



# SERVICE MANUAL

VHF TRANSCEIVER

# IC-H16T MKII

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## INTRODUCTION

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This service manual describes the latest service information for the **IC-H16T MKII** VHF TRANSCEIVER at the time of publication.

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## DANGER

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**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.

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## ORDERING PARTS

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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>

1110000070	IC	μPC358C	IC-H16T MK II	MAIN UNIT	5 pieces
8810002050	Screw	FH M2×4	IC-H16T MK II	CHASSIS PARTS	10 pieces

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

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## REPAIR NOTES

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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	SYMBOL	FREQUENCY RANGE	CHANNEL SPACING	5-TONE SYSTEM	SUPPLIED BATTERY PACK
#33	United Kingdom	UK	146~174 MHz	12.5 kHz	CCIR	—
#34	General	GEN-2	146~174 MHz	25 kHz	ZVEI	CM-8B
#36	South Africa	SAF	146~174 MHz	12.5 kHz	EEA	CM-8B
#37	Sweden	SWE	146~174 MHz	25 kHz	CCIR	CM-8B
#38	Italy	ITA	146~174 MHz	25 kHz	ZVEI	CM-8B
#39	Italy	ITA-1	146~174 MHz	12.5 kHz	ZVEI	CM-8B
#40	Greece	GRE	146~174 MHz	12.5 kHz	CCIR	CM-8B
#41	France	FRA	146~174 MHz	12.5 kHz	DAPL	CM-8B
#42	Holland	HOL	146~174 MHz	20 kHz	ZVEI	CM-8B
#43	France	FRA-1	146~174 MHz	12.5 kHz	CCIR	CM-8B
#44	France	FRA-2	146~174 MHz	12.5 kHz	CCIR	CM-8B
#45	Sweden	SWE-1	146~174 MHz	25 kHz	CCIR	CM-8B
#46	General	GEN-4	146~174 MHz	25 kHz	ZVEI	CM-96B
#47	Italy	ITA-2	146~174 MHz	25 kHz	ZVEI	CM-96B
#48	Italy	ITA-3	146~174 MHz	12.5 kHz	ZVEI	CM-96B
#49	Greece	GRE-1	146~174 MHz	12.5 kHz	CCIR	CM-96B

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 : 146~174 MHz  
Ask your Icom Dealer about the permitted frequency range in your area.
- Frequency bandwidth : 28 MHz
- Mode : 16K0F3E (#34, #37, #38, #45, #46, #47)  
14K0F3E (#42)  
8K50F3E (#33, #36, #39, #40, #41, #43, #44, #48, #49)
- Channel spacing : 25 kHz (#34, #37, #38, #45, #46, #47)  
20 kHz (#42)  
12.5 kHz (#33, #36, #39, #40, #41, #43, #44, #48, #49)
- 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  $\Omega$  (unbalanced)
- Current drain (with CM-8B) :
 

Receive	Stand-by	80 mA
	Max. audio output	250 mA
Transmit	High	1.3 A
	Low	750 mA
- Usable temperature range :  $-25^{\circ}\text{C} \sim +60^{\circ}\text{C}$  ( $-13^{\circ}\text{F} \sim +130^{\circ}\text{F}$ )
- Frequency stability :  $\pm 5$  ppm ( $-25^{\circ}\text{C} \sim +60^{\circ}\text{C}$ ;  $-13^{\circ}\text{F} \sim +140^{\circ}\text{F}$ )
- Dimensions (with CM-8B) : 65 (W)  $\times$  196 (H)  $\times$  38 (D) mm  
2.5 (W)  $\times$  7.7 (H)  $\times$  1.5 (D) in  
(Projections not included.)
- Weight (with CM-8B) : 596 g (1.3 lbs)

### 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 :  $\pm 5$  kHz (#34, #37, #38, #45, #46, #47)  
 $\pm 4$  kHz (#42)  
 $\pm 2.5$  kHz (#33, #36, #39, #40, #41, #43, #44, #48, #49)
- Spurious emissions :  $< 0.25$   $\mu\text{W}$
- Harmonic emissions :  $< 0.25$   $\mu\text{W}$
- FM noise and hum :  $< -40$  dB

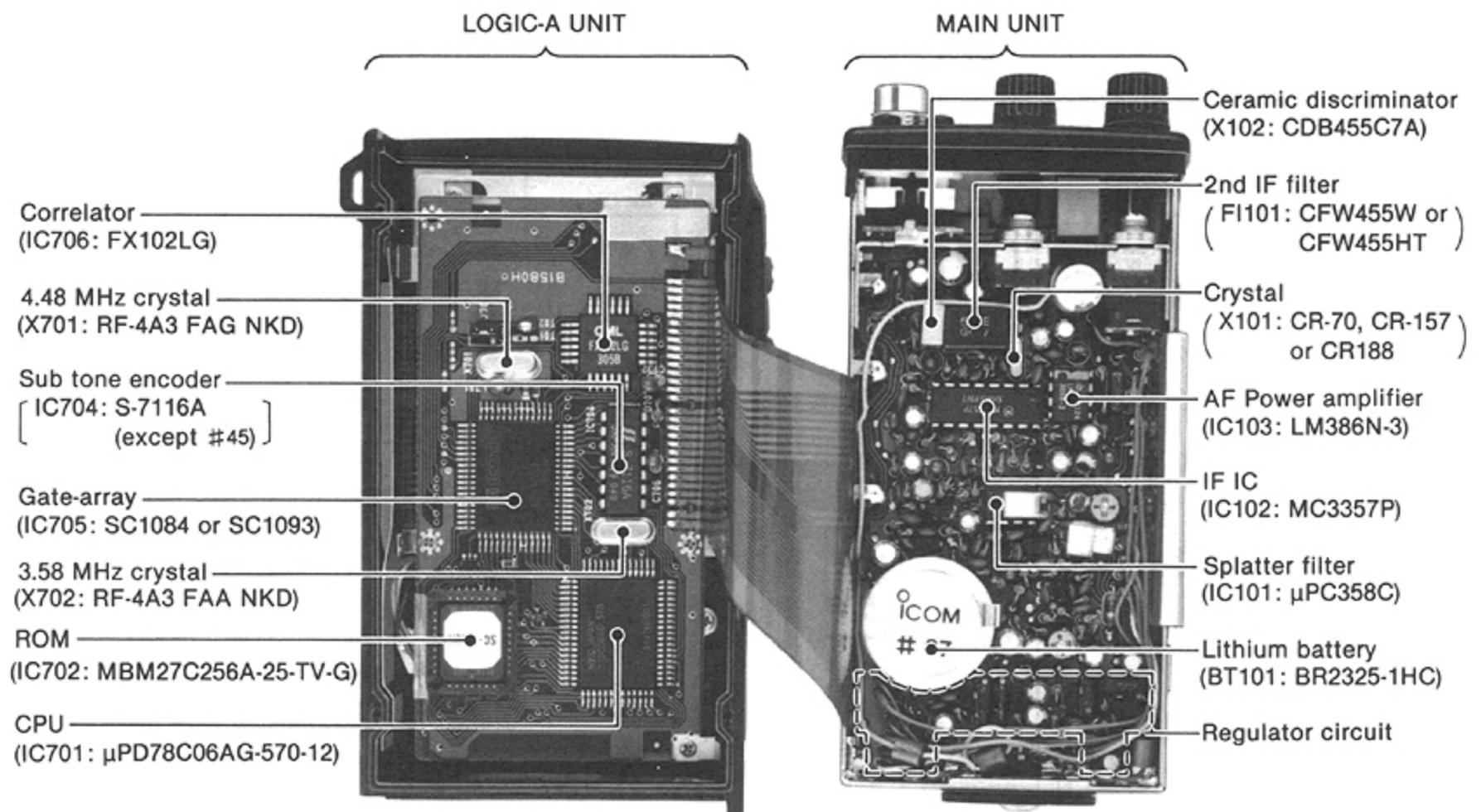
### RECEIVER

- Receiver system : Double-conversion superheterodyne
- Intermediate frequency : 1st 21.8 MHz 2nd 455 kHz
- Sensitivity : 0.35  $\mu\text{V}$  (PD) for 12 dB SINAD, signal input modulated by 1 kHz tone at 60 % peak deviation
- Squelch sensitivity (threshold) : 0.4  $\mu\text{V}$
- Adjacent channel selectivity :  $> 70$  dB (#34, #37, #38, #42, #45, #46, #47)  
 $> 60$  dB (#33, #36, #39, #40, #41, #43, #44, #48, #49)
- Intermodulation rejection :  $> 70$  dB
- Spurious and image rejection :  $> 70$  dB
- Audio output power (with CM-8B) : 500 mW 10 % distortion with an 8  $\Omega$  load
- Audio output impedance : 8  $\Omega$

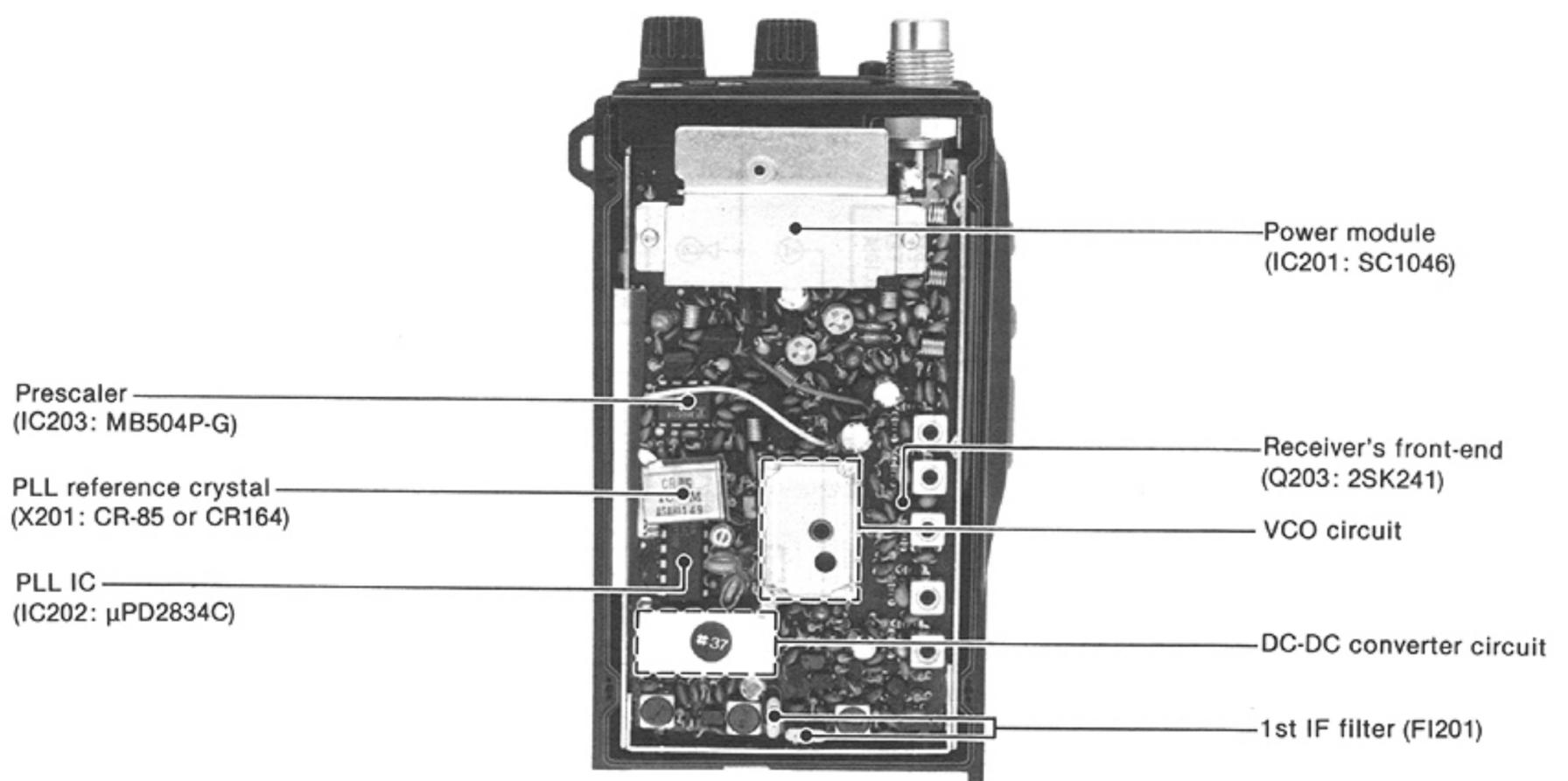
All stated specifications are subject to change without notice or obligation.

## SECTION 2 INSIDE VIEWS

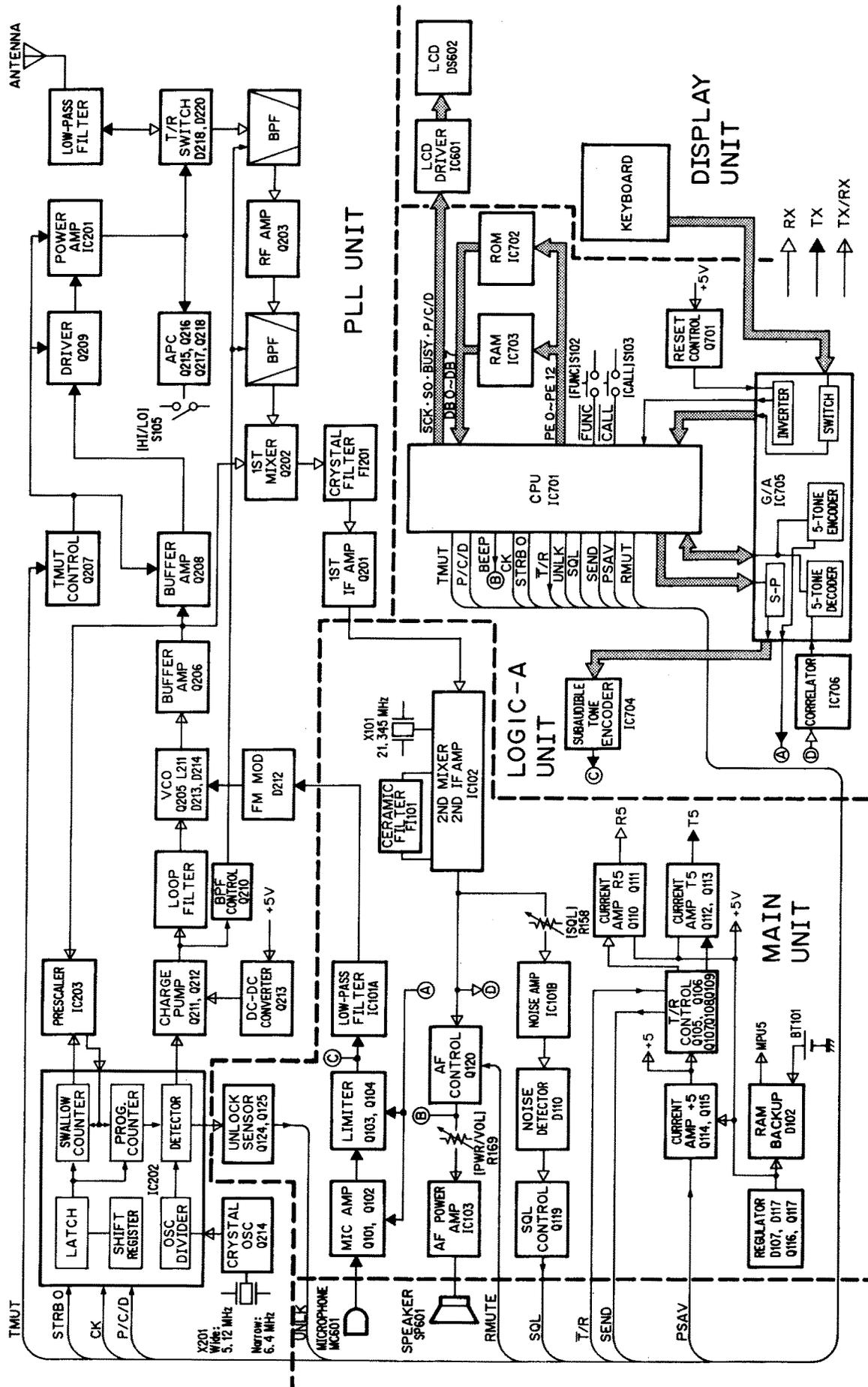
### • MAIN AND LOGIC-A UNITS



### • 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 enter the antenna connector and pass through a two-stage Chebyshev low-pass filter (L221, L222, C262~C266) to suppress out-of-band signals. The filtered signals are applied to the  $\lambda/4$  type antenna switching circuit (D218, D220, L220, C267, C268) and then to a two-stage bandpass filter (L207, L208, D208~D211, C221, C225).

#### 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 signals from the bandpass filter are applied to the RF amplifier (Q203). The amplified signals enter a three-stage bandpass filter (L204~L206, D202~D207, C215, C218) to suppress unwanted signals.

D202~D211 employ varactor diodes, that are controlled by the PLL lock voltage, to track the bandpass filters. These varactor diodes tune the center frequency of an RF passband for wide bandwidth receiving and good image response rejection.

#### 4-1-3 1ST MIXER AND IF CIRCUITS (PLL UNIT)

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 Q202 with a 1st LO signal coming from the VCO circuit to produce a 1st IF signal. The 1st IF signal is applied to L203 and then to a pair of crystal filters (FI201) in order to obtain wide selection capability and to pass only the desired signals. The filtered signal passes through a 1st IF amplifier (Q201). The amplified signal is applied to a 2nd IF circuit.

#### 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 on the PLL unit is applied to a 2nd mixer section of IC102 (pin 16) 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 21.345 MHz for the 2nd LO signal.

#### • 2ND IF AND DEMODULATOR CIRCUITS

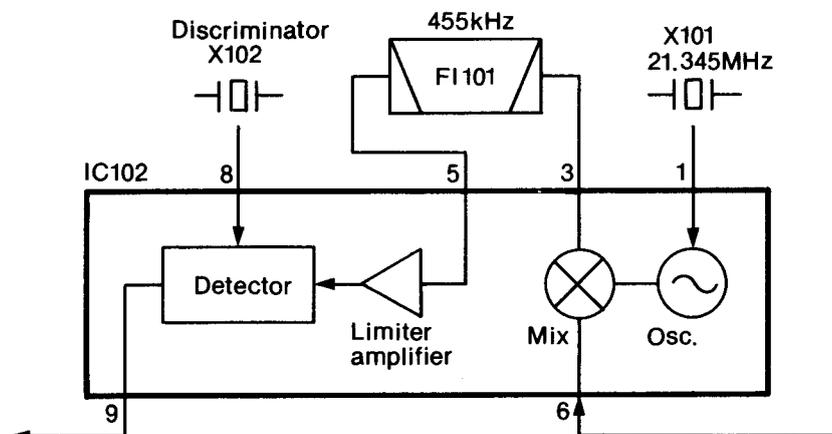


Fig. 1

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 an AF signal. The AF signal is output from IC102 (pin 9).

**4-1-5 AF CIRCUIT (MAIN UNIT)**

The AF circuit de-emphasizes the demodulated signal 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 signal output from IC102 (pin 9) passes 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 signal is applied to the AF mute circuit (Q120). When the squelch is closed, Q120 cuts off the AF signal as an AF mute switch. The AF signal is applied to the [PWR/VOL] control (R169) and is then power-amplified at the AF power amplifier (IC103) to drive a speaker.

**4-1-6 SQUELCH CIRCUIT (MAIN AND LOGIC-A 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 and are then applied to an active filter circuit (IC101B, pin 2). The active filter circuit amplifies the noise components of frequency 20 kHz and above.

The noise signals from IC101B (pin 1) are rectified by D110 and are then converted to DC voltage at R164, R165, C158 and C159. The DC voltage triggers the squelch control switch (Q119).

An "SQL" signal from Q119 is applied to the CPU (IC701, pin 15) on the LOGIC unit. When the CPU (IC701, pin 15) receives the "SQL" signal, the CPU (IC705, 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-A UNIT)**

A portion of the AF signals from the FM IF IC (IC102) 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.

**• AF CIRCUIT**

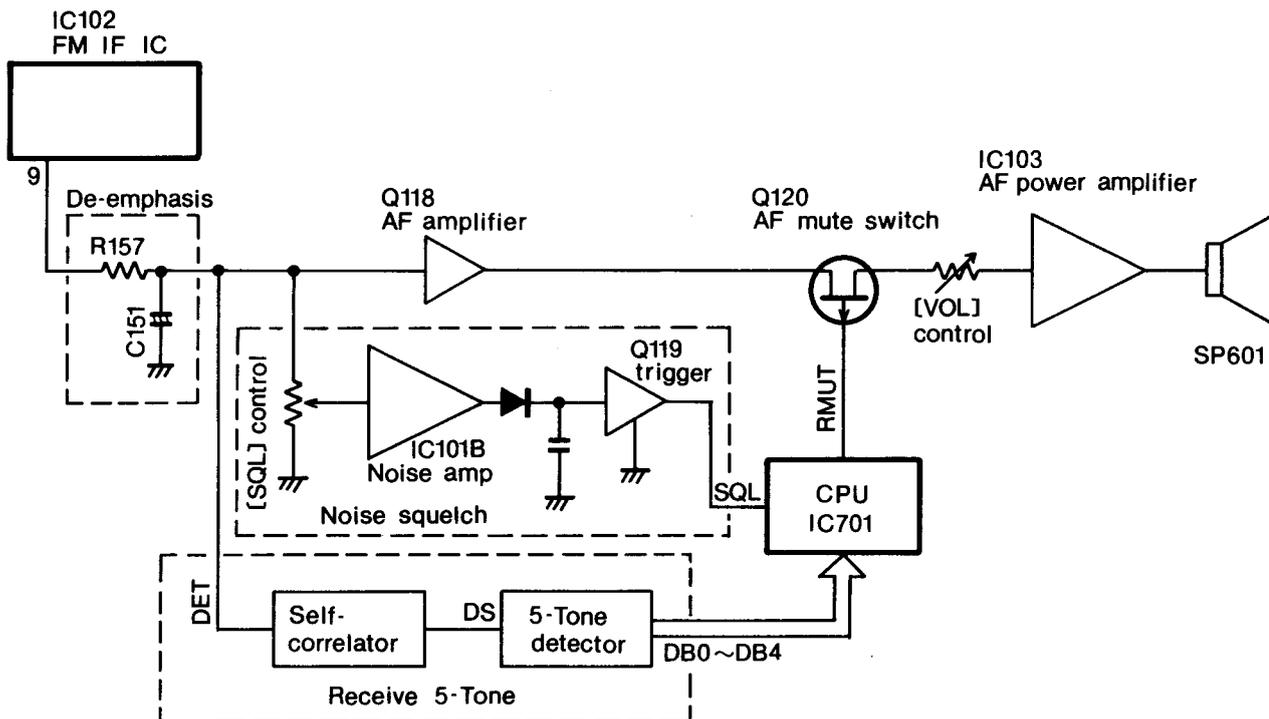


Fig. 2

## 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 the limiter amplifier circuit (Q101~Q104). This circuit is a negative feedback circuit with +6 dB/octave pre-emphasis characteristics in the 300 Hz~3 kHz range. The output signals from the limiter amplifier pass through a splatter filter circuit (IC101A) which eliminates signal components greater than 3 kHz. Pin 7 of IC101A outputs a "MOD" signal. The "MOD" signal is applied to the modulation circuit on the PLL unit.

### 4-2-2 MODULATION CIRCUIT (PLL UNIT)

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

The "MOD" signal changes the reactance of a varactor diode (D212) to modulate the oscillated signal at the VCO circuit (Q205, L211, D213, D214). The oscillated signal is buffer-amplified at Q206.

The buffer-amplified signal passes through the transmit/receive switching circuit (D216) 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 (D216) is amplified at the pre-drive amplifier (Q208) and is then re-amplified at a drive amplifier (Q209) to obtain 20 mW.

The control voltage from the APC circuit is applied to the collector of Q209 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 (Q209) 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 (L218, D217, D218) where the forward and reflection components are detected as an APC voltage. When the antenna impedance is matched at 50  $\Omega$ , 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 (Q217, Q218). The APC reference voltage is determined by the power output control circuit (R270~R274) and is then applied to the base of Q217.

When the antenna impedance is mismatched, the base voltage of Q218 exceeds the reference voltage. The collector voltage of Q218 decreases.

The current from the differential amplifier circuit (Q217, Q218) is amplified at Q216 to control Q215 and Q221. The control voltage changes the supply voltage to IC201 and Q209. This decreases the output power from the drive amplifier (Q209) and power module (IC201) until the base voltage of Q218 reaches the same level as the voltage of Q217.

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

The power output control circuit (R270~R274) 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 R270, R271 and R274. The RF output power is adjusted with R270.

When "LOW" output power is selected, the APC reference voltage is determined by R270~R274. The RF output power is adjusted with R273.

### 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 Q207 OFF to interrupt the transmission, the bias voltages are prevented from entering Q208, Q209 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, D218 and D220 are turned ON. The RF output signal is not permitted to enter the receiver circuit. The signal passes through D218 and the low-pass filter (L221, L222, C262~C266). 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.

### 4-3-2 PLL CIRCUIT (PLL UNIT)

The PLL circuit, using a PLL IC (IC202) and a prescaler (IC203), directly generates the transmit frequency and the receive 1st LO frequency with the VCO (Q205, L211, D213, D214). Signals from the VCO are prescaled at the prescaler (IC203) based on N-data from the PLL IC (IC202, pin 5). The resulting signal is applied to the PLL IC (IC202, pin 4). The PLL IC (IC202) detects the out-of-step phase and outputs it from pins 12 and 13.

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

A 5.12 MHz (wide type) or a 6.4 MHz (narrow type) reference frequency is produced by Q214 and X201. The frequency is adjusted with C292. D223, R261 and R265 compensate for temperature to maintain frequency stability within  $\pm 5$  ppm ( $-25^{\circ}\text{C} \sim +60^{\circ}\text{C}$ ;  $-13^{\circ}\text{F} \sim +140^{\circ}\text{F}$ ). The reference frequency is applied to the PLL IC (IC202, pin 17).

### 4-3-4 VCO CIRCUIT (PLL UNIT)

The VCO circuit (Q205, L211, D213, D214) generates the transmit frequency and the receive 1st LO frequency. The varactor diodes (D213, D214) provide frequency control.

In receive mode, Q204 and D212 are turned ON as the "RS5" voltage line becomes 5 V. C234 is connected to D213 and D214 in parallel. Therefore, the VCO output frequency is shifted to a lower frequency than while transmitting.

In transmit mode, Q204 and D212 are turned OFF as the "RS5" voltage line becomes 0 V. C234 is 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 a buffer amplifier (Q206) which amplifies VCO oscillation and does not permit the latter circuit to affect the VCO oscillation.

### • PLL CIRCUIT

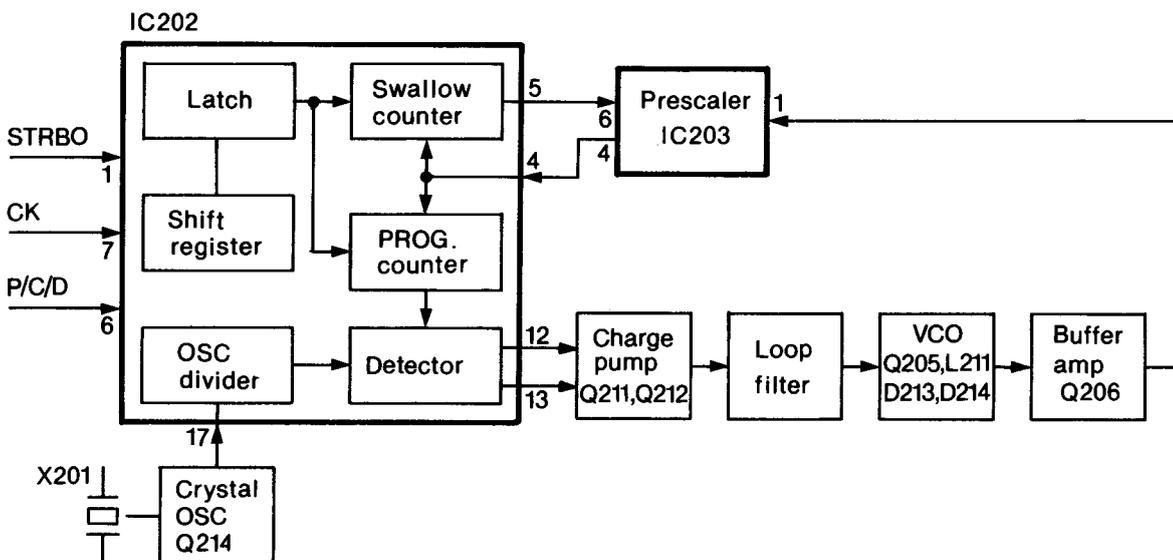


Fig. 3

### 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.

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

A 5.12 MHz (wide type) or a 6.4 MHz (narrow type) reference frequency from X201 is applied to IC202 (pin 17) and passes through a programmable reference counter section of IC202. Both of the divided signals are compared at a phase detector section of IC202. The phase-detected signal (pulse signal) is output from IC202 (pins 12 and 13).

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

The phase-detected signal (pulse signal) from IC202 (pins 12 and 13) passes through the charge pump (Q211, Q212) and is then applied to a lag-lead loop filter (R244, R245, C277). The pulse signal is converted to DC voltage (PLL voltage) to control the oscillation from the VCO circuit.

The charge pump (Q211, Q212) is used to expand the range of the PLL lock voltage. The PLL lock voltage changes the reactance of varactor diodes (D213, D214).

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

When the PLL circuit is unlocked, IC202 (pin 10) becomes "LOW." The "LOW" signal passes through the unlock sensor circuit (Q124, Q125) 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).
+5 V	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 in all modes.
+5	5 V controlled by the power saver function. When the power save is turned ON, a "PSAV" signal from the CPU (IC701, pin 29) interrupts the "+5" line intermittently to save power. 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 Q112, Q113 and D105. 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-A 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

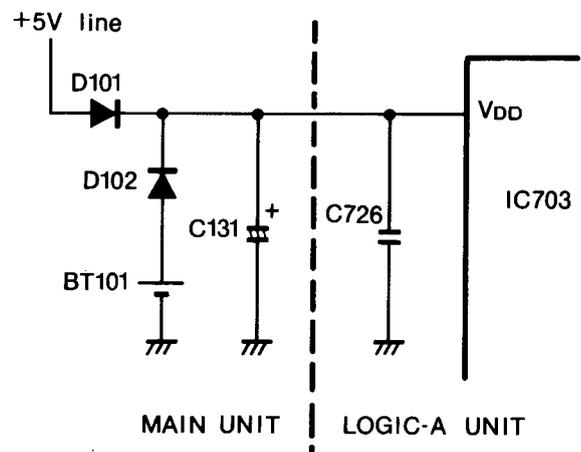


Fig. 4

## 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/decode and a subaudible tone encoder. The circuit controls frequency, tone setting, FUNCTION DISPLAY and more.

### 4-5-2 PORT ALLOCATIONS

#### IC701 CPU (LOGIC-A 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.
PA2 [PSAV]	29	Outputs a power save control signal.
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	Outputs the transmit/receive switching signal. "HIGH": transmit "LOW": receive
PB0~PB3 [S0~S3]	38, 35, 36, 37	Input/output ports for 5-Tone data.

PORT NAME	PIN NUMBER	DESCRIPTION
PC5 [BUSY]	11	Outputs the BUSY signal for IC601.
PC4 [FUNC]	12	Input port for the [FUNCTION] 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.
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.
φout	60	Outputs clock signals for controlling 5-Tone signals. The output frequency is 560 kHz.

## 4-6 5-TONE CIRCUITS

### 4-6-1 5-TONE IC (LOGIC-A 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 #33, #41, #43~#45.

SC1084 for #34, #36~#40, #42, #46~#49.

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.
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	#33, #41, #43~#45	#34, #36~#40, #42, #46~#49
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-A 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 OTHER CIRCUITS

### 4-7-1 DC-DC CONVERTER CIRCUIT (PLL UNIT)

A DC-DC converter (Q213) and L223 form a blocking oscillator circuit which supplies a stable output voltage to the charge pump (Q211, Q212). The DC voltage is used to obtain wide range lock voltage for the PLL circuits.

### 4-7-2 DISPLAY CIRCUIT (DISPLAY UNIT)

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

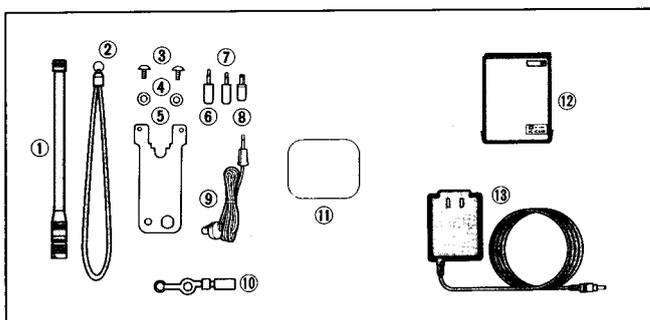
## SECTION 5 MECHANICAL PARTS AND DISASSEMBLY

### • CHASSIS PARTS

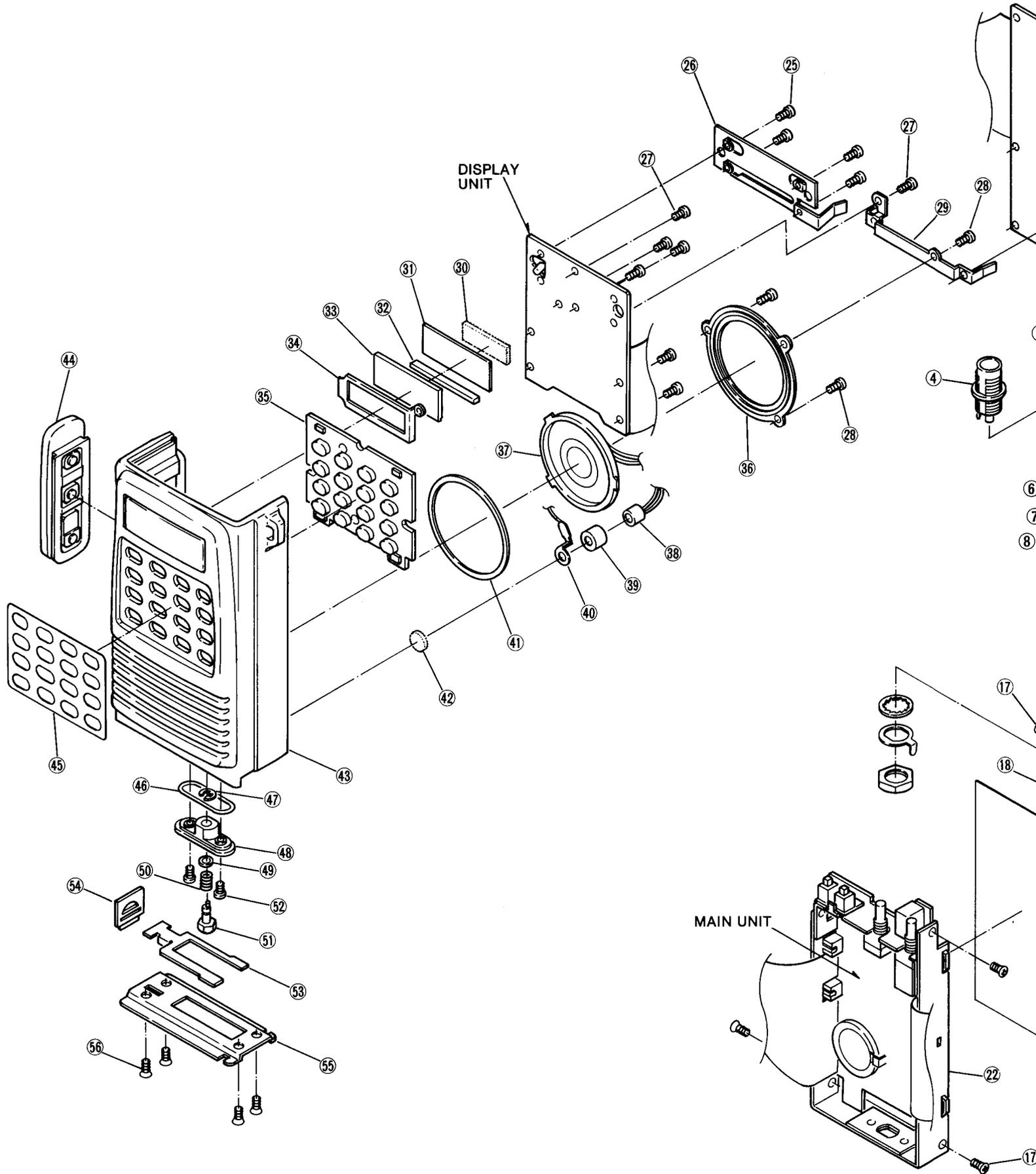
LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.	LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	8610008030	Knob N191 [SQL], [PWR/VOL]	2	②7	8810001710	Screw PH B0 No. 0-3 M1.4×3.5 ZK	7
②	8810000100	Screw PH M2×4 ZK	2	②8	8810004040	Screw B0 No. 0 M2×5 ZU	3
③	8010013190	554 top plate (#38, #39, #47, #48 only)	1	②9	8930011150	Logic shield plate	1
④	6510004920	Antenna connector TNC-102-N1-W1-L1	1	③0	8930001380	Sponge (I)	1
⑤	8210007641	554 top panel-1 (#33, #34, #36, #37, #40~#46, #49)	1	③1	6910001200	Reflector ALF33×11×0.58	1
	8010013181	554 top panel (A)-1 (#38, #39, #47, #48)		③2	8930007790	LCD contact SRCN-411	1
⑥	8610008020	Knob K191 [LIGHT]	1	③3	5030000230	LCD LR580-E	1
⑦	8610008020	Knob K191 [HI/LO] (#33, #34, #36, #37, #40~#46, #49 only)	1	③4	8510007750	LCD shield plate (A)	1
⑧	8930006050	Switch waterproof seal (#33, #34, #36, #37, #40~#46, #49)	1	③5	8210007560	554 10-key (#33, #34, #36~#40, #42~#44, #46~#49)	1
	8930009060	Switch waterproof seal (A) (#38, #39, #47, #48)			8210007700	554 10-key (A) (#41, #45)	
⑨	8310005130	Knob seal	2	③6	8930007200	Speaker plate (A)	1
⑩	8930002940	Top ring	1	③7	2510000140	Speaker 40P-157B	1
⑪	8810000740	Screw PH A M2×15 ZK	4	③8	7700000480	Microphone KUC2023-01-006	1
⑫	8010012550	554 rear panel	1	③9	8930001630	Microphone holder	1
⑬	8930002950	Panel seal-1	1	④0	8930007210	297 microphone lug	1
⑭	8510001733	461 rear shield plate-3	1	④1	8930002930	Speaker seal	1
⑮	8510003370	PA shield plate	1	④2	8930001620	Microphone sponge	1
⑯	8010007380	Chassis A	1	④3	8210007790	554 front panel (incl. window plate)	1
⑰	8810002050	Screw FH M2×4	4	④4	8930025010	554 PTT rubber	1
⑱	8810001850	Screw PH M2.6×8 NI BS	2	④5	8210007650	554 10-key panel (#33, #34, #36~#40, #42~#44, #46~#49)	1
⑲	8310000010	297 shield sheet	1		8210007710	554 10-key panel (A) (#41, #45)	
⑳	8830000030	VR nut (C)	2	④6	8930002780	O ring (E)	1
㉑	8850000070	Icom washer (J)	2	④7	8860000300	E ring M2	1
㉒	8010007390	Chassis B	1	④8	8010002740	Terminal holder	1
㉓	8810004800	Screw PH B0 No. 0 M2×4	3	④9	8930002790	O ring (F)	1
㉔	8930011160	Logic ground plate	1	⑤0	8930007220	Spring (A)-1	1
㉕	8810001720	Screw PH B0 No. 0-3 M1.4×4	4	⑤1	6510000630	Positive terminal	1
㉖	8510003310	Front shield plate	1	⑤2	8810001840	Screw PH M2.6×6 NI BS	2
				⑤3	8930005612	Lock plate-3	1
				⑤4	8930024570	554 release button	1
				⑤5	8010002880	Sliding plate (A)	1
				⑤6	8810002380	Screw PH M2.6×6 NI BS	4

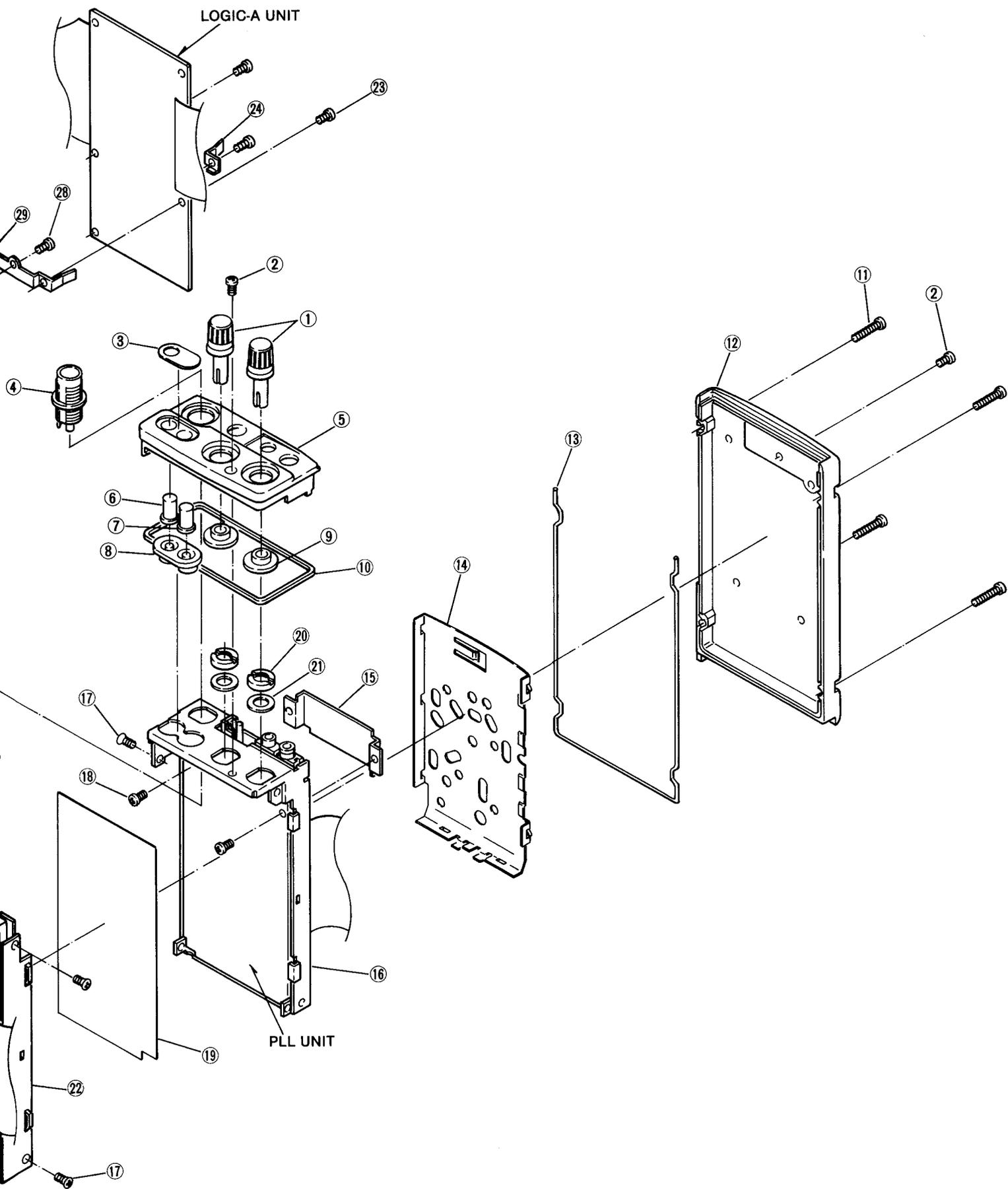
**Screw abbreviations** B0: Self-tapping screw PH: Pan head FH: Flat head BS: Brass NI: Nickel ZK: Black

### • ACCESSORIES



LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	3310000410	Flexible antenna #208-7 (#33)	1
	3310000150	Flexible antenna #208-11 (#34, #36, #38~#44, #46~#49)	
	3310000190	Flexible antenna #208-13 (#37, #45)	
②	8010003030	Handstrap	1
③	8810003650	Icom screw A4	2
④	8850000640	Nylon washer B M3	2
⑤	8930005660	Belt clip (except #44)	1
	8930019110	Belt clip (A) (for #44)	
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	Battery pack CM-8B (#34, #36~#45)	1
		Battery pack CM-96B (#46~#49)	
⑬	Optional product	Wall charger CM-16E (#34, #36, #41~#44, #46)	1
		Wall charger BC-17 (#37, #45)	
		Wall charger CM-17E (#38~#40, #47~#49)	





## SECTION 6 PARTS LIST

## [MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC101	1110000070	IC	μPC358C
IC102	1110000630	IC	MC3357 P
IC103	1110000530	IC	LM386N-3
Q101	1530000110	TRANSISTOR	2SC2458-GR
Q102	1530000110	TRANSISTOR	2SC2458-GR
Q103	1510000080	TRANSISTOR	2SA1048-GR
Q104	1530000110	TRANSISTOR	2SC2458-GR
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
Q119	1590000350	TRANSISTOR	RN1204
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	1710000170	DIODE	1SS211
D103	1710000170	DIODE	1SS211
D104	1710000170	DIODE	1SS211
D105	1710000170	DIODE	1SS211
D106	1710000170	DIODE	1SS211
D107	1730000360	ZENER	RD5.1JS B2
D108	1710000170	DIODE	1SS211
D109	1710000170	DIODE	1SS211
D110	1710000170	DIODE	1SS211
D111	1710000170	DIODE	1SS211
D112	1710000170	DIODE	1SS211
D113	1710000170	DIODE	1SS211
D114	1710000170	DIODE	1SS211
D115	1710000170	DIODE	1SS211
D116	1730000080	ZENER	RD4.7E B2
D117	1730000140	ZENER	RD6.8E B2
X101	6050002000	XTAL	CR-70 (#33, #34, #36~#43, #46~#49)
	6050002870	XTAL	CR-157 (#44)
	6050003420	XTAL	CR-188 (#45)
X102	6070000010	DISCRIMINATOR	CDB455C7A
FI101	2020000120	CERAMIC	CFW455E (#34, #37, #38, #41, #42, #45, #46, #47)
	2020000150	CERAMIC	CFW455HT (#33, #36, #39, #40, #43, #44, #48, #49)
L101	6180000880	COIL	LAL 03NA 100K

## [MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R101	7010002120	RESISTOR	ELR10J 33 kΩ
R102	7010001940	RESISTOR	ELR10J 1 kΩ
R103	7010001940	RESISTOR	ELR10J 1 kΩ
R104	7010001950	RESISTOR	ELR10J 1.2 kΩ
R105	7010002180	RESISTOR	ELR10J 100 kΩ
R106	7010002190	RESISTOR	ELR10J 120 kΩ
R107	7010001900	RESISTOR	ELR10J 470 Ω
R108	7010002030	RESISTOR	ELR10J 5.6 kΩ
R109	7010002060	RESISTOR	ELR10J 10 kΩ
R110	7010002120	RESISTOR	ELR10J 33 kΩ
R112	7010001900	RESISTOR	ELR10J 470 Ω
R113	7010002240	RESISTOR	ELR10J 330 kΩ
R114	7010001940	RESISTOR	ELR10J 1 kΩ
R115	7010001980	RESISTOR	ELR10J 2.2 kΩ
R116	7010002000	RESISTOR	ELR10J 3.3 kΩ
R117	7010002220	RESISTOR	ELR10J 220 kΩ
R118	7010002200	RESISTOR	ELR10J 150 kΩ
R119	7010002130	RESISTOR	ELR10J 39 kΩ
R120	7010002120	RESISTOR	ELR10J 33 kΩ
R121	7010002120	RESISTOR	ELR10J 33 kΩ (#33, #34, #36~#44, #46~#49)
R122	7310000590	TRIMMER	RH0521C15J05A (104)
R123	7010002130	RESISTOR	ELR10J 39 kΩ
R124	7010002130	RESISTOR	ELR10J 39 kΩ (#34, #37, #38, #41, #42, #45, #46, #47)
	7010002150	RESISTOR	ELR10J 56 kΩ (#33, #36, #39, #40, #43, #44, #48, #49)
R125	7010002070	RESISTOR	ELR10J 12 kΩ
R126	7310000590	TRIMMER	RH0521C15J05A (104)
R127	7010001900	RESISTOR	ELR10J 470 Ω
R128	7010001960	RESISTOR	ELR10J 1.5 kΩ (#33, #34, #36~#43, #45~#49)
	7010002000	RESISTOR	ELR10J 3.3 kΩ (#44)
R129	7010002140	RESISTOR	ELR10J 47 kΩ
R130	7010001960	RESISTOR	ELR10J 1.5 kΩ (#34, #37, #38, #41, #42, #45, #46, #47)
R130	7010001980	RESISTOR	ELR10J 2.2 kΩ (#33)
R131	7010002180	RESISTOR	ELR10J 100 kΩ
R132	7010001960	RESISTOR	ELR10J 1.5 kΩ (#34, #37, #38, #41, #42, #45, #46, #47)
	7010001980	RESISTOR	ELR10J 2.2 kΩ (#33, #36, #39, #40, #43, #44, #48, #49)
R133	7010002100	RESISTOR	ELR10J 22 kΩ
R134	7010002160	RESISTOR	ELR10J 68 kΩ (#33, #36, #39, #40, #43, #44, #48, #49)
	7010002210	RESISTOR	ELR10J 180 kΩ (#34, #37, #38, #41, #42, #45, #46, #47)
R135	7010002650	RESISTOR	R10J 560 Ω
R136	7010002790	RESISTOR	R10J 10 kΩ
R137	7010002910	RESISTOR	R10J 100 kΩ
R138	7010002910	RESISTOR	R10J 100 kΩ
R139	7010002950	RESISTOR	R10J 220 kΩ
R140	7010002850	RESISTOR	R10J 33 kΩ
R141	7010002060	RESISTOR	ELR10J 10 kΩ
R142	7010002210	RESISTOR	ELR10J 180 kΩ
R143	7010002060	RESISTOR	ELR10J 10 kΩ
R144	7010002060	RESISTOR	ELR10J 10 kΩ
R145	7010002060	RESISTOR	ELR10J 10 kΩ
R146	7010002060	RESISTOR	ELR10J 10 kΩ
R147	7010002440	RESISTOR	R10J 10 Ω
R148	7010001990	RESISTOR	ELR10J 2.7 kΩ

S.=Surface mount

## [MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R149	7010002060	RESISTOR	ELR10J 10 kΩ
R150	7010002680	RESISTOR	R10J 1 kΩ
R151	7010002910	RESISTOR	R10J 100 kΩ
R152	7010002040	RESISTOR	ELR10J 6.8 kΩ
R153	7010002300	RESISTOR	ELR10J 1 MΩ
R154	7010002260	RESISTOR	ELR10J 470 kΩ
R155	7010002020	RESISTOR	ELR10J 4.7 kΩ
R156	7010001930	RESISTOR	ELR10J 820 Ω
R157	7010002070	RESISTOR	ELR10J 12 kΩ
R158	7210000240	VARIABLE	RK094111000NA (10KB) [SQL]
R159	7010002030	RESISTOR	ELR10J 5.6 kΩ
R160	7010002210	RESISTOR	ELR10J 180 kΩ
R161	7010002240	RESISTOR	ELR10J 330 kΩ
R162	7010002300	RESISTOR	ELR10J 1 MΩ
R163	7010002180	RESISTOR	ELR10J 100 kΩ
R164	7010001940	RESISTOR	ELR10J 1 kΩ
R165	7010002200	RESISTOR	ELR10J 150 kΩ
R166	7010002290	RESISTOR	ELR10J 820 kΩ
R167	7010002260	RESISTOR	ELR10J 470 kΩ
R168	7010002300	RESISTOR	ELR10J 1 MΩ
R169	7210000250	VARIABLE	RK0941111003A (10KA) [PWR/VOL]
R170	7010002220	RESISTOR	ELR10J 220 kΩ
R171	7010002200	RESISTOR	ELR10J 150 kΩ
R172	7010002200	RESISTOR	ELR10J 150 kΩ
R173	7010002120	RESISTOR	ELR10J 33 kΩ
R174	7010001900	RESISTOR	ELR10J 470 Ω
	7010001970	RESISTOR	(#33, #36, #39, #40, #43, #44, #48, #49) ELR10J 1.8 kΩ (#34, #37, #38, #41, #42, #45, #46, #47)
R175	7010001950	RESISTOR	ELR10J 1.2 kΩ
R176	7010002140	RESISTOR	ELR10J 47 kΩ
R177	7010002910	RESISTOR	R10J 100 kΩ
R178	7010002990	RESISTOR	R10J 470 kΩ
R179	7010002850	RESISTOR	R10J 33 kΩ
R180	7010002860	RESISTOR	R10J 39 kΩ
R181	7010002190	RESISTOR	ELR10J 120 kΩ
R182	7010002000	RESISTOR	ELR10J 3.3 kΩ
R183	7010002790	RESISTOR	R10J 10 kΩ
R184	7010002150	RESISTOR	ELR10J 56 kΩ
C101	4010000500	CERAMIC	DD104 B 102K 50V
C102	4510001550	ELECTROLYTIC	16 RC3 10 μF
C103	4040000190	BARRIER	UAT 05X 103K
C104	4010000460	CERAMIC	DD104 B 471K 50V
C105	4010000460	CERAMIC	DD104 B 471K 50V
C106	4010000460	CERAMIC	DD104 B 471K 50V
C107	4010000460	CERAMIC	DD104 B 471K 50V
C108	4010000460	CERAMIC	DD104 B 471K 50V
C109	4550000320	TANTALUM	DN 1V 0R1M
C110	4010000460	CERAMIC	DD104 B 471K 50V
C111	4010000460	CERAMIC	DD104 B 471K 50V
C112	4010000500	CERAMIC	DD104 B 102K 50V
C113	4510001600	ELECTROLYTIC	50 RC3 0.22 μF
C114	4010000500	CERAMIC	DD104 B 102K 50V
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 (#34, #37, #38, #41, #42, #45, #46, #47)
	4010000340	CERAMIC	DD105 SL 121J 50V (#33, #36, #39, #40, #43, #44, #48, #49)
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	4510001550	ELECTROLYTIC	16 RC3 10 μF

## [MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C126	4010000320	CERAMIC	DD104 SL 820J 50V
C127	4550000320	TANTALUM	DN 1V 0R1M
C128	4560000020	CERAMIC	D33Y5V 1E 104Z21
C129	4010000220	CERAMIC	DD104 SL 330J 50V (#45)
	4010000300	CERAMIC	DD104 SL 680J 50V (#33, #34, #36~#44, #46~#49)
C130	4010000200	CERAMIC	DD104 SL 270J 50V (#45)
	4010000340	CERAMIC	DD105 SL 121J 50V (#33, #34, #36~#44, #46~#49)
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	4010000460	CERAMIC	DD104 B 471K 50V
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 (#34, #37, #38, #41, #42, #45, #46, #47)
	4040000110	BARRIER	UAT 04X 222K (#33, #36, #39, #40, #43, #44, #48, #49)
C153	4010000260	CERAMIC	DD104 SL 470J 50V
C154	4010000500	CERAMIC	DD104 B 102K 50V
C155	4010000120	CERAMIC	DD104 SL 100D 50V
C156	4010000500	CERAMIC	DD104 B 102K 50V
C157	4550000360	TANTALUM	DN 1V R47M
C158	4510001600	ELECTROLYTIC	50 RC3 0.22 μF
C159	4510001600	ELECTROLYTIC	50 RC3 0.22 μF
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	4510000450	ELECTROLYTIC	10 MS 220 μF
C172	4510001560	ELECTROLYTIC	25 RC3 4.7 μF (#33, #34, #36~#44, #46~#49)
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
S101	2260000070	SWITCH	SKHHAK013A [PTT]

S.=Surface mount

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
S102	2260000070	SWITCH	SKHHA013A [FUNC]
S103	2260000070	SWITCH	SKHHA013A [CALL]
S104	2230000290	SWITCH	SPPH22039A [LIGHT]
S105	2230000250	SWITCH	SPPH22014A [HI/LO] (#33, #34, #36, #37, #40~#46, #49)
BT101	3020000040	LITHIUM	BR2325-1HC
RL101	6330000560	RELAY	OUC-SH-114D
EP101	0910015894	PCB	B 1317D (MAIN)
EP102	0910007250	PCB	B 908 (MAIN)
EP103	0910012020	FPC	B 1045
EP104	6910000970	BEAD	DL 2OP 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	1150000400	IC	SC1046
IC202	1130000530	IC	μPD2834C
IC203	1110000970	IC	MB504P-G
Q201	1560000100	FET	2SK241-Y
Q202	1580000050	FET	3SK121-Y
Q203	1560000100	FET	2SK241-Y
Q204	1590000350	TRANSISTOR	RN1204
Q205	1560000080	FET	2SK192A-Y
Q206	1530000520	TRANSISTOR	2SC2026
Q207	1520000070	TRANSISTOR	2SB561C
Q208	1530000520	TRANSISTOR	2SC2026
Q209	1530000520	TRANSISTOR	2SC2026
Q210	1560000010	FET	2SK184-Y
Q211	1510000080	TRANSISTOR	2SA1048-GR
Q212	1530000110	TRANSISTOR	2SC2458-GR
Q213	1530001740	TRANSISTOR	2SC3327-B
Q214	1530000110	TRANSISTOR	2SC2458-GR
Q215	1520000080	TRANSISTOR	2SB909M R
Q216	1530000110	TRANSISTOR	2SC2458-GR
Q217	1510000080	TRANSISTOR	2SA1048-GR
Q218	1510000080	TRANSISTOR	2SA1048-GR
Q219	1510000080	TRANSISTOR	2SA1048-GR
Q220	1530000110	TRANSISTOR	2SC2458-GR
Q221	1520000080	TRANSISTOR	2SB909M R
D201	1710000160	DIODE	1SS133
D202	1720000040	VARICAP	1SV153
D203	1720000040	VARICAP	1SV153
D204	1720000040	VARICAP	1SV153
D205	1720000040	VARICAP	1SV153
D206	1720000040	VARICAP	1SV153
D207	1720000040	VARICAP	1SV153
D208	1720000040	VARICAP	1SV153
D209	1720000040	VARICAP	1SV153

[PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
D210	1720000040	VARICAP	1SV153
D211	1720000040	VARICAP	1SV153
D212	1710000180	DIODE	1SS216
D213	1720000050	VARICAP	1SV50E
D214	1720000050	VARICAP	1SV50E
D215	1710000180	DIODE	1SS216
D216	1710000180	DIODE	1SS216
D217	1790000250	DIODE	1SS97
D218	1710000180	DIODE	1SS216
D219	1790000250	DIODE	1SS97
D220	1710000180	DIODE	1SS216
D221	1730000470	ZENER	RD20E B1
D222	1710000430	DIODE	1SS130
D223	1720000050	VARICAP	1SV50E
D224	1730000360	ZENER	RD5.1JS B2
D225	1710000170	DIODE	1SS211
D226	1710000160	DIODE	1SS133
D227	1710000160	DIODE	1SS133
X201	6050002150	XTAL	CR-85 (#33, #36, #37, #39~ #41, #43~#45, #48, #49)
	6050002940	XTAL	CR-164 (#34, #38, #42, #46, #47)
FI201	2010000200	FILTER	21M15B3 (FL-42) (#34, #37, #38, #41, #42, #46, #47)
	2010000660	FILTER	23M15B2 (FL-79) (#45)
	2010000890	FILTER	23M 7B (FL-105) (#44)
	2010001020	FILTER	21M 7B2 (FL-125) (#33, #36, #39, #40, #43, #48, #49)
L201	6150001990	COIL	LS-263 (#33, #34, #36~#43, #46~#49)
L201	6150002000	COIL	LS-264 (#44, #45)
L202	6150002000	COIL	LS-264
L203	6150002000	COIL	LS-264
L204	6150002780	COIL	LS-295
L205	6150002780	COIL	LS-295
L206	6150002800	COIL	LS-296
L207	6150002780	COIL	LS-295
L208	6150002780	COIL	LS-295
L209	6180000680	COIL	LAL 02NA 4R7K
L210	6180000680	COIL	LAL 02NA 4R7K
L211	6130001800	COIL	LB-188
L212	6180000680	COIL	LAL 02NA 4R7K
L213	6110001570	COIL	LA-237
L214	6180000920	COIL	LAL 03NA 221K
L215	6180000920	COIL	LAL 03NA 221K
L216	6110001570	COIL	LA-237
L217	6110001570	COIL	LA-237
L218	6110001550	COIL	LA-235
L219	6180000850	COIL	LAL 03NA 4R7K
L220	6110001570	COIL	LA-237
L221	6110001550	COIL	LA-235
L222	6110001540	COIL	LA-234
L223	6170000290	COIL	LW-30
R201	7010001820	RESISTOR	ELR10J 100 Ω
R202	7010002060	RESISTOR	ELR10J 10 kΩ
R203	7010002060	RESISTOR	ELR10J 10 kΩ
R204	7010001960	RESISTOR	ELR10J 1.5 kΩ
R205	7010001820	RESISTOR	ELR10J 100 Ω
R206	7010001930	RESISTOR	ELR10J 820 Ω
R207	7010002140	RESISTOR	ELR10J 47 kΩ
R208	7010002180	RESISTOR	ELR10J 100 kΩ

S. = Surface mount

## [PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
R209	7010002200	RESISTOR ELR10J 150 kΩ
R210	7010002200	RESISTOR ELR10J 150 kΩ
R211	7010002200	RESISTOR ELR10J 150 kΩ
R212	7010001820	RESISTOR ELR10J 100 Ω
R213	7010002040	RESISTOR ELR10J 6.8 kΩ
R215	7010002200	RESISTOR ELR10J 150 kΩ
R216	7010002200	RESISTOR ELR10J 150 kΩ
R217	7010001820	RESISTOR ELR10J 100 Ω
R218	7010002050	RESISTOR ELR10J 8.2 kΩ
R219	7010002040	RESISTOR ELR10J 6.8 kΩ
R220	7010002070	RESISTOR ELR10J 12 kΩ
R221	7010002060	RESISTOR ELR10J 10 kΩ
R222	7010002220	RESISTOR ELR10J 220 kΩ
R223	7010001980	RESISTOR ELR10J 2.2 kΩ
R224	7010001820	RESISTOR ELR10J 100 Ω
R225	7010002020	RESISTOR ELR10J 4.7 kΩ
R226	7010002030	RESISTOR ELR10J 5.6 kΩ
R227	7010001860	RESISTOR ELR10J 220 Ω
R228	7010002060	RESISTOR ELR10J 10 kΩ
R229	7010002100	RESISTOR ELR10J 22 kΩ
R230	7010002020	RESISTOR ELR10J 4.7 kΩ
R231	7010002060	RESISTOR ELR10J 10 kΩ
R232	7010002030	RESISTOR ELR10J 5.6 kΩ
R233	7010002020	RESISTOR ELR10J 4.7 kΩ
R234	7010001860	RESISTOR ELR10J 220 Ω
R235	7010001910	RESISTOR ELR10J 560 Ω
R236	7010001950	RESISTOR ELR10J 1.2 kΩ
R237	7010001780	RESISTOR ELR10J 47 Ω
R238	7010002020	RESISTOR ELR10J 4.7 kΩ
R239	7010002020	RESISTOR ELR10J 4.7 kΩ
R240	7010001820	RESISTOR ELR10J 100 Ω
R241	7010001880	RESISTOR ELR10J 330 Ω
R242	7010002060	RESISTOR ELR10J 10 kΩ
R243	7010002190	RESISTOR ELR10J 120 kΩ
R244	7010001990	RESISTOR ELR10J 2.7 kΩ
R245	7010001980	RESISTOR ELR10J 2.2 kΩ (#45)
	7010002030	RESISTOR ELR10J 5.6 kΩ (#33, #34, #36~#44, #46~#49)
R246	7010002860	RESISTOR R10J 39 kΩ
R247	7010001820	RESISTOR ELR10J 100 Ω
R248	7010002060	RESISTOR ELR10J 10 kΩ
R249	7010002060	RESISTOR ELR10J 10 kΩ
R250	7010002180	RESISTOR ELR10J 100 kΩ
R251	7010002060	RESISTOR ELR10J 10 kΩ
R252	7010002180	RESISTOR ELR10J 100 kΩ
R253	7010002120	RESISTOR ELR10J 33 kΩ
R254	7010002060	RESISTOR ELR10J 10 kΩ
R255	7010001940	RESISTOR ELR10J 1 kΩ
R256	7010001820	RESISTOR ELR10J 100 Ω
R257	7010001980	RESISTOR ELR10J 2.2 kΩ
R258	7010002160	RESISTOR ELR10J 68 kΩ
R259	7010002920	RESISTOR R10J 120 kΩ
R260	7010002040	RESISTOR ELR10J 6.8 kΩ
R261	7510000020	THERMISTOR 33D28
R262	7010002060	RESISTOR ELR10J 10 kΩ
R263	7010002060	RESISTOR ELR10J 10 kΩ
R264	7010002080	RESISTOR ELR10J 15 kΩ
R265	7510000020	THERMISTOR 33D28
R266	7010002020	RESISTOR ELR10J 4.7 kΩ
R267	7010002270	RESISTOR ELR10J 560 kΩ
R268	7010002040	RESISTOR ELR10J 6.8 kΩ
R269	7010002040	RESISTOR ELR10J 6.8 kΩ
R270	7310000560	TRIMMER RH0521CJ4J06A (223)
R271	7010001980	RESISTOR ELR10J 2.2 kΩ
R272	7010001980	RESISTOR ELR10J 2.2 kΩ
R273	7310000550	TRIMMER RH0521C14J08A (103)
R274	7010002110	RESISTOR ELR10J 27 kΩ
R275	7010002170	RESISTOR ELR10J 82 kΩ
R276	7010002100	RESISTOR ELR10J 22 kΩ
R277	7010002140	RESISTOR ELR10J 47 kΩ
R278	7010002300	RESISTOR ELR10J 1 MΩ
R279	7010001750	RESISTOR ELR10J 27 Ω
R280	7010002030	RESISTOR ELR10J 5.6 kΩ
R281	7010002140	RESISTOR ELR10J 47 kΩ

## [PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
R282	7010002140	RESISTOR ELR10J 47 kΩ
R283	7010002210	RESISTOR ELR10J 180 kΩ
R285	7010001730	RESISTOR ELR10J 18 Ω
R286	7010001820	RESISTOR ELR10J 100 Ω
R287	7010001900	RESISTOR ELR10J 470 Ω
R288	7010003160	RESISTOR ELR20J 10 Ω
R289	7010003160	RESISTOR ELR20J 10 Ω
C201	4010000500	CERAMIC DD104 B 102K 50V
C202	4010000500	CERAMIC DD104 B 102K 50V
C203	4040000190	BARRIER UAT 05X 103K
C205	4010000260	CERAMIC DD104 SL 470J 50V
C206	4010000070	CERAMIC DD104 SL 050C 50V (#34, #37, #38, #41, #42, #45, #46, #47)
	4010000150	CERAMIC DD104 SL 150J 50V (#33, #36, #39, #40, #43, #48, #49)
	4010000160	CERAMIC DD104 SL 180J 50V (#44)
C207	4010000500	CERAMIC DD104 B 102K 50V
C208	4040000190	BARRIER UAT 05X 103K
C209	4010000260	CERAMIC DD104 SL 470J 50V
C210	4010000260	CERAMIC DD104 SL 470J 50V
C211	4010000080	CERAMIC DD104 SL 060D 50V
C212	4010000040	CERAMIC DD104 SL 020C 50V
C213	4010000500	CERAMIC DD104 B 102K 50V
C214	40400000470	BARRIER RAU 04AK R35C
C215	4010000040	CERAMIC DD104 SL 020C 50V
C216	4010000500	CERAMIC DD104 B 102K 50V
C217	4010000010	CERAMIC DD104 SL 0R5C 50V
C218	4010000040	CERAMIC DD104 SL 020C 50V
C219	4010000500	CERAMIC DD104 B 102K 50V
C220	4010000500	CERAMIC DD104 B 102K 50V
C221	4010000010	CERAMIC DD104 SL 0R5C 50V
C222	4010000500	CERAMIC DD104 B 102K 50V
C223	4010000500	CERAMIC DD104 B 102K 50V
C224	4010000010	CERAMIC DD104 SL 0R5C 50V
C225	4010000050	CERAMIC DD104 SL 030C 50V
C226	4010000500	CERAMIC DD104 B 102K 50V
C227	4010000500	CERAMIC DD104 B 102K 50V
C228	4510001290	ELECTROLYTIC 50 RC2 2.2 μF
C229	4010000500	CERAMIC DD104 B 102K 50V
C230	4510002270	ELECTROLYTIC 6.3 RC2 47 μF (D=5.0)
C231	4010000500	CERAMIC DD104 B 102K 50V
C232	4510001550	ELECTROLYTIC 16 RC3 10 μF
C233	4040000070	BARRIER UAT 04X 102K
C234	4010000670	CERAMIC DD104 CH 070D 50V
C235	4010000500	CERAMIC DD104 B 102K 50V
C236	4010000500	CERAMIC DD104 B 102K 50V
C237	4010000020	CERAMIC DD104 SL 010C 50V
C238	4010000500	CERAMIC DD104 B 102K 50V
C239	4010000500	CERAMIC DD104 B 102K 50V
C240	4010000460	CERAMIC DD104 B 471K 50V
C241	4010000180	CERAMIC DD104 SL 220J 50V
C242	4560000020	CERAMIC D33Y5V 1E 104Z21
C243	4010000500	CERAMIC DD104 B 102K 50V
C244	4010000040	CERAMIC DD104 SL 020C 50V
C245	4010000500	CERAMIC DD104 B 102K 50V
C246	4010000460	CERAMIC DD104 B 471K 50V
C247	4010000200	CERAMIC DD104 SL 270J 50V
C248	4010000500	CERAMIC DD104 B 102K 50V
C249	4010000500	CERAMIC DD104 B 102K 50V
C250	4010000500	CERAMIC DD104 B 102K 50V
C251	4010000120	CERAMIC DD104 SL 100D 50V
C252	4010000500	CERAMIC DD104 B 102K 50V
C253	4010000500	CERAMIC DD104 B 102K 50V
C254	4010000040	CERAMIC DD104 SL 020C 50V
C255	4040000480	BARRIER RAU 04AK R75C
C256	4010000120	CERAMIC DD104 SL 100D 50V
C257	4010000120	CERAMIC DD104 SL 100D 50V
C258	4010000040	CERAMIC DD104 SL 020C 50V
C259	4040000480	BARRIER RAU 04AK R75C
C260	4010000460	CERAMIC DD104 B 471K 50V
C261	4010000500	CERAMIC DD104 B 102K 50V

S.=Surface mount

## [PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C262	4010000150	CERAMIC	DD104 SL 150J 50V
C263	4010000040	CERAMIC	DD104 SL 020C 50V
C264	4010000200	CERAMIC	DD104 SL 270J 50V
C265	4010000100	CERAMIC	DD104 SL 080D 50V
C266	4010000140	CERAMIC	DD104 SL 120J 50V
C267	4010000150	CERAMIC	DD104 SL 150J 50V
C268	4010000150	CERAMIC	DD104 SL 150J 50V
C269	4010000340	CERAMIC	DD105 SL 121J 50V
C270	4010000460	CERAMIC	DD104 B 471K 50V
C271	4010000500	CERAMIC	DD104 B 102K 50V
C272	4010000500	CERAMIC	DD104 B 102K 50V
C273	4510002270	ELECTROLYTIC	6.3 RC2 47 $\mu$ F (D=5.0)
C274	4510002270	ELECTROLYTIC	6.3 RC2 47 $\mu$ F (D=5.0)
C275	4550000320	TANTALUM	DN 1V 0R1M
C276	4510001250	ELECTROLYTIC	50 RC2 0.1 $\mu$ F
C277	4550000310	TANTALUM	DN 1V 2R2M
C278	4510002290	ELECTROLYTIC	35 RC2 10 $\mu$ F
C279	4010000330	CERAMIC	DD105 SL 101J 50V
C280	4510002290	ELECTROLYTIC	35 RC2 10 $\mu$ F
C281	4010000500	CERAMIC	DD104 B 102K 50V
C282	4010000040	CERAMIC	DD104 SL 020C 50V
C283	4010000120	CERAMIC	DD104 SL 100D 50V
C284	4560000020	CERAMIC	D33Y5V 1E 104Z21
C285	4560000060	CERAMIC	D33Y5V 1H 104Z21
C286	4010000500	CERAMIC	DD104 B 102K 50V
C287	4040000190	BARRIER	UAT 05X 103K
C288	4560000020	CERAMIC	D33Y5V 1E 104Z21
C289	4010000330	CERAMIC	DD105 SL 101J 50V
C290	4010000380	CERAMIC	DD107 SL 221J 50V
C291	4010000820	CERAMIC	DD105 CH 330J 50V
C292	4610000380	TRIMMER	ECR-GA020 E30
C293	4010000640	CERAMIC	DD104 CH 040C 50V
C294	4010000500	CERAMIC	DD104 B 102K 50V
C296	4550000340	TANTALUM	DN 1C 100M
C297	4510002270	ELECTROLYTIC	6.3 RC2 47 $\mu$ F (D=5.0)
C298	4010000500	CERAMIC	DD104 B 102K 50V
C299	4550002310	TANTALUM	DN 1E 1R5M
C300	4010000500	CERAMIC	DD104 B 102K 50V
C301	4010000500	CERAMIC	DD104 B 102K 50V
C302	4010000500	CERAMIC	DD104 B 102K 50V
C303	4510001220	ELECTROLYTIC	16 RC2 10 $\mu$ F
C304	4510001220	ELECTROLYTIC	16 RC2 10 $\mu$ F
C305	4010000460	CERAMIC	DD104 B 471K 50V
C306	4010000460	CERAMIC	DD104 B 471K 50V
C307	4010000500	CERAMIC	DD104 B 102K 50V
C308	4010000460	CERAMIC	DD104 B 471K 50V
C309	4010000500	CERAMIC	DD104 B 102K 50V
C310	4010000500	CERAMIC	DD104 B 102K 50V
C311	4010000500	CERAMIC	DD104 B 102K 50V
C312	4010000500	CERAMIC	DD104 B 102K 50V
C313	4010000460	CERAMIC	DD104 B 471K 50V
C314	4010000500	CERAMIC	DD104 B 102K 50V
C315	4010000120	CERAMIC	DD104 SL 100D 50V
C316	4010000460	CERAMIC	DD104 B 471K 50V
C317	4010000220	CERAMIC	DD104 SL 330J 50V (#44, #45)
C318	4010000150	CERAMIC	DD104 SL 150J 50V (#44, #45)
J201	6510004920	CONNECTOR	TNC-102-N1-W1-L1 [ANT]
J202	6450000130	CONNECTOR	HSJ1102-01-540 [EXT MIC]
J203	6450000110	CONNECTOR	HSJ0836-01-010 [EXT SP]
J204	6450000220	CONNECTOR	HEC0747-01-010 [EXT DC]
J205	6510004540	CONNECTOR	171255-1
J206	6510004540	CONNECTOR	171255-1
W204	7120000010	JUMPER	JPW 02A

## [PLL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
EP201	0910015903	PCB	B 1318C (PLL)
EP210	0910008191	FPC	B 1050A
EP211	0910012080	FPC	B 1044

## [DISPLAY UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC601	1130000790	S. IC	$\mu$ PD7225G00
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 k $\Omega$ (184)
R602	7030000500	S. RESISTOR	MCR10EZHZ 10 k $\Omega$ (103)
R603	7030000500	S. RESISTOR	MCR10EZHZ 10 k $\Omega$ (103)
R604	7030000500	S. RESISTOR	MCR10EZHZ 10 k $\Omega$ (103)
C601	4030001090	S. CERAMIC	GRM40 B 471K 50PT (#31~#33, #35, #40, #41, #44~#49)
	4030004710	S. CERAMIC	C2012 JB 1H 471K-T-A (#34, #36~#39, #42, #43)
C602	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

S. = Surface mount

## [LOGIC-A UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC701	1140000540	S. IC	$\mu$ PD78C06AG-570-12
IC702	1130003800	S. IC	MBM27C256A-25-TV-G
IC703	1130002560	S. IC	$\mu$ PD446G
IC704	1130000950	IC	S-7116A (#33, #34, #36~#44, #46~#49)
IC705	1140000640	S. IC	SC1084 (#34, #36~#40, #42, #46~#49)
	1140000840	S. IC	SC1093 (#33, #41, #43~#45)
IC706	1140000620	S. IC	FX102LG
IC707	1130003610	S. IC	TC4SU69F (TE85R)
IC708	1130003610	S. IC	TC4SU69F (TE85R)
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)
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	1710000600	DIODE	1SS254
D708	1750000010	S. DIODE	1SS181 (TE85R)
D710	1790000450	S. DIODE	MA862 (TX)
X701	6050003450	XTAL	RF-4A3 FAG NKD (4.480000M)
X702	6050003120	XTAL	RF-4A3 FAA NKD (3.579545M)
L701	6180002250	COIL	LAL 03NA 331K
R701	7030000550	S. RESISTOR	MCR10EZHZ 27 k $\Omega$ (273)
R702	7030000540	S. RESISTOR	MCR10EZHZ 22 k $\Omega$ (223)
R703	7030000540	S. RESISTOR	MCR10EZHZ 22 k $\Omega$ (223)
R704	7030000670	S. RESISTOR	MCR10EZHZ 270 k $\Omega$ (274)
R705	7030000380	S. RESISTOR	MCR10EZHZ 1 k $\Omega$ (102)
R706	7030000660	S. RESISTOR	MCR10EZHZ 220 k $\Omega$ (224) (#45)
	7030000970	S. RESISTOR	MCR10EZHZ 2.2 M $\Omega$ (225) (#33, #34, #36~#44, #46~#49)
R707	7030000580	S. RESISTOR	MCR10EZHZ 47 k $\Omega$ (473) (#33, #34, #36~#44, #46~#49)
R708	7030000510	S. RESISTOR	MCR10EZHZ 12 k $\Omega$ (123)
R709	7030000510	S. RESISTOR	MCR10EZHZ 12 k $\Omega$ (123)
R710	7030000510	S. RESISTOR	MCR10EZHZ 12 k $\Omega$ (123)
R711	7030000510	S. RESISTOR	MCR10EZHZ 12 k $\Omega$ (123)
R712	7030000580	S. RESISTOR	MCR10EZHZ 47 k $\Omega$ (473)
R713	7030000620	S. RESISTOR	MCR10EZHZ 100 k $\Omega$ (104)
R714	7030000620	S. RESISTOR	MCR10EZHZ 100 k $\Omega$ (104)
R715	7030000620	S. RESISTOR	MCR10EZHZ 100 k $\Omega$ (104)
R716	7030000580	S. RESISTOR	MCR10EZHZ 47 k $\Omega$ (473)
R717	7030000580	S. RESISTOR	MCR10EZHZ 47 k $\Omega$ (473)
R718	7030000580	S. RESISTOR	MCR10EZHZ 47 k $\Omega$ (473)
R719	7030000580	S. RESISTOR	MCR10EZHZ 47 k $\Omega$ (473)
R720	7030000580	S. RESISTOR	MCR10EZHZ 47 k $\Omega$ (473)
R721	7030000500	S. RESISTOR	MCR10EZHZ 10 k $\Omega$ (103)
R722	7030000460	S. RESISTOR	MCR10EZHZ 4.7 k $\Omega$ (472)
R723	7030000500	S. RESISTOR	MCR10EZHZ 10 k $\Omega$ (103)
R724	7030000520	S. RESISTOR	MCR10EZHZ 15 k $\Omega$ (153)
R725	7030000460	S. RESISTOR	MCR10EZHZ 4.7 k $\Omega$ (472)
R726	7030000430	S. RESISTOR	MCR10EZHZ 2.7 k $\Omega$ (272)

## [LOGIC-A UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R727	7030000500	S. RESISTOR	MCR10EZHZ 10 k $\Omega$ (103)
R728	7030000500	S. RESISTOR	MCR10EZHZ 10 k $\Omega$ (103)
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
C706	4550000400	TANTALUM	DN 1C 2R2M
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
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	4010000180	CERAMIC	DD104 SL 220J 50V
J701	6910003140	CONNECTOR	IMSA-9202B-1-02T
J704	7030000010	S. JUMPER	MCR10EZHZ JPW (000)
P701	6910003120	CONNECTOR	IMSA-9206H-T
EP701	0910016808	PCB	B 1580H (LOGIC-A)

S.=Surface mount

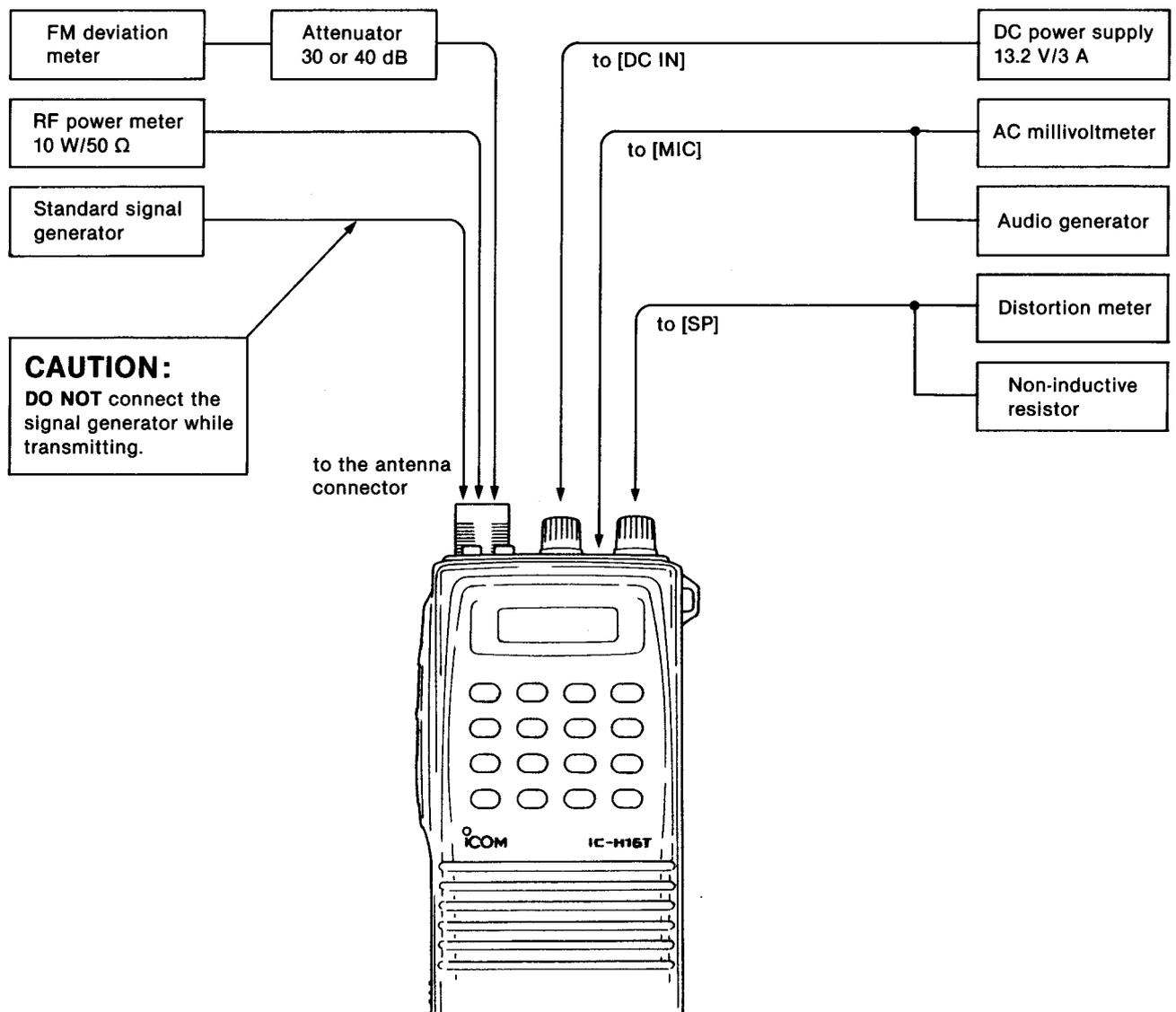
## SECTION 7 ADJUSTMENT PROCEDURES

### 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 : 120~180 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 : 0.1~180 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 : 0.1~180 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 : 180 MHz Measuring range : 0~±5 kHz
		Digital multimeter or oscilloscope	Input impedance : 1 MΩ/DC or better

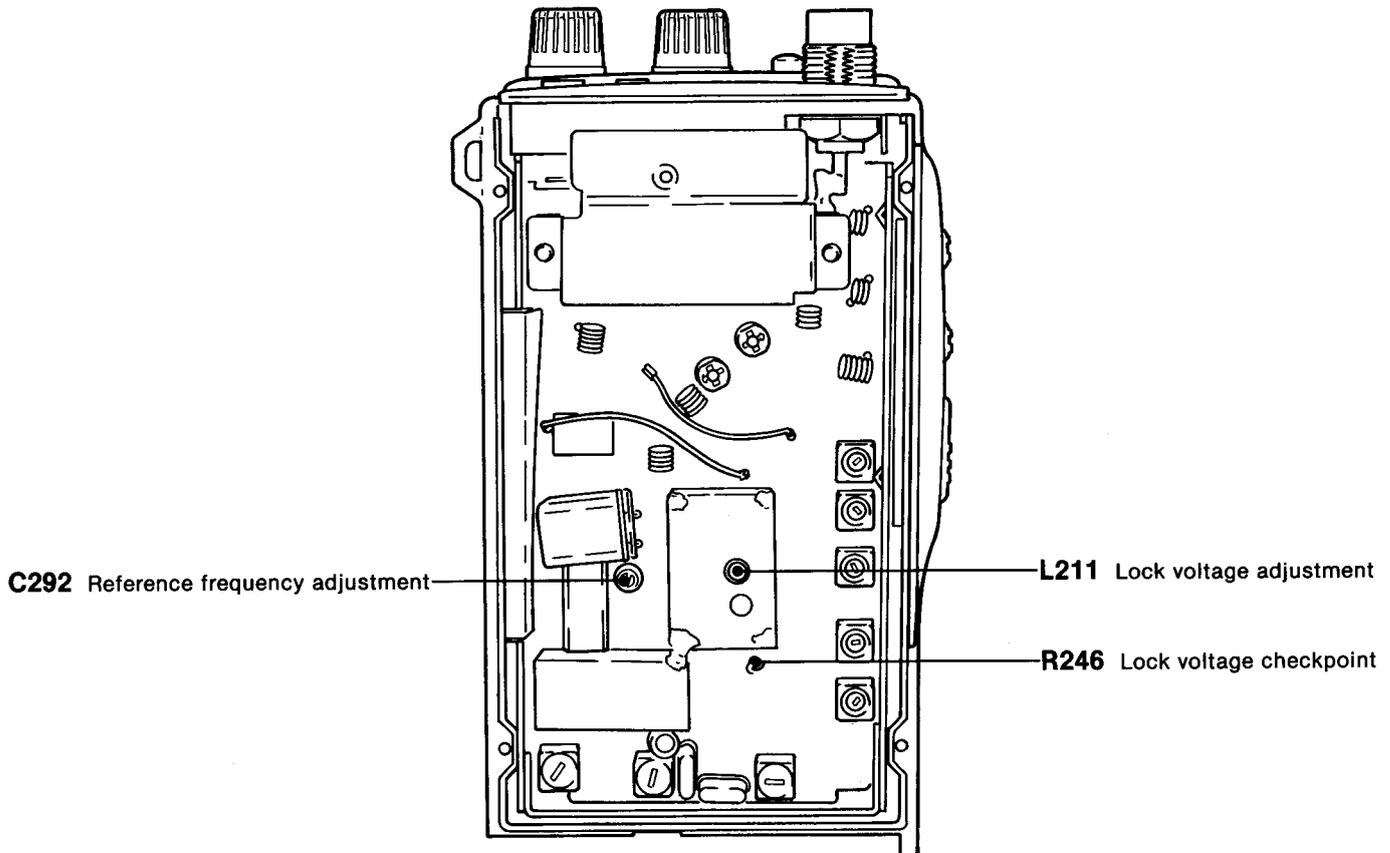
#### ■ CONNECTION



## 7-2 PLL ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
LOCK VOLTAGE	1 • Operating frequency: 173.900 MHz • Receiving	PLL	Connect the digital multimeter or oscilloscope to R246.	15.0 V	PLL	L211
	2 • Transmitting			Less than 16.0 V		Verify
	3 • Operating frequency: 146.000 MHz • Receiving			Higher than 3.8 V		Verify
REFERENCE FREQUENCY	1 • Operating frequency: 146.000 MHz • Connect the RF power meter or a 50 Ω dummy load to the antenna connector. • Transmitting	Top panel	Loosely couple the frequency counter to the antenna connector.	146.000 MHz	PLL	C292

### • PLL UNIT

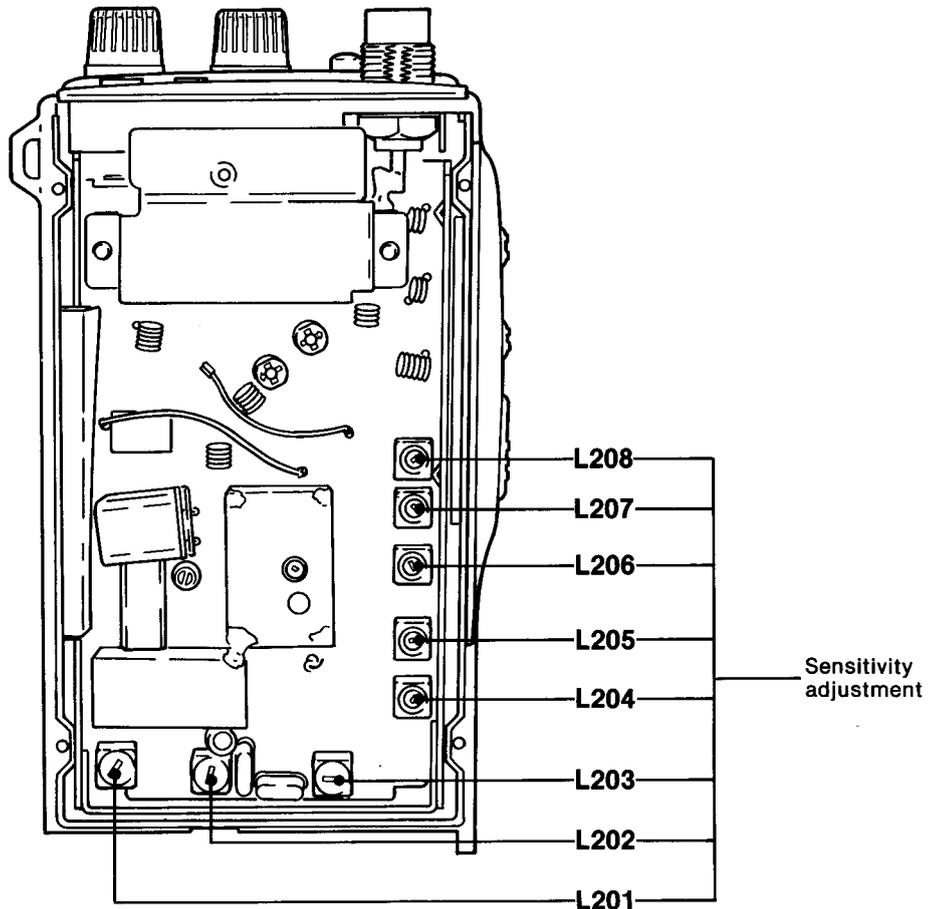


### 7-3 RECEIVER ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
SENSITIVITY	<p><b>CAUTION:</b> 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.</p>						
	1	<ul style="list-style-type: none"> <li>Operating frequency: Center of the frequency range.</li> <li>Connect the SSG to the antenna connector and set as:                             <ul style="list-style-type: none"> <li>Level : 0.35 <math>\mu</math>V* (-116 dBm)</li> <li>Modulation: 1 kHz</li> <li>Deviation : <math>\pm</math>3.5 kHz                                     <ul style="list-style-type: none"> <li>(#34, #37, #38, #41, #45, #46, #47)</li> <li><math>\pm</math>2.4 kHz (#42)</li> <li><math>\pm</math>1.75 kHz</li> <li>(#33, #36, #39, #40, #43, #44, #48, #49)</li> </ul> </li> </ul> </li> <li>Receiving</li> </ul>	Top panel	Connect the distortion meter to the [EXT SP] jack with an 8 $\Omega$ load.	Minimum distortion level	PLL	Adjust in sequence L201, L202, L203, L204, L205, L206, L207, L208
SQUELCH SENSITIVITY	1	<ul style="list-style-type: none"> <li>Select any channel.</li> <li>Apply no signal to the antenna connector.</li> <li>Receiving</li> </ul>	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.

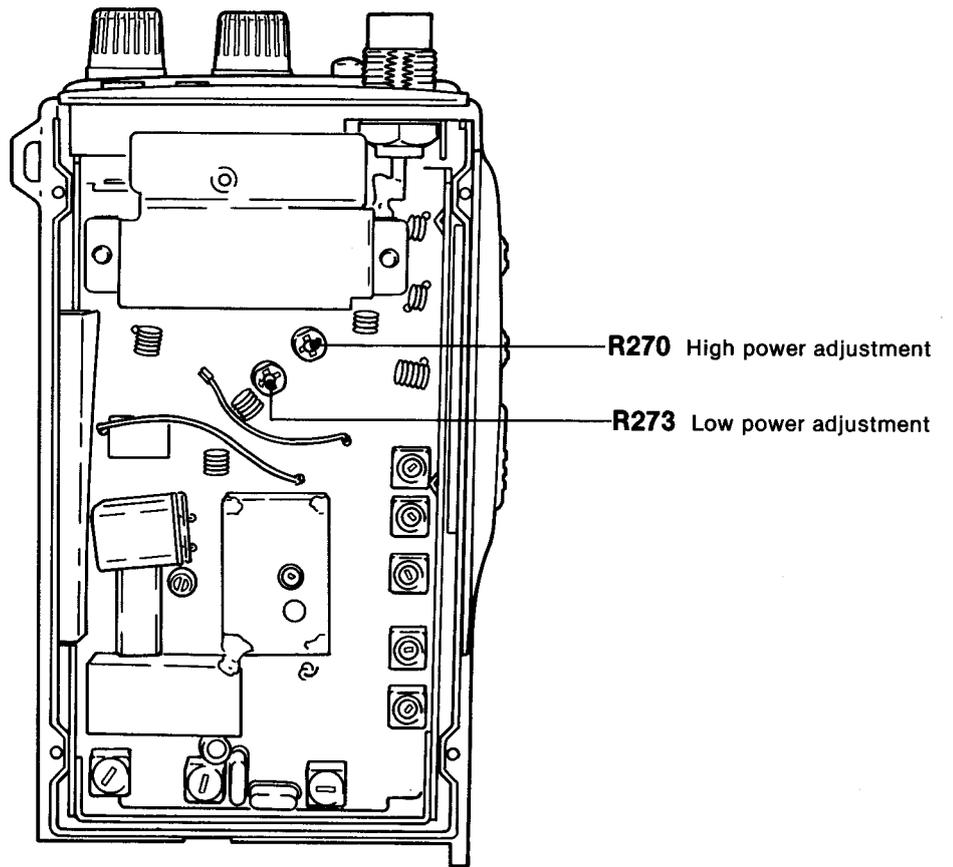
• PLL UNIT



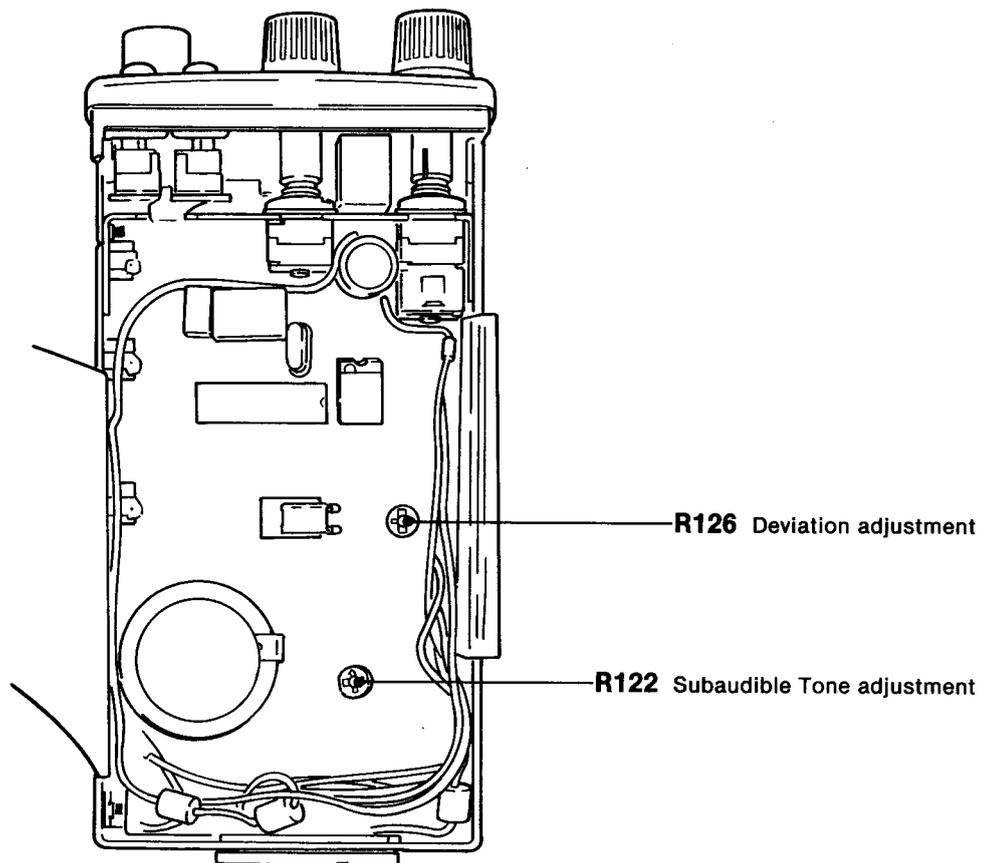
## 7-4 TRANSMITTER ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
OUTPUT POWER	1	<ul style="list-style-type: none"> <li>Operating frequency: 160.000 MHz</li> <li>Output power : HIGH</li> <li>Transmitting</li> </ul>	Top panel	Connect the RF power meter to the antenna connector.	5.0 W	PLL	R270
	2	<ul style="list-style-type: none"> <li>Output power : LOW</li> </ul>					0.75 W
DEVIATION	1	<ul style="list-style-type: none"> <li>Operating frequency: 173.900 MHz</li> <li>Output power : HIGH</li> <li>Connect the audio generator to the microphone connector with an AC millivoltmeter and set as: Level : 170 mV Frequency : 1.0 kHz</li> <li>Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2</li> <li>Transmitting</li> </ul>	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	$\pm 4.4$ kHz ( #34, #37, #38, #41, #45, #46, #47 ) $\pm 3.6$ kHz (#42) $\pm 2.3$ kHz ( #33, #36, #39, #40, #43, #44, #48, #49 )	MAIN	R126
	2	<ul style="list-style-type: none"> <li>Connect the audio generator to the microphone connector with an AC millivoltmeter and set as: Level : 17 mV Frequency : 1.0 kHz</li> </ul>					$\pm 3.0 \sim \pm 4.0$ kHz ( #34, #37, #38, #41, #45, #46, #47 ) $\pm 2.4 \sim \pm 3.2$ kHz (#42) $\pm 1.5 \sim \pm 2.0$ kHz ( #33, #36, #39, #40, #43, #44, #48, #49 )
SUBAUDIBLE TONE (except #45)	1	<ul style="list-style-type: none"> <li>Operating frequency: 173.900 MHz</li> <li>Tone number : 01</li> <li>Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2</li> <li>Apply no signal to the microphone connector.</li> <li>Transmitting</li> </ul>	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	$\pm 0.75$ kHz ( #34, #37, #38, #41, #46, #47 ) $\pm 0.5$ kHz (#42) $\pm 0.3$ kHz ( #33, #36, #39, #40, #43, #44, #48, #49 )	MAIN	R122
	2	<ul style="list-style-type: none"> <li>Tone number : 38</li> </ul>					$\pm 0.5 \sim \pm 1.0$ kHz ( #34, #37, #38, #41, #46, #47 ) $\pm 0.3 \sim \pm 0.7$ kHz (#42) $\pm 0.25 \sim \pm 0.5$ kHz ( #33, #36, #39, #40, #43, #44, #48, #49 )

• PLL UNIT

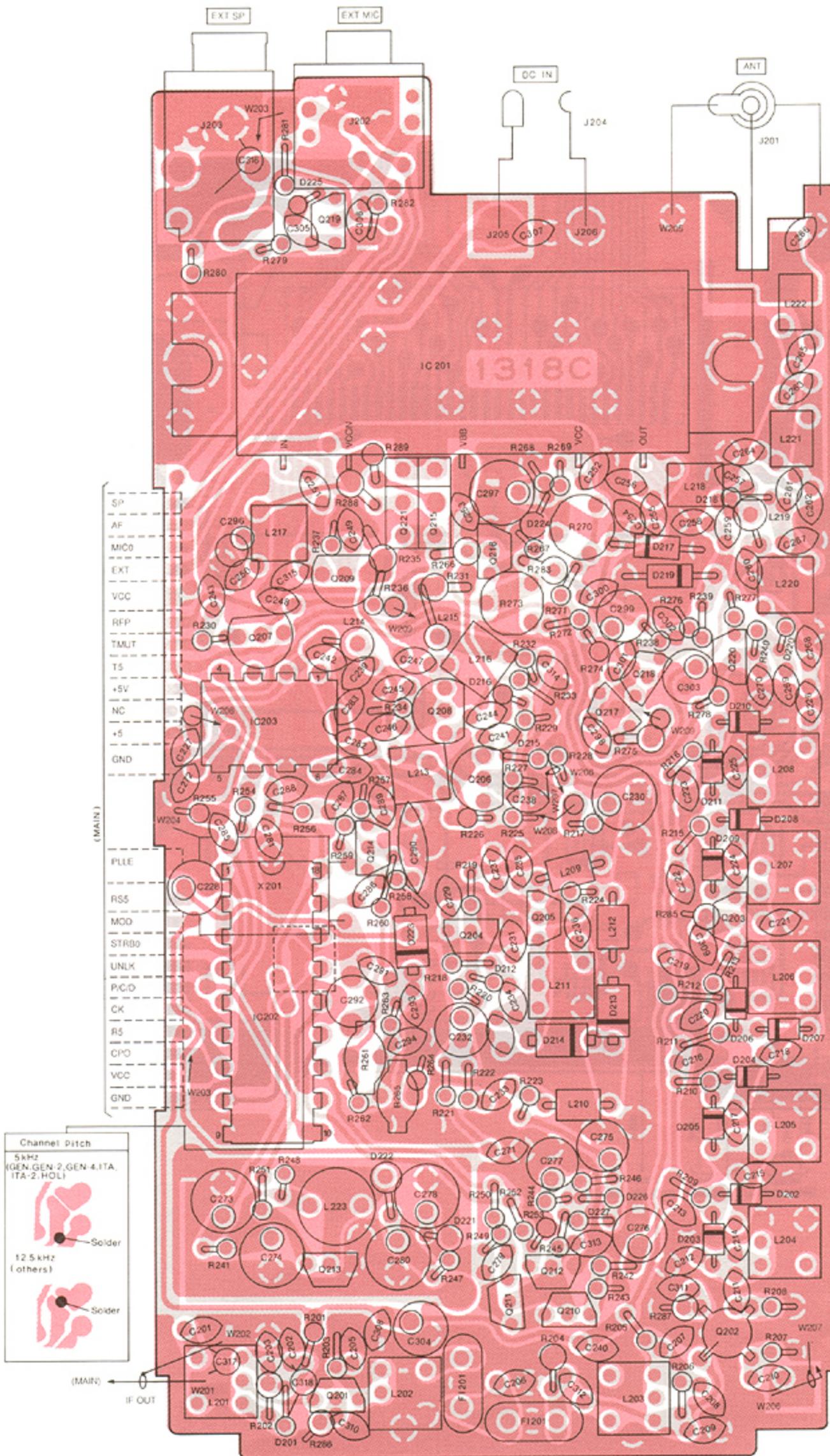


• MAIN UNIT

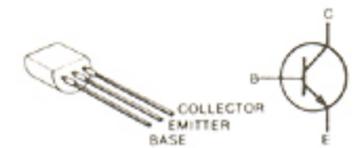




# 8-2 PLL UNIT

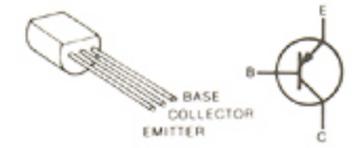


**2SC2026**



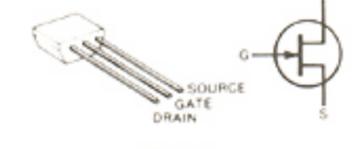
Q206, Q208, Q209

**2SB561C**



Q207

**2SK184 Y**



Q210

**2SA1048 GR**



Q211, Q217, Q218, Q219

**2SC2458 GR**



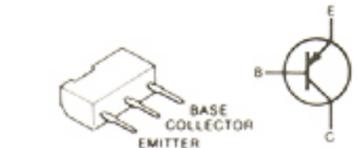
Q212, Q214, Q216, Q220

**2SC3327 B**



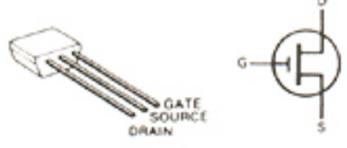
Q213

**2SB909M R**



Q215, Q221

**2SK241 Y**



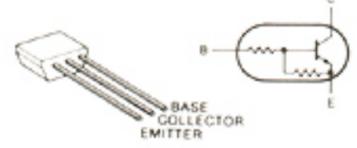
Q201, Q203

**3SK121 Y**



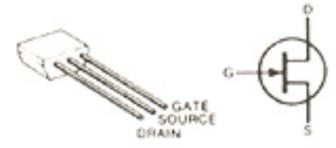
Q202

**RN1204**



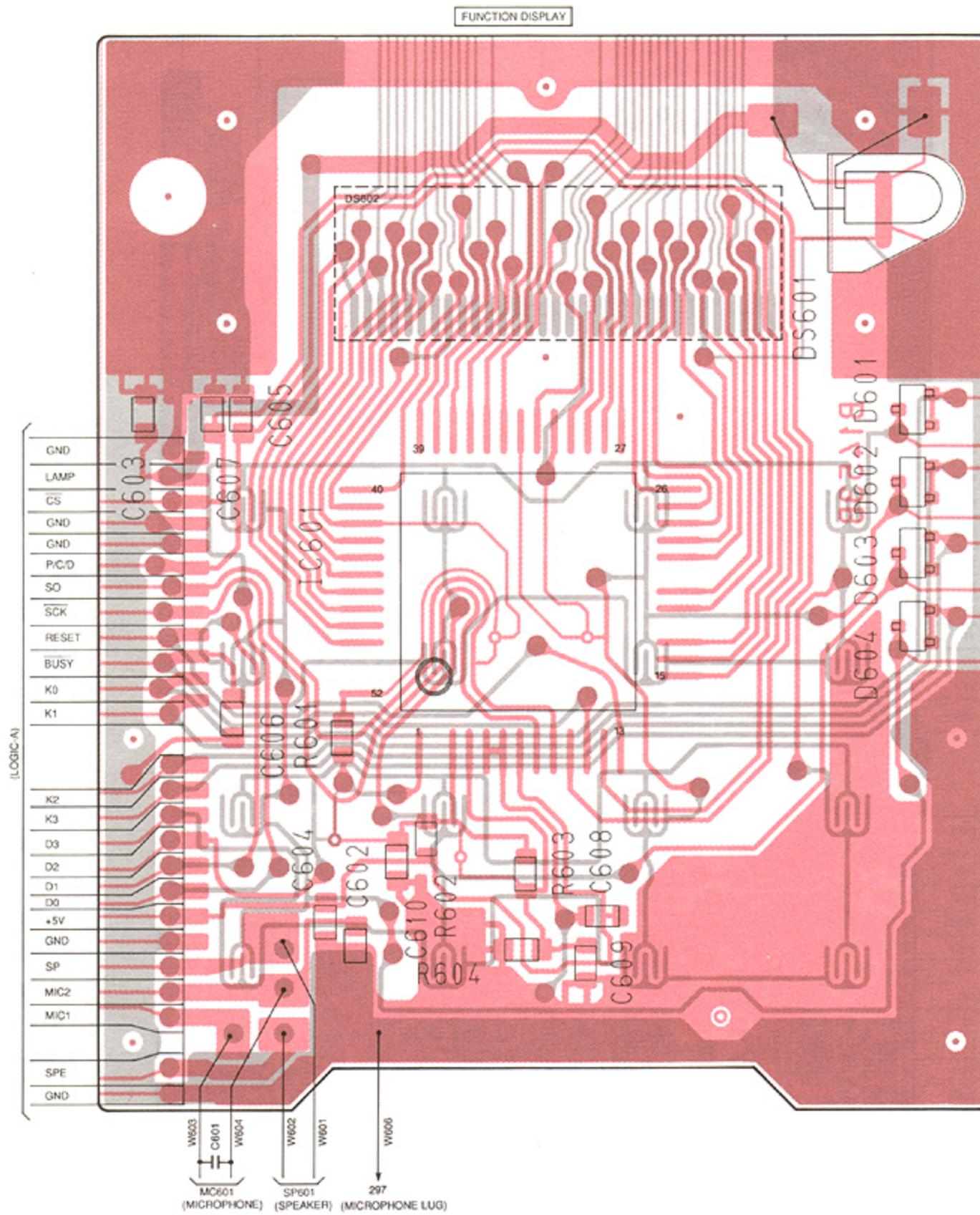
Q204

**2SK192A Y**



Q205

### 8-3 DISPLAY UNIT



**1SS193**  
(Symbol: F3)

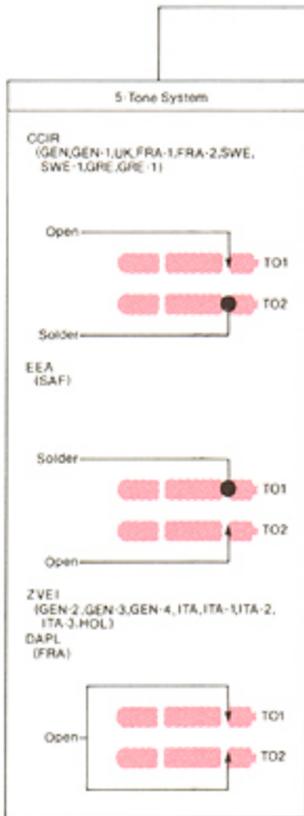
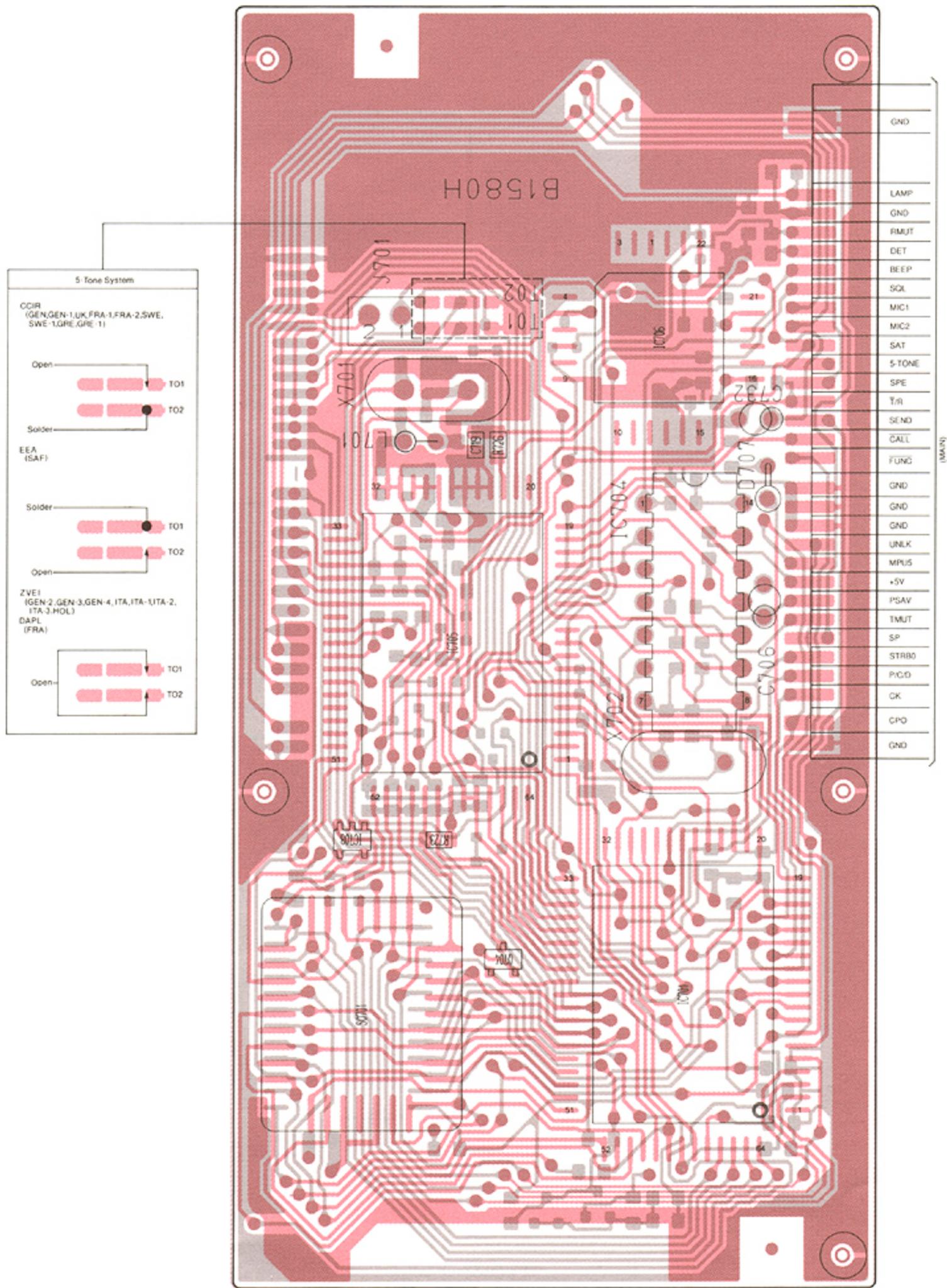


D601, D602, D603,  
D604

# 8-4 LOGIC-A UNIT

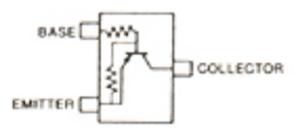
## • LOGIC-A UNIT

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



- GND
- LAMP
- GND
- RMUT
- DET
- BEEP
- SQL
- MIC1
- MIC2
- SAT
- S-TONE
- SPE
- T/R
- SEND
- CALL
- FUNG
- (MAIN)
- GND
- GND
- GND
- UNLK
- MPUS
- +5V
- PSAV
- TMUT
- SP
- STRBO
- P/C/D
- CK
- CPO
- GND

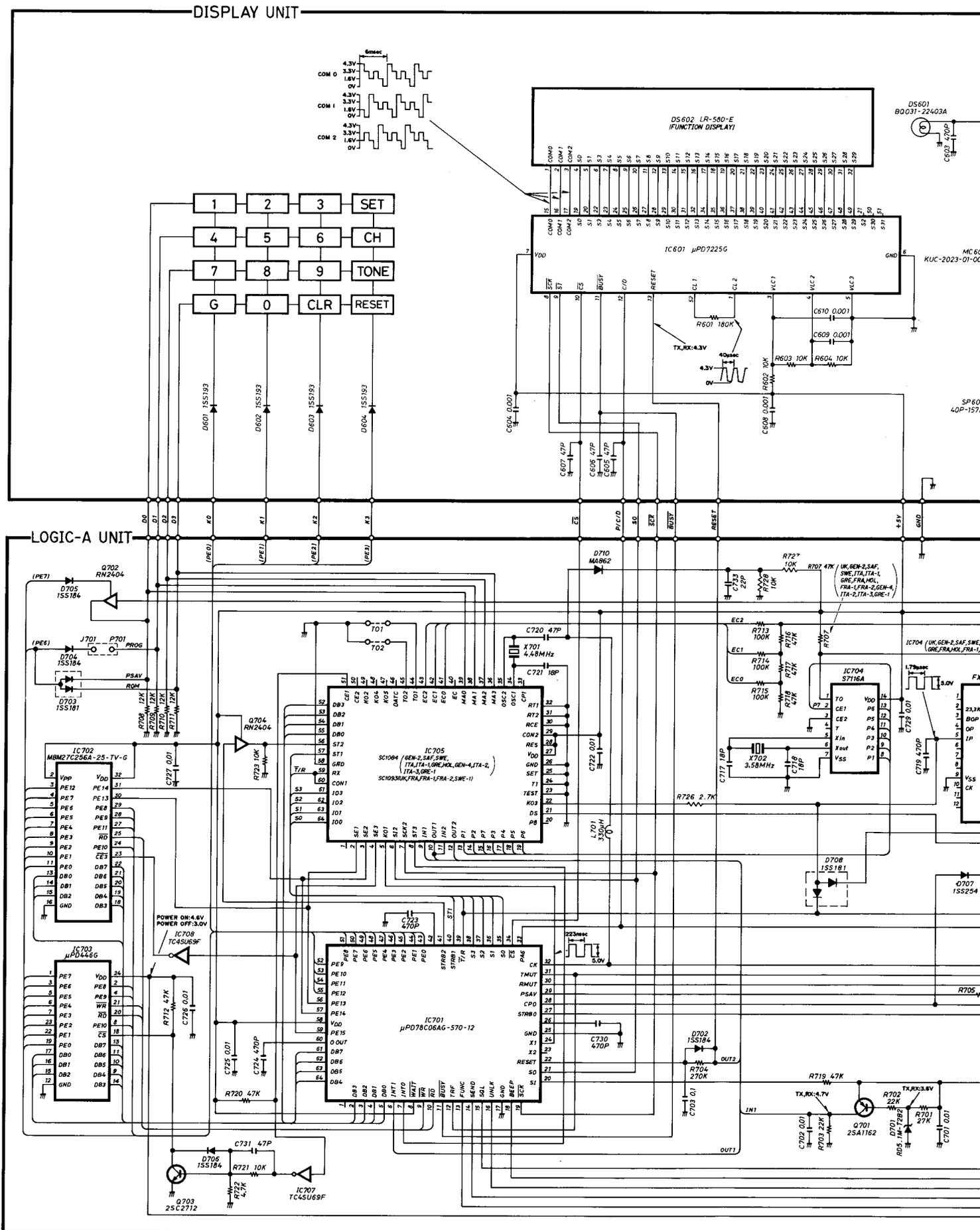
**RN2404**  
(Symbol: YD)



Q704



# SECTION 9 VOLTAGE DIAGRAM







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