



SERVICE MANUAL

VHF MARINE TRANSCEIVER

IC-M304

S-14311XZ-C1
Dec. 2006

Icom Inc.

INTRODUCTION

This service manual describes the latest service information for the **IC-M304** VHF MARINE TRANSCEIVER at the time of publication.

MODEL	VERSION	SYMBOL	COLOR
IC-M304	U.S.A.	[USA]	Black
		[USA-01]	Super White
		[USA-02]	Gray

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

CAUTION

NEVER connect the transceiver to an AC outlet or to a DC power supply that uses more than 15 V. This will ruin the transceiver.

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>

1110003491	S.IC	TA31136FNG	IC-M304	MAIN UNIT	5 pieces
8820001210	Screw	2438 screw	IC-M304	CHASSIS	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 50 dB to 60 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.

CONTENTS

SECTION 1 SPECIFICATIONS

SECTION 2 INSIDE VIEWS

SECTION 3 DISASSEMBLY INSTRUCTIONS

SECTION 4 CIRCUIT DESCRIPITON

4-1	RECEIVER CIRCUITS.....	4-1
4-2	TRANSMITTER CIRCUITS.....	4-2
4-3	PLL CIRCUITS	4-3
4-4	DSC CIRCUITS.....	4-4
4-5	LOGIC CIRCUITS	4-4
4-6	POWER SUPPLY CIRCUITS.....	4-4
4-7	PORT ALLOCATIONS.....	4-5

SECTION 5 ADJUSTMENT PROCEDURES

5-1	PREPARATION	5-1
5-2	FREQUENCY ADJUSTMENT.....	5-2
5-3	TRANSMIT ADJUSTMENT.....	5-3
5-4	RECEIVE ADJUSTMENT	5-4

SECTION 6 PARTS LIST

SECTION 7 MECHANICAL PARTS AND DISASSEMBLY

SECTION 8 SEMICONDUCTOR INFORMATION

SECTION 9 BOARD LAYOUTS

SECTION 10 BLOCK DIAGRAM

SECTION 11 VOLTAGE DIAGRAM

11-1	LOGIC UNIT (Incl. SQL and VR UNITS)	11-1
11-2	MAIN UNIT	11-2

SECTION 12 HM-164B/SW/G

■ GENERAL

• Frequency coverage	: TX 156.025–157.425 MHz RX 156.050–163.275 MHz
• Type of emission	: 16K0G3E (FM), 16K0G2B (DSC)
• Channel spacing	: 25 kHz
• Antenna impedance	: 50 Ω (Nominal)
• Operating temperature range	: –20°C to +60°C; –4°F to +140°F
• Power supply requirement	: 13.8 V DC (negative ground)
• Current drain (At 13.8 V DC ; approx.)	: Receiving 1.5 A (at max. audio) Transmitting 5.5 A (at 25 W)
• Dimensions (Projections not included)	: 153(W)×67(H)×133(D) mm; 6 1/32(W)×2 5/8 (H)×5 1/4 (D) in.
• Weight (Approx.)	: 825 g; 1.8 lb

■ TRANSMITTER

• Output power (At 13.8 V DC)	: 25 W (High)/1 W (Low)
• Modulation	: Variable reactance frequency modulation
• Maximum frequency deviation	: ± 5.0 kHz
• Frequency stability	: ± 10 ppm
• Spurious emissions	: Less than –70 dBc (at 25 W) Less than –56 dBc (at 1 W)
• Adjacent channel power	: More than 70 dB
• Audio harmonic distortion	: Less than 10% (at 60% deviation)
• Residual modulation	: More than 40 dB
• Audio frequency response	: +1 dB to –3 dB of 6 dB oct. from 300 Hz to 2500 Hz
• Microphone impedance	: 2 k Ω

■ RECEIVER

• Receive system	: Double conversion superheterodyne system
• Intermediate frequencies	: 1st IF: 21.7 MHz, 2nd IF: 450 kHz
• Sensitivity	: –13 dB μ typical at 12 dB SINAD
• Squelch sensitivity	: Less than –13 dB μ
• Adjacent channel selectivity	: More than 70 dB
• Spurious response	: More than 70 dB
• Intermodulation rejection ratio	: More than 70 dB
• Hum and noise	: More than 40 dB
• Audio frequency response	: +1 dB to –3 dB of –6 dB oct. from 300 Hz to 3000 Hz
• Audio output power	: 4.5 W typical at 10% distortion with a 4 Ω load
• Audio output impedance	: 4 Ω

Specifications are measured in accordance with TIA/EIA 603

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

• CHANNEL LIST

Channel number			Frequency (MHz)	
USA	INT	CAN	Transmit	Receive
	01	01	156.050	160.650
01A			156.050	156.050
	02	02	156.100	160.700
	03	03	156.150	160.750
03A			156.150	156.150
	04		156.200	160.800
		04A	156.200	156.200
	05		156.250	160.850
05A		05A	156.250	156.250
06	06	06	156.300	156.300
	07		156.350	160.950
07A		07A	156.350	156.350
08	08	08	156.400	156.400
09	09	09	156.450	156.450
10	10	10	156.500	156.500
11	11	11	156.550	156.550
12	12	12	156.600	156.600
13* ²	13	13* ¹	156.650	156.650
14	14	14	156.700	156.700
15* ²	15* ¹	15* ¹	156.750	156.750
16	16	16	156.800	156.800
17* ¹	17	17* ¹	156.850	156.850
	18		156.900	161.500
18A		18A	156.900	156.900
	19		156.950	161.550
19A		19A	156.950	156.950
20	20	20* ¹	157.000	161.600
20A			157.000	157.000

Channel number			Frequency (MHz)	
USA	INT	CAN	Transmit	Receive
	21	21	157.050	161.650
21A		21A	157.050	157.050
		21b	Rx only	161.650
	22		157.100	161.700
22A		22A	157.100	157.100
	23	23	157.150	161.750
23A			157.150	157.150
24	24	24	157.200	161.800
25	25	25	157.250	161.850
		25b	Rx only	161.850
26	26	26	157.300	161.900
27	27	27	157.350	161.950
28	28	28	157.400	162.000
		28b	Rx only	162.000
	60	60	156.025	160.625
	61		156.075	160.675
61A		61A	156.075	156.075
	62		156.125	160.725
		62A	156.125	156.125
	63		156.175	160.775
63A			156.175	156.175
	64	64	156.225	160.825
64A		64A	156.225	156.225
	65		156.275	160.875
65A	65A	65A	156.275	156.275
	66		156.325	160.925
66A	66A	66A* ¹	156.325	156.325
67* ²	67	67	156.375	156.375

Channel number			Frequency (MHz)	
USA	INT	CAN	Transmit	Receive
68	68	68	156.425	156.425
69	69	69	156.475	156.475
70* ³	70* ³	70* ³	156.525	156.525
71	71	71	156.575	156.575
72	72	72	156.625	156.625
73	73	73	156.675	156.675
74	74	74	156.725	156.725
75* ¹	75* ¹	75* ¹	156.775	156.775
76* ¹	76* ¹	76* ¹	156.825	156.825
77* ¹	77	77* ¹	156.875	156.875
	78		156.925	161.525
78A		78A	156.925	156.925
	79		156.975	161.575
79A		79A	156.975	156.975
	80		157.025	161.625
80A		80A	157.025	157.025
	81		157.075	161.675
81A		81A	157.075	157.075
	82		157.125	161.725
82A		82A	157.125	157.125
	83	83	157.175	161.775
83A		83A	157.175	157.175
		83b	Rx only	161.775
84	84	84	157.225	161.825
84A			157.225	157.225
85	85	85	157.275	161.875
85A			157.275	157.275
86	86	86	157.325	161.925

Channel number			Frequency (MHz)	
USA	INT	CAN	Transmit	Receive
86A			157.325	157.325
87	87	87	157.375	161.975
87A			157.375	157.375
88	88	88	157.425	162.025
88A			157.425	157.425

WX channel	Frequency (MHz)	
	Transmit	Receive
1	RX only	162.550
2	RX only	162.400
3	RX only	162.475
4	RX only	162.425
5	RX only	162.450
6	RX only	162.500
7	RX only	162.525
8	RX only	161.650
9	RX only	161.775
10	RX only	163.275

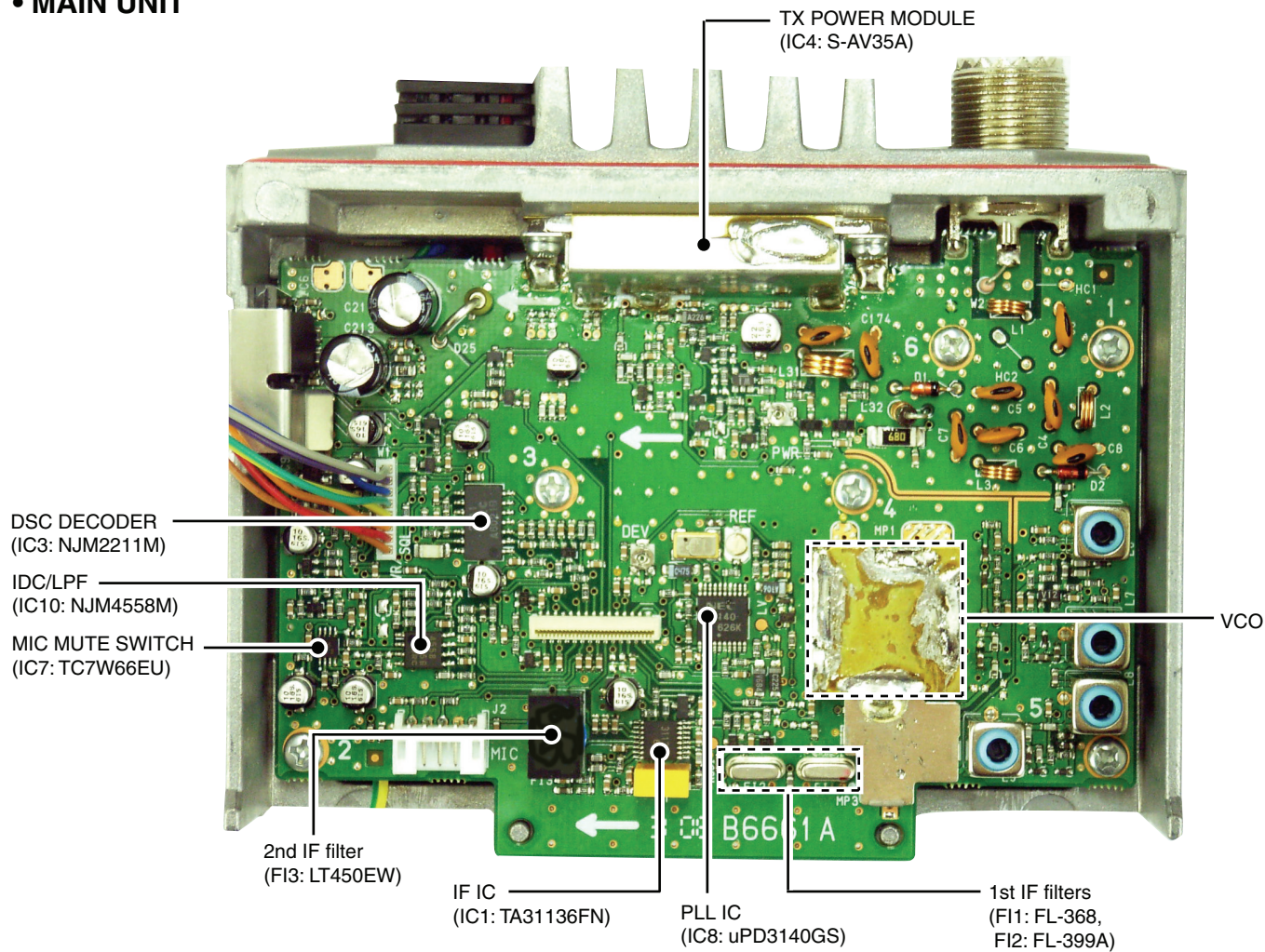
*¹ Low power only. *² Momentary high power. *³ DSC operation only.

NOTE: Simplex channels, 3, 21, 23, 61, 64, 81, 82 and 83 **CANNOT** be lawfully used by the general public in U.S.A. waters.

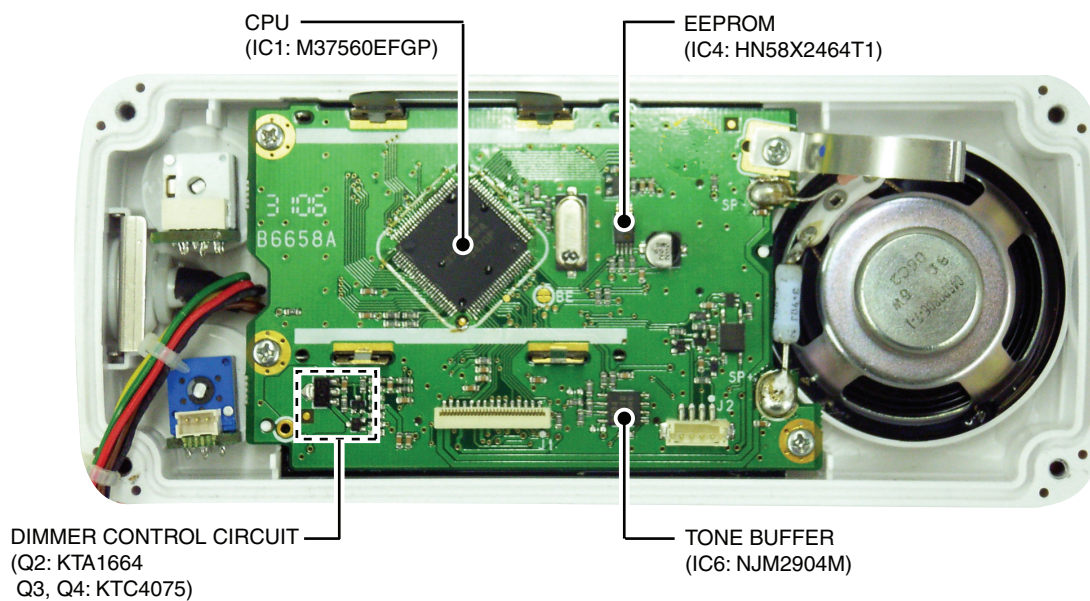
SECTION 2

INSIDE VIEWS

• MAIN UNIT



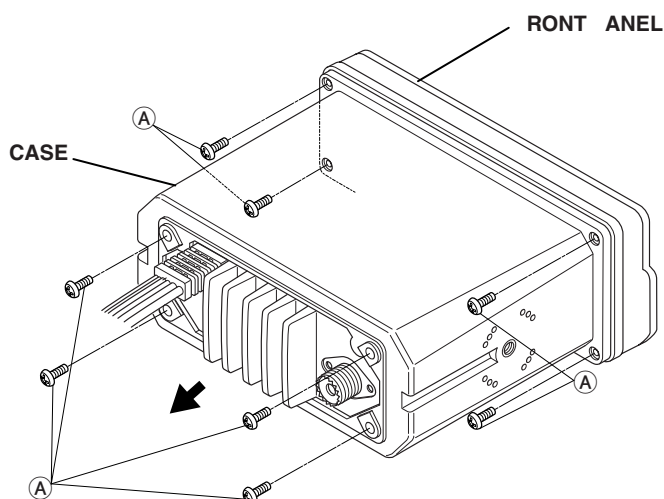
• LOGIC UNIT



SECTION 3 DISASSEMBLY INSTRUCTION

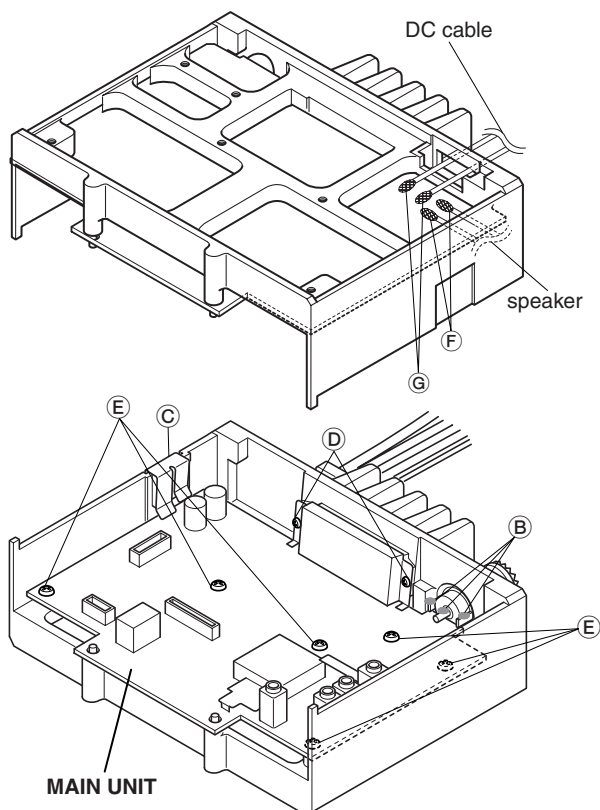
1. Removing the front panel

- ① Unscrew 8 screws (A), as shown below, and then remove the case in the direction of the arrow.



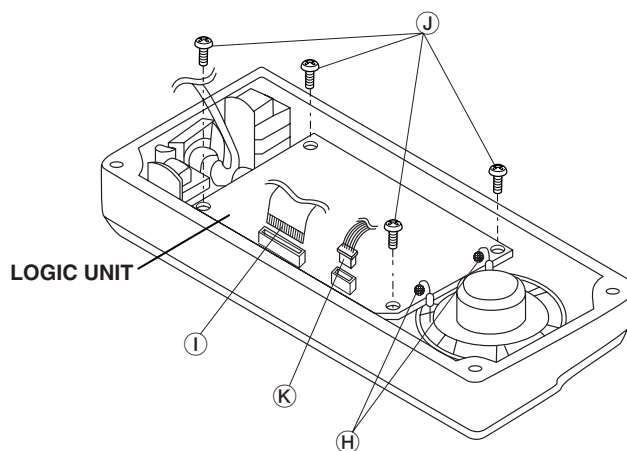
2. Removing the MAIN UNIT

- ① Unsolder the external speaker cable (F) (2 points), and DC cable (G) (2 points), on the bottom side of the MAIN UNIT.
- ② Unsolder the antenna connector (B) (3 points).
- ③ Remove the clip (C).
- ④ Unscrew 2 screws (D), and 7 screws (E), to remove the MAIN UNIT.



3. Removing the LOGIC UNIT

- ① Disconnect 2 cables (I) and (K).
- ② Unsolder 2 points (H).
- ③ Unscrew 4 screws (J), to remove the LOGIC UNIT.



4-1 RECEIVER CIRCUITS

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

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

Received signals enter the MAIN unit from the antenna connector and pass through the low-pass filter (L1, L2, C3–C5). The signals are then applied to the RF circuit via the antenna switching circuit (D2).

4-1-2 RF CIRCUIT (MAIN UNIT)

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

The signals from the antenna switching circuit pass through a tunable bandpass filter (D4, L6, C12–C16) where the object signals are led to the RF amplifier circuit (Q1).

The amplified signals at Q1, L7–L9 are applied to other tunable bandpass filter (D5–D7, C22–C26, C29–C34) to suppress unwanted signals and improve the selectivity. The signals are then applied to the 1st mixer circuit.

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

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

The signals from the RF circuit are mixed with the VCO signals at the 1st mixer circuit (Q2) to produce a 21.7 MHz 1st IF signal.

The 1st IF signal is applied to two crystal filters (F11, F12) to suppress out-of-band signals and is then amplified at the IF amplifier (Q4). The amplified signal is applied to the 2nd mixer circuit (IC1).

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 FM IF IC (IC1) contains the 2nd local oscillator, 2nd mixer, limiter amplifier, quadrature detector, and noise detector circuits, etc.

The 1st IF signal from Q4 is applied to the 2nd mixer section of IC1 (pin 16), and is mixed with a 21.25 MHz 2nd LO signal generated at the PLL circuit using the reference frequency (21.25 MHz) to produce a 450 kHz 2nd IF signal.

The 2nd IF signal from IC1 (pin 3) is passed through the ceramic filter (F13), where unwanted signals are suppressed, and is then applied to the 2nd IF (limiter) amplifier in IC1 (pin 5). The signal is applied to the FM detector section in IC1 for demodulation into AF signals.

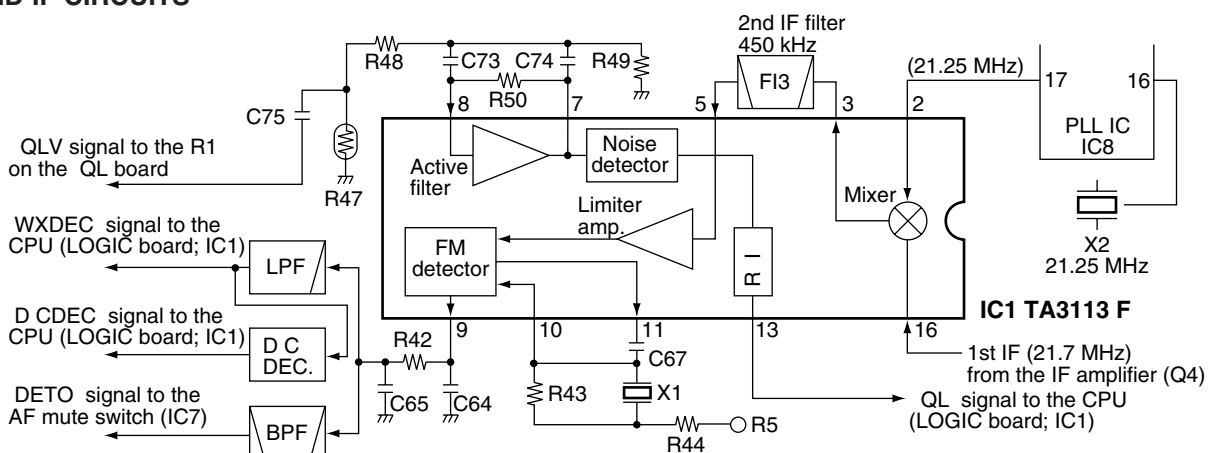
The FM detector circuit employs a quadrature detection method (linear phase detection), which uses a ceramic discriminator (X1) for phase delay to obtain a non-adjusting circuit. The detected signal from IC1 (pin 9) is applied to the AF circuit.

4-1-7 WEATHER ALERT DECODER CIRCUIT (MAIN UNIT AND LOGIC BOARD)

When the weather alert function is activated and a 1050 Hz alert tone from an NOAA weather radio broadcast is received, the IC-M304 emits beep tones and indicates flashing “ALT” on the display to inform of an emergency weather report on the air.

AF signals from the FM IF IC (IC1, pin 9) pass through the low-pass filter (Q5, R52–R58, C83–C86) via the “DET” signal, and are then applied to A/D port of the CPU (LOGIC board; IC1, pin 8) as “WXDEC” signal. The CPU has the tone decoder function. When a 1050 Hz signal is detected by software decode, the CPU (LOGIC BOARD; IC1) controls beep tones and the “ALT” indicator.

• 2ND IF CIRCUITS



4-1-5 AF AMPLIFIER CIRCUIT (MAIN AND FRONT UNITS)

The AF amplifier circuit amplifies the detected signals to drive a speaker. The AF circuit includes an AF mute circuit for the squelch.

AF signals from IC1 (pin 9) are applied to the de-emphasis circuit (R61, C89). The de-emphasis circuit is an integrated circuit with frequency characteristic of -6 dB/octave.

The integrated signals pass through the Band-pass filter (Q6, Q7, R62–R70, C90–C94) to suppress unwanted lower noise signals.

The filtered signals are applied to the AF mute circuit (IC7B), and then passes through the [VOLUME] control (VR board; R1) via the “VOL1” signal. The signals are applied to the AF power amplifier (IC6, pin 1). The output signal from IC6 (pin4) drives the internal (external) speaker.

4-1-6 SQUELCH CIRCUIT (MAIN UNIT, LOGIC AND SQL BOARDS)

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

A portion of the AF signals from the FM IF IC (IC1, pin 9) pass through the squelch adjustment volume (SQL board; R1), and are then applied to the active filter section (IC1, pin 8). The active filter section amplifies and filters noise components. The filtered signals are applied to the noise detector section and output from pin 13 as the “SQL” signal. The “SQL” signal is applied to the CPU (LOGIC board; IC1, pin 30). The CPU analyzes the noise condition and outputs the “RMUTE” signal to toggle the AF mute switches (IC7B).

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 at the modulation circuit.

The AF signals from the microphone are amplified at the microphone amplifier (IC10A) via the analog switch (IC7A, pins 1, 2). A capacitor (C223) and resistor (R171) are connected to the amplifier to obtain the pre-emphasis characteristics.

The amplified signals are applied to the IDC amplifier and are passed through the splatter filter (IC10B, pins 5–7) to suppress unwanted 3 kHz or higher signals. The filtered signals are then applied to the modulation circuit.

4-2-2 MODULATION CIRCUIT (MAIN UNIT)

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

Audio signals from the splatter filter (IC10B) pass through the frequency deviation adjustment pot (R184) and are then applied to the modulation circuit (D11, D12) to change the reactance of D11–D14 and modulate the oscillated signal at the VCO (Q13, Q14).

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

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

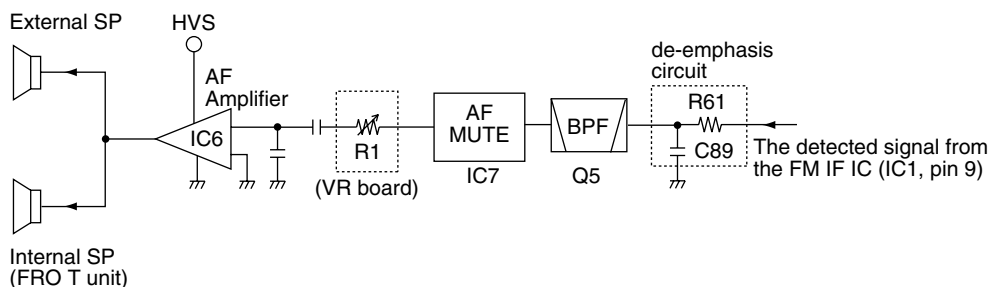
The VCO output is buffer-amplified by Q15 and Q16, and is then applied to the Tx/Rx switch (D16, D17). The transmit signal from the Tx/Rx switch is amplified to the YGR (Q17) amplifiers to obtain an approximate 10 mW signal level. The amplified signal is then applied to the RF power amplifier (IC4).

4-2-4 POWER AMPLIFIER CIRCUIT (MAIN UNIT)

The power amplifier circuit amplifies the driver signal to an output power level.

IC4 is a power module which has amplification output capabilities of about 25 W with 10 mW input. The output from IC4 (pin 4) is passed through the antenna switching circuit (D1) and is then applied to the antenna connector via the low-pass filter.

• AF CIRCUITS



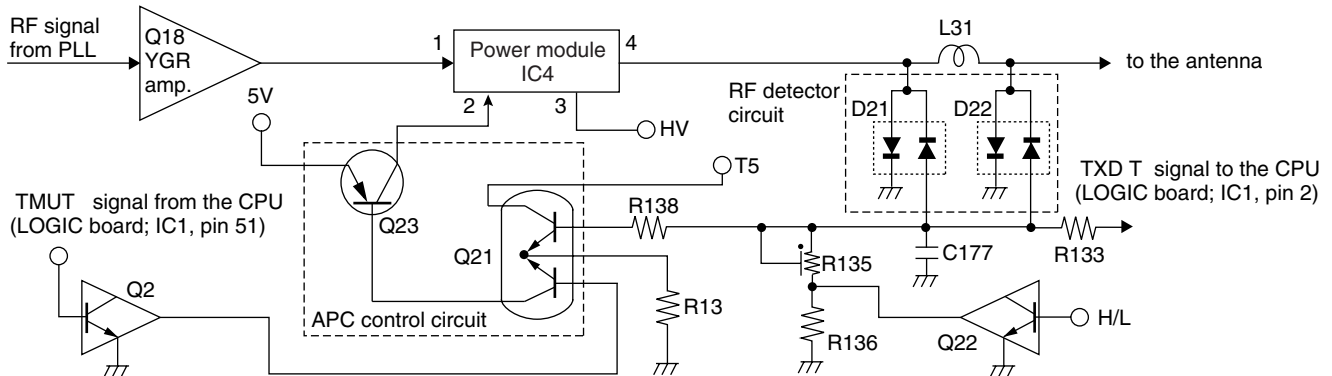
4-2-5 APC CIRCUIT (MAIN UNIT)

The APC circuit stabilizes transmit output power.

The RF output signal from the power amplifier (IC4) is detected at the power detector circuit (D21, D22, L31) and is then applied to one of the differential amplifier inputs (Q21, pin 3) via the High/Low control circuit (Q22, R137). The

applied voltage controls the differential amplifier output (Q21, pin 1) and the bias voltage control (Q23). Thus the APC circuit maintains a constant output power.

• APC CIRCUIT



4-3 PLL CIRCUITS

4-3-1 GENERAL (MAIN UNIT)

The PLL circuit provides stable oscillation of the transmit frequency and receive 1st LO frequency. The PLL circuit compares the phase of the divided VCO frequency to the reference frequency. The PLL output frequency is controlled by a crystal oscillator and the divided ratio of the programmable divider.

IC8 on the MAIN unit is a dual PLL IC which controls both VCO circuits for Tx and Rx, and contains a prescaler, programmable counter, programmable divider, phase detector, charge pump, etc.

The PLL circuit, using a one chip PLL IC (MAIN unit; IC8), directly generates the transmit frequency and receive 1st IF frequency with VCO. The PLL sets the divided ratio based on serial data from the CPU on the LOGIC BOARD and compares the phases of VCO signals with the reference oscillator frequency. The PLL IC detects the out-of-step phase and output from pins 8 for Tx and Rx. The reference frequency (21.25 MHz) is oscillated at X2 (MAIN unit).

4-3-2 TX AND RX LOOP (MAIN UNIT)

The generated signal at the VCO (Q13, Q14, D11–D14) enters the PLL IC (IC8, pin 2) and is divided at the programmable divider section and is then applied to the phase detector section.

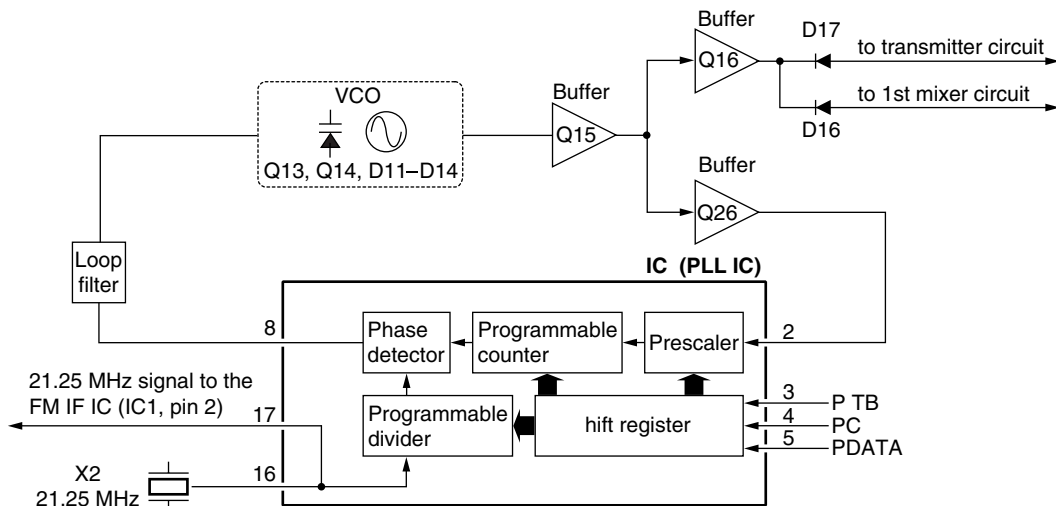
The phase detector compares the input signal with a reference frequency, and then outputs the out-of-phase signal (pulse-type signal) from pin 8.

The pulse-type signal is converted into DC voltage (lock voltage) at the loop filter (R211–R213, C252, C254), and is then applied to varactor diodes (D13, D14) of the VCO to stabilize the oscillated frequency.

4-3-4 VCO CIRCUIT (MAIN UNIT)

The VCO outputs from Q13, Q14 are buffer-amplified at the buffer amplifiers (Q15 and Q16), and are then sent to the Tx/Rx switch (D16 and D17). The receive LO signal is applied to the 1st mixer circuit (Q2) through a low-pass filter, and the transmit signal is applied to the YGR amplifier (Q17). A portion of the VCO output is reapplied to the PLL IC (IC8, pin 2) via the buffer amplifier (Q26).

• PLL CIRCUITS



4-4 DSC CIRCUITS

4-4-1 DSC ENCODE CIRCUIT (LOGIC UNIT AND MAIN UNIT)

The DSC signal is created at the CPU (IC1, pin 9). The signal passes through the buffer amplifier (IC6A, pins 1, 3), and is then applied to the D/A convertor (R176–R179) to convert into the analog signal. The analog signal passes through the low-pass filter (MAIN unit; IC10B, pins 5–7), and is then applied to the VCO circuit to modulate the DSC signal.

4-4-2 DSC DECODE CIRCUIT (MAIN UNIT AND LOGIC UNIT)

The AF signal from the FM IF IC (IC1, pin 9) are filtered at the low-pass filter (Q5, R52–R58, C83–C86) to suppress unwanted higher noise signals. The filtered signals are converted analog signals into digital signals at the DSC decoder IC (IC3), and are then applied to the CPU (LOGIC UNIT; IC1, pin 22) via the "DSCDEC" signal.

4-5 LOGIC CIRCUITS (LOGIC UNIT)

• CPU

IC1 is an 8 bit single chip micro-computer and contains LCD driver, serial I/O, timer, A/D converter, programmable I/O, ROM and RAM. The CPU controls to display characters on the LCD too.

• SYSTEM CLOCK CIRCUIT

X1 is a ceramic oscillator and oscillate 7.9872 MHz system clock for the CPU (IC1).

• RESET CIRCUIT

IC5 which is a reset IC outputs a reset signal ("HIGH" pulse signal) to the CPU (IC1, pin 33) from pin 1 when the transceiver turns power ON.

• LOW BATTERY DETECTOR

"HVS" voltage is divided by R14 and R15, and is applied to the low battery detector section in the CPU (IC1, pin 1).

• DIMMER CIRCUIT

CPU (IC1), Q2, Q3 and Q4 compose dimmer circuit. The circuit controls 4 steps LCD backlight (DS2–DS7).

• UART PORT

IC-M304 has the UART port which is used for cloning data and NMEA interface. The signals pass through the photo coupler circuit (IC2), and are then applied to the buffer amplifier (IC3, pin 2). The amplified signals are applied to the CPU (IC1, pin 20).

4-6 POWER SUPPLY CIRCUITS

Line	Description
HV/ HVS	The voltage from the connected DC power supply.
5V	Common 5V converted from the HV line at the L5V regulator (LOGIC UNIT; IC9). The converted voltage is applied to the CPU (LOGIC UNIT; IC1)
T5	Transmit 5V controlled by the T5 control circuit (Q31, Q32) using the "SEND" signal from CPU (LOGIC UNIT; IC1, pin 52).
R8	Receive 8 V converted from the VCC line at the R8 regulator (Q35, Q36). The converted voltage is applied to the receiver circuits.
R5	Receive 5V controlled by the R5 control circuit (Q33, Q34) using the "RCV" signal from CPU (LOGIC UNIT; IC1, pin 53). The controlled voltage is applied to the receiver circuits.

4-7 CPU PORT ALLOCATIONS

Pin NO.	Port name	Description
2	KEYM	Input port for keys on HM-150B/SW. Approx. 2.02 V: [▲] key is pushed. Approx. 3.00 V: [▼] key is pushed. Approx. 3.84 V: [H/L] key is pushed.
3	TXDET	Input port for transmit detected voltage.
4	LBAT	Input port for low battery detecting.
5	SQL	Input port for "NOISE" signal from the squelch amplifier (IC11, pin 4).
6	SQLV	Input port for squelch adjustment pot (SQL BOARD; R1).
7	WXDEC	Input port for weather alert signal from the LPF (Q38).
8	PDATA	Outputs data signal to the PLL IC (IC1, pin 5).
9	PCK	Outputs clock signal to the PLL IC (IC1, pin 4).
10	PSTB	Outputs strobe signal to the PLL IC (IC1, pin3).
12	EVDATA	Outputs volume control signal to the volume controller (IC13, pin 5) for PA circuit.
13	EVCK	Outputs clock signal to the volume controller (IC13, pin 4) for PA circuit.
14	DSDEC	Input port for the DSC decode signal from the DSC decoder (IC15, pin 7).
28, 29	CONT1, CONT0	Output LCD contrast adjust signal to the CPU (IC1, pin 134).
32	COMTXD	Outputs serial data signal to the connected HM-157 (Optional product).
33	COMRXD	Input port for the serial data signal from the connected HM-157 (Optional product).
34	ECK	Outputs clock signal to the EEPROM (LOGIC BOARD; IC4, pin 6).
35	EDATA	I/O port for the EEPROM (LOGIC BOARD; IC4, pin 5) control data.
37	NMTXD	Outputs NMEA command signal.
38	NMRXD	Input port for the NMEA signal.
48	PWR	Input port for power switch (VR BOARD; R1). Low: When [VOL] is pushed.
49	PAMUTE	Outputs control signal to the AF (Public Address) mute circuit (Q65). High: During mute.
50	PWRON	Outputs power control signal to the power control circuit (Q61, Q62). High: While the transceiver is switched ON.
51	TMUTE	Outputs transmit mute signal to the APC circuit (IC12, pin 3). High: During mute.
53	RCV	Outputs control signal to the R5 control circuit (Q53, Q54). High: While receiving.
54	H/L	Outputs TX power control signal to the TX power control circuit (Q17, D11). High: 25 W Low: 1 W
55	ATT	Outputs attenuator control signal to the attenuator (D22). High: Attenuator ON.
57	PTT	Input port for the [PTT] switch (HM-150B/SW; S1). Low: [PTT] key is pushed.
60	UNLK	Input port for the "UNLK" signal from the PLL IC (IC1, pin7). High: PLL circuit is unlocked.

Pin NO.	Port name	Description
61	DTRS	Input port for the [DISTRESS] key (LOGIC BOARD; S9). Low: [DISTRESS] key is pushed.
62	RMUTEP	Outputs AF (Public Address) mute signal to the AF mute circuit (IC4, pin12). Low: During mute.
63	RMUTES	Outputs AF mute signal to the AF mute circuit (IC4, pin 5) for the connected HM-157 (Optional product). Low: During mute.
64	RMUTEM	Outputs AF (internal speaker) mute signal to the AF mute circuit (IC4, pin 6). Low: During mute.
65	MMUTEP	Outputs microphone (Public Address) mute signal to the AF mute circuit (IC5, pin 6). Low: During mute.
66	MMUTES	Outputs microphone mute signal to the AF mute circuit (IC5, pin 5) for the connected HM-157 (Optional product). Low: During mute.
67	MMUTEM	Outputs microphone (HM-150B/SW) mute signal to the AF mute circuit (IC5, pin 13). Low: During mute.
68	PTTS	Outputs AF/MIC control signal to the AF mute circuit (IC6, pin 5). High: PTT switch (HM-157) is pushed
69	PTTM	Outputs AF/MIC control signal to the AF mute circuit (IC5, pin 12).
70	LO/DX	Input port for the [LO/DX] key (LOGIC BOARD; S8). Low: [LO/DX] key is pushed.
71	DSC	Input port for the [DSC] key (LOGIC BOARD; S7). Low: [DSC] key is pushed.
72	PA	Input port for the [PA] key (LOGIC BOARD; S6). Low: [PA] key is pushed.
73	CH/WX	Input port for the [CH/WX] key (LOGIC BOARD; S5). Low: [CH/WX] key is pushed.
74	SCAN	Input port for the [SCAN] key (LOGIC BOARD; S4). Low: [SCAN] key is pushed.
75	CH16	Input port for the [16] key (LOGIC BOARD; S3). Low: [16] key is pushed.
76	DOWN	Input port for the [▼] key (LOGIC BOARD; S2). Low: [▼] key is pushed.
77	UP	Input port for the [▲] key (LOGIC BOARD; S1). Low: [▲] key is pushed.
138	DIM	Outputs dimmer control signal to the LCD control circuit (LOGIC BOARD; Q2, Q3).
139	BEEP	Outputs beep signal to the AF amplifier (IC9, pin 1).
141	DS/BPF	- While transmitting: Outputs DSC encode signal as "DSENC" to the LPF (IC8, pin 5) via the buffer amplifier (LOGIC BOARD; IC5, pins 1, 3). - While receiving: Outputs tuning signal as "BPFV" to the tunable BPFs (D25–D28) via buffer amplifier (LOGIC BOARD; IC5, pins 5, 7).

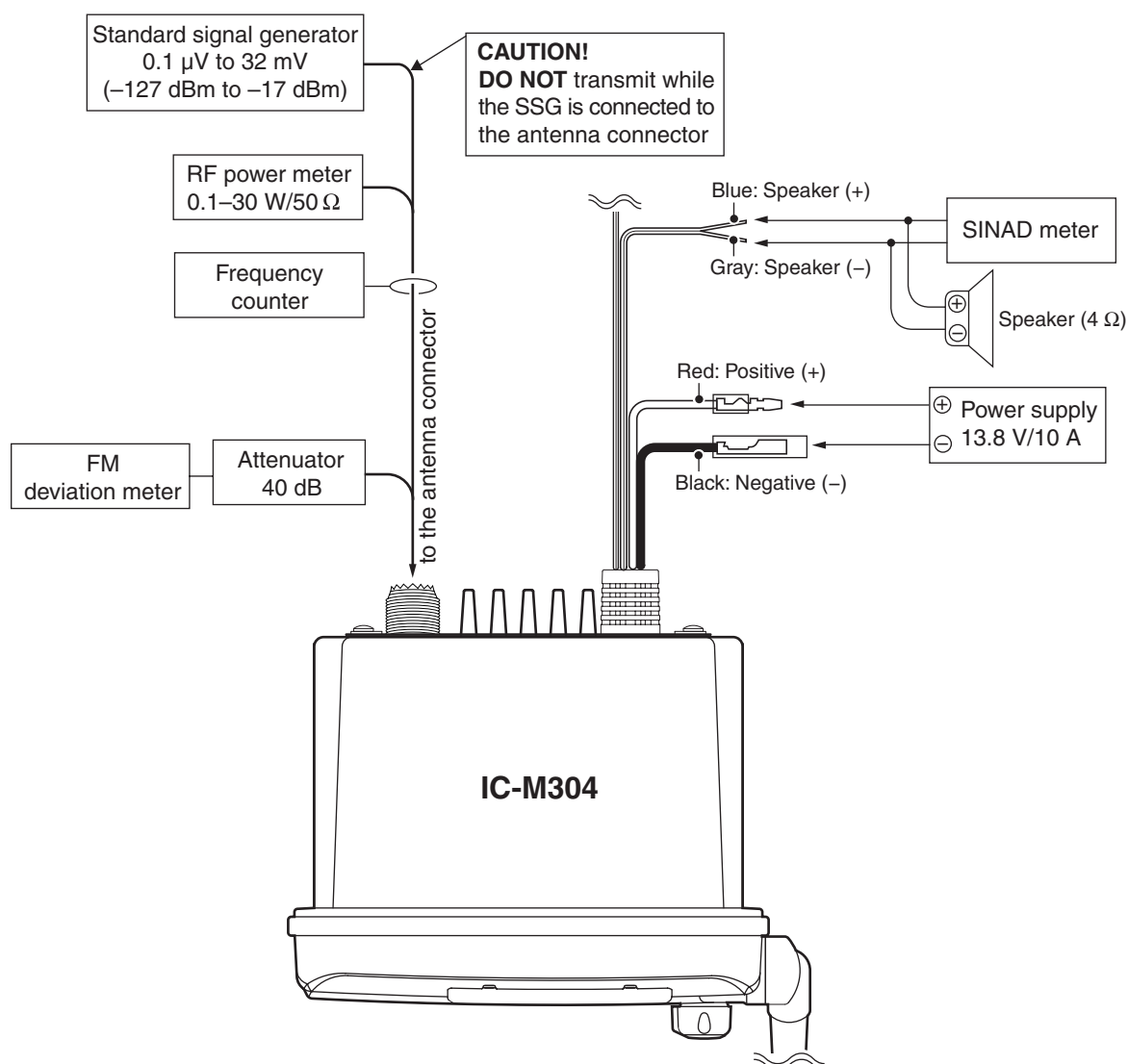
SECTION 5 ADJUSTMENT PROCEDURE

5-1 PREPARATION

■ REQUIRED TEST EQUIPMENTS

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.8 V DC Current capacity : More than 10 A	DC voltmeter	Input impedance : 50 k Ω /V DC or more
RF power meter (terminated type)	Measuring range : 0.1–30 W Frequency range : 100–300 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Standard signal generator (SSG)	Frequency range : 0.1–300 MHz Output level : 0.1 μ V to 32 mV (–127 to –17 dBm)
Frequency counter	Frequency range : 0.1–300 MHz Frequency accuracy : $\pm$ 1 ppm or better Sensitivity : 100 mV or better	AC millivoltmeter	Measuring range : 10 mV to 10 V
FM deviation meter	Frequency range : 30–300 MHz Measuring range : 0 to $\pm$ 10 kHz	External speaker	Input impedance : 4 Ω Capacity : More than 5 W
Audio generator	Frequency range : 300–3000 Hz Output level : 1–500 mV	Attenuator	Power attenuation : 40 dB Capacity : More than 30 W

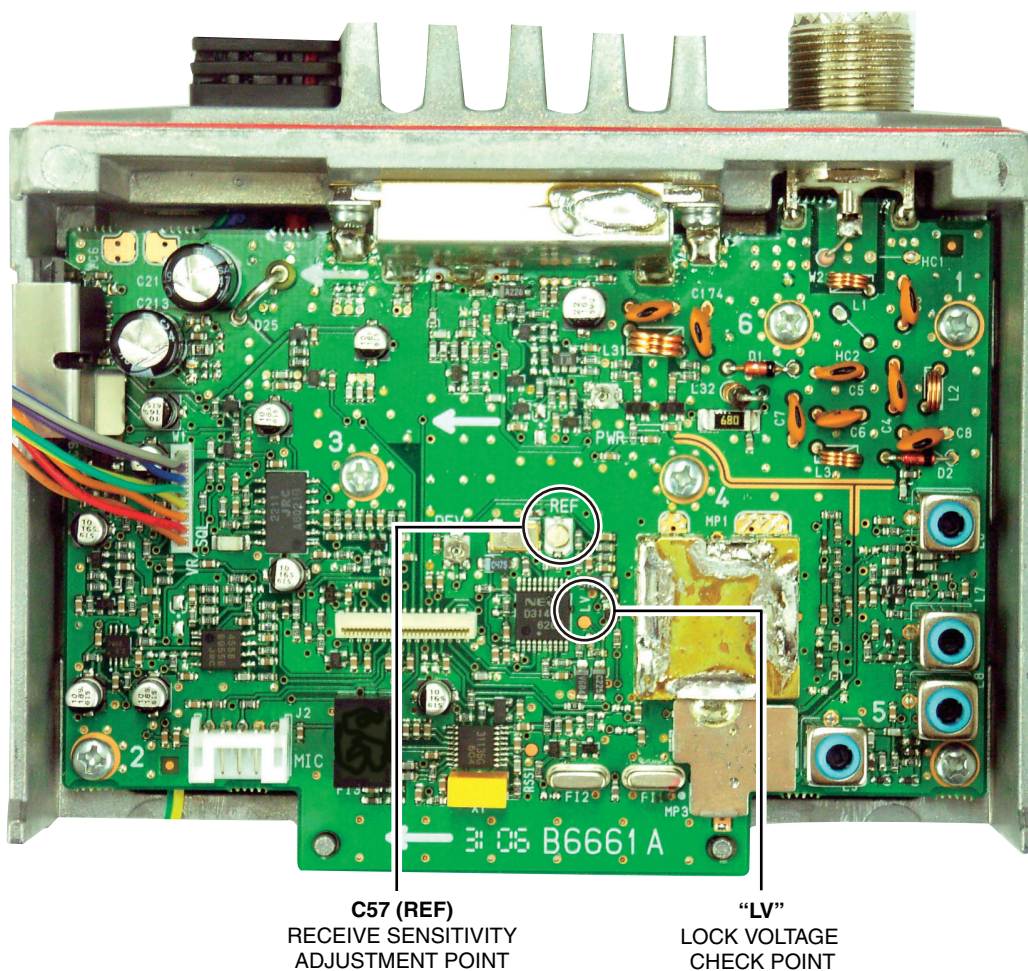
■ CONNECTIONS



5-2 FREQUENCY ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITION	OPERATION	VALUE
LOCK VOLTAGE (Verify)	1 • Channel : CH16 (156.800 MHz) • Receiving	Connect a DC voltmeter to the check point 'LV.'	1.3–2.3 V (Verify)
	2 • Channel : CH16 (156.800 MHz) • Output power : Low • Connect a power meter to the antenna connector. • Transmitting		1.4–2.4 V (Verify)
REFERENCE FREQUENCY	1 • Channel : CH16 (156.800 MHz) • Output power : Low • Connect a power meter to the antenna connector. • Transmitting	1) Loosely couple a frequency counter to the antenna connector. 2) Adjust C257 (REF).	156.800 MHz

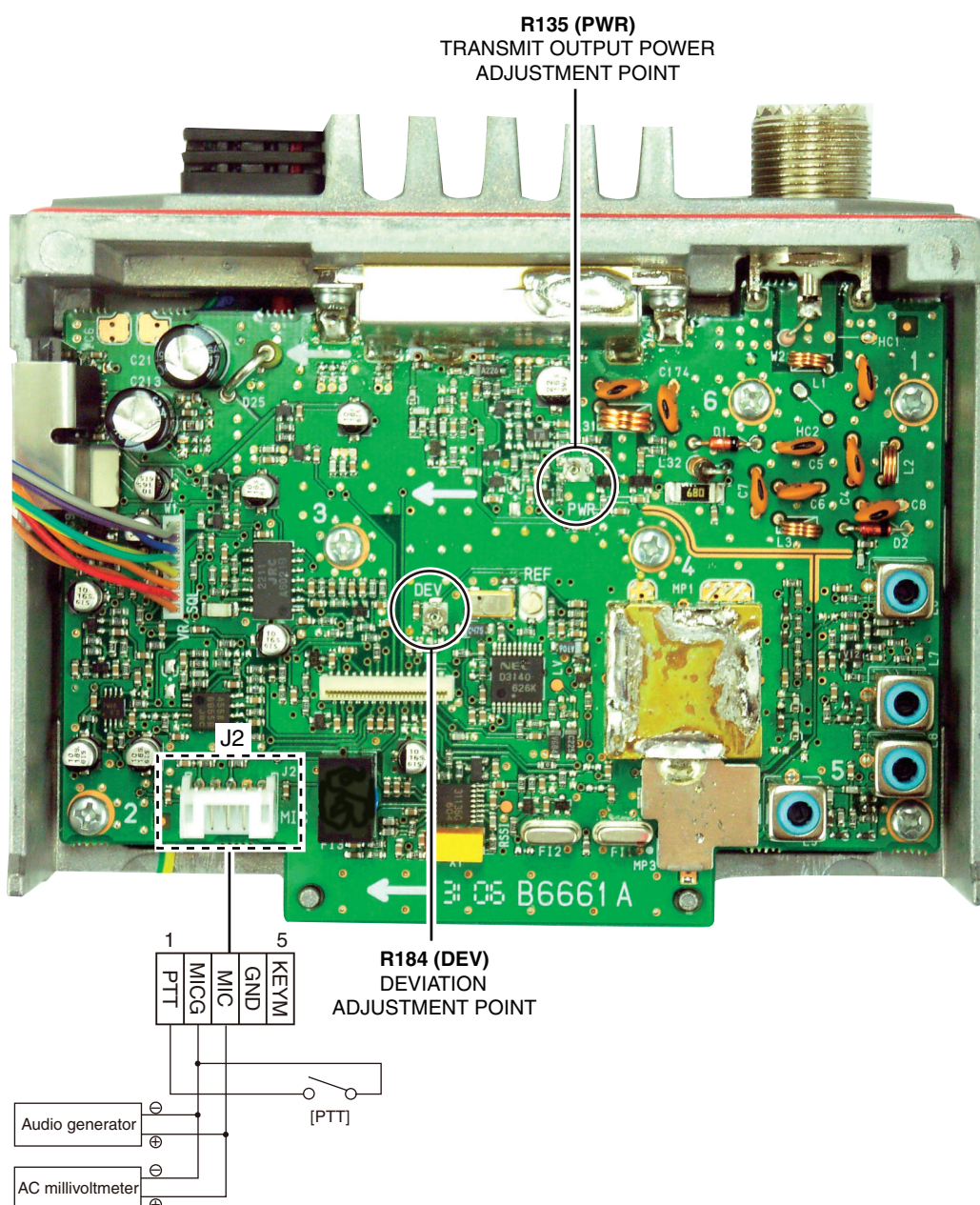
• ADJUST&CHECK POINTS LOCATION (FREQUENCY)



5-3 TRANSMIT ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITION	OPERATION	VALUE
TRANSMIT OUTPUT POWER	1 - Channel : CH16 (156.800 MHz) - Output power : High - Connect an RF power meter to the antenna connector. - Transmitting	Adjust R135 (PWR).	23.5 W
DEVIATION	1 - Channel : CH16 (156.800 MHz) - Output power : Low - Connect an audio generator to the 'MIC' line (see the picture below), and set as; - Frequency : 1 kHz - Level : 140 mV - Connect an FM deviation meter to the antenna connector through an attenuator, and set as ; - HPF : OFF - LPF : 20 kHz - De-emphasis : OFF - Detector : (P-P)/2 - Transmitting	Adjust R184 (DEV).	±4.3 kHz

• ADJUST&CHECK POINTS LOCATION (TRANSMIT)

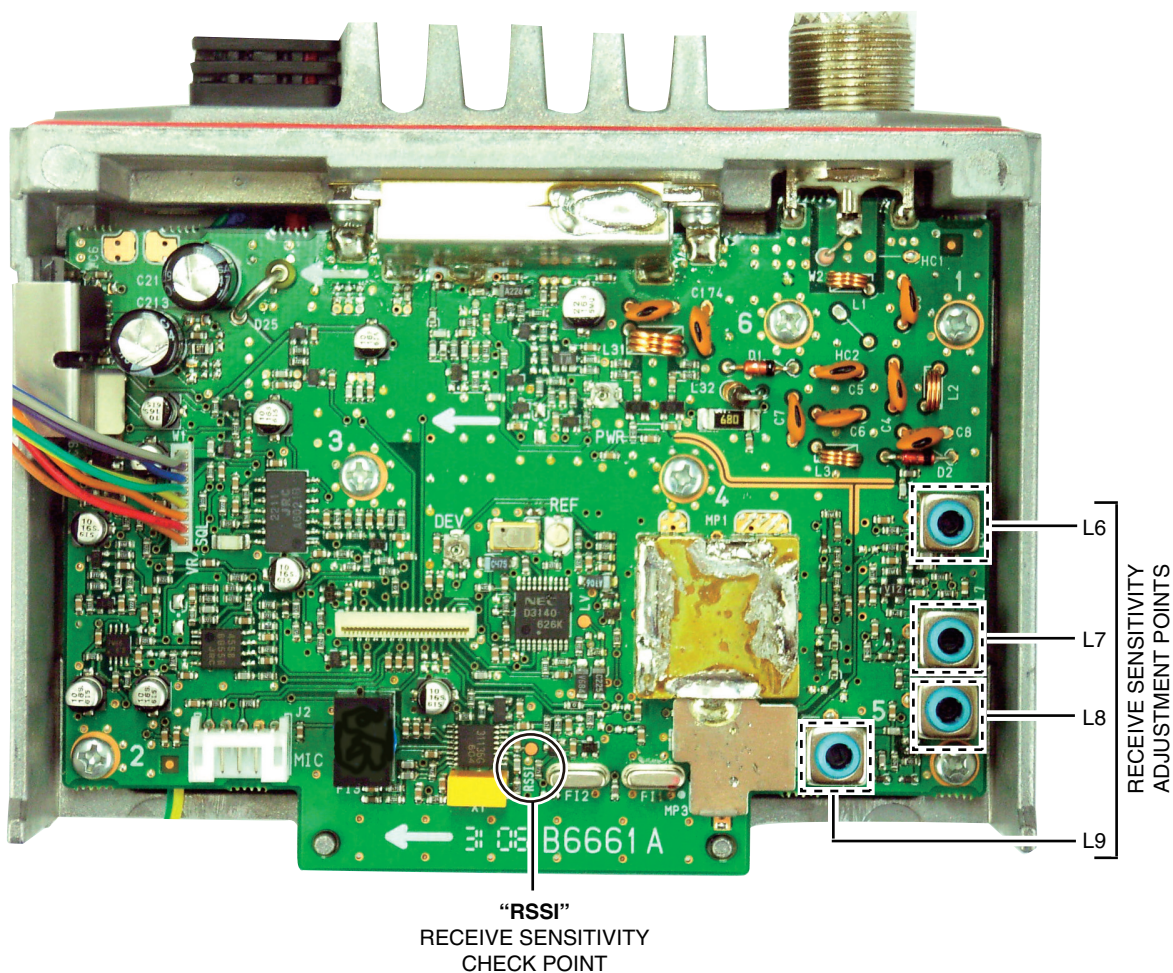


5-4 RECEIVE ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITION	CONNECTION	VALUE
RECEIVE SENSITIVITY	1 • Channel : CH16 (156.800 MHz) • [SQUELCH] : Open (Max. counterclockwise) • Connect an external speaker to the [EXT SP] lead receptacle. • Connect an SSG to the antenna connector and set as; Frequency : 156.800 MHz Level : 0 dBu[†] (-107 dBm) Modulation : 1 kHz Deviation : ±3.0 kHz • Receiving	1) Connect a DC voltmeter to the check point 'RSSI'. 2) Adjust in sequence L6, L7, L8 and L9. (Repeat the adjustment at least twice.)	Maximum voltage

[†] The output level of the standard signal generator (SSG) is indicated as the SSG's open circuit.

• ADJUST&CHECK POINTS LOCATION (RECEIVE)



SECTION 6

PARTS LIST

[REPLACEMENT UNITS]

ORDER NO.	UNIT NAME
0329890101	U M304 #01 FRONT (FRONT+LOGIC+VR+SQL) [Black]
0329890201	U M304 #02 FRONT (FRONT+LOGIC+VR+SQL) [Super White]
0329890301	U M304 #03 FRONT (FRONT+LOGIC+VR+SQL) [Gray]
0329890102	U M304 #01 MAIN (MAIN+CHASSIS)

[LOGIC UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
IC1	1140013950	S.IC M37560MFA-347GP	B	53/33
IC2	1170000352	S.IC PC357N6J000F	B	13.4/19.7
IC3	1130007431	S.IC TC7S14FU (TE85R,F)	B	13.7/25.2
IC4	1140008650	S.IC HN58X2464TI	B	29.2/35.7
IC5	1110005771	S.IC S-80942CNMC-G9CT2G	B	30.2/42.1
IC6	1110002700	S.IC NJM2904M-TE1-#FMZB	B	29.3/9.2
Q2	1520000840	S.TR KTA1664Y-RTF/P	B	73.5/11.6
Q3	1530003900	S.TR KTC4075 BL-RTK/P	B	68.5/6.8
Q4	1530003900	S.TR KTC4075 BL-RTK/P	B	68.2/9.7
Q6	1590001050	S.TR DTC114TUA T106	B	18/19
D1	1750000550	S.DIO 1SS355 TE-17	B	16/15.4
D2	1750000550	S.DIO 1SS355 TE-17	B	18/22.8
D3	1750001180	S.DIO KDS122 RTK/P	B	20.9/18.3
X1	6050012460	S.XTL CR-834 (SMD-49/7.9872 MHz)		
R1	7030003530	S.RES ERJ3GEYJ 562 V (5.6 k)	B	63.4/22.9
R3	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	60.6/22.9
R4	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	60.6/21.6
R5	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	63.4/21.6
R14	7030003700	S.RES ERJ3GEYJ 154 V (150 k)	B	61.4/11.9
R15	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	B	61.4/13.2
R16	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	49.9/16.1
R21	7030003250	S.RES ERJ3GEYJ 270 V (27)	B	65.5/9.4
R22	7030003250	S.RES ERJ3GEYJ 270 V (27)	B	65.5/10.7
R23	7030003250	S.RES ERJ3GEYJ 270 V (27)	B	65.5/12
R24	7030003630	S.RES ERJ3GEYJ 393 V (39 k)	B	65.5/6.8
R25	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	B	65.5/5.5
R26	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	B	65.5/8.1
R27	7030003570	S.RES ERJ3GEYJ 123 V (12 k)	B	70.2/9.8
R28	7030003500	S.RES ERJ3GEYJ 332 V (3.3 k)	B	67.5/12.6
R29	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	B	15.9/42.6
R30	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	B	38.8/7.3
R31	7030003390	S.RES ERJ3GEYJ 391 V (390)	B	77.9/23.4
R35	7030003360	S.RES ERJ3GEYJ 221 V (220)	B	17.7/13.3
R36	7030003540	S.RES ERJ3GEYJ 682 V (6.8 k)	B	10.8/23.7
R37	7030003580	S.RES ERJ3GEYJ 153 V (15 k)	B	18/21.2
R38	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	B	21.3/20.5
R40	7030003340	S.RES ERJ3GEYJ 151 V (150)	B	28/30.4
R41	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	29.6/30.4
R42	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	31/30.4
R43	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	27.8/42.1
R51	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	B	32.2/13.3
R52	7030003800	S.RES ERJ3GEYJ 105 V (1 M)	B	30.9/13.3
R53	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	34.3/12.1
R54	7030003540	S.RES ERJ3GEYJ 682 V (6.8 k)	B	34.3/9.3
R55	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	35.6/7.8
R56	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	36.4/10
R61	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	B	31.7/25.7
R62	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	33/25.7
R63	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	40.4/36.5
R64	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	B	41.8/37.7
R65	7030003800	S.RES ERJ3GEYJ 105 V (1 M)	B	40.4/39.3
R67	7030003860	S.RES ERJ3GE JPW V	B	28.9/5.3
C1	4030006900	S.CER C1608 JB 1H 103K-T	B	60.8/4.4
C2	4030006850	S.CER C1608 JB 1H 471K-T	B	62.1/4.4
C3	4030006900	S.CER C1608 JB 1H 103K-T	B	49.9/13.5
C4	4030006850	S.CER C1608 JB 1H 471K-T	B	49.9/14.8
C5	4030006900	S.CER C1608 JB 1H 103K-T	B	66.8/26.4
C6	4030011600	S.CER C1608 JB 1E 104K-T	B	16.1/20.3
C7	4030006900	S.CER C1608 JB 1H 103K-T	B	61.4/10.3
C11	4030006900	S.CER C1608 JB 1H 103K-T	B	67/22.9
C12	4030006860	S.CER C1608 JB 1H 102K-T	B	63.5/12.5
C13	4030006900	S.CER C1608 JB 1H 103K-T	B	65.5/13.3
C14	4030006860	S.CER C1608 JB 1H 102K-T	B	70.2/12.6
C16	4030006880	S.CER C1608 JB 1H 472K-T	B	17.9/15.7
C17	4030006900	S.CER C1608 JB 1H 103K-T	B	16.8/24.4
C18	4030006900	S.CER C1608 JB 1H 103K-T	B	26.6/28.9
C21	4030017480	S.CER C1608 JB 1A 474K-T	B	26.5/42.1
C22	4510008570	S.ELC EEE1CA220SR	B	23.5/32.7
C23	4030008890	S.CER C1608 JB 1H 273K-T	B	30/44.5
C25	4030006900	S.CER C1608 JB 1H 103K-T	B	25.2/42.1
C26	4030006860	S.CER C1608 JB 1H 102K-T	B	29/14
C31	4030009650	S.CER C1608 CH 1H 240J-T	B	43.5/40.1
C32	4030007050	S.CER C1608 CH 1H 220J-T	B	42.1/41.1
C41	4030006850	S.CER C1608 JB 1H 471K-T	B	9/6.9

[LOGIC UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
C42	4030006850	S.CER C1608 JB 1H 471K-T	B	9/38.2
C43	4030006860	S.CER C1608 JB 1H 102K-T	B	41.8/13.3
C44	4030006850	S.CER C1608 JB 1H 471K-T	B	51.7/12.1
J1	6510021721	S.CNR 30FLT-SM2-TB (LF) (SN)	B	48.3/8.2
J2	6510015541	S.CNR B4B-ZR-SM4-TF (LF) (SN)	B	18.5/5.8
DS1	5030002990	LCD SDT-DM2360-HP-0		
DS2	5040002310	S.LED SML-311YTT86	T	13.5/13.7
DS3	5040002310	S.LED SML-311YTT86	T	13.5/39.5
DS4	5040002310	S.LED SML-311YTT86	T	75.7/11.5
DS5	5040002310	S.LED SML-311YTT86	T	42.8/7.3
DS6	5040003230	S.LED RY-SP110UHY24-5M	T	79.8/42.5
DS7	5040003230	S.LED RY-SP110UHY24-5M	T	79.8/27
EP2	8930054970	LCT SRCN-2438-SP-N-W		

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
IC1	1110003491	S.IC TA31136FNG (D,EL)	T	50.2/15.6
IC3	1110003650	S.IC NJM2211M-TE1	T	26.8/44.1
IC4	1150002172	IC S-AV35A (I,Q)		
IC6	1110003091	IC LA4425A-E		
IC7	1130009581	S.IC TC7W66FU (TE12L,F)	T	6.7/27.6
IC8	1130007611	S.IC uPD3140GS-E1-A	T	58/31.7
IC9	1180002780	REG KIA7805API U/P		
IC10	1110000960	S.IC NJM4558M-TE1	T	19.3/27.3
Q1	15800000540	S.FET 3SK131-T2-LA	T	100.4/35
Q2	15800000540	S.FET 3SK131-T2-LA	T	82.4/12.9
Q4	1530003950	S.TR KTC4080 Y-RTK/P	T	59.6/15.4
Q5	1530003900	S.TR KTC4075 BL-RTK/P	T	37.9/40.0
Q6	1530003900	S.TR KTC4075 BL-RTK/P	T	4.1/38.1
Q7	1530003900	S.TR KTC4075 BL-RTK/P	T	5.1/32.7
Q11	1530003900	S.TR KTC4075 BL-RTK/P	T	85.8/28.2
Q12	1590003580	S.TR KRC404 RTK/P	T	66.4/31.9
Q13	1530002920	S.TR 2SC4226-T1 R25	T	72.2/37.4
Q14	1530002920	S.TR 2SC4226-T1 R25	T	72.4/31.6
Q15	1530002601	S.TR 2SC4215-O (TE85R,F)	T	82/38.1
Q16	1530002601	S.TR 2SC4215-O (TE85R,F)	T	84.6/36.4
Q17	1530002920	S.TR 2SC4226-T1 R25	T	47.3/31.7
Q19	1590003580	S.TR KRC404 RTK/P	T	54.5/60.4
Q20	1590003580	S.TR KRC404 RTK/P	T	55.2/57
Q21	1590000670	S.TR FMW1 T148	T	60.4/63.1
Q22	1590003680	S.TR KRC402 RTK/P	T	61.3/55.4
Q23	1510001090	S.TR KTA2015Y-RTK/P	T	55.5/66.3
Q25	1590003580	S.TR KRC404 RTK/P	T	32.9/26.1
Q26	1530003950	S.TR KTC4080 Y-RTK/P	T	81.7/33.3
Q31	1510001090	S.TR KTA2015Y-RTK/P	T	28.1/65.9
Q32	1590003580	S.TR KRC404 RTK/P	T	30/60.5
Q33	1510001090	S.TR KTA2015Y-RTK/P	T	20/57
Q34	1590003580	S.TR KRC404 RTK/P	T	19.8/51.6
Q35	1520000840	S.TR KTA1664Y-RTF/P	T	4.6/49.4
Q36	1530003900	S.TR KTC4075 BL-RTK/P	T	6.1/45.5
D1	1710001081	DIO L308CCB		
D2	1710001081	DIO L308CCB		
D4	1750001190	S.VCP KDV214E RTK/P	T	107.2/39.4
D5	1750001190	S.VCP KDV214E RTK/P	T	99.9/29.3
D6	1750001190	S.VCP KDV214E RTK/P	T	102.5/12
D7	1750001190	S.VCP KDV214E RTK/P	T	99.1/12
D8	1790000980	S.DIO MA742 (TX)	T	63.9/15.5
D9	1750000471	S.DIO 1SS321 (TE85L,F)	T	53/20.1
D11	1790001260	S.DIO MA2S077-(TX)	T	66.1/34.1
D12	1790001260	S.DIO MA2S077-(TX)	T	73.3/26.8
D13	1750000711	S.VCP HVC350BTRF-E	T	76.8/33.5
D14	1750000711	S.VCP HVC350BTRF-E	T	75.5/33.5
D16	1790001260	S.DIO MA2S077-(TX)	T	92.1/37.1
D17	1790001260	S.DIO MA2S077-(TX)	T	92.1/40.6
D21	1790000691	S.DIO HSM88ASRTR-E	T	69.3/57.2
D22	1790000691	S.DIO HSM88ASRTR-E	T	73.5/57.2
D25	1790000700	DIO DSA3A1		
D26	1750001180	S.DIO KDS122 RTK/P	T	32.2/34
FI1	2030000350	MLH FL-368 (21.7 MHz)		
FI2	2030000481	MLH FL-399A (21.7 MHz)		
FI3	2020002250	CER LT450EW		
X1	6070000290	DCR JTB450C24		
X2	6050012121	S.XTL CR-804A (21.250 MHz)	T	54.5/41.3
L1	6110001600	COL LA-243		
L2	6110001600	COL LA-243		

M.=Mounted side (T: Mounted on the Top side, B: Mounted on the Bottom side)
S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
L3	6110001600	COL LA-243		
L6	6150003821	COL LS-440-LF		
L7	6150003821	COL LS-440-LF		
L8	6150003821	COL LS-440-LF		
L9	6150003821	COL LS-440-LF		
L10	6200010090	S.COL ELJND R82JF	T	79.5/15.5
L12	6200009560	S.COL MLG1608B R10J-T	T	93.5/25.3
L13	6200009560	S.COL MLG1608B R10J-T	T	93.5/28.9
L21	6200003711	S.COL NLV25T-2R7J	T	75.7/26
L22	6200012510	S.COL 0.25-1.9-8TL 72.0N	T	77.2/30.7
L23	6200009560	S.COL MLG1608B R10J-T	T	80.6/36.2
L26	6200009560	S.COL MLG1608B R10J-T	T	86.5/34.8
L28	6200009560	S.COL MLG1608B R10J-T	T	45.7/64
L29	6200009680	S.COL MLG1608B 47NJ-T	T	44.4/68
L31	6110001670	COL LA-253		
L32	6170000230	COL LW-25		
L35	6200009560	S.COL MLG1608B R10J-T	T	81.6/31.2
L36	6200009620	S.COL MLG1608B 68NJ-T	T	80.8/27.4
R4	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	100.3/42.4
R5	7030003630	S.RES ERJ3GEYJ 393 V (39 k)	T	100.3/37.4
R6	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	T	98/37.1
R7	7030003410	S.RES ERJ3GEYJ 561 V (560)	T	107/34.7
R8	7030004050	S.RES ERJ3GEYJ 1R0 V (1)	T	100.8/32.3
R9	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	103.5/36.2
R10	7030003260	S.RES ERJ3GEYJ 330 V (33)	T	106.2/36.8
R12	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	97.4/27.6
R14	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	102.8/14.2
R16	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	100.8/14.2
R17	7030003860	S.RES ERJ3GE JPW V	T	61.9/20.6
R21	7030003320	S.RES ERJ3GEYJ 101 V (100)	T	100.3/40.3
R25	7030003820	S.RES ERJ3GEYJ 155 V (1.5 M)	T	85.8/14.5
R26	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	T	86.6/13.2
R27	7030003600	S.RES ERJ3GEYJ 223 V (22 k)	T	83.8/16.1
R28	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	86.6/19.4
R31	7030003200	S.RES ERJ3GEYJ 100 V (10)	T	83.7/18.1
R32	7030003540	S.RES ERJ3GEYJ 682 V (6.8 k)	T	75.3/15.3
R33	7030003450	S.RES ERJ3GEYJ 122 V (1.2 k)	T	79.2/12.7
R34	7030003450	S.RES ERJ3GEYJ 122 V (1.2 k)	T	57.7/12.7
R35	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	60/18.2
R36	7030003460	S.RES ERJ3GEYJ 152 V (1.5 k)	T	63.9/19
R37	7030003400	S.RES ERJ3GEYJ 471 V (470)	T	58.7/18.2
R38	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	93.7/36.1
R39	7030003400	S.RES ERJ3GEYJ 471 V (470)	T	93.7/33.3
R41	7030003660	S.RES ERJ3GEYJ 683 V (68 k)	T	50.7/19.8
R42	7030003400	S.RES ERJ3GEYJ 471 V (470)	T	45.3/8.9
R43	7030003460	S.RES ERJ3GEYJ 152 V (1.5 k)	T	55.1/10.5
R44	7030003390	S.RES ERJ3GEYJ 391 V (390)	T	49.4/21.3
R45	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	9.1/42.8
R46	7030003450	S.RES ERJ3GEYJ 122 V (1.2 k)	T	10/39.5
R47	7510001671	S.TMR NTCG16 4BH 103JT	T	37.5/8.9
R48	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	T	40.3/10.3
R49	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	T	40.3/8.9
R50	7030003730	S.RES ERJ3GEYJ 274 V (270 k)	T	44.8/12.5
R51	7030003460	S.RES ERJ3GEYJ 152 V (1.5 k)	T	48.7/19.1
R52	7030003590	S.RES ERJ3GEYJ 183 V (18 k)	T	36.6/38
R53	7030003620	S.RES ERJ3GEYJ 333 V (33 k)	T	34.5/37.3
R54	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	38.7/38.1
R55	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	40.8/43.2
R56	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	39.5/43.2
R57	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	T	35.6/43.2
R58	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	35.2/41.2
R61	7030003600	S.RES ERJ3GEYJ 223 V (22 k)	T	12/35.6
R62	7030003580	S.RES ERJ3GEYJ 153 V (15 k)	T	7.3/38.6
R63	7030003400	S.RES ERJ3GEYJ 471 V (470)	T	7.5/42.8
R64	7030003760	S.RES ERJ3GEYJ 474 V (470 k)	T	6.6/35.3
R65	7030003720	S.RES ERJ3GEYJ 224 V (220 k)	T	8/35.3
R66	7030003490	S.RES ERJ3GEYJ 272 V (2.7 k)	T	4/36.1
R67	7030003390	S.RES ERJ3GEYJ 391 V (390)	T	7.3/39.9
R68	7030003620	S.RES ERJ3GEYJ 333 V (33 k)	T	4/34.8
R69	7030003620	S.RES ERJ3GEYJ 333 V (33 k)	T	3.2/32.5
R70	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	8.3/32.5
R71	7030003280	S.RES ERJ3GEYJ 470 V (47)	T	33.7/38.9
R72	7030003760	S.RES ERJ3GEYJ 474 V (470 k)	T	33/43.2
R73	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	T	39.3/36.8
R74	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	21.9/46.1
R75	7030003630	S.RES ERJ3GEYJ 393 V (39 k)	T	21.9/43.3
R76	7030003580	S.RES ERJ3GEYJ 153 V (15 k)	T	19.9/42.5
R77	7030003860	S.RES ERJ3GE JPW V	T	40.1/34.9
R78	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	19.1/44.7
R81	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	T	85.8/30.2
R82	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	T	85.7/26.3
R83	7030003410	S.RES ERJ3GEYJ 561 V (560)	T	73.1/24.3
R84	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	T	75.7/23.7
R85	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	T	73.1/25.5
R86	7030003320	S.RES ERJ3GEYJ 101 V (100)	T	67.1/28.9
R87	7030003620	S.RES ERJ3GEYJ 333 V (33 k)	T	62.3/41
R88	7030003600	S.RES ERJ3GEYJ 223 V (22 k)	T	62.3/38.2
R89	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	65.6/38.8
R90	7030003550	S.RES ERJ3GEYJ 822 V (8.2 k)	T	65.6/40.1
R91	7030003320	S.RES ERJ3GEYJ 101 V (100)	T	75.3/39.6
R92	7030003390	S.RES ERJ3GEYJ 391 V (390)	T	72.4/39.6
R93	7030003550	S.RES ERJ3GEYJ 822 V (8.2 k)	T	74.8/36.4
R94	7030003350	S.RES ERJ3GEYJ 181 V (180)	T	73.1/35.1
R95	7030003550	S.RES ERJ3GEYJ 822 V (8.2 k)	T	72.2/29.7
R96	7030003420	S.RES ERJ3GEYJ 681 V (680)	T	77.4/38.5
R97	7030003660	S.RES ERJ3GEYJ 683 V (68 k)	T	78.7/38.5
R102	7030003320	S.RES ERJ3GEYJ 101 V (100)	T	86.5/32.2
R103	7030003610	S.RES ERJ3GEYJ 273 V (27 k)	T	84.6/39.4
R106	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	T	93.7/39.1
R108	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	53.1/63
R109	7030003390	S.RES ERJ3GEYJ 391 V (390)	T	92.9/44.3
R110	7030003200	S.RES ERJ3GEYJ 100 V (10)	T	48.8/67.4

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
R111	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	47/64
R112	7030003580	S.RES ERJ3GEYJ 153 V (15 k)	T	49.6/60.2
R113	7030003370	S.RES ERJ3GEYJ 271 V (270)	T	50.9/64
R126	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	57.8/66.4
R127	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	57.2/68.6
R128	7030003370	S.RES ERJ3GEYJ 271 V (270)	T	55.1/68.8
R129	7030003360	S.RES ERJ3GEYJ 221 V (220)	T	53.8/68.8
R130	7030001110	S.RES MCR50JZHJ 68 (680)	T	80.4/55.8
R134	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	68.8/54.2
R135	7310005270	S.TRI RH03ADCJ2X (220)	T	65/58.7
R136	7030003520	S.RES ERJ3GEYJ 472 V (4.7 k)	T	63.2/55.4
R137	7030003310	S.RES ERJ3GEYJ 820 V (82)	T	61.5/58.3
R138	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	63.5/61.7
R139	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	63.5/63
R140	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	59.4/60.3
R141	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	58/63.6
R144	7030003500	S.RES ERJ3GEYJ 332 V (3.3 k)	T	58.9/58.3
R145	7030003240	S.RES ERJ3GEYJ 220 V (22 k)	T	57.4/59.6
R146	7030003470	S.RES ERJ3GEYJ 182 V (1.8 k)	T	67.2/62.5
R147	7030003470	S.RES ERJ3GEYJ 182 V (1.8 k)	T	67.2/61.1
R148	7030003470	S.RES ERJ3GEYJ 182 V (1.8 k)	T	75.6/62.5
R149	7030003470	S.RES ERJ3GEYJ 182 V (1.8 k)	T	75.6/61.1
R151	7030003320	S.RES ERJ3GEYJ 101 V (100)	T	18.5/20.5
R152	7030000100	S.RES MCR10EZHJ 4.7 (4R7)	T	16.5/63.9
R153	7030003580	S.RES ERJ3GEYJ 153 V (15 k)	T	31.1/31
R154	7030003450	S.RES ERJ3GEYJ 122 V (1.2 k)	T	31.1/28
R155	7030003800	S.RES ERJ3GEYJ 105 V (1 M)	T	16.7/45.3
R156	7030003600	S.RES ERJ3GEYJ 223 V (22 k)	T	5.2/65.6
R157	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	17.6/48.9
R158	7030004050	S.RES ERJ3GEYJ 1R0 V (1)	T	5.2/68.4
R159	7030004050	S.RES ERJ3GEYJ 1R0 V (1)	T	3.9/68.4
R161	7030003800	S.RES ERJ3GEYJ 105 V (1 M)	T	3.6/26.1
R162	7030003800	S.RES ERJ3GEYJ 105 V (1 M)	T	9.9/28.1
R164	7030003800	S.RES ERJ3GEYJ 105 V (1 M)	T	7.8/23.2
R165	7030003490	S.RES ERJ3GEYJ 272 V (2.7 k)	T	22.5/20.5
R170	7030003640	S.RES ERJ3GEYJ 473 V (47 k)	T	13.3/25.8
R171	7030003340	S.RES ERJ3GEYJ 151 V (150)	T	17.5/34.6
R172	7030003680	S.RES ERJ3GEYJ 104 V (100 k)	T	17.5/33.3
R173	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	15.5/31.2
R174	7030010310	S.RES ERJ3GEYF 223 V (22 k)	T	17.5/30.7
R176	7030010290	S.RES ERJ3GEYF 273 V (27 k)	T	24.7/31.3
R177	7030003660	S.RES ERJ3GEYJ 683 V (68 k)	T	24.7/30
R178	7030003670	S.RES ERJ3GEYJ 823 V (82 k)	T	24.7/27.1
R179	7030003670	S.RES ERJ3GEYJ 823 V (82 k)	T	24.7/23.9
R180	7030003610	S.RES ERJ3GEYJ 273 V (27 k)	T	24.7/32.6
R181	7510001521	S.TMR NTCG16 4LH 223JT	T	26.8/31.2
R182	7030003580	S.RES ERJ3GEYJ 153 V (15 k)	T	28.1/32.2
R183	7030003580	S.RES ERJ3GEYJ 153 V (15 k)	T	28.1/29.4
R184	7310005030	S.TRI RH03ADCS4X (47 k)	T	47.5/39.5
R188	7030003280	S.RES ERJ3GEYJ 470 V (47)	T	22.3/32.7
R189	7030003550	S.RES ERJ3GEYJ 822 V (8.2 k)	T	20.9/35.9
R190	7030003570	S.RES ERJ3GEYJ 123 V (12 k)	T	20.3/34.6
R191	7030003670	S.RES ERJ3GEYJ 823 V (82 k)	T	20.3/33.3
R201	7030003400	S.RES ERJ3GEYJ 471 V (470)	T	83.2/29.9
R202	7030003660	S.RES ERJ3GEYJ 683 V (68 k)	T	83.6/32.6
R203	7030003370	S.RES ERJ3GEYJ 271 V (270)	T	80.4/27.1
R204	7030003230	S.RES ERJ3GEYJ 180 V (18)	T	77.8/19.8
R205	7030003370	S.RES ERJ3GEYJ 271 V (270)	T	76.3/31.1
R206	7030003280	S.RES ERJ3GEYJ 470 V (47)	T	75.7/18.3
R210	7030003280	S.RES ERJ3GEYJ 470 V (47)	T	50.9/34.9
R211	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	60.4/25.9
R212	7030003200	S.RES ERJ3GEYJ 100 V (10)	T	62.5/27.8
R213	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	64.7/27.1
R214	7030003380	S.RES ERJ3GEYJ 331 V (330)	T	58.4/25.2
R215	7030003380	S.RES ERJ3GEYJ 331 V (330)	T	59.1/37.7
R216	7030003500	S.RES ERJ3GEYJ 332 V (3.3 k)	T	53.6/32.7
R221	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	28.2/63.7
R222	7030003480	S.RES ERJ3GEYJ 222 V (2.2 k)	T	28.2/62.4
R223	7030003560	S.RES ERJ3GEYJ 103 V (10 k)	T	18.1/56.8
R224	7030003440	S.RES ERJ3GEYJ 102 V (1 k)	T	20.6/54.1
R225	7030003510	S.RES ERJ3GEYJ 392 V (3.9 k)	T	3.1/46.2
R226	7030003520	S.RES ERJ3GEYJ 472 V (4.7 k)	T	3.1/44.9
C3	4010007630	CER HM60SJ CH 270J 500V		
C4	4010005420	CER HM60SJ CH 040C 500V		
C5	4010008050	CER HM60SJ CH 180J 500V		
C6	4010005790	CER RT-HM60SK YB 102K 500V		
C7	4010007630	CER HM60SJ CH 270J 500V		
C8	4010008070	CER HM60SJ CH 220J 500V		
C12	4030006990	S.CER C1608 CH 1H 080D-T	T	102.3/49.4
C13	4030007010	S.CER C1608 CH 1H 100D-T	T	101.5/47.4
C14	4030009510	S.CER C1608 CH 1H 010B-T	T	104.4/38.1
C15	4030006980	S.CER C1608 CH 1H 070D-T	T	104.4/39.4
C16	4030009920	S.CER C1608 CH 1H 050B-T	T	102.4

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
C36	4030006860	S.CER C1608 JB 1H 102K-T	T	100.3/38.7
C42	4030009350	S.CER C1608 CH 1H 3R5B-T	T	91.6/26.5
C44	4030006860	S.CER C1608 JB 1H 102K-T	T	92.1/32.1
C46	4030006860	S.CER C1608 JB 1H 102K-T	T	86.6/15.8
C47	4030007100	S.CER C1608 CH 1H 560J-T	T	77.9/15.3
C48	4030007010	S.CER C1608 CH 1H 100D-T	T	76.6/15.3
C49	4030006860	S.CER C1608 JB 1H 102K-T	T	82.4/16.1
C50	4030011600	S.CER C1608 JB 1E 104K-T	T	81.1/16.1
C52	4030011600	S.CER C1608 JB 1E 104K-T	T	70.1/17
C53	4030006900	S.CER C1608 JB 1H 103K-T	T	12.4/16.4
C55	4030009920	S.CER C1608 CH 1H 050B-T	T	67/10.2
C57	4030006860	S.CER C1608 JB 1H 102K-T	T	61.9/15.4
C59	4030006860	S.CER C1608 JB 1H 102K-T	T	63.3/18.2
C60	4030006900	S.CER C1608 JB 1H 103K-T	T	55.8/18
C61	4030008920	S.CER C1608 JB 1H 473K-T	T	55.4/20.2
C62	4030006900	S.CER C1608 JB 1H 103K-T	T	69.7/20
C63	4030011600	S.CER C1608 JB 1E 104K-T	T	55.1/16
C64	4030006860	S.CER C1608 JB 1H 102K-T	T	46.1/10.9
C65	4030006860	S.CER C1608 JB 1H 102K-T	T	43.2/9.7
C67	4030007130	S.CER C1608 CH 1H 101J-T	T	55.1/13.3
C68	4510008540	S.ELE EEE1CA100SR	T	45/21.7
C70	4030006860	S.CER C1608 JB 1H 102K-T	T	44.1/17.6
C71	4030006900	S.CER C1608 JB 1H 103K-T	T	42.8/17.6
C72	4030011600	S.CER C1608 JB 1E 104K-T	T	41.5/17.6
C73	4030007170	S.CER C1608 CH 1H 221J-T	T	41.8/11.9
C74	4030007170	S.CER C1608 CH 1H 221J-T	T	41.8/13.2
C75	4030011600	S.CER C1608 JB 1E 104K-T	T	37.5/10.3
C76	4030011600	S.CER C1608 JB 1E 104K-T	T	44.6/14.5
C77	4030006860	S.CER C1608 JB 1H 102K-T	T	53.6/29.6
C80	4030006860	S.CER C1608 JB 1H 102K-T	T	95.1/33.2
C82	4030011600	S.CER C1608 JB 1E 104K-T	T	17.5/37.7
C83	4030009880	S.CER C1608 JB 1H 682K-T	T	40.5/41.1
C84	4030008880	S.CER C1608 JB 1H 223K-T	T	36.9/43.2
C85	4030006870	S.CER C1608 JB 1H 222K-T	T	38.2/43.2
C86	4030009880	S.CER C1608 JB 1H 682K-T	T	34.3/43.2
C88	4030011600	S.CER C1608 JB 1E 104K-T	T	12.8/37.6
C89	4030011600	S.CER C1608 JB 1E 104K-T	T	11.2/32.3
C90	4030008880	S.CER C1608 JB 1H 223K-T	T	10.5/34.3
C91	4030008880	S.CER C1608 JB 1H 223K-T	T	7.3/37.3
C92	4510008540	S.ELE EEE1CA100SR	T	3.3/41.8
C93	4030006870	S.CER C1608 JB 1H 222K-T	T	7/32.5
C94	4030010040	S.CER C1608 JB 1H 561K-T	T	1.9/32.5
C95	4030017490	S.CER C1608 JB 1A 105K-T	T	9.8/31.5
C97	4030006900	S.CER C1608 JB 1H 103K-T	T	32.4/41.2
C99	4340000310	S.MLR ECHU 1C 333JX5	T	20.1/40.3
C100	4030011600	S.CER C1608 JB 1E 104K-T	T	25.5/50
C101	4030006870	S.CER C1608 JB 1H 222K-T	T	20.6/47.5
C102	4030006900	S.CER C1608 JB 1H 103K-T	T	20.6/44.7
C103	4030011810	S.CER C1608 JB 1A 224K-T	T	31.7/43.2
C104	4510008540	S.ELE EEE1CA100SR	T	26.9/36.4
C105	4030011600	S.CER C1608 JB 1E 104K-T	T	30.9/38.9
C110	4030006900	S.CER C1608 JB 1H 103K-T	T	85/32.6
C111	4550007520	S.TAN F931A106MAABMA	T	83.2/26.3
C112	4030017460	S.CER ECJ0EB1E102K	T	85.2/25.1
C113	4550000530	S.TAN TEESVA 1V 104M8R	T	79.5/24.7
C114	4030017460	S.CER ECJ0EB1E102K	T	77.7/26.2
C115	4030017500	S.CER ECJ0EC1H560J	T	75.2/28.5
C116	4030017420	S.CER ECJ0EC1H470J	T	74.2/28.6
C117	4030006850	S.CER C1608 JB 1H 471K-T	T	65.6/37.5
C118	4550007520	S.TAN F931A106MAABMA	T	64.7/35.8
C119	4030017460	S.CER ECJ0EB1E102K	T	73.2/28.3
C121	4030006860	S.CER C1608 JB 1H 102K-T	T	63.6/38.2
C122	4030017490	S.CER C1608 JB 1A 105K-T	T	65.6/41.4
C124	4030017460	S.CER ECJ0EB1E102K	T	75.4/38.4
C125	4030017550	S.CER ECJ0EC1H1R5B	T	75.4/35.3
C126	4030017460	S.CER ECJ0EB1E102K	T	71.4/35
C127	4030017550	S.CER ECJ0EC1H1R5B	T	74.3/33.3
C128	4030017540	S.CER ECJ0EC1HR75B	T	75.4/37.5
C129	4030017460	S.CER ECJ0EB1E102K	T	73.3/33.7
C130	4030016790	S.CER ECJ0EB1C103K	T	79.9/38
C135	4030017580	S.CER ECJ0EC1H060C	T	84.4/38.2
C136	4030017460	S.CER ECJ0EB1E102K	T	84.9/34.6
C138	4030017400	S.CER ECJ0EC1H220J	T	86.6/37.4
C139	4030006860	S.CER C1608 JB 1H 102K-T	T	93.7/42.2
C140	4030007150	S.CER C1608 CH 1H 151J-T	T	52/58.2
C145	4030006860	S.CER C1608 JB 1H 102K-T	T	50.9/67.2
C146	4030006860	S.CER C1608 JB 1H 102K-T	T	48.3/66.1
C147	4030007090	S.CER C1608 CH 1H 470J-T	T	48.3/64
C148	4030006860	S.CER C1608 JB 1H 102K-T	T	49.6/64
C149	4030007010	S.CER C1608 CH 1H 100D-T	T	44.4/64
C151	4030007010	S.CER C1608 CH 1H 100D-T	T	45.2/66
C153	4030009920	S.CER C1608 CH 1H 050B-T	T	45.5/71.8
C159	4030007130	S.CER C1608 CH 1H 101J-T	T	49.9/71.1
C161	4550007090	S.TAN TEESVA 1A 226M8R	T	53.9/71.3
C162	4030006850	S.CER C1608 JB 1H 471K-T	T	54/73
C164	4030006850	S.CER C1608 JB 1H 471K-T	T	65.3/73
C165	4030007130	S.CER C1608 CH 1H 101J-T	T	57.8/70.7
C166	4030006860	S.CER C1608 JB 1H 102K-T	T	59.1/70.7
C167	4510008570	S.ELE EEE1CA220SR	T	62.7/69.3
C171	4010008070	CER HM60SJ CH 220J 500V	T	
C172	4030006860	S.CER C1608 JB 1H 102K-T	T	69.3/60.3
C173	4030006860	S.CER C1608 JB 1H 102K-T	T	73.5/60.3
C174	4010005430	CER HM60SJ CH 050C 500V	T	
C175	4030006860	S.CER C1608 JB 1H 102K-T	T	82.9/52.9
C176	4030006860	S.CER C1608 JB 1H 102K-T	T	63.5/64.5
C177	4030006900	S.CER C1608 JB 1H 103K-T	T	70.9/53.4
C178	4030006860	S.CER C1608 JB 1H 102K-T	T	66/51.3
C179	4030006850	S.CER C1608 JB 1H 471K-T	T	44.2/35.7
C180	4030006860	S.CER C1608 JB 1H 102K-T	T	73.4/54.9
C181	4030006860	S.CER C1608 JB 1H 102K-T	T	59.4/55.4
C182	4030006850	S.CER C1608 JB 1H 471K-T	T	45.5/35.7
C184	4030006900	S.CER C1608 JB 1H 103K-T	T	60.2/58.3
C185	4030006850	S.CER C1608 JB 1H 471K-T	T	54.7/54.7
C186	4030006860	S.CER C1608 JB 1H 102K-T	T	52.5/68.8

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
C194	4030007130	S.CER C1608 CH 1H 101J-T	T	41.3/70.7
C198	4030007130	S.CER C1608 CH 1H 101J-T	T	26.1/60.9
C199	4030006850	S.CER C1608 JB 1H 471K-T	T	26.1/59.6
C201	4030007050	S.CER C1608 CH 1H 220J-T	T	34.3/58.8
C202	4030007130	S.CER C1608 CH 1H 101J-T	T	35.6/58.8
C203	4030006850	S.CER C1608 JB 1H 471K-T	T	36.9/58.8
C205	4030006860	S.CER C1608 JB 1H 102K-T	T	15.9/20.5
C206	4030006850	S.CER C1608 JB 1H 471K-T	T	13.8/16.4
C207	4030006860	S.CER C1608 JB 1H 102K-T	T	42/25.7
C208	4030006860	S.CER C1608 JB 1H 102K-T	T	28.7/17.1
C211	4510004591	ELE 16 ME 470 HC+TS	T	
C212	4030011600	S.CER C1608 JB 1E 104K-T	T	4.4/72.7
C213	4510004591	ELE 16 ME 470 HC+TS	T	
C214	4030011600	S.CER C1608 JB 1E 104K-T	T	16.1/65.5
C215	4030006900	S.CER C1608 JB 1H 103K-T	T	29.6/29.3
C216	4030017490	S.CER C1608 JB 1A 105K-T	T	4.7/62.3
C217	4030006860	S.CER C1608 JB 1H 102K-T	T	3.9/65.6
C220	4030011810	S.CER C1608 JB 1A 224K-T	T	4.3/28.4
C221	4030006860	S.CER C1608 JB 1H 102K-T	T	9.1/26.2
C222	4030011600	S.CER C1608 JB 1E 104K-T	T	6.4/23.2
C223	4030011600	S.CER C1608 JB 1E 104K-T	T	15.5/33.9
C225	4030007140	S.CER C1608 CH 1H 121J-T	T	17.5/32
C226	4030011600	S.CER C1608 JB 1E 104K-T	T	21.9/30.7
C227	4510008540	S.ELE EEE1CA100SR	T	3.1/21.8
C228	4030011600	S.CER C1608 JB 1E 104K-T	T	15/23.9
C230	4510008540	S.ELE EEE1CA100SR	T	10.9/21.7
C232	4030006860	S.CER C1608 JB 1H 102K-T	T	24.7/28.7
C233	4030010770	S.CER C1608 JB 1H 392K-T	T	24.7/25.8
C234	4030007130	S.CER C1608 CH 1H 101J-T	T	21.9/23.9
C236	4030006850	S.CER C1608 JB 1H 471K-T	T	45.1/40.4
C241	4030017380	S.CER ECJ0EC1H050B	T	82.5/35.6
C242	4030017460	S.CER ECJ0EB1E102K	T	79.9/38.6
C243	4030017390	S.CER ECJ0EC1H180J	T	81.4/29.8
C244	4030017400	S.CER ECJ0EC1H220J	T	81.5/28.5
C245	4030017400	S.CER ECJ0EC1H220J	T	80.7/26.3
C246	4030006860	S.CER C1608 JB 1H 102K-T	T	75/19.8
C247	4030006860	S.CER C1608 JB 1H 102K-T	T	78.5/18.3
C248	4550007260	S.TAN F931C475MAABMA	T	52.5/38
C249	4030011600	S.CER C1608 JB 1E 104K-T	T	52.3/28.7
C250	4030006900	S.CER C1608 JB 1H 103K-T	T	53.6/26.8
C251	4030006860	S.CER C1608 JB 1H 102K-T	T	53.4/35.5
C252	4550003260	S.TAN TEESVA 1V 684M8R	T	62.9/23.7
C254	4550002980	S.TAN TEESVA 1C 225M8R	T	65/23.7
C257	4610001590	S.TRI TZC3R100A110R00	T	59.8/41.3
C258	4030007020	S.CER C1608 CH 1H 120J-T	T	57/44.7
C259	4030007040	S.CER C1608 CH 1H 180J-T	T	55.9/37.3
C269	4510008540	S.ELE EEE1CA100SR	T	10.4/50.2
C270	4030011600	S.CER C1608 JB 1E 104K-T	T	5.7/55.7
C273	4510008540	S.ELE EEE1CA100SR	T	11.8/56.2
C274	4030011600	S.CER C1608 JB 1E 104K-T	T	5.7/58.6
C275	4030006860	S.CER C1608 JB 1H 102K-T	T	30/65.8
C276	4510008540	S.ELE EEE1CA100SR	T	37/64.9
C277	4030006850	S.CER C1608 JB 1H 471K-T	T	32.2/60.3
C278	4030006860	S.CER C1608 JB 1H 102K-T	T	22.2/54.8
C279	4510008540	S.ELE EEE1CA100SR	T	25.3/55.5
C280	4030006850	S.CER C1608 JB 1H 471K-T	T	22.1/51.9
C291	4030006850	S.CER C1608 JB 1H 471K-T	T	39.4/25.7
C292	4030006850	S.CER C1608 JB 1H 471K-T	T	40.7/25.7
C294	4030006860	S.CER C1608 JB 1H 102K-T	T	6.6/53
C295	4030007090	S.CER C1608 CH 1H 470J-T	T	17.6/51.9
C296	4030006850	S.CER C1608 JB 1H 471K-T	T	11.6/46.5
C297	4030006850	S.CER C1608 JB 1H 471K-T	T	18.9/48.9
C298	4030006860	S.CER C1608 JB 1H 102K-T	T	11.6/45
C299	4030007090	S.CER C1608 CH 1H 470J-T	T	11.6/43.6
C300	4030007090	S.CER C1608 CH 1H 470J-T	T	11.6/42.3
C301	4030006850	S.CER C1608 JB 1H 471K-T	T	34.4/34
C302	4030006850	S.CER C1608 JB 1H 471K-T	T	35.1/25.7
C303	4030006860	S.CER C1608 JB 1H 102K-T	T	36.8/25.7
C304	4030006860	S.CER C1608 JB 1H 102K-T	T	36.4/35.2
C305	4030006860	S.CER C1608 JB 1H 102K-T	T	41.5/38.2
C306	4030007090	S.CER C1608 CH 1H 470J-T	T	50.6/24.2
C307	4030006900	S.CER C1608 JB 1H 103K-T	T	60.4/24.3
J1	6510021721	S.CNR 30FLT-SM2-TB (LF) (SN)	T	41.5/30.3
J2	6510024601	CNR S5B-PH-K-S (LF) (SN)	T	
W1	8900012401	CBL OPC-1264A <TJM>		
W2	7120000470	JMP ERDS2T0		

[VR UNIT]

REF NO.	ORDER NO.	DESCRIPTION		M.	H/V LOCATION
R1	7210003140	VAR	TP96N97N-15SK-10KA-2685		
J1	6510009381	CNR	B5B-ZR (LF) (SN)		

SECTION 7 MECHANICAL PARTS AND DISASSEMBLY

[CHASSIS PARTS]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J1	6510004880	MR-DSE-01	1
W1	8900012331	OPC-1258A	1
MP2	8010019302	2685 CHASSIS-2	1
MP3	8930061050	2685 R-BUSH PLATE	1
MP4	8510015570	2685 CASE [Black]	1
	8510018180	2685 CASE (C) [Super White]	1
	8510015690	2685 CASE (B) [Gray]	1
MP5	8930060440	2685 R-PACKING	1
MP6	8930060451	2685 F-PACKING-1 [Black]	1
	8930060451	2685 F-PACKING-1 [Super White]	1
	8930061191	2685 F-PACKING (A)-1 [Gray]	1
MP7	8930034300	1542 ANT SEAL	1
MP8	8930052440	2345 B-IC CLIP	1
MP10	8510015560	2685 MODULE COVER	1
MP11	8930055070	2438 SHEET	1
MP12	8810008661	Screw BT B0 3X8 NI-ZC3 (BT)	6
MP13	8810008201	Screw BTB0 2.6X6NI-ZC3 (BT)	2
MP14	8810002950	Screw BiH M3X6 SUS	2
MP15	8810004540	Screw BiH M3X8 SUS	4
MP16	8810004700	Screw BT A0 3X16 SUS	4
MP19	8510018260	2989 MODULE PLATE	1

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J2	6510024601	S5B-PH-K-S (LF) (SN)	1
W1	8900012401	OPC-1264A	1
W2	7120000470	ERDS2T0	1
MP1*	8510011111	1922 VCO CASE-1	1
MP2	8510011101	1922 VCO COVER-1	1
MP3	8510016170	2685 SHIELD PLATE	1
MP4	8930005320	Filter spacer	2

*: Refer to SECTION 9 BOARD LAYOUTS.

[SQL UNIT]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
R1	7210003150	TP96N97-15SK-10KB-2685	1
J1	6510009471	S3B-ZR (LF) (SN)	1

[VR UNIT]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
R1	7210003140	TP96N97N-15SK-10KA-2685	1
J1	6510009381	B5B-ZR (LF) (SN)	1

[FRONT UNIT]

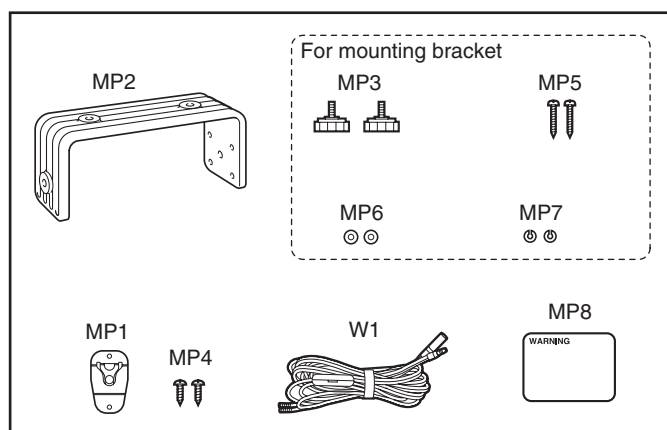
REF NO.	ORDER NO.	DESCRIPTION	QTY.
R1	7070001220	3.9 ERX2SJ	1
MC1	Optional product	HM-164B [Black]	1
	Optional product	HM-164SW [Super White]	1
	Optional product	HM-164G [Gray]	1
SP1	2510001350	045P0806-7-1	1
W1	7120000470	ERDS2T0	1
W2	8900012412	OPC-1263B	1
MP1	8210023510	2989 FRONT PANEL [Black]	1
	8210023520	2989 FRONT PANEL (A) [Super White]	1
	8210023670	2989 FRONT PANEL (B) [Gray]	1
MP2	8930071270	2989 KEY BOARD	1
MP3	8310068590	2989 WINDOW PLATE	1
MP4	8610011370	KNOB N-312 [Black]	2
	8610012140	KNOB N-312 (C) [Super White]	2
	8610011640	KNOB N-312 (B) [Gray]	2
MP5	8930014280	Speaker net (FX-706)	1
MP6	8810010021	Screw BTB0 2.6X8NI-ZC3 (BT)	4
MP7	8930052010	2345 SHAFT	1
MP8	8930060481	2685 SPRING-1	1
MP9	8110008990	2989 D-COVER	1
MP10	8930060470	2685 SHAFT ANGLE	1
MP11	8930060490	2685 F-BUSH PLATE	1
MP12	8930052280	O-ring (AC)	2
MP13	8930055841	2490 EARTH SPRING-1	1

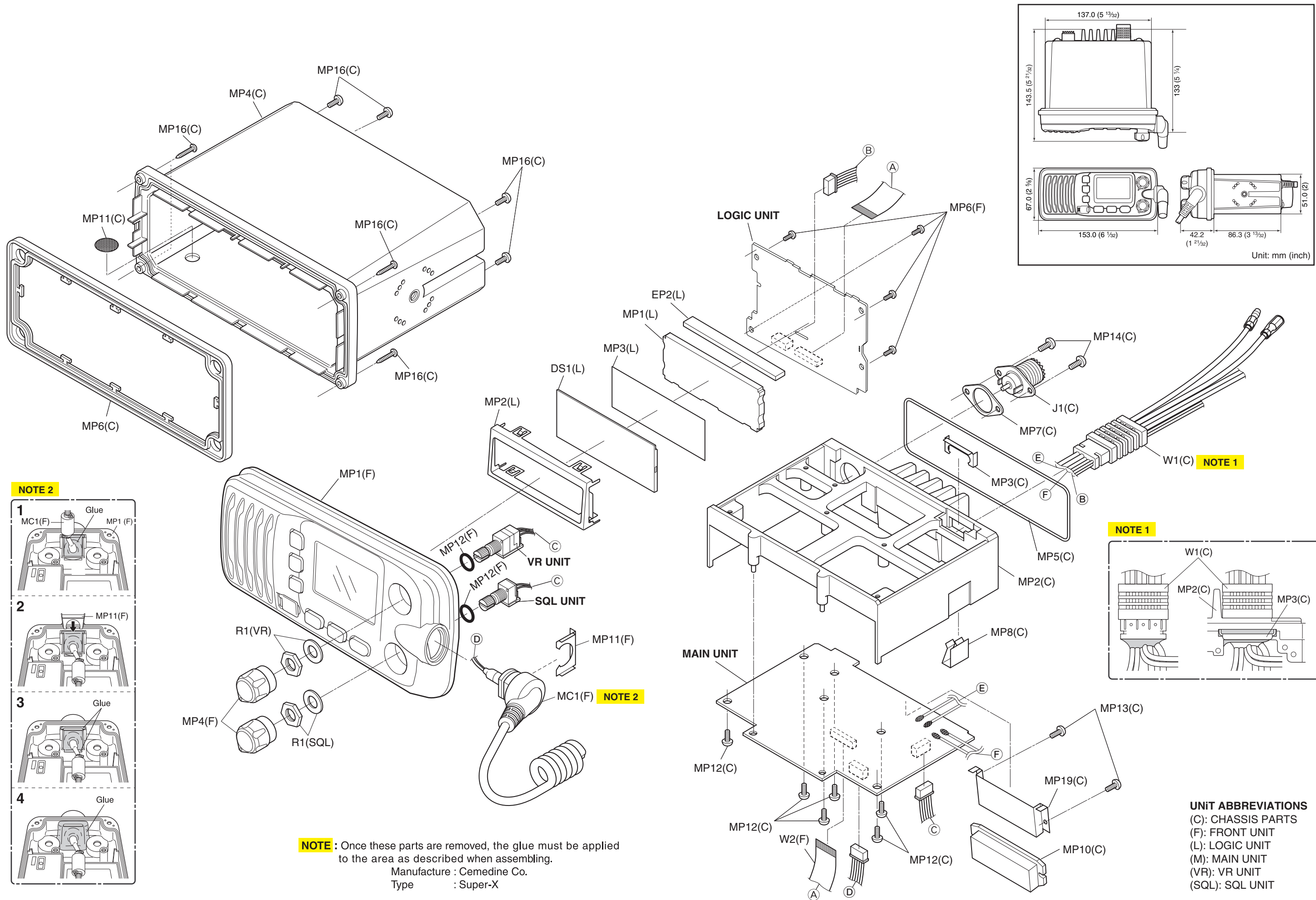
[ACCESSORIES]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
W1	8900009041	OPC-891A	1
MP1	8950005110	2289 MIC HANGER	1
MP2	8010017250	2040 MOBILE BRACKET [Black]	1
	8010020710	2040 MOBILE BRACKET (C) [Super White]	1
	8010019400	2040 MOBILE BRACKET (B) [Gray]	1
MP3	8610010561	2040 KNOB BOLT-1 [Black]	2
	8610011260	2040 KNOB BOLT (B)-1 [Super White]	2
	8820001271	2040 KNOB BOLT (C)-1 [Gray]	2
MP4	8810004700	Screw BT A0 3X16 SUS	2
MP5	8810001490	Screw BT A0 5X20 SUS	2
MP6	8850000180	Flat washer M5 SUS	2
MP7	8850000500	S-washer M5 SUS	2
MP8	8310050900	2438 warning sticker	1

[LOGIC UNIT]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
DS1	5030002990	SDT-DM2360-HP-0	1
EP2	8930054970	SRCN-2438-SP-N-W	2
MP1	8210017700	2438 REFLECTOR	1
MP2	8930054650	2438 LCD HOLDER	1
MP3	8930055060	2438 WHITE SHEET	1





SECTION 8 SEMICONDUCTOR INFORMATION

• TRANSISTERS AND FETs

• DTC114TUA (Marking: 04)	• KTA1664Y (Marking: QO)	• 2SC4215 (Marking: XX)	• 2SC4226 (Marking: R24)	• 3SK131 (Marking: V13)
• FMW1 (Marking: W1)	• KRC402 (Marking: NB)	• KRC404 (Marking: ND)	• KTA2015Y (Marking: Z)	• KTC4080 (Marking: Q)

• DIODES

• 1SS355 (Marking: 5D)	• KDS122 (Marking: C3)	• 1SS321 (Marking: F9)	• DSA3A1 (Marking: green)	• HSM88ASRTR (Marking: C3)
• HVC350BTRF (Marking: B0)	• KDV214E (Marking: UO)	• MA2S077 (Marking: S)	• MA742 (Marking: M1U)	

BOARD LAYOUTS

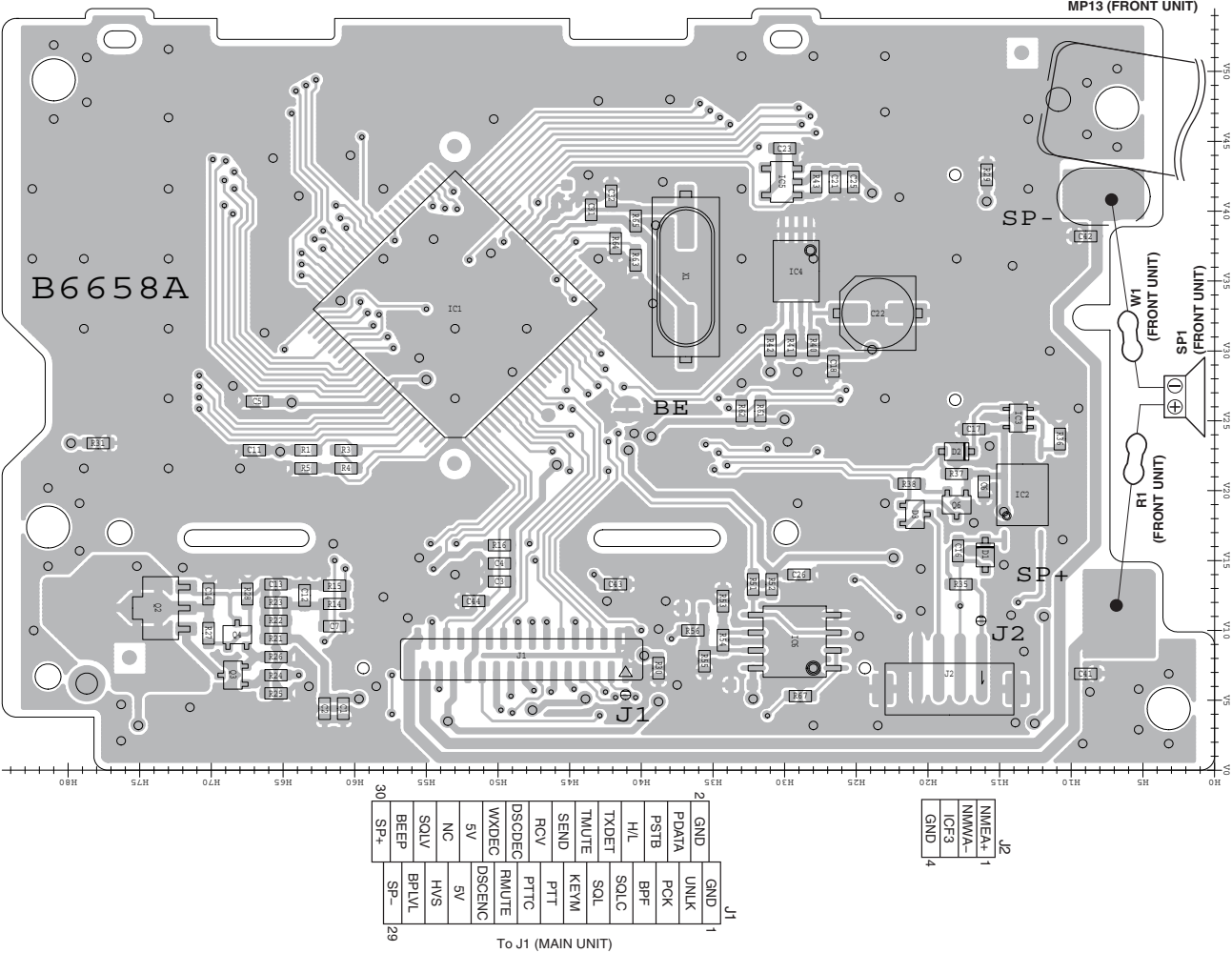
[illegible]

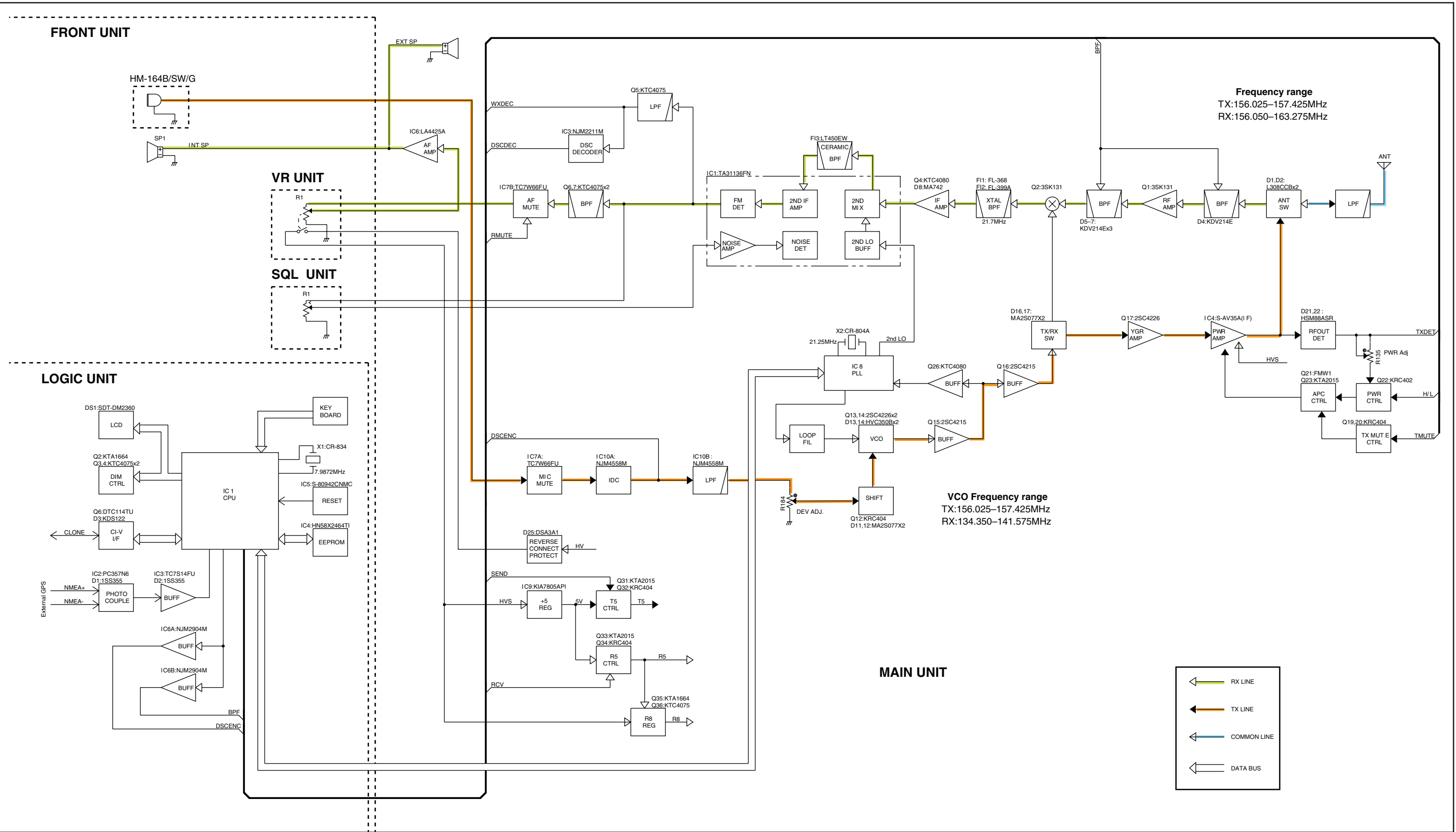
To W1 (MAIN UNIT)

J1	
1	HVS
	VOL1
	VOL2
	GND
5	HV

The combination of this side and the bottom side shows the board layout in the same configuration as the actual P.C.Board.

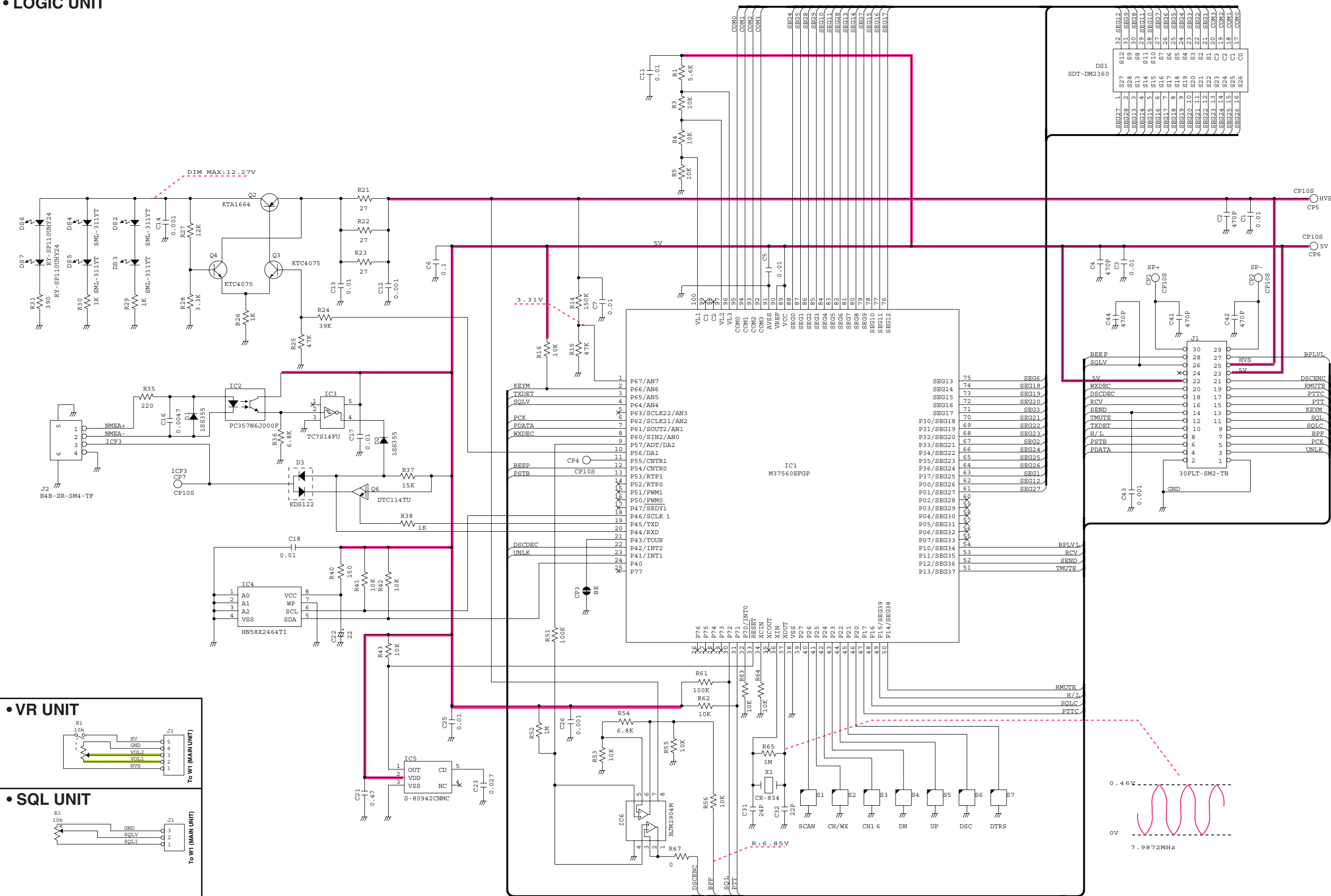
• LOGIC UNIT (BOTTOM VIEW)



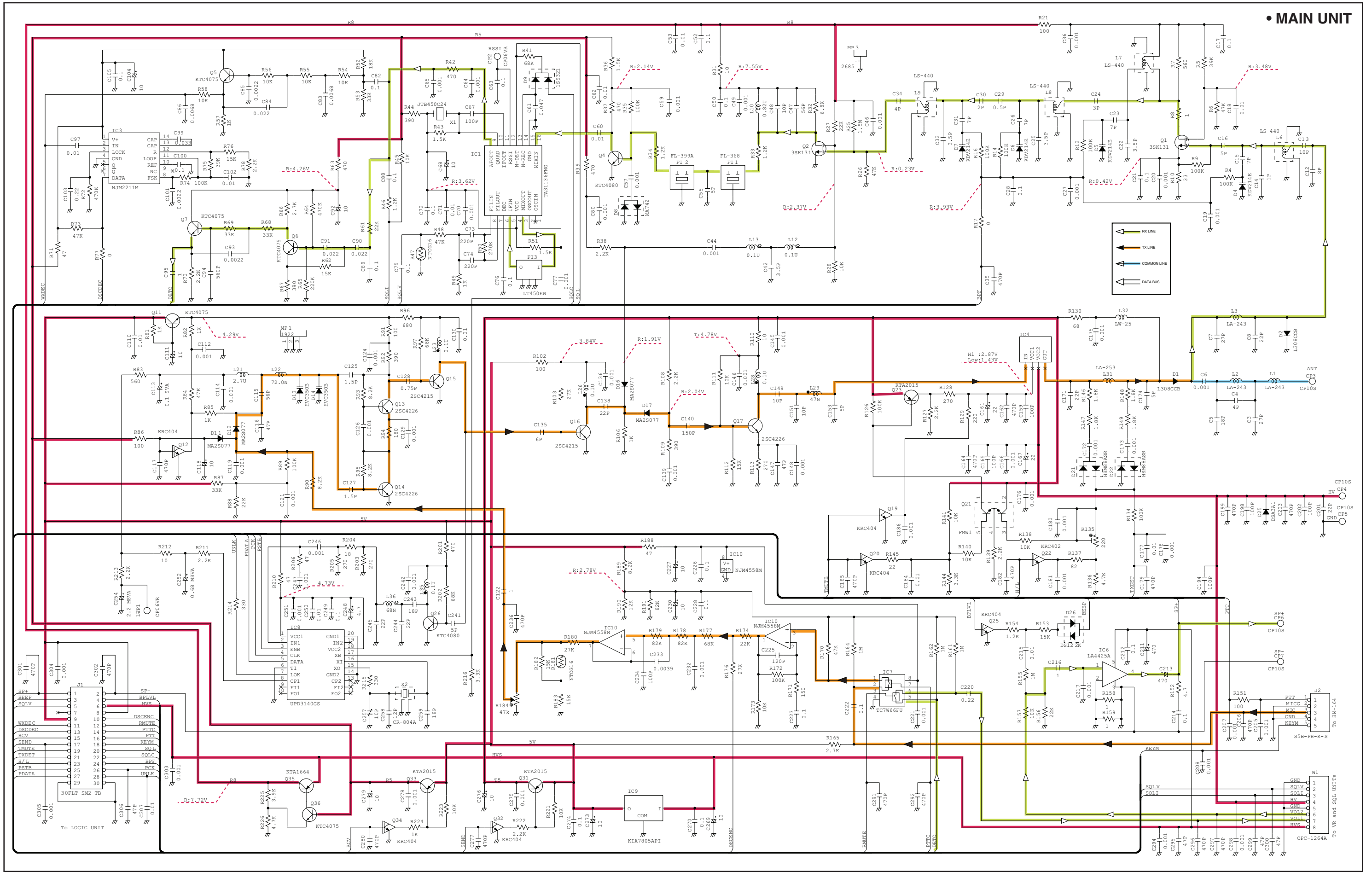


SECTION 11 VOLTAGE DIAGRAM

• LOGIC UNIT



MAIN UNIT



SECTION 12

HM-164B/SW/G

• REPLACEMENT UNIT

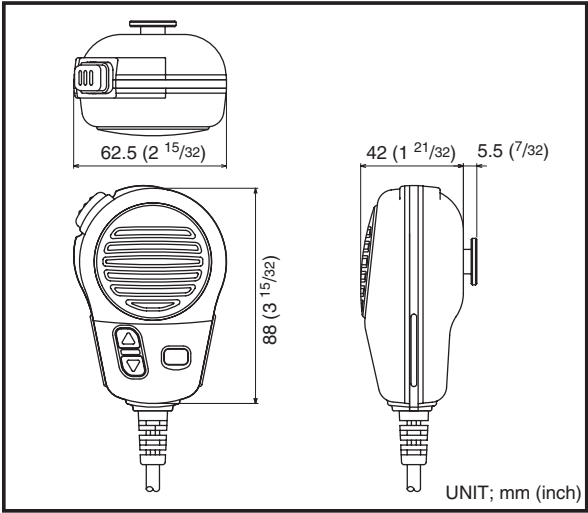
ORDER NO.	UNIT NAME	
Optional product	HM-164B	[Black]
Optional product	HM-164SW	[Super White]
Optional product	HM-164G	[Gray]

• CHASSIS PARTS LIST

REF NO.	ORDER NO.	DESCRIPTION		QTY.
W1	8900012212	OPC-1249B	[Black]	1
	8900013570	OPC-1406	[Super White]	1
	8900012502	OPC-1285B	[Gray]	1
MP1	8210023240	2995 FRONT PANEL	[Black]	1
	8210023250	2995 FRONT PANEL (A)	[Super White]	1
	8210023660	2995 FRONT PANEL (B)	[Gray]	1
MP2	8210020120	2715 REAR PANEL	[Black]	1
	8210021240	2715 REAR PANEL (C)	[Super White]	1
	8210020380	2715 REAR PANEL (B)	[Gray]	1
MP3	8930060910	2715 KEY	[Black], [Super White]	1
	8930061150	2715 KEY (A)	[Gray]	1
MP4	8930060920	2715 PTT RUBBER	[Black], [Super White]	1
	8930061160	2715 PTT RUBBER (A)	[Gray]	1
MP5	8930061970	2715 A-PTT HOLDER		1
MP6	8930060940	2715 RUBBER	[Black], [Super White]	1
	8930061810	2715 RUBBER (A)	[Gray]	1
MP7	8930060930	2715 MAIN SEAL		1
MP8	8610011600	2715 HANGER KNOB		1
MP9	8930060951	2715 BUSH PLATE-1		1
MP10	8930060990	2715 MIC SHEET		1
MP11	8930061000	2715 MIC TAPE		1
MP12	8930070800	2715 VENT SHEET		1
MP13	8930060960	O-RING (AY)		5
MP14	8930060970	O-RING (AZ)		1
MP15	8820001260	2715 SCREW 2.6X18 SUS		5
MP16	8810010230	Screw BiH M4X8 ZK		1
MP17	8850002000	SPRING WASHER M4 SUS		1
MP19	8810010240	Screw BT B0 2X6NI		2
MP20	8930061700	2715 PTT PLATE		1

Screw abbreviations A, B0, BT: Self-tapping PH: Pan head
ZK: Black NI-ZU: Nickel-Zinc SUS: Stainless

• DIMENTIONS

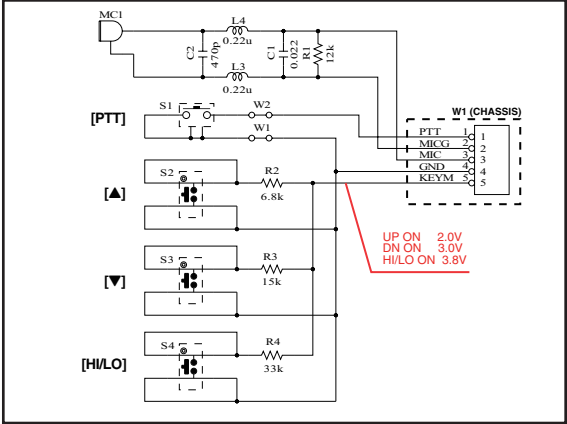


• MAIN UNIT PARTS LIST

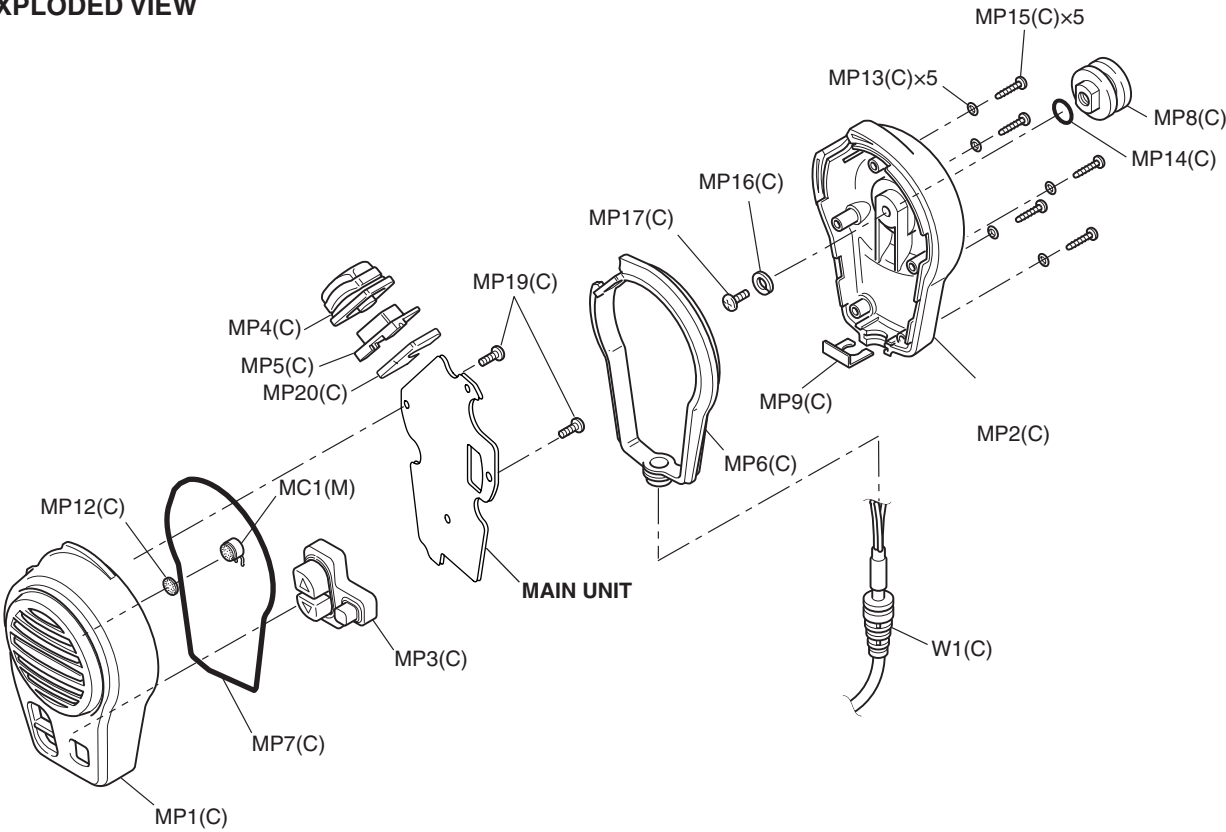
REF NO.	ORDER NO.	DESCRIPTION		M.	H/V LOCATION
L3	6180003720	COL	SP0203-R22K-PF 0.22U		
L4	6180003720	COL	SP0203-R22K-PF 0.22U		
R1	7010007590	RES	RD1/4S 123JTA		
R2	7010007600	RES	RD1/4 682JTA		
R3	7010007610	RES	RD1/4 153JTA		
R4	7010007620	RES	RD1/4 333JTA		
C1	4030018660	S.CER	C1608 JB 1H 223K-T		
C2	4030018670	S.CER	C1608 CH 1H 471J		
MC1	7700002640	MIC	KUC3523-040245	B	36.85/70.8
S1	2260002780	SW	SKHHLPA010		
S2	2260002790	SW	SKHHAMA010		
S3	2260002790	SW	SKHHAMA010		
S4	2260002790	SW	SKHHAMA010		
W1	9027150010	WIR	71/98/010/X98/X98		
W2	9027150010	WIR	71/98/010/X98/X98		

M.=Mounted side (T: Mounted on the Top side, B: Mounted on the Bottom side)
S.=Surface mount

• VOLTAGE DIAGRAM



• EXPLODED VIEW



Icom Inc.

1-1-32, Kamiminami, Hirano-ku, Osaka 547-0003, Japan

Phone : +81 (06) 6793 5302

Fax : +81 (06) 6793 0013

URL : <http://www.icom.co.jp/world/index.html>

Icom America Inc.

<Corporate Headquarters>

2380 116th Avenue N.E., Bellevue, WA 98004, U.S.A.

Phone : +1 (425) 454-8155 Fax : +1 (425) 454-1509

URL : <http://www.icomamerica.com>

E-mail : sales@icomamerica.com

<Customer Service>

Phone : +1 (425) 454-7619

Icom Canada

Glenwood Centre #150-6165

Highway 17 Delta, B.C., V4K 5B8, Canada

Phone : +1 (604) 952-4266 Fax : +1 (604) 952-0090

URL : <http://www.icomcanada.com>

E-mail : info@icomcanada.com

Icom (Australia) Pty. Ltd.

Unit 1 / 103 Garden Road, Clayton VIC 3168 Australia

Phone : +61 (03) 9549-7500 Fax : +61 (03) 9549-7505

URL : <http://www.icom.net.au>

E-mail : sales@icom.net.au

Icom New Zealand

146A Harris Road, East Tamaki,

Auckland, New Zealand

Phone : +64 (09) 274 4062 Fax : +64 (09) 274 4708

URL : <http://www.icom.co.nz>

E-mail : inquiries@icom.co.nz

Beijing Icom Ltd.

Room C01, 10th Floor, Long Silver Mansion, No. 88,

Yong Ding Road, Haidian District, Beijing, 100039, China

Phone : +86 (010) 5889 4250 Fax : +86 (010) 5889 4250

URL : <http://www.bjicom.com>

E-mail : bjicom@bjicom.com

Icom (Europe) GmbH

Communication Equipment

Himmelgeister Str. 100, D-40225 Düsseldorf, Germany

Phone : +49 (0211) 346047 Fax : +49 (0211) 333639

URL : <http://www.icomeurope.com>

E-mail : info@icomeurope.com

Icom Spain S.L

Ctra. Rubi, 88, 08190, Sant Cugat del Valles, Barcelona, SPAIN

Phone : +34 (93) 590 26 70 Fax : +34 (93) 589 04 46

URL : <http://www.icomspain.com>

E-mail : icom@icomspain.com

Icom (UK) Ltd.

Unit 9, Sea St., Herne Bay, Kent, CT6 8LD, U.K.

Phone : +44 (01227) 741741 Fax : +44 (01227) 741742

URL : <http://www.icomuk.co.uk>

E-mail : info@icomuk.co.uk

Icom France s.a.s.

Zac de la Plaine

1 Rue Brindejonc des Moulinais BP 5804

31505 Toulouse Cedex, France

Phone : +33 (5) 61 36 03 03 Fax : +33 (5) 61 36 03 00

URL : <http://www.icom-france.com>

E-mail : icom@icom-france.com

Asia Icom Inc.

6F No.68, Sec. 1 Cheng-Teh Road, Taipei, Taiwan, R.O.C.

Phone : +886 (02) 2559 1899 Fax : +886 (02) 2559 1874

URL : <http://www.asia-icom.com>

E-mail : sales@asia-icom.com

Icom Polska

Sopot, 3 Maja 54 Poland

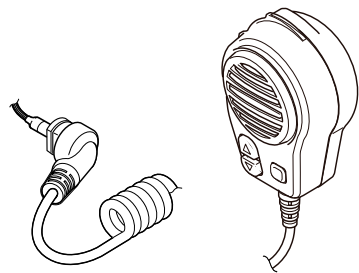
Phone : +48 (58) 550 7135 Fax : +48 (58) 551 0484

E-mail : icompolska@icompolska.com.pl

Count on us!

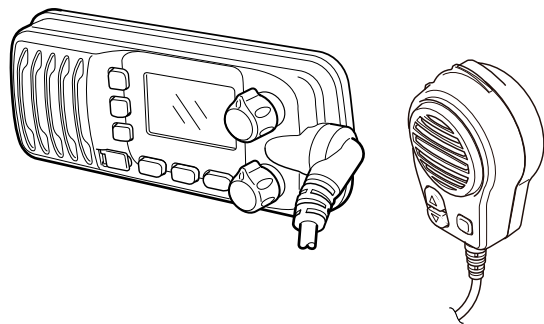
• REPLACEMENT UNIT INFORMATION FOR IC-M304

HM-164



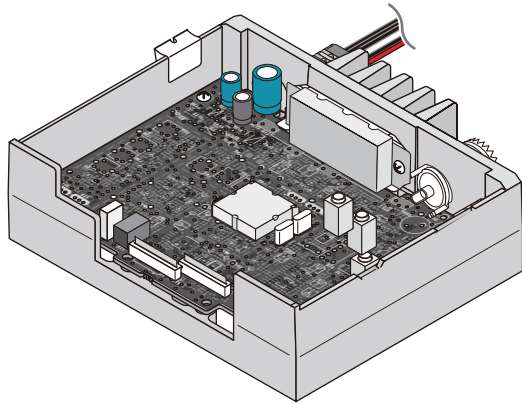
ORDER NO.	UNIT NAME	
Optional product	HM-164B	[Black]
Optional product	HM-164SW	[Super White]
Optional product	HM-164G	[Gray]

FRONT UNIT (Incl. LOGIC, VR, SQL UNITS and HM-164)



ORDER NO.	UNIT NAME	
0329890101	U M304 #01 FRONT (FRONT+LOGIC+VR+SQL, and HM-164B)	[Black]
0329890201	U M304 #02 FRONT (FRONT+LOGIC+VR+SQL, and HM-164SW)	[Super White]
0329890301	U M304 #03 FRONT (FRONT+LOGIC+VR+SQL, and HM-164G)	[Gray]

CHASSIS (Incl. MAIN UNIT)



ORDER NO.	UNIT NAME
0329890102	U M304 #01 MAIN (MAIN+CHASSIS)