

ICOM

**SERVICE
MANUAL**

UHF FM TRANSCEIVER

IC-U200T

FOREWORD

INTRODUCTION

This service manual describes the latest service information for the **IC-U200T** UHF FM TRANSCEIVER at the time of going to press.

Two versions of the **IC-U200T** have been designed. This service manual covers both versions.

VERSION NO.	VERSION	FREQUENCY RANGE	CHANNEL SPACING	OUTPUT POWER	5-TONE SPEC.
#01	General	450~470 MHz	12.5 kHz	25 W	CCIR
#02	General	450~470 MHz	25 kHz	25 W	CCIR

DANGER

DO NOT connect the transceiver to an AC outlet or to a DC power supply that uses more than 16 V. This will ruin the transceiver.

DO NOT expose the transceiver to rain, snow or any liquids.

DO NOT reverse the polarities of the power supply when connecting the transceiver.

DO NOT apply an RF signal of more than 20 dBm (100 mW) to the antenna connector. This could damage the transceiver's front end.



ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:

1. Component part number and name.
2. Equipment model name and unit name.
3. 10-digit order numbers for mechanical parts.
4. Quantity required.

<SAMPLE ORDER>

IC MC3357P IC-U200T MAIN UNIT 5 pieces
Screw HS M4 x 35 SUS ZK IC-U200T Front panel 8810004240 10 pieces

Addresses are provided on the inside back cover for your convenience.

REPAIR NOTE

1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from a power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated tuning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the transceiver is defective.
6. **DO NOT** transmit power into a signal generator or a sweep generator.
7. **ALWAYS** connect a 30 dB ~ 40 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.

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SECTION 1 SPECIFICATIONS

■ GENERAL

Frequency coverage	: 450 MHz~470 MHz
Antenna impedance	: 50 Ω unbalanced
Audio output impedance	: 4 Ω
Usable temperature range	: -30 °C ~ +60 °C
Frequency tolerance	: ± 2.5 kHz (#02) ± 1.5 kHz (#01)
Current drain	: Receive standby 450 mA Receive Max. audio 1.0 A Transmit 8.0 A
Power supply requirement	: 13.8 V DC (negative ground)
Dimensions	: 140(W) x 50(H) x 179(D) mm (Projections not included)
Weight	: 1.4 kg
5-Tone specification	: CCIR

■ TRANSMITTER

Output power	: 25 W
Emission mode	: 16K0F3E (#02) 8K50F3E (#01)
Limiting of modulator	: 70%~100% of max. deviation
Max. frequency deviation	: ± 5 kHz (#02) ± 2.5 kHz (#01)
Audio frequency response	: +1 dB ~ -3 dB with 6 dB/octave between 300 Hz ~ 3000 Hz (#02) between 300 Hz ~ 2550 Hz (#01)
Audio harmonic distortion	: 10% max.
Noise and hum ratio	: 40 dB
Adjacent channel power	: 70 dB

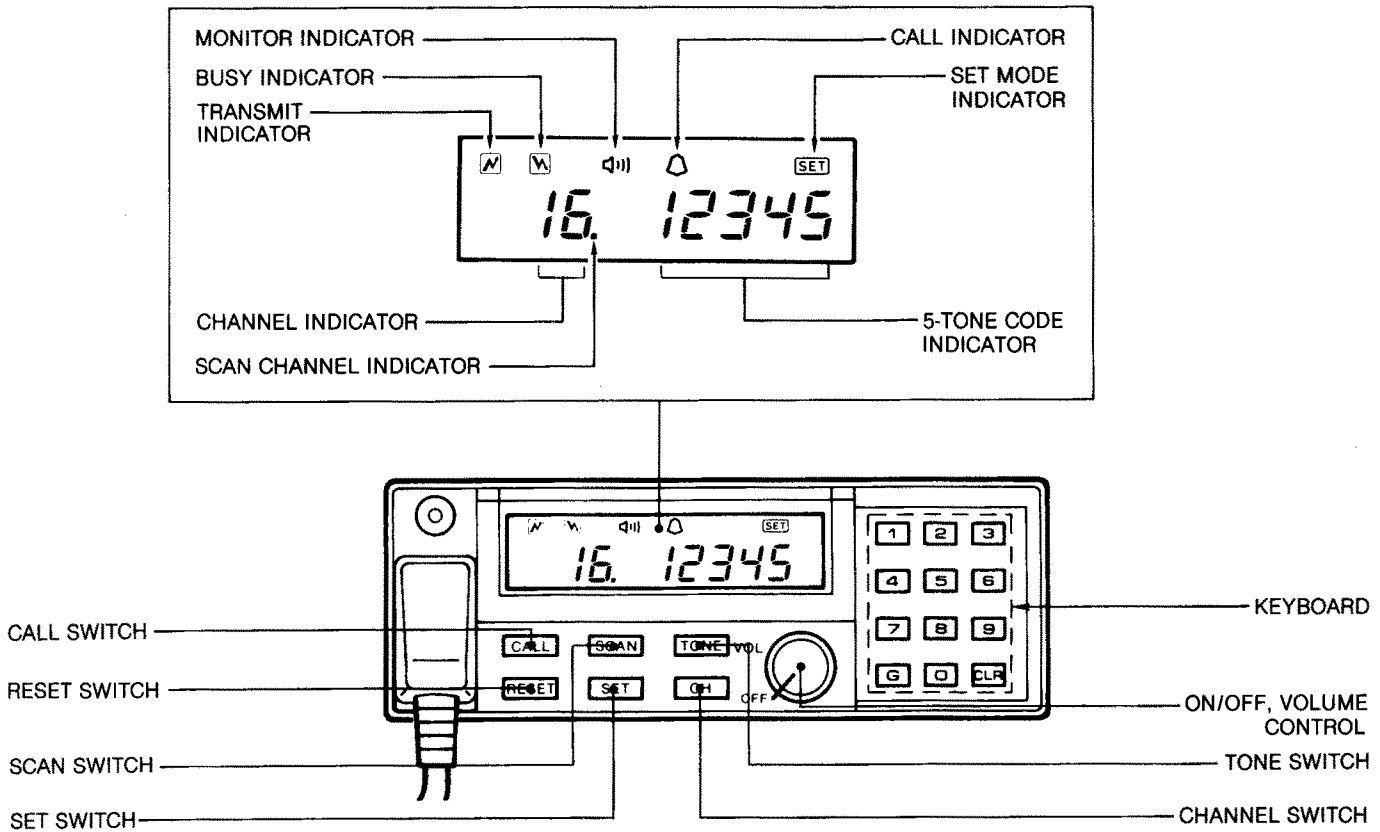
■ RECEIVER

Receiving system	: Double-conversion superheterodyne
Intermediate frequencies	: 1st 30.875 MHz 2nd 455 kHz
Intermodulation	: 70 dB
Sensitivity	: 0.35 μ V for 12 dB SINAD
Squelch sensitivity (threshold)	: 0.35 μ V
Audio output power	: 3.0 W at 10% distortion with a 4 Ω load
Adjacent channel selectivity	: 70 dB (#02) 60 dB (#01)
Spurious response rejection	: 70 dB
Blocking and desensitization	: 90 dB μ
Audio frequency response	: +1 dB ~ -3 dB with -6 dB/octave between 300 Hz ~ 3000 Hz (#02) between 300 Hz ~ 2550 Hz (#01)
Noise and hum ratio	: 40 dB

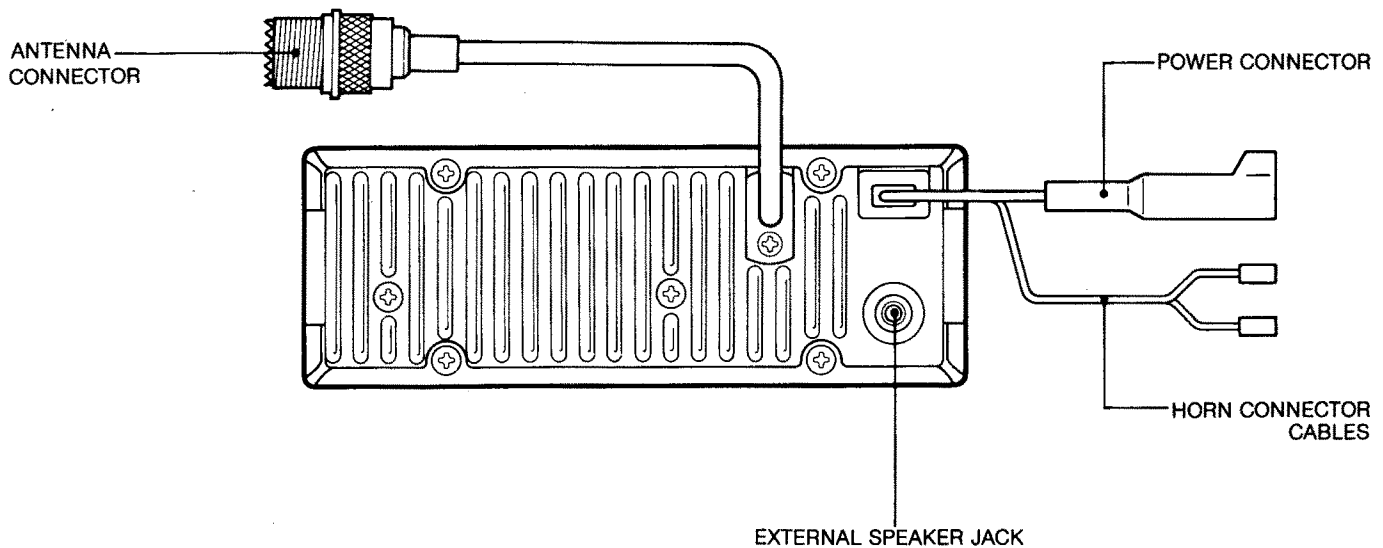
SECTION 2 OUTSIDE AND INSIDE VIEWS

2-1 OUTSIDE VIEWS

2-1-1 FRONT PANEL

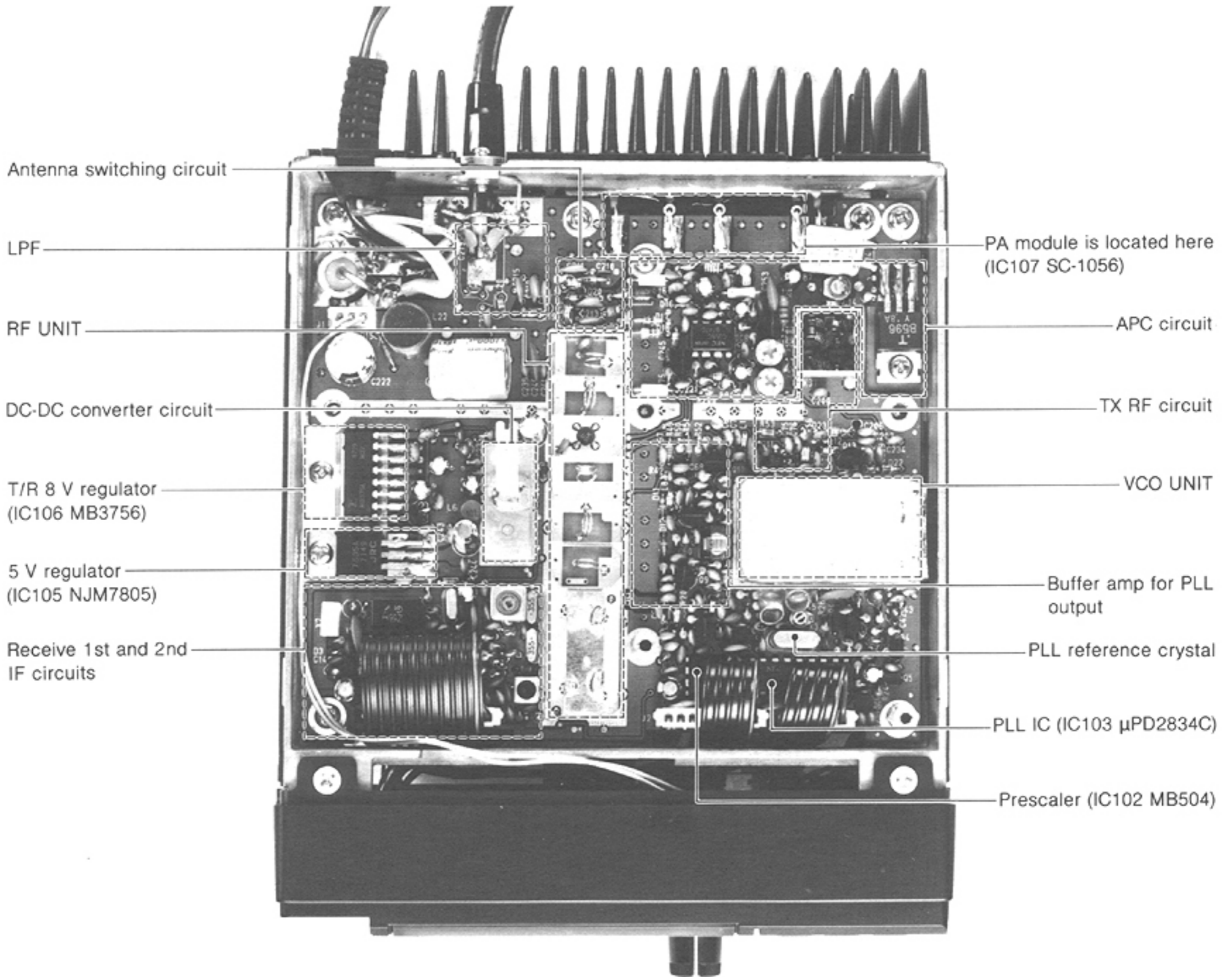


2-1-2 REAR PANEL

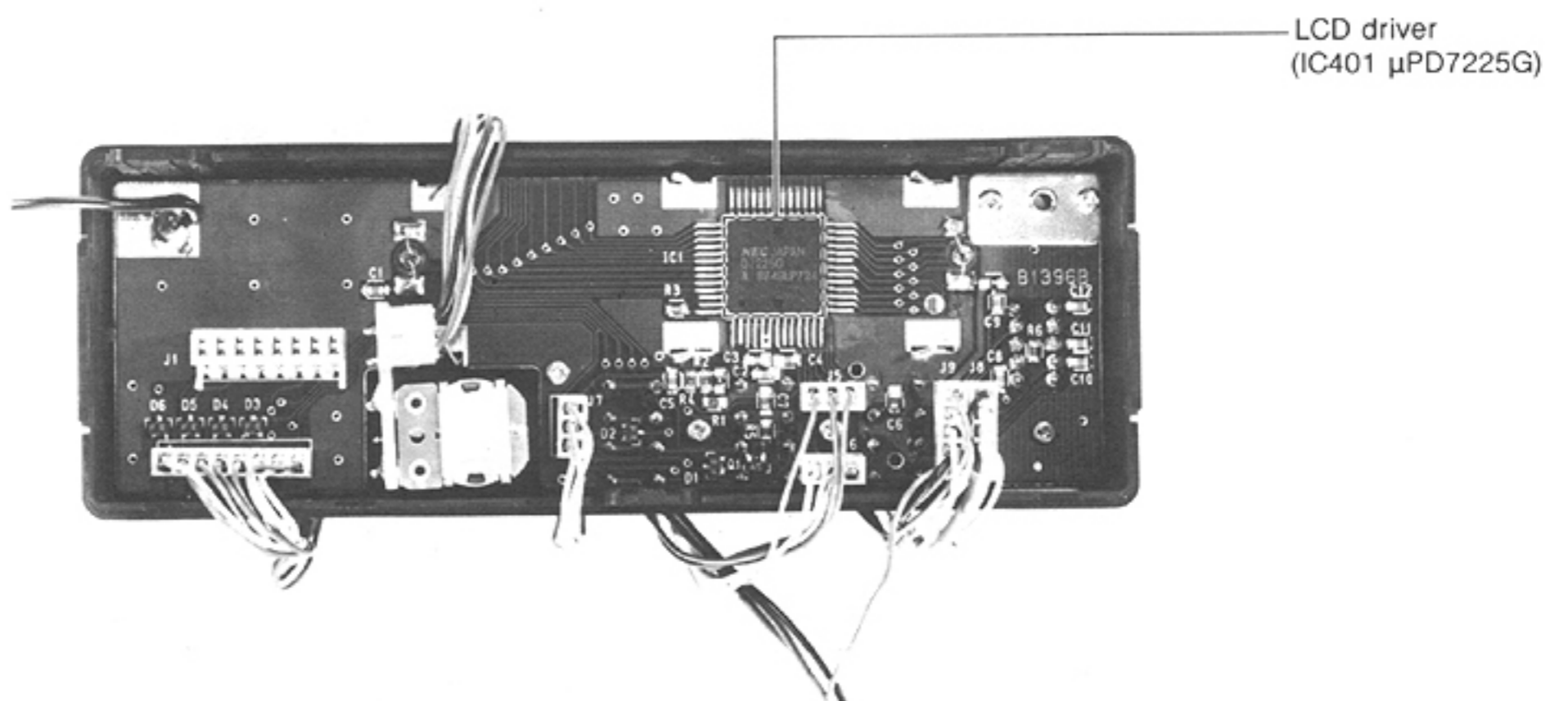


2-2 INSIDE VIEWS

2-2-1 MAIN UNIT

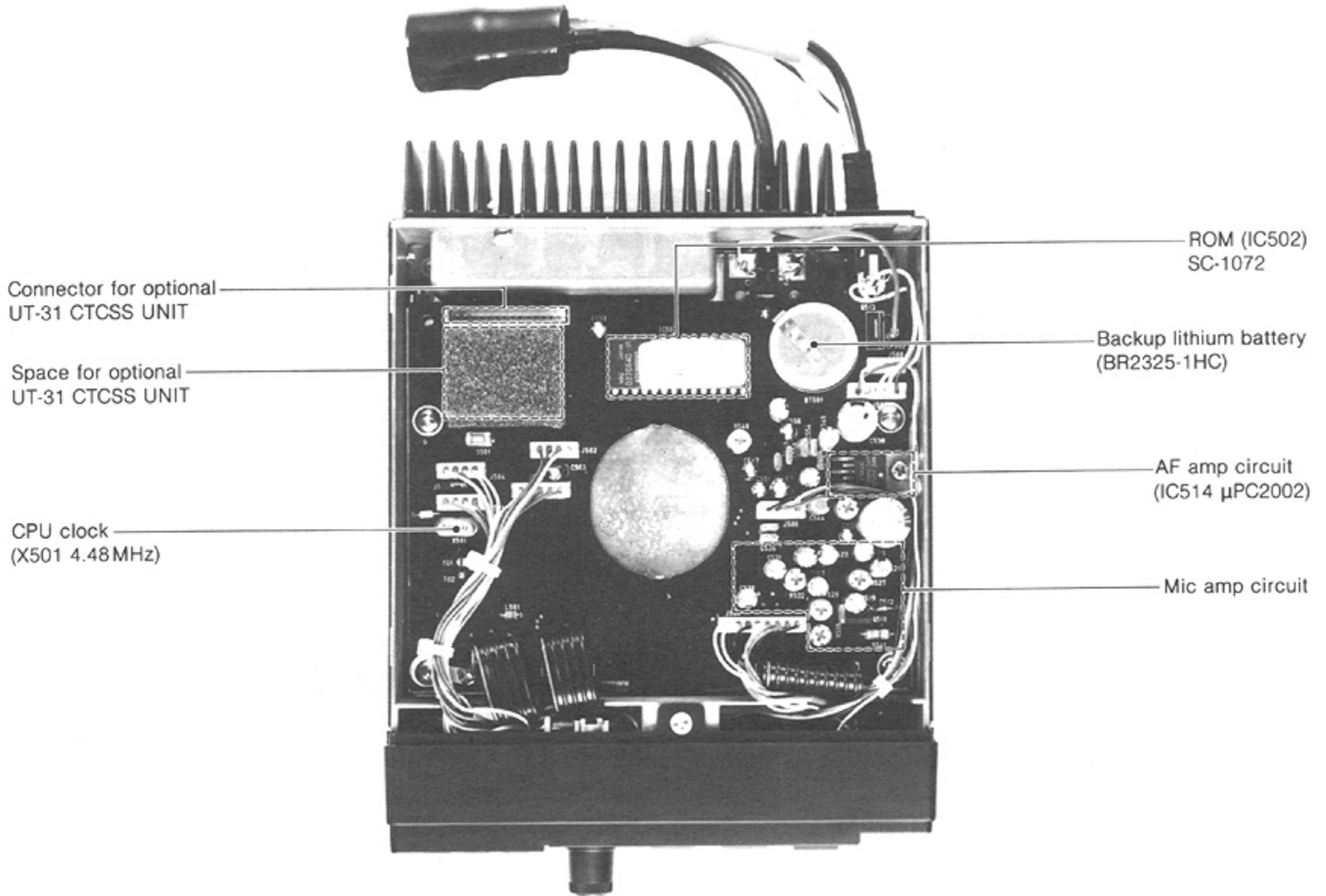


2-2-2 DISPLAY UNIT

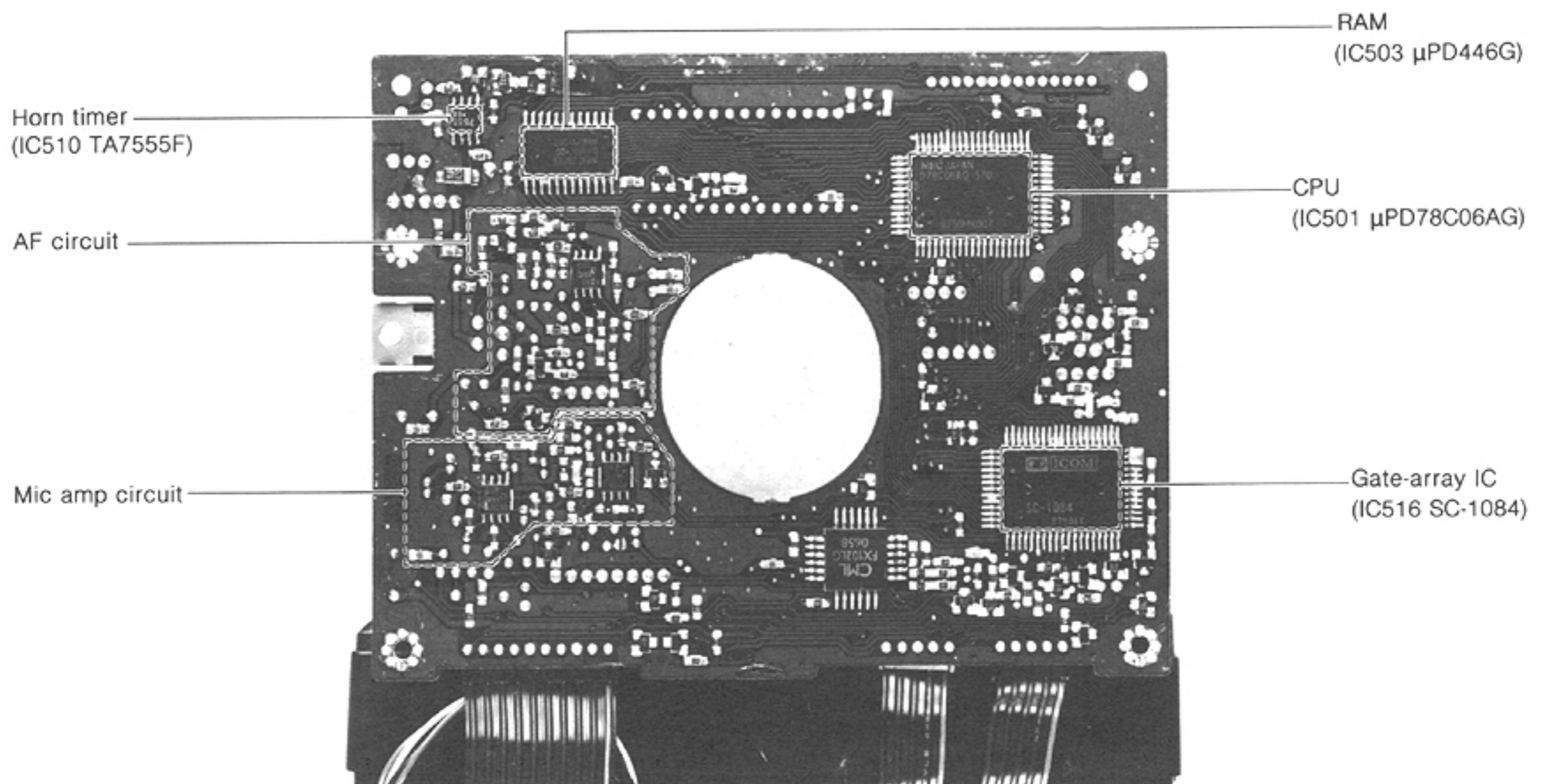


2-2-3 LOGIC-A UNIT

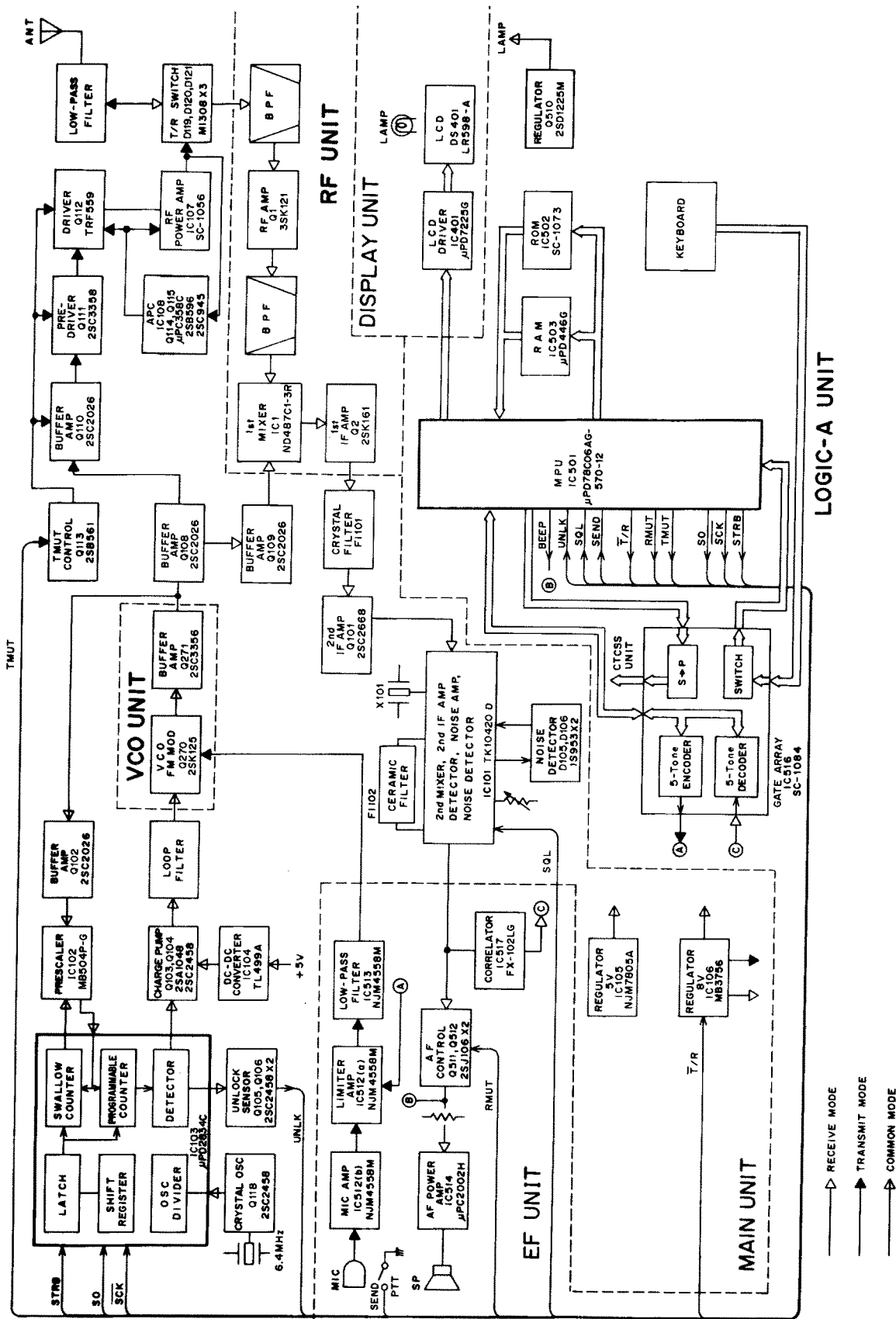
• COMPONENT SIDE



• FOIL SIDE



SECTION 3 BLOCK DIAGRAM



SECTION 4 CIRCUIT DESCRIPTION

4-1 RECEIVER CIRCUITS

4-1-1 ANTENNA SWITCHING CIRCUIT (MAIN UNIT)

Receive signals enter from the antenna connector and pass through a low-pass filter consisting of C215, C217, C219, C257 and L119~L121. They are then fed to an antenna switching circuit consisting of D119~D121.

4-1-2 RF CIRCUIT (MAIN AND RF UNITS)

Receive signals from the antenna switching circuit pass through a bandpass filter consisting of L1, L2, C2, C3, C6, C7, D3 and D4 to eliminate unnecessary signals. They are then amplified by N-channel GaAs FET Q1 for high-gain and low-noise amplification.

Signals amplified by Q1 pass through a 3-stage bandpass filter consisting of L3~L5, C13, C17, C18, C22, C23 and D3~D5. They are then fed into a balanced mixer circuit consisting of IC1, L6 and L7 where they are mixed with 1st LO signals. They are then converted to 30.875 MHz 1st IF frequency signals.

4-1-3 1st LO CIRCUIT (VCO UNIT)

The 1st LO signal is generated at the VCO circuit (Q270), amplified by Q271, and passed through a switching circuit and a low-pass filter before being applied to L103.

4-1-4 IF CIRCUIT (MAIN UNIT)

1st IF signals from L7 in the mixer pass through crystal filter F1101 and are amplified by Q101. The amplified signals are fed to IC101 (pin 16).

IC101 is an FM-IF IC chip. This IC chip includes an amplifier for the 2nd LO circuit, the 2nd mixer, the limiter amplifier, and the quadrature detector.

Signals entering IC101 (pin 16) are mixed with the 2nd LO signals of crystal X101 (30.42 MHz), and are emitted from pin 3 as the 2nd IF frequency of 455 kHz. These signals pass through the ceramic filter of F1102, enter pin 5, and are amplified at a limiter amplifier and detected by the quadrature detector in IC101 with ceramic resonator X102.

4-1-5 AF CIRCUIT (LOGIC-A UNIT)

The detected audio signals from IC101 (pin 9) pass through a de-emphasis circuit consisting of C116 and R113, and enter AF amplifier IC515a. The characteristics of the de-emphasis circuit are -6 dB/octave.

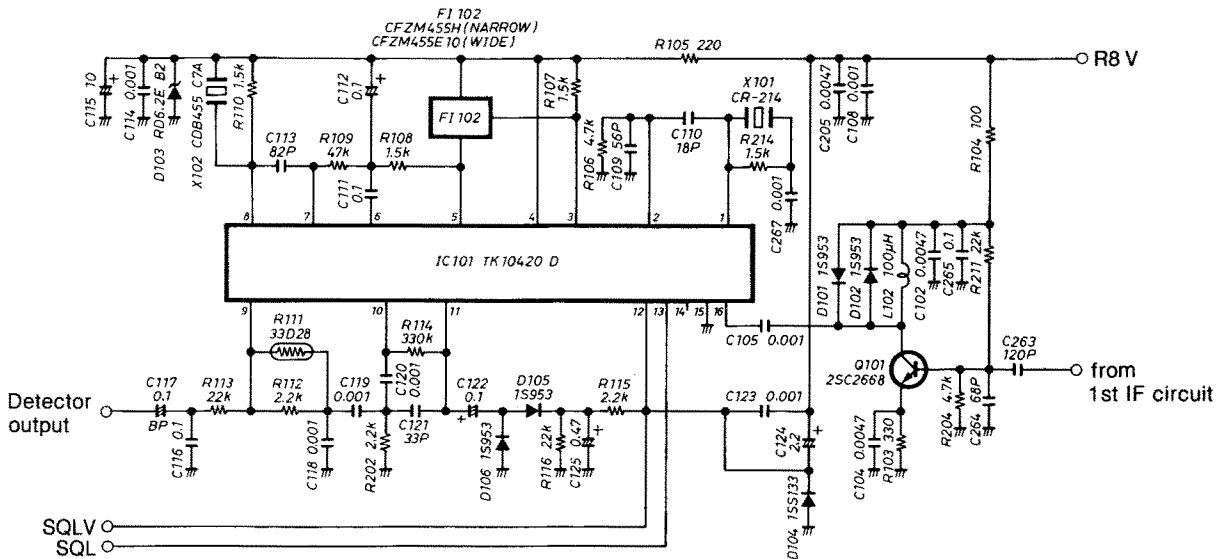
The AF signal from IC515a passes through AF control Q512 and is fed to IC515b to suppress a subaudible tone signal. The AF signal from IC515a is also fed to the 5-Tone decoder section in IC516.

The AF signal from IC515b is applied to the AF power amplifier (IC514) via analog switch Q511 and the VOLUME CONTROL (R1) on the front panel. The signal amplified by IC514 drives speaker SP1.

Q511 and Q512 function as a muting circuit using analog switches to block the AF signal. Q511 and Q512 block the signal when an RMUTE signal appears.

IC514 is a small-packaged power amplifier. High-power and low-distortion amplifiers and protection circuits for overload are collected in one package.

• 2ND IF CIRCUIT



4-1-6 SQUELCH CIRCUIT (MAIN AND LOGIC-A UNIT)

Audio signals from IC101 (pin 9) consist of noise components higher than 20 kHz that are amplified by IC101 then output from pin 11. Amplified noise signals are detected by D105 and D106, and are converted to DC voltage. This voltage is supplied to the squelch trigger circuit (pin 12). The squelch control pot (R543) in the LOGIC-A UNIT is also connected to IC101 (pin 12) to adjust converted DC voltage.

A "HIGH" or "LOW" squelch control signal is output from IC101 (pin 13) and then applied to CPU IC501 (pin 15) on the LOGIC-A UNIT.

IC301 (pin 30) becomes "HIGH" as the RMUTE signal while pin 15 receives "LOW". The RMUTE signal is applied to Q511 and Q512 to cut the audio signals.

4-2 TRANSMITTER CIRCUITS

4-2-1 MIC AMP, LIMITER AMP, SPLATTER FILTER AND VCO CIRCUIT

The AF signals from J403 are fed to IC512a via a pre-emphasis circuit consisting of C518 and R525. The characteristics of the pre-emphasis circuit are +6 dB octave.

After waveform adjustment with R527 and gain adjustment with R259 is made, output signals from IC512a are fed to limiter amplifier IC512b.

Output signals from IC512b pass through splatter filter IC513 which eliminates components greater than 3 kHz of the signals. The signals are then applied to D273 on the VCO UNIT as FM modulation signals.

4-2-2 DRIVER AMP (MAIN UNIT)

Signals generated at the VCO UNIT are buffer amplified at Q108. Signals from Q108 are amplified at Q110 and Q111, then at driver amplifier Q112. The signals are then amplified by Q111 and Q112 to get 200 mW of RF output power.

A TMUT signal prevents unnecessary RF power emissions from occurring at the moment of switching from receive to transmit mode or when the PLL circuit is unlocked. Q113 controls the bias voltage of Q110, Q112 using the TMUT signal.

(See Fig. 2 below)

4-2-3 POWER AMP CIRCUIT (MAIN UNIT)

The transmit output from the drive amplifier enters IC107 (pin 1). IC107 is an RF power module that can attain 25 W with an input of 200 mW.

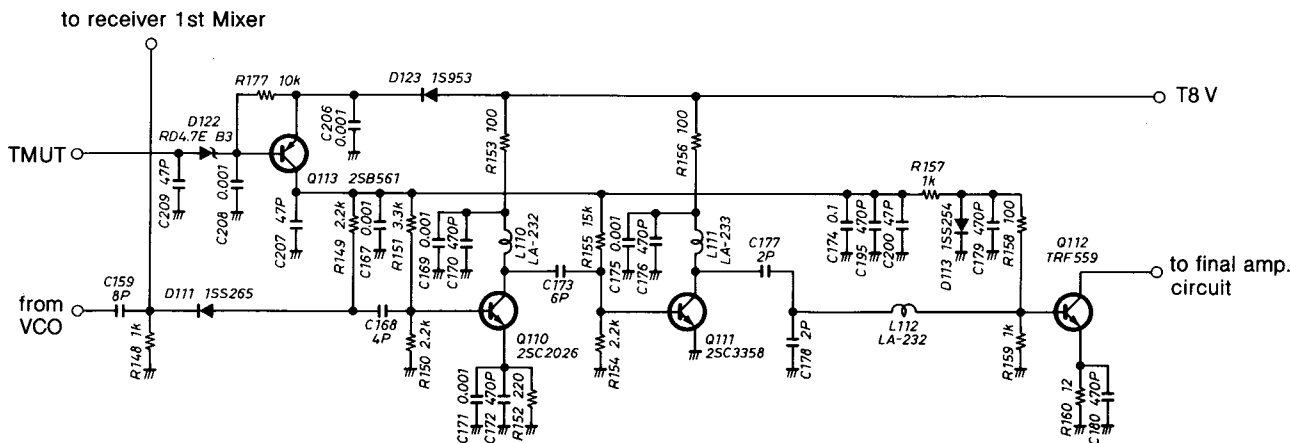
Output signals from IC108 (pin 4) are fed to the antenna switching circuit.

4-2-4 APC CIRCUIT (MAIN UNIT)

The APC circuit operates when the antenna impedance is not matched with the transceiver's antenna impedance. A part of output signals from IC107 (pin 5) is applied via a pattern coil to an APC detector circuit consisting of D117 and D118.

The detected voltage is fed into inverted amplifier IC108a. Output signals from IC108a are applied to Q115 and then the output voltage from Q115 controls the output current of Q114. The input current of IC107 (pin 2) and Q112 (collector) is controlled by Q114 to keep the output power of IC107 constant.

• DRIVER AMPLIFIER



4-2-5 ANTENNA SWITCHING CIRCUIT

Output signals from IC107 pass through a 3-stage low-pass filter consisting of L119, L121, C215, C217, C219 and C257 via D119. This filter suppresses high-frequency spurious signals.

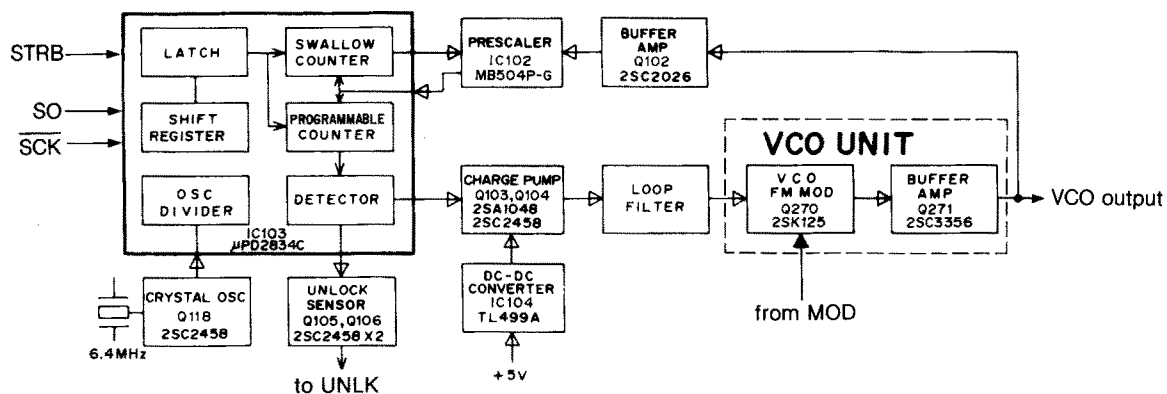
4-3 PLL CIRCUITS

4-3-1 DUAL MODULUS PRESCALER (MAIN UNIT)

The PLL is designed in a way that allows the desired frequency to be generated directly by the VCO, adopting a dual modulus prescaler system. The PLL consists of a prescaler (IC102) and PLL IC (IC103). It is fed "divided by N-data" from the CPU which determines the operating frequency.

N-data is determined by dividing the desired frequency by the reference frequency. The desired frequency is the transmit frequency in transmit mode and the first local oscillator frequency in receive mode.

$$N\text{-data} = \frac{\text{Desired frequency}}{\text{Reference frequency}}$$



A reference frequency of 12.5 kHz is acquired by X103, Q118, and the divider inside IC103. A signal from the VCO is buffer amplified at Q102, fed into IC102, and divided N times at IC102 and IC103. The divided signal is applied to the phase detector in IC103. Phase detection results in lock voltages being output from pins 12 and 13.

4-3-2 LOOP FILTER CIRCUIT (MAIN AND VCO UNITS)

Output from IC103 (pins 12 and 13) is fed into a charge pump circuit consisting of Q103 and Q104 and is then applied to a lag-lead type loop filter consisting of R132, R133 and C141.

The signal passing through the loop filter is fed to varactor diodes D271 and D272 in the VCO UNIT via RF choke coil L271 to control the VCO output frequency.

D109 and D110 shorten the lockup time when changing from receive to transmit mode or vice versa.

4-3-3 DC-DC CONVERTER (MAIN UNIT)

DC-DC converter IC104 makes 20 V DC from 5 V DC to obtain lock voltages for the PLL circuit and a voltage range of 1~20 V for bandpass tuning operation of the RF circuit.

4-4 LOGIC CIRCUITS

The logic circuit section consists of an 8-bit CMOS-type CPU, 8 K-byte CMOS RAM, 2 K-byte CMOS RAM, 5-Tone encoder/decoder and mainly displays frequency and tone numbers.

4-4-1 CPU (LOGIC-A UNIT)

CPU IC501 μPD78C06AG mainly performs all functions related to the controls and switches on the front panel of the IC-U200T and incorporates a 4 K-byte ROM and a 128-byte RAM in the chip. The ports are distributed as follows:

(1) DATA BUS (DB0~DB7)

This is an 8-bit data bus which performs data exchange with the 2 K-byte RAM. DB0~DB3 are also matrix input ports.

(2) ADDRESS BUS (PE0~PE15)

This is a 16-bit port which can switch ADDRESS and OUTPUT ports according to the program. PE13~PE15 are used as ENABLE signals for RAM, ROM or MATRIX selection.

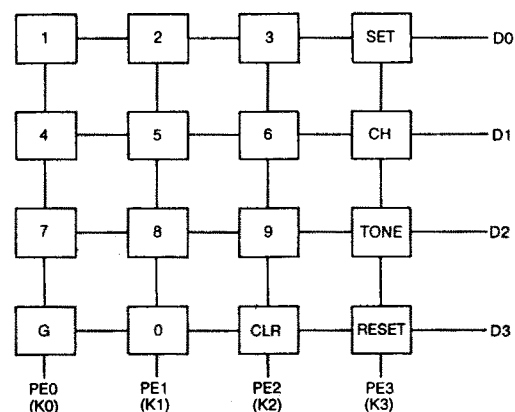


Fig. 4

(3) PORT A (PA0~PA7)

These are 8-bit output ports with latch capability.

PIN NO.	NAME	DESCRIPTION
27	PA0 (STRB0)	Outputs a latch signal for PLL N-data.
28	PA1 (CPO)	Outputs cloning data.
29	PA2 (PSAV)	Not used.
30	PA3 (RMUT)	This port becomes "HIGH" when the speaker sound is muted.
31	PA4 (TMUT)	This port becomes "HIGH" when RF power is turned OFF.
32	PA5 (CK)	Outputs a synchronized clock signal when PLL N-data is sent out.
33	PA6 (PLL C/D)	Outputs a signal for switching between PLL N-data and LCD command data as a switching signal.
34	PA7 ($\overline{\text{CS}}$)	Outputs an enable signal of the LCD driver when LCD command data is sent out.

CLONING DATA CONSTRUCTION

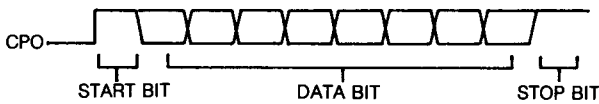
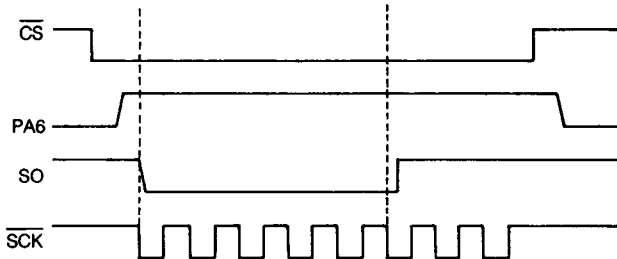


Fig. 5.

TIMING CHARTS OF THE ADDRESS BUS

• AT COMMAND TRANSMITTING (CODE 0E0H, BLINKING ON)



• AT DATA TRANSMITTING (DATA 0A5H)

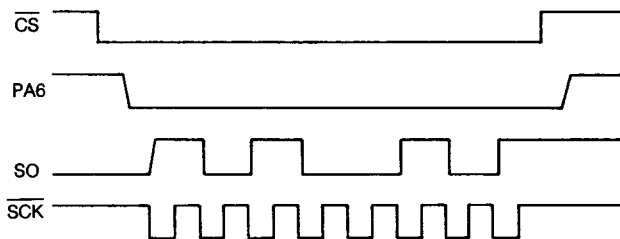


Fig. 6

(4) PORT B (PB0~PB7)

These are 8-bit ports which can switch between INPUT and OUTPUT per bit according to the program.

PIN NO.	NAME	DESCRIPTION
35~38	PB0~PB3 (S0~S3)	Input/output port for 5-Tone data.
39	PB4 ($\overline{\text{T/R}}$)	Output port for transmit/receive switching signal. The port becomes "LOW" during transmit and "HIGH" during receive.
40	PB5 (STRB1)	Output port for the 5-Tone encoder strobe signal.
41	PB6 (STRB2)	Output port for CTCSS tone data strobe signal.
42	PB7 (EXC)	When the received 5-Tone code is matched to the desired code, this terminal becomes "HIGH" for about 1 msec.

(5) PORT C (PC0~PC5)

These are 6-bit input/output ports.

PIN NO.	NAME	DESCRIPTION
11	PC5 ($\overline{\text{BUSY}}$)	Input port for the $\overline{\text{BUSY}}$ signal of the LCD driver.
12	PC3 (TRF)	Input port for "TX" INDICATOR. The indicator appears on the LCD when this port is "HIGH".
13	PC4 (FUNC)	Input port for the FUNCTION SWITCH. If this port is "LOW" when power is ON, it accepts the receive cloning input.
14	PC2 (SEND)	Input port for transmit/receive switching signals that are ready at a HIGH level (This terminal is used for cloning input.)
15	PC1 (SQL)	Input port for squelch open signal, which becomes "HIGH" when opened.
16	PC0 (UNLK)	Input port for PLL unlock signals. During unlock conditions, this port is "LOW".

(6) SERIAL PORT

PIN NO.	NAME	DESCRIPTION
19	$\overline{\text{SCK}}$	Output port for the SO data output timing signal. The data of the SO changes the trailing edge of $\overline{\text{SCK}}$.
21	SO	Output port for the shift register inside the CPU. This terminal outputs CTCSS tone data and LCD command data.

(7) OTHER PORTS

PIN NO.	NAME	DESCRIPTION
6	INT1	This port is "HIGH" when the CPU is in standby mode. When the POWER SWITCH is in the OFF position the port is "HIGH"; when the POWER SWITCH is in ON position the port is "LOW".
7	INT0	This is an input port for 5-Tone decoder data. The 5-Tone data is input when this port is "HIGH".
9	WR	This port outputs the timing signal when writing in the external memory (RAM).
18	BEEP	Output port for the beep tone signal.

4-4-2 ROM

IC502 is a CMOS, 8191-word 8-bit ROM.

This ROM memorizes the control program for the CPU (IC501). Reading data is performed by the address specified by PE0~PE12 in the CPU.

ROM READ TIMING DIAGRAM

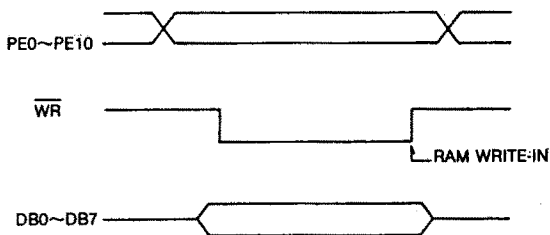


Fig. 7

4-4-3 RAM

IC503 is a CMOS 2048-word 8-bit RAM.

This RAM memorizes the channel, transmit/receive N-data, tone number, shift frequency, tone data table, etc., in current use.

Reading or writing data is performed by the address specified by PE0~PE10 in the CPU.

RAM READ TIMING DIAGRAM

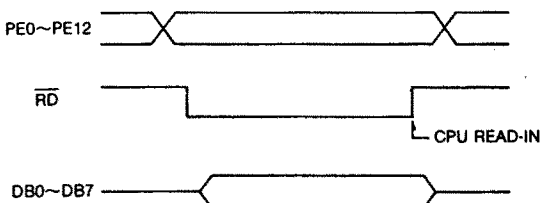


Fig. 8

RAM WRITE TIMING DIAGRAM

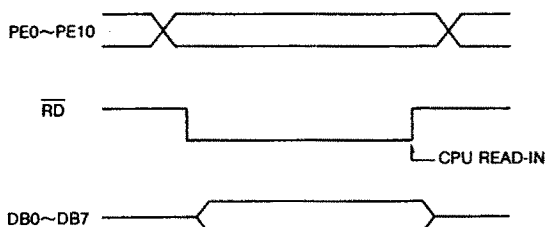


Fig. 9

4-4-4 5-TONE GATE ARRAY (LOGIC-A UNIT)

IC516 contains a 5-Tone encoder/decoder, data selector, serial-parallel converter, a driver and inverter. The 5-Tone encoder can generate 12 kinds of tones.

PIN NO.	NAME	DESCRIPTION
64~61	IO0~IO3	These ports are 5-Tone data input/output ports for the 5-Tone encoder/decoder.
60	CON1	This port is used for selecting either the input or output ports of IO0~IO3. The port becomes "LOW" for output and "HIGH" for input.
59	RX	This port is used for selecting either the encoder or decoder function. It becomes "LOW" for encoding and "HIGH" for decoding.
44, 45	TO1, TO2	These ports select one of the 5-Tone sequential systems: CCIR, ZVEI, EEA or EIA.
57	ST1	This port inputs a strobe signal for the 5-Tone encoder/decoder.
40~43	EC, EC0~EC2	These ports output 5-Tone encoder data.
21	DS	This port is used as an input port for 5-Tone signals.
8	ST3	This port outputs a strobe signal for the 5-Tone encoder/decoder.
2~4	SE1~SE3	This port is used as a data selector.
39~36, 55~52, 51, 50	MA0~MA3, DB0~DB3, CE1, CE2	Function of each port (CE1, CE2, and DB0~DB3) is determined by data from ports SE1~SE3. Ports MA0~MA3 are allocated as data input.
56, 7, 6	ST2, SCK2, SI2	These are serial input ports for converting data from sequential to parallel.
13~20	P1~P8	These are used as parallel output ports after data is converted from serial to parallel. P1~P3 signals are sent to the optional UT-31 CTCSS UNIT.
9, 11	IN1, IN2	These ports are connected to internal inverter inputs.
10, 12	OUT1, OUT2	These ports are connected to internal inverter outputs.
5	KO1	This port outputs a 4.48 MHz clock signal for CPU IC501.
23~25, 28~33, 46~49	TEST, T1, SET, RES, CON2, RCE, RT2, RT1, CP1, DATC, KO5, KO4, KO2	These ports are used for checking IC testing.

5-TONE FREQUENCY SETTINGS

5-TONE CODE	FREQUENCY			
	CCIR (Hz)	EEA (Hz)	ZVEI (Hz)	EIA (Hz)
0	1981	1981	2400	600
1	1124	1124	1060	741
2	1197	1197	1160	882
3	1275	1275	1270	1023
4	1358	1358	1400	1164
5	1446	1446	1530	1305
6	1540	1540	1670	1446
7	1640	1640	1830	1587
8	1747	1747	2000	1728
9	1860	1860	2200	1869
G	2400	1055	2800	2151
R	2110	2110	2600	459

4-4-5 SERIAL-PARALLEL CONVERTER (LOGIC-A UNIT)

Serial CTCSS data from the CPU (IC501) is converted to parallel data at IC516 and is applied to the optional CTCSS UNIT.

4-4-6 HORN-HONK DRIVER CIRCUIT (LOGIC-A UNIT)

The horn-honk driver circuit consists of IC510 and Q513. If the transceiver acknowledges a 5-Tone signal, IC501 (pin 42) outputs one pulse signal to IC510, and then IC510 turns Q513 ON for about 2 seconds.

4-4-7 AF MUTE AND 5-TONE CANCELLER CIRCUITS (LOGIC-A UNIT)

When an optional UT-31 CTCSS UNIT is installed, a DOUT signal (J512) becomes "LOW" and then the collector of Q518 becomes "HIGH".

The output signal (Q518) is applied to the gates of Q511 and Q512 via D510.

"HIGH" signals from Q518 turn Q511 and Q512 ON, and then AF signals are muted. Simultaneously, signals are applied to IC501 (pin 7, INT0) via Q504. Thus the interrupt signal from the 5-Tone encoder/decoder circuit is canceled.

While a CTCSS tone signal is received, DOUT signals become "LOW" and AF signal muting is released if the tone number matches the desired number.

When a HANG signal from J505 (pin 7) is "HIGH", Q506 turns OFF and the CTCSS UNIT does not function.

4-5 DISPLAY CIRCUITS (DISPLAY AND LOGIC-A UNITS)

IC401 is a programmable LCD controller/driver. DS401 is an LCD panel which displays the following indicators:

- 5-Tone code
- Channel number
- Transmit/Receive
- Answer back

A voltage regulator circuit consisting of Q510 and D512 applies 8 V to DS402 and DS403 for illuminating the LCD.

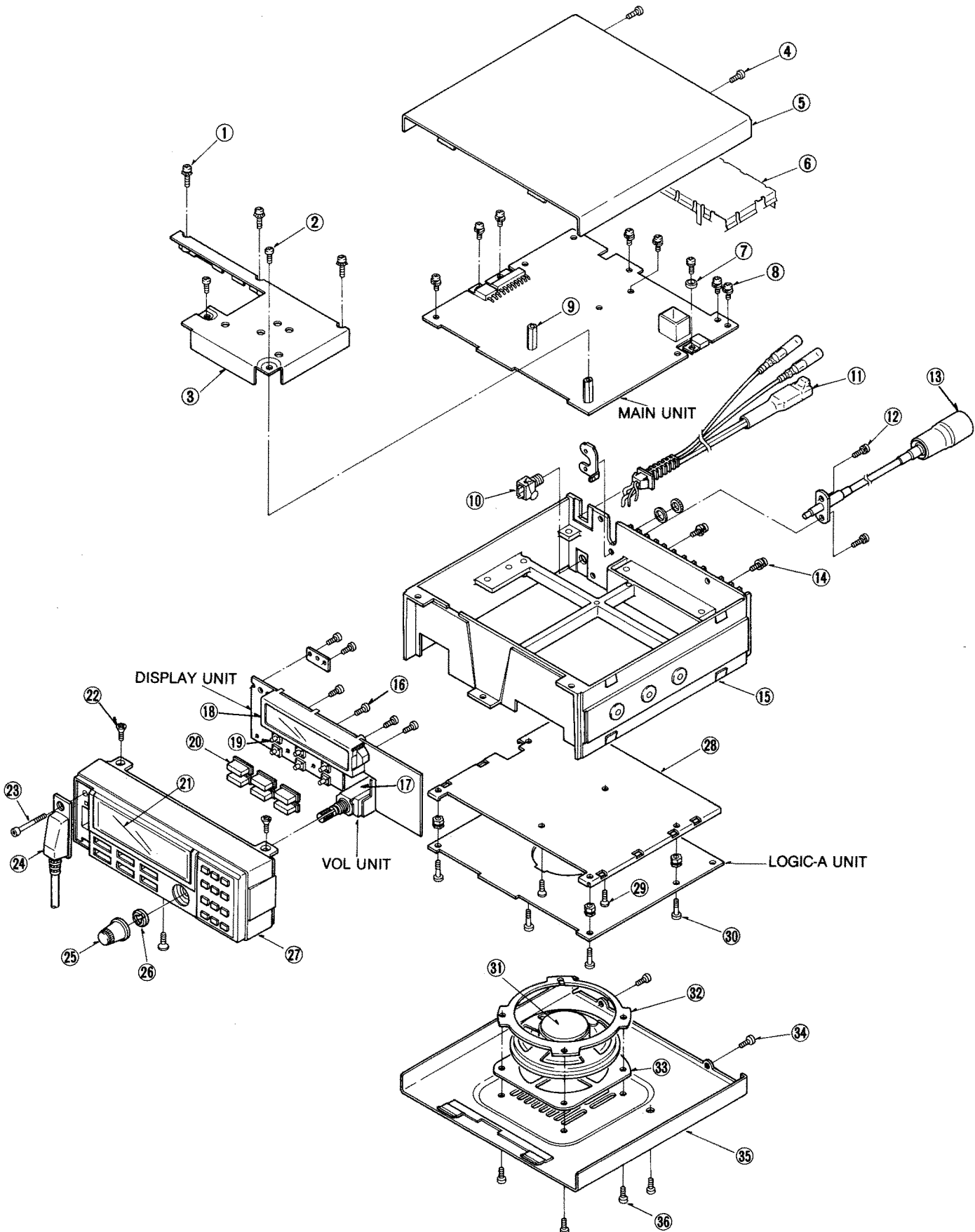
4-6 VOLTAGE REGULATOR CIRCUITS (MAIN UNIT)

The 13.8 V line passes through the POWER SWITCH on the front panel and is applied to IC106 on the MAIN UNIT. IC106 is a voltage regulator with a selector switch IC chip that applies a constant 8 V, R8 voltage during receive, and T8 voltage during transmit operations.

IC105 outputs a constant 5 V. The voltage is applied to IC103 and IC104 on the LOGIC-A UNIT.

SECTION 5 MECHANICAL PARTS AND ASSEMBLY

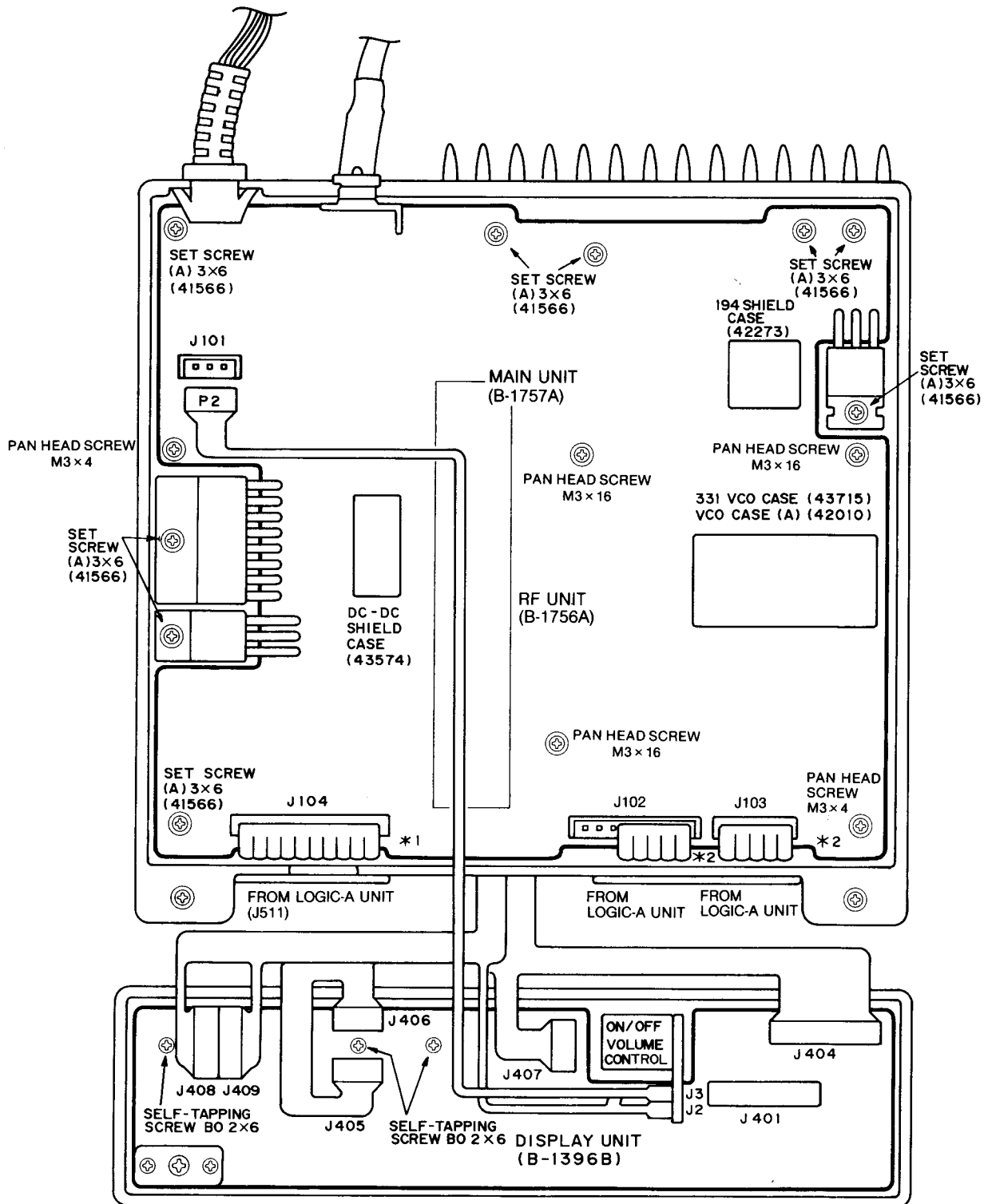
5-1 MECHANICAL PARTS



LABEL NUMBER	DESCRIPTION	ORDER NUMBER	QTY.
①	Set Screw (G) M3 × 17	8810005000	3
②	PH M3 × 4	8810000210	2
③	Main Shield Plate (A) (30529)	8510005260	1
④	BH M3 × 6 ZK SUS	8810002960	2
⑤	Top Cover (C) (30410)	8110002690	1
⑥	PA Shield Plate (B) (43661)	8510005270	1
⑦	Insulated Washer B-17	6910000280	1
⑧	Set Screw (A) M3 × 6	8810003160	9
⑨	Standoff (F)	8930000100	2
⑩	External Speaker Jack (HSJ0780-01-010)	6450000420	1
⑪	DC Power Cable (OPC-164A)	8900001660	1
⑫	Set Screw (A) M2.6 × 8	8810003140	2
⑬	Antenna Connector Cable (OPC-103)	8900001050	1
⑭	Set Screw (A) M3 × 10	8810003180	2
⑮	452 Chassis (A)-1 (20217-1)	8010005261	1
⑯	Self-Tapping Screw BO M2 × 6	8810001000	6
⑰	ON/OFF, Volume Control (EVK-QVB 315 A14)	7210001280	1
⑱	FUNCTION DISPLAY (LR598-A)	5030000260	1
⑲	Switch (SKHHBV001A)	2260000680	6
⑳	Button K-50 (A)-1 [CALL]	8610003310	1
	Button K-50 (B)-1 [SCAN]	8610003320	1
	Button K-50 (C)-1 [RESET]	8610003330	1
	Button K-50 (D)-1 [SET]	8610003340	1
	Button K-50 (E)-1 [TONE]	8610003350	1
	Button K-50 (F)-1 [CH]	8610003360	1
㉑	331 Window 43602 (C02191)	8310010500	1
㉒	FH M3 × 6	8810002170	3
㉓	Hex Socket Screw M3 × 18	8820000510	1
㉔	Microphone (HM-45)	7700000710	1
㉕	Knob N-115	8610003370	1
㉖	VR Nut (B)	8830000050	1
㉗	331 Front Panel 20274 (C02791)	8210003380	1
㉘	Plate	8010003240	1
㉙	FH M3 × 6	8810002710	2
㉚	Icom Screw (C)-10	8810003760	4
㉛	Speaker (66F09N-7)	2510000200	1
㉜	Speaker Holder (42944)	8930006390	1
㉝	57 Speaker Spacer	8930004950	1
㉞	BH M3 × 6 ZK SUS	8810002960	2
㉟	Bottom Cover (B)	8110001870	1
㊱	BH M3 × 8 ZK SUS	8810003840	4

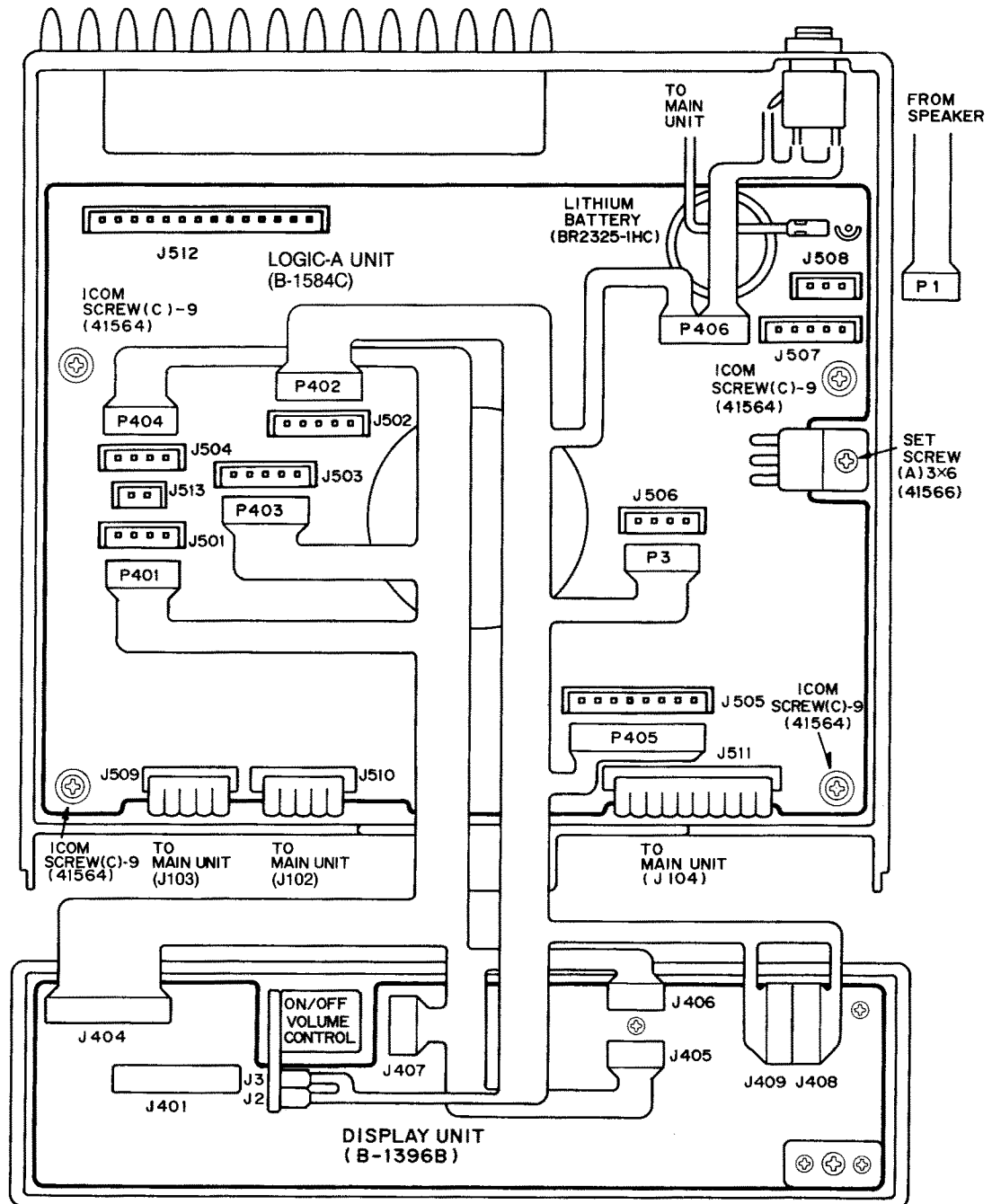
Screw type Screw: M2.6 × 4, etc. Self-tapping screw: BO 2 × 4, etc.
Screw's head style PH: Pan head FH: Flat head BH: Button head

5-2 FRONT AND MAIN UNITS CONNECTOR ASSEMBLY



- * 1 FLAT CABLE (MAIN-LOGIC-A)
STYLE-2468 AWG26 VW-1 E43172 (10)
- * 2 FLAT CABLE (MAIN-LOGIC-A)
STYLE-2468 AWG26 VW-1 E43172 (5)

5-3 FRONT AND LOGIC-A UNITS CONNECTOR ASSEMBLY



SECTION 6 ADJUSTMENT PROCEDURES

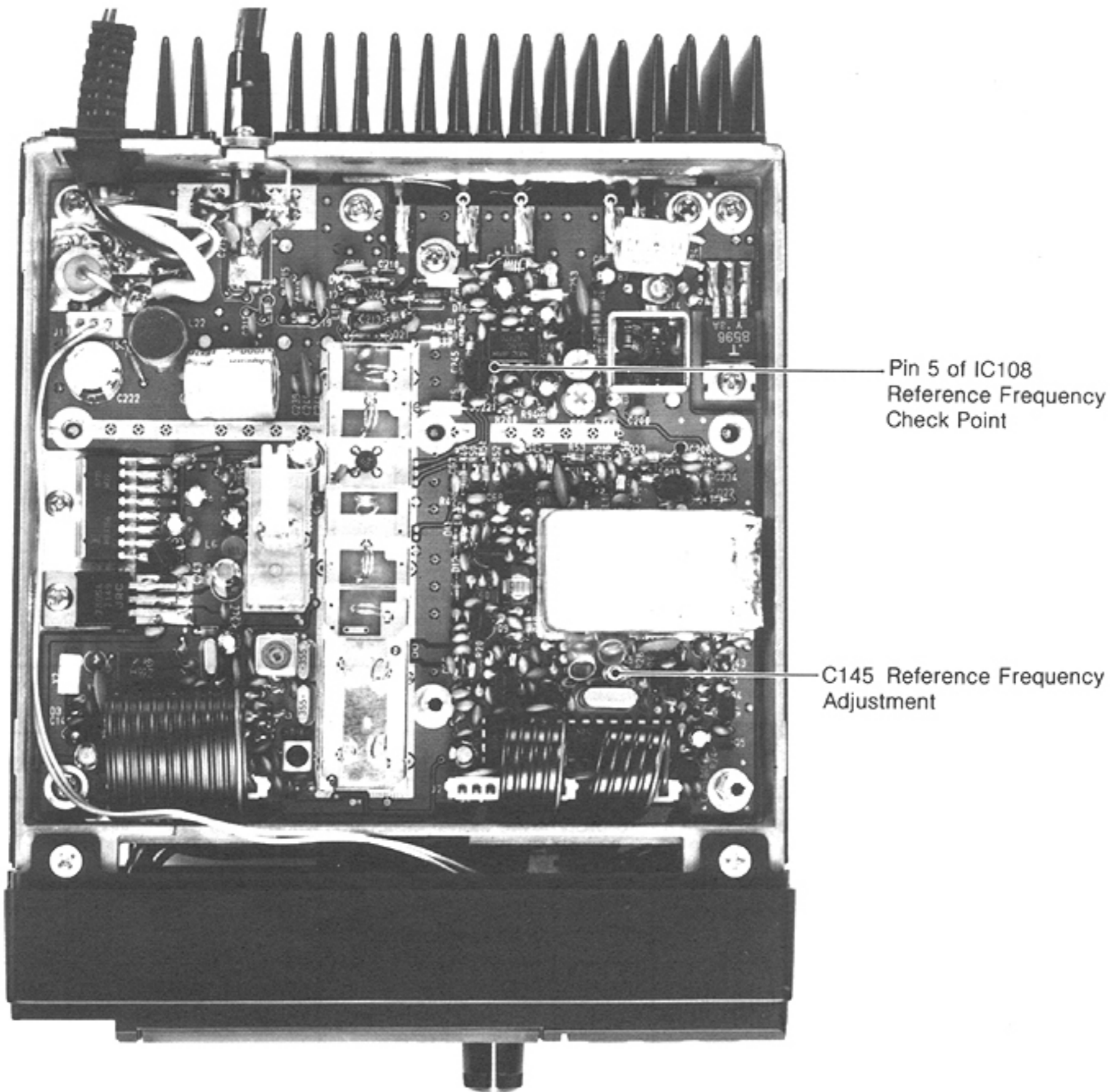
6-1 PREPARATION BEFORE SERVICING

1. **Detach** the power cord and turn OFF the POWER SWITCH before performing any work on the transceiver.
2. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
3. Follow the instructions exactly. If an indicated result is not obtained, repeat the instruction until the correct result is obtained.
4. Confirm defective operation of the transceiver first when checking an out-of-service unit. Verify that external sources **DO NOT** cause the problem.
5. Remove the transceiver covers.
6. For transmission problems, connect a dummy load to the ANTENNA CONNECTOR. For reception problems, connect an antenna or signal generator to the ANTENNA CONNECTOR. **DO NOT** transmit into the signal generator.
7. Re-check for the suspected malfunction with the POWER SWITCH ON.
8. There are different versions of this transceiver. Adjustment procedures and results may differ for each version. Be sure to follow the correct procedure for the transceiver you adjust.

6-2 PLL ADJUSTMENT

TEST INSTRUMENTS REQUIRED		MEASUREMENT CONNECTION LOCATION				
(1) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 13.8 V DC \pm 10% • Current capacity : 10 A or more (2) RF POWER METER • Terminated type • Measuring range : 5~30 W • Frequency minimum : At least 500 MHz • Impedance : 50 Ω (3) VOLTMETER • Input impedance : 40 k Ω /V DC or better (4) FREQUENCY COUNTER • Frequency minimum : At least 500 MHz • Frequency accuracy : 1 ppm or better • Sensitivity : 100 mV or better						
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
LOCK VOLTAGE	1 • Operating frequency: 450.000 MHz • Receive mode	MAIN	Connect a voltmeter to pin 5 of IC108.	Approx. 7.5 V		Verify
	2 • Operating frequency: 450.000 MHz • Transmit mode			Approx. 10.5 V		Verify
	3 • Operating frequency: 470.000 MHz • Receive mode			Approx. 9.5 V		Verify
	4 • Operating frequency: 470.000 MHz • Receive mode			Approx. 12.5 V		Verify
REFERENCE FREQUENCY	1 • Operating frequency: 450.00 MHz • Transmit mode	MAIN	Make a loose coupling between a frequency counter and the ANTENNA CONNECTOR.	450.00 MHz	MAIN	C145

MAIN UNIT

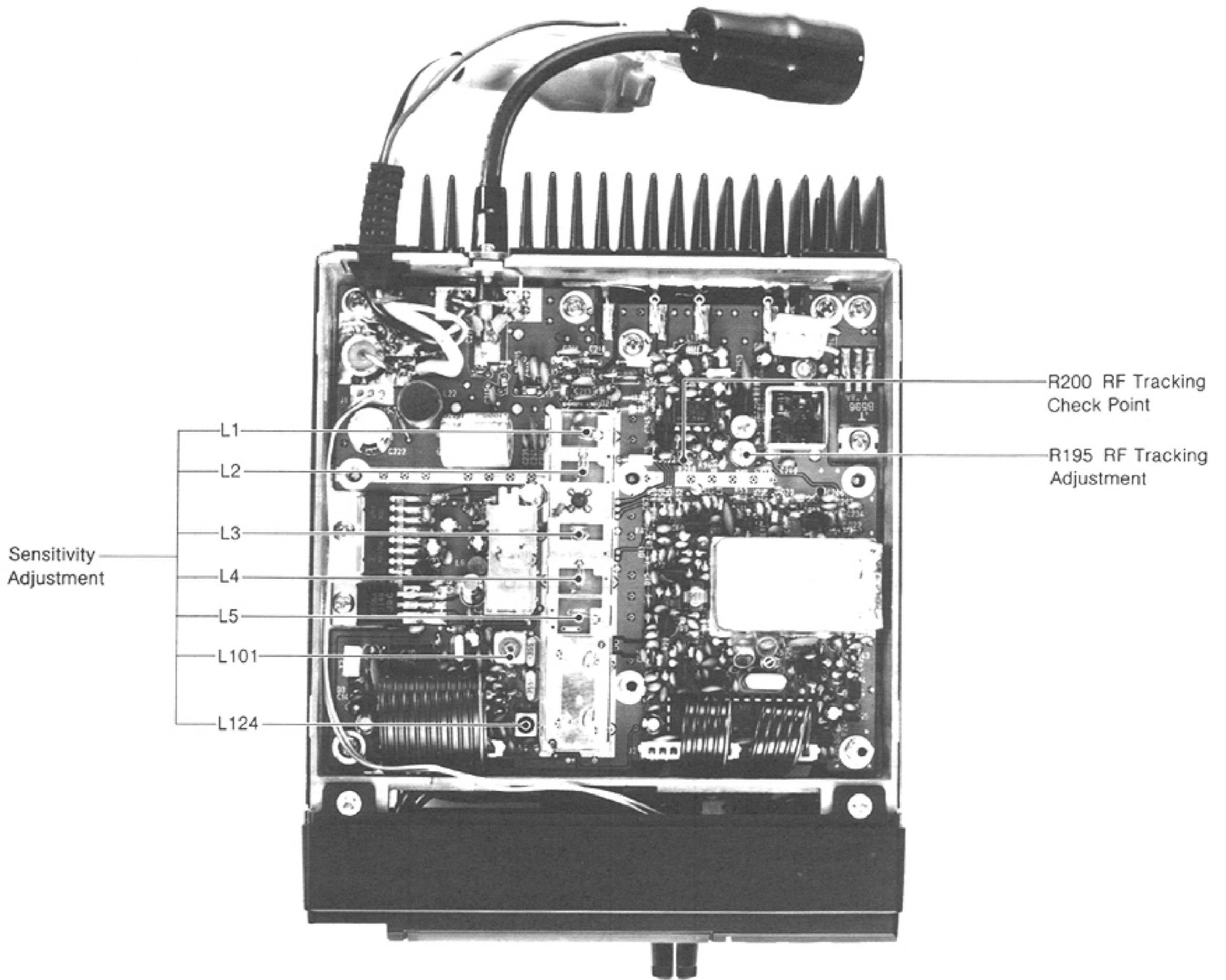


NOTE: Add "100" to the indicated numbers which are "100" or less on the unit for the actual part number.

6-3 RECEIVER ADJUSTMENT

TEST INSTRUMENTS REQUIRED		MEASUREMENT CONNECTION LOCATION					
(1) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 13.8 V DC \pm 10 % • Current capacity : 10 A or more (2) RF SIGNAL GENERATOR • Frequency range : 400~500 MHz • Output level : 0.1 μ V~100 mV (3) DISTORTION METER • Frequency range : 1 kHz \pm 10 Hz • Measuring range : 1%~100% (4) VOLTMETER • Input impedance : 50 k Ω /V DC or better (5) SPEAKER • Impedance : 4 Ω							
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
CAUTION: The answer back function must be turned OFF to protect the signal generator while making receiver adjustment. See p. 18 in the PROGRAMMING MANUAL (A-0876) for details.							
RF TRACKING	1	• Operating frequency: 450.00 MHz	MAIN	Connect the voltmeter to R200.	8.0 V	MAIN	R195
SENSITIVITY	1	• Operating frequency: 460.00 MHz • Apply an RF signal to the ANTENNA CONNECTOR. Level : 0.5 μ V Mod. : 1 kHz Dev. : \pm 1.75 kHz (#01) \pm 3.5 kHz (#02) • ON/OFF, VOLUME CONTROL: PULL ON (Squelch opens) • Push [RESET] to turn ON the monitor function.	REAR PANEL	Connect the distortion meter with a 4 Ω load to the EXTERNAL SPEAKER JACK.	Minimum distortion level	MAIN	L101 L124
						RF	L5 L4 L3 L2 L1

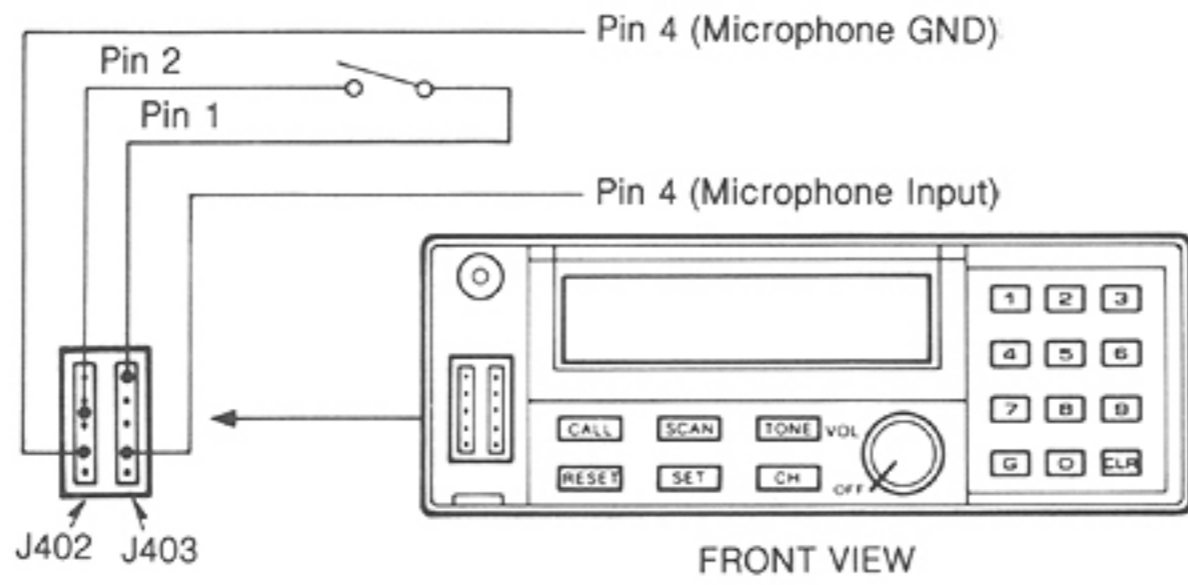
MAIN AND RF UNITS



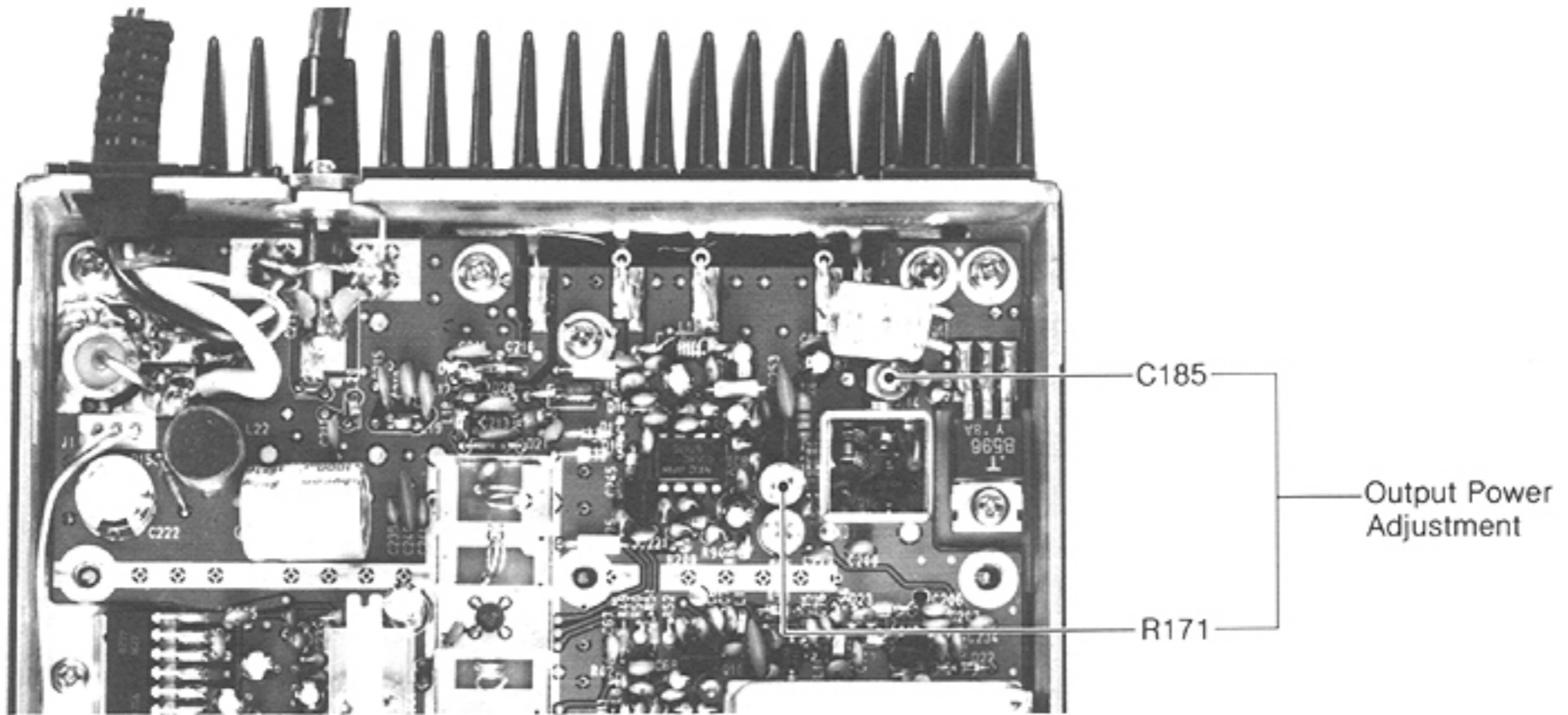
NOTE: Add "100" to the indicated numbers which are "100" or less on the unit for the actual part number.

6-4 TRANSMITTER ADJUSTMENT

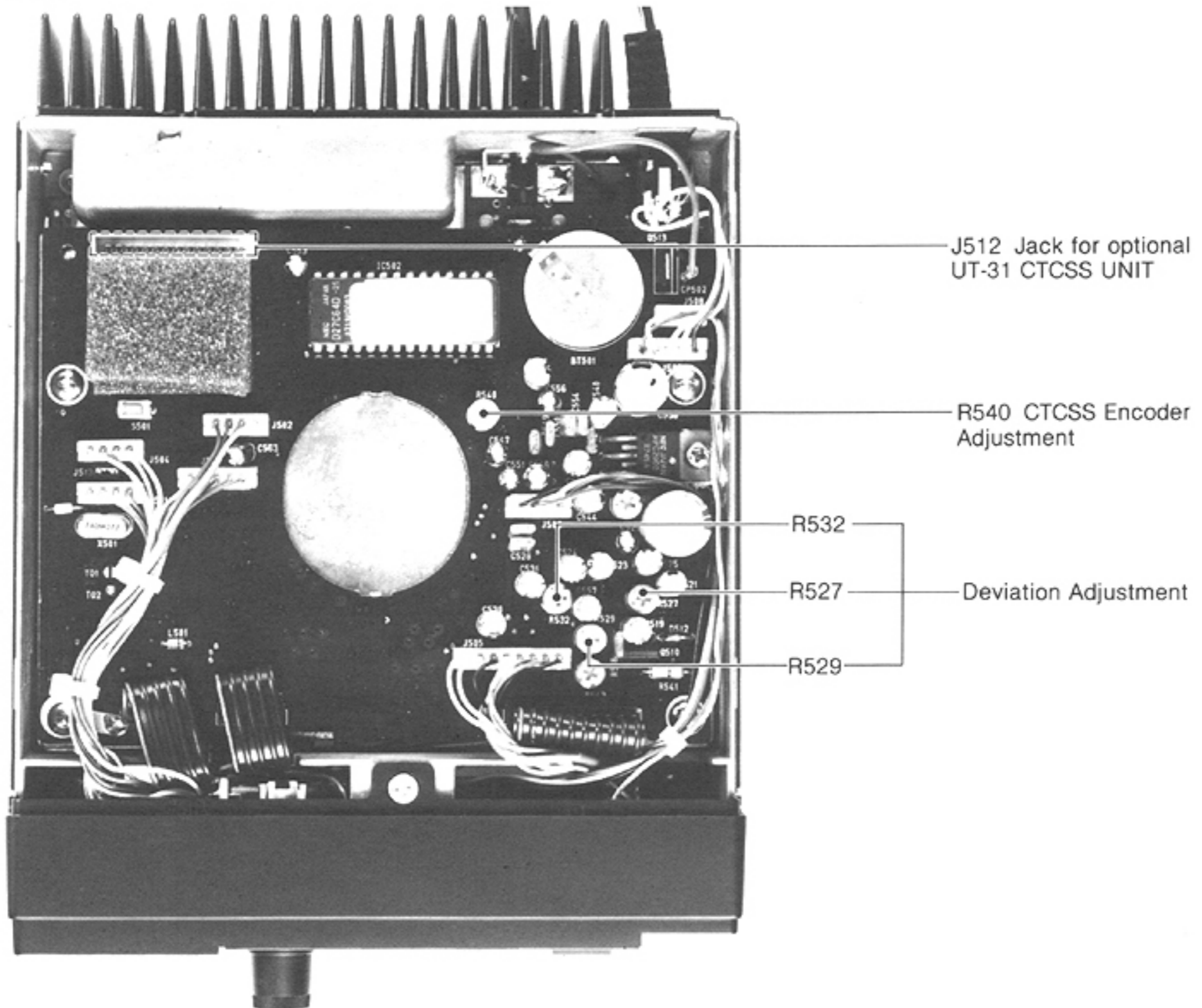
TEST INSTRUMENTS REQUIRED		MEASUREMENT CONNECTION LOCATION					
(1) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 13.8 V DC \pm 10% • Current capacity : 10 A or more (2) RF POWER METER • Terminated type • Measuring range : 5~25 W • Frequency minimum : At least 500 MHz • Impedance : 50 Ω (3) DEVIATION METER • Frequency range : 400~500 MHz • Measuring range : 0~ \pm 5 kHz (4) AC MILLI-VOLTMETER • Measuring range : 5 mV~10 V (5) ATTENUATOR • Attenuation : 30 dB or 40 dB							
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
OUTPUT POWER	1	REAR PANEL	Connect the RF power meter to the ANTENNA CONNECTOR.	Maximum power	MAIN	C185	
	2			25 W		R171	
DEVIATION	1	REAR PANEL	Connect the deviation meter to the ANTENNA CONNECTOR via the attenuator. Deviation meter: LPF: 20 kHz HPF: OFF Deemphasis: OFF Detector: P-P/2	\pm 2.2 kHz (#01) \pm 4.4 kHz (#02)	LOGIC-A	R532	
	2			Connect the oscilloscope to the deviation meter.		Symmetrical waveform	R527
	3			Connect the deviation meter to the ANTENNA CONNECTOR via an attenuator.		\pm 1.75 kHz (#01) \pm 3.5 kHz (#02)	R529
TRANSMIT S/N RATIO	1	REAR PANEL	Connect the AC milli-voltmeter to the deviation meter.	The ratio of the AC milli-voltmeter levels between 5 mV input and no signal input should be: More than 35 dB (#01) More than 40 dB (#02)		Verify	
	2						Apply no AF signal to the MIC CONNECTOR.
NOTE: An optional UT-31 CTCSS UNIT is required for CTCSS encoder adjustment.							
CTCSS ENCODER	1	REAR PANEL	Connect the deviation meter to the ANTENNA CONNECTOR.	\pm 0.3 kHz (#01) \pm 0.5 kHz (#02)	LOGIC-A	R540	



MAIN UNIT



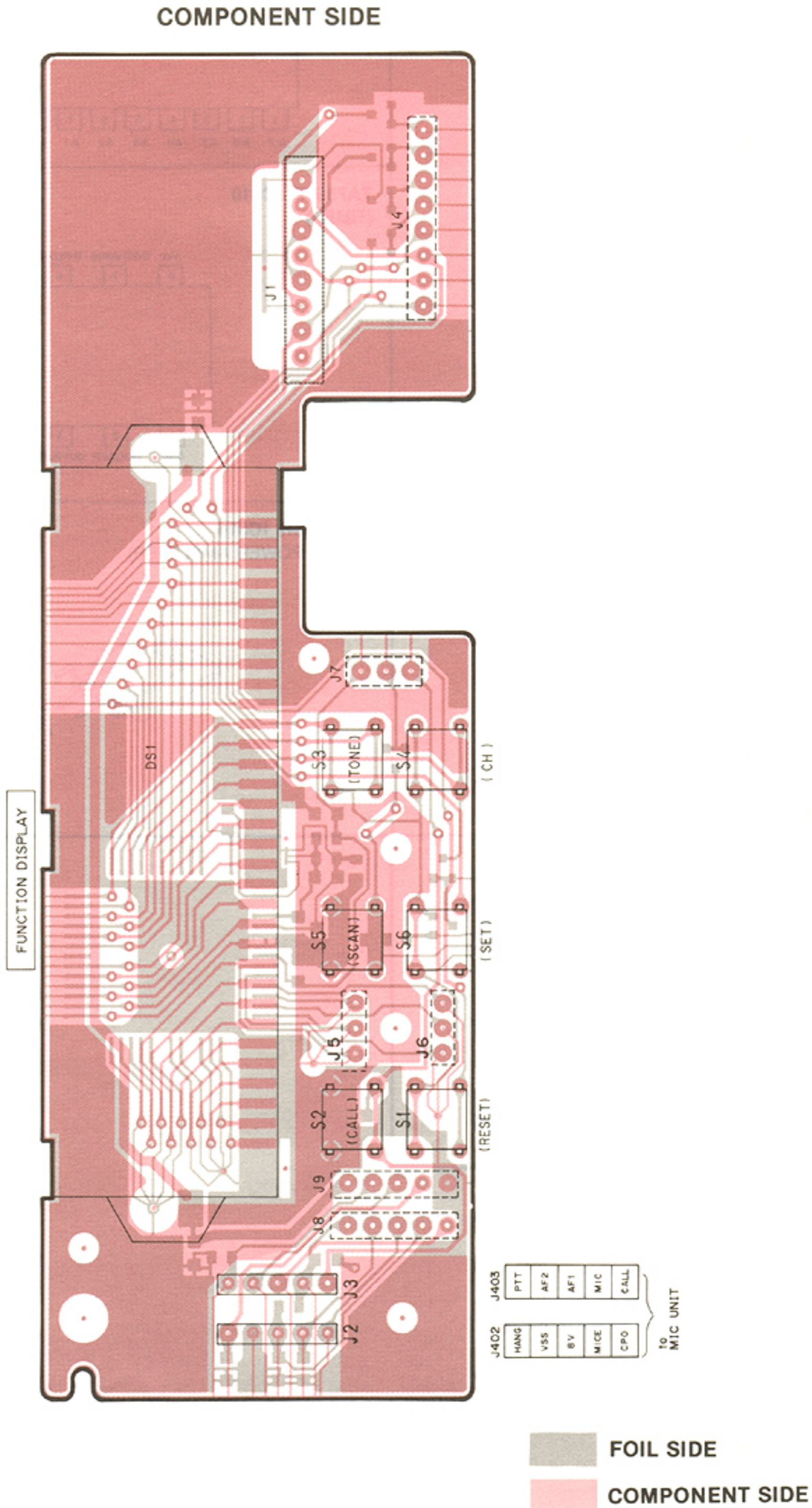
LOGIC-A UNIT



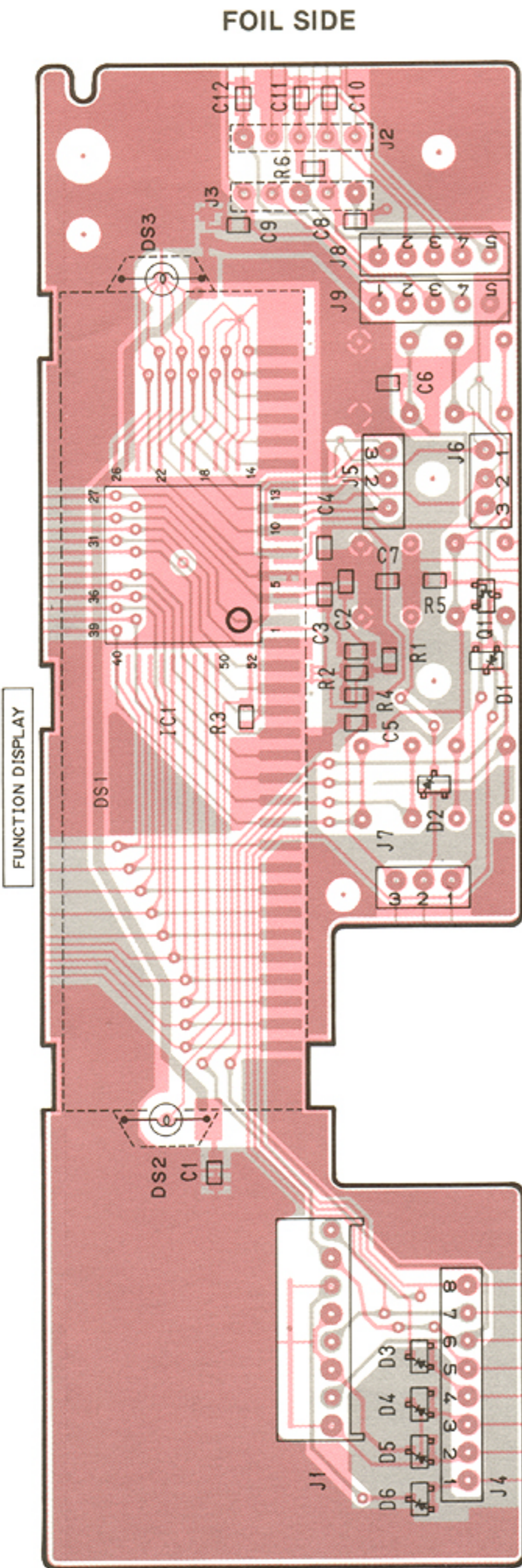
SECTION 7 BOARD LAYOUTS

7-1 DISPLAY UNIT

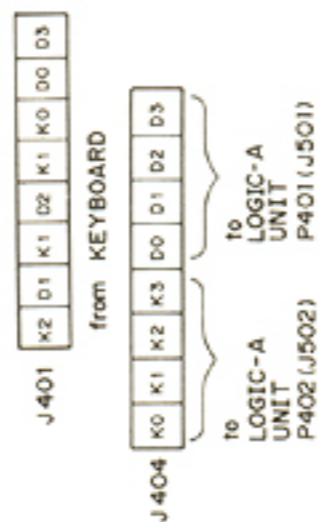
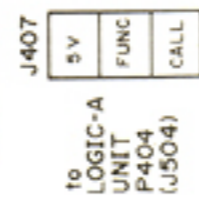
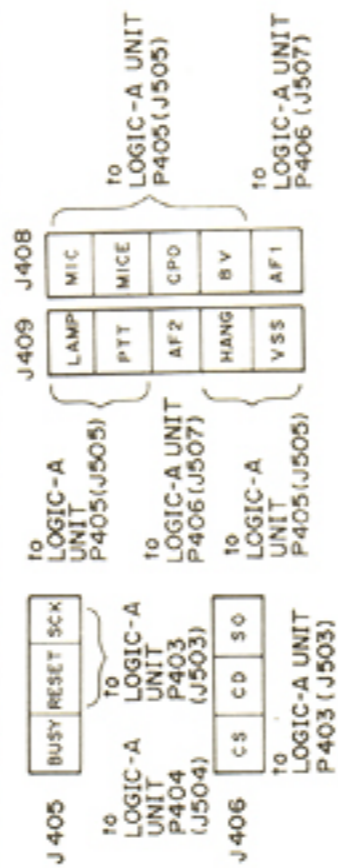
• DISPLAY UNIT



NOTE: Add "400" to the indicated number on the unit for the actual part number.

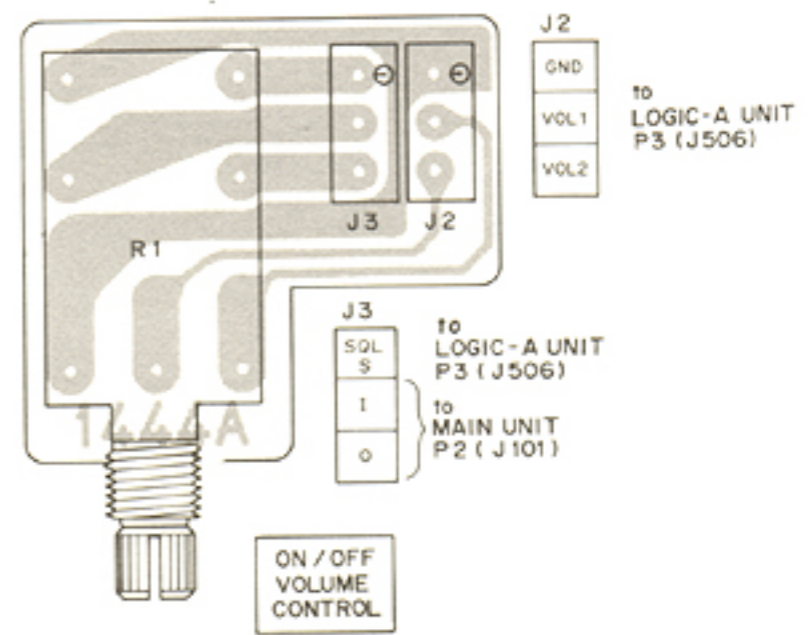


FOIL SIDE

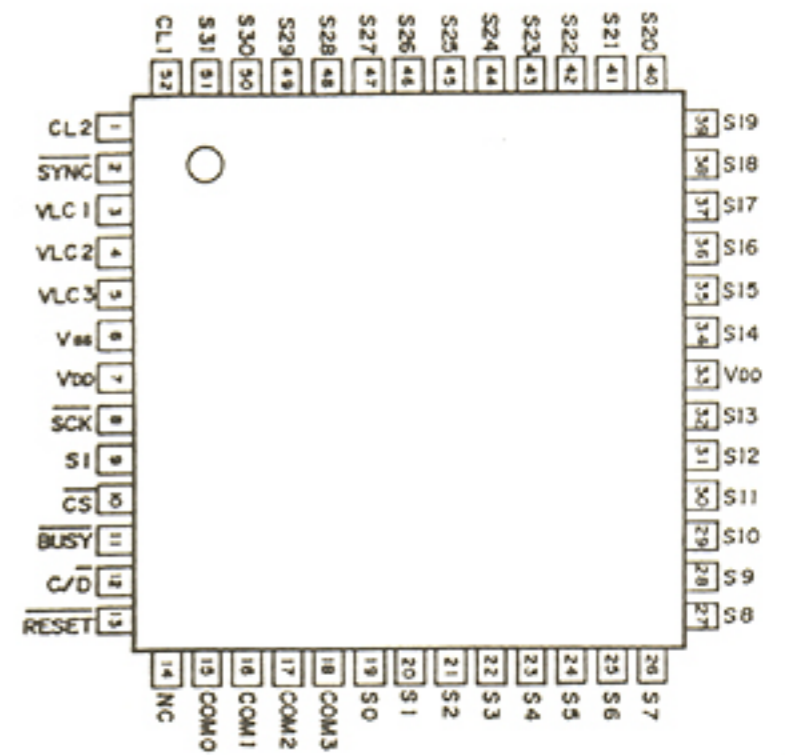


FOIL SIDE
COMPONENT SIDE

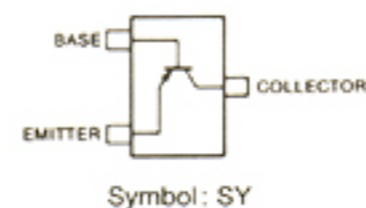
• VOL UNIT



μPD7225G IC401
(PROGRAMMABLE LCD DRIVER)

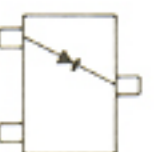


2SA1162 Y
Q401



Symbol: SY

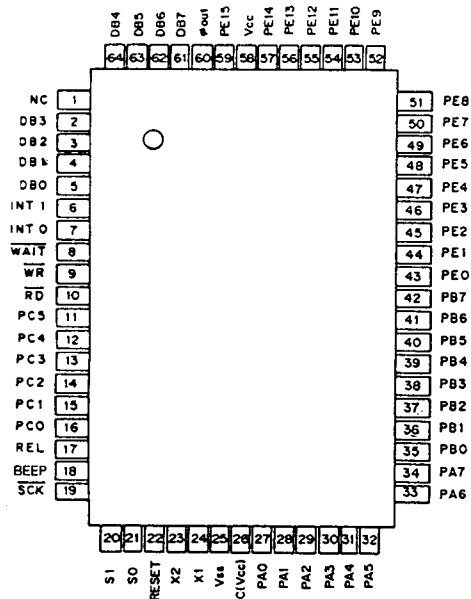
1SS193
D401, D402, D403
D404, D405, D406



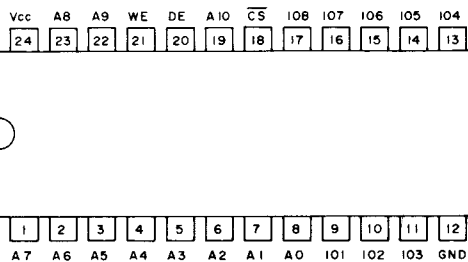
Symbol: F3

7-2 LOGIC-A UNIT

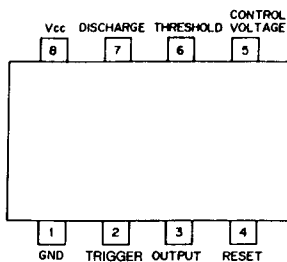
μPD78C06AG IC501
(MPU)



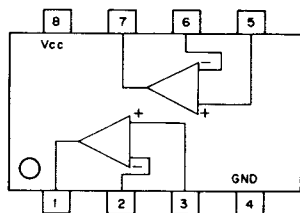
μPD446G IC503
(RAM)



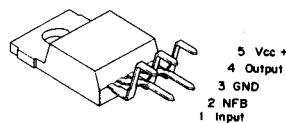
TA7555F IC510
(TIMER)



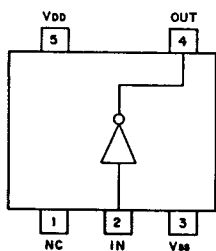
NJM4558M IC512, IC513, IC515
(LOW NOISE DUAL OPERATIONAL AMPLIFIER)



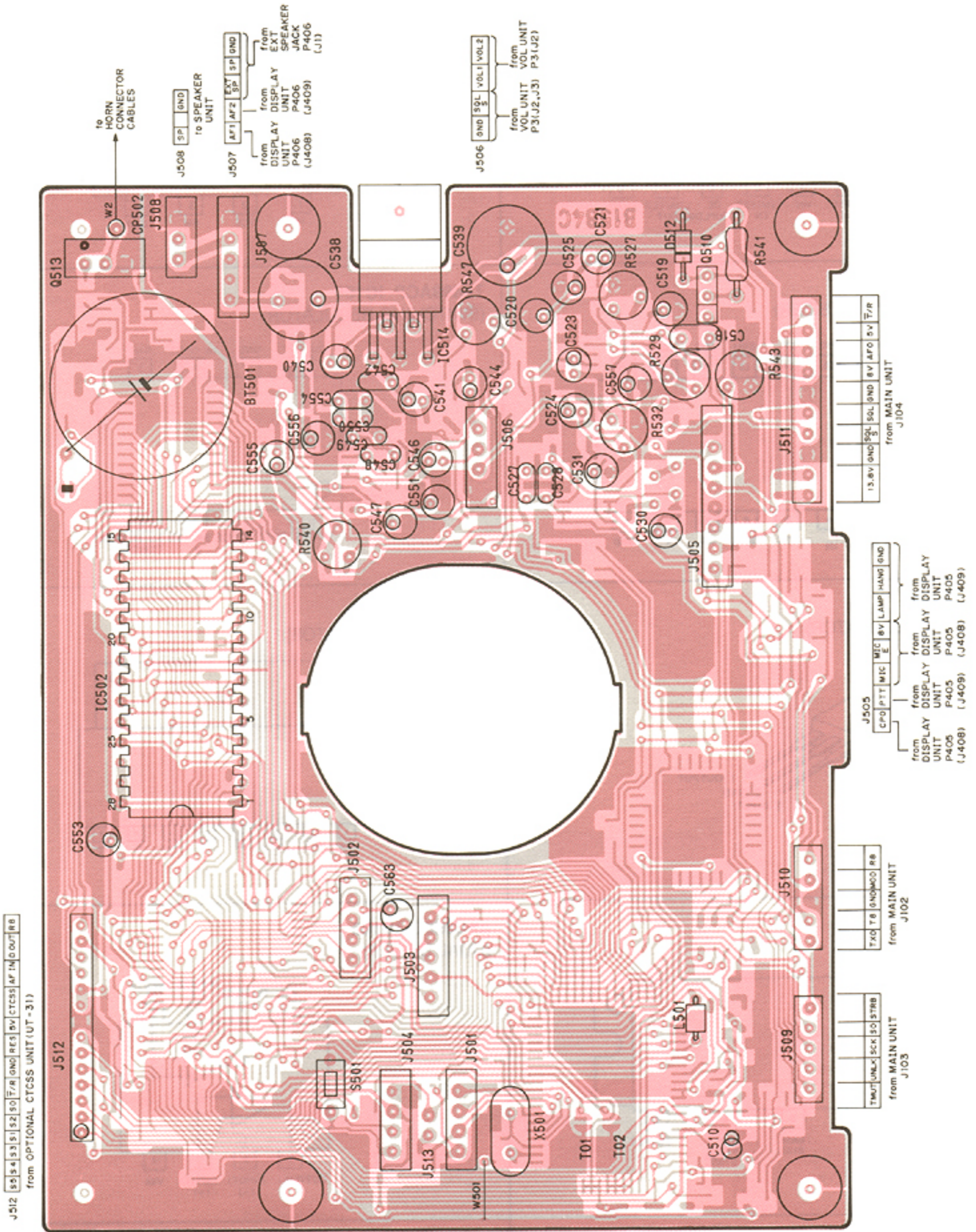
μPC2002H IC514
(AUDIO POWER AMPLIFIER)



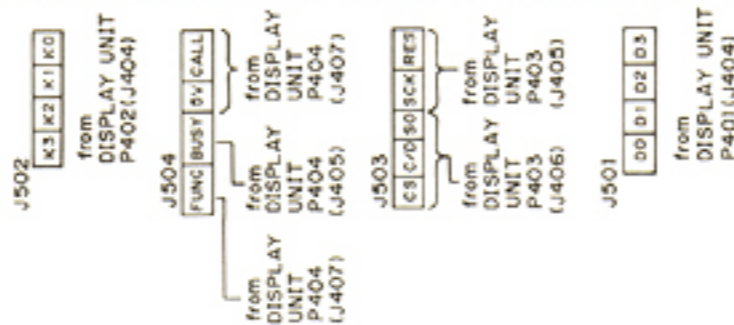
TC4SU69F IC518
(HEX INVERTER GATE)



• LOGIC-A UNIT
COMPONENT SIDE

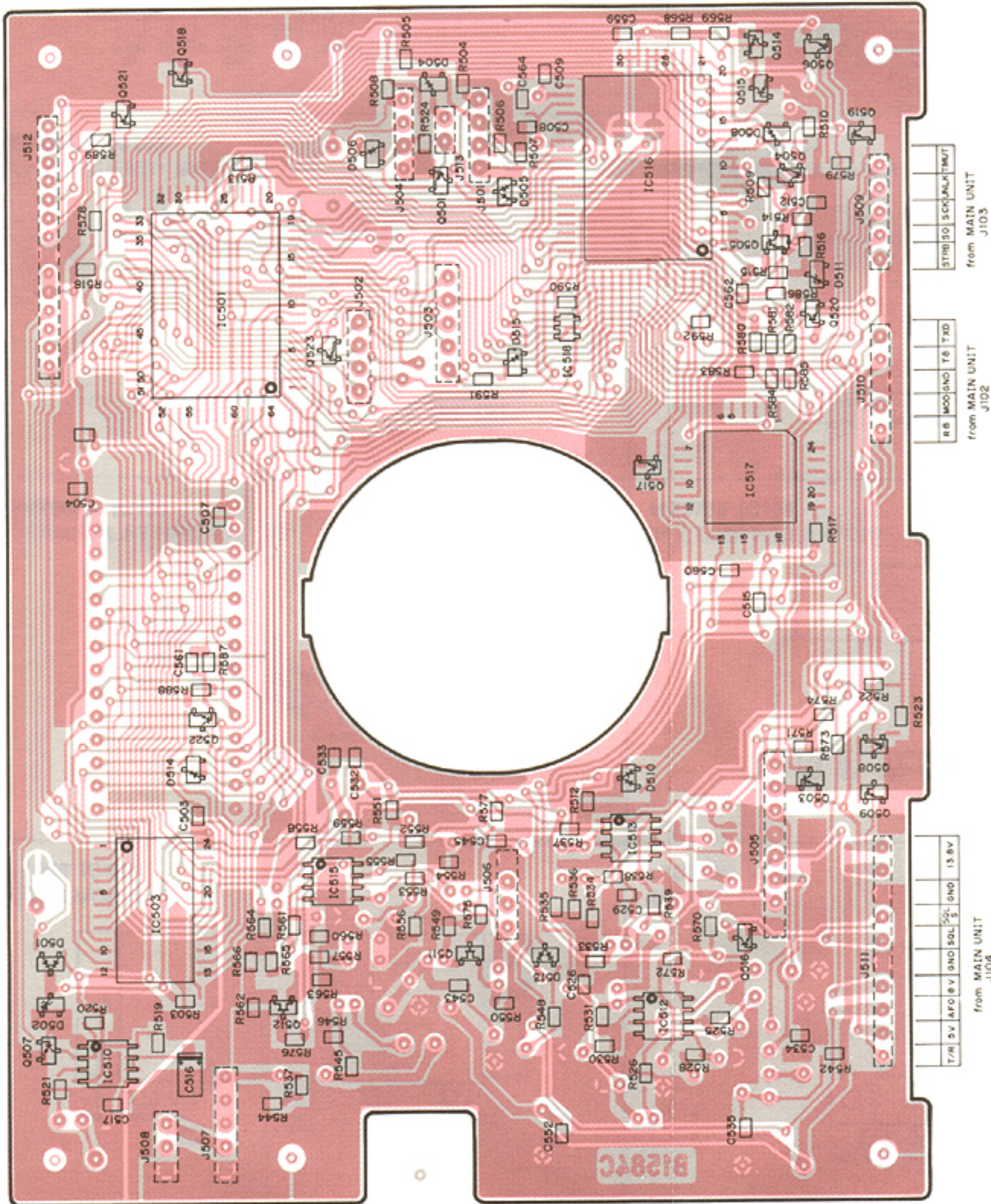


J512 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
from OPTIONAL CTCSS UNIT (UT-31)

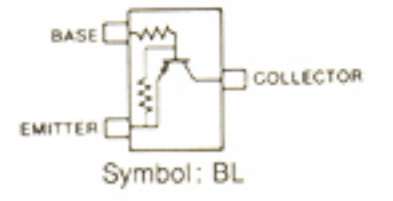


FOIL SIDE
COMPONENT SIDE

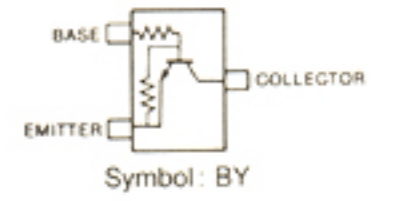
FOIL SIDE



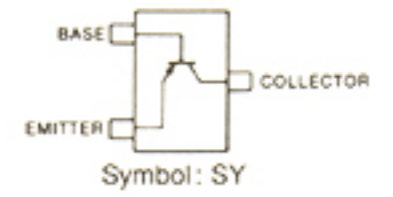
2SA1341
Q501, Q503, Q506



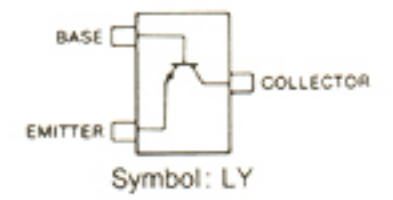
2SC3395
Q504, Q507, Q509
Q515, Q516, Q517
Q518, Q520, Q521
Q523



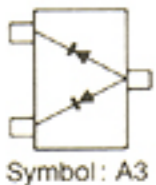
2SA1162 Y
Q505



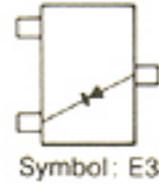
2SC2712 Y
Q508, Q514, Q519
Q522



1SS181
D505, D513



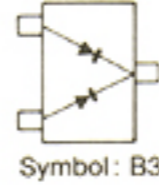
1SS190
D504, D506



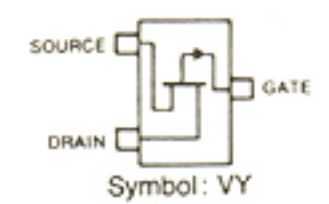
RD6.2 M B2
D502



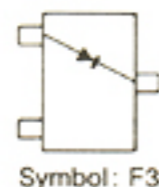
1SS184
D501, D510



2SJ106 Y
Q511, Q512



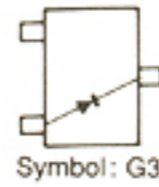
1SS193
D514



RD5.1 M B2
D511



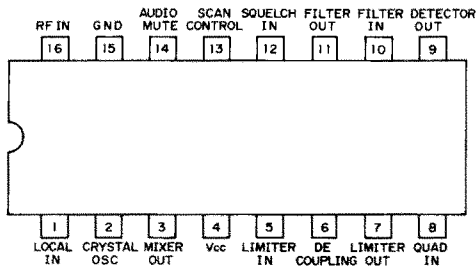
1SS196
D508, D515



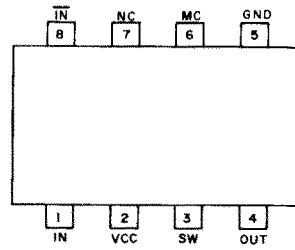
FOIL SIDE
COMPONENT SIDE

7-3 MAIN UNIT

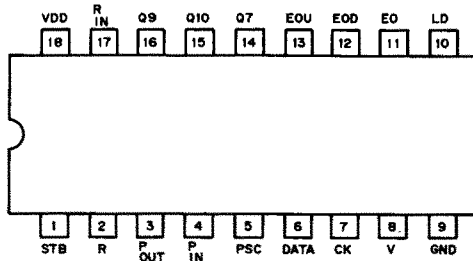
TKD1042 D IC101
(FM IF)



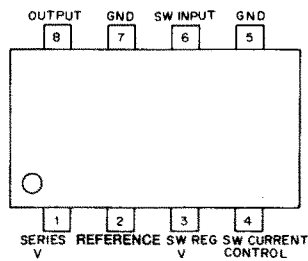
MB504P-G IC102
(PRESCALER)



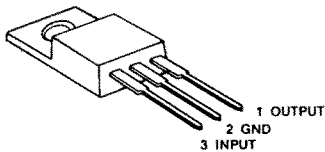
μPD2834C IC103
(PLL FREQUENCY SYNTHESIZER)



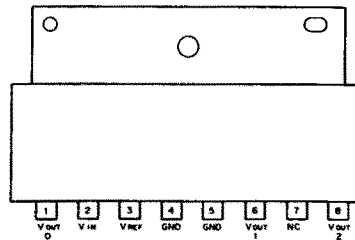
TL499ACP IC104
(SWITCHING REGULATOR)



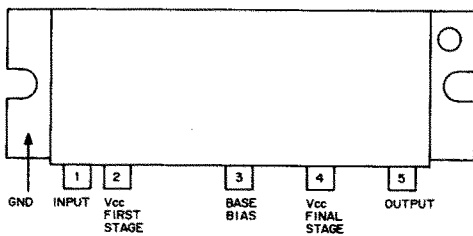
NJM7805A IC105
(3-TERMINAL 5V REGULATOR)



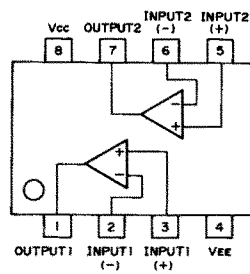
MB3756 IC106
(VOLTAGE REGULATOR)



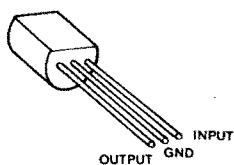
SC-1056 IC107
(POWER MODULE)



μPC358C IC108
(DUAL DRIVER)

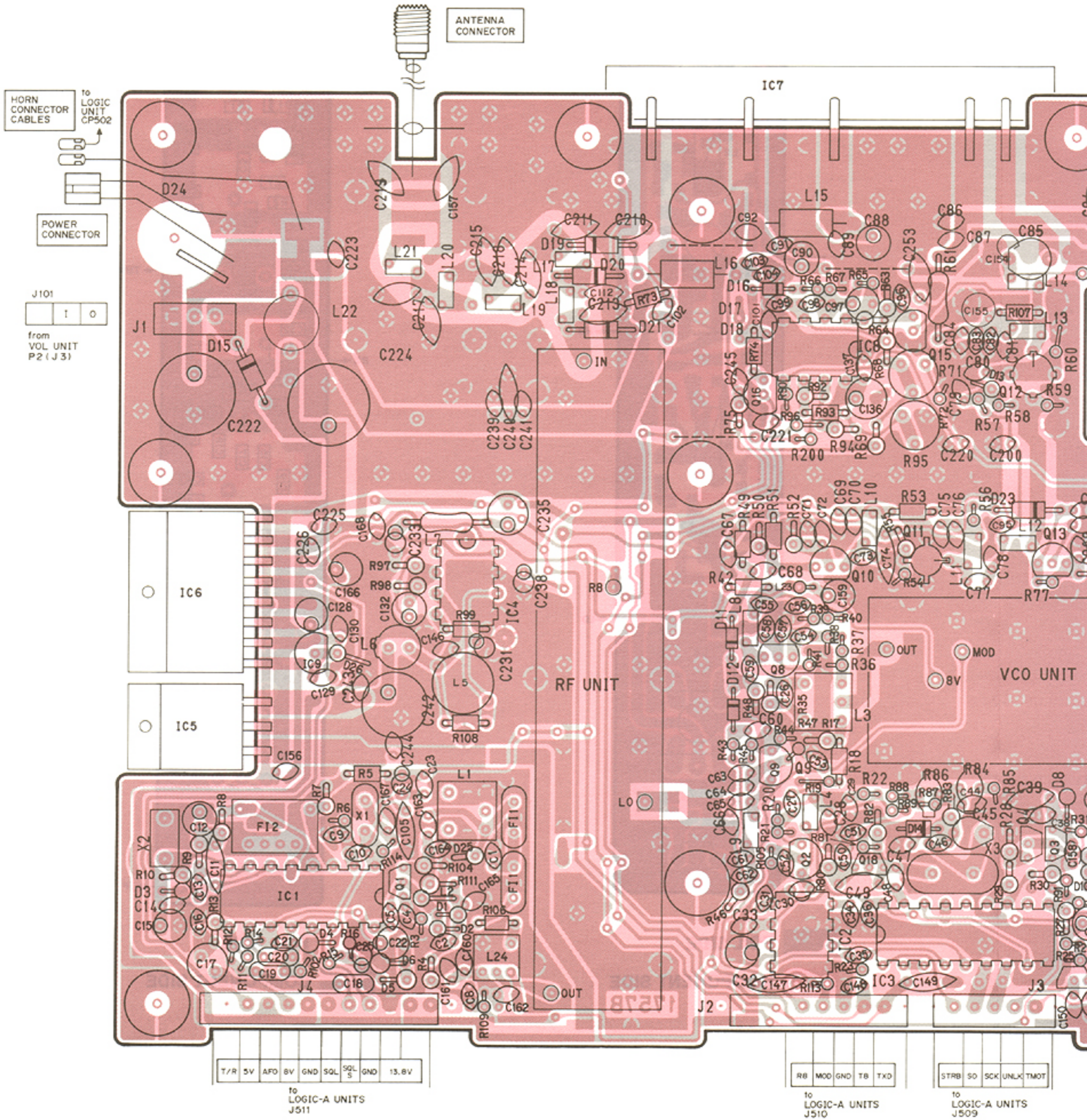


NA78L82 IC109
(3-TERMINAL 8.2V REGULATOR)

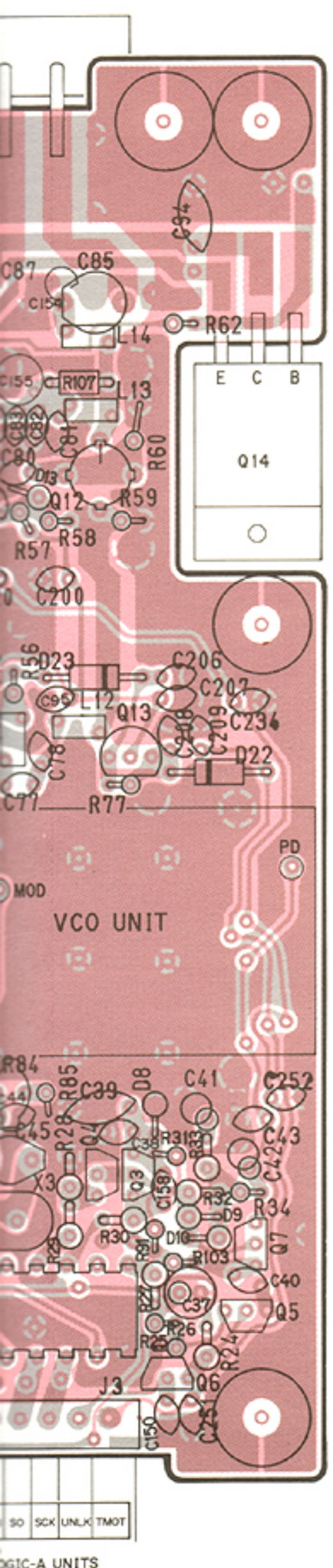


• MAIN UNIT

NOTE: Add "100" to the indicated numbers which are "100" or less on the unit for the actual part number.



FOIL SIDE
 COMPONENT SIDE



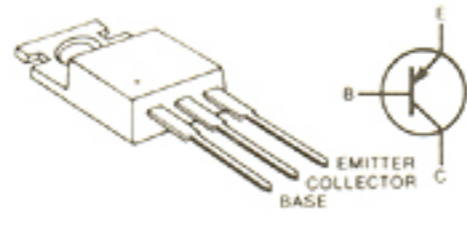
2SA1048
Q103



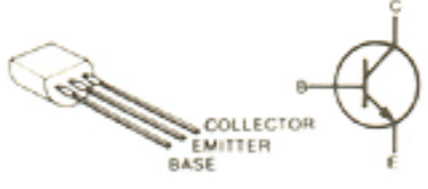
2SB561 C
Q113



2SB596 Y
Q114



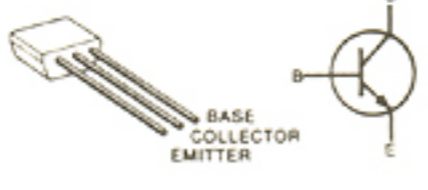
2SC2026
Q102, Q108,
Q109, Q110



2SC2458 GR
Q103, Q104,
Q105, Q118



2SC2668
Q101



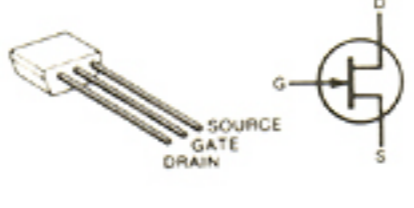
2SC3355
Q111



TRF559
Q112

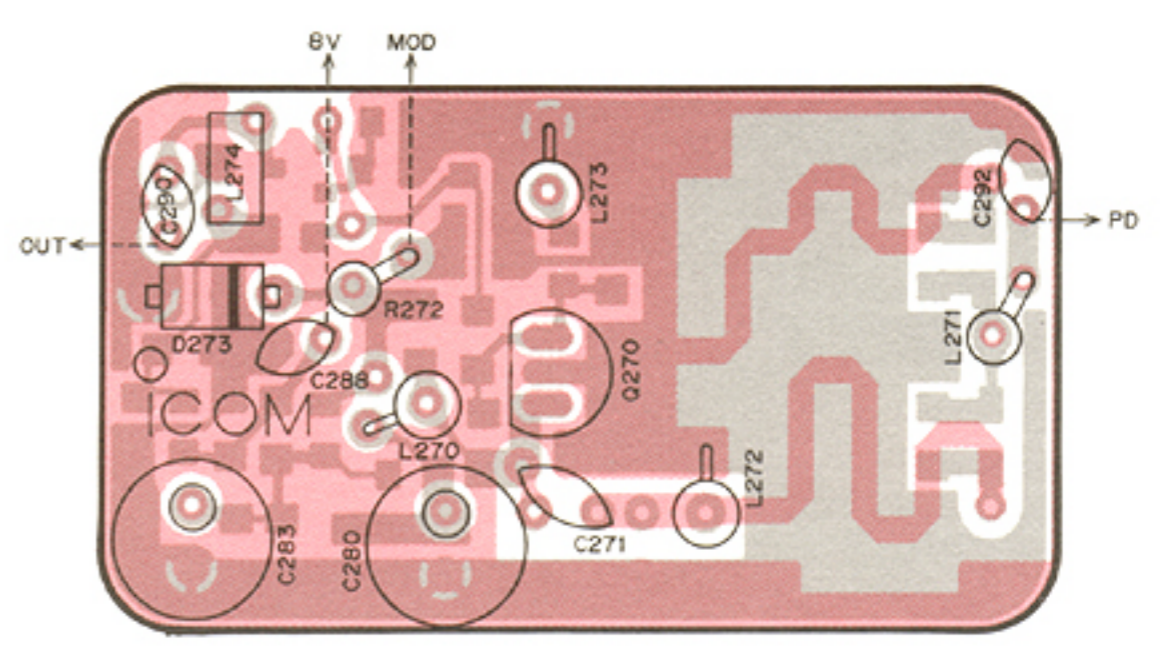


2SK184 Y
Q107

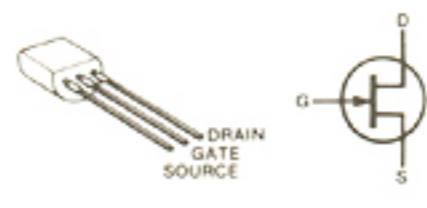


• VCO UNIT

COMPONENT SIDE

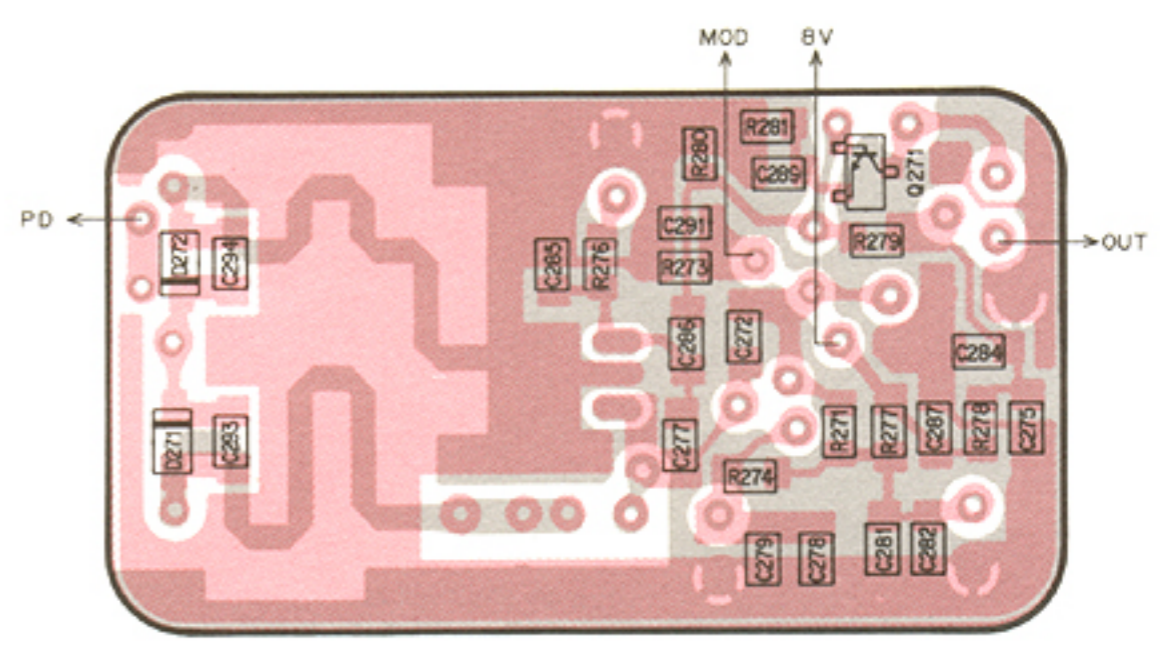


2SK125
Q270

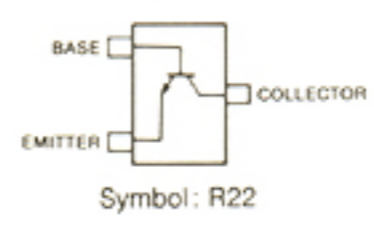


FOIL SIDE
COMPONENT SIDE

FOIL SIDE



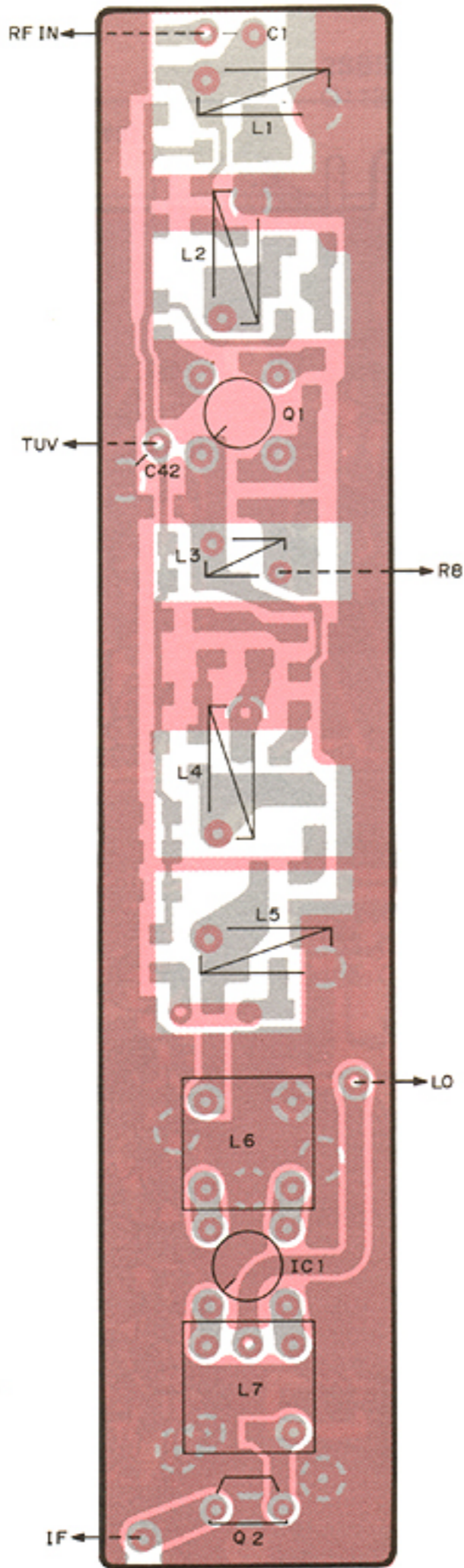
2SC3356
Q271



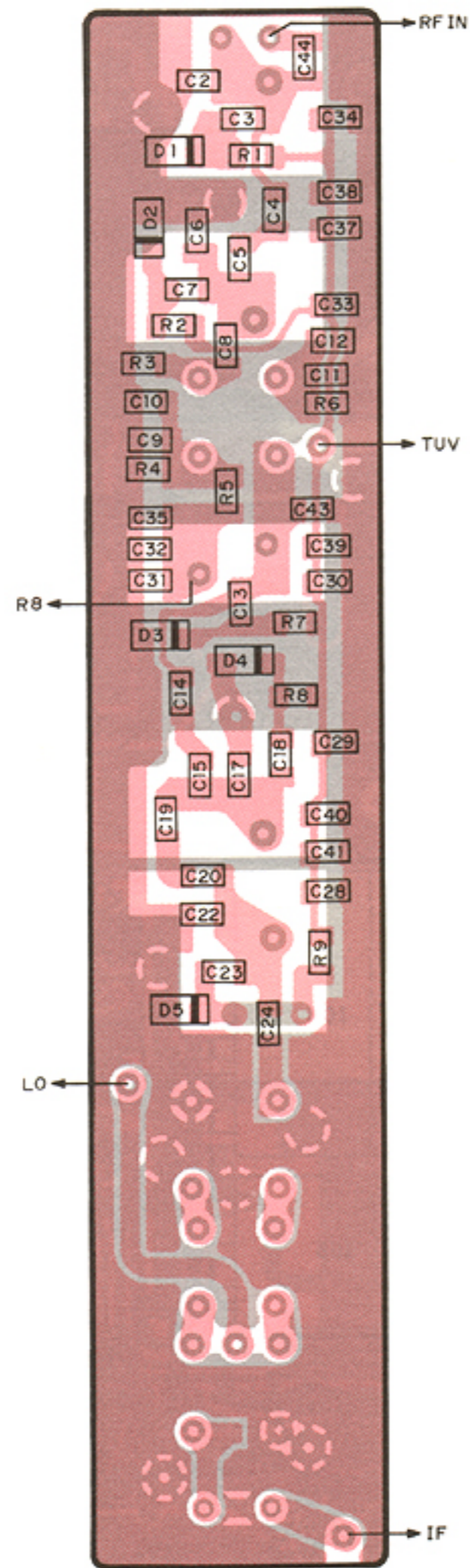
FOIL SIDE
COMPONENT SIDE

7-4 RF UNIT

COMPONENT SIDE



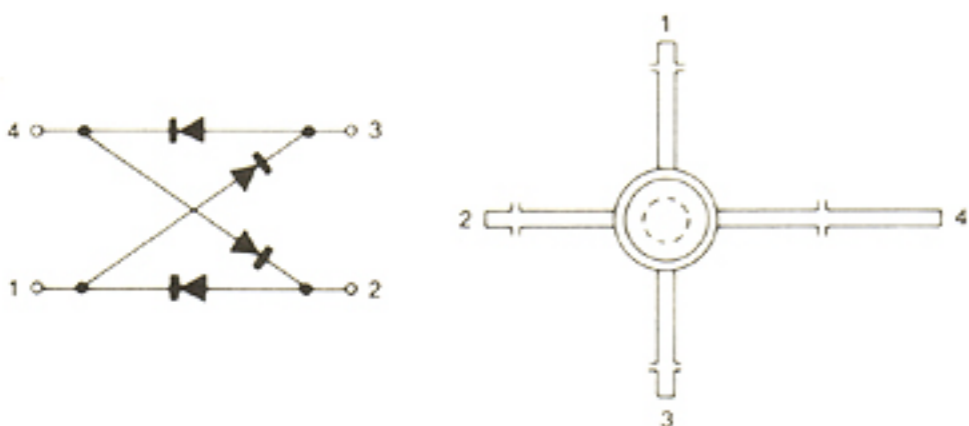
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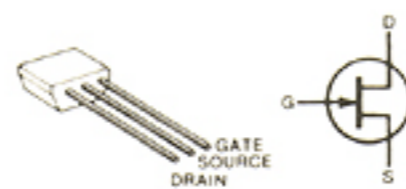
FOIL SIDE
COMPONENT SIDE

FOIL SIDE
COMPONENT SIDE

ND487C1-3R
(SCHOTTKY BARRIER DIODE QUAD)



2SK161GR
Q2



3SK121Y
Q1



SECTION 8 PARTS LIST

[EF UNIT]

REF. NO.	DESCRIPTION	PART NO.
R1	Variable Resistor	EVK-QVB 315 A14
C1	Ceramic	0.0047 μ F 50 V
J1	Connector	HSJ0780-01-010
J2	Connector	TLB-P03H-B1
J3	Connector	TLB-P03H-B1
SP1	Speaker	66F09N-7
EP1	P.C. Board	B-1444A

[DISPLAY UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC401	IC	μ PD7225G
Q401	Transistor	2SA1162 Y
D401	Diode	1SS193
D402	Diode	1SS193
D403	Diode	1SS193
D404	Diode	1SS193
D405	Diode	1SS193
D406	Diode	1SS193
R401	Resistor	10 k Ω MCR10
R402	Resistor	10 k Ω MCR10
R403	Resistor	180 k Ω MCR10
R404	Resistor	10 k Ω MCR10
R405	Resistor	47 k Ω MCR10
R406	Resistor	1 k Ω MCR10
C401	Ceramic	0.001 μ F GRM40
C402	Ceramic	0.001 μ F GRM40
C403	Ceramic	0.001 μ F GRM40
C404	Ceramic	0.001 μ F GRM40
C405	Ceramic	0.001 μ F GRM40
C406	Ceramic	470 pF GRM40
C407	Ceramic	470 pF GRM40
C408	Ceramic	0.001 μ F GRM40
C409	Ceramic	0.001 μ F GRM40
C410	Ceramic	0.001 μ F GRM40
C411	Ceramic	0.001 μ F GRM40
C412	Ceramic	0.001 μ F GRM40
J401	Connector	5124-08BH
J402	Connector	SB-5P-HVQ-CA
J403	Connector	SB-5P-HVQ-CA
J404	Connector	TLB-P08H-B1
J405	Connector	TLB-P03H-B1
J406	Connector	TLB-P03H-B1
J407	Connector	TLB-P03H-B1

[DISPLAY UNIT]

REF. NO.	DESCRIPTION	PART NO.
J408	Connector	TLB-P05H-B1
J409	Connector	TLB-P05H-B1
P401	Connector	EHR-04
P402	Connector	EHR-04
P403	Connector	EHR-05
P404	Connector	EHR-04
P405	Connector	EHR-08
P406	Connector	EHR-05
DS401	LCD	LR598-A
DS402	Lamp	BQ031-22403A
DS403	Lamp	BQ031-22403A
S401	Switch	SKHHBV011A
S402	Switch	SKHHBV011A
S403	Switch	SKHHBV011A
S404	Switch	SKHHBV011A
S405	Switch	SKHHBV011A
S406	Switch	SKHHBV011A
W401	Wire	23/01/120/B06/C22
W402	Wire	23/03/120/B06/C22
W403	Wire	23/04/120/B06/C22
W404	Wire	23/05/120/B06/C22
W405	Wire	23/06/150/B06/C22
W406	Wire	23/07/150/B06/C22
W407	Wire	23/08/150/B06/C22
W408	Wire	23/09/150/B06/C22
W409	Wire	23/05/200/B06/C22
W410	Wire	23/06/200/B06/C22
W411	Wire	23/07/170/B06/C22
W412	Wire	23/01/200/B06/C22
W413	Wire	23/03/200/B06/C22
W414	Wire	23/04/200/B06/C22
W415	Wire	23/02/150/B06/C22
W416	Wire	23/03/145/B06/C22
W417	Wire	23/04/150/B06/C22
W418	Wire	23/04/070/B06/C22
W419	Shield cable	{ 51/02/070/B06A/C22A }
W420		{ 08 A A }
W421	Wire	23/02/070/B06/C22
W422	Wire	23/06/140/B06/C22
W423	Wire	23/01/070/B06/C22
W424	Wire	23/03/070/B06/C22
W425	Wire	23/04/140/B06/C22
W426	Wire	23/05/070/B06/C22
W427	Wire	23/00/070/B06/C22
W428	Wire	23/04/070/B06/X04
W429	Wire	23/09/060/B06/X04
W430	Wire	23/00/060/B06/X04
W431	Wire	13/00/070/W02/W02
EP401	P.C. Board	B-1396B
EP402	Rubber Conductor	0.25 \times 70 \times 11.0 \times 2.5

[LOGIC-A UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC501	IC	μPD78C06AG-570-12
IC502	IC	SC-1073
IC503	IC	μPD446G
IC510	IC	TA7555F
IC512	IC	NJM4558M
IC513	IC	NJM4558M
IC514	IC	μPC2002H
IC515	IC	NJM4558M
IC516	IC	SC-1084
IC517	IC	FX-102LG
IC518	IC	TC4SU69F
Q501	Transistor	2SA1341
Q503	Transistor	2SA1341
Q504	Transistor	2SC3395
Q505	Transistor	2SA1162 Y
Q506	Transistor	2SA1341
Q507	Transistor	2SC3395
Q508	Transistor	2SC2712 Y
Q509	Transistor	2SC3395
Q510	Transistor	2SD1225M R
Q511	FET	2SJ106 Y
Q512	FET	2SJ106 Y
Q513	Transistor	2SD1286
Q514	Transistor	2SC2712 Y
Q515	Transistor	2SC3395
Q516	Transistor	2SC3395
Q517	Transistor	2SC3395
Q518	Transistor	2SC3395
Q519	Transistor	2SC2712 Y
Q520	Transistor	2SC3395
Q521	Transistor	2SC3395
Q522	Transistor	2SC2712 Y
Q523	Transistor	2SC3395
D501	Diode	1SS184
D502	Zener	RD6.2M B2
D504	Diode	1SS190
D505	Diode	1SS181
D506	Diode	1SS190
D508	Diode	1SS196
D510	Diode	1SS184
D511	Zener	RD5.1M B2
D512	Zener	RD8.2E B2
D513	Diode	1SS181
D514	Diode	1SS193
D515	Diode	1SS196
X501	Crystal	FAGNKD
L501	Coil	LAL02TB 330K
R503	Resistor	47 kΩ MCR10
R504	Resistor	10 kΩ MCR10
R505	Resistor	10 kΩ MCR10
R506	Resistor	10 kΩ MCR10
R507	Resistor	10 kΩ MCR10
R508	Resistor	47 kΩ MCR10
R509	Resistor	47 kΩ MCR10
R510	Resistor	270 kΩ MCR10
R512	Resistor	47 kΩ MCR10
R513	Resistor	47 kΩ MCR10
R514	Resistor	22 kΩ MCR10
R515	Resistor	22 kΩ MCR10
R516	Resistor	27 kΩ MCR10
R517	Resistor	2.2 MΩ MCR10
R518	Resistor	47 kΩ MCR10
R519	Resistor	1 MΩ MCR10
R520	Resistor	47 kΩ MCR10
R521	Resistor	4.7 kΩ MCR10

[LOGIC-A UNIT]

REF. NO.	DESCRIPTION	PART NO.
R522	Resistor	47 kΩ MCR10
R523	Resistor	47 kΩ MCR10
R524	Resistor	47 kΩ MCR10
R525	Resistor	4.7 kΩ MCR10
R526	Resistor	15 kΩ MCR10
R527	Trimmer	10 kΩ RH0651C14J2WA
R528	Resistor	1.2 kΩ MCR10
R529	Trimmer	220 kΩ RH0651CJ5J01A
R530	Resistor	6.8 kΩ MCR10
R531	Resistor	470 kΩ MCR10
R532	Trimmer	4.7 kΩ RH0651CS3J2KA
R533	Resistor	270 kΩ MCR10
R534	Resistor	120 kΩ MCR10
R535	Resistor	47 kΩ MCR10
R536	Resistor	39 kΩ MCR10
R537	Resistor	33 kΩ MCR10
R538	Resistor	39 kΩ MCR10
R539	Resistor	100 Ω MCR10
R540	Trimmer	1 MΩ RH0651C16J0RA
R541	Resistor	33 Ω R50X
R542	Resistor	1 kΩ MCR10
R543	Trimmer	47 kΩ RH0651CS4J25A
R544	Resistor	1 Ω MCR10
R545	Resistor	390 Ω MCR10
R546	Resistor	2.2 Ω MCR10
R547	Trimmer	47 kΩ RH0651CS4J25A
R548	Resistor	1 MΩ MCR10
R549	Resistor	10 kΩ MCR10
R550	Resistor	1 MΩ MCR10
R551	Resistor	100 Ω MCR10
R552	Resistor	8.2 kΩ MCR10
R553	Resistor	560 kΩ MCR10
R554	Resistor	10 kΩ MCR10
R555	Resistor	8.2 kΩ MCR10
R556	Resistor	27 kΩ MCR10
R557	Resistor	33 kΩ MCR10
R558	Resistor	56 kΩ MCR10
R559	Resistor	10 kΩ MCR10
R560	Resistor	10 kΩ MCR10
R561	Resistor	8.2 kΩ MCR10
R562	Resistor	1 MΩ MCR10
R563	Resistor	1 MΩ MCR10
R564	Resistor	1.2 kΩ MCR10
R565	Resistor	1.2 kΩ MCR10
R566	Resistor	1.2 kΩ MCR10
R568	Resistor	47 kΩ MCR10
R569	Resistor	47 kΩ MCR10
R570	Resistor	47 kΩ MCR10
R571	Resistor	4.7 kΩ MCR10
R572	Resistor	100 Ω MCR10
R573	Resistor	1 kΩ MCR10
R574	Resistor	10 kΩ MCR10
R575	Resistor	100 kΩ MCR10
R576	Resistor	100 kΩ MCR10
R577	Resistor	820 kΩ MCR10
R578	Resistor	4.7 kΩ MCR10
R579	Resistor	47 kΩ MCR10
R580	Resistor	100 kΩ MCR10
R581	Resistor	100 kΩ MCR10
R582	Resistor	100 kΩ MCR10
R583	Resistor	47 kΩ MCR10
R584	Resistor	47 kΩ MCR10
R585	Resistor	47 kΩ MCR10
R586	Resistor	47 kΩ MCR10
R587	Resistor	10 kΩ MCR10
R588	Resistor	4.7 kΩ MCR10
R589	Resistor	47 kΩ MCR10
R590	Resistor	47 kΩ MCR10
R591	Resistor	4.7 kΩ MCR10
R592	Resistor	2.7 kΩ MCR10
C503	Ceramic	0.01 μF GRM40 F
C504	Ceramic	0.01 μF GRM40 F
C507	Ceramic	0.01 μF GRM40 F

[LOGIC-A UNIT]

REF. NO.	DESCRIPTION	PART NO.
C508	Ceramic	10 pF GRM40
C509	Ceramic	30 pF GRM40
C510	Tantalum	0.1 μF 35 V DN
C512	Ceramic	0.01 μF GRM40 F
C515	Ceramic	0.0022 μF GRM40
C516	Tantalum	3.3 μF TESVB1A335M12L
C517	Ceramic	0.1 μF GRM40 F
C518	Mylar	0.01 μF 50 V
C519	Electrolytic	10 μF 16 V SS
C520	Electrolytic	0.1 μF 50 V MS7
C521	Electrolytic	1 μF 50 V SS
C523	Electrolytic	2.2 μF 50 V SS
C524	Electrolytic	4.7 μF 25 V SS
C525	Electrolytic	0.47 μF 50 V
C526	Ceramic	0.0022 μF GRM40
C527	Mylar	0.01 μF 50 V
C528	Mylar	0.001 μF 50 V
C529	Ceramic	150 pF GRM40 (#01)
C529	Ceramic	100 pF GRM40 (#02)
C530	Electrolytic	1 μF 50 V SS
C531	Electrolytic	4.7 μF 25 V SS
C532	Ceramic	0.001 μF GRM40
C533	Ceramic	0.001 μF GRM40
C534	Ceramic	0.1 μF GRM40 F
C535	Ceramic	0.001 μF GRM40
C537	Ceramic	0.1 μF GRM40 F
C538	Electrolytic	470 μF 16 V SS
C539	Electrolytic	470 μF 16 V MS16
C540	Electrolytic	10 μF 16 V SS
C541	Electrolytic	4.7 μF 25 V SS
C542	Mylar	0.01 μF 50 V
C543	Ceramic	0.01 μF GRM40 F
C544	Electrolytic	0.47 μF 50 V SS
C545	Ceramic	0.01 μF GRM40 F
C546	Electrolytic	0.47 μF 50 V SS
C547	Electrolytic	4.7 μF 25 V MS7
C548	Mylar	0.01 μF 50 V
C549	Mylar	0.01 μF 50 V
C550	Mylar	0.01 μF 50 V
C551	Electrolytic	0.22 μF 50 V MS7
C552	Ceramic	0.01 μF GRM40 F
C553	Electrolytic	10 μF 16 V MS7
C554	Mylar	0.001 μF 50 V
C555	Electrolytic	1 μF 50 V SS
C556	Electrolytic	0.22 μF 50 V MS7
C557	Electrolytic	4.7 μF 25 V SS
C559	Ceramic	0.01 μF GRM40 F
C560	Ceramic	0.01 μF GRM40 F
C561	Ceramic	47 pF GRM40
C562	Ceramic	100 pF GRM40
C563	Electrolytic	4.7 μF 25 V MS7
C564	Ceramic	22 pF GRM40
CP502	Check Point	RT-01T-1.0B
J501	Connector	B04B-EH-S
J502	Connector	B04B-EH-S
J503	Connector	B05B-EH-S
J504	Connector	B04B-EH-S
J505	Connector	B08B-EH-S
J506	Connector	B04B-EH-S
J507	Connector	B05B-EH-S
J508	Connector	B03B-EH-S
J509	Connector	HBRB5S-1J
J510	Connector	HBRB5S-1J
J511	Connector	HBRB10S-1J
J512	Connector	5512-14A
J513	Connector	1MSA-9201B-2-02-T
S501	Switch	SKHLAB064A

[LOGIC-A UNIT]

REF. NO.	DESCRIPTION	PART NO.
BT501	Lithium Battery	BR2325-1HC
W501	Jumper	JPW-01 R-01
EP501	P.C. Board	B-1584C

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC101	IC	TK10420 D
IC102	IC	MB504P-G
IC103	IC	μPD2834C
IC104	IC	TL499ACP
IC105	IC	NJM7805A
IC106	IC	MB3756
IC107	IC	SC-1056
IC108	IC	μPC358C
IC109	IC	NA78L82 AWC
Q101	Transistor	2SC2668 0
Q102	Transistor	2SC2026
Q103	Transistor	2SA1048 GR
Q104	Transistor	2SC2458 GR
Q105	Transistor	2SC2458 GR
Q106	Transistor	2SC2458 GR
Q107	FET	2SK184 Y
Q108	Transistor	2SC2026
Q109	Transistor	2SC2026
Q110	Transistor	2SC2026
Q111	Transistor	2SC3358
Q112	Transistor	TRF559
Q113	Transistor	2SB561 C
Q114	Transistor	2SB596 Y
Q115	Transistor	2SC945 P
Q116	Transistor	2SC945 P
Q118	Transistor	2SC2458 GR
D101	Diode	1S953
D102	Diode	1S953
D103	Zener	RD6.2E B2
D104	Diode	1SS133
D105	Diode	1S953
D106	Diode	1S953
D108	Zener	RD15E B1
D109	Diode	1SS97
D110	Diode	1SS97
D111	Diode	1SS265
D112	Diode	1SS265
D113	Diode	1SS254
D114	Varicap	1SV50E (1)
D115	Diode	1S953
D116	Diode	1SS133
D117	Diode	1SS97
D118	Diode	1SS97
D119	Diode	M1308
D120	Diode	M1308
D121	Diode	M1308
D122	Zener	RD4.7E B3
D123	Diode	1S953
D124	Diode	15CD11
D125	Diode	1S953
D126	Diode	1SS254

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
F1101	Crystal	30M7B (#01)
F1101	Crystal	30M15B (#02)
F1102	Ceramic	CFZM455H (#01)
F1102	Ceramic	CFZM455E10 (#02)
X101	Crystal	CR-214
X102	Discriminator	CDB455 C7A
X103	Crystal	CR85
L101	Coil	LS-189
L102	Coil	LAL03NA 101K
L103	Coil	LR-116
L104	Coil	LA-232
L105	Coil	LW-12A
L106	Coil	FL5H 101K
L107	Coil	LAL03NA 101K
L108	Coil	LA-232
L109	Coil	LA-232
L110	Coil	LA-232
L111	Coil	LA-233
L112	Coil	LA-232
L113	Coil	LA-232
L114	Coil	LA-232
L115	Coil	LW-29
L116	Coil	LW-19
L117	Coil	LA-232
L118	Coil	LA-232
L119	Coil	LA-223
L120	Coil	LA-223
L121	Coil	LA-232
L122	Coil	LW-16
L123	Coil	LAL03NA 1R0M
L124	Coil	LS-319
R103	Resistor	330 Ω R20
R104	Resistor	100 Ω ELR20
R105	Resistor	220 Ω R20
R106	Resistor	4.7 kΩ ELR20
R107	Resistor	1.5 kΩ ELR20
R108	Resistor	1.5 kΩ ELR20
R109	Resistor	47 kΩ ELR20
R110	Resistor	1.5 kΩ ELR20
R111	Thermistor	33D28
R112	Resistor	2.2 kΩ ELR20
R113	Resistor	22 kΩ ELR20
R114	Resistor	330 kΩ ELR20
R115	Resistor	2.2 kΩ ELR20
R116	Resistor	22 kΩ ELR20
R117	Resistor	150 Ω ELR20
R118	Resistor	33 Ω R20
R119	Resistor	150 Ω ELR20
R120	Resistor	6.8 kΩ ELR20
R121	Resistor	1.8 kΩ ELR20
R122	Resistor	330 Ω ELR20
R123	Resistor	1 kΩ ELR20
R124	Resistor	470 kΩ ELR20
R125	Resistor	39 kΩ ELR20
R126	Resistor	33 kΩ ELR20
R127	Resistor	120 kΩ ELR20
R128	Resistor	47 kΩ ELR20
R129	Resistor	82 kΩ ELR20
R130	Resistor	82 kΩ ELR20
R131	Resistor	5.6 kΩ ELR20
R132	Resistor	1 kΩ ELR20
R133	Resistor	1.8 kΩ ELR20
R134	Resistor	10 kΩ ELR20
R135	Resistor	15 Ω ELR20
R136	Resistor	330 Ω ELR20
R137	Resistor	22 Ω ELR20
R138	Resistor	330 Ω ELR20
R139	Resistor	2.2 kΩ ELR20
R140	Resistor	3.3 kΩ ELR20

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
R141	Resistor	220 Ω ELR20
R142	Resistor	100 Ω R20
R143	Resistor	2.2 kΩ ELR20
R144	Resistor	2.2 kΩ ELR20
R145	Resistor	3.3 kΩ ELR20
R146	Resistor	100 kΩ ELR20
R147	Resistor	220 Ω ELR20
R148	Resistor	1 kΩ ELR20
R149	Resistor	2.2 kΩ R20
R150	Resistor	2.2 kΩ ELR20
R151	Resistor	3.3 kΩ R20
R152	Resistor	220 Ω ELR20
R153	Resistor	100 Ω R20
R154	Resistor	2.2 kΩ ELR20
R155	Resistor	15 kΩ ELR20
R156	Resistor	100 Ω ELR20
R157	Resistor	1 kΩ ELR20
R158	Resistor	100 Ω ELR20
R159	Resistor	1 kΩ ELR20
R160	Resistor	12 Ω ELR25
R161	Resistor	15 Ω R50X
R162	Resistor	1.2 kΩ ELR20
R163	Resistor	5.6 kΩ ELR20
R164	Resistor	12 kΩ ELR20
R165	Resistor	27 kΩ ELR20
R166	Resistor	10 kΩ ELR20
R167	Resistor	27 kΩ ELR20
R168	Resistor	15 kΩ ELR20
R169	Resistor	330 kΩ ELR20
R171	Trimmer	470 kΩ RH0651CS5J10A
R172	Resistor	100 kΩ ELR20
R173	Resistor	47 Ω R20
R174	Resistor	100 kΩ R20
R175	Resistor	150 Ω ELR20
R177	Resistor	10 kΩ ELR20
R180	Resistor	2.2 kΩ ELR20
R181	Resistor	100 kΩ ELR20
R182	Resistor	100 kΩ ELR20
R183	Resistor	10 kΩ ELR20
R184	Thermistor	33D28
R185	Resistor	15 kΩ ELR20
R186	Thermistor	33D28
R187	Resistor	10 kΩ ELR20
R188	Resistor	6.8 kΩ ELR20
R189	Resistor	100 Ω ELR20
R190	Resistor	10 kΩ ELR20
R191	Resistor	560 Ω ELR20
R192	Resistor	47 kΩ ELR20
R193	Resistor	10 kΩ R20
R194	Resistor	47 kΩ ELR20
R195	Trimmer	47 kΩ RH0651CS4J25A
R196	Resistor	47 Ω ELR20
R197	Resistor	4.7 kΩ ELR20
R198	Resistor	82 kΩ ELR20
R199	Resistor	1.5 kΩ R20
R200	Resistor	10 kΩ R20
R202	Resistor	2.2 kΩ ELR20
R203	Resistor	1 kΩ ELR20
R204	Resistor	4.7 kΩ ELR20
R205	Resistor	100 Ω ELR20
R206	Resistor	100 Ω R20
R207	Resistor	100 Ω R20
R208	Resistor	2.2 kΩ R20
R209	Resistor	100 Ω ELR20
R211	Resistor	22 kΩ ELR20
R213	Resistor	47 kΩ ELR20 (#01)
R213	Resistor	22 kΩ ELR20 (#02)
R214	Resistor	1.5 kΩ ELR20
C101	Ceramic	27 pF 50 V (#01)
C101	Ceramic	12 pF 50 V (#02)
C102	Barrier Layer	0.0047 μF 25 V
C104	Barrier Layer	0.0047 μF 25 V
C105	Ceramic	0.001 μF 50 V

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
C108	Ceramic	0.001 μF 50 V
C109	Ceramic	56 pF 50 V
C110	Ceramic	18 pF 50 V
C111	Barrier Layer	0.1 μF 16 V
C112	Tantalum	0.1 μF 35 V DN
C113	Ceramic	82 pF 50 V
C114	Ceramic	0.001 μF 50 V
C115	Tantalum	10 μF 16 V DN
C116	Ceramic	0.1 μF D33Y5V1E104Z21
C117	Electrolytic	0.1 μF 50 V BP
C118	Mylar	0.001 μF 50 V
C119	Mylar	0.001 μF 50 V
C120	Mylar	0.001 μF 50 V
C121	Ceramic	33 pF 50 V
C122	Tantalum	0.1 μF 35 V DN
C123	Ceramic	0.001 μF 50 V
C124	Electrolytic	2.2 μF 50 V MS7
C125	Tantalum	0.47 μF 35 V DN
C126	Ceramic	15 pF 50 V
C127	Ceramic	10 pF 50 V
C128	Ceramic	0.001 μF 50 V
C129	Barrier Layer	0.01 μF 25 V
C130	Ceramic	10 pF 50 V
C131	Ceramic	4 pF 50 V
C132	Electrolytic	47 μF 6.3 V MS7
C133	Ceramic	0.001 μF 50 V
C134	Ceramic	0.001 μF 50 V
C135	Ceramic	0.001 μF 50 V
C136	Barrier Layer	0.01 μF 25 V
C137	Electrolytic	4.7 μF 25 V MS7
C138	Ceramic	0.001 μF 50 V
C139	Barrier Layer	0.1 μF 16 V
C140	Ceramic	0.001 μF 50 V
C141	Tantalum	3.3 μF 35 V DN
C142	Tantalum	0.22 μF 35 V DN
C143	Ceramic	470 pF 50 V
C144	Ceramic	0.001 μF 50 V
C145	Trimmer	20 pF CV38D2001
C146	Ceramic	33 pF 50 V CH
C147	Ceramic	4 pF 50 V CH
C148	Ceramic	47 pF 50 V
C149	Ceramic	220 pF 50 V
C150	Ceramic	100 pF 50 V
C151	Barrier Layer	0.01 μF 25 V
C152	Ceramic	470 pF 50 V
C153	Ceramic	0.001 μF 50 V
C154	Ceramic	10 pF 50 V
C155	Ceramic	470 pF 50 V
C156	Ceramic	0.001 μF 50 V
C157	Ceramic	470 pF 50 V
C158	Ceramic	0.001 μF 50 V
C159	Ceramic	8 pF 50 V
C160	Ceramic	4 pF 50 V
C161	Ceramic	470 pF 50 V
C162	Ceramic	0.001 μF 50 V
C163	Ceramic	470 pF 50 V
C164	Ceramic	0.001 μF 50 V
C165	Ceramic	6 pF 50 V
C166	Ceramic	2 pF 50 V
C167	Ceramic	0.001 μF 50 V
C168	Ceramic	4 pF 50 V
C169	Ceramic	0.001 μF 50 V
C170	Ceramic	470 pF 50 V
C171	Ceramic	0.001 μF 50 V
C172	Ceramic	470 pF 50 V
C173	Ceramic	6 pF 50 V
C174	Barrier Layer	0.1 μF 16 V
C175	Ceramic	0.001 μF 50 V
C176	Ceramic	470 pF 50 V
C177	Ceramic	2 pF 50 V
C178	Ceramic	2 pF 50 V
C179	Ceramic	470 pF 50 V
C180	Ceramic	470 pF 50 V
C181	Ceramic	47 pF 50 V
C182	Ceramic	0.001 μF 50 V

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
C183	Ceramic	470 pF 50 V
C184	Ceramic	0.001 μF 50 V
C185	Trimmer	6 pF CV05A0601
C186	Ceramic	47 pF 50 V
C187	Electrolytic	10 μF 16 V MS5
C188	Electrolytic	10 μF 16 V MS7
C189	Ceramic	470 pF 50 V
C190	Electrolytic	10 μF 16 V MS7
C191	Ceramic	470 pF 50 V
C192	Ceramic	47 pF 50 V
C194	Electrolytic	470 μF 16 V SS
C195	Ceramic	470 pF 50 V
C196	Barrier Layer	0.01 μF 25 V
C197	Electrolytic	10 μF 16 V MS5
C198	Ceramic	0.001 μF 50 V
C199	Ceramic	47 pF 50 V
C200	Ceramic	47 pF 50 V
C201	Ceramic	0.001 μF 50 V
C202	Ceramic	47 pF 50 V
C203	Ceramic	470 pF 50 V
C204	Ceramic	0.001 μF 50 V
C205	Ceramic	0.0047 μF 50 V
C206	Ceramic	0.001 μF 50 V
C207	Ceramic	47 pF 50 V
C208	Ceramic	0.001 μF 50 V
C209	Ceramic	47 pF 50 V
C211	Ceramic	6 pF 500 V
C212	Ceramic	12 pF 500 V
C213	Ceramic	5 pF 500 V
C214	Ceramic	39 pF 500 V
C215	Ceramic	6 pF 500 V
C217	Ceramic	6 pF 500 V
C218	Ceramic	1 pF 500 V
C219	Ceramic	2 pF 500 V
C220	Ceramic	470 pF 50 V
C221	Ceramic	0.001 μF 50 V
C222	Electrolytic	470 μF 16 V SS
C223	Barrier Layer	0.01 μF 25 V
C224	Electrolytic	1000 μF 16 V MS16
C225	Ceramic	0.001 μF 50 V
C226	Ceramic	0.001 μF 50 V
C228	Electrolytic	4.7 μF 25 V MS7
C229	Ceramic	0.001 μF 50 V
C230	Ceramic	0.001 μF 50 V
C231	Tantalum	22 μF 6.3 V DN
C232	Electrolytic	0.1 μF 50 V MS7
C233	Tantalum	0.1 μF 35 V DN
C234	Ceramic	470 pF 50 V
C235	Electrolytic	10 μF 50 V SS
C236	Electrolytic	3.3 μF 50 V MS7
C237	Ceramic	470 pF 50 V
C238	Tantalum	0.1 μF 35 V DN
C239	Ceramic	0.001 μF 50 V
C240	Barrier Layer	0.1 μF 16 V
C241	Ceramic	0.001 μF 50 V
C242	Electrolytic	100 μF 10 V SS
C243	Ceramic	0.001 μF 50 V
C244	Ceramic	0.001 μF 50 V
C245	Ceramic	0.1 μF D33Y5V1E104Z21
C246	Barrier Layer	0.01 μF 25 V
C247	Ceramic	0.0047 μF 50 V
C248	Ceramic	0.001 μF 50 V
C249	Ceramic	0.0047 μF 50 V
C250	Ceramic	0.001 μF 50 V
C251	Ceramic	0.001 μF 50 V
C252	Ceramic	470 pF 50 V
C253	Barrier Layer	0.1 μF 16 V
C254	Ceramic	3 pF 50 V
C255	Electrolytic	47 μF 16 V MS5
C256	Ceramic	470 pF 50 V
C257	Ceramic	2 pF 500 V
C258	Ceramic	27 pF 50 V CH
C259	Tantalum	22 μF 10 V DN
C260	Barrier Layer	0.01 μF 25 V
C261	Ceramic	0.001 μF 50 V

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.	
C262	Ceramic	22 pF	50 V
C263	Ceramic	120 pF	50 V
C264	Ceramic	68 pF	50 V
C265	Ceramic	0.1 μF	D33Y5V1E104Z21
C266	Electrolytic	10 μF	16 V MS7
C267	Ceramic	0.001 μF	50 V
C268	Ceramic	0.1 μF	D33Y5V1E104Z21
J101	Connector	B03B-EH-S	
J102	Connector	WH8D-1	
J103	Connector	WH5D-1	
J104	Connector	WH10D-1	
W101	Ribbon Cable	2468 AW626 VW-1	E43172 (10)
W102	Ribbon Cable	2468 AW626 VW-1	E43172 (5)
W103	Jumper	JPW-02A	
W104	Jumper	JPW-02A	
W105	Jumper	JPW-02A	
W106	Ribbon Cable	2468 AW626 VW-1	E43172 (5)
EP101	P.C. Board	B-1757A	

[VCO UNIT]

REF. NO.	DESCRIPTION	PART NO.	
C286	Ceramic	0.5 pF	GRM40
C287	Ceramic	470 pF	GRM40
C288	Ceramic	0.001 μF	50 V
C289	Ceramic	0.001 μF	GRM40
C290	Ceramic	2 pF	50 V
C291	Ceramic	47 pF	GRM40
C292	Barrier Layer	0.01 μF	25 V
C293	Ceramic	3 pF	GRM40 CH
C294	Ceramic	3 pF	GRM40 CH
EP270	P.C. Board	B-1758A	

[RF UNIT]

REF. NO.	DESCRIPTION	PART NO.	
IC1	IC	ND487C1-3R	
Q1	FET	3SK121 Y	
Q2	FET	2SK161 GR	
D1	Diode	1SV164 T2B	
D2	Diode	1SV164 T2B	
D3	Diode	1SV164 T2B	
D4	Diode	1SV164 T2B	
D5	Diode	1SV164 T2B	
L1	Coil	LA-242	
L2	Coil	LA-242	
L3	Coil	LA-233	
L4	Coil	LA-242	
L5	Coil	LA-242	
L6	Coil	LR-145	
L7	Coil	LR-116	
R1	Resistor	220 kΩ	MCR10
R2	Resistor	220 kΩ	MCR10
R3	Resistor	470 kΩ	MCR10
R4	Resistor	47 kΩ	MCR10
R5	Resistor	100 kΩ	MCR10
R6	Resistor	120 Ω	MCR10
R7	Resistor	220 kΩ	MCR10
R8	Resistor	220 kΩ	MCR10
R9	Resistor	220 kΩ	MCR10
C1	Ceramic	0.35 pF	50 V
C2	Ceramic	2 pF	GRM40
C3	Ceramic	4 pF	GRM40
C4	Ceramic	0.5 pF	GRM40
C5	Ceramic	0.5 pF	GRM40
C6	Ceramic	2 pF	GRM40
C7	Ceramic	4 pF	GRM40
C8	Ceramic	2 pF	GRM40
C9	Ceramic	470 pF	GRM40
C10	Ceramic	0.001 μF	GRM40
C11	Ceramic	470 pF	GRM40
C12	Ceramic	0.001 μF	GRM40
C13	Ceramic	4 pF	GRM40
C14	Ceramic	0.5 pF	GRM40
C15	Ceramic	0.5 pF	GRM40
C17	Ceramic	2 pF	GRM40
C18	Ceramic	5 pF	GRM40
C19	Ceramic	0.5 pF	GRM40

[VCO UNIT]

REF. NO.	DESCRIPTION	PART NO.	
Q270	FET	2SK125	
Q271	Transistor	2SC3356	
D271	Diode	1SV166T 2B	
D272	Diode	1SV166T 2B	
D273	Diode	1T25	
L270	Coil	LAL03NA 1R0M	
L271	Coil	LAL03NA R39M	
L272	Coil	LAL03NA R39M	
L273	Coil	LAL03NA R27M	
L274	Coil	LA-233	
R271	Resistor	120 kΩ	MCR10
R272	Resistor	270 Ω	R20
R273	Resistor	47 kΩ	MCR10
R274	Resistor	10 Ω	MCR10
R276	Resistor	39 Ω	MCR10
R277	Resistor	22 Ω	MCR10
R278	Resistor	100 Ω	MCR10
R279	Resistor	3.3 kΩ	MCR10
R280	Resistor	2.2 kΩ	MCR10
R281	Resistor	220 Ω	MCR10
C271	Ceramic	47 pF	50 V
C272	Ceramic	0.5 pF	GRM40 CK
C275	Ceramic	470 pF	GRM40
C277	Ceramic	7 pF	GRM40 CH
C278	Ceramic	470 pF	GRM40
C279	Ceramic	0.1 μF	GRM40 F
C280	Electrolytic	100 μF	10 V MS7
C281	Ceramic	0.001 μF	GRM40
C282	Ceramic	470 pF	GRM40
C283	Electrolytic	100 μF	10 V MS7
C284	Ceramic	0.001 μF	GRM40
C285	Ceramic	9 pF	GRM40 CH

[RF UNIT]

REF. NO.	DESCRIPTION	PART NO.
C20	Ceramic	0.5 pF GRM40
C22	Ceramic	2 pF GRM40
C23	Ceramic	4 pF GRM40
C24	Ceramic	1 pF GRM40
C28	Ceramic	0.001 μ F GRM40
C29	Ceramic	470 pF GRM40
C30	Ceramic	0.001 μ F GRM40
C31	Ceramic	470 pF GRM40
C32	Ceramic	0.001 μ F GRM40
C33	Ceramic	470 pF GRM40
C34	Ceramic	0.001 μ F GRM40
C35	Ceramic	470 pF GRM40
C37	Ceramic	47 pF GRM40
C38	Ceramic	470 pF GRM40
C39	Ceramic	470 pF GRM40
C40	Ceramic	47 pF GRM40
C41	Ceramic	470 pF GRM40
C42	Ceramic	47 pF 50 V
C43	Ceramic	1 pF GRM40
C44	Ceramic	1 pF GRM40
EP1	P.C. Board	B-1756A

SECTION 9 OPTIONAL UNITS

9-1 UT-31 CIRCUIT DESCRIPTION

9-1-1 GENERAL DESCRIPTION

IC2 is a tone encoder/decoder IC chip that outputs and detects 37 different kinds of tones from 67~250.3 Hz. A tone is set by data signals from the CPU in the IC-U200T.

Crystal unit X1 is used in the circuit as the reference oscillator. By using this crystal unit, the UT-31 achieves very high frequency stability for tone signals.

9-1-2 ENCODER CIRCUIT

IC501, the CPU in the transceiver, outputs programming data through S0~S5 data lines to IC2.

When the transceiver is in transmit mode, "LOW" is applied to pin 12 of IC2. Pin 26 outputs the programmed tone signal. The signal is applied to the modulator circuit in the transceiver.

9-1-3 DECODER CIRCUIT

When the transceiver is in receive mode, "HIGH" is applied to pin 12 of IC2. Pin 1 of IC515a on the transceiver LOGIC-A UNIT outputs detected signals. The signals are applied to the AF IN line on the UT-31.

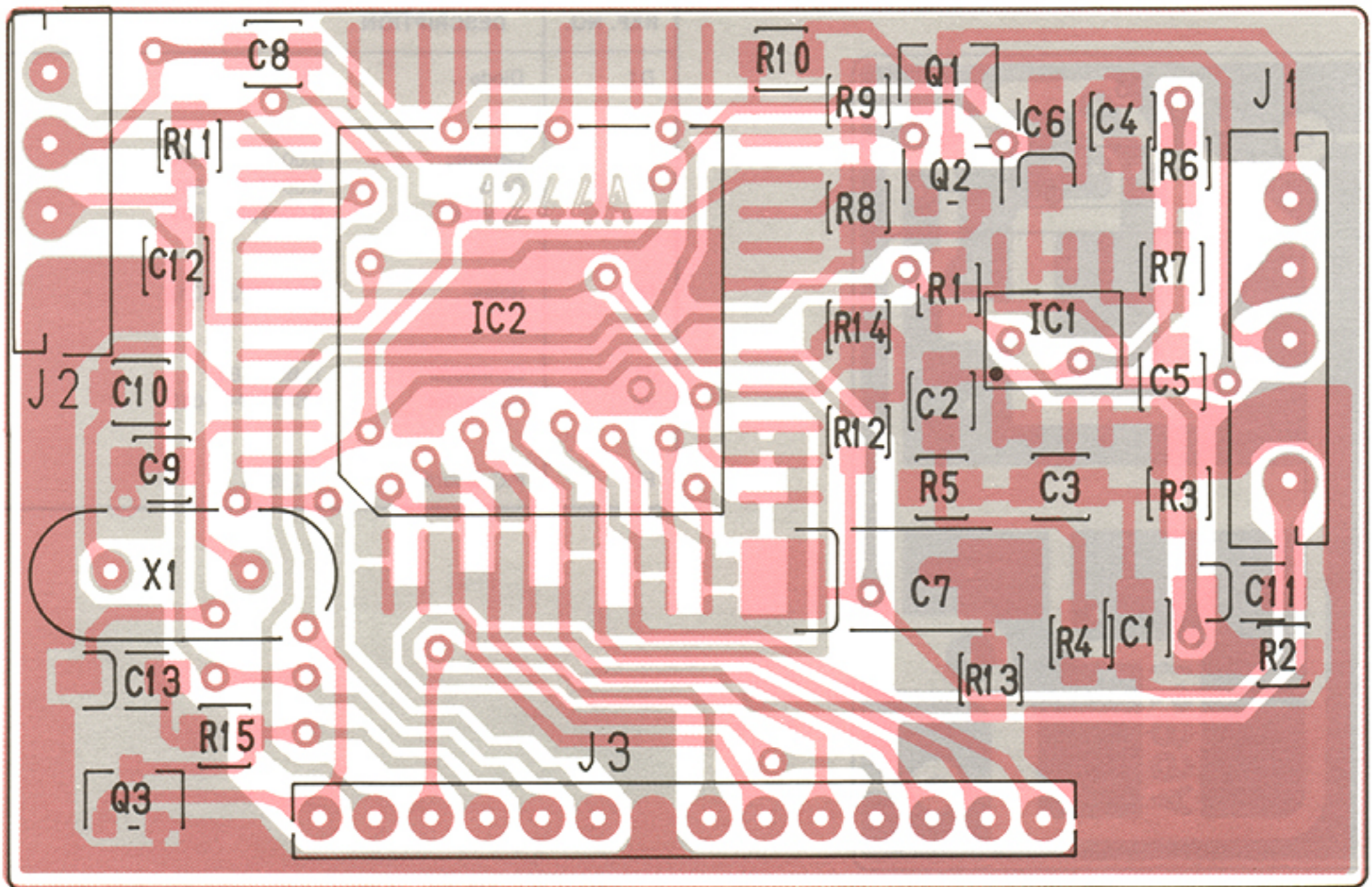
IC1a and IC1b form a low-pass filter which passes signals of approximately 300 Hz or less. Detected and filtered signals are applied to pin 29 of IC2 through C6.

When the received tone frequency is matched with the programmed tone frequency, pin 23 becomes "HIGH" and the DOUT line becomes "HIGH." Therefore, the squelch on the transceiver opens.

9-1-4 SUBAUDIBLE TONE FREQUENCY AND DATA CHART

OUTPUT FREQUENCY [Hz]	IC2 INPUT PIN NUMBER					
	3	4	5	6	7	8
67.0	L	H	H	H	H	H
71.9	H	H	L	H	H	H
74.4	H	H	L	H	H	L
77.0	L	L	H	H	H	H
79.7	H	L	L	H	H	L
82.5	H	H	L	H	H	H
85.4	H	H	H	L	H	L
88.5	L	H	L	H	H	H
91.5	H	L	H	L	H	L
94.8	H	L	L	H	H	H
100.0	L	L	L	H	H	H
103.5	H	H	H	L	H	H
107.2	L	H	H	L	H	H
110.9	H	L	H	L	H	H
114.8	L	L	H	L	H	H
118.8	H	H	L	L	H	H
123.0	L	H	L	L	H	H
127.3	H	L	L	L	H	H
131.8	L	L	L	L	H	H
136.5	H	H	H	H	L	H
141.3	L	H	H	H	L	H
146.2	H	L	H	H	L	H
151.4	L	L	H	H	L	H
156.7	H	H	L	H	L	H
162.2	L	H	L	H	L	H
167.9	H	L	L	H	L	H
173.8	L	L	L	H	L	H
179.9	H	H	H	L	L	H
186.2	L	H	H	L	L	H
192.8	H	L	H	L	L	H
203.5	L	L	H	L	L	H
210.7	H	H	L	L	L	H
218.1	L	H	L	L	L	H
225.7	H	L	L	L	L	H
233.6	L	L	L	L	L	H
241.8	H	H	H	H	H	L
250.3	L	H	H	H	H	L

9-3 UT-31 BOARD LAYOUT



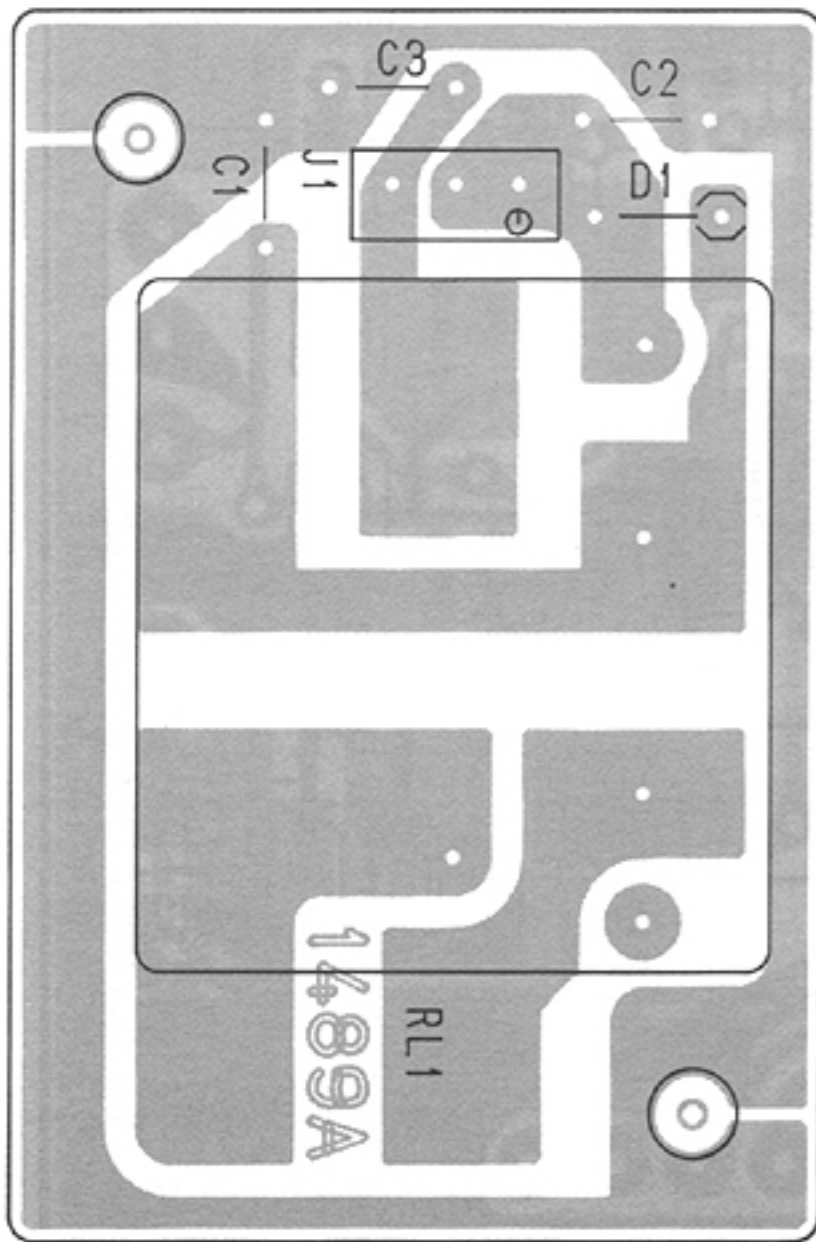
R8 DOUT AF IN CTCSS 5V RES GND T/R S0 S2 S1 S3 S4 S5

9-4 UT-31 PARTS LIST

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	NJM4558M
IC2	IC	MN6520
Q3	Transistor	2SC3395
X1	Crystal	RF4A3 4.194304MHZ
R1	Chip	220kΩ MCR10
R2	Chip	220kΩ MCR10
R3	Chip	220kΩ MCR10
R4	Chip	220kΩ MCR10
R5	Chip	270kΩ MCR10
R6	Chip	220kΩ MCR10
R7	Chip	180kΩ MCR10
R8	Chip	10kΩ MCR10
R9	Chip	15kΩ MCR10
R11	Chip	10kΩ MCR10
R12	Chip	2.2kΩ MCR10
R13	Chip	10kΩ MCR10
R14	Chip	150kΩ MCR10

REF. NO.	DESCRIPTION	PART NO.
C1	Monolithic	0.01μF GRM40 F
C2	Monolithic	0.022μF GRM40 B
C3	Monolithic	470pF GRM40
C4	Monolithic	0.033μF GRM40 F
C5	Monolithic	270pF GRM40
C6	Electrolytic	SVA1D474M1 0.47μF 20V
C7	Electrolytic	SVD0J476M 47μF 6.3V
C8	Monolithic	0.1μF GRM40 F
C9	Monolithic	18pF GRM40
C10	Monolithic	18pF GRM40
C11	Electrolytic	SVA1D474M1 0.47μF 20V
C12	Monolithic	0.1μF GRM40 F
J3	Connector	5513-14CPB
EP1	P.C. Board	B-1244A

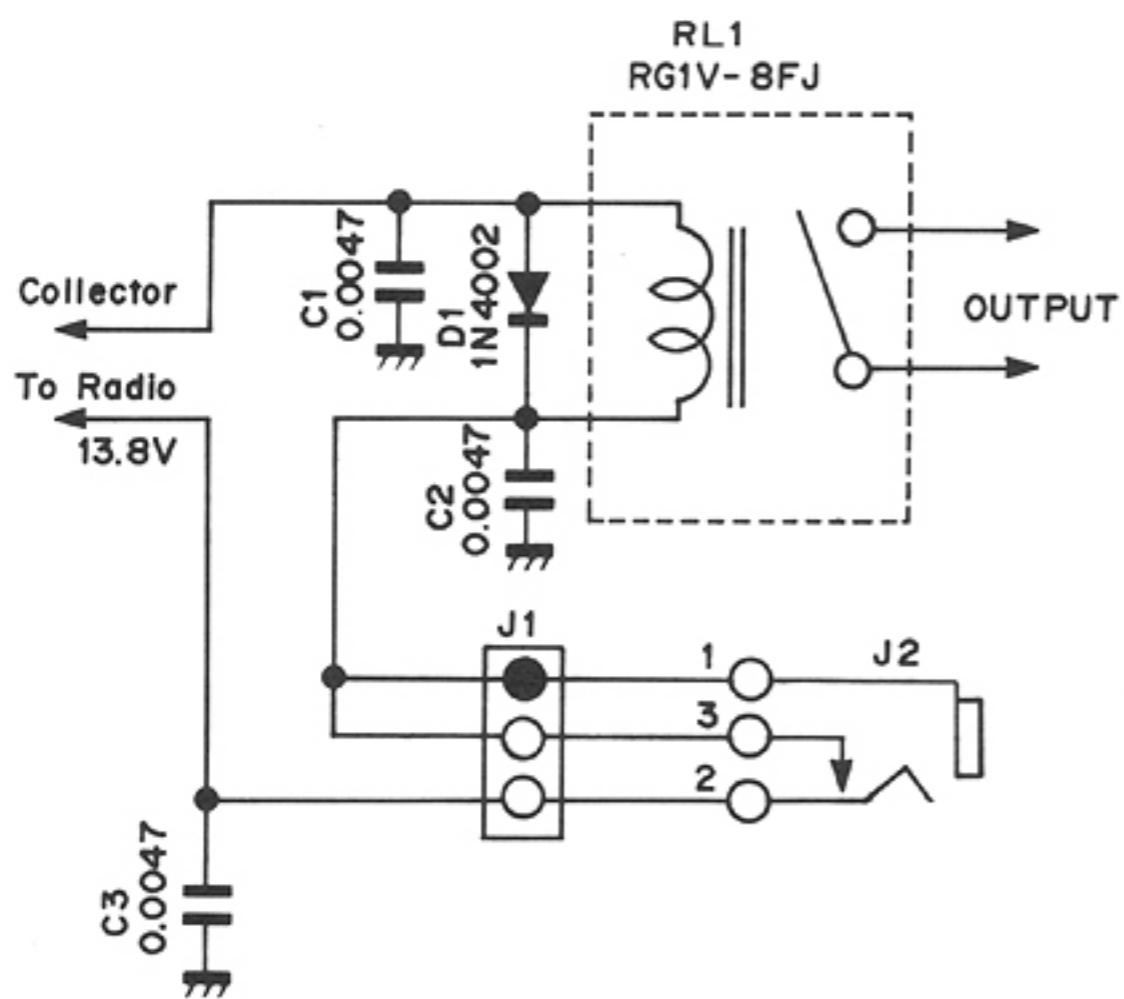
9-5 UX-11 BOARD LAYOUT



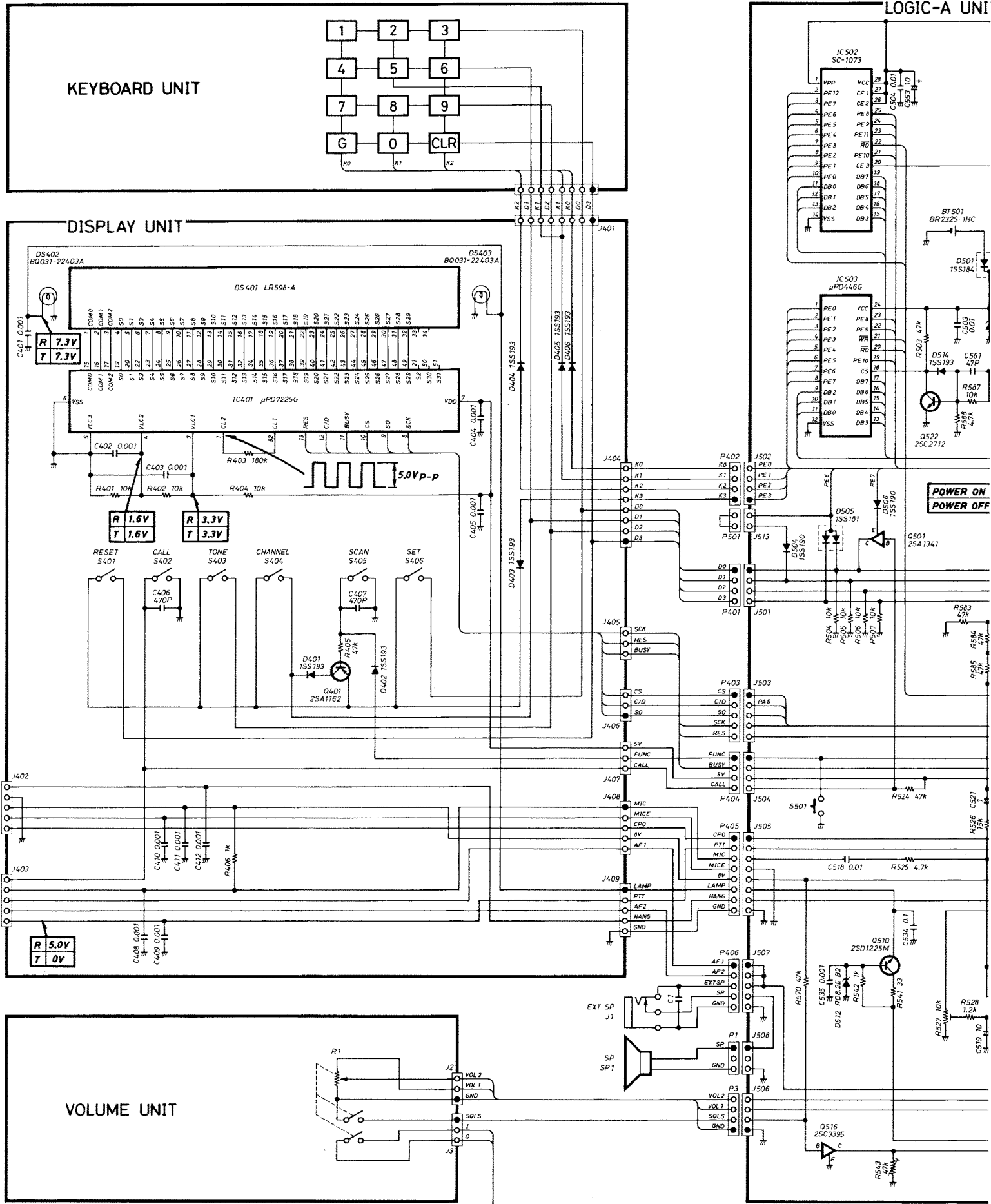
9-7 UX-11 PARTS LIST

REF. NO.	DESCRIPTION	PART NO.
D1	Diode	1N4002
C1	Ceramic	0.0047 μ F 50V
C2	Ceramic	0.0047 μ F 50V
C3	Ceramic	0.0047 μ F 50V
RL1	Relay	RG1V-8FJ DC12
J1	Connector	TLB03H-B1
J2	Connector	HSJ0780-01-010
EP1	P.C. Board	B-1489A

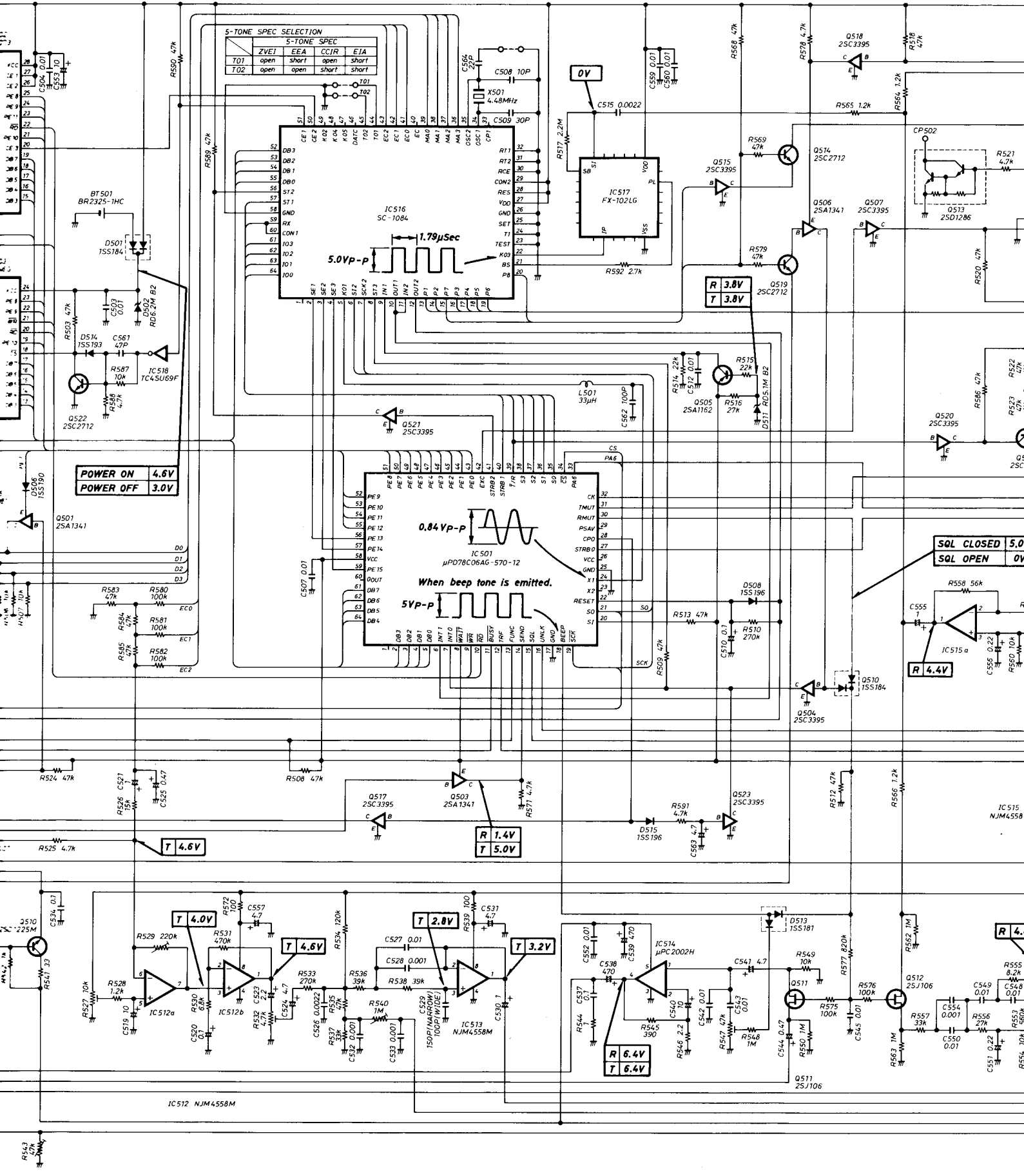
9-6 UX-11 SCHEMATIC DIAGRAM

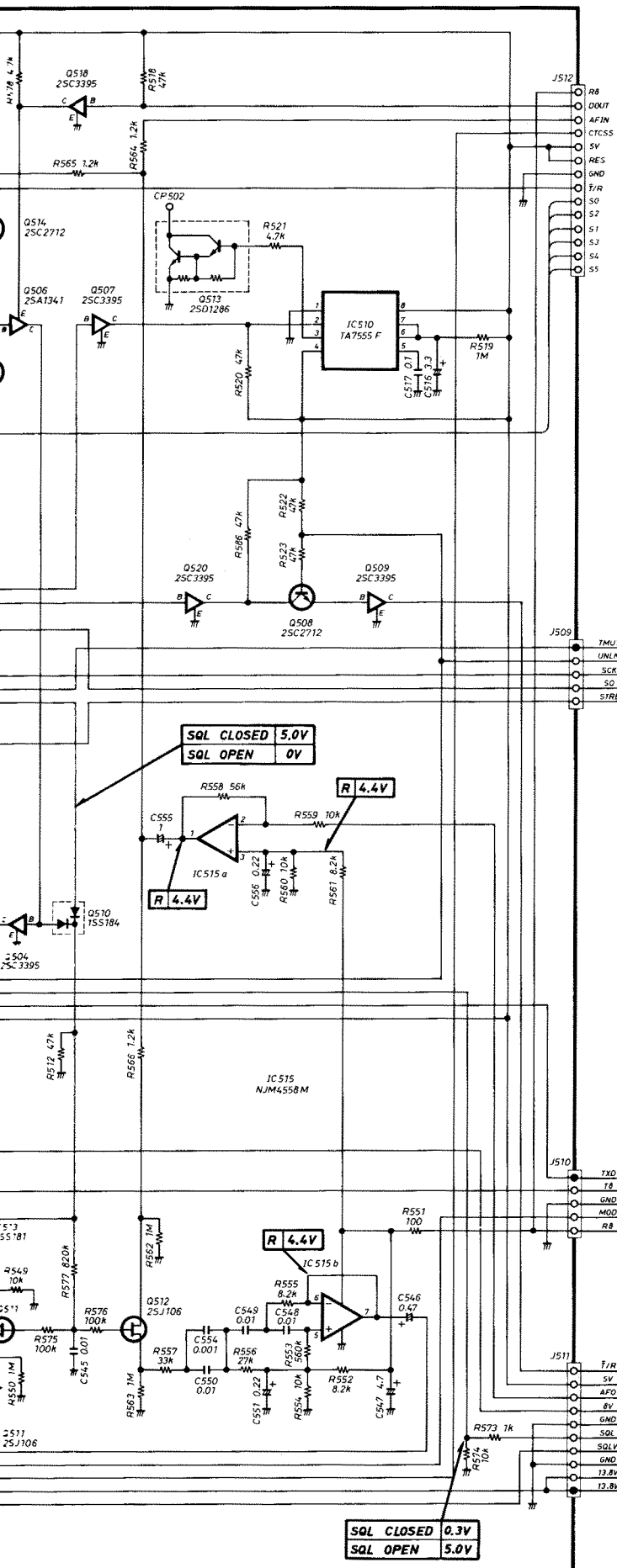


SECTION 10 VOLTAGE DIAGRAM

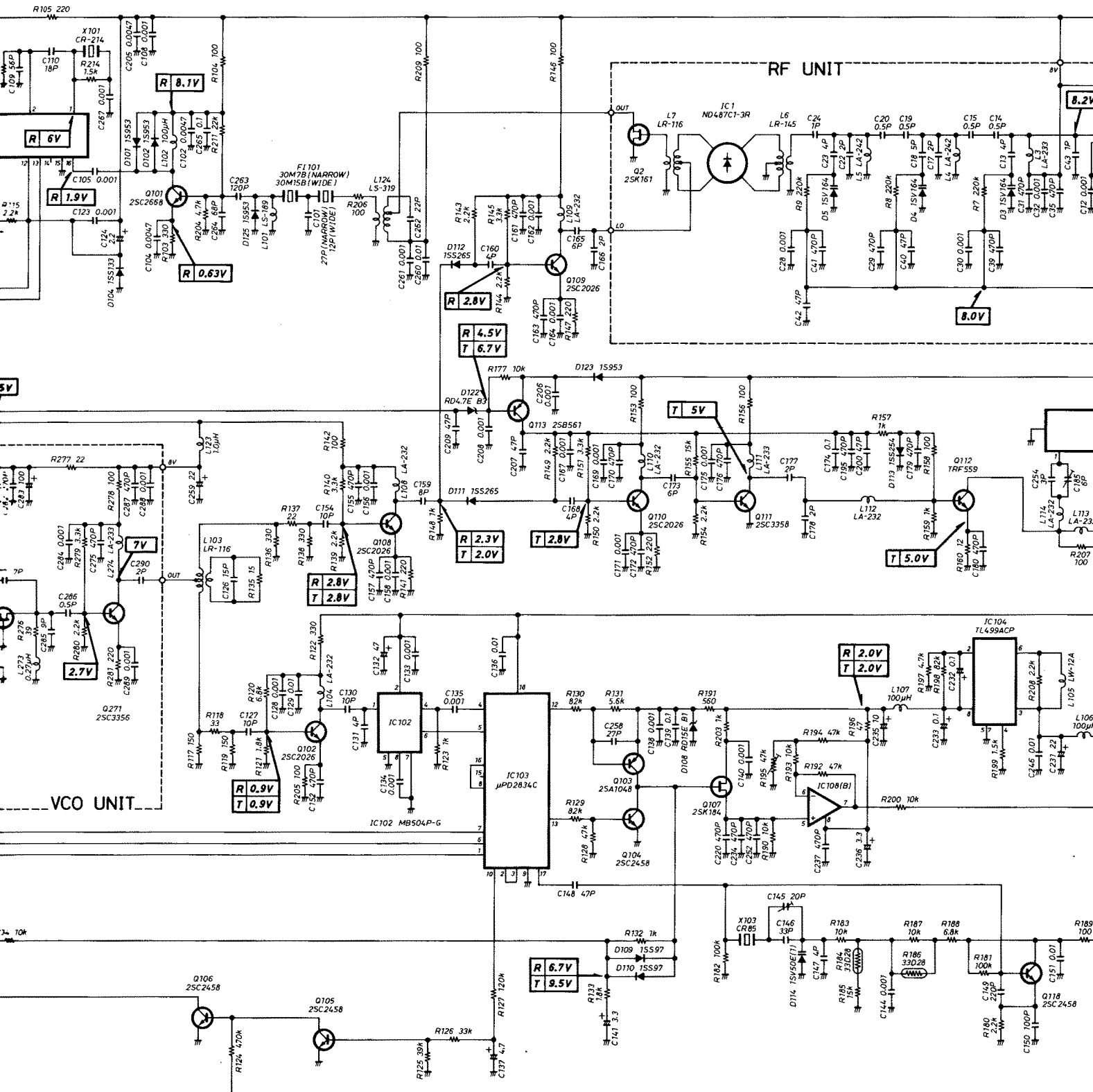


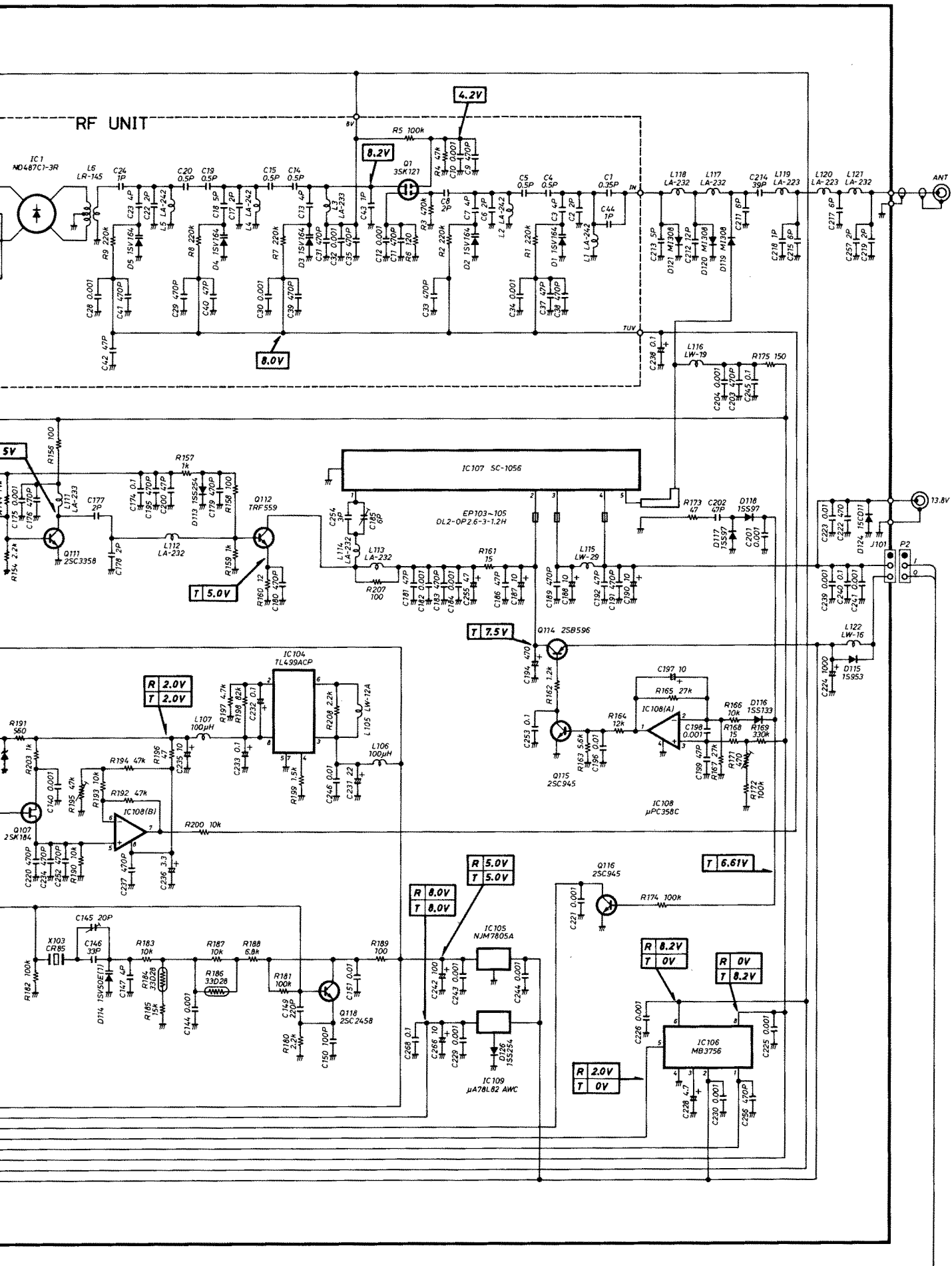
LOGIC-A UNIT





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