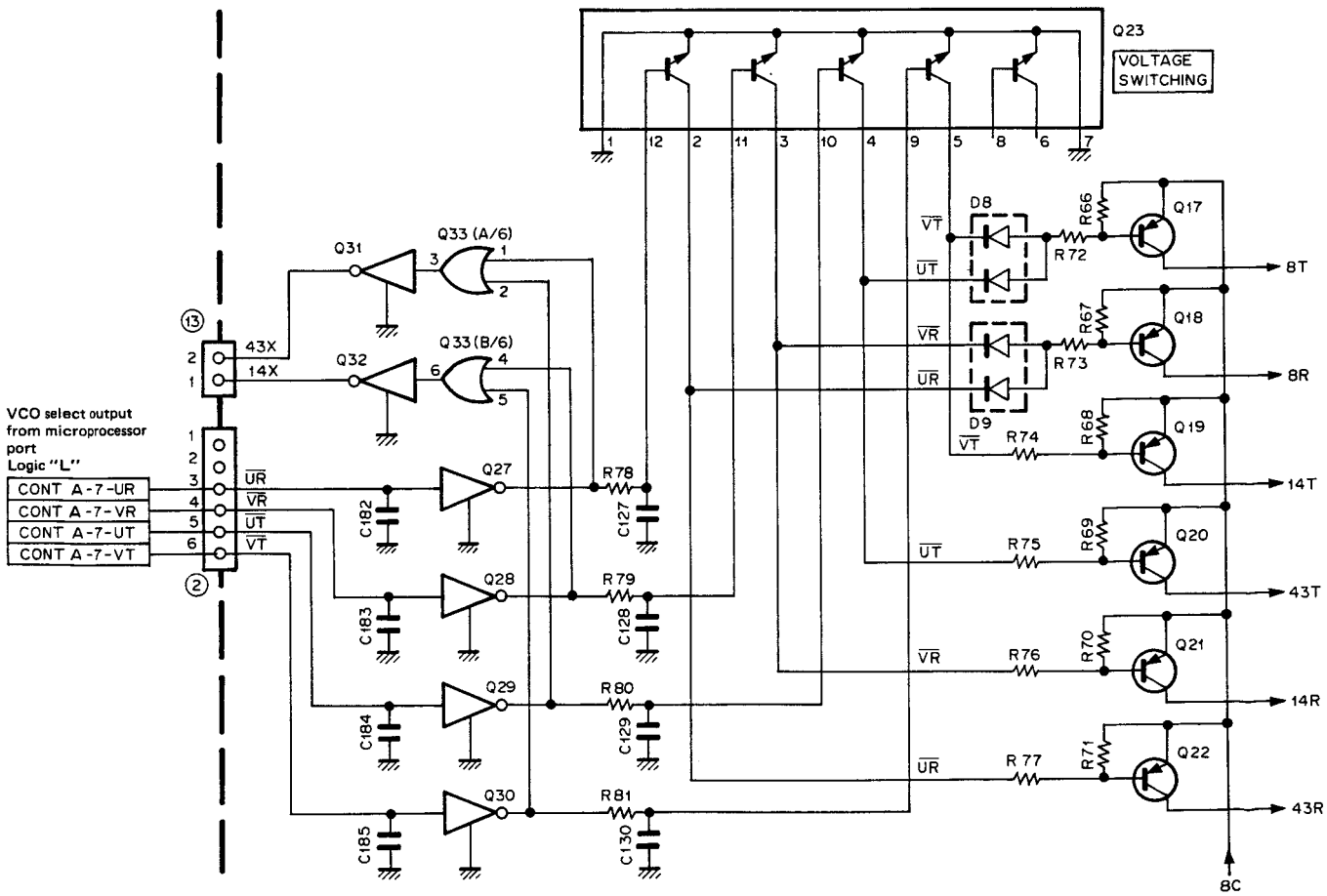


Fig. 13 Voltage switching circuit

CIRCUIT DESCRIPTION

Pin No.	Name	I/O	Logic	Function	Pin No.	Name	I/O	Logic	Function
1	P41	I	L	Input.	33	PTH01	I	–	Not used.
2	P40	I	L	Input.	34	PTH00	I	–	S & RF meter analog voltage input.
3	P53	I	L	BUSY input ("L" : BUSY,"H" : OPEN).	35	TI1	–	–	Not used.
4	P52	I	L	VFO/M.CH key input.	36	TI0	–	–	Not used.
5	P51	I	–	Encoder input.	37	P23	O	–	Not used.
6	P50	I	–	Encoder input.	38	P22	O	H	Audio mute output.
7	$\overline{RES}$	I	L	Reset input.	39	P21	O	–	Repeater tone control.
8	X2	–	–	Crystal input pin (f = 4.194304MHz).	40	P20	O	–	Not used.
9	X1	–	–	Crystal input pin (f = 4.194304MHz).	41	P03/SI	I	–	Serial data input pin.
10	P63	O	H	Squelch select ("H" : Internal, "L" : External).	42	P02/SO	O	–	Serial data output pin.
					43	P01/$\overline{SCK}$	I/O	L	Serial clock I/O pin.
11	P62	I	H	Setting.	44	P00/INT4	I	–	Backup detection pin.
12	P61	O	H	DCL microprocessor chip select output.	45	P123	I	L	
13	P60	I	H	DCL microprocessor request input.	46	P122	I	L	Key return input port
14	P73	I	L	Microphone DOWN switch input.	47	P121	I	L	See Circuit description.
15	P72	I	L	Microphone UP switch input.	48	P120	I	L	
16	P71	I	L	Microphone MR switch input.	49	P133	O	L	
17	P70	I	L	Microphone PTT switch input.	50	P132	O	L	Key scan output port.
18	P83	O	L	VCO select VHF RX.	51	P131	O	L	See Circuit description.
19	P82	O	L	VCO select VHF TX.	52	P130	O	L	
20	P81	O	L	VCO select UHF RX.	53	P143	O	H	LCD driver chip enable
21	P80	O	L	VCO select UHF TX.	54	P142	O	L	LCD driver inhibit ("L" : All off).
22	P93	O	H	BZ oscillator enable output.	55	P141	O	H	430MHz band PLL enable.
23	P92	O	–	Not used.	56	P140	O	H	144MHz band PLL enable.
24	P91	O	–	Not used.	57	NC	–	–	Not used.
25	P90	O	H	VS-2 strobe output.	58	VDD	–	–	Power pin.
26	Vss	–	–	GND pin (0V).	59	P33	I	H	430MHz band unlock input.
27	P13	I	L	VOICE switch input.	60	P32	I	H	144MHz band unlock input.
28	P12	I	H	VS-2 BUSY input.	61	P31	I	–	Not used.
29	P11	I	–	Low power switch input ("H" : Low power, "L" : High power).	62	P30	I	–	Not used.
					63	P43	I	L	Input.
30	P10	I	H	Setting.	64	P42	I	L	Input.
31	PTH03	I	–	Not used.					
32	PTH02	I	–	Not used.					

Table 7 μPD75108G-509-1B pin functions (Control unit Q1)

Pin No.	Name	I/O	Logic	Function	Pin No.	Name	I/O	Logic	Function
1	P43	I	H	Not used.	15	CL2	O	–	Not used.
2	X1	I	–	88.5Hz reference 349kHz input.	16	INT1	I	H	Modem clock input (from MU-1)
3	X2	–	–	Not used.	17	INT0	I	–	Not used.
4	P20	O	L	External tone enable (to TU-7).	18	$\overline{SCK}$	O	L	Serial clock output.
5	P21	O	–	Not used.	19	SO	O	H	Serial data output.
6	P22	O	–	Not used.	20	SI	I	H	Serial data input.
7	P23	O	–	Not used.	21	P50	O	H	DCL microprocessor request output.
8	P30	O	L	External tone clock (to TU-7).	22	P51	O	–	Not used.
9	P31	O	–	External tone data (to TU-7).	23	P52	O	–	Not used.
10	P32	O	–	Not used.	24	P53	O	H	Modem enable output (to MU-1)
11	P33	O	–	Not used.	25	P40	I/O	–	Modem data I/O (to MU-1).
12	RESET	I	H	Reset input.	26	P41	I	H	DCL microprocessor chip select input.
13	CL1	I	–	349kHz system clock input.	27	P42	–	–	Not used: pull-up or "H".
14	VDD	–	–	Power pin.	28	Vss	–	–	GND pin.

Table 8 μPD7507SCT-226 pin functions (Control unit Q2)

DESCRIPTION OF COMPONENTS

CONTROL UNIT (X53-3000-XX)

Component	Function	Operation/Condition
Q1	Microprocessor 1	Control the entire setting, mainly frequency control.
Q2	Microprocessor 2	Control options MU-1 and TU-7 when they are in use.
Q3	349kHz oscillator	Q2 : μPD7507SCT-226 system clock.
Q4	Schmitt trigger inverter	Reset circuit pulse shaping, beep output, rotary encoder, inversion buffer.
Q5	Reset IC	Reset output and low-voltage detection.
Q7	Logic inversion	Set RES logic to $\overline{RES}$.
D2~D16	Setting	Only setting diodes D2, 6, 8~13, 15, 16 are used. **(K type)** Only setting diodes D2, 5, 6, 8~13, 15, 16 are used. **(M1 type)** Only setting diodes D2, 6~9, 11~13, 15, 16 are used. **(M2 type)** Only setting diodes D4~16 are used. **(W type)** Only setting diodes D3~16 are used. **(T type)**
D17,D18	Current reversal prevention	
D19	BEEP switching	
D20	Current reversal prevention	
D21		1750Hz switch, OR logic.
D23	Reset waveform shaping	Trailing negative pulse aborption.

PLL SUB-VCO (X58-3000-XX)

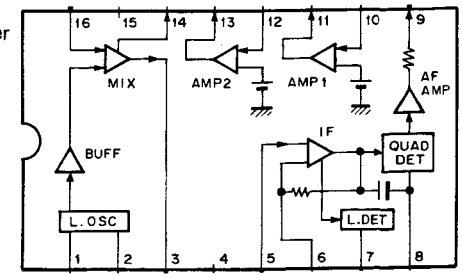
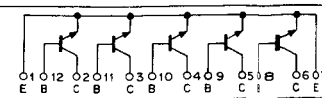
Component	Function	Operation/Condition
Q1	144MHz band RX VCO	113.175 to 115.17MHz.
Q2	144MHz band TX VCO	144 to 146MHz, output level −8dBm.
Q3	144MHz band RX VCO operation switch	Active "H".
Q4	144MHz band TX VCO operation switch	Active "H"
Q5	430MHz band RX LOCAL amplifier	Output level 0dBm/AVE.
Q6	430MHz band RX VCO	399.175 to 409.17MHz.
Q7	430MHz band TX LOCAL amplifier	Output level −4dBm/AVE.
Q8	430MHz band TX VCO	430 to 440MHz.
Q9	430MHz band RX VCO operation switch	Active "H".
Q10	430MHz band TX VCO operation switch	Active "H"
Q11	144MHz band RX LOCAL amplifier	Output level 4.5dBm/AVE.
D1	144MHz band F.CONT & MOD diode	145MHz : 5V.
D2	430MHz band RX F.CONT diode	435MHz : 3.5V
D3	430MHz band F.CONT & MOD diode	435MHz : 3.5V.
D4	144MHz band RX F.CONT diode	145MHz : 5V.

KEYBOARD ASS'Y (W03-2003-15)

Component	Function	Operation/Condition
Q1	LCD driver	Drive LCD with 1/2 duty.
D1~D7	Key matrix.	

DESCRIPTION OF COMPONENTS

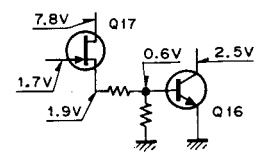
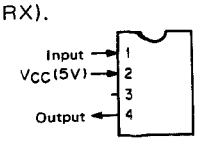
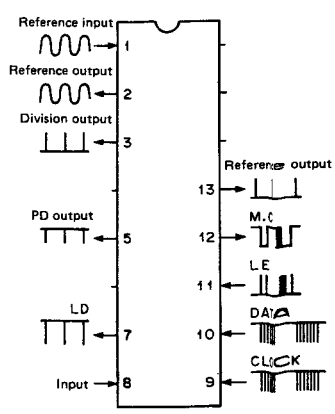
COMPOSITE UNIT (TX-RX) (X60-3000-XX)

Component	Function	Operation/Condition
Q1	High frequency amplification	144MHz band.
Q2	First mixer	144MHz-band local frequency (113.175 to 115.17MHz), input level 4.5dBm/AVE.
Q3,Q4	First IF amplification	Cascade amplification.
Q5	Q2 operation switching switch	Active "H".
Q6,Q7	High-frequency amplification	430MHz band.
Q8	First mixer	430MHz-band local frequency (399.175 to 409.17MHz), input level 0dBm/AVE.
Q9	Q8 operation switching switch	Active "H".
Q10	Second local oscillator 455kHz IF amplification S-meter amplifier Detection, AF amplifier Squelch noise amplifier Second mixer	① Base, ② Emitter ⑤ Input, 5-stage limiter amplifier ⑦ S-meter output, Active "L" ⑨ Output ⑩ Input, ⑪ Output ⑯ Input 
Q11	AF amplifier	
Q12	Microphone mute	Mute the microphone during DCL operations.
Q13	Microphone amplifier	
Q14	Microphone buffer amplifier	
Q15	3-pin AVR	Input : 13.2V, output : 8.1V.
Q16	Audio power amplifier	
Q17~Q22	Voltage control	Q17 : 8T (8V for common TX). Q18 : 8R (8V for common RX). Q19 : 14T (8V for 144MHz-band TX). Q20 : 43T (8V for 430MHz-band TX). Q21 : 14R (8V for 144MHz-band RX). Q22 : 43R (8V for 430MHz-band RX).
Q23	5 parallel transistor array	Drive Q17 to Q22. 
Q24	430MHz-band power module	
Q27~Q30	Q23 switching switch	
Q31,Q32	Q33 operation switching switch	
Q33	PLL IC operation switching switch	OR IC
Q50	1750Hz tone oscillator	(T, W type)
D1,D2	Limiter diode	First IF limiting diode
D3,D4	Noise rectification	For squelch.
D5,D6	Discriminator detection diode	Center meter detection.
D7	Current reversal prevention	External COM 8V.
D8,D9	Current reversal prevention	Standby circuit.
D10	Current reversal prevention	
D11	430MHz-band ANT switching switch	

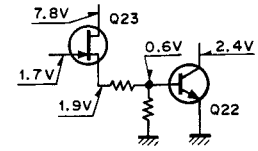
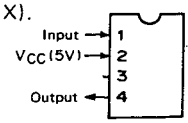
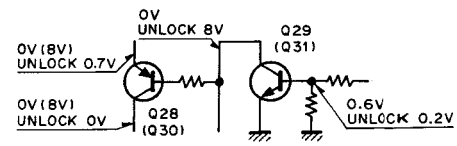
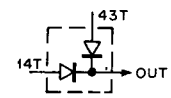
DESCRIPTION OF COMPONENTS

Component	Function	Operation/Condition
D12	Receive switching	
D13	430MHz-band RF PWR CONT & RF meter.	
D14	430MHz-band protection detection	
D15	Current reversal prevention	
D16	Constant-voltage diode	Input : 8V (COM), output : 5.8V.
D17,D21	Voltage drop	S-meter pointer 9 connector 11 pin 3 (RM) output : 3.8V
D20	Constant-voltage diode	Input : 8V (8T), output : 5.6V
D22	Current reversal prevention	

COMPOSITE UNIT (PLL-TX) (X60-3010-XX)

Component	Function	Operation/Condition
Q1	DC amplification	For 144MHz band protection. Adjust to 2A with VR1.
Q2	144MHz-band power module	
Q3	144MHz-band drive transistor	0.38W for 145MHz.
Q4	144MHz-band drive transistor	
Q5	144MHz-band drive transistor	
Q6	430MHz-band drive transistor	0.35W for 435MHz.
Q7	430MHz-band drive transistor	
Q8	430MHz-band drive transistor	
Q9	DC amplification	430MHz-band power control.
Q10	DC amplification	144MHz-band power control.
Q11	DC amplification	For 430MHz band protection. Adjust to 1.5A with VR9.
Q12	DC voltage control	
Q13	DC voltage control drive	
Q14,Q15	Differential amplification	
Q16,Q17	PLL low-pass filter	144MHz band 
Q18	Preamplifier	Input for 145MHz : 100mVp-p, output : 1.5Vp-p.
Q19	1/64 divider	① Input 144 to 146MHz (TX), TX frequency—30.825MHz (RX). ② Vcc 5V. ④ Output 1/64, 1.5Vp-p. 
Q20,Q26	1/2560, 1/2048 dividers	① Reference input (12.8MHz) 450mVp-p. ② Reference output (12.8MHz) 1.5Vp-p. ③ Input division output (5kHz or 6.25kHz). ⑤ PD output 1.6Vp-p. ⑦ Unlock pin, 5V when locked. ⑧ Input 1/64, 1.5Vp-p. ⑨ CLOCK input; always present. ⑩ Data input; always present. ⑪ LE input. This signal is applied only when the frequency changes. ⑫ Modulus control 5Vp-p. ⑬ Reference division output (5kHz or 6.25kHz). Note : Locked when ③ and ⑬ match. 
Q21	12.8MHz reference OSC	

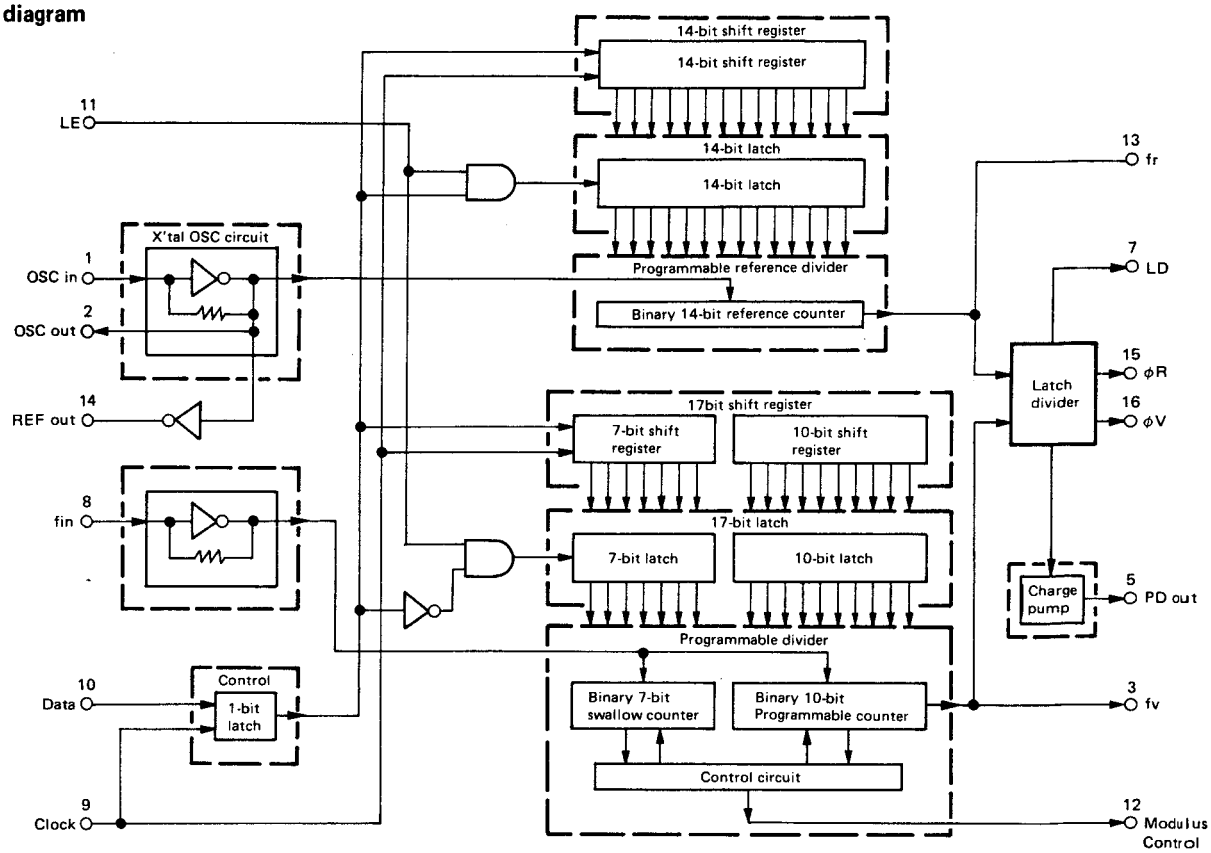
DESCRIPTION OF COMPONENTS

Component	Function	Operation/Condition
Q22,Q23	PLL low-pass filter	430MHz band. 
Q24	Preamplifier	Input for 435MHz : 100mVp-p, output : 1.5Vp-p.
Q25	1/128 divider	① Input 430 to 440MHz (TX, TX frequency−30.825MHz (RX). ② Vcc 5V. ④ Output 1/128, 1.5Vp-p. 
Q27	Ripple filter	
Q28~Q31	Unlock switching	Q28,Q29 : 430MHz band Q30,Q31 : 144MHz band Lock : ON, Unlock : OFF. 
Q32	3 pin AVR	Input : 13.4V, output : 5.8V.
D1	144MHz-band protection detection	
D2	144MHz-band RF PWR CONT & RF meter	
D3	144MHz-band ANT switching switch	
D4	Division operation stop	When 144MHz-band operation stops : 4,5V.
D5	Q3 base bias	
D6	144MHz-band ANT switching switch	
D7	Q6 base bias	
D8	Current reversal prevention	
D9,D10	Current reversal prevention	Low power cathode ground.
D11	Current reversal prevnetion	RF meter switching.
D12	Division operation stop	When 430MHz-band operation stops : 4.5V.
D13	144MHz-band UNLOCK detection	
D14	430MHz-band UNLOCK detection	
D15	Q27 start	
D16,D17	Voltage drop	
D18~D21	Current reversal prevention	
D23	Voltage drop	

SEMICONDUCTOR DATA

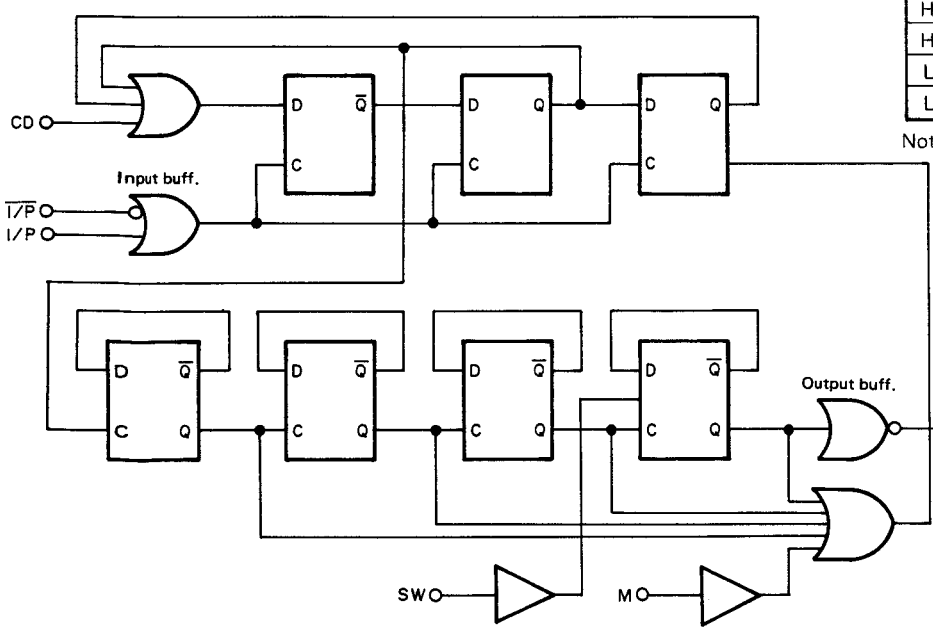
MB87006 (COMPOSITE UNIT (PLL-TX) Q20,26)

● **Block diagram**



MB501P/MB504P (COMPOSITE UNIT (PLL-TX) Q19,25)

● **Block diagram**



● **Function table**

MB501P

SW	M	Divide ratio
H	H	64 divide
H	L	65 divide
L	H	128 divide
L	L	129 divide

MB504P

SW	M	Divide ratio
H	H	32 divide
H	L	33 divide
L	H	64 divide
L	L	65 divide

Note : SW terminal H : Vcc, L : VEE OPEN
M terminal H : 2.0V to Vcc, L : VEE to 0.8V

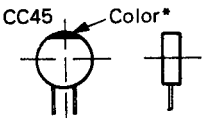
Symbol	Function
IP/$\overline{IP}$	Input
O/P	Output
VCC	Power (+5V)
VEE	GND
SW	Switching the divide ratio
M	Setting the module
CD	Data set for checking (Actually open or GND)

PARTS LIST

CAPACITORS

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

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



- **Capacitor value**

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

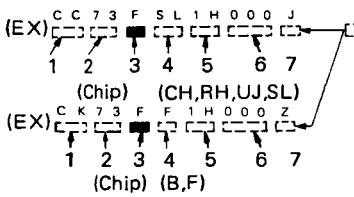
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

- **Rating voltage**

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

- **Chip capacitors**

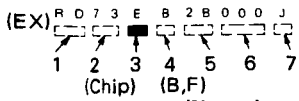


Dimension

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

RESISTORS

- **Chip resistor (Carbon)**



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

Dimension

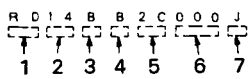
Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

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

- **Carbon resistor (Normal type)**



PARTS LIST

SEMICONDUCTOR

N : New parts

Item	Re-marks	Parts No.
Diode		1N60PSPA
		1S1555
		1S1587
		1SS101
		1SS133
		MC921
		MI308
		U15B
		UM9401
Vari-cap diode		1SV153
Chip diode		1SS181
		1SS184
		1SS196
		DAN202(K)
		DAP202(K)
Zener diode		MTZ5.6JC
		MTZ6.2JC
LCD		LU1262
Thermister		112-202-2
	N	112-203-2
		112-502-2
TR		2SA1015(Y)
		2SB698
		2SC1775(E)
		2SC2026
		2SC2347
		2SC2407(1)
		2SC2458(Y)
		2SC2603(E)
		2SC3019
	N	2SD1761

Item	Re-marks	Parts No.
Chip TR		2SC2712(BL)
		2SC2712(Y)
		2SC2714(Y)
		2SC3295(B)
		2SC3326(A)
Digital TR		DTC114EK
		DTC114TK
FET		2SK125
Chip FET		2SK208(Y)
		3SK184(R)
		3SK184(S)
Transistor array	N	TA78
Power module		M57726
	N	M57788M
IC	N	LC7582
		LR4087
	N	MB501P
	N	MB504P
		MB87006
		NJM78L06A
		NJM555M
		NJM4558M
		PST523C
		TA7761P
		TC40H032F
	N	TC74HC14F
		μPC1242H
		μPC7808H
	N	μPD7507SCT-226
	N	μPD75108G-509-1B

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	Remarks 備考
			TW-4100A/E			
1	1B	*	A01-1014-23	METALLIC CABINET(TOP)		
2	3B	*	A01-1015-23	METALLIC CABINET(CASE)		
3	2C	*	A20-2585-03	PANEL ASSY	M1T1W1	
3	2C	*	A20-2590-03	PANEL ASSY	K1M2	
4	2C	*	A21-1507-04	DRESSING PANEL (DCL PLATE)		
-		*	A20-2584-03	PANEL		
5	3A	*	B42-2440-04	LABEL(BOTTOM CASE,144/430)	M1T1W1	
5	3A	*	B42-2456-04	LABEL(BOTTOM CASE,144/440)	K1M2	
6	1B,2G	*	B42-2438-04	LABEL(144MHZ,430MHZ)ACSY	M1T1W1	
6	1B,2G	*	B42-2439-04	LABEL(144MHZ,440MHZ)ACSY	K1M2	
7	1C	*	B43-1080-04	BADGE(TW-4100A)	K1M1M2	
7	1C	*	B43-1081-04	BADGE(TW-4100E)	T1W1	
11	1F		B46-0058-10	WARRANTY CARD	K1	
12	1G	*	B50-8142-00	INSTRUCTION MANUAL		
-		*	B10-0680-04	FRONT GLASS	M1T1W1	
-		*	B10-0682-04	FRONT GLASS	K1M2	
C1			CC45SL2H150J	CERAMIC 15PF J		
C32			CC45SL2H030C	CERAMIC 3.0PF C		
C196	2B		CE04EW1C102M	ELECTRO 1000UF 16WV		
18	1B,2B		E23-0473-04	GND LUG (ANT)		
19	2B		E04-0164-05	RF RECEPTACLE (M TYPE)		
20	1B		E04-0162-25	RF RECEPTACLE (N TYPE)	T1W1	
20	2B		E04-0164-05	RF RECEPTACLE (M TYPE)	K1M1M2	
21	2B	*	E30-2085-15	DC CABLE (REAR PANEL)		
22	1G		E30-2054-05	DC CABLE ASSY (ACSY)		
24	1D	*	E31-3198-05	CONNECTING WIRE(3P,ENCODER)		
25	2A		E31-3197-05	CONNECTING WIRE(2P,SP)		
-			E23-0420-05	GND LUG (POWER MODULE)		
-			E23-0427-05	GND LUG (PLL)		
-			E23-0447-05	SLEEVE TERMINAL(DC CABLE,-)		
27	1B	*	F01-0948-05	HEAT SINK		
28	2B,2G		F05-1031-05	FUSE (10A)		
31	2C	*	F19-0645-14	BLIND PLATE (DCL PLATE)		
32	2A	*	F20-0570-04	INSULATING PLATE(CHASSIS,TOP)		
33	2A	*	F20-0571-04	INSULATING PLATE(CHASSIS,BTM)		
34	1E	*	F20-0572-04	INSULATING PLATE(CONTROL,MIC)		
36	2A,1B	*	F20-0565-04	INSULATING PLATE(CHASSIS)		
37	1B	*	F20-0557-14	INSULATING PLATE(CASE)		
38	2A,3A	*	F90-0686-04	ABSORBER (SP,CHASSIS,CASE)		
-			F05-2036-05	FUSE (20A)		
-			F20-0520-04	FELT (LITHIUM BATTERY,TOP)		
-			F20-0521-04	FELT (LITHIUM BATTERY,BOTTOM)		
9	3A	*	G10-0650-04	FELT (SP)		
39	2C		G02-0505-05	SPRING (VOL,SQL)		
40	3B	*	G11-0621-14	CONDUCTIVE RUBBER(RX SHIELD)		
41	2G	*	G10-0645-04	FELT (TONE UNIT)		
42	1A	*	G11-0619-04	CONDUCTIVE RUBBER(VCO)		
44	2D	*	G13-0832-24	CUSHION (5 KEYS)		
45	2D	*	G13-0833-14	CUSHION (DCL KEY)		
46	1C	*	G13-0834-24	CUSHION (3 KEYS)		
48	2G	*	G13-0837-14	CUSHION (MODEM UNIT)		

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49	2B	*	G11-0620-14	CONDUCTIVE RUBBER(CHASSIS)		
50	3B		G13-0687-04	CUSHION (BETWEEN RX AND HIC)		
51	2A		G13-0843-14	CUSHION (SPRING OF RF UNIT)		
-		*	G13-0836-14	CUSHION		
-		*	G13-0842-04	CUSHION	M1M2TW	
-		*	G13-0855-04	CUSHION	M1M2T1	
-		*	G13-0855-04	CUSHION	W1	
53	2F	*	H01-8020-03	ITEM CARTON BOX(144/440)4100A	K1M2	
53	2F	*	H01-8021-03	ITEM CARTON BOX(144/430)4100A	M1	
53	2F	*	H01-8022-03	ITEM CARTON BOX TW-4100E	T1W1	
55	1G		H12-1345-04	PACKING FIXTURE(TOP)		
56	2F	*	H13-0810-04	PROTECTION PLATE(MIC)		
57	2F	*	H13-0811-04	PROTECTION PLATE(ROTARY ENC.)		
58	2G		H25-0029-04	PROTECTION BAG (ACSY)		
59	2G		H25-0103-04	PROTECTION BAG (MIC)		
60	2G		H25-0105-04	PROTECTION BAG (MOUNT BRACKET)		
61	2G		H25-0117-04	PROTECTION BAG (DC CABLE)		
63	2F	*	H25-0713-04	PROTECTION BAG (RADIO)		
64	3G	*	H10-2613-02	POLYSTYRENE FOAMED FIXTURE		
67	2A		J21-1144-34	MOUNTING HARDWARE(SP)		
68	2G	*	J29-0414-22	MOUNTING BRACKET		
69	2B		J41-0033-05	CABLE BUSHING (DC CABLE)		
-			J61-0307-05	WIRE BAND		
73	2C		K21-0779-15	KNOB (MAIN)		
74	2C		K23-0779-04	KNOB (VOL,SQL)		
75	1C,2D	*	K29-3049-04	KNOB		
76	1C	*	K29-3050-04	KNOB		
77	2D	*	K29-3051-04	KNOB (DCL)		
L1	2B	*	L92-0121-05	TOROIDAL CORE		
L2 ,3			L92-0110-05	BEAD CORE		
82	2G	*	N99-0315-04	SCREW SET (MOUNTING BLACKET)		
A	1B		N87-3006-41	BRAZIER TAPTITE SCREW(ANT)		
B	2B		N35-3005-41	BINDING SCREW(DC CABLE,-)		
C	2A,2B		N32-3006-46	FLAT SCREW(HEAT SINK,CHASSIS)		
D	2B		N88-3006-46	FLAT TAPTITE SCREW(HEAT SINK)		
E	1A,3B		N87-2605-46	BRAZIER TAPTITE SCREW(COMP.PCB		
F	1A		N35-3006-46	BINDING SCREW(COMP.UNIT RX)		
G	1B,2B		N09-0623-04	SEMUSE SCREW(POWER MODULE)		
H	1D,1E		N35-2004-46	BINDING SCREW(CONTROL,KEYBOARD		
J	2A,2C		N32-3004-46	FLAT SCREW(PANEL,SUB PANEL)		
K	3A,3B		N32-3004-45	FLAT SCREW(SP)		
L	3A,3B		N35-3006-45	BINDING SCREW(CASE)		
M	3A,3B		N32-3008-45	FLAT SCREW(CASE)		
N	3A,3B		N32-3005-45	FLAT SCREW (CASE)		
-			S50-1406-05	TACT SWITCH (MIC UP/DWN)	M1M2T1	
-			S50-1406-05	TACT SWITCH (MIC UP/DWN)	W1	
90	3A		T07-0240-05	LOUDSPEAKER(FULLRANGE)		
91	2G		T91-0357-15	MICROPHONE (ACSY)	M1M2T1	
91	2G		T91-0357-15	MICROPHONE (ACSY)	W1	
91	2G		T91-0359-05	MICROPHONE (ACSY)	K1	
-			LR4087	IC(TONE DIALER)	K1	
Q2	1A		M57726	IC(POWER MODULE)		

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Q24	2B	*	M57788M	IC(POWER MODULE)		
101	1D	*	W02-0378-05	ROTARY ENCODER		
102	2D	*	W03-2003-15	KEYBOARD ASSY		
-			W09-0326-05	LITHIUM BATTERY(BR2032)		
107	1D,1E	*	X53-3000-11	CONTROL UNIT	K1	
107	1D,1E	*	X53-3000-21	CONTROL UNIT	M1	
107	1D,1E	*	X53-3000-22	CONTROL UNIT	M2	
107	1D,1E	*	X53-3000-51	CONTROL UNIT	T1	
107	1D,1E	*	X53-3000-61	CONTROL UNIT	W1	
108	1A	*	X60-3010-01	COMPOSITE UNIT (PLL-TX)	M1T1W1	
108	1A	*	X60-3010-11	COMPOSITE UNIT (PLL-RX)	K1M2	
109	2B	*	X60-3000-11	COMPOSITE UNIT (RX)	K1M1M2	
109	2B	*	X60-3000-51	COMPOSITE UNIT (RX)	T1W1	
KEYBOARD ASS'Y (W03-2003-15)						
PL1 ,2			B30-0851-05	PILOT LAMP		
-			S50-1412-05	TACT SWITCH (SELECT)		
-			S50-1426-05	TACT SWITCH		
713	2D		LU1262	LCD		
Q1		*	LC7582	IC(LCD DRIVER)		
CONTROL UNIT (X53-3000-XX) -11 : K -21 : M1 -22 : M2 -51 : T -61 : W						
C1			CK73FB1H103K	CHIP C 0.010UF K		
C6 -8			CK73FB1H102K	CHIP C 1000PF K		
C9			CK73FF1E104Z	CHIP C 0.10UF Z		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			CK73FB1H182K	CHIP C 1800PF K		
C12			CK73FB1H102K	CHIP C 1000PF K		
C13			CK73FB1H182K	CHIP C 1800PF K		
C14 -22			CK73FB1H102K	CHIP C 1000PF K		
C23			C90-0838-05	ELECTRO 1UF 50WV		
C24 -29			CK73FB1H102K	CHIP C 1000PF K		
C32 -36			CK73FB1H102K	CHIP C 1000PF K		
C37			CE04CW1A330M	ELECTRO 33UF 10WV		
C38			CK73FB1H102K	CHIP C 1000PF K		
C39			CK73FB1H471K	CHIP C 470PF K		
C40			CS15E1A100M	TANTAL 10UF 10WV		
C41			CK73FF1E104Z	CHIP C 0.10UF Z		
C42 ,43			CC73FCH1H220J	CHIP C 22PF J		
C44			CC73FCH1H221J	CHIP C 220PF J		
C45			CC73FCH1H331J	CHIP C 330PF J		
C46			CC73FCH1H560J	CHIP C 56PF J		
C47			CC73FCH1H331J	CHIP C 330PF J		
C48 -52			CK73FB1H102K	CHIP C 1000PF K		
C53 ,54			CC73FCH1H330J	CHIP C 33PF J		
C55			CK73FB1H102K	CHIP C 1000PF K		
C56			CE04CW1A100M	ELECTRO 10UF 10WV		
C57 ,58			CC45CH1H330J	CERAMIC 33PF J		
C59 -62			CK73FB1H103K	CHIP C 0.010UF K		
C63			CC45CH1H330J	CERAMIC 33PF J		
C64 ,65			CK45B1H102K	CERAMIC 1000PF K		
C66 -70			CC45SL1H101J	CERAMIC 100PF J		
C101-103			CK73FB1H102K	CHIP C 1000PF K		
C104			CK45B1H102K	CERAMIC 1000PF K		

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-			E06-0858-05	8P METAL SOCKET		
CN1		*	E40-5073-05	PIN CONNECTOR (PH 2P)		
CN2		*	E40-5074-05	PIN CONNECTOR (3P)		
CN3			E40-3328-05	PIN CONNECTOR (8P)		
CN4 ,5		*	E40-5079-05	PIN CONNECTOR (MQ 8P)		
CN6		*	E40-5073-05	PIN CONNECTOR (PH 2P)		
CN7		*	E40-5077-05	PIN CONNECTOR (12P)		
CN8		*	E40-5075-05	PIN CONNECTOR (4P)		
CN9			E40-3638-05	PIN CONNECTOR (5P)		
CN10		*	E40-5073-05	PIN CONNECTOR (PH 2P)		
CN12			E40-3328-05	PIN CONNECTOR (8P)		
CN13			E40-3661-05	PIN CONNECTOR (7P)		
TP1 -3			E23-0465-05	TERMINAL (TEST TERMINAL)		
-			F29-0428-04	INSULATOR (MIC)		
200	1E		G13-0815-04	CUSHION		
X1		*	L77-1313-05	CRYSTAL RESONATOR(4.19430MHZ)		
X2		*	L78-0020-05	RESONATOR (350KHZ)		
J1 -4			R92-1061-05	JUMPER REST 0 OHM		
JP1			R92-0150-05	JUMPER REST 0 OHM		
R1			RK73FB2A104J	CHIP R 100K J 1/10W		
R7			RK73FB2A473J	CHIP R 47K J 1/10W		
R10			RD14CB2C103J	RD 10K J 1/6W		
R11			RK73FB2A273J	CHIP R 27K J 1/10W		
R12			RK73FB2A153J	CHIP R 15K J 1/10W		
R13			RK73FB2A273J	CHIP R 27K J 1/10W		
R14 ,15			RK73FB2A473J	CHIP R 47K J 1/10W		
R16			RK73FB2A564J	CHIP R 560K J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R18			RK73FB2A104J	CHIP R 100K J 1/10W		
R19			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R20 -30			RK73FB2A473J	CHIP R 47K J 1/10W		
R31			RK73FB2A684J	CHIP R 680K J 1/10W		
R32			RK73FB2A683J	CHIP R 68K J 1/10W		
R33			RK73FB2A823J	CHIP R 82K J 1/10W		
R34			RD14BB2C473J	RD 47K J 1/6W		
R35			RK73FB2A103J	CHIP R 10K J 1/10W		
R36			RK73FB2A154J	CHIP R 150K J 1/10W		
R37			R92-0670-05	CHIP R 0 OHM		
R38			RK73FB2A563J	CHIP R 56K J 1/10W		
R39 -48			RK73FB2A473J	CHIP R 47K J 1/10W		
R49 -51			R92-0670-05	CHIP R 0 OHM		
R52			RK73FB2A101J	CHIP R 100 J 1/10W		
R53			RD14BB2C104J	RD 100K J 1/6W		
R55 -58			RD14BB2C222J	RD 2.2K J 1/6W		
R59			RD14BB2C272J	RD 2.7K J 1/6W		
R60			RD14BB2C222J	RD 2.2K J 1/6W		
R61 ,62			RK73FB2A473J	CHIP R 47K J 1/10W		
R63			RK73FB2A333J	CHIP R 33K J 1/10W		
R64			RD14BB2C333J	RD 33K J 1/6W		
VR1		*	R05-3438-05	POTENTIOMETER(10KK)		
VR2		*	R05-4417-05	POTENTIOMETER(50KB)		
D2			1SS133	DIODE	K1M1M2	

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D3			1SS133	DIODE			T1	
D4			1SS133	DIODE			T1W1	
D5			1SS133	DIODE			M1T1W1	
D6			1SS133	DIODE				
D7			1SS133	DIODE			M2T1W1	
D8 ,9			1SS133	DIODE				
D10			1SS133	DIODE			K1M1	
D10			1SS133	DIODE			T1W1	
D11 -13			1SS133	DIODE				
D14			1SS133	DIODE			T1W1	
D15 -18			1SS133	DIODE				
D19			1SS196	CHIP DIODE				
D20			DAP202(K)	CHIP DIODE				
D21			DAN202(K)	CHIP DIODE				
D23 -27			1SS133	DIODE				
Q1		*	75108G-509-1B	IC(MICROPROCESSOR)				
Q2		*	UPD75075CT-226	IC(MICROPROCESSOR)				
Q3			2SC2712(Y)	CHIP TRANSISTOR				
Q4		*	TC74HC14F	IC(HEX SCHUMITT INVERTER)				
Q5			PST523C	IC(SYSTEM RESET)				
Q7			DTC114EK	DIGITAL TRANSISTOR				
PLL SUB VCO (X58-3000-XX) -00 : M1,T,W -11 : K,M2								
C1			CC73FCH1H100D	CHIP C	10PF	D		
C2			CC73FCH1H040C	CHIP C	4.0PF	C		
C3			CC73FCH1H120J	CHIP C	12PF	J		
C4 ,5			CK73FB1H102K	CHIP C	1000PF	K		
C7			CK73FB1H102K	CHIP C	1000PF	K		
C8			CC73FCH1H020C	CHIP C	2.0PF	C		
C9			CC73FCH1H010C	CHIP C	1.0PF	C		
C10			CC73FCH1H080D	CHIP C	8.0PF	D		
C11			CC73FCH1H150J	CHIP C	15PF	J		
C12			CK73FB1H102K	CHIP C	1000PF	K		
C13			CC73FCH1H390J	CHIP C	39PF	J		
C14			CK73FB1H102K	CHIP C	1000PF	K		
C15			CS15E1V0R1M	TANTAL	0.1UF	35WV		
C16			CC73FCH1H220J	CHIP C	22PF	J		
C17			CC73FCH1H390J	CHIP C	39PF	J		
C18			CC73FCH1H270J	CHIP C	27PF	J		
C19			CC73FCH1H070D	CHIP C	7.0PF	D		
C20			CC73FCH1H010C	CHIP C	1.0PF	C		
C21			CC73FCH1H080D	CHIP C	8.0PF	D		
C22			CC73FCH1H150J	CHIP C	15PF	J		
C23			CK73FB1H102K	CHIP C	1000PF	K		
C24			CC73FCH1H330J	CHIP C	33PF	J		
C25 ,26			CK73FB1H102K	CHIP C	1000PF	K		
C27			CS15E1E010M	TANTAL	1.0UF	25WV		
C28			CS15E1V0R1M	TANTAL	0.1UF	35WV		
C29 -35			CK73FB1H102K	CHIP C	1000PF	K		
C36			C90-0896-05	ELECTRO	47UF	16WV		
C37			CC73FCH1H100D	CHIP C	10PF	D		
C38			CC73FCH1H080D	CHIP C	8.0PF	D		
C39 -41			CK73FB1H102K	CHIP C	1000PF	K		
C42			CC73FCH1H020C	CHIP C	2.0PF	C		
C43			CC73FCH1H010C	CHIP C	1.0PF	C		

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C44			CC73FCH1H080D	CHIP C 8.0PF D		
C45			CC73FCH1H100D	CHIP C 10PF D		
C46			CK73FB1H102K	CHIP C 1000PF K		
C47			CC73FCH1H150J	CHIP C 15PF J		
C48 ,49			C90-0896-05	ELECTRO 47UF 16WV		
C50			CK73FB1H102K	CHIP C 1000PF K		
C51			CS15E1V0R1M	TANTAL 0.1UF 35WV		
C52			CK73FB1H102K	CHIP C 1000PF K		
C53			CC73FCH1H100D	CHIP C 10PF D		
C54 -57			CK73FB1H102K	CHIP C 1000PF K		
C58 ,59			CC73FCH1H010C	CHIP C 1.0PF C		
C60			CC73FCH1H080D	CHIP C 8.0PF D		
C61			CC73FCH1H090D	CHIP C 9.0PF D		
C62			CK73FB1H102K	CHIP C 1000PF K		
C63			CC73FCH1H100D	CHIP C 10PF D		
C64			CC73FCH1H080D	CHIP C 8.0PF D		
C66			CS15E1E010M	TANTAL 1.0UF 25WV		
C67			CS15E1V0R1M	TANTAL 0.1UF 35WV		
C68 -73			CK73FB1H102K	CHIP C 1000PF K		
C74			C90-0896-05	ELECTRO 47UF 16WV		
C75 ,76			CK73FB1H102K	CHIP C 1000PF K		
C77 ,78			C90-0896-05	ELECTRO 47UF 16WV		
C79			CK73FB1H102K	CHIP C 1000PF K		
C80			CC73FCH1H100D	CHIP C 10PF D		
C81			CC73FCH1H080D	CHIP C 8.0PF D		
C82			CC73FCH1H020C	CHIP C 2.0PF C		
C83			CK73FB1H102K	CHIP C 1000PF K		
C84			CC73FCH1H471J	CHIP C 470PF J		
C85			CK73FF1E104Z	CHIP C 0.10UF Z		
C86			CK45B1H102K	CERAMIC 1000PF K		
C87			CK73EF1E104Z	CHIP C 0.10UF Z		
TC1 ,2			C05-0349-05	TRIMMING CAP (10PF)		
-			E23-0464-05	TERMINAL (TEST TERMINAL)		
L1			L34-0890-05	TUNING COIL		
L2 ,3			L40-4791-14	SMALL FIXED INDUCTOR(4.7UH)		
L4		*	L32-0687-05	OSCILLATING COIL(7T)		
L5			L40-4791-14	SMALL FIXED INDUCTOR(4.7UH)		
L6 ,7			L34-1158-05	COIL (3,4.5R)		
L8 ,9			L40-4791-14	SMALL FIXED INDUCTOR(4.7UH)		
L10		*	L32-0686-05	OSCILLATING COIL(4T)		
L11			L40-4791-14	SMALL FIXED INDUCTOR(4.7UH)		
L12			L34-1058-05	COIL (3,2.5N)		
L13			L40-1092-14	SMALL FIXED INDUCTOR(1UH)		
L14 ,15			L40-4782-14	SMALL FIXED INDUCTOR(0.47UH)		
L16		*	L34-1180-05	COIL (3,2.5R)		
L17			L40-4782-14	SMALL FIXED INDUCTOR(0.47UH)		
L18		*	L34-1175-05	COIL (3,1.5R)		
L19			L40-4782-14	SMALL FIXED INDUCTOR(0.47UH)		
L20		*	L34-1185-05	COIL (3,2.5N)		
L21 ,22			L40-4782-14	SMALL FIXED INDUCTOR(0.47UH)		
L23			L34-0890-05	TUNING COIL		
R1			RK73FB2A470J	CHIP R 47 J 1/10W		
R2			RK73FB2A562J	CHIP R 5.6K J 1/10W		

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R3			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R4			RD14BB2C221J	RD 220 J 1/6W		
R5			RK73FB2A221J	CHIP R 220 J 1/10W		
R6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			RK73FB2A391J	CHIP R 390 J 1/10W		
R8			RK73FB2A221J	CHIP R 220 J 1/10W		
R9			RK73FB2A470J	CHIP R 47 J 1/10W		
R10			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R11			RK73FB2A561J	CHIP R 560 J 1/10W		
R12 ,13			RK73FB2A473J	CHIP R 47K J 1/10W		
R14			RK73FB2A153J	CHIP R 15K J 1/10W		
R15			RK73FB2A101J	CHIP R 100 J 1/10W		
R16			RK73FB2A221J	CHIP R 220 J 1/10W		
R17			RK73FB2A470J	CHIP R 47 J 1/10W		
R18			RK73FB2A103J	CHIP R 10K J 1/10W		
R19			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R20			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R21			RK73FB2A470J	CHIP R 47 J 1/10W		
R22			RK73FB2A103J	CHIP R 10K J 1/10W		
R23			RD14BB2C101J	RD 100 J 1/6W		
R24			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R25			RK73FB2A470J	CHIP R 47 J 1/10W		
R26			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R27			R92-0670-05	CHIP R 0 OHM		
R28			RK73FB2A221J	CHIP R 220 J 1/10W		
R29			RK73FB2A470J	CHIP R 47 J 1/10W		
R30			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R31			RK73FB2A561J	CHIP R 560 J 1/10W		
R32 ,33			RK73FB2A473J	CHIP R 47K J 1/10W		
R34			RK73FB2A153J	CHIP R 15K J 1/10W		
R35 -38			RK73FB2A331J	CHIP R 330 J 1/10W		
R39			RK73FB2A471J	CHIP R 470 J 1/10W		
R40			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R41			RK73FB2A471J	CHIP R 470 J 1/10W		
R42			R92-0670-05	CHIP R 0 OHM		
VR1			R12-3445-05	TRIMMING POT. (47K)		
VR2			R12-3444-05	TRIMMING POT. (10K)		
VR3			R12-3445-05	TRIMMING POT. (47K)		
VR4			R12-3444-05	TRIMMING POT. (10K)		
D1 -4			1SV153	VARI-CAP DIODE		
Q1 ,2			2SK125	FET		
Q3 ,4			DTC114EK	DIGITAL TRANSISTOR		
Q5			2SC2026	TRANSISTOR		
Q6			2SK125	FET		
Q7			2SC2026	TRANSISTOR		
Q8			2SK125	FET		
Q9 ,10			DTC114EK	DIGITAL TRANSISTOR		
Q11			2SC2026	TRANSISTOR		
MIC AMP., S-METER (X59-1010-10)						
C1			CK73FB1H472K	CHIP C 4700PF K		
-			E23-0471-05	TERMINAL		
R1			RK73FB2A473J	CHIP R 47K J 1/10W		
R2			RK73FB2A474J	CHIP R 470K J 1/10W		

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R3			RK73FB2A103J	CHIP R 10K 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		
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		
D1			1SS184	CHIP DIODE		
D2			1SS181	CHIP DIODE		
IC1			NJM4558M	IC(OP AMP X2)		
ALERT, VACANT CH. (X59-1020-10)						
C1			CK73FB1H102K	CHIP C 1000PF K		
-			E23-0471-05	TERMINAL		
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		
D1			1SS181	CHIP DIODE		
Q1			2SC3326(A)	CHIP TRANSISTOR		
Q2 -4			2SC2712(Y)	CHIP TRANSISTOR		
CENTER DETECTOR (X59-1030-10)						
C1 ,2			CK73FB1H102K	CHIP C 1000PF K		
C3 ,4			CK73FF1E473Z	CHIP C 0.047UF Z		
C5			CK73FB1H102K	CHIP C 1000PF K		
-			E23-0471-05	TERMINAL		
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		
D1			1SS181	CHIP DIODE		
IC1			NJM4558M	IC(OP AMP X2)		
Q1			2SC2714(Y)	CHIP TRANSISTOR		
MIC AMP. (X59-3190-00)						
C1			CC73FSL1H390J	CHIP C 39PF J		
C2			CK73FB1H152K	CHIP C 1500PF K		
C3			CC73FSL1H331J	CHIP C 330PF J		
C4			CC73FSL1H561J	CHIP C 560PF J		
C5			CC73FSL1H331J	CHIP C 330PF J		
-			E23-0471-05	TERMINAL		
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R2			RK73FB2A221J	CHIP R 220 J 1/10W		

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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			RK73FB2A224J	CHIP R	220K	J 1/10W		
R7			RK73FB2A822J	CHIP R	8.2K	J 1/10W		
R8			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		
D1			1SS184	CHIP DIODE				
D2			1SS181	CHIP DIODE				
IC1			NJM4558M	IC(OP AMP X2)				
Q1			2SC2712(Y)	CHIP TRANSISTOR				
SQUELCH CONTROL (X59-3200-00)								
C1			CK73FB1H102K	CHIP C	1000PF	K		
-			E23-0471-05	TERMINAL				
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			
D1			1SS184	CHIP DIODE				
Q1			2SC2712(Y)	CHIP TRANSISTOR				
Q2 ,3			2SC3295(B)	CHIP TRANSISTOR				
Q4			2SC2712(BL)	CHIP TRANSISTOR				
Q5			2SC2712(Y)	CHIP TRANSISTOR				
Q6			2SC2712(BL)	CHIP TRANSISTOR				
COMPOSITE UNIT (RX-TX) (X60-3000-XX) -11 : K,M1,M2 -51 : T,W								
C1			CC73FCH1H330J	CHIP C	33PF	J		
C2			CC73FCH1H120J	CHIP C	12PF	J		
C3			CC73FCH1H030C	CHIP C	3.0PF	C		
C4			CC73FCH1H220J	CHIP C	22PF	J		
C5			CC73FCH1H150J	CHIP C	15PF	J		
C6 -10			CK73FB1H102K	CHIP C	1000PF	K		
C11			CC73FCH1H180J	CHIP C	18PF	J		
C12			CC73FCH1H010C	CHIP C	1.0PF	C		
C13			CC73FCH1H020C	CHIP C	2.0PF	C		
C14			CK73FB1H102K	CHIP C	1000PF	K		
C15			CC73FCH1H070D	CHIP C	7.0PF	D		
C16			CC73FCH1H080D	CHIP C	8.0PF	D		
C17			CC73FCH1H101J	CHIP C	100PF	J		
C18			CK73FB1H102K	CHIP C	1000PF	K		
C19 ,20			CK73FB1H472K	CHIP C	4700PF	K		

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C21 -23			CK73FB1H102K	CHIP C	1000PF	K		
C24			CC73FCH1H300J	CHIP C	30PF	J		
C25 ,26			CK73FB1H102K	CHIP C	1000PF	K		
C27			CC73FCH1H100D	CHIP C	10PF	D		
C28			CC73FCH1H030C	CHIP C	3.0PF	C		
C29 -31			CK73FB1H102K	CHIP C	1000PF	K		
C33			CK73FB1H102K	CHIP C	1000PF	K		
C34			CC73FCH1H020C	CHIP C	2.0PF	C		
C35			CC73FCH1H390J	CHIP C	39PF	J		
C36 -42			CK73FB1H102K	CHIP C	1000PF	K		
C44			CK73FB1H102K	CHIP C	1000PF	K		
C45			CC73FCH1H060D	CHIP C	6.0PF	D		
C46			CK73FB1H102K	CHIP C	1000PF	K		
C47			CC73FCH1H240J	CHIP C	24PF	J		
C48			CC73FCH1H560J	CHIP C	56PF	J		
C49			CC73FCH1H101J	CHIP C	100PF	J		
C50			CK73FB1H472K	CHIP C	4700PF	K		
C51			CC73FCH1H390J	CHIP C	39PF	J		
C52			CC73FCH1H220J	CHIP C	22PF	J		
C53			CK73FB1H102K	CHIP C	1000PF	K		
C54			CK73FB1H472K	CHIP C	4700PF	K		
C55			CK73FB1H102K	CHIP C	1000PF	K		
C56			CC73FCH1H680J	CHIP C	68PF	J		
C57			CC73FCH1H101J	CHIP C	100PF	J		
C58			CC73FCH1H121J	CHIP C	120PF	J		
C59			CQ92M1H103K	MYLAR	0.010UF	K		
C60			CK73FB1H472K	CHIP C	4700PF	K		
C61 -63			CK73FB1H102K	CHIP C	1000PF	K		
C64 -66			CF92V1H104J	MF	0.10UF	J		
C67			CK73FB1H102K	CHIP C	1000PF	K		
C68			C90-0480-05	ELECTRO	47UF	10WV		
C69		*	C90-2044-05	ELECTRO	1UF	25WV		
C70		*	C90-2043-05	ELECTRO	0.68UF	25WV		
C71			CE04W1A470M	ELECTRO	47UF	10WV		
C72			C90-0824-05	ELECTRO	1UF	50WV		
C73			C90-0478-05	ELECTRO	10UF	16WV		
C74			CK73FB1H102K	CHIP C	1000PF	K		
C75			CQ92M1H152K	MYLAR	1500PF	K		
C76			C90-0478-05	ELECTRO	10UF	16WV		
C77		*	C90-2042-05	ELECTRO	0.1UF	50WV		
C78			CC73FCH1H101J	CHIP C	100PF	J		
C79 ,80			CK73FB1H102K	CHIP C	1000PF	K		
C81			C90-0824-05	ELECTRO	1UF	50WV		
C82			CQ92M1H333K	MYLAR	0.033UF	K		
C83			CQ92M1H563K	MYLAR	0.056UF	K		
C84			CQ92M1H333K	MYLAR	0.033UF	K		
C85			CQ92M1H473K	MYLAR	0.047UF	K		
C86			CE04W1A470M	ELECTRO	47UF	10WV		
C87			CE04W1C470M	ELECTRO	47UF	16WV		
C88			CK73FB1H102K	CHIP C	1000PF	K		
C89			CE04CW1H010M	ELECTRO	1.0UF	50WV		
C90			CK73FB1H102K	CHIP C	1000PF	K		
C92 ,93			C90-0824-05	ELECTRO	1UF	50WV		
C94 ,95			CK73FB1H102K	CHIP C	1000PF	K		
C96		*	C90-2044-05	ELECTRO	1UF	25WV		

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C97			C90-0824-05	ELECTRO	1UF	50WV		
C98			C90-0820-05	ELECTRO	470UF	16WV		
C99 -101			CK73FB1H102K	CHIP C	1000PF	K		
C102			C90-0824-05	ELECTRO	1UF	50WV		
C103			CK73EB1E393K	CHIP C	0.039UF	K		
C104			C90-0480-05	ELECTRO	47UF	10WV		
C105			CK73FB1H102K	CHIP C	1000PF	K		
C106			C90-0480-05	ELECTRO	47UF	10WV		
C107			CQ92M1H104K	MYLAR	0.10UF	K		
C108			CE04W1C221M	ELECTRO	220UF	16WV		
C109			C90-0480-05	ELECTRO	47UF	10WV		
C110-118			CK73FB1H102K	CHIP C	1000PF	K		
C119			C90-0481-05	ELECTRO	3.3UF	50WV		
C120-124			C90-0478-05	ELECTRO	10UF	16WV		
C125			CK73FB1H102K	CHIP C	1000PF	K		
C126			C90-0820-05	ELECTRO	470UF	16WV		
C127-130			CK73FB1H102K	CHIP C	1000PF	K		
C131			CK73FB1H471K	CHIP C	470PF	K		
C132			C90-0478-05	ELECTRO	10UF	16WV		
C133			CK73FB1H471K	CHIP C	470PF	K		
C134			C90-0478-05	ELECTRO	10UF	16WV		
C135			CC73ECH1H030C	CHIP C	3.0PF	C		
C136			CC73ECH1H040C	CHIP C	4.0PF	C		
C137,138			CK73EB1H471K	CHIP C	470PF	K		
C139			CC73ECH1H060D	CHIP C	6.0PF	D		
C140			CC73ECH1H040C	CHIP C	4.0PF	C		
C141			CC45CH2H470J	CERAMIC	47PF	J		
C142			C90-0824-05	ELECTRO	1UF	50WV		
C143			CK73FB1H102K	CHIP C	1000PF	K		
C144			CC73ECH1H0R5C	CHIP C	0.5PF	C		
C145			CC73ECH1H070D	CHIP C	7.0PF	D		
C146			CM73F2H100D	CHIP C	10PF	D		
C147			CC73ECH1H050C	CHIP C	5.0PF	C	T1W1	
C147			CC73ECH1H060D	CHIP C	6.0PF	D	K1M1M2	
C148-152			CK73FB1H471K	CHIP C	470PF	K		
C153		*	C90-2045-05	ELECTRO	2.2UF	25WV		
C154			CQ92M1H223K	MYLAR	0.022UF	K		
C155,156			C90-0824-05	ELECTRO	1UF	50WV		
C157			CE04W1H010M	ELECTRO	1.0UF	50WV		
C158-162			CK73FB1H102K	CHIP C	1000PF	K		
C163			C90-0478-05	ELECTRO	10UF	16WV		
C164-186			CK73FB1H102K	CHIP C	1000PF	K		
C187			CE04W1A470M	ELECTRO	47UF	10WV		
C188			CK73FB1H102K	CHIP C	1000PF	K		
C189			CE04CW1H010M	ELECTRO	1.0UF	50WV		
C190			CC73FCH1H101J	CHIP C	100PF	J		
C191			CC73FCH1H120J	CHIP C	12PF	J		
C192			CE04CW1H010M	ELECTRO	1.0UF	50WV		
C193			CC73FCH1H080D	CHIP C	8.0PF	D		
C194,195			CK73FB1H102K	CHIP C	1000PF	K		
C197-199			CK73FB1H102K	CHIP C	1000PF	K		
C200			CK73FB1H471K	CHIP C	470PF	K		
C201-203			CK73FB1H102K	CHIP C	1000PF	K		
C204			CC73FCH1H101J	CHIP C	100PF	J		
C205			CC73FCH1H330J	CHIP C	33PF	J		

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C206			CC73FCH1H220J	CHIP C 22PF J		
C207			CK73FB1H471K	CHIP C 470PF K		
C208			CK73FB1H102K	CHIP C 1000PF K		
C210-215			CK73FB1H102K	CHIP C 1000PF K		
C218,219			CK73FB1H102K	CHIP C 1000PF K		
C220			CK45B1H471K	CERAMIC 470PF K		
C222			CC73FCH1H020C	CHIP C 2.0PF C		
C223			CC45CH1H020C	CERAMIC 2.0PF C		
C225			CK45B1H102K	CERAMIC 1000PF K		
C226			CC73FCH1H070D	CHIP C 7.0PF D		
C227			CK73FB1H102K	CHIP C 1000PF K		
C228			CK45B1H102K	CERAMIC 1000PF K		
C229			CK73FB1H102K	CHIP C 1000PF K		
C300,301			CK73FB1H102K	CHIP C 1000PF K	T1W1	
C302			CQ92M1H333K	MYLAR 0.033UF K	T1W1	
C303			CK73FB1H102K	CHIP C 1000PF K	T1W1	
C304			CQ92M1H392K	MYLAR 3900PF K	T1W1	
C305			CK73FB1H102K	CHIP C 1000PF K	T1W1	
C306			C90-0480-05	ELECTRO 47UF 10WV	T1W1	
C308			CK73FB1H102K	CHIP C 1000PF K	T1W1	
TC1 ,2			C05-0329-05	TRIMMING CAP (6PF)		
TC4			C05-0329-05	TRIMMING CAP (6PF)		
-			E23-0453-05	TERMINAL		
-			E23-0454-04	TERMINAL (ANT TERMINAL)		
CN1			E40-3238-05	PIN CONNECTOR (3P)		
CN2			E40-3241-05	PIN CONNECTOR (6P)		
CN3			E40-3239-05	PIN CONNECTOR (4P)		
CN4			E40-3241-05	PIN CONNECTOR (6P)		
CN5 ,6			E40-3238-05	PIN CONNECTOR (3P)		
CN7			E40-3237-05	PIN CONNECTOR (2P)		
CN8			E40-3243-05	PIN CONNECTOR (8P)		
CN9			E40-3237-05	PIN CONNECTOR (2P)		
CN10-12			E40-3238-05	PIN CONNECTOR (3P)		
CN13			E40-3237-05	PIN CONNECTOR (2P)		
JP2			E31-1448-05	CONNECTING WIRE(5MM)		
JP7			E31-0381-05	CONNECTING WIRE(10MM)		
JP11			E31-1448-05	CONNECTING WIRE(5MM)		
PJ1 -4			E04-0154-05	RF COAX. JACK		
RP			E23-0465-05	TERMINAL (TEST TERMINAL)		
TP1			E40-0211-05	PIN CONNECTOR (2P)		
TP2			E23-0465-05	TERMINAL (TEST TERMINAL)		
TP3			E40-0211-05	PIN CONNECTOR (2P)		
TP4			E23-0465-05	TERMINAL (TEST TERMINAL)		
TP5			E40-0211-05	PIN CONNECTOR (2P)		
TP6			E23-0465-05	TERMINAL (TEST TERMINAL)		
		*	F20-0554-14	INSULATING BOARD		
		*	F20-0555-14	INSULATING BOARD		
		*	G02-0566-04	SPRING		
-			J30-0545-05	SPACER (MCF)		
L1 ,2			L31-0267-05	ANT COIL		
L3		*	L30-0537-05	IFT (30.825MHZ)		
L4		*	L30-0539-05	IFT		

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L5			L34-1079-05	COIL (3,1.5T)		
L6			L34-1115-05	COIL		
L8			L34-1115-05	COIL		
L9			L40-2282-17	SMALL FIXED INDUCTOR(0.22UH)		
L10		*	L30-0538-05	IFT (455KHZ)		
L11			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L12		*	L30-0538-05	IFT (455KHZ)		
L13 ,14			L40-1021-12	SMALL FIXED INDUCTOR(1MH)		
L15			L15-0308-05	LOW-FREQUENCY CHOKE COIL		
L16			L34-1040-05	COIL (4,1T)		
L17		*	L34-1174-05	COIL (3,9.5T)		
L18			L34-1079-05	COIL (3,1.5T)		
L20 ,21			L34-1039-05	COIL (4,1.5T)		
L22 ,23			L40-1092-14	SMALL FIXED INDUCTOR(1.0UH)		
L24			L79-0498-15	HELICAL BLOCK (145MHZ)	T1W1	
L24			L79-0499-05	HELICAL BLOCK (146MHZ)	K1M1M2	
L25 ,26			L79-0690-05	HELICAL BLOCK (435MHZ)		
L27		*	L71-0263-05	MCF (30.825MHZ)		
L28		*	L72-0359-05	CERAMIC FILTER (CFV455E)		
L29			L79-0446-05	CERAMIC DISCRI (CFY455S)		
L30			L34-0890-05	TUNING COIL		
L31			L40-1072-80	CHIP INDUCTOR (10NH)		
X1		*	L77-1312-05	CRYSTAL RESONATOR(30.370MHZ)		
-			N35-3004-46	BINDING HEAD MACHINE SCREW		
-			R92-0150-05	JUMPER REST 0 OHM		
-			R92-1061-05	JUMPER REST 0 OHM		
R1 ,2			RK73FB2A333J	CHIP R 33K J 1/10W		
R3			RK73FB2A274J	CHIP R 270K J 1/10W		
R4 -6			RK73FB2A470J	CHIP R 47 J 1/10W		
R7			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R8			RK73FB2A473J	CHIP R 47K J 1/10W		
R9			R90-0228-05	MULTI-COMP 10KX5 J 1/6W		
R10			RK73FB2A470J	CHIP R 47 J 1/10W		
R11			RD14BB2C473J	RD 47K J 1/6W		
R12			RK73FB2A271J	CHIP R 270 J 1/10W		
R13			RK73FB2A560J	CHIP R 56 J 1/10W		
R14			RK73FB2A153J	CHIP R 15K J 1/10W		
R15			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R16			RK73FB2A823J	CHIP R 82K J 1/10W		
R17			RK73FB2A473J	CHIP R 47K J 1/10W		
R18			RK73FB2A101J	CHIP R 100 J 1/10W		
R19			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R20			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R21			RK73FB2A333J	CHIP R 33K J 1/10W		
R22			RK73FB2A184J	CHIP R 180K J 1/10W		
R23			RK73FB2A470J	CHIP R 47 J 1/10W		
R24			RK73FB2A394J	CHIP R 390K J 1/10W		
R25			RK73FB2A470J	CHIP R 47 J 1/10W		
R26			RD14BB2C101J	RD 100 J 1/6W		
R27			RD14BB2C2R2J	RD 2.2 J 1/6W		
R28			RK73FB2A470J	CHIP R 47 J 1/10W		
R29			RK73FB2A153J	CHIP R 15K J 1/10W		
R30			RK73FB2A223J	CHIP R 22K J 1/10W		
R31			RK73FB2A102J	CHIP R 1.0K J 1/10W		

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R32			RK73FB2A271J	CHIP R 270 J 1/10W		
R33			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R34			R92-0670-05	CHIP R 0 OHM		
R35			RK73FB2A394J	CHIP R 390K J 1/10W		
R36			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R37			RK73FB2A333J	CHIP R 33K J 1/10W		
R38			RK73FB2A683J	CHIP R 68K J 1/10W		
R39			RK73FB2A182J	CHIP R 1.8K J 1/10W		
R40			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R41			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R42			RK73FB2A273J	CHIP R 27K J 1/10W		
R43			RK73FB2A181J	CHIP R 180 J 1/10W		
R44			R92-0670-05	CHIP R 0 OHM		
R45			RK73FB2A273J	CHIP R 27K J 1/10W		
R46			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R47			RK73FB2A221J	CHIP R 220 J 1/10W		
R48			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R49			RK73FB2A823J	CHIP R 82K J 1/10W		
R50			RK73FB2A183J	CHIP R 18K J 1/10W		
R51			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R52			RK73FB2A101J	CHIP R 100 J 1/10W		
R53			RK73FB2A683J	CHIP R 68K J 1/10W		
R54			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R55			RK73FB2A221J	CHIP R 220 J 1/10W		
R56			RK73FB2A104J	CHIP R 100K J 1/10W		
R57			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R58			RK73FB2A103J	CHIP R 10K J 1/10W		
R59			RK73FB2A470J	CHIP R 47 J 1/10W		
R60			RK73FB2A681J	CHIP R 680 J 1/10W		
R61			RK73FB2A101J	CHIP R 100 J 1/10W		
R62			RD14CB2C2R2J	RD 2.2 J 1/6W		
R63			RK73FB2A473J	CHIP R 47K J 1/10W		
R64			RK73FB2A823J	CHIP R 82K J 1/10W		
R65			RK73FB2A473J	CHIP R 47K J 1/10W		
R66 -71			RK73FB2A223J	CHIP R 22K J 1/10W		
R72 -77			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R78 -81			RK73FB2A473J	CHIP R 47K J 1/10W		
R82			RD14DB2H151J	SMALL-RD 150 J 1/2W		
R83			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R84			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R85			RK73FB2A333J	CHIP R 33K J 1/10W		
R86			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R87			RK73FB2A473J	CHIP R 47K J 1/10W		
R88			RK73FB2A2R2J	CHIP R 2.2 J 1/10W		
R89			RK73FB2A220J	CHIP R 22 J 1/10W		
R90			RK73FB2A471J	CHIP R 470 J 1/10W		
R91			RK73FB2A103J	CHIP R 10K J 1/10W		
R96			RK73FB2A473J	CHIP R 47K J 1/10W		
R97			RK73FB2A103J	CHIP R 10K J 1/10W		
R98			RK73FB2A271J	CHIP R 270 J 1/10W		
R99			RK73FB2A223J	CHIP R 22K J 1/10W		
R100			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R101			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R102			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R103			R92-0670-05	CHIP R 0 OHM		

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R104			RK73FB2A473J	CHIP R 47K J 1/10W		
R300			RK73FB2A103J	CHIP R 10K J 1/10W	T1W1	
R301			RK73FB2A123J	CHIP R 12K J 1/10W	T1W1	
R302			RK73FB2A473J	CHIP R 47K J 1/10W	T1W1	
R303			RK73FB2A123J	CHIP R 12K J 1/10W	T1W1	
R304			RK73FB2A913J	CHIP R 91K J 1/10W	T1W1	
R305			RK73FB2A472J	CHIP R 4.7K J 1/10W	T1W1	
R306			RK73FB2A271J	CHIP R 270 J 1/10W	T1W1	
VR1			R12-3445-05	TRIMMING POT. (47K)		
VR2			R12-3444-05	TRIMMING POT. (10K)		
VR3			R12-5419-05	TRIMMING POT. (220K)		
VR4			R12-3451-05	TRIMMING POT. (22K)		
VR5			R12-3445-05	TRIMMING POT. (47K)		
VR6			R12-0418-05	TRIMMING POT. (100)		
VR10			R12-3444-05	TRIMMING POT. (10K)	T1W1	
VR11			R12-3451-05	TRIMMING POT. (22K)	T1W1	
D1 -4			1S1587	DIODE		
D5 ,6			1N60PSPA	DIODE		
D7			1S1555	DIODE		
D8 ,9			DAP202(K)	CHIP DIODE		
D10			U15B	DIODE		
D11			UM9401	DIODE		
D12			MI308	DIODE		
D13			1SS101	DIODE		
D14			1S1587	DIODE		
D15			1SS133	DIODE		
D16			MTZ6.2JC	ZENER DIODE		
D17			1S1555	DIODE		
D20			MTZ5.6JC	ZENER DIODE	T1W1	
D21 ,22			1S1555	DIODE		
Q1			3SK184(S)	CHIP FET		
Q2			3SK184(R)	CHIP FET		
Q3 ,4			2SC2714(Y)	CHIP TRANSISTOR		
Q5			DTC114EK	DIGITAL TRANSISTOR		
Q6			3SK184(S)	CHIP FET		
Q7			2SK125	FET		
Q8			3SK184(R)	CHIP FET		
Q9			DTC114EK	DIGITAL TRANSISTOR		
Q10			TA7761P	IC(FM IF)		
Q11			2SC2712(Y)	CHIP TRANSISTOR		
Q12			DTC114EK	DIGITAL TRANSISTOR		
Q13			2SC1775(E)	TRANSISTOR		
Q14			2SC2712(Y)	CHIP TRANSISTOR		
Q15			UPC7808H	IC(VOLTAGE REGULATOR/ +8V)		
Q16			UPC1242H	IC		
Q17 -22			2SB698	TRANSISTOR		
Q23		*	TA78	TRANSISTOR ARRAY		
Q25			2SC2712(Y)	CHIP TRANSISTOR		
Q26 -32			DTC114EK	DIGITAL TRANSISTOR		
Q33			TC40H032F	IC		
Q34			2SC2712(Y)	CHIP TRANSISTOR		
Q35			DTC114EK	DIGITAL TRANSISTOR		
Q50			NJM555M	IC(TIMER)	T1W1	
TH1			112-202-2	THERMISTER (2K)		

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TH2			112-502-2	THERMISTER (5K)		
TH3		*	112-203-2	THERMISTER (20K)		
-			X59-1010-10	MODULE UNIT(MIC AMP,S METER)		
-			X59-1020-10	MODULE UNIT(ALERT VACANT CH)		
-			X59-1030-10	MODULE UNIT(CENTER DETECT)		
-		*	X59-3190-00	MODULE UNIT(MIC AMP)		
-		*	X59-3200-00	MODULE UNIT(SQ CONTROL)		
COMPOSITE UNIT (PLL-TX) (X60-3010-XX) -01 : M1,T,W -11 : K,M2						
C2			CK73FF1E104Z	CHIP C 0.10UF Z		
C3			CK73FB1H102K	CHIP C 1000PF K		
C4			CC73ECH1H0R5C	CHIP C 0.5PF C		
C5			CC73ECH1H270J	CHIP C 27PF J		
C6 ,7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73ECH1H010C	CHIP C 1.0PF C		
C9			CM73F2H390J	CHIP C 39PF J		
C10 -12			CK73FB1H102K	CHIP C 1000PF K		
C13			CC73ECH1H180J	CHIP C 18PF J		
C14			CK45B2H102K	CERAMIC 1000PF K		
C15			CC73ECH1H120J	CHIP C 12PF J		
C16			CK73EB1H102K	CHIP C 1000PF K		
C17			CK73FB1H102K	CHIP C 1000PF K		
C18			CC73FCH1H120J	CHIP C 12PF J		
C19			CC73ECH1H100D	CHIP C 10PF D		
C20			CK73FB1H102K	CHIP C 1000PF K		
C21			CC73FCH1H470J	CHIP C 47PF J		
C22			CK73FB1H102K	CHIP C 1000PF K		
C23			C90-0478-05	ELECTRO 10UF 16WV		
C24			CC45CH1H100D	CERAMIC 10PF D		
C25			C90-0478-05	ELECTRO 10UF 16WV		
C26 -29			CK73FB1H102K	CHIP C 1000PF K		
C30			CC73FCH1H270J	CHIP C 27PF J		
C31			CC73FCH1H240J	CHIP C 24PF J		
C32 ,33			CK73FB1H102K	CHIP C 1000PF K		
C34			CC73FCH1H270J	CHIP C 27PF J		
C35 -37			CK73FB1H102K	CHIP C 1000PF K		
C38			CC73FCH1H680J	CHIP C 68PF J		
C40			C90-0868-05	ELECTRO 10UF 16WV		
C41			CK73FB1H102K	CHIP C 1000PF K		
C42			CK73FB1H471K	CHIP C 470PF K		
C43			CK73FB1H102K	CHIP C 1000PF K		
C44			CK73FB1H471K	CHIP C 470PF K		
C45 -48			CK73FB1H102K	CHIP C 1000PF K		
C49			CC73FCH1H040C	CHIP C 4.0PF C		
C50 ,51			CK73FB1H102K	CHIP C 1000PF K		
C52			CC73FCH1H150J	CHIP C 15PF J		
C53 ,54			CK73FB1H102K	CHIP C 1000PF K		
C56 -58			CK73FB1H102K	CHIP C 1000PF K		
C59			CK73FF1E104Z	CHIP C 0.10UF Z		
C60			CC73FCH1H030C	CHIP C 3.0PF C		
C61 -63			CK73FB1H102K	CHIP C 1000PF K		
C64			CK73FB1H472K	CHIP C 4700PF K		
C65			CK73FF1E104Z	CHIP C 0.10UF Z		
C66 -72			CK73FB1H102K	CHIP C 1000PF K		
C73			CC45CH1H220J	CERAMIC 22PF J		

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C74			CK73FB1H102K	CHIP C	1000PF	K		
C75			CS15E1VR22M	TANTAL	0.22UF	35WV		
C76			CK73FB1H102K	CHIP C	1000PF	K		
C77			CE04CW1C470M	ELECTRO	47UF	16WV		
C78			CC45CH1H180J	CERAMIC	18PF	J		
C79 ,80			CK73FB1H102K	CHIP C	1000PF	K		
C81			CC73FCH1H010C	CHIP C	1.0PF	C		
C82			C90-0896-05	ELECTRO	47UF	16WV		
C83			CC73FCH1H100D	CHIP C	10PF	D		
C84 ,85			CK73FB1H102K	CHIP C	1000PF	K		
C86			CC73FCH1H101J	CHIP C	100PF	J		
C87 -89			CK73FB1H102K	CHIP C	1000PF	K		
C90			C90-0822-05	ELECTRO	47UF	16WV		
C91 -93			CK73FB1H102K	CHIP C	1000PF	K		
C94			CC73ECH1H200J	CHIP C	20PF	J		
C95 -97			CK73FB1H102K	CHIP C	1000PF	K		
C98			C90-0896-05	ELECTRO	47UF	16WV		
C99			CK73FB1H102K	CHIP C	1000PF	K		
C100			CC73FCH1H120J	CHIP C	12PF	J		
C101			CK73FB1H102K	CHIP C	1000PF	K		
C102			CC73FCH1H221J	CHIP C	220PF	J		
C103,104			CC73FCH1H101J	CHIP C	100PF	J		
C105,106			CK73FB1H102K	CHIP C	1000PF	K		
C107			CC73FCH1H101J	CHIP C	100PF	J		
C108			CK73FB1H102K	CHIP C	1000PF	K		
C109			CC45CH1H1R5C	CERAMIC	1.5PF	C		
C110			CK73FB1H102K	CHIP C	1000PF	K		
C111			C90-0822-05	ELECTRO	47UF	16WV		
C112-114			CK73FB1H102K	CHIP C	1000PF	K		
C115			CC73FCH1H330J	CHIP C	33PF	J		
C116			C90-0896-05	ELECTRO	47UF	16WV		
C117			CK73FB1H472K	CHIP C	4700PF	K		
C118			CE04CW1H010M	ELECTRO	1.0UF	50WV		
C119			CC73FCH1H060D	CHIP C	6.0PF	D		
C120			C90-0824-05	ELECTRO	1UF	50WV		
C121			CS15E1V0R1M	TANTAL	0.1UF	35WV		
C122			CK73FB1H102K	CHIP C	1000PF	K		
C123			C90-0478-05	ELECTRO	10UF	16WV		
C124,125			CK73FB1H102K	CHIP C	1000PF	K		
C126			CE04CW1H010M	ELECTRO	1.0UF	50WV		
C127,128			CK73FB1H102K	CHIP C	1000PF	K		
C129			CE04CW1H2R2M	ELECTRO	2.2UF	50WV		
C130			CK73FB1H102K	CHIP C	1000PF	K		
C131			C90-0822-05	ELECTRO	47UF	16WV		
C132			C90-2011-05	ELECTRO	4.7UF	25WV		
C133			CK73FB1H102K	CHIP C	1000PF	K		
C134			CQ92M1H563K	MYLAR	0.056UF	K		
C135			CC73FCH1H470J	CHIP C	47PF	J		
C137			CE04W1C101M	ELECTRO	100UF	16WV		
C138			CC73ECH1H080D	CHIP C	8.0PF	D		
C139,140			CK73FB1H102K	CHIP C	1000PF	K		
C141			CK73FB1H471K	CHIP C	470PF	K		
C142-145			CK73FB1H102K	CHIP C	1000PF	K		
C146			CE04CW1C220M	ELECTRO	22UF	16WV		
C147			CE04EW1E470M	ELECTRO	47UF	25WV		

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C148			CQ92M1H223K	MYLAR 0.022UF K		
C149			CS15E1VR22M	TANTAL 0.22UF 35WV		
C150-152			CK73FB1H102K	CHIP C 1000PF K		
C154			CC73FCH1H070D	CHIP C 7.0PF D		
C155,156			CK73FB1H102K	CHIP C 1000PF K		
C159			CK73FB1H102K	CHIP C 1000PF K		
C160			C90-0824-05	ELECTRO 1UF 50WV		
C161-165			CK73FB1H102K	CHIP C 1000PF K		
C167			CC73FCH1H020C	CHIP C 2.0PF C		
C168-182			CK73FB1H102K	CHIP C 1000PF K		
C183			CK73FB1H471K	CHIP C 470PF K		
C184-196			CK73FB1H102K	CHIP C 1000PF K		
C197			CC73FCH1H020C	CHIP C 2.0PF C		
C198-200			CK73FB1H102K	CHIP C 1000PF K		
C201			CK73FB1H471K	CHIP C 470PF K		
C202,203			CK73FB1H102K	CHIP C 1000PF K		
C204			CC73FCH1H120J	CHIP C 12PF J		
C205			CC45SL1H101J	CERAMIC 100PF J		
C206			CC73FCH1H100D	CHIP C 10PF D		
C208-211			CS15E1C4R7M	TANTAL 4.7UF 16WV		
C212			CC45CH1H330J	CERAMIC 33PF J		
C213			CC73ECH1H330J	CHIP C 33PF J		
C214			CC45CH1H330J	CERAMIC 33PF J		
C215			CK45B1H102K	CERAMIC 1000PF K		
C216			C90-2055-05	ELECTRO 3.3UF 16WV		
C217			CE04EW1E101M	ELECTRO 100UF 25WV		
TC1			C05-0030-15	TRIMMING CAP (20PF)		
TC2 ,3			C05-0062-05	TRIMMING CAP (6PF)		
TC4			C05-0319-05	TRIMMING CAP (10PF)		
-			E23-0453-05	TERMINAL		
-			E23-0454-04	TERMINAL (ANT TERMINAL)		
-			E23-0463-05	GND LUG		
CN1			E40-5066-05	PIN CONNECTOR (EH 9P)		
CN2			E40-3240-05	PIN CONNECTOR (EH 5P)		
CN3			E40-5068-05	PIN CONNECTOR (EH 11P)		
CN4			E40-3242-05	PIN CONNECTOR (EH 7P)		
CN5 ,6			E40-3238-05	PIN CONNECTOR (EH 3P)		
PJ1		*	E11-0425-05	PHONE JACK (3.5D)		
TP1 ,2			E23-0465-05	TERMINAL (TEST TERMINAL)		
TP4			E23-0465-05	TERMINAL (TEST TERMINAL)		
-		*	G13-0840-04	CUSHION (TERMINAL SW)		
-			J31-0503-05	BEAD		
L1		*	L34-1184-05	COIL (3,4.5R)		
L2			L40-1092-14	SMALL FIXED INDUCTOR(1UH)		
L3			L34-0742-05	COIL (3,5N)		
L4		*	L34-1170-05	COIL (3,9.5R)		
L5			L34-0452-05	COIL (3,6N)		
L6			L40-1092-14	SMALL FIXED INDUCTOR(1UH)		
L7			L34-0895-05	COIL (3,6N)		
L8			L34-1174-05	COIL (3,9,5N)		
L9			L34-0499-05	COIL (3,4N)		
L10			L34-1158-05	COIL (3,4.5R)		

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L11 -13		*	L34-1177-05	COIL (3,4.5N)		
L14			L34-1059-05	COIL (3,2.5R)		
L15			L34-1036-05	COIL (3,1.5N)		
L16			L34-1083-05	COIL (3,1N)		
L17		*	L34-1175-05	COIL (3,1.5R)		
L18			L34-1058-05	COIL (3,2.5N)		
L19			L34-1158-05	COIL (3,4.5R)		
L23			L92-0110-05	BEAD CORE		
X1		*	L77-1311-05	CRYSTAL RESONATOR(12.8MHZ)		
JP3			R92-1061-05	JUMPER REST 0 OHM		
R1			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R2			RD14DB2H151J	SMALL-RD 150 J 1/2W		
R3			RD14DB2H330J	SMALL-RD 33 J 1/2W		
R4			RK73FB2A470J	CHIP R 47 J 1/10W		
R5			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R6			RK73FB2A121J	CHIP R 120 J 1/10W		
R7			RK73FB2A391J	CHIP R 390 J 1/10W		
R8			RD14BB2C822J	RD 8.2K J 1/6W		
R9			RK73FB2A151J	CHIP R 150 J 1/10W		
R10			RK73FB2A470J	CHIP R 47 J 1/10W		
R11			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R12			RK73FB2A681J	CHIP R 680 J 1/10W		
R14			RD14DB2H560J	SMALL-RD 56 J 1/2W		
R15			RD14BB2C152J	RD 1.5K J 1/6W		
R16			RD14BB2C470J	RD 47 J 1/6W		
R17			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R18			RD14BB2C471J	RD 470 J 1/6W		
R19			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R20			RD14BB2C101J	RD 100 J 1/6W		
R21			RK73FB2A470J	CHIP R 47 J 1/10W		
R22			RD14BB2C472J	RD 4.7K J 1/6W		
R23			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R24			RK73FB2A223J	CHIP R 22K J 1/10W		
R25			RK73FB2A183J	CHIP R 18K J 1/10W		
R26			RD14BB2C223J	RD 22K J 1/6W		
R27			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R28			RK73FB2A103J	CHIP R 10K J 1/10W		
R29			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R30			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R31			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R32			RK73FB2A123J	CHIP R 12K J 1/10W		
R33			RK73FB2A103J	CHIP R 10K J 1/10W		
R34			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R35			RK73FB2A821J	CHIP R 820 J 1/10W		
R36			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R37			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R38			RK73FB2A221J	CHIP R 220 J 1/10W		
R39			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R40			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R41 ,42			RK73FB2A101J	CHIP R 100 J 1/10W		
R43			RK73FB2A333J	CHIP R 33K J 1/10W		
R44			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R45			RK73FB2A823J	CHIP R 82K J 1/10W		
R46			R92-0670-05	CHIP R 0 OHM		

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R47			RK73FB2A473J	CHIP R 47K J 1/10W		
R49			RK73FB2A271J	CHIP R 270 J 1/10W		
R50			RK73FB2A471J	CHIP R 470 J 1/10W		
R51			RK73FB2A124J	CHIP R 120K J 1/10W		
R52			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A123J	CHIP R 12K J 1/10W		
R54			RK73FB2A223J	CHIP R 22K J 1/10W		
R55			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R56			RK73FB2A821J	CHIP R 820 J 1/10W		
R57			RK73FB2A221J	CHIP R 220 J 1/10W		
R58			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R59			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R60			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R61			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R62			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R63			RK73FB2A470J	CHIP R 47 J 1/10W		
R64			RK73FB2A101J	CHIP R 100 J 1/10W		
R65			R92-0670-05	CHIP R 0 OHM		
R66			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R67			RK73FB2A473J	CHIP R 47K J 1/10W		
R68			RK73FB2A823J	CHIP R 82K J 1/10W		
R71			RK73FB2A103J	CHIP R 10K J 1/10W		
R72			RK73FB2A474J	CHIP R 470K J 1/10W		
R73 -76			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R77			RK73FB2A474J	CHIP R 470K J 1/10W		
R78			RK73FB2A103J	CHIP R 10K J 1/10W		
R79			RD14CB2C220J	RD. 22 J 1/6W		
R80			RK73FB2A223J	CHIP R 22K J 1/10W		
R81			RD14BB2C103J	RD 10K J 1/6W		
R82 ,83			RK73FB2A333J	CHIP R 33K J 1/10W		
R84			RD14CB2C101J	RD 100 J 1/6W		
R85			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R86			RD14BB2C682J	RD 6.8K J 1/6W		
R89 ,90			RK73FB2A473J	CHIP R 47K J 1/10W		
R91			RD14CB2C820J	RD 820 J 1/6W		
R92			RD14CB2C680J	RD 680 J 1/6W		
R94			RD14BB2C221J	RD 220 J 1/6W		
R95			RD14BB2C220J	RD 22 J 1/6W		
VR1			R12-3444-05	TRIMMING POT. (10K)		
VR2			R12-0418-05	TRIMMING POT. (100)		
VR3			R12-3445-05	TRIMMING POT. (47K)		
VR4			R12-3444-05	TRIMMING POT. (10K)		
VR5 -7			R12-3445-05	TRIMMING POT. (47K)		
VR8 ,9			R12-3444-05	TRIMMING POT. (10K)		
TS1			S59-1408-05	THERMAL SWITCH		
D1 ,2			1S1587	DIODE		
D3			MI308	DIODE		
D4 ,5			1S1555	DIODE		
D6			UM9401	DIODE		
D7			1S1555	DIODE		
D8			MC921	DIODE		
D9 ,10			1N60PSPA	DIODE		
D11			MC921	DIODE		
D12			1S1555	DIODE		

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D13 ,14			DAN202(K)	CHIP DIODE		
D15 -17			1S1555	DIODE		
D18 ,19			1SS133	DIODE		
D20 ,21			DAN202(K)	CHIP DIODE		
D23			1S1555	DIODE		
Q1			DTC114TK	DIGITAL TRANSISTOR		
Q3			2SC3019	TRANSISTOR		
Q4			2SC2026	TRANSISTOR		
Q5			2SC2347	TRANSISTOR		
Q6			2SC2407(1)	TRANSISTOR		
Q7 ,8			2SC2026	TRANSISTOR		
Q9 ,10			2SC2712(Y)	CHIP TRANSISTOR		
Q11			DTC114TK	DIGITAL TRANSISTOR		
Q12		*	2SD1761	TRANSISTOR		
Q13			2SA1015(Y)	TRANSISTOR		
Q14 ,15			2SC2458(Y)	TRANSISTOR		
Q16			2SC2712(Y)	CHIP TRANSISTOR		
Q17			2SK208(Y)	CHIP FET		
Q18			2SC2026	TRANSISTOR		
Q19		*	MB504P	IC(MODULAS PRE-SCALAR)		
Q20			MB87006	IC(FREQ SYNTHESIZER PLL)		
Q21 ,22			2SC2712(Y)	CHIP TRANSISTOR		
Q23			2SK208(Y)	CHIP FET		
Q24			2SC2026	TRANSISTOR		
Q25		*	MB501P	IC(MODULAS PRE-SCALAR)		
Q26			MB87006	IC(FREQ SYNTHESIZER PLL)		
Q27			2SC2603(E)	TRANSISTOR		
Q28			2SB698	TRANSISTOR		
Q29			2SC2712(Y)	CHIP TRANSISTOR		
Q30			2SB698	TRANSISTOR		
Q31			2SC2712(Y)	CHIP TRANSISTOR		
Q32			NJM78L06A	IC(VOLTAGE REGULATOR/ +6V)		
TH1			112-203-2	THERMISTER (20K)		
-		*	X58-3000-00	SUB UNIT (VCO)	M1T1W1	
-		*	X58-3000-11	SUB UNIT (VCO)	K1M2	

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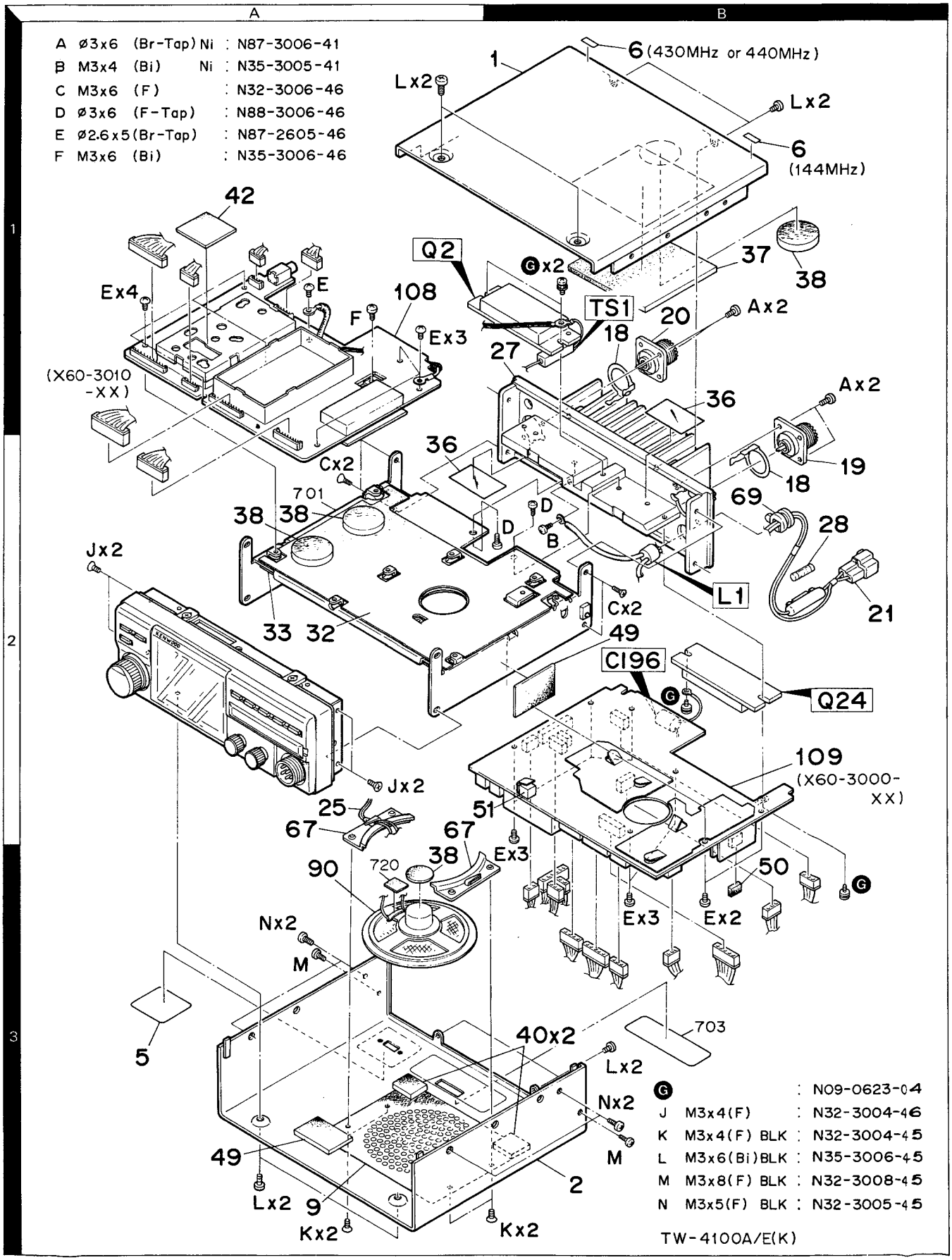
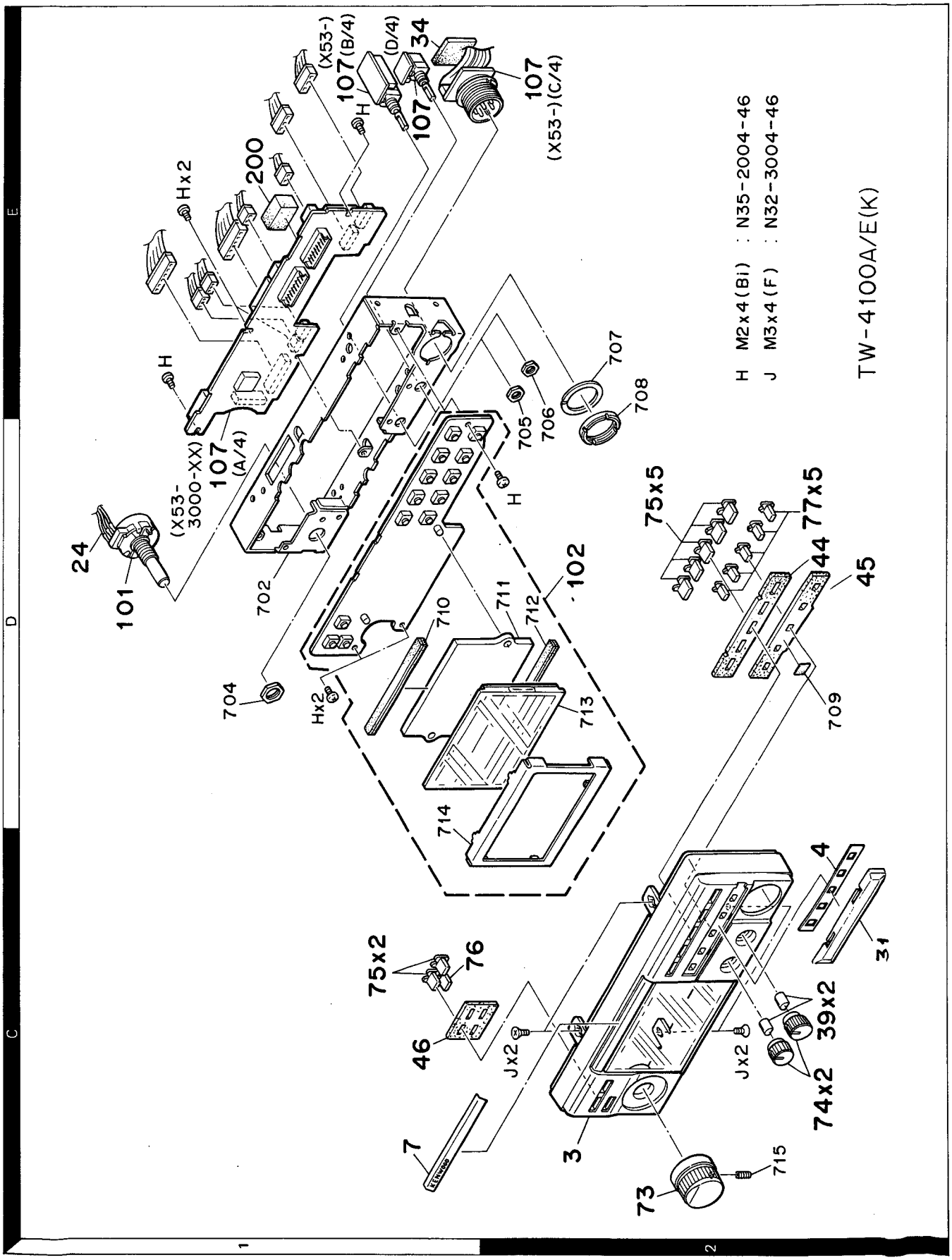
EXPLODED VIEW



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

EXPLODED VIEW



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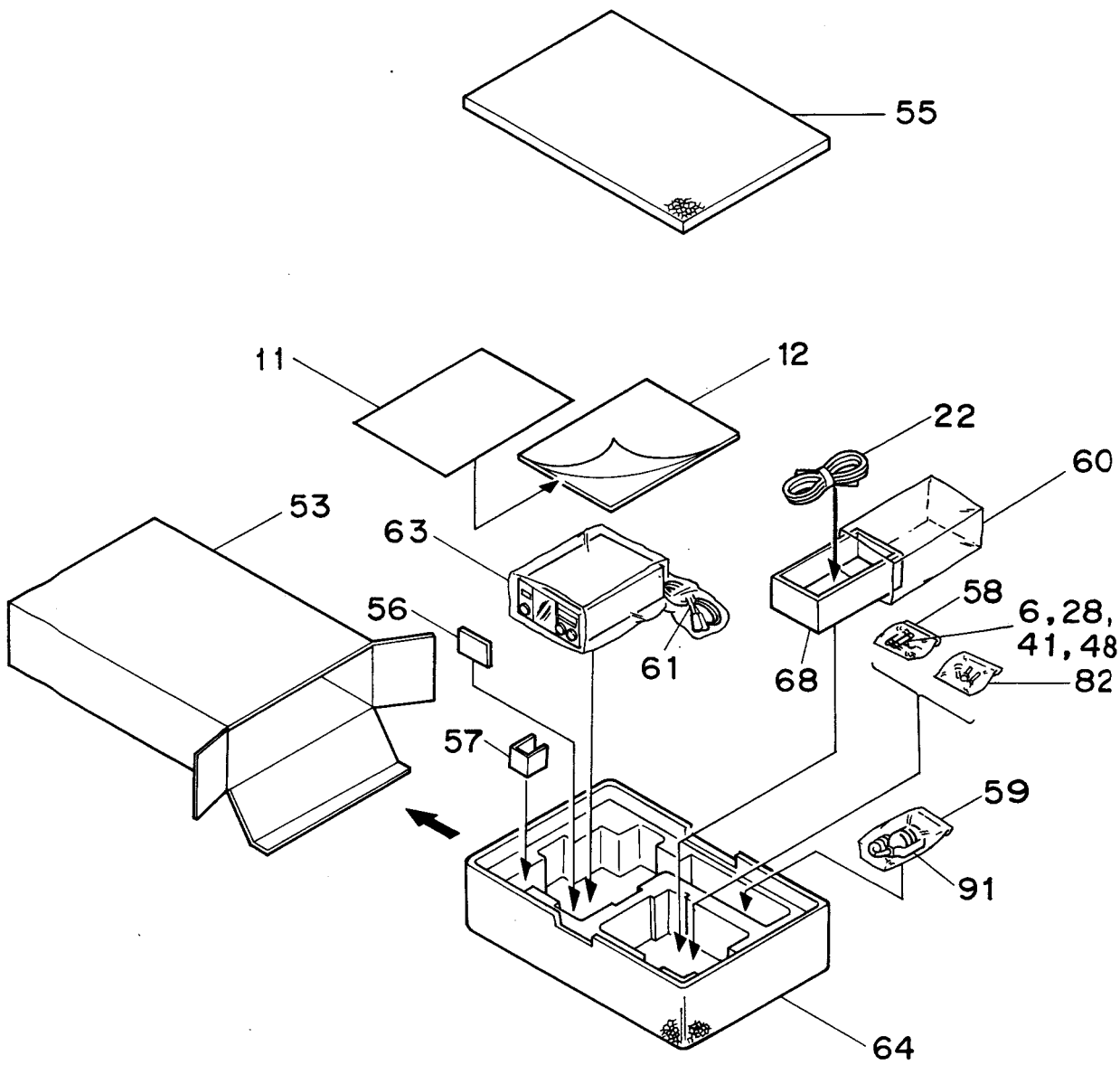
PACKING



Instruction manual (B50-8142-00)
Item carton box (144/440)(H01-8020-03) : **K,M2**
Item carton box (144/430)(H01-8021-03) : **M1**
Item carton box (H01-8022-03) : **T,W**
Packing fixture (Top)(H12-1345-04)
Protection plate (MIC)(H13-0810-04)
Protection plate (Rotary enc.)(H13-0811-04)
Protection bag (Acsy)(H25-0029-04)
Protection bag (MIC)(H25-0103-04)
Protection bag (Mounting bracket)(H25-0105-04)
Protection bag (DC cable)(H25-0117-04)
Protection bag (Radio)(H25-0713-04)
Polystyrene foamed fixture (H10-2613-02)

Accessary

Label (144MHz, 430MHz)(B42-2438-04) : **M1,T,W**
Label (144MHz, 440MHz)(B42-2439-04) : **K,M2**
Warranty card (B46-0058-10) : **K**
DC cable ass'y (E30-2054-05)
Fuse (10A) (F05-1031-05)
Felt (TONE UNIT) (G10-0645-04)
Cushion (MODEM UNIT) (G13-0837-14)
Mounting bracket (J29-0414-22)
Screw set (Mounting bracket)(N99-0315-04)
Microphone (T91-0357-15) : **M1,M2,T,W**
Microphone (T91-0359-05) : **K**

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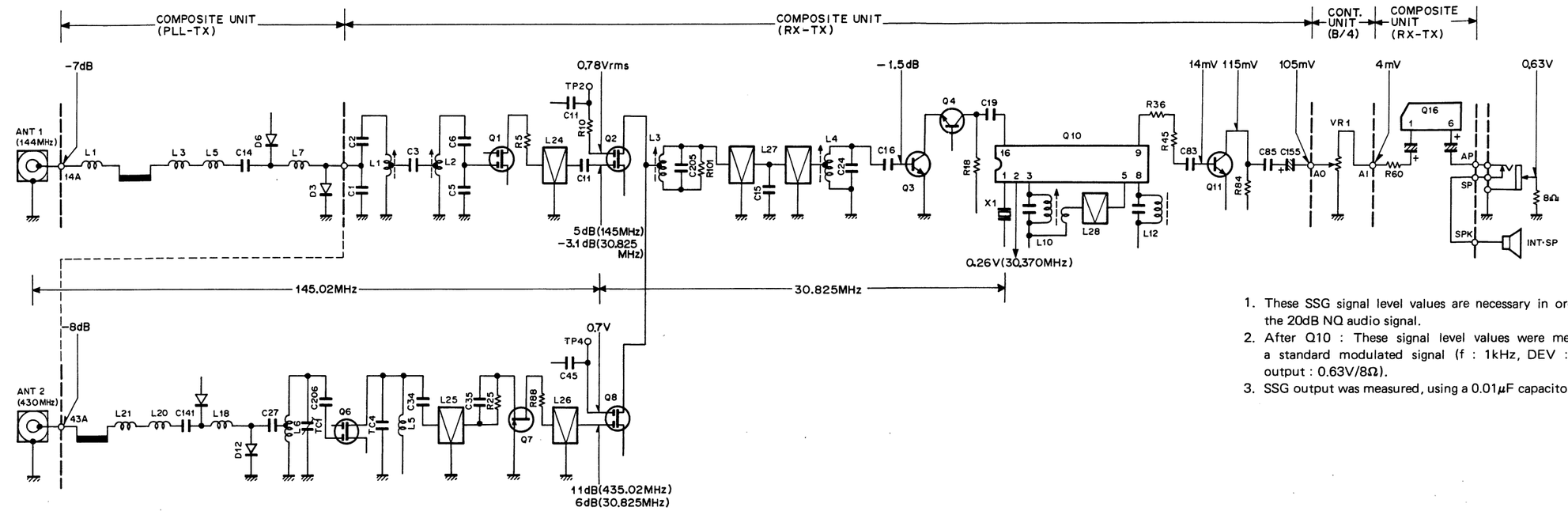
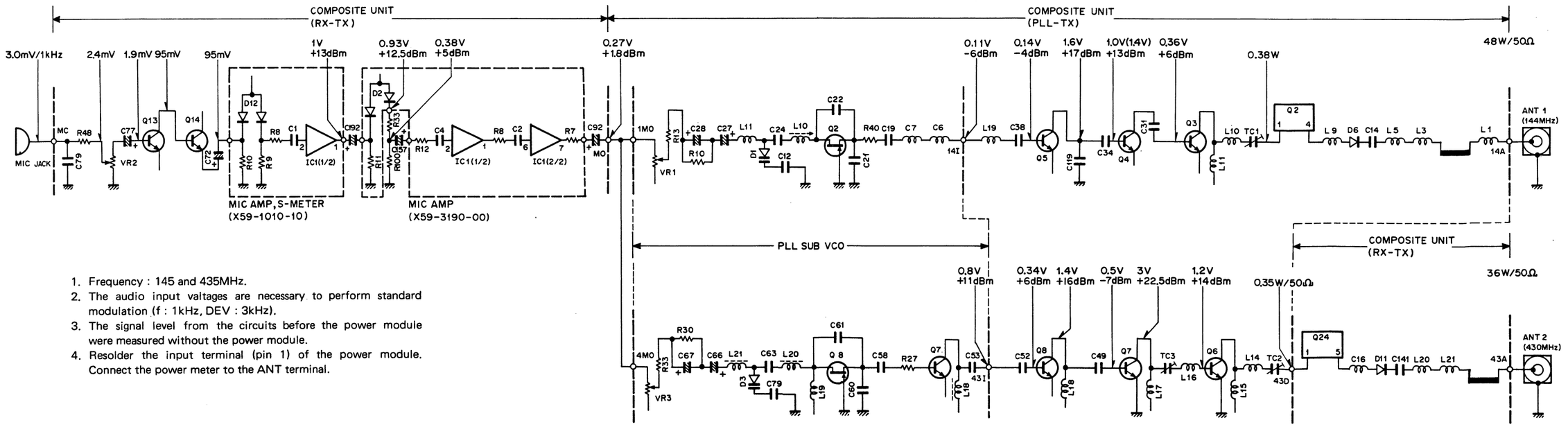
LEVEL DIAGRAM

RX SECTION



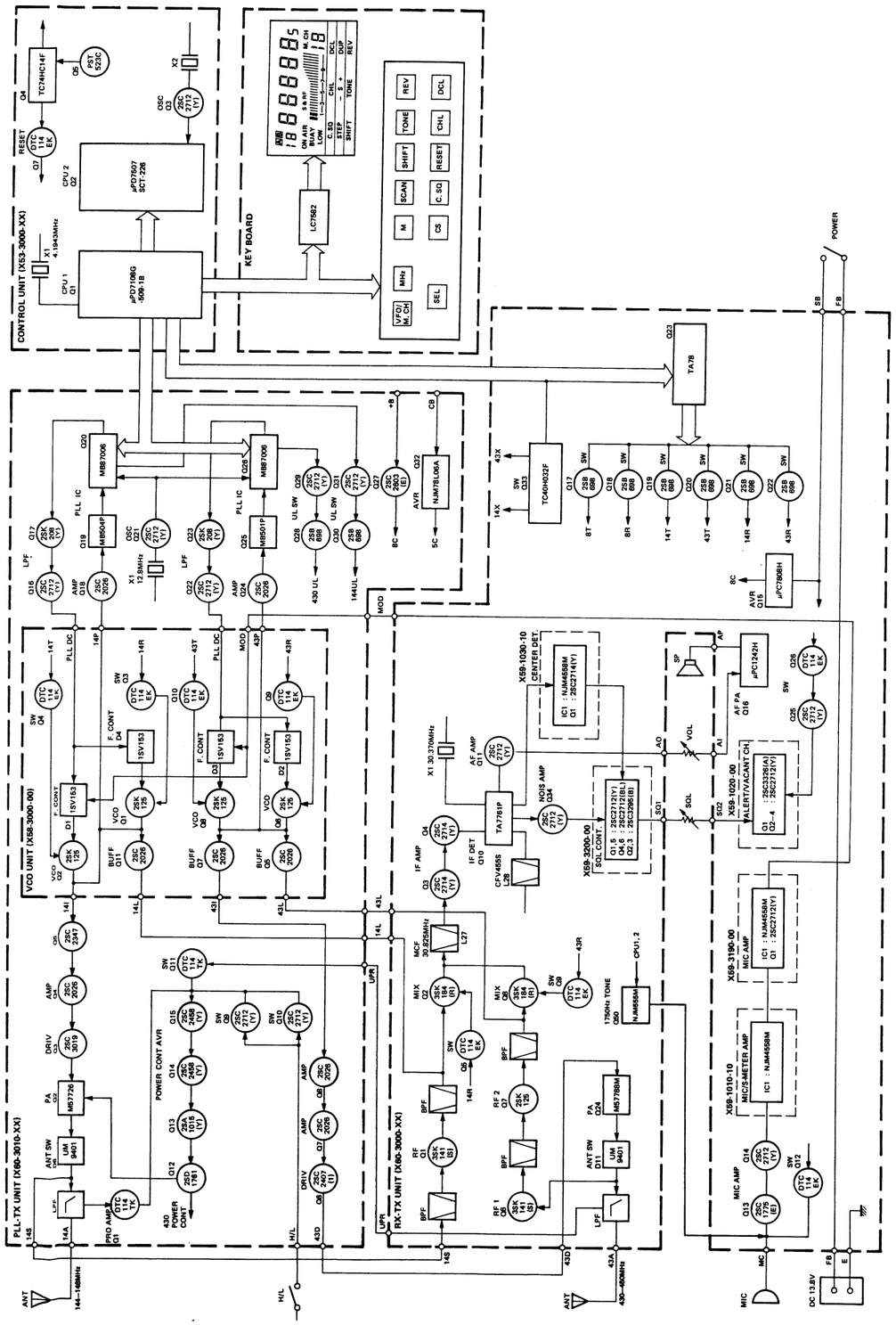
1. These SSG signal level values are necessary in order to obtain the 20dB NQ audio signal.
2. After Q10 : These signal level values were measured, using a standard modulated signal (f : 1kHz, DEV : 3.0kHz, AF output : 0.63V/8Ω).
3. SSG output was measured, using a 0.01μF capacitor.

TX SECTION



1. Frequency : 145 and 435MHz.
2. The audio input valtages are necessary to perform standard modulation (f : 1kHz, DEV : 3kHz).
3. The signal level from the circuits before the power module were measured without the power module.
4. Resolder the input terminal (pin 1) of the power module. Connect the power meter to the ANT terminal.

BLOCK DIAGRAM



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 450MHz
3. **Frequency Counter (f. counter)**
   1) Input sensitivity : Approx. 50mV
   2) Frequency range : Up to 450MHz
4. **DC Power Supply**
   1) Voltage : 10V ~ 17V, variable
   2) Current : 10A min.
5. **Power Meter**
   1) Measurement range Approx. : 50W , 3W, 1W
   2) Input impedance : 50Ω
   3) Frequency range : 450MHz
6. **AF VTVM (AF V.M)**
   1) Input impedance : 1MΩ min.
   2) Voltage range : F.S = 1mV ~ 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 : 450MHz
9. **Spectrum Analyzer**
   1) Frequency range : 1GHz
10. **Directional Coupler**
11. **Oscilloscope**
    1) High sensitivity oscilloscope with horizontal input terminal
12. **SSG**
    1) Frequency range : 144MHz and 430MHz bands
    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 450MHz.
15. **Sweep Generator**
    1) Sweep range : 1440MHz and 430MHz bands
16. **Tracking generator**

PREPARATION

1) Unless otherwise specified, knobs and switches should be set as follows **Table 9**.

POWER SW	ON	SEL SW	OFF
AF VOL VR	MIN	M SW	OFF
SQL VR	MIN	SCAN SW	OFF
LOW SW	OFF	SHIFT SW	S
VFO/M.CH SW	VFO	TONE SW	OFF
MHz SW	OFF	REV SW	OFF

Table 9

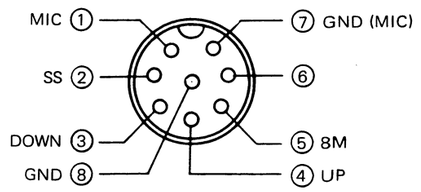


Fig. 14 MIC terminals (view from front panel side)

2) Use an insulated adjusting rod to adjust trimmers and coils.
3) To prevent damaging SSG, never connect the microphone to mic jack while adjusting the receiver section.
4) Be sure to turn the power switch OFF, before connecting the power cable to a power source.
5) SSG output levels are those at the time the output terminal is open.
6) Meter and display section should be set as follows **Fig. 15**.

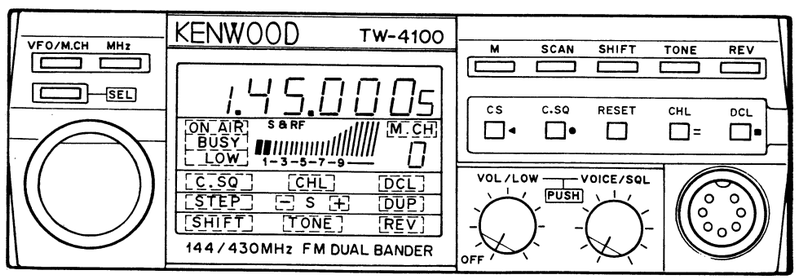


Fig. 15

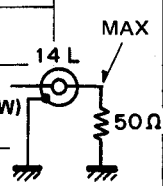
ADJUSTMENT

COMMON ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Setting	1) VOL SW : OFF SQL VR : MAX. Connect DC power supply to the DC connector on the rear panel (13.8V DC). Before connecting the power supply, turn the Power SW OFF.							
2. Reset	1) Press and hold the M key and turn on the Power SW.							
	2) Turn the M SW OFF							Display 145.000

PLL SYSTEM ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. VCO	1) FREQ. : 146.000 **(K,M2)** 145.000 **(M1,T,W)**	Digital multi-meter Power meter	PLL-TX	TP1 (3D)	SUB VCO	L4(4B)	4.2V **(K,M2)** 4.6V **(M1,T,W)**	±0.2V
	2) Transmit.		Rear panel	ANT1 (1E)		L10 (3C)	3.5V	±0.2V ON AIR indicator lights.
	3) FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** Receive.		PLL-TX	TP2 (3D)		TC1 (3B)	4.0V	±0.2V
	4) Transmit. Return to receive mode after adjustment.		Rear panel	ANT2 (1K)		TC2 (3C)	2.7V	±0.2V ON AIR indicator lights.
2. VCO output level	1) FREQ. : 146.000 **(K,M2)** 145.990 **(M1,T,W)** Disconnect the coax. connector (14L). Connect the 50Ω dummy load to the 14L coax. jack.	RF V.M	RX-TX	14L (4J) (Mini-pin)	SUB VCO	L1(4C) L23 (4C)	MAX.	0.38V±0.07V (4.5dBm±1.5dBm)
	2) Transmit.		PLL-TX	14I (3C)			Check	0.1V±0.03V (−7dBm±2dBm)
	3) FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** Receive.		RX-TX	43L (4J)			Check	0.24V±0.04V (0dBm±2dBm)
	4) Transmit.		PLL-TX	43I (4J)			Check	0.14V±0.03V (−4dBm±2dBm)
	5) After adjustment, reconnect 14L coax. connector.							



ADJUSTMENT

RECEIVER SYSTEM ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1–1. Helical (144MHz)	1) Disconnect coax. plug (14L) from the COMP. unit (RX-TX). FREQ. : 146.050 **(K,M2)** 145.050 **(M1,T,W)** 2) Connect the sweep gen. to the ANT terminal ANT1 (35dBμ) and the oscilloscope to the detector output. 3) After adjustment, reconnect 14L coax. plug.	Detector Oscilloscope or Spectrum analyzer Sweep gen. or Tracking gen.	RX-TX	TP1 (4J)	RX-TX	L1(4K) L2(4K) L24 (4J)	Adjust for the waveform perform shown on right.	145 146 144 (146) (148) ( ) : K, M2
1–2. Helical (430MHz)	1) Disconnect coax. plug (43L) from the COMP. unit (RX-TX). FREQ. : 445.050 **(K,M2)** 435.050 **(M1,T,W)** 2) Connect the sweep gen. to the ANT terminal (ANT2) and the oscilloscope to the detector output. 3) After adjustment, reconnect 43L coax. plug.			TP3 (4J)		L25 (4K) L26 (4J) TC1 (4K) TC4 (4K)	Adjust for the waveform perform shown on right. Repeat for MAX.	430 440 (440) 435 (455) FREQ : 435.00MHz **(M1,T,W)** 445.00MHz **(K,M2)**
1–3. 430MHz LO.		RF V.M	RX-TX	TP4 (4J)	RX-TX	TC2 (4J)	MAX.	
2–1. Sensitivity (144MHz)	1) Connect SSG to the ANT terminal (ANT1). FREQ. : 146.020 **(K,M2)** 145.020 **(M1,T,W)** SSG MOD : 1kHz DEV : 3kHz Output : –4dBμ	SSG AF V.M Dummy (8Ω) Distortion meter	Rear panel	ANT1 (1E) SP	RX-TX	L30 (4I) L3(4I) L4(4I) L10 (3H)	SINAD MAX. Repeat 2 or 3 times. 1). Turn the core of L3 and L4 up the case surface level. 2) Repeat the adjustment of L3 and L4 to obtain the MAX. deflection.	12dB SINAD –12dBμ or more. **Note)** Do not connect a microphone to the MIC jack.
2–2. Sensitivity (430MHz)	1) Connect SSG to the ANT terminal (ANT2). FREQ. : 445.020 **(K,M2)** 435.020 **(M1,T,W)** SSG MOD : 1kHz DEV : 3kHz Output : –4dBμ			ANT2 (1K) SP		TC1 (4K) TC4 (4K) TC2 (4J)		
3. Discri	1) FREQ. : 445.020 **(K,M2)** 435.020 **(M1,T,W)** SSG MOD : 1kHz DEV : 3kHz Output : 30dBμ	SSG AF V.M Dummy (8Ω)	Rear panel	ANT2 (1K) SP	RX-TX	L12 (3H)	MAX. reading of AF V.M.	4V/8Ω or more.
4. S-meter	1) FREQ. : 146.020 **(K,M2)** 145.020 **(M1,T,W)** SSG MOD : 1kHz DEV : 3kHz Output : –5dBμ	SSG SP	Rear panel	ANT1 (1E)	RX-TX	VR3 (3J)	Set the RF scale to "1".	–5dBμ±1dBμ.
			Front panel	S-meter			RF scale to a value greater than "10"	5dBμ±1dBμ or more.
5. Open channel search	1) FREQ. : 445.020 **(K,M2)** 435.020 **(M1,T,W)** SSG MOD : OFF DEV : OFF Output : –9dBμ Connect TP5 terminal to the GND terminal from the COMP. unit (RX-TX).	SSG AF V.M SP	Rear panel	SP ANT2 (1K)	RX-TX	VR1 (3I)	Turn the VR1 to the point at which the BUSY LED blinking.	–9dBμ±2dBμ

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
6. Squelch	1) SQL VR : Threshold point	AF V.M SP	Rear panel	SP	Front panel	SQL VR (5H)	Turn the SQL VR clockwise to the point at which squelch just close.	8 : 00~11 : 00
	2) Tight squelch FREQ. : 435.020 SSG MOD : 1kHz DEV : 3kHz Output : −12dBμ SQL VR : MAX.	SSG AF V.M SP	Rear panel Front panel	ANT2 (1K) SP			Squelch out : Squelch just open.	NQ sensitivity : 18dB or more.
7. Beep level	1) VOL VR : 12 o'clock (Center)	AF V.M Dummy (8Ω)	Rear panel	EXT. SP	RX-TX	VR5 (3K)	0.3V/8Ω	±1.0dB
	2) Press the M key.							

TRANSMITTER SYSTEM ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. FM FREQ.	1) FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** Transmit.	f.counter Power meter	Rear panel	ANT2 (1K)	PLL-TX	TC4 (3D)	445.000.0MHz **(K,M2)** 435.000.0MHz **(M1,T,W)**	±100Hz

144MHz TRANSMITTER SYSTEM ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1−1. RF output (HI power)	1) Preparation COMP. unit (PLL-TX) VR1 : MIN. VR2 : 12 o'clock (center) VR6 : MAX. VR7 : 10 o'clock VR8 : MIN. FREQ. : 146.000 **(K,M2)** 145.000 **(M1,T,W)** HI/LOW SW : HI Transmit.	Power meter (DC power supply galvo-meter)	Rear panel	ANT1 (1E)	PLL-TX	TC1 (2B)	POWER MAX.	50W or more, 11A or less.
						VR8 (3E)	48W	48W±1W, 9.5A or less.
1−2. RF output (LOW power)	1) FREQ. : 146.000 **(K,M2)** 145.000 **(M1,T,W)** HI/LOW SW : LOW Transmit.	Power meter (DC power supply galvo-meter)	Rear panel	ANT1 (1E)	PLL-TX	VR7 (4E)	5.0W	5.0W±0.5W, 4.0A or less. "LOW" indicator lights.
2−1. Protection (NULL)	1) FREQ. : 146.000 **(K,M2)** 145.000 **(M1,T,W)** VR1 from COMP. unit : MIN. (fully counter-clockwise) HI/LOW SW : HI Transmit.	DC V.M	PLL-TX	L2 (2E)	PLL-TX	VR2 (2D)	MIN.	0.3V or less. (Ref. 0.02V)
2−2. Protection (CURRENT)	1) FREQ. : 146.000 **(K,M2)** 145.000 **(M1,T,W)** Disconnect the power meter from the ANT terminal and open the ANT terminal.	(DC power supply galvo-meter)			PLL-TX	VR1 (2E)	4.5A	4.5A±0.1A
3. RF meter	1) FREQ. : 146.000 **(K,M2)** 145.000 **(M1,T,W)** HI/LOW SW : HI		Front panel	RF meter	PLL-TX	VR6 (3E)	Set to the RF scale reads to "10".	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
4. DEV.	1) FREQ. : 146.000 **(K,M2)** 145.000 **(M1,T,W)** COMP. unit (RX-TX) VR2 : MAX. VR4 : MIN. AG : 1kHz, 30mV SUB VCO VR1 : Center	Linear detector or Modulation analyzer Dummy (50Ω) Direcnal coupler	Rear panel	ANT1 (1E)	SUB VCO	VR1 (3B)	±4.5kHz	±4.5kHz±200Hz • 4101 (WAVE TEK) FILTER : 25kHz/15kHz De-emphasis : OFF
	2) AG : 1kHz, 3mV				RX-TX	VR2 (4I)	±3.0kHz Repeat 2 or 3 times.	±3.0kHz±200Hz
5–1. TONE DEV. **(W)**	1) FREQ. : 145.000 TONE SW : ON (Press the TONE SW and		Rear panel	ANT1 (1E)	RX-TX	VR11 (3K)	1750Hz	1750±10Hz
5–2. TONE DEV. **(T)**	1) Disconnect the CN9 connector from the COMP. unit					VR10 (3K)	±3.5kHz	±3.5kHz±200Hz
	2) Connect the DC power supply (+ 5V) to the CN9 terminal (1 pin).							

430MHz TRANSMITTER SYSTEM ADJUSTMENT

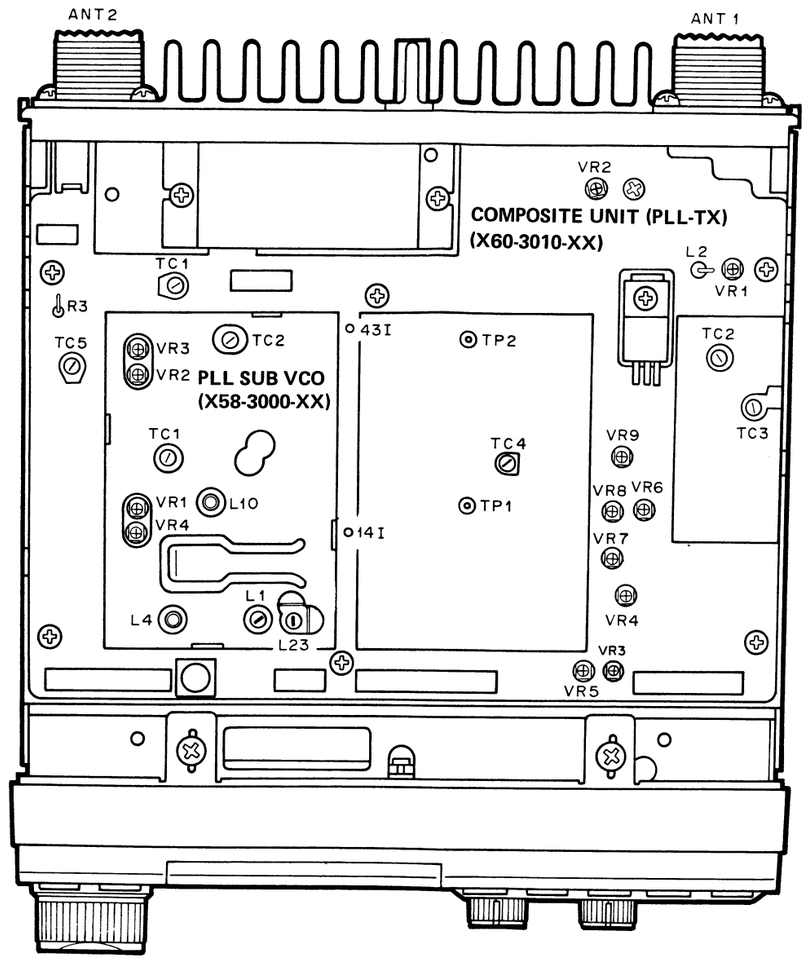
Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1–1. RF output (HI power)	1) Preparation COMP. unit (PLL-TX) VR3 : MIN VR4 : MAX VR5 : Center VR9 : MAX. COMP. unit (RX-TX) VR6 : Center FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** HI/LOW SW : HI Transmit.	Power meter (DC power supply galvo-meter)	Rear panel	ANT2 (1K)	PLL-TX	TC3 (3E) TC2 (3E)	POWER MAX.	38W or more, 11A or less.
						VR4 (4E)	36W	36W±0.5W, 9.5A or less.
	2) ACP adjustment	DC V.M	PLL-TX	R3 (3B)		TC3 (3E) TC2 (3E)	MIN. Repeat 2 or 3 times.	10.2V±0.5V
1–2. RF output (LOW power)	1) FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** HI/LOW SW : LOW Transmit.	Power meter (DC power supply galvo-meter)	Rear panel	ANT2 (1K)	PLL-TX	VR5 (4D)	5W	5W±0.5W, 4.0A or less. "LOW" indicator lights.
2–1. Protection (NULL)	1) FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** COMP. unit (PLL-TX) VR9 : MIN. (fully counter clockwise) HI/LOW SW : HI Transmit.	DC V.M	RX-TX	L23 (2K)	RX-TX	VR6 (2J)	MIN	0.7V or less.
2–2. Protection (CURRENT)	1) FREQ. : 435.000 Disconnect the power meter from the ANT terminal and open the ANT terminal. Transmit.	(DC power supply galvo-meter)			PLL-TX	VR9 (3E)	4.0A	4.0A±0.1A

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
3. RF meter	1) FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** HI/LOW SW : HI		Front panel	RF meter	PLL-TX	VR3 (4E)	Set to the RF scale reads to "10".	
4. DEV.	1) FREQ. : 445.000 **(K,M2)** 435.000 **(M1,T,W)** SUB VCO VR3 : Center COMP. unit (RX-TX) VR2 : MAX. VR4 : MIN. AG : 1kHz, 30mV	Linear detector or Modulation analyzer Dummy (50Ω) Directional coupler	Rear panel	ANT2 (1K)	SUB VCO	VR3 (3B)	±4.5kHz ● MS-57A/61A (Anritsu) HPF : OFF LPF : 20kHz De-emphasis : OFF ● 4101 (WAVE TEK) FILTER : 25kHz/15kHz De-emphasis : OFF	±4.5kHz±200Hz
	2) MIC GAIN : See the 144MHz transmitter system adjustment "4. DEV.".							

ADJUSTMENT

TOP VIEW



COMPOSITE UNIT (PLL-TX)

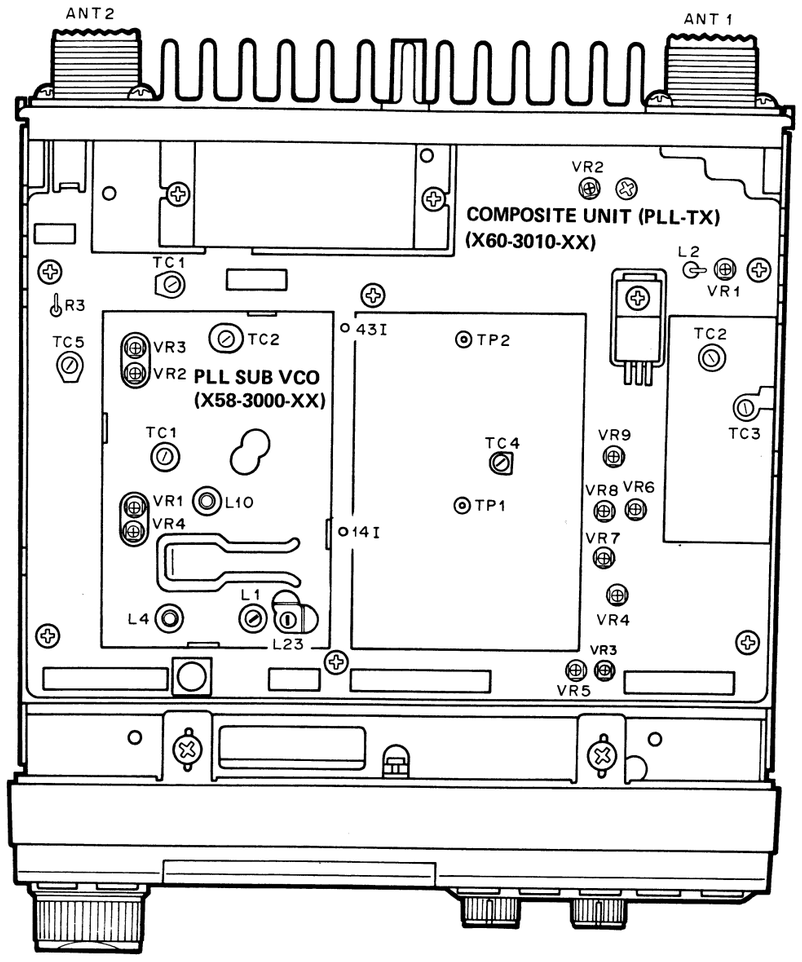
VR1 : 144MHz Protection current
VR2 : 144MHz Protection null
VR3 : 430MHz RF meter
VR4 : 430MHz Hi power
VR5 : 430MHz Low power
VR6 : 144MHz RF meter
VR7 : 144MHz Low power
VR8 : 144MHz Hi power
VR9 : 430MHz Protection current
TC1 : 144MHz Hi power
TC2,3 : 430MHz Hi power
TC4 : Output frequency
TC5 : 144MHz Hi power

PLL SUB VCO

VR1 : 144MHz Dev.
VR2 : 430MHz Tone dev.
VR3 : 430MHz Dev.
VR4 : 144MHz Tone dev.
TC1,2 : VCO voltage
L1,23 : VCO output
L4,10 : VCO voltage

ADJUSTMENT

TOP VIEW



COMPOSITE UNIT (PLL-TX)

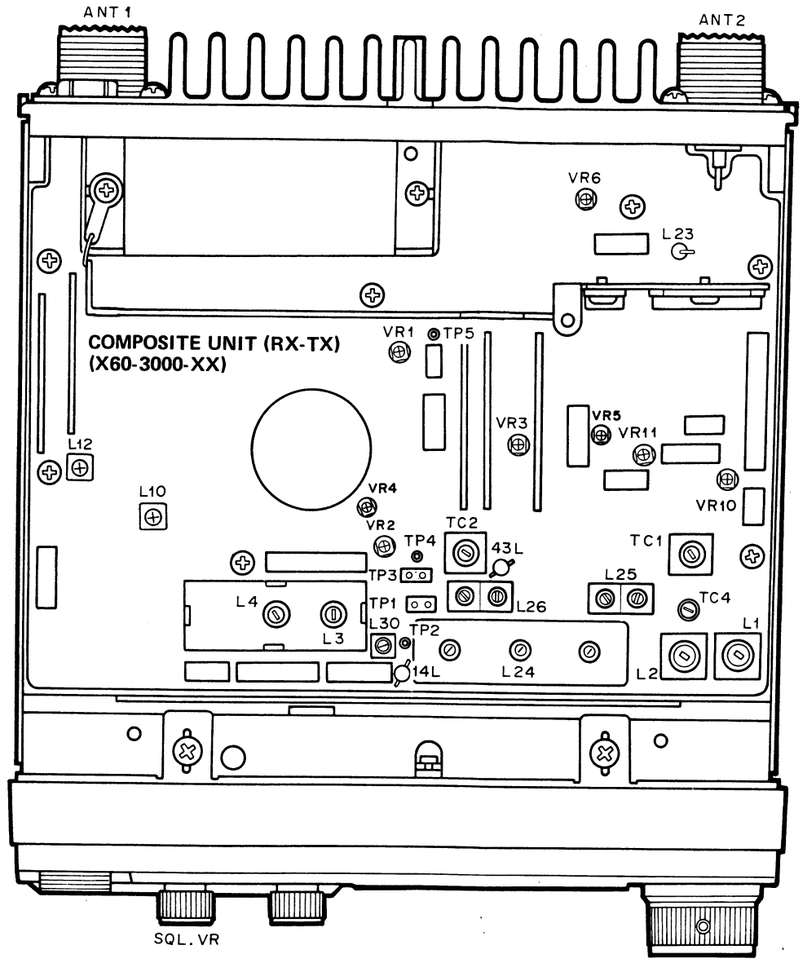
VR1	: 144MHz Protection current
VR2	: 144MHz Protection null
VR3	: 430MHz RF meter
VR4	: 430MHz Hi power
VR5	: 430MHz Low power
VR6	: 144MHz RF meter
VR7	: 144MHz Low power
VR8	: 144MHz Hi power
VR9	: 430MHz Protection current
TC1	: 144MHz Hi power
TC2,3	: 430MHz Hi power
TC4	: Output frequency
TC5	: 144MHz Hi power

PLL SUB VCO

VR1	: 144MHz Dev.
VR2	: 430MHz Tone dev.
VR3	: 430MHz Dev.
VR4	: 144MHz Tone dev.
TC1,2	: VCO voltage
L1,23	: VCO output
L4,10	: VCO voltage

ADJUSTMENT

BOTTOM VIEW



COMPOSITE UNIT (RX-TX)

VR1	: Vacant channel level
VR2	: Mic gain
VR3	: S meter
VR4	: RPT
VR5	: Beep level
VR6	: 430MHz Protection null
VR10	: 144MHz Tone dev. **(T)**
VR11	: 144MHz Tone dev. **(W)**
TC1,2,4	: 430MHz RX sensitivity
L1,2,24	: 144MHz Helical
L3,4,10	: Common IF gain
L12	: Discri
L25,26	: 430MHz Helical
L30	: 144MHz RX sensitivity

TERMINAL FUNCTIONS

Terminal Function

Connector No.	Terminal No.	Terminal Name	Terminal Function
CONTROL UNIT (X53-3000-XX)			
J1	1	5C	+ 5V
	2	GND	GND
J2	1	GND	GND
	2	EN1	Encoder out 1
	3	EN2	Encoder out 2
J3	1	43E	430MHz PLL Enable
	2	14E	144MHz PLL Enable
	3	43U	430MHz Unlock input
	4	14U	144MHz Unlbock input
	5	DAT	PLL DATA (SO)
	6	GND	GND
	7	CLK	PLL CLOCK (SCK)
	8	GND	GND
J4	1	MCH	VFO/MCH KEY input
	2	KRO	Key return input
	3	KR1	Key return input
	4	KR2	Key return input
	5	KS3	Key scan output
	6	KS2	Key scan output
	7	KS1	Key scan output
	8	KS0	Key scan output
J5	1	GND	GND
	2	LAP	Lamp input (+ 8V)
	3	DAT	PLL DATA (SO)
	4	CLK	PLL CLOCK (SCK)
	5	CE	LCD driver chip enable
	6	INH	LCD driver inhibit
	7	5C	+ 5V
	8	GND	GND
J6	1	GND	GND
	2	LAP	Lamp out (+ 8V)
J7	1	AM	Audio mute output
	2	SR	S&RF meter input
	3	VR	VCO select VHF RX
	4	VT	VCO select VHF TX
	5	UR	VCO select UHF RX
	6	UT	VCO select UHF TX
	7	BZ	Beep output
	8	175	1750Hz Tone out
	9	MM	Model enable output
	10	TO	Tone output
	11	BCU	+ 8V Line
	12	RD	RX data
J8	1	HL	Low power SW input
	2	GND	GND
	3	VOS	VOICE SW input
	4	GND	GND
J9	1	MR	MIC MR SW input
	2	SS	MIC PTT SW input
	3	UP	MIC UP SW input
	4	DWN	MIC DWN SW input
	5	GND	GND
J10	1	BUS	BUSY input
	2	SQS	Squelch select out
J11	1	DAT	PLL DATA (SO)
	2	CLK	PLL CLOCK (SCK)
	3	BSY	VS-2 BUSY input
	4	SR	VS-3 Strobe output
	5	5C	+ 5V
	6	GND	GND

Connector No.	Terminal No.	Terminal Name	Terminal Function
J12	1	MC	Modem clock input
	2	ME	Modem enable output
	3	MD	Modem data input/output
	4	5C	+ 5V
	5	GND	GND
	6	RD	RX data
	7	TD	TX data
	8	GND	GND
J13	1	ME	Modem enable output
	2	TC	EXT Tone clock
	3	TD	EXT Tone data
	4	TE	EXT Tone enable
	5	5C	+ 5V
	6	TO	Tone output
	7	GND	GND
COMPOSITE UNIT (RX-TX) (X60-3000-XX)			
J1	1	DV	Module drive + B
	2	SQ2	Squelch Volume 2
	3	SQ1	Squelch Volume 1
J2	1	BZ	Beep input
	2	8C	+ 8V
	3	UR	VCO select UHF RX
	4	VR	VCO select VHF RX
	5	UT	VCO select UHF TX
	6	VT	VCO select VHF TX
J3	1	43T	430MHz TX + 8V
	2	14R	144MHz RX + 8V
	3	43R	430MHz RX + 8V
	4	14T	144MHz TX + 8V
J4	1	TD	} Not used
	2	GND	
	3	MM	Modem enable output
	4	MC	
	5	GND	
	6	8M	
J5	1	RD	RX data
	2	GND	GND
	3	AO	Audio ouptut
J6	1	8C	Not used
	2	GND	GND
	3	VO	VS-2 output
J7	1	GND	GND
	2	SPK	Speaker input
J8	1	GND	GND
	2	A1	Audio input
	3	SB	Switched + B (B, 8V)
	4	CB	Common + B
	5	CB	Common + B
	6	AP	Audio out to EXT SP
	7	GND	GND
	8	SP	Speaker input
J9	1	TI	Tone data input
	2	GND	GND
J10	1	UPR	UHF Protection out
	2	UPC	UHF APC output
	3	43T	Not used
J11	1	MO	Modulation output
	2	GND	GND
	3	RM	RF Meter output
J12	1	AM	Audio mute output
	2	BUS	BUSY input
	3	SQS	Squelch select out

TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal Name	Terminal Function
J13	1	14X	UHF MODE : + 8V
	2	43X	VHF MODE : + 8V
COMPOSITE UNIT (RX-TX) (X60-3010-XX)			
J1	1	GND	GND
	2	MOD	Modulation output
	3	GND	GND
	4	TON	Tone output
	5	GND	GND
	6	43T	430MHz TX + 8V
	7	14R	144MHz RX + 8V
	8	43R	430MHz RX + 8V
	9	14T	144MHz TX + 8V
J2	1	GND	GND
	2	DV	Module drive + V
	3	CB	Common + B
	4	8C	+ 8V
	5	LAP	Lamp line (+ 8V)

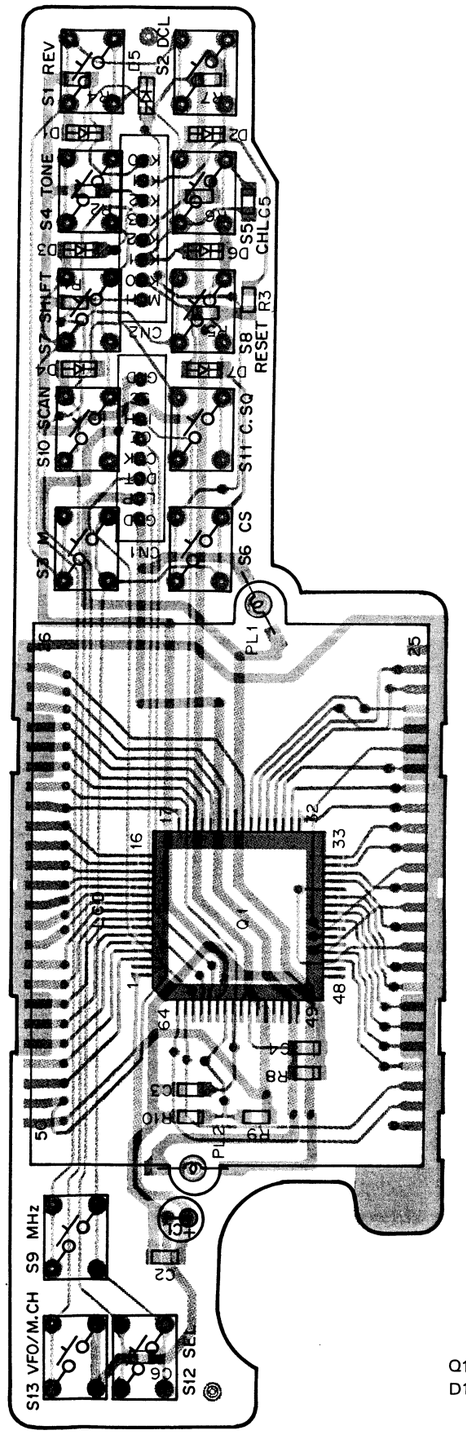
Connector No.	Terminal No.	Terminal Name	Terminal Function
J3	1	5C	+ 5V
	2	GND	GND
	3	43E	430MHz Unlock input data
	4	43U	430MHz Unlock
	5	14E	144MHz Unlock input data
	6	14U	144MHz Unlock
	7	DAT	PLL DATA (SO)
	8	GND	GND
	9	CLK	PLL CLOCK (SCK)
	10	GND	GND
	11	8C	+ 8V
J4	1	UPR	UHF Protection out
	2	14X	VHF (RX, TX) + 8V
	3	UPC	UHF APC output
	4	43X	UHF (RX, TX) + 8V
	5	RM	RF METER
	6	SR	S&RF meter input
	7	HL	Low power SW input
J5	1	AP	Audio out
	2	SP	Speaker input
	3	GND	GND

TERMINAL FUNCTIONS

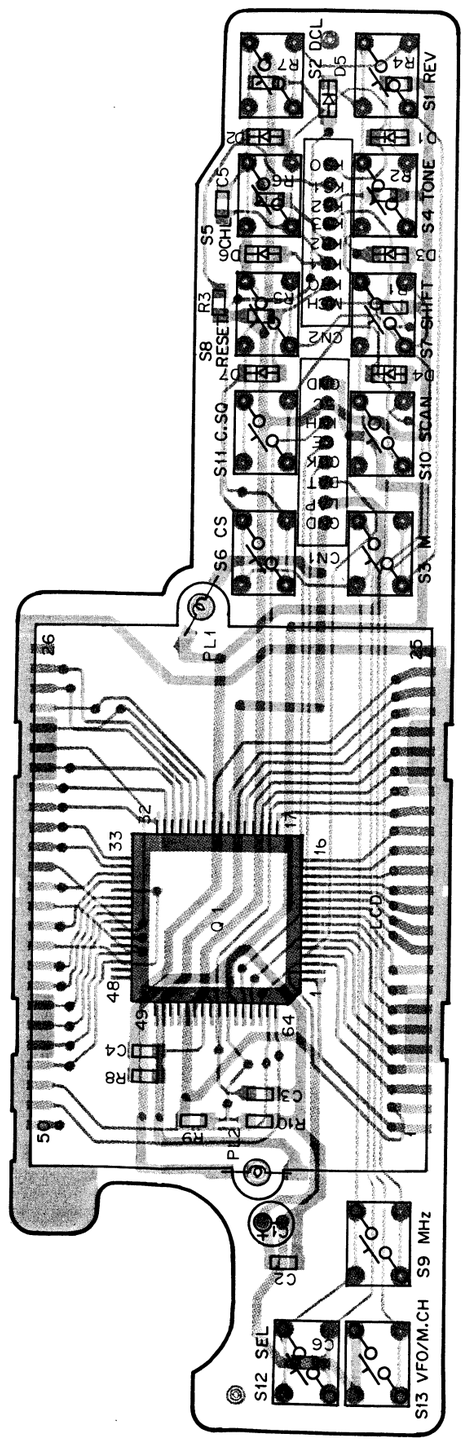
tor	Terminal No.	Terminal Name	Terminal Function
	1	14X	UHF MODE : + 8V
	2	43X	VHF MODE : + 8V
COMPOSITE UNIT (RX-TX) (X60-3010-XX)			
	1	GND	GND
	2	MOD	Modulation output
	3	GND	GND
	4	TON	Tone output
	5	GND	GND
	6	43T	430MHz TX + 8V
	7	14R	144MHz RX + 8V
	8	43R	430MHz RX + 8V
	9	14T	144MHz TX + 8V
	1	GND	GND
	2	DV	Module drive + V
	3	CB	Common + B
	4	8C	+ 8V
	5	LAP	Lamp line (+ 8V)

Connector No.	Terminal No.	Terminal Name	Terminal Function
J3	1	5C	+ 5V
	2	GND	GND
	3	43E	430MHz Unlock input data
	4	43U	430MHz Unlock
	5	14E	144MHz Unlock input data
	6	14U	144MHz Unlock
	7	DAT	PLL DATA (SO)
	8	GND	GND
	9	CLK	PLL CLOCK (SCK)
	10	GND	GND
	11	8C	+ 8V
J4	1	UPR	UHF Protection out
	2	14X	VHF (RX, TX) + 8V
	3	UPC	UHF APC output
	4	43X	UHF (RX, TX) + 8V
	5	RM	RF METER
	6	SR	S&RF meter input
	7	HL	Low power SW input
J5	1	AP	Audio out
	2	SP	Speaker input
	3	GND	GND

KEYBOARD ASS'Y (W03-2003-15) Component side view

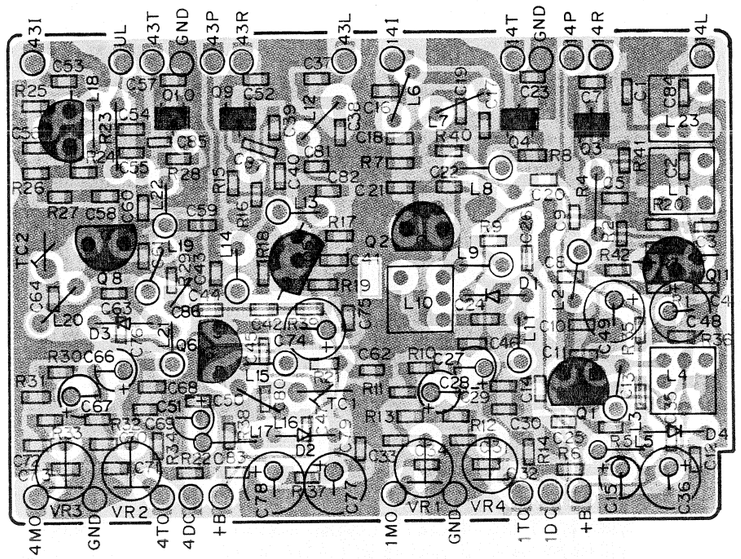


KEYBOARD ASS'Y (W03-2003-15) Foil side view

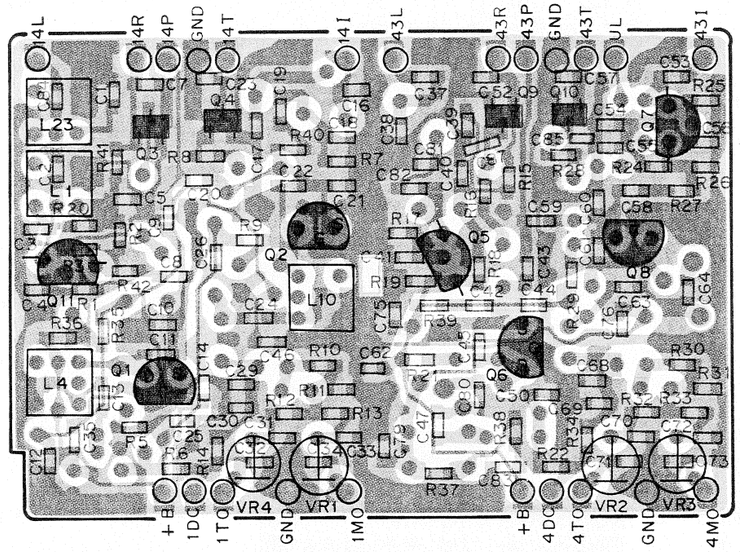


Q1 : LC7582
D1–7 : RLS-73

PLL SUB VCO (X58-3000-XX) -00 : M1,T,W -11 : K,M2 Component side view

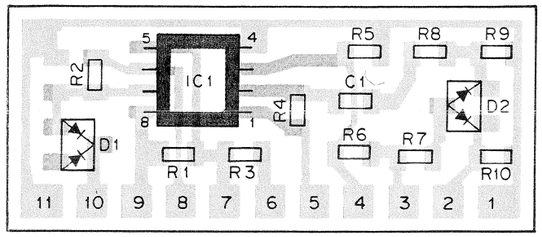


PLL SUB VCO (X58-3000-XX) -00 : M1,T,W -11 : K,M2 Foil side view



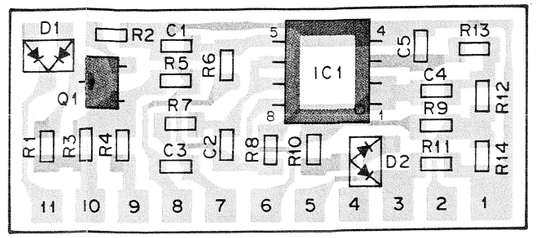
Q1,2,6,8 : 2SK125 Q3,4,9,10 : DTC114EK Q5,7,11 : 2SC2026
D1–4 : 1SV153

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



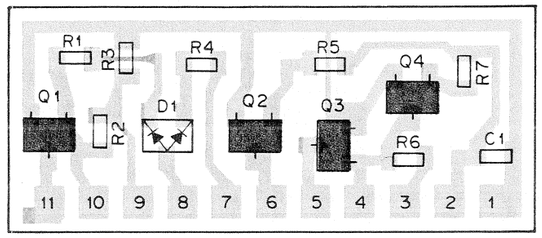
IC1 : NJM4558M
D1 : 1SS184 D2 : 1SS181

MIC AMP. (X59-3190-00) Component side view



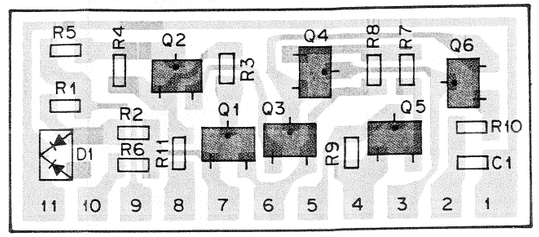
Q1 : 2SC2712(Y) IC1 : NJM4558M
D1 : 1SS184 D2 : 1SS181

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



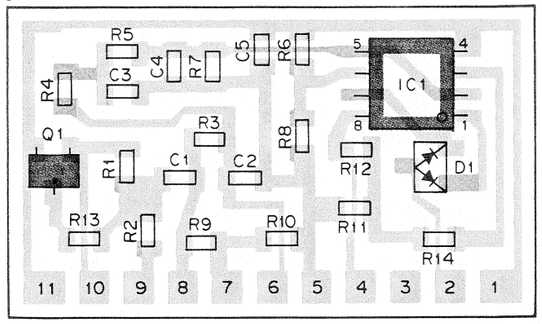
Q1 : 2SC3326(A) Q2–4 : 2SC2712(Y)
D1 : 1SS181

SQUELCH CONTROL (X59-3200-00) Component side view



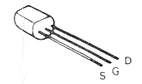
Q1,5 : 2SC2712(Y) Q2,3 : 2SC3295(B) Q4,6 : 2SC2712(BL)
D1 : 1SS184

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



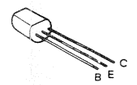
Q1 : 2SC2714(Y) IC1 : NJM4558M
D1 : 1SS181

2SK125



DTC114EK

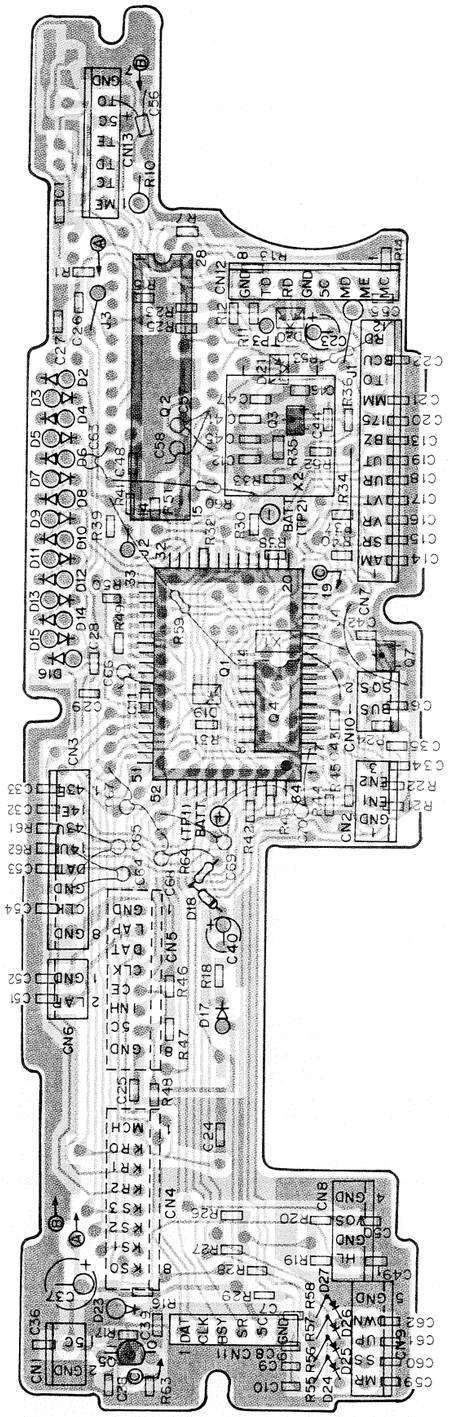
2SC2026

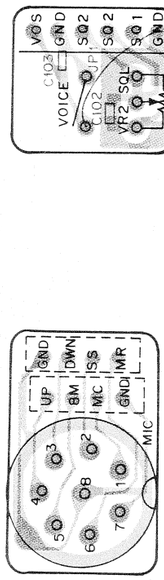


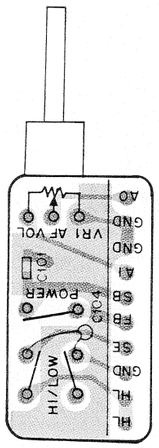
2SC2712
2SC2714
2SC3295
2SC3326

TW-4100A/E PC BOARD VIEWS

CONTROL UNIT (X53-3000-XX) -11 : K -21 : M1 -22 : M2 -51 : T -61 : W Component side view





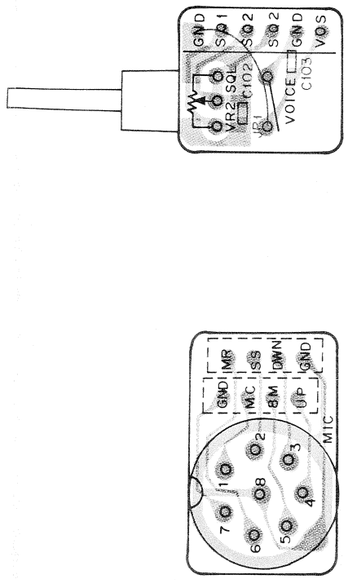


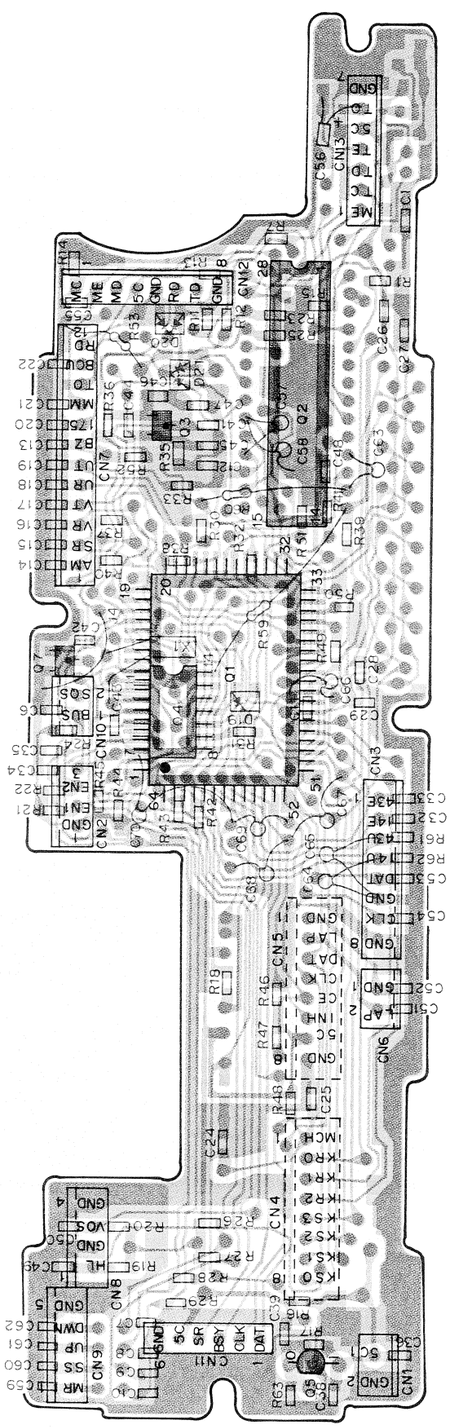
	D2	D3	D4	D5	D7	D10	D14
K	○	×	×	×	×	○	×
M1	○	×	×	×	×	○	×
M2	○	×	×	×	×	×	×
T	×	○	○	×	×	×	○
W	×	×	○	×	×	×	○

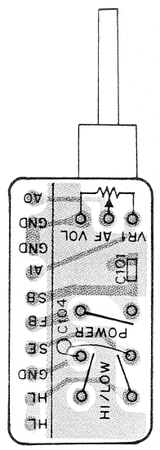
○ : Used, × : Not used

Q1 : μPD75108G-509-1B Q2 : μPD7507SCT-226 Q3 : 2SC2712(Y) Q4 : TC74HC14F
Q5 : PST523C Q7 : DTC114EK
D2–18,23–27 : 1SS133 D19 : 1SS196 D20 : DAP202K D21 : DAN202K

CONTROL UNIT (X53-3000-XX) -11 : K -21 : M1 -22 : M2 -51 : T -61 : W Foil side view

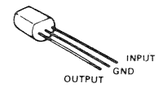






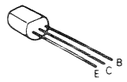
2SC2712
2SC2714

PST523C

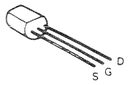


DTC114EK

2SB698
2SC1775

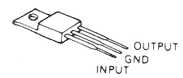


2SK125



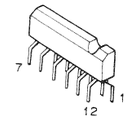
3SK184

μPC7808H

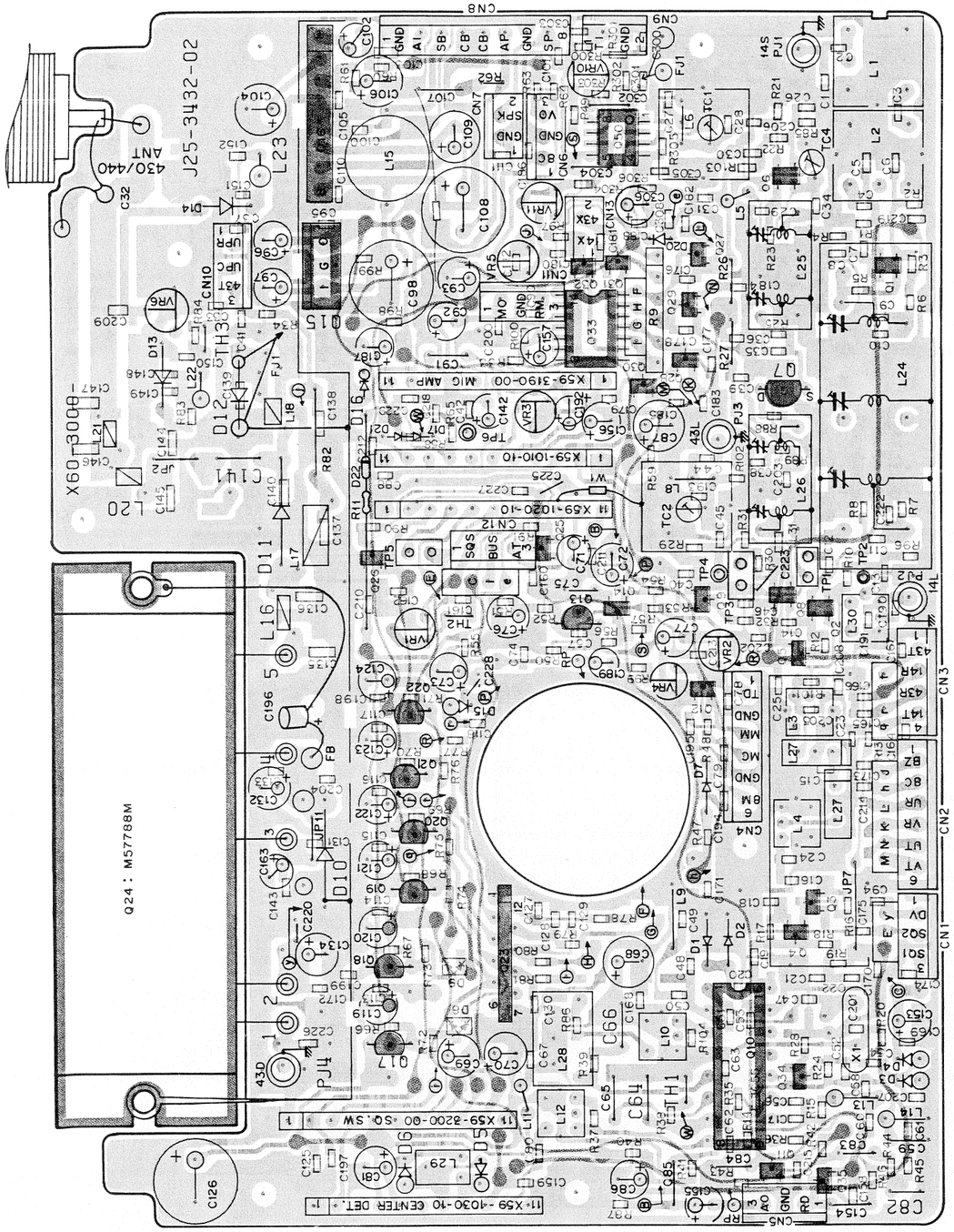


μPC1242H

TA78



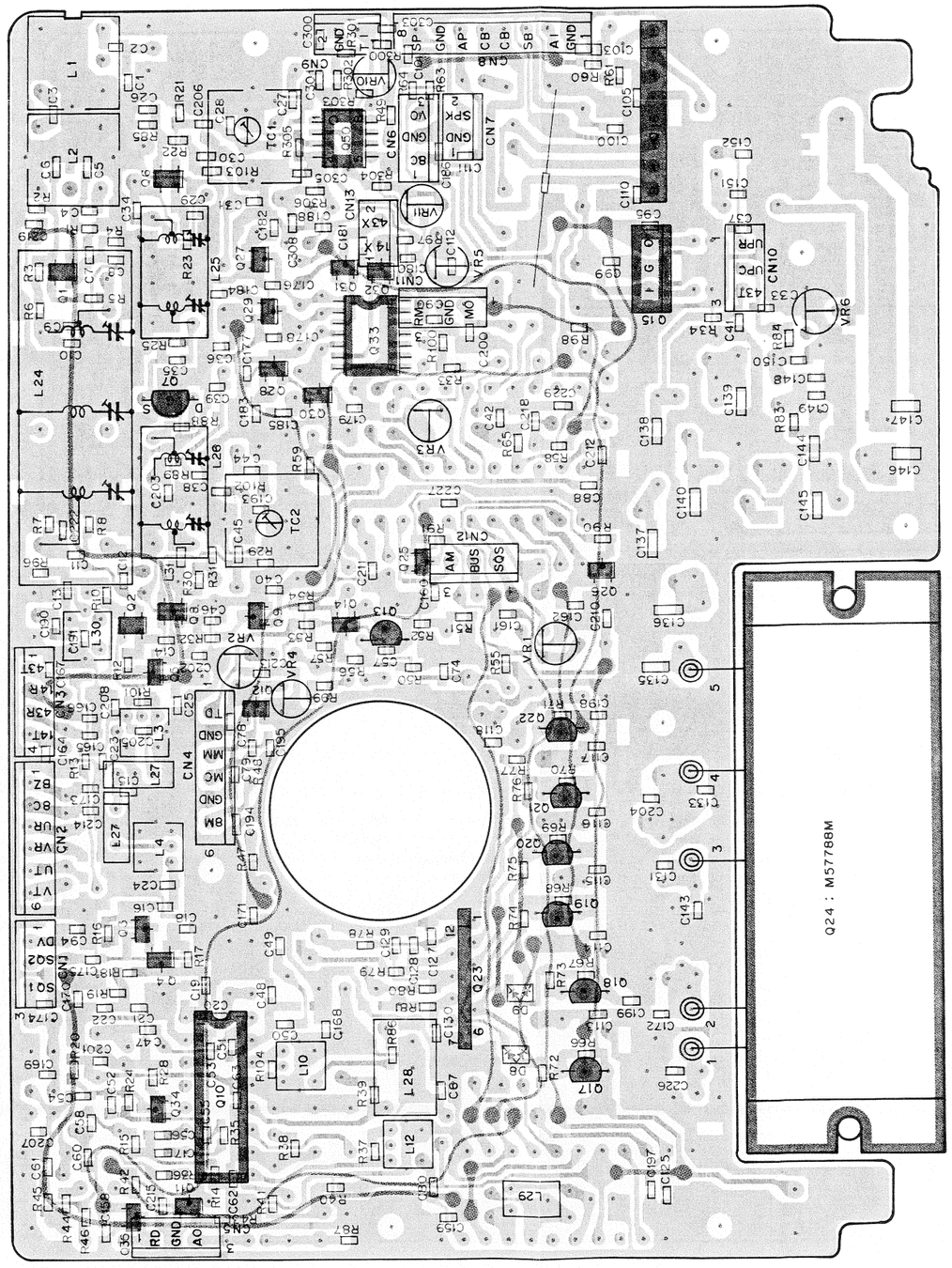
COMPOSITE UNIT (RX-TX) (X60-3000-XX) -11 : K,M1,M2 -51 : T,W Component side view



Q1,6 : 3SK184(S) Q2,8 : 3SK184(R) Q3,4 : 2SC2714(Y) Q5,9,12,26–32,35 : DTC114EK Q7 : 2SK125 Q10 : TA7761P Q11,14,25,34 : 2SC2712(Y)
Q13 : 2SC1775(E) Q15 : μPC7808H Q16 : μPC1242H Q17–22 : 2SB698 Q23 : TA78 Q24 : M57788M Q33 : TC40H032F Q50 : NJM555M(**TW-4100E**)
D1–4 : 1S1587 D5,6 : 1N60PSPA D7,17,21,22 : 1S1555 D8,9 : DAP202K D10 : U15B D11 : UM9401 D12 : MI308 D13 : 1SS101
D14 : 1S1587 D15 : 1SS133 D16 : MTZ6.2JC D20 : MTZ5.6JC(**TW-4100E**)

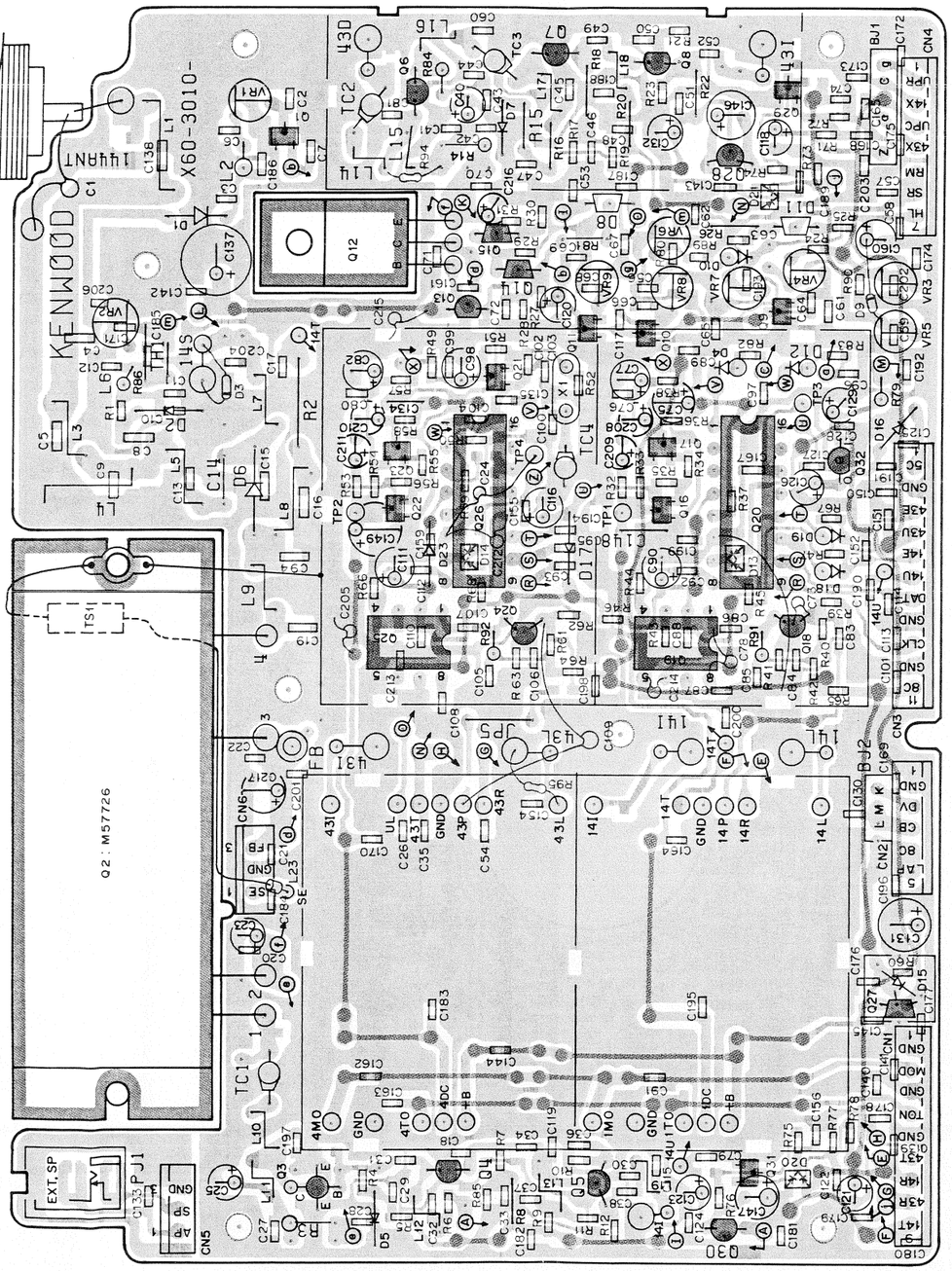
Q50, VR10,11, D20, C300~306,308, R300~306 : **TW-4100E only.**

COMPOSITE UNIT (RX-TX) (X60-3000-XX) -11 : K,M1,M2 -51 : T,W Foil side view



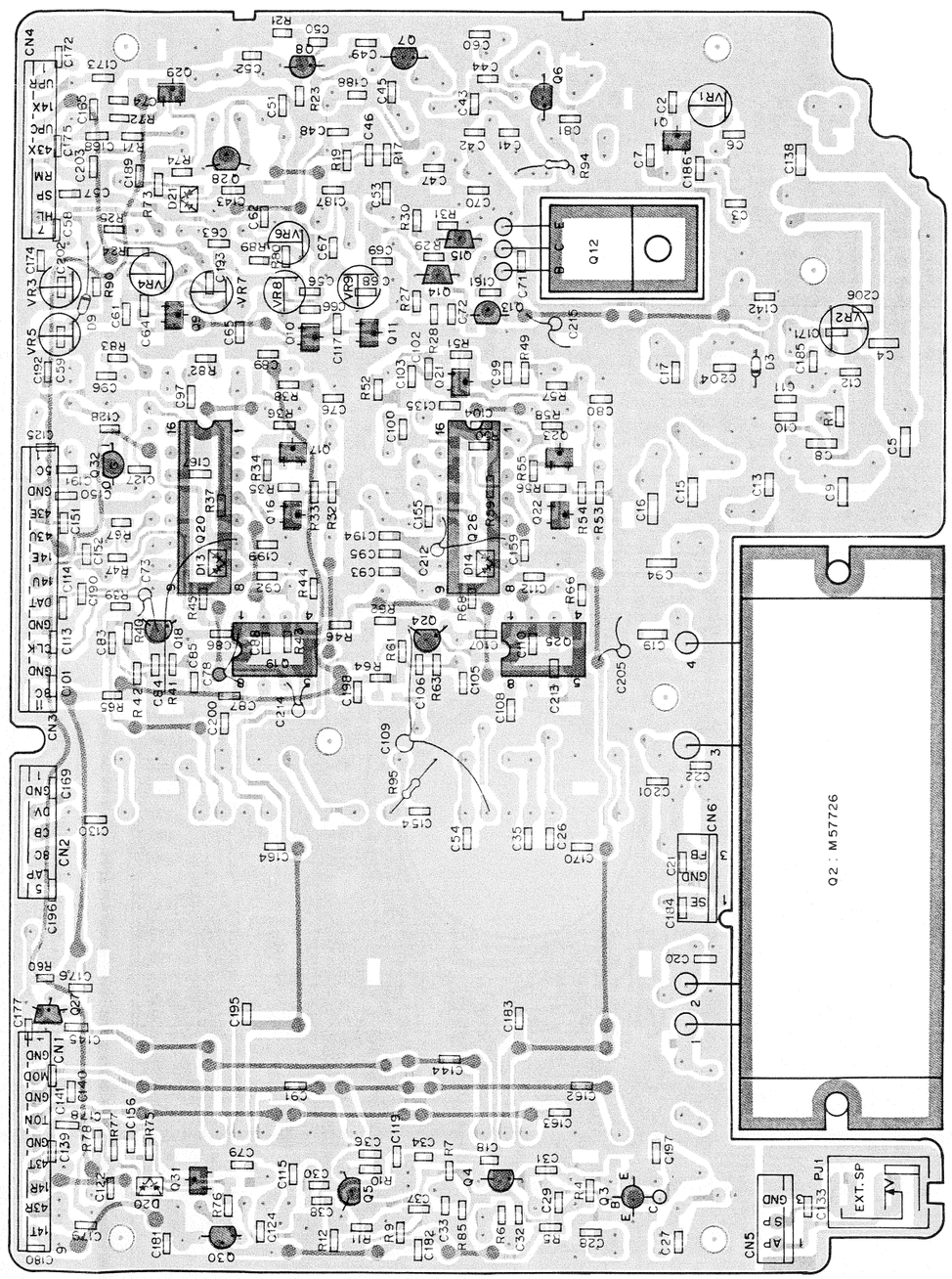
TW-4100A/E PC BOARD VIEWS

COMPOSITE UNIT (PLL-TX) (X60-3010-XX) -01 : M1,T,W -11 : K,M2 Component side view



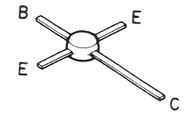
Q1,11 : DTC114TK Q2 : M57726 Q3 : 2SC3019 Q4,7,8,18,24 : 2SC2026 Q5 : 2SC2347 Q6 : 2SC2407(1) Q9,10,16,21,22,29,31 : 2SC2712(Y)
Q12 : 2SD1761 Q13 : 2SA1015(Y) Q14,15 : 2SC2458(Y) Q17,23 : 2SK208(Y) Q19 : MB504P Q20,26 : MB87006 Q25 : MB501P
Q27 : 2SC2603(E) Q28,30 : 2SB698 Q32 : NJM78L06A
D1,2 : 2SC1587 D3 : MI308 D4,5,7,12,15–17,23 : 1S1555 D6 : UM9401
D8,11 : MC921 D9,10 : 1N60PSPA D13,14,20,21 : DAN202K D18,19 : 1SS133

COMPOSITE UNIT (PLL-TX) (X60-3010-XX) -01 : M1,T,W -11 : K,M2 Foil side view

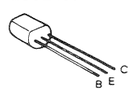


2SC2712

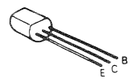
2SC3019



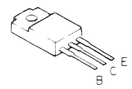
2SC2026
2SC2407



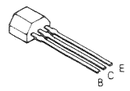
2SA1015
2SB698
2SC2347



2SD1761

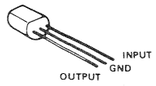


2SC2458
2SC2603



2SK208

NJM78L06A

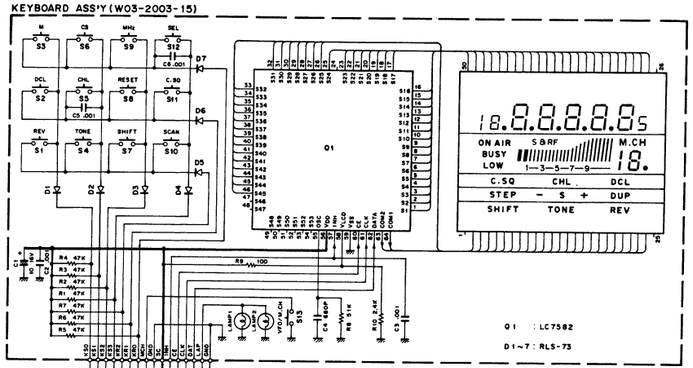


DTC114TK

SCHEMATIC DIAGRAM

Signal line — Control line — Common DC line

KEYBOARD ASS'Y (W03-2003-15)



Q1 : LC7582

D1~7 : RLS-73

Q1, 11 : DTC114TK
Q9, 10, 16, 21, 22, 29, 31 : 2SC2712(Y)
Q2 : M57726
Q3 : 2SC3019
Q4, 7, 8, 18, 24 : 2SC2026
Q5 : 2SC2347
Q6 : 2SC2407(1)
Q12 : 2SD1761
Q13 : 2SA1015(Y)
Q14, 15 : 2SC2458(Y)
Q17, 23 : 2SK208(Y)
Q19 : MB504P
Q20, 26 : MB87006
Q25 : M5501P
Q27 : 2SC2603(E)
Q28, 30 : 2SB698
Q32 : NJM78L06A

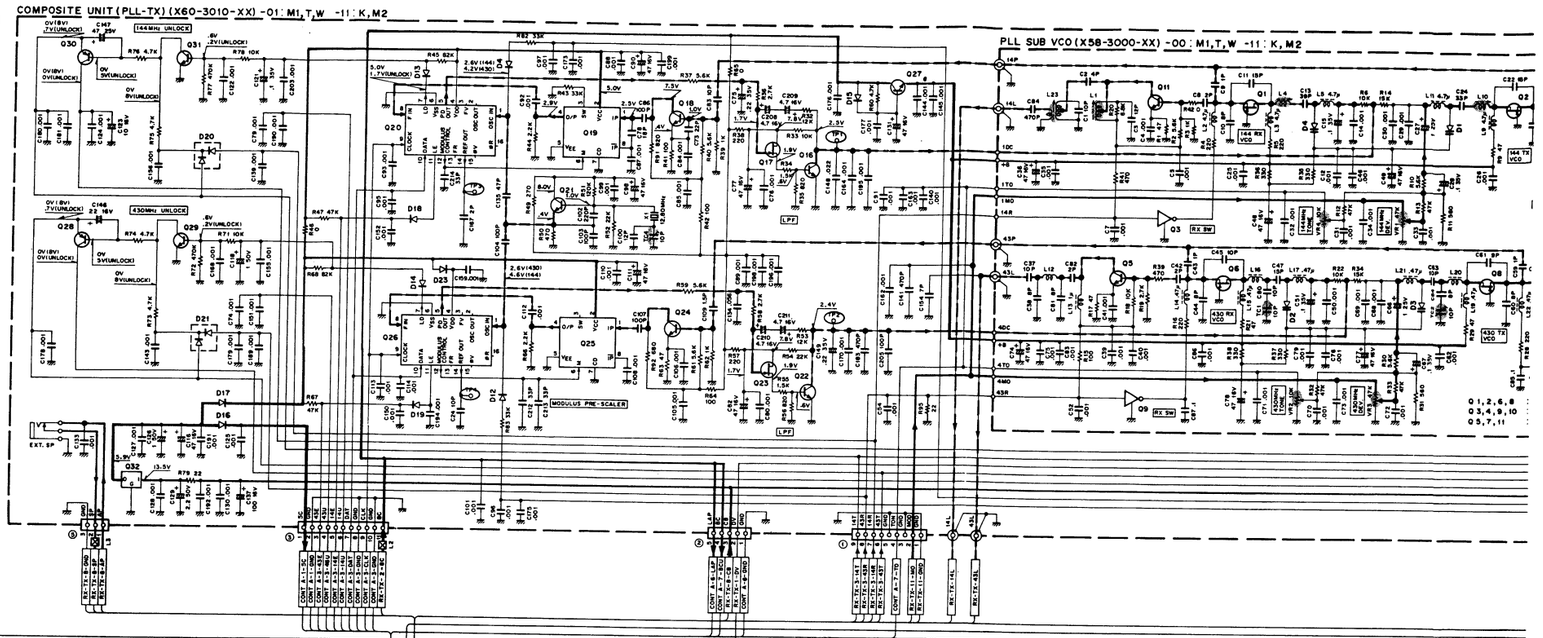
D1, 2 : 1S1587
D3 : M1308
D4, 5, 7, 12, 15~17, 23 : 1S1555
D6 : UM9401
D8, 11 : MC921
D9, 10 : IN60PSPA
D13, 14, 20, 21 : DAN202K
D18, 19 : 1SS133

(X53-3000-XX)

	D2	D3	D4	D5	D7	D10	D14
K	O	X	X	X	X	O	X
M1	O	X	X	O	X	O	X
M2	O	X	X	X	O	X	X
T	X	O	O	O	O	O	O
W	X	X	O	O	O	O	O

O: USED X: NOT USED

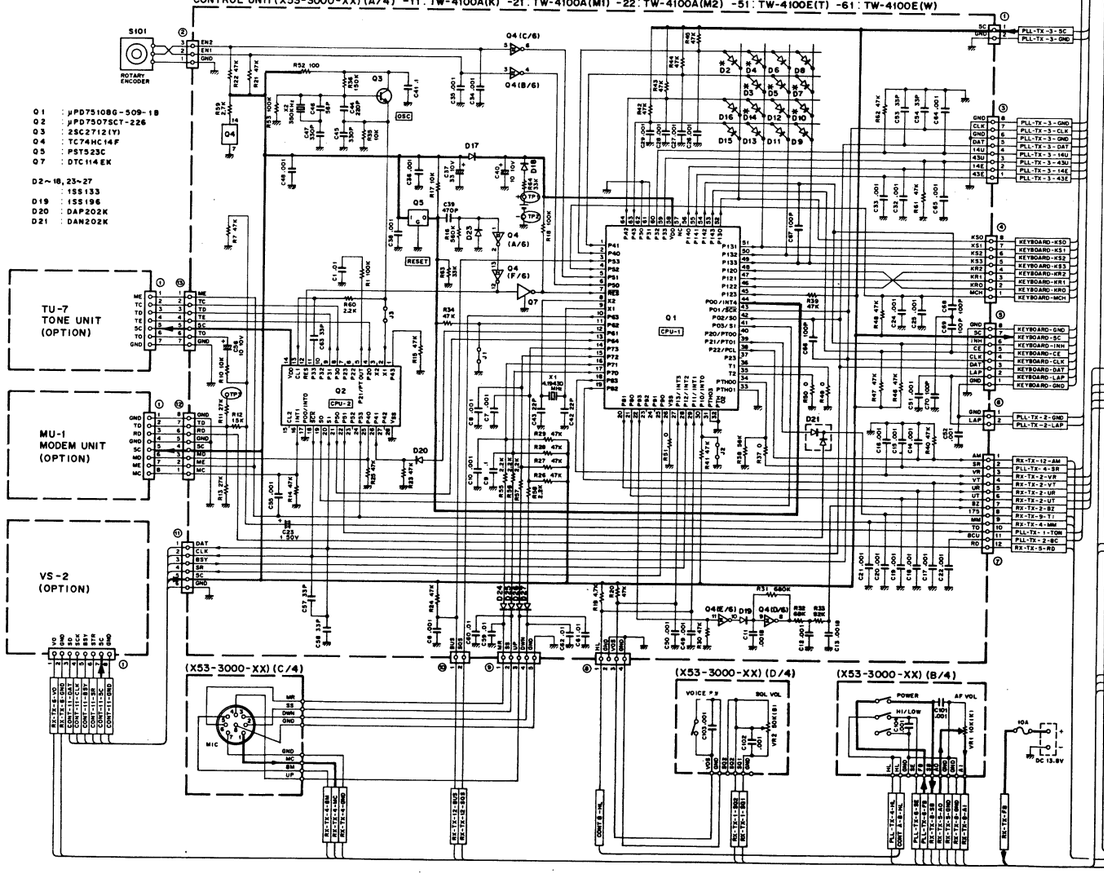
COMPOSITE UNIT (PLL-TX) (X60-3010-XX) -01 : M1, T, W -11 : K, M2



PLL SUB VCO (X58-3000-XX) -00 : M1, T, W -11 : K, M2

Q1, 2, 6, 8
Q3, 4, 9, 10
Q5, 7, 11

CONTROL UNIT (X53-3000-XX) (A/4) -11 : TW-4100A(K) -21 : TW-4100A(M1) -22 : TW-4100A(M2) -51 : TW-4100E(T) -61 : TW-4100E(W)



Q1 : μPD75108G-509-1B
Q2 : μPD75075CT-226
Q3 : 2SC2712(Y)
Q4 : TC74HC14F
Q5 : PST523C
Q7 : DTC114EK

D2~16, 23~27 : 1SS133
D19 : 1SS196
D20 : DAP202K
D21 : DAN202K

TU-7 TONE UNIT (OPTION)

MU-1 MODEM UNIT (OPTION)

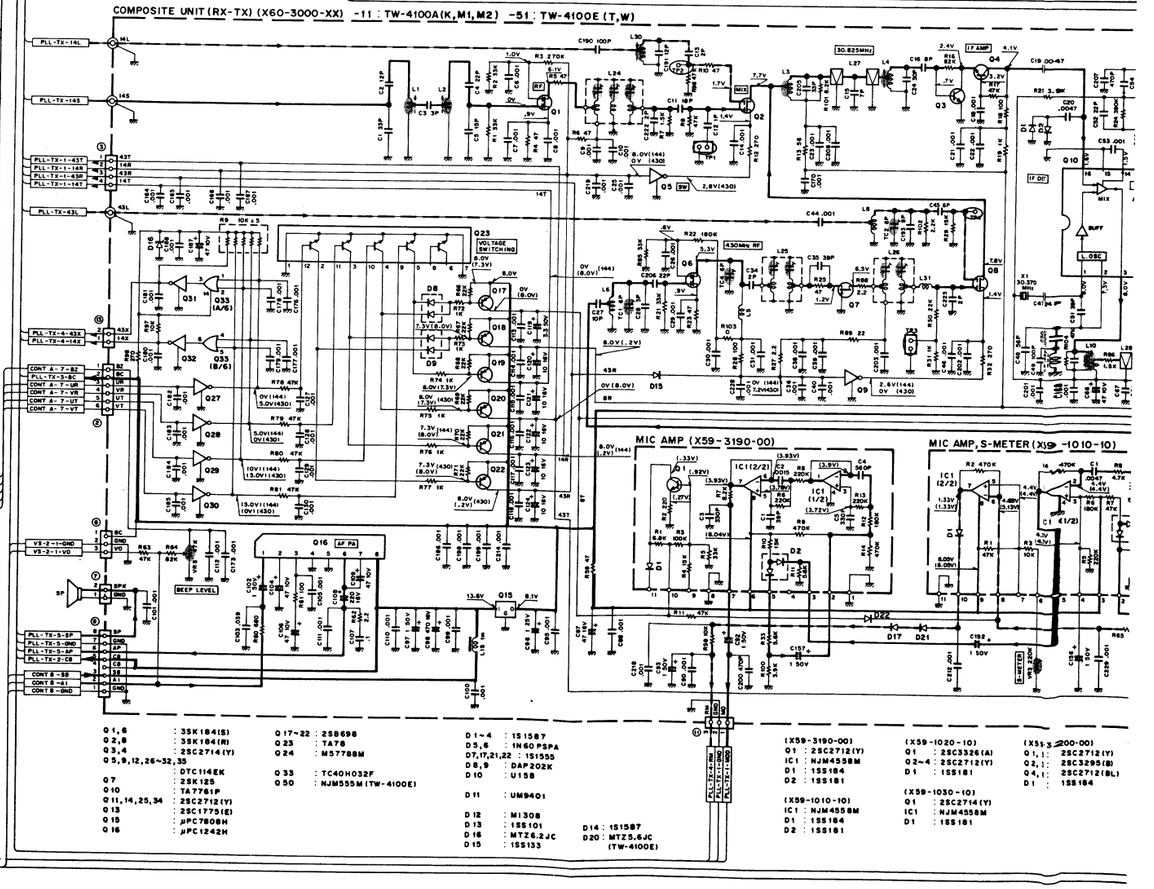
VS-2 (OPTION)

(X53-3000-XX) (C/4)

(X53-3000-XX) (D/4)

(X53-3000-XX) (B/4)

COMPOSITE UNIT (RX-TX) (X60-3000-XX) -11 : TW-4100A(K, M1, M2) -51 : TW-4100E(T, W)



Q1, 6 : 3SK184(S)
Q2, 8 : 3SK184(R)
Q3, 4 : 2SC2714(Y)
Q5, 9, 12, 26~32, 35 : DTC114EK
Q7 : 2SK125
Q10 : TA7761P
Q11, 14, 25, 34 : 2SC2712(Y)
Q13 : 2SC1775(E)
Q15 : μPC7808H
Q16 : μPC1242H
Q17~22 : 2SB698
Q23 : TA78
Q24 : M57788M
Q33 : TC40H032F
Q50 : NJM555M(TW-4100E)

D1~4 : 1S1587
D5, 6 : IN60PSPA
D7, 17, 21, 22 : 1S1555
D8, 9 : DAP202K
D10 : U15B
D11 : UM9401
D12 : M1308
D13 : 1SS101
D16 : MTZ6.2JC
D15 : 1S5133
D14 : 1S1587
D20 : MTZ5.6JC (TW-4100E)

MIC AMP (X59-3190-00)

MIC AMP, S-METER (X59-1010-10)

(X59-3190-00)
Q1 : 2SC2712(Y)
IC1 : NJM4558M
D1 : 1SS184
D2 : 1SS181

(X59-1010-10)
IC1 : NJM4558M
D1 : 1SS184
D2 : 1SS181

(X59-1020-10)
Q1 : 2SC3326(A)
Q2~4 : 2SC2712(Y)
D1 : 1SS181

(X59-1030-10)
Q1 : 2SC2714(Y)
IC1 : NJM4558M
D1 : 1SS184

(X59-3200-00)
Q1, 3 : 2SC2712(Y)
Q2, 5 : 2SC3295(B)
Q4 : 2SC2712(BL)
D1 : 1SS184

SCHEMATIC DIAGRAM

Voltage measurement conditions f = 145.00MHz, 435MHz, RX no signal, ( ) : TX.

TW-4100A/E

-01 : M1,T,W -11 : K,M2

PLL SUB VCO (X58-3000-XX) -00 : M1,T,W -11 : K,M2

Q1,2,6,8 : 2SK125 D1~4 : 1SV153
Q3,4,9,10 : DTC114EK
Q5,7,11 : 2SC2026

COMPOSITE UNIT (RX-TX) (X60-3000-XX) -11 : TW-4100A(K,M1,M2) -51 : TW-4100E(T,W)

SQUELCH CONTROL (X59-3200-00) ( ) : CLOSE

ALERT, VACANT CH. (X59-1020-10)

CENTER DETECTOR (X59-1030-10)

MIC AMP (X59-3190-00)

MIC AMP, S-METER (X59-1010-10)

Q1,6 : 3SK184(S)
Q2,8 : 3SK184(R)
Q3,4 : 2SC2714(Y)
Q5,9,12,26~32,35 : DTC114EK
Q7 : 2SK125
Q10 : TA7761P
Q11,14,25,34 : 2SC2712(Y)
Q13 : 2SC1775(E)
Q15 : μPC7808H
Q16 : μPC1242H
Q17~22 : 2SB698
Q23 : TA78
Q24 : M57788M
Q33 : TC40H032F
Q50 : NJM555M (TW-4100E)

D1~4 : 1S1587
D5,6 : 1N60 PSPA
D7,17,21,22 : 1S1555
D8,9 : DAP202K
D10 : U15B
D11 : UM9401
D12 : MI308
D13 : 1SS101
D16 : MTZ6.2JC
D15 : 1SS133
D14 : 1S1587
D20 : MTZ5.6JC (TW-4100E)

(X59-3190-00)
Q1 : 2SC2712(Y)
IC1 : NJM4558M
D1 : 1SS184
D2 : 1SS181

(X59-1010-10)
IC1 : NJM4558M
D1 : 1SS184
D2 : 1SS181

(X59-1020-10)
Q1 : 2SC3326(A)
Q2~4 : 2SC2712(Y)
D1 : 1SS181

(X59-1030-10)
Q1 : 2SC2714(Y)
IC1 : NJM4558M
D1 : 1SS181

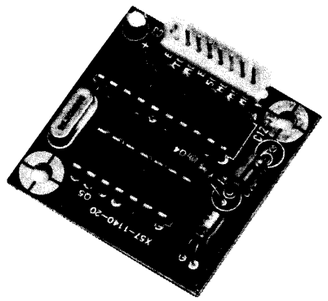
(X59-3200-00)
Q1,5 : 2SC2712(Y)
Q2,3 : 2SC3295(B)
Q4,6 : 2SC2712(BL)
D1 : 1SS184

	A	CH17
TW-4100A	X	SP
TW-4100E	O	SP

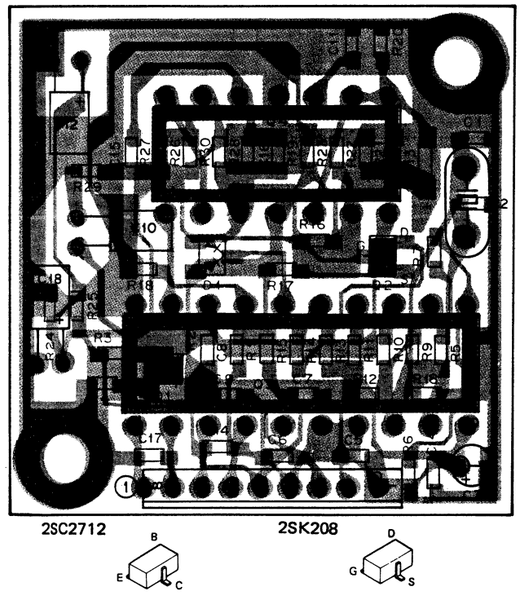
O: USED
X: NOT USED

MU-1 (MODEM UNIT)

MU-1 OUTSIDE VIEW



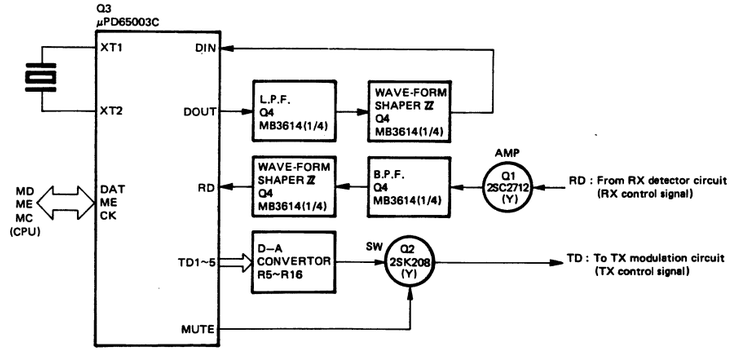
MU-1 PC BOARD VIEW
(X57-1140-20) Component side view



MU-1 PARTS LIST

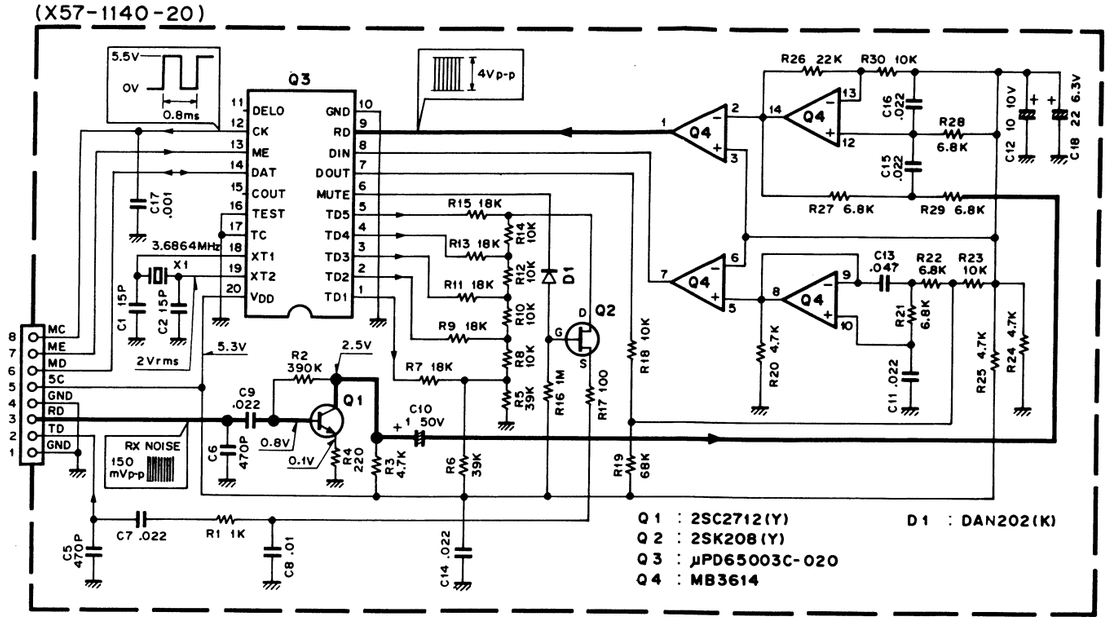
Part No.	Re-marks	Description	Q'Ty	Ref. No.
MU-1 (GENERAL)				
B50-8046-10	N	Instruction manual	1	
G13-0826-04		Cushion	1	
H01-4680-03	N	Carton (Inside)	1	
H25-0029-04		Protective bag	2	
J32-0791-04		Hex. head boss	1	
N35-2604-41		Binding screw	2	
X57-1140-20	N	MODEM unit	1	
MODEM UNIT (X57-1140-20)				
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
DAN202(K)		Chip diode	1	D1

MU-1 BLOCK DIAGRAM



MU-1 (MODEM UNIT)/MB-11 (MOUNTING BRACKET)

MU-1 SCHEMATIC DIAGRAM



- **Modulation output (TD terminal output on MODEM unit)**

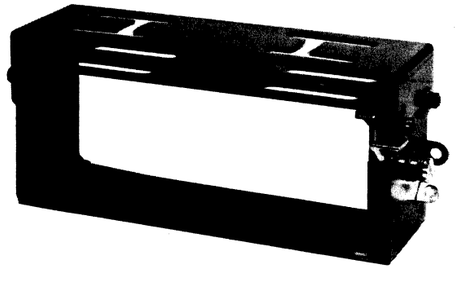
Condition		TD terminal output	
ME	MD	Frequency (Hz)	Output voltage (V)
5V	5V	1,200	1.3 ± 0.15
5V	0V	1,800	1.1 ± 0.15

- **Demodulation output**

Operation condition (RD terminal) : 40mV±3dB
(Confirm DAT terminal voltage by receiving a 60dBμ signal from SSG)

SSG MOD. frequency	DAT terminal voltage
1,200Hz	5V
1,800Hz	0V

MB-11 OUTSIDE VIEW



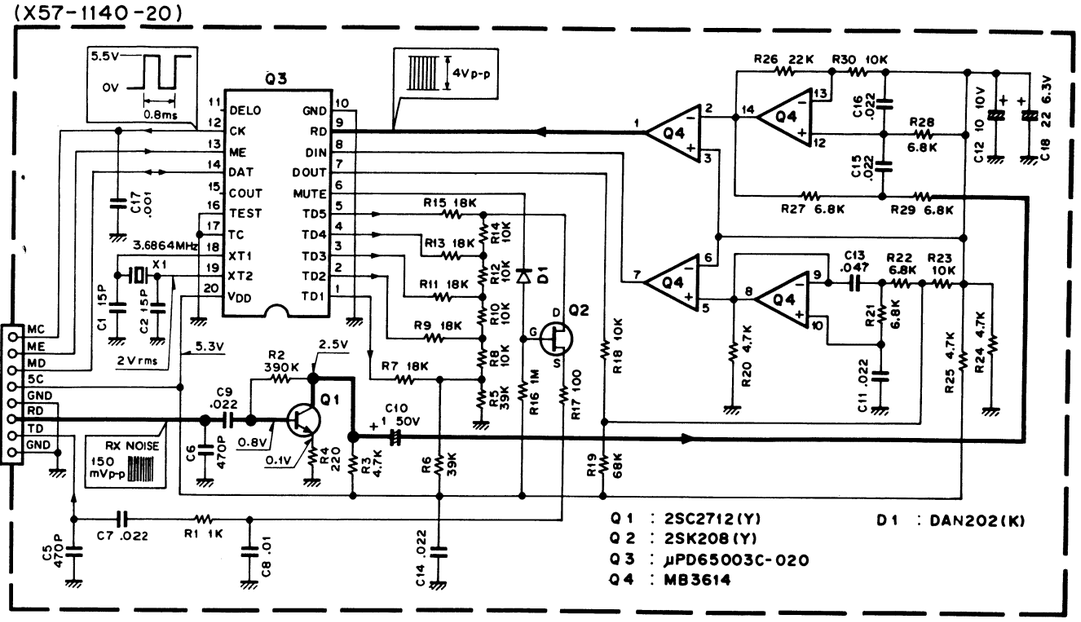
MB-11 PARTS LIST

Parts No.	New parts	Cescription	Q'Ty	Ref. No.
B50-8089-00		Insuruction manual	1	
G13-0836-04		Cushion	2	
H01-8023-03		Item cartaon box	1	
H13-0809-03		Protection plate	1	
H25-0105-04		Protection bag	1	
J29-0414-02		Bracket	1A	
N99-0315-04		Screw ass'y	1A	

MU-1 (MODEM UNIT)/MB-11 (MOUNTING BRACKET)

MU-1 SCHEMATIC DIAGRAM

(X57-1140-20)



- **Modulation output (TD terminal output on MODEM unit)**

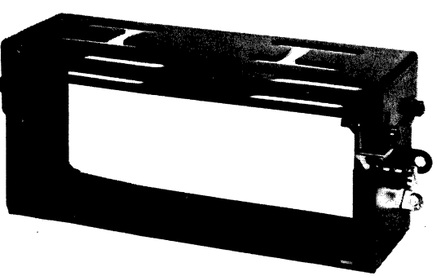
Condition		TD terminal output	
ME	MD	Frequency (Hz)	Output voltage (V)
5V	5V	1,200	1.3 ± 0.15
5V	0V	1,800	1.1 ± 0.15

- **Demodulation output**

Operation condition (RD terminal) : 40mV±3dB
(Confirm DAT terminal voltage by receiving a 60dBμ signal from SSG)

SSG MOD. frequency	DAT terminal voltage
1,200Hz	5V
1,800Hz	0V

MB-11 OUTSIDE VIEW

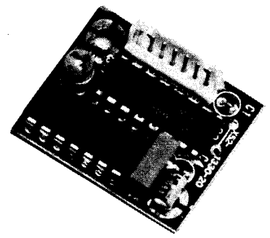


MB-11 PARTS LIST

Parts No.	New parts	Cescription	Q'Ty	Ref. No.
B50-8089-00		Insuruction manual	1	
G13-0836-04		Cushion	2	
H01-8023-03		Item cartaon box	1	
H13-0809-03		Protection plate	1	
H25-0105-04		Protection bag	1	
J29-0414-02		Bracket	1A	
N99-0315-04		Screw ass'y	1A	

TU-7 (TONE UNIT)

TU-7 OUTSIDE VIEW



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	

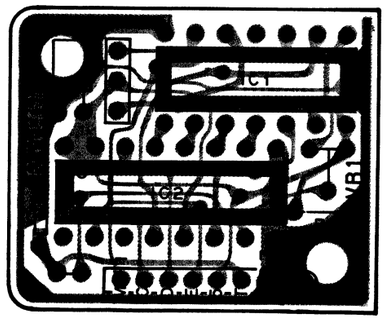
Refer to the instruction manual provided with the transceiver.

TU-7 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

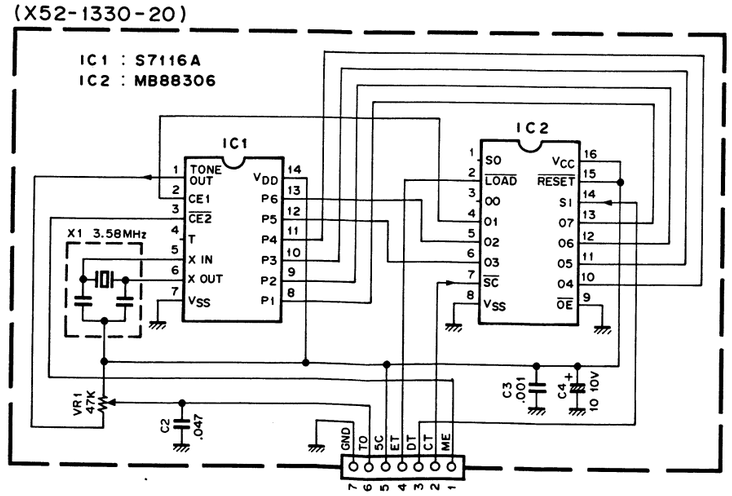
TU-7 PC BOARD VIEW

(X52-1330-20) Component side view



TU-7 SCHEMATIC DIAGRAM

(X52-1330-20)

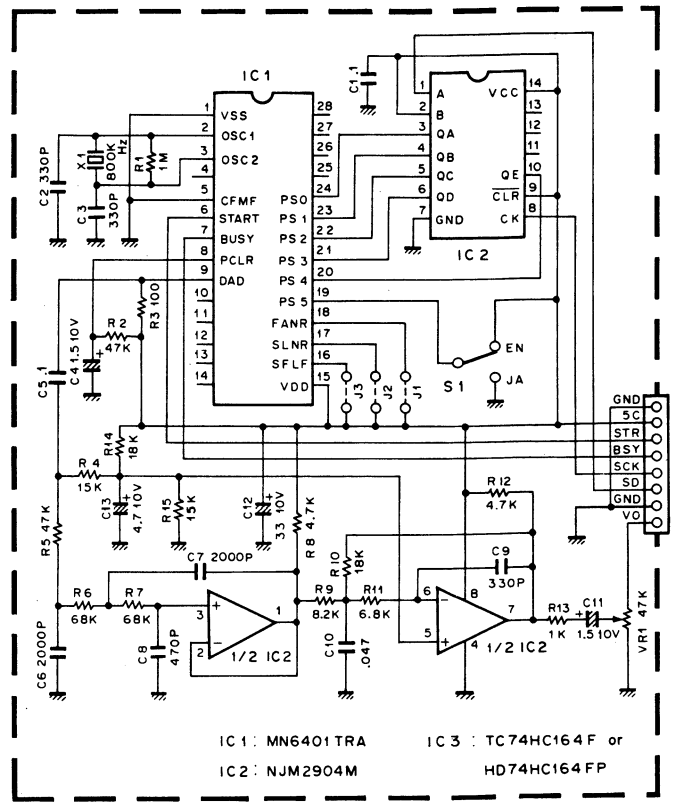


VS-2 (VOICE SYNTHESIZER)

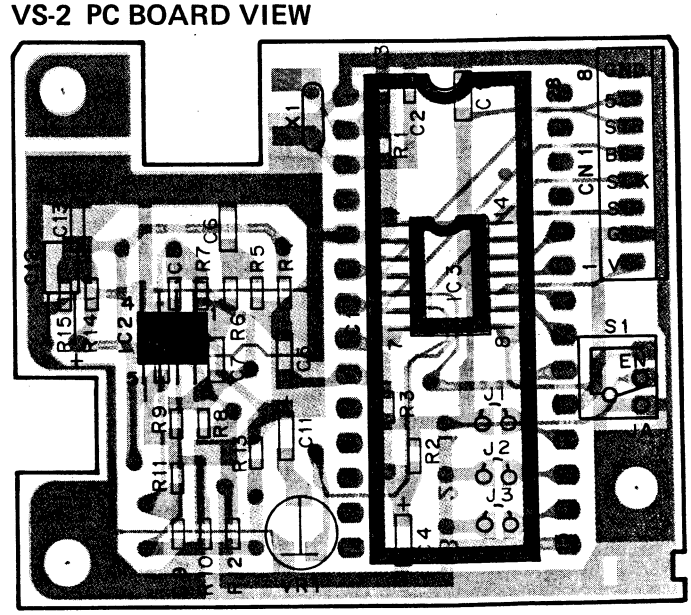
VS-2 PARTS LIST

Parts No.	New Parts	Description	Ref. No.
VS-2			
B50-8095-00	*	Instruction manual	
G13-0645-04		Cushion Accessary	
H01-8025-03	*	Item carton box	
H25-0029-04		Protection bag	
N32-2004-41		Flat screw	
N35-2604-41		Bind screw x 3	
X42-3000-00	*	Accessary unit	
ACCESSARY UNIT (X42-3000-00)			
CC73ECH1H202J		Chip C 2000pF J	C6,7
CC73FCH1H331J		Chip C 330pF J	C2,3,9
CC73FCH1H471J		Chip C 470pF J	C8
CE04CW1A330M		Electro 33μF 10WV	C12
CK73EB1E104K		Chip C 0.1μF K	C1,5
CK73EB1H473K		Chip C 0.047μF K	C10
C92-0009-05	*	Chip tantal 4.7μF 10WV	C13
C92-0501-05	*	Chip tantal 1.5μF 10WV	C4,11
E40-5022-05		Pin ass'y 8P	CN1
J21-4146-04		Mounting hardware	
L78-0006-05		Ceramic oscillator	X1
RK73FB2A101J		Chip R 100 J 1/10W	R3
RK73FB2A102J		Chip R 1k J 1/10W	R13
RK73FB2A105J		Chip R 1M J 1/10W	R1
RK73FB2A153J		Chip R 15k J 1/10W	R4,15
RK73FB2A183J		Chip R 18k J 1/10W	R10,14
RK73FB2A472J		Chip R 4.7k J 1/10W	R8,12
RK73FB2A473J		Chip R 47k J 1/10W	R2,5
RK73FB2A682J		Chip R 6.8k J 1/10W	R11
RK73FB2A683J		Chip R 68k J 1/10W	R6,7
RK73FB2A822J		Chip R 8.2k J 1/10W	R9
R12-3457-05	*	Trimming pot. 47k	VR1
S31-1418-05	*	Slide switch	S1
MN6401TRA		IC	IC1
NJM2904M		IC	IC2
TC74HC164FP	*	IC	IC3
HD74HC164FP	*	IC	IC3

VS-2 SCHEMATIC DIAGRAM



VS-2 PC BOARD VIEW



TW-4100A/E

SPECIFICATIONS

Specifications \ Model			TW-4100A		TW-4100E
			K1,M2	M1	T1,W1
General	Frequency range		144 to 148MHz 440 to 450MHz	144 to 146MHz 430 to 440MHz	144 to 146MHz 430 to 440MHz
	Mode		FM (F3E, F2D for control signal of the DCL system)		
	Antenna impedance		50 ohms		
	Operating temperature		13.8V DC ± 15%		
	Grounding		Negative		
	Current drain	Receive mode with no input signal	0.6A		
		Transmit mode (Max.)	9.5A		
	Frequency stability (−10°C to +50°C)		Better than ± 15 x 10^{-6}		
	Operating temperature		−20°C to +50°C (−4°F to +122°F)		
	Dimensions (Projections included, W x H x D mm)		150 x 50 x 214		
	Weight		1.8kg (3.96lbs)		
Transmitter	Output power*	HI 2m/70cm	45W/35W		
		LOW	5W		
	Modulation		Reactance modulation		
	Spurious radiation		Less than −60dB		
	Max. frequency deviation (FM)		± 5kHz		
	Audio distortion (FM, at 60% modulation)		Less then 3% (300Hz to 3000Hz)		
	Microphone impedance		500 to 600 ohms		
Receiver	Circuitry		Double conversion		
	Intermediate frequency	1st IF	30.825MHz		
		2nd IF	455kHz		
	Sensitivity (12dB SINAD) 2m/70cm		Less than 0.2μV/Less than 0.16μV		
	Selectivity	−6dB	More than 15kHz		
		−60dB	Less than 30kHz		
	Spurious response		Better than 60dB		
	Squelch sensitivity		Less than 0.16μV		
	Output		More than 2W across 8 ohms load (5% distortion)		
	External speaker		8 ohms		
DCL control	Code		NRZ equal-length code		
	Modulation		MSK modulation		
	Frequency deviation		± 3.5kHz (Reference)		
	Mark frequency and deviation		1200Hz, ± 2 x 10^{-4}		
	Space frequency and deviation		1800Hz, ± 2 x 10^{-4}		
	Code transmission speed and deviation		1200 bits/second, ± 2 x 10^{-4}		

Notes :

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

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

KENWOOD U.S.A. CORPORATION
2201 East Dominguez Street Carson, CA 90810, U.S.A.

KENWOOD COMMUNICATIONS
DIVISION OF KENWOOD ELECTRONICS, DEUTSCHLAND GMBH
Rembrücker Str. 15, 6056 Heusenstamm, West Germany

KENWOOD ELECTRONICS, BENELUX N.V.
Mechelsesteenweg 418 B-1930 Zaventem, Belgium

KENWOOD ELECTRONICS, AUSTRALIA PTY. LTD.
4E. Woodcock Place, Lane Cove, N.S.W. 2066, Australia