



SERVICE MANUAL

UHF TRANSCEIVER

IC-U16T MKII

INTRODUCTION

This service manual describes the latest service information for the **IC-U16T MKII** UHF TRANSCEIVER at the time of publication.

DANGER

NEVER 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. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

<SAMPLE ORDER>

1110001150	IC	NJM4560DD	IC-U16T MKII	MAIN UNIT	5 pieces
8810000740	Screw	PH A M2 × 15 ZK	IC-U16T MKII	Rear panel	10 pieces

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

REPAIR NOTES

1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from its 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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VERSIONS

VERSION NUMBER	REGION	FREQUENCY RANGE	CHANNEL SPACING	5-TONE SYSTEM	SUPPLIED BATTERY PACK
#21	General	460~470 MHz	12.5 kHz	CCIR	CM-8B
#22	General	460~470 MHz	25 kHz	CCIR	CM-8B
#23	General	450~460 MHz	12.5 kHz	CCIR	CM-8B
#24	General	450~460 MHz	25 kHz	CCIR	CM-8B
#25	Italy	460~470 MHz	25 kHz	ZVEI	CM-8B
#26	France	460~470 MHz	12.5 kHz	CCIR	CM-8B
#27	France	450~460 MHz	12.5 kHz	CCIR	CM-8B
#28	Sweden	460~470 MHz	25 kHz	CCIR	CM-8B
#29	Greece	410~420 MHz	25 kHz	CCIR	CM-8B
#30	United Kingdom	460~470 MHz	12.5 kHz	CCIR	CM-8B
#31	France	405~415 MHz	12.5 kHz	CCIR	CM-8B

To upgrade quality, all electrical and mechanical parts and internal circuits are subject to change without notice or obligation.

SECTION 1 SPECIFICATIONS

GENERAL

- Frequency coverage : See VERSIONS on the right page of inside front cover.
- Frequency bandwidth : 10 MHz
- Mode : 16K0F3E (#22, #24, #25, #28, #29)
8K50F3E (#21, #23, #26, #27, #30, #31)
- Channel spacing : 25 kHz (#22, #24, #25, #28, #29)
12.5 kHz (#21, #23, #26, #27, #30, #31)
- Number of channels : Up to 16
- Usable battery pack :

BATTERY PACK	OUTPUT VOLTAGE
CM-7B	13.2 V/450 mAh
CM-8B	8.4 V/800 mAh
CM-96B	8.4 V/1200 mAh

- Antenna impedance : 50 Ω (unbalanced)
- Current drain (with CM-8B) :

Receive	Stand-by	105 mA
	Max. audio output	260 mA
Transmit	High	1.5 A
	Low	1 A
- Usable temperature range : $-25^{\circ}\text{C} \sim +60^{\circ}\text{C}$
- Frequency stability : ± 1.5 kHz ($-10^{\circ}\text{C} \sim +55^{\circ}\text{C}$)
- Dimensions (with CM-8B) : 65 (W) \times 196 (H) \times 38 (D) mm
(Projections not included.)
- Weight (with CM-8B) : 595 g

TRANSMITTER

- Output power : High 5 W (with CM-7B)
3 W (with CM-8B or CM-96B)
Low 1 W (with CM-7B, CM-8B or CM-96B)
- Modulation system : Variable reactance frequency modulation
- Max. frequency deviation : ± 5 kHz (#22, #24, #25, #28, #29)
 ± 2.5 kHz (#21, #23, #26, #27, #30, #31)
- Spurious emissions : < 0.25 μW

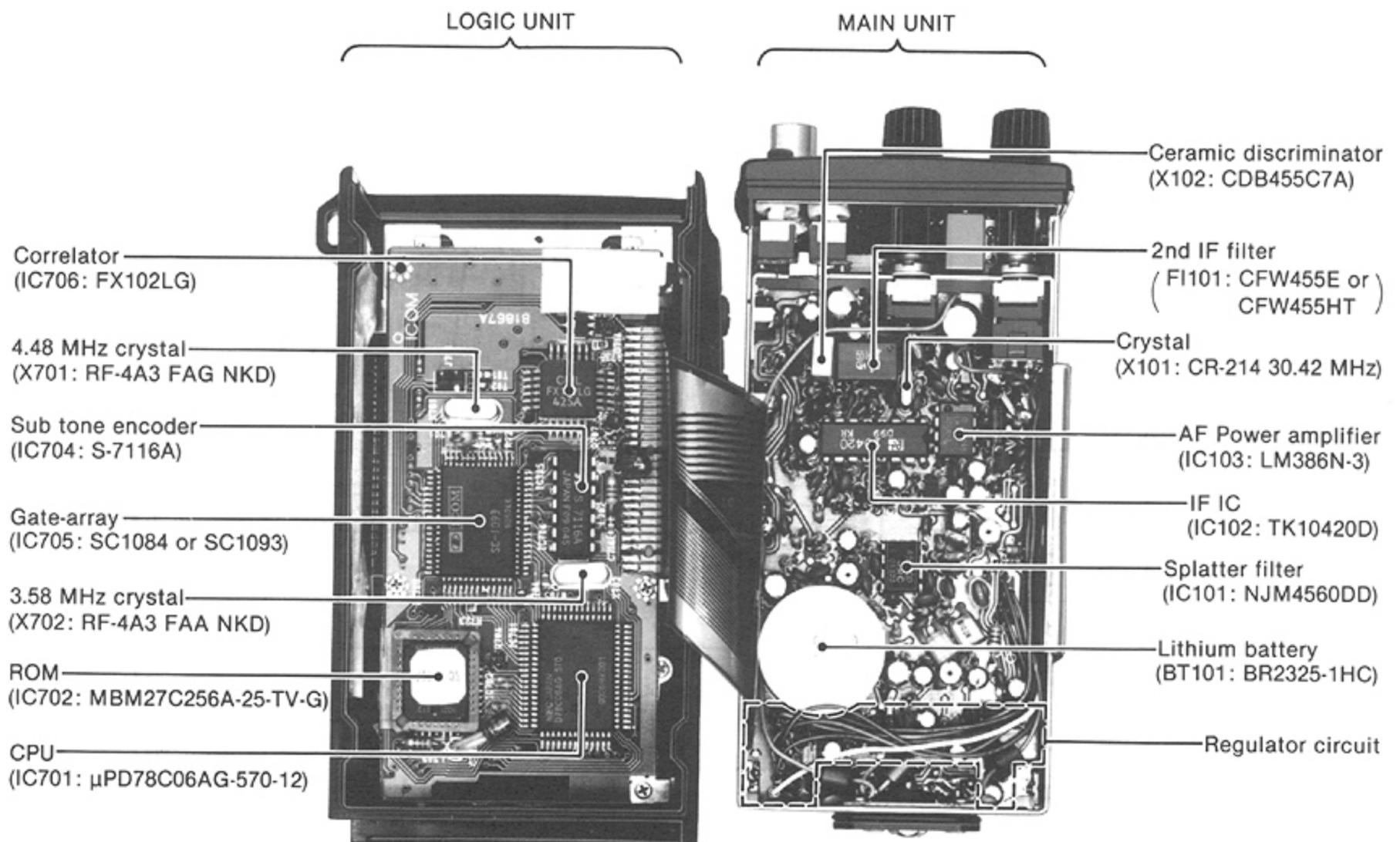
RECEIVER

- Receiver system : Double-conversion superheterodyne
- Intermediate frequency : 1st 30.875 MHz 2nd 455 kHz
- Sensitivity : 0.35 μV (PD) for 12 dB SINAD, signal input modulated by 1 kHz tone at 60 % peak deviation
- Squelch sensitivity (threshold) : 0.3 μV
- Adjacent channel selectivity : > 70 dB (#22, #24, #25, #28, #29)
 > 60 dB (#21, #23, #26, #27, #30, #31)
- Spurious response rejection : > 70 dB
- Audio output power (with CM-8B) : 500 mW at 10 % distortion with an 8 Ω load
- Audio output impedance : 8 Ω

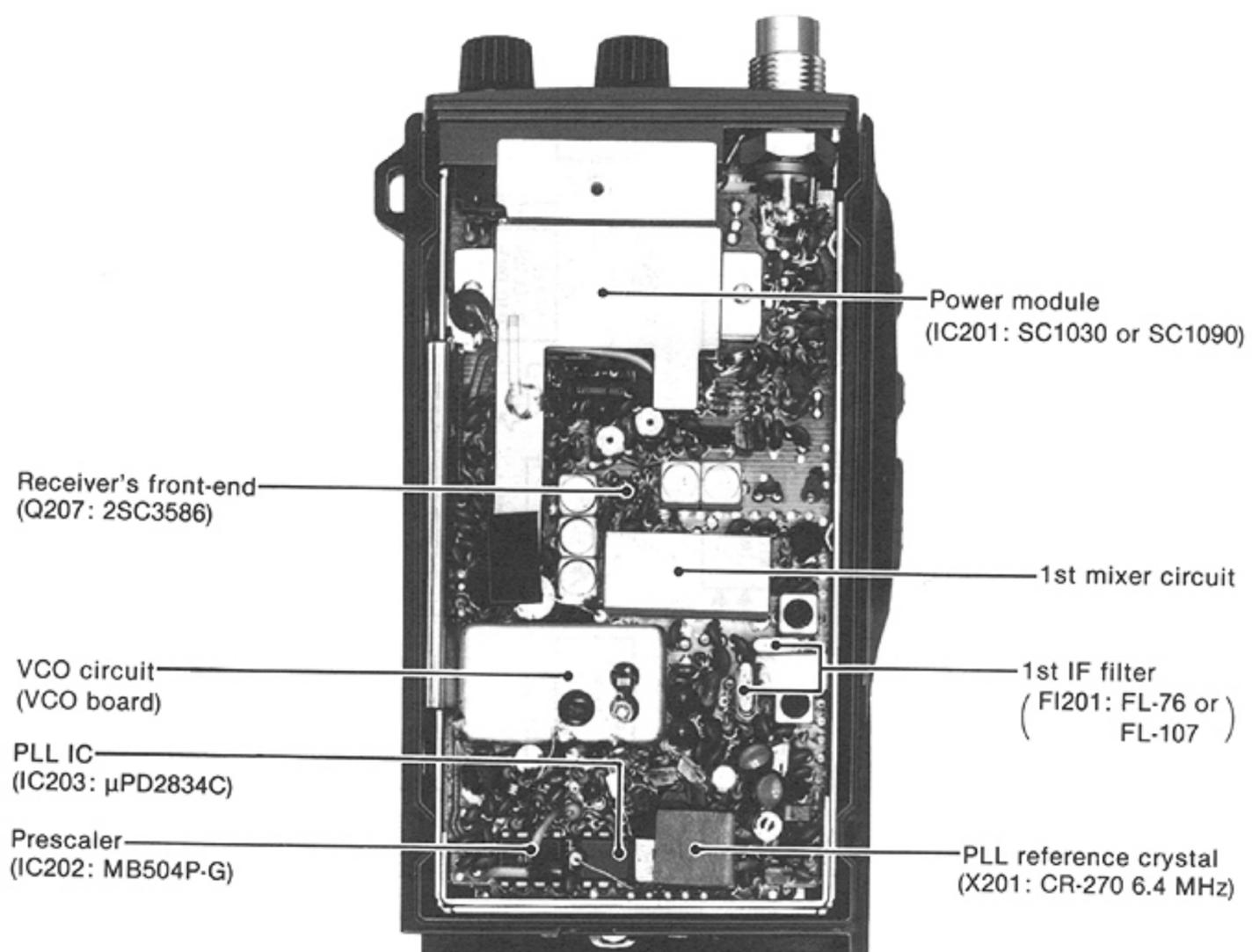
All stated specifications are subject to change without notice or obligation.

SECTION 2 INSIDE VIEWS

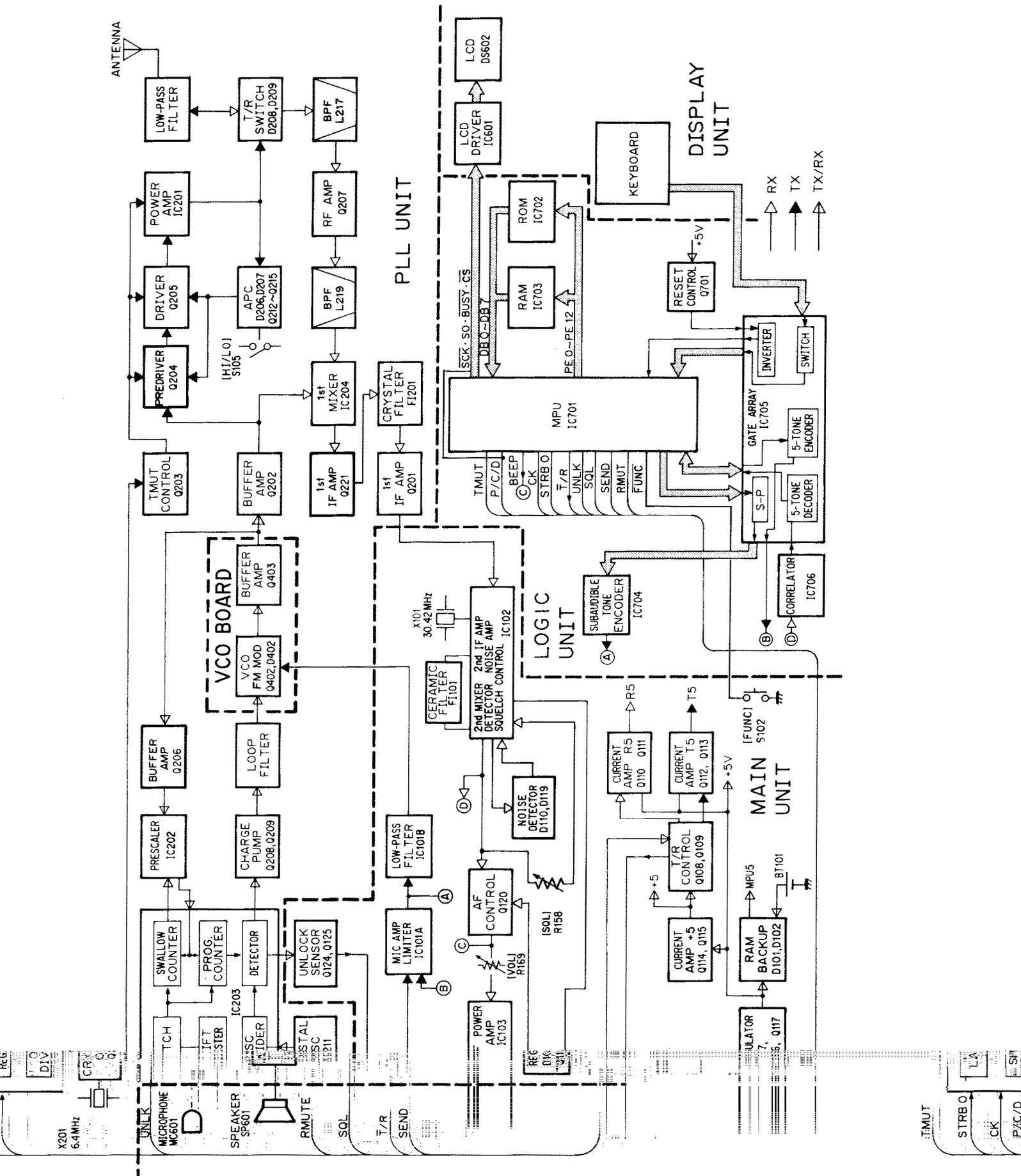
• MAIN AND LOGIC UNITS



• PLL UNIT



SECTION 3 BLOCK DIAGRAM



SECTION 4 CIRCUIT DESCRIPTION

4-1 RECEIVER CIRCUITS

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

The antenna switching circuit functions as a low-pass filter while receiving and a resonator circuit while transmitting. The circuit does not allow transmit signals to enter receiver circuits.

Received signals from the antenna connector pass through a Chebyshev low-pass filter (L211, L212, C243 ~C245) to suppress out-of-band signals and are then applied to the $\lambda/4$ type antenna switching circuit (D208, D209, L209, C246, C309).

D208 and D209 are turned OFF while receiving. The signals from the antenna switching circuit pass through a helical bandpass filter (L217) to suppress out-of-band signals and are then applied to the RF circuit.

4-1-2 RF CIRCUIT (PLL UNIT)

The RF circuit amplifies signals within the range of frequency coverage and filters out-of-band signals.

The filtered signals are amplified at the RF amplifier (Q207) and are then applied to a helical bandpass filter (L219) to suppress out-of-band signals. The filtered signals are applied to a 1st mixer circuit.

4-1-3 1ST MIXER AND IF CIRCUITS (PLL AND MAIN UNITS)

The 1st mixer circuit converts the received signal to a fixed frequency of the 1st IF signal with a PLL output frequency. By changing the PLL frequency, only the desired frequency will be passed through a pair of crystal filters at the next stage of the 1st mixer.

The signals from the RF circuit are mixed at IC204 with a 1st LO signal coming from the VCO circuit to produce a 30.875 MHz 1st IF signal. IC204 employs a DBM (Double Balanced Mixer).

The 30.875 MHz 1st IF signal is obtained at L221 and is then amplified at Q221. The amplified signal is applied to a pair of crystal filters (F1201) in order to obtain wide selection capability and to pass only the desired signal. The filtered signal is amplified at Q201 and is then applied to a 2nd IF circuit on the MAIN unit.

4-1-4 2ND IF AND DEMODULATOR CIRCUITS (MAIN UNIT)

The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal. A double superheterodyne system (which converts receive signals twice) improves the image rejection ratio and obtains stable receiver gain.

The 1st IF signal from Q201 is applied to a 2nd mixer section of IC102 (pin 16) on the MAIN unit and is then mixed with a 2nd LO signal for conversion to a 455 kHz 2nd IF signal.

IC102 contains the 2nd mixer, local oscillator circuit, limiter amplifier, quadrature detector circuit and active filter circuit. The local oscillator section and X1 generate 30.42 MHz for the 2nd LO signal.

The 2nd IF signal from the 2nd mixer (IC102, pin 3) passes through a high-quality ceramic filter (F1101) to suppress unwanted heterodyned frequency signals. It is then amplified at the limiter amplifier section (IC102, pin 5) and applied to the quadrature detector section (IC102, pin 8 and ceramic discriminator X102) to demodulate the 2nd IF signal into AF signals. The AF signals are output from IC102 (pin 9).

4-1-5 AF CIRCUIT (MAIN UNIT)

The AF circuit de-emphasizes the demodulated signals with -6 dB/octave and power-amplifies the AF signal to drive a speaker. The AF circuit includes an AF mute circuit for the squelch.

The AF signals output from IC102 (pin 9) pass through a de-emphasis circuit (R157, C151) and is then amplified at Q118. This de-emphasis circuit is an integrated circuit with frequency characteristics of -6 dB/octave.

The amplified signals are passed through the AF mute circuit (Q120). When the squelch is closed, Q120 cuts off the AF signals as an AF mute switch. The AF signals are applied to the [PWR/VOL] control (R169) and is then power-amplified at the AF power amplifier (IC103) to drive a speaker.

• 2ND IF AND DEMODULATOR CIRCUITS

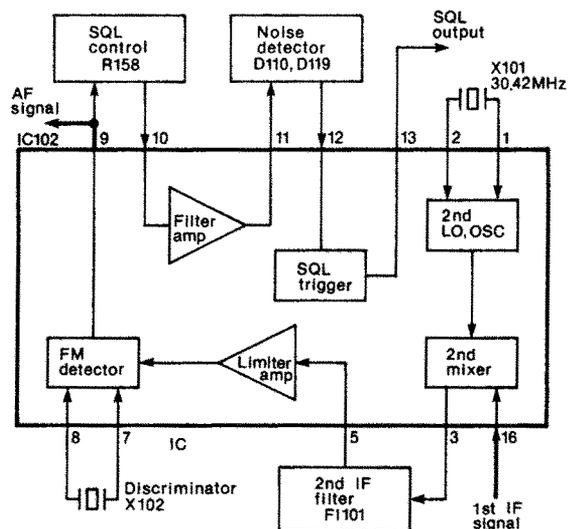


Fig. 1

4-1-6 SQUELCH CIRCUIT (MAIN AND LOGIC UNITS)

A squelch circuit cuts out AF signals when no RF signal is received. By detecting noise components in the AF signals, the squelch circuit switches the AF mute switches.

Some noise components in the AF signals from IC102 (pin 9) pass through the [SQL] control (R158) and are then applied to an active filter circuit (IC102, pin 10). The active filter circuit amplifies the noise components of frequency 20 kHz and above.

The noise signals from IC102 (pin 11) are rectified by D110 and D119 and are then converted to DC voltage at R164, C158 and C159. The DC voltage is applied to the squelch trigger circuit (IC102, pin 12) and is then output from IC102 (pin 13) as an "SQL" signal.

An "SQL" signal from IC102 (pin 13) is applied to the CPU (IC701, pin 15) on the LOGIC unit. When the CPU (IC701, pin 15) receives the "SQL" signal, the CPU (IC701, pin 30) outputs an "RMUT" voltage. The "RMUT" signal cuts the AF signal using the AF mute circuit (Q120).

4-1-7 5-TONE DECODER CIRCUIT (LOGIC UNIT)

A portion of the AF signals from the FM IF IC (IC102, pin 9) in the MAIN unit are applied to the self-correlator (IC706). The self-correlator picks up only audio components in the AF signals and then applies them to the 5-Tone encoder/decoder IC (IC705).

The 5-Tone encoder/decoder IC decodes the correlated signals to 5-Tone data and applies them to the CPU (IC701). Once the 5-tone data are decoded, 5-Tone mute signals are released and the AF mute circuit (Q120) in the MAIN unit functions as a noise squelch only.

4-2 TRANSMITTER CIRCUITS

4-2-1 MICROPHONE AMPLIFIER CIRCUIT (MAIN UNIT)

The microphone amplifier circuit amplifies audio signals with +6 dB/octave pre-emphasis from the microphone to a level needed for the modulation circuit.

The AF signals from the built-in condenser microphone or from the [EXT MIC] jack are applied to IC101a (pin 3). IC101a functions as the microphone amplifier and the limiter with +6 dB/octave pre-emphasis characteristics.

The output signals from IC101a (pin 1) pass through a splatter filter circuit (IC101b) which eliminates signal components greater than 3 kHz. Pin 7 of IC101b outputs a "MOD" signal. The "MOD" signal is applied to the modulation circuit on the VCO board.

4-2-2 MODULATION CIRCUIT (VCO BOARD)

The modulation circuit modulates the VCO oscillating signal (RF signal) using the microphone audio signals.

The "MOD" signal changes the reactance of a diode (D402) to modulate the oscillated signal at the VCO circuit (Q402, D401).

• MICROPHONE AMPLIFIER CIRCUIT

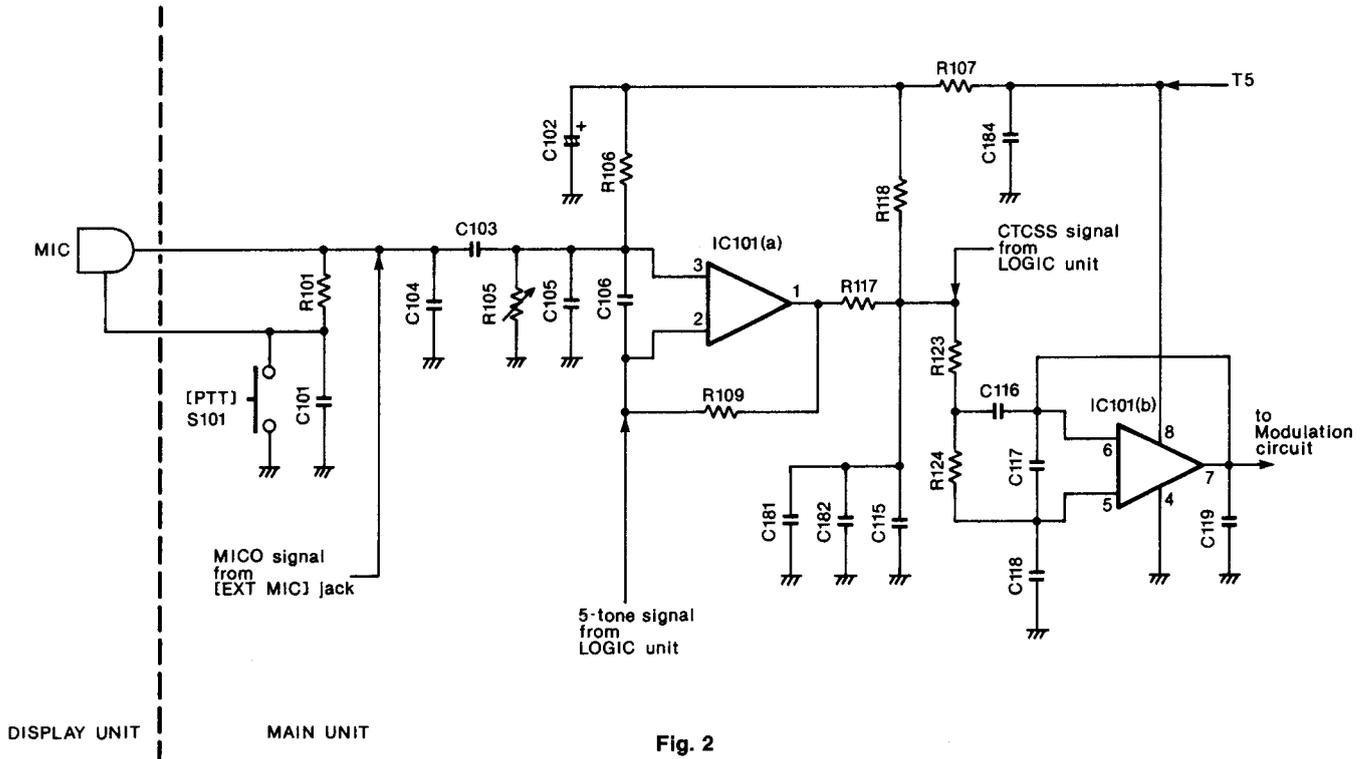


Fig. 2

The oscillated signal is buffer-amplified at Q403 and Q202 on the VCO board and PLL unit respectively. The buffer-amplified signal passes through the transmit/receive switching circuit (D204) and is then applied to the drive amplifier circuit.

4-2-3 DRIVE AMPLIFIER CIRCUIT (PLL UNIT)

The drive amplifier circuit amplifies the VCO oscillating signal to the needed level at the power amplifier.

The signal from the transmit/receive switching circuit (D204) is amplified at the pre-drive amplifier (Q204) and is then re-amplified at a drive amplifier (Q205) to obtain 150 mW.

The control voltage from the APC circuit is applied to the collector of Q205 for stable RF output power from a power amplifier (IC201).

4-2-4 RF POWER AMPLIFIER (PLL UNIT)

IC201 is a power module which provides a stable 5 W (at DC 13.2 V) of output power.

The RF signal from the drive amplifier (Q205) is applied to the power amplifier (IC201, pin 1). The amplified signal is output from IC201 (pin 5). The output signal is applied to the antenna connector through the APC detector circuit, antenna switching circuit and low-pass filter circuit.

4-2-5 APC CIRCUIT (PLL UNIT)

The APC circuit protects the power module (IC201) from a mismatched output load and selects HIGH or LOW output power.

The output power from the power module (IC201, pin 5) passes through the APC detector circuit (L207, D206, D207) where the forward and reflection components are detected as an APC voltage.

When the antenna impedance is matched at 50 Ω, the detected voltage is at its minimum. However, when antenna impedance is mismatched, the detected voltage is higher than when it is matched.

The detected voltage is applied to a differential amplifier circuit (Q214, Q215). The APC reference voltage is determined by the power output control circuit (R262~R266) and is then applied to the base of Q215.

When the antenna impedance is mismatched, the base voltage of Q214 exceeds the reference voltage. The collector voltage of Q214 decreases.

The current from the differential amplifier circuit (Q214, Q215) is amplified at Q215 to control Q212. The control voltage changes the supply voltage to the pre-driver (Q204) and driver (Q205). This decreases amplifying gain of the pre-driver and driver until the base voltage of Q214 reaches the same level as the voltage of Q215.

4-2-6 POWER OUTPUT CONTROL CIRCUIT (PLL UNIT)

The power output control circuit (R262~R266) selects "HIGH" or "LOW" output power levels and controls the RF output power with the APC reference voltage.

When "HIGH" output power is selected, the APC reference voltage is determined by R262, R263 and R266. The RF output power is adjusted with R262.

When "LOW" output power is selected, the APC reference voltage is determined by R262~R266. The RF output power is adjusted with R264.

• APC CIRCUIT

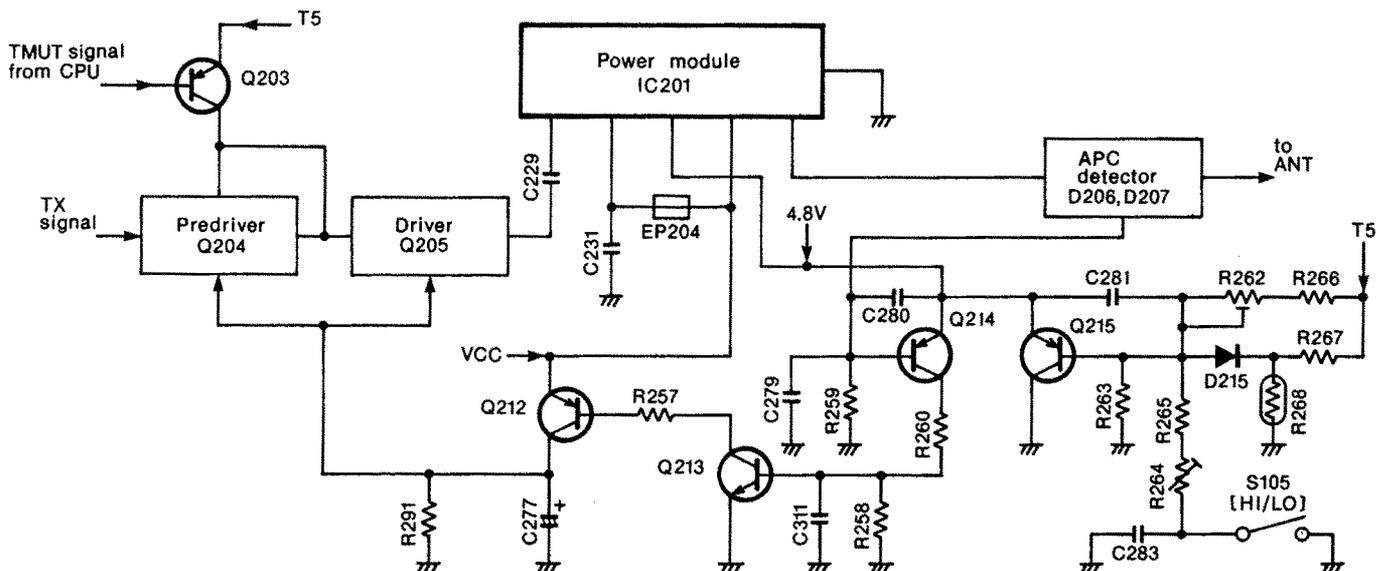


Fig. 3

4-2-7 TX MUTE CIRCUIT (PLL UNIT)

The TX mute circuit interrupts the transmission by controlling the TMUTE signal.

When a "TMUT" signal from the CPU (IC701, pin 31) on the LOGIC unit turns Q203 OFF to interrupt the transmission, the bias voltages are prevented from entering Q204, Q205 and IC201.

4-2-8 ANTENNA SWITCHING CIRCUIT (PLL UNIT)

The antenna switching circuit applies the received signal to the receiver circuit and the transmitter signal to the antenna connector.

When transmitting, D208 and D209 are turned ON. The RF output signal is not permitted to enter the receiver circuit. The signal passes through D208 and the low-pass filter (L211, L212, C243~C245). The filtered signal is applied to the antenna connector. The low-pass filter suppresses high harmonic components.

4-3 PLL CIRCUITS

4-3-1 GENERAL

PLL circuits provide steady oscillation of the transmit frequency and the receive 1st LO frequency. The PLL output frequency is controlled by the divided ratio (N-data) of the programmable divider.

• PLL CIRCUIT

4-3-2 PLL CIRCUIT (VCO BOARD AND PLL UNIT)

The PLL circuit, using a PLL IC (IC203) and a prescaler (IC202), directly generates the transmit frequency and the receive 1st LO frequency with the VCO (Q402, D401) on the VCO board. Signals from the VCO are prescaled at the prescaler (IC202) based on N-data from the PLL IC (IC203, pin 5). The resulting signal is applied to the PLL IC (IC203, pin 4). The PLL IC (IC203) detects the out-of-step phase and outputs it from pins 12 and 13.

4-3-3 REFERENCE OSCILLATOR CIRCUIT (PLL UNIT)

A 6.4 MHz reference frequency is produced by Q211 and X201. The frequency is adjusted with C269. D213, R246 and R248 compensate for temperature to maintain frequency stability within ± 5 ppm ($-25^{\circ}\text{C} \sim +60^{\circ}\text{C}$). The reference frequency is applied to the PLL IC (IC203, pin 17).

4-3-4 VCO CIRCUIT (VCO BOARD)

The VCO circuit (Q402, D401) generates the transmit frequency and the receive 1st LO frequency. The varactor diode (D401) provide frequency control.

In receive mode, Q401 and D402 are turned ON as the "RS5" voltage line becomes 5 V. C405 and C406 are connected to L403, C402, C403 and D401 in parallel. Therefore, the VCO output frequency is shifted to a lower frequency than while transmitting.

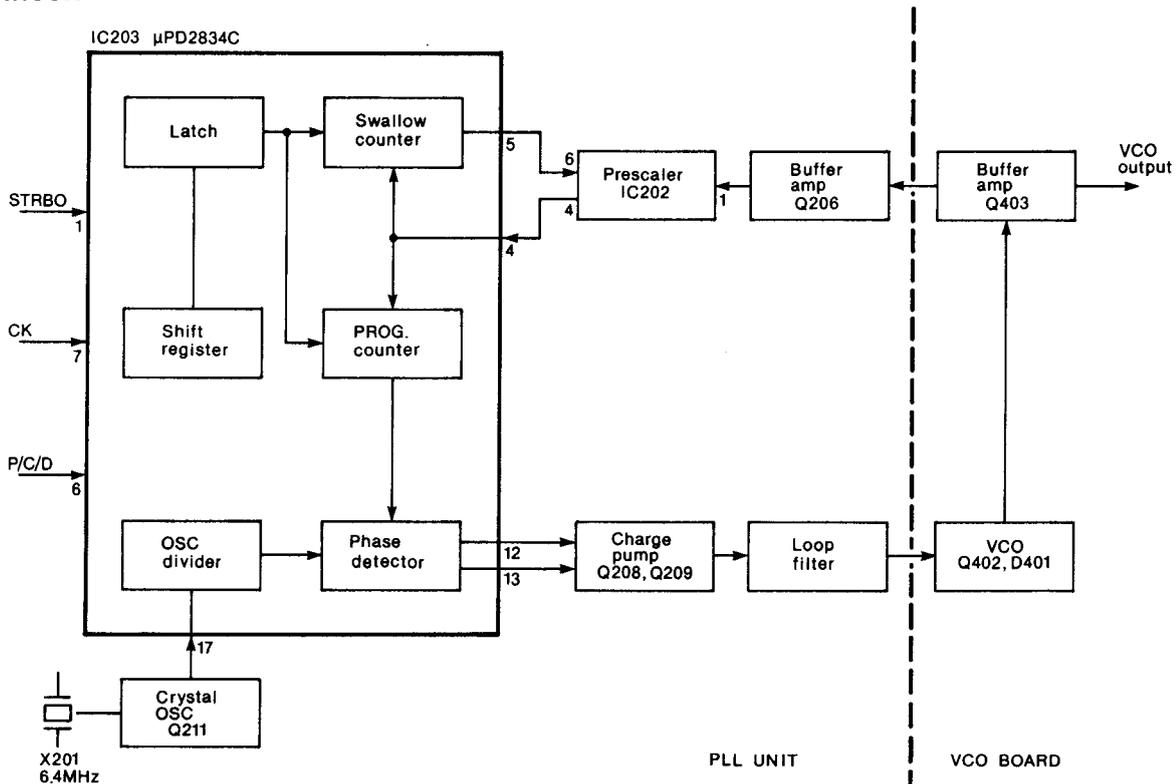


Fig. 4

In transmit mode, Q401 and D402 are turned OFF as the "RS5" voltage line becomes 0 V. C405 and C406 are disconnected from the resonant circuit. Therefore, the VCO output frequency is shifted to a higher frequency than while receiving.

The output signal from the VCO circuit is applied to buffer amplifiers (Q403, Q202 and Q206 on the PLL unit) which amplifies VCO oscillation and does not permit the latter circuit to affect the VCO oscillation. The amplified signal at Q206 is divided at the prescaler (IC202) and is then applied to the PLL IC (IC203). On the other hand, the amplified signal at Q202 is applied to the transmit/receive switching circuit (D203, D204) as the transmit and the receive 1st LO frequencies.

4-3-5 PROGRAMMABLE DIVIDER AND PHASE DETECTOR CIRCUITS (PLL UNIT)

The programmable divider shifts the dividing ratio, depending on the operating frequency, with a prescaler and determines the VCO oscillating frequency. The phase detector circuit detects the off-phase components of the VCO frequency using a stable reference frequency.

IC203 is a PLL IC that contains a pulse counter, a programmable divider and a phase detector. IC203 accepts up to 14 MHz inputs. The input signal from the prescaler (IC202, pin 4) passes through the programmable counter section of IC203.

A 6.4 MHz reference frequency from X201 is applied to IC203 (pin 17) and passes through a programmable reference counter section of IC203. Both of the divided signals are compared at a phase detector section of IC203. The phase-detected signal (pulse signal) is output from IC203 (pins 12 and 13).

4-3-6 LOOP FILTER CIRCUIT (PLL UNIT)

The phase-detected signal (pulse signal) from IC203 (pins 12 and 13) passes through the charge pump (Q208, Q209) and is then applied to a lag-lead loop filter (R241, R282, R284, C267). The pulse signal is converted to DC voltage (PLL voltage) to control the oscillation from the VCO circuit.

The charge pump (Q208, Q209) is used to expand the range of the PLL lock voltage. The PLL lock voltage changes the reactance of varactor diode (D401) on the VCO board.

4-3-7 UNLOCK SENSOR CIRCUIT (MAIN AND PLL UNITS)

When the PLL circuit is unlocked, IC203 (pin 10) becomes "LOW." The "LOW" signal passes through the unlock sensor circuit (Q124, Q125) on the MAIN unit and is then applied to the CPU (IC701, pin 16) as an unlock signal.

4-4 POWER SUPPLY CIRCUITS

4-4-1 VOLTAGE LINES

LINE	DESCRIPTION
EXT	The external DC power from the DC power connector (J204).
VCC	This voltage passes through a power switch (R169) and is then applied to the 5 V regulator circuit. This voltage line changes depending on the battery pack type: 8.4 V (CM-8B, CM-96B), 13.2 V (CM-7B).
+5V	Common 5 V converted from the VCC line at the 5 V regulator circuit (Q116, Q117, D107, D108). This regulator circuit is composed of a complementary connection to ensure high current amplification and supplies stable output voltage continuously with good temperature characteristics during transmission and reception.
+5	This voltage is converted from the VCC line at Q114, Q115 and D106. This regulator circuit forms a complementary circuit.
R5	Receive 5 V controlled by a "T/R" signal from the CPU (IC701, pin 39). This voltage is converted from the VCC line at Q110, Q111 and D104. This regulator circuit forms a complementary circuit.
T5	Transmit 5 V controlled by a "T/R" signal from the CPU (IC701, pin 39). This voltage is converted from the VCC line at Q112, Q113 and D105. This regulator circuit forms a complementary circuit.

4-4-2 CPU POWER SUPPLY CIRCUIT (MAIN AND LOGIC UNITS)

The DC voltage is applied to the 16k CMOS RAM (IC703, pin 24) via D102 from the lithium backup battery (BT101) to provide backup for the memory contents regardless of the power switch supply.

• CPU POWER SUPPLY CIRCUIT

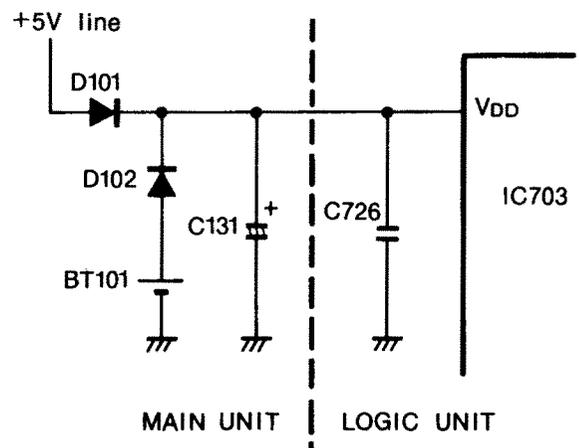


Fig. 5

4-5 LOGIC CIRCUITS

4-5-1 GENERAL

Logic circuits consist of an 8-bit CPU, a CMOS EPROM, a 16k CMOS RAM a 5-Tone encoder/decoder and a subaudible tone encoder. The circuit controls frequency, tone setting, function display and more.

4-5-2 PORT ALLOCATIONS

IC701 CPU (LOGIC UNIT)

PORT NAME	PIN NUMBER	DESCRIPTION
DB0~DB7	5~2, 64~61	These are 8-bit data busses for an external ROM and RAM. DB0~DB3 are also used as matrix input ports.
PE0~PE15	43~57, 59	These are 16-bit data busses. PE0~PE7 are used as matrix output ports. PE13~PE15 are used as matrix select signal ports for the RAM.
PA7 [CS]	34	This port becomes "LOW" when IC701 outputs command or data signals to IC601.
PA6 [P/C/D]	33	Outputs a selector signal for selecting the signal of PLL N-data and IC601 command/data.
PA5 [CK]	32	Outputs a synchronizing signal when the PLL N-data is output.
PA4 [TMUT]	31	Outputs a transmit mute signal. "HIGH": transmit mute.
PA3 [RMUT]	30	Outputs a receive mute signal. "HIGH": receive mute.
PA1 [CPO]	28	Outputs cloning data.
PA0 [STRB0]	27	Outputs a strobe signal for PLL data.
PB6 [STRB2]	41	Outputs a strobe signal for the CTCSS data.
PB5 [STRB1]	40	Outputs a strobe signal for the 5-Tone encoder.
PB4 [T/R]	39	Output the transmit/receive switching signal. "HIGH": transmit "LOW": receive
PB0~PB3 [S0~S3]	38, 35, 36, 37	Input/output ports for 5-Tone data.
PC5 [BUSY]	11	Outputs the BUSY signal for IC601 on the DISPLAY unit.
PC4 [FUNC]	12	Input port for the [FUNC] switch. The transceiver enters the cloning receive mode when the port is "LOW" at turning the power ON.
PC3 [TRF]	13	Input port for the TRANSMIT indicator. "LOW": indicates.
PC2 [SEND]	14	Input port for the transmit/receive switching signal. The port is also used as the cloning input.

PORT NAME	PIN NUMBER	DESCRIPTION
PC1 [SQL]	15	Input port for the squelch open/close. "HIGH": squelch opens.
PC0 [UNLK]	16	Input port for the PLL unlock signal. "LOW": PLL unlocked.
SO	21	Outputs serial data.
SCK	19	Outputs a data timing signal synchronized with the SO port.
INT0	7	Input port for a strobe signal from the 5-Tone decoder IC. Readies the CPU to read the 5-Tone data.
INT1	6	IC701 enters the stand-by mode when the port becomes "HIGH." This port becomes "HIGH" and "LOW" when the power is turned OFF and ON respectively.
TO	18	Outputs beep signals.
WR	9	Outputs the write signal to the external RAM (IC703). "LOW": data are stored into RAM.
RD	10	Outputs the read signal to the external ROM and RAM. "LOW": data are recalled from the ROM or RAM.

4-6 5-TONE CIRCUITS

4-6-1 5-TONE IC (LOGIC UNIT)

IC705* is a gate-array IC consisting of a 5-tone encoder/decoder, a data selector for controlling the CPU, a serial-parallel converter and divider and an inverter for resetting. The following I/O ports are equipped.

* IC705

SC1093 for #26, #27, #30, #31

SC1084 for #21~#25, #28, #29

PORT NAME	PIN NUMBER	DESCRIPTION
IO0~IO3	64~61	These are input/output ports for the 5-Tone encoder/decoder.
CON1	60	Input port for selecting IO0~IO3 condition. "LOW": output ports "HIGH": input ports
RX	59	Input port for selecting IC705 function. "LOW": encoder "HIGH": decoder
TO1, TO2	44, 45	Input ports for 5-Tone format selection.
ST1	57	Input port for 5-Tone encoder/decoder strobe signal.
EC0~EC2	41~43	Outputs the 5-Tone encoder data.
DS	21	Input port for audio signals.
ST3	8	Outputs a strobe signal for the 5-Tone decoder.

PORT NAME	PIN NUMBER	DESCRIPTION
SE1~SE3	2~4	Input ports for a data selector.
MA0~MA3, DB0~DB3, CE1	39~36, 55~52, 51	Function of each port CE1 and DB0~DB3 is determined by data from ports SE1~SE3. Ports MA0~MA3 are allocated as data input.
ST2, SCK2, SI2	56, 6, 7	These are serial input ports for converting data from serial to parallel.
P1~P7	13~19	Outputs the parallel signal to the subaudible tone encoder (IC704).
IN1, IN2	9, 11	These ports are connected to internal inverter input.
OUT1, OUT2	10, 12	These ports are connected to internal inverter output.
KO1	5	Outputs 4.48 MHz signals.
KO3	22	Outputs 560 kHz signals.
OSC1, OSC2	34, 35	Ports for a crystal oscillator.

The 5-Tone system depends on the transceiver version and combination of the ports TO1 and TO2 as follows: (Refer to Section 8-4)

TO1	TO2	#21~#25, #28, #29	#26, #27, #30, #31
L	L	EIA	DZVEI
H	L	CCIR	CCIR
L	H	EEA	EEA
H	H	ZVEI	DAPL

L: ground H: open

4-6-2 5-TONE FREQUENCY TABLE

5-TONE CODE	EIA	CCIR	EEA	ZVEI	DZVEI	DAPL
0	600	1981	1981	2400	2200	1981
1	741	1124	1124	1060	970	1124
2	882	1197	1197	1160	1060	1197
3	1023	1275	1275	1270	1160	1275
4	1164	1358	1358	1400	1270	1358
5	1305	1446	1446	1530	1400	1446
6	1446	1540	1540	1670	1530	1540
7	1587	1640	1640	1830	1670	1640
8	1728	1747	1747	2000	1830	1747
9	1869	1860	1860	2200	2000	1860
A=Group	2151	2400	1055	2800	885	2400
B	2433	930	930	810	810	2548
C	2010	2247	2247	970	2600	2247
D	2292	991	991	886	2800	770
E=Repeat	459	2110	2110	2600	2400	2110
F	No tone					

4-6-3 D/A CONVERTER CIRCUIT (LOGIC UNIT)

EC0~EC2 of IC701 outputs 5-Tone signals digitally. R713~R718 convert signals from digital to analog, and then output the signals as 5-Tones to the MAIN unit.

4-7 DISPLAY CIRCUIT (DISPLAY UNIT)

IC601 is a programmable LCD controller/driver IC chip. Data from the LOGIC unit are applied to IC601 and divided by 3 to be indicated on the function display.

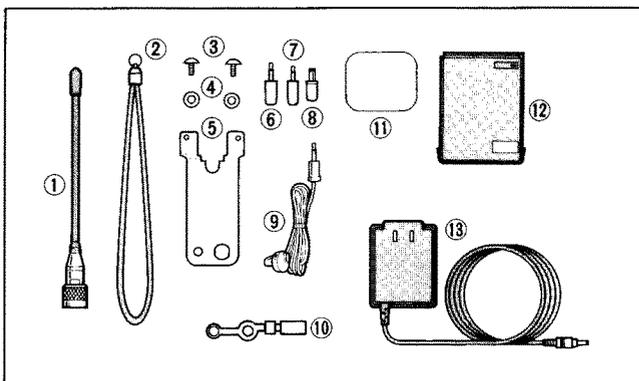
SECTION 5 MECHANICAL PARTS AND DISASSEMBLY

• CHASSIS PARTS

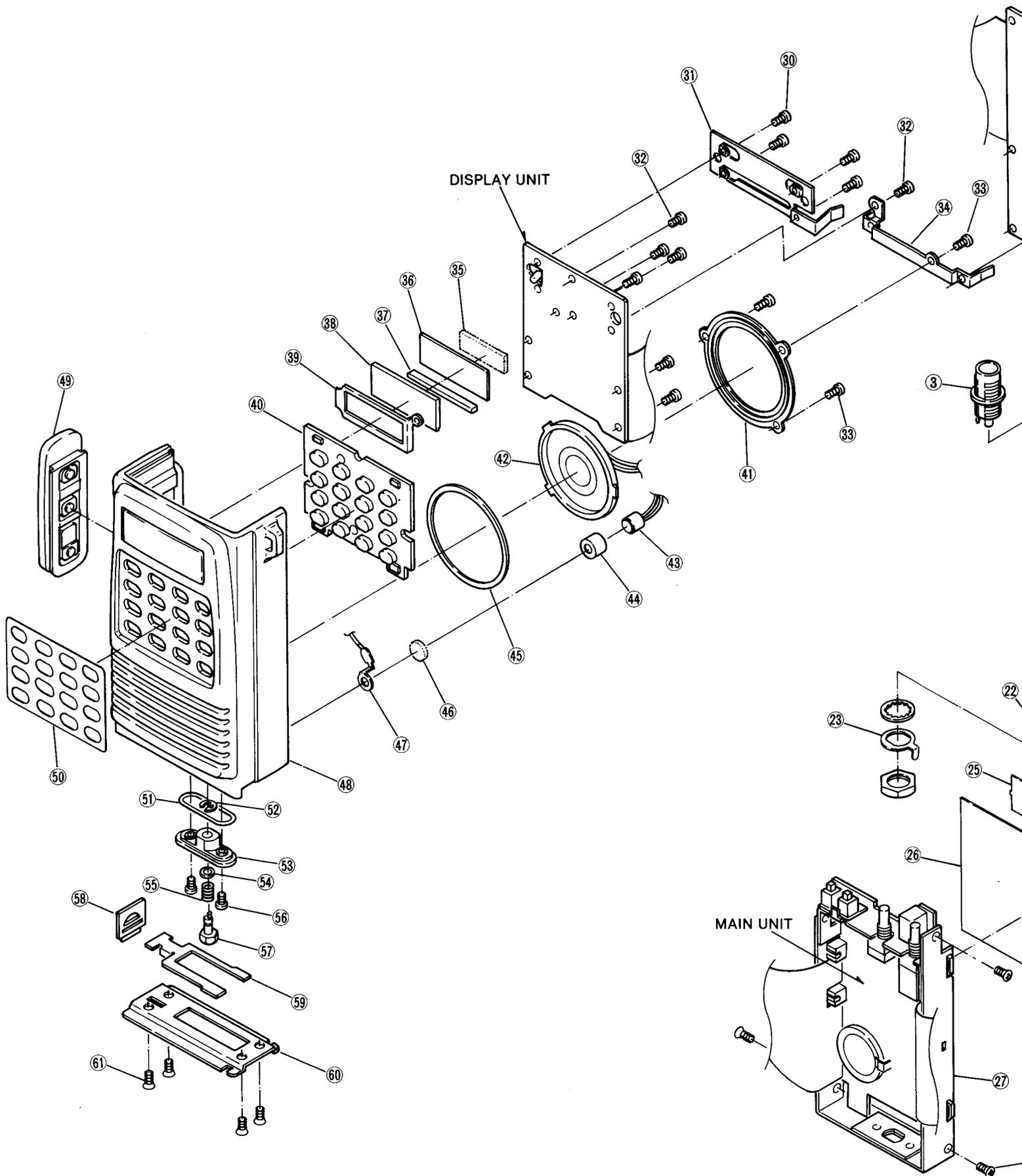
LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.	LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	8610008030	Knob N191 [SQL], [PWR/VOL]	2	③②	8810001710	Screw PH B0 No. 0-3 M1.4×3.5 ZK	7
②	8810000100	Screw PH M2×4 ZK	2	③③	8810004040	Screw PH B0 No. 0 M2×5 ZU	3
③	6510004920	Antenna connector TNC-102-N1-W1-L1	1	③④	8930011150	Logic shield plate	1
④	8210007641	554 top panel-1 (#21~#24, #26~#31)	1	③⑤	8930001380	Sponge (I)	1
	8010013180	554 top panel (A) (#25)		③⑥	6910001200	Reflector ALF33×11×0.58	1
⑤	8610008020	Knob K191 [LIGHT]	1	③⑦	8930007790	LCD contact SRCN-411	1
⑥	8610008020	Knob K191 [HI/LO] (#21~#24, #26~#31)	1	③⑧	5030000230	LCD LR580-E	1
⑦	8930006050	Switch waterproof seal (#21~#24, #26~#31)	1	③⑨	8510007750	LCD shield plate (A)	1
	8930009060	Switch waterproof seal (A) (#25)		④①	8210007560	554 10-key	1
⑧	8310005130	Knob seal	2	④②	8930007200	Speaker plate (A)	1
⑨	8930002940	Top ring	1	④③	2510000140	Speaker 40P-157B	1
⑩	8810000740	Screw PH A M2×15 ZK	4	④④	7700000480	Microphone KUC2023-01-006	1
⑪	8010012550	554 rear panel	1	④⑤	8930001630	Microphone holder	1
⑫	8930002950	Panel seal-1	1	④⑥	8930002930	Speaker seal	1
⑬	8510005491	660 rear shield plate-1	1	④⑦	8930001620	Microphone sponge	1
⑭	8930015190	Copper sheet (A)	1	④⑧	8930007210	297 microphone lug	1
⑮	8830000030	VR nut (C)	2	④⑨	8210007800	554 front panel (A) (incl. window plate)	1
⑯	8850000070	Icom washer (J)	2	④⑩	8930025010	554 PTT rubber (#21~#28, #30, #31)	1
⑰	8510003280	ANT shield plate	1		8930006040	PTT rubber (#29)	
⑱	8510002770	PA shield plate	1	⑤①	8210007650	554 10-key panel	1
⑲	8930014130	660 ground spring	1	⑤②	8930002780	O ring (E)	1
⑳	8930001510	Sponge (V)	1	⑤③	8860000300	E ring M 2	1
㉑	8010007380	Chassis A	1	⑤④	8010002740	Terminal holder	1
㉒	8810005490	Screw FH No. 0-3 M2×3	4	⑤⑤	8930002790	O ring (F)	1
㉓	6910000710	Ground lug for antenna connector	1	⑤⑥	8930007220	Spring (A)-1	1
㉔	8810001840	Screw PH M2.6×6 NI BS	2	⑤⑦	8810001840	Screw PH M2.6×6 NI BS	2
㉕	8510002280	Shield plate	1	⑤⑧	6510000630	Positive terminal	1
㉖	8930007030	Insulating sheet (W)	1	⑤⑨	8930024570	554 release button	1
㉗	8010007390	Chassis B	1	⑤⑩	8930005612	Lock plate-3	1
㉘	8810004800	Screw PH B0 No. 0 M2×4	3	⑥①	8010002880	Sliding plate (A)	1
㉙	8930011160	Logic ground plate	1	⑥②	8810002380	Screw FH M2.6×6 NI BS	4
⑳	8810001720	Screw PH B0 No. 0-3 M1.4×4	4		8010013190	554 top plate (#25 only)	1
㉑	8510003310	Front shield plate	1				

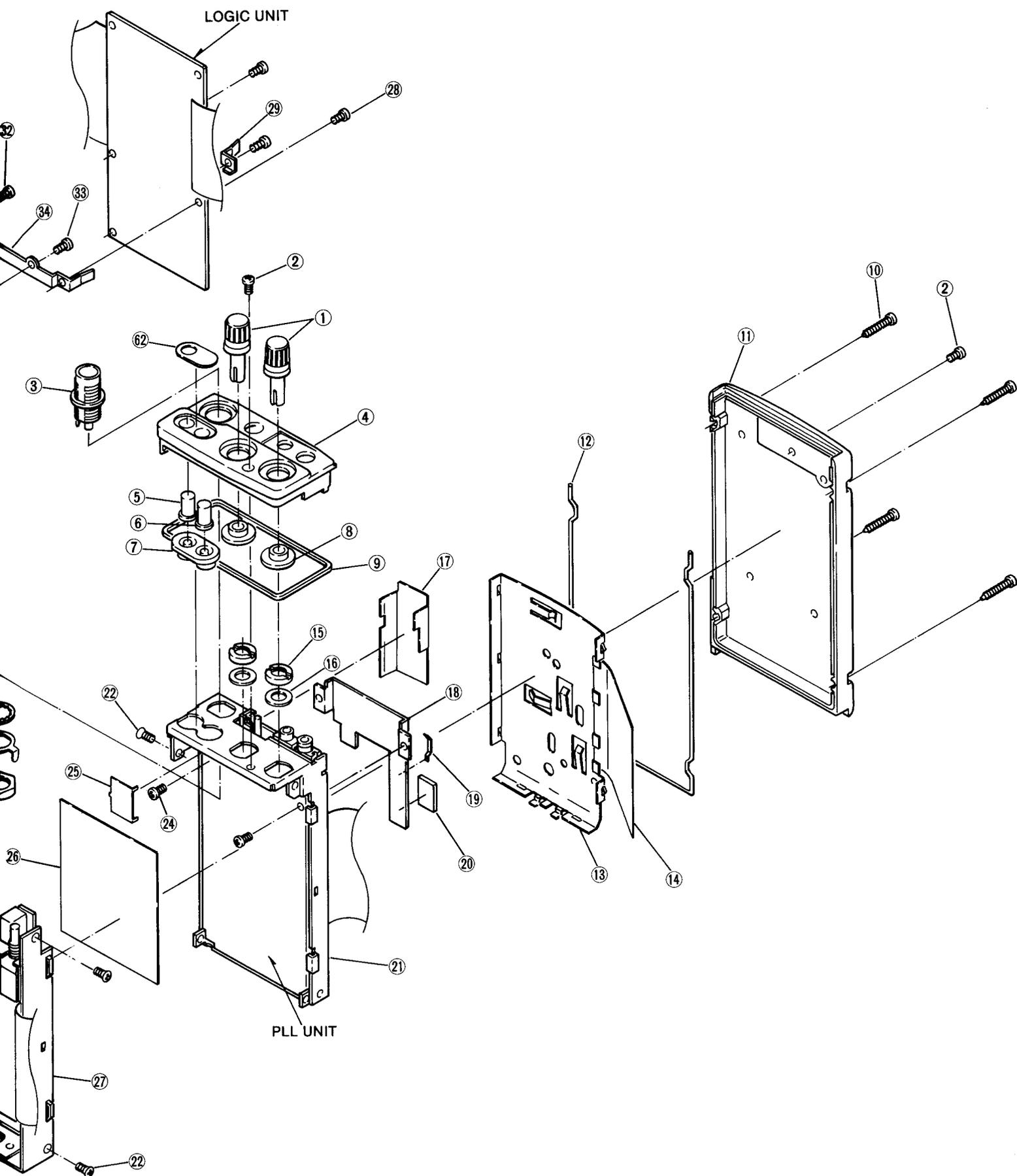
Screw abbreviations B0: Self-tapping screw PH: Pan head FH: Flat head BS: Brass NI: Nickel ZK: Black

• ACCESSORIES



LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	3310000120	Flexible antenna #208-8 (#21~#28, #30)	1
	3310000630	Flexible antenna #208-22 (#29, #31)	
②	8010003030	Handstrap	1
③	8810003650	Icom screw A4	2
④	8850000640	Nylon washer B M3	2
⑤	8930005660	Belt clip	1
⑥	5610000020	External speaker plug	1
⑦	5610000030	External mic plug	1
⑧	5610000010	External DC power plug	1
⑨	2530000050	Earphone ME-35NMIJ-8/1M	1
⑩	8930013960	Rainproof cap (A)	1
⑪	8010013170	554 front cover	1
⑫	Optional product	CM-8B BATTERY PACK	1
⑬	Optional product	CM-16E WALL CHARGER	1





SECTION 6 PARTS LIST

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC101	1110001150	IC	NJM4560DD
IC102	1110000460	IC	TK-10420D
IC103	1110000530	IC	LM386N-3
Q105	1510000080	TRANSISTOR	2SA1048-GR
Q106	1510000080	TRANSISTOR	2SA1048-GR
Q107	1530000110	TRANSISTOR	2SC2458-GR
Q108	1510000080	TRANSISTOR	2SA1048-GR
Q109	1510000080	TRANSISTOR	2SA1048-GR
Q110	1530000110	TRANSISTOR	2SC2458-GR
Q111	1520000080	TRANSISTOR	2SB909M R
Q112	1530000110	TRANSISTOR	2SC2458-GR
Q113	1520000080	TRANSISTOR	2SB909M R
Q114	1530000110	TRANSISTOR	2SC2458-GR
Q115	1520000080	TRANSISTOR	2SB909M R
Q116	1530000110	TRANSISTOR	2SC2458-GR
Q117	1520000080	TRANSISTOR	2SB909M R
Q118	1530000110	TRANSISTOR	2SC2458-GR
Q120	1590000280	FET	2SJ105-Y
Q121	1530000110	TRANSISTOR	2SC2458-GR
Q122	1520000080	TRANSISTOR	2SB909M R
Q123	1530000110	TRANSISTOR	2SC2458-GR
Q124	1530000110	TRANSISTOR	2SC2458-GR
Q125	1530000110	TRANSISTOR	2SC2458-GR
D101	1710000070	DIODE	1SS233
D102	1710000600	DIODE	1SS254
D103	1710000600	DIODE	1SS254
D104	1710000600	DIODE	1SS254
D105	1710000600	DIODE	1SS254
D106	1710000600	DIODE	1SS254
D107	1730000360	ZENER	RD5.1JS B2
D108	1710000600	DIODE	1SS254
D109	1710000600	DIODE	1SS254
D110	1710000040	DIODE	1S953
D111	1710000600	DIODE	1SS254
D112	1710000600	DIODE	1SS254
D113	1710000600	DIODE	1SS254
D114	1710000600	DIODE	1SS254
D115	1710000600	DIODE	1SS254
D116	1730000080	ZENER	RD4.7E B2
D117	1730000140	ZENER	RD6.8E B2
D118	1710000600	DIODE	1SS254
D119	1710000040	DIODE	1S953
X101	6050005010	XTAL	CR-214
X102	6070000010	DISCRIMINATOR	CDB455C7A
F1101	2020000120	CERAMIC	CFW455E (#22, #24, #25, #28, #29)
	2020000150	CERAMIC	CFW455HT (#21, #23, #26, #27, #30, #31)
L101	6180000880	COIL	LAL 03NA 100K
R101	7010003600	RESISTOR	ELR20J 33 kΩ
R102	7010003400	RESISTOR	ELR20J 1 kΩ
R103	7010003400	RESISTOR	ELR20J 1 kΩ
R104	7010003410	RESISTOR	ELR20J 1.2 kΩ
R105	7310001860	TRIMMER	RH0421CS5J02A (474)
R106	7010003700	RESISTOR	ELR20J 220 kΩ
R107	7010003360	RESISTOR	ELR20J 470 Ω
R109	7010003690	RESISTOR	ELR20J 180 kΩ
R110	7010003530	RESISTOR	ELR20J 10 kΩ
R112	7010003290	RESISTOR	ELR20J 120 Ω
R113	7010003530	RESISTOR	ELR20J 10 kΩ

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R114	7510000020	THERMISTOR	33D28
R115	7010003580	RESISTOR	ELR20J 22 kΩ
R117	7010003700	RESISTOR	ELR20J 220 kΩ
R118	7010003640	RESISTOR	ELR20J 68 kΩ
R119	7010003610	RESISTOR	ELR20J 39 kΩ
R120	7010003600	RESISTOR	ELR20J 33 kΩ
R121	7010003530	RESISTOR	ELR20J 10 kΩ
R122	7310001720	TRIMMER	RH0421C15J06A (104)
R123	7010003610	RESISTOR	ELR20J 39 kΩ
R124	7010003610	RESISTOR	ELR20J 39 kΩ (#22, #24, #25, #28, #29)
	7010003630	RESISTOR	ELR20J 56 kΩ (#21, #23, #26, #27, #30, #31)
R125	7010003540	RESISTOR	ELR20J 12 kΩ
R126	7310001720	TRIMMER	RH0421C15J06A (104)
R127	7010003360	RESISTOR	ELR20J 470 Ω
R128	7010003420	RESISTOR	ELR20J 1.5 kΩ
R129	7010003620	RESISTOR	ELR20J 47 kΩ
R130	7010003420	RESISTOR	ELR20J 1.5 kΩ (#22, #24, #25, #28, #29)
	7010003440	RESISTOR	ELR20J 2.2 kΩ (#21, #23, #26, #27, #30, #31)
R132	7010003420	RESISTOR	ELR20J 1.5 kΩ (#22, #24, #25, #28, #29)
	7010003440	RESISTOR	ELR20J 2.2 kΩ (#21, #23, #26, #27, #30, #31)
R133	7010003480	RESISTOR	ELR20J 4.7 kΩ
R134	7010003640	RESISTOR	ELR20J 68 kΩ (#21, #23, #26, #27, #30, #31)
	7010003690	RESISTOR	ELR20J 180 kΩ (#22, #24, #25, #28, #29)
R135	7010004160	RESISTOR	R20J 560 Ω
R136	7010004320	RESISTOR	R20J 10 kΩ
R137	7010004450	RESISTOR	R20J 100 kΩ
R138	7010004450	RESISTOR	R20J 100 kΩ
R139	7010004490	RESISTOR	R20J 220 kΩ
R140	7010004390	RESISTOR	R20J 33 kΩ
R141	7010003530	RESISTOR	ELR20J 10 kΩ
R142	7010003690	RESISTOR	ELR20J 180 kΩ
R143	7010003530	RESISTOR	ELR20J 10 kΩ
R144	7010003530	RESISTOR	ELR20J 10 kΩ
R145	7010003530	RESISTOR	ELR20J 10 kΩ
R146	7010003530	RESISTOR	ELR20J 10 kΩ
R147	7010004350	RESISTOR	R20J 18 kΩ
R148	7010003450	RESISTOR	ELR20J 2.7 kΩ
R149	7010003530	RESISTOR	ELR20J 10 kΩ
R150	7010004320	RESISTOR	R20J 10 kΩ
R151	7010004450	RESISTOR	R20J 100 kΩ
R152	7010003510	RESISTOR	ELR20J 6.8 kΩ
R153	7010003780	RESISTOR	ELR20J 1 MΩ
R154	7010003740	RESISTOR	ELR20J 470 kΩ
R155	7010003480	RESISTOR	ELR20J 4.7 kΩ
R156	7010003390	RESISTOR	ELR20J 820 Ω
R157	7010003540	RESISTOR	ELR20J 12 kΩ
R158	7210000240	VARIABLE	RK094111000NA (10KB) [SQL]
R159	7010003450	RESISTOR	ELR20J 2.7 kΩ
R160	7010003440	RESISTOR	ELR20J 2.2 kΩ
R161	7510000020	THERMISTOR	33D28
R162	7010003780	RESISTOR	ELR20J 1 MΩ
R163	7010003660	RESISTOR	ELR20J 100 kΩ
R164	7010003580	RESISTOR	ELR20J 22 kΩ
R165	7010003400	RESISTOR	ELR20J 1 kΩ
R166	7010003530	RESISTOR	ELR20J 10 kΩ
R167	7010003740	RESISTOR	ELR20J 470 kΩ
R168	7010003780	RESISTOR	ELR20J 1 MΩ
R169	7210000250	VARIABLE	RK0941111003A (10KA) [PWRVOL]
R170	7010003700	RESISTOR	ELR20J 220 kΩ
R171	7010003680	RESISTOR	ELR20J 150 kΩ

S.=Surface mount

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
R172	7010003680	RESISTOR ELR20J 150 kΩ
R173	7010003600	RESISTOR ELR20J 33 kΩ
R174	7010003420	RESISTOR ELR20J 1.5 kΩ (#21, #23, #26, #27, #30, #31)
	7010003430	RESISTOR ELR20J 1.8 kΩ (#22, #24, #25, #28, #29)
R175	7010003410	RESISTOR ELR20J 1.2 kΩ
R176	7010003620	RESISTOR ELR20J 47 kΩ
R177	7010004450	RESISTOR R20J 100 kΩ
R178	7010004530	RESISTOR R20J 470 kΩ
R179	7010004390	RESISTOR R20J 33 kΩ
R180	7010004400	RESISTOR R20J 39 kΩ
R181	7010003580	RESISTOR ELR20J 22 kΩ
R182	7010003460	RESISTOR ELR20J 3.3 kΩ
R183	7010004320	RESISTOR R20J 10 kΩ
R184	7010003530	RESISTOR ELR20J 10 kΩ
R185	7010003420	RESISTOR ELR20J 1.5 kΩ
R186	7010003400	RESISTOR ELR20J 1 kΩ
C101	4010000500	CERAMIC DD104 B 102K 50V
C102	4510001550	ELECTROLYTIC 16 RC3 10 μF
C103	4040000190	BARRIER UAT 05X 103K
C104	4010000500	CERAMIC DD104 B 102K 50V
C105	4010000260	CERAMIC DD104 SL 470J 50V
C106	4010000260	CERAMIC DD104 SL 470J 50V
C109	4550000320	TANTALUM DN 1V 0R1M
C110	4550000320	TANTALUM DN 1V 0R1M
C113	4510001600	ELECTROLYTIC 50 RC3 0.22 μF
C115	4310000050	MYLAR 50 F2D 222K
C116	4310000020	MYLAR 50 F2D 103K
C117	4010000460	CERAMIC DD104 B 471K 50V
C118	4010000330	CERAMIC DD105 SL 101J 50V (#22, #24, #25, #28, #29)
	4010000340	CERAMIC DD105 SL 121J 50V (#21, #23, #26, #27, #30, #31)
C119	4010000460	CERAMIC DD104 B 471K 50V
C120	4310000050	MYLAR 50 F2D 222K
C121	4510001620	ELECTROLYTIC 50 RC3 1 μF
C122	4550000320	TANTALUM DN 1V 0R1M
C123	4010000500	CERAMIC DD104 B 102K 50V
C124	4040000190	BARRIER UAT 05X 103K
C125	4550000340	TANTALUM DN 1C 100M
C126	4010000320	CERAMIC DD104 SL 820J 50V
C127	4550000320	TANTALUM DN 1V 0R1M
C128	4560000020	CERAMIC D33Y5V 1E 104Z21
C129	4010000280	CERAMIC DD104 SL 560J 50V
C130	4010000160	CERAMIC DD104 SL 180J 50V
C131	4510001520	ELECTROLYTIC 6.3 RC3 47 μF
C132	4510001650	ELECTROLYTIC 50 RC3 4.7 μF
C133	4010000500	CERAMIC DD104 B 102K 50V
C134	4010000460	CERAMIC DD104 B 471K 50V
C135	4510001510	ELECTROLYTIC 6.3 RC3 22 μF
C136	4510001510	ELECTROLYTIC 6.3 RC3 22 μF
C137	4550000010	TANTALUM DN 1C 4R7M
C138	4510001630	ELECTROLYTIC 50 RC3 2.2 μF
C139	4510001510	ELECTROLYTIC 6.3 RC3 22 μF
C140	4010000500	CERAMIC DD104 B 102K 50V
C141	4510001510	ELECTROLYTIC 6.3 RC3 22 μF
C142	4010000500	CERAMIC DD104 B 102K 50V
C143	4010000460	CERAMIC DD104 B 471K 50V
C144	4510001510	ELECTROLYTIC 6.3 RC3 22 μF
C145	4510002020	ELECTROLYTIC 25 MS7 47 μF
C146	4010000460	CERAMIC DD104 B 471K 50V
C147	4010000460	CERAMIC DD104 B 471K 50V
C148	4010000460	CERAMIC DD104 B 471K 50V
C149	4040000190	BARRIER UAT 05X 103K
C150	4560000020	CERAMIC D33Y5V 1E 104Z21
C151	4510001590	ELECTROLYTIC 50 RC3 0.1 μF
C152	4010000500	CERAMIC DD104 B 102K 50V (#22, #24, #25, #28, #29)
	4040000110	BARRIER UAT 04X 222K (#21, #23, #26, #27, #30, #31)
C153	4010000260	CERAMIC DD104 SL 470J 50V
C154	4010000500	CERAMIC DD104 B 102K 50V

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
C155	4010000120	CERAMIC DD104 SL 100D 50V
C156	4010000500	CERAMIC DD104 B 102K 50V
C157	4550000360	TANTALUM DN 1V R47M
C158	4510001590	ELECTROLYTIC 50 RC3 0.1 μF
C159	4010000500	CERAMIC DD104 B 102K 50V
C160	4510001620	ELECTROLYTIC 50 RC3 1 μF
C161	4510001620	ELECTROLYTIC 50 RC3 1 μF
C162	4040000160	BARRIER UAT 05X 562K
C163	4560000020	CERAMIC D33Y5V 1E 104Z21
C164	4010000460	CERAMIC DD104 B 471K 50V
C165	4510001630	ELECTROLYTIC 50 RC3 2.2 μF
C166	4510001550	ELECTROLYTIC 16 RC3 10 μF
C167	4510001550	ELECTROLYTIC 16 RC3 10 μF
C168	4510001550	ELECTROLYTIC 16 RC3 10 μF
C169	4550000400	TANTALUM DN 1C 2R2M
C170	4550002440	TANTALUM DN 1V R68M
C171	4510004170	ELECTROLYTIC 10 MS7 220 μF
C172	4510001560	ELECTROLYTIC 25 RC3 4.7 μF
C173	4010000460	CERAMIC DD104 B 471K 50V
C174	4010000460	CERAMIC DD104 B 471K 50V
C175	4010000260	CERAMIC DD104 SL 470J 50V
C176	4010000260	CERAMIC DD104 SL 470J 50V
C177	4010000260	CERAMIC DD104 SL 470J 50V
C178	4010000260	CERAMIC DD104 SL 470J 50V
C179	4560000020	CERAMIC D33Y5V 1E 104Z21
C180	4560000020	CERAMIC D33Y5V 1E 104Z21
C181	4010000340	CERAMIC DD105 SL 121J 50V
C182	4010000460	CERAMIC DD104 B 471K 50V
C183	4560000020	CERAMIC D33Y5V 1E 104Z21
C184	4560000020	CERAMIC D33Y5V 1E 104Z21
C185	4010000500	CERAMIC DD104 B 102K 50V
C186	4010000500	CERAMIC DD104 B 102K 50V
C187	4010000500	CERAMIC DD104 B 102K 50V
C188	4310000170	MYLAR 50 F2D 682K
S101	2260000070	SWITCH SKHHAK013A [PTT]
S102	2260000070	SWITCH SKHHAK013A [FUNC]
S103	2260000070	SWITCH SKHHAK013A [CALL]
S104	2230000290	SWITCH SPFH22039A [LIGHT]
S105	2230000250	SWITCH SPFH22014A [HI/LO] (#21~#24, #26~#31)
BT101	3020000040	LITHIUM BR2325-1HC
RL101	6330000560	RELAY OUC-SH-114D
EP101	0910018732	PCB B 1761B (MAIN)
EP102	0910007250	PCB B 908 (MAIN)
EP103	0910012020	FPC B 1045
EP104	6910000970	BEAD DL 20P 2.6-3-1.2H
EP108	6910000600	BEAD FSOH050RN
EP109	6910000600	BEAD FSOH050RN
EP110	6910000600	BEAD FSOH050RN

[PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
IC201	1150000090	IC SC1030 (#21~#28, #30)
	1150000710	IC SC1090 (#29, #31)
IC202	1110000970	IC MB504P-G
IC203	1130000530	IC μPD2834C
IC204	1790000050	IC ND487C1-3R

S.=Surface mount

[PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
Q201	1530000150	TRANSISTOR	2SC2668-O
Q202	1530000520	TRANSISTOR	2SC2026
Q203	1520000070	TRANSISTOR	2SB561C
Q204	1530000520	TRANSISTOR	2SC2026
Q205	1530000530	TRANSISTOR	2SC2407
Q206	1530000520	TRANSISTOR	2SC2026
Q207	1530001760	TRANSISTOR	2SC3586
Q208	1510000080	TRANSISTOR	2SA1048-GR
Q209	1530000110	TRANSISTOR	2SC2458-GR
Q211	1530000110	TRANSISTOR	2SC2458-GR
Q212	1520000080	TRANSISTOR	2SB909M R
Q213	1530000110	TRANSISTOR	2SC2458-GR
Q214	1510000080	TRANSISTOR	2SA1048-GR
Q215	1510000080	TRANSISTOR	2SA1048-GR
Q216	1530000110	TRANSISTOR	2SC2458-GR
Q217	1510000080	TRANSISTOR	2SA1048-GR
Q218	1560000280	FET	2SK184-GR
Q219	1560000010	FET	2SK184-Y
Q220	1530000110	TRANSISTOR	2SC2458-GR
Q221	1530000520	TRANSISTOR	2SC2026
D201	1710000600	DIODE	1SS254
D202	1710000600	DIODE	1SS254
D203	1710000580	DIODE	1SS265
D204	1710000580	DIODE	1SS265
D205	1710000600	DIODE	1SS254
D206	1790000250	DIODE	1SS97
D207	1790000250	DIODE	1SS97
D208	1710000580	DIODE	1SS265
D209	1710000580	DIODE	1SS265
D213	1720000050	VARICAP	1SV50E
D214	1730000140	ZENER	RD6.8E B2
D215	1710000600	DIODE	1SS254
D216	1710000600	DIODE	1SS254
D219	1710000600	DIODE	1SS254
D221	1710000040	DIODE	1S953
D222	5040000820	LED	SLN-210MC
X201	6050005480	XTAL	CR-270
F1201	2010000230	MONOLITHIC	30M15B (FL-76) (#22, #24, #25, #28, #29)
	2010000940	FILTER	30M 7B (FL-107) (#21, #23, #26, #27, #30, #31)
F1202	2040000210	FILTER	EXC-EMT103DC
L201	6150003210	COIL	LS-319
L202	6150003220	COIL	LS-320
L204	6110001530	COIL	LA-233
L205	6110000950	COIL	LA-126
L206	6110000950	COIL	LA-126
L207	6110001520	COIL	LA-232
L208	6180002350	COIL	LAL 02NA R56K
L209	6110001520	COIL	LA-232
L211	6110001120	COIL	LA-147
L212	6110001520	COIL	LA-232
L213	6110001530	COIL	LA-233
L214	6180001300	COIL	LAL 02NA 100K
L215	6180000850	COIL	LAL 03NA 4R7K
L216	6180001300	COIL	LAL 02NA 100K
L217	6190000390	COIL	5HW-44545A-470 (#21~#28, #30)
	6190000620	COIL	LS-422 (5HW-39545A-415) (#29, #31)
L218	6110001520	COIL	LA-232
L219	6190000400	COIL	LS-348 (HR-5T 05M-3075) (#21~#28, #30)
	6190000630	COIL	LS-423 (HR5T) (#29, #31)
L220	6140001200	COIL	LR-145
L221	6140001200	COIL	LR-145

[PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R201	7010003280	RESISTOR	ELR20J 100 Ω
R203	7010003280	RESISTOR	ELR20J 100 Ω
R204	7010003340	RESISTOR	ELR20J 330 Ω
R205	7010003240	RESISTOR	ELR20J 47 Ω
R206	7010003550	RESISTOR	ELR20J 15 kΩ
R207	7010003490	RESISTOR	ELR20J 5.6 kΩ
R208	7010003240	RESISTOR	ELR20J 47 Ω
R209	7010003200	RESISTOR	ELR20J 22 Ω
R213	7010003480	RESISTOR	ELR20J 4.7 kΩ
R214	7010003550	RESISTOR	ELR20J 15 kΩ
R215	7010003280	RESISTOR	ELR20J 100 Ω
R216	7010003510	RESISTOR	ELR20J 6.8 kΩ
R217	7010003530	RESISTOR	ELR20J 10 kΩ
R218	7010003580	RESISTOR	ELR20J 2.2 kΩ
R219	7010003530	RESISTOR	ELR20J 10 kΩ
R220	7010003400	RESISTOR	ELR20J 1 kΩ
R221	7010003410	RESISTOR	ELR20J 1.2 kΩ
R222	7010003320	RESISTOR	ELR20J 220 Ω
R223	7010003370	RESISTOR	ELR20J 560 Ω
R224	7010003240	RESISTOR	ELR20J 47 Ω
R225	7010003160	RESISTOR	ELR20J 10 Ω
R226	7010003560	RESISTOR	ELR20J 18 kΩ
R227	7010003560	RESISTOR	ELR20J 18 kΩ
R228	7010003280	RESISTOR	ELR20J 100 Ω
R229	7010003660	RESISTOR	ELR20J 100 kΩ
R230	7010003430	RESISTOR	ELR20J 1.8 kΩ
R231	7010003510	RESISTOR	ELR20J 6.8 kΩ
R232	7010003360	RESISTOR	ELR20J 470 Ω
R233	7010003510	RESISTOR	ELR20J 6.8 kΩ
R234	7010003420	RESISTOR	ELR20J 1.5 kΩ
R238	7010003550	RESISTOR	ELR20J 15 kΩ
R239	7010003660	RESISTOR	ELR20J 100 kΩ
R241	7010003480	RESISTOR	ELR20J 4.7 kΩ
R242	7010003530	RESISTOR	ELR20J 10 kΩ
R243	7010003560	RESISTOR	ELR20J 18 kΩ
R245	7010003530	RESISTOR	ELR20J 10 kΩ
R246	7510000020	THERMISTOR	33D28
R247	7510000020	THERMISTOR	33D28
R248	7010003550	RESISTOR	ELR20J 15 kΩ
R249	7010003530	RESISTOR	ELR20J 10 kΩ
R250	7010003510	RESISTOR	ELR20J 6.8 kΩ
R251	7010003660	RESISTOR	ELR20J 100 kΩ
R252	7010003660	RESISTOR	ELR20J 100 kΩ
R253	7010003440	RESISTOR	ELR20J 2.2 kΩ
R255	7010003660	RESISTOR	ELR20J 100 kΩ
R256	7010003280	RESISTOR	ELR20J 100 Ω
R257	7010003430	RESISTOR	ELR20J 1.8 kΩ
R258	7010003750	RESISTOR	ELR20J 560 kΩ
R259	7010003580	RESISTOR	ELR20J 22 kΩ
R260	7010003680	RESISTOR	ELR20J 150 kΩ
R261	7010003650	RESISTOR	ELR20J 82 kΩ
R262	7310001850	TRIMMER	RH0421CS4J08A (473)
R263	7010003580	RESISTOR	ELR20J 22 kΩ
R264	7310001850	TRIMMER	RH0421CS4J08A (473)
R265	7010003440	RESISTOR	ELR20J 2.2 kΩ
R266	7010003520	RESISTOR	ELR20J 8.2 kΩ
R267	7010003530	RESISTOR	ELR20J 10 kΩ
R268	7510000060	THERMISTOR	112-503-2AI
R269	7010003620	RESISTOR	ELR20J 47 kΩ
R270	7010003780	RESISTOR	ELR20J 1 MΩ
R271	7010003490	RESISTOR	ELR20J 5.6 kΩ
R272	7010003620	RESISTOR	ELR20J 47 kΩ
R273	7010003210	RESISTOR	ELR20J 27 Ω
R274	7010003620	RESISTOR	ELR20J 47 kΩ
R275	7010003320	RESISTOR	ELR20J 220 Ω
R276	7010003240	RESISTOR	ELR20J 47 Ω
R278	7010003400	RESISTOR	ELR20J 1 kΩ (#21~#28, #30)
	7010003480	RESISTOR	ELR20J 4.7 kΩ (#29, #31)
R279	7010003580	RESISTOR	ELR20J 22 kΩ
R280	7010003530	RESISTOR	ELR20J 10 kΩ
R281	7010003480	RESISTOR	ELR20J 4.7 kΩ
R282	7010004110	RESISTOR	R20J 220 Ω
R283	7010003810	RESISTOR	ELR20J 2.2 M Ω
R284	7010003300	RESISTOR	ELR20J 150 Ω

S.=Surface mount

[PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
R285	7010004270	RESISTOR R20J 4.7 kΩ
R286	7010003700	RESISTOR ELR20J 220 kΩ
R287	7010003710	RESISTOR ELR20J 270 kΩ
R288	7010003660	RESISTOR ELR20J 100 kΩ
R290	7010003660	RESISTOR ELR20J 100 kΩ
R291	7010003530	RESISTOR ELR20J 10 kΩ
R292	7010003580	RESISTOR ELR20J 22 kΩ
R293	7010003530	RESISTOR ELR20J 10 kΩ
C201	4010000460	CERAMIC DD104 B 471K 50V
C202	4010000120	CERAMIC DD104 SL 100D 50V
C203	4010000500	CERAMIC DD104 B 102K 50V
C204	4010000500	CERAMIC DD104 B 102K 50V
C205	4040000190	BARRIER UAT 05X 103K
C206	4010000180	CERAMIC DD104 SL 220J 50V
C207	4010000140	CERAMIC DD104 SL 120J 50V
	4010000200	CERAMIC DD104 SL 270J 50V (#21, #22, #24, #25, #28, #29, #23, #26, #27, #30, #31)
C208	4040000190	BARRIER UAT 05X 103K
C209	4040000150	BARRIER UAT 05X 472K
C210	4010000340	CERAMIC DD105 SL 121J 50V
C211	4010000260	CERAMIC DD104 SL 470J 50V
C212	4010000300	CERAMIC DD104 SL 680J 50V
C213	4010000500	CERAMIC DD104 B 102K 50V
C216	4040000090	BARRIER UAT 04X 152K
C217	4010000100	CERAMIC DD104 SL 080D 50V
C218	4010000500	CERAMIC DD104 B 102K 50V
C219	4010000500	CERAMIC DD104 B 102K 50V
C220	4010000080	CERAMIC DD104 SL 060D 50V
C221	4010000460	CERAMIC DD104 B 471K 50V
C222	4010000260	CERAMIC DD104 SL 470J 50V
C224	4010000500	CERAMIC DD104 B 102K 50V
C225	4010000060	CERAMIC DD104 SL 040C 50V
C226	4010000500	CERAMIC DD104 B 102K 50V
C227	4010000500	CERAMIC DD104 B 102K 50V
C228	4010000460	CERAMIC DD104 B 471K 50V
C229	4010000140	CERAMIC DD104 SL 120J 50V
C230	4010000500	CERAMIC DD104 B 102K 50V
C231	4010000260	CERAMIC DD104 SL 470J 50V
C232	4010000260	CERAMIC DD104 SL 470J 50V
C233	4010000500	CERAMIC DD104 B 102K 50V
C234	4010000080	CERAMIC DD104 SL 060D 50V
C235	4010000120	CERAMIC DD104 SL 100D 50V
C236	4010000260	CERAMIC DD104 SL 470J 50V
C237	4010000260	CERAMIC DD104 SL 470J 50V
C238	4010000500	CERAMIC DD104 B 102K 50V
C239	4010000230	CERAMIC DD104 SL 360J 50V
C240	4010000500	CERAMIC DD104 B 102K 50V
C241	4010000320	CERAMIC DD104 SL 820J 50V
C242	4010000160	CERAMIC DD104 SL 180J 50V
C243	4010000120	CERAMIC DD104 SL 100D 50V
C244	4010000140	CERAMIC DD104 SL 120J 50V
C245	4010000080	CERAMIC DD104 SL 060D 50V
C246	4010000080	CERAMIC DD104 SL 060D 50V
C247	4010000220	CERAMIC DD104 SL 330J 50V
C248	4010000260	CERAMIC DD104 SL 470J 50V
C249	4010000260	CERAMIC DD104 SL 470J 50V
C253	4010000460	CERAMIC DD104 B 471K 50V
C254	4010000040	CERAMIC DD104 SL 020C 50V
C255	4010000500	CERAMIC DD104 B 102K 50V
C256	4010000120	CERAMIC DD104 SL 100D 50V
C257	4560000020	CERAMIC D33Y5V 1E 104Z21
C258	4550000320	TANTALUM DN 1V 0R1M
C259	4010000500	CERAMIC DD104 B 102K 50V
C260	4010000260	CERAMIC DD104 SL 470J 50V
C261	4010000260	CERAMIC DD104 SL 470J 50V
C262	4010000260	CERAMIC DD104 SL 470J 50V
C265	4510001550	ELECTROLYTIC 16 RC3 10 μF
C267	4550002120	TANTALUM DN 1C 220M
C268	4010000500	CERAMIC DD104 B 102K 50V
C269	4610000300	TRIMMER ECR-GA015 E30
C270	4010000820	CERAMIC DD105 CH 330J 50V
C271	4010000640	CERAMIC DD104 CH 040C 50V

[PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
C272	4010000500	CERAMIC DD104 B 102K 50V
C274	4010000380	CERAMIC DD107 SL 221J 50V
C275	4010000330	CERAMIC DD105 SL 101J 50V
C276	4040000190	BARRIER UAT 05X 103K
C277	4550000340	TANTALUM DN 1C 100M
C279	4010000260	CERAMIC DD104 SL 470J 50V
C280	4010000260	CERAMIC DD104 SL 470J 50V
C281	4010000260	CERAMIC DD104 SL 470J 50V
C283	4010000460	CERAMIC DD104 B 471K 50V
C284	4010000460	CERAMIC DD104 B 471K 50V
C285	4010000260	CERAMIC DD104 SL 470J 50V
C287	4010000460	CERAMIC DD104 B 471K 50V
C288	4510001200	ELECTROLYTIC 6.3 RC2 22 μF
C289	4010000460	CERAMIC DD104 B 471K 50V
C290	4010000460	CERAMIC DD104 B 471K 50V
C292	4010000460	CERAMIC DD104 B 471K 50V
C293	4010000500	CERAMIC DD104 B 102K 50V
C294	4510002300	ELECTROLYTIC 6.3 RC2 100 μF (D=6.3)
C296	4010000260	CERAMIC DD104 SL 470J 50V
C297	4010000260	CERAMIC DD104 SL 470J 50V
C299	4010000260	CERAMIC DD104 SL 470J 50V
C300	4560000020	CERAMIC D33Y5V 1E 104Z21
C302	4010000500	CERAMIC DD104 B 102K 50V
C304	4550000320	TANTALUM DN 1V 0R1M
C308	4010000500	CERAMIC DD104 B 102K 50V
C309	4010000090	CERAMIC DD104 SL 070D 50V
C311	4010000500	CERAMIC DD104 B 102K 50V
C312	4010000500	CERAMIC DD104 B 102K 50V
C313	4010000500	CERAMIC DD104 B 102K 50V
C314	4560000020	CERAMIC D33Y5V 1E 104Z21
C315	4040000190	BARRIER UAT 05X 103K
C316	4010000460	CERAMIC DD104 B 471K 50V
C317	4560000020	CERAMIC D33Y5V 1E 104Z21 (#21~#28, #30)
C318	4550002470	TANTALUM DN 1V 6R8M
C319	4010000050	CERAMIC DD104 SL 030C 50V
C320	4010000260	CERAMIC DD104 SL 470J 50V
C321	4560000020	CERAMIC D33Y5V 1E 104Z21
C322	4550001890	TANTALUM DN 0J 100M
C323	4010000460	CERAMIC DD104 B 471K 50V
C324	4010000460	CERAMIC DD104 B 471K 50V
C325	4010000260	CERAMIC DD104 SL 470J 50V
C326	4010000500	CERAMIC DD104 B 102K 50V
C327	4560000020	CERAMIC D33Y5V 1E 104Z21 (#29, #31)
J201	6510004920	CONNECTOR TNC-102-N1-W1-L1 [ANT]
J202	6450000110	CONNECTOR HSJ0836-01-010 [EXT MIC]
J203	6450000130	CONNECTOR HSJ1102-01-540 [EXT SP]
J204	6450000220	CONNECTOR HEC0747-01-010 [EXT DC]
J205	6510004540	CONNECTOR 171255-1
J206	6510004540	CONNECTOR 171255-1
W205	7120000380	JUMPER JPW 01 R-01
W207	7120000380	JUMPER JPW 01 R-01
W209	7120000380	JUMPER JPW 01 R-01
W210	7120000380	JUMPER JPW 01 R-01
W216	7120000380	JUMPER JPW 01 R-01
EP201	0910017663	PCB B 1674C (PLL)
EP202	6910000970	BEAD DL 20P 2.6-3-1.2H
EP203	6910000970	BEAD DL 20P 2.6-3-1.2H
EP204	6910000970	BEAD DL 20P 2.6-3-1.2H
EP212	6910000970	BEAD DL 20P 2.6-3-1.2H
EP215	0910012080	FPC B 1044
EP217	0910012160	FPC B 1147
EP218	6910000970	BEAD DL 20P 2.6-3-1.2H
EP227	0910022321	FPC B 2176A

S. = Surface mount

[VCO BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
Q401	1590000040	S. TRANSISTOR	DTC124EK T146
Q402	1530000370	S. TRANSISTOR	2SC3356-T2B
Q403	1530001750	S. TRANSISTOR	2SC3585-T2B
D401	1790000460	S. DIODE	MA334B (TX)
D402	1710000580	DIODE	1SS265
L401	6110001380	COIL	LA-182
L402	6200000010	S. COIL	LQN 5N 1R0M
L403	6110001040	COIL	LA-135
R401	7010004190	RESISTOR	R20J 1 kΩ
R402	7030000260	S. RESISTOR	MCR10EZHZ 100 Ω (101)
R403	7030000460	S. RESISTOR	MCR10EZHZ 4.7 kΩ (472)
R404	7030000580	S. RESISTOR	MCR10EZHZ 47 kΩ (473)
R405	7030000480	S. RESISTOR	MCR10EZHZ 6.8 kΩ (682)
R406	7030000460	S. RESISTOR	MCR10EZHZ 4.7 kΩ (472)
R407	7030000300	S. RESISTOR	MCR10EZHZ 220 Ω (221)
R408	7030000300	S. RESISTOR	MCR10EZHZ 220 Ω (221)
R409	7030000540	S. RESISTOR	MCR10EZHZ 22 kΩ (223)
R410	7030000470	S. RESISTOR	MCR10EZHZ 5.6 kΩ (562)
C401	4560000020	CERAMIC	D33Y5V 1E 104Z21
C402	4610000520	S. TRIMMER	TZB04N100BA006
C403	4030000570	S. CERAMIC	GRM40 SL 030C 50PT (#21~#28,#30)
	4030000600	S. CERAMIC	GRM40 SL 060D 50PT (#29,#31)
C404	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C405	4030000610	S. CERAMIC	GRM40 SL 070D 50PT
C406	4030000610	S. CERAMIC	GRM40 SL 070D 50PT
C407	4030000600	S. CERAMIC	GRM40 SL 060D 50PT (#29,#31)
	4030000620	S. CERAMIC	GRM40 SL 080D 50PT (#21~#28,#30)
C408	4030000620	S. CERAMIC	GRM40 SL 080D 50PT
C409	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C410	4030000600	S. CERAMIC	GRM40 SL 060D 50PT
C411	4030001150	S. CERAMIC	GRM40 F 104Z 25PT
C412	4030003170	S. CERAMIC	GRM40 SL 0R75C 50PT
C413	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C414	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C415	4010000080	CERAMIC	DD104 SL 060D 50V
C416	4030001090	S. CERAMIC	GRM40 B 471K 50PT
EP401	0910018790	PCB	B 1762 (VCO)

[DISPLAY UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC601	1130000790	S. IC	μPD7225G00
D601	1750000050	S. DIODE	1SS193 (TE85R)
D602	1750000050	S. DIODE	1SS193 (TE85R)
D603	1750000050	S. DIODE	1SS193 (TE85R)
D604	1750000050	S. DIODE	1SS193 (TE85R)
R601	7030000650	S. RESISTOR	MCR10EZHZ 180 kΩ (184)
R602	7030000500	S. RESISTOR	MCR10EZHZ 10 kΩ (103)

[DISPLAY UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R603	7030000500	S. RESISTOR	MCR10EZHZ 10 kΩ (103)
R604	7030000500	S. RESISTOR	MCR10EZHZ 10 kΩ (103)
C601	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C603	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C604	4030001100	S. CERAMIC	GRM40 B 102K 50PT
C605	4030000700	S. CERAMIC	GRM40 SL 470J 50PT
C606	4030000700	S. CERAMIC	GRM40 SL 470J 50PT
C607	4030000700	S. CERAMIC	GRM40 SL 470J 50PT
C608	4030001100	S. CERAMIC	GRM40 B 102K 50PT
C609	4030001100	S. CERAMIC	GRM40 B 102K 50PT
C610	4030001100	S. CERAMIC	GRM40 B 102K 50PT
DS601	5080000110	LAMP	BQ031-22403A
DS602	5030000230	LCD	LR580-E [FUNCTION DISPLAY]
MC601	7700000480	MICROPHONE	KUC2023-01-006
SP601	2510000140	SPEAKER	40P-157B
EP601	8930007790	LCD CONTACT	SRCN-411
EP603	0910015122	PCB	B 1453B (DISPLAY)
EP604	0910012061	FPC	B 1046A

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC701	1140000540	S. IC	μPD78C06AG-570-12
IC702	1130003800	S. IC	MBM27C256A-25-TV-G
IC703	1130002560	S. IC	μPD446G
IC704	1130000950	IC	S-7116A
IC705	1140000640	S. IC	SC1084 (#21~#25,#28,#29)
	1140000840	S. IC	SC1093 (#26,#27,#30,#31)
IC706	1140000620	S. IC	FX102LG
IC707	1130003610	S. IC	TC4SU69F (TE85R)
IC708	1130003610	S. IC	TC4SU69F (TE85R)
IC709	1130003030	S. IC	μPD74HC00G
Q701	1510000110	S. TRANSISTOR	2SA1162-Y (TE85R)
Q702	1590000410	S. TRANSISTOR	RN2404 (TE85R)
Q703	1530000160	S. TRANSISTOR	2SC2712-Y (TE85RTEM)
Q704	1590000410	S. TRANSISTOR	RN2404 (TE85R)
Q705	1590000420	S. TRANSISTOR	RN1404 (TE85R)
Q706	1590000420	S. TRANSISTOR	RN1404 (TE85R)
Q708	1520000200	S. TRANSISTOR	2SB798-T2 DK
D701	1730000410	S. ZENER	RD5.1M-T2B2
D702	1750000020	S. DIODE	1SS184 (TE85R)
D703	1750000010	S. DIODE	1SS181 (TE85R)
D704	1750000020	S. DIODE	1SS184 (TE85R)
D705	1750000020	S. DIODE	1SS184 (TE85R)
D706	1750000020	S. DIODE	1SS184 (TE85R)
D707	1750000020	S. DIODE	1SS184 (TE85R)
D708	1750000010	S. DIODE	1SS181 (TE85R)
D709	1750000020	S. DIODE	1SS184 (TE85R)
D710	1790000450	S. DIODE	MA862 (TX)

S.=Surface mount

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
D711	1750000010	S. DIODE	1SS181 (TE85R)
D712	1750000020	S. DIODE	1SS184 (TE85R)
D713	1750000020	S. DIODE	1SS184 (TE85R)
D714	1750000070	S. DIODE	1SS226 (TE85R)
X701	6050003450	XTAL	RF-4A3 FAG NKD (4.480000M)
X702	6050003120	XTAL	RF-4A3 FAA NKD (3.579545M)
L701	6180002250	COIL	LAL 03NA 331K
L702	6180000920	COIL	LAL 03NA 221K
L703	6180000920	COIL	LAL 03NA 221K
R701	7030000550	S. RESISTOR	MCR10EZHZ 27 k Ω (273)
R702	7030000540	S. RESISTOR	MCR10EZHZ 22 k Ω (223)
R703	7030000540	S. RESISTOR	MCR10EZHZ 22 k Ω (223)
R704	7030000670	S. RESISTOR	MCR10EZHZ 270 k Ω (274)
R706	7030000970	S. RESISTOR	MCR10EZHZ 2.2 M Ω (225)
R707	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R708	7030000510	S. RESISTOR	MCR10EZHZ 12 k Ω (123)
R709	7030000510	S. RESISTOR	MCR10EZHZ 12 k Ω (123)
R710	7030000510	S. RESISTOR	MCR10EZHZ 12 k Ω (123)
R711	7030000510	S. RESISTOR	MCR10EZHZ 12 k Ω (123)
R712	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R713	7030000620	S. RESISTOR	MCR10EZHZ 100 k Ω (104)
R714	7030000620	S. RESISTOR	MCR10EZHZ 100 k Ω (104)
R715	7030000620	S. RESISTOR	MCR10EZHZ 100 k Ω (104)
R716	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R717	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R718	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R719	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R720	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R721	7030000500	S. RESISTOR	MCR10EZHZ 10 k Ω (103)
R722	7030000460	S. RESISTOR	MCR10EZHZ 4.7 k Ω (472)
R723	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R724	7030000520	S. RESISTOR	MCR10EZHZ 15 k Ω (153)
R725	7030000460	S. RESISTOR	MCR10EZHZ 4.7 k Ω (472)
R726	7030000430	S. RESISTOR	MCR10EZHZ 2.7 k Ω (272)
R727	7030000500	S. RESISTOR	MCR10EZHZ 10 k Ω (103)
R728	7030000500	S. RESISTOR	MCR10EZHZ 10 k Ω (103)
R729	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R730	7030000660	S. RESISTOR	MCR10EZHZ 220 k Ω (224)
R731	7030000580	S. RESISTOR	MCR10EZHZ 47 k Ω (473)
R732	7030000500	S. RESISTOR	MCR10EZHZ 10 k Ω (103)
R733	7030000740	S. RESISTOR	MCR10EZHZ 1 M Ω (105)
R737	7030000150	S. RESISTOR	MCR10EZHZ 12 Ω (120)
R738	7030000470	S. RESISTOR	MCR10EZHZ 5.6 k Ω (562)
C701	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C702	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C703	4030001150	S. CERAMIC	GRM40 F 104Z 25PT
C704	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C705	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C707	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C708	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C709	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C710	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C711	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C712	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C713	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C714	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C715	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C716	4030001110	S. CERAMIC	GRM40 B 222K 50PT
C717	4030000660	S. CERAMIC	GRM40 SL 180J 50PT
C718	4030000660	S. CERAMIC	GRM40 SL 180J 50PT
C719	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C720	4030000700	S. CERAMIC	GRM40 SL 470J 50PT
C721	4030000660	S. CERAMIC	GRM40 SL 180J 50PT
C722	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C723	4030001090	S. CERAMIC	GRM40 B 471K 50PT

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C724	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C725	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C726	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C727	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C728	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C729	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C730	4030001090	S. CERAMIC	GRM40 B 471K 50PT
C731	4030000700	S. CERAMIC	GRM40 SL 470J 50PT
C732	4550000010	TANTALUM	DN 1C 4R7M
C733	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
C734	4550002120	TANTALUM	DN 1C 220M
C735	4510001510	ELECTROLYTIC	6.3 RC3 22 μ F
C736	4030001150	S. CERAMIC	GRM40 F 104Z 25PT
C737	4550000460	S. TANTALUM	TESVA 1C 105M1-8L
C738	4030001140	S. CERAMIC	GRM40 F 103Z 50PT
J701	6910003140	CONNECTOR	IMSA-9202B-1-02T
P701	6910003120	CONNECTOR	IMSA-9206H-T
W703	7030000010	S. JUMPER	MCR10EZHZ JPW (000)
W704	7030000010	S. JUMPER	MCR10EZHZ JPW (000)
W705	7030000010	S. JUMPER	MCR10EZHZ JPW (000)
EP701	0910019601	PCB	B 1867A (LOGIC)

S. = Surface mount

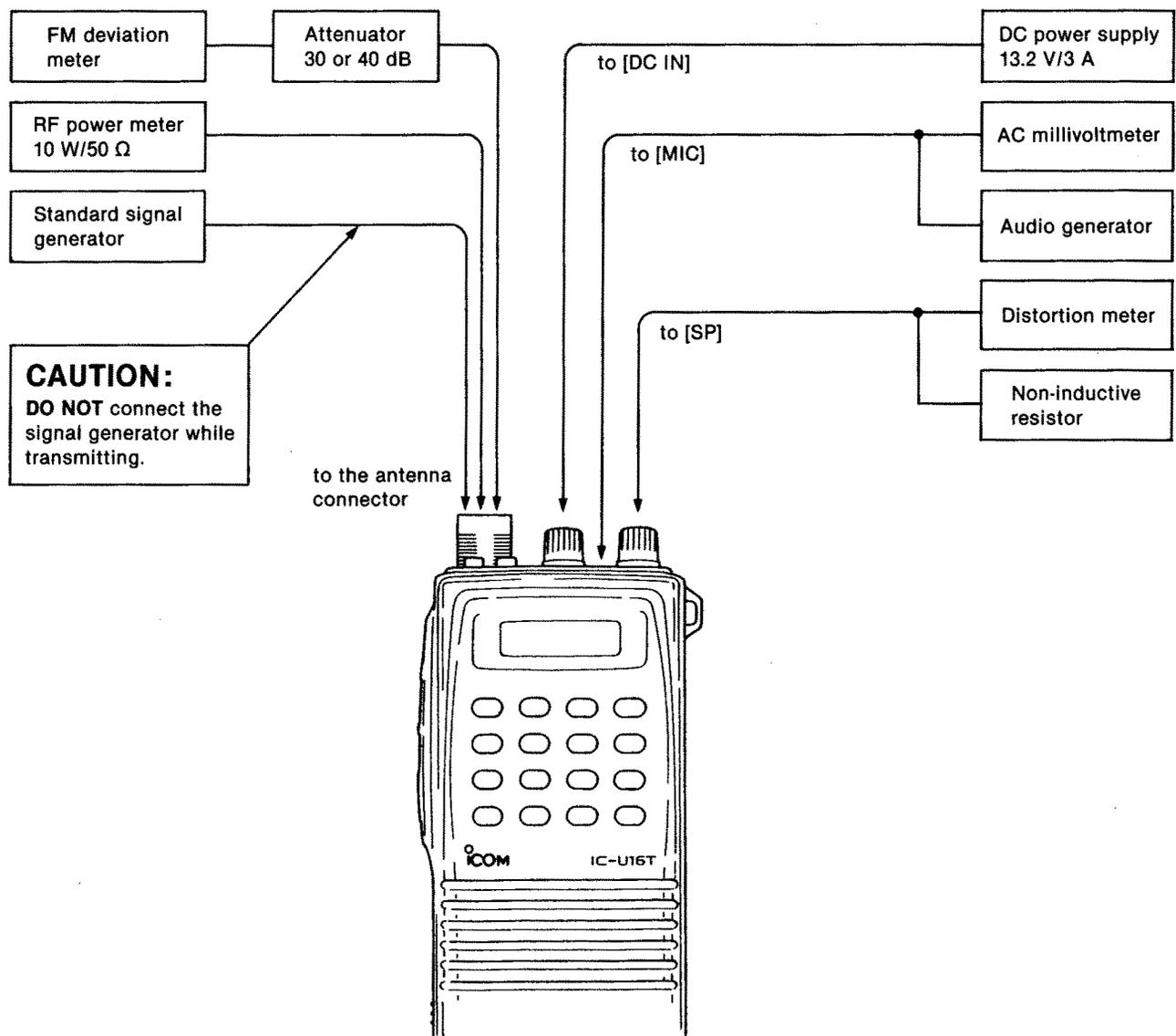
SECTION 7 ADJUSTMENT PROCEDURES

7-1 PREPARATION BEFORE SERVICING

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.2 V DC Current capacity : 3 A or more	Audio generator	Frequency range : 300~3000 Hz Output level : 1~200 mV
RF power meter (terminated type)	Measuring range : 1~10 W Frequency range : 400~600 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Attenuator	Power attenuation : 40 or 50 dB Capacity : 10 W or more
Frequency counter	Frequency range : 0.1~600 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	AC millivoltmeter	Measuring range : 2~200 mV
Distortion meter	Frequency range : 1 kHz ± 10 Hz Measuring range : 1~100 %	Non-inductive resistor	Impedance : 8 Ω
Standard signal generator (SSG)	Frequency range : 0.1~600 MHz Output level : -127~-17 dBm (0.1 μV~32 mV)	DC voltmeter	Input impedance : 50 kΩ/DC or better
		FM deviation meter	Frequency minimum : 480 MHz Measuring range : 0~±5 kHz
		Digital multimeter or oscilloscope	Input impedance : 1 MΩ/DC or better

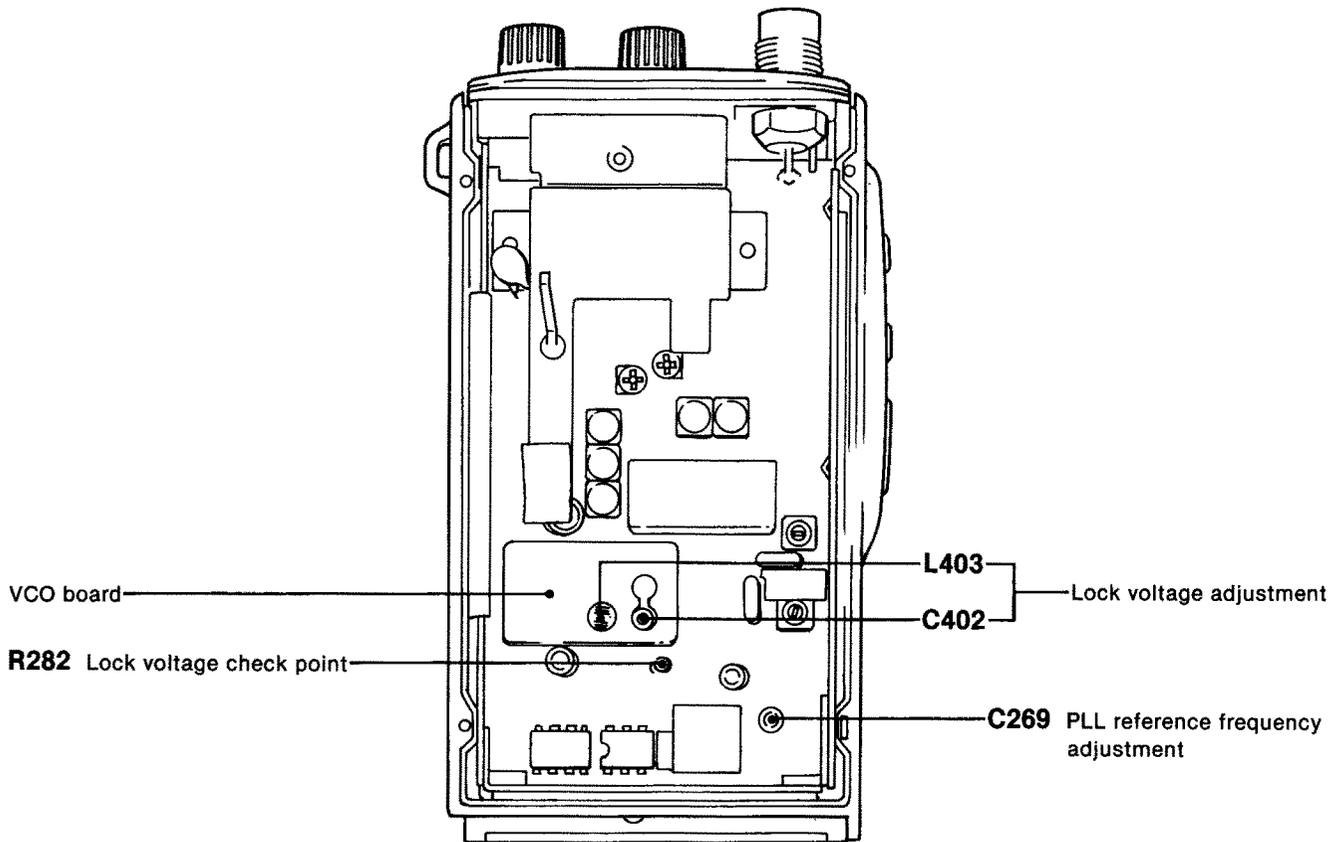
■ CONNECTION



7-2 PLL ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
LOCK VOLTAGE	1 <ul style="list-style-type: none"> • Operating frequency: 470.0000 MHz (#21~#28, #30) 420.0000 MHz (#29, #31) • Receiving 	PLL	Connect the digital multimeter or oscilloscope to R282.	5.5 V	VCO board	C402
	2 <ul style="list-style-type: none"> • Transmitting 					5.2~5.8 V
NOTE: Spread the center of L403 (VCO board) to 30° for the adjustment of #21~#28 and #30 as follows. <div style="text-align: center;">  <p>30° L403</p> </div>						
PLL REFERENCE FREQUENCY	1 <ul style="list-style-type: none"> • Select any channel. • Connect the RF power meter of a 50 Ω dummy load to the antenna connector. • Transmitting 	Top panel	Loosely couple the frequency counter to the antenna connector.	The same frequency as the programmed one.	PLL	C269

• PLL UNIT

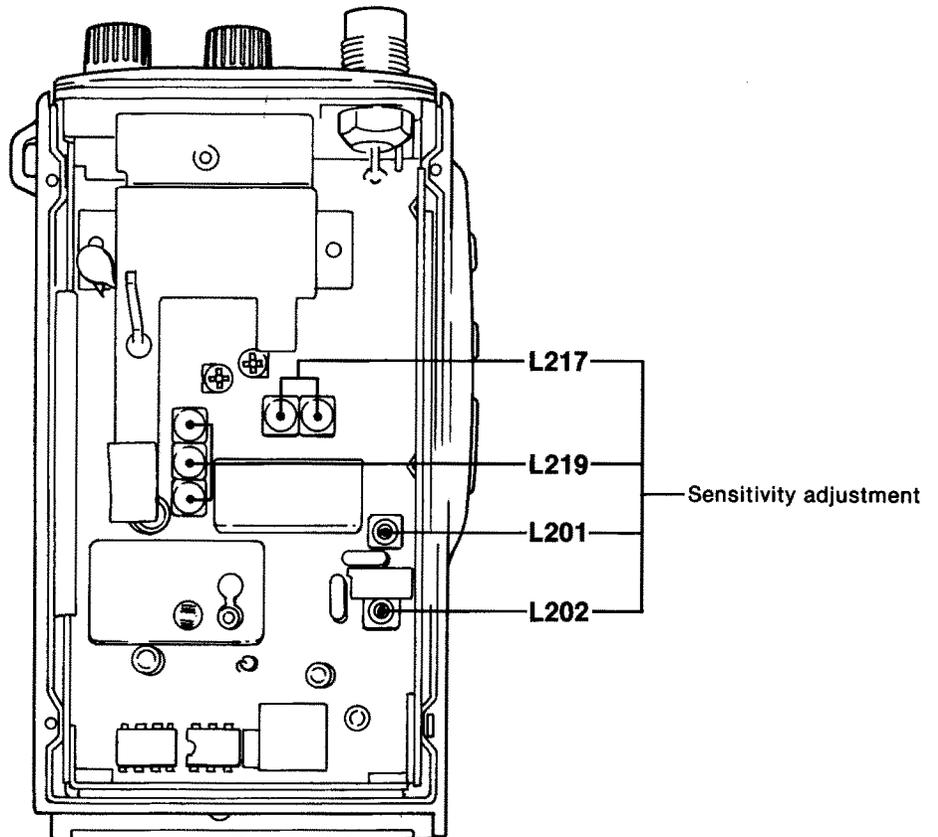


7-3 RECEIVER ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
SENSITIVITY	CAUTION: This transceiver automatically transmits an answer back code when a 5-tone code is received. Be careful when connecting the SSG to the antenna connector.					
	1	<ul style="list-style-type: none"> Operating frequency: <ul style="list-style-type: none"> 455.0000 MHz (#23, #24, #27) 465.0000 MHz (#21, #22, #25, #26, #28, #30) 415.0000 MHz (#29) 410.0000 MHz (#31) Connect the SSG to the antenna connector and set as: <ul style="list-style-type: none"> Level : 0.35 μV^* (-116 dBm) Modulation: 1 kHz Deviation : ± 3.5 kHz <ul style="list-style-type: none"> (#22, #24, #25.) (#28, #29) ± 1.75 kHz <ul style="list-style-type: none"> (#21, #23, #26.) (#27, #30, #31) Receiving 	Top panel	Connect the distortion meter to the [EXT SP] jack with an 8 Ω load.	Minimum distortion level	PLL
SQUELCH SENSITIVITY	1	<ul style="list-style-type: none"> Select any channel. Apply no signal to the antenna connector. Receiving 	Front panel	Speaker	Squelch threshold point is between the 9 o'clock and 12 o'clock positions.	Verify

* This output level of the standard signal generator (SSG) is indicated as the SSG's open circuit.

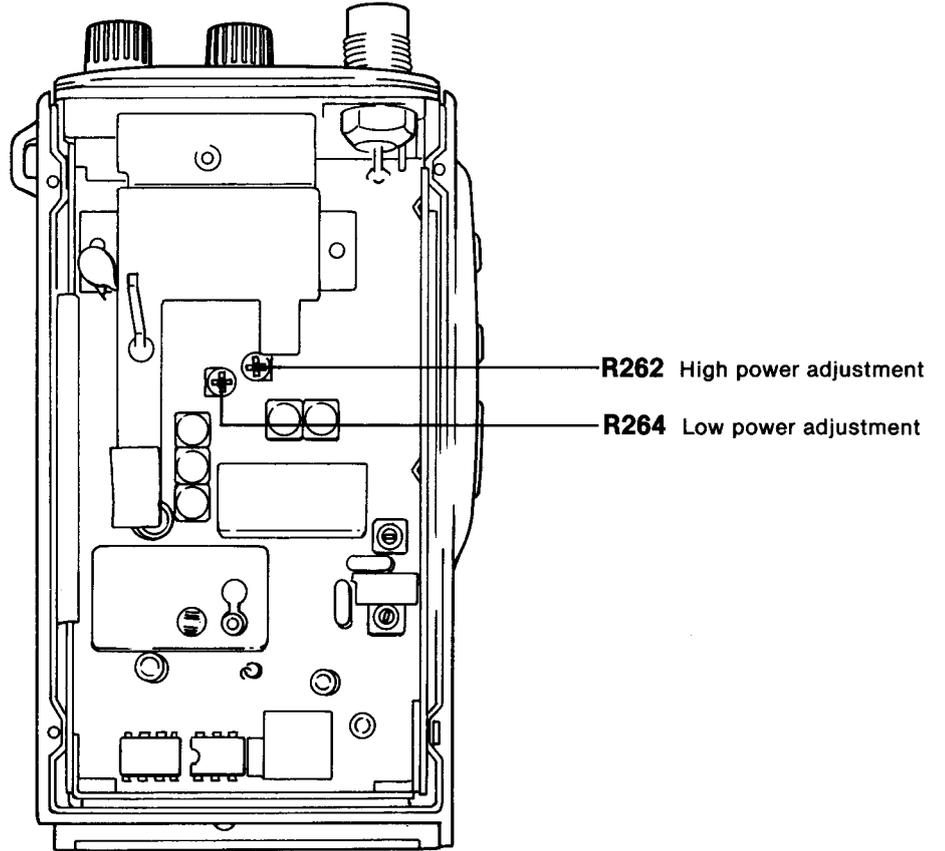
• PLL UNIT



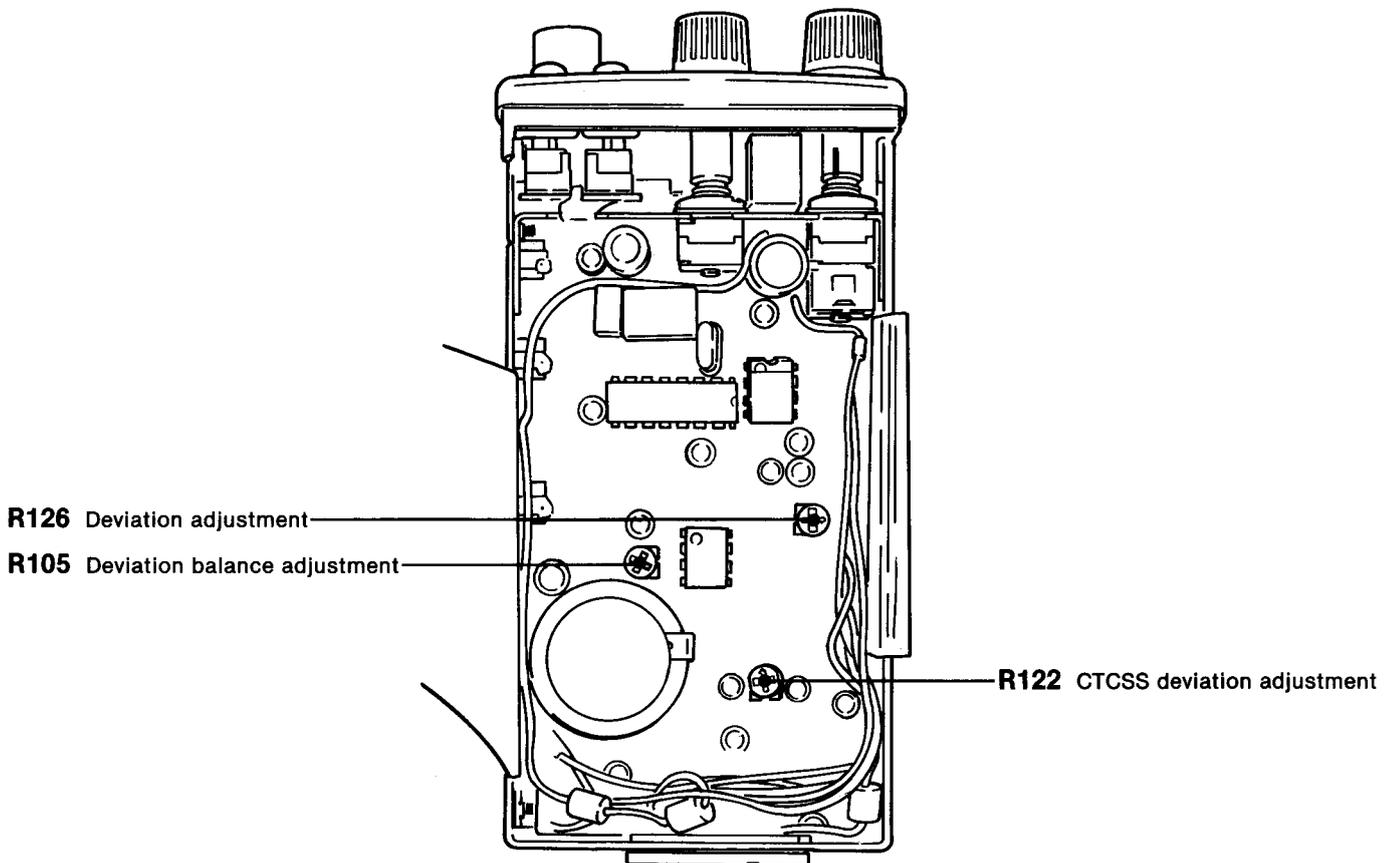
7-4 TRANSMITTER ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
OUTPUT POWER	1 <ul style="list-style-type: none"> • Operating frequency: 460.0000 MHz (#21~#28, #30) 410.0000 MHz (#29, #31) • Output power : HIGH • Transmitting 	Top panel	Connect the RF power meter to the antenna connector.	5.0 W	PLL	R262
	2 <ul style="list-style-type: none"> • Output power : LOW 			1.0 W		R264
DEVIATION	1 <ul style="list-style-type: none"> • Operating frequency: 460.0000 MHz (#21~#28, #30) 410.0000 MHz (#29, #31) • Output power : HIGH • Connect the audio generator to the microphone connector with an AC millivoltmeter and set as: Level : 170 mV Frequency : 1.0 kHz • Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • Transmitting 	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	±4.3 kHz (#22, #24, #25,) (#28, #29) ±2.1 kHz (#21, #23, #26,) (#27, #30, #31)	MAIN	R126
	2 <ul style="list-style-type: none"> • Set the FM deviation meter as: Detector : P and -P 			Symmetrical deviation level		R105
CTCSS DEVIATION	1 <ul style="list-style-type: none"> • Operating frequency: 460.0000 MHz (#21~#28, #30) 410.0000 MHz (#29, #31) • Tone number : 01 • Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • Apply no signal to microphone connector. • Transmitting 	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	±0.75 kHz (#22, #24, #25,) (#28, #29) ±0.35 kHz (#21, #23, #26,) (#27, #30, #31)	MAIN	R122
	2 <ul style="list-style-type: none"> • Tone number : 38 			±0.5~±1.0 kHz (#22, #24, #25,) (#28, #29) ±0.25~±0.5 kHz (#21, #23, #26,) (#27, #30, #31)		Verify

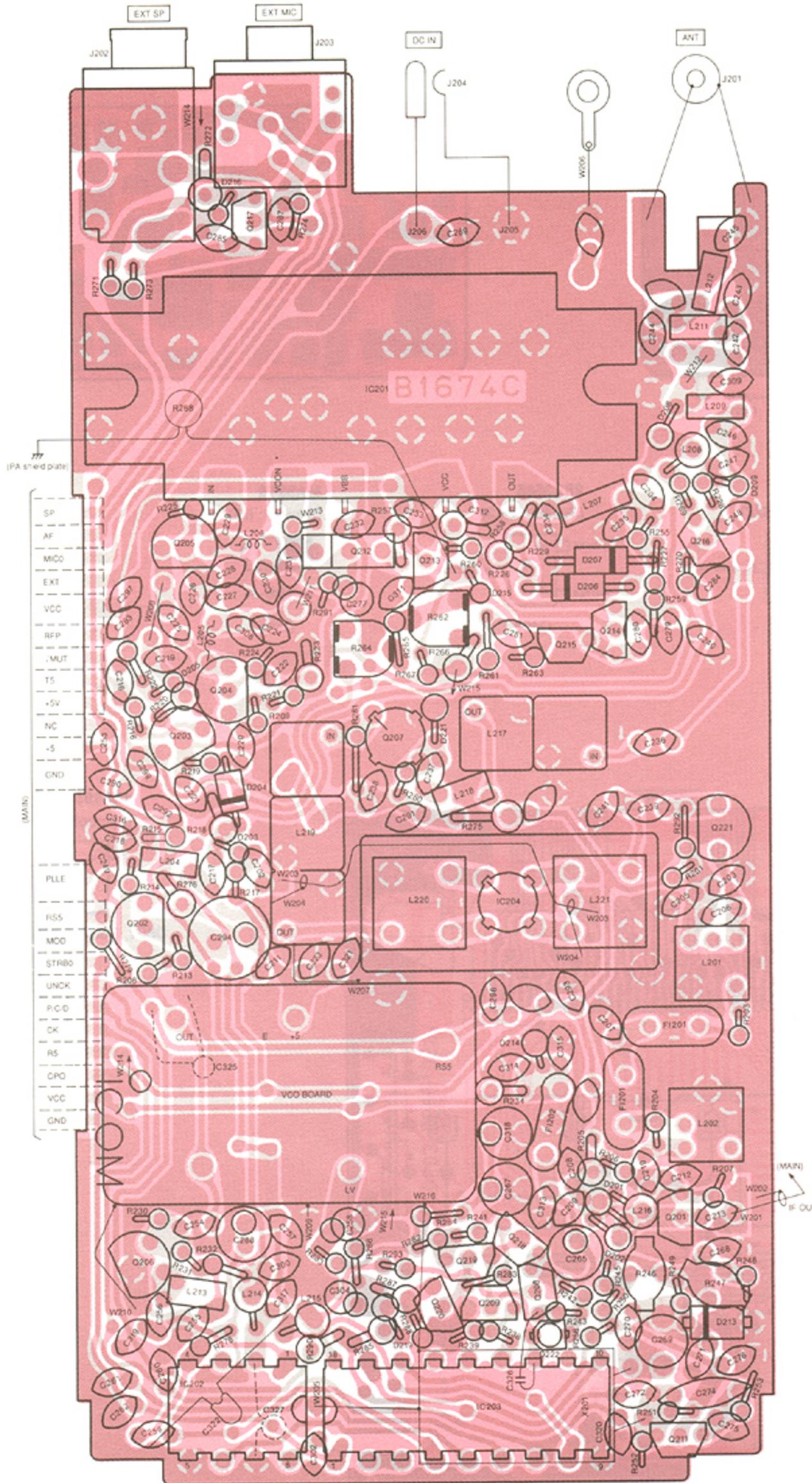
• PLL UNIT



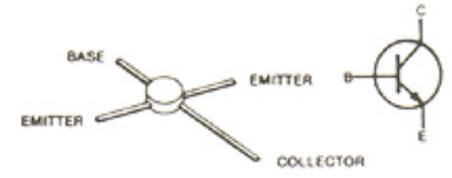
• MAIN UNIT



8-2 PLL UNIT



2SC3586



Q207

2SA1048 GR



Q208, Q214, Q215, Q217

2SC2458 GR



Q209, Q211, Q213, Q216, Q220

2SB909M R



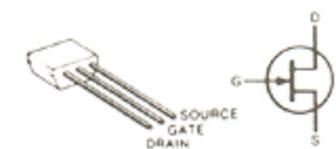
Q212

2SK184 GR



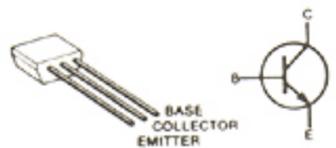
Q218

2SK184 Y



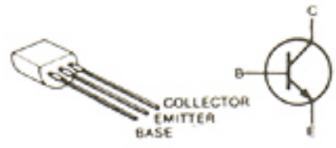
Q219

2SC2668 O



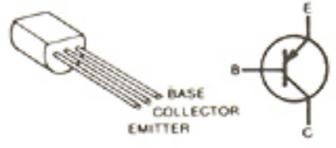
Q201

2SC2026



Q202, Q204, Q206, Q221

2SB561C



Q203

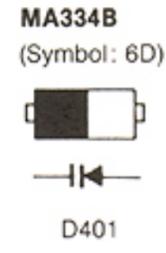
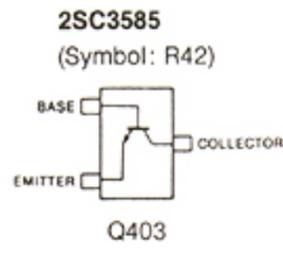
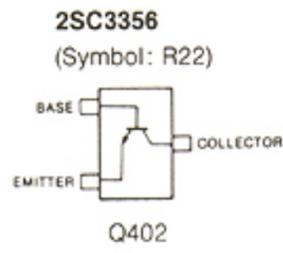
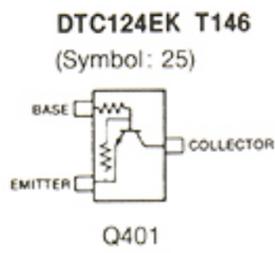
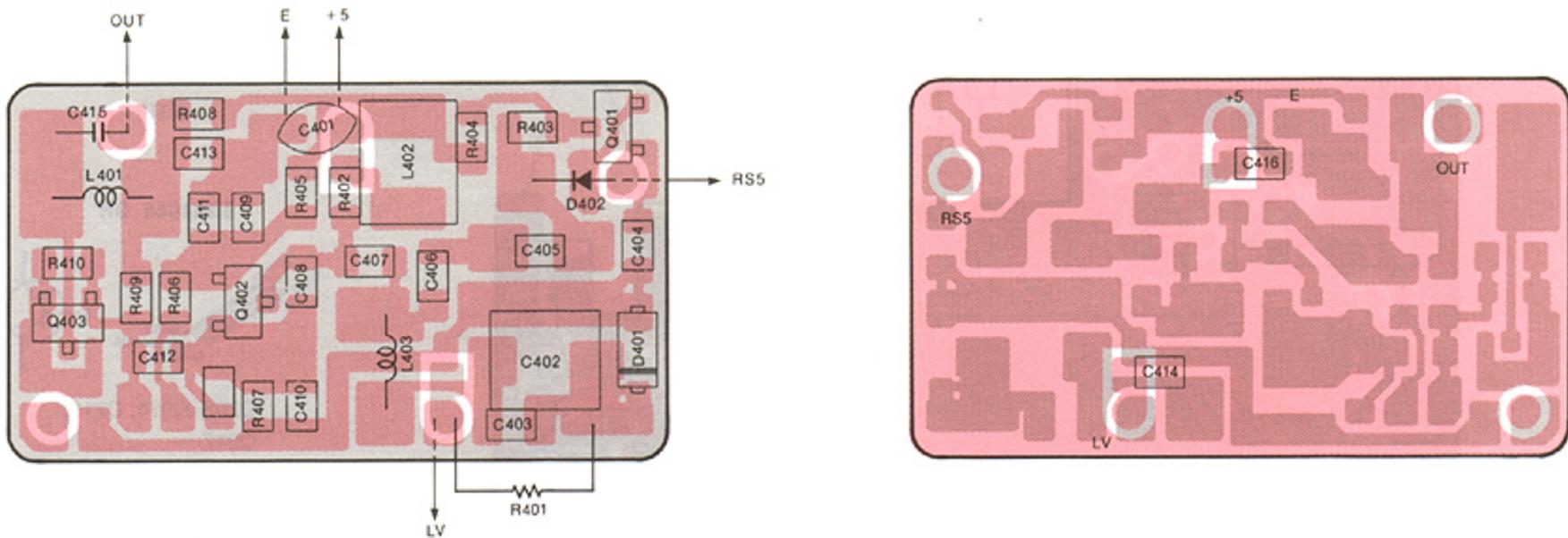
2SC2407



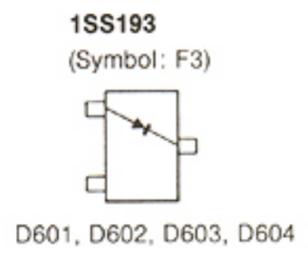
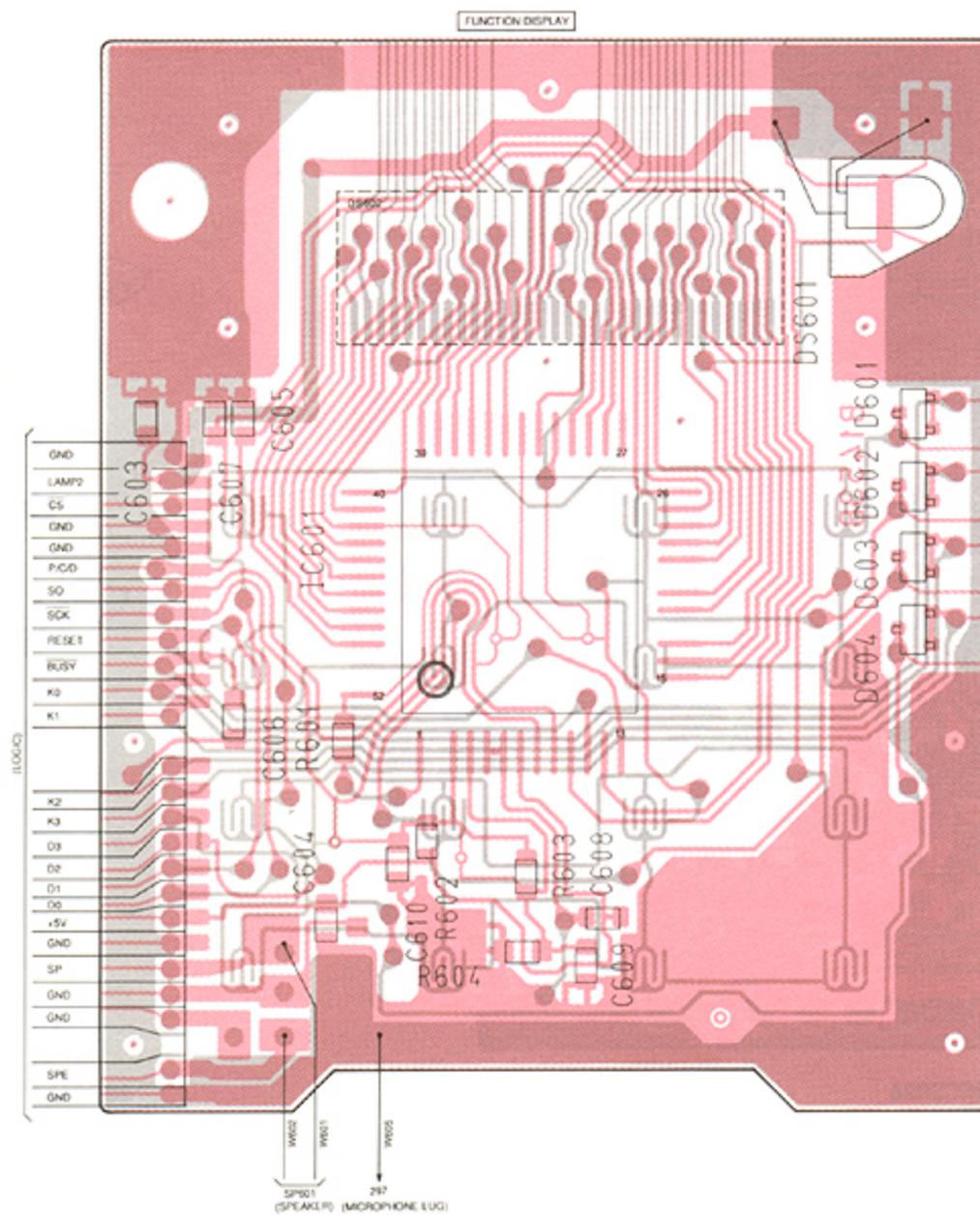
Q205

8-3 VCO BOARD AND DISPLAY UNIT

• VCO BOARD



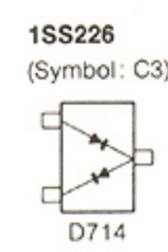
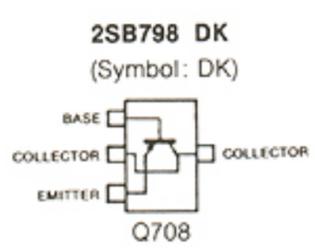
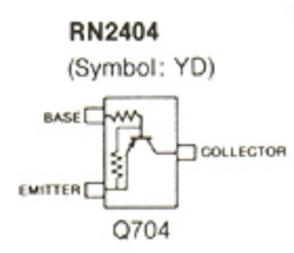
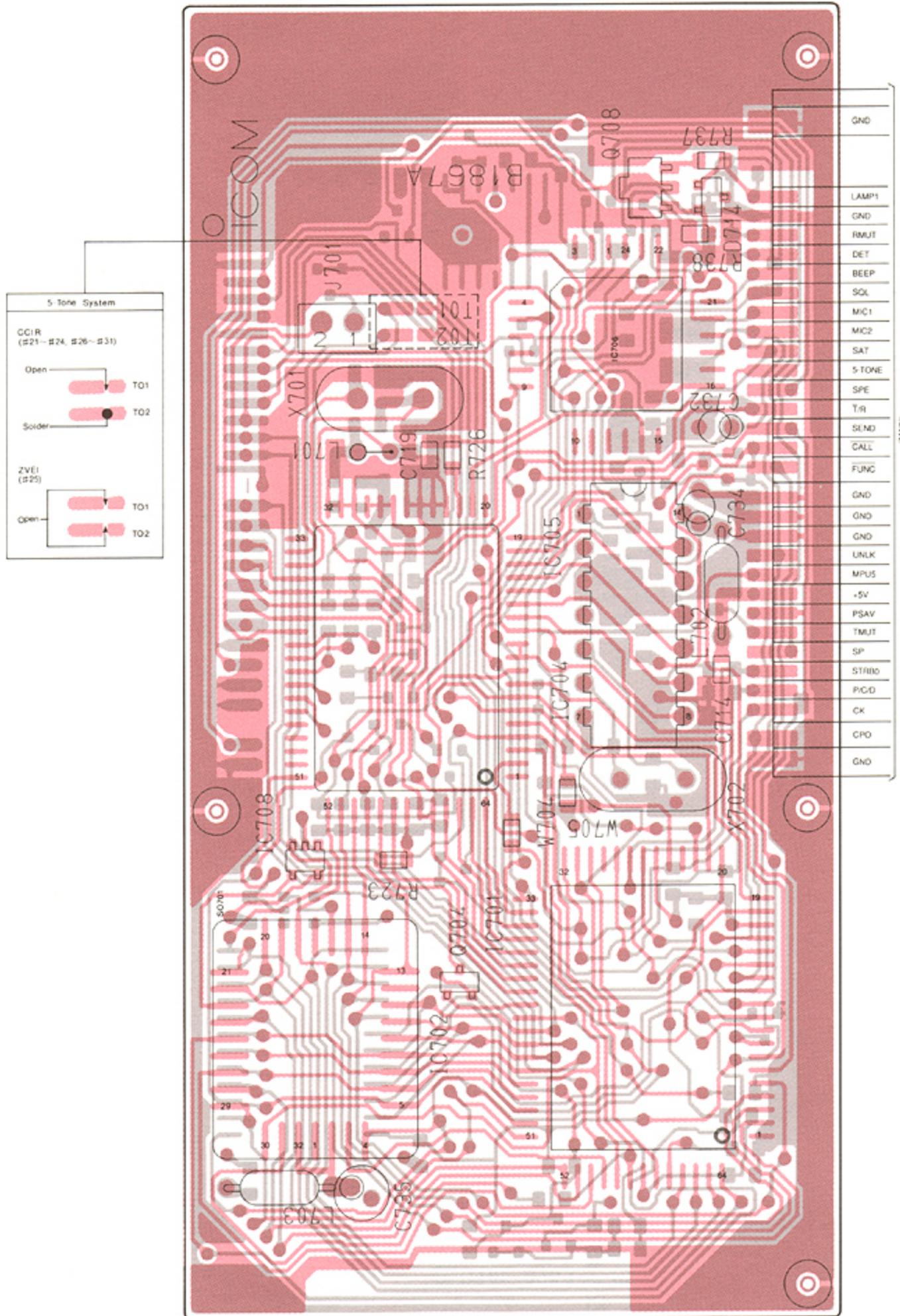
• DISPLAY UNIT



8-4 LOGIC UNIT

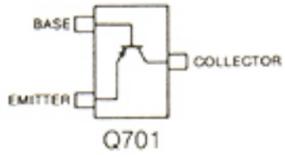
• LOGIC UNIT

The combination of this page and the next page show the unit layout in the same configuration as the actual P.C. Board.

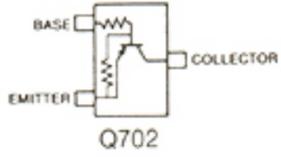


• LOGIC UNIT

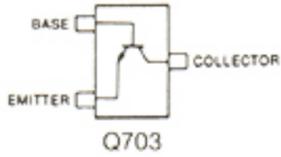
2SA1162 Y
(Symbol: SY)



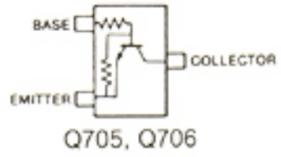
RN2404
(Symbol: YD)



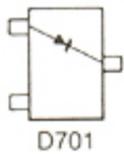
2SC2712 Y
(Symbol: LY)



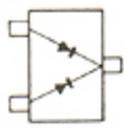
RN1404
(Symbol: XD)



RD5.1M B2
(Symbol: 512)

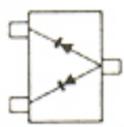


1SS184
(Symbol: B3)



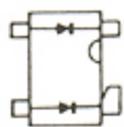
D702, D704, D705, D706,
D707, D709, D712, D713

1SS181
(Symbol: A3)

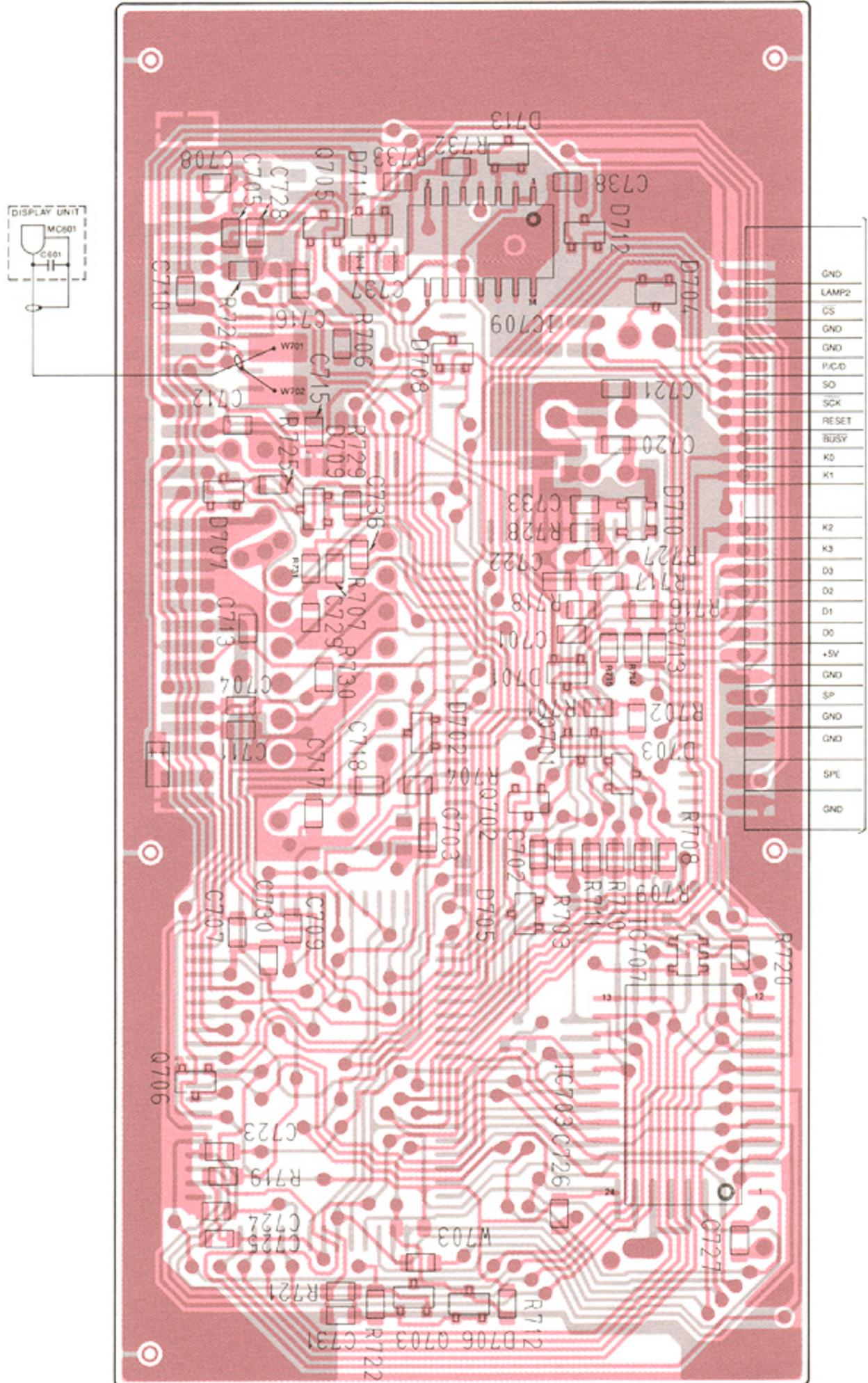


D703, D708, D711

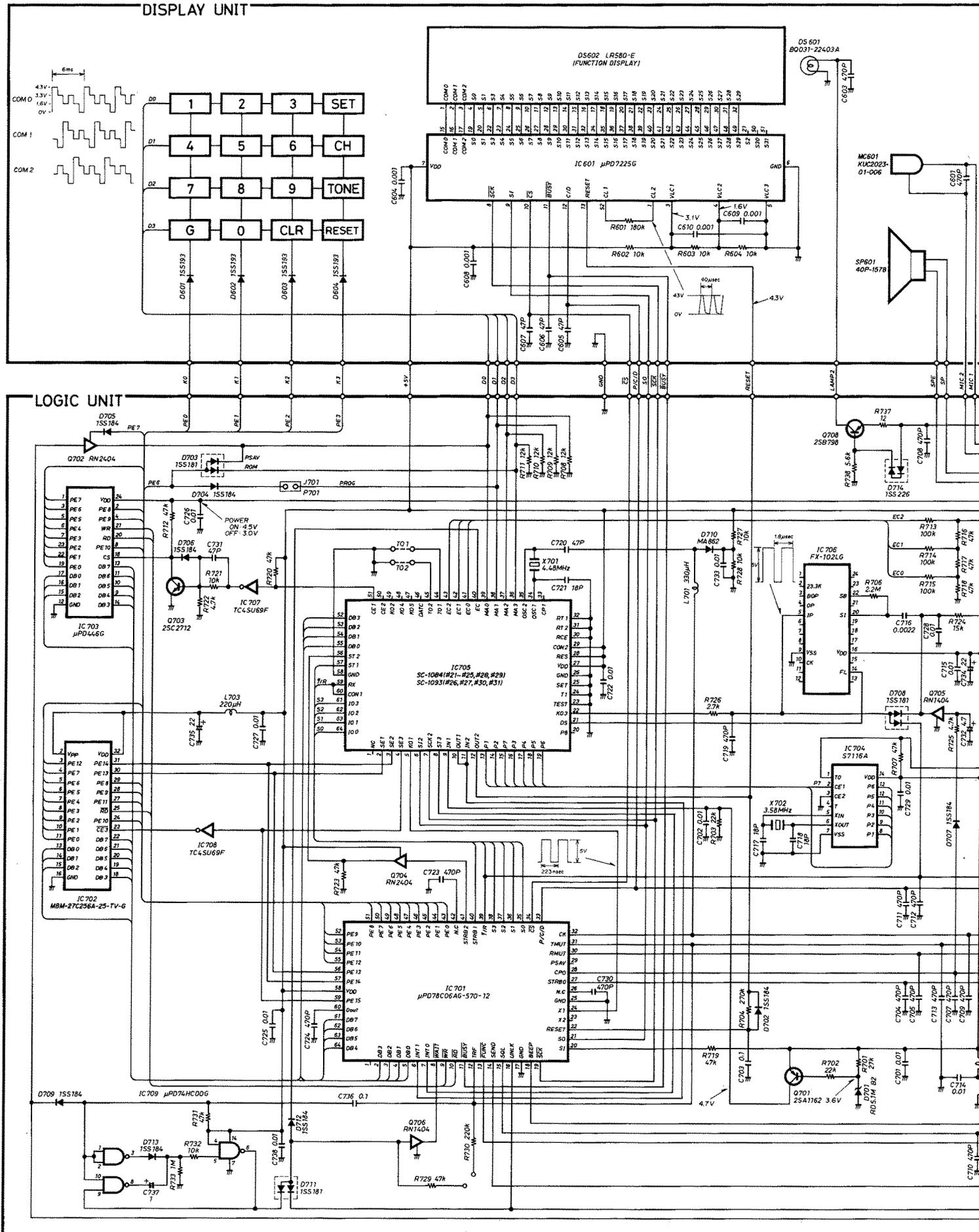
MA862
(Symbol: M11)

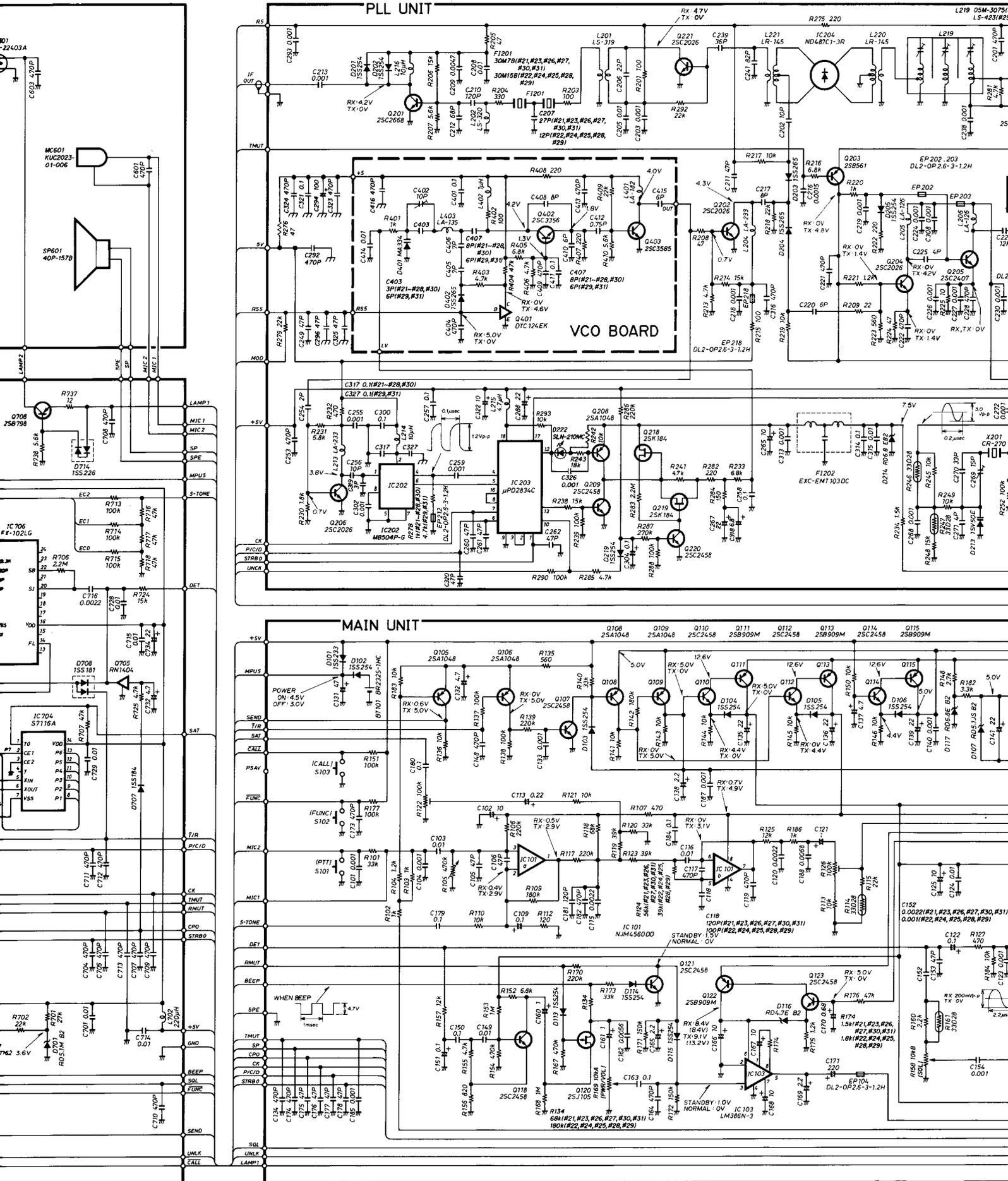


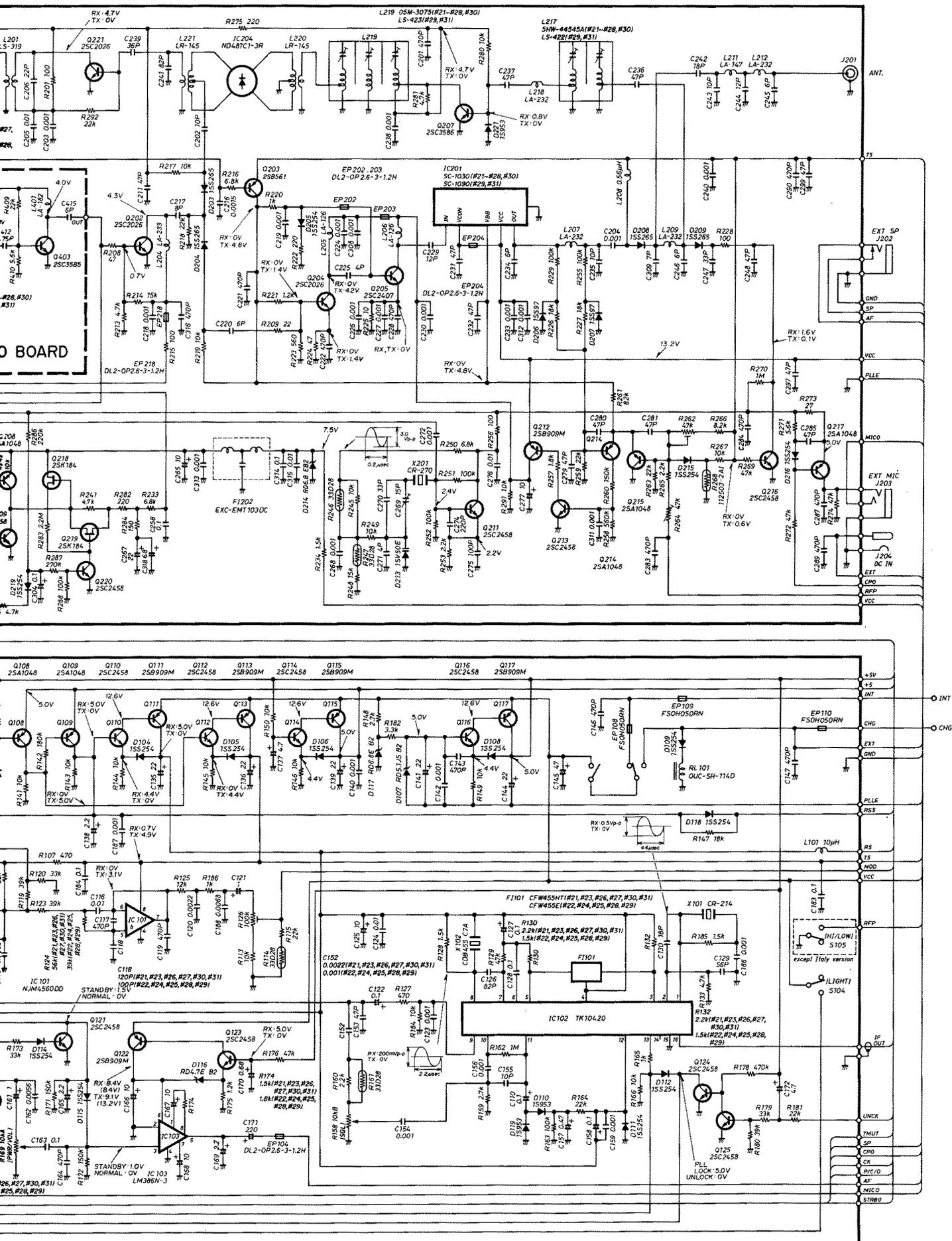
D710



SECTION 9 VOLTAGE DIAGRAM







Icom Inc.

6-9-16, Kamihigashi, Hirano-ku, Osaka 547, Japan
Phone: 06 793 5302
Fax : 06 793 0013
Telex : 05277822 ICOMTR J

Icom America Inc.

<Corporate Headquarters>
2380 116th Avenue N.E., Bellevue, WA 98004, U.S.A.
Phone : (206) 454-8155
Fax : (206) 454-1509
Telex : 152210 ICOM AMER BVUE

<Customer Service>
Phone : (206) 454-7619

<Regional Customer Service Centers>
18102 Sky Park South, Suite 52-B, Irvine, CA 92714, U.S.A.
Phone : (714) 852-8026
Fax : (714) 852-8716

1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349, U.S.A.
Phone : (404) 991-6166
Fax : (404) 991-6327

Icom Canada

A Division of Icom America Inc.
3071 #5 Road, Unit 9, Richmond, B.C., V6X 2T4, Canada
Phone : (604) 273-7400
Fax : (604) 273-1900

Icom (Europe) GmbH

Communication Equipment
Himmelgeister Str. 100, 4000 Düsseldorf 1, F.R.G.
Phone : 0211 346047
Fax : 0211 333639
Telex : 8588082 ICOM D

Icom (Australia) Pty. Ltd.

A.C.N 006 092 575
7 Duke Street, Windsor, Victoria, 3181, Australia
Phone : 03 529 7582
Fax : 03 529 8485
Telex : AA 35521 ICOM AS

Icom (UK) Ltd.

Unit 9, Sea St., Herne Bay, Kent, CT6 8LD, U.K.
Phone : 0227 741741
Fax : 0227 741742
Telex : 965179 ICOM G

Icom France S.a

Zac de la Plaine, Rue Brindejanc des Moulinais
BP 5804, 31505 Toulouse Cedex, France
Phone : 61. 36. 03. 03 Fax : 61. 34. 05. 91
Telex : 521515 ICOM FRA

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