500-1 Service Manual

500-1 Service Manual

Contents

Chapter 1 General

1.1 Introduction

This manual applies to the service and maintenance of 500-1 radios, and is for the engineers and professional technicians that have been trained by our company. In this manual you can find all the information of product service. Our company reserve the rights to modify the product construction and specification without notice in order to enhance product performance and quality.
Read this manual before repairing the product.

1.2 Attention

Safety
Do not touch the antenna connector with your skin directly. .
Do not reverse the power polarities.
Do not turn on the radio before the antenna and load connection is completed.
Do not contact the damaged antenna when transmitting, or may make lightly burning on the skin.

Electromagnetism Interference
It's prohibited to use or repair the radio in the following places:
Hospital, health center, air port
Any area with a potentially explosive atmosphere (e.g. fuel and chemical storage and transport devices etc.)
Any area of dynamite or exploder.

Change Components
All the components used in repair service should be supplied by our company.
Other components of the same models available on the market are not surely able to use in this product and we do not guarantee the quality of the product using such components.

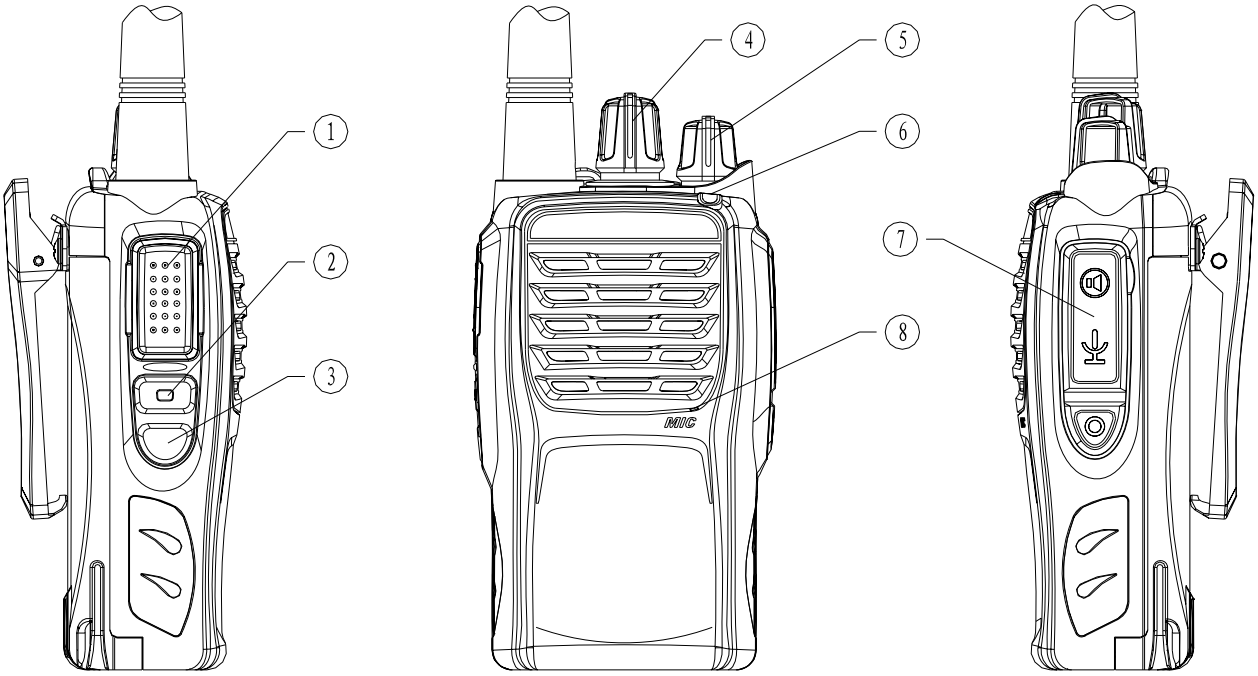
1.3 Service

All the products of our company are subject to the service warranty.
After-sales service will be provided, and the length of warranty is stated by our company. 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 service warranty or original invoice.
Malfunction caused by disassemble, repair or reconstruct the radio by the users without permission.
Wear and tear or any man-made sabotage such as mechanical damage, burning or water

leaking.
Product serial number has been damage or the product trademark is difficult to identify.
Beyond the warranty time, lifetime service is still available with paid. And we also provide service components to service stations and staff.

Chapter 2 Radio Overview



1. PTT (PUSH-TO-TALK) Button

To make a call, press and hold the PTT button, then speak into the microphone in normal voice. Release the PTT button to receive signals.

2. Side Button 1 (Programmable Button)
3. Side Button 2(Programmable Button)
4. Channel Selector

   Rotate to select channel 1~16.

5. Power/Volume Knob

Turn clockwise to switch on the radio.

Turn counterclockwise till a click is heard to switch off the radio.

Rotate to adjust the volume after turning on the radio.

6. LED Indicator

   LED Indicates Status/Alert. Green LED lights when a carrier is detected in the current channel. Red LED lights during transmission. Orange LED flashes when receiving the Radio ID 5-Tone signaling or 2-Tone signaling or MDC signaling. Green LED flashes when scanning. Red LED flashes when low battery.

7. Speaker/Microphone Jacks

   Used to connect the optional speaker/microphone.

8. MIC Input

   Please keep your mouth about 10 cm (3-4 inches) away from the microphone input to achieve the best voice quality. If the distance is too far or too close to the radio, it will affect the voice quality.

Programmable Button Function

The dealer can program the Side Button 1, Side Button 2 and the Top Button with the following Optional functions:

None (No Function)
Annunciation Selection
Talkaround
Call1/Call2/Call3/Call4
Lone Work
Emergency Call
Cancel Emergency Call
Scan
Noise Channel Delete
Call Forward
H/M/L Power Switch
Squelch Adjust
Monitor Momentary/Call Cancel
Monitor/Call Cancel
Squelch Off Momentary/Call Cancel
Squelch Off/Call Cancel
Lock Keyboard
Battery Check
Surveillance
CTCSS Scan/Forever Save CH
CTCSS Scan/Save CH

Chapter 3 Mode Introduction

Mode combinations

Mode		Function	How to access
User Mode		For normal use	Power on
PC Mode	Data Programming mode	Reading and writing frequency data and other functions	Receive instructions from the PC
	Test Mode	Used to tune the radio using the PC.	Receive instructions from the PC
	Firmware Upgrading Mode	Upgrades the software when new features are added	Receive instructions from the PC

User Mode：

You can enter User Mode (conventional communication mode) by turning on the power switch. Users in the mode can use the defined function of the radio.

Data programming mode:

Before leaving the factory, the radio has been set in factory. However, due to different requirements of users, functional parameters of the radio such as working frequency, channels, CTCSS/DCS and auto scanning, etc. should be set again. Therefore, the company has specially designed a set of 500 Programming software with friendly interface, convenient operation and visualized display for setting functional parameters of the radio.
Steps for setting the functional parameters of the interphone by computer are as follows:

1. Install 500 Programming software on the computer.
2. As shown in the figure below, connect the radio to the computer through a special serial or USB programming cable.

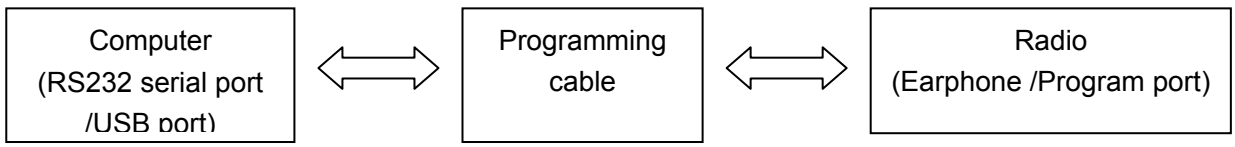


Figure 3-1

3. Turn on the power of the computer.

4. Turn on the power of the interphone.
5. Click on 500 Programming software icon to perform the program.
6. In the main menu of the programming software, click on [Read] to read the parameters of the radio into the computer; click on [Write] to write the parameters set in the computer into the radio.

Caution:

1. Before editing for the first time, the data should be read from the interphone and properly backed up.
2. If the edited data cannot work normally after being written into the interphone, please open the backup data and rewrite them.
3. “Model Information” is the important information of the interphone and should not be altered.

Test Mode

According to Figure 3-1, connect the radio to the computer with the special programming cable.

Warning: Before entering the Test Mode, please first connect a high-frequency load of 50 ohm to the antenna port of the radio or connect the radio a certain test instrument.

With the 500-1 Programming Software, you can enter the adjustment status in Computer Test Mode to adjust the following parameters of the radio:

（1） Frequency stability
（2） RF transmitting high power
（3） RF transmitting Middle power
（4） RF transmitting Low power
（5） Maximum TX voice deviation
（6） VOX1(Tight)
（7） VOX10
（8） 2/5 tone deviation
（9） DTMF deviation
（10） MSK deviation
（11） DCS/LTR balance
（12） DCS deviation
（13） LSD deviation
（14） CTCSS(67.0Hz) deviation
（15） CTCSS(254.1Hz) deviation
（16） Battery warning level
（17） RX Sensitivity
（18） DCS RX middle level
（19） RX squelch 9 open level
（20） RX squelch 9 close level
（21） RX squelch 1 open level
（22） RX squelch 1 close level

（23） RSSI(-120dBm)
（24） RSSI(-70dBm)

Firmware Upgrading Mode

The radio is equipped with an internal FLASH ROM, it can be upgraded if required.

1. Connect the radio to the PC with a proper programming cable, then power on the radio.
2. Run computer programming software.
3. Select the right “com port” you connected and the upgrading firmware and then click on “E.P” to start downloading.
4. Turn off the radio and exit the programming software.

Chapter 4 Disassembly For Repair

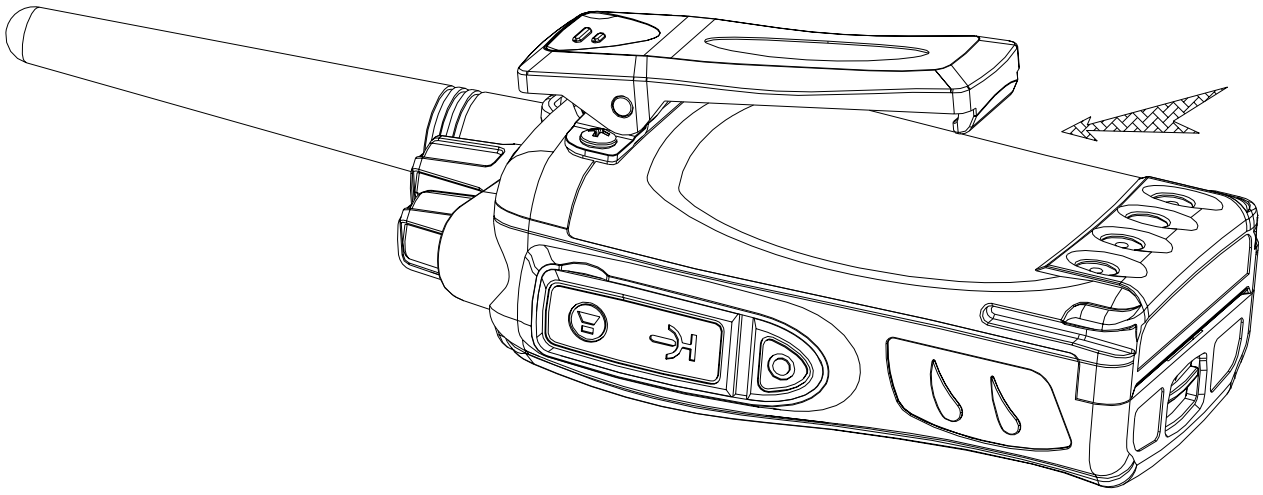
The radio is a kind of sophisticated communication equipment with small and fine mechanical structure. You should assemble and disassemble it carefully during the maintenance process. The Instruction for assembly and disassembly are as follows:

Installing/Removing the Battery Pack

To install the battery, please place it into the groove on the top of the radio chassis about 5mm away from latch.

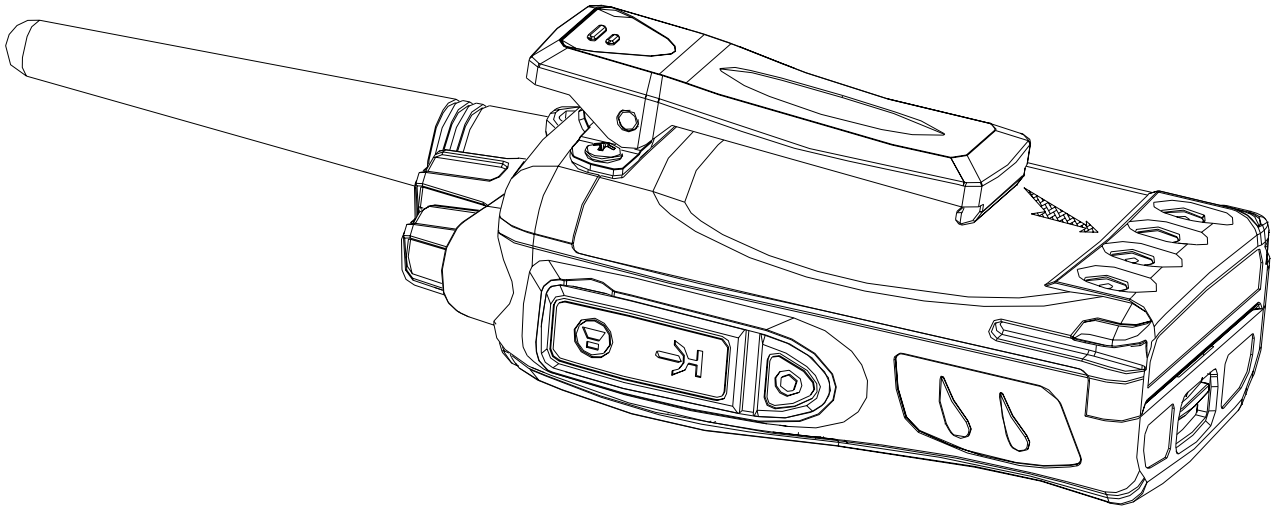
If the radio has the belt clip installed, you will have to press one side of the clip, to raise it and slide the battery in proper position.

Press the battery with your fingers and push the battery until you hear a latch click, the battery is now installed.



Removing the battery pack：

If you want to remove the battery from the radio, first press the battery latch located on the bottom of the radio, and then press down to slide the battery about 5mm to release the latch.



Notice:

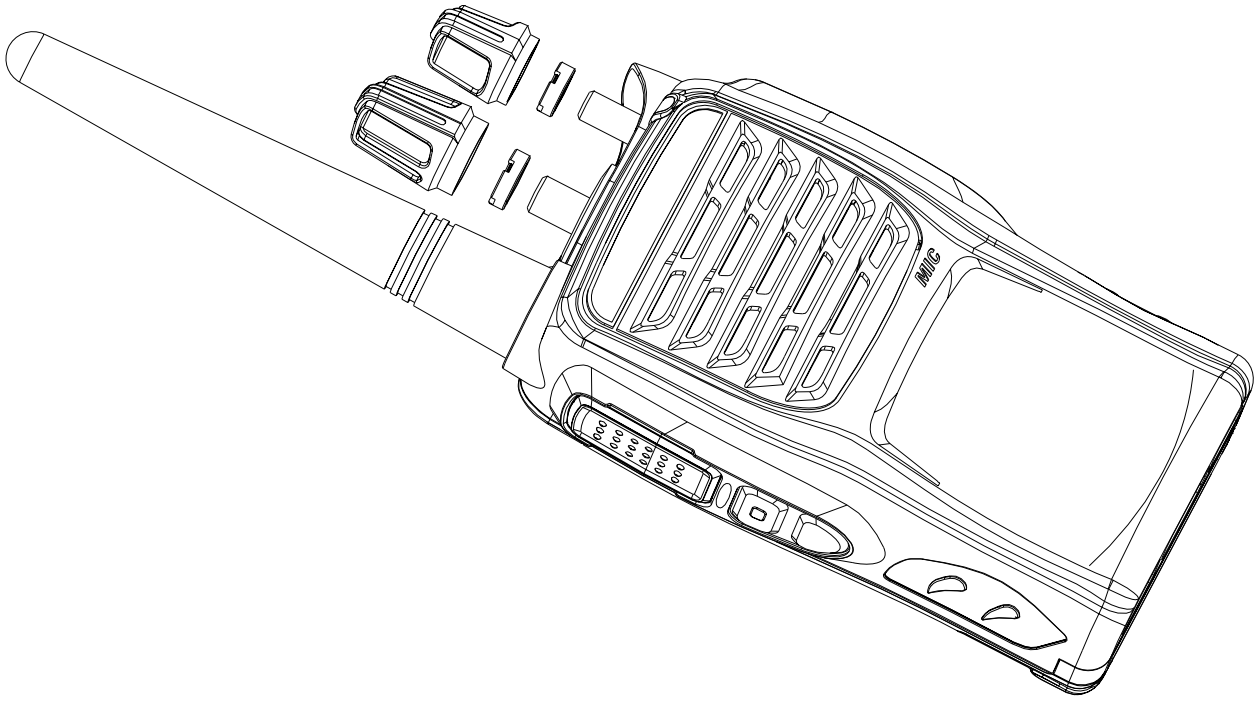
***** Do not short-circuit the battery terminals or dispose the battery in fire.

* Do not disassemble the battery case.

Installing/Removing Antenna, Channel Selector, Power/Volume Knob

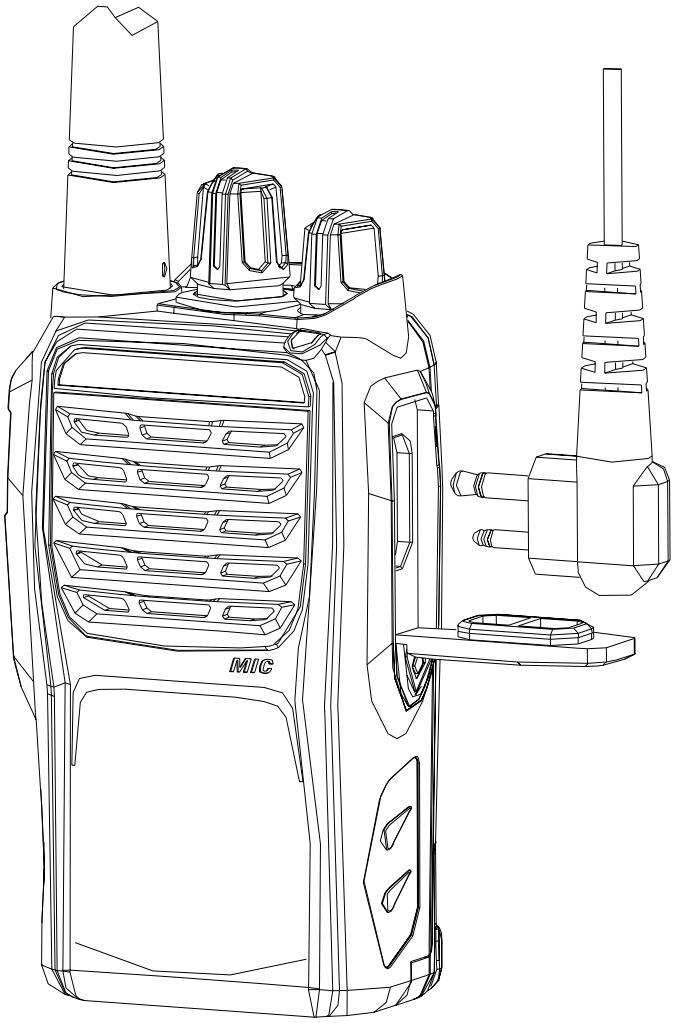
Screw the antenna out of the connector at the top of the radio by holding the bottom of the antenna and turn it counter clockwise until apart.

Using a smooth tool or a tool protected with cloth to hold or prize up form the bottom of channel selector or volume knob until apart，then screw the two screws under the channel selector and volume knob using the special tool.



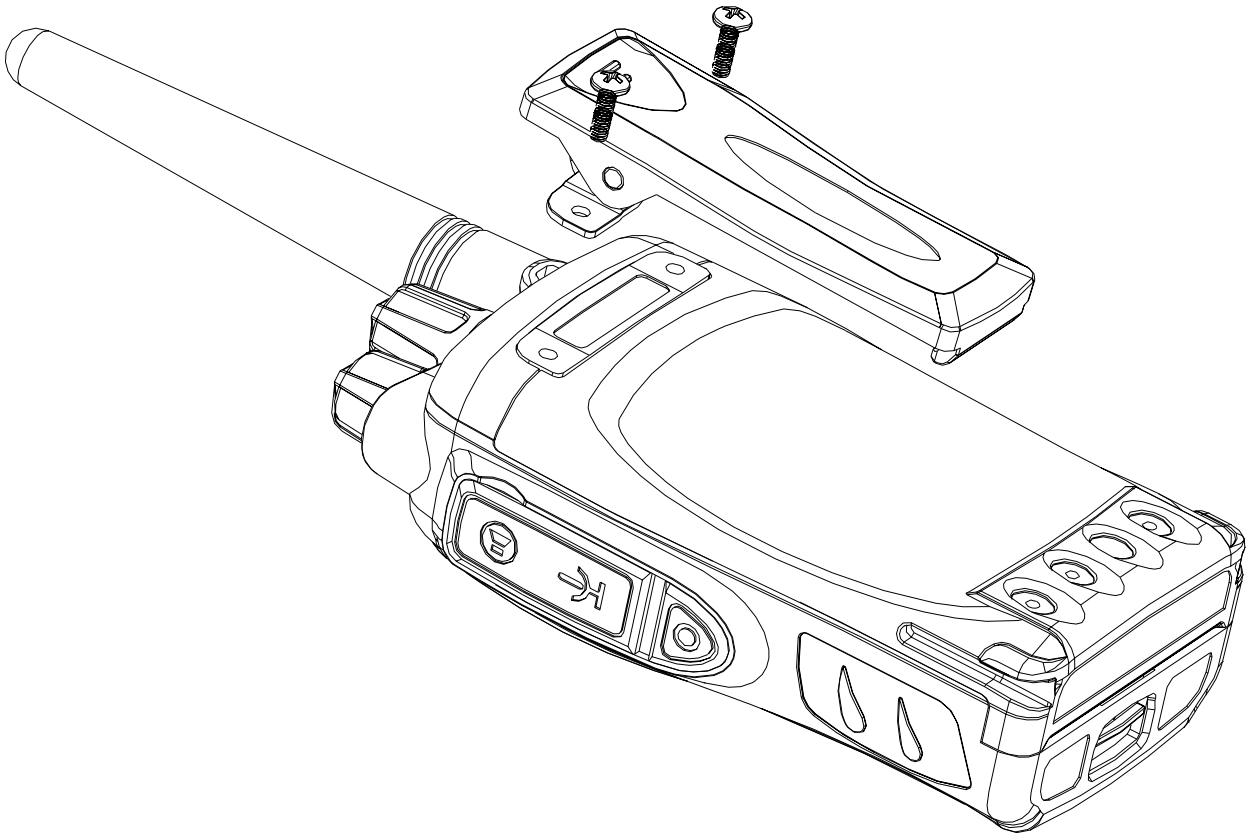
Install external speaker/MIC

Open the cover of the jack for external speaker/MIC, and then insert the plug of the external speaker or microphone into the jack on the radio. When inserting the accessory plug, make sure it is properly aligned (straight) to avoid internal damage to the connector in the radio.

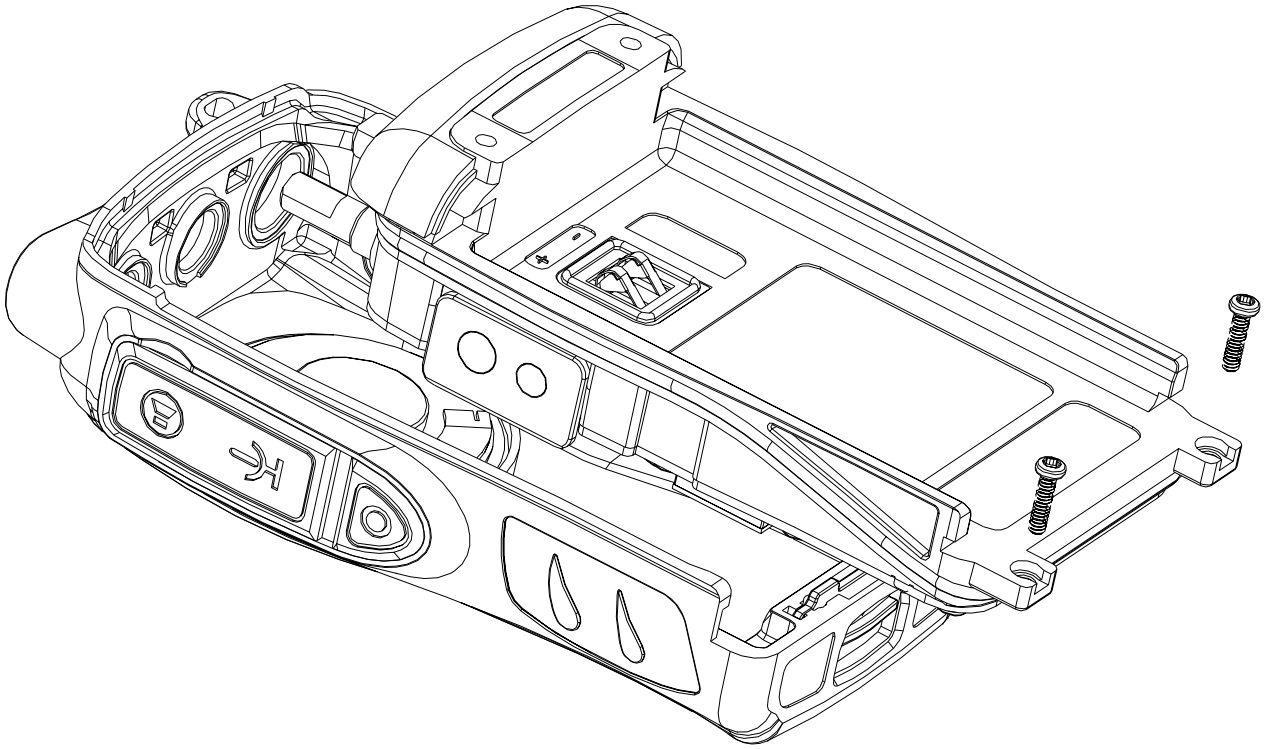


Installing/Removing the Belt Clip

Use the 2 screws (M2.5x8.0) supplied with the radio and fix these screws on the holes in the radio clip and into the holes in the aluminum case. If you want to remove the clip from the radio, just unscrew them, and remove the clip, you can put the screws back to make sure you do not loose them.

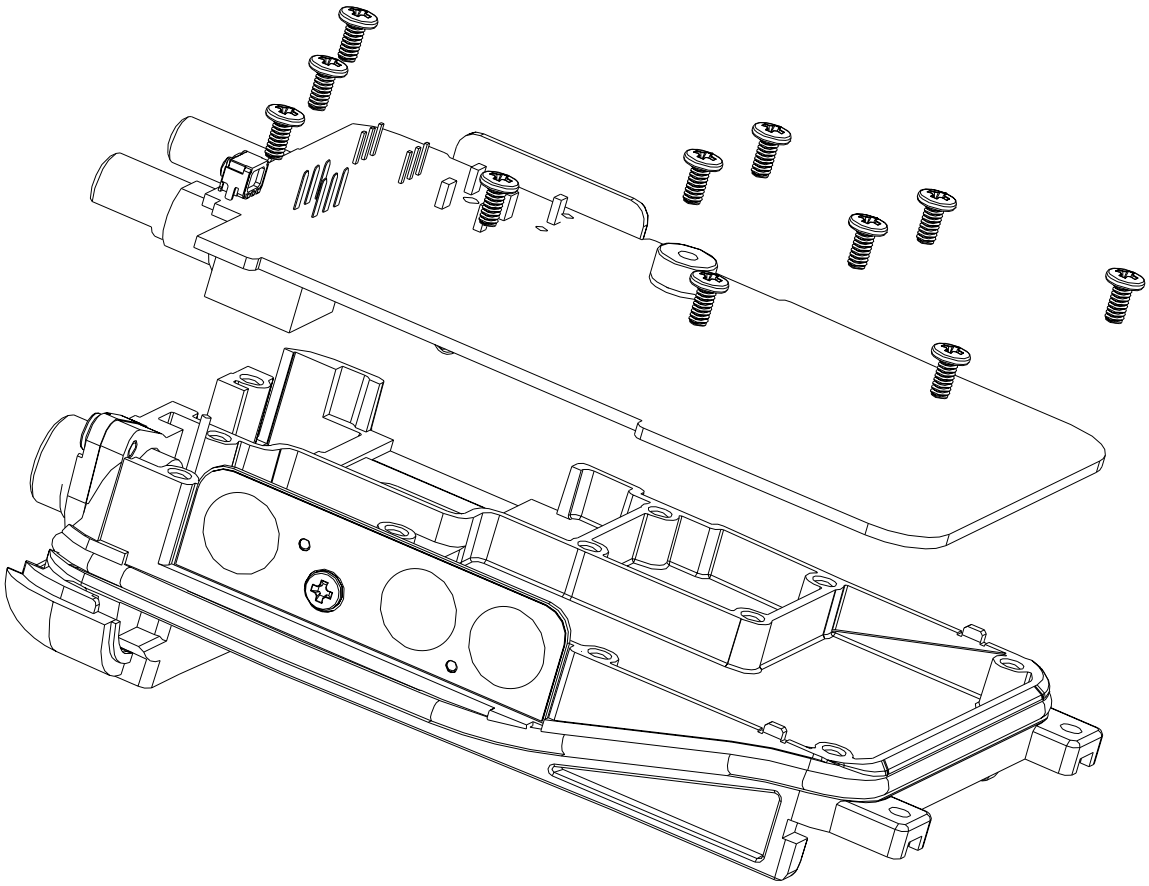


Installing/Removing the Chassis, PCB

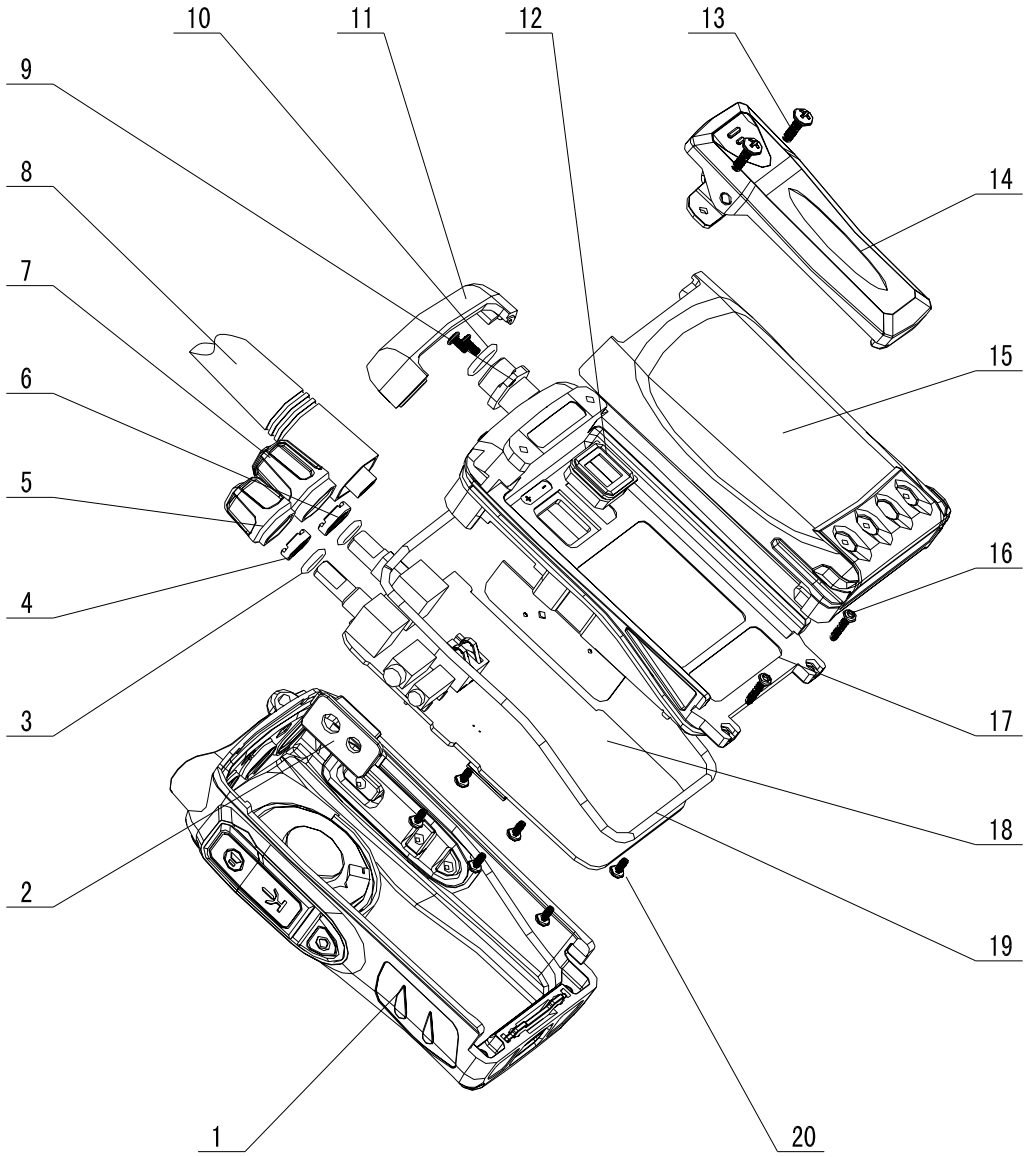


1. Remove the antenna, channel selector and power/volume knob and two screws under the channel selector and volume knob.
2. Screw off the two screws at the bottom of the radio by a hexagon screwdriver.
3. Pry up the aluminum shell by peaking a straight screwdriver in the cross-slot at the bottom of the aluminum shell, and then pull out the surface shell after placing the aluminum shell inclined to the back; but please be careful not to snap off the cable of the speaker.
4. Screw off the 11 screws on the PCB by a cross screwdriver.
5. Unsolder the endpoints of the antenna , PTT key board and speaker by an electric iron, then remove the main board.

After the disassembly above, you can carry out corresponding reparation and debugging according to the actual malfunction.



Exploded View of the Parts



No.	Parts No.	Description	Qty.
1	604CU50001001	Cabinet asm.	1
2	2010CU600004X	Ear phone cabinet	1
3	2020CU500004X	O-ring Φ5X1.5	2
4	304060250001X	Volume screw M6X0.75X2.5 special shape brass	1
5	2010CU600006X	Volume knob black	1
6	304070250001X	Volume screw M7X0.75X2.5 special shape brass	1
7	2010CU600007X	Encoder knob black	1
8	7100600113171	Anntenna	1
9	2030CU600003X	SMA RF socket	1
10	2020CU500003X	O-ring Φ7X1.5	1
11	2010CU600005X	radio top cover black	1
12	2020CU500002X	2 PIN power socket washer	1

13	301250607001X	machine screw M2.5X6.0 PB(+) black Ni-plate	2
14	7110CLP02001	CLP-02 clip asm.	1
15	70600CB03001	Battery CB-03 (OR CB-05 70600CB05001)	1
16	301200807001X	Machine screw M2.0X8.0	2
17	2030CU500001X	AL cabinet polishing ADC 12	1
18	1010500200102	Main PCB	1
19	2020CU500001X	cabinet waterproof ring	1
20	301200407001X	machine screw M2.0X4.0	14

Exchangeable part list

No.	Parts No.	Description	Qty.
	604CU50001001	Cabinet asm.	
1	2010CU500001X	Radio front cabinet black	1
2	2010CU600010X	Light-guider clear PC	1
3	2010CU600002X	PTT plastic key black	1
4	2010CU600003X	Ear phone plastic plug	1
5	2010CU600008X	Ear phone cover black	1
6	2020CU600001X	PTT silicon key block	1
7	306003301001X	Φ36mm air filter nylon weave	1
8	1211361601001	Speaker Φ36mm	1
9	2040CU600004X	7mm mic air filter Φ7.0X4.5X0.2	1
10	2020CU600004X	Mic waterproof washer	1
11	2010CU600009X	Battery locker black	1
12	2030CU600004X	Spring Φ2.3X10.5 Φ0.25	2
	604CU50001002	AL cabinet asm.	
1	2030CU500001X	AL cabinet	1
2	2010CU600005X	Radio top cover black	1
3	2020CU500001X	Cabinet waterproof ring orange	1
4	2020CU500002X	Power socket washer	1
5	301250607001X	Machine screw M2.5X6.0	2
	2010CU600006X	Volume knob	
	2010CU600007X	Encoder knob	
	7110CLP02001	CLP-02 Clip	

Chapter 5 Circuit Description

5.1 Frequency configuration

The reference frequency of frequency synthesizer is provided by 12.8MHz crystal oscillator X1 TCXO. The receiver adopts quadric mixing mode. The first IF is 38.85MHz, and the second IF is 450kHz. The first local oscillation signal of the receiver is produced by frequency synthesizer and the second local oscillation signal selects the 3rd harmonics of 12.8MHz of crystal oscillator X1 TCXO. The signal of transmitter is produced by frequency synthesizer directly.

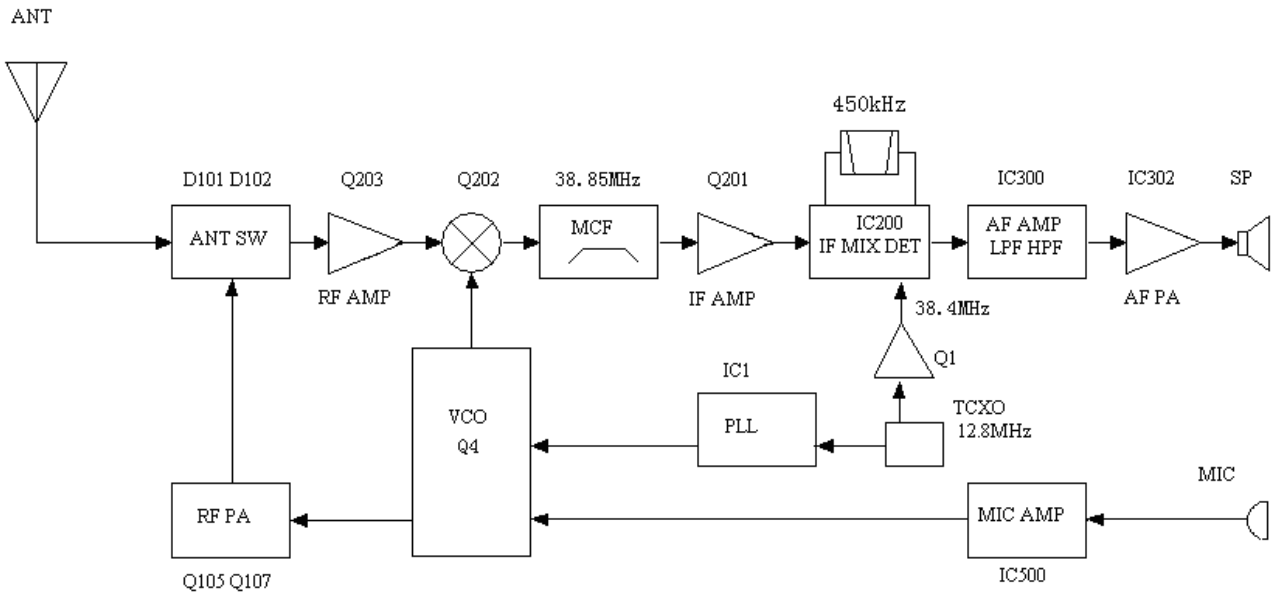


Figure 1 Frequency configuration

5.2 Receiver（Rx）

The receiver is double conversion superheterodyne, designed to operate in the frequency range of 136 to 174MHz,The frequency configuration in Fig 2

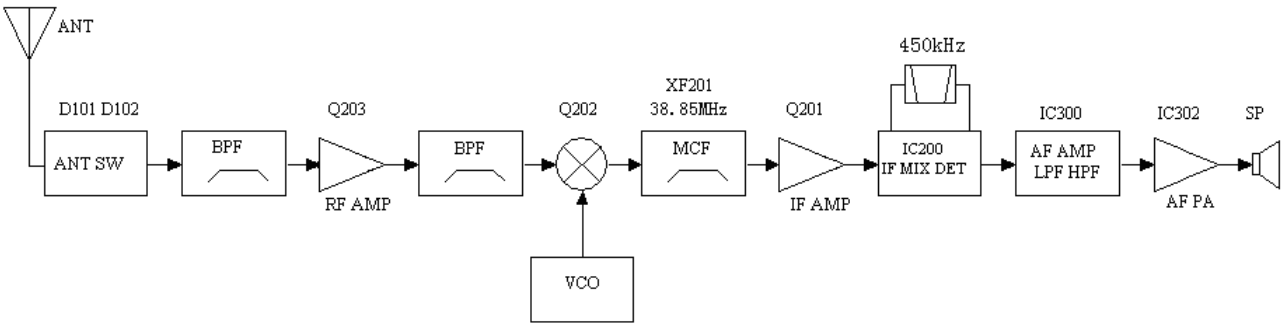


Figure 2 Receiver section configuration

Front End of Receiver

Signals from the antenna are filtered by BPF which consists of C235 C233 C604 C252 C951 C234 C255 C255 L209 L208 D201 D202 via RX/TX switch (D101　D102 and D103). After being filtered out the useless out-of-band signals, the signals are amplified by LNA consisting of Q203 and external components.
Signals from LNA are filtered again by BPF which consists of C228 C226 C238 C229 C227 C239 C947 C259 C948 L214 L204 L203 D905 and D206 before entering the 1st mixer (Q202).

The PWM wave is output by MCU composed of 58 foot and then commutated to adjustable voltage after filtering to change the capacity of varactor diode D905 D203 D206 D201 D202 to control the center frequency of BPF.

1st mixer

The first IF (51.65MHz) signal is produced after mixing of the receiving signal from LNA and the 1st local oscillation signal from frequency synthesizer. The first IF signal is filtered out adjacent channel and other useless signals by crystal filter (XF201).

IF Circuit

The 1st IF signal from crystal filter is amplified by the first IF amplifier (Q201) before processing of IC in IF(IC200，GT3136).

IF IC consists of the 2nd mixer, 2nd local oscillation, IF amplifier, limiter, frequency discriminator and noise amplifier.

Frequency (12.8MHz) produced by TCXO(X1) is amplified and then selects 3rd harmonics (38.4MHZ) as the second local oscillator signal source. The second IF signals (450kHz) are generated after signals mixing of the second local oscillation (38.4MHz) and the first IF (38.85MHz) in IC200. Audio signals are demodulated and outputted by IC200 after the second IF signals are amplified and limited in IC200 and then filtered by ceramic filter(450kHz).

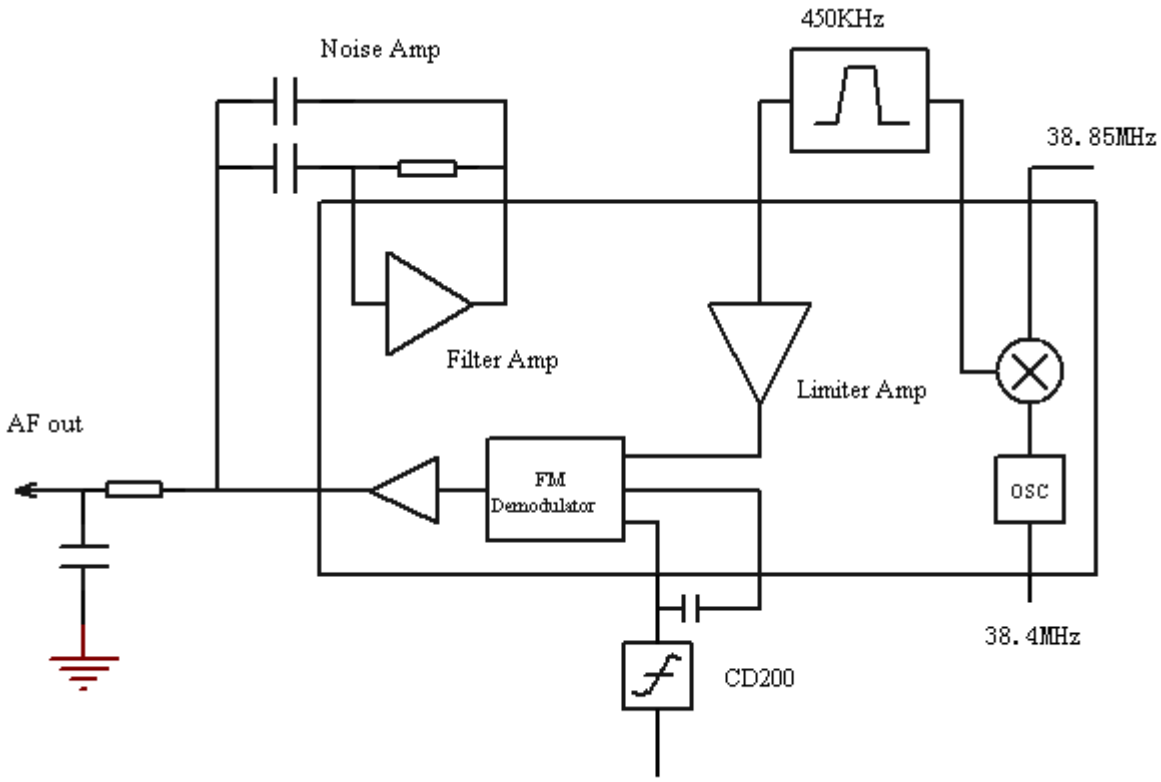


Figure 3 Schematic Diagram for IF System

Receiving Audio Signal Processing:

The audio processing circuit of receiver consists of IC300 and the peripheral circuit. Voice signals from IC200 are sent to IC301（CTCSS signaling filter circuit）and IC300-D respectively after amplified in IC300-C. After that, the signals are removed of the HF and LF components after amplification, de-emphasis and filtering by other units of IC300, and only audit components from 300 to 3000Hz can be sent to audio power amplifier (IC302) after amplified in Q300 and adjusted by volume potentiometers.

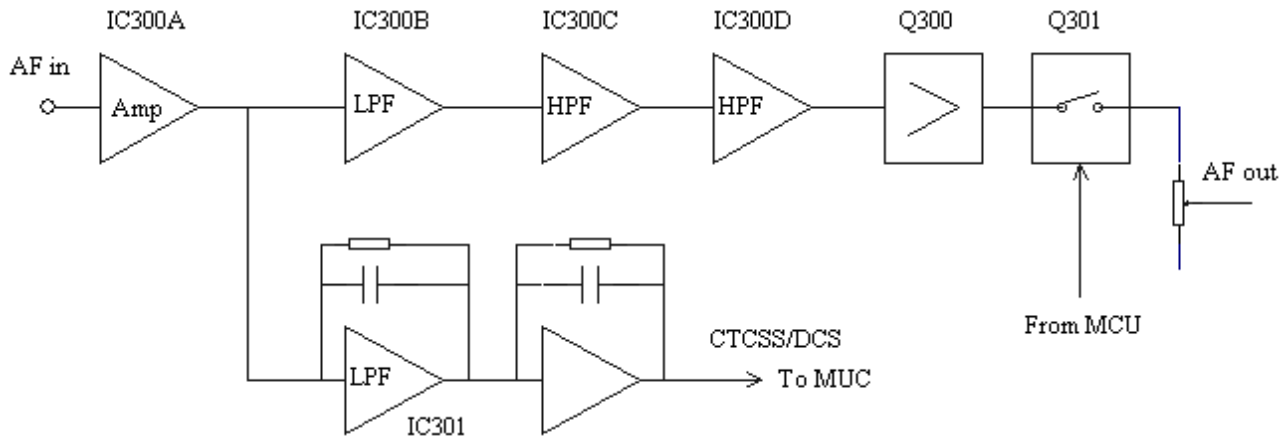


Figure 4 Schematic Diagram for Audio Processing of Receiver

Squelch Circuit

Part of the AF signal from the IC200 enters the FM IC again,and the noise component is amplified and rectified by a filter and an amplifier to produce a DC voltage corresponding to the noise level.
The DC signal from the FM IC goes to the analog port of the microprocessor(IC403).IC403 determines whether to output sounds from the speaker by checking whether the input voltage is higher or lower than the preset value.
To output sounds from the speaker,IC403 sends a high signal to the MUTE and AFCO lines and turns IC302 on through Q302 Q304 and Q305.

Audio Power Amplification

The audio power amplifying circuit consists of IC302 and the peripheral components.
The signals are amplified by audio power amplifier to drive the speaker after collecting the receiving audio signals, voice signals and warning tone signals. The warning tone has no volume limitation.
When AFCO is high level, Q304 is on, IC302 begins to work and the speaker sounds. Speaker Impedance: 16ohm

CTCSS Signal filtering

The audio signals after demodulation in IC200 may contain CTCSS (continuous tone control squelch system) or DCS（digital squelch）signals. The spectrum component of CTCSS/DCS is 67 to 250Hz. The filtering circuit composed of IC301 can filter out signals except CTCSS/DCS spectrum, which makes MCU decode the CTCSS/DCS more accurately.

5.3 Transmitter (Tx)

Transmitter Power Amplifier

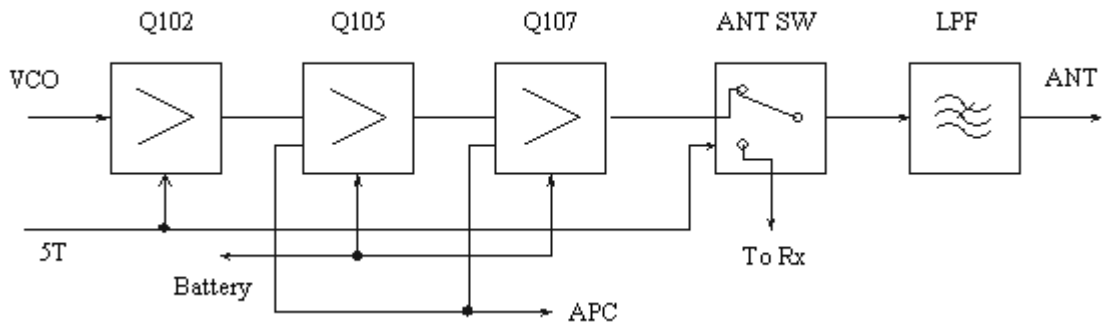


Figure 5 Schematic Diagram for Power Amplifier and Antenna Switch

The modulated RF signals from VCO are amplified by Q102 and Q105 before the power

amplification in Q107.

Gate bias of Q105 and Q107 is controlled by APC circuit, so the output power of transmitter can be controlled conveniently by changing the gate bias voltage.

APC（Automatic Power Control）

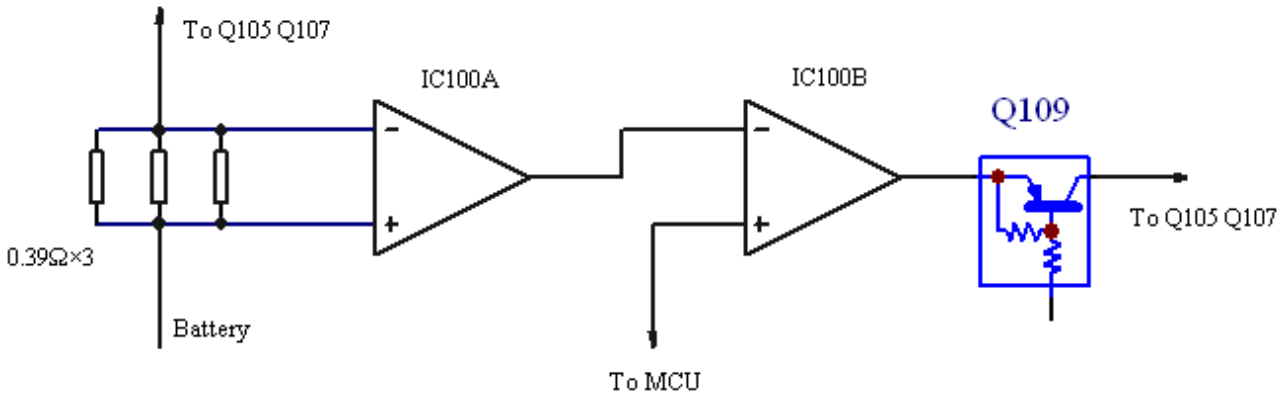


Figure 6 Schematic Diagram for APC Circuit

R130 R131 and R132 are power amplification current detector, IC100A is power amplification current sampling amplifier and IC00B is power comparison amplifier.

The power amplification current and IC100A output will increase with oversized output power of transmitter. When the output voltage of IC100B decreases, the bias voltage of Q105 and Q107 will decrease, finally the output power of transmitter will decrease or vice versa. Thus, the output power of transmitter will keep stable under any different working condition.
MCU can set the power by changing the voltage input to IC100B.

Audio Signal Processing of Transmitter

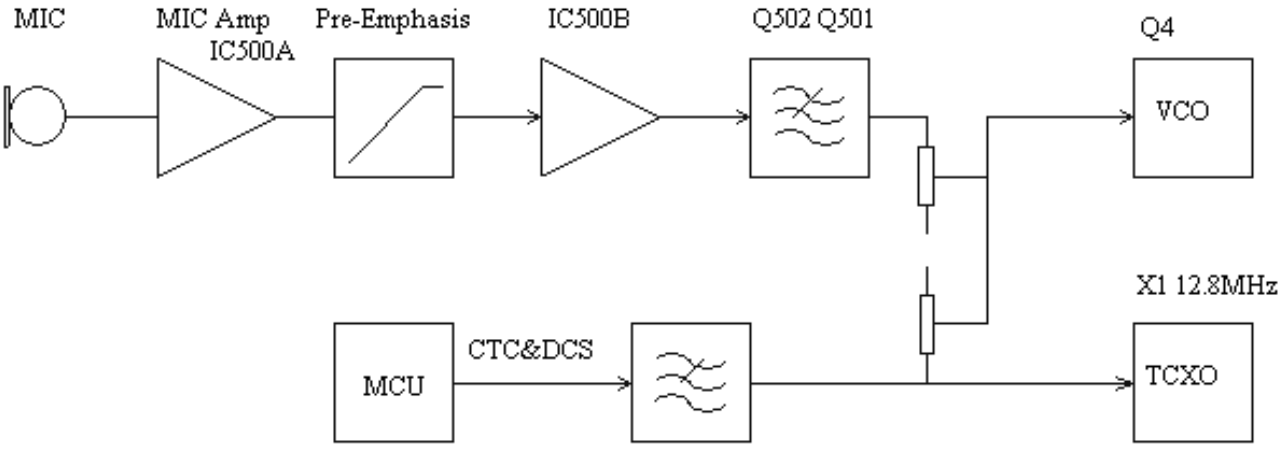


Figure 7 Schematic Diagram for Audit Circuit of Receiver

The audio signal processing circuit of Transmitter consists of IC500 and the peripheral components. Voice signals from MIC are sent to VCO for modulation together with CTCSS/DCS after amplification, limitation and filtering.
AGC circuit consists of D500, D501 and Q503. The signal amplitude is reduced to ensure no distortion in case of oversized MIC signal.
Q504, the power switch of voice processing circuit, controlled by MCU, will give power supply to IC500 only during transmission.
J501 is the socket for external MIC, and the internal MIC will disconnect automatically when using external MIC, but the internal PTT is still effective.

5.4 PLL Frequency Synthesizer

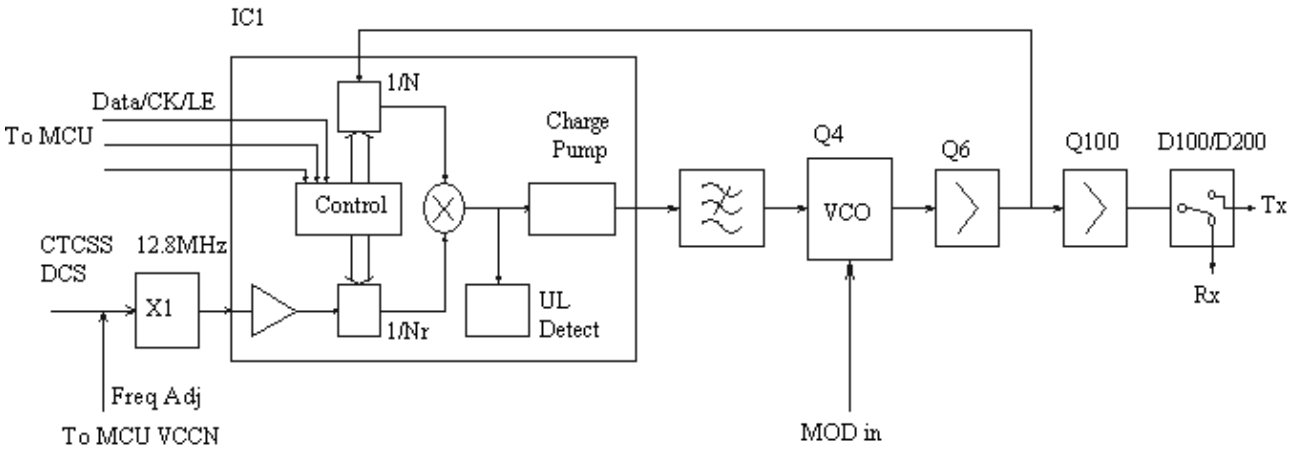


Figure 8 Schematic Diagram for Frequency Synthesizer

The 500-1(CU510-1) adopts PLL frequency synthesizer.
Frequency synthesizer consists of reference oscillator, voltage controlled oscillator (VCO), programmable frequency divider (PFD), phase comparator and low pass filter (LPF).

RX VCO Unit consists of Q4 D2 D4 L14 C35 C41 C44 C45 .

TX VCO Unit consists of Q4 D2 D4 L14 C35 C41 C44 C45 and D1 Q5,D5 is the modulation circuit of VCO.

IC1 (MB15E03) is PLL integrated circuit and contains programmable parametric frequency divider (PPFD), programmable frequency divider (PFD), phase comparator and charge pump, etc.

Low pass filter consists of R5 R7 R9 R10 C12 C15 and C18.
Reference frequency is provided by X1 (TCXO, 12.8MHz).
Reference frequency of TCXO (Temperature-controlled Crystal Oscillator) is divided by PPFD in IC1 to produce reference frequency of 5kHz or 6.25kHz (controlled by MCU based on the set channel frequency).

The oscillation frequency of VCO is compared with reference frequency to produce error signal after divided by PFD in IC1. The error signal is filtered by low pass filter before changing the VCO frequency to the set value in VCO (it is locking).

$N=F_{VCO}/F_R$

N：Division Frequency

F_{VCO}：VCO Oscillation Frequency

F_R：Reference Frequency

Lock lost detection: When PLL is out of lock, IC pin14 will output low level signal to MCU，and then MCU prohibit transmitter from transmitting with a warning tone.

Q8, the power filter, can provide PLL with more purified power to reduce the noise of frequency synthesizer.

5.5 Voice Circuit

The station is equipped with Voice Prompt Function, which is very useful during night or under dark condition.
The speaker will voice the current channel number when changing the channel every time because of the voice memory chip (IC401), which stores channel voice prompts.

5.6 Power Supply:

The station use lithium battery (7.4V, 1500mAh), while transmitter amplifier circuit (Q105 Q107) and receiver audio amplifier (IC302) use battery directly for power supply, and other circuits use regulated voltage (5V and 3V).

IC404:micro-power voltage stabilizer of 3V LDO, provides power (3V) of heavy current for the station together with Q10 and Q30.

IC902:5V LDO

Q405: 5T switch (controlled by MCU)

5T: supply power for the front end of transmitter

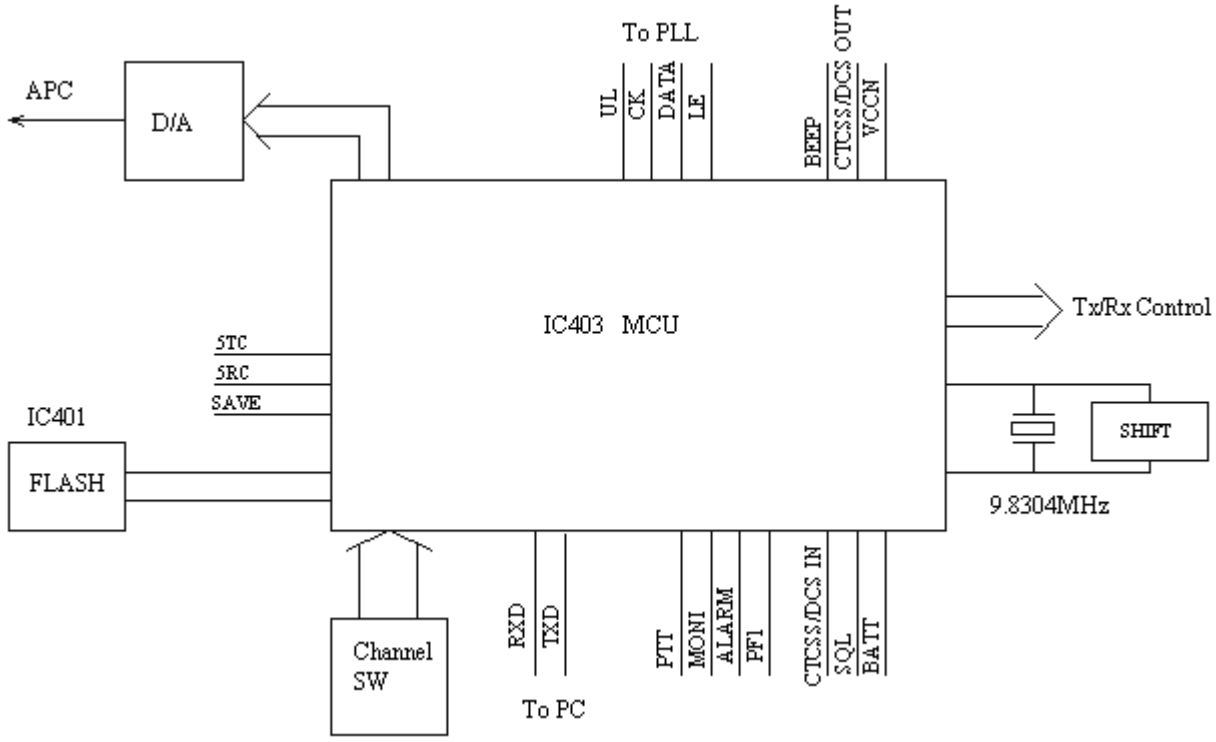
Q408: 5R switch (controlled by MCU)

5R: supply power for the units such as RF amplification, mixing, IF processing and audio signal processing.

Q910: 5C switch (controlled by MCU)

5C: the power (5V), controlled by power-down mode, is the supply power of frequency synthesizer.

5.7 MCU Unit:



5.9 Schematic Diagram for MCU Unit

MCU Unit controls the operation of every unit to realize all functions of the 500-1(CU510-1).
Communication with external PC
State data access
Control PLL for the generation, receiving and transmitting of local oscillation frequency
Access to the current channel state
Control LED status indicator
Control power supplied condition of every unit
Detect action of every function key
Produce CTCSS signal
Produce DCS signal
Produce power controlled signal
Finish CTCSS decoding
Finish DCS decoding
Squelch detection and control
Control voice prompt content

Memory (FLASH)
Channel data, voice data and other function setting data and parameter adjustment data.

CTCSS/DCS signal coding and decoding:

CTCSS/DCS signals from MCU (pin22 and pin18 output) are sent to VCO and TCXO for modulation respectively after filtering by R500 R501 C500 C501 and R504 R503 C920 C921.

CTCSS/DCS signals from receiver are sent to MCU(pin52) for decoding, and then MCU test if there are CTCSS/DCS signals with the same setting of the station to decide whether open the speaker or not.

CTCSS (continuous tone control squelch system, hereinafter referred to as CTCSS), is a kind of squelch control system with modulation on carrier and continuous sub-audio signals as pilot tone. If CTCSS function is set, the call is available only at the same CTCSS frequency of both receiving and transmitting parties to avoid the disturbance of other signals.
The station has 39 groups of standard CTCSS frequency for your selection, such as Table 1.
CTCSS signals produced by MCU are sent to VCO for modulation after filtered the HF components over 300Hz in low pass filter composed by RC.

Table 1 CTCSS Frequency Table

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 signaling：

DCS (Digital code squelch), is a kind of continuous digital code modulated on carrier with voice signal and used for squelch control. If DCS function is set, the speaker is available only when receiving the same DCS code to avoid the disturbance of useless signals.
The station has 83 kinds of standard codes including positive and inverse code for your selection, such as Table 2.
DCS signals produced by MCU (PWM waveform) are sent to VCO and TCXO for modulation (the HF components of DCS signals are modulated by VCO, while the LF components by TCXO) after filtered the HF components over 300Hz in low pass filter composed by RC.
CTCSS/DCS signals from receiver are sent to MCU for decoding, and then MCU test if there are DCS codes with the same setting of the station to decide whether open the speaker or not.

Table 2 DCS Coding Schedule

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	

5.8 Description of Semiconductor Devices
The distribution of each pin goes as the table 3.

Table 3---Definition of CPU Base Pin:

Pin No.	Port Name	Pin Name	I/O	Active Level	Function
1	APCSW	P33	O	H	APC switch
2	PTT	P34	I	L	PTT switch input
3	MODE	-	-	-	Connect this pin to VCC via a 4.7K resistor(*Burn)

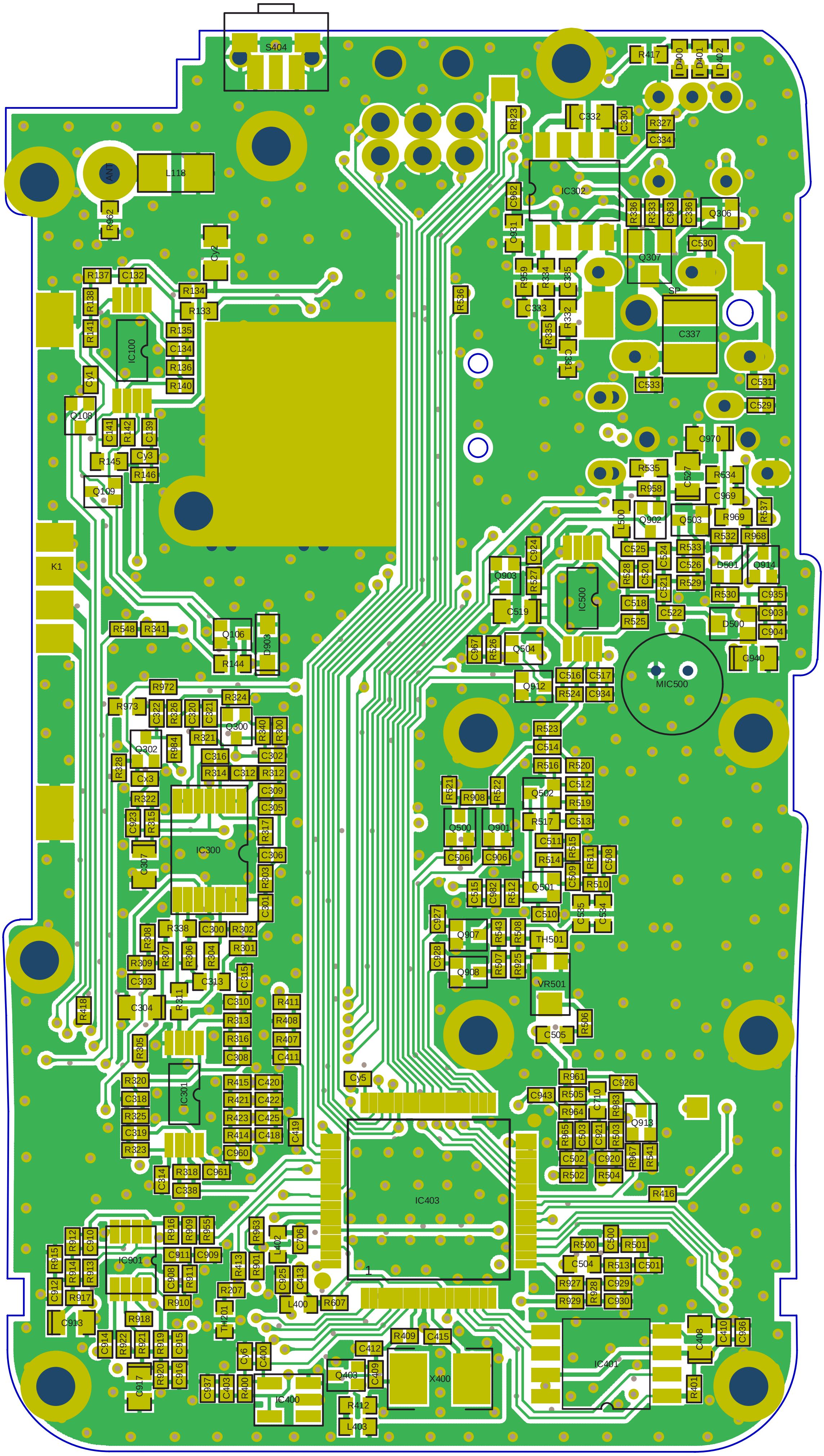
4	SK1	P43	I	L	SIDE KEY1 input
5	SK2	P44	I	L	SIDE KEY2 input
6	RESET	-	I	L	CUP reset (*Burn)
7	XOUT	-	O	-	MCU clock
8	VSS	-	-	-	GND
9	XIN	-	I	-	MCU clock
10	VCC	-	-	-	+3V
11	BSHIFT	P54	O	H	Beat shift switch
12	F_CS	P53	O	L	FLASH chip select output
13	F_DI	P52	O	-	FLASH data in
14	F_CLK	P51	O	-	FLASH serial clock output
15	F_DIO	P50	I/O	-	FLASH data input/output
16	NC	P27	O	-	
17	VCCN	P26	O	-	Frequency regulation output（PWM）
18	DCSTCXO	P25	O	-	CTCSS/DCS output（PWM）
19	PLL_CLK	P24	O	H	PLL clock Output
20	PLL_DAT	P23	O	-	PLL data Output
21	PLL_EN	P22	O	H	PLL enable
22	DCSVCO	P21	O	-	CTCSS/DCS output（PWM）
23	PLL_UL	P20	I	H	PLL unlock detect pin
24	RXVCO	P17	O	H	TX/RX VCO selection(H,RX)
25	BEEP_AF	P16	O	-	Local Beep Control Pin
26	RXD0	P15	I	-	Serial data
27	TXD0	P14	O	-	Serial data
28	GLED	P86	O	H	Green LED
29	RLED	P85	O	H	Red LED
30	NC	P84	O		
31	TDIN	P83	I	TRFI	TONE data input
32	ALARMC	P82	O	L	Alarm switch control（H：Controlled by Volume Switch L：Emergency siren maximum volume)
33	DEV2	P81	O	-	Voice deviation adjustment 2
34	DEV1	P80	O	-	Voice deviation adjustment 1
35	NARROW	P60	O	H	12.5KHz
36	MIDDLE	P45	O	H	20KHz
37	TXD1	P66	O	-	Reserved
38	RXD1	P67	I	-	Reserved
39	MIC_MUTE	P65	O	L	MIC mute L: MIC mute
40	5TC	P64	O	H	Transmitting power control
41	EXTPTT	P63	I	L	External PTT switch input
42	SAVE	P31	O	H	Battery power control H：Power save

43	5RC	P30	O	H	Receiving power control
44	ENC0	P36	I	-	Channel selector input
45	ENC1	P32	I	-	Channel selector input
46	ENC2	P13	I	-	Channel selector input
47	ENC3	P12	I	-	Channel selector input
48	VOX	P11	I	AN9	VOX level input
49	BATT	P10	I	AN8	Battery voltage input
50	AFCO	P00	O	L	Audio Amplification Power
51	SPKSW	P01	O	L	Audio amplifier control
52	DCS_IN	P02	I	AN5	CTCSS/DCS input Recording level input
53	NC	P03	I		
54	BUSY	P04	I	AN3	Busy level input
55	TOPKEY	P62	I	L	TOPKEY input
56	RXMUTE	P61	O	H	RX audio mute
57	RSSI	P05	I	AN2	Received Signal Strength Indicator input
58	PCTV	P06	O	DA0	APC/BPF control output
59	AVSS	-	I		GND
60	DTMF	P07	O	DA1	DTMF/Beep output
61	VREF	-	I		+3V
62	AVCC	-	I		+3V
63	NC	P37	O		
64	RX_W/N	P53	O	H	RX Wide/Narrow switch

Table 4 Functional description of semiconductor device

Item	Model	Function Description
IC1	MB15E03	Frequency Synthesizer
IC100	NJM2904	APC, Voltage Comparison, Driving
IC200	GT3136	Receiver 2nd Local Oscillation, 2nd IF Amplification, Limitation, Demodulation, Noise Amplification
IC300	NJM2902V	Receiver demodulated signal Amplification, Filtering
IC500	NJM2100V	MIC Amplification, Limitation, Filtering
IC302	TDA2822D	Audio Frequency Power Amplification
IC401	W25Q80	FLASH, Channel Frequency Data Storage, Function Setting Parameter, Debug Mode Parameter
IC403	R5F212BCSNFP	MCU

Chapter 6 500-1 PCB Layout



S404
R417
D400
D401
D402
C332
C330
R327
C334
ANT
L118
R923
IC302
C962
C961
R336
R333
C963
C336
Q306
C530
R962
Q307
SP
Cy2
R137
C132
R138
R134
R133
R141
IC100
R135
C134
R136
R140
Cy1
R959
R334
C335
C333
R335
R332
C331
C337
R536
C533
C531
C529
Q108
C141
R142
C139
R145
Cy3
R146
Q109
C970
R535
C527
R534
R958
C969
L500
Q902
Q503
R969
R537
R532
R968
K1
C924
C525
C524
R533
Q903
R527
IC500
R528
C520
C526
D501
Q914
C521
R529
C519
C518
R530
C935
R525
C522
C903
D500
C904
R548
R341
Q106
D903
C967
R526
Q504
C940
R144
Q912
C516
C517
MIC500
R524
C934
R972
R324
R973
C322
R326
C320
C321
Q300
R340
R300
R523
Q302
R984
R321
C514
R328
C316
C302
R516
R520
Cx3
R314
C312
R312
R521
R908
R522
C512
Q502
R322
C309
R519
C923
R315
C305
R517
C513
Q500
Q901
R317
C511
R515
C307
IC300
C306
C506
C906
R514
R511
C508
R303
C509
Q501
R510
C515
C982
R512
C301
C535
C534
C510
C927
R338
C300
R302
Q907
R543
R508
TH501
R308
R306
R304
R301
C928
R307
R309
Q908
R507
R925
C303
C313
C315
VR501
R311
C310
R411
C304
R418
R313
R408
R506
R316
R407
C505
R305
C308
C411
Cy5
R961
C926
R320
R415
C420
C943
R505
C318
IC301
R421
C422
C710
R983
R325
R423
C425
R964
Q913
C319
R414
C418
C419
R965
C503
C921
R503
R323
C960
C502
C920
R967
R541
R318
C961
R502
R504
C314
C338
R416
IC403
R912
C910
R916
R909
R955
R963
L402
C706
C500
R915
R500
R501
IC901
C911
C909
R914
R913
C908
R911
R413
R901
C925
C413
C504
R513
C501
1
R207
R927
R928
C929
C912
R917
R910
TH201
L400
R607
R929
C930
C913
R918
C410
C936
C408
R409
C415
C914
R922
R921
R919
C915
Cy6
C400
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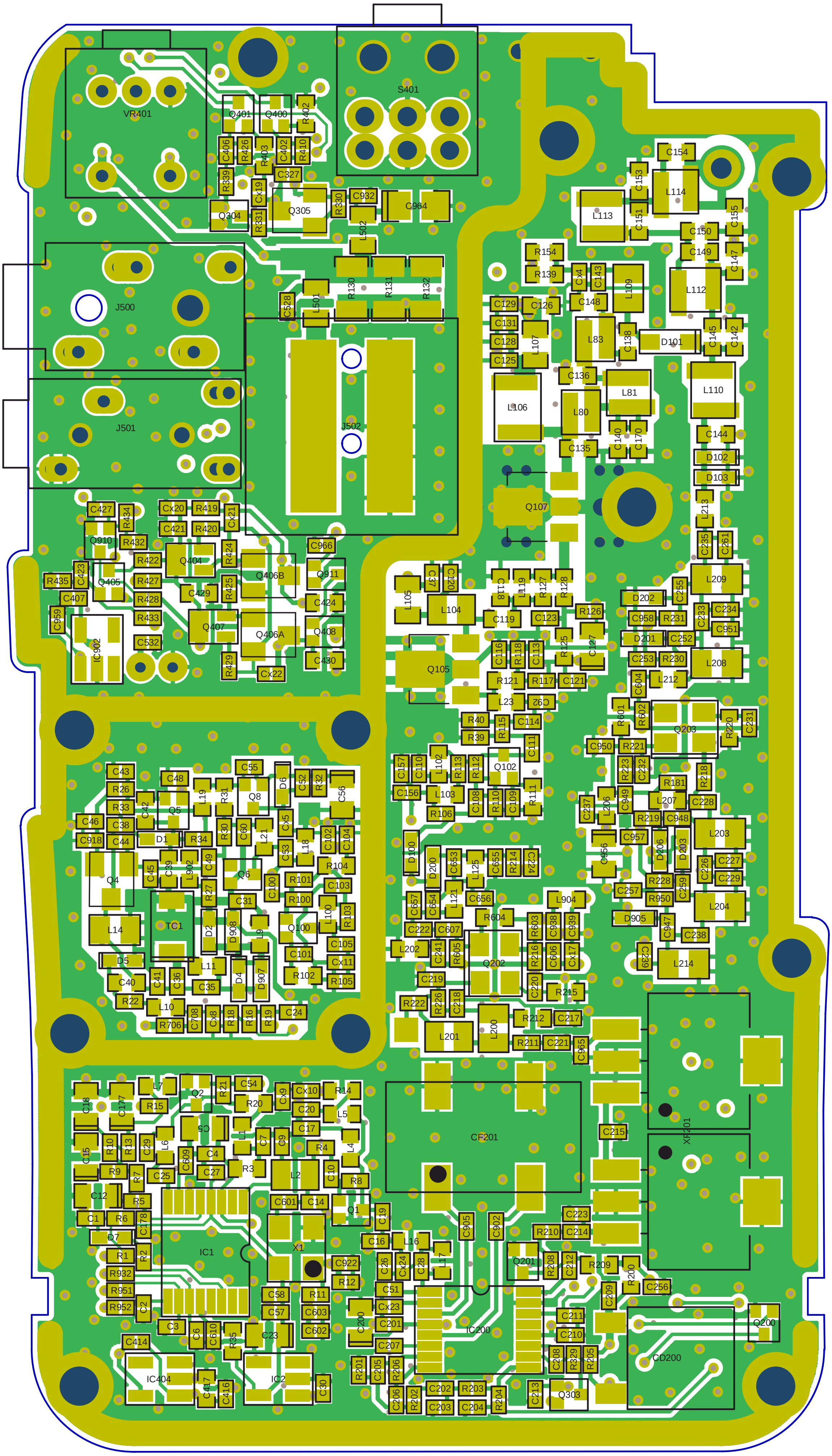
R400
IC400
Q403
C409
X400
R401
R412
L403



VR401
Q401
Q400
R402
S401
C406
R426
R403
C402
R410
R339
Cx19
C327
R330
C932
C964
Q304
Q305
R331
L502
C154
C153
L114
L113
C151
C155
C150
C149
C147
R154
R139
C4
C143
L109
L112
J500
C528
L501
R130
R131
R132
C129
C126
C148
C131
L83
C138
D101
C145
C142
C128
L107
C125
C136
L106
L81
L110
L80
J501
J502
C140
C170
C144
C135
D102
D103
Q107
L213
C235
C261
C427
R434
Cx20
R419
Cx21
C421
R420
Q910
R432
R422
Q404
R424
C966
Q406B
Q911
R435
C423
Q405
R427
C429
R425
L209
C407
R428
C424
C37
C120
C118
L119
R127
R128
D202
C255
L105
L104
R126
C958
R231
C234
C959
R433
Q407
Q406A
Q408
C119
C123
C233
C951
IC902
C532
D201
C252
R429
Cx22
C430
Q105
C116
R118
C113
R125
C127
C253
R230
L208
R121
R117
C121
C604
L212
L23
C92
R40
R115
C114
R601
R602
Q203
R220
C231
R39
C111
C950
R221
C43
C48
C55
D6
C52
R32
C157
C110
L102
R113
R112
Q102
R223
C232
R218
R26
R31
Q8
C56
R181
C42
L19
C156
L103
C108
R110
C109
R111
C237
L206
C949
L207
C228
R33
Q5
R106
R219
C948
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C104
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C653
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C655
R214
C224
C956
D206
D203
C53
Q4
C45
C39
L902
C49
Q6
R104
C227
C226
C229
R101
C103
R228
R950
C259
C257
C100
R27
C31
R100
C657
C654
L121
C656
L904
L14
TC1
D2
D908
L9
Q100
L100
R103
R604
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C607
C238
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C241
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Q202
R216
C606
Cx17
C239
L214
D5
L11
C101
C40
C41
C36
D4
D907
Cx11
C219
C220
R215
C35
R102
R105
R22
L10
C708
Cx8
R18
R16
R19
C24
R222
R226
C218
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R706
L201
L200
R211
C221
C965
L7
Q2
R21
C54
Cx10
R14
C18
C177
R15
R20
Cx9
C20
L5
C215
CF201
XF201
C17
L6
C15
R10
R13
C29
C609
C4
L1
C7
C9
R4
L4
R9
R7
C25
C27
R3
L2
C10
R8
C12
R5
C601
C14
Q1
C19
C223
C1
R6
C178
C16
L16
C905
C902
R210
C214
D7
R1
R2
IC1
X1
C26
Cx24
C28
L17
Q201
R208
C212
R209
R200
R932
C922
R12
R951
C58
R11
C51
C209
C256
R952
C2
C57
C603
Cx23
C200
C211
C3
C6
C610
R35
C23
C602
C201
IC200
C210
Q200
C414
C207
CD200
R201
C205
R206
C208
R329
R205
IC404
C417
C416
IC2
C30
C206
R202
C202
C203
R203
C204
R204
C213
Q303

Chapter 7 ADJUSTMENT

7.1 Required Test Equipment

Table 7.1

Number	Name	Parameter requirements
1	Computer	Above P2, compatible IBM PC, WINDOWS 98/ME/2000/XPOperating System
2	Programming software	500 Programming software
3	Programming cable	Special Serial/USB (CPL-01) programming cable
4	Dubbing cable	CPL-02
5	DC regulator	Output voltage:7.4V, output electric current:≥ 5A
6	RF power meter	Test range: 0.5---10W Frequency range: 100MHz—500MHz Resistance: 50Ω SWR≤1.2
7	Frequency meter	Frequency range: 0.1—600MHz Frequency accuracy: higher than$\pm 1\times 10^{-6}$ Sensitivity: higher than 100mV
8	Frequency deviator	Frequency range: DC—600MHz Test range: 0--±5kHz
9	DMM	Input resistance: above 10MΩ/V DC, capable of measuring voltage, electric current and resistance.
10	Audio signal generator	Frequency range:2---3000Hz Output level: 1---500mV
11	RF power attenuator	Decrement: 40db or 50db Receive power : higher than10W
12	Standard signal source	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

Recommend how to use: item 6, 7, 8, 10, 11 and 12 which listed in the table can be substituted by integrated tester HP8920/HP8921.

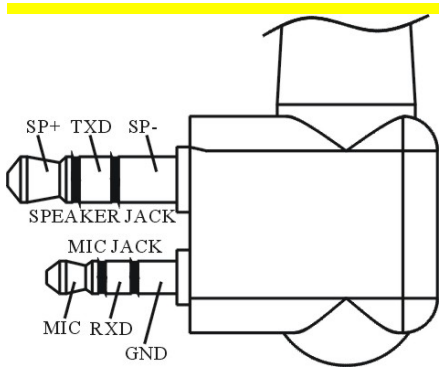


Figure 1 External Speaker/microphone Interface Definition

7.2 Adjustment Items

Some detection and adjustment shall be made to the station technical data after changing the components during the maintenance. The debugging introduction of some related circuits goes as follows:

Some parameters of the product can be adjusted by use of 500-1 Programming Software of our company. The adjustable parameters are as follows：

（1） Frequency stability
（2） RF transmitting high power
（3） RF transmitting Middle power
（4） RF transmitting Low power
（5） Maximum TX voice deviation
（6） VOX1(Tight)
（7） VOX10
（8） 2/5 tone deviation
（9） DTMF deviation
（10） MSK deviation
（11） DCS/LTR balance
（12） DCS deviation
（13） LSD deviation
（14） CTCSS(67.0Hz) deviation
（15） CTCSS(254.1Hz) deviation
（16） Battery warning level
（17） RX Sensitivity
（18） DCS RX middle level
（19） RX squelch 9 open level
（20） RX squelch 9 close level
（21） RX squelch 1 open level
（22） RX squelch 1 close level
（23） RSSI(-120dBm)
（24） RSSI(-70dBm)

Steps for adjustment：
1) Enter Computer Test Mode by selecting “Test Mode” in main menu of 500-1 Programming Software.
2) Select the items to be adjusted in choice menus, and then adjust the parameters by function keys on the computer keyboard.
3) Exit Computer Test Mode after adjustment.

7.3 Adjustment

7.3.1 VCO Adjustment

Close “Power-saving Mode”. Set receiving frequency to low frequency point (see Table 7.2) and in the receiving state, test voltage of PD by DMM and adjust fine-tuning capacitor TC1/TC2 to get CV voltage of 1.0V±0.2V
Set transmitting frequency to high frequency point (refer to Table 2), press PTT and test voltage of PD by DMM, which shall less than 4.0V

Table 2 High/ Intermediate/ Low Frequency Point of All Models

	Low Frequency Point	Intermediate Frequency Point	High Frequency Point
500-1	136.000 MHz	155.100 MHz	173.975 MHz

7.3.2 Frequency stability

Double-click to enter “Frequency Stability” in “Test Mode Manual” to achieve the rated transmitting frequency by adjusting the number from 0 to 255 (Error<100Hz).

7.3.3 RF transmitting power

High power
Adjusts the transmitting power to 4.8-5.2W in the computer
(5 frequency points including Highest, High, Med, Low, lowest)
Middle Power
Adjust the transmitting power to 1.8-2.2W in the computer
Low Power
Adjust the transmitting power to 0.8-1.2W in the computer

7.3.4 Voice deviation

Maximum voice deviation
Signal source: MOD:1kHz/120mV LPF:15kHz
Adjust the max frequency deviation in the computer adjustment mode.

mode.
3.9kHz---4.5kHz (wideband)
3.2kHz---3.9kHz (median band)
between 1.8kHz---2.3kHz (narrowband)

(2/5)TONE, DTMF, MSK Deviation
Adjust TONE, DTMF, MSK deviation in the computer adjustment mode.
3.2---4.0 kHz (wideband)
3.0kHz---3.6kHz (median band)
1.8---2.3kHz (narrowband)

VOX1, VOX10
Adjust VOX1, VOX10 microphone sensitivity in the computer adjustment mode.
VOX1 for 50mv and VOX10 for 5 mv

7.3.5 CTCSS/DCS deviation

DCS/LTR balance
Signal source: LPF: 300Hz
Adjust DCS/LTR balance in the computer adjustment mode.
Make the transmitting demodulation waveform be flat square wave.

DCS deviation
Signal source: LPF: 300Hz
Adjust DCS frequency deviation in the computer adjustment mode.
0.50kHz---0.85kHz (wideband)
0.50kHz ---0.65kHz (medium band)
0.25kHz--0.45kHz (narrowband)
The waveform shall be good.

LSD deviation
Reserved for the future.

CTCSS(67.0, 254.1Hz) deviation
Signal source: LPF:300Hz
Adjust CTCSS deviation in the computer adjustment mode.
0.50kHz---0.85kHz (wideband)
0.50kHz ---0.65kHz (medium band)
0.25kHz--0.45kHz (narrowband)
The waveform shall be good.

7.3.6 Battery warning level

Adjust the battery warning level in the computer adjustment mode.
Set the power supply voltage at 6.8V, and press start and then end.

7.3.7 Receive sensitivity

Adjust the sensitivity in the computer adjustment mode.
Make the sensitivity of all frequency points the highest
(provided the sensitivity is the highest, the better data)

7.3.8 Squelch adjustment

Adjust squelch in the computer adjustment mode.

Squelch 9 open

The signal level output is set to -118dBm (wideband) or -117dBm (narrowband)
Automatically records the corresponding squelch level.

Squelch 9 close

The signal level output is set to -120dBm(wideband) or -119dBm (narrowband)
Automatically records the corresponding squelch level.

Squelch 1 open

The signal level output is set to -124dBm (wideband) or -123dBm (narrowband)
Automatically records the corresponding squelch level

Squelch 1 close

The signal level output is set to -126dBm (wideband) or -125dBm (narrowband)
Automatically records the corresponding squelch level

7.3.9 RSSI adjustment

RSSI(-120dBm), RSSI(-70dBm)

The signal level output is set to -120dBm or -70dBm.
Automatically records the corresponding RSSI level.

Note: Voltage for the aforesaid tests: 7.5V +/-0.1V in room temperature

Chapter 8 500-1 BOM

500-1 PARTS LIST					No. TP-5001 Ver 01
No.	**Parts No.**	**Description**	**Component Name/Specification**	**Qty.**	**Ref. No.**
1					
2					
3	702CU5001001	**500-1 UNIT**			
4	701CU5001001	500-1 portable two-way radio		1	
5	605CU5000101	500-1 packaging BOM		1	
6	71200CT02001	CT-02 radio ring		1	
7	70700CP02001	CP-02 rapid charger		1	
8	709CA02US001	Power Supply(DC 12V 500mA)	CA-02	1	
9	70600CB05001	Lithium-ion Battery 1300mAH 7.4V	CB-05	1	
10	7100600113171	CU600-1ANTENNA	G-RAPK14149101-B0072（red）	1	136-174MHz
11					
12					
13					
14					
15	701CU5001001	**500-1 portable two-way radio**			
16					
17		**RESISTOR**			
18	1090400050001	0402 CHIP R 0Ω	RC0402JR-070R	8	C29 R4 R7 R115 R419 R513 R901 R911
19	1090422050001	0402 CHIP R 22Ω	RC0402JR-0722R	1	R218
20	1090410150001	0402 CHIP R 100Ω	RC0402JR-07100R	4	R19 R26 R210 R530
21	1090415150001	0402 CHIP R 150Ω	RC0402JR-07150R	1	R27
22	1090433150001	0402 CHIP R 330Ω	RC0402JR-07330R	2	R113 R181
23	1090447150001	0402 CHIP R 470Ω	RC0402JR-07470R	2	R5 R13
24	1090456150001	0402 CHIP R 560Ω	RC0402JR-07560R	2	R110 R211
25	1090482150001	0402 CHIP R 820Ω	RC0402JR-07820R	2	R429 R532
26	1090410250001	0402 CHIP R 1kΩ	RC0402JR-071K	15	R2 R9 R222 R328 R407 R409 R413 R420 R427 R433 R434 R932 R951 R952 R967
27	1090412250001	0402 CHIP R 1.2kΩ	RC0402JR-071K2	1	R10
28	1090415250001	0402 CHIP R 1.5kΩ	RC0402JR-071K5	4	R112 R331 R521 R525

29	1090418250001	0402 CHIP R 1.8kΩ	RC0402JR-071K8	4	R205 R329 R522 R908
30	1090422250001	0402 CHIP R 2.2kΩ	RC0402JR-072K2	7	R1 R226 R418 R500 R501 R536 R537
31	1090427250001	0402 CHIP R 2.7kΩ	RC0402JR-072K7	2	R422 R428
32	1090433250001	0402 CHIP R 3.3kΩ	RC0402JR-073K3	10	R100 R103 R105 R203 R204 R303 R424 R425 R510 R548
33	1090439250001	0402 CHIP R 3.9kΩ	RC0402JR-073K9	1	R201
34	1090447250001	0402 CHIP R 4.7kΩ	RC0402JR-074K7	5	R32 R106 R416 R607 R909
35	1090456250001	0402 CHIP R 5.6kΩ	RC0402JR-075K6	8	R101 R301 R302 R324 R326 R910 R914 R923
36	1090468250001	0402 CHIP R 6.8kΩ	RC0402JR-076K8	2	R523 R972
37	1090482250001	0402 CHIP R 8.2kΩ	RC0402JR-078K2	3	R339 R410 R426
38	1090410350001	0402 CHIP R 10kΩ	RC0402JR-0710K	16	R15 R33 R140 R214 R308 R327 R432 R435 R502 R503 R511 R516 R913 R920 R928 R964
39	1090412350001	0402 CHIP R 12kΩ	RC0402JR-0712K	1	R312
40	1090415350001	0402 CHIP R 15kΩ	RC0402JR-0715K	3	R526 R527 R955
41	1090418350001	0402 CHIP R 18kΩ	RC0402JR-0718K	3	R305 R529 R919
42	1090422350001	0402 CHIP R 22kΩ	RC0402JR-0722K	5	R321 R504 R925 R927 R958
43	1090433350001	0402 CHIP R 33kΩ	RC0402JR-0733K	8	R11 R508 R514 R515 R519 R520 R929 R963
44	1090439350001	0402 CHIP R 39kΩ	RC0402JR-0739K	4	R117 R313 R506 R915
45	1090447350001	0402 CHIP R 47kΩ	RC0402JR-0747K	8	R22 R141 R307 R320 R330 R917 R921 R968
46	1090451350001	0402 CHIP R 51kΩ	RC0402JR-0751K	1	R524
47	1090456350001	0402 CHIP R 56kΩ	RC0402JR-0756K	2	R216 R605
48	1090468350001	0402 CHIP R 68kΩ	RC0402JR-0768K	3	R118 R602 R603
49	1090482350001	0402 CHIP R 82kΩ	RC0402JR-0782K	2	R126 R918
50	1090491350001	0402 CHIP R 91kΩ	RC0402JR-0791K	2	R300 R543
51	1090410450001	0402 CHIP R 100kΩ	RC0402JR-07100K	12	R6 R21 R146 R221 R318 R323 R325 R341 R401 R408 R533 R541
52	1090412450001	0402 CHIP R 120kΩ	RC0402JR-07120K	2	R30 R340
53	1090415420001	0402 CHIP R 150kΩ	RC0402DR-07150K	6	R134 R135 R136 R137 R138 R961
54	1090418450001	0402 CHIP R 180kΩ	RC0402JR-07180K	4	R202 R306 R507 R706
55	1090422450001	0402 CHIP R 220kΩ	RC0402JR-07220K	6	R322 R411 R414 R415 R421 R423
56	1090427450001	0402 CHIP R 270kΩ	RC0402JR-07270K	4	R16 R18 R316 R317
57	1090433450001	0402 CHIP R 330kΩ	RC0402JR-07330K	3	R8 R208 R400

58	1090439450001	0402 CHIP R 390kΩ	RC0402JR-07390K	1	R315
59	1090447450001	0402 CHIP R 470kΩ	RC0402JR-07470K	6	R206 R309 R314 R333 R983 R984
60	1090468450001	0402 CHIP R 680kΩ	RC0402JR-07680K	2	R912 R922
61	1090475450001	0402 CHIP R 750kΩ	RC0402JR-07750K	2	R505 R528
62	1090410550001	0402 CHIP R 1MΩ	RC0402JR-071M0	6	R142 R219 R228 R230 R231 R304
63	1090418550001	0402 CHIP R 1.8MΩ	RC0402JR-071M8	1	R512
64					
65	1090600050001	0603 CHIP R 0Ω	RC0603JR-070R	3	L400 R311 R973
66	109064R750001	0603 CHIP R 4.7Ω	RC0603JR-074R7	2	R332 R959
67	1090610050001	0603 CHIP R 10Ω	RC0603JR-0710R	7	R3 R104 R111 R200 R334 R412 R417
68	1090622050001	0603 CHIP R 22Ω	RC0603JR-0722R	1	R127
69	1090647050001	0603 CHIP R 47Ω	RC0603JR-0747R	4	R121 R128 R212 R220
70	1090610150001	0603 CHIP R 100Ω	RC0603JR-07100R	4	R14 R31 R403 L21
71	1090622150001	0603 CHIP R 220Ω	RC0603JR-07220R	2	R215 R402
72	1090627150001	0603 CHIP R 270Ω	RC0603JR-07270R	3	R102 R139 R154
73	1090647150001	0603 CHIP R 470Ω	RC0603JR-07470R	2	R535 R969
74	1090656150001	0603 CHIP R 560Ω	RC0603JR-07560R	1	R20
75	1090618250001	0603 CHIP R 1.8kΩ	RC0603JR-071K8	1	R534
76	1090622250001	0603 CHIP R 2.2kΩ	RC0603JR-072K2	1	R144
77	1090627250001	0603 CHIP R 2.7kΩ	RC0603JR-072K7	1	R209
78	1090610350001	0603 CHIP R 10kΩ	RC0603JR-0710K	1	R35
79	1090647350001	0603 CHIP R 47kΩ	RC0603JR-0747K	2	R125 R338
80	1090668350001	0603 CHIP R 68kΩ	RC0603JR-0768K	1	R962
81	1090610450001	0603 CHIP R 100kΩ	RC0603JR-07100K	2	R601 R604
82	1090615420001	0603 CHIP R 150kΩ	RC0603DR-07150K	1	R133
83	1090618450001	0603 CHIP R 180kΩ	RC0603JR-07180K	1	R145
84	1090618550001	0603 CHIP R 1.8MΩ	RC0603JR-071M8	1	R517
85					
86	10910R3950001	1206 CHIP R 0.39Ω	RC1206JR-07R39	3	R130 R131 R132
87					
88	1101147300001	Adjustable resistance 47kΩ	EVM2NSX80BQ4 47K	1	VR501
89					
90					
91		**CAPACITOR**			
92	112043P500091	0402 CHIP C 0.5pF	GRM1555C1HR50BZ01D	2	C41 C49
93	1120431P50091	0402 CHIP C 1.5pF	GRM1555C1H1R5BZ01D	2	C226 C233
94	1120432P00091	0402 CHIP C 2pF	GRM1555C1H2R0BZ01D	2	C222 C234
95	1120433P00091	0402 CHIP C 3pF	GRM1555C1H3R0BZ01D	3	C229 C409 C951
96	1120434P00091	0402 CHIP C 4pF	GRM1555C1H4R0BZ01D	1	C654
97	1120435P00091	0402 CHIP C 5pF	GRM1555C1H5R0BZ01D	1	C215

98	1120436P00091	0402 CHIP C 6pF	GRM1555C1H6R0BZ01D	3	C105 C653 C657
99	1120437P00091	0402 CHIP C 7pF	GRM1555C1H7R0BZ01D	1	C44
100	1120438P00091	0402 CHIP C 8pF	GRM1555C1H8R0BZ01D	3	C100 C219 C655
101	1120439P00091	0402 CHIP C 9pF	GRM1555C1H9R0BZ01D	5	C38 C45 C227 C235 C656
102	1120431005091	0402 CHIP C 10pF	GRM1555C1H100JZ01D	8	C9 C14 C16 C54 C92 C412 C415 C516
103	1120432205091	0402 CHIP C 22pF	GRM1555C1H220JZ01D	1	C28
104	1220432405091	0402 CHIP C 24pF	GRM1555C1H240JZ01D	2	C111 C261
105	1120433305091	0402 CHIP C 33pF	GRM1555C1H330JZ01D	3	C53 C202 C212
106	1120434705091	0402 CHIP C 47pF	GRM1555C1H470JZ01D	2	C10 C108
107	1120435605091	0402 CHIP C 56pF	GRM1555C1H560JZ01D	2	C208 C338
108	1120436805091	0402 CHIP C 68pF	GRM1555C1H680JZ01D	1	C51
109	1120438205091	0402 CHIP C 82pF	GRM1555C1H820JZ01D	4	C252 C255 C259 C948
110	1120431015091	0402 CHIP C 100pF	GRM1555C1H101JZ01D	6	C2 C3 C6 C35 C134 C910
111	1120432216091	0402 CHIP C 220pF	GRM155R71H221KA01D	6	C205 C206 C529 C530 C531 C533
112	1120432716091	0402 CHIP C 270pF	GRM155R71H271KA01D	1	C708
113	1120433316091	0402 CHIP C 330pF	GRM155R71H331KA01D	2	C17 C26
114	1120434716091	0402 CHIP C 470pF	GRM155R71H471KA01D	58	C7 C24 C25 C27 C46 C48 C52 C55 C57 C101 C102 C103 C110 C120 C121 C125 C129 C132 C139 C141 C143 C157 C203 C218 C224 C228 C231 C232 C237 C238 C253 C257 C402 C403 C406 C410 C411 C414 C416 C427 C506 C517 C526 C528 C532 C601 C602 C604 C606 C906 C927 C928 C938 C950 C957 C958 C966 C982
115	1120436816091	0402 CHIP C 680pF	GRM155R71H681KA01D	2	C510 C513
116	1120431026091	0402 CHIP C 1000pF	GRM155R71H102KA01D	19	C31 C43 C60 C109 C114 C116 C123 C178 C314 C407 C521 C607 C609 C610 C706 C912 C916 C922 C932
117	1120433326091	0402 CHIP C 3300pF	GRM155R71H332KA01D	5	C500 C509 C512 C920 C929
118	1120433926091	0402 CHIP C 3900pF	GRM155R71H392KA01D	1	C502

119	1120434726091	0402 CHIP C 4700pF	GRM155R71H472KA01D	1	C204
120	1120435626091	0402 CHIP C 5600pF	GRM155R71H562KA01D	1	C308
121	1120436826091	0402 CHIP C 6800pF	GRM155R71H682KA01D	4	C309 C501 C921 C930
122	1120438226091	0402 CHIP C 8200pF	GRM155R71H822KA01D	1	C300
123	1120431036071	0402 CHIP C 0.01μF	GRM155R71E103KA01D	34	C19 C20 C37 C128 C201 C214 C217 C220 C221 C305 C306 C312 C316 C330 C334 C336 C418 C420 C421 C422 C425 C508 C515 C603 C924 C934 C935 C936 C937 C939 C961 C962 C963 C967
124	1120431836071	0402 CHIP C 0.018μF	GRM155R71E183KA01D	1	C301
125	1120432236071	0402 CHIP C0.022μF	GRM155R71E223KA12D	2	C518 C520
126	1120432736051	0402 CHIP C0.027μF	GRM155R71C273KA01D	1	C524
127	1120433336051	0402 CHIP C0.033μF	GRM155R71C333KA01D	5	C318 C320 C321 C423 C503
128	1120434736051	0402 CHIP C0.047μF	GRM155R71C473KA01D	3	C319 C511 C514
129	1120431046031	0402 CHIP C 0.1μF	GRM155R61A104KA01D	31	C1 C4 C30 C58 C104 C113 C131 C156 C207 C209 C210 C211 C213 C256 C302 C303 C322 C327 C400 C419 C522 C525 C902 C905 C911 C914 C915 C918 C925 C943 C960
130	1120431056031	0402 CHIP C 1μF	GRM155R61A105KE15D	8	C310 C413 C903 C904 C923 C926 C949 C959
131					
132	112063P750091	0603 CHIP C 0.75pF	GRM1885C1H0R75BZ01D	1	C40
133	1120631005091	0603 CHIP C 10pF	GRM1885C1H100JA01D	5	C135 C136 C142 C149 C154
134	1120631205091	0603 CHIP C 12pF	GRM1885C1H120JA01D	1	C151
135	1120631605091	0603 CHIP C 16pF	GRM1885C1H160JA01D	1	C147
136	1120631805091	0603 CHIP C 18pF	GRM1885C1H180JA01D	1	C153
137	1120632005091	0603 CHIP C 20pF	GRM1885C1H200JA01D	1	C118
138	1120632205091	0603 CHIP C 22pF	GRM1885C1H220JA01D	1	C150
139	1120632705091	0603 CHIP C 27pF	GRM1885C1H270JA01D	1	C144
140	1120633005091	0603 CHIP C 30pF	GRM1885C1H300JA01D	2	C140 C148
141	1120635605091	0603 CHIP C 56pF	GRM1885C1H560JA01D	1	C170
142	1120631015091	0603 CHIP C 100pF	GRM1885C1H101JA01D	1	C145
143	1120631515091	0603 CHIP C 150pF	GRM1885C1H151JA01D	1	C138
144	1120632215091	0603 CHIP C 220pF	GRM188R71H221KA01D	1	C119

145	1120634716091	0603 CHIP C 470pF	GRM188R71H471KA01D	1	L23
146	1120631026091	0603 CHIP C 1000pF	GRM188R71H102KA01D	2	C39 C42
147	1120631046091	0603 CHIP C 0.1μF	GRM188R71H104KA01D	3	C331 C333 C335
148	1120634746051	0603 CHIP C 0.47μF	GRM188R71C474KA01D	1	C931
149	1120631056051	0603 CHIP C 1μF	GRM188R61C105KA01D	11	C126 C313 C417 C424 C429 C430 C504 C505 C535 C710 C969
150					
151	1120731066031	0805 CHIP C 10μF	GRM21BR61A106K	16	C5 C23 C56 C127 C200 C304 C307 C332 C408 C519 C527 C913 C917 C940 C956 C970
152					
153	1120721047081	CHIP-TAN 0.1μF P	TC211P104M035A	3	C12 C18 C177
154	1120722257031	CHIP-TAN 2.2μF P	TEESVP1A225M8R	1	C15
155	1121021066051	CHIP-TAN 10μF A	TEESVA1C106K8R	1	C964
156	1121221077021	CHIP-TAN 100μF	TEESVB20J107M8R	1	C337
157					
158					
159					
160		**INDUCTOR**			
161	1170660100001	0603 FERRITE CHIP	BLM18AG601S	10	L1 L7 L10 L19 L103 L206 L402 L403 L500 L904
162	1170722100001	0805 FERRITE CHIP	BLM21PG221S	4	L104 L105 L501 L502
163	1170760000001	0805 FERRITE CHIP	BLM21PG600S	1	L107
164	1140612205001	SMALL FIXED INDUCTOR	MLG1608B22NJ	1	L212
165	1140612705001	SMALL FIXED INDUCTOR	MLG1608B27NJ	1	L119
166	1140613305001	SMALL FIXED INDUCTOR	MLG1608B33NJ	1	L125
167	1140614705001	SMALL FIXED INDUCTOR	MLG1608B47NJ	2	L121 L213
168	1140714705001	SMALL FIXED INDUCTOR	C2012C47NJ	1	L14
169	1140715605001	SMALL FIXED INDUCTOR	C2012C56NJ	4	L203 L204 L208 L209
170	1140611015001	SMALL FIXED INDUCTOR	MLG1608BR10J	3	L11 L100 L102
171	1140712215001	SMALL FIXED INDUCTOR	C2012CR22J	1	L109
172	1140612215001	SMALL FIXED INDUCTOR	MLG1608SR22J	4	L16 L17 L202 L207

173	1140713315001	SMALL FIXED INDUCTOR	C2012CR33J (or SDWL2012CR33JSTF)	1	L200
174	1140624716001	SMALL FIXED INDUCTOR	MLF1608AR47KT000	1	L4
175	1140715615001	SMALL FIXED INDUCTOR	C2012CR56J (or SDWL2012CR56JSTF)	1	L201
176	1140625616001	SMALL FIXED INDUCTOR	MLF1608DR56KT	1	L5
177	1140711025001	SMALL FIXED INDUCTOR	C2012C1R0J	1	L2
178	1140623326001	SMALL FIXED INDUCTOR	MLF1608A3R3KT	1	L902
179	1140626826001	SMALL FIXED INDUCTOR	MLF1608A6R8KT	1	L9
180					
181	1152R401R5031	AIR-CORE COIL 3T	ER0.4×1.5×3	2	L80 L83
182	1152R301R5051	AIR-CORE COIL 5T	ER0.3×1.5×5	2	L81 L114
183	1152R301R5061	AIR-CORE COIL 6T	ER0.3×1.5×6	2	L112 L113
184	1152R301R5071	AIR-CORE COIL 7T	ER0.3×1.5×7	1	L110
185	1152R351R6081	AIR-CORE COIL 8T	ER0.35×1.6×8	1	L106
186					
187		**DIODE**			
188	1030000137201	DIODE	1SS372	1	D500
189	1030000022201	DIODE	DAN222TL	1	D501
190	1030000013101	DIODE	HVU131TRF	1	D101
191	1030000211101	DIODE	MA2S111TX	2	D6 D7
192	1030000207701	DIODE	MA2S077	5	D1 D100 D102 D103 D200
193	1030019213201	LED(RED)	HT19-2132SURC-HHH	1	D400
194	1030019213202	LED(GREEN)	HT19-2132SYGC	2	D401 D402
195	1030000035001	VARIABLE CAPACITANCE DIODE	HVC350BTRF	4	D201 D202 D203 D206
196	1030000127801	VARIABLE CAPACITANCE DIODE	1SV278	1	D5
197	1030000132501	VARIABLE CAPACITANCE DIODE	1SV325	2	D2 D4
198					
199		**TRANSISTOR\FET**			
200	1040002136201	TRANSISTOR	2SA1362-GR	3	Q305 Q406A Q406B
201	1040002461701	TRANSISTOR	2SC4617(S)	4	Q8 Q300 Q501 Q502

202	1040002506601	TRANSISTOR	2SC5066-Y	7	Q1 Q2 Q6 Q100 Q102 Q201 Q503
203	1040000012301	TRANSISTOR	DTA123JE-TL	1	Q408
204	1040000014301	TRANSISTOR	DTA143ZETL	2	Q504 Q902
205	1040000014401	TRANSISTOR	DTA144EE-TL	2	Q109 Q303
206	1040000011401	TRANSISTOR	DTC114EE-TL	3	Q5 Q400 Q401
207	1040000014402	TRANSISTOR	DTC144EE-TL	14	Q106 Q108 Q200 Q304 Q306 Q403 Q405 Q903 Q907 Q908 Q910 Q911 Q912 Q914
208	1040000000301	TRANSISTOR	UMG3NTR	2	Q404 Q407
209	1050000230201	FET	ST2302 (or SI2302)	1	Q307
210	1050002182401	FET	2SK1824	4	Q302 Q500 Q901 Q913
211	1050000001201	FET	RD01MUS2-T113	1	Q105
212	1050000004601	FET	RFM04U6P	1	Q107
213	1050000250801	FET	2SK508-T1B(K52)	1	Q4
214	1050000331801	FET	3SK318	2	Q202 Q203
215					
216		**IC**			
217	1020620130201	LDO	XC6201P302MR	2	IC2 IC404
218	1020620150201	LDO	XC6201P502MR	1	IC902
219	1020000150301	PLL IC	MB15E03SL	1	IC1
220	1020000258001	FLASH IC	W25Q80BVSIG	1	IC401
221	1020000313601	FM IF DEMODULATOR	GT3136	1	IC200
222	1020000521202	MICROPROCESSOR	R5F212B8SNFP (or R5F212BCSNFP)	1	IC403
223	1020000210001	OPERATIONAL AMPLIFIER	NJM2100V	1	IC500
224	1020000290201	OPERATIONAL AMPLIFIER	NJM2902V	1	IC300
225	1020000290401	OPERATIONAL AMPLIFIER	NJM2904V	2	IC100 IC301
226	1020000750101	OPERATIONAL AMPLIFIER	TA75W01FU	1	IC901
227	1020000282201	AUDIO PROCESSOR IC	TDA2822D	1	IC302
228					
229					
230					
231		**OTHERS**			

232	1221009830402	CHIP CRYSTAL RESONATOR	[5032SMD(glass)]	1	X400
233	1221012800002	TCXO	3225VCTCXO-12.8MHz	1	X1
234	1080000388501	38.85MHz CRYSTAL FILTER	MCF-5×2(5KHz)	1	XF201
235	1060000001001	TACT SWITCH	SKRTLAE010	1	S404
236	1010500100102	500-1 PCB	500-1V02.PCB	1	
237	1080000045001	Ceramic Filter	ELFY450G (or LTWC450G)	1	CF201
238					
239	1080004502401	Discriminator	JTM450C24	1	CD200
240	1212602762201	MIC ELEMENT	PF0-6027P-62±2dB	1	MIC500
241	1102210300001	POWER SWITCH	RP08110SNAX-V02-0000	1	VR401
242	1061001010001	ROTARY SWITCH	RE1001BA-V01-0001	1	S401
243	1230525200801	SOCKET(φ2.5)	PJ-D2008K	1	J501
244	1230535302701	SOCKET(φ3.5)	PJ-D3027	1	J500
245	1010600200202	CU600 KEY PCB	CU600pttV03.PCB	1	
246	1211361601001	SPEAKER	φ36 16Ω 1W	1	
247					
248					
249		**STRUCTURE**			
250	2010CU500001A	CU500 radio front cabinet black		1	
251	2010CU600002A	CU600 PTT plastic key black PC+ABS 2950		1	
252	2010CU600003A	CU600 ear phone plastic plug black PC+ABS 2950		1	
253	2010CU600004A	CU600 ear phone cabinet PC+ABS 2950		1	
254	2010CU600005A	CU600 radio top cover black PC+ABS 2950		1	
255	2010CU600006A	CU600 volume knob black ABS 700		1	
256	2010CU600007A	CU600 encoder knob black ABS 700		1	
257	2010CU600008A	CU600 ear phone cover black TPU		1	
258	2010CU600009A	CU600 battery locker black PC+ABS 2950		1	
259	2010CU600010A	CU600 light-guider clear PC		1	
260	2020CU600001A	CU600 PTT silicon key block 60A 50% high spring silicon		1	
261	2020CU500001A	CU500 cabinet waterproof ring orange 40A 50% high spring silicon		1	
262	2020CU600004A	CU600 mic waterproof washer 60A 50% high spring silicon		1	
263	2020CU500002A	2 PIN power socket washer 60A 50% high spring silicon		1	
264	2020CU500003A	Φ7X1.5 waterproof ring high spring silicon		1	
265	2020CU500004A	Φ5X1.5 waterproof ring high spring silicon		1	
266	2030CU500001A	CU500 AL cabinet polishing ADC 12		1	
267	2030CU600002A	CU600 battery metal locker polishing SUS304		1	
268	2030CU600003A	SMA RF socket		1	

269	2030CU600004A	spring Φ2.3X10.5 Φ0.25 spring steel Ni-plate		2	
270	2040CU500001A	2 PIN power socket		1	J502
271	2040CU600002A	CU600 PTT metal dome plate		1	
272	306003301001A	Φ33mm air filter nylon weave		1	
273	2040CU600004A	7mm mic air filter Φ7.0X4.5X0.2		1	
274	304060250001A	encoder screw M7X0.75 special shape brass		1	
275	304070250001A	volume screw M6X0.75 special shape brass		1	
276	301200407001A	machine screw M2.0X4.0 PB(+) Ni-plate nylok blue patch		14	
277	301200807001A	machine screw M2.0X8.0 six lobe pan Ni-plate nylok blue patch		2	
278	301250607001A	machine screw M2.5X6.0 PB(+) black Ni-plate		2	
279	306006005001A	mic washer Φ6.0X0.5mm soft PVC		1	
280					
281					

Chapter 9 CP-02 Charger

9.1 General Description:
Function: intelligent rapid charging
Applicable battery: CB-05(1300mAh, 7.4V Li-ion battery)
Battery type identification: External
Input power supply: DC12±0.5V, 500mA, ripples <500mV

9.2 Operating environment
Temperature: -5℃±2℃-- +55℃±2℃
Humidity: 95%@40℃

9.3 Safety requirements
In accordance with safety requirements of CCC, CE and UL, etc.

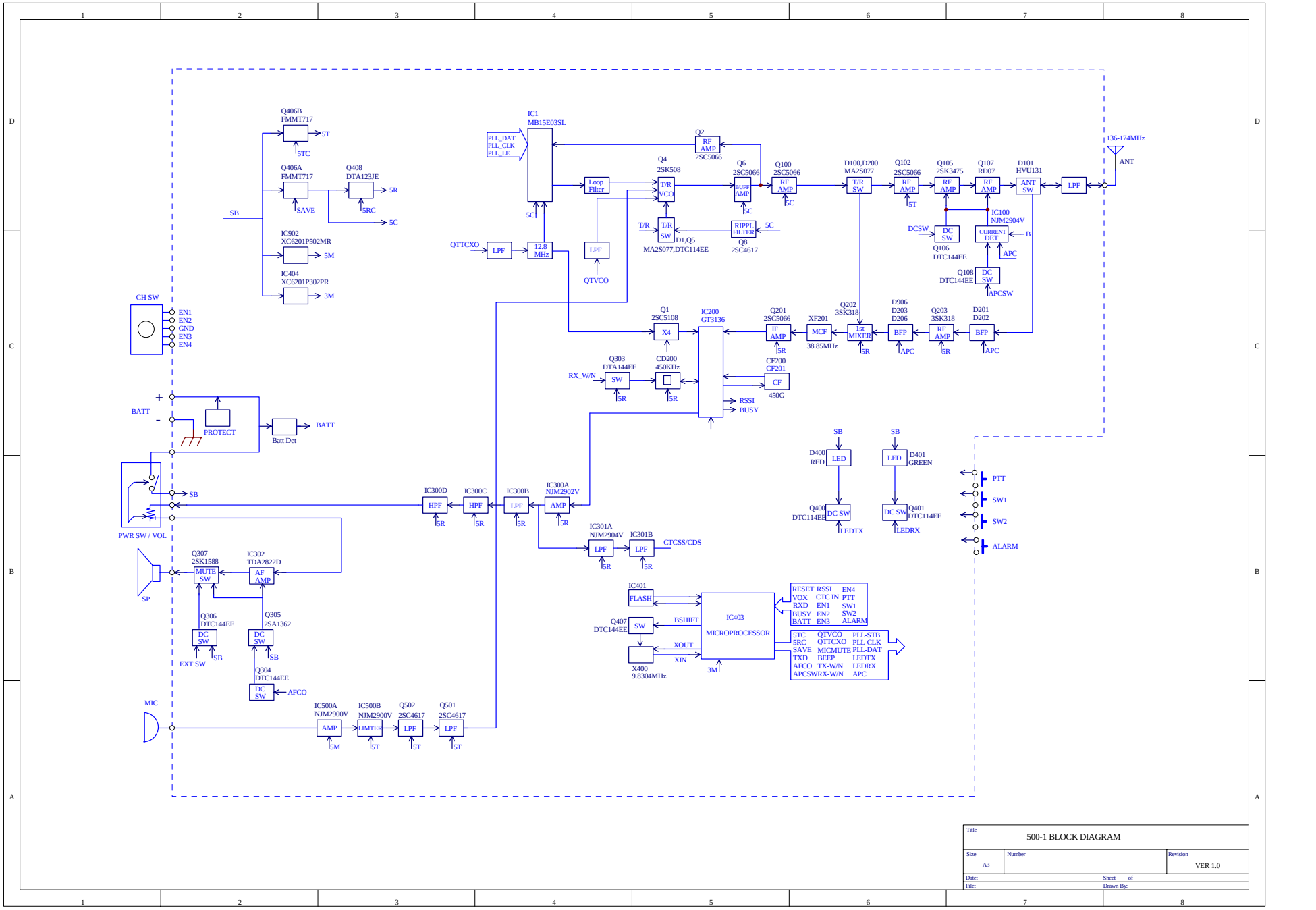
9.4 Technical Specifications
Current: 600±50mA
Max. charging time : 300 minutes
Max. Battery temperature: +55℃

Specified voltage of charged battery:
Nickel-hydrogen battery: recovery the battery when the voltage < 3.7V; pre-charging when the voltage < 6.4±0.1V, when the battery voltage reaches 6.4±0.1V, the charging turns to rapid charging. When the battery voltage reaches 8.35V, the battery will be deemed as full and the charging will be stopped.
Li-ion battery: pre-charging when the voltage < 6.4±0.1V, when the battery voltage reaches 6.4±0.1V, the charging turns to rapid charging.
Charging process checking: battery voltage, battery temperature rise, -△V, charging time, max. Battery temperature

9.5 LED Status Table:

LED Status	RED	GREEN
Standby/battery not installed	0.2s ON 4.5s OFF	/
charging	ON	/
Charging completed	/	ON
Error	0.2s ON 0.2s OFF	/

Chapter 10 Block and Schematic


Q406B
FMMT717
5T
5TC
Q406A
FMMT717
SAVE
Q408
DTA123JE
5R
5RC
5C
SB
IC902
XC6201P502MR
5M
IC404
XC6201P302PR
3M
IC1
MB15E03SL
PLL_DAT
PLL_CLK
PLL_LE
Q2
RF AMP
2SC5066
Q4
2SK508
T/R VCO
Q6
2SC5066
BUFF AMP
Q100
2SC5066
RF AMP
5C
Loop Filter
T/R SW
D1,Q5
MA2S077,DTC114EE
RIPPL FILTER
Q8
2SC4617
QTTCXO
LPF
12.8 MHz
QTVCO
D100,D200
MA2S077
T/R SW
Q102
2SC5066
RF AMP
5T
Q105
2SK3475
RF AMP
Q107
RD07
RF AMP
D101
HVU131
ANT SW
LPF
136-174MHz
ANT
IC100
NJM2904V
CURRENT DET
B
APC
DCSW
DC SW
Q106
DTC144EE
Q108
DTC144EE
DC SW
APCSW
CH SW
EN1
EN2
GND
EN3
EN4
BATT
PROTECT
Batt Det
Q1
2SC5108
X4
IC200
GT3136
Q201
2SC5066
IF AMP
5R
XF201
MCF
38.85MHz
Q202
3SK318
1st MIXER
D906
D203
D206
BFP
APC
Q203
3SK318
RF AMP
D201
D202
BFP
APC
Q303
DTA144EE
SW
RX_W/N
CD200
450KHz
CF200
CF201
CF
450G
RSSI
BUSY
PWR SW / VOL
IC300D
HPF
IC300C
HPF
IC300B
LPF
IC300A
NJM2902V
AMP
IC301A
NJM2904V
IC301B
LPF
CTCSS/CDS
SB
D400
RED
LED
D401
GREEN
LED
Q400
DTC114EE
DC SW
LEDTX
Q401
DTC114EE
DC SW
LEDRX
PTT
SW1
SW2
ALARM
SP
Q307
2SK1588
MUTE SW
IC302
TDA2822D
AF AMP
Q306
DTC144EE
DC SW
EXT SW
Q305
2SA1362
DC SW
Q304
DTC144EE
DC SW
AFCO
IC401
FLASH
Q407
DTC144EE
SW
BSHIFT
XOUT
XIN
X400
9.8304MHz
IC403
MICROPROCESSOR
3M
RESET RSSI EN4
VOX CTC IN PTT
RXD EN1 SW1
BUSY EN2 SW2
BATT EN3 ALARM
5TC QTVCO PLL-STB
5RC QTTCXO PLL-CLK
SAVE MICMUTE PLL-DAT
TXD BEEP LEDTX
AFCO TX-W/N LEDRX
APCSW RX-W/N APC
MIC
IC500A
NJM2900V
AMP
5M
IC500B
NJM2900V
LIMTER
5T
Q502
2SC4617
LPF
5T
Q501
2SC4617
LPF
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Title
500-1 BLOCK DIAGRAM
Size
A3
Number
Revision
VER 1.0
Date:
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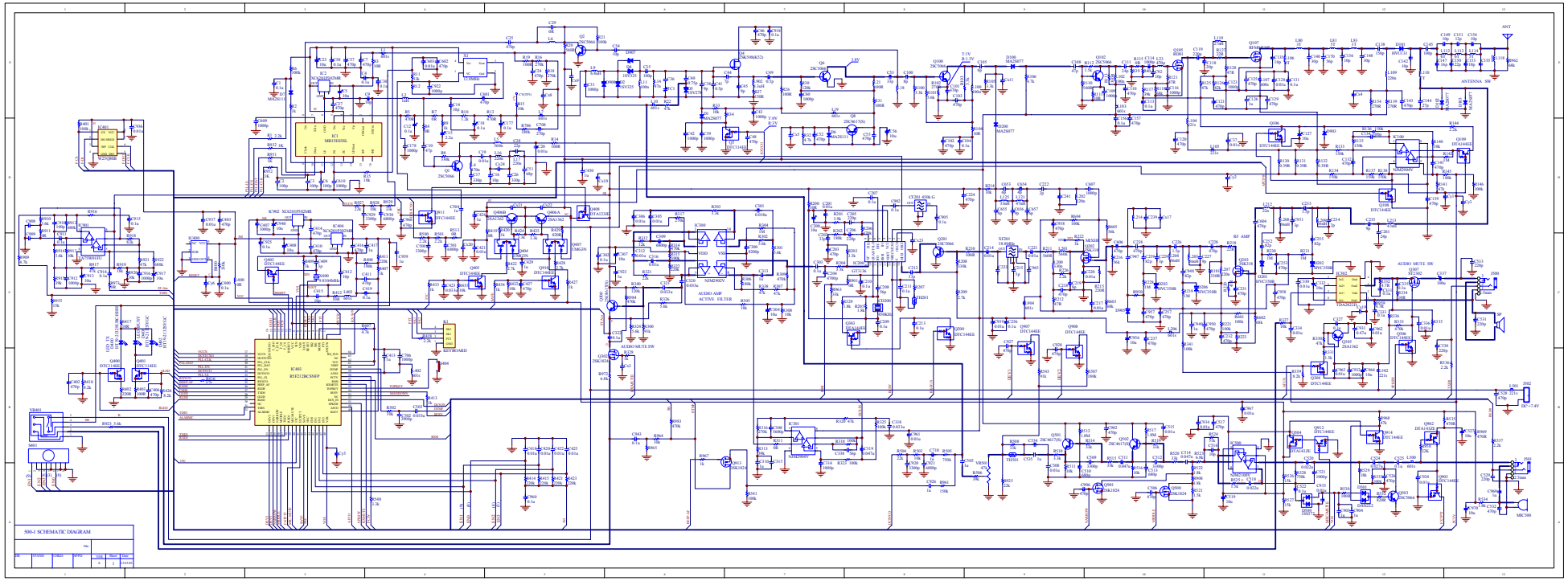
File:
Drawn By:


500-1 SCHEMATIC DIAGRAM

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）
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 Compensated Crystal Oscillators）
TX （transmitter）
UL (un-lock)
VCO （voltage control oscillator）

Appendix 2: Main Technical Indexes

Technical Parameters	500-1
7.1 General Specification	
Frequency	(136 ~ 174) MHz
Number of channels	16 个
Channel separation	W:25 kHz /M:20KHz/N:12.5kHz
Working temperature	-30℃~ +60℃
Antenna Impedance	50Ω
Frequency Stability	±2.5ppm
Battery (Standard Configuration)	Lithium-ion Battery: 1300mAh 7.4V
Dimension (W×L×H)	97.5 mm ×53.5 mm×31 mm
Weight	230g (With battery and antenna)
7.2 Receiving part	
Sensitivity (12dB SINAD)	0.25μV(W) / 0.28μV(N)
Adjacent channel selectivity	W:≥ 70dB / N:≥60dB
Intermodulation immunity	≥70dB(±50, 100kHz)
Audio Output Power	1W (16Ω)
Audio distortion	≤5%
7.3 Transmitting part	
Transmitting Power	5W
Modulation Mode	F3E
Clutter and Harmonics	-36dBm ＜ 1GHz, -30dBm ＞1GHz
Residual FM （300~3000Hz）	W:≤-45 dB / N:≤-40dB
Audio distortion （300~3000Hz）	≤5%
Adjacent power	W:≥70dB / N:≥60dB
Max Frequency Offset	W:≤±5kHz / M:≤±4kHz /N:≤±2.5kHz

Appendix 3: Troubleshooting

No.	Problems	Solutions
1	The radio cannot be switched on or no display after switched on.	● Battery pack may not be installed properly. Remove the battery pack and install it again. ● Battery power may be insufficient. Recharge or replace the battery pack.
2	The battery power consume quickly after charging.	● The battery life is finished; please replace it with a new battery pack.
3	Cannot talk to or hear other members in your group.	● The frequency or CTCSS/DCS signaling are not identical and please reprogram it. ● Make sure the setting of the selective signaling 5-Tone in he RX Squelch Mode is proper. ● Beyond the radio efficient communication range.
4	Other voices from non-group members are heard on the channel.	● Change the CTCSS/DCS tone, and make sure change the tone on all radios in your group. ● Please set 5-Tone selective signaling on the channel.
5	Communication range is too small.	● Make sure the antenna is well connected. ● Make sure the antenna is the originally supplied one. ● Check if the battery power is in the normal state. ● Ask your local dealer to adjust the squelch level.
6	Unable to transmit.	● Make sure the PTT button has been pressed completely. ● Battery power may be insufficient. Recharge or replace the battery pack. ● Transmitting frequency has not been set on the channel and the radio has been remote killed.
7	Noise is too loud.	● Battery power may be insufficient. Recharge or replace the battery pack. ● Beyond the efficient communication range.