



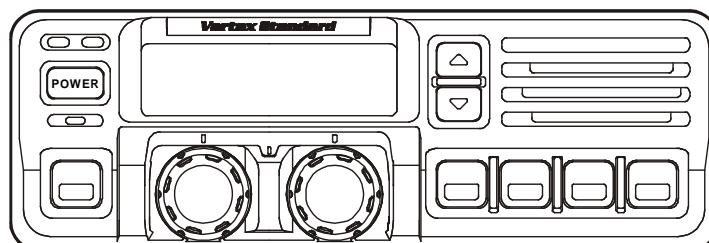
VHF FM Transceiver

VX-5500V

Service Manual

Vertex Standard LMR, Inc.

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EC034N90H



INTRODUCTION

This manual provides technical information necessary for servicing the VX-5500V VHF 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 ("lead" or "chip-only"). In most cases one side has only chip components, and the other has either a mixture of both chip and lead components (trimmers, coils, electrolytic capacitors, ICs, etc.), or lead 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

After Lot. 15 of this transceiver is 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.

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Board Unit (Schematics & Layouts)

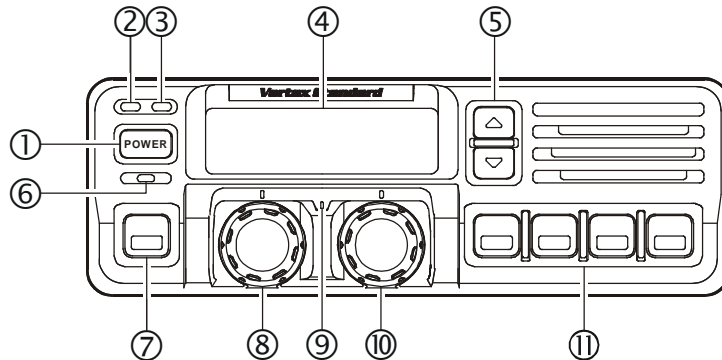
| | |
|-----------------------|------|
| MAIN Unit | 6A-1 |
| DISPLAY Unit | 6B-1 |
| KEY Unit | 6C-1 |
| VR Unit | 6D-1 |
| MIC CONN Unit | 6E-1 |
| MIC CONN 2 Unit | 6E-2 |

Optional Board Unit (Schematics & Layouts)

| | |
|---|------|
| F2D-8 2-Tone Decode Unit | 7A-1 |
| VTP-50 VX-Trunk Unit | 7B-1 |
| FVP-25 Encryption / DTMF Pager Unit | 7C-1 |
| F5D-14 5-Tone Unit | 7D-1 |
| FIF-7A Connection Unit | 7E-1 |

CONTROLS & CONNECTORS

Front Panel



① POWER Button

Press the button to turn the transceiver ON and OFF.

② TX Indicator

This lamp glows red when the radio is transmitting.

③ BUSY Indicator

This lamp glows green when the channel is busy.

④ Liquid Crystal Display

The display include an 8-character alpha-numeric section showing channel and group names, status and identity information, and error messages. Additional indicators on the display show priority channel assignments and scan include / exclude selection.

⑤ ▲/▼ Button

Pressing these buttons changes the current group (and displayed group number or name). Holding this button for more than 1/2 second causes the function to repeat.

⑥ SQC Indicator

This lamp glows orange when incorrect position at the setting of CE49.

⑦ Programmable Function Button (PF button)

This button can be set up for special applications, such as high/low power selection, monitor, dimmer, talk-around, and call alert function, as determined by your network requirements and programmed by your VERTEX STANDARD dealer.

⑧ VOLUME Knob

This knob sets the volume of the receiver.

⑨ EMERGENCY Microphone

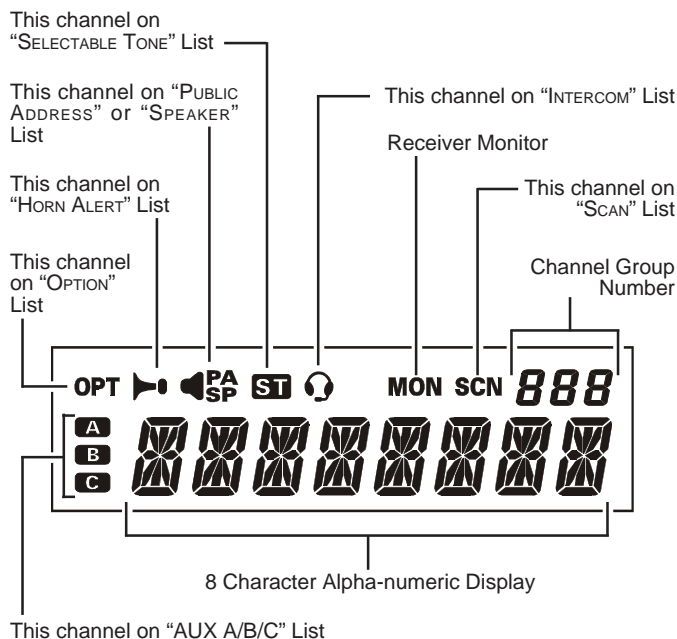
The emergency microphone is located behind this small slit. When the emergency feature is activated, this Microphone is enabled.

⑩ CHANNEL Selector Knob

This knob select the operating channel.

⑪ Programmable Function Button (PF button)

This button can be set up for special applications, such as high/low power selection, monitor, dimmer, talk-around, and call alert function, as determined by your network requirements and programmed by your VERTEX STANDARD dealer.

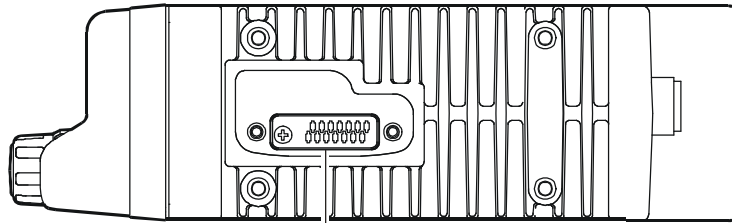


CONTROLS & CONNECTORS

Side Panel

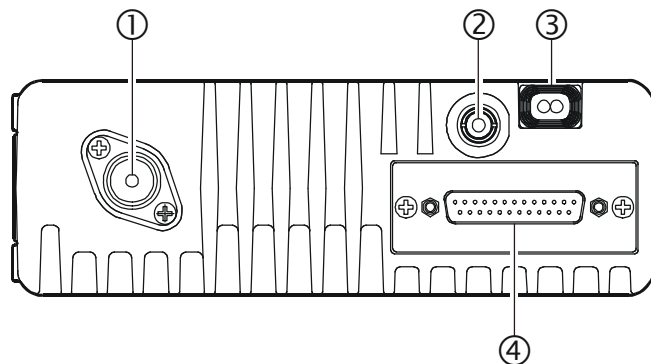
Microphone Jack (It is on both sides.)

Connect the microphone plug to this jack.



Microphone Jack

Rear (Heatsink)



① Antenna Socket

The 50-ohm coaxial feedline to the antenna must be connected here, using a type-M (PL-259) plug.

② External Speaker Jack

An external loudspeaker may be connected to this 2-contact, 3.5-mm mini-phone jack.

Caution: Do not connect this line to ground, and be certain that the speaker has adequate capability to handle the audio output from the VX-5500.

③ 13.8-V DC Power Connector

The supplied DC power cable must be connected to this 4-pin connector. Use only the supplied fused cable, extended if necessary, for power connection.

④ DSUB 25-Pin Accessory Connector

External TX audio line input, PTT (Push To Talk), Squelch, and external RX audio line output signal may be obtained from this connector for use with accessories such as data transmission/reception modems, etc.

BASIC OPERATION OF THE TRANSCEIVER

Important! - Before turning on the radio the first time, confirm that the power connections have been made correctly and that a proper antenna is connected to the antenna jack.

Switching Power ON/OFF

Push the **POWER** switch turn on the radio. The display will become illuminated. The radio will start up on the last channel used prior to shut-down during the previous operating session.

Turn the **CHANNEL** selector knob to choose the desired operating channel. A channel name will appear on the display. If you want to select the operating channel from a different Memory Channel Group, press the **UP** (▲) or **DOWN** (▼) button to select the Memory Channel Group you want before selecting the operating channel.

Setting the Volume

Turn the **VOLUME** knob clockwise to increase the volume, and counterclockwise to decrease it. If no signal is present, press and hold in the **MON** button more than 1/2 seconds; background noise will now be heard, and you may use this to set the **VOLUME** knob for the desired audio level. Press and hold the **MON** button more than 1/2 seconds to quiet the noise and resume normal (quiet) monitoring.

Transmitting

To transmit, wait until the “**BUSY**” indicator is off (the channel is not in use), and press the **PTT** (Push-To-Talk) switch on the side of the microphone (the “**TX**” indicator will appear or the “**TX**” indicator will glow red). While holding in the **PTT** switch, speak across the face of the microphone in a clear, normal voice level, and then release the **PTT** switch to receive.

Selecting Groups and Channels

- Press the **UP** (▲) or **DOWN** (▼) button (repeatedly, if necessary) to select a different group of channels.
- Turn the **CHANNEL** selector knob to select a different channel *within the current group*.

Automatic Time-Out Timer

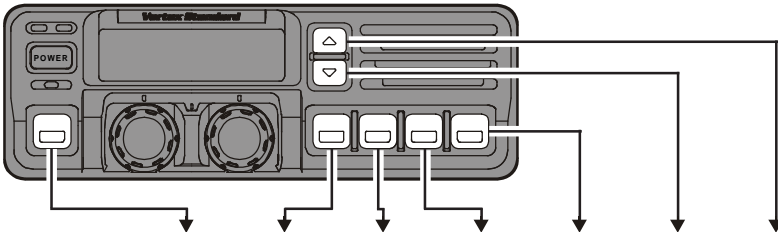
If the selected channel has been programmed for automatic time-out, you must limit the length of each transmission. While transmitting, a beep will sound five seconds before time-out. Another beep will sound just before the deadline; the “**TX**” indicator will disappear and transmission will cease soon thereafter. To resume transmitting, you must release the **PTT** and wait for the “penalty timer” to expire (if you press the **PTT** before this timer expires, the timer restarts, and you will have to wait another “penalty” period.)

ADVANCED OPERATION

Programmable Function Button (PF button)

The VX-5500 includes the seven **Programmable Function Buttons (PF button)**. The **PF** button functions can be customized, via programming by your VERTEX STANDARD dealer, to meet your communications/network requirements. Some features may require the purchase and installation of optional internal accessories. The

possible **PF** button programming features are illustrated at the below, and their functions are explained on next page. For further details, contact your VERTEX STANDARD dealer. For future reference, check the box next to each function that has been assigned to the **PF** button on your particular radio, and keep it handy.



| Functions | Programmable Function Button (PF button) | | | | | | | | | | | | | |
|----------------------|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | <1.5 sec | >1.5 sec | <1.5 sec | >1.5 sec | <1.5 sec | >1.5 sec | <1.5 sec | >1.5 sec | <1.5 sec | >1.5 sec | <1.5 sec | >1.5 sec | <1.5 sec | >1.5 sec |
| None | | | | | | | | | | | | | | |
| SCAN (SCN) | | | | | | | | | | | | | | |
| Dual Watch | | | | | | | | | | | | | | |
| Call/Reset | | | | | | | | | | | | | | |
| Talk-Around (TA) | | | | | | | | | | | | | | |
| Alpha Numeric (A/N) | | | | | | | | | | | | | | |
| DIMMER (DIM) | | | | | | | | | | | | | | |
| Emergency (EMG) | | | | | | | | | | | | | | |
| Horn Alert (HA) | | | | | | | | | | | | | | |
| Home Channel (HOM) | | | | | | | | | | | | | | |
| Intercom (IC) | | | | | | | | | | | | | | |
| Low Power (LOW) | | | | | | | | | | | | | | |
| GRP UP | | | | | | | | | | | | | | |
| GRP DWN | | | | | | | | | | | | | | |
| CH UP | | | | | | | | | | | | | | |
| CH DWN | | | | | | | | | | | | | | |
| AUX A | | | | | | | | | | | | | | |
| AUX B | | | | | | | | | | | | | | |
| AUX C | | | | | | | | | | | | | | |
| Public Address (PA) | | | | | | | | | | | | | | |
| Monitor (MON) | | | | | | | | | | | | | | |
| RCL | | | | | | | | | | | | | | |
| Selectable Tone (ST) | | | | | | | | | | | | | | |
| SP* | | | | | | | | | | | | | | |
| Squelch Level (SQL) | | | | | | | | | | | | | | |
| Compander | | | | | | | | | | | | | | |
| Encryption** (OPT) | | | | | | | | | | | | | | |

* requires RMK-4000 ** requires Encryption Unit

ADVANCED OPERATION

Channel Scan

The Scanning feature is used to monitor multiple signals programmed into the transceiver. While scanning, the transceiver will check each channel for the presence of a signal, and will stop on a channel if a signal is present.

To activate scanning:

- Press the assigned **PF** button of the “Scan” momentarily to activate scanning.
- The scanner will search the channels, looking for active ones; it will pause each time it finds a channel on which someone is speaking.

To stop scanning

- Press the assigned **PF** button of the “Scan”.
- Operation will revert to the channel to which the **CHANNEL** selector knob is set.

Note: Your dealer may have programmed your radio to stay on one of the following channels if you press the **PTT** switch during scanning pause:

- ☐ Current channel (“Talk Back”)
- ☐ “Last Busy” channel
- ☐ “Priority” channel
- ☐ “Home” channel
- ☐ Scan Start” channel

Dual Watch

The Dual Watch feature is similar to the Scan feature, except that only two channels are monitored:

- ☐ The current operating channel; and
- ☐ The “Priority” channel.

To activate Dual Watch:

- Press the assigned **PF** button of the “Dual Watch”.
- The scanner will search the two channels; it will pause each time it finds a channel on which someone is speaking.

To stop Dual Watch:

- Press the assigned **PF** button of the “Dual Watch”.
- Operation will revert to the channel to which the **CHANNEL** selector knob is set.

ARTS (Auto Range Transpond System)

This system is designed to inform you when you and another ARTS-equipped station are within communication range.

During ARTS operation, your radio automatically transmits for about 1 second every 25 (or 55) seconds (the interval is programmed by Dealer) in an attempt to Shake hands with the other station. If you move out of range for more than one minutes, your radio senses that no signal has been received, a ringing beeper will sound. If you subsequently move back into range, as soon as the other station transmits, your beeper will sound.

The PF Button Function

The **PF** (Programmable Function) button can be programmed by the dealer to provide two of the other functions described below.

To activate the primary Accessory function, press the **PF** button momentarily. To access the secondary Accessory function (which may include the Alarm), press and hold the **PF** button for 1.5 seconds or longer.

Call/Reset

When this feature is programmed and a selective call has been received, momentarily press the assigned **PF** button of the “Call/Reset” to reset the flashing indicator and mute the receiver, otherwise press the assigned **PF** button of the “Call/Reset” to sent your radio’s identification code (ANI) to the dispatcher.

Talk-Around

The feature causes the assigned **PF** button of the “Talk-Around” to select simplex operation on semi-duplex channels: the transmit frequency becomes the same as the receive frequency (regardless of any programmed offset for the channel).

Note: This feature has no effect on simplex channels. After pressing the button, “-TAKARD-” is displayed on the LCD.

Alpha Numeric

Press the assigned **PF** button of the “Alpha Numeric” to switch the display between the Group/Channel number, and the Group/Channel name (alphanumeric). A tone will sound each time you switch between numerical and alphanumeric display.

ADVANCED OPERATION


DIM

Press the assigned **PF** button of the “**DIM**” to adjust the brightness of the display and key backlight.

EMG (Emergency)

Press the assigned **PF** button of the “**EMG**” to initiate an emergency call (requires ANI board). When an emergency call is made, no tone is emitted and the display does not change. To end the emergency call, turn the transceiver power OFF.


HA (Horn Alert)

Press the assigned **PF** button of the “**HA**” to turn the Horn Alert function ON or OFF. If you receive a call from the base station with 2Tone or DTMF signaling, horn alert will activate. When you turn Horn Alert ON, a tone will sound and “” appears on the display.

Home (Home Channel)

Press the assigned **PF** button of the “**Home**” to select the pre-programmed Home Channel. Press it again to return to the previous channel. If used while scanning, pressing this key a second time will change to the revert channel.

IC (Intercom)

This feature requires dual head configuration. Press the assigned **PF** button of the “**IC**” to turn the intercom feature ON or OFF. While ON, you can press the PTT switch to communicate to another control head operator without transmitting over the air. When you press this key, a tone sounds and “” appears on the display. The intercom can be used even while scanning and receiving a call.

Low Power

Press the assigned **PF** button of the “**Low Power**” to set the radio's transmitter to the “Low Power” mode.

Press this key again to return to “High Power” operation when in difficult terrain.

GRP UP/DWN

Press the assigned **PF** button of the “**GRP UP**” or “**GRP DWN**” to select a different group of channels.


CH UP/DWN

Press the assigned **PF** button of the “**CH UP**” or “**CH DWN**” to select a different channel within the current group.

AUX A/B/C

Press the assigned **PF** button of the “**AUX A**”, “**AUX B**”, or “**AUX C**” to turn the output port (respectively).

PA (Public Address)

Press the assigned **PF** button of the “**PA**” to use the transceiver as a PA amplifier. When you enable this function, a tone sounds and “**PA**” appears on the display. The public address can be used even while scanning and receiving a call.

MONI (Monitor)

Press the assigned **PF** button of the “**MONI**” momentarily to cancel CTCSS and DCS signaling squelch; the “**MON**” icon appears on the display. Press and hold this key for 1/2 seconds to hear background noise (unmute the audio); the **MON** icon blinks on the display.


RCL (Channel Recall)

During scan, you can press the assigned **PF** button of the “**RCL**” to select the last called channel.

ST (Selectable Tone)

Press the assigned **PF** button of the “**Selectable Tone**”, then rotate the CHANNEL selector knob to select a 2-Tone.

SP

Press the assigned **PF** button of the “**SP**” to switch “Front panel”, “Front panel & Body” and “Body” speaker. When “Body” is selected, a tone sounds and the “**SP**” icon appears on the display. You can use this function while scanning and receiving a call. However, all audio will be emitted from the PA speaker.

SQL (Squelch Level)

You can manually adjust the squelch level using this function:

1. Press the assigned **PF** button of the “**SQL**”. A tone sounds and SQL appears on the display with the current squelch level.
2. Rotate the **CHANNEL** selector knob to select the desired level.
3. Press this key. A tone sounds and the display returns to the normal channel.

ADVANCED OPERATION

COMP (Compander)

Press the **PF** button assigned to the “**COMP**” function to turn the “Compander” IC ON or OFF. This IC contains two variable gain circuits configured for compressing and expanding the dynamic range of the radio's transmitted audio signal.

When you enable this function, the signal-to-noise ratio can be improved by reducing the transmitted audio dynamic range.

Encryption (Option)

When the Voice Scrambler feature is enabled, pressing the assigned **PF** button of the “**Encryption**” toggles the Scrambler on and off.

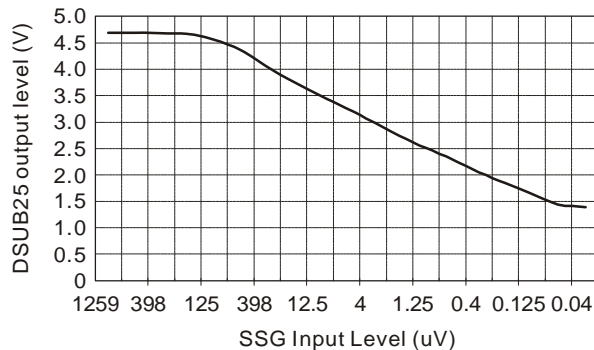
OPTIONAL ACCESSORIES

| | |
|-----------------------------|---|
| MH-25 _{B7A} | Microphone |
| MH-53 _{C7A} | Heavy Duty Microphone |
| MH-53 _{A7A} | Heavy Duty Microphone w/Noise Canceler |
| MH-53 _{B7A} | Heavy Duty DTMF Microphone w/Noise Canceler |
| CT-93 | Cable for RMK-4000 (33 ft, 10 m) |
| CT-81 | Cable for RMK-4000 (20 ft, 6 m) |
| CT-82 | Cable for RMK-4000 (8 ft, 2.5 m) |
| CT-83 | Cable for RMK-4000 (2 ft, 0.6 m) |
| CNT-6000 | Control Head |
| RF DECK | RF Deck w/MMB-75 (for Dual Band Installations) |
| RMK-4000H | Remote Kit (for Head) |
| RMK-4000B | Remote Kit (for RF Deck) |
| BSC-5000 | Base Station Console |
| VCS-5000 | Channel Selector |
| F2D-8 | 2-Tone Decode Unit (Requires FIF-7A) |
| F5D-14 | 5-Tone ENC-DEC Unit (Requires FIF-7A) |
| FVP-25 | Band inversion scrambler/DTMF paging Unit (Requires FIF-7A) |
| FVP-35 | Encryption Unit (Rolling code voice scrambler; Requires FIF-7A) |
| FVP-36 | Encryption Unit (voice Inversion Type scrambler; Requires FIF-7A) |
| VME-100 | MDC1200®/GE-STAR® ANI Encoder Unit (Requires FIF-7A) |
| FP-1030A | External 25 A Power Supply |
| MLS-200 | Mobile Loud speaker (15 W Peak Power) |
| MLS-100 | Mobile Loud speaker (12 W Peak Power) |
| MMB-75 | Mobile Mounting Bracket |
| MMB-76 | Locking Mobile Mounting Bracket |
| FIF-7A | Inter face Board (for F2D-8, F5D-14, FVP-25, FVP-36) |
| CN-6 | Inter face Board (for Accessories) |
| LF-1 | Line Filter |
| CE49 | Programming Software |
| FIF-12 | USB Programming Interface |
| CT-105 | Radio Programming Cable (for FIF-12) |
| CT-72 | Radio to Radio Programming Cable |

DSUB 25-PIN ACCESSORY CONNECTOR

Pin 1: RSSI [Analog Output]

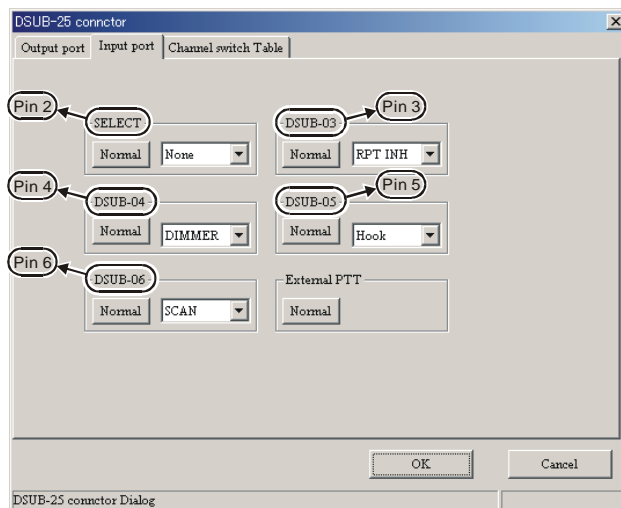
A DC voltage proportional to the strength of the signal currently being received (Receiver Signal Strength Indicator) is provided on this pin. This low impedance output is generated by the receiver IF sub-system and buffered by an internal op-amp. Typical voltages are graphed as follows:



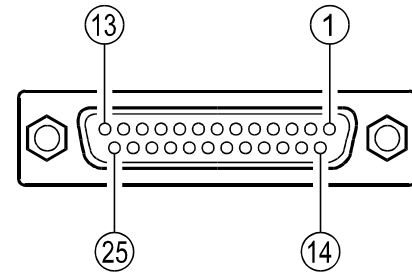
Pin 2, 3, 4, 5 & 6: SELECT, DSUB 03, DSUB 04, DSUB 05 & DSUB 06 [Digital Input Port]

These input port features can be programmed via the CE49 programmer. The same item can not be chosen twice.

To select the "Input port" page, (Common ➡ DSUB-25 ➡ Input port).



LOGIC level (+5V / 0V) input (Low active).
High Impedance input.



DSUB 25-Pin Numbering

None:

MON: This feature is the same as pressing and holding in the Monitor key.

DIMMER: LCD illumination dimmer "on."

Hook: Activates the Hook1 feature.

SCAN: Activates the scanner.

G-SCAN: Activates the Group scanner.

RPT INH: Disables the repeater feature during Multi Deck operation.

EMG: Activates the Emergency feature.

Home: Switches to the Home Channel.

CH SW0: Memory channel recall (Channel Switch Table bit 0)

CH SW1: Memory channel recall (Channel Switch Table bit 1)

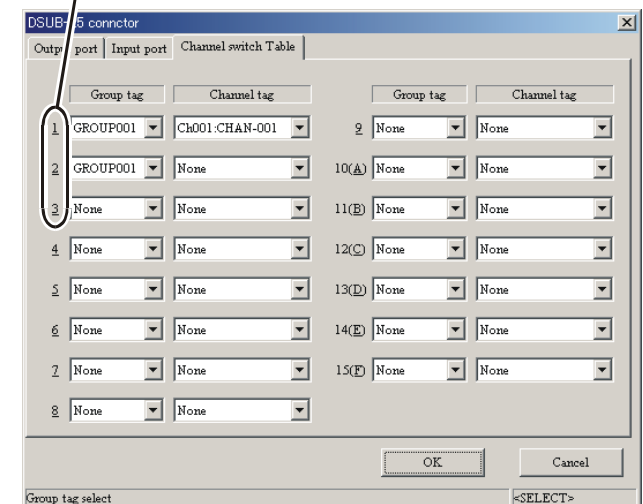
CH SW2: Memory channel recall (Channel Switch Table bit 2)

CH SW3: Memory channel recall (Channel Switch Table bit 3)

Example

If you assign "CH SW0" and "CH SW1" to the Universal Input Port, you can recall Channels 1~3 as shown below.

| Channel | CH SW0 | CH SW1 |
|---------|--------|--------|
| 1 | 1 | 0 |
| 2 | 0 | 1 |
| 3 | 1 | 1 |



DSUB 25-PIN ACCESSORY CONNECTOR

Similarly, if you assign "CH SW0," "CH SW1," and "CH SW2" to the Universal Input Port, you can recall Channels 1~7 as shown below:

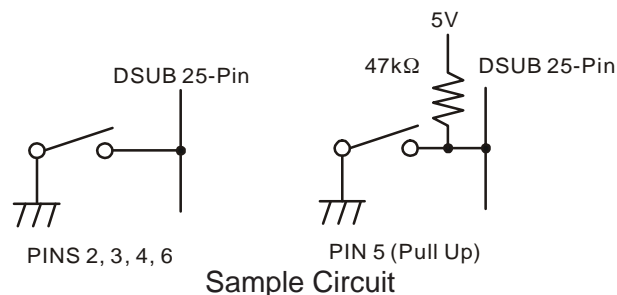
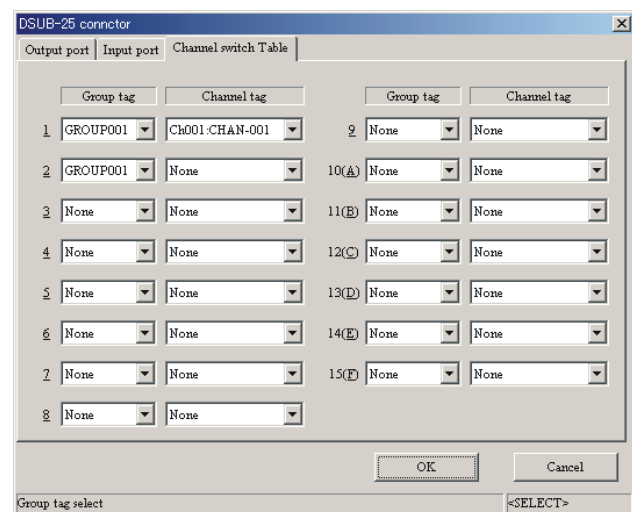
| Channel | CH SW0 | CH SW1 | CH SW2 |
|---------|--------|--------|--------|
| 1 | 1 | 0 | 0 |
| 2 | 0 | 1 | 0 |
| 3 | 1 | 1 | 0 |
| 4 | 0 | 0 | 1 |
| 5 | 1 | 0 | 1 |
| 6 | 0 | 1 | 1 |
| 7 | 1 | 1 | 1 |

If you need to recall all memory channels (15 CH) from the External Controller via the Uni-versal Input Port, you should assign the "All Channel Recall" Command (CH SW 0 ~ CH SW 3) to the Universal Input Port.

In this case:

| Channel | CH SW0 | CH SW1 | CH SW2 | CH SW3 |
|---------|--------|--------|--------|--------|
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |
| 10 | 0 | 1 | 0 | 1 |
| 11 | 1 | 1 | 0 | 1 |
| 12 | 0 | 0 | 1 | 1 |
| 13 | 1 | 0 | 1 | 1 |
| 14 | 0 | 1 | 1 | 1 |
| 15 | 1 | 1 | 1 | 1 |

The Memory Channel is determined via the CE49 Programmer. (Common \blacksquare DSUB-25pin connector \blacksquare Channel switch Table).



Pin 7: E [GND]

Ground for all logic levels and power supply return.

Pin 8: A KEY OUT [Universal Output Port]

Open collector output. Output voltage 0 ~ 5 V, Max. sink current 30 mA.

The possible programming features (use CE49) are illustrated below.

A PORT/B PORT/C PORT/D PORT/E PORT/None

Refer to the "Pins 20, 21, & 22" section for details.

Pin 9: TXD [Digital Output for Alignment software]

Connect to the RS232C cable (requires FIF-8 and CT-88)

Pin 10: RXD [Digital Input for Alignment software]

Connect to the RS232C cable (requires FIF-8 and CT-88)

Pin 11: 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.

Pin 12: MIC MUTE

MIC mute on: Level High (5V)

MIC mute off: Open

LOGIC level (+5V / 0V) output.

When the PTT/EXT PTT switch is pressed, this pin switches to "open."

DSUB 25-PIN ACCESSORY CONNECTOR

Pin 13: TXDI [Digital Input for DATA Communications]

- TX Hi-speed Data Input Type (jumper JP2005). Input level 800 mV/600 Ohms, Max.input 1.2V
- Tx Low-speed Data input Type (Jumper JP2006). Input level 40 mV/600-Ohms

If the Jumper setting is "Low-speed Data" (JP2006 jumpered), this port is usable in the AUDIO (300~3000 Hz) range.

If the jumper setting is "HI-speed Data" (JP2005 jumpered), this port is usable for 9600 bps DATA communications, because the filter and limiter are not engaged in the Audio line.

Pin 14: DC OUT [13.4 V/5 V DC Output]

- Switched 13.8V output for supplying power to an accessory (jumper JP2008).
 - Switched and regulated DC 5.0V output for supplying power to an accessory (jumper JP2007).
- Maximum output current is 200 mA

Pin 15: IGN [Ignition Sense feature]

Connecting this line to the ignition sense line of the vehicle will automatically turn the radio on when the vehicle's ignition key is turned on.

Pin 16: NC [NO connection]

Pin 17: RX DO [Digital Output for DATA Communications]

- RX Hi-speed Data Output Type (jumper JP2003). output level 600 mV/10k Ohms
- RX Low-speed Data Output Type (jumper JP2004). output level 200 mV/600 Ohms

If the Jumper setting is "Low-speed Data" (JP2004 jumpered), this port is usable in the AUDIO (300~3000 Hz) range.

If the jumper setting is "HI-speed Data" (JP2003 jumpered), this port is usable for 9600 bps DATA communications, because the filter and limiter are not engaged in the Audio line.

Pin 18: E [GND]

Ground for all logic levels and power supply return.

Pins 19, 20, 21, & 22: DSUB 19, DSUB 20, DSUB 21 and DSUB 22 [Universal Output Port]

LOGIC level (+5V / 0V) output.

The logic output appears at these pins when the front panel's PF key is turned on.

The possible programming features (use CE49) are illustrated below.

If the HA feature is assigned to these ports, a current amplifier must be connected between the Horn circuit and the port.

None/A PORT/B PORT/C PORT/D PORT/E PORT/HA PORT

Pin 23: EXT SQL [Squelch Signal Output]

Open collector output. Max. sink current 10 mA.
 A Signal is present (Squelch is open): Level High
 No Signal is present (Squelch is closed): Open
 When you connect the solder jumper on J2002, this port changes to PULL UP (5 V) output.
 This status can be changed by CE49 programmer.

Pin 24: SP MUTE [Speaker Mute Output]

Open collector output.
 External Speaker mute on: Level High
 External Speaker mute off: Open

Pin 25: E [GND]

Chassis ground.

OPERATING MANUAL REPRINT

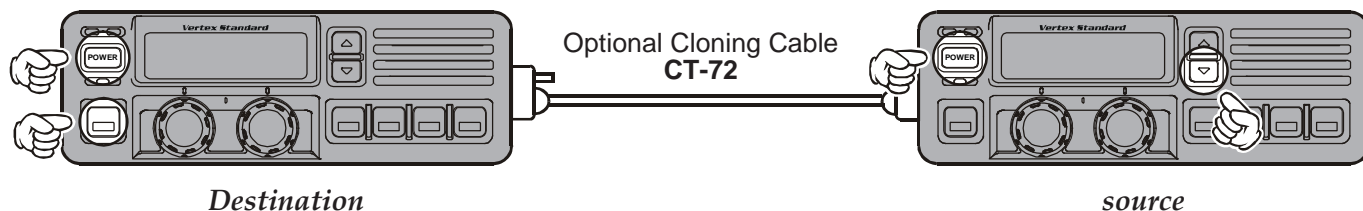
Note:

The **VX-5500** includes a convenient "Clone" feature, which allows the programming data from one transceiver to be transferred to another **VX-5500**. Here is the procedure for Cloning one radio's data to another.

Note: When a cloning isn't made, you correct the following part using "CE49."

When a "Radio to Radio Clone" which is in the "Miscellaneous" menu is "Disabled," change this menu to "Enabled."

1. Turn both transceivers off.
2. Remove the plastic cap and its two mounting screws from the **Microphone** jack on the transceiver. Do this for both transceivers.
3. Connect the optional **CT-72** cloning cable between the **Microphone** jacks of the two transceivers.
4. On the **Destination** transceiver, press and hold the **PF Button** (just below the **POWER Button**) while turning the transceiver on.
5. Now, on the **source** transceiver, press and hold the **▼ Button** while turning the transceiver on. Data will now be transferred to the **Destination** transceiver from the **source** transceiver.
6. If there is a problem during the cloning process, sound an error beep from source the transceiver. Check your cable connections and battery voltage, and try again.
7. If cloning is a successful, turn the **Destination** transceiver off. Now turn the **source** transceiver off.
8. Disconnect the **CT-72**. Replace the plastic cap and its two mounting screws.
9. You can then turn the transceivers back on, and begin normal operation.

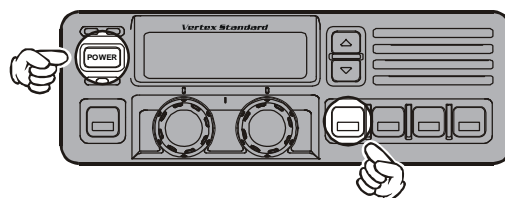


Dealer Programming of VTP-50 and F5D-14

These procedures are designed to be used by the installing technician after the **VTP-50** and **F5D-14** has been installed in the transceiver. To program a **VX-5500's VTP-50** and **F5D-14** board, you will need the **CT-71** programming interface cable, the **CE-26** Programming diskette, and an IBM PC/AT or PS/2-compatible type computer.

To enter the Programming mode, use the following procedure:

1. Turn the transceiver off.
2. Turn on the transceiver while holding in the **PF Button** (just below the **▼ Button**).



SPECIFICATIONS

GENERAL

| | |
|----------------------------|---|
| Number of Channels: | 250 channels |
| Frequency Range: | 148 - 174 MHz (Type C) 134 - 160 MHz (Type A) |
| Channel Spacing: | 12.5 / 25 kHz |
| PLL Steps: | 2.5 / 5 / 6.25 kHz |
| Power Supply Voltage: | 13.6 V DC \pm 15 % |
| Current Consumption: | Standby: 600 mA Receive: 2.1 A Transmit: 12 A |
| Ambient Temperature Range: | -22 °F to +140 °F (-30 °C to +60 °C) |
| Frequency Stability: | \pm 2 ppm |
| RF Input-Output Impedance: | 50 Ohms |
| Audio Output Impedance: | 4 Ohms |
| Dimensions: | 7" (W) x 2.4" (H) x 7.7" (D) (178 x 60 x 195 mm) |
| Weight (Approx.): | 4.9 lbs. (2.2 kg) |

RECEIVER (Measurements made per EIA standard TIA/EIA-603)

| | |
|-------------------------------|---|
| Circuit Type: | Double-conversion Super-heterodyne |
| Sensitivity(EIA 12 dB SINAD): | 0.25 μ V |
| Adjacent Channel Selectivity: | 85/80 dB |
| Intermodulation: | 80/75 dB |
| Spurious and Image Rejection: | 90 dB |
| Audio Output: | 5 W @ 4 Ohms w/3 % THD (Internal) 10 W @ 4 Ohms w/3 % THD (External) |

TRANSMITTER (Measurements made per EIA standard TIA/EIA-603)

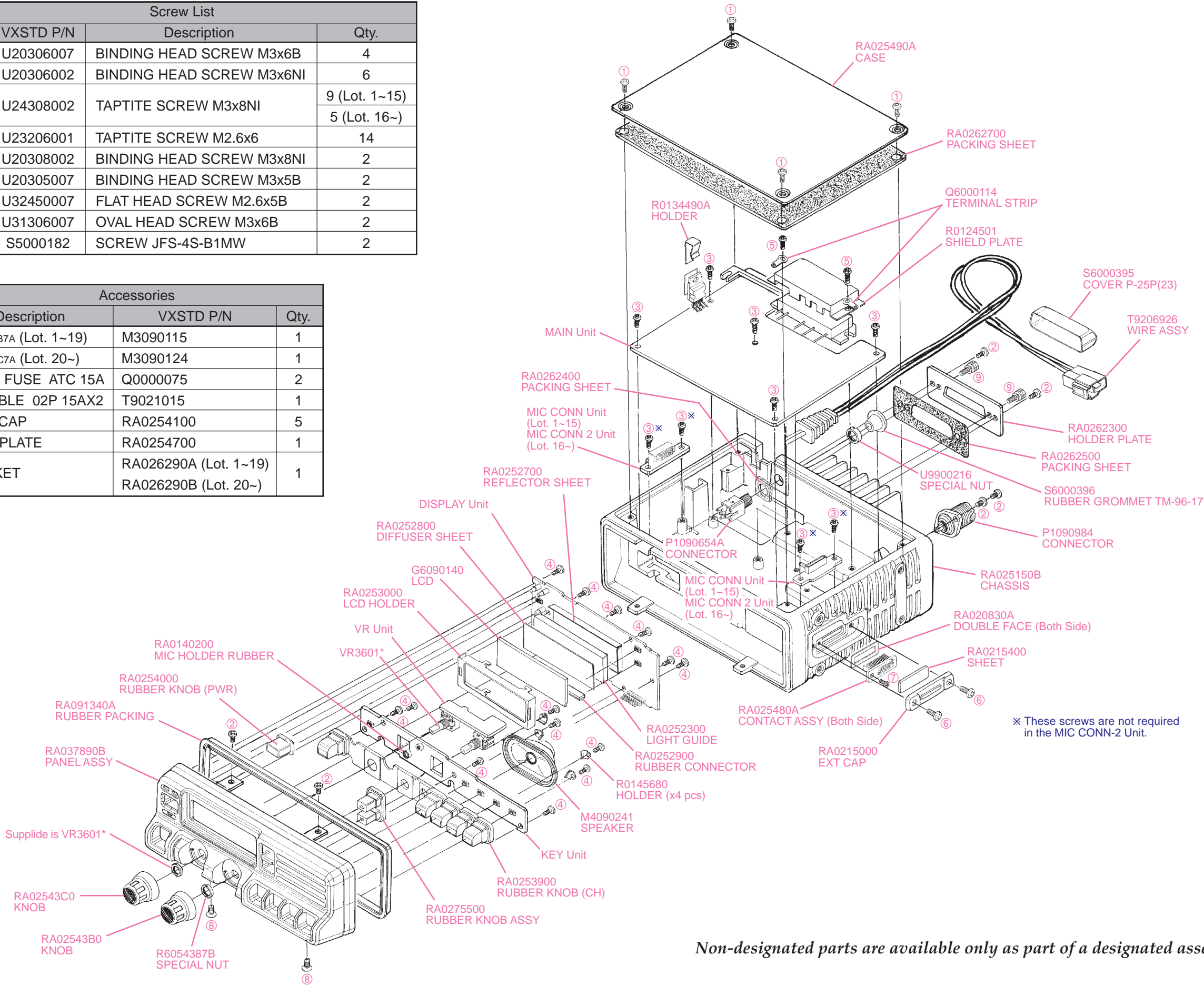
| | |
|-------------------------------|------------------------|
| Power Output: | 50 W Adjustable to 5 W |
| Modulation: | 16K0F3E, 11K0F3E |
| Max Deviation: | 5.0/2.5 kHz |
| Conducted Spurious Emissions: | 80 dB Below Carrier |

Measurements per EIA standards unless noted above.

Specifications subject to change without notice or obligation.

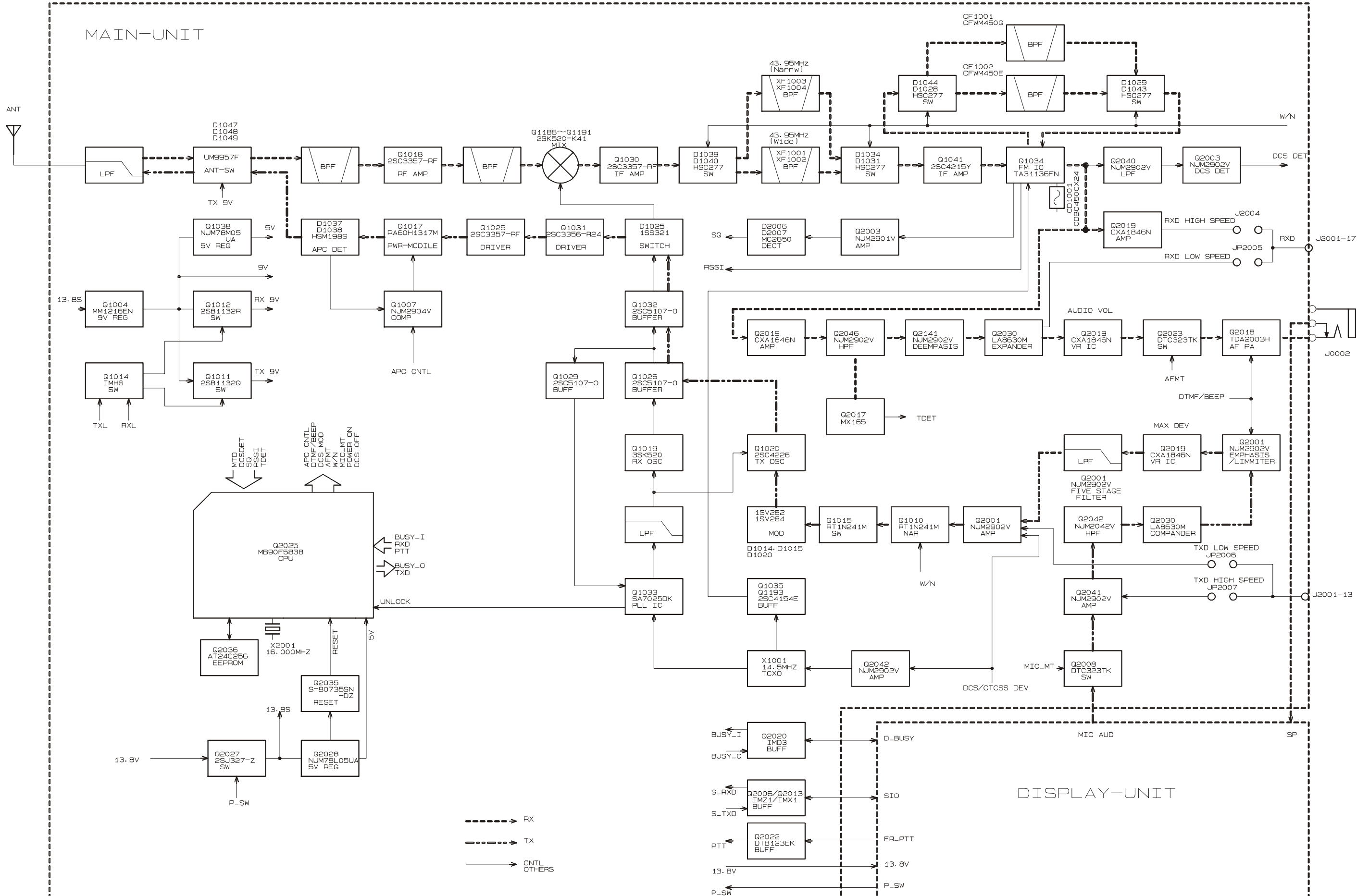
| Screw List | | | |
|------------|-----------|---------------------------|---------------|
| REF. | VXSTD P/N | Description | Qty. |
| 1 | U20306007 | BINDING HEAD SCREW M3x6B | 4 |
| 2 | U20306002 | BINDING HEAD SCREW M3x6NI | 6 |
| 3 | U24308002 | TAPTITE SCREW M3x8NI | 9 (Lot. 1~15) |
| | | | 5 (Lot. 16~) |
| 4 | U23206001 | TAPTITE SCREW M2.6x6 | 14 |
| 5 | U20308002 | BINDING HEAD SCREW M3x8NI | 2 |
| 6 | U20305007 | BINDING HEAD SCREW M3x5B | 2 |
| 7 | U32450007 | FLAT HEAD SCREW M2.6x5B | 2 |
| 8 | U31306007 | OVAL HEAD SCREW M3x6B | 2 |
| 9 | S5000182 | SCREW JFS-4S-B1MW | 2 |

| Accessories | | |
|----------------------|-----------------------|------|
| Description | VXSTD P/N | Qty. |
| MH-25B7A (Lot. 1~19) | M3090115 | 1 |
| MH-53C7A (Lot. 20~) | M3090124 | 1 |
| BLADE FUSE ATC 15A | Q0000075 | 2 |
| DC CABLE 02P 15AX2 | T9021015 | 1 |
| KNOB CAP | RA0254100 | 5 |
| NAME PLATE | RA0254700 | 1 |
| BRACKET | RA026290A (Lot. 1~19) | 1 |
| | RA026290B (Lot. 20~) | |

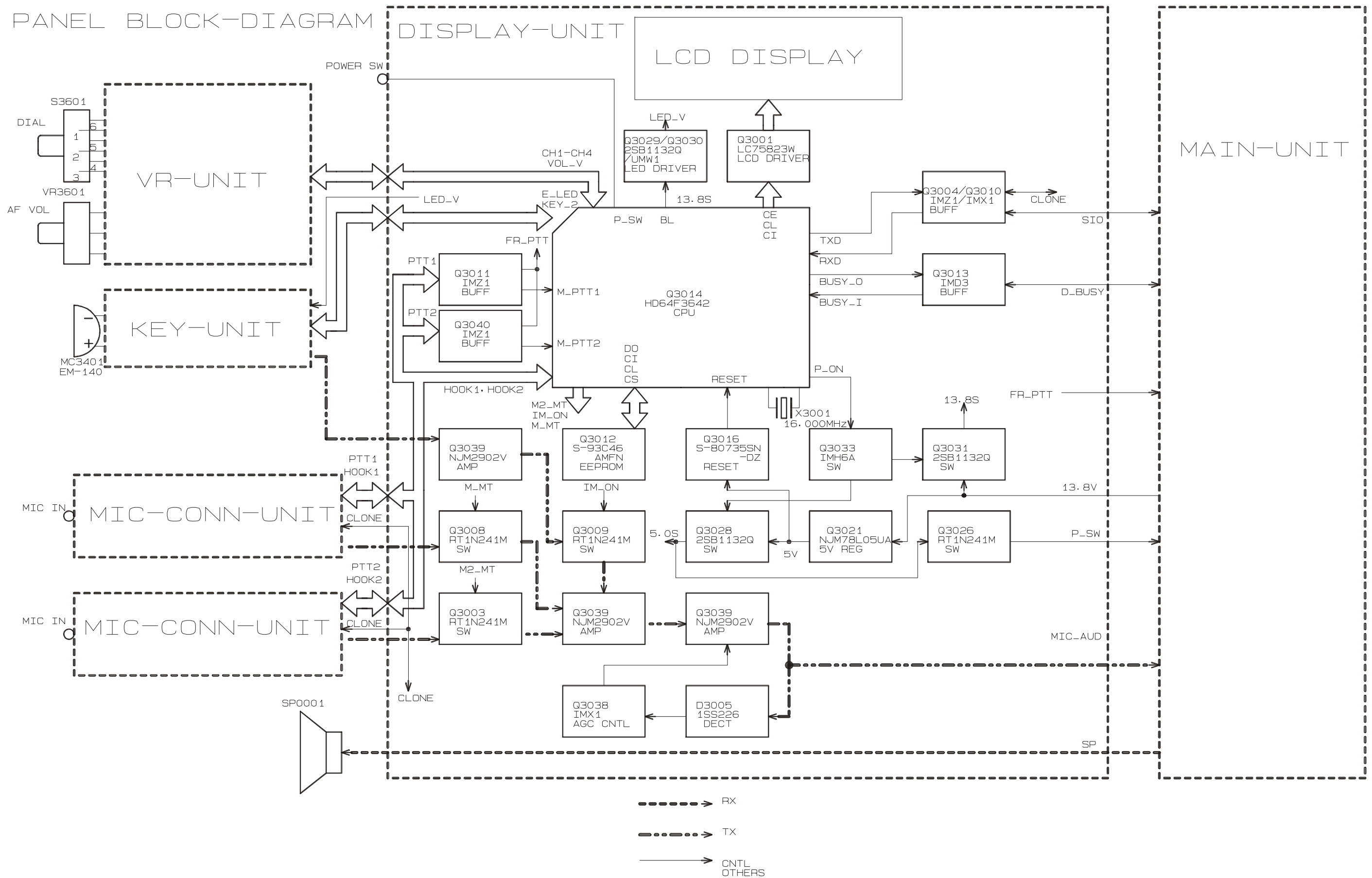


Non-designated parts are available only as part of a designated assembly.

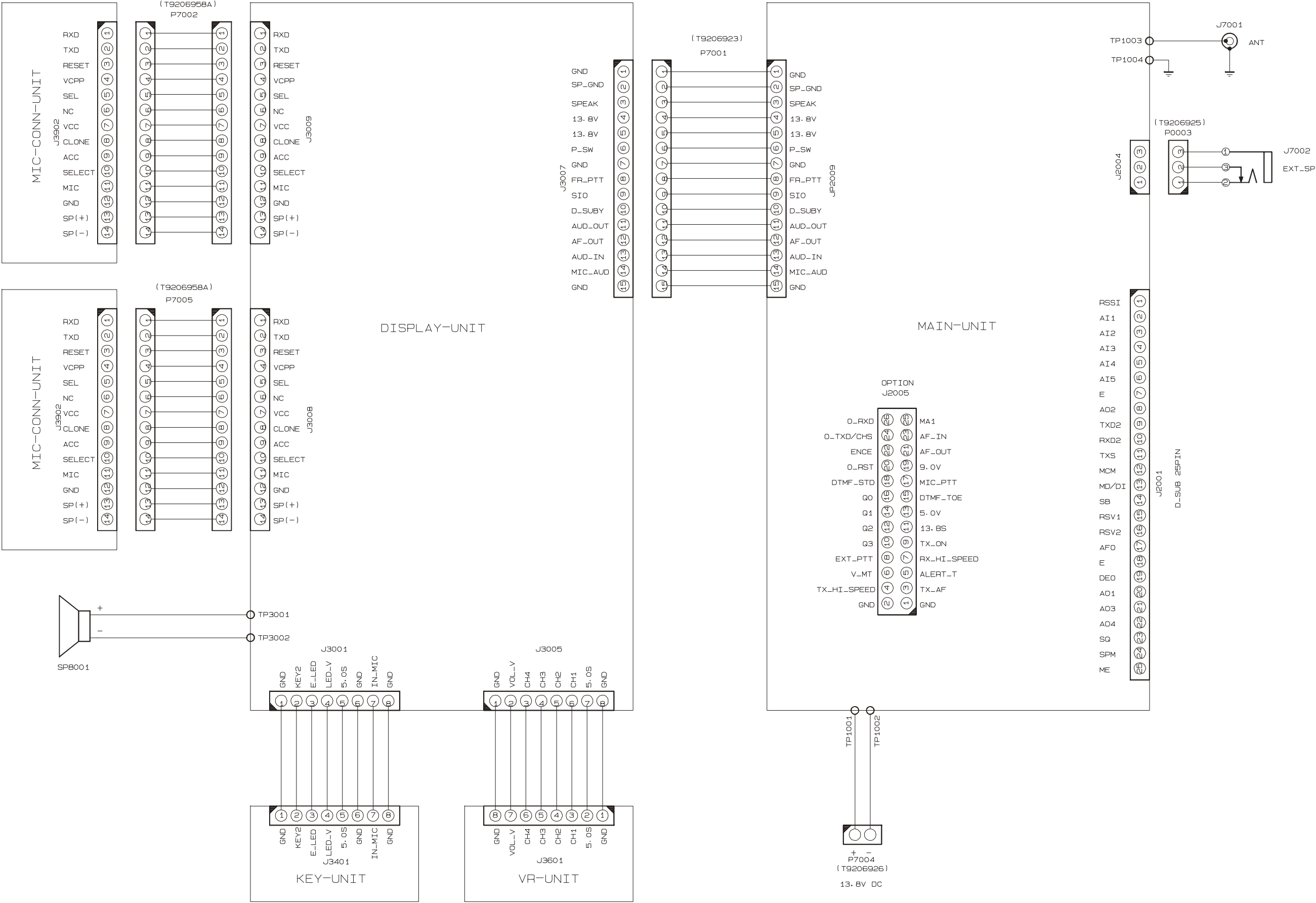
BLOCK DIAGRAM



BLOCK DIAGRAM



INTERCONNECTION DIAGRAM



PARTS LIST

| REF. | DESCRIPTION | VALUE | V/W | TOL. | MFR'S DESIG | VXSTD P/N | VERS. | LOT. | SIDE | LAY ADR |
|---------------------------------------|--------------------|----------------|-----|------|------------------------|---------------|-------|------|------|---------|
| Printed Circuit Board with Components | | | | | | | | | | |
| | MAIN UNIT | | | | CB1977001 | VERSION C | | | | |
| | | | | | CB1977002 | VERSION A | | | | |
| | DISPLAY UNIT | | | | CB1980001 | | | | | |
| | KEY UNIT | | | | CB1981001 | | | | | |
| | VR UNIT | | | | CB1981002 | | | | | |
| | MIC CONN UNIT | | | | CB1978001 | (Lot. 1 ~ 15) | | | | |
| | MIC CONN 2 UNIT | | | | CB4293001 | (Lot. 16 ~) | | | | |
| Mechanical Parts | | | | | | | | | | |
| | PANEL ASSY | | | | | RA037890B | | | | |
| | CHASSIS | | | | | RA025150B | | | | |
| | CASE | | | | | RA025490A | | | | |
| | RUBBER KNOB ASSY | | | | | RA0275500 | | | | |
| | RUBBER KNOB | | | | CH | RA0253900 | | | | |
| | RUBBER KNOB | | | | PWR | RA0254000 | | | | |
| | KNOB | | | | CHANNEL | RA2543B0 | | | | |
| | KNOB | | | | VOLUME | RA2543C0 | | | | |
| | COVER | | | | P-25P(23) | S60000395 | | | | |
| | RUBBER GROMMET | | | | TM-96-17 | S60000396 | | | | |
| | RUBBER PACKING | | | | | RA091340A | | | | |
| | HOLDER PLATE | | | | | RA0262300 | | | | |
| | PACKING SHEET | | | | | RA0262400 | | | | |
| | PACKING SHEET | | | | | RA0262500 | | | | |
| | PACKING SHEET | | | | | RA0262700 | | | | |
| | DOUBLE FACE | (x2 pcs) | | | | RA020830A | | | | |
| | HOLDER | (x4 pcs) | | | | R0145680 | | | | |
| | SPECIAL NUT | | | | | R6054387B | | | | |
| | SPECIAL NUT | | | | | U9900216 | | | | |
| Electrical Parts | | | | | | | | | | |
| | CONNECTOR | | | | ANT | P1090984 | | | | |
| | CONNECTOR | | | | EXT SP | P1090654A | | | | |
| | SPEAKER | | | | 1.5 W, 8-ohm | M4090133 | | | | |
| | WIRE ASSY | | | | DC Cable | T9206926 | | | | |
| | CW ASSY | | | | MAIN <---> DISPLAY | T9206923 | | | | |
| | CW ASSY | (x2 pcs) | | | DISPLAY <---> MIC CONN | T9206958A | | | | |
| Screws | | | | | | | | | | |
| | BINDING HEAD SCREW | (x2 pcs) | | | M3x5B | U20305007 | | | | |
| | BINDING HEAD SCREW | (x6 pcs) | | | M3x6NI | U20306002 | | | | |
| | BINDING HEAD SCREW | (x4 pcs) | | | M3x6B | U20306007 | | | | |
| | BINDING HEAD SCREW | (x2 pcs) | | | M3x8NI | U20308002 | | | | |
| | TIPTITE SCREW | (x5 or x9 pcs) | | | M3x8NI | U24308002 | | | | |
| | OVAL HEAD SCREW | (x2 pcs) | | | M3x6B | U31306007 | | | | |
| | FLAT HEAD SCREW | (x2 pcs) | | | M2.6x5B | U32450007 | | | | |
| | TIPTITE SCREW | (x14 pcs) | | | M2.6x6 | U23206001 | | | | |
| | SCREW | (x2 pcs) | | | JFS-4S-B1MW | S5000182 | | | | |

PARTS LIST

| REF. | DESCRIPTION | VALUE | V/W | TOL. | MFR'S DESIG | VXSTD P/N | VERS. | LOT. | SIDE | LAY ADR |
|-----------------|--|----------|-----|------|-------------------------|---|-------|------|------|---------|
| MAIN UNIT | | | | | | | | | | |
| CD1001 | CERAMIC DISC | | | | CDBC450KCAY24-R0 | H7901340 | | | B | b5 |
| CF1001 | CERAMIC FILTER | | | | CFWLB450KGFA-B0 | H3900435 | | | A | F4 |
| CF1002 | CERAMIC FILTER | | | | CFWLB450KE2A-B0 | H3900466 | | | A | F4 |
| CO2001 | CERAMIC OSC | 1MHz | | | CSBFB1M00J2B021-R1 | H7900950 | | | A | C4 |
| F 2001 | CHIP FUSE | 0.25A | | | KAB2402-251NA31010 | Q0000085 | | | A | A2 |
| J 2001 | CONNECTOR | | | | JBV-25S-1A3F(LF)(SN) | P1090815 | | | B | f1 |
| J 2004 | CONNECTOR | | | | BM03B-SRSS-TBT(LF)(SN) | P0091301 | | | A | A2 |
| J 2005 | CONNECTOR | | | | AXN426C530P | P0091296 | | | A | B4 |
| Q 1017 | IC | | | | RA60H1317M-124 | G1094314 | | | A | C1 |
| TH1001 | THERMISTOR | | | | TBPS1R104K475H5Q | G9090069 | | | B | a2 |
| VR1001 | POT. | 10kohm | | | EVM3VSX50B14 | J51843103 | | | A | E5 |
| X 1001 | XTAL OSC | 14.5MHz | | | TTS12V 14.5MHZ | H9500630 | | | A | E5 |
| X 2001 | XTAL 92SMX(CN) | 16MHz | | | 16.000MHZ | H0103322 | | | A | A4 |
| XF1001 | XTAL FILTER | 43.95MHz | | | UM-5-3P 43Y12B5F(IM) | H1102420 | | | A | G4 |
| XF1002 | XTAL FILTER | 43.95MHz | | | UM-5-3P 43Y12B5F(IM) | H1102420 | | | A | G5 |
| XF1003 | XTAL FILTER | 43.95MHz | | | 43Y07B5 UM-5-3P TMK5292 | H1102486 | | | A | G4 |
| XF1004 | XTAL FILTER | 43.95MHz | | | 43Y07B5 UM-5-3P TMK5292 | H1102486 | | | A | G5 |
| | SHIELD PLATE HOLDER TERMINAL STRIP | (x2 pcs) | | | | R0124501 R0134490A Q6000114 | | | | |
| DISPLAY UNIT | | | | | | | | | | |
| DS3002 | LCD | | | | M762-1 | G6090140A | | | A | D2 |
| J 3001 | CONNECTOR | | | | 9210B-1-08ZA105-PT1 | P0091576 | | | A | F4 |
| J 3005 | CONNECTOR | | | | 9210B-1-08ZA104-PT1 | P0091575 | | | A | C3 |
| J 3007 | CONNECTOR | | | | SB20-15WS | P0091093 | | | B | h3 |
| J 3008 | CONNECTOR | | | | BM14B-SRSS-TBT(LF)(SN) | P0091302 | | | B | c2 |
| J 3009 | CONNECTOR | | | | BM14B-SRSS-TBT(LF)(SN) | P0091302 | | | B | h3 |
| S 3007 | TACT SWITCH | | | | SKQDAB | N5090058 | | | A | A2 |
| S 3008 | TACT SWITCH | | | | SKQDAB | N5090058 | | | A | F1 |
| S 3009 | TACT SWITCH | | | | SKQDAB | N5090058 | | | A | F1 |
| X 3001 | XTAL 92SMX(CN) | 16MHz | | | 16.000MHZ | H0103322 | | | B | a3 |
| | LIGHT GUIDE REFLECTOR SHEET DIFFUSER SHEET RUBBER CONNECTOR LCD HOLDER | | | | | RA0252300 RA0252700 RA0252800 RA0252900 RA0253000 | | | | |
| KEY UNIT | | | | | | | | | | |
| J 3401 | CONNECTOR | | | | 9110S-08 | P1091014 | | | | |
| MC3401 | MIC. ELEMENT | | | | EM-140 | M3290032 | | | | |
| S 3401 | TACT SWITCH | | | | SKQDAB | N5090058 | | | | |
| S 3402 | TACT SWITCH | | | | SKQDAB | N5090058 | | | | |
| S 3403 | TACT SWITCH | | | | SKQDAB | N5090058 | | | | |
| S 3404 | TACT SWITCH | | | | SKQDAB | N5090058 | | | | |
| S 3405 | TACT SWITCH | | | | SKQDAB | N5090058 | | | | |
| VR UNIT | | | | | | | | | | |
| J 3601 | CONNECTOR | | | | 9110S-08L | P1091104 | | | | |
| S 3601 | ROTARY SWITCH | | | | SRZW0L010K | N0190177 | | | | |
| VR3601 | POT. | | | | RK09L1120 L=15 10KC | J60800258 | | | | |
| MIC CONN 2 UNIT | | | | | | | | | | |
| J 3952 | CONNECTOR | | | | SM14B-SRSS-TB(LF)(SN) | P0091497 | | | | |

Reception and transmission are switched by “RX” and “TX” lines from the microprocessor unit (MPU). The receiver uses double-conversion super-heterodyne circuitry, with a 43.95 MHz 1st IF and 450 kHz 2nd IF. The 1st LO, produced by a PLL synthesizer, yields the 43.95 MHz 1st IF.

The 2nd LO uses a 43.5 MHz (43.95 MHz - 450 kHz) signal generated by a crystal oscillator. The 2nd mixer and other circuits use a custom IC to convert and amplify the 2nd IF, and detect FM to obtain demodulated signals. During transmit, the PLL synthesizer oscillates at the desired frequency directly, for amplification to obtain RF power output. During transmit, voice modulation and CTCSS (or DCS) modulation are applied to this synthesizer. Transceiver functions, such as Tx/Rx control, PLL synthesizer settings, and channel programming, are controlled using the MPU.

Receiver

Incoming RF signals from the antenna connector are delivered to the MAIN Unit, and pass through a low-pass filter (LPF) antenna switching network consisting of coils L1008, L1004, L1022 and L1003, capacitors C1338, C1337, C1336, C1335, and C1037, and antenna switching diodes **D1047**, **D1048** and **D1049** for delivery to the receiver front end.

Signals within the frequency range of the transceiver are then passed through a varactor-tuned band-pass filter consisting of L1007, L1020 before RF amplification by **Q1018 (2SC3357)**.

The amplified RF is then band-pass filtered again by varactor-tuned resonators L1009, L1011 to ensure pure in-band input to 1st mixer **Q1188**, **Q1189**, **Q1190**, **Q1191** (all **2SK520**).

Buffered output from the VCO Unit is amplified by **Q1032 (2SC5107)**, **Q1192 (2SC3357)** and low-pass filtered by L1041, L1045, L1060 and C1153, C1154, C1174, C1089, to provide a pure 1st local signal between 177.95 and 203.95 MHz (Type A) or 191.95 and 217.95 MHz (Type C) to the 1st mixer.

The 43.95MHz 1st mixer product then passes through dual monolithic crystal filters XF1001 and XF1002 (12 kHz BW) or XF1003 and XF1004 (7kHz BW), and is amplified by **Q1041 (2SC4215Y)** and delivered to the input of the FM IF subsystem IC **Q1034 (TA31136FN)**.

This IC contains the 2nd mixer, 2nd local oscillator, limiter amplifier, FM detector, noise amplifier, and squelch gates.

The 2nd LO in the IF-IC is produced from crystal OSC X1001 (14.500 MHz), and the 1st IF is converted to 450 kHz by the 2nd mixer and stripped of unwanted components by ceramic filter CF1001 or CF1002. After passing through a limiter amplifier, the signal is demodulated by the FM detector.

Demodulated receive audio from the IF-IC is amplified by **Q2019 (CXA1846N)**. After volume adjustment by the AF power amplifier **Q2018 (TDA7240AV)**, the audio signal is passed to the optional headphone jack or 4 W loudspeaker.

PLL synthesizer

The 1st LO maintains stability from the PLL synthesizer by using a 14.500 MHz reference signal from crystal OSC X1001. PLL synthesizer IC **Q1033 (SA7025DK)** consists of a prescaler, reference counter, swallow counter, programmable counter, a serial data input port to set these counters based on the external data, a phase comparator, and charge pump. The PLL-IC divides the 14.500 MHz reference signal by 725 using the reference counter (20.0 kHz comparison frequency). The phase detector comparison frequency to be eight times the channel spacing (2.5 kHz). The VCO output is divided by the prescaler, swallow counter and programmable counter. These two signals are compared by the phase comparator and input to the charge pump. A voltage proportional to their phase difference is delivered to the low-pass filter circuit, then fed back to the VCO as a voltage with phase error, controlling and stabilizing the oscillating frequency. This synthesizer also operates as a modulator during transmit.

The RX-VCO is comprised of **Q1019 (2SK520)** and **D1010**, **D1011**, **D1016**, **D1018** (all **1SV282**), and oscillates between 177.95 and 203.95 MHz (Type A) or 191.95 and 217.95 MHz (Type C) according to the programmed receiving frequency. And the TX-VCO is comprised of **Q1020 (2SC4226-R24)** and **D1014**, **D1015** (both **1SV282**), **D1020 (1SV284)** and oscillates between 134.000 MHz and 160.000 MHz (Type A) or 148.000 MHz and 174.000 MHz (Type C) according to the programmed transmit frequency. The VCO output passes through buffer amplifier **Q1026 (2SC5107)**, and a portion is fed to the buffer amplifier **Q1029 (2SC5107)** of the PLL IC, and at the same time amplified by **Q1032 (2SC5107)** to obtain stable output. The VCO DC supply is regulated by **Q1006 (2SC4154E)**. Synthesizer output is fed to the 1st mixer by diode switch **D1021 (1SS321)** during receive, and to drive amplifier **Q1031 (2SC3356)**, **Q1025 (2SC3357)** for transmit.

CIRCUIT DESCRIPTION

Transmitter

Voice audio from the microphone is delivered via the MIC (Jack) Unit to the MAIN Unit, after passing through amplifier **Q3039** and **Q2040** (both **NJM2902V**), pre-emphasis, limiter (IDC instantaneous deviation control), and LPF **Q2001** (**NJM2902V**), is adjusted for optimum deviation level and delivered to the next stage.

Voice input from the microphone and CTCSS are FM-modulated to the VCO of the synthesizer, while DCS audio is modulated by the reference frequency oscillator of the synthesizer.

Synthesizer output, after passing through diode switch **D1025** (**1SS321**), is amplified by driver **Q1031** (**2SC3356**), **Q1025** (**2SC3357**) and power module **Q1017** (**RA60H1317M**) to obtain full RF output. The RF energy then passes through antenna switch **D1047**, **D1048** (both **L709CER**) and a low-pass filter circuit and finally to the antenna connector.

RF output power from the final amplifier is sampled by CM coupler and is rectified by **D1037**, **D1038** (both **HSM198S**). The resulting DC is fed through Automatic Power Controller **Q1007** (**NJM2904V**) to transmitter RF amplifier and thus the power output.

Generation of spurious products by the transmitter is minimized by the fundamental carrier frequency being equal to the final transmitting frequency, modulated directly in the transmit VCO. Additional harmonic suppression is provided by a low-pass filter consisting of L1008 L1004, L1002, L1001 and C1338, C1336, C1337, C1335, C1334, C1333, C1332 and C1326, resulting in more than 60 dB of harmonic suppression prior to delivery to the RF energy to the antenna.

DCS Demodulator

DCS signals are demodulated on the MAIN UNIT, and are applied to low-pass filter **Q2040** (**NJM2902V**), as well as the limiter comparator **Q2003** (**NJM2902V**).

CTCSS encoder/decoder

The CTCSS code is generation and encoding by MPU IC **Q2025** (**MB90F583B**).

Demodulation and detection of the CTCSS tones are carried out by IC **Q2017** (**MX165C**).

MPU

Operation is controlled by 16-bit MPU IC **Q2025** (**MB90F583B**). The system clock uses a 16.000 MHz crystal for a time base. IC **Q2035** (**RN5V35AA**) resets the MPU when the power is on, and monitors the voltage of the regulated 5 V power supply line.

EEPROM

The EEPROM retains TX and RX data for all memory channels and CTCSS data, DCS data, prescaler dividing, and REF oscillator data (internal/external).

The VX-5500V has been carefully aligned at the factory for the specified performance across the frequency range specified for each version.

Realignment should therefore not be necessary except in the event of a component failure, or when altering the transceiver version. 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. All component replacement and service should be performed only by an authorized Vertex Standard representative, or the warranty policy may be voided. 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.

Required Test Equipment

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.

- ☐ RF signal generator: calibrated output level at 1000 MHz
- ☐ Deviation Meter (linear detector)
- ☐ AF Millivoltmeter
- ☐ SINAD Meter
- ☐ Inline Wattmeter with 5 % accuracy at 1000 MHz
- ☐ Regulated DC Power Supply: adjustable from 10 to 17 VDC, 15 A
- ☐ 50-ohm non-reactive Dummy Load: 100 W at 1000 MHz
- ☐ Frequency Counter: <0.1 ppm accuracy at 1000 MHz
- ☐ AF Signal Generator
- ☐ DC Voltmeter: high impedance
- ☐ RF Sampling Coupler (attenuation pad)
- ☐ Oscilloscope
- ☐ Spectrum Analyzer
- ☐ Vertex Standard SVC49 channel programming editor.
- ☐ IBM® PC/Compatible computer with Microsoft® Windows® 2000, XP, Vista or 7.
- ☐ Vertex Standard FIF-12 USB Programming Interface and T9101628 Connection Cable.
- ☐ Vertex Standard FRB-6 Tuning Interface Box and CT-161 Programming Cable.

Alignment Preparation & Precautions

A dummy load and inline 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 68 °F and 86 °F (20 °C ~ 30 °C). When the transceiver is brought into the shop from hot or cold air it should be allowed some time for thermal equalization with the environment before alignment. If 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.

ALIGNMENT

Before beginning, connect the transceiver and PC using the FIF-12 USB Programming Interface and T9101628 Connection Cable, then download the EEPROM data from the transceiver to the computer.

Store this data in a disk file so that it can be saved and retrieved later. Using the table below, program the channel, CTCSS, and DCS alignment settings for your transceiver version. Upload this file to the transceiver.

Note:

Signal levels in dB referred to in this procedure are based on $0 \text{ dB}\mu = 0.5 \text{ }\mu\text{V}$ (closed circuit).

Alignment Channel Frequencies

| Channel | Type | Frequency (simplex) | CTCSS Encode | DCS Encode | Narrow/Wide |
|---------|------|---------------------|--------------|------------|-------------|
| CH1 | C | 148.01 MHz | None | None | Wide |
| | A | 134.01 MHz | | | |
| CH2 | C | 161.01 MHz | None | None | Wide |
| | A | 147.01 MHz | | | |
| CH3 | C | 173.99 MHz | None | None | Wide |
| | A | 159.99 MHz | | | |
| CH4 | C | 148.01 MHz | None | None | Narrow |
| | A | 134.01 MHz | | | |
| CH5 | C | 161.01 MHz | None | None | Narrow |
| | A | 147.01 MHz | | | |
| CH6 | C | 173.99 MHz | None | None | Narrow |
| | A | 159.99 MHz | | | |
| CH7 | C | 161.01 MHz | 151.4 Hz | None | Wide |
| | A | 147.01 MHz | | | |
| CH8 | C | 161.01 MHz | None | 023 | Wide |
| | A | 147.01 MHz | | | |
| CH9 | C | 161.01 MHz | 151.4 Hz | None | Narrow |
| | A | 147.01 MHz | | | |
| CH10 | C | 161.01 MHz | None | 023 | Narrow |
| | A | 147.01 MHz | | | |

PLL & Transmitter

Set up the test equipment as shown for transmitter alignment.

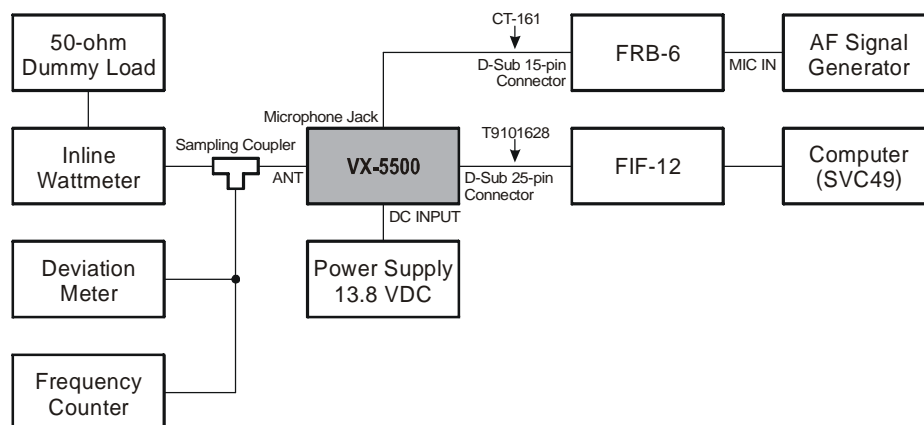
Maintain the supply voltage at 13.8 V DC for all steps.

PLL VCV

- ❑ Connect the positive lead of the DC voltmeter to test point **TP1008** (VCV) on the Main Unit, as indicated in the figure, and connect the negative lead to chassis ground.
- ❑ Set the transceiver to the high band edge frequency channel (CH3 or CH6), then key the transmitter, and adjust **L1026** on the Main Unit for $4.3 \text{ V} \pm 0.1 \text{ V}$ (Type C) or $4.4 \text{ V} \pm 0.1 \text{ V}$ (Type A) on the voltmeter.
- ❑ Adjust **L1023** on the Main Unit for $4.3 \text{ V} \pm 0.1 \text{ V}$ (Type C) or $4.4 \text{ V} \pm 0.1 \text{ V}$ (Type A) on the voltmeter.
- ❑ Next select to the low edge frequency channel (CH1 or CH4) and confirm the VCV is more than 0.8 V on the voltmeter.
- ❑ Key the transmitter, and confirm the VCV is more than 1.0 V (Type C) or 0.8 V (Type A) on the voltmeter.

PLL Reference Frequency

With the wattmeter, dummy load and frequency counter connected to the antenna jack, and select band center frequency channel (CH2 or CH5), key the transmitter and adjust **VR1001** on the Main Unit, if necessary, so the counter frequency is within 100 Hz of the channel center frequency for the transceiver version.



TRANSMITTER ALIGNMENT SETUP

Transmitter Output Power

The following transmitter parameters can be adjusted from the computer by utilizing the Alignment Software. Refer to the onboard help of the Alignment Software Manual for details.

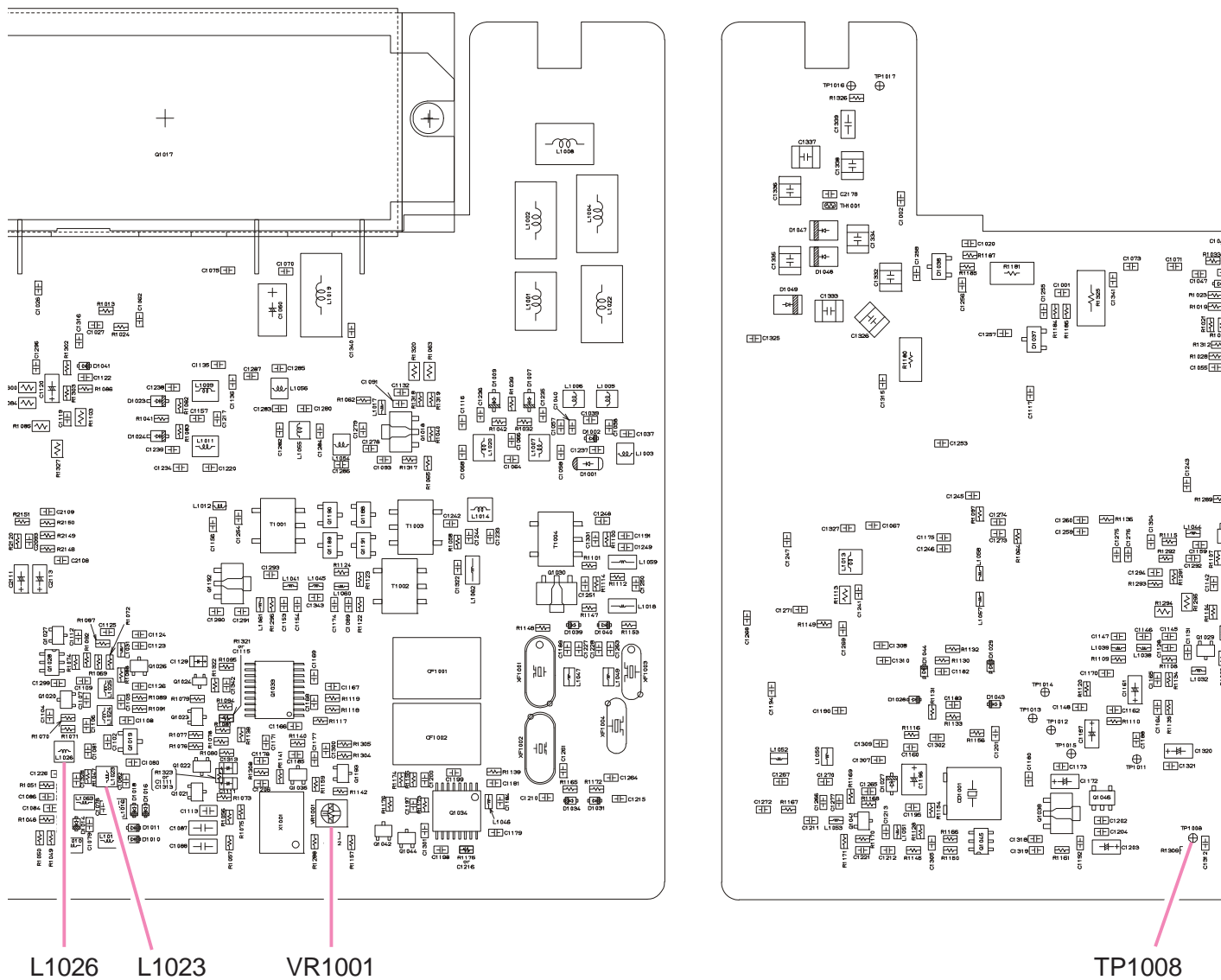
- ❑ Select the band center frequency channel (CH2 or CH5), and select the “high” power output level.
Key the transmitter and adjust “TX PWR Hi” for a power output of 50 Watts (± 1.0 W) as indicated on the wattmeter.
- ❑ Stay on the band center frequency channel (CH2 or CH5), and select the “low” power output level.
Key the transmitter and adjust “TX PWR L3” for a power level of 25 Watts (± 0.5 W) as indicated on the wattmeter.

Transmitter Deviation

The following modulation parameters can be adjusted from the computer by utilizing the Alignment Software. Refer to the onboard help of the Alignment Software Manual for details.

Microphone Audio Modulation Level

- ☐ Select the band center frequency channel (CH2), and select the “low” power output level.
- ☐ Adjust the AF generator for 50 mV (–30 dBm) output at 1 kHz, as applied to the microphone jack.
- ☐ Key the transmitter and adjust “MAX Dev (wide)” for maximum deviation of $4.3 \text{ kHz} \pm 0.1 \text{ kHz}$ as indicated on the deviation meter.
- ☐ Select the band center frequency channel (CH5), and select the “low” power output level.
- ☐ Adjust the AF generator for 50 mV (–30 dBm) output at 1 kHz, as applied to the microphone jack.
- ☐ Key the transmitter and adjust “MAX Dev (Narrow)” for maximum deviation of $2.2 \text{ kHz} \pm 0.2 \text{ kHz}$ as indicated on the deviation meter.



ALIGNMENT

CTCSS Modulation Level

- ☐ Select the “low” power output level.
- ☐ Select the band center frequency channel (CH7), with 151.4 Hz CTCSS encode, and reduce the AF generator injection to zero.
- ☐ Key the transmitter and adjust “CTCSS Dev (wide)” for CTCSS deviation of $0.9 \text{ kHz} \pm 0.1 \text{ kHz}$ as indicated on the deviation meter.
- ☐ Select the band center frequency channel (CH9), with 151.4 Hz CTCSS encode, and reduce the AF generator injection to zero.
- ☐ Key the transmitter and adjust “CTCSS Dev (Narrow)” for CTCSS deviation of $0.45 \text{ kHz} \pm 0.1 \text{ kHz}$ as indicated on the deviation meter.

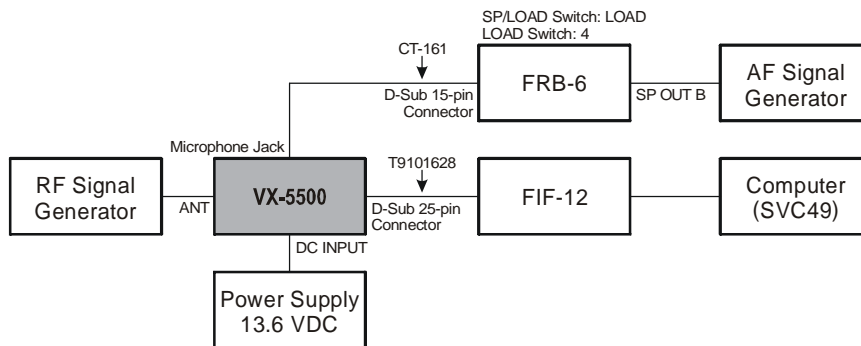
DCS Modulation Level

- ☐ Select the “low” power output level.
- ☐ Select the band center frequency channel (CH8), with 023 DCS code, and reduce the AF generator injection to zero.
- ☐ Key the transmitter and adjust “DCS Dev (wide)” for DCS deviation of $0.8 \text{ kHz} \pm 0.1 \text{ kHz}$ as indicated on the deviation meter.
- ☐ Select the band center frequency channel (CH10), with 023 DCS code, and reduce the AF generator injection to zero.
- ☐ Key the transmitter and adjust “DCS Dev (Narrow)” for CTCSS deviation of $0.4 \text{ kHz} \pm 0.1 \text{ kHz}$ as indicated on the deviation meter.

Receiver

The sensitivity parameters can be adjusted from the computer by utilizing the Alignment Software. Refer to the onboard help of the Alignment Software Manual for details.

- ☐ Set up the test equipment as shown for receiver alignment, and install the audio test adapter.
- quency channel (CH2), and with the RF signal generator tuned to the same frequency, set the generator for $\pm 3.0 \text{ kHz}$ deviation with 1 kHz tone modulation, and set the output level for $-5.0 \text{ dB}\mu$ at the antenna jack.
- ☐ Adjust “Rx TUNE” the receiver front-end tuning for optimum SINAD, reducing signal generator output level as necessary for proper meter deflection.
- ☐ After the previous step, the final signal generator level should be less than $-5.0 \text{ dB}\mu$ for 12dB SINAD.



RECEIVER ALIGNMENT SETUP

Squelch Threshold

The squelch parameters can also be adjusted from the computer by utilizing the Alignment Software. Refer to the onboard help of the Alignment Software Manual for details.

Tight SQL RSSI LEVEL (Wide)

- ❑ Select the band center frequency channel (CH2), and with the RF signal generator turned to the same frequency, set the generator for ± 3.0 kHz deviation with 1 kHz tone modulation, and set the output level for 3.0 dB μ at the antenna jack.

Threshold NSQ LEVEL (Wide)

- ❑ Select the band center frequency channel (CH2), and with the RF signal generator turned to the same frequency, set the generator for ± 3.0 kHz deviation with 1 kHz tone modulation, and set the output level for -8.0 dB μ at the antenna jack.

Tight SQL NSQ LEVEL (Wide)

- ❑ Select the band center frequency channel (CH2), and with the RF signal generator turned to the same frequency, set the generator for ± 3.0 kHz deviation with 1 kHz tone modulation, and set the output level for 0 dB μ at the antenna jack.

Tight SQL RSSI LEVEL (Narrow)

- ❑ Select the band center frequency channel (CH5), and with the RF signal generator turned to the same frequency, set the generator for ± 1.5 kHz deviation with 1 kHz tone modulation, and set the output level for 3.0 dB μ at the antenna jack.

Threshold NSQ LEVEL (Narrow)

- ❑ Select the band center frequency channel (CH5), and with the RF signal generator turned to the same frequency, set the generator for ± 1.5 kHz deviation with 1 kHz tone modulation, and set the output level for -8.0 dB μ at the antenna jack.

Tight SQL NSQ LEVEL (Narrow)

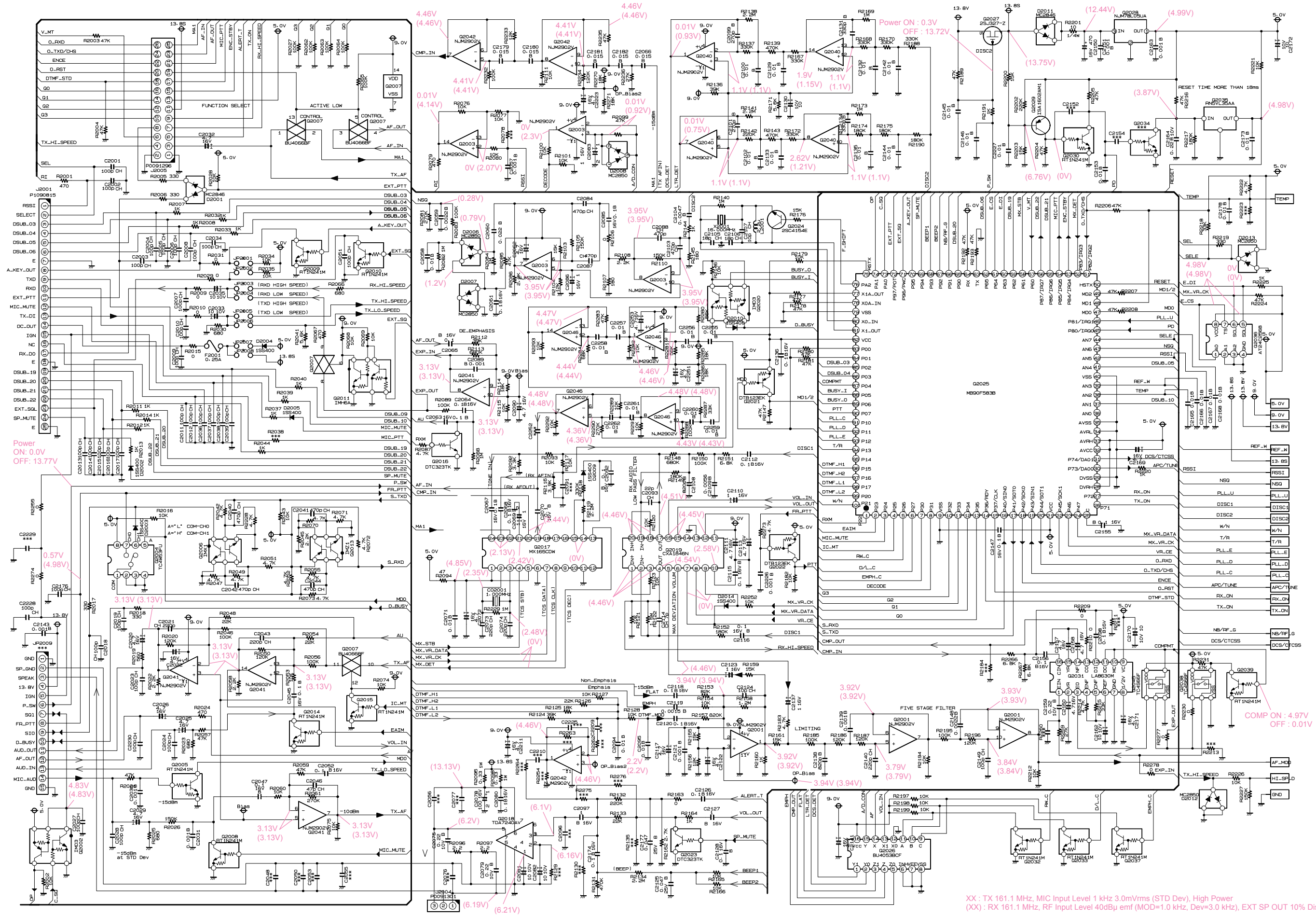
- ❑ Select the band center frequency channel (CH5), and with the RF signal generator turned to the same frequency, set the generator for ± 1.5 kHz deviation with 1 kHz tone modulation, and set the output level for 0 dB μ at the antenna jack.
- ❑ Adjust the squelch threshold level "Tight SQL NSQ(Narrow)" such that the squelch just open at this signal input level (the BUSY LED will turn on).

ALIGNMENT

Note:

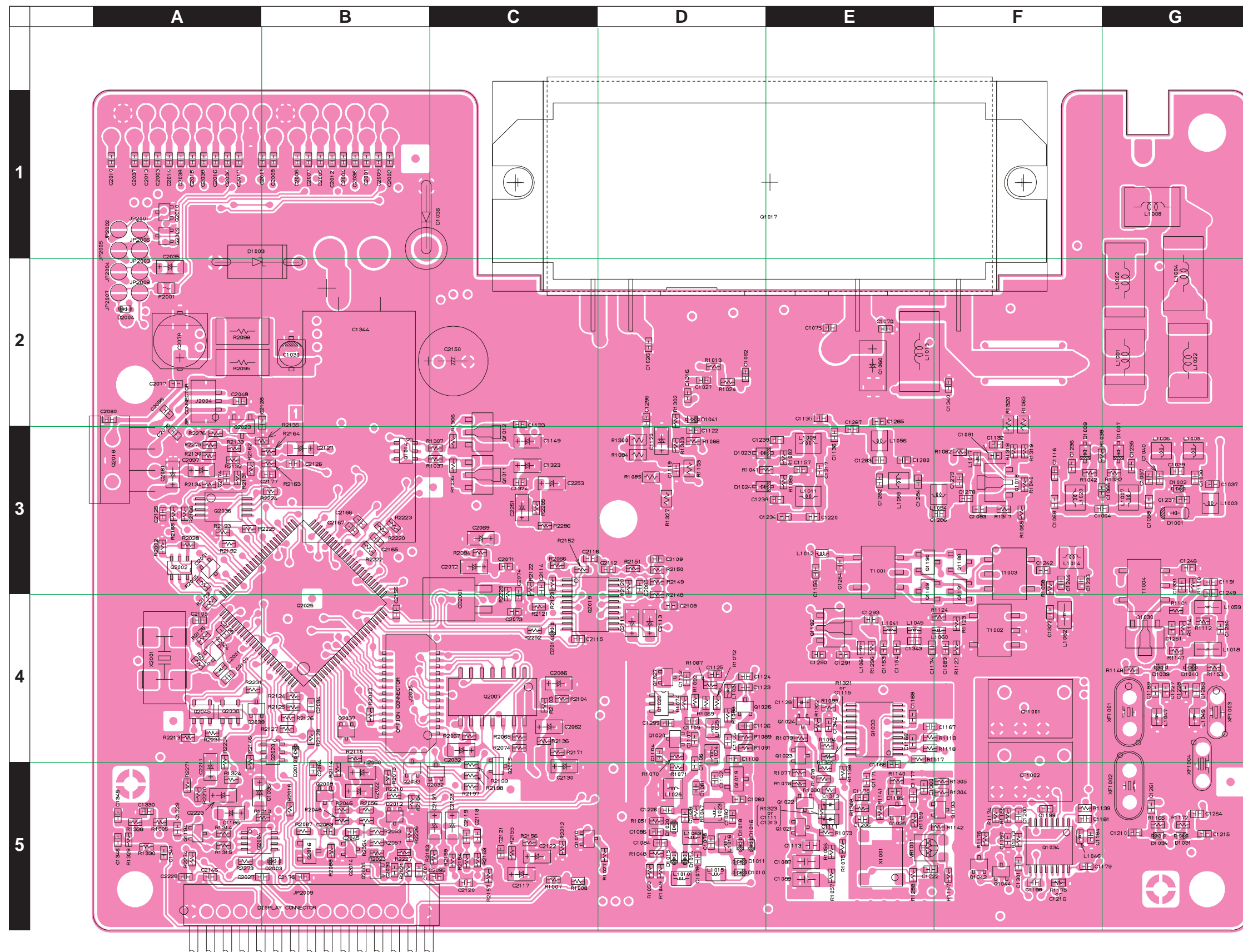


MAIN UNIT (FR008100B)



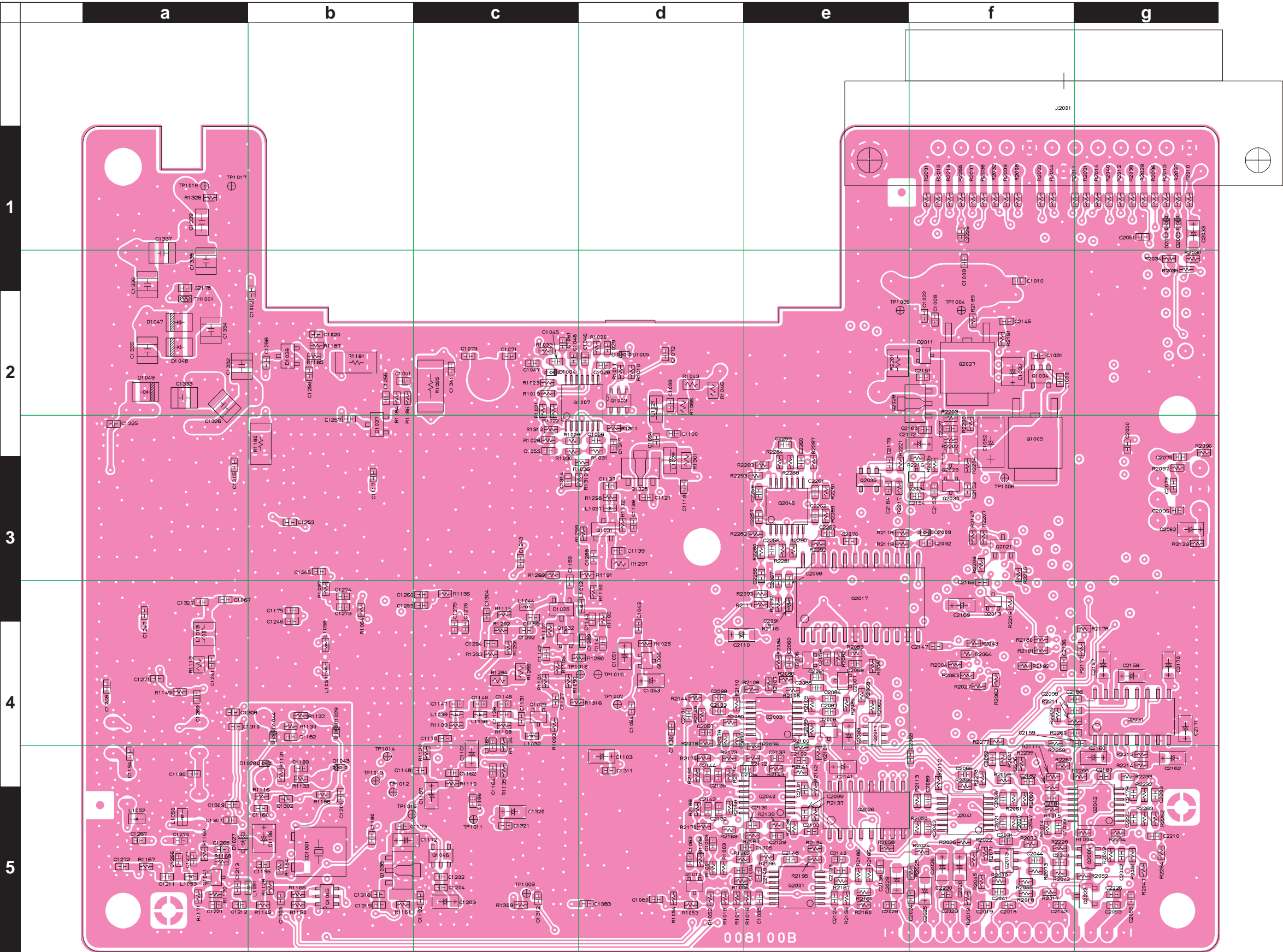
| Q2031 | | | |
|-------|-------|----|-------|
| 1 | 2.53V | 9 | - |
| 2 | 0.71V | 10 | - |
| 3 | 2.53V | 11 | - |
| 4 | - | 12 | 2.51V |
| 5 | - | 13 | 2.52V |
| 6 | 2.53V | 14 | 2.53V |
| 7 | - | 15 | 0.6V |
| 8 | 2.52V | 16 | 2.52V |

Parts Layout (Side A)

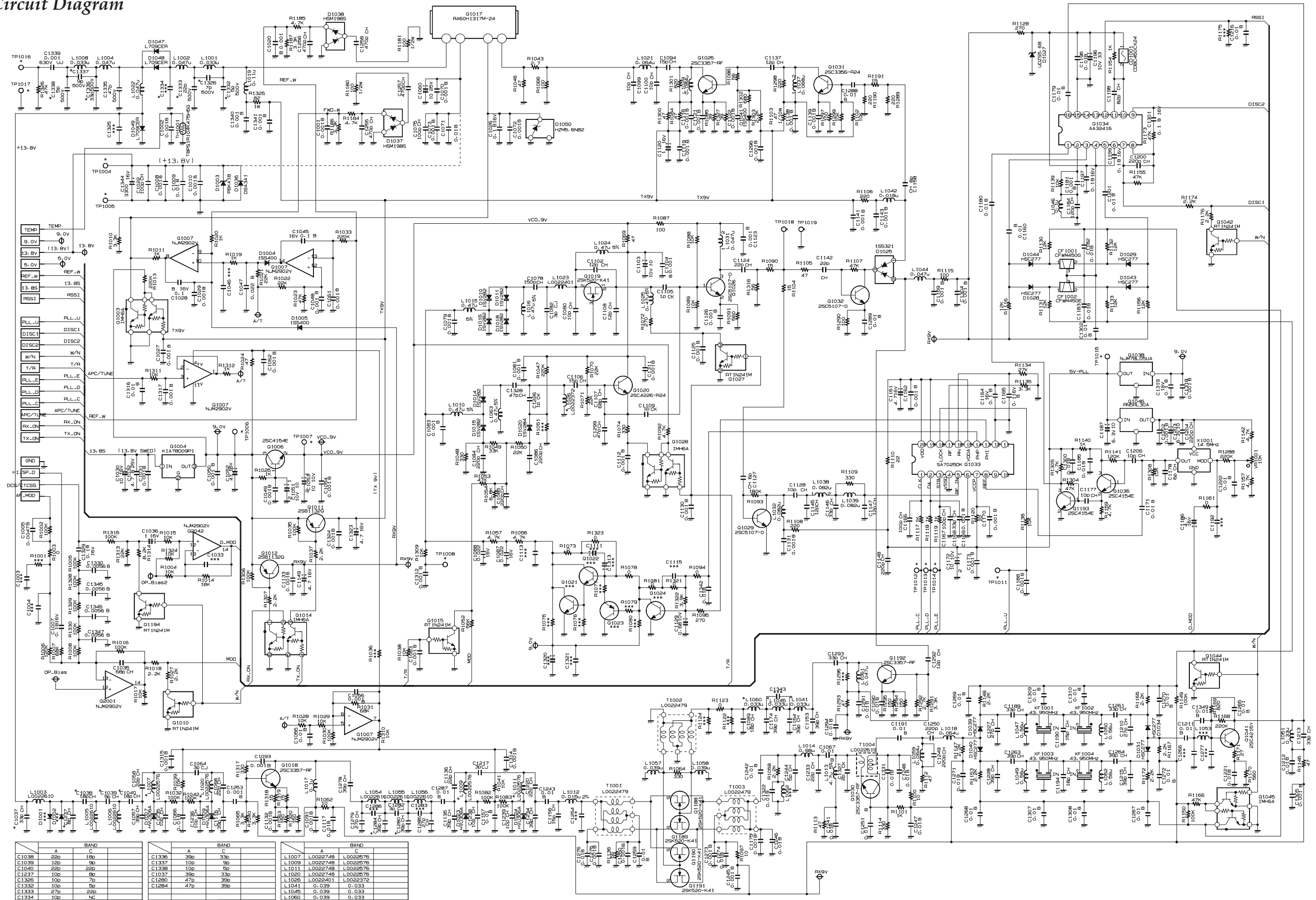


MAIN UNIT (FR008100B)

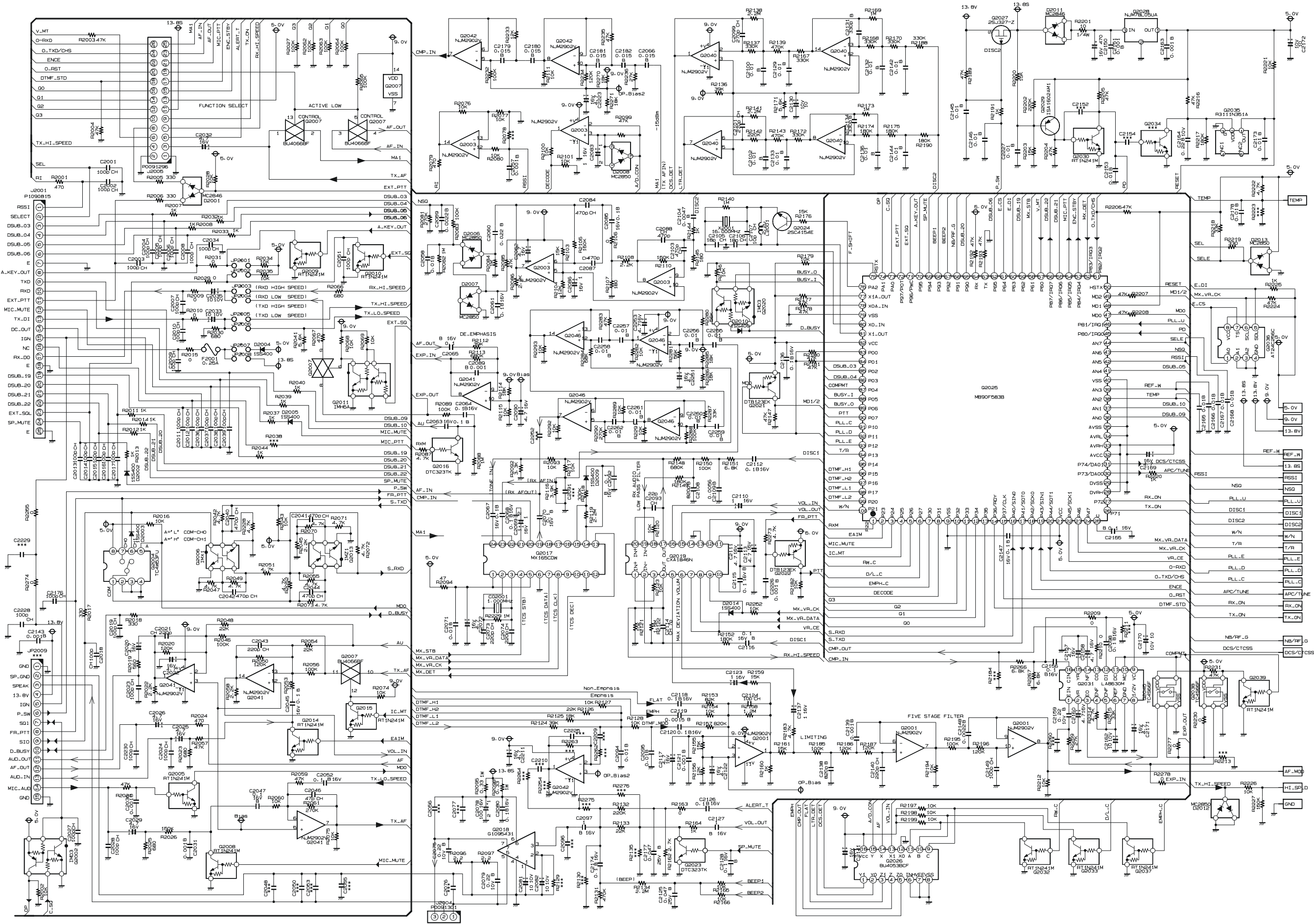
Parts Layout (Side B)



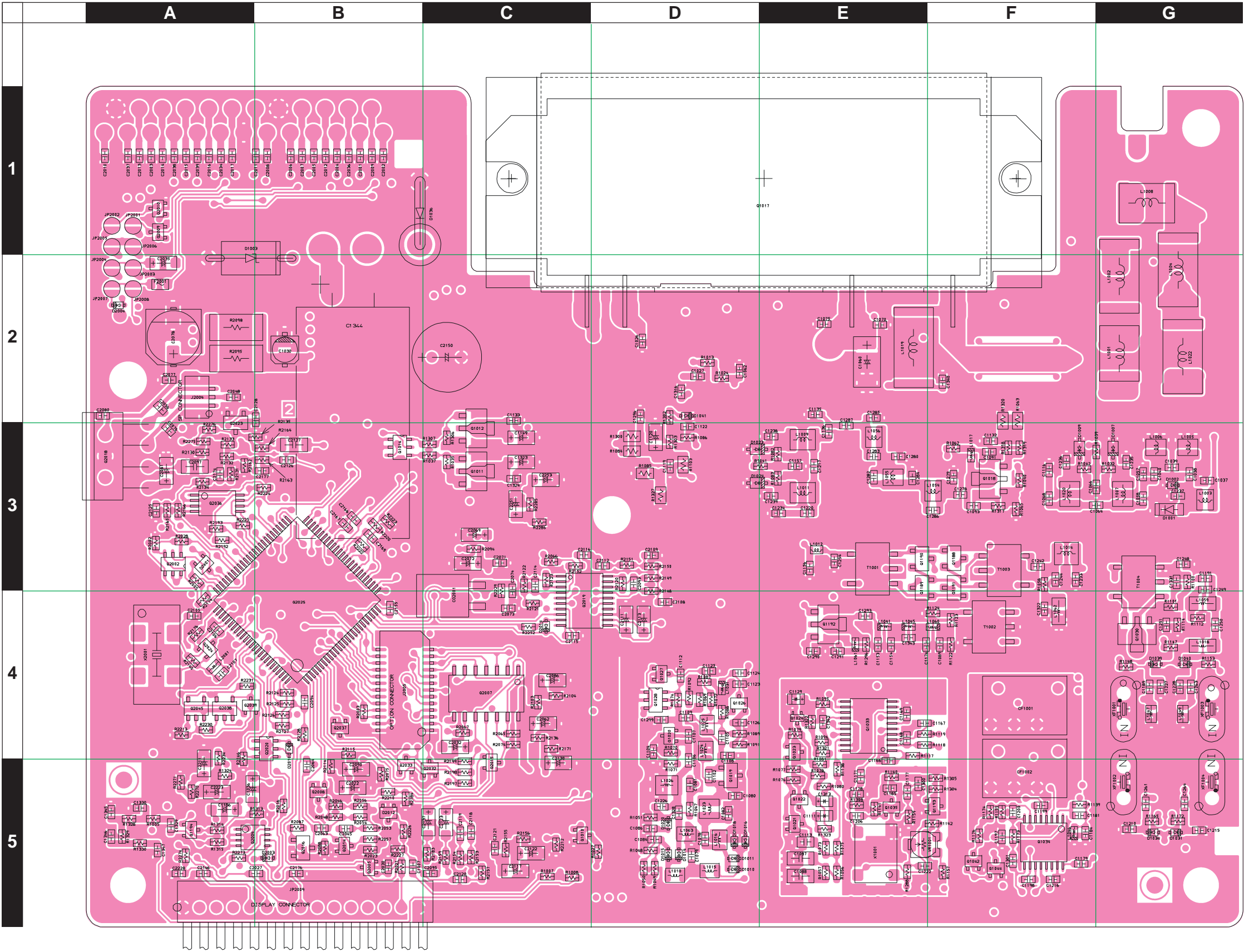
Circuit Diagram



MAIN UNIT (FR008100C)

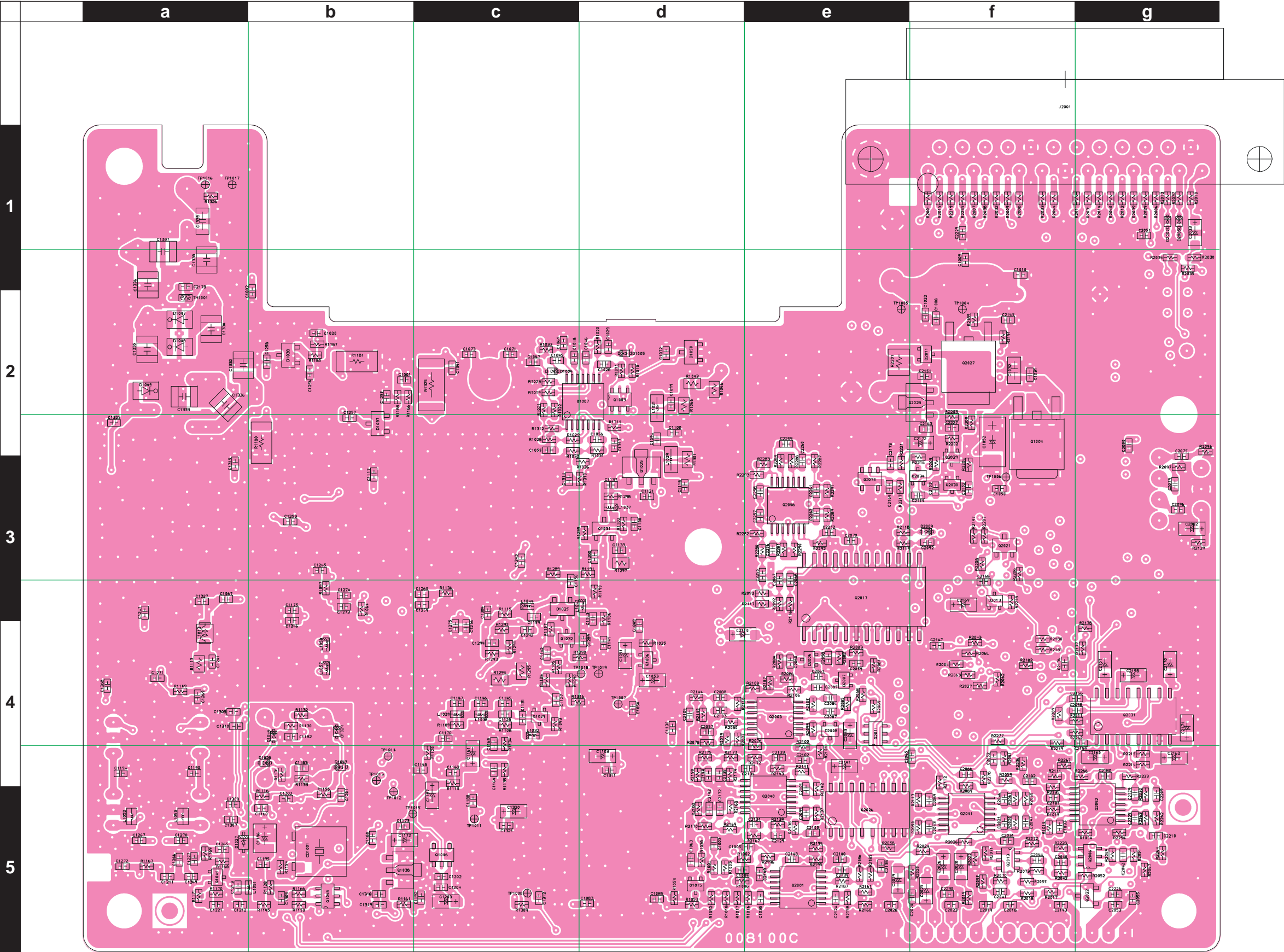


Parts Layout (Side A)

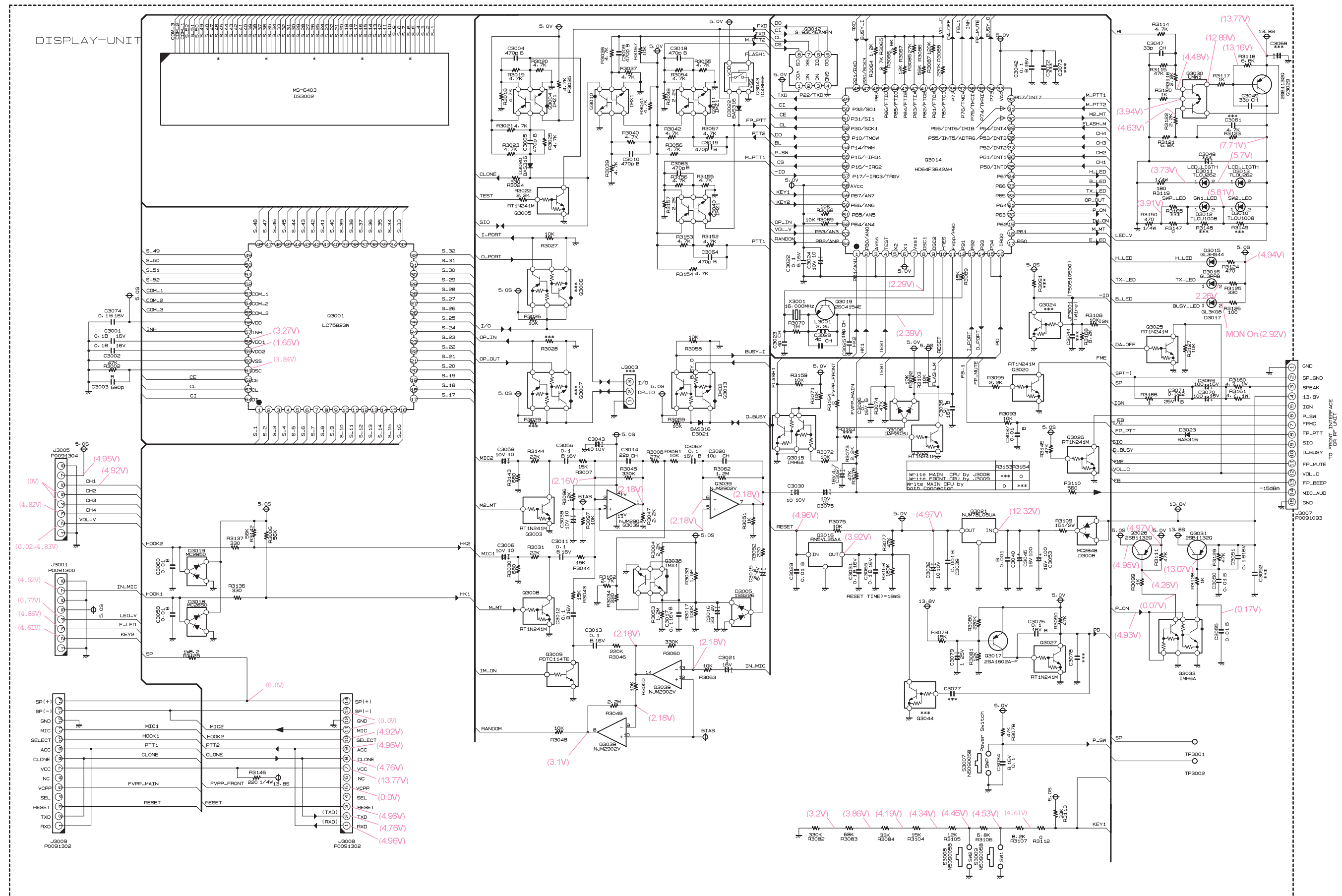


MAIN UNIT (FR008100C)

Parts Layout (Side B)

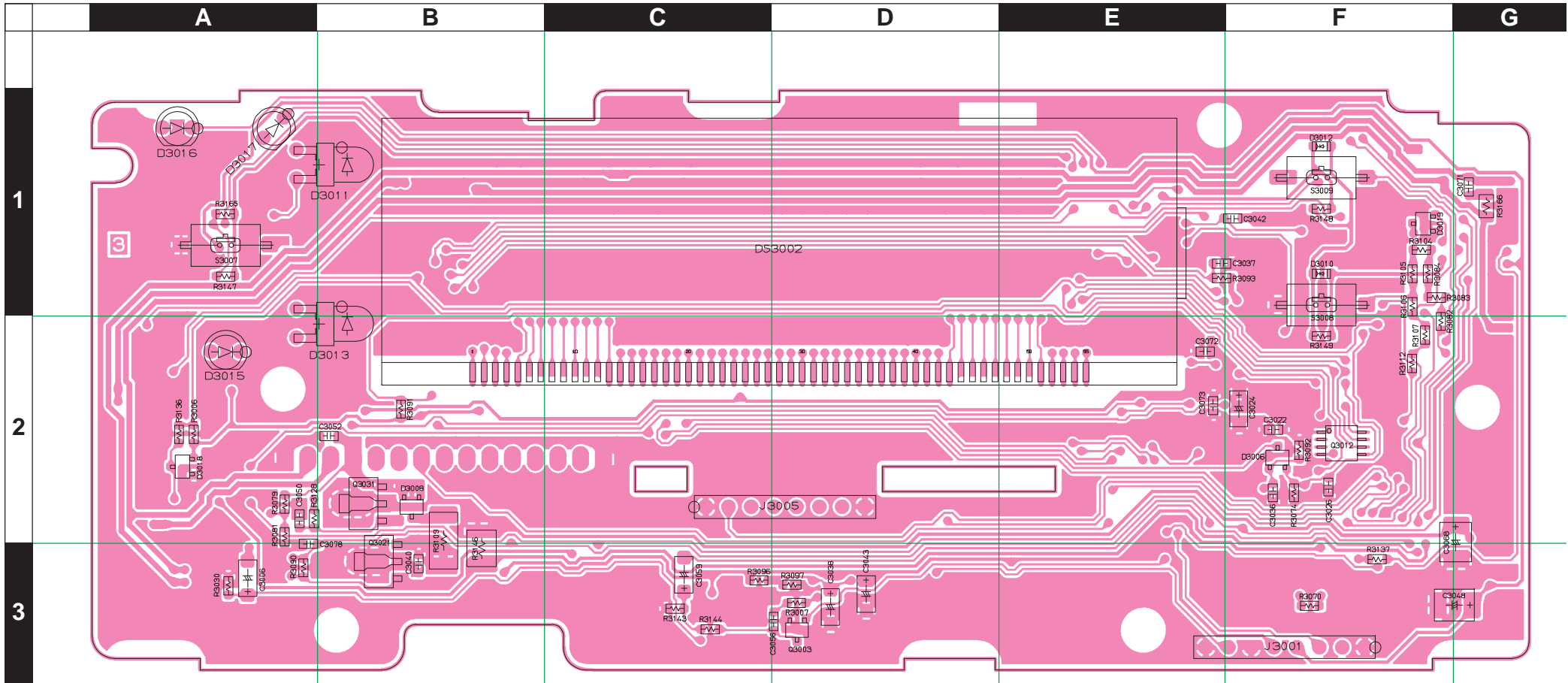


Circuit Diagram

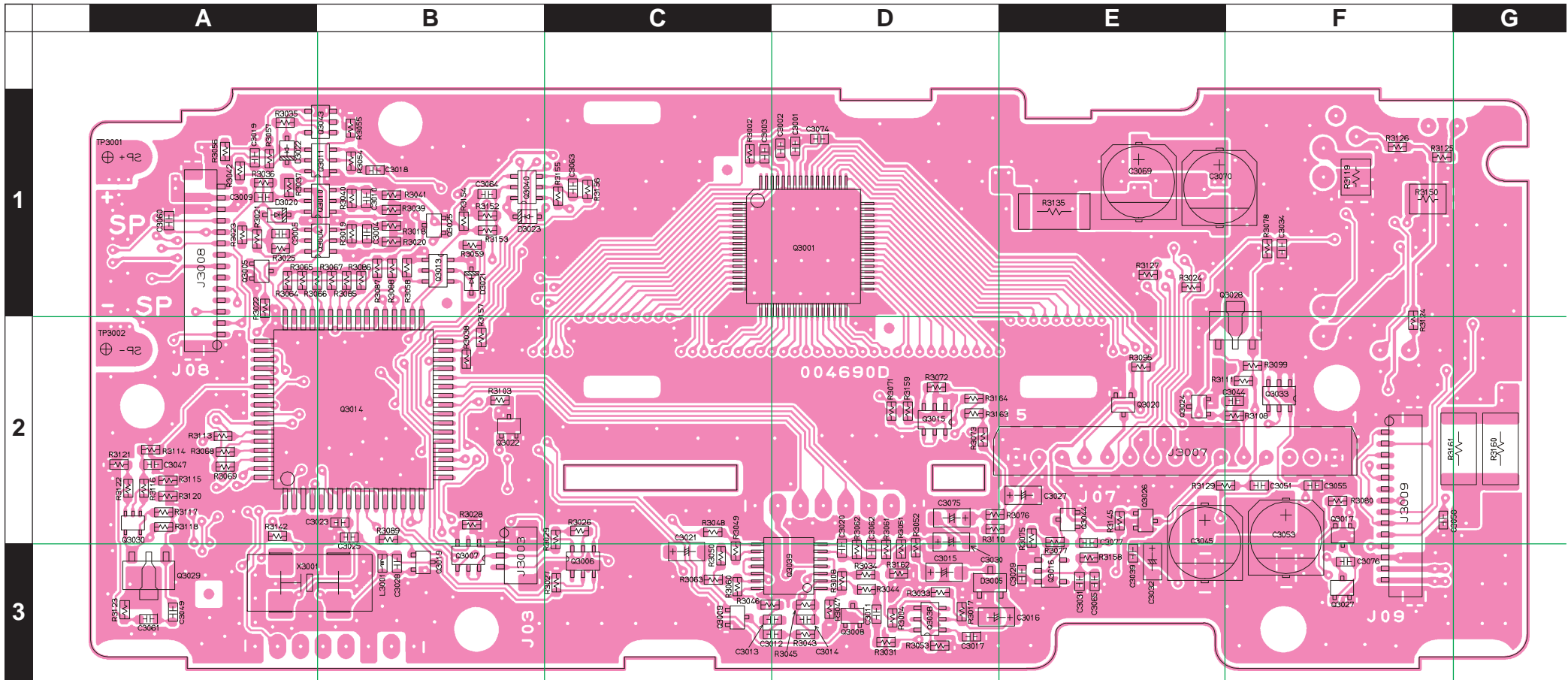


DISPLAY UNIT (FR004690D)

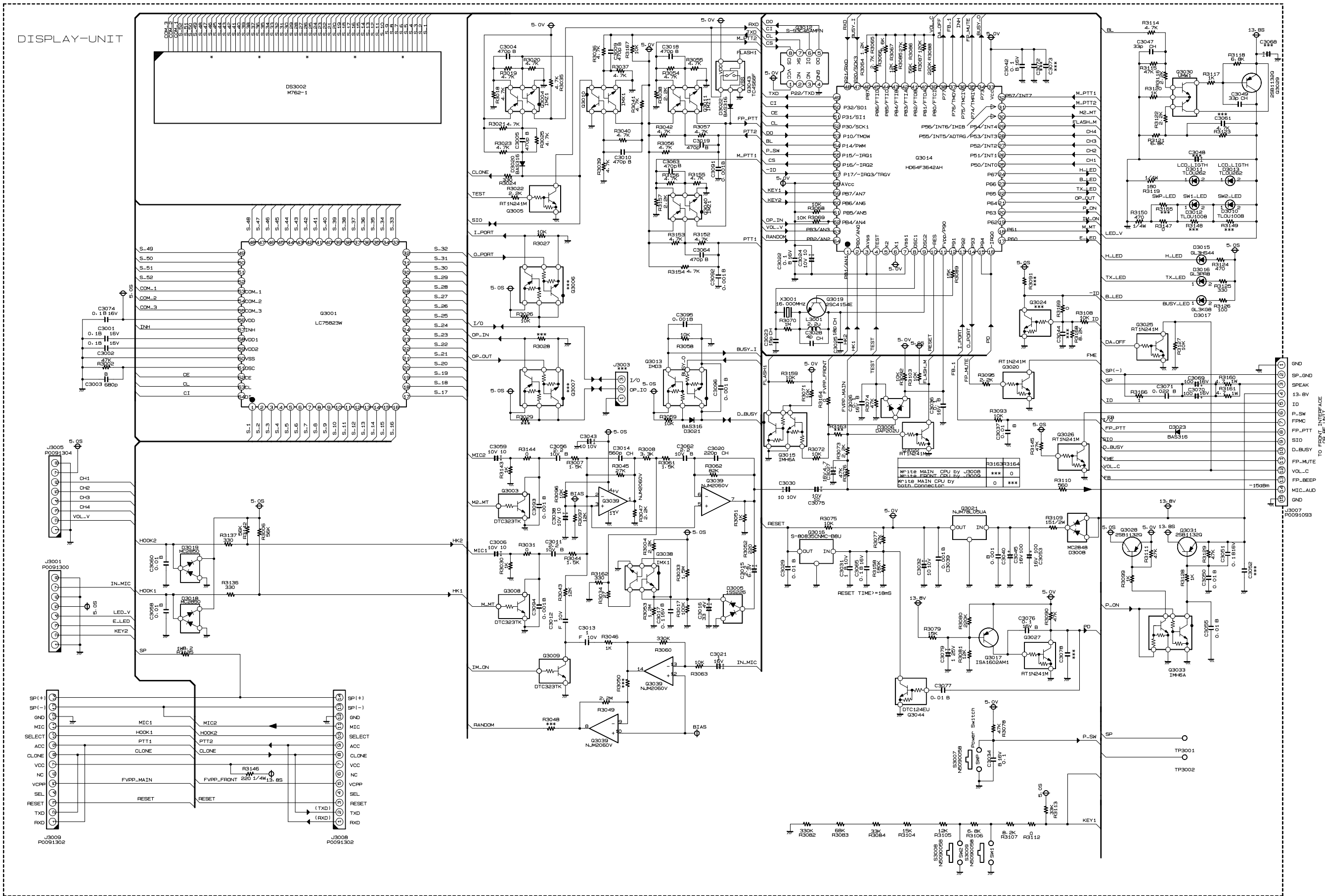
Parts Layout (Side A)



Parts Layout (Side B)

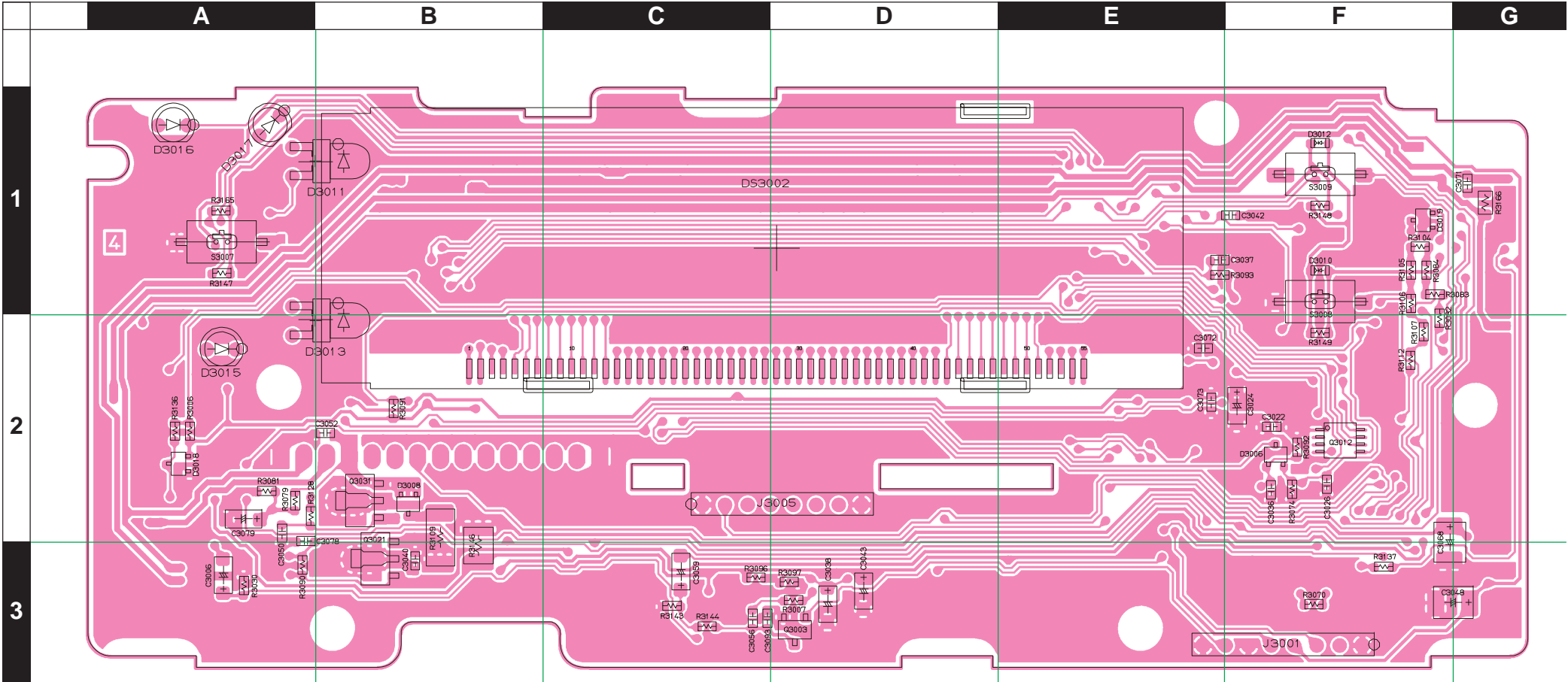


Circuit Diagram

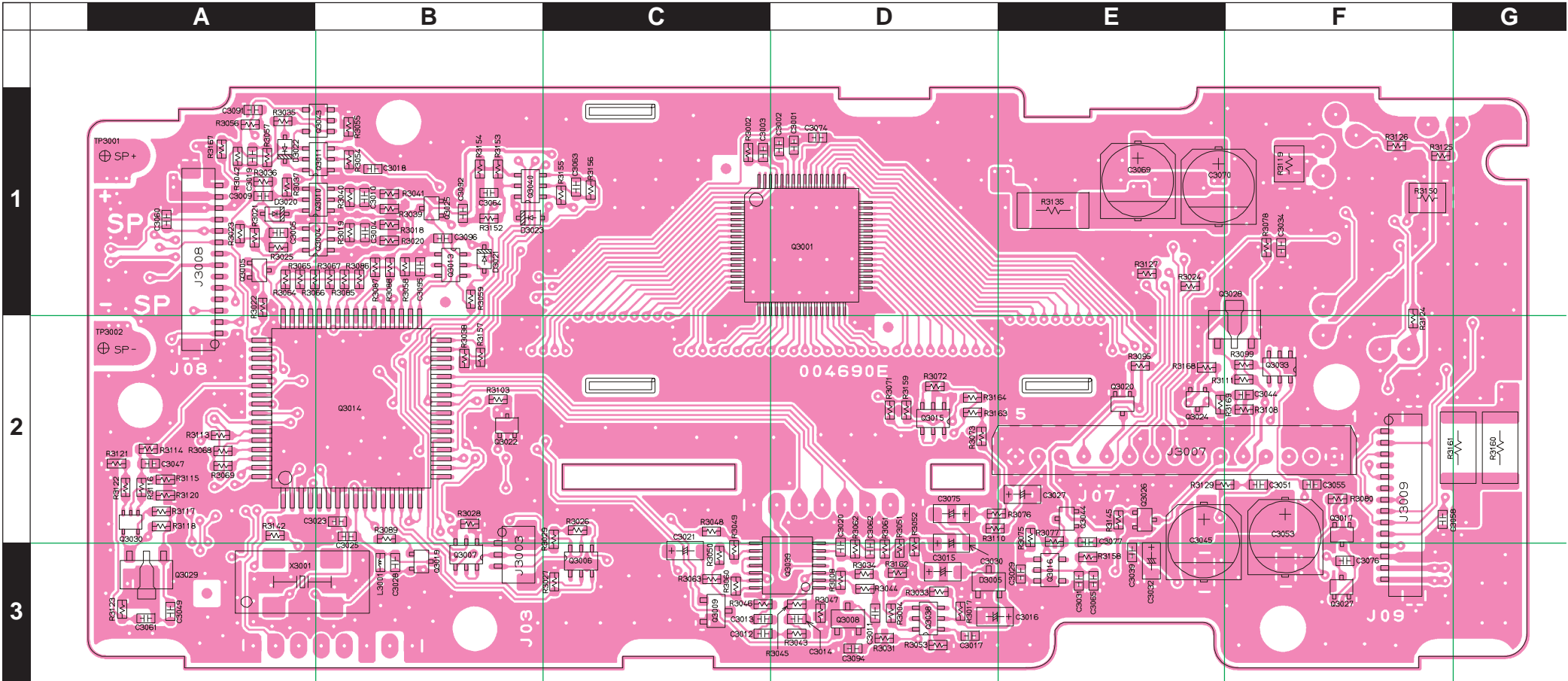


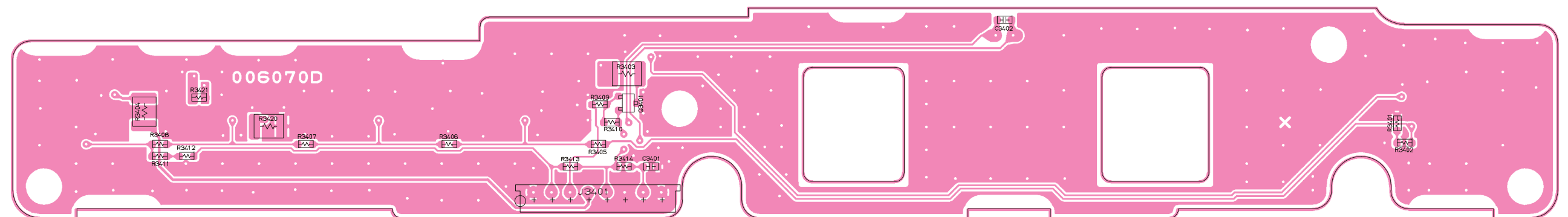
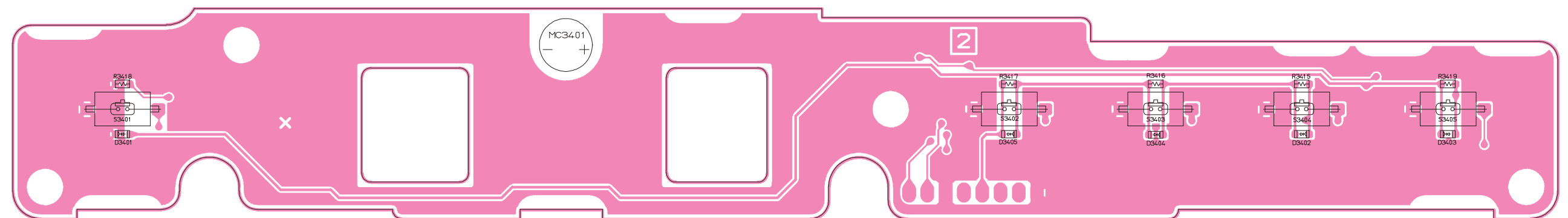
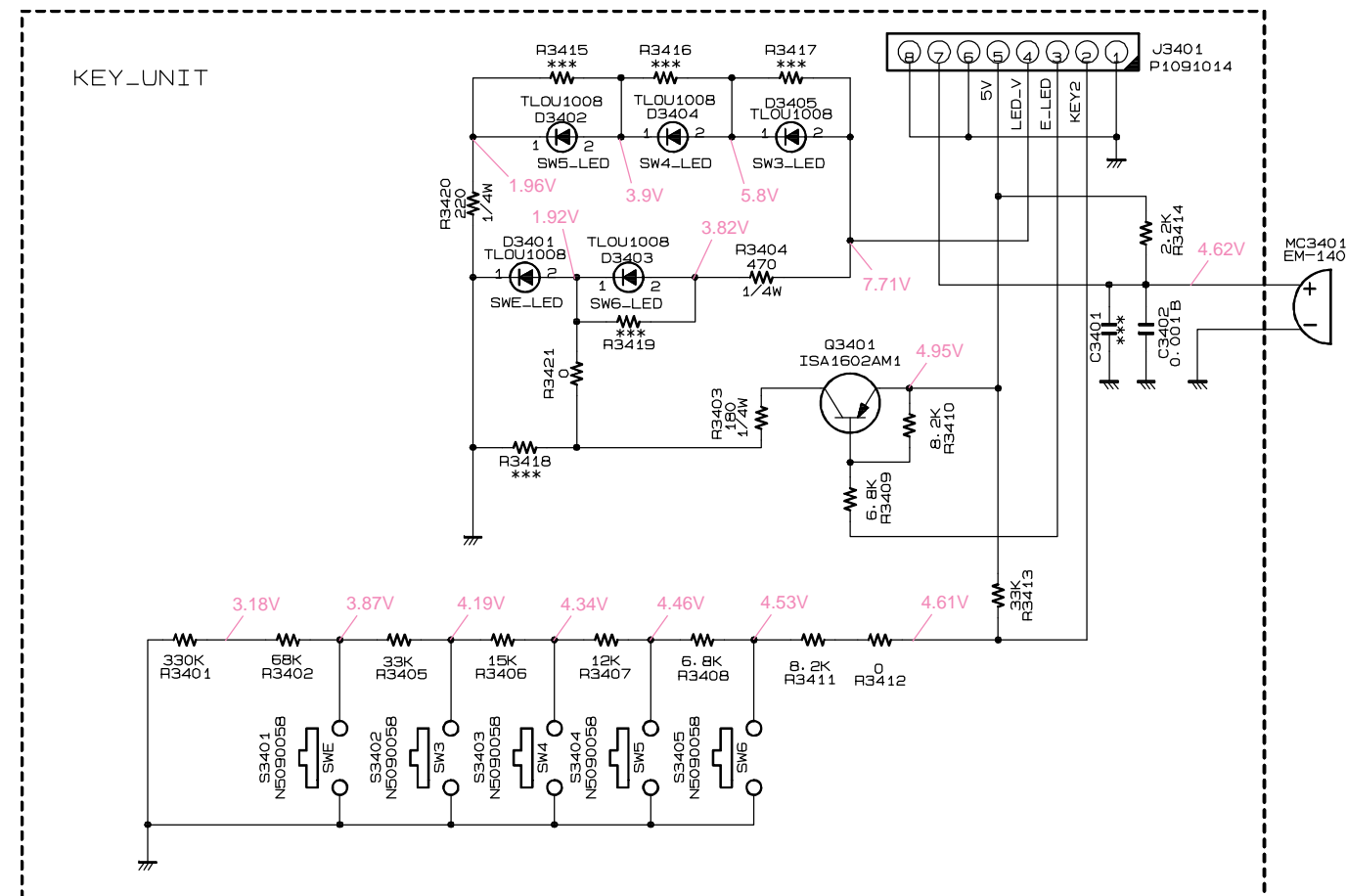
DISPLAY UNIT (FR004690E)

Parts Layout (Side A)



Parts Layout (Side B)

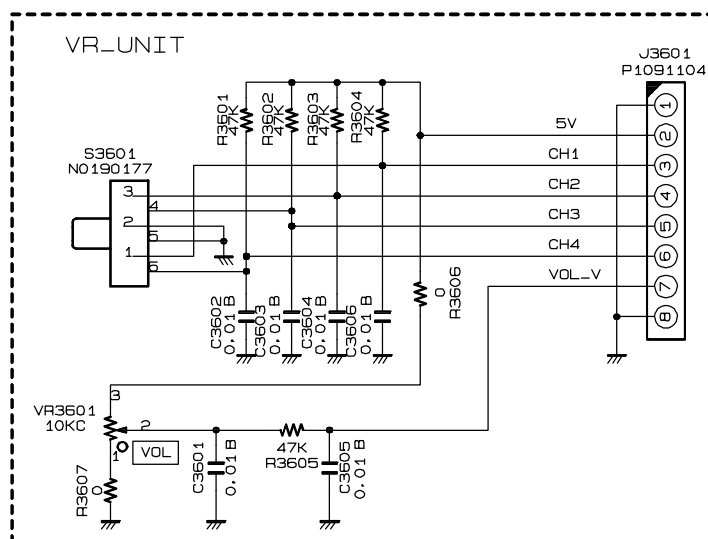




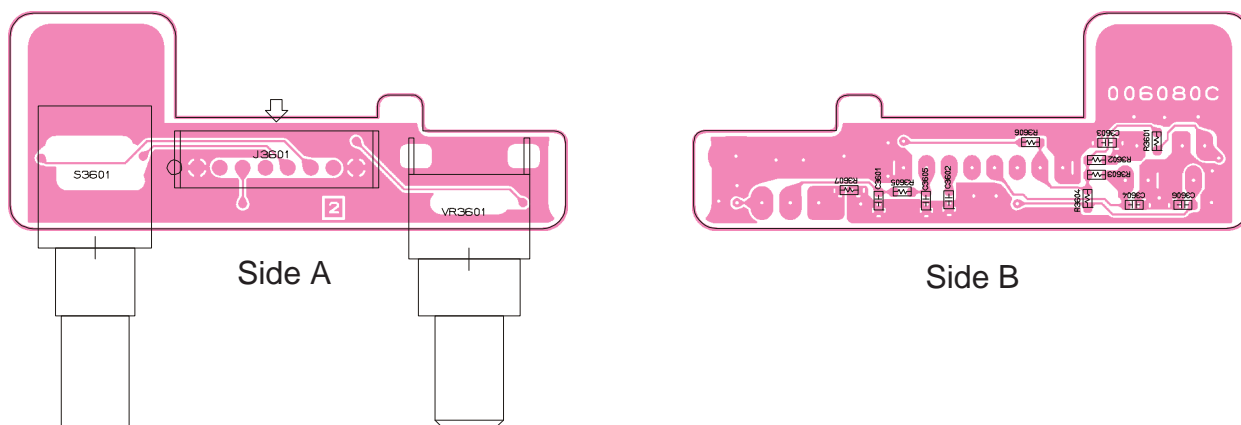
KEY UNIT

Note:

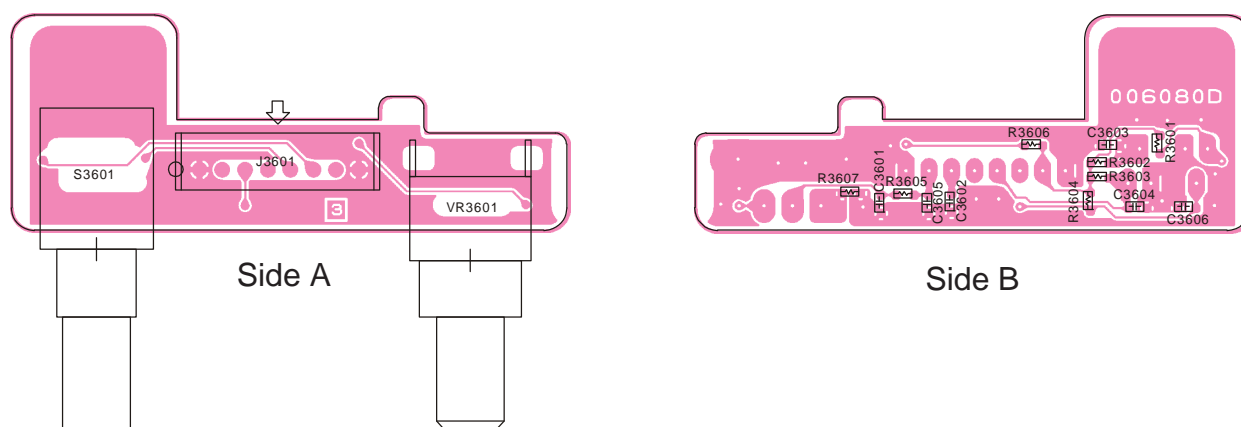
Circuit Diagram



Parts Layout (FR006080C)



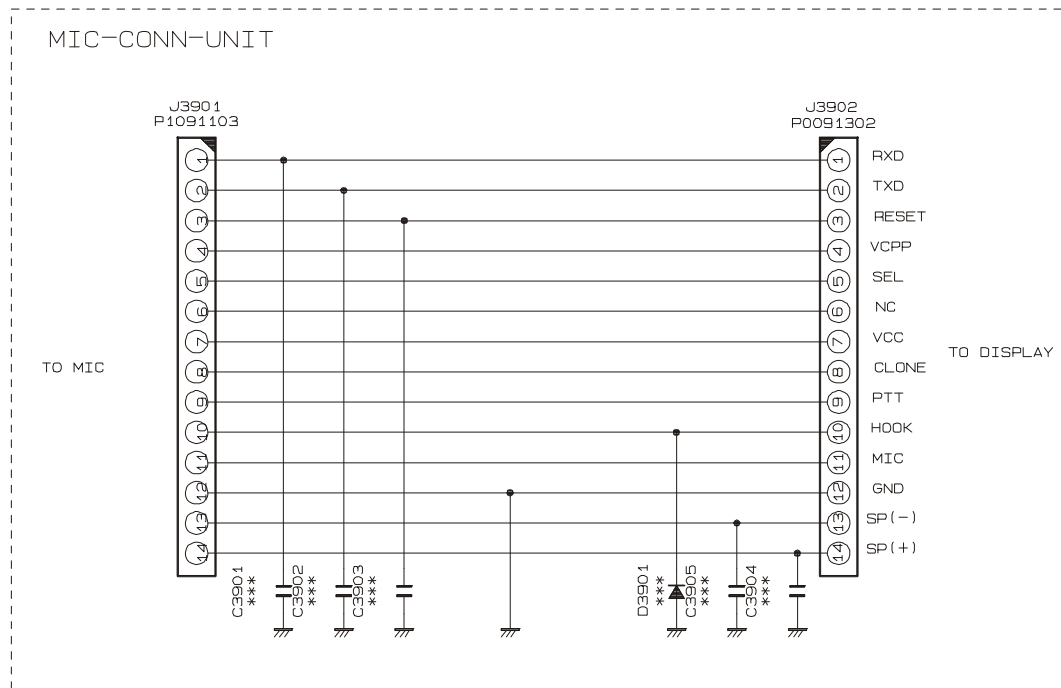
Parts Layout (FR006080D)



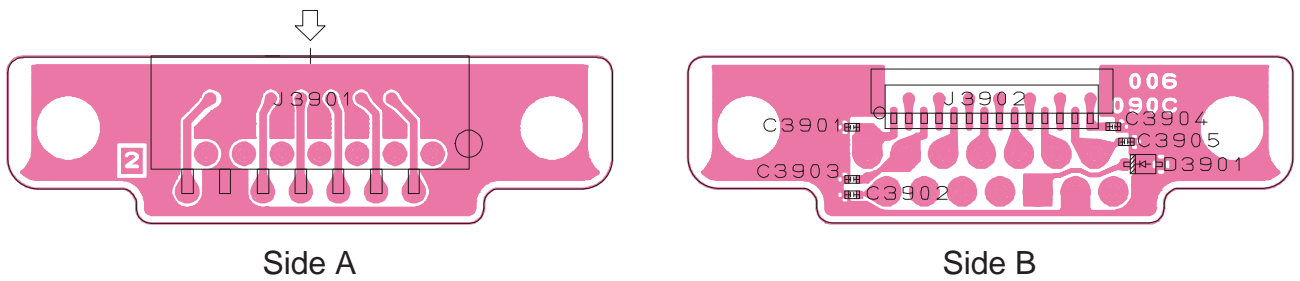
VR UNIT

Note

Circuit Diagram

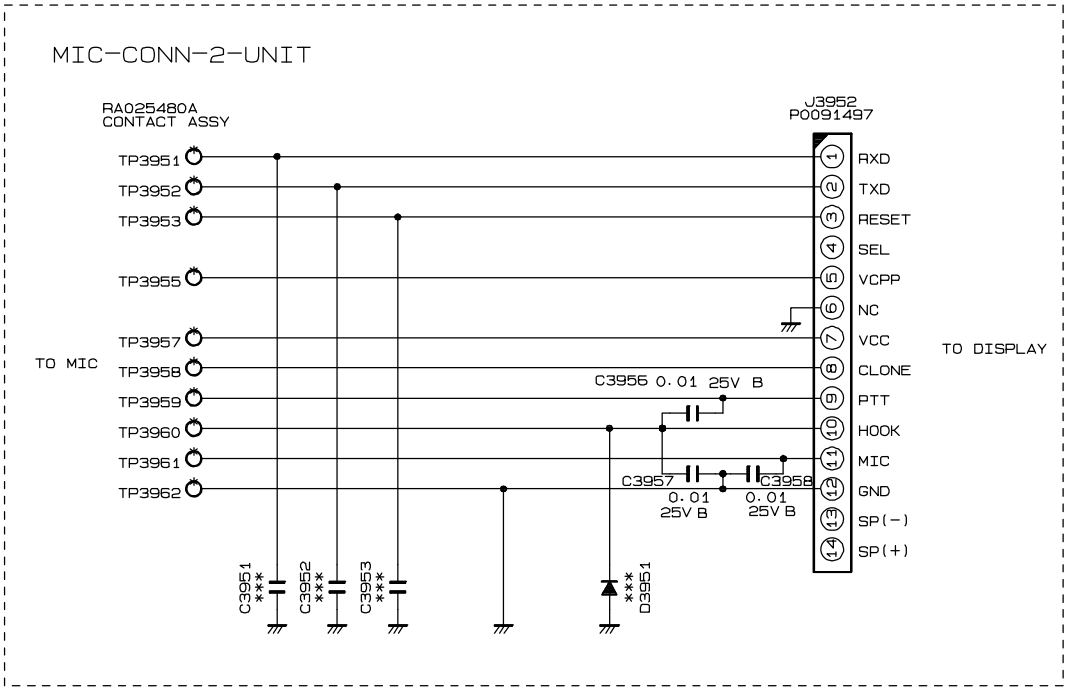


Parts Layout

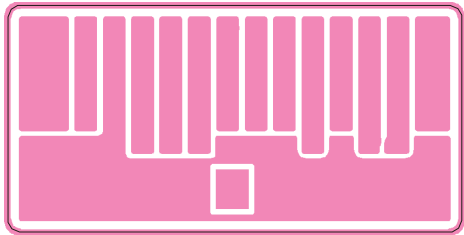


MIC CONN 2 UNIT

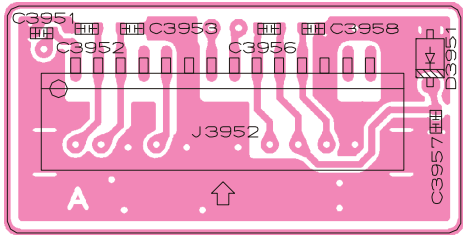
Circuit Diagram



Parts Layout

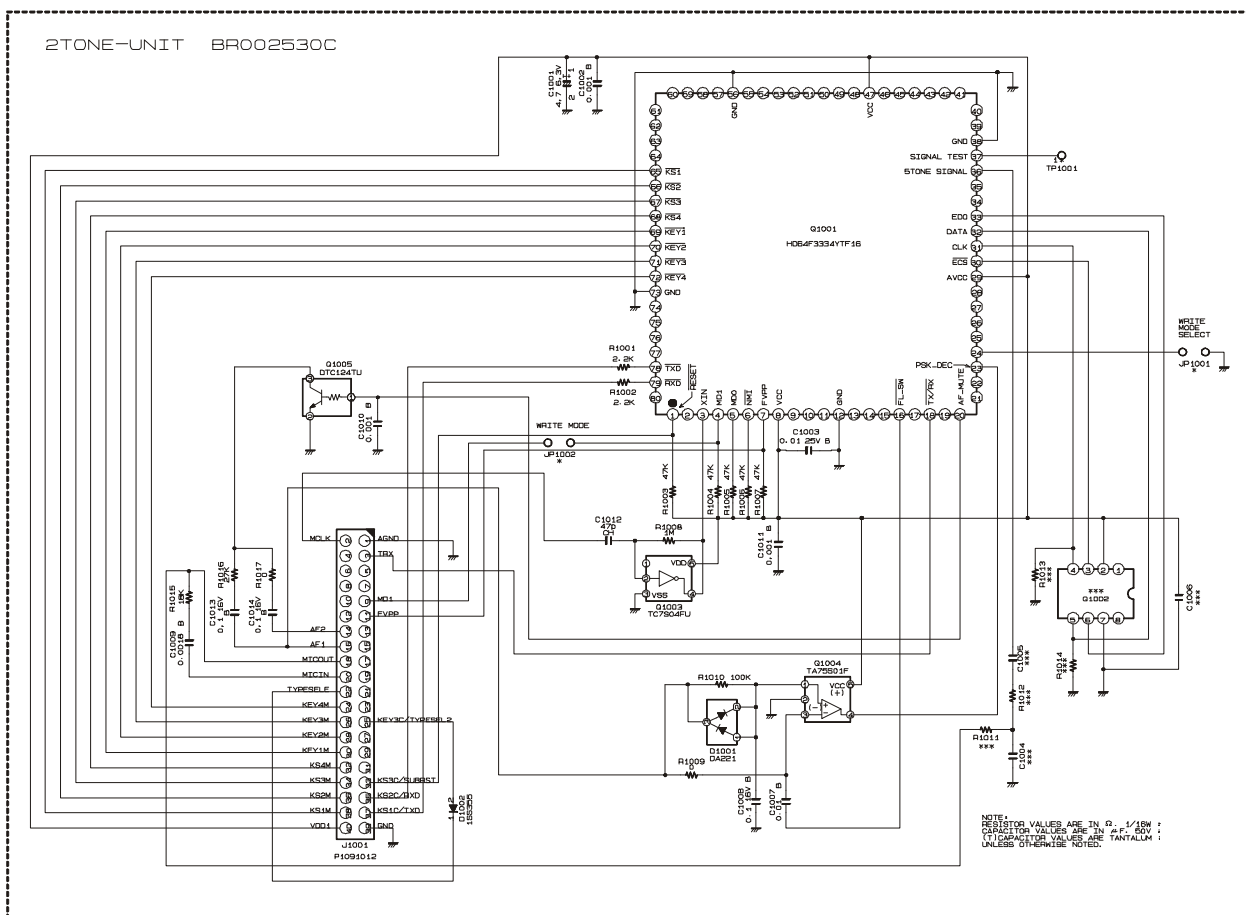


Side A

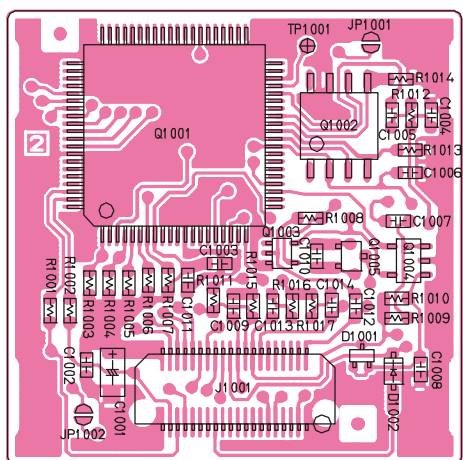


Side B

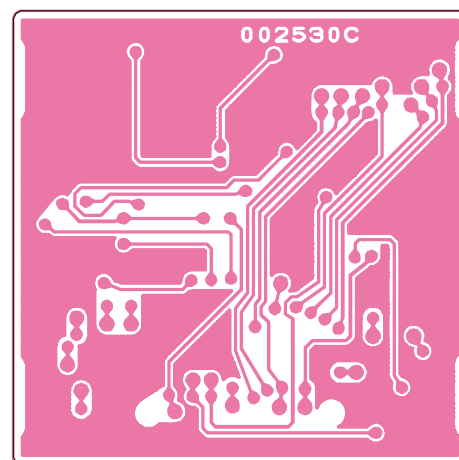
Circuit Diagram



Parts Layout

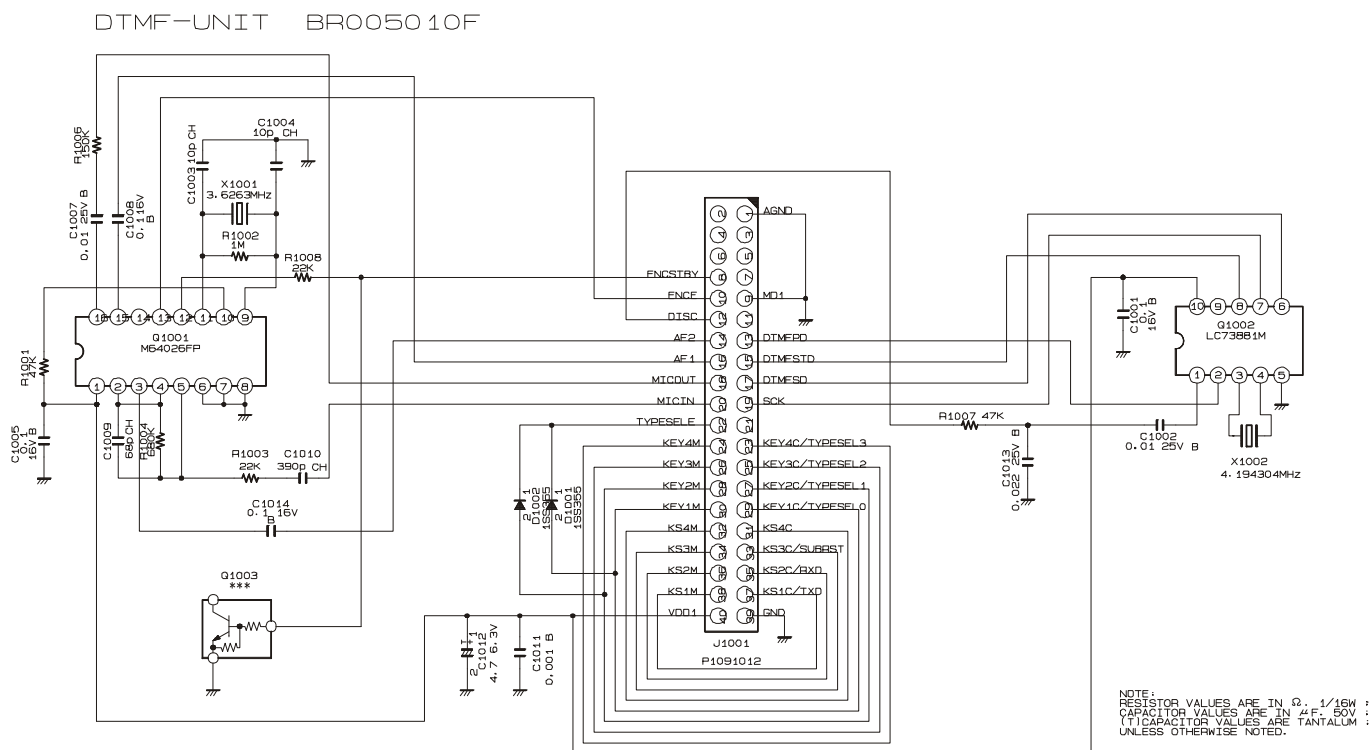


Side A

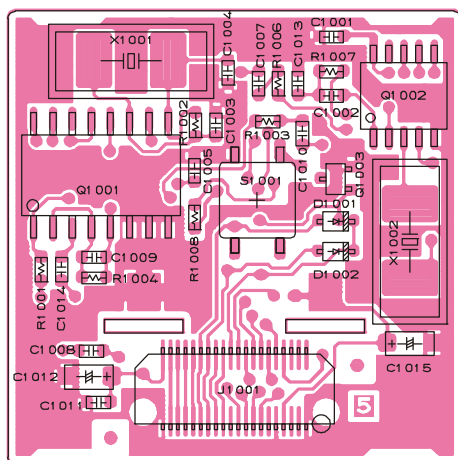


Side B

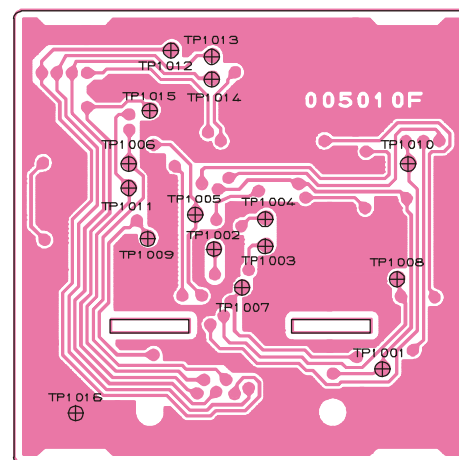
Circuit Diagram



Parts Layout



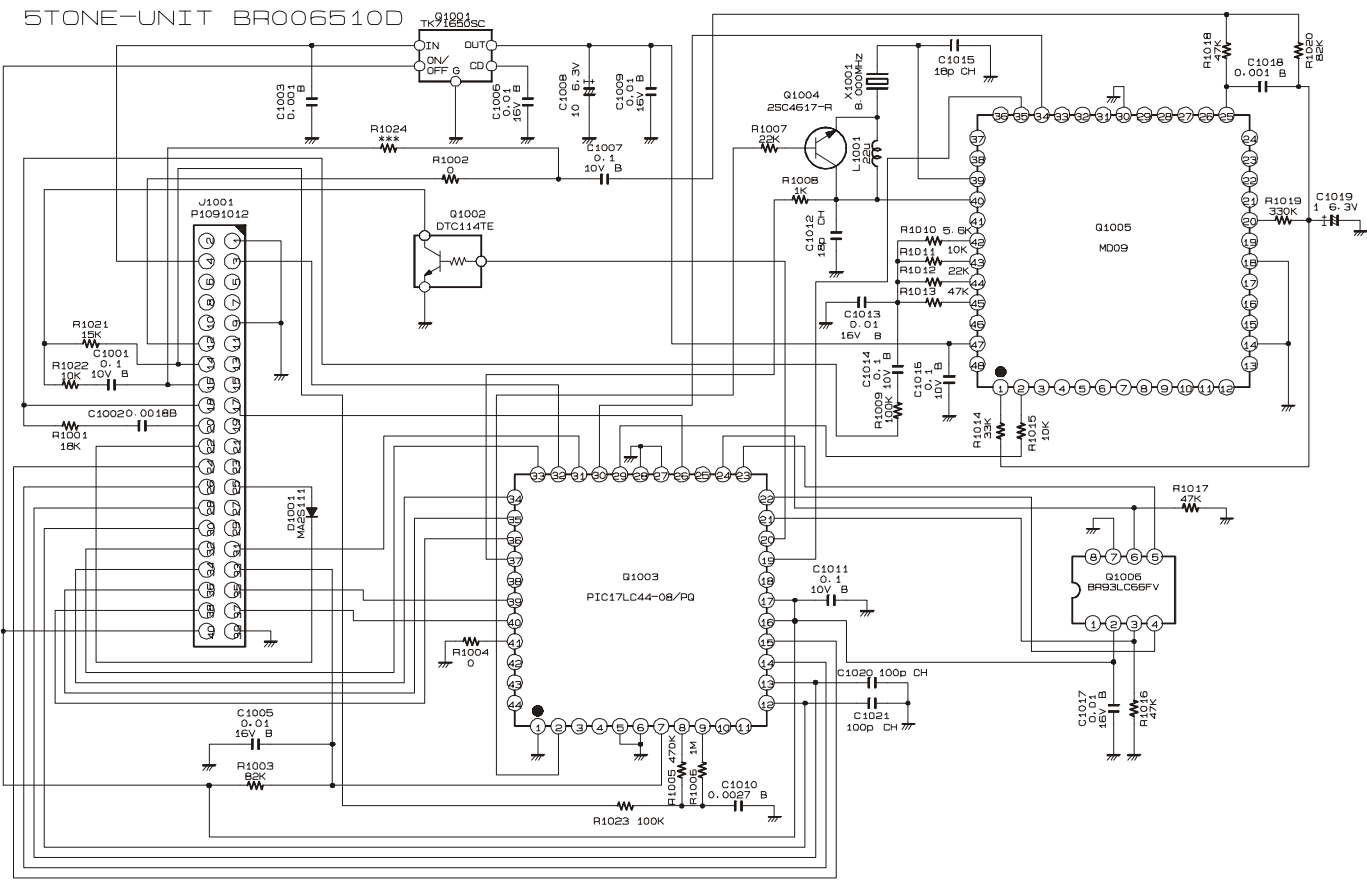
Side A



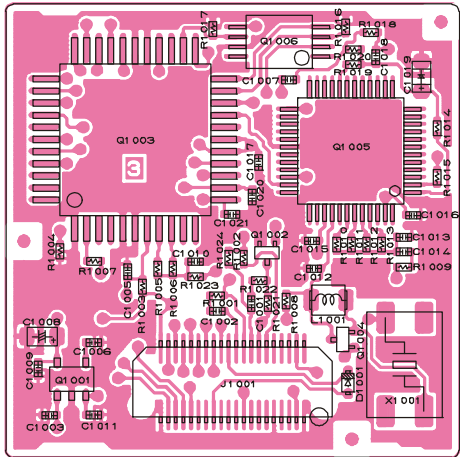
Side B

F5D-14 5-TONE UNIT

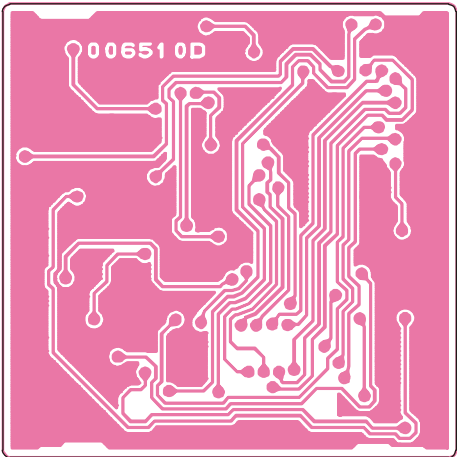
Circuit Diagram



Parts Layout

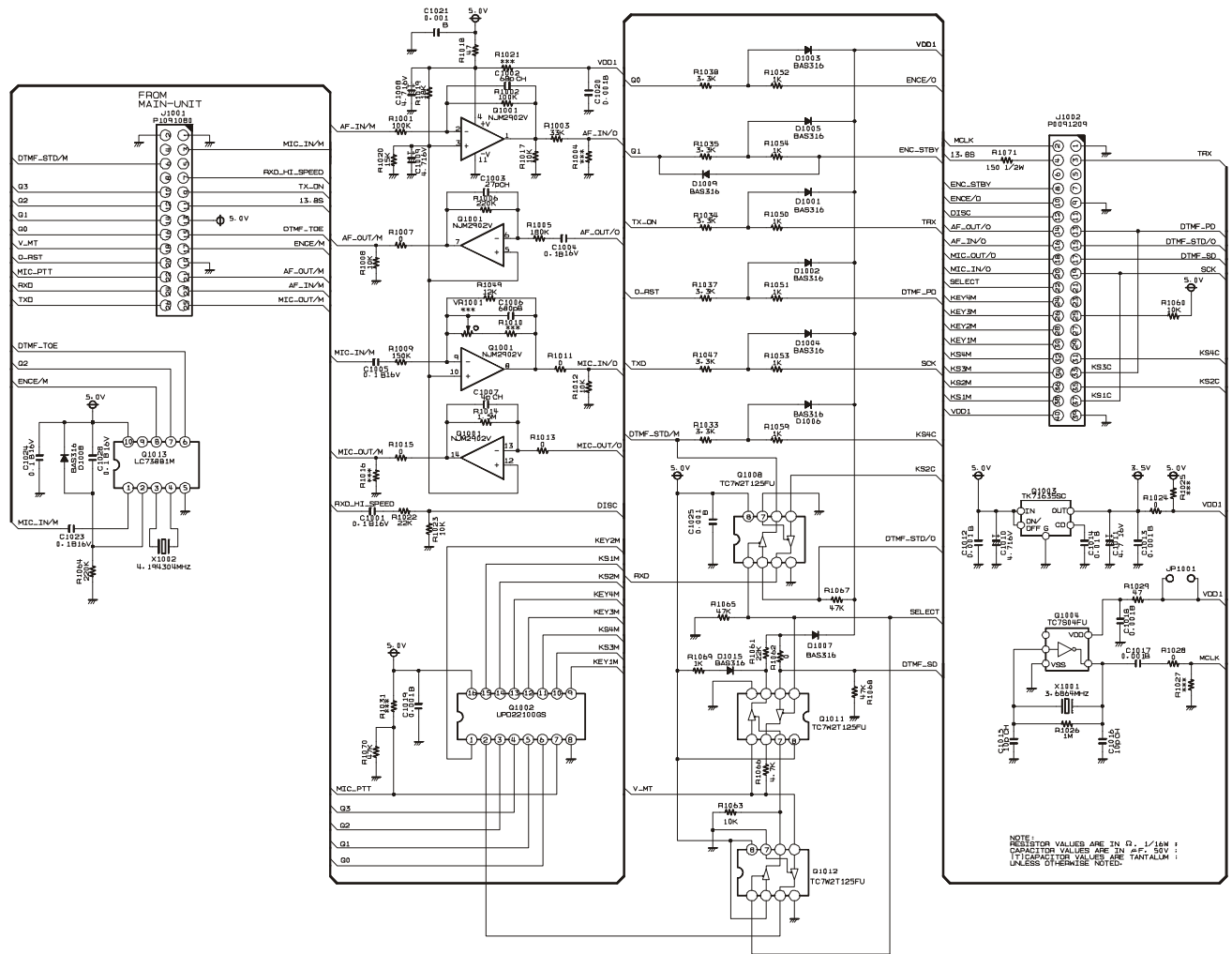


Side A

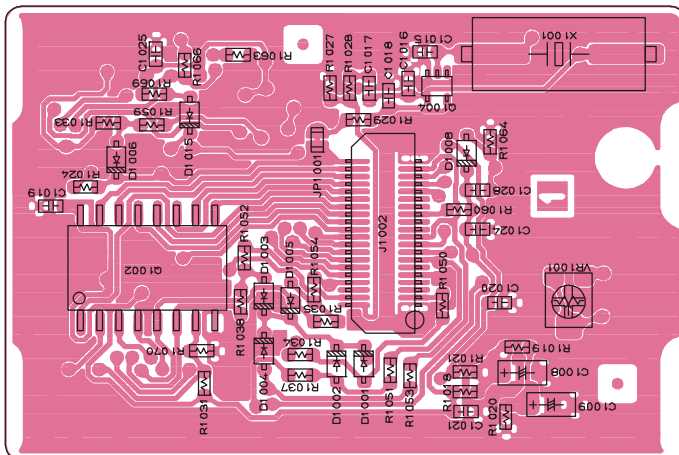


Side B

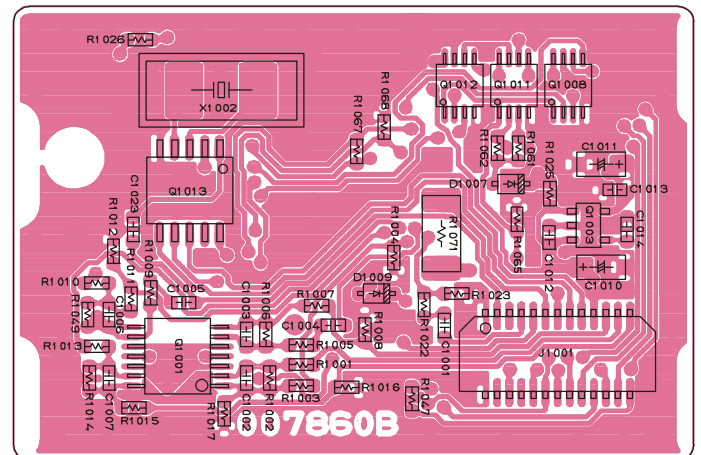
Circuit Diagram



Parts Layout



Side A



Side B



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