⟍⟍ Vertex Standard

VHF FM Transceiver

VX-4500 Series
VX-4600 Series

Service Manual

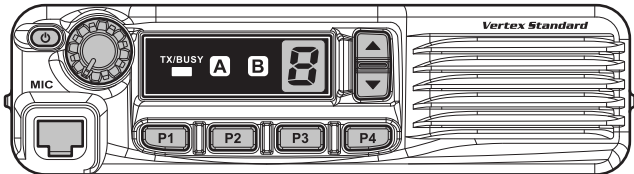©2011VERTEX STANDARD CO., LTD.   EC093N90B

VX-4500 Series
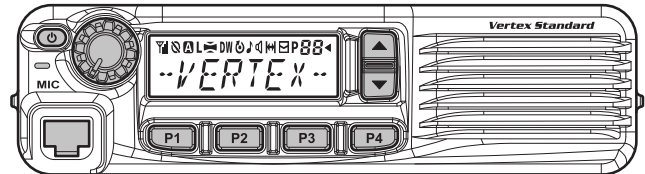
VX-4600 Series

Introduction

This manual provides the technical information necessary for servicing the **VX-4500/-4600** Series Mobile Transceiver.

Servicing this equipment requires expertise in handing 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 board in this transceiver. Each side of the board is referred to by the type of the majority of components installed on that side ("Side A" or "Side B"). In most cases one side has only chip components (surface-mount devices), and the other has either a mixture of both chip and leaded components (trimmers, coils, electrolytic capacitors, ICs, etc.), or leaded components only.

As described in the pages to follow, the advanced microprocessor design of the **VX-4500/-4600** allows a complete alignment of this transceiver to be performed without opening the case of the radio; all adjustments can be performed from the personal computer, using with the Vertex Standard FIF-10A USB Programming Interface and CE115 Software.

While we believe the 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

The VX-4500/-4600 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

General

Frequency Ranges:	134 -174 MHz
Number of Channels:	8 channels (VX-4500 Series)
	512 channels with 32 groups (VX-4600 Series)
Power Supply Voltage:	13.6 V ± 20 %
Channel Spacing:	12.5/20/25 kHz
Pll Steps:	1.25/2.5/5/6.25 kHz
Current Consumption (@13.6 V):	11 A (TX: 50 W), 6 A (TX: 25 W)
	2.5 A (RX)
	200 mA (RX: SQL Closed)
Operating Temperature Range:	–22 °F to +140 °F (–30 °C to +60 °C)
Frequency Stability:	±2.5 ppm (–22 °F to +140 °C [–30 °C to +60 °C])
Antenna Impedance:	50 Ohms
Dimension (W x H x D):	6.5" x 1.8" x 6.1" inch (165 x 45 x 155 mm) (W/O knob)
Weight (Approx.):	2.8 lbs (1.25 kg)

Receiver: measured by TIA/EIA-603

Circuit Type:	Double-conversion Superheterodyne
Intermediate Frequency:	1st: 50.85 MHz, 2nd: 450 kHz
Sensitivity (12 dB SINAD):	0.25 µV
Adjacent Channel Selectivity:	70 dB (12.5 kHz)
	75 dB (25 kHz)
Hum & Noise:	40 dB (12.5 kHz)
	45 dB (25 kHz)
Intermodulation:	75 dB
Spurious & Image Rejection:	80 dB
Audio Output:	Internal: 4 W @20 Ohms, 5% THD
	External: 12 W @4 Ohms, 5% THD

Transmitter: measured by TIA/EIA-603

|	
Modulation Type:	Variable Reactance
Output Power (selectable):	50/25/12.5/5 W
Emission Type:	16K0F3E, 11K0F3E
Maximum Deviation:	±2.5 kHz (12.5 kHz)
	±5 kHz (25 kHz)
FM Hum & Noise:	40 dB (12.5 kHz)
	45 dB (25 kHz)
Audio Distortion:	< 3 % (@1 kHz)
Conducted Spurious Emission:	70 dB below Carrier

Receiver: measured by EN 300 086

Circuit Type:	Double-conversion Superheterodyne
Intermediate Frequency:	1st: 50.85 MHz, 2nd: 450 kHz
Sensitivity (20 dB SINAD):	-5 dBµ/-2dBµ (25 kHz/12.5 kHz)
Adjacent Channel Selectivity:	70 dB (12.5 kHz)
	75 dB (25 kHz)
Hum & Noise:	40 dB (12.5 kHz)
	45 dB (25 kHz)
Intermodulation:	70 dB
Spurious & Image Rejection:	85 dB
Audio Output:	Internal: 4 W @20 Ohms, 5% THD
	External: 12 W @4 Ohms, 5% THD

Transmitter: measured by EN 300 086

Modulation Type:	Variable Reactance
Output Power (selectable):	25/12.5/5/1 W
Emission Type:	16K0F3E, 11K0F3E
Maximum Deviation:	±2.5 kHz (12.5 kHz)
	±5 kHz (25 kHz)
FM Hum & Noise:	40 dB (12.5 kHz)
	45 dB (25 kHz)
Audio Distortion:	< 3 % (@1 kHz)
Conducted Spurious Emission:	< -36 dBm@≦1 GHz, -30 dBm>@1 GHz

Specifications subject to change without notice or obligation.

DSUB 15-pin Accessory Connector
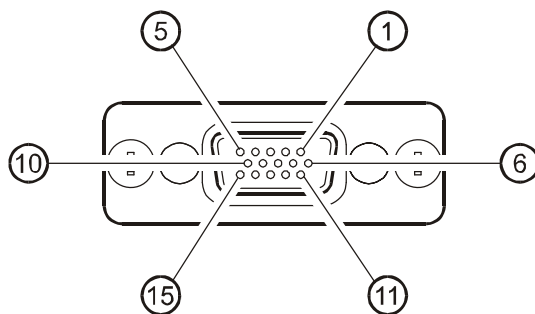
Pin 1: AF IN (ANALOG INPUT)

External Microphone Input. Nominal input level is 4 mV (or -10 dBm; programmed via the CE115 programmer) at 600-ohm.

Pin 2: AF OUT (ANALOG OUTPUT)

Low-level receiver output. Peak signal level is -10 dBm at 600-ohm.

Pin 3: AF GND

Ground for all logic levels and power supply return.

Pin 4: DC OUT (13.6 V DC OUTPUT)

Switched 13.6V output for supplying power to an accessory.
Maximum output current is 1 A.

Pin 5: RSSI (ANALOG OUTPUT)

A DC voltage proportional to the strength of the signal currently being received (Receiver Signal Strength Indicator) is provided on this pin. This low impedance output is gererated by the receiver IF sub-system and bufferd by an internal op-amp. Typical output voltages are 1 V (@No Signal Input) through 2.5 V (@50 dB Signal Input).

Pin 6: EXT PTT

Shorting this port to ground causes the transceiver to be placed in the Transmit mode, while opening the connection to this port returns the transceiver to the Receive mode. Opening voltage is 5 V, closed current approx. 5 mA.

Pin 7: TRX

This port is intended for controlling an external TX/RX switching circuit. When the transceiver is placed in the Receiver mode, this port is 5 V. When the transceiver is placed in the Transmit mode, this port reduce to 0 V.
This port is open drain output which can sink approx. 50 mA when active.

Pin 8: ING (IGNITION SENSE feature)

The VX-4500/-4600 may be automatically be switched to the STND-BY mode when the vehicle's ignition key is turned on. Maximum current is 20 mA.

Pin 9 - 12: ACC1 - ACC4 (ACCESSORY PORT)

These output port features can be programmed via the CE115 programmer. Each port is open drain output which can sink approx. 50 mA when active.
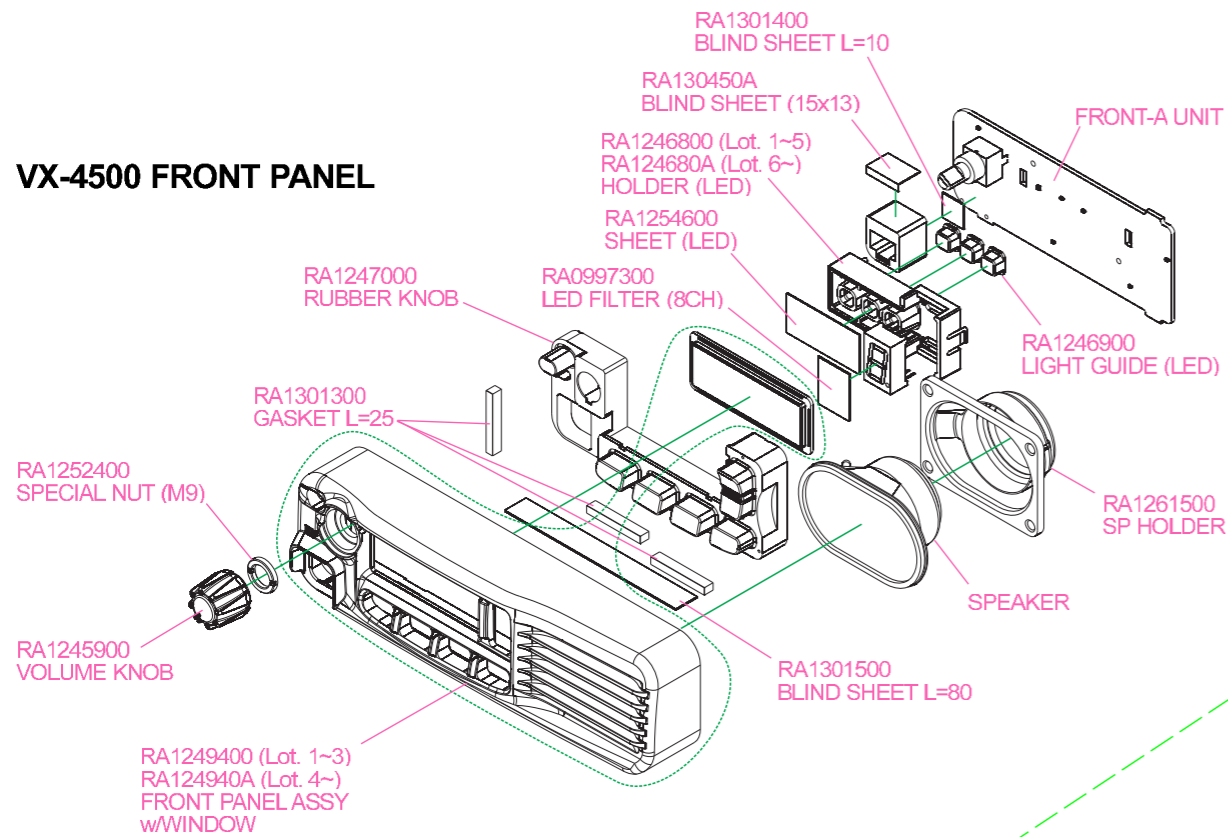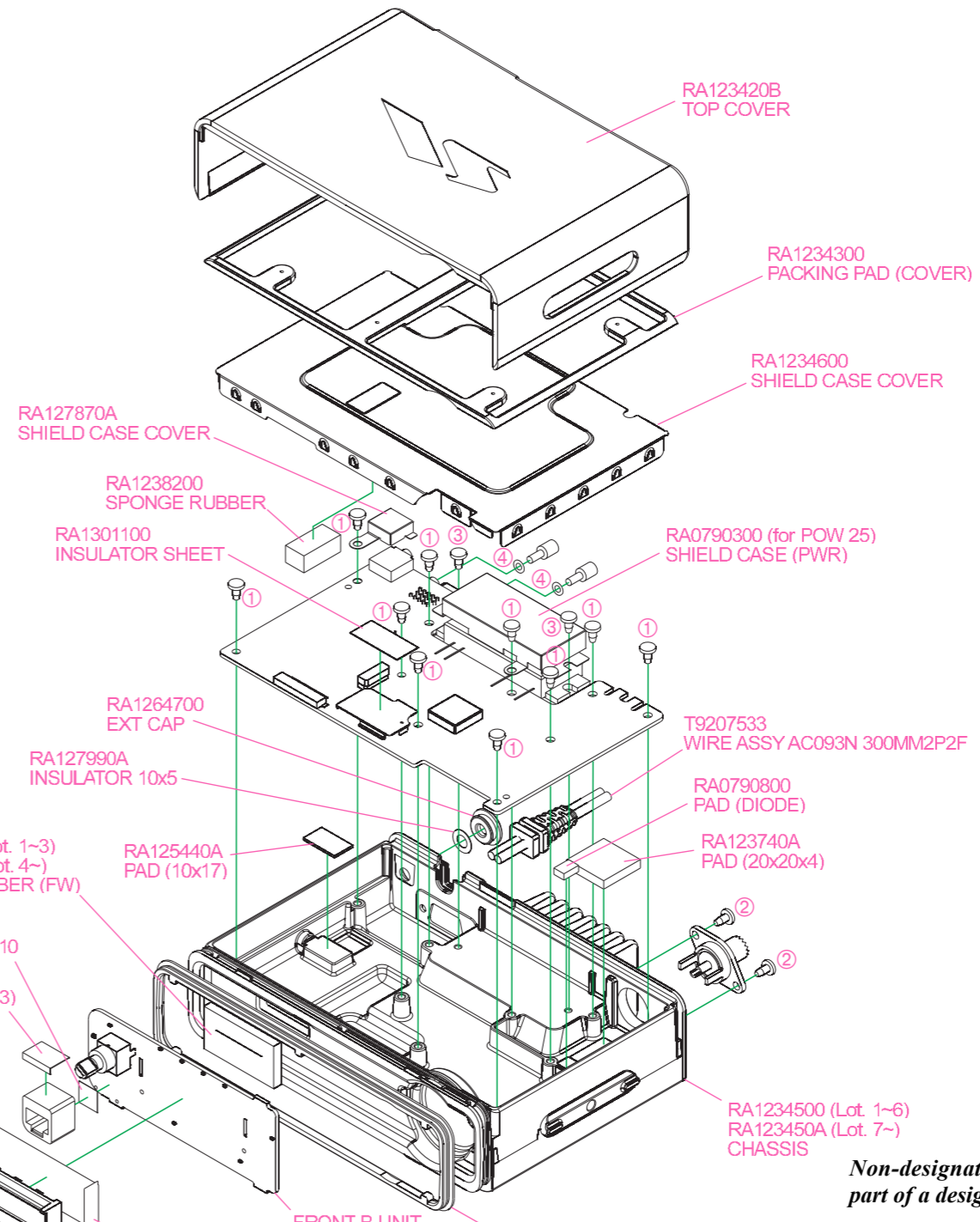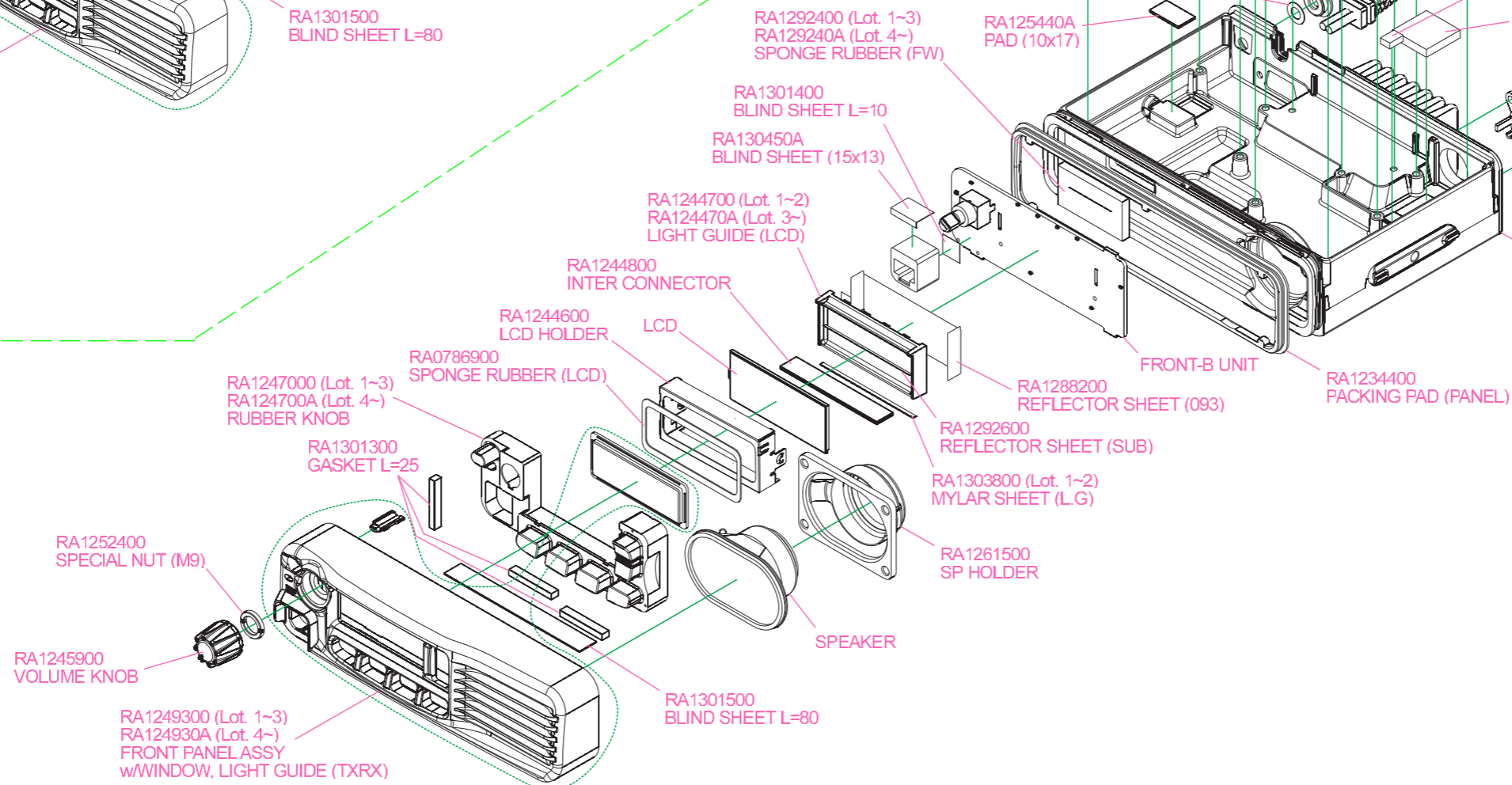
Pin 13: Not Used

Pin 14: Not Used

Pin 15: GND

Chassis ground

Exploded View & Miscellaneous Parts

VX-4500 FRONT PANEL

RA1301400
BLIND SHEET L=10

RA130450A
BLIND SHEET (15x13)

RA1246800 (Lot. 1~5)
RA124680A (Lot. 6~)
HOLDER (LED)

RA1254600
SHEET (LED)

FRONT-A UNIT

RA1247000
RUBBER KNOB

RA0997300
LED FILTER (8CH)

RA1246900
LIGHT GUIDE (LED)

RA1301300
GASKET L=25

RA1252400
SPECIAL NUT (M9)

RA1261500
SP HOLDER

RA1245900
VOLUME KNOB

SPEAKER

RA1301500
BLIND SHEET L=80

RA1249400 (Lot. 1~3)
RA124940A (Lot. 4~)
FRONT PANEL ASSY
w/WINDOW

RA123420B
TOP COVER

RA1234300
PACKING PAD (COVER)

RA1234600
SHIELD CASE COVER

RA127870A
SHIELD CASE COVER

RA1238200
SPONGE RUBBER

RA1301100
INSULATOR SHEET

RA0790300 (for POW 25)
SHIELD CASE (PWR)

RA1264700
EXT CAP

RA127990A
INSULATOR 10x5

RA125440A
PAD (10x17)

T9207533
WIRE ASSY AC093N 300MM2P2F

RA0790800
PAD (DIODE)

RA123740A
PAD (20x20x4)

RA1292400 (Lot. 1~3)
RA129240A (Lot. 4~)
SPONGE RUBBER (FW)

RA1234500 (Lot. 1~6)
RA123450A (Lot. 7~)
CHASSIS

VX-4600 FRONT PANEL

RA1301400
BLIND SHEET L=10

RA130450A
BLIND SHEET (15x13)

RA1244700 (Lot. 1~2)
RA124470A (Lot. 3~)
LIGHT GUIDE (LCD)

RA1244800
INTER CONNECTOR

RA1244600
LCD HOLDER

LCD

RA0786900
SPONGE RUBBER (LCD)

RA1247000 (Lot. 1~3)
RA124700A (Lot. 4~)
RUBBER KNOB

RA1288200
REFLECTOR SHEET (093)

RA1292600
REFLECTOR SHEET (SUB)

RA1303800 (Lot. 1~2)
MYLAR SHEET (L.G)

FRONT-B UNIT

RA1234400
PACKING PAD (PANEL)

RA1301300
GASKET L=25

RA1252400
SPECIAL NUT (M9)

RA1261500
SP HOLDER

RA1245900
VOLUME KNOB

SPEAKER

RA1301500
BLIND SHEET L=80

RA1249300 (Lot. 1~3)
RA124930A (Lot. 4~)
FRONT PANEL ASSY
w/WINDOW, LIGHT GUIDE (TXRX)

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

SUPPLIED ACCESSORIES		
VXSTD P/N	DESCRIPTION	QTY.
Q0000175	BLADE FUSE ATY-N15 (POW 50)	1
Q0000177	BLADE FUSE ATY-N10 (POW 25)	
T9026415	DC CABLE (POW 50)	1
T9026510	DC CABLE (POW 25)	
RA1234700	BRACKET	1
RA0790600	KNOB SCREW	2
U9900209	HEX HEAD BOLT HSM5x12B	2
U71005007	SPRING WASHER SW5B	2

No.	VXSTD P/N	DESCRIPTION	QTY.
①	U24308001	BIND HEAD TAPTITE-B M3X8	10
②	U24306001	BIND HEAD TAPTITE-B M3X6	2
③	U03308002	SEMS SCREW ASM3X8NI	2
④	U71002001	SPRING LOCK WASHER SW2.6	2

Block Diagram

MAIN-UNIT
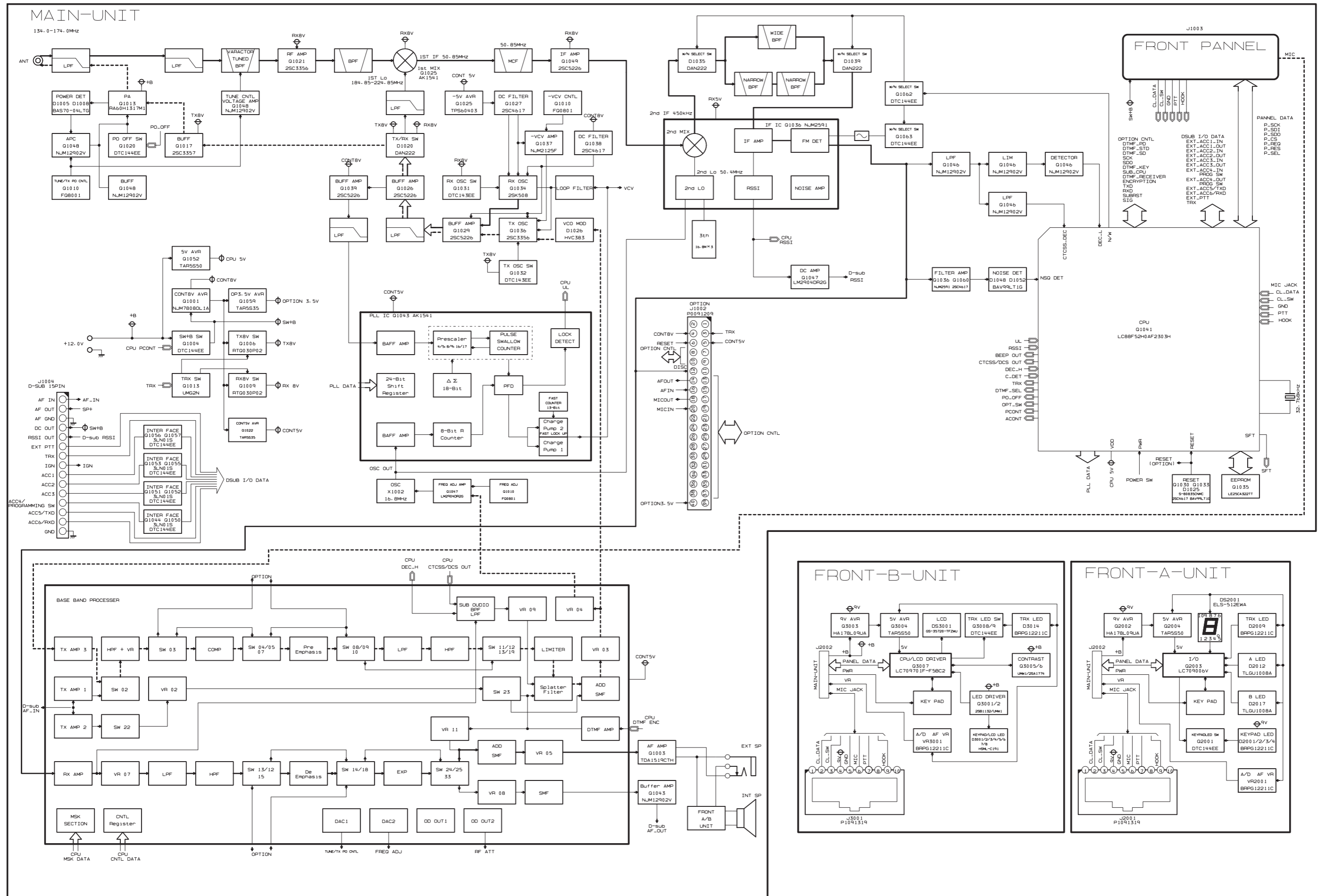
Circuit Description

1. Circuit Configuration by Frequency

The receiver is a double-conversion superheterodyne with a first intermediate frequency (IF) of 50.85 MHz and a second IF of 450 kHz. Incoming signal from the antenna is mixed with the local signal from the VCO/PLL to produce the first IF of 50.85 MHz. This is then mixed with the 50.4 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 the Low-pass filter, Undesired frequencies are removed by the varactor diode tuned band-pass filter consisting of diodes **D1013**, **D1015**, **D1022**, & **D1023** (all **HVC327C**) and Coils L1012 & L1013, and capacitors C1090, C1095, C1105, C1107, C1116, & C1117. The passed signal is amplified by **Q1021** (**2SC3356**) and moreover cuts animage frequency with the band pass filter consisting of Coils L1012, L1015, L1018, & L1033, and capacitors C1130, C1135, C1151, C1156, C1173, C1181, C1182, C1197, C1205, C1217, & C1233. The filtered RF signal is then delivered to the first Mixer.

2-2. First Mixer

The 1st mixer consists of **Q1040** (**AK1220**). Buffered output from the VCO is amplified by **Q1026** (**2SC5226**) to provide a pure first local signal between 184.85 and 224.85 MHz for injection to the first mixer. The output IF signal is sent to the crystal filter. The IF signal then passes through monolithic crystal filter XF1001 (± 5.5 kHz BW) to strip away all but the desired signal.

2-3. IF Amplifier

The first IF signal is amplified by **Q1049** (**2SC5226**). The amplified first IF signal is applied to FM IF subsystem IC **Q1054** (**NJM2591V**) which contains the second mixer, second local oscillator, limiter amplifier, noise amplifier, and S-meter amplifier. The signal from reference oscillator X1002 is multiplied 3 times in **Q1054** (**NJM2591V**). It is mixed with the first IF signal and becomes the second IF signal of 450 kHz. The second IF then passes through the ceramic filter CF1002 (for wide channels) or CF1001 and CF1003 (for narrow channels) to strip away unwanted mixer products and remove amplitude variations in the 450 kHz IF before detection of the speech by the ceramic discriminator CD1001.

2-4. Audio amplifier

Detected signal from **Q1054** (**NJM2591V**) is delivered to **Q1010** (**FQ0801**) and is output by **Q1010** (**FQ0801**) pin 17 through the band pass filter. When the optional unit is installed, **Q1010** (**FQ0801**) is made "OFF" and the AF signal from **Q1010** (**FQ0801**) pin 21 goes to the optional unit and returns to **Q1010** (**FQ0801**) pin 20 from the optional unit. When the optional unit is not installed, **Q1010** (**FQ0801**) is made "ON" and the signal goes through **Q1010** (**FQ0801**) pin 20/21. The signal is stored in the AF volume via AF mute and the de-emphasis inside **Q1010** (**FQ0801**). The AF volume is controlling **Q1010** (**FQ0801**) by the CPU. After that, it enters AF power amplifier **Q1003** (**TDA1519CTH**) after passing AF volume. The output of **Q1003** (**TDA1519CTH**) drives a speaker (it chooses the external SP or internal SP in J1001).

2-5. Squelch Circuit

There are 16 levels of squelch setting from 0 to 15. The level 0 means open squelch. The level 1 means the threshold setting Level and level 15 means tight squelch. From 1 to 14 is established in the middle of threshold and tight. The bigger figure is nearer the tight setting. The level 16 becomes setting of carrier squelch.

2-5-1. Noise Squelch

The noise squelch circuit is composed of the band pass filter of **Q1054** (**NJM2591V**), noise amplifier **Q1060** (**2SC4617**), and noise detector **D1048**, **D1052** (both **DA221**). When a carrier isn't received, the noise ingredient which goes out of the demodulator **Q1054** (**NJM2591V**) is amplified in **Q1060** (**2SC4617**) through the band pass filter **Q1054** (**NJM2591V**), is detected to DC voltage with **D1048** and **D1052** (both **DA221**), and is inputted to pin 15 the A/D port of the **Q1041** (**LC88F52H0A**) 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 **Q1010** (**FQ0801**) "OFF". When the detected voltage is low, the CPU makes **Q1010** (**FQ0801**) "ON" and the AF signal is output.

2-5-2. Carrier Squelch

Pin 14 (A/D port) of **Q1047** (**NJM2904V**) CPU detects RSSI voltage output from pin 12 of **Q1054** (**NJM2591V**), and controls AF output. The RSSI output voltage changes according to the signal strength of carrier. The stronger signal causes the RSSI voltage to be higher voltage. The process of the AF signal control is the same as Noise Squelch. The shipping data is adjusted 3 dB higher than squelch tight sensitivity.

Circuit Description

3. Transmitter System

3-1. Mic Amplifier
The AF signal from microphone jack J2001 (VX-4500) or J3001 (VX-4600) is amplified with microphone amplifier in **Q1010** (**FQ0801**), is amplified a second time after microphone selection switch **Q1010** (**FQ0801**), and passes through microphone gain volume in **Q1010** (**FQ0801**). The control from the CPU passes output and it passes a pre-emphasis circuit. When an option unit is installed, the AF signal from **Q1010** (**FQ0801**) pin 38 goes through the option unit, and returns to **Q1010** (**FQ0801**) pin 39. When an option unit isn't installed, **Q1010** (**FQ0801**) is inputted to the pre-emphasis circuit. The signal passes the limiter and splatter filter of **Q1010** (**FQ0801**), and is adjusted by maximum deviation adjustment volume. The adjusted low frequency signal ingredient is amplified by **Q1047** (**NJM2904V**), added modulation terminal of TCXO (X1002), the FM modulation is made by reference oscillator.

The high frequency signal ingredient is amplified, and adjusted the level by volume **Q1010** (**FQ0801**) to make frequency balance between low frequency. After that, it is made FM modulation to transmit carrier by the modulator **D1026** (**HVC383B**) of VCO.

3-2. Drive and Final amplifier
The modulated signal from the VCO **Q1034** (**2SK508**) is buffered by **Q1026** (**2SC5226**) and amplified by **Q1017** (**2SC3356**). The low-level transmit signal is then applied to the Power Module **Q1013** (**RA60H1317M1A**: for 50 W, **RA30H1317M1**: for 25 W) for final amplification up to 50 or 25 watts output power. The transmit signal is then low-pass filtered to suppress away harmonic spurious radiation before delivery to the antenna.

3-3. Automatic Transmit Power Control
The output power of Power Module is detected by CM coupler, it is detected by **D1005** & **D1008** (both **HSM88AS**) and is input to comparator **Q1048** (**NJM12902V**). The comparator compares two different voltages and makes output power stable by controlling the bias voltage of the Power Module. There are 4 levels of output power (Hi, Lo3, Lo2 and Lo1) it is switched by the Voltage of **Q1010** (**FQ0801**) pin 44.

3-4. PLL Frequency Synthesizer
The frequency synthesizer consists of PLL IC **Q1043** (**AK1541**), 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 –22 °F to +140 °F [–30 °C to +60 °C]).

3-4-1. VCO
While the radio is receiving, the RX oscillator **Q1034** (**2SK508**) in VCO generates a programmed frequency between 184.85 and 224.85 MHz as 1st local signal. While the radio is transmitting, the TX oscillator **Q1036** (**2SC3356**) in VCO generates a frequency between 134 and 174 MHz. The output from the oscillator is amplified by buffer amplifier **Q1029** (**2SC5226**) and becomes output of VCO. The output from the VCO is divided, one is amplified by **Q1039** (**2SC5226**) and feed back to pin 17 of the PLL IC **Q1043** (**AK1541**). It is amplified about the RF signal **Q1029** (**2SC5226**) which was made by VCO. RF changes with the carrier signal of the transmitter and the mixer local signal of the receiver with **D1020** (**DAN222**).

3-4-2. VCV CNTL
Tuning voltage (VCV) of the VCO is expanding the lock range of VCO by controlling of the varactor diode at the voltage and the control voltage from PLL IC **Q1043** (**AK1541**). As for the control voltage adjustment by the varactor diode, it controls the negative voltage to make with **Q1025** (**TPS60303**) with the D/A converter inside **Q1010** (**FQ0801**) and **Q1037** (**NJM2125F**), it has the anode potential of the varactor diode variably.

3-4-3. PLL
The PLL IC **Q1043** (**AK1541**) consists of reference divider, main divider, phase detector, charge pumps and delta sigma-fractional accumulator. The reference frequency from TCXO is inputted to pin 10 of PLL IC **Q1043** (**AK1541**) and is divided by reference divider. This IC is decimal point dividing PLL IC **Q1043** (**AK1541**) and the dividing ratio becomes 1/8 of usual PLL frequency step. Therefore, the output of the reference divider is 8 times the frequency of the channel step. For example when the channel stepping is 5 kHz, the output of reference divider becomes 40 kHz. On the other hand, inputted feed back signal to pin 17 of PLL IC **Q1043** (**AK1541**) from VCO is divided with the dividing ratio which becomes the same frequency as the output of reference divider. These two signals are compared by the phase detector, and the phase difference pulse is generated. The phase difference pulse and the pulse from fractional accumulator pass through the charge pumps and LPF. It becomes the DC voltage (VCV) to control the VCO. The oscillation frequency of VCO is locked by the control of this DC voltage. The PLL serial data from CPU **Q1041** (**LC88F52H0A**) is sent with three lines of SDO (pin 20), SCK (pin 22) and PSTB (pin 45). The lock condition of PLL is output from the UL (pin 18) terminal and UL becomes "H" at the time of the lock condition and becomes "L" at the time of the unlocked condition. The CPU **Q1041** (**LC88F52H0A**) always watches over the UL condition, and when it becomes "L" unlocked condition, the CPU **Q1041** (**LC88F52H0A**) prohibits transmitting and receiving.

Alignment

Introduction

The **VX-4500/-4600** 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, 50-W RF Dummy Load
❐ Regulated DC Power Supply (standard 13.6V DC, 15A)
❐ Frequency Counter: ±0.2 ppm accuracy at 200 MHz
❐ AF Signal Generator
❐ AC Voltmeter
❐ DC Voltmeter
❐ VHF Sampling Coupler
❐ Microsoft® Windows® 2000, XP, Vista or Windows7
❐ Vertex Standard FIF-10A USB Programming Interface and CT-104A PC Programming Cable or VPL-1 cable.
❐ Vertex Standard CE115 PC Programming Software

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.

Beacuse of the BTL (**B**ridged **T**rans **L**ess) Amplifier circuit used in the VX-4500/-4600, do not connect either side of the speaker leads to chassis "ground."

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 align-ment, apply 13.6V DC power to the transceiver. Refer to the drawings below for Alignment Points.
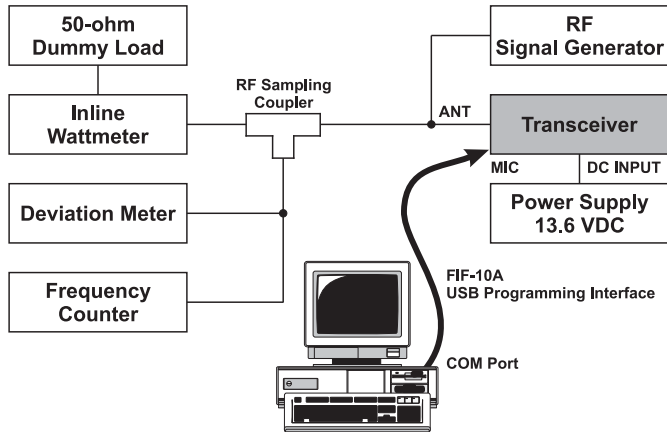
The Alignment Tool Outline

Installation of the alignment tool

❒ Install the CE115 (PC Programming Software) to your PC.

❒ "Alignment" function in the "Radio" menu tab of CE115.

Action of the switches

When the transceiver is in the "Alignment mode," the action of the PTT and all PF KEYS are ignored. All of the action is controlled by the PC.

Caution!

Please never turn off the power supply during alignment. If the power supply is turned off dur-ing alignment, the alignment data will be corrupt-ed.

Alignment

Alignment Mode

The Alignment mode allows you to align the entire radio. The value of each parameter can be changed to the desired value by use of the "←" / "→" and up/down arrow keys, along with direct number input and dragging of the PC mouse.
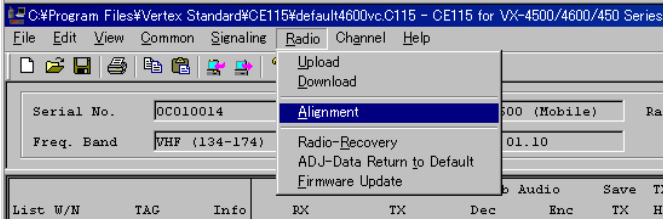
To enter the Alignment Mode, select "Alignment" in the main "Radio" menu. It will start to "Upload" the alignment data from the radio to the PC. Pressing the "OK" button will then "Download" the alignment data to the radio and exit the Alignment Mode.

Note: when all items are to be aligned, it is strongly recommended to align them according to the following sequence. Detailed information for each step may be found in the "Help" file within CE115 (PC Programming Software).

1. VCO (*Please do not adjust it*)
2. PLL Reference Frequency (Frequency)
3. RX Sensitivity (RX Tune)
4. Squelch (SQL/RSSI)
5. TX Power <High/Low3/Low2/Low1>
6. Maximum Deviation <Wide/Narrow>

Please adjust the following items when needed.

❍ Modulation Balance <Wide/Narrow>
❍ CTCSS Deviation <Wide/Narrow>
❍ DCS Deviation <Wide/Narrow>
❍ DTMF Alignment
❍ Seq Tone
❍ VOX ON Level
❍ TX MSK
❍ Ext AF Out
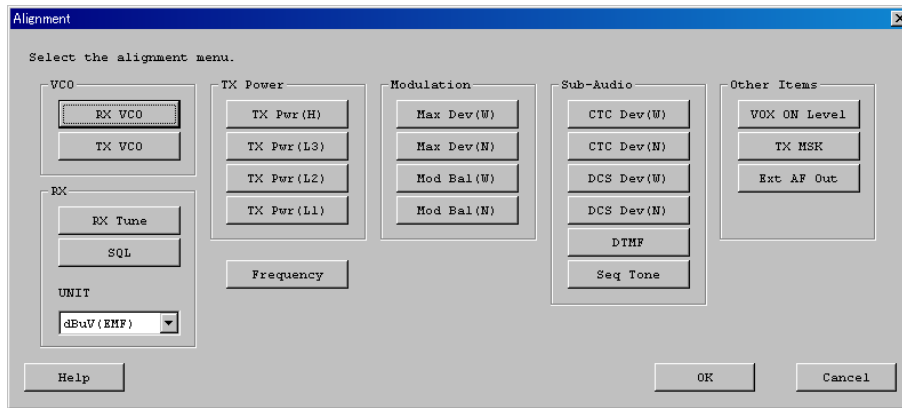
Unit

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

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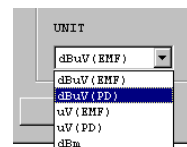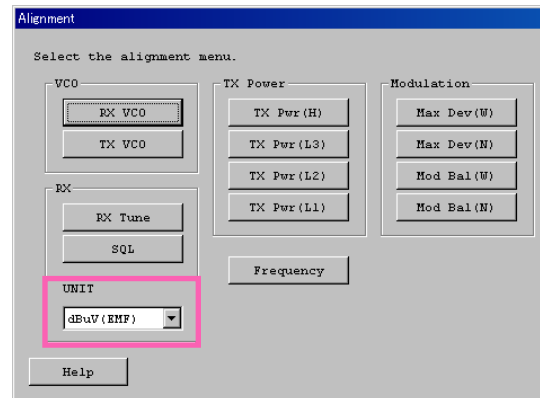
Alignment

1. VCO (RX VCO/TX VCO) - Normally there is no need to adjust this parameter -

This parameter is to align the VCO Voltage adjustment.
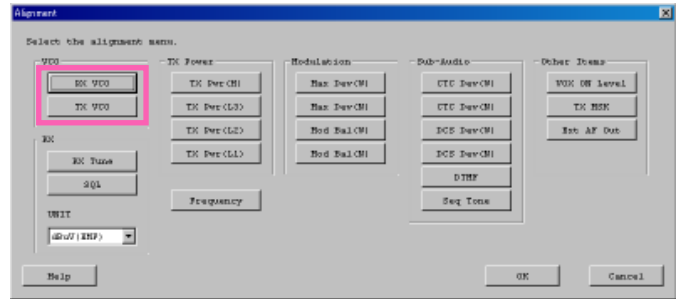
2. PLL Reference Frequency (Frequency)

This parameter is to align the reference frequency for PLL.

1. Press the "Frequency" button to start the alignment. The Frequency Alignment window will appear.
2. Click the "PTT" button or press the "SPACE" bar, and the radio will start to transmit on the center frequency channel.
3. Set the value to get the desired frequency by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box.
4. After getting the desired frequency click the "PTT" button or press the "SPACE" bar to stop transmitting.
5. Click the "OK" button to finish the frequency alignment and save the data.
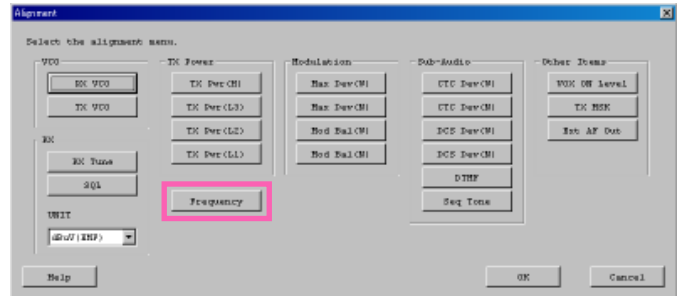
Alignment

3. RX Sensitivity (RX Tune)

This parameter is to align the RX BPF (Band Pass Filter) for Receive (RX) sensitivity. The PLL Reference Frequency (Frequency) alignment must be done before this alignment is performed.

1. Press the "RX Tune" button to start the alignment. The RX Sensitivity Alignment window will appear.
2. Click the left mouse button on the slide bar or press the Up / Down arrow keys, to switch to the desired channel for alignment.
3. Set the Signal Generator according to the indication at the top of the screen (Setting Your SG as followings).
4. Drag the slide bar, click the up-down buttons, press the left or right arrow key, or enter the value in the entry box to get the best RX sensitivity (Highest RSSI value) on the selected channel.
5. Click the "OK" button to finish the RX Sensitivity alignment and save the data.

ADJ Type

Basic: "Low-edge / band center / high-edge" and select the channel for alignment (Default).

Single : Alignment value changes only on the selected channel.

All Freq : Alignment value changes on all channels.
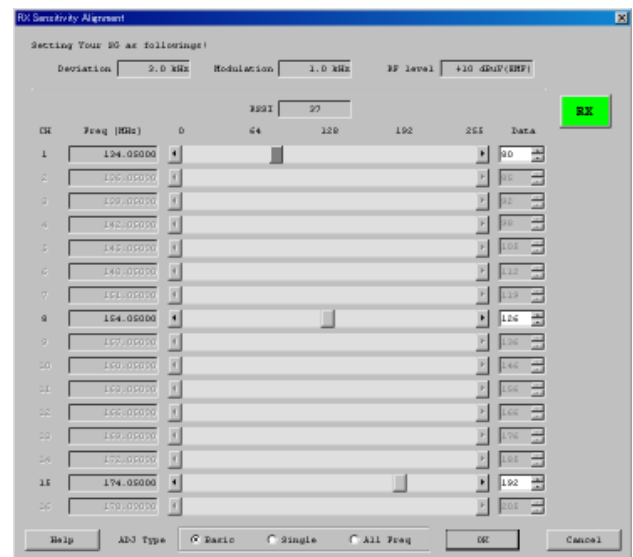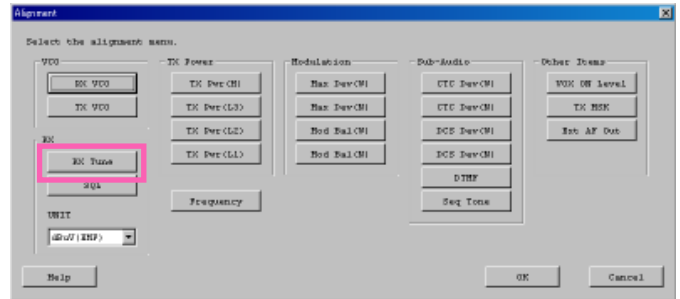
Alignment

4. Squelch (SQL)

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

There are several alignments as follows in the Squelch Sensitivity.

Tight SQL Level (TI NSQ W/N)
The Alignment for the Noise SQL Tight level at Wide (5k/4k) or Narrow (2.5k).

Threshold SQL Level (TH NSQ W/N)
The Alignment for the Noise SQL Threshold level at Wide (5k/4k) or Narrow (2.5k).

Tight SQL RSSI Level (TI RSSI W/N)
The Alignment for the "level 14" of the RSSI SQL level at Wide (5k/4k) or Narrow (2.5k).

TX Save RSSI Level (TX SAVE W/N)
The Alignment for the TX Save RSSI level at Wide (5k/4k) or Narrow (2.5k).

The procedure for all the alignments is as follows.
1. Click the "Start" button to open the alignment window in the SQL/RSSI Alignment menu.
2. The Alignment window will appear, Set the Signal Generator according to the indication, then click the "Start" button.
3. The automatic alignment will start to get the SQL or RSSI level.
4. It will show the alignment result in the "New" box.
5. Click the "OK" button, then the data will be saved and the alignment is finished.
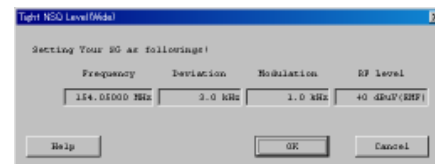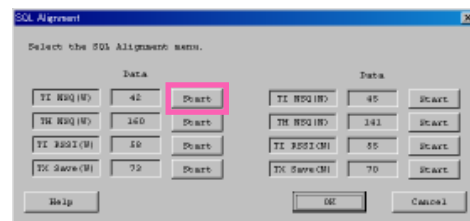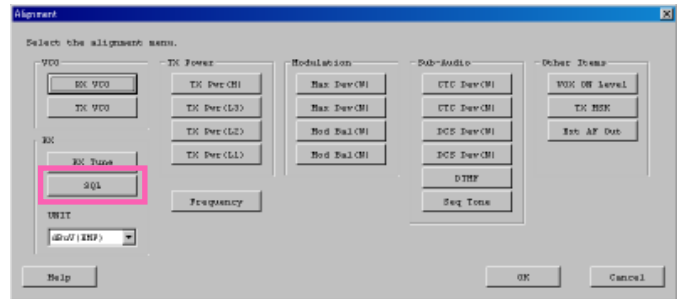
Alignment

5. TX Power

This parameter is to align the "Power High", "Power Low3", "Power Low2" or "Power Low1" for the selected channel.

1. Press the "TX Pwr(H / L3 / L2 / L1)" button to start the alignment. The TX Power Alignment window will appear.
2. Click the left mouse button on the slide bar or press the Up / Down arrow key, to select the desired channel.
3. Click the "PTT" button or press the "SPACE" bar at the desired channel, then the radio starts to transmit on the selected channel.
4. Set the value to get desired output power on the Power Meter by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box on the selected channel.
5. After getting the desired output power click the "PTT" button or press the "SPACE" bar to stop transmitting.
6. Click the "OK" button to finish the TX Power alignment and save the data.

ADJ Type

    Basic: "Low-edge / band center / high-edge" and select the channel for alignment (Default).

    Single :   Alignment value changes only on the selected channel.

    All Freq :   Alignment value changes on all channels.
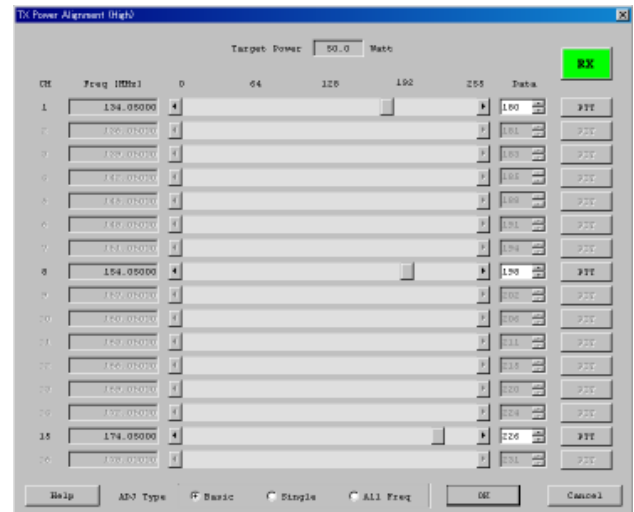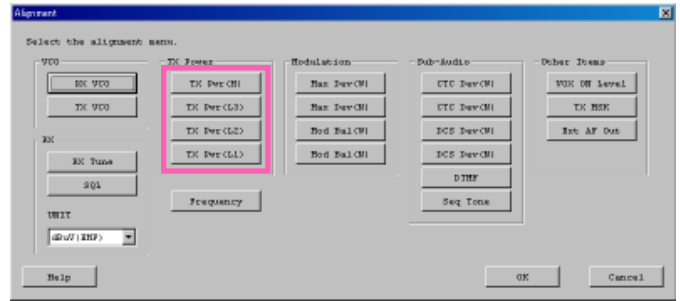
Alignment

6. Maximum Deviation <Wide> / <Narrow>

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

It requires the appropriate JIG (Tuning Interface BOX). Connect the JIG and Test Equipment to the radio before the alignment is started.

1. Press the "Max Dev (W /N)" button to start the alignment.
2. The Max Deviation alignment window will appear.
3. Connect the Generator to the JIG's (Tuning Interface Box) MIC IN jack and connect the JIG to the radio's microphone connector. Then inject a 1 kHz tone / Sine Wave / -24 dBm.
4. Click the left mouse button on the slide bar or press the Up / Down arrow key, to select the desired channel.
5. Click the "PTT" button or press the "SPACE" bar the radio starts to transmit on the selected channel.
6. Set the value to get desired deviation (Wide: 4.2kHz, Narrow: 2.1kHz) on the deviation meter by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box on the selected channel.
7. After getting the desired deviation click the "PTT" button or press the "SPACE" bar to stop transmitting.
8. Click the "OK" button to finish the Max Deviation alignment and save the data.

ADJ Type

Basic: "Low-edge / band center / high-edge" and select the channel for alignment (Default).
Single : Alignment value changes only on the selected channel.
**All Freq** : Alignment value changes on all channels.
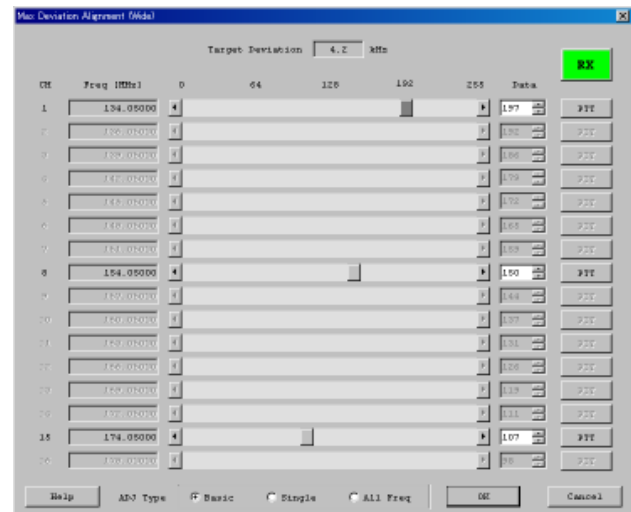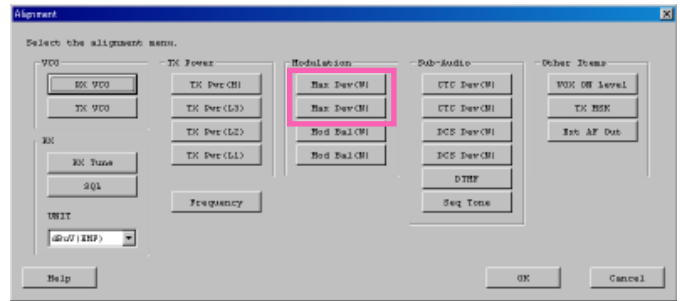
Alignment

Please adjust the following items when needed.

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

This parameter is to align the "Modulation Balance" (Wide/Narrow).

It needs the appropriate JIG (Tuning Interface BOX). Connect the JIG and Test Equipment to the radio before the alignment is started.

1. Press the "Mod Bal (W / N)" button to start the alignment.
2. The Modulation Balance Alignment window will appear.
3. Set the Bal Data to 150.
4. Connect the Generator to pin 1 of the D-SUB connector. Then inject a 3 kHz tone / Sine Wave / -24 dBm.
5. Click the left mouse button on the slide bar or press the Up / Down arrow key, to select the desired channel.
6. Click the "PTT" button or press the "SPACE" bar the radio starts to transmit on the selected channel.
7. Write down the measured deviation level.
8. Change the Generator input to pin 1 of the D-SUB connector. to the following: 40 Hz tone / Sine Wave / -24 dBm.
9. Set the value to get "deviation of step 7" by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box on the selected channel.
10. After setting the deviation level click the "PTT" button or press the "SPACE" bar to stop transmitting.
11. Click the "OK" button to finish the Modulation Balance alignment and save the data.

ADJ Type
Basic: "Low-edge / band center / high-edge" and select the channel for alignment (Default).

Single : Alignment value changes only on the selected channel.

All Freq : Alignment value changes on all channels.
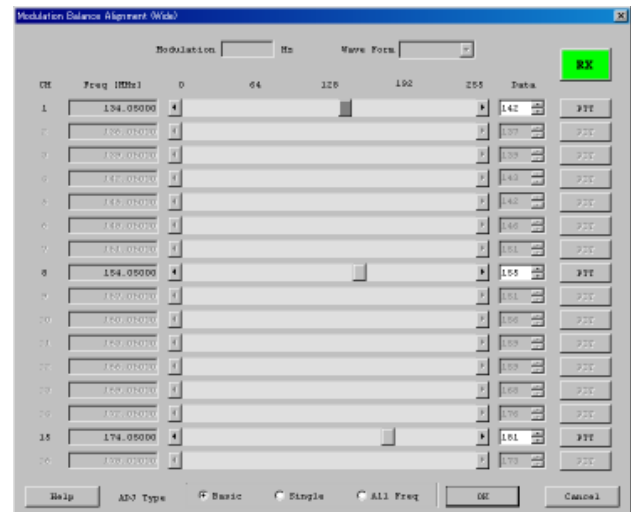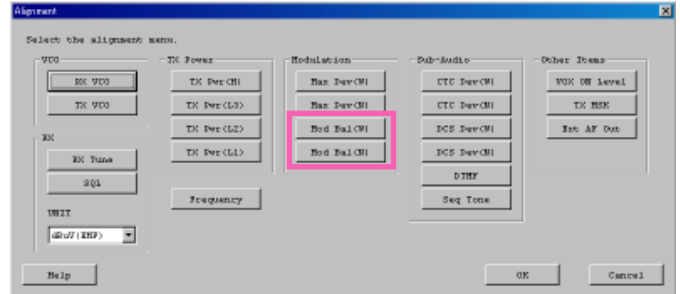
Alignment

CTCSS Deviation <Wide> / <Narrow>

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

1. Press the "CTC Dev (W / N)" button to start the alignment.
   The CTCSS Deviation Alignment window will appear.
2. Click the left mouse button on the slide bar or press the Up / Down arrow key, to select the desired channel.
3. Click the "PTT" button or press the "SPACE" bar the radio starts to transmit with CTCSS tone on the selected channel.
4. Set the value to get desired deviation on the deviation meter by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box on the selected channel.
5. After getting the desired deviation (Wide: 0.6 kHz, Narrow: 0.3 kHz) click the "PTT" button or press the "SPACE" bar to stop transmitting.
6. Click the "OK" button to finish the CTCSS Deviation alignment and save the data.

ADJ Type
Basic: "Low-edge / band center / high-edge" and select the channel for alignment (Default).
Single :   Alignment value changes only on the selected channel.
All Freq : Alignment value changes on all channels.
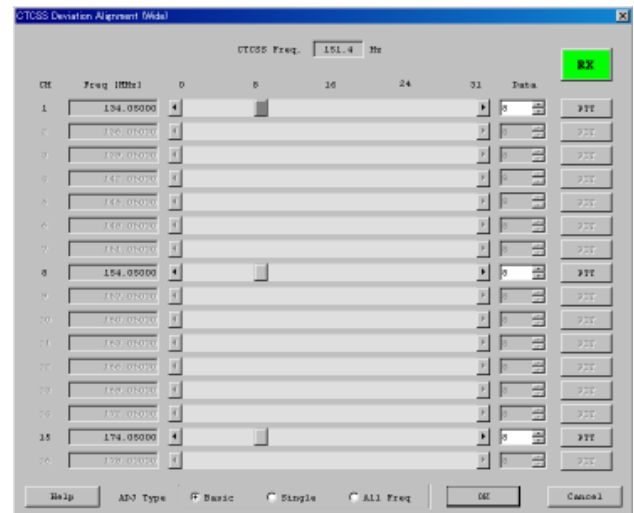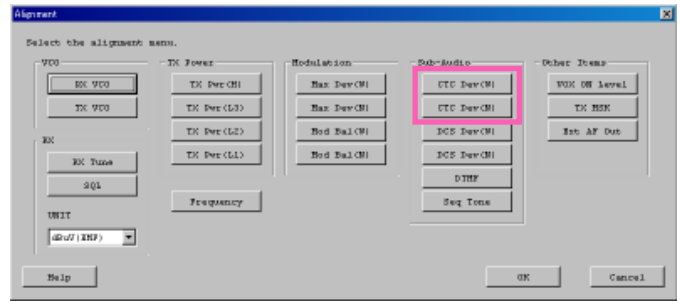
Alignment

DCS Deviation <Wide> / <Narrow>

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

1. Press the "DCS Dev (W / N)" button to start the alignment.
   The DCS Deviation Alignment window will appear.
2. Click the left mouse button on the slide bar or press the Up / Down arrow key, to select the desired channel.
3. Click the "PTT" button or press the "SPACE" bar the radio starts to transmit with DCS Code on the selected channel.
4. Set the value to get desired deviation (Wide: 0.6 kHz, Narrow: 0.3 kHz) on the deviation meter by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box on the selected channel.
5. After getting the desired deviation click the "PTT" button or press the "SPACE" bar to stop transmitting.
6. Click the "OK" button to finish the DCS Deviation alignment and save the data.

ADJ Type

Basic: "Low-edge / band center / high-edge" and select the channel for alignment (Default).

Single : Alignment value changes only on the selected channel.

All Freq : Alignment value changes on all channels.
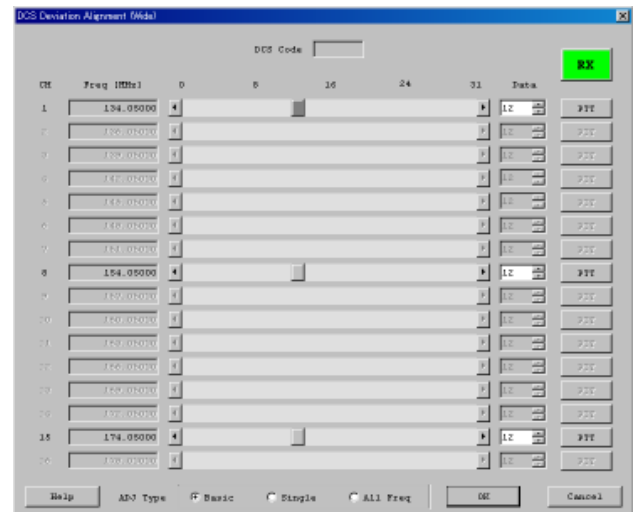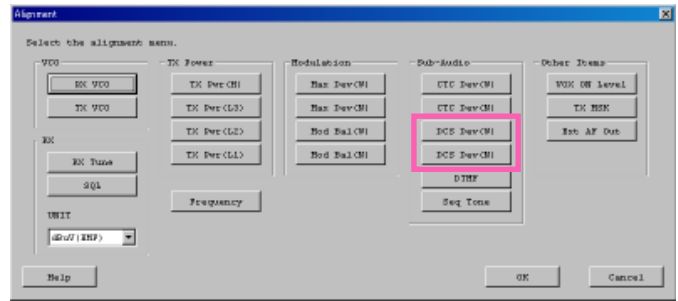
Alignment

DTMF Deviation

This parameter is to align "DTMF Deviation".

1. Press the "DTMF" button to start the alignment. The DTMF Alignment window will appear.
2. Click the "PTT" button or press the "SPACE" bar the radio starts to transmit on the Center frequency channel.
3. Set the value to get desired deviation (3.0 kHz) on the deviation meter by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box.
4. After getting the desired deviation click the "PTT" button or press the "SPACE" bar to stop transmitting..
5. Click the "OK" button to finish the DTMF Deviation alignment and save the data.
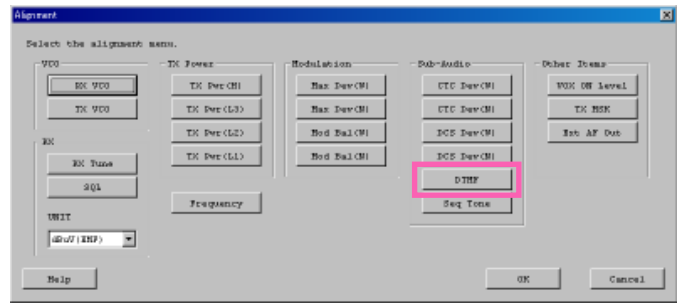
Sequential Tone Deviation

This parameter is to align "Sequential Tone Deviation".

1. Press the "Seq Tone" button to start the alignment. The Sequential Tone Deviation Alignment window will appear.
2. Click the "PTT" button or press the "SPACE" bar the radio starts to transmit on the Center frequency channel.
3. Set the value to get desired deviation (3.0 kHz) on the deviation meter by dragging the slide bar, clicking the up-down button, pressing the left or right arrow key, or entering the value in the entry box.
4. After getting the desired deviation click the "PTT" button or press the "SPACE" bar to stop transmitting.
5. Click the "OK" button to finish the Sequential Tone Deviation alignment and save the data.
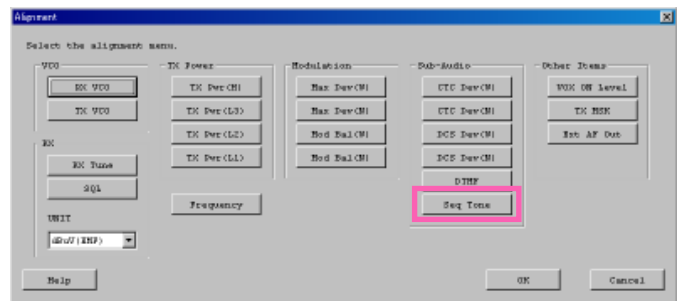
Alignment

VOX On Level

This parameter is to align the "VOX On Level".

Set the Sensitivity of the VOX circuitry's input audio detector.

1. Press the "VOX ON Level" button to start the alignment.
   The VOX ON Level window will appear.
2. Then input the alignment value in the "New" box.
   Default: 80
   Input Range: 0 (Level Down) ~ 255 (Level Up)
3. Click the "OK" button, the data will be saved and the alignment is complete.
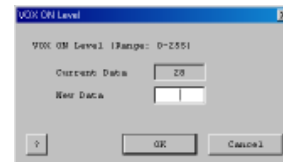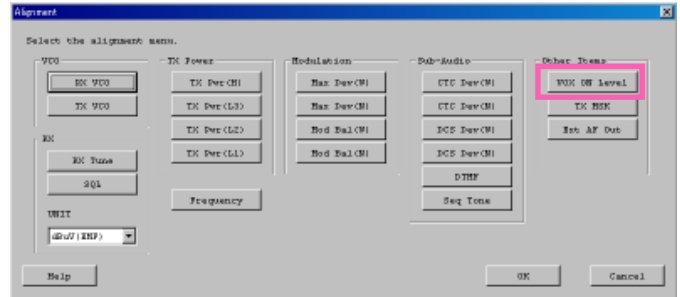
TX MSK Level

This parameter is to align the modulation level of the ANI function.

1. Press the "TX MSK" button to start the alignment. The TX MSK Level window will appear.
2. Then input the alignment value in the "New" box.
   Default: 10
   Input Range: 0 (Level Down) ~ 15 (Level Up)
3. Click the "OK" button, the data will be saved and the alignment is complete.
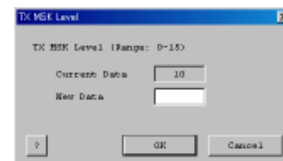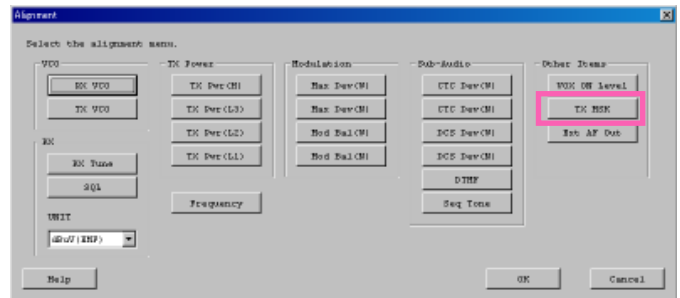
Alignment

EXT AF OUT Level

This parameter is to align the "EXT AF OUT Level".

Set the Low-level receiver output of pin 2 of the D-SUB Connector.

1. Press the "Ext AF Out" button to start the alignment. The Ext AF Out Level window will appear.
2. Connect the Generator to pin 1 of the D-SUB connector. Then inject a 1 kHz tone / Sine Wave / +40 dBu.
3. Set the Peak signal level to -10 dBm ±0.7 dB at 600-ohm on pin 2 of the D-SUB connector by entering the alignment value in the "New" box.
   Default: 7
   Input Range: 0 (Level Down) ~ 15 (Level Up)
4. Click the "OK" button, the data will be saved and the alignment is complete.
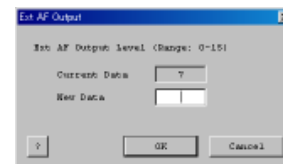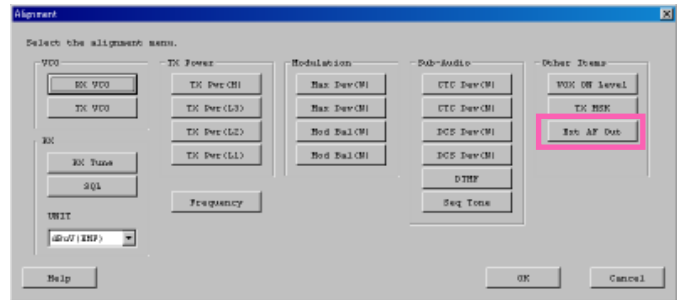
Installation of Option

FVP-35, DVS-8, VT-60F/FS

The **FVP-35** is a Rolling Code Encryption Unit which permits secure voice communications with station within your network, while preventing others from listening using normal communications equipment.

The **DVS-8** is a Voice Storage Unit which allows you to record and play back incoming receiver audio.

The **VT-60F/FS** is a module which provides a complete multi-chanel digital-access radio trunking system.

Each optional Unit is easily programmed the configulations using a Vertex Standard CE115 programmer with an IBM PC-compatible computer.

1. Disconnect the DC power cable.
2. Referring to Figure 1, grasp the Top Case Cover with both hands, Lift up the Top Case Cover to remove while sprend both side of the Top Case Cover.
3. Referring to Figure 2, remove the Shield Case Cover.
4. Referring to Figure 3, locate the empty connector for the Optional Unit, connect the Optional Unit here.
5. Replace the Shield Case Cover, then replace the Top Case Cover. Installation is now complete.

Do not install all Optional Unit at onece
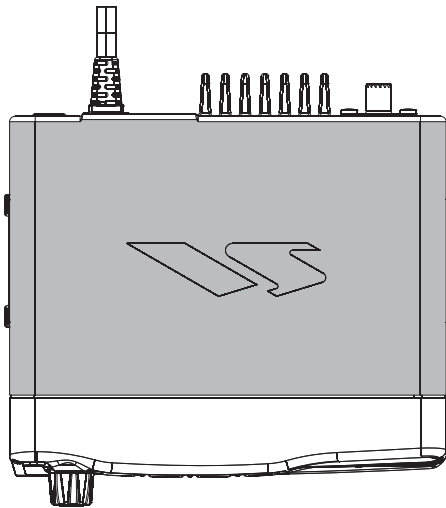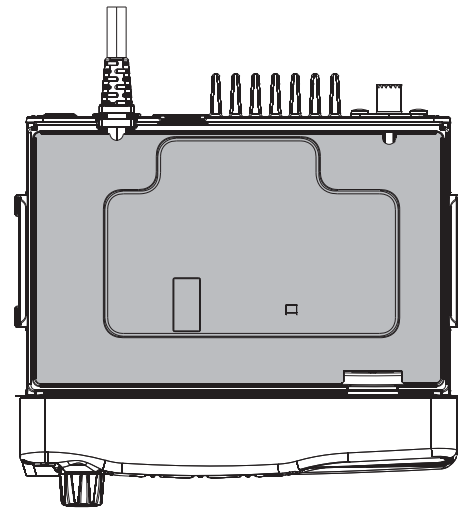
Figure 1

Figure 2
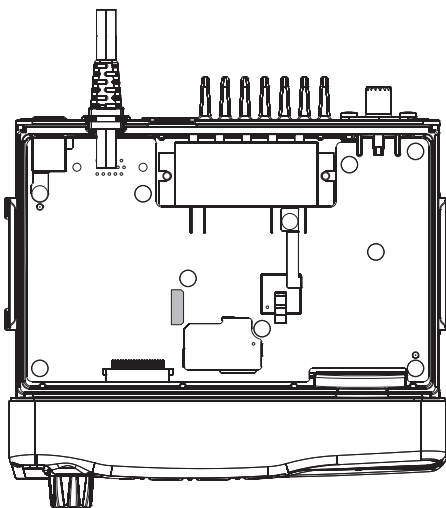
Figure 3
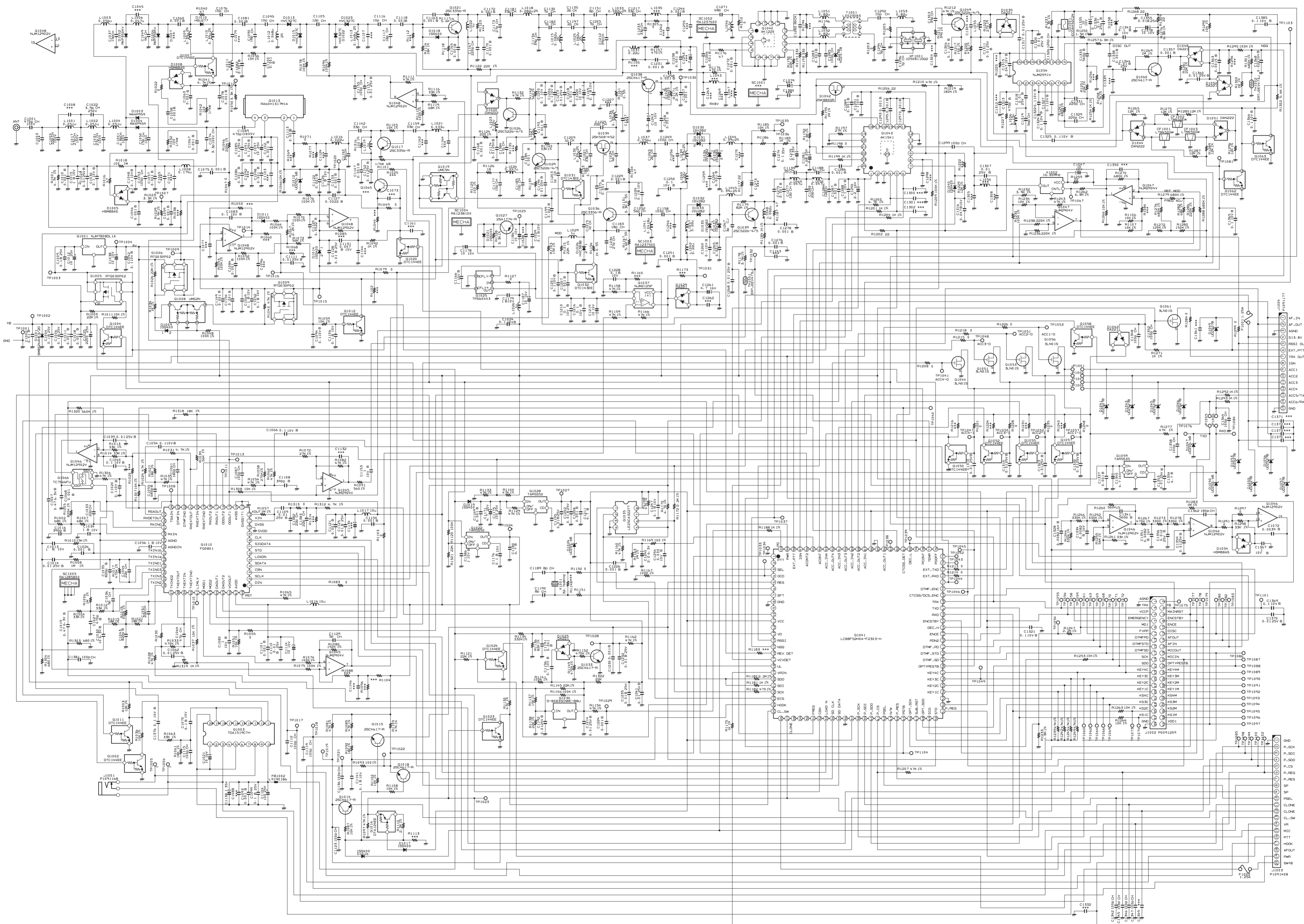
Parts Layout (Side A)

MAIN Unit (Lot. 1~3)

Parts Layout (Side B)

ADD	25W	45W	ADD	25W	45W
C1096	0.1u	***	L1023	***	220n
C1124	47p	***	Q1013	RA30H1317M1	RA6DH1317MA
C1131	0.22u	0.047u	R1029	6.8K	3.9K
C1140	47p	39p	R1076	15K	100K
C1142	18p	33p	R1085	330K	***
C1162	47p	***	R1095	330	***
C1164	47p	***	R1105	15K	10K
C1384	2p	47p	R1124	470	220
D1003	***	MA4P959	R1174	220	470
L1016	47n	22n	R1316	***	100
L1019	82n	***			
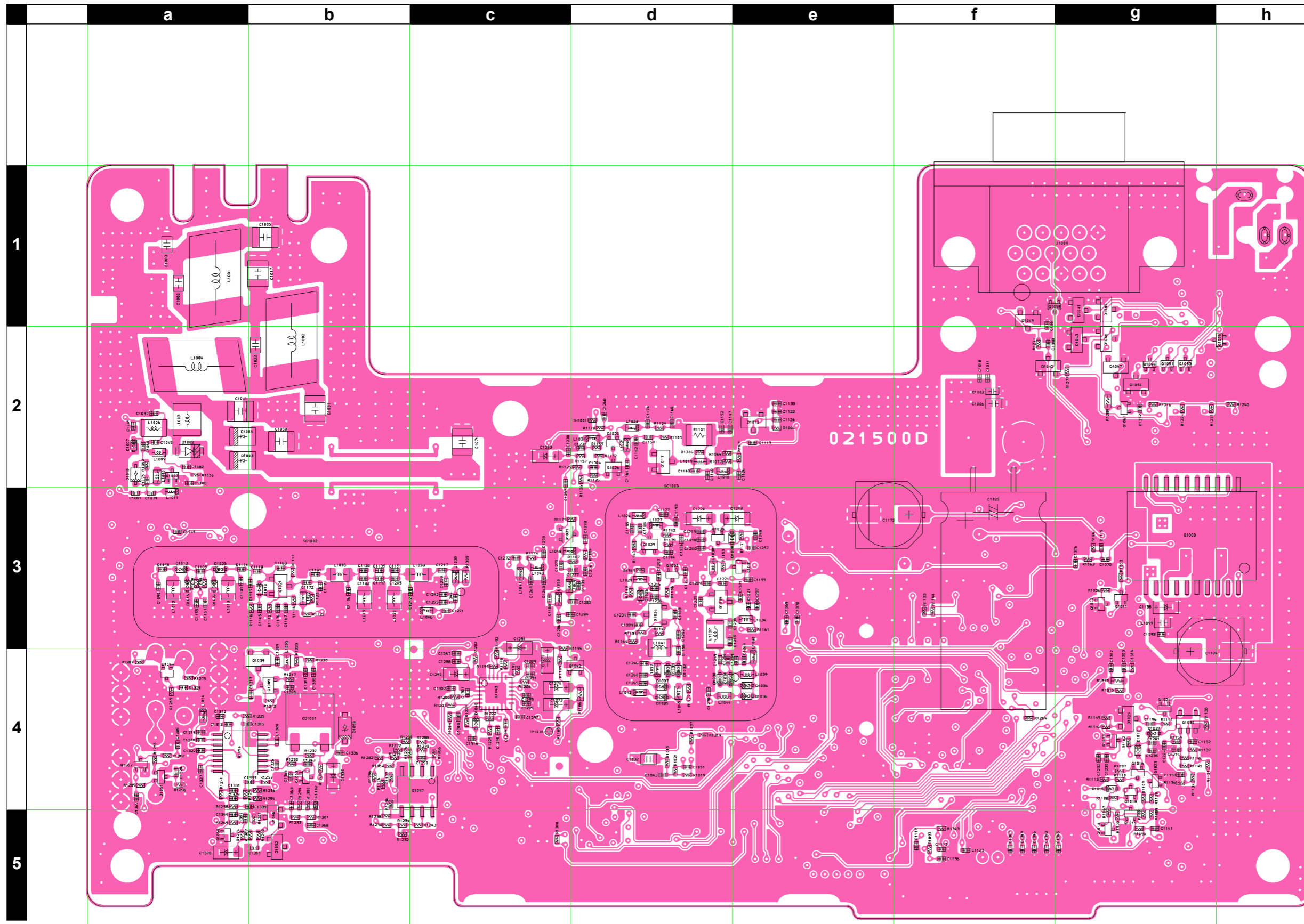
MAIN Unit (Lot. 4~)

Parts Layout (Side A)

Parts Layout (Side B)
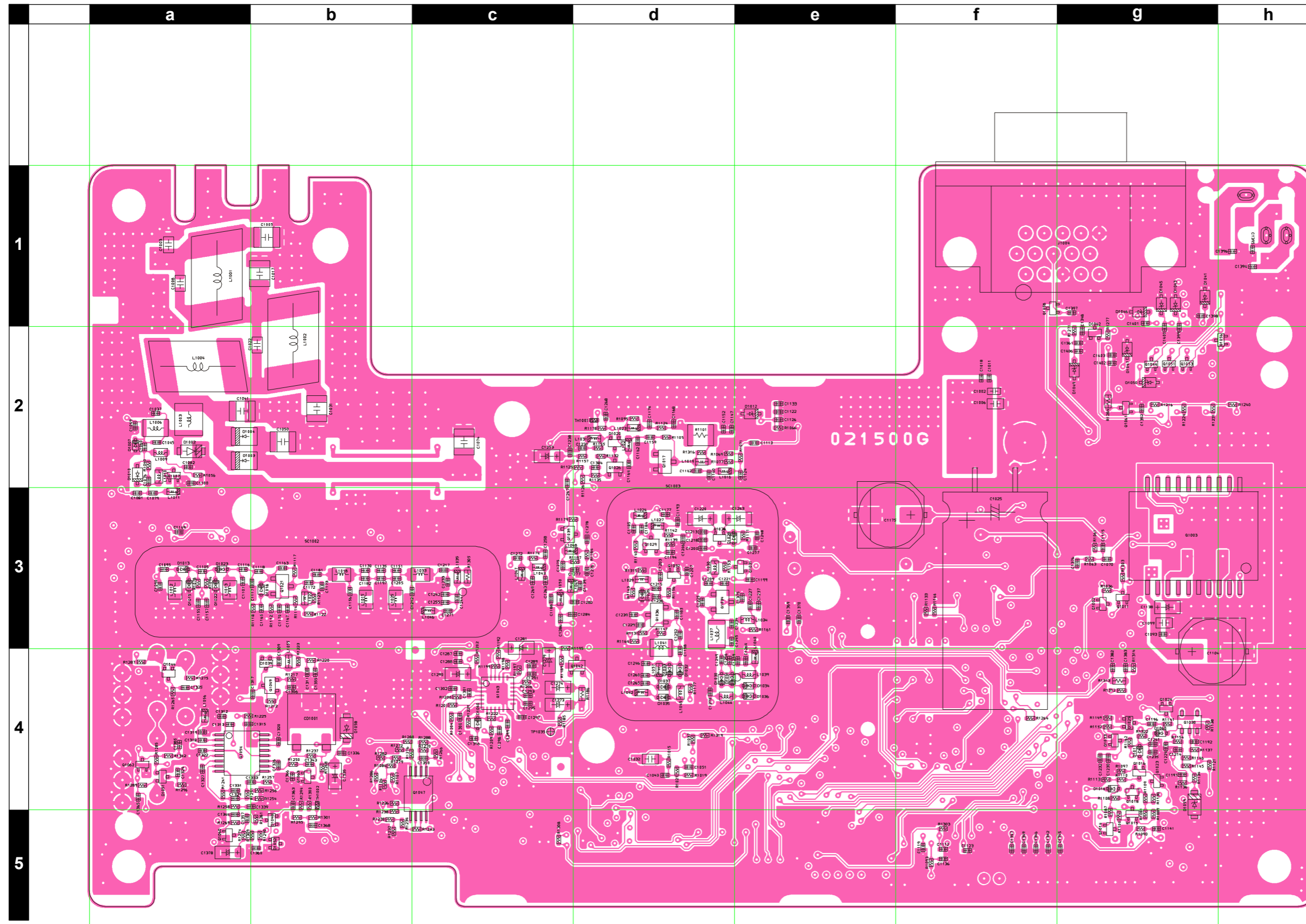
MAIN Unit

Parts List

REF	DESCRIPTION	VALUE	V/W	TOL.	MFR'S DESIG	VXSTD P/N	VERS.	LOT	SIDE	LAY ADR
	PCB with Components					CS2092701	CH:8, POW:50			
						CS2092702	CH:512, POW:50			
						CS2092703	CH:8, POW:25			
						CS2092704	CH:512, POW:25			
	Printed Circuit Board					FR021500D	1-3			
						FR021500G	4-			
	TOP COVER					RA123420B				
	PACKING PAD				(COVER)	RA1234300				
	SEMS SCREW				ASM3X8NI	U03308002				
	BIND HEAD TAPTITE-B				M3X8	U24308001				
	BIND HEAD TAPTITE-B				M3X6	U24306001				
	SPRING LOCK WASHER				SW2.6	U71002001				
CD1001	CERAMIC DISC				ECDA450C24	H7901460			B	b4
CF1001	CERAMIC FILTER				LTM450GW	H3900573			A	H4
CF1002	CERAMIC FILTER				LTM450EW	H3900574			A	G4
CF1003	CERAMIC FILTER				LTM450GW	H3900573			A	H4
F 1001	CHIP FUSE	1.25A			FCC16 132ABTP	Q0000109			A	B1
F 1002	CHIP FUSE	1.25A			FCC16 132ABTP	Q0000109			A	C5
Q 1001	IC				NJM7808DL1A-TE1	G1093802			A	C3
Q 1003	IC				TDA1519CTH	G1093778			B	g3
Q 1013	IC				RA60H1317M1A-101	G1094554	POW:50		A	C1
Q 1013	IC				RA30H1317M1-101	G1094553	POW:25		A	C1
Q 1042	FET				2SK880GR(TE85R.F)	G3808807G			B	d4
Q 1044	FET				3LN01S-TL	G3070330			B	g2
X 1001	XTAL	32.768kHz			4809995L18 32.768KHZ	H0103407			A	A4
X 1002	TCXO	16.8MHz			TTS14VSB-A3 16.80MHZ	H9501100			A	F4
XF1001	XTAL FILTER				1D50811GQ2 50.85M	H1102462			A	G4

Circuit Diagram

FRONT-A Unit (VX-4500: Lot. 1~2)

Parts Layout (Side A)

Parts Layout (Side B)
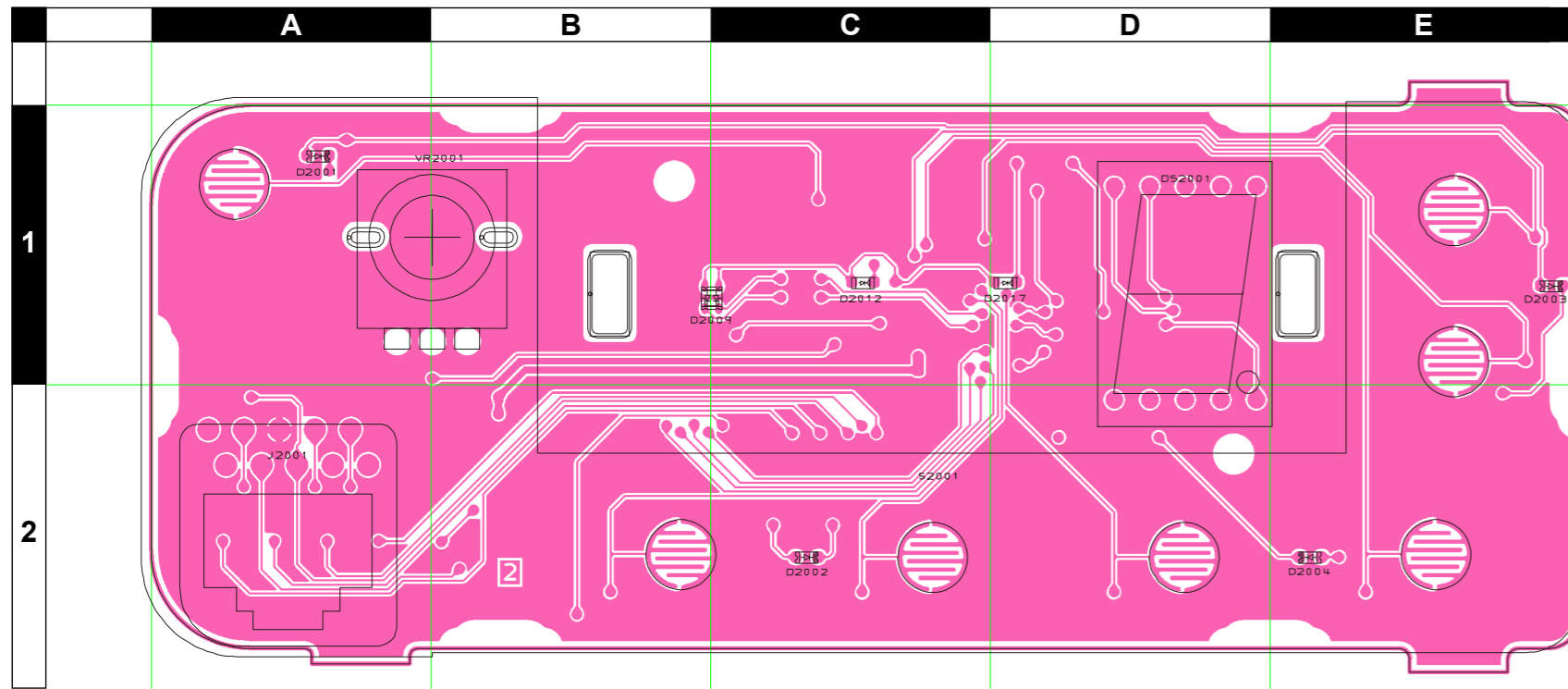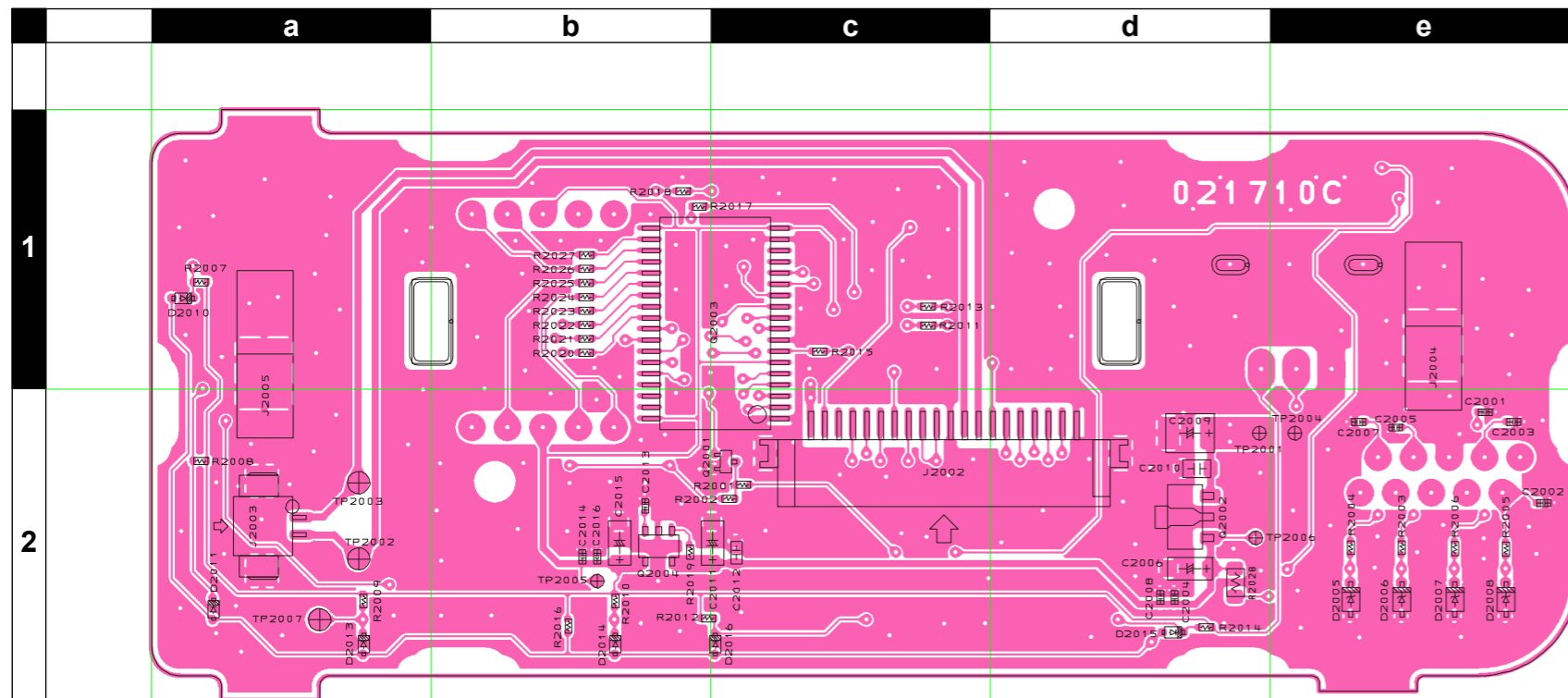
Circuit Diagram

FRONT-A Unit (VX-4500: Lot. 3)
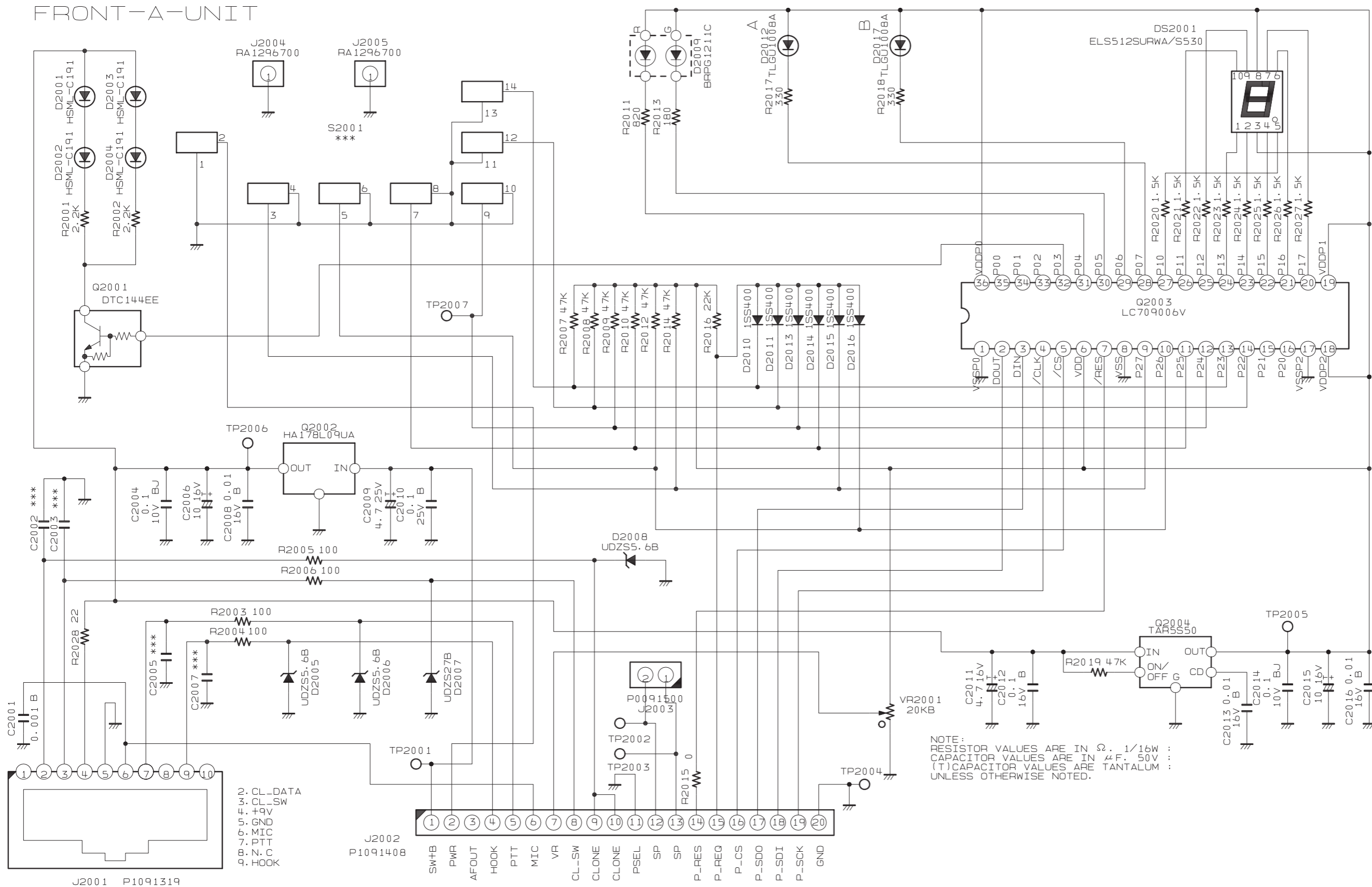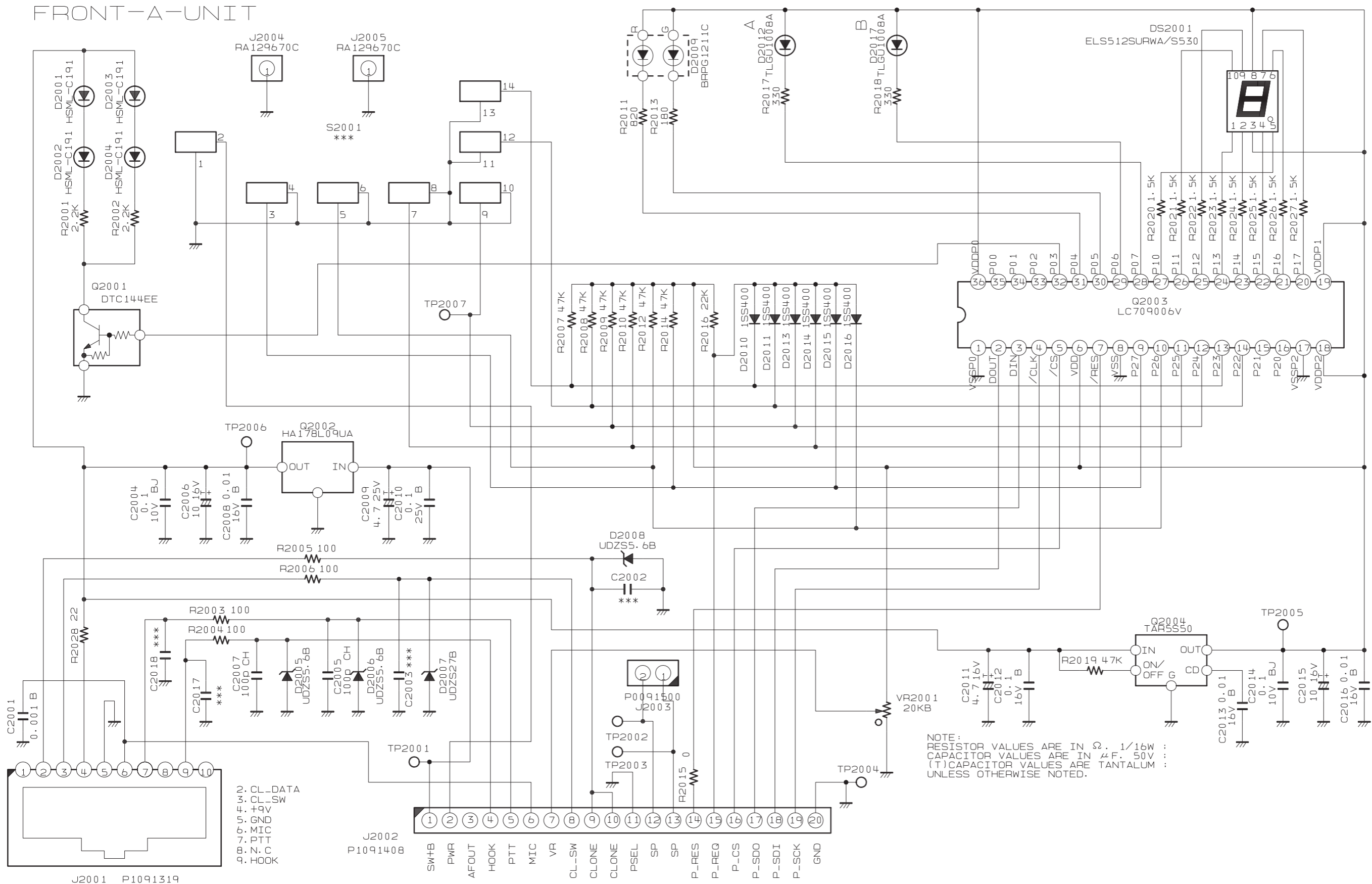
Parts Layout (Side A)

Parts Layout (Side B)
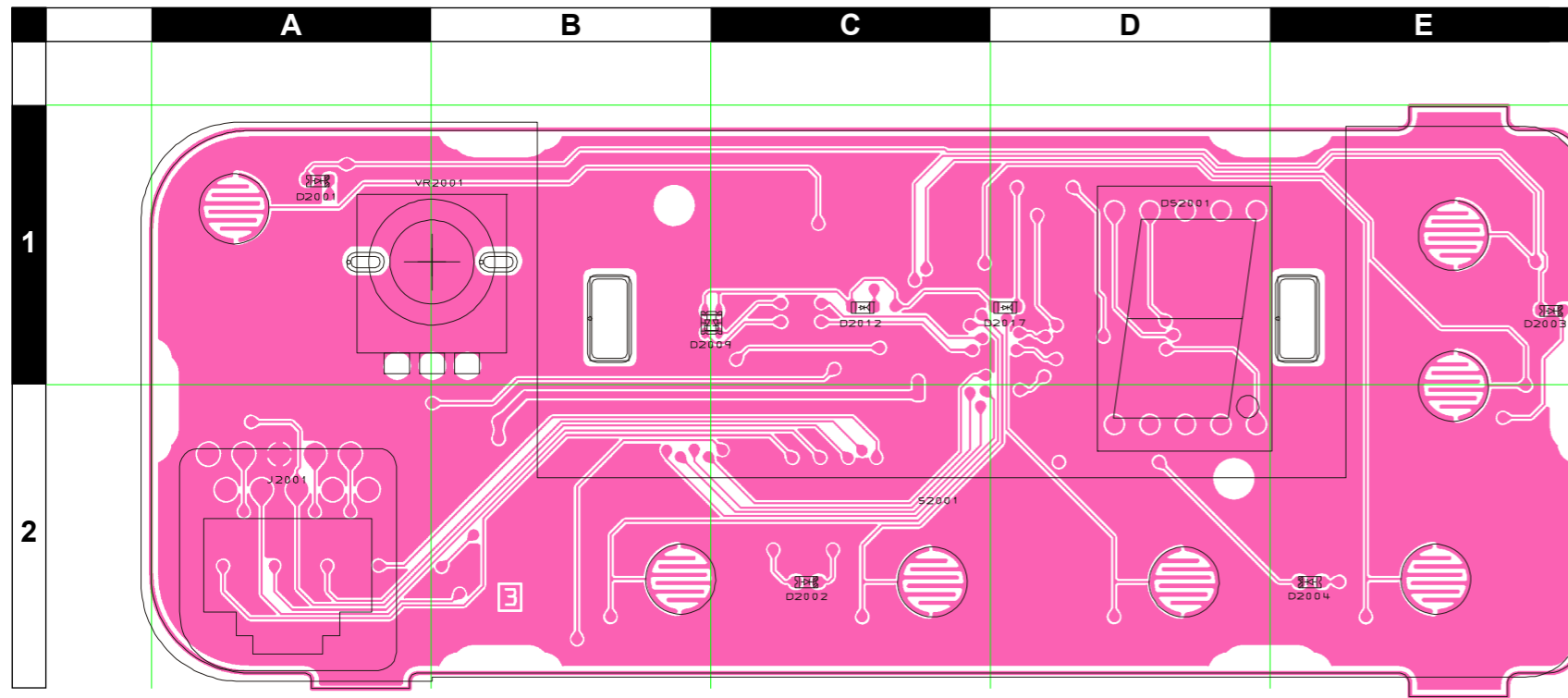
FRONT-A Unit (VX-4500: Lot. 4~)
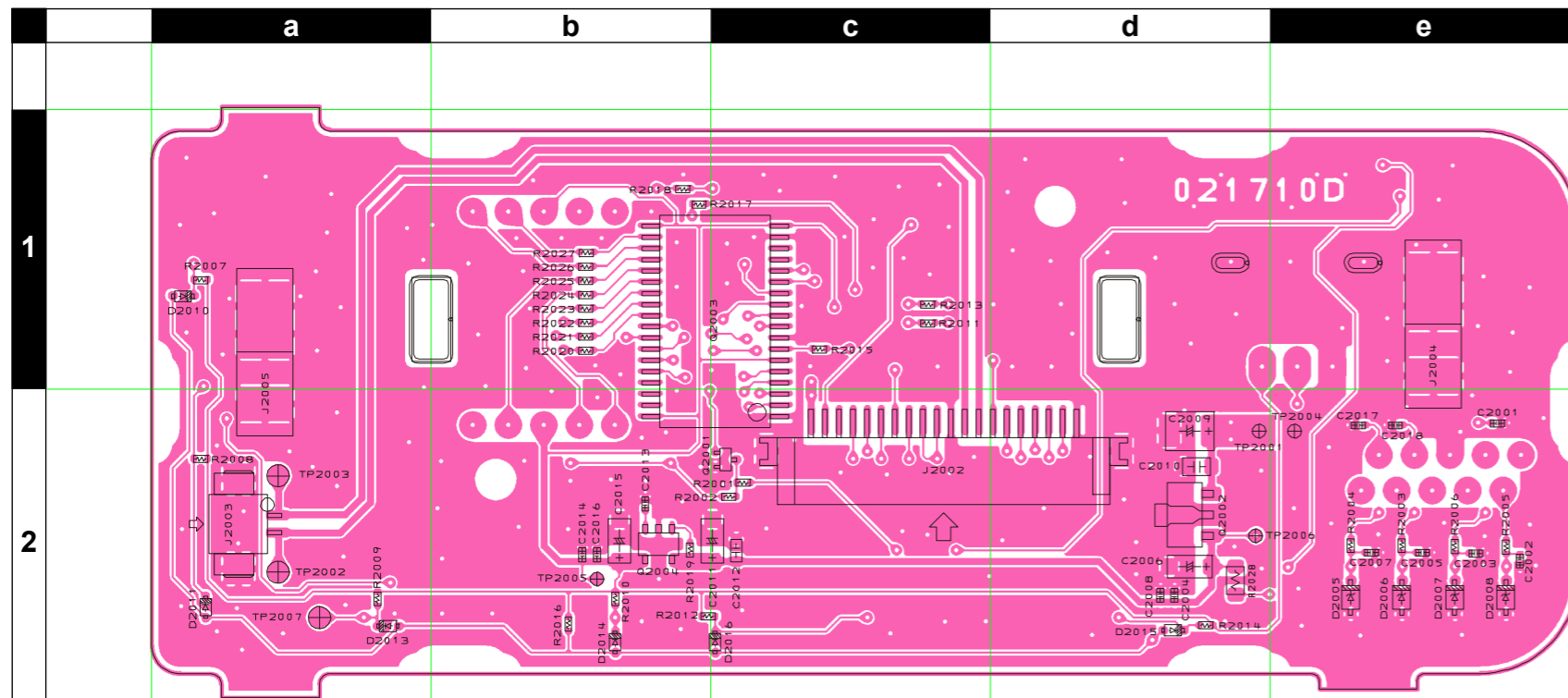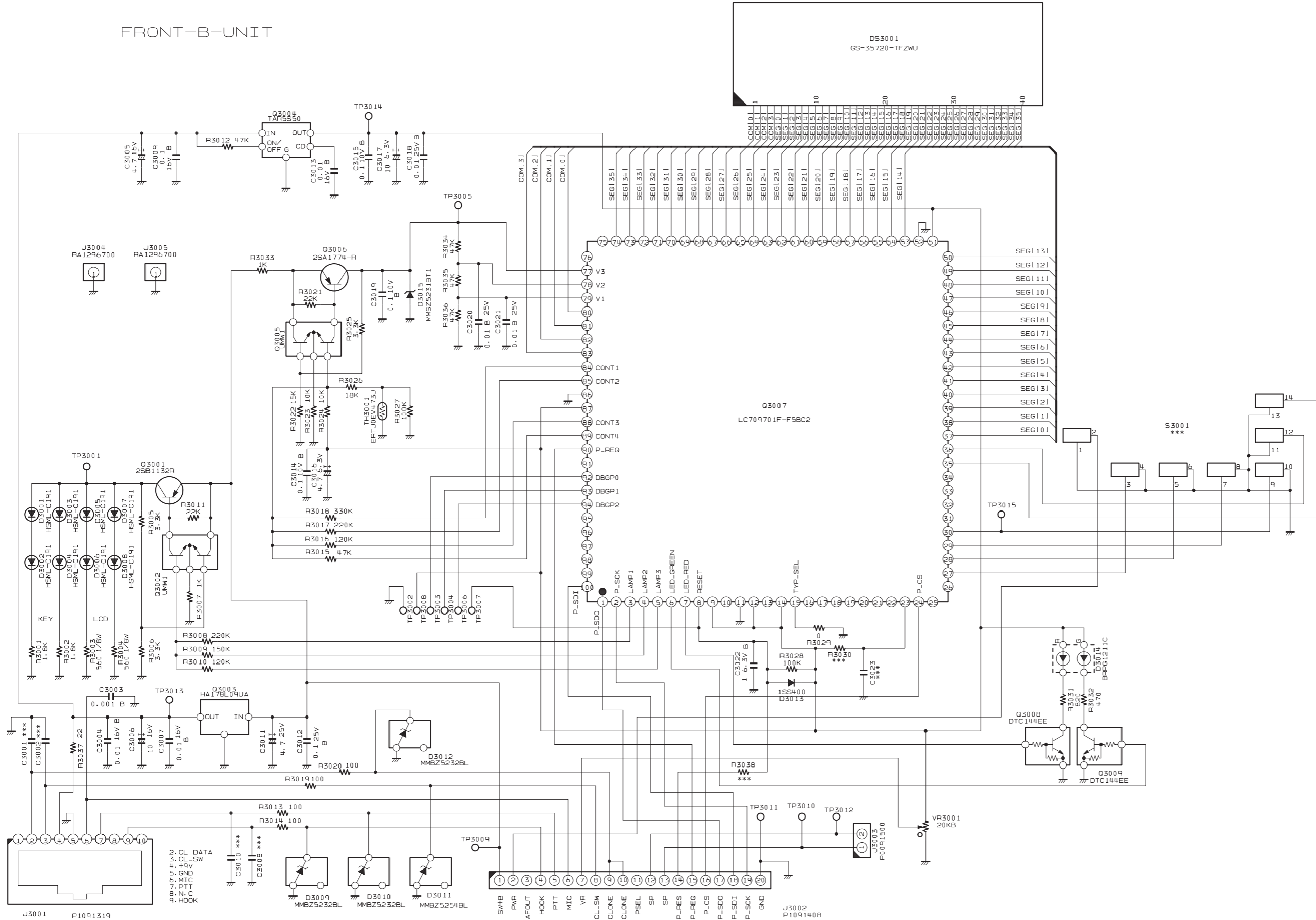
Circuit Diagram

FRONT-A-UNIT

NOTE :
RESISTOR VALUES ARE IN Ω. 1/16W :
CAPACITOR VALUES ARE IN μF. 50V :
(T)CAPACITOR VALUES ARE TANTALUM :
UNLESS OTHERWISE NOTED.

FRONT-A Unit (VX-4500: Lot. 4~)

Parts Layout (Side A)

Parts Layout (Side B)

FRONT-A Unit

Parts List

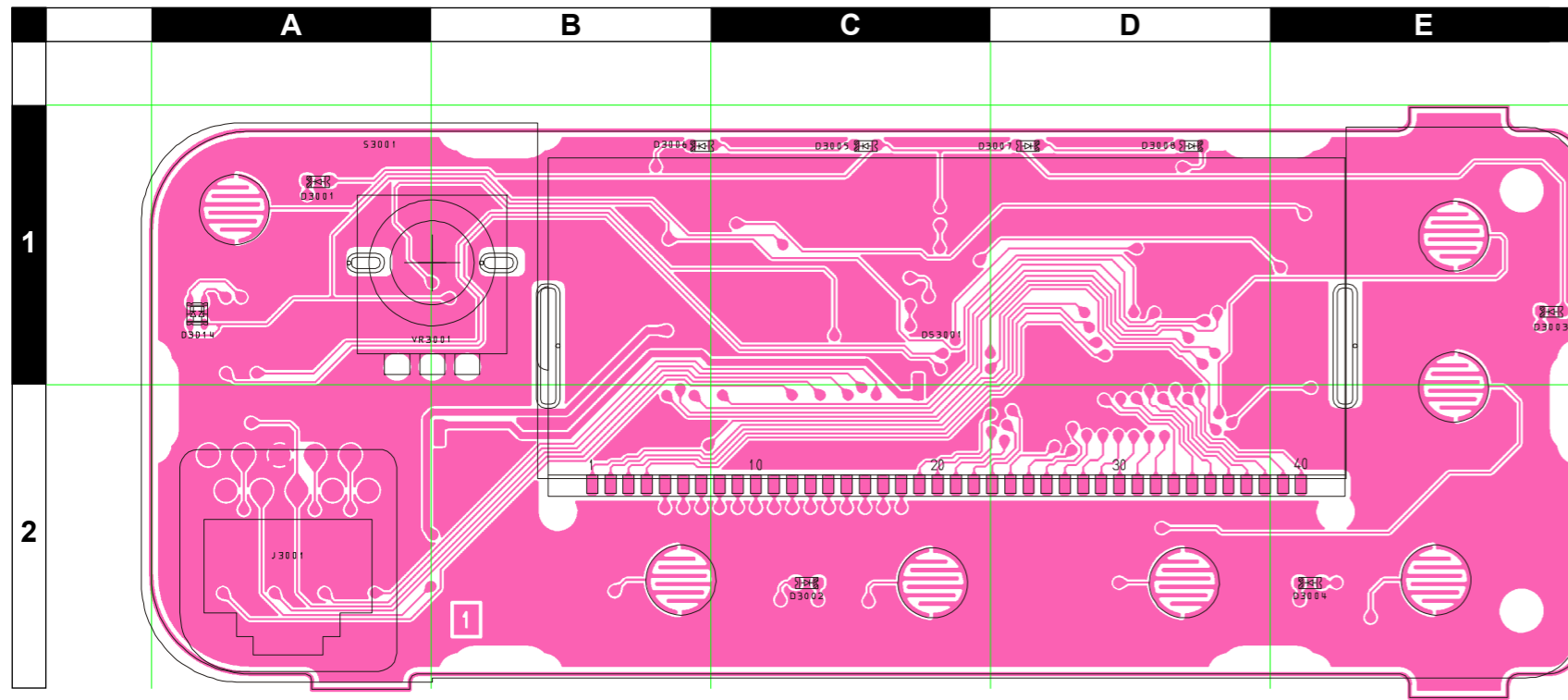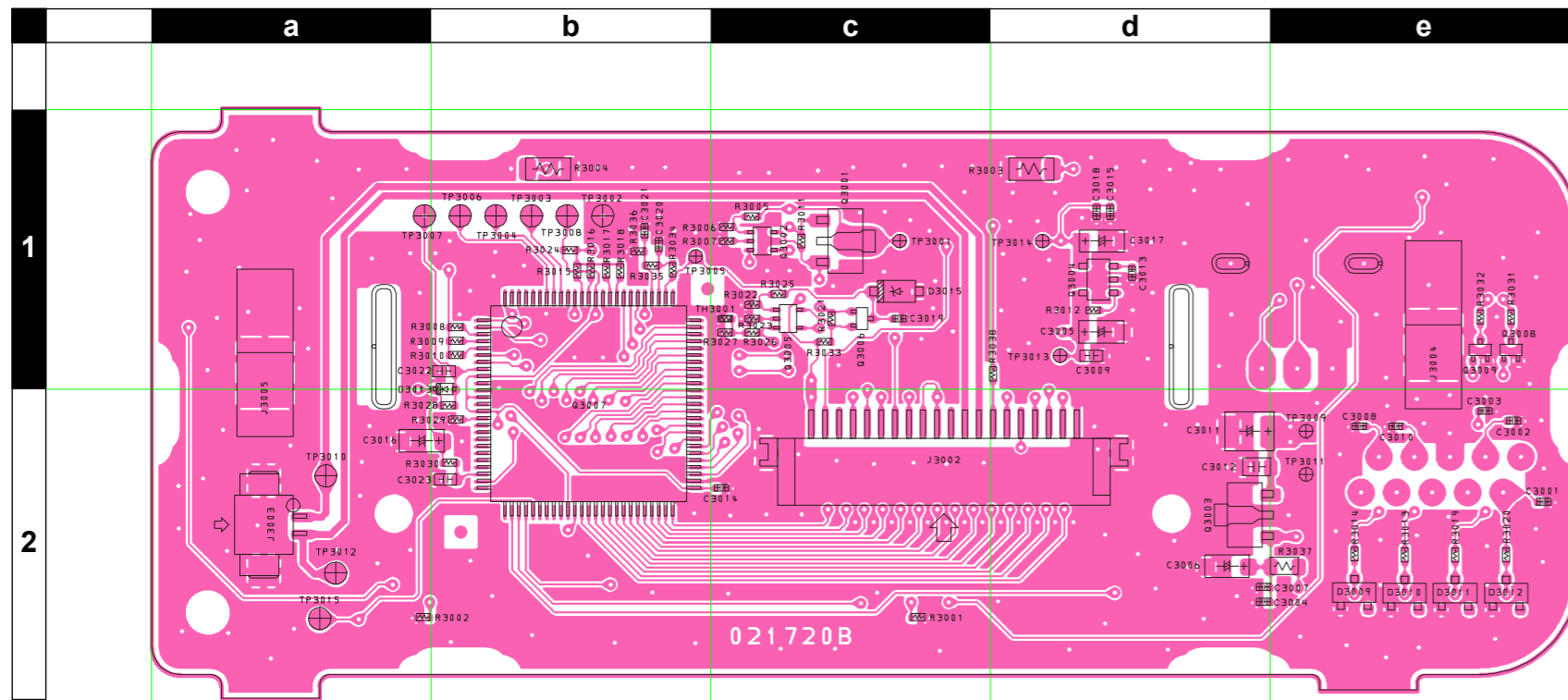| REF	DESCRIPTION	VALUE	V/W	TOL.	MFR'S DESIG	VXSTD P/N	VERS.	LOT	SIDE	LAY ADR
	PCB with Components					CB5426001	CH:8			
	Printed Circuit Board					FR021710B		1-2		
						FR021710C		3		
						FR021710D		4-		
	FRONT PANEL ASSY				(8CH)	RA124940A				
	PACKING PAD				(PANEL)	RA1234400				
	RUBBER KNOB					RA124700A				
	VOLUME KNOB					RA1245900				
	SPEAKER	20-			5015134H02	M4090203				
	SP HOLDER					RA1261500				
	HOLDER				(LED)	RA124680A				
	LIGHT GUIDE				(LED)	RA1246900				
	SHEET				(LED)	RA1254600				
	LED FILTER				(8CH)	RA0997300				
J 2004	LEAF SPRING					RA1296700		1-2	B	e1
J 2004	LEAF SPRING					RA129670B		3	B	e1
J 2004	LEAF SPRING					RA129670C		4-	B	e1
J 2005	LEAF SPRING					RA1296700		1-2	B	a1
J 2005	LEAF SPRING					RA129670B		3	B	a1
J 2005	LEAF SPRING					RA129670C		4-	B	a1
VR2001	POT.				RK09L1140 20KB	J60800308		1-3	A	B1
VR2001	POT.				RK09L1140C33 20KB	J60800312		4-	A	B1

Circuit Diagram

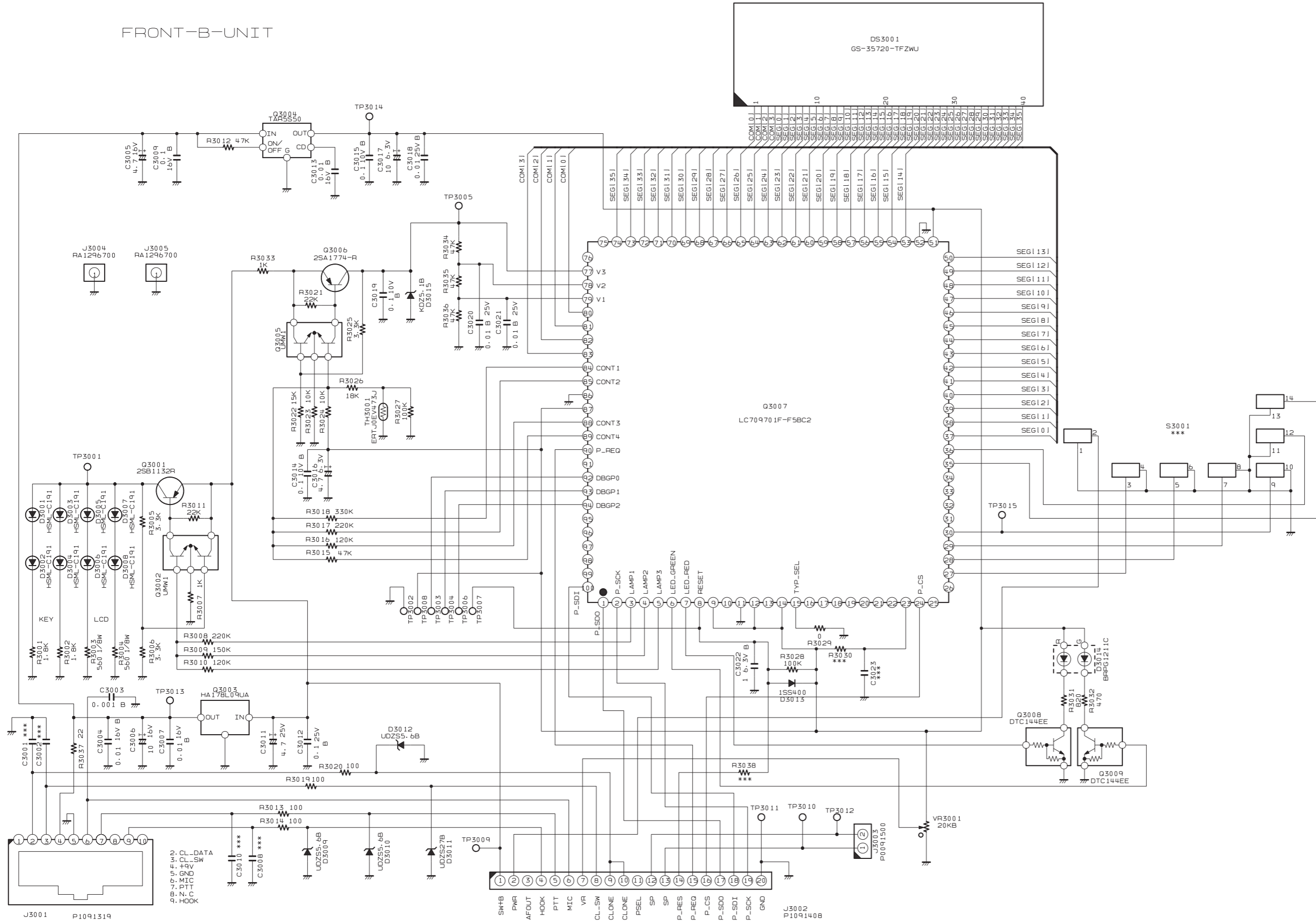# FRONT-B Unit (VX-4600: Lot. 1~2)

Parts Layout (Side A)

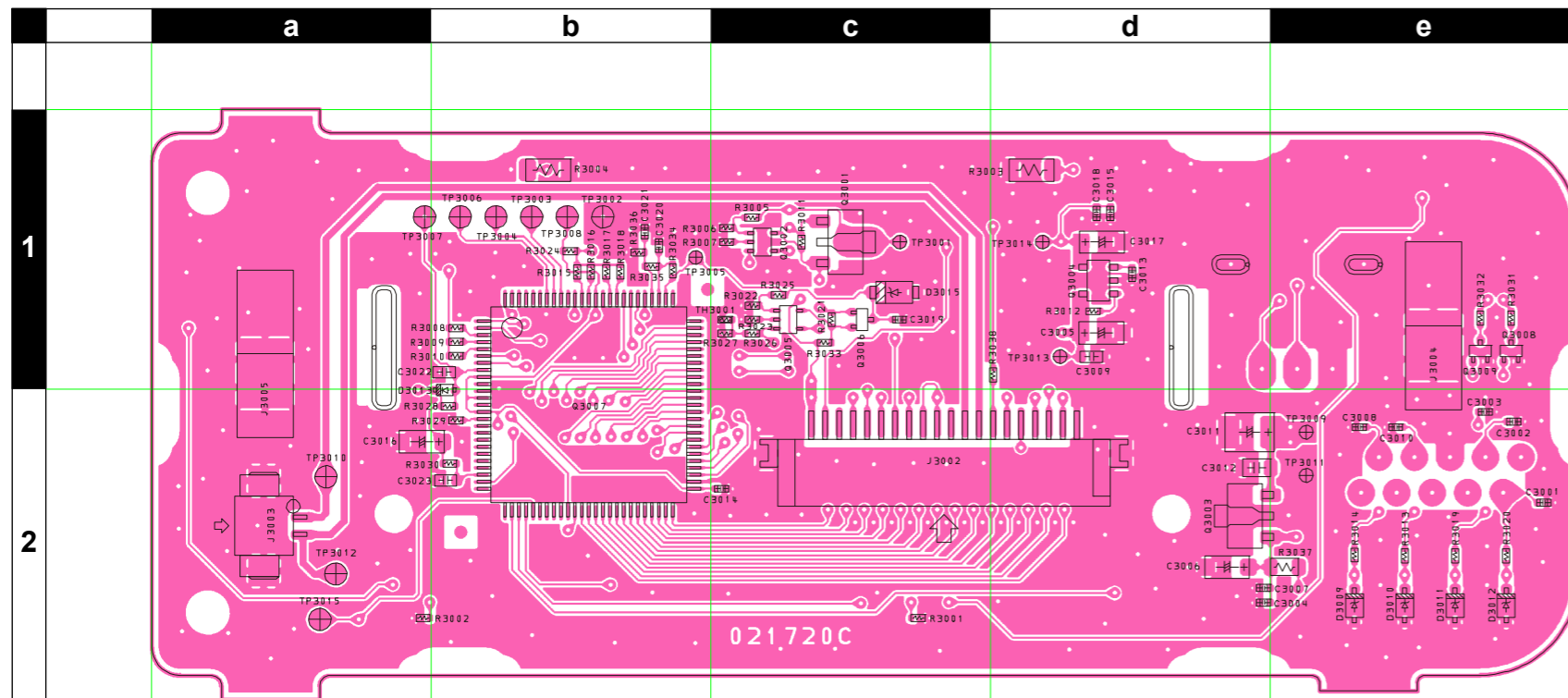## Parts Layout (Side B)

FRONT-B Unit (VX-4600: Lot. 3)

Circuit Diagram

FRONT-B-UNIT

FRONT-B Unit (VX-4600: Lot. 3)

Parts Layout (Side A)
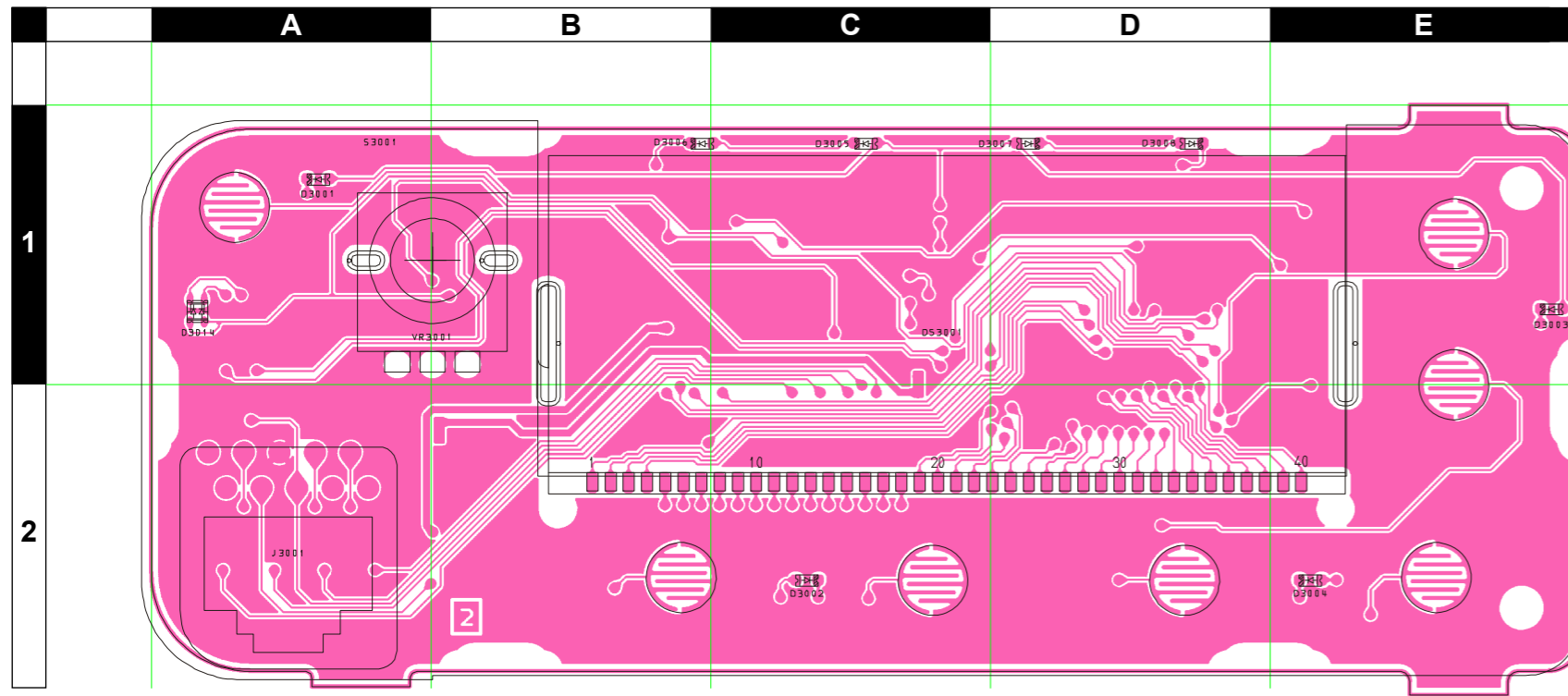
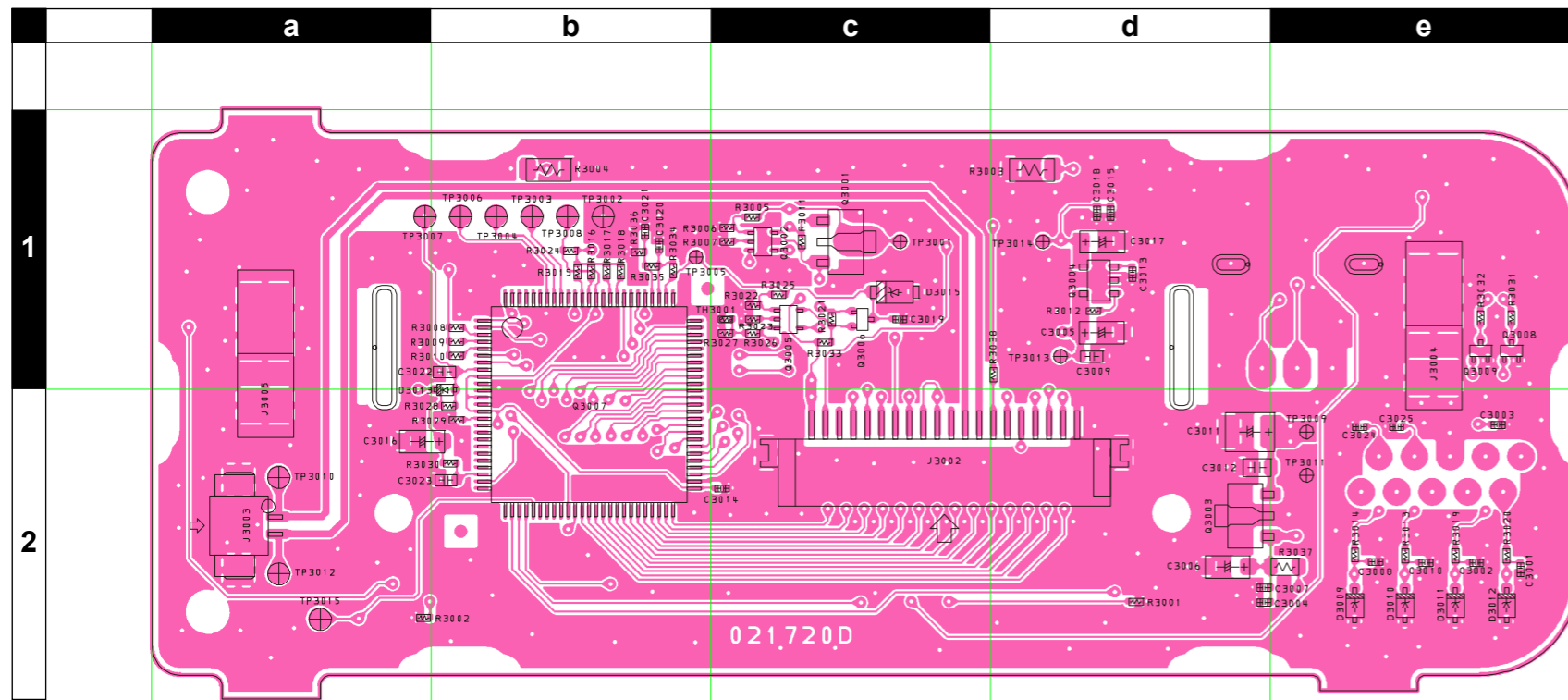## Parts Layout (Side B)

Circuit Diagram

FRONT-B-UNIT

FRONT-B Unit (VX-4600: Lot. 4~)
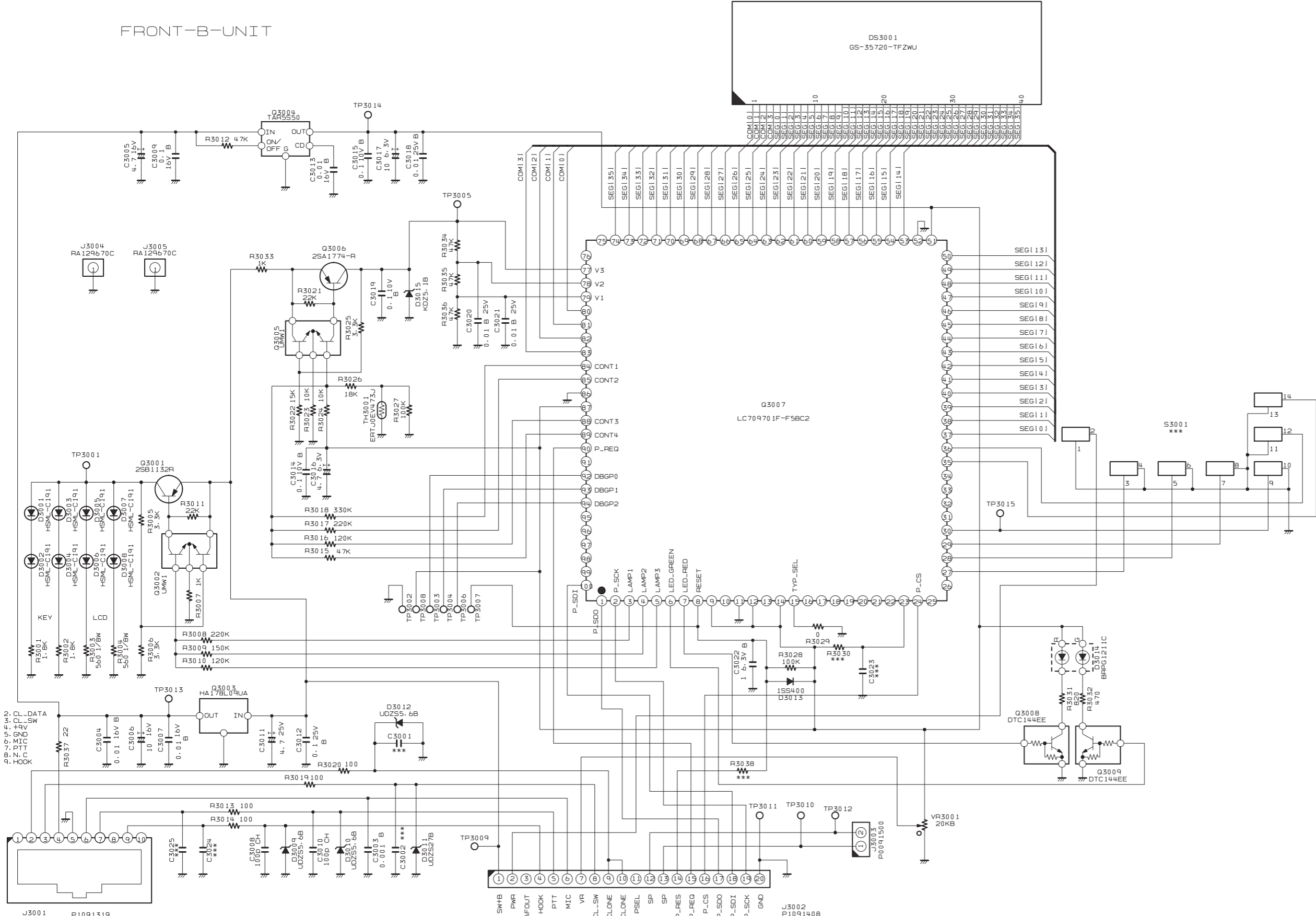
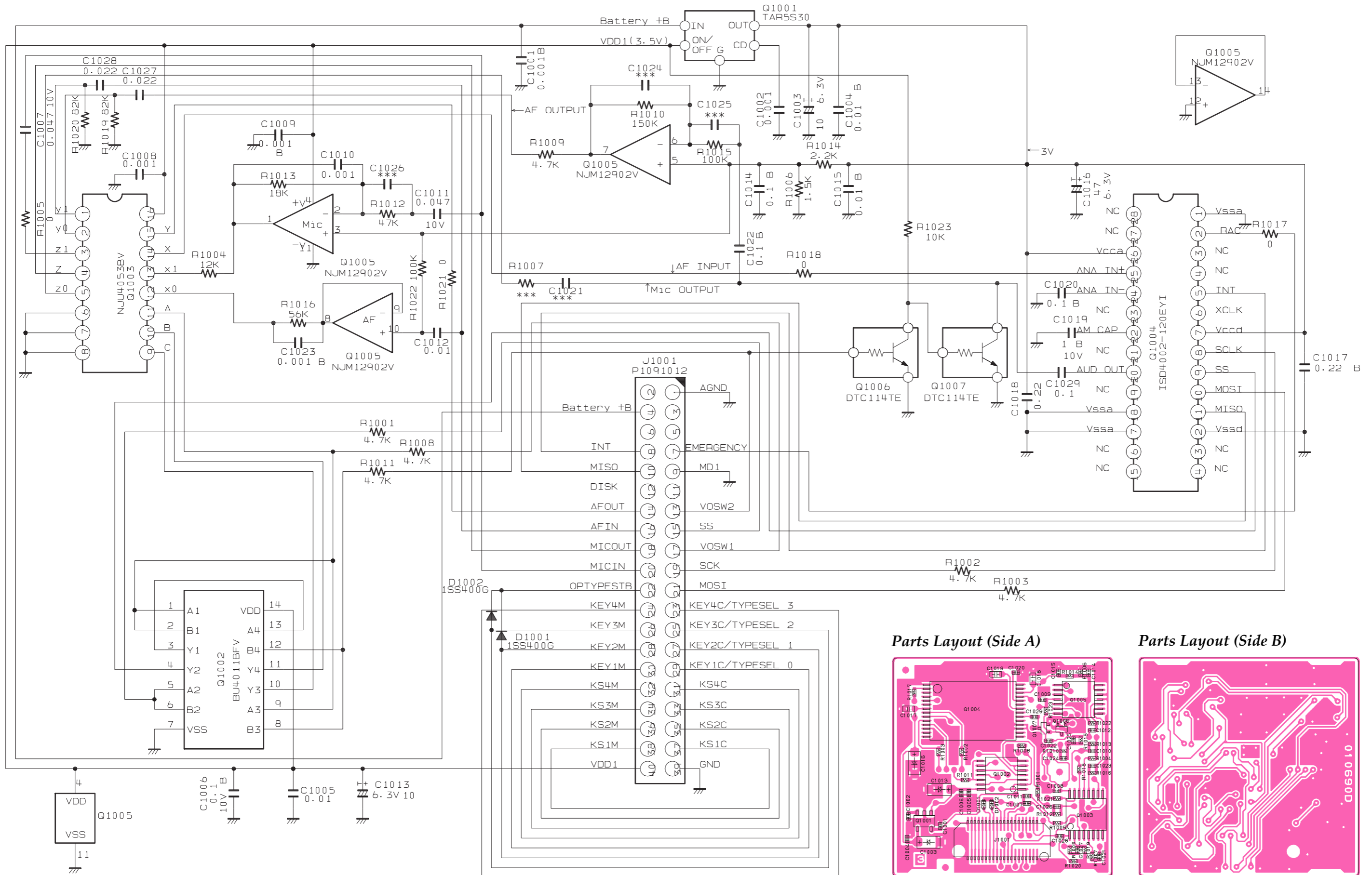## Parts Layout (Side A)
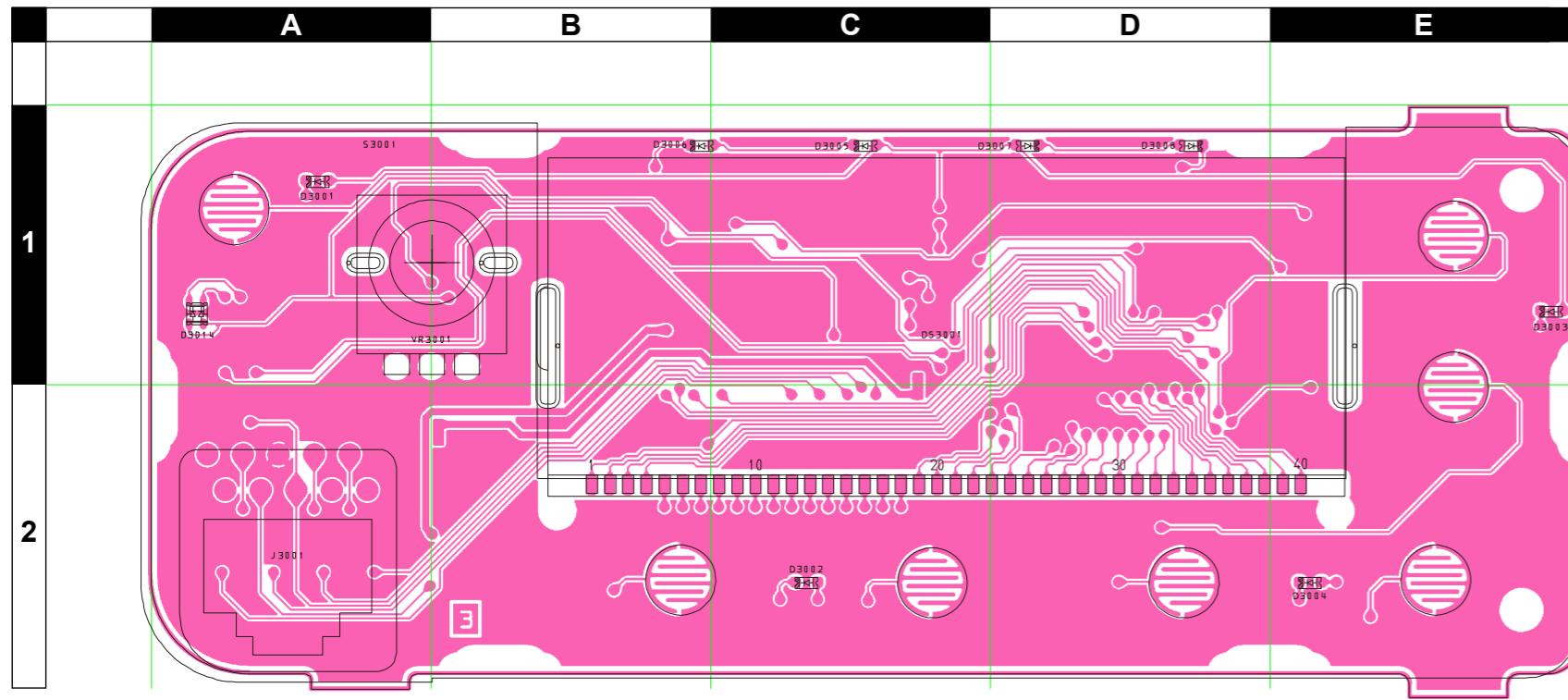
Parts Layout (Side B)

FRONT-B Unit

Parts List

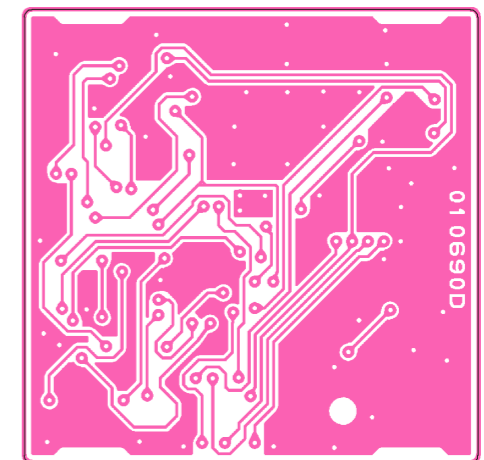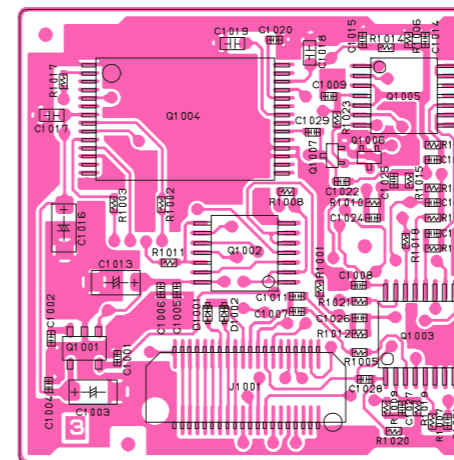| REF	DESCRIPTION	VALUE	V/W	TOL.	MFR'S DESIG	VXSTD P/N	VERS.	LOT	SIDE	LAY ADR
	PCB with Components					CB5427001	CH:512			
	Printed Circuit Board					FR021720B		1-2		
						FR021720C		3		
						FR021720D		4-		
	FRONT PANEL ASSY					RA124930A				
	PACKING PAD				(PANEL)	RA1234400				
	RUBBER KNOB					RA124700A				
	VOLUME KNOB					RA1245900				
	LCD HOLDER					RA1244600				
	LIGHT GUIDE				(LCD)	RA124470A				
	REFLECTOR SHEET				(093)	RA1288200				
	INTER CONNECTOR					RA1244800				
	SPONGE RUBBER				(LCD)	RA0786900				
	REFLECTOR SHEET				(SUB)	RA1292600				
	SPEAKER	20-			5015134H02	M4090203				
	SP HOLDER					RA1261500				
DS3001	LCD				GS-35720-TFZWU	G6090201			A	C1
J 3004	LEAF SPRING					RA1296700		1-2	B	e1
J 3004	LEAF SPRING					RA129670B		3	B	e1
J 3004	LEAF SPRING					RA129670C		4-	B	e1
J 3005	LEAF SPRING					RA1296700		1-2	B	a1
J 3005	LEAF SPRING					RA129670B		3	B	a1
J 3005	LEAF SPRING					RA129670C		4-	B	a1
Q 3001	TRANSISTOR				2SB1132 T100 R	G3211327R			B	c1
Q 3003	IC				HA178L09UA-TL-E	G1094350			B	d2
TH3001	THERMISTOR				ERTJ0EV473J	G9090120			B	c1
VR3001	POT.				RK09L1140 20KB	J60800308		1-2	A	B1
VR3001	POT.				RK09L1140C33 20KB	J60800312		3-	A	B1

DVS-8 Voice Storage Unit (Option)

Circuit Diagram

Parts Layout (Side A)

Parts Layout (Side B)

Vertex Standard