



SERVICE MANUAL

SURVIVAL CRAFT 2-WAY RADIO

IC-GM1600
IC-GM1600E

S-14122IZ-C1-①

Jun. 2005

Icom Inc.

INTRODUCTION

This service manual describes the latest service information for the **IC-GM1600/E** VHF MARINE TRANSCEIVER at the time of publication.

MODEL	VERSION	TX HI-POWER
IC-GM1600	USA	2 W
	GEN	2 W
IC-GM1600E	EUR	2 W
	UK	2 W

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

DANGER

NEVER connect the transceiver to an AC outlet or to a DC power supply that uses more than 7.5 V. Such a connection could cause a fire or electric hazard.

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>

5030002790 LCD A0286 IC-GM1600 Main unit 5 pieces
8810009510 Screw BO 2x4 NlxZU (BT) IC-GM1600E 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 turning 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 to 40 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.


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SECTION 1 SPECIFICATIONS

			IC-GM1600	IC-GM1600/E	
			[USA]	[GEN], [EUR], [UK]	
GENERAL	• Frequency coverage	TX	156.025–157.425 MHz [ON-BOARD]	156.000–161.450 MHz [ON-BOARD]	
		RX	156.050–163.275 MHz [ON-BOARD]	156.000–163.425 MHz [ON-BOARD]	
		TX/RX	156.300–156.875 MHz [SURVIVAL]		
	• Number of programable channels		100 channels		
	• Type of emission		16K0G3E	16K0G3E (for ATIS)	
	• Antenna impedance		50 Ω (nominal)		
	• Operating temperature range		–4°F to +140°F	–20°C to +55°C	
	• Power supply requirement		7.5 V DC nominal (negative ground)	7.2 V DC nominal (negative ground)	
	• Current drain (approx.)	RX		0.2 A (at max. audio)	
			2 W	1.0 A	
TX		1 W	0.7 A		
• Dimensions (projections not included)		65(W) × 145(H) × 44(D) mm; 2 9/16(W) × 5 23/32(H) × 1 3/4(D) in.			
• Weight (approx.)		385 g; 13.58 oz. (Including BP-234)			
TRANSMITTER	• Output power	High	2 W		
		Low	1 W		
	• Modulation		Variable reactance frequency modulation		
	• Max. frequency deviation		± 5.0 kHz		
	• Frequency error		±5.0 ppm	±1.5 kHz	
	• Spurious emissions		–70 dBc typ.	0.25 μW (30 MHz to 1 GHz) 1.00 μW (1 GHz–2 GHz)	
	• Adjacent channel power		70 dB		
	• Audio harmonic distortion		10% (at 60% deviation)		
	• FM hum and noise		40 dB	–	
	• Residual modulation		–	40 dB	
	• Audio frequency response		+1 dB to –3 dB of 6 dB oct. from 300 Hz to 3000 Hz		
	• Limiting charact. of modulation		60–100% of max. deviation		
	• Microphone impedance		2 kΩ		
RECEIVER	• Receive system		Double conversion superheterodyne system		
	• Intermediate frequencies		1st : 31.05 MHz, 2nd : 450 kHz		
	• Sensitivity		0.25 μV typ. at 12 dB SINAD	–2 dBμ emf typ. at 20 dB SINAD	
	• Squelch sensitivity		–6dBμ typ. (at threshold)	–2 dBμ emf typ. (at threshold)	
	• Adjacent channel selectivity		70 dB typ.	70 dB	
	• Spurious response		70 dB typ.	70 dB	
	• Intermodulation rejection ratio		70 dB typ.	68 dB	
	• Hum and Noise		40 dB		
	• Audio frequency response		+1 dB to –3 dB of 6 dB oct. (from 300 Hz to 3000 Hz)	+1 dB to –3 dB of –6 dB oct. (from 300 Hz to 3000 Hz)	
	• Audio output power (at 10% distortion with an 8 Ω load)		0.35 W typ.	0.2 W typ.	
• Output impedance (audio)		8 Ω			

Specifications are measured in accordance with TIA/EIA–603 and FCC PARTS 80.271 (IC-GM1600), and IEC61097–12 (IC-GM1600E). All stated specifications are subject to change without notice or obligation.

• CHANNEL LISTS

• International channels

CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)	
	Transmit	Receive		Transmit	Receive		Transmit	Receive		Transmit	Receive		Transmit	Receive		Transmit	Receive
01	156.050	160.650	11	156.550	156.550	21	157.050	161.650	61	156.075	160.675	71	156.575	156.575	81	157.075	161.675
02	156.100	160.700	12	156.600	156.600	22	157.100	161.700	62	156.125	160.725	72	156.625	156.625	82	157.125	161.725
03	156.150	160.750	13	156.650	156.650	23	157.150	161.750	63	156.175	160.775	73	156.675	156.675	83	157.175	161.775
04	156.200	160.800	14	156.700	156.700	24	157.200	161.800	64	156.225	160.825	74	156.725	156.725	84	157.225	161.825
05	156.250	160.850	15 ^{*1}	156.750	156.750	25	157.250	161.850	65	156.275	160.875	75 ^{*3}	156.775	156.775	85	157.275	161.875
06	156.300	156.300	16	156.800	156.800	26	157.300	161.900	66	156.325	160.925	76 ^{*3}	156.825	156.825	86	157.325	161.925
07	156.350	160.950	17 ^{*1}	156.850	156.850	27	157.350	161.950	67	156.375	156.375	77	156.875	156.875	87	157.375	157.375
08	156.400	156.400	18	156.900	161.500	28	157.400	162.000	68	156.425	156.425	78	156.925	161.525	88	157.425	157.425
09	156.450	156.450	19	156.950	161.550	37A ^{*2}	157.850	157.850	69	156.475	156.475	79	156.975	161.575	P4 ^{*2}	161.425	161.425
10	156.500	156.500	20	157.000	161.600	60	156.025	160.625	70 [†]	156.525	156.525	80	157.025	161.625			

[†]Receive only

^{*1} Channels 15 and 17 may also be used for on-board communications provided the effective radiated power does not exceed 1 W, and subject to the national regulations of the administration concerned when these channels are used in its territorial waters.

^{*2} UK Marina Channels: M1=37A (157.850 MHz), M2=P4 (161.425 MHz) for U.K. version only

^{*3} The use of these channels should be restricted to navigation-related communications only and all precautions should be taken to avoid harmful interference to channel 16, e.g. by limiting the output power to 1 W or by means geographical separation.

• USA channels (for U.K. version only)

CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)		CH	Frequency (MHz)	
	Transmit	Receive		Transmit	Receive		Transmit	Receive		Transmit	Receive		Transmit	Receive		Transmit	Receive
01A	156.050	156.050	12	156.600	156.600	22A	157.100	157.100	64A	156.225	156.225	77	156.875	156.875	86	157.325	161.925
--	---	---	13 [†]	156.650	156.650	23A	157.150	157.150	65A	156.275	156.275	78A	156.925	156.925	86A	157.325	157.325
03A	156.150	156.150	14	156.700	156.700	24	157.200	161.800	66A	156.325	156.325	79A	156.975	156.975	87	157.375	161.975
--	---	---	15 [†]	156.750	156.750	25	157.250	161.850	67 [†]	156.375	156.375	80A	157.025	157.025	87A	157.375	157.375
05A	156.250	156.250	16	156.800	156.800	26	157.300	161.900	68	156.425	156.425	81A	157.075	157.075	88	157.425	162.025
06	156.300	156.300	17 [†]	156.850	156.850	27	157.350	161.950	69	156.475	156.475	82A	157.125	157.125	88A	157.425	157.425
07A	156.350	156.350	18A	156.900	156.900	28	157.400	162.000	70 [‡]	156.525	156.525	83A	157.175	157.175	P4 [*]	161.425	161.425
08	156.400	156.400	19A	156.950	156.950	37A [*]	157.850	157.850	71	156.575	156.575	84	157.225	161.825			
09	156.450	156.450	20	157.000	161.600	61A	156.075	156.075	72	156.625	156.625	84A	157.225	157.225			
10	156.500	156.500	20A	157.000	157.000	--	---	---	73	156.675	156.675	85	157.275	161.875			
11	156.550	156.550	21A	157.050	157.050	63A	156.175	156.175	74	156.725	156.725	85A	157.275	157.275			

[†]Low power only

[‡]Receive only

^{*}UK Marina Channels: M1=37A (157.850 MHz), M2=P4 (161.425 MHz) for U.K. version only

• Survival operation channels

Channel number	TX/RX	Channel number	TX/RX	Channel number	TX/RX
06	156.300 MHz	08	156.400 MHz	09	156.450 MHz
10	156.500 MHz	11	156.550 MHz	12	156.600 MHz
13	156.650 MHz	14	156.700 MHz	15 [*]	156.750 MHz
16	156.800 MHz	17 [*]	156.850 MHz	67	156.375 MHz
68	156.425 MHz	69	156.475 MHz	71	156.575 MHz
72	156.625 MHz	73	156.675 MHz	74	156.725 MHz
77	156.875 MHz				

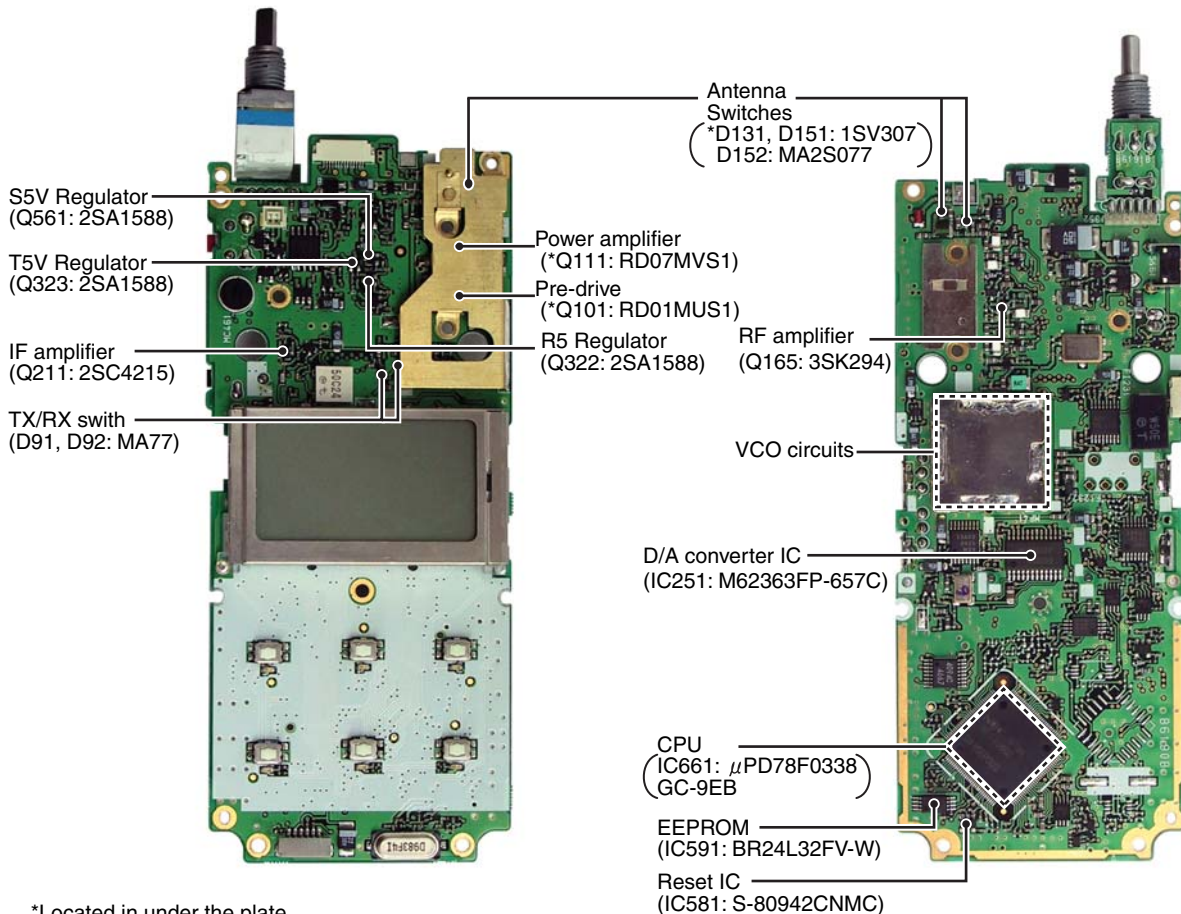
^{*}U.S.A. version is low power only

SECTION 2 INSIDE VIEWS

● MAIN UNIT

TOP VIEW

BOTTOM VIEW



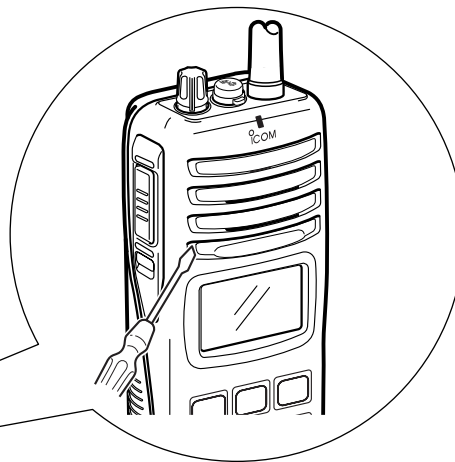
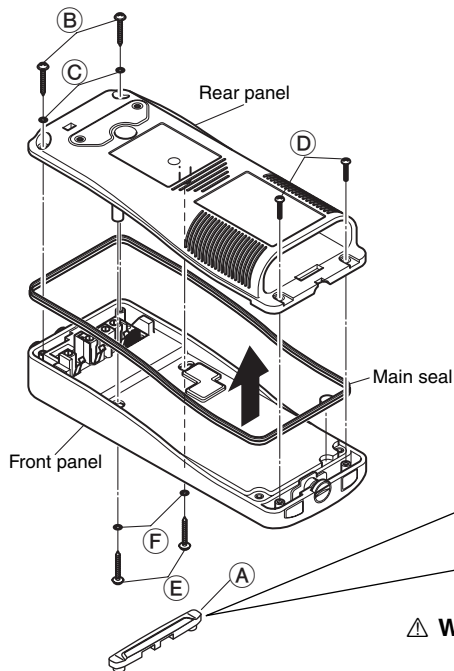
*Located in under the plate.

SECTION 3 DISASSEMBLY INSTRUCTIONS

● REMOVING THE REAR PANEL

- ① Remove the speaker panel (A).
- ② Unscrew 2 screws (B), and remove 2 washers (C).
- ③ Unscrew 2 screws (D).
- ④ Unscrew 2 screws (E), and remove 2 washers (F).
- ⑤ Remove the rear panel and the main seal from the front panel.

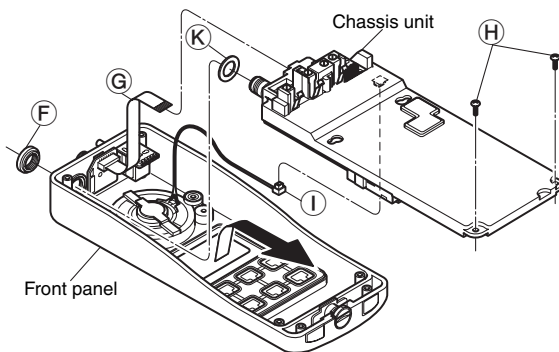
Note: When replacing the screws, 10–12 kg of torque MUST be applied to ensure water resistance.



⚠ WARNING! NEVER attempt to remove the speaker panel using your finger nails, this may result injury. Use a flat head screw driver or a similar flat instrument.

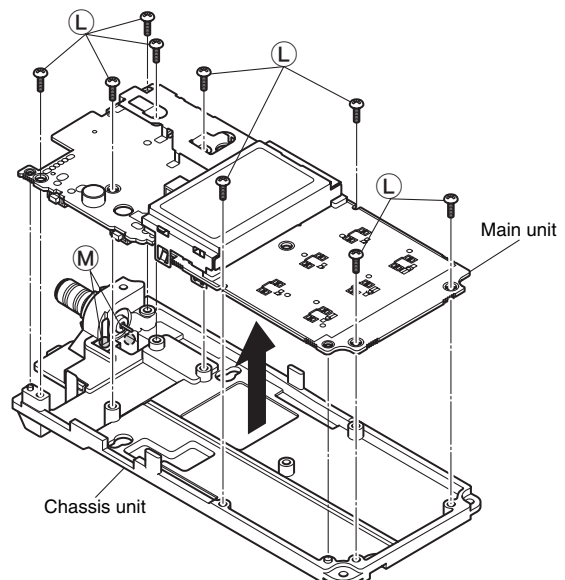
● REMOVING THE CHASSIS UNIT

- ① Unscrew 1 nut (G).
- ② Unscrew 2 screws (H).
- ③ Take off the chassis unit in the direction of the arrow.
- ④ Unplug the connector (I) and the cable (J) from the chassis unit.
- ⑤ Remove 1 washer (K).



● REMOVING THE MAIN UNIT

- ① Unscrew 9 screws (L).
- ② Unsolder 2 points (M), and take off the main unit in the direction of the arrow.



SECTION 4 CIRCUIT DESCRIPTION

4-1 RECEIVER CIRCUITS

4-1-1 ANTENNA SWITCHING CIRCUIT

The antenna switching circuit toggles receive line and transmit line. This circuit does not allow transmit signals to enter the receiver circuits.

Received signals from the antenna are passed through the low-pass filter (LPF: L131, L132, C131–C136) and applied to the antenna switching circuit (D151, D152).

While receiving, no voltage is applied to D151 and D152. Thus, the receive line and the ground are disconnected and L151, L152, C151, C152 and C153 function as an LPF which leads received signals to the RF circuits.

4-1-2 RF CIRCUITS

The RF circuits amplify signals within the range of frequency coverage and filters off out-of-band signals.

The signals from the antenna switching circuit are passed through the two-stage tunable bandpass filter (BPF: D154, D155, L154–L156, C156, C157, C159–C161, C163, C164, C168), then applied to the RF amplifier (Q165).

The amplified signals are passed through another two-stage BPF (D181, D182, L166, L181 C181, C182, C184–C186, C188) to suppress unwanted signals. The filtered signals are then applied to the 1st mixer circuit.

4-1-3 1st MIXER AND 1st IF AMPLIFIER CIRCUITS

The 1st mixer circuit converts received signals into the 1st intermediate frequency (IF) signal by mixing with local oscillator (LO) signal. The converted 1st IF signal is filtered at the 1st IF filter, then amplified at the 1st IF amplifier.

The signals from the two-stage BPF are converted into the 31.05 MHz 1st IF signal at the 1st mixer (Q191) by being mixed with the 1st LO signals generated at RX VCO (Q41, D31–D34).

The 1st IF signal from the 1st mixer is passed through the crystal filter (F1211) to suppress unwanted signals, and amplified at the 1st IF amplifier (Q211).

The amplified 1st IF signal is applied to the FM IF IC (IC231).

4-1-4 2nd IF AND DEMODULATOR CIRCUITS

The 1st IF signal is converted into the 2nd IF signal and de-modulated by the FM IF IC. The FM IF IC contains 2nd mixer, limiter amplifier, quadrature detector, etc. in its package.

The 1st IF signal from the 1st IF amplifier is applied to pin 16 of IC231, and mixed with the 30.6 MHz 2nd LO signal coming from the doubler (Q221), to convert into the 450 kHz 2nd IF signal and output from pin 3. The 2nd IF signal is filtered by the ceramic filters (F1231, F1232) to suppress the heterodyne noise, then applied to IC231 (pin 5) again and amplified at the limiter amplifier section and demodulated by the quadrature detector.

The quadrature detector is a detection method which uses a ceramic discriminator (X231). The demodulated AF signals are output from pin 9.

4-1-5 AF CIRCUITS

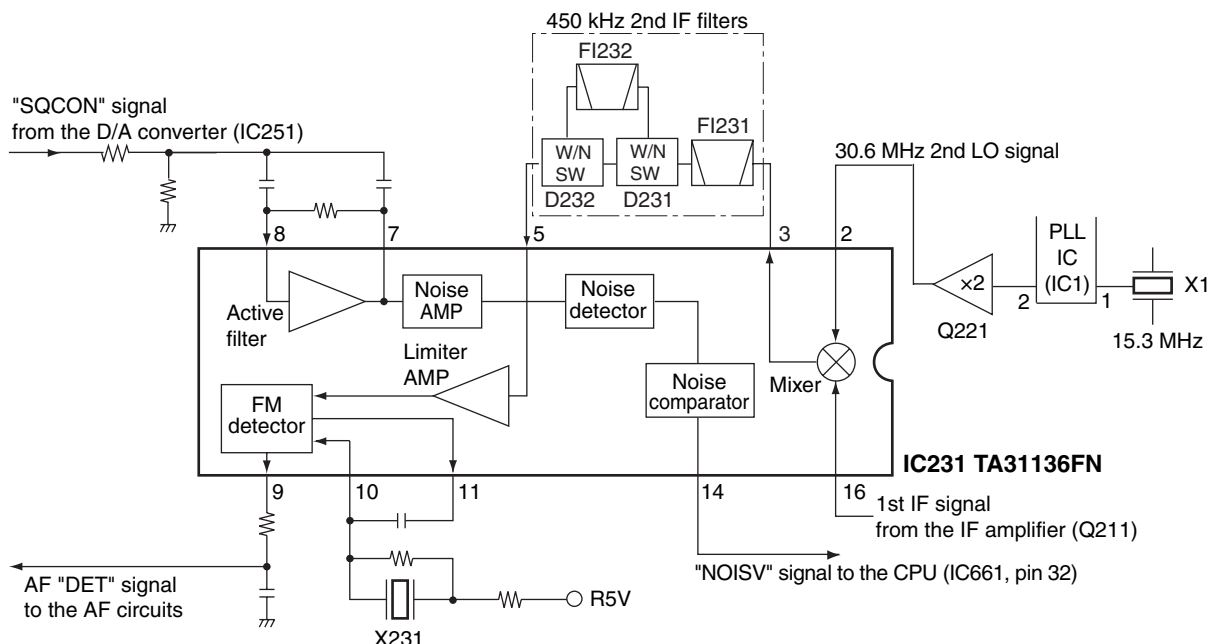
Demodulated signals are filtered and amplified at the AF circuits.

AF signals from IC231 (pin 9) are passed through the AF mute switch (IC281 A; pins 1, 2), analog switch (IC282; pins 1, 7), LPF (IC261 C; pins 8–10) and R801 (VR BOARD) to control the AF output level.

The level controlled AF signals are passed through the AF mute switch (Q411) and the de-emphasis circuit (R411, C413) to obtain the frequency characteristic of -6 dB/oct.

The de-emphasized signals are applied to the AF power amplifier (IC421, pin 4). The AF power amplifier provides more than 0.3 W of audio power.

• 2nd IF AND DEMODULATOR CIRCUITS



4-1-6 SQUELCH CIRCUIT

Squelch circuit mutes AF output signal when no signals are received.

A portion of the AF signals from the FM IF IC (IC231, pin 9) are applied to the IC251 to control the level, and the active filter (R239–R241, C237, C238). The filtered signals are applied to the noise amplifier section in the FM IF IC (IC231, pin 8) to amplify the noise components only.

The amplified noise components are detected at the noise detector section, and output from pin 14 as the "NOISV" signal to the CPU (IC661, pin 32). Then the CPU outputs "AFMS" signal from pin 84 according to the "NOISV" signal level to control the AF mute switch (Q411).

4-2 TRANSMITTER CIRCUITS

4-2-1 MIC AMPLIFIER, SPLATTER FILTER CIRCUITS

The MIC amplifier circuit amplifies audio signals from the microphone within +6 dB/oct pre-emphasis characteristics and amplifies to the level needed for modulation.

The AF signals from the microphone are passed through the microphone switch (Q461) and the microphone mute switches (IC682 A, pins 1, 2; IC682 B, pins 5, 6). The AF signals are then passed through the pre-emphasis circuit (R463, C463) to obtain frequency characteristics of +6 dB/oct.

The pre-emphasized AF signals are amplified at the microphone amplifier (IC261 B), and adjusted its level at the microphone gain control circuit (Q653, Q654, R474, R705, R707, R708). The level adjusted signals are applied to the limiter amplifier (IC491 A; pins 1, 2) to limit its level via the AF mute switch (IC481 A; pins 1, 2).

The AF signals are then passed through the splatter filter (IC491 B; pins 6, 7) to suppress unwanted 3 kHz and higher audio signals, then applied to the modulation circuit via the D/A converter (IC251; pins 3, 4).

4-2-2 MODULATOR CIRCUIT

The modulation circuit modulates the VCO oscillating signal with the audio signals from the microphone.

AF signals from the D/A converter (IC251, pin 3) are applied to the modulation circuit (D39) to modulate the oscillated signal by changing the reactance of D39 at the TX VCO (Q51, D35–38).

4-2-3 TRANSMIT AMPLIFIERS

Transmit amplifiers amplify the TX VCO output to transmit power level.

The TX VCO output signal is buffer-amplified by the buffer amplifiers (Q61, Q62) and passes through the TX/RX switch (D91). The signals from the TX/RX switch are applied to the another buffer amplifier (Q91), pre-drive (Q101) and power amplifier (Q111) and amplified to the transmit level.

The power amplifier output is applied to the antenna connector (J41: CHASSIS UNIT) via the antenna switching circuit and the LPFs.

4-2-4 APC CIRCUIT

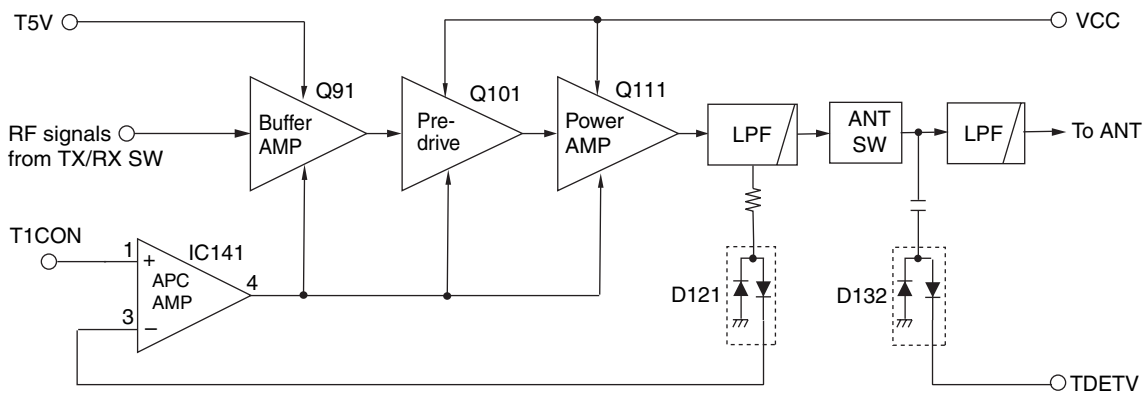
The APC (Automatic Power Control) circuit stabilizes transmit output power and controls transmit output power High, Middle and Low.

The RF output signal from the power amplifier (Q111) is detected at the power detector (D121). The detector converts the RF signals into DC voltage, and the detected voltage is applied to the APC amplifier (IC141, pin 3).

The transmit output power setting voltage is applied to another input terminal of the APC amplifier (IC141, pin 1) as the reference voltage. The APC amplifier controls the bias of the buffer, pre-drive and power amplifiers by comparing the detected voltage and reference voltage. Thus the APC circuit maintains a constant output power.

Another power detector (D132) detects the RF output level and outputs "TDETV" signal to the CPU (IC661, pin 31). The CPU outputs "TLED" signal to the LED driver (Q655) to light TX LED (DS655).

• APC CIRCUIT



4-3 PLL CIRCUITS

4-3-1 GENERAL

PLL circuits control TX and RX VCO circuits. IC1 is a PLL IC and contains prescaler, programmable counter, programmable divider, phase detector, charge pump in its package.

The VCOs directly generate the transmit frequency and the 1st LO frequency for receiving. The PLL sets the divided ratio based on the serial data from the CPU (IC661), and compares the phase of the VCO output with the reference oscillator's frequency (15.3 MHz) oscillated by X1.

If the oscillated signal drifts, the phase of its frequency changes from the phase of the reference frequency, causing a lock voltage change to compensate for the drift in the oscillated frequency.

The phase detector compares the input signal with a reference frequency, and then outputs the control signal (pulse-type) from pin 5. The pulse-type signal is converted into DC voltage at the loop filter (R17–R19, C16, C17), and then applied to the RX VCO (Q41, D31–D34) as the lock voltage.

4-3-2 TRANSMIT LOOP

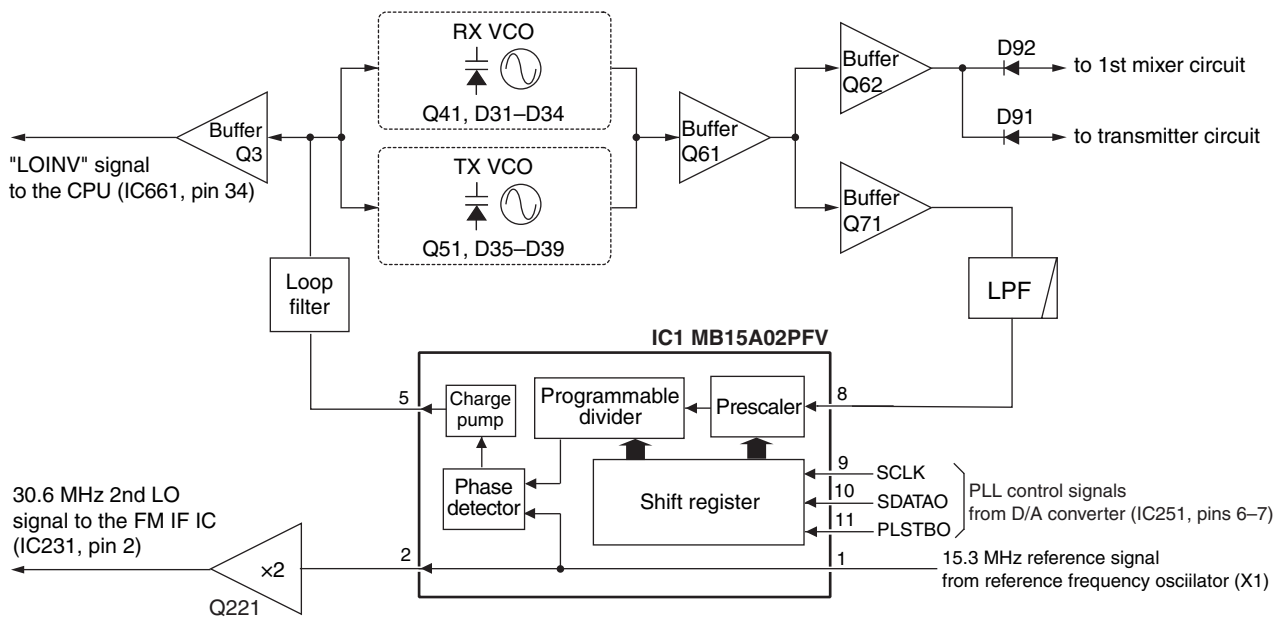
A portion of the generated signal at the TX VCO (Q51, D35–D39) is applied to the PLL IC (IC1, pin 8) via buffer-amplifier (Q71). The applied signal is divided at the prescaler section and programmable divider section and is then applied to the phase detector section.

The phase detector compares the input signal with the reference frequency, and then outputs the control signal (pulse-type) from pin 5 via the charge pump section. The pulse-type signal is converted into DC voltage at the loop filter (R17–R19, C16, C17), and then applied to the TX VCO (Q51, D35–D39) as the lock voltage.

4-3-3 RECEIVE LOOP

The generated signal at the RX VCO (Q41, D31–D34) is applied to the PLL IC (IC1, pin 8) via buffer-amplifier (Q71) and is divided at the prescaler section and programmable divider section and is then applied to the phase detector section.

• PLL CIRCUITS



4-4 POWER SUPPLY CIRCUITS

4-4-1 VOLTAGE LINES

LINE	DESCRIPTION
VCC	The voltage from the connected DC power supply passed through the [VOL] switch (R1: VR BOARD).
CPU5V	5V for the CPU (IC661) converted from the VCC line at the CPU5V regulator circuit (IC551).
M5V	Common 5V line converted from the VCC line at the M5V regulator circuit (Q551–Q553).
T5V	5V for the transmit circuits controlled by the T5V control circuit (Q323) using the T5VS signal from the CPU (IC661, pin 90).
S5V	5V for the AF circuits controlled by the S5V control circuit (Q561) using the S5VS signal from the CPU (IC661, pin 87).
R5V	5V for the receive circuits controlled by the R5V control circuit (Q322) using the R5VS signal from CPU (IC661, pin 89).

4-5 PORT ALLOCATIONS

4-5-1 CPU (IC661)

PIN NUMBER	PORT NAME	DESCRIPTION
1	BEEP	Output port for BEEP signal.
3	EXSTB	Output port for external expander strobe signal.
4	DASTB	Output port for external D/A strobe signal.
5	PLSTB	Output port for PLL strobe.
6	ERXDI	Input port for cloning.
7	ETXDO	Output port for cloning.
10	SDATA	Output port for serial data.
11	SCK	Output port for serial clock.
12	ESCK	Input port for EEPROM clock.
13	ESDA	I/O port for EEPROM data.
14	TLED	Output port for TX LED driver.
15	RLED	Output port for RX LED driver.
17	CSIFT	Output port for clock shift signal.
25	RESET	Input port for reset signal.
27	WDECV	Input port for WX tone signal.
28	EXDET	Input port for the [MIC/SP] detect signal.
29	VOXT	Input port for VOX signal.
30	BATTV	Input port for battery voltage detection signal.
31	TDETV	Input port for TX power level.
32	NOISV	Input port for noise level.
33	RSSIV	Input port for RSSI level.
34	LOINV	Input port for PLL lock voltage level.
35	TEMPV	Input port for temperature level.
75, 76	CONT1, CONT2	Output ports for LCD contrast control signal.

PIN NUMBER	PORT NAME	DESCRIPTION
77, 78	LEDS1, LEDS2	Output port for dimmer control signal.
80	MICMS	Output port for microphone mute signal. "HIGH": Microphone mute
81	ISPMS	Output port for internal speaker mute signal. "HIGH": Speaker mute
84	AFMS	Output port for AF mute signal.
85	AFVS	Output port for AF amplifier power supply control signal.
102	PTTIN	Input port for [PTT] switch.
103	EXPTT	Input port for external PTT switch.
104	BTYPE	Input port for battery type detection.
105	PTTM	Output port for microphone mute signal.
106–108	MIC1–MIC3	Output ports for microphone sensitivity detection signal.
109	SQL	Input port for [SQL] key.
110	UP	Input port for [▲] key.
111	DOWN	Input port for [▼] key.
112	CH/WX	Input port for [CALL] key.
113	16/9	Input port for [16] key.
114	SCAN	Input port for [CH] key.
115	H/L	Input port for [Hi/Lo] key.
117	VOXM	Output port for mute signal in VOX mode.
119	UNLK	Input port for PLL unlock signal.

4-5-2 EXPANDER (IC341)

PIN NUMBER	PORT NAME	DESCRIPTION
6	DETMS	Output port for DET mute signal.
11	ATTS	Output port for RF attenuator control signal.
12	TXMS	Output port for TX mute signal.
13	VCOS	TX/RX VCO switching signal.
14	SQLT	Output port for squelch control signal.

SECTION 5 ADJUSTMENT PROCEDURES

5-1 PREPARATION

■ REQUIRED TEST EQUIPMENTS

When adjusting IC-GM1600/E, the optional CS-M90/GM1600 ADJ ADJUSTMENT SOFTWARE (Rev. 1.0 or later), OPC-478 (RS-232 type) or OPC-478U (USB type) CLONING CABLE, OPC-1028 and JIG cable (see page 5-2) are required.

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
RF power meter (terminated type)	Measuring range : 0.1–3 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 μV to 32 mV (–127 to –17 dBm)
Frequency counter	Frequency range : 0.1–300 MHz Frequency accuracy: ±1 ppm or better Sensitivity : 100 mV or better	Oscilloscope	Frequency range : DC–20 MHz Measuring range : 0.01–20 V
FM deviation meter	Frequency range : 30–300 MHz Measuring range : 0 to ±10 kHz	AC millivoltmeter	Measuring range : 10 mV to 10 V
Audio generator	Frequency range : 300–3000 Hz Output level : 1–500 mV	External speaker	Input impedance : 8 Ω Capacity : More than 0.3 W
		Attenuator	Power attenuation : 20 or 30 dB Capacity : More than 5 W

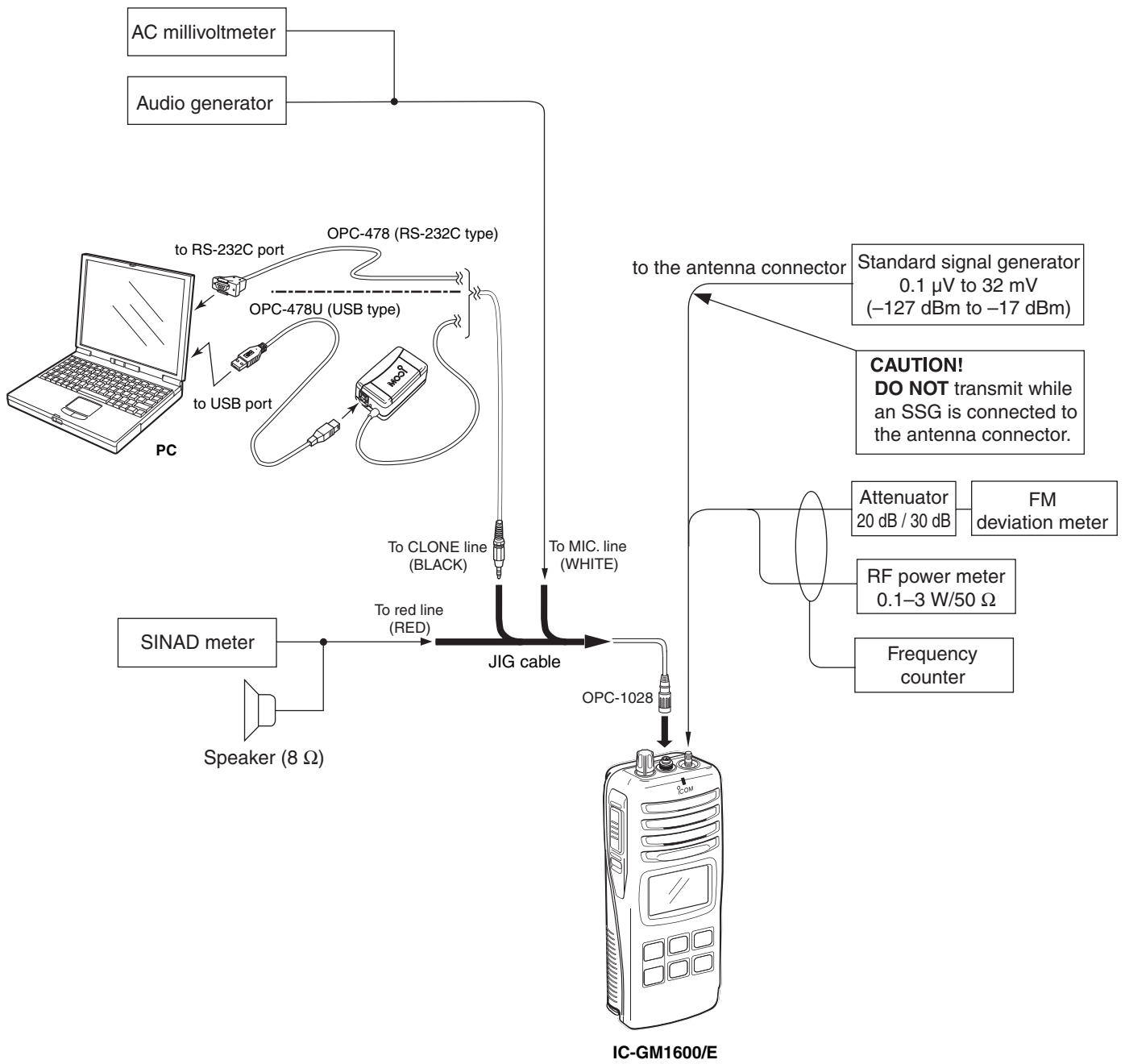
■ STARTING SOFTWARE ADJUSTMENT

- (1) Connect IC-GM1600/E and a PC with OPC-478/U, OPC-1028 and JIG CABLE.
- (2) Turn the transceiver ON.
- (3) Boot up Windows®, and click the program group 'CS-M90/GM1600 ADJ' in the 'Programs' folder of the [Start] menu, then CS-M90/GM1600 ADJ's window appears.
- (4) Click 'Adjust' on the CS-M90/GM1600's window, then IC-GM1600/E's up-to-date condition appears.
- (5) Set or modify adjustment data as desired.

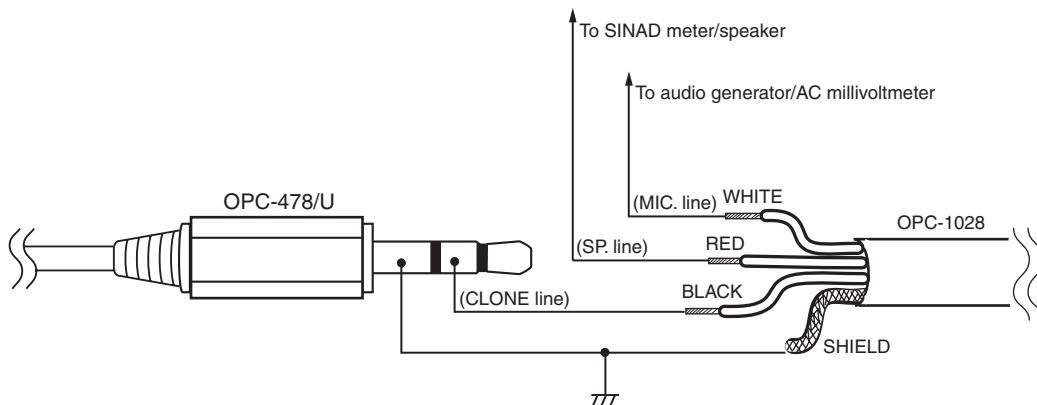
CAUTION!: BACK UP the originally programmed memory data in the transceiver before programming the adjustment frequencies. When program the adjustment frequencies into the transceiver, the transceiver's memory data will be overwritten and lose original memory data at the same time.

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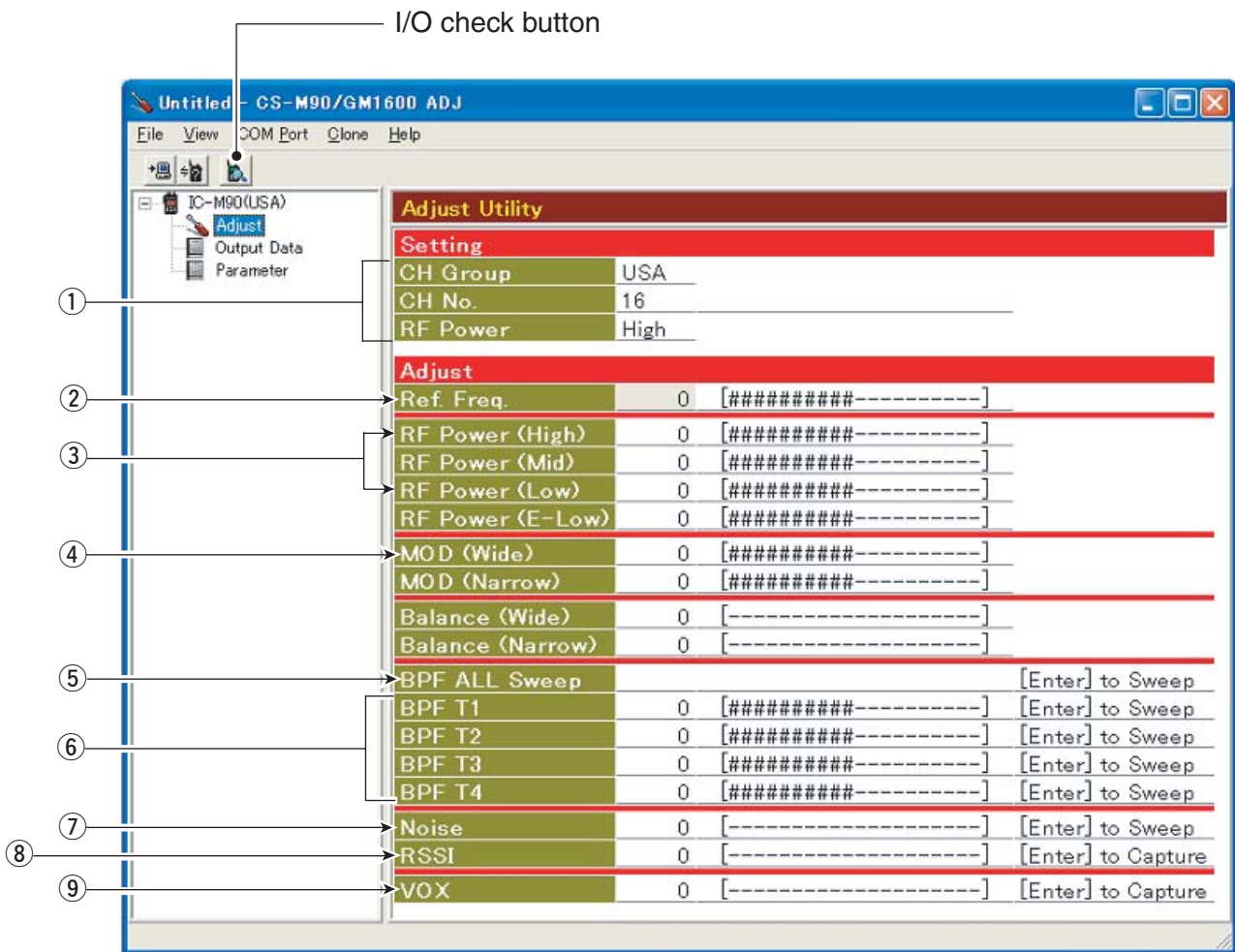
• CONNECTION



• JIG CABLE



• PC SCREEN EXAMPLE



NOTE: The above screen is an example.
Each transceiver has its own specific values for each setting.

- | | |
|---------------------------------------|----------------------------------|
| ①: Adjustment condition | ⑥: Receive sensitivity (Manualy) |
| ②: Reference frequency | ⑦: Squelch level |
| ③: RF output power | ⑧: S-meter |
| ④: FM deviation (Wide) | ⑨: VOX |
| ⑤: Receive sensitivity (Automaticaly) | |

5-2 SOFTWARE ADJUSTMENT (FREQUENCY)

Select the adjustment item with [↑] / [↓] keys, then set the value with [←] / [→] keys on the connected PC.

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE
		UNIT	OPERATION	
PLL LOCK VOLTAGE	1 <ul style="list-style-type: none"> • Operating CH. : 16 • Receiving 	PC screen	Check the LVIN Data cell's value in the I/O check window. Click the "I/O check button" on the CS-M90/GM1600 ADJ's screen (see page 5-3) to open the I/O check window as below.	1.5–3.0 V [USA] 1.85–3.35 V [Others] (Verify)
	2 <ul style="list-style-type: none"> • Operating CH. : 16 • RF power : Low • Transmitting 			1.4–2.9 V (Verify)
REFERENCE FREQUENCY [Ref. Freq.]	1 <ul style="list-style-type: none"> • Operating CH. : 16 • Connect the RF power meter or a 50 Ω dummy load to the antenna connector. • RF power : Low • Transmitting 	Top Panel	Loosely couple the frequency counter to the antenna connector.	156.8000 MHz ±500 Hz

The screenshot shows the 'I/O Check' window of the CS-M90/GM1600 ADJ software. The window contains two tables: 'Input' and 'Output'. The 'Input' table has columns for 'Input', 'Dec', 'Hex', and 'Data'. The 'Output' table has columns for 'Output', 'Dec', 'Hex', and 'Data'. The 'LVIN' row in the 'Input' table is highlighted in blue, and its 'Data' value is 2.08V. An arrow points from the text 'PLL LOCK VOLTAGE' to this value. The window also has 'Update' and 'OK' buttons at the bottom.

Input	Dec	Hex	Data
BATT	123	7B	7.72V
NOIS	57	39	1.12V
SD	52	34	1.02V
LVIN	106	6A	2.08V
TEMPS	184	B8	29.45°C
TXDET	0	0	0.00V
VOXT	83	53	1.63V

Output	Dec	Hex	Data
FRQCON	143	8F	2.80V
T1/POW	74	4A	1.45V
T2	99	63	1.94V
T3	74	4A	1.45V
T4	92	5C	1.80V

NOTE: The above screen is an example.
Each transceiver has its own specific values.

5-2 SOFTWARE ADJUSTMENT (TRANSMITTING)

Select the adjustment item with [↑] / [↓] keys, then set the value with [←] / [→] keys on the connected PC.

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE
		UNIT	OPERATION	
OUTPUT POWER [RF Power (High)]	1 <ul style="list-style-type: none"> • Operating CH. : 16 • RF power : High • Transmitting 	Top panel	Connect the RF power meter to the antenna connector.	2.0 W
[RF Power (Low)]	2 <ul style="list-style-type: none"> • Operating CH. : 16 • RF power : Low • Transmitting 			0.75 W
FM DEVIATION [MOD (Wide)]	1 <ul style="list-style-type: none"> • Operating CH. : 16 • Set the FM deviation meter as; <ul style="list-style-type: none"> HPF : OFF LPF : 20 kHz De-emphasis : OFF Detector : (P±P)/2 • Connect the audio generator to the [MIC/SP] jack through OPC-1028 and set as; <ul style="list-style-type: none"> Frequency : 1 kHz Level : 25 mV rms • Transmitting 	Top panel	Connect the FM deviation meter to the antenna connector through the attenuator.	±4.15–4.25 kHz
VOX [VOX]	1 <ul style="list-style-type: none"> • Operating CH. : 16 • Set to VOX mode. (Push [SQL] + [Hi/Lo].) • No audio applied to the [MIC/SP] jack. 	PC screen	Push the [ENTER] key on the keyboard of the connected PC.	Automatic adjustment

5-2 SOFTWARE ADJUSTMENT (RECEIVING)

Select the adjustment item with [↑] / [↓] keys, then set the value with [←] / [→] keys on the connected PC.

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE
		UNIT	OPERATION	
RECEIVE SENSITIVITY [BPF T1] [BPF T2] [BPF T3] [BPF T4]	1 <ul style="list-style-type: none"> Operating CH. : 16 Connect the standard signal generator to the antenna connector and set as; <ul style="list-style-type: none"> Frequency : 156.800 MHz Level : +20 dBμ* Modulation : 1 kHz Deviation : \pm3.0 kHz Receiving 	Top panel	Connect the distortion meter with an 8 Ω load to the [MIC/SP] jack through the JIG cable.	Minimum distortion level
<p>CONVENIENT: RECEIVE SENSITIVITY can be adjusted automatically.</p> <ol style="list-style-type: none"> Put the cursor on the [BPF ALL Sweep] on the CS-M90/GM1600 ADJ's screen and push the [ENTER] key. The connected PC tunes BPF T1–T4 to peak level automatically. <p style="text-align: center;">or</p> <ol style="list-style-type: none"> Put the cursor on the one of BPF T1–T4 as desired. Push the [ENTER] key to start tuning. Repeat 1 and 2 to perform additional BPF tuning. 				
SQUELCH LEVEL [Noise]	1 <ul style="list-style-type: none"> Operating CH. : 16 Connect the standard signal generator to the antenna connector and set as; <ul style="list-style-type: none"> Frequency : 156.800 MHz Level : -5 dBμ* [USA] -6 dBμ* [Others] Modulation : 1 kHz Deviation : \pm3.0 kHz Receiving 	Top panel	Push the [ENTER] key on the keyboard of the connected PC.	Automatic adjustment
S-METER [RSSI]	1 <ul style="list-style-type: none"> Operating CH. : 16 Connect the standard signal generator to the antenna connector and set as; <ul style="list-style-type: none"> Frequency : 156.800 MHz Level : -5 dBμ* [USA] -4 dBμ* [Others] Modulation : 1 kHz Deviation : \pm3.0 kHz Receiving 	Top panel	Push the [ENTER] key on the keyboard of the connected PC.	Automatic adjustment

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

SECTION 6 PARTS LIST

• IC-GM1600/E

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
IC1	1140005990	S.IC MB15A02PFV1-G-BND-ER	B	55.7/12.1
IC141	1110002750	S.IC TA75S01F (TE85R)	T	107.2/24.2
IC231	1110003201	S.IC TA31136FNG (EL)	B	76.4/36.5
IC251	1190000350	S.IC M62363FP-650C	B	53.5/24.2
IC261	1110005340	S.IC NJM12902V-TE1	B	56.1/41.6
IC281	1130007301	S.IC TC4W66FU F(TE12L)	T	59/38.1
IC282	1130006220	S.IC TC4W53FU (TE12L)	T	61.1/42.4
IC341	1130007570	S.IC BU4094BCFV-E2	B	33/8.6
IC382	1110003800	S.IC NJM2904V-TE1	B	33.1/34
IC383	1130007990	S.IC TC3W03FU (TE12L)	B	9.5/38.5
IC421	1110001811	S.IC TA7368F G (ER)	T	102.1/34.9
IC481	1130007301	S.IC TC4W66FU F (TE12L)	B	46/37.6
IC491	1110003800	S.IC NJM2904V-TE1	B	41/32.8
IC551	1110005350	S.IC NJM2870F05-TE1	T	94.5/35.1
IC581	1110005770	S.IC S-80942CNMC-G9C-T2	B	6.8/12.4
IC591	1130011570	S.IC BR24L32FV-WE2	B	10.3/6.6
IC661	1140012420	S.IC μ PD78F0338GC-9EB	B	20/18.6
IC681	1130007301	S.IC TC4W66FU F(TE12L)	B	8.8/28.7
IC682	1130007301	S.IC TC4W66FU F(TE12L)	B	44.6/42.9
IC683	1110002750	S.IC TA75S01F (TE85R)	B	37.1/42.8
Q3	1560000540	S.FET 2SK880-Y (TE85R)	B	47.8/6
Q41	1530002920	S.TR 2SC4226-T1 R25	B	78.1/11.7
Q47	1590001190	S.TR XP6501-(TX) AB	B	78.2/3.8
Q51	1530002920	S.TR 2SC4226-T1 R25	B	74.5/16.2
Q61	1530002380	S.TR 2SC4215-Y (TE85R)	B	78.1/17.5
Q62	1530002380	S.TR 2SC4215-Y (TE85R)	B	76.8/23.2
Q71	1530002380	S.TR 2SC4215-Y (TE85R)	B	66.3/23.2
Q81	1590001400	S.TR XP1214 (TX)	T	72.2/17.3
Q82	1590003290	S.TR UNR9213J-(TX)	T	72.2/19.9
Q91	1530003420	S.TR 2SC5110-O (TE85R)	T	82.3/8.9
Q101	1560001240	S.FET RD01MUS1	T	93.9/10.4
Q111	1560001230	S.FET RD07MVS1	T	100.1/10
Q141	1590003230	S.TR UNR91113J-(TX)	T	110/23
Q165	1580000751	S.FET 3SK294 E (TE85L)	B	96.3/19
Q171	1560000840	S.FET 2SK1829 (TE85R)	B	98.9/17.1
Q191	1580000760	S.FET 3SK299-T1 U73	B	86.5/19.6
Q211	1530002600	S.TR 2SC4215-O (TE85R)	T	84.5/37.9
Q221	1530002690	S.TR 2SC4116-GR (TE85R)	B	65.1/30.3
Q231	1590003230	S.TR UNR91113J-(TX)	T	69.7/38.2
Q232	1530003310	S.TR 2SC5107-O (TE85R)	T	85.4/34
Q291	1590001650	S.TR XP4601 (TX)	T	59.1/32.5
Q321	1510000670	S.TR 2SA1588-GR (TE85R)	T	93.3/23.3
Q322	1510000670	S.TR 2SA1588-GR (TE85R)	T	96.9/24.1
Q323	1510000670	S.TR 2SA1588-GR (TE85R)	T	99.7/26.5
Q324	1590001770	S.TR XP1213 (TX)	B	81.1/29.8
Q381	1590003290	S.TR UNR9213J-(TX)	B	5.7/37.2
Q411	1530003091	S.TR 2SC4213-B F (TE85R)	B	96.3/31.1
Q431	1520000450	S.TR 2SB1132 T100 Q	T	111.4/30.5
Q432	1590001190	S.TR XP6501-(TX) AB	T	107.6/29.6
Q441	1530002850	S.TR 2SC4116-BL (TE85R)	T	101.5/39.2
Q442	1560001330	S.FET RSR025N03	T	103.3/42.4
Q443	1560001330	S.FET RSR025N03	T	97.9/41.4
Q444	1590003290	S.TR UNR9213J-(TX)	T	98.3/38.4
Q461	1590003380	S.TR UNR9111J-(TX)	B	90.3/42.5
Q462	1590003380	S.TR UNR9111J-(TX)	B	90/45.6
Q501	1590003290	S.TR UNR9213J-(TX)	B	34.6/26.1
Q531	1590001770	S.TR XP1213 (TX)	B	37.5/16.8
Q532	1530002850	S.TR 2SC4116-BL (TE85R)	B	36.9/23
Q551	1520000450	S.TR 2SB1132 T100 Q	B	101.1/39.9
Q552	1590001190	S.TR XP6501-(TX) AB	B	102.2/35.5
Q553	1590003290	S.TR UNR9213J-(TX)	B	98.6/35
Q561	1510000670	S.TR 2SA1588-GR (TE85R)	T	100.5/23.8
Q651	1590001770	S.TR XP1213 (TX)	B	27.3/27.8
Q652	1590000660	S.TR DTC144TU T106	B	6.4/33.7
Q653	1590001770	S.TR XP1213 (TX)	B	52/35.6
Q654	1590003290	S.TR UNR9213J-(TX)	B	53.5/33.1
Q655	1590001540	S.TR UMD6N TR	T	112.4/20.6
Q656	1590003550	S.TR XP4313 (TX)	B	3.6/31.2
D1	1790001250	S.DIO MA2S111-(TX)	B	51.2/14.6
D31	1750000711	S.VCP HVC350B-E	B	70.7/9.2
D32	1750000711	S.VCP HVC350B-E	B	72/9.2
D33	1750000711	S.VCP HVC350B-E	B	68.1/9.2
D34	1750000711	S.VCP HVC350B-E	B	69.4/9.2
D35	1750000711	S.VCP HVC350B-E	B	65.7/16
D36	1750000711	S.VCP HVC350B-E	B	65.7/14.7
D37	1750000711	S.VCP HVC350B-E	B	63.8/17.5
D38	1750000711	S.VCP HVC350B-E	B	63.8/18.8
D39	1720000400	S.VCP 1SV245 (TPH3)	T	66.4/20.1
D40	1790001620	S.DIO 1SV308 (TPL3)	B	65.4/10
D41	1790000680	S.DIO SB20-03P-TD	B	118.7/29.3
D91	1790000620	S.DIO MA77 (TX)	T	82.5/18.4

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
D92	1790000620	S.DIO MA77 (TX)	T	81.3/22
D121	1790001670	S.DIO RB706F-40T106	T	108.3/15.9
D131	1750000580	S.DIO 1SV307 (TPH3)	T	111.9/9.8
D132	1790001210	S.DIO 1SS375-TL	T	114.3/14
D141	1790001240	S.DIO MA2S728-(TX)	T	102.6/25.1
D151	1750000580	S.DIO 1SV307 (TPH3)	B	113.2/8.5
D152	1790001260	S.DIO MA2S077-(TX)	B	111.3/12.7
D153	1790001620	S.DIO 1SV308 (TPL3)	B	112.9/15.1
D154	1750000711	S.VCP HVC350BTRF-E	B	109.1/20.4
D155	1750000711	S.VCP HVC350BTRF-E	B	104.1/21.6
D171	1790001250	S.DIO MA2S111-(TX)	B	102/16.9
D181	1750000711	S.VCP HVC350BTRF-E	B	93.5/21.5
D182	1750000711	S.VCP HVC350BTRF-E	B	90.5/21.5
D231	1750000520	S.DIO DAN222TL	T	76.1/41.2
D232	1750000520	S.DIO DAN222TL	T	74.1/37.6
D601	1790001260	S.DIO MA2S077-(TX)	T	7.3/12.6
D602	1750000370	S.DIO DA221 TL	B	10/32.6
D603	1790001250	S.DIO MA2S111-(TX)	B	34.6/42.1
FI211	2030000230	S.MLH FL-355 (31.05 MHz) [GEN], [EUR], [UK] B 89.1/32.7		
		[GEN], [EUR], [UK] B 89.1/32.7		
		[USA] B 89.1/32.7		
		[USA] B 89.1/32.7		
FI231	2020001270	S.FIL FL-377 MFT31P (31.05 MHz)	B	89.1/32.7
FI232	2020001410	CER CFWLB450KE2A-B0	B	89.1/32.7
		CER CFWLB450KGF-A-B0	B	89.1/32.7
X1	6050011940	S.XTL CR-783 (15.3 MHz)	B	47.6/11.9
X231	6070000190	S.DCR CDBCBC450KAY24-R0	T	79.2/30.1
X381	6050011560	S.XTL CR-746 (4.000 MHz)	B	13.9/38.5
X601	6050011550	S.XTL CR-747 (9.8304 MHz)	T	2.9/17.6
L31	6200005540	S.COL ELJNC R47K-F	T	66.7/9.9
L32	6200007710	S.COL LQW2BHN27NJO1L [GEN], [EUR], [UK] B 67.4/12.2		
		[GEN], [EUR], [UK] B 67.4/12.2		
		[USA] B 67.4/12.2		
L33	6200008090	S.COL LQW2BHN68NJO1L	B	63.6/13.8
L34	6200005540	S.COL ELJNC R47K-F	T	63.5/15.2
L35	6200007760	S.COL LQW2BHN82NJO1L	B	63.9/12.3
L41	6200007730	S.COL LQW2BHN39NJO1L Except [USA]	B	63.9/12.3
L41	6200007760	S.COL LQW2BHN82NJO1L	B	71.5/12.2
L51	6200007770	S.COL LQW2BHN10JO1L	B	68.6/17.2
L61	6200006980	S.COL ELJRE R10G-F	B	76.6/19.9
L62	6200006980	S.COL ELJRE R10G-F	B	74.2/22.3
L71	6200006980	S.COL ELJRE R10G-F	B	68.4/21.3
L72	6200005720	S.COL ELJRE 33NG-F	B	63.8/21.6
L81	6200007170	S.COL MLF1608A 3R3K-T	T	74.9/12.3
L82	6200007170	S.COL MLF1608A 3R3K-T	T	74.8/15.3
L92	6200006980	S.COL ELJRE R10G-F	T	84.7/11.2
L102	6200007690	S.COL LQW2BHN18NJO1L	T	93.9/15.2
L112	6200009240	S.COL 0.20-1.0-7TL 31N	T	104.1/13.9
L121	6200010640	S.COL 0.26-1.0-3TL 8.5N	T	102.9/5.2
L122	6200009450	S.COL 0.20-1.0-6TL 25N	T	105.6/4.3
L123	6200008280	S.COL 0.30-1.7-7TL 50N	T	110.1/5.9
L124	6200003711	S.COL NLV25T 2R7J 2.7U	T	111.1/13
L131	6200009800	S.COL 0.26-1.1-7TR 30N	B	112.1/4.6
L132	6200008580	S.COL 0.30-1.4-6TL 32N	T	115.4/9.8
L151	6200008280	S.COL 0.30-1.7-7TL 50N	B	110/8.7
L152	6200005740	S.COL ELJRE 47NG-F	B	109.3/12
L153	6200003960	S.COL MLF1608A 1R0K-T	B	112.9/16.5
L154	6200007750	S.COL LQW2BHN56NJO1L	B	107.9/18
L155	6200007750	S.COL LQW2BHN56NJO1L	B	103.7/17.3
L156	6200001770	S.COL ELJNC 47NK-F [GEN], [EUR], [UK] B 112.6/18.4		
		[USA] B 112.6/18.4		
L165	6200003960	S.COL MLF1608A 1R0K-T	B	97.3/24.7
L166	6200007750	S.COL LQW2BHN56NJO1L	B	95.3/22.1
L181	6200007750	S.COL LQW2BHN56NJO1L	B	89.6/17.9
L191	6200010960	S.COL C2520C-R47G-A (0.47U)	B	83.1/21.7
L203	6200009180	S.COL ELJRE R10J-F3	B	84.7/16
L221	6200003960	S.COL MLF1608A 1R0K-T	B	64.2/28.1
L222	6200004480	S.COL MLF1608D R82K-T	B	69.6/28.9
R1	7030005100	S.RES ERJ2GEJ 154 X (150 k Ω)	B	54/16.4
R2	7030007250	S.RES ERJ2GEJ 220 X (22 Ω)	B	54.6/17.8
R4	7510001660	S.TMR NTCG16 4LH 473KT	B	41.8/9.1
R5	7030003940	S.RES ERJ3GEYF 104 V (100 k Ω)	B	43.8/8
R6	7030005110	S.RES ERJ2GEJ 224 X (220 k Ω)	B	44.4/16.6
R9	7030005230	S.RES ERJ2GEJ 334 X (330 k Ω)	B	43.9/15.1
R15	7030005050	S.RES ERJ2GEJ 103 X (10 k Ω)	B	50/8.7
R16	7030005580	S.RES ERJ2GEJ 560 X (56 Ω)	B	53.6/15.4
R17	7030004980	S.RES ERJ2GEJ 101 X (100 Ω)	B	53.5/8.8
R18	7030005120	S.RES ERJ2GEJ 102 X (1 k Ω)	B	53.5/7.8
R19	7030005000	S.RES ERJ2GEJ 471 X (470 Ω)	B	54.9/8.3
R20	7030005120	S.RES ERJ2GEJ 102 X (1 k Ω)	B	45.3/6.8

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

S.=Surface mount

[MAIN UNIT]

Table with columns: REF NO., ORDER NO., DESCRIPTION, M., H/V LOCATION. Contains 203 rows of component specifications.

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

[MAIN UNIT]

Table with columns: REF NO., ORDER NO., DESCRIPTION, M., H/V LOCATION. Contains 242 rows of component specifications.

S.=Surface mount

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
C522	4030016970	S.CER ECJ0EB1C223K	B	48.2/30
C531	4030016950	S.CER ECJ0EB1A473K	B	35.2/15.5
C532	4030016940	S.CER ECJ0EB1A393K	B	37.8/18.6
C533	4030016930	S.CER ECJ0EB1A104K	B	37.3/20.9
C534	4030017740	S.CER ECJ0EB1E821K	B	39.4/23.7
C535	4030016790	S.CER ECJ0EB1C103K	B	35/21.5
C536	4030016950	S.CER ECJ0EB1A473K	B	38.6/20
C552	4030017460	S.CER ECJ0EB1E102K	T	109.2/37.1
C553	4550006820	S.TAN ECST1DX106R	B	118.9/22.5
C554	4030016790	S.CER ECJ0EB1C103K	T	92.2/34.5
C555	4030011810	S.CER C1608 JB 1A 224K-T	B	100.5/31.6
C556	4030017460	S.CER ECJ0EB1E102K	T	97.3/33.4
C557	4550006710	S.TAN ECST1AX226R	B	98.1/31
C561	4030016790	S.CER ECJ0EB1C103K	T	98.7/21.2
C571	4030016790	S.CER ECJ0EB1C103K	B	105.1/26.7
C581	4030017030	S.CER ECJ0EB1A273K	B	5.6/15.1
C591	4030016790	S.CER ECJ0EB1C103K	B	7.9/8.1
C601	4030017400	S.CER ECJ0EC1H220J	T	6.1/15.9
C602	4030017590	S.CER ECJ0EC1H070C	T	6.1/20.8
C603	4030017660	S.CER ECJ0EC1H330J	T	7.1/18.9
C604	4030016790	S.CER ECJ0EB1C103K	T	6.1/12.3
C605	4030017420	S.CER ECJ0EC1H470J	T	5.8/10.8
C606	4030016790	S.CER ECJ0EB1C103K	T	5.8/9.8
C611	4030017460	S.CER ECJ0EB1E102K	T	55.5/44.8
C612	4030016970	S.CER ECJ0EB1C223K	T	54.2/41.1
C641	4550006710	S.TAN ECST1AX226R	T	4/27.5
C642	4030016790	S.CER ECJ0EB1C103K	B	34.6/19.9
C643	4030016790	S.CER ECJ0EB1C103K	B	28.2/9.1
C661	4030016950	S.CER ECJ0EB1A473K	B	7.7/14.6
C662	4030017460	S.CER ECJ0EB1E102K	B	113.8/30.3
C664	4030016950	S.CER ECJ0EB1A473K	B	5.8/17.6
C665	4030016950	S.CER ECJ0EB1A473K	B	6.8/19.2
C666	4030017040	S.CER ECJ0EB1A333K	B	5.7/19.2
C667	4030016950	S.CER ECJ0EB1A473K	B	5.2/20.5
C668	4030016950	S.CER ECJ0EB1A473K	B	5.2/21.5
C669	4030016950	S.CER ECJ0EB1A473K	B	5.6/23
C670	4030016950	S.CER ECJ0EB1A473K	B	6.6/23
C671	4030016930	S.CER ECJ0EB1A104K	B	10/23.6
C681	4030016930	S.CER ECJ0EB1A104K	B	7.4/31.3
C682	4030017480	S.CER C1608 JB 1A 474K-T	B	8.3/24.6
C683	4030017480	S.CER C1608 JB 1A 474K-T	B	6.3/25.3
C684	4030017480	S.CER C1608 JB 1A 474K-T	B	14.6/29.7
C685	4030017480	S.CER C1608 JB 1A 474K-T	B	10.6/25.1
C686	4030017420	S.CER ECJ0EC1H470J	B	6.4/31.3
C687	4030017420	S.CER ECJ0EC1H470J	B	9.7/30.9
C688	4030016930	S.CER ECJ0EB1A104K	B	89.9/47.7
C689	4030017460	S.CER ECJ0EB1E102K	B	45.2/40.7
C690	4030016960	S.CER ECJ0EB1C183K	B	40/43
C691	4030016960	S.CER ECJ0EB1C183K	B	39.8/44.3
C692	4030017730	S.CER ECJ0EB1E471K	B	39.3/45.6
C693	4030017460	S.CER ECJ0EB1E102K	B	32.1/42.3
C695	4030018860	S.CER ECJ0EB0J105K	B	48.8/39.5
C696	4030016930	S.CER ECJ0EB1A104K	B	48.5/41.8
C697	4030016930	S.CER ECJ0EB1A104K	B	36/45.5
C698	4030017460	S.CER ECJ0EB1E102K	B	113.8/31.3
C699	4030017460	S.CER ECJ0EB1E102K	B	90.9/48
C700	4030018860	S.CER ECJ0EB0J105K	B	92.9/48
J352	6910016370	CNR IMSA-9230B-1-06Z032-PT1		
J412	6510021900	S.CNR BM02B-ASRS-TF	T	107.3/40.1
J414	6510024530	S.CNR 14FH-SM1-TB	T	118.8/28.5
DS653	5040002310	S.LED SML-311YTT86	T	31.8/40.6
DS654	5040002310	S.LED SML-311YTT86	T	15.3/40.6
DS656	5040002310	S.LED SML-311YTT86	T	32.3/9.4
DS657	5040002310	S.LED SML-311YTT86	T	15.8/9.4
DS658	5040002310	S.LED SML-311YTT86	T	32.3/24.9
DS659	5040002310	S.LED SML-311YTT86	T	15.8/24.9
DS681	5030002790	LCD A0286 LCD39		
MC461	7700002480	MIC SKB-2746 LPC		
S100	2260002850	S.SW EVQP2T02M	T	18.3/40.6
S101	2260002850	S.SW EVQP2T02M	T	34.8/40.6
S102	2260002850	S.SW EVQP2T02M	T	35.3/24.9
S103	2260002850	S.SW EVQP2T02M	T	18.8/24.9
S104	2260002850	S.SW EVQP2T02M	T	35.3/9.4
S105	2260002850	S.SW EVQP2T02M	T	18.8/9.4
S461	2260002840	SW SKHLLFA010		
S641	2260002800	S.SW SW-167 (SKQTLAE010)	B	80.4/49
EP2	6910015370	S.BEA ACZ1005Y-102-T	B	41.2/7.9
EP3	6910015370	S.BEA ACZ1005Y-102-T	B	41.5/10.3
EP4	6910015370	S.BEA ACZ1005Y-102-T	B	43.5/10.3
EP101	6910013370	S.BEA BLM18BB221SN1D	T	91.7/16.5
EP111	6910014690	S.BEA MPZ1608S221A-T	T	107/18
EP681	8930064210	LCT SRCN-2795-SP-N-W		
EP682	6910016340	E.OTH CV1083 FX2795		

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

[VR UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
R801	7210002530	VAR TP96N937N-15F-10KA-1540		
F1	5210000900	S.FUS 0434003.NRP	B	12.2/4.4

[MIC UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
Q655	1590001770	S.TR XP1213 (TX)	B	3.6/2.1
R713	7030005010	S.RES ERJ2GEJ 681 X (680 Ω)	B	6.1/1.8
R714	7030005120	S.RES ERJ2GEJ 102 X (1 kΩ)	B	5.9/2.8
C700	4030017420	S.CER ECJ0EC1H470J	B	11.4/5.1
C702	4030017420	S.CER ECJ0EC1H470J	B	3.8/5
C703	4030017620	S.CER ECJ0EC1H100C	B	4.5/7.8
J415	6510022020	S.CNR 14FLT-SM1-TB	B	6.6/13
J416	6510024650	CNR 246S-550-4P-134 (ORANGE)		
DS655	5040003090	S.LED FRDG1211F-TR	B	10/1.8
W470	8900013540	CBL OPC-1410 (N=14,L=50)		
EP451	6910012350	S.BEA MMZ1608Y 102BT	B	9.6/5.1
EP452	6910012350	S.BEA MMZ1608Y 102BT	B	12.6/10.7
EP454	6910012350	S.BEA MMZ1608Y 102BT	B	3.4/8.9
EP458	6910012350	S.BEA MMZ1608Y 102BT	B	3.7/6.4

[CHASSIS UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
J41	6910016650	CNR 2795 ANT CONNECTOR		
SP1	2510001092	SP 036D0801B <FG>		
W3	8900010960	CBL OPC-1129		

• BC-158

[CHARGE UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
R1	7070001130	RES ERG2SJ 121 X (120 Ω)		
R2	7070001140	RES ERG2SJ 151 X (150 Ω)		
R3	7010007100	RES PSD1/4 V 102 (150 Ω)		
J1	6510024940	CNR HEC2305-016250		
DS1	5040003020	LED SEL2410G		

S.=Surface mount

SECTION 7 MECHANICAL PARTS AND DISASSEMBLY

7-1 CABINET PARTS

[MAIN UNIT]

REF.	ORDER. NO.	DESCRIPTION	QTY.
DS681	5030002790	LCD A0286	1
EP681	8930064210	LCD contact SRCN-2795-SP-N-W	1
MP681	8930063850	2795 LCD holder	1

[CHASSIS PARTS]

REF.	ORDER. NO.	DESCRIPTION	QTY.
J41	6910016650	2600 ANT connector	1
SP1	2510001092	Speaker 036D0801B	1
W3	8900010960	Cable OPC-1129	1
MP1	8210021100	2795 Front panel (A)	[USA] 1
	8210021170	2795 Front panel (C)	[Others] 1
MP8	8210020870	2795 SP panel	1
MP10	8930063640	2795 SP rubber	1
MP18	8930063600	2795 MIC cap	1
MP20	8210021090	2795 rear panel	1
MP21	8610011151	2497 BATT lock-1	1
MP22	8930065070	2795 lock plate	1
MP23	8930063630	2795 terminal holder	1
MP24	8930063840	2795 A-terminal	1
MP25	8930063830	2795 B-terminal	1
MP26	8930063820	2795 C-terminal	1
MP31	8830001140	VR nut (J)	1
MP32	8930052280	O ring (AC)	1
MP33	8610012110	Knob N-321 (A)	1
MP35	8830001480	VR nut (O)	1
MP41	8010019740	2795 chassis	1
MP46	8930064200	2795 main seal	1
MP47	8810009510	Screw B0 2X4 NI-ZU (BT)	9
MP51	8830001600	Screw nut (L)	1
MP52	8930065190	O ring (BB)	1
MP66	8930059800	2600 pet sheet	1
MP69	8820001330	Screw M3X3 BS NI	2
MP70	8810010150	Screw B0 2X10 SUS ZK	2
MP71	8820001320	2795 screw	4
MP73	8930063690	O ring (BA)	4
MP74	8810009560	Screw B0 2X6 ZK (BT)	3
MP75	8810009560	Screw B0 2X6 ZK (BT)	1
MP76	8810010150	Screw B0 2X10 SUS ZK	2
MP77	8510016610	2795 shield plate	1
MP80	8930064360	2795 antenna rubber	1

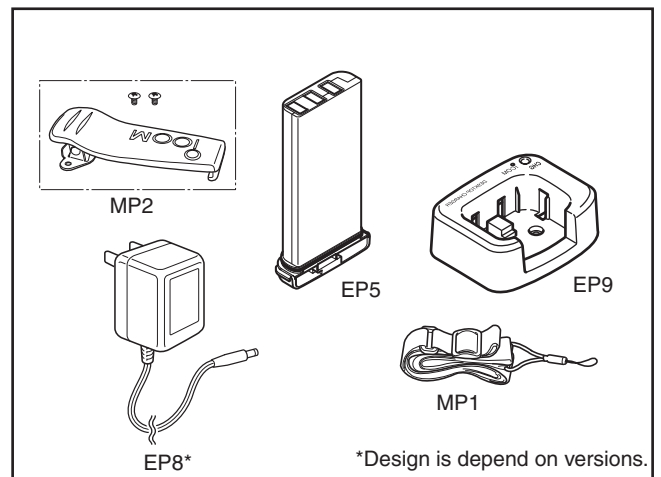
Screw abbreviations B0, BT: Self-tapping
 ZK: Black
 SUS: Stainless
 NI-ZU: Nickel-zinc

[MIC BOARD]

REF.	ORDER. NO.	DESCRIPTION	QTY.
J416	6510024650	246S-550-4P-134 connector	1

[ACCESSORIES]

REF.	ORDER. NO.	DESCRIPTION	QTY.
EP1	3310003330	FA-S61V	1
EP5	Optional product	BP-224	1
EP8	Optional product	BC-147A	[USA] 1
	Optional product	BC-147E	[GEN], [EUR] 1
EP9	Optional product	BC-158	Except [UK] 1
MP1	8930068180	IC-GM1600 NECK STRAP	1
MP2	Optional product	MB-103	1



SECTION 8 SEMICONDUCTOR INFORMATION

• BC-158 CHARGER PARTS LIST

MECHANICAL PARTS

[CHASSIS UNIT]

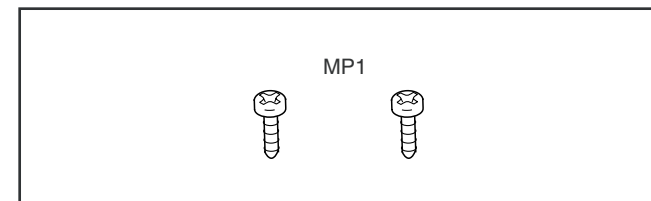
REF.	ORDER. NO.	DESCRIPTION	QTY.
MP1	8510016540	2810 case	1
MP2	8110007680	2523 cover	1
MP3	8810008660	Screw B0 3 x 8 NI-ZU (BT)	2
MP4	8930047830	Leg cushion (C)	2

[CHARGE UNIT]

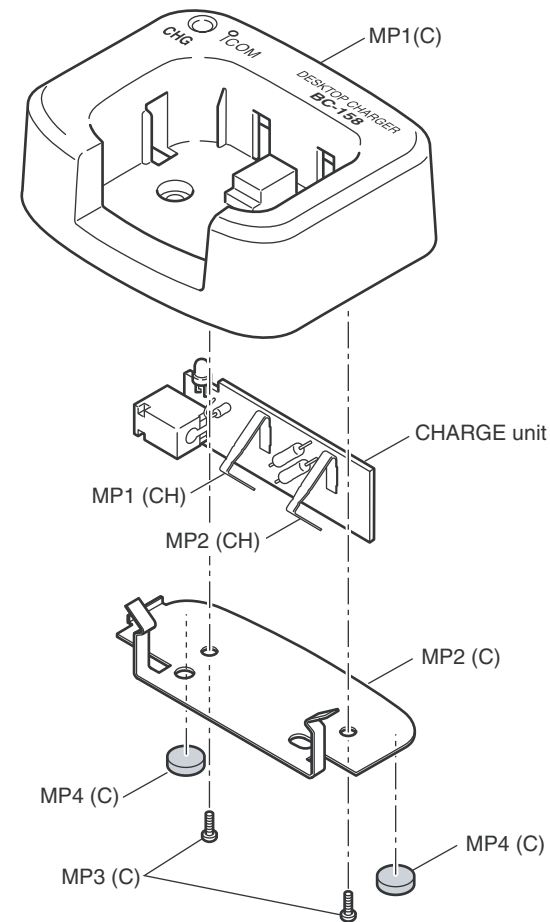
REF.	ORDER. NO.	DESCRIPTION	QTY.
MP1	8930057120	2523 Terminal	1
MP2	8930057120	2523 Terminal	1

[ACCESSORIES]

REF.	ORDER. NO.	DESCRIPTION	QTY.
MP1	8810001460	Screw A0 3.5 x 20 SUS	2

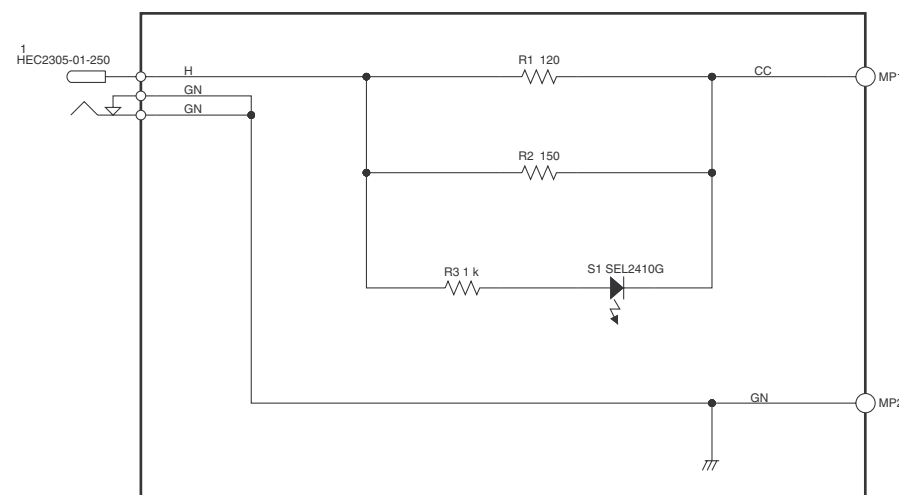


Screw abbreviations A0, B0, BT: Self-tapping
 NI-ZU: Nickel-zinc
 SUS: Stainless



NOTE: (C) : CHASSIS
 (CH) : CHARGE UNIT

• CIRCUIT DIAGRAM



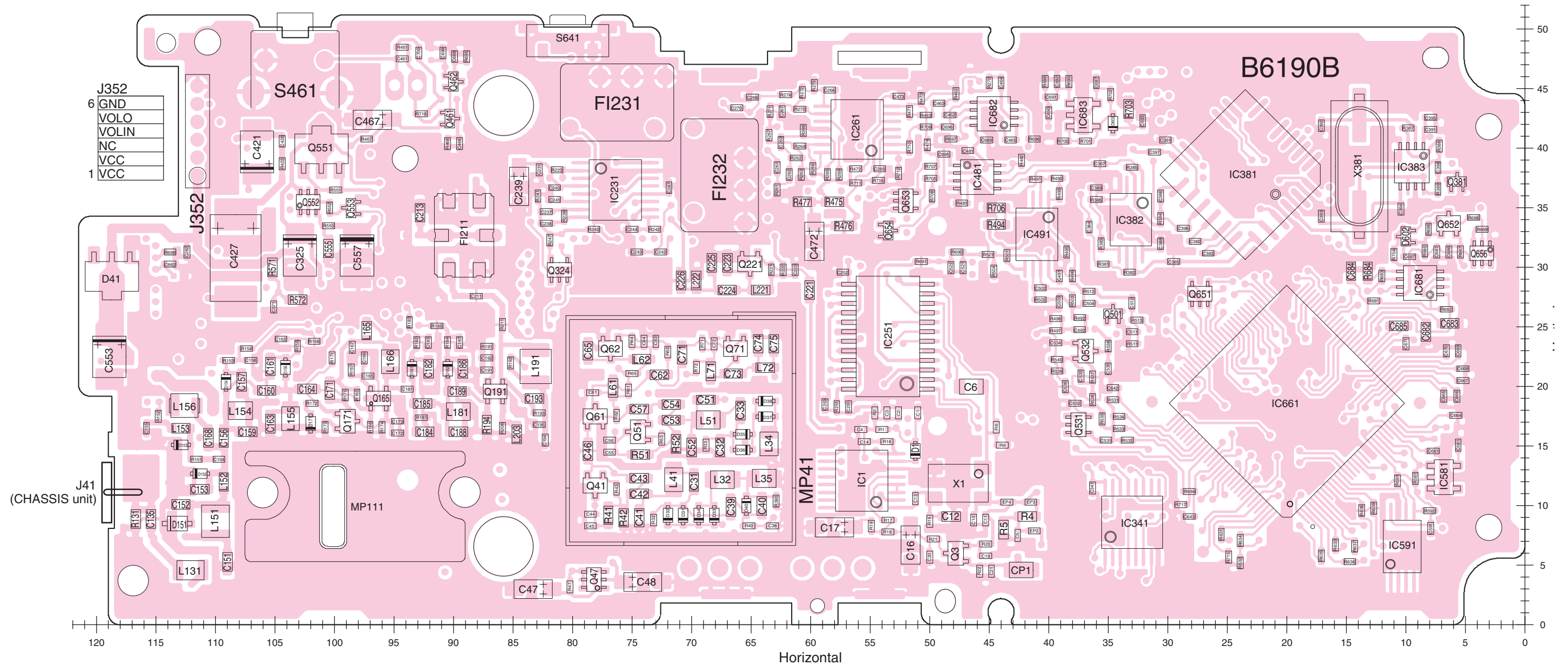
• TRANSISTORS AND FET's

2SA1588 GR (Symbol: ZG) 	2SB1132 Q (Symbol: BAQ) 	2SC4116 BL (Symbol: LL) 	2SC4116 GR (Symbol: LG) 	2SC4213 B (Symbol: AB)
2SC4215 O (Symbol: QO) 	2SC4215 Y (Symbol: QY) 	2SC4226 R25 (Symbol: R25) 	2SC5107 O (Symbol: MFO) 	2SC5110 O (Symbol: MGO)
2SK880 Y (Symbol: XY) 	2SK1829 (Symbol: K1) 	3SK294 (Symbol: UV) 	3SK299 U73 (Symbol: U73) 	DTA144 TU (Symbol: 06)
RD01MUS1 (Symbol: K2) 	RD07MVS1 (Symbol: RD07MVS1) 	RSR025N03 (Symbol: QY) 	UMD6 (Symbol: D6) 	UNR9111J (Symbol: 6A)
UNR9113J (Symbol: 6C) 	UNR9213J (Symbol: 8C) 	XP1213 (Symbol: 9L) 	XP4313 (Symbol: 8S) 	XP4601 (Symbol: 5C)
XP1214 (Symbol: 9H) 	XP6501 AB (Symbol: 5N) 			

• DIODES

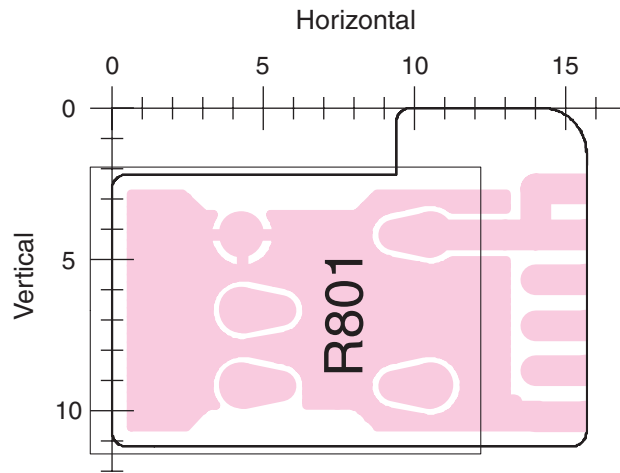
1SS375 (Symbol: FH) 	1SV245 (Symbol: T3) 	1SV307 (Symbol: TX) 	1SV308 (Symbol: TX) 	DA221 (Symbol: K)
DAN222 (Symbol: N) 	HVC350B (Symbol: B0) 	MA2S077 (Symbol: S) 	MA2S111 (Symbol: A) 	MA2S728 (Symbol: B)
MA77 (Symbol: 4B) 	RB706F-40 (Symbol: 3J) 	SB20-03P (Symbol: SC) 		

● BOTTOM VIEW



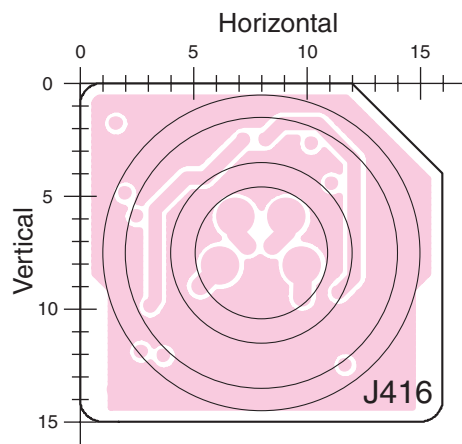
9-2 VR BOARD

• TOP VIEW



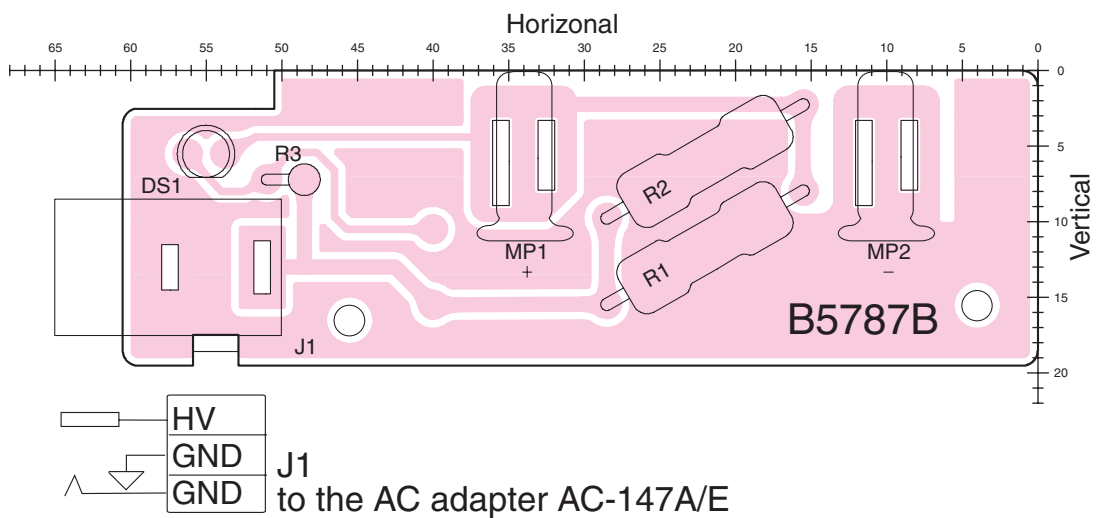
9-3 MIC BOARD

• TOP VIEW

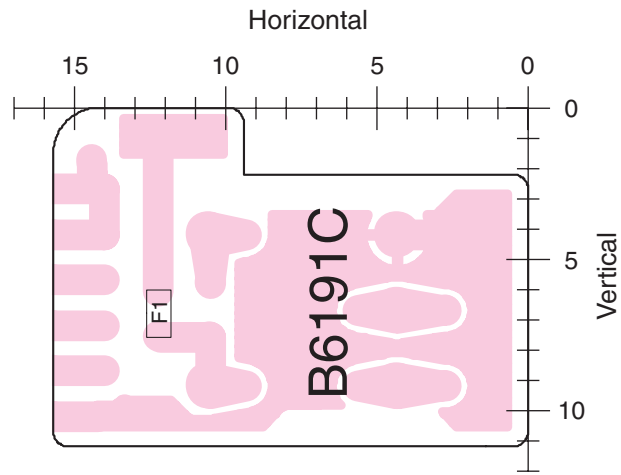


9-4 BC-158

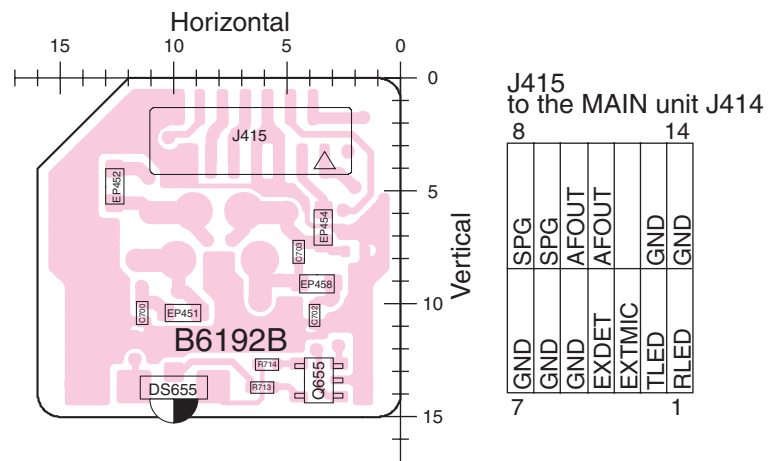
• TOP VIEW



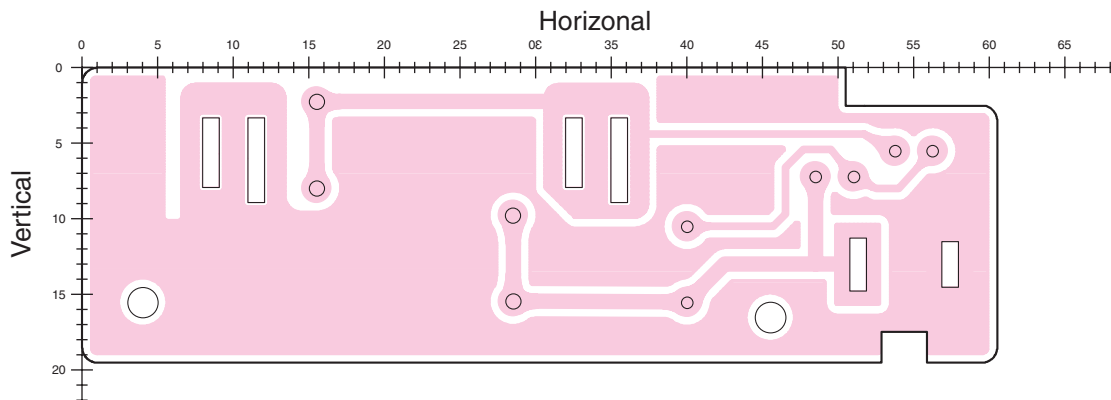
● BOTTOM VIEW



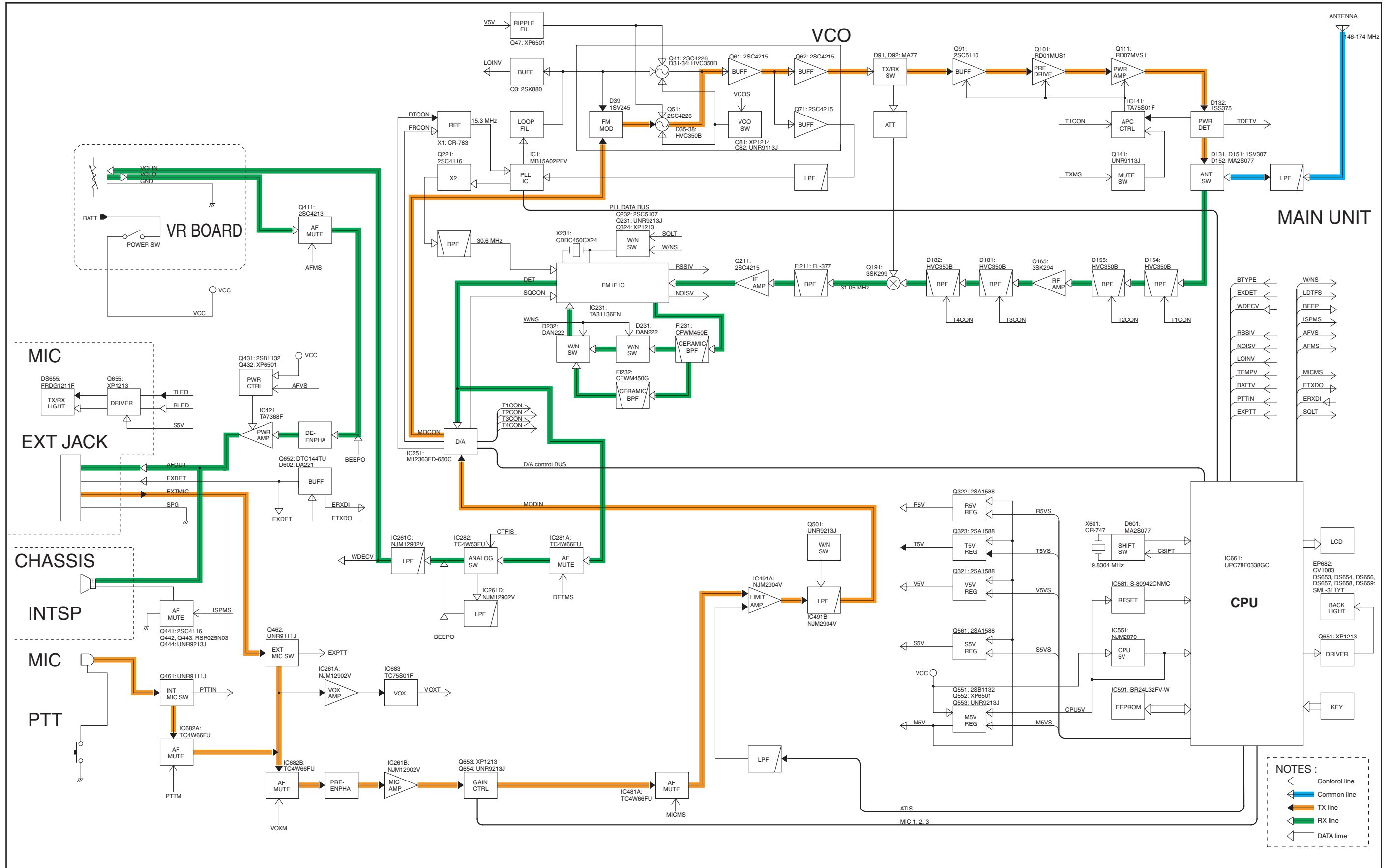
● BOTTOM VIEW



● BOTTOM VIEW

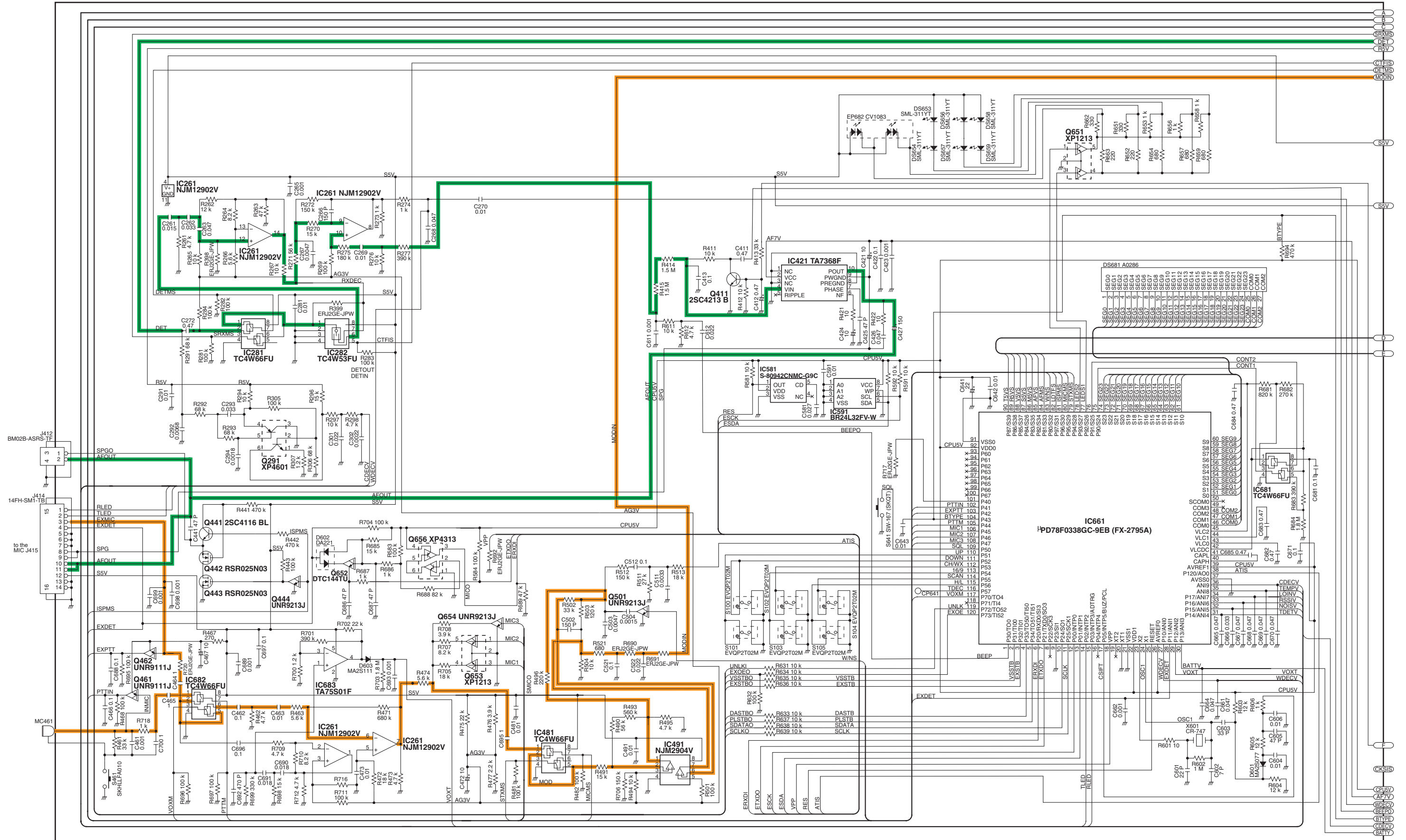


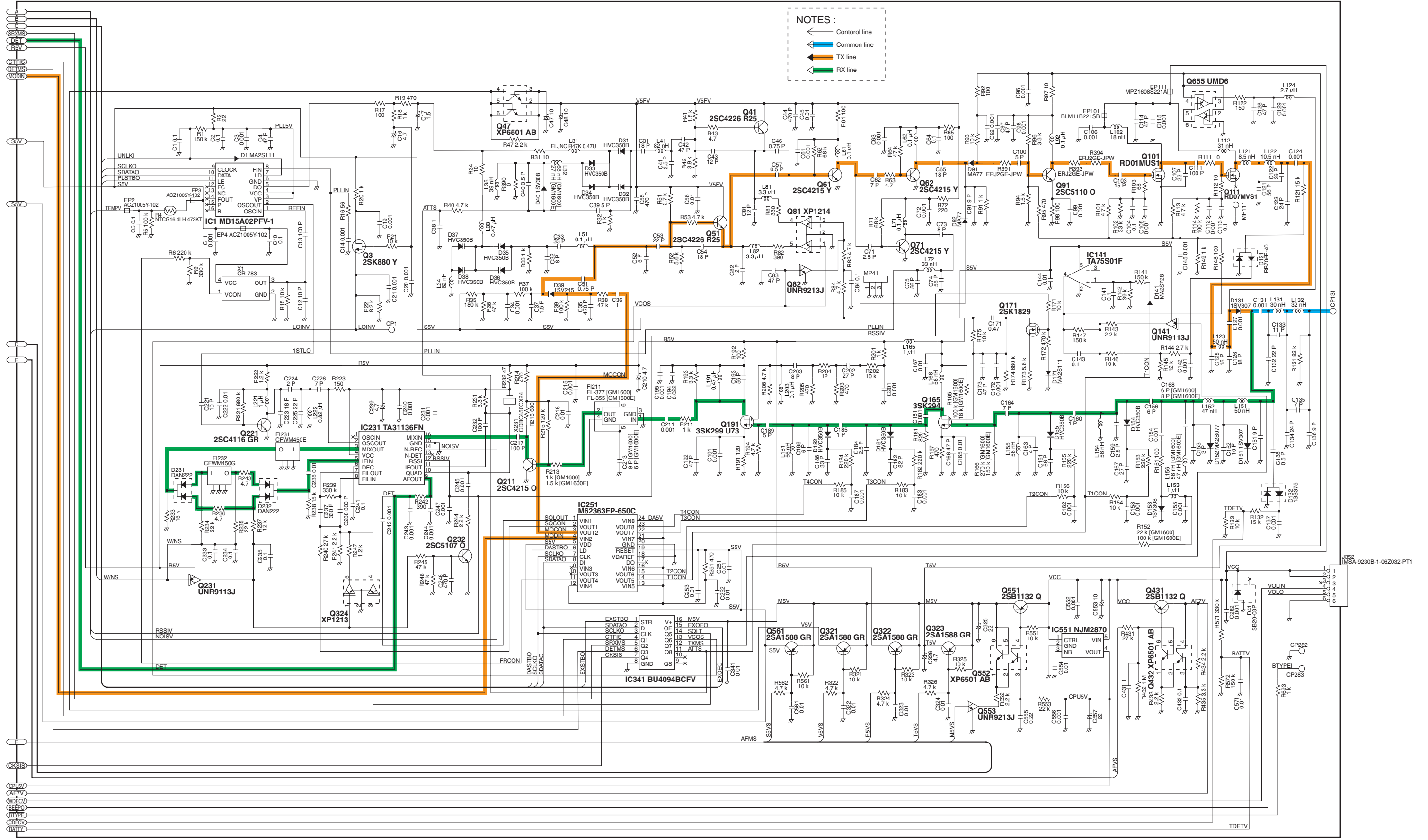
SECTION 10 BLOCK DIAGRAM



SECTION 11 VOLTAGE DIAGRAM

11-1 MAIN UNIT





NOTES :

- ← Contour line
- ← Common line
- ← TX line
- ← RX line

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