



# SERVICE MANUAL

SSB RADIO TELEPHONE  
**IC-M700PRO**

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S-14410XZ-C1  
June, 2007

## INTRODUCTION

This service manual describes the latest service information for the **IC-M700PRO** SSB RADIO TELEPHON at the time of publication.

MODEL	VERSION	ALARM UNIT
IC-M700PRO	GEN-1	N/A
	GEN-2	Yes
	GEN-21	N/A
	GEN-22	Yes
	GEN-24	N/A
	GEN-25	Yes
	CHN	N/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 specified. This will ruin the transceiver.

**DO NOT** expose the transceiver to rain, snow or any liquids.

**DO NOT** reverse the polarities of the power supply when connecting the transceiver.

**DO NOT** apply an RF signal of more than 20 dBm (100 mW) to the antenna connector. This could damage the transceiver's front-end.



## ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:

1. 10-digit Icom parts numbers
2. Component name
3. Equipment model name and unit name
4. Quantity required

### <ORDER EXAMPLE>

1110003491 S.IC TA31136FNG IC-M700PRO MAIN UNIT 5 pieces  
8820001210 Screw 2438 screw IC-M700PRO Top cover 10 pieces

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

## REPAIR NOTES

1. Make sure the 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 Standard 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 a test equipment to the transceiver.

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# CONTENTS

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## SECTION 1 SPECIFICATIONS

## SECTION 2 INSIDE VIEWS

## SECTION 3 CIRCUIT DESCRIPTION

3 - 1 RECEIVER CIRCUITS .....	3 - 1
3 - 2 TRANSMITTER CIRCUITS .....	3 - 3
3 - 3 PLL CIRCUIT .....	3 - 5
3 - 4 PORT ALLOCATIONS .....	3 - 6

## SECTION 4 ADJUSTMENT PROCEDURES

4 - 1 PREPARATION .....	4 - 1
4 - 2 PLL ADJUSTMENT .....	4 - 2
4 - 3 TRANSMITTER ADJUSTMENTS.....	4 - 4
4 - 4 RECEIVER ADJUSTMENTS.....	4 - 8

## SECTION 5 PARTS LIST

## SECTION 6 MECHANICAL PARTS AND DISASSEMBLY

## SECTION 7 SEMICONDUCTOR INFORMATION

## SECTION 8 BOARD LAYOUTS

8 - 1 PLL UNIT .....	8 - 1
8 - 2 MAIN UNIT .....	8 - 2
8 - 3 LOGIC-J UNIT, ALARM AND PA150W BOARD'S .....	8 - 3
8 - 4 MIC-J, VR1/2-J, SENSOR1/2, FILTER-J AND TERMINAL-J BOARD'S.....	8 - 4

## SECTION 9 BLOCK DIAGRAM

## SECTION 10 VOLTAGE DIAGRAM

LOGIC-J UNIT, VR1/2-J, SENSOR1/2-J AND MIC-J BOARD'S .....	10 - 1
MAIN UNIT .....	10 - 2
PLL UNIT .....	10 - 5
PA150W, FILTER-J, TERMINAL-J BOARD'S .....	10 - 6

# SECTION 1

# SPECIFICATIONS

## ■ GENERAL

- Frequency coverage : Receive 500 kHz–29.9999 MHz  
Transmit 1.6000–2.9999 MHz 4.0000–4.9999 MHz  
6.0000–6.9999 MHz 8.0000–8.9999 MHz  
12.0000–13.9999 MHz 16.0000–17.9999 MHz  
18.0000–19.9999 MHz 22.0000–22.9999 MHz  
25.0000–27.50000 MHz
- Mode : J3E (USB), H3E (AM), J2B (AFSK), F1B (FSK), R3E, A1A (CW)  
(Available modes differ with version)
- Number of channels : 150 channels (max.)—3 groups of 50 channels each
- Antenna impedance : 50  $\Omega$  (nominal)
- Usable temperature range : –30°C to +60°C; –22°F to +140°F
- Frequency stability :  $\pm 10$  Hz (–30°C to +60°C; –22°F to +140°F)  
( $\pm 20$  Hz above 15 MHz)
- Power supply requirement : 13.6 V DC  $\pm 15\%$  Negative ground
- Current drain (at 13.6 V DC) : Transmit (max. output power) 30 A  
Receive (max. audio output) 2.5 A
- Dimensions (projections not included) : 291.4(W) $\times$ 116.4(H) $\times$ 315(D) mm; 11<sup>15</sup>/<sub>32</sub>(W) $\times$ 4<sup>19</sup>/<sub>32</sub>(H) $\times$ 12<sup>13</sup>/<sub>32</sub>(D) in
- Weight (with ant., battery case and cells) : 7.9 kg; 17 lb 7 oz
- Remote connector : NMEA D-sub 9-pin (female)
- ACC 1 connector : DIN 8-pin (female)
- ACC 2 connector : DIN 7-pin (female)

## ■ TRANSMITTER

- Output power (at 13.6 V DC) : 150, 60, 20 W PEP  
(60, 20 W PEP only above 24 MHz)
- Spurious emissions : –75 dB typical
- Carrier suppressions : 65 dB typical
- Unwanted sideband suppression : 75 dB typical
- Microphone impedance : 600  $\Omega$

## ■ RECEIVER

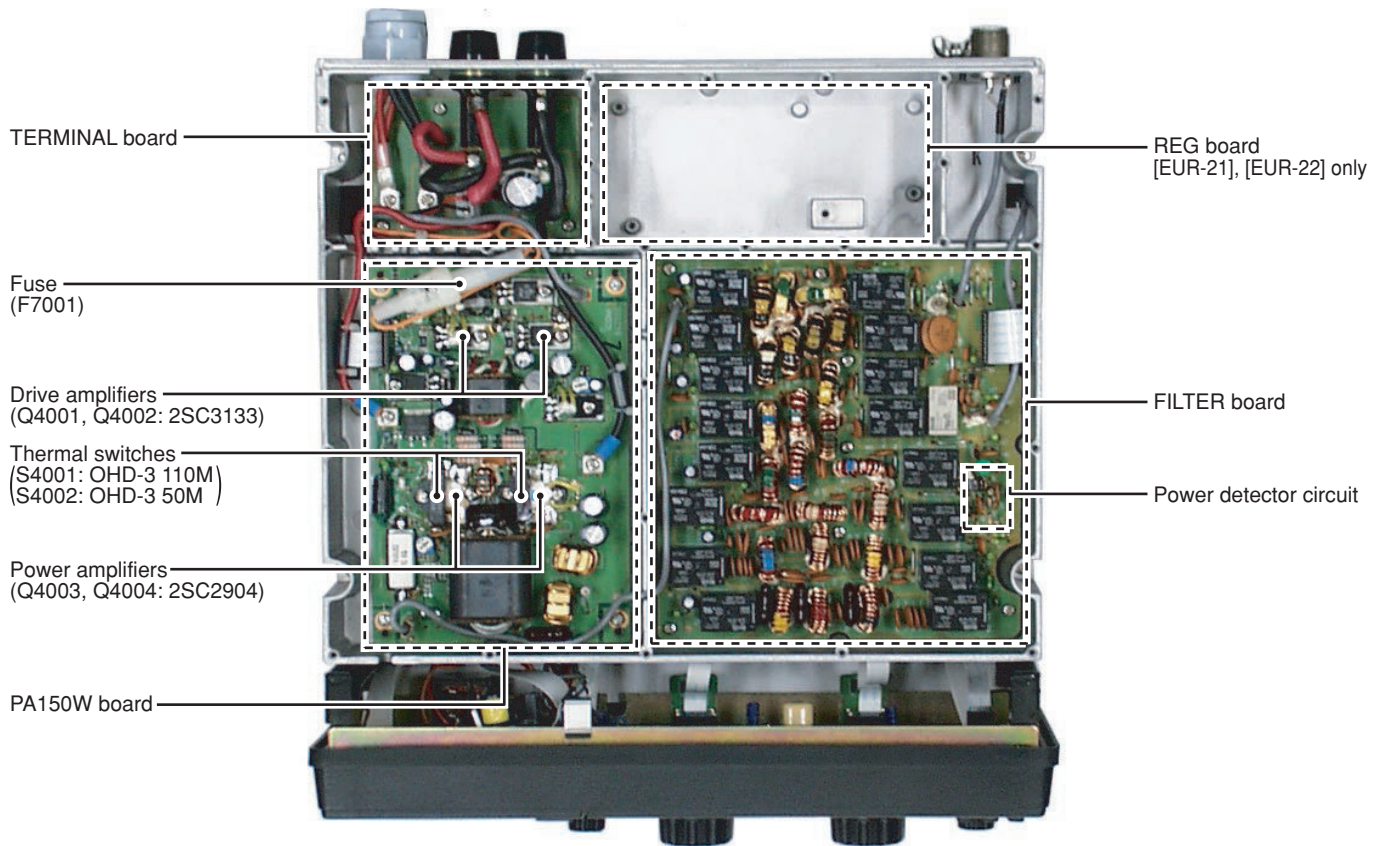
- Sensitivity :  
J3E, R3E, J2B, A1A 0.35  $\mu$ V typical (1.8000–29.9999 MHz)  
(for 12dB SINAD) 1.0  $\mu$ V (1.6000–1.7999 MHz)  
6.3  $\mu$ V (0.5000–1.5999 MHz)  
H3E (for 10dB S/N) 2.2  $\mu$ V typical (1.8000–29.9999 MHz)  
6.3  $\mu$ V (1.6000–1.7999 MHz)  
32  $\mu$ V (0.5000–1.5999 MHz)
- Spurious response rejection : 80 dB (1.6000–29.9999 MHz)
- Audio output power : 5.0 W typical (at 10% distortion with a 4  $\Omega$  load)
- Audio impedance : 4 to 8  $\Omega$
- Clarity variable range :  $\pm 150$  Hz

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

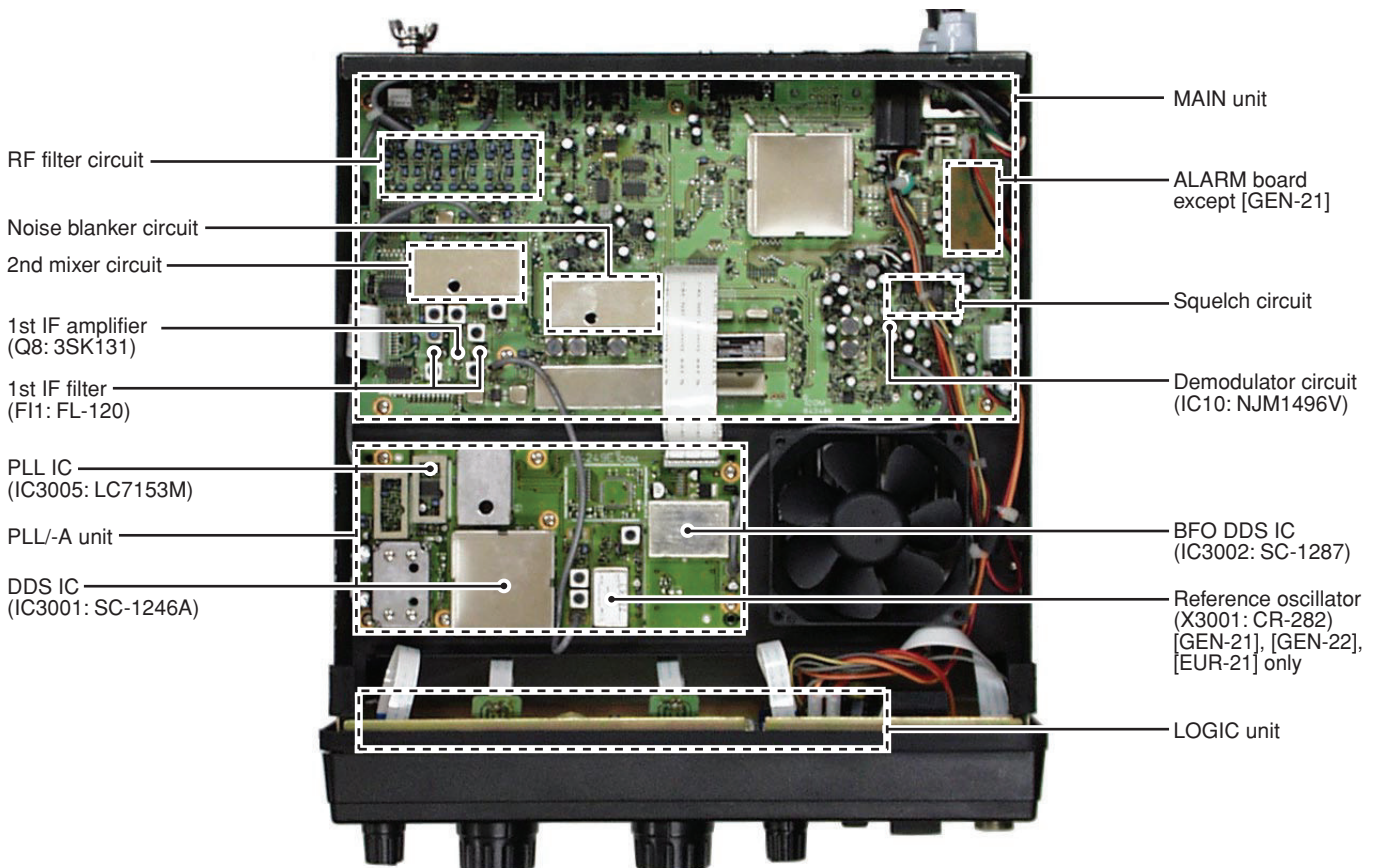
## SECTION 2

## INSIDE VIEWS

### • PA150W, FILTER AND TERMINAL BOARDS



### • MAIN, PLL AND LOGIC UNITS



## 3-1 RECEIVER CIRCUITS

### 3-1-1 RF FILTER CIRCUIT (MAIN UNIT)

Received signals from the antenna connector pass through the transmit/receive switching relay (FILTER board RL4317) and are then applied to the MAIN unit via J2.

The signals pass through the protection relay (RL2), 1.6 MHz cut off high-pass filter (L2–L4, C4–C8, C629) and are then applied to one of nine bandpass filters (including one low-pass filter for below 2.0 MHz). These filters are selected by the filter control signals (B0–B8) as described in the table below.

The filtered signals pass through the 30 MHz cut-off low-pass filter (L71, L72, C130–C134, C618), and are then applied to the 1st mixer circuit (Q6, Q7).

#### • RF FILTERS USED

Frequency (MHz)	Control signal	Entrance coil	Frequency (MHz)	Control signal	Entrance coil
0.5–1.999	B0	L49	10–13.999	B5	L28
2–2.999	B1	L8	14–17.999	B6	L33
3–4.999	B2	L13	18–23.999	B7	L38
5–6.999	B3	L18	24–29.999	B8	L43
7–9.999	B4	L23			

### 3-1-2 1ST MIXER AND IF CIRCUITS (MAIN UNIT)

The 1st mixer circuit converts the received signals into a fixed frequency, 69.0115 MHz 1st IF signal using the PLL output frequency. By changing the PLL frequency, only the desired frequency is picked up at the pair of crystal filters (F11a, F11b) at the next stage.

The IF amplifier (Q8) and resonator circuits are designed between the filter pair. The PLL output signal (1LO) enters the MAIN unit via J3 and is amplified at the 1st LO amplifier (Q5) and then applied to the 1st mixer (Q6, Q7)

### 3-1-3 2ND MIXER AND IF CIRCUITS (MAIN UNIT)

The 1st IF signal from the crystal filter (F11b) is converted again into a 9.0115 MHz 2nd IF signal at the 2nd mixer circuit (D52, L66, L67). The 60 MHz 2nd local signal (2LO) from the PLL unit enters the MAIN unit via J4 to be applied to the 2nd mixer.

The 2nd IF signal is passed through the noise blanker gate (D15, D16) and amplified at the 2nd IF amplifier (Q16) and then applied to one of the 9 MHz IF filters as described below. The passed signal is amplified at the two stage 2nd IF amplifiers (Q32, Q33) and is applied to a demodulator circuit (D39 for H3E or IC10 for J3E and others).

#### • 2ND IF FILTERS USED

MODE	Used filter	Control signal
J3E, R3E, FSK	F12	SEL8: low, H3E8: low
H3E	F13/F14	SEL8: low, H3E8: high
FSK narrow, A1A narrow	Optional narrow filter*	SEL8: high, H3E8: low

\*Built-in to the GMDSS versions

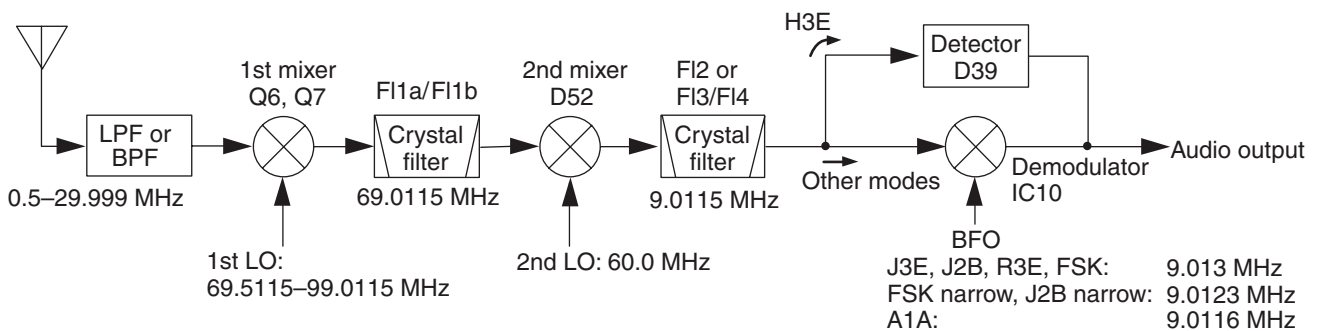
### 3-1-4 NOISE BLANKER CIRCUIT (MAIN UNIT)

The noise blanker circuit cuts off the IF circuit line at the moment of receiving a pulse-type noise.

A portion of the 2nd IF signal between resonator circuits (L83, L84 after stage of the 2nd mixer, D52) is amplified at the noise amplifiers (Q9, IC8, Q11). The signal is then detected at the noise detector (D17) to convert the noise components to DC voltages.

The signals are then applied to the noise blanker switch (Q13, Q14). At the moment the detected voltage exceeds the Q13's threshold level, Q14 outputs a blanking signal to close the noise blanker gate (D15, D16) by applying reverse-biased voltage. Q15 turns the noise blanker circuit ON and OFF.

#### • RECEIVE FREQUENCY CONSTRUCTION



The detected voltage is also applied to the noise blanker AGC circuit (Q12, Q10) and is then fed back to the noise amplifier (IC8) as a bias voltage. The noise AGC circuit prevents closure of the noise blanker gate for long periods by non-pulse-type noise. The time constant of the noise blanker AGC circuit is determined by R58 and C114.

### 3-1-5 DEMODULATOR CIRCUIT (MAIN UNIT)

This circuit mixes the 2nd IF and BFO signals to pick up the AF components (except H3E mode). The 2nd IF signal from the 2nd IF amplifier (Q33) is applied to the balanced mixer (IC10, pin 1). The 9.0116–9.0130 MHz BFO signal from the PLL unit is also applied to IC10 (pin 10). AF signals are output from pin 12 and are then applied to the AF circuits.

### 3-1-6 H3E DETECTOR CIRCUIT (MAIN UNIT)

The 2nd IF signal from the 2nd IF amplifier (Q33) is applied to the AM detector circuit (D39) to be demodulated into AF signals. The detected signals are amplified at the buffer amplifier (Q45), and are then applied to the AF circuits.

### 3-1-7 AGC CIRCUIT (MAIN UNIT)

The AGC (Automatic Gain Control) circuit reduces IF amplifier gain to prevent the receiver circuit from distorting and to keep the audio output at a constant level.

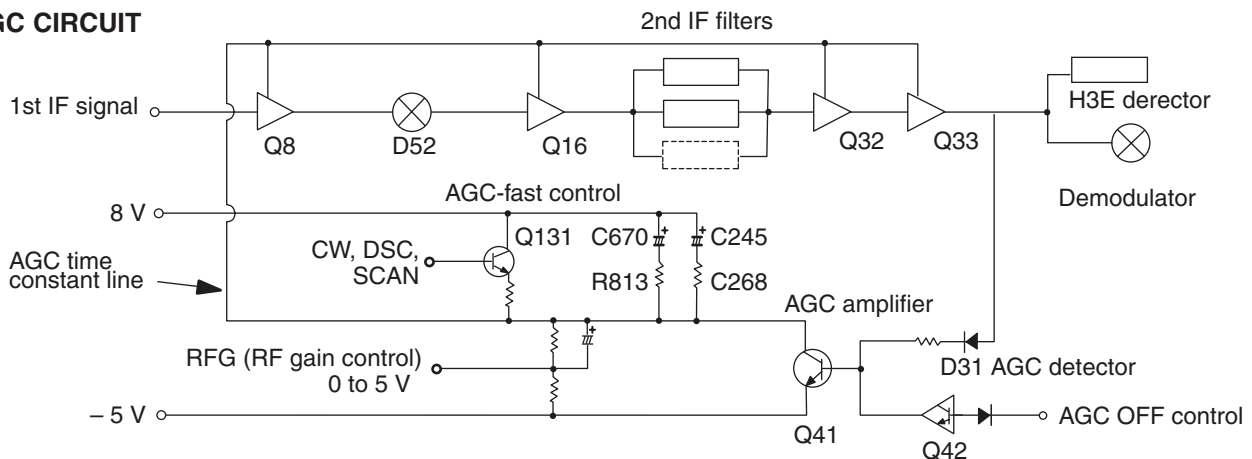
A portion of the IF signals from the 2nd IF amplifier (Q33) is detected at the AGC detector circuit (D31) and is then applied to the AGC amplifier (Q41) to control the AGC time constant line. The reference voltage of the AGC line is controlled by the “RFG” line which comes from the CPU for the RF gain setting.

When receiving a strong signal, the detected voltage increases and the voltage of the AGC line is decreased by the AGC amplifier (Q41) via the –5 V voltage line. The AGC line is used for the bias voltage of the IF amplifiers (Q8, Q16, Q32, Q33), so that these amplifiers reduce gain.

When the strong signal disappears, the AGC line voltage is released by C245/R268 and C670/R813.

The AGC switch (Q42, D38) turns the AGC circuit OFF when the AGC OFF function activates. The AGC-fast switch (Q131) sets the AGC line as fast-release during scanning, A1A mode selection and DSC operation.

#### • AGC CIRCUIT



### 3-1-8 S-METER CIRCUIT (MAIN UNIT)

The S-meter indicates the AGC level on the display, since the AGC level varies with the received signal strength.

The AGC bias voltage (AGC time constant line) from the AGC amplifier (Q41) is inverted and amplified at the meter amplifier (IC19b). The amplified signal is applied to the CPU via the “RSM” line.

### 3-1-9 AF AMPLIFIER CIRCUITS (MAIN UNIT AND LOGIC BOARD)

AF signals from the demodulator or H3E detector circuits pass through the active low-pass filter (IC20b) and squelch gate (IC12a), and are then applied to the electronic volume control (IC36). The CPU (IC132, pin 37) outputs the volume control signal (1 to 5 V) according to the [VOLUME] control setting.

The AF output signal from IC36 (9 pin) are supplied to the LOGIC unit via J23. The signals are amplified at the AF power amplifier (IC2007) and are then applied to the internal speaker via microphone connector (pins 3, 4) and external [SP] jack via the MAIN unit.

The speaker switch relay (RL2001) is connected to the (–) terminal of internal speaker for the [SPEAKER] switch function.

### 3-1-10 SQUELCH CIRCUIT (MAIN UNIT)

The transceiver has two squelch circuits, voice activated squelch for J3E/H3E and S-meter squelch for A1A/F1B/J2B.

#### (1) AF ACTIVATED SQUELCH

A portion of the AF signal from the active low-pass filter (IC20b) is amplified at the limiter amplifier (IC20a) and is then applied to the one-shot multi-vibrator (IC22c, IC22d). The one shot multi-vibrator functions as an F-V converter which generates a signal only when audio signals are received.

The output signals pass through the NOR gate (IC22b) and then the 3 Hz low-pass filter (IC21a) to remove the remaining noise components. The filtered signal is applied to the window comparator (IC21b). The NOR gate (IC22b) deactivates the audio activated squelch during A1A/F1B/J2B mode operation.

The comparator outputs “High” when the integrated signals exceed the reference voltage. C269, R310 and R780 are used as a time constant circuit. The resulting signal output from IC22a is inverted at Q46 and is then applied to the CPU as the “SQLS” signal. The CPU controls the squelch gate (IC12a) when the “SQLS” signal is received.

## (2) S-METER SQUELCH

The S-meter signal from IC19b is applied to the squelch comparator (IC19a) to close or open the squelch circuit. The reference voltage is adjusted by R257 and then applied to the (-) terminal of the comparator (IC19a). When the S-meter signal exceeds the reference voltage, the comparator outputs “High” to the CPU via IC22a and Q46 in the same manner as the voice activated squelch circuit.

## 3-2 TRANSMITTER CIRCUITS

### 3-2-1 MICROPHONE AMPLIFIER CIRCUIT (LOGIC BOARD)

The AF signals from the [MICROPHONE] connector are pass through the AF amplifier (IC2008a), and are applied to the balanced modulator (MAIN unit; IC9, pin 1) via the AF switch (IC38b). The microphone AGC circuit (D2008, D2009, Q2009) controls the amplifier gain to prevent signal distortion.

External modulation inputs from the ACC, NBDP, DSC sockets or a 2-tone emergency signal from the CPU are applied to the balanced modulator directly via AF switches (IC37–IC39).

### 3-2-2 MODULATION CIRCUIT (MAIN UNIT)

#### (1) J3E AND J2B MODES

The balanced modulator is used for J3E and J2B modes to add the audio signal to the BFO frequency, and outputs the IF signal while suppressing the BFO signal.

The AF signals from the microphone amplifier or external audio from the modulation terminals are applied to the balanced modulator (IC9, pin 1). The BFO signal from the PLL unit is applied to (IC9, pin 10) as a carrier signal. A double sideband signal is output from IC9 (pin 6), and is then applied to the 9 MHz filter (FI2) to create an SSB signal.

R238 adjusts the balanced level of IC9 for maximum carrier suppression. In J2B mode, the BFO frequency is shifted 1.7 kHz to set the transmit frequency the same as the displayed frequency.

The SSB signal from FI2 is amplified at the 9 MHz amplifiers (Q17–Q19) and is then applied to the mixer circuit (D52). The switching diode (D19) is turned ON when R8 voltage disappears.

#### (2) H3E AND R3E MODES

An SSB signal is applied to the IF amplifier (Q18) in the same manner as with J3E/J2B mode. The BFO signal from the PLL unit is amplified at the buffer amplifier (Q30) and is then applied to the IF amplifier (Q18) as a carrier signal to be added to an SSB signal. R211 and R212 adjust the carrier levels in H3E and R3E modes, respectively.

#### (3) A1A AND F1B MODES

The CW8 or FSK8 voltage are applied to the balanced modulator (IC9, pin 4) to upset the balance and create a carrier signal.

In A1A mode, the CW keying circuit (IC18a) controls the bias voltage of the IF amplifiers (Q18, Q19) and T/R switching diode (D19) to switch the carrier transmission.

In F1B mode, BFO frequency is shifted in the PLL unit to create the mark and space frequencies.

### 3-2-3 1ST MIXER CIRCUIT (MAIN UNIT)

The amplified signal from the IF amplifier (Q17) is mixed with a 60 MHz LO signal at the 1st mixer circuit (D52) to produce a 69.0115 MHz IF signal. The mixer is commonly used with the receiver 2nd mixer.

The 69.0115 MHz IF signal passes through the filter (FI1b) and is then applied to the 2nd mixer circuit.

### 3-2-4 2ND MIXER CIRCUIT (MAIN UNIT)

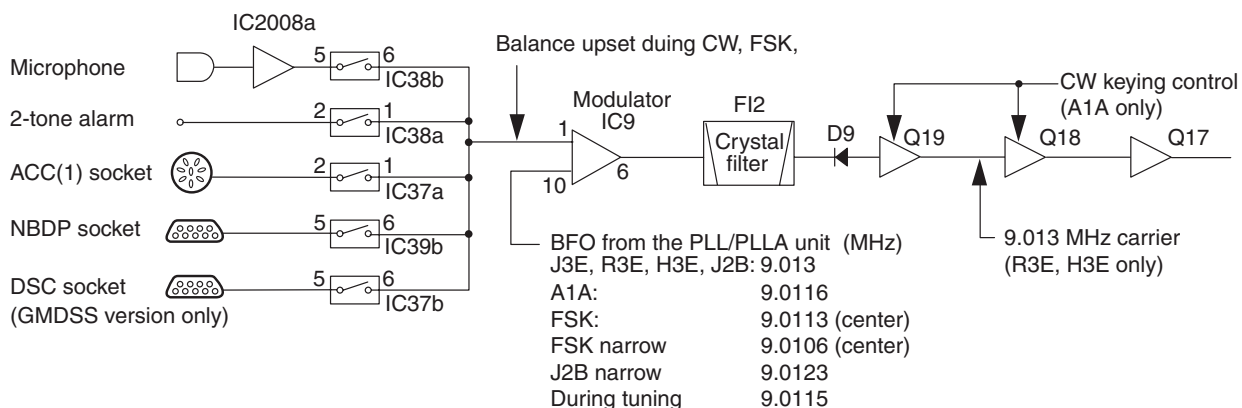
The filtered signal is mixed with a PLL output frequency (1LO: 69.5155–99.0155 MHz) at the 2nd mixer circuit (Q3, Q4) to produce an RF signal which is the same frequency as the displayed one.

### 3-2-5 RF FILTER CIRCUIT (MAIN UNIT)

The RF signal passes through the low-pass filter (L55, L56, C89–C93, C620, C628) and is then amplified at the RF amplifier (Q2).

The amplified signal is applied to one of nine RF filters. These RF filters are commonly used with the receiver circuit which consists of eight high-pass filters and one low-pass filter. The filtered signal is amplified at the RF amplifier (Q1) and is then applied to the PA150W board via J1.

## • MODULATOR CIRCUIT





### 3-2-6 POWER AMPLIFIER CIRCUIT (PA150W BOARD)

This circuit provides a stable 150 W (at 13.6 V) of output power. The RF signal from the MAIN unit is amplified at the pre-driver (Q4008), drivers (Q4001, Q4002), and power amplifiers (Q4003, Q4004).

The driver and power amplifiers form class AB push-pull circuits. Bias voltage to these transistors is produced by diodes (D4001–D4003) which have temperature junctions with the transistors.

The amplified signal is then applied to one of eight low-pass filters to suppress high harmonic components. The filtered signal passes through the power detector circuit (FILTER board; L4341) and transmit/receive switching relay (FILTER board; RL4317) and is then applied to the antenna connector.

#### • LOW-PASS FILTERS USED (FILTER BOARD)

Frequency (MHz)	Control signal	Entrance Relay	Frequency (MHz)	Control signal	Entrance Relay
0.5–1.999	L0	RL4301	10–13.999	L5	RL4311
2–2.999	L1	RL4303	14–17.999	L6	RL4313
3–4.999	L2	RL4305	18–19.999		
5–6.999	L3	RL4307	20–21.999	L7	RL4315
7–9.999	L4	RL4309	22–23.999		
			24–29.999		

### 3-2-7 ALC CIRCUIT

The transceiver has two ALC (Auto Level Control) loops for constant output power over all marine bands and for high power setting.

#### (1) IF ALC CIRCUIT (MAIN UNIT)

A portion of the IF signals from the IF amplifier (Q17) is applied to the IF ALC circuit. The signal is amplified at Q126 and then detected at the ALC detector (D46). The detected signal is amplified at the ALC amplifier (IC17b) and is then applied to the comparator (IC17a).

The reference voltage for the comparator is set by R184. The antenna tuning control voltage (TUN8) and low power set signal (POC1) are also affected by the reference voltage to decrease the IF signal level.

The comparator output controls the gate bias of the IF amplifier (Q19), so that the IF signal level is determined by the reference voltage of the comparator (IC17a).

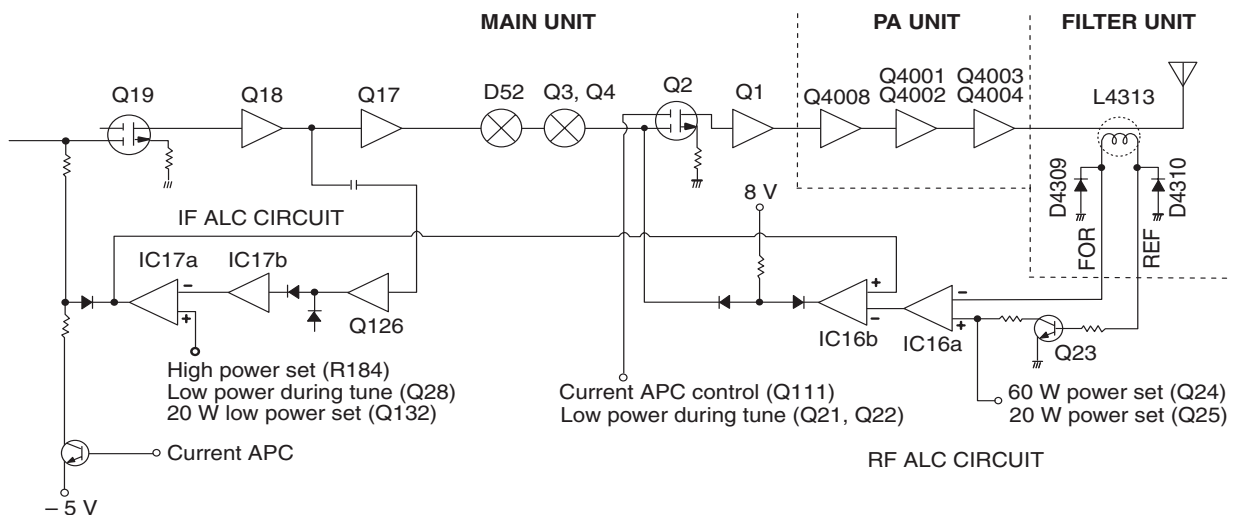
#### (2) RF ALC CIRCUIT (FILTER BOARD)

The RF output power level is detected at D4309 of the power detector circuit (FILTER board; L4341, D4309, D4310). The detected signal (“FOR” signal) is applied to the RF ALC amplifier (MAIN unit; IC16a).

The amplified signal enters the transmit gain controller (IC16b) which functions as an inversion amplifier. The gain controller decrease the gain of the IF amplifier (MAIN unit; Q2) to constant output power from differential amplifier gains which are occurred by their frequency characteristics.

The bias voltage of the RF ALC amplifier (IC16a) is controlled by the low power control signal (POC1 for 20 W, POC2 for 60 W) and APC signal.

#### • ALC CIRCUIT



### 3-2-8 APC CIRCUIT

The APC (Auto Power Control) circuit protects the power amplifiers on the PA unit from high SWR and excessive current.

#### (1) SWR APC (FILTER BOARD AND MAIN UNIT)

The reflected wave signal appears and increases on the antenna connector. When the antenna is mismatched, D4310 of the power detector circuit (FILTER board; D4309, D4310, L4341) detects the signal and applies it to the APC amplifier (MAIN unit; Q23). The amplified signal decreases the bias voltage of the RF ALC amplifier to reduce the output power.

#### (2) CURRENT APC (PA150W BOARD AND MAIN UNIT)

The power transistor current is detected from the different voltages between both terminals of a 0.012 Ω resistor (R4026) on the PA150W board. The detected voltage is applied to the differential amplifier (IC4002b). When the current of the final transistors is more than 30 A, the detected voltage is applied to the APC amplifier controller (MAIN unit; Q111) to reduce the gate-2 voltage of the IF amplifier (MAIN unit; Q2) and thus reduce the output power.

### 3-2-9 TEMPERATURE DETECTION (PA150W BOARD)

Thermal switches (S4001, S4002) protect the final transistors from excessive temperatures. When the temperature of the final transistors exceeds 50°C (122°F), S4002 is turned ON to start the cooling fan. When the temperature of the final transistors exceeds 110°C (230°F), S4001 is turned ON to control the “POC2” line and sets the power to 60 W.

### 3-2-10 RF METER CIRCUIT (MAIN UNIT)

The output of the ALC amplifier (IC16a) is applied to the CPU (pin 31) to indicate the transmit power level on the display.

For antenna current meter indication, the “ANTC” signal from an optional AT-130E is applied to the CPU (pin 32).

### 3-3 PLL CIRCUIT

#### 3-3-1 GENERAL

The PLL unit generates a 1st LO frequency (69.5115–99.0114 MHz), 2nd LO frequency (60 MHz) and a BFO frequency (9.0106–9.013 MHz) for the MAIN unit. The 1st LO PLL adopts a mixerless dual loop PLL system. The BFO uses a DDS and a 2nd LO as a fixed frequency double that the crystal oscillator.

#### 3-3-2 1ST LO PLL (PLL UNIT)

The 1st LO PLL contains a main loop and reference loop as a dual loop system. The reference loop generates a 10.65 to 10.75 MHz frequency using a DDS circuit, and the main loop generates a 69.5115 to 99.0114 MHz frequency using the reference loop frequency.

##### (1) REFERENCE LOOP PLL

The oscillated signal at the reference VCO (Q3005, D3003) is amplified at the buffer amplifiers (Q3006, Q3011) and is then applied to the DDS IC (IC3001, pin 46). The signal is then divided and detected on phase with the DDS generated frequency.

The detected signal output from IC3001 (pin 56) is converted into a DC voltage (lock voltage) at the loop filter (R3018, R3019, C3044) and then fed back to the varactor diode (D3003) in the VCO circuit.

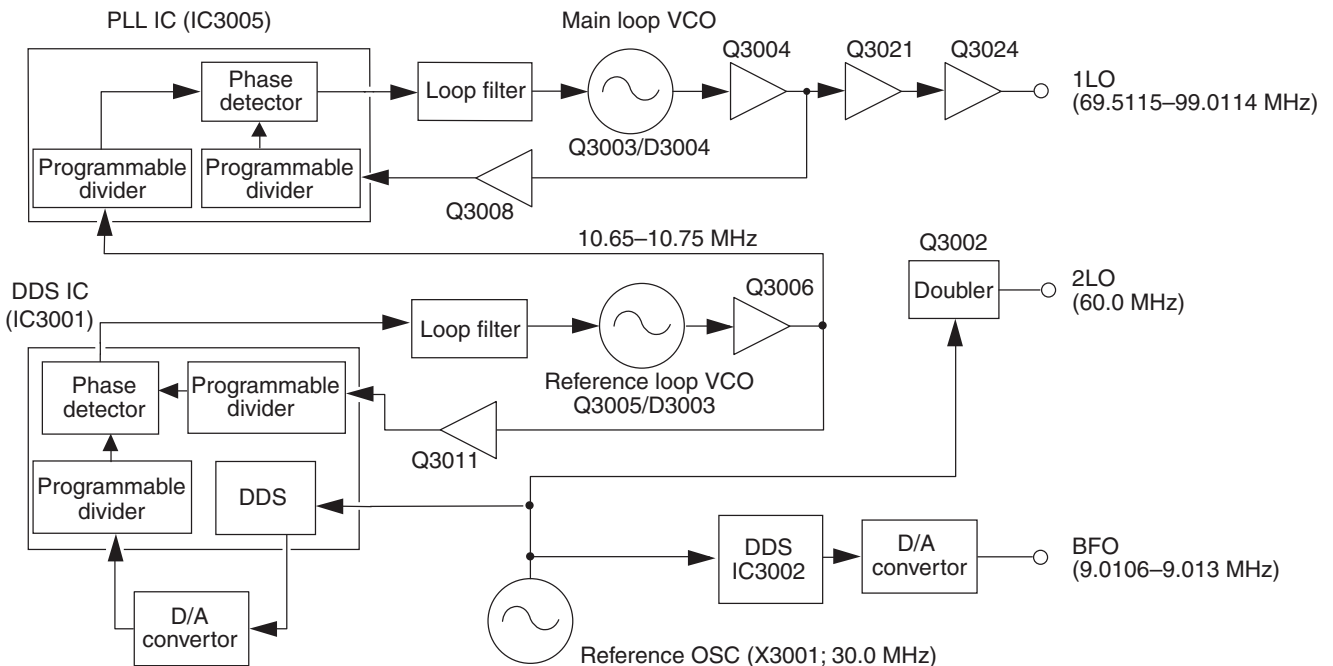
##### (2) MAIN LOOP PLL

The oscillated signal at the main loop VCO (Q3003, D3004) is amplified at the buffer amplifiers (Q3004, Q3008), and is then applied to the PLL IC (IC3005, pin 14). The signal is then divided and detected on phase with the reference loop output frequency.

The detected signal output from IC3005 (pins 3009, 3010) is converted into a DC voltage (lock voltage) at the loop filter and then fed back to the varactor diode (D3004) in the VCO circuit.

The oscillated signal is amplified at the buffer amplifiers (Q3004, Q3021, Q3024) and then applied to the MAIN unit as a 1st LO signal.

#### • PLL CIRCUIT



### 3-3-3 2ND LO AND REFERENCE OSCILLATOR CIRCUITS

The reference oscillator (X3001) generates 30.0 MHz frequency used for the both DDS ICs as a system clock and for the LO output. The oscillated signal is doubled at the driver (Q3002) and picked up the 60 MHz frequency at the resonator circuit (L3004, L3005). The 60 MHz signal is applied to the MAIN unit as a 2nd LO signal.

### 3-3-4 BFO CIRCUIT

The DDS IC (IC3002) generates a 10-bit digital signal using the 30 MHz system clock. The digital signal is converted to an analog wave signal at the D/A converter (R3120–R3139). The analog wave is passed through the low-pass filter (L3037, L3038, C3154–C3158), and is then applied to the MAIN unit as the BFO signal. The PA unit separate grounding from the other units to obtain floating.

### 3-4 PORT ALLOCATIONS CPU (MAIN unit; IC132)

Pin number	Port name	Description
1	RES	Input port for the CPU reset signal. When receiving a "LOW" pulse, the CPU is reset.
10	RXDO	Data input port from the sub CPU in the FRONT unit.
11	TXDO	Data output port to the sub CPU in the FRONT unit.
16	NSEN	Input port to the sub CPU in the FRONT unit.
17	POC2	Outputs low power control signal for 60 W power.
18	POC1	Outputs low power control signal for 20 W power.
20	CWIN	Input port for the CW keying. High: When key is closed.
21	ASEN	Outputs a "SEND" control signal for the ACC (1) and ACC (2) sockets.
22	CSEN	Outputs a "SEND" control signal for T8 and R8 voltage line control. Low : For transmit.
23	ALMS	Outputs an alarm control signal to activate the 2-tone emergency alarm encoder. High : Alarm ON.
24	ALMC	Outputs a tone switching signal for the 2-tone emergency alarm encoder. High : High tone.
25	SCL	Outputs a clock signal for the EEPROM (IC134).
26	SDA	Data bus line for the EEPROM (IC134).
27	SO	Outputs a serial signal for the EEPROM (IC135).
28	SDA	Data bus line for the EEPROM (IC135).
30	RSM	Input port for the S-meter indication.
31	MFOR	Input port for the RF-meter indication.
32	ANTC	Input port for the antenna current meter indication for [EUR] version. The ANTC signal can be received when an optional AT-130E is connected.
33	SQLS	Input port for the squelch detected signal. High : When squelch is open.
34	TRC	Input port for the transmit/receive switching signal.
35	SCAS	Input port for the scan control signal from the ACC (1) socket.
36	RFG	Outputs RF gain control signal to the AGC circuit.

**(MAIN unit; IC132)–Continued**

<b>Pin number</b>	<b>Port name</b>	<b>Description</b>
37	AFG	Outputs AF gain control signal to the control (IC36).
39	STAT	Outputs the "tuner start" pulse to an optional AT-130E.
40	BEEP	Outputs a BEEP signal (1 kHz or 500 Hz).
41	STB1	Outputs a strobe signal to the main loop PLL IC (C3005).
42	STB2	Outputs a strobe signal to the reference loop DSS IC (IC3001).
48	STB3	Outputs a strobe signal to the BFO PLL IC (IC3002).
49	DATA	Outputs a data signal to PLL and DDS ICs.
50	CK	Outputs a clock signal to PLL and DDS ICs.
51	SQL C	Outputs an AF mute signal for squelch function. High : Squelch closed.
52	NBS	Outputs a "noise blanker" signal. High : Noise blanker is on
53	AGCS	Outputs an AGC -OFF signal. High: AGC deactivate.
54	NMS	Outputs an external NBDP equipment control signal. Low: During NBDP data output.
55	P20	Outputs a strobe signal for an initial matrix.
57–60	P17–P14	Input ports for an initial matrix.
61–64	PD–PA	Output band signals for RF LPF and BPF selection.
65–67	J2B, R3E, H3E	Outputs mode signals.
68	KEY	Input port for an optional AT-130E. Low : During tuning.
69	CW	Outputs a mode signal.
70	TUNE	Outputs an antenna tuner tuning control signal for transceiver's power/mode control.
71	FSEL	Outputs a narrow filter selection signal. Low : Optional narrow filter selection.
72	PROG	Outputs a program scan control signal for "AGC fast" and "audio squelch" deactivation.

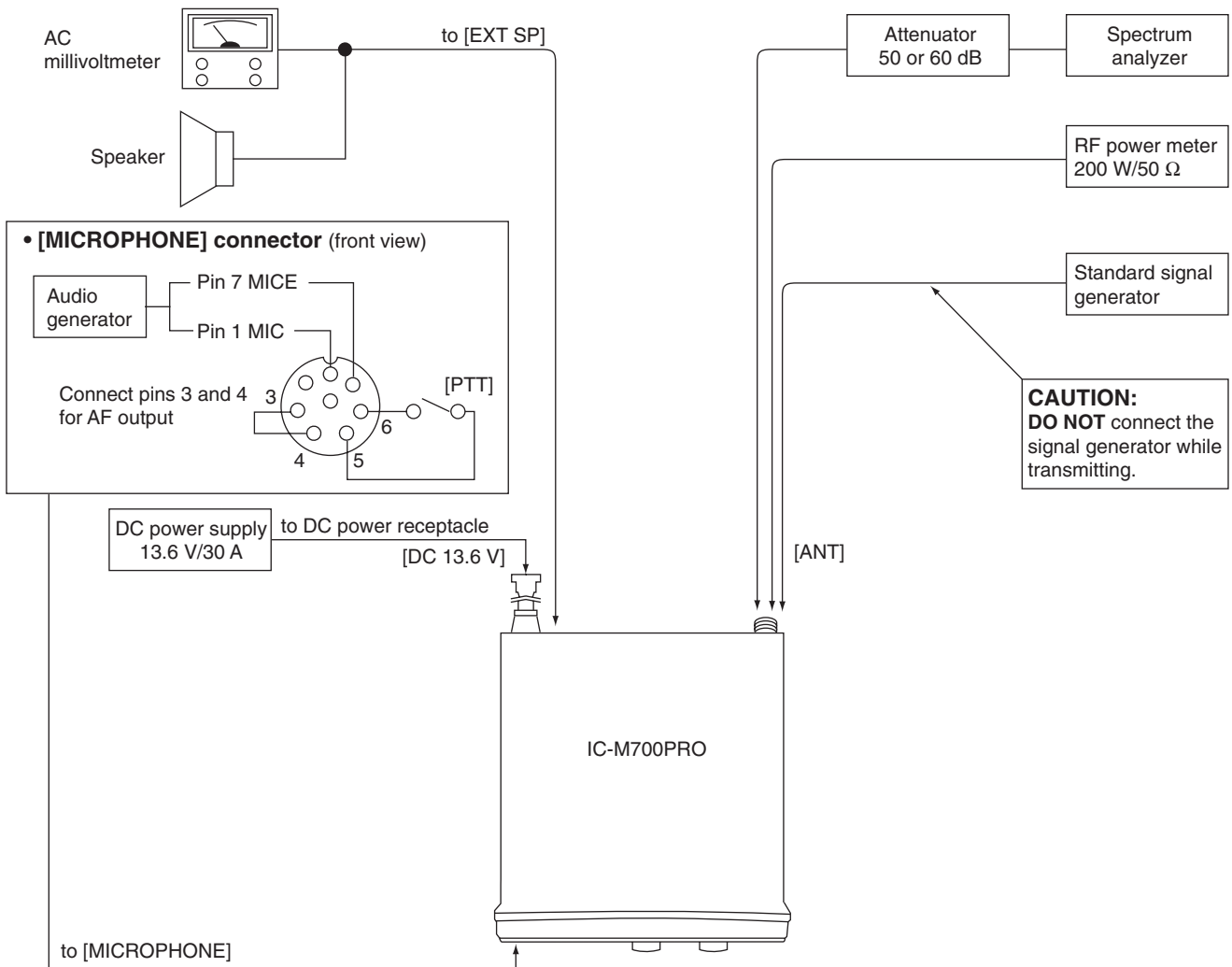
# SECTION 4 ADJUSTMENT PROCEDURE

## 4-1 PREPARATION

### • REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.6 V DC Current capacity : 30 A or more	Audio generator	Frequency range : 300–3000 Hz Measuring range : 1–500 mV
RF power meter (terminated type)	Measuring range : 10–200 W Frequency range : 1.8–30 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Standard signal generator (SSG)	Frequency range : 0.1–30 MHz Output level : 0.1 μV–32 mV (–127 to –17 dBm)
Frequency counter	Frequency range : 0.1–100 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	Oscilloscope	Frequency range : DC–100 MHz Measuring range : 0.01–10 V
		AC millivoltmeter	Measuring range : 10 mV–10 V
RF voltmeter	Frequency range : 0.1–100 MHz Measuring range : 0.01–10 V	External speaker	Input impedance : 4 Ω Capacity : 6 W or more
DC voltmeter	Input impedance : 50 Ω/V DC or better	Attenuator	Power attenuation : 50 or 60 dB Capacity : 150 W or more
Spectrum analyzer	Frequency minimum : At least 90 MHz Spectrum bandwidth : 100 kHz or more	DC ammeter	Measurement capability: 1 A/3 A/50 A

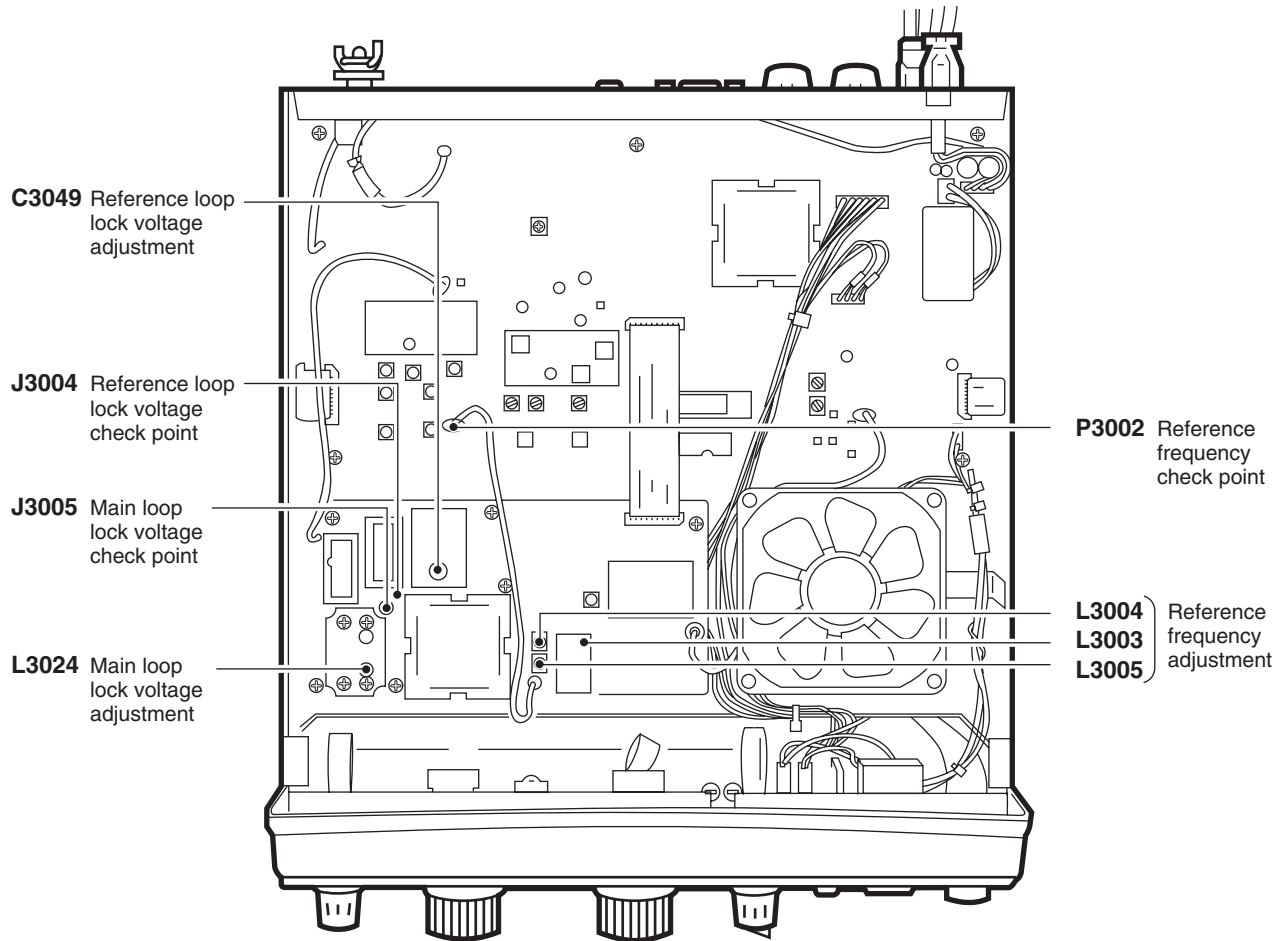
### • CONNECTION



## 4-2 PLL ADJUSTMENTS

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
REFERENCE LOOP LOCK VOLTAGE	1	<ul style="list-style-type: none"> <li>• Display frequency : 7.9999 MHz</li> <li>• Mode : J3E</li> <li>• Receiving</li> </ul>	PLL	Connect a digital multimeter or oscilloscope to check point J3004.	3.2 V	PLL	C3049
	2	<ul style="list-style-type: none"> <li>• Display frequency : 0.0300 MHz</li> </ul>			More than 1.5 V		Verify
MAIN LOOP LOCK VOLTAGE	1	<ul style="list-style-type: none"> <li>• Display frequency : 0.5000 MHz</li> <li>• Receiving</li> </ul>	PLL	Connect a digital multimeter or oscilloscope to check point J3005.	4.0 V	PLL	L3024
	2	<ul style="list-style-type: none"> <li>• Display frequency : 29.9999 MHz</li> </ul>			More than 1.0 V		Verify
REFERENCE FREQUENCY	1	<ul style="list-style-type: none"> <li>• Wait for 5 min. after power ON.</li> <li>• Terminate P3002 to ground with a 50 ohms resistor.</li> <li>• Receiving</li> </ul>	PLL	Connect an RF voltmeter to check point P3002.	Maximum level (More than +2 dBm)	PLL	L3004, L3005
	2			Connect a frequency counter to check point P3002.	60.000000 MHz		L3003

• MAIN AND PLL UNITS

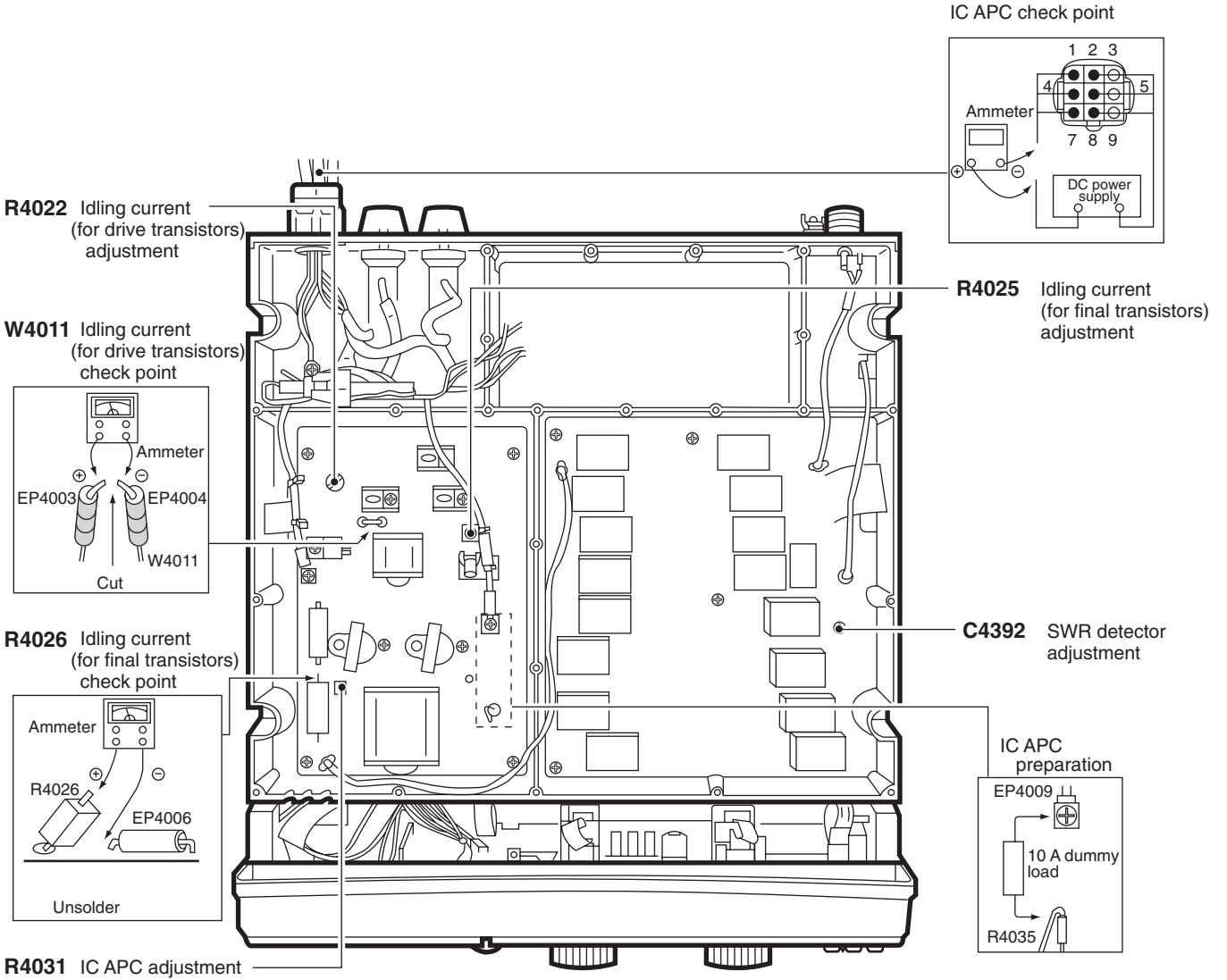


## 4-3 TRANSMITTER ADJUSTMENTS

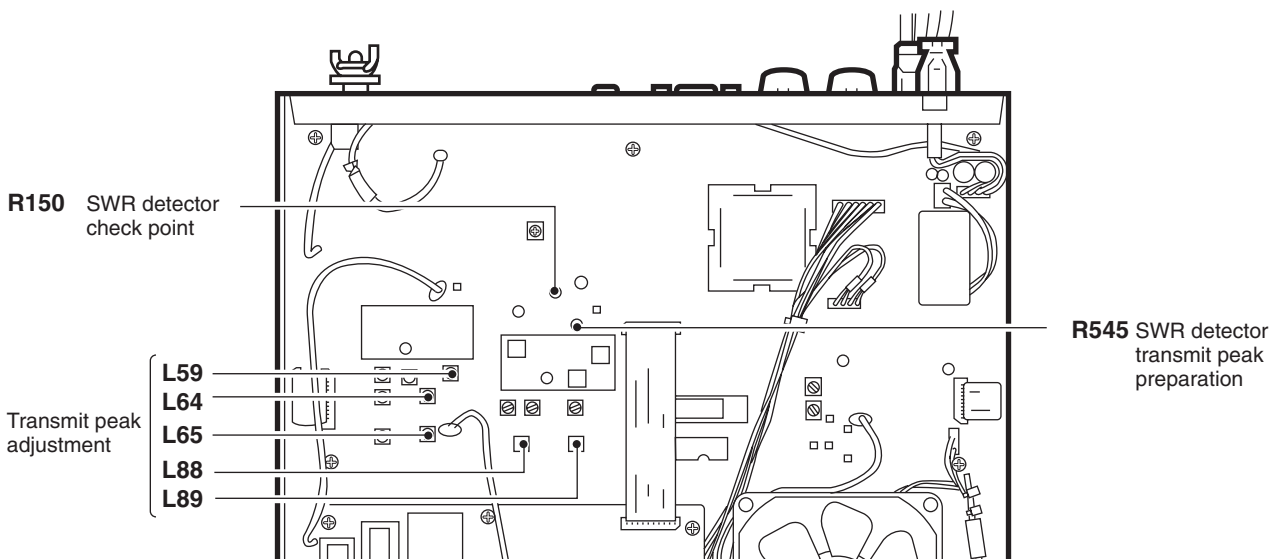
ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
IDLING CURRENT (For drive transistors)	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• mode : J3E</li> <li>• Apply no audio signal to the [MICROPHONE] connector.</li> <li>• Transmitting</li> </ul>	PA	Cut the lead wire (W4011) and connect a DC ammeter (1 A) to the cut points.	100 mA	PA	R4022
	After adjustment, re-solder the lead wire (W4011).						
(For final transistors)	2	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• mode : J3E</li> <li>• Apply no audio signal to the [MICROPHONE] connector.</li> <li>• Transmitting</li> </ul>	PA	Unsolder R4026 and connect the DC ammeter (3 A) to the unsoldered points.	500 mA	PA	R4025
	After adjustment, re-solder R4026.						
IC APC	1	<ul style="list-style-type: none"> <li>• Display frequency : 22.0000 MHz</li> <li>• Mode : J3E</li> <li>• Preset R4031 on the PA unit to the maximum counterclockwise position.</li> <li>• Connect a dummy load (10 A) between lead of R4035 (power line) and EP4009 (power ground) on the PA unit.</li> <li>• Connect an audio generator to the [MICROPHONE] connector and set as: Frequency : 1.5 kHz Level : 100 mV rms</li> <li>• Connect an RF power meter to the [ANT] connector.</li> <li>• Transmitting</li> </ul>	Rear Panel	Connect a DC ammeter (50 A) between the DC power supply and DC power receptacle (DC input +).	30 A	PA	R4031
	After adjustment, remove the dummy load.						
SWR DETECTOR	1	<ul style="list-style-type: none"> <li>• Display frequency : 22.0000 MHz</li> <li>• Mode : J3E</li> <li>• Ground the lead of R545 on the MAIN unit with a wire.</li> </ul>	Rear Panel	Connect an RF power meter to the [ANT] connector.	140 W	Audio generator	Output level
	2	<ul style="list-style-type: none"> <li>• Connect an audio generator to the [MICROPHONE] connector and set as: Frequency : 1.5 kHz</li> <li>• Transmitting</li> </ul>	MAIN	Connect a DC voltmeter to R150.	Minimum level	FILTER	C4392
	After adjustment, remove the wire from R545.						
TRANSMIT PEAK	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> <li>• Ground the lead of R545 on the MAIN unit with a wire.</li> <li>• Connect an audio generator to the [MICROPHONE] connector and set as: Frequency : 1.5 kHz Level : 3 mV</li> <li>• Transmitting</li> </ul>	Rear Panel	Connect an RF power meter to the [ANT] connector.	Maximum output power	MAIN	Adjust in sequence L89, L88, L65, L64, L59
	After adjustment, remove the wire from R545.						



• PA AND FILTER BOARDS



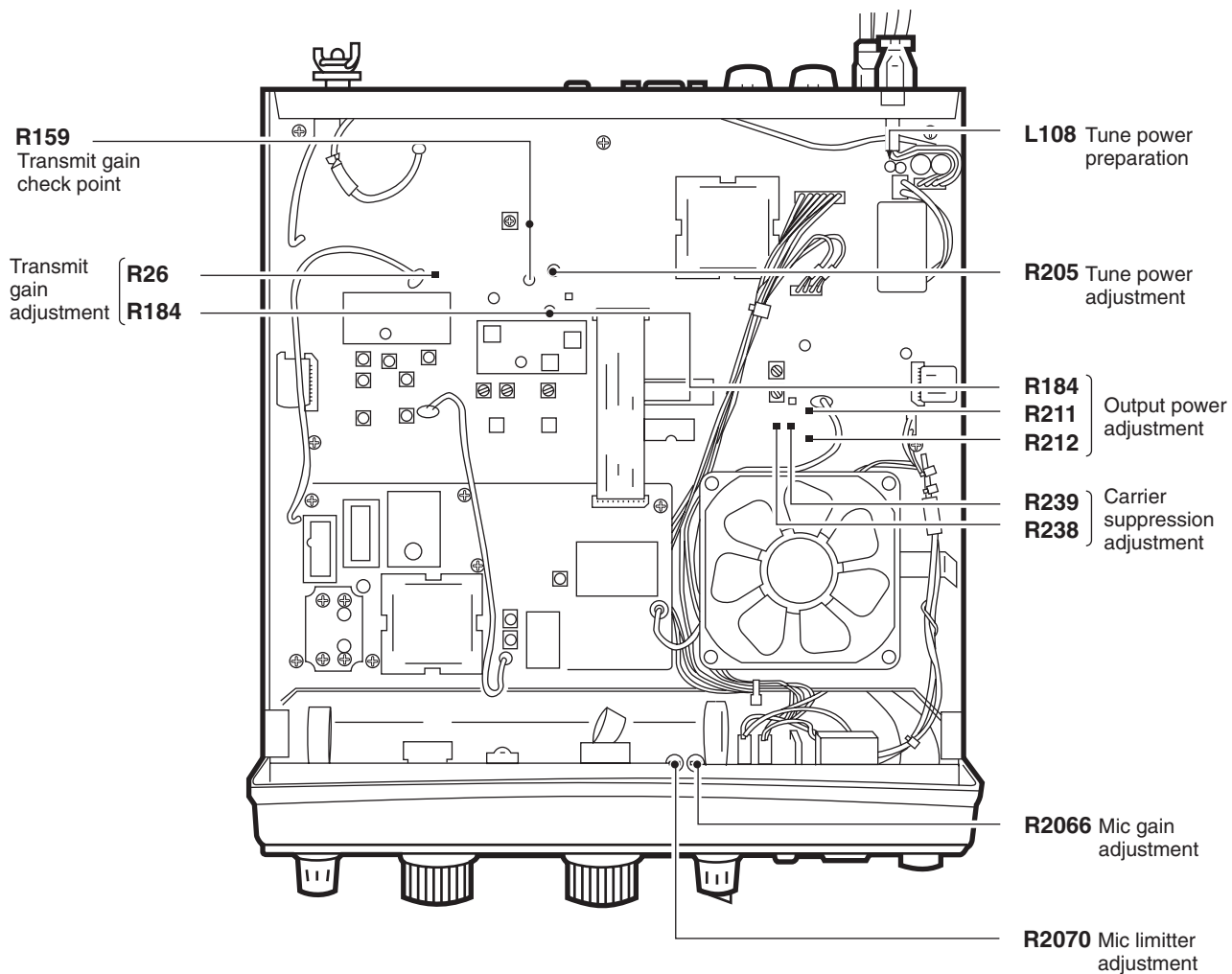
• MAIN UNIT



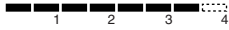
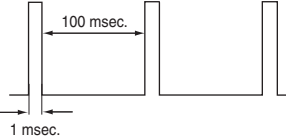
## TRANSMITTER ADJUSTMENTS (continued)

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
TRANSMIT GAIN	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• mode : A1A</li> <li>• Transmitting</li> </ul>	Rear Panel	Connect an RF power meter to the [ANT] connector.	140 W	MAIN	R184
	2	<ul style="list-style-type: none"> <li>• Display frequency : 16.3650 MHz</li> <li>• Transmitting</li> </ul>	MAIN	Connect a digital multimeter to R159.	0.5 V		R26
OUTPUT POWER	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : H3E</li> <li>• Apply no audio signal to the [MICROPHONE] connector.</li> <li>• Transmitting</li> </ul>	Rear Panel	Connect an RF power meter to the [ANT] connector.	45 W	MAIN	R211
	2	<ul style="list-style-type: none"> <li>• Mode : R3E</li> <li>• Transmitting</li> </ul>			2.0 W		R212
	3	<ul style="list-style-type: none"> <li>• Mode : A1A</li> <li>• Transmitting</li> </ul>			140 W		R184
CARRIER SUPPRESSION	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> <li>• Apply no audio signal to the [MICROPHONE] connector.</li> <li>• Transmitting</li> </ul>	Rear Panel	Connect a spectrum analyzer or RF voltmeter to the [ANT] connector via an attenuator.	Minimum carrier level (Less than -40 dB)	MAIN	Adjust alternately R238, R239
TUNE POWER	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Ground the lead of L108 (KEY line) on the MAIN unit with a wire.</li> <li>• Transmitting</li> </ul>	Rear Panel	Connect an RF power meter to the [ANT] connector.	10 W	MAIN	R205
POWER METER	1	<ul style="list-style-type: none"> <li>• While pushing the [SQL] and [ENT] switches, turn power ON.</li> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> <li>• Connect an audio generator to the [MICROPHONE] connector and set as:</li> </ul>	Rear Panel	Connect an RF power meter to the [ANT] connector.	17 W	Audio generator	Output level
	2	<ul style="list-style-type: none"> <li>• Set the transmit power: [PO-1] (20 W PEP)</li> <li>• Transmitting</li> </ul>			Push the [DIMMER] switch.	Font Panel	[DIMMER]
MIC LIMITTER	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> <li>• Disconnect BFO plug (J5) on the MAIN unit.</li> <li>• Connect an audio generator to the [MICROPHONE] connector and set as:</li> <li>• Transmitting</li> </ul>	MAIN	Connect an oscilloscope to R243.	70 mV PEP	LOGIC	R2070
MIC GAIN	1	<ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> <li>• Connect an audio generator to the [MICROPHONE] connector and set as:</li> <li>• Transmitting</li> </ul>	Rear Panel	Connect an RF power meter to the [ANT] connector.	100 W	LOGIC	R2066

• MAIN UNIT AND LOGIC BOARD



## 4-4 RECEIVER ADJUSTMENTS

ADJUSTMENT	ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
RECEIVER GAIN	1 <ul style="list-style-type: none"> <li>• Display frequency : 2.1820 MHz</li> <li>• Mode : J3E</li> <li>• Noise blanker : OFF</li> <li>• Squelch : OFF</li> <li>• Speaker : OFF</li> <li>• AGC : ON</li> <li>• RF gain : 9</li> <li>• R223 (MAIN unit) : Max. clockwise</li> <li>• R257 (MAIN unit) : Max. counter clockwise</li> <li>• R300 (MAIN unit) : Center</li> <li>• Connect a standard signal generator to the [ANT] connector and set as:               <ul style="list-style-type: none"> <li>Frequency : 2.1815 MHz</li> <li>Level : 0.5 <math>\mu</math>V (-113 dBm)</li> <li>modulation : OFF</li> </ul> </li> <li>• Receiving</li> </ul>	Rear Panel	Connect an AC millivoltmeter to the [EXT SP] jack with a 4 dummy load.	Maximum output level	MAIN	Adjust in sequence L74, L75, L78, L79, L83, L84, L85, L92, L93
CLARITY	1 <ul style="list-style-type: none"> <li>• While pushing the [SQL] and [CL] switches, turn power ON.</li> </ul>	Set the [CLARITY] control to the center position and push the [DIMMER] switch.			Front Panel	[CLARITY]
TOTAL GAIN	1 <ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> <li>• Connect a standard signal generator to the [ANT] connector and set as:               <ul style="list-style-type: none"> <li>Frequency : 12.2315 MHz</li> <li>Level : 0.32 mV (-57 dBm)</li> <li>modulation : OFF</li> </ul> </li> <li>• Receiving</li> </ul>	Rear Panel	Connect an AC millivoltmeter to the [EXT SP] jack with a 4 ohms dummy load.	1.0 V	Front Panel	[VOLUME]
	2 <ul style="list-style-type: none"> <li>• Set the signal generator to OFF (no output).</li> </ul>			-30 dB (32 mV)		
S-METER	1 <ul style="list-style-type: none"> <li>• While pushing the [SQL] and [T ONLY] switches, turn power ON.</li> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> </ul>	Function display	S/RF meter	Push the [DIMMER] switch.	Font Panel	[DIMMER]
	2 <ul style="list-style-type: none"> <li>• Connect a standard signal generator to the [ANT] connector and set as:               <ul style="list-style-type: none"> <li>Frequency : 12.2315 MHz</li> <li>Level : 1 mV (-47 dBm)</li> </ul> </li> <li>• Receiving</li> </ul>			7th dot just appears while pushing the [DIMMER]. 		Verify
NOISE BLANKER	1 <ul style="list-style-type: none"> <li>• Display frequency : 12.2300 MHz</li> <li>• Mode : J3E</li> <li>• Connect a standard signal generator to the [ANT] connector and set as:               <ul style="list-style-type: none"> <li>Frequency : 12.2315 MHz</li> <li>Level : 3.2 <math>\mu</math>V (-97 dBm)</li> </ul> </li> <li>Add the following signal into the signal generator output.</li> </ul>  <ul style="list-style-type: none"> <li>• Receiving</li> </ul>	MAIN	Connect an oscilloscope to R59.	Adjust the maximum noise wave displayed on the oscilloscope.	MAIN	L80, L81

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

























[PA150W-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION
R4018	7030000460	S.RES MCR10EZHZ 4.7 k
R4019	7030000460	S.RES MCR10EZHZ 4.7 k
R4020	7010004741	RES PSD1/2 150
R4022	7310004950	TRI KVSF687AC 101 100
R4023	7070000311	RES ERG1SJ 100 (10)
R4024	7030000290	S.RES MCR10EZHZ 180 (181)
R4025	7310004940	TRI KVSF637AC 471 470
R4026	7100000890	RES RWL5 0R012J
R4027	7030000600	S.RES MCR10EZHZ 68 k
R4028	7030000600	S.RES MCR10EZHZ 68 k
R4029	7030000560	S.RES MCR10EZHZ 33 k
R4030	7030000560	S.RES MCR10EZHZ 33 k
R4031	7310004970	TRI KVSF637AC 472 4.7 k
R4032	7030000740	S.RES MCR10EZHZ 1 M
R4033	7030000500	S.RES MCR10EZHZ 10 k
R4034	7010000301	RES PSN1/4V 270
R4035	7070000251	RES ERX2SJ 4R7 (4.7)
R4036	7010000331	RES PSN1/4V 470
R4039	7010000091	RES PSN1/4V 4.7
R4040	7030000650	S.RES MCR100ZJH 100 (101)
R4044	7010000331	RES PSN1/4V 470
R4045	7030000140	S.RES MCR10EZHZ 10 (100)
R4046	7030000290	S.RES MCR10EZHZ 180 (181)
R4047	7010000051	RES PSN1/4V 2.2
R4048	7010000061	RES PSN1/4V 2.7
R4049	7010000281	RES PSN1/4V 180
R4050	7010000411	RES PSN1/4V 2.2 k
R4051	7030000340	S.RES MCR10EZHZ 470 (471)
R4052	7030000150	S.RES MCR10EZHZ 12 (120)
R4053	7030000340	S.RES MCR10EZHZ 470 (471)
R4061	7030000010	S.RES MCR10EZHZ JPW (000)
R4062	7030000010	S.RES MCR10EZHZ JPW (000)
R4063	7030000010	S.RES MCR10EZHZ JPW (000)
R4064	7030000010	S.RES MCR10EZHZ JPW (000)
R4065	7030000010	S.RES MCR10EZHZ JPW (000)
R4066	7030000010	S.RES MCR10EZHZ JPW (000)
R4067	7030000010	S.RES MCR10EZHZ JPW (000)
R4068	7030000010	S.RES MCR10EZHZ JPW (000)
C4003	4010005360	CER HM11SJ SL 301J 500V
C4004	4010005360	CER HM11SJ SL 301J 500V
C4006	4310000360	MLR 50 F2D 103J
C4007	4310000360	MLR 50 F2D 103J
C4008	4030000505	S.CER C2012 CH 1H 331J-T
C4010	4030011760	S.CER GRM55R1X2D682JV01L (GRM44-1) [GEN-24] only
C4011	4030011760	S.CER GRM55R1X2D682JV01L (GRM44-1) [GEN-24] only
C4012	4010006410	CER HM13SJ SL 471J 500V
C4013	4030018370	S.CER ERF22X 6C1H 102J D01L
C4014	4030018370	S.CER ERF22X 6C1H 102J D01L
C4015	4030011760	S.CER GRM55R1X2D682JV01L (GRM44-1) [GEN-24] only
C4016	4030011760	S.CER GRM55R1X2D682JV01L (GRM44-1) [GEN-24] only
C4018	4030004740	S.CER C2012 JB 1H 472K-T
C4019	4030004740	S.CER C2012 JB 1H 472K-T
C4020	4510005120	ELE 16 ME 47 HC
C4021	4510004990	ELE 16 ME 100 HC
C4022	4030005110	S.CER C2012 JB 1E 473K-T
C4023	4510004510	ELE 25 ME 470 HC
C4024	4030005110	S.CER C2012 JB 1E 473K-T
C4026	4510006160	ELE 25 ME 10 HC
C4027	4030004740	S.CER C2012 JB 1H 472K-T
C4028	4510004601	ELE 16 ME 1000 HC
C4029	4030005110	S.CER C2012 JB 1E 473K-T
C4030	4030005110	S.CER C2012 JB 1E 473K-T
C4031	4030005110	S.CER C2012 JB 1E 473K-T
C4032	4030004990	S.CER C2012 CH 1H 101J-T
C4033	4030011790	S.CER GRM55R52A684ZD01L (GRM44-1) [GEN-24] only
C4034	4030004740	S.CER C2012 JB 1H 472K-T
C4035	4510005040	ELE 25 ME 1000 HC
C4036	4030004740	S.CER C2012 JB 1H 472K-T
C4038	4030004740	S.CER C2012 JB 1H 472K-T
C4045	4320000340	DMI DM20C 472J5
C4046	4030004740	S.CER C2012 JB 1H 472K-T
C4047	4030004740	S.CER C2012 JB 1H 472K-T
C4048	4030004740	S.CER C2012 JB 1H 472K-T
C4050	4510005040	ELE 25 ME 1000 HC
C4051	4510004591	ELE 16 ME 470 HC
C4052	4510006160	ELE 25 ME 10 HC
C4053	4030004740	S.CER C2012 JB 1H 472K-T
C4054	4030004740	S.CER C2012 JB 1H 472K-T
C4055	4030018370	S.CER ERF22X 6C1H 102J D01L
C4056	4030004740	S.CER C2012 JB 1H 472K-T
C4057	4320000220	DMI DM19C 681J5
C4059	4030004740	S.CER C2012 JB 1H 472K-T
C4063	4510004591	ELE 16 ME 470 HC
C4064	4030005030	S.CER C2012 CH 1H 221J-T
C4065	4020000990	CYR UP050 B 473K-NA-CZ
C4066	4020000990	CYR UP050 B 473K-NA-CZ
C4067	4010008570	CER RPER11H473K2K1A01
C4068	4030004740	S.CER C2012 JB 1H 472K-T
C4069	4030005110	S.CER C2012 JB 1E 473K-T
C4070	4030004720	S.CER C2012 JB 1H 102K-T
C4071	4030004890	S.CER C2012 CH 1H 150J-T
C4072	4030008960	S.CER C2012 JB 1C 104K-T
C4077	4030004720	S.CER C2012 JB 1H 102K-T
C4078	4030008960	S.CER C2012 JB 1C 104K-T
C4079	4030004990	S.CER C2012 CH 1H 101J-T
J4002	6510007020	CNR TMP-J01X-V6
J4003	6510018381	CNR 10FE-BT-VK-N
J4004	6510003081	CNR RT01T-1.0B (LF)
J4005	6510003081	CNR RT01T-1.0B (LF)

[PA150W-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION
S4001	6910006900	TML OHD-3 110M
S4002	6910000050	TML OHD-3 50M
W4001	7030011280	JMP J1/4ZC
W4002	7030011280	JMP J1/4ZC
W4003	7120000470	JMP ERDS2T0
W4004	7120000470	JMP ERDS2T0
W4008	9045201001	WIR 74/98/040/X98/X98
W4009	9045201001	WIR 74/98/040/X98/X98
W4010	9040401001	JMP 74/98/050/X98/X98 [GEN-24] only
W4011	9056000180	WIR 74/98/080/X98/X98 [GEN-24] only
EP4003	6910000610	BEA FSRH050100RN000B (FSOH050RN01)
EP4004	6910000610	BEA FSRH050100RN000B (FSOH050RN01)
EP4006	6910000630	BEA FSRH070140RN000B (FSOH070RN)
EP4008	6510018330	TER F4053A
EP4009	6510018330	TER F4053A
EP4010	9001602001	TUB IRRAX 0.7 (d) L=10 mm
EP4011	9001602001	TUB IRRAX 0.7 (d) L=10 mm
EP4012	9034701901	TUB IRRAX 0.7 (d) L=20 mm
EP4014	9029305901	TUB IRRAX 1 (d) L=15 mm [GEN-24] only

[TERMINAL-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION
C7001	4510005980	ELE 16 ME 4700 HC [GEN-24] only
C7002	4010006900	CER HE80SJ YB 472K 50V
C7003	4010006890	CER HE60SJ YB 222K 50V
C7004	4010006890	CER HE60SJ YB 222K 50V
C7005	4010006900	CER HE80SJ YB 472K 50V
C7006	4010006900	CER HE80SJ YB 472K 50V
J7001	6510010021	CNR RTB-1.5-2F (LF)
EP7003	6510018330	TER F4053A
EP7004	6510018330	TER F4053A
EP7010	9017680190	TUB 10 L=25MM [GEN-24] only

[SENSOR1-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION
J2601	6510018391	CNR 06FE-BT-VK-N
S2601	2260002430	SW SW-165 (SRBM1L)

[SENSOR2-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION
J2701	6510018391	CNR 06FE-BT-VK-N
S2701	2260002430	SW SW-165 (SRBM1L)

[MIC-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION
J2301	6510009211	CNR 14RS-8H-MI-AU (F) -1
J2302	6510018381	CNR 10FE-BT-VK-N

[VR1-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION
R2401	7210002540	VAR TP96N937-15F-10KB-1540
J2401	6510018390	CNR 06FE-BT-M [GEN-21], [GEN-22], [GEN-24] [others]
J2401	6510018391	CNR 06FE-BT-VK-N

S.=Surface mount



**[VR2-J BOARD]**

REF NO.	ORDER NO.	DESCRIPTION	
R2501	7210002730	VAR	TP96N944-15F-10KB-1632
J2501	6510018391	CNR	06FE-BT-VK-N

**[ALARM BOARD] ([GEN-22], [GEN25] only)**

REF NO.	ORDER NO.	DESCRIPTION	
IC5001	1130007800	S.IC	S-7116AF-TF
Q5001	1530002691	S.TR	2SC4116-GR (TE85R,F)
X5001	6060000150	S.CER	CSAC3.58MGCD512-TC (300CD)
R5001	7030003620	S.RES	ERJ3GEYJ 333 V (33 k)
R5002	7030003640	S.RES	ERJ3GEYJ 473 V (47 k)
R5003	7030003440	S.RES	ERJ3GEYJ 102 V (1 k)
R5004	7030003640	S.RES	ERJ3GEYJ 473 V (47 k)
R5005	7030003440	S.RES	ERJ3GEYJ 102 V (1 k)
R5006	7030003680	S.RES	ERJ3GEYJ 104 V (100 k)
R5007	7030003710	S.RES	ERJ3GEYJ 184 V (180 k)
R5008	7030003440	S.RES	ERJ3GEYJ 102 V (1 k)
R5009	7030003440	S.RES	ERJ3GEYJ 102 V (1 k)
R5010	7030003640	S.RES	ERJ3GEYJ 473 V (47 k)
C5001	4550007610	S.TAN	F931E474MAABMA
C5002	4550006210	S.TAN	ECST1CX106R
C5002	4550007510	S.TAN	F931C106MBABMA

S.=Surface mount

# SECTION 6

# MECHANICAL PARTS

## [MAIN UNIT]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J1	6510017150	TMP-S01X-C1	1
J2	6510017150	TMP-S01X-C1	1
J3	6510007020	TMP-J01X-V6	1
J4	6510007020	TMP-J01X-V6	1
J5	6510007020	TMP-J01X-V6	1
J6	6450001240	HLJ4306-01-3000	1
J7	6450001440	HSJ1403-01-010	1
J9	6510017660	52045-1645	1
J11	6510023120	CD6109SA1J0	1
J12	6450001581	TCS5073-2841577	1
J13	6510024541	TCS5073-2741577	1
J15	6510003401	B04B-EH-S (LF) (SN)	1
J16	6510003431	B07B-EH-S (LF) (SN)	1
J19	6510017660	52045-1645	1
J20	6510003391	B03B-EH-S (LF) (SN)	1
J22	6510017650	52045-1045	1
J23	6510003401	B04B-EH-S (LF) (SN)	1
J32	6510010021	RTB-1.5-2F (LF)	1
J33	6450001560	PD-72	4
S9	2220000520	ESD11V120	1
S11	2220000520	ESD11V120	1
W1	7120000470	ERDS2T0	1
W11	7120000470	ERDS2T0	1
W13	7120000490	ERD25T0	1
W32	7030011280	J1/4Z	1
MP1	8510000231	220 SHIELD CASE-1	1
MP2	8510000241	220 Shield case cover-1	1
MP3	8510002200	VCO case (FX-15)	1
MP4	8510000231	220 SHIELD CASE-1	1
MP5	8510008300	963 DDS SHIELD CASE	1
MP6	8510008310	963 DDS SHIELD COVER	1
MP8	8510001060	Shield case (SX-65)	1
MP9	8510001740	Shield case TOP cover (SX-117)	1
MP10	8930011830	9Mfilter holder	1
MP11	8510004640	220 Shield plate (C)	1
MP12	8930005440	Insulation sheet (E)	1
MP13	8510004640	220 Shield plate (C)	1
MP14	8930005440	Insulation sheet (E)	1
MP15	8510000241	220 Shield case cover-1	1
MP16	8930005320	Filter spacer	2
MP17	8930005200	crystal holder	1
MP18	8930005200	crystal holder	1

## [CHASSIS PARTS]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
MF1001	2710000520	SB0812H-ICOM-00	1
W1003	8900006220	OPC-539	1
W1012	8900006082	OPC-567B	1
EP1001	6910013480	Super ground (MGB12-07B)	1
MP1003	8010015771	1632 MAIN CHASSIS-1	1
MP1004	8930035801	Rubber leg (J)-1	4
MP1005	8850000180	Flat washer M5 SUS	3
MP1006	8850000500	S-washer M5 SUS	1
MP1007	8830000250	Nut M5 SUS	1
MP1008	8830000370	Nut M5 SUS	1
MP1010	8810008631	Screw BT B0 3X6 NI-ZC3 (BT)	7
MP1011	8810008631	Screw BT B0 3X6 NI-ZC3 (BT)	7
MP1015	8810009851	Screw BT B0 4X12NI-ZC3 (BT)	4
MP1018	8110005512	1632 COVER-2	1
MP1020	8210012221	1632 REAR PANEL-1	1
MP1022	8930035780	1632 REAR SEAL	1
MP1024	8930035750	1632 CONNECTOR PLATE	1
MP1029	8810003841	Screw BiH M3X8 SUS SSBC	1
MP1030	8810003841	Screw BiH M3X8 SUS SSBC	4
MP1031	8820000551	Cap volt M4X8 ZK3	4
MP1038	8810003841	Screw BiH M3X8 SUS SSBC	9
MP1040	8810008790	Screw M3X6 NI	4
MP1045	8930037030	1562 STAND-OFF	2
MP1050	8930037900	Thermal sheet (BB)	1
MP1051	8930040020	Thermal sheet (BJ)	4
MP1059	8930050321	THERMALLY SHEET (M)-1	1
MP1060	8930050331	THERMALLY SHEET (N)-1	1

## [LOGIC-J UNIT]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J2002	6510016960	7P-SCN	1
J2003	6510016930	4P-SCN	1
J2007	6510003391	B03B-EH-S (LF) (SN)	1
J2008	6510018381	10FE-BT-VK-N	1
J2009	6510018391	06FE-BT-VK-N	1
J2010	6510018391	06FE-BT-VK-N	1
J2011	6510018391	06FE-BT-VK-N	1
J2012	6510018391	06FE-BT-VK-N	1
J2013	6510010021	RTB-1.5-2F (LF)	1
J2014	6510010021	RTB-1.5-2F (LF)	1
P2002	6510003670	EHR-07	1
P2003	6510003640	EHR-04	1
DS2004	5010000220	DLC-8300P	1
W2001	9016320320	51/99/330/B06/B24	1
W2002	9086800830	Cable 00	1
W2003	9016320330	14/01/330/B06/B24	1
W2004	9016320340	14/03/330/B06/B24	1
W2005	9016320350	14/00/330/B06/B24	1
W2006	9016320940	23/04/330/B06/B24	1
W2007	9016320360	14/02/330/B06/B24	1
W2008	9016320320	51/99/330/B06/B24	1
W2009	9086800830	Cable 00	1
W2010	9016320320	51/99/330/B06/B24	1
W2011	9086800830	Cable 00	1
W2022	9034103010	13/02/050/W04/W04	1
W2023	7030011280	J1/4Z	1
EP2002	9034701901	IRRAX D=0.7 L=20MM	1
MP2001	8410002002	1632 HEATSINK PLATE-2	1
MP2002	8930035621	1632 LCD HOLDER-1	1
MP2003	8930036280	1632 LCD-L FILTER	1
MP2004	8930046100	1632 LCD-U FILTER (A)	1
MP2006	8810004301	Screw PH M3X10 ZK3	1
MP2007	8830000191	NUT M3 BS-CD NI	1
MP2008	8930036570	1632 LAMP Rubber	3

## [MIC-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J2301	6510009211	14RS-8H-MI-AU (F)-1	1
J2302	6510018381	10FE-BT-VK-N	1

## [VR1-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
R2401	7210002540	TP96N937-15F-10KB-1540	1
J2401	6510018391	06FE-BT-VK-N	1

## [VR2-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
R2501	7210002730	TP96N944-15F-10KB-1632	1
J2501	6510018391	06FE-BT-VK-N	1

## [SENSOR1-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J2601	6510018391	06FE-BT-VK-N	1
S2601	2260002430	SW-165	1

## [SENSOR2-J BOARD]

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J2701	6510018391	06FE-BT-VK-N	1
S2701	2260002430	SW-165	1

Screw abbreviations

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



**[FILTER-J BOARD]**

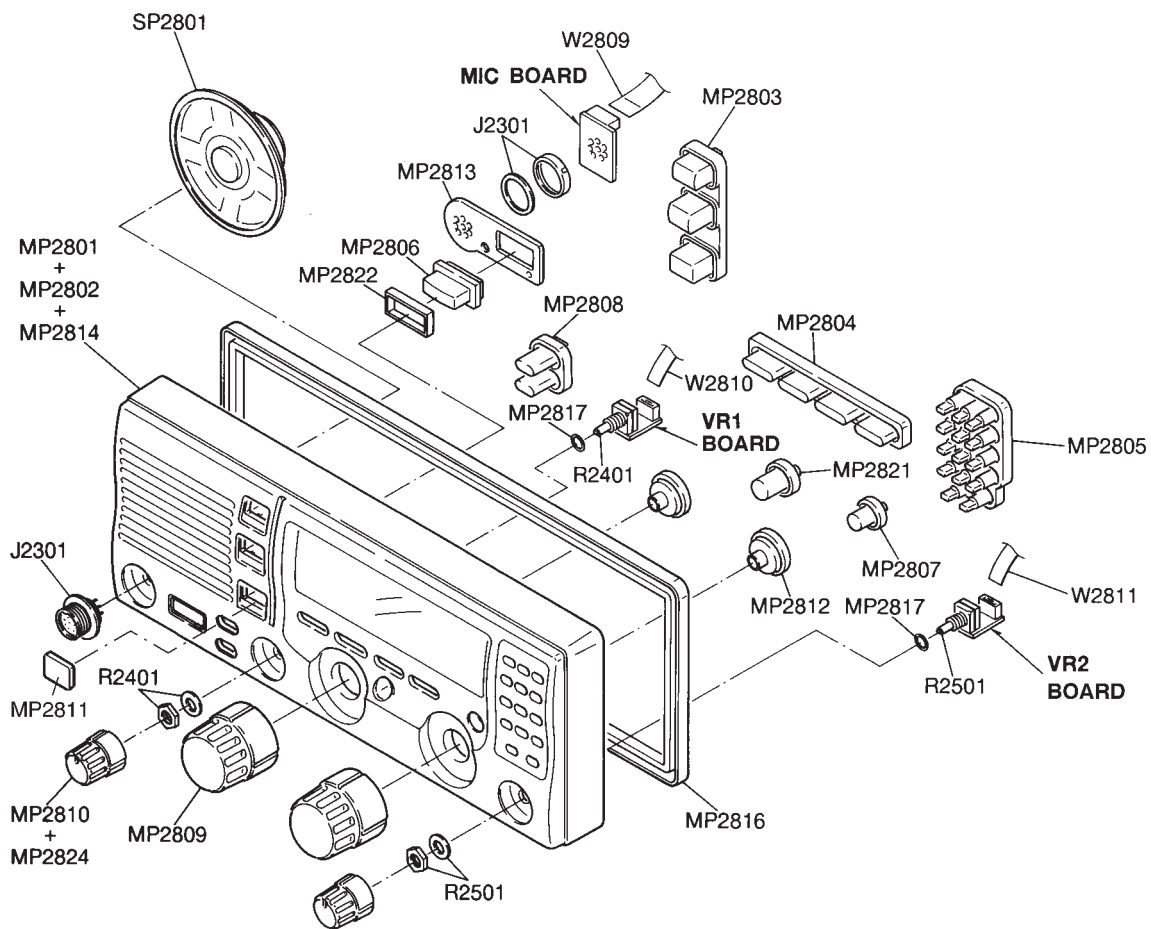
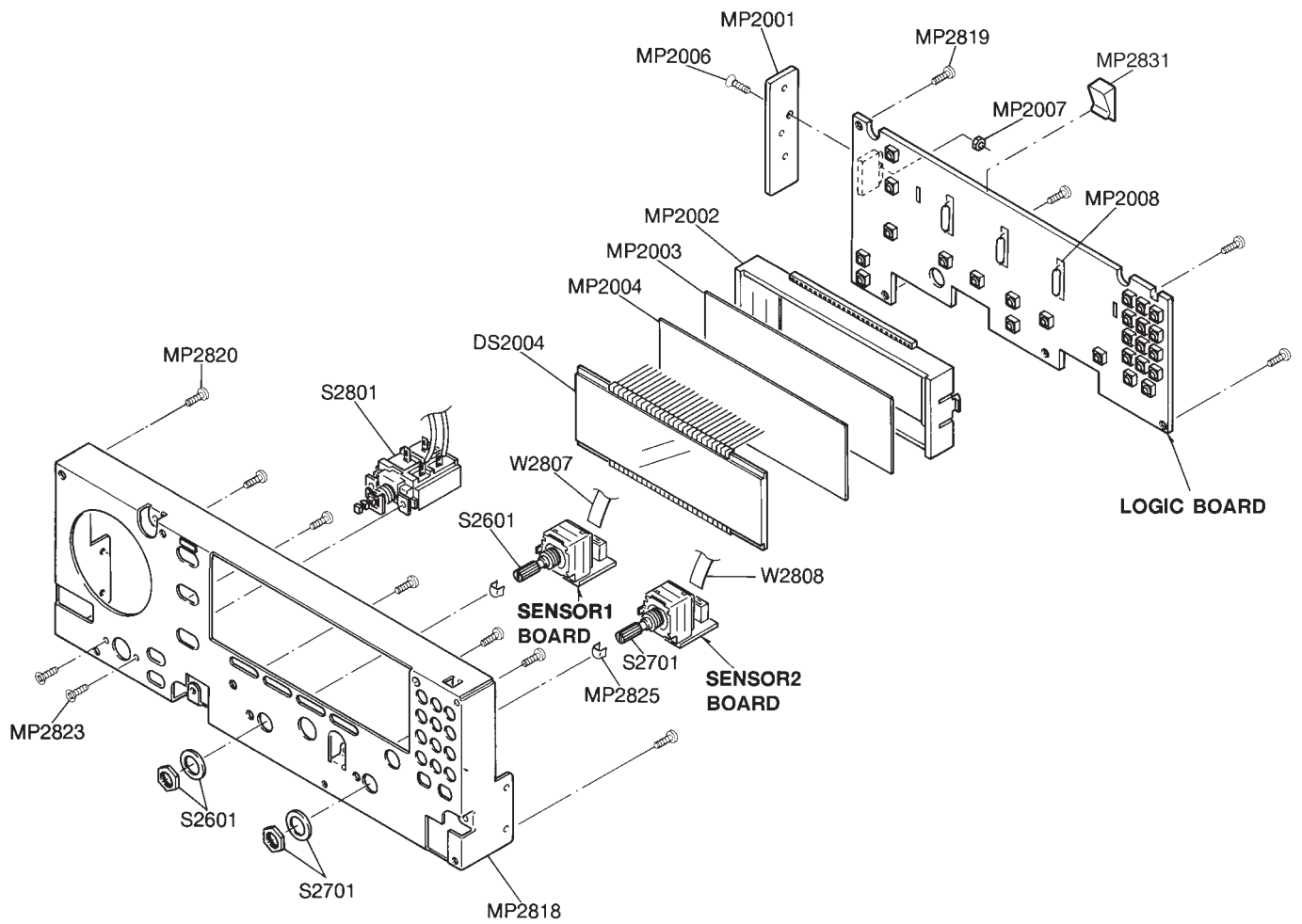
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J4301	6510007900	TBP-P01X-A1	1
J4302	6510007900	TBP-P01X-A1	1
J4303	6510018571	16FE-BT-VK-N	1
J4304	6510007020	TMP-J01X-V6	1
P4301	6510003240	TMP-P01X-A1	1
P4302	6510003240	TMP-P01X-A1	1
W4302	9019601025	74/98/025/X98/X98	1
W4303	9019601025	74/98/025/X98/X98	1
W4304	9019601025	74/98/025/X98/X98	1
W4305	9019601025	74/98/025/X98/X98	1
W4306	9019601025	74/98/025/X98/X98	1
W4307	9019601025	74/98/025/X98/X98	1
W4308	9019601025	74/98/025/X98/X98	1
W4309	9019601025	74/98/025/X98/X98	1
W4310	9019601025	74/98/025/X98/X98	1
W4312	6910001031	IPS-1041-4-PT	1
W4313	6910001031	IPS-1041-4-PT	1
W4314	6910001031	IPS-1041-4-PT	1
W4315	9008503020	74/98/030/X98/X98	1
W4316	9019601025	74/98/025/X98/X98	1
W4317	9008503020	74/98/030/X98/X98	1
W4319	7030011280	J1/4Z	1
W4320	6910001031	IPS-1041-4-PT	1
W4321	6910001031	IPS-1041-4-PT	1
W4323	9014130390	62/99/290/C24/C31	1
W4324	9011450130	Wire /08/	1
W4325	9014140050	62/99/220/C24/C31	1
W4326	9011450130	Wire /08/	1
W4328	9019601025	74/98/025/X98/X98	1
W4329	7120000380	JPW-01 R-01	1
W4330	7120000470	ERDS2T0	1
MP4301	8930014140	Earth spring (D)	1

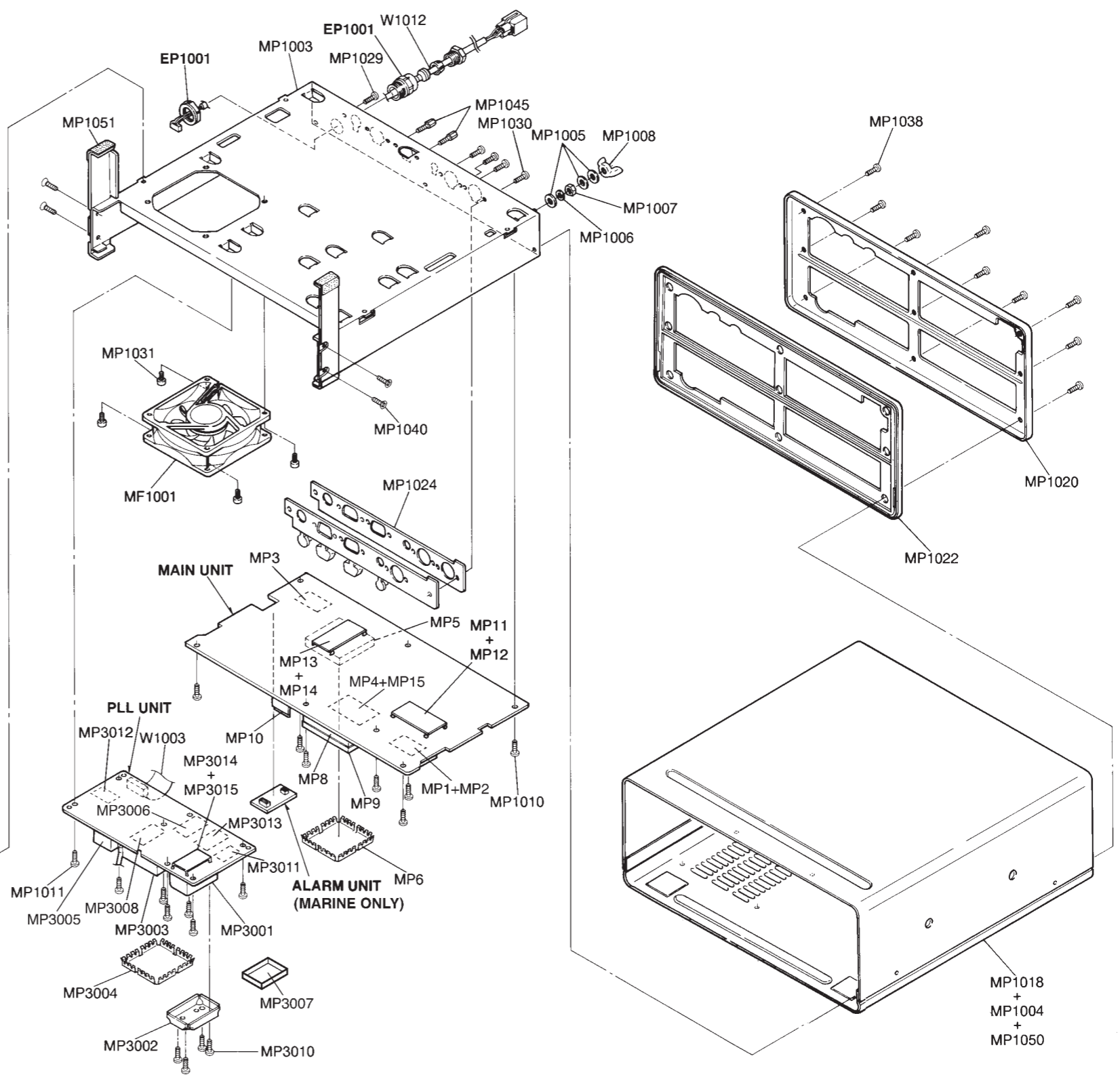
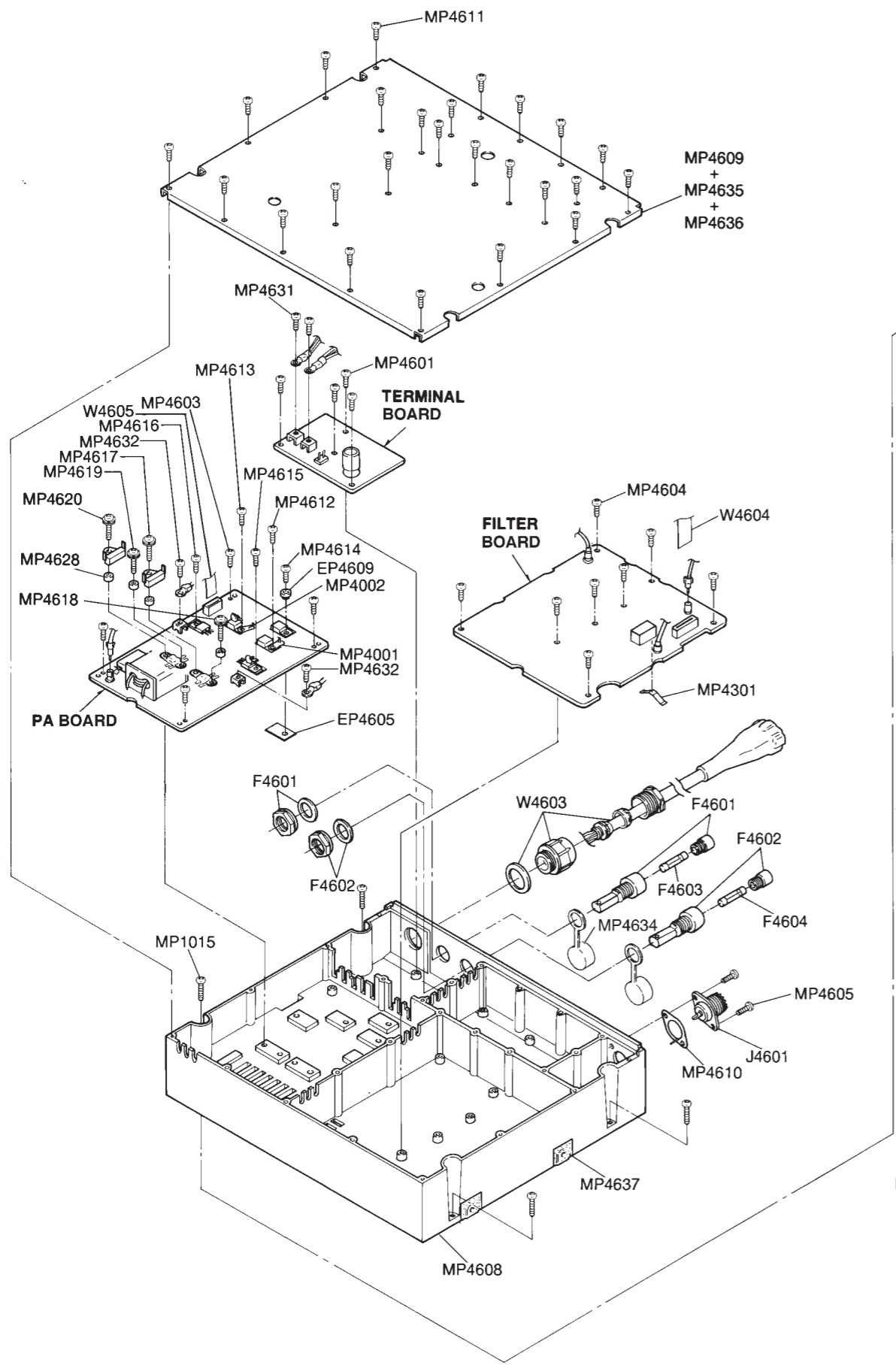
**[TERMINAL-J BOARD]**

REF NO.	ORDER NO.	DESCRIPTION	QTY.
J7001	6510010021	RTB-1.5-2F (LF)	1
P7001	6510011270	S2P-SVF	1
F7001	5220000110	TFH-S30	1
F7002	5210000061	FGB 5A PBF	1
EP7003	6510018330	F4053A	1
EP7004	6510018330	F4053A	1
EP7005	6910000630	FSOH070RN	1
EP7006	6910000630	FSOH070RN	1
EP7007	6510013860	FV2-S3.3	1
EP7008	6510013860	FV2-S3.3	1
EP7009	6910000640	FSOH090RN	1
EP7010	9017680190	Tube D=10.0 L=25MM	1
MP7001	8950000180	Cable tie -80	2
MP7002	8950000180	Cable tie -80	2
MP7003	8950000180	Cable tie -80	2

**[ACCESSORIES]**

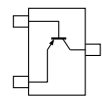
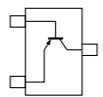
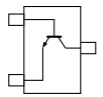
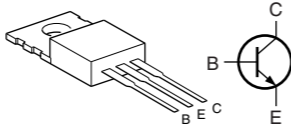
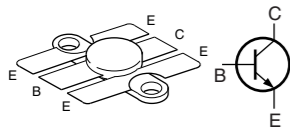
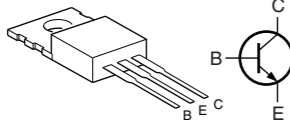
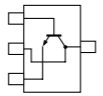
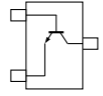
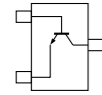
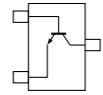
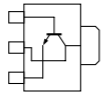
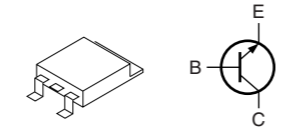
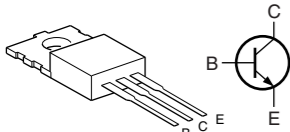
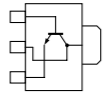
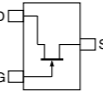
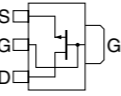
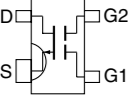
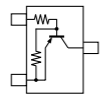
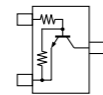
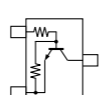
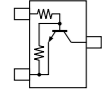
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J1201	6450001271	TCP0577-715267	1
J1202	6450001281	TCP0587-715467	1
J1203	5610000440	AP-301BK	1
P1201	5610000150	CL07A04M	1
P1202	5610000160	215001-2M	4
MC1201	7700001980	EM-101	1
F1201	5210000090	FGB 30A	2
F1202	5210000061	FGB 5A PBF	2
W1201	8900015990	OPC-568A	1
EP1202	6910009540	WS07MF-0A	4
MP1203	8850000180	Flat washer M5 SUS	4
MP1207	8830000260	Nut M6 SUS	8
MP1208	8850000510	S-washer M6 SUS	4
MP1211	8010016140	1632 MOBIL BRACKET	1
MP1212	8810001500	Screw BT A0 6X30 SUS	4
MP1214	8810001470	Screw BT A0 3.5X30 SUS	2
MP1215	8850000200	Flat washer M6 6X20X1.5 SUS	8
MP1216	8820000170	Screw (A) M5X10 SUS (SX-260)	4
MP1217	8930036560	1632 CUSHION Rubber	4
MP1218	8950004140	1632 MIC HANGER	1
MP1219	8810003500	Hex head bolt M6X50 SUS	4



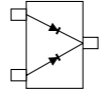
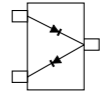
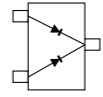
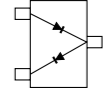
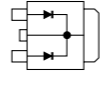
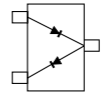
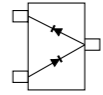
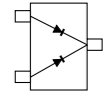
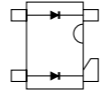
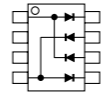


# SECTION 7 SEMICONDUCTOR INFORMATION

## • TRANSISTOR AND FET'S

<b>2SA1037K R</b> (Symbol: FR) 	<b>2SA1586 GR</b> (Symbol: SG) 	<b>2SC1623</b> (Symbol: No Symbol) 	<b>2SC1971</b> (Symbol: 43F) 
<b>2SC2904</b> 	<b>2SC3133</b> 	<b>2SC3647S</b> (Symbol: CC) 	<b>2SC4116 GR</b> (Symbol: LG) 
<b>2SC4213 B</b> (Symbol: AB) 	<b>2SC4215 O</b> (Symbol: QO) 	<b>2SC4673D</b> (Symbol: CO) 	<b>2SD1448</b> (Symbol: 46) 
<b>2SD1585K</b> 	<b>2SD1619 T</b> (Symbol: DB) 	<b>2SK210 GR</b> (Symbol: YG) 	<b>2SK2171 4</b> (Symbol: KM) 
<b>3SK131 MAS</b> (Symbol: V11) 	<b>DTA114EU</b> (Symbol: 14) 	<b>DTC114EK</b> (Symbol: 24) 	<b>DTC114ES</b> (Symbol: E.SK) 
<b>DTC114EU</b> (Symbol: 24) 			

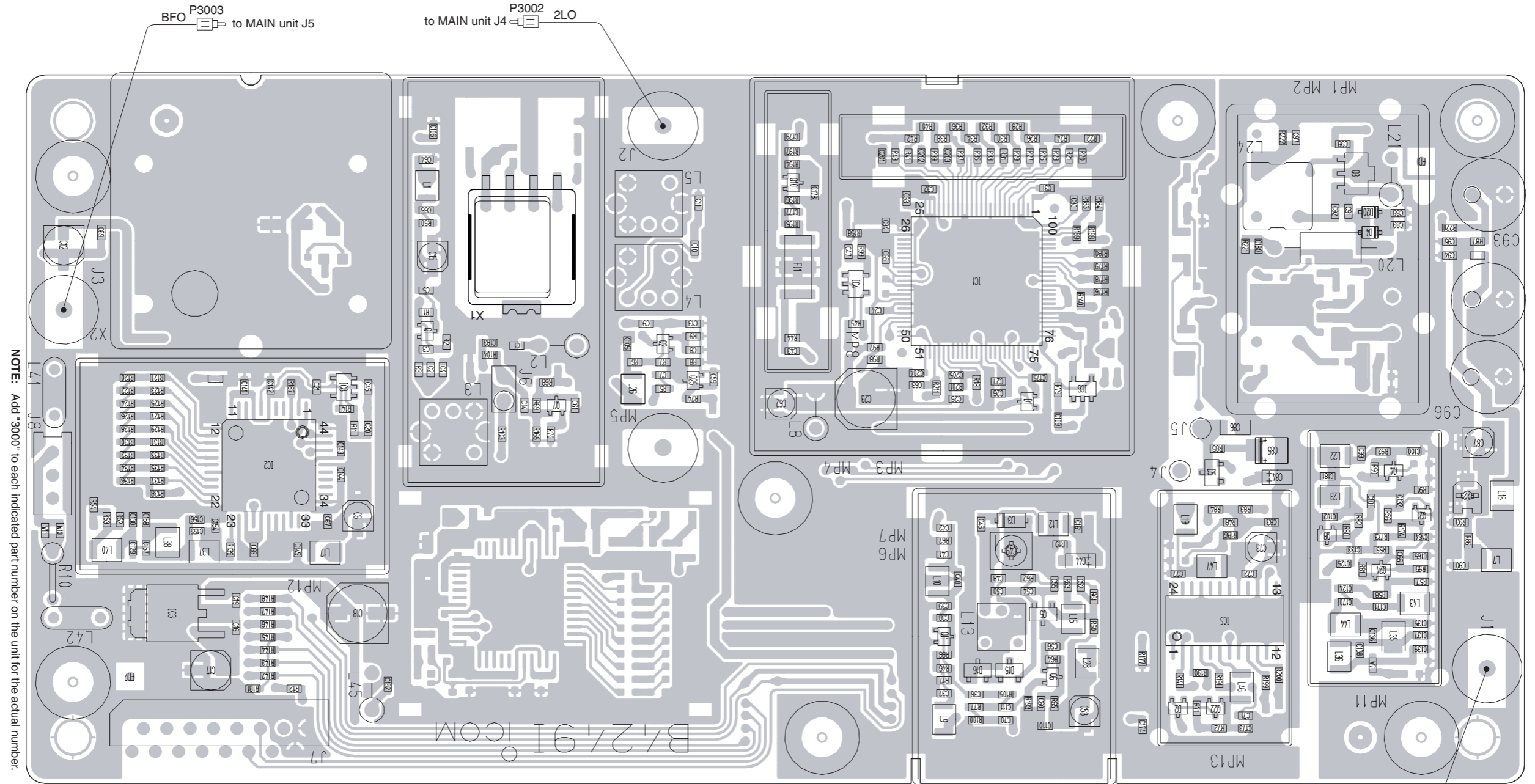
## • DIODES

<b>1SS184</b> (Symbol: B3) 	<b>1SS226</b> (Symbol: C3) 	<b>1SS301</b> (Symbol: B3) 	<b>1SS302</b> (Symbol: C3) 
<b>DF30SC4M</b> (Symbol: 30SC4M) 	<b>HSM88AS</b> (Symbol: C1) 	<b>HSM88ASR</b> (Symbol: C3) 	<b>HVM17-01TR</b> (Symbol: T6) 
<b>MA862</b> (Symbol: M11) 	<b>ND433G</b> (Symbol: 433) 		

# SECTION 8

# BOARD LAYOUTS

## • PLL UNIT



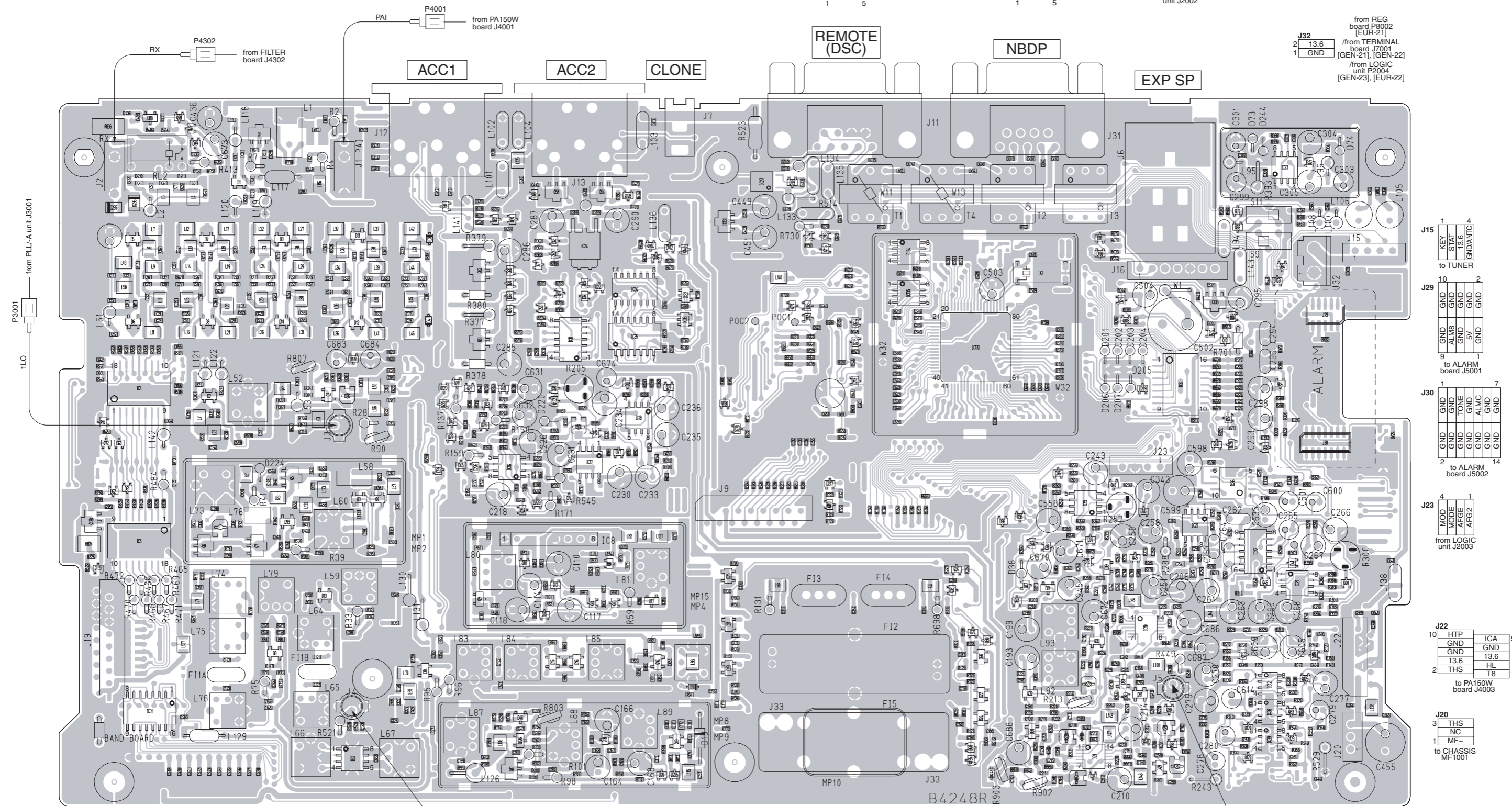
NOTE: Add "3000" to each indicated part number on the unit for the actual number.

16	GND	15	GND
15	PFSK	14	8V
14	STB2	13	STB1
13	CON2	12	CON1
12	CON0	11	DRST
11	STB3	10	DATA
10	CK	9	13.6
9	13.6	8	1

to MAIN unit J9



• MAIN UNIT



J11

6	NM+	9
5	NM-	8
4	DM+	7
3	DM-	6
2	DAF+	5
1	DAF-	4
	NMI+	3
	GND	2

J31

6	NC	9
5	NC	8
4	NAF+	7
3	NAF-	6
2	NSEN	5
1	GND	4

J16

1	LTXD	7
2	LRXD	6
3	SPE	5
4	SP	4
5	GND	3
6	13.6	2
7	13.6	1

from LOGIC unit J2002

J32

2	13.6	1
1	GND	1

from REG board P8002 (EUR-21)  
/from TERMINAL board J7001 (GEN-21), (GEN-22)  
/from LOGIC unit P2004 (GEN-23), (EUR-22)

J15

1	KEY	4
2	STAT	3
3	13.6	2
4	GND/ANTIC	1

to TUNER

J29

10	GND	2
9	GND	1
8	ALM	1
7	GND	1
6	ALM	1
5	GND	1
4	5V	1
3	GND	1
2	GND	1
1	GND	1

to ALARM board J5001

J30

1	GND	7
2	GND	6
3	GND	5
4	GND	4
5	ALM	3
6	GND	2
7	GND	1

to ALARM board J5002

J23

4	MOD	1
3	MODE	1
2	AFGE	1
1	AFGE2	1

from LOGIC unit J2003

J22

10	HTP	9
9	GND	8
8	GND	7
7	13.6	6
6	HL	5
5	T8	4
4	THS	3
3	THS	2
2	THS	1

to PA150W board J4003

J20

3	THS	1
2	NC	1
1	MF	1

to CHASSIS MF1001

J19

1	FOR	2
2	REF	1
3	GND	1
4	GND	1
5	L7	1
6	L0	1
7	L1	1
8	L4	1
9	L2	1
10	L3	1
11	L5	1
12	L6	1
13	L8	1
14	L9	1
15	13.6	1
16	T8	1

to FILTER board J4303

J9

2	GND	16
1	GND	15
16	PFSK	15
15	STB2	14
14	STB1	13
13	CON2	12
12	CON1	11
11	CON0	10
10	DRST	9
9	STB3	8
8	DATA	7
7	OK	6
6	13.6	5
5	13.6	4
4	13.6	3
3	13.6	2
2	13.6	1

to PLL-A unit J3007

P3001 from PLL-A unit J3001

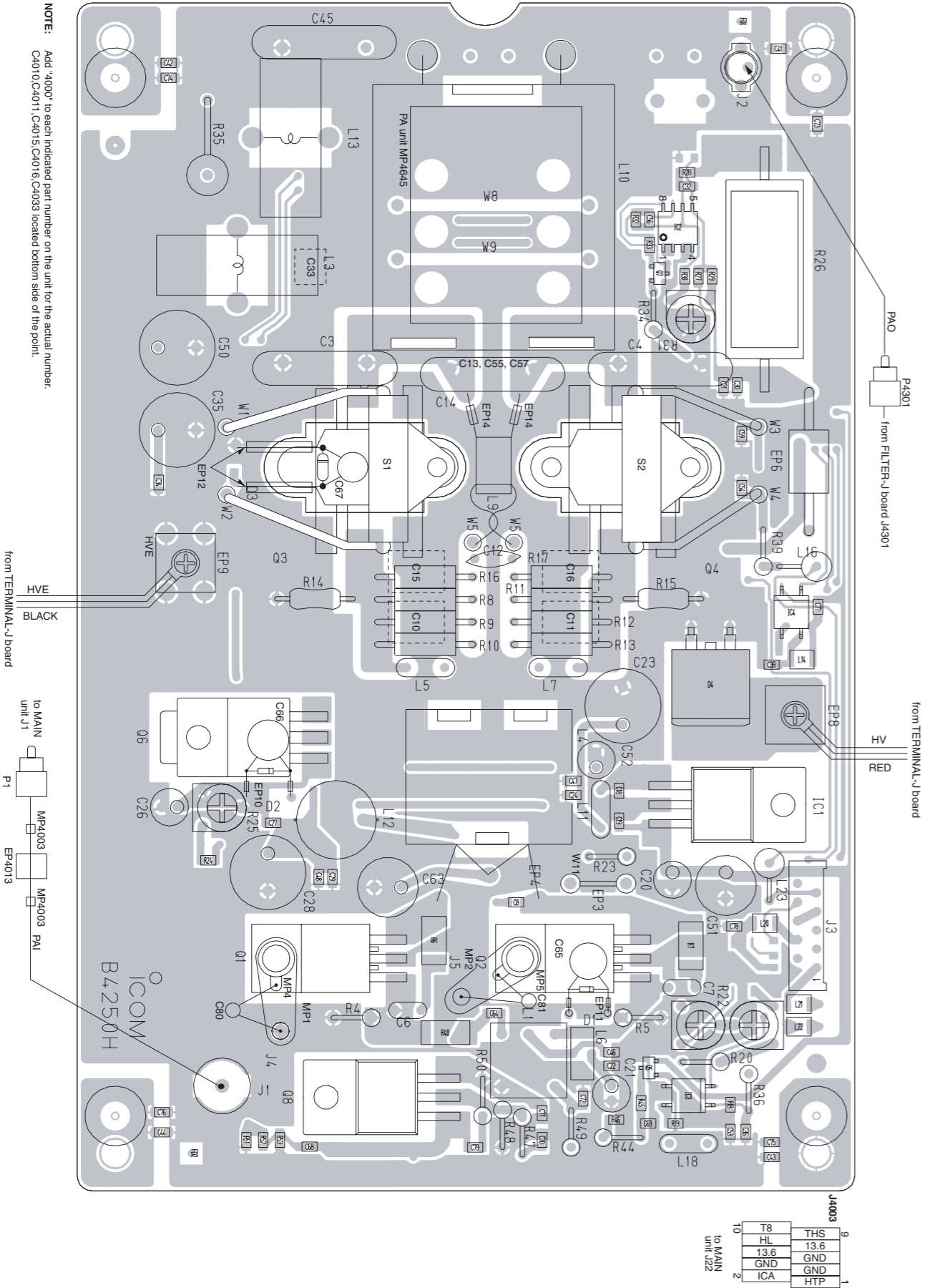
P4302 from FILTER board J4302

P4001 from PA150W board J4001

P3002 from PLL-A unit J3002

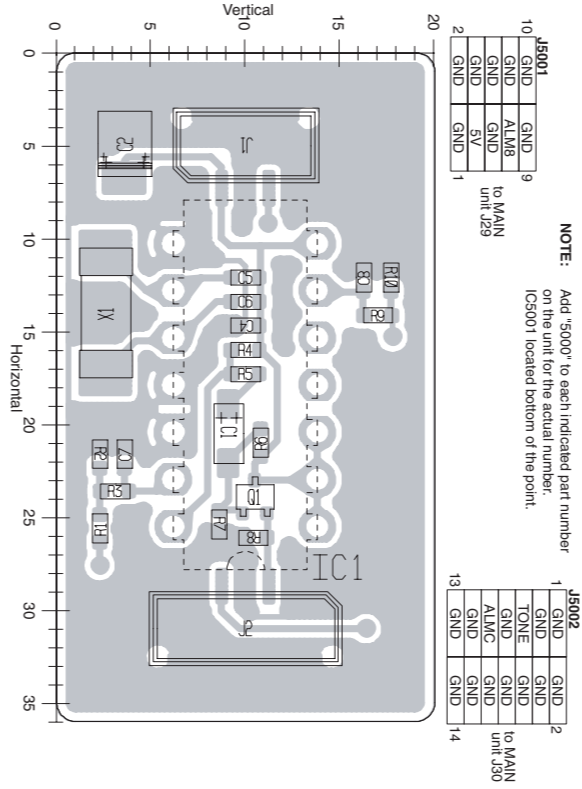
P3003 from PLL-A unit J3003

• PA150W-J BOARD

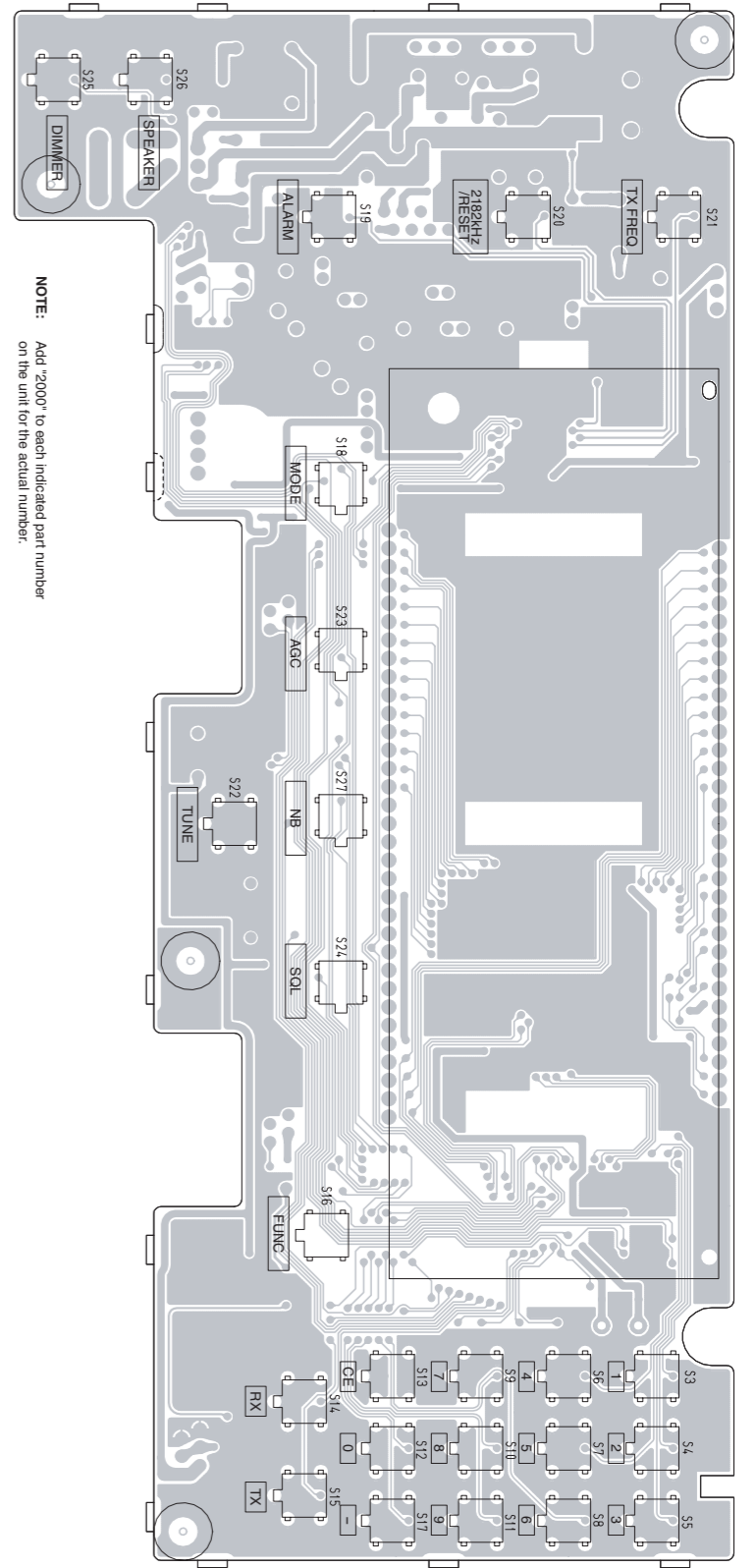


NOTE: Add "4000" to each indicated part number on the unit for the actual number:  
C4010, C4011, C4015, C4016, C4033 located bottom side of the point.

• ALARM BOARD ([GEN-22], [GEN-25] only)

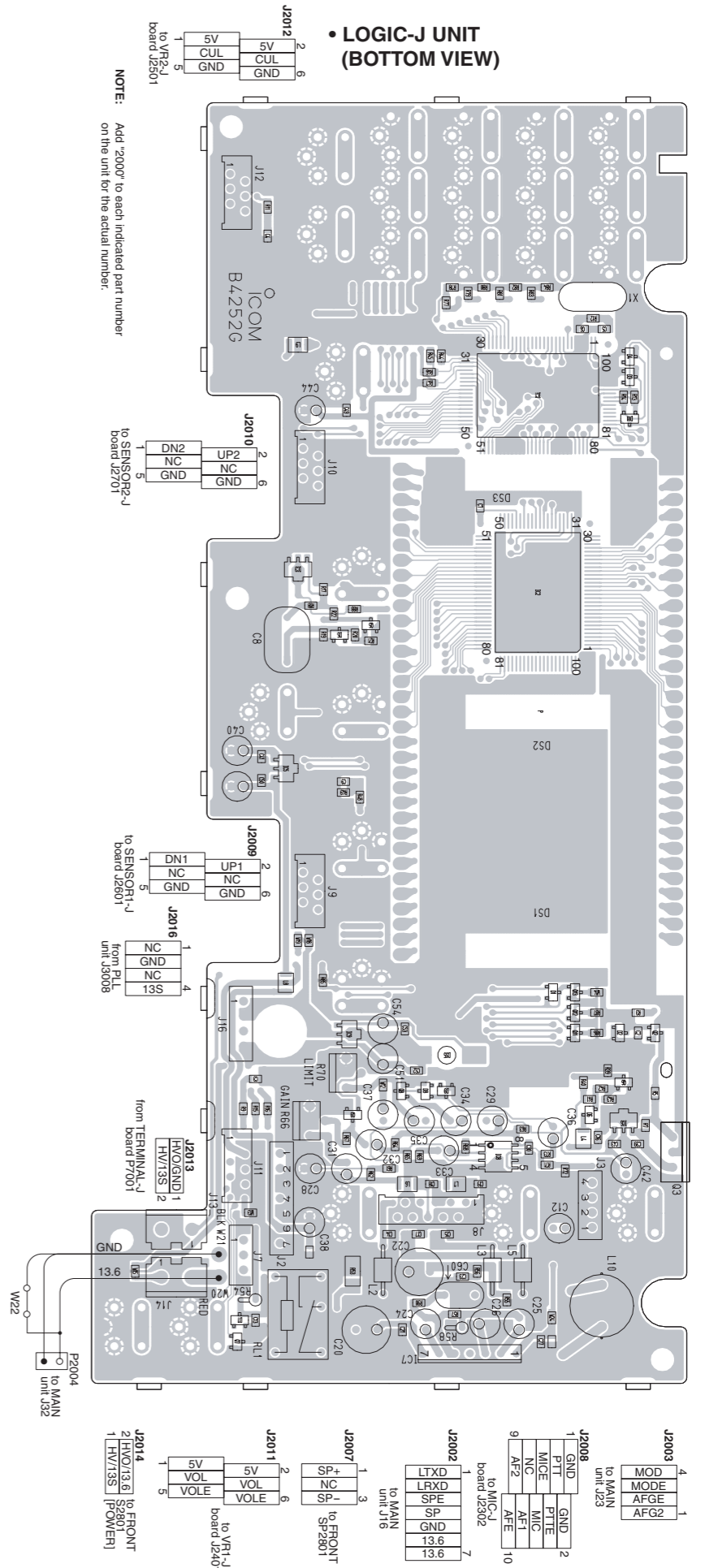


• LOGIC-J UNIT (TOP VIEW)

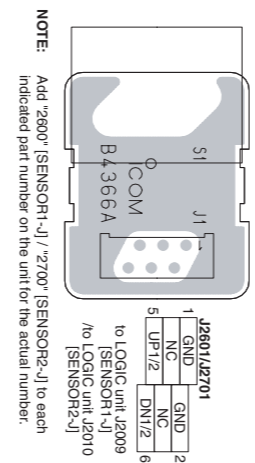


NOTE: Add "2000" to each indicated part number on the unit for the actual number.

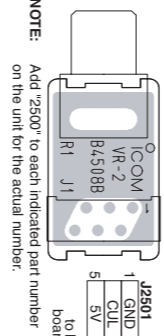
• LOGIC-J UNIT (BOTTOM VIEW)



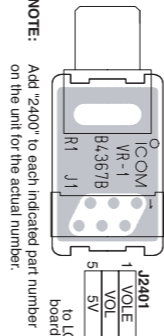
• SENSOR1-J/SENSOR2-J BOARD



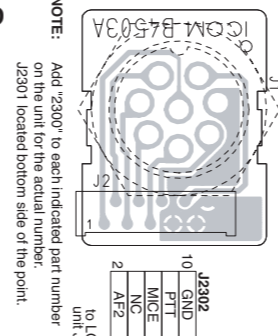
• VR2-J BOARD



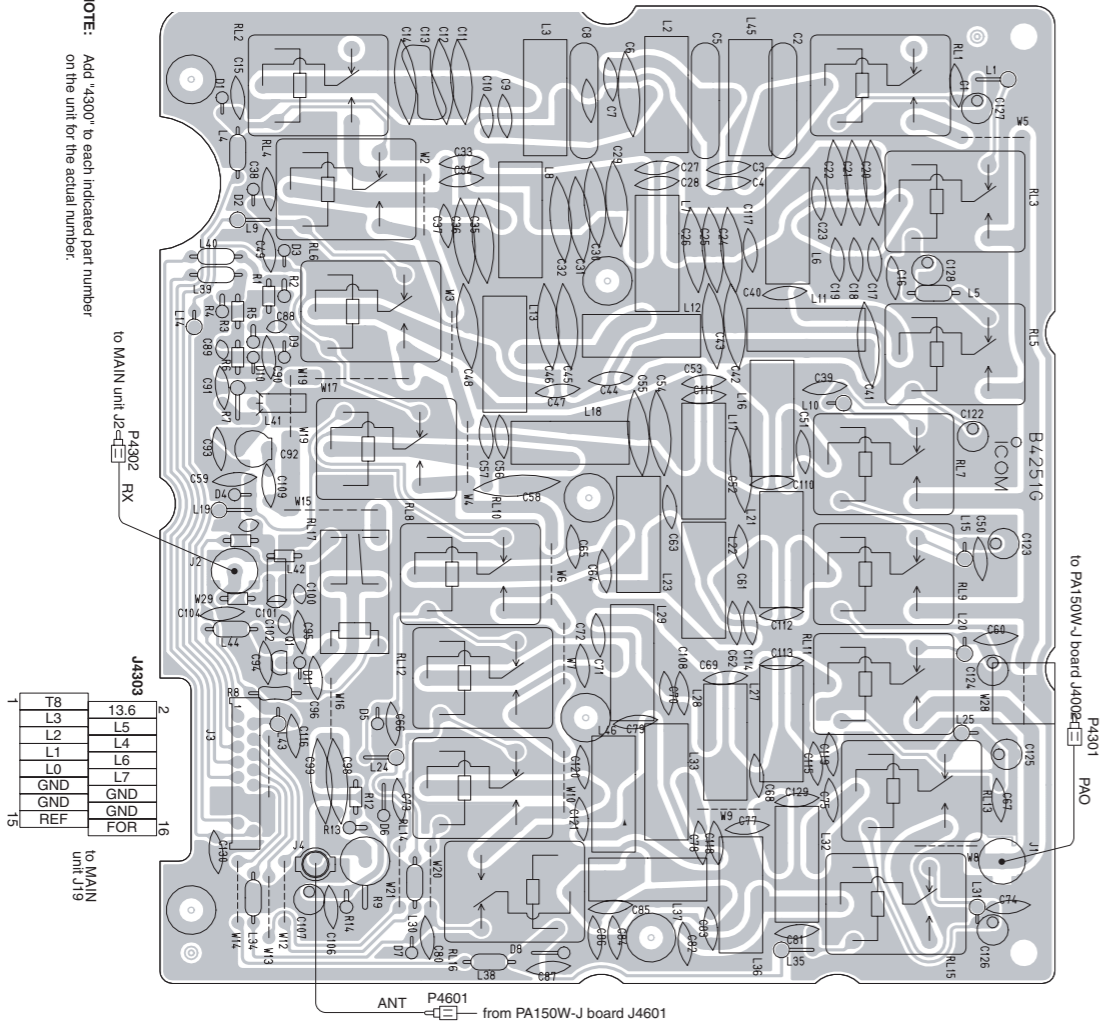
• VR1-J BOARD



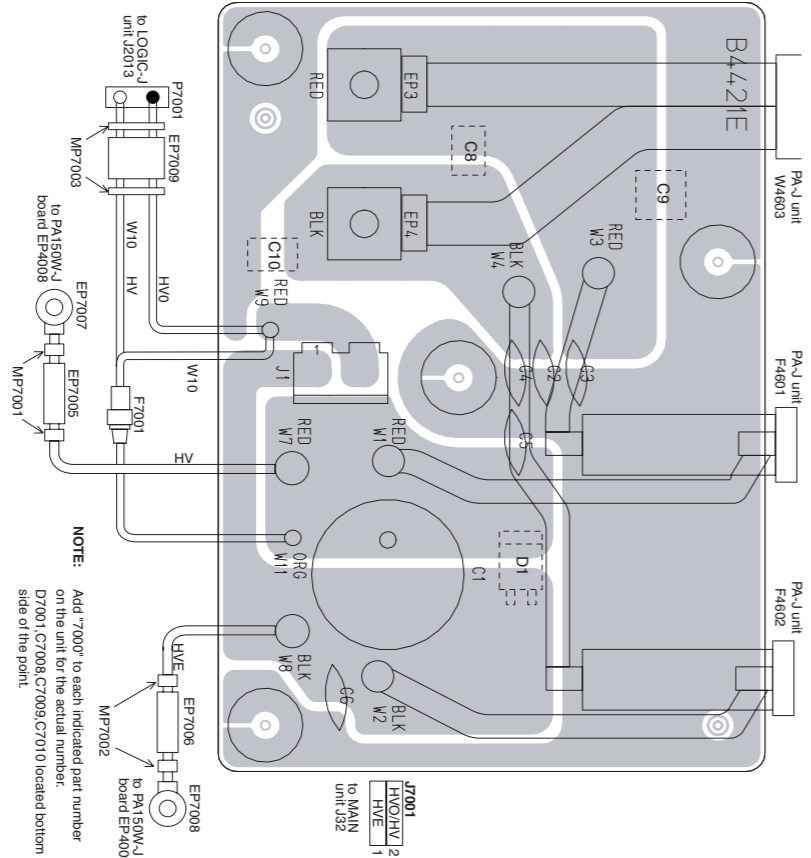
• MIC-J BOARD



• FILTER-J BOARD

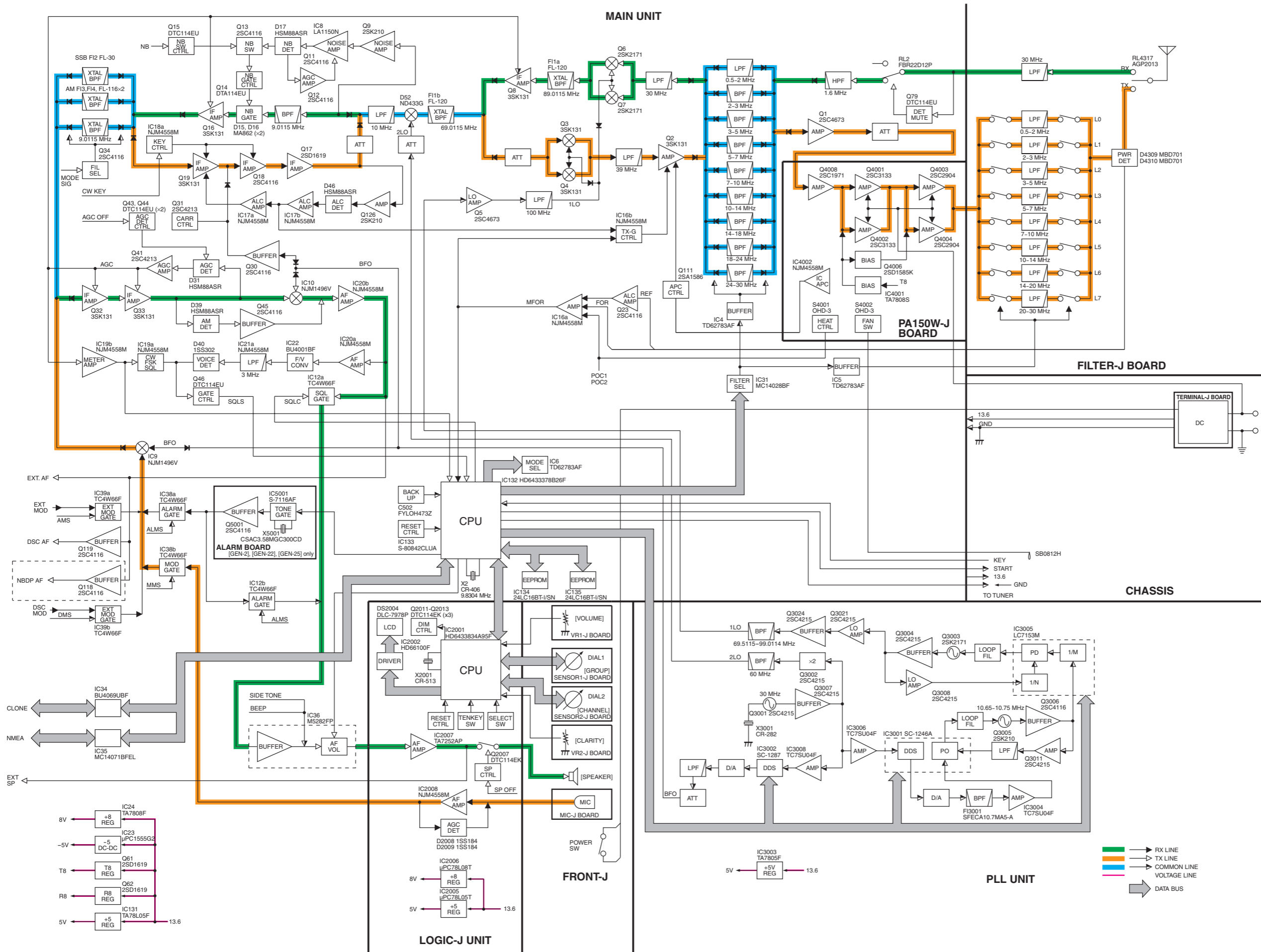


• TERMINAL-J BOARD



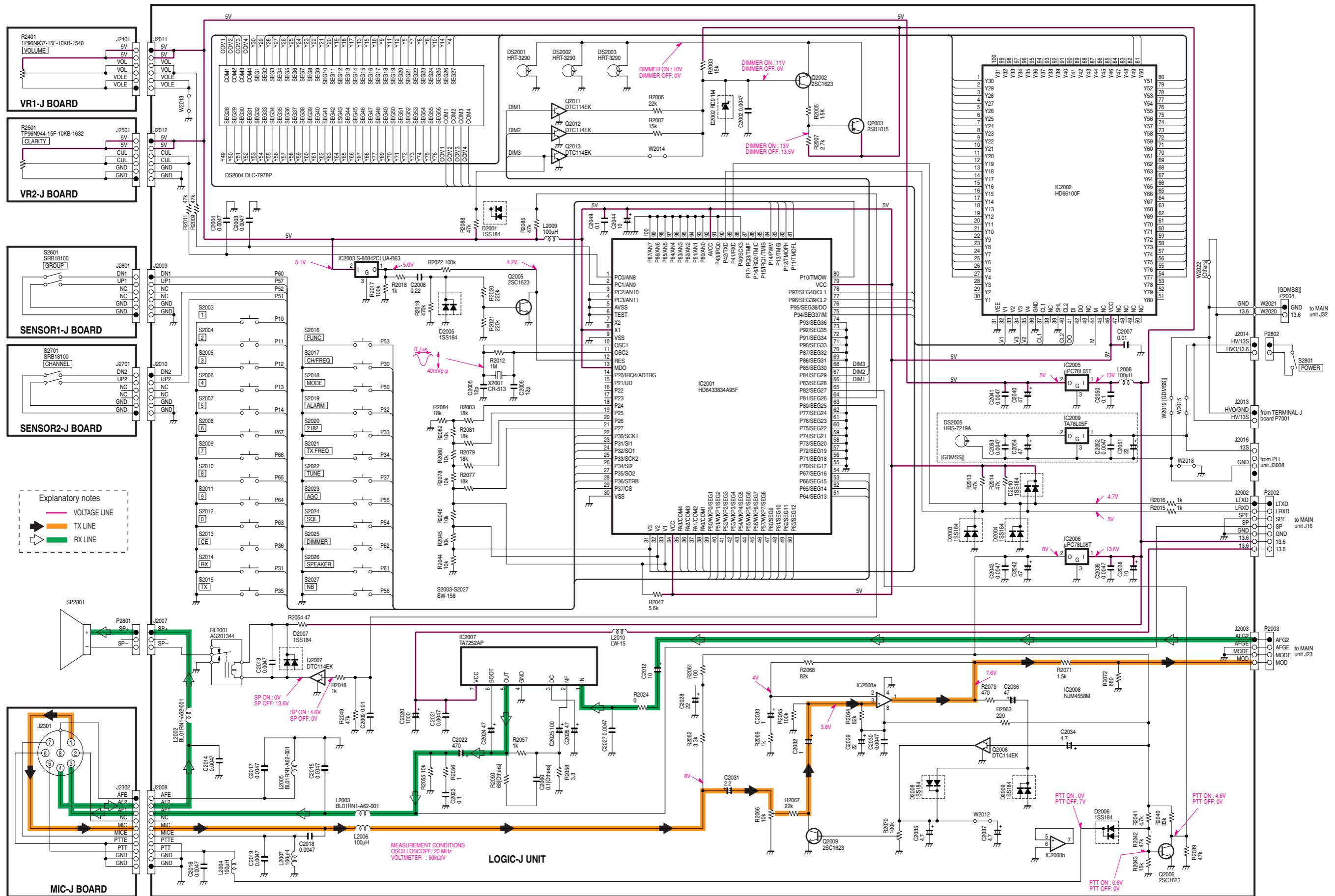
# SECTION 9

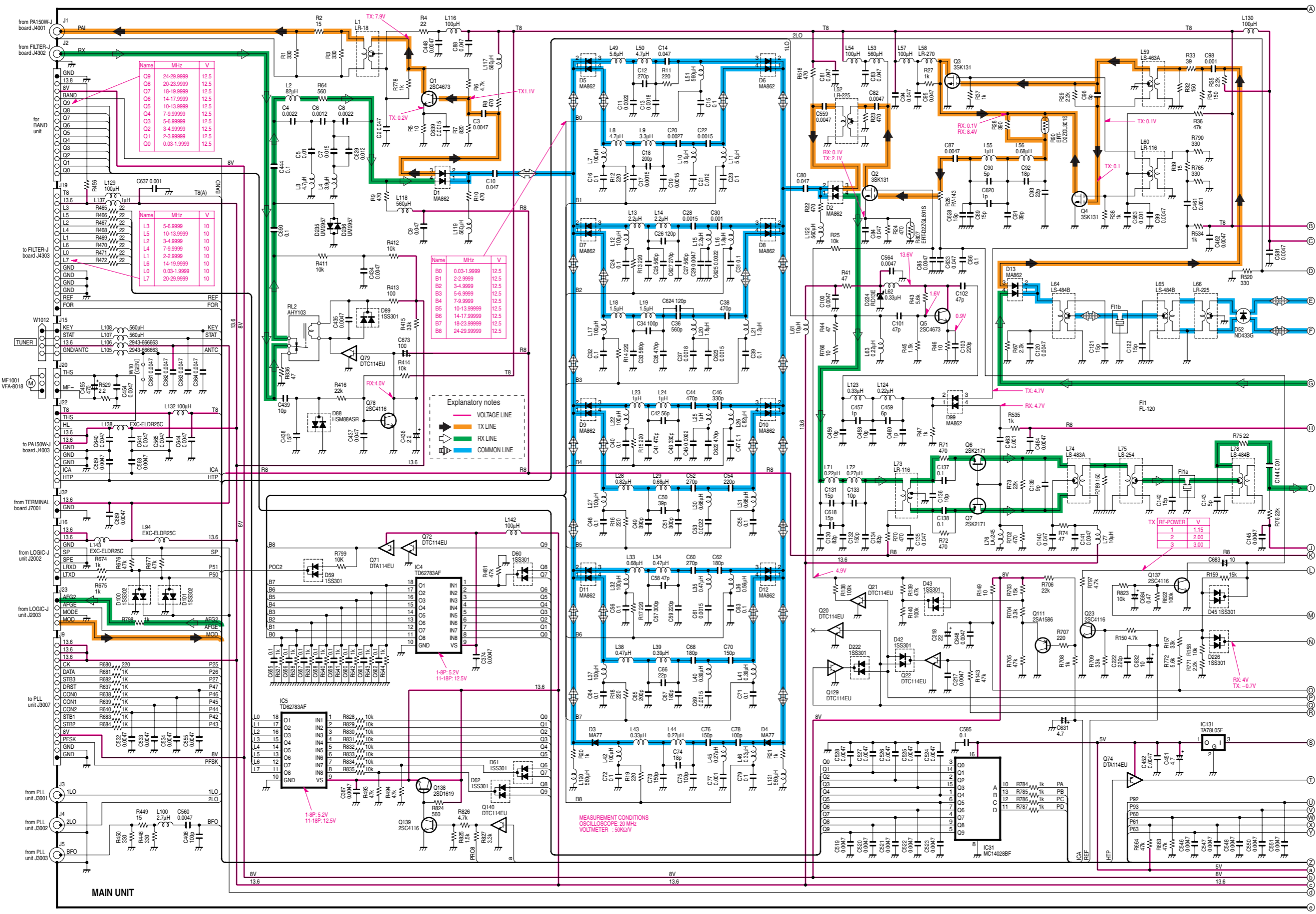
# BLOCK DIAGRAM



# SECTION 10

# VOLTAGE DIAGRAM





Name	MHz	V
Q9	24-29.9999	12.5
Q8	20-23.9999	12.5
Q7	18-19.9999	12.5
Q6	14-17.9999	12.5
Q5	10-13.9999	12.5
Q4	7-9.99999	12.5
Q3	5-6.99999	12.5
Q2	3-4.99999	12.5
Q1	2-3.99999	12.5
Q0	0.03-1.9999	12.5

Name	MHz	V
L3	5-6.9999	10
L2	10-13.9999	10
L1	3-4.9999	10
L4	7-9.9999	10
L5	2-2.9999	10
L6	14-13.9999	10
L7	0.03-1.9999	10
L8	20-29.9999	10

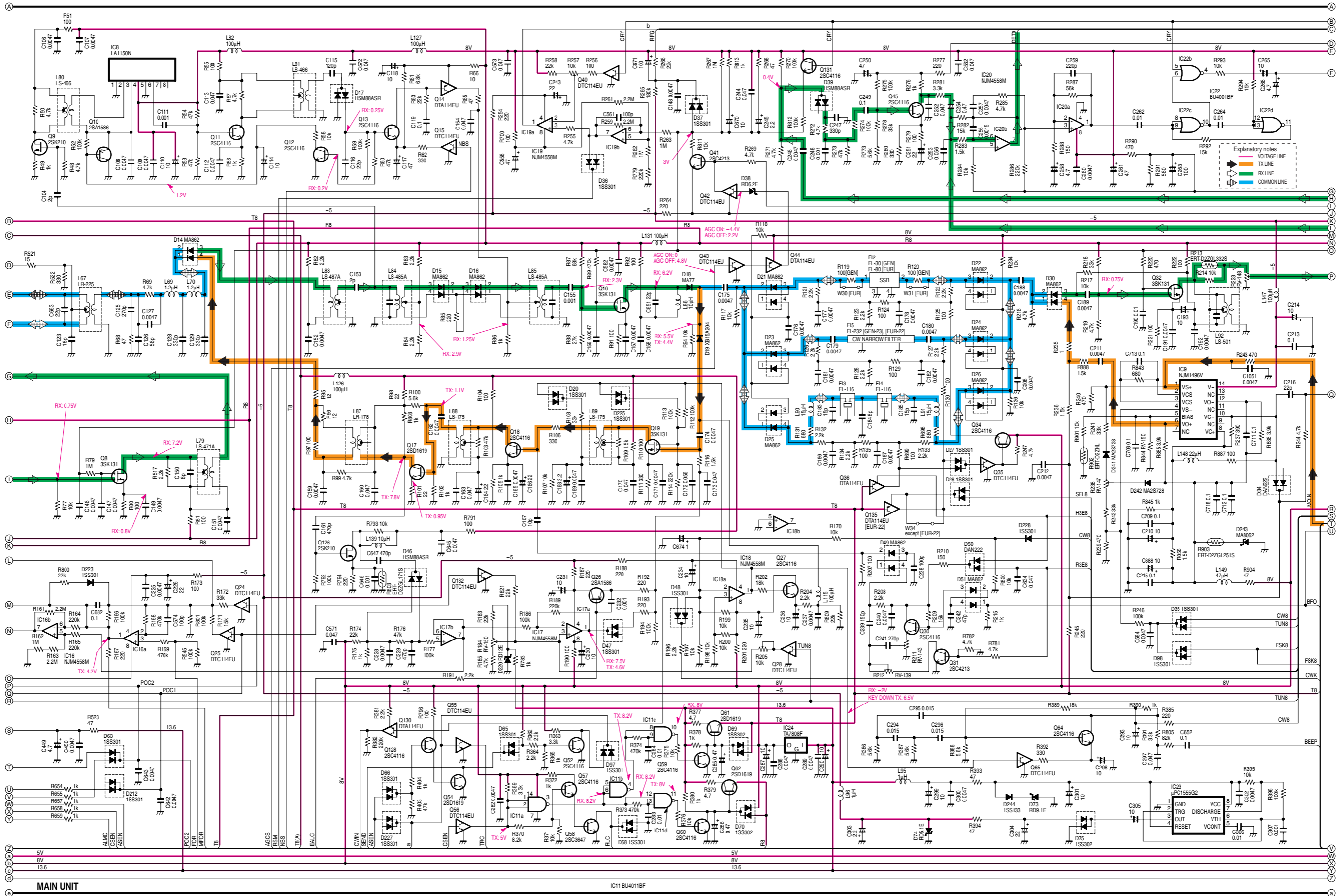
Name	MHz	V
B0	0.03-1.9999	12.5
B1	2-2.9999	12.5
B2	3-4.9999	12.5
B3	5-6.9999	12.5
B4	7-9.9999	12.5
B5	10-13.9999	12.5
B6	14-17.9999	12.5
B7	18-23.9999	12.5
B8	24-29.9999	12.5

Explanatory notes

- VOLTAGE LINE
- TX LINE
- RX LINE
- COMMON LINE

TX RF-POWER	V
1	1.15
2	2.00
3	9.00

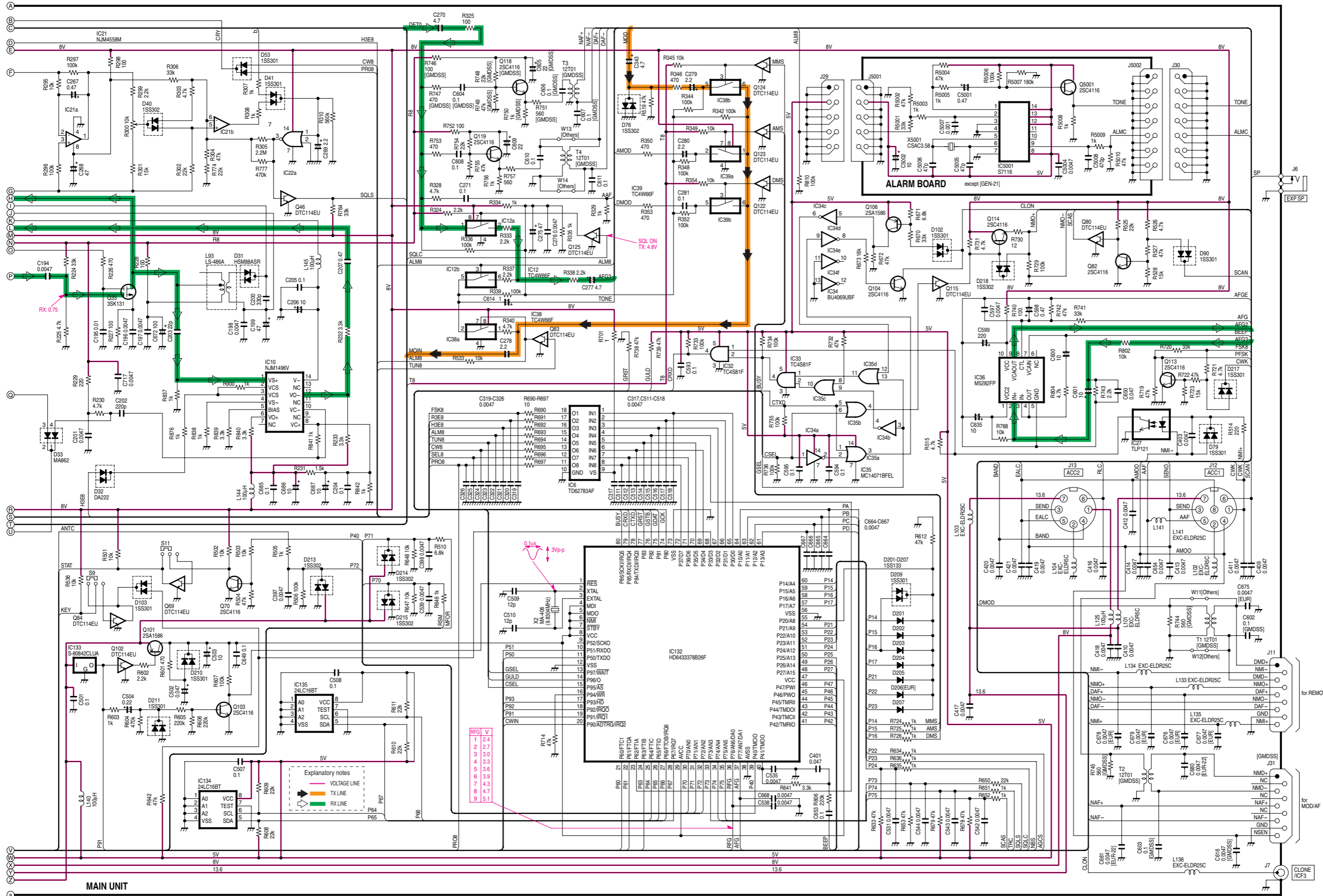
MEASUREMENT CONDITIONS  
OSCILLOSCOPE: 20 MHz  
VOLTMETER: 50kV/V



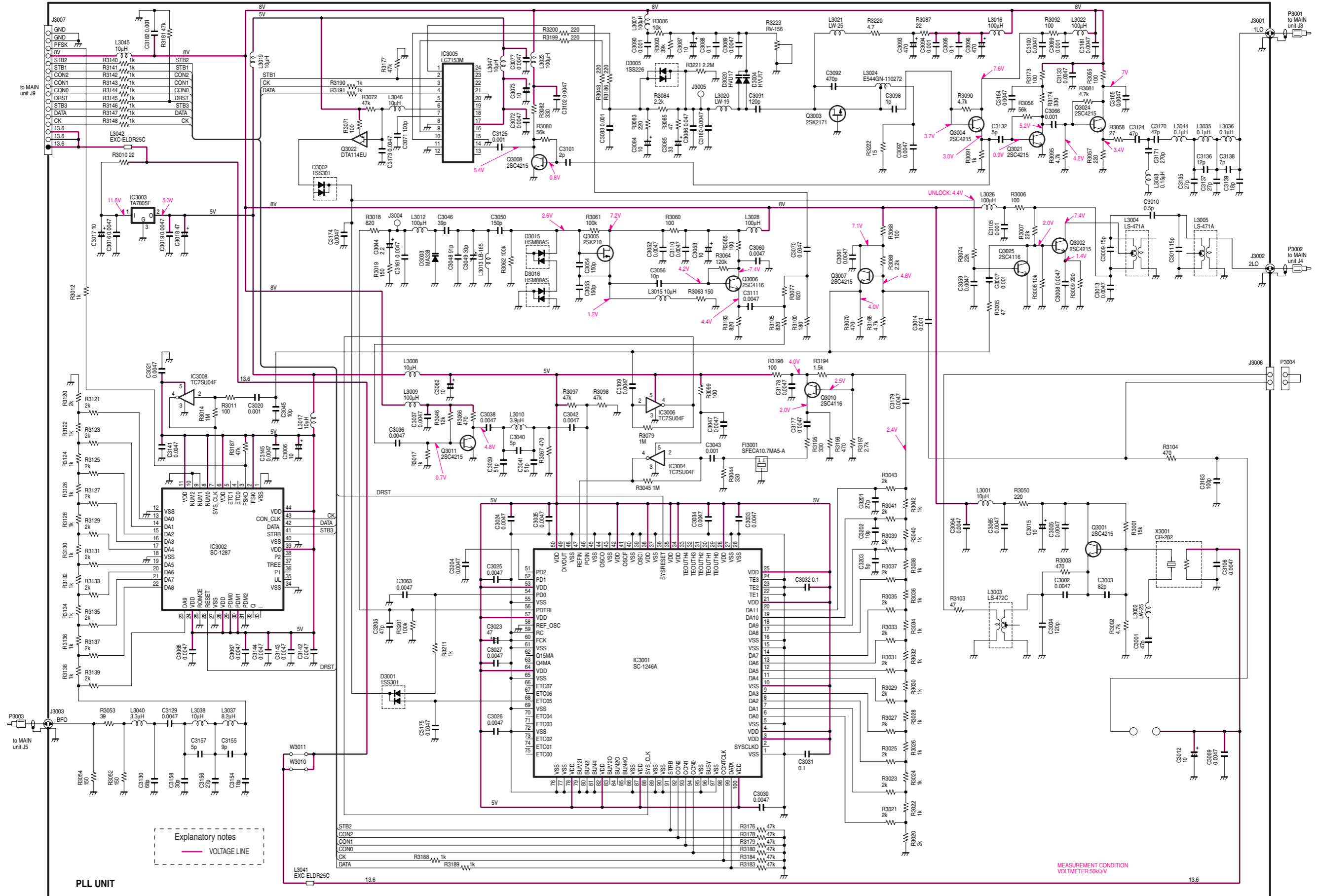
Explanatory notes  
VOLTAGE LINE  
TX LINE  
RX LINE  
COMMON LINE

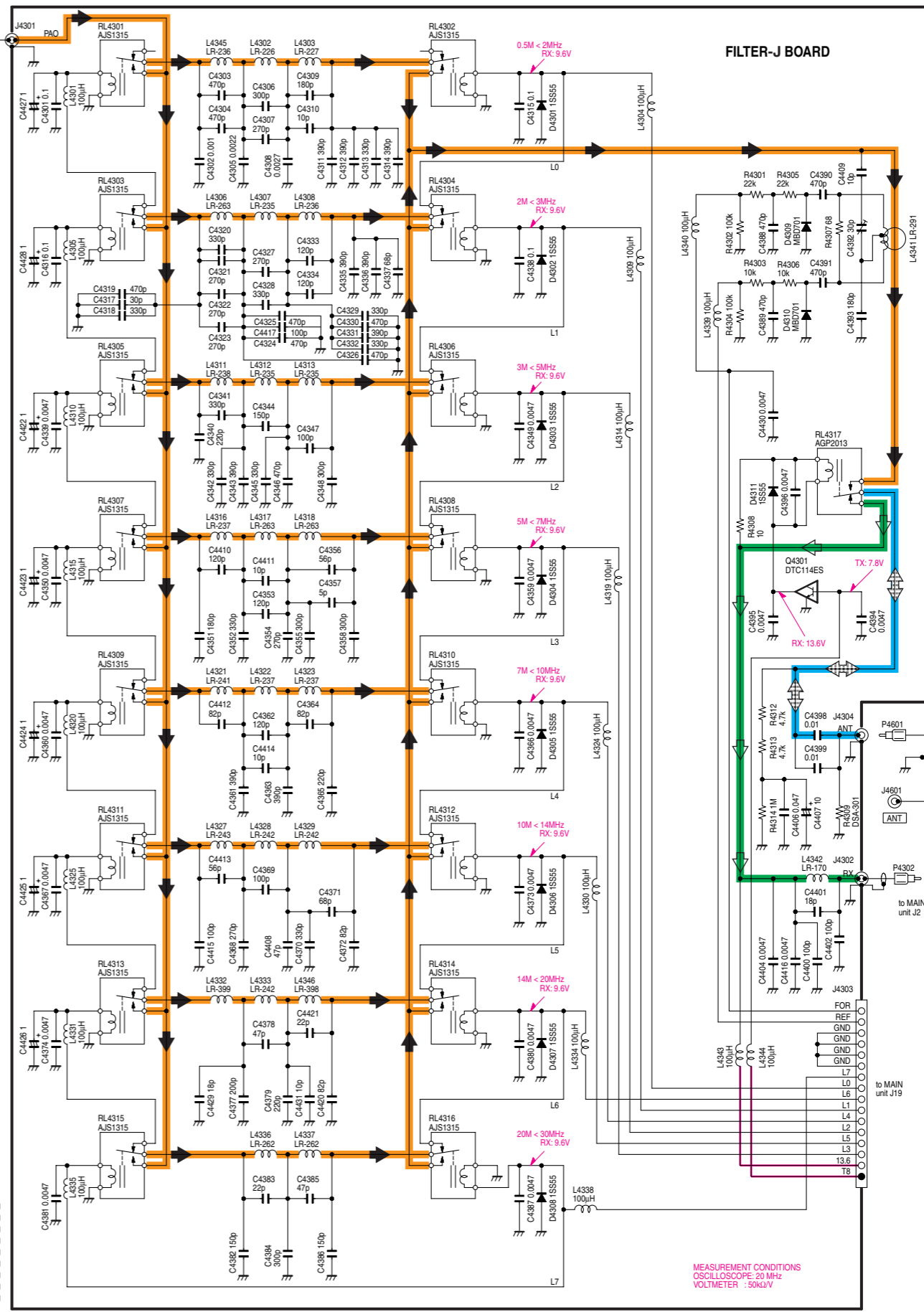
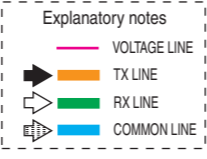
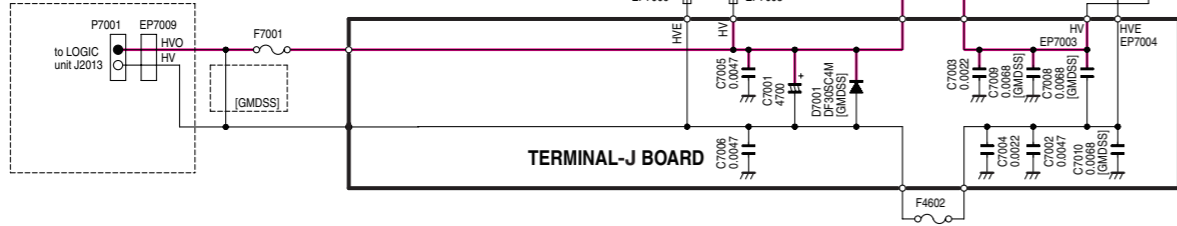
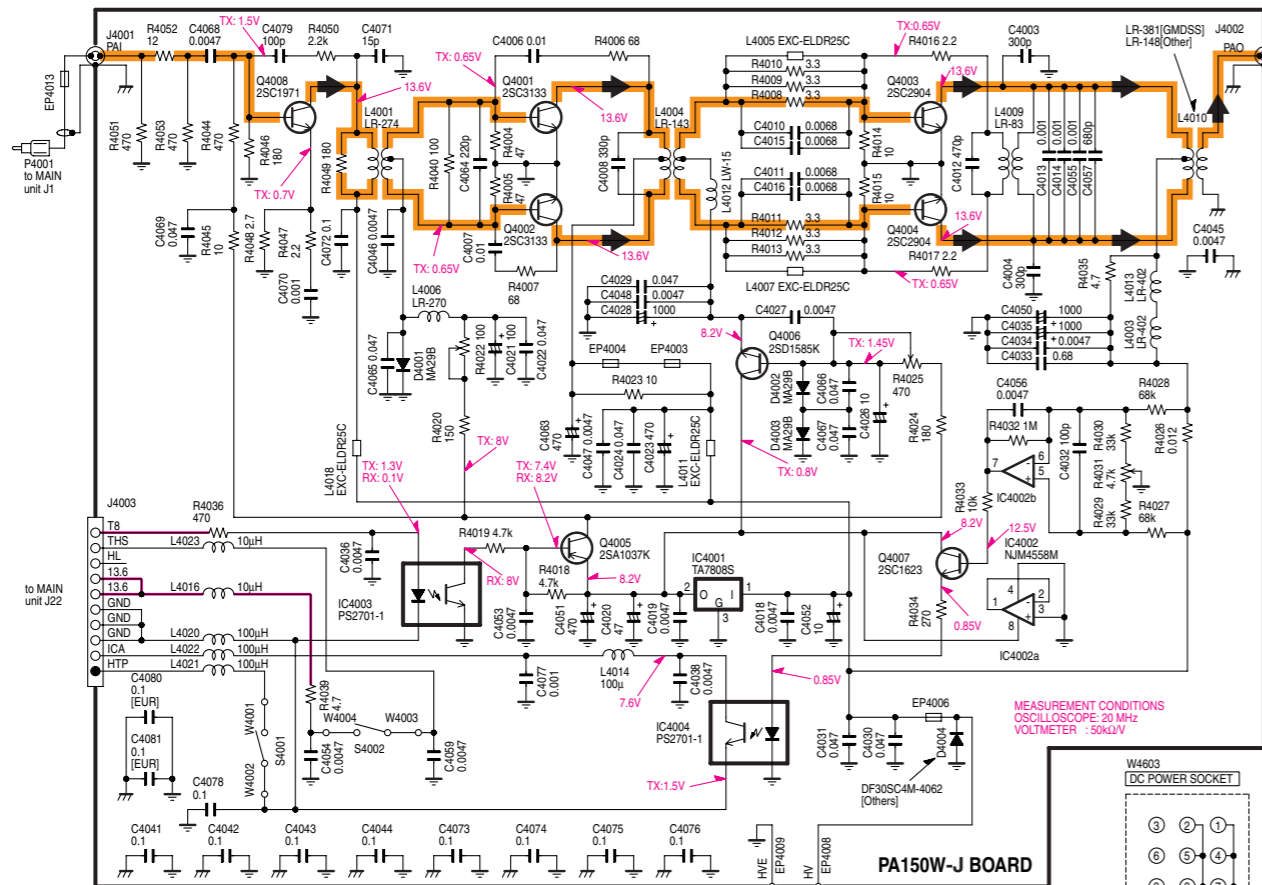
MAIN UNIT

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