PT8100

SERVICE MANUAL

VHF /UHF MOBILE RADIO

Dangerous!

Do not connect the AC power or DC power over 18V with any connector or terminal of the radio. Otherwise it will cause fire, electric shock or damage to the radio.

Warning!

Do not reverse power connection.

Do not turn on the radio before the antenna or load connection is completed.

Do not touch the antenna while the radio is transmitting, otherwise, it may cause light burning on skin.

The radio is not waterproof, so it's better to avoid putting it in rain or snow, or any other liquid to ensure its life and performance.

Statement!

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Contents

Chapter 1 Overview

1.1 Introduction

This manual applies to the service and maintenance of PT8100 mobile radios, and is intended for use by engineers and professional technicians that have been trained by Kirisun. It contains all required service information for the equipment. Kirisun reserves the right to modify the product structure and specifications without notice in order to enhance product performance and quality. You can also log on our website www.kirisun.com to download the latest service manual or contact your local dealer or us.

Please read this manual before repairing the product.

1.2 Service Attentions

* Safety

Do not touch the antenna connector while repairing the radio.

Do not reverse the battery polarity.

Do not turn on the radio before the antenna or load connection is completed.

Do not touch the antenna while the mobile radio is transmitting, otherwise, it may cause light burning on skin.

* Explosive Atmosphere

It's prohibited to use or repair the radio in the following places:

Hospital, health center, airport

Any area with a potentially explosive atmosphere (e.g. orlop deck of the ship, storage or transportation equipment for fuel and chemical etc.)

Any place near blasting sites or area with electrical blasting cap.

* Replacement Parts

All components used for repair should be supplied by Kirisun.

Components of the same type available on the market are not surely able to be used in this product and we do not guarantee the quality of the product using such components.

If you want to apply for any component from Kirisun, please fill in an application form as below.

e.g.

Component Application Form

Radio Model	Component	Position Mark	Model/ Specifications	Part No.	Qty
PT8100-01	FET	Q18	3SK318	105-3SK318-R01	1
PT8100-01	Triode	Q5	2SC3357	104-SC3357-R01	1

1.3 Service

All the Kirisun products are subject to the service warranty.

After-sales service will be provided, and the length of warranty is stated by Kirisun. The radio and its accessories are all in the warranty. However, in one of the following cases, charge free service will be not available.

* No valid warranty card or original invoice.

* Malfunction caused by disassembling, repairing or reconstructing the radio by the users without permission.

* Wear and tear or any man-made damage such as mechanical damage, burning or water leaking.

* Product's serial number has been damaged or the product trademark is difficult to identify.

After the warranty expires, lifetime service is still available. We also provide service components to service stations and staffs.

Chapter 2 Unpacking and Checking

2.1 Unpacking and Checking

Unpack the radio carefully. We recommend that you check the radio and the supplied accessories listed in the following table before discarding the packing material. If any damage or loss has occurred during shipment, please contact the dealer without delay.

No.	Item	Qty
1	Mounting Bracket	1
2	Power Cable	1
3	Hand Microphone	1
4	Microphone Hanger	1
5	M4*10 SEMS Screw	4
6	M4*16 Self-tapping Screw	2
7	M5*16 Self-tapping Screw	4
8	Instruction Manual	1

Mounting Bracket	Power Cable	Hand Microphone
Microphone Hanger	M4*10 SEMS Screw	M5*16 / M4*16 Self-tapping Screw

2.2 Licenses

It is requested by rules that each radio installation site (for mobile station or base station) should be provided with a license. The license carrier should guarantee that the Tx power, frequency and deviation comply with the license requirements. Transmission adjustment can only be conducted by license-authorized technicians. Installation or operation of the radio does not need a license.

2.3 Check before Installation

Every radio has been adjusted and checked before shipment.

Before installation, it's better to check if the radio's transmission and receiving are normal to make sure its proper operation.

The test should be performed with all cables and accessories correctly connected.

Tx frequency, deviation, and power output should be checked, as should Rx sensitivity, squelch, audio output, and signaling operation.

2.4 Installation

1) Preparation

Check the vehicle and decide how and where to install the radio antenna and accessories. Make sure that the cable will not be extruded. And pay attention to the heat dissipation of the radio to avoid overheating.

2) Antenna

The best position for the antenna is in the center of an open and flat conduction region, usually the center of the vehicle roof or the cover of the luggage trunk. Connect one end of the earth wire to the cover of the luggage trunk and the other end to the car outer shell so that the cover of the luggage trunk is grounded.

3) Connection of Power Cable

* First of all, please check whether there is a hole for the power cable on the insulating board. If no, please bore the board with a suitable drill bit and fix a rubber grommet on it to protect the cable from abrasion.

* Afterwards, please pass the cable through the insulating board and lead from the car into the engine room. Connect the red conductor to the positive terminal of the accumulator and the black conductor to the negative terminal.

* At last, ring the remained conductor and fix it.

Note: Please guarantee sufficient relaxation of the power cable in the car so that the radio can be conveniently disassembled, assembled, and repaired in the state of power connection.

4) Installation

Warning: For passenger safety, please install the radio securely using the supplied mounting bracket so that the radio will not be loosened in case of collision.

* Take the mounting bracket as the sample to draw the position of the four holes for screws. Then drill the holes on the instrument panel, and then install the mounting bracket with 4 M5*16 self-tapping screws. (Note: Please install the radio at a position convenient for operation, and leave enough space for connection of the cable.)

* Slide the radio into the mounting bracket and fix it to the bracket with 4 M4*10 SEMS screws (with flat washer and spring washer). (Set an appropriate height and angle for the radio by using different screw holes of the bracket.)

* Connect the antenna and the power cable to the radio.

* Install the microphone hanger at an appropriate position using 2 M4*16 self-tapping screws. (It should be made sure that the microphone and its cable will not affect safe driving.)

* Connect the microphone to the MIC jack on the front panel of the radio and put the microphone on the hanger.

Note: When replacing the fuse of the power cable, only use fuses of the same type and rating; otherwise the radio could be damaged.

5) Attention

If you have no plan to use external speaker, please cover the speaker jack with the supplied rubber plug to prevent dust and sand getting in.

Chapter 3 External View and Functional Keys

3.1 Front Panel
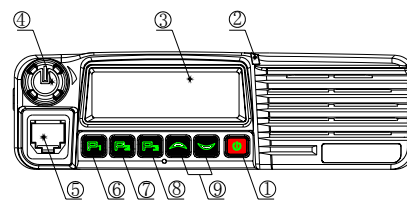
① ⏻ Power Button

Press and hold this button (1.5 seconds or longer) to turn the radio power ON or OFF.

② LED Indicator

Lights red while the radio is transmitting, lights green while the radio is receiving.

Flashes orange while receiving DTMF, 2Tone or 5Tone signals the same as the setting of the radio.

Flashes red while the radio is scanning (This function can be

enabled/disabled by PC software).

③ LCD Display

Refer to "LCD Display Screen" for details.

④ Volume Knob

Adjust volume of the mobile radio.

⑤ MIC Jack/Programming Interface

⑥ P1 Button (Programmable Button)

⑦ P2 Button (Programmable Button)

⑧ P3 Button (Programmable Button)

⑨ ⏑/⏐ Button (Programmable Button)

3.2 Microphone
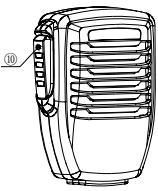
⑩ PTT Button (on the hand microphone)

Press and hold the PTT button, then speak into the microphone, your voice can be transmitted to the recipient. Release PTT to receive.

3.3 LCD Display Screen

Display	Description
▼.ıll	Shows the strength of the received signals; 4 bars indicates the strongest signal.
L M H	Shows the transmitting power level of the radio: 'L' indicates low Tx power level; 'M' indicates middle Tx power level; 'H' indicates high Tx power level.
♪	Appears when the radio receives a Sel Call/Call Alert.
ᴆ	Appears when the radio is in "Monitor" state.
⇄	Appears when the radio is scanning.
(ᴑ)	Function not used.
⊢→⊢	Appears when the radio is in talk-around mode.
◑	Function not used.
P2	Appears when the radio is in OST state.

3.4 Rear Panel

① Antenna Connector

② Power Terminal

③ External Speaker Jack
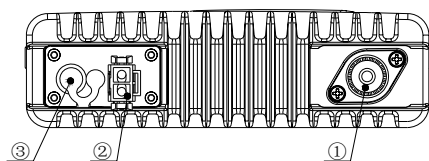
3.5 Auxiliary Functions for Programmable Buttons

The following auxiliary functions can be assigned to ⏑/⏐, P1, P2, P3 buttons by the distributor.

No.	Function	Description
0	None	No function is assigned.
1	Channel Up	Select the next channel.
2	Channel Down	Select the previous channel.
3	Zone Up	Select the next zone.
4	Zone Down	Select the previous zone.
5	Display CH Frequency	Press the button, frequency of the current channel will be shown on the LCD.
6	Display CH Alias	Press the button, alias of the current channel will be shown on the LCD.
7	Display Mode Switch	Press the button to switch the display mode between "Channel No.", "Channel Alias", "Zone No.", "Zone Alias", and "Channel Frequency".
8	OST	This allows the radio user to change the QT/DQT setting of current channel by pre-programmed OST list.
9	Power Level	This allows the radio user to adjust the transmit power setting to "High", "Mid" or "Low". Meanwhile, the LCD will display "H", "M", "L" respectively.
10	Squelch Level	Press the button to enter "Squelch Level Adjustment Mode", then the user can adjust the squelch level by pressing ⏑/⏐. Press P3 button to save the selected squelch level and the radio then quits this mode.
11	Key Lock	Press to lock/unlock some keys.
12	Scan	Press to start/stop scanning.
13	FCS	Press to start free channel scanning (FCS).
14	Nuisance Delete (temporarily)	When the radio lands on an unwanted channel during scanning, press the button to delete this channel temporarily. When exit scan mode and enter it again, the channel will be added to the scan list again.
15	Public Address	Press to enable the public address function. When press and hold the PTT key and speak to the microphone, your voice will be heard by yourself and surround people through the external speaker, but will not be transmitted. Press this button again to disable the public address function, and the radio returns to user mode.
16	Home Channel	Press the button to switch to the preset home channel. If the radio has set two home channels, it will switch to home channel 1 upon pressing this button, and will switch to home channel 2 if you press this button again within 2 seconds, and will switch to the original channel if you press this button for the third time within 2 seconds. When switching to the home channel, the zone is also switched. If the radio has only set one home channel, the radio will switch between the working channel and the home channel upon pressing this button within 2 seconds. If the interval between two pressings is longer than 2 seconds, the radio will always switch to home channel 1.
17	Talk Around	Press the button to toggle between Repeater Mode and Talkaround Mode. In Talkaround Mode, the Rx parameters are used in place of the Tx parameters when transmitting.

18	Momentary Monitor / Call Cancel	Press and hold the button, QT/DQT/2Tone/5Tone/DTMF signaling will be closed. Release the button to return to normal operation. Press the button during the Select Call state, the radio will exit Select Call state.
19	Monitor/Call Cancel	Press the button to close QT/DQT/2Tone/5Tone/DTMF signaling, then you can receive signals that cannot be received during normal operation. Press the button again to resume normal operation. Press the button during the Select Call state, the radio will exit Select Call state.
20	Momentary Squelch Off / Call Cancel	Press and hold the button to open squelch; release it to resume normal operation. Press it during the Select Call state, the radio will exit Select Call state.
21	Squelch Off/Call Cancel	Press the button to open squelch; press it again to resume normal operation.
22	Emergency	Press the button to make an alarm tone according to the setting of the programming software or send your ID or background sound to your partner or the system.
23	Call 1	Press to send the preset code.
24	Call 2	Press to send the preset code.
25	Call 3	Press to send the preset code.
26	Call 4	Press to send the preset code.
27	Menu Select/Enter	Press to enter the Menu Mode, to make menu selections and save.
28	Lone Worker	Press to enable/disable Lone Worker function.
29	Scan List Edit	This allows the radio-user to edit a Scan List. Scan List editing is only available for Scan Lists where the User Programmable field has been enabled.
30	Backlight	Press to toggle between "Light", "Dark" and "Auto" for the backlight.

Chapter 4 Circuit Description

4.1 Frequency Configuration
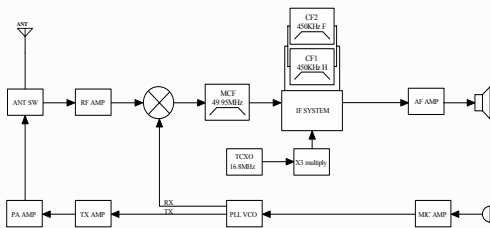
Figure 4.1 Frequency Configuration

The receiver adopts double mixing. The first IF is 49.95MHz and the second IF is 450kHz.

The first local oscillator signal of the receiver is generated by the frequency synthesizer and the second local oscillator signal is generated by frequency tripler X1.

The transmitter signal is produced by the frequency synthesizer.

The reference frequency of the frequency synthesizer is provided by TCXO.

4.2 Principle of Receiver (RX)
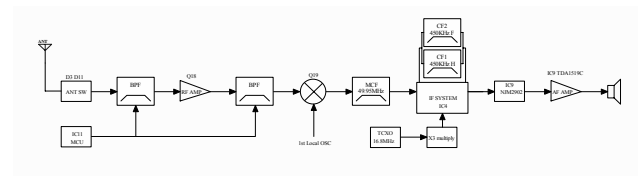
Figure 4.2 Principle of Receiver

Front end

The signal coming from the antenna passes through the RX/TX switch circuit (D3 and D37), and passes through a BPF consists of two LCs to remove unwanted out-of-band signals, and then is routed to the low noise amplifier (LNA) consists of Q18 and its peripheral components where it is amplified.

Output signal from the LNA passes through a BPF consists of three LCs to further remove unwanted out-of-band signal, and then goes to the first mixer (Q19).

AGC circuit

AGC circuit, which consists of Q16 and its peripheral circuit, will work to reduce the gain of Q18 only when the input signal is too large.

First mixer

The Rx signal from LNA is mixed with the first local oscillator signal from the frequency synthesizer to produce the first IF signal (49.95MHz).

IF circuit

The first IF signal passes through the crystal filter (XF1) to remove the adjacent channel signal and signal outside the adjacent channel. Then the filtered signal is amplified by the first IF amplifier (Q20), and is sent to the IF processing IC (IC6, TA31136).

IF IC consists of the second mixer, IF amplifier, limiter, discriminator, noise amplifier, and audio low pass filter.

Signal (16.8MHz) from X1 is multiple-amplified by Q11 and its peripheral circuit to produce the second local oscillator signal. Then the second local oscillator signal (50.4MHz) is mixed with the first IF signal (49.95MHz) in IC6 to generate the second IF signal (450kHz). And then the second IF signal is amplified and limited in IC6, filtered by its ceramic filter (CF1 or CF2, 450kHz), and then demodulated in IC6. After that, the demodulated signal is routed to the audio circuit to output audio signal.

The selection circuit of the second IF filter consists of CF1, CF2, D20, D21, and the peripheral circuit. When the mobile radio is set to wideband, CF2 is put through and takes effect, while

CF1 is cut off; when the mobile radio is set to narrowband, CF1 is put through and takes effect, while CF2 is cut off.

Squelch circuit

The demodulated signal from IC6 is sent to the internal noise amplifier in IC6. Then the resulting signal is further amplified in Q21 and demodulated in D25, and then the resulting DC level is sent to the MCU squelch control circuit. This voltage is in inverse proportion to the input signal.

4.3 Principle of Transmitter (TX)

TX power amplification
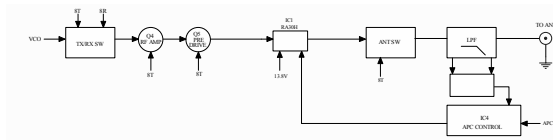
Figure 4.3 Principle of Power Amplifier and Antenna Switch

The modulated RF signal from VCO is amplified by Q1, Q2, Q4, and Q5, and is sent to IC1 for power amplification. Output power of IC1: 25W.

Grid bias of IC1 is controlled by the APC circuit. Through changing the grid bias voltage, the Tx output power can be controlled conveniently.

APC（Automatic Power Control）circuit

D9 and D10 are RF detector diodes. The output power of the RF amplifier is detected by RF detector diodes and converted into DC level. Then the DC level is compared with the signal from MCU and amplified in IC4, and is sent to grid in IC1 to control the power output.

If the Tx output power is too high, the voltage detected by the detector diodes will increase; IC4 output voltage will decrease, so the bias voltage imposed on IC1 will also decrease, which causes the Tx output power to be lowered, and vice versa. Thus, the Tx output power can keep stable under different working conditions.

MCU can set the power through changing the voltage input to IC4.

4.4 Principle of Frequency Synthesizer
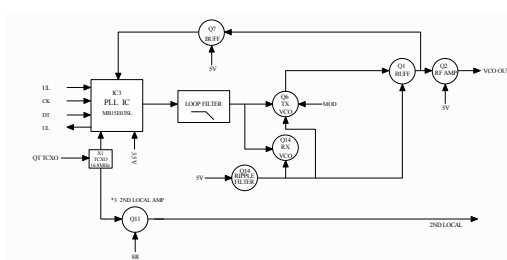
Figure 4.4 Frequency Synthesizer

PT8100 adopts PLL type frequency synthesizer.

The frequency synthesizer consists of reference oscillator, voltage control oscillator (VCO), programmable divider, phase comparator, and low pass filter (LPF).

Tx VCO unit consists of Q6, D1, D4, D5, and D6. D8 is the modulation circuit of Tx VCO.

Rx VCO unit consists of Q12, D14, D16, D17 and D18.

IC3 (MB15E03SL) is the PLL integrated circuit, which consists of programmable reference divider, programmable divider, phase comparator, and charge pump.

The low pass filter consists of R54 and C113.

The reference frequency is provided by X1 (TCXO, 16.8MHz).

Reference frequency from TCXO (Temperature-Controlled Crystal Oscillator) is divided by the programmable reference divider in IC3 to produce reference frequency of 5kHz or 6.25kHz (determined by the preset channel frequency and is controlled by MCU).

The oscillation frequency from VCO goes to IC3 where it is divided by the programmable divider and is then compared with the reference frequency to obtain the error signal. The signal is then filtered by a low pass filter and is sent to VCO to change the oscillation frequency of the VCO, enabling the frequency to reach the set value. Then the VCO is locked.

Unlock detection: When PLL is unlocked, pin14 of IC3 will output low level signal to MCU. Then MCU prohibits the Tx from transmitting and makes an alert tone.

4.5 Audio Processing Circuit
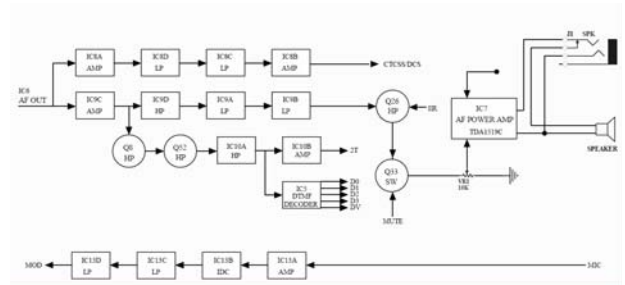
Figure 4.5 Audio Processing

MIC signal processing:

Voice signal from MIC is sent to IC13A for amplification (IC13A, D32, Q32 and other components form the AGC circuit to improve the dynamic range of the circuit). Then the resulting signal is pre-emphasized by C322 and R267 and goes to the IDC circuit consists of IC13B. After being limited, the signal is switched into wideband or narrowband in Q30 and then passes through the low pass circuit consists of IC13C and IC13D to remove signals above 3000Hz. Then the filtered signal is sent to VR2 to adjust the deviation and modulated by D8, and then is

sent to Tx VCO.

Rx audio signal processing:

Voice signal from IC6 is divided into two parts. One branch of the signal is routed to the low pass circuit consists of IC8, where it is amplified and filtered (to remove the voice signal) to obtain more purified CTCSS/DCS signal, which is then sent to MCU for processing. The other branch of the signal goes to IC9. After being amplified by IC9C (Q29 is the gain switching circuit which is used to switch volume between wideband and narrowband), the signal is divided into two branches again. One branch is sent to the 2-tone (5-tone) shaping circuit consists of Q8, Q52 and IC10, where it is shaped into better square wave signal, and then is sent to MCU to judge the 2-tone (5-tone) signal; the other branch passes through the high pass circuit consists of IC9D to remove the sub-audio signal and passes through the de-emphasis circuit consists of R173 and C245. Then the de-emphasized signal is passed through the low pass circuit consists of IC9A and IC9B and the high pass circuit consists of Q26. After that, the resulting signal goes to the volume switch where the signal volume will be adjusted. After being amplified in IC7, the signal will be output to drive the speaker.

Impedance of the speaker: 16Ω

Note:

* None of the terminals of the speaker should be grounded.

* The emergency alarm sound has no volume limit.

4.6 Power Supply:

The radio uses 13.8V battery, and the Tx power amplification circuit (IC1) and Rx audio power amplifier (IC7) directly adopt the battery for power supply.

IC17: 3V, LDO, micropower regulator, which supplies power for MCU, DTMF decoding unit etc.

IC16: 8V, LDO, micropower regulator.

Q38: 8T switch, which is controlled by MCU.

8T: Supplies power for front end of transmitter.

Q40: 8R switch, which is controlled by MCU.

8R: Supplies power for RF amplifier and mixer of the receiver.

4.7 MCU Unit

MCU unit controls the operation of each unit of the radio so that all functions can be realized.

Communicate with external PC.

Access the status data of the radio.

Control the PLL to generate Rx and Tx local oscillator frequencies.

Obtain status parameters of the working channel.

Control status of LED indicator.

Control power supply for each unit.

Check the actions of each functional key.

Generate CTCSS signal.

Generate DCS signal.

Generate power control signal.

Perform CTCSS decoding.

Perform DCS decoding.

Perform 2Tone (5Tone) decoding.

Test and control the squelch.

Control content of voice alert.

4.8 Memory (E²PROM, AT24C512)

The memory is stored with channel data, CTCSS/DCS data, other data for function setting, and parameter adjusting data.

CTCSS/DCS signal encoding and decoding:

CTCSS/DCS signal (output from pin97, PWM wave) generated by MCU is sent to TCXO for modulation; and the CTCSS/DCS signal (output from pin98, PWM wave) is sent to VCO modulation.

CTCSS/DCS signal from the receiver is sent to MCU for decoding. MCU checks if the CTCSS/DCS signal in the receiving signal matches the preset value of the radio, and determines whether to open the speaker or not.

CTCSS

CTCSS (Continuous Tone Control Squelch System) is a squelch control system which is modulated on carrier and is guided by a continuous sub-audio signal. If CTCSS is set, the communication between the transmitting and receiving radios can be realized only when the two radios have set the same CTCSS frequency. In doing this, disturbance from other signals can be avoided.

PT8100 has 39 groups of standard CTCSS frequencies for your selection. See Table 4.1.

CTCSS signal (PWM wave) is generated by MCU, and is passed through low pass filter consists of RC to remove the high frequency components (above 300Hz). Then the resulting signal is routed to VCO for modulation.

Table 4.1 CTCSS Frequencies

No.	Frequency [Hz]	No.	Frequency [Hz]	No.	Frequency [Hz]	No.	Frequency [Hz]
1	67.0	11	94.8	21	131.8	31	186.2
2	69.3	12	97.4	22	136.5	32	192.8
3	71.9	13	100.0	23	141.3	33	203.5

4	74.4	14	103.5	24	146.2	34	210.7
5	77.0	15	107.2	25	151.4	35	218.1
6	79.7	16	110.9	26	156.7	36	225.7
7	82.5	17	114.8	27	162.2	37	233.6
8	85.4	18	118.8	28	167.9	38	241.8
9	88.5	19	123.0	29	173.8	39	250.3
10	91.5	20	127.3	30	179.9		

DCS

DCS (Digital Code Squelch), which is used to control squelch, is a series of continuous digital codes modulated on carrier together with voice signal. If DCS is set, the speaker can be opened only when the radio receives signal with the same DCS to avoid disturbance of unwanted signals.

PT8100 has 83 standard codes (inverted and non-inverted) for your selection. See Table 4.2.

DCS signal (PWM wave) is produced by MCU. It passes through the low pass filter consists of RC to remove the high frequency components (above 300Hz). Then the resulting signal is sent to VCO and TCXO for modulation, with HF components of the DCS signal being modulated by VCO, and the LF components of the DCS signal being modulated by TCXO.

The DCS signal coming from the receiver is routed to MCU for decoding. MCU checks if the DCS code in the received signal matches the preset DCS of the radio, and determines whether to open the speaker or not.

Table 4.2 DCS Codes

023	114	174	315	445	631
025	115	205	331	464	632
026	116	223	343	465	654
031	125	226	346	466	662
032	131	243	351	503	664
043	132	244	364	506	703
047	134	245	365	516	712
051	143	251	371	532	723
054	152	261	411	546	731
065	155	263	412	565	732
071	156	265	413	606	734
072	162	271	423	612	743
073	165	306	431	624	754
074	172	311	432	627	

4.9 Semiconductor Data

MCU Description

Table 4.3 Port Description of MCU (MB90F882)

No.	Port name	Pin Name	I/O	Function
1	GLED	P40	O	Rx Green Indicator　H: on
2	NC			
3	NC	-	-	
4	NC	-	-	
5	P5	P32	I	P5 Button Input
6	P1	P33	I	P1 Button Input
7	P2	P34	I	P2 Button Input
8	P3	P35	I	P3 Button Input
9	P4	P36	I	P4 Button Input
10	POWER	P37	I	Power Button Input
11	NC			
12	NC			
11	NC	-	-	
12	NC	-	-	
13	VCC	VCC	-	CPU Power Input
14	VSS	VSS	-	GND
15	C	C	-	
16	LCD RST	P42	O	LCD Reset Control
17	LCD BLC	P43	O	LCD Backlight Control
18	LCD DAT	P44	I/O	LCD Serial Data Input/Output
19	LCD WR	P45	O	LCD Write Clock Output
20	LCD RD	P46	O	LCD Read Clock Output
21	LCD CS	P47	O	LCD Chip Selection Signal Output
22	MICDAT	P90	I	Reserved: Hand MIC Digital Keypad Data Input
23	HOOK	P91	I	Hook Signal Input
24	DEV2	P92	O	Max. Deviation Compensation
25	DEV1	P93	O	
26	UL	P94	I	PLL Unlock Detect Pin H：Locked，L：Unlocked
27	CK	P95	O	PLL Clock Output
28	LE	P96	O	PLL IC Enable Pin
29	DT	P97	O	PLL Data Output
30	AVCC	AVCC	-	Connect with VCC
31	AVRH	AVRH	-	Connect with VCC
32	NC	-	-	
33	AVSS	AVSS	-	Connect with VSS
34	QT/DQT IN	AN0	I（A/D0）	QT/DQT Signal Input
35	RSSI	AN1	I（A/D1）	Signal Strength Input
36	BUSY	AN2	I（A/D2）	Busy Signal Input
37	TEMP	AN3	I（A/D3）	Power Amplifier Temperature Protection Input
38	NC	-	-	
39	NC	-	-	
40	NC	-	-	
41	NC	-	-	
42	VSS	VSS	-	GND
43	DTMFD0	P71	I	DTMF Detect Input
44	DTMFD1	P72	I	DTMF Detect Input
45	DTMFD2	P73	I	DTMF Detect Input
46	DTMFD3	P74	I	DTMF Detect Input
47	RX	P76	O	TX/RX VCO Selection H: TX，　L: RX
48	DTMFDV	P75	I	DTMF Decoding Valid Input
49	MD2	MD2	-	Programming Test Point
50	MD1	MD1	-	Programming Test Point
51	MD0	MD0	-	Programming Test Point
52	RESET	RST	I	Programming Test Point
53	SCL	UI6	O	E^{2}PROM Clock Line
54	SDA	UO6	I/O	
55	TEST	P82	O	L：Writable
56	NC			
57	RXD	P84	I	RS－232 Input, Programming Test Point
58	TXD	P85	O	RS－232 Output, Programming Test Point
59	NC	-	-	
60	NC	-	-	
61	NC	-	-	

62	INT	IRQ20	I	Power Detect Input
63	DVCC	DVCC	-	
64	DVSS	DVSS	-	
65	8TC	PA2	O	Tx Power Control　H：On
66	8RC	PA3	O	Rx Power Control　H：On
67	SBC	P50	O	Main Power Switch Control　H: on
68	TXGSW	P51	O	Tx Gate Control　L: Tx
69	PA	P52	O	Public Address Control　H: PA
70	AF_MUTE	P53	O	Mute Control　L: AF Mute
71	NC	-	-	
72	NC	-	-	
73	DTMF	PPG6	O(PWM)	DTMF/2T/5T/Beep Output
74	VCCN	PPG7	O(PWM)	Frequency Voltage Regulation Output VCCN
75	P00	P00		High Level Programming Test Point
76	P01	P01		Low Level Programming Test Point
77	MIC_MUTE	P02	O	Mute Control　H: MIC Mute
78	AFCO	P03	O	AF Power Amplifier Control L: Power Amplifier On
79	NC	-	-	
80	NC	-	-	
81	NC	-	-	
82	PTT	P07	I	PTT Button Input
83	IGN	P10	I	Reserved: Ignition Switch Detect Input
84	EXT-ALARM	P11	I	Reserved: External Alarm Input
85	MAXAF	P12	O	Max. Alarm Volume Control Switch H: Controlled by Volume Switch L: Max Volume at Emergency Alarm
86	NC	-	-	
87	NC	-	-	
88	VCC	VCC	-	CPU Power Input
89	VSS	VSS	-	GND
90	X1	X1	-	Oscillator
91	X0	X0	-	Oscillator
92	SHIFT	P15	O	Clock Beat Shift H：On
93	W/N	P16	O	Wideband/Narrowband Control H：Narrowband　L：Wideband (Reserved)
94	W/N	P17	O	Wideband/Narrowband Control H：Wideband　L：Narrowband
95	APC	PPG0	O(PWM)	TX: Automatic Power Control Output
96	TV	PPG1	O(PWM)	RX:BPF Tuning Output
97	DCSTCXO	PPG2	O(PWM)	CTCSS/DCS Output to TCXO
98	DCSVCO	PPG3	O(PWM)	CTCSS/DCS Output to VCO
99	TONEIN	TIO1	I	2T/5T Signal Input
100	RLED	P25	O	Tx Red Indicator　H：Light

Table 4.4 Function Description of Semiconductor Components

Position Mark	Model	Function Description
IC5	HT9172	DTMF decoder chip
IC14	PST9140NR	MCU reset circuit
IC13	NJM2902V	MIC amplification, limitation, filtering
IC3	MB15E03SL	Frequency synthesizer
IC4	NJM2904	APC, Voltage comparison, driving
IC6	TA31136	Rx 2nd local oscillation, 2nd IF amplification, limitation, demodulation, and noise amplification
IC9	NJM2902	Rx demodulated signal amplification and filtering
IC8	NJM2902	Rx CTCSS/DCS signal amplification and filtering
IC11	MB90F882	MCU
IC12	AT24C512	E^{2}PROM, memorizes channel frequency data, function setting parameters, and adjusting status parameters
IC7	TDA7297D	Rx AF power amplification
IC1	RA30H1317M	Tx final power amplification

IC17	TA78033AF	3V voltage regulation output
IC16	L7808CV	8V voltage regulation output
IC18	NJM78L05UA	5V voltage regulation output
IC19	UPB1509GV	Frequency divider
Q9	DTC144EE	APC control switch
Q12	2SK508NV	Rx VCO oscillation circuit
Q14	2SC4617	VCO power filter
Q11	2SC5108	Rx 2nd local oscillation frequency multiplier circuit
Q16	2SK1829	Rx high power amplifier gain control switch
Q18	3SK318	Rx high power amplifier
Q19	3SK318	First mixer
Q1	2SC5108	VCO buffer amplifier
Q20	2SC5108	1st IF amplifier
Q21	2SC4617	Rx noise amplifier
Q22	DTC144EE	Wideband/narrowband noise toggle switch
Q23	DTA144EE	Rx wideband/narrowband frequency discrimination toggle switch
Q29	DTA144EE	Rx wideband/narrowband toggle switch
Q30	2SK1824	Tx wideband/narrowband toggle switch
Q27	DTC144EE	Beat shift control switch
Q33	2SK1824	Rx AF mute switch
Q45	2SK1824	Rx AF output switch, disconnect on emergency
Q28	DTC144EE	AF power amplification control switch
Q35	DTA144EE	Power switch of MIC amplification unit
Q40	KTA1298	8R switch
Q1	2SC5108	VCO buffer amplifier
Q38	KTA1298	8T switch
Q32	2SC4919	MIC AGC control switch
Q4	2SC3357	Tx 1st amplifier
Q5	2SC3357	Tx 2nd amplifier
Q46	2SK1824	Rx AF output switch, put through on emergency
Q6	2SK508NV	Tx VCO oscillation circuit
Q3	2SC4116	Tx VCO control switch
Q7	2SC5108	VCO buffer amplifier
Q13	2SC4116	Rx VCO control switch
Q53	2SK1824	Speaker/PA toggle switch
Q54	2SK1824	Speaker/PA toggle switch

Table 4.5 Function Description of Diodes

Position Mark	Model	Function Description
D3, D37	L709CE	Transmitter antenna switch diode
D12	MA2S111	Unlock detect diode
D14, D16, D17, D18	HVC376	Rx VCO oscillation varactor diode
D7	HZU5ALL	APC output voltage limiting diode
D2, D19	HSC277	VCO output switch
D20, D21	DAN222	Rx 2nd IF filter wideband/narrowband toggle switch
D23	HVC355B	Rx BPF varactor diode
D25	MA742	Noise demodulation
D27, D28, D30, D29	HVC376B	Rx BPF varactor diode
D32	1SS372	MIC AGC detect diode
D1, D4, D5, D6	HVC376	Tx VCO oscillation varactor diode
D8	1SV278	Tx VCO modulation diode

Table 4.6：Features of Crystal Filter XF1

Item	Rated Value
Nominal center frequency	49.95MHz
Passband width	±7.5kHz or higher

40dB stop bandwidth	±20.0kHz or lower
Pulse	1.0dB or lower
Insertion loss	3.0dB or lower
Guarantee attenuation	80dB or higher
Terminal impedance	330Ω

Table 4.7 Features of CF1 LTWC450H

Item	Rated Value
Nominal center frequency	450kHz
6dB band width	±3.0kHz or higher
50dB band width	±9.5kHz or lower
Pulse	2.0dB or lower
Insertion loss	6.0dB or lower
Guarantee attenuation	47.0dB or higher
Terminal impedance	1.5kΩ

Table 4.8 Features of CF1 LTWC450F

Item	Rated Value
Nominal center frequency	450kHz
6dB band width	±6.0kHz or higher
50dB band width	±12.5kHz or lower
Pulse	2.0dB or lower
Insertion loss	6.0dB or lower
Guarantee attenuation	47.0dB or higher
Terminal impedance	1.5kΩ

Chapter 5 Mode Introduction

Mode Introduction

Mode		Function	How to enter
User Mode		For normal use	Power ON
PC Mode	Data Programming Mode	Used to read and write frequency data and other features to and from the radio	Received commands from PC. See below for further information.
	PC Test Mode	Tune the radio parameters by PC	Received commands from PC. See below for further information.
	Firmware Programming Mode	Upgrade the radio when new features are released	Received commands from PC. See below for further information.
Wired Clone Mode		Used to transfer programming data from one radio to another	Press and hold P1 and P2 for over 2 seconds while turning the radio power ON
Firmware Version Display Mode		Display firmware version	Press and hold ◣ while turning the radio power on to see the firmware version; release the button to enter user mode

5.1 Data Programming Mode

The radio has been set before leaving the factory. However, due to different requirements of users, the radio's operating frequency, channels, CTCSS/DCS, auto scan, and other functional parameters should be reprogrammed. Therefore, Kirisun has specially designed a set of Chinese/English programming software KSP8100 with friendly interface,

convenient operation and visualized display for setting functional parameters of the radio.

Steps for setting the functional parameters of the radio by PC are as follows:

A. Install KSP8100 on the PC.

B. Connect the mobile radio to the serial port of the PC with the special programming cable. Refer to the figure below.

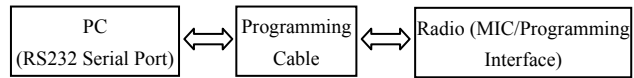| PC (RS232 Serial Port)	⟷	Programming Cable	⟷	Radio (MIC/Programming Interface)

Figure 5.1

C. Turn the computer power ON.

D. Turn the radio power ON.

E. Run the KSP8100 programming software by double clicking on its executive program.

F. Click "Program" in the main menu of KSP8100, and click "Read from radio" in the pull-down menu to read parameters of the radio to the computer; click "Write to radio" in the pull-down menu to write parameters in the computer to the radio.

G. The following parameters can be set by using KSP8100 according to requirements of the user:

1) Functions of programmable buttons

2) Alert tone

3) Optional functions

4) 2Tone/DTMF/5Tone signalling

5) TOT

6) Emergency alarm

7) Personal template

8) Scan/FCS/Vote functions

9) Channel information

Please refer to the "Help" document of KSP8100 for details.

Note:

1. Please turn the radio power off before connecting it to the PC.

2. While reading data from the mobile radio, the LED on the radio lights red, and the PTT key should not be pressed; while writing data to the mobile radio, the LED on the radio lights green.

3. Please firstly read data of the radio and back up the data before editing the parameters on KSP8100.

4. If the radio cannot function normally after being written in with the edited data, please rewrite the backup data into the radio.

5. "Model Information" is important for the radio; users should not modify it.

6. After the programming is finished, the mobile radio will restart automatically and return to the user mode.

5.2 PC Test Mode

Connect the radio to the serial port of the computer with the special programming cable. Refer to Figure 5.1.

Warning: Before entering the PC Test Mode, please firstly connect a 50Ω HF load to the antenna connector of the radio or connect the radio to a general test set.

With the KSP8100 programming software, you can enter the Tuning Mode under PC Test Mode to tune the following parameters of the radio:

1) Frequency

2) Low/Mid/High power

3) Tone Deviation

4) DTMF Deviation

5) DCS Balance

6) DCS Deviation

7) CTCSS (67) Deviation

8) CTCSS (151.4) Deviation

9) CTCSS (254.1) Deviation

10) Rx Sensitivity

11) SQL9/SQL1 On

12) SQL9/SQL1 Off

13) RSSI Level1/Level4

5.3 Firmware Programming Mode

The radio is equipped with an internal Flash ROM which can be upgraded when new features are released. The operation procedures are as follows:

1. Turn the radio power ON and the radio enters User Mode.

2. Run the firmware programming software KMU on PC.

3. Connect the radio to the computer by the programming cable.

4. Select a COM port and proper baud rate (115200 is recommended) according to the actual situation. Then click on "E.P" to start downloading. The LCD will display "Firmware".

5. After the communication ends successfully, click on "OK" to exit.

6. If you want to continue programming other radios, repeat steps 1 to 5.

Chapter 6 Disassembly and Assembly for Maintenance

The radio is a kind of sophisticated communication equipment with precise structure and small size. You should assemble and disassemble it carefully during the maintenance. The instructions for the assembly and disassembly are as follows.

6.1 Exploded View
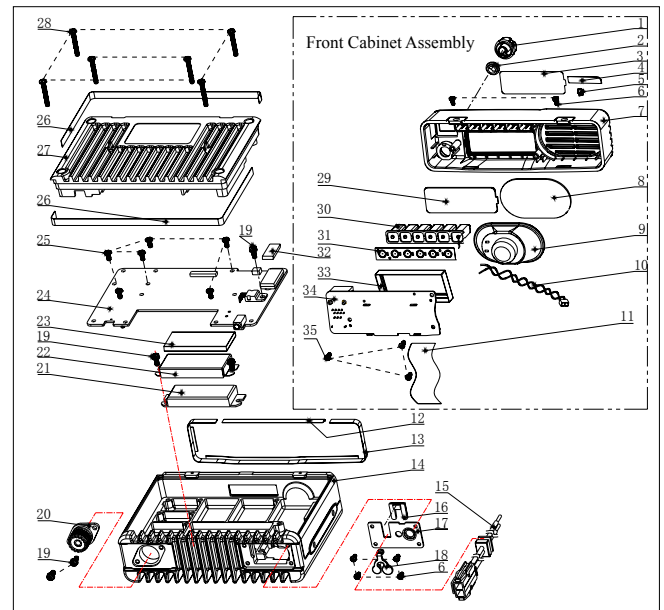
No.	Part No.	Description	PCS
1	201-008100-R02A	Volume Knob	1
2	203-007200-R08	Nut for Knob	1
3	204-008200-R08A	LCD Protective Film	1
4		LOGO	1
5	201-008100-R05A	Light Guide	1
6	301-25050J-R01C	Screw M2.5*5	6
7	201-008100-R01A	Front Cabinet	1
8	204-008000-R01A	Dustproof Net for Speaker	1
9	121-100000-R19	Speaker	1
10	120-400000-R14	Speaker Wire	1
11	120-400000-R15	Flat Cable	1
12	204-008000-R02A	Upper Dustproof Strip for Front Cabinet	1
13	204-008000-R03A	Lower Dustproof Strip for Front Cabinet	1
14	203-008000-R02B	Al Top Case	1
15	120-100000-R42A	Power Cable	1
16	201-008100-R03A	Power Cable Fastener	1
17	203-008000-R03A	Metal Baffle Plate	1
18	202-008200-R02A	Rubber Plug for External Speaker Jack	1
19	303-30100G-R01	Screw M3*10, with Spring Washer	5
20	203-008200-R03B	Antenna Connector	1
21	102-304452-R01	Power Module	1
22	203-008200-R05A	Shield for Power Module	1
23	204-008200-R10B	Electric Conductive Sponge	1
24		Main Board Assembly	1
25	301-30060G-R01	Screw M3*6	7

| 26	204-008000-R04A	Dustproof Strip between Top and Bottom Al Case	2
27	203-008000-R01B	Al Bottom Case	1
28	301-30250D-R01	Screw M3*25	6
29	201-008100-R04A	Lens	1
30	202-008100-R01A	Rubber Key	1
31	203-008100-R01A	Metal Dome	1
32	202-008000-R03A	Heat Conductive Rubber Cushion	1
33	202-008100-R02A	LCD Dustproof Rubber Cushion	1
34		PCB Assembly	1
35	302-26060D-R01	Screw M2.6*6	3

6.2 Instruction for Disassembly of the Radio for Maintenance

6.2.1 RF-PCB disassembly

① Screw off the six M3*25 screws on the Al bottom case, and remove the Al bottom case (See figure below).

② Screw off the two screws for power module and then remove the shield for power module. Then remove the solder of the power module on the PCB with a soldering iron (See figure below).

③ Screw off the four M2.5*5 screws on the baffle plate, and then remove the metal baffle plate, the power cable fastener and the rubber plug for external speaker jack (See figure below).
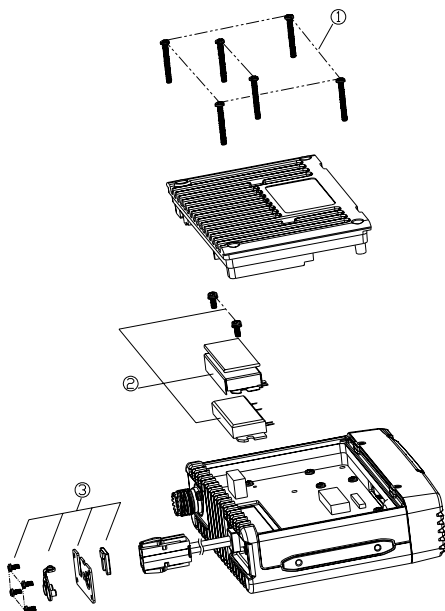
④ Remove the flat cable and the speaker wire, and then remove the solder between the antenna connector and the RF-PCB with a soldering iron. Screw off the screws, and take the RF-PCB out of the top Al case carefully (See figure below).
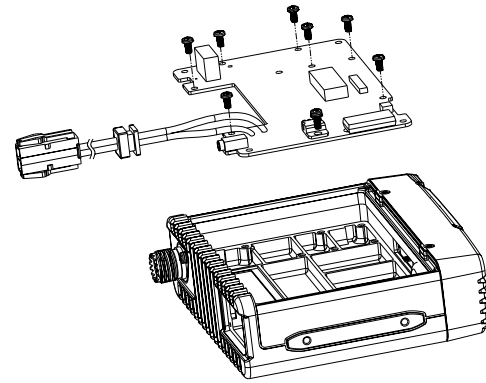
6.2.2 Key-PCB disassembly

① Screw off the six M3*25 screws on the Al bottom case, and remove the bottom case (See figure below).

② Remove the flat cable and speaker wire (See figure below).

③ Screw off the two M2.5*5 screws on the front cabinet, and then separate the front cabinet from the main machine (See figure below).
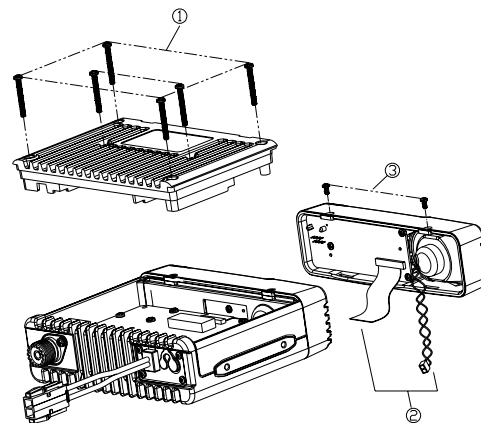
④ Pull out the volume knob, and then remove the circlip and nut for volume knob (See figure below).

⑤ Screw off the three fixing screws (M2.6*6) for Key-PCB, and then take the Key-PCB out of the plastic front cabinet (See figure below).
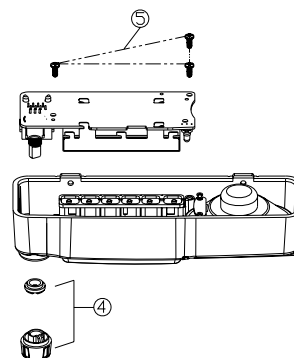
After the disassembly above, you can repair and adjust the radio according its actual malfunction.

Chapter 7 Adjustment

Before test/adjustment, make sure all equipment has been well grounded!

Before test/adjustment, make sure the antenna output terminal has been correctly connected to corresponding equipment or load!

The transmitter output terminal must be terminated with an RF power attenuator and connected to a standard signal generator (SSG)/frequency counter/deviation meter/spectrum analyzer!

Make sure no transmission operation is being conducted while measuring the receiver!

During the adjustment/test/maintenance, make sure reliable anti-static measures are taken for human body and equipment.

7.1 Equipment and Software Required for Test and Adjustment

Equipment and software listed in Table 7.1 are required for test and adjustment of PT8100.

Table 7.1 Equipment and Software Required for Test and Adjustment

No.	Item	Specifications
1	Computer	P2 or above, IBM compatible PC, WINDOWS 98/ME/2000/XP Operating System
2	Programming software	KSP8100
3	Programming cable	KSPL05
4	Clone cable	KCL02
5	DC regulated power supply	Output voltage: 13.8V Output current: ≥ 20A
6	RF power meter	Measurement range: 0.5-50W Frequency range: 100MHz-500MHz Impedance: 50Ω SWR ≤ 1.2
7	Frequency counter	Frequency range: 0.1 - 600MHz Frequency accuracy: better than ±1×10⁻⁶ Sensitivity: better than 100mV
8	Deviation meter	Frequency range: DC - 600MHz Measurement range: 0 - ±5kHz
9	DMM	Input impedance: above 10MΩ/V DC, capable of measuring voltage, current and resistance.
10	Audio signal generator	Frequency range:2-3000Hz Output level: 1-500mV
11	RF power attenuator	Attenuation: 40dB or 50dB Supporting power : higher than 50W
12	Standard signal generator	Frequency range: 10MHz-1000MHz Output level: 0.1uV-32mV (-127dBm~-17dBm)
13	Oscilloscope	Frequency range: DC~20MHz Test range: 10mV-20V
14	Audio frequency voltmeter	Test range: 10mV-10V

Recommendation: Item 6, 7, 8, 10, 11, and 12 listed in the table can be replaced by HP8920 general test set.
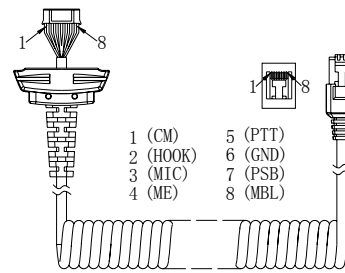

Figure 7.1 External Microphone Interface Definition

7.2 Adjustment

After changing components during the maintenance, it is necessary to test the radio and adjust its technical parameters. The following part is going to introduce the adjustment items.

Some parameters can be adjusted by use of KSP8100 programming software (in the Tuning Mode). The adjustable parameters are as follows:

7.2.1 VCO

a. Adjust the channel to its high frequency point (See Table 7.2).

b. Under the receiving status, measure the voltage of PD by DMM. Then adjust the PD voltage to be 3.5V ± 0.3V by tuning the trimming capacitor C122.

c. Under the transmitting status, measure the voltage of PD by DMM. Then adjust the PD voltage to be 3.5V ± 0.3V by tuning the trimming capacitor C39.

d. Adjust the channel to its low frequency point (See Table 7.2).

e. Under the receiving status, measure the voltage of PD by DMM, the value should be larger than 0.6V.

f. Under the transmitting status, measure the voltage of PD by DMM, the value should be larger than 0.6V.

Table 7.2 High/Center/Low Frequency Point for PT8100

	Low Freq Point	Center Freq Point	High Freq Point
PT8100-01	136.125MHz	154.125MHz	173.975MHz
PT8100-02	400.125MHz	425.125MHz	449.975MHz
PT8100-03	438.125 MHz	464.125 MHz	489.975MHz

7.2.2 Tx deviation (set the HP8920 to be in the Tx status, and set the filter to be 50Hz~15kHz)

a. Input audio signal of 120mV, 1000Hz to the MIC jack of the radio.

b. Set the channel to its low frequency point (See Table 7.2).

c. Press and hold the PTT key while adjusting VR2 to make the deviation be 4.2kHz.

d. Observe the deviation of other channels, which should be larger than 3.5kHz.

7.2.3 PLL frequency (set the HP8920 to be in the Tx status)

In the "Tuning Mode", double click "Frequency Stability", and adjust the value within the range of 0~255 to make the Tx frequency reach the rated value (within ±100Hz).

7.2.4 Tx power (set the HP8920 to be in the Tx status)

a. In the "Tuning Mode", double click "Tx High Power", and adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the Tx power be 22W. Meanwhile, observe the operating current, which should be no larger than 7A.

b. In the "Tuning Mode", double click "Tx Mid Power", and adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the Tx power be 10W. Meanwhile, the operating current should be no larger than 5A.

c. In the "Tuning Mode", double click "Tx Low Power", and adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the Tx power be 5W.

7.2.5 DCS waveform balance (set the HP8920 to be in the Tx status, and set the filter to be 20Hz ~ 300Hz)

a. In the "Tuning Mode", double click "DCS Balance", select wideband, and adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the waveform be similar to good square wave.

b. In the "Tuning Mode", double click "DCS Balance", and select narrowband. Adjust the value within the range of 0~255 to make the waveform be similar to good square wave.

7.2.6 DCS Deviation (set the HP8920 to be in the Tx status, and set the filter to be 20Hz ~ 300Hz)

a. In the "Tuning Mode", double click "DCS Deviation", and select "Wideband". Adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the deviation be 0.75kHz.

b. In the "Tuning Mode", double click "DCS Deviation", and select "Narrowband". Adjust the value within the range of 0~255 to make the deviation be 0.35kHz.

7.2.7 QT (67) Deviation (set the HP8920 to be in the Tx status, and set the filter to be 20Hz ~ 300Hz)

a. In the "Tuning Mode", double click "QT(67) Deviation", and select "Wideband". Adjust the five frequency points of "Lowest",

"Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the deviation be 0.75kHz.

b. In the "Tuning Mode", double click "QT(67) Deviation", and select "Narrowband". Adjust the value within the range of 0~255 to make the deviation be 0.35kHz.

7.2.8 QT (151) Deviation (set the HP8920 to be in the Tx status, and set the filter to be 20Hz ~ 300Hz)

a. In the "Tuning Mode", double click "QT(151) Deviation", and select "Wideband". Adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the deviation be 0.75kHz.

b. In the "Tuning Mode", double click "QT(151) Deviation", and select "Narrowband". Adjust the value within the range of 0~255 to make the deviation be 0.35kHz.

7.2.9 QT (254) Deviation (set the HP8920 to be in the Tx status, and set the filter to be 20Hz ~ 300Hz)

a. In the "Tuning Mode", double click "QT(254) Deviation", and select "Wideband". Adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the deviation be 0.75kHz.

b. In the "Tuning Mode", double click "QT(254) Deviation", and select "Narrowband". Adjust the value within the range of 0~255 to make the deviation be 0.35kHz.

7.2.10 Tone Deviation/DTMF Deviation (set the HP8920 to be in the Tx status, and set the filter to be 50Hz ~ 15kHz)

a. In the "Tuning Mode", double click "Tone Deviation/DTMF Deviation", and select "Wideband". Adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the deviation be 3.5kHz.

b. In the "Tuning Mode", double click "Tone Deviation/DTMF Deviation", and select "Narrowband". Adjust the value within the range of 0~255 to make the deviation be 1.7kHz.

7.2.11 Rx Sensitivity (set the HP8920 to be in the Rx status)

In the "Tuning Mode", double click "Rx Sensitivity", and adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively within the range of 0~255 to make the sensitivity of each frequency point be the highest.

See Table 7.4 for detailed parameters.

7.2.12 Rx squelch (set the HP8920 to be in the Rx status)

a. In the "Tuning Mode" (input RF signal with the same

frequency as the adjusted frequency point and with the signal level of -116dBm, audio frequency of 1kHz, and deviation of 3kHz to the antenna connector of the mobile radio), double click "SQL9 Open", and select "Wideband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

b. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -116dBm, audio frequency of 1kHz, and deviation of 1.5kHz to the antenna connector of the mobile radio), double click "SQL9 Open", and select "Narrowband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

c. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -118dBm, audio frequency of 1kHz, and deviation of 3kHz to the antenna connector of the mobile radio), double click "SQL9 Close", and select "Wideband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

d. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -118dBm, audio frequency of 1kHz, and deviation of 1.5kHz to the antenna connector of the mobile radio), double click "SQL9 Close", and select "Narrowband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

e. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -123dBm, audio frequency of 1kHz, and deviation of 3kHz to the antenna connector of the mobile radio), double click "SQL1 Open", and select "Wideband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK",

the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

f. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -123dBm, audio frequency of 1kHz, and deviation of 1.5kHz to the antenna connector of the mobile radio), double click "SQL1 Open", and select "Narrowband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

g. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -125dBm, audio frequency of 1kHz, and deviation of 3kHz to the antenna connector of the mobile radio), double click "SQL1 Close", and select "Wideband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

h. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -125dBm, audio frequency of 1kHz, and deviation of 1.5kHz to the antenna connector of the mobile radio), double click "SQL1 Close", and select "Narrowband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

7.2.13 Rx RSSI (set the HP8920 to be in the Rx status)
a. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -116dBm, audio frequency of 1kHz, and deviation of 3kHz to the antenna connector of the mobile radio), double click "RSSI Level1", and select "Wideband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

b. In the "Tuning Mode" (input RF signal with the same

frequency as the adjusted frequency point and with the signal level of -116dBm, audio frequency of 1kHz, and deviation of 1.5kHz to the antenna connector of the mobile radio), double click "RSSI Level1", and select "Narrowband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment is completed.

c. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -80dBm, audio frequency of 1kHz, and deviation of 3kHz to the antenna connector of the mobile radio), double click "RSSI Level4", and select "Wideband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment of that frequency point is completed. Use the

method to adjust the five frequency points of "Lowest", "Low", "Mid", "High" and "Highest" respectively.

d. In the "Tuning Mode" (input RF signal with the same frequency as the adjusted frequency point and with the signal level of -80dBm, audio frequency of 1kHz, and deviation of 1.5kHz to the antenna connector of the mobile radio), double click "RSSI Level4", and select "Narrowband". Choose a frequency point, and click "Begin", the programming software will adjust the value automatically. When the value keeps stable, click "OK", the adjustment is completed.

7.3 Adjustment Description

Refer to Table 7.3, 7.4, and 7.5 for the above mentioned adjustment.

Table 7.3 VCO

Item	Test Condition	Test Equipment	Measurement Terminal	Adjustment Parts	Requirement	Remark
Setting	BATT terminal voltage: 13.8V	DMM	PD			
VCO lock voltage	CH: Rx high freq point			C122	3.5V ± 0.3V	Adjust
	CH: Rx low freq point				> 0.6V	Observe
	CH: Tx high freq point			C39	3.5V ± 0.3V	Adjust
	CH: Tx low freq point				> 0.6V	Observe

Table 7.4 Receiver Section

Item	Test Condition	Test Equipment	Measurement Terminal	Adjustment Parts	Requirement	Remark
BPF		Spectrum analyzer / General test set	Before mixing	Tuning mode	Smooth wave	User adjustment not recommended
Audio Power	Test freq: Mid freq point Antenna connector input: RF OUT: -47dBm (1μV) MOD: 1kHz DEV: ± 3.0kHz/± 1.5kHz Audio load: 8Ω	RF signal generator Oscilloscope Audio frequency voltmeter Distortion meter General test set	Speaker connector	Tuning mode	(Turn the volume knob clockwise to the end) Audio power ＞ 4W	
Sensitivity	CH: Mid freq point CH: Low freq point CH: High freq point RF OUT: -119dBm (0.25μV) MOD: 1kHz DEV: ± 3.0kHz/± 1.5kHz			Tuning mode	SINAD: 12dB or higher	
Squelch	CH: Rx mid freq point			Tuning mode	Normal squelch open after adjustment	
	SQL9 Open RF OUT: -116dBm					
	SQL9 Close RF OUT: -118dBm					
	SQL1 Open RF OUT: -123dBm					
	SQL1 Close RF OUT: -125dBm					

Table 7.5 Transmitter Section

Item	Test Condition	Test Equipment	Measurement Terminal	Adjustment Parts	Requirement	Remark
Tx frequency		Frequency counter / General test set	Antenna	Tuning mode	Within ± 100Hz	
DCS waveform (balance)		Oscilloscope / General test set		VR1	Smooth and similar to square wave	
Power		Power meter / General test set Ammeter		Tuning mode	Adjust to 22W/5W	
Max. modulation DEV	CH: Tx low freq point AG: 1kHz/120mV	Deviation meter / General test set		VR2	Adjust to ± 4.2kHz/2.1kHz	± 200Hz
DTMF DEV				Tuning mode	Adjust to ±3.5kHz/1.7kHz	
CTCSS DEV	CTCSS: 67Hz			Tuning mode	Adjust to ± 0.75kHz/0.35kHz	± 50Hz
CTCSS DEV	CTCSS: 151.4Hz			Tuning mode		
CTCSS DEV	CTCSS: 254.1Hz			Tuning mode		
DCS DEV	DCS: 023N			Tuning mode		

Chapter 8 Specifications

8.1 General Specifications

Product Model	PT8100	
Frequency	136-174MHz	400-450MHz
	438-490MHz	350-400MHz
Type of Modulation	16KΦF3E/11KΦF3E	
Number of Channels	256	
Channel Spacing	25kHz/12.5kHz	
IF	1st IF: 49.95MHz; 2nd IF: 450kHz	
Operating Voltage	13.8V, cathode grounded	
Operating Temperature	-30℃~ +60℃	
Antenna Impedance	50Ω	
MIC Impedance	2.2k Ω	
Dimension	150*43*131mm (radio only)	
Weight	1070g (radio only)	

8.2 RX Part

Usable Sensitivity (12dB SINAD)	≤ -118dBm
Squelch Open Sensitivity	≤ -121dBm @ SQL1
Rx Residual Output	W: ≤ -45dB; N: ≤ -40dB
Modulation Rx Bandwidth	W: ± 7kHz; N: ± 3.5kHz
Adjacent Channel Selectivity	W: ≥ 70dB; N: ≥ 60dB
Intermodulation Rejection	≥ 65dB
Spurious Response Rejection	≥ 70dB
Audio Output Power	4W, balanced @ distortion ≤ 5%, 8 Ω
Rx Current Consumption	≤ 1A
Standby Current	≤ 100mA

8.3 TX Part

Tx Power	20W/5W @ 13.8V DC

Frequency Stability	≤ ± 2.5ppm
Max. Modulation Deviation	± 5kHz / ± 2.5kHz
Modulation Distortion (300-3000Hz)	≤ 3%
Adjacent Channel Tx Power	W: ≥ 70dB; N ≥ 60dB
Spurious Emission	≥ 70dB
Residual FM	W: ≤ -45dB; N: ≤ -40dB
Tx Current Consumption	≤ 7A @ 13.8V DC

Chapter 9 Troubleshooting

No.	Problem	Causes and Solutions
1	Power on Failure	A. The power cable is not reliably connected with the accumulator or the radio, please reconnect it. Make sure the power voltage should be larger than 13V. B. The fuse of the power cable is burnt out. Please change it. C. The power button is in poor contact. Please change the rubber key or change the key PCB. D. The accumulator is out of power. Please charge it or change a new one. E. The MCU is broken, please change the IC. F. The zener diode IC17 is broken, please change the IC.
2	PLL unlocked (Beeping)	A. The PLL crystal oscillator X1 is broken. Please change it. B. The oscillator transistor is broken. Please change it. D. The PLL IC3 is broken. Please change it.
3	Cannot transmit	A. The frequencies of both users are not the same. Please select the same frequency

		channel again. B. The CTCSS/DCS signals of both users are not the same. Please reset it. C. The radio is out of effective communication range.
4	No signal	A. The antenna is in poor contact. Please fasten the antenna until secure. B. The sensitivity is low; please adjust it in the "Tuning Mode". C. The high-frequency amplifying tube Q18 is broken. Please change it. D. The squelch level is too high and the squelch cannot be opened. Please reset the squelch level. E. The mixing tube Q19 is broken. Please change it. F. The FM processing chip IC16 is broken. Please change it.
5	The transmitting red light is on, but no voice is heard by the recipient.	A. Power module IC1 is broken, so there is no power output, please change it. B. The microphone is broken, please change it. C. The operational amplifier IC13 is broken, please change it.
6	The receiving green light is on, but no voice is heard.	A. The speaker is broken. Please change it. B. The audio power amplifier IC7 is broken. Please change a new IC. C. The switching tube Q33 is broken, please change a new one. D. The operational amplifier IC9 is broken, please change a new IC.
7	Abnormal programming	A. The programming cable connection is abnormal, check the cable connection. B. The RS-232 serial port output of the computer is abnormal, please check the computer. C. The radio's socket for programming cable is in poor contact, please check the socket. If the socket is abnormal, please change it.

Appendix 1 Abbreviations

AMP: Amplify, Amplifier

ANT: Antenna

APC: Automatic Power Control

BPF: Band Pass Filter

CTCSS: Continuous Tone Control Squelch System

DCS: Digital Code Squelch

DEMOD: Demodulation

E^{2}PROM: Electrical Erasable Programmable Read Only Memory

HPF: High Pass Filter

IDC: Instantaneous Deviation Control

IF: Intermediate Frequency

LED: Light-Emitting Diode

LNA: Low Noise Amplifier

LPF: Low Pass Filter

MCU: Micro Control Unit

MIC: Microphone

MOD: Modulation

MONI: Monitor

PLL: Phase Lock Loop

PTT: Push-to-talk

RX: Receiver

SPK: Speaker

TCXO: Temperature Controlled Crystal Oscillators

TX: Transmitter

UL: Un-lock

VCO: Voltage Control Oscillator

Appendix 2 Electronic Parts List

No.	Part No.	Description	Qty	Position Mark
1	101-08100V-R04	PT8100PCB / FR4, 1.6mm, PT8100V-100325.PCB, ROHS	1	
2	102-0MB90F-R01	CPU / MB90F882PMC-GE1, LQFP100, FUJITSU, ROHS	1	IC11
3	102-1509GV-R01	Frequency Divider IC / UPB1509GV, ROHS	1	IC19
4	102-301317-R01	power modules / RA30H1317M, ROHS	1	IC1
5	102-9124NR-R01	Reset IC / SYSTEM, RESET, PST9124NR, ROHS	1	IC14
6	102-A31136-R01	IF(FM) demodulation IC / TA31136FN, SSOP, ROHS	1	IC6
7	102-AT24C5-R01	Memory IC / AT24C512BN-SH25, ROHS	1	IC12
8	102-B15E03-R01	PLL IC / MB15E03SL, PLL, 16-PIN, SSOP, ROHS	1	IC3
9	102-FP3502-R01	Voltage regulator IC / XC62FP3502PR, SOT-89, ROHS	1	IC2
10	102-HT9172-R01	DTMF decode IC/ HT9172, SOP, ROHS	1	IC5
11	102-L7808C-R01	Voltage regulator IC / L7808CV, ROHS	1	IC16
12	102-M2902V-R01	Operational amplifier / NJM2902V, OP-AMP, ROHS	4	IC8, IC9, IC10, IC13
13	102-M2904V-R01	Operational amplifier / NJM2904V, OP-AMP, ROHS	1	IC4
14	102-M78L05-R01	Voltage regulator IC / NJM78L05UA，ROHS	1	IC18
15	102-TA7803-R01	Voltage regulator IC / TA78033AF, TOSHIBA, ROHS	1	IC17
16	102-TDA729-R01	AUDIO, AMP IC / TDA7297D, ST, ROHS	1	IC7

17	103-00DZ18-R01	Chip Voltage regulator diode ／ 02DZ18(X.Y)，ROHS	1	D35
18	103-0DA221-R01	Chip diode ／ DA221(ROHM)，ROHS	1	D13
19	103-1SS372-R01	Chip switch diode ／ 1SS372(TOSHIBA)，ROHS	1	D32
20	103-1SV278-R01	Chip variable capacitor diode ／ 1SV278，ROHS	1	D8
21	103-709CER-R01	Chip diode ／ L709CER，ROHS	4	D3，D11，D36，D37
22	103-A2S111-R01	Chip switch diode ／ 0603，MA2S111(PANASONIC)，ROHS	2	D12，D15
23	103-DAN222-R01	Chip switch diode／ DAN222，(ROHM)，ROHS	3	D20，D21，D33
24	103-HSC277-R01	Chip diode / Waveband switch,HSC277(HITACHI)，ROHS	2	D2，D19
25	103-HVC376-R01	Chip variable capacitor diode ／ HVC376B，ROHS	12	D1，D4，D5，D6，D14，D16，D17，D18，D27，D28，D29，D30
26	103-HZU5AL-R01	Chip Voltage regulator diode ／ HZU5ALL(HITACHI)，ROHS	1	D7
27	103-RB706F-R01	Chip switch diode ／ RB706F-40，SOT-323，ROHS	3	D9，D10，D25
28	103-SM3MA1-R01	diode ／ DSM3MA1，ROHS	1	D34
29	104-A144EE-R01	Chip transistor ／ DTA144EE(ROHM)，ROHS	4	Q23，Q29，Q35，Q36
30	104-C144EE-R01	Chip transistor ／ DTC144EE(ROHM)，ROHS	14	Q9，Q10，Q17，Q22，Q24，Q25，Q27，Q28，Q37，Q42，Q43，Q44，Q47，Q50
31	104-KRC404-R01	Chip transistor ／ KRC404RTK，ROHS	1	Q41
32	104-SA1641-R01	Chip transistor ／ 2SA1641(S.T)，ROHS	1	Q39
33	104-SC3357-R01	Chip transistor ／ 2SC3357，ROHS	2	Q4，Q5
34	104-SC4116-R01	Chip transistor ／ 2SC4116-GR，ROHS	1	Q13
35	104-SC4617-R02	Chip transistor ／ 2SC4617(R)(ROHM)，ROHS	6	Q8，Q14，Q21，Q26，Q31，Q52
36	104-SC4919-R01	Chip transistor ／ 2SC4919,MUTING,CIRCUIT(SANYO)，ROHS	1	Q32
37	104-SC5108-R01	Chip transistor ／ 2SC5108Y(TOSHIBA)，ROHS	5	Q1，Q2，Q7，Q11，Q20
38	104-TA1298-R01	Chip transistor ／ KTA1298(Y)，ROHS	2	Q38，Q40
39	105-2SK508-R01	Chip FET(field-effect transistor) ／ 2SK508NV(K52)，ROHS	2	Q6，Q12
40	105-3SK318-R01	Chip FET(field-effect transistor) ／ 3SK318，ROHS	2	Q18，Q19
41	105-SK1824-R01	Chip FET(field-effect transistor) ／ 2SK1824，ROHS	9	Q3，Q30，Q33，Q34，Q45，Q46，Q49，Q53，Q54
42	107-008200-R01	PT8200 LCD ／ 8200 LCD ，ROHS	1	
43	108-450C24-R02	Chip phase frequency detector ／ JTBM450CX24，ROHS	1	CD1
44	108-CF450F-R01	Plug-in porcelain filter ／ LTM450FW，450kHz±7kHz，ROHS	1	CF2
45	108-CF450H-R01	Plug-in porcelain filter ／ LTM450HT，450kHz±3kHz，ROHS	1	CF1
46	108-XF4995-R01	plug-in IF filter ／ 49.95MHz±7.5KHz，U-5*2，ROHS	1	XF1，XF2
47	109-040000-R01	Chip resistor ／ 0402，0R±5%，ROHS	31	C134，C135，C374，C375，R17，R66，R68，R72，R84，R85，R86，R144，R145，R167，R172，R187，R188，R189，R196，R229，R236，R237，R248，R252，R257，R268，R302，R322，R325，R336，R339
48	109-040100-R01	Chip resistor ／ 0402，10R±5%，ROHS	5	R2，R3，R71，R82，R266
49	109-040101-R01	Chip resistor ／ 0402，100R±5%，ROHS	5	R21，R26，R101，R121，R247
50	109-040102-R01	Chip resistor ／ 0402，1K±5%，ROHS	16	R9，R48，R70，R83，R104，R136，R201，R219，R231，R254，R265，R270，R292，R297，R315，R338
51	109-040103-R01	Chip resistor ／ 0402，10K±5%，ROHS	28	R10，R12，R13，R15，R24，R35，R62，R65，R74，R79，R81，R112，R174，R210，R228，R233，R280，R284，R285，R286，R287，R298，R307，R308，R309，R313，R314，R316
52	109-040104-R01	Chip resistor ／ 0402，100K±5%，ROHS	13	R40，R52，R53，R59，R60，R67，R80，R199，R208，R214，R225，R230，R239
53	109-040105-R01	Chip resistor ／ 0402，1M±5%，ROHS	8	R130，R131，R133，R137，R139，R192，R277，R312
54	109-040121-R01	Chip resistor ／ 0402，120R±5%，ROHS	1	R61
55	109-040122-R01	Chip resistor ／ 0402，1.2K±5%，ROHS	2	R152，R267
56	109-040123-R01	Chip resistor ／ 0402，12K±5%，ROHS	2	R16，R245
57	109-040124-R01	Chip resistor ／ 0402，120K±5%，ROHS	2	R150，R175
58	109-040151-R01	Chip resistor ／ 0402，150R±5%，ROHS	2	R63，R111
59	109-040152-R01	Chip resistor ／ 0402，1.5K±5%，ROHS	2	R54，R218
60	109-040153-R01	Chip resistor ／ 0402，15K±5%，ROHS	2	R162，R272
61	109-040154-R01	Chip resistor ／ 0402，150K±5%，ROHS	8	R6，R11，R27，R168，R181，R216，R223，R226
62	109-040183-R01	Chip resistor ／ 0402，18K±5%，ROHS	5	R198，R207，R217，R259，R320
63	109-040184-R01	Chip resistor ／ 0402，180K±1%，ROHS	5	R92，R117，R169，R170，R177
64	109-040204-R01	Chip resistor ／ 0402，200K±5%，ROHS	1	R69
65	109-040220-R01	Chip resistor ／ 0402，22R±5%，ROHS	2	R37，R103
66	109-040222-R01	Chip resistor ／ 0402，2.2K±5%，ROHS	2	R1，R227
67	109-040223-R01	Chip resistor ／ 0402，22K±5%，ROHS	6	R106，R109，R110，R153，R171，R215
68	109-040224-R01	Chip resistor ／ 0402，220K±5%，ROHS	3	R183，R213，R311
69	109-040272-R01	Chip resistor ／ 0402，2.7K±5%，ROHS	3	R57，R148，R222
70	109-040273-R01	Chip resistor ／ 0402，27K±5%，ROHS	5	R78，R118，R161，R205，R251
71	109-040274-R01	Chip resistor ／ 0402，270K±5%，ROHS	5	R42，R164，R246，R306，R318
72	109-040331-R01	Chip resistor ／ 0402，330R±5%，ROHS	2	R14，R43
73	109-040332-R01	Chip resistor ／ 0402，3.3K±5%，ROHS	5	R124，R142，R146，R159，R211
74	109-040333-R01	Chip resistor ／ 0402，33K±5%，ROHS	7	R147，R151，R156，R157，R185，R249，R319
75	109-040334-R01	Chip resistor ／ 0402，330K±5%，ROHS	4	R73，R108，R134，R269
76	109-040361-R01	Chip resistor ／ 0402，360R±5%，ROHS	1	R299
77	109-040392-R01	Chip resistor ／ 0402，3.9K±5%，ROHS	1	R279

78	109-040393-R01	Chip resistor ／ 0402,39K±5%,ROHS	3	R64, R143, R278
79	109-040394-R01	Chip resistor ／ 0402,390K±5%,ROHS	3	R202, R220, R310
80	109-040433-R01	Chip resistor ／ 0402,43K±5%,ROHS	1	R163
81	109-040470-R01	Chip resistor ／ 0402,47R±5%,ROHS	1	R33
82	109-040471-R01	Chip resistor ／ 0402,470R±5%,ROHS	4	R100, R271, R290, R291
83	109-040472-R01	Chip resistor ／ 0402,4.7K±5%,ROHS	22	R5, R38, R39, R91, R128, R154, R158, R173, R176, R179, R180, R191, R195, R197, R200, R203, R282, R283, R288, R289, R303, R304
84	109-040473-R01	Chip resistor ／ 0402,47K±5%,ROHS	16	R89, R105, R123, R126, R127, R129, R141, R160, R238, R293, R294, R300, R328, R331, R333, R337
85	109-040474-R01	Chip resistor ／ 0402,470K±5%,ROHS	6	R140, R165, R204, R250, R253, R305
86	109-040560-R01	Chip resistor ／ 0402,56R±5%,ROHS	2	R115, R135
87	109-040561-R01	Chip resistor ／ 0402,560R±5%,ROHS	2	R51, R55
88	109-040562-R01	Chip resistor ／ 0402,5.6K±5%,ROHS	7	R155, R178, R184, R193, R212, R241, R260
89	109-040563-R01	Chip resistor ／ 0402,56K±5%,ROHS	7	R97, R125, R149, R232, R258, R263, R275
90	109-040564-R01	Chip resistor ／ 0402,560K±5%,ROHS	2	R99, R243
91	109-040682-R01	Chip resistor ／ 0402,6.8K±5%,ROHS	6	R94, R95, R113, R114, R244, R317
92	109-040683-R01	Chip resistor ／ 0402,68K±5%,ROHS	3	R194, R264, R274
93	109-040821-R01	Chip resistor ／ 0402,820R±5%,ROHS	3	R76, R77, R255
94	109-040822-R01	Chip resistor ／ 0402,8.2K±5%,ROHS	2	R235, R242
95	109-040823-R01	Chip resistor ／ 0402,82K±5%,ROHS	3	R75, R88, R224
96	109-040913-R01	Chip resistor ／ 0402,91K±5%,ROHS	2	R190, R209
97	109-040914-R01	Chip resistor ／ 0402,910K±5%,ROHS	1	R221
98	109-060000-R01	Chip resistor ／ 0603,0R±5%,ROHS	5	C31, C176, D23, L52, L62
99	109-060100-R01	Chip resistor ／ 0603,10R±5%,ROHS	1	R8
100	109-060103-R01	Chip resistor ／ 0603,10K±5%,ROHS	1	R45
101	109-060121-R01	Chip resistor ／ 0603,120R±5%,ROHS	1	R4
102	109-060152-R02	Chip resistor ／ 0603,1.5K±1%,ROHS	1	R41
103	109-060220-R01	Chip resistor ／ 0603,22R±5%,ROHS	1	R30
104	109-060221-R01	Chip resistor ／ 0603,220R±5%,ROHS	1	L8
105	109-060222-R01	Chip resistor ／ 0603,2.2K±5%,ROHS	2	R18, R19
106	109-060271-R01	Chip resistor ／ 0603,270R±5%,ROHS	1	R44
107	109-060274-R01	Chip resistor ／ 0603,270K±5%,ROHS	1	R36
108	109-060332-R01	Chip resistor ／ 0603,3.3K±5%,ROHS	1	R32
109	109-060470-R01	Chip resistor ／ 0603,47R±5%,ROHS	2	R29, R34
110	109-060473-R01	Chip resistor ／ 0603,47K±5%,ROHS	2	R182, R206
111	109-060561-R01	Chip resistor ／ 0603,560R±5%,ROHS	2	R22, R23
112	109-060681-R01	Chip resistor ／ 0603,680R±5%,ROHS	1	R58
113	109-070000-R01	Chip resistor ／ 0805,0R±5%,ROHS	1	L54
114	109-070220-R01	Chip resistor ／ 0805,22R±5%,ROHS	1	L30
115	109-070470-R01	Chip resistor ／ 0805,47R±5%,ROHS	1	L31
116	109-100221-R01	Chip resistor ／ 1206,220R±5%,ROHS	2	R46, R47
117	110-110503-R01	Chip trimming resistor ／ EVM2NSX80B54,50K±25%,ROHS	1	VR2
118	111-010000-R01	plug-in piezoresistance ／ 10D220, ROHS	1	R281
119	111-030000-R07	Chip Resettable Fuse ／ 1206L150PR,1206,1.5A/6V,ROHS	1	F1
120	111-030000-R09	plug-in glass tube fuse ／ 313010,32V,10A,ROHS	4	
121	112-043100-R01	Chip capacitor ／ 0402,10P±0.5P,50V,COG,ROHS	6	C7, C16, C80, C138, C139, C307
122	112-043101-R01	Chip capacitor ／ 0402,100P±5%,50V,COG,ROHS	28	C27, C28, C97, C103, C105, C108, C112, C114, C125, C335, C336, C349, C350, C351, C352, C353, C354, C356, C359, C360, C361, C362, C363, C364, C369, C382, C383, C384
123	112-043102-R01	Chip capacitor ／ 0402,1000P±10%,50V,X7R,ROHS	38	C82, C98, C19, C21, C36, C37, C49, C57, C58, C59, C68, C87, C89, C90, C91, C92, C95, C99, C167, C170, C171, C188, C189, C196, C206, C214, C220, C223, C231, C266, C311, C321, C370, C371, C372, C373, C413, C416
124	112-043103-R01	Chip capacitor ／ 0402,0.01uF±10%,50V,X7R,ROHS	15	C33, C51, C55, C81, C110, C115, C121, C133, C145, C153, C242, C284, C330, C333, C385
125	112-043104-R02	Chip capacitor ／ 0402,0.1uF±10%,16V,X7R,ROHS	41	C17, C23, C24, C83, C102, C144, C172, C173, C183, C184, C186, C187, C204, C209, C210, C211, C213, C230, C235, C253, C259, C260, C261, C264, C268, C270, C271, C272, C275, C295, C300, C308, C312, C319, C325, C329, C334, C337, C338, C394, R296
126	112-043105-R01	Chip capacitor ／ 0402,1uF±10%,6.3V,X5R,ROHS	11	C56, C120, C254, C280, C298, C303, C304, C323, C367, C378, C414
127	112-043123-R01	Chip capacitor ／ 0402,0.012uF±10%,25V,X7R,ROHS	3	C252, C292, C386
128	112-043150-R01	Chip capacitor ／ 0402,15P±5%,50V,COG,ROHS	5	C13, C53, C118, C168, C190
129	112-043151-R01	Chip capacitor ／ 0402,150P±5%,50V,COG,ROHS	1	C195
130	112-043153-R01	Chip capacitor ／ 0402,0.015uF±10%,50V,X7R,ROHS	6	C249, C258, C263, C273, C387, C389
131	112-043181-R01	Chip capacitor ／ 0402,180P±10%,50V,X7R,ROHS	2	C2, C106
132	112-043182-R01	Chip capacitor ／ 0402,1800P±10%,50V,X7R,ROHS	3	C154, C158, C217

133	112-043183-R01	Chip capacitor / 0402, 0.018uF±10%, 25V, X7R, ROHS	4	C257, C276, C390, C391
134	112-0431R5-R01	Chip capacitor / 0402, 1.5P±0.25P, 50V, C0G, ROHS	2	C69, C70
135	112-043200-R01	Chip capacitor / 0402, 20P±5%, 50V, C0G, ROHS	2	C281, C296
136	112-043221-R01	Chip capacitor / 0402, 220P±5%, 50V, C0G, ROHS	1	C282
137	112-043222-R01	Chip capacitor / 0402, 2200P±10%, 50V, X7R, ROHS	1	C248
138	112-043223-R01	Chip capacitor / 0402, 0.022uF±10%, 25V, X7R, ROHS	5	C238, C239, C322, C355, C365
139	112-043270-R01	Chip capacitor / 0402, 27P±5%, 50V, C0G, ROHS	3	C194, C197, C198
140	112-043273-R01	Chip capacitor / 0402, 0.027uF±10%, 50V, X7R, ROHS	1	C396
141	112-0432R0-R01	Chip capacitor / 0402, 2P±0.25P, 50V, C0G, ROHS	2	C104, C201
142	112-043330-R01	Chip capacitor / 0402, 33P±5%, 50V, C0G, ROHS	5	C6, C93, C130, C147, C232
143	112-043331-R01	Chip capacitor / 0402, 330P±10%, 50V, X7R, ROHS	1	C140
144	112-043332-R01	Chip capacitor / 0402, 3300P±10%, 50V, X7R, ROHS	1	C297
145	112-043333-R01	Chip capacitor / 0402, 0.033uF±10%, 16V, X7R, ROHS	1	C243
146	112-043360-R01	Chip capacitor / 0402, 36P±5%, 50V, C0G, ROHS	1	C205
147	112-043390-R01	Chip capacitor / 0402, 39P±5%, 50V, C0G, ROHS	2	C225, C229
148	112-043392-R01	Chip capacitor / 0402, 3900P±10%, 50V, X7R, ROHS	8	C256, C301, C314, C377, C399, C400, C401, C402
149	112-043393-R01	Chip capacitor / 0402, 0.039uF±10%, 10V, X7R, ROHS	4	C156, C250, C251, C288
150	112-0433R0-R01	Chip capacitor / 0402, 3P±0.25P, 50V, C0G, ROHS	3	C124, C177, C291
151	112-043470-R01	Chip capacitor / 0402, 47P±5%, 50V, C0G, ROHS	2	C129, C255
152	112-043471-R01	Chip capacitor / 0402, 470P±10%, 50V, X7R, ROHS	55	C3, C9, C11, C12, C20, C38, C47, C52, C54, C71, C76, C88, C116, C119, C123, C128, C136, C142, C143, C148, C151, C157, C160, C169, C174, C178, C182, C207, C212, C215, C218, C221, C222, C247, C274, C279, C283, C285, C293, C302, C305, C310, C317, C326, C328, C332, C339, C340, C342, C343, C347, C348, C392, C395, C405
153	112-043472-R01	Chip capacitor / 0402, 4700P±10%, 25V, X7R, ROHS	1	C262
154	112-043473-R01	Chip capacitor / 0402, 0.047uF±10%, 16V, X7R, ROHS	3	C287, C294, C306
155	112-043474-R01	Chip capacitor / 0402, 0.47uF±10%, 10V, X5R, ROHS	1	C267
156	112-0434R0-R01	Chip capacitor / 0402, 4P±0.25P, 50V, C0G, ROHS	4	C35, C162, C163, C208
157	112-0435R0-R01	Chip capacitor / 0402, 5P±0.25P, 50V, C0G, ROHS	1	C200
158	112-043681-R01	Chip capacitor / 0402, 680P±10%, 16V, X7R, ROHS	1	C132
159	112-043682-R01	Chip capacitor / 0402, 6800P±10%, 16V, X7R, ROHS	1	C299
160	112-043683-R02	Chip capacitor / 0402, 0.068uF±10%, 10V, X7R, ROHS	7	C236, C240, C357, C358, C244, C245, C320
161	112-0436R0-R01	Chip capacitor / 0402, 6P±0.5P, 50V, C0G, ROHS	7	C72, C73, C126, C161, C164, C166, C175
162	112-0437R0-R01	Chip capacitor / 0402, 7P±0.5P, 50V, C0G, ROHS	1	C107
163	112-043820-R01	Chip capacitor / 0402, 82P±5%, 50V, C0G, ROHS	1	C234
164	112-043821-R01	Chip capacitor / 0402, 820P±10%, 16V, X7R, ROHS	3	C406, C409, C412
165	112-0438R0-R01	Chip capacitor / 0402, 8P±0.5P, 50V, C0G, ROHS	2	C165, C192
166	112-0439R0-R01	Chip capacitor / 0402, 9P±0.5P, 50V, C0G, ROHS	1	C100
167	112-043R50-R01	Chip capacitor / 0402, 0.5P±0.1P, 50V, C0G, ROHS	5	C48, C60, C61, C65, C127
168	112-063101-R01	Chip capacitor / 0603, 100P±5%, 50V, C0G, ROHS	1	C18
169	112-063102-R01	Chip capacitor / 0603, 1000P±10%, 50V, X7R, ROHS	13	C22, C25, C26, C64, C67, C77, C78, C79, C84, C85, C86, C101, R7
170	112-063104-R01	Chip capacitor / 0603, 0.1uF±10%, 50V, X7R, ROHS	1	C96
171	112-063150-R01	Chip capacitor / 0603, 15P±5%, 50V, C0G, ROHS	1	C30
172	112-0631R0-R01	Chip capacitor / 0603, 1P±0.25P, 50V, C0G, ROHS	2	C4, C5
173	112-0635R0-R01	Chip capacitor / 0603, 5P±0.25P, 50V, C0G, ROHS	1	C34
174	112-0636R0-R01	Chip capacitor / 0603, 6P±0.5P, 50V, C0G, ROHS	1	C32
175	112-0637R0-R01	Chip capacitor / 0603, 7P±0.5P, 50V, C0G, ROHS	1	C10
176	112-0638R0-R01	Chip capacitor / 0603, 8P±0.5P, 50V, C0G, ROHS	1	C75
177	112-063R50-R01	Chip capacitor / 0603, 0.5P±0.1P, 50V, C0G, ROHS	2	C41, C111
178	112-072105-R01	Chip Ta capacitor/ TP Model, SIZE P, 1uF±20%, 10V, ROHS	2	C290, C415
179	112-072106-R01	Chip Ta capacitor/ TP Model, SIZE P, 10uF±20%, 6.3V, ROHS	1	C327
180	112-072225-R01	Chip Ta capacitor/TP Model, SIZE P, 2.2uF±20%, 10V, ROHS	3	C233, C237, C313
181	112-072475-R01	Chip Ta capacitor/TP Model, SIZE P, 4.7uF±20%, 10V, ROHS	13	C1, C8, C42, C131, C159, C216, C226, C246, C278, C286, C345, C346, C404
182	112-073334-R01	Chip capacitor/0805, 0.33uF+80%--20%, 10V, Y5V, ROHS	1	C181
183	112-102104-R01	Chip Ta capacitor/ TS Model, SIZE A, 0.1uF±20%, 35V, ROHS	2	C109, C113
184	112-102105-R01	Chip Ta capacitor/ TS Model, SIZE A, 1uF±20%, 16V, ROHS	2	C117, C411
185	112-102156-R01	Chip Ta capacitor/TS Model, SIZE A, 15uF±20%, 6.3V, ROHS	2	C137, C149
186	112-102475-R02	Chip Ta capacitor/ TS Model, SIZE A, 4.7uF±20%, 16V, ROHS	1	C380
187	112-103100-R02	Chip monolithic ceramic capacitors / 1206,10P ± 5%, 1000V, C0G, ROHS	2	C44, C376
188	112-103102-R02	Chip monolithic ceramic capacitors / 1206,1000P ± 10%, 1000V, C0G, ROHS	2	C29, C403
189	112-103106-R01	Chip capacitor / 1206, 10uF+80%--20%, 16V, Y5V, ROHS	1	C265
190	112-103150-R02	Chip monolithic ceramic capacitors / 1206,15P ± 5%, 1000V, C0G, ROHS	1	C45

191	112-103180-R02	Chip monolithic ceramic capacitors / 1206,18P ± 5%,1000V,COG,ROHS	1	C62
192	112-103220-R01	Chip monolithic ceramic capacitors / 1206,22P ± 5%,1000V,COG,ROHS	1	C94
193	112-103270-R01	Chip monolithic ceramic capacitors / 1206,27P ± 5%,1000V,COG,ROHS	1	C43
194	112-1032R0-R02	Chip monolithic ceramic capacitors / 1206,2P ± 5%,1000V,COG,ROHS	1	C14
195	112-103300-R02	Chip monolithic ceramic capacitors / 1206,30P ± 5%,1000V,COG,ROHS	1	C46
196	112-1033R0-R02	Chip monolithic ceramic capacitors / 1206,3P ± 5%,1000V,COG,ROHS	1	C63
197	112-1035R0-R01	Chip monolithic ceramic capacitors / 1206,5P ± 5%,1000V,COG,ROHS	1	C152
198	112-1038R0-R02	Chip monolithic ceramic capacitors / 1206,8P ± 5%,1000V,COG,ROHS	1	C15
199	112-191477-R01	plug-in electrolytic capacitor / Φ10*16,470UF25V,±20%,ROHS	1	C331
200	112-201476-R02	Chip electrolytic capacitor / Φ6.3*5.3,47U25V,±20%,ROHS	3	C66, C341, C379
201	113-010100-R01	Chip trimming capacitor / TZV2Z100A110,3~10p+100,ROHS	2	C39, C122
202	114-06E180-R01	Chip Wire inductor / C1608CB-18NJ, ceramic 18NH ± 5%,0603,ROHS	1	L20
203	114-06E330-R01	Chip Wire inductor / C1608CB-33NJ, green, ceramic core ,33NH±5%,0603,ROHS	2	L13, L45
204	114-06E470-R01	Chip Wire inductor / C1608CB-47NJ, green,ceramic core47NH±5%,0603,ROHS	2	L36, L46
205	114-06E560-R01	Chip Wire inductor / C1608CB-56NJ, ceramic 56nH ± 5%,0603,ROHS	1	L53
206	114-06G102-R01	Chip inductor / MLF1608A1R0K,1uH±5%,0603,ROHS	1	L48
207	114-06G151-R01	Chip inductor / MLF1608DR15K,150nH±10%,0603,ROHS	1	L47
208	114-06G221-R02	Chip inductor / LGHK1608R22J-T,220nH±5%,0603,ROHS	3	L21, L27, L44
209	114-06G332-R01	Chip inductor / MLF1608A3R3K,3.3uH±5%,0603,ROHS	2	L5, L37
210	114-06G471-R01	Chip inductor / MLF1608DR47K,470nH±10%,0603,ROHS	1	L41
211	114-06G561-R01	Chip inductor / MLF1608DR56K,560nH±10%,0603,ROHS	1	L42
212	114-06G680-R01	Chip inductor / MLG1608B68NJ,68nH±5%,0603,ROHS	2	L14, L15
213	114-06G682-R01	Chip inductor / MLF1608E6R8K,6.8uH±10%,0603,ROHS	4	L2, L12, L34, L38
214	114-06G820-R01	Chip inductor / MLG1608B82N,82nH±5%,0603,ROHS	1	L7
215	114-07E180-R01	Chip Wire inductor / C2012C-18NJ,18nH±5%,0805,ROHS	1	L35
216	114-07E270-R01	Chip Wire inductor / C2012C-27NJ,27nH±5%,0805,ROHS	1	L3
217	114-07E390-R01	Chip Wire inductor / C2012C-39NJ,39nH±5%,0805,ROHS	2	L29, L57
218	114-07E470-R02	Chip Wire inductor / C2012C-47NG,47nH±2%,0805,ROHS	1	L58
219	114-07E560-R02	Chip Wire inductor / C2012C-56NJ,56nH±5%,0805,ROHS	1	L55
220	114-08E103-R01	Chip inductor / FSLM2520-100J,10uH±5%,1008,ROHS	1	L40
221	114-08E471-R01	Chip inductor / FSLM2520-R47K,470nH±10%,1008,ROHS	1	L49
222	114-08E821-R01	Chip inductor / FSLM2520-R82K,820nH±10%,1008,ROHS	1	L50
223	115-3R0110-R01	Chip air-cored coil / 0.9*3.0*11TR, positive, high pin, ROHS	1	L19
224	115-3R05R0-R05	Chip air-cored coil / 0.9*3.0*4.5TR, positive, ROHS	4	L9, L10, L11, L79
225	115-3R06R0-R02	Chip air-cored coil / 0.9*3.0*6TR, positive, high pin, ROHS	2	L18, L28
226	117-000000-R05	Chip bead / EMI,FILTER, SMT,BLM21P300S,0805,ROHS	3	L64, L72, L77
227	117-000000-R07	Chip bead / EMI,FILTER, SMT,BLM41P600SPT,1206,ROHS	2	L25, L26
228	117-000000-R08	Chip bead / EMI,FILTER, SMT,BLM11A601S,0603,ROHS	21	L1, L4, L22, L23, L24, L32, L33, L39, L51, L59, L60, L61, L65, L66, L67, L69, L70, L74, L75, L76, L78
229	119-060104-R01	Thermistor / NTH5G16P42B104K07TH, 100K, 0603, ROHS	2	R90, R138
230	120-100000-R39C	PT8200 Power Line with LV-2A jack, Length=3000mm, ROHS	1	
231	120-100000-R42A	PT8000/PT8100 Power Line Unit main, with LV-2A jack and SR, ROHS	1	
232	120-400000-R14	black and white twisted-pair with jack,2.0*2P*70mm, ROHS	1	
233	120-400000-R15	flat cable / 0.5*34P*60mm,ROHS	1	
234	121-100000-R19	Speaker / 16Ω,7W,SANYO , ROHS	1	
235	122-116M80-R01	Chip TCXO / DSA535SA,16.8MHz±2.5PPm，ROHS	1	X1
236	122-13M580-R02	Chip crystal resonator / 3.58MHz,SMT-49,30PPM,ROHS	1	X2
237	122-19M830-R01	Chip crystal resonator/ 9.8304MHZ-NX5032GA,ROHS	1	X3
238	124-020000-R08	Chip connector / 08 6210 034 340 800, 34PIN, P=0.5mm, ROHS	1	CN4
239	124-050000-R16	3.5mm MIC socket / MOTOROLA, PJ-D3027, DC30V0.5A, ROHS	1	J1
240	124-090000-R01	Speaker socket / WCPW20-02, ROHS	2	CN2, CN3

Appendix 3 Structural Parts List

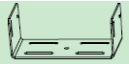| No.	Part number	Description	Unit	Qty.
1	201-008100-R01A	PT8100 Case Front/ ABS, Black, ROHS	pcs	1
2	201-008100-R02A	PT8100 Knob Volume / ABS, Black, white sign, ROHS	pcs	1
3	201-008100-R03A	PT8100 SR Power Line/ ABS, Black, ROHS	pcs	1
4	201-008100-R04A	PT8100 Lens Display Window / PC, Transparent, ROHS	pcs	1
5	201-008100-R05A	PT8100 Lens Led / PC, Transparent, ROHS	pcs	1
6	202-008000-R03A	PT8000/8100 Washer Transmit Thermal / Rubber, Black, 3*7*15mm, HC240, ROHS	pcs	1
7	202-008100-R01A	PT8100 Key Rubber / rubber, silkprint, ROHS	pcs	1
8	202-008100-R02A	PT8100 Dustproof Cushion LCD/ Rubber,45 degree, black, ROHS	pcs	1
9	202-008200-R02A	PT8200 Plug Speaker Jack/ Rubber, Black, ROHS	pcs	1
10	203-00618A-R08	PT618A Handed Microphone Bracket/ with 2pcs Screw(SP4*16), ROHS	pcs	1
11	203-007200-R08	PT7200 Nut Volume Knob/ Cu, Zn-Plated, Black, ROHS	pcs	1
12	203-008000-R01B	PT8000 Case Top / Al, Spray Black Oil, ROHS	pcs	1
13	203-008000-R02B	PT8000 Case Bottom / Al, Spray Black Oil, ROHS	pcs	1
14	203-008000-R03A	PT8000 Metal Plate/ SECC, Thk's=1.2mm,Spray Black Oil, ROHS	pcs	1
15	203-008000-R04A	V8000 Assemble Bracket/ SUS304,Spray Black Oil, ROHS	pcs	1
16	203-008100-R01A	PT8100 METAL DOME, ROHS	pcs	1
17	203-008200-R03B	PT8200 Base Antenna / SL16-50KF-3,Plated Gold, ROHS	pcs	1
18	203-008200-R05A	PT8200 Shield Cover Power Module/Cu, Ni-Plated, ROHS	pcs	1
19	204-008000-R01A	PT8000 Dustproof Net Speaker/Black, ROHS	pcs	1
20	204-008000-R02A	PT8000 Dustproof Strip Case Front Top/ with Tape, Black, ROHS	pcs	1
21	204-008000-R03A	PT8000 Dustproof Strip Case Front Bottom/ with Tape, Black, ROHS	pcs	1
22	204-008000-R04A	PT8000 Dustproof Case Al/ with Tape, Black, ROHS	pcs	2
23	204-008000-R06A	PT8000/8100 Washer Sponge/ Sponge,60*38*10mm,ROHS	pcs	1
24	204-008200-R08A	PT8200 Film LCD Lens/ 0.1mm PVC,ROHS	pcs	1
25	204-008200-R10B	PT8200 Conductive Sponge/ 50*18.5*3,with Tape, ROHS	pcs	1
26	301-25050J-R01C	Screw/ M2.5*5.0,Black Zn-Plated, ROHS	pcs	6
27	301-30060G-R01	Screw/ M3.0*6.0,Black Zn-Plated, ROHS	pcs	7
28	301-30250D-R01	Screw/ M3.0*25.0,Black Zn-Plated, ROHS	pcs	6
29	302-26060D-R01	Screw/ SP2.6*6.0,Black Zn-Plated, ROHS	pcs	3
30	302-50160E-R01	Screw/ SP5.0*16.0,Ni-Plated,ROHS	pcs	4
31	303-30100G-R01	Screw/ M3.0*10.0,with Flat and Spring Washer, Ni-Plated, ROHS	pcs	5
32	303-40100D-R01	Screw/ M4.0*10.0, with Flat and Spring Washer, Black Zn-Plated, ROHS	pcs	4

Appendix 4 Accessories

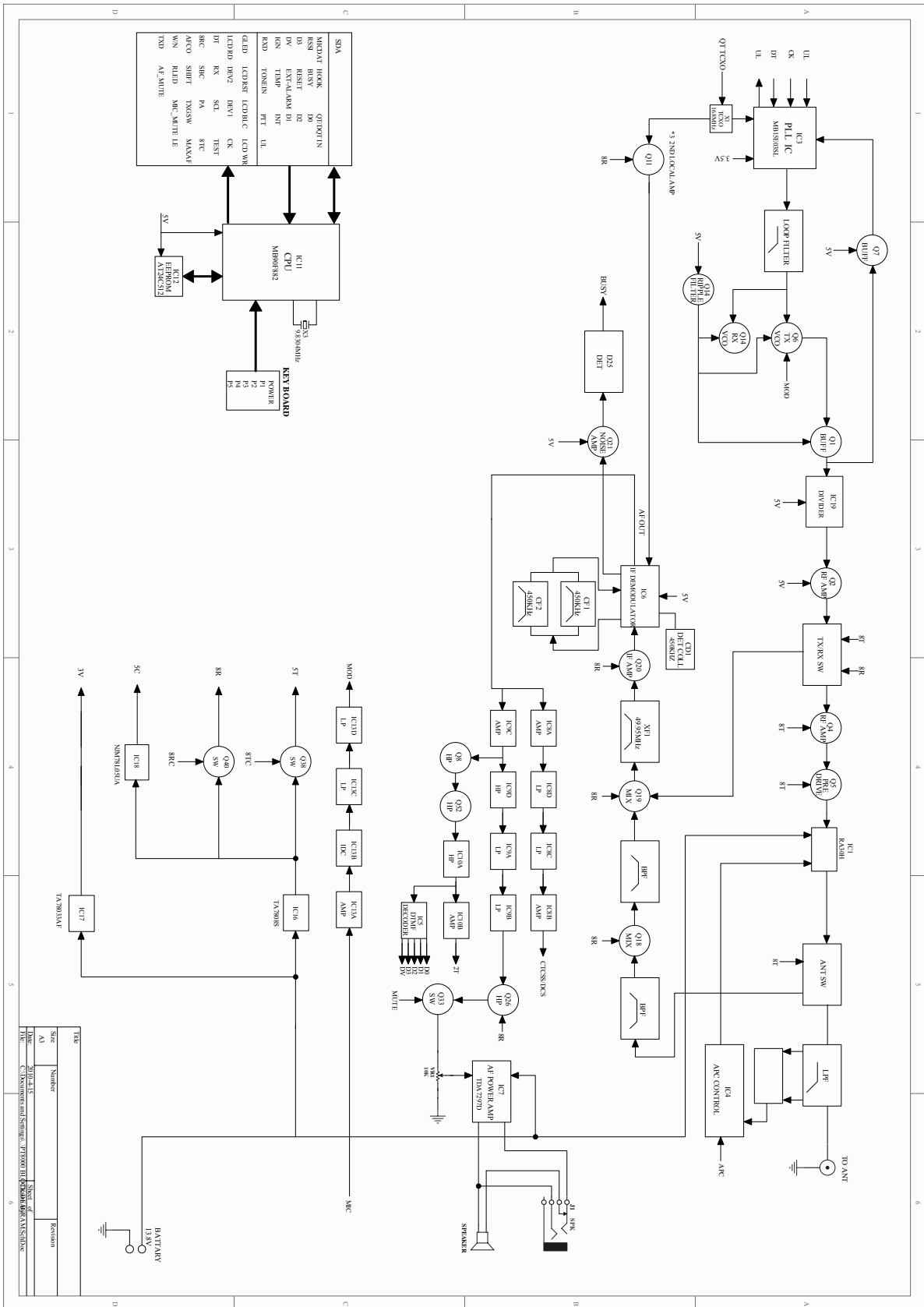| Item	Model	Specifications	External View
Mounting Bracket			
Power Cable			
Hand Microphone	KME215		
Microphone Hanger			
SEMS Screw		M4.0*10.0	
Self-tapping Screw		M5.0*16.0	
Self-tapping Screw		M4.0*16.0	

Figure 1 PT8100 Block Diagram

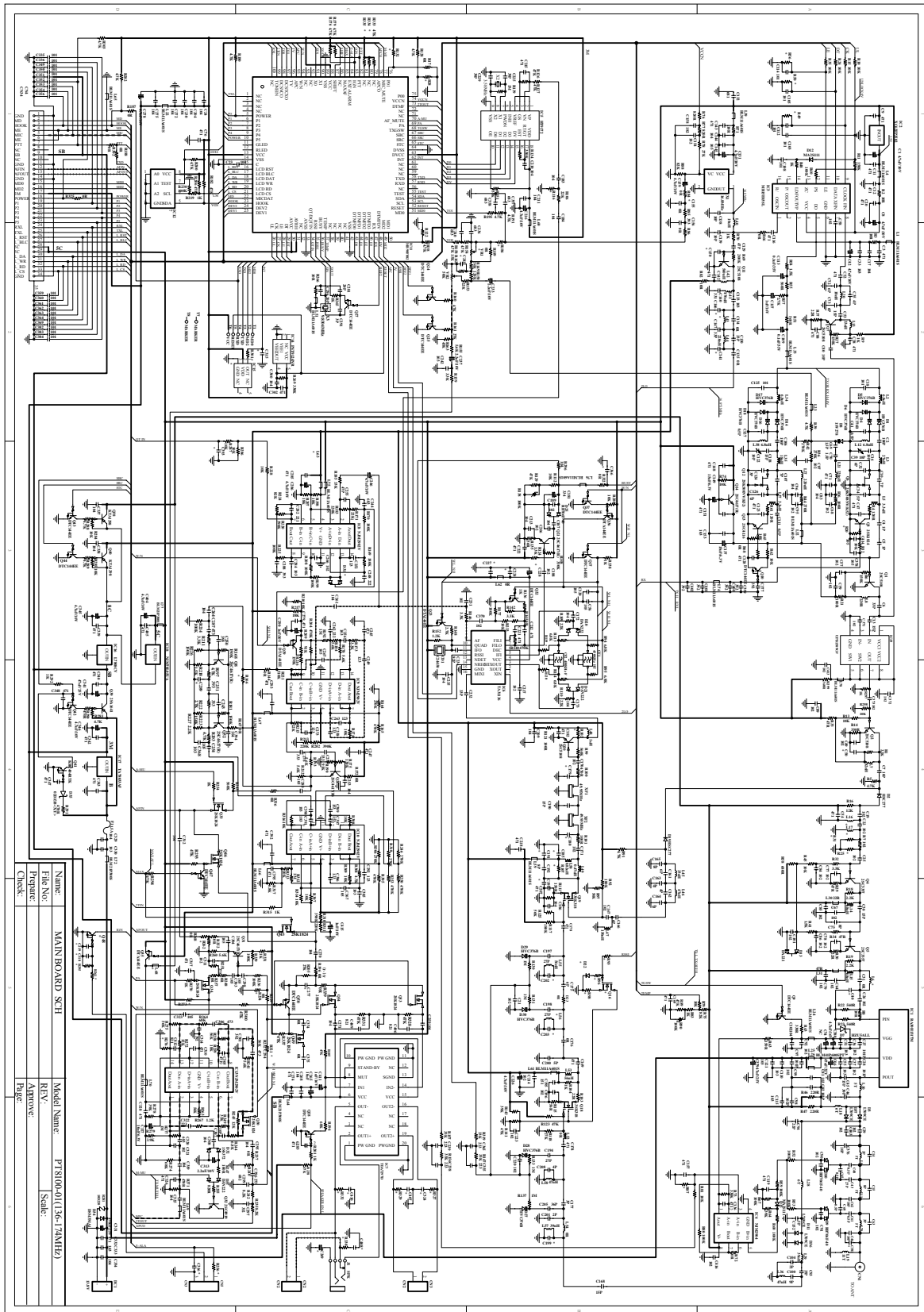**Figure 2 PT8100 Main Board Schematic Circuit Diagram**

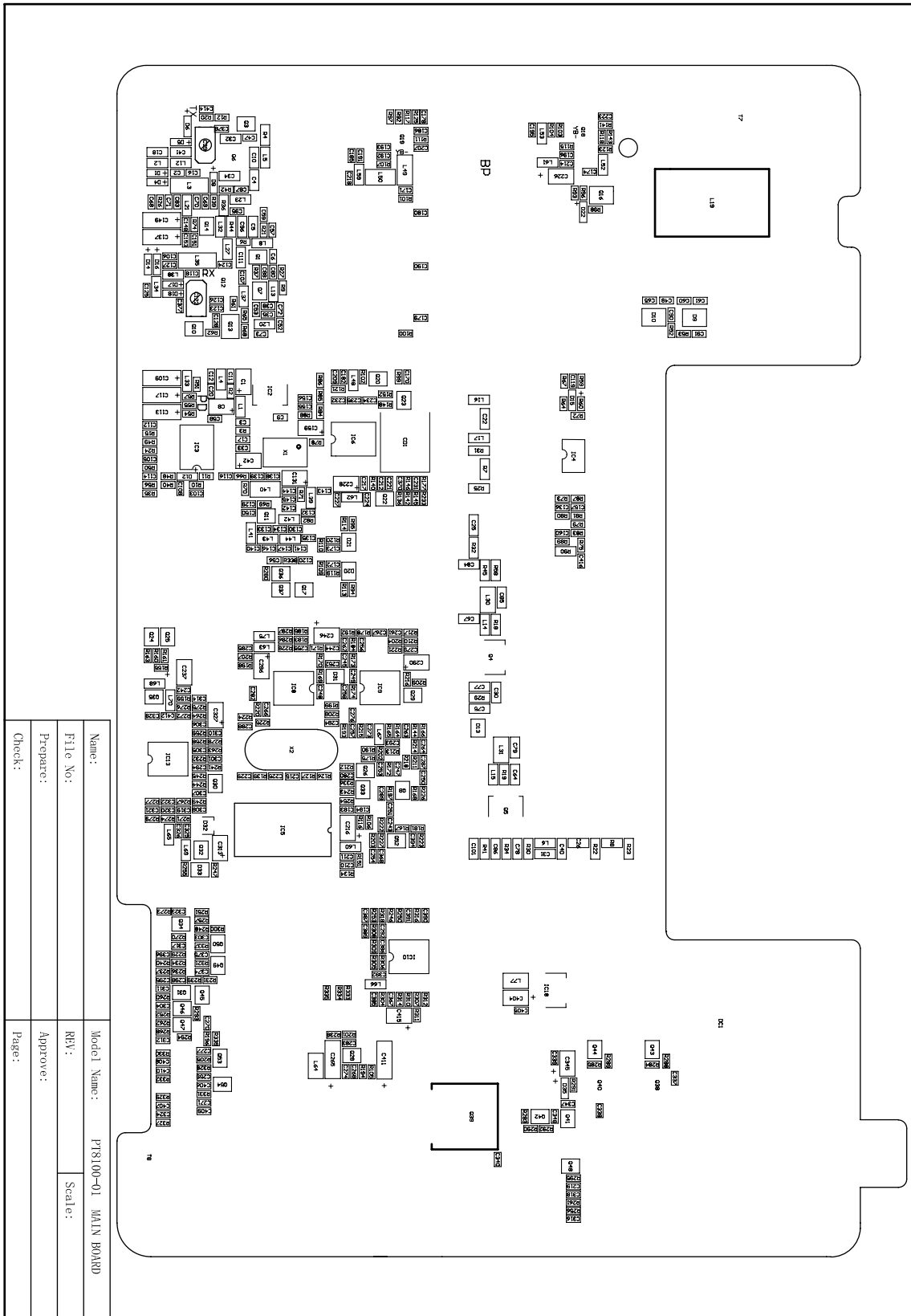# Figure 3 PT8100 Main Board Top Layer Position Mark Diagram

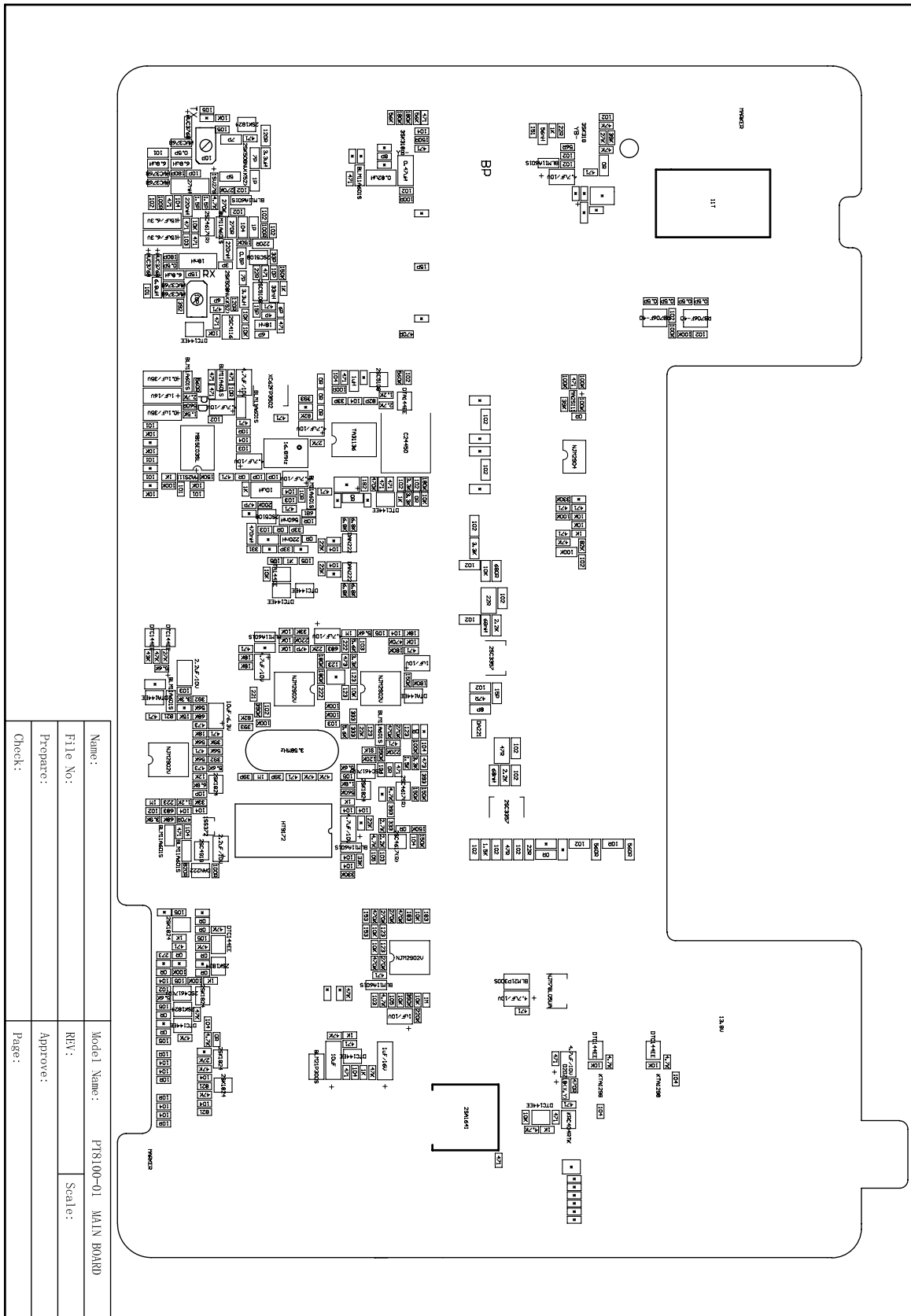**Figure 4 PT8100 Main Board Top Layer Position Value Diagram**

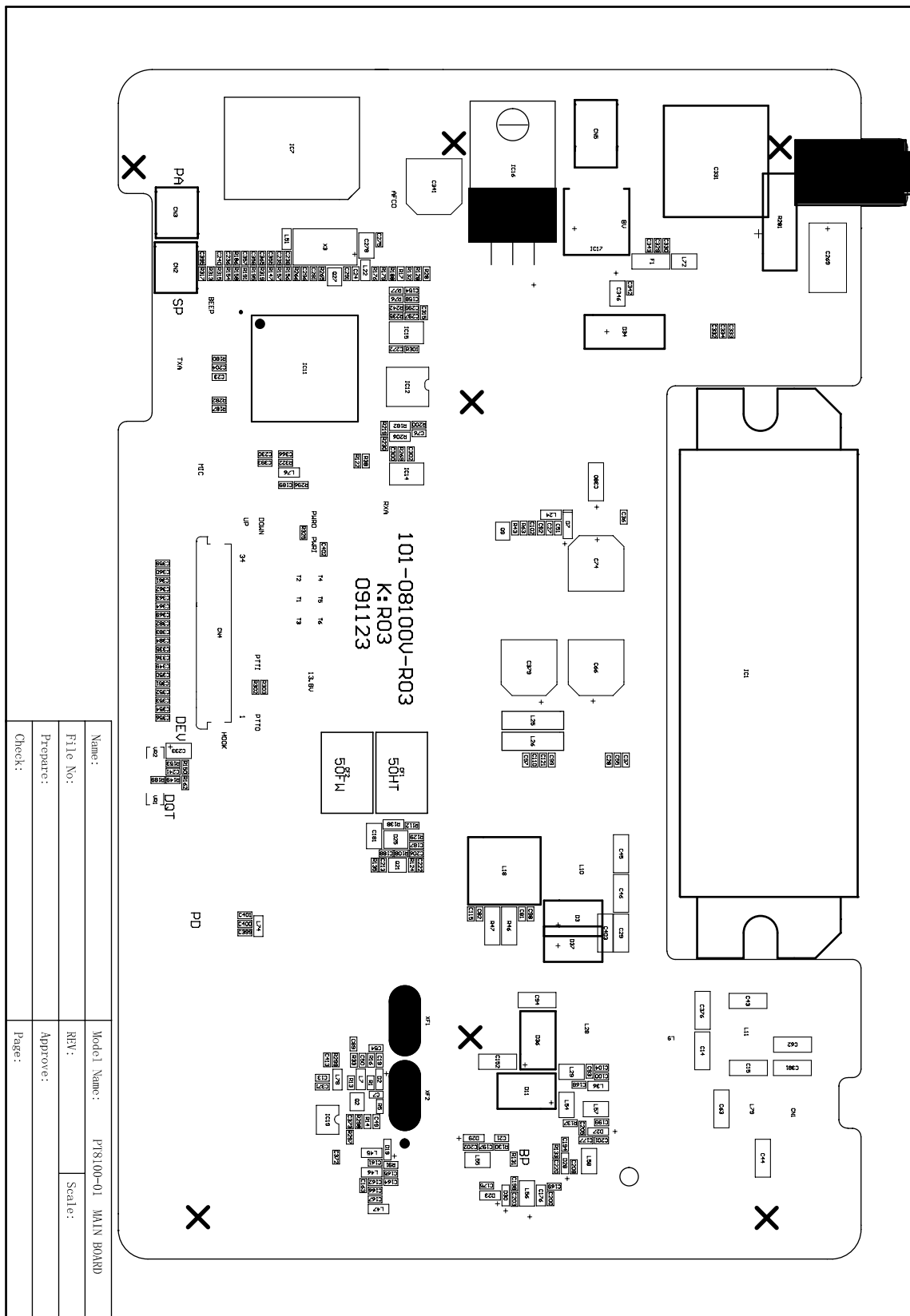# Figure 5 PT8100 Main Board Bottom Layer Position Mark Diagram

Figure 6 PT8100 Main Board Bottom Layer Position Value Diagram
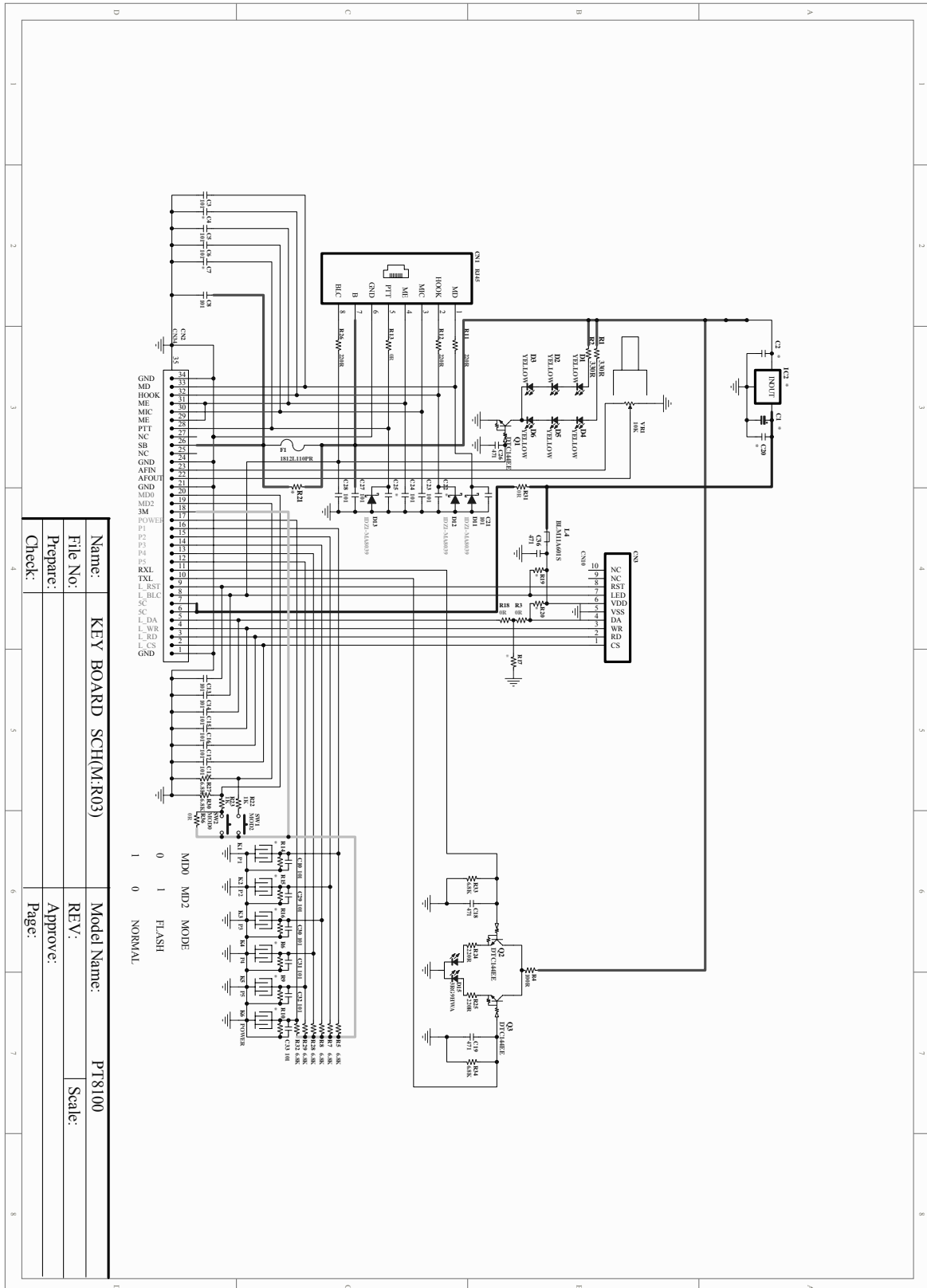
Figure 7 PT8100 Key Board Schematic Circuit Diagram

Figure 8 PT8100 Key Board Top Layer Position Mark Diagram
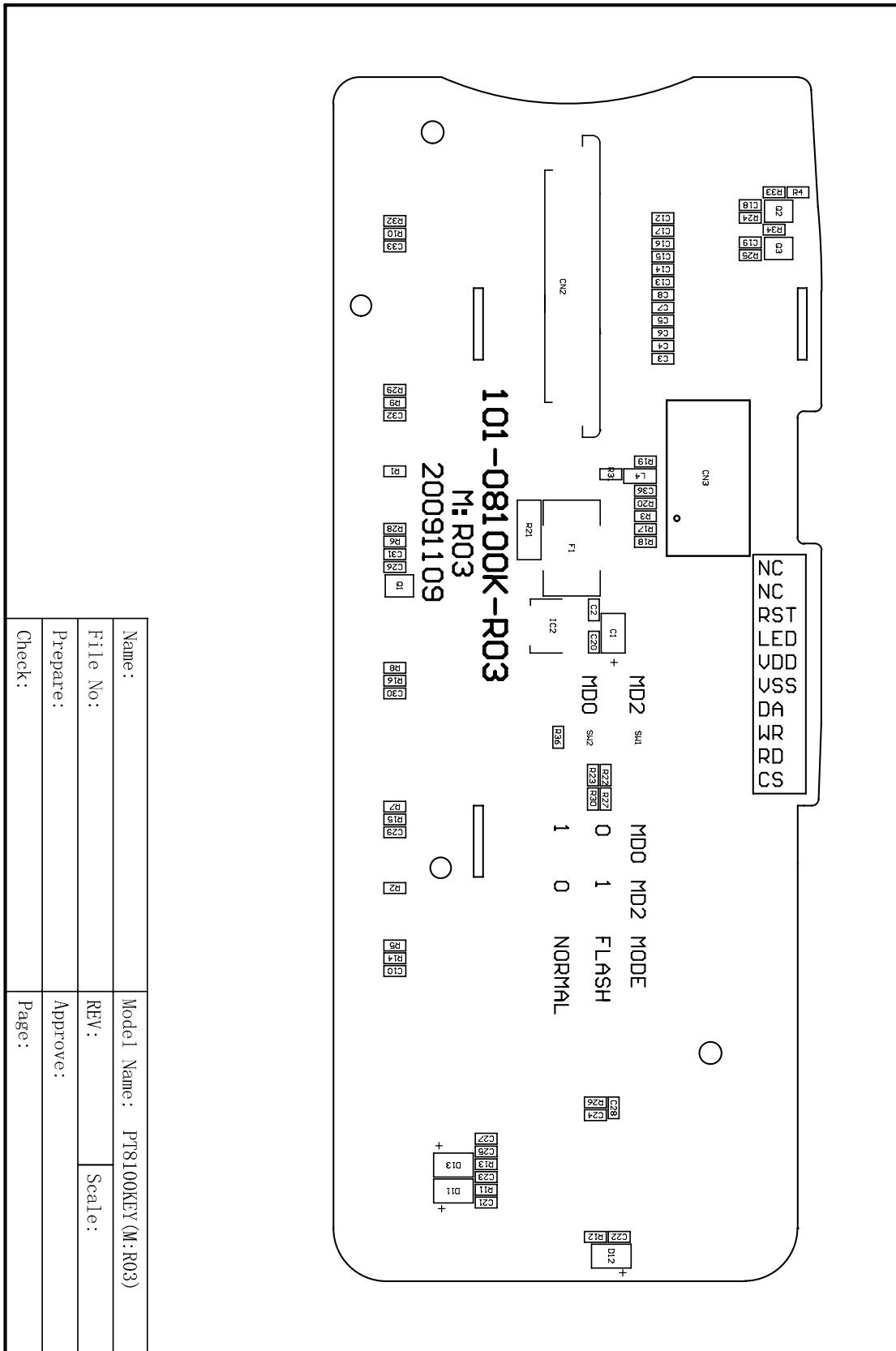
Figure 9 PT8100 Key Board Top Layer Position Value Diagram

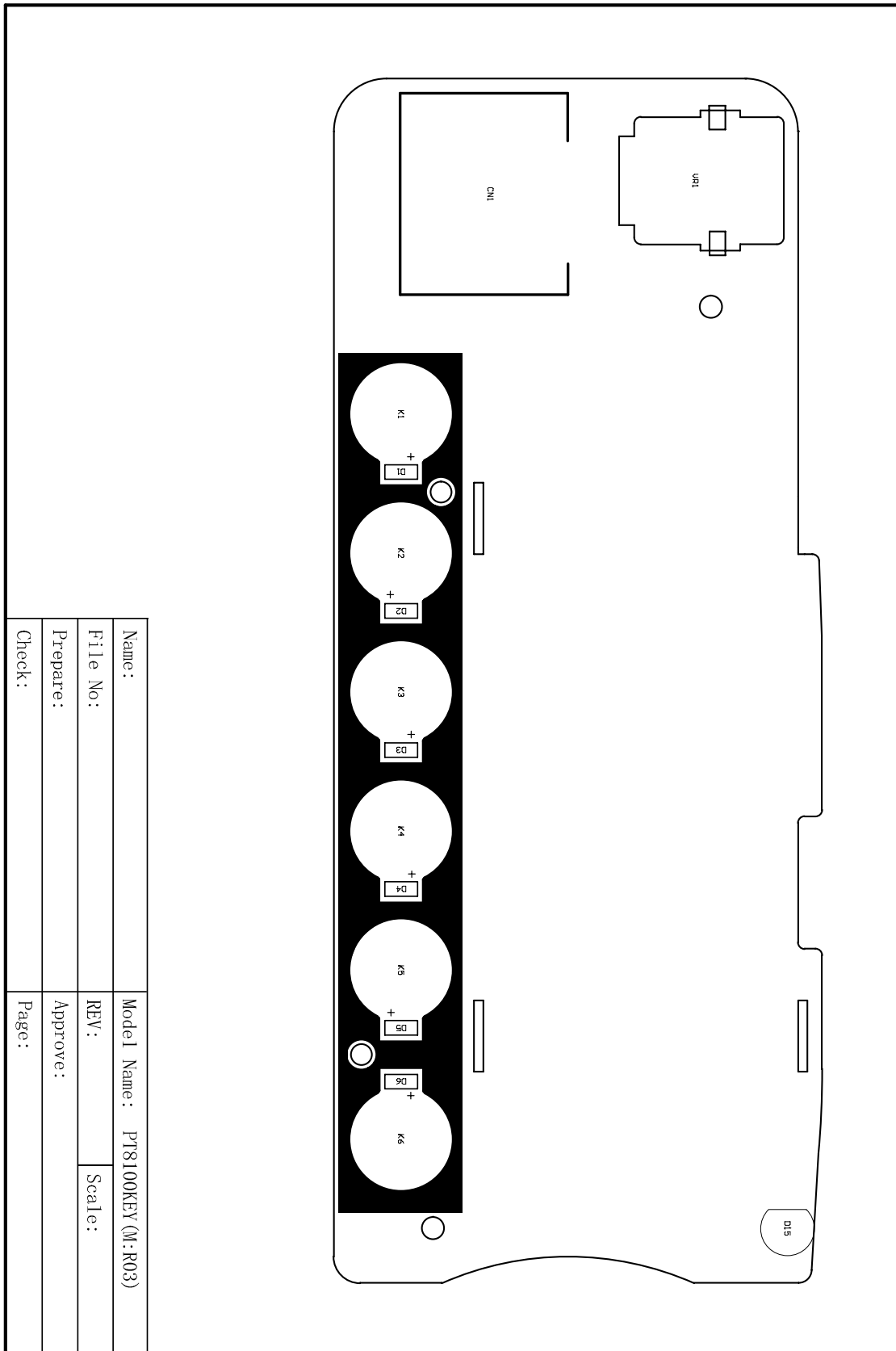**Figure 10 PT8100 Key Board Bottom Layer Position Mark Diagram**

Figure 11 PT8100 Key Board Bottom Layer Position Value Diagram