

# Forward

## **Manual Scope**

This manual is intended for use by experienced technicians familiar with similar types of communication equipment. It contains all service information required for the equipment and is current as of the publication date.

## **Product Safety and RF Exposure for Portable Two-Way Radios Compliance with RF Energy Exposure Standards**

**NOTICE:** This radio is intended for use in occupational/controlled applications where users have been made aware of the potential for exposure and can exercise control over their exposure. This radio device is **NOT** authorized for general population, consumer or similar use.

BEFORE USING THIS RADIO, READ THE TRAINING MATERIAL BELOW WHICH CONTAINS IMPORTANT OPERATING INSTRUCTIONS FOR SAFE USAGE AND RF ENERGY AWARENESS AND CONTROL INFORMATION FOR COMPLIANCE WITH RF ENERGY EXPOSURE LIMITS IN APPLICABLE NATIONAL AND INTERNATIONAL STANDARDS.

### **Federal Communication Commission (FCC) Regulations**

The FCC has established limits for safe exposure to radio frequency (RF) emissions from portable two-way radios. The FCC requires manufacturers to demonstrate compliance with RF exposure limits before portable two-way radios can be marketed in the U.S. When two-way radios are approved for occupational/controlled environment exposure limits, the FCC requires users to be fully aware of, and exercise control over, their exposure. Awareness and control of RF exposure can be accomplished by the use of labels, or by education and training through appropriate means, such as information and instructions in user manuals or safety booklets. Your **HYT** two-way radio has an RF exposure information label in the battery compartment. The training material below includes useful information about RF exposure and helpful instructions on how to control your RF exposure.

Your **HYT** two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to RF electromagnetic energy. In terms of measuring RF energy for compliance with FCC exposure guidelines, your radio radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode.

### **Compliance and Control Guidelines and Operating Instructions for Portable Two-Way Radios**

To control your exposure and ensure compliance with the occupational/controlled environment exposure limits, always adhere to the following procedures:

\* Transmit no more than 50% of the time. To transmit (talk), push the Push-To-Talk (PTT) button. To receive calls, release the PTT button. Transmitting 50% of the time or less is

important since the radio generates measurable RF energy exposure only when transmitting (in terms of measuring standards compliance).

\* Hold the radio in a vertical position in front of the face with the microphone positioned at least one inch (2.5 cm) away from the lips. Keeping the radio at the proper distance is important since RF exposure decreases with increasing distance from the antenna.

\* For body-worn operation, always use the radio with the HYT Belt-Clip. HYT-approved accessories, antennas, and device combinations have been tested and comply with the occupational/controlled environment RF exposure limits. The use of non - HYT approved accessories may result in exposure levels that may exceed the RF exposure limits for the occupational/controlled environment.

\* If you are not using a body-worn accessory and are not using the radio held in front of the face, ensure the radio is kept a minimum of 0.7 cm from the body when transmitting. Keeping the radio at a proper distance is important since RF exposure decreases with increasing distance from the antenna.

### **FCC license Information**

Your HYT radio operates on communications frequencies which are subject to FCC (Federal Communications Commission) Rules & Regulations. FCC Rules require that all operators using Private Land Mobile radio frequencies obtain a radio license before operating their equipment. Application for license must be made on FCC form 601, and schedules D, E, and G.

**FAX:** Forms can be obtained by fax from the FCC Fax-On-Demand system. Call 1-202-418-0177 from your fax machine and request document number 000600 for the form, schedules, and instructions.

**MAIL:** Forms can be ordered by telephone, and will be sent to you by first class mail. Call the FCC Forms Hotline at 1-800-418-FORM (1-800-418-3676).

**INTERNET:** Form 601 and instructions can be downloaded from the FCC Forms website at: <http://www.fcc.gov/Forms/Form601/601.html>

Before filling out your Form 601 application Technical Data section, you must decide which frequency (or frequencies) you will operate on. Refer to the frequency chart on page 16.

**Questions?** Call the FCC for license application questions at 1-888-CALL-FCC (1-888-225-5322).

## **Notices to The User**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

One or more of the following statements may be applicable:

### **FCC WARNING**

This equipment generates or uses radio frequency energy. Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. The user could lose the authority to operate this equipment if an unauthorized change or modification is made.

### **INFORMATION TO THE DIGITAL DEVICE USER REQUIRED BY THE FCC**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can generate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer for technical assistance.

### **SAFETY INFORMATION:**

Your HYT portable two-way radio has been designed using a low power transmitter.

When the **PTT** switch is pressed, the radio generates radio frequency (RF) electromagnetic energy (EME). This radio is designed to comply with the FCC Report and Order

FCC 96-326 (August, 1996).

### **User Safety Information**

The following precautions are recommended for personnel safety:

- DO NOT transmit until all RF connectors are verified secure and any open connectors are properly terminated.
- SHUT OFF and do not operate this equipment near electrical blasting caps or in an explosive atmosphere.
- When in vehicles with an airbag, do not place a portable radio in the area over an airbag or in the airbag deployment area.
- Do not expose the radio to direct sunlight for a long time nor place it close to a heating source.
- Do not use any portable radio with a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn may result.
- This equipment should be serviced by a qualified technician only.

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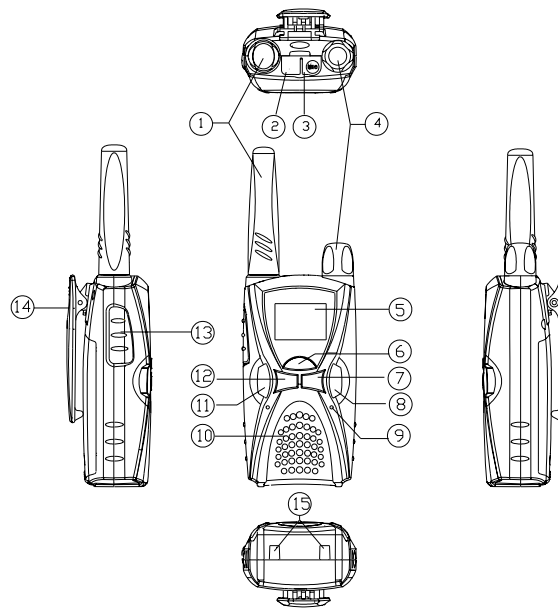
TC1688P PC Board View

TC1688P Block Diagram

TC1688P Schematic Diagram

Specifications

## Brief Introduction



1. Antenna
2. Programming Jack
3. Speaker/Mic Jack
4. Power/Volume Knob

Rotate the Power/Volume Knob clockwise until a “click” is heard to turn the radio on, fully counter clockwise to turn the radio off. When the radio is on, turn the knob to adjust volume.

5. LCD Display

Indicate operation status of the radio. (Refer to “LCD Display” for details)

6. MENU key

In standby mode, briefly press MENU key to display current channel information and hold down this key to enter menu mode. During setting, press MENU key to save and switch to the next setting.

7. “-” key


Used to select the channel/interference eliminator code downwards or change menu settings.

8. MON key

In standby mode, briefly press MON key to begin channel scanning; hold down MON key to begin monitoring.

9. MIC

10. Speaker

11. “”key (CALL key)

If Call feature is enabled, briefly press the CALL key to transmit a call signal; During setting, press CALL key to save and return to the first setting or exit; Hold down the CALL key to lock/unlock keypad.

12. “+” key

Used to select the channel/interference eliminator code upwards or change menu settings.

#### 13. PTT button

Press and hold PTT, radio operates in transmit mode. Release PTT, radio returns to receive mode.

#### 14. Belt Clip

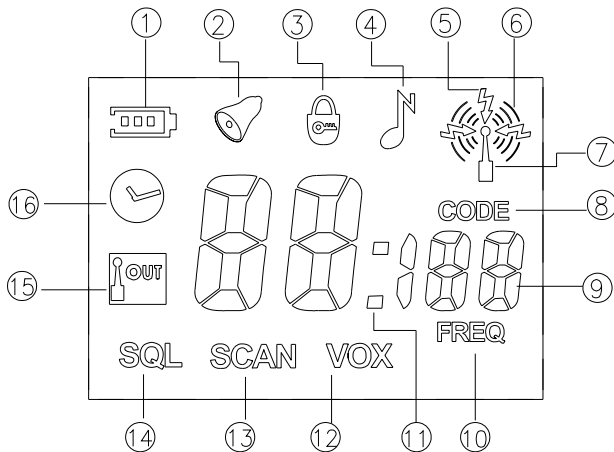
Used to clip radio on your belt.

#### 15. Charging Connectors

Connect the charging connectors with that on the charger to begin charging.



## LCD Display



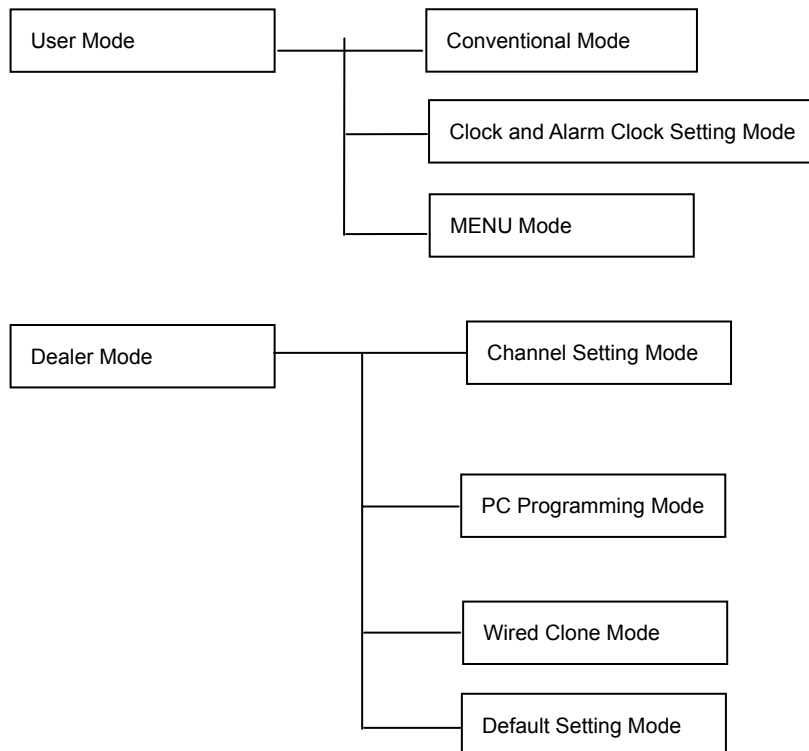
1. Battery Meter, used to indicate the battery power.
2. Appears when setting the Alarm Clock or the Alarm Clock is on; Flashes when the Alarm Clock rings.
3. Appears when keypad lock is on.
4. Appears when setting the call tone.
5. Appears when receiving signals from the selected channel.
6. Appears when transmitting.
7. Appears when transmitting/receiving is enabled.
8. Indicate that the number on the LCD displays interference eliminator code and channel number. The number under it indicates current interference eliminator code.
9. Two large "8", a small "1" and two small "8" display the current channel number, interference eliminator code, frequency number, time or the status of current setting.
10. Indicate that the number on the LCD displays channel number and frequency number. The number above the icon indicates the frequency number of current channel.
11. Appears between hour and minute when LCD displays clock.
12. Appears when setting VOX or VOX feature is enabled.
13. Appears when scanning channel or setting channel scan add/delete.
14. Appears when setting squelch level.
15. Communication Range Alarm, flashes when your companion is out of range; appears when setting communication range alarm or communication range alarm is enabled.
16. Appears when setting the clock.

## Software Description

### Radio Feature Description

	Feature	Description
1	56 UHF frequencies available	Frequency Range: 461 – 470 MHz
2	Selectable number of available channels 1-8	User can select 1-8 frequencies from 56 available frequencies
3	Selectable 121 Interference Eliminator Codes	Include 38 CTCSS and 83 CDCSS
4	LCD Display	Display operation status and setting modes
5	LCD Backlight	
6	Keypad Lock	Pressing any key is invalid except PTT, briefly pressing MENU key and holding down CALL key.
7	VOX Feature	Only available when connected with external audio accessory.
8	Five VOX Sensitivity Levels Available	The lower the level, the higher the sensitivity.
9	Battery Power Indicator	
10	Low Battery Alert	The radio will sound alert when the battery voltage is lower than preset threshold value.
11	Channel Scan	The radio will only scan the selected 1-8 channels. If 4 channels are selected, the radio will scan these 4 channels only.
12	Battery Save (Sleep Mode)	The radio will enable battery save feature if no button is pressed and no operation takes place within 25 seconds. The radio will switch between 200ms standby mode and 600ms sleep mode.
13	Clock Display and Alarm Clock	
14	Five CALL TONES available	The radio will sound call tone when receiving a valid call. User can disable the call tone.
15	PC Programmable	In this mode, MCU is connected with PC via UART port.
16	Enable/Disable Certain Features (through PC programming)	
17	Wired Clone	MCU transfer the data in one radio to another via UART port.
18	Monitor	
19	Time Out Timer	TOT time: 1 minute or 5 minutes. This feature can be disabled.
20	Auto Squelch	4 squelch levels available. Higher squelch level makes it harder for the radio to receive weak signals
21	Communication Range Alarm	The radio will sound alert when you are almost out of communication range.

## Radio Modes



## Functions and Operations

### 1. Conventional Mode

Turn the power on. If no key is pressed, the radio will enter conventional mode. In this mode, you can operate as following:

- Receive or press PTT to transmit;
- Display clock (It's set by your dealer) or channel number;
- Low battery detect and battery power indication;
- VOX feature (Only valid when connecting with external audio accessory) (It's set by your dealer);
- Communication Range Alarm (It's set by your dealer);
- Alarm Clock (It's set by your dealer);
- Briefly press CALL key to transmit a CALL (It's set by your dealer);
- Press and hold CALL key to enable/disable keypad lock (It's set by your dealer);
- Briefly press MENU key to display current channel information (frequency number and interference eliminator code); Press and hold MENU key to enter setting menu;
- Press UP/DOWN key to increase/decrease channel number;
- Briefly press MONI key to enter channel scan mode; Press and hold MONI key to begin monitor;
- Battery Save feature (It's set by your dealer).

## 2. Clock and Alarm Clock Setting Mode

Turn the power on while holding down CALL key and PTT key simultaneously. After 2 seconds, the radio enters clock and alarm clock setting mode.

Press UP/DOWN to select upwards/downwards. Press MENU key to save and go to next setting item. Press CALL key to save and go to the first setting item. If the current item is the first setting item, press CALL key to save and exit.


In this mode, you can operate as following:

- Select to display clock or channel number in conventional mode;
- Set hour of the clock;
- Set minute of the clock;
- Alarm clock enable/disable setting;
- Set hour of the alarm clock;
- Set minute of the alarm clock.

## 3. Menu Mode

In conventional mode, press and hold down MENU key to enter menu mode.

Press UP/DOWN to select upwards/downwards. Press MENU key to save and go to next setting item. Press CALL key to save and go to the first setting item. If the current item is the first setting item, press CALL key to save and exit.

In menu mode, LCD displays “” icon indicating that you can transmit/receive. LCD displays channel information when pressing PTT to transmit. And the display returns to the setting mode before transmission when releasing PTT or time out timer is due.

In this mode, you can operate as following:

- VOX feature enable/disable and five sensitivity levels setting (It's set by your dealer);
- Call tone setting (five call tones) (It's set by your dealer);
- Button beep enable/disable (It's set by your dealer);
- Squelch level setting;
- Communication rang alarm feature enable/disable (It's set by your dealer);
- Battery type setting.

## 4. Channel Setting Mode

Turn the power on while holding down MON and PTT key simultaneously. After 2 seconds, the radio enters channel setting mode.

Press UP/DOWN to select upwards/downwards. Press MENU key to save and go to next setting item. Press CALL key to save and go to the first setting item. If the current item is

the first setting item, press CALL key to save and exit.

In this mode, you can operate as following:

- Select channel number from 1 to 8;
- Select frequency number from 1 to 56;
- Select interference eliminator code from 0 to 121;
- Set the number of available channels from 1 to 8;
- Scan Add/Delete.

#### 5. PC Programming Mode

Insert programming cable into the programming jack and then turn the power on, the radio enters PC programming mode.

#### 6. Wired Clone Mode

Connect the radio with wired clone cable and then turn the power on while holding down CALL and MON key simultaneously, the radio enters wired clone mode after 2 seconds. And then press MON key to begin data transmission.

#### 7. Default Setting Mode (It's set by your dealer)

Turn the power on while holding down "+" and "-" key simultaneously to restore the factory settings after 2 seconds.

## Circuit Description

### 1. Frequency Configuration

The receiver utilizes double conversion. The first IF is 21.7 MHz and the second is 450 KHz. The first local oscillator signal is supplied from PLL circuit. PLL circuit in the transmitter generates the necessary frequencies. Figure 1 shows the frequency configuration.

Frequency range: TC1688P: 460—470MHz

(Please refer to “appendix1: TC1688P frequency chart” for more details.)

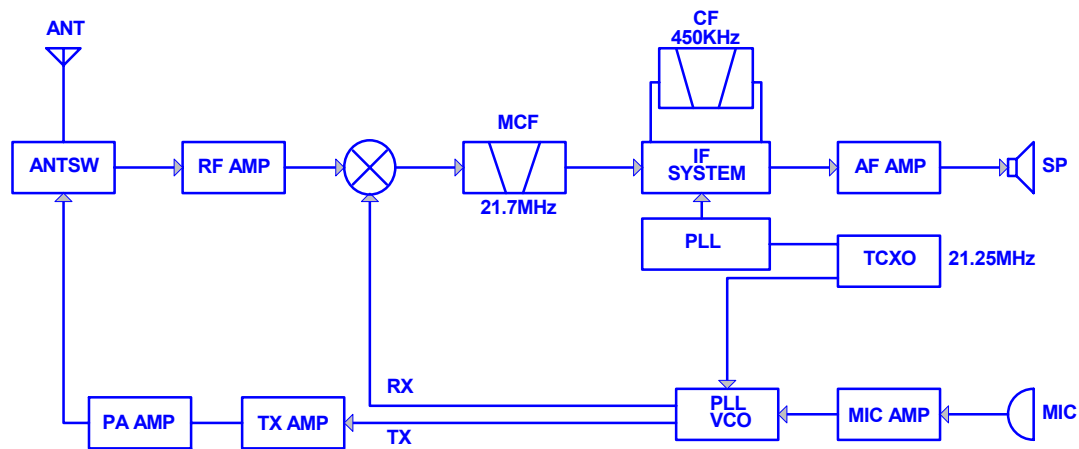


Fig1. Frequency Configuration

### 2. Receiver

The receiver utilizes double conversion super heterodyne.

#### 1) Front-end RF Amplifier

The signal from the antenna passes through a transmit/receive switch circuit before entering the SAW filter F1 to eliminate unwanted signals, and then is amplified at RF amplifier Q11. The resulting amplified signal then goes to the first mixer.

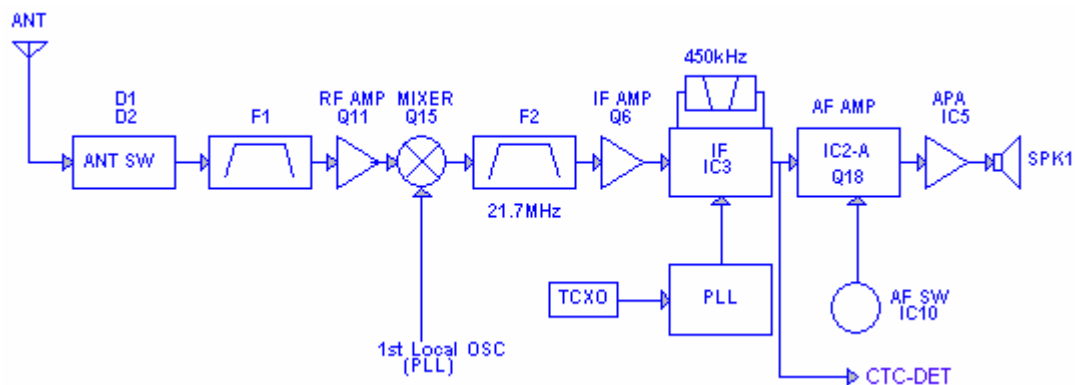


Fig.2 Receiver Section Configuration

## 2) First Mixer

The signal from RF amplifier is mixed with the first local oscillator signal from PLL frequency synthesizer in the first mixer Q15 to generate a 21.7 MHz first IF signal. The first IF signal is then fed through the 21.7MHz crystal filter F2 to remove spurious signals from adjacent channel.

## 3) IF Amplifier

The first IF signal is amplified at Q6 and then enter the IF process chip IC3. The signal is mixed with the second local oscillator signal to generate a 450KHz second IF signal. The second IF signal is then fed to a 450 KHz ceramic filter F3 to eliminate unwanted signals before it is amplified and detected at IC3.

## 4) AF Amplifier

The AF signal obtained from IC3 is filtered in IC2-A, and then amplified in Q18. Then resulting AF signal passes through an AF squelch switch IC10 and a volume control circuit and then is amplified in an AF power amplifier IC5 to drive the speaker.

## 5) Squelch

Part of the AF signal from IC3 enters IC3 again and the noise component is amplified by a filter and an amplifier, and then enters Q21 to amplify the noise further. After rectified and filtered by D7 and C94, the DC signals goes to the analog port IC8 of the microprocessor. IC8 determines whether to output sounds from the speaker by detecting whether the input voltage is higher or lower than the preset value.

To output sounds from the speaker, IC8 sends a mute and an AF control signal APA-EN to IC5. (See figure 3)

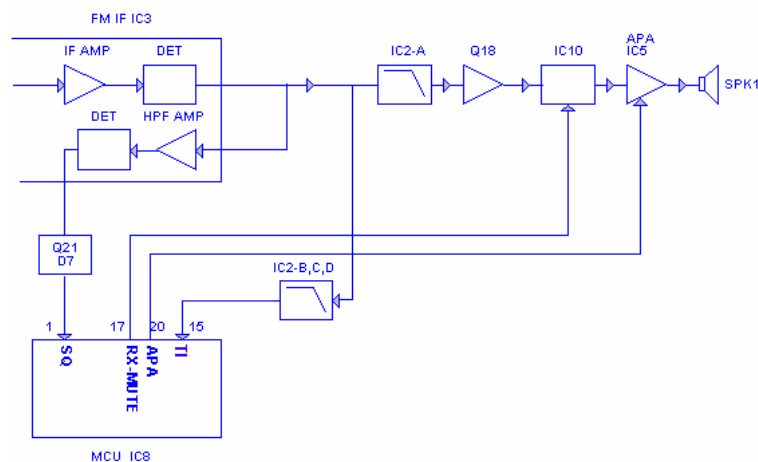


Fig. 3 AF amplifier and squelch circuit

## 6) Receiving CTCSS/CDCSS signal

300Hz-and-higher audio frequency of the signal output from IC3 is filtered by low-pass filter IC2-B, C, D. The resulting signal TI enters the microprocessor IC8. IC8 determines whether the CTCSS/CDCSS matches the pre-set value, and controls the RX-MUTE, APA and the speaker output sounds according to the squelch result.

## 3. PLL Synthesizer

PLL circuit generates the first local oscillator signal for reception and the RF signal for transmission.

### 1) PLL circuit

The step frequency of PLL circuit is 5 KHz or 6.25 KHz. A 21.25MHz reference oscillator signal is divided at IC1 by a mixed counter to create a 5 KHz or 6.25 KHz reference frequency. Output signal from VCO enters the 16 pin of IC1 and is divided at IC1 by a dual-module programmable counter. The divided signal is compared in the phase comparator IC1 with a 5 KHz or 6.25 KHz reference signal. The signal from phase comparator is filtered through a low-pass filter and generates a VCO voltage adding to varicap diodes D10 to control the oscillator frequency. (See Figure 4)

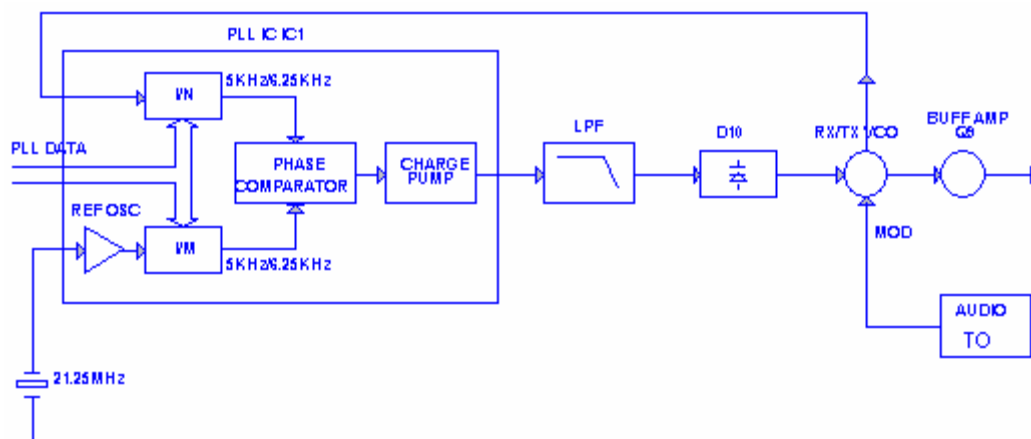


Fig.4 PLL Circuit

### 2) VCO

Q4 composes Colpitts oscillator circuit together with the outside circuit. The oscillator frequency is controlled by PLL. In receive mode, the oscillator frequency is the first local oscillator frequency for reception. In transmit mode, the oscillator frequency is the RF frequency for transmission.



#### 4. Transmitter

##### 1) Transmitting AF

The AF signal from the microphone passes through a pre-emphasis circuit, is amplified and filtered by a low-pass filter at IC6-A, B, Q5 and Q7. The resulting signal enters VCO for direct modulation. (See figure 5)

##### 2) CTCSS/CDCSS Encoder

The necessary signal for 38 CTCSS and 83 CDCSS encoder is generated by TO pin of IC8 and FM-modulated to the PLL reference signal. Since the reference OSC does not modulate the loop characteristic frequency or higher, modulation is performed at the VCO side by adjusting the balance. (See fig.5)

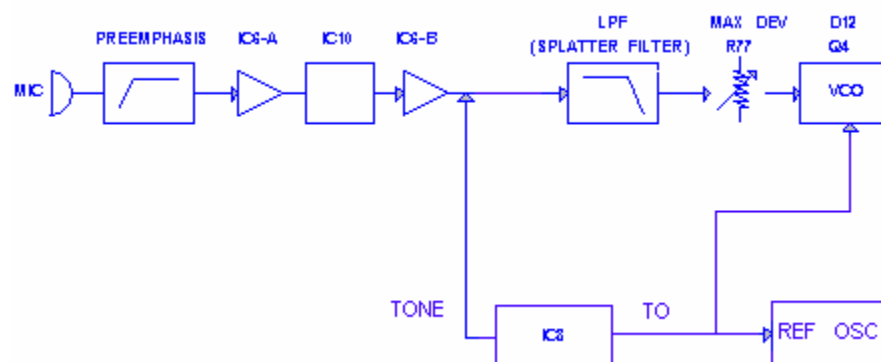


Fig 5. Transmit AF and CTCSS/CDCSS

##### 3) RF Amplifier

The RF signal obtained from VCO buffer amplifier is amplified by Q9. The amplified signal is amplified by power amplifier Q3, Q8 and Q10 to generate RF power. (See Fig.6)

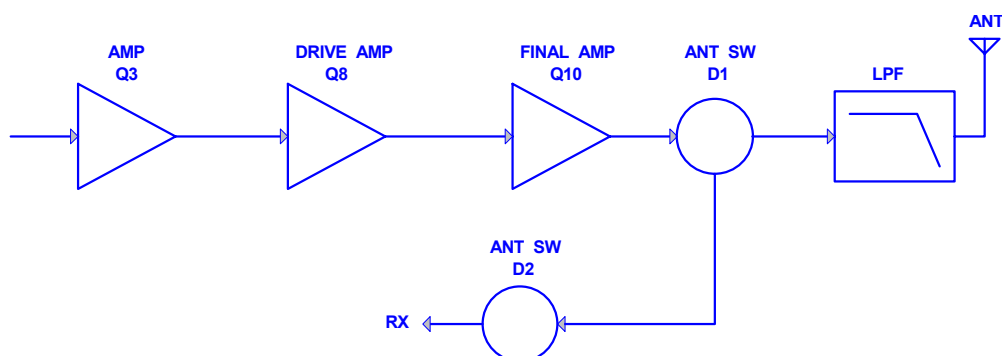


Fig.6 Final Module

##### 4) Antenna Switch and LPF

The RF signal is passed through a low-pass filter network and a transmit/receive switch (D1 and D2) before it is passed to the antenna terminal. D1 is turned on in transmit mode and off in receive mode.

## **5. Power Supply**

IC4 supply stabilized power for the control circuit. In transmit mode, IC9 is turned on and supply voltage for the transmit VCO; Q2 is turned on and supply operation voltage for the transmitting front-end amplifier. In receiving mode, IC9 is turned on and supply voltage for the receive VCO high-frequency amplified circuit; Q1 is turned on and supply operation voltage for the receiving circuit.

## **6. Control System**

The IC8 CPU operates at 4.9152MHz and supply control signal voltage for the control circuit.

## Appendix 1: Frequency Chart (Initialization)

Frequency No.	Frequency (MHz)	Frequency No.	Frequency (MHz)
1	464.5000	29	462.9125
2	464.5500	30	464.4875
3	467.7625	31	464.5125
4	467.8125	32	464.5375
5	467.8500	33	464.5625
6	467.8750	34	466.0375
7	467.9000	35	466.0625
8	467.9250	36	466.0875
9	461.0375	37	466.1125
10	461.0625	38	466.1375
11	461.0875	39	466.1625
12	461.1125	40	466.1875
13	461.1375	41	466.2125
14	461.1625	42	466.2375
15	461.1875	43	466.2625
16	461.2125	44	466.2875
17	461.2375	45	466.3125
18	461.2625	46	466.3375
19	461.2875	47	466.3625
20	461.3125	48	467.7875
21	461.3375	49	467.8375
22	461.3625	50	467.8625
23	462.7625	51	467.8875
24	462.7875	52	467.9125
25	462.8125	53	469.4875
26	462.8375	54	469.5125
27	462.8625	55	469.5375
28	462.8875	56	469.5625

**Appendix 2: CTCSS Table**

Display Number	Frequency (Hz)	Display Number	Frequency (Hz)
1	67.0	20	131.8
2	71.9	21	136.5
3	74.4	22	141.3
4	77.0	23	146.2
5	79.7	24	151.4
6	82.5	25	156.7
7	85.4	26	162.2
8	88.5	27	167.9
9	91.5	28	173.8
10	94.8	29	179.9
11	97.4	30	186.2
12	100.0	31	192.8
13	103.5	32	203.5
14	107.2	33	210.7
15	110.9	34	218.1
16	114.8	35	225.7
17	118.8	36	233.6
18	123.0	37	241.8
19	127.3	38	250.3

**Appendix 3: CDCSS Table**

Display Number	CDCSS	Display Number	CDCSS
39	023	82	331
40	025	83	343
41	026	84	346
42	031	85	351
43	032	86	364
44	043	87	365
45	047	88	371
46	051	89	411
47	054	90	412
48	065	91	413
49	071	92	423
50	072	93	431
51	073	94	432
52	074	95	445
53	114	96	464
54	115	97	465
55	116	98	466
56	125	99	503
57	131	100	506
58	132	101	516
59	134	102	532
60	143	103	546
61	152	104	565
62	155	105	606
63	156	106	612
64	162	107	624
65	165	108	627
66	172	109	631
67	174	110	632
68	205	111	654
69	223	112	662

70	226		113	664
71	243		114	703
72	244		115	712
73	245		116	723
74	251		117	731
75	261		118	732
76	263		119	734
77	265		120	743
78	271		121	754
79	306			
80	311			
81	315			

### CPU Pins

Pin No.	Pin Name	I/O	Description
1	SQ	I	Squelch detect input
2	EXT-PTT	I	External Mic PTT detect pin
3	TIBI	I	CTCSS/CDCSS external circuit central point input
4	TI	I	CTCSS/CDCSS signal input
5	NC	-	
6	NC	-	
7	CNVSS		
8	RESET	I	Reset detect pin
9	XOUT2	O	Auxiliary oscillator pin, connected with 32.768KHz crystal
10	XIN2	I	
11	VSS		CPU Ground
12	XIN1	I	Master oscillator pin, connected with 4.9152MHz crystal
13	XOUT1	O	
14	VCC		CPU main power supply
15	VCO-CTRL	O	VCO power supply control
16	RX-CTL	O	Receiving circuit power supply control
17	RX-MUTE	O	Receiving tone output control
18	TONE	O	TONE output pin
19	TX-CTL	O	Transmit circuit power supply control
20	APA-EN	O	AF power amplifier power control
21	MIC-EN	O	MIC Enable
22	LED2	O	LED control
23	LED1	O	
24	COM1	O	LCD COM control
25	COM2	O	
26	COM3	O	
27	COM4	O	

28	VL3		Not connected.
29	VL2		
30	VL1		
31	SEG12	O	SEG1-SEG12 is LCD SEG control
32	SEG11	O	
33	SEG10	O	
34	SEG9	O	
35	SEG8	O	
36	SEG7	O	
37	SEG6	O	
38	SEG5	O	
39	SEG4	O	
40	SEG3	O	
41	SEG2	O	
42	SEG1	O	
43	FILT-CTL	O	CTCSS/CDCSS LPF control
44	PLL-EN	O	PLL enable
45	PLL-CLK	O	PLL serial clock
46	PLL-DATA	O	PLL serial data
47	ST-CTL	O	VOX side-tone control
48	KEY-OUT2	O	Keypad signal input output pin
49	KEY-OUT1	O	
50	KEY-IN3	I	
51	KEY-IN2	I	
52	KEY-IN1	I	
53	EEP-DATA	I/O	EEPROM serial data
54	EEP-CLK	O	EEPROM serial clock
55	TXD	O	RS232 Transmit
56	RXD	I	RS232 Receive



57	NC	-	
58	TO	O	CTCSS/CDCSS signal output
59	POW-DET	I	Power switch detect input
60	EXT-MIC	I	External Mic detect pin
61	AVSS		GND input pin for A-D converter. Connect to VSS.
62	VREF	I	Reference power supply input
63	BAT-DET	I	Battery voltage detect input
64	VOX-DET	I	VOX signal input

## Adjustment Description

Before the adjustment, please beforehand save the user's setting.

### Required Test Instrument

1. Stabilized power supply 1set
  - 1) The supply voltage can be changed between 2V and 6V DC, and the output current is 2A or more;
  - 2) The standard output voltage is 3.6V DC;
  - 3) The power supply output voltage stabilizes.
2. Ammeter 1 set
3. Digital Voltmeter 1 set
4. Radio Communication Test Set 1 set

### Test and Adjustment

1. Setting: Put the main unit under test on the jig (Note: Make sure the test terminal and the jig connect well), and turn on the power.
2. VCO

Enable "Default Set Mode" function in programming software. And then press "+", "-" and "MENU" keys simultaneously to turn on the radio and enter adjustment mode.

Item	Condition	Measurement		Adjustment		Specification/ Remarks
		Test Instrument	Terminal	Parts	Method	
Transmit VCO lock voltage	CH1: Transmitting	Digital Voltmeter	P6	L22	Adjust L22 using ceramic screwdriver until the lock voltage reaches the selected range	$2.5 \pm 0.1V$
Receive VCO lock voltage	CH1: Receiving	Digital Voltmeter	P6	L22	Check	Around 1.0V

### 3. Receiver

Item	Condition	Measurement		Adjustment		Specification/Remarks
		Test Instrument	Terminal	Parts	Method	
RX IF demodulation output	Adjust to CH1. Press MON for 1 second to receive.	Radio Communication Test Set SSG: -60dB MOD: 1KHz, DEV: 1.5KHz FILTER: 0.3~3KHz	Antenna Mic jack	L20	Adjust L20 using ceramic screwdriver until the max. AF output signal appears.	When adjusting, rotate the volume control to the right position so that the output won't limit.

Item	Condition	Measurement		Adjustment		Specification/Remarks
		Test Instrument	Terminal	Parts	Method	
Receiving Sensitivity	Adjust to CH1. Press MON for 1 second to receive.	Radio Communication Test Set SSG: -119dBm, MOD:1KHz DEV: 1.5KHz FILTER: 0.3~3KHz	Antenna Mic jack		Check	SINAD: 12dB or higher
Squelch	Adjust to CH1 and set SQ as level 1	Radio Communication Test Set SSG: -119dBm,	Antenna Mic jack		Reduce the SSG output signal gradually until AF output mutes.	Squelch level: -122 ± 1.5dB
	Adjust to CH1 and set SQ as level 4	Radio Communication Test Set SSG: -110dBm,				Squelch level: -114 ± 1.5dB

4. Transmitter (Be sure to connect the antenna or dummy load before adjustment)

Item	Condition	Measurement		Adjustment		Specification/Remarks
		Test Instrument	Terminals	Parts	Method	
Transmitting Frequency	Adjust to CH1. Press PTT to transmit.	Radio Communication Test Set	Antenna	VC1	Use ceramic screwdriver to adjust VC1 so that the center frequency is no more than the error.	± 2.5ppm
Transmitting power		Radio Communication Test Set Ammeter			Check	≥ 700mW
Max frequency deviation	Adjust to CH1. Press PTT to transmit.	Radio Communication Test Set LPF: 15KHz AF OUT: 1KHz/150mV	Antenna Mic Jack	R77	Use screwdriver to adjust R77 so that frequency deviation is in the regulated range.	Frequency deviation: 2.1KHz~2.2KHz
Modulation Sensitivity	Adjust to CH1. Press PTT to	Radio Communication	Antenna Mic Jack		Check	Frequency deviation: 1.1KHz~1.8KHz

	transmit.	Test Set BPF:0.3~3KHz AF OUT: 1KHz/12mV				
CTCSS /CDCSS Frequency Deviation	Adjust to <b>CH2</b> and CTCSS code automatically turns to "1". Press PTT to transmit.	Radio Communication Test Set LPF:0.3KHz	Antenna		Use screwdriver to adjust R153 and R152 so that CTC frequency deviation is in the regulated range.	Frequency deviation: <b>0.45 ± 0.05KHz</b>
	Adjust to <b>CH3</b> and CTCSS code automatically turns to "38". Press PTT to transmit.	Radio Communication Test Set LPF:0.3KHz	Antenna		Check	Frequency deviation: <b>0.45 ± 0.05KHz</b>
	Adjust to <b>CH4</b> ; automatically turn to CDCSS. Press PTT to transmit.	Radio Communication Test Set LPF:0.3KHz	Antenna		Check	Frequency deviation: <b>0.5 ± 0.1KHz</b>
Low Battery Alert Level	Set the battery as A	Digital Voltmeter	Power supply port	Power supply	Adjust power supply output voltage and check alert level	<b>3.3 ± 0.1V</b>
	Set the battery as n				Adjust power supply output voltage and check alert level	<b>3.1 ± 0.1V</b>
Low Battery Power-off Level	Set the battery as A	Digital Voltmeter	Power supply port	Power supply	Adjust power supply output voltage and check power off level	<b>3.1 ± 0.1V</b>
	Set the battery as n				Adjust power supply output voltage and check power off level	<b>3.0 ± 0.1V</b>

5. After adjustment, recover the original setting (before adjustment) of the radio through programming software.

## Assembly and Disassembly for Repair

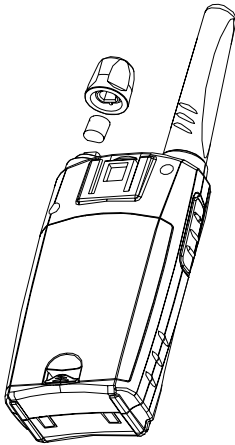


Fig. 1

Remove the power knob. See figure1.

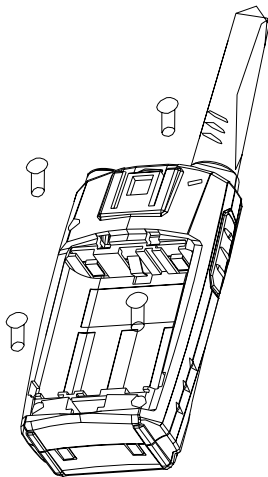


Fig. 2

Remove the four screws on the chassis. See figure 2.

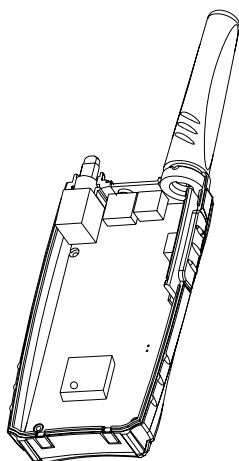


Fig. 3

The disassembled unit is shown as figure 3.

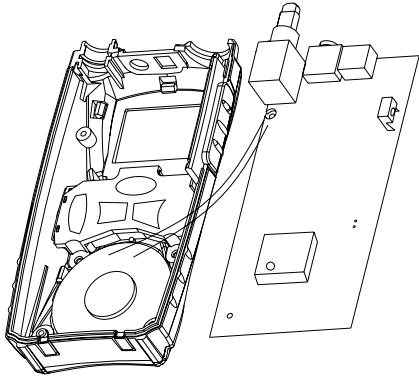
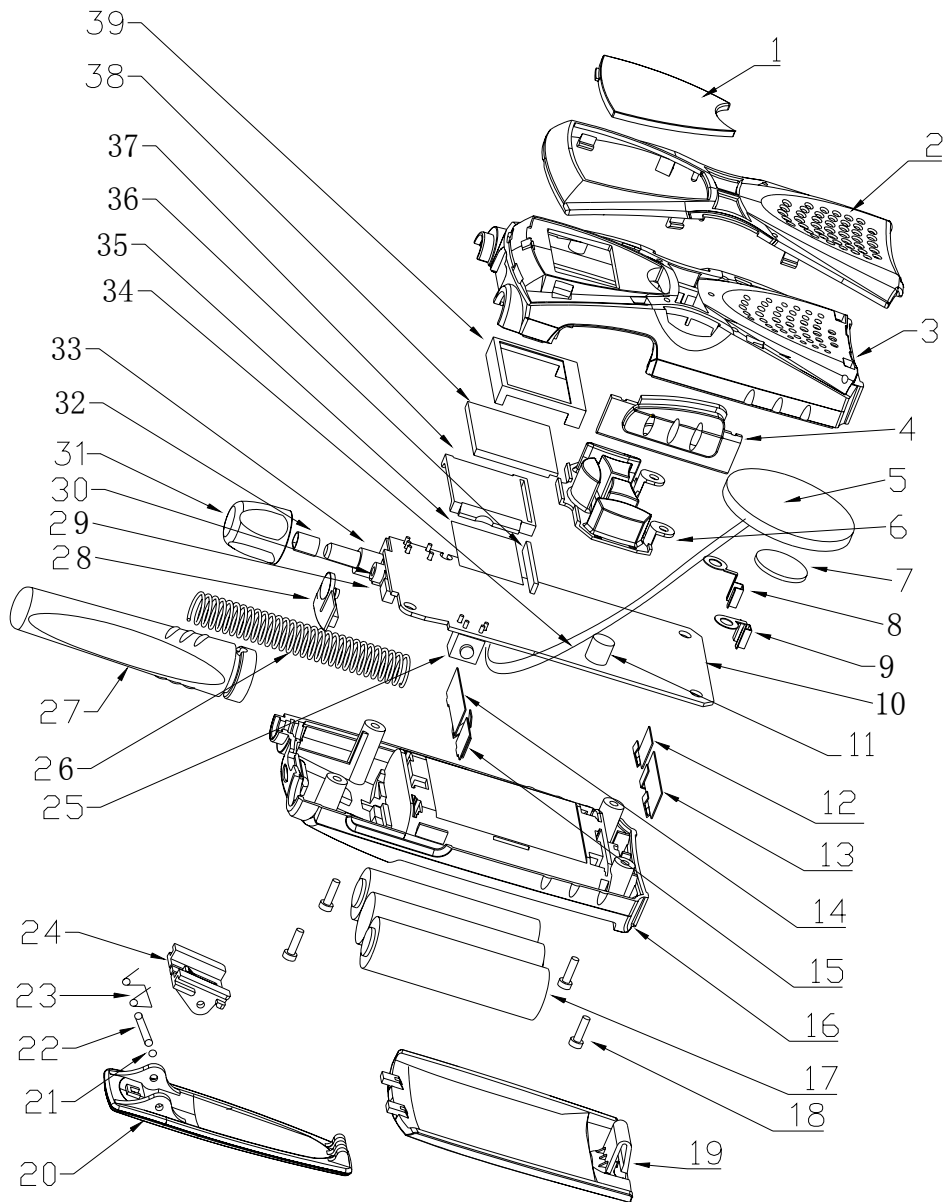


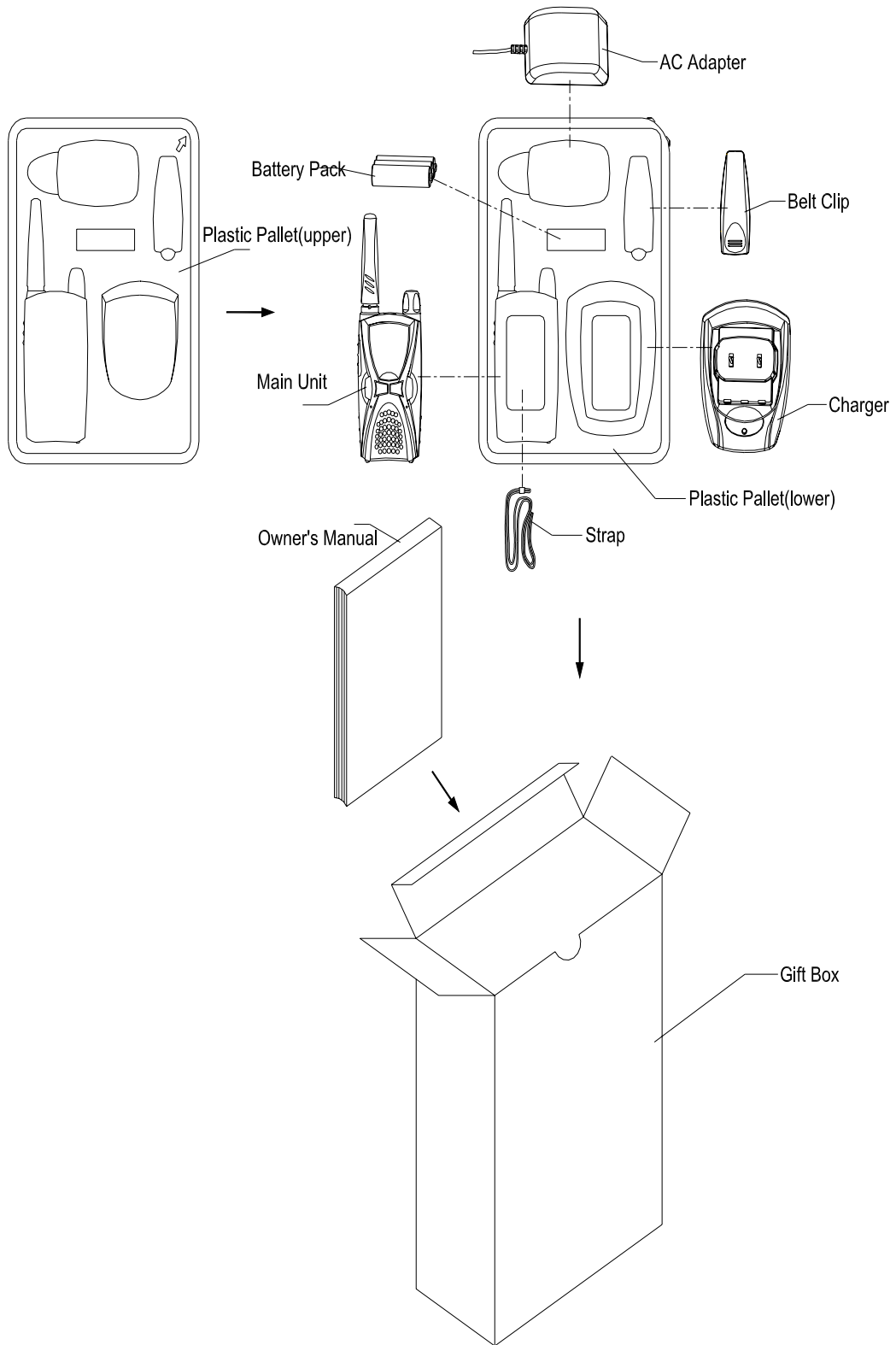
Fig. 4

Take out the antenna spring, antenna cover and PCB. See figure 4.

# Exploded View



# Packing





## Specifications

Frequency Range	460MHz-470MHz
Number of Channels	56 (Max.)
Number of CTCSS	38
Number of CDCSS	83
Frequency Error	$\leq \pm 2.5\text{PPM}$
Transmitting Power	1.0W
Radiated Power	0.2W
Transmitter Spurious Emission	$\leq 20\mu\text{W}$
Modulation Limitation	$\pm 2.5\text{KHz}$
Bandwidth	$\leq 8.5\text{KHz}$
Adjacent Channel Power Rejection	$\geq 60\text{dB}$
Modulation AF Distortion	$\leq 10\%$
Receiving Sensitivity	$\leq 0.3\mu\text{V}$ (12dB SINAD)
Co-channel Rejection	$\geq -8\text{dB}$
Blocking	$\geq 85\text{dB}$
Intermodulation Rejection	$\geq 50\text{dB}$
Adjacent Channel Selectivity	$\geq 50\text{dB}$
Receiver Spurious Emission	$\leq 2\text{nW}$
Receiving AF Distortion	$\leq 10\%$