CONTENTS

General

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.

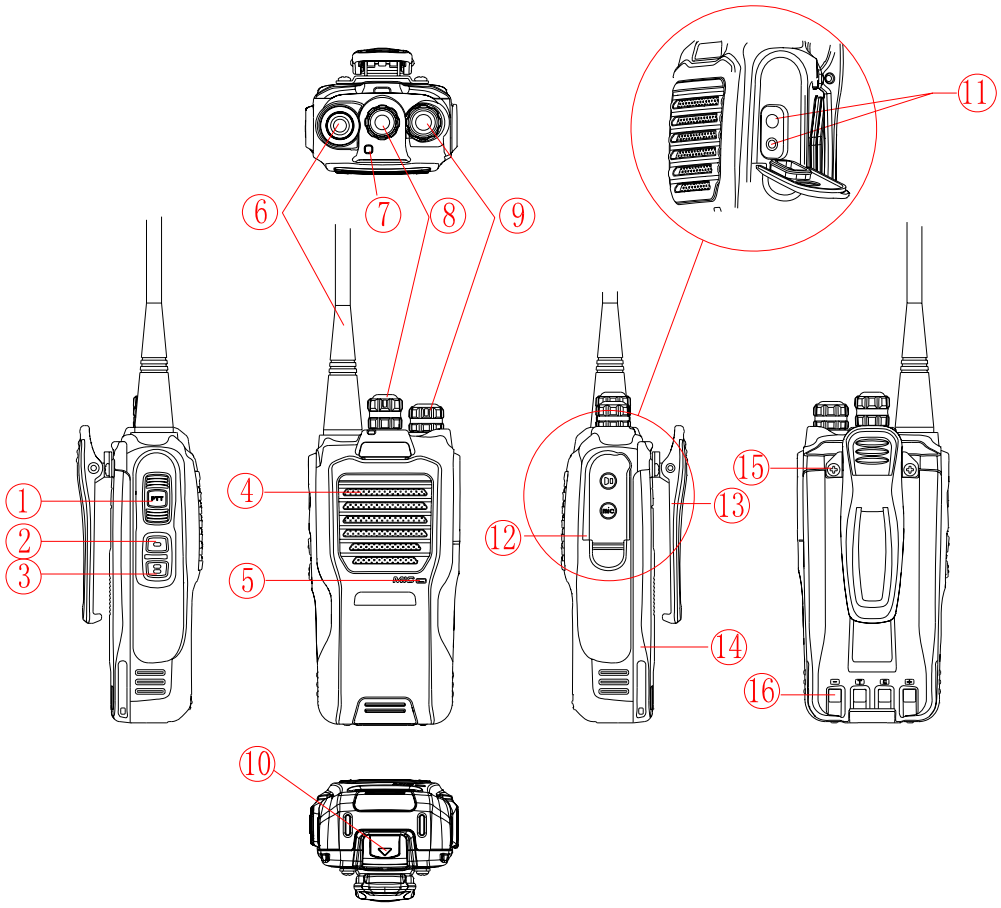
Safety and General Information

The following general safety precautions as would normally apply, should be observed during all phases of operation, service and repair of this equipment.

- This equipment should be serviced by qualified technicians only.
- DO NOT operate the transmitter of radio unless all RF connectors are secure and any open connectors are properly terminated.
- Do not modify the radio for any reason.
- Use only HYT original batteries and chargers.
- Use only the supplied or an approved antenna.
- Do not use any portable radio that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn can result.
- For vehicles with an air bag, do not place a radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of the vehicle.
- Turn off your radio prior to entering any area with a potentially explosive atmosphere.
- Do not charge your battery in a potentially explosive atmosphere.
- To avoid possible interference with blasting operations, turn off your radio when you are near electrical blasting caps, in a blasting area, or in areas posted: “Turn off two-way radio.” Obey all signs and instructions.
- Do not expose the radio to direct sunlight over a long time, nor place it close to heating source.
- When using your radio, hold the radio in a vertical position with the microphone 3 to 4 centimeters away from your lips.
- If you wear a radio on your body when transmitting, ensure that the radio and its antenna are at least 2.5cm away from your body.

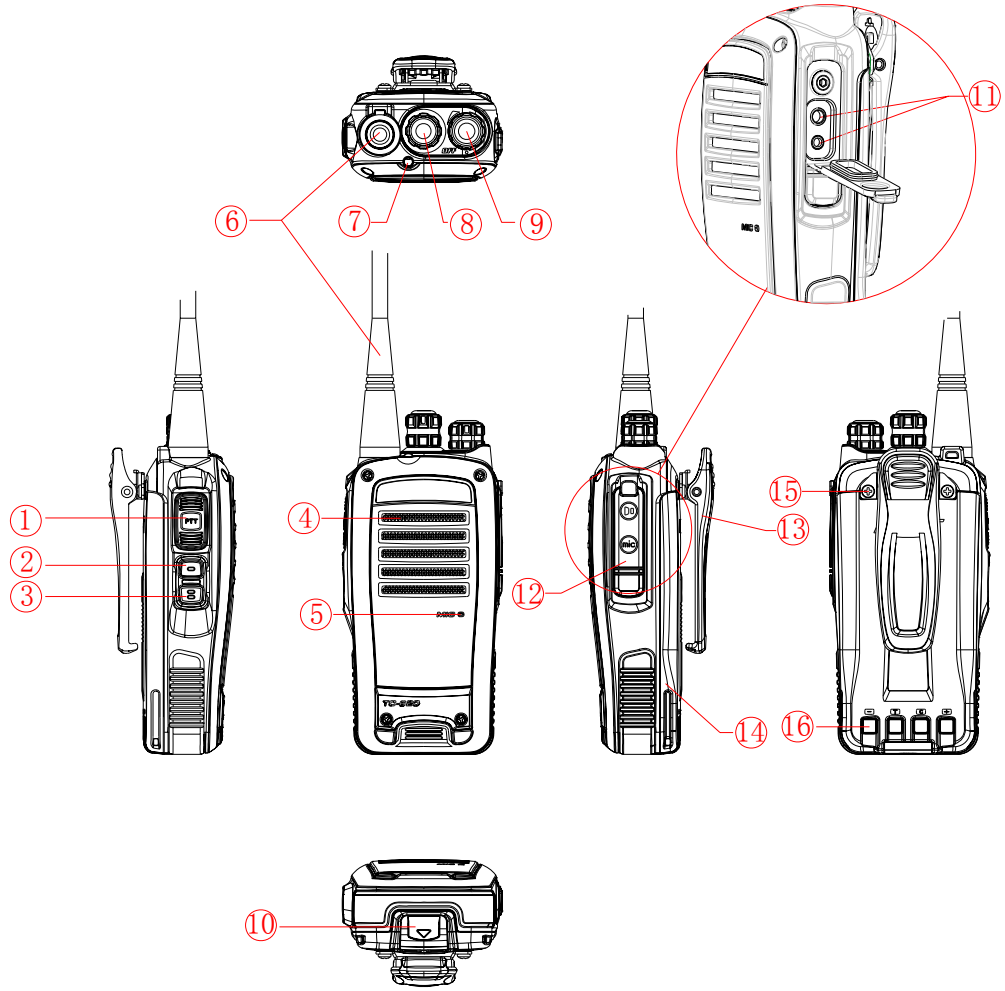
Radio Overview

TC-610



① PTT	② SK1 (programmable key)	③ SK2 (programmable key	④ Speaker
⑤ Microphone	⑥ Antenna	⑦ LED	⑧ Channel Selector Knob
⑨ On-Off/Volume Control Knob	⑩ Battery Latch	⑪ Earpiece Jack and Programming Port	⑫ Earpiece Cover
⑬ Belt Clip	⑭ Battery	⑮ Belt Clip Screw	⑯ Charging Piece

TC-620



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PTT

Used to switch between transmitting and receiving modes. Hold down **PTT** and speak into the microphone to transmit, while release it to receive.

SK1

Side key 1, programmable. Your dealer can program the key with a function via the programming software.

SK2

Side key 2, programmable. Your dealer can program the key with a function via the programming software.

LED

LED statuses and alert tones:

User Wired Clone	Power on the source radio while holding down the SK2 key. Power on the slave radio directly.	LED flashes orange once.
	Source radio (After the slave radio is powered on and the cloning cable is connected, press SK2 on the source radio to start cloning)	When cloning, LED flashes red. When completed, red LED goes out. When failed, red LED goes out.
	Slave radio	When cloning, LED flashes green. When completed, green LED goes out.
Powering On in User Mode		The power-on alert tone sounds when the radio is powered on. When the current channel is idle, “BEEP” tone sounds continuously.
Low Battery Power Alert		LED flashes red and a descending tone sounds every ten seconds.

Transmit	LED glows red. When transmission times out, “BEEP” tone sounds continuously. TOT pre-alert: “BEEP” tone sounds once.
Receive	When a carrier is received, LED glows green.
Scan	When detecting, LED flashes green every second. Scan start tone (programmable by your dealer): “BEEP” tone sounds once. Scan stop tone (programmable by your dealer): “BEEP” tone sounds once. Priority channel scan tone (programmable by your deader): If the radio stays on a priority channel during receiving, “BEEP” tone sounds once.
Programming	Reading: LED flashes red. Writing: LED flashed green.
Power Adjust	When switching from high power to low power, a descending tone sounds. When switching from low power to high power, an ascending tone sounds.
VOX	When enabling the VOX function, an ascending tone sounds. When disabling the VOX function, a descending tone sounds.

Channel Selector Knob

Rotate the knob to select from channels 1 to 16.

On-Off/Volume Control Knob

Rotate the knob clockwise to turn the radio on, while rotate the knob fully counter-clockwise until a “click” is heard to turn the radio off.

Turn the knob clockwise to increase the volume, or counter-clockwise to decrease the volume.

Software Specifications

Functions

1. Available Channels: 1 to 16 channels

   Frequency Range:

   UHF: 400-420MHz

   UHF: 450-470MHz
2. Channel Spacing: 25KHz/12.5KHz
3. Channel Step: 5/6.25/10/12.5KHz channel scan function
4. Tx/Rx Indication (red/green LED)
5. CTCSS/CDCSS (38 groups of CTCSS and 83 groups of CDCSS with degrees of 180/120 available for CTCSS squelch tail reverse method)
6. Low Battery Power Alert
7. Auto Battery Save
8. Unlock Detect and Alarm
9. 9 Selectable Squelch Levels
10. Monitor
11. TOT
12. Squelch Tail Elimination
13. PC Programming (including PC manual adjustment and PC automatic adjustment)
14. High/Low Power Switch (2.0/5.0W)
15. Wide/Narrow Band Compatible
16. Busy Channel Lockout
17. Wired Clone
18. Battery Power Indication
19. Manual Adjustment
20. VOX and 5 Selectable Sensitivity Levels

Circuit Description

Realization Methods for Basic Functional Modules

PLL Frequency Synthesizer

The PLL circuit generates local oscillator signals for reception and RF carrier signals for transmission.

The PLL circuit consists of the VCO oscillator circuit and baseband processor chip and realizes frequency tracking and channel conversion under the control of MCU signals.

1. PLL

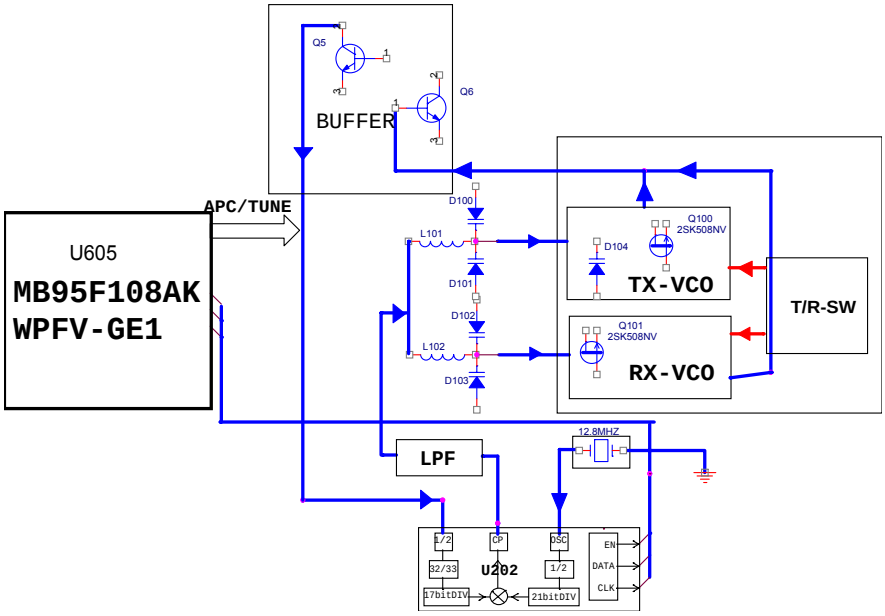


Figure 2

The step frequency of the PLL circuit is 5.0KHz, 6.25KHz, 10.0KHz or 12.5KHz. Therefore, the reference oscillator signal (38.4MHz) is divided into 5.0KHz, 6.25KHz, 10.0KHz or 12.5KHz reference signals by a fixed counter in PLL of U202. Signals output by VCO pass through buffer Q102 followed by amplifier Q103 and enters PLL of U200 for frequency division by a variable divider. The signals from the frequency division are compared with reference signals in the phase comparator PD of PLL. Signals output by the phase comparator is added to the varactors D100, D101, D102 and D103 of VCO to control the output frequency after passing through a low pass filter.

2. VCO

The VCO section is realized by the oscillator circuit of three-point capacitor.

In transmitting mode, the operation frequency of VCO is generated by Q100; in receiving mode, the operation frequency of VCO is generated by Q101.

U202 generates a control voltage via the phase comparator to control varactors (D100 and D101 in transmitting mode; D102 and D103 in receiving mode) to bring the oscillator frequency of VCO in line with the preset frequency of MCU within a broader frequency range.

The switching tube Q652 switches between transmitting and receiving under the control of T/R. In transmitting mode, T/R is set as low level and Q100 operates when Q653 becomes conductive. In receiving mode, T/R is set as high level and Q101 operates when Q653 cuts off. Output from Q100 and Q101 is sent to the buffer amplifier for process after passing through amplifier Q102.

If PLL is unlocked, LD pin of U202 outputs low level. When this situation is detected by a microprocessor, transmitting and receiving operations are suspended and an alert tone sounds.

RF Power Amplifying Circuit (Tx Section)

Block Diagram for RF Power Amplifying Circuit

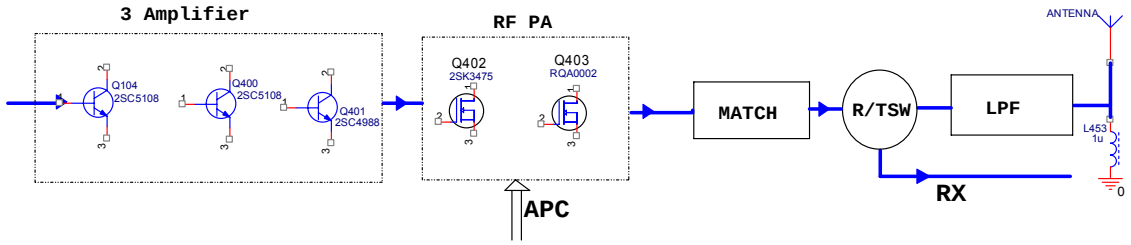


Figure 3

To obtain the required RF power, RF signals from VCO is amplified by driving amplifiers Q400 and Q401 after passing through buffer Q104. The amplified RF signals enters driver Q402, which performs power pre-amplification on the input signals to derive a certain power to drive the final power amplifier. The final power amplifier Q403 performs power amplification again on the input RF signals to derive the required power. Then the amplified RF signals pass through Tx-Rx switching diode D401 followed by the LC low pass filter circuit (LPF). The signals are transmitted through the antenna after ultraharmonics are filtered by the LPF.

Rx Amplification (LNA) and RF Bandpass Network (BPF)

To obtain better frequency selectivity, the Rx bandpass utilizes multiple electrically tunable circuits. The block diagram is shown below:

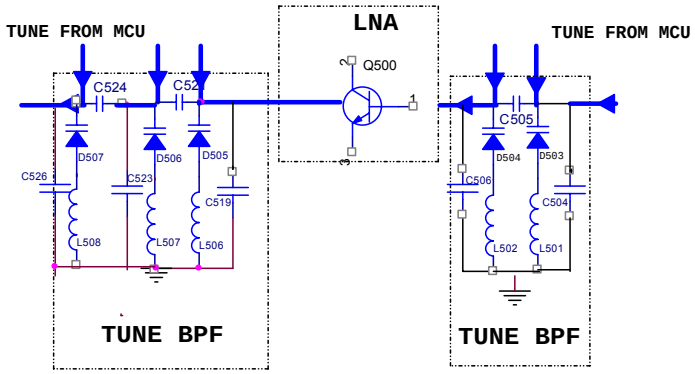


Figure 4

The Rx signals input from the antenna is filtered to remove out-of-band signals at the electrically tunable bandpass network (D503, D504, L501, L502, C503, C505 and 507) and then amplified by low-noise amplifier (LNA) Q500 to obtain a certain level required by reception. The signals pass through the three-level bandpass network (mainly consisting of D505, D506, D507 and periphery components) to effectively restrain the out-of-band interference and to derive pure Rx RF signals, which will be fed to the mixing stage.

The electrically tunable control signals are provide by MCU. The required level can be obtained through table looking up or formula computing to accurately control varactors to operate within proper voltage range. It constitutes a bandpass filter with the periphery inductive capacitors to track the Rx frequency under the change of MCU control voltage and to obtain the preset Rx sensitivity requirements and out-of-band interference requirements.

Mixing Circuit (MIXER) and IF Bandpass Network (BPF)

Block Diagram for the Mixing Circuit

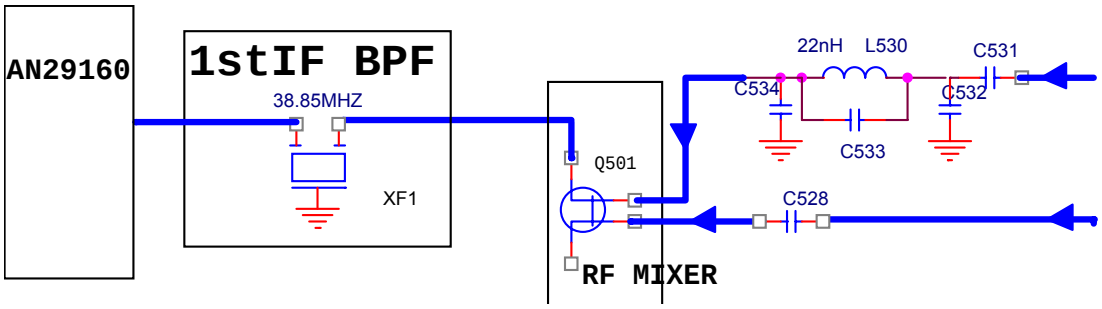


Figure 5

The mixer mainly processes the local oscillator signals and Rx RF signals output by VCO. The first IF from the mixer is used by the demodulator chip to discriminate frequency. Here the active mixer

is utilized.

The mixer tube (Q501) utilizes dual gate FET MOS (3SK318) and has better noise characteristics and square law characteristics. The isolation between the local oscillator signals and the Rx signals is high. To ensure proper sensitivity and certain gain for the mixer tube, tune delicately via the offset.

The signals output from the mixer pass through inductor L509 to remove residual spurious and then enter the first IF filter. The filter utilizes the first-class crystal filter to ensure sufficient bandwidth and excellent selectivity. The signals finally enter baseband processing chip AN29160 for demodulation.

APC/TUNE Automatic Power Control Circuit

Block Diagram for the Circuit:

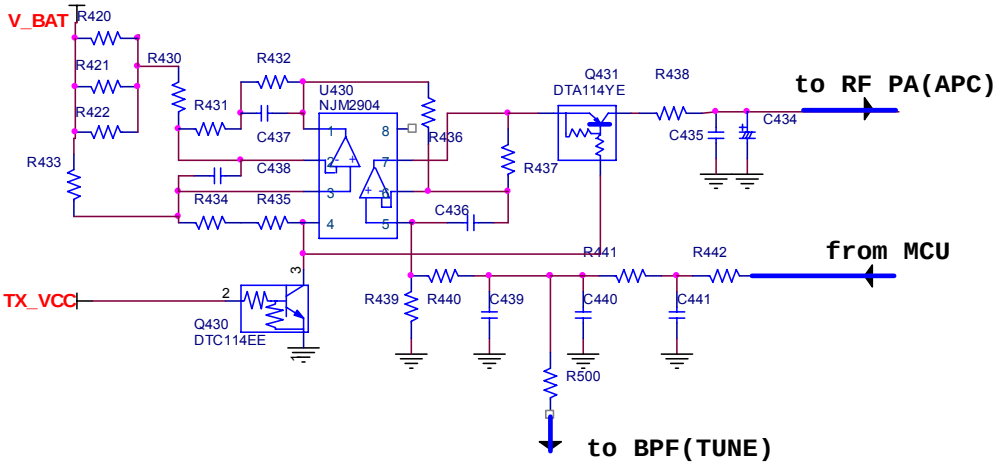


Figure 6

Subject to the selected channel, MCU outputs the corresponding PWM waveform, which is reshaped by the RC filter network (R441, R442, C440 and C441) to derive the APC/TUNE control signal level. One part of them is used as the control voltage of the electrically tunable circuit after passing through R500. In transmitting mode, the levels are voltage-divided by R439 and R440 to obtain the APC reference voltage.

The transmitting current passes through R420, R421 and R422 to derive the error detect voltage. The voltage is amplified by operational amplifier IC U430 and then compared with APC reference voltage to output APC control voltage and to form closed-loop negative feedback power control when the transmitting current changes.

Audio and Signalling Processing Circuit

Baseband processing IC AN29160 has high integration level and powerful functions. Many of the processing functions (as VCO level detect&output, SQ signal level detect&output, Tx-Rx audio processing switch, audio amplifier, etc) and can be realized inside. The Tx-Rx sharing can also be realized.

Block Diagram for Tx Audio&Signalling Process

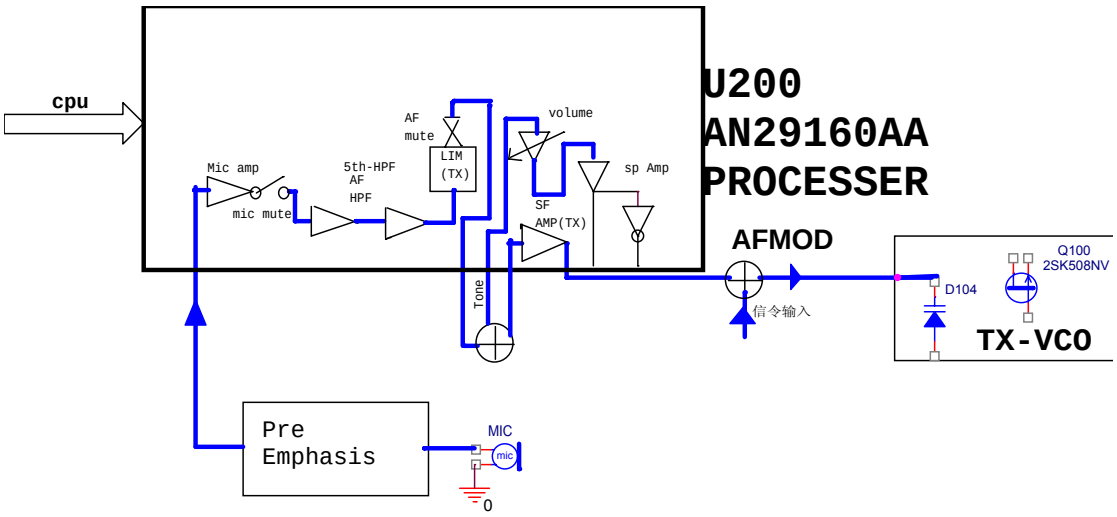


Figure 7

Tx Audio Process: Audio signals input from the MIC is converted to electrical signals through the audioelectric conversion of MIC and the amplitude limit of them are amplified by U200 after the signals are pre-emphasized. The processed signals go to the low-pass filter circuit to remove frequencies above 3KHz and then go to VCO for direct frequency modulation after passing through potentiometer VR200.

Tx Sinalling Process: MCU outputs, via the QTO port, signalling encoder waveform, which is divided into two parts for modulation after passing through the RC network. One part is used to modulate PLL reference-frequency oscillator directly, while the other part is used to modulate VCO. VR260 balances the modulation and adjust the signal amplitude ratio of one part to the other, which optimizes the singalling waveform modulated on the carrier.

Block Diagram for Rx Audio&Signalling Process

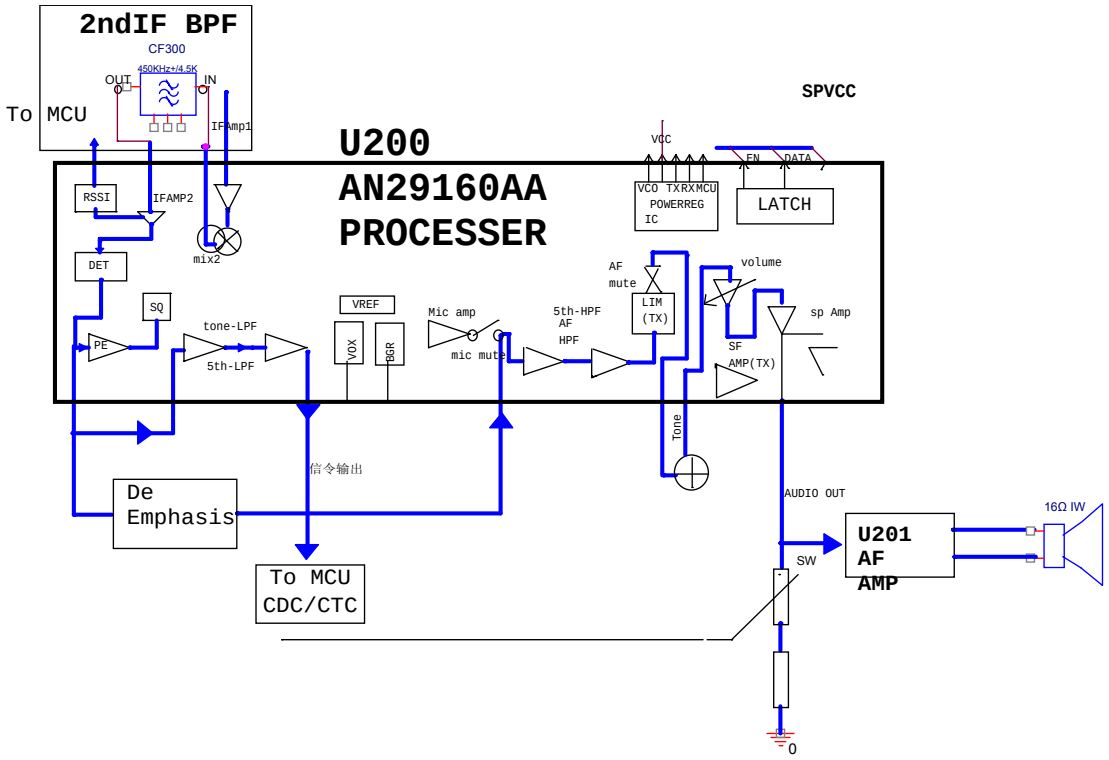


Figure 8

U200 outputs initial audio signals (including noise, signaling, audio, etc) after performing frequency-discrimination and demodulation on the received signals. Therefore, the audio process is divided into three parts:

Rx Audio Process: One part of the audio signal output by U200 is fed to the RC low-pass filter and de-emphasis circuit and then amplified by U200. The audio signal is recovered after frequencies below 300Hz are removed. The recovered audio signal is adjusted by the potentiometer and then goes to audio power amplifier IC (U201), which amplifies power for the input audio signals to drive the speaker directly. To obtain higher power, the BTL bridge dual output is utilized.

Rx Signalling Process: One part of the audio signal output by U200 is fed to the 300Hz low-pass filter circuit (U640). After audio signals above 300Hz are removed, CTCSS/CDCSS goes to the QTIN pin of CPU. CPU decodes the input signallings.

Noise Signalling Process: One part of the audio signal output by U200 goes to U200 again. After the signal is filtered, amplified and rectified inside U200, a DC voltage signal (SQ) corresponding to the noise component is derived. The DC signal is fed to the BUSY pin of MCU via the ND pin of U200. Then MCU processes the input signals.

MCU Control Section

The block diagram for the MCU control section is shown below. MCU works under the 7.3728MHz clock frequency.

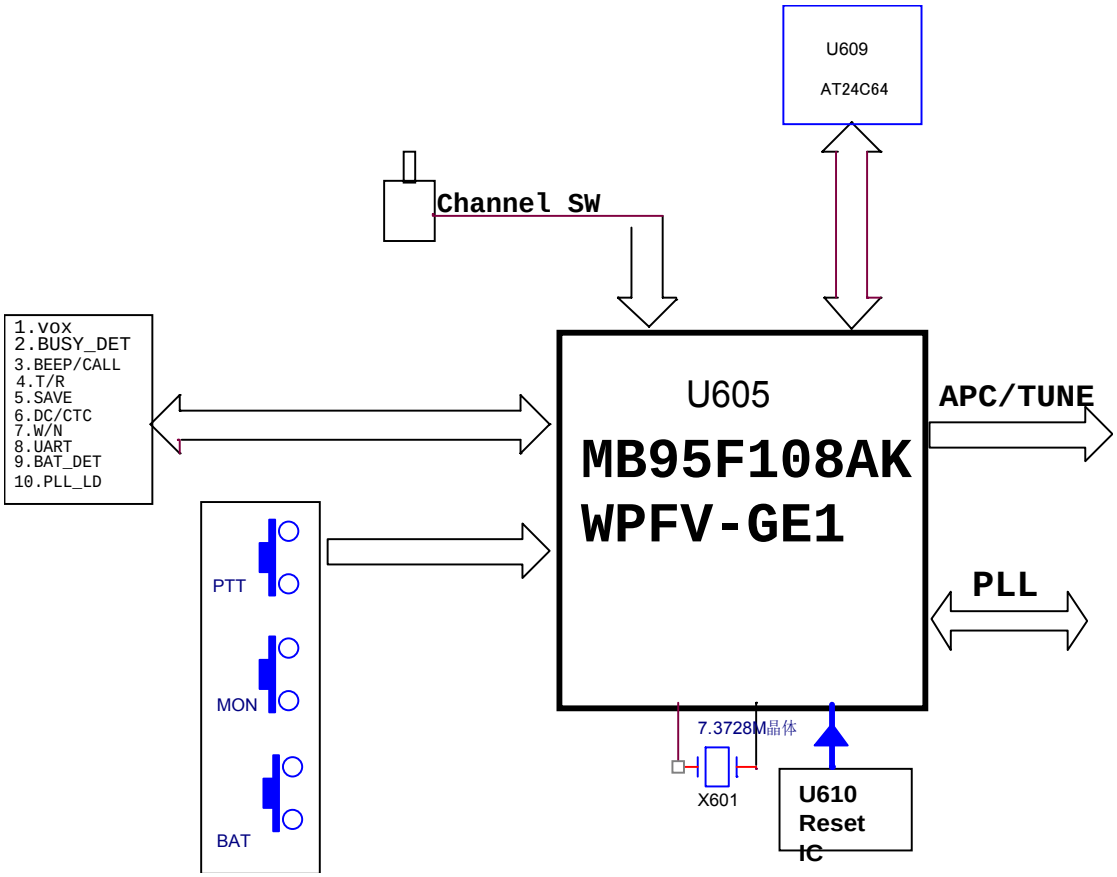


Figure 9

The MCU control section is composed of MCU, EEPROM, RESET IC, keys, Channel Selector knob, etc. Main functions realized by this circuit section are:

1. Control Signal:

   Control of battery save mode

   Control of high/low power switch

   Control of band/narrow band switch

   Control of Tx-Rx switch

   Control of APC/TUNE output voltage

   Control of Tx power supply and power supply of audio power amplifier

   Control of squelch ON detect

2. Signal Detect

Detect of external PTT, MONI and VOX

Detect of PLL unlock (UL)

Detect of VOX ON level

Detect of battery power alarm

Detect of enabling and checking external remote speaker microphone

3. Data Transfer and Process

EEPROM data initiation

Programming data transfer

Encoding process of channel selector knob

Signalling encoding and decoding

Data transfer of baseband processing chip (PLL)

Power Supply Process

Block Diagram for the Circuit

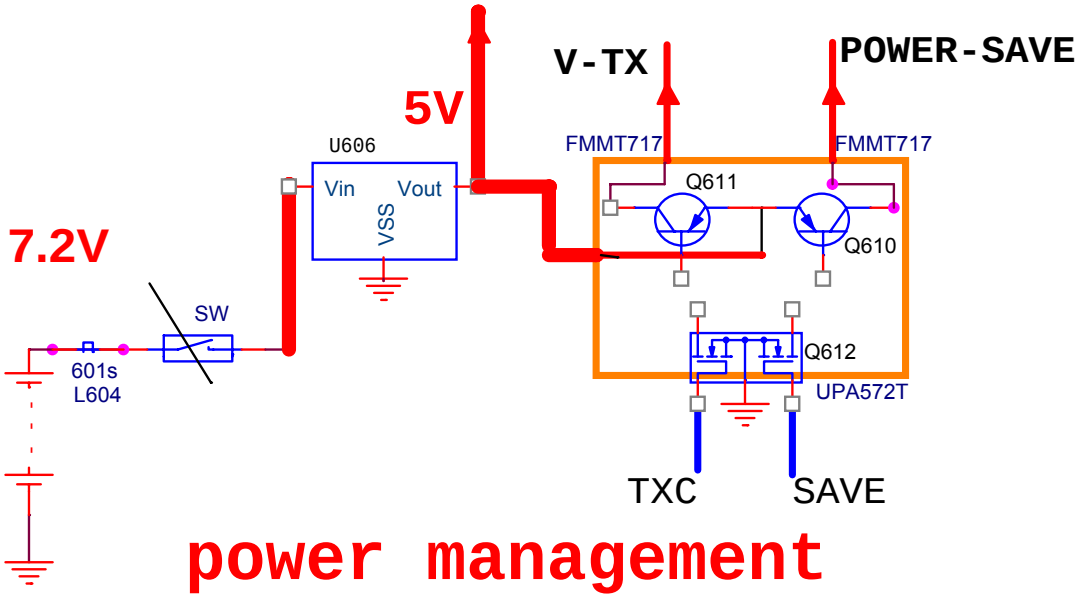


Figure 10

After the radio is powered on, the battery voltage is provided to the RF power amplifier and audio power amplifier to meet the requirements of sufficient power amplification after filtered by L604 and C682. Another path is input with the regulator IC (U606) of 5V and outputs voltage of VCC_5V for use by MCU and the baseband processing chip after regulated. Because the radio works under the half duplex mode, it is required to control the Tx and Rx power supply alternately. To meet the requirement of the battery save mode, MCU should output a pulse signal with fixed duty factor

(control signal of SAVE). When the SAVE signal of MCU is of high level, Q610 becomes conductive and provides a 5V voltage (V_SAVE) for the operating circuit. PLL and the receiving circuit operate. When the SAVE signal is a pulse signal, the radio enter the battery save mode. When transmitting, TXC, control signal of CPU, is of high level. Q611 becomes conductive and provide a 5V voltage for the transmitting circuit and the transmitting circuit operates.

Power supplies of the Tx section and Rx section both have symmetrical regulation measures. When the load change changes the output voltage/current, the regulator closed-loop feedback circuit operates, regulating the output voltage at 5V.

VOX Realization

The block diagram is shown below:

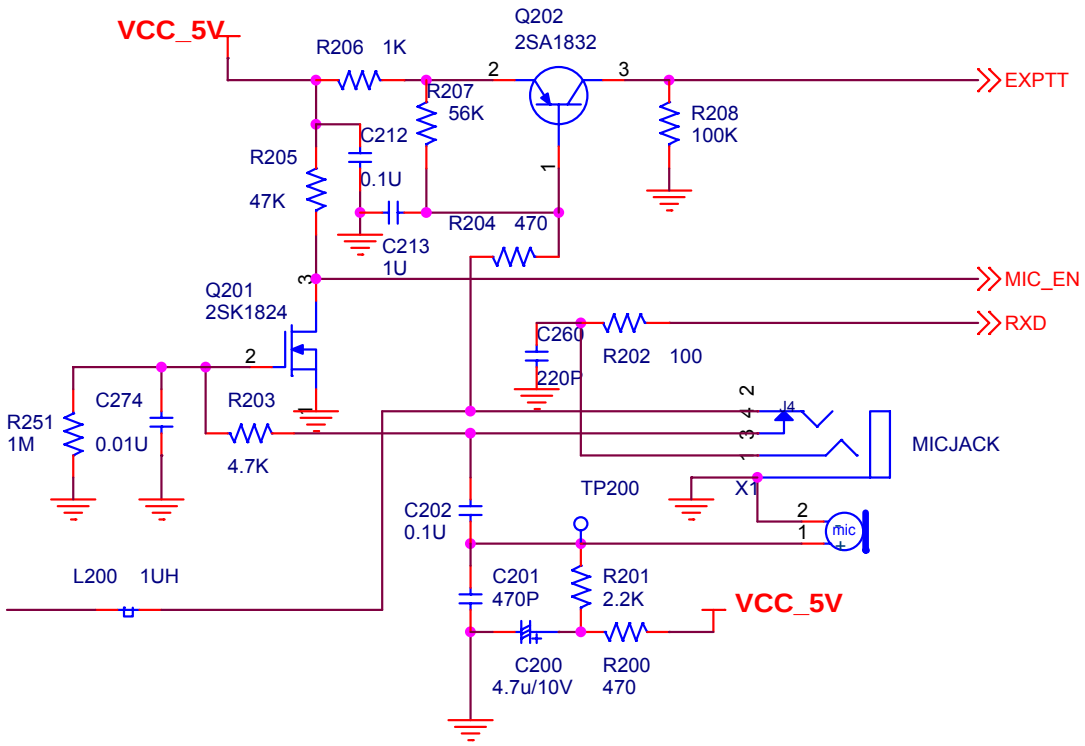


Figure 11

After the function key VOX is held down, the radio enters the VOX status. The VOX function can only be enabled when MCU detect that MIC enabling signal (MIC_EN) and external VOX enabling signal (EXT-PTT) switch from low level to high level almost at the same time (within hundreds of milliseconds). Otherwise, it is detected as the earpiece without VOX and the VOX function is off.

When the remote speaker microphone with VOX is inserted into the earpiece jack, Q201 cuts off. MIC_EN switches from low level to high level and Q202 completes the circuit with R204 and the external remote speaker microphone simultaneously. Q202 becomes conductive. EXT-PTT switches from low level to high level, which is detected by MCU as insert of a remote speaker microphone with VOX. The VOX function is enabled. When the VOX detect level (5 levels available) meets the preset requirements, the radio transmits and the audio signal goes to the baseband processing IC AN29160 through the processing path.

If a remote speaker microphone without VOX (remote speaker microphone with PTT) is inserted, Q201 cuts off. MIC_EN switches from low level to high level but Q202 can not complete the circuit and keep the cut-off status. EXT-PTT is of low level. MCU detects as the remote speaker microphone without VOX and the radio returns to the common mode. Press the PTT key on the remote speaker microphone to transmit.

Semiconductor Data

Pin No.	Pin Name	TC-610	TC-620	I/O	Description
1	AVcc	Vcc	Vcc		Power supply pin for A/D, connecting power supply
2	AVR	Vcc	Vcc		A/D reference input pin, connecting power supply
3	PE3/INT13	PTT	PTT	I	PTT key (connected with pull-up resistor) (valid at low level)
4	PE2/INT12	A_KEY	A_KEY	I	SK1, programmable function key (connected with pull-up resistor) (valid at low level)
5	PE1/INT11	EXT-PTT	EXT-PTT	I	PTT key on the earpiece (connected with pull-down resistor) (valid at high level)
6	PE0/INT10	B_KEY	B_KEY	I	SK2, programmable function key (connected with pull-up resistor) (valid at low level)
7	P83	ENC3	ENC3	I	Encoder input of channel selector knob(connected with pull-up resistor)
8	P82	ENC2	ENC2	I	
9	P81	ENC1	ENC1	I	
10	P80	ENC0	ENC0	I	
11	P71/TI0	T/R	T/R	O	Tx-Rx switch control H(R)/L(T)
12	P70/TO0	Reserve	Reserve	O	Reserved
13	MOD	For down -loading	For down -loading	I	An operating mode designation pin. When downloading, this pin is connected with Vcc and a resistor of 47K is also connected between the

					pin and the grounded Vss. When not downloading, only a resistor of 47K is connected between the pin and the grounded Vss.
14	X0	OSC0	OSC0		Connecting pin of 7.3728MHzMHz master crystal oscillator
15	X1	OSC1	OSC1		
16	Vss	GND	GND		Power supply (GND) pin (When recording, it is connected with the GND recording port signals.)
17	Vcc	VCC	VCC		MCU 5V power supply (When recording, it is connected with the VCC recording port signals)
18	PG0	C	C		This port can not be used as IO and a capacitor is connected between the port and the grounded Vss.
19	PG2/X1A	OSC32K	OSC32K		Subsystem clock pin (Reserved）
20	PG1/X0A	OSC32K	OSC32K		
21	/RST	RESET	RESET	I	Reset (When recording, it is connected with the RSTX recording port signals.)
22	P00/INT00	Reserve	Reserve	O	Reserved
23	P01/INT01	Reserve	Reserve	O	
24	P02/INT02	Reserve	Reserve	O	
25	P03/INT03	Reserve	Reserve	O	
26	P04/INT04	PLLEN2	PLLEN2	I/O	PLL ENABLE
27	P05/INT05	PLLDATA2	PLLDATA2	I/O	PLL DATA
28	P06/INT06	PLLCLK2	PLLCLK2	I/O	PLL CLOCK
29	P07/INT07	UL2	UL2	I/O	TB31202 PLL circuit unlock detect (H: Lock L Unlock) (connected with pull-up resistor)
30	P10/UI0	RXD	RXD	I	UART RX (When recording, it is connected with the UI recording port signals)
31	P11/UO0	TXD	TXD	O	UART TX (When recording, it is connected with the UO recording port signals)
32	P12/UCK0	Reserve	Reserve	O	Reserved
33	P13/TRG0/ADTG	Reserve	Reserve	I	Reserved
34	P14/PPG0	MIC_EN	MIC_EN	I	Check whether the MIC is connected(connected with pull-down resistor) (valid at high level)
35	P20/PPG00	CTC_DCS	CTC_DCS	PWM	CTCSS/CDCSS output
36	P21/PPG01	Reserve	Reserve	O	Reserved
37	P22/TO00	TONE	TONE	O	BEEP tone output/CALL tone output
38	P23/TO01	W/N	W/N	O	Wide/Narrow band control W(L)/N(H)
39	P24/EC0	Reserve	Reserve	O	Reserved

40	P50/SCL0	SCL	SCL	SCL	EEPROM CLOCK
41	P51/SDA0	SDA	SDA	SDA	EEPROM DATA
42	P52/PPG1	AP/TU	AP/TU	PWM	Auto power control/adjust
43	P53/TRG1	TX_CTRL	TX_CTRL	O	Tx power supply control “H”: valid Transmission is on.
44	P60/PPG10	PLLCLK	PLLCLK	O	PLL CLK
45	P61/PPG11	PLLDATA	PLLDATA	O	PLL DATA
46	P62/TO10	PLLEN	PLLEN	O	PLL ENABLE
47	P63/TO11	Reserve	Reserve	O	Reserved
48	P64/EC1	Reserve	Reserve	O	Reserved
49	P65/SCK	Reserve	Reserve	O	Reserved
50	P66/SOT	Reserve	Reserve	O	Reserved
51	P67/SIN	Self	Self	I	For test (used to enter the factory clone mode, connected with pull-up resistor)
52	P43/AN11	SPCNT	SPCNT	O	Power supply control of main audio "H": audio ON
53	P42/AN10	PCONT	PCONT	O	Power supply control pin of AN29160AA
54	P41/AN09	RLED	RLED	O	Red LED
55	P40/AN08	GLED	GLED	O	Green LED
56	P37/AN07	Reserve	Reserve	O	Reserved
57	P36/AN06	Reserve	Reserve	O	Reserved
58	P35/AN05	TI	TI	I/AD	CTCSS/CDCSS input
59	P34/AN04	BUSY	BUSY	I/AD	Channel busy check (requiring 10-digit AD)
60	P33/AN03	BAT_DET	BAT_DET	I/AD	Battery voltage detect (requiring 10-digit AD)
61	P32/AN02	Reserve	Reserve	O	Reserved
62	P31/AN01	Reserve	VOX	I/AD	VOX detect (requiring 10-digit AD)
63	P30/AN00	Reserve	Reserve	O	Reserved
64	AVss	GND	GND		Power supply (GND) pin for A/D, ground

Adjustment

User Mode

Power on the radio to enter the conventional mode when no key is pressed.

Programming Mode

In user mode, the PC programming software triggers the PC programming mode by communication through a special communication protocol. The programming mode can set functions and adjustment parameters of the radio via the PC programming software (including user version and factory version).

Wired Clone Mode

Description

The wired clone mode is a separate mode. To enter other modes, the radio must be turned off and back on.

The wired clone mode is classified into user wired clone mode and factory wired clone mode.

User Wired Clone Mode

Connect the two radios with the cloning cable. Power on the mother radio while holding down SK2 on it. The radio enters the wired clone mode in two seconds. Power on the slave radio directly and the radio enters the user mode. The user wired clone mode clones the parameter data in EEPROM of the mother radio into that of the slave radio. The transferred data only includes channel data and shared setting parameters, excluding adjustment parameters, model version information, serial number, etc.

Factory Wired Clone Mode

Short connect the SELF pin of the mother radio's MCU and connect the two radios with the cloning cable. Power on the mother radio while holding down SK2 on it. The radio enters the wired clone mode in two seconds. Power on the slave radio directly and the radio enters the user mode. The transferred data includes all data (excluding the serial number) in EEPROM and the switch icon of the manual adjustment inhibit.

Process

Wired Clone

1. LED flashes orange once when the mother radio enters the wired clone mode. Press SK2 to

clone data into the slave radio.

2. During communication, LED of the mother radio flashes red, while LED of the slave radio flashes green. When the communication is completed, red LED of the mother radio and green LED of the slave radio go out, preparing for the next cloning.
3. During communication, if an exception occurs, the communication will be terminated. Red LED of the mother radio goes out, preparing for the next cloning.
4. When the communication is completed, the mother radio returns to the preparing status. Press SK2 to clone again.

Manual Adjustment Mode

Power on the radio while holding down PTT and SK2 simultaneously. The radio enters the manual adjustment mode

Note: The operation is controlled by the switch of Manual Adjustment Inhibit in the programming software. When the adjustment function is disabled, the radio can not enter the mode. This can prevent users' accidental entry and parameter changing, which will affect radio performances

During production, turn off the adjustment switch to avoid users' accidental entry and from changing adjustment values after the values are adjusted. The adjustment values can only be reset in the production setting mode and are adjusted again according to the requirements. However, they can not be changed in any other mode.

Adjustment Description

Enter Manual Adjustment Mode

Hold down PTT and SK2 simultaneously for two seconds at least to power on the radio. Orange LED (red LED + green LED) lights, indicating the entry into the adjustment mode. Release the keys to enter the N item (N is dependant on the location of the channel selector knob) of the Tx adjustment items in the adjustment mode. The radio stays at the Tx adjustment items by default and LED glows red.

Note: The CH15 adjustment item is invalid, while CH16 is used to toggle between Tx adjustment items and Rx adjustment items. If the channel selector knob locates at CH15 or CH16, LED glows neither red nor green.

Switch between Tx Adjustment Items and Rx Adjustment Items

Rotate the channel selector knob to CH16. Hold down PTT for 1.5s at least to toggle between Tx

adjustment items and Rx adjustment items. If LED lights red upon key pressing, the radio switches to Tx adjustment items. If LED lights green upon key pressing, the radio switches to Rx adjustment items.

LED glows red for Tx adjustment items.

LED glows green for Rx adjustment items.

Switch among Tx/Rx Adjustment Items

Switch via the channel selector knob.

Tx: CH1-CH14 indicate Tx preset power, Tx low power, Tx medium power, Tx high power, CDCSS deviation, CTCSS deviation (low), CTCSS deviation (medium), CTCSS deviation (high), VOX 1, VOX 2, VOX 3, VOX 4, VOX 5 and Tx low voltage threshold respectively.

Note: Tx medium power of TC-610/620 is not required to be adjusted. Please skip this item.

LED glows red for the adjustment items CH1-CH14.

CH15 is invalid and red LED goes out.

Rx: CH1-CH8 indicate SQL ON 1, SQL ON 5, SQL ON 9, SQL OFF 1, SQL OFF 5, SQL OFF 9, Rx low voltage threshold and Rx bandpass filter respectively.

LED glows green for the adjustment items CH1-CH8.

CH9-CH15 are invalid and green LED goes out.

Wide/Narrow Band Switch in an Adjustment Item

In an adjustment item, hold down the PTT key for 1.5s at least. LED flashes orange, indicating the long key pressing is valid. Release the key and the radio switches between wide band and narrow band periodically. After the wide/narrow band switch, the adjustment point is regarded as the first frequency of the current band by default.

Frequency Switch in a Band of an Adjustment Item

In a band of an adjustment item, short press the PTT key for less than 1.5s. LED flashes green, indicating the short key pressing is valid. The radio switches frequencies one after another.

Plus-Minus of the Adjustment Value in a Band of an Adjustment Item

In a band of an adjustment item, short press SK1, and the adjustment value increases in step of 1. Hold down SK1, and the adjustment value increases continuously in step of 1. When the adjustment value gets to the maximum value allowed by the adjustment item, the adjustment value will keep the maximum value constant.

In a band of an adjustment item, short press SK2, and the adjustment value decreases in step of 1.

Hold down SK1, and the adjustment value decreases continuously in step of 1. When the adjustment value gets to the minimum value allowed by the adjustment item, the adjustment value will keep the minimum value constant.

Process on Several Exceptional Items

Tx: CH9-CH14 indicate VOX 1, VOX 2, VOX 3, VOX 4, VOX 5 and Tx low voltage threshold respectively, which are related with the AD sampling. After the above adjustment items are entered, press SK1 or SK2 to start the AD sampling (including calculation process) once. Rotate the channel selector knob to save the current AD sampling value. If SK1 or SK2 is not pressed, the AD sampling is not started and the previous adjustment values can not be updated.

Rx: CH1-CH8 indicate SQL ON 1, SQL ON 5, SQL ON 9, SQL OFF 1, SQL OFF 5, SQL OFF 9 and Rx low voltage threshold respectively, which are related with the AD sampling. After the above adjustment items are entered, press SK1 or SK2 to start the AD sampling (including calculation process) once. Rotate the channel selector knob to save the current AD sampling value. If SK1 or SK2 is not pressed, the AD sampling is not started and the previous adjustment values can not be updated.

Key Description

Short Press: key pressing time is less than 1.5s.

Long Press: key pressing time is 1.5s at least.

Description of Adjustment Items

TC-610/620 Adjustment Items											
Channel	Adjustable Freq.	Wide					Narrow				
		Freq. 1	Freq. 2	Freq. 3	Freq. 4	Freq.5	Freq. 1	Freq. 2	Freq. 3	Freq. 4	Freq. 5
Tx Section											
1	Adjust preset RF power			Y							
2	Tx low power	Y	Y	Y	Y	Y					
3	Reserved channel (not adjust)										
4	Tx high power	Y	Y	Y	Y	Y					
5	CDCSS deviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	CTCSS (67Hz) deviation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	CTCSS (151.8Hz) deviatior	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	CTCSS (254.1Hz) deviatior	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	VOX gain1			Y							
10	VOX gain2			Y							
11	VOX gain3			Y							
12	VOX gain4			Y							
13	VOX gain5			Y							
14	Tx low voltage threshold			Y							
Rx Section											
1	Carrier SQL level 1 ON	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Carrier SQL level 5 ON	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Carrier SQL level 9 ON	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Carrier SQL level 1 OFF	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	Carrier SQL level 5 OFF	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	Carrier SQL level 9 OFF	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	Tx low voltage threshold			Y							
8	Bandpass filter	Y	Y	Y	Y	Y					
	Note: Y indicates the valid adjustment frequency. The residual channels are idle and has no adjustment items.										

Switch between Tx Adjustment Items and Rx Adjustment Items

Rotate the channel selector knob to CH16. Long press the PTT key for 1.5s at least to toggle between Tx adjustment items and Rx adjustment items. If LED lights red upon key pressing, the radio switches to Tx adjustment items. If LED lights green upon key pressing, the radio switches to Rx adjustment items.

LED glows red for Tx adjustment items.

LED glows green for Rx adjustment items.

Wide/Narrow Band Switch and Frequency Switch in an Adjustment Item

In an adjustment item, long press the PTT key for 1.5s at least to switch between wide band and narrow band periodically. The adjustment point is regarded as the first frequency of the current band by default. Short press the PTT key for less than 1.5s to switch frequencies periodically.

Adjustment Items

Tx

Tx frequency tolerance, VCO lock voltage adjustment, maximum deviation and modulation sensitivity

Note: These items are adjusted outside the adjustment mode (unnecessary to enter the adjustment mode) via the hardware adjustment.

Tx low power, Tx high power, CDCSS waveform, CDCSS deviation, CTCSS deviation (low), CTCSS deviation (high) and Tx low voltage threshold

Note: These items are adjusted inside the adjustment mode via the software adjustment.

Rx

VCO lock voltage adjustment (outside the mode), squelch, Rx bandpass filter, Rx low voltage threshold

Specific Operations and Requirements

Conventional Adjustment Items (outside the adjustment mode): Tx frequency tolerance, VCO voltage adjustment, maximum deviation, modulation sensitivity.

Note: The configuration file has preset CH1, CH2 and CH3 as wide band with low, medium and high frequency respectively and CH4, CH5 and CH6 as narrow band with low, medium and high frequency respectively. Make sure the antenna or load is connected before adjusting.

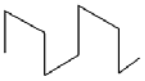
Adjustment Item	Condition	Measurement		Adjustment		Specifications/ Remarks
		Test Equipment	Test Point	Part	Method	
Tx frequency tolerance	Rotate to CH2. Press PTT to transmit.	Radio communication test set	Antenna	VR300	Adjust VR300 with a ceramic alignment screwdriver to limit the center frequency to the error range.	≤150Hz
Tx VCO lock voltage	Rotate to CH1. Press PTT to transmit.	Digital voltmeter	CV	TC100	Adjust TC100 with a ceramic alignment screwdriver until the lock voltage is within the required range.	0.7V（+0.1V）
	Rotate to CH3. Press PTT to transmit.				Check	≥2.3V
Rx VCO lock voltage	Rotate to CH1.			TC101	Adjust TC101 with a ceramic alignment screwdriver until the	0.7V（+0.1V）

						lock voltage is within the required range.	
		Rotate to CH3.				Check	≥2.3V
Max. Deviation	Wide	Rotate to CH1, CH2 and CH3 respectively. Press PTT to transmit.	Radio communication test set LPF: 15kHz AF:1kHz 150mV	Antenna Earpiece jack	VR200	Adjust VR200 with a ceramic alignment screwdriver to limit the deviation to the specified range.	3.7-4.3KHz
	Narrow	Rotate to CH4, CH5 and CH6 respectively. Press PTT to transmit.				Check	1.7-2.2KHz
Modulation Sensitivity	Wide	Rotate to CH1, CH2 and CH3 respectively. Press PTT to transmit.	Radio communication test set BPF: 0.3-3KHz AF: 1KHz			Adjust the audio output signal of the radio communication test set to get the deviation to 3.0KHz.	10-20mV
	Narrow	Rotate to CH4, CH5 and CH6 respectively. Press PTT to transmit.				Adjust the audio output signal of the radio communication test set to get the deviation to 1.5KHz.	10-20mV

Adjustments in the adjustment mode

Note: The antenna or load must be connected before adjusting.

Adjustment Item		Condition	Measurement		Adjustment		Specifications/ Remarks
			Test Equipment	Test Point	Parts	Method	
Tx Power	High	Rotate to CH4. Press PTT to enable the function. Low frequency	Radio communication test set Ammeter	Antenna port	SK1 SK2	Press SK1/SK2 to increase/decrease the output power and rotate the channel selector knob to save.	4.5-5W I≤1.7A
		Short press PTT to switch frequencies periodically (refer to the adjustment list)					

	Low	Rotate to CH2. Press PTT to enable the function. Low frequency Short press PTT to switch frequencies periodically (refer to the adjustment list)				Press SK1/SK2 to increase/decrease the output power and rotate the channel selector knob to save.	2W±0.3W I≤1.2A
CDCSS Waveform		Rotate to CH5. Press PTT to enable the function. Low frequency	Radio communication test set LPF:0.3KHz	Antenna	VR260	Adjust VR260 with a ceramic alignment screwdriver to enable the waveform approximate to the rectangular wave.	
		Short press PTT to switch frequencies periodically and long press PTT to switch between wide band and narrow band.				Check	
CDCSS Deviation	Wide	Rotate to CH5. Press PTT to enable the function. Wide band Low frequency			VR601 SK1 SK2	Adjust VR601 with a ceramic alignment screwdriver check each frequency. Adjust finely with SK1 and SK2 to limit the CDCSS deviation to the required range if necessary.	500-800Hz
		Press PTT to switch other frequencies (medium-low, medium, medium-high and high)					
	Narrow	Long press PTT (≥1.5s) to enter narrow band.				Check	300-500Hz

		Low frequency Press PTT to switch other frequencies (medium-low, medium, medium-high and high)					
CTCSS Deviation	Wide	Rotate to CH6, CH7 and CH8 respectively and CTCSS is set to low, medium and high. Press PTT to enable this function. Wide band Short press PTT to switch frequencies on each channel.	Radio communication test set LPF:0.3KHz	Antenna	VR601 SK1 SK2	Adjust VR601 with a ceramic alignment screwdriver and check each frequency. Adjust finely with SK1 and SK2 to limit the CTCSS deviation to the required range if necessary.	500-800Hz
	Narrow	Long press PTT (≥1.5s) to enter narrow band on CH6, CH7 and CH8 and short press PTT to switch frequencies.				Check	300-500Hz
Low Tx Voltage Threshold			Digital voltmeter	Power supply port	Power supply	Adjust the output voltage of the power supply and check the alarm level	6.2V-7.0V(≤7.0V: LED flashes; ≤6.2V: the alarm tone sounds and transmission suspended)
Low voltage Power-Off Level			Digital voltmeter	Power supply port	Power supply	Adjust the output voltage of the power supply and check the power-off level	<5.80V

Item		Condition	Test Equipment	Parts		Method	Specification/ Remarks
Rx Sensitivity (bandpass)		Rotate to CH8. Low frequency Short press PTT to switch other frequencies.	Radio communication test set SSG:-119dB MOD:1KHz DEV:3.0KHz Filter: 0.3-3KHz	Antenna Remote speaker MIC jack	SK1 SK2	Check whether SINAD is within the range and whether to get SINAD≥12dB by adjusting SK1 or SK2. Rotate the channel selector knob to save after the five-point adjustment is completed.	Adjust the volume control knob to the right place, which will not limit the output. SINAD≥12dB
SQL ON	Wide	Rotate to CH2 and SQL is set to level 5 ON. Press SK1 or SK2 to enable the function. The channel spacing is wide band. Low frequency Short press PTT to switch frequencies.	Radio communication test set SSG:-119dB MOD:1KHz DEV:1.5KHz Filter: 0.3-3KHz	Antenna Remote speaker MIC jack	SK1 SK2	Adjust the output signals of SSG to the squelch level. Rotate the channel selector knob to save after the five-point adjustment is completed.	SQL level: -119±1dB
	Narrow	Long press PTT (≥1.5s) to enter narrow band. Press SK1 or SK2 to enable this function. Short press PTT to switch frequencies.				Adjust the output signals of SSG to the squelch level. Rotate the channel selector knob to save after the five-point adjustment is completed.	SQL level: -118±1dB

SQL OFF	Wide	Rotate to CH5 and SQL is set to level 5 OFF. Press SK1 or SK2 to enable the function. The channel spacing is wide band. Low frequency Short press PTT to switch frequencies.	Radio communication test set SSG:-121dBm	Antenna Remote speaker MIC jack	SK1 SK2	Adjust the output signals of SSG to the squelch level. Rotate the channel selector knob to save after the five-point adjustment is completed.	SQL level: -121±1dB
	Narrow	Long press PTT (≥1.5s) to enter narrow band. Press SK1 or SK2 to enable this function. Short press PTT to switch frequencies.	Radio communication test set SSG:-120dBm	Antenna Remote speaker MIC jack	SK1 SK2	Adjust the output signals of SSG to the squelch level. Rotate the channel selector knob to save after the five-point adjustment is completed.	SQL level: -120±1dB
Rx Low Voltage Threshold			Digital voltmeter	Power supply port	Power supply	Adjust the output voltage of the power supply and check the alarm level (LED flashes red and the alarm tone sounds)	≤6.50V
Low Voltage Power-Off Level						Adjust the output voltage of the power supply and check the power-off level.	<5.80V

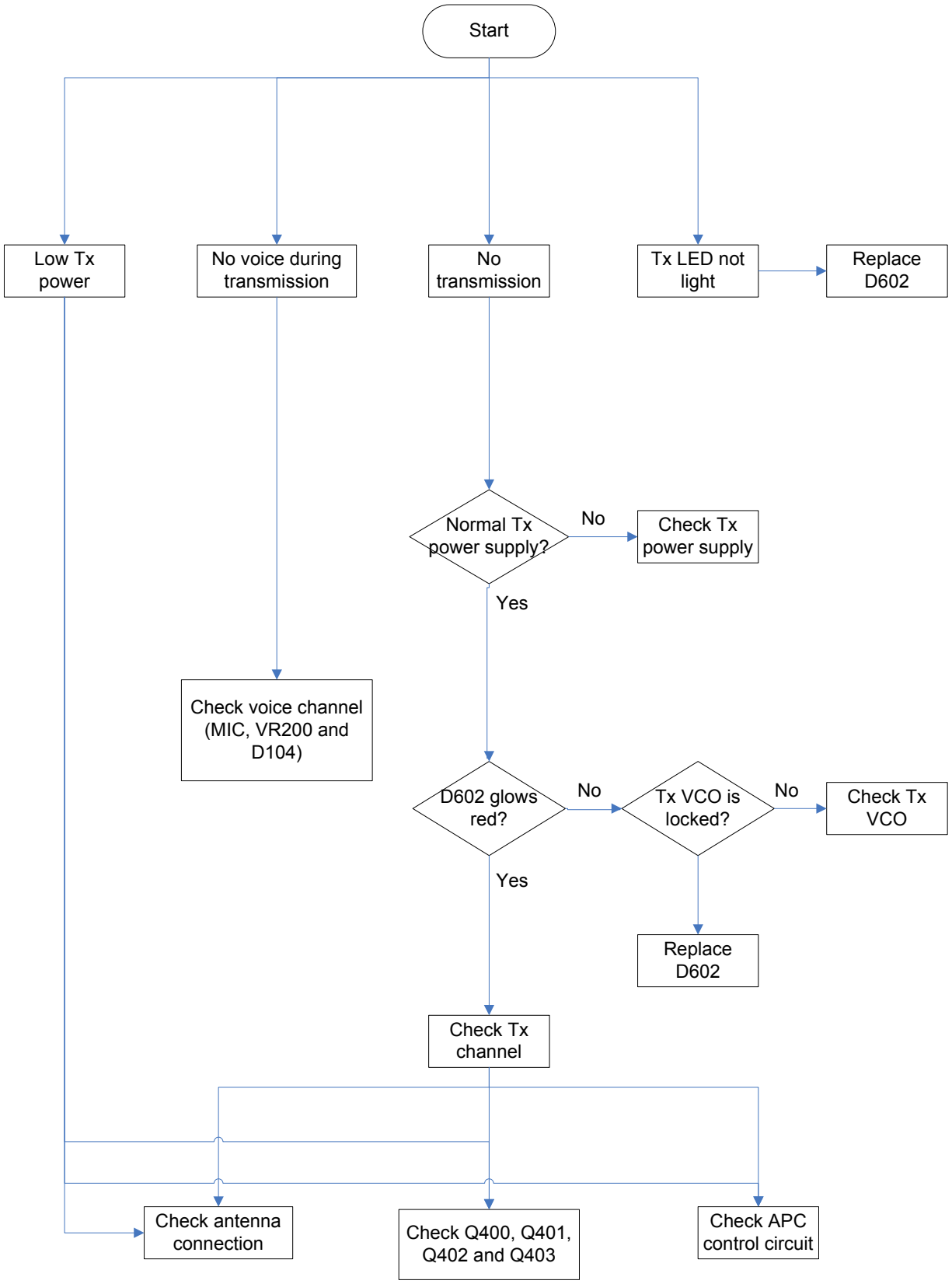
Appendix: Reference Voltage Setting of Battery Capacity

Check in transmitting mode		
Green LED (70%-100%)	>7.35V	18min
Orange LED (50%-70%)	7.15V - 7.35V	12min
Red LED (30%-50%)	7.00V - 7.15V	12min
LED flashes red	6.20V - 7.00V	18min
LED flashes red +an alarm tone sounds every 10	5.80V - 6.20V	
Halt	<5.80V	

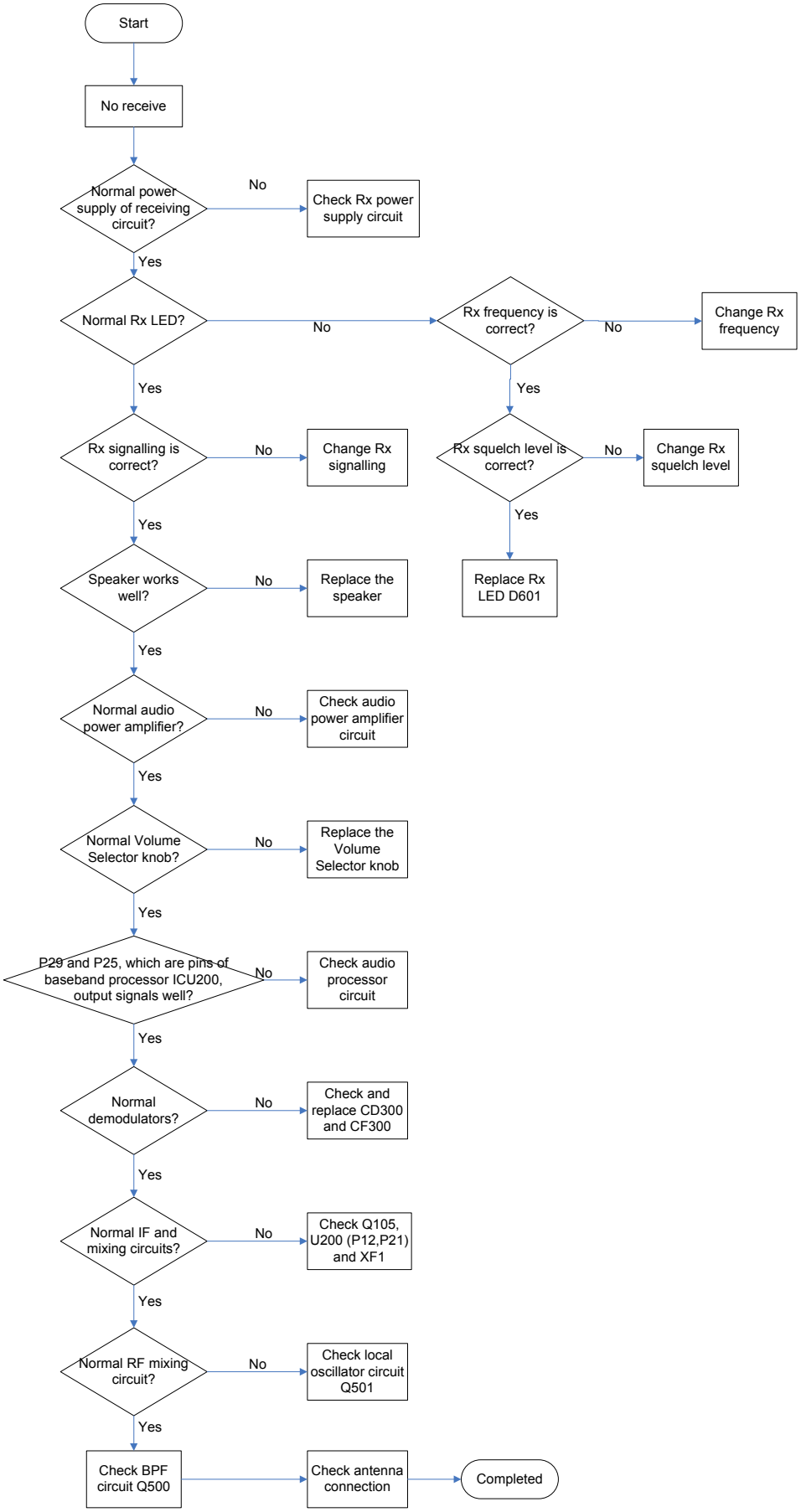
Check in transmitting and standby mode (or press the battery capacity check key.		
Green LED (70%-100%)	>7.55V	18min
Orange LED (50%-70%)	7.35V-7.55V	12min
Red LED (30%-50%)	7.00V-7.35V	20min
LED flashes red (<30%)	6.50V-7.00V	18min
LED flashes red +an alarm tone sounds every 10 seconds.	5.80V-6.50V	
Halts	<5.80V	

Troubleshooting Flow Chart

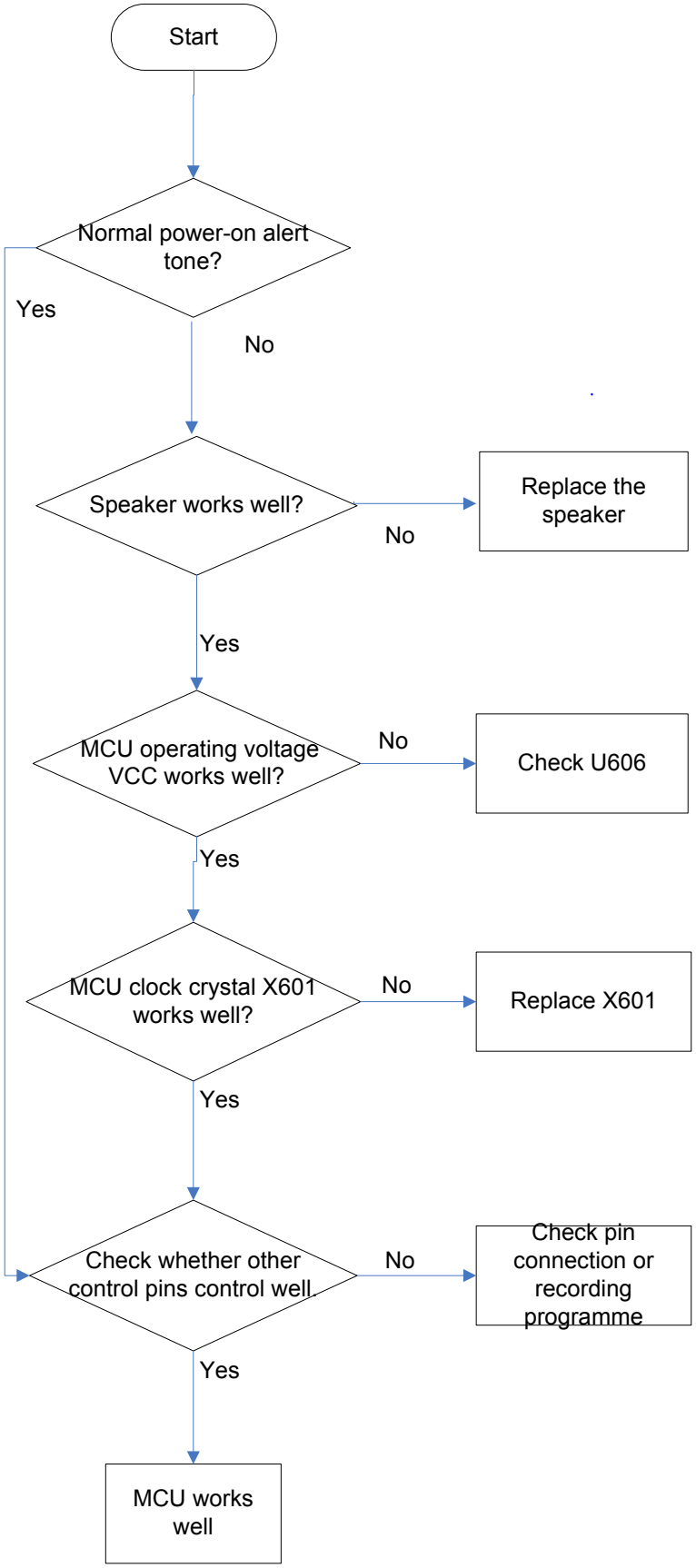
Tx Section



Rx Section


Start
No receive
Normal power supply of receiving circuit?
No
Check Rx power supply circuit
Yes
Normal Rx LED?
No
Rx frequency is correct?
No
Change Rx frequency
Yes
Yes
Rx signalling is correct?
No
Change Rx signalling
Rx squelch level is correct?
No
Change Rx squelch level
Yes
Yes
Speaker works well?
No
Replace the speaker
Replace Rx LED D601
Yes
Normal audio power amplifier?
No
Check audio power amplifier circuit
Yes
Normal Volume Selector knob?
No
Replace the Volume Selector knob
Yes
P29 and P25, which are pins of baseband processor ICU200, output signals well?
No
Check audio processor circuit
Yes
Normal demodulators?
No
Check and replace CD300 and CF300
Yes
Normal IF and mixing circuits?
No
Check Q105, U200 (P12,P21) and XF1
Yes
Normal RF mixing circuit?
No
Check local oscillator circuit Q501
Yes
Check BPF circuit Q500
Check antenna connection
Completed

MCU


Start
Normal power-on alert tone?
Yes
No
Speaker works well?
No
Replace the speaker
Yes
MCU operating voltage VCC works well?
No
Check U606
Yes
MCU clock crystal X601 works well?
No
Replace X601
Yes
Check whether other control pins control well.
No
Check pin connection or recording programme
Yes
MCU works well

Disassembly and Assembly

Attaching the Battery

① Hold the battery and push it towards the top of the aluminum chassis under the belt clip of the radio. See figure 1.

Note: Insert the tabs at the top of the battery into the top of the battery slots.

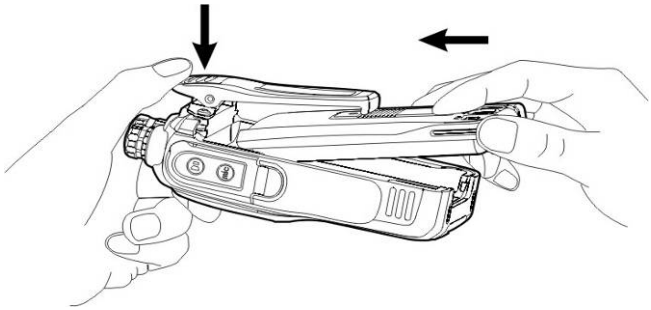


Figure 1

② Press the bottom of the battery until a “click” is heard to fasten the battery on the bottom of the radio. See figure 2.

Note: If the battery is not fastened or is still adrift, please remove the battery and attach it again.

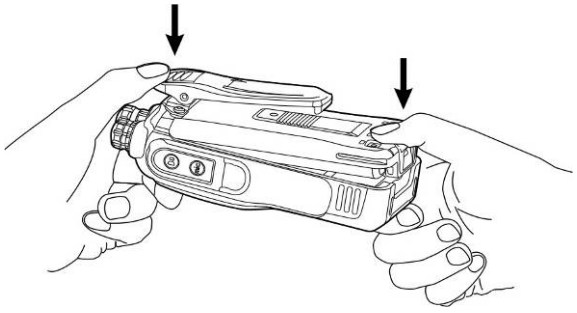


Figure 2

Removing the Battery

① Turn off the radio. Hold the upper side of the radio and press the belt clip until it tilts. Push the battery latch upwards along the slot of the battery latch at the bottom of the battery. See figure 1.

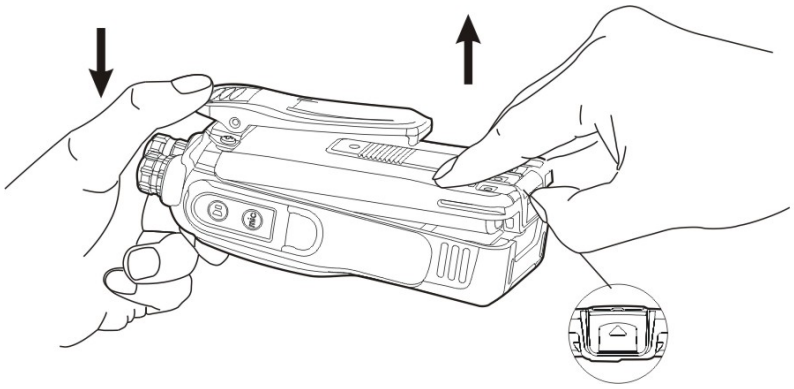


Figure 1

② Release the battery latch and remove the battery when the bottom of the battery tilts. See figure 2.

Note: To avoid serious abrasion between the tab on the top of the battery and the slot on the top of the radio, the angel between the radio unit and the tilting battery must not be too large.

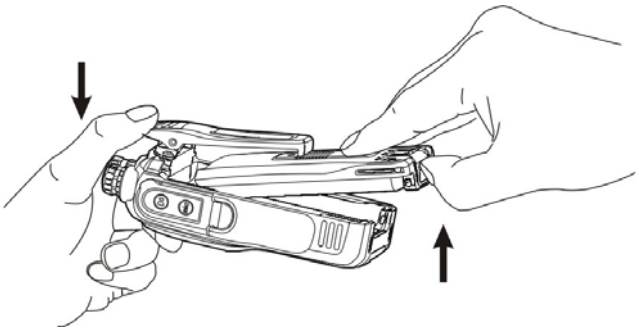


Figure 2

Attaching the Antenna

① Insert the threaded end of the antenna into the big threaded hole at the top of the radio.

② Rotate the antenna clockwise until it is fastened.

Removing the Antenna

Rotate the antenna counter-clockwise to remove the antenna.

Attaching the Belt Clip

Loose the screw for the belt clip and fix the belt clip on the radio unit. Align the hole on the belt clip with that on the aluminum chassis and rotate the screw for the belt clip clockwise to fasten the clip. See figure 1.

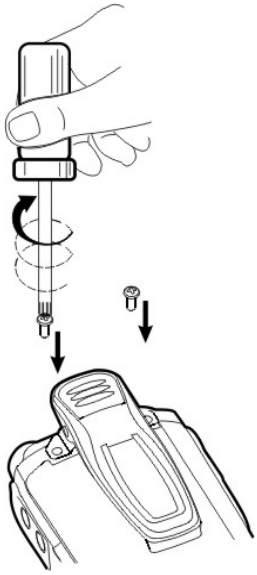


Figure 1

Removing the Belt Clip

Please refer to the steps for attaching the belt clip when removing the belt clip. Loose the screw by rotating it counter-clockwise. See figure 2.

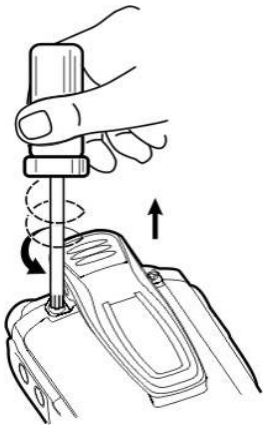


Figure 2

Attaching the External Earphone/Microphone

① Open the earphone/microphone jack cover (unnecessary to remove). See figure 1.

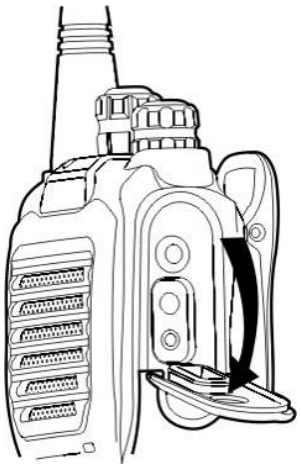


Figure 1

② Plug the earphone/microphone into the jack and fasten the screw. See figure 2.

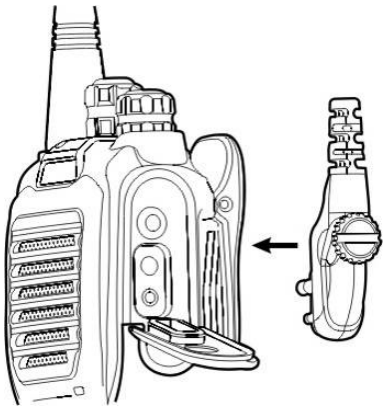


Figure 2

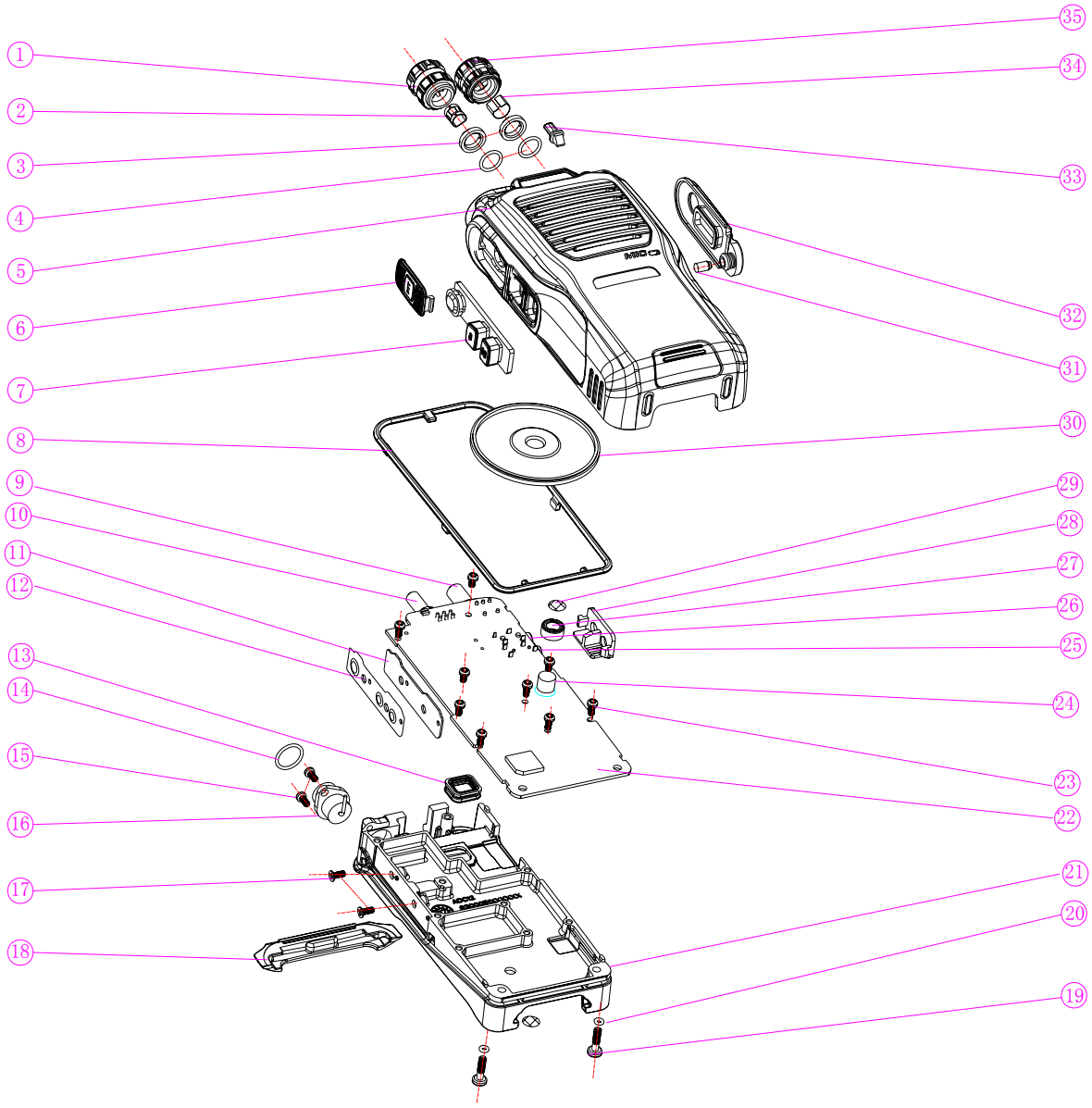
Removing the External Earphone/Microphone

Loose the screw and unplug the earphone/microphone.

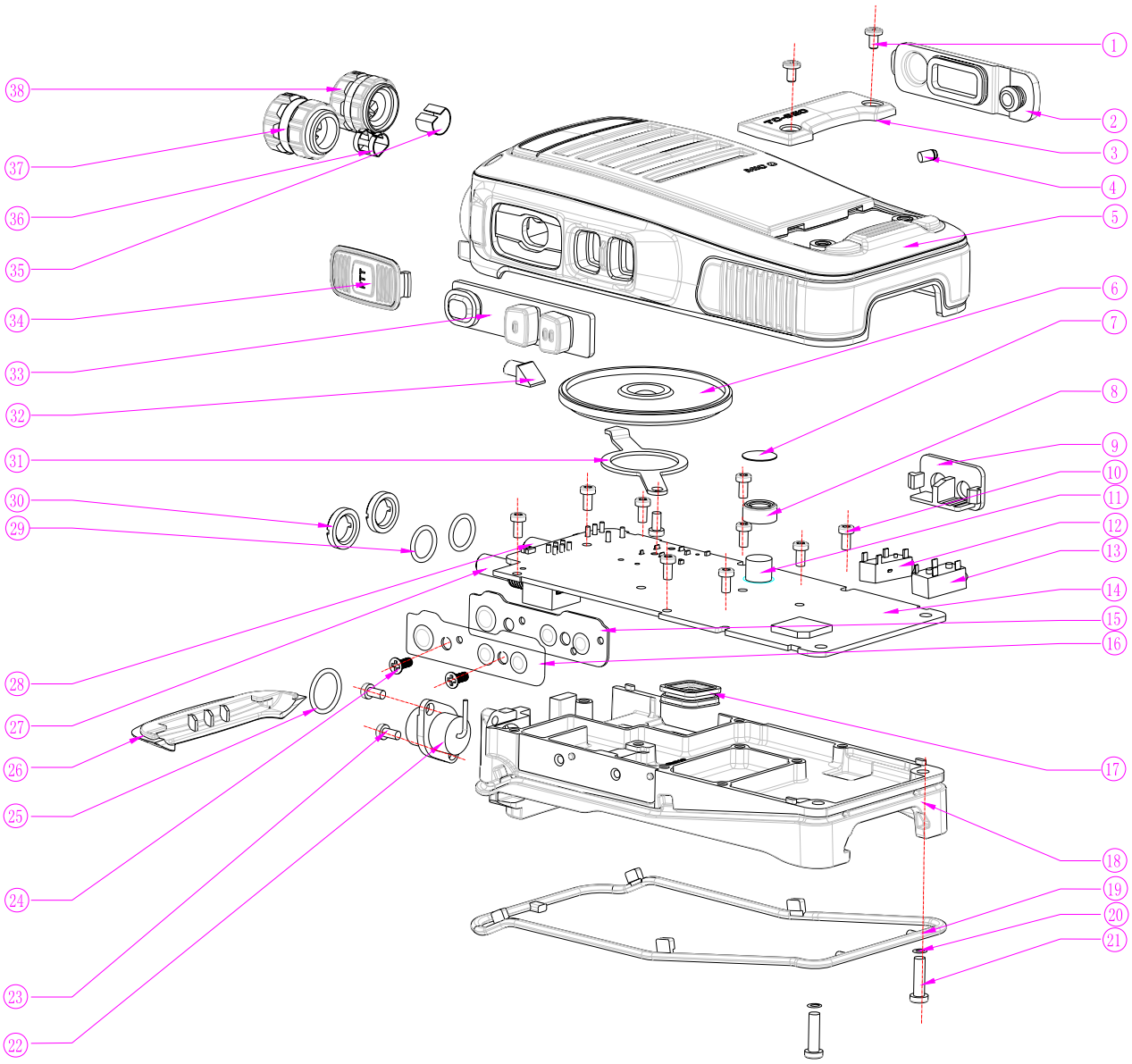
Note: When the external earphone/microphone is used, the radio's waterproof performance will be affected.

Exploded View

TC-610



TC-620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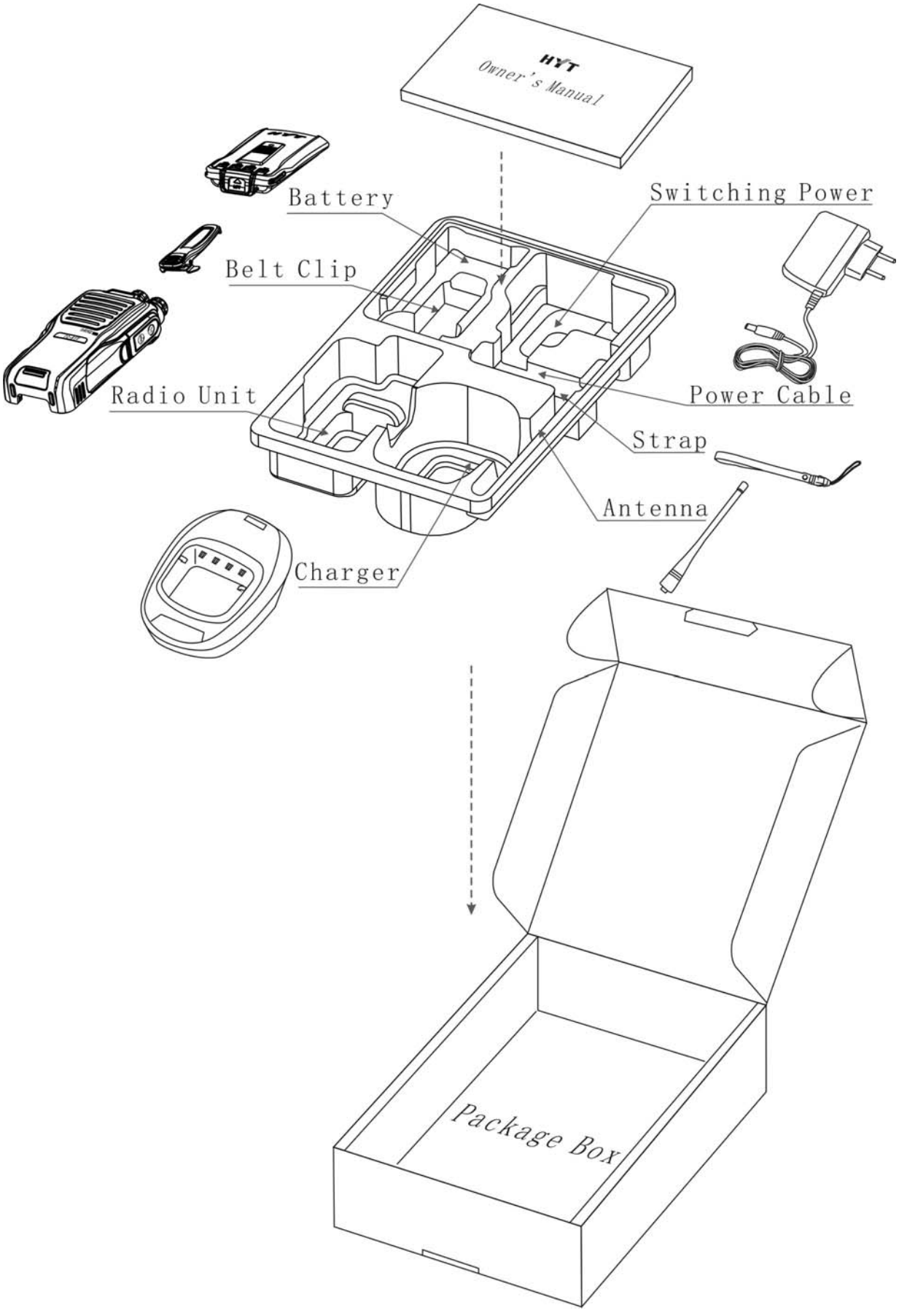
TC-610/620 Parts List 2

TC-610

No.	Material No.	Description	Qty.
1	6000631000000	Volume control knob	1
2	6201006000000	Inner liner knob	1
3	7207002200200	Nut	2
4	6100325000000	O-RING (knob)	2
5	1500006100000	Front case kit	1
6	6000634000000	Plastic PTT key	1
7	6100312000000	Silica rubber PTT key	1
8	6100307000000	Waterproof ring (main unit)	1
9	4303020000020	Volume control knob	1
10	4304030000010	Gray-code range switch	1
11	6100314000000	Waterproof ring (battery connector)	1
12	6100246000000	O_RING (antenna)	1
13	7102504000300	Machine screw	2
14	4400100008000	SMA-connector	1
15	4100510300000	PCB (PTT key)	1
16	7300029000000	Metal dome (3-key)	
17	7102005000000	Machine screw	2
18	6000627000000	Rear cover (radio unit)	1
19	7102508000000	Machine screw	2
20	7400216000000	TC-610 waterproof PC sheet	2
21	6300051000000	Aluminum chassis	1
22	4100610100000	PCB (main board)	1
23	7102004020100	Self-tapping screw	9
24	5002220000050	MIC	1
25	5205000000190	Earpiece jack	1
26	5205000000280	Speaker jack	1
27	6100123000000	MIC cover	1
28	6100323000000	Holder (speaker jack)	1
29	7400184000000	Waterproof mic net	2
30	5001210000030	Speaker	1
31	6000127000000	Earpiece cover stopper	1
32	6000635000000	Earpiece cover	1
33	6000640000000	Light guide	1
34	6201066000000	Inner liner knob	1
35	6000630000000	Channel selector knob	1

No.	Material No.	Description	Qty.
1	7102003500100	Machine screw	2
2	6000639000000	Earpiece cover	1
3	6300040000000	Decorative plate (zinc alloy)	1
4	6000127000000	Earpiece cover stopper	1
5	1500006200000	Front case kit	1
6	5001210000170	Speaker	1
7	7400141000000	NSM08Z01mic net	2
8	6100123000000	MIC cover	1
9	6100323000000	Holder (speaker jack)	1
10	7102004021030	Self-tapping screw ST2.0*3.8mm	10
11	5002220000050	MIC	1
12	5205000000280	Speaker jack	1
13	5205000000190	Earpiece jack	1
14	4100610100000	PCB (main board)	1
15	4100510300000	PCB (PTT key)	1
16	7300029000000	Metal dome (PTT key) (3-key)	1
17	6100314000000	Waterproof ring (battery connector)	1
18	6300051000000	Aluminum chassis	1
19	6100307000000	Waterproof ring (radio unit)	1
20	7400216000000	Waterproof transparent PC sheet	2
21	7102508000000	Machine screw M2.5*8.0mm	2
22	4400100008000	SMA-connector	1
23	7102504000300	Machine screw M2.5*4.0mm	2
24	7102005000000	Machine screw M2.0*5.0mm	2
25	6100246000000	O_RING (antenna)	1
26	6000629000000	Rear cover (radio unit)	1
27	4303020000020	Volume control knob	1
28	4304030000010	Gray-code range switch	1
29	6100325000000	O-RING (channel selector knob)	2
30	7207002200200	Nut M7.0*2.2mm	2
31	6201545000000	Speaker tablet	1
32	6000624000000	Light guide	1
33	6100312000000	Silica rubber PTT key	1
34	6000634000000	Plastic PTT key	1
35	6201006000000	Inner liner knob	1
36	6201066000000	Inner liner knob	1
37	6000631000000	Volume control knob	1
38	6000630000000	Channel selector knob	1

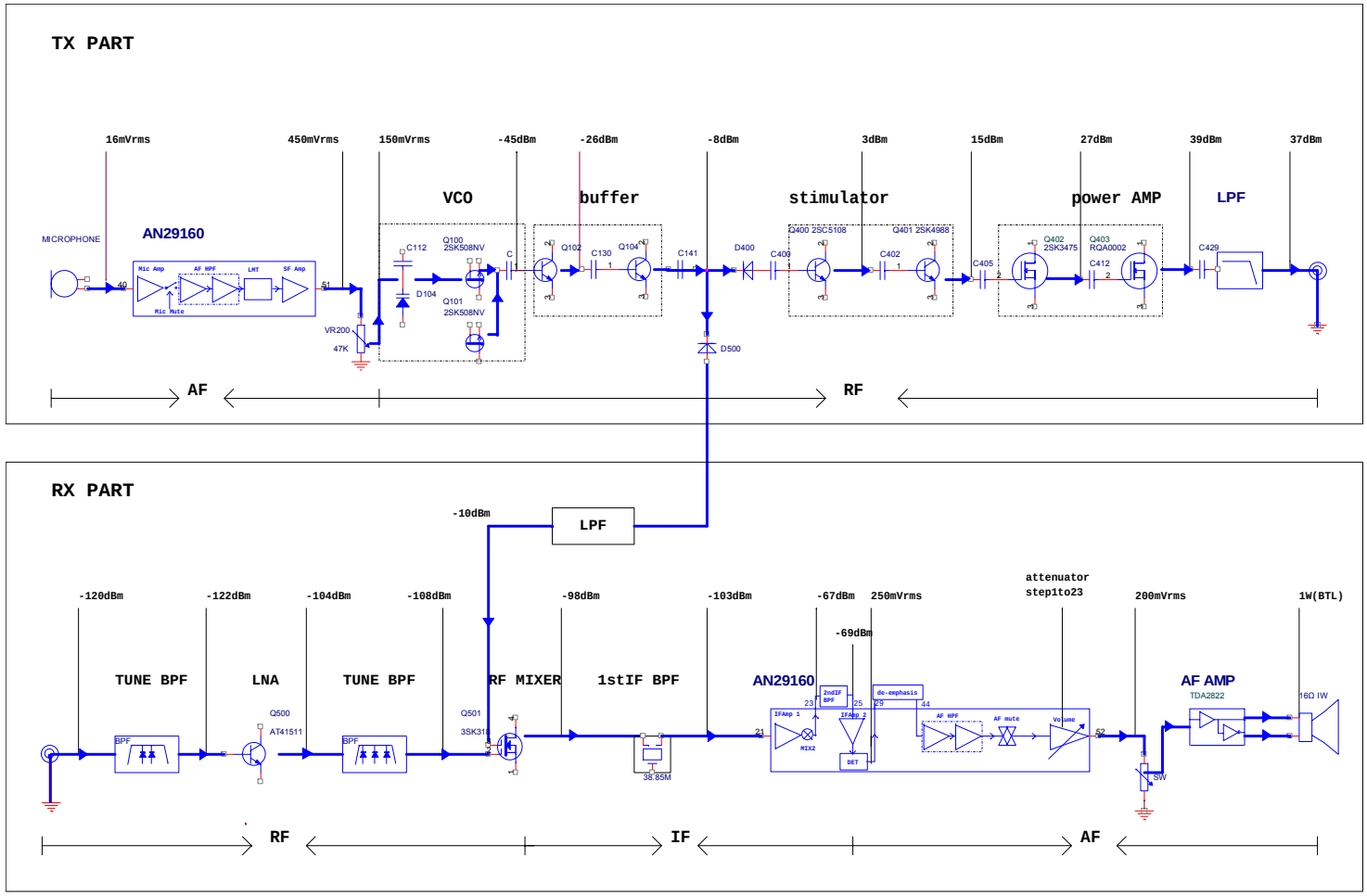
Packing


HYT
Owner's Manual
Battery
Switching Power
Belt Clip
Radio Unit
Power Cable
Strap
Antenna
Charger
Package Box

TC-610/620 PCB View

TC-610/620 Block Diagram

TC-610/620 Level Diagram



TC-610/620 Schematic Diagram

Specifications

General	
Frequency Range	146－174 MHz 400－420 MHz 450－470 MHz
Channel Capacity	16
Channel Spacing	25/12.5 MHz
Operating Voltage	7.5V DC
Battery Life （5-5-90 Duty Cycle）	About 8 hours
Operating Temperature	-20～+50℃
Dimensions (H×W×D)	TC-610:119mm x 54.6mm x 32.5mm (without antenna) TC-620:117mm x 54.3mm x 31mm (without antenna)
Weight	TC-610: 270g (with antenna) TC-620: 275g (with antenna)
Frequency Stability	±2.5ppm
Receiver	
Sensitivity	-119dBm/-118dBm
Adjacent Channel Selectivity	≥65(W)/55(N)
Intermodulation	≥60dB
Spurious Response Rejection	≥65dB
Audio Power Output	1200mW
Transmitter	
RF Power Output	5±0.5W(H)/2.0±0.3W(L)
Spurious and Harmonics	<1GHz: -36dBm/>1GHz: -30dBm
Modulation Limitation	5 KHz/2.5KHz
FM Noise	40dB(W)/35dB(N)
Modulation Distortion	≤5%

All Specifications are tested according to TIA/EIA-603, and subject to change without notice due to continuous development.

HYT endeavors to achieve the accuracy and completeness of this manual, but no warranty of accuracy or reliability is given. All the specifications and design are subject to change without prior notice due to continuous technology development. Changes which may occur after publication are highlighted by Revision History contained in Service Manual.