Vertex Standard

VHF FM Transceiver

VX-230 Series

Service Manual

Vertex Standard LMR, Inc.

EC085N90L

Introduction

This manual provides technical information necessary for servicing the **VX-230** FM Transceiver.

Servicing this equipment requires expertise in handling surface-mount chip components. Attempts by non-qualified persons to service this equipment may result in permanent damage not covered by the warranty, and may be illegal in some countries.

Two PCB layout diagrams are provided for each double-sided circuit board in the transceiver. Each side of is referred to by the type of the majority of components installed on that side ("leaded" or "chip-only"). In most cases one side has only chip components, and the other has either a mixture of both chip and leaded components (trimmers, coils, electrolytic capacitors, ICs, etc.), or leaded components only.

While we believe the technical information in this manual to be correct, VERTEX STANDARD assumes no liability for damage that may occur as a result of typographical or other errors that may be present. Your cooperation in pointing out any inconsistencies in the technical information would be appreciated.

Important Note

This transceiver was assembled using Pb (lead) free solder, based on the RoHS specification.
Only lead-free solder (Alloy Composition: Sn-3.0Ag-0.5Cu) should be used for repairs performed on this apparatus. The solder stated above utilizes the alloy composition required for compliance with the lead-free specification, and any solder with the above alloy composition may be used.

Contents

Specifications: USA (NA) & Except EIA (CE) Models

General

Frequency Range:	134 -174 MHz
Number of Channels:	16
Power Supply Voltage:	7.4 V DC ±10 %
Channel Spacing:	12.5 / 20 / 25 kHz
Battery Life (5-5-90 duty):	10.8 hours (8.8 hours w/o saver) with FNB-V103LIA/FNB-V131LI-UNI
	19 hours (15.5 hours w/o saver) w/FNB-V104LIA/FNB-V132LI-UNI
Operating Temperature Range:	–22 °F to +140 °F (–30 °C to +60 °C)
Frequency Stability:	±2.5 ppm
RF Input-Output Impedance:	50 Ohm
Dimension (W x H x D):	2.2” x 4.3” x 1.2” (58 x 110 x 30 mm) with FNB-V103LIA/FNB-V131LI-UNI
	2.2” x 4.3” x 1.4” (58 x 110 x 36 mm) with FNB-V104LIA/FNB-V132LI-UNI
Weight (Approx.):	10.1 oz (287 g) with FNB-V103LIA, Antenna, Belt Clip
	11.5 oz (326 g) with FNB-V104LIA, Antenna, Belt Clip
	10.2 oz (288 g) with FNB-V131LI-UNI, Antenna, Belt Clip
	11.6 oz (329 g) with FNB-V132LI-UNI, Antenna, Belt Clip

Receiver (measured by TIA/EIA-603)

Sensitivity (12dB SINAD):	0.25 µV typical
Adjacent Channel Selectivity:	65 / 60 dB (25 kHz / 12.5 kHz)
Intermodulation:	65 / 60 dB (25 kHz / 12.5 kHz)
Spurious and Image Rejection:	65 dB
Audio Output:	500 mW @ 4 ohms 5 % THD

Transmitter (measured by TIA/EIA-603)

Output Power:	5 / 1 W
Modulation:	16K0F3E, 11K0F3E
Conducted Spurious Emission:	65 dB below carrier
FM Hum & Noise:	45 / 40 dB (25 kHz / 12.5 kHz)
Audio Distortion:	< 3 % @1 kHz

Specification may be changed without notification.

Specifications: EIA (CE) Model

General

Frequency Range:	134MHz - 174MHz (VX-231-ED0B-5)
Number of Channels:	16
Power Supply Voltage:	7.4 V DC ±10 %
Channel Spacing:	12.5 / 20 / 25 kHz
Battery Life (5-5-90 duty):	10.8 hours (8.8 hours w/o saver) with FNB-V103LIA/FNB-V131LI-UNI 19 hours (15.5 hours w/o saver) w/FNB-V104LIA/FNB-V132LI-UNI
Temperature Range:	–20 °C to +55 °C (Operation) –0 °C to +45 °C (Battery Charging) Turn the radio off while charging the battery, and use only the Vertex Standard Model PA-42C/U AC Adapter and CD-34 Desktop.
Frequency Stability:	±2.5 ppm
RF Input-Output Impedance:	50 Ohm
Battery Pack:	FNB-V103LIA / FNB-V104LIA / FNB-V131LI-UNI / FNB-V132LI-UNI Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.
Dimension (W x H x D):	58 x 110 x 30 mm with FNB-V103LIA/FNB-V131LI-UNI 58 x 110 x 36 mm with FNB-V104LIA/FNB-V132LI-UNI
Weight (Approx.):	287 g with FNB-V103LIA, Antenna, Belt Clip 326 g with FNB-V104LIA, Antenna, Belt Clip 288 g with FNB-V131LI-UNI, Antenna, Belt Clip 329 g with FNB-V132LI-UNI, Antenna, Belt Clip

Receiver (Measurement per EN 300 086)

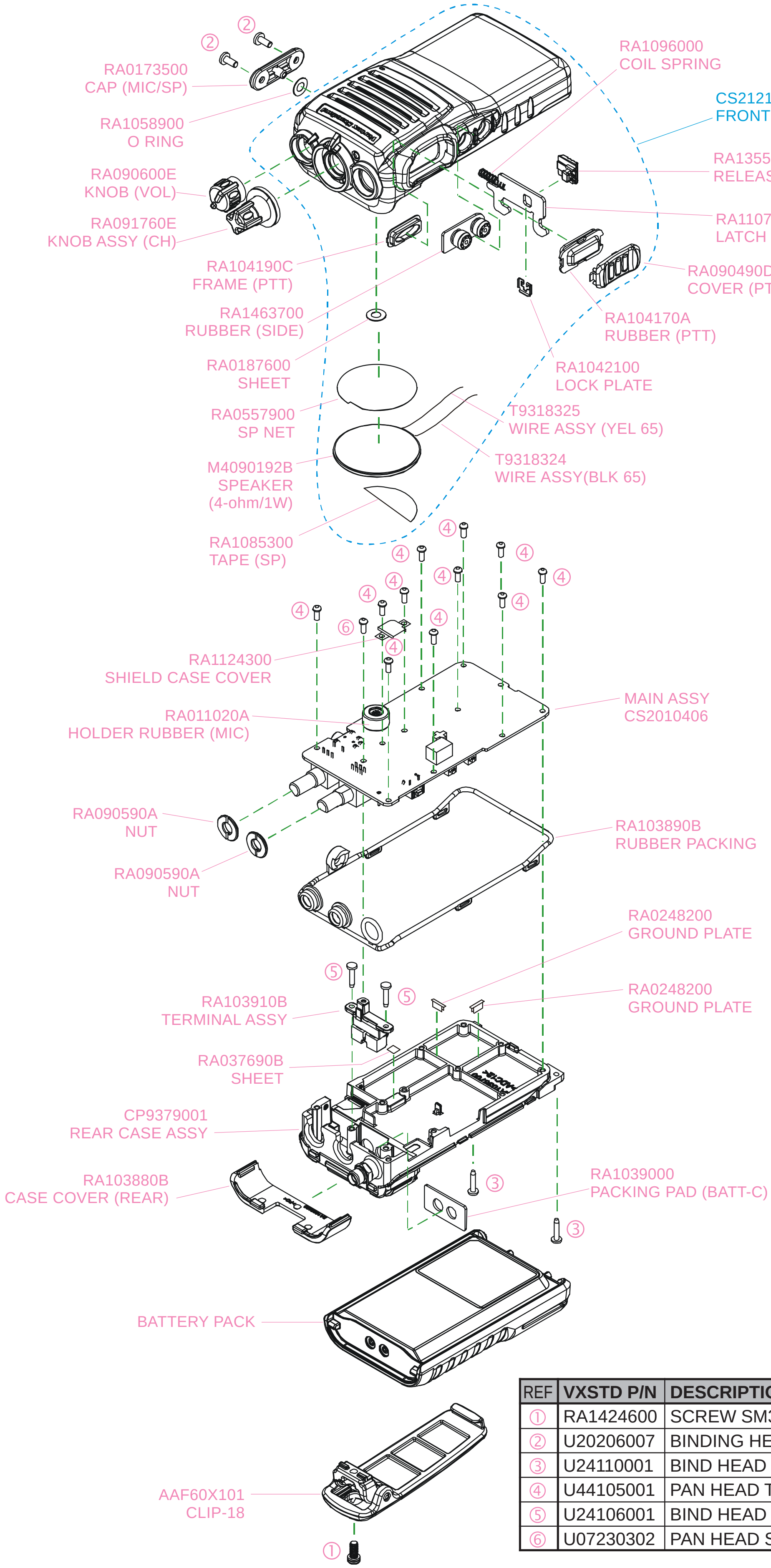
Sensitivity (20 dB SINAD):	0.5 µV
Adjacent Channel Selectivity:	70 / 60 dB (25 kHz / 12.5 kHz)
Intermodulation:	65 dB
Spurious and Image Rejection:	70 dB
FM Noise:	45 / 40 dB (25 kHz / 12.5 kHz)
Spurious Emission:	–36 dBm (<1GHz), –30 dBm (>1GHz)
Audio Output:	500 mW @ 4 ohms 5 % THD

Transmitter (Measurement per EN 300 08)

Output Power:	5 / 1 W
Modulation:	Variable Reactance Modulation
Maximum Frequency Deviation:	±2.5 / ±4.0 / ±5.0 kHz (12.5 kHz / 20 kHz / 25 kHz)
FM Hum & Noise:	45 / 40 dB (25 kHz / 12.5 kHz)
Audio Distortion:	< 5 % @1 kHz
Spurious Emission:	–36 dBm (<1GHz), –30 dBm (>1GHz)

Specification may be changed without notification.

Exploded View & Miscellaneous Parts



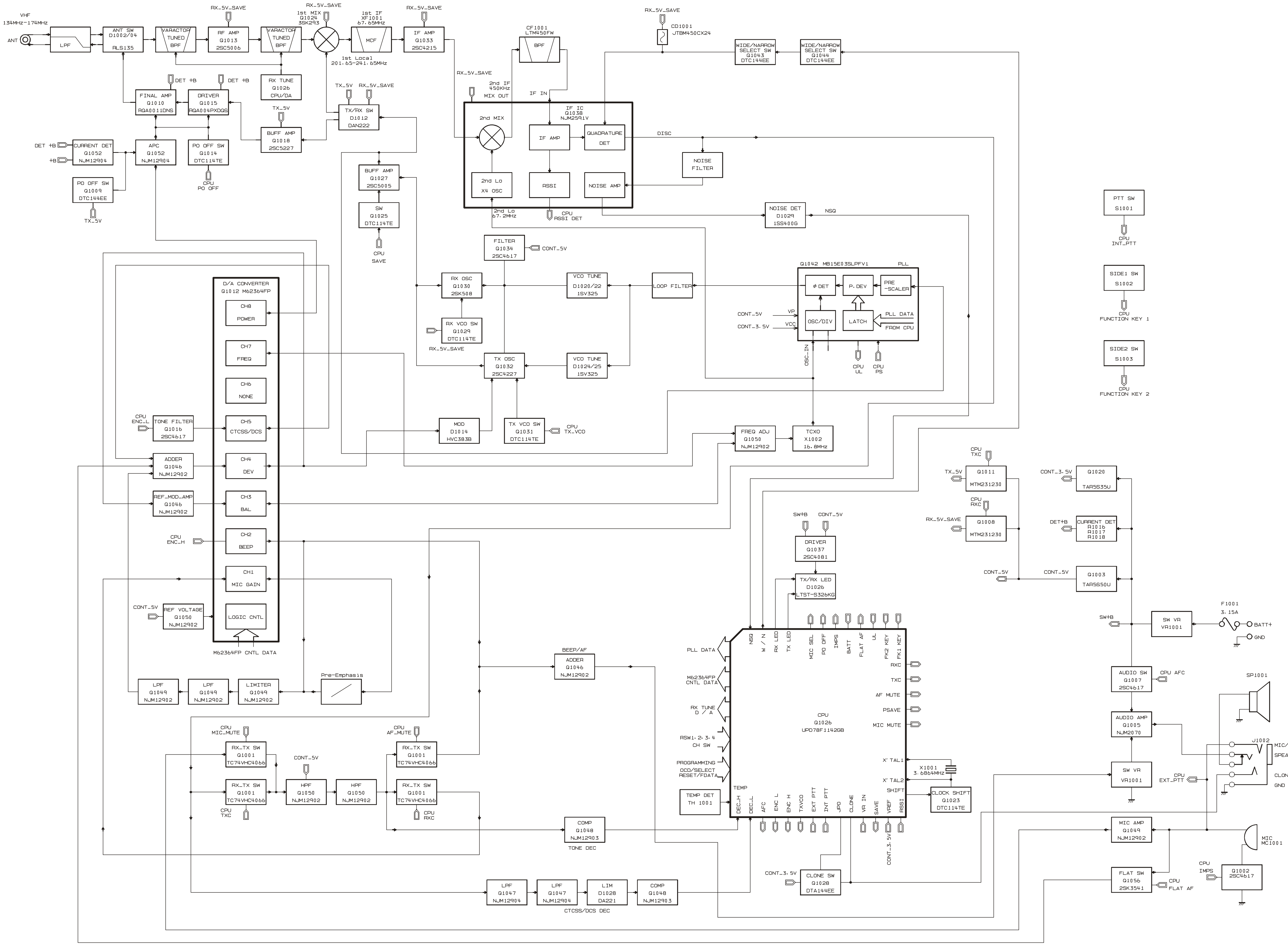
REF	VXSTD P/N	DESCRIPTION	QTY.
①	RA1424600	SCREW SM3X8SUS	1
②	U20206007	BINDING HEAD SCREW M2.6X6B	2
③	U24110001	BIND HEAD TAPTITE-B 2X10(3)	2
④	U44105001	PAN HEAD TAPTITE-B M2X5	11
⑤	U24106001	BIND HEAD TAPTITE-B M2X6	2
⑥	U07230302	PAN HEAD SCREW M2X3NI #3	1

Non-designated parts are available only as part of a designated assembly.

Parts List

REF.	DESCRIPTION	VALUE	V/W	TOL.	MFR'S DESIG	VXSTD P/N	VERS.	LOT.	SIDE	LAY ADR
	PCB with Components					CS2010406				
	FRONT CASE ASSY					CS2121102				
	REAR CASE ASSY					CP9379001				
	TERMINAL ASSY					RA103910B				
	CASE COVER				REAR	RA103880B				
	KNOB				VOL	RA090600E				
	KNOB ASSY				CH	RA091760E				
	NUT					RA090590A				
	RUBBER PACKING					RA103890B				
	PACKING PAD				BATT-C	RA1039000				
	HOLDER RUBBER				MIC	RA011020A				
	SCREW	(1 pc)			SM3X8SUS	RA1424600				
	BINDING HEAD SCREW	(2 pcs)			M2.6X6B	U20206007				
	BIND HEAD TAPTITE-B	(2 pcs)			2X10(3)	U24110001				
	PAN HEAD TAPTITE-B	(11 pcs)			M2X5	U44105001				
	BIND HEAD TAPTITE-B	(2 pcs)			M2X6	U24106001				
	PAN HEAD SCREW	(1 pc)			M2X3NI #3	U07230302				
	SPEAKER	4-ohm			A-S0000036-004 4-OHM/1W	M4090192B				
CD1001	CERAMIC DISC				JTBM450CX24	H7901530			B	c3
CF1001	CERAMIC FILTER				LTM450FW-A	H3900572A			A	A2
F 1001	CHIP FUSE	3.15A			FHC16 322ADTP	Q0000118			A	B1
MC1001	MIC. ELEMENT				PF0-1055P	M3290045			A	C2
Q 1010	FET				RQA0011DNS#G0	G3070507			A	B2
S 1001	TACT SWITCH				SKHLLD	N5090066			B	c1
S 1002	TACT SWITCH				SKRTLAE010	N5090130			B	c2
S 1003	TACT SWITCH				SKRTLAE010	N5090130			B	c3
S 1004	ROTARY SWITCH				ED10304O-FB15S7.0-A16-100	N0190195			B	b1
VR1001	POT.				R9710NS-FB15A7.0-A203-005	J60800325			B	a1
X 1001	XTAL U3B	3.6864MHz			3.686400MHz (11p)	H0103307			B	c4
X 1002	TCXO	16.8MHz			TTS14VSB-A3 16.80MHZ	H9501100			B	b4
XF1001	XTAL FILTER				MFT67N2 67.650MHZ	H1102473			B	b3

Block Diagram



Circuit Description

1. Circuit Configuration by Frequency

The receiver is a Double-conversion Super-heterodyne with a first intermediate frequency (IF) of 67.65 MHz and a second IF of 450kHz. Incoming signal from the antenna is mixed with the local signal from the VCO/PLL to produce the first IF of 67.65 MHz.

This is then mixed with the 67.2 MHz second local oscillator output to produce the 450 kHz second IF. This is detected to give the demodulated signal.

The transmit signal frequency is generated by the PLL VCO, and modulated by the signal from the microphone. It is then amplified and sent to the antenna.

2. Receiver System

2-1. Front-end RF amplifier

Incoming RF signal from the antenna is delivered to the RF Unit and passes through Low-pass filer, antenna switching diode, high pass filter and removed undesired frequencies by varactor diode (tuned band-pass filer).

The passed signal is amplified in **Q1013** (**2SC5006**) and moreover cuts an image frequency with the tuned band pass filter and comes into the 1st mixer.

2-2. First Mixer

The 1st mixer consists of the **Q1024** (**3SK293**). Buffered output from the VCO is amplified by **Q1027** (**2SC5005**) to provide a pure first local signal between 201.65 and 241.65 MHz for injection to the first mixer.

The IF signal then passes through monolithic crystal filters XF1001(±7.5 kHz BW) to strip away all but the desired signal.

2-3. IF Amplifier

The first IF signal is amplified by **Q1033** (**2SC4215Y**).

The amplified first IF signal is applied to FM IF subsystem IC **Q1038** (**NJM2591V**) which contains the second mixer, second local oscillator, limiter amplifier, noise amplifier, and RSSI amplifier.

The signal from reference oscillator X1002 becomes 4 times of frequencies in **Q1038**, it is mixed with the IF signal and becomes 450 kHz.

The second IF then passes through the ceramic filter CF1001 (LTM450FW) to strip away unwanted mixer products, and is applied to the limiter amplifier in **Q1038**, which removes amplitude variations in the 450kHz IF, before detection of the speech by the ceramic discriminator CD1001 (TBM450CX24).

2-4. Audio amplifier

Detected signal from **Q1038** is inputted to TX/RX switch **Q1001-4** (**TC74VHC4066AFT**).

The signal which appeared from **Q1001** is in high pass filter **Q1050** (**NJM12902**).

The signal which passed **Q1050** goes to AF volume (VR1001). And then the signal goes to audio amplifier **Q1005** (**NJM2070M**).

The output signal from **Q1005** is in audio speaker.

2-5. Squelch Circuit

There are 16 levels of squelch setting from 0 to 15. The level 0 means open the squelch. The level 1 means the threshold setting level and level 14 means tight squelch. From 2 to 13 is established in the middle of threshold and tight.

The bigger figure is nearer the tight setting. The level 15 becomes setting of carrier squelch.

<u>2-5-1. Noise Squelch</u>

Noise squelch circuit is composed of the band path filter of **Q1038**, and noise detector **D1029** (**1SS400G**).

When a carrier isn't received, the noise ingredient which goes out of the demodulator **Q1038** is amplified in **Q1038** through the band path filter **Q1038**, is detected to DC voltage with **D1029** and is inputted to 52pin (the A/D port) of the **Q1026** (CPU).

When a carrier is received, the DC voltage becomes low because the noise is compressed.

When the detected voltage to CPU is high, the CPU stops AF output with **Q1001-3** "OFF" by making the 41pin (CPU) "L" level.

When the detection voltage is low, the CPU makes **Q1001** ON with making 41pin "H" and the AF signal is output.

<u>2-5-2. Carrier Squelch</u>

The CPU (53pin: A/D port) detect RSSI voltage output from **Q1038** 12 pin, and controls AF output.

The RSSI output voltage changes according to the signal strength of carrier. The stronger signal makes the RSSI voltage to be higher voltage.

The process of the AF signal control is same as Noise Squelch

The shipping data is adjusted –1dBu (EMF) higher than squelch tight sensitivity.

3. Transmitter System

3-1. Mic Amplifier

The AF signal from internal microphone MC1001 or external microphone J1002 is amplified with microphone amplifier **Q1049-3** (**NJM12902V**).

This signal enters high pass filter Q1050 via the mute switch **Q1001-1**(**TC74VHC4066AFT**).

Afterwards, the switch circuit is controlled in the gain by way of microphone gain volume **Q1012** (**M62364FP-CH1**).

AF signal is passes a pre-emphasis circuit and is input to the limiter amplifier **Q1049-2** (**NJM12902V**).

The signal passed splatter filter of **Q1049** and adder amplifier **Q1046** is adjusted by maximum deviation adjustment volume **Q1012** (**M62364FP-CH4**).

The AF signal ingredient is amplified **Q1046**(**NJM12902V**).

After that, it is made FM modulation to transmit carrier by the modulator **D1014** (**HVC383B**) of VCO.

3-2. Drive and Final amplifier

The modulated signal from the VCO **Q1032** (**2SC4227**) is buffered by **Q1027** (**2SC5005**). Then the signal is buffered by **Q1018** (**2SC5227**) for the final amplifier driver **Q1015** (**RQA0004PXDQS**). The low-level transmit signal is then applied to **Q1010** (**RQA0011DNS**) for final amplification up to 5watts output power.
The transmit signal then passes through the antenna switch **D1002** (**RLS135**) and is low pass filtered to suppress away harmonic spurious radiation before delivery to the antenna.

3-3. Automatic Transmit Power Control

The current detector **Q1052-1** (**NJM12904R**) detects the current of **Q1010** and **Q1015**, and converts the current difference to the voltage difference.
The output from the current detector **Q1052-1** is compared with the reference voltage and amplified by the power control amplifier **Q1052-2**.
The output from **Q1052-2** controls the gate bias of the final amplifiers **Q1010** and the final amplifier driver **Q1015**.
The reference voltage changes into four values (Transmit Power High and Low) controlled by **Q1012** (**M62364FP-CH8**).

4. PLL Frequency Synthesizer

The frequency synthesizer consists of PLL IC, **Q1042** (**MB15E03SL**), VCO, TCXO (X1002) and buffer amplifier.
The output frequency from TCXO is 16.8 MHz and the tolerance is ±2.5 ppm (in the temperature range –30 to +60 degrees).

4-1. VCO

While the radio is receiving, the RX oscillator **Q1030** (**2SK508**) in VCO generates a programmed frequency between 201.65 and 241.65 MHz as 1st local signal.
While the radio is transmitting, the TX oscillator **Q1032** (**2SC4227**) in VCO generates a frequency between 134 and 174 MHz.
The output from oscillator is amplified by buffer amplifier **Q1027** (**2SC5005**) and becomes output of VCO. The output from VCO is divided, one is amplified by **Q1027** and feed back to the PLL IC 8pin. It is put into the mixer as the 1st local signal through **D1012**, in transmission, it is buffered **Q1018**, and more amplified in **Q1015** through **D1012** and it is put into the final amplifier **Q1010**.

4-2. VCO Tuning Voltage

Tuning voltage of VCO is expanding the lock range of VCO by controlling the cathode of varactor diode at the voltage and the control voltage from PLL IC.

4-3. PLL

The PLL IC consists of reference divider, main divider, phase detector, charge pumps and pulse swallow operation. The reference frequency from TCXO is inputted to 1pin of PLL IC and is divided by reference divider.
The other hand, inputted feed back signal to 8pin of PLL IC from VCO is divided with the dividing ratio which becomes same frequency as the output of reference divider. These two signals are compared by phase detector, the phase difference pulse is generated.
The phase difference pulse and the pulse from through the charge pumps and LPF. It becomes the DC voltage to control the VCO.
The oscillation frequency of VCO is locked by the control of this DC voltage.
The PLL serial data from CPU is sent with three lines of SDO (60pin), SCK (58pin) and PSTB (59pin).
The lock condition of PLL is output from the UL (14Pin) terminal and UL becomes “H” at the time of the lock condition and becomes “L” at the time of the unlocked condition. The CPU always watches over the UL condition, and when it becomes “L” unlocked condition, the CPU prohibits transmitting and receiving.

Alignment

Introduction

The **VX-230** series has been aligned at the factory for the specified performance across the entire frequency range specified. Realignment should therefore not be necessary except in the event of a component failure. All component replacement and service should be performed only by an authorized Vertex Standard representative, or the warranty policy may be voided.

The following procedures cover the sometimes critical and tedious adjustments that are not normally required once the transceiver has left the factory. However, if damage occurs and some parts are replaced, realignment may be required. If a sudden problem occurs during normal operation, it is likely due to component failure; realignment should not be done until after the faulty component has been replaced.

We recommend that servicing be performed only by authorized Vertex Standard service technicians who are experienced with the circuitry and fully equipped for repair and alignment. Therefore, if a fault is suspected, contact the dealer from whom the transceiver was purchased for instructions regarding repair. Authorized Vertex Standard service technicians realign all circuits and make complete performance checks to ensure compliance with factory specifications after replacing any faulty components. Those who do undertake any of the following alignments are cautioned to proceed at their own risk. Problems caused by unauthorized attempts at realignment are not covered by the warranty policy. Also, Vertex Standard must reserve the right to change circuits and alignment procedures in the interest of improved performance, without notifying owners. Under no circumstances should any alignment be attempted unless the normal function and operation of the transceiver are clearly understood, the cause of the malfunction has been clearly pinpointed and any faulty components replaced, and the need for realignment determined to be absolutely necessary. The following test equipment (and thorough familiarity with its correct use) is necessary for complete realignment. Correction of problems caused by misalignment resulting from use of improper test equipment is not covered under the warranty policy. While most steps do not require all of the equipment listed, the interactions of some adjustments may require that more complex adjustments be performed afterwards. Do not attempt to perform only a single step unless it is clearly isolated electrically from all other steps. Have all test equipment ready before beginning, and follow all of the steps in a section in the order presented.

Required Test Equipment

- ❒ Radio Tester with calibrated output level at 200 MHz
- ❒ In-line Wattmeter with 5% accuracy at 200 MHz
- ❒ 50-ohm, 10-W RF Dummy Load
- ❒ Regulated DC Power Supply (standard 7.5 VDC, 2 A)
- ❒ Frequency Counter: ±0.2 ppm accuracy at 200 MHz
- ❒ AF Signal Generator
- ❒ AC Voltmeter
- ❒ DC Voltmeter
- ❒ VHF Sampling Coupler
- ❒ IBM® PC/Compatible Computer with Microsoft® Windows® 2000, XP, Vista, 7, or 8
- ❒ Micorosoft® Net Framework 2.0 or later
- ❒ Vertex Standard CE99 PC Programming Software
- ❒ Vertex Standard FIF-12 USB Programming Interface and CT-106 PC Programming Cable
- ❒ Vertex Standard FRB-6 Tuning Interface Box and CT-160 Connection Cable.

Alignment Preparation & Precautions

A 50-ohm RF Dummy load and in-line wattmeter must be connected to the main antenna jack in all procedures that call for transmission, except where specified otherwise. Correct alignment is not possible with an antenna.

After completing one step, read the following step to determine whether the same test equipment will be required. If not, remove the test equipment (except dummy load and wattmeter, if connected) before proceeding.

Correct alignment requires that the ambient temperature be the same as that of the transceiver and test equipment, and that this temperature be held constant between 20 °C and 30 °C (68 °F ~ 86 °F). When the transceiver is brought into the shop from hot or cold air, it should be allowed time to come to room temperature before alignment.

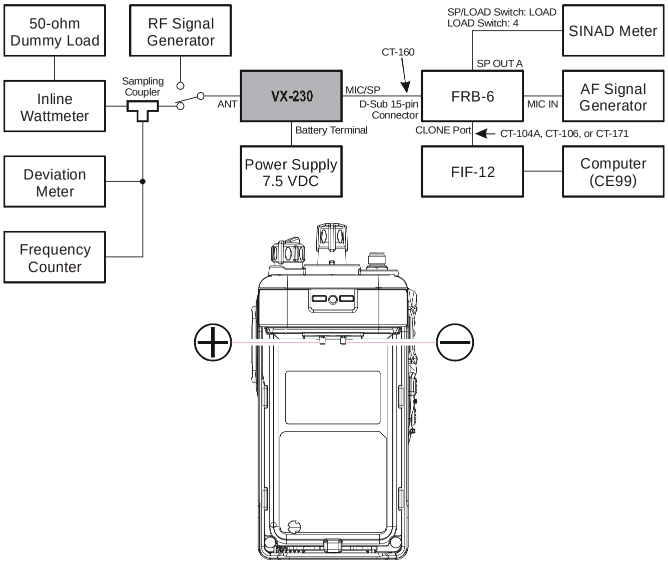
Whenever possible, alignments should be made with oscillator shields and circuit boards firmly affixed in place. Also, the test equipment must be thoroughly warmed up before beginning.

Note: Signal levels in dB referred to in this procedure are based on 0 dBμ EMF = 1.0 μV.

Alignment

Test Setup

Setup the test equipment as shown for transceiver alignment, then apply 7.5 V DC power to the transceiver.



The Alignment Tool Outline

Installation the tool

- ❒ Install the CE99 (PC Programming Software) to your PC.
- ❒ "Basic Alingment" function in the "Radio" menu of CE99.

Action of the switches

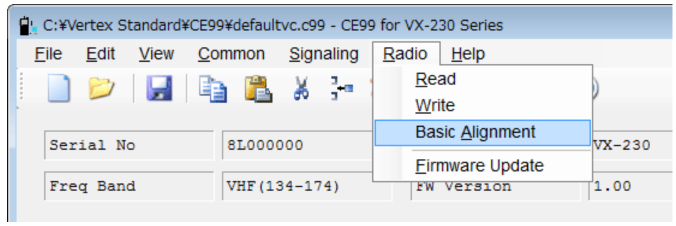
When the transceiver is in alignment mode, the action of PTT and KEY is ignored. All of the action is remote controlled by PC.

Caution!

Please never turn off a power supply while alignment. If the power supply turn off while alignment, the setting data is failed.

Basic Alignment Mode

In the Basic Alignment mode, the aligned data written in the radio will be able to re-align its alignment data. In this mode, there are many items to align with five points (F1, F2, F3, F4, F5) except "Frequency", "Mic Sense", "SQL/RSSI", and "Battery". The value of each parameter can be changed to desired position by "←" / "→" arrow key for up/down, direct number input and drag the mouse.



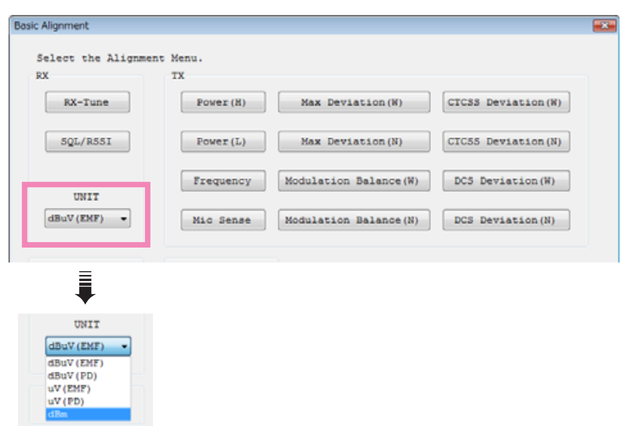
To enter the Basic Alignment Mode, select "Basic Alignment" in the main menu "Radio". It will start to "Read" the written personalized data from the radio. Then pressing the button "OK" will start the Basic Alignment Mode.

Note: when all items are aligned, it is strongly recommended to align according to following order. The detail information is written in the help of CE99 (PC Programming Software).

1. PLL Reference Frequency (Frequency)
2. RX Sensitivity (RX Tune)
3. Squelch (SQL/RSSI)
4. TX Power <High> / <Low>
5. Mic Sense
6. Maximum Deviation <Wide> / <Narrow>
7. Modulation Balance <Wide> / <Narrow>
8. CTCSS Deviation <Wide> / <Narrow>
9. DCS Deviation <Wide> / <Narrow>
10. Battery

Unit

During alignment, you may select the value among dBμV, μV (EMF or PD), or dBm.



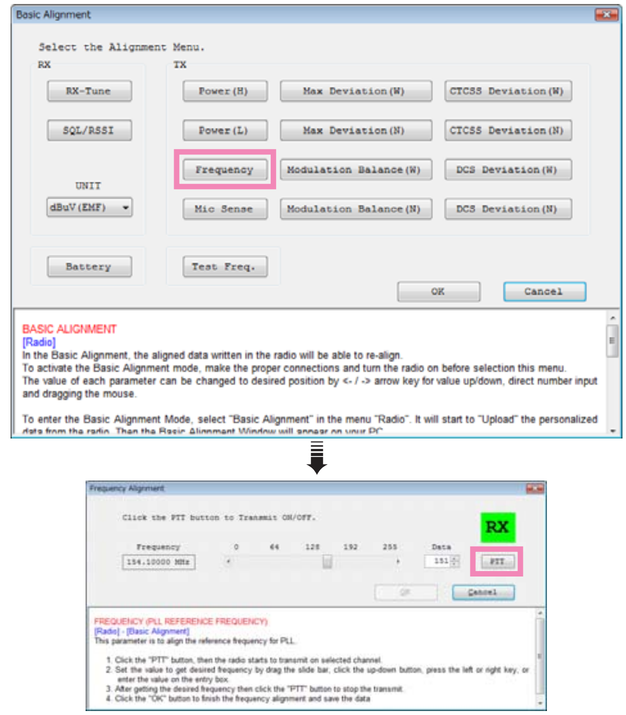
When perform the RX Tune and SQL alignment, the RF level shows this unit according to this setting.

Alignment

1. PLL Reference Frequency (Frequency)

This parameter is to align the reference frequency for PLL.

1. Click the “Frequency” button to open the Frequency Alignment window.
2. Click the “PTT” button. The radio will start to transmit on the center frequency channel.
3. Set the value to get desired frequency by the following ways:
   - Drag the slide bar
   - Click the up/down button
   - Press the left/right arrow key of the computer’s keyboard
   - Enter the value in the “Data” box from the computer’s keyboard.
4. After getting the desired frequency, click the “PTT” button to stop the transmit.
5. Click the “OK” button to finish the PLL Reference Frequency alignment and save the data.



2. RX Sensitivity (RX Tune)

This parameter is to align the RX BPF (Band Pass Filter) for Receive (RX) sensitivity. It must be done both alignments of the "Frequency" before this alignment is going to start. There are following 2 Way for Alignment.

Manual Alignment

1. Click the "RX-Tune" button to open the RX Sensitivity Tuning window.
2. Click the "Auto•h button on the frequency which you wish to alignment. The Auto Tuning window will appear.
3. Set the RF Signal Generator output according to the indication of the screen.
4. Click the "Start" button to start the automatic alignment to get the best RX sensitivity. The alignment result will show in the "New" box.
5. Click the "OK" button to finish the RX Sensitivity alignment and save the data.

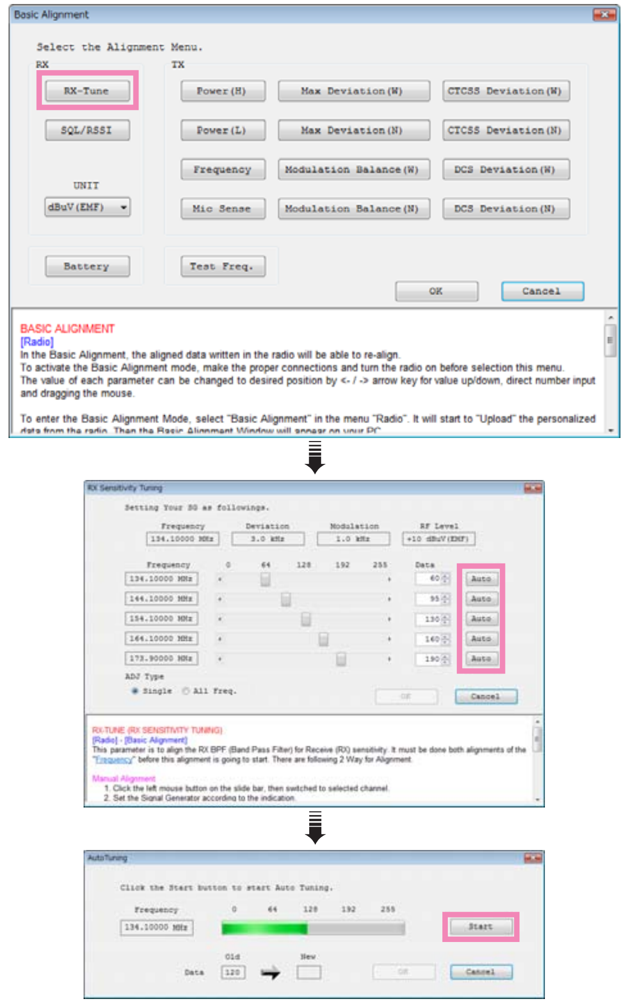
1) You may adjust the RX sensitivity manually by the following ways:
- Drag the slide bar
- Click the up/down button
- Press the left/right arrow key of the computer's keyboard
- Enter the value in the "Data" box from the computer's keyboard.

2) You may select the alignment type from the Radio button (ADJ Type) located at the bottom of the screen, as needed.

ADJ Type

Single : Alignment value change only to selected channel.

All Freq : Alignment value change for connecting with other channels.



Alignment

3. Squelch (SQL)

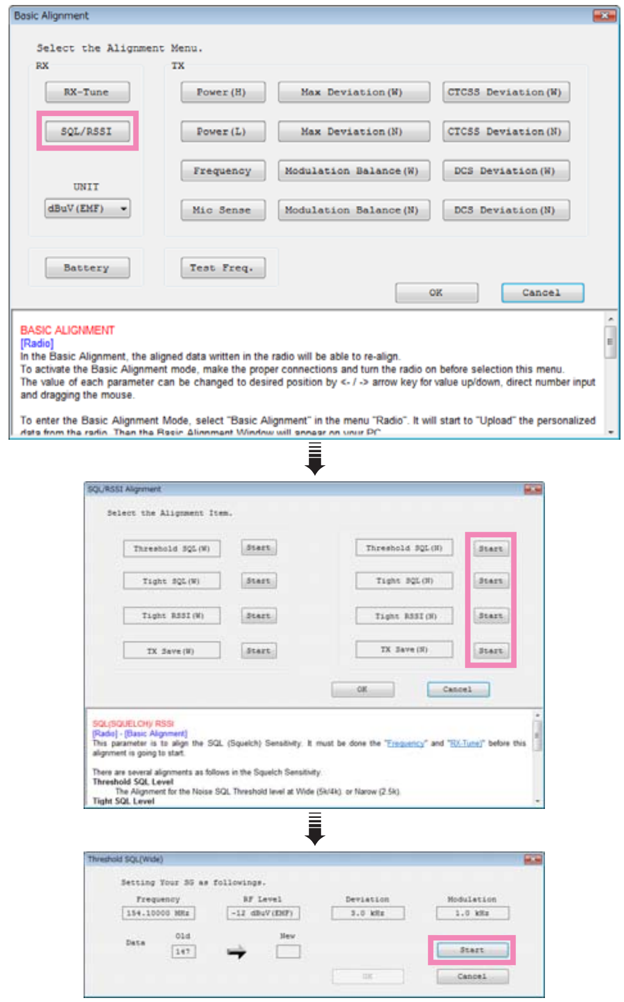
This parameter is to align the SQL (Squelch) Sensitivity.

There are several alignments as follows in the Squelch Sensitivity.

- **Threshold SQL Level**: The Alignment for the Noise SQL Threshold level at Wide (5k/4k) or Narow (2.5k).
- **Tight SQL Level**: The Alignment for the Noise SQL Tight level at Wide (5k/4k) or Narow (2.5k).
- **Tight SQL RSSI Level**: The Alignment for the “level 14” of the RSSI SQL level at Wide (5k/4k) or Narow (2.5k).
- **TX Save RSSI Level**: The Alignment for the TX Save RSSI level at Wide (5k/4k) or Narow (2.5k).

The procedure for all the alignment is as follows.

1. Click the “SQL/RSSI” button to open the SQL/RSSI Alignment window.
2. Click the “Start” button on the desired alignment item which you wish to alignment. The another window will open.
3. Set the RF Signal Generator output according to the indication of the screen.
4. Click the “Start” button to start the automatic alignment to get the optimum level. The alignment result will show in the “New” box.
5. Click the “OK” button to finish the SQL Sensitivity alignment and save the data.

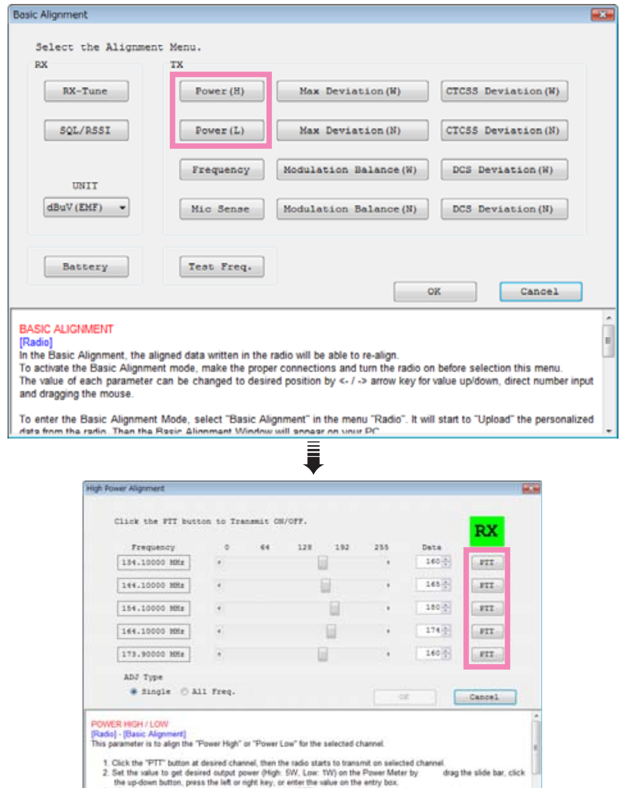


Alignment

4. TX Power

This parameter is to align the “Power High” or “Power Low” for the selected channel.

1. Click the “POWER (H)” or “POWER (L)” button to open the Power Alignment window.
2. Click the “PTT” button on the desired frequency which you wish to alignment. The radio starts to transmit on selected frequency.
3. Set the value to get desired output power (High: 5W, Low: 1W) on the Power meter by the following ways:
   - Drag the slide bar
   - Click the up/down button
   - Press the left/right arrow key of the computer’s keyboard
   - Enter the value in the “Data” box from the computer’s keyboard.
4. After getting the desired output power, click the “PTT” button to stop the transmit.
5. Click the “OK” button to finish the TX Power alignment and save the data.



You may select the alignment type from the Radio button (ADJ Type) located at the bottom of the screen, as needed.

ADJ Type

Single : Alignment value change only to selected channel.

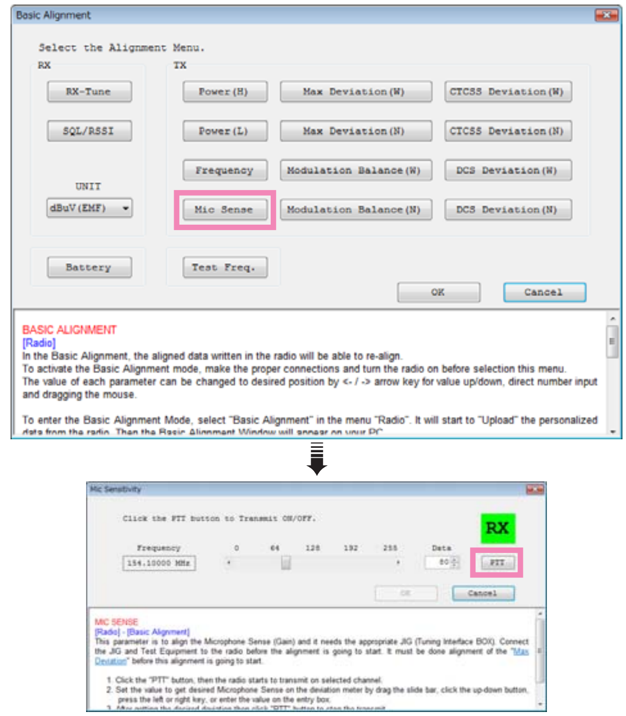
All Freq : Alignment value change for connecting with other channels.

Alignment

5. Mic Sense

This parameter is to align the “Microphone Sense” (Gain). The “Max Deviation” alignment must be done before this alignment is performed.

1. Click the “Mic Sense” button to open the Mic Sensitivity Alignment window.
2. Set the AF Signal Generator output to 10 mV at 1 kHz tone.
3. Click the “PTT” button. The radio starts to transmit on the center frequency channel.
4. Set the value to get desired deviation (3.0 kHz) on the deviation meter by the following ways:
   - Drag the slide bar
   - Click the up/down button
   - Press the left/right arrow key of the computer’s keyboard
   - Enter the value in the “Data” box from the computer’s keyboard.
5. After getting the desired deviation, click the “PTT” button to stop the transmit.
6. Click the “OK” button to finish the Mic Sense alignment and save the data.



6. Maximum Deviation <Wide> / <Narrow>

This parameter is to align the Maximum Deviation (Wide/Narrow).

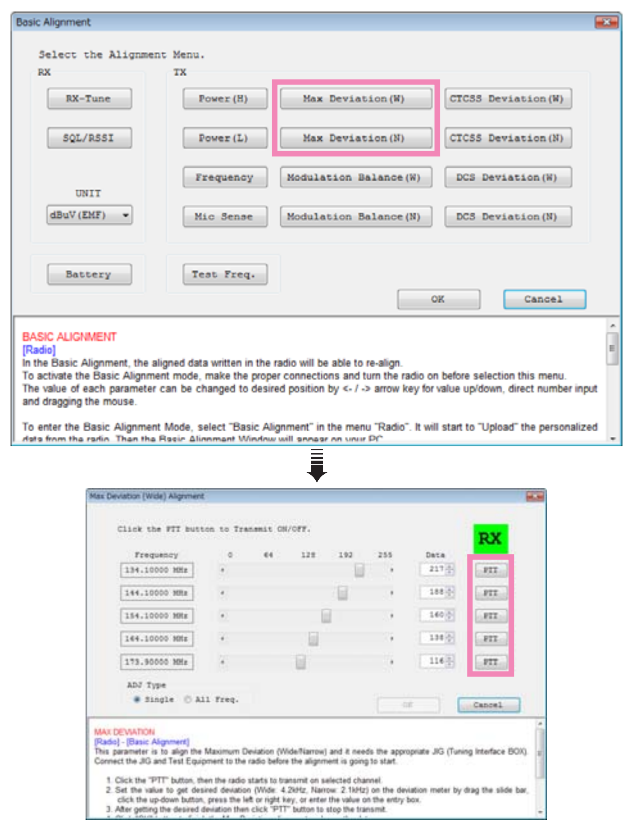
1. Click the “Max. Deviation (W)” or “Max. Deviation (N)” button to open the Max Deviation Alignment window.
2. Set the AF Signal Generator output to 100 mV at 1 kHz tone.
3. Click the “PTT” button on the desired frequency which you wish to alignment. The radio starts to transmit on the selected frequency.
4. Set the value to get desired deviation (Wide: 4.2 kHz, Narrow: 2.1 kHz) on the deviation meter by the following ways:
   - Drag the slide bar
   - Click the up/down button
   - Press the left/right arrow key of the computer’s keyboard
   - Enter the value in the “Data” box from the computer’s keyboard.
5. After getting the desired deviation, click the “PTT” button to stop the transmit.
6. Click the “OK” button to finish the Maximum Deviation alignment and save the data.

You may select the alignment type from the Radio button (ADJ Type) located at the bottom of the screen, as needed..

ADJ Type

Single : Alignment value change only to selected channel.

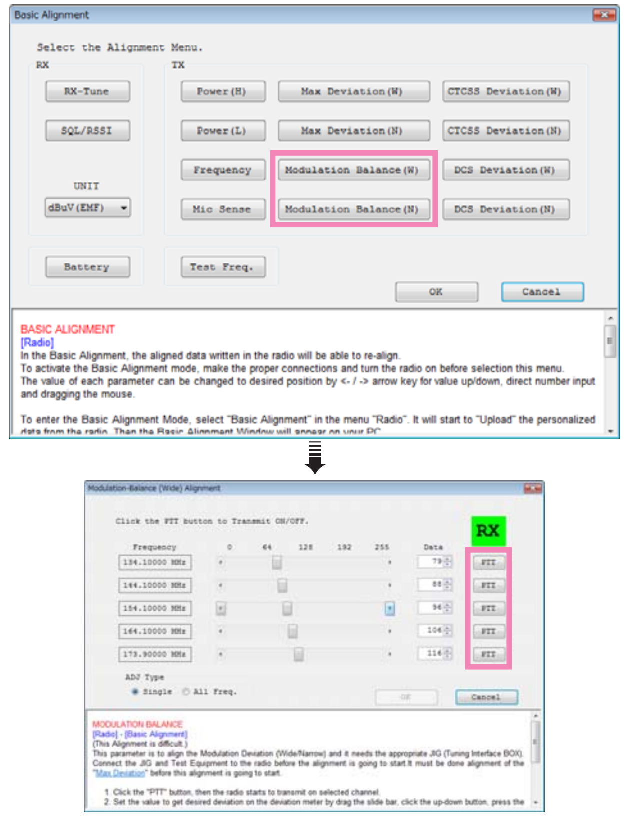
All Freq : Alignment value change for connecting with other channels.



7. Modulation Balance <Wide> / <Narrow> (This Alignment is difficult.)

This parameter is to align the "Modulation Deviation" (Wide/Narrow). The "Max Deviation" alignment must be done before this alignment is performed.

1. Click the "Modulation Balance (W)" or "Modulation Balance (N)" button to open the Modulation Balance Alignment window.
2. Set the AF Signal Generator output to 40 mV at 1 kHz tone.
3. Click the "PTT" button on the desired frequency which you wish to alignment. The radio starts to transmit on selected frequency.
4. Write down a deviation level of the deviation meter, then click the "PTT" button to stop the transmit.
5. Set the AF Signal Generator output to 40 mV at 40 Hz tone.
6. Click the same "PTT" button which you clicked in step 3, then set the value to get the same deviation level that wrote down by following ways:
   - Drag the slide bar
   - Click the up/down button
   - Press the left/right arrow key of the computer's keyboard
   - Enter the value in the "Data" box from the computer's keyboard.
7. After getting the desired deviation, click the "PTT" button to stop the transmit.
8. Click the "OK" button to finish the Modulation Balance alignment and save the data.



You may select the alignment type from the Radio button (ADJ Type) located at the bottom of the screen, as needed..

ADJ Type

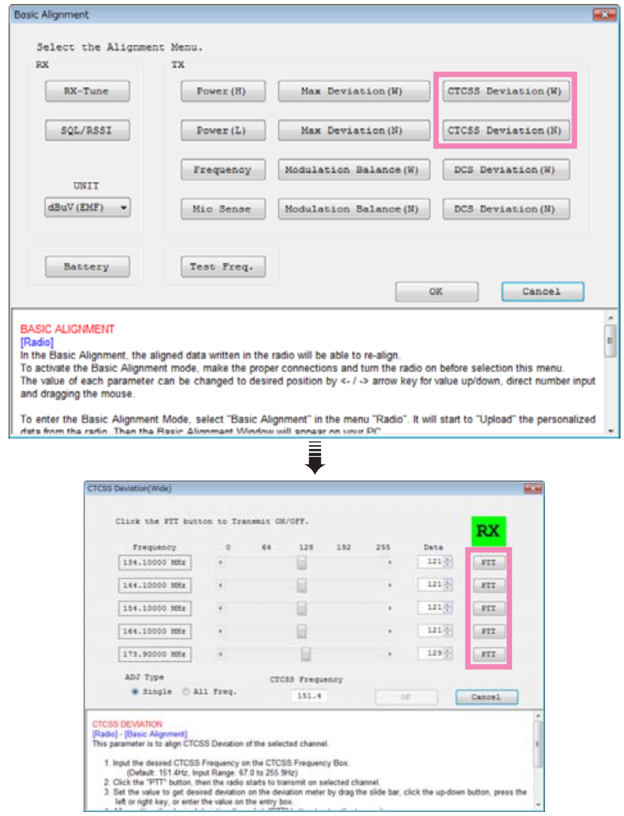
Single : Alignment value change only to selected channel.

All Freq : Alignment value change for connecting with other channels.

8. CTCSS Deviation <Wide> / <Narrow>

This parameter is to align CTCSS Deviation of the selected channel.

1. Click the "CTCSS Deviation (W)" or "CTCSS Deviation (N)" button to open the CTCSS Deviation Alignment window.
2. Input the desired CTCSS Frequency to the "CTCSS Frequency" Box.
   Available input range is 67.0 to 255.9 Hz (default: 151.4 Hz).
3. Click the "PTT" button on the desired frequency which you wish to alignment. The radio starts to transmit on selected frequency.
4. Set the value to get desired deviation (Wide: 0.6 kHz, Narrow: 0.35 kHz) on the deviation meter by the following ways:
   - Drag the slide bar
   - Click the up/down button
   - Press the left/right arrow key of the computer's keyboard
   - Enter the value in the "Data" box from the computer's keyboard.
5. After getting the desired deviation, click the "PTT" button to stop the transmit.
6. Click the "OK" button to finish the CTCSS Deviation alignment and save the data.



You may select the alignment type from the Radio button (ADJ Type) located at the bottom of the screen, as needed.

ADJ Type

Single : Alignment value change only to selected channel.

All Freq : Alignment value change for connecting with other channels.

9. DCS Deviation <Wide> / <Narrow>

This parameter is to align DCS Deviation of the selected channel.

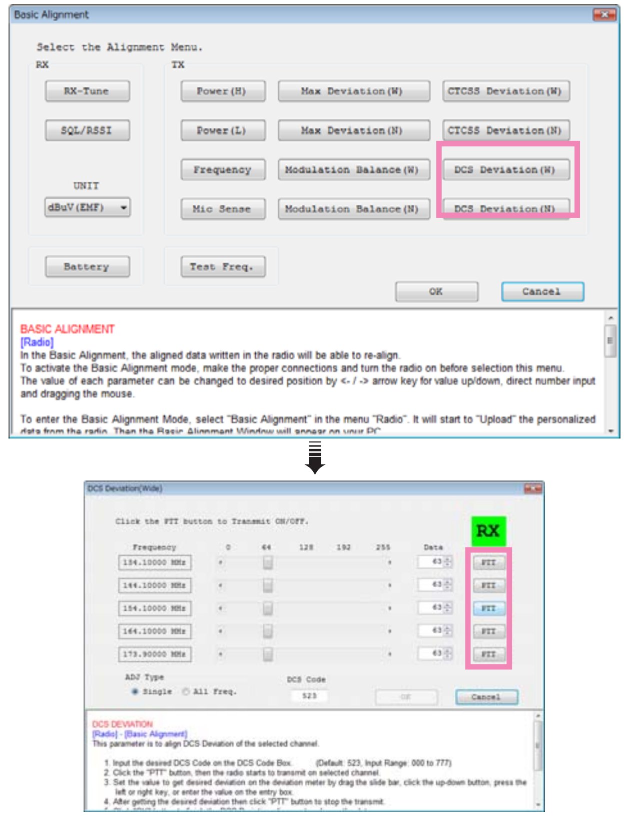
1. Click the “DCS Deviation (W)” or “DCS Deviation (N)” button to open the DCS Deviation Alignment window.
2. Input the desired DCS Code to the “DCS Code” Box. Available input range is 000 to 777 (Octal notation), and default value is 523.
3. Click the “PTT” button on the desired frequency which you wish to alignment. The radio starts to transmit on selected frequency.
4. Set the value to get desired deviation (Wide: 0.65 kHz, Narrow: 0.4 kHz) on the deviation meter by the following ways:
   - Drag the slide bar
   - Click the up/down button
   - Press the left/right arrow key of the computer’s keyboard
   - Enter the value in the “Data” box from the computer’s keyboard.
5. After getting the desired deviation, click the “PTT” button to stop the transmit.
6. Click the “OK” button to finish the DCS Deviation alignment and save the data.

You may select the alignment type from the Radio button (ADJ Type) located at the bottom of the screen, as needed..

ADJ Type

Single : Alignment value change only to selected channel.

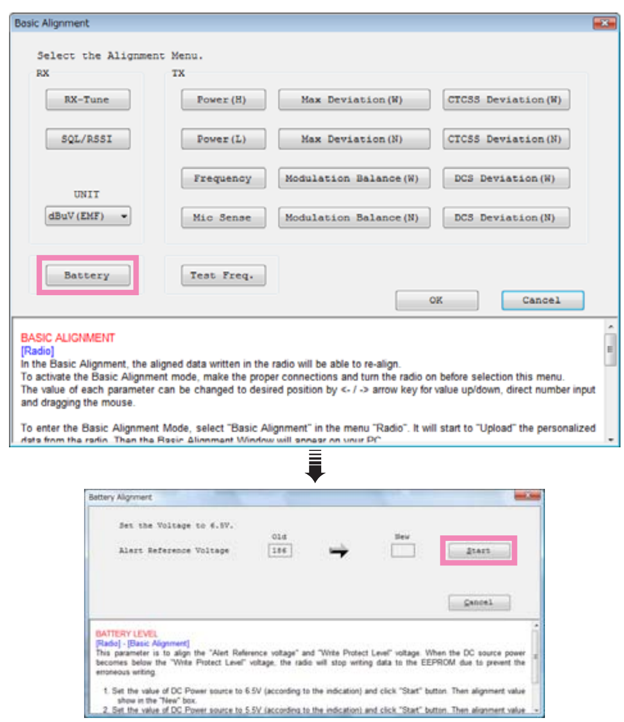
All Freq : Alignment value change for connecting with other channels.



10. Battery

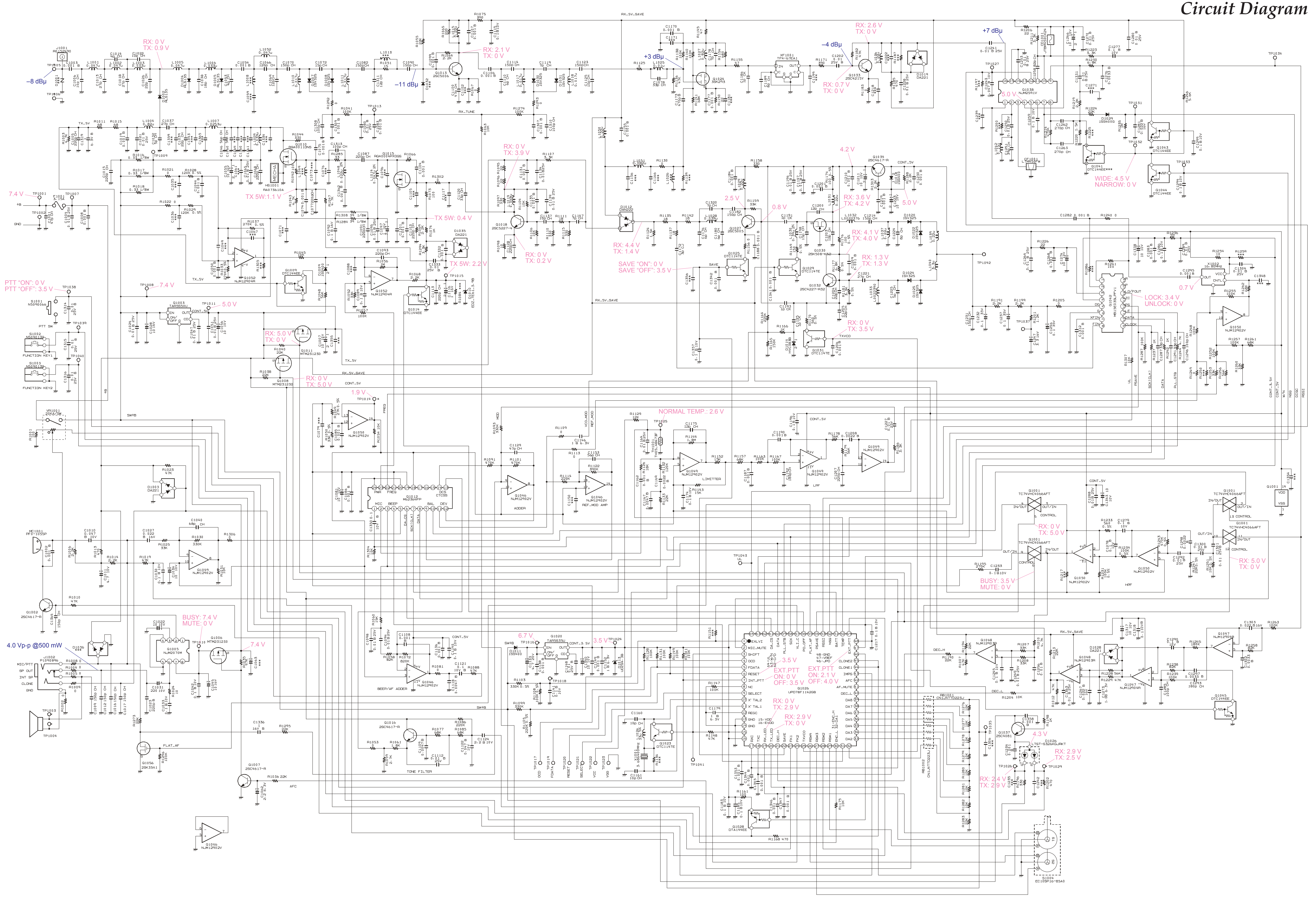
This parameter is to align the “Alert Reference voltage” and “Write Protect Level” voltage. When the DC source power becomes below the “Write Protect Level” voltage, the radio will stop writing data to the EEPROM due to prevent the erroneous writing.

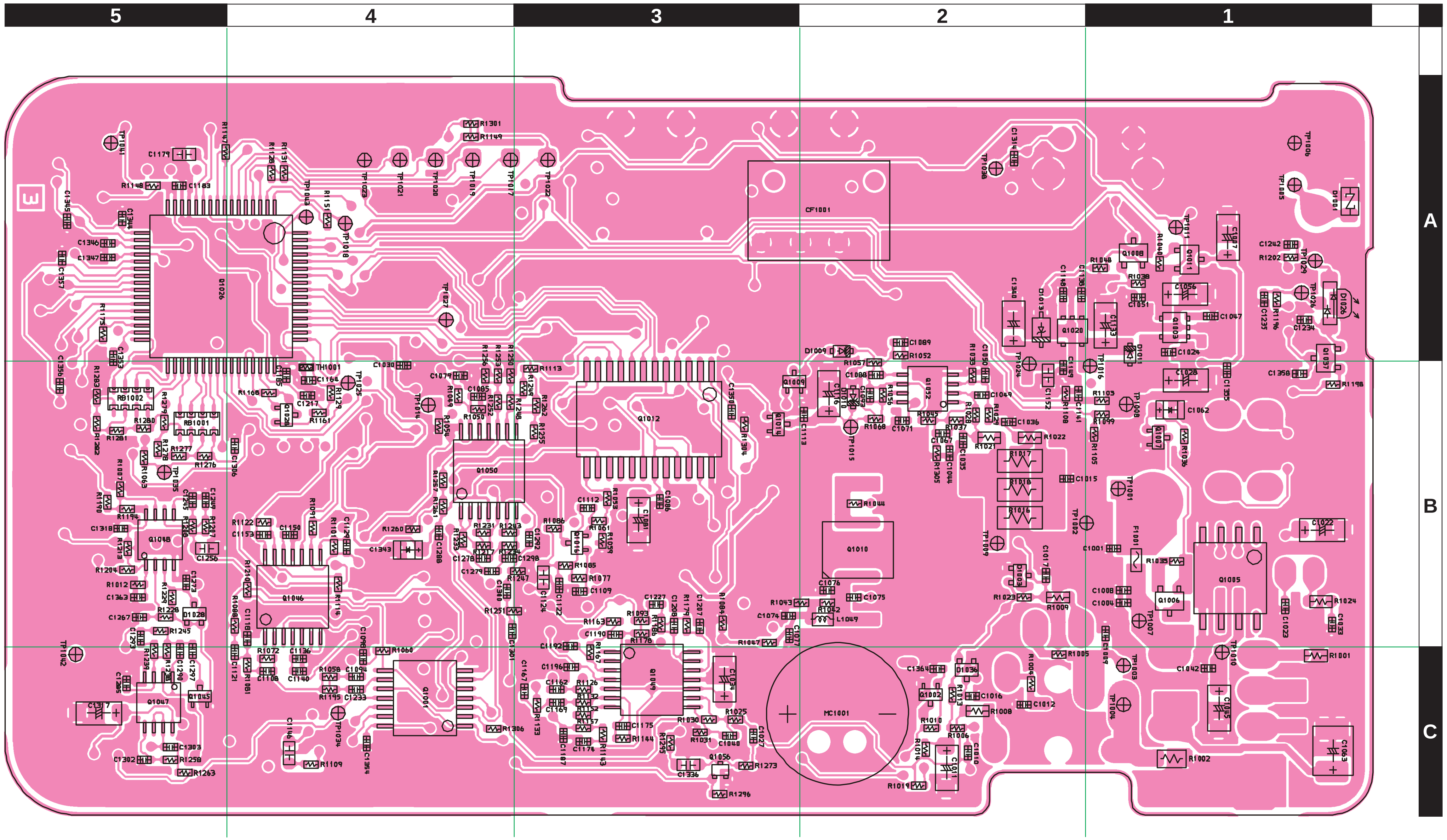
1. Click the “Battery” button to open the Battery Alignment window.
2. Reduce the DC Power source to 6.5 V (according to the indication), then click the“Start” button. The alignment value will show in the “New” box.
3. Reduce the DC Power source to 5.5 V (according to the indication), then click the “Start” button. The alignment value will show in the “New” box.
4. Set the DC Power source to 7.5 V (according to the indication), then click the “Start” button. The alignment value will show in the “New” box.

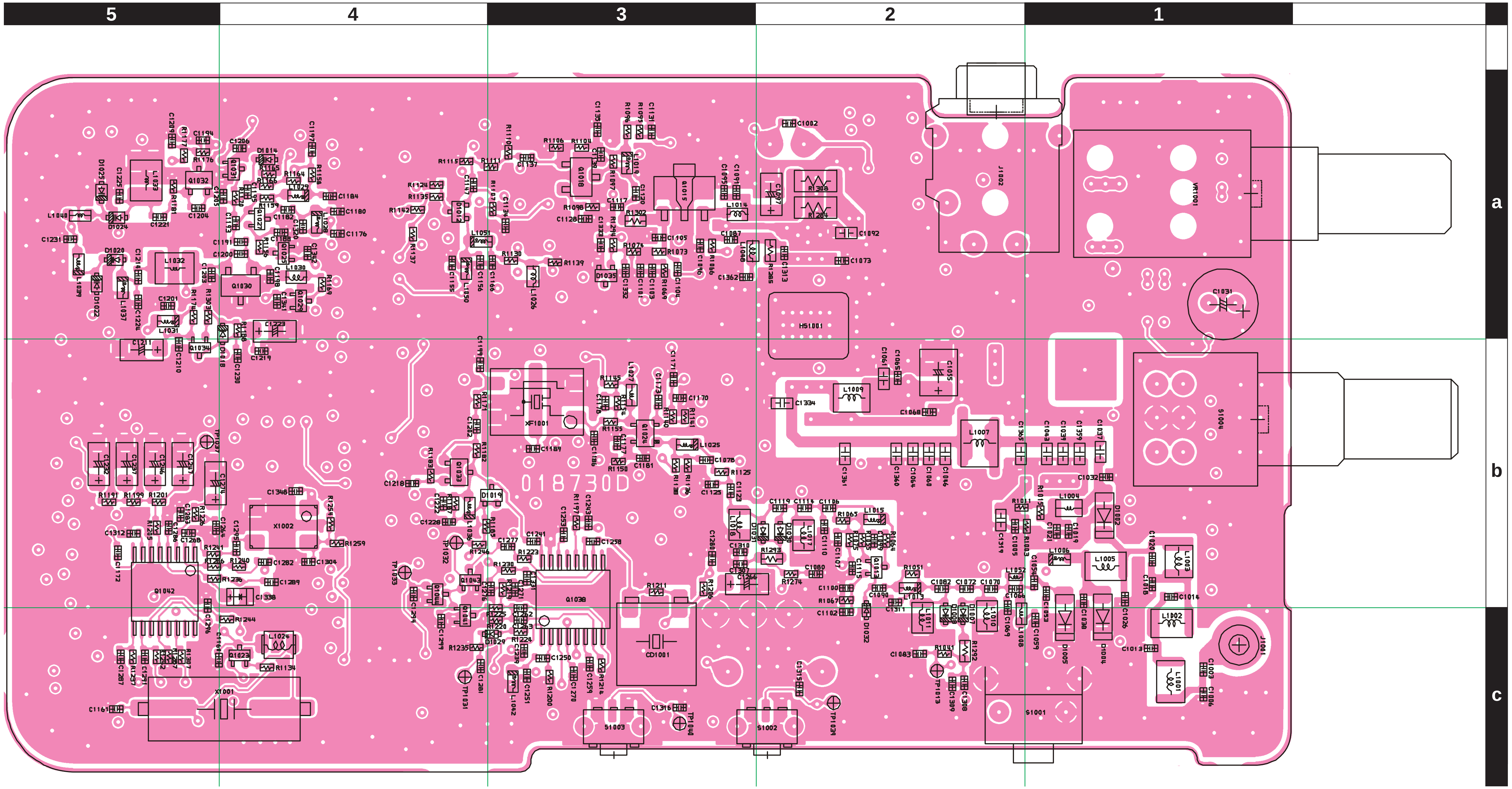


MAIN Unit (Lot. 1 ~ 4)

Circuit Diagram







5
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3
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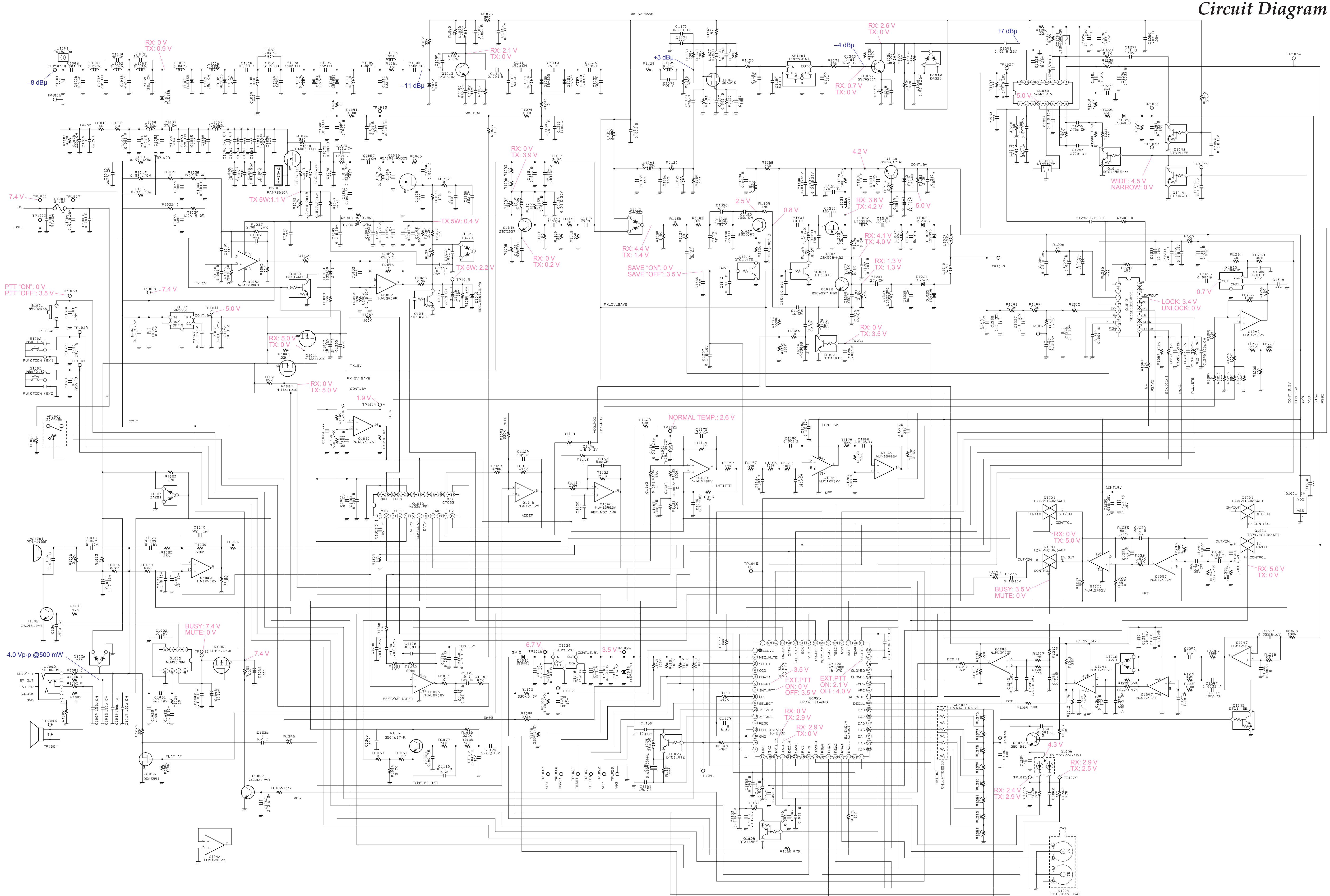
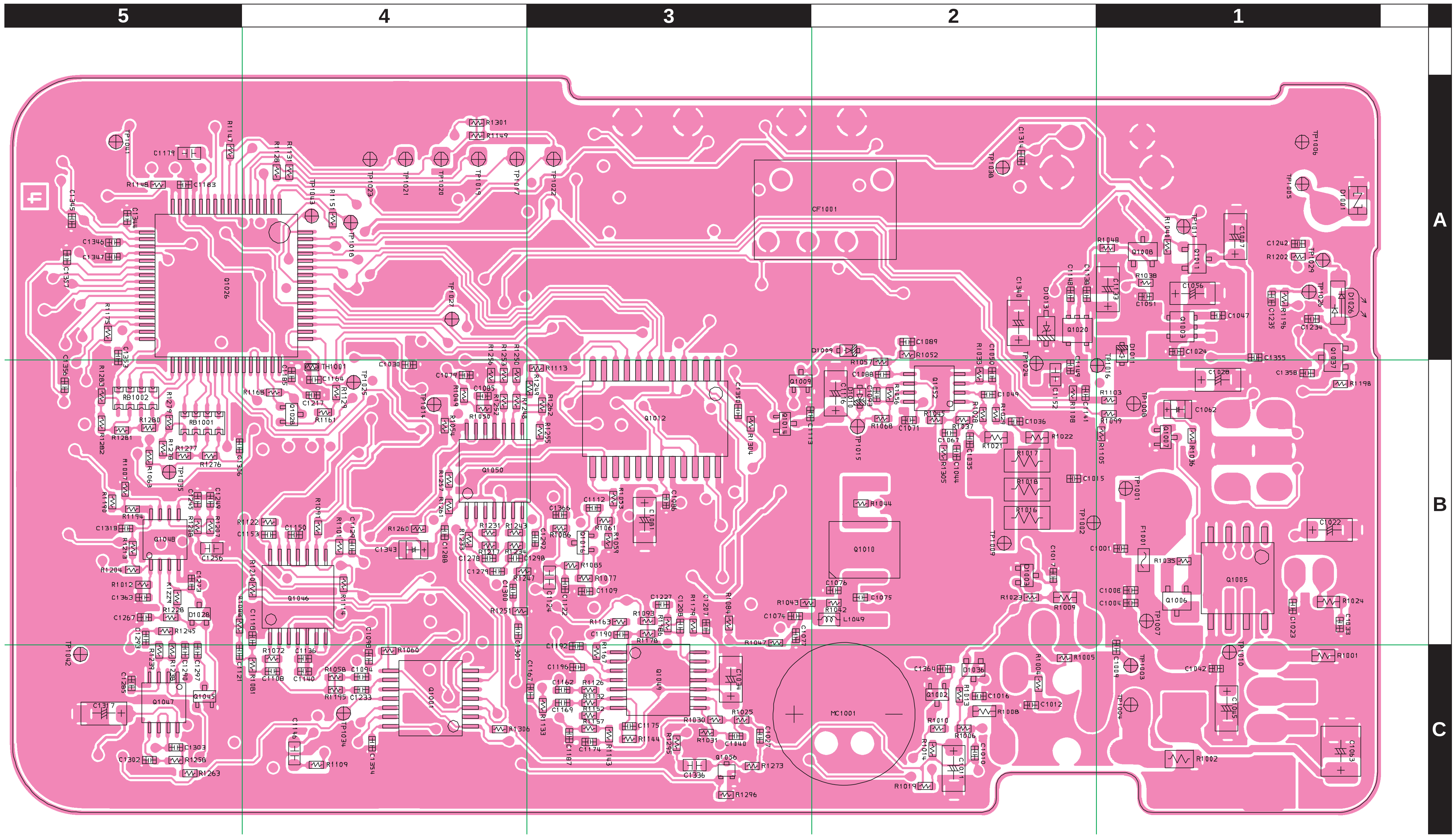
1
a
b
c

MAIN Unit (Lot. 5 ~ 7)



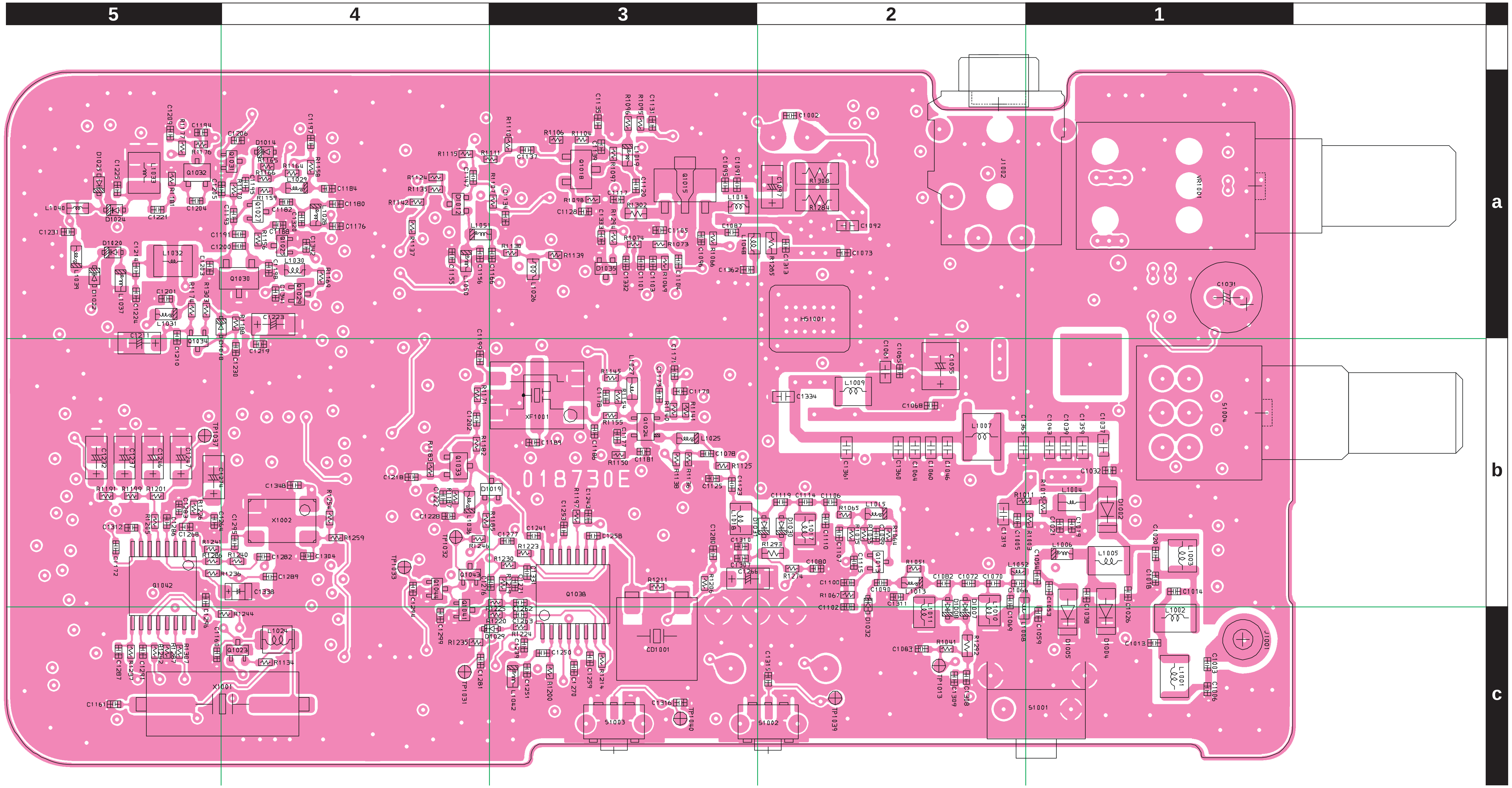
MAIN Unit (Lot. 5 ~ 7)

Parts Layout (Side A)

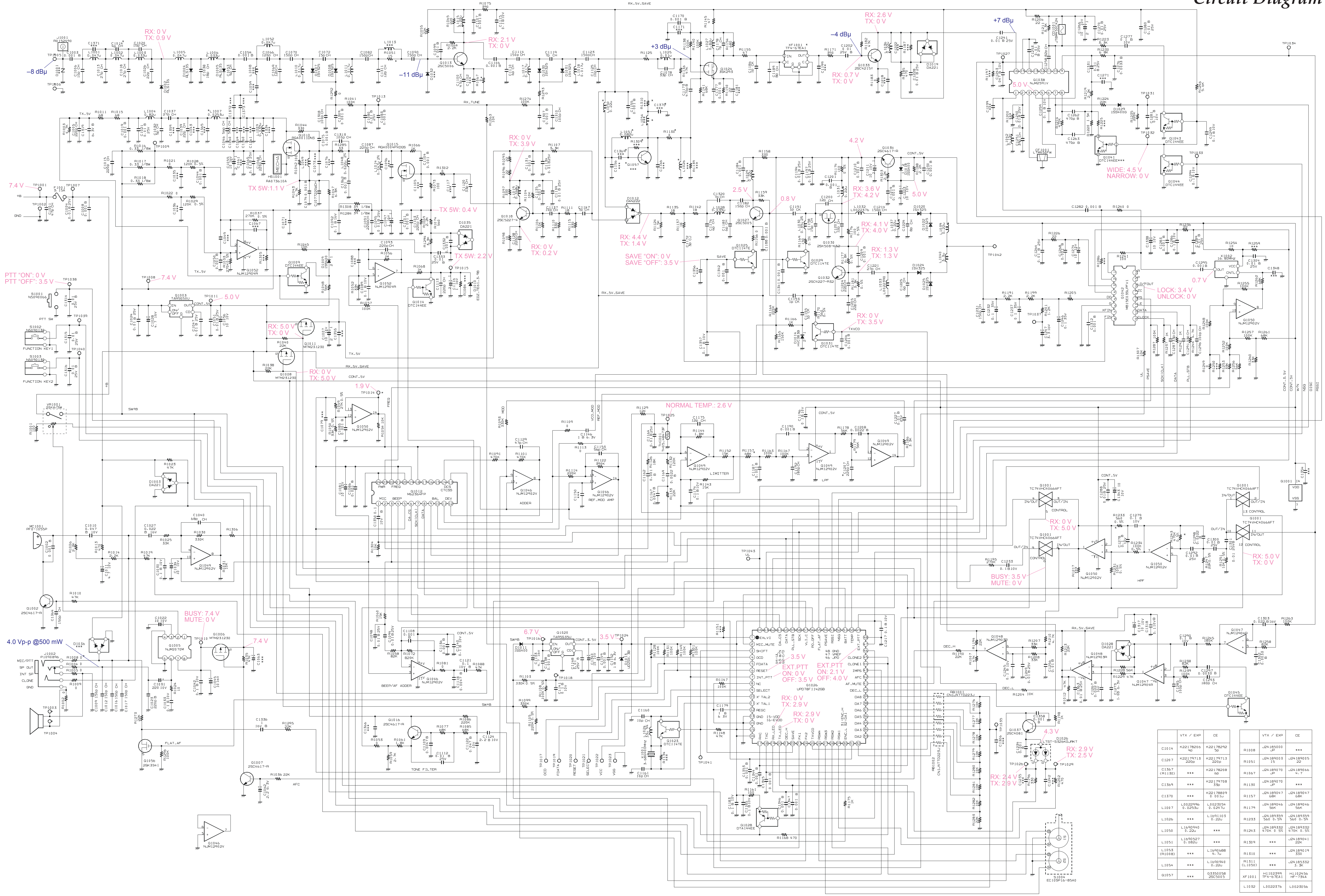


MAIN Unit (Lot. 5 ~ 7)

Parts Layout (Side B)

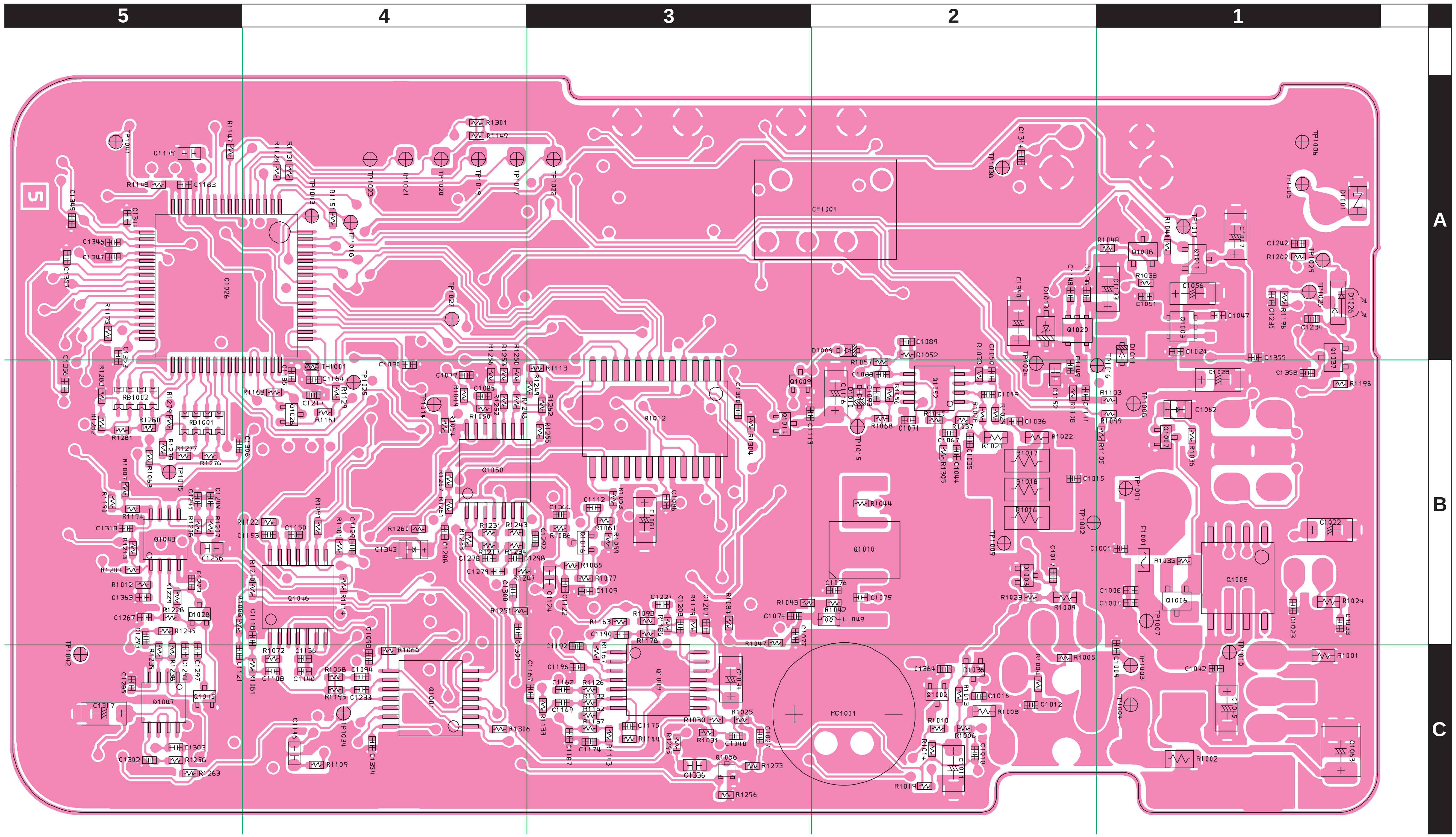


MAIN Unit (Lot. 8 ~ 44)



	VTX / EXP	CE
C1014	K22178206 4p	K22178292 5p
C1207	K22179713 220p	K22179713 220p
C1367 (R1130)	***	K22178208 6p
C1369	***	K22179708 33p
C1370	***	K22178809 0.001u
L1007	L0022996 0.0253u	L0023054 0.0247u
L1026	***	L1691103 0.22u
L1050	L1690940 0.22u	***
L1051	L1690527 0.082u	***
L1053 (R1008)	***	L1690688 4.7u
L1054	***	L1690940 0.22u
Q1057	***	G3350058 2SC5005

	VTX / EXP	CE
R1008	J24185000 JP	***
R1051	J24189003 15	J24189005 22
R1067	J24189070 JP	J24189066 4.7
R1130	J24189070 JP	***
R1157	J24189047 68K	J24189047 68K
R1179	J24189046 56K	J24189046 56K
R1233	J24189359 560 0.5%	J24189359 560 0.5%
R1243	J24189332 470K 0.5%	J24189332 470K 0.5%
R1309	***	J24189041 22K
R1310	***	J24189019 330
R1311 (L1050)	***	J24185332 3.3K
XF1001	H1102399 TF4-67EA1	H1102456 HF-734A
L1032	L0022376	L0023056


5
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A
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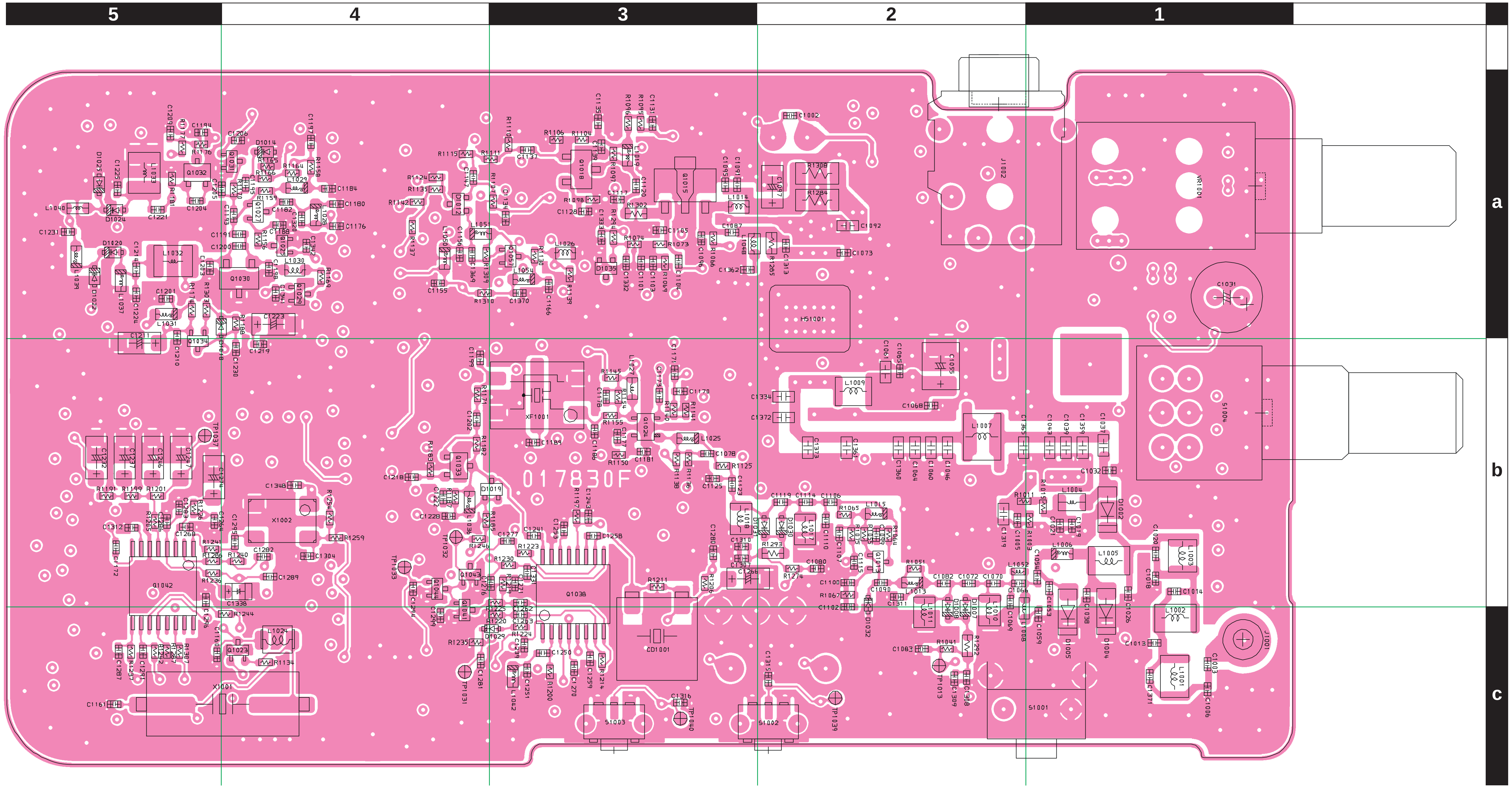
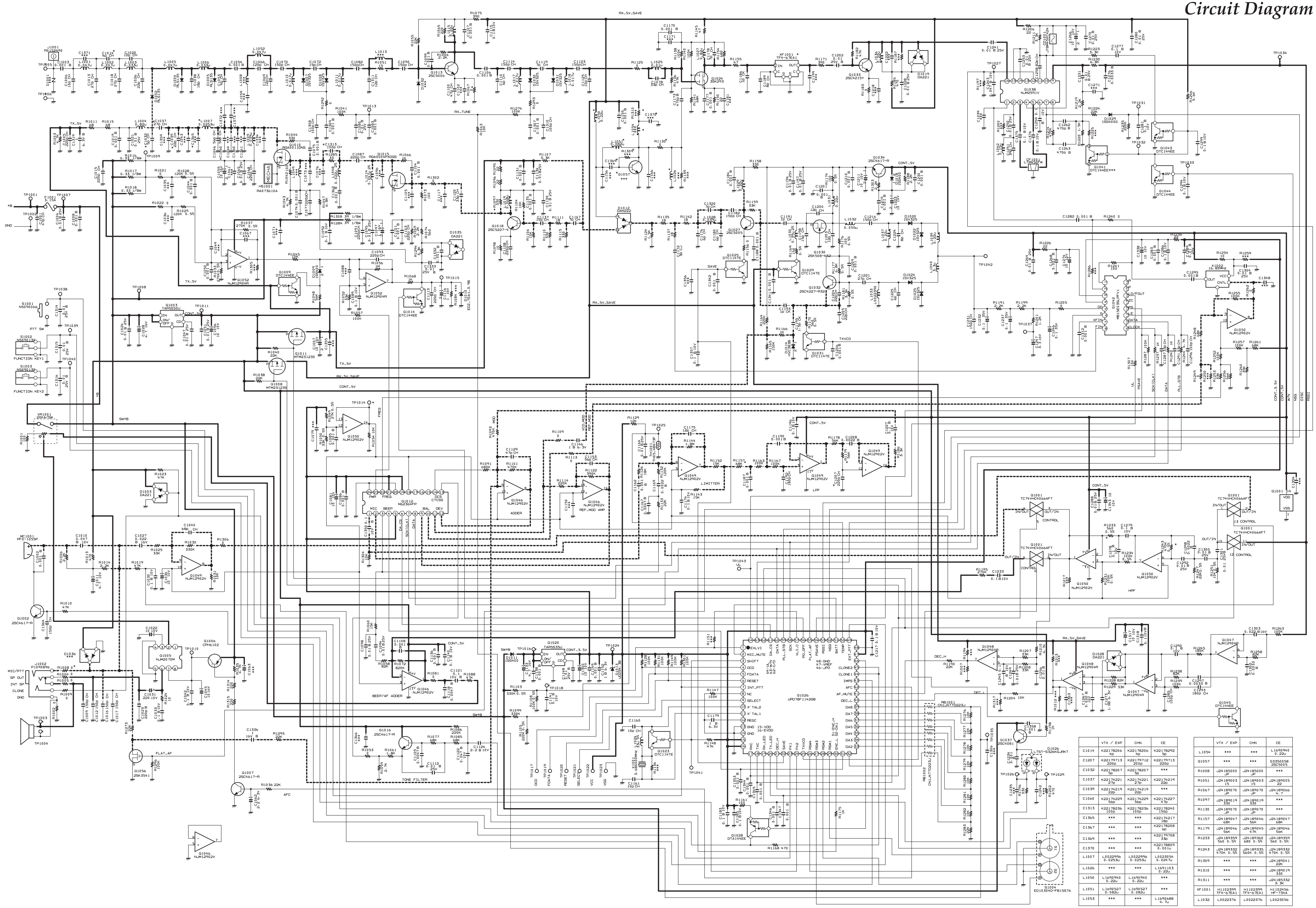
C

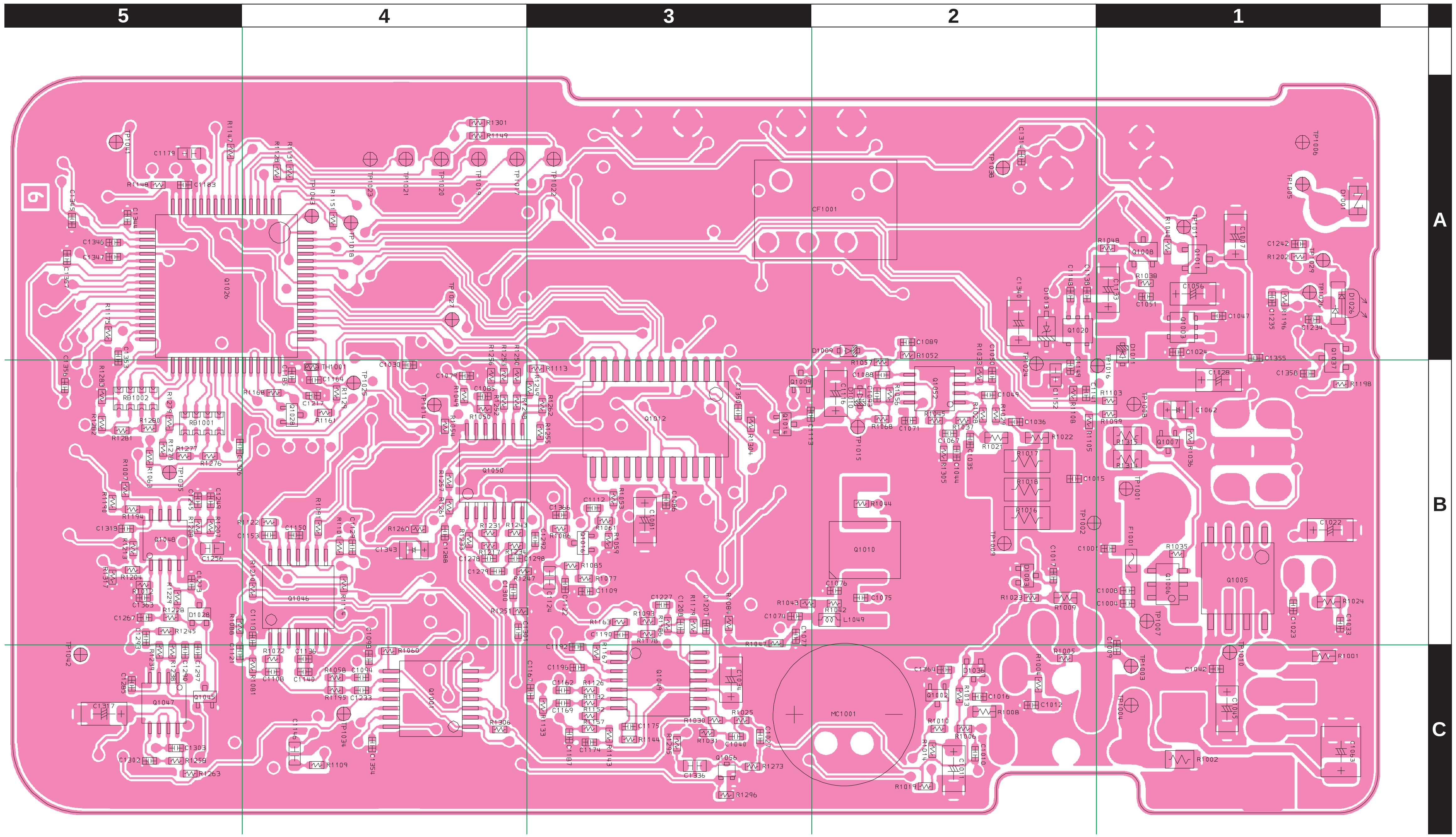

5
4
3
2
1
a
b
c
017830F



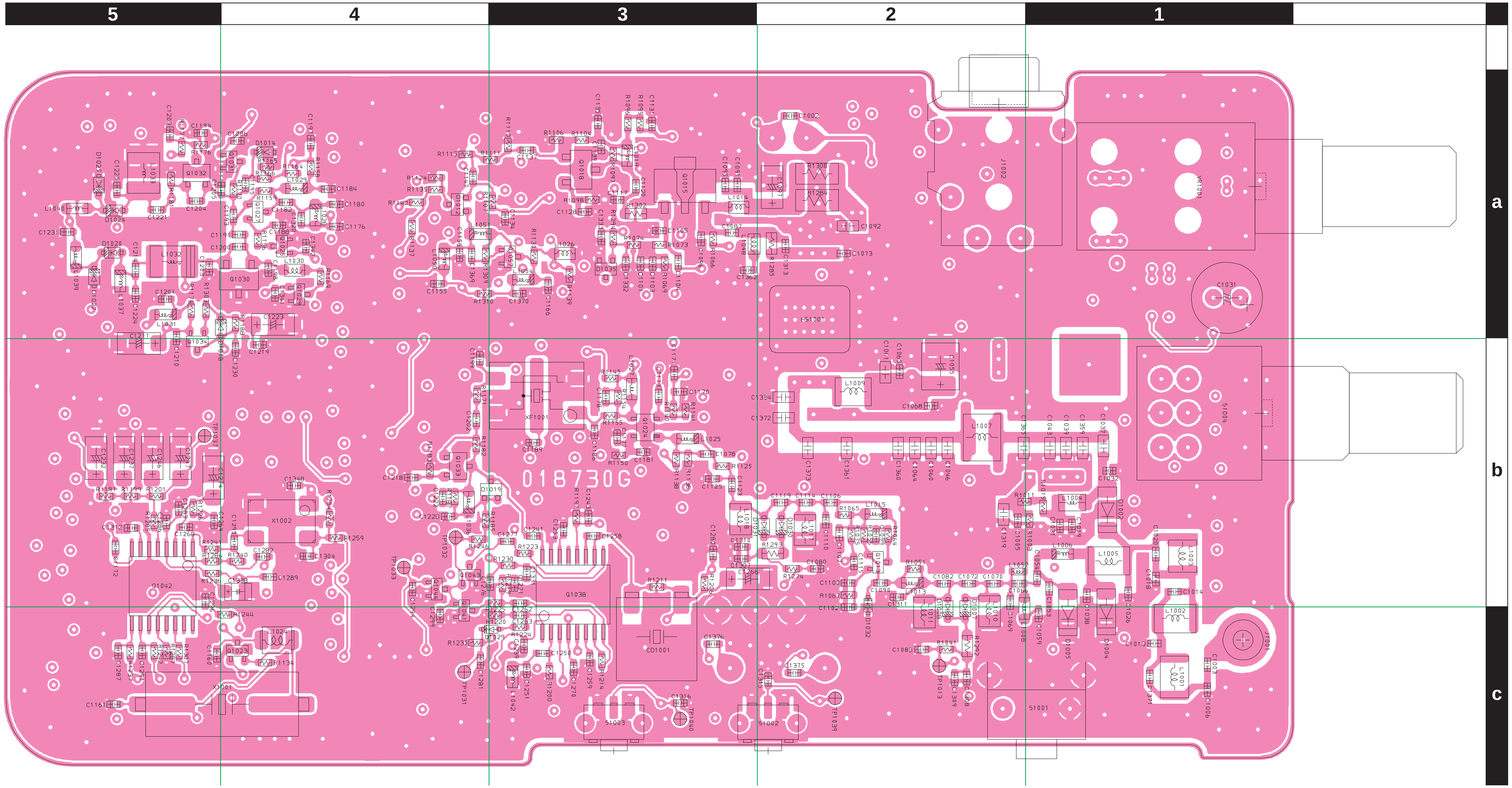
	VTX / EXP	CHN	CE
C1014	K22178206 4p	K22178206 4p	K22178292 5p
C1207	K22179713 220p	K22179712 200p	K22179713 220p
C1032	K22178207 5p	K22178207 5p	***
C1037	K22174221 27p	K22174221 27p	K22174219 22p
C1039	K22174219 22p	K22174219 22p	***
C1060	K22174229 56p	K22174229 56p	K22174227 47p
C1313	K22178236 100p	K22178236 100p	K22178240 150p
C1365	***	***	K22174217 18p
C1367	***	***	K22178208 6p
C1369	***	***	K22179708 33p
C1370	***	***	K22178809 0.001u
L1007	L0022996 0.0253u	L0022996 0.0253u	L0023054 0.0247u
L1026	***	***	L1691103 0.22u
L1050	L1690940 0.22u	L1690940 0.22u	***
L1051	L1690527 0.082u	L1690527 0.082u	***
L1053	***	***	L1690688 4.7u

	VTX / EXP	CHN	CE
L1054	***	***	L1690940 0.22u
Q1057	***	***	G3350058 2SC5005
R1008	J24185000 JP	J24185000 JP	***
R1051	J24189003 15	J24189003 15	J24189005 22
R1067	J24189070 JP	J24189070 JP	J24189066 4.7
R1097	J24189019 330	J24189019 330	***
R1130	J24189070 JP	J24189070 JP	***
R1157	J24189047 68K	J24189046 56K	J24189047 68K
R1179	J24189046 56K	J24189045 47K	J24189046 56K
R1233	J24189359 560 0.5%	J24189360 680 0.5%	J24189359 560 0.5%
R1243	J24189332 470K 0.5%	J24189335 560K 0.5%	J24189332 470K 0.5%
R1309	***	***	J24189041 22K
R1310	***	***	J24189019 330
R1311	***	***	J24185332 3.3K
XF1001	H1102399 TF4-67EA1	H1102399 TF4-67EA1	H1102456 HF-734A
L1032	L0022376	L0022376	L0023056

MAIN Unit (Lot. 45 ~ 50)

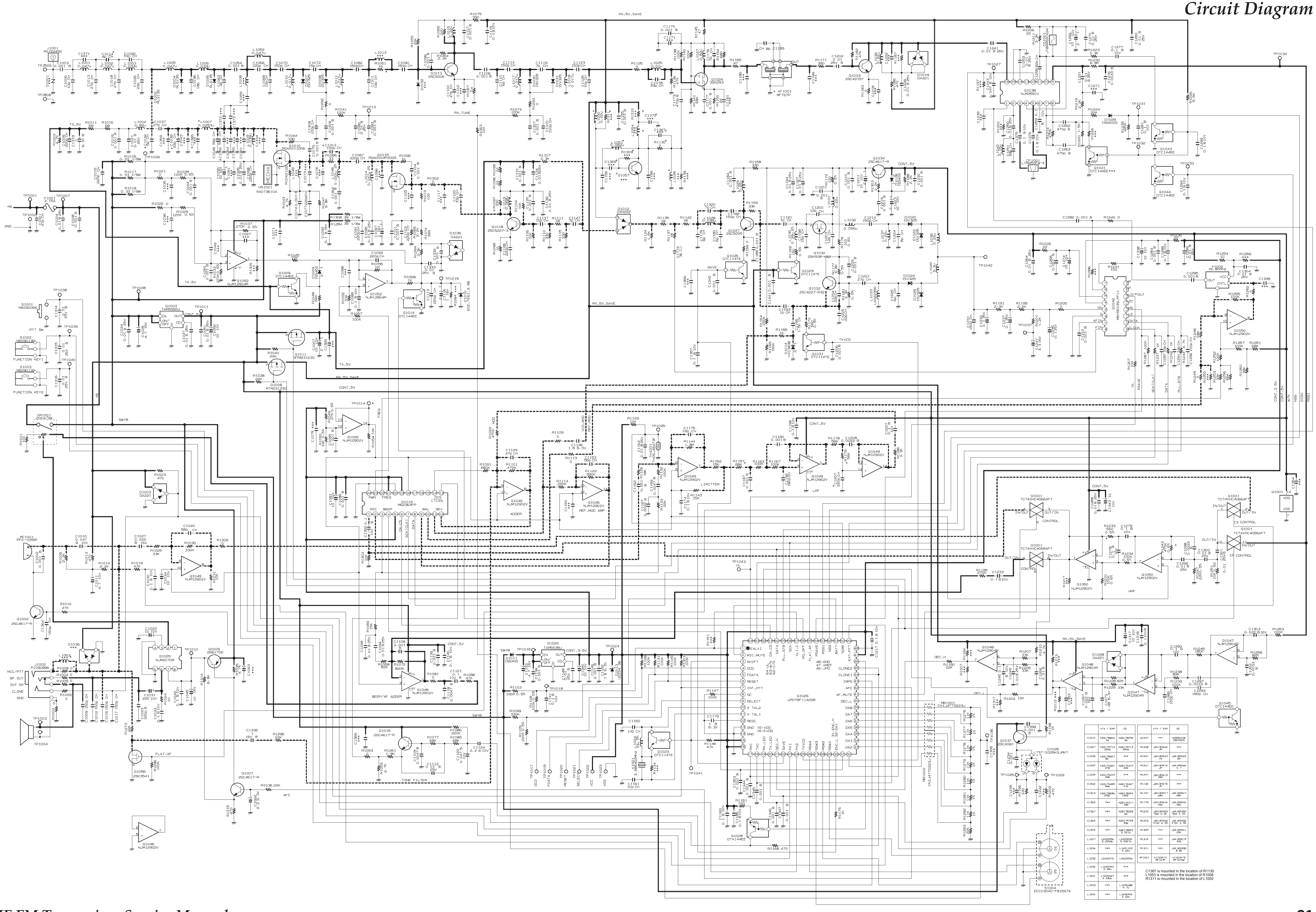


Parts Layout (Side B)



MAIN Unit (Lot. 51 ~)

Circuit Diagram

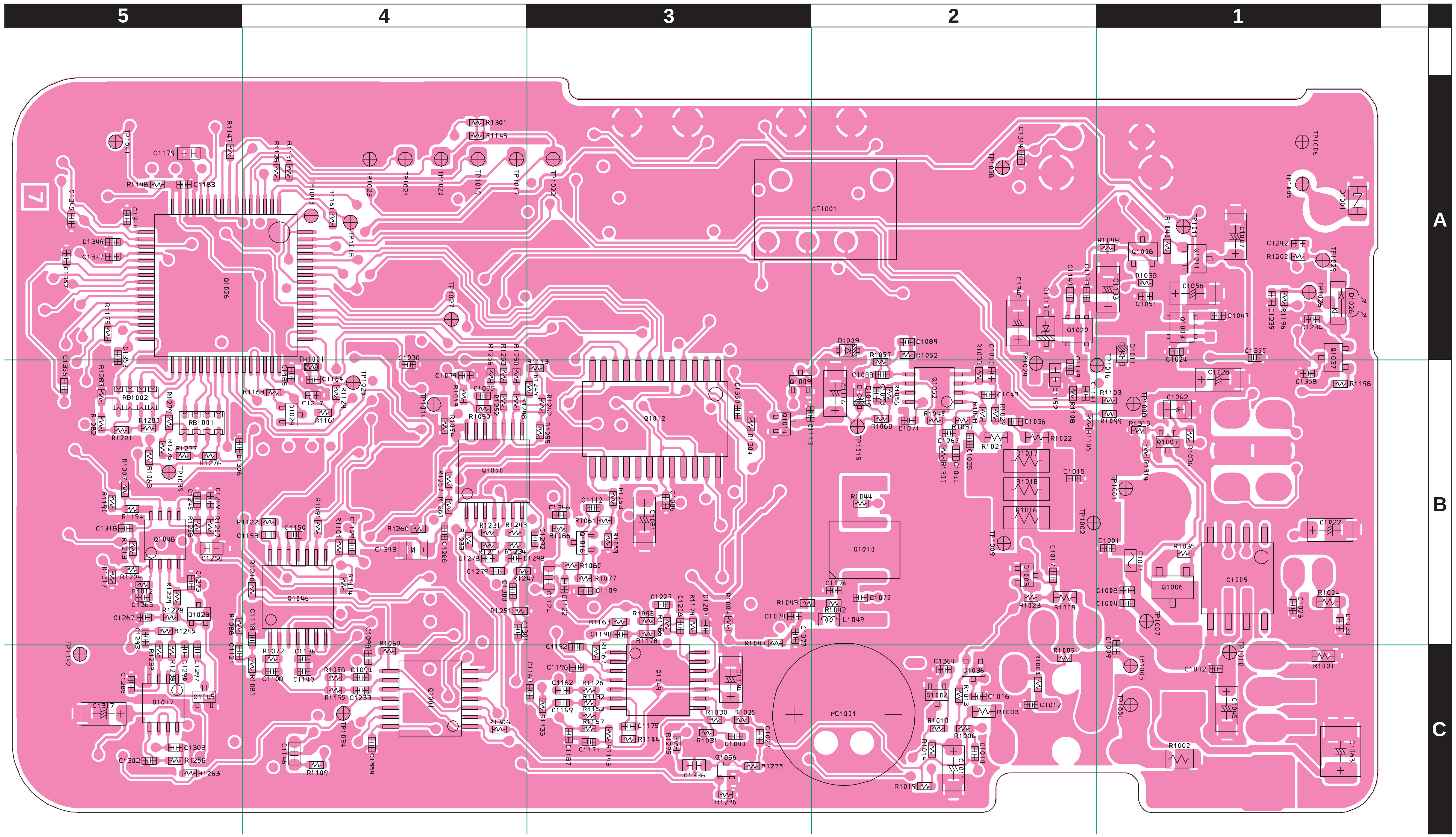


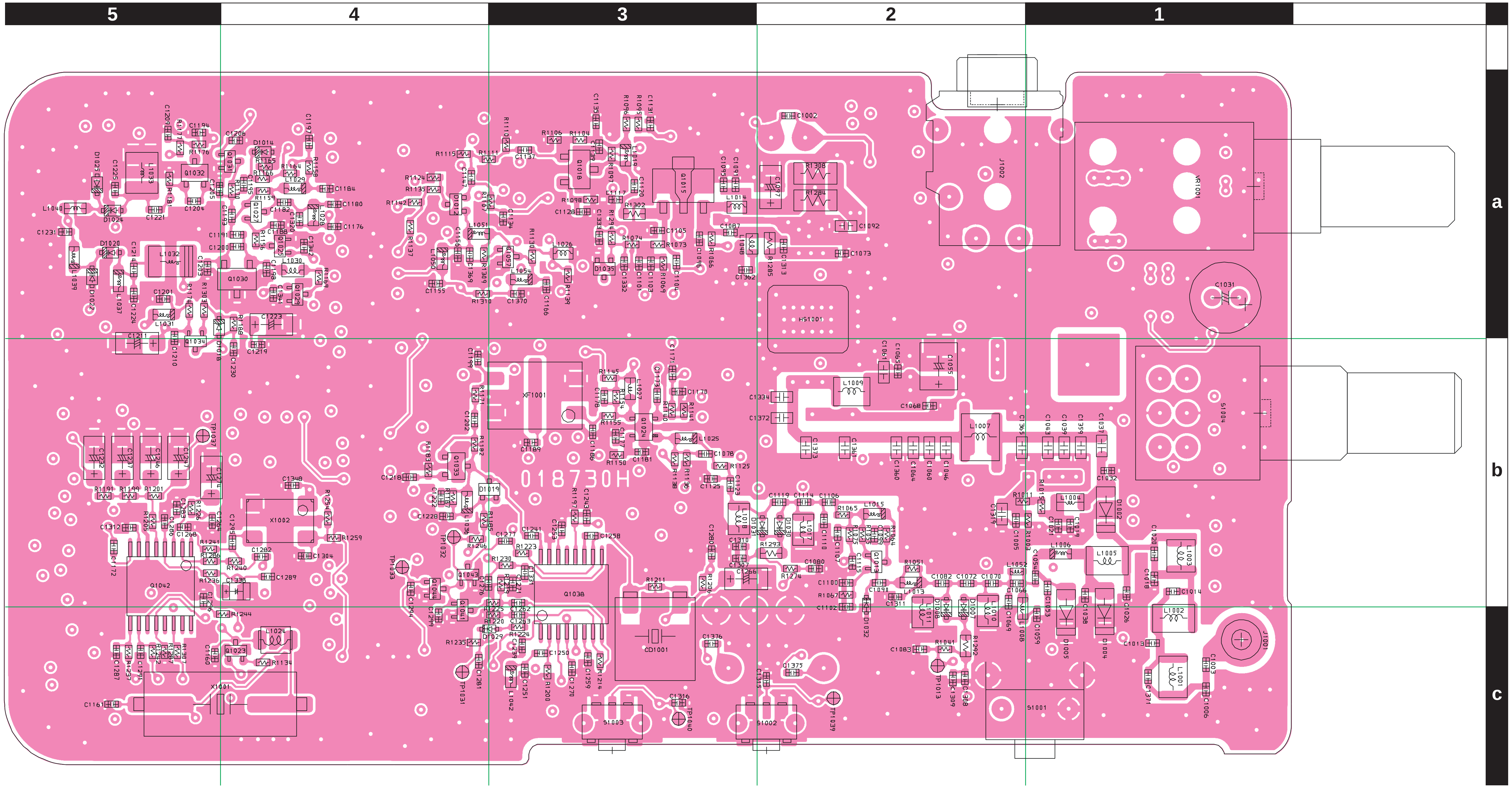
	VTX / EXP	CE
C1014	K22178206 4p	K22178292 5p
C1207	K22179713 220p	K22179713 220p
C1032	K22178207 5p	***
C1037	K22174221 27p	K22174219 22p
C1039	K22174219 22p	***
C1060	K22174229 56p	K22174227 47p
C1313	K22178236 100p	K22178240 150p
C1365	***	K22174217 18p
C1367	***	K22178208 6p
C1369	***	K22179708 33p
C1370	***	K22178809 0.001u
L1007	L0022996 0.0253u	L0023054 0.0247u
L1026	***	L1691103 0.22u
L1032	L0022376	L0023056
L1050	L1690940 0.22u	***
L1051	L1690527 0.082u	***
L1053	***	L1690688 4.7u
L1054	***	L1690940 0.22u

	VTX / EXP	CE
Q1057	***	G3350058 2SC5005
R1008	J24185000 JP	***
R1051	J24189003 15	J24189005 22
R1067	J24189070 JP	J24189066 4.7
R1097	J24189019 330	***
R1130	J24189070 JP	***
R1157	J24189047 68K	J24189047 68K
R1179	J24189046 56K	J24189046 56K
R1233	J24189359 560 0.5%	J24189359 560 0.5%
R1243	J24189332 470K 0.5%	J24189332 470K 0.5%
R1309	***	J24189041 22K
R1310	***	J24189019 330
R1311	***	J24185332 3.3K
XF1001	H1102471 MFT67P	H1102473 MFT67N2

C1367 is mounted in the location of R1130
L1053 is mounted in the location of R1008
R1311 is mounted in the location of L1050

MAIN Unit (Lot. 51 ~)




5
4
3
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a
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018730H