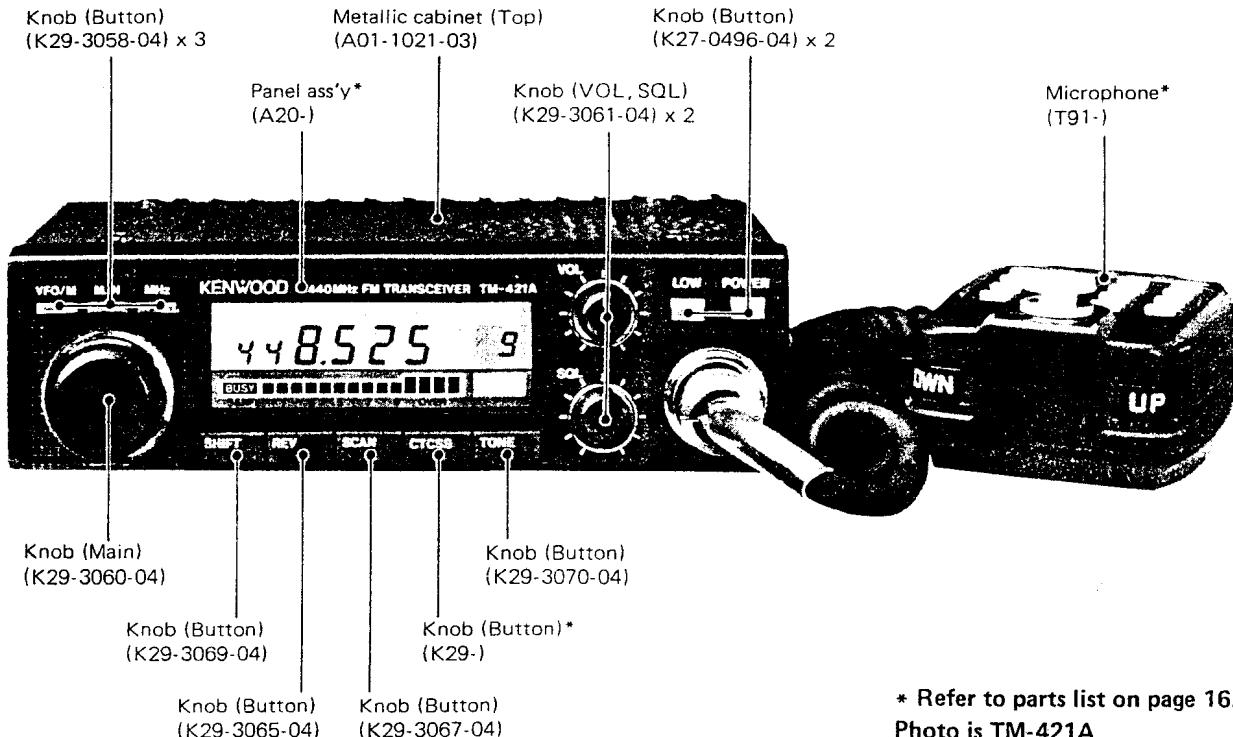


430MHz/440MHz FM TRANSCEIVER
TM-421A/E/ES
 SERVICE MANUAL

KENWOOD

©1987-3 PRINTED IN JAPAN
 B51-3218-00 (O) 801



* Refer to parts list on page 16.
 Photo is TM-421A.

CONTENTS

CIRCUIT DESCRIPTION	2	SQL (X59-3150-XX)	42
SEMICONDUCTOR DATA	12	MIC (X59-3160-00)	42
DESCRIPTION OF ELEMENTS	13	VOL (X59-3170-00)	42
PARTS LIST	16	DRIVE (X59-3180-00)	42
EXPLODED VIEW	32	FINAL UNIT (X45-1370-XX)	43
PACKING	33	TX-RX UNIT (X57-3070-XX)	44
DISASSEMBLY	34	CONTROL UNIT (X53-3040-XX)	46
ADJUSTMENT	35	SCHEMATIC DIAGRAM	47
PC BOARD VIEWS		LEVEL DIAGRAM	51
LCD ASS'Y (B38-0303-05)	41	BLOCK DIAGRAM	52
VCO (X58-3100-XX)	41	TERMINAL FUNCTIONS	53
APC (X59-3130-00)	41	TSU-5 (CTCSS UNIT)	54
IF (X59-3140-00)	42	SPECIFICATIONS	BACK COVER

TM-421A/E/ES

CIRCUIT DESCRIPTION

MODEL UNIT	TM-421A (35W)		TM-421E (10W)		TM-421ES (35W)	
	K	M	T1	W1	T2	W2
FINAL UNIT	X45-1370-12	X45-1370-03		X45-1370-52		X45-1370-53
CONTROL UNIT	X53-3040-12	X53-3040-23	X53-3040-52	X53-3040-62	X53-3040-52	X53-3040-62
TX-RX UNIT	X57-3070-11	X57-3070-21		X57-3070-51		X57-3070-52
VCO	X58-3100-11	X58-3100-21		X58-3100-51		X58-3100-51
SQL	X59-3150-00			X59-3150-51		X59-3150-51

Table 1 Comparison of TM-421A, TM-421E and TM-421ES

Frequency configuration

The TM-421A/E/ES utilize a PLL synthesizer system incorporating a digital VFO. (See Fig. 1.) The channel step can be selected as 5, 10, 12.5, 15, 20, or 25kHz.

The receiver operates as a double conversion system. Received signals are mixed with the first local oscillator (418.400~428.395MHz (K), 408.400~418.395MHz (M,T,W)) to produce the first intermediate frequency of 21.6MHz. The first intermediate frequency is mixed with the second local oscillator (21.145MHz) to produce the second intermediate frequency of 455kHz.

The transmitter system consists of a PLL circuit incorporating a direct oscillator and direct divider. The output is amplified by a linear amplifier prior to being transmission.

Receiver system

- General

Incoming signals from the antenna pass through a low-pass filter in the Transmitter Final unit and a diode transmit/receive switch, then enter the receiver front end.

After passing through antenna matching coils the signals are amplified by a GaAs (gallium arsenide) FET (Q1 : 3SK184(S)), and goes through the 2-pole helical resonator (L3). It is then supplied again to another FET stage (Q2 : 2SK125) and 2-pole helical resonator (L4) to remove undesired signals, and applied to the 1st mixer (Q3 : 3SK184(R)), which employs the same GaAs FET as in the RF stage to obtain a good 2-signal characteristics. In the first mixer (Q3) the signal is mixed with the first local oscillator from the PLL system to produce the first IF signal of 21.6MHz. Interfering Adjacent channel interference is removed from the first IF signal by a two-stage monolithic crystal filter (MCF) (L8).

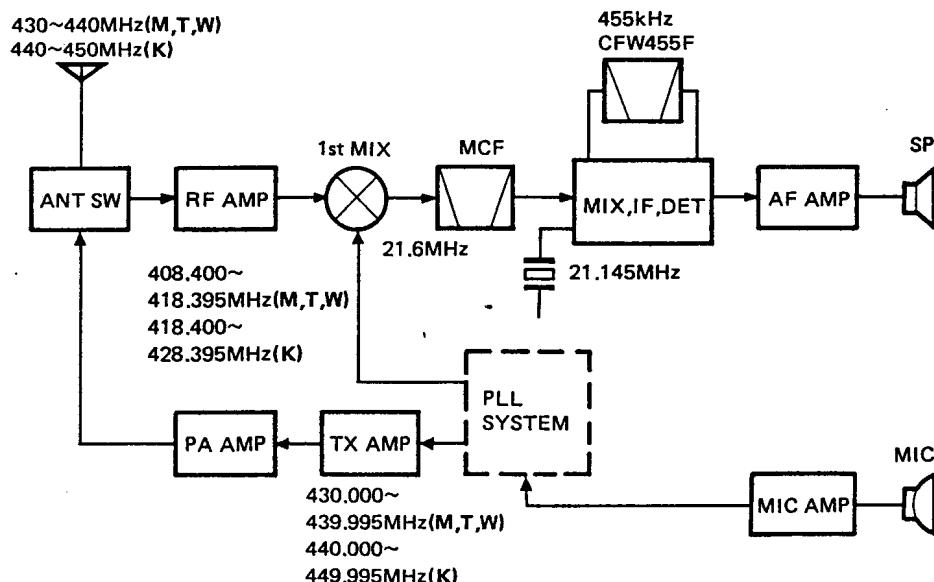


Fig. 1 Frequency configuration

CIRCUIT DESCRIPTION

The first IF signal is amplified by Q4 : 2SC2714(Y) and fed to a special narrow-FM IC (TA7761F). Here the signal is mixed with the 21.145MHz frequency from the second local oscillator to produce the 455kHz second IF signal. This signal is sharpened by passing it through a six-element ceramic filter (CFW455F). The signal is then amplified by a five-stage limiting amplifier contained in IC1. This is followed by quadrature detection which is also performed by IC1. Undesirable high-frequency components are removed from the detected signal by an active low-pass filter. The signal then passes through the audio volume control, then is amplified by the audio power amplifier (IC4), and applied to the speaker. The circuit configuration from detection onward is shown in Fig. 2.

- S-meter circuit**

The S-meter output voltage of the special narrow-FM IC (TA7761F) is amplified by an inverting amplifier, then fed to the Control unit. The microprocessor converts the analog voltage to a digital signal that is used to control the LCD bar meter.

- Squelch circuit**

The noise component extracted from the detector output is filtered to remove the second intermediate frequency component (455kHz), amplified twice, and is then fed to the rectifier. After rectification, the signal passes through the squelch control to the audio limiter circuit.

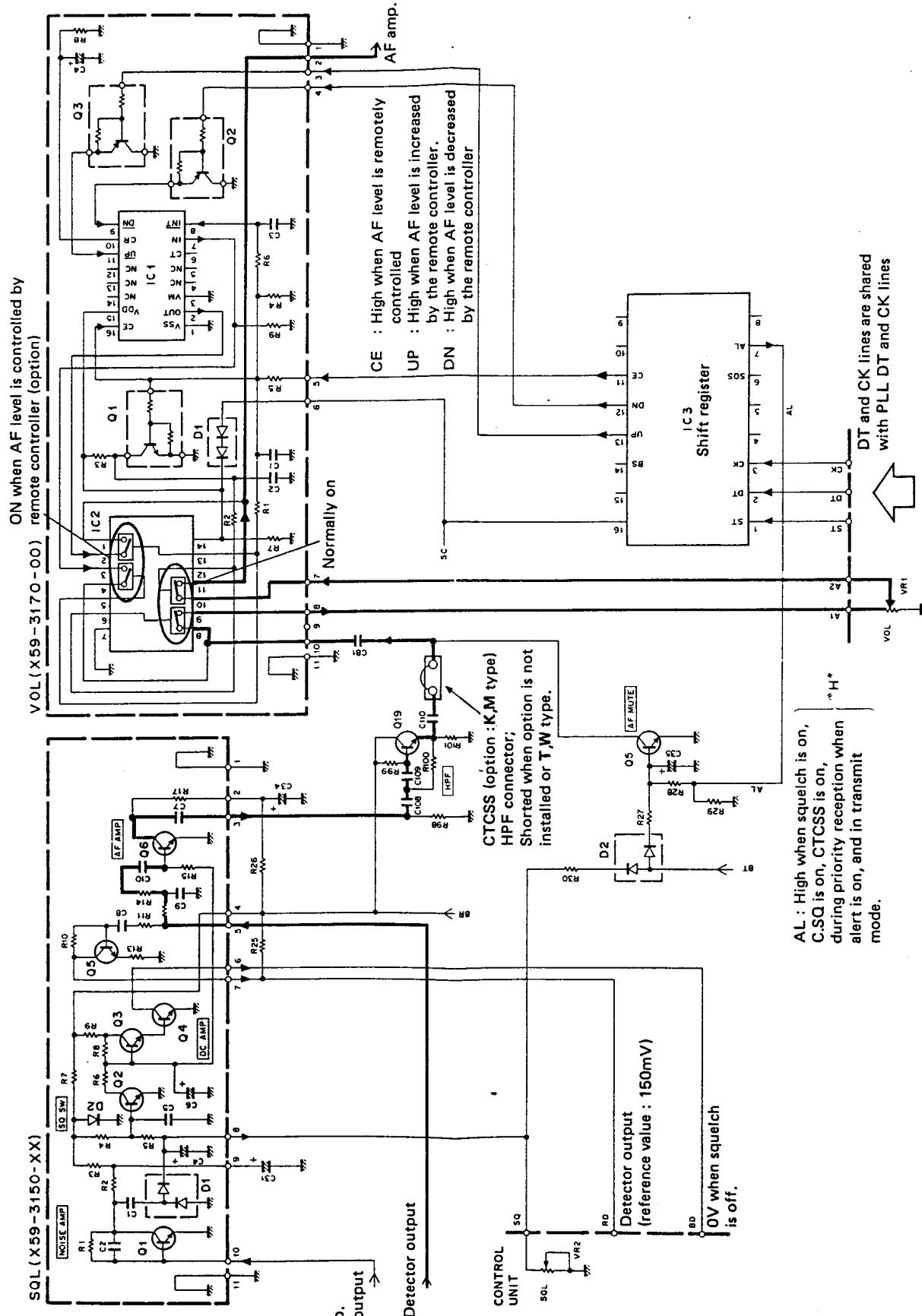
Item	Rating
Nomical center frequency (fo)	21.600kHz
3dB bandwidth	$\pm 7.5\text{kHz}$ or more
Attenuation bandwidth	$\pm 25\text{kHz}$ or less at 40dB $\pm 45\text{kHz}$ or less at 60dB
Guaranteed attenuation	70dB or more within $\pm 1\text{MHz}$ (Spurious response 35dB or more) 80dB or more within $\pm (910\text{kHz} \pm 20\text{kHz})$
Ripple	1.0dB or less
Loss	2.0dB or less
Input and output impedance	$1\text{k}\Omega/1\text{pF}$

Table 2 MCF (L71-0227-05) characteristics
(TX-RX unit L8)

Item	Rating
Nominal center frequency	455kHz $\pm 1\text{kHz}$
6dB bandwidth	$\pm 6\text{kHz}$ or more (from 455kHz)
50dB bandwidth	$\pm 12.5\text{kHz}$ or less (from 455kHz)
Ripple (within $455 \pm 4\text{kHz}$)	3dB or less
Insertion loss	6dB or less
Guaranteed attenuation (within $455 \pm 100\text{kHz}$)	35dB or less
I/O impedance	$2.0\text{k}\Omega$

Table 3 Ceramic filter CFW455F (L72-0315-05)
characteristics (TX-RX unit L13)

CIRCUIT DESCRIPTION



CIRCUIT DESCRIPTION

Transmitter system

General

In the transmitter system the desired frequency is produced directly by an oscillator. Frequency modulation is obtained directly thru the use of a varactor diode.

Modulation circuit

Audio signals from the microphone are applied to a three-stage operational amplifier which adds preemphasis, performs amplification and limiting, and includes a splatter filter to remove undesired high-frequency components. After amplification by the operational amplifier, part of the audio signal is applied to the microphone check circuit used in the low-power mode.

In the FM modulation circuit, the frequency of the VCO is directly modulated by a varactor diode.

Preamplifier stage circuit

The output from the VCO enters the linear amplifier, which is capable of high-quality signal amplification because it operates entirely in linear mode. APC, (Automatic Power Control) is performed by controlling the collector voltage of the 3 stage final preamplifier stage.

Power amplifier circuit

The drive signal is applied to the power module and amplified to the required level. In the model TM-421A/ES heat is dissipated efficiently by a large mechanically strong heatsink.

APC and SWR protection circuits

Fig. 3 shows the basic ALC (Automatic Level Control) and SWR (Standing Wave Ratio) protection circuits. The SWR protection circuit incorporates a CM coupler that detects any reflected power caused by mismatching of the antenna. After detection and amplification, this circuit acts to lower the output control voltage, which protects the power module by reducing the gain. The automatic power control (APC) circuit incorporates a diode that is used to detect a portion of the output from the power module. The detected signal is amplified and is then used to control the power control voltage. The control voltage is inversely proportional to the output, so a constant output level is maintained.

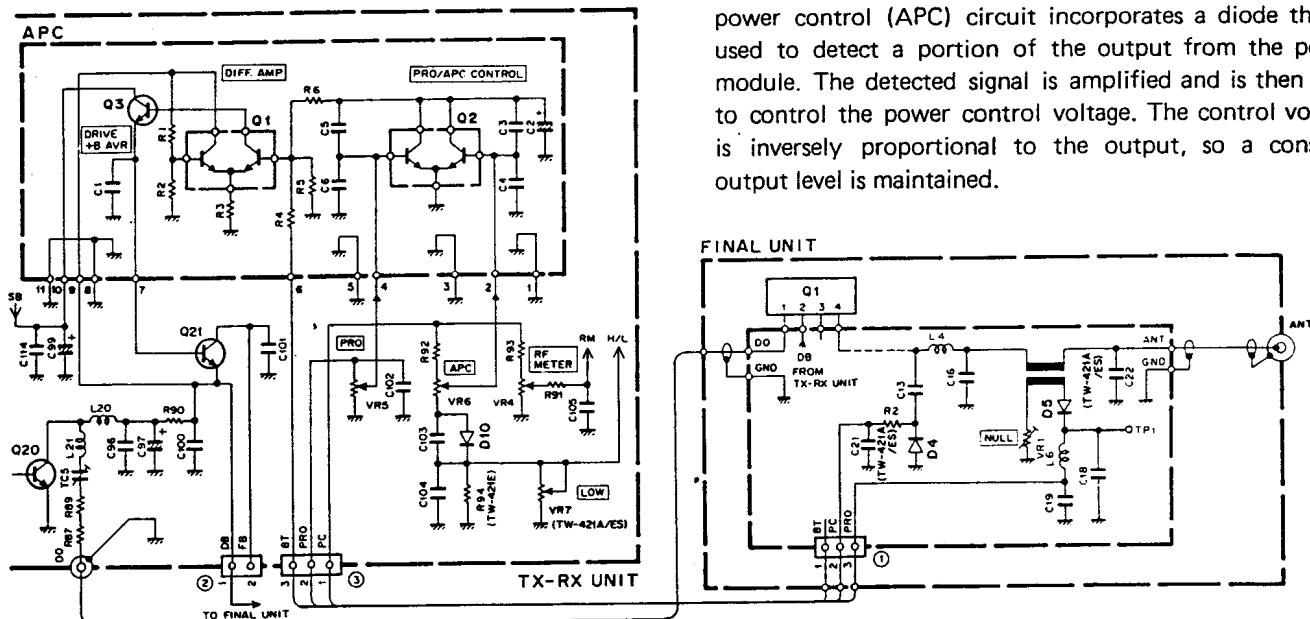


Fig. 3 APC and SWR protection circuits

Item	Symbol	TC (°C)	Unit	Condition	Specifications	
					M57752	M57788M
Operating voltage	Vcc	25	V		17	17
Current consumption	Icc	25	A		5	14
Input power	pin	25	W	ZG=ZL=50Ω	0.4 (VCC1≤12.5V)	0.6 (VCC1≤13.8V)
Output power	Po	25	W	ZG=ZL=50Ω	20	55
Case temperature (operating)	Tc(op)		°C		-30~+110	-30~+110
Storage temperature	Tstg		°C		-40~+110	-40~+110

Table 4 Power module M57752 (TM-421E), M57788M (TM-421A/ES)
absolute maximum ratings (Final unit Q1)

TM-421A/E/ES

CIRCUIT DESCRIPTION

PLL synthesizer

Fig. 4 is the PLL system block diagram. The transmitter and receiver systems of the TM-421A/E/ES have independent VCOs and PLLs, but share a common low-pass filter.

The VCOs are configured as subunits. This construction minimizes outside influence and improves frequency stability.

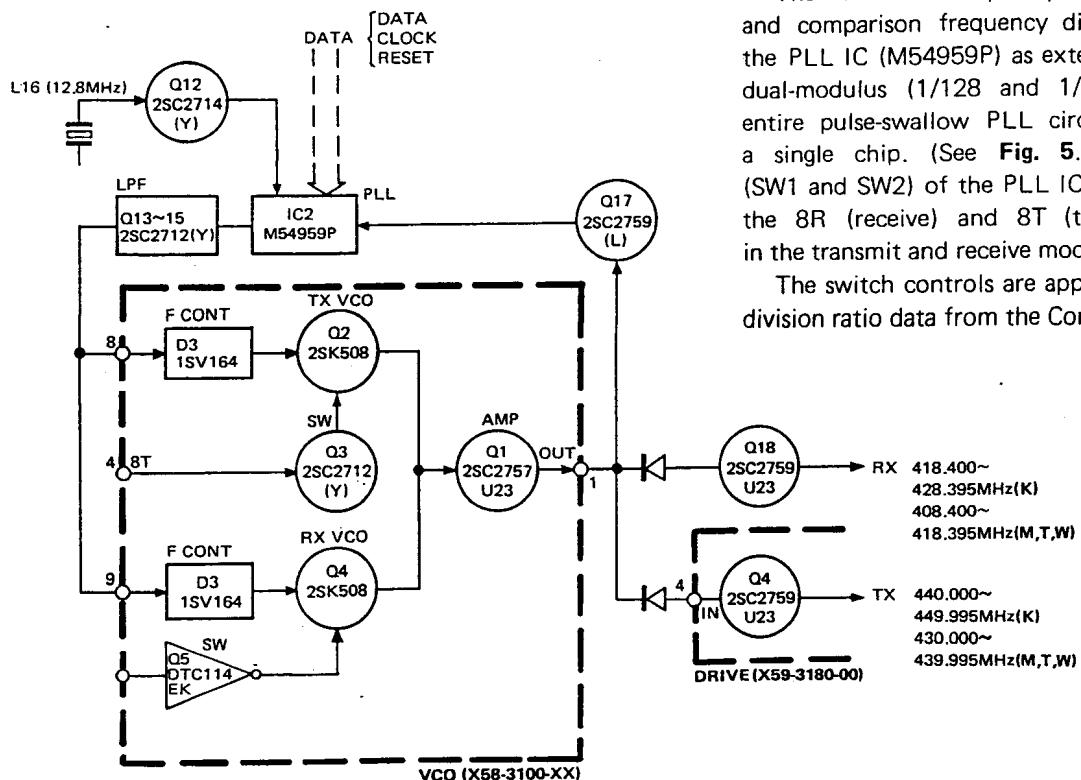


Fig. 4 PLL system block diagram

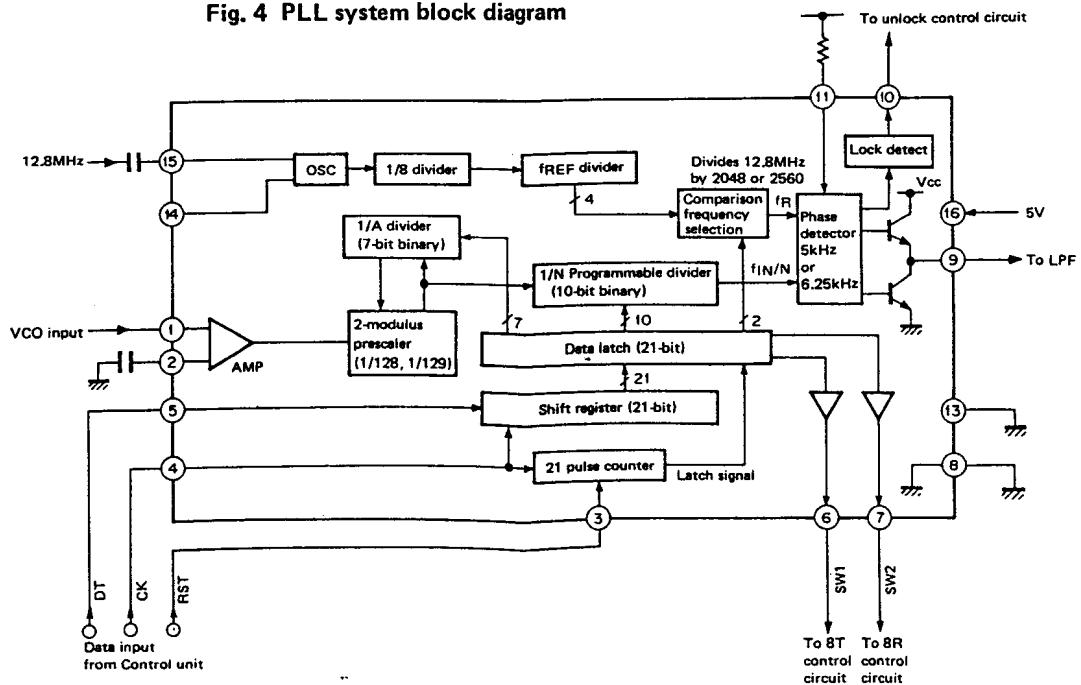


Fig. 5 PLL IC ; M54959P block diagram

CIRCUIT DESCRIPTION

At 440MHz (K), fVCO (RX) has the following relationship to the various frequency division ratios :

$$f_{VCO} = (440 - 21.6) = [(n \times 128) + A] \times f_{osc}/R$$

where, fVCO : Frequency output by the VCO

n : 10-bit binary programmable counter setting
 A : 7-bit binary programmable counter setting
 fosc : 12.8MHz reference oscillator
 R : 14-bit binary programmable counter setting
 (2560)

If n=653 and A=96, then;

$$\begin{aligned} f_{VCO} &= [(653 \times 128) + 96] \times 12800/2560 \\ &= [83584 + 96] \times 5 \\ &= 418400\text{kHz} = 418.400\text{MHz} \end{aligned}$$

• Unlock detector circuit

Whenever the PLL is unlocked, pin 10 of the PLL IC goes high ("H") (5.5V), turning off Q16 so that Q1 and Q2 in the module unit (drive unit) turn OFF. The result is that during receive Q18 is OFF, and during transmit Q4 and Q5 in the module unit are OFF. This halts transmit, preventing unwanted radiation from the antenna. (See Fig. 6.)

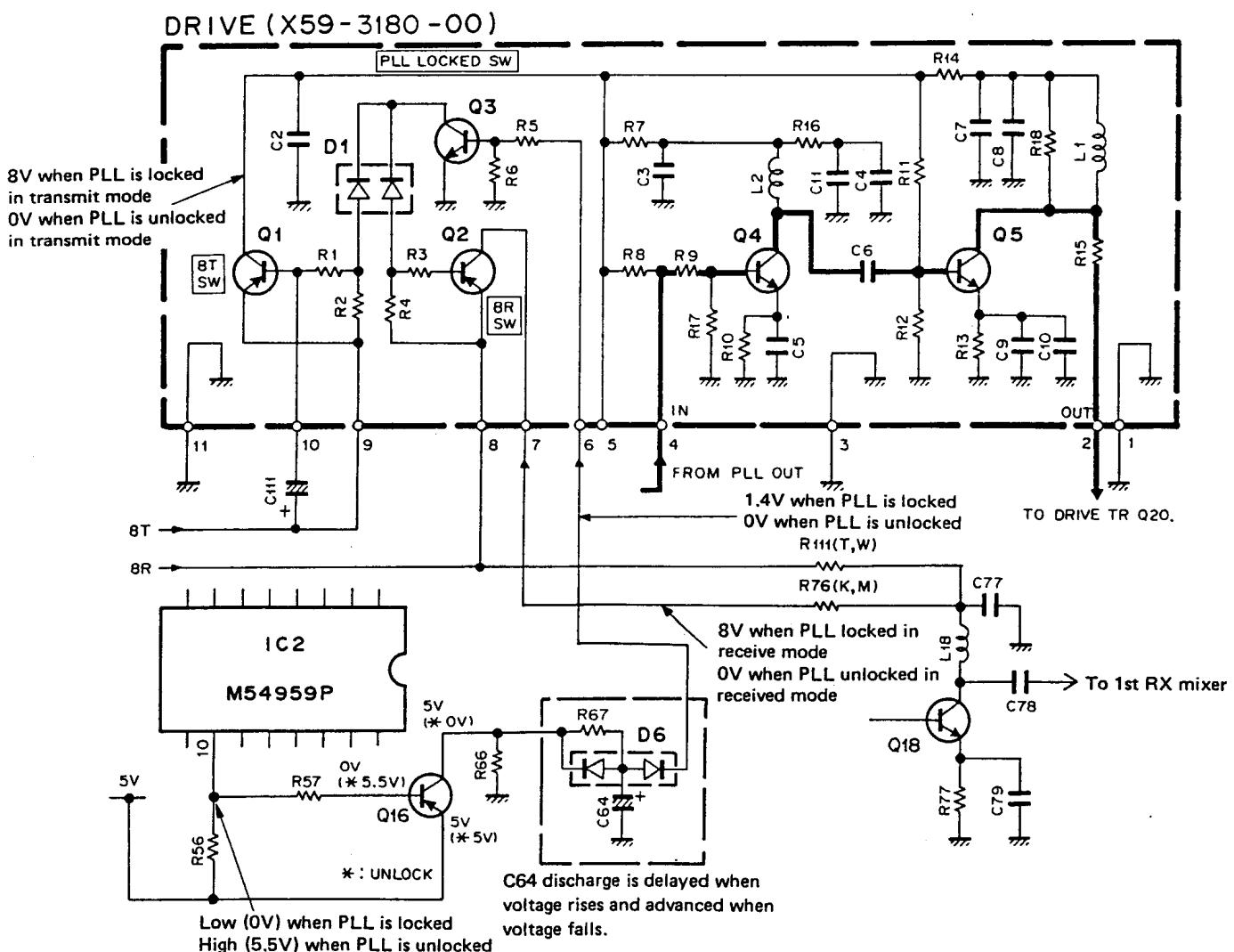


Fig. 6 PLL unlock detector circuit

CIRCUIT DESCRIPTION

Digital control unit

• General

The control unit consists of a microprocessor, input keys, peripheral circuits, and a display. The single microprocessor (IC3) controls all transceiver functions. The pin assignments of the microprocessor are listed on the **Table 5**.

• Keys and rotary encoder input circuits

Fig. 7 shows the input circuit for the keys, microphone keys, and rotary encoder. Data from the front panel keys, microphone keys, and rotary encoder are applied directly to the microprocessor.

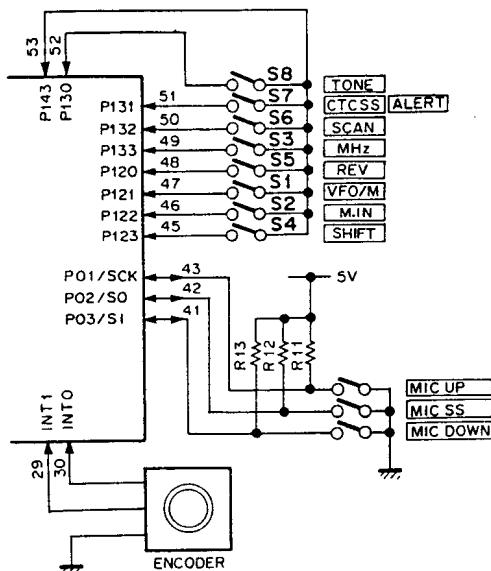


Fig. 7 Key and rotary encoder input circuits

Terminal No.	Name	I/O	Logic	Function	Terminal No.	Name	I/O	Logic	Function
1	P41	O	-	Digital output of D-A conv.	35	T11	-	-	Not used.
2	P40	O	-		36	T10	-	-	
3	P53	O	-		37	P23	O	-	
4	P52	O	-		38	P22	O	H	Squelch control during remote control.
5	P51	O	-		39	P21	O	H	Shift register strobe.
6	P50	O	-		40	PT00	O	-	Beep oscillator output.
7	RESET	I	L	Reset input.	41	P03/SI	I/I	L/-	Microphone DOWN switch input/serial data input.
8	X2	-	-	4.194304MHz crystal oscillator.	42	P02/SO	I/O	L/-	Microphone PTT switch input/serial data input.
9	X1	-	-	Not used.	43	P01/SCK	I/-	L/-	Microphone UP switch input/serial data input.
10	P63	-	-		44	INT4	I	-	Backup detect input.
11	P62	-	-	CTCSS shift register reset (K,M)	45	P123	I	L	SHIFT switch input.
12	P61	O	—		46	P122	I	L	M.IN switch input.
13	P60	I	L		47	P121	I	L	VFO/M select switch input.
14	P73	O	-		48	P120	I	L	REV switch input.
15	P72	O	—		49	P133	I	L	Frequency step select switch input.
16	P71	O	H		50	P132	I	L	SCAN switch input.
17	P70	-	-	Directional input.	51	P131	I	L	CTCSS switch input (K,M). Alert switch input (T,W).
18	P83	I	L		52	P130	I	L	TONE switch input.
19	P82	I	L		53	P143	O	-	Pull-down pin.
20	P81	I	L		54	P142	O	-	Not used.
21	P80	I	L		55	P141	O	-	
22	P93	O	-		56	P140	O	-	
23	P92	O	—		57	NC	-	-	
24	P91	O	-	PLL and shift register clock.	58	VDD	-	-	Power supply pin (5V).
25	P90	O	L	PLL and shift register data.	59	P33	-	-	GND terminal (0V).
26	Vss	-	-	PULL enable.	60	P32	I	H	Tone detect input (when CTCSS is on (K,M)).
27	P13	I	L	GND terminal (0V).	61	P31	O	-	CTCSS IC data (K,M).
28	INT2	I	-	BUSY input.	62	P30	O	—	CTCSS IC clock.
29	INT1	I	-	Encoder input.	63	P43	O	-	DAC digital data output.
30	INT0	I	H		64	P42	O	-	
31	PTH03	I	-						
32	PTH02	I	-	Not used.					
33	PTH01	I	-	RF meter analog input.					
34	PTH00	I	-	S meter analog input.					

Table 5 μPD75106G-508-1B pin assignments (Control unit IC3)

CIRCUIT DESCRIPTION

● Display circuit

Located in the LCD assembly (Fig. 8), the display circuit consists of the LCD driver, its peripheral circuits, and the LCD. The LCD is driven with a 50% duty cycle

according to serial data sent from pins P71 to P73 of the microprocessor to the LCD driver. Fig. 9 shows the common output and segment output signals of the LCD driver.

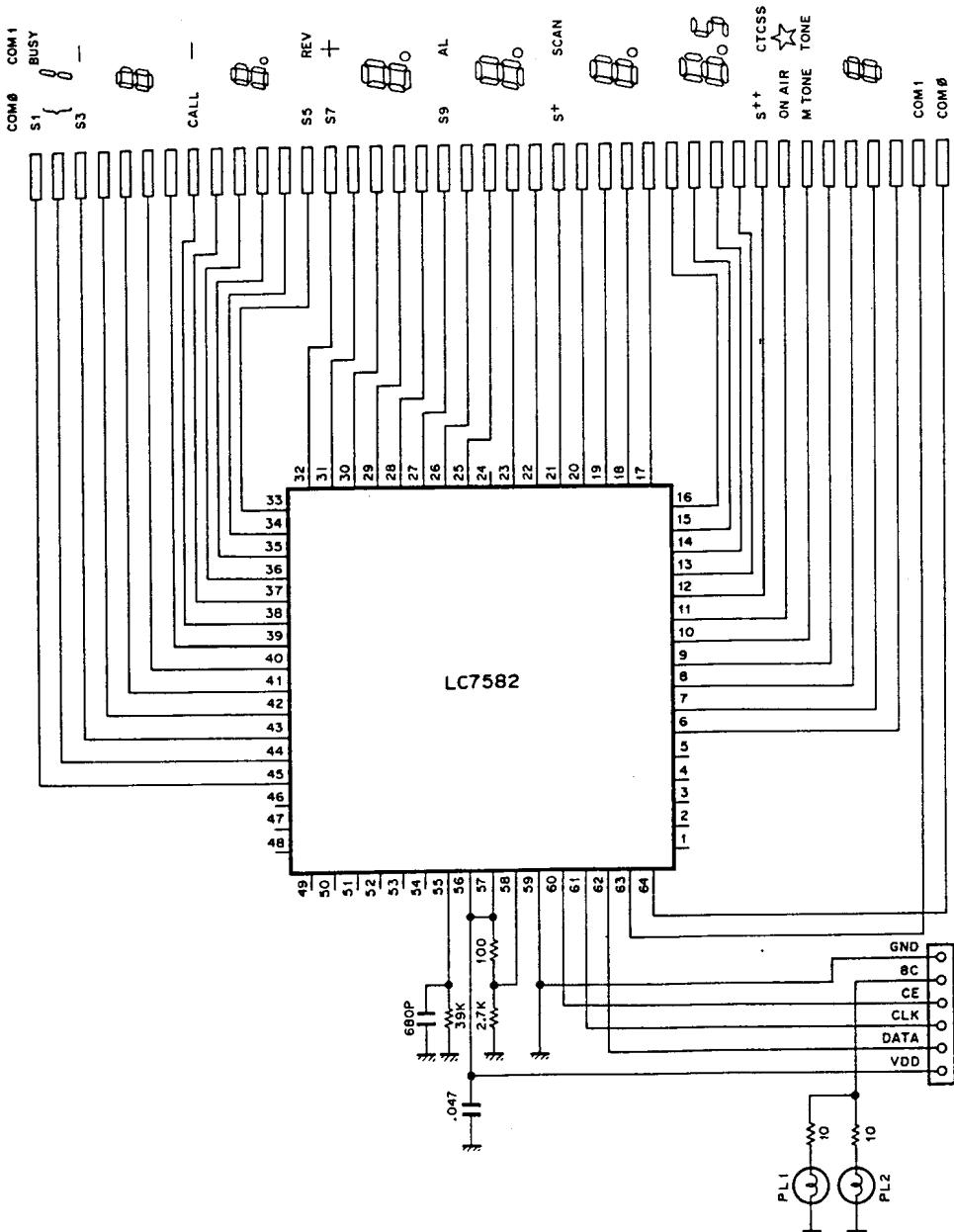


Fig. 8 LCD ass'y (B38-0303-05)

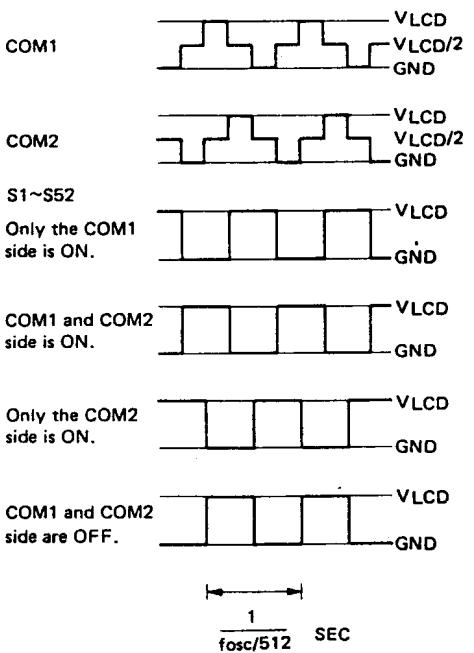


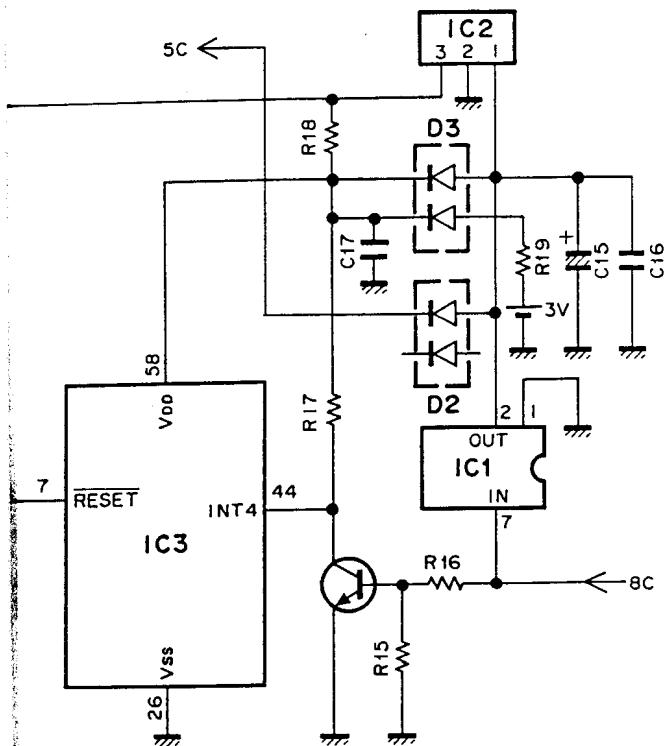
Fig. 9 LCD driver common and segment output signals

M-421A/E/ES

CIRCUIT DESCRIPTION

- **Reset backup circuit**

Fig. 10 shows the reset backup circuit. When the transceiver is turned ON, 3.0V is applied at the INT4 pin causing IC3 to enter the backup mode.



IC2 timing chart

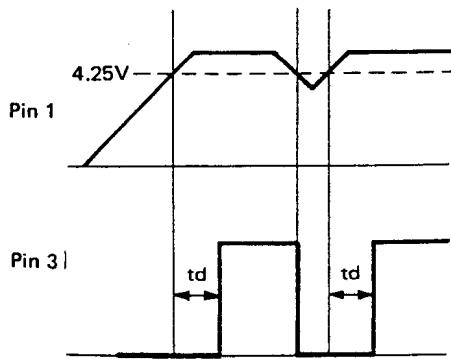


Fig. 10 Reset and backup circuit

- **PLL data output**

PLL data is supplied from pins P92 (CK), P91 (DT), and P90 (RST) of the microprocessor. **Fig. 11** shows the data transfer format. **Fig. 12** shows the data configuration.

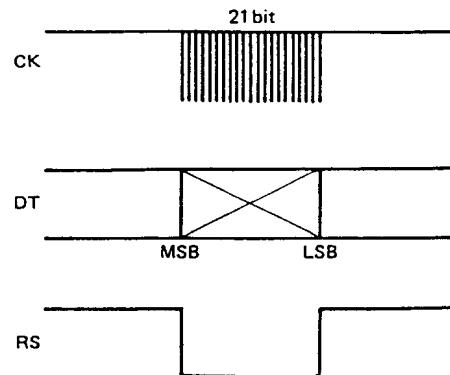
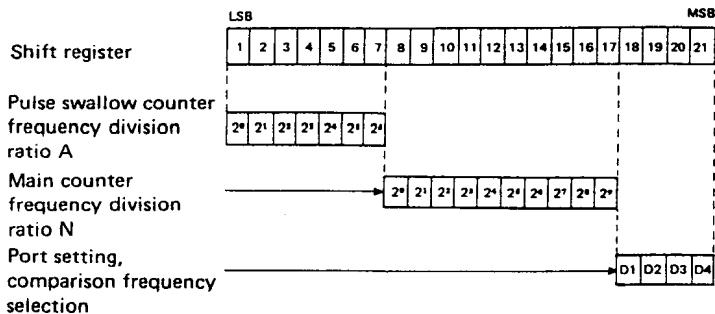


Fig. 11 PLL data transfer format



The 21-bit data is converted by the procedure below.

1. Frequency division ratio data A, N (17 bits)

$$F \text{ (RX display - 21.6MHz)} = [(N \times 128) + A] \times 12.8\text{MHz/ref}$$

N : Frequency division ratio of main 10-bit counter

A : Frequency division ratio of 7-bit pulse swallow counter

2. Comparison frequency (ref) selection (2 bits)

Data		Phase comparison frequency			
D1	D2	L	L	5kHz	5, 10, 15, 20 or 25kHz steps
H	L	L	H	6.25kHz	12.5kHz step

3. Switch selection (2 bits)

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

Fig. 12 PLL data configuration

CIRCUIT DESCRIPTION

- Alert and electronic volume control output (when optional remote controller is connected)**

The alert and electronic volume control outputs are provided by pins P92 (CK), P91 (DT), and P21 (ST) of the microprocessor to the 8-bit shift register (IC3) in the TX-RX unit. P92 (CK) and P91 (DT) are also used for the PLL data. **Fig. 13** shows the data transfer format. **Fig. 14** shows the data configuration.

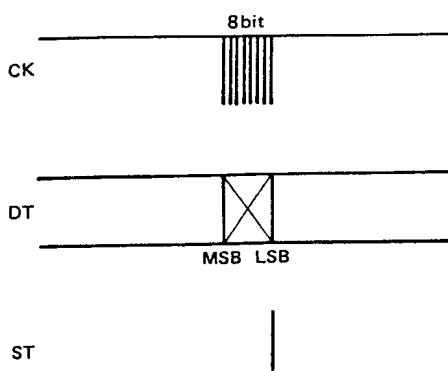


Fig. 13 Data transfer format for alert and electronic volume control

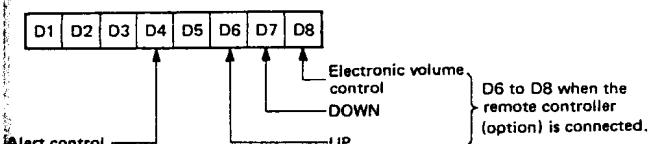


Fig. 14 Data configuration for alert and electronic volume control

- Tone output**

The outputs from pins P40 to P43 and P50 to P53 of the microprocessor are applied to a ladder resistance network (IC4) which converts these signals into an analog waveform with 38 possible tone frequencies combinations 67.0 to 250.3Hz. **Fig. 15** shows the internal configuration of IC4.

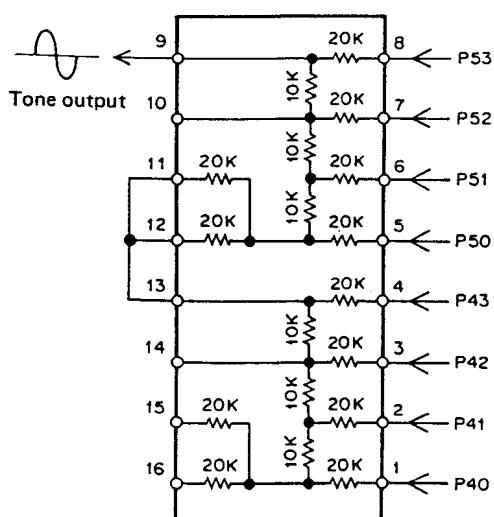


Fig. 15 Internal configuration of KRR-C001 ladder resistance network (Control unit IC4)

- S-meter and RF meter input**

The analog voltage of the S-meter is applied to pin PTH00 of the microprocessor, and the analog voltage of the RF meter to pin PTH01. After 4-bit (16-step) analog-to-digital conversion, the resulting signal is sent to the display.

- Busy input**

When squelch is ON and an input signal is present, a low input lights the busy indicator.

- CTCSS unit (option : TM-421A only) input and output**

The microprocessor sends data from pins P30, P31, and P61 to the CTCSS unit. **Fig. 16** shows the data transfer format. **Fig. 17** shows the data configuration. When a tone is detected from the CTCSS unit, a "H" is applied to pin P32 of the microprocessor to open the squelch.

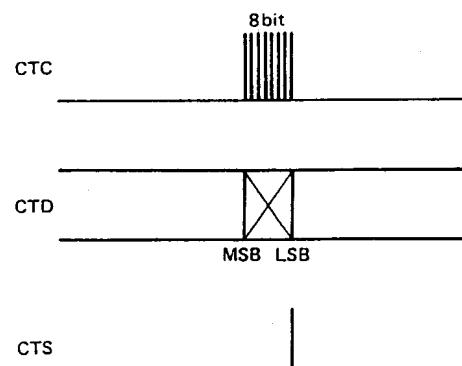
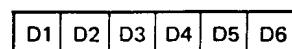


Fig. 16 CTCSS data transfer format

CTCSS unit MN6520 tone frequency select data



Ex. 88.5Hz L H L H H H

Fig. 17 CTCSS data configuration

- Remote control (RC-10) (option) input and output**

When the RC-10 remote control unit is connected a "H" is applied to pin INT0 of the microprocessor, switching the following pins to the functions indicated:

P03 → SI : Serial data input pin

P02 → SO : Serial data output pin

P01 → SCK : Serial clock input/output pin

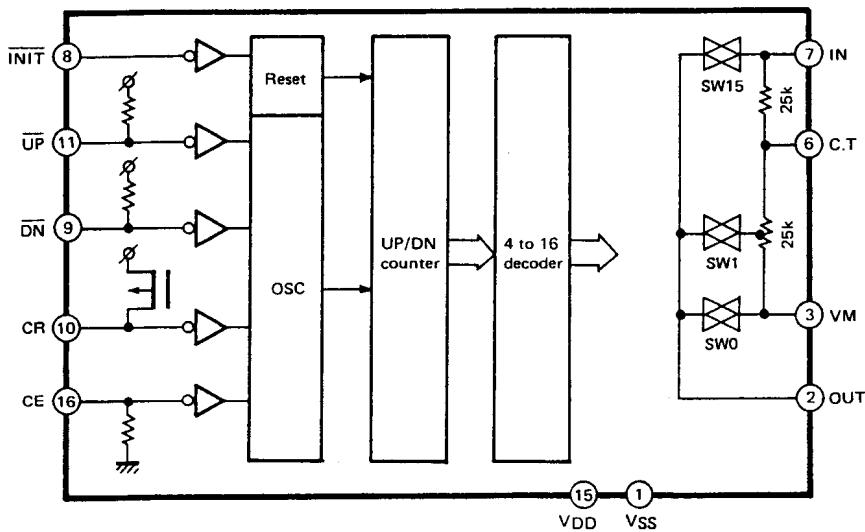
SEMICONDUCTOR DATA

Electronic volume (VOL IC1)

● Electric characteristics

Item	Symbol	Conditions	Specifications			Unit
			Min.	Typ.	Max.	
High-frequency distortion	THD1	VDD=3V, $R_L=50\text{k}\Omega$, $f=1\text{kHz}$, VR MAX, VIN=-20dBV		0.1	0.5	%
	THD2	VDD=2.1V, $R_L=50\text{k}\Omega$, $f=1\text{kHz}$, VR MAX, VIN=-20dBV		0.3	1.0	%
Output in low-power mode	X OUT	At 0dBm input : $f=1\text{kHz}$, $R_L=51\text{k}\Omega$		-95	-60	dB
Input impedance	R IN	$\overline{\text{UP}}, \overline{\text{DN}}, \text{CE}$	100		400	$\text{k}\Omega$
Current consumption	IDD (1)	VDD=3V when operating		0.035	1	mA
	IDD (2)	VDD=3V, CE="L"		4		μA

● Block diagram



DESCRIPTION OF ELEMENTS

FINAL UNIT(X45-1370-XX)

Element	Function	Description
Q1	Power amplifier	Boosts power to the required level. M57752 in TM-421E,M57788M in TM-421A/ES.
D1	Protection against reverse power connection	
D2,D3	Transmit/receive select	ON during transmit.
D4	High-frequency output voltage level detect	Detects high-frequency output level and controls output in the APC circuit.
D5	Reflected power detector	Adjustable with VR1.

CONTROL UNIT (X53-3040-XX)

Element	Function	Description
IC1	6V AVR	
IC2	Reset IC	Outputs Reset signal and detects low voltage.
IC3	Microprocessor	Controls frequencies and general set functions.
IC4	Tone DAC	Converts digital data from IC3 (P40 to P43, P50 to P53) to an analog tone frequency.
Q1	Squelch switching	Switches squelch on/off when remote controller is connected.
Q2	Switching	Controls the microprocessor's backup detect input.
D1	Reverse current protection	Protects against external voltage applied to pin 5 of the microprocessor.
D2(1/2)	Microprocessor protection	Protects against static surge.
D2(2/2)	Voltage drop	
D3(1/2)	Reverse current protection	Prevents current from flowing to the backup battery.
D3(2/2)	Reverse current protection	Prevents backup battery current from flowing to inappropriate circuits.
D4	Microprocessor protection	Protects against static surge.

TX-RX UNIT (X57-3070-XX)

Element	Function	Description
IC1	8V AVR	
IC2	PLL	Pulse-swallow type phase-locked loop.
IC3	Shift register	Controls alert (T,W), electronic volume functions.
IC4	AF amplifier	Speaker output.
Q1,Q2	High-frequency amplifier	Operates in receive mode (430MHz).
Q3	First mixer	Converts the 2 meter-band received frequency into the 21.6MHz.
Q4	High-frequency amplifier	First intermediate frequency amplifies.
Q5	AF muting	Operates when CTCSS is ON (K,M), during priority reception when alert is ON (T,W), when SQS is high, and in transmit mode.
Q6	8R switching	ON in receive mode.
Q7	8T switching	ON in transmit mode.
Q8	8T switching control	ON in transmit mode.
Q9	8R switching control	ON in receive mode.
Q10	Ripple filter	
Q11	Constant-voltage control	5V power supply for PLL.
Q12	OSC circuit	Oscillates 12.8MHz.
Q13~Q15	PLL low-pass filter	
Q16	PLL unlock control	ON when the PLL is locked.
Q17	High-frequency amplifier	Amplifies the VCO output to the level required for the PLL.
Q18	High-frequency amplifier	Amplifies the VCO output to the level required for input to the 1st IF mixer (Q3).
Q19	HPF	Improves AF frequency characteristics in the receive mode.
Q20	Transmit driver (power amplifier)	Amplifies to the level required for input to the final unit power module.
Q21	+ B (DB) AVR of Q20	Operates in transmit mode.

M-421A/E/ES

DESCRIPTION OF ELEMENTS

Element	Function	Description
D1	Limiting	Limits the first IF signal.
D2	Reversal current protection	Turns on the SQ circuit and Q5 for AL, in transmit mode for muting of the AF line.
D3	Rectifier/Reversal current protection	Prevents flow of RF meter current to the microphone check circuit and rectifies the microphone check output.
D4	Motive power for Q10	
D5	AVR	Zener diode for setting the AVR circuit reference voltage.
D6	Switching characteristic	Diode to provide rise and fall hysteresis on the LD line.
D7	PLL output switch	ON in transmit mode.
D8	PLL output switch	ON in receive mode.
D9	Temperature compensation	Temperature compensation for Q20 (driver).
D10	Temperature compensation	Temperature compensation for APC circuit.
D11	Switching characteristic	Quickens the fall of 8R at the switching from receive mode to transmit mode.
D12	Discharging	Discharges C107 to delay the rise of RX VCO at the switching from transmit mode to receive mode.
D13,14	S-meter circuit protection	Protect for S-meter circuit when TX to RX mode.

VCO (X58-3100-XX)

Element	Function	Description
Q1	Amplifier	Operates in all modes to amplify the VCO output to the required level.
Q2	Transmit VCO	Oscillates 430 to 439.995MHz.
Q3	Transmit VCO switch	Turns on the transmit VCO.
Q4	Receive VCO	Oscillates 399.175 to 409.17MHz.
Q5	Receive VCO switch	Turns on the receive VCO.
D1	Transmit frequency control varactor	430MHz : 2.5V
D2	Transmit modulation varactor	Adds FM modulation to TX VCO.
D3	Receive frequency control varactor	430MHz : 2.5V.

APC (X59-3130-00)

Element	Function	Description
Q1	Differential amplifier	
Q2(1/2)	Protection control	Adjustable with VR5.
Q2(2/2)	APC control	Adjustable with VR6.
Q3	Drive stage + B AVR	

IF (X59-3140-00)

Element	Function	Description	
IC1	Second local oscillator, mixer, IF amplifier, quadrature detector, noise amplifier	(7) S-meter output. (9) Detector output	(11) Noise amplifier output (first stage). (16) First IF signal input.

DESCRIPTION OF ELEMENTS

SQL (X59-3150-XX)

Element	Function	Description
Q1	Noise amplifier	
Q2	Squelch switching	ON when squelch is on.
Q3,Q4	DC amplifier	OFF when squelch is on.
Q5	Low-frequency amplifier	For RD terminal.
Q6	Low-frequency amplifier	OFF when squelch is on.
D1	Squelch noise rectifier	
D2	Base bias setting	

MIC (X59-3160-00)

Element	Function	Description
IC1(1/2)	Low-frequency amplifier	① Output, ② Input.
IC1(2/2)	Low-frequency amplifier	For microphone check. ⑥ Input ⑦ Output.
IC2(1/2)	Limiting amplifier	① Output ② Input.
IC2(2/2)	LPF	⑥ , ⑦ Output.

VOL (X59-3170-00)

Element	Function	Description
IC1	Electronic volume control (16 steps, initialized to the 6th step from the bottom)	② Output. ⑦ Input. ⑧ Initialize input : "L" → step 6. ⑨ Increase ("L" input raises the volume 1 step). ⑪ Decrease ("L" input lowers the volume 1 step). ⑯ "H" while operating.
IC2	Bidirectional switch (4 circuits)	① – ② controlled by ⑬ . ③ – ④ controlled by ⑤ . ⑧ – ⑨ controlled by ⑥ . ⑩ – ⑪ controlled by ⑫ .
Q1	Bidirectional switch enable	ON to enable electronic volume control.
Q2	Switching	ON to decrease by 1 step.
Q3	Switching	ON to increase by 1 step.
D1	Voltage drop	

DRIVE (X59-3180-00)

Element	Function	Description
Q1	Switching	Supplies 8V to the drive circuit; switched by Q3.
Q2	Switching	Supplies 8V to the local oscillator amplifier; switched by Q3.
Q3	Switching	ON when the PLL is locked.
Q4,Q5	High-frequency amplifier	Operates in transmit mode. When checking levels near these transistors, be careful of the probe ground points.
D1	Reversal current protection	Separates Q1 and Q2.

M-421A/E/ES

PARTS LIST

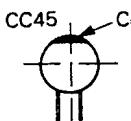
CAPACITORS CC 45 TH 1H 220 J
 1 2 3 4 5 6

1 = Type ceramic, electrolytic, etc.
 2 = Shape round, square, etc.
 3 = Temp. coefficient

4 = Voltage rating
 5 = Value
 6 = Tolerance

• Temperature Coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/ $^{\circ}$ C	0	-80	-150	-220	-330	-470	-750



• Capacitor value

1 0 3 = 0.01 μ F

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

0 1 0 = 1pF

1 0 0 = 10pF

1 0 1 = 100pF

1 0 2 = 1000pF = 0.001 μ F

2nd Word	G	H	J	K	L
ppm/ $^{\circ}$ C	\pm 30	\pm 60	\pm 120	\pm 250	\pm 500

Example CC45TH = -470 \pm 60 ppm/ $^{\circ}$ C

• Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code	Code	B	C	D	F	G
(%)	\pm 0.25	\pm 0.5	\pm 2	\pm 5	\pm 10	\pm 20	+ 40	+ 80	+ 100	More than Less than	10 μ F - 10~ + 50					

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 7 3 F S L 1 H 0 0 0 J
 1 2 3 4 5 6 7
 (Chip) (CH,RH,UJ,SL)

EX) CK 7 3 F F 1 H 0 0 0 Z
 1 2 3 4 5 6 7
 (Chip) (B,F)

→ Refer to the table above.

Dimension

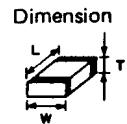
Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

Dimension

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

Rating wattage

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



RESISTORS

• Chip resistor (Carbon)

EX) R D 7 3 E 8 2 B 0 0 0 J
 1 2 3 4 5 6 7
 (Chip) (B,F)

• Carbon resistor (Normal type)

R D 1 4 B B 2 C C 0 0 0 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

SEMICONDUCTOR

Item	Re-marks	Parts No.
Diode		1S1555 1SS101 BA282 DSA3A1 MI308 UM9401
Chip diode		1SS181 1SS184 1SS226
Chip zener diode		02CZ6.2(Y,Z)
Chip vari-cap diode		1SV164
Thermister		112-502-2
Posistor	N	PTH59U332M
TR		2SC2407(1) 2SC3369 2SD1406(Y)
Chip TR		2SA1162(Y) 2SB1119S 2SC2712(Y) 2SC2714(Y) 2SC2759(U23) 2SC3295(B) 2SC3326(A)

N : New parts

Item	Re-marks	Parts No.
Digital TR		DTA114EK DTC114EK DTC124EK DTC144EK
FET		FMW-1
Chip FET		2SK125
Power module		2SK508(K52)
IC		3SK184(R) 3SK184(S)
	N	M57752 M57788M
	N	KRR-C001
	N	LA5006M LC7532M LC7582
	N	M51951BML M54959P MC7808C MN4066BS
	N	NJM4558M
	N	TA7761F TC4094BP
		μ PC1241H μ PD75106G-508-1B

TM-421A/E/ES

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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	Desti- nation 仕 向	Re- marks 備考
TM-421A/E/ES						
1	1B		A01-1021-03	METALLIC CABINET(TOP)		
2	2B		A01-1022-03	METALLIC CABINET(BOTTOM)		
4	1A	*	A20-2602-02	PANEL ASSY	K1	
4	1A	*	A20-2603-02	PANEL ASSY	M1	
4	1A	*	A20-2620-02	PANEL ASSY	T1W1	
4	1A	*	A20-2620-02	PANEL ASSY	T2W2	
-			A20-2574-03	PANEL		
9	2A		B11-0442-04	REFLECTOR		
11	2A		B38-0303-05	LCD ASSY		
14	1B		B42-2455-04	LABEL (M4X8 MAX)	K1	
15	1E		B46-0410-10	WARRANTY CARD	K1M1	
16	1D		B50-8148-00	INSTRUCTION MANUAL		
16	1D		B50-8149-00	INSTRUCTION MANUAL	W1W2	
-		*	B10-0690-03	FRONT GLASS	T1T2	
-		*	B10-0691-03	FRONT GLASS	K1	
-		*	B10-0695-03	FRONT GLASS	M1	
-		*	B11-0446-04	FRONT GLASS	T1W1	
-		*	B10-0695-03	REFLECTOR	T2W2	
22	3D		E30-2053-05	DC CORD ASSY (ACSY)		
-			E31-3224-05	FLAR CABLE (LCD-CONTROL)		
-			E31-3239-15	LEAD WITH CONNECTOR		
27	3D		F05-1031-05	FUSE (10A) ACSY	K1M1	
27	3D		F05-1031-05	FUSE (10A) ACSY	T2W2	
27	3D		F05-5022-05	FUSE (5A) ACSY	T1W1	
30	2B		F20-0520-04	INSULATING SHEET(LITHIUM BATT)		
31	2A		F20-0521-04	INSULATING SHEET(LITHIUM BATT)		
32	2A		F29-0431-05	INSULATOR (VOL,SQL)		
-			F05-2036-05	FUSE (20A) FOR DC CORD		
			G13-0838-04	CUSHION		
			G13-0842-04	CUSHION	M1T1T2	
			G13-0842-04	CUSHION		
			G13-0853-04	CUSHION		
35	1C		G10-0607-04	CUSHION (HEAT SINK)		
36	1A		G09-0405-05	KNOB FITTING SPRING		
37	1B,2B		G10-0604-04	FELT		
38	1B		G10-0651-04	FELT (SPEAKER)		
40	2A		G13-0839-04	CUSHION (KNOB)		
42	1B		G13-0845-04	CUSHION (SP)		
43	2A		G53-0508-04	FELT		
-		*	G16-0513-04	VIBRO-ISOLATING SHEET	T1W1	
-		*	G16-0513-04	VIBRO-ISOLATING SHEET	T2W2	
48	3E	*	H01-8087-04	ITEM CARTON BOX	K1	
48	3E	*	H01-8088-04	ITEM CARTON BOX	M1	
48	3E	*	H01-8089-04	ITEM CARTON BOX	T1	
48	3E	*	H01-8090-04	ITEM CARTON BOX	T2	
48	3E	*	H01-8091-04	ITEM CARTON BOX	W1	
48	3E	*	H01-8092-04	ITEM CARTON BOX	W2	
49	3D		H10-2626-02	POLYSTYRENE FOAMED FIXTURE	T1W1	
49	3D		H10-2627-02	POLYSTYRENE FOAMED FIXTURE	K1M1	
49	3D		H10-2627-02	POLYSTYRENE FOAMED FIXTURE	T2W2	

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-421A : K1,M1

TM-421E : T1,W1

TM-421ES : T2,W2

 indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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	Desti- nation 仕向	Re- marks 備考
51	1D		H13-0812-04	POLYSTYRENE FOAMED PLATE		
52	2D		H13-0814-04	BUFFER PLATE(MOUNT BLACKET)		
53	3D		H25-0049-03	PROTECTION BAG (DC CORD)		
54	2D		H25-0720-04	PROTECTION BAG (RADIO)		
55	3D		H25-0029-04	PROTECTION BAG (MIC HOOK,SCREW)	K1	
57	3D		J20-0319-24	MIC HOOK (ACSY)	K1	
59	2D		J29-0416-03	MOUNTING BLACKET(ACSY)		
60	2A		J31-0141-04	SPACER RING (MIC)		
61	1B		J19-1422-04	HOLDER (SP)		
62	2D		J21-4147-14	MOUNTING HARDWARE(DBL STACK)		
-			J61-0307-05	WIRE BAND		
64	1A		K27-0496-04	KNOP(BUTTON)	POWER,LOW	
66	2A		K29-3058-04	KNOP(BUTTON)	MHZ,VFO/M,M. IN	
67	1A		K29-3060-04	KNOP	(MAIN)	
68	1A		K29-3061-04	KNOP	(VOL,SQL)	
69	1A		K29-3069-04	KNOP(BUTTON)	SHIFT	
70	1A		K29-3065-04	KNOP(BUTTON)	REV	
71	1A		K29-3067-04	KNOP(BUTTON)	SCAN	
72	1A		K29-3066-04	KNOP(BUTTON)	ALERT	T1W1
72	1A		K29-3066-04	KNOP(BUTTON)	ALERT	T2W2
72	1A		K29-3068-04	KNOP(BUTTON)	CTCSS	K1M1
73	1A		K29-3070-04	KNOP(BUTTON)	TONE	
-			K29-3057-04	KNOP RING		
77	3D		N99-0318-05	SCREW SET		
78	3D		N46-3010-46	PAN HEAD TAPPING SCREW	K1	
A	1B,1C		N32-2606-46	FLAT HEAD MACHINE SCREW		
B	2A		N87-2606-46	BRAZIER HEAD TAPTITE SCREW		
C	2A,2B		N89-2606-46	BINDING HEAD TAPTITE SCREW		
D	1B,2B		N35-2606-45	BINDING HEAD MACHINE SCREW		
-			S50-1406-05	TACT SWITCH	M1T1T2	
-			S50-1406-05	TACT SWITCH	W1W2	
85	1B		T07-0246-05	LOUDSPEAKER(FULLRANGE)		
86	2D		T91-0359-05	MICROPHONE (ACSY)	K1	
86	2D		T91-0365-15	MICROPHONE (ACSY)	M1T1T2	
86	2D		T91-0365-15	MICROPHONE (ACSY)	W1W2	
-			LC7582	IC(LCD DRIVER)		
94	2A		W09-0326-05	LITHIUM BATTERY		
99	1B,1C		X45-1370-03	FINAL UNIT	M1	
99	1B,1C		X45-1370-12	FINAL UNIT	K1	
99	1B,1C		X45-1370-52	FINAL UNIT	T1W1	
99	1B,1C		X45-1370-53	FINAL UNIT	T2W2	
100	2A		X53-3040-12	CONTROL UNIT	K1	
100	2A		X53-3040-23	CONTROL UNIT	M1	
100	2A		X53-3040-52	CONTROL UNIT	T1T2	
100	2A		X53-3040-62	CONTROL UNIT	W1W2	
101	2B		X57-3070-11	TX-RX UNIT	K1	
101	2B		X57-3070-21	TX-RX UNIT	M1	
101	2B		X57-3070-51	TX-RX UNIT	T1W1	
101	2B		X57-3070-52	TX-RX UNIT	T2W2	

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-421A : K1,M1

TM-421E : T1,W1

TM-421ES : T2,W2

 indicates safety critical components.

TM-421A/E/ES

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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			Desti- nation 仕 向	Re- marks 備考
FINAL UNIT (X45-1370-XX) -12 : K -03 : M -52 : T1,W1 -53 : T2,W2								
C1			CK73EB1H471K	CHIP C	470PF	K		
C2			CE04CW1C100M	ELECTRQ	10UF	16WV	T1W1	
C2			C90-2040-05	ELECTRQ	10UF	16WV	K1M1	
C2			C90-2040-05	ELECTRQ	10UF	16WV	T2W2	
C3			CK73EB1H471K	CHIP C	470PF	K		
C4			CE04CW1C100M	ELECTRQ	10UF	16WV		
C5			CM73F2H030C	CHIP C	3.0PF	C	K1	
C5			CM73F2H040C	CHIP C	4.0PF	C	T1W1	
C5			CM73F2H050C	CHIP C	5.0PF	C	M1T2W2	
C6 ,7			CK73EB1H471K	CHIP C	470PF	K		
C8			CC45SL2H040C	CERAMIC	4.0PF	C	K1M1	
C8			CC45SL2H040C	CERAMIC	4.0PF	C	T2W2	
C8			CC45SL2H050C	CERAMIC	5.0PF	C	T1W1	
C9			CC45CH1H040C	CERAMIC	4.0PF	C		
C10			CC45SL2H150J	CERAMIC	15PF	J		
C11			CC45SL2H180J	CERAMIC	18PF	J		
C12			CC45SL2H220J	CERAMIC	22PF	J		
C13			CC45CH1H0R5C	CERAMIC	0.5PF	C	T1W1	
C13			CC45CH2H0R5C	CERAMIC	0.5PF	C	K1M1	
C13			CC45CH2H0R5C	CERAMIC	0.5PF	C	T2W2	
C14			CK73EB1H471K	CHIP C	470PF	K		
C15			CC45SL2H040C	CERAMIC	4.0PF	C	K1M1	
C15			CC45SL2H040C	CERAMIC	4.0PF	C	T2W2	
C15			CC45SL2H050C	CERAMIC	5.0PF	C	T1W1	
C16			CM73F2H160J	CHIP C	16PF	J		
C17			CC45SL2H080D	CERAMIC	8.0PF	D		
C18			CK45B1H471K	CERAMIC	470PF	K		
C19			CK73EB1H471K	CHIP C	470PF	K		
C21			CC73ECH1H010C	CHIP C	1.0PF	C	M1T2W2	
C21			CC73ECH1H1R5C	CHIP C	1.5PF	C	K1	
C22			CC45SL2H020C	CERAMIC	2.0PF	C	K1M1	
C22			CC45SL2H020C	CERAMIC	2.0PF	C	T2W2	
C25			CK73EB1H102K	CHIP C	1000PF	K	K1M1	
C25			CK73EB1H102K	CHIP C	1000PF	K	T2W2	
C26			CC45SL1H040C	CERAMIC	4.0PF	C	K1M1	
C26			CC45SL1H040C	CERAMIC	4.0PF	C	T2W2	
110	1C		E30-2079-05	DC CABLE				
111	1C		E30-2075-05	ANT CABLE WITH CONNECTOR(N)			T1W1	
111	1C		E30-2075-05	ANT CABLE WITH CONNECTOR(N)			T2W2	
-			E11-0401-05	EAR PHONE JACK				
-			E23-0015-04	TERMINAL (GND)			K1M1	
-			E23-0015-04	TERMINAL (GND)				
-			E30-2074-05	ANT CABLE WITH CONNECTOR(M)			T2W2	
-			E31-2066-05	COAX CABLE WITH TERMINAL(D)			K1M1	
-			E31-3230-15	COAX CABLE WITH TERMINAL(RA)				
TP1			E23-0512-05	TERMINAL (TEST TERMINAL)				
115	1C		F01-0949-05	HEAT SINK			T1W1	
115	1C		F01-0950-05	HEAT SINK			K1M1	
115	1C		F01-0950-05	HEAT SINK			T2W2	
-			F05-1031-05	FUSE (10A)			K1M1	
-			F05-1031-05	FUSE (10A)			T2W2	
-			F05-5022-05	FUSE (5A)			T1W1	

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-421A : K1,M1

TM-421E : T1,W1

TM-421ES : T2,W2

 indicates safety critical components.

PARTS LIST

× New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位 置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti- nation 仕向	Re- marks 備考
120	1B		J31-0503-05 J19-1375-04	BEAD COAX CABLE FITTING HARDWARE		
121	1C		J41-0033-05	BUSHING (DC CORD)	T1W1	
122	1C		J42-0425-05	BUSHING (ANT CABLE)	K1M1	
122	1C		J42-0448-05	BUSHING (ANT CABLE)		
122	1C		J42-0448-05 J61-0307-05	BUSHING (ANT CABLE) WIRE BAND	T2W2	
L1			L34-0908-05	COIL (3.9.5T)	T1W1	
L2			L34-1052-05	COIL (3.1.5T)	K1M1	
L2			L34-1123-05	COIL (3.1.5T)	T2W2	
L2			L34-1123-05	COIL (3.1.5T)		
L3			L34-1032-05	COIL (3.3.5T)		
L4 ,5			L34-1052-05	COIL (3.1.5T)	T1W1	
L4 ,5			L34-1123-05	COIL (3.1.5T)	K1M1	
L4 ,5			L34-1123-05	COIL (3.1.5T)	T2W2	
L6			L40-1091-03	SMALL FIXED INDUCTOR(1UH)		
E	1B		N09-0626-04	SCREW (M3X10)		
F	1B		N87-2606-41	BRAZIER HEAD TAPTRITE SCREW		
JP1			R92-1061-05	JUMPER REST 0ΩHM	K1M1	
JP1			R92-1061-05	JUMPER REST 0ΩHM	T2W2	
R1			RD14DB2H151J	SMALL-RD 150 J 1/2W	K1M1	
R1			RD14DB2H151J	SMALL-RD 150 J 1/2W	T2W2	
R1			RD14DB2H181J	SMALL-RD 180 J 1/2W	T1W1	
R2			RD14BB2C103J	RD 10K J 1/6W		
VR1			R12-0541-05	TRIMMING POT. (100)		
D1			DSA3A1	DIODE	T1W1	
D2			MI308	DIODE	K1M1	
D2			UM9401	DIODE	T2W2	
D3			UM9401	DIODE		
D4 ,5			MI308	DIODE		
Q1			1SS101	POWER MODULE	T1W1	
Q1			M57752	POWER MODULE	K1M1	
Q1			M57788M	POWER MODULE	T2W2	
Q1			M57788M	POWER MODULE		

CONTROL UNIT (X53-3040-XX) -12 : K -23 : M -52 : T1,T2 -62 : W1,W2

C1 ,2			CK73FB1H103K	CHIP C 0.010UF K		
C3 ,4			CC73FCH1H330J	CHIP C 33PF J		
C5 -14			CK73FB1H102K	CHIP C 1000PF K		
C15			CE04CW1C100M	ELECTR0 10UF 16WV		
C16			CK73FB1H103K	CHIP C 0.010UF K		
C17			CK73EF1C105Z	CHIP C 1.0UF Z		
			E06-0858-05	8P METAL SOCKET(MIC)		
			E40-1878-05	PIN CONNECTOR		
L1			L77-1313-05	CRYSTAL RESONATOR(4.194304MHZ)		
R1			RD41FB2B224J	CYLND CHIP R 220K J 1/8W	K1M1	
R1			RD41FB2B683J	CYLND CHIP R 68K J 1/8W	T1W1	
R1			RD41FB2B683J	CYLND CHIP R 68K J 1/8W	T2W2	
R2 -5			RD41FB2B105J	CYLND CHIP R 1.0M J 1/8W		
R6			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		
R7			RD41FB2B105J	CYLND CHIP R 1.0M J 1/8W		
R8 ,9			RD41FB2B104J	CYLND CHIP R 100K J 1/8W		

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-421A : K1,M1

TM-421E : T1,W1

TM-421ES : T2,W2

△ indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位 置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti- nation 仕 向	Re- marks 備考
R10 -13			RD41FB2B473J	CYLND CHIP R 47K	J 1/8W	
R14			RD41FB2B2R2J	CYLND CHIP R 2.2	J 1/8W	
R15			RD41FB2B103J	CYLND CHIP R 10K	J 1/8W	
R16			RD41FB2B473J	CYLND CHIP R 47K	J 1/8W	
R17 ,18			RD41FB2B474J	CYLND CHIP R 470K	J 1/8W	
R19			RD41FB2B472J	CYLND CHIP R 4.7K	J 1/8W	
R20			RD41FB2B105J	CYLND CHIP R 1.0M	J 1/8W	
R22			R92-0687-05	CHIP R 0 ΩHM		K1M1
R23			R92-0687-05	CHIP R 0 ΩHM		W1W2
R24 ,25			R92-0687-05	CHIP R 0 ΩHM		K1
R25			RD41FB2B102J	CHIP R 0 ΩHM		
R26			R92-0687-05	CYLND CHIP R 1.0K	J 1/8W	
VR1			R05-3441-05	POTENTIOMETER(10KA)VOL		
VR2			R05-4420-05	POTENTIOMETER(50KB)SQL		
S1 -8			S40-1086-05	TACT SWITCH		
S9 ,10			S40-2458-05	PUSH SWITCH		
D1 -4			ISS184	CHIP DIODE		
IC1			LA5006M	IC(LOW SATURATION REGULATOR)		
IC2			M51951BML	IC(SYSTEM RESET)		
IC3			75106G-508-1B	IC(MICROPROCESSOR)		
IC4			KRR-C001	IC		
Q1			DTC124EK	DIGITAL TRANSISTOR		
Q2			2SC2712(Y)	CHIP TRANSISTOR		
			W02-0388-05	ROTARY ENCODER		
TX-RX UNIT (X57-3070-XX) -11 : K -21 : M -51 : T1,W1 -52 : T2,W2						
166	1B		A13-0675-01	FRAME		
C1			CC41FCH1H100D	CYLND CHIP C 10PF	D	
C2			CC41FCH1H030C	CYLND CHIP C 3.0PF	C	
C3			CC73FSL1H101J	CHIP C 100PF	J	
C4 ,5			CK73FB1H102K	CHIP C 1000PF	K	
C6			CC73FSL1H101J	CHIP C 100PF	J	
C7			CC41FCH1H010C	CYLND CHIP C 1.0PF	C	
C8			CK73FB1H102K	CHIP C 1000PF	K	
C9			CC41FSL1H390J	CYLND CHIP C 39PF	J	
C10 -12			CK73FB1H102K	CHIP C 1000PF	K	
C13			CC41FCH1H050C	CYLND CHIP C 5.0PF	C	
C14			CC41FCH1H020C	CYLND CHIP C 2.0PF	C	
C15			CC73FCH1H330J	CHIP C 33PF	J	
C16			CK73FB1H102K	CHIP C 1000PF	K	
C17			CC73FSL1H101J	CHIP C 100PF	J	
C18 ,19			CK73FB1H102K	CHIP C 1000PF	K	
C20			CC41FCH1H100D	CYLND CHIP C 10PF	D	
C22 -24			CK73FB1H103K	CHIP C 0.010UF	K	
C25			CK73FB1H102K	CHIP C 1000PF	K	
C26			CC73FCH1H330J	CHIP C 33PF	J	
C28			CEO4EW1A470M	ELECTR0 47UF	10WV	
C29			CK73FB1H103K	CHIP C 0.010UF	K	
C30			CK73FB1H102K	CHIP C 1000PF	K	
C31			CEO4EW1C100M	ELECTR0 10UF	16WV	
C32			CK73EF1C105Z	CHIP C 1.0UF	Z	
C33			CK73FB1H103K	CHIP C 0.010UF	K	
C34 ,35			CEO4EW1A470M	ELECTR0 47UF	10WV	

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

TM-421A : K1,M1

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

TM-421E : T1,W1

UE : AAFES(Europe) X: Australia

TM-421ES : T2,W2

▲ indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格			Desti- nation 仕向	Re- marks 備考
C36 ,37			CK73EB1E104K	CHIP C	0.10UF	K		
C38 ,39			CK73FB1H102K	CHIP C	1000PF	K		
C40			CE04EW1A470M	ELECTRQ	47UF	10WV		
C41			CK73EB1E473K	CHIP C	0.047UF	K		
C42			CE04EW1A470M	ELECTRQ	47UF	10WV		
C43			CK73FB1H562K	CHIP C	5600PF	K	K1M1	
C44			CK73EF1C105Z	CHIP C	1.0UF	Z		
C45			CK73FB1H102K	CHIP C	1000PF	K		
C46			CE04EW1C100M	ELECTRQ	10UF	16WV		
C47			CK73FB1H103K	CHIP C	0.010UF	K		
C48			C92-0501-05	CHIP TAN	1.5UF	10WV		
C49			CE04EW1A470M	ELECTRQ	47UF	10WV		
C50			CK73FB1H103K	CHIP C	0.010UF	K		
C51			CC41FCH1H150J	CYLND CHIP C	15PF	J		
C52			CK73FB1H103K	CHIP C	0.010UF	K		
C53			CC73FSL1H221J	CHIP C	220PF	J		
C54			CC73FSL1H101J	CHIP C	100PF	J		
C55			CK73FB1H102K	CHIP C	1000PF	K		
C56			CC73FSL1H101J	CHIP C	100PF	J		
C57 ,58			CK73FB1H223K	CHIP C	0.022UF	K		
C59			C92-0501-05	CHIP TAN	1.5UF	10WV		
C60			CK73EB1E683K	CHIP C	0.068UF	K		
C61			CK73FB1H102K	CHIP C	1000PF	K		
C62			CK73EB1E683K	CHIP C	0.068UF	K		
C63			CK73FB1H103K	CHIP C	0.010UF	K		
C64			C92-0004-05	CHIP TAN	1UF	16WV		
C65			CK73FB1H103K	CHIP C	0.010UF	K		
C66			CK73FB1H102K	CHIP C	1000PF	K		
C67			CK73FB1H103K	CHIP C	0.010UF	K		
C68			CE04EW1A221M	ELECTRQ	220UF	10WV		
C69			CK73FB1H103K	CHIP C	0.010UF	K		
C70			CE04EW1A221M	ELECTRQ	220UF	10WV		
C71			CC41FCH1H020C	CYLND CHIP C	2.0PF	C		
C72			CC41FCH1H060D	CYLND CHIP C	6.0PF	D		
C73			CC41FCH1H030C	CYLND CHIP C	3.0PF	C		
C74			CK73FB1H102K	CHIP C	1000PF	K		
C75			CC41FCH1H060D	CYLND CHIP C	6.0PF	D		
C76 ,77			CK73FB1H102K	CHIP C	1000PF	K		
C78			CC41FCH1H100D	CYLND CHIP C	10PF	D		
C79			CK73FB1H102K	CHIP C	1000PF	K		
C80			CC73FCH1H330J	CHIP C	33PF	J		
C81 ,82			CK73EF1C105Z	CHIP C	1.0UF	Z		
C83			CK73EB1E333K	CHIP C	0.033UF	K		
C84 -86			CE04EW1A470M	ELECTRQ	47UF	10WV		
C87			C90-2074-05	ELECTRQ	470UF	10WV		
C88			CK73EB1E104K	CHIP C	0.10UF	K		
C89			C90-2033-05	ELECTRQ	1000UF	16WV		
C90			CK73FB1H103K	CHIP C	0.010UF	K		
C91			C90-2033-05	ELECTRQ	1000UF	16WV		
C92			CC73FSL1H101J	CHIP C	100PF	J		
C93			CC41FCH1H050C	CYLND CHIP C	5.0PF	C		
C94			CE04EW1A470M	ELECTRQ	47UF	10WV		
C95 ,96			CK73FB1H102K	CHIP C	1000PF	K		
C97			CE04EW1C100M	ELECTRQ	10UF	16WV		
C98			CC73FCH1H150J	CHIP C	15PF	J	K1	

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

TM-421A : K1,M1

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

TM-421E : T1,W1

UE: AAFES(Europe) X: Australia

TM-421ES : T2,W2

△ indicates safety critical components.

M-421A/E/ES

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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				Desti- nation 仕 向	Re- marks 備考
C99			CE04EW1C101M	ELECTRQ	100UF	16WV			
C100-105			CK73FB1H102K	CHIP C	1000PF	K			
C106			CE04EW1C220M	ELECTRQ	22UF	16WV			
C107			C92-0501-05	CHIP TAN	1.5UF	10WV			
C108,109			CK73FB1H562K	CHIP C	5600PF	K			
C110			CK73EB1E104K	CHIP C	0.10UF	K			
C111			CE04EW1E4R7M	ELECTRQ	4.7UF	25WV			
C112			CC73FSL1H101J	CHIP C	100PF	J			
C113-115			CK73FB1H103K	CHIP C	0.010UF	K			
C116			CC73FSL1H101J	CHIP C	100PF	J	K1M1		
C117			CC73FSL1H101J	CHIP C	100PF	J			
C118			CC45SS1H101J	CERAMIC	100PF	J			
TC1 ,2			C05-0062-05	TRIMMING CAP	(6PF)				
TC3			C05-0308-05	TRIMMING CAP	(4PF)				
TC4 ,5			C05-0349-05	TRIMMING CAP	(10PF)				
TC6			C05-0062-05	TRIMMING CAP	(6PF)				
J1			E04-0154-05	COAX CONNECTOR					
J2			E31-3237-05	LEAD WITH CONNECTOR			K1M1		
J3			E40-5016-05	PIN CONNECTOR (2P)			K1M1		
J4			E40-3237-05	PIN CONNECTOR (2P,EH)					
J5			E40-3238-05	PIN CONNECTOR (3P,EH)					
J6			E40-3237-05	PIN CONNECTOR (2P,EH)					
J7 ,8			E40-5099-05	PIN CONNECTOR (SSQ-9)					
TP1			E40-0211-05	PIN CONNECTOR (2P)					
TP2 ,3			E23-0465-05	TERMINAL					
-			F11-0836-05	SHIELDING CASE					
L1			L34-1115-05	COIL					
L2			L34-1052-05	COIL					
L3 ,4			L79-0690-05	HELICAL	(435MHZ)				
L5			L40-1072-80	CHIP INDUCTOR	(10NH)				
L6			L34-1115-05	COIL					
L7			L30-0508-05	TUNING COIL	(21.6MHZ)				
L8			L71-0227-05	MCF	(21.6MHZ)				
L9			L34-0749-05	TUNING COIL	(21.6MHZ)				
L10			L40-1072-80	CHIP INDUCTOR	(10NH)		K1		
L11			L77-0997-05	CRYSTAL RESONATOR(21.145MHZ)					
L12			L30-0531-05	TUNING COIL	(455KHZ)				
L13			L72-0315-05	CERAMIC FILTER	(CFW455F)				
L14			L30-0503-05	TUNING COIL	(455KHZ)				
L15			L40-1001-81	CHIP INDUCTOR	(10NH)				
L16			L77-1311-05	CRYSTAL RESONATOR(12.8MHZ)					
L17 ,18			L40-2272-80	CHIP INDUCTOR	(22NH)				
L19			L15-0308-05	LOW-FREQUENCY CHOKE COIL					
L20			L34-1052-05	COIL					
L21			L34-1096-05	COIL					
B	1B,2B		N87-2606-46	BRAZIER HEAD TAPITIE SCREW					
R1 ,2			RD41FB2B223J	CYLND CHIP R 22K	J	1/BW			
R3			RD41FB2B104J	CYLND CHIP R 100K	J	1/BW			
R4 ,5			RD41FB2B101J	CYLND CHIP R 100	J	1/BW			
R6			RD41FB2B470J	CYLND CHIP R 47	J	1/BW			

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-421A : K1,M1

TM-421E : T1,W1

TM-421ES : T2,W2

▲ indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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	Desti- nation 仕向	Re- marks 備考
R7			RD41FB2B3R3J	CYLND CHIP R 3.3	J	1/8W
R8			RD41FB2B220J	CYLND CHIP R 22	J	1/8W
R9 ,10			RD41FB2B223J	CYLND CHIP R 22K	J	1/8W
R11			RD41FB2B102J	CYLND CHIP R 1.0K	J	1/8W
R12			RD41FB2B221J	CYLND CHIP R 220	J	1/8W
R13			RD41FB2B470J	CYLND CHIP R 47	J	1/8W
R14			RD41FB2B681J	CYLND CHIP R 680	J	1/8W
R15			RD41FB2B473J	CYLND CHIP R 47K	J	1/8W
R16			RD41FB2B103J	CYLND CHIP R 10K	J	1/8W
R17			RD41FB2B471J	CYLND CHIP R 470	J	1/8W
R18			RD41FB2B221J	CYLND CHIP R 220	J	1/8W
R19			RD41FB2B101J	CYLND CHIP R 100	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
R28			RD41FB2B472J	CYLND CHIP R 4.7K	J	1/8W
R29 ,30			RD41FB2B223J	CYLND CHIP R 22K	J	1/8W
R31			RD41FB2B102J	CYLND CHIP R 1.0K	J	1/8W
R32			RD41FB2B103J	CYLND CHIP R 10K	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
R35			RD41FB2B104J	CYLND CHIP R 100K	J	1/8W
R36			RD41FB2B224J	CYLND CHIP R 220K	J	1/8W
R37			RD41FB2B274J	CYLND CHIP R 270K	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			RD41FB2B472J	CYLND CHIP R 4.7K	J	1/8W
R46 -50			RD41FB2B473J	CYLND CHIP R 47K	J	1/8W
R51			RD41FB2B101J	CYLND CHIP R 100	J	1/8W
R52			RD41FB2B223J	CYLND CHIP R 22K	J	1/8W
R53			RD41FB2B333J	CYLND CHIP R 33K	J	1/8W
R54			RD41FB2B222J	CYLND CHIP R 2.2K	J	1/8W
R55 -57			RD41FB2B473J	CYLND CHIP R 47K	J	1/8W
R58			RD41FB2B221J	CYLND CHIP R 220	J	1/8W
R59			RD41FB2B103J	CYLND CHIP R 10K	J	1/8W
R60			RD41FB2B182J	CYLND CHIP R 1.8K	J	1/8W
R61			RD41FB2B222J	CYLND CHIP R 8.2K	J	1/8W
R62			RD41FB2B182J	CYLND CHIP R 1.8K	J	1/8W
R63			RD41FB2B474J	CYLND CHIP R 470K	J	1/8W
R64 -66			RD41FB2B103J	CYLND CHIP R 10K	J	1/8W
R67			RD41FB2B223J	CYLND CHIP R 22K	J	1/8W
R68			RD41FB2B102J	CYLND CHIP R 1.0K	J	1/8W
R69			RD41FB2B101J	CYLND CHIP R 100	J	1/8W
R70			RD41FB2B472J	CYLND CHIP R 4.7K	J	1/8W
R71			RD41FB2B222J	CYLND CHIP R 2.2K	J	1/8W

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

TM-421A : K1,M1

TM-421E : T1,W1

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

TM-421ES : T2,W2

UE : AAFES(Europe) X: Australia

△ indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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 部 品 番 号	Parts No. 部品番号	Description 部品名 / 規 格	Desti- nation 仕 向	Re- marks 備考
R72		RD41FB2B101J	CYLND CHIP R 100	J 1/8W		
R73		RD41FB2B102J	CYLND CHIP R 1.0K	J 1/8W		
R74		RD41FB2B222J	CYLND CHIP R 2.2K	J 1/8W		
R75		RD41FB2B331J	CYLND CHIP R 330	J 1/8W		
R76		RD41FB2B101J	CYLND CHIP R 100	J 1/8W	K1M1	
R77		RD41FB2B471J	CYLND CHIP R 470	J 1/8W		
R78		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		
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		RD41FB2B151J	CYLND CHIP R 150	J 1/8W		
R86		RD41FB2B182J	CYLND CHIP R 1.8K	J 1/8W		
R87		RD41FB2B5R6J	CYLND CHIP R 5.6	J 1/8W		
R88		RD41FB2B221J	CYLND CHIP R 220	J 1/8W		
R89		RD41FB2B5R6J	CYLND CHIP R 5.6	J 1/8W		
R90		R92-0685-05	RD 22	J 1/2W		
R91 ,92		RD41FB2B104J	CYLND CHIP R 100K	J 1/8W	K1M1	
R93		RD41FB2B103J	CYLND CHIP R 10K	J 1/8W		
R93		RD41FB2B472J	CYLND CHIP R 4.7K	J 1/8W	T2W2	
R94		RD41FB2B223J	CYLND CHIP R 22K	J 1/8W	T1W1	
R95 ,96		RD41FB2B102J	CYLND CHIP R 1.0K	J 1/8W	T1W1	
R97		RD41FB2B103J	CYLND CHIP R 10K	J 1/8W	T2W2	
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		RD41FB2B102J	CYLND CHIP R 1.0K	J 1/8W		
R104		R92-0687-05	CHIP R 0 ΩHM			
R105		RD41FB2B822J	CYLND CHIP R 8.2K	J 1/8W	T1W1	
R105		RD41FB2B822J	CYLND CHIP R 8.2K	J 1/8W	T2W2	
R106		RD41FB2B223J	CYLND CHIP R 22K	J 1/8W	T1W1	
R106		RD41FB2B223J	CYLND CHIP R 22K	J 1/8W	T2W2	
R107		R92-0687-05	CHIP R 0 ΩHM			
R107		R92-0687-05	CHIP R 0 ΩHM			
R108		RD41FB2B473J	CYLND CHIP R 47K	J 1/8W		
R109		R92-0670-05 -	CHIP R 0 ΩHM			
R110		RD14BB2C103J	RD 10K	J 1/6W	K1	
R111		RD41FB2B101J	CYLND CHIP R 100	J 1/8W	T1W1	
R111		RD41FB2B101J	CYLND CHIP R 100	J 1/8W	T2W2	
R112,113		RD14BB2C223J	RD 22K	J 1/6W		
VR1		R12-5047-05	TRIMMING POT. (220K)			
VR2		R12-3096-05	TRIMMING POT. (10K)			
VR3		R12-3096-05	TRIMMING POT. (10K)			
VR4		R12-3099-05	TRIMMING POT. (47K)			
VR5 ,6		R12-3096-05	TRIMMING POT. (10K)			
VR7		R12-3098-05	TRIMMING POT. (33K)			
VR7		R12-3098-05	TRIMMING POT. (33K)			
D1		1SS226	CHIP DIODE			
D2		1SS181	CHIP DIODE			
D3 ,4		1SS184	CHIP DIODE			
D5		O2CZ6.2(Y,Z)	CHIP ZENER DIODE			
D6		1SS181	CHIP DIODE			

E: Scandinavia & Europe

K: USA

P: Canada

W:Europe

TM-421A : K1,M1

TM-421E : T1,W1

U: PX(Far East, Hawaii)

T: England

M: Other Areas

TM-421ES : T2,W2

UE : AAFES(Europe)

X: Australia

△ indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位 置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕	Re- marks 備考
D7 ,8 D9 ,10 D11 ,12 D13 ,14 IC1			BA282 1SS181 1SS184 1S1555 MC7808C	DIODE CHIP DIODE CHIP DIODE DIODE IC(VOLTAGE REGULATOR/ +14V)		
IC2 IC3 IC4 Q1 Q2			M54959P TC4094BP UPC1241H 3SK184(S) 2SK125	IC(FREQ SYNTHESIZER PLL) IC(8-STAGE SHIFT/STORE BUS REG IC CHIP FET FET		
Q3 Q4 Q5 Q6 ,7 Q8 ,9			3SK184(R) 2SC2714(Y) 2SC3326(A) 2SB1119S DTC124EK	CHIP FET CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR DIGITAL TRANSISTOR		
Q10 ,11 Q12 Q13 -15 Q16 Q17 ,18			2SC2712(Y) 2SC2714(Y) 2SC2712(Y) 2SA1162(Y) 2SC2759(U23)	CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR CHIP TRANSISTOR		
Q19 Q20 Q20 Q20 Q21			2SC2712(Y) 2SC2407(1) 2SC3369 2SC3369 2SD1406(Y)	CHIP TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR	T1W1 K1M1 T2W2	
TH1 TH2 TH2	*	*	112-502-2 PTH59U332M PTH59U332M	THERMISTER (5K) POTISTOR (3.3K) POTISTOR (3.3K)	T1W1 T2W2	
- - - - -	*	*	X58-3100-11 X58-3100-21 X58-3100-51 X58-3100-51 X59-3130-00	SUB UNIT (VC0,440MHZ) SUB UNIT (VC0,430MHZ) SUB UNIT (VC0,430MHZ) SUB UNIT (VC0,430MHZ) MODULE UNIT (APC)	K1 M1 T1W1 T2W2	
- - - - -			X59-3140-00 X59-3150-00 X59-3150-51 X59-3150-51 X59-3160-00	MODULE UNIT (IF) MODULE UNIT (SQL) MODULE UNIT (SQL) MODULE UNIT (SQL) MODULE UNIT (MIC)	K1M1 T1W1 T2W2	
- -	*	*	X59-3170-00 X59-3180-00	MODULE UNIT (VQL) MODULE UNIT (DRIVE)		
VCO (X58-3100-XX) -11 : K -21 : M -51 : T1,W1,T2,W2						
C1 C2 C3 C4 C5			CK73FB1H102K CK73FB1H103K CC73FCH1H020C CC73FCH1H080D CC73FCH1H080D	CHIP C 1000PF CHIP C 0.010UF CHIP C 2.0PF CHIP C 8.0PF CHIP C 8.0PF	K K C D D	K1
C5 C5 C6 C7 C8			CC73FCH1H100D CC73FCH1H100D CC73FCH1H120J CC73FCH1H070D CK73FB1H102K	CHIP C 10PF CHIP C 10PF CHIP C 12PF CHIP C 7.0PF CHIP C 1000PF	D D J D K	M1 T1W1 T2W2
C9 C10 C11			CC73FCH1H020C CC73FCH1H080D CC73FCH1H080D	CHIP C 2.0PF CHIP C 8.0PF CHIP C 8.0PF	C D D	M1

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-421A : K1,M1

TM-421E : T1,W1

TM-421ES : T2,W2

▲ indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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			Desti- nation 仕 向	Re- marks 備考
C11			CC73FCH1H100D	CHIP C	10PF	D	K1	
C11			CC73FCH1H100D	CHIP C	10PF	D	T1W1	
C11			CC73FCH1H100D	CHIP C	10PF	D	T2W2	
C12			CC73FCH1H060D	CHIP C	6.0PF	D	M1	
C12			CC73FCH1H100D	CHIP C	10PF	D	T1W1	
C12			CC73FCH1H100D	CHIP C	10PF	D	T2W2	
C12			CC73FCH1H150J	CHIP C	15PF	J	K1	
C13			CC73FCH1H050C	CHIP C	5.0PF	C	M1	
C13			CC73FCH1H070D	CHIP C	7.0PF	D	K1	
C13			CC73FCH1H180J	CHIP C	18PF	J	T1T2W1	
C13	-16		CC73FCH1H180J	CHIP C	18PF	J	W2	
C14	-16		CK73FB1H102K	CHIP C	1000PF	K		
C17			CC73FCH1H0R5C	CHIP C	0.5PF	C		
C18			CC73FCH1H020C	CHIP C	2.0PF	C		
TC1 ,2		*	C05-0346-05	CHIP TRIMMING CAP (6PF)			K1	
			E40-5095-05	PIN ASSY	(10PF)			
L1		*	L34-1194-05	COIL	(3.2.5T)			
L2		*	L34-1195-05	COIL	(3.3.5T)		M1	
L2		*	L34-1196-05	COIL	(3.3T)		K1T1T2	
L2		*	L34-1196-05	COIL	(3.3T)		W1W2	
L3	-8	*	L40-5682-81	CHIP COIL	(0.56UH)			
L9			L40-3972-80	CHIP COIL	(39NH)			
R1			RK73FB2A121J	CHIP R	120	J	1/10W	
R2			RK73FB2A103J	CHIP R	10K	J	1/10W	
R3			RK73FB2A223J	CHIP R	22K	J	1/10W	
R4			RK73FB2A101J	CHIP R	100	J	1/10W	
R5			RK73FB2A471J	CHIP R	470	J	1/10W	
R6			RK73FB2A221J	CHIP R	220	J	1/10W	
R7			RK73FB2A103J	CHIP R	10K	J	1/10W	
R8			RK73FB2A152J	CHIP R	1.5K	J	1/10W	
R9			RK73FB2A470J	CHIP R	47	J	1/10W	
R10			RK73FB2A103J	CHIP R	10K	J	1/10W	
R11			RK73FB2A104J	CHIP R	100K	J	1/10W	
R12			RK73FB2A471J	CHIP R	470	J	1/10W	
R13			RK73FB2A221J	CHIP R	220	J	1/10W	
R14			RK73FB2A470J	CHIP R	47	J	1/10W	
R15	,16		R92-0670-05	CHIP R	0 QHM			
D1	-3		1SV164	CHIP VARI-CAP DIODE				
Q1			2SC2759(U23)	CHIP TRANSISTOR				
Q2			2SK508(K52)	CHIP FET				
Q3			2SC2712(Y)	CHIP TRANSISTOR				
Q4			2SK508(K52)	CHIP FET				
Q5			DTC114EK	DIGITAL TRANSISTOR				
APC (X59-3130-00)								
C1			CK73FB1H102K	CHIP C	1000PF	K		
C2			C92-0501-05	CHIP TAN	1.5UF	10WV		
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				

E: Scandinavia & Europe K: USA

U: PX(Far East, Hawaii) T: England

UE : AAFES(Europe) X: Australia

P: Canada W: Europe

M: Other Areas

TM-421A : K1,M1

TM-421E : T1,W1

TM-421ES : T2,W2

 indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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			Desti- nation 仕 向	Re- marks 備考
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	DIGITAL TRANSISTOR				
Q3			2SA1162(Y)	CHIP TRANSISTOR				
IF (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	-10		CK73FB1H103K	CHIP C 0.010UF	K			
C8			CK73EB1H104K	CHIP C 0.10UF	K			
L1			E23-0471-05	TERMINAL				
L2		*	L40-2211-81	CHIP COIL (220UH)				
			L33-0695-05	CHIP 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				
SQL (X59-3150-00) -00 : K,M -51 : T1,W1,T2,W2								
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			
R1			E23-0471-05	TERMINAL				
R2			RD41FB2B104J	CYLND CHIP R 100K	J	1/8W		
R3			RD41FB2B272J	CYLND CHIP R 2.7K	J	1/8W		
R4			RD41FB2B222J	CYLND CHIP R 2.2K	J	1/8W		
R5			RD41FB2B223J	CYLND CHIP R 22K	J	1/8W		
R6			RD41FB2B332J	CYLND CHIP R 3.3K	J	1/8W		
R6			RD41FB2B152J	CYLND CHIP R 1.5K	J	1/8W	T1T2W1	
R6			RD41FB2B152J	CYLND CHIP R 1.5K	J	1/8W	W2	
R6			RD41FB2B682J	CYLND CHIP R 6.8K	J	1/8W	K1M1	
R7			RD41FB2B103J	CYLND CHIP R 10K	J	1/8W		
R8			RD41FB2B104J	CYLND CHIP R 100K	J	1/8W	T1W1	
R8			RD41FB2B104J	CYLND CHIP R 100K	J	1/8W		
R8			RD41FB2B474J	CYLND CHIP R 470K	J	1/8W	T2W2	
R9			RD41FB2B472J	CYLND CHIP R 4.7K	J	1/8W	K1M1	
R10			RD41FB2B474J	CYLND CHIP R 470K	J	1/8W		
R11			RD41FB2B273J	CYLND CHIP R 27K	J	1/8W		
R12			RD41FB2B223J	CYLND CHIP R 22K	J	1/8W		
R13			RD41FB2B222J	CYLND CHIP R 2.2K	J	1/8W		
R14			RD41FB2B393J	CYLND CHIP R 39K	J	1/8W		

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

TM-421A : K1,M1

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

TM-421E : T1,W1

UE: AAFES(Europe) X: Australia

TM-421ES : T2,W2

 indicates safety critical components.

M-421A/E/ES

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés 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	Desti- nation 仕 向	Re- marks 備考
R15			RD41FB2B273J	CYLND CHIP R 27K	J 1/BW	
R16			RD41FB2B331J	CYLND CHIP R 330	J 1/BW	
R17			RD41FB2B222J	CYLND CHIP R 2.2K	J 1/BW	
D1			1SS226	CHIP DIODE		
D2			1SS181	CHIP DIODE		
Q1 ,2			2SC2712(Y)	CHIP TRANSISTOR		
Q3 ,4			2SC3295(B)	CHIP TRANSISTOR		
Q5 ,6			2SC2712(Y)	CHIP TRANSISTOR		

MIC (X59-3160-00)

C1			CK73FB1H223K	CHIP C 0.022UF	K	
C2			CK73EF1C105Z	CHIP C 1.0UF	Z	
C3			CK73FB1H333K	CHIP C 0.033UF	K	
C4 ,5			CK73FB1H223K	CHIP C 0.022UF	K	
C6			CK73EF1C105Z	CHIP C 1.0UF	Z	
C7			CC73FSL1H101J	CHIP C 100PF	J	
C8			CK73FB1H272K	CHIP C 2700PF	K	
C9			CK73EF1C105Z	CHIP C 1.0UF	Z	
C10			CC73FSL1H101J	CHIP C 100PF	J	
C11			CK73FB1H821K	CHIP C 820PF	K	
			E23-0471-05	TERMINAL		
R1			RD41FB2B123J	CYLND CHIP R 12K	J 1/BW	
R2			RD41FB2B473J	CYLND CHIP R 47K	J 1/BW	
R3			RD41FB2B563J	CYLND CHIP R 56K	J 1/BW	
R4			RD41FB2B101J	CYLND CHIP R 100	J 1/BW	
R5			RD41FB2B154J	CYLND CHIP R 150K	J 1/BW	
R6			RD41FB2B104J	CYLND CHIP R 100K	J 1/BW	
R7			RD41FB2B101J	CYLND CHIP R 100	J 1/BW	
R8			RD41FB2B153J	CYLND CHIP R 15K	J 1/BW	
R9			RD41FB2B473J	CYLND CHIP R 47K	J 1/BW	
R10			RD41FB2B561J	CYLND CHIP R 560	J 1/BW	
R11			RD41FB2B274J	CYLND CHIP R 270K	J 1/BW	
R12			RD41FB2B563J	CYLND CHIP R 56K	J 1/BW	
R13			RD41FB2B224J	CYLND CHIP R 220K	J 1/BW	
R14 -16			RD41FB2B823J	CYLND CHIP R 82K	J 1/BW	
R17			RD41FB2B103J	CYLND CHIP R 10K	J 1/BW	
R19 ,20			R92-0687-05	CHIP R 0 ΩHM		
IC1 ,2			NJM4558M	IC(OP AMP X2)		

VOL (X59-3170-00)

C1 ,2			CK73EB1E104K	CHIP C 0.10UF	K	
C3			CK73FF1E104Z	CHIP C 0.10UF	Z	
C4			C92-0004-05	CHIP TAN 1UF	16WV	
			E23-0471-05	TERMINAL		
R1 -3			RD41FB2B473J	CYLND CHIP R 47K	J 1/BW	
R4			RD41FB2B823J	CYLND CHIP R 82K	J 1/BW	
R5			RD41FB2B103J	CYLND CHIP R 10K	J 1/BW	
R6			RD41FB2B104J	CYLND CHIP R 100K	J 1/BW	
R7			RD41FB2B272J	CYLND CHIP R 2.7K	J 1/BW	
R8			RD41FB2B104J	CYLND CHIP R 100K	J 1/BW	
R9			RD41FB2B272J	CYLND CHIP R 2.7K	J 1/BW	
D1		*	1SS226	CHIP DIODE		
IC1		*	LC7532M	IC(BILATERAL SWITCH)		

E: Scandinavia & Europe K: USA

P: Canada W:Europe

TM-421A : K1,M1

U: PX(Far East, Hawaii) T: England

M: Other Areas

TM-421E : T1,W1

UE: AAFES(Europe)

X: Australia

TM-421ES : T2,W2

 indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

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

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位 置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti- nation 仕 向	Re- marks 備考
IC2 Q1 Q2 ,3		*	MN4066BS DTC144EK DTA114EK	IC(QUAD ANALOG SWITCH) DIGITAL TRANSISTOR DIGITAL TRANSISTOR		
DRIVE (X59-3180-00)						
C2 -5			CK73FB1H102K	CHIP C 1000PF K		
C6			CC41FCH1H220J	CYLND CHIP C 22PF J		
C7			CK73FB1H102K	CHIP C 1000PF K		
C8 ,9			CK41FB1H471K	CYLND CHIP C 470PF K		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			CK73EF1C105Z	CHIP C 1.0UF Z		
			E23-0471-05	TERMINAL		
L1 ,2			L40-1072-80	CHIP COIL (10NH)		
R1 -4			RD41FB2B472J	CYLND CHIP R 4.7K J 1/8W		
R5			RD41FB2B223J	CYLND CHIP R 22K J 1/8W		
R6			RD41FB2B103J	CYLND CHIP R 10K J 1/8W		
R7			RD41FB2B101J	CYLND CHIP R 100 J 1/8W		
R8			RD41FB2B682J	CYLND CHIP R 6.8K J 1/8W		
R9 ,10			RD41FB2B470J	CYLND CHIP R 47 J 1/8W		
R11			RD41FB2B332J	CYLND CHIP R 3.3K J 1/8W		
R12			RD41FB2B681J	CYLND CHIP R 680 J 1/8W		
R13			RD41FB2B470J	CYLND CHIP R 47 J 1/8W		
R14			RD41FB2B220J	CYLND CHIP R 22 J 1/8W		
R15			R92-0338-05	CLYND CHIP R 0 QHM		
R16			R92-0687-05	CHIP R Q QHM		
R17			RD41FB2B473J	CYLND CHIP R 47K J 1/8W		
R18			RD41FB2B471J	CYLND CHIP R 470 J 1/8W		
D1			1SS184	CHIP DIODE		
Q1 ,2			2SA1162(Y)	CHIP TRANSISTOR		
Q3			2SC2712(Y)	CHIP TRANSISTOR		
Q4 ,5			2SC2759(U23)	CHIP TRANSISTOR		

E: Scandinavia & Europe K: USA

P: Canada W:Europe

TM-421A : K1,M1

U: PX(Far East, Hawaii) T: England

M: Other Areas

TM-421E : T1,W1

UE : AAFES(Europe)

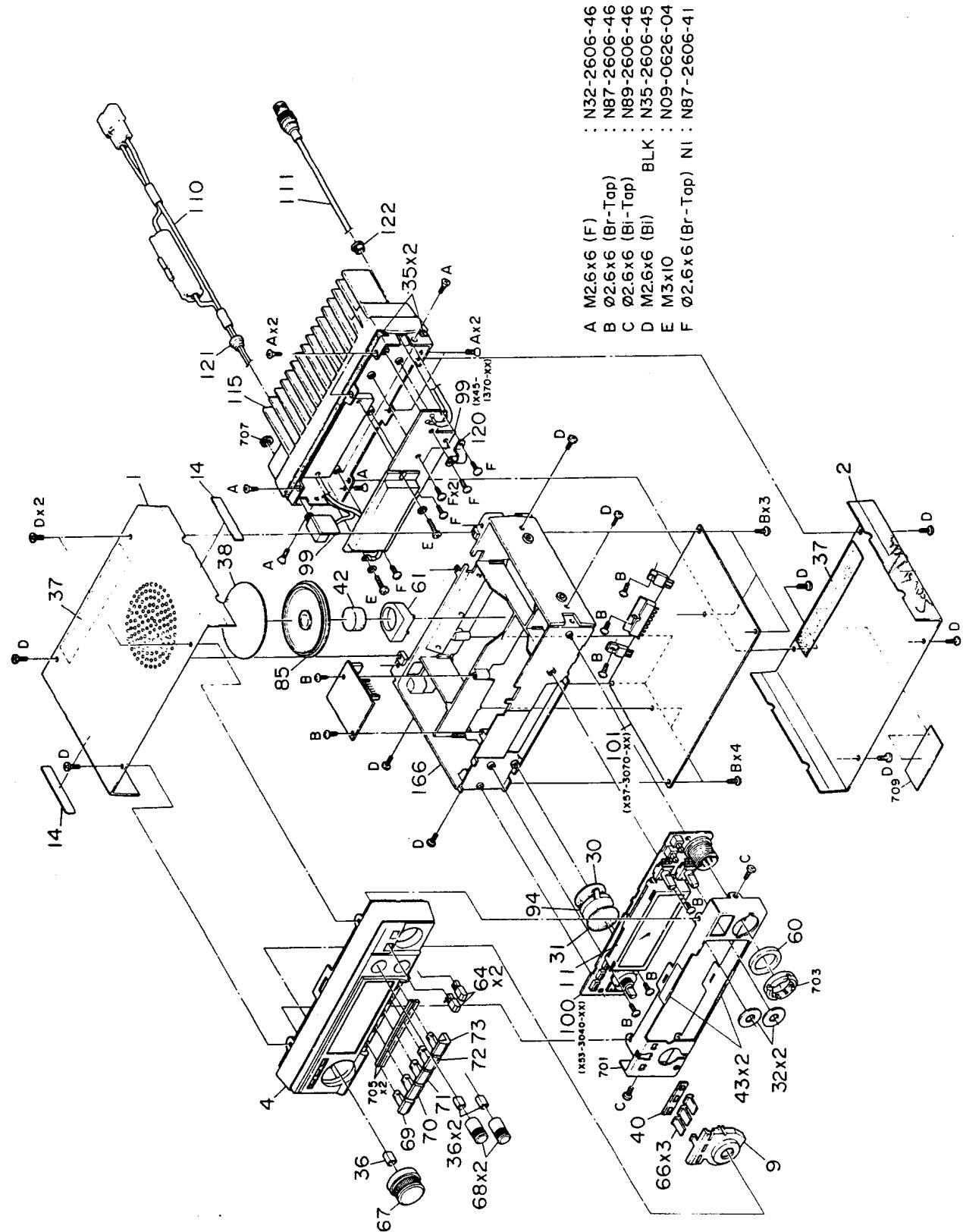
X: Australia

TM-421ES : T2,W2

 indicates safety critical components.

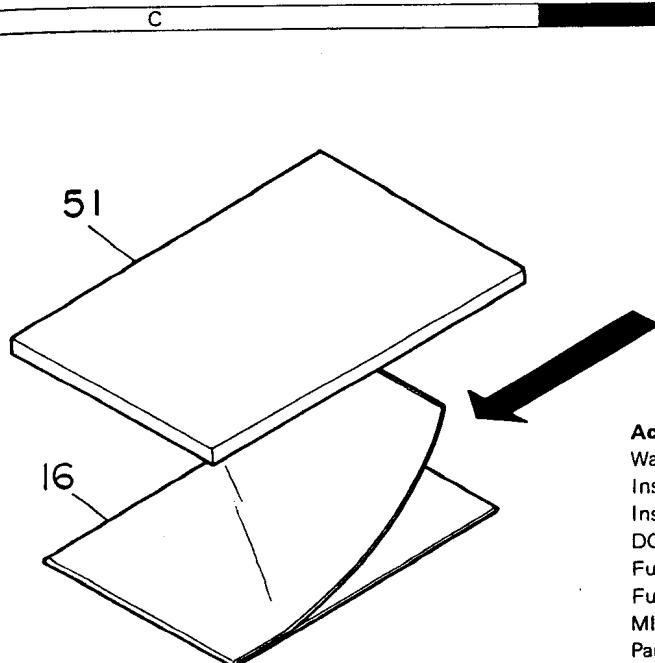
VI-421A/E/ES

EXPLODED VIEW

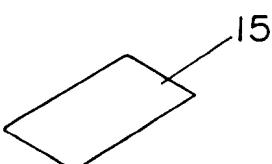


Parts with the exploded numbers larger than 700 are not supplied.

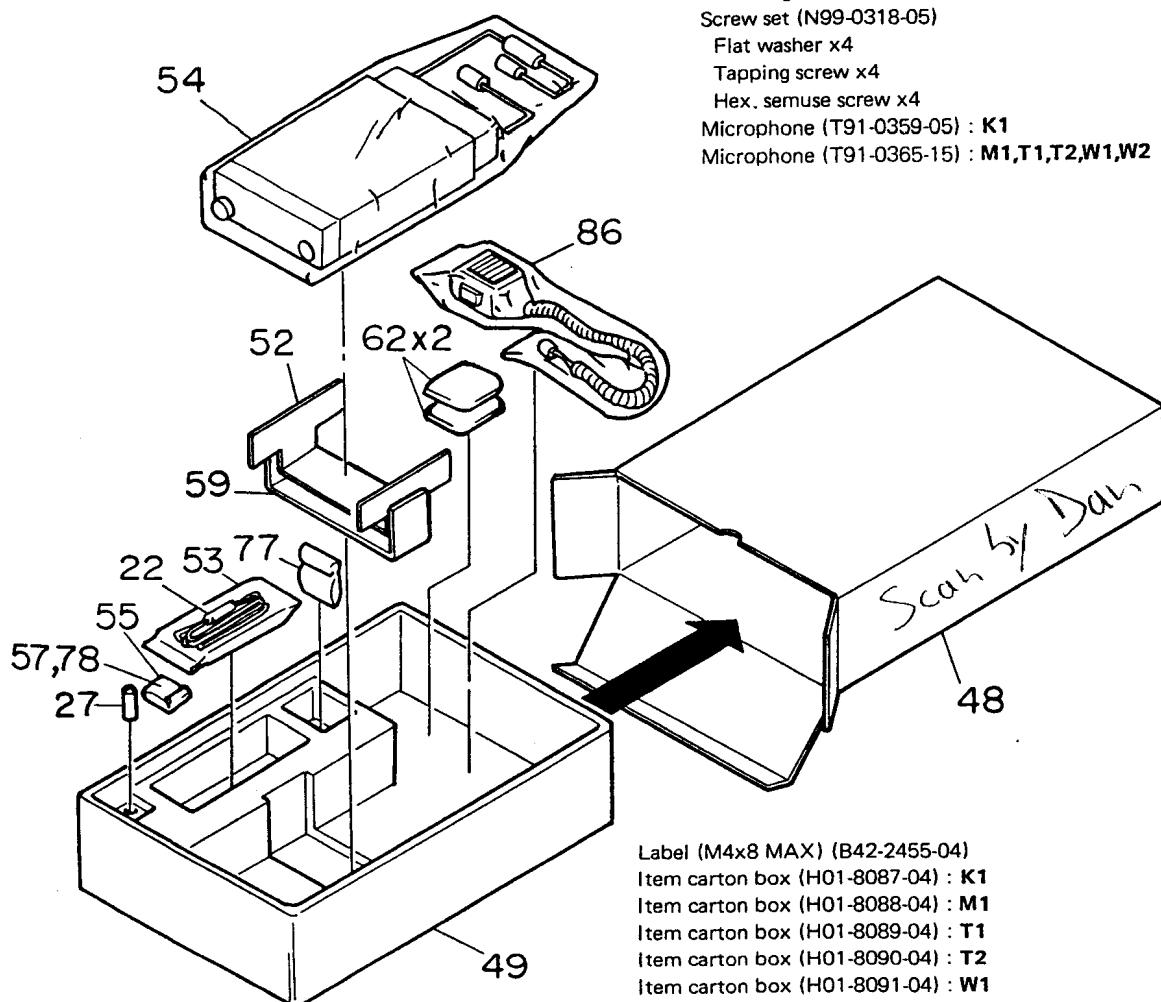
PACKING



D

**Accessory**

- Warranty card (B46-0410-10) : K1
- Instruction manual (B50-8148-00) : K1,M1,W1,W2
- Instruction manual (B50-8149-00) : T1,T2
- DC cord ass'y (E30-2053-05)
- Fuse (10A) (F05-1031-05) : K1,M1,T2,W2
- Fuse (5A) (F05-5022-05) : T1,W1
- MIC hook (J20-0319-24) : K1
- Pan head tapping screw x2 (N46-3010-46) : K1
- Mounting hardware x2 (J21-4147-14)
- Mounting bracket (J29-0416-03)
- Screw set (N99-0318-05)
 - Flat washer x4
 - Tapping screw x4
 - Hex. semuse screw x4
- Microphone (T91-0359-05) : K1
- Microphone (T91-0365-15) : M1,T1,T2,W1,W2



- Label (M4x8 MAX) (B42-2455-04)
- Item carton box (H01-8087-04) : K1
- Item carton box (H01-8088-04) : M1
- Item carton box (H01-8089-04) : T1
- Item carton box (H01-8090-04) : T2
- Item carton box (H01-8091-04) : W1
- Item carton box (H01-8092-04) : W2
- Polystyrene foamed fixture (H10-2626-02) : T1,W1
- Polystyrene foamed fixture (H10-2627-02) : K1,M1,T2,W2
- Polystyrene foamed plate (H13-0812-04)

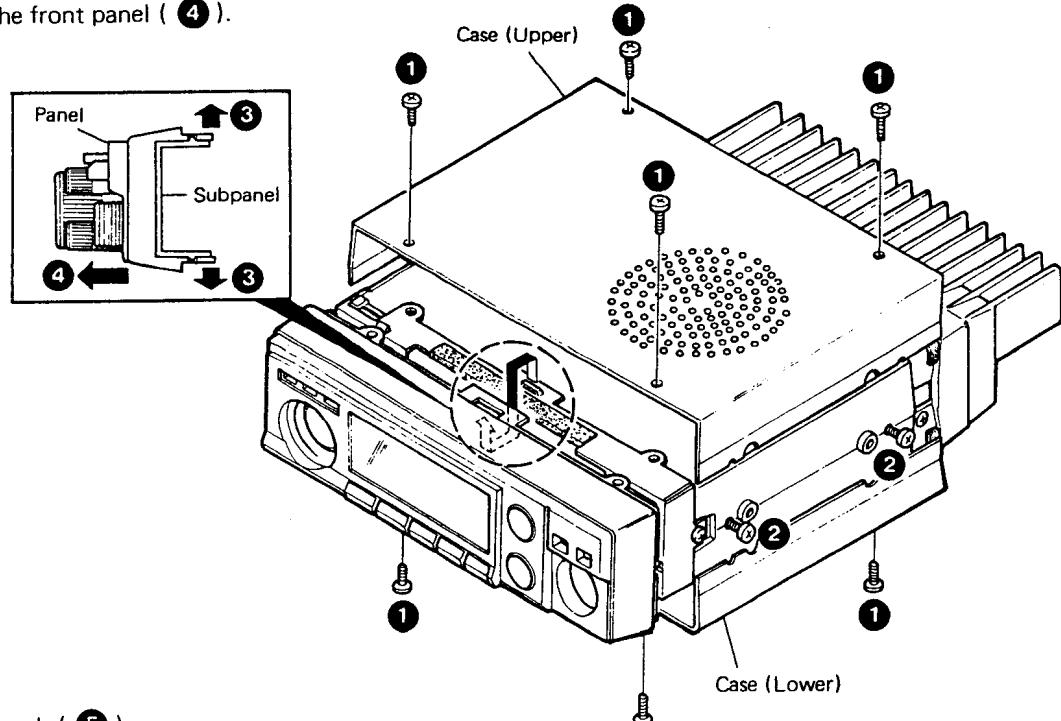
With the exploded numbers larger than 700 are not supplied.
 Buffer (H13-0814-04)
 Protection bag (MIC hook & screw) (H25-0029-04) : K1
 Protection bag (DC cord ass'y) (H25-0049-03)
 Protection bag (TM-421) (H25-0720-04)

M-421A/E/ES

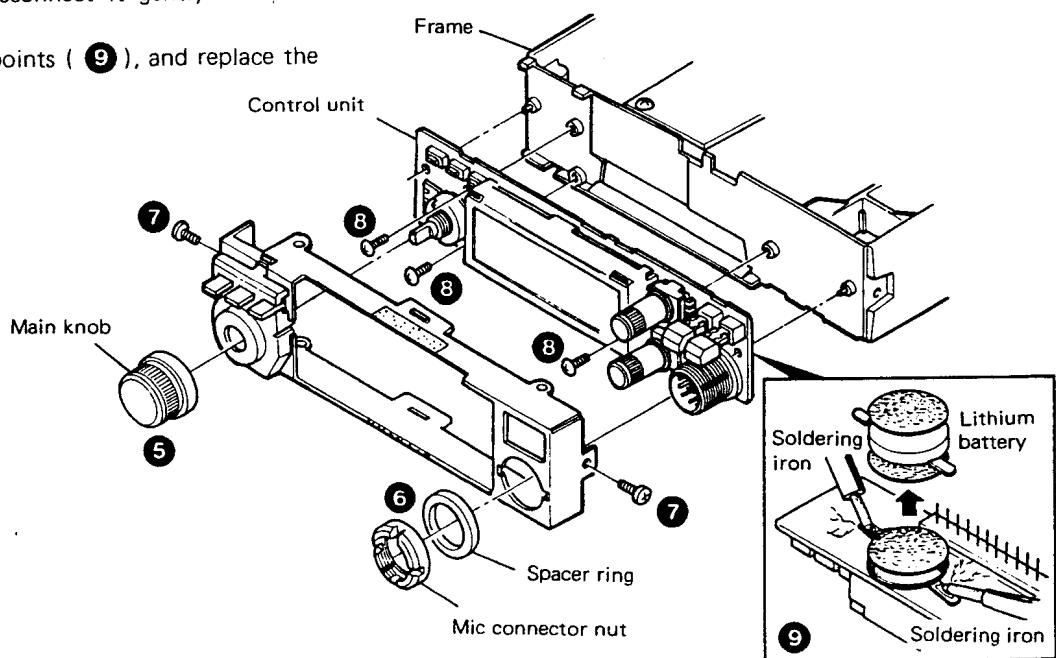
DISSASSEMBLY

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.



ADJUSTMENT

EQUIRED TEST EQUIPMENT

DC V.M

1) High input impedance

RF VTVM (RF V.M)

1) Input impedance : $1M\Omega$ min., $2pF$ max.

2) Voltage range : F.S = $10mV \sim 300V$

3) Frequency range : Up to 450MHz

Frequency Counter (f. counter)

1) Input sensitivity : Approx. $50mV$

2) Frequency range : Up to 450MHz

DC Power Supply

1) Voltage : $10V \sim 17V$, variable

2) Current : $6A$ min.

Power Meter

1) Measurement range Approx. : $30W, 3W, 1W$

2) Input impedance : 50Ω

3) Frequency range : 450MHz

AF VTVM (AF V.M)

1) Input impedance : $1M\Omega$ min.

2) Voltage range : F.S = $1mV \sim 30V$

3) Frequency range : $50Hz \sim 10kHz$

AF Generator (AG)

1) Output frequency : $100Hz \sim 10kHz$

2) Output voltage : $0.5mV \sim 1V$

Linear Detector

1) Frequency range : 450MHz

Field Strength Meter

1) Frequency range : 450MHz

Directional Coupler

Oscilloscope

1) High sensitivity oscilloscope with horizontal input terminal

SSG

1) Frequency range : 144MHz and 430MHz bands

2) Modulation : AM and FM MOD.

3) Output level : $-20dB$ to $100dB$

Dummy Load

1) 8Ω , $50W$ (approx.)

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

- Unless otherwise specified, knobs and switches should be set as follows **Table 6**.

POWER SW	ON	SHIFT SW	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 (T,W)	OFF
		TONE SW	OFF

Table 6

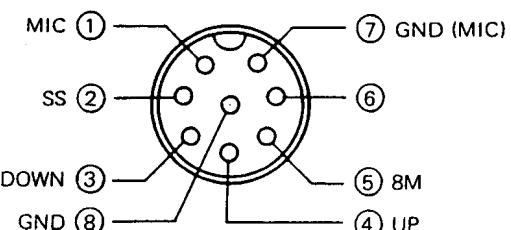


Fig 18 MIC terminals (view from front panel side)

- Use an insulated adjusting rod to adjust trimmers and coils.
- To prevent damaging SSG, never connect the microphone to mic jack while adjusting the receiver section.
- Be sure to turn the power switch OFF, before connecting the power cable to a power source.
- SSG output levels are those at the time the output terminal is open.
- Meter and display section should be set as follows Fig 19.

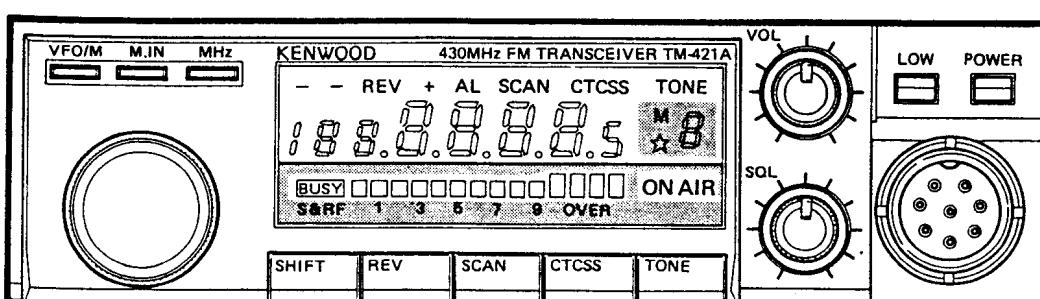


Fig 19

M-421A/E/ES

ADJUSTMENT

COMMON ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
Setting	1) Power supply : 13.8V DC Power SW : OFF VOL VR : Fully counter clockwise (CCW) SQL VR : Fully counter clockwise (CCW) VR6 on the TX-RX unit : Fully counter clockwise (CCW)							
Reset	1) Turn the Power SW ON, holding the VFO/M and M.IN SW down.							Display 440.000 (K) 430.000 (M,T,W)
	2) Release the VFO/M and M.IN SW.							
PLL	1) RX VCO FREQ. : 440.000 (K) 430.000 (M,T,W) Receive.	Digital voltmeter	TX-RX	TP3 (4C)	VCO	TC2 (4B)	2.5V	±0.1V
	FREQ. : 449.975 (K) 439.975 (M,T,W) Receive.						Check	Less than 7.2V.
	2) TX VCO FREQ. : 440.000 (K) 430.000 (M,T,W) Transmit.			VCO	TC1 (4B)	2.5V		±0.1V
	FREQ. : 449.975 (K) 439.975 (M,T,W) Transmit.						Check	Less than 7.0V.
TX FREQ. ADJ.	1) FREQ. : 445.000 (K) 435.000 (M,T,W) Transmit.	f.counter Power meter	Rear panel	ANT (1E)	TX-RX	TC3 (4C)	445.000MHz (K) 435.000MHz (M,T,W)	±100Hz

RECEIVER SYSTEM ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
Antenna	1) FREQ. : 445.025 (K) 435.025 (M,T,W) Connect the sweep gen. to the ANT terminal and the Oscilloscope to the detector output.	Oscilloscope	TX-RX	TP1 (4E)	TX-RX	TC1 (2E) TC2 (3F) L3(3F) L4(4F)	Adjust for the waveform perform shown on right.	430 435 440 (M,T,W) 440 445 450 (K)
	2) Connect the spectrum analyzer to the TP1 terminal from the TX-RX unit.							
	3) Connect the TP3 terminal to GND terminal.							
AIN	1) FREQ. : 445.025 (K) 435.025 (M,T,W) SSG output : 5dB μ MOD : OFF	Digital multimeter	TX-RX	TP2 (4D)	TX-RX	TC6 (4E) L7(4E) L9(4E) L12 (4E)	Repeat for MIN. Repeat the adjustment in order of L7 and L9.	Check : Accurate SSG's freq.
AF	1) FREQ. : 445.025 (K) 435.025 (M,T,W) SSG output : 20dB μ MOD : 1kHz DEV : ±5kHz	AF VM Oscilloscope 8Ω dummy load	Rear panel	SP (1B)	TX-RX	L14 (4D)	AF MAX.	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
Sensitivity	1) FREQ. : 445.025 (K) 435.025 (M,T,W) SSG output : -10dB μ	AF VM Oscillo-scope 8Ω dummy load	Rear panel	SP (1B)			Check	SINAD 12dB or more.
	2) FREQ. : 440.025 (K) 430.025 (M,T,W)							
	3) FREQ. : 449.950 (K) 439.950 (M,T,W)							
S-meter	1) FREQ. : 445.025 (K) 435.025 (M,T,W) SSG output : -6dB μ MOD : OFF	LCD (S-meter)			TX-RX	VR1 (4D)	Set the RF scale to reads "2 digit".	
	2) SSG output : 16dB μ						All digits light.	
	3) SSG : OFF							S-meter lights OFF.

TRANSMITTER SYSTEM ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
RF output	1) FREQ. : 445.000 (K) 435.000 (M,T,W) VR6 (TX-RX unit) : Fully clockwise (CW) Transmit.	Power meter (DC power supply galvo meter)	Rear panel	ANT (1E)	TX-RX	TC4 (3A)	MAX.	37W or more (K) 13W or more (M,T,W)
	2) FREQ. : 440.000 (K) 435.000 (T1,W1) 430.000 (M,T2,W2) Transmit.				Final	VR1 (2E)		
	3) FREQ. : 445.000 (K) 435.000 (T,W) 435.000 (M,T2,W2) Transmit.				TX-RX	VR6 (3B)	36W (K,M,T2,W2) 12W (T1,W1)	±3W, less than 9.5A. (K,M,T2,W2) ±2W, less than 3.2A. (T1,W1)
	4) FREQ. : 449.975 (K) 439.975 (M,T,W) Transmit.						Check	33~42W, less than 9.5A. (K,M,T2,W2) 10~14W, less than 3.2A. (T1,W1)
LOW Power	1) FREQ. : 445.000 (K) 435.000 (M,T,W) LOW SW : ON Transmit						Check	0.5~2W, less than 1.5A. (T1,W1)
					TX-RX	VR7 (3B)	5W (K,M,T2,W2)	±2W, less than 4A. (K,M,T2,W2)
S-meter	1) FREQ. : 445.000 (K) 435.000 (M,T,W) Transmit.	LCD (RF meter)			TX-RX	VR4 (3B)	Set to the RF scale reads "3 digits".	
	2) LOW SW : OFF Transmit.							All digits light.
V.	1) FREQ. : 445.000 (K) 435.000 (M,T,W) AG : 1kHz, 50mV (K,M) 1kHz, 30mV (T,W) ● MS-57A/61A (Anritsu) HPS : OFF LPF : 20kHz	Linear detector Modulation analyzer Power meter	Rear panel	ANT (1E)	TX-RX	VR3 (3C)	±4.4kHz	±200Hz
	2) AG : 1kHz, 5mV (K,M) 1kHz, 3mV (T,W)				TX-RX	VR2 (3C)	±3kHz (K,M)	±200Hz (K,M)
							Check	±2.2~3.6kHz (T,W)

M-421A/E/ES

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
Protection	1) FREQ. : 445.000 (K) 435.000 (M,T,W) Transmit.	Power meter Digital multi-meter	Final	TP1 (2E)	Final	VR1 (2E)	Dip point 	
	2) Disconnect the power meter from ANT terminal. Transmit.	DC AM (DC power supply galvometer)			TX-RX	VR5 (3C)	4.5A (K,M,T2,W2)) 2.2A (T1,W1)	±0.5A (K,M,T2,W2) ±0.2A (T1,W1)
TONE (K,M)	1) FREQ. : 445.000 (K) 435.000 (M) TONE SW : ON Transmit.	Linear detector Modulation	Rear panel	ANT (1E)				FREQ. : 88.0~89.0Hz DEV. : ±0.5~1kHz
TONE (T,W)	1) FREQ. : 435.000 TONE SW : ON Transmit.	analyzer Power meter f.counter		ANT (1E)				FREQ. : 1750±10Hz DEV. : ±2.5kHz or more.

Processor operation check

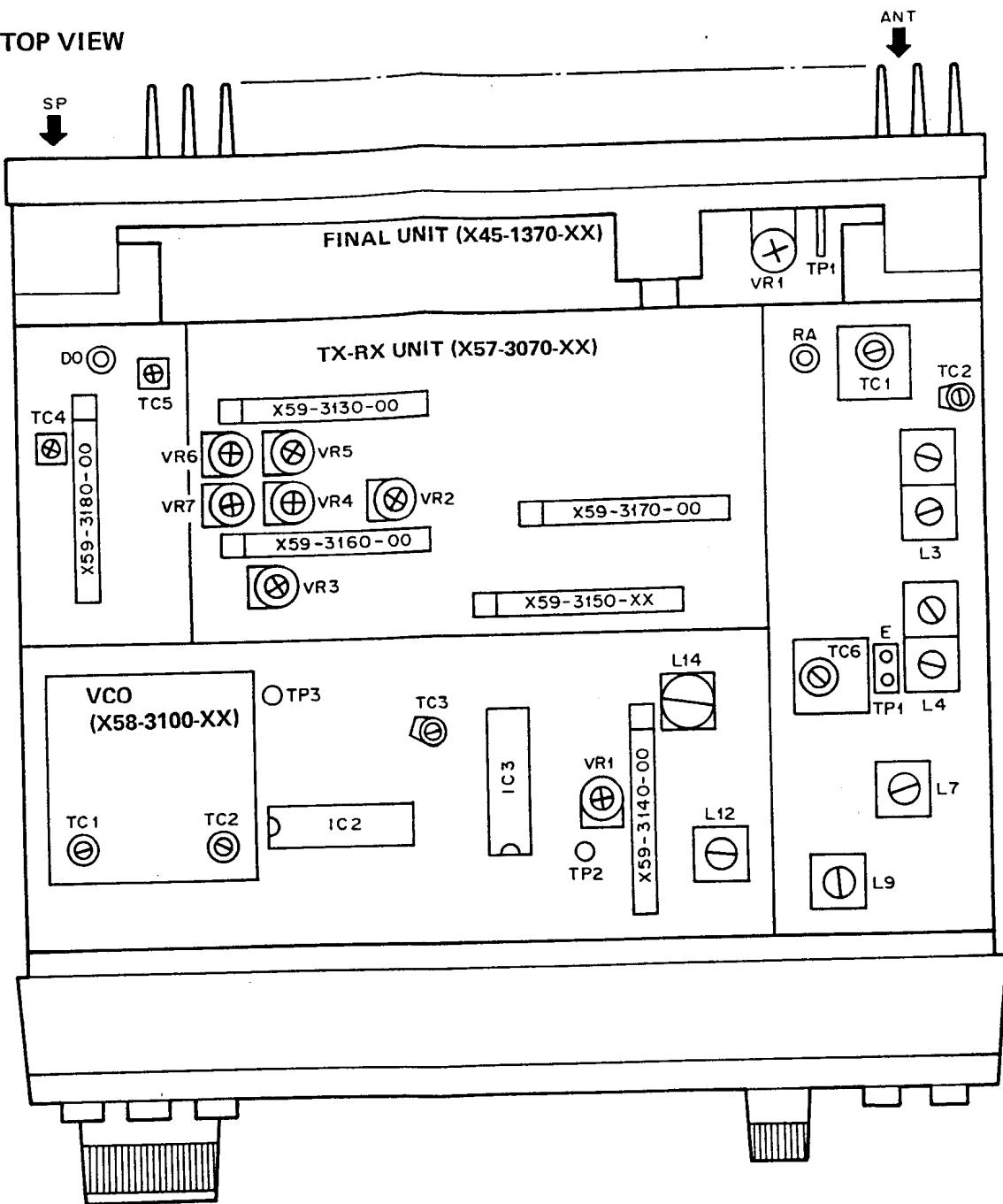
Item	Condition	Operation check	Item	Condition	Operation check
Set	1) Turn the Power switch ON holding the VFO/M and M.IN switches down.	Display 440000 (K) The M indicator and the Memory channel number display light for approx. 5 sec. after release the switches.	4-1. Memory entry (simplex standard offsets)	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.	
REQ. op- ec- m	1) Press the M.IN switch.	M indicator lights.	4-2. Odd split memory channels	2) Select the desired memory channel using the Tuning control or the Microphone UP/DOWN 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 000005 Turn the Tuning control and the UP/DOWN switches to increase or decrease the figures as shown below. 20 ← 25 ← 5 → 10 → 12.5 ↓ 15 CCW CW 15 ↓ 12.5 → 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.)	
EQ. op- ec- n Hz	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 1MHz step.			
	3) Press any switch except the LOW and the Power switches to return to the normal receive FREQ.	The kHz digits lights.			

ADJUSTMENT

Item	Condition	Operation check	Item	Condition	Operation check
4-2. Odd split memory channels	2) Press the M.IN switch	The beeper sound changes.  indicator lights. The memory channel number display is not light. The receive FREQ. memory entry is completed, then changes to the waiting mode of the transmit FREQ. memory entry.	5. TONE FREQ.	3) Press any switch except the LOW and the Power switches to return to the normal VFO FREQ.	Receive FREQ. lights.
	4) Select the desired transmit FREQ. using the Tuning control or the Microphone UP/DOWN switch.		6. Memory channel lockout selection	1) Press the VFO/M switch to select the memory channel mode. 2) Select the desired memory channel to skip using the Tuning control or the Microphone UP/DOWN switch.	 indicator lights.
	5) Press the M.IN switch.	Memory entry is completed.		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. TONE FREQ.	1) Press the M.IN switch and then TONE switch. (within 5 sec. after pressing the M.IN switch.) 2) Select the desired TONE FREQ. using the Tuning control or the Microphone UP/DOWN switch. (a value in the 67.0 to 250.3)	TONE FREQ. lights.			

ADJUSTMENT

TOP VIEW



TX-RX UNIT (X57-3070-XX)

VR1 : S-1
 VR2 : DEV. 1kHz, 5mV, ±3kHz (K,M)
 VR3 : DEV. 1kHz, 50mV(K,M), 30mV(T,W), ±4.4kHz
 VR4 : RF meter
 VR5 : PRO.
 VR6 : RF output
 VR7 : Low power (K,M,T2,W2)
 L3,4 : Helical
 L7,9,12 : IF GAIN
 L14 : Discri
 TC1,2 : Helical
 TC3 : TX frequency
 TC4,5 : RF output
 TC6 : IF GAIN

FINAL UNIT (X45-1370-XX)

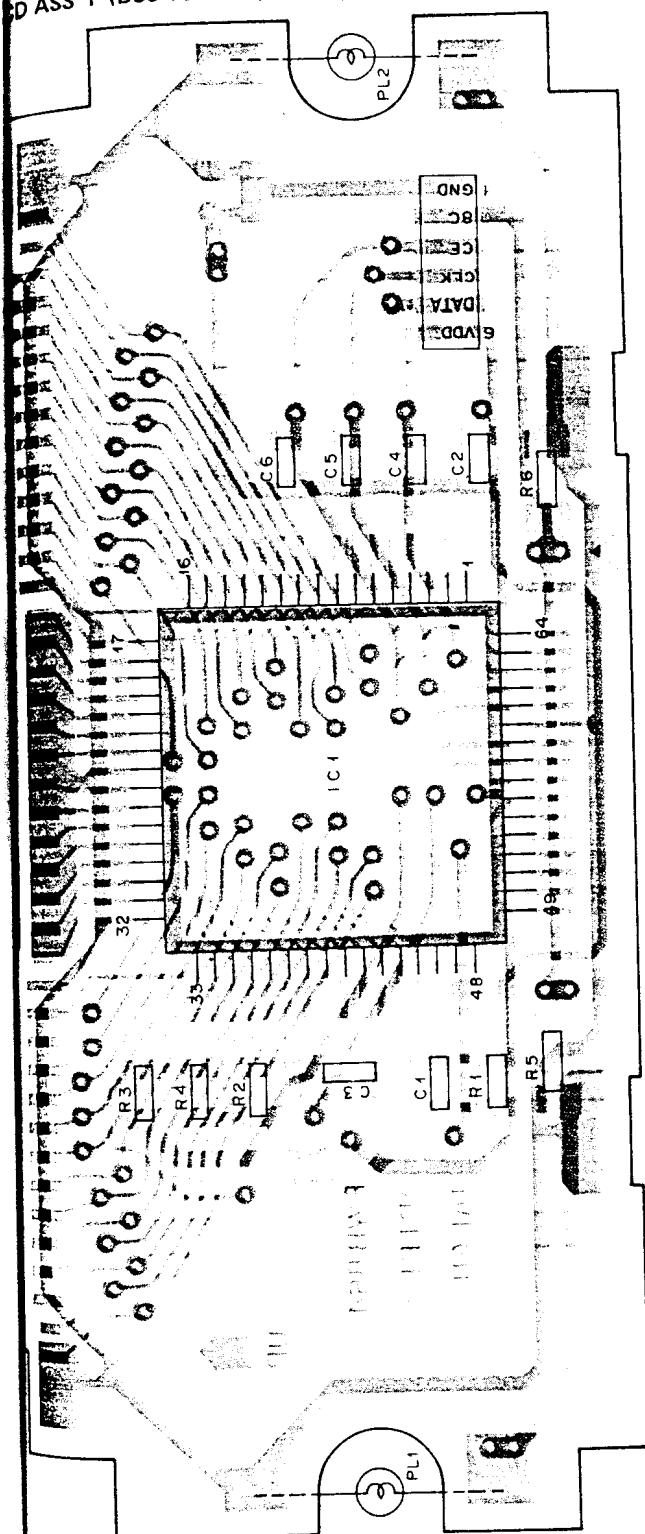
VR1 : PRO. (NULL)

VCO (X58-3100-XX)

TC1 : TX VCO
TC2 : RX VCO

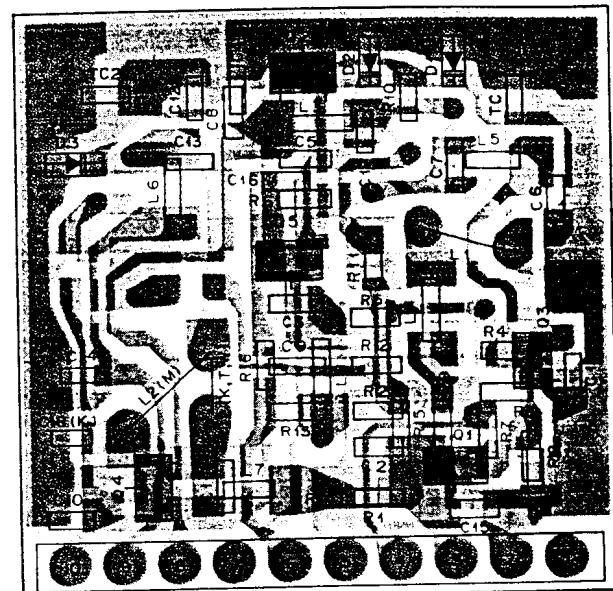
A M-421A/E/ES PC BOARD VIEWS

on ASS'Y (B38-0303-05) Component side view



C1 : LC7582

VCO (X58-3100-XX) Component side view

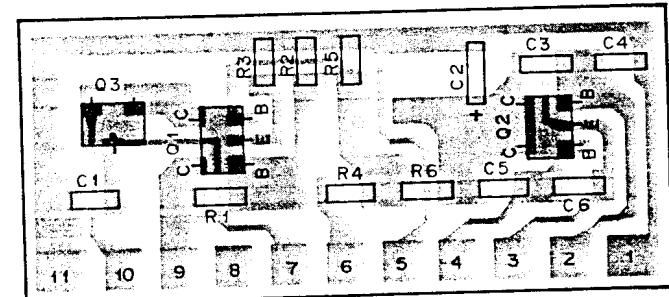


Q1 : 2SC2759(U23) Q2,4 : 2SK508(K52)

Q3 : 2SC2712(Y) Q5 : DTC114EK

D1-3 : 1SV164

APC (X59-3130-00) Component side view



Q1.2 : FMW-1 Q3 : 2SA1162(Y)

A

B

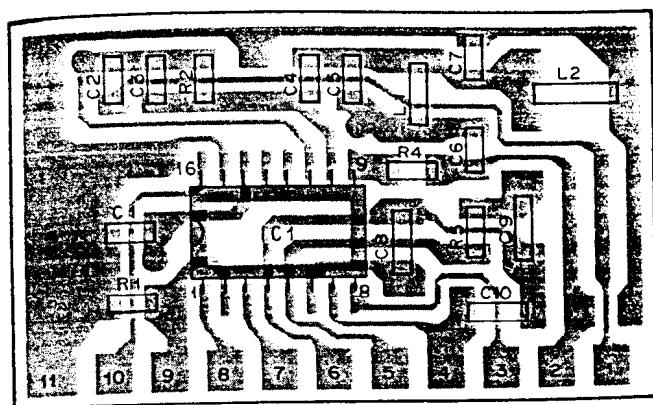
C

D

E

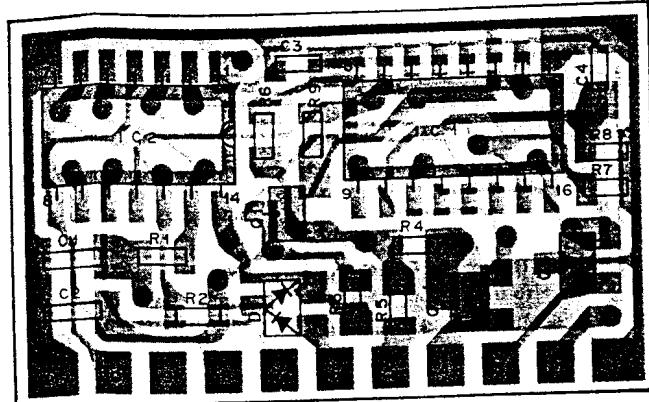
F

IF (X59-3140-00) Component side view



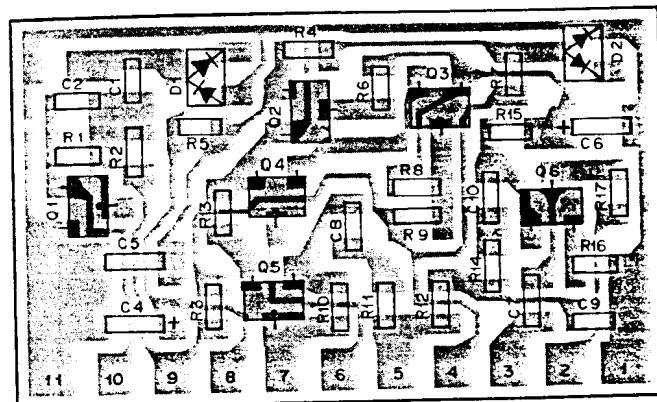
IC1 : TA7761F

VOL (X59-3170-00) Component side view



Q1 : DTC144EK Q2,3 : DTA114EK
IC1 : LC7532M IC2 : MN4066BS
D1 : 1SS226

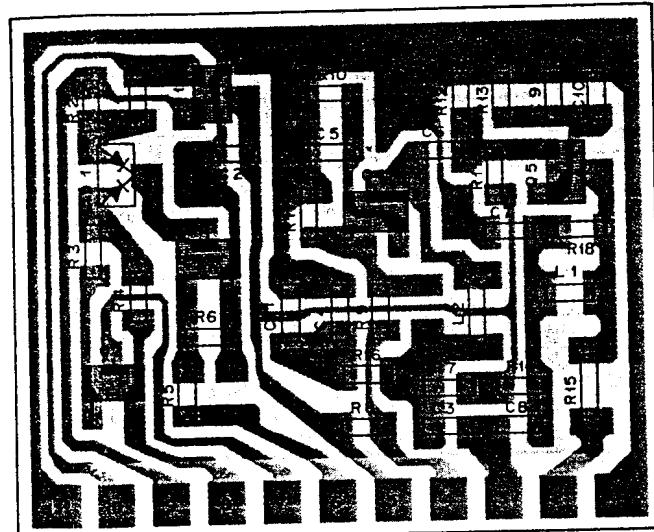
SQL (X59-3150-XX) Component side view



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

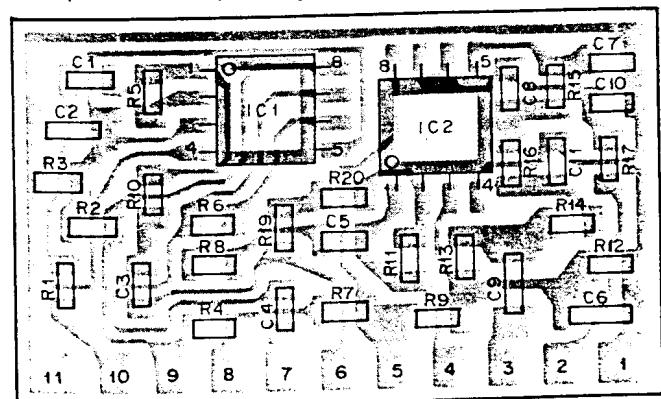
D1 : 1SS226 D2 : 1SS181

DRIVE (X59-3180-00) Component side view



Q1,2 : 2SA1162(Y) Q3 : 2SC2712(Y) Q4,5 : 2SC2759(U23)
D1 : 1SS184

MIC (X59-3160-00) Component side view



IC1,2 : NJM4558M

2SA1162 2SC2759
2SC2712 2SC3295

2SK508



FMW-1

DTC114EK
DTC144EK

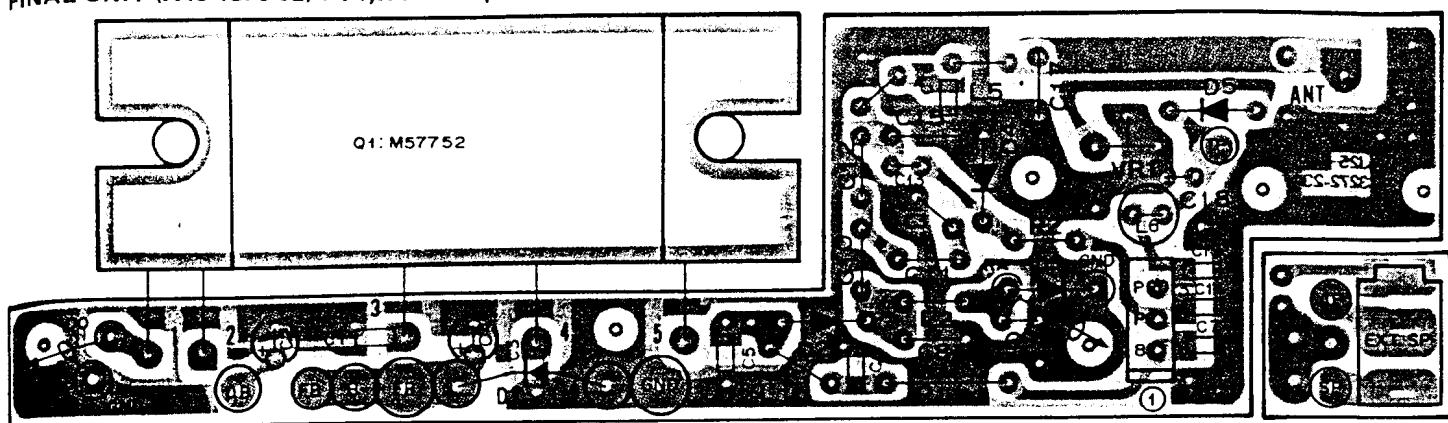
DTA114EK



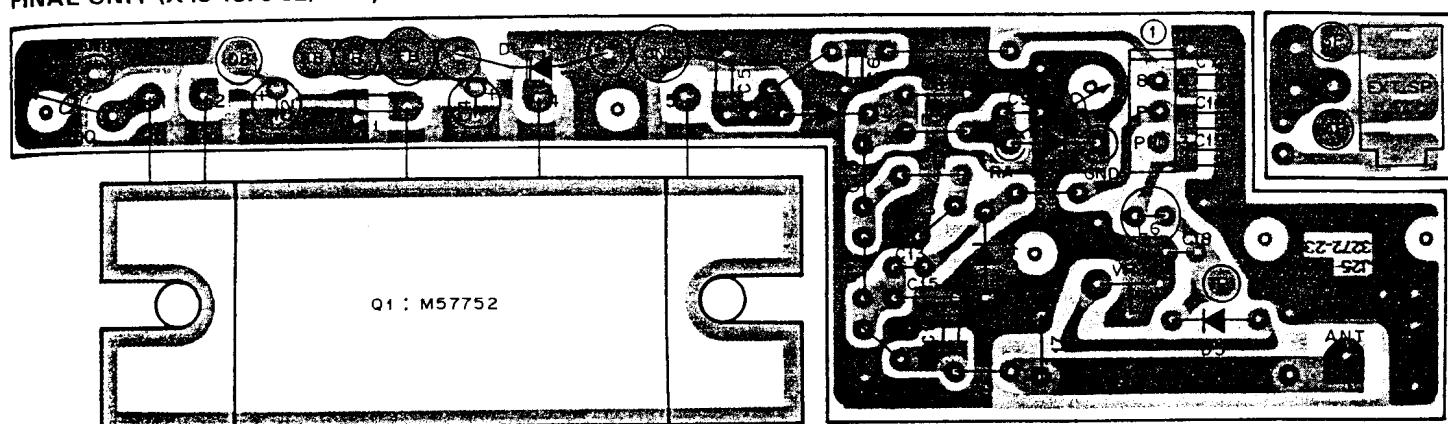
B C D E F

PC BOARD VIEWS TM-421A/E/ES

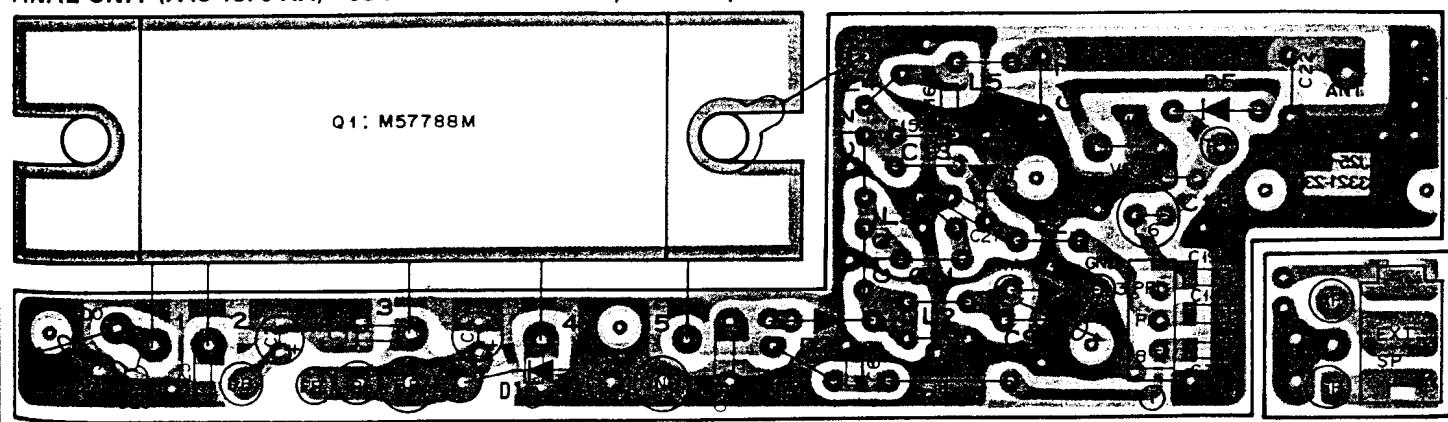
FINAL UNIT (X45-1370-52) : T1,W1 Component side view



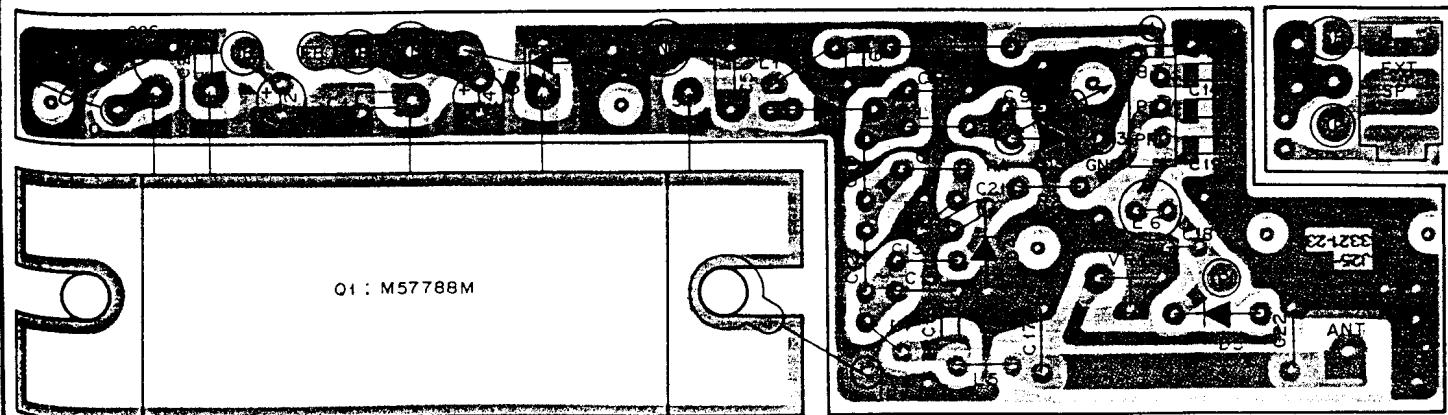
FINAL UNIT (X45-1370-52) : T1,W1 Foil side view



FINAL UNIT (X45-1370-XX) -03 : M -12 : K -53 : T2,W2 Component side view



FINAL UNIT (X45-1370-XX) -03 : M -12 : K -53 : T2,W2 Foil side view

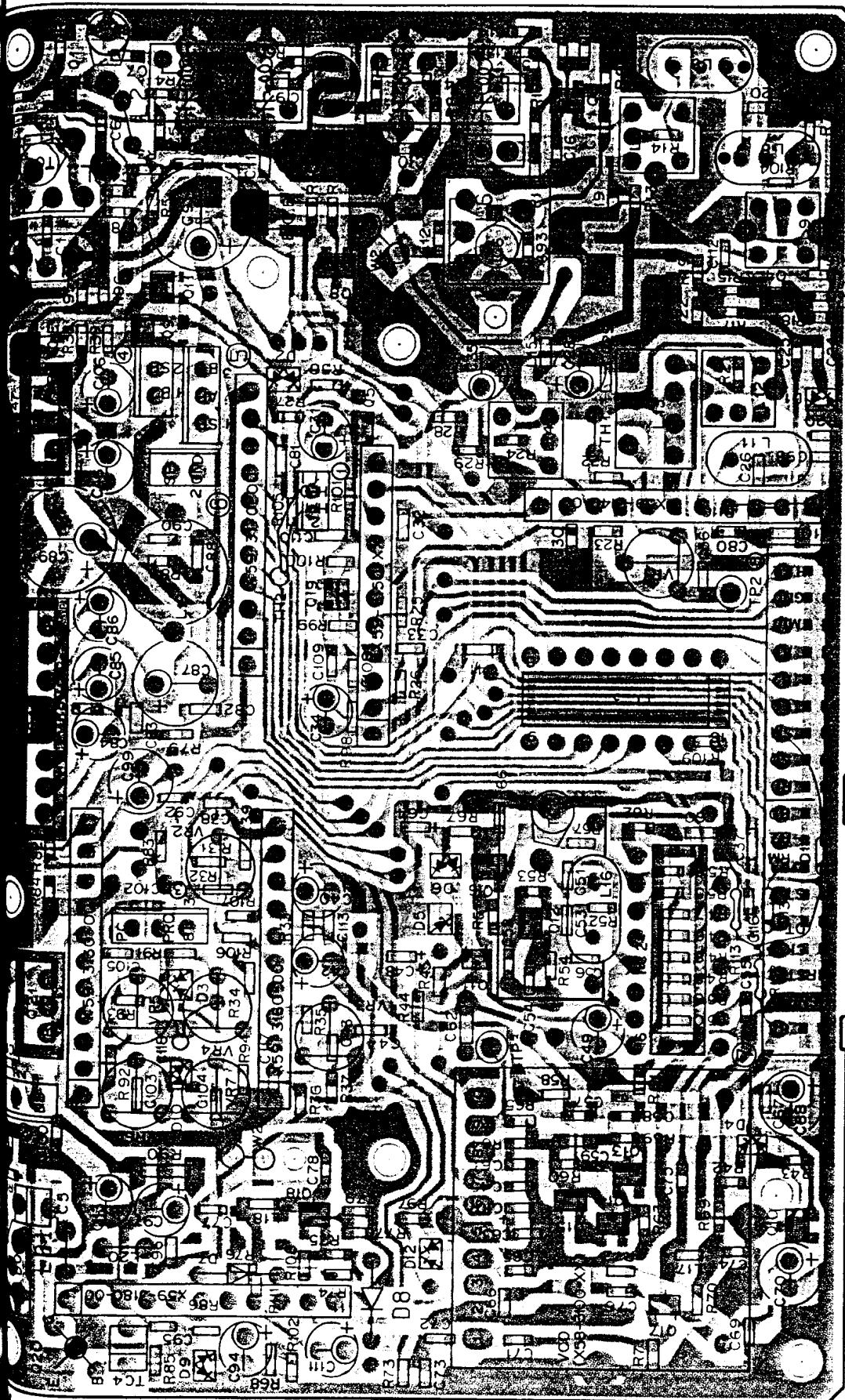


Q1 : M57752(TM-421E), M57788M(TM-421A,TM421ES)

Q1 : DSA3A1 D2 : MI308(TM-421E), UM9401(TM-421A, TM-421ES) D3 : MI308 D4,5 : 1SS101

TM-421A/E/ES PC BOARD VIEW

RX UNIT (X57-3070-XX) -11 : K -21 : M -51 : T1,W1 -52 : T2,W2 Component side view



Q1 : 3SK184(S) Q2 : 2SK125 Q3 : 3SK184(R) Q4,12 : 2SC2714(Y) Q5 : 2SC3326(A) Q6,7 : 2SB1119S Q8,9 : DTC124EK Q10,11,13-15,19 : 2SC2712(Y)
 Q16 : 2SA1162(Y) Q17,18 : 2SC2789(U23) Q20 : 2SC3369(TM-421A,TM-421ES),2SC2407(1)(TM-421E) Q21 : 2SD1406(Y)

IC1 : MC7808C IC2 : M54959P IC3 : TC4094BP IC4 : μPC1241H
 D1 : ISS226 D2,6,9,10 : ISS181 D3,4,11,12 : ISS184 D5 : 02CZ6.2(Y.Z) D7,8 : BA282 D13,14 : 1S1555

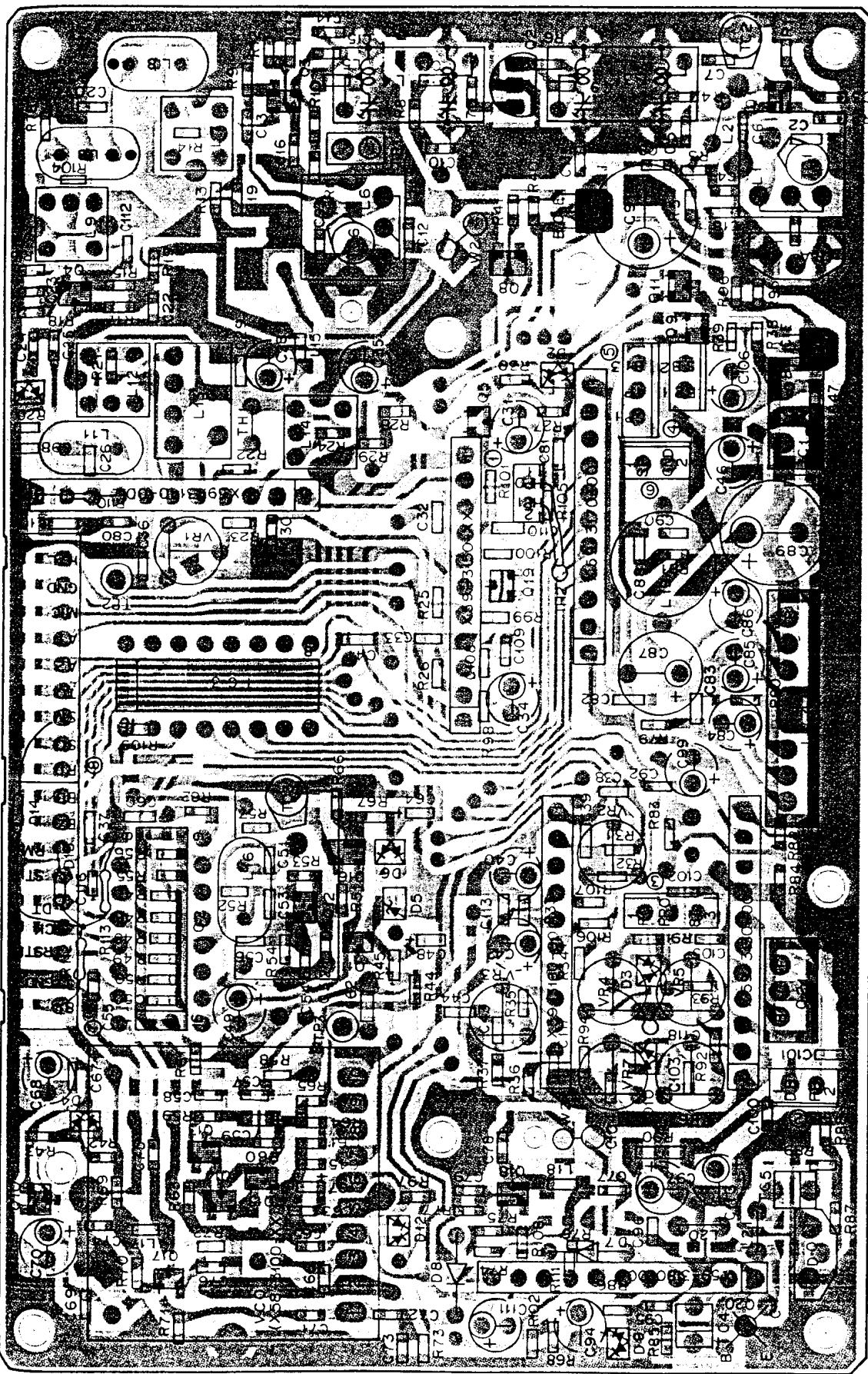
	VR2	VR7	R32	R34	R36	R37	R76	R94	R105	R106	R107	R110	R111	C43	C98	C116	L10	Connector ①	TH2
TM-421A	-11 (K)	O	O	X	O	O	O	X	X	X	O	X	O	O	O	O	O	O	X
	-21 (M)	O	O	X	O	O	O	X	X	X	X	X	O	X	O	O	O	O	X
TM-421E	-51 (T1,W1)	X	X	O	X	X	X	O	O	O	O	O	O	X	O	X	O	O	X
TM-421ES	-52 (T2,W2)	X	O	O	X	X	X	X	X	X	O	O	O	X	X	X	X	X	O

O : Used, X : Not used

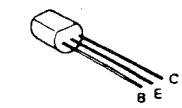
B C D E F

PC BOARD VIEW TM-421A/E/ES

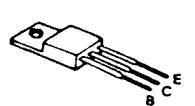
TX-RX UNIT (X57-3070-XX) -11 : K -21 : M -51 : T1,W1 -52 : T2,W2 Foil side view



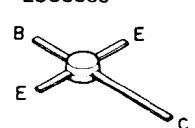
2SC2407



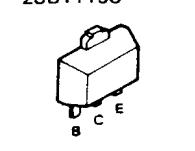
2SD1406



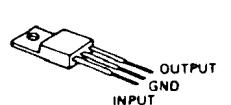
25G3369



2SB1119S



MC7808C



2SA1162

2SC2712

2SC2714
2SC2759

2SC3326

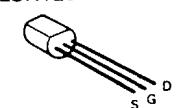
8



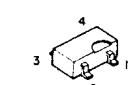
DTC124EK



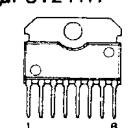
2SK125



3SK184



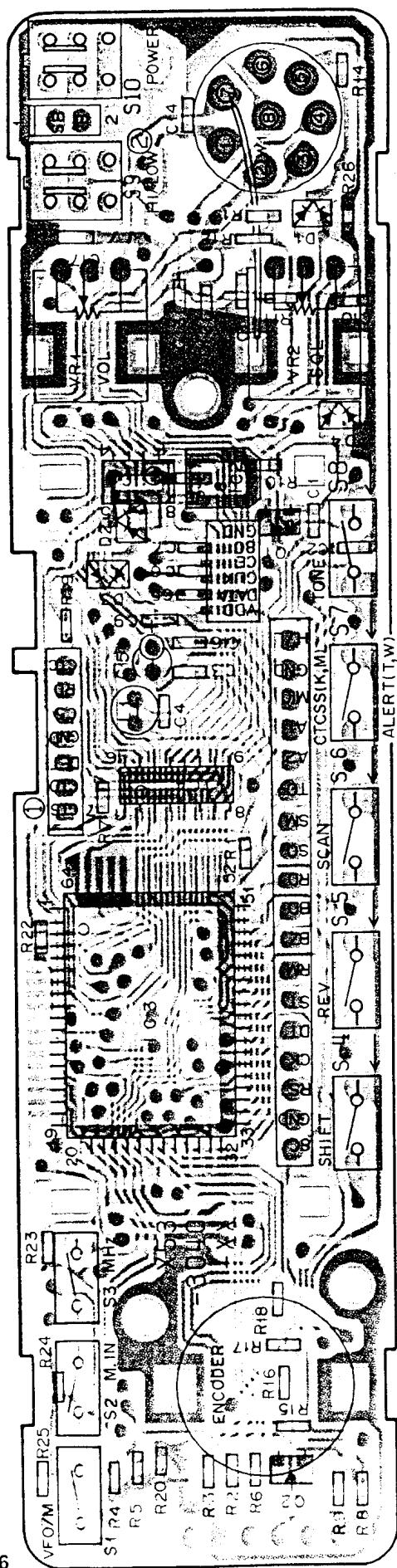
WPC1241H



TM-421A/E/ES PC BOARD VIEWS

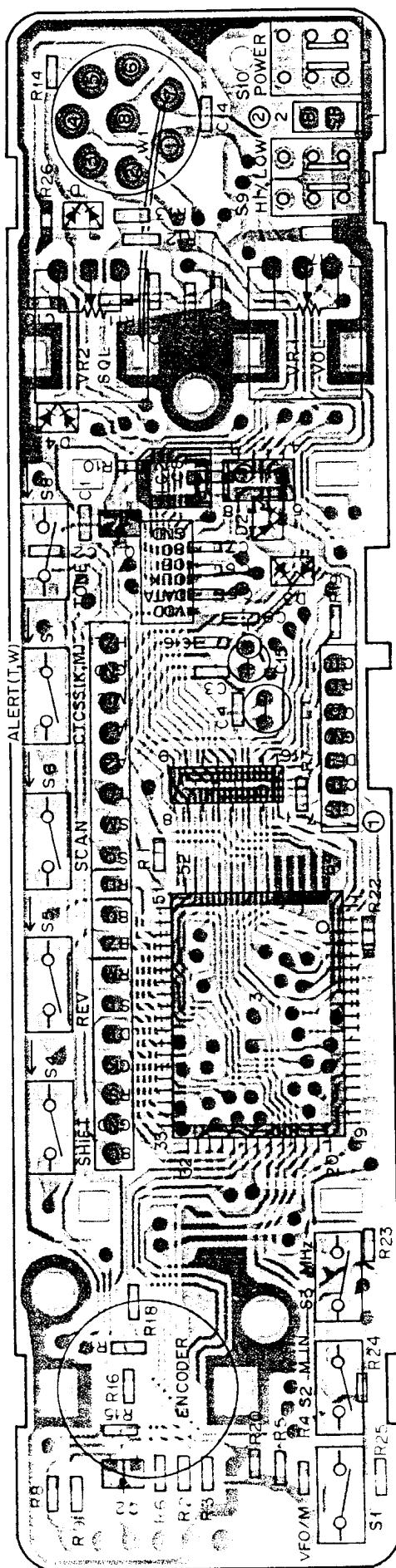
CONTROL UNIT (X53-3040-XX)

Component side view



CONTROL UNIT (X53-3040-XX)

Foil side view



	R22	R23	R24
TM-421A	-12 (K)	O	X
TM-421E/ES	-23 (M)	O	X

O : Used , X : Not used

Q1 : DTC124EK Q2 : 2SC2712(Y)
IC1 : LA5006M IC2 : M51951BML IC3 : μPD7106G-508-1B IC4 : KRR-C001
D1-4 : 1S184

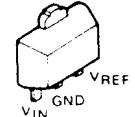
DTC124EK



2SC2712(Y)



M51951BML



B

C

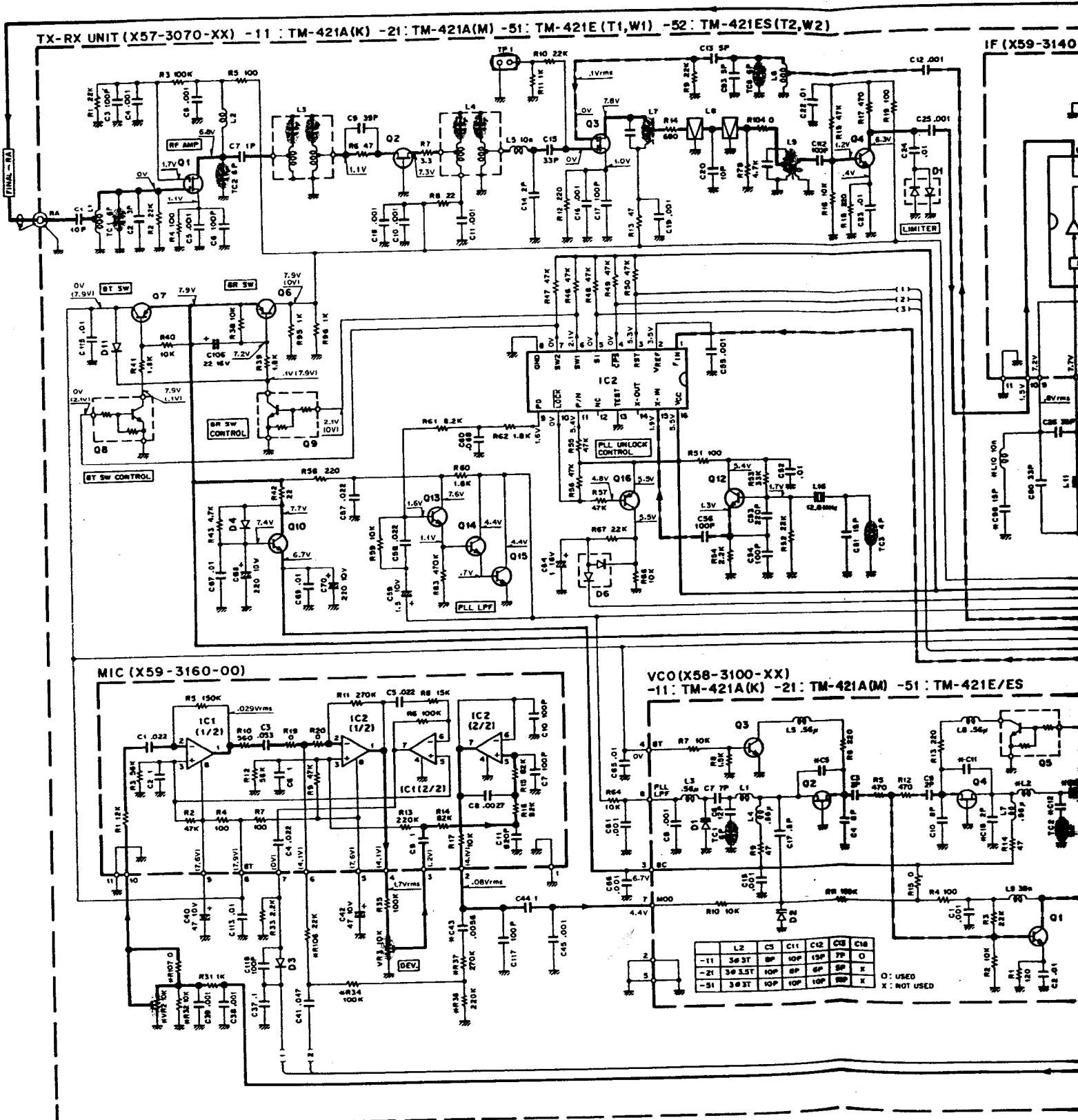
D

三

F

3

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

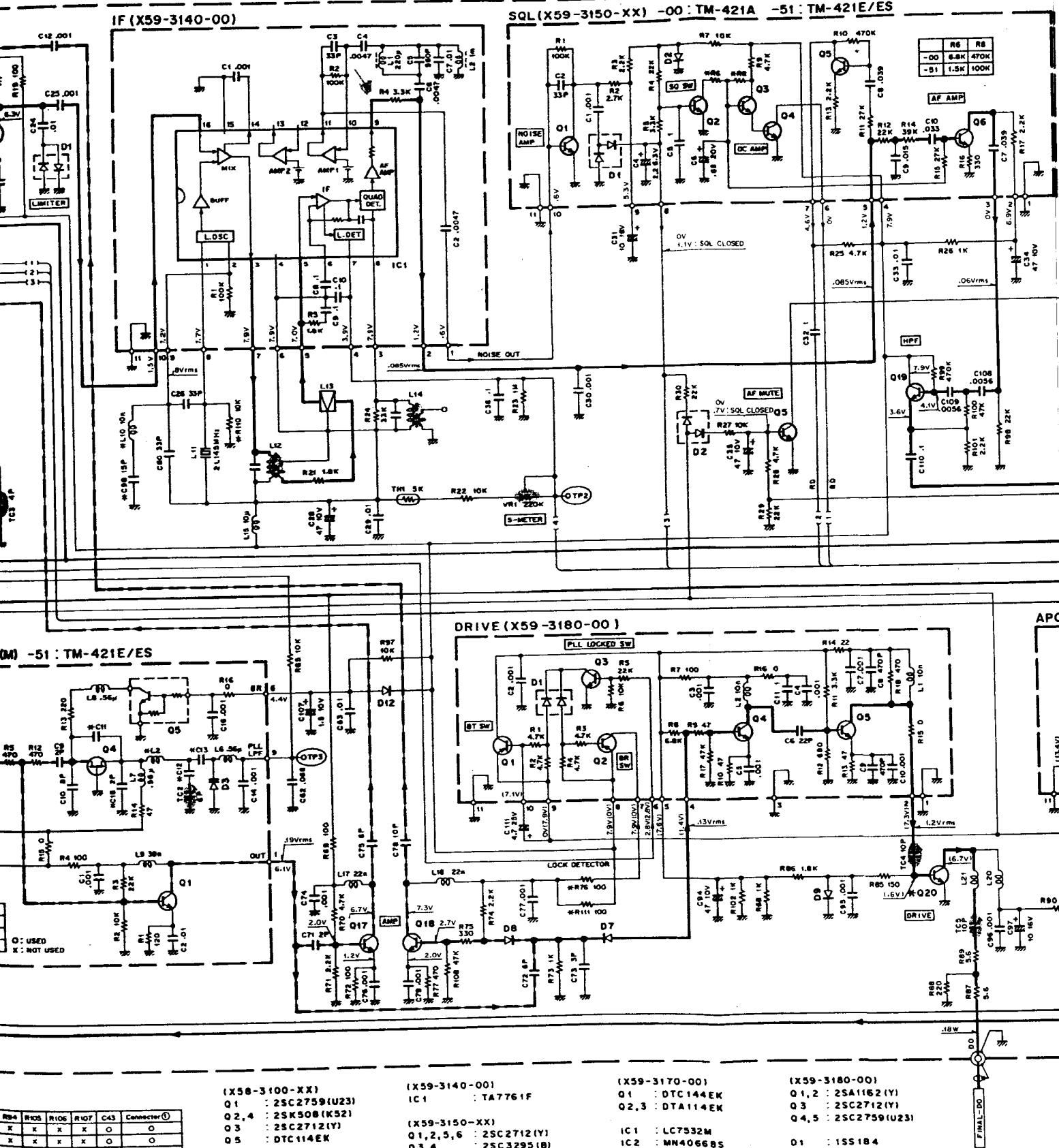


0 1	: 3SK184 (S)
0 2	: 2SK125
0 3	: 3SK184 (R)
0 4,12	: 2SC2714(Y)
0 5	: 2SC3326(A)
0 6,7	: 2SB1119S
0 8,9	: DTC124EK
0 10,11,13~15,19	: 2SC2712(Y)
0 16	: 2SA1162(Y)
0 17,18	: 2SC2759(U)
0 21	: ZSD1406(Y)

IC 1	:	MC7808C
IC 2	:	MS4959P
IC 3	:	TC4094BP
IC 4	:	μ PC1241H
D 1	:	1SS226
D 2, 6, 9, 10	:	1SS181
D 3, 4, 11, 12	:	1SS184
D 5	:	02CZ6.2(Y,Z)
D 7, 8	:	BA282
D 13, 14	:	1S1555
TH 1	:	112-502-2
TH 2	:	PTH590U332M

O : USED
X : NOT USED

SCHEMATIC DIAGRAM



(X58-3100-XX)
Q1 : 2SC2759(U23)
Q2,4 : 2SK508(K52)
Q3 : 2SC2712(Y)
Q5 : DTC114EK

D1~3 : 1SV164

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

(X59-3140-00)
IC1 : TA7761F
(X59-3150-XX)
Q1,2,5,6 : 2SC2712(Y)
Q3,4 : 2SC3295(B)

D1 : 1SS226
D2 : 1SS181
(X59-3160-00)
IC1,2 : NJM4558M

(X59-3170-00)
Q1 : DTC144EK
Q2,3 : DTA114EK

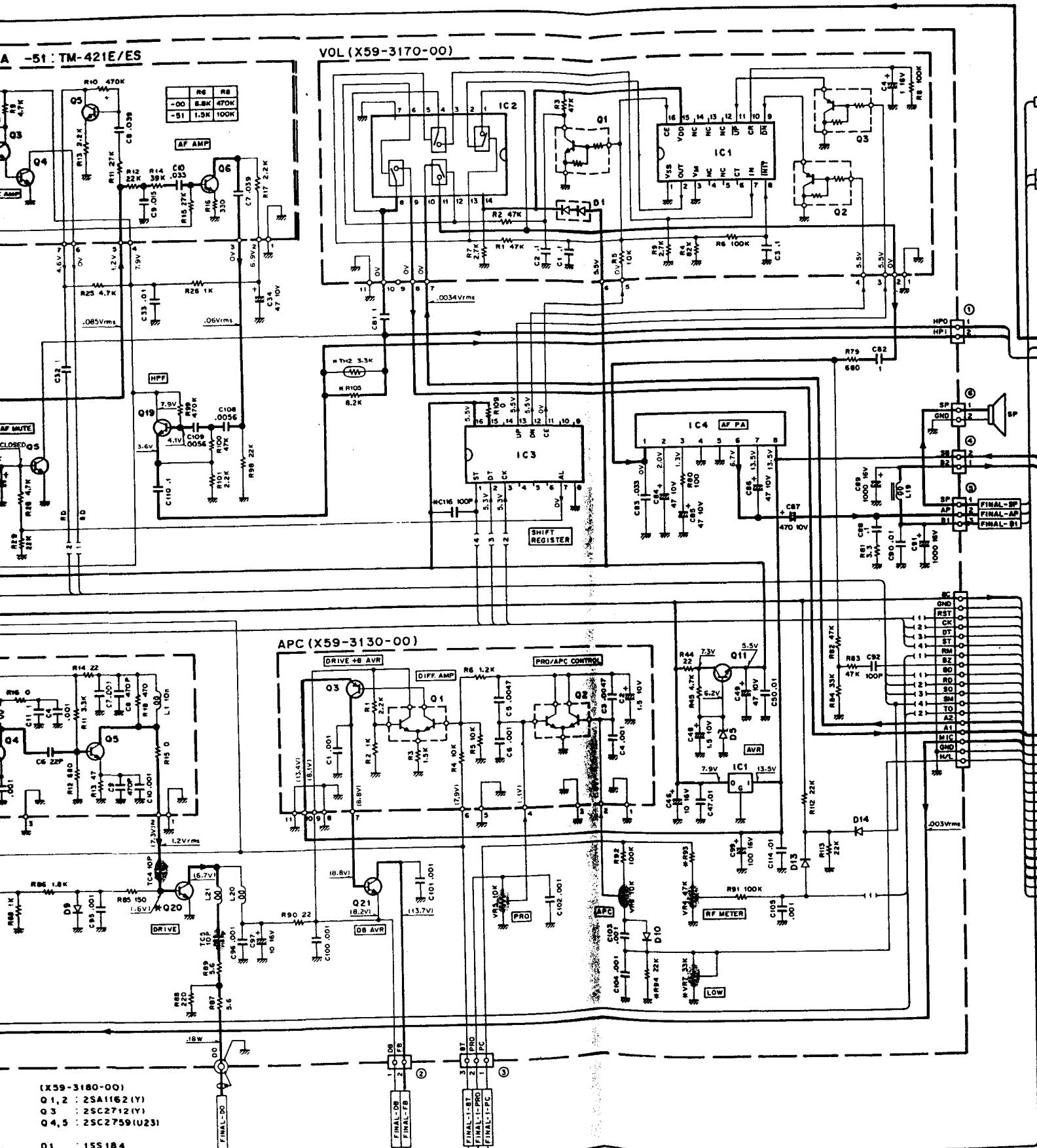
D1 : 1SS226

(X59-3180-00)
Q1,2 : 2SA1162(Y)
Q3 : 2SC2712(Y)
Q4,5 : 2SC2759(U23)

D1 : 1SS184

FINAL DO

SCHMATIC DIAGRAM



(X59-3180-00)
Q 1,2 : 2SA1162(Y)
Q 3 : 2SC2712(Y)
Q 4,5 : 2SC2759(U23)

D 1 : 155184

		R1	R22	R23	R24
TM-421A	X - 12	220K	O	X	O
	M - 23	220K	O	X	X
TM-421E,ES	T1,T2 - 53	68K	X	X	O
	W1,W2 - 62	68K	X	O	X

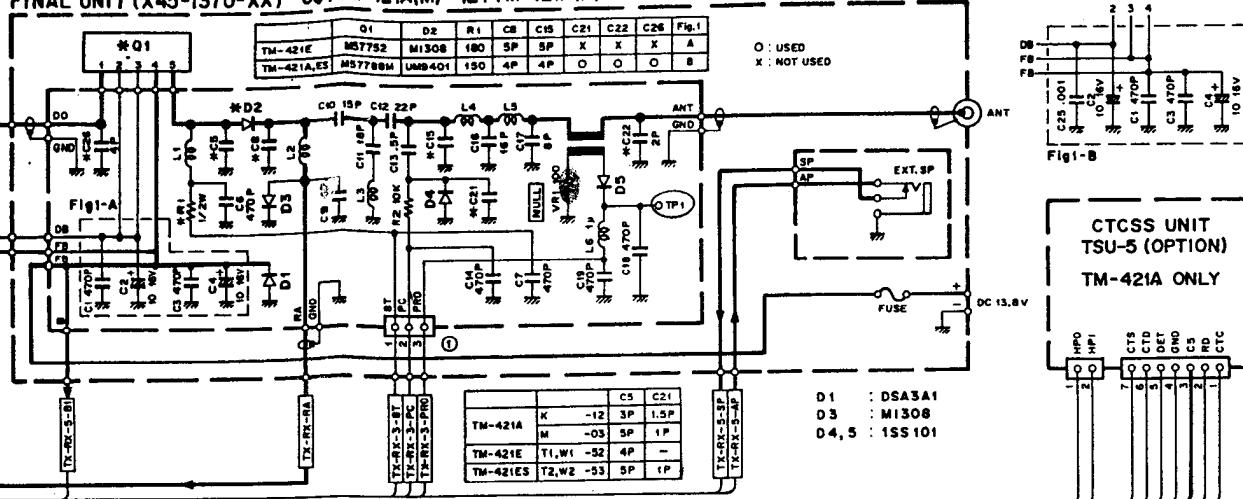
O : USED
X : NOT USED

(X53-3040-XX)
 01 : DTC124EK D1~4 : 15510
 02 : 2SC2712(Y)
 IC1 : LA5006M
 IC2 : M51951BML
 IC3 : μPD75106G-508-1B
 IC4 : KRR-C001

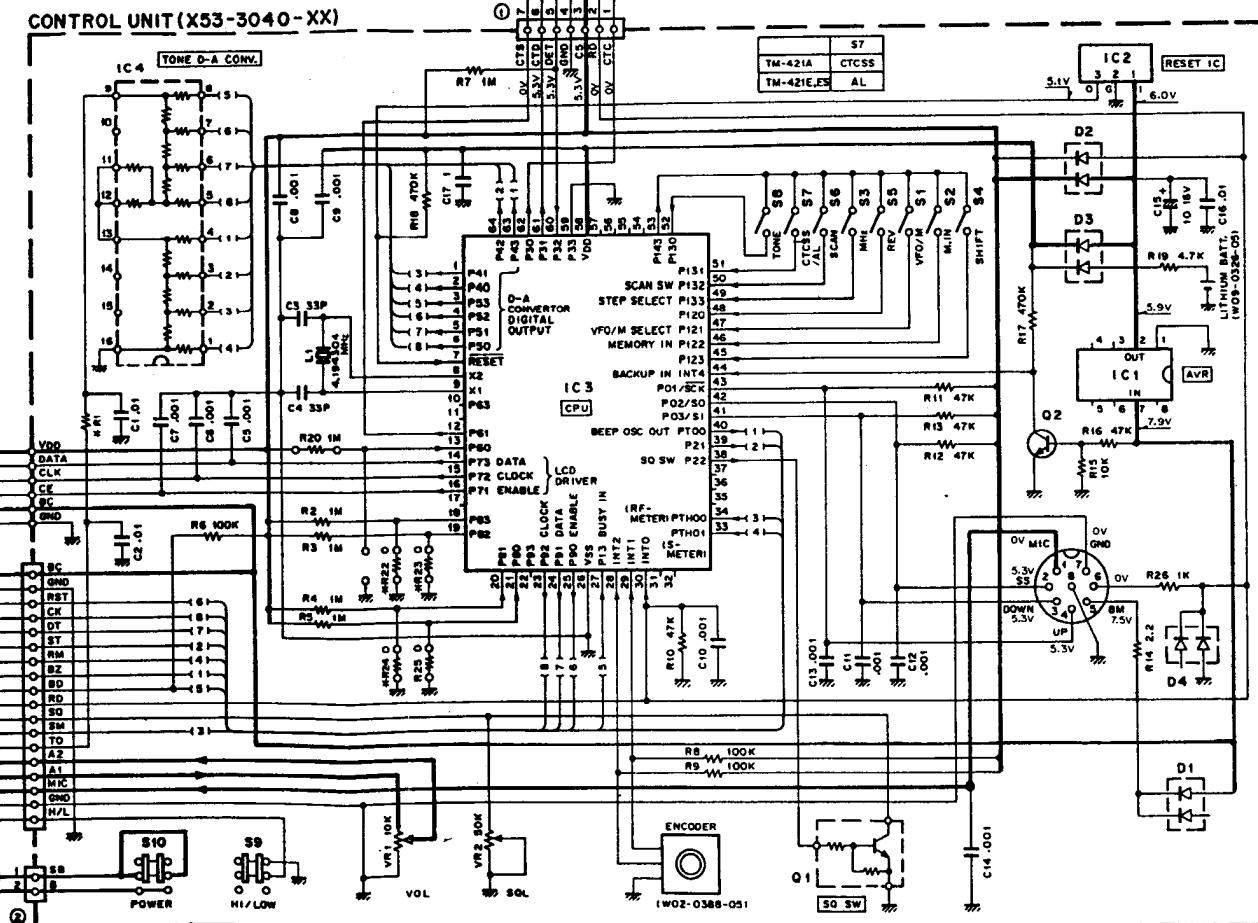
TM-421A/E/ES

Voltage measurement conditions f = 435.00MHz, RX no signal, () : TX.

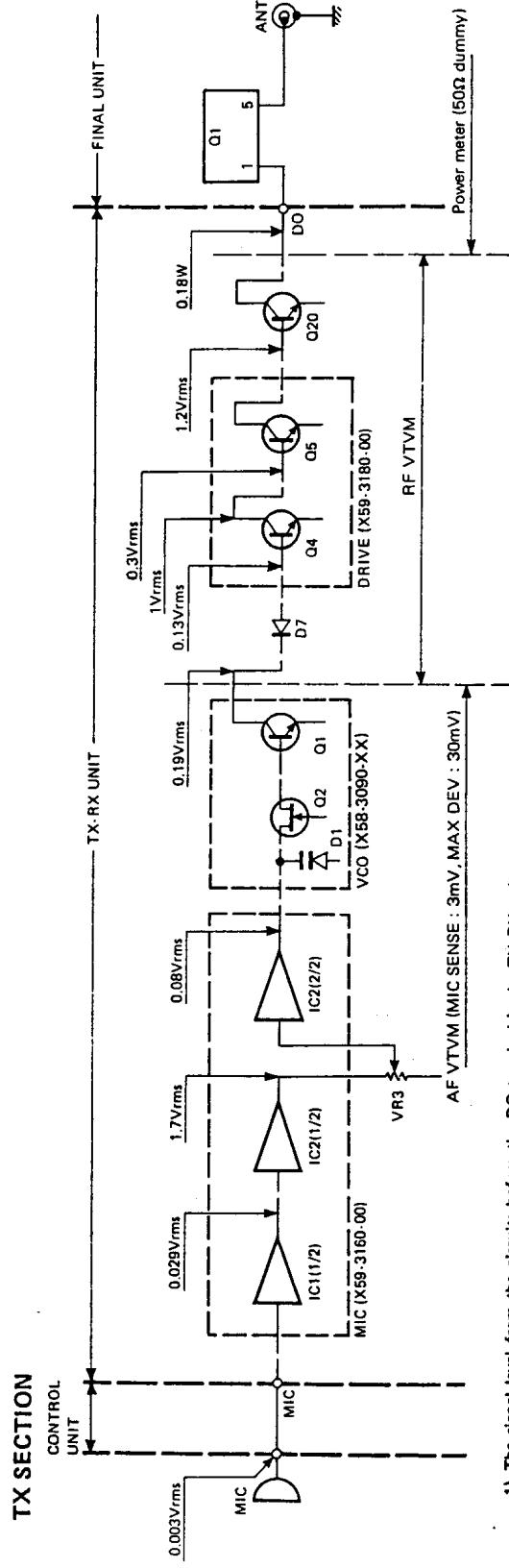
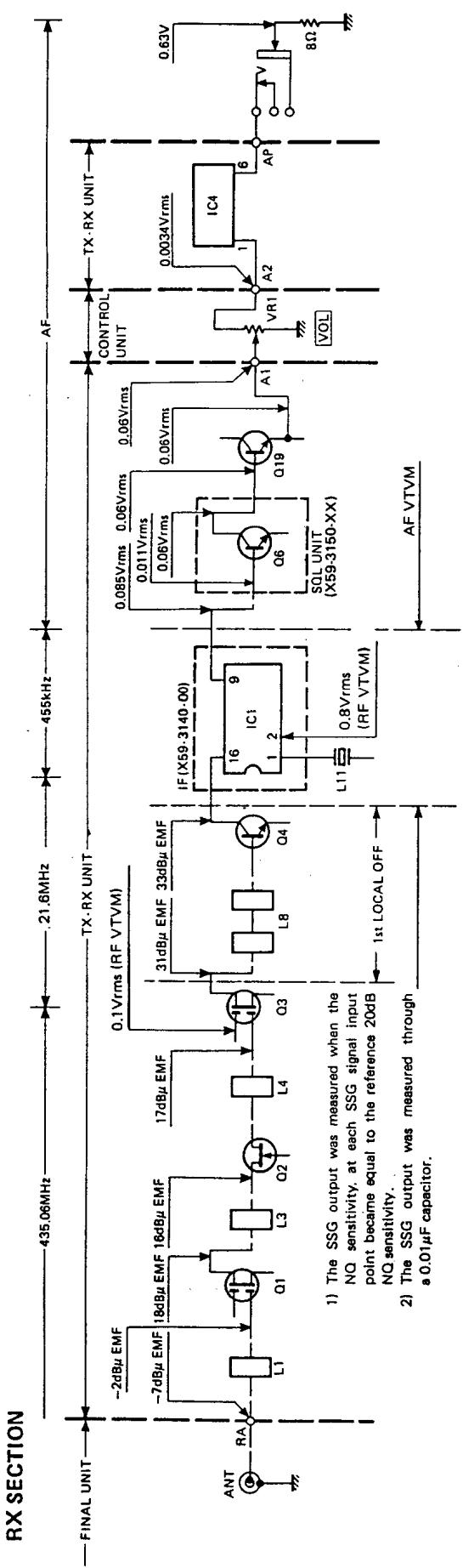
FINAL UNIT (X45-1370-XX) -03 : TM-421A(M) -12 : TM-421A(K) -52 : TM-421E(T1,W1) -53 : TM-421ES(T2,W2)



CONTROL UNIT (X53-3040-XX)

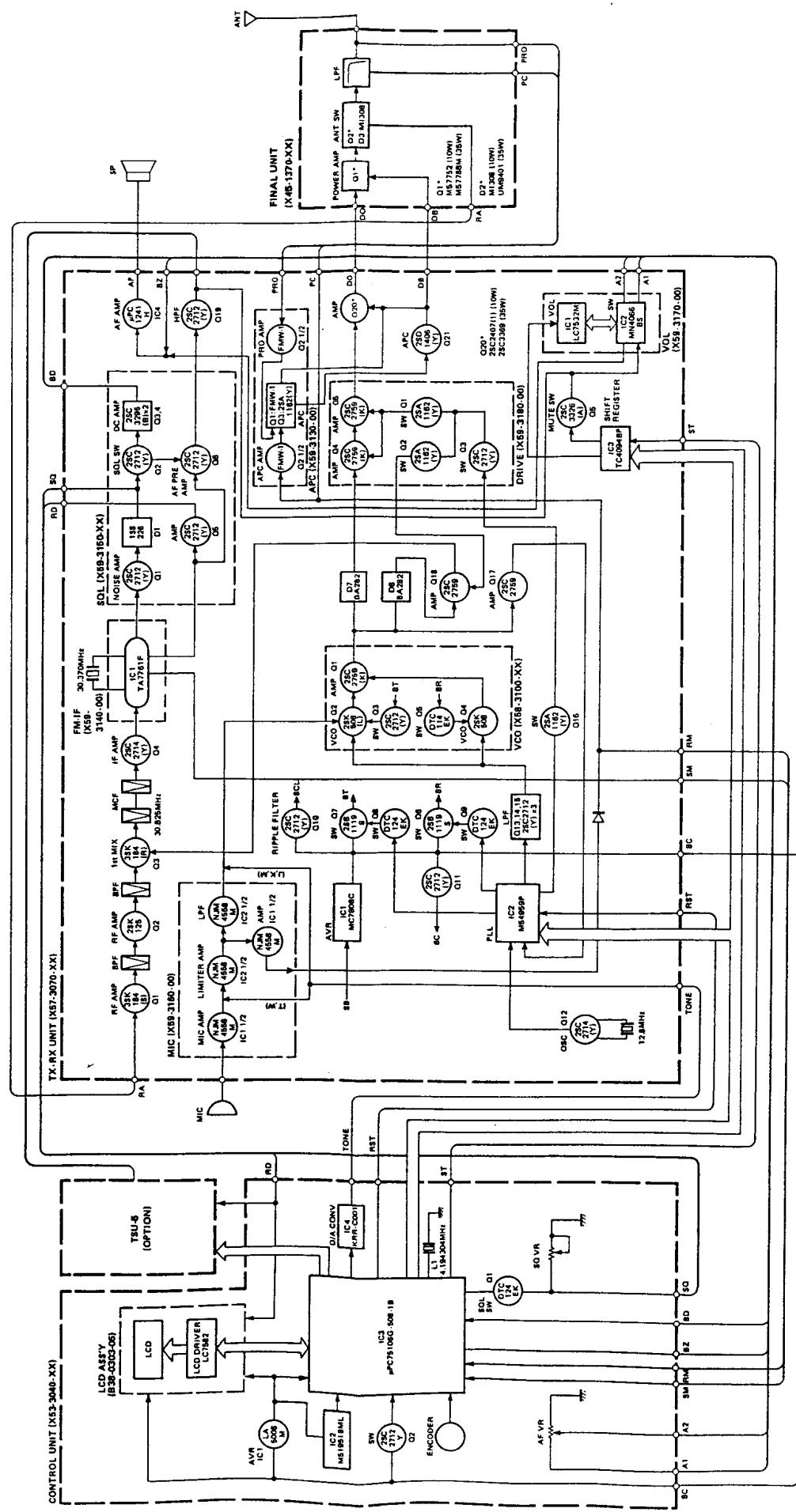


LEVEL DIAGRAM



- 1) The SSG output was measured when the NQ sensitivity at each SSG signal input point became equal to the reference 20dB NQ sensitivity.
- 2) The SSG output was measured through a 0.01μF capacitor.

BLOCK DIAGRAM



TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal Name	Terminal Function
FINAL UNIT (X45-1370-XX)			
(1)	1	8T	TX + 8T
	2	PC	Auto power control
	3	PRO	Protection
		RA	RX ANT
		DO	Drive output
		AP	Audio power
		B	+ B
		SP	Speaker
		FB	Final + B
		DB	Drive +B
CONTROL UNIT (X53-3040-XX)			
(1)	1	CTC	CTCSS IC clock
	2	RD	Remote data
	3	5C	+ 5V
	4	GND	GND
	5	DET	Tone detector output
	6	CTD	CTCSS IC data
	7	CTS	CTCSS shift register reset
(2)	1	SB	Switched + B (13.8V)
	2	B	+ B2
(3)		8C	+ 8V
		GND	GND
		RS	PLL enable
		CK	PLL & shift register clock
		DT	PLL & shift register data
		ST	Shift register strobe
		RM	RF meter
		BZ	Beep output
		BD	Busy display
		RD	Remote data
		SQ	Squelch
		SM	S meter
		TO	Tone output
		A2	AF output
		A1	AF input
		MIC	Mic AF input
		GND	GND
		H/L	Hi/low switch
(4)		VDD	Backup voltage
		DATA	LCD driver data
		CLK	LCD driver clock
		CE	LCD driver enable
		8C	+ 8V
		GND	GND

Connector No.	Terminal No.	Terminal Name	Terminal Function
TX-RX UNIT (X57-3070-XX)			
(1)	1	HPO	
	2	HPI	
(2)	1	DB	Drive +B
	2	FB	Final +B
(3)	1	PC	Auto power control
	2	PRO	Protection
	3	8T	TX + 8V
(4)	1	B2	+ B2
	2	SB	Switched + B (13.8V)
(5)	1	SP	Speaker
	2	AP	Audio power
	3	B1	+ B1
(6)	1	SP	Speaker
	2	GND	GND
(7)		8C	+ 8V
		GND	GND
		RST	PLL enable
		CK	PLL & shift register clock
		DT	PLL & shift register data
		ST	Shift register strobe
		RM	RF meter
		BZ	Beep output
		BD	Busy display
(8)		RD	Remote data
		SQ	Squelch
		SM	S meter
		TO	Tone output
		A2	AF output
		A1	AF input
		MIC	Mic AF input
		GND	GND
		H/L	Hi/low switch
		RA	RX ANT
		DO	Drive output

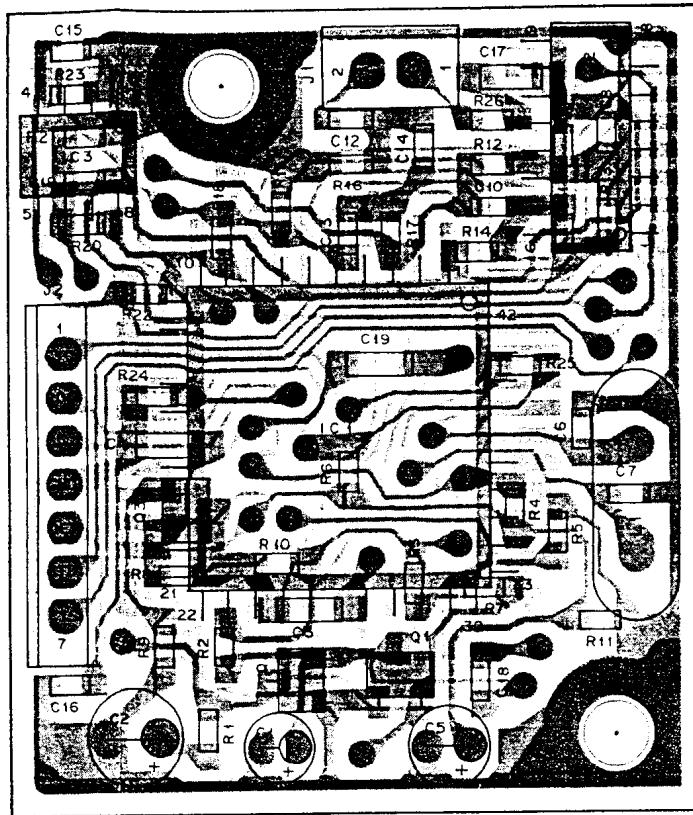
M-421A/E/ES

TSU-5 (CTCSS UNIT)

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 10μF 10WV	C1
CE04CW1A101M		Electro 100μF 10WV	C2
CE04CW1A220M		Electro 22μF 10WV	C5
CK73EF1C104Z		Chip C 0.1μF Z	C3,4
CK73EF1C105Z		Chip C 1μF Z	C17,19
CK73FB1H103K		Chip C 0.01μF 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 2SC2712(GR)		Digital transistor Chip transistor	Q1,2 Q3

TSU-5 PC BOARD VIEW



2SC2712

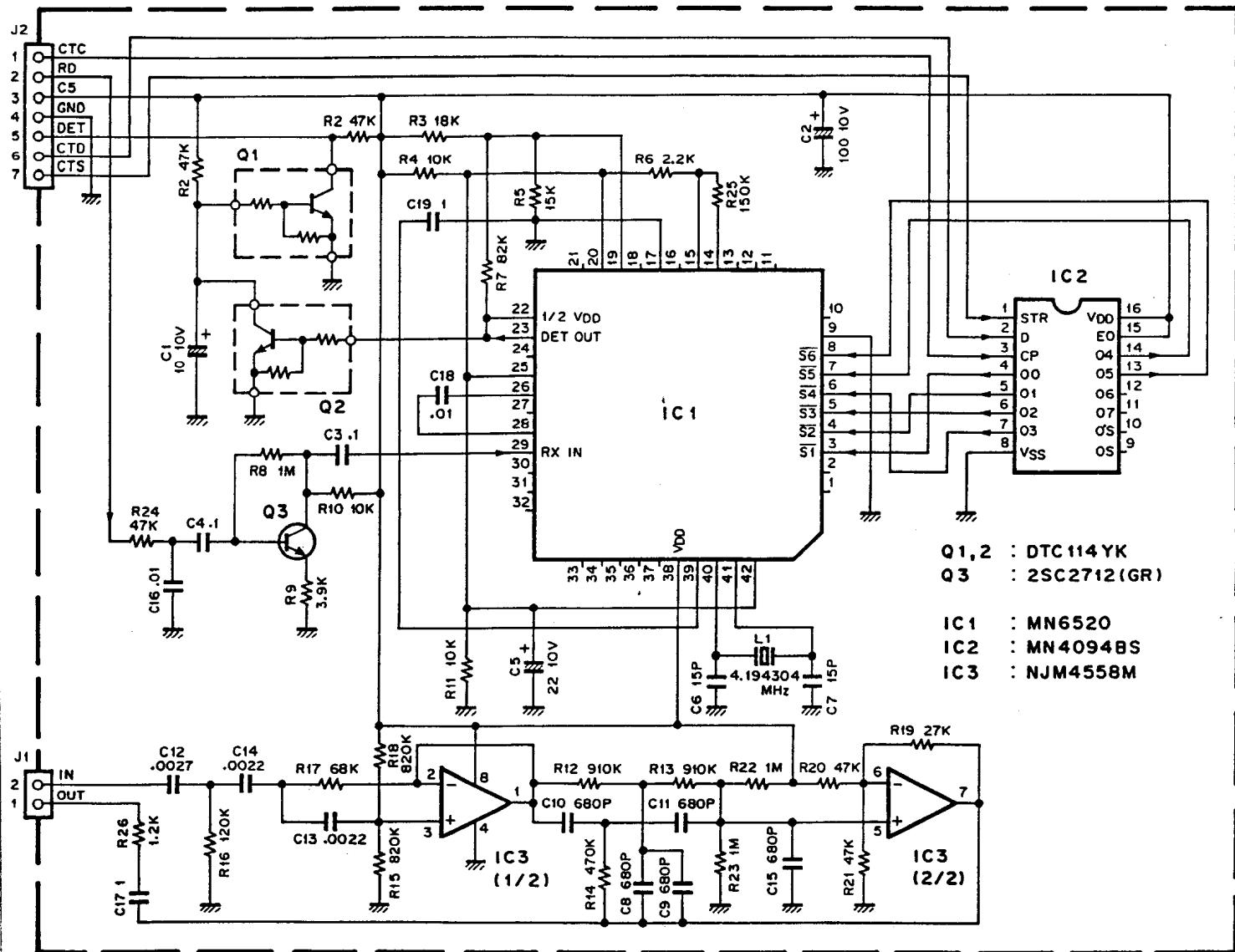


DTC114YK



TSU-5 (CTCSS UNIT)

TSU-5 SCHEMATIC DIAGRAM



Q1,2 : DTC 114 YK
Q3 : 2SC2712(GR)

IC1 : MN6520
IC2 : MN4094BS
IC3 : NJM4558M

Scan by Dan

TM-421A/E/ES

SPECIFICATIONS

Specifications	Model	TM-421A	TM-421ES	TM-421E
General	Frequency range	440 to 450MHz (U.S.A. version) 430 to 440MHz		
	Mode	F3E (FM)		
	Antenna impedance	50 ohms		
	Operating temperature	-20°C to +60°C (-4°F to +140°F)		
	Power requirements	13.8V DC ± 15%		
	Ground	Negative		
	Current drain	Transmit mode (Max.) Receive mode with no input signal	8.5A 0.4A	3.2A
	Frequency stability	Better than $\pm 10 \times 10^{-6}$		
	Dimensions (Projections included, W x H x D mm)	141 x 42 x 193		141 x 42 x 154
	Weight	1.2kg		1.0kg
Transmitter	Output power*	HI LOW	35W Approx. 5W Adjustable up to out 20W	10W Approx. 1W
	Modulation		Reactance modulation	
	Spurious radiation		Less than -60dB	
	Max. frequency deviation		±5kHz	
	Audio distortion (at 60% modulation)		Less than 3%	
	Microphone impedance		500 to 600 ohms	
	Circuitry		Double conversion superheterodyne	
	Intermediate frequency		21.6MHz/455kHz	
	Sensitivity (12dB SINAD)		Less than 0.16µV	
	Selectivity		-6dB : More than 12kHz, -60dB : Less than 26kHz	
Receiver	Spurious response		Better than 65dB	
	Squelch sensitivity		Less than 0.1µV	
	Output (5% distortion)		More than 2W across 8 ohms load	
	External speaker impedance		8 ohms	

Notes :

1. Circuit and ratings are subject to change without notice due to advancement in technology.

2. * : Recommended duty-cycle :

1 minute : Transmission

3 minutes : Reception

KENWOOD CORPORATION

Tokyo 150, Japan

Scan by Dan

SCHLAND GMBH