

Nov. 2008



SERVICE MANUAL ADDENDUM

IC-F110 IC-F111 IC-F121

CONTENTS

REPLACEMENT PAGE 5-5

5-3 SOFTWARE ADJUSTMENT

Select an operation using [↑] / [↓] keys, then set specified value using [←] / [→] keys on the connected computer keyboard.

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE
		UNIT	LOCATION	
REFERENCE FREQUENCY [TXF]	1 <ul style="list-style-type: none"> • Operating freq. : 173.900 MHz • Output power : Low1 • Connect the RF power meter or 50 Ω dummy load to the antenna connector. • Transmitting 	Rear panel	Loosely couple a frequency counter to the antenna connector.	173.9000 MHz
OUTPUT POWER [Power (Hi)]	1 <ul style="list-style-type: none"> • Operating freq.: 155.000 MHz (25 W ver.) 173.900 MHz (50 W ver.) • Output power : High • Transmitting 	Rear panel	Connect an RF power meter to the antenna connector.	25.0 W (25 W ver.) 50.0 W (50 W ver.)
[Power (L2)]	2 <ul style="list-style-type: none"> • Output power : Low2 • Transmitting 			10.0 W (25 W ver.) 25.0 W (50 W ver.)
[Power (L1)]	3 <ul style="list-style-type: none"> • Output power : Low1 • Transmitting 			2.5 W (25 W ver.) 5.0 W (50 W ver.)
FM DEVIATION [MOD W]	1 <ul style="list-style-type: none"> • Operating freq. : 155.000 MHz • Output power : Low1 • IF bandwidth : Wide • Connect an audio generator to the [MIC] jack through the JIG cable and set as: 1.0 kHz/40 mVrms • Set an FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • Transmitting 	Rear panel	Connect an FM deviation meter to the antenna connector through the attenuator.	±4.1 kHz [N/W] ±3.3 kHz [N/M]
[MOD Ratio]	2 <ul style="list-style-type: none"> • IF bandwidth : Narrow • Transmitting 			±2.1 kHz
MODULATION BALLANCE [BAL W]	1 <ul style="list-style-type: none"> • Set to the DTCS set channel, and push [Connect] on the Adjustment software. • Operating freq. : 155.000 MHz • Output power : Low1 • Transmitting 	Rear panel	Connect an FM deviation meter with an oscilloscope to the antenna connector through an attenuator.	Set to square wave form 
[BAL Ratio]	2 <ul style="list-style-type: none"> • IF bandwidth : Narrow • Transmitting 			
CTCSS/DTCS DEVIATION [CTCS/DTCS]	1 <ul style="list-style-type: none"> • Operating freq. : 155.000 MHz • Output power : Low1 • IF bandwidth : Wide • CTCSS : 151.4 Hz • DTCS code : 007 • Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • No audio applied to the [MIC] connector. • Transmitting 	Rear panel	Connect an FM deviation meter to the antenna connector through the attenuator.	±0.56 kHz [EUR-45] ±0.65 kHz [RUS-02] ±0.7 kHz [Others]

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VOLTAGE DIAGRAM	9

[MAIN UNIT]

Table with columns: REF NO., ORDER NO., DESCRIPTION, M., H/V LOCATION. Lists various electronic components and their specifications, including part numbers like 4510008540 and 4030006860, and descriptions such as S.ELE and S.CER.

[MAIN UNIT]

Table with columns: REF NO., ORDER NO., DESCRIPTION, M., H/V LOCATION. Lists various electronic components and their specifications, including part numbers like 4030009570 and 6510018430, and descriptions such as S.CER and S.CON.

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

BOARD LAYOUTS

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

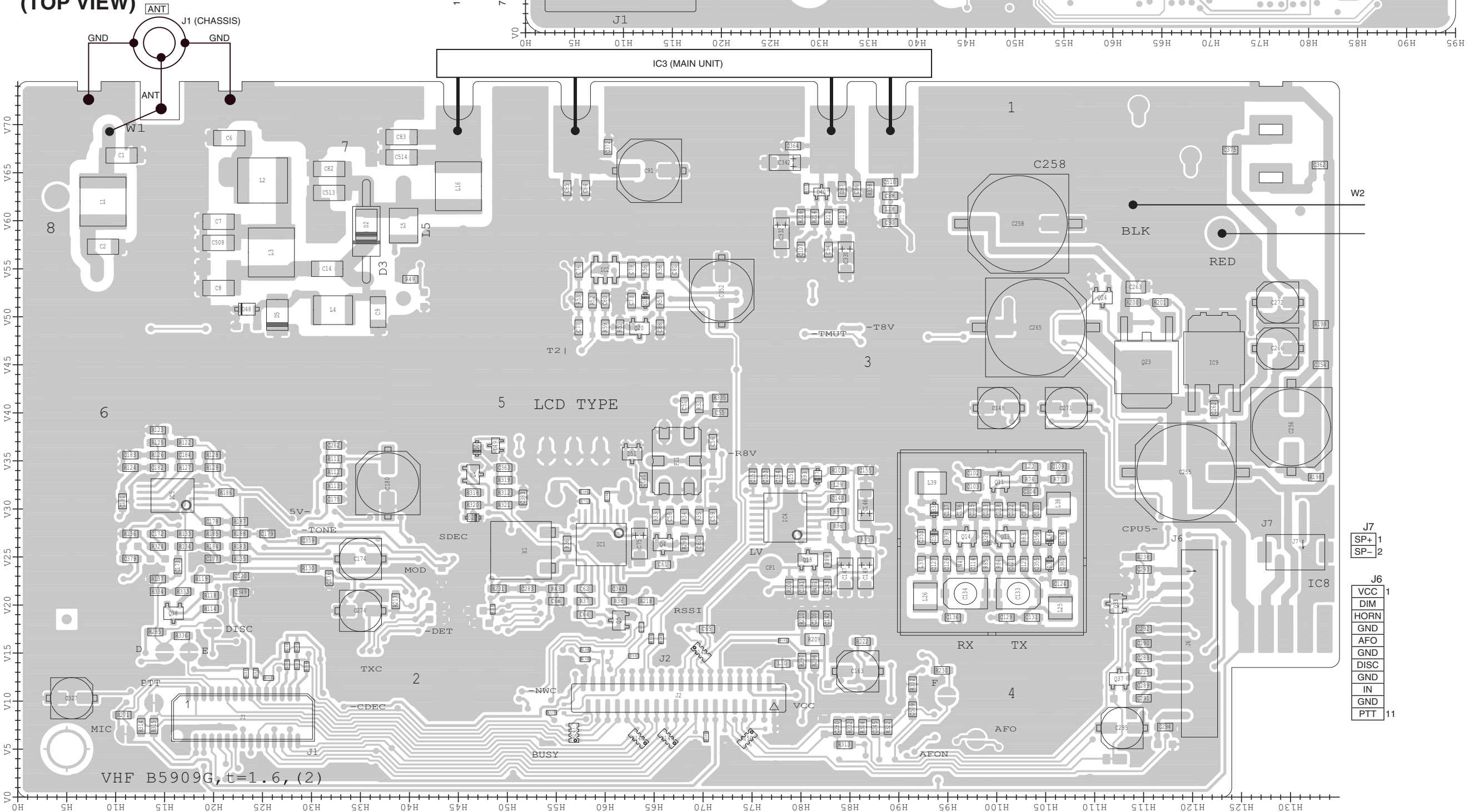
• FRONT UNIT (TOP VIEW)

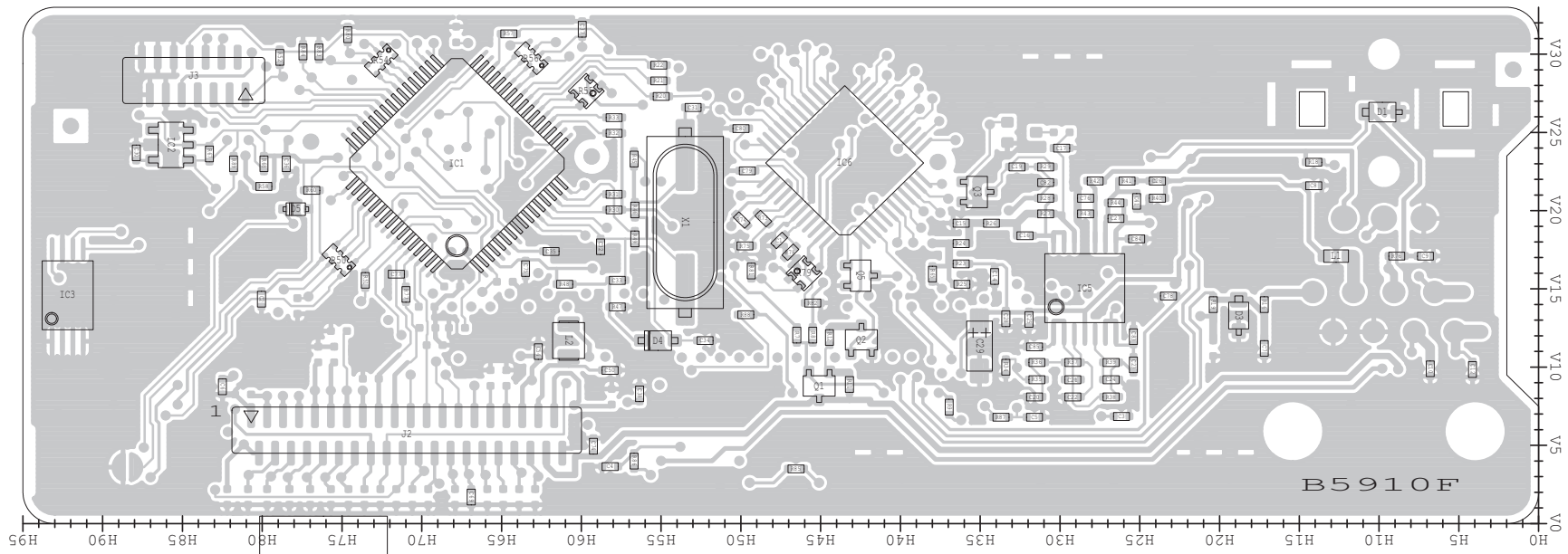
1	8V	AFO	MICE	GND
2	CLO	PTT	MIC	CLI
7				
8				

• MAIN UNIT (TOP VIEW)

30	GND	PTTI	1
	5V	PTTO	
	VCC	MCOT	
	MMUTE	MCIN	
	AFONO	NC	
	BEEPO	BUSY	
	RMUTE	NC	
	DET	SIGO	
	DISC	OPT1	
	REM	OPT2	
	CCS	OPT3	
	CIRQ	GND	
	SO	DAST	
	SI	OV12	
16	SCK	OV12	15

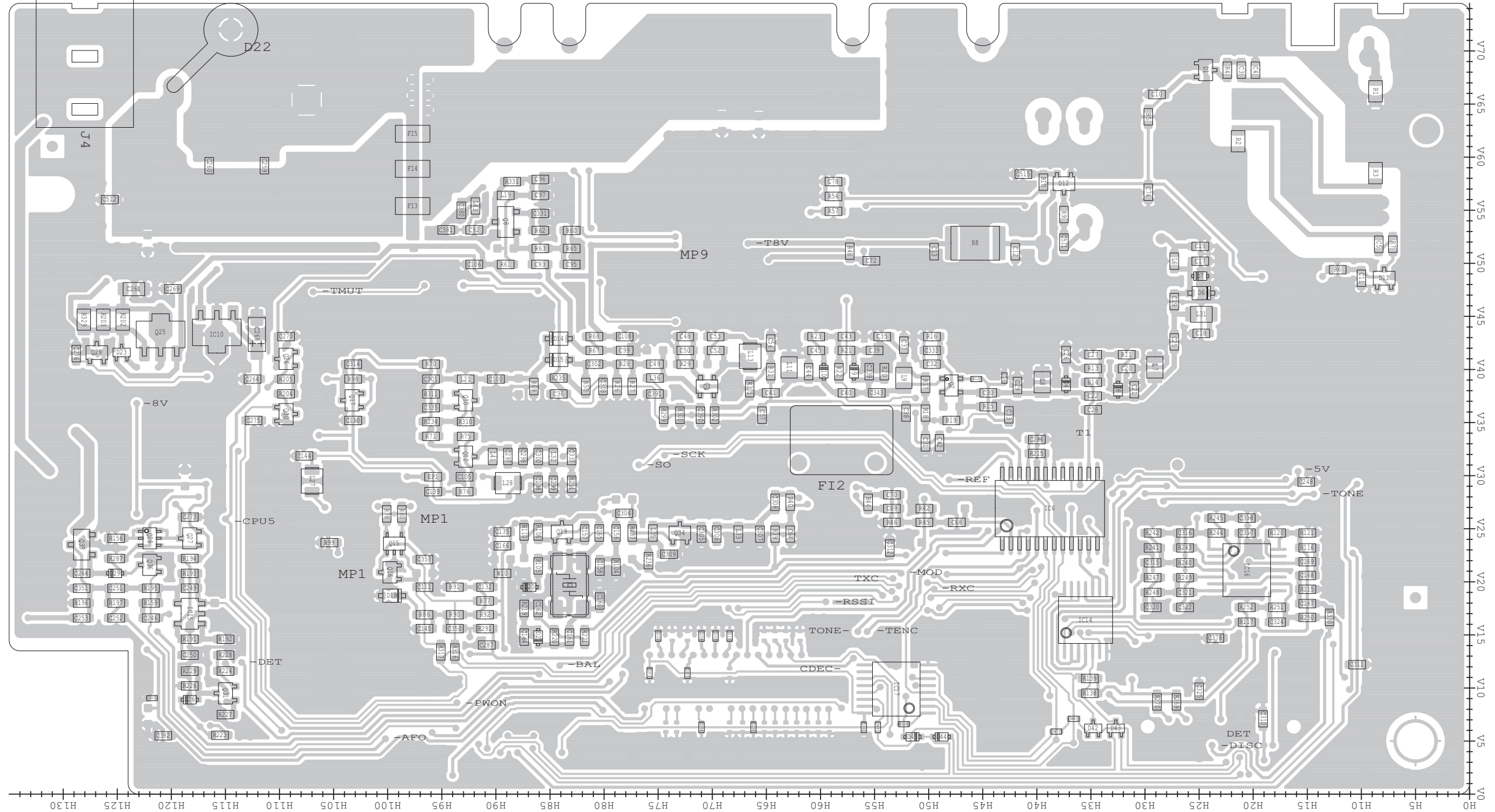
39	DIM	GND	40
	DAST	TSNE	
	OPT3	TENC	
	OPT2	NOIS	
	OPT1	EXOE	
	PTTO	EXST	
	PTTI	UNLK	
	REM	PLST	
	SCK	CDEC	
	SI	SDEC	
	SO	OV12	
	CIRQ	RSSI	
	CCS	LVIN	
	MIC	TEMP	
	EPTT	BATV	
	NC	NC	
	BEEP	NC	
	PWON	5V	
	8V	CPU5	
1	GND	AFO	2





• FRONT UNIT
(BOTTOM VIEW)

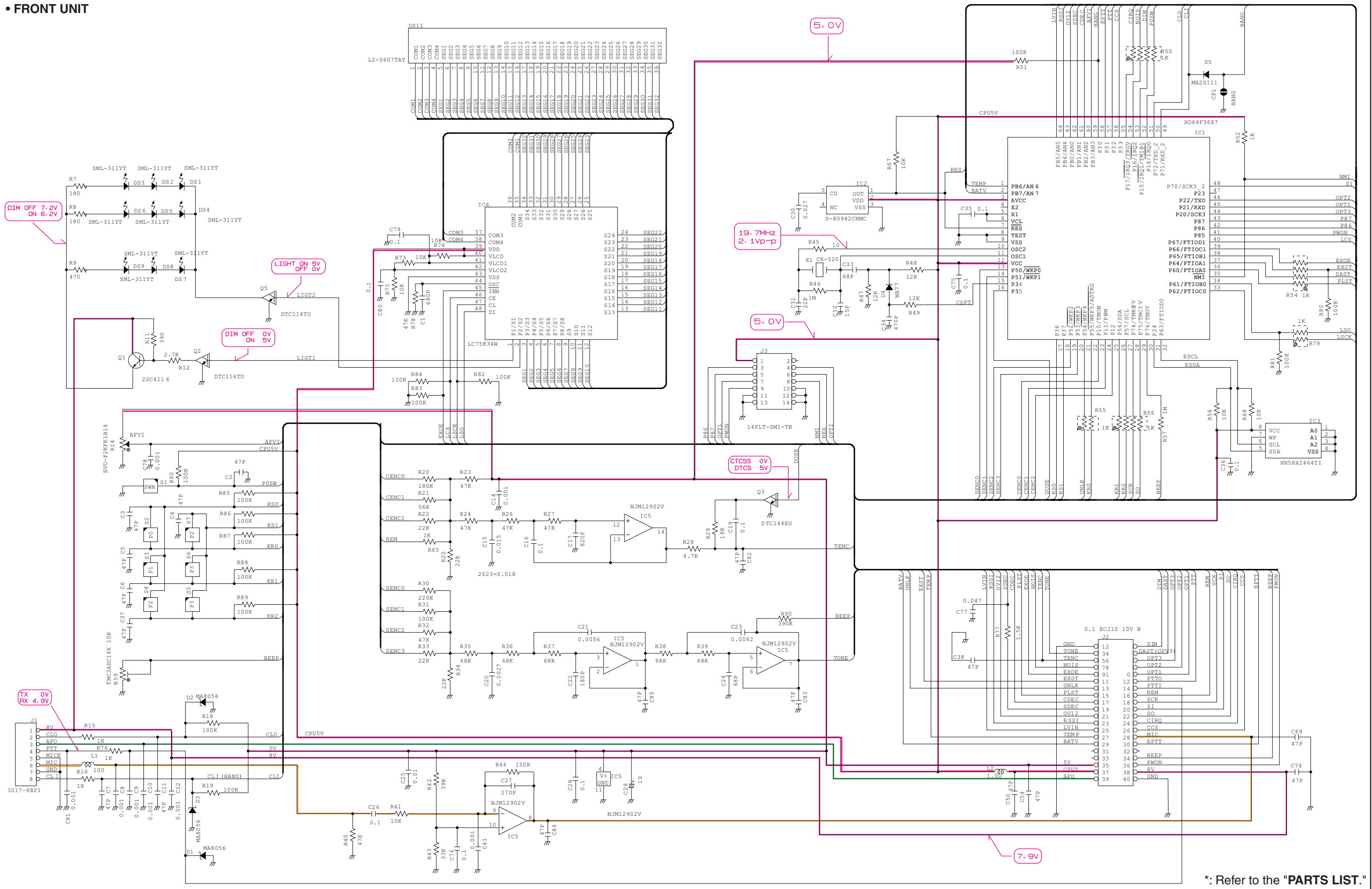
The combination of this side and the bottom side shows the board layout in the same configuration as the actual P.C.Board.



• MAIN UNIT
(BOTTOM VIEW)

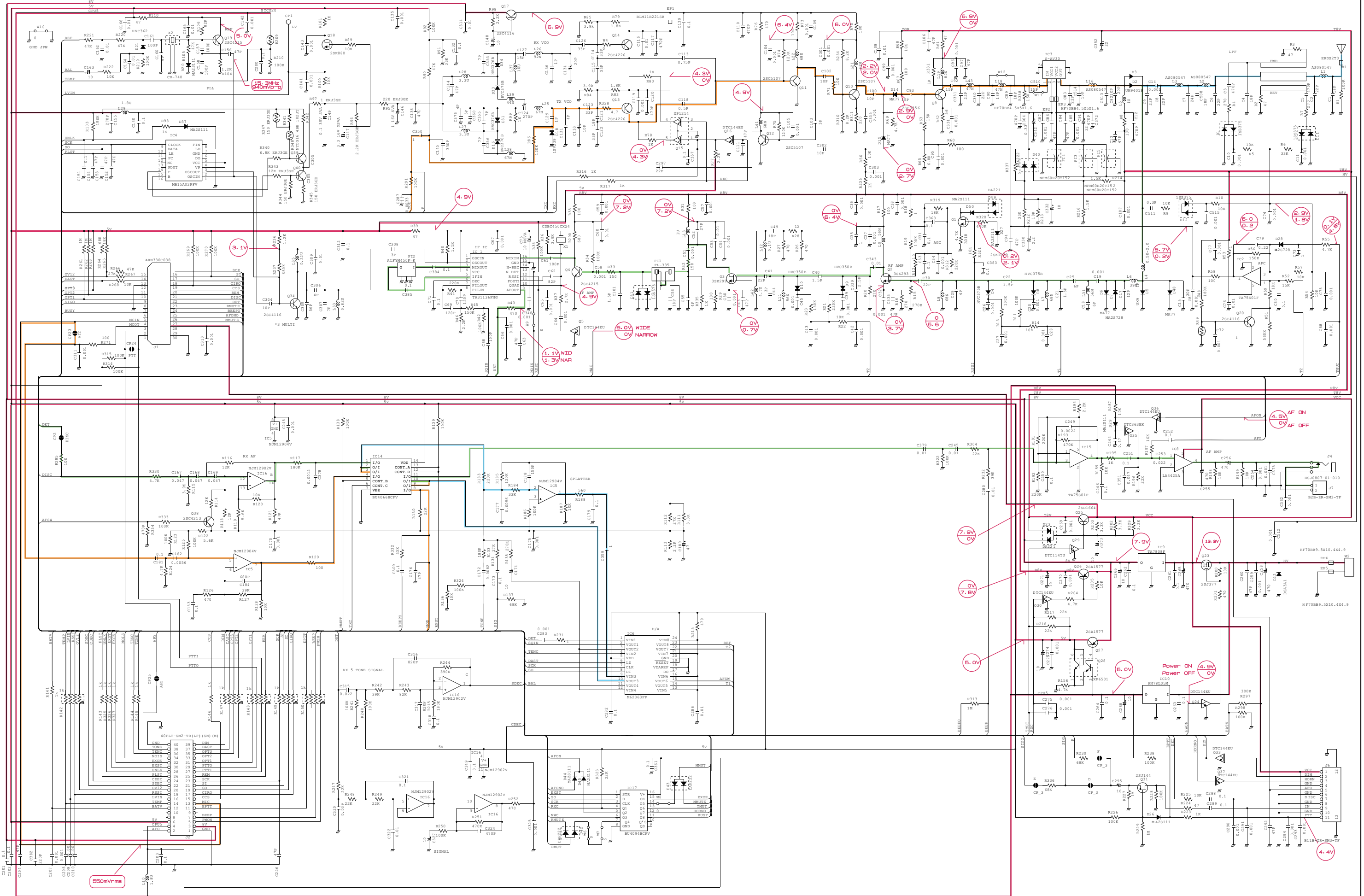
VOLTAGE DIAGRAM

FRONT UNIT



*: Refer to the "PARTS LIST."

• MAIN UNIT



*: Refer to the "PARTS LIST."

Nov .2006



SERVICE MANUAL ADDENDUM

IC-F110 IC-F111 IC-F112

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[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	M.	H/V LOCATION
W11	7030003860	S.RES ERJ3GE JPW V [USA-02], [GEN-02]		
W12	7030003860	S.RES ERJ3GE JPW V [USA-02], [GEN-02] only		
EP1	6910013370	S.BEA BLM18BB221SN1D	B	95.8/29.9
EP2	6910011560	BEA HF70BB4.5X5X1.6		
EP3	6910011560	BEA HF70BB4.5X5X1.6		
EP4	6910010280	BEA HF70BB9.5X10.4X4.9		
EP5	6910010280	BEA HF70BB9.5X10.4X4.9		

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

MECHANICAL PARTS

[CHASSIS PARTS]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J1	6510004880	MR-DSE-01	1
W1	8900011800	OPC-1199	1
MP1	8010019063	2601 CHASSIS-3 [Others]	1
	8010019133	2601 LONG CHASSIS-3 [USA-02], [GEN-02]	1
MP2	8110007821	2601 COVER-1	1
MP3	8210019340	2622 FRONT PANEL	1
MP4	8930059010	2622 KEYBOARD	1
MP5	8930059090	2622 LCD PLATE	1
MP6	8210019350	2622 REFLECTOR	1
MP7	8610011180	Knob N-292	1
MP8	8610007420	knob spring NO.6601	1
MP9	8810008661	Screw BT B0 3X8 NI-ZC3 (BT)	8
MP10	8810008661	Screw BT B0 3X8 NI-ZC3 (BT)	2
MP11	8810008661	Screw BT B0 3X8 NI-ZC3 (BT)	2
MP12	8810008761	Screw BT B0 2X8 NI-ZC3 (BT)	3
MP13	8810008661	Screw BT B0 3X8 NI-ZC3 (BT)	1
MP14	8810009991	Screw BT B0 3X8 NI-ZK3 (BT)	4
MP15	8810009991	Screw BT B0 3X8 NI-ZK3 (BT)	2
MP16	8930059100	2622 LCD FILTER	1
MP17	8930059000	2601 SP NET	1

[FRONT UNIT]

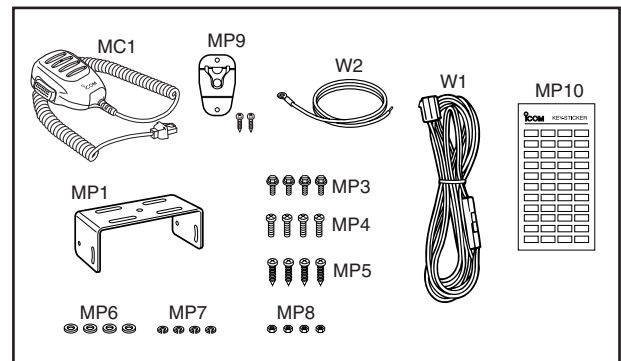
REF NO.	ORDER NO.	DESCRIPTION	QTY.
J1	6450002210	3017-8821	1
DS11	5030002720	L2-0607TAY-1	1
SP1	2510001221	C052SB500-14	1
W1	8900010503	OPC-1046B-1	1
EP2	8930059170	SRCN-2622-SP-N-W	1
MP1	8930059110	2622 SPRING	1
MP2	8930053490	Insulation sheet (GH)	1

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
W1	7120000470	ERDS2T0	1
W2	8900011862	OPC-1195B	1
EP2	6910011560	HF70BB4.5X5X1.6 [USA-02], [GEN-02] only	1
EP3	6910011560	HF70BB4.5X5X1.6 [USA-02], [GEN-02] only	1
EP4	6910010280	HF70BB9.5X10.4X4.9	1
EP5	6910010280	HF70BB9.5X10.4X4.9	1
MP1	8510002280	VCO shield plate (A)	1
MP5	8510014950	2601 VCO COVER	1
MP6	8510014910	2601 FILTER CASE	1
MP7	8510015110	2602 M-PLATE	1
MP9	8930058990	SHIELD SPONGE (V)	1
MP10	8930058840	SHIELD SPONGE (T)	1
		[GEN-02], [USA-02], [GEN-02] only	1
MP11	8930058840	SHIELD SPONGE (T)	1
MP12	8930061830	THERMALLY SHEET (AN) [USA-02], [GEN-02] only	1

[ACCESSORIES]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
MC1	Optional product	HM-152	1
W1	Optional product	OPC-1194A [Others]	1
	Optional product	OPC-1132 [USA-02], [GEN-02]	1
W2	8900000730	OPC-049	1
MP1	8010019151	2601 MOBIL BRACKET-1	1
MP2	8930059160	2601 FELT	2
MP3	8820000530	Flange bolt M4X8 NI	4
MP4	8810000471	Screw PH (+-) M5X12 ZC3	4
MP5	8810005841	Screw BT A0 5X20 ZC3	4
MP6	8850000150	Flat washerM5 BS NI	4
MP7	8850000391	SPRING WASHER M5 ZC3	4
MP8	8830000121	Nut M5 ZC3	4
MP9	8950005110	2289 MIC HANGER	1
MP10	8310054770	1705 LCD SEAL (F)	1
MP11	8810004700	Screw BT A0 3X16 SUS	2



Screw abbreviations

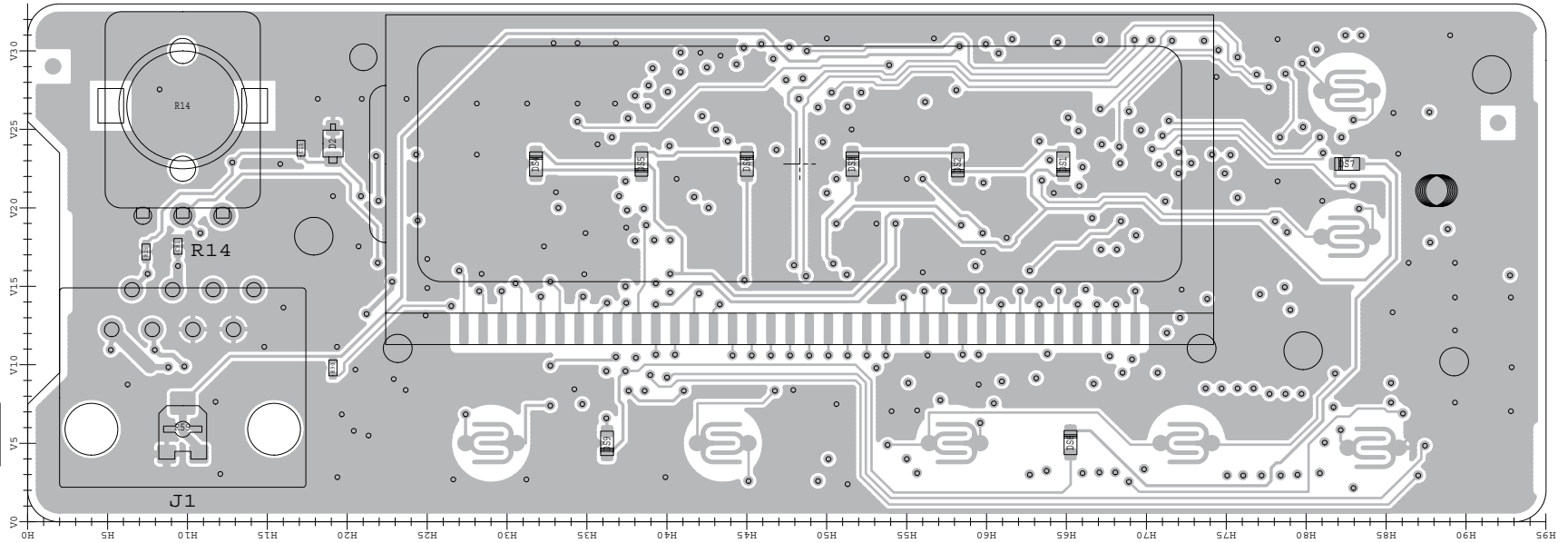
A, B0, BT: Self-tapping PH: Pan head ZK: Black NI-ZU: Nickel-Zinc SUS: Stainless

BOARD LAYOUTS

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

• FRONT UNIT (TOP VIEW)

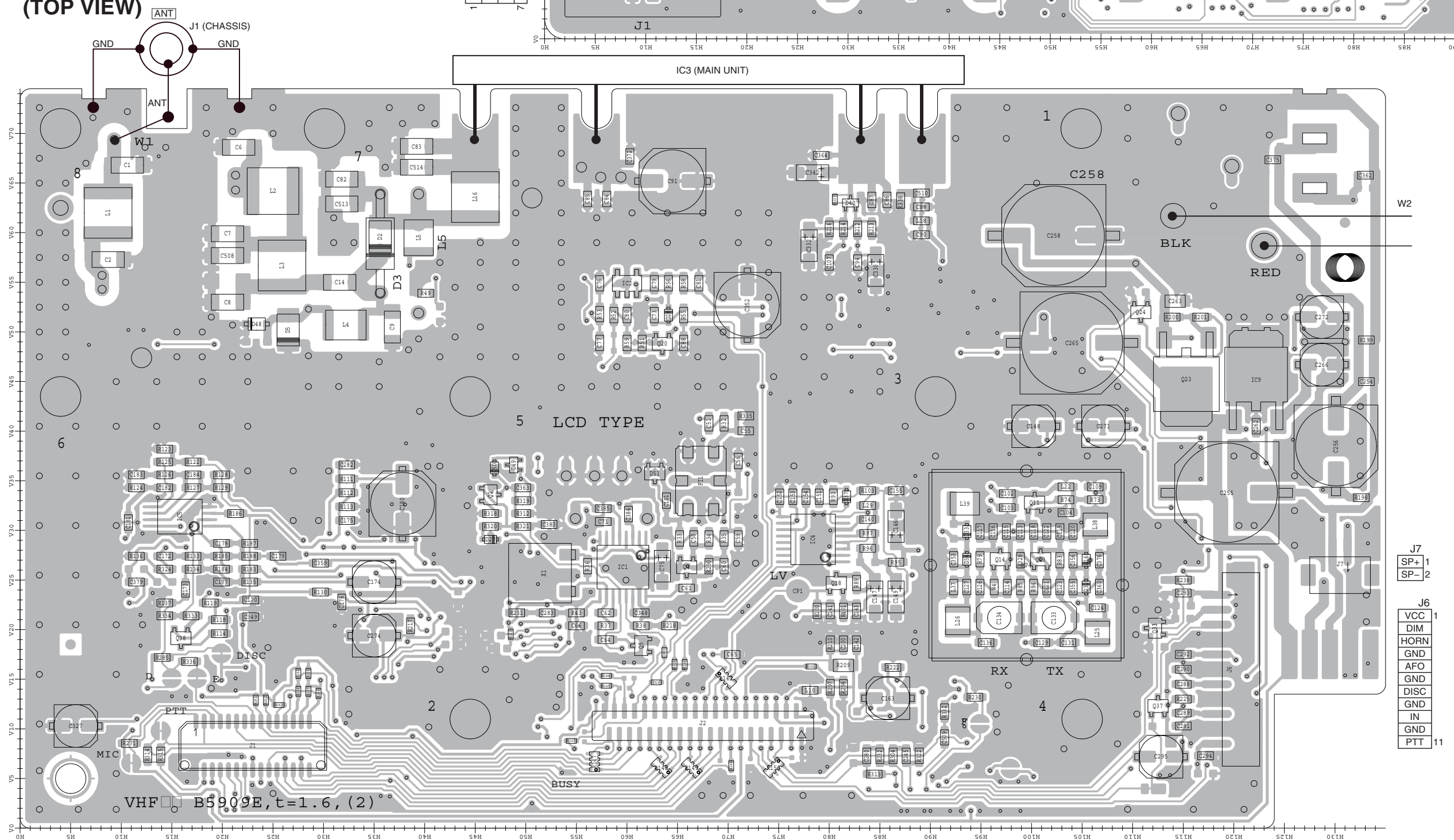
1	8V	2	CLO
2	AFO	3	PTT
3	MICE	4	MIC
4	GND	5	CLI
5		6	
6		7	
7		8	

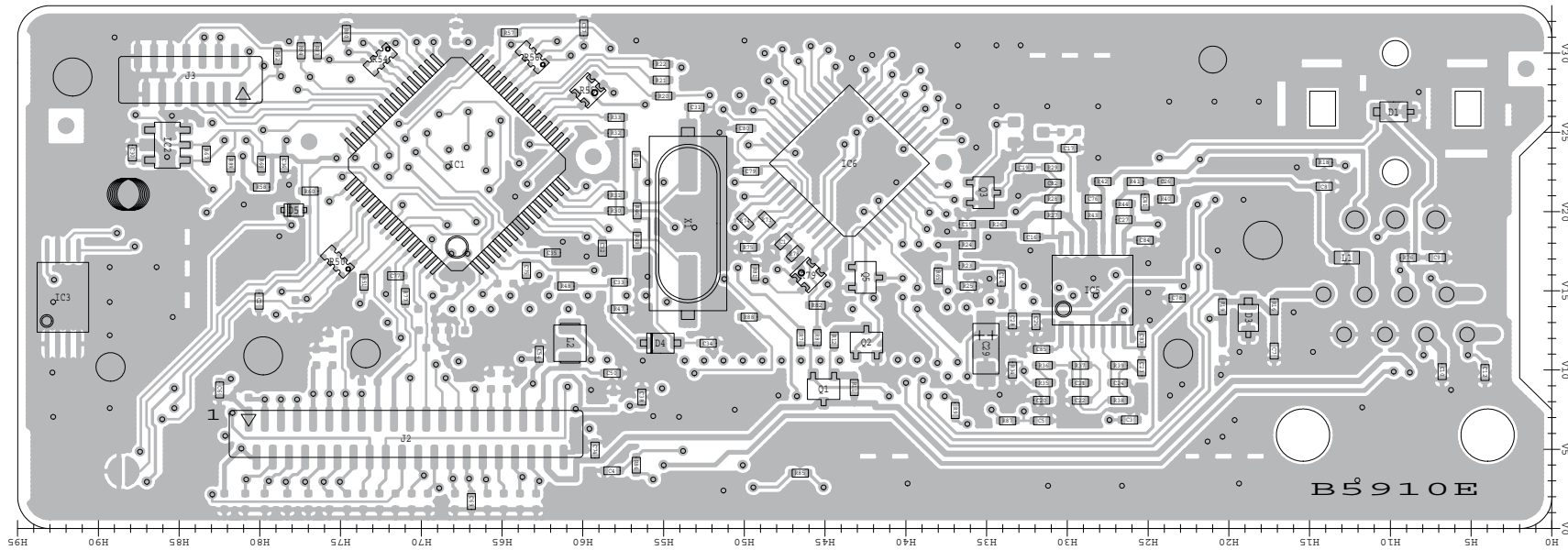


• MAIN UNIT (TOP VIEW)

30	GND	PTTI	1
	5V	PTTO	1
	VCC	MCOT	
	MMUTE	MCIN	
	AFONO	NC	
	BEEPO	BUSY	
	RMUTE	NC	
	DET	SIGO	
	DISC	OPT1	
	REM	OPT2	
	CCS	OPT3	
	CIRQ	GND	
	SO	DAST	
	SI	OV12	
16	SCK	OV12	15

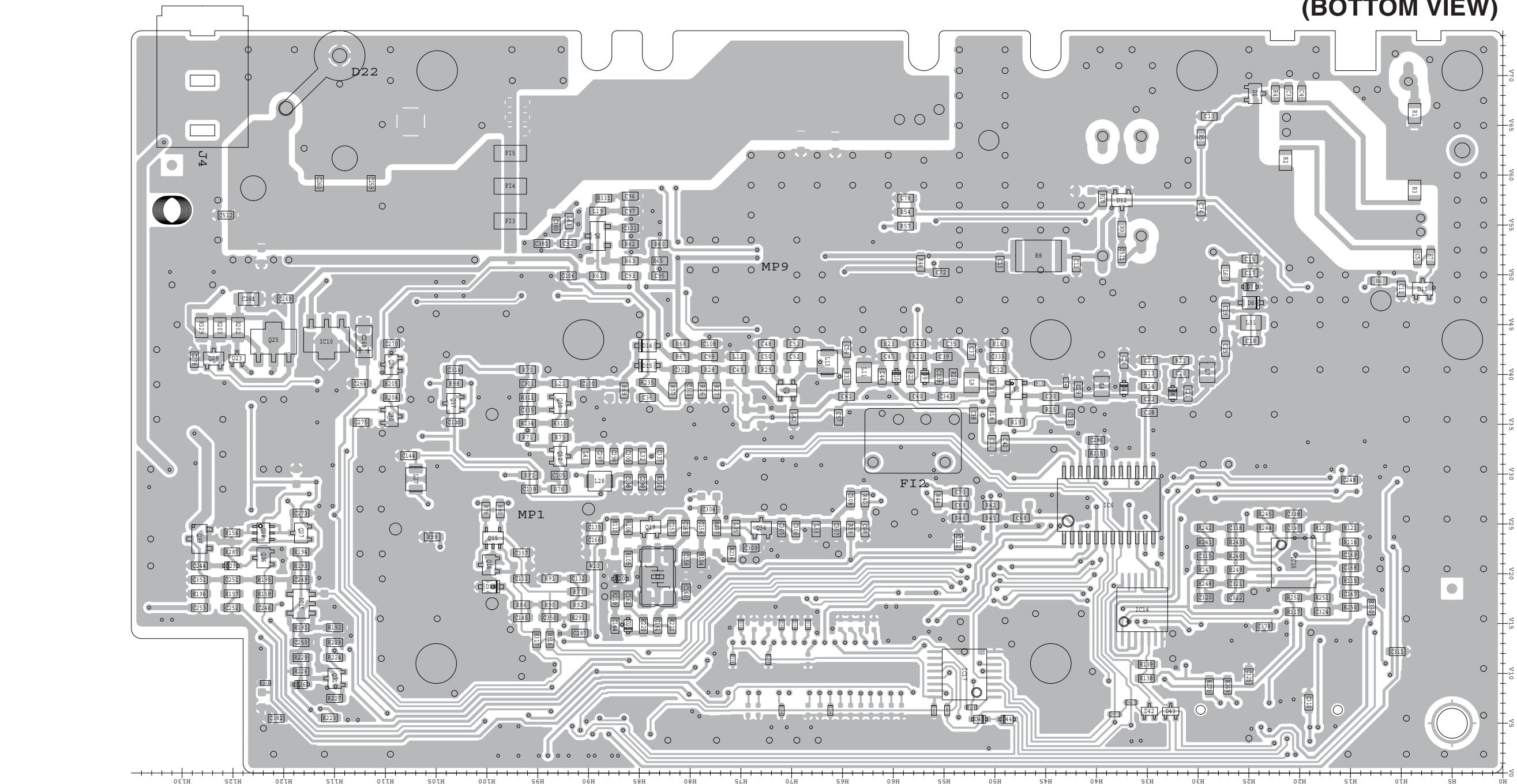
39	DIM	GND	40
	DAST	tone	
	OPT3	TENC	
	OPT2	NOIS	
	OPT1	EXOE	
	PTTO	EXST	
	PTTI	UNLK	
	REM	PLST	
	SCK	CDEC	
	SI	SDEC	
	SO	OV12	
	CIRQ	RSSI	
	CCS	LVIN	
	MIC	TEMP	
	EPTT	BATV	
	NC	NC	
	BEEP	NC	
	PWON	5V	
	8V	CPU5	
1	GND	AFO	2





• FRONT UNIT
(BOTTOM VIEW)

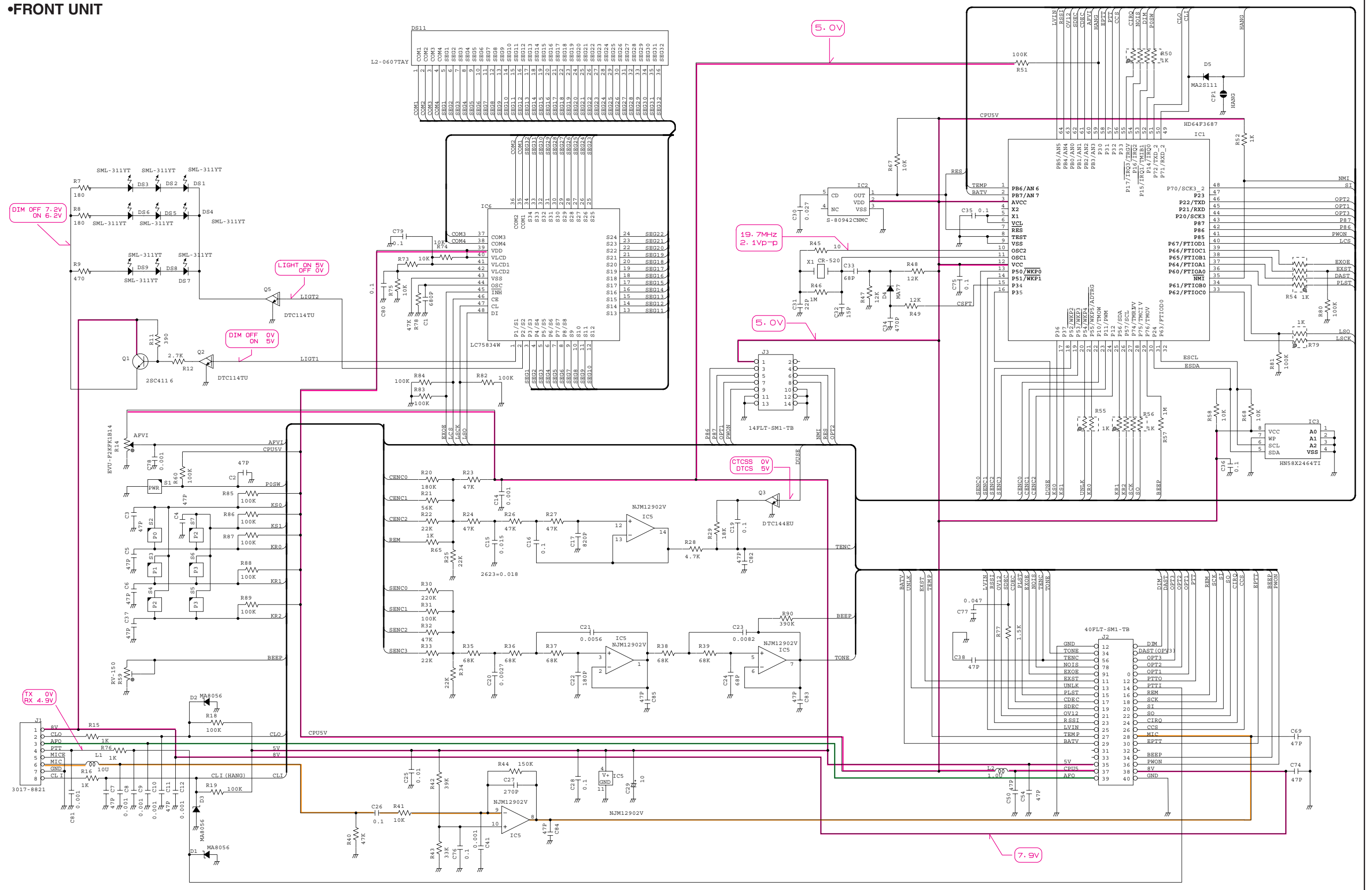
The combination of this side and the bottom side shows the board layout in the same configuration as the actual P.C.Board.



• MAIN UNIT
(BOTTOM VIEW)

VOLTAGE DIAGRAM

•FRONT UNIT





SERVICE MANUAL

VHF TRANSCEIVER

IC-F110
IC-F111
IC-F121

INTRODUCTION

This service manual describes the latest service information for the **IC-F110, IC-F111, IC-F121** VHF TRANSCEIVERS at the time of publication.

MODEL	VERSION	SYMBOL
IC-F110	Europe	[EUR-02]
		[EUR-42]
IC-F111	General	[GEN-02]
IC-F121		U.S.A.

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 16 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-F110 MAIN UNIT 5 pieces
8510014910 MP6 2601 FILTER CASE IC-F110 MAIN UNIT 5 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.

EXPLICIT DEFINITIONS

FREQUENCY COVERAGE

136 – 174 MHz

CHANNEL SPACING

Narrow/Wide-type	12.5 kHz/ 25.0 kHz
	15.0 kHz/ 30.0 kHz
Narrow/Middle-type	12.5 kHz/ 20.0 kHz

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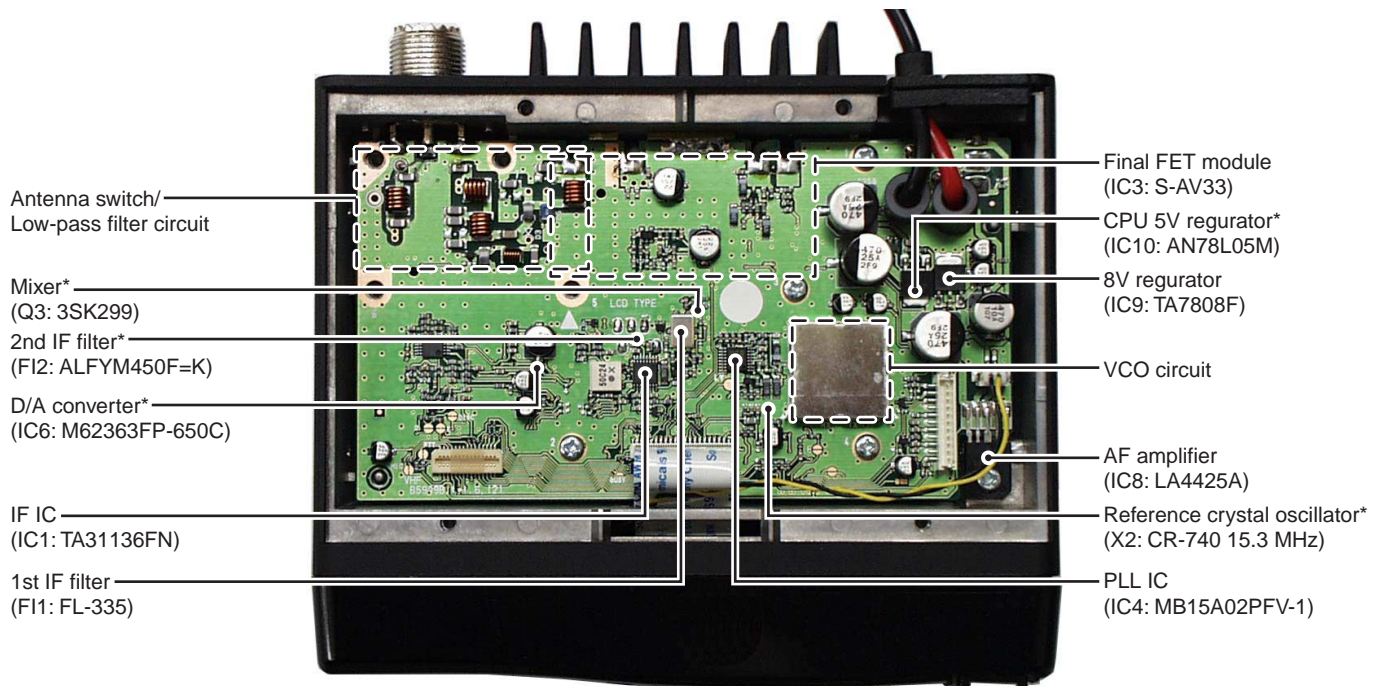
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SECTION 1 SPECIFICATIONS

		[GEN], [USA]	[EUR]
GENERAL	Measurement method	EIA-152-C/204D or TIA-603	ETS 300 086
	Frequency coverage	136.000–174.000 MHz	
	Type of emission	N/W: (12.5 kHz; Narrow/25 kHz; Wide): 8K50F3E/16K0F3E (12.5 kHz; Narrow/25 kHz; Wide): 11K0F3E/16K0F3E (15 kHz; Narrow/30 kHz; Wide): 11K0F3E/16K0F3E N/M (12.5 kHz; Narrow/20 kHz; Middle): 8K50F3E/14K0F3E	[EUR] [GEN] [USA] [EUR]
	Number of conventional channels	maximum 128 channels	
	Antenna impedance	50 Ω nominal (SO-239)	
	Power supply voltage (negative ground)	13.6 V DC nominal	13.2 V DC nominal
	Current drain (approx.)	TX; 7.0 A (at 25 W), 14.0 A (at 50 W) Rx; 1200 mA (maximum audio) 300 mA (stand-by)	
	Usable temperature range	–30°C to +60°C (–22°F to +140°F)	–25°C to +55°C
	Dimensions (proj. not included)	150(W) × 40(H) × 117.5(D) mm; 5 ²⁹ / ₃₂ (W) × 4 ⁹ / ₁₆ (H) × 4 ⁵ / ₈ (D) inch 150(W) × 40(H) × 167.5(D) mm; 5 ²⁹ / ₃₂ (W) × 4 ⁹ / ₁₆ (H) × 6 ¹⁹ / ₃₂ (D) inch	[25 W] [50 W]
	Weight	0.8 kg; 1 lb 12 oz [25 W], 1.1 kg; 2 lb 7 oz [50 W]	
TRANSMITTER	RF output power	High/Low2/Low1: 25 W/10 W/2.5 W [25 W] High/Low2/Low1: 50 W/25 W/5 W [50 W]	
	Modulation system	Variable reactance frequency modulation	
	Maximum permissible deviation	±2.5 kHz [Narrow], ±4.0 kHz [Middle], ±5.0 kHz [Wide]	
	Frequency error	±5.0 ppm	±1.5 kHz
	Spurious emissions	70 dB (typical)	0.25 μW ≤ 1GHz, 1.0 μW > 1 GHz
	Adjacent channel power	60 dB minimum [Narrow]; 70 dB minimum [Middle], [Wide]	
	Audio frequency response	+2 dB to –5 dB of 6 dB/octave Range from 300 Hz to 2550 Hz [Narrow] / 3000 Hz [Middle], [Wide]	
	Audio harmonic distortion	3% typical at 1 kHz (40% deviation)	
	FM hum and noise (typical) (without CCICT filter)	34 dB (min.), 40 dB (typ.) [Narrow] 40 dB (min.), 46 dB (typ.) [Wide]	—
	Residual modulation (typical) (with CCICT filter)	—	40 dB (min.), 50 dB (typ.) [Narrow] 43 dB (min.), 53 dB (typ.) [Middle] 45 dB (min.), 55 dB (typ.) [Wide]
	Limiting charact of modulator	70 – 100% of maximum deviation	
	Microphone connector	8-pin modular (600 Ω)	
RECEIVER	Receive system	Double-conversion superheterodyne system	
	Intermediate frequencies	1st: 46.35 MHz, 2nd: 450 kHz	
	Sensitivity (typical)	0.25 μV typical at 12 dB SINAD	–4 dBμV (emf) typical at 20 dB SINAD
	Squelch sensitivity (at threshold)	0.25 μV typical	–4 dBμV (emf) typical
	Hum and noise	34 dB (min.), 40 dB (typ.) [Narrow] 40 dB (min.), 45 dB (typ.) [Wide]	40 dB (min.), 50 dB (typ.) [Narrow] 43 dB (min.), 53 dB (typ.) [Middle] 45 dB (min.), 55 dB (typ.) [Wide]
	Adjcent channel selectivity	60 dB (min.), 65 dB (typ.) 70 dB (min.), 75 dB (typ.)	[Narrow] [Middle]/[Wide]
	Spurious response	75 dB	
	Intermoduration	70 dB (min.), 74 dB (typ.)	65 dB (min.), 67 dB (typ.)
	Audio output power	4 W typical at 10% distortion with a 4 Ω load	
	External SP connector	2-conductor 3.5 (d) mm (1/8")/4 Ω	

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

SECTION 2 INSIDE VIEW

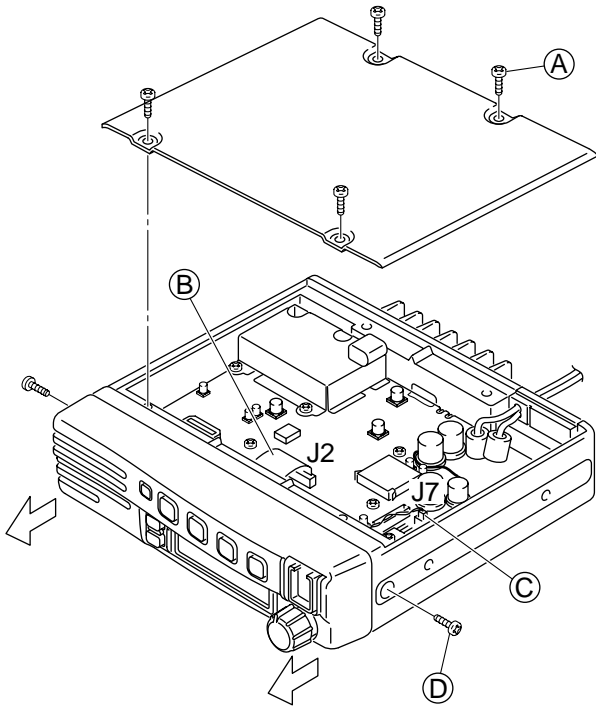


* Located under side of the point.

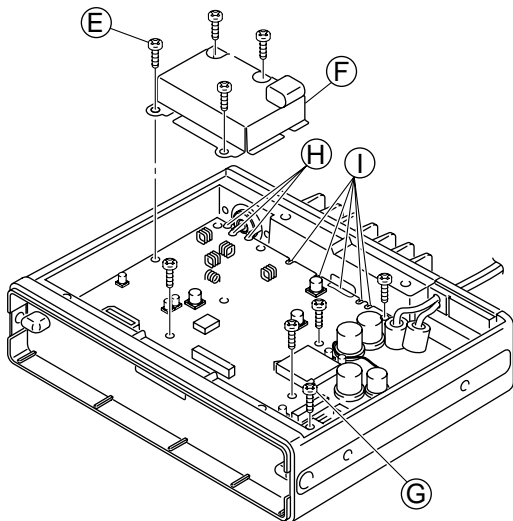
SECTION 3 DISASSEMBLY INSTRUCTIONS

• Opening case

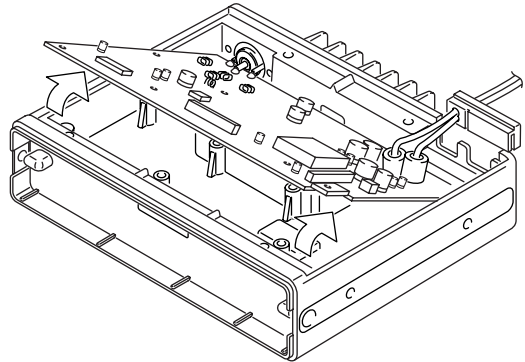
- ① Unscrew 4 screws (A), and remove the bottom cover.
- ② Disconnect the flat cable (B) from J2.
- ③ Disconnect the cable (C) from J7.
- ④ Unscrew 2 screws (D), and remove the front unit.



- ⑤ Unscrew 8 screws (E).
- ⑥ Remove the filter case (F).
- ⑦ Unscrew the screw (G).
- ⑧ Unsolder 3 points (H) from the antenna connector.
- ⑨ Unsolder 4 points (I) from IC3.

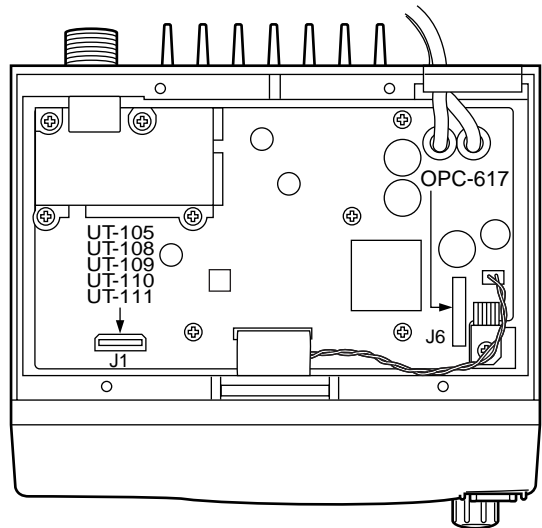


- ⑩ Lift up the front portion of the main unit and remove it.



• Installation location

- | | |
|---------|--|
| UT-105 | SmarTrank 2™ logic board |
| UT-108 | DTMF decoder unit |
| UT-109 | Voice scrambler unit |
| UT-110 | |
| UT-111 | Trunking unit |
| OPC-617 | ACC cable (for external terminal connection) |



SECTION 4 CIRCUIT DESCRIPTION

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. This circuit does not allow transmit signals to enter the receiver circuits.

Received signals enter the antenna connector and pass through the low-pass filters (L1–L3, C1, C2, C6–8). The filtered signals are then applied to the RF circuit passed through the $\lambda/4$ type antenna switching circuit (D5–D7, D48, L4, L6).

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 the two-stage tunable bandpass filters (D8, D4). The filtered signals are amplified at the RF amplifier (Q2) and then enter other two-stage bandpass filters (D9, D10) to suppress unwanted signals. The filtered signals are applied to the 1st mixer circuit (Q3).

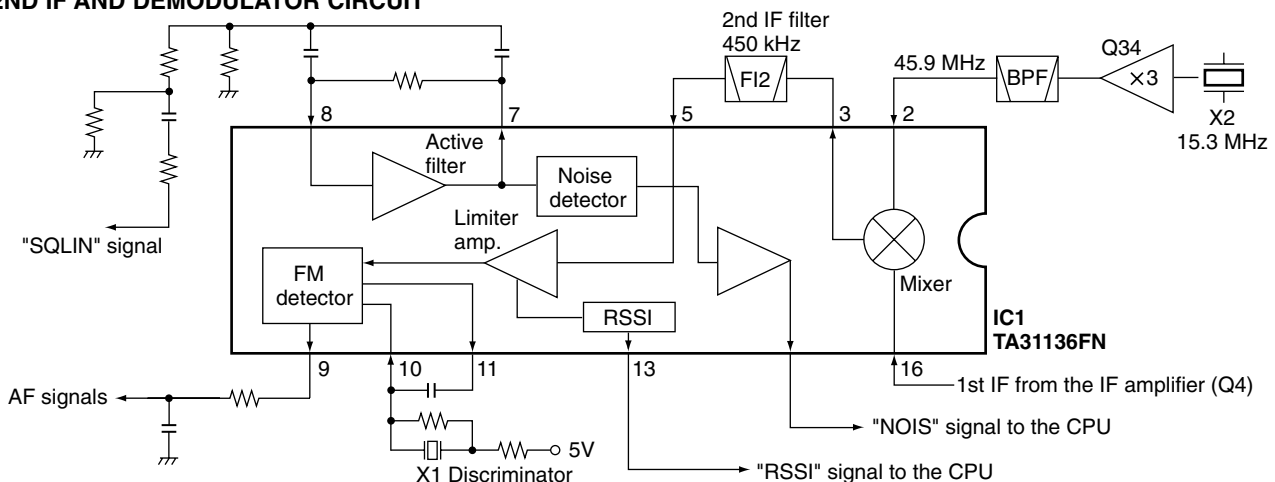
The tunable bandpass filters (D4, D8–D10) employ varactor diodes to tune the center frequency of the RF passband for wide bandwidth receiving and good image response rejection. These diodes are controlled by the CPU (FRONT unit; IC1) via the D/A converter (IC6).

The gate control circuit reduces RF amplifier gain and attenuates RF signal to keep the audio output at a constant level.

The receiver gain is determined by the voltage on the "RSSI" line from the FM IF IC (IC1, pin 12). The gate control circuit (Q1) supplies control voltage to the RF amplifier (Q2) and sets the receiver gain.

When receiving strong signals, the "RSSI" voltage increases and the gate control voltage decreases. As the gate control voltage is used for the bias voltage of the RF amplifier (Q2), then the RF amplifier gain is decreased.

• 2ND IF AND DEMODULATOR CIRCUIT



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

The 1st mixer circuit converts the received signals to a fixed frequency of the 1st IF signal with the PLL output frequency. By changing the PLL frequency, only the desired frequency will pass through a MCF (Monolithic Crystal Filter; F11) at the next stage of the 1st mixer.

The RF signals from the bandpass filter are applied to the 1st mixer circuit (Q3). The applied signals are mixed with the 1st LO signal coming from the RX VCO circuit (Q14) to produce a 46.35 MHz 1st IF signal. The 1st IF signal passes through a MCF (Monolithic Crystal Filter; F11) to suppress out-of-band signals. The filtered signal is amplified at the 1st IF amplifier (Q4) and applied to the 2nd IF circuit.

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

The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal. A double-conversion superheterodyne system improves the image rejection ratio and obtains stable receiver gain.

The 1st IF signal from the 1st IF amplifier (Q4) is applied to the 2nd mixer section of the FM IF IC (IC1, pin 16) and is then mixed with the 2nd LO signal for conversion to a 450 kHz 2nd IF signal.

IC1 contains the 2nd mixer, limiter amplifier, quadrature detector, active filter and noise amplifier circuits, etc. A tripled frequency from the PLL reference oscillator is used for the 2nd LO signal (45.9 MHz).

The 2nd IF signal from the 2nd mixer (IC1, pin 3) passes through a ceramic filter (F12) to remove unwanted heterodyned frequencies. It is then amplified at the limiter amplifier section (IC1, pin 5) and applied to the quadrature detector section (IC1, pins 10, 11 and X1) to demodulate the 2nd IF signal into AF signals.

The AF signals are output from pin 9 (IC1) and are then applied to the AF amplifier circuit.

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

The AF amplifier circuit amplifies the demodulated AF signals to drive a speaker.

The AF signals from the FM IF IC (IC1, pin 9) are applied to the active filter circuit (IC16). The active filter circuit (high-pass filter) removes CTCSS or DTCS signals.

The filtered AF signals are output from pin 14 (IC16) and are applied to the de-emphasis circuit (R117, C378) with frequency characteristics of -6 dB/octave, and then passed through the analog switch (IC14, pins 1–3) and low-pass filter (IC5). The filtered signal is applied to the electronic volume controller (IC6, pin 9).

The output AF signals from the electronic volume controller (IC6, pin 10) are passed through the analog switch (IC14 pins 9–11) and are applied to the AF amplifier (IC15) and AF power amplifier (IC8) to drive the speaker.

4-1-6 RECEIVER MUTE CIRCUITS (MAIN AND FRONT UNITS)

• NOISE SQUELCH

The noise 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.

Some noise components in the AF signals from the FM IF IC (IC1, pin 9) are passed through the level controller (IC6, pins 1, 2). The level controlled signals are applied to the active filter section in the FM IF IC (IC1, pin 8). Noise components about 10 kHz are amplified and output from pin 7.

The filtered signals are converted to the pulse-type signals at the noise detector section and output from pin 13 (NOIS).

The NOIS signal from the FM IF IC is applied to the CPU (FRONT unit; IC1, pin 53). The CPU then analyzes the noise condition and controls the AF mute signal via "AFON" line (D44, D45) to the AF mute circuit (Q35, Q36, D29, D30).

• CTCSS AND DTCS

The tone squelch circuit detects AF signals and opens the squelch only when receiving a signal containing a matching subaudible tone (CTCSS or DTCS). When tone squelch is in use, and a signal with a mismatched or no subaudible tone is received, the tone squelch circuit mutes the AF signals even when noise squelch is open.

A portion of the AF signals from the FM IF IC (IC1, pin 9) passes through the low-pass filter (IC16) to remove AF (voice) signals and is applied to the CTCSS or DTCS decoder inside the CPU (FRONT unit; IC1, pin 60) via the "CDEC" line to control the AF mute switch.

4-2 TRANSMITTER CIRCUITS

4-2-1 MICROPHONE AMPLIFIER CIRCUIT (MAIN AND FRONT UNITS)

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

The AF signals (MIC) from the MIC jack (FRONT unit; J1) are amplified at the AF amplifier (FRONT unit; IC5) and applied to the MAIN unit via J2 (pin 28). The AF signal are applied to the limiter amplifier (IC5, pin 5).

The entered signals are pre-emphasized with $+6$ dB/octave at a limiter amplifier, then passed through the analog switch (IC14, pins 2–4) and splatter filter (IC5, pins 2, 1). The output signals from the splatter filter are applied to the level controller (IC6, pin 9).

The deviation level controlled signals are then applied to the modulation circuit (D18) as the "MOD" signal after being passed through the analog switch (IC14, pins 9, 8).

4-2-2 MODULATION CIRCUIT (MAIN AND FRONT UNITS)

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

The AF signals from the analog switch (IC14, pin 8) change the reactance of varactor diode (D18) to modulate the oscillated signal at the TX VCO circuit (Q13, D16, D31). The modulated VCO signal is amplified at the buffer amplifiers (Q11, Q10) and is then applied to the drive amplifier circuit via the T/R switch (D14).

The CTCSS/DTCS signals from the CPU (FRONT unit; IC1, pins 22–24) are passed through the low-pass filter (FRONT unit; IC5), and mixer and splatter filter (IC5), and are then applied to the VCO circuit.

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

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

The RF signal from the buffer amplifier (Q10) passes through the T/R switch (D14) and is amplified at the drive amplifier circuit (Q8). The amplified signal is applied to the power amplifier circuit.

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

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

The RF signal from the drive amplifier (Q8) is passed through the low-pass filter circuit (L18, L43, C89, C90, C92, C380, C381, C510) and applied to the power module (IC3) to obtain 25 W or 50 W of RF power.

The amplified signal is passed through the antenna switching circuit (D2), low-pass filter and APC detector, and is then applied to the antenna connector.

Control voltage for the power amplifier (IC3, pin 2) comes from the APC amplifier (IC2) to stabilize the output power. The transmit mute switch (D28) controls the APC amplifier when transmit mute is necessary.

4-2-5 APC CIRCUIT (MAIN UNIT)

The APC circuit protects the power amplifier from a mismatched output load and stabilizes the output power.

The APC detector circuit detects forward signals and reflection signals at D1 and D11 respectively. The combined voltage is at minimum level when the antenna impedance is matched at 50 Ω , and is increased when it is mismatched.

The detected voltage is applied to the APC amplifier (IC2, pin 3), and the power setting "T2" signal from the D/A converter (IC6, pin 22), controlled by the CPU (FRONT unit; IC1), is applied to the other input for reference. When antenna impedance is mismatched, the detected voltage exceeds the power setting voltage. Then the output voltage of the APC amplifier (IC2, pin 4) controls the input current of the drive amplifier (Q8) and power module (IC3) to reduce the output power.

4-3 PLL CIRCUITS

4-3-1 PLL CIRCUIT (MAIN UNIT)

A PLL circuit provides stable oscillation of the transmit frequency and receive 1st LO frequency. The PLL output compares the phase of the divided VCO frequency to the reference frequency. The PLL output frequency is controlled by the divided ratio (N-data) of a programmable divider.

The PLL circuit contains the TX/RX VCO circuit (Q13, Q14). The oscillated signal is amplified at the buffer amplifiers (Q11, Q12) and then applied to the PLL IC (IC4, pin 8) via the low-pass filter (L32, C298–C300).

The PLL IC contains a prescaler, programmable counter, programmable divider and phase detector, etc. The entered signal is divided at the prescaler and programmable counter section by the N-data ratio from the CPU. The reference signal is generated at the reference oscillator (X2) and is also applied to the PLL IC. The PLL IC detects the out-of-step phase using the reference frequency, and outputs it from pin 5. The output signal is passed through the loop filter (R97/C149, R96/C147), and is then applied to the VCO circuit as the lock voltage.

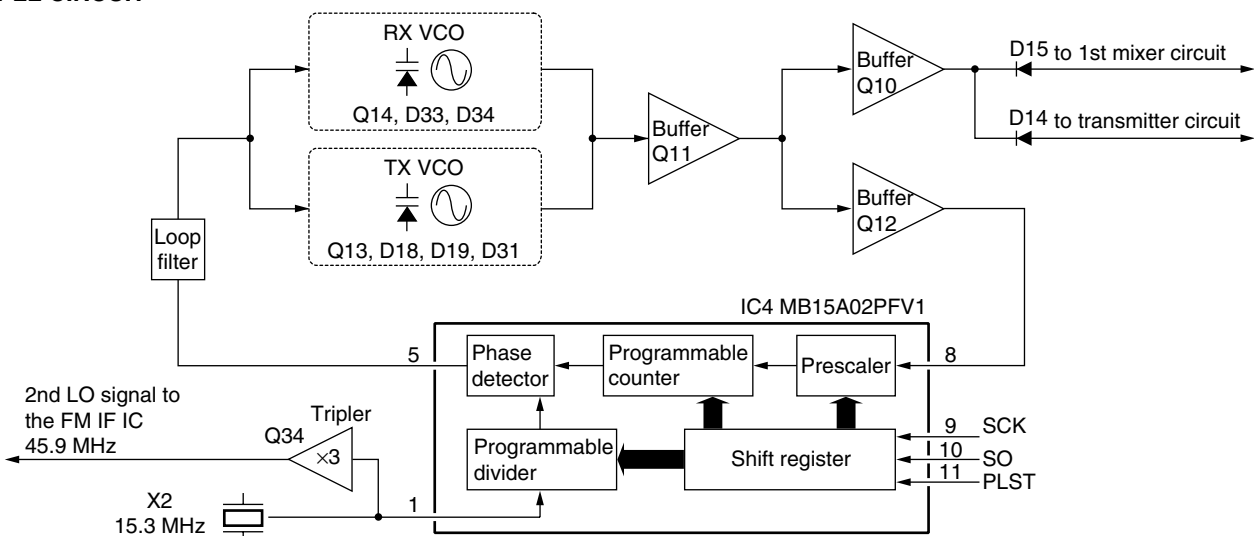
If the oscillated signal drifts, its phase changes from that of the reference frequency, causing a lock voltage change to compensate for the drift in the oscillated frequency.

4-3-2 VCO CIRCUIT (MAIN UNIT)

The VCO circuit contains a separate RX VCO (Q14, D33, D34) and TX VCO (Q13, D16, D18, D31). The oscillated signal is amplified at the buffer amplifiers (Q11, Q10) and is then applied to the T/R switch circuit (D14, D15). Then the receive 1st LO (Rx) signal is applied to the 1st mixer (Q3) and the transmit (Tx) signal to the drive amplifier circuit (Q8).

A portion of the signal from the buffer amplifier (Q11) is fed back to the PLL IC (IC4, pin 8) via the buffer amplifier (Q12) and low-pass filter (L32, C298–C300) as the comparison signal.

• PLL CIRCUIT



4-4 POWER SUPPLY CIRCUITS

4-4-1 VOLTAGE LINES (MAIN UNIT)

Line	Description
HV	The voltage from a DC power supply.
VCC	The same voltage as the HV line which is controlled by the power switching circuit (Q23, Q24). When the [POWER] switch is pushed, the CPU outputs the "PWON" control signal to the power switching circuit to turn the circuit ON.
CPU5V	Common 5 V for the CPU converted from the HV line by the CPU5V regulator circuit (IC10). The circuit outputs the voltage regardless of the power ON/OFF condition.
8V	Common 8 V converted from the VCC line by the 8V regulator circuit (IC9).
5V	Common 5 V converted from the 8 V and CPU5V lines by the 5V regulator circuit (Q27, Q28).
R8V	Receive 8 V controlled by the R8 regulator circuit (Q26, Q30) using the "RXC" signal from the expander IC (IC17, pin 4).
T8V	Transmit 8 V controlled by the T8 regulator circuit (Q25, Q29, D23) using the "TMUT" signal from the expander IC (IC17, pin 13).

4-5 PORT ALLOCATIONS

4-5-1 CPU (FRONT UNIT; IC1)

Pin number	Port name	Description
1	TEMP	Input port for the internal temperature.
2	BATV	Input port for the low voltage detection from the connected power supply.
7	RES	Input port for reset signal.
13-14	SENC0-SENC1	Output ports for 5/2 tone and DTMF signals.
15	CSFT	Outputs the CPU clock shift signal.
16	DUSE	Outputs cut-off frequency control signal to the low-pass filter (MAIN unit; IC5) for CTCSS/DTCS switching.
17, 18	KS0, KS1	Input port for the key matrix.
19-20	SENC2-SENC3	Output ports for 5/2 tone and DTMF signals.
21	UNLK	Input port for the PLL unlock signal from the PLL IC (MAIN unit; IC4).
22	KR0	Input port for the key matrix.
23-25	CENO0-CENO2	Output ports for CTCSS/DTCS signals.
26, 27	KR1, KR2	Input ports for the key matrix.
28	SCK	Outputs the clock signal to the PLL IC (MAIN unit; IC4), D/A converter (MAIN unit; IC6), LED driver (IC4) and optional board (connect to MAIN unit; J1).
29	SO	Outputs the data signal to the PLL IC (MAIN unit; IC4), D/A converter (MAIN unit; IC6) and optional board (connect to MAIN unit; J1).
30	BEEP	Output port for beep sound signal.
31	ESDA	I/O port for the data signal for the EEPROM (IC3)
32	ESCL	Outputs the clock signal for the EEPROM (IC3).
33	LSCK	Outputs the clock signal for the LCD driver (IC6, pin 17).
34	LSO	Outputs the data signal for the LCD driver (IC6, pin 48).
36	PLST	Outputs the strobe signal for the PLL IC (MAIN unit; IC4).
37	DAST	Outputs the strobe signal for the D/A converter IC (MAIN unit; IC6).
38	EXST	Outputs the strobe signal for the expander IC (IC17).
39	EXOE	Outputs the control signal for the LCD driver IC (IC6).
41	PWON	Outputs the control signal for the power switching circuit (MAIN unit; Q24, Q23).

CPU-Continued

Pin number	Port name	Description
44-46	OPT3- OPT1	I/O ports for the optional board control signals.
48	SI	Input port for the clock signal from the optional board via J1.
49	CLI	Input port for the cloning signal.
50	CLO	Output port for the cloning signal.
51	POSW	Input port for the POWER switch.
52	IGSW	<ul style="list-style-type: none"> Input port for the remote power control signal from the external connector.(J6) Input port for the dimmer control.
83	NOIS	Input port for the "NOIS" signal from the FM IF IC (MAIN unit; IC1) for noise squelch operation.
54	CIRQ	Input port for interruption signal from the optional board via J1.
55	CCS	Outputs chip select signal for the optional board via J1.
56	PTT	Input port for the PTT switch from microphone.
57	EPTT	Input port for the PTT switch from the external connector (J6). Low : External PTT switch is ON.
58	HANG	Input port for the microphone hanger detection signal. Low : Microphone on hook.
59	AFVI	Input port for the AF volume control signal (R14). High : [VOL] is maximum clockwise.
60	CDEC	Input port for the CTCSS/DTCS decoding signals.
61	SDEC	Input port for the single tone decoding signal.
62	OPV1V2	Input port for the optional board detection signal.
63	RSSI	Input port for receiving signal strength level detection.
64	LVIN	Input port for the PLL lock voltage.

4-5-2 OUTPUT EXPANDER (MAIN UNIT; IC17)

Pin number	Port name	Description
4	RXC	Outputs transmit/receive control signal. High: While receiving.
5	AFON	Outputs audio output control signal. High: While receiving.
6	NWC	Outputs wide/narrow control signal. High: Wide is selected.
7	RMUT	Outputs receiving mute control signal. Low: While receiving is muting.
13	TMUT	Outputs transmitting mute control signal. Low: While transmitting is muting.
14	MMUT	Outputs the microphone mute control signal. Low: While the microphone is muting.

4-5-3 LCD DRIVER (FRONT UNIT; IC6)

Pin number	Port name	Description
1	LIGT1	Outputs dimmer control signal. High: Dimmter is ON.
2	LIGT2	Outputs backlight control signal. High: Backlight is ON.
3-34	SEG32- SEG1	Output LCD segment signals.
35-38	COM4- COM1	Output LCD common signals.

SECTION 5 ADJUSTMENT PROCEDURES

5-1 PREPARATION

When you adjust the contents on pages 5-5 and 5-6, SOFTWARE ADJUSTMENT, the optional CS-F100 ADJ ADJUSTMENT SOFTWARE (Rev. 1.0 or later), *OPC-1122 JIG CABLE (modified OPC-1122 CLONING CABLE; see illustration below) are required.

SYSTEM REQUIREMENTS

- IBM PC compatible computer with an RS-232C serial port (38400 bps or faster).
- Microsoft Windows 95/98 or Windows ME
- Intel Pentium 100 MHz processor or faster
- At least 16 MB RAM and 10 MB of hard disk space
- 640x480 pixel display (800x600 pixel display recommended)

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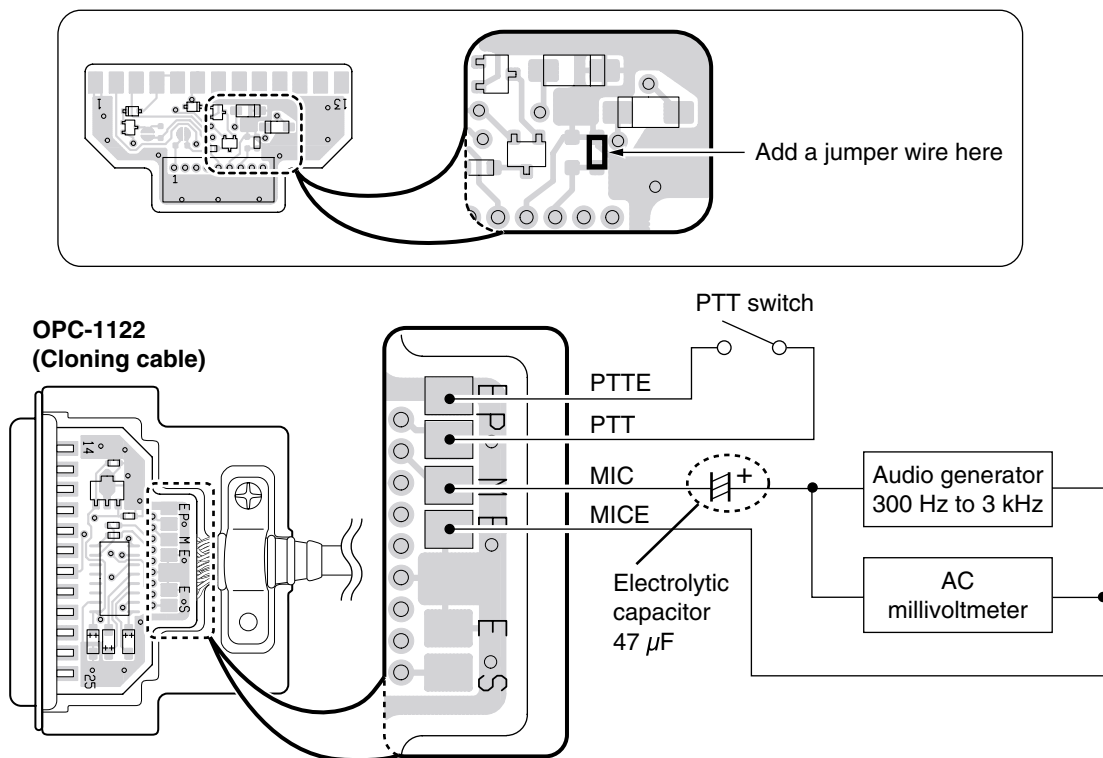
ADJUSTMENT SOFTWARE INSTALLATION

- ① Boot up Windows.
 - Quit all applications when Windows is running.
- ② Insert the 'CS-F100' into the appropriate CD drive.
- ③ Select 'Run' from the [Start] menu.
- ④ Type the setup program name using the full path name, then push [Enter] key.
(ex. D:\CSF100ADJ\Setup.exe)
- ⑤ Follow the prompts.
- ⑥ Program group 'CS-F100 ADJ' appears in the 'Programs' folder of the [Start] menu.

STARTING SOFTWARE ADJUSTMENT

- ① Connect IC-F110 and PC with *OPC-1122 JIG CABLE.
- ② Turn the transceiver power ON.
- ③ Boot up Windows, and click the program group 'CS-F100 ADJ' in the 'Programs' folder of the [Start] menu, then CS-F100 ADJ's window appears.
- ④ Click 'Connect' on the CS-F100 ADJ's window, then appears IC-F110's up-to-date condition.
- ⑤ Set or modify adjustment data as desired.

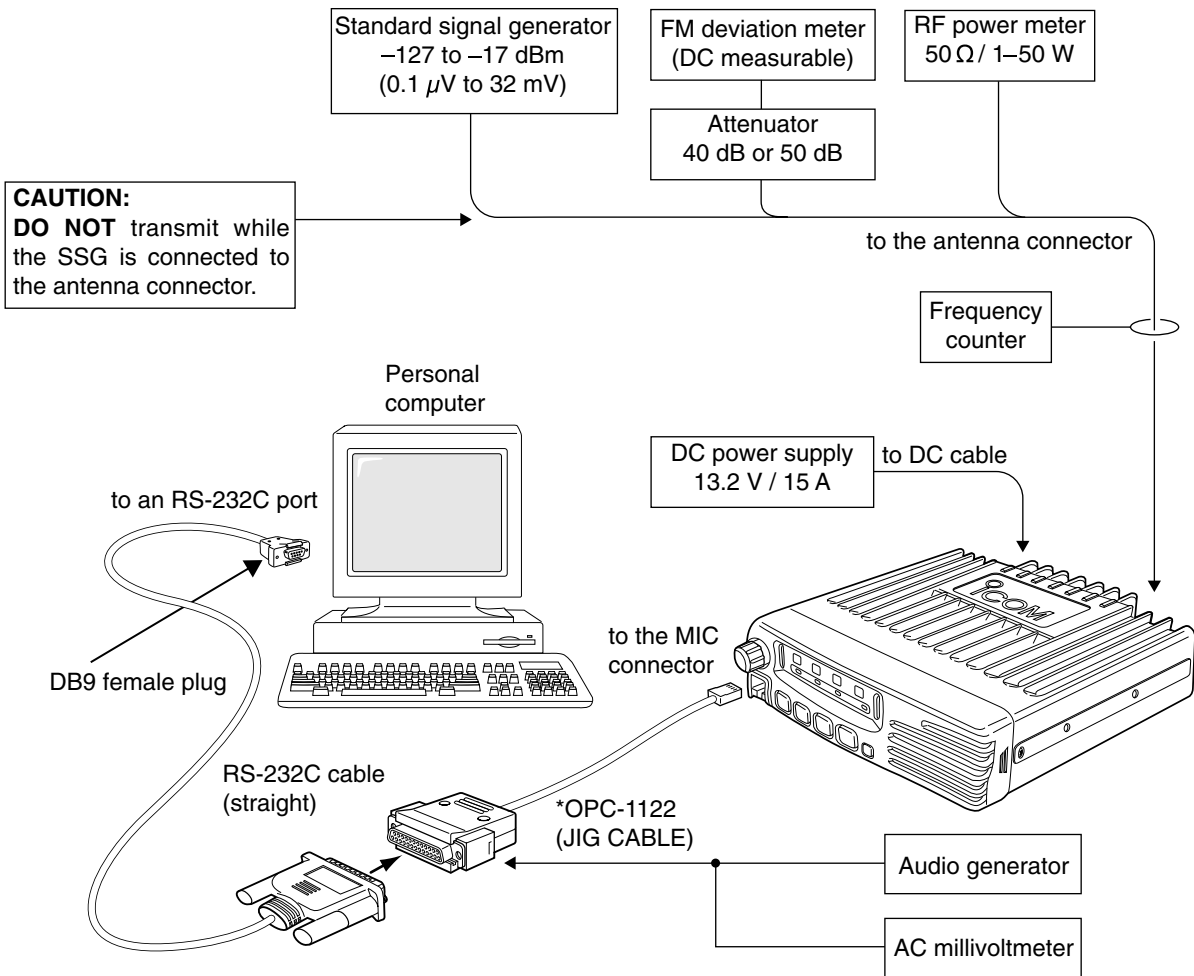
*OPC-1122 (JIG CABLE)



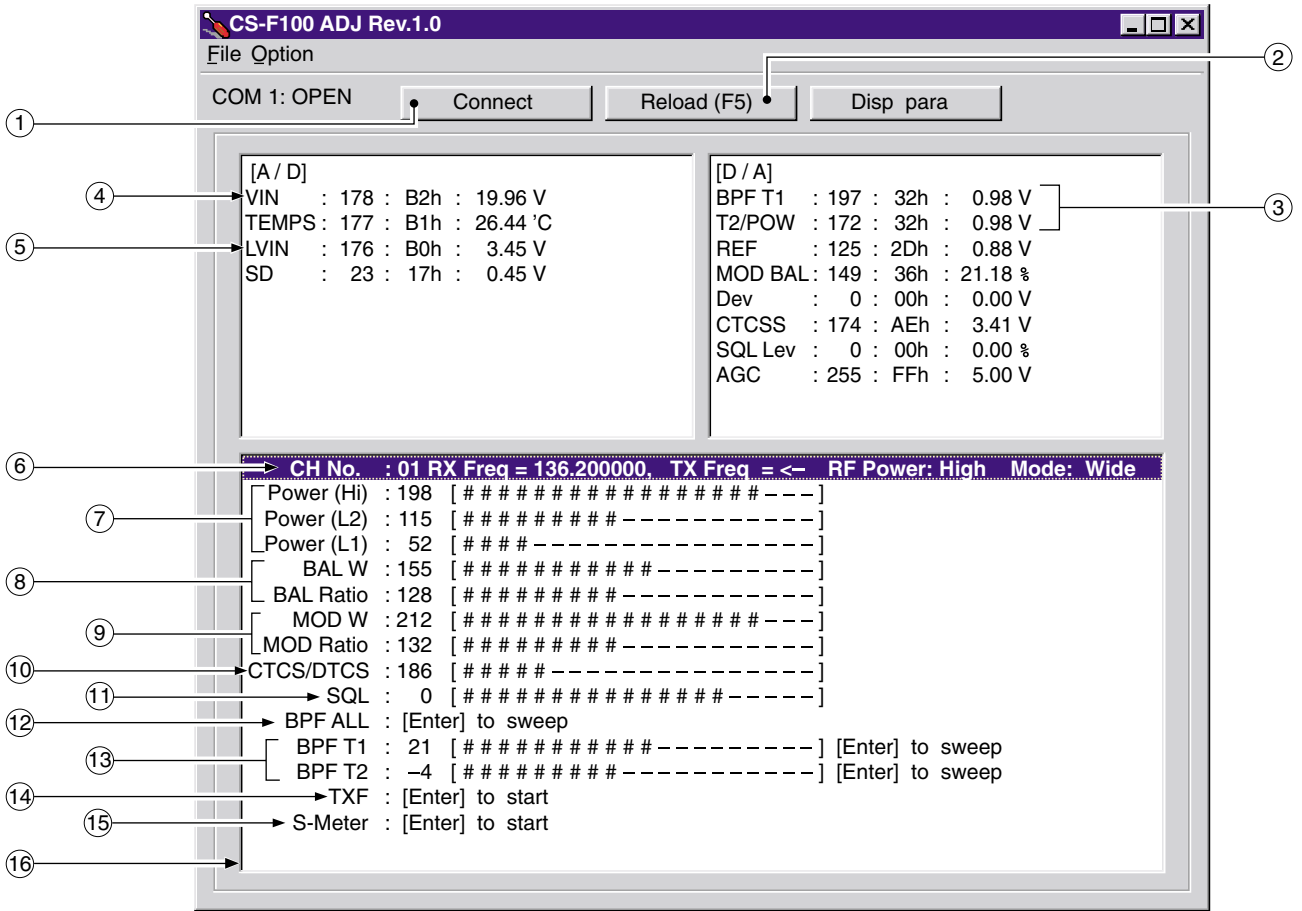
■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.2 V DC Current capacity : 15 A or more	Audio generator	Frequency range : 300–3000 Hz Measuring range : 1–500 mV
RF power meter (terminated type)	Measuring range : 1–100 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–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 : DC–300 MHz Measuring range : 0 to ±10 kHz	AC millivoltmeter	Measuring range : 10 mV–10 V
DC voltmeter	Input impedance : 50 kΩ/V DC or better	External speaker	Input impedance : 4 Ω Capacity : 7 W or more
		Attenuator	Power attenuation : 40 or 50 dB Capacity : 50 W or more

• CONNECTIONS



• SCREEN DISPLAY EXAMPLE

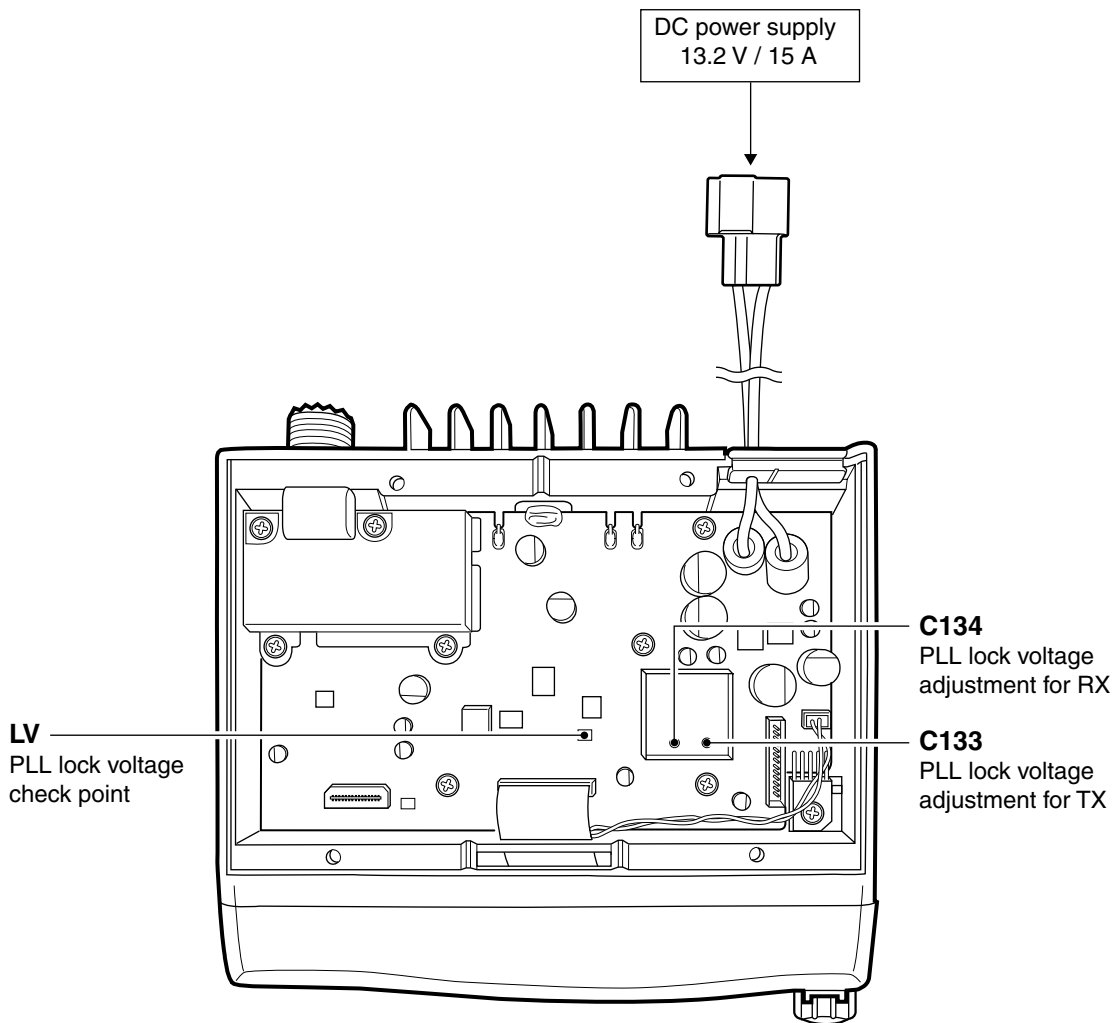


NOTE: The above values for settings are example only.
Each transceiver has its own specific values for each setting.

- | | |
|------------------------------------|--|
| ①: Transceiver's connection state | ⑨: FM deviation |
| ②: Reload adjustment data | ⑩: CTCSS/DTCS deviation |
| ③: Receive sensitivity measurement | ⑪: Squelch level |
| ④: Connected DC voltage | ⑫: Receive sensitivity (automatically) |
| ⑤: PLL lock voltage | ⑬: Receive sensitivity (manually) |
| ⑥: Operating channel select | ⑭: Reference frequency |
| ⑦: RF output power | ⑮: S-meter |
| ⑧: Modulation balance | ⑯: Adjustment items |

5-2 PLL ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT		
		UNIT	LOCATION		UNIT	ADJUST	
PLL LOCK VOLTAGE	1 • Operating freq. : 174.000 MHz • Receiving	MAIN	Connect a digital multi-meter or an oscilloscope to the check point, "LV".	3.2 V	MAIN	C134	
	2 • Output power : Low1 • Transmitting					3.6 V	C133
	3 • Operating freq. : 136.000 MHz • Receiving					0.9–1.5 V	Verify
	4 • Output power : Low1 • Transmitting					0.8–1.4 V	



5-3 SOFTWARE ADJUSTMENT

Select an operation using [↑] / [↓] keys, then set specified value using [←] / [→] keys on the connected computer keyboard.

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE
		UNIT	LOCATION	
REFERENCE FREQUENCY [TXF]	1 <ul style="list-style-type: none"> • Operating freq. : 174.000 MHz • Output power : Low1 • Connect the RF power meter or 50 Ω dummy load to the antenna connector. • Transmitting 	Rear panel	Loosely couple a frequency counter to the antenna connector.	174.0000 MHz
OUTPUT POWER [Power (Hi)]	1 <ul style="list-style-type: none"> • Operating freq. : 155.000 MHz • Output power : High • Transmitting 	Rear panel	Connect an RF power meter to the antenna connector.	25.0 W (25 W type) 50.0 W (50 W type)
[Power (L2)]	2 <ul style="list-style-type: none"> • Output power : Low2 • Transmitting 			10.0 W (25 W type) 25.0 W (50 W type)
[Power (L1)]	3 <ul style="list-style-type: none"> • Output power : Low1 • Transmitting 			2.5 W (25 W type) 5.0 W (50 W type)
FM DEVIATION [MOD W]	1 <ul style="list-style-type: none"> • Operating freq. : 155.000 MHz • Output power : Low1 • IF bandwidth : Wide • Connect an audio generator to the [MIC] jack through the JIG cable and set as: 1.0 kHz/40 mVrms • Set an FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • Transmitting 	Rear panel	Connect an FM deviation meter to the antenna connector through the attenuator.	±4.1 kHz [N/W] ±3.3 kHz [N/M]
[MOD Ratio]	2 <ul style="list-style-type: none"> • IF bandwidth : Narrow • Transmitting 			±2.1 kHz
MODULATION BALLANCE [BAL W]	1 <ul style="list-style-type: none"> • Set to the DTCS set channel, and push [Connect] on the Adjustment software. • Operating freq. : 155.000 MHz • Output power : Low1 • Transmitting 	Rear panel	Connect an FM deviation meter with an oscilloscope to the antenna connector through an attenuator.	Set to square wave form 
[BAL Ratio]	2 <ul style="list-style-type: none"> • IF bandwidth : Narrow • Transmitting 			
CTCSS/DTCS DEVIATION [CTCS/DTCS]	1 <ul style="list-style-type: none"> • Operating freq. : 155.000 MHz • Output power : Low1 • IF bandwidth : Wide • CTCSS : 151.4 Hz • DTCS code : 007 • Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • No audio applied to the [MIC] connector. • Transmitting 	Rear panel	Connect an FM deviation meter to the antenna connector through the attenuator.	±0.7 kHz [N/W] ±0.56 kHz [N/W]

SOFTWARE ADJUSTMENT – continued

Select an operation using [↑] / [↓] keys, then set specified value using [←] / [→] keys on the connected computer keyboard.

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE
		UNIT	LOCATION	
RX SENSITIVITY [BPF T1], [BPF T2]	1 <ul style="list-style-type: none"> • Operating freq. : 136.000 MHz • IF bandwidth : Wide • Connect a standard signal generator to the antenna connector and set as: <ul style="list-style-type: none"> Frequency : 136.000 MHz Level : 10 μV* (-87 dBm) Modulation : 1 kHz Deviation : \pm3.5 kHz [N/W] \pm2.8 kHz [N/M] • Receiving 	MAIN	Connect a SINAD meter with a 4 Ω load to the external [SP] jack.	Minimum distortion level
CONVENIENT: The BPF T1–BPF T2 can be adjusted automatically. ①-1: Set the cursor to “BPF ALL” on the adjustment program and then push [ENTER] key. ①-2: The connected PC tunes BPF T1, BPF T2 to peak levels. or ②-1: Set the cursor to BPF T1 or BPF T2 as desired. ②-2: Push [ENTER] key to start tuning. ②-3: Repeat ②-1 and ②-2 to perform additional BPF tuning.				
SQUELCH LEVEL [SQL]	1 <ul style="list-style-type: none"> • Operating freq. : 136.000 MHz • IF bandwidth : Narrow • Connect an SSG to the antenna connector and set as: <ul style="list-style-type: none"> Frequency : 136.000 MHz Level : 0.2 μV* (-121 dBm) Modulation : 1 kHz Deviation : \pm1.75 kHz • Receiving 	Rear panel	Connect a SINAD meter with a 4 Ω load to the external [SP] jack.	Set “SQL level” to close squelch. Then set “SQL level” at the point where the audio signals just appears.
S-METER [S-METER] (S3 LEVEL)	1 <ul style="list-style-type: none"> • Operating freq. : 136.000 MHz • IF bandwidth : Wide • Connect an SSG to the antenna connector and set as: <ul style="list-style-type: none"> Frequency : 136.000 MHz Level : 14 μV* (-84 dBm) Modulation : 1 kHz Deviation : \pm3.5 kHz [N/W] \pm2.8 kHz [N/M] • Receiving 	<ul style="list-style-type: none"> • Adjusting S3 and S1’s S-meter level automatically when push the return key on the key board. 		
(S1 LEVEL)	2 <ul style="list-style-type: none"> • Set an SSG as: <ul style="list-style-type: none"> Level : 0.45 μV* (-114 dBm) 			

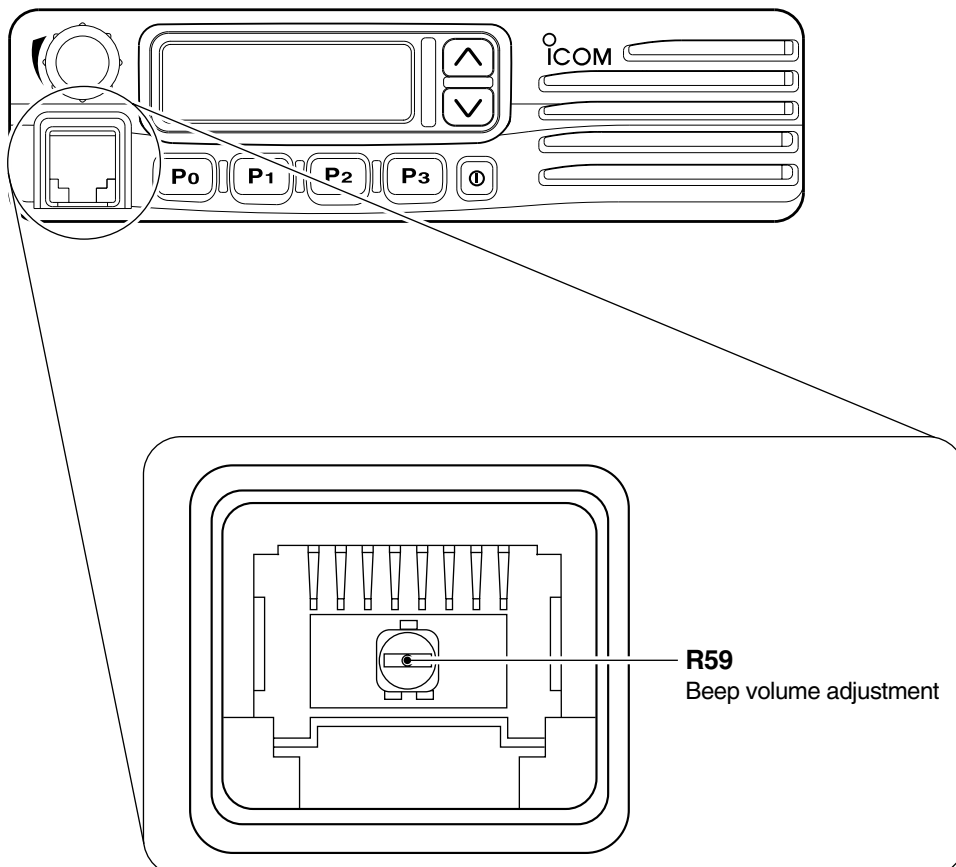
*The output level of the standard signal generator (SSG) is indicated as the SSG’s open circuit.

5-4 TRIMMER ADJUSTMENT

- Make this adjustment if necessary (For example, when beep sound is too loud or too soft).
- **BE CAREFUL!**: 5-tone calling beep sound becomes loud or soft when beep volume adjusts to loud or soft.

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		ADJUSTMENT	
		UNIT	LOCATION	UNIT	ADJUST
BEEP VOLUME	1 <ul style="list-style-type: none"> • Operating freq. : Any • Receiving 	FRONT	Push any button except [POWER] switch, then verify the beep volume level.	FRONT	R59

• FRONT PANEL



[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION
C264	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C265	4510008030	S.ELECTROLYTIC ECEV1EA471P
C266	4510004630	S.ELECTROLYTIC ECEV1CA100SR
C268	4550006700	S.TANTALUM ECST1AY106R
C269	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C270	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C271	4510004630	S.ELECTROLYTIC ECEV1CA100SR
C272	4510004630	S.ELECTROLYTIC ECEV1CA100SR
C273	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C274	4510004630	S.ELECTROLYTIC ECEV1CA100SR
C275	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C276	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C280	4030006900	S.CERAMIC C1608 JB 1H 103K-T
C282	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C283	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C286	4030006900	S.CERAMIC C1608 JB 1H 103K-T
C287	4030008650	S.CERAMIC C1608 JB 1H 332K-T
C288	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C289	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C290	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C291	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C292	4030007090	S.CERAMIC C1608 CH 1H 470J-T
C293	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C294	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C295	4510004630	S.ELECTROLYTIC ECEV1CA100SR
C297	4030007050	S.CERAMIC C1608 CH 1H 220J-T
C298	4030007020	S.CERAMIC C1608 CH 1H 120J-T
C299	4030007020	S.CERAMIC C1608 CH 1H 120J-T
C300	4030007010	S.CERAMIC C1608 CH 1H 100D-T
C301	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C302	4030007010	S.CERAMIC C1608 CH 1H 100D-T
C303	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C304	4030007010	S.CERAMIC C1608 CH 1H 100D-T
C305	4030007100	S.CERAMIC C1608 CH 1H 560J-T
C306	4030009910	S.CERAMIC C1608 CH 1H 040B-T
C307	4030006980	S.CERAMIC C1608 CH 1H 070D-T
C308	4030009530	S.CERAMIC C1608 CH 1H 030B-T
C309	4030006900	S.CERAMIC C1608 JB 1H 103K-T
C310	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C311	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C312	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C314	4030006900	S.CERAMIC C1608 JB 1H 103K-T
C315	4030008880	S.CERAMIC C1608 JB 1H 223K-T
C316	4030009490	S.CERAMIC C1608 JB 1H 821K-T
C317	4030009490	S.CERAMIC C1608 JB 1H 821K-T
C318	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C320	4030008910	S.CERAMIC C1608 JB 1H 393K-T
C321	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C322	4030006900	S.CERAMIC C1608 JB 1H 103K-T
C324	4030011340	S.CERAMIC C1608 CH 1H 471J-T
C325	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C327	4510004630	S.ELECTROLYTIC ECEV1CA100SR
C330	4550006170	S.TANTALUM ECST1AY225R
C331	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C332	4550006700	S.TANTALUM ECST1AY106R
C333	4030007090	S.CERAMIC C1608 CH 1H 470J-T
C335	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C337	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C339	4030009550	S.CERAMIC C1608 CH 1H 2R5B-T
C342	4550006410	S.TANTALUM ECST1VY334R
C343	4030006900	S.CERAMIC C1608 JB 1H 103K-T
C348	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C349	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C350	4030017490	S.CERAMIC C1608 JB 1A 105K-T
C351	4030008920	S.CERAMIC C1608 JB 1H 473K-T
C352	4510005750	S.ELECTROLYTIC ECEV1EA220SP
C353	4030011770	S.CERAMIC C1608 CH 1H 060B-T
C355	4030006990	S.CERAMIC C1608 CH 1H 080D-T
C356	4030006990	S.CERAMIC C1608 CH 1H 080D-T
C357	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C359	4030017490	S.CERAMIC C1608 JB 1A 105K-T
C360	4030009920	S.CERAMIC C1608 CH 1H 050B-T
C361	4030016930	S.CERAMIC ECJ0EB1A104K
C362	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C363	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C364	4030006850	S.CERAMIC C1608 JB 1H 471K-T
C372	4030006850	S.CERAMIC C1608 JB 1H 471K-T
C375	4030006860	S.CERAMIC C1608 JB 1H 102K-T
C376	4030009910	S.CERAMIC C1608 CH 1H 040B-T
C378	4030010020	S.CERAMIC C1608 JB 1H 122K-T
C379	4030006900	S.CERAMIC C1608 JB 1H 103K-T

[MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION
C380	4030007050	S.CERAMIC C1608 CH 1H 220J-T (A)
	4030007040	S.CERAMIC C1608 CH 1H 180J-T (B)
C381	4030007050	S.CERAMIC C1608 CH 1E 220J-T (A)
	4030009650	S.CERAMIC C1608 CH 1H 240J-T (B)
C382	4030007170	S.CERAMIC C1608 CH 1H 221J-T
C383	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C384	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C385	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C508	4030011170	S.CERAMIC GRM31M2C2H180JV01L (GRM42-6 CH)
C509	4030011600	S.CERAMIC C1608 JB 1E 104K-T
C510	4030007030	S.CERAMIC C1608 CH 1H 150J-T (A) only
C511	4030009570	S.CERAMIC C1608 CH 1H 0R3B-T (B) only
C512	4030006860	S.CERAMIC C1608 JB 1H 102K-T (B) only
C513	4030011120	S.CERAMIC GRM31M2C2H100JV01L (GRM42-6 CH) (B) only
C514	4030011120	S.CERAMIC GRM31M2C2H100JV01L (GRM42-6 CH) (B) only
C515	4030006860	S.CERAMIC C1608 JB 1H 102K-T (B) only
J1	6510018430	S.CONNECTOR AXN330C038P
J2	6510022470	S.CONNECTOR 40FLT-SM1-TB
J4	6450000140	CONNECTOR HSJ0807-01-010
J6	6510019250	S.CONNECTOR B11B-ZR-SM3-TF
J7	6510014960	S.CONNECTOR B2B-ZR-SM3-TF
W1	7120000470	JUMPER ERDS2T0
W2	8900011861	CABLE OPC-1195A <CMI>
W4	7030003860	S.JUMPER ERJ3GE JPW V
W6	7030010040	S.JUMPER ERJ2GE-JPW
W7	7030010040	S.JUMPER ERJ2GE-JPW
W8	7030010040	S.JUMPER ERJ2GE-JPW
W9	7030010040	S.JUMPER ERJ2GE-JPW
W10	7030003860	S.JUMPER ERJ3GE JPW V
W11	7030003860	S.JUMPER ERJ3GE JPW V (B) only
W12	7030003860	S.JUMPER ERJ3GE JPW V (B) only
EP1	6910013370	S.BEAD BLM18BB221SN1D (BLM11B221SB)
EP2	6910011560	BEAD HF70BB4.5X5X1.6
EP3	6910011560	BEAD HF70BB4.5X5X1.6
EP4	6910010280	BEAD HF70BB9.5X10.4X4.9
EP5	6910010280	BEAD HF70BB9.5X10.4X4.9
EP6	0910055673	PCB B 5909C

(A): [F110] (B): [F111] and [F121] (C): IC-F110 for [EUR]
 (D): IC-F110 for [GEN] (E): IC-F110 for 25 kHz (F): IC-F110 for 20 kHz

S.=Surface mount

SECTION 7 MECHANICAL PARTS AND DISASSEMBLY

[CHASSIS PARTS]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
J1	6510004880	Connector MR-DS-E 01	1
MP1	8010019060	2601 chassis	1
MP2	8110007820	2601 cover	1
MP3	8210019340	2622 front panel	1
MP4	8930059010	2622 keyboard	1
MP5	8930059090	2622 LCD plate	1
MP6	8210019350	2622 reflector	1
MP7	8610011180	Knob N292	1
MP9	8810008660	Screw PH BT M3 × 8 NI-ZU	8
MP10	8810008660	Screw PH BT M3 × 8 NI-ZU	2
MP11	8810008660	Screw PH BT M3 × 8 NI-ZU	2
MP12	8810008760	Screw PH BT M3 × 8 NI-ZU	3
MP13	8810008660	Screw PH BT M3 × 8 NI-ZU	1
MP14	8810009990	Screw PH BT M3 × 8 ZK	4
MP15	8810009990	Screw PH BT M3 × 8 ZK	2
MP16	8930059100	2622 LCD filter	1
MP17	8930059000	2601 SP net	1

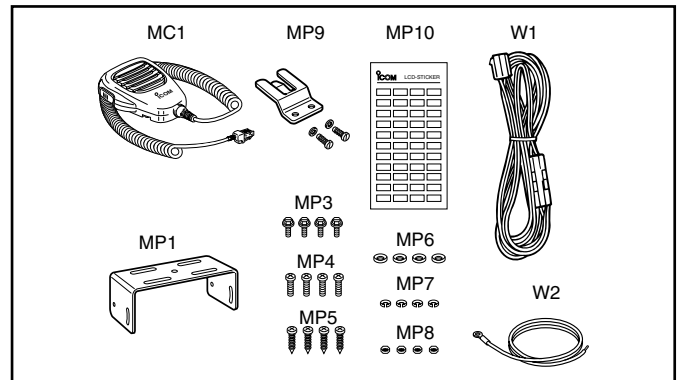
[ACCESSORIES]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
MC1	0800005780	Microphone HM-100N	1
W1	8900011780	Cable OPC-1194	1
W2	8900000730	Cable OPC-049	1
MP1	8010019170	2601 mobil bracket assembly	1
MP3	8820000530	Flange bolt M4 × 8 NI	4
MP4	8810000470	Screw PH M5 × 12 (+)	4
MP5	8810005840	Screw PH A M5 × 20	4
MP6	8850000150	Flat washer M5 NI BS	4
MP7	8850000390	Spring washer M5	4
MP8	8830000120	Nut M5	4
MP9	6910004210	731 mic hanger set	1
MP10	8310054770	1705 LCD seal (F)	1

Screw abbreviations A,BT: Self-tapping PH: Pan head
 ZK: Black BS: Brass
 NI: Nickel NI-ZU: Nickel-Zinc

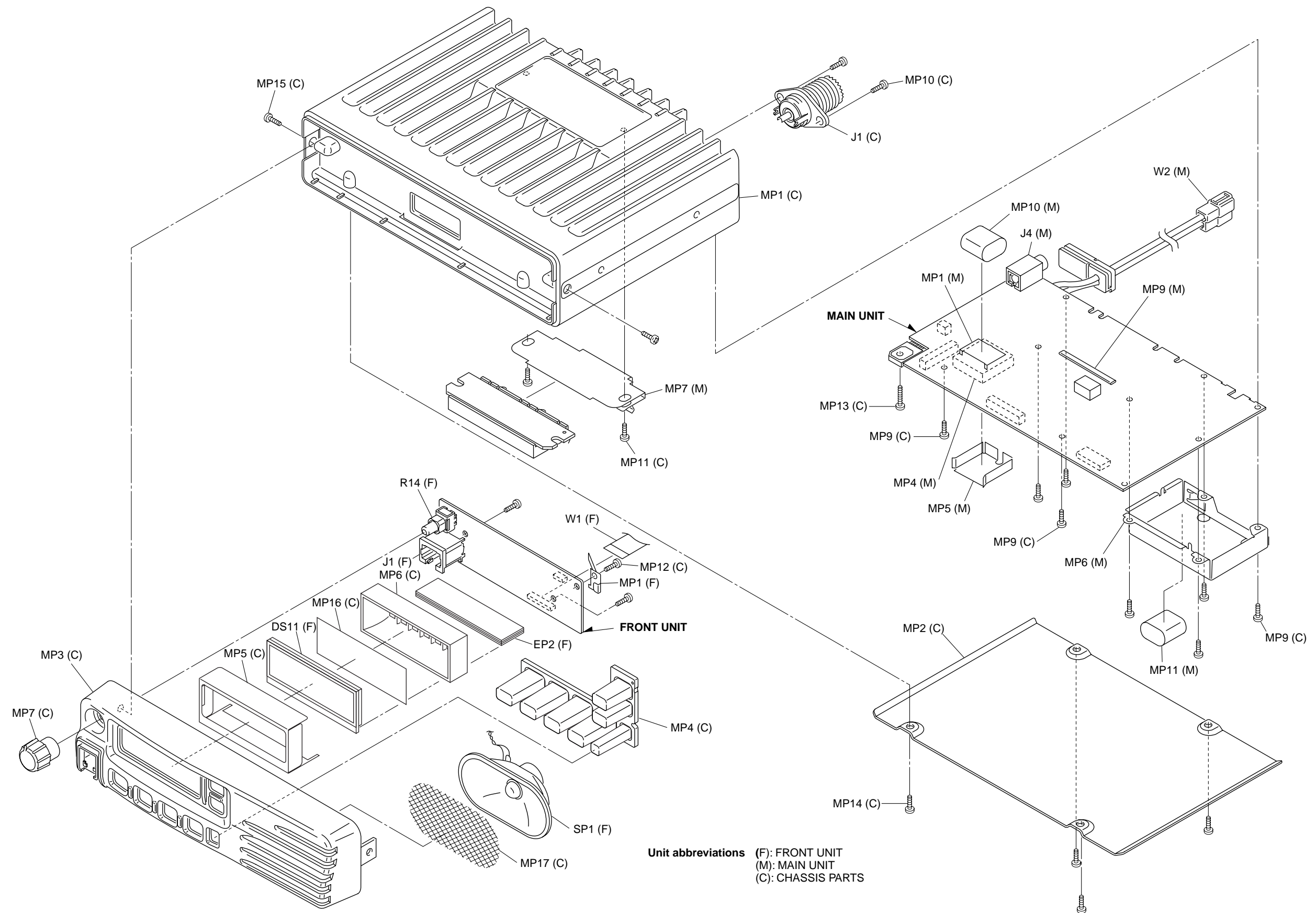
[FRONT UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
R14	7210003020	Variable resistor EVU-F2KFK1 B14	1
SP1	2510001220	Speaker C052SB500-13	1
J1	6450002210	Connector 3017-8821	1
W1	8900010500	Cable OPC-1046	1
DS11	5030002510	LCD L2-0607TAY	1
EP2	8930059170	LCD contact SRCN-2622-SP-N-W	1
MP1	8930059110	2622 spring	1



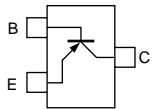
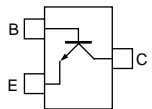
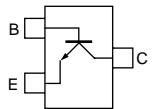
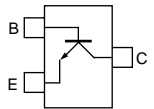
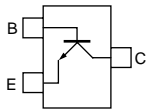
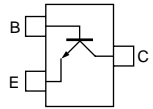
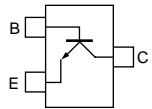
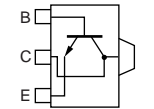
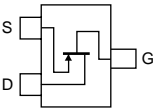
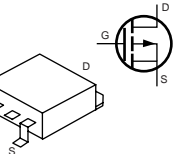
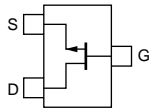
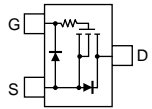
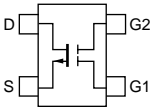
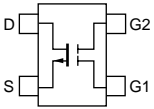
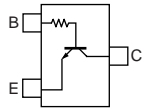
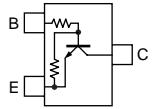
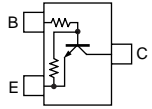
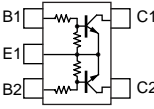
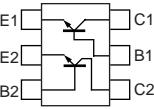
[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	QTY.
J4	6450000140	Connector HSJ0807-01-010	1
W2	8900011861	Cable OPC-1195A	1
MP1	8510002280	VCO shield plate (A)	1
MP4	8510014940	2601 VCO case	1
MP5	8510014950	2601 VCO cover	1
MP6	8510014910	2601 filter case	1
MP7	8510015110	2602 M-plate	1
MP9	8930058990	Shield sponge (V)	1
MP10	8930058840	Shield sponge (T) [GEN] only	1
MP11	8930058840	Shield sponge (T)	1

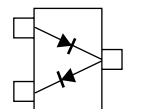

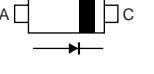
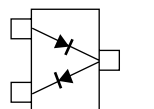
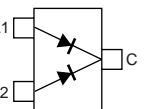
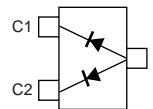
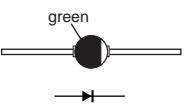
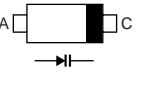
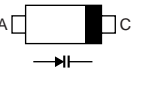
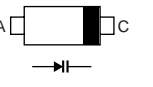
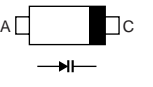
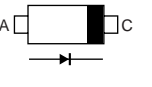
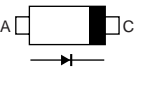
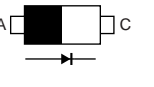
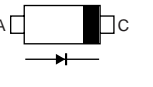
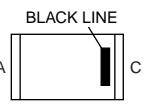


SECTION 8 SEMI-CONDUCTOR INFORMATION

• TRANSISTORS AND FET'S

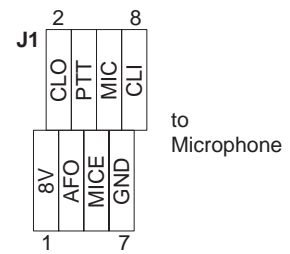
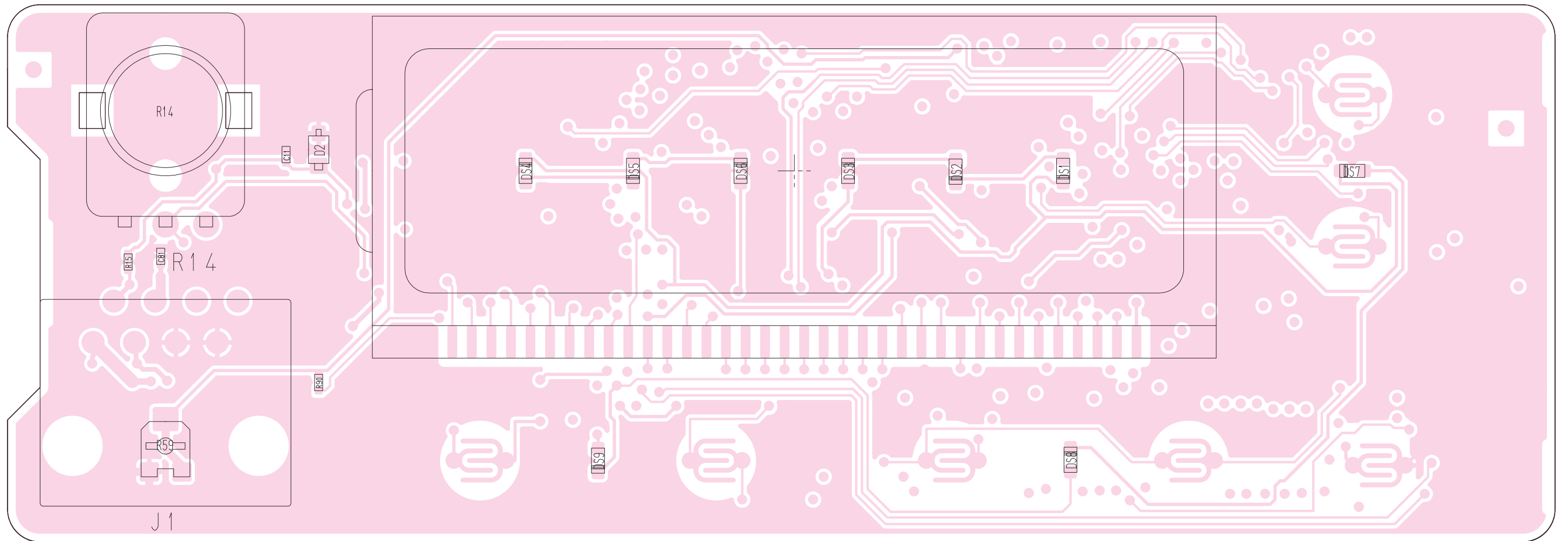
2SA1577 T106 Q (Symbol: HQ) 	2SC3356 T1B R25 (Symbol: R25) 	2SC4116 BL (Symbol: LL) 	2SC4213 B (Symbol: AB) 	2SC4215 O (Symbol: QO) 
2SC4226 T1 R25 (Symbol: R25) 	2SC5107 O (Symbol: MFO) 	2SD1664 T100Q (Symbol: DAQ) 	2SJ144 GR (Symbol: VG) 	2SJ377 (Symbol: 4L) 
2SK880 Y (Symbol: XY) 	2SK1829 (Symbol: K1) 	3SK293 (Symbol: UF) 	3SK299 T1 U73 (Symbol: U73) 	DTC114TUA T106 (Symbol: 04) 
DTC144EUA T106 (Symbol: 26) 	DTC363 EK (Symbol: H27) 	XP1214 (Symbol: 9H) 	XP6501 AB (Symbol: 5N) 	

• DIODES

1SS375-TL (Symbol: FH) 	1SV239 (Symbol: TC) 	1SV307 (Symbol: TX) 	DA221 TL (Symbol: K) 	DAN222TL (Symbol: N) 
DAP222 (Symbol: P) 	DSA3A1 (Symbol: Green) 	HVC350B (Symbol: B0) 	HVC362 (Symbol: V2) 	HVC375B (Symbol: B8) 
HVC376B (Symbol: B9) 	MA2S111 (Symbol: A) 	MA2S728 (Symbol: B) 	MA77 (Symbol: 4B) 	MA8056 M (Symbol: 5-6) 
UM9401F (Symbol: none) 				

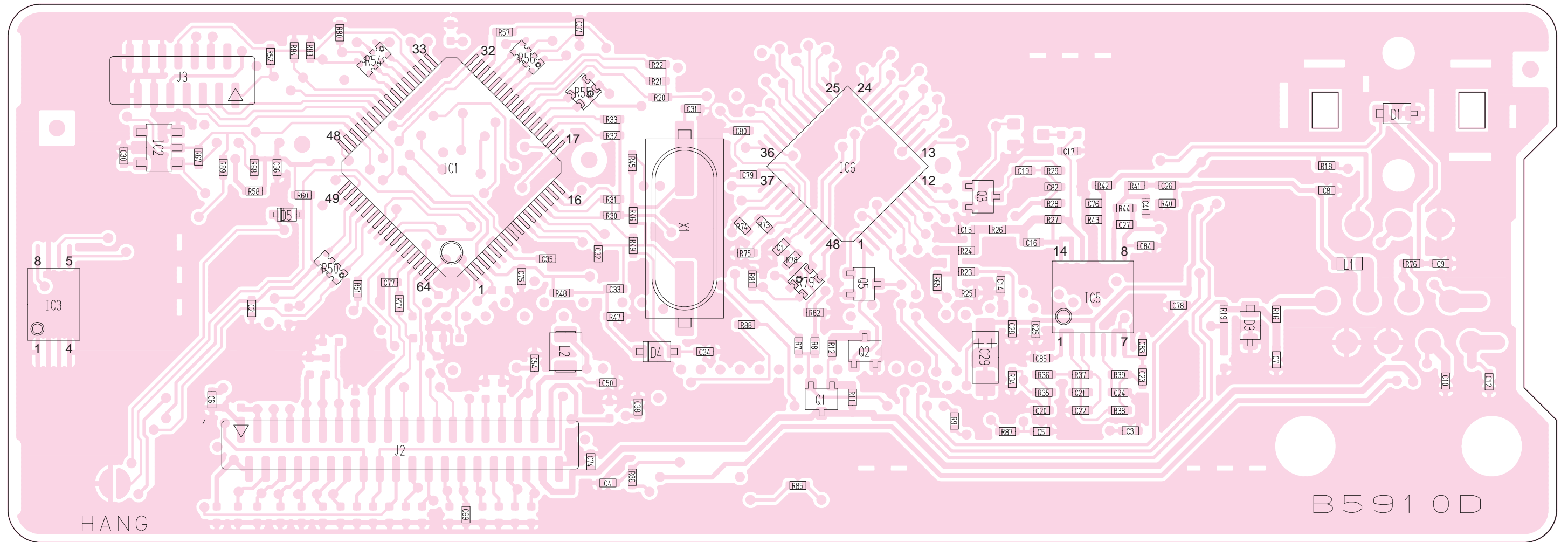
SECTION 9 BOARD LAYOUTS

9-1 FRONT UNIT • TOP VIEW



• BOTTOM VIEW (FRONT UNIT)

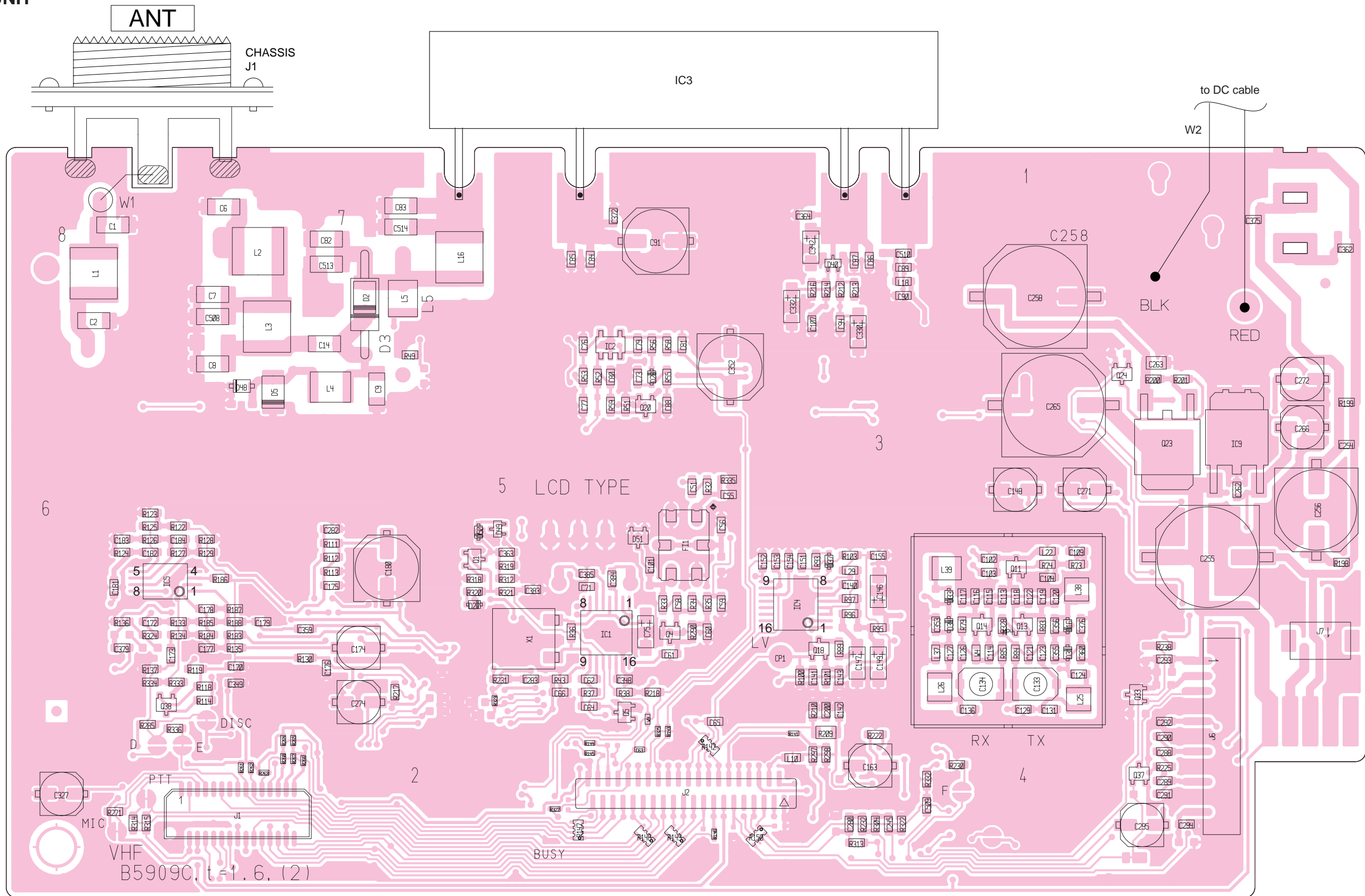
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13	GND	1
12	GND	
11	PWON	
10	OPT1	
9	P87	
8	P86	
7	CPU5V	



1	GND	39
2	TONE	
3	TENC	
4	NOIS	
5	EXOE	
6	EXST	
7	UNLK	
8	PLST	
9	CDEC	
10	SDEC	
11	OV12	
12	RSSI	
13	LVIN	
14	TEMP	
15	BATV	
16	NC	
17	NC	
18	5V	
19	CPU5	
20	AFO	
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		

to MAIN unit J2

9-2 MAIN UNIT
• TOP VIEW



J1	1	PTTI	15
		PTTO	
		MCOT	
		MCIN	
		NC	
		BUSY	
		NC	
		SIGO	
		OPT1	
		REM	
		OPT2	
		OPT3	
		GND	
		DAST	
		SI	
		OV12	
		SCK	
30			16

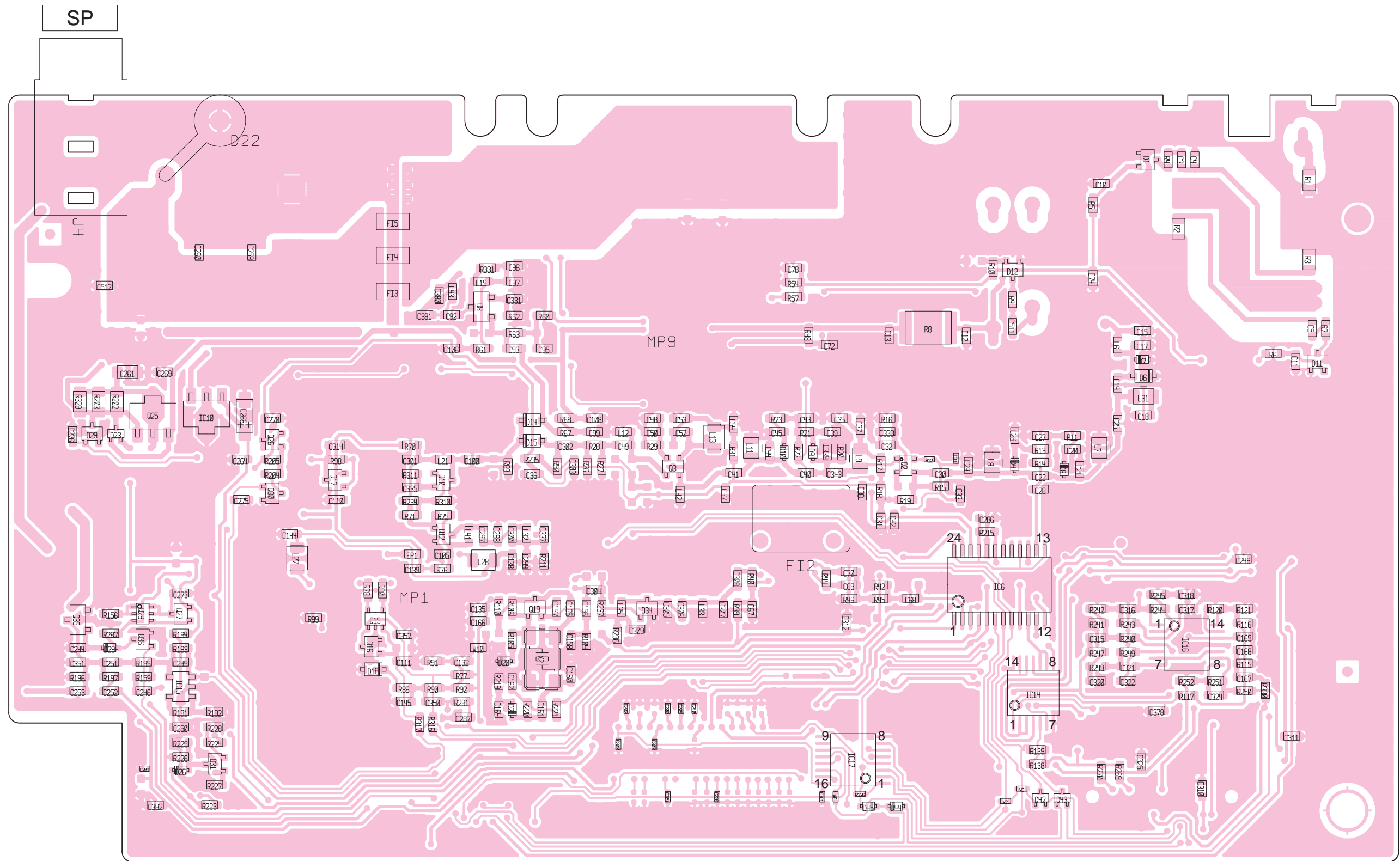
to Optional unit

J2	40	GND	2
		tone	
		TENC	
		NOIS	
		EXOE	
		EXST	
		UNLK	
		PLST	
		REEM	
		SCK	
		CDEC	
		SDEC	
		SI	
		OV12	
		RSSI	
		LVIN	
		CCS	
		MIC	
		TEMP	
		BATV	
		NC	
		NC	
		BEEP	
		PWON	
		5V	
		CPU5	
		8V	
		AFO	
39			1

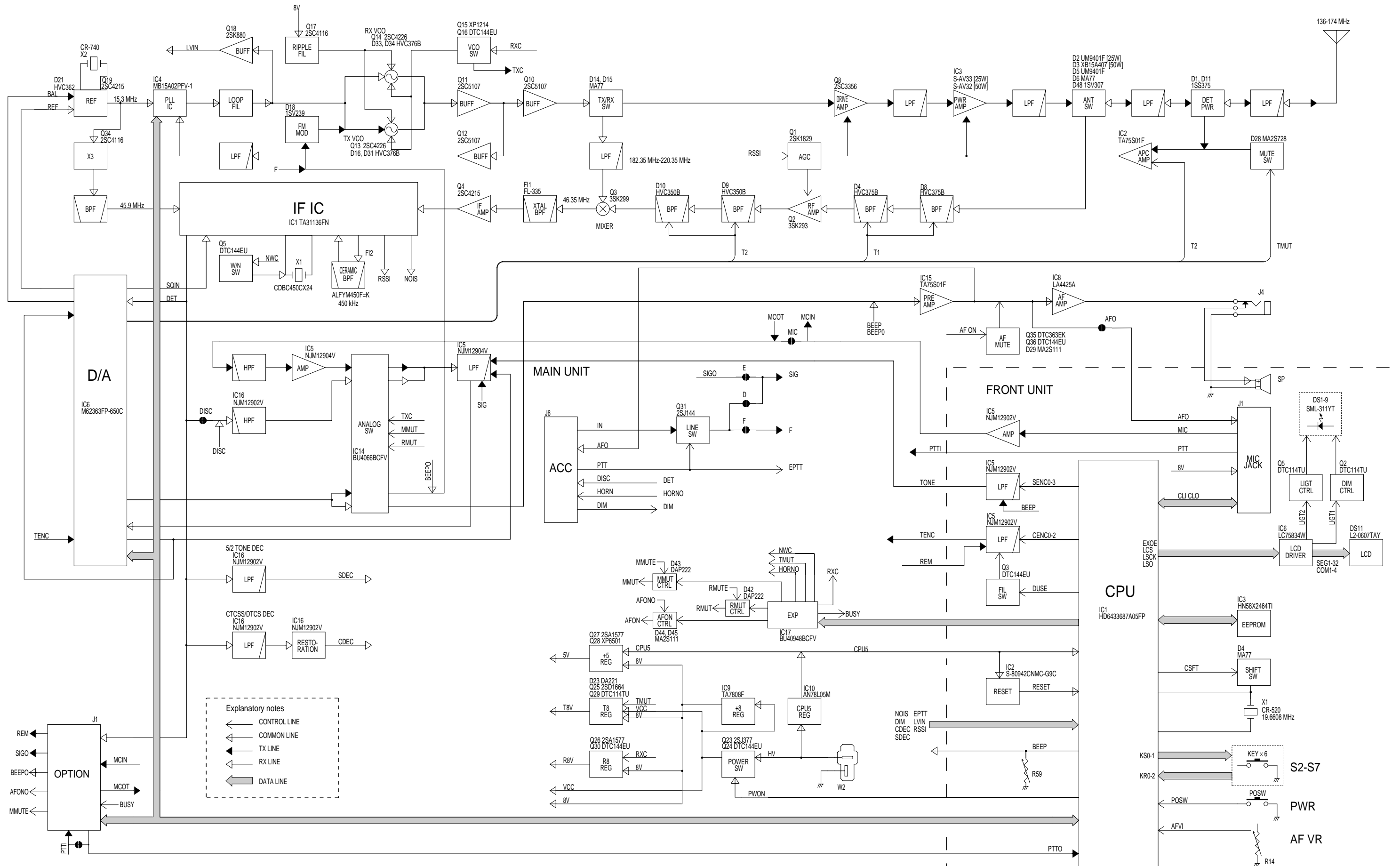
to FRONT unit J2

J7	2	1
		SP
		OS
		to speaker
J6	1	VCC
		DIM
		HORN
		GND
		AFO
		GND
		DISC
		GND
		IN
		GND
		PTT
11		to Optional cable OPC-617

• BOTTOM VIEW (MAIN UNIT)

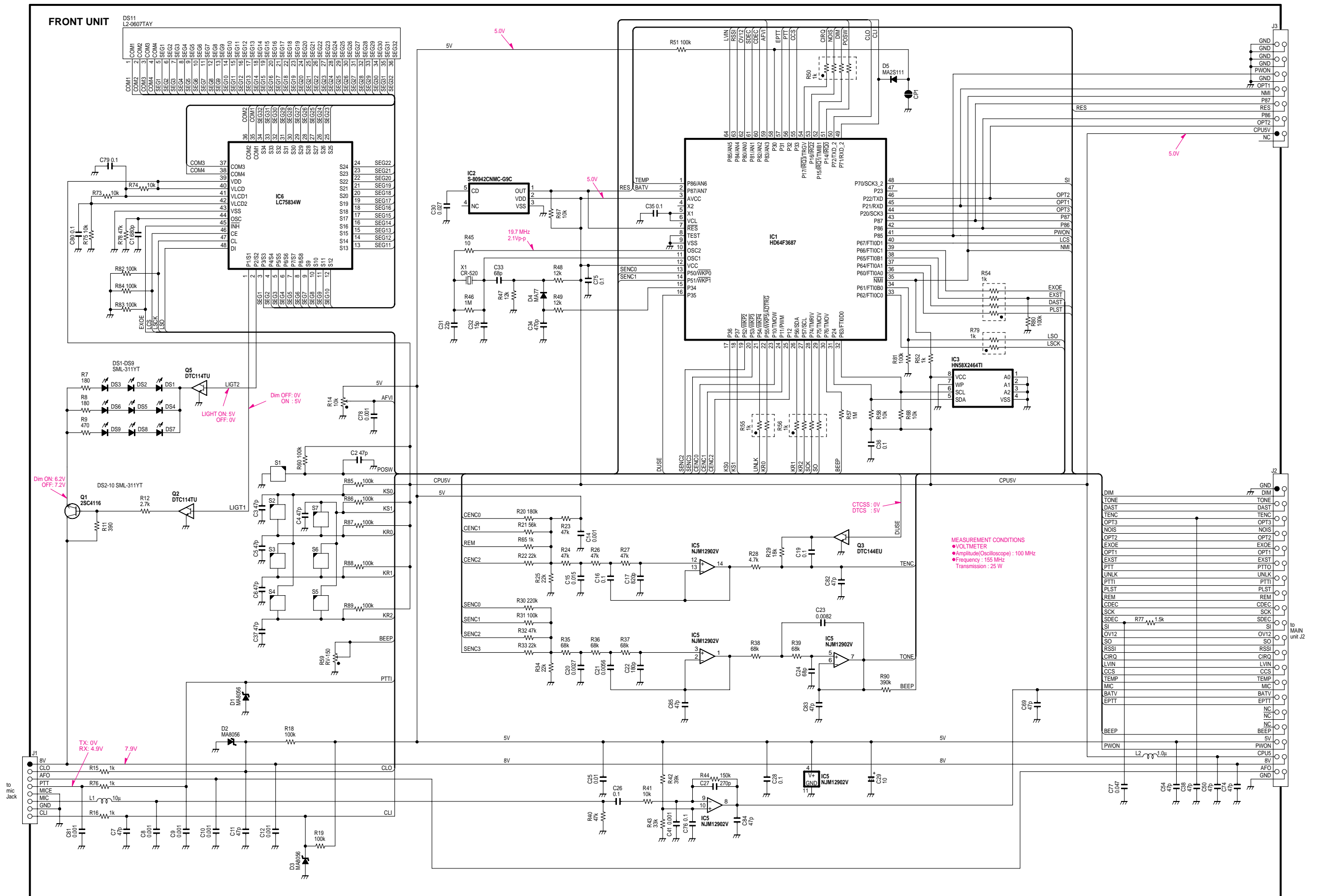


SECTION 10 BLOCK DIAGRAM

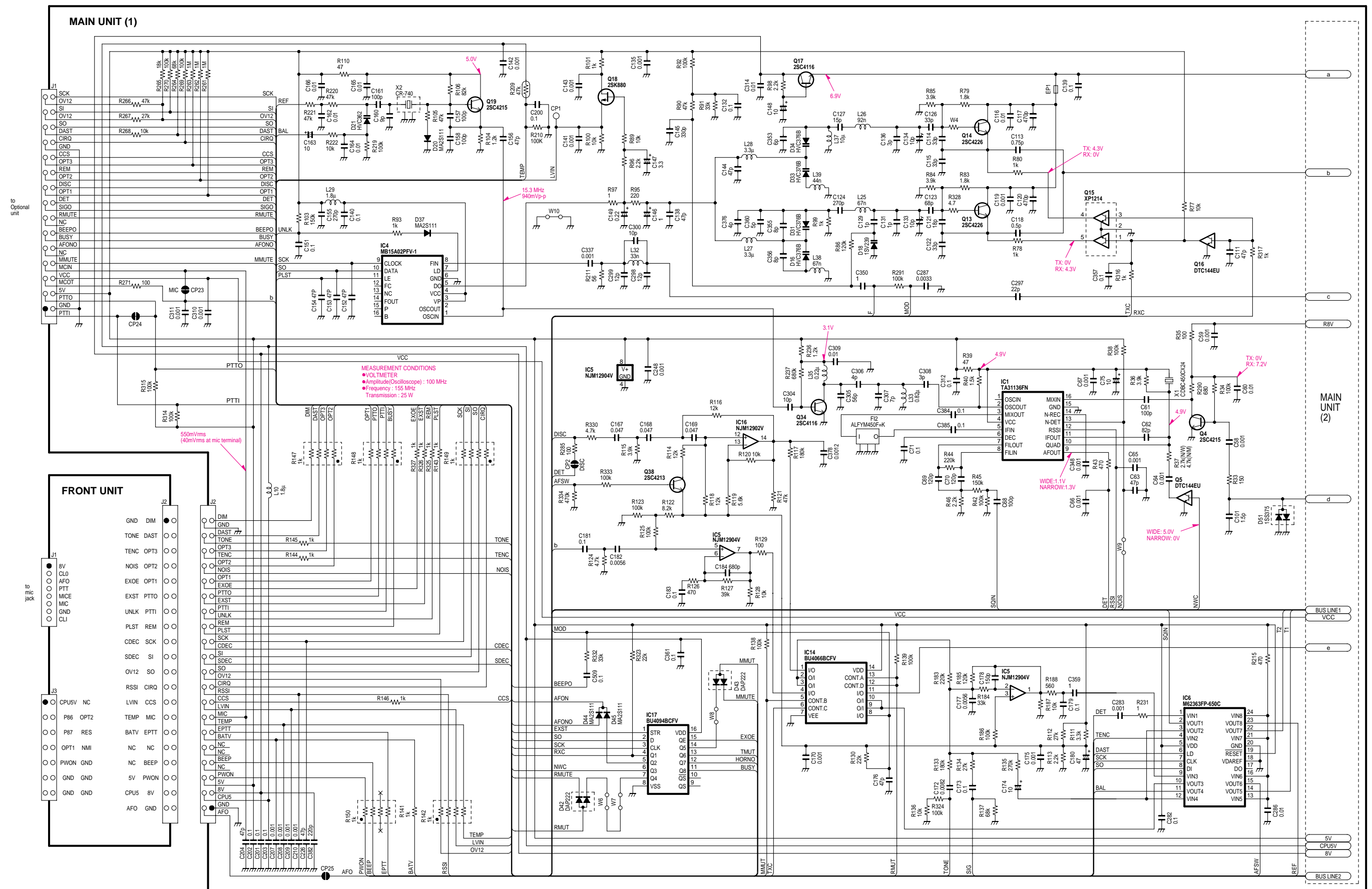


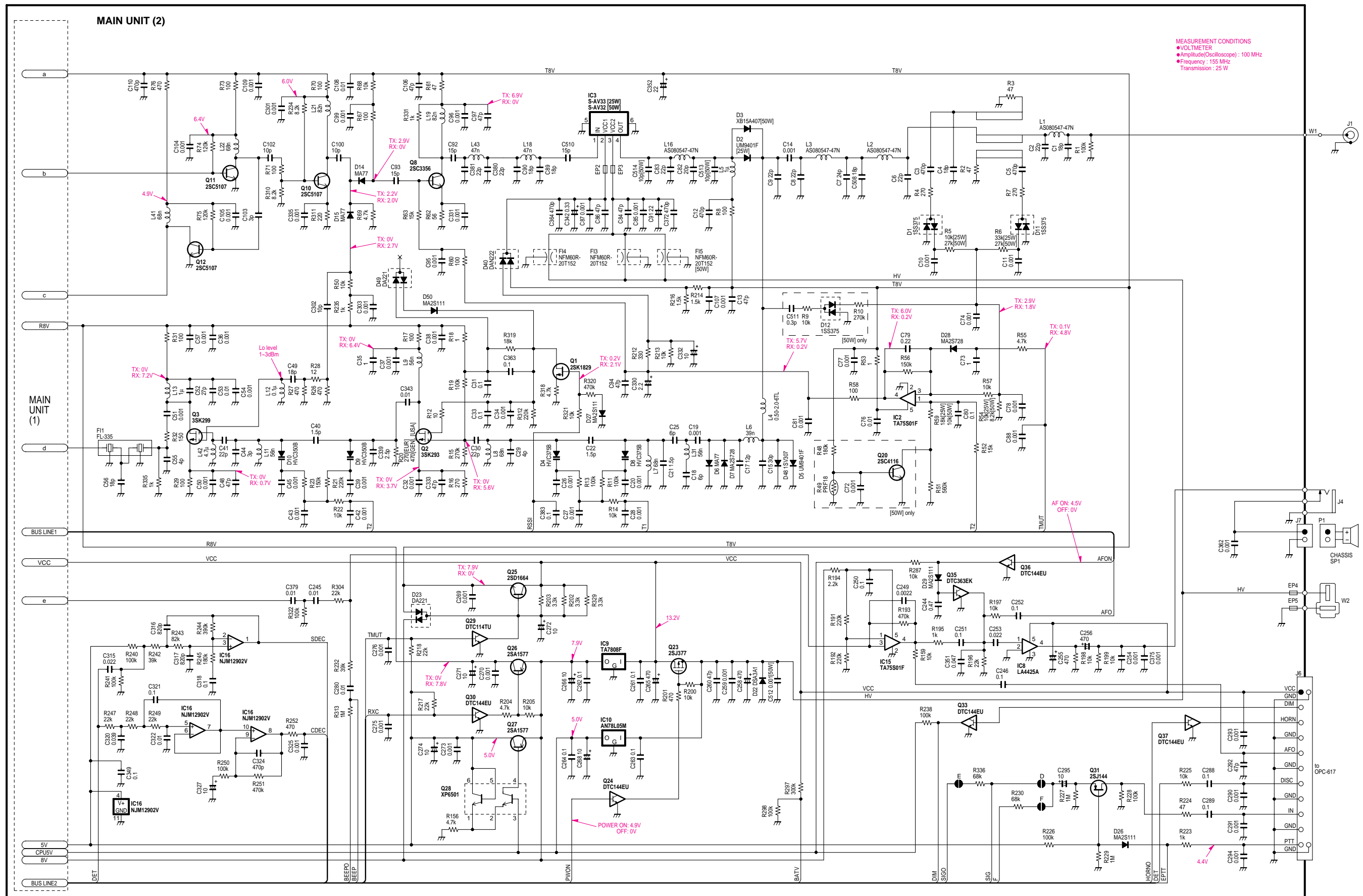
SECTION 11 VOLTAGE DIAGRAMS

11-1 FRONT UNIT



11-2 MAIN UNIT





MEASUREMENT CONDITIONS
 ● VOLTMETER
 ● Amplitude (Oscilloscope) : 100 MHz
 ● Frequency : 155 MHz
 ● Transmission : 25 W

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