144MHz FM TRANSCEIVER

TM-251A/E

SERVICE MANUAL

KENWOOD

B51-8267-00(O) 1295

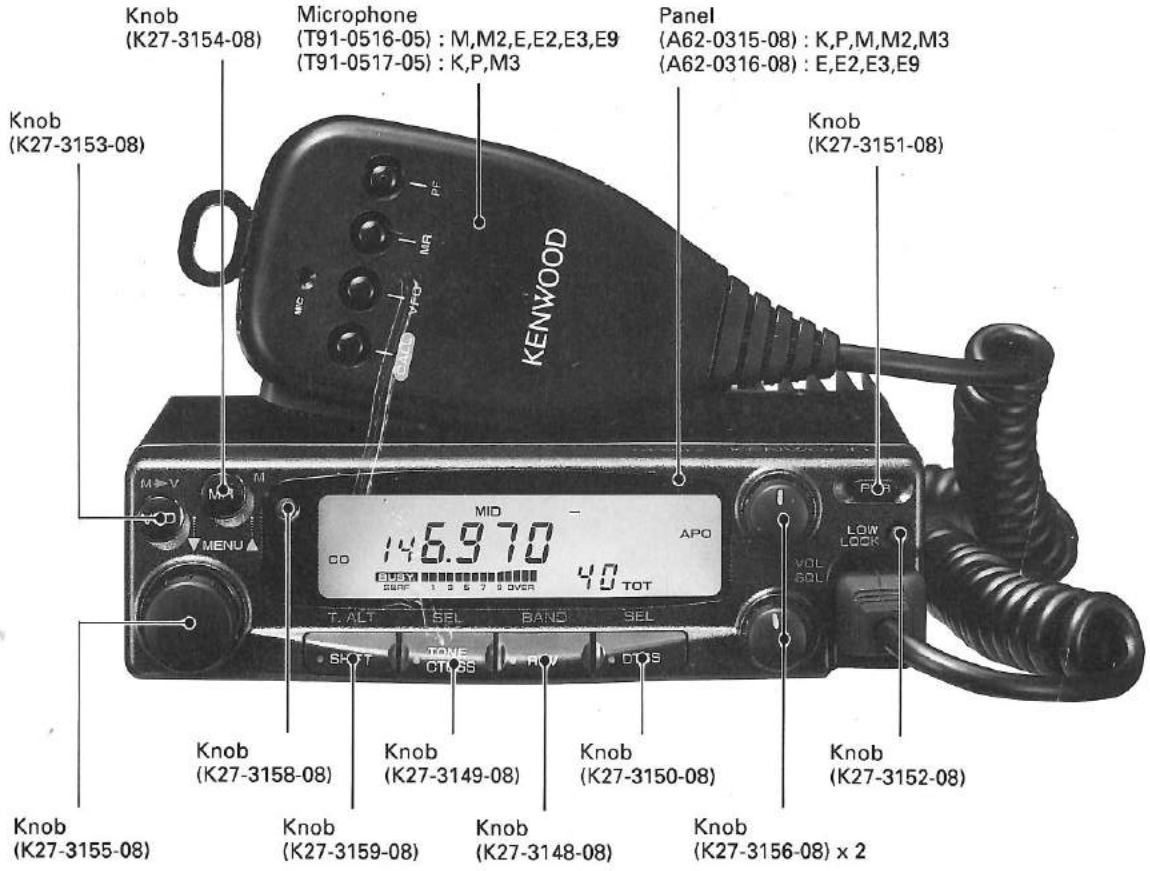

Photo is TM-251A.

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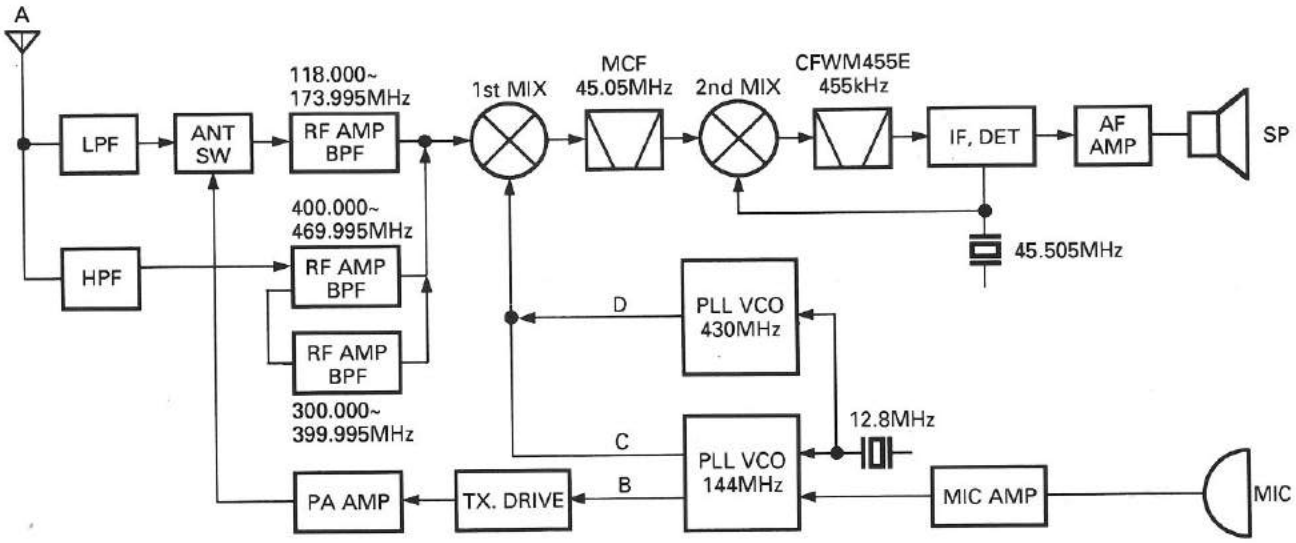
CIRCUIT DESCRIPTION

Frequency Configuration

The TM-251A/E transceiver incorporates a digital variable frequency oscillator (VFO), based on a phase-locked loop (PLL) synthesizer system, allowing a channel step of 5, 10, 12.5, 15, 20, or 25kHz.

The receiver is a dual-band type covering the 144 and 430MHz bands. Double conversion is used, in which the received signal is mixed with a first local oscillator frequency of 163.05 to 219.045MHz (**K,P,M2, M3,E2**), 189.05 to 193.045MHz (**M**), and 189.05 to 191.045MHz (**E,E3,E9**) for 144MHz-band reception, or 345.05 to 445.045MHz (**K,P,M2,M3,E2**), 354.95 to 424.945MHz (**K,P,M2,M3,E2**), and 384.95 to 394.945 MHz (**M,E,E3,E9**) for 430MHz-band reception, to produce the 45.05MHz first IF. The first IF signal is then mixed with the second local oscillator frequency of 45.505MHz to produce the 455kHz second IF.

The signal in the transmitter system is directly oscillated and frequency-divided by a PLL circuit, and amplified by a linear amplifier, then transmitted.



A : TX 144.000~147.995MHz (**K, P, M**)
144.000~145.995MHz (**E, E3, E9**)
136.000~173.995MHz (**M2, M3, E2**)

RX 118.000~173.995MHz (**K, P, M2, M3, E2**)
144.000~147.995MHz (**M**)
144.000~145.995MHz (**E, E3, E9**)
300.000~469.995MHz (**K, P, M2, M3, E2**)
430.000~439.995MHz (**M, E, E3, E9**)

B : 144.000~147.995MHz (**K, P, M**)
144.000~145.995MHz (**E, E3, E9**)
136.000~173.995MHz (**M2, M3, E2**)

C : 163.05~219.045MHz UPPER (**K, P, M2, M3, E2**)
189.05~193.045MHz UPPER (**M**)
189.05~191.045MHz UPPER (**E, E3, E9**)

D : 345.05~445.045MHz UPPER (**K, P, M2, M3, E2**)
354.95~424.945MHz LOWER (**K, P, M2, M3, E2**)
384.95~394.945MHz LOWER (**M, E, E3, E9**)

Fig. 1 Frequency configuration

CIRCUIT DESCRIPTION

Receiver System

- **Outline**

The signal from the antenna passes through a low-pass filter in the final transmission stage and then goes through a transmission/reception selection diode switch to the receiving front end, where it is amplified by Q301 and unwanted components eliminated by a band-pass filter. The resulting signal is amplified by Q302 and unwanted components eliminated by another band-pass filter. The resulting signal goes to the first mixer, Q306.

The 430MHz sub-band signal from the antenna passes through a high-pass filter and is amplified by Q304.

When RX frequency is 400 to 469.995MHz, unwanted components are removed by a band-pass filter, the resulting signal is amplified by Q305, further unwanted signal components are removed by a band-pass filter, and it goes to the first mixer, Q306.

When RX frequency is 300 to 399.995MHz, the signal is amplified by Q313 and IC302, and it goes to the first mixer, Q306.

The signal is mixed with the first local oscillator signal from the PLL circuit by the first mixer, Q306, to convert it to the first IF of 45.05MHz. Unwanted near-by signals are removed by a two-stage MCF. The first IF signal is amplified by Q307 and input to the second mixer Q7. This signal is then mixed with the second local oscillator signal to produce the second IF of 455kHz.

Unwanted near-by signal components are then eliminated by an FM ceramic filter and input to the FM IF HIC (IC1). The signal is amplified to the second IF signal level and FM-detected to produce an audio signal.

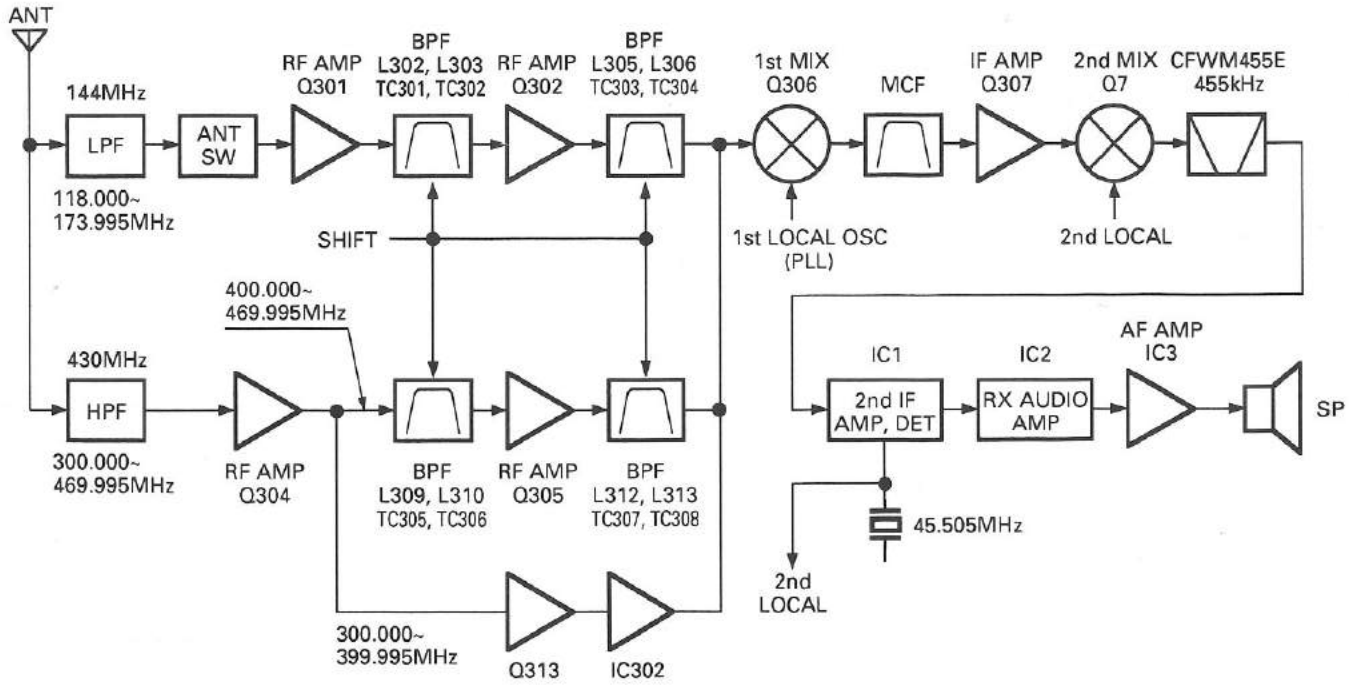


Fig. 2 Receiver system configuration

Item	Rating
Nominal center frequency	45.050MHz
Pass bandwidth	±7.5kHz or more at 3dB
Attenuation bandwidth	±22kHz or less at 25dB ±35kHz or less at 40dB
Guaranteed attenuation	80dB or more at ±890~930kHz Spurious: 40dB or morewithin ±1MHz
Insertion loss	1dB or less
Ripple	3.0dB or less
Terminating impedance	800Ω/2pF

Table 1 MCF characteristics

Item	Rating
Nominal center frequency	455kHz
6dB bandwidth	±7.5kHz or more
50dB bandwidth	±15kHz or less
Pass bandwith ripple	3dB or less
Guaranteed attenuation	35dB or more at ±100kHz
Insertion loss	6dB or less
I/O impedance	1.5kΩ

Table 2 Ceramic filter characteristics

CIRCUIT DESCRIPTION

- **S-meter circuit**

The S-meter output voltage of the FM IF HIC IC1 (KCD04) is sent to the control unit and digitized by the CPU to operate the bar meter on the LCD.

- **Shift register circuit**

The SDT+, SCK+, and LER+ serial data from the control unit are sent to IC5 (BU4094BF) and IC4 (W02-1830-08) to control operations as outlined in the following table.

Pin No.	Name	Function
1	LER+	Enable input
2	SDT+	Serial data input
3	SCK+	Clock input
4	V5	+5V
5	GND	GND
6	SQL C	Squelch level control output *
7	SUB+	Sub reception ON. ON : High
8	360+	360MHz band ON. ON : High
9	800+	(Not used)

* The SQL C (pin 6) is described in the section "Squelch circuit in the AF signal system".

Table 4 IC4 : W02-1830-08 function table

Pin No.	Name	Function
1	Strobe	Enable input
2	Serial IN	Serial data input
3	Clock	Clock input
4	Q1	Main VCO frequency selection
5	Q2	Sub VCO frequency selection
6	Q3	Packet 1200 bps ON. ON : High
7	Q4	Packet 9600 bps ON. ON : High
8	Vss	GND
9	Qs	Serial data output to IC4
10	Qs'	(Not used)
11	Q8	TX power selection LOW. LOW : High
12	Q7	TX power selection MID. MID : High
13	Q6	AM circuit ON. ON : High
14	Q5	Sub PLL circuit ON. ON : High
15	OUTPUT	Output enable. Pulled up to +5V.
16	VDD	5V

Table 3 IC5 : BU4094BF function table

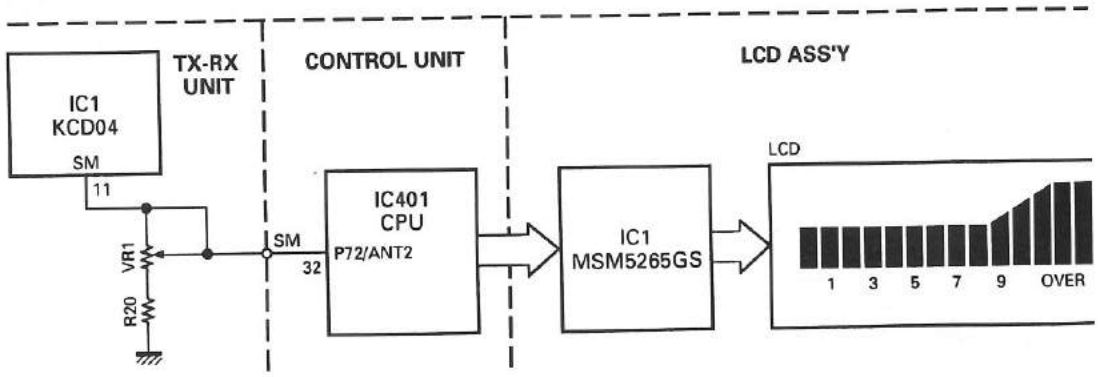


Fig. 3 S-meter circuit

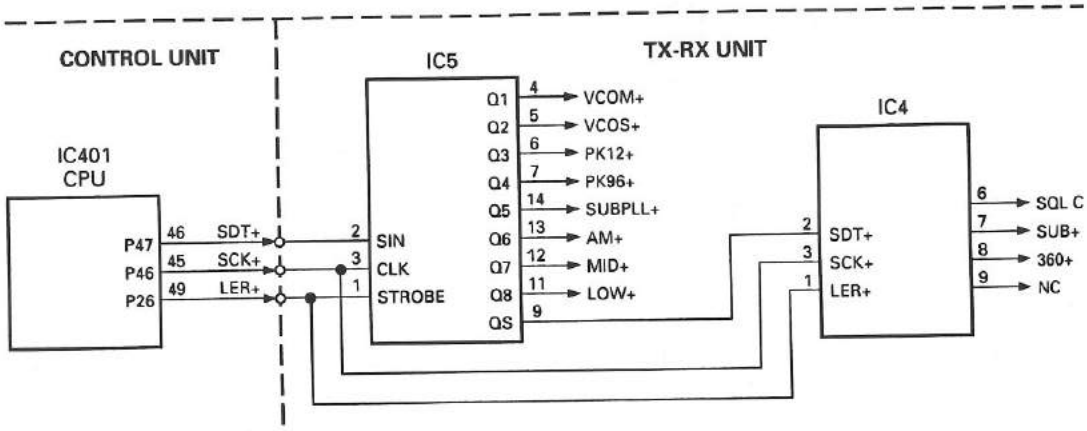


Fig. 4 Shift register circuit

CIRCUIT DESCRIPTION

Transmitter System

- **Outline**

The transmitter circuit directly produces and modulates the desired frequency by means of a vari-cap diode.

- **Modulator circuit**

The audio signal from the microphone is amplified by microphone amplifier IC408 in the control unit, and input to IC202 in the TX-RX unit. IC202 consists of a pre-emphasis circuit, amplifier, limiter, and splatter circuit that eliminates unwanted high-frequency components. (See the section "TX. audio filter circuit.") The frequency modulation circuit directly modulates frequency by means of a varicap diode.

- **Younger-stage circuit**

The signal output from the VCO is buffer-amplified by Q201 and input to drive circuit HIC IC102. The amplifier provides a stable drive output without adjustment because of its wide bandwidth. The APC circuit controls the collector voltage in the Younger final stage.

- **Power amplifier circuit**

The drive signal is input to power module IC101 and amplified to the specified level.

- **APC circuit**

The automatic transmission power control (APC) circuit detects part of the power module output with diodes D105 and D106, and generates the VDET detection voltage. The APC circuit compares VDET with reference voltage VREF by mean of transistor Q103, and controls the control voltage with DC amplifiers Q101 and Q102 so that VDET equals VREF, thus keeping the transmission output constant.

The transmission output is switched between low, medium, and high with reference voltage VREF by mean of transistor Q109. The switching signal is output from shift register IC5.

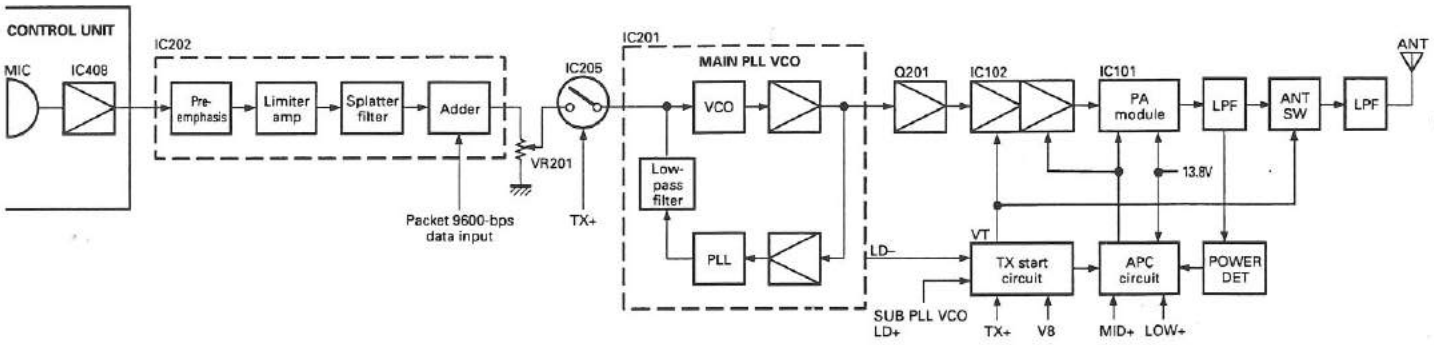


Fig. 5 Transmitter system block diagram

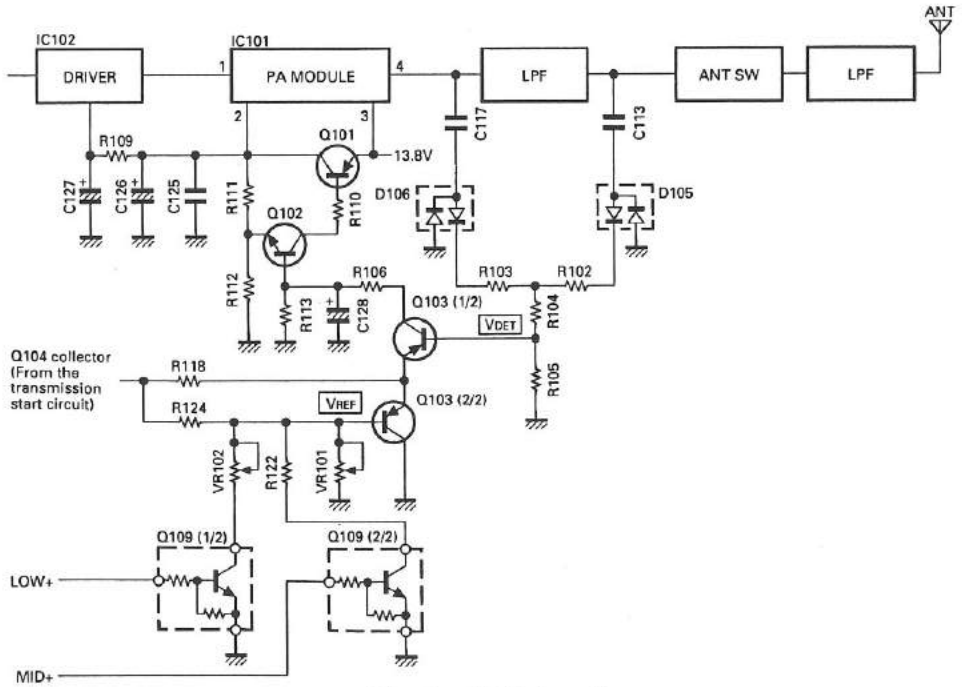


Fig. 6 APC circuit

CIRCUIT DESCRIPTION

- **TX audio circuit (IC202 : W02-1828-08)**

Figure 7 shows the TX audio circuit.

As explained in the description of the modulation circuit, C4 and R5 comprise a pre-emphasis circuit, IC2 (1/2) is a limiter amplifier, R9 and R10 comprise an attenuator, and IC2 (2/2) and its peripheral circuits comprise a splatter filter of 60dB log (f/3k). The output from the splatter filter is summed with the tone and the packet modulation data (9600bps) signal, PKD, that passes through the IC1 analog switch by IC3 (2/2), and is output as the TX MOD signal.

The PKD packet modulation data signal can be switched to 1200bps or 9600bps by the IC1 analog switch. The switching control signal is output from the shift register circuit IC5 (BU4094BF) as the PK12+ or PK96+ signal. In addition, for the packet demodulation data (1200bps), the RXA signal is amplified by IC3 (1/2) and output as the PKRD signal.

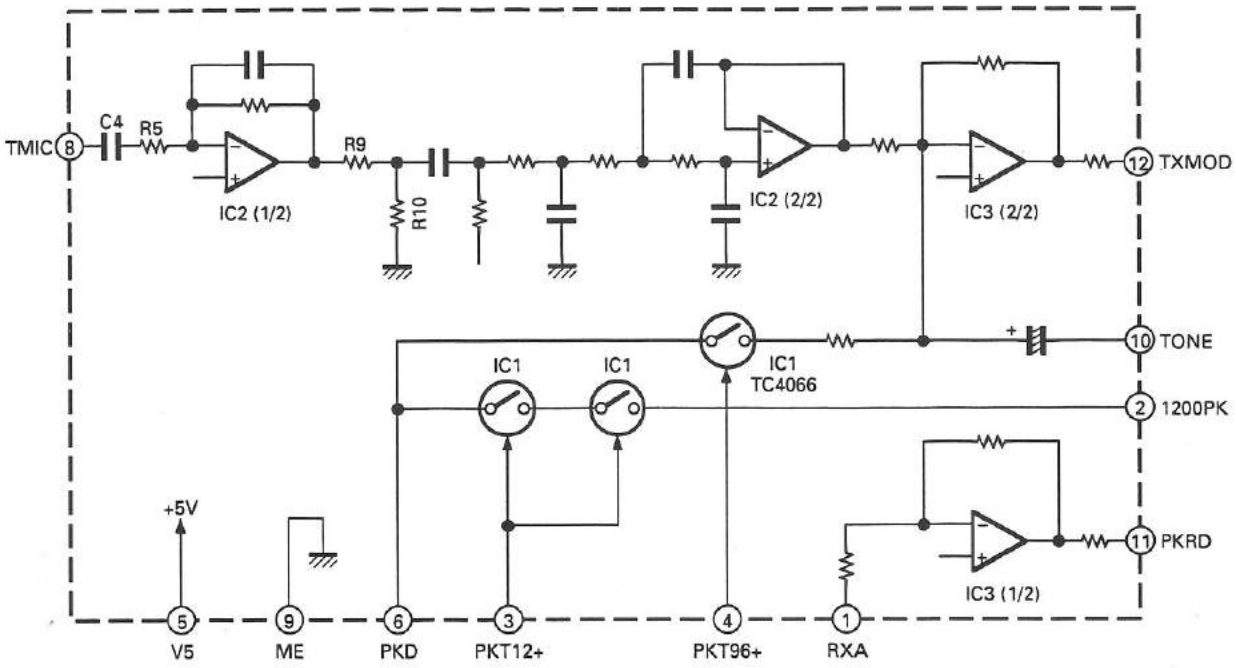


Fig. 7 TX audio circuit (IC202 : W02-1828-08)

CIRCUIT DESCRIPTION

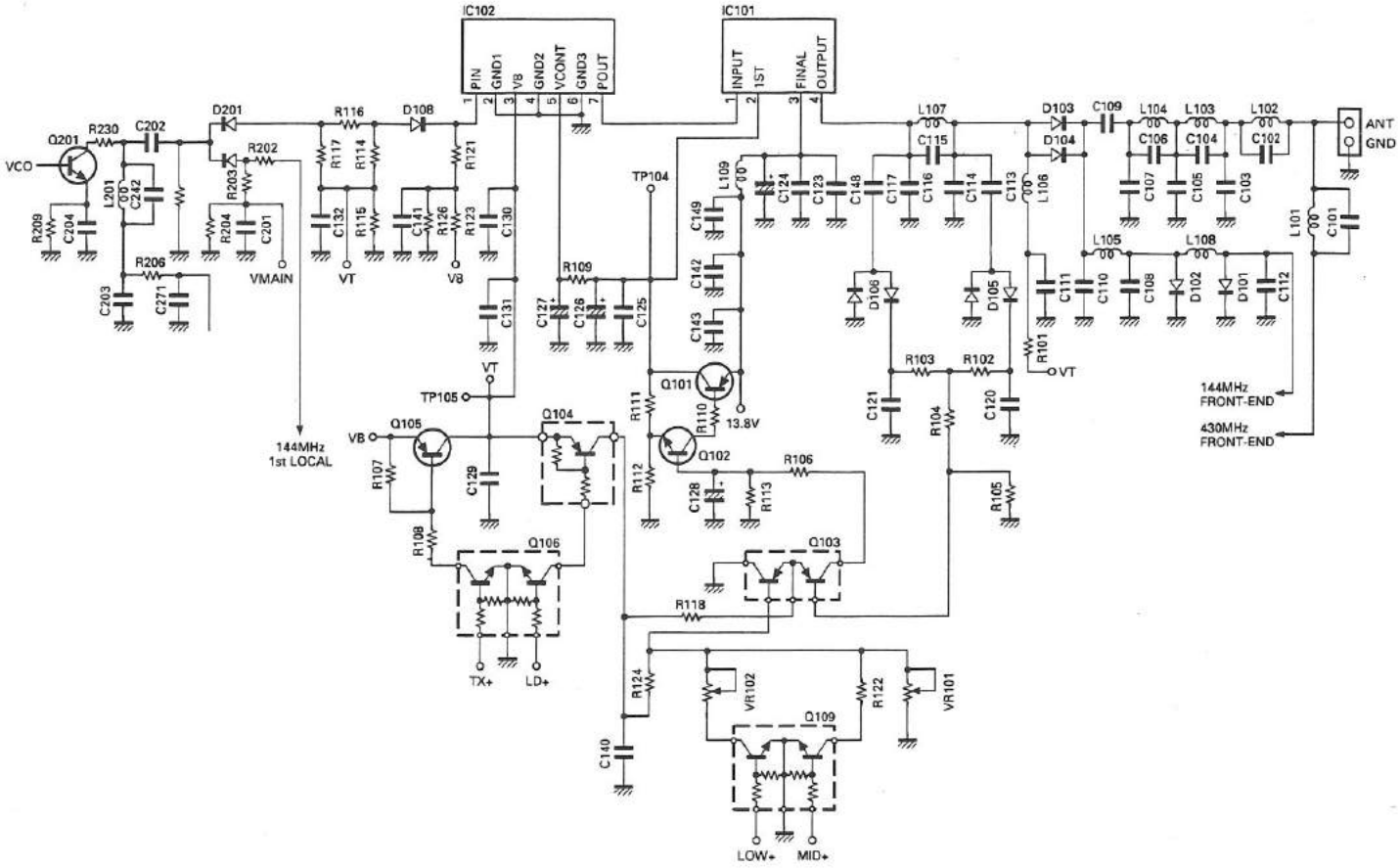


Fig. 8 Younger stage, power amplifier, and APC circuits

Item	Code	Condition	Rating	Unit
Power supply voltage	Vcc		16	V
Control voltage	Vcon		16	V
Current consumption	I		14	A
Input power	Pi		600	mW
Output power	Po	12.5V < Vcc ≤ 16V, Vcon ≤ 12.5V, Pi = 400mW, Zg = ZL = 50Ω	65	W
Operating case temperature	Tc (opr)		-30~+100	°C
Storage temperature	Tstg		-40~+110	°C

Table 5 Maximum rating of power module S-AV24-01K (TX-RX unit IC101)

CIRCUIT DESCRIPTION

PLL Synthesizer Section

The PLL and VCO circuits are housed in a solid shield case as a hybrid integrated circuit. IC201 (L78-0350-08) is for 144MHz band transmission and reception, and IC203 (L78-0353-08) is for 430MHz band reception. They share the 12.8MHz reference oscillator.

IC201 and IC203 consist of PLL and VCO circuits. The PLL circuit consists of the PLL control IC (IC1 : MB1504L), the operational amplifier (IC3 : NJM3404) that forms a loop filter, RF buffer amplifier Q4, and Q7, which forms an unlock detector.

The VCO circuit consists of the VCO (comprising vari-cap diode D3 and oscillation transistor Q1) that varies the control voltage (VCONT) from the PLL circuit, buffer amplifier Q2, transistor Q3, which that is controlled via the SHIFT pin according to the oscillation frequency, and diode switch D5. The following paragraphs describe the oscillation frequency and the divide ratio of the PLL circuit.

Comparison frequencies of 5 and 6.25kHz are produced by dividing the 12.8MHz reference oscillator frequency by 2560 or 2048 to correspond to the 5, 10, 12.5, 15, 20 and 25kHz channel steps.

For 144MHz, the relationship between fVCO (RX) and each frequency divide ratio is given by the following equation :

Where :

$fVCO = (144 + 45.05) = \{ (n \times 64) + A \} \times fOSC \div R$ [MHz]

fVCO : VCO output frequency

n : Binary 11-bit programmable counter setting value (divide ratio : 16 to 2047)

A : Binary 7-bit programmable counter setting value (divide ratio : 0 to 63)

fOSC : Reference frequency 12.8MHz

R : Binary 14-bit programmable counter setting value (divide ratio : 8 to 16383)
5, 10, 15, 20kHz steps : 2560
12.5, 25kHz steps : 2048

In this case, n is 590 and A is 50.

$\therefore fVCO = \{ (590 \times 64) + 50 \} \times 12800 \div 2560$
$= \{ 37760 + 50 \} \times 5$
$= 189050kHz = 189.05MHz$

For 430MHz, the relationship between fvco (RX) and each frequency divide ratio is given by the following equation:

$fVCO = (430 - 45.05) = \{ (n \times 64) + A \} \times fOSC \div R$ [MHz]

In this case, n is 1202 and A is 62.

$\therefore fVCO = \{ (1202 \times 64) + 62 \} \times 12800 \div 2560$
$= \{ 76928 + 62 \} \times 5$
$= 384950kHz = 384.95MHz$

The following table lists the pin functions of the PLL VCO circuit :

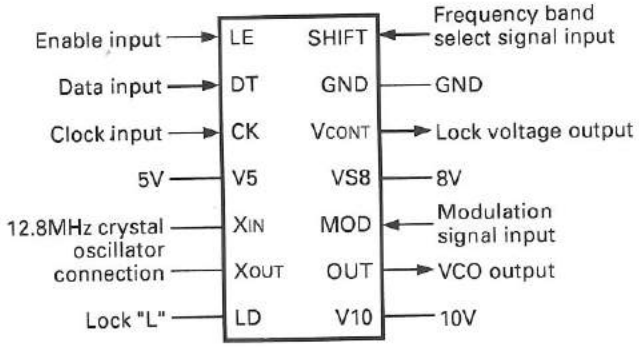


Fig. 9 Main PLL VCO pin description (IC201 : L78-0350-08)

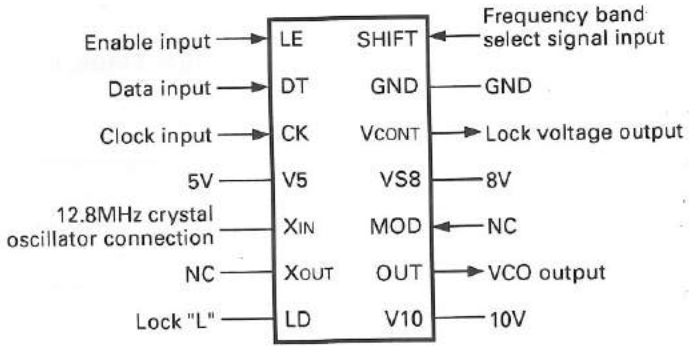


Fig. 10 Sub PLL VCO pin description (IC203 : L78-0353-08)

No.	Name	Function
1	LE	Enable input
2	DT	Data input
3	CK	Clock input
4	V5	5V
5, 6	XIN, XOUT	12.8MHz crystal oscillator connection
7	LD	Lock signal (Low : Lock)
8	V10	10V
9	OUT	VCO output
10	MOD	Modulation signal input
11	VS8	8V (Ripple filter)
12	VCONT	Lock voltage output
13	GND	Ground
14	SHIFT	Frequency band select signal input

Table 6 Main PLL VCO pin functions

No.	Name	Function
1	LE	Enable input
2	DT	Data input
3	CK	Clock input
4	V5	5V
5	XIN, XOUT	12.8MHz crystal oscillator connection
6, 10	XOUT, MOD	Not used
7	LD	Lock signal (Low : Lock)
8	V10	10V
9	OUT	VCO output
11	VS8	8V (Ripple filter)
12	VCONT	Lock voltage output
13	GND	Ground
14	SHIFT	Frequency band select signal input

Table 7 Sub PLL VCO pin functions

CIRCUIT DESCRIPTION

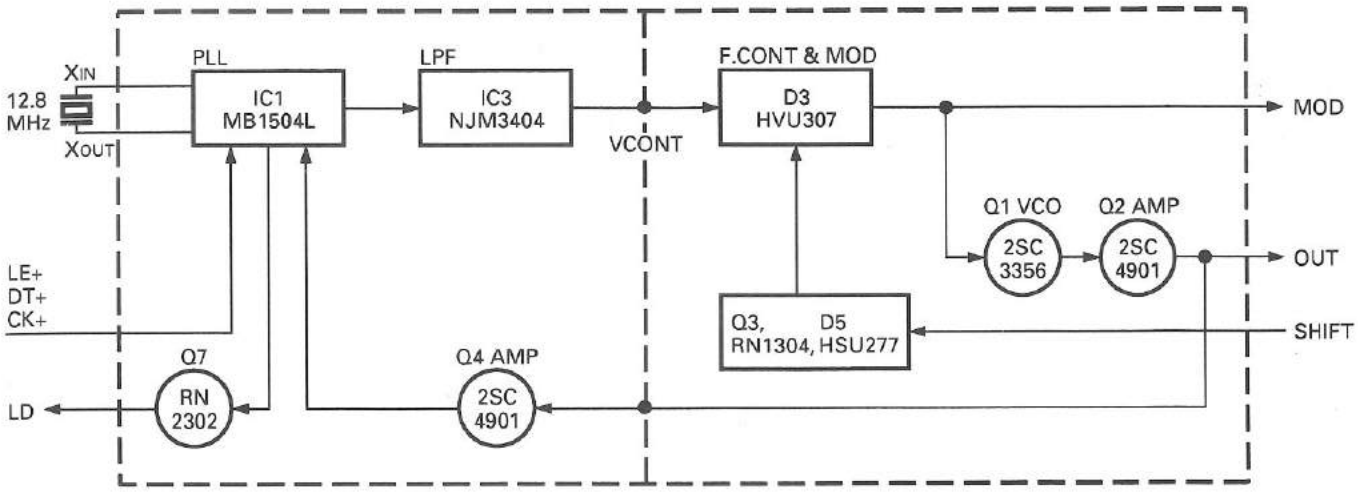


Fig. 11 Main PLL VCO block diagram (IC201 : L78-0350-08)

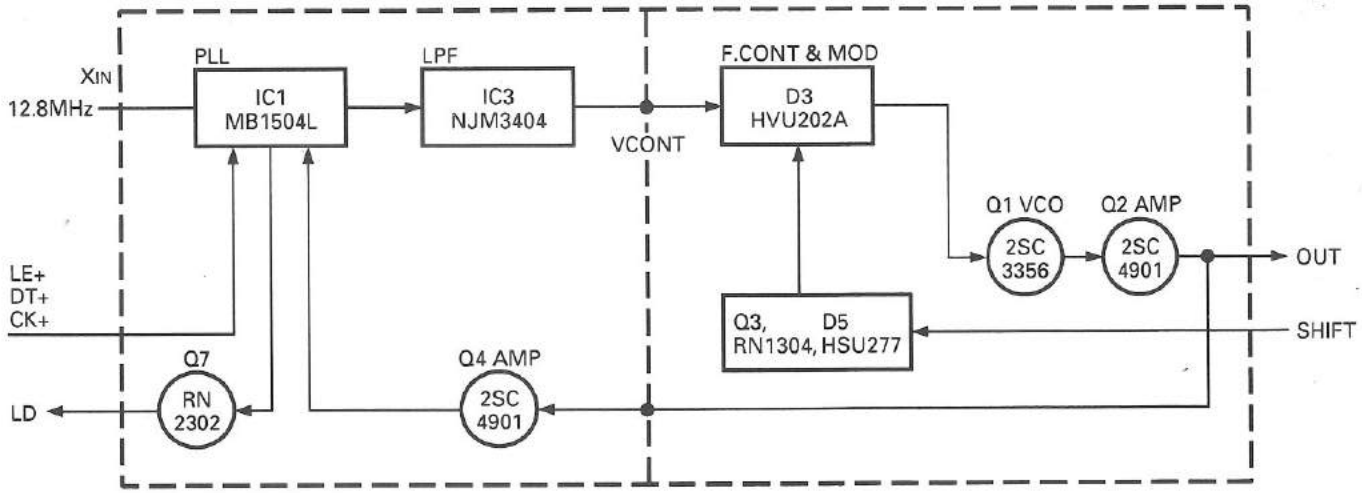


Fig. 12 Sub PLL VCO block diagram (IC203 : L78-0353-08)

CIRCUIT DESCRIPTION

- **VT (8 V during transmission) and unlock signal**

The base of Q106 (1/2) has 0V applied to it during reception (TX+ : Low level), and Q106 (1/2) and Q105 are turned off. No voltage is applied to the collector (VT) of Q105.

The base of Q106 (1/2) has 2.5 to 5V applied to it during transmission (TX+ : High level), Q106 (1/2) and Q105 are turned on, and 8V is applied to the collector (VT) of Q105. When the main or sub PLL VCO is unlocked, Q208 is turned on and Q106 (2/2) and Q104 are turned off, the 8V applied to the APC circuit is cut off, and the transmit signal is not output.

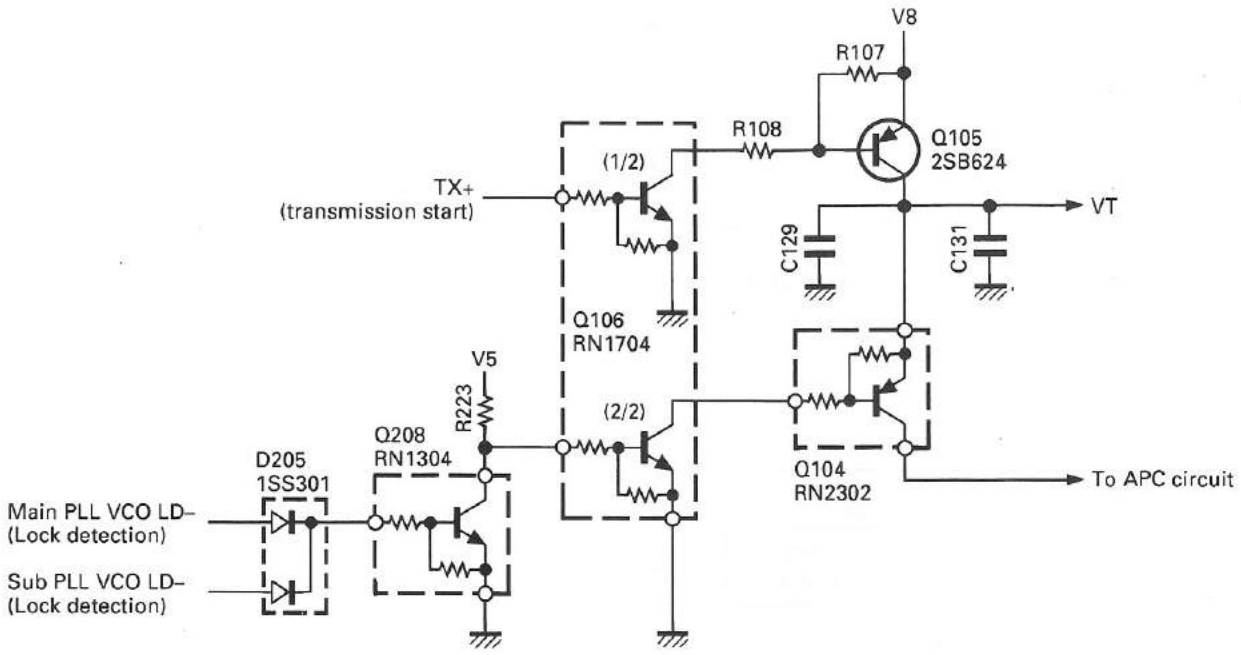


Fig. 13 Transmission start circuit

AF Signal System

- **Outline**

The audio signal (RXA) from the FM IF HIC (IC1) in input to the RX audio HIC (IC2). The signal passes through the mute circuit in IC2, is summed with the digital recording playback tone, passes through the VR in the control unit, and goes to IC2 again. The signal is then summed with a BUZZER signal (beep and DTMF tones), power-amplified by AF amplifier IC3, and output to the speaker.

When the remote controller is connected, the volume is controlled by the electronic VR in IC2 instead of the VR in the control unit.

- **RX audio circuit**

Figure 14 shows the circuit of the RX audio (IC2). The path of the audio signal through the VR in the control unit is indicated by the bold line. If the electronic VR is selected ($\overline{CS}$ low), the analog switch (IC2 3/4) is turned off, and the VR in the control unit is isolated. At the same time, IC2 (1/4) is turned off, IC2 (4/4) is turned on, and the volume is controlled by the electronic VR.

The electronic VR consists of 31 resistor elements. The signal can be output from both ends of each element. The element from which the signal is output is specified using CPU pin 45 (CS–), pin 43 (U/D–), and pin 42 (INC–) signals.

CIRCUIT DESCRIPTION

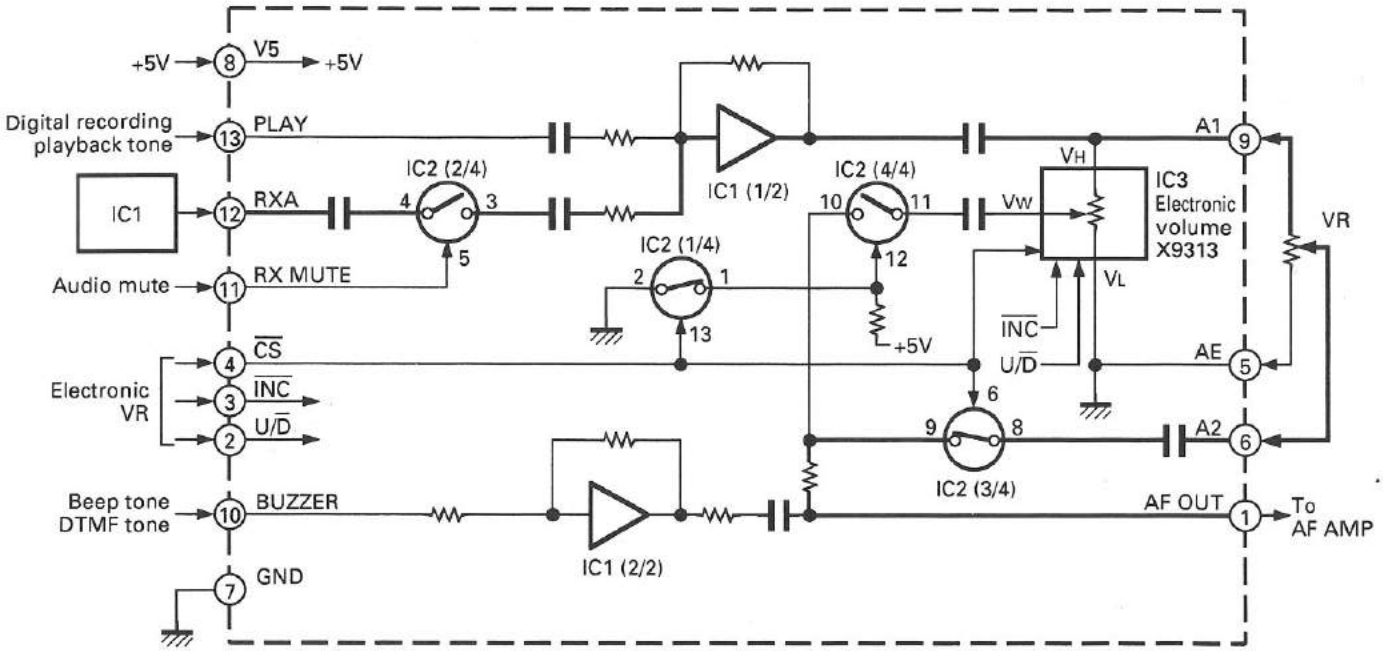


Fig. 14 RX audio circuit (IC2 : W02-1829-08)

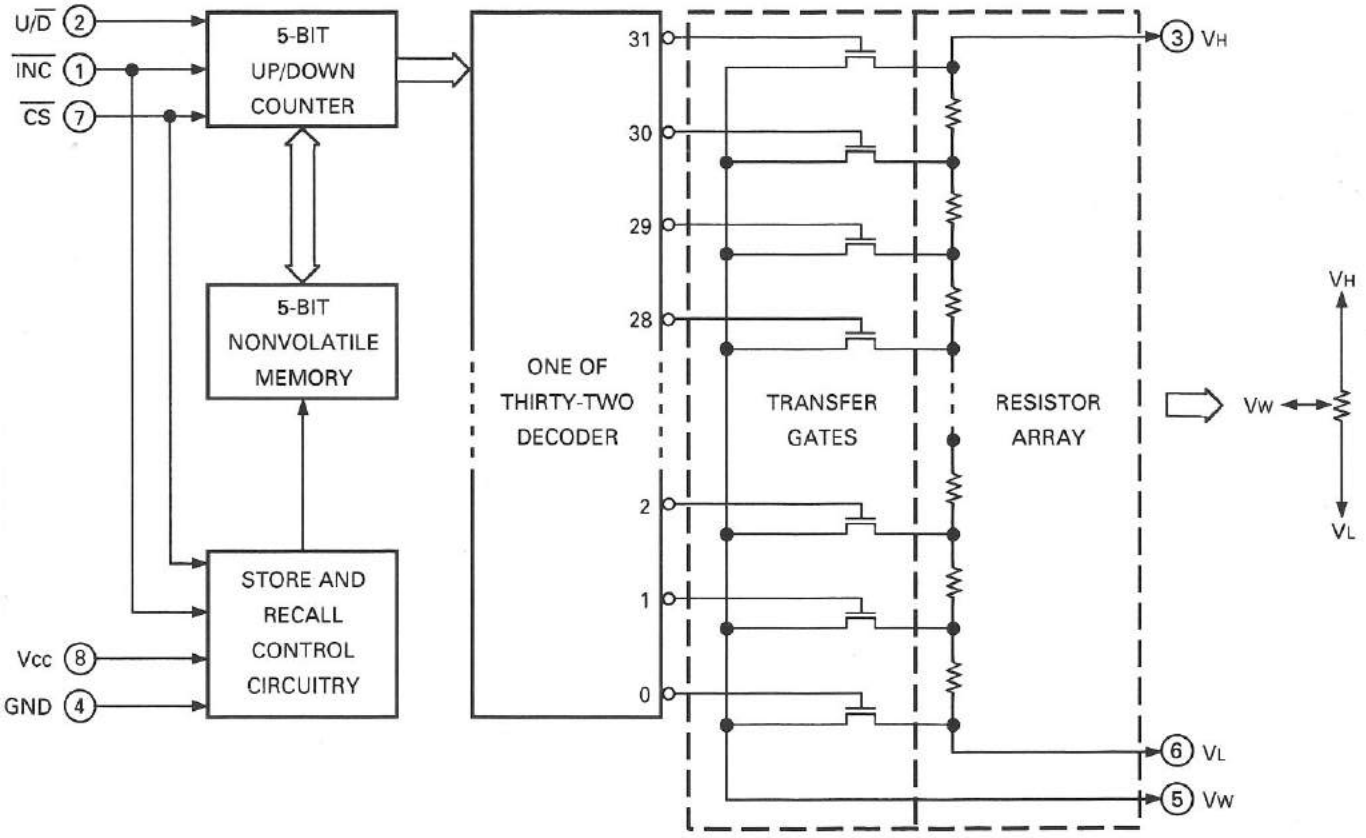


Fig. 15 Electronic VR (X9313) block diagram

CIRCUIT DESCRIPTION

- **Squelch circuit**

The squelch can be set with the squelch VR in the control unit. The CPU in the control unit converts the squelch VR level to 5-bit digital data and transfers it to the shift register circuit (IC4). (See the description of the shift register circuit.)

The shift register circuit converts the digital data to analog using the shift register and analog switch, generates the control voltage for IC1 (KCD04) at the SQLC pin, and inputs it to the IC1 SQ pin.

The BUSY signal output from the IC1 SC pin is sent to the CPU as the SC+ signal, and at the same time is output to the hysterisis circuit by Q1, logically reversed by Q6, and output as the SQC signal for packet transmission.

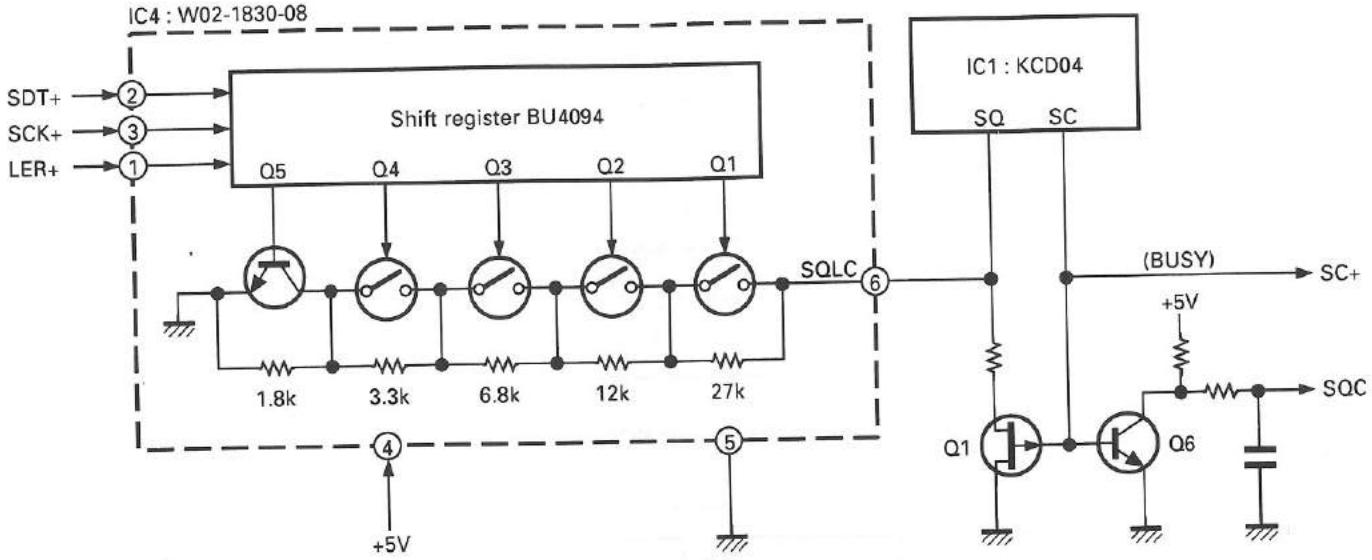


Fig. 16 Squelch circuit

Digital Control Section

- **Outline**

The digital control section controls each function with the microcomputer (CPU). It consists of the key rotary encoder input circuit, display circuit, reset and backup circuits, DTMF circuit, tone output circuit, digital recording circuit, microphone key input circuit, and SQL input circuit.

- **Key and rotary encoder input circuit**

The keys on the panel are arranged in a matrix, and signals are input to the CPU by key scanning. The rotary encoder is directly connected to the CPU.

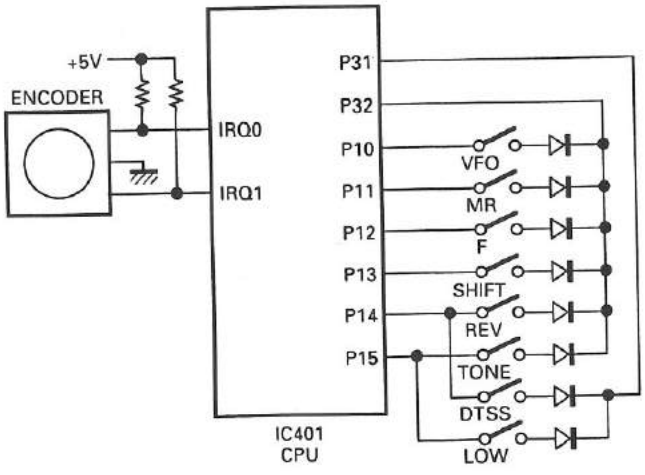


Fig. 17 Key and rotary encoder input circuits

CIRCUIT DESCRIPTION

- **Microphone key input circuit**

The microphone UP, DOWN, and function keys are connected to the analog input of the CPU. The appropriate function is activated according to the voltage generated when a key is pressed.

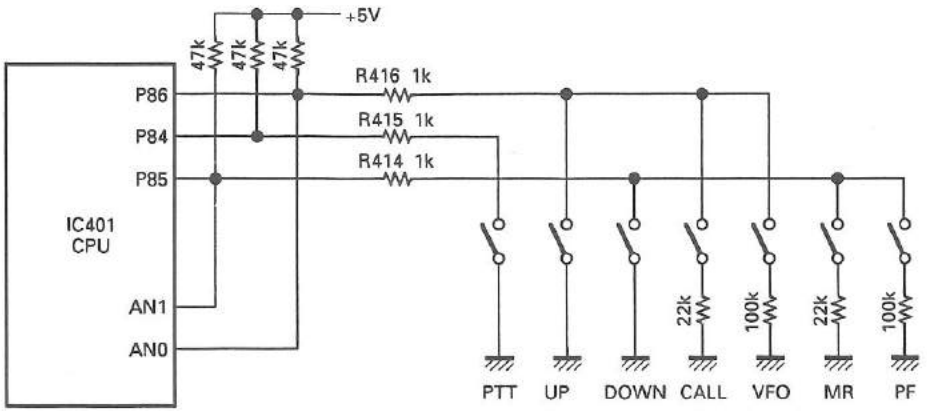


Fig. 18 Microphone key input circuit

- **Reset and backup circuits**

When the power is turned on, a roughly 20ms low-level pulse is output by the reset circuit according to the time constant, and input to the RESET pin of the CPU. This pulse power-on resets the CPU. When the power is turned off, the +13.8V line voltage drop is detected by the backup circuit, the NMI pin of the CPU goes high, and the CPU enters backup mode.

The signal is input to the NMI pin and the pin 97 input port at the same time because pin 97 is used to check whether the operating voltage for the backup circuit is correct after the power is turned on.

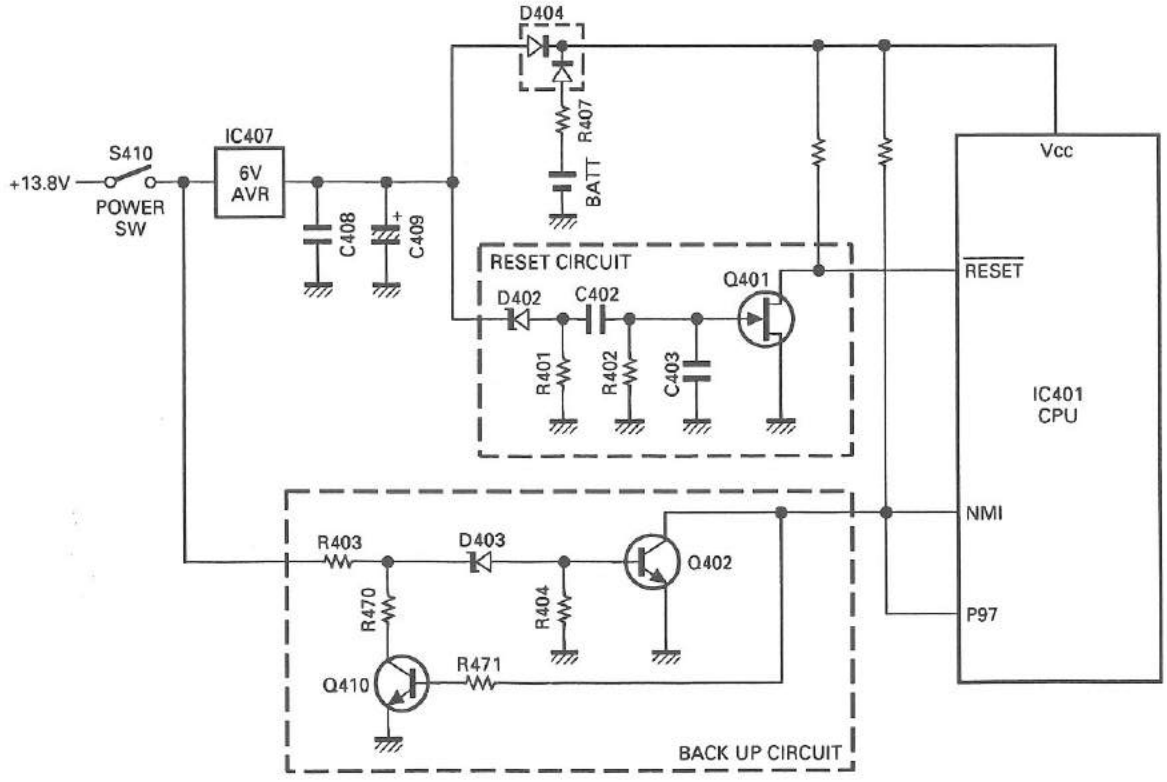


Fig. 19 Reset and backup circuits

CIRCUIT DESCRIPTION

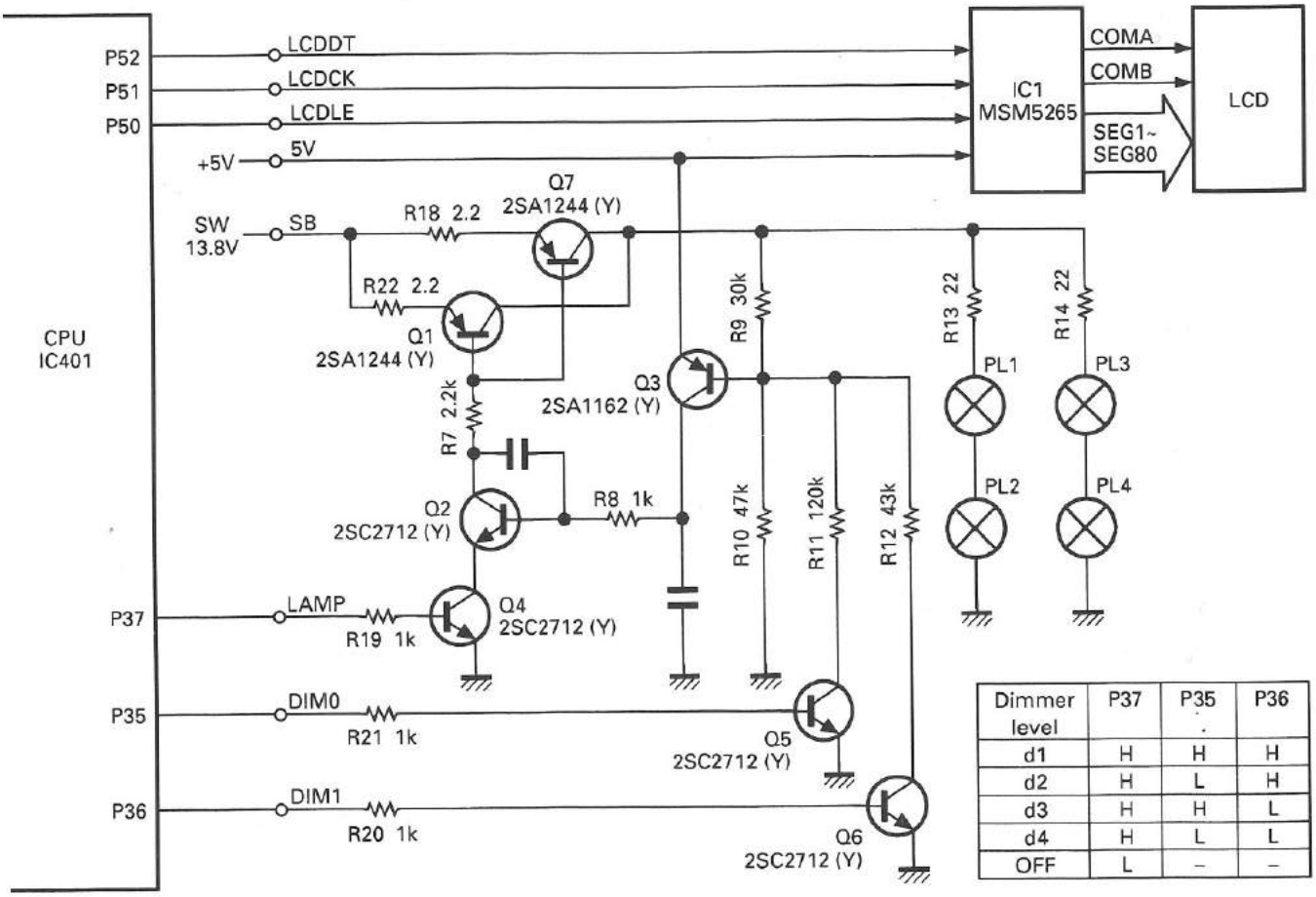
- **Display circuit**

The display circuit in the LCD assembly consists of an LCD driver, its peripheral circuits, a dimmer circuit, and an LCD. The LCD is dynamically lit with half duty. Serial data is transferred from pins 50, 51, and 52 of the CPU to the LCD driver.

- **Dimmer circuit**

The dimmer circuit changes the brightness of the lamp in four steps or turns it off. Q3 amplifies the error of the stabilized power supply using the 5V reference voltage. Pins 35 and 36 of the CPU are made high or low to turn Q5 and Q6 on or off. The output voltage can be controlled in four steps by combining these ports.

If pin 37 of the CPU is made low, Q4 is turned off, and the lamp voltage is not output, making the lamp go off.



Dimmer level	P37	P35	P36
d1	H	H	H
d2	H	L	H
d3	H	H	L
d4	H	L	L
OFF	L	–	–

Fig. 20 Display and dimmer circuits

CIRCUIT DESCRIPTION

- **PLL data output**

PLL data is output from CPU pin 47 (SDT+), pin 46 (SCK+), pin 22 (LEM+), and pin 23 (LES+). Pin 22 (LEM+) is a main band PLL enable signal, and pin 23 (LES+) is a sub-band PLL enable signal.

The data transfer format and data configuration are illustrated below.

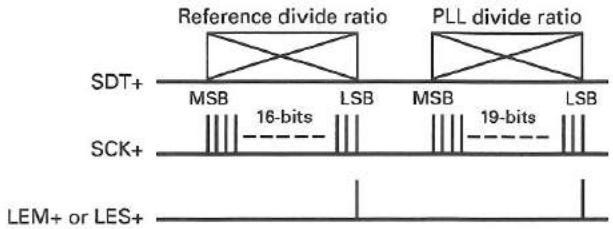


Fig. 21 Data transfer format

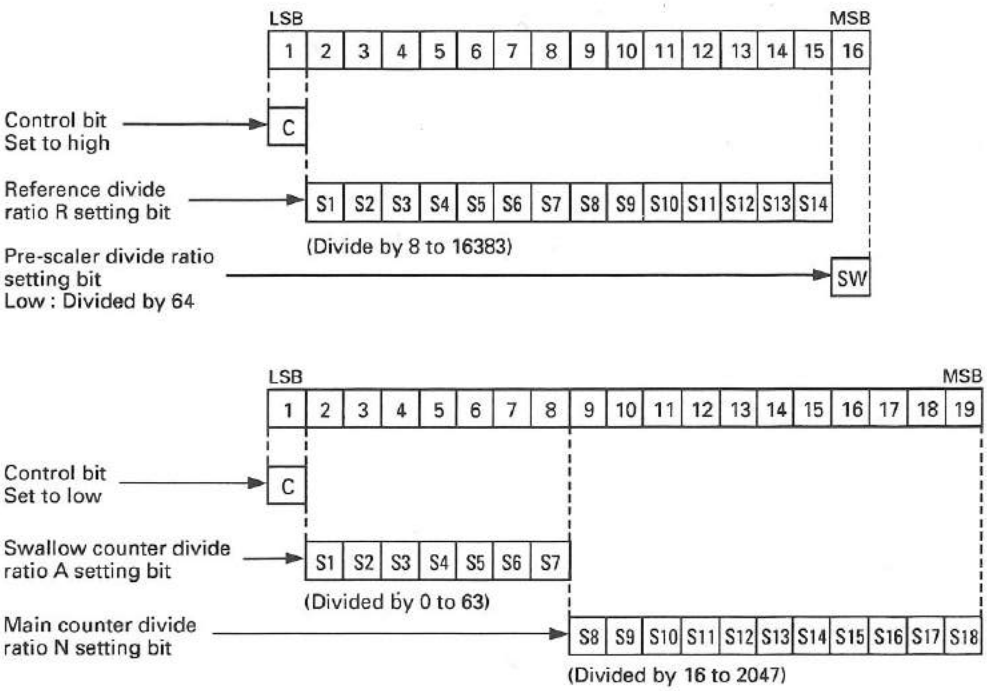


Fig. 22 Data configuration

- **Squelch VR input**

The CPU digitizes the voltage output by dividing the 5V applied to variable resistor VR401 through the analog port to read the rotation angle of the squelch VR.

- **Tone output circuit**

The staircase waveform corresponding to the set tone frequency is output from the D/A converter in the CPU, filtered and output via buffer amplifier Q405.

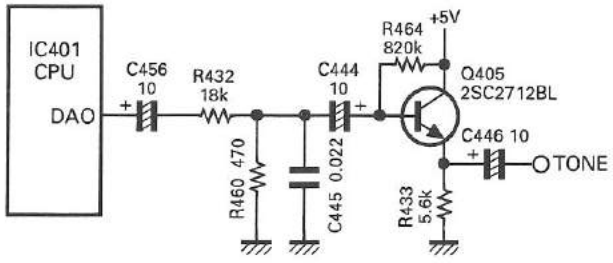


Fig. 23 Tone output circuit

CIRCUIT DESCRIPTION

- **DTMF input/output**

The DTMF encode IC404 (TC35219F) and DTMF decode IC405 (LC7385M) share CPU pins 80 to 83 to control input and output operations.

For the encoder, when data arrives at pins 80 to 83 and pin 16 (TE+) is high, the tone corresponding to each item of data is output from the IC404 TONE pin. The output DTMF tone passes through buffer amplifier Q406 and analog switch IC409, and is output as the DTMF modulation signal. The DTMF tone is output to the AF signal system as a beeper signal together with the beep tone output from CPU pin 44.

For the decoder, the detection signal RXD from TX-RX unit IC1 passes through analog switch IC406 and is input to IC405.

When a valid tone is detected, the STD pin goes high and CPU pin 33 is enabled. When the CPU makes pin 34 high, data is input to pins 80 to 83, and the CPU confirms that it matches the preset DTSS code. The input from the DTMF microphone can be read when the CPU switches the analog switch IC406.

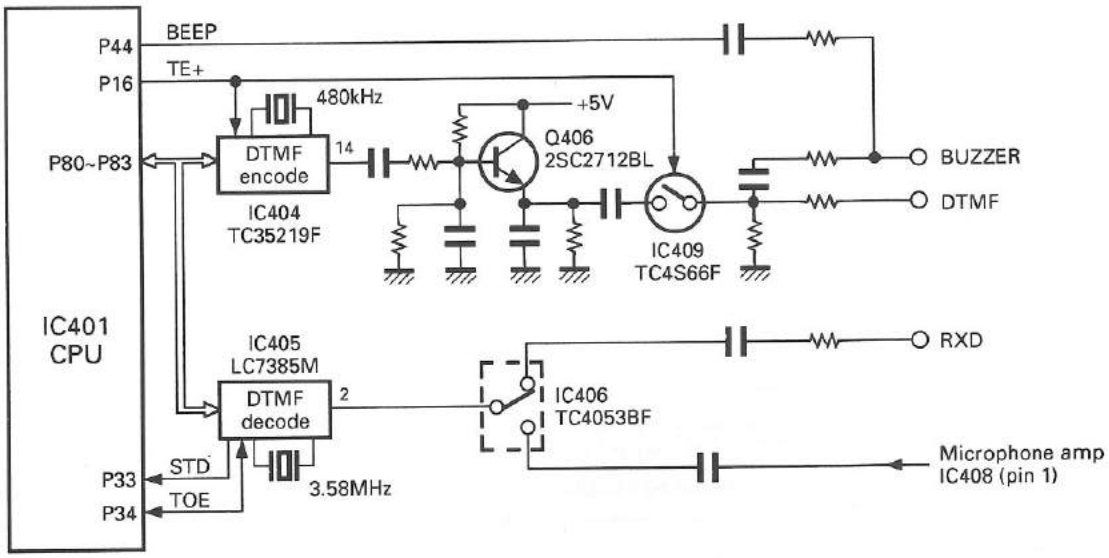


Fig. 24 DTMF input/output

CIRCUIT DESCRIPTION

- **Digital recording circuit**

The digital recording circuit consists of recording LSI IC402 (MSM6588) based on the ADPCM system and 256-Kbit serial register IC403 (MSM6586). IC402 is controlled by pins 80 to 83 (shared by DTMF encode/decode control), and pins 60 to 63.

Recording is performed by applying the receive audio RXA signal to the IC402 MIN pin with CPU control. The playback tone output from the IC402 Fout pin is amplified by IC408 (2/2), passes through analog switches IC410 and IC406, is output as the PLAY signal, and is output from the speaker.

The playback tone can be input to the microphone amplifier IC408 (1/2) and transmitted by controlling the IC406 analog switch with the CPU. (Same band repeater function) In addition, the playback tone is also output to the microphone RD pin.

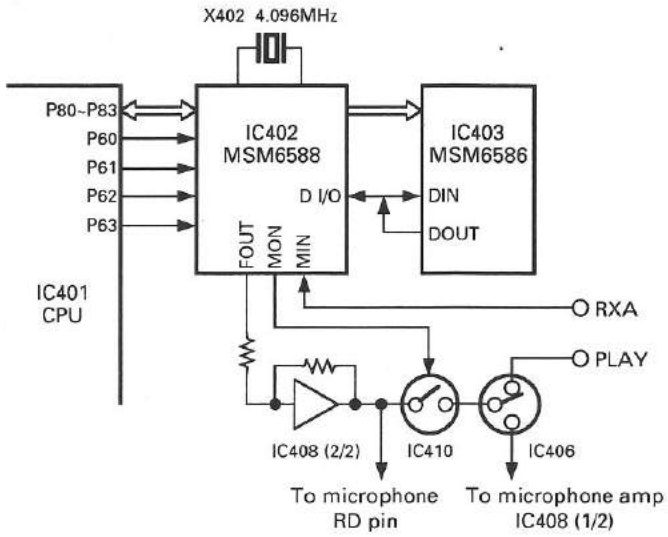


Fig. 25 Digital recording circuit

- **CTCSS input/output (option TSU-8)**

The CTCSS unit is controlled by using CPU pin 47 (SDT+), pin 46 (SCK+), pin 65 (CTE+), and pin 96 (SDO–). Figure 26 shows the data transfer format and Figure 27 shows the data configuration. When a tone from the CTCSS unit is detected, the SDO– pin goes low, and the signal is input to CPU pin 96 to open the squelch.

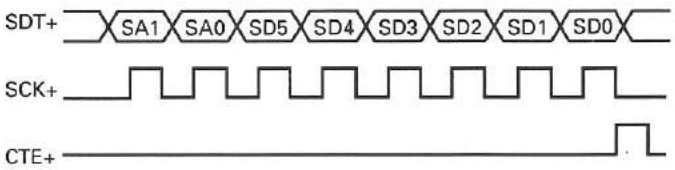


Fig. 26 Data transfer format

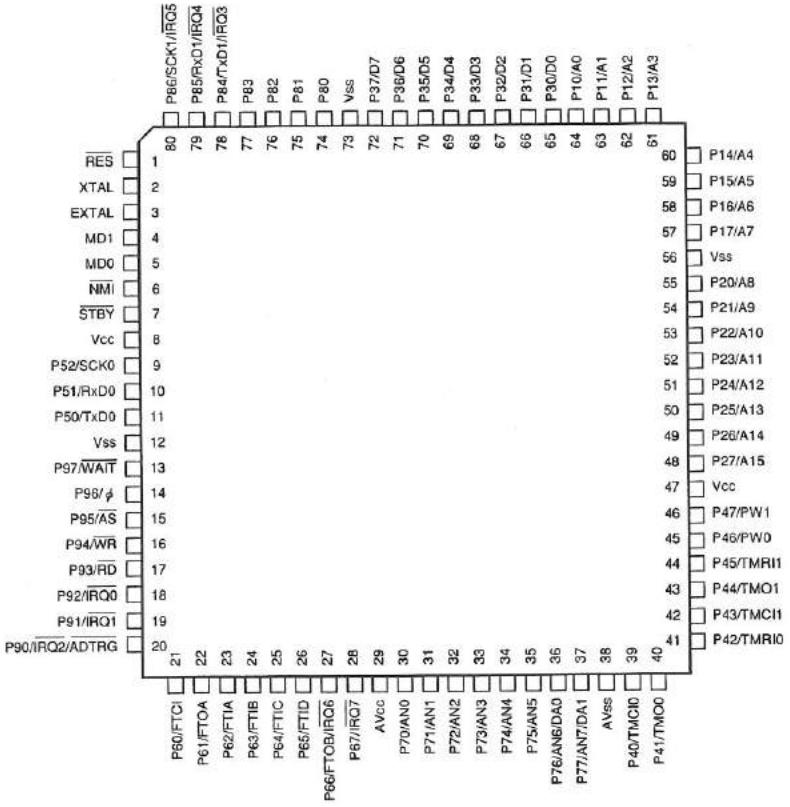
SA1	SA0	SD5	SD4	SD3	SD2	SD1	SD0	Tone frequency
H	H	L	L	L	H	L	H	88.5Hz

Fig. 27 CTCSS data configuration

SEMICONDUCTOR DATA

CPU : HD6433388F (Control Unit IC401)

- **Terminal connection diagram**



- **Terminal function** (○ : Pullup by soft, ● : Pullup by hard, ■ : Pulldown by hard)

No.	CPU name	Port name	I/O	Pullup	Backup	Function
1	$\overline{RES}$		I	●		Reset pin. Normally : High, Reset : Low
2	XTAL		–			Crystal input pin. 4.194304MHz
3	EXTAL		–			Crystal input
4, 5	MD1, MD0		I	●		Operation mode (mode 3) setting. Set to high
6	$\overline{NMI}$		I	●		Power supply check. Backup processing on rising edge and power recovery on falling edge.
7	$\overline{STBY}$		I	●		Set to high
8	Vcc		–			Power supply voltage
9	P52/SCK0	LCD DT+	O		I	LCD driver data output
10	P51/RXD0	LCD CK+	O		I	LCD driver clock output
11	P50/TXD0	LCD LE+	O		I	LCD driver enable output
12	Vss		–			GND
13	P97/$\overline{WAIT}$		I		I	Power supply check. 1 : Backup, 0 : Power supply voltage normal
14	P96/ø	SDO–	I	■	I	CTCSS tone detection. 1 : Mismatch, 0 : Match
15	P95/$\overline{AS}$	RM+	O		I	DTMF decoder input signal switching. 1 : Receive RXD, 0 : Microphone input
16	P94/$\overline{WR}$	REP+	O		I	Cross-band repeater demodulation signal output switching. 1 : Microphone amplifier
17	P93/$\overline{RD}$	RD MUTE+	O		I	Microphone connector RD signal output control. 1 : Mute, 0 : Mute cancel
18	P92/$\overline{IRQ0}$	ENC CK–	I	●	I	Encoder clock input
19	P91/$\overline{IRQ1}$	ENC DT–	I	●	I	Encoder data input
20	P90/$\overline{IRQ2}$/$\overline{ADTRG}$	T MUTE+	O		I	Not used
21	P60/FTCI	DRS WR–	O		I	DRS write output. 0 : Write
22	P61/FTOA	DRS RD–	O		I	DRS read output. 0 : Read
23	P62/FTIA	DRS CE–	O		I	DRS chip enable output. 0 : Chip enable

SEMICONDUCTOR DATA

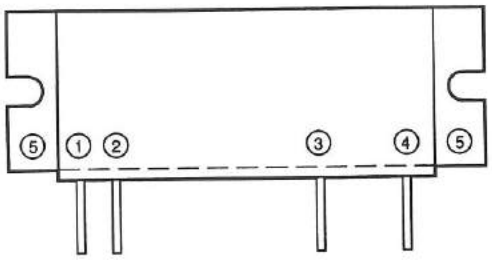
No.	CPU name	Port name	I/O	Pullup	Backup	Function
24	P63/FTIB	DRS RST–	O	■	I	DRS reset output. 0 : Reset
25	P64/FTIC	M MUTE–	O		I	Microphone mute output. 1 : Mute cancel, 0 : Mute
26	P65/FTID	CTE–	O	●	I	CTCSS load enable output
27	P66/FTOB/$\overline{IRQ6}$	PKTS–	I	●	I	Packet PTT input. 1 : Space, 0 : Mark
28	P67/$\overline{IRQ7}$	PSW+	O		I	SW 13.8V power switch. 1 : ON, 0 : OFF
29	AVcc		–			Analog power supply. Reference power supply for A/D and D/A conversion
30	P70/AN0	UP	I		I	Microphone switch input (UP, CALL, VFO)
31	P71/AN1	DWN	I		I	Microphone switch input (DOWN, MR, PF)
32	P72/AN2	SM	I		I	S-meter level input
33	P73/AN3	ALD	I		I	Not used
34	P74/AN4	SQL	I		I	Squelch volume position detection
35	P75/AN5	RD+	I		I	Controller connection detection. 1 : Connected, 0 : Not connected
36	P76/AN6/DA0	TONE	O		I	38-wave CTCSS tone output
37	P77/AN7/DA1	BPFC	O		I	BPF control voltage control output
38	AVss		–			Analog ground. Ground for A/D and D/A conversion
39	P40/TMCIO	RX MUTE–	O		I	Demodulation audio mute. 1 : Mute cancel, 0 : Mute
40	P41/TMO0	1750	O		I	1750Hz tone output (for destination E only)
41	P42/TMRI0	INC–	O		I	Electronic volume incremental output
42	P43/TMCI1	U/D–	O		I	Electronic volume UP/DOWN selection. 1 : UP, 0 : DOWN
43	P44/TMO1	BEEP	O		I	Beep, effect sound output
44	P45/TMRI1	CS–	O		I	Electronic volume chip select output. 1 : Non-select, 0 : Select
45	P46/PW0	SCK+	O		I	Common serial clock output
46	P47/PW1	SDT+	O		I	Common serial data output
47	Vcc		–			Power supply voltage
48	P27/A15	TX+	O		I	Transmit/Receive select output. 1 : Transmit, 0 : Receive
49	P26/A14	LER+	O		I	Shift register load enable
50	P25/A13	SC+	I	●	I	SC signal input. 1 : No signal, 0 : Signal
51	P24/A12	MUTE+	O		I	Speaker output mute output. 1 : Speaker mute, 0 : Mute cancel
52	P23/A11	LES+	O		I	Sub-PLL load enable output
53	P22/A10	LEM+	O		I	Main PLL load enable output
54	P21/A9	MDT+	I/O	○	I	EEPROM data input/output (ME-1)
55	P20/A8	MCK+	O		I	EEPROM clock output (ME-1)
56	Vss		–			GND
57	P17/A7	STE–	O		I	DTMF encoder tone selection. 1 : Dual tone, 0 : Single tone
58	P16/A6	TE+	O	■	I	DTMF encoder tone enable. 1 : ON, 0 : OFF
59	P15/A5	KIN5–	I	○	I	Key input. TONE, LOW
60	P14/A4	KIN4–	I	○	I	Key input. REV, DTSS
61	P13/A3	KIN3–	I	○	I	Key input. SHIFT, model recognition
62	P12/A2	KIN2–	I	○	I	Key input. F, model recognition
63	P11/A1	KIN1–	I	○	I	Key input. MR
64	P10/A0	KIN0–	I	○	I	Key input. VFO
65	P30/D0	KOUT0–	O		I	Key output
66, 67	P31/D1, P32/D2	KOUT1–, 2–	O		I	Key output
68	P33/D3	DET+	I		I	DTMF decoder detection input. 1 : Signal detection, 0 : No signal
69	P34/D4	OE+	O		I	DTMF decoder output enable output. 1 : Enable, 0 : High impedance
70	P35/D5	DIM0+	O		I	LCD dimmer switching
71	P36/D6	DIM1+	O		I	
72	P37/D7	LAMP+	O		I	LCD lamp switching. 1 : ON, 0 : OFF
73	Vss		–			GND
74~77	P80~P83	D0+~D3+	I/O		I	DRS/DTMF data line D0~D3
78	P84/TXD1/$\overline{IRQ3}$	PTT–	I/O	●	I	PTT input, K bus SO output. 1 : Space, 0 : Mark
79	P85/RXD1/$\overline{IRQ4}$	DWN	I	●	I	K bus SI input
80	P86/SCK1/$\overline{IRQ5}$	UP	I/O	●	I	K bus clock output

	D1	D2	D3	D4
DIM0	1	0	1	0
DIM1	1	1	0	0

SEMICONDUCTOR DATA

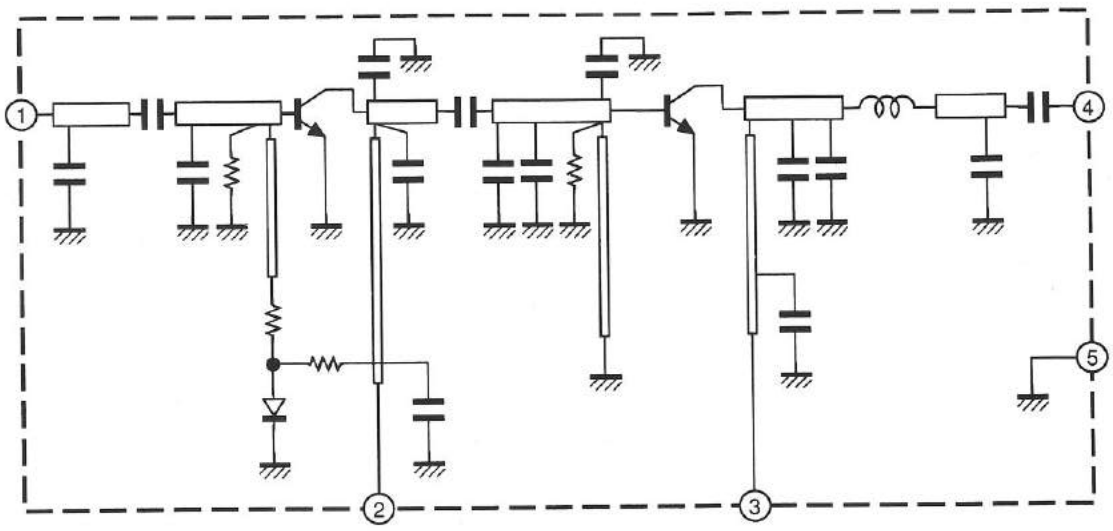
Power Module : S-AV24-01K (TX-RX Unit 101)

- **Terminal connection diagram**



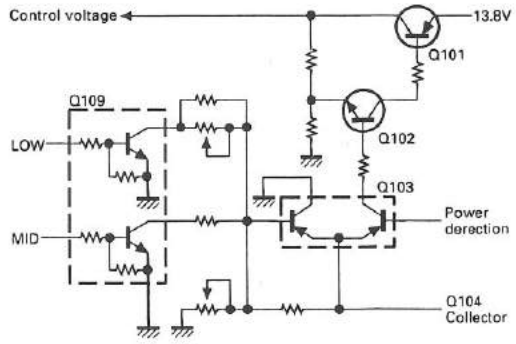
1 : High-frequency input
2 : V1 VCON pin
3 : V2 Vcc pin
4 : High frequency output
5 : GND (Flange)

- **Equivalent circuit**



DESCRIPTION OF COMPONENTS

TX-RX UNIT (W02-1810-08)

Ref No.	Use and function	Operation/Condition/Compatibility
IC1	2nd local oscillator, IF amplifier, FM detection, Low-frequency amplifier, Noise amplifier, Noise detection, Squelch switching	3, 4 : 2nd local oscillator 45.505MHz 7 : 2nd IF input 455kHz 9 : Scan control BUSY signal (Busy : 0V) 10 : Noise detection voltage output (DC) 11 : S-meter output 12 : FM detection output 14 : RD output 15 : RA output
IC2	AF mute, Adder, Electronic VR	See circuit description.
IC3	AF amplifier	1 : AF input 4 : AF output
IC4	Shift register, Analog switch (squelch)	See circuit description.
IC5	Shift register	See circuit description.
IC6	AM demodulation	
IC101	Final power amplifier	
IC102	Transmit driver amplifier	
IC103	8V AVR	
IC104	5V AVR	
IC201	144MHz-band PLL VCO	See circuit description.
IC202	Pre-emphasis, Limiter amplifier, Splatter filter, Packet modulation data switching, Packet demodulation buffer amplifier	See circuit description.
IC203	430MHz-band PLL VCO	See circuit description.
IC204	430MHz-band PLL VCO output amplifier	
IC205	Analog switch (modulation input on/off)	
IC208	10 AVR	
IC302	360MHz-band RF amplifier	
IC303	RF band-pass filter control, DC amplifier, RD buffer amplifier	
Q1	Squelch hysteresis	Squelch on : ON
Q3	AM AF amplifier	
Q4	AM circuit 5V switch	
Q5	Q4 control	
Q6	Inverter	SC logic inversion
Q7	Second mixer	
Q8	Speaker output mute switch	
Q101	DC amplifier	
Q102	DC amplifier	
Q103	Differential amplifier (APC circuit)	
Q109	Mid/low power change switch	
Q104~106	Switching	See circuit description.
Q107, 108	Switching	13.8V on/off
Q201	144MHz-band PLL VCO output amplifier	
Q202	PLL VCO 8V ripple filter	
Q204, 205	430MHz-band PLL VCO power switch	Q204 : 5V, Q205 : 8V
Q206	Q204 and Q205 control	
Q207	12.8MHz buffer	
Q208	Inverter (PLL lock signal)	OFF : Lock

DESCRIPTION OF COMPONENTS

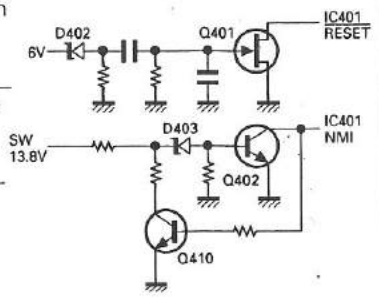
Ref No.	Use and function	Operation/Condition/Compatibility
Q209	Packet modulation, Excessive input detection	
Q210	Inverter (Packet PTT)	
Q301, 302	High-frequency amplifier (144MHz-band reception)	
Q304, 305	High-frequency amplifier (430MHz-band reception)	
Q306	First mixer	
Q307	First IF amplifier	
Q308	430 and 360MHz-band receiver circuit power switch	
Q309	Q308 control	
Q310	144MHz-band receive circuit power switch	
Q311	Q310 control	
Q312	Q307 gain control	When AM circuit operates
Q313	High-frequency amplifier (360MHz-band reception)	
D101~104	Antenna switch	
D105, 106	Power detection	
D107	Power reverse-connection prevention	
D108	VCO output switch	
D201	VCO output switch (transmission/reception switching)	
D203	First local change-over switch	
D204	Circuit protection	
D205	Unlock signal OR (logical sum)	
D206	Packet modulation input signal detection	
D301~304	Vari-cap tuning	144MHz-band band-pass filter
D305	OR (logical sum)	
D307, 308	RF amplifier protection	
D309	RF switch	430MHz/360MHz
D310~313	Vari-cap tuning	430MHz-band band-pass filter
D314, 315	RF switch	144MHz/430MHz/360MHz
D316	OR (logic sum)	

CONTROL UNIT (W02-1811-08)

Ref No.	Use and function	Operation/Condition/Compatibility
IC401	Microprocessor	See circuit description.
IC402	Digital recording control	See circuit description.
IC403	256-kbit serial register	See circuit description.
IC404	DTMF encoder	See circuit description.
IC405	DTMF decoder	See circuit description.
IC406	Analog switch (multiplexer)	1 : Audio playback modulation output 2 : Audio playback speaker output 3 : Receive audio output (repeater) 4 : Receive audio input 12 : DTMF microphone input 13 : DTMF receive input 14 : Output to DTMF decoder 15 : Audio playback tone input
IC407	6V AVR	
IC408	Low-frequency amplifier, Adder	1 : Output 4 : GND 8 : 5V 2 : Microphone input, 1200-bps AFSK data input, 1750Hz tone input, Receive audio input (repeater) 6 : Audio playback tone input 7 : Audio playback tone output
IC409	Analog switch	DTMF signal on/off
IC410	Analog switch	Audio playback tone on/off

DESCRIPTION OF COMPONENTS

Ref No.	Use and function	Operation/Condition/Compatibility
Q401	Reset switch	ON for about 20ms when the power is turned on. Normally OFF.
Q402	Backup switch	OFF when the 13.8V line is below 8.3 V. Normally ON.
Q410	Hysteresis switch	ON when Q402 is OFF. Normally OFF.
Q403	Microphone muting	ON : During reception, OFF : Microphone remote, ON : Repeater
Q404	RD muting	ON : Digital recording playback Interlocked with SQL when the RD mute function is on.
Q405	Buffer amplifier	For tone
Q406	Buffer amplifier	For DTMF
Q409	Switch	DTMF decoder IC405 power save
D401	Reverse-flow prevention	
D402	Reset detection voltage	
D403	Backup detection voltage	
D404	Reverse-flow prevention	Lithium battery ON when the power is off.
D405	Microprocessor protection	
D407~410	Reverse-flow prevention	
D411, 412	Channel display mode setting	D411 is not installed.
D413~418	Destination setting	
D419, 420	Reverse-flow prevention	



MAIN PLL VCO (IC201 : L78-0350-08)

Ref No.	Use and function	Operation/Condition/Compatibility
IC1	PLL controller	7 : Unlock : Pulse output, 8 : VCO input During reception; 163.05 to 219.045MHz (**K,P,M2,M3,E2**) 189.05 to 193.045MHz (**M**) 189.05 to 191.045MHz (**E,E3,E9**) During transmission; 144 to 147.995MHz (**K,P,M**) 144 to 145.995MHz (**E,E3,E9**) 136 to 173.995MHz (**M2,M3,E2**)
IC2	Analog switch	Normally OFF.
IC3	LPF	Loop filter
Q1	VCO	
Q2	VCO output buffer	
Q3	VCO frequency band switching	
Q4	VCO output buffer	
Q7	Lock detector	
D3	VCO voltage control and transmit modulation	
D5	High-frequency switch	

DESCRIPTION OF COMPONENTS

SUB PLL VCO (IC203 : L78-0353-08)

Ref No.	Use and function	Operation/Condition/Compatibility
IC1	PLL controller	7 : Unlock : Pulse output 8 : VCO input During reception; 345.05 to 445.045MHz (**K,P,M2,M3,E2**) 354.95 to 424.945MHz (**K,P,M2,M3,E2**) 384.95 to 394.945MHz (**M,E,E3,E9**)
IC3	LPF	
Q1	VCO	
Q2	VCO output buffer	
Q3	VCO frequency band switching	
Q4	VCO output buffer	
Q7	Lock detector	
D3	VCO voltage control	
D5	High-frequency switch	

144MHz RF AMP (IC102 : W02-1827-08)

Ref No.	Use and function	Operation/Condition/Compatibility
Q1, 2	High-frequency amplifier	

TX AUDIO (IC202 : W02-1828-08)

Ref No.	Use and function	Operation/Condition/Compatibility
IC1	Analog switch	See circuit description.
IC2 (1/2)	Limit amplifier	Preemphasis, limiter
IC2 (2/2)	LPF	Splatter filter
IC3 (1/2)	Receive data output buffer	
IC3 (2/2)	Adder	

RX AUDIO (IC2 : W02-1829-08)

Ref No.	Use and function	Operation/Condition/Compatibility
IC1 (1/2)	Adder amplifier	
IC1 (2/2)	Output buffer	
IC2	Analog switch	See circuit description.
IC3	Audio electronic VR	1 : INC input (Operate on rising edge.) 2 : Up/down control input 3 : Audio input 4 : GND 5 : Audio output 6 : GND 7 : Chip select input 8 : +5V

PROG SQL (IC4 : W02-1830-08)

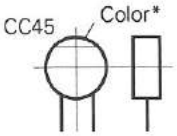
Ref No.	Use and function	Operation/Condition/Compatibility
IC1	Shift register	1 : Enable input 2 : Serial data input 3 : Clock input 4 : SQL0 output 5 : SQL1 output 6 : SQL2 output 7 : SQL3 output 8 : GND 11 : Sub-band reception ON 12 : 360MHz-band reception ON 14 : SQL4 output 15 : Output enable input (normally high) 16 : +5V
IC2	Analog switch	See circuit description.
Q1	Inverter	

PARTS LIST

CAPACITORS

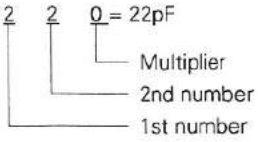
CC 45 TH 1H 220 J
1 2 3 4 5 6

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



• Capacitor value

010 = 1pF
100 = 10pF
101 = 100pF
102 = 1000pF = 0.001μF
103 = 0.01μF



• Temperature coefficient

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

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

Example : CC45TH = –470 ± 60ppm/°C

• Tolerance

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

Less than 10pF

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

• Voltage rating

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

• Chip capacitors (Refer to the table above except dimension)

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

(EX) CK 73 F F 1H 000 Z
1 2 3 4 5 6 7
(Chip) (B, F)

RESISTORS

• Chip resistor (Carbon)

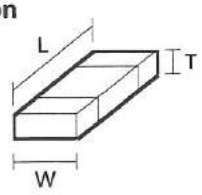
(EX) RD 73 E B 2B 000 J
1 2 3 4 5 6 7
(Chip) (B,F)

• Carbon resistor (Normal type)

(EX) RD 14 B B 2C 000 J
1 2 3 4 5 6 7

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

Dimension



• Dimension (Chip capacitor)

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 (Chip resistor)

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

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

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TM-251A/E

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
			TM-251A/E			
1	1C	*	A01-2090-08	METALLIC CABINET(TOP)		
2	2B	*	A01-2091-08	METALLIC CABINET(BOTTOM)		
3	1C	*	A10-1343-08	CHASSIS		
4	2B	*	A22-0788-08	SUB PANEL		
5	2A	*	A62-0315-08	PANEL	KPMM2	
5	2A	*	A62-0315-08	PANEL	M3	
5	2A	*	A62-0316-08	PANEL	EE2E3	
5	2A	*	A62-0316-08	PANEL	E9	
7	2A	*	B10-1217-08	FRONT GLASS		
8	2B	*	B38-0721-08	LCD ASSY		
9	1B,1C	*	B42-5539-08	LABEL (M4X8MAX)		
10	1C	*	B42-5540-08	S/NOLABEL (NAME PLATE)		
11	1B	*	B42-5551-08	SPECIHICATION PLATE	K	
12	1D		B46-0310-03	WARRANTY CARD	EE2E3	
12	1D		B46-0310-03	WARRANTY CARD	E9	
12	1D		B46-0410-30	WARRANTY CARD	K	
12	1D		B46-0422-00	WARRANTY CARD	P	
13	1D	*	B62-0455-08	INSTRUCTION MANUAL	K	
13	1D	*	B62-0456-08	INSTRUCTION MANUAL	PMM2M3	
13	1D	*	B62-0456-08	INSTRUCTION MANUAL	E3E9	
13	1D	*	B62-0457-08	INSTRUCTION MANUAL	EE2	
13	1D	*	B62-0458-08	INSTRUCTION MANUAL	PMM2M3	
13	1D	*	B62-0458-08	INSTRUCTION MANUAL	E3E9	
14	2C	*	B72-0651-04	MODEL NAME PLATE	E9	
15	1C	*	B72-0676-08	MODEL NAME PLATE	KP	
15	1C	*	B72-0677-08	MODEL NAME PLATE	MM2M3	
15	1C	*	B72-0678-08	MODEL NAME PLATE	EE2E3	
15	1C	*	B72-0678-08	MODEL NAME PLATE	E9	
16	3E	*	B82-0009-08	POS LABEL	KP	
16	3E	*	B82-0011-08	POS LABEL	MM2M3E	
16	3E	*	B82-0011-08	POS LABEL	E2E3E9	
18	1C		E30-1237-15	DC CABLE		
19	2D		E30-2111-05	DC CABLE ASSY		
20	1C	*	E30-3209-08	ANT CABLE		
21	2B	*	E58-0427-08	MIC MODULER CONNECTOR		
22	2A	*	F15-0687-08	SHIELD PLATE		
23	1C,2E		F51-0017-05	FUSE (15A) DC CABLE,SPARE		
25	1B	*	G02-0757-08	FLAT SPRING		
26	2C	*	G02-0761-08	GND SPRING		
27	2A	*	G09-0427-08	SPRING (KNOB)		
28	1B	*	G10-0748-08	NON-WOVEN FABRIC(SP)		
29	1B,2B	*	G10-0757-08	NON-WOVEN FABRIC(CASE)		
30	1B	*	G10-0758-08	NON-VOVEN FABRIC		
31	1B,2C	*	G13-1441-08	CUSHION		
32	1B	*	G13-1443-08	CUSHION (CABINETTOP)		
33	2A	*	G13-1447-08	CUSHION (4KEY)		
34	2B	*	G13-1448-08	CUSHION (LOWKEY)		
35	2A	*	G13-1449-08	CUSHION		
36	2B	*	G13-1456-08	CUSHIN		
37	1B	*	G13-1457-08	CUSHIN		
39	2E	*	H12-1464-08	PACKIN FIXTURE		

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TM-251A/E
TX-RX UNIT (W02-1810-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
40	2A	*	H12-0747-08	PROTECTION FILM		
41	1E	*	H13-0930-08	PROTECTION BOARD		
42	2D	*	H13-0931-08	PROTECTION BOARD		
43	1E	*	H25-0792-08	PROTECTION BAG(RADIO)		
44	2D	*	H25-0793-08	PROTECTION BAG(DC CABLE)		
45	3E	*	H52-0580-08	ITEM CARTON BOX	KPMM2	
45	3E	*	H52-0580-08	ITEM CARTON BOX	M3	
45	3E	*	H52-0581-08	ITEM CARTON BOX	EE2E3	
45	3E	*	H52-0581-08	ITEM CARTON BOX	E9	
47	1C	*	J19-1555-08	HOLDER		
48	2B	*	J19-1563-08	HOLDER		
49	2D	*	J29-0614-08	BRACKET		
50	2D	*	J29-0617-08	HOOK(MICROPHONE)	KP	
51	1B	*	J90-0409-08	VFO GUIDE		
53	2A	*	K27-3148-08	KNOB (REV)		
54	2A	*	K27-3149-08	KNOB (TONE/CTCSS)		
55	2A	*	K27-3150-08	KNOB (DTSS)		
56	2B	*	K27-3151-08	KNOB (POWEW)		
57	2B	*	K27-3152-08	KNOB (LOW/LOCK)		
58	2A	*	K27-3153-08	KNOB (VFO)		
59	2A	*	K27-3154-08	KNOB (MR)		
60	2A	*	K27-3155-08	KNOB (MAIN)		
61	2A	*	K27-3156-08	KNOB (VOL SQL)		
62	2B	*	K27-3158-08	KNOB (FUNC)		
63	2A	*	K27-3159-08	KNOB (SHIFT)		
A	2B,2C	*	N09-2234-08	SCREW		
B	1B,2B		N33-2606-46	OVALHEADMACHINESCREW(CASE)		
C	1C,2B		N52-2606-46	TAPTITE SCREW(ANT DCCABLE)		
D	2B,2C		N53-2606-46	FLAT HEAD TAPTITESCREW		
65	2D	*	N99-0384-08	SCREW SET		
67	1B	*	T07-0246-08	LOUD SPEAKER		
68	2E		T91-0516-05	MICROPHONE	MM2EE2	
68	2E		T91-0516-05	MICROPHONE	E3E9	
68	2E		T91-0517-05	MICROPHONE	KPM3	
70	2D	*	W01-0426-08	WRENCH		
71	2C	*	W02-1810-08	TX-RX UNIT		
72	1B	*	W02-1811-08	CONTROL UNIT	KPMM2	
72	1B	*	W02-1811-08	CONTROL UNIT	EE3E9	
72	1B	*	W02-1811-08	CONTROL UNIT	E2E3	
TX-RX UNIT (W02-1810-08)						
C1			CC73GCG1H150J	CHIP C 15PF J		
C2			CC73GCG1H390J	CHIP C 39PF J		
C3			CK73GB1H103K	CHIP C 0.010UF K		
C4			C92-0610-05	ELECTRO 47UF 16V		
C5			CK73GB1H103K	CHIP C 0.010UF K		
C6		*	C93-0585-08	CERAMIC 1UF 16V		
C7			C92-0502-05	ELECTRO 0.33UF 35V		
C8			CK73GF1E104Z	CHIP C 0.1UF Z		
C10			C92-0516-05	CHIP TAN 4.7UF 10V		
C11			CK73GF1E104Z	CHIP C 0.1UF Z		
C12		*	C93-0585-08	CERAMIC 1UF 16V		
C13			C92-0610-05	ELECTRO 47UF 16V		
C14 ,15			CK73FB1E473Z	CHIP C 0.047UF Z		
C16 ,17		*	C92-0615-08	ELECTRO 220UF 10V		

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TX-RX UNIT (W02-1810-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格			Destination 仕向	Remarks 備考
C18 -20			CK73GF1E104Z	CHIP C	0.1UF	Z		
C21			C92-0609-05	ELECTRO	10UF	16V		
C22			C92-0004-05	ELECTRO	1.0UF	16V		
C23			CK73GF1E333Z	CHIP C	0.033UF	Z		
C24			CK73GF1E223Z	CHIP C	0.022UF	Z		
C25			CK73GB1H103K	CHIP C	0.010UF	K		
C26			CK73GF1E104Z	CHIP C	0.1UF	Z		
C27			CC73GCG1H101J	CHIP C	100PF	J		
C28			CK73GB1H103K	CHIP C	0.010UF	K		
C29			CC73GCG1H101J	CHIP C	100PF	J		
C30			CK73GB1H103K	CHIP C	0.010UF	K		
C31			CC73GCH1H030C	CHIP C	3PF	C		
C32			CK73GB1H103K	CHIP C	0.010UF	K		
C33			CC73GCG1H101J	CHIP C	100PF	J		
C34			C93-0516-05	CHIP TAN	4.7UF	10V		
C36			C92-0516-05	CHIP TAN	4.7UF	10V		
C101		*	C93-0587-08	CERAMIC	15PF	500V		
C102		*	C91-0577-08	CERAMIC	4PF	500V		
C103		*	C93-0583-08	CERAMIC	18PF	500V		
C104		*	C93-0580-08	CERAMIC	8PF	500V		
C105		*	C91-1150-08	CERAMIC	22PF	500V		
C106		*	C93-0582-08	CERAMIC	10PF	500V		
C107		*	C93-0583-08	CERAMIC	18PF	500V		
C108			CC73GCG1H330J	CHIP C	33PF	J		
C109		*	C91-1154-08	CERAMIC	220PF	500V		
C110		*	C93-0582-08	CERAMIC	10PF	500V		
C111			CK73GB1H102K	CHIP C	1000PF	K		
C112			CC73GCG1H150J	CHIP C	15PF	J		
C113			CC73GCH1H0R5C	CHIP C	0.5PF	C		
C114		*	C93-0583-08	CERAMIC	18PF	500V		
C115		*	C93-0579-08	CERAMIC	6PF	500V		
C116		*	C93-0589-08	CERAMIC	27PF	500V		
C117			CC73GCH1H0R5C	CHIP C	0.5PF	C		
C120,121			CK73GB1H102K	CHIP C	1000PF	K		
C123			CK73GB1H102K	CHIP C	1000PF	K		
C124			C92-0612-05	ELECTRO	33UF	25V		
C125			CK73GB1H102K	CHIP C	1000PF	K		
C126			C92-0612-05	ELECTRO	33UF	25V		
C127			C92-0611-05	ELECTRO	10UF	25V		
C128			C92-0609-05	ELECTRO	10UF	16V		
C129,130			CK73GB1H102K	CHIP C	1000PF	K		
C131			CK73GB1H103K	CHIP C	0.010UF	K		
C132			CK73GB1H102K	CHIP C	1000PF	K		
C133		*	C90-4031-08	ELECTRO	1500UF	16V		
C134			CK73GB1H103K	CHIP C	0.010UF	K		
C135,136			CK73GB1H102K	CHIP C	1000PF	K		
C137			C92-0610-05	ELECTRO	47UF	16V		
C138			CK73GB1H102K	CHIP C	1000PF	K		
C139			C92-0609-05	ELECTRO	10UF	16V		
C140-142			CK73GB1H102K	CHIP C	1000PF	K		
C143			CK73GB1H103K	CHIP C	0.01UF	K		
C144,145			CC73GCG1H101J	CHIP C	100PF	J		
C146,147			CC73GCG1H220J	CHIP C	22PF	J		
C148-152			CC73GCG1H101J	CHIP C	100PF	J		
C201			CK73GB1H102K	CHIP C	1000PF	K		

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TX-RX UNIT (W02-1810-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格			Destination 仕向	Remarks 備考
C202			CC73GCG1H220J	CHIP C	22PF	J		
C203,204			CK73GB1H102K	CHIP C	1000PF	K		
C205			CK73GB1H103K	CHIP C	0.010UF	K		
C206			C92-0610-05	ELECTRO	47UF	16V		
C207			CK73GB1H102K	CHIP C	1000PF	K		
C208			CK73GB1H103K	CHIP C	0.01UF	K		
C209			CK73GF1E104Z	CHIP C	0.1UF	Z		
C210			CK73GB1H102K	CHIP C	1000PF	K		
C211			CK73GCG1H101J	CHIP C	100PF	J		
C212			CK73GB1H102K	CHIP C	1000PF	K		
C213			CK73GCG1H101J	CHIP C	100PF	J		
C214			C92-0516-05	CHIP TAN	4.7UF	10V		
C215			CC73GCH1H020	CHIP C	2PF			
C216			CC73GCG1H150J	CHIP C	15PF	J		
C217			CC73GCH1H270J	CHIP C	27PF	J		
C218,219			CK73GF1E104Z	CHIP C	0.1UF	Z		
C220			CK73GB1H103K	CHIP C	0.010UF	K		
C221			C92-0610-050	ELECTRO	47UF	16V		
C222			CK73GB1H103K	CHIP C	0.010UF	K		
C223			CK73GF1E104Z	CHIP C	0.1UF	Z		
C224			CK73GB1H103K	CHIP C	0.010UF	K		
C225,226			CC73GCG1H101J	CHIP C	100PF	J		
C227			CK73GB1H102K	CHIP C	1000PF	K		
C228			CC73GCG1H101J	CHIP C	100PF	J		
C229			CK73GB1H103K	CHIP C	0.010UF	K		
C230			CK73GF1E104Z	CHIP C	0.1UF	Z		
C231			CK73GB1H103K	CHIP C	0.010UF	K		
C232		*	C93-0584-08	CERAMIC	0.1UF	16V		
C234		*	C93-0585-08	CERAMIC	1UF	16V		
C235			C92-0516-05	CHIP TAN	4.7UF	10V		
C236			CC73GCG1H101J	CHIP C	100PF	J		
C237,238			CK73GB1H102K	CHIP C	1000PF	K		
C239,240			CC73GCH1H040	CHIP C	4.0PF			
C241			CC73GCH1H020	CHIP C	2.0PF			
C242			CC73GCH1H080	CHIP C	8.0PF			
C243,244			CC73GCG1H101J	CHIP C	100PF	J		
C245			CC73GCH1H030C	CHIP C	3PF	C		
C246-261			CC73GCG1H101J	CHIP C	100PF	J		
C262		*	C93-0585-08	CERAMIC	1.0UF	16V		
C263			CK73GB1E104Z	CHIP C	0.1UF	Z		
C264			C92-0516-05	CHIP TAN	4.7UF	10V		
C265-273			CC73GCG1H101J	CHIP C	100PF	J		
C274			CC73GCH1H040	CHIP C	4.0PF			
C275-292			CC73GCG1H101J	CHIP C	100PF	J		
C293,294			CC73GCG1H150J	CHIP C	15PF	J		
C295-297			CC73GCG1H101J	CHIP C	100PF	J		
C298			CC73GCG1H120J	CHIP C	12PF	J		
C301			CC73GCG1H270J	CHIP C	27PF	J		
C302,303			CC73GB1H102K	CHIP C	1000PF	K		
C304			CC73GCH1H080	CHIP C	8.0PF			
C305			CC73GB1H102K	CHIP C	1000PF	K		
C306			CC73GCG1H121J	CHIP C	120PF	J		
C308			CC73GCG1H151J	CHIP C	150PF	J		
C309			CC73GCH1H080	CHIP C	8.0PF			
C310			CC73GB1H102K	CHIP C	1000PF	K		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C312			CC73GB1H102K	CHIP C 1000PF K		
C313			CC73GCH1H080	CHIP C 8.0PF		
C314			CC73GB1H102K	CHIP C 1000PF K		
C315			CC73GCG1H121J	CHIP C 120PF J		
C317			CC73GCG1H151J	CHIP C 150PF J		
C318			CC73GB1H102K	CHIP C 1000PF K		
C319			CC73GCH1H090	CHIP C 9.0PF		
C320			CK73GB1H102K	CHIP C 1000PF K		
C321			CK73GF1E104Z	CHIP C 0.1UF Z		
C322			CK73GB1H331K	CHIP C 330PF K		
C323			CK73GB1H102K	CHIP C 1000PF K		
C324			CC73GCG1H180J	CHIP C 18PF J		
C325			CK73GB1H102K	CHIP C 1000PF K		
C326			CC73GCG1H180J	CHIP C 18PF J		
C328			CK73GB1H102K	CHIP C 1000PF K		
C329			CC73GCG1H470J	CHIP C 47PF J		
C330			CC73GCG1H270J	CHIP C 27PF J		
C331			CC73GCH1H080	CHIP C 8.0PF		
C332			CC73GCG1H150J	CHIP C 15PF J		
C333			CK73GB1H102K	CHIP C 1000PF K		
C334			CC73GCG1H101J	CHIP C 100PF J		
C335-337			CK73GB1H102K	CHIP C 1000PF K		
C338			CC73GCG1H120J	CHIP C 12PF J		
C339			CC73GCH1H060	CHIP C 6.0PF		
C340			CC73GB1H102K	CHIP C 1000PF K		
C341			CC73GCH1H040	CHIP C 4.0PF		
C342			CC73GCH1H060D	CHIP C 6PF D		
C343			CC73GCH1H080	CHIP C 8.0PF		
C344			CC73GCG1H220J	CHIP C 22PF J		
C345			CK73GB1H102K	CHIP C 1000PF K		
C346			CC73GCH1H020	CHIP C 2.0PF		
C348			CK73GB1H102K	CHIP C 1000PF K		
C349			CC73GCH1H080	CHIP C 8.0PF		
C350			CC73GCH1H040	CHIP C 4.0PF		
C351			CC73GCG1H101J	CHIP C 100PF J		
C352			CK73GB1H102K	CHIP C 1000PF K		
C354			CK73GB1H102K	CHIP C 1000PF K		
C355			CC73GCH1H030	CHIP C 3.0PF		
C356			CC73GCH1H080	CHIP C 8.0PF		
C357,358			CK73GB1H102K	CHIP C 1000PF K		
C359			CC73GCH1H020	CHIP C 2.0PF		
C361			CK73GB1H102K	CHIP C 1000PF K		
C362			CC73GCH1H080	CHIP C 8.0PF		
C363			CC73GCH1H040	CHIP C 4.0PF		
C364			CK73GB1H102K	CHIP C 1000PF K		
C365			CC73GCH1H030C	CHIP C 3PF C		
C366			CC73GCG1H181J	CHIP C 180PF J		
C367			CC73GCH1H040	CHIP C 4.0PF		
C368			CK73GB1H102K	CHIP C 1000PF K		
C369			CC73GCG1H101J	CHIP C 100PF J		
C370			CK73GB1H102K	CHIP C 1000PF K		
C371,372			CC73GCH1H090	CHIP C 9.0PF		
C376-378			CK73GB1H103K	CHIP C 0.010UF K		
C379			CK73GB1H102K	CHIP C 1000PF K		
C380			CC73GCG1H150J	CHIP C 15PF J		

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TX-RX UNIT (W02-1810-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C381			CK73GF1E104Z	CHIP C 0.1UF Z		
C382			CK73GB1H102K	CHIP C 1000PF K		
C383			CC73GCH1H080	CHIP C 8.0PF		
C384			CK73GF1E104Z	CHIP C 0.1UF Z		
C385			CK73GB1H103K	CHIP C 0.010UF K		
C386			CC73GCH1H030	CHIP C 3.0PF		
C388,389			CK73GB1H103K	CHIP C 0.010UF K		
C391			CK73GB1H103K	CHIP C 0.010UF K		
C392			CC73GCG1H101J	CHIP C 100PF J		
TC201			C05-0371-05	TRIM CAP 10PF		
TC301-304			C05-0370-05	TRIM CAP 20PF		
TC305-308			C05-0371-05	TRIM CAP 10PF		
CN1			E40-3237-05	CONNECTOR (2P)		
CN2		*	E56-0406-08	DIN CONNECTOR		
CN201,202		*	E40-5723-08	CONNECTOR (20P)		
J1		*	E12-0403-08	EXT SPJACK (3.5D)		
CD1			L79-1013-05	DISCRETE (455KHZ)		
CF1			L72-0366-05	CERAMIC FILTER(455KHZ)		
L1			L40-5671-34	CHIP COIL 0.56UH		
L2			L40-1005-34	CHIP COIL 10UH		
L3			L40-1295-34	CHIP COIL 0.12UH		
L101		*	L34-4385-08	COIL		
L102		*	L34-4383-08	COIL		
L103		*	L34-4382-08	COIL		
L104		*	L34-4383-08	COIL		
L105		*	L34-4380-08	COIL		
L106		*	L34-4378-08	COIL		
L107		*	L34-4383-08	COIL		
L108			L40-4771-34	CHIP COIL 0.047UH		
L109		*	L34-4381-08	COIL		
L201			L40-5671-34	CHIP COIL 0.056UH		
L202			L40-1005-34	CHIP COIL 10UH		
L203			L40-1271-34	CHIP COIL 0.012UH		
L204			L40-2271-34	CHIP COIL 0.022UH		
L301			L40-8271-34	CHIP COIL 0.082UH		
L302,303			L33-0797-05	CHIP COIL 39NH		
L304			L40-8271-34	CHIP COIL 0.082UH		
L305,306			L33-0797-05	CHIP COIL 39NH		
L307			L40-2271-34	CHIP COIL 0.022UH		
L308			L40-1871-34	CHIP COIL 0.018UH		
L309,310			L33-0796-05	CHIP COIL 33NH		
L311			L40-1571-34	CHIP COIL 0.015UH		
L312,313			L33-0796-05	CHIP COIL 33NH		
L314			L40-1571-34	CHIP COIL 0.015UH		
L315		*	L34-4386-08	IFT 45.05MHZ		
L316			L40-1295-34	CHIP COIL 0.12UH		
L317			L40-1271-34	CHIP COIL 0.012UH		
L318			L40-6871-34	CHIP COIL 0.068UH		
L319		*	L34-4377-08	COIL		
L320			L40-1871-34	CHIP COIL 0.018UH		
L330			L77-0451-05	CRYSTAL F (45.05MHZ)		
X1		*	L77-1582-08	CRYSTALRESONATOR(45.505MHZ)		
X201		*	L77-1576-08	CRYSTALRESONATOR(12.8MHZ)		

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TX-RX UNIT (W02-1810-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R1			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R5			RK73GB1J101J	CHIP R 100 J 1/16W		
R6		*	R92-1380-08	CHIP R 220 1/16W		
R7			RK73GB1J2R2J	CHIP R 2.2 J 1/16W		
R8		*	R92-1384-08	CHIP R 1 J 1/16W		
R9 ,10			RK73GB1J103J	CHIP R 10K J 1/16W		
R11			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R12			RK73GB1J274J	CHIP R 270K J 1/16W		
R13			RK73GB1J104J	CHIP R 100K J 1/16W		
R15			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R16			RK73GB1J334J	CHIP R 330K J 1/16W		
R17			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R18			RK73GB1J103J	CHIP R 10K J 1/16W		
R20			RK73GB1J333J	CHIP R 33K J 1/16W		
R21			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R22			RK73GB1J333J	CHIP R 33K J 1/16W		
R23			RK73GB1J103J	CHIP R 10K J 1/16W		
R24			RK73GB1J104J	CHIP R 100K J 1/16W		
R25			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R26			RK73GB1J221J	CHIP R 220 J 1/16W		
R101			R92-1319-05	CHIP R 82 1W		
R102,103			RK73GB1J103J	CHIP R 10K J 1/16W		
R104			RK73GB1J104J	CHIP R 100K J 1/16W		
R105			RK73GB1J273J	CHIP R 27K J 1/16W		
R106			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R107			RK73GB1J103J	CHIP R 10K J 1/16W		
R108			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R109		*	R92-1379-08	CHIP R 5.6 1W		
R110		*	R92-1381-08	CHIP R 390 1/4W		
R111			R92-1276-05	CHIP R 820 1/4W		
R112		*	R92-1382-08	CHIP R 47 1/4W		
R113			RK73GB1J104J	CHIP R 100K J 1/16W		
R114			RK73GB1J271J	CHIP R 270 J 1/16W		
R115			RK73GB1J563J	CHIP R 56K J 1/16W		
R116			RK73GB1J180J	CHIP R 18 J 1/16W		
R117			RK73GB1J271J	CHIP R 270 J 1/16W		
R118			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R119			RK73GB1J103J	CHIP R 10K J 1/16W		
R120			R92-1383-08	CHIP R 680 1/4W		
R121			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R122			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R123			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R124			RK73GB1J223J	CHIP R 22K J 1/16W		
R125			RK73GB1J103J	CHIP R 10K J 1/16W		
R126			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R202			RK73GB1J331J	CHIP R 330 J 1/16W		
R203			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R204			RK73GB1J563J	CHIP R 56K J 1/16W		
R205			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R206			RK73GB1J101J	CHIP R 100 J 1/16W		
R207			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R208			RK73GB1J221J	CHIP R 220 J 1/16W		
R209			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R210			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R211			RK73GB1J121J	CHIP R 120 J 1/16W		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R212-214			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R215			RK73GB1J560J	CHIP R 56 J 1/16W		
R216,217			RK73GB1J121J	CHIP R 120 J 1/16W		
R218			RK73GB1J563J	CHIP R 56K J 1/16W		
R219			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R221			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R222			RK73GB1J274J	CHIP R 270K J 1/16W		
R223			RK73GB1J103J	CHIP R 10K J 1/16W		
R224,225			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R226			RK73GB1J101J	CHIP R 100 J 1/16W		
R227			RK73GB1J821J	CHIP R 820 J 1/16W		
R228			RK73GB1J333J	CHIP R 33K J 1/16W		
R229			RK73GB1J273J	CHIP R 27K J 1/16W		
R230			RK73GB1J100J	CHIP R 10 J 1/16W		
R231,232			RK73GB1J103J	CHIP R 10K J 1/16W		
R234			RK73GB1J333J	CHIP R 33K J 1/16W		
R235			RK73GB1J103J	CHIP R 10K J 1/16W		
R236			RK73GB1J473J	CHIP R 47K J 1/16W		
R237,238			RK73GB1J103J	CHIP R 10K J 1/16W		
R239			RK73GB1J274J	CHIP R 270K J 1/16W		
R240,241			RK73GB1J103J	CHIP R 10K J 1/16W		
R242			R92-1252-05	CHIP R 0 OHM		
R243			RK73GB1J101J	CHIP R 100 J 1/16W		
R301			RK73GB1J101J	CHIP R 100 J 1/16W		
R302			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R303			RK73GB1J561J	CHIP R 560 J 1/16W		
R304			RK73GB1J563J	CHIP R 56K J 1/16W		
R305			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R306			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R307			RK73GB1J471J	CHIP R 470 J 1/16W		
R308			RK73GB1J221J	CHIP R 220 J 1/16W		
R309			RK73GB1J100J	CHIP R 10 J 1/16W		
R310			RK73GB1J563J	CHIP R 56K J 1/16W		
R313			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R314			RK73GB1J101J	CHIP R 100 J 1/16W		
R315			RK73GB1J121J	CHIP R 120 J 1/16W		
R316			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R318			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R319			RK73GB1J272J	CHIP R 2.7K J 1/16W		
R320			RK73GB1J221J	CHIP R 220 J 1/16W		
R321,322			RK73GB1J151J	CHIP R 150 J 1/16W		
R323			RK73GB1J390J	CHIP R 39 J 1/16W		
R326			R92-1252-05	CHIP R 0 OHM		
R327			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R328			RK73GB1J101J	CHIP R 100 J 1/16W		
R329			RK73GB1J181J	CHIP R 180 J 1/16W		
R330			RK73GB1J330J	CHIP R 33 J 1/16W		
R331			RK73GB1J473J	CHIP R 47K J 1/16W		
R332			RK73GB1J471J	CHIP R 470 J 1/16W		
R333			RK73GB1J680J	CHIP R 68 J 1/16W		
R335			RK73GB1J181J	CHIP R 180 J 1/16W		
R337			RK73GB1J680J	CHIP R 68 J 1/16W		
R338			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R339			RK73GB1J120J	CHIP R 12 J 1/16W		
R340,341			RK73GB1J332J	CHIP R 3.3K J 1/16W		

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TX-RX UNIT (W02-1810-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R343			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R344			RK73GB1J470J	CHIP R 47 J 1/16W		
R345,346			RK73GB1J563J	CHIP R 56K J 1/16W		
R348			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R349			RK73GB1J152J	CHIP R 1.5K J 1/16W		
R351			RK73GB1J151J	CHIP R 150 J 1/16W		
R352			RK73GB1J101J	CHIP R 100 J 1/16W		
R353,354			RK73GB1J563J	CHIP R 56K J 1/16W		
R355			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R358			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R360			RK73GB1J271J	CHIP R 270 J 1/16W		
R361			RK73GB1J471J	CHIP R 470 J 1/16W		
R363			RK73GB1J103J	CHIP R 10K J 1/16W		
R364			RK73GB1J222J	CHIP R 2.2K J 1/16W		
R365			RK73GB1J392J	CHIP R 3.9K J 1/16W		
R366			RK73GB1J331J	CHIP R 330 J 1/16W		
R367			RK73GB1J330J	CHIP R 33 J 1/16W		
R368			RK73GB1J332J	CHIP R 3.3K J 1/16W		
R369			RK73GB1J681J	CHIP R 680 J 1/16W		
R370			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R371			RK73GB1J273J	CHIP R 27K J 1/16W		
R372			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R373			RK73GB1J122J	CHIP R 1.2K J 1/16W		
R374			RK73GB1J331J	CHIP R 330 J 1/16W		
R375			RK73GB1J101J	CHIP R 100 J 1/16W		
R378			RK73GB1J120J	CHIP R 12 J 1/16W		
VR1			R12-8429-05	TRIM POT 100K		
VR101			R12-8427-05	TRIM POT 50K		
VR102			R12-7423-05	TRIM POT 10K		
VR201			R12-8427-05	TRIM POT 50K		
D101			HSU277	DIODE		
D102			MI809	DIODE		
D103,104			MI407	DIODE		
D105,106			MA716	DIODE		
D107			DSA3A1	DIODE		
D108			HSU277	DIODE		
D201			HSM2693	DIODE		
D203			HSM2693	DIODE		
D204-206			1SS301	DIODE		
D301-304			HVU202	DIODE		
D305			1SS301	DIODE		
D307,308			HSU277	DIODE		
D309			HSM2693	DIODE		
D310-313			HVU202	DIODE		
D314			HSU277	DIODE		
D315			HSM2693	DIODE		
D316			1SS301	DIODE		
IC1			KCD04	HIC (FMIF)		
IC2		*	W02-1829-08	HIC (RX AUDIO)		
IC3			TDA2003V	IC (AF AMP)		
IC4		*	W02-1830-08	HIC (PROG SOL)		
IC5			BU4094BF	IC(SHIFT/STORE REGISTER)		
IC6			TA7787AF	IC(FM/AM IF/3V) DET		
IC101		*	S-AV24-01K	IC (POWER MODULE 50W)		
IC102		*	W02-1827-08	HIC (RF AMP144MHZ)		

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TX-RX UNIT (W02-1810-08)
CONTROL UNIT (W02-1811-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
IC103			NJM7808A	IC (REGULATOR 8V)		
IC104			NJM78L05UA	IC (REGULATPR 5V)		
IC201		*	L78-0350-08	PLL VCO (144MHZ)		
IC202		*	W02-1828-08	HIC (TX AUDIO)		
IC203		*	L78-0353-08	PLL VCO (430MHZ)		
IC204			UPC1676G	IC (RF AMP)		
IC205			TC4S66F	IC (ANALOG SW)		
IC208			LA5010M	IC(LOW SATURATION REGULATOR)		
IC302			UPC1676G	IC (RF AMP)		
IC303			NJM3404AV	IC (OP ANP)		
Q1			2SJ144(GR)	FET		
Q3			2SC2712(BL)	TRANSISTOR		
Q4			RN2701	TRANSISTOR		
Q5			RN1704	TRANSISTOR		
Q6			RN1304	TRANSISTOR		
Q7			2SC2714	TRANSISTOR		
Q8			2SC2712(BL)	TRANSISTOR		
Q101			2SB1292	TRANSISTOR		
Q102			2SD1621	TRANSISTOR		
Q103			2SA1618GR	TRANSISTOR		
Q104			RN2302	TRANSISTOR		
Q105			2SB624	TRANSISTOR		
Q106			RN1704	TRANSISTOR		
Q107			2SB1302(T)	TRANSISTOR		
Q108			2SC2712(BL)	TRANSISTOR		
Q109			RN1704	TRANSISTOR		
Q201		*	2SC4901YK-02TR	TRANSISTOR		
Q202			2SC2712(BL)	TRANSISTOR		
Q204,205			RN2302	TRANSISTOR		
Q206			RN1704	TRANSISTOR		
Q207			2SC2712(BL)	TRANSISTOR		
Q208			RN1304	TRANSISTOR		
Q209			2SC2712(BL)	TRANSISTOR		
Q210			RN1704	TRANSISTOR		
Q301,302		*	2SC4901YK-02TR	TRANSISTOR		
Q304,305		*	2SC4901YK-02TR	TRANSISTOR		
Q306			2SC3356	TRANSISTOR		
Q307			2SC2714	TRANSISTOR		
Q308			RN2701	TRANSISTOR		
Q309			RN1704	TRANSISTOR		
Q310			RN2302	TRANSISTOR		
Q311			RN1704	TRANSISTOR		
Q312			2SK208	FET		
Q313			2SC4901YK-02TR	TRANSISTOR		
CONTROL UNIT (W02-1811-08)						
C401			CK73GB1H103K	CHIP C 0.010UF K		
C402,403			CK73FB1E223Z	CHIP C 0.022UF Z		
C404,405			CC73GCG1H150J	CHIP C 15PF J		
C406-408			CK73GB1H103K	CHIP C 0.010UF K		
C409			C92-0614-08	ELECTRP 47UF 10V		
C410			CK73GB1H103K	CHIP C 0.010UF K		
C411-413			CC73GCG1H101J	CHIP C 100PF J		
C414			CK73GB1H102K	CHIP C 1000PF K		
C415		*	C93-0585-08	CERAMIC 1UF 16V		
C416			CC73GCG1H101J	CHIP C 100PF J		

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CONTROL UNIT (W02-1811-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C417		*	C93-0584-08	CERAMIC 0.1UF 16V		
C418,419			CC73GCG1H330J	CHIP C 33PF J		
C420		*	C93-0584-08	CERAMIC 0.1UF 16V		
C421			CC73GCG1H470J	CHIP C 47PF J		
C422		*	C93-0585-08	CERAMIC 1UF 16V		
C423			CC73GCG1H470J	CHIP C 47PF J		
C424			CK73GF1E104Z	CHIP C 0.1UF Z		
C425			C92-0516-05	CHIP TAN 4.7UF 10V		
C426		*	C93-0585-08	CERAMIC 1UF 16V		
C427			CK73GF1E104Z	CHIP C 0.1UF Z		
C428,429		*	C93-0585-08	CERAMIC 1UF 16V		
C430			CK73GF1E104Z	CHIP C 0.1UF Z		
C431,432			CC73GCG1H151J	CHIP C 150PF J		
C433		*	C93-0584-08	CERAMIC 0.1UF 16V		
C434			CK73GF1E104Z	CHIP C 0.1UF Z		
C435		*	C93-0584-08	CERAMIC 0.1UF 16V		
C436			CK73GB1H332K	CHIP C 3300PF K		
C437			CC73GCG1H101J	CHIP C 100PF J		
C438		*	C93-0584-08	CERAMIC 0.1UF 16V		
C439,440			CC73GCG1H330J	CHIP C 33PF J		
C441		*	C93-0585-08	CERAMIC 1UF 16V		
C442			CK73GF1E104Z	CHIP C 0.1UF Z		
C443			CC73GCG1H470J	CHIP C 47PF J		
C444			C92-0536-05	CHIP TAN 10UF 10V		
C445			CK73GF1E223Z	CHIP C 0.022UF Z		
C446			C92-0536-05	CHIP TAN 10UF 10V		
C447-451		*	C93-0585-08	CERAMIC 1UF 16V		
C452			C92-0516-05	CHIP TAN 4.7UF 10V		
C453			CK73GF1E104Z	CHIP C 0.1UF Z		
C454		*	C93-0585-08	CERAMIC 1UF 16V		
C455			CK73GB1H332K	CHIP C 3300PF K		
C456			C92-0536-05	CHIP TAN 10UF 10V		
C457			CC73GCG1H101J	CHIP C 100PF J		
C458			CC73GCG1H390J	CHIP C 39PF J		
C459		*	C93-0585-08	CERAMIC 1UF 16V		
C460			CK73GF1E104Z	CHIP C 0.1UF Z		
C461		*	C93-0585-08	CERAMIC 1UF 16V		
C463,464			CC73GCG1H101J	CHIP C 100PF J		
C465		*	C93-0584-08	CERAMIC 0.1UF 16V		
C466			CK73GF1E104Z	CHIP C 0.1UF Z		
CN401		*	E40-5720-08	CONNECTOR (11P)		
CN402		*	E40-5724-08	CONNECTOR (8P)		
CN402-2		*	E58-0427-08	MODULER SOCKET(8P)		
CN403		*	E40-5722-08	CONNECTOR (8P)		
CN404		*	E40-5725-08	CONNECTOR (5P)		
CN405,406		*	E40-5721-08	CONNECTOR (20P)		
PC402-2		*	E37-0468-08	FPC (CN402-2)		
W1		*	E33-1978-08	WIRE (GREEN)	KP	
W2		*	E33-1979-08	WIRE (BLUE)	KP	
W3		*	E33-1980-08	WIRE (WHITE)	KP	
F1			F53-0054-05	CHIP FUSE (1.2A)		
X401		*	L77-1578-08	CRYSTAL RESONATOR (4.194304MHZ)		
X402		*	L78-0348-08	CERAMIC RESONATOR (4.096MHZ)		
X403		*	L78-0346-08	CERAMIC RESONATOR (480KHZ)		

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CONTROL UNIT (W02-1811-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
X404		*	L78-0347-08	CERAMIC RESONATOR (3.58MHZ)		
R401			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R402			RK73GB1J824J	CHIP R 820K J 1/16W		
R403			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R404			RK73GB1J103J	CHIP R 10K J 1/16W		
R405			RK73GB1J104J	CHIP R 100K J 1/16W		
R406			RK73GB1J473J	CHIP R 47K J 1/16W		
R407			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R408			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R409-413			RK73GB1J473J	CHIP R 47K J 1/16W		
R414-416			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R417			RK7GGB1J473J	CHIP R 47K J 1/16W		
R418			RK7GGB1J474J	CHIP R 470K J 1/16W		
R419			RK7GGB1J103J	CHIP R 10K J 1/16W		
R420			RK7GGB1J102J	CHIP R 1K J 1/16W		
R421			RK7GGB1J272J	CHIP R 2.7K J 1/16W		
R422			RK7GGB1J394J	CHIP R 390K J 1/16W		
R423			RK7GGB1J822J	CHIP R 8.2K J 1/16W		
R424			RK7GGB1J472J	CHIP R 4.7K J 1/16W		
R425			RK7GGB1J102J	CHIP R 1K J 1/16W		
R426			RK73GB1J103J	CHIP R 10K J 1/16W		
R428			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R429-430			RK73GB1J473J	CHIP R 47K J 1/16W		
R431			RK73GB1J103J	CHIP R 10K J 1/16W		
R432			RK73GB1J183J	CHIP R 18K J 1/16W		
R433			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R434			RK73GB1J224J	CHIP R 220K J 1/16W		
R435			RK73GB1J104J	CHIP R 100K J 1/16W		
R436			RK73GB1J224J	CHIP R 220K J 1/16W		
R437			RK73GB1J154J	CHIP R 150K J 1/16W		
R438			RK73GB1J104J	CHIP R 100K J 1/16W		
R439			RK73GB1J682J	CHIP R 6.8K J 1/16W		
R440			RK73GB1J684J	CHIP R 680K J 1/16W		
R441			RK73GB1J564J	CHIP R 560K J 1/16W		
R442			RK73GB1J754J	CHIP R 750K J 1/16W		
R443			RK73GB1J153J	CHIP R 15K J 1/16W		
R444			RK73GB1J104J	CHIP R 100K J 1/16W		
R445			RK73GB1J273J	CHIP R 27K J 1/16W		
R446			RK73GB1J393J	CHIP R 39K J 1/16W		
R447			RK73GB1J334J	CHIP R 330K J 1/16W		
R448			RK73GB1J683J	CHIP R 68K J 1/16W		
R449			RK73GB1J394J	CHIP R 390K J 1/16W		
R451			RK73GB1J154J	CHIP R 150K J 1/16W		
R452			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R453			RK73GB1J562J	CHIP R 5.6K J 1/16W		
R454			RK73GB1J103J	CHIP R 10K J 1/16W		
R455			RK73GB1J104J	CHIP R 100K J 1/16W		
R456			RK73GB1J393J	CHIP R 39K J 1/16W		
R457			RK73GB1J274J	CHIP R 270K J 1/16W		
R458			RK73GB1J104J	CHIP R 100K J 1/16W		
R459			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R460			RK73GB1J471J	CHIP R 470 J 1/16W		
R461			RK73GB1J104J	CHIP R 100K J 1/16W		
R462-463			RK73GB1J473J	CHIP R 47K J 1/16W		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R464			RK73GB1J824J	CHIP R 820K J 1/16W		
R465			RK73GB1J334J	CHIP R 330K J 1/16W		
R466			RK73GB1J152J	CHIP R 1.5K J 1/16W	EE2E3	
R466			RK73GB1J152J	CHIP R 1.5K J 1/16W	E9	
R466			RK73GB1J272J	CHIP R 2.7K J 1/16W	KPM	
R466			RK73GB1J272J	CHIP R 2.7K J 1/16W	M2M3	
R467			RK73GB1J222J	CHIP R 2.2K J 1/16W	KPM	
R467			RK73GB1J222J	CHIP R 2.2K J 1/16W	M2M3	
R467			RK73GB1J682J	CHIP R 6.8K J 1/16W	EE3P9	
R467			RK73GB1J682J	CHIP R 6.8K J 1/16W	E2	
R468			RK73GB1J103J	CHIP R 10K J 1/16W		
R469			RK73GB1J102J	CHIP R 1.0K J 1/16W		
R470			RK73GB1J393J	CHIP R 39K J 1/16W		
R471			RK73GB1J225J	CHIP R 2.2M J 1/16W		
R472			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R473,474			R92-1252-05	CHIP R 0 ΩHM	MM2M3	
R476			RK73GB1J474J	CHIP R 470K J 1/16W		
R477,478			RK73GB1J472J	CHIP R 4.7K J 1/16W		
R479			RK73GB1J104J	CHIP R 100K J 1/16W		
R480,481			RK73GB1J473J	CHIP R 47K J 1/16W		
R482			R92-1252-05	CHIP R 0 ΩHM		
R483			RD14BB2E101J	RD 100 J 1/4W		
R484,485			RK73GB1J272J	CHIP R 2.7K J 1/16W		
R486-491			RK73GB1J101J	CHIP R 100 J 1/16W		
R492			RK73GB1J103J	CHIP R 10K J 1/16W		
VR401		*	R31-0602-08	POTENTIOMETER 50K		
VR402		*	R31-0601-08	POTENTIOMETER 10K		
S401		*	W02-1826-08	ENCODER		
S402-409			S70-0408-05	TACT SW 100G		
S410		*	S70-0437-08	ROCK SW		
D401			LFB01	DIODE		
D402			02CZ3.0	CHIP ZENERDIODE		
D403			02CZ7.5	CHIP ZENERDIODE		
D404			1SS301	DIODE		
D405			1SS302	DIODE		
D406			LFB01	DIODE		
D407-410			1SS301	DIODE		
D412			1SS352	DIODE		
D413,414			1SS352	DIODE	KPM	
D413,414			1SS352	DIODE	M2M3	
D415			1SS352	DIODE	KP	
D416			1SS352	DIODE	KPEE3	
D416			1SS352	DIODE	E2E9	
D417			1SS352	DIODE	MEE3E9	
D418			1SS352	DIODE	MM2M3E	
D418			1SS352	DIODE	E2E3E9	
D419			1SS272	DIODE		
D420			1SS337	DIODE		
IC401			HD6433388F	IC (CPU)		
IC402			MSM6588GS-VIK	IC (DIGITAL RECORDINGCONTROL)		
IC403			MSM6586JS	IC (REGISTER 256K BIT)		
IC404			TC35219F	IC (DTMF GEN)		
IC405			LC7385M	IC(DTMF DECODER)		
IC406			TC4053BF	IC(3-INPUT 2CH MPX/DE-MPX)		

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CONTROL UNIT (W02-1811-08)
IC102 : 144MHz RF AMP (W02-1827-08)
IC202 : TX AUDIO (W02-1828-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
IC407		*	TA7806F	IC (6V AVR)		
IC408		*	NJM062V	IC (DP AMPX2)		
IC409,410			TC4S66F	IC(BILATERAL SWITCH)		
Q401			2SK536	FET		
Q402			2SC2712(BL)	TRANSISTOR		
Q403			RN1502	TRANSISTOR		
Q404			2SD596	TRANSISTOR		
Q405,406			2SC2712(BL)	TRANSISTOR		
Q409			RN1302	TRANSISTOR		
Q410			2SC2712(Y)	TRANSISTOR		
BA401		*	W09-0859-08	LITHIUM BATTERY		
IC102 : 144MHz RF AMP (W02-1827-08)						
C1			CC73GCG1H101D	CHIP C 100PF D		
C2			CC73GCG1H180J	CHIP C 18PF J		
C3 ,4			CK73GB1H102K	CHIP C 1000PF K		
C5			CK73GB1H103K	CHIP C 0.010UF K		
C6			CC73GCG1H220J	CHIP C 22PF J		
C8 ,9			CK73GB1H103K	CHIP C 0.010UF K		
C10			CC73GCG1H180J	CHIP C 18PF J		
C12			CK73GB1H103K	CHIP C 0.010UF K		
C13			CK73GF1E104Z	CHIP C 0.1UF Z		
L1			L40-4771-34	CHIP COIL 47NH		
L2			L40-6871-34	CHIP COIL 68NH		
L4			L40-6871-34	CHIP COIL 68NH		
R1			R92-2512-08	CHIP R 1.8K J 1/16W		
R2			R92-2518-08	CHIP R 2.7K J 1/16W		
R3 ,4			R92-2526-08	CHIP R 47 J 1/16W		
R5			R92-2505-08	CHIP R 12 J 1/16W		
R6			R92-2527-08	CHIP R 4.7K J 1/16W		
R7			R92-1252-08	CHIP R 0 OHM		
R8			R92-2502-08	CHIP R 1.0K J 1/16W		
R9			R92-2521-08	CHIP R 330 J 1/16W		
D1			1SS302	DIODE		
Q1			2SC3357	TRANSISTOR		
Q2			2SC2954	TRANSISTOR		
IC202 : TX AUDIO (W02-1828-08)						
C3			CC73GCG1H101J	CHIP C 100PF		
C4		*	C93-0590-08	FILM C 0.033UF 16V		
C5			C92-0516-05	CHIP TAN 4.7UF 10V		
C6			CC73GCG1H820J	CHIP C 82PF J		
C7		*	C93-0590-08	FILM C 0.033UF 16V		
C8			CK73GB1H821K	CHIP C 820PF K		
C9			CK73GB1H332K	CHIP C 3300PF K		
C10			CC73GCG1H101J	CHIP C 100PF J		
C11			CK73GB1H103K	CHIP C 0.010UF K		
C12			CC73GCG1H101J	CHIP C 100PF J		
C13			C92-0516-05	CHIP TAN 4.7UF 10V		
C14			CC73GCG1H101J	CHIP C 100PF J		
R1			R92-2509-08	CHIP R 15K J 1/16W		
R2			R92-2515-08	CHIP R 22K J 1/16W		
R3			R92-1252-05	CHIP R 0 OHM		
R5			R92-2529-08	CHIP R 560 J 1/16W		
R6			R92-2532-08	CHIP R 6.8K J 1/16W		

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IC202 : TX AUDIO (W02-1828-08)
IC2 : RX AUDIO (W02-1829-08)
IC4 : PROG SQL (W02-1830-08)
LCD ASSY (B38-0721-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R7			R92-2530-08	CHIP R 5.6K J 1/16W		
R8			R92-2513-08	CHIP R 180K J 1/16W		
R9			R92-2523-08	CHIP R 33K J 1/16W		
R10			R92-2528-08	CHIP R 47K J 1/16W		
R11			R92-2516-08	CHIP R 220K J 1/16W		
R12 -14			R92-2535-08	CHIP R 82K J 1/16W		
R16 ,17			R92-2507-08	CHIP R 120K J 1/16W		
R18			R92-2502-08	CHIP R 1.0K J 1/16W		
R19			R92-2504-08	CHIP R 100K J 1/16W		
IC1			TC4066BF	IC(BILATERAL SWITCH)		
IC2 ,3			NJM3404AM	IC(OP AMP X2)		
IC2 : RX AUDIO (W02-1829-08)						
C1 ,2		*	C93-0585-08	CHIP C 1UF 16V		
C3			C92-0516-05	CHIP TAN 4.7UF 10V		
C4 ,5			CK73GB1H103	CHIP C 0.010UF		
C6 -8		*	C93-0585-08	CHIP C 1UF 16V		
C9			CK73FB1E104Z	CHIP C 0.10UF Z		
C10		*	C93-0585-08	CHIP C 1UF 16V		
C11			CK73GB1H681K	CHIP C 680PF K		
C12			CK73GB1H472K	CHIP C 4700PF K		
C13			CC73GCG1H101J	CHIP C 100PF J		
R1			R92-2513-08	CHIP R 180K J 1/16W		
R2			R92-2509-08	CHIP R 15K J 1/16W		
R3			R92-2534-08	CHIP R 8.2K J 1/16W		
R4			R92-2510-08	CHIP R 150K J 1/16W		
R5			R92-2503-08	CHIP R 10K J 1/16W		
R6			R92-1252-05	CHIP R 0 OHM		
R7 -9			R92-2503-08	CHIP R 10K J 1/16W		
R10			R92-2509-08	CHIP R 15K J 1/16W		
R11 -13			R92-2504-08	CHIP R 100K J 1/16W		
R14			R92-2502-08	CHIP R 1.0K J 1/16W		
R15			R92-2503-08	CHIP R 10K J 1/16W		
IC1			NJM4558M	IC(OP AMP X2)		
IC2			TC4066BF	IC(BILATERAL SWITCH)		
IC3		*	X9313WS	IC(ELECTRONIC VR)		
IC4 : PROG SQL (W02-1830-08)						
C1			CK73GB1H103K	CHIP C 0.010UF K		
R1			R92-2519-08	CHIP R 27K J 1/16W		
R2			R92-2512-08	CHIP R 1.8K J 1/16W		
R3			R92-2522-08	CHIP R 3.3K J 1/16W		
R4			R92-2532-08	CHIP R 6.8K J 1/16W		
R5			R92-2506-08	CHIP R 12K J 1/16W		
R6			R92-2519-08	CHIP R 27K J 1/16W		
IC1			BU4094BF	IC(SHIFT/STORE REGISTER)		
IC2			TC4066BF	IC(BILATERAL SWITCH)		
Q1			RN1304	TRNNSISTOR		
LCD ASSY (B38-0721-08)						
PL1-PL4		*	B30-2133-08	LAMP		
C2			CK73FB1E104K	CHIP C 0.10UF K		
C3 ,4			CK73FB1E103K	CHIP C 0.01UF K		
C5			CK73FB1E223K	CHIP C 0.022UF K		

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LCD ASSY (B38-0721-08)

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
C6			CC73ESL1H102J	CHIP C 1000PF J		
C7			CC73ESL1H332J	CHIP C 3300PF J		
CN1		*	E40-5726-08	PIN CONNECTOR		
LCD1		*	B38-0729-08	LCD	KPME	
R1 ,2			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R3		*	R92-1392-08	CHIP R 470K J 1/16W		
R4			RK73FB2A104J	CHIP R 100K J 1/10W		
R5			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R6		*	R92-1391-08	CHIP R 22K J 1/16W		
R7		*	R92-1393-08	CHIP R 2.2K J 1/16W		
R8			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R9		*	R92-1397-08	CHIP R 30K J 1/16W		
R10		*	R92-1392-08	CHIP R 47K J 1/16W		
R11		*	R92-1394-08	CHIP R 120K J 1/16W		
R12		*	R92-1398-08	CHIP R 43K J 1/16W		
R13 ,14		*	R92-1395-08	CHIP R 22 J 1/16W		
R15 ,16			RK73FB2A152J	CHIP R 1.5K J 1/16W		
R18		*	R92-1396-08	CHIP R 2.2 J 1/16W		
R19 ,21			RK73FB2A102J	CHIP R 1.0K J 1/16W		
R22		*	R93-1396-08	CHIP R 2.2 J 1/10W		
IC1			MSM5265GS-VIK	IC(LCD DRIVER)		
Q1			2SA1244(Y)	TRANSISTOR		
Q2			2SC2712(Y)	TRANSISTOR		
Q3			2SA1162(Y)	TRANSISTOR		
Q4 -6			2SC2712(Y)	TRANSISTOR		
Q7			2SA1244(Y)	TRANSISTOR		

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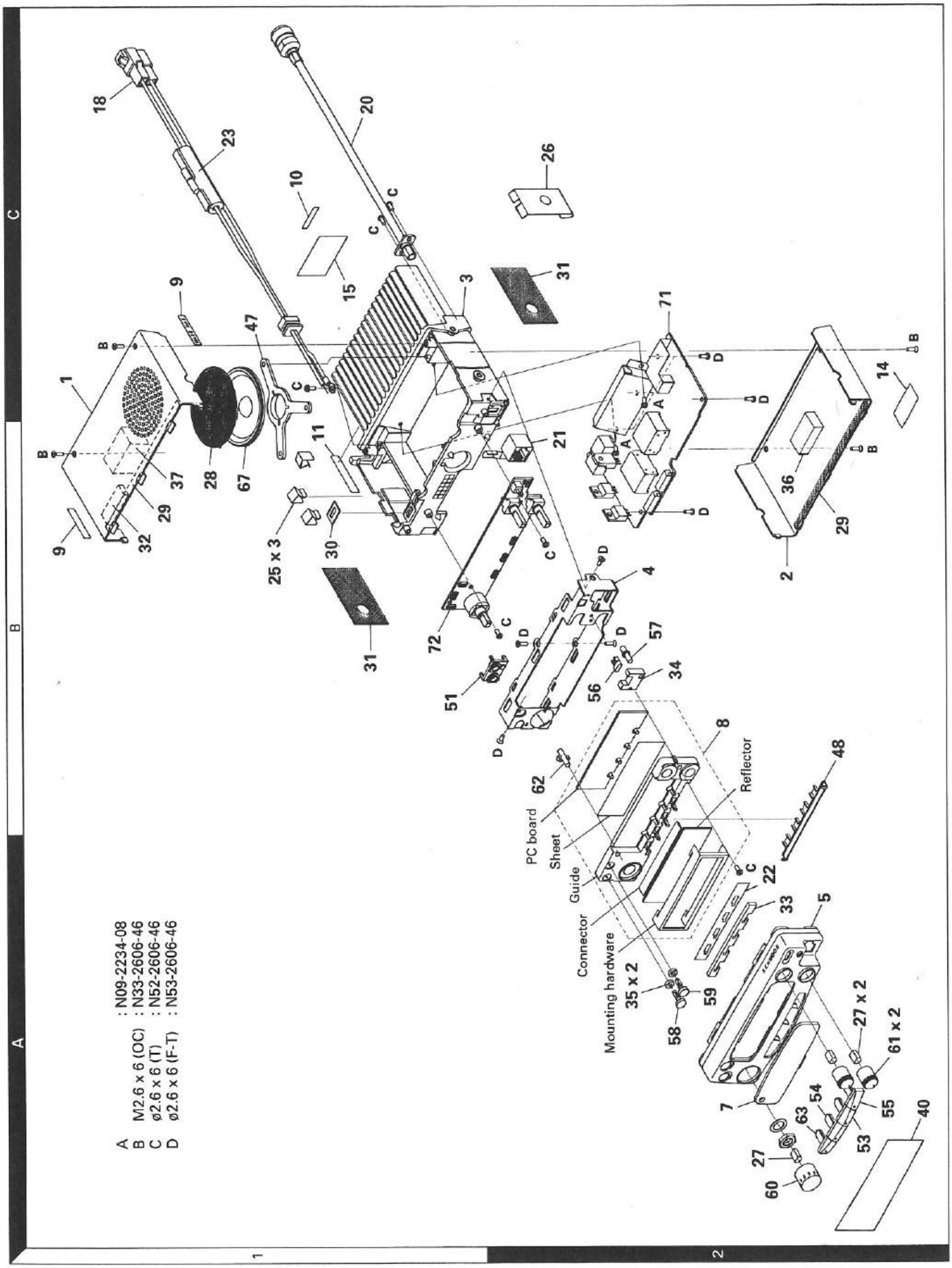
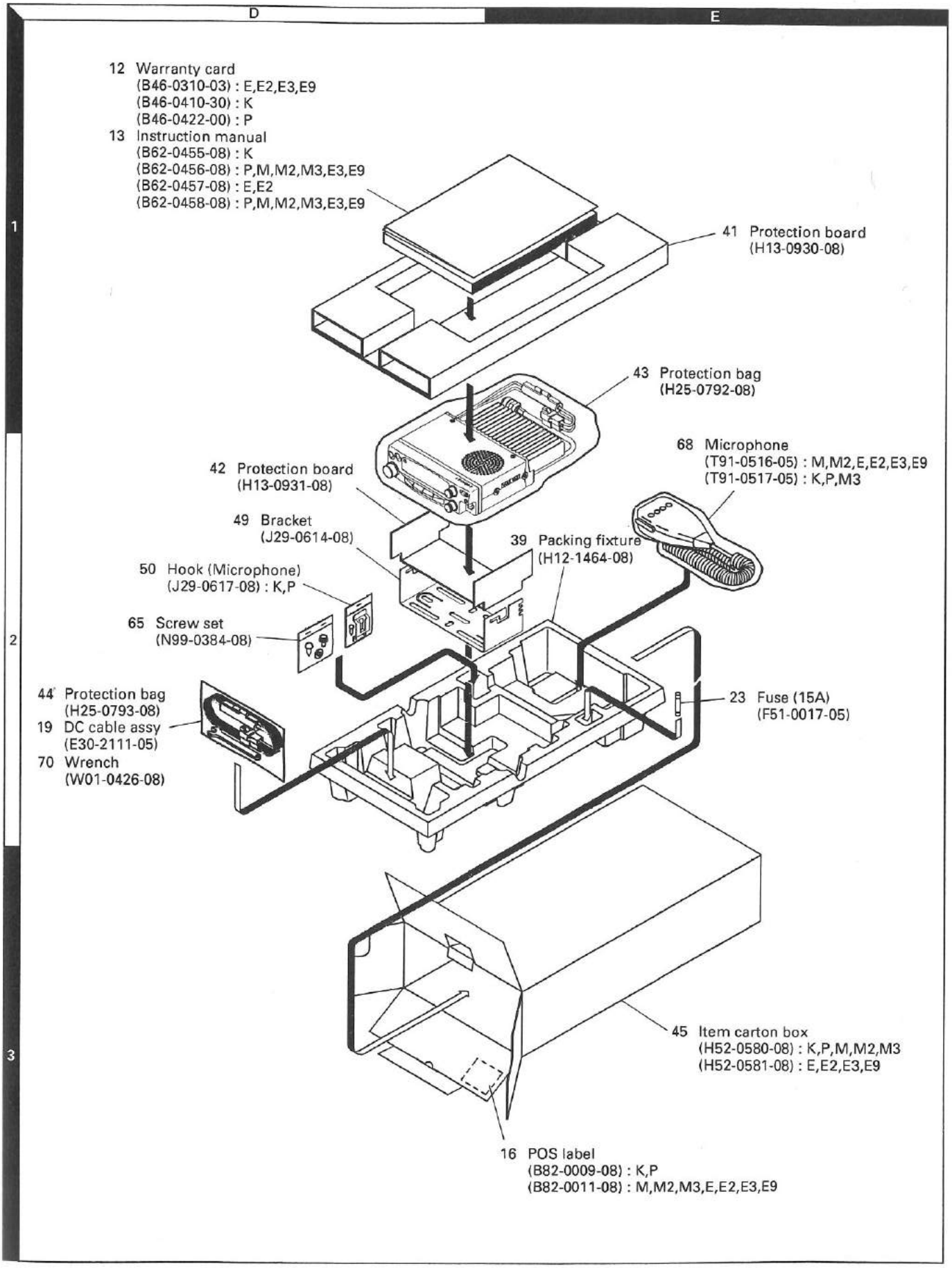
TM-251A/E

EXPLODED VIEW

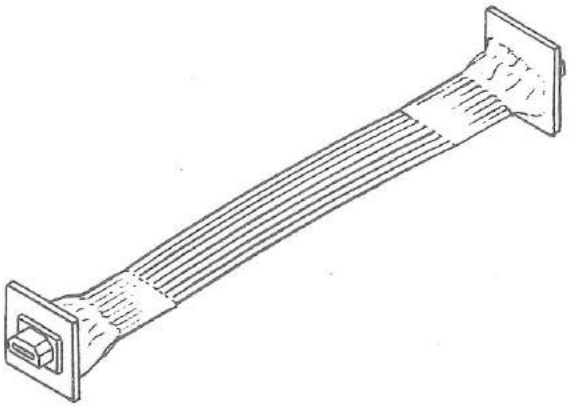


PACKING

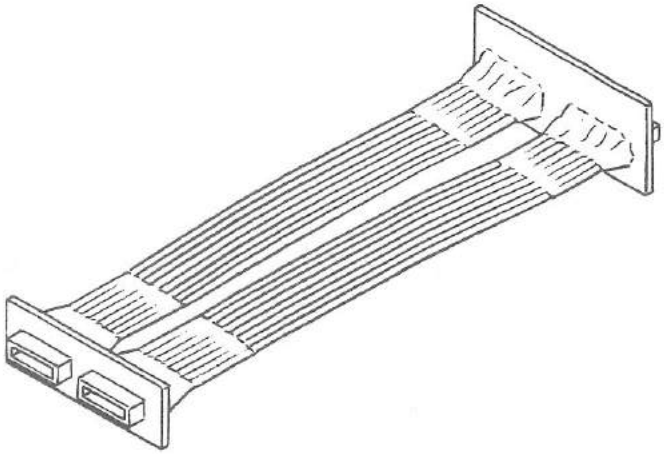

D
E
1
2
3
12 Warranty card
(B46-0310-03) : E,E2,E3,E9
(B46-0410-30) : K
(B46-0422-00) : P
13 Instruction manual
(B62-0455-08) : K
(B62-0456-08) : P,M,M2,M3,E3,E9
(B62-0457-08) : E,E2
(B62-0458-08) : P,M,M2,M3,E3,E9
41 Protection board
(H13-0930-08)
43 Protection bag
(H25-0792-08)
68 Microphone
(T91-0516-05) : M,M2,E,E2,E3,E9
(T91-0517-05) : K,P,M3
42 Protection board
(H13-0931-08)
49 Bracket
(J29-0614-08)
39 Packing fixture
(H12-1464-08)
50 Hook (Microphone)
(J29-0617-08) : K,P
65 Screw set
(N99-0384-08)
44 Protection bag
(H25-0793-08)
19 DC cable assy
(E30-2111-05)
70 Wrench
(W01-0426-08)
23 Fuse (15A)
(F51-0017-05)
45 Item carton box
(H52-0580-08) : K,P,M,M2,M3
(H52-0581-08) : E,E2,E3,E9
16 POS label
(B82-0009-08) : K,P
(B82-0011-08) : M,M2,M3,E,E2,E3,E9

ADJUSTMENT

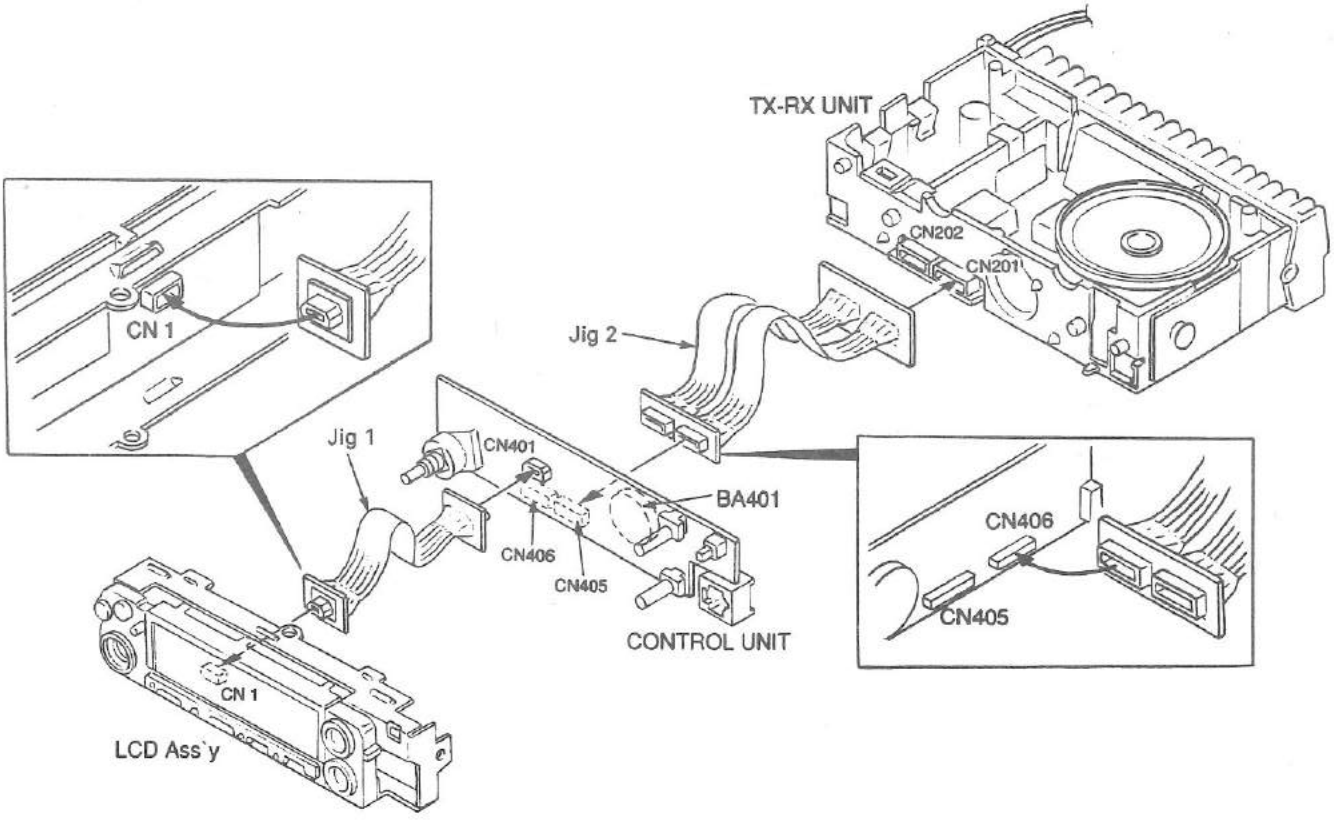
Jig 1 (11 pin flat cable)



Jig 2 (20 pin flat cable)



How to use



ADJUSTMENT

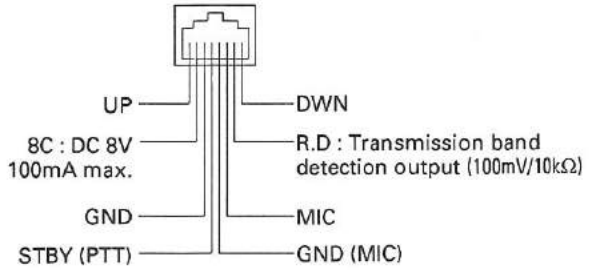
Measuring Equipment for Adjustment

1. Tester
   Input impedance: High
2. RF valve voltmeter (RF V.M)
   Input impedance: 1MΩ or more, 2 pF or less
   Voltage range: Full scale = 10mV to 300V
   Measurable frequency range: up to 450MHz
3. Frequency counter (f. counter)
   Input sensitivity: About 50mV
   Measurable frequency: 450MHz or more
4. DC power supply
   Voltage: Variable in the range 10 to 17V
   Current: 13A or more
5. Power meter
   Measurement power: 60W, 3W, 1W
   Impedance: 50Ω
   Measurable frequency: 450MHz
6. AF valve voltmeter (AF V.M)
   Input impedance: 1MΩ or more
   Voltage range: Full scale = 1mV to 30V
   Measurable frequency range: 50Hz to 10kHz
7. AF generator (AG)
   Output frequency: 100Hz to 10kHz
   Output voltage: 0.5mV to 1V
8. Line detector
   Measurable frequency: 450MHz
9. Spectrum analyzer
   Measurable frequency: 450MHz
10. Directional coupler
11. Oscilloscope
    High sensitivity with horizontal input terminal
12. Standard signal generator (SSG)
    The standard signal generator must be able to generate the 144 and 430MHz band frequencies and vary the amplitude and frequency.
    Output: –20 to 100dBμ
13. Dummy load
    8Ω, about 5W
14. Noise generator
    The noise generator must be able to generate noise similar to ignition noise containing high-frequency components of 450MHz or more.
15. Sweep generator
    The sweep generator must be able to sweep the 144 and 430MHz bands.
16. Tracking generator

Preparation

- Set the controls and switches to the positions listed below unless otherwise specified.

VOL control	Fully counterclockwise
SQL control	Fully counterclockwise
POWER switch	OFF
(For fixed stations) DC power supply POWER switch	OFF



Microphone socket
(as viewed from the front of the set)

- Use an insulated rod, such as a plastic rod, for adjustment (especially for trimmers, coils, etc.).
- To protect the signal generator, never connect the microphone to the microphone socket when the receiver section is adjusted.
- Before the power cord is connected, make sure the power switch is off.
- See the instruction manual for transmit and receive operations.

ADJUSTMENT

Common Section Adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Setting	1) Power supply voltage : 13.8V DC POWER SW : OFF VOL VR, SQL VR : Fully counterclockwise							
2. Reset	1) Hold down the MR key, and turn the power switch on. Confirm that all LCD segments turn on, then release the MR key.						Check	All LCD segments on
3. PLL lock voltage	1) 144MHz band FREQ. : 144.980MHz Receive and transmit.	DVM	TX-RX	TP201			Check	RX : 3.8~4.8V TX : 3.3~4.3V
	2) 430MHz band FREQ. : 435.000MHz **M,M2,M3,E,E2,E3,E9** FREQ. : 445.040MHz **K,P** Receive			TP202				3.8~4.8V **M,M2,M3,E,E2,E3,E9** 4.4~5.4V **K,P**
4. Transmit frequency	1) FREQ. : 144.980MHz Transmit	f. counter Dummy load	Rear panel	ANT	TX-RX	TC201	144.980MHz	±100Hz

Receiver Section Adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. BPF (144MHz band)	1) FREQ. : 145.980MHz AF VOL : 9 o'clock position Connect the distortion meter to the EXT. SP socket. (Dummy load : 8Ω) Connect the SSG to the ANT.	SSG Distortion meter Oscilloscope AF VTVM	Rear panel	EXT. SP	TX-RX			
	2) SSG output : -118dBm/0.28μV MOD : 1kHz DEV : ±3kHz					TC303 TC304	Adjust TC304, TC303, and TC304 in the order listed so that SINAD is the best.	
	3) SSG output : -122dBm/0.18μV MOD : 1kHz DEV : ±3kHz					TC301 TC302	Adjust TC302, TC301, and TC302 in the order listed so that SINAD is the best.	SINAD 12dB or more.
2. Crystal filter coil	1) SSG output : -88dBm/8.91μV MOD : 1kHz DEV : ±5kHz					L315	Best distortion rate.	SINAD 30dB or more.
3. BPF (430MHz band)	1) FREQ. : 435.040MHz **M,M2,M3,E,E2,E3,E9** FREQ. : 445.040MHz **K,P** AF VOL : 9 o'clock position Connect the distortion meter to the EXT. SP socket. (Dummy load : 8Ω) Connect the SSG to the ANT.							
	2) SSG output : -118dBm/0.28μV MOD : 1kHz DEV : ±3kHz					TC307 TC308	Adjust TC308, TC307, and TC308 in the order listed so that SINAD is the best.	
	3) SSG output : -122dBm/0.178μV MOD : 1kHz DEV : ±3kHz					TC305 TC306	Adjust TC306, TC305, and TC306 in the order listed so that SINAD is the best.	SINAD 12dB or more.

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
4. Sensitivity	1) 144MHz band **E,E2,E3,E9** FREQ. : 144.040MHz FREQ. : 145.040MHz FREQ. : 145.980MHz **K,P,M,M2,M3** FREQ. : 144.040MHz FREQ. : 145.980MHz FREQ. : 147.980MHz SSG output : –122dBm/0.178μV	SSG Distortion meter Oscilloscope AF VTVM	Rear panel	EXT. SP			Check	SINAD 12dB or more.
	2) 430MHz band **M,M2,M3,E,E2,E3,E9** FREQ. : 430.040MHz FREQ. : 435.040MHz FREQ. : 439.980MHz **K,P** FREQ. : 438.040MHz FREQ. : 445.040MHz FREQ. : 449.980MHz SSG output : –122dBm/0.178μV						Check	SINAD 12dB or more.
5. Major input S/N ratio	1) 144MHz band FREQ. : 145.040MHz **E,E2,E3,E9** FREQ. : 145.980MHz **K,P,M,M2,M3** SSG output : –53dBm/501μV AF output : 2.83V/8Ω	SSG Oscilloscope AF VTVM	Rear panel	EXT. SP			Check	S/N 50dB or more.
	2) 430MHz band FREQ. : 435.040MHz **M,M2,M3,E,E2,E3,E9** FREQ. : 445.040MHz **K,P** SSG output : –53dBm/501μV AF output : 2.83V/8Ω							S/N 46dB or more.
6. Distortion ratio	1) 144MHz band FREQ. : 145.040MHz **E,E2,E3,E9** FREQ. : 145.980MHz **K,P,M,M2,M3** SSG output : –73dBm/50μV AF output : 4V/8Ω	SSG Distortion meter Oscilloscope AF VTVM	Rear panel	EXT. SP			Check	5% or less.
	2) 430MHz band FREQ. : 435.040MHz **M,M2,M3,E,E2,E3,E9** FREQ. : 445.040MHz **K,P** SSG output : –73dBm/50μV AF output : 4V/8Ω							5% or less.
7. S-meter	1) 430MHz band FREQ. : 435.040MHz **M,M2,M3,E,E2,E3,E9** FREQ. : 445.040MHz **K,P** SSG output : –96dBm/3.55μV	SSG	Rear panel	ANT	TX-RX	VR1	Turn clockwise gradually until all the S-meter segments turn on.	All S-meter segments on.
	2) SSG output : OFF						Check	All S-meter segments off.
	3) 144MHz band FREQ. : 145.040MHz **E,E2,E3,E9** FREQ. : 145.980MHz **K,P,M,M2,M3** SSG output : –89dBm/7.94μV							All S-meter segments on.
	4) SSG output : OFF							All S-meter segments off.

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
8. Squelch	1) 144MHz band FREQ. : 145.040MHz **E,E2,E3,E9** FREQ. : 145.980MHz **K,P,M,M2,M3** SSG output : OFF Turn the SQL VR until noise disappears.	SSG Oscilloscope	Rear panel	EXT. SP			Check	Control position : 8~11 o'clock BUSY off.
	2) SSG output : –127dBm/0.1μV							Squelch is open. BUSY on.
	3) SQL VR : Fully clockwise							AF output off. BUSY off.
	4) SSG output : –116dBm/0.36μV							Squelch is open.
	5) 430MHz band FREQ. : 435.040MHz **M,M2,M3,E,E2,E3,E9** FREQ. : 445.040MHz **K,P** SSG output : OFF Turn the SQL VR until noise disappears.							Control position : 8~11 o'clock BUSY off.
	6) SSG output : –127dBm/0.1μV							Squelch is open. BUSY on.
	7) SQL VR : Fully clockwise							AF output off. BUSY off.
	8) SSG output : –116dBm/0.36μV							Squelch is open.

Transmitter Section Adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Power	1) FREQ. : 144.980MHz **E,E2,E3,E9** FREQ. : 145.940MHz **K,P,M,M2,M3**	Power meter Ammeter	Rear panel	ANT	TX-RX	VR101	Fully clockwise	57W or more.
	2) Power : High Transmit					VR101	55W	±2W 11A or less.
	3) Power : Low Transmit					VR102	5W	±1W
	4) Power : Mid						Check	10~14W
	5) **E,E2,E3,E9** FREQ. : 144.000MHz FREQ. : 145.940MHz **K,P,M,M2,M3** FREQ. : 144.000MHz FREQ. : 147.940MHz Power : High Transmit							50~60W 11A or less.
	6) **M2,M3,E2** FREQ. : 136.000MHz FREQ. : 173.940MHz Power : High Transmit							5W or more.
	7) Power : Mid Transmit							10~14W
	8) Power : Low Transmit							3~8W

ADJUSTMENT

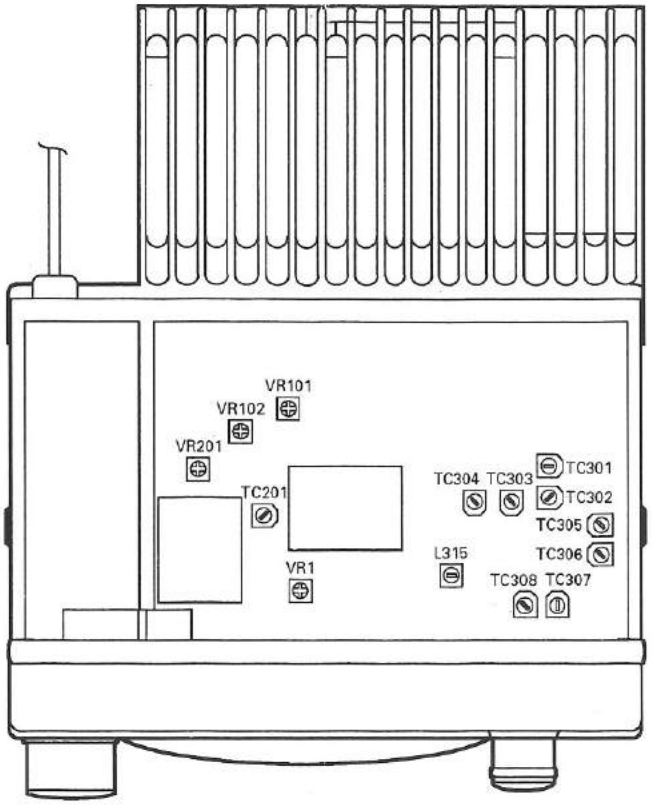
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
2. DEV.	1) FREQ. : 144.980MHz **E,E2,E3,E9** FREQ. : 145.940MHz **K,P,M,M2,M3** AG : 1kHz/25mV **E,E2,E3,E9** AG : 1kHz/50mV **K,P,M,M2,M3**	Line detector Oscilloscope AG	Rear panel	ANT	TX-RX	VR201	±4.3kHz (larger one)	±200Hz
	2) AG : 1kHz/2.5mV **E,E2,E3,E9** AG : 1kHz/5.0mV **K,P,M,M2,M3**						Check	±2.2~3.6kHz
3. TONE	1) FREQ. : 144.980MHz **E,E2,E3,E9** FREQ. : 145.940MHz **K,P,M,M2,M3** TONE key : ON Transmit After check TONE key : OFF	Line detector Oscilloscope	Rear panel	ANT			Check	±0.5~1.5kHz
4. DTSS	1) POWER SW : OFF Hold down the F, VFO, DTSS, and LOW keys, and turn the power switch on. Transmit Confirm, reset, and put the frequency in memory again.						Check the 1633Hz single tone.	±2.5kHz or more.
5. Abnormal spurious oscillation	1) **E,E3,E9** FREQ. : 144.000MHz FREQ. : 144.980MHz FREQ. : 145.940MHz **K,P,M** FREQ. : 144.000MHz FREQ. : 145.940MHz FREQ. : 147.940MHz **M2,M3,E2** FREQ. : 136.000MHz FREQ. : 145.940MHz FREQ. : 173.940MHz Power : High/Mid/Low Power supply voltage : 11.5 to 16.0V	Spectrum analyzer					Check	Spurious : –60dB or less There must be no abnormal spurious oscillation.
6. CTCSS	1) FREQ. : 145.440MHz For only units containing TSU-8 Set the tones of the main unit and monitor unit to the same frequency. (Press the F key, then the TONE key.) Turn SQL VR until noise disappears. Adjust mutually.	Monitor unit					Check	Mutual adjustment must be possible.
	2) Change the tone frequency and transmit it from the monitor unit.							The squelch must not be open.
7. Protection	1) FREQ. : 145.940MHz **E,E2,E3,E9** FREQ. : 147.940MHz **K,P,M,M2,M3** ANT : Open ANT : Short Transmit	Ammeter					Check	11.0A or less.

ADJUSTMENT

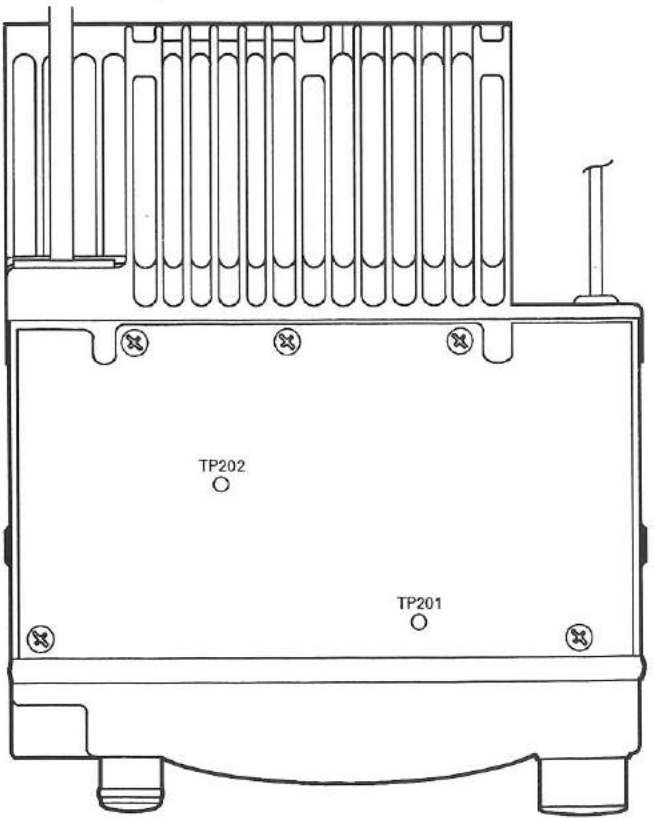
Adjustment Points

- **Top view**

TC201 : Transmit frequency
TC301~304 : 144MHz BPF
TC305~308 : 430MHz BPF
L315 : Crystal filter coil
VR1 : S-meter (430MHz)
VR101 : High power
VR102 : Low power
VR201 : DEV.



- **Bottom view**

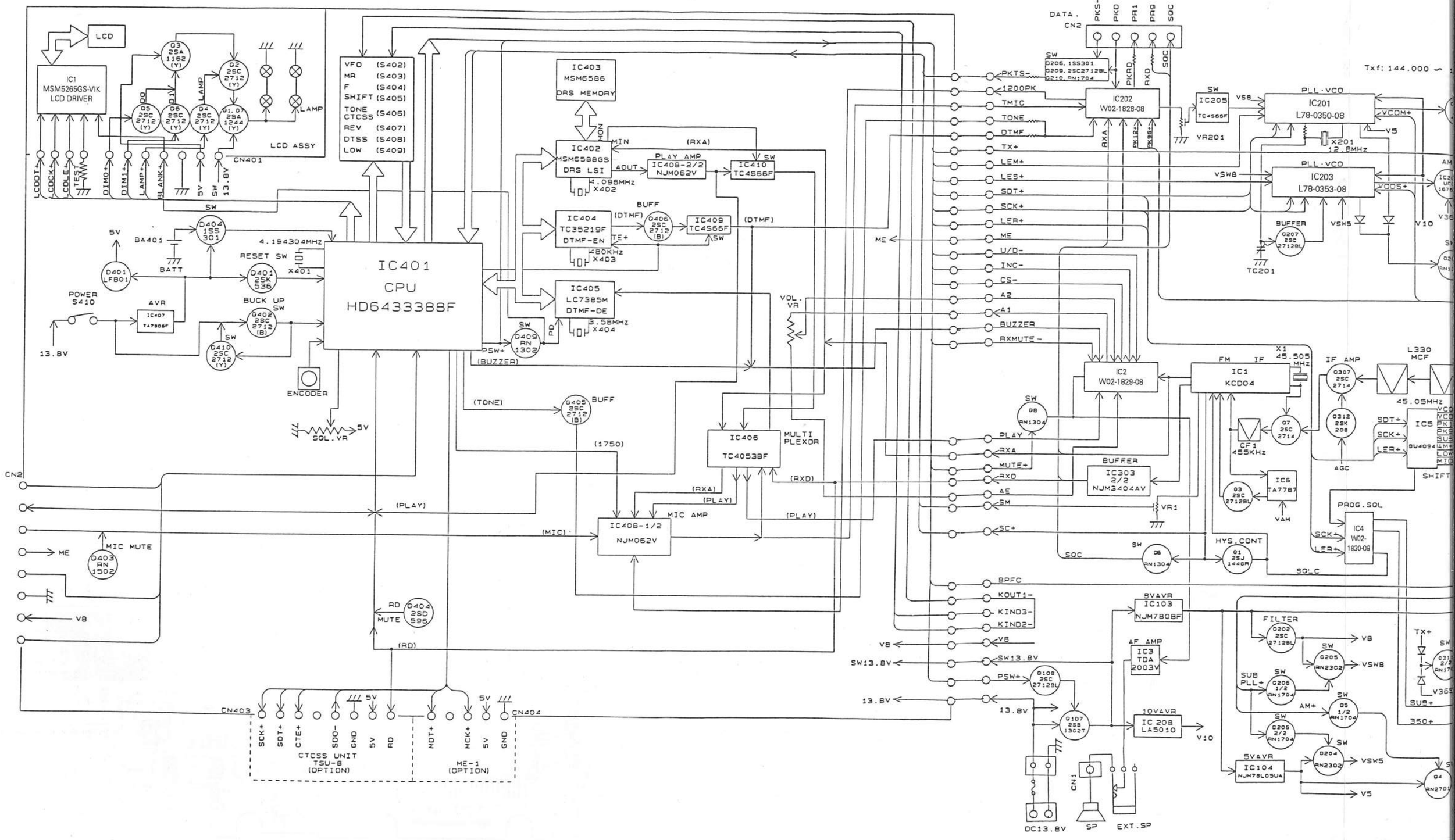


TERMINAL FUNCTION

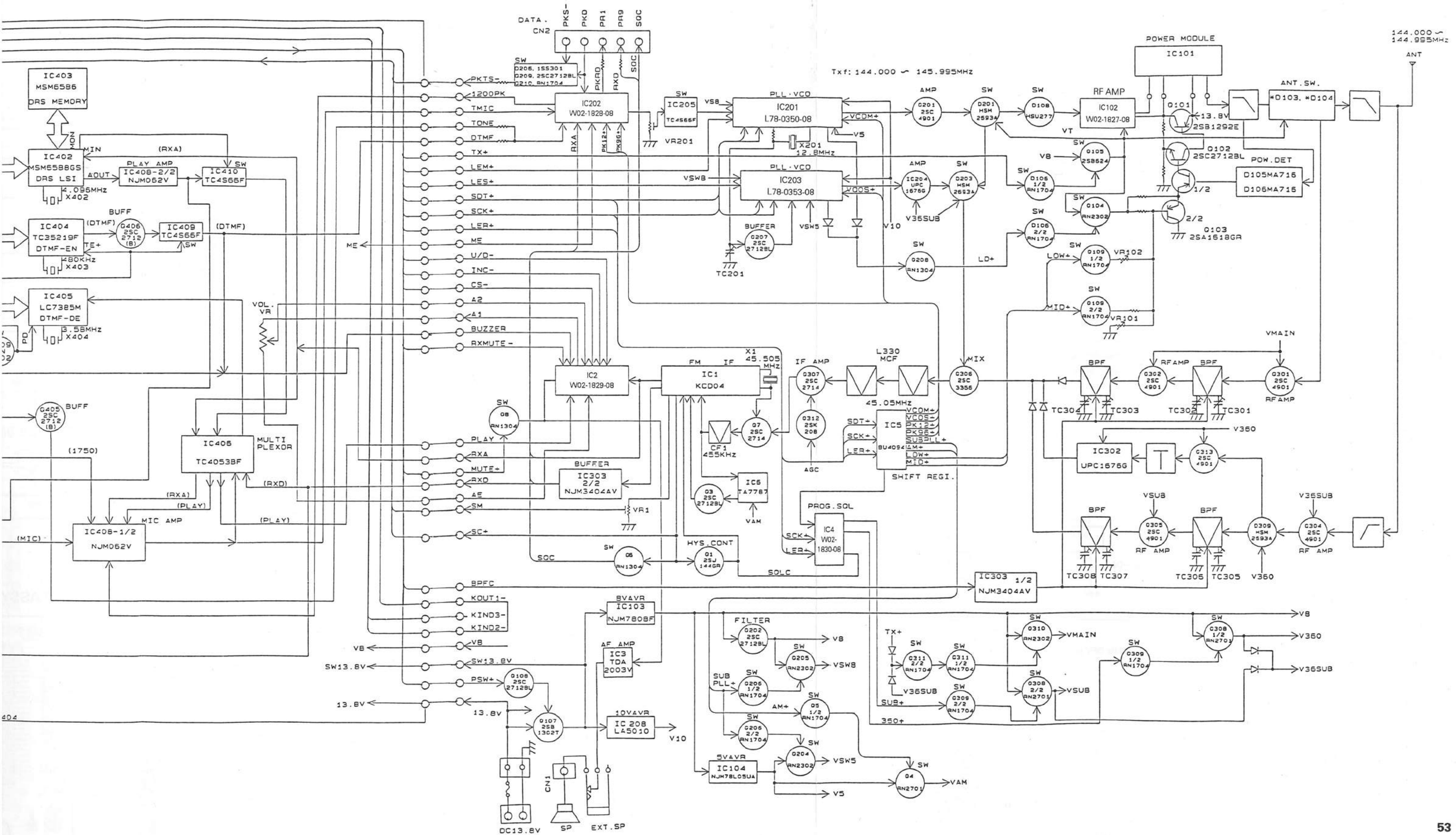
CN No.	Pin No.	Name	Function
TX-RX UNIT			
CN1	1	GND	GND
	2	SP	Speaker output
CN2	1	PKD	Packet data modulation input
	2	DE	GND
	3	PKS–	Packet PTT signal input
	4	PR9	Packet 9600-bps data demodulation output
	5	PR1	Packet 1200-bps data demodulation output
	6	SQC	Squelch control output
CN201	1	GND	GND
	2	KOUT1–	Frequency band identification data input
	3	ALD	Connected to GND
	4	KIND2–	Frequency band identification data output
	5	BPFC	Receive RF band-pass filter control input
	6	KIND3–	Frequency band identification data output
	7	MUTE+	Audio mute control input
	8	SDT+	PLL data, shift register serial data input
	9	SCK+	PLL data, shift register serial clock input
	10	LEM+	144MHz-band PLL enable input (main PLL)
	11	LES+	430MHz-band PLL enable input (sub PLL)
	12	LER+	Shift register enable input
	13	TX+	Transmission start signal input
	14	NC	
	15	NC	
	16	NC	
	17	SC+	Squelch busy control output
	18	SM	S-meter output
	19	RXA	Audio signal output
	20	RXD	Demodulation signal output
CN202	1	NC	
	2	U/D–	Audio electronic VR up/down control input
	3	INC–	Audio electronic VR increment control input
	4	CS–	Audio electronic VR chip select input
	5	AE	GND
	6	A2	Audio input (from AF VOL of control unit)
	7	A1	Audio output (to AF VOL of control unit)
	8	BUZZER	Beeper input (Beep and DTMF tone)
	9	RX MUTE–	Receive audio mute control input
	10	PLAY	Digital recording playback tone input
	11	ME	MIC GND
	12	DTMF	DTMF modulation input
	13	TONE	Sub-tone modulation input
	14	TMIC	Audio input (from the mic amp circuit of control unit)
	15	1200PK	Packet modulation data 1200-bps output
	16	PKTS–	Packet PTT output
	17	PSW+	Power switch control input
	18	V8	+8V
	19	SW13.8V	Switched 13.8V
	20	13.8V	+13.8V
CONTROL UNIT			
CN401	1	LCDDT+	LCD driver data output
	2	LCDCK+	LCD driver clock output
LCD	3	LCDLE+	LCD driver enable output
ASSY	4	TEST+	Not used
	5	DIM0+	Dimmer control output
	6	DIM1+	Dimmer control output
	7	LAMP+	Lamp drive output
	8	NC	
	9	GND	GND
	10	5V	+5V
	11	SW13.8V	Switched 13.8V

CN No.	Pin No.	Name	Function
CN402	1	DWN	MIC SW DOWN, MR, PF input : (K bus serial input)
	2	RD	Demodulation signal, DRS playback tone output : (Controller connection detection input)
MODULAR			
FPC	3	MIC	Microphone audio input : (Controller audio input)
MC-45	4	ME	Microphone ground (GND)
	5	PTT	Microphone PTT input : (K bus serial output)
	6	GND	GND
	7	V8	+8V
	8	UP	MIC SW UP, CALL, VFO input : (K bus serial output)
CN403	1	SCK+	CTCSS serial clock output
	2	SDT+	CTCSS serial data output
TSU-8	3	CTE+	CTCSS serial data strobe output
(Option)	4	NC	
	5	SDO–	CTCSS tone detection input
	6	GND	GND
	7	5V	+5V
	8	RD	Demodulation signal output
CN404	1	GND	GND
	2	5V	+5V
ME-1	3	MCK+	ME-1 serial clock output
(Option)	4	NC	
	5	MDT+	ME-1 serial data input/output
CN405	1	GND	GND
	2	KOUT1–	Frequency band identification data output
TX-RX	3	ALD	Not used
UNIT	4	KIND2–	Frequency band identification data input
CN201	5	BPFC	Receive RF band-pass filter control output
	6	KIND3–	Frequency band identification data input
	7	MUTE+	Audio mute control output
	8	SDT+	PLL data, shift register serial data output
	9	SCK+	PLL data, shift register serial clock output
	10	LEM+	144MHz-band PLL enable output (main PLL)
	11	LES+	430MHz-band PLL enable output (sub PLL)
	12	LER+	Shift register enable output
	13	TX+	Transmission start signal output
	14	NC	
	15	NC	
	16	NC	
	17	SC+	Squelch busy control input (To CPU)
	18	SM	S-meter input (To CPU)
	19	RXA	Audio signal input
	20	RXD	Demodulation signal input
CN406	1	NC	
	2	U/D–	Audio electronic VR up/down control output
TX-RX	3	INC–	Audio electronic VR increment control output
UNIT	4	CS–	Audio electronic VR chip select output
CN202	5	AE	GND
	6	A2	Audio output (from AF VOL)
	7	A1	Audio input (to AF VOL)
	8	BUZZER	Beeper output (Beep and DTMF tone)
	9	RX MUTE–	Receive audio mute control output
	10	PLAY	Digital recording playback tone output
	11	ME	MIC GND
	12	DTMF	DTMF modulation output
	13	TONE	Sub-tone modulation output
	14	TMIC	Audio output (from the mic amp circuit)
	15	1200PK	Packet modulation data 1200-bps input
	16	PKTS–	Packet PTT input
	17	PSW+	Power switch control output
	18	V8	+8V
	19	SW13.8V	Switched 13.8V
	20	13.8V	+13.8V

BLOCK DIAGRAM

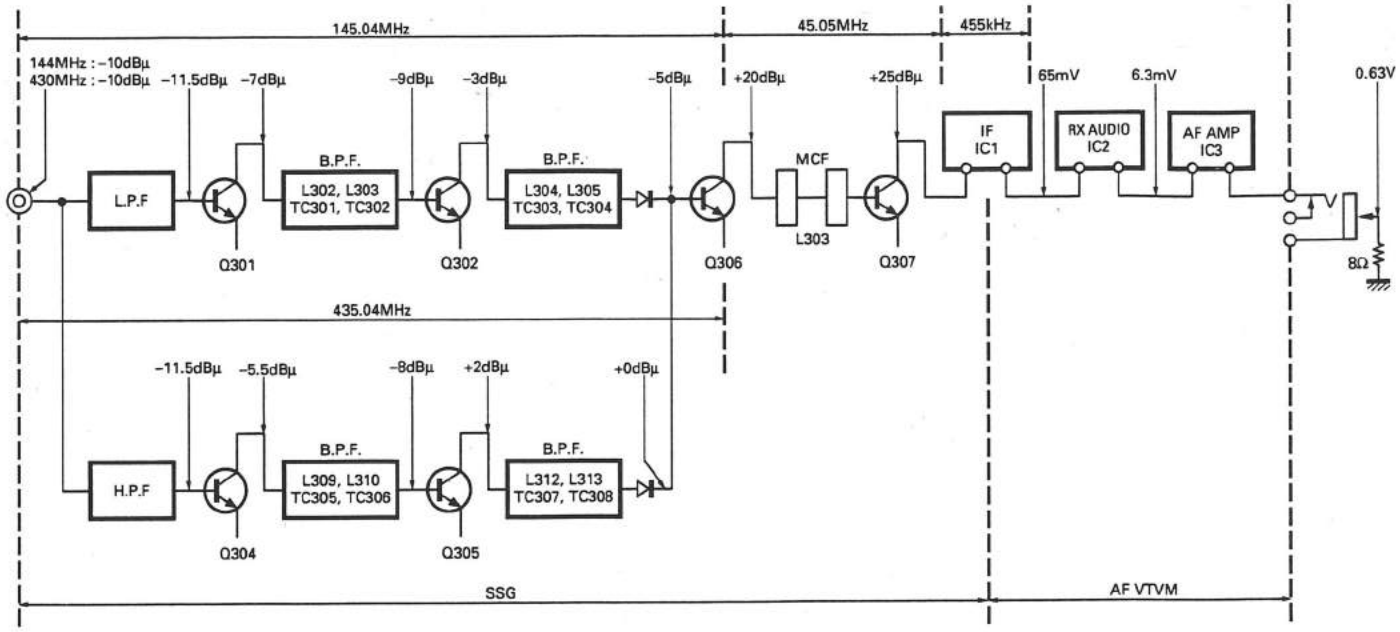


BLOCK DIAGRAM



LEVEL DIAGRAM

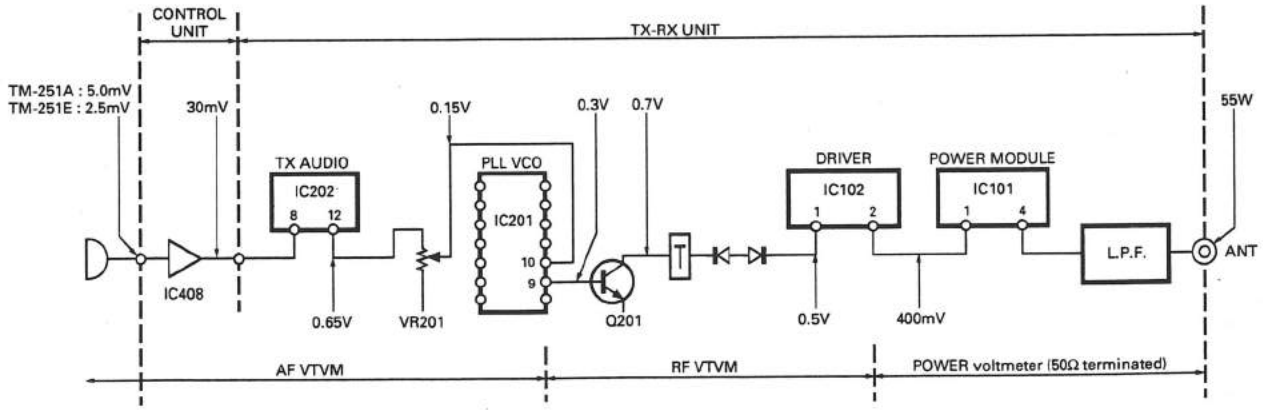
Receiver Section



Note 1 : 12dB SINAD is obtained at this signal generator level when the signal is input from the signal generator via the 0.01μF coupling at each point the first IF. Unit : dBμ EMF.

Note 2 : The AF level is measured with the AF valve voltmeter when the 40dBμ EMF signal generator signal that is modulated by a modulation signal of 1kHz with a deviation of 3kHz is received and the AF output is adjusted with AF VOL to 0.63V/8Ω.

Transmitter Section



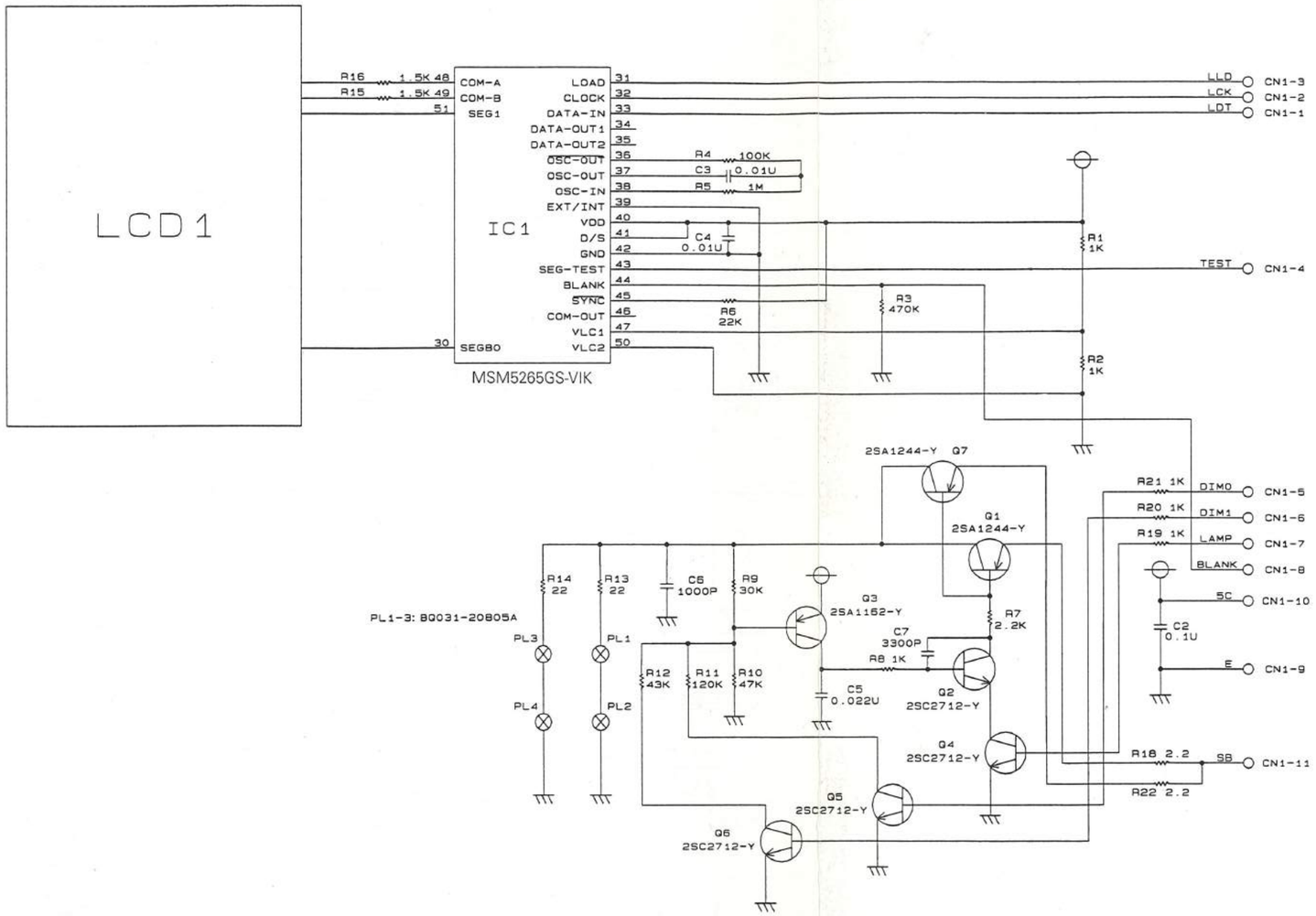
Note 1 : Set the AF generator so that the MIC socket input is 3kHz DEV at 1kHz MOD.

Note 2 : The transmit frequency is 144.98MHz.

Note 3 : The High/Low switch is High.

TM-251A/E CIRCUIT DIAGRAM / PC BOARD VIEWS

LCD ASSY (B38-0721-08)



2SA1162
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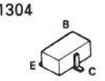
RN1304



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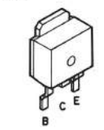
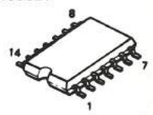
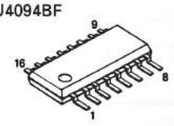


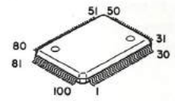
TC4066BF



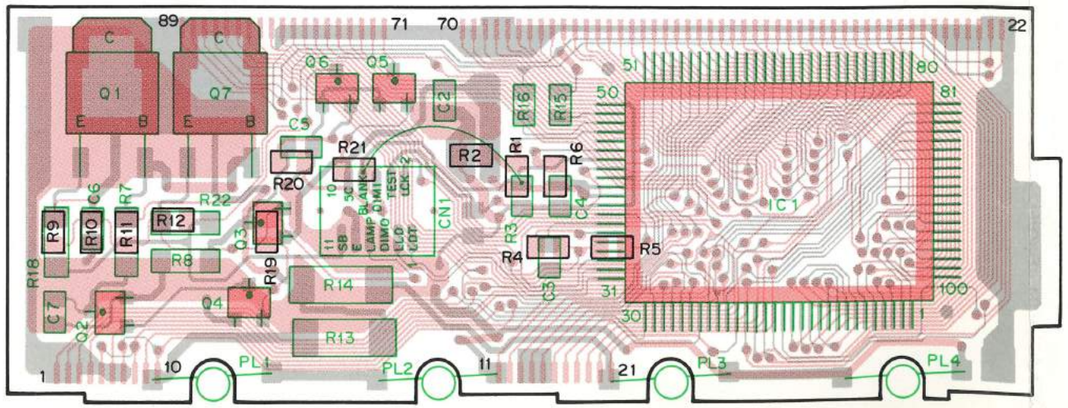
BU4094BF



MSM5265GS-VIK

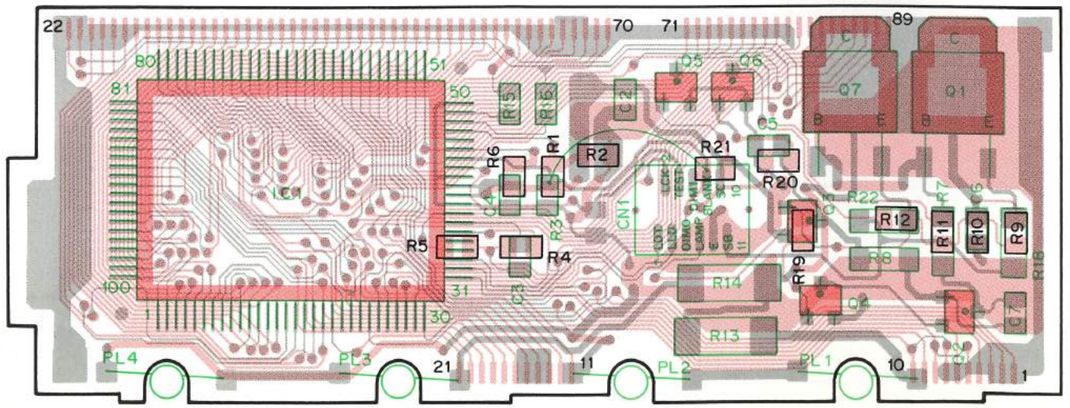


LCD ASSY (B38-0721-08) Component side view



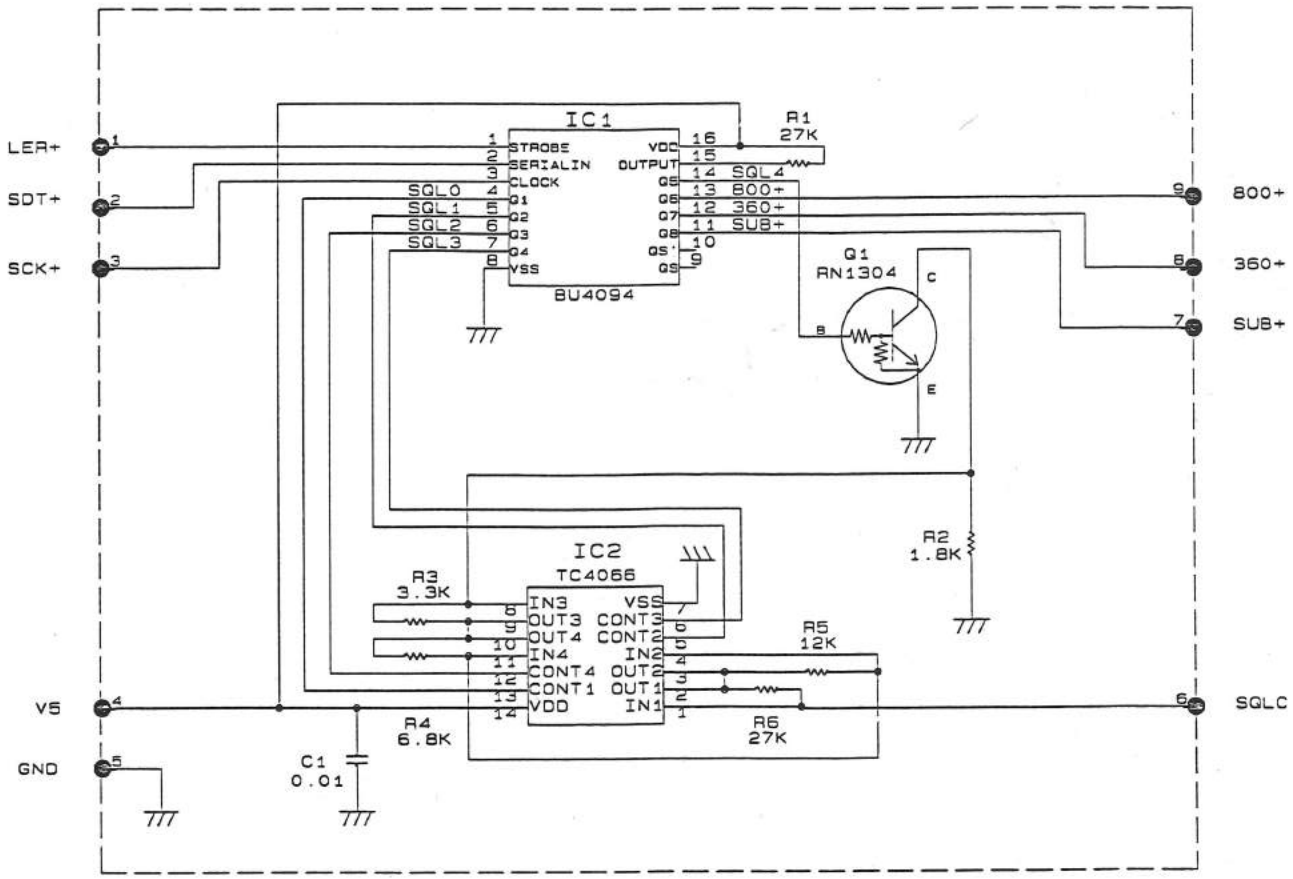
LCD ASSY (B38-0721-08) Foil side view

Component side
Foil side

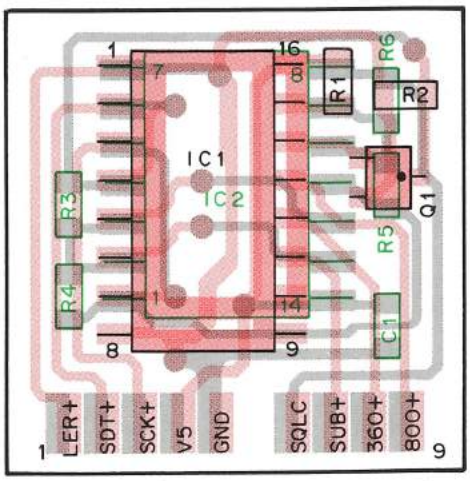


CIRCUIT DIAGRAM / PC BOARD VIEWS TM-251A/E

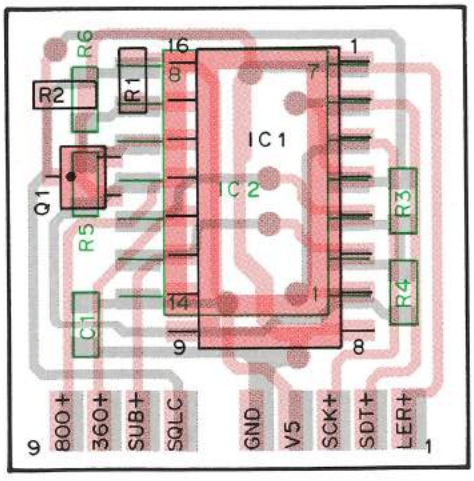
IC4 : PROG SQL (W02-1830-08)



IC4 : PROG SQL (W02-1830-08) Component side view



IC4 : PROG SQL (W02-1830-08) Foil side view

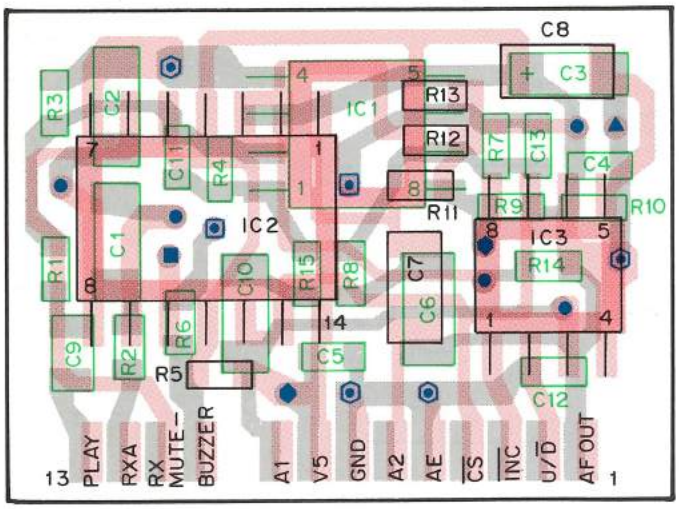


Component side
Foil side

TM-251A/E PC BOARD VIEWS

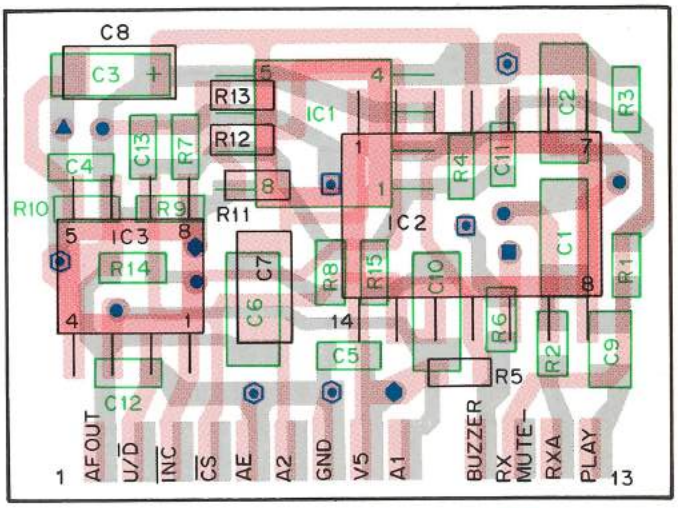
IC2 : RX AUDIO (W02-1829-08)

Component side view

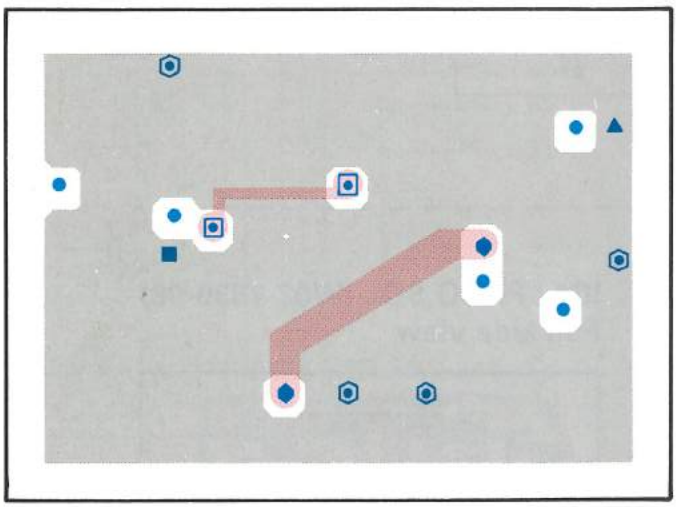


A pattern
B pattern

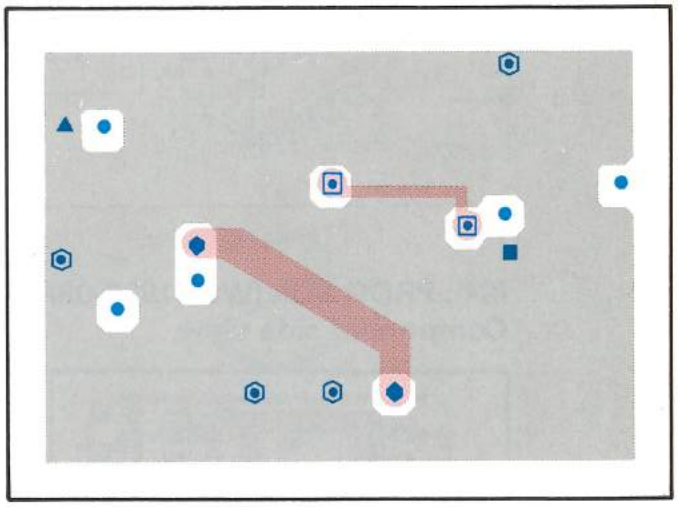
Foil side view



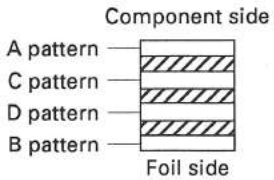
A pattern
B pattern



C pattern
D pattern



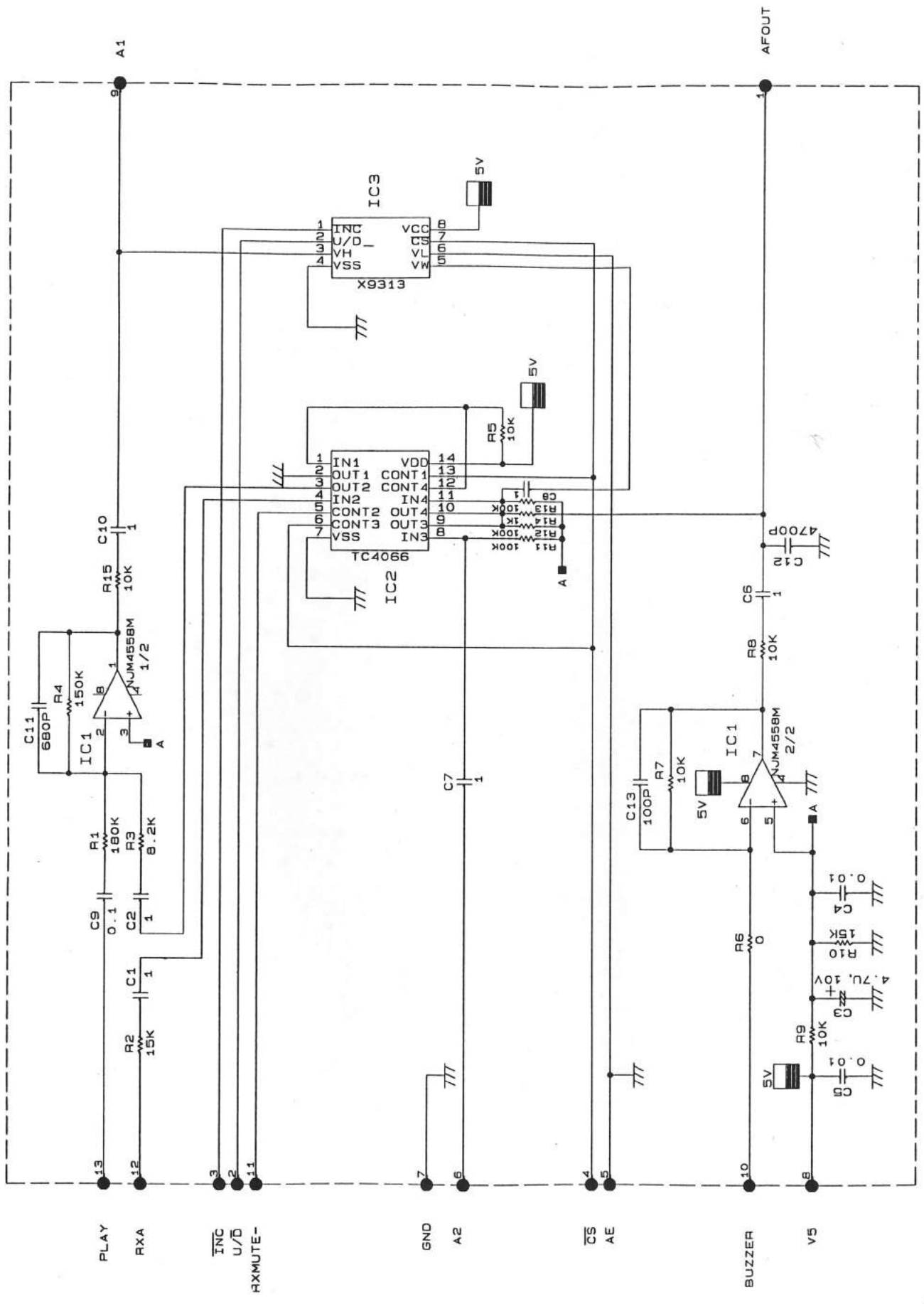
C pattern
D pattern



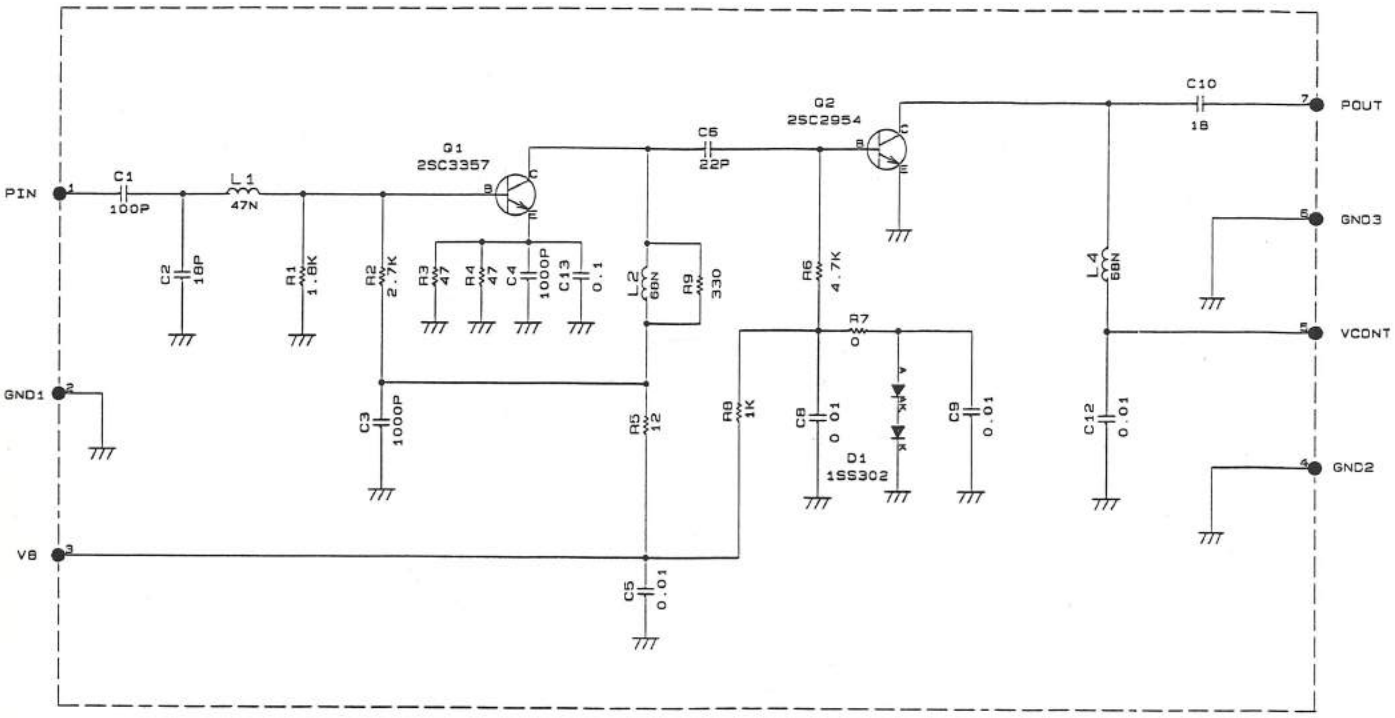
- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, B and C connected
- A, B and D connected
- A, C and D connected
- B, C and D connected
- A, B, C and D connected
- A only
- B only
- C only
- D only

No mark is not connected

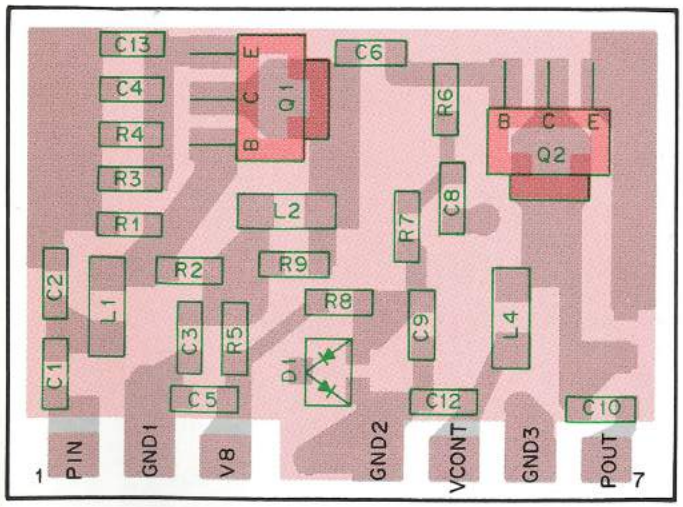
IC2 : RX AUDIO (W02-1829-08)



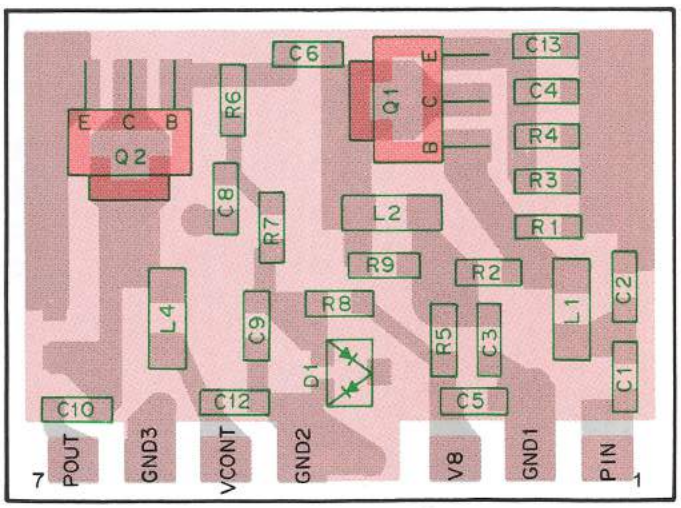
IC102 : 144MHz RF AMP (W02-1827-08)



IC102 : 144MHz RF AMP (W02-1827-08) Component side view

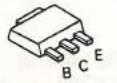


IC102 : 144MHz RF AMP (W02-1827-08) Foil side view

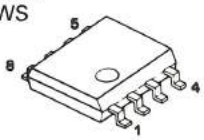


Component side
Foil side

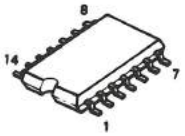
2SC2954
2SC3357



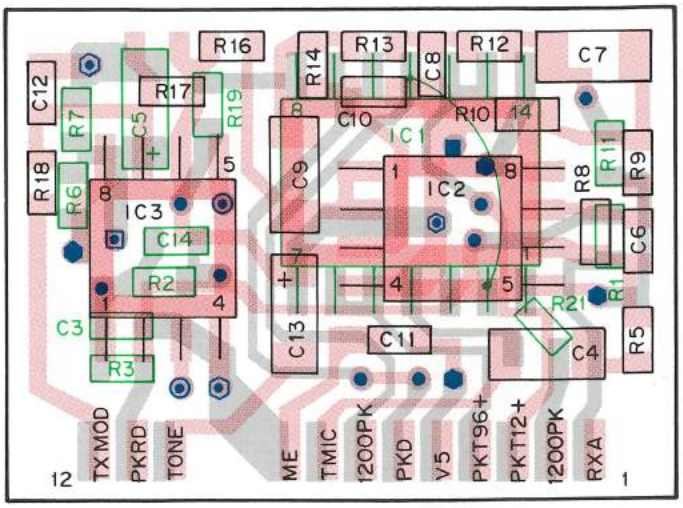
NJM3404AM
NJM4558M
X9313WS



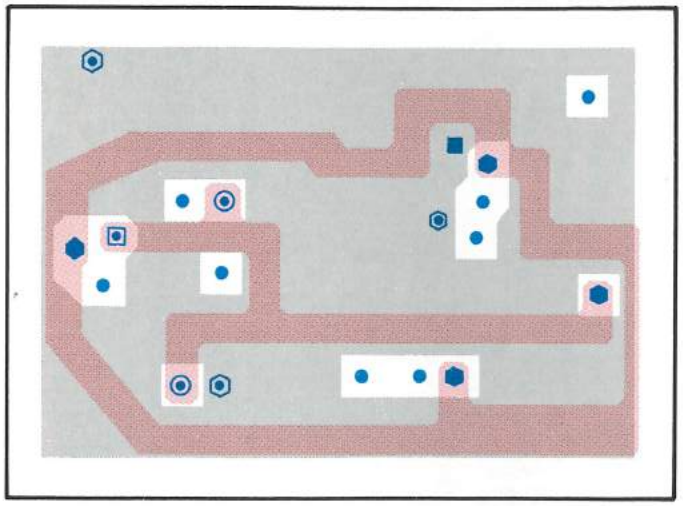
TC4066BF



IC202 : TX AUDIO (W02-1828-08)
Component side view

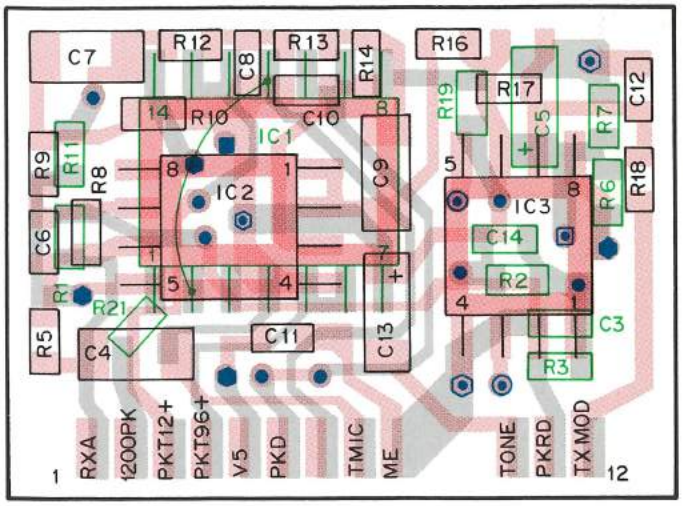


A pattern
B pattern



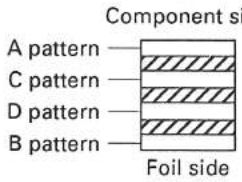
C pattern
D pattern

IC202 : TX AUDIO (W02-1828-08)
Foil side view



A pattern
B pattern

C pattern
D pattern

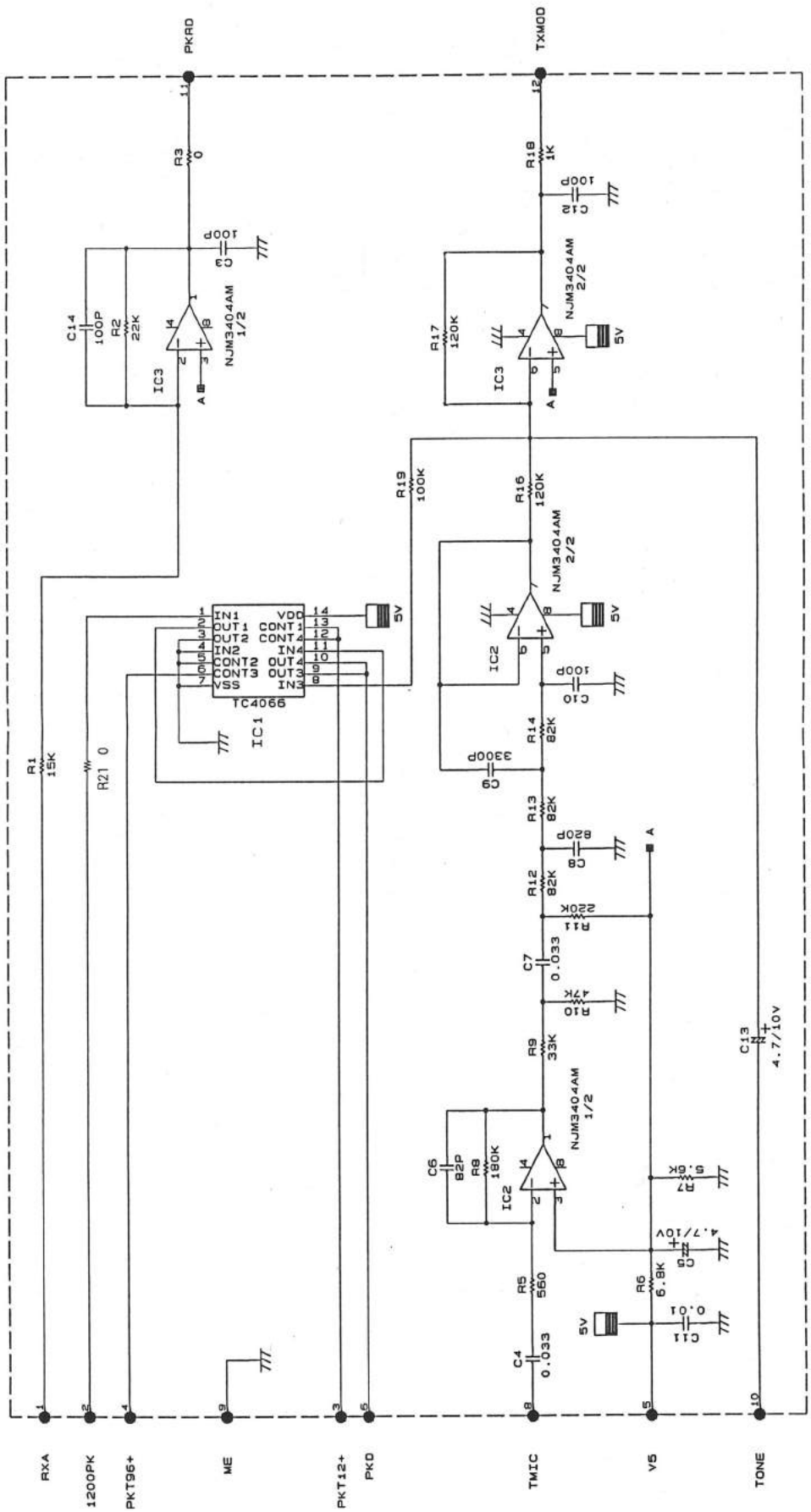


- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, B and C connected
- A, B and D connected
- A, C and D connected
- B, C and D connected
- A, B, C and D connected
- A only
- B only
- C only
- D only

No mark is not connected

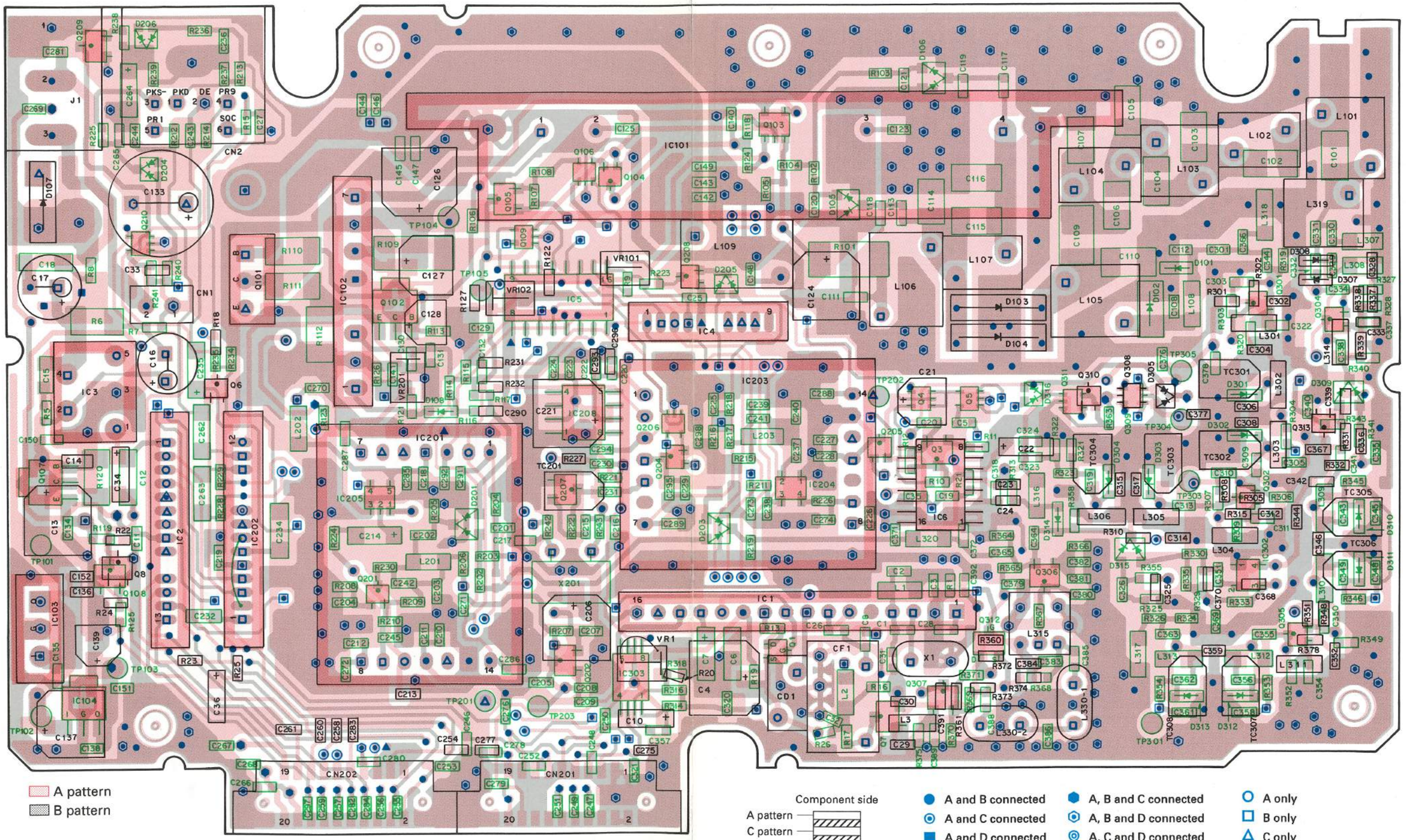
CIRCUIT DIAGRAM / PC BOARD VIEWS TM-251A/E

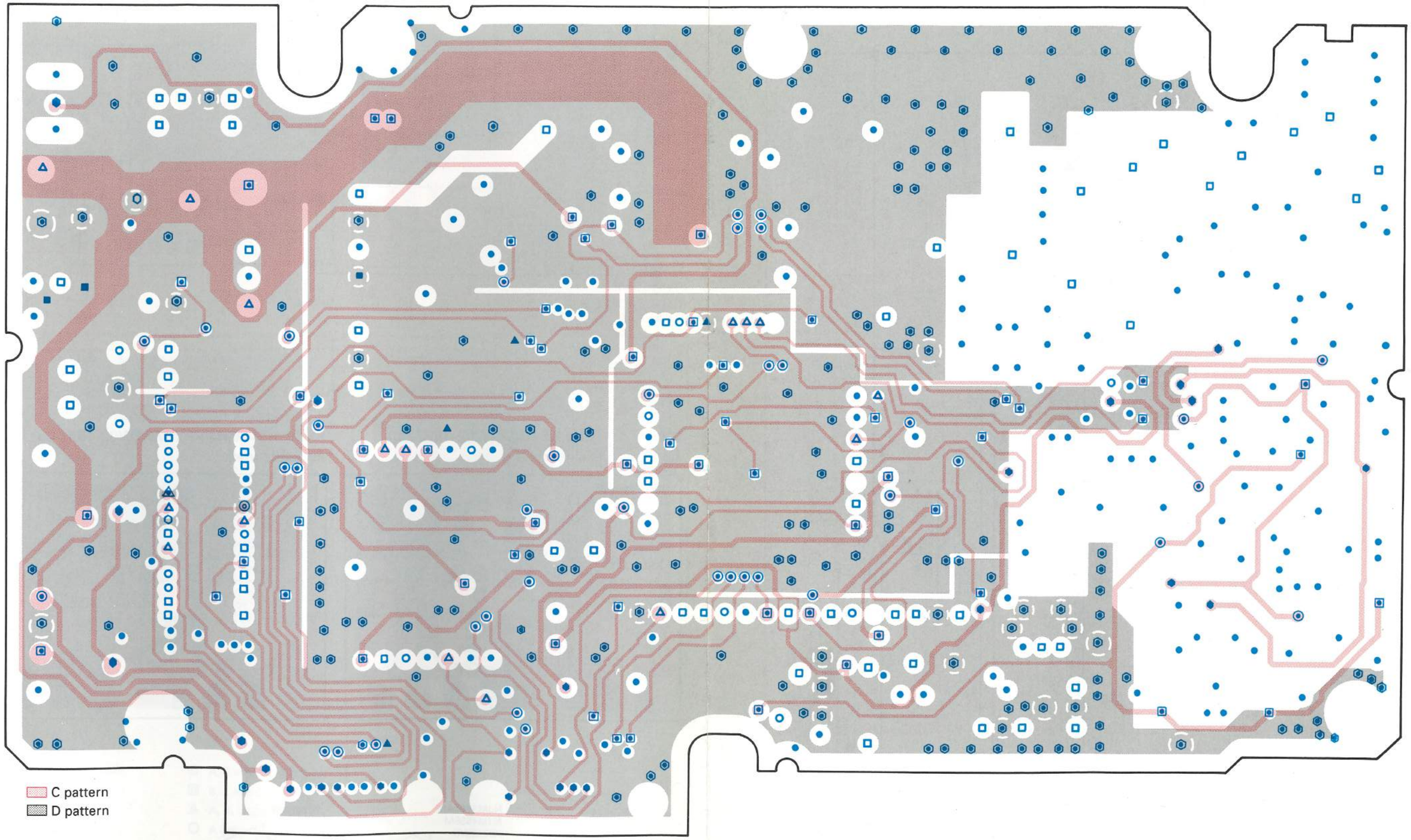
IC202 : TX AUDIO (W02-1828-08)



TM-251A/E PC BOARD VIEWS

TX-RX UNIT (W02-1810-08) Component side view





C pattern
D pattern

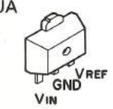
2SB624
2SC2712
2SC2714
2SC3356

2SC4901YK-02TR
RN1304
RN2302

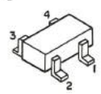
2SB1302
2SD1621

2SJ144
2SK208

NJM78L05UA

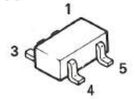


µPC1676G

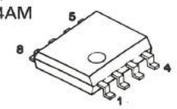


S-AV24-01K

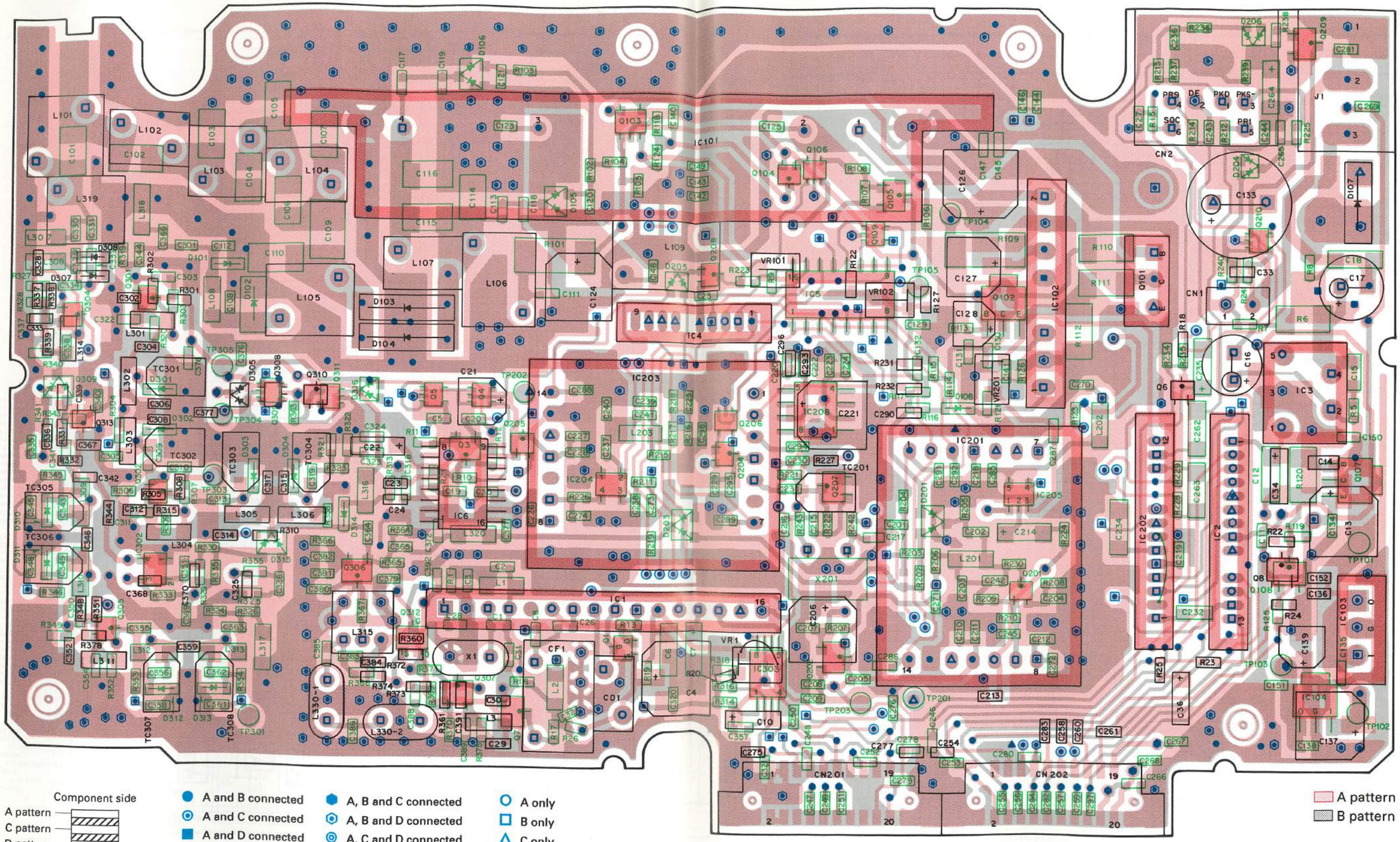
TC4S66F



LA5010M
NJM3404AM



TX-RX UNIT (W02-1810-08) Foil side view



Component side

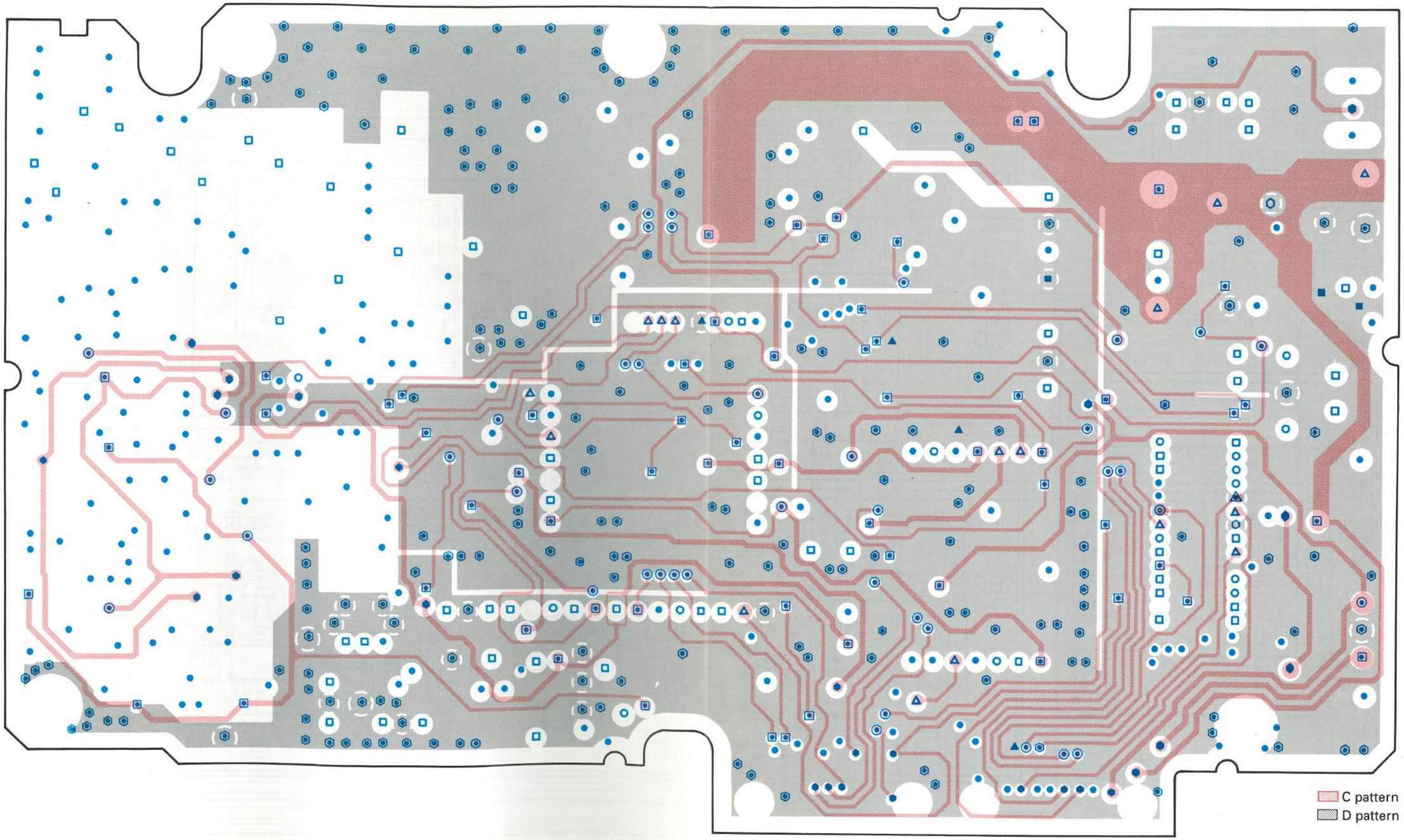
A pattern
C pattern
D pattern
B pattern

Foil side

- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, B and C connected
- A, B and D connected
- A, C and D connected
- B, C and D connected
- A, B, C and D connected
- A only
- B only
- C only
- D only

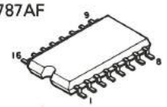
No mark is not connected

A pattern
B pattern

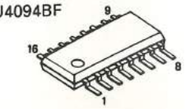


C pattern
D pattern

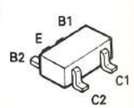
TA7787AF



BU4094BF



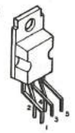
2SA1618GR
RN1704
RN2701



2SB1292

NJM7808A

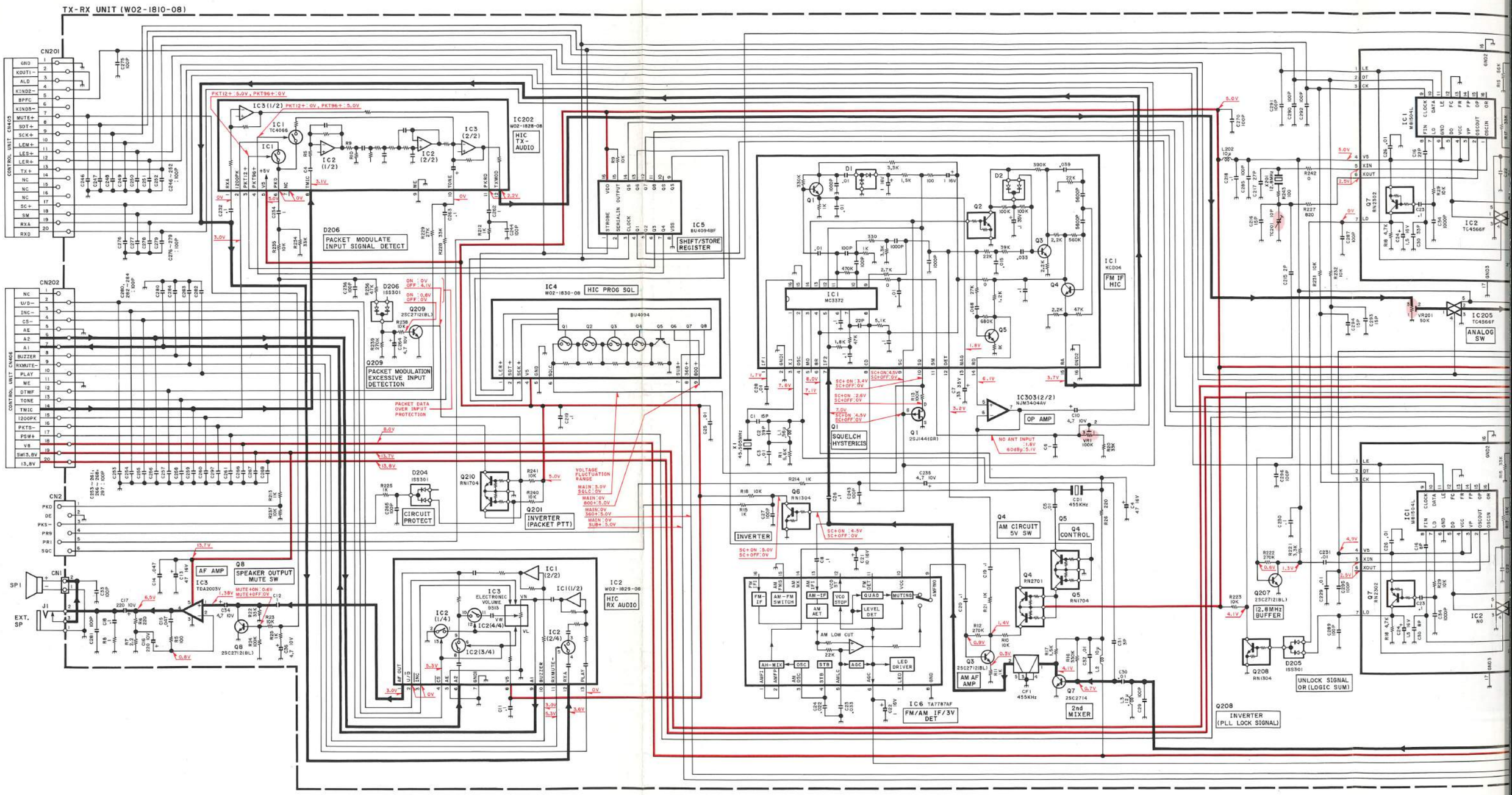
TDA2003V

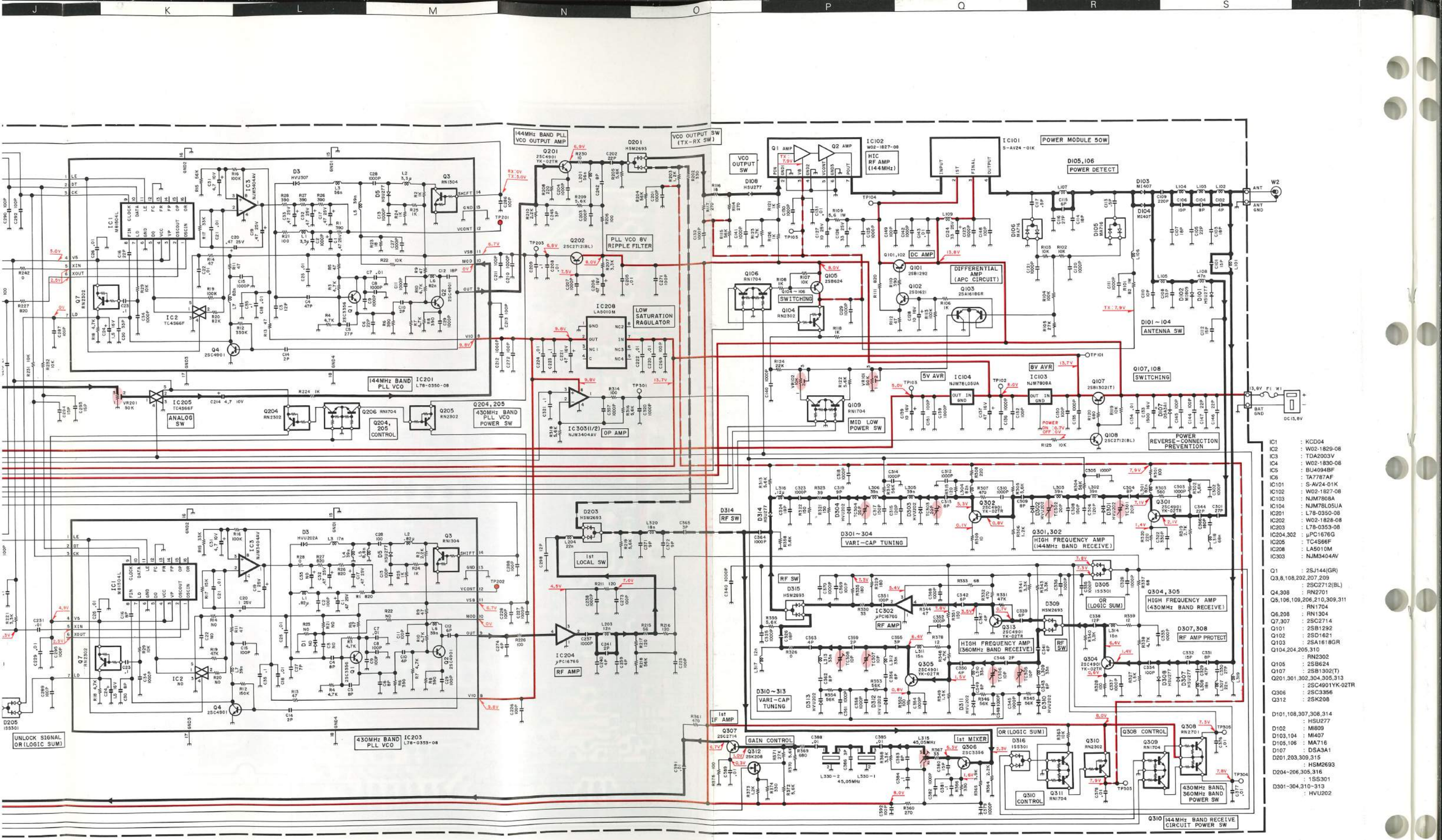


1 : Non inverting input
2 : Inverting input
3 : Ground
4 : Output
5 : Supply voltage

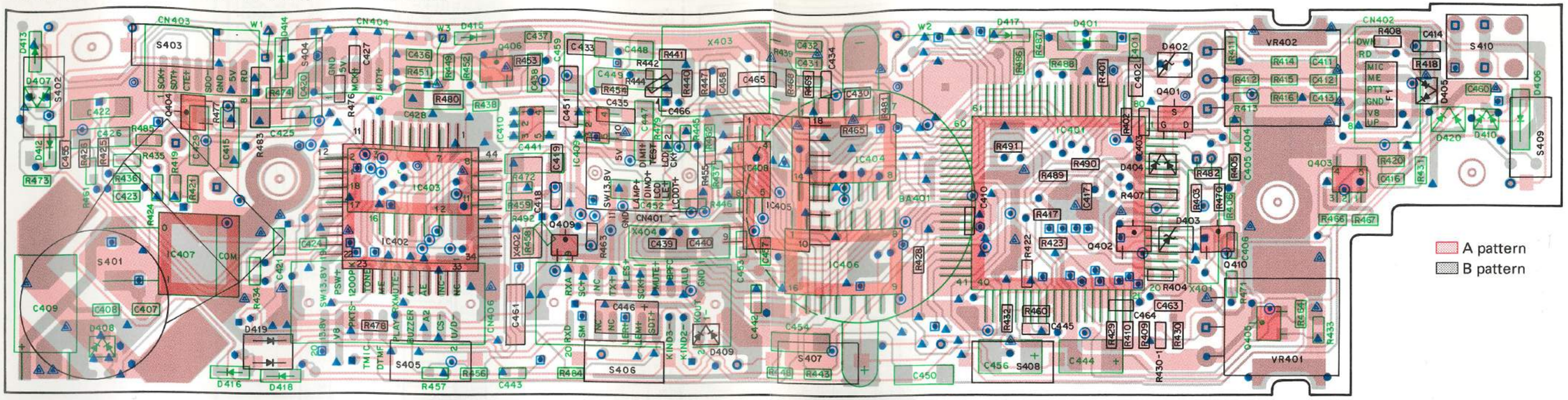
TM-251A/E CIRCUIT DIAGRAM

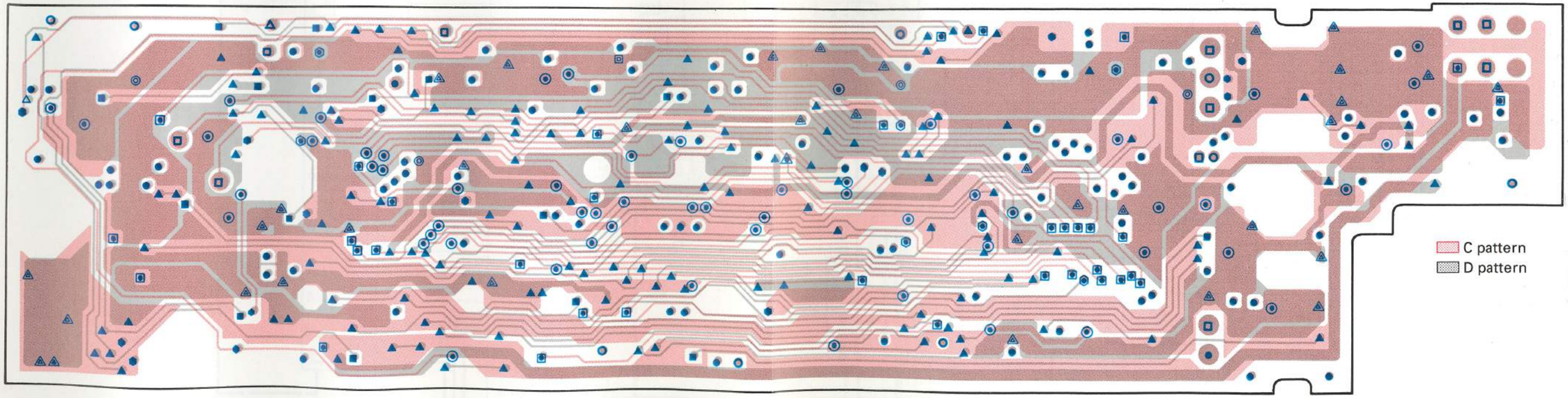
TX-RX UNIT (W02-1810-08)




144MHz BAND PLL VCO OUTPUT AMP
VCO OUTPUT SW (TX-RX SW)
VCO OUTPUT SW
IC102 W02-1827-08 HIC RF AMP (144MHz)
IC101 S-AV24-01K
POWER MODULE 50W
D105,106 POWER DETECT
PLL VCO 8V RIPPLE FILTER
LOW SATURATION REGULATOR
IC208 LA5010M
144MHz BAND PLL VCO
IC201 L78-0350-08
IC205 TC4S66F ANALOG SW
Q204,205 430MHz BAND PLL VCO POWER SW
Q204,205 CONTROL
IC303(1/2) NJM3404AV OP AMP
Q101,102 DC AMP
DIFFERENTIAL AMP (APC CIRCUIT)
SWITCHING
D101~104 ANTENNA SW
5V AVR
8V AVR
IC104 NJM78L05UA
IC103 NJM7808A
Q107,108 SWITCHING
MID LOW POWER SW
POWER ON 6.7V OFF 0V
POWER REVERSE-CONNECTION PREVENTION
D314 RF SW
D301~304 VARI-CAP TUNING
Q301,302 HIGH FREQUENCY AMP (144MHz BAND RECEIVE)
Q304,305 HIGH FREQUENCY AMP (430MHz BAND RECEIVE)
HIGH FREQUENCY AMP (360MHz BAND RECEIVE)
D310~313 VARI-CAP TUNING
IC302 μPC1676G RF AMP
1st LOCAL SW
IC204 μPC1676G RF AMP
1st IF AMP
1st MIXER
GAIN CONTROL
Q307 2SC2714
Q312 2SK208
IC303(2/2) NJM3404AV OP AMP
OR (LOGIC SUM)
Q308 CONTROL
Q309 RN1704
Q310 RN2302
Q310 CONTROL
Q311 RN1704
430MHz BAND, 360MHz BAND POWER SW
Q310 144MHz BAND RECEIVE CIRCUIT POWER SW
IC201 L78-0353-08 430MHz BAND PLL VCO
UNLOCK SIGNAL OR (LOGIC SUM)
D205 1SS301
IC1 : KCD04
IC2 : W02-1829-08
IC3 : TDA2003V
IC4 : W02-1830-08
IC5 : BU4094BF
IC6 : TA7787AF
IC101 : S-AV24-01K
IC102 : W02-1827-08
IC103 : NJM7808A
IC104 : NJM78L05UA
IC201 : L78-0350-08
IC202 : W02-1828-08
IC203 : L78-0353-08
IC204,302 : μPC1676G
IC205 : TC4S66F
IC208 : LA5010M
IC303 : NJM3404AV
Q1 : 2SJ144(GR)
Q3,8,108,202,207,209 : 2SC2712(BL)
Q4,308 : RN2701
Q5,106,109,206,210,309,311 : RN1704
Q6,208 : RN1304
Q7,307 : 2SC2714
Q101 : 2SB1292
Q102 : 2SD1621
Q103 : 2SA1618GR
Q104,204,205,310 : RN2302
Q105 : 2SB624
Q107 : 2SB1302(T)
Q201,301,302,304,305,313 : 2SC4901YK-02TR
Q306 : 2SC3356
Q312 : 2SK208
D101,108,307,308,314 : HSU277
D102 : MI809
D103,104 : MI407
D105,106 : MA716
D107 : DSA3A1
D201,203,309,315 : HSM2693
D204~206,305,316 : 1SS301
D301~304,310~313 : HVU202

CONTROL UNIT (W02-1811-08) Component side view



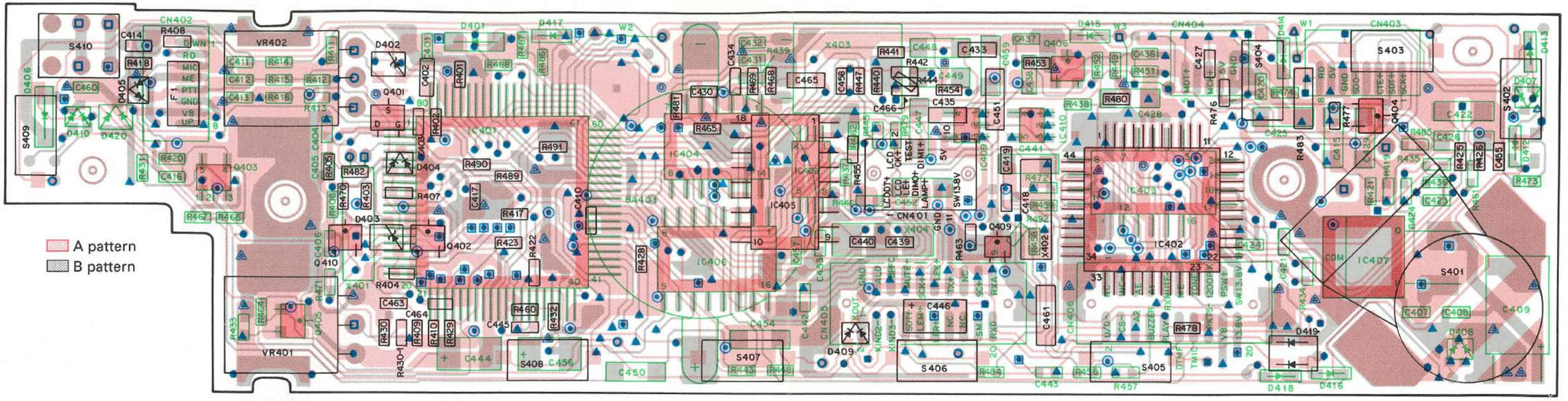


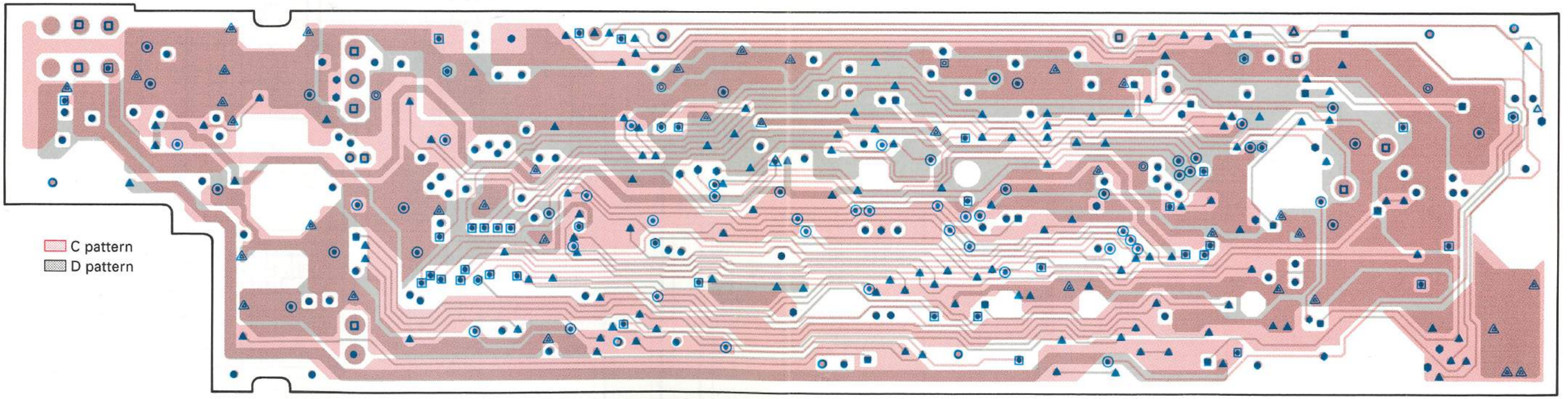
Component side
A pattern
C pattern
D pattern
B pattern
Foil side

- A and B connected
- A and C connected
- A and D connected
- B and C connected
- B and D connected
- C and D connected
- A, B and C connected
- A, B and D connected
- A, C and D connected
- B, C and D connected
- A, B, C and D connected
- A only
- B only
- C only
- D only

No mark is not connected

CONTROL UNIT (W02-1811-08) Foil side view

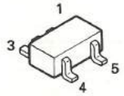




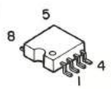
2SC2712
2SD596
RN1302

2SK536

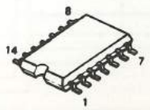
RN1502
TC4S66F



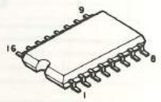
NJM062V



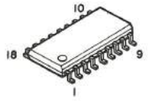
TC35219F



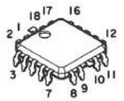
TC4053BF



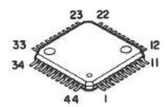
LC7385M



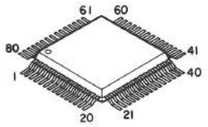
MSM6586JS



MSM6588GS-VIK

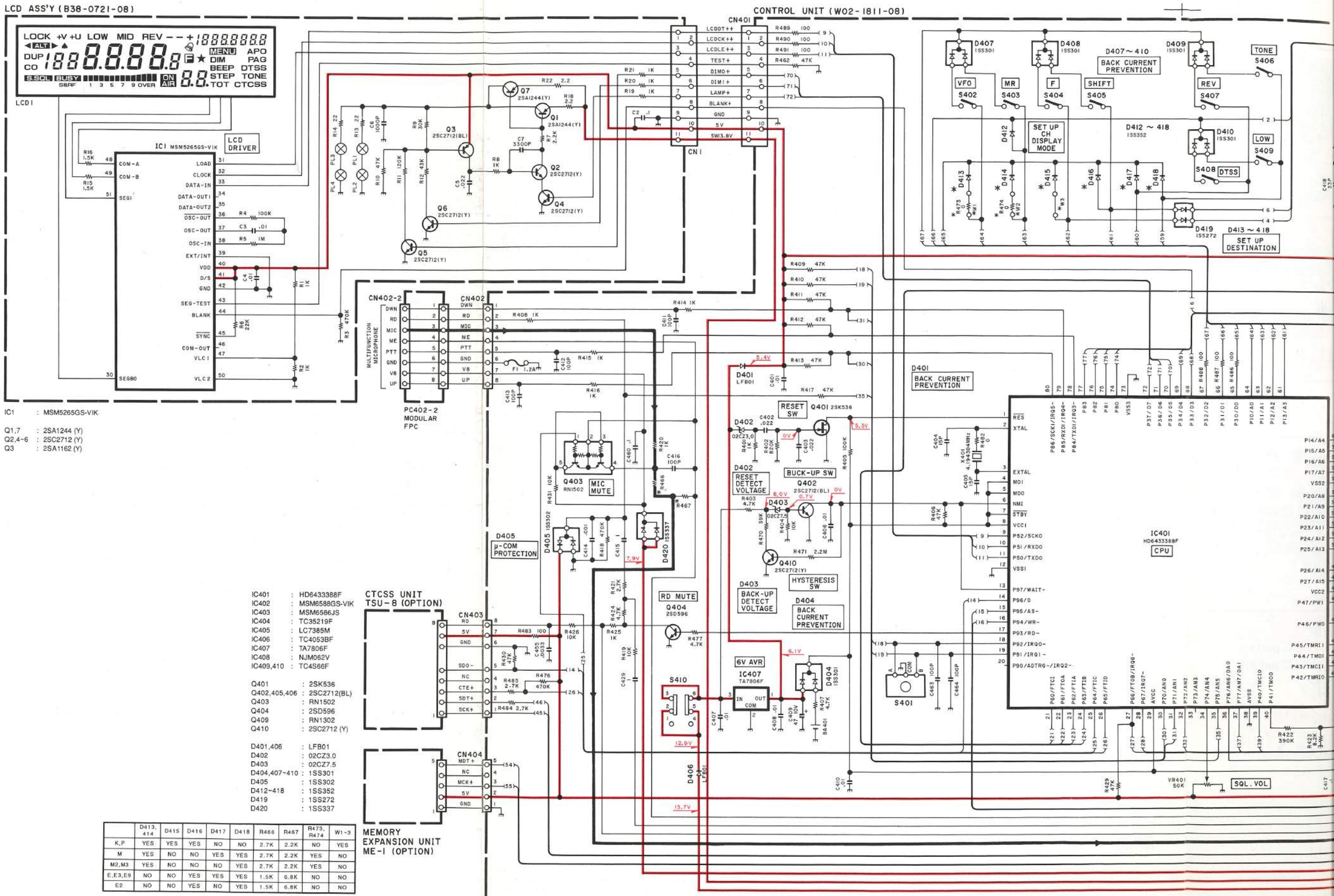


HD6433388F



TA7806F

TM-251A/E SCHEMATIC DIAGRAM



IC1 : MSM5265GS-VIK

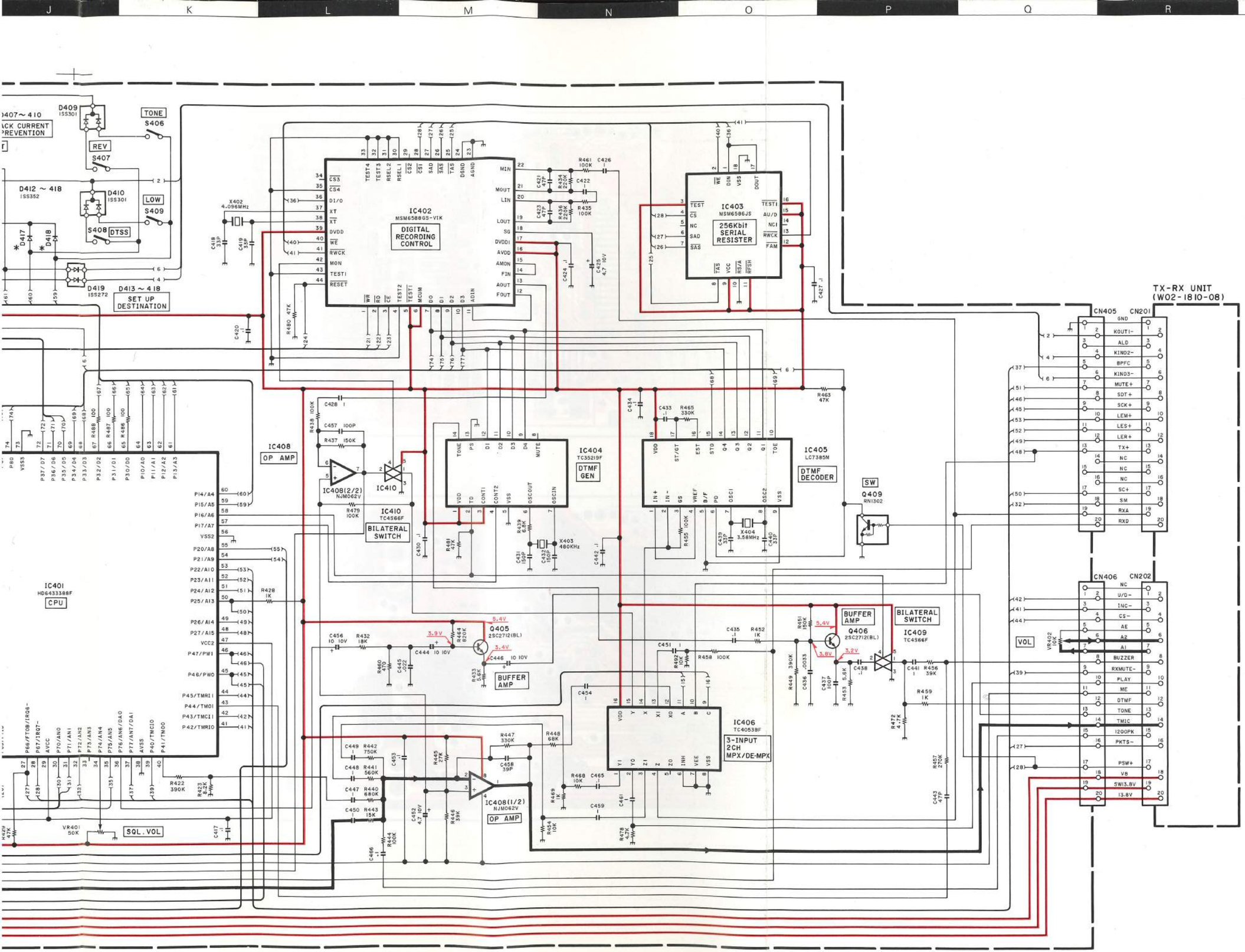
Q1,7 : 2SA1244 (Y)
Q2,4~6 : 2SC2712 (Y)
Q3 : 2SA1162 (Y)

IC401 : HD6433388F
IC402 : MSM6588GS-VIK
IC403 : MSM6586JS
IC404 : TC35219F
IC405 : LC7385M
IC406 : TC4053BF
IC407 : TA7806F
IC408 : NJM062V
IC409,410 : TC4S66F

Q401 : 2SK536
Q402,405,406 : 2SC2712(BL)
Q403 : RN1502
Q404 : 2SD596
Q409 : RN1302
Q410 : 2SC2712 (Y)

D401,406 : LFB01
D402 : 02CZ3.0
D403 : 02CZ7.5
D404,407~410 : 1SS301
D405 : 1SS302
D412~418 : 1SS352
D419 : 1SS272
D420 : 1SS337

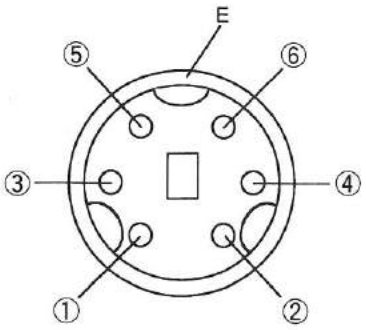
	D413, 414	D415	D416	D417	D418	R466	R467	R473, R474	W1~3
K,P	YES	YES	YES	NO	NO	2.7K	2.2K	NO	YES
M	YES	NO	NO	YES	YES	2.7K	2.2K	YES	NO
M2,M3	YES	NO	NO	NO	YES	2.7K	2.2K	YES	NO
E,E3,E9	NO	NO	YES	YES	YES	1.5K	6.8K	NO	NO
E2	NO	NO	YES	NO	YES	1.5K	6.8K	NO	NO


TX-RX UNIT
(W02-1810-08)
IC401
HD6433388F
CPU
IC402
MSM6588GS-VIK
DIGITAL RECORDING CONTROL
IC403
MSM6586JS
256Kbit SERIAL RESISTER
IC404
TC35219F
DTMF GEN
IC405
LC7385M
DTMF DECODER
IC406
TC4053BF
3-INPUT 2CH MPX/DE-MPX
IC408
OP AMP
IC408(2/2)
NJM062V
IC408(1/2)
NJM062V
OP AMP
IC409
TC4566F
BILATERAL SWITCH
IC410
TC4566F
BILATERAL SWITCH
BUFFER AMP
Q405
2SC2712(BL)
BUFFER AMP
Q406
2SC2712(BL)
SW
Q409
RN1302
X402
4.096MHz
X403
480KHz
X404
3.58MHz
TONE
S406
REV
S407
LOW
S409
S408
DTSS
D409
1SS301
D410
1SS301
D419
1SS272
D412 ~ 418
1SS352
D413 ~ 418
SET UP DESTINATION
D407~410
BACK CURRENT PREVENTION
SQL.VOL
VR401
50K
VOL
VR402
10K
CN405
CN201
CN406
CN202
GND
KOUT1-
ALD
KIND2-
BPFC
KIND3-
MUTE+
SDT+
SCK+
LEM+
LES+
LER+
TX+
NC
NC
NC
SC+
SM
RXA
RXD
NC
U/D-
INC-
CS-
AE
A2
A1
BUZZER
RXMUTE-
PLAY
ME
DTMF
TONE
TMIC
1200PK
PKTS-
PSW+
V8
SW13.8V
13.8V
5.4V
3.9V
3.4V
3.8V
3.2V

PG-5A (DATA CABLE)

PG-5A External View

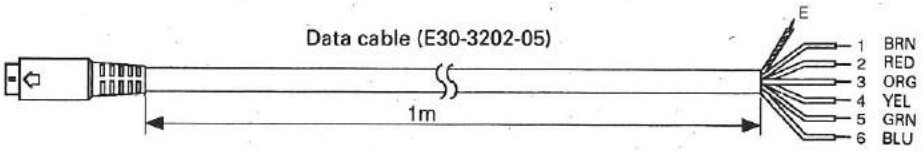
PG-5A Wiring



Plug (6P mini DIN)

Pin No.	Wire color
1	Braun
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
E	Shield

PG-5A Dimension



TM-251A/E

SPECIFICATIONS

General

Frequency range	
Main band	144.000~147.995MHz : TM-251A 144.000~145.995MHz : TM-251E
Sub band (receive)	438.000~449.995MHz : K,P 430.000~439.995MHz : M,M2,M3,E,E2,E3,E9
Mode	F3E
Antenna impedance	50Ω
Usable temperature range	–20°C~+60°C
Power supply	DC 13.8V ± 15% (11.7~15.8V)
Grounding method	Negative ground
Current	
Transmit (max.)	11.0A or less
Receive (no signal)	0.6A or less
Frequency stability	
Main band	Within ±10ppm
Sub band (receive)	Within ±10ppm
Dimensions (W x H x D) Projections not included	140 x 40 x 160mm
Weight	1kg

Transmitter

Power output	
High	50W
Mid	Approx. 10W
Low	Approx. 5W
Modulation	Reactance
Spurious emissions	–60dB or less
Maximum frequency deviation	±5kHz
Audio distortion (at 60% modulation)	3% or less
Microphone impedance	600Ω

Receiver

Circuitry	Double conversion superheterodyne
Intermediate frequency (1st/2nd)	45.05MHz/455kHz
Sensitivity (12dB SINAD)	0.16μV or less
Selectivity	
–6dB	12kHz or more
–60dB	28kHz or less
Squelch sensitivity	0.1μV or less
Audio output (8Ω, 5% distortion)	2W or higher
Audio output impedance	8Ω

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