



VHF FM Transceiver

VX-2500V

Service Manual

© 2003 VERTEX STANDARD CO., LTD. (EC031N90A)

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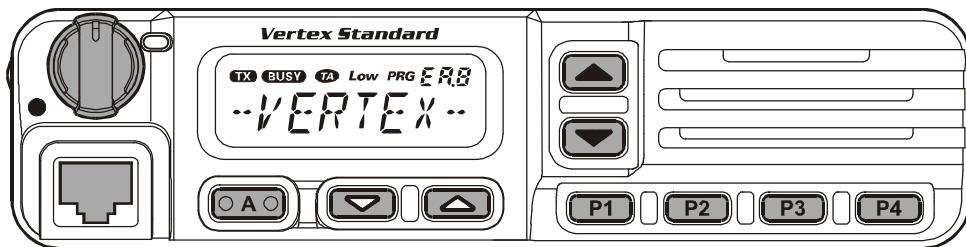
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Introduction

This manual provides technical information necessary for servicing the VX-2500V 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 the board is referred to by the type of the majority of components installed on that side ("leaded" or "chip-only"). In most cases one side has only chip components, and the other has either a mixture of both chip and leaded components (trimmers, coils, electrolytic capacitors, ICs, etc.), or leaded components only.

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

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Specifications

General

Frequency range:	134-160 MHz (Type A) 148-174 MHz (Type C)
Number of Systems:	32
Number of Groups:	250
Number of Channels :	250 channels (Conventional) 640 channels (<i>Trunking</i>)
PLL Steps:	5.0 kHz / 6.25 kHz
Power Supply Voltage:	13.8V DC ±15 %
Channel Spacing:	12.5 / 25.0 kHz
Current Consumption (Approx.):	TX: 6 A RX: 700 mA STBY: 250 mA
Operating Temperature range:	-22 °F to 140 °F (-30 °C to +60 °C)
Frequency Stability:	Better than ±2.5 ppm
RF Input-Output Impedance:	50 ohms
Audio Output Impedance:	4 ohms
Dimensions:	6.3 x 1.6 x 4.3 inch (160 x 40 x 110 mm)
Weight (Approx.):	1.87 lb (0.85 kg)

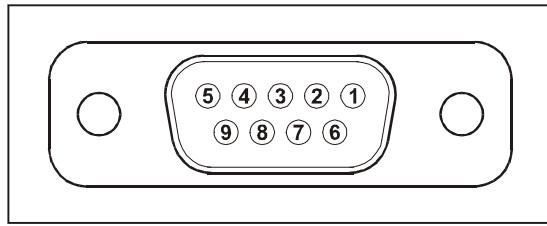
Receiver (Typical Values)

Circuit type:	Double conversion Super-heterodyne
Sensitivity:	0.25 uV (12 dB SINAD)
Adjacent Channel Selectivity:	80/70 dB
Intermodulation:	75 dB
Spurious and Image Rejection:	90 dB
Audio Output:	4 W @ 4 ohms 5% THD
Audio Distortion:	<3 % @1 kHz

Transmitter (Typical Values)

Power Output:	25 W (low: 5W)
Modulation:	16K0F3E, 11K0F3E
Max Deviation:	5.0/2.5 kHz
Conducted Spurious Emission:	70 dB below carrier
Audio Distortion:	<3 % @ 1 kHz
Microphone type:	Dynamic
Microphone impedance:	600 ohms

DSUB 9-pin Accessory Connector



Pin 1: Output Logic squelch

High: Radio receiving the signal with the correct CTCSS, DCS, or LTR ID.
Low: Radio not receiving the signal with the correct CTCSS, DCS, or LTR ID.

Pin 2: Output Rx discriminator

JP3 (JP1503) - Flat: 10 Hz to 3.0 kHz (140 mVrms /STD deviation with 600 ohm termination)
or
JP4 (JP1504) - Filtered 300 Hz to 3.0 kHz (70 mVrms /STD deviation with 600 ohm termination)
* Note: JP3 is closed from the factory, and JP4 is not closed from the factory.

Pin 3: Input TX data to the radio modulator. (Flat: 10 Hz to 3.0 kHz) (40 mVrms /STD deviation)

Pin 4: Input DTR (to switch the radio operation between dispatch operation and Data mode)

[DTR Low: Turn on the Data transmission, less than 0.5 V]
[DTR High: Turn off the Data transmission, more than 4.0 V]

Pin 5: Ground

Pin 6: Output Horn alert signal (Open collector with maximum 16.0 V, 100 mA sink).

Pin 7: Input external PTT

[Low: Request the transmission]
[High: Request the Receiving]

Pin 8: Output supply voltage (Need to set the solder short on the PCB)

JP1 (JP1501) Output 5.0 V (Maximum 100 mA output)
or

JP2(JP1502) Output 13.8 V (Maximum 100 mA output)
* Both JP1 and JP2 are not closed from the factory.

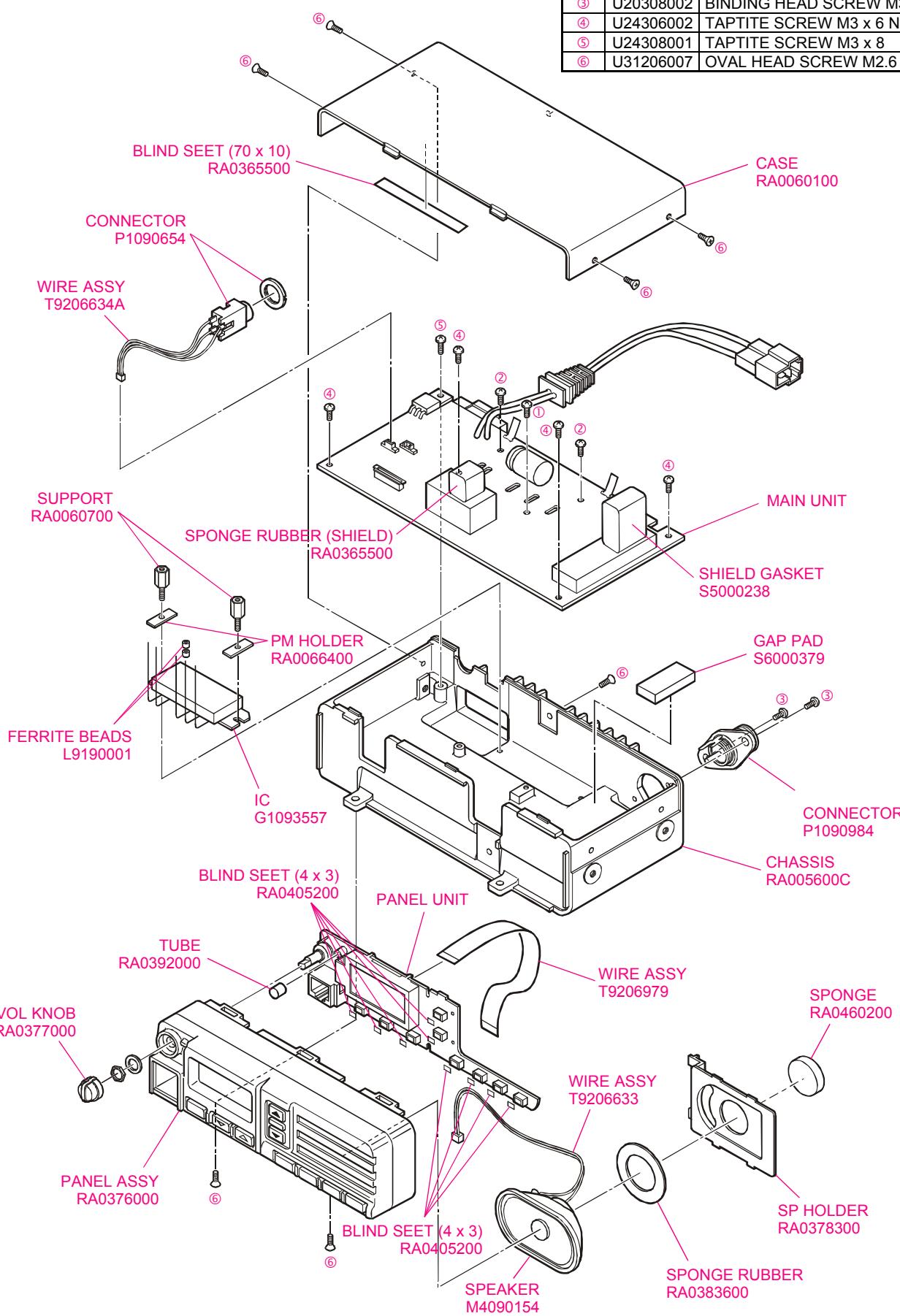
Pin 9: Input the ignition signal of the CAR.

This signal is for the following operation,

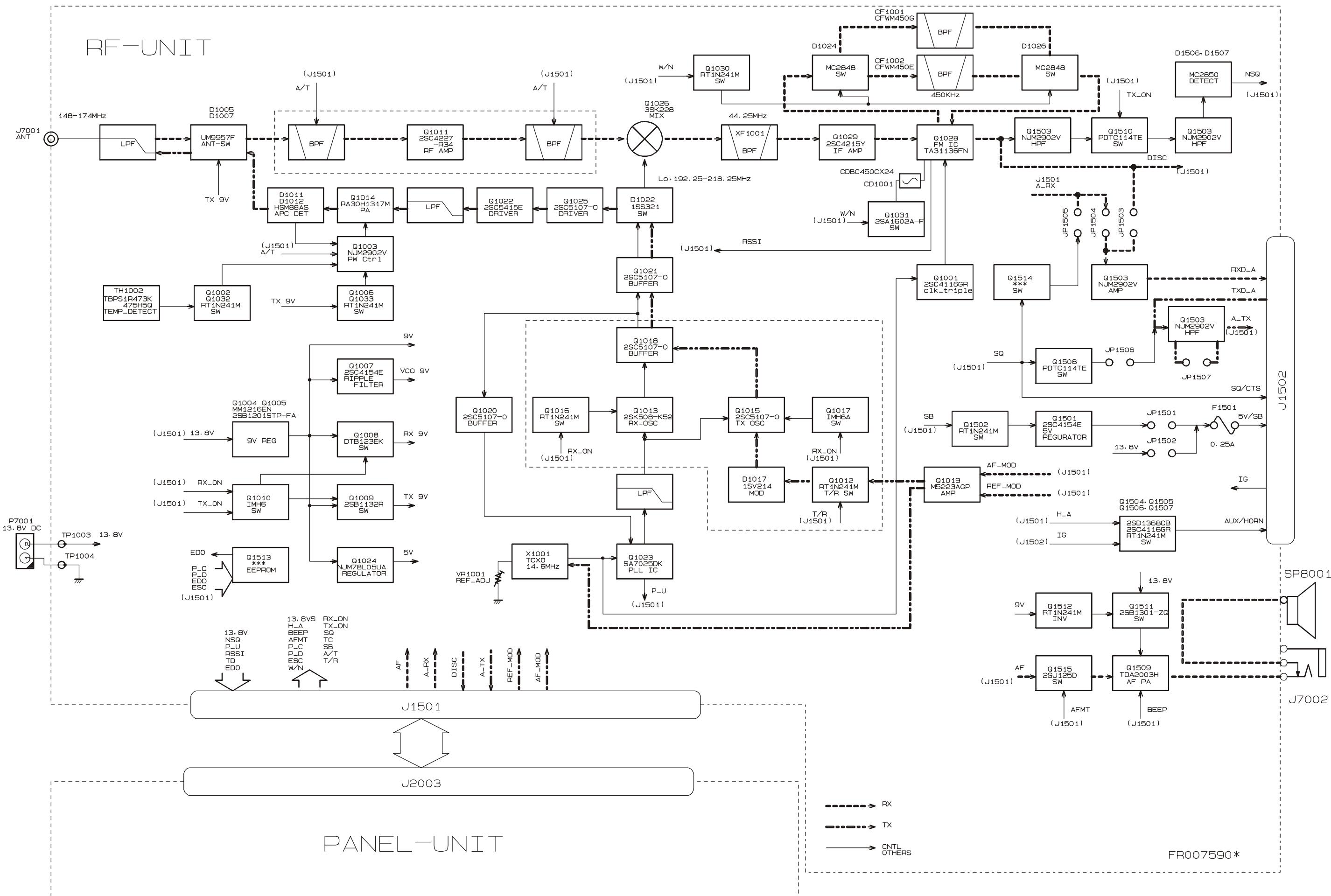
- (1) Disable the Horn alert during the ignition is turned on.
- (2) Turn on and off the radio. This function requires the solder short JP8 (JP1508).

Exploded View & Miscellaneous Parts

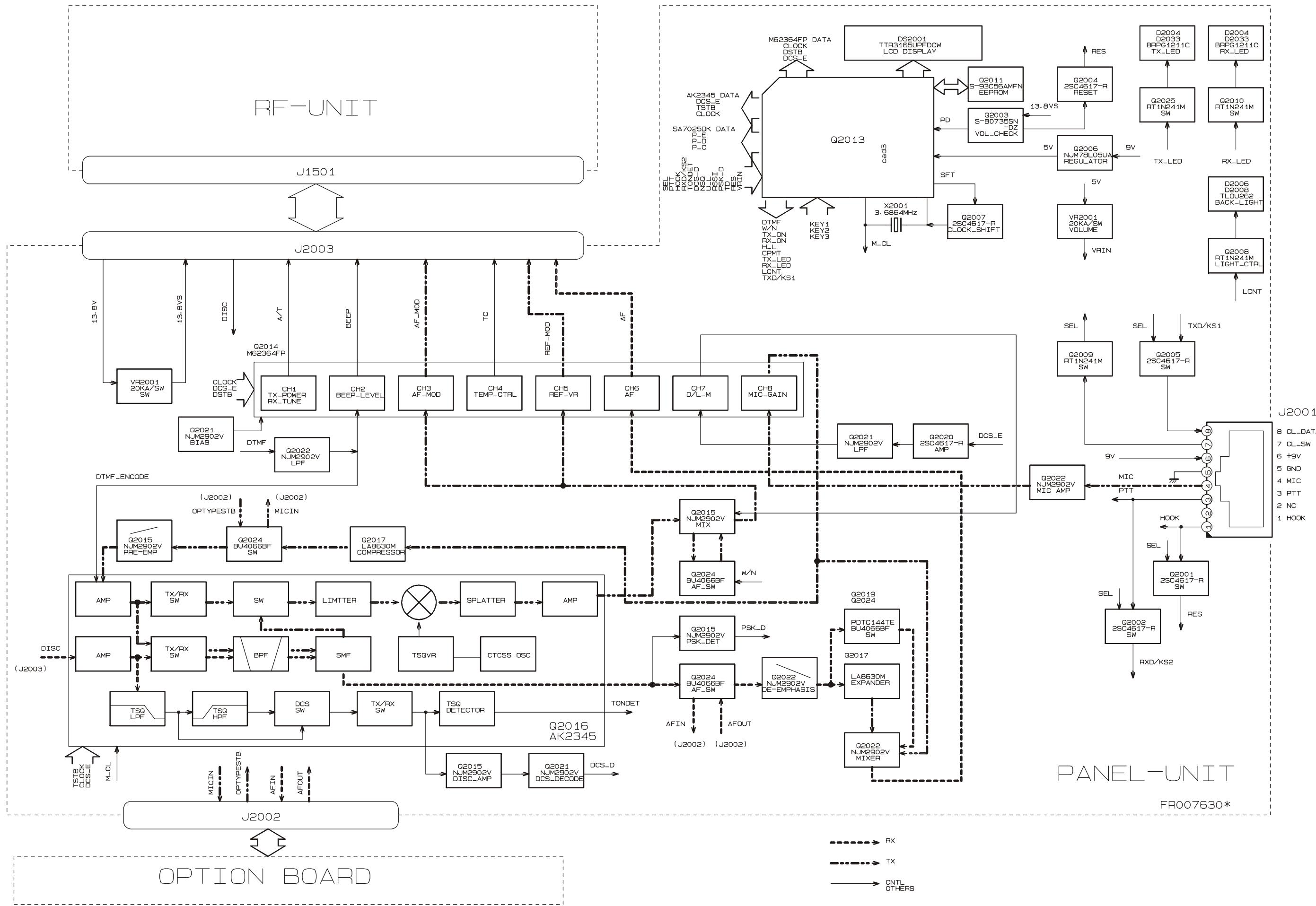
REF.	VXSTD P/N	DESCRIPTION	QTY.
①	U20206002	BINDING HEAD SCREW M2.6 x 6 NI	1
②	U20306002	BINDING HEAD SCREW M3 x 6 NI	2
③	U20308002	BINDING HEAD SCREW M3 x 8 NI	2
④	U24306002	TAPTITE SCREW M3 x 6 NI	4
⑤	U24308001	TAPTITE SCREW M3 x 8	1
⑥	U31206007	OVAL HEAD SCREW M2.6 x 6 B	7



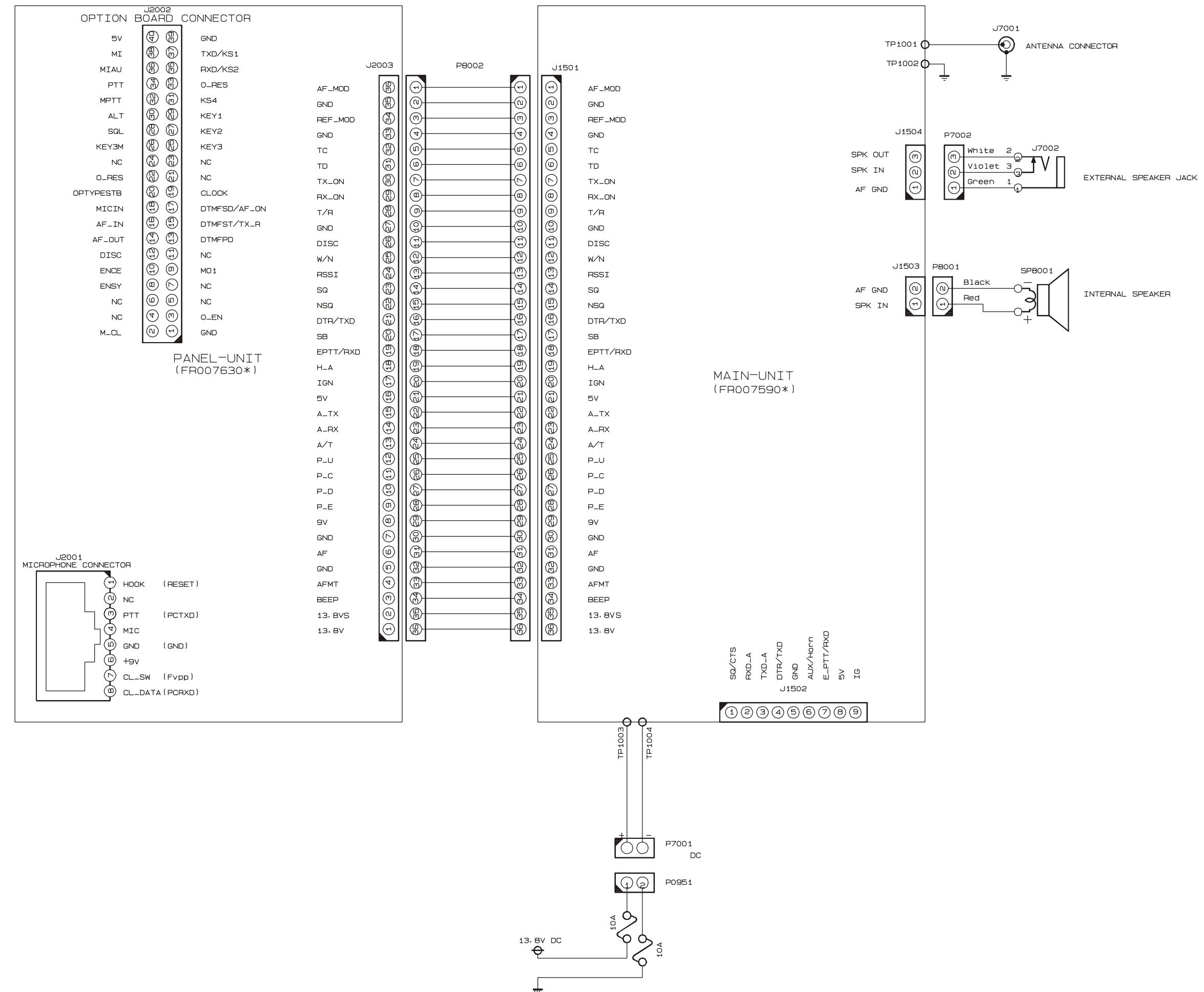
Block Diagram (1)



Block Diagram (2)



Interconnection Diagram



Note

Introduction

The **VX-2500V** is 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 altering version type. All component replacement and service should be performed only by an authorized Vertex Standard representative, or the warranty policy may be void.

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 subsequently are placed, 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 reserves 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 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

- RF Signal Generator with calibrated output level at 500MHz
- Deviation Meter (linear detector)
- In-line Wattmeter with 5% accuracy at 1000MHz
- 50Ω RF Dummy Load with power rating 100W at 500MHz
- 4Ω AF Dummy Load
- Regulated DC Power Supply (standard 13.8V DC, 15A)
- Frequency Counter with 0.1ppm accuracy at 500MHz
- AC Voltmeter
- DC Voltmeter
- VHF Sampling Coupler
- IBM PC/compatible Computer
- Oscilloscope
- Vertex Standard **VPL-1** Connection Cable & Alignment program

Alignment Preparation & Precautions

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

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

Correct alignment requires that the ambient temperature be the same as that of the transceiver and test equipment, and that this temperature be held constant between 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 time to come to room temperature before alignment.

Whenever possible, alignments should be made with oscillator shields and circuit boards firmly affixed in place.

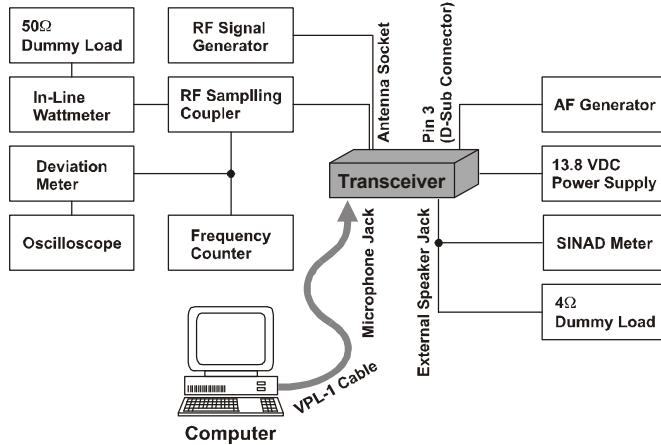
Also, the test equipment must be thoroughly warmed up before beginning.

Note: Signal levels in dB referred to in the alignment procedure are based on 0dBm EMF = 0.5mV.

Alignment

Setup the test equipment as shown below, apply 13.8V DC power to the transceiver.

The transceiver must be programmed for use in the intended system before alignment is attempted. The RF parameters are loaded from the file during the alignment process.



Important

In order to facilitate alignment over the complete switching range of the equipment it is recommended that the channel data in the transceiver is preset as the chart below.

CHANNEL	CHANNEL SPACE	FREQUENCY (SIMPLEX)	
		Version A	Ver. C
CH 1	Wide	147.100 MHz	161.100 MHz
CH 2	Narrow	147.100 MHz	161.100 MHz
CH 3	Wide	134.100 MHz	148.100 MHz
CH 4	Wide	159.900 MHz	173.900 MHz

The alignment mode is accessed by "Alignment mode" command from the computer whilst switching on. And it is operated by the alignment tool automatically.

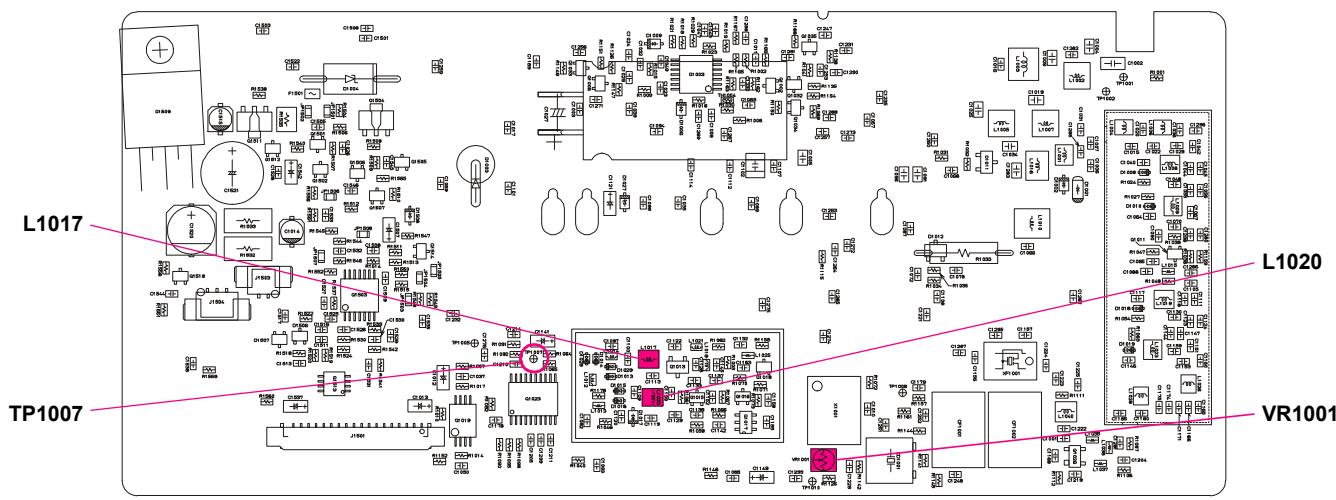
During the alignment mode, normal operation is suspended. Use the alignment tool program running on PC.

PLL VCV

- Connect the positive lead of the DC voltmeter to the test point **TP1007** (VCV) on the RF-Unit, as indicated in the figure, and the negative lead to chassis ground.
- Set the transceiver to the high band edge frequency channel, then adjust coil **L1017** on the Unit for 7.25V on the voltmeter.
- Key the transmitter, and adjust coil **L1020** on the Unit for 7.25V on the voltmeter.
- Next select to the low edge frequency channel and confirm above 2.00V to 3.00V on the voltmeter.
- Key the transmitter, and confirm above 2.00V to 3.00V 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, key the transmitter and adjust **VR1001** on the RF-Unit, if necessary, so the counter frequency is within 100 Hz of the channel center frequency for the transceiver version.



RF Unit Test & Alignment Points

The alignment tool outline

Installation the tool

This alignment tool consists, MS-DOS based, only one execute file "svc47.exe." You make a directly as you think fit, and copy this file. That is all of the installation process.

Boot the tool

Change directly and input in command line, "svc47 [enter]," and boot the alignment tool.

Preparation

Setup the test equipment as "Alignment Preparation & Precautions."

Set the RF Ch. List to Table 1 on the CE47 Clone editor software.

Enter to the alignment mode

To enter the alignment mode, press "[0] Alignment Mode" on the personal computer Key board. You turn off the power of the transceiver, and turn on the transceiver. If entry succeed, the alignment tool display as follows.

[0]Common TX

[1]Common RX

Action of the switches

When the transceiver is in alignment mode, the action of [PTT], [MON], [UP], and [DOWN] is ignored. All of the action is remote controlled by PC.

Menu of the tool

[0] Common TX

- [0] Tx Power High

This parameter is used to align TX High power (25W).

- Press [Enter] on "[0] Tx Power High" to align TX High power.
- Select the Channel "1" in alignment range.
- Press the [Space] key on the keyboard to activate the transmitter.
- Press the [UP] or [DWN] key, as needed, to set the power output to the following specification, as indicated on the external wattmeter.

Tx Power High: 25 W (± 0.5 W)

- When the 25 Watt level is attained, press [Enter] to lock in the new data.

- [1] Tx Power Low

This parameter is used to align TX Low power (5W).

- Press [Enter] on "[1] Tx Power Low" to align TX Low power.
- Select the Channel "1" in alignment range.
- Press the [Space] key on the keyboard to activate the transmitter.
- Press the [UP] or [DWN] key, as needed, to set the power output to the following specification, as indicated on the external wattmeter.

Tx Power Low: 5 W (± 0.1 W)

- When the 5 Watt level is attained, press [Enter] to lock in the new data.

- [2] VCO Deviation

This parameter is used to align the VCO Deviation.

- Press [Enter] on "[2] VCO Deviation" to align VCO Deviation.
- Select the Channel "1" in alignment range.
- Adjust the AF generator output level to 38mVrms (-26dBm) at 2 kHz to the pin 3 of the J1502 (D-sub 9pin).
- Press the [Space] key on the keyboard to activate the transmitter.
- Press the [UP] or [DWN] key, as needed, to set the VCO Deviation (Wide) to the following specification, as indicated on the deviation meter.
- When the desired deviation level is attained, press [Enter] to lock in the new data.
- Select the Channel 2, and set the VCO Deviation (Narrow), same as Channel "1."

VCO Deviation (Wide): 3.0 kHz (± 0.1 kHz)

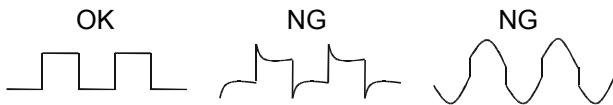
VCO Deviation (Narrow): 1.5 kHz (± 0.1 kHz)

Alignment

- [3] REF Deviation

This parameter is used to align the REF Deviation.

- Press [Enter] on “[3] REF Deviation” to align REF Deviation.
- Select the Channel “1” in alignment range.
- Adjust the AF generator output level to 776mVrms(0dBm) at 300Hz to the pin 3 of the J1502.
- Press the [Space] key on the keyboard to activate the transmitter.
- Press the [UP] or [DWN] key, as needed, to set the modulation wave as follows.
- Press [Enter] to lock in the new data.
- Select the Channel “2,” and set the modulation wave, same as Channel “1.”



- [4] CTCSS Deviation

This parameter is used to align the CTCSS deviation.

- Press [Enter] on “[4] CTCSS Deviation” to align CTCSS Deviation.
 - Select the Channel “1” in alignment range.
 - Press the [Space] on the keyboard to activate the transmitter, and injects a CTCSS test tone.
 - Press the [UP]/[DWN] key, as need, to set the CTCSS Deviation (Wide) to the following specification.
 - Press [Enter] to lock in the new data.
 - Select the Channel “2,” and set the CTCSS Deviation (Narrow), same as Channel “1.”
- CTCSS Deviation (Wide): 0.70 kHz (± 0.1 kHz)
CTCSS Deviation (Narrow): 0.35 kHz (± 0.1 kHz)

- [5] DCS Deviation

This parameter is used to align the DCS deviation.

- Press [Enter] on “[5] DCS Deviation” to align DCS Deviation.
 - Select the Channel “1” in alignment range.
 - Press the [Space] key on the keyboard to activate the transmitter, and injects a DCS test tone.
 - Press the [UP] or [DWN] key, as needed, to set the DCS deviation (Wide) to the following specification.
 - Press [Enter] to lock in the new data.
 - Select the Channel “2,” and set the DCS deviation (Narrow), same as Channel “1.”
- DCS Deviation (Wide): 0.60 kHz (± 0.1 kHz)
DCS Deviation (Narrow): 0.30 kHz (± 0.1 kHz)
- The actual DCS deviation will increase around 20% based on the above alignment as follows,
- Actual DCS Deviation (Wide): 0.70 kHz
Actual DCS Deviation (Narrow): 0.35 kHz

- [6] LTR Deviation

This parameter is used to align the LTR deviation.

- Press [Enter] on “[6] LTR Deviation” to align LTR Deviation.
 - Select the Channel “1” in alignment range.
 - Press the [Space] key on the keyboard to activate the transmitter, and injects a LTR test tone.
 - Press the [UP] or [DWN] key, as needed, to set the LTR Deviation (Wide) to the following specification.
 - Press [Enter] to lock in the new data.
 - Select the Channel “2,” and set the LTR deviation (Narrow), same as Channel “1.”
- LTR Deviation (Wide): 0.80 kHz (± 0.1 kHz)
LTR Deviation (Narrow): 0.60 kHz (± 0.1 kHz)
- The actual LTR deviation will increase around 20% based on the above alignment as follows,
- Actual LTR Deviation (Wide): 1.00 kHz
Actual LTR Deviation (Narrow): 0.70 kHz

[1] Common RX

- [0] Tight NSQL

This parameter is used to align the noise level in squelch Tight. It adjusts this alignment RX Tuning after ending.

- Select the MID frequency channel in alignment range.
- Set the SG output level to 0dBm EMF, and obey the message.

- [1] Threshold NSQL

This parameter is used to align the noise level in squelch Threshold. It adjusts this alignment RX Tuning after ending.

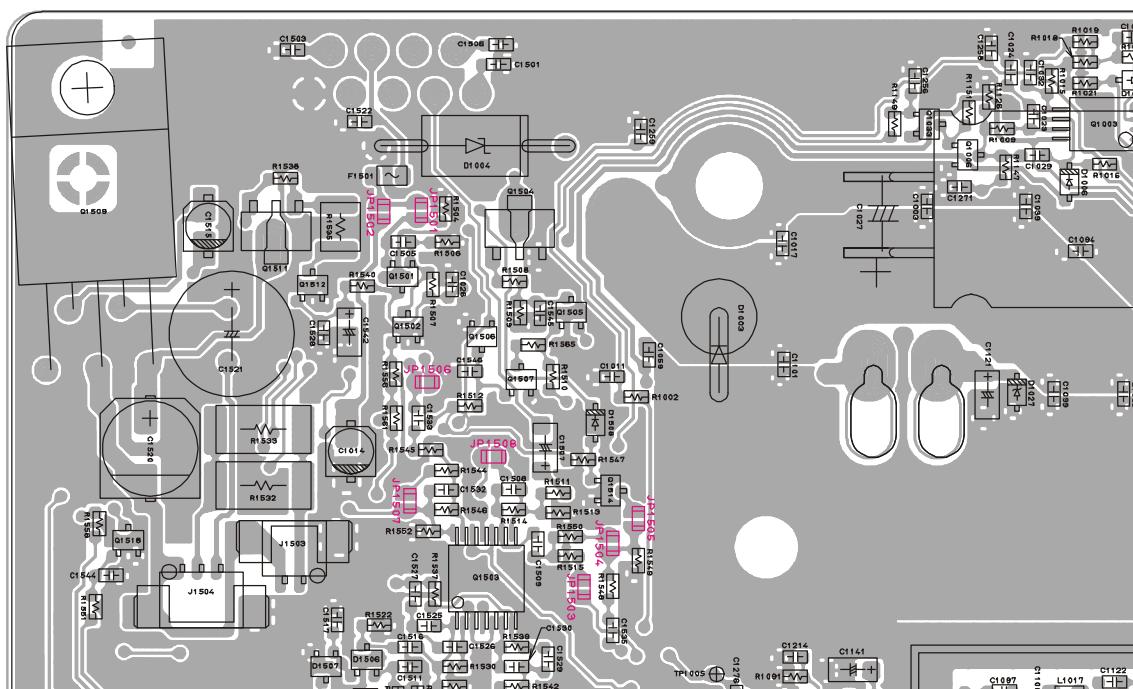
- Select the MID frequency channel in alignment range.
- Set the SG output level to -7dBm EMF, and obey the message.

- [2] RX Tune

This parameter is used to align RX Tune.

- Select the MID frequency channel in alignment range.
- Set the SG output level to -6dBm EMF.
- Pressing the [DWN] key, reduce the RX Tune Level and set the SINAD above 12dB.

RF Unit Jumper Information



JP1501 (JP1): Determine the output supply voltage at pin 8 of DSUB 9-pin Accessory Connector.

Close: +5.0 V (Maximum 100 mA)

Open: No Action

JP1502 (JP2): Determine the output supply voltage at pin 8 of DSUB 9-pin Accessory Connector.

Close: +13.8 V (Maximum 100 mA)

Open: No Action

JP1503 (JP3): Determine the Rx discriminator output characteristic at pin 2 of DSUB 9-pin Accessory Connector.

Close: Flat 10 Hz to 3.0 kHz (140 mVrms /STD deviation with 600 ohm termination)

Open: No Action

JP1504 (JP4): Determine the Rx discriminator output characteristic at pin 2 of DSUB 9-pin Accessory Connector.

Close: Filtered 300 Hz to 3.0 kHz (70 mVrms /STD deviation with 600 ohm termination)

Open: No Action

JP1505 (JP5): No Action (Spare Jumper).

JP1506 (JP6): Define whether the TX Data Input at pin 3 of DSUB 9-pin Accessory Connector shall be "on" or "off" according to the external PTT Input signal signal (pin 7 of DSUB 9-pin Accessory Connector).

Close: on (Enabled)

Open: off (Disabled)

JP1507 (JP7): Determine the TX Data Input level at pin 3 of DSUB 9-pin Accessory Connector.

Close: 400 mVrms /STD deviation with 600 ohm termination

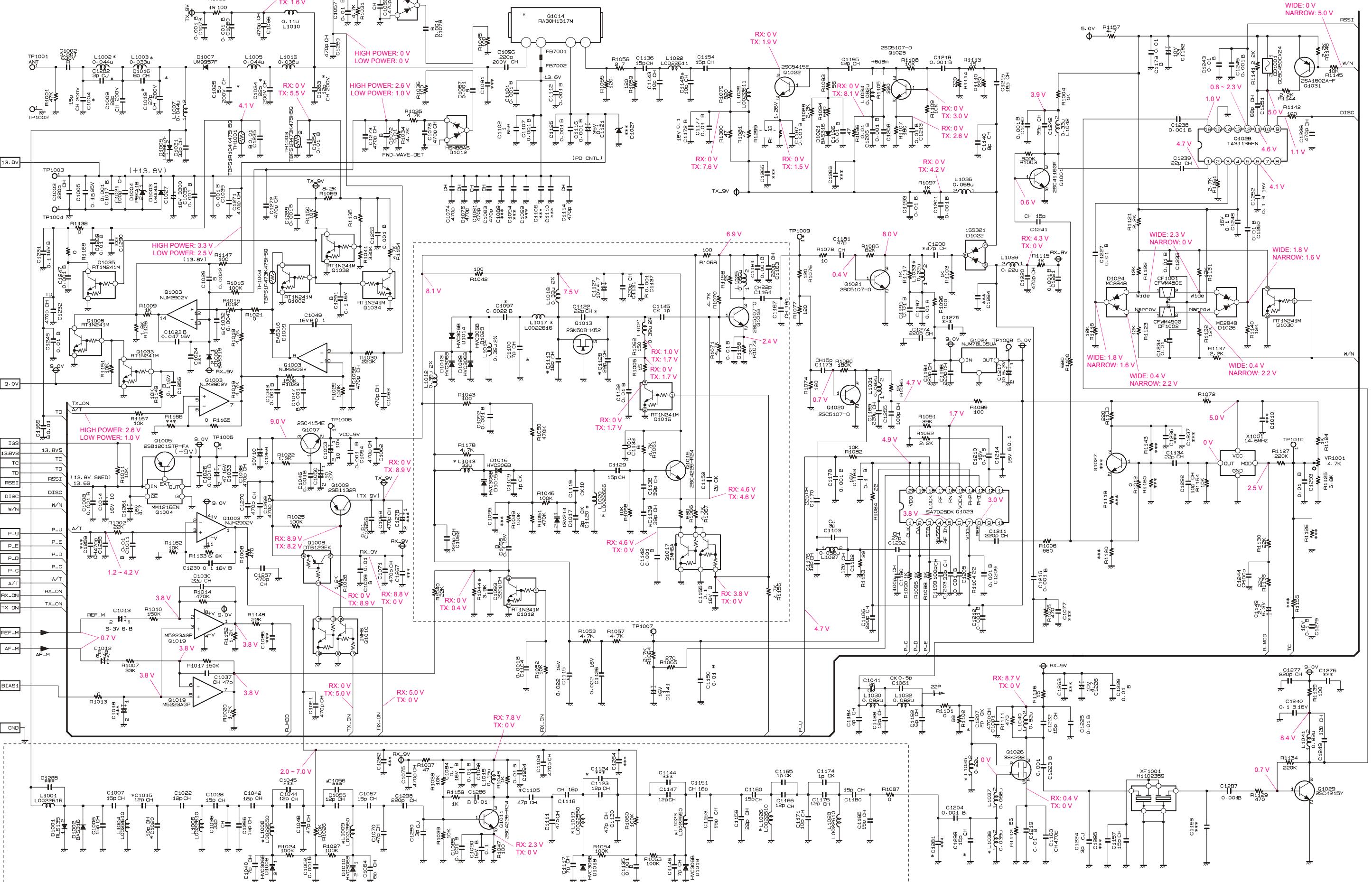
Open: 40 mVrms /STD deviation with 600 ohm termination

JP1508 (JP8): Define whether the Transceiver's power shall be "on" or "off" according to the Ignition Signal Input (pin 9 of DSUB 9-pin Accessory Connector).

Close: Turn the transceiver on when the Ignition Signal Input (pin 9 of DSUB 9-pin Accessory Connector) is turned to "High" while the VOL/PWR knob is set to the "ON" position (out of the click-stop position).

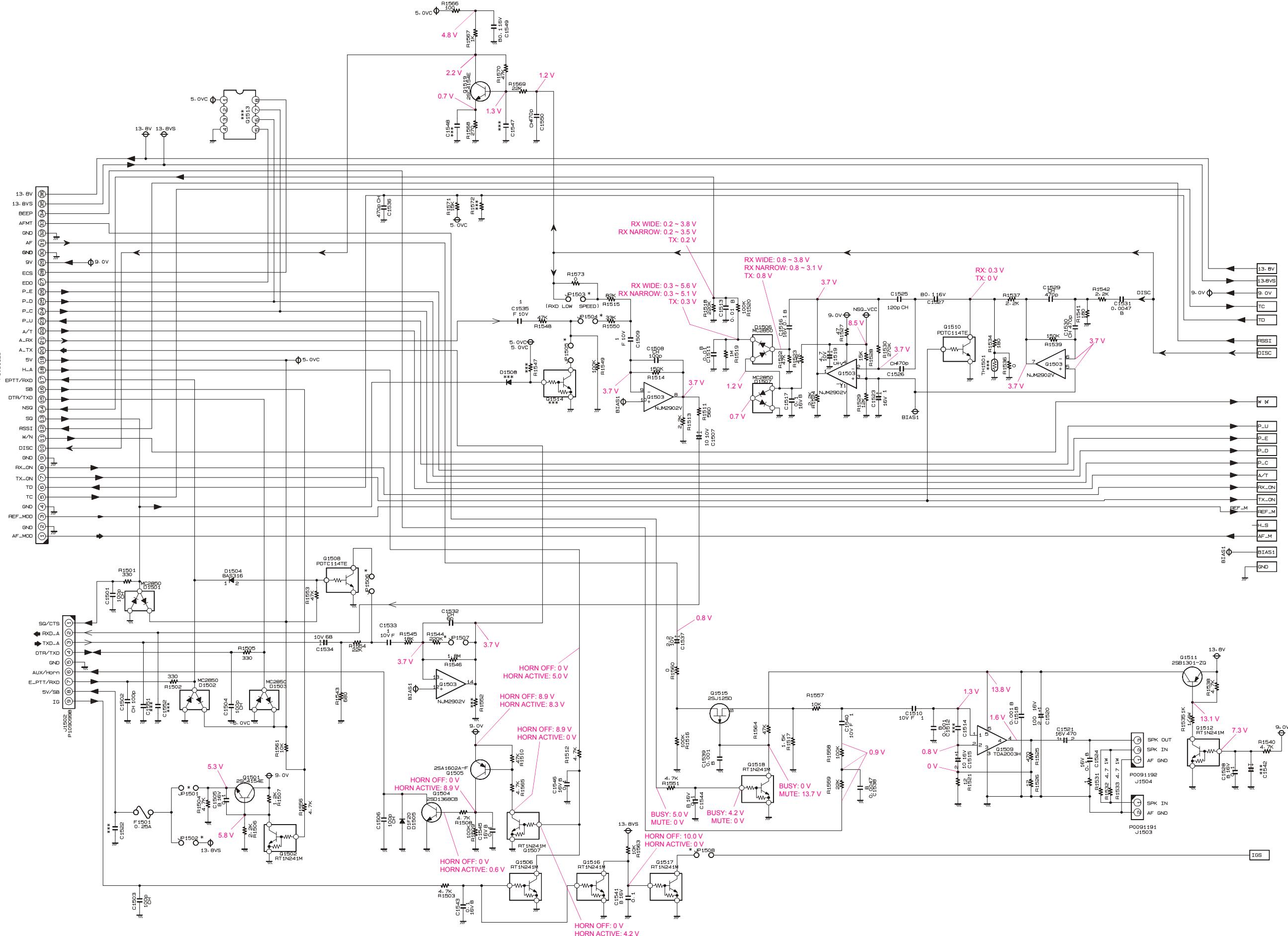
Open: No Action

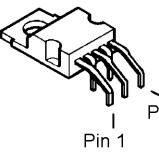
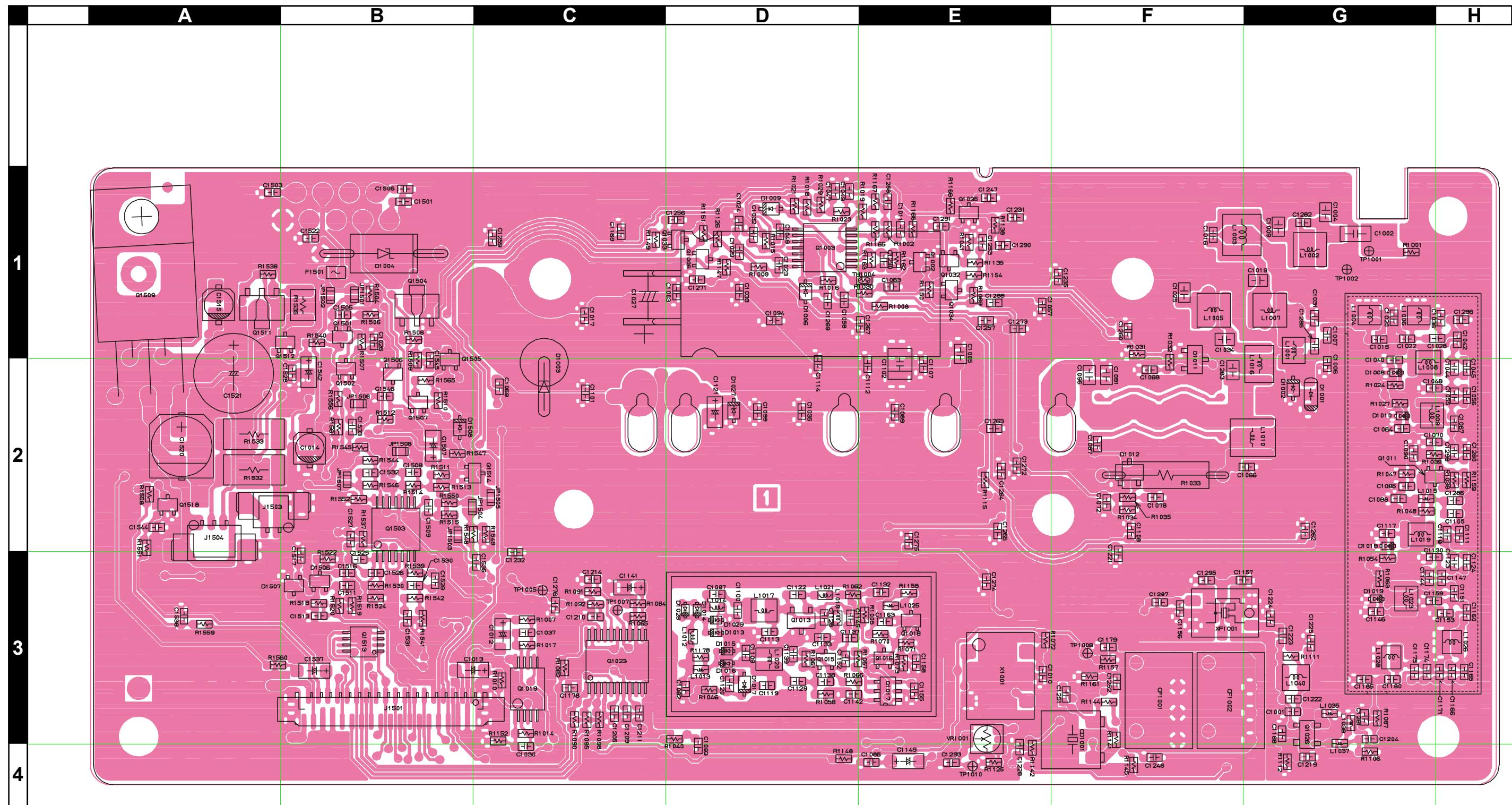
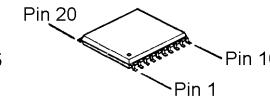
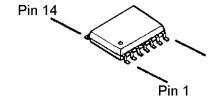
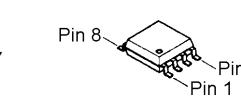
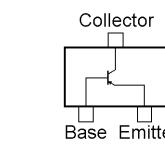
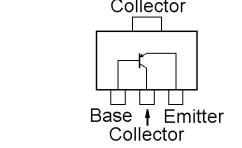
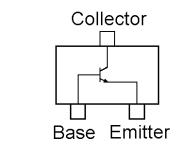
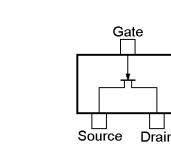
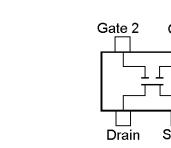
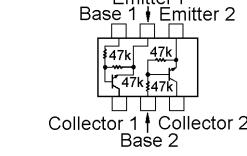
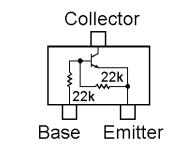
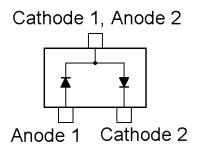
Circuit Diagram (1)



RF Unit

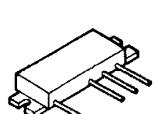
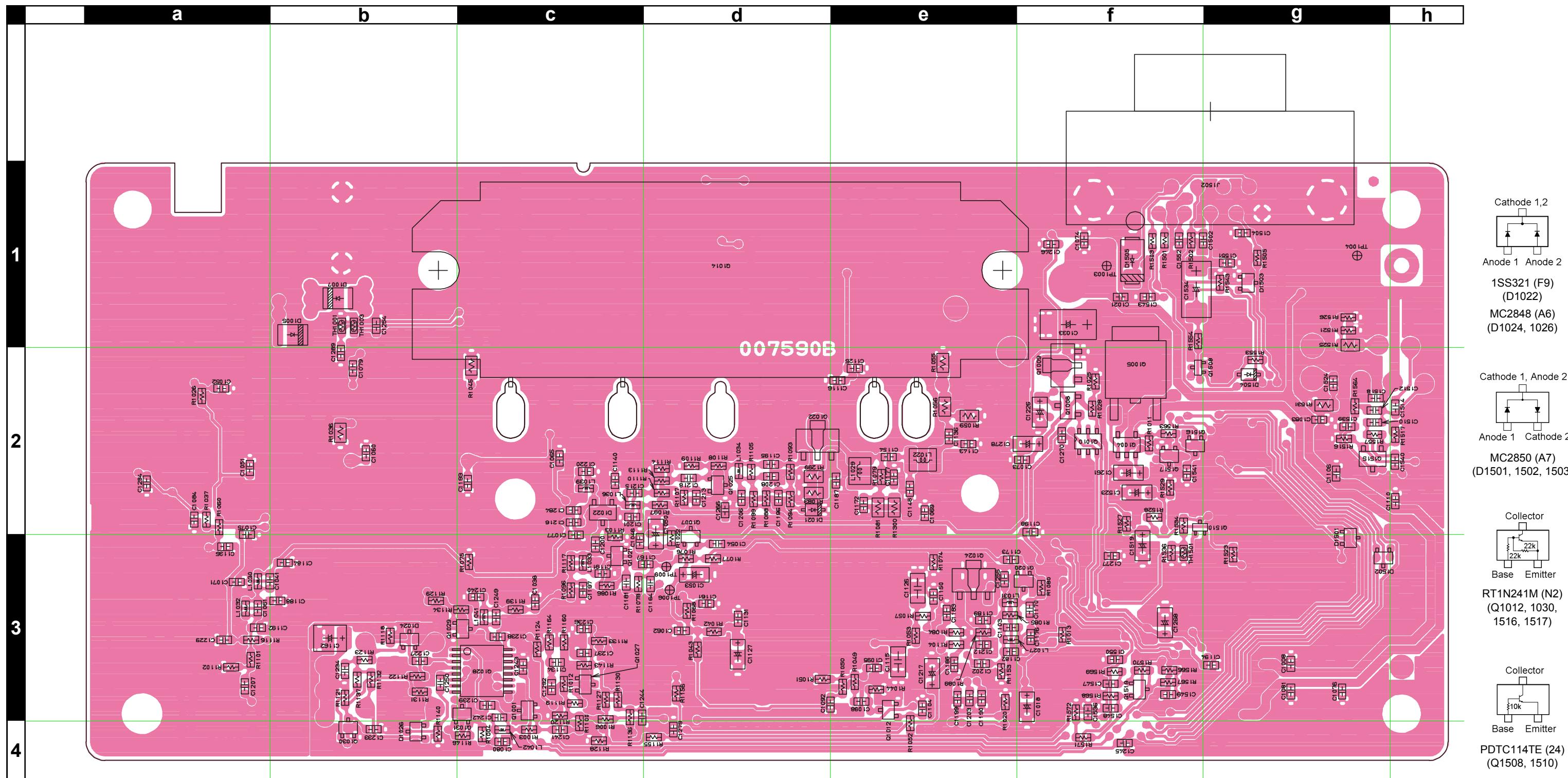
Circuit Diagram (2)



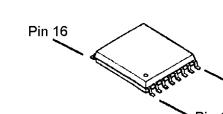
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(Q1003, 1503)M5223
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(Q1511)2SD1368CB (CB)
(Q1504)2SC5107 (MF0)
(Q1518)2SC4154 (LE)
(Q1501)2SC4226 (R22)
(Q1011, 1015)2SC5107 (MF0)
(Q1518)2SK508 (K52)
(Q1013)3SK228 (XR)
(Q1026)IMH6A (H6)
(Q1017)RT1N241M (N2)
(Q1002, 1006,
1016, 1032, 1033,
1034, 1035, 1502,
1506, 1507, 1512,
1518)HSM88AS (C11)
(D1011, 1012)MC2850 (A7)
(D1506, 1507)

RF Unit

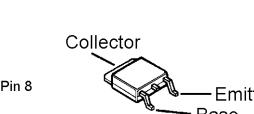
Parts Layout (Side B)



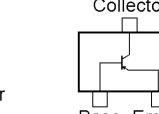
RA30H1317M
(Q1014)



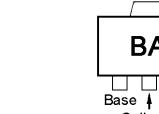
TA31136FN
(Q1028)



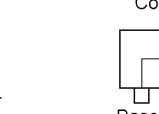
2SB1201S
(Q1005)



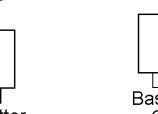
2SA1602A (MF)
(Q1031)



2SB1132 (BA)
(Q1009)



2SC4116 (LG)
(Q1001)
2SC4154 (LE)
(Q1007, 1519)
2SC4215Y (QY)
(Q1029)
2SC5107 (MFO)
(Q1020, 1021, 1025)



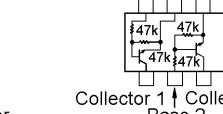
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(Q1022)



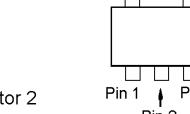
2SJ125D (JD)
(Q1515)



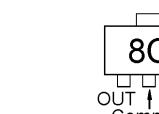
DTB123EK (F12)
(Q1008)



IMH6A (H6)
(Q1010)



MM1216ENRE
(Q1004)



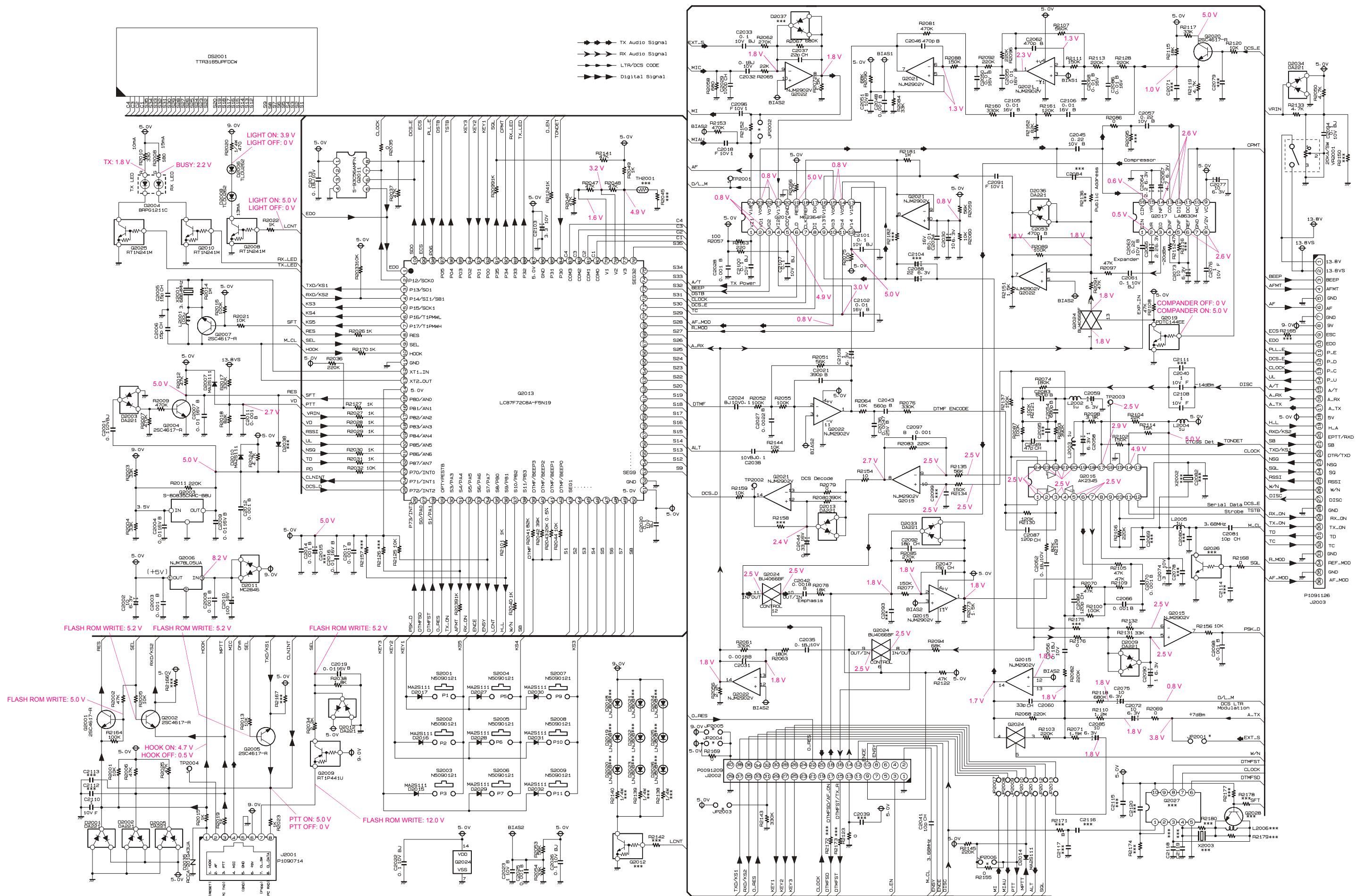
NJM78L05
(Q1024)

RF Unit

Note

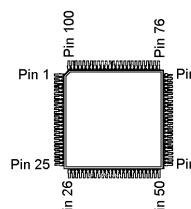
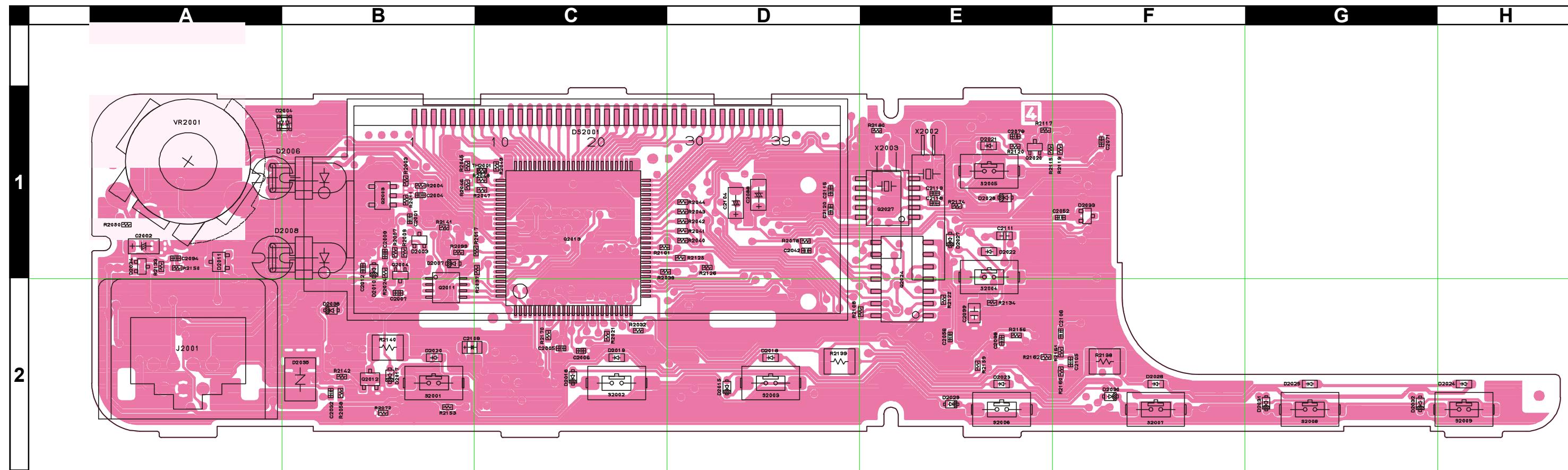
PANEL Unit

Circuit Diagram

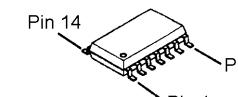


PANEL Unit

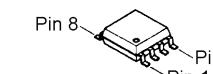
Note



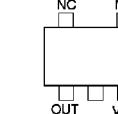
LC87F72C8A
(Q2013)



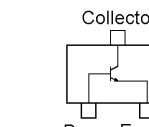
BU4066BF
(Q2024)



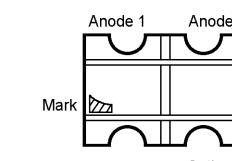
S-93C56AMFN
(Q2011)



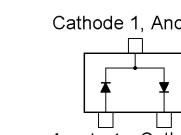
S-80835CNMC
(Q2003)



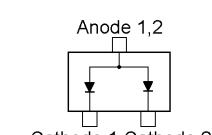
2SC4617 (BR)
(Q2004, 2020)



BRPG1211C
(D2004)



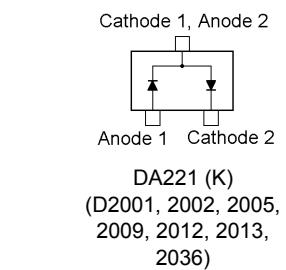
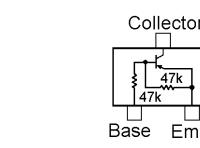
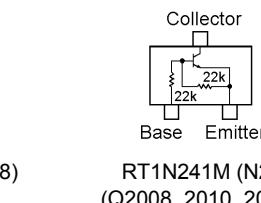
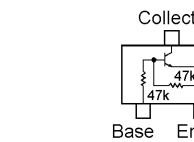
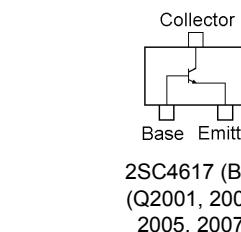
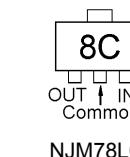
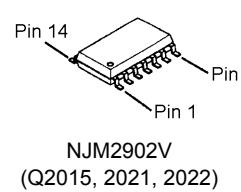
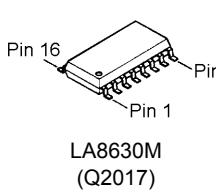
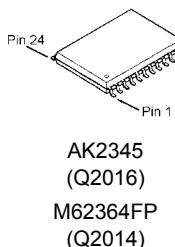
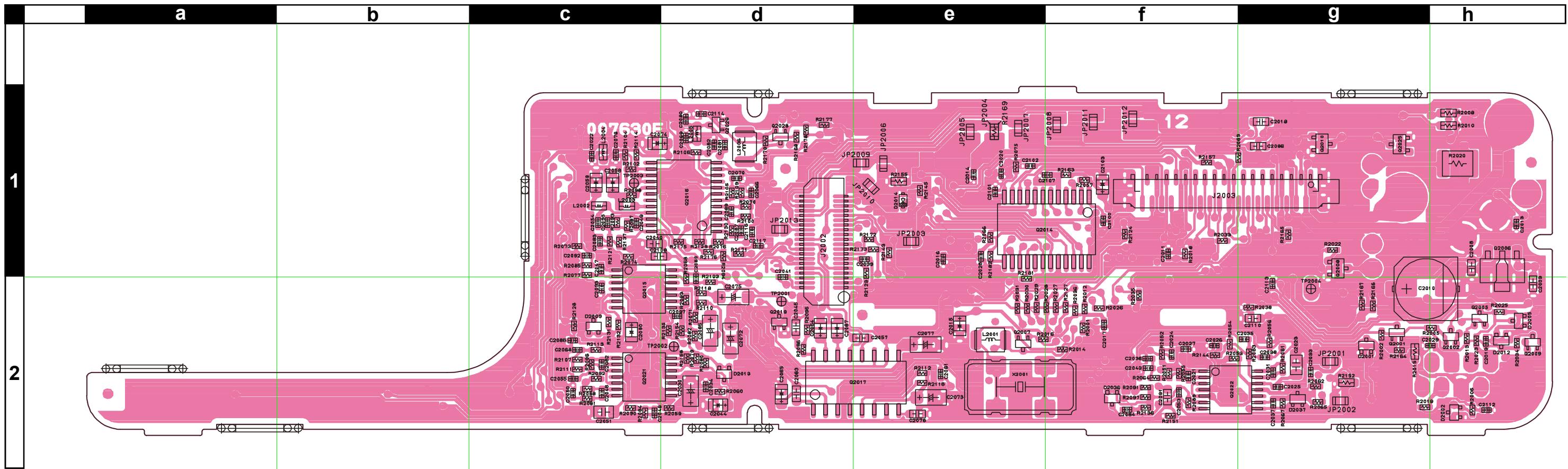
DA221 (K)
(D2003, 2033, 2034)



MC2846 (A4)
(D2011)

PANEL Unit

Parts Layout (Side B)



PANEL Unit

Parts List

REF	DESCRIPTION	VALUE	V/W	TOL.	MFR'S DESIG	VXSTD P/N	VERS.	LOT	SIDE	LAY ADR
R 2162	CHIP RES.	82k	1/16W	5%	RMC1/16S 823JTH	J24189048		1-	A	E2
R 2163	CHIP RES.	220	1/16W	5%	RMC1/16S 221JTH	J24189017		1-	B	f1
R 2164	CHIP RES.	100k	1/16W	5%	RMC1/16S 104JTH	J24189049		1-	B	g2
R 2168	CHIP RES.	0	1/16W	5%	RMC1/16S JPTH	J24189070		1-	B	d1
R 2169	CHIP RES.	0	1/16W	5%	RMC1/16 000JATP	J24185000		1-	B	e1
R 2170	CHIP RES.	1k	1/16W	5%	RMC1/16S 102JTH	J24189025		1-	A	C2
R 2172	CHIP RES.	0	1/16W	5%	RMC1/16S JPTH	J24189070		1-	B	e1
R 2173	CHIP RES.	0	1/16W	5%	RMC1/16S JPTH	J24189070		1-	B	e1
R 2176	CHIP RES.	0	1/16W	5%	RMC1/16S JPTH	J24189070		1-	B	d1
R 2181	CHIP RES.	1M	1/16W	5%	RMC1/16S 105JTH	J24189061		1-	B	e2
S 2001	TACT SWITCH				SKQMAQE010	N5090121		1-	A	B2
S 2002	TACT SWITCH				SKQMAQE010	N5090121		1-	A	C2
S 2003	TACT SWITCH				SKQMAQE010	N5090121		1-	A	D2
S 2004	TACT SWITCH				SKQMAQE010	N5090121		1-	A	E1
S 2005	TACT SWITCH				SKQMAQE010	N5090121		1-	A	E1
S 2006	TACT SWITCH				SKQMAQE010	N5090121		1-	A	E2
S 2007	TACT SWITCH				SKQMAQE010	N5090121		1-	A	F2
S 2008	TACT SWITCH				SKQMAQE010	N5090121		1-	A	G2
S 2009	TACT SWITCH				SKQMAQE010	N5090121		1-	A	H2
VR2001	POT.				V12M4-20A20K-1	J60800260		1-	A	A1
X 2001	XTAL SX-2204	3.6864MHz			3.6864MHz	H0103249		1-	B	e2
	LCD HOLDER LIGHT GUIDE REFLECTOR SHEET DIFFUSER SHEET RUBBER CONNECTOR SPONGE RUBBER LED SPACER BLIND SHEET				(LCD) (IC) LH-5-5 (4X3)	RA0377100 RA0376600 RA0381800 RA0013600 RA0383700 RA0384100 S6000238 RA0405200		1- 1- 1- 1- 1- 1- 1- 1-		

PANEL Unit

Note



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