

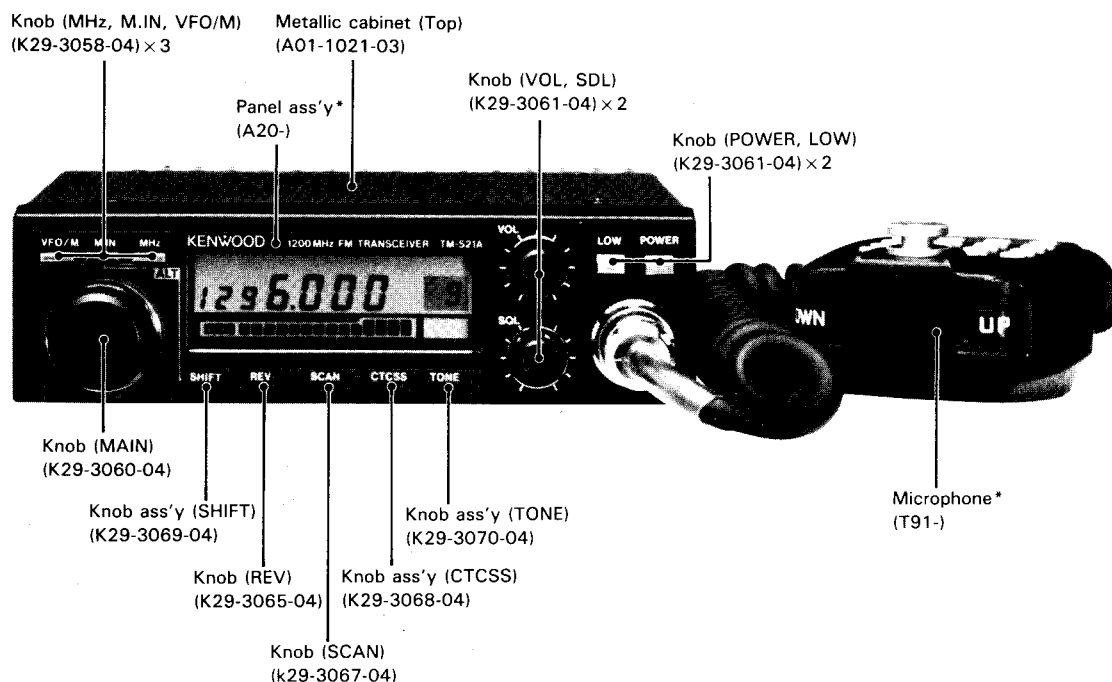
1200MHz FM TRANSCEIVER

TM-521A/E

SERVICE MANUAL

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* Refer to parts list on page 18.
Photo is TM-521A.

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CIRCUIT DESCRIPTION

MODEL	TM-521A	TM-521E
Unit Name		
Final Unit	X45-3200-00	X45-3200-00
Control Unit	X53-3160-11	X53-3160-61
TX-RX Unit	X57-3240-11	X57-3240-61

Table 1

Frequency Configuration

The TM-521A/E utilizes a PLL synthesizer system and digital VFO. The VFO is capable of tuning in 10 kHz, 12.5 kHz, 20 kHz, and 25 kHz steps.

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

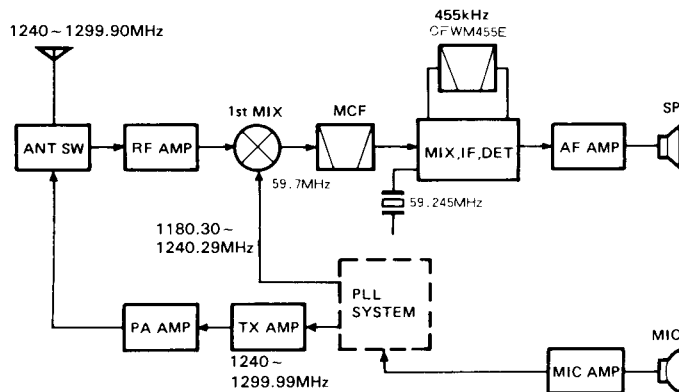


Fig. 1 Frequency configuration diagram

Receiver System

• General

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

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

The first IF signal is amplified and applied to the narrow-band FM IC (TA7761F). The incoming IF signal is mixed with the second local oscillator frequency (59.7 MHz) to obtain the second IF frequency of 455 kHz. This signal is then applied to a six element ceramic filter (CFWM455E) to sharpen the signal quality. The second if is then amplified by a 5 stage limiting amplifier and applied to the quadrature detector in order to obtain an audio frequency signal. Undesirable high-frequency components in the detected audio are removed by an active low pass filter. The audio signal is then applied to the volume control, amplified and is finally applied to the speaker. The signal path after detection is shown in Fig. 2.

• Squelch Circuit

The noise components from the detector output are filtered to remove the 455 kHz component and are then applied to a two stage amplifier. This amplified signal is then applied to the squelch detector. The signal obtained from this DC detector passes through the squelch control and is then used to control the audio muting circuits.

• S-Meter Circuit

A portion of the output from the TA7761F is applied to the S-Meter control circuits. The output from this circuit is applied to an analog to digital (A/D) conversion circuit in the microprocessor and is used to control the LCD bargraph.

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

Table 2 MCF (L71-0280-05) characteristics (TX-RX unit L8)

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

Table 3 Ceramic filter CFWM455E (L72-0366-05) Characteristics (TX—RX unit L13)

CIRCUIT DESCRIPTION

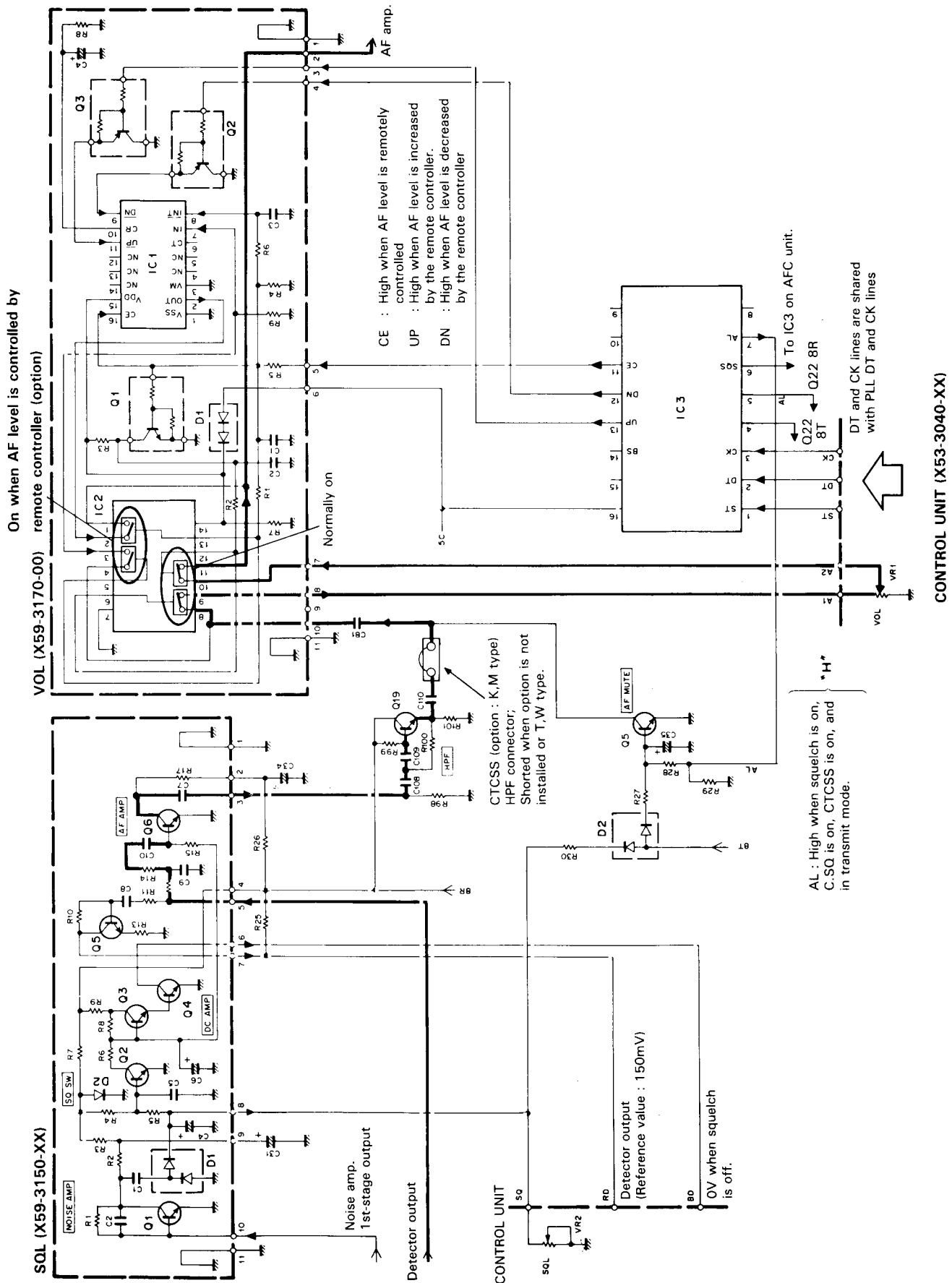


Fig. 2 Circuits from detector output onward

CIRCUIT DESCRIPTION

Transmitter System• **Outline**

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

• **Modulation Circuit**

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

• **PreAmplifier Circuit**

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

• **Final Amplifier Circuit**

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

• **APC Circuit (Automatic Power Control)**

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

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

Table 4 Power module M6711, maximum rating (Final Unit IC1)

	VCBO	VEBO	ICBO	Ic	Pc	Po	Tj	Ta
Test condition			ICBO	Ic	Tc = 25°C	f = 860 MHz Vcc = 13.5 V Pi = 0.1 W		25°C
Maximum rating	35 V	3 V	50 μ A	250 mA	8.3 W	1.25 W	200°C	

Table 5 Maximum rating of 2SC2558 (Final Unit Q1)

CIRCUIT DESCRIPTION

• Antenna Switching Circuit

The antenna switching circuit is shown in **Fig. 3**. The receive circuit consists of a two stage cutoff circuit that is formed by $1/4$ wavelength striplines which provide low insertion loss and good isolation.

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

Fig. 4 shows the equivalent circuit for the transmit section.

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

The equivalent circuit for receive is shown in **Fig. 5**.

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

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

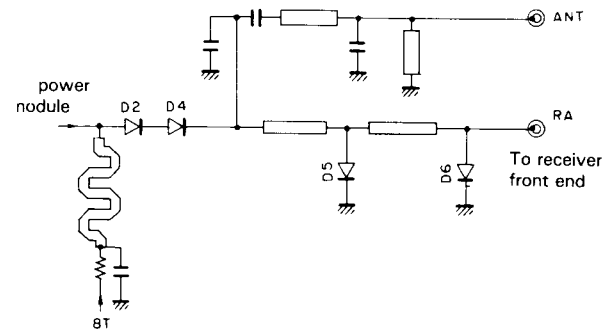


Fig. 3 Antenna Switching Circuit

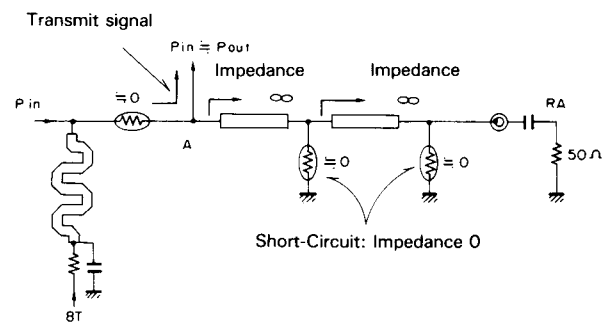


Fig. 4 Equivalent circuit for transmit

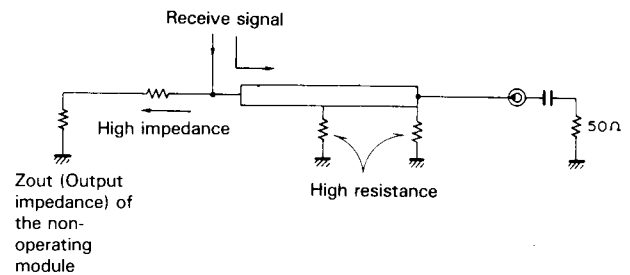


Fig. 5 Equivalent circuit for receive

CIRCUIT DESCRIPTION

PLL Synthesizer Unit

A Block diagram of the PLL unit is provided in **Fig. 6**. The PLL unit of the TM-521A/E is constructed so that the VCO unit is contained in a separate shielded case that forms its own subassembly. This technique results in improved electrical and mechanical stability, which increases the overall frequency stability of the radio.

The VCO oscillates at a frequency of 600 MHz. Its second harmonic (1200 MHz) is amplified by transistor Q2 in order to obtain a useable 1200 MHz signal. This signal is then amplified by Q101 and applied directly to the prescaler (MB507PF) with a maximum input frequency of 1.6 GHz. Here the signal is divided by 128 or 129. The resulting signal is applied to the phase comparator (MB87006APF) to obtain the correction voltage that is used to lock the VCO on frequency. A TCXO (Temperature Compensated Crystal Oscillator) reference oscillator operates at 12.8 MHz which helps to reduce frequency drift and offers high stability.

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

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

- $f_{vco}(RX) = f_{RX} - 59.7 = \{(n \times 128) + A\} \times f_{osc} \div R$
- $f_{vco}(RX)$: The output frequency (Q2 output) of the VCO during receive
- f_{RX} : Receive frequency
- n : Set value of the binary 10 bit programmable counter

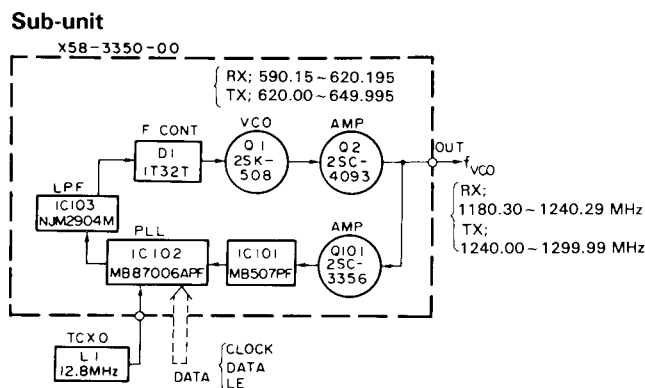


Fig. 6 Block diagram of the PLL unit

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

In the case of 1260 MHz,

- $f_{vco} (RX) = 1260 - 59.7$
 $= \{(n \times 128) + A\} \times 12800 \div 1280$
 $= 1200.300 \text{ MHz}$

where $n = 937$ and $A = 94$.

For transmitting,

- $f_{vco} \text{ (TX)} = 1260 = \{(n \times 128) + A\} \times 12800 \div 1280$
 $= 1260.000 \text{ MHz}$

where $n = 984$ and $A = 48$.

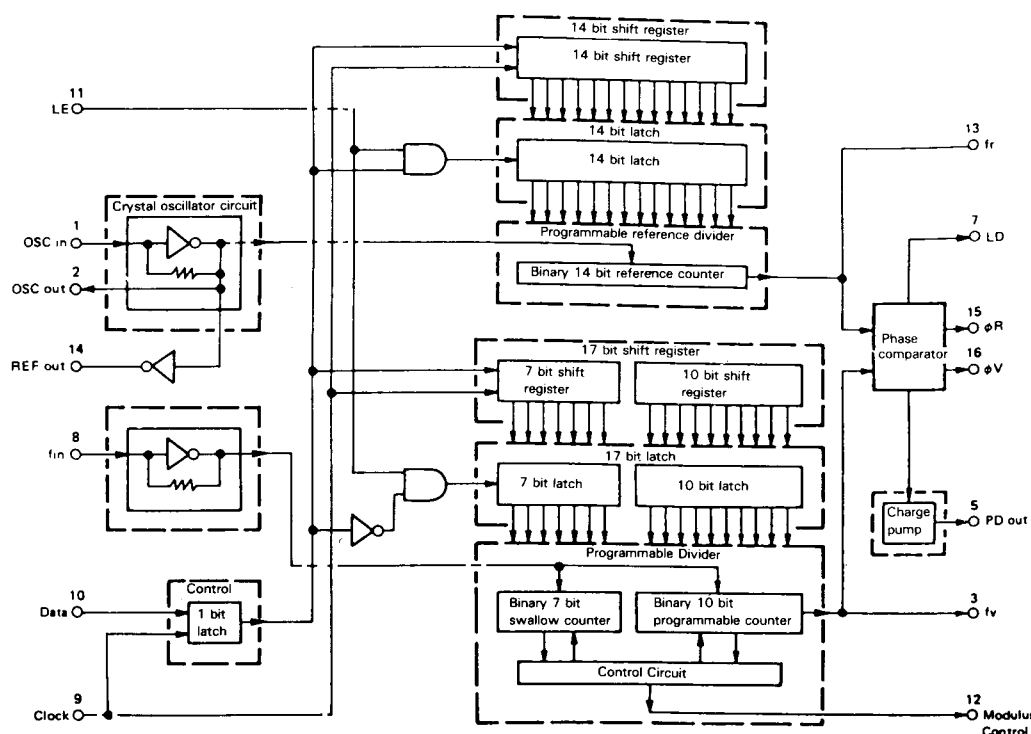


Fig. 7 Block diagram of MB87006 APF (VCO unit IC 102)

CIRCUIT DESCRIPTION

• ALT (Automatic Frequency Locked Tuning) Circuit

The block diagram of the ALT unit is shown in **Fig. 8**.

The ALT system uses a portion of the second local oscillator signal, mixer, and the TA7761F ALT module to form a feed-back circuit that is used to provide analog automatic frequency control.

When the first IF (59.7 MHz) changes due to a shift in the transmitter frequency a corresponding shift will occur in the second intermediate frequency. A portion of this second IF signal is detected and converted into a DC correction voltage by a ceramic discriminator, CFY455S. This correction voltage is amplified (NJM4558M) and is used to control D7 and D8 via analog switch MN4066BS. TP1 can be used to check the value of this control voltage. D7 and D8 are in series with the 59.245 MHz oscillator circuit and provide voltage control of this oscillator (VCXO, Voltage controlled oscillator). Therefore, fluctuations of the second IF cause a corresponding change in the second local oscillator circuit, which keeps the frequency of the second IF within the bandwidth of the IF filter. This

system maintains close agreement between the transmit and receive frequency bandwidths. (In practice, the receiver frequency and transmit frequency are automatically maintained in close agreement.) The center voltage of the vari-cap diode is set by a voltage divider circuit. Stability of this voltage is maintained by a voltage follower circuit. When the ALT circuit is off, the control voltage applied to the vari-cap diode is switched to this fixed voltage divider circuit in order to set the second local oscillator frequency.

The control voltage for the vari-cap diode is subject to one additional voltage divider stage. During receive this DC signal is applied from the RM line to the microprocessor terminal PTH01 which turns on the tuning indicator light. Switching is performed by the 8R line.

The relationship between the input voltage on the PTH01 terminal and the tuning indicator, and the relationship between the RM voltage and the deviation during receive is shown in **Table 6** and **Fig. 9**.

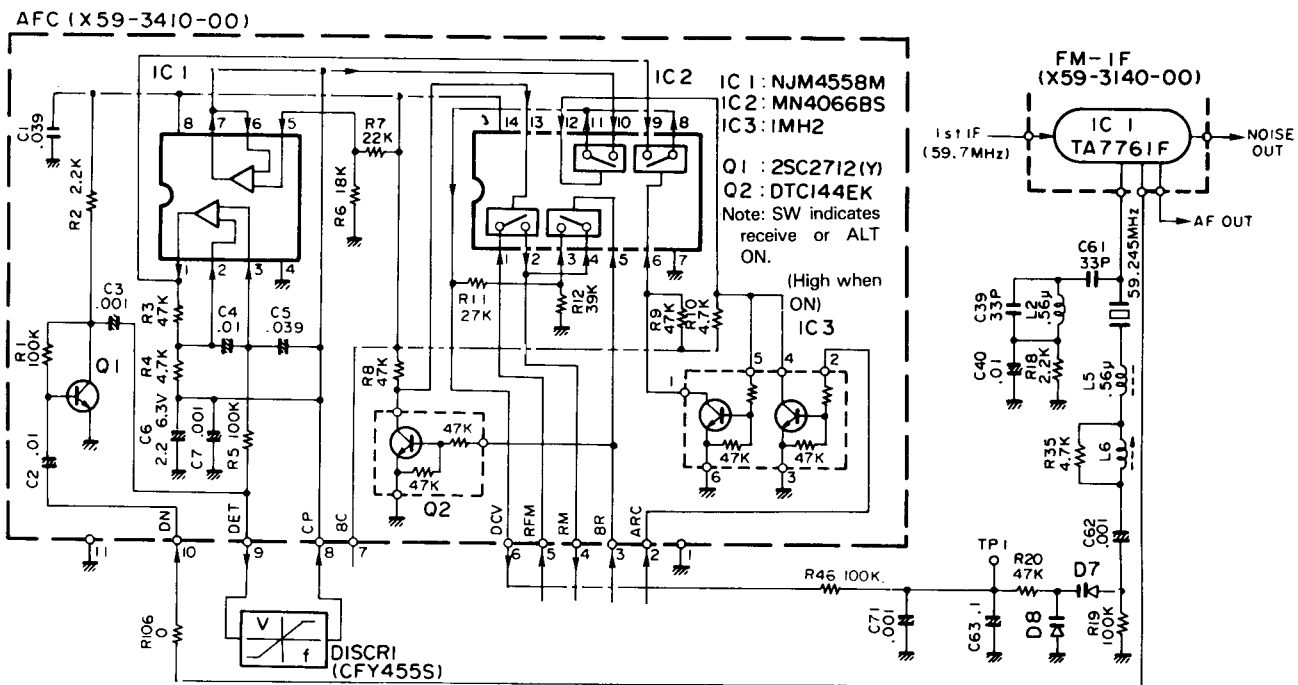


Fig. 8 Block diagram of the ALT unit

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

Table 6 Relationship between PTH01 input voltage and the T indicator

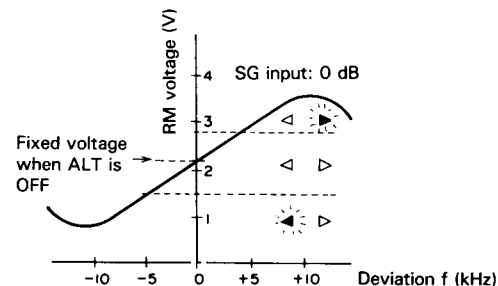


Fig. 9 Relationship between the RM voltage and deviation during receive

CIRCUIT DESCRIPTION

- **Unlock Circuit**

Whenever an unlock condition in the PLL unit is sensed the LD (Lock Detect) terminal of the subunit will go low. This causes D16 to turn OFF, and Q15 to turn OFF. The bias applied to the DRIVE HIC (KCB01) line is removed thus disabling transmit. This prevents undesirable output signals from being transmitted during this unlock condition. **(See Fig. 10)**

- **Drive HIC (KCB01)**

The output from the VCO is amplified by Q13 and enters the DRIVE HIC. Three stages of amplification are provided (1) 2SC4093 and (2) 2SC3357. With an input of 0 dBm approximately 23 dBm is generated by these three amplifiers. Stable operation is obtained thru the use of alumina substrates and hybrid IC's.

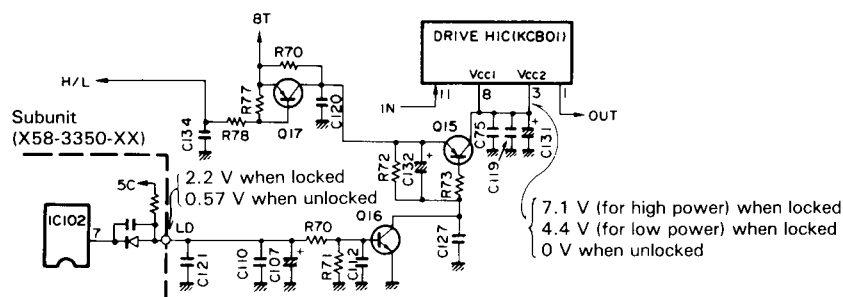


Fig. 10 **Unlock circuit**

- **Electrical characteristics**

NO.	Item	Symbol	Rating			Unit	Test condition, etc.	
			Min	Typ	Max			
1	Current consumption	Icc		90		mA	No signal	
2	Characteristics within the band width	Po1				dBm	f = 1220 MHz	Input -3 dB
		Po2	18.5				1270	
		Po3					1320	
3	Saturation output	Pos1	20.3			dBm	Vcc = 7.0 [V]	Input 3 dBm 1270 MHz
		Pos2	21.0				7.5 [V]	
		Pos3	21.5				8.0 [V]	

Input/output impedance 50 Ohms

Table 7 Drive HIC (KCB01) characteristics

- **Circuit diagram**

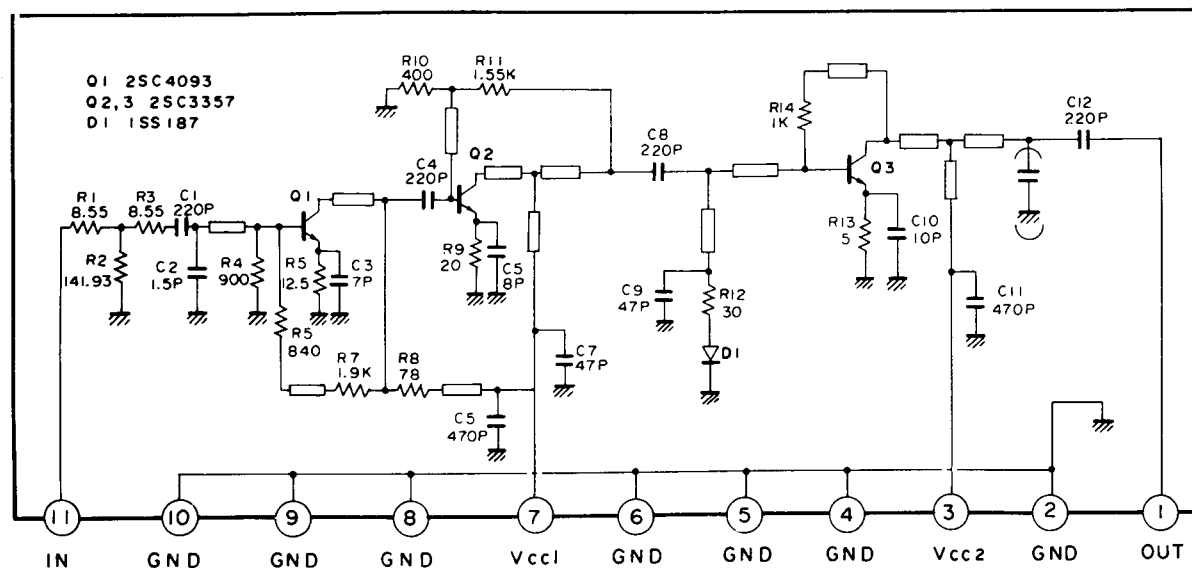


Fig. 11 Circuit diagram of Drive HIC (KCB01)

CIRCUIT DESCRIPTION

Digital Control Unit

• General

The control unit is composed of the microprocessor (CPU), the input keys, peripheral circuits and the display unit. All of the various functions are controlled by a single microprocessor. The terminal functions of the microprocessor (IC3) are listed in **Table 8**.

• Key and Rotary Encoder Input Circuit

The key and rotary encoder input circuit is shown in **Fig. 12**. The front panel keys, microphone keys, and the rotary encoder are connected directly to the microprocessor.

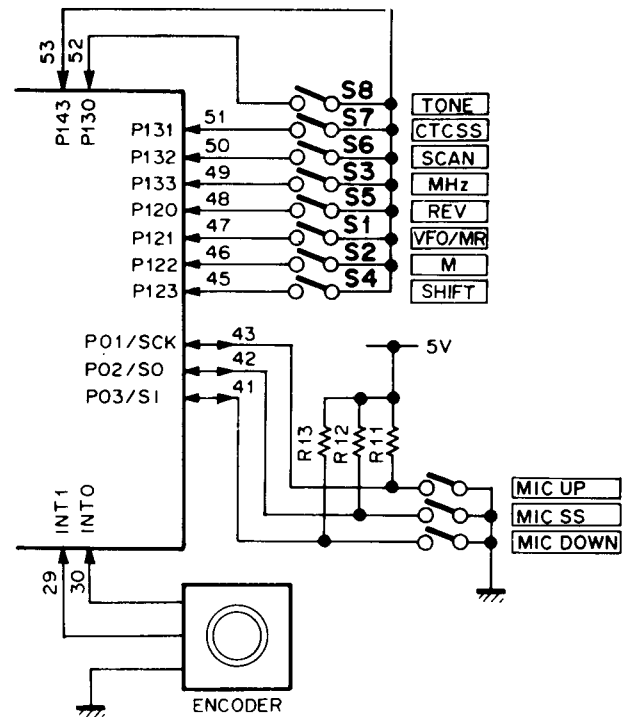


Fig. 12 Key and rotary encoder input circuit

Terminal No.	Name	I/O	Logic	Function	Terminal No.	Name	I/O	Logic	Function
1	P41	O	—	Digital output of D-A converter	33	PTH01	I	—	RF meter analog input, ALT indicator analog input
2	P40	O	—		34	PTH00	I	—	S-meter analog input
3	P53	O	—		35	T11	—	—	Unused
4	P52	O	—		36	T10	—	—	
5	P51	O	—		37	P23	O	—	Squelch Switch for remote control
6	P50	O	—		38	P22	O	H	
7	RESET	I	L	Reset input	39	P21	O	H	Shift register strobe
8	X2	—	—	Crystal oscillator 4.194304 MH	40	PT00	O	—	BEEP tone oscillator input
9	X1	—	—		41	P03/SI	I/I	L/—	Microphone DOWN switch input/serial data input
10	P63	—	—	Unused	42	P02/SO	I/O	L/—	Microphone PTT switch input/serial data output
11	P62	—	—		43	P01/SCK	I/—	L/—	Microphone UP switch input/serial clock input/output
12	P61	O	↑	CTCSS shift register reset	44	INT4	I	—	Back-up detection input
13	P60	I	L	LCD driver data	45	P123	I	L	SHIFT switch input
14	P73	O	—		46	P122	I	L	Memory switch input
15	P72	O	↑		47	P121	I	L	VFO, MR select switch input
16	P71	O	H		48	P120	I	L	REV switch input
17	P70	—	—	Unused	49	P133	I	L	High-frequency step select switch input
18	P83	I	L	Forced input	50	P132	I	L	SCAN switch input
19	P82	I	L		51	P131	I	L	CTCSS input switch
20	P81	I	L		52	P130	I	L	TONE switch input
21	P80	I	L	Unused	53	P143	O	—	Pull down terminal
22	P93	O	—		54	P142	O	—	Unused
23	P92	O	↓	PLL and shift register clock	55	P141	O	—	
24	P91	O	—	PLL and shift register data	56	P140	O	—	
25	P90	O	L	PLL enable	57	NC	—	—	
26	Vss	—	—	GND terminal (0 V)	58	VDD	—	—	Power source terminal (5 V)
27	P13	I	L	BUSY input	59	P33	—	—	GND terminal (0 V)
28	INT2	I	—	Encoder input	60	P32	I	H	TONE detection input (when CTCSS is ON)
29	INT1	I	—		61	P31	O	—	CTCSS IC data
30	INT0	I	H	Detection input for remote control (only when connected)	62	P30	O	↑	CTCSS IC clock
31	PTH03	I	—	Unused	63	P43	O	—	Digital output of D-A converter
32	PTH02	I	—		64	P42	O	—	

Table 8 Terminal functions of Control Unit IC3 PD75106G-508-1N

CIRCUIT DESCRIPTION

• Display Circuit

The display circuit is installed in the LCD assembly (see **Fig. 13**), and consists of an LCD driver, its peripheral circuits, and LCDs. The LCD display is a 50% duty, dynamic operation

device, and displays data based upon the serial data transmitted to the LCD driver from P71-P73 of the microprocessor.

Fig. 14 shows the common and segment output signals of the LCD driver.

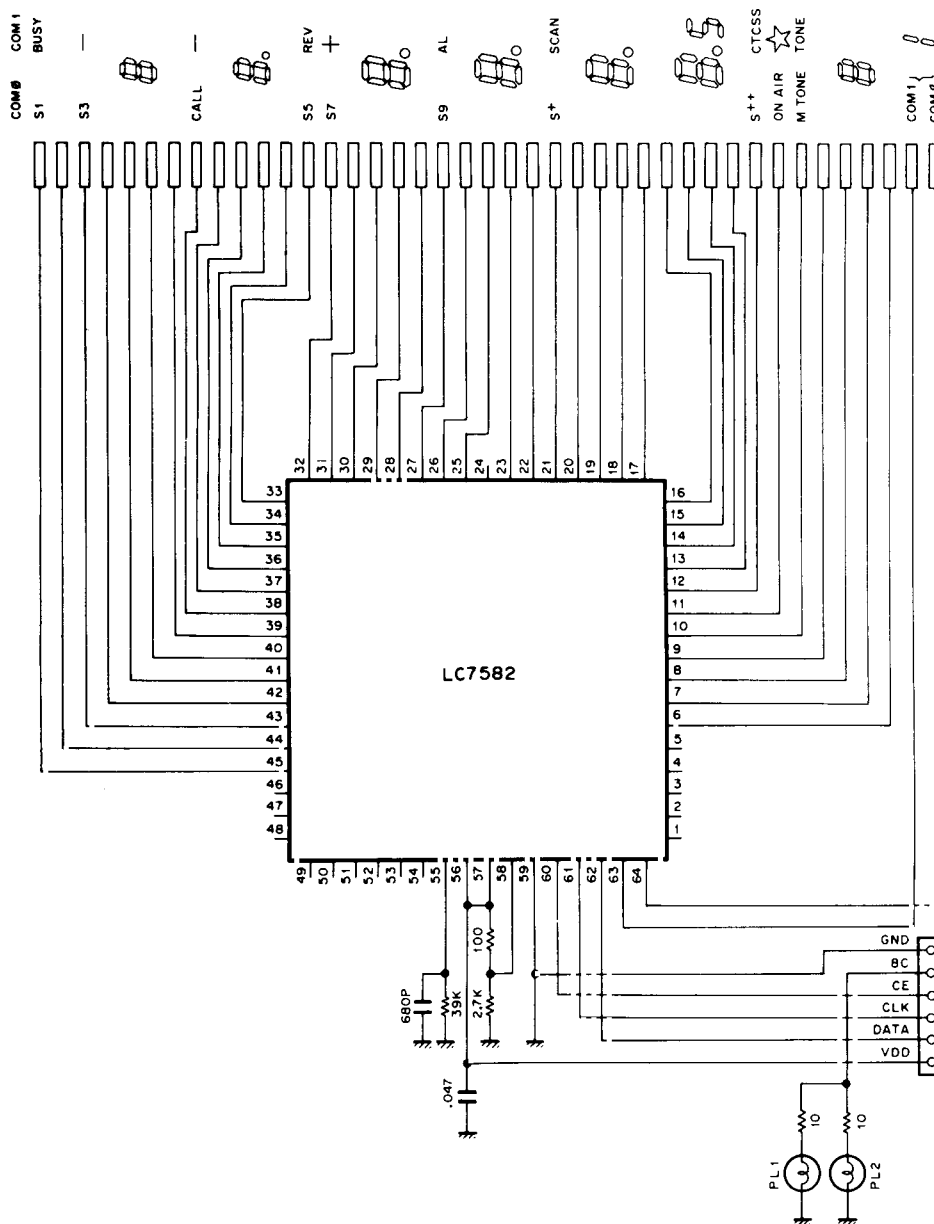


Fig. 13 LCD assembly (B38-0307-05)

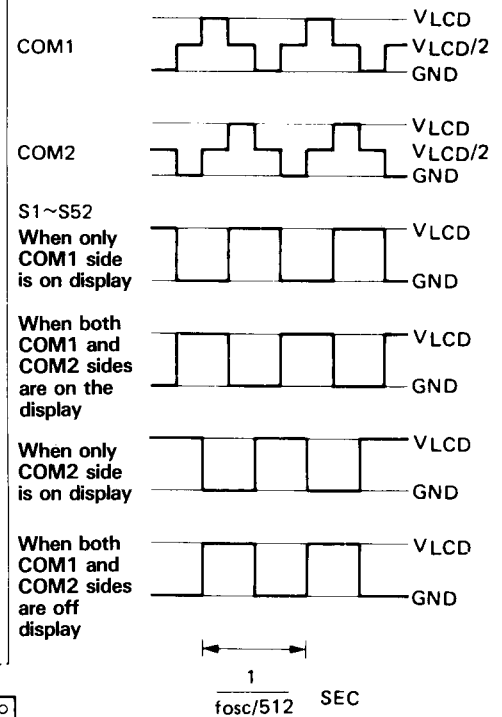
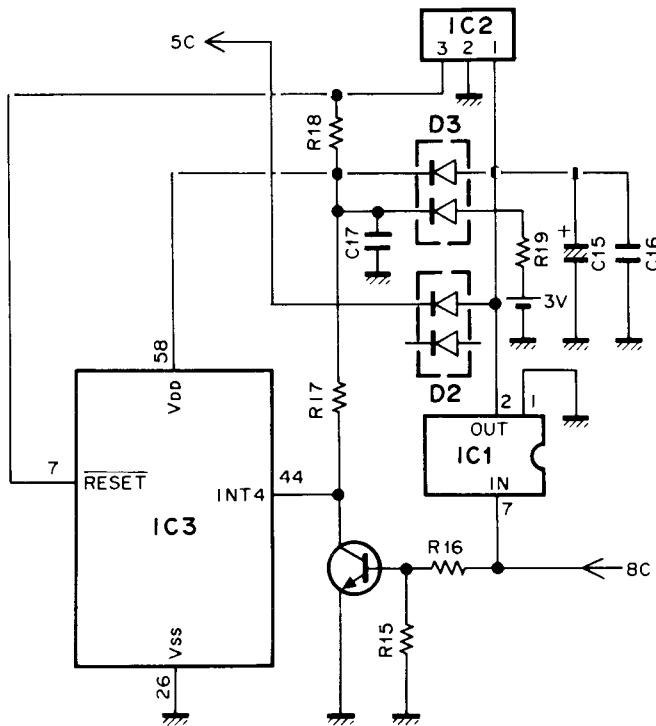


Fig. 14 Common and segment output signals of the LCD driver

CIRCUIT DESCRIPTION

• Reset and Backup Circuit

The reset and backup circuit is shown in Fig. 15. When power is being supplied, the voltage on terminal INT4 rises to 3.0 V and IC3 enters the backup mode.



IC2 Timing Chart

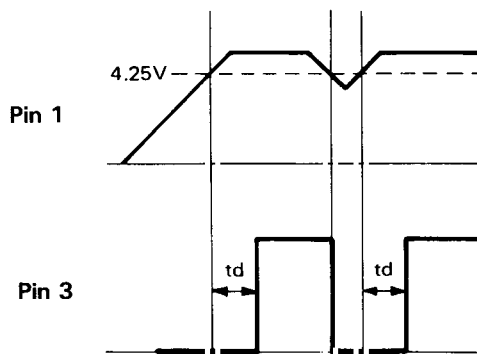


Fig. 15 Reset and backup circuit

• Data Output

The data that provides PLL frequency division rate and reference frequency division rate are provided on P92 (CK), P91 (DT), and P90 (RST) on the microprocessor.

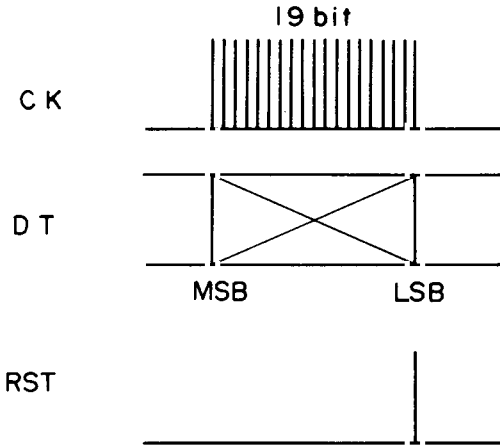


Fig. 16 Transmit PLL division rate data

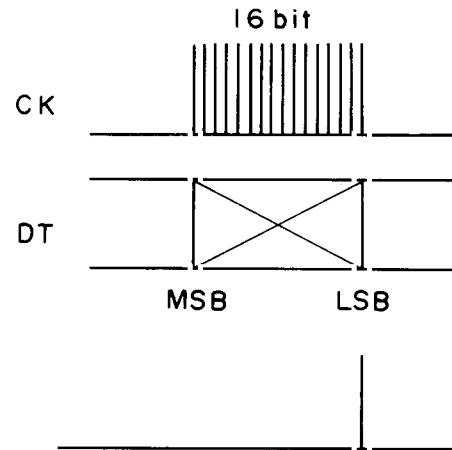


Fig. 17 Transmit reference division rate data

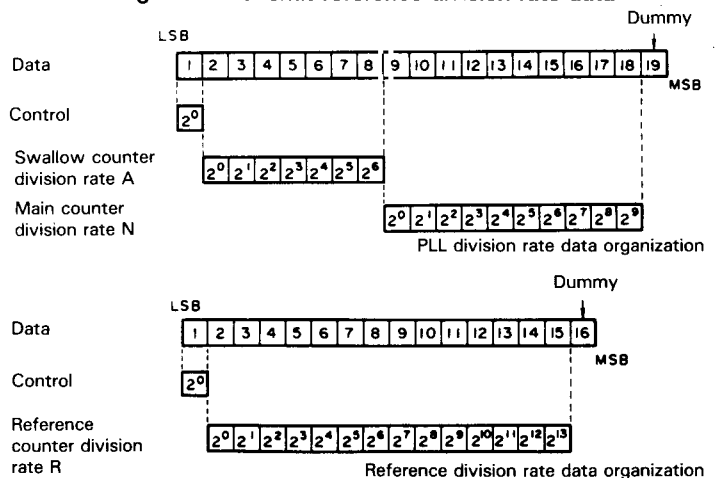


Fig. 18 Data Organization

$$F \text{ (for RX - 59.7 MHz)}$$

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

The reference frequency division rate (R) is available only when power is applied and the reference frequency (10 kHz or 12.5 kHz) is changed. (The order in which this data is supplied is first the reference division rate data followed by the PLL division rate data.)

CIRCUIT DESCRIPTION

• Power Switching, ALT, and Electronic Volume Control Output (When connected to the RC-10 Remote Controller)

The power switching (8R and 8T), ALT, and control output of the electronic volume control are written into the 8 bit shift register IC3 of the TX/RX unit and are applied through P92 (CK), P91 (DT), and P21 (ST) of the microprocessor. P92 (CK) and P91(DT) are also shared by the PLL data. The transmit data form and organization are shown in **Fig. 19** and **20**.

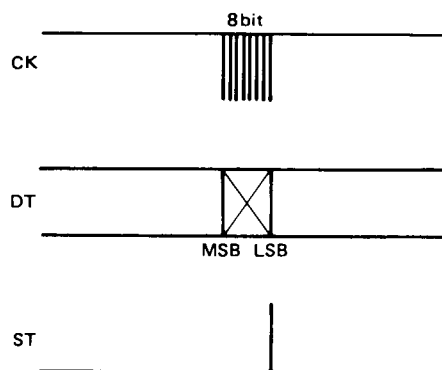


Fig. 19 Transmit Data form

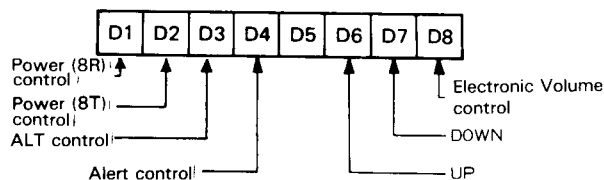


Fig. 20 Data Organization

D6-D8 function when the RC-10 is connected

• Tone Output

IC4 on the Control Unit is used in conjunction with inputs from the microprocessor on lines P40-43 and P50-53 to generate a total of 38 different tone frequencies. The internal structure of IC4 is shown in **Fig. 21**.

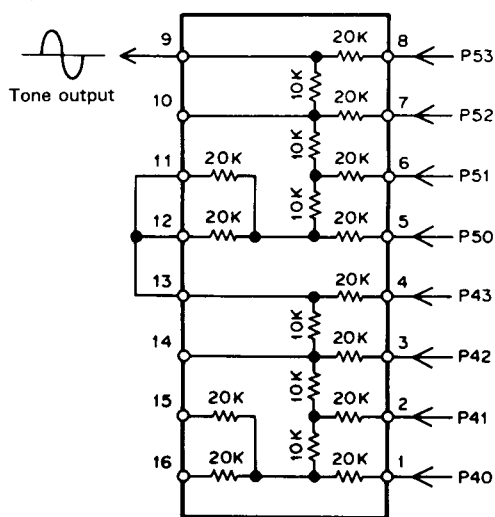


Fig. 21 Ladder resistance network: Control Unit IC4 (KRR-C001)

• S-Meter and RF Meter

An analog voltage that corresponds with the incoming receive signal is applied to the microprocessor on pin PTH00. Transmit RF Meter voltage and ALT indicator voltages (for RX) are applied to the microprocessor on pin PTH01. An internal 4 bit, 16 stage, analog to digital converter supplies control voltages to the LCD bar graph for display.

• BUSY Indicator

A low voltage is felt when the squelch is opened by an incoming receive signal to turn on the BUSY light.

• Input/output on the CTCSS unit (Optional)

Data for the CTCSS unit is available on pins P30, P31 and P61 of the microprocessor. The data form and organization is shown in **Fig. 22** and **23**. When the correct tone is detected on the receiver input the squelch is turned off, by means of the logic high applied to pin P32 of the microprocessor.

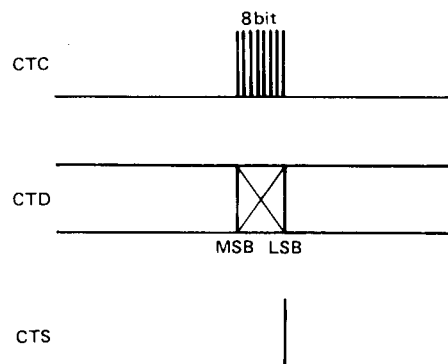
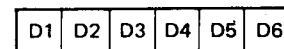


Fig. 22 Transmit form of the CTCSS data

Tone frequency select data of the CTCSS unit MN6520



Example: 88.5 Hz L H L H H H

Fig. 23 Organization of the CTCSS data

• Remote Control input/output (Optional RC-10)

When the RC-10 remote controller is attached a high is applied to the INTO print of the microprocessor. This signal causes the following to occur:

P03 → SI : Input terminal for serial data

P02 → SO : Output terminal for serial data

P01 → SCK: Serial data clock input/output terminal

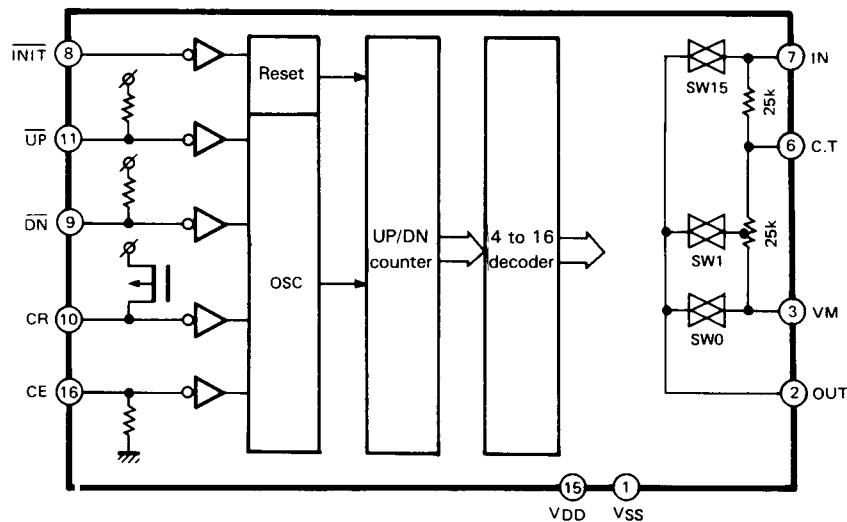
SEMICONDUCTOR DATA

Electronic Volume Control LC7532M (VOL IC1)

• Electrical characteristics

Item	Symbol	Condition	Standard value			Unit
			Minimum	Standard	Maximum	
Harmonic distortion factor	THD1	$V_{DD} = 3\text{ V}$, $R_L = 50\text{ k}\Omega$, $f = 1\text{ kHz}$, $V_R\text{ MAX}$, $V_{IN} = -20\text{ dBV}$		0.1	0.5	%
	THD2	$V_{DD} = 2.1\text{ V}$, $R_L = 50\text{ k}\Omega$, $f = 1\text{ kHz}$, $V_R\text{ MAX}$, $V_{IN} = -20\text{ dBV}$		0.3	1.0	%
Output	X OUT	$f = 1\text{ kHz}$, $R_L = 51\text{ k}\Omega$ for 0 dBm input		-95	-60	dB
Input impedance	R IN	UP, DN, CE	100		400	k Ω
Current consumption	IDD (1)	$V_{DD} = 3\text{ V}$, in operation		0.035	1	mA
	IDD (2)	$V_{DD} = 3\text{ V}$, CE = "L"		4		μA

• Block diagram



MGF1502

Test item	Symbol	Condition	Allowable value			Unit
			Minimum	Standard	Maximum	
Gate-source breakdown voltage	V (BR) GSO	$I_G = -100\text{ }\mu\text{A}$	-6			V
Gate-drain breakdown voltage	V (BR) GDO	$I_G = -100\text{ }\mu\text{A}$	-6			V
Gate leakage current	I GSS	$V_{DS} = 0\text{ V}$ $V_{GS} = -3\text{ V}$			10	μA
Drain current	I DSS	$V_{DS} = 3\text{ V}$ $V_{GS} = 0\text{ V}$	15	35	80	mA
Gate-source cutoff voltage	V GS (off)	$V_{DS} = 3\text{ V}$, $I_D = 100\text{ }\mu\text{A}$	-0.3		-3.5	V
Mutual inductance	gm	$V_{DS} = 3\text{ V}$, $I_D = 10\text{ mA}$	10	25		mS
Power gain at minimum noise	GS	$V_{DS} = 3\text{ V}$, $I_D = 10\text{ mA}$, $f = 4\text{ GHz}$	10			dB
Minimum noise figure	NF min				1.5	dB

DESCRIPTION OF ELEMENTS

FINAL UNIT (X45-3200-00)

Element No.	Purpose, function	Operation, condition, compatibility
IC1	Power amplification	10 W
Q1	Power amplification (driver)	Power-up to the regulated input power of the power module (Q1)
D1	Temperature compensation for Q1 (idling)	Temperature correction for Q1 (driver)
D2	Protection against reverse voltage	
D3	Radio-frequency output voltage level detection	Radio-frequency output level and output control at the APC circuit detection
D4 ~ 7	Transmit/receive switch	ON when transmitting

CONTROL UNIT (X53-3160-XX) -11 : K, -61 : W

Element No.	Purpose, function	Operation, condition, compatibility
IC1	6 V AVR	
IC2	Reset IC	Reset output and low voltage detection
IC3	Microcomputer	Control of the whole set, especially frequency control
IC4	D-A conversion for the tone	Obtain the tone frequency after D-A conversion by IC3 (P40-43, 50-53)
Q1	Squelch switching	Squelch on/off control when connected to the RC-10 remote controller
Q2	Switching	Control of microcomputer backup detection
D1	Reverse current prevention	For protection when external voltages are present on the fifth pin of the microphone
D2 (1/2)	Microcomputer protection	Protection against damage by electrostatic surge
D2 (2/2)	Voltage drop	
D3 (1/2)	Reverse current prevention	Prevents reverse current from flowing into the backup circuit
D3 (2/2)	Reverse current prevention	Prevent the backup current from flowing into other circuits
D4	Microcomputer protection	Protection against damage by electrostatic surge

TX-RX UNIT (X57-3240-XX) -11 : K, -61 : W

Element No.	Purpose, function	Operation, condition, compatibility
IC1	8 V AVR	
IC2 (Absent)		
IC3	Shift register	Electronic volume, power switching (8R, 8T) and ALT
IC4	AF amplification	Speaker output
IC5	HIC (DRIVE)	Transmitter drive stage
IC6	DC-DC converter	Conversion from 8 V to 24 V
Q1, 2	Radio-frequency amplification	
Q3	First mixer	Change the received frequency into the first IF, 59.7 MHz
Q4	IF amplification	First IF frequency amplifier
Q5	Muting	When CTCSS is on, SQS is high, and when transmitting: On
Q6	8R switching	When receiving: On
Q7	8T switching	When transmitting: On
Q8	IF amplification	First IF frequency amplifier
Q9	Power switching	Power (CB) control
Q10	Ripple filter	
Q11	Constant voltage control	5 V power for the PLL system
Q12	Band switching	
Q13	Radio-frequency amplification	Amplifies the VCO to the required input level for the HIC (drive)
Q14	Radio-frequency amplification	Amplifies the VCO to the required input level for the first IC mixer Q3
Q15	HIC (drive) power switching	When PLL is locked: On
Q16	PLL unlock control	When PLL is locked: On

DESCRIPTION OF ELEMENTS

Element No.	Purpose, function	Operation, condition, compatibility
Q17	HIC (drive) power control	For high power: 0 V; for low power: 0.7 V
Q18	RF meter voltage setting control	For low power: On
Q19	HPF	Correction of AF frequency characteristics on reception
Q20	High/low power switching control	
Q21	DB voltage control	
Q22	Power switching control	8R, 8T switching
D1	Voltage setting	
D2	Reverse current prevention	Setting the Q5 and SQ circuits for AL on when receiving, and muting the AF line
D3	Reverse current prevention	Prevent the PF meter current from flowing into the microphone check current
D4	For starting Q10	
D5	For AVR	Setting standard voltage for the AVR circuit
D6	Voltage setting	
D7	For variation of the second local oscillator frequency	The second local oscillator voltage is variable according to the control voltage of the ALT circuit
D8	For variation of the second local oscillator frequency	The second local oscillator voltage is variable according to the control voltage of the ALT circuit
D9	For discriminator	The discriminator S-letter characteristics of the ALT circuit
D10	Temperature compensation	Temperature compensation of the APC circuit
D11	Switching characteristics	Shorten the recovery time of the 8R line when switching from receive to transmit

VCO UNIT (X58-3350-11)

Element No.	Purpose, function	Operation, condition, compatibility
IC101	Prescaler	
IC102	PLL	
IC103	Loop filter	
Q1	VCO	Oscillates between 590.15 and 649.995 MHz
Q2	Radio-frequency amplification	Increases the VCO output to the required level
Q101	Radio-frequency amplification	Increases the VCO output to the required level for the prescaler
D1	Varactor for frequency control	1299.990 MHz: 18.0 V
D2	Varactor for transmitter modulation	Applies FM modulation to VCO when transmitting
D3	Varactor for frequency control	Operates when BSW terminal is high
D4, 5	For band switching	On when BSW terminal is high
D101	For UNLOCK detection	

APC (X59-3130-00)

Element No.	Purpose, function	Operation, condition, compatibility
Q1	Differential amplification	
Q2 (1/2)	Protection control	Regulating at VR5
Q2 (2/2)	APC control	Regulating at VR6
Q3	Drive stage + B AVR	

IF (X59-3140-00)

Element No.	Purpose, function	Operation, condition, compatibility
IC1	Second local oscillation, mixer, IF amplification quadrature detection, and noise amplification	S-meter output Noise amplification (first stage) output Detection output First IF signal input

DESCRIPTION OF ELEMENTS

SQL (X59-3150-00)

Element No.	Purpose, function	Operation, condition, compatibility
Q1	Noise amplification	
Q2	Squelch switching	On when squelch is on
Q3, 4	DC amplification	Off when squelch is on
Q5	Audio-frequency amplification	For the RD terminal
Q6	Audio-frequency amplification	Off when squelch is on
D1	Squelch noise rectification	
D2	Base bias setting	

MIC (X59-3160-00)

Element No.	Purpose, function	Operation, condition, compatibility
IC1 (1/2)	Audio-frequency amplification	① Output ② Input
IC1 (2/2)	Audio-frequency amplification	For microphone check ⑥ Input ⑦ Output
IC2 (1/2)	Limiter amplification	① Output ② Input
IC2 (2/2)	LPF	⑥, ⑦ Output

VOL (X59-3170-00)

Element No.	Purpose, function	Operation, condition, compatibility
IC1	Electronic volume 16 steps The sixth step from the bottom when initializing	② Output ⑦ Input ⑧ Initial terminal Step 6 when low ⑨ Step up when low (volume up) ⑪ Step down when low (volume down) ⑬ High when in operation
IC2	Bi-lateral switch (4 circuits)	Control ⑬ between ① and ② Control ⑤ between ③ and ④ Control ⑥ between ⑧ and ⑨ Control ⑫ between ⑩ and ⑪
Q1	Bi-lateral switch changing	Electronic volume control in operation when on
Q2	Switching	Step down when on
Q3	Switching	Step up when on
D1	Voltage drop	

AFC (X59-3410-00)

Element No.	Purpose, function	Operation, condition, compatibility
IC1	DC amplification, voltage follower	Amplify the DC output voltage and stabilize the center voltage
IC2	Bi-lateral switch (4 circuits)	Switching of the RM line signal and the varicap control voltage SW1 For TX: Connects the microphone check signal to the RM line SW2 For RX: Connects the DC voltage signal for the tuning indicator to the RM line SW3 When ALT is on: Applies the DC amplifier output to the varicap diode SW4 When ALT is off: Applies the center voltage (fixed to the varicap diode)
IC3	Switching control of IC2	Controls the two circuits in IC2 through the 4094 output When ALT is on (④, ⑤) "L" ① "H" When ALT is off (④, ⑤) "H" ① "L"

DESCRIPTION OF ELEMENTS

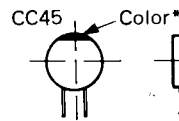
Element No.	Purpose, function	Operation, condition, compatibility
Q1	Radio-frequency amplification	Amplifies the second IF (455 kHz) from L14
Q2	Switching control of IC2	Control of the two circuits within IC2 through 8R For TX: Tr turns off and the collector terminal is high For RS: Tr turns on and the collector terminal is low

HIC (KCB01)

Element No.	Purpose, function	Operation, condition, compatibility
Q1 ~ 3	Radio-frequency amplification	
D1	Temperature compensation	Temperature compensation for the base current of Q3

CAPACITORS

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



Capacitor value

1 0 3 = 0.01 μ F .

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

- 0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001 μ F

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 $\pm$ 60 ppm/°C

Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+40 -20	+80 -20	+100 -0	More than Less than 10 μ F - 10 ~ +50 4.7 μ F - 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	A	B	C	D	E	F	G	H	J	K	V
1st word	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

(EX) CC 73 F SL 1H 000 J
1 2 3 4 5 6 7
(Chip) (CH, RH, UJ, SL)
(EX) CK 73 F F 1H 000 J
1 2 3 4 5 6 7
(Chip) (B, F)

Refer to the table above.

Dimension

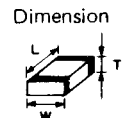
Dimension code	L	W	T
Empty	5.6 $\pm$ 0.5	5.0 $\pm$ 0.5	Less than 2.0
E	3.2 $\pm$ 0.2	1.6 $\pm$ 0.2	Less than 1.25
F	2.0 $\pm$ 0.3	1.25 $\pm$ 0.2	Less than 1.25

Dimension

Dimension code	L	W	T	Wattage
E	3.2 $\pm$ 0.2	1.6 $\pm$ 0.2	0.57	2B
F	2.0 $\pm$ 0.3	1.25 $\pm$ 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				



RESISTORS

Chip resistor (Carbon)

(EX) RD 73 E B 28 000 J
1 2 3 4 5 6 7
(Chip) (B, F)

Carbon resistor (Normal type)

RD 14 B B 28 000 J
1 2 3 4 5 6 7

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

PARTS LIST

SEMICONDUCTORS LIST

N: New Parts

Item	Re- marks	Parts No.
Diode	N	DLS1585 DLS7585 DSA3A1
	N	HSK151 HSK277 MI407 MI308
	N	MA713
Chip diode		1SS184 1SS181 1SS196 1SS226
Chip zener diode		02CE3.6 (Y, Z) 02CE6.2 (Y, Z)
Chip vari- cap diode		1SV166 1SV209
	N	1T32T HSK277
	N	HVR12
Thermister		112-502-R 112-351-2
TR		2SC2558 (K) 2SD1406 (Y)
Chip TR		2SA1162 (Y) 2SB1119S 2SC2712 (Y) 2SC2714 (Y)

Item	Re- marks	Parts No.
Chip TR		2SC3356 2SC3295 2SC3326 (A) 2SC4093 2SD1624S FMW1 IMH2
	N	
Digital TR		DTA114EK DTC124EK DTC144EK
FET	N	MGF1502
Chip FET		3SK184 (Q) 2SK508 (K51)
IC		KCB01 KRR-C001 LA5006M LC7532M
	N	M67711 M51951BML MB506PF MB87006APF MC7808C MC1409BF MN4066BS NJM4558M NJM2904M μ A7808 μ PC124H
Microproses- sor	N	75106G-531-1B

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* New Parts

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
TM-521A/E						
1	1B		A01-1021-03	METALLIC CABINET(TOP)		
2	2B		A01-1022-03	METALLIC CABINET(BOTTOM)		
4	1A	*	A20-2649-02	PANEL ASSY	K	
4	1A	*	A20-2650-02	PANEL ASSY	W	
		*	A20-2574-03	PANEL		
		*	A13-0651-13	STACK PLATE (ACSY)		
		*	B40-3803-04	MODEL NAME PLATE	K	
		*	B40-3804-04	MODEL NAME PLATE	W	
9	2A		B11-0442-04	FILTER		
11	2A	*	B38-0307-05	LCD ASSY		
14	1B		B42-2455-04	LABEL (M4X8 MAX)		
		*	B10-1106-03	FRONT GLASS	K	
		*	B10-1107-03	FRONT GLASS	W	
			B11-0446-14	FILTER		
			B46-0410-20	WARRANTY CARD	K	
			B46-0419-00	WARRANTY CARD	W	
		*	B50-8221-00	INSTRUCTION MANUAL		
			E30-2053-05	DC CORD ASSY (ACSY)		
			E31-3224-05	CONNECTING WIRE		
			E31-3239-15	CONNECTING WIRE(FOR SP)		
30	2B		F20-0587-04	INSULATING PLATE(BATT)		
31	2A		F20-0521-04	INSULATING PLATE(BATT)		
32	2A		F29-0431-05	INSULATOR (VOL,SOL)		
			F05-2036-05	FUSE FOR DC CORD ASSY(20A)		
			F05-8021-05	FUSE (8A) ACSY		
			G13-0838-04	CUSHION		
			G13-0847-04	CUSHION		
			G13-0853-04	CUSHION (LCD)		
			G13-0855-04	CUSHION	W	
			G53-0537-04	PACKING (SPEAKER)		
36	1A		G09-0405-05	SPRING (FOR KNOB)		
37	1B, 2B		G10-0604-04	FELT (CABINET)		
38	1B		G10-0651-04	FELT (SPEAKER)		
40	2A		G13-0839-04	CUSHION (KNOB)		
41	1A		G53-0508-04	FELT (PANEL, FRAME)		
42	1B		G13-0845-04	CUSHION (SPEAKER)		
43	2A		G10-0659-14	FELT (SUB PANEL)		
		*	H01-8171-04	ITEM CARTON BOX	K	
		*	H01-8172-04	ITEM CARTON BOX	W	
			H10-2627-02	POLYSTYRENE FOAMED FIXTURE		
			H13-0812-04	POLYSTYRENE FOAMED PLATE		
			H13-0814-04	PROTECTION PLATE		
			H25-0029-04	PROTECTION BAG	K	
			H25-0049-03	PROTECTION BAG (DC CORD)		
			H25-0720-04	PROTECTION BAG (MIC HOOK, SCREW)		
60	2A		J31-0141-04	COLLAR (MIC)		
61	1B		J19-1422-14	HOLDER (SP)		
			J20-0319-24	MIC HOOK (ACSY)	K	
			J21-4147-14	MOUNTING HARDWARE		
			J29-0416-03	WIRING BOARD		
			J61-0307-05	WIRE BAND		

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

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

UE: AAFES(Europe) X: Australia

TM-521A : K

TM-521E : W

⚠ indicates safety critical components.

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※ New Parts

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64	1A		K27-0496-04	KNØB(BUTTON) POWER, LOW		
66	2A		K29-3058-04	KNØB (MHZ, VFO/M, M. IN)		
67	1A		K29-3060-04	KNØB (MAIN)		
68	1A		K29-3061-04	KNØB (VOL, SOL)		
69	1A		K29-3069-04	KNØB ASSY (SHIFT)		
70	1A		K29-3065-04	KNØB (REV)		
71	1A		K29-3067-04	KNØB (SCAN)		
72	1A		K29-3068-04	KNØB ASSY (CTCSS)	K	
73	1A		K29-3070-04	KNØB ASSY (TONE)		
-			K29-3057-14	KNØB RING		
-		*	K29-3140-04	KNØB ASSY (ALT)	W	
-			N46-3010-46	PAN HEAD TAPPING SCREW	K	
-			N99-0318-05	SCREW SET		
A	1B, 1C		N32-2604-46	FLAT HEAD MACHINE SCREW		
B	2A		N87-2606-46	BRAZIER HEAD TAPTITE SCREW(PCB		
C	2A, 2B		N89-2606-46	BINDING HEAD TAPTITE SCREW		
D	1B, 2B		N33-2606-45	OVAL HEAD MACHINE SCREW(CASE)		
G	1B, 2B		N09-2020-05	SCREW		
-			S50-1406-05	TACT SWITCH (MIC)	W	
85	1B		T07-0246-05	LOUDSPEAKER(FULLRANGE)		
86	2D		T91-0359-05	MICROPHONE	K	
-			T91-0365-15	MICROPHONE	W	
94	2A		LC7582	IC(LCD DRIVER)ONE (DTMF)		
99	1C	*	W09-0326-05	LITHIUM BATTERY		
100	2A	*	X45-3200-00	PA UNIT		
100	2A	*	X53-3160-11	CONTRØL UNIT	K	
100	2A	*	X53-3160-61	CONTRØL UNIT	W	
101	2B	*	X57-3240-11	TX-RX UNIT	K	
101	2B	*	X57-3240-61	TX-RX UNIT	W	
FINAL UNIT (X45-3200-00)						
C1 -4			CC73FCH1H020C	CHIP C 2.0PF C		
C5			CC73FCH1H030C	CHIP C 3.0PF C		
C6			CC73FSL1H101J	CHIP C 100PF J		
C7			C90-0868-05	ELECTRØ 10UF 16WV		
C8			CC73FSL1H101J	CHIP C 100PF J		
C9			CK73FB1H102K	CHIP C 1000PF K		
C11			C90-0868-05	ELECTRØ 10UF 16WV		
C12 ,13			CK73FB1H102K	CHIP C 1000PF K		
C14 ,15			C90-0868-05	ELECTRØ 10UF 16WV		
C16			CK73FB1H471K	CHIP C 470PF K		
C17 ,18			CK73FB1H102K	CHIP C 1000PF K		
C19			CC73FCH1H010C	CHIP C 1.0PF C		
C20			CC73FCH1H100D	CHIP C 10PF D		
C21 -23			CK73FB1H471K	CHIP C 470PF K		
C24			CM73F2H010C	CHIP C 1.0PF C		
C25			CM73F2H470J	CHIP C 47PF J		
C26			CM73F2H010C	CHIP C 1.0PF C		
J1			E11-0401-05	PHONE JACK (EXT. SP)		
W1 ,2		*	E31-3368-05	COAX CABLE WIRE(DA,DB)		
W3		*	E31-3370-05	CONNECTING WIRE(FB,DB)		
W4			E31-3371-05	CONNECTING WIRE(8T,PC)		

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

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TM-521A : K

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W5 W6 W7	1C 1C	* *	E31-3372-05 E30-2108-05 E30-2114-05	CONNECTING WIRE (AP, SP, B1) ANT. CABLE DC CORD		
A1 A2 F1	1C 2B 1C	* *	F01-0959-02 F11-1099-04 F05-8021-05	HEAT SINK SHIELDING COVER FUSE (8A)		
— A3 A4	— — 1C	* *	J61-0307-05 J21-4233-04 J41-0033-05	WIRE BAND MOUNTING HARDWARE BUSHING		
— — E F	— — 1B 1B		N87-2606-41 N87-2606-46 N30-3012-41 N32-2604-41	BRAZIER HEAD TAPTITE SCREW (ANT) BRAZIER HEAD TAPTITE SCREW PAN HEAD MACHINE SCREW FLAT HEAD MACHINE SCREW		
R1 R2 R3 R4 R5			RK73FB2A220J R92-1201-05 R92-0699-05 RK73FB2A472J RK73FB2A470J	CHIP R 22 J 1/10W SOLID 220 1/2W SOLID 10 1/2W CHIP R 4.7K J 1/10W CHIP R 47 J 1/10W		
R6			R92-0700-05	SOLID 180 1/2W		
D1 D2 D3 D4 D5		* *	DLS1585 DSA3A1 HSK151 MI407 MI308	DIODE DIODE DIODE DIODE DIODE		
D7 IC1 DI			MI407 M67711 2SC2558K	DIODE POWER MODULE TRANSISTOR		
CONTROL UNIT (X53-3160-XX) -11 : K, -61 : W						
C1 C3 C5 C15 C16	.2 .4 -14		CK73FB1H103K CC73FCH1H330J CK73FB1H102K CE04CW1C100M CK73FB1H103K	CHIP C 0.010UF K CHIP C 33PF J CHIP C 1000PF K ELECTR 10UF 16WV CHIP C 0.010UF K		
C17			CK73EF1C105Z	CHIP C 1.0UF Z		
L1			E06-0858-15 E31-3231-05 E31-3238-05 E40-1878-05	8P METAL SOCKET CONNECTING WIRE CONNECTING WIRE (CTCSS) PIN CONNECTOR (18P)	K	
R1 R2 R6 R7 R8	—5 —9		L77-1313-05 RD41FB2B563J RD41FB2B105J RD41FB2B104J RD41FB2B105J RD41FB2B104J	CRYSTAL RESONATOR (4.194304MHZ) CYLND CHIP R 56K J 1/8W CYLND CHIP R 1.0M J 1/8W CYLND CHIP R 100K J 1/8W CYLND CHIP R 1.0M J 1/8W CYLND CHIP R 100K J 1/8W		
R10 R14 R15 R16 R17	-13 —18		RD41FB2B473J RD41FB2B2R2J RD41FB2B103J RD41FB2B473J RD41FB2B474J	CYLND CHIP R 47K J 1/8W CYLND CHIP R 2.2 J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 470K J 1/8W		
R19 R26			RD41FB2B472J RD41FB2B102J	CYLND CHIP R 4.7K J 1/8W CYLND CHIP R 1.0K J 1/8W		

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VR1 VR2			R05-3441-05 R05-4420-05	POTENTIOMETER (10K) POTENTIOMETER (50K)		
S1 -8 S9 ,10			S40-1086-05 S40-2458-05	PUSH SWITCH PUSH SWITCH		
D1 -4 IC1 IC2 IC3 IC4		*	1SS184 LA5006M MS19S1BML 75106G-531-1B KRR-C001	DIODE IC(LOW SATURATION REGULATOR) IC(SYSTEM RESET) IC(MICROPROCESSOR) IC(CHIP NETWORK)		
Q1 Q2			DTC124EK 2SC2712(Y)	DIGITAL TRANSISTOR TRANSISTOR		
-			WD2-0388-05	ROTARY ENCODER		
TX-RX UNIT (X57-3240-XX) -11 : K, -61 : W						
C1 C2 C3 C4 C5			CC73FCH1H1R5C CC73FSL1H470J CC73FCH1HR75C CK73FB1H102K CC73FSL1H470J	CHIP C 1.5PF C CHIP C 47PF J CHIP C 0.75PF C CHIP C 1000PF K CHIP C 47PF J		
C6 C7 C8 C9 C10			CK73FB1H102K CC73FSL1H470J CK73FB1H103K CK73FB1H102K CK73FB1H103K	CHIP C 1000PF K CHIP C 47PF J CHIP C 0.010UF K CHIP C 1000PF K CHIP C 0.010UF K		
C11 C12 C13 C14 C15			CC73FCH1H020C CC73FCH1H1R5C CC73FSL1H470J CC73FCH1HR75C CK73FB1H102K	CHIP C 2.0PF C CHIP C 1.5PF C CHIP C 47PF J CHIP C 0.75PF C CHIP C 1000PF K		
C16 C17 C19 C20 C21			CC73FSL1H470J CK73FB1H102K CK73FB1H103K CK73FB1H102K CK73FB1H103K	CHIP C 47PF J CHIP C 1000PF K CHIP C 0.010UF K CHIP C 1000PF K CHIP C 0.010UF K		
C22 C23 C24 C25 C26			CC73FCH1H020C CC73FCH1H030C CC73FCH1H020C CC73FSL1H101J CK73FB1H102K	CHIP C 2.0PF C CHIP C 3.0PF C CHIP C 2.0PF C CHIP C 100PF J CHIP C 1000PF K		
C28 C29 C30 C31 C32			CE04EW1A470M CK73FB1H103K CK73FB1H102K CE04EW1C100M CK73EF1C105Z	ELECTRO 47UF 10WV CHIP C 0.010UF K CHIP C 1000PF K ELECTRO 10UF 16WV CHIP C 1.0UF Z		
C34 ,35 C36 ,37 C38 ,39 C40 C41			CE04EW1A470M CK73EB1E104K CK73FB1H102K CE04EW1A470M CK73EB1E473K	ELECTRO 47UF 10WV CHIP C 0.10UF K CHIP C 1000PF K ELECTRO 47UF 10WV CHIP C 0.047UF K		
C42 C43 C44 C45 C47			CE04EW1A470M CK73FB1H103K CK73EF1C105Z CK73FB1H272K CK73FB1H103K	ELECTRO 47UF 10WV CHIP C 0.010UF K CHIP C 1.0UF Z CHIP C 2700PF K CHIP C 0.010UF K		

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C48			C92-Q501-05	CHIP TAN	1.5UF	6.3WV
C49			CE04EW1A470M	ELECTR0	47UF	10WV
C50			CK73FB1H103K	CHIP C	0.010UF	K
C51			CK73FB1H102K	CHIP C	1000PF	K
C52			CC73FCH1H080D	CHIP C	8.0PF	D
C53 -58			CK73FB1H102K	CHIP C	1000PF	K
C59			CC73FUJ1H330J	CHIP C	33PF	J
C60			CK73FB1H103K	CHIP C	0.010UF	K
C61			CC73FUJ1H330J	CHIP C	33PF	J
C62			CC73FUJ1H221J	CHIP C	220PF	J
C63			CK73EB1E104K	CHIP C	0.10UF	K
C64			CE04EW1C100M	ELECTR0	10UF	16WV
C64			CK73FB1H103K	CHIP C	0.010UF	K
C65			CK73FB1H562K	CHIP C	5600PF	K
C66 ,67			CK73FB1H103K	CHIP C	0.010UF	K
C68			CE04EW1A221M	ELECTR0	220UF	10WV
C69			CK73FB1H103K	CHIP C	0.010UF	K
C70			CE04EW1A221M	ELECTR0	220UF	10WV
C71			CK73FB1H102K	CHIP C	1000PF	K
C72			CC73FSL1H101J	CHIP C	100PF	J
C73 ,74			CK73FB1H102K	CHIP C	1000PF	K
C74			CK73FB1H103K	CHIP C	0.010UF	K
C75			CC73FSL1H470J	CHIP C	47PF	J
C76			CC73FCH1H030C	CHIP C	3.0PF	C
C77			CC73FCH1H090D	CHIP C	9.0PF	D
C78			CC73FCH1H030C	CHIP C	3.0PF	C
C79			CC73FCH1H100D	CHIP C	10PF	D
C80			CC73FCH1H020C	CHIP C	2.0PF	C
C81 ,82			CK73EF1C105Z	CHIP C	1.0UF	Z
C83			CK73FB1E333K	CHIP C	0.033UF	K
C84 -86			CE04EW1A470M	ELECTR0	47UF	10WV
C87			C90-2074-05	ELECTR0	470UF	10WV
C88			CK73EB1E104K	CHIP C	0.10UF	K
C89			C90-2033-05	ELECTR0	1000UF	16WV
C90			CK73FB1H103K	CHIP C	0.010UF	K
C91			C90-2033-05	ELECTR0	1000UF	16WV
C92 ,93			CC73FSL1H101J	CHIP C	100PF	J
C94			CC73FCH1H010C	CHIP C	1.0PF	C
C95			CC73FCH1H100D	CHIP C	10PF	D
C96			CC73FCH1H030C	CHIP C	3.0PF	C
C97			CC73FCH1H020C	CHIP C	2.0PF	C
C98			CC73FCH1H030C	CHIP C	3.0PF	C
C99			CE04EW1C101M	ELECTR0	100UF	16WV
C100,101			CK73FB1H102K	CHIP C	1000PF	K
C102			CC73FSL1H101J	CHIP C	100PF	J
C103,104			CK73FB1H102K	CHIP C	1000PF	K
C105			CC73FCH1H030C	CHIP C	3.0PF	C
C106			CE04EW1C220M	ELECTR0	22UF	16WV
C107			C92-0004-05	CHIP TAN	1UF	16WV
C108,109			CK73FB1H562K	CHIP C	5600PF	K
C110			CK73EB1E104K	CHIP C	0.10UF	K
C111			CC73FSL1H101J	CHIP C	100PF	J
C112			CK73FB1H102K	CHIP C	1000PF	K
C113-115			CK73FB1H103K	CHIP C	0.010UF	K
C116			CK73FB1H102K	CHIP C	1000PF	K

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C117-119 C120,121 C122-124 C125 C126,127			CC73FSL1H101J CK73FB1H102K CC73FSL1H101J CK73FB1H562K CC73FSL1H101J	CHIP C 100PF J CHIP C 1000PF K CHIP C 100PF J CHIP C 5600PF K CHIP C 100PF J		
C128 C130 C131,132 C133 C134-136			CK73FB1H103K CC73FSL1H101J CE04EW1C100M CE04EW1A470M CC73FSL1H101J	CHIP C 0.010UF K CHIP C 100PF J ELECTR0 10UF 16WV ELECTR0 47UF 10WV CHIP C 100PF J		
C138 C139,140			CK73FB1H103K CC73FSL1H101J	CHIP C 0.010UF K CHIP C 100PF J		
J1 J2 J3			E23-0465-05 E31-3237-05 E40-5016-05 E40-3237-05 E40-3238-05	TERMINAL CONNECTING WIRE PIN CONNECTOR (2P) PIN CONNECTOR PIN CONNECTOR	K K	
J4 J5 J6 J7 .8 J9 -11			E40-3237-05 E40-3238-05 E40-3237-05 E40-5099-05 E04-0154-05	PIN CONNECTOR PIN CONNECTOR PIN CONNECTOR PIN CONNECTOR (SSQ-9) MINI PIN SOCKET		
W3 .4 W5			E33-1826-00 E33-1824-00	FINISHED WIRE SET FINISHED WIRE SET		
			F10-1379-04 602-0551-14	SHIELDING PLATE SPRING		
			J21-4135-04 J30-0545-05	MOUNTING HARDWARE SPACER (FOR L11)		
L1 L2 L3 .4 L5 L6			L77-1376-05 L40-5682-19 L79-0827-05 L40-5682-19 L34-2034-05	TCX0 (12.8MHZ) SMALL FIXED INDUCTOR(0.56UH) HELICAL COIL SMALL FIXED INDUCTOR(0.56UH) COIL (VX0)		
L7 L8 L10 L11 L12		*	L34-4087-05 L71-0280-05 L40-1001-81 L77-1375-05 L30-0538-05	COIL (59.7MHZ) MCF (59.7MHZ) SMALL FIXED INDUCTOR(10UH) CRYSTAL RESONAT(59.245MHZ) IFT (455KHZ)		
L13 L14 L15			L72-0366-05 L30-0538-05 L79-0446-05	CERAMIC FILTER (CFWM455E) IFT (455KHZ) CERAMIC DISCRI (CFY455S)		
			N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
R1 R2 R3 R4 R5 .6			RD41FB2B820J RD41FB2B221J RD41FB2B560J RD41FB2B221J RD41FB2B471J	CYLND CHIP R 82 J 1/8W CYLND CHIP R 220 J 1/8W CYLND CHIP R 56 J 1/8W CYLND CHIP R 220 J 1/8W CYLND CHIP R 470 J 1/8W		
R7 R8 R9 R10			RD41FB2B560J RD41FB2B151J RD41FB2B103J RD41FB2B101J	CYLND CHIP R 56 J 1/8W CYLND CHIP R 150 J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 100 J 1/8W		

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R11			R92-0687-05	CHIP R 0.0HM		
R12			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
R13			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R14			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R15			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R17, 18			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W	W	
R19			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R20			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R21			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R22			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R23			RD41FB2B105J	CYLND CHIP R 1.0M J 1/8W		
R24			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R25			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R26			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R27			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R29, 30			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R32			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R33			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R34			RD41FB2B104J	CYLND CHIP R 100K J 1/8W	K	
R34			R92-0687-05	CHIP R 0.0HM	W	
R35			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R38			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R39			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R40			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R41			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
R42			RD41FB2B220J	CYLND CHIP R 22 J 1/8W		
R43			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R44			RD41FB2B220J	CYLND CHIP R 22 J 1/8W		
R45			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R46			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R47, 48			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R49			RD41FB2B560J	CYLND CHIP R 56 J 1/8W		
R50			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R55			R92-0687-05	CHIP R 0.0HM		
R56			RD41FB2B180J	CYLND CHIP R 18 J 1/8W		
R57			RD41FB2B331J	CYLND CHIP R 330 J 1/8W		
R58			RD41FB2B180J	CYLND CHIP R 18 J 1/8W		
R59			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R60			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R62			RD41FB2B151J	CYLND CHIP R 150 J 1/8W		
R63			RD41FB2B180J	CYLND CHIP R 18 J 1/8W		
R64			RD41FB2B331J	CYLND CHIP R 330 J 1/8W		
R65			RD41FB2B180J	CYLND CHIP R 18 J 1/8W		
R66			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R67			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R69			RD41FB2B151J	CYLND CHIP R 150 J 1/8W		
R70			RD41FB2B153J	CYLND CHIP R 15K J 1/8W		
R71			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R72			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R74			R92-0687-05	CHIP R 0.0HM		
R75			R92-0687-05	CHIP R 0.0HM		
R76			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R77			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R79			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R80			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		

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R81			RD41FB2B3R3J	CYLND CHIP R 3.3 J 1/8W		
R82 ,83			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R84			RD41FB2B333J	CYLND CHIP R 33K J 1/8W		
R85 -87			R92-0687-05	CHIP R 0 0HM		
R88			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R89			RD41FB2B224J	CYLND CHIP R 220K J 1/8W		
R90			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R91			RD41FB2B224J	CYLND CHIP R 220K J 1/8W		
R92			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R93			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R94			R92-0687-05	CHIP R 0 0HM		
R96 ,97			R92-0687-05	CHIP R 0 0HM		
R98			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R99			RD41FB2B474J	CYLND CHIP R 470K J 1/8W		
R100			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R101			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R102,103			R92-0687-05	CHIP R 0 0HM		
R104			RD41FB2B223J	CYLND CHIP R 22K J 1/8W	W	
R106			R92-0687-05	CHIP R 0 0HM		
R107			R92-0687-05	CHIP R 0 0HM	W	
R108			R92-0687-05	CHIP R 0 0HM		
R109			RD41FB2B560J	CYLND CHIP R 56 J 1/8W		
R110			RD41FB2B153J	CYLND CHIP R 15K J 1/8W		
R111-113			R92-0687-05	CHIP R 0 0HM		
VR1			R12-5419-05	TRIMMING PNT. (220K)		
VR2		*	R12-1433-05	TRIMMING PNT. (4.7K)		
VR3 ,5			R12-3096-05	TRIMMING PNT. (10K)	K	
VR4 ,5		*	R12-3096-05	TRIMMING PNT. (10K)	W	
VR6			R12-5046-05	TRIMMING PNT. (10K)		
W1 ,2			R92-0150-05	JUMPER REST 0 0HM		
W6 ,7			R92-0150-05	JUMPER REST 0 0HM	W	
W7			R92-0150-05	JUMPER REST 0 0HM	K	
D1			02C23.6(Y,Z)	ZENER DIODE		
D2			1SS181	DIODE		
D3 ,4			1SS196	DIODE		
D5			02C26.2(Y,Z)	ZENER DIODE		
D6			02C23.6(Y,Z)	ZENER DIODE		
D7 ,8			1SV166	DIODE		
D9		*	MA713	DIODE		
D10 ,11			1SS196	DIODE		
IC1			MC7808C	IC(VOLTAGE REGULATOR/ +14V)		
IC3		*	MC14094BF	IC(8-ST SHIFT/STORE REGISTER)		
IC4			UPC1241H	IC		
IC5			KCB01	IC(DRIVE AMP)		
Q1 ,2		*	MGF1502	FET		
Q3			3SK184(R)	CHIP FET		
Q4			2SC2714(Y)	CHIP TRANSISTOR		
Q5			2SC3326(A)	CHIP TRANSISTOR		
Q6 ,7			2SB1119S	CHIP TRANSISTOR		
Q8			2SC2714(Y)	CHIP TRANSISTOR		
Q9			2SD1624S	CHIP TRANSISTOR		
Q10 ,11			2SC2712(Y)	CHIP TRANSISTOR		
Q12			DTC144EK	DIGITAL TRANSISTOR		
Q13 ,14			2SC3356	CHIP TRANSISTOR		

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Q15 Q16 Q17 Q18 Q19			2SA1162(Y) 2SC2712(Y) 2SA1162(Y) DTC144EK 2SC2712(Y)	CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR DIGITAL TRANSISTOR CHIP TRANSISTOR		
Q20 Q21 Q22 TH1 TH2			1MH2 2SD1406(Y) 1MH2 112-502-2 112-351-2	DIGITAL TRANSISTOR CHIP TRANSISTOR DIGITAL TRANSISTOR THERMISTOR (5K) THERMISTOR (350)		
IC6			W02-0818-05	MODULE UNIT (DC-DC CONV)		
		*	X58-3350-11 X59-3130-00 X59-3140-00 X59-3150-00 X59-3160-00	SUB UNIT (VCO) MODULE UNIT (APC) MODULE UNIT (IF) MODULE UNIT (SQ) MODULE UNIT (MIC)		
		*	X59-3170-00 X59-3410-00	MODULE UNIT (VSL) MODULE UNIT (AFC)		
SUB UNIT (X58-3350-11)						
C1 C2 C3 C4 C5			CK73FB1H102K CC73FCH1H0R5C CC73FCH1H030C CC73FCH1H060D CC73FCH1H040C	CHIP C 1000PF K CHIP C 0.5PF C CHIP C 3.0PF C CHIP C 6.0PF D CHIP C 4.0PF C		
C6 C7 C9 ,10 C11 C12			CC73FCH1H0R5C CC73FSL1H470J CK73FB1H471K CC73FSL1H101J CK73FB1H102K	CHIP C 0.5PF C CHIP C 47PF J CHIP C 470PF K CHIP C 100PF J CHIP C 1000PF K		
C13 C14 C15 ,16 C17 ,18 C19			CK73FB1H103K CC73FSL1H101J CC73FCH1H070D CC73FCH1H020C CC73FCH1H040C	CHIP C 0.010UF K CHIP C 100PF J CHIP C 7.0PF D CHIP C 2.0PF C CHIP C 4.0PF C		
C21 -24 C101 C102 C103,104 C105,106			CK73FB1H102K CC73FCH1H070D CC73FCH1H020C CC73FCH1H030C CC73FSL1H101J	CHIP C 1000PF K CHIP C 7.0PF D CHIP C 2.0PF C CHIP C 3.0PF C CHIP C 100PF J		
C107 C108 C109 C109,110 C111,112			CK73FB1H103K CK73EB1H102K CK73FB1H103K CK73FB1H102K C92-0001-05	CHIP C 0.010UF K CHIP C 1000PF K CHIP C 0.010UF K CHIP C 1000PF K CHIP TAN 0.1UF 35WV		
C113 C114,115 C116 C117 C118			CK73FB1E393K C92-0504-05 CK73FB1E393K C92-0502-05 C92-0003-05	CHIP C 0.039UF K CHIP-TAN 0.68UF 20WV CHIP C 0.039UF K ELECTR 0.33UF 35WV CHIP TAN 0.47UF 25WV		
C120 C121 C122 TC1			C92-0001-05 CC73FSL1H101J CK73EB1E473K C05-0362-05	CHIP TAN 0.1UF 35WV CHIP C 100PF J CHIP C 0.047UF K TRIMMING CAP (3PF)		

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J1		*	E40-5162-05	PIN CONNECTOR (3P)		
J2			E40-5047-05	PIN CONNECTOR (4P)		
J101			E40-5158-05	PIN CONNECTOR (4P)		
J102		*	E40-5161-05	PIN CONNECTOR (3P)		
L1		*	L33-0713-05	CHOKe COIL (180NH)		
L2			L40-1081-80	SMALL FIXED INDUCTOR(100NH)		
L3			L40-1881-80	SMALL FIXED INDUCTOR(180NH)		
E120			RK73FB2A221J	CHIP R 220 J 1/10W		
R1			RK73FB2A103J	CHIP R 10K J 1/10W		
R2			RK73FB2A470J	CHIP R 47 J 1/10W		
R3			RK73FB2A121J	CHIP R 120 J 1/10W		
R6			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R7			RK73FB2A223J	CHIP R 22K J 1/10W		
R8			RK73FB2A4R7J	CHIP R 4.7 J 1/10W		
R9			RK73FB2A223J	CHIP R 22K J 1/10W		
R10			RK73FB2A103J	CHIP R 10K J 1/10W		
R11			RK73FB2A820J	CHIP R 82 J 1/10W		
R12			RK73FB2A470J	CHIP R 47 J 1/10W		
R14			RK73FB2A103J	CHIP R 10K J 1/10W		
R15 ,16			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R17			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R101			RK73FB2A180J	CHIP R 18 J 1/10W		
R102			RK73FB2A331J	CHIP R 330 J 1/10W		
R103			RK73FB2A180J	CHIP R 18 J 1/10W		
R104			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R105			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R106			RK73FB2A151J	CHIP R 150 J 1/10W		
R107			RK73FB2A101J	CHIP R 100 J 1/10W		
R108			RK73FB2A333J	CHIP R 33K J 1/10W		
R109			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R110			RK73EB2B222J	CHIP R 2.2K J 1/8W		
R111			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R112			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R113			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R114			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R115,116			RK73FB2A123J	CHIP R 12K J 1/10W		
R118			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R119			R92-0670-05	CHIP R 0.0HM		
R120			RK73EB2B221J	CHIP R 220 J 1/8W		
R121			RK73FB2A473J	CHIP R 47K J 1/10W		
R122			RK73FB2A392J	CHIP R 3.9K J 1/10W		
D1			1T32T	CHIP DIODE		
D2			HVR12	CHIP DIODE		
D3			1SV209	CHIP DIODE		
D4 ,5			HSK277	CHIP DIODE		
D101			DLS1585	CHIP DIODE		
IC101		*	MB507PF	IC(PRE SCALER)		
IC102			MB87006APF	IC(FREQ SYNTHESIZER PLL)		
IC103			NJM2904M	IC(OP AMP X2)		
Q1			2SK508(K51)	CHIP FET		
Q2			2SC4093	CHIP TRANSISTOR		
Q101			2SC3356	CHIP TRANSISTOR		
Q102			2SC2712(Y)	CHIP TRANSISTOR		

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APC UNIT (X59-3130-00)						
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			C92-0501-05	CHIP TAN 1.5UF 6.3WV		
C3			CK73FB1H472K	CHIP C 4700PF K		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			CK73FB1H472K	CHIP C 4700PF K		
C6			CK73FB1H102K	CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R1			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R2			RD41FB2B102J	CYLND CHIP R 1.0K J 1/8W		
R3			RD41FB2B152J	CYLND CHIP R 1.5K J 1/8W		
R4	.5		RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R6			RD41FB2B122J	CYLND CHIP R 1.2K J 1/8W		
Q1	.2		FMW1	CHIP TRANSISTOR		
Q3			2SA1162(Y)	CHIP TRANSISTOR		
IF UNIT (X59-3140-00)						
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			CK73FB1H472K	CHIP C 4700PF K		
C3			CC73FCH1H330J	CHIP C 33PF J		
C4			CK73FB1H472K	CHIP C 4700PF K		
C5			CC73FSL1H561J	CHIP C 560PF J		
C6			CK73FB1H472K	CHIP C 4700PF K		
C7			CK73FB1H103K	CHIP C 0.010UF K		
C8	-10		CK73EB1H104K	CHIP C 0.10UF K		
			E23-0471-05	TERMINAL		
L1			L40-2211-B1	SMALL FIXED INDUCTOR(220UH)		
L2			L33-0695-05	CHIP CHOKER COIL(1MH)		
R1	.2		RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R4			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R5			RD41FB2B182J	CYLND CHIP R 1.8K J 1/8W		
IC1			TA7761F	IC(FM IF)		
SQL UNIT (X59-3150-00)						
C1			CK73FB1H102K	CHIP C 1000PF K		
C2			CC73FCH1H330J	CHIP C 33PF J		
C4			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C5			CK73EF1C105Z	CHIP C 1.0UF Z		
C6			C92-0504-05	CHIP-TAN 0.68UF 20WV		
C7	.8		CK73FB1E393K	CHIP C 0.039UF K		
C9			CK73FB1H153K	CHIP C 0.015UF K		
C10			CK73FB1H333K	CHIP C 0.033UF K		
			E23-0471-05	TERMINAL		
R1			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R2			RD41FB2B272J	CYLND CHIP R 2.7K J 1/8W		
R3			RD41FB2B222J	CYLND CHIP R 2.2K J 1/8W		
R4			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R5			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R6			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R7			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R9			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		

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R10 R11 R12 R13 R14			RD41FB2B474J RD41FB2B273J RD41FB2B223J RD41FB2B222J RD41FB2B393J	CYLND CHIP R 470K J 1/8W CYLND CHIP R 27K J 1/8W CYLND CHIP R 22K J 1/8W CYLND CHIP R 2.2K J 1/8W CYLND CHIP R 39K J 1/8W		
R15 R16 R17			RD41FB2B273J RD41FB2B331J RD41FB2B222J	CYLND CHIP R 27K J 1/8W CYLND CHIP R 330 J 1/8W CYLND CHIP R 2.2K J 1/8W		
D1 D2 Q1 .2 Q3 .4 Q5 .6			1SS226 1SS181 2SC2712(Y) 2SC3295(B) 2SC2712(Y)	CHIP DIODE CHIP DIODE CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR		
MIC UNIT (X59-3160-00)						
C1 C2 C3 C4 .5 C6			CK73FB1H223K CK73EF1C105Z CK73FB1H333K CK73FB1H223K CK73EF1C105Z	CHIP C 0.022UF K CHIP C 1.0UF Z CHIP C 0.033UF K CHIP C 0.022UF K CHIP C 1.0UF Z		
C7 C8 C9 C10 C11			CC73FSL1H101J CK73FB1H272K CK73EF1C105Z CC73FSL1H101J CK73FB1H821K	CHIP C 100PF J CHIP C 2700PF K CHIP C 1.0UF Z CHIP C 100PF J CHIP C 820PF K		
			E23-0471-05	TERMINAL		
R1 R2 R3 R4 R5			RD41FB2B123J RD41FB2B473J RD41FB2B563J RD41FB2B101J RD41FB2B154J	CYLND CHIP R 12K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 56K J 1/8W CYLND CHIP R 100 J 1/8W CYLND CHIP R 150K J 1/8W		
R6 R7 R8 R9 R10			RD41FB2B104J RD41FB2B101J RD41FB2B153J RD41FB2B473J RD41FB2B561J	CYLND CHIP R 100K J 1/8W CYLND CHIP R 100 J 1/8W CYLND CHIP R 15K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 560 J 1/8W		
R11 R12 R13 R14 -16 R17			RD41FB2B274J RD41FB2B563J RD41FB2B224J RD41FB2B823J RD41FB2B103J	CYLND CHIP R 270K J 1/8W CYLND CHIP R 56K J 1/8W CYLND CHIP R 220K J 1/8W CYLND CHIP R 82K J 1/8W CYLND CHIP R 10K J 1/8W		
R19 .20 R25			R92-0687-05 R92-0687-05	CHIP R 0 OHM CHIP R 0 OHM		
IC1 .2			NJM4558M	IC(OP AMP X2)		
VOL UNIT (X59-3170-00)						
C1 .2 C3 C4			CK73EB1E104K CK73FF1E104Z C92-0004-05	CHIP C 0.10UF K CHIP C 0.10UF Z CHIP TAN 1UF 16WV		
			E23-0471-05	TERMINAL		
R1 -3 R4 R5 R6			RD41FB2B473J RD41FB2B823J RD41FB2B103J RD41FB2B104J	CYLND CHIP R 47K J 1/8W CYLND CHIP R 82K J 1/8W CYLND CHIP R 10K J 1/8W CYLND CHIP R 100K J 1/8W		

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R7 R8 R9			RD41FB2B272J RD41FB2B104J RD41FB2B272J	CYLND CHIP R 2.7K J 1/8W CYLND CHIP R 100K J 1/8W CYLND CHIP R 2.7K J 1/8W		
D1 IC2 IC4 Q1 Q2 ,3			1SS226 MN4066BS LC7532M DTC144EK DTA114EK	CHIP DIODE IC(QUAD ANALOG SWITCH) IC(BILATERAL SWITCH) DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
AFC UNIT (X59-3410-00)						
C1 C2 C3 C4 C5			CK73FB1E393K CK73FB1H103K CK73FB1H102K CK73FB1H103K CK73FB1E393K	CHIP C 0.039UF K CHIP C 0.010UF K CHIP C 1000PF K CHIP C 0.010UF K CHIP C 0.039UF K		
C6 C7			C92-0005-05 CK73FB1H102K	CHIP-TAN 2.2UF 6.3WV CHIP C 1000PF K		
			E23-0471-05	TERMINAL		
R1 R2 R3 R4 R5			RD41FB2B104J RD41FB2B222J RD41FB2B473J RD41FB2B472J RD41FB2B104J	CYLND CHIP R 100K J 1/8W CYLND CHIP R 2.2K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 4.7K J 1/8W CYLND CHIP R 100K J 1/8W		
R6 R7 R8 ,9 R10 R11			RD41FB2B183J RD41FB2B223J RD41FB2B473J RD41FB2B472J RD41FB2B273J	CYLND CHIP R 18K J 1/8W CYLND CHIP R 22K J 1/8W CYLND CHIP R 47K J 1/8W CYLND CHIP R 4.7K J 1/8W CYLND CHIP R 27K J 1/8W		
R12			RD41FB2B393J	CYLND CHIP R 39K J 1/8W		
IC1 IC2 IC3 Q1 Q2			NJM4558M MN4066BS IMH2 2SC2712(Y) DTC144EK	IC(OP AMP X2) IC(QUAD ANALOG SWITCH) IC CHIP TRANSISTOR DIGITAL TRANSISTOR		

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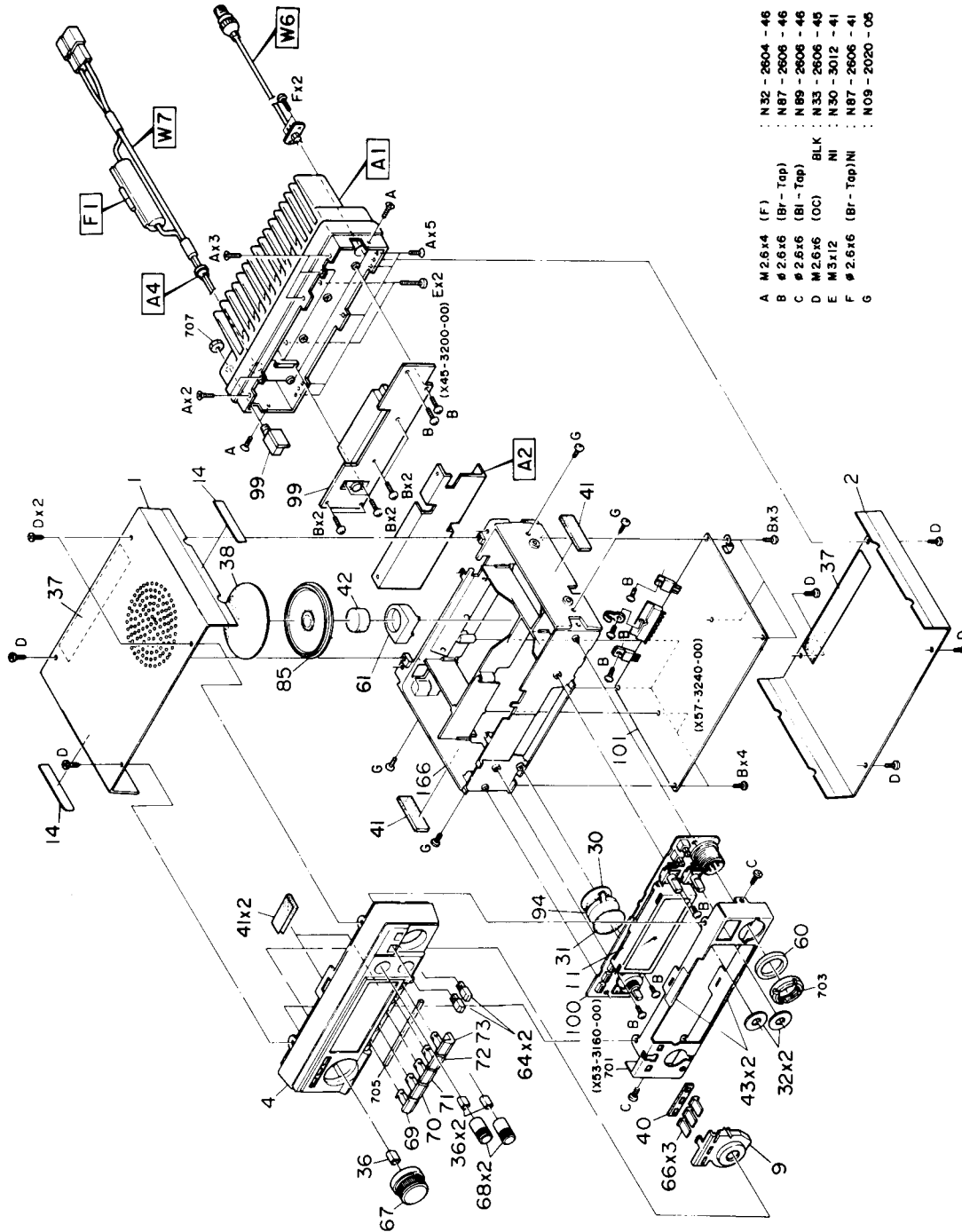
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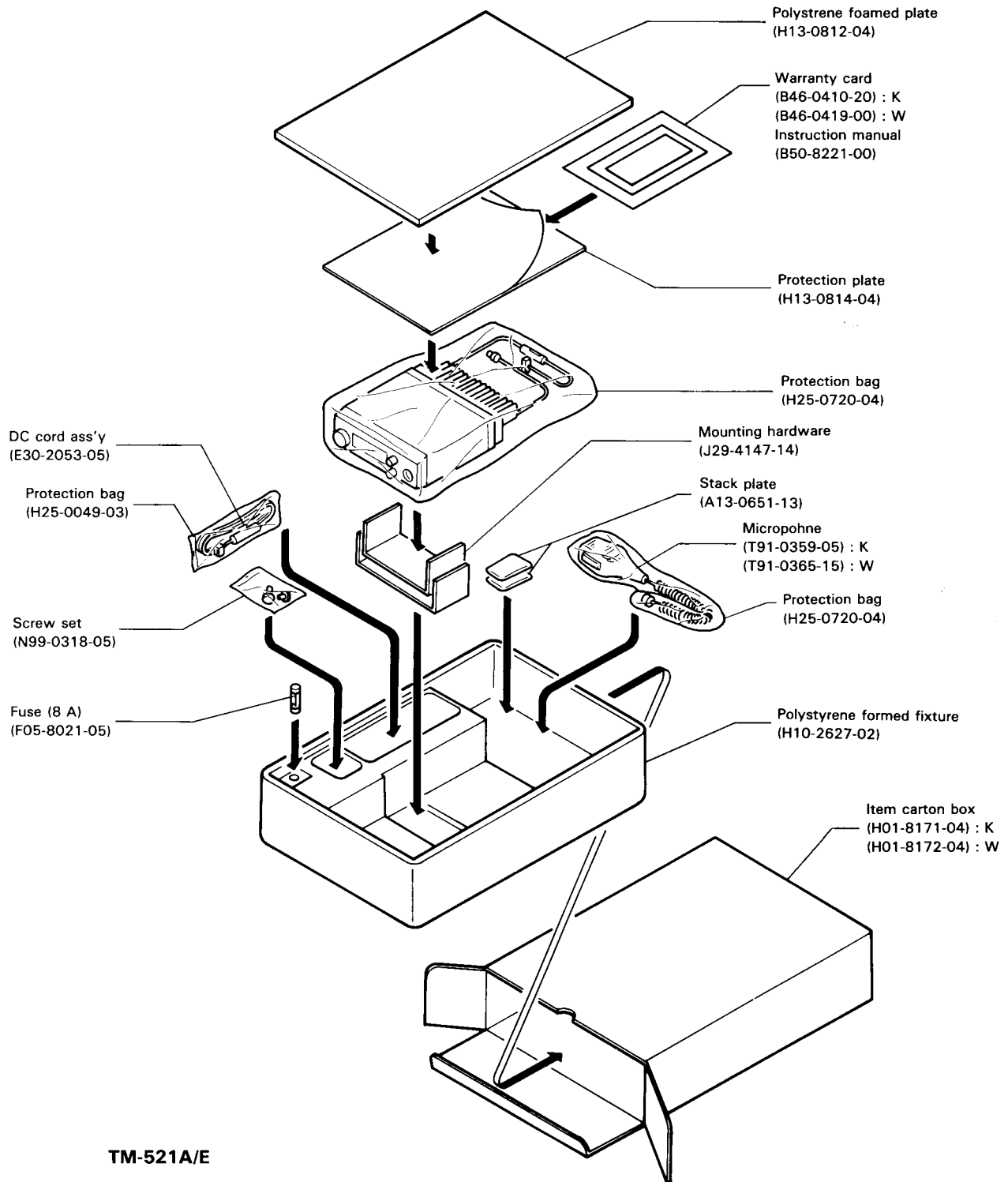
EXPLODED VIEW

TM-521A/E



- A M 2.5x4 (F) : N 32 - 2604 - 46
- B # 2.5x6 (Br - Tap) : N 87 - 2606 - 46
- C # 2.5x6 (Bl - Tap) : N 89 - 2606 - 46
- D M 2.5x6 (OC) : BLK : N 33 - 2606 - 46
- E M 3x1/2 : NI : N 30 - 3012 - 41
- F # 2.5x6 (Br - Tap) NI : N 87 - 2606 - 41
- G : N 09 - 2020 - 05

PACKING

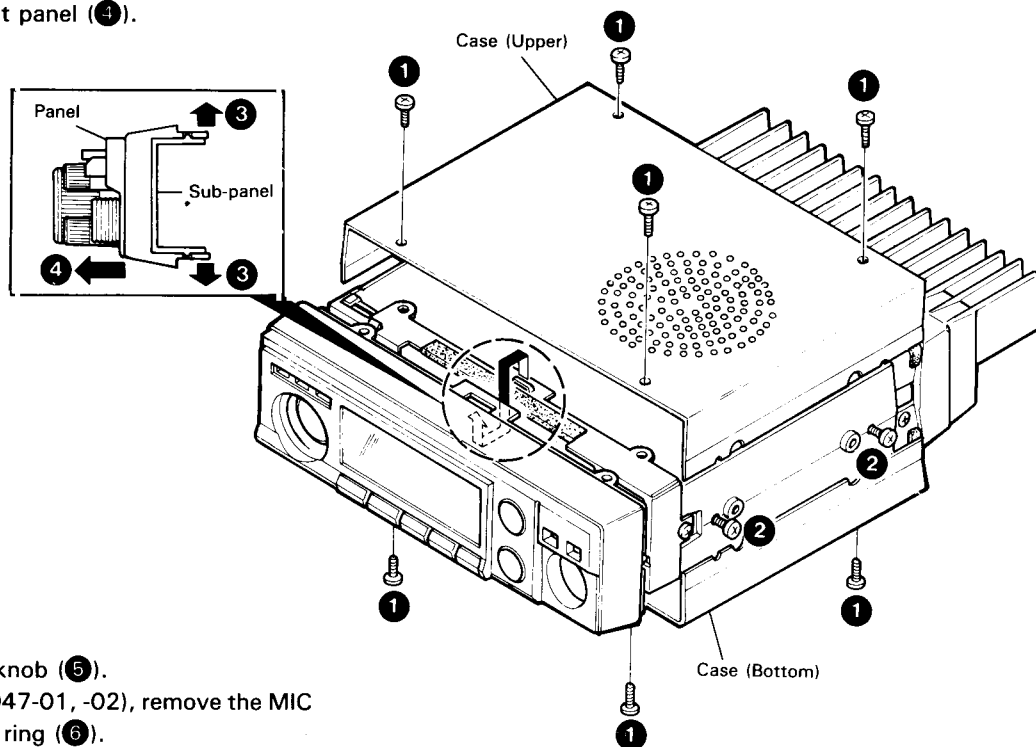


TM-521A/E

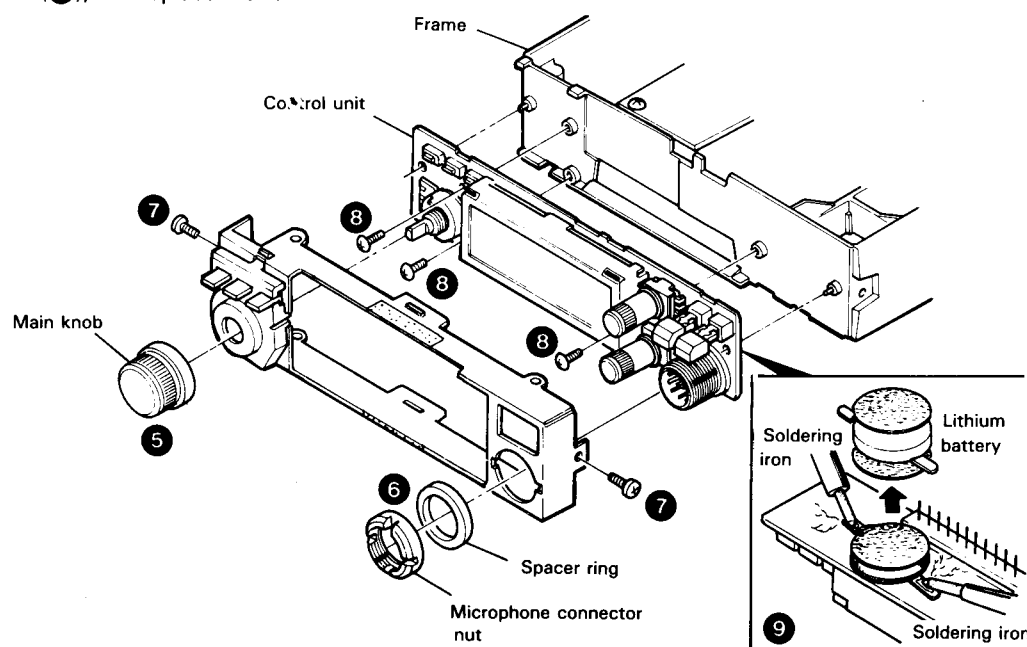
DISASSEMBLY FOR REPAIR

Replacement of Lithium Battery

1. Remove the eight screws from the upper and lower case (1). Loosen the four screws on the left and right panel (2), and remove the upper and lower case.
2. Release the stoppers fixing the front panel and sub-panel (3), and remove the front panel (4).



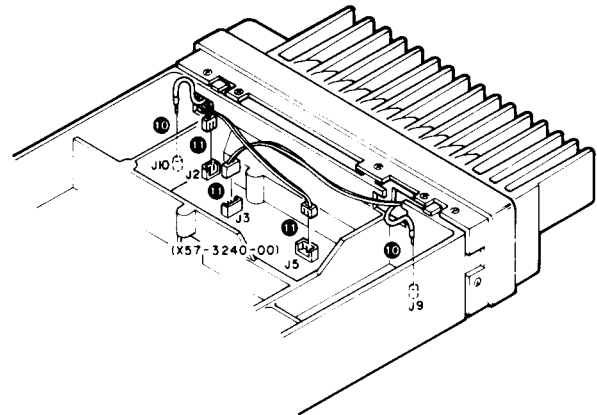
3. Pull out the main control knob (5).
4. Using the special tools (T-047-01, -02), remove the MIC connector nut and spacer ring (6).
5. Remove the two screws (7), and remove the sub-panel.
6. Remove three screw (8), and remove the Control unit.
As it is connected to the TX-RX unit at the rear of it via a connector pin, disconnect it gently when removing.
7. Remove solder from two points (9), and replace the lithium battery.



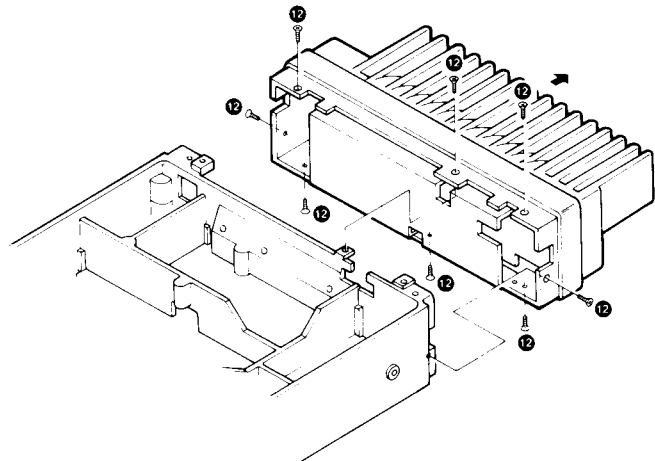
DISASSEMBLY FOR REPAIR

Disassembling procedure of the Complete unit

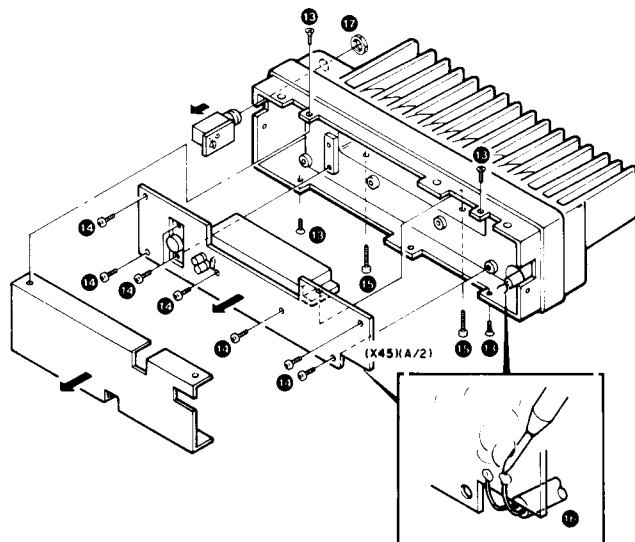
8. Unplug the cord from J9 and J10 of the TX-RX unit (X57-3240-00) (10).
9. Unplug the connector from J2, J3, and J5 of the TX-RX unit (X57-3240-00) (11).



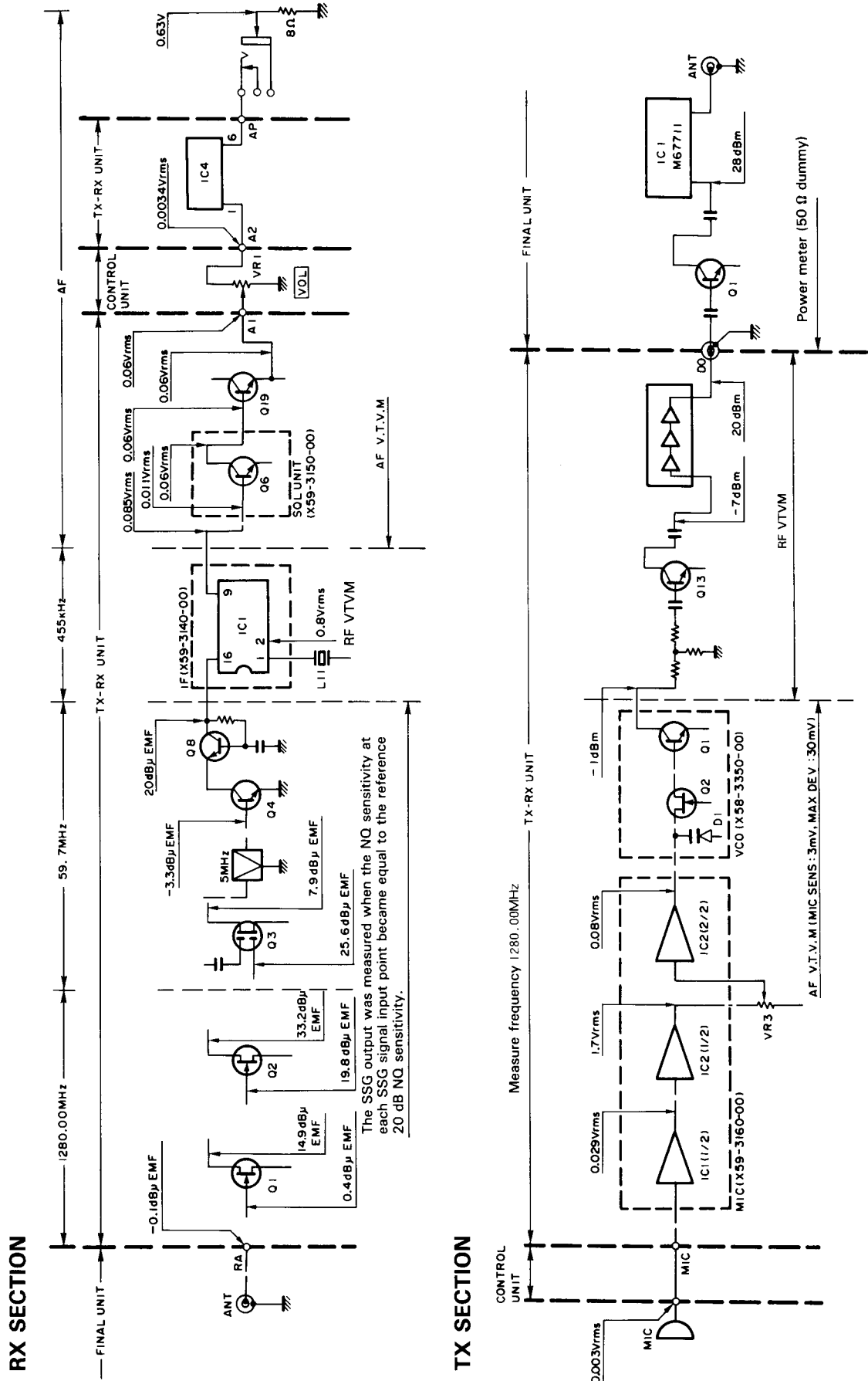
10. Remove the 8 screws (12) that fix the unit to the main chassis, and pull the unit in the direction of the arrow.



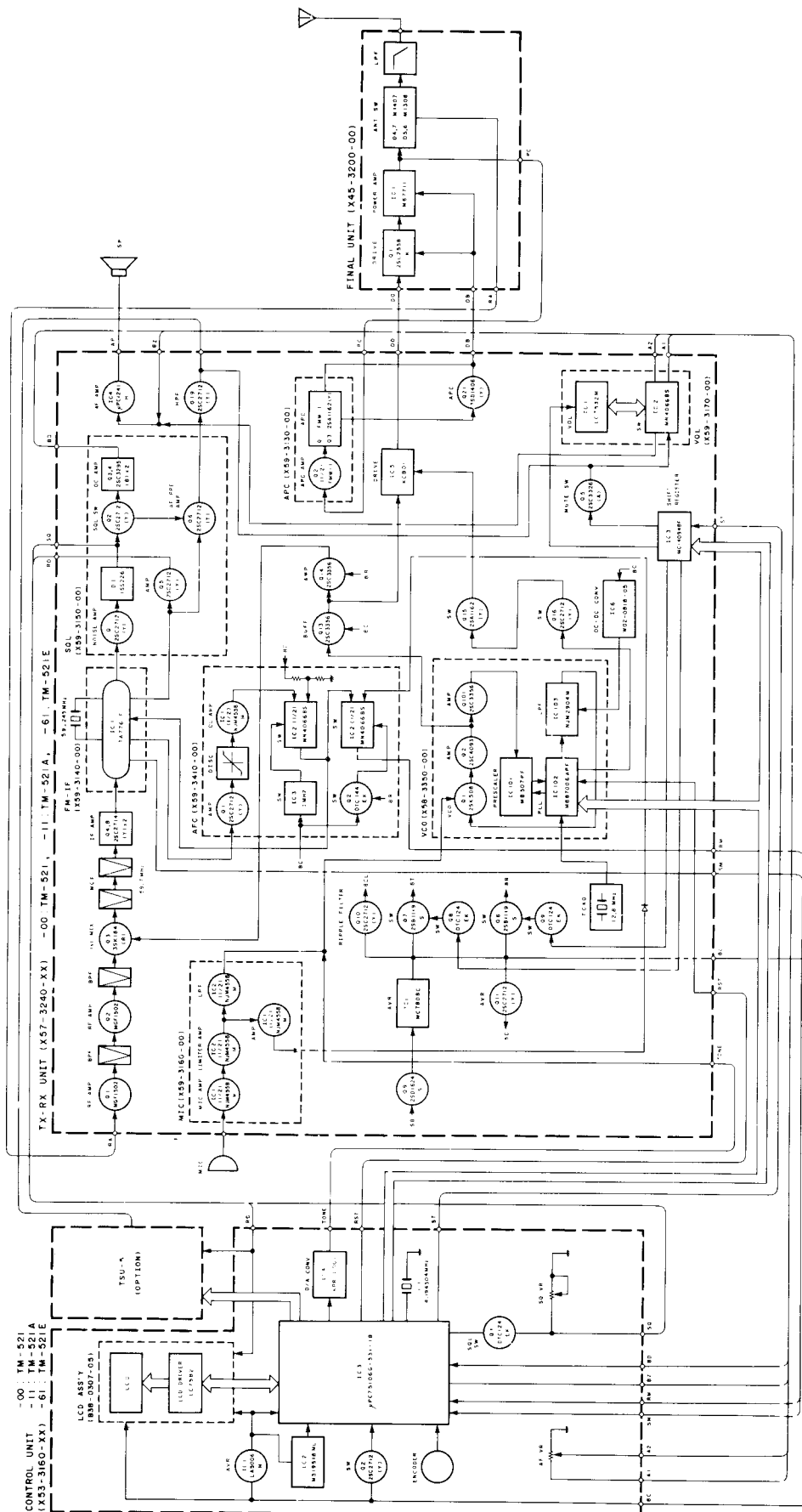
11. Remove the four screws (13) that fix the cover of the unit, and lift the cover in the direction of the arrow.
12. Remove the 8 screws (14) that hold the unit (X45) (A/2).
13. Remove the two screws (15) that hold the IC at the back of the unit (X45) (A/2).
14. Unsolder the Ground wire, and then remove out the unit (X45) (A/2) in the direction of the arrow (16).
15. Unscrew the nut (17) that holds the speaker unit in the direction of the arrow.



LEVEL DIAGRAM



BLOCK DIAGRAM



ADJUSTMENT

Required test equipment

1. **DC V.M**
 - 1) High input impedance
2. **RF VTVM (RF V.M)**
 - 1) Input impedance: 1 M Ω min., 2 pF max.
 - 2) Voltage range: F.S = 10 mV ~ 300 V
 - 3) Frequency range: Up to 1300 MHz
3. **Frequency Counter (f.counter)**
 - 1) Input sensitivity: Approx. 50 mV
 - 2) Frequency range: Up to 1300 MHz
4. **DC Power Supply**
 - 1) Voltage: 10V ~ 17 V, variable
 - 2) Current: 15 A min.
5. **Power Meter**
 - 1) Measurement range Approx.: 50 W, 3 W, 1 W
 - 2) Input impedance: 50 Ω
 - 3) Frequency range: 1300 MHz
6. **AF VTVM (AF V.M)**
 - 1) Input impedance: 1 M Ω min.
 - 2) Voltage range: F.S = 1 mV ~ 30 V
 - 3) Frequency range: 50 Hz ~ 10 kHz
7. **AF Generator (AG)**
 - 1) Output frequency: 100 Hz ~ 10 kHz
 - 2) Output voltage: 0.5 mV ~ 1 V
8. **Linear Detector**
 - 1) Frequency range: 1300 MHz
9. **Field Strength Meter**
 - 1) Frequency range: 1300 MHz
10. **Directional Coupler**
11. **Oscilloscope**
 - 1) High sensitivity oscilloscope with horizontal input terminal
12. **SSG**
 - 1) Frequency range: 1300 MHz bands
 - 2) Modulation: AM and FM MOD
 - 3) Output level: -20 dB to 100 dB
13. **Dummy Load**
 - 1) 8 Ω , 10 W (approx.)
14. **Noise Generator**
 - 1) Must generate ignition-like noise containing harmonics beyond 1300 MHz.

15. Sweep Generator

- 1) Sweep range: 1300 MHz

16. Tracking generator

Preparation

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

POWER SW	ON	SHIFT	OFF
AF VOL VR	MIN	REV SW	OFF
SQL VOL VR	MIN	SCAN SW	OFF
LOW SW	OFF	CTCSS SW (K,M)	OFF
VFO/M SW	VFO	ALERT SW (K,W)	OFF
		TONE SW	OFF

Table 9

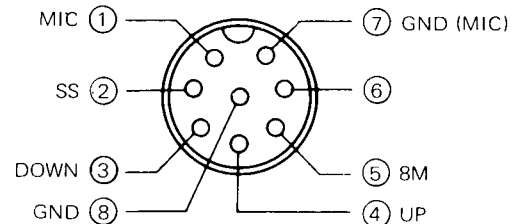


Fig. 24 MIC terminals (view from front panel side)

- 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. 25**.

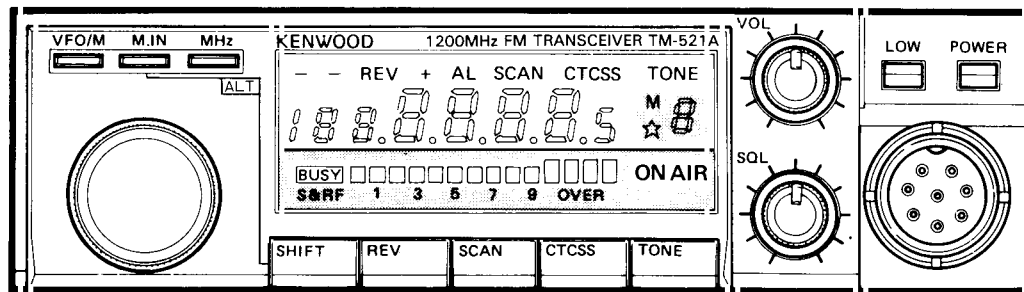


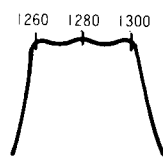
Fig. 25

ADJUSTMENT

Common section adjustment

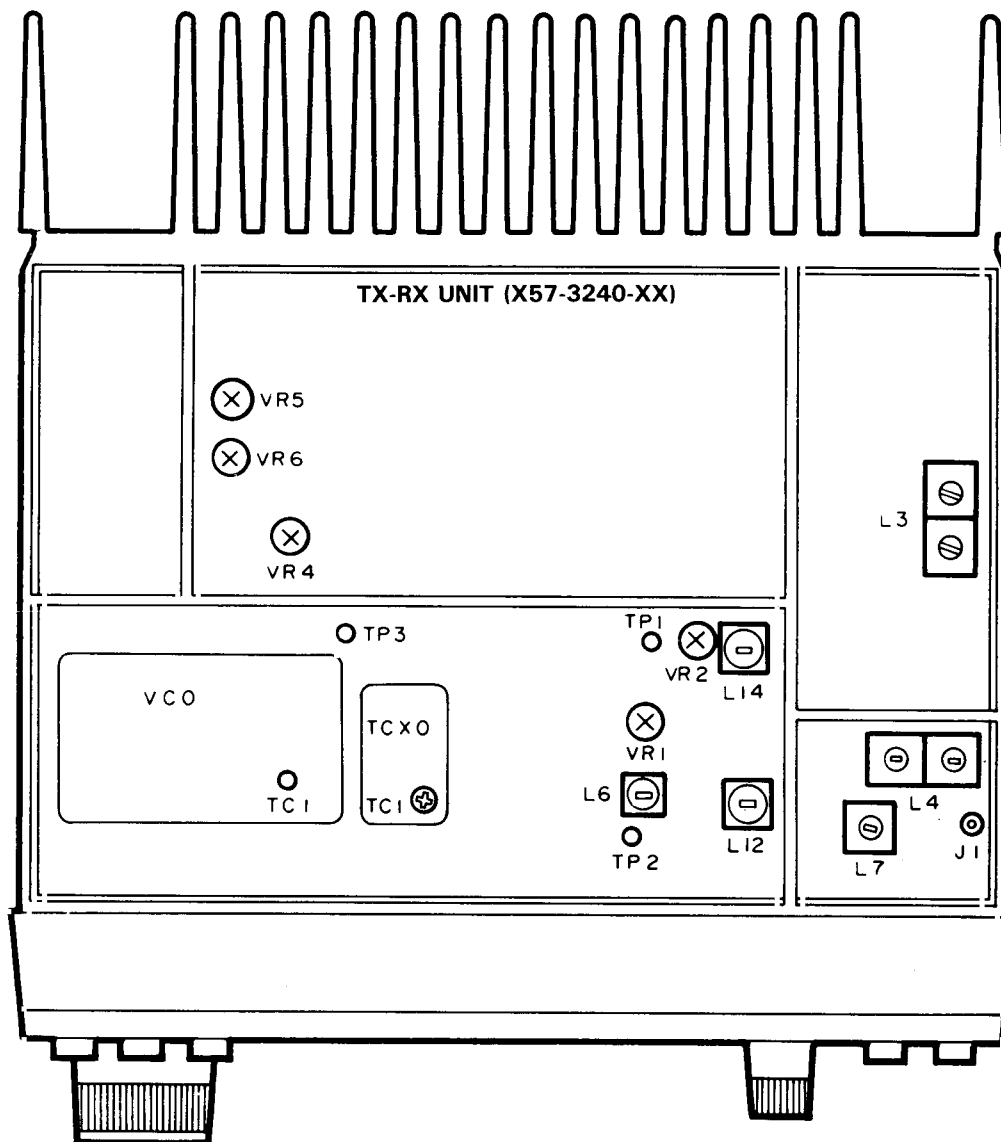
Item	Condition	Measurement			Adjustment			Specification/remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Setting	1) Power supply: DC 13.8 V POWER SW: OFF VOL VR: Fully counter clockwise SOL VR :Fully counter clockwise VR5 on the TX-RX unit :Fully counter clockwise							
2. Reset	1) Turn the Power SW ON, holding the VFO/M and M.IN SW down							Display 1240.000  Appeared during 5 sec.
3. PLL	FREQ.: 1299.975	Digital volt-meter Dummy load	TX-RX	TP3	VCO module	TC1 (4B)	21.5 V	± 0.1 V
	Transmit				Check		Check	More than 1.5 V
	FREQ.: 1240.000							
4. TX FREQ. ADJ.	Receive							
	1) FREQ.: 1270.000	f. counter power-meter adjustment	Rear panel	ANT (IC)	1280 TCXO	TC1	1270.000 MHz	± 2 kHz
	Transmit							

Receiver section

Item	Condition	Measurement			Adjustment			Specification/remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Helical	1) FREQ.: 1270.100 Connect the tracking generator to ANT. Connect the Spectrum analyzer side to TP1. Connect the TP3 to GND terminal tracking generator output: -40 dB μ	Tracking generator, Oscilloscope or Spectrum analyzer	TX-RX	TP1 (4E)	TX-RX	L3 L4	The specified range should be secured with the GAIN set to MAX. position. Oscilloscope or Spectrum analyzer L3 L4	
2. f (2nd OSC)	1) FREQ.: 1270.100 SSG: 10 dB μ MOD: OFF ALT: ON (M-IN PUSH, SHIFT, PUSH)	DC:V,M	TX-RX	TP1 (4D) TP1	TX-RX	L6	Set the voltage at ALT OFF.	Note: A accurate SSG's freq. The voltage at ALT OFF: ±0.1 V
3. GAIN	1) FREQ.: 1270.100 SSG output: 5 dB μ (MOD. 0%)	AF VM Oscilloscope	TX-RX	TP2 (4D)	TX-RX	L7 (4E) L12 (4E)		Note: Accurate SSG's freq.
4. Discriminator	1) FREQ.: 1270.100 (K) SSG output: 20 dB μ MOD: 1 kHz DEV: ± 5 kHz	AF VM Oscilloscope	Rear panel	SP (1B)	TX-RX	L14 (4D)	AF MAX	
4. Receiving sensitivity	1) FREQ.: 1270.100 SSG output: -10 dB μ	Oscilloscope	Rear panel	SP (1B)	TX-RX		Check	SINAD: More than 12 dB
	2) FREQ.: 1240.100							
	3) FREQ.: 1299.900							
5. S-meter	1) FREQ.: 1270.100 SSG output: -4 dB μ	LSD (S-meter)			TX-RX	VR1 (4E)	Set to S1 position	
	2) SSG: 16 dB μ							S-meter: all digit lights
6. Squelch (Tight squelch)	FREQ.: 1270.100 SSG output: -6 dB μ SQL: MAX	Oscilloscope		EXT.SP	TX-RX	VR2	Squel. OPEN	

ADJUSTMENT

Item	Condition	Operation check	Item	Condition	Operation check
4-2. Odd split memory channels	1) Press the M.IN switch.	The beeper sound changes.  indicator lights. The memory channel number display is not light.	5. Memory channel lock-out selection	1) Press the VFO/M switch to select the memory channel mode.	 indicator lights.
	The receive FREQ. memory entry is completed, then changes to the waiting mode of the transmit FREQ. memory entry.			2) Select the desired memory channel to skip using the Tuning control or the Microphone UP/DOWN switch.	
	3) Select the desired transmit FREQ. using the Tuning control or the Microphone UP/DOWN switch.			3) Press the M.IN switch and the SCAN switch. When the M.IN switch is pressed, the M indicator lights. The SCAN switch should be pressed within 5 sec. after the M.IN switch is pressed, or the M indicator goes off.	 indicator lights. The asterisk (*) lights in the left of the memory channel number display. The indicated memory channel is skipped during SCAN operation.
	5) Press the M.IN switch.	Memory entry is completed.			



• TX-RX UNIT (X57-3240-XX)

- VR1: S-meter
- VR2: Tight squelch
- VR4: DEV.
- VR5: APC
- VR6: LOW POWER

- L3,4: Helical
- L6: f(2nd Local OSC)
- L7, 12: GAIN
- L14: Discriminator
- TC1: PLL

• TCXO (12.8 MHz)

- TC1: TX freq.

ADJUSTMENT

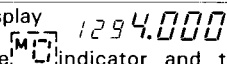
Transmission section adjustment

Item	Condition	Measurement			Adjustment			Specification/remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1-1. APC	1) FREQ.: 1270.000 Transmit MIC-GND600 Ω	Power meter Am-meter	Rear panel	ANT (IE)	TX-RX	VR5	MAX	More than 13 W
	2) FREQ.: 1240.000 Transmit						12 W	
	3) FREQ.: 1299.975 Transmit						Check	10 ~ 14 W, Less than 5.5 A
1-2. LOW POWER	1) LOW SW: ON FREQ.: 1270.000				TX-RX	VR6	Check	0.5 ~ 2 W, Less than 2.5 A
	Transmit						1 W	± 0.2 W, Less than 2.5 A

Transmission section adjustment

Item	Condition	Measurement			Adjustment			Specification/remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
2-1. DEV	1) FREQ.: 1270.000 (K) AG: 1 kHz, 30 mV (W,T) 50 mV (K)	Linear detector Oscilloscope Power-meter	Rear panel	ANT (IE)	TX-RX	VR4	± 4.4 kHz (Either + or - value which is larger)	± 200 Hz There should be no abnormal within detecting range.
2-2. MIC GAIN	AG: 1 kHz, 3 mV (W,T) 5 mV (K)					VR3	± 3.0 kHz	$\pm 2.2 \sim 3.6$ kHz

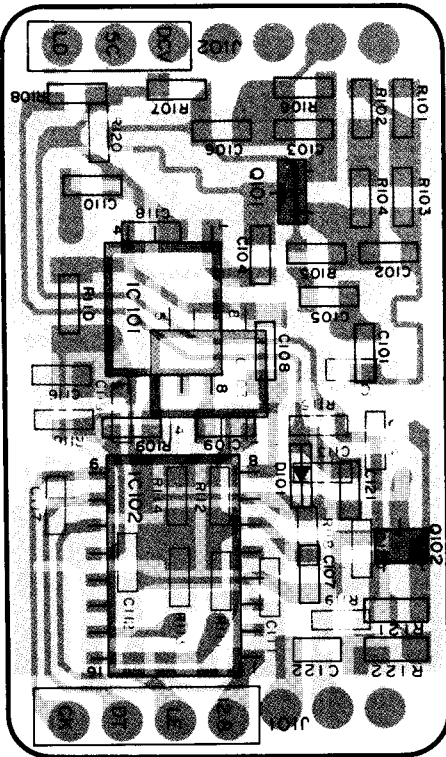
Microprocessor operation check

Item	Condition	Operation check	Item	Condition	Operation check
1. Reset	1) Turn the power switch ON holding the VFO/M and M.IN switches down.	Display  The  indicator and the Memory channel number display light for approx. 5 sec. after release the switches.	4-1. Memory entry (simplex standard offsets)	Simplex memory channels are: M0 ~ 9, MA, b. Determine the desired FREQ., SHIFT, CTCSS, TONE FREQ. then follow the procedure below.	
	2) Release the VFO/M and M.IN switches			1) Press the M.IN switch.	The memory channel number display lights.
2. FREQ. step selection	1) Press the M.IN switch	indicator lights.	4-2. Odd split memory channels	2) Select the desired memory channel using the Tuning control or the Microphone UP/ DOWM switch. This selection should be completed within 5 sec. after the M.IN switch is pressed.	 
	2) Press the M.IN switch, then press the REV switch within 5 sec.	Display  Turn the Tuning control and the UP/DOWN switches to increase or decrease the figures as shown below. 20 ← 25 ← 5 ← 10 ← 125 ↓ ↓ 15 CCW CW 15 ↓ 125 → 10 → 5 → 25 → 20 →		3) Press the M.IN switch within 5 sec. after the memory channel selection is completed.	Memory entry is completed.
	3) Press any switch except the LOW and the Power switches to return to the normal receive FREQ.	Receive FREQ. lights. (to return to the normal FREQ.)		1) Select the desired FREQ. using the Tuning control or the Microphone UP/DOWN switch. (as described in Item 4-1.)	
3. FREQ. step selection (MHz)	1) Press the MHz switch.	The kHz digits goes off.			
	2) Turn the Tuning control switch to CW or CCW.	Rotating the Tuning control switch changes the FREQ. in 1 MHz step.			
	3) Press any switch except the LOW and the Power switches to return to the normal receive FREQ.	The kHz digits lights.			

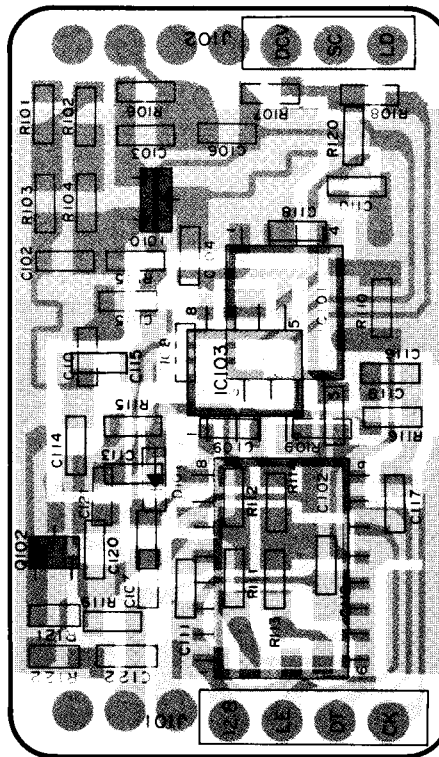
TM-521A/E PC BOARD VIEWS

ManualsPlus.com

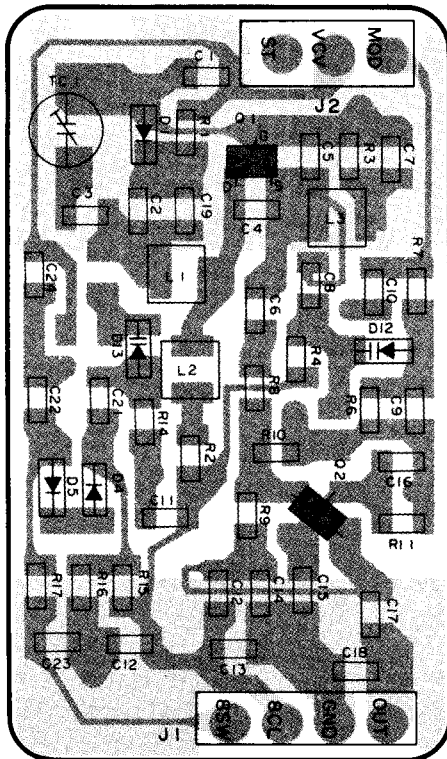
▼ VCO UNIT A (X58-3350-11)
(Component side view)



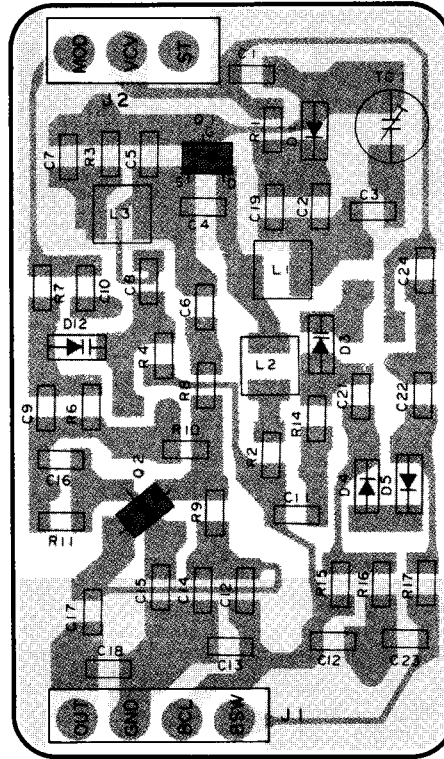
▼ VCO UNIT A (X58-3350-11)
(Foil side view)



▼ VCO UNIT B (X58-3350-11)
(Component side view)



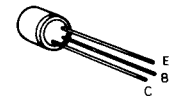
▼ VCO UNIT B (X58-3350-11)
(Foil side view)



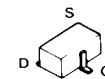
2SC3356
2SC2712 (Y)



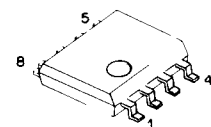
2SC4093



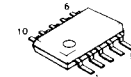
2SK508(K51)



MB507PF

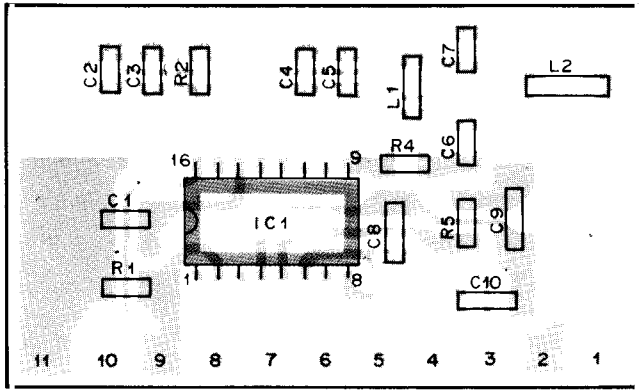


MB87006APF



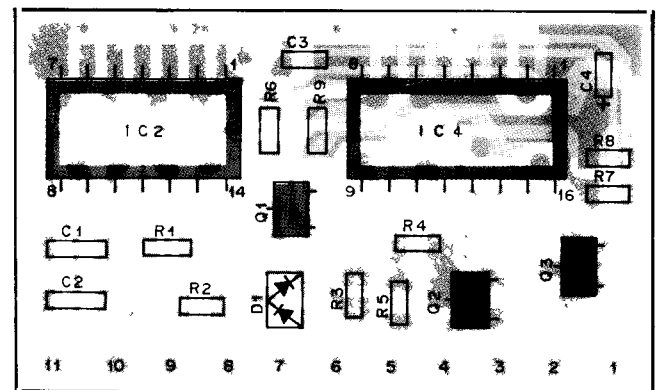
IC101 : MB507PF IC102 : MB87006APF IC103 : NJM2904M Q1 : 2SK508(K51) Q2 : 2SC4093 Q101 2SC3356
Q102: 2SC2712 (Y) D1 : 1T32T D2 : HVR12 D3 : 1SV209 D4,5 : HSK277 D101 : DLS1585

▼ IF (X59-3140-00) (Component side view)



IC1 : TA7761F

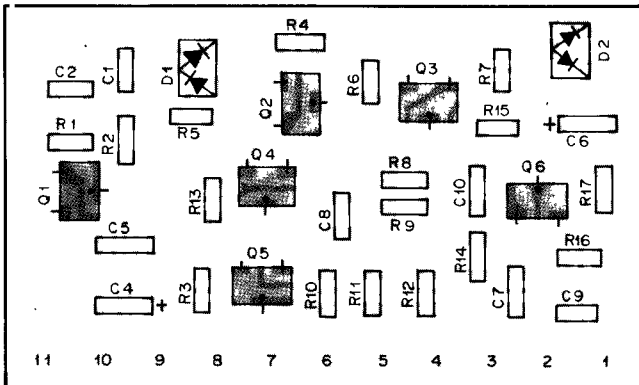
▼ VOL (X58-3170-00) (Component side view)



IC2 : MN4066BS IC4: LC7532M

Q1 : DTC144EK Q2,3 : DTA114EK D1 : 1SS226

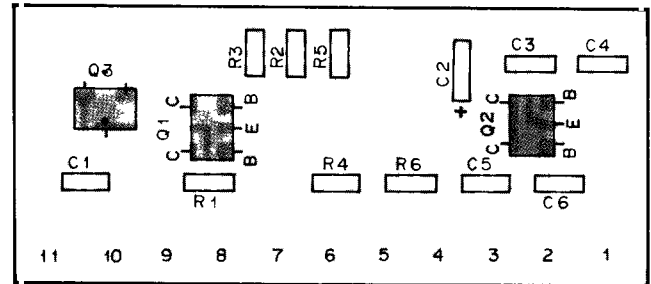
▼ SQL (X59-3150-00) (Component side view)



Q1,2,5,6 : 2SC2712(Y) Q3,4 : 2SC3295(B)

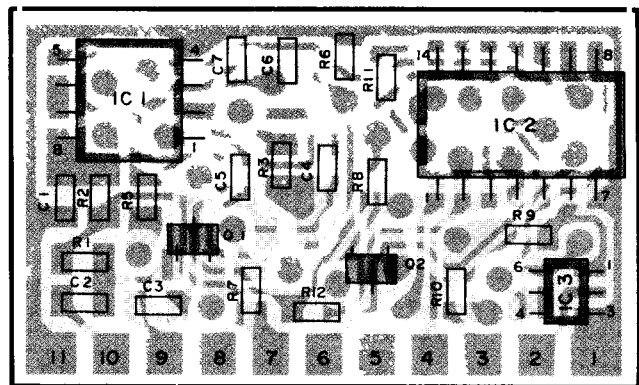
D1 : 1SS226 D2 : 1SS181

▼ APC (X59-3130-00) (Component side view)



Q1,2 : FMW 1 Q3 : 2SA1162(Y)

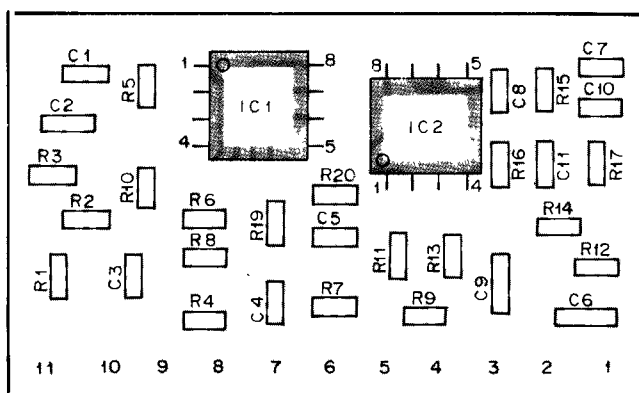
▼ AFC (X59-3410-00) (Component side view)



IC1 : NJM4558M IC2: MN4066BS IC3: IMH2

Q1 : 2SC2712(Y) Q2: DTC144EK

▼ MIC (X59-3160-00) (Component side view)



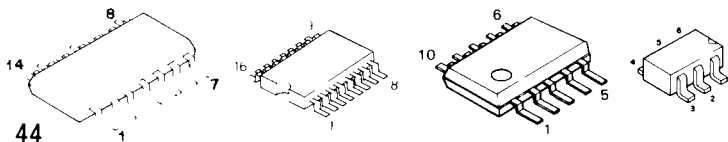
IC1,2 : NJM4558M

MW4066BS

TA7761F

LC7532M

IMH2



2SA1162 2SC2759
2SC2712 2SC3295

2SK508

FMW-1



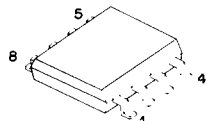
DTC144EK
DTC124EK



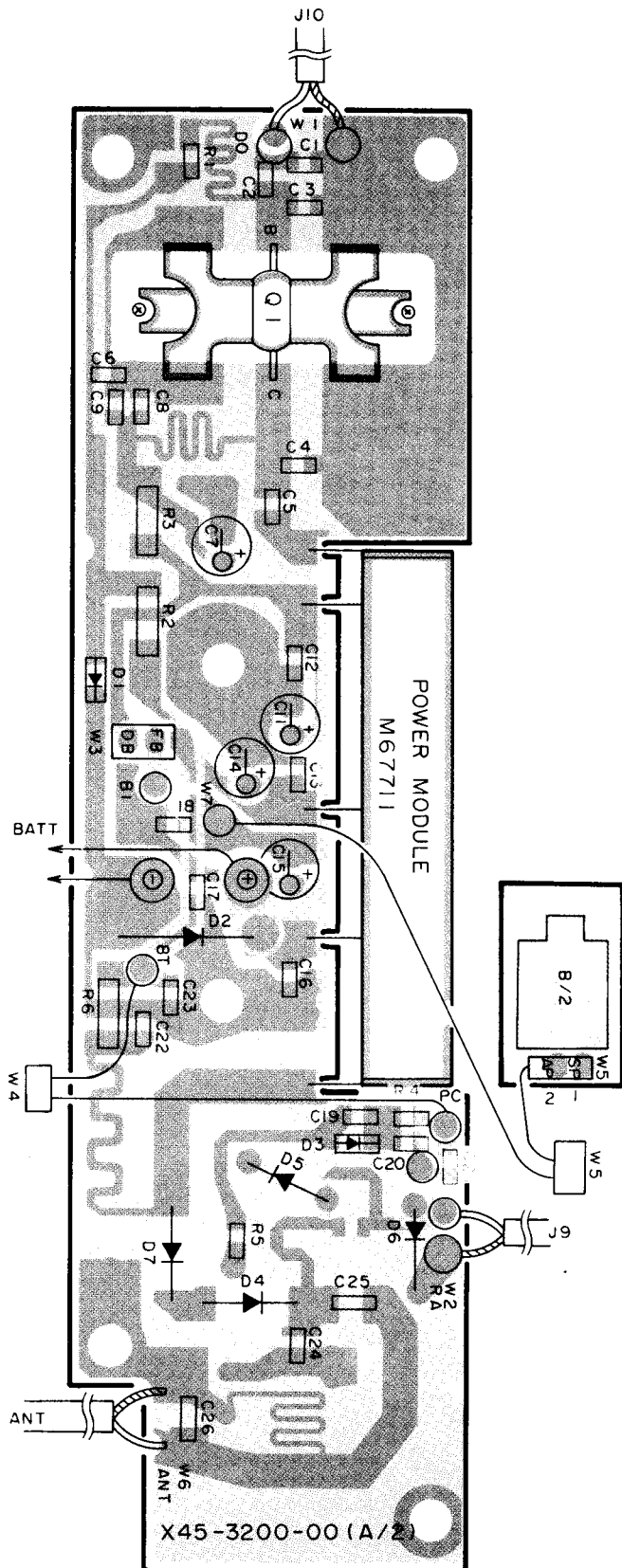
DTA114EK



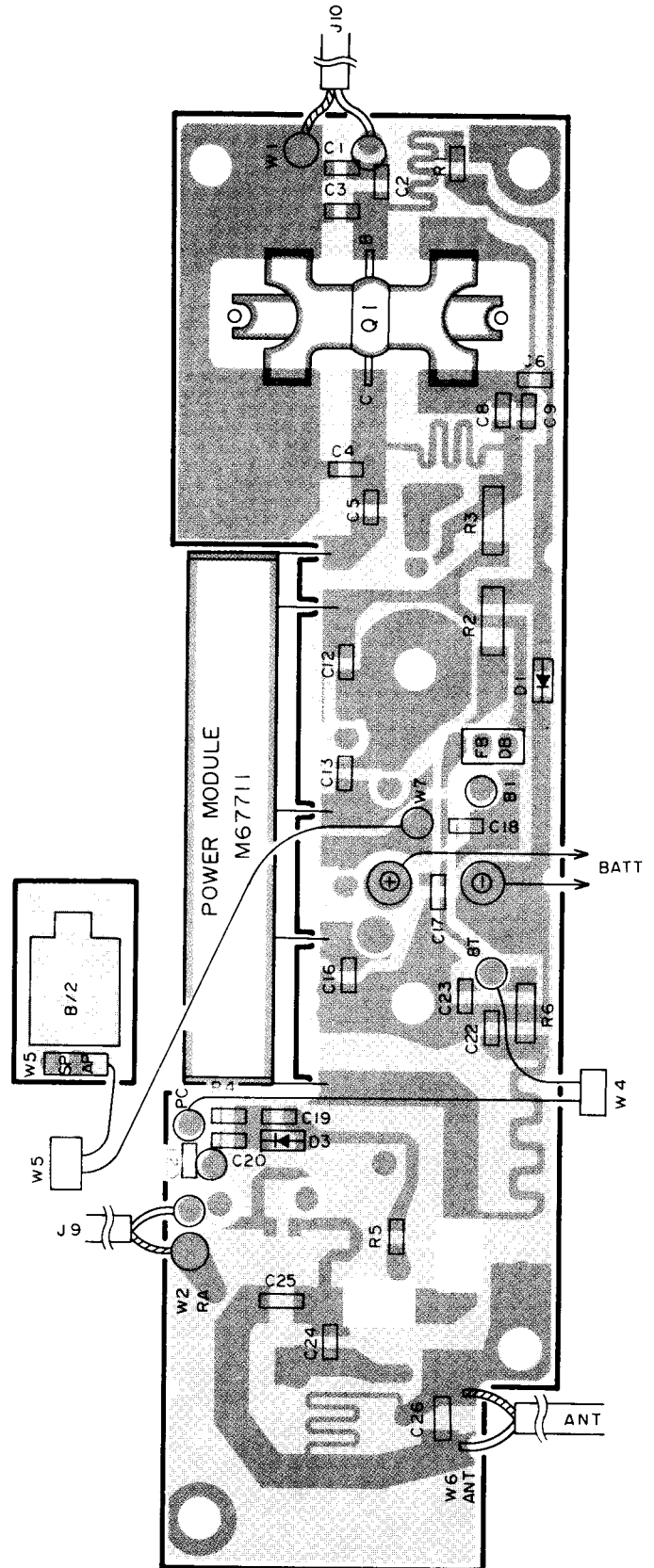
NJM4558M



▼ FINAL UNIT (X45-3200-00)
(Component side view)

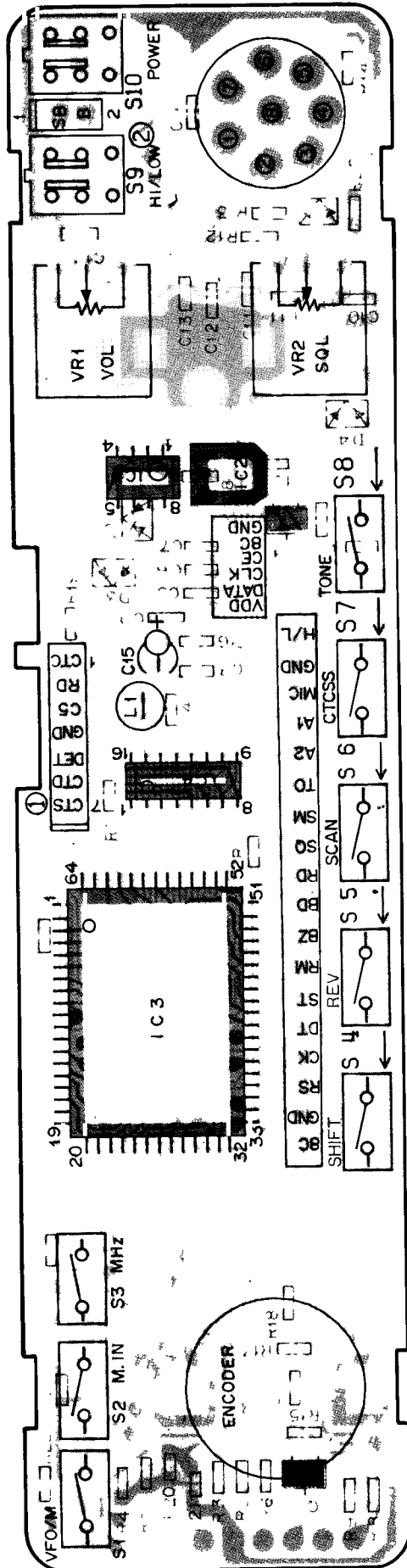


▼ FINAL UNIT (X45-3200-00)
(Foil side view)



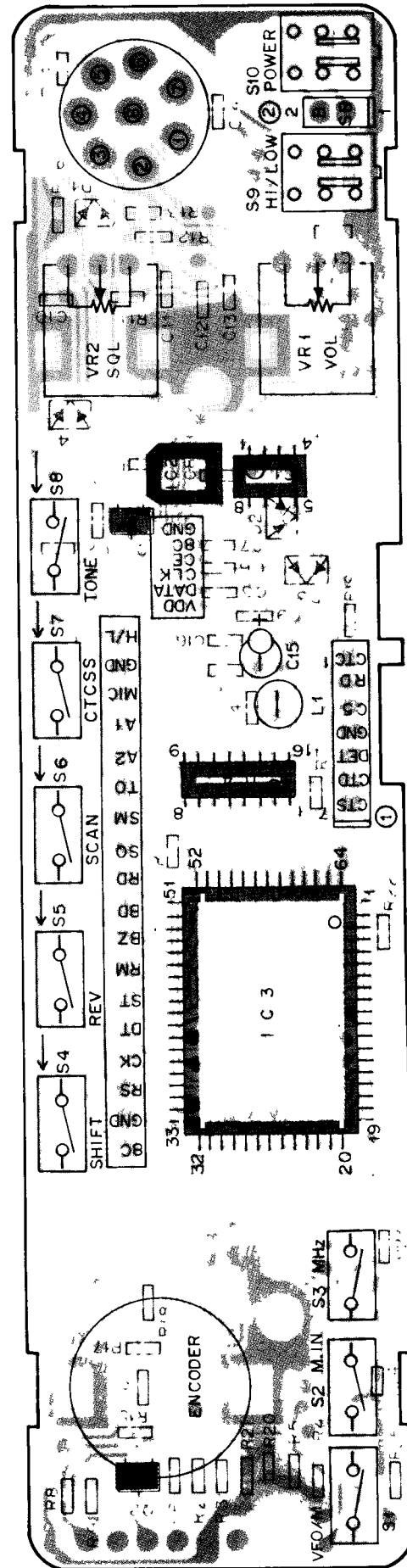
IC1 : M67711 Q1 : 2SC2558K D1 : DLS1585 D2 : DSA3A1 D3 : HSK151 D4,7 : M1407 D5,6 : M1308

▼ CONTROL UNIT (X53-3160-XX) -11:K, -61:W
(Component side view)



IC1 : LA5006M IC2 : M51951BML IC3 : μ PD75106G-531-1B IC4 : KRR C001 Q1 : DTC124EK Q2 : 2SC2712(Y)
D1 ~ 4 : 1SS184

▼ CONTROL UNIT (X53-3160-XX) -11:K, -61:W
(Foil side view)



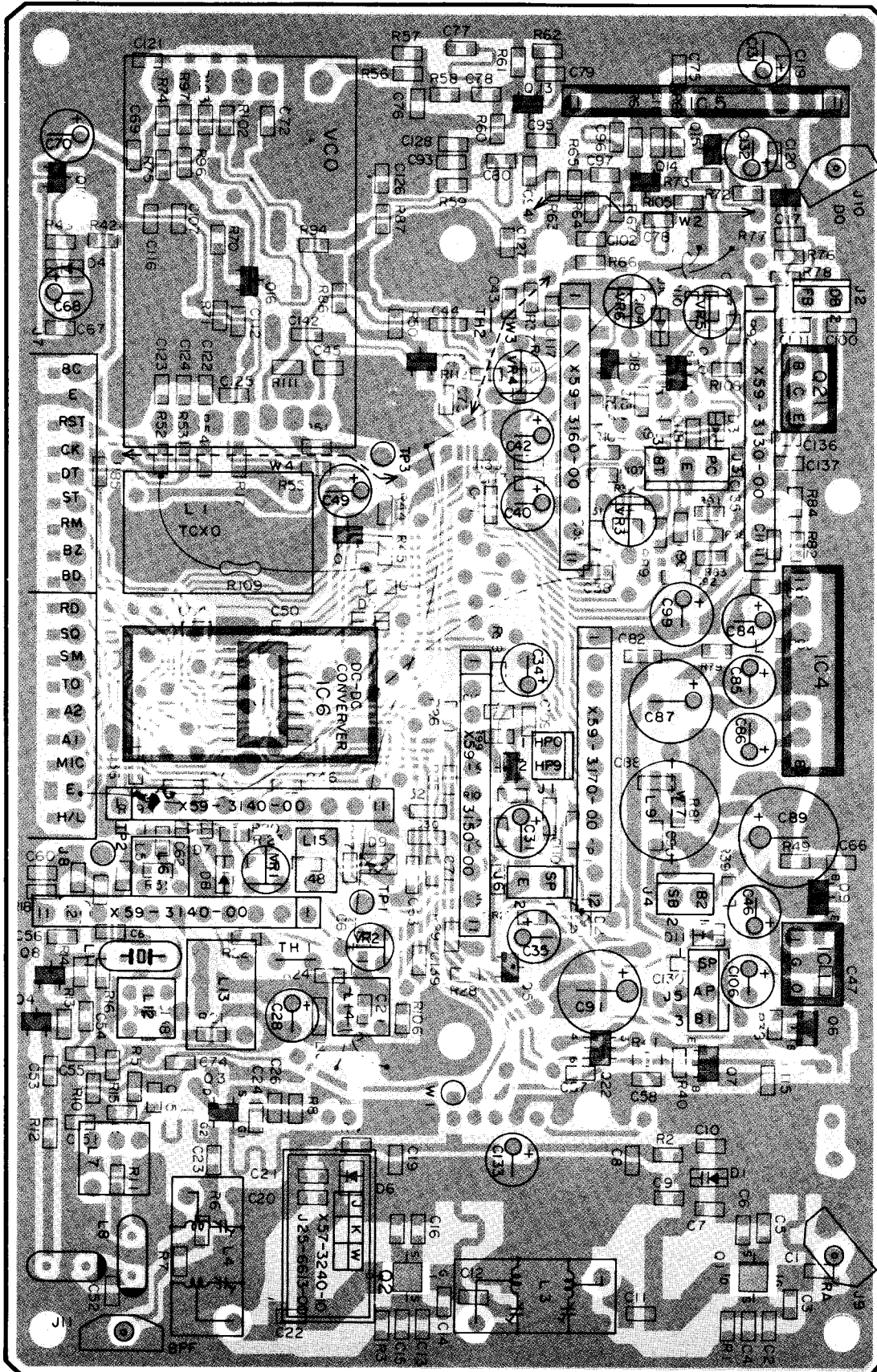
- LA5006M
- M51951BML
- μ PD75106G-531-1B
- KRR-C001
- DTC124EK
2SC2712(Y)
- M6711

TM-521A/E

PC BOARD VIEWS

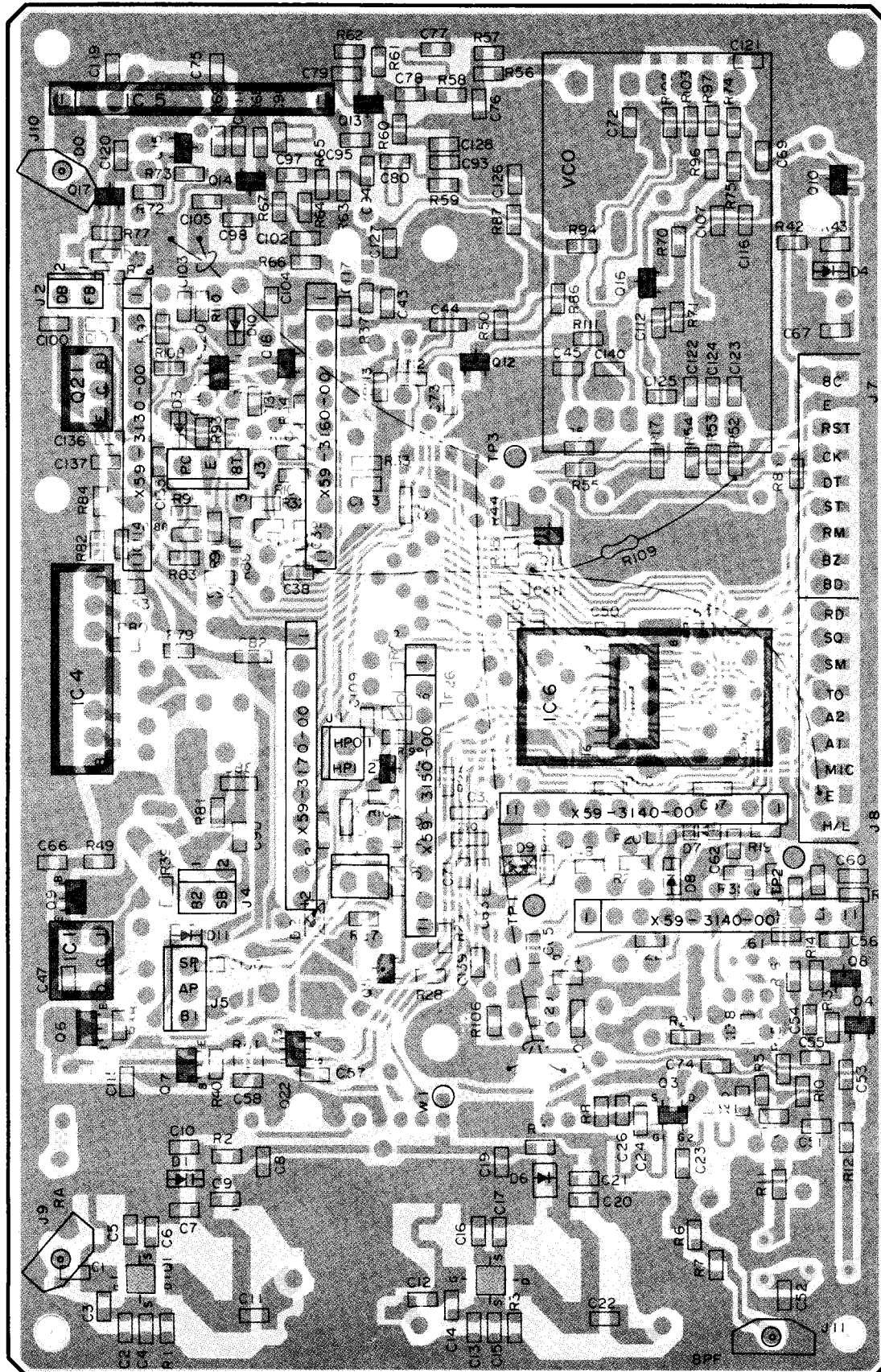
▼TX-RX UNIT (X57-3240-XX) -11:K, -61:W

(Component side view)



IC1 : MC7808C IC3 : MC14094BF IC4 : μ PC1241H IC5 : KC801 IC6 : W02-0818-05 Q1,2 : MGF1502 Q3 : 3SK184(R)
 Q4,8 : 2SC2714(Y) Q5 : 2SC3326(A) Q6,7 : 2SB1119S Q9 : 2SD1624S Q10,11,16,19 : 2SC2712(Y)
 Q12,18 : DTC144EK D13,14 : 2SC3356 Q15,17 : 2SA1162(Y) Q20,22 : IMH2 Q21 : 2SD1406(Y) D1,6 : 02CZ3,6(Y,Z)
 D2 : 1SS181 D3,4,10,11 : 1SS196 D5 : 02CZ6,2(Y,Z) D7,8 : 1SV166 D9 : MA713

▼ TX-RX UNIT (X57-3240-XX) -11:K, -61:W
(Foil side view)

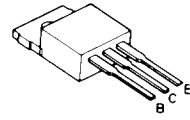


2SB1119S

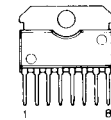


2SC2714(Y)
2SC3326(A)
2SC2712(Y)
DTC144EK
2SC3356
2SA1162(Y)

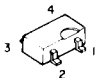
2SD1406(Y)



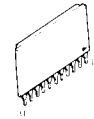
μPC1241H



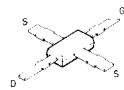
3SK184(R)



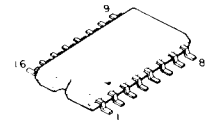
KC801



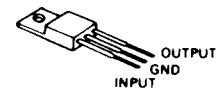
MGF1502



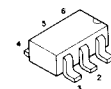
MC14094BF



MC7808C



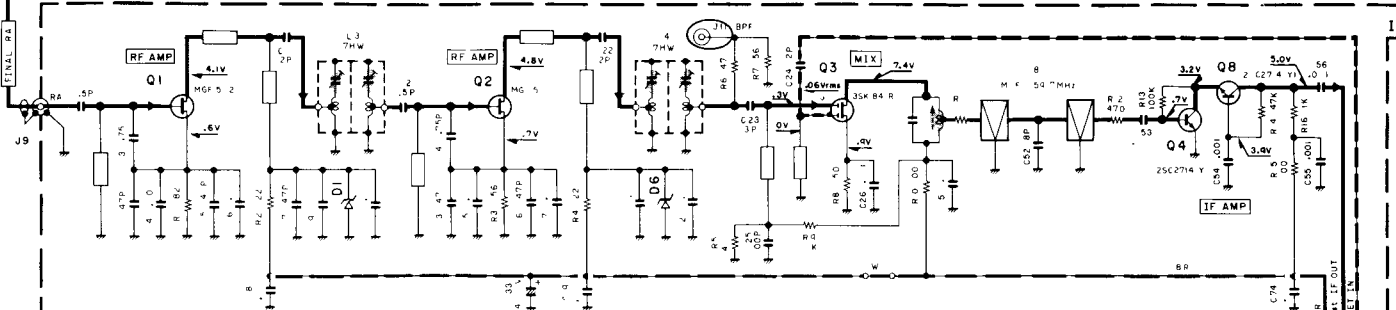
IMH2



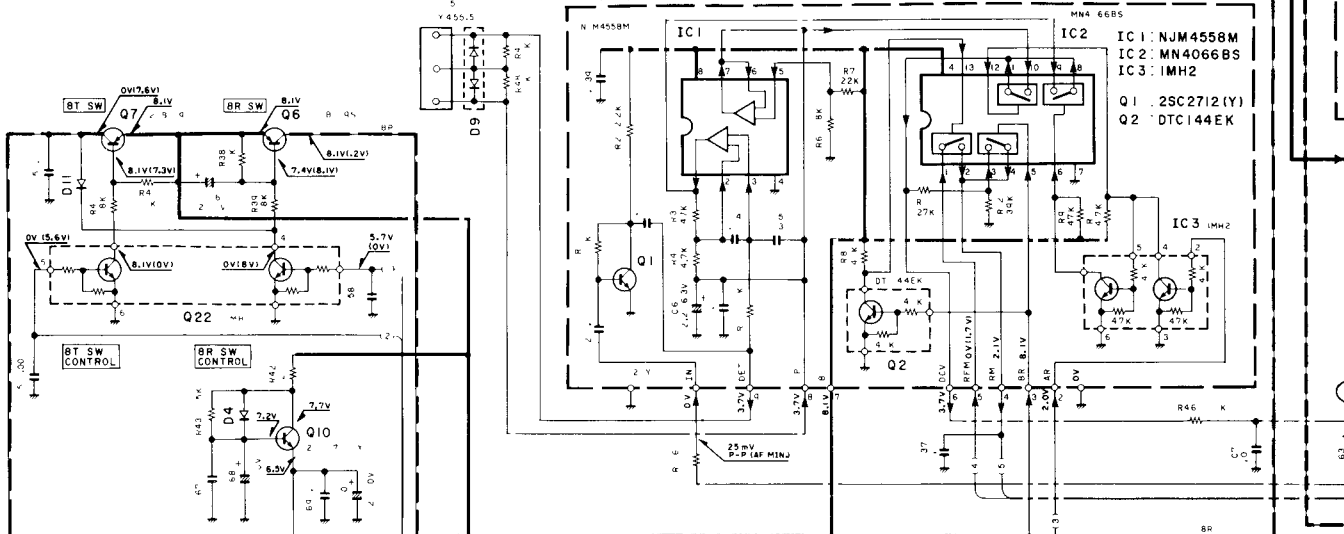
— Signal line --- Control line — Common DC line

• Voltage measurement condition $f = 1280 \text{ MHz}$, RX no signal, ():TX

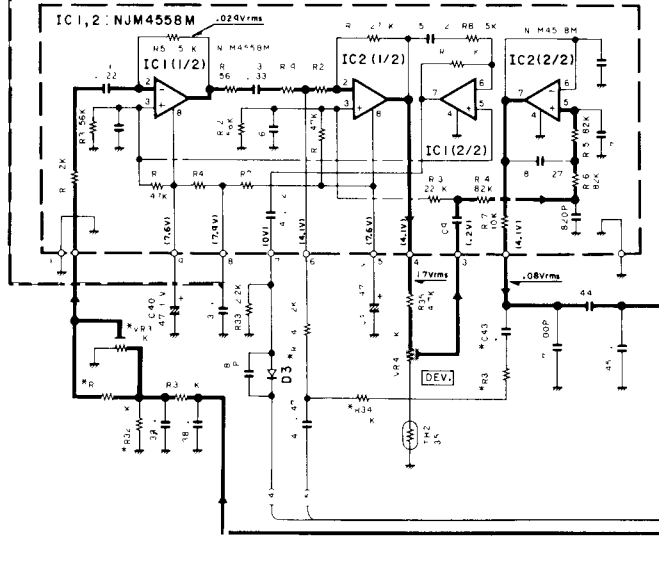
TX-RX UNIT (X57-3240-11/0-61) TM-521A/TM-521E



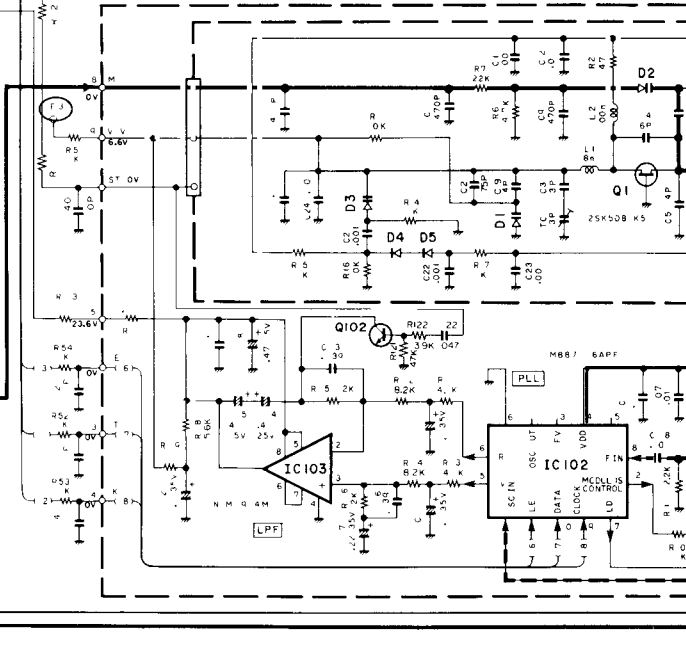
AFC (X59-3410-00)



MIC (X59-3160-00)



VCO (X58-3350-00)



(X57-3240-00)

IC1: MC7808C
IC2: MC14094BF
IC3: μ PC1241H
IC4: KC801
IC5: W02-0818-05

Q1,2: MGF 502
Q3: 3SK184(R)
Q4,8: 2SC2714(Y)
Q5: 2SC3326(A)
Q6,7: 2SB1119S
Q9: 2SD1624S

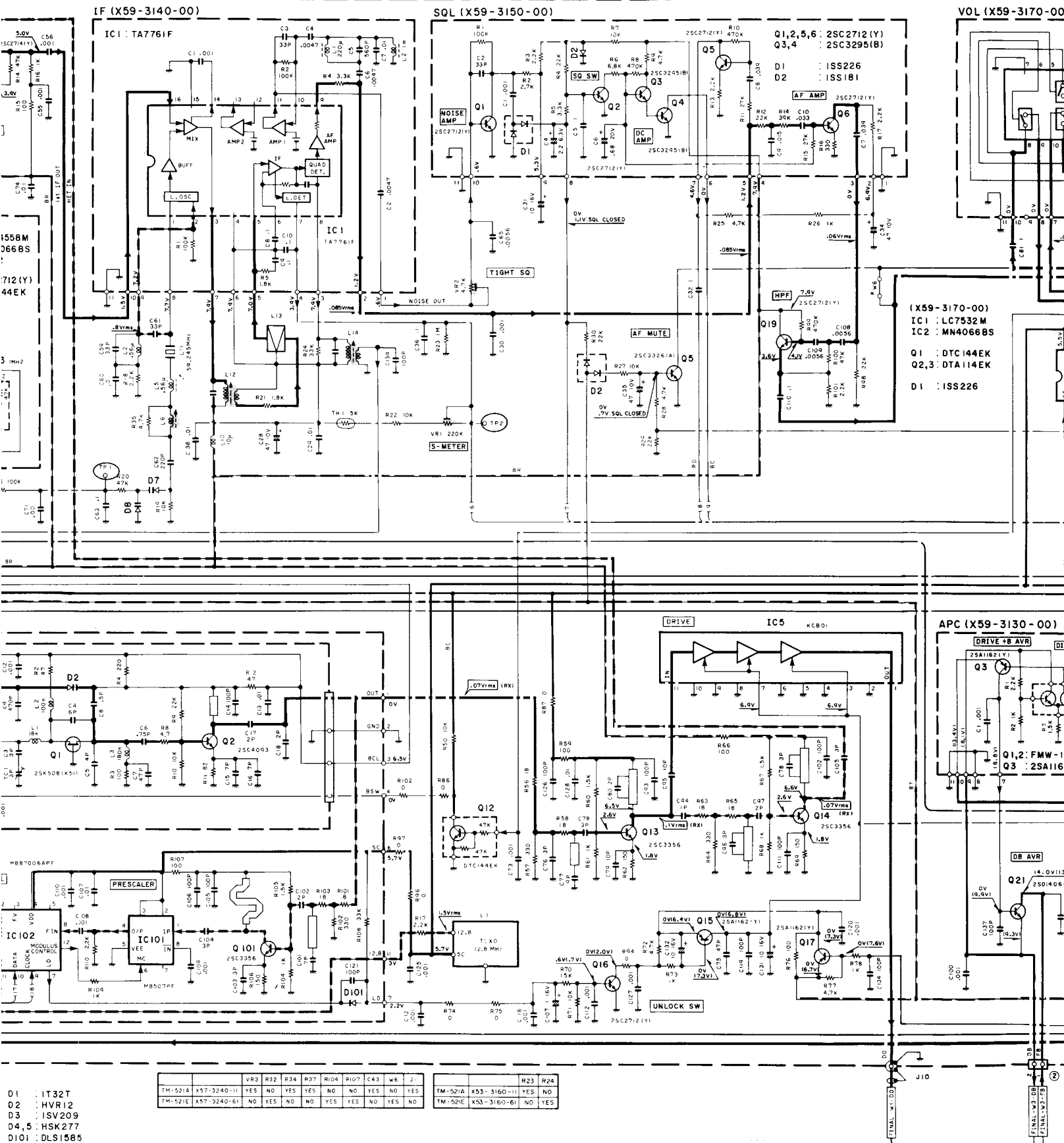
Q10,11,16,19: 2SC2712(Y)
Q12,18: DTC144EK
Q13,14: 2SC3356
Q15,17: 2SA1162(Y)
Q20,22: 1MH2
Q21: 2SD1406(Y)

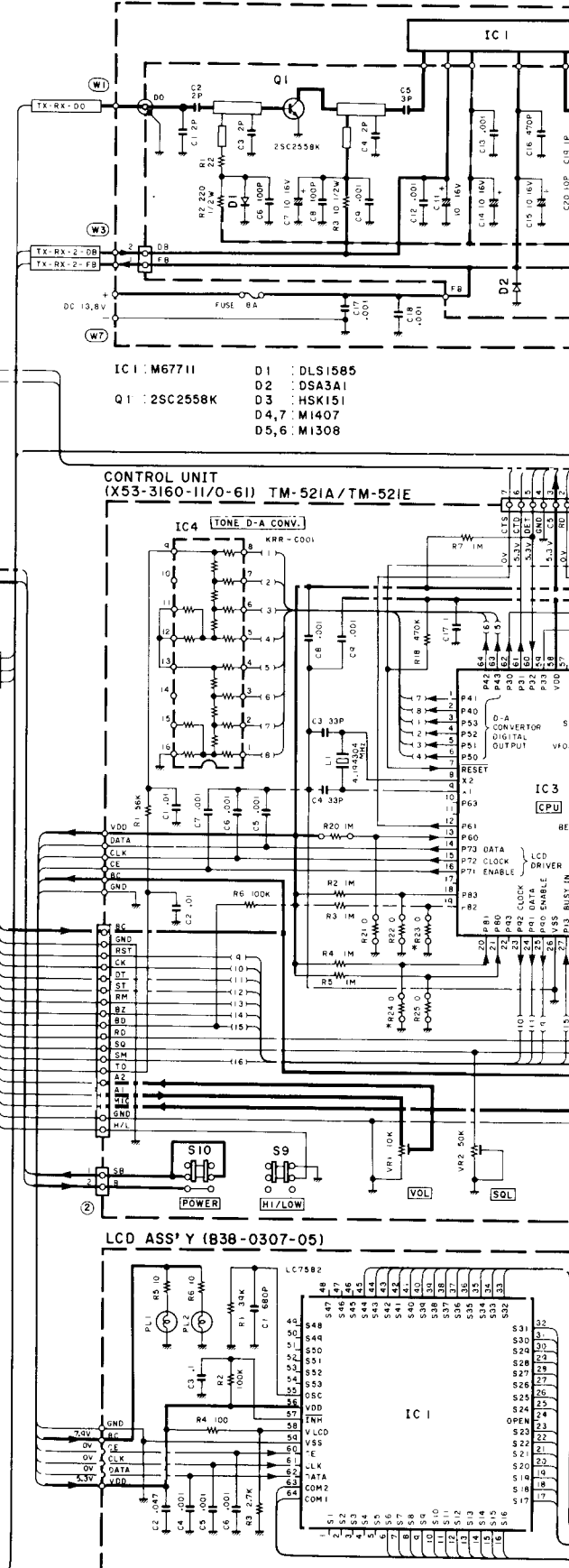
D1,6: 02CZ3.6(Y,Z)
D2: ISS181
D3,4,10,11: ISS196
D5: 02CZ6.2(Y,Z)
D7,8: ISV166
D9: MA713

(X58-3350-00)

IC101: MB507PF
IC102: MB87006APF
IC103: NJM2904M
Q1: 2SK508(K51)
Q2: 2SC4093
Q101: 2SC3356
Q102: 2SC2712(Y)

D1: IT32T
D2: HVR12
D3: ISV209
D4,5: HSK277
D101: DLS1585





TERMINAL FUNCTIONS

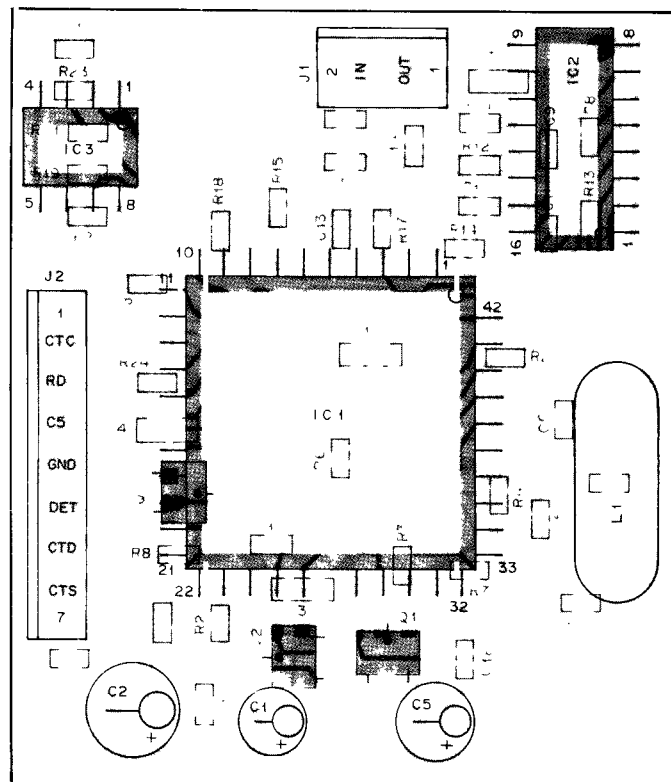
Connector No.	Terminal No.	Terminal Name	Terminal Function
FINAL UNIT (X45-3200-00)			
W1		D0	Drive output
W2		RA	RX ANT
W3	1 2	FB DB	Final + B Drive + B
W4	1 2 3	PC NC 8T	Auto power control — TX + 8T
W5	1 2 3	B1 AP SP	Audio power Speaker
W6		ANT	
W7	+ —		DC 13.8 V
CONTROL UNIT (X53-3160-XX)			
1	1 2 3 4 5 6 7	CTC RD 5C GND DET CTD CTS	CTCSS IC lock Remote data + 5 V GND Tone detector output CTCSS IC data CTCSS shift register reset
2	1 2	SB B	Switched + B (13.8 V) + B2
3		8C GND RS CK DT ST RM BZ BD RD	+ 8 V GND PLL enable PLL & shift resistor clock PLL & shift resistor data Shift enable strobe RF meter Beep output Busy display Remote data
		SQ SM TO A2 A1 MIC GND H/L	Squelch S meter Tone output AF output AF input Mic AF input GND Hi/Low switch
4		VDD DATA CLK CE 8C GND	Back up voltage LCD drive data LCD drive clock LCD drive enable + 8 V GND

Connector No.	Terminal No.	Terminal Name	Terminal Function
TX-RX UNIT (X57-3240-XX)			
1	1 2	HPO HP1	
2	1 2	FB DB	Final + B Drive + B
3	1 2 3	PC GND 8T	Auto power control GND TX + 8 V
4	1 2	B2 SB	+ B2 Switched + B (13.8 V)
5	1 2 3	SP AP B1	Speaker Audio power + B1
6	1 2	SP GND	Speaker GND
7		8C GND RST CK DT ST RM BZ BD	+ 8 V GND PLL enable PLL & shift resistor clock PLL & shift resistor data Shift resistor strobe RF meter Beep output Busy display
8		RD SQ SM TO A2 A1 MIC GND H/L	Remote data Squelch S meter Tone output AF output AF input Mic AF input GND Hi/Low switch
		RA	RX ANT
		DO	Drive output

TSU-5 PARTS LIST

Parts No.	New Parts	Description	Ref. No.
TSU-5			
E31-3248-05	*	Lead with connector	
N87-2606-46		Brazier head taptite screw x 2	
X52-3060-00	*	CTCSS unit	
CTCSS UNIT (X52-3060-00)			
CC41FCH1H150J		Chip C 15pF J	C6,7
CC73FSL1H681J		Chip C 680pF J	C15
CE04CW1A100M		Electro 10 μ F 10WV	C1
CE04CW1A101M		Electro 100 μ F 10WV	C2
CE04CW1A220M		Electro 22 μ F 10WV	C5
CK73EF1C104Z		Chip C 0.1 μ F Z	C3,4
CK73EF1C105Z		Chip C 1 μ F Z	C17,19
CK73FB1H103K		Chip C 0.01 μ F K	C16,18
CK73FB1H222K		Chip C 2200pF K	C13,14
CK73FB1H272K		Chip C 2700pF K	C12
C93-0501-05	*	Chip C 680pF	C8-11
E31-3248-05	*	Lead with connector	—
E40-5016-05		Pin ass'y 2P	J1
E40-5021-05		Pin ass'y 7P	J2
L77-1333-05		X'tal 4,194304MHz	L1
RD41FB2B103J		Chip R 10k J 1/8W	R4,10,11
RD41FB2B104J		Chip R 100k J 1/8W	R1
RD41FB2B105J		Chip R 1M J 1/8W	R8,22,23
RD41FB2B122J		Chip R 1.2k J 1/8W	R26
RD41FB2B124J		Chip R 120k J 1/8W	R16
RD41FB2B153J		Chip R 15k J 1/8W	R5
RD41FB2B154J		Chip R 150k J 1/8W	R25
RD41FB2B183J		Chip R 18k J 1/8W	R3
RD41FB2B222J		Chip R 2.2k J 1/8W	R6
RD41FB2B273J		Chip R 27k J 1/8W	R19
RD41FB2B392J		Chip R 3.9k J 1/8W	R9
RD41FB2B473J		Chip R 47k J 1/8W	R2,20,21,24
RD41FB2B683J		Chip R 68k J 1/8W	R17
RD41FB2B823J		Chip R 82k J 1/8W	R7
RD41FB2B824J		Chip R 820k J 1/8W	R15,18
R92-0688-05	*	Chip R 470k	R14
R92-0689-05	*	Chip R 910k	R12,13
MN6520		IC	IC1
MN4094BS	*	IC	IC2
NJM4558M		IC	IC3
DTC114YK		Digital transistor	Q1,2
2SC2712(GR)		Chip transistor	Q3

PC BOARD VIEWS



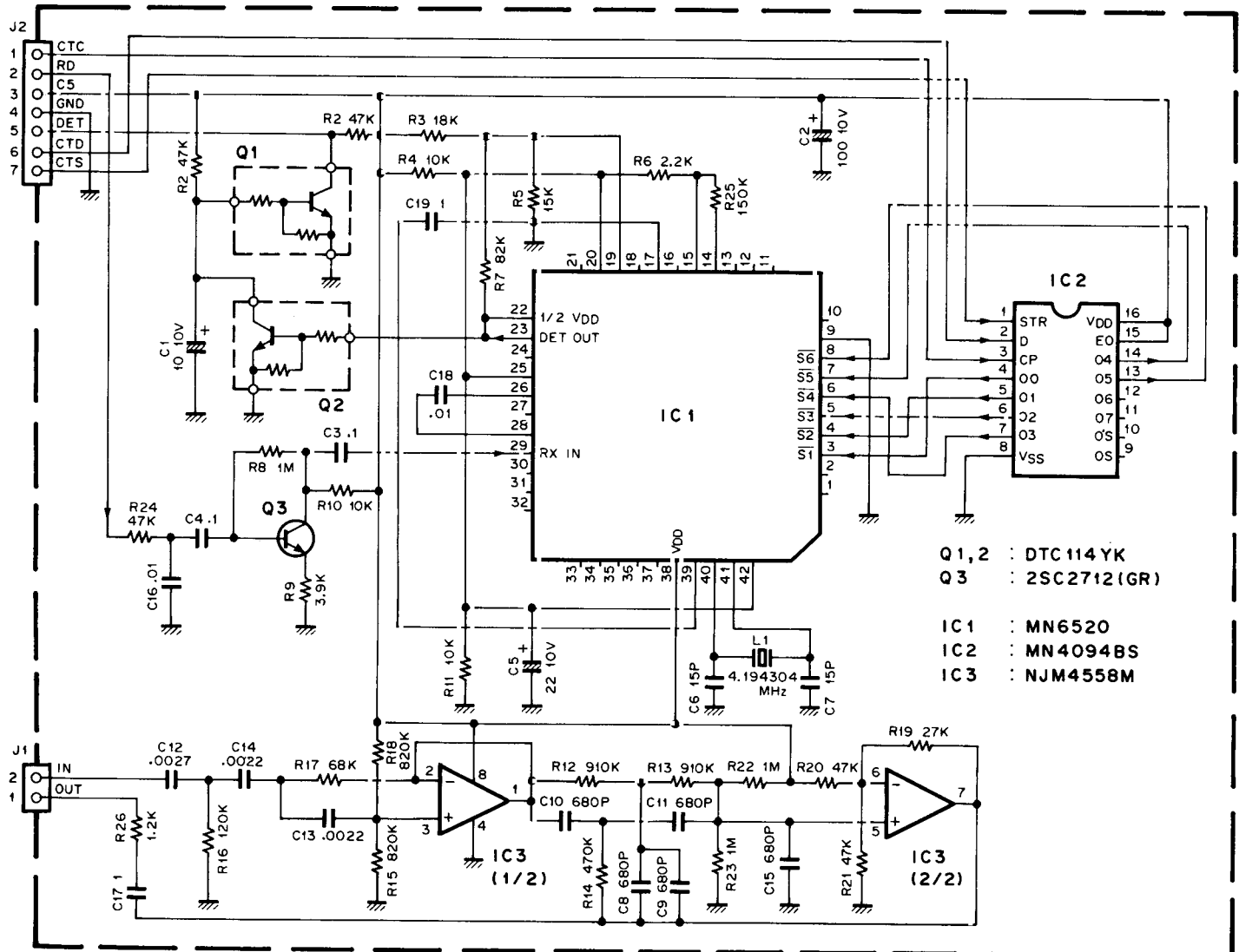
2SC2712



DTC114YK



TSU-5 SCHEMATIC DIAGRAM



SPECIFICATIONS

TM-521A/TM-521E

General

Frequency range.....1240 to 1300 MHz
 Mode.....F3E (FM)
 Antenna impedance.....50 ohms
 Operating temperature.....- 20°C to + 60°C (- 4°F to + 140°F)
 Power requirement.....13.8 VDC $\pm$ 15%
 Grounding.....Negative
 Current drain

Transmit mode (Max.)5.5 A
 Receive mode with no input signal.....0.6 A

Frequency stability.....Better than $\pm 3 \times 10^{-6}$

Dimensions

Wide.....141 mm (5-9/16")
 High.....42 mm (1-21/32")
 Deep.....193 mm (7-19/32")

Weight.....1.2 kg (2.65 lbs)

Transmitter

*Output power

HI.....10 W
 LOW.....Approx. 1 W. Adjustable up to out 5 W.

Modulation.....Reactance modulation

Spurious radiation.....Less than - 50 dB

Max. frequency deviation..... ± 5 kHz

Audio distortion (at 60% modulation).....Less than 3%

Microphone impedance.....500 to 600 ohms

Receiver

Circuitry.....Double conversion superheterodyne

Intermediate frequency

1st.....59.7 MHz
 2nd.....455 kHz

Sensitivity(12 dB SINAD).....Less than 0.16 μ V

Selectivity

- 6 dB.....More than 12 kHz
 - 60 dB.....Less than 36 kHz

Spurious response.....Better than 40 dB

Squelch sensitivity.....Less than 0.1 μ V

Output (5% distortion).....More than 2 W across 8 ohms load

External speaker impedance.....8 ohms

Notes:

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

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KENWOOD

TTN-037

TECH NOTES

AMATEUR RADIO

SUBJECT	DATE
SERVICE NOTES TM-221/421/521	05/06/91

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The following is a list of random complaints and probable solutions compiled on the TM-221/421/521. In order to expedite repairs, please use this list as a troubleshooting aid.

Low TX power.

Perform SB-933 and SB-934.

Intermittent unlock in TX or unstable TX when warm.

Check C64 in the PLL LPF (TX-RX unit). Check/replace the VCO module (TX-RX unit).

No DTMF with MC-48B or no control using RC-10.

Replace R14 (Control unit).

On air chattering after TX using a mobile microphone (MC-55).

Add a 1S1555 diode between pin 2 of the MIC jack and pin 42 of the CPU (Control unit). The cathode goes to pin 2 of the MIC jack.

Intermittent display.

Check the solder connections on the cable between the Control unit and the LCD assembly.

Hum on encode tone.

Check for solder splashes at pins 1-6, 63, and 64 of the CPU. Check the solder at IC4 (Control unit).

Memory loss.

Check the Lithium battery. Replace the CPU (Control unit).

Int. RX audio, TX audio, HI/LOW pwr selection, or squelch operation.

Clean flux off pins of board connectors that connect the TX-RX unit to the Control unit.

Poor RX intelligibility or rustling noise.

Add a 10uF, 16V electrolytic capacitor between pin 8 of the squelch module and ground. Add a 0.022uF Mylar capacitor between pin 1 of the AF PA and ground (TX-RX unit).

Ignition or alternator noise (TM-421A only).

Remove C91 from the TX-RX board and install it at the FB terminal on the Final board. If you need a new part, it is C90-2033-05 (1000uF, 16V Electrolytic).

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