

# **HYT**

## **SERVICE MANUAL TWO-WAY RADIO**

# **TC-320**

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## **Introduction**

### **Manual Scope**

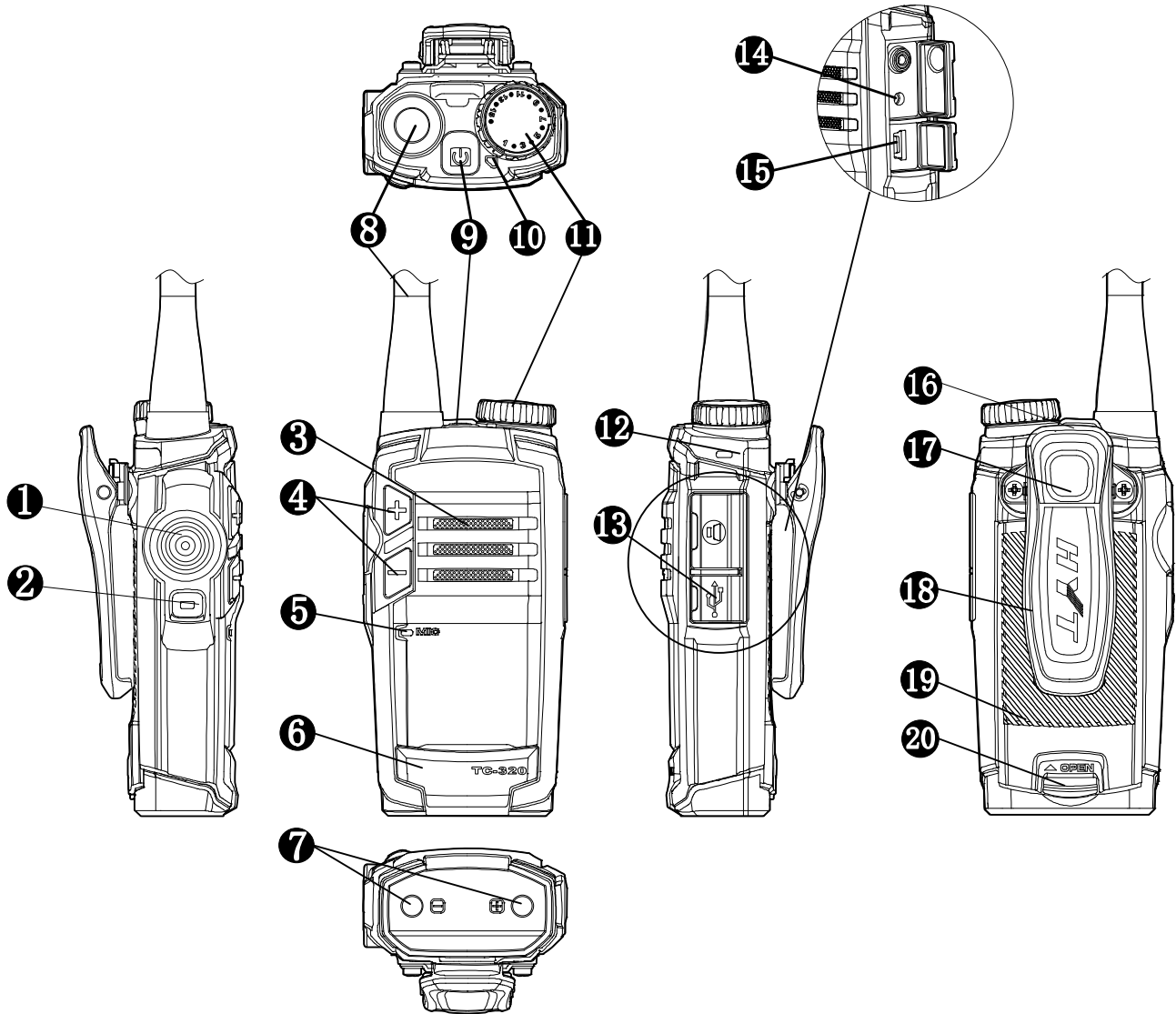
This manual is intended for use by experienced technicians familiar with similar types of communication equipment. It contains all service information required for the equipment and is current as of the publication date.

## **Safety Information**

The following safety precautions shall always be observed during operation, service and repair of this equipment.

- ◇ This radio shall be serviced by qualified technicians only.
- ◇ Only use HYT supplied or approved batteries and chargers.
- ◇ To avoid electromagnetic interference and/or compatibility conflicts, turn off your radio in any area where posted notices instruct you to do so. Turn off your radio before boarding an aircraft. Any use of the radio must be in accordance with airline regulations or crew instructions.
- ◇ 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.
- ◇ Turn off your radio prior to entering any area with explosive and flammable materials.
- ◇ Do not charge or replace your battery in a location with explosive and flammable materials.
- ◇ Turn off your radio before entering a blasting area.
- ◇ Do not use any portable radio that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn may result.
- ◇ Do not expose the radio to direct sunlight for a long time, nor place it close to a heating source.
- ◇ When transmitting with a portable radio, hold the radio in a vertical position with the microphone 2.5 to 5.0 centimeters (one to two inches) away from your lips. Keep antenna at least 2.5 centimeters (one inch) away from your body when transmitting.
- ◇ If you wear a portable radio on your body, ensure that the antenna is at least 2.5 centimeters (one inch) away from your body when transmitting.

## **Radio Overview**



(1) PTT(Push-to-Talk) Key	(2) SK(Programmable key)	(3) Speaker	(4) Volume Control Keys [+] / [-]
(5) Microphone	(6) Nameplate	(7) Charging Terminal	(8) Antenna
(9) Power On/Off Key	(10) Channel/Status Indicator	(11) Channel Selector Knob	(12) Charge Indicator
(13) Accessory Jack Cover	(14) Audio Accessory Jack	(15) Mini USB Jack	(16) Strap Hole
(17) Screw of Belt Clip	(18) Belt clip	(19) Rear Cover	(20) Battery Latch

### PTT (Push-to-Talk) Key

Press and hold down the **PTT** key to transmit, and release it to receive.

**SK (Side Key)**

Side Key can be programmed with long/short press functions by your dealer. Note: Short Press means key press no longer than 1 second, and Long Press means key press longer than 1 second. )

**Channel/Status Indicator**

Status indications and alert tones are shown in the table below:

Operations/Functions		LED Indications and Alert Tones
Wired Clone	To enter Wired Clone mode	Hold down both <b>SK</b> and <b>Power On/Off Key</b> , and then the source radio is turned on with red LED flashing once. Turn on the target radio directly.
	Status of the source radio (After target radio is turned on and cloning cable is connected, press <b>PTT</b> of source radio to begin cloning.)	Red LED glows during cloning process. Error occurs during cloning: <ul style="list-style-type: none"> <li>a. User Clone: Once cloning begins, frequency band and Model ID will be checked. LED glows orange for 2 seconds and then goes out to indicate a failed check. If the check is successfully carried out but error occurs during cloning, LED will keep flashing orange until you press any key other than the <b>Power On/Off Key</b> to cancel it.</li> <li>b. Factory clone. If error occurs during cloning, LED will keep flashing orange until you press any key other than the <b>Power On/Off Key</b> to cancel it.</li> </ul> Once cloning is completed, green LED solidly glows. Red LED will flash if battery runs low when the radio is in Clone Mode, while the radio will make no response if battery runs low during cloning process.
	Status of the target radio	LED solidly glows green when cloning is in progress. Green LED goes out when cloning is completed.
Power On (to enter User Mode)		When the radio is turned on, an alert tone sounds and orange LED flashes once. When the radio is currently on a blank channel, it sounds beep

	tone continuously.
Power Off	When the radio is turned off, the power off alert tone is heard.
Low Battery Alert	LED flashes red, and a low-pitched tone sounds at intervals of 10 seconds.
Transmitting	Red LED solidly glows. When TOT timer expires, the radio sounds beep tone continuously. A TOT pre-alert tone sounds before TOT timer expires.
Receiving	LED glows green when carrier is present.
Scan	Green LED flashes once every 1 second, while scanning is in process. Scan Start Alert (programmable by the dealer): a beep is heard. Scan End Alert (programmable by the dealer): a beep is heard.
Writing/Reading Data	Red LED glows when reading data. Green LED glows when writing data.
VOX	One beep is heard when the VOX feature is activated. Two beeps are heard when the VOX feature is disabled.

**Channel Selector Knob**

Rotate the knob to select your desired channel.

**Power On/Off Key**

Long press the **Power On/Off Key** until an alert tone is heard to turn the radio on/off.

**Volume Control Keys [+] / [-]**

You may adjust the volume level through keys [+] / [-]. Press **[+]** to increase or **[-]** to decrease the volume level.

**Battery Latch**

Used to secure or remove the battery.

**Audio Accessory Jack**

Used to connect audio accessories such as earpiece and microphone.

**Mini USB Jack**

To connect accessories such as programming cable, cloning cable and switching power.

## **Software Specifications**

### **Description of Features**

1. Channel Capacity: 16
2. Channel Spacing: 12.5KHz
3. Channel Scan
4. Rx/Tx status indication (red/green LED)
5. CTCSS/CDCSS Encode&Decode (38 groups of CTCSS, 83 groups of CDCSS, and CTCSS Tail Revert of 180 degrees.)
6. Low Battery Alert
7. Battery Save
8. Unlock Detection and Emergency Alarm
9. Two Selectable Squelch Levels
10. Monitor
11. Time-out Timer (TOT)
12. Squelch Tail Elimination
13. PC Programming (manual/ automatic adjustment)
14. Busy Channel Lockout (transmission prohibited in busy status)
15. Wired Clone
16. Battery Strength Indicator
17. Manual Adjustment
18. VOX and Three Selectable Sensitivity Levels

### **Description of Modes**

#### **User Mode**

It is a conventional communication mode. After the radio is turned on, it enters the User Mode.

#### **PC Programming Mode**

The radio will enter PC Programming Mode through communication with PC programming software. In this mode, radio functions and adjustment parameters can be set through programming software (including User Version and Factory Version).

The operation procedures are as follows:

1. Install PC programming software and its driver dedicated for TC-320 before your initial use.



2. Connect the USB port of PC with the Mini USB jack of the radio using a programming cable.
3. Turn on the radio.
4. Launch the programming software to perform reading or writing operation.

Note:

1. When reading/writing data is in progress, red/green LED glows; when reading/writing data is completed, LED goes out.
2. During the operation, if any abnormal situation occurs or no reply is given within a period, the reading/writing operation will fail and an error message window will pop up.

## **Wired Clone Mode**

### 1. Description

Wired Clone Mode is an independent mode. To access other modes, you must restart the radio.

Wired Clone Mode covers User Clone mode and Factory Clone mode.

#### 1.1 User Clone Mode:

Connect two radios using a clone cable. Hold down both **SK** and **Power On/Off Key** of the source radio, it will be turned on and will enter User Clone Mode after 2 seconds. The target radio can be directly turned on to enter the mode. In this mode, parameter data stored in EEPROM of the source radio will be cloned to EEPROM of the target radio. The data transferred only covers channel data and common parameters, excluding adjustment data, version and serial No. of the model.

#### 1.2 Factory Clone Mode:

Connect two radios using a clone cable. Hold down both **SK** and **Power On/Off Key** of the source radio, it will be turned on and will enter User Clone Mode by default after 2 seconds. Press SK afterwards to switch to Factory Clone Mode. The target radio can be directly turned on to enter the mode. The data transferred covers all data in EEPROM other than serial No, with flag of manual adjustment switch included.

## 2. Process

Process of Wired Clone:

- 2.1 Red LED flashes once after the source radio enters Wired Clone Mode. Press **PTT** to clone data to the target radio.
- 2.2 During communication, the source radio glows red LED, and the target radio glows green LED. When communication ends, the source radio glows green LED and LED of the target radio

goes out, which indicates both radios are ready for another cloning.

2.3 If any abnormal situation occurs during communication, the source radio will flash orange LED and will stop communication for another cloning.

2.4 When the communication ends, the source radio goes back to standby status. Press **PTT** again to begin another cloning.

## **Manual Adjust Mode**

Hold down **PTT**, **SK** and **Power On/Off Key** to turn the radio on and to enter Manual Adjust Mode. (Note: This operation is subject to the option Panel Test Mode in the programming software. When this option is unchecked, the radio will be unable to enter the adjustment mode. It helps avoid change of parameters and degradation of radio performance caused by user's misoperations. )

Keep this option unchecked after values are well adjusted from factory, to avoid any unexpected change of values. The adjustment values can be reset and changed in Factory Mode only.

Description of adjustment:

### **1. To enter Manual Adjust Mode**

Hold down **PTT**, **SK** and **Power On/Off Key** until the radio is turned on and orange LED glows, the radio will enter Adjust Mode. When the keys are released, the radio will enter item N of Tx group (N depends on the position where the **Channel Selector Knob** locates). Red LED glows for adjustment of Tx group items and green LED glows for adjustment of Rx group items.

### **2. To switch between Tx group and Rx group**

This operation is done through the Channel Selector Knob.

Red LED solidly glows when adjusting items in Tx group.

Green LED solidly glows when adjusting items in Rx group.

### **3. To switch between items of Tx group/Rx group**

This operation is done through the Channel Selector Knob.

发射组: Tx group: CH1 stands for Tx Low Power, and CH3-CH9 stand for Tx High Power, CDCSS Balance, CDCSS Deviation, CTCSS Deviation (low), CTCSS Deviation (medium), CTCSS Deviation (high), Tx Low Voltage Threshold and Max. and Deviation of Tx Audio respectively.

Red LED solidly glows when adjusting items CH1 to CH9.

Rx group: CH10 to CH12 stand for SQL On 5, SQL Off 5, and Rx Low Voltage Threshold respectively.

Green LED solidly glows when adjusting items CH10 to CH12.

CH13 to CH16 are invalid and carry no adjustment item.

#### **4. To switch between wide and narrow bandwidth**

When adjusting a certain item, short press **SK** (orange LED flashes indicating valid press) to switch between wide/narrow bandwidth. After this operation, the first frequency of current bandwidth is the frequency for adjustment by default.

#### **5. To switch frequency**

Short press (no longer than 1 second) **PTT** (green LED flashes indicating valid press) to switch frequency one by one, under certain bandwidth and certain adjustment item.

#### **6. To add/subtract adjustment value**

Short press **[+]** under certain bandwidth and certain tuning item, and the adjustment value will increase in steps of 1; hold down **[+]**, and the adjustment value will keep increasing in steps of 1. The adjustment value will remain unchanged once it reaches the allowed maximum value.

Short press **[-]** under certain bandwidth and certain tuning item, and the adjustment value will decrease in steps of 1; hold down **[-]**, and the adjustment value will keep decreasing in steps of 1. The adjustment value will remain unchanged once it reaches the allowed minimum value.

#### **7. Measures on special items:**

**Tx group:** CH8 is the Tx Low Voltage Threshold. These adjustment items are related to AD sampling. Press **[+]** or **[-]** after entering the above item, to activate AD sampling (including calculation) once. Rotate the Channel Selector Knob to save the current AD sampling value. If **[+]** and **[-]** are not pressed, neither the adjustment value will be updated, nor will AD sampling be activated.

**Rx group:** CH10 to CH12 stand for SQL On 5, SQL Off 5, and Rx Low Voltage Threshold respectively. These adjustment items are related to AD sampling. Press **[+]** or **[-]** after entering the above items, to activate AD sampling (including calculation) once. Rotate the Channel Selector Knob to save the current AD sampling value. If **[+]** and **[-]** are not pressed, neither the adjustment value will be updated, nor will AD sampling be activated.

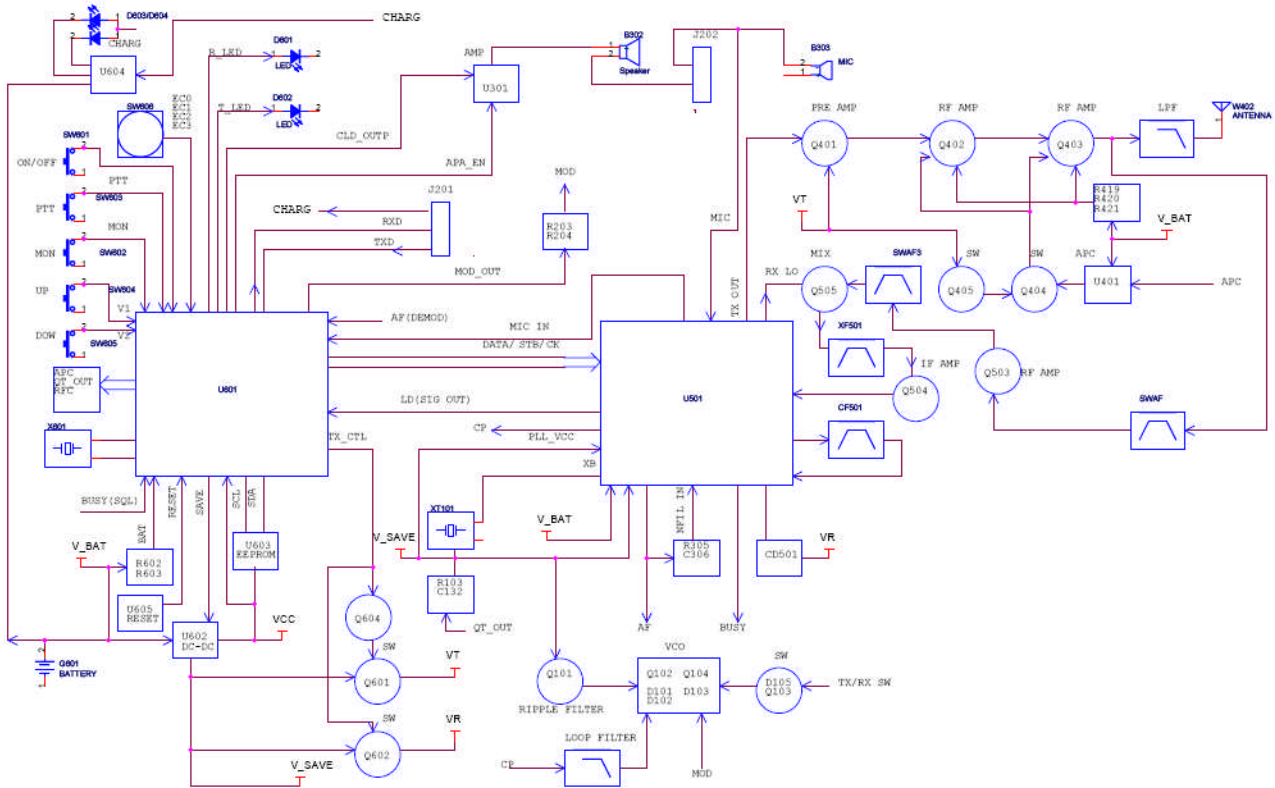
#### **8. Description of key-press:**

Short press: key press no longer than 1 second;

Long press: key press time longer than 1 second.

# Circuit Description

## 1. General Diagram



**Tx Section:** Audio signal from MIC is sent to the RF chip (U501) directly. In U501, the signal is amplitude limited and amplified, and then sent to the MCU chip (U601). The baseband signal processing circuit in U601 will convert the amplified audio signal to digital signal via A/D conversion, and then convert the digital signal to modulation signal via D/A conversion after processing such as filtering, signal compression, encryption, pre-emphasis, Tx gain control and amplitude limiting isare completed. The modulation signal from MCU will pass through the low-pass filter circuit and then will go to VCO for direct frequency modulation. The modulated carrier signal is converted to RF signal by the buffer amplifier (U501), and then enters front-stage power amplifier (Q401) for amplification. The amplified RF signal will be further amplified by the pre-driver (Q402) and final-stage power amplifier (Q403), and then will enter low-pass filter circuit through the switching diode (D401), and will be finally transmitted via antenna after ultraharmonics are removed. D402 and D501 compose the Rx-Tx switch circuit.

**Rx section:** Desired and undesired RF signals received via the antenna are fed to the bandpass filter (SAWF502) to filter out undesired out-of-band interference signal, and then amplified by the RF amplifier (U501). The amplified signal is then fed to the bandpass filter (SAWF503) to filter out undesired out-of-band interference signal. The desired RF signal is mixed with the first local oscillator signal (output

from VCO) by Q505. The newly generated signal is processed by the crystal filter (XF501) to get the first IF signal (desired signal). After being amplified by Q504, this IF signal enters the RF chip (U501), and is mixed with the second local oscillator signal to generate the second IF signal. The second IF signal is demodulated by U501 to output audio signal, which is sent to MCU for A/D conversion and filtering. Afterwards, the audio signal is divided into two flows. One flow is processed by CTCSS/CDCSS decoder; the other is restored to audio signal through filtering, de-emphasis, decoding, signal expansion and D/A conversion. Then the restored audio signal is amplified by the audio power amplifier (U301) to drive the speaker directly.

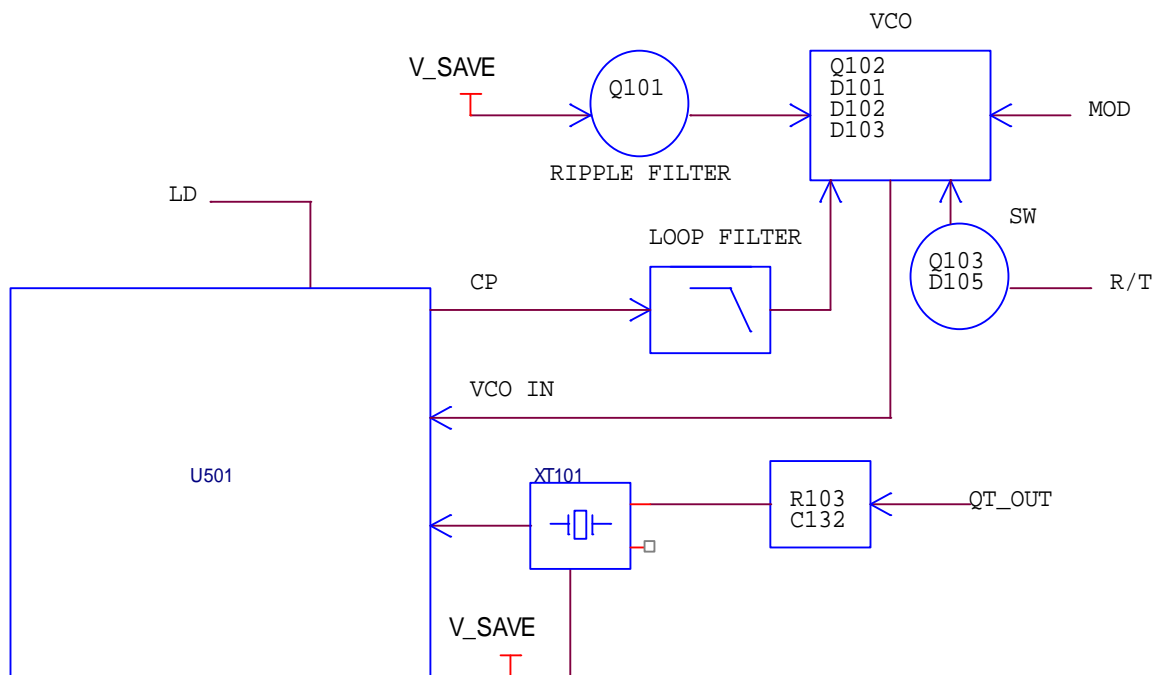
**Power Supply Section:** The 3.7V battery voltage is converted to two flows of 3.0V DC voltage by the LDO module (U602). One flow supplies 3.0V VCC for the CPU; the other outputs 3.0V V-SAVE voltage, which goes through Q604 and Q601 respectively to supply, under the control TX-CTRL, 3.0V VT for Tx circuit. The V-SAVE voltage also goes through Q602 to supply 3.0V VR for Rx circuit.

**Signaling Encode:** Signaling encode signal output from the port MCU QT\_OUT is divided into two flows. One flow goes through RC network to modulate the PLL reference frequency oscillator; the other goes through QT-MOD to modulate the VCO.

**2. Realization Methods of Basic Functional Modules**

**2.1 HF Section**

**2.1.1 Block Diagram of PLL Circuit**

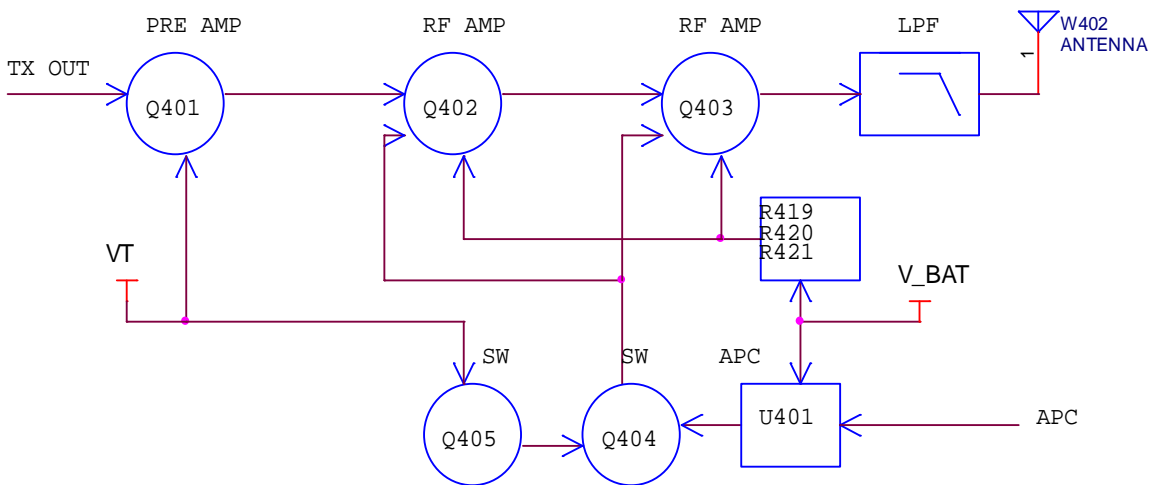


PLL circuit generates RF carrier signal for Tx and the first local oscillator signal for Rx. Step frequency of the PLL circuit is 6.25 KHz, 10.0 KHz or 12.5 KHz. In U501, the 21.25MHz reference oscillator signal is divided into 6.25 KHz, 10.0 KHz or 12.5 KHz reference frequencies via a fixed counter in PLL. The signal output from the VCO (Tx/RxVCO) enters PLL and is processed by the buffer amplifier. The amplified signal is further processed in PLL by the variable frequency-divider. Then the signal is compared with the reference frequency in the phase detector (PD) of PLL. Signal generated from PD passes through a low-pass filter, and then is sent to the varactors (D101 and D102) of VCO so as to control output frequency. The signal buffer amplified by PLL also serves as the first local oscillator signal for both Tx and Rx.

The Q103 switch controls connection status of D105 so as to switch between Rx VCO and Tx VCO. When R/T is at high level, Tx VCO is valid; when R/T is at low level, Rx VCO is valid.

In case pin LD of U501 is at low level, unlock status is valid. When this status is detected by the microprocessor, transmit/receive operations are prohibited.

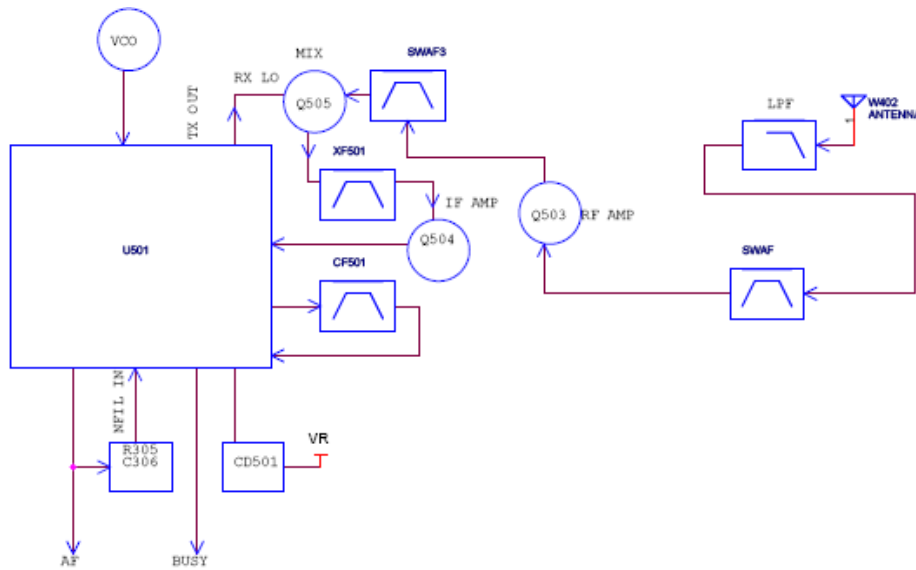
**2.1.2 Block Diagram of RF Power Amplifier**



The modulated carrier signal output from VCO is pre-amplified by U501, and then is further amplified by the front-stage amplifier Q401. Driver-stage amplifier Q402 and final-stage amplifier Q403 respectively. Afterwards, the amplified RF signal enters the low-pass filter (LPF) circuit through diode D401, and then is transmitted via the antenna after ultraharmonics are removed. D402 and D501 compose the Rx-Tx switch circuit.

APC circuit is composed of Q404, Q405 and U401. U401 controls the bias voltage at the gates of Q402 and Q403, to control Tx current and to further regulate power.

**2.1.3 Block Diagram of Rx Circuit**

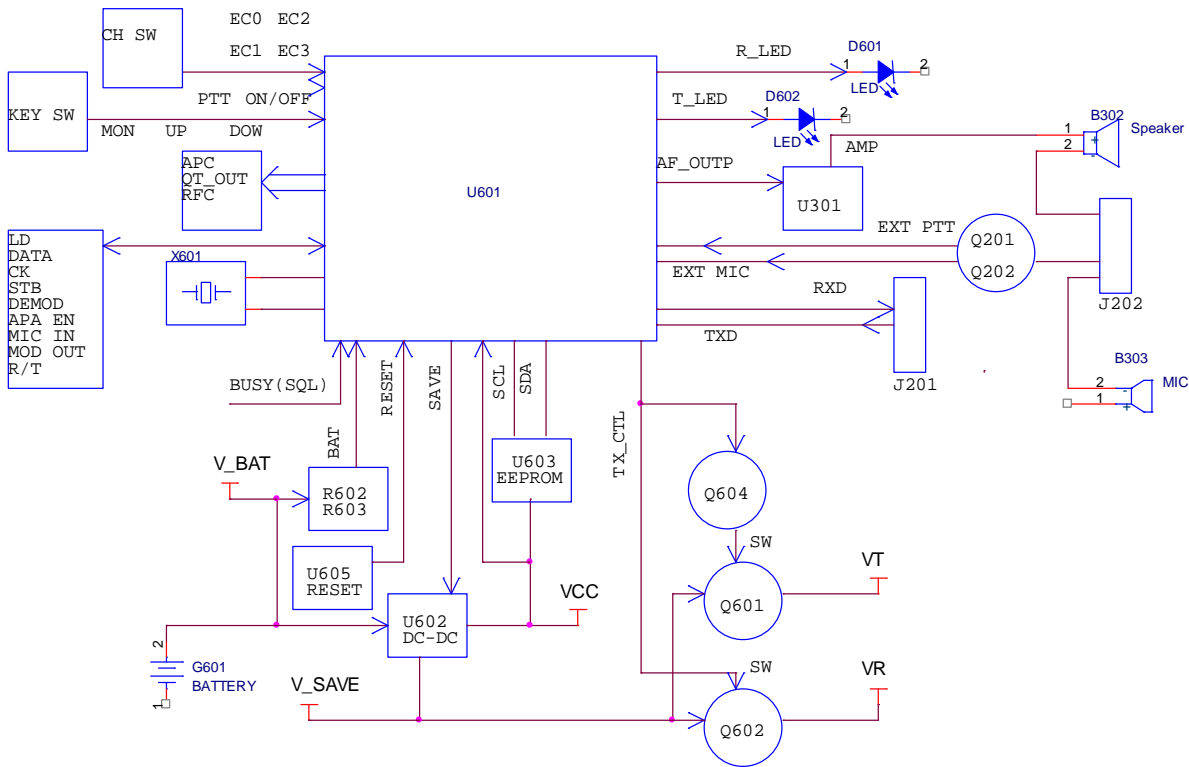


Desired and undesired RF signals received via the antenna are fed to the SAW filter to filter out undesired out-of-band interference signal. Then the desired RF signal is amplified by Q506 and enters U501, where it is amplified by the high-frequency low-noise amplifier. Afterwards, the amplified signal goes through the bandpass filter again to filter out undesired out-of-band interference signal. Desired RF signal is mixed with the first local oscillator signal (output from VCO) by Q505, to output the first IF signal (21.7MHz), which is processed by the IF filter and IF amplifier Q504. Afterwards, it is sent to the IF processing circuit of U501.

In U501, this first IF signal is mixed with the second local oscillator signal to generate the second IF signal. Then the second IF signal is demodulated by U501 to output audio signal, which is sent to MCU for A/D conversion and filtering. Afterwards, the audio signal is divided into two flows. One flow is processed by CTCSS/CDCSS decoder; the other is restored to audio signal through filtering, de-emphasis, decoding, signal expansion and D/A conversion. Then the restored audio signal is amplified by the audio power amplifier IC (U301) to drive the speaker directly.

**2.2 MCU Control, Signal Processing and Audio Power Amplification**

Circuit diagram of this section is shown as below:



**2.2.1 MCU Control Circuit**

MCU control circuit is composed of MCU, EEPROM, LCD (exclusive for TC-320), keys, etc. This section has the following functions: to initialize data of the radio and save data to EEPROM; to drive LCD to display some user set information and status; to detect battery voltage and signals from external keys, LD and VOX-DET, and to make response; to transmit required data to PLL based on the channel encoding status; to switch and control Rx/Tx based on the input PTT signal; to switch the squelch circuit on/off based on the input signaling decode signal and squelch level signal; to control circuits of high/low power switch, audio power amplifier, VCO power supply, Rx power supply and Tx power supply; (for programming) to communicate with PC via RXD/TXD based on the RS232 protocol, and transmit/receive data to/from PC.

**2.2.2 Signal Processing Section**

**2.2.2.1 Tx Baseband Processing**

The audio signal input from MIC enters U601, and is then converted into digital signal by analog-to-digital conversion. Afterwards, the signal is divided by the digital low-pass filter into 2 flows. One flow serves as the signal of VOX detection; the other is processed by AGC, compandor, high-pass filter, encryption and pre-emphasis, mixed with DTMF signal from MCU, converted to baseband signal via digital-to-analog conversion to output. Then the signal is processed by the active low-pass filter, and sent to the VCO for modulation.



2.2.2.2 Rx Baseband Processing

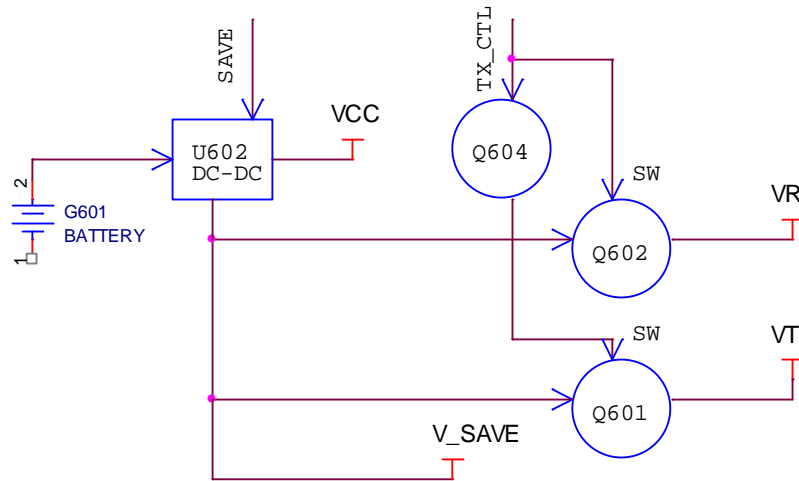
After entering U601, the DEMOD signal derived from IF demodulation is converted to digital signal via analog-to-digital conversion (ADC), and then is sent to the digital low-pass filter. The signal is divided into 2 flows. One flow is processed by CTCSS/CDCSS decoder; the other is processed by high-pass filter, and then is subject to de-emphasis, decryption, signal expansion and DTMF demodulation and etc, and finally digital-to-analog conversion to output audio signal.

2.2.3 Audio Power Amplifier

The audio signal output from U601 is amplified by the audio power amplifier (U301) to drive the speaker directly.

**2.3 Power Supply Processing**

Block diagram of power supply circuit is shown as below:



Power Supply Section: The 3.7V battery voltage is converted to two flows of 3.0V DC voltage by U602. One flow supplies 3.0V VCC for the CPU; the other outputs 3.0V V-SAVE, which goes through Q601, Q602 and Q604 respectively to supply, under the control TX-CTRL, VT for Tx circuit and VR for Rx circuit. U602 also supplies the PLL circuit with voltage V-SAVE.

**CPU Pins**

Pin No.	Port	Pin Name	I/O	Function
1	NC	/	/	/
2	NC	/	/	/
3	NC	/	/	/
4	NC	/	/	/
5	NC	/	/	/
6	TXD	TXD	O	UART TxD
7	RXD	RXD	I	UART RxD
8	P60	APA_EN	O	Control speaker; H: unmute, L: mute
9	P61	SAVE_CTL	O	Control Power Save; in non-Power-Save status, it is at high level.
10	P62	EXT MIC	I	Check MIC connection (valid for high level)
11	P63	EXT PTT	I	PTT key on the earpiece (valid for high level)
12	P64	Red LED	O	Red LED
13	P65	Green LED	O	Green LED
14	P66	Reserve	O	Reserved
15	P67	Reserve	O	Reserved
16	Vssd	GND	S	Ground power supply for digital circuit
17	Vddd	VCC (3.0V)	S	Power supply for digital circuit
18	P50/INT0	VOL+	I	To increase the volume
19	P51/INT1	VOL-	I	To decrease the volume
20	P52/INT2	Reserve	O	Reserved
21	P53/INT3	/POWER ON/OFF	I	Radio On/Off
22	P54/INT4	SK	I	Programmable function key (side key) (valid for low level), external pull-up resistor connected
23	P55/INT5	PTT	I	PTT key (valid for low level), external pull-up resistor connected
24	P56/INT6	Reserve	O	Reserved
25	P57/INT7	Reserve	O	Reserved
26	Vdd_CLD	VCC (3.0V)	S	Power supply for digital PA
27	CLD_OUTP	CLD_OUTP	O	LINEOUT output; positive output of digital PA
28	VSS_CLD	GND	S	Ground power supply for digital PA

29	CLD_OUTM	Reserve	O	Negative output of digital PA
30	Vdd_CLD	VCC (3.0V)	S	Power supply for digital PA
31	P77	RF_CTRL	O	Control Rx frequency band; valid for high level (high frequency band); low level (low frequency band)
32	P76/DAC1	APC	DA	Control transmit power
33	P75/VREF	VCC(3.0V)	I	Input of reference voltage of ADC and DAC Pin
34	P74/DAC0	QT_OUT	DA	CTCSS/CDCSS output
35	P73/AD3	Reserve	AD	Reserved
36	Vssa	GND	S	Ground power supply for analog circuit
37	Vdda	VCC (3.0V)	S	Power supply for analog circuit
38	P72/AD2	Reserve	AD	Reserved
39	P71/AD1	SQL	AD	Detect noise
40	P70/AD0	BAT_DET	AD	Detect battery strength
41	XTAL0	OSC0		For 32.678KHz main crystal oscillator
42	XTAL1	OSC1		
43	PLL_CAP	PLL_CAP		For PLL external capacitor (10nF)
44	NC	/	/	/
45	NC	/	/	/
46	NC	/	/	/
47	NC	/	/	/
48	NC	/	/	/
49	P03/COM3	Reserve	O	Reserved
50	P02/COM2	Reserve	O	Reserved
51	P01/COM1	Reserve	O	Reserved
52	P00/COM0	Reserve	O	Reserved
53	P10/SEG0	Reserve	O	Reserved
54	P11/SEG1	Reserve	O	Reserved
55	P12/SEG2	Reserve	O	Reserved
56	P13/SEG3	Reserve	O	Reserved
57	P14/SEG4	Reserve	O	Reserved
58	P15/SEG5	Reserve	O	Reserved
59	P16/SEG6	Reserve	O	Reserved
60	P17/SEG7	Reserve	O	Reserved

61	P20/SEG8	EN0	I	To detect input from encoder switch
62	P21/SEG9	EN1	I	
63	P22/SEG10	EN2	I	
64	P23/SEG11	EN3	I	
65	P24/SEG12	Reserve	O	Reserved
66	P25/SEG13	Reserve	O	Reserved
67	P26/SEG14	Reserve	O	Reserved
68	P27/SEG15	Reserve	O	Reserved
69	P30/SEG16	Reserve	O	Reserved
70	P31/SEG17	Reserve	O	Reserved
71	NC	/	/	/
72	NC	/	/	/
73	NC	/	/	/
74	NC	/	/	/
75	NC	/	/	/
76	P32/SEG18	Reserve	O	Reserved
77	P33/SEG19	Reserve	O	Reserved
78	P34/SEG20	Reserve	O	Reserved
79	P35/SEG21	Reserve	O	Reserved
80	P36/SEG22	Reserve	O	Reserved
81	P37/SEG23	Reserve	O	Reserved
82	P40/SEG24	Reserve	O	Reserved
83	P41/SEG25	SCL	O	EEPROM CLOCK, external pull-up resistor connected
84	P42/SEG26	SDA	O	EEPROM DATA, external pull-up resistor connected
85	P43/SEG27	LD	I	To detect PLL circuit unlock (H: lock; L: unlock), external pull-up resistor connected
86	P44/SEG28	DATA	O	PLL DATA
87	P45/SEG29	CK	O	PLL CLOCK
88	P46/SEG30	STB	O	PLL ENABLE
89	Vssd	GND	S	Ground power supply for digital circuit
90	Vddd	VCC (3.0V)	S	Power supply for digital circuit
91	SW_P0	R/T	O	Rx/Tx control, H: Rx; L: Tx (switch to VCO)
92	SW_P1	TX_CTRL	O	Control power supply for Tx (transmit at high level)

93	RESET	RESET	I	Reset input
94	Vssa	GND	S	Ground power supply for analog circuit
95	Vdda	VCC (3.0V)	S	Power supply for analog circuit
96	BG_REF		O	To output reference voltage
97	MIC_IN	MIC_IN	I	Microphone input
98	DEMODE	DEMODE	I	To input baseband signal (audio and CTCSS/CDCSS)
99	MODOUT	MODOUT	O	To output baseband signal (audio and CTCSS/CDCSS)
100	NC	/	/	/

**TC-320 446MHz Parts List 1**

<b>TC-320 446MHz Parts List 1</b>					
<b>No.</b>	<b>Part No.</b>	<b>Description</b>	<b>Qty.</b>	<b>Ref No.</b>	<b>Print No.</b>
1	3001050000000	Chip resistor 0402 0Ω J 1/16W (RoHS)	1	R222	T3G
2	3001050000000	Chip resistor 0402 0Ω J 1/16W (RoHS)	1	R223	T3G
3	3001050000000	Chip resistor 0402 0Ω J 1/16W (RoHS)	1	L510	B2H
4	3001050000000	Chip resistor 0402 0Ω J 1/16W (RoHS)	1	R314	T3B
5	3001050000000	Chip resistor 0402 0Ω J 1/16W (RoHS)	1	R527	B2H
6	3001051000020	Chip resistor 0402 10Ω F 1/16W (RoHS)	1	R101	B4H
7	3001051000020	Chip resistor 0402 10Ω F 1/16W (RoHS)	1	R111	B4E
8	3001051000020	Chip resistor 0402 10Ω F 1/16W (RoHS)	1	R119	B3F
9	3001051000020	Chip resistor 0402 10Ω F 1/16W (RoHS)	1	R311	T3A
10	3001051000020	Chip resistor 0402 10Ω F 1/16W (RoHS)	1	R516	B3I
11	3001051000020	Chip resistor 0402 10Ω F 1/16W (RoHS)	1	R530	B2G
12	3001051010040	Chip resistor 0402 100Ω F 1/16W (RoHS)	1	R604	T2E
13	3001051010040	Chip resistor 0402 100Ω F 1/16W (RoHS)	1	R614	T4E
14	3001051010040	Chip resistor 0402 100Ω F 1/16W (RoHS)	1	R621	T4E
15	3001051010040	Chip resistor 0402 100Ω F 1/16W (RoHS)	1	R623	T4E
16	3001051010040	Chip resistor 0402 100Ω F 1/16W (RoHS)	1	R518	B3H
17	3001051020000	Chip resistor 0402 1KΩ F 1/16W (RoHS)	1	R109	B4E
18	3001051020000	Chip resistor 0402 1KΩ F 1/16W (RoHS)	1	R114	B3E
19	3001051020000	Chip resistor 0402 1KΩ F 1/16W (RoHS)	1	R207	T2G
20	3001051020000	Chip resistor 0402 1KΩ F 1/16W (RoHS)	1	R214	T3D
21	3001051020000	Chip resistor 0402 1KΩ F 1/16W (RoHS)	1	R309	T4D
22	3001051020000	Chip resistor 0402 1KΩ F 1/16W (RoHS)	1	R613	T2G
23	3001051020000	Chip resistor 0402 1KΩ F 1/16W (RoHS)	1	R507	B3H
24	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R107	B4E
25	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R116	B3E
26	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R120	B3F
27	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R210	T5E
28	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R219	T2D
29	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R409	T2B
30	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R428	T2B
31	3001051030000	Chip resistor 0402 10KΩ J 1/16W (RoHS)	1	R301	T3A
32	3001051040000	Chip resistor 0402 100KΩ F 1/16W (RoHS)	1	R113	B3E
33	3001051040000	Chip resistor 0402 100KΩ F 1/16W (RoHS)	1	R213	T3D
34	3001051050000	Chip resistor 0402 1MΩ F 1/16W (RoHS)	1	R218	T2D
35	3001051050000	Chip resistor 0402 1MΩ F 1/16W (RoHS)	1	R405	T2B
36	3001051050000	Chip resistor 0402 1MΩ F 1/16W (RoHS)	1	R501	B3H
37	3001051220000	Chip resistor 0402 1.2KΩ J 1/16W (RoHS)	1	R220	T4E
38	3001051230000	Chip resistor 0402 12KΩ J 1/16W (RoHS)	1	R224	T3G
39	3001051230000	Chip resistor 0402 12KΩ J 1/16W (RoHS)	1	R528	B2G
40	3001051230000	Chip resistor 0402 12KΩ J 1/16W (RoHS)	1	R208	T4D
41	3001051530000	Chip resistor 0402 15KΩ J 1/16W (RoHS)	1	R406	T2A
42	3001051540000	Chip resistor 0402 150KΩ F 1/16W (RoHS)	1	R422	T3A
43	3001051540000	Chip resistor 0402 150KΩ F 1/16W (RoHS)	1	R423	T3B
44	3001051540000	Chip resistor 0402 150KΩ F 1/16W (RoHS)	1	R424	T3B
45	3001051540000	Chip resistor 0402 150KΩ F 1/16W (RoHS)	1	R425	T3B
46	3001051540000	Chip resistor 0402 150KΩ F 1/16W (RoHS)	1	R426	T3A
47	3001051540000	Chip resistor 0402 150KΩ F 1/16W (RoHS)	1	R427	T2A
48	3001052200000	Chip resistor 0402 22Ω J 1/16W (RoHS)	1	R429	B2F
49	3001052220000	Chip resistor 0402 2.2KΩ J 1/16W (RoHS)	1	R110	B4E

50	3001052220000	Chip resistor 0402 2.2KΩ J 1/16W (RoHS)	1	R202	T2D
51	3001052220000	Chip resistor 0402 2.2KΩ J 1/16W (RoHS)	1	R216	T3D
52	3001052220000	Chip resistor 0402 2.2KΩ J 1/16W (RoHS)	1	R306	B3H
53	3001052220000	Chip resistor 0402 2.2KΩ J 1/16W (RoHS)	1	R407	T2B
54	3001052220000	Chip resistor 0402 2.2KΩ J 1/16W (RoHS)	1	R615	T3H
55	3001052230010	Chip resistor 0402 22KΩ J 1/16W (RoHS)	1	R215	T3D
56	3001052230010	Chip resistor 0402 22KΩ J 1/16W (RoHS)	1	R312	B4H
57	3001052240010	Chip resistor 0402 220KΩ F 1/16W (RoHS)	1	R602	T2E
58	3001052240010	Chip resistor 0402 220KΩ F 1/16W (RoHS)	1	R603	T2E
59	3001052710010	Chip resistor 0402 270Ω J 1/16W (RoHS)	1	R115	B3E
60	3001052710010	Chip resistor 0402 270Ω J 1/16W (RoHS)	1	R505	B2I
61	3001052710010	Chip resistor 0402 270Ω J 1/16W (RoHS)	1	R506	B3H
62	3001052720010	Chip resistor 0402 2.7KΩ F 1/16W (RoHS)	1	R502	T3H
63	3001052730010	Chip resistor 0402 27KΩ F 1/16W (RoHS)	1	R408	T2A
64	3001052740000	Chip resistor 0402 270KΩ J 1/16W (RoHS)	1	R303	B3H
65	3001053310010	Chip resistor 0402 330Ω J 1/16W (RoHS)	1	R404	B2E
66	3001053320000	Chip resistor 0402 3.3KΩ J 1/16W (RoHS)	1	R203	T4E
67	3001053320000	Chip resistor 0402 3.3KΩ J 1/16W (RoHS)	1	R204	T4E
68	3001053320000	Chip resistor 0402 3.3KΩ J 1/16W (RoHS)	1	R305	B4H
69	3001053320000	Chip resistor 0402 3.3KΩ J 1/16W (RoHS)	1	R307	B4H
70	3001053320000	Chip resistor 0402 3.3KΩ J 1/16W (RoHS)	1	R401	B2F
71	3001053320000	Chip resistor 0402 3.3KΩ J 1/16W (RoHS)	1	R402	B2E
72	3001053330000	Chip resistor 0402 33KΩ F 1/16W (RoHS)	1	R125	B4H
73	3001053920010	Chip resistor 0402 3.9KΩ J 1/16W (RoHS)	1	R606	T4D
74	3001053920010	Chip resistor 0402 3.9KΩ J 1/16W (RoHS)	1	R633	T3G
75	3001053930000	Chip resistor 0402 39KΩ J 1/16W (RoHS)	1	R302	T3A
76	3001054790000	Chip resistor 0402 4.7Ω J 1/16W (RoHS)	1	R308	T3A
77	3001054790000	Chip resistor 0402 4.7Ω J 1/16W (RoHS)	1	R310	T3A
78	3001054790000	Chip resistor 0402 4.7Ω J 1/16W (RoHS)	1	R403	B2E
79	3001054790000	Chip resistor 0402 4.7Ω J 1/16W (RoHS)	1	R525	B2G
80	3001054700000	Chip resistor 0402 47Ω J 1/16W (RoHS)	1	R123	B3F
81	3001054700000	Chip resistor 0402 47Ω J 1/16W (RoHS)	1	R618	T4G
82	3001054700000	Chip resistor 0402 47Ω J 1/16W (RoHS)	1	R619	T3G
83	3001054710000	Chip resistor 0402 470Ω J 1/16W (RoHS)	1	R201	T2D
84	3001054720000	Chip resistor 0402 4.7KΩ J 1/16W (RoHS)	1	R112	B3E
85	3001054720000	Chip resistor 0402 4.7KΩ J 1/16W (RoHS)	1	R206	T3G
86	3001054720000	Chip resistor 0402 4.7KΩ J 1/16W (RoHS)	1	R608	T4B
87	3001054720000	Chip resistor 0402 4.7KΩ J 1/16W (RoHS)	1	R622	T3D
88	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R103	B4G
89	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R106	B3E
90	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R121	T4F
91	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R205	T4D
92	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R217	T3D
93	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R313	B4H
94	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R607	T3G
95	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R610	T4B
96	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R611	T4B
97	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R612	T4B
98	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R616	T4G
99	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R617	T4G
100	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R620	T4B
101	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R624	T4E
102	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R630	T2G
103	3001054730000	Chip resistor 0402 47KΩ J 1/1W (RoHS)	1	R631	T3H
104	3001054740000	Chip resistor 0402 470KΩ J 1/16W (RoHS)	1	R212	T5E

105	3001054740000	Chip resistor 0402 470KΩ J 1/16W (RoHS)	1	R517	B3H
106	3001055620000	Chip resistor 0402 5.6KΩ J 1/16W (RoHS)	1	R211	T4E
107	3001055620000	Chip resistor 0402 5.6KΩ J 1/16W (RoHS)	1	R117	B3F
108	3001056820000	Chip resistor 0402 6.8KΩ J 1/16W (RoHS)	1	R529	B2G
109	3001056830000	Chip resistor 0402 68KΩ J 1/16W (RoHS)	1	R102	B4H
110	3001056830000	Chip resistor 0402 68KΩ J 1/16W (RoHS)	1	R124	B4F
111	3001056830000	Chip resistor 0402 68KΩ J 1/16W (RoHS)	1	R304	B4H
112	3001057520000	Chip resistor 0402 7.5KΩ J 1/16W (RoHS)	1	R118	B3E
113	3001058200000	Chip resistor 0402 82Ω F 1/16W (RoHS)	1	R526	B3G
114	3001058220000	Chip resistor 0402 8.2KΩ J 1/16W (RoHS)	1	R209	B3F
115	3001058220000	Chip resistor 0402 8.2KΩ J 1/16W (RoHS)	1	R606	T4C
116	3001058230000	Chip resistor 0402 82KΩ J 1/16W (RoHS)	1	R632	T3G
117	3001060000000	Chip resistor 0603 0Ω J 1/10W (RoHS)	1	L105	B3F
118	3001060000000	Chip resistor 0603 0Ω J 1/10W (RoHS)	1	D503	B1F
119	3001060000000	Chip resistor 0603 0Ω J 1/10W (RoHS)	1	D505	B1H
120	3001061010000	Chip resistor 0603 100Ω J 1/10W (RoHS)	1	R418	T2B
121	3001061010000	Chip resistor 0603 100Ω J 1/10W (RoHS)	1	R605	T3A
122	3001061230000	Chip resistor 0603 12KΩ J 1/10W (RoHS)	1	R417	B2C
123	3001061530000	Chip resistor 0603 15KΩ D 1/10W (RoHS)	1	R416	B2D
124	3001062230000	Chip resistor 0603 22KΩ J 1/10W (RoHS)	1	R411	B2D
125	3001062230000	Chip resistor 0603 22KΩ J 1/10W (RoHS)	1	R412	B2D
126	3001063310010	Chip resistor 0603 330Ω J 1/10W RCT03331 (RoHS)	1	R609	T5D
127	3001064700000	Chip resistor 0603 47Ω J 1/10W (RoHS)	1	R410	B2D
128	3001064700000	Chip resistor 0603 47Ω J 1/10W (RoHS)	1	R415	B3C
129	3001064710000	Chip resistor 0603 470Ω J 1/10W (RoHS)	1	R634	B5A
130	3001064710000	Chip resistor 0603 470Ω J 1/10W (RoHS)	1	R609	B5A
131	3001066810010	Chip resistor 0603 680Ω J 1/10W (RoHS)	1	R625	T4A
132	3099080398000	Chip resistor 1206 0.39Ω J 1/4W (RoHS)	1	R419	T3B
133	3099080398000	Chip resistor 1206 0.39Ω J 1/4W (RoHS)	1	R420	T3B
134	3099080398000	Chip resistor 1206 0.39Ω J 1/4W (RoHS)	1	R421	T3B
135	3005051020010	Resistor array 0402 1K*4 J 1/16W (RoHS)	1	RN101	T4F
136	3002991030150	Trimmer resistor (2.7*2.0*0.9) 10KΩ ±30% (RoHS)	1	VR101	B4H
137	3002991030150	Trimmer resistor (2.7*2.0*0.9) 10KΩ ±30% (RoHS)	1	VR601	T3G
138	3101050390000	Chip capacitor 0402 0.3PF B 50V Hi-Q (RoHS)	1	C534	B3H
139	3101050590010	Chip capacitor 0402 0.5PF B 50V (RoHS)	1	C109	B3E
140	3101050590010	Chip capacitor 0402 0.5PF B 50V (RoHS)	1	C144	B3F
141	3101050100010	Chip capacitor 0402 1PF B 50V Hi-Q (RoHS)	1	C527	T2H
142	3199051590000	Chip capacitor 0402 1.5PF B 50V Hi-Q (RoHS)	1	C431	B3A
143	3101050200010	Chip capacitor 0402 2PF B 50V (RoHS)	1	C110	B3E
144	3101050200010	Chip capacitor 0402 2PF B 50V (RoHS)	1	C401	B2F
145	3101050200010	Chip capacitor 0402 2PF B 50V (RoHS)	1	C531	T2I
146	3101050200010	Chip capacitor 0402 2PF B 50V (RoHS)	1	C532	T3I
147	3101050200010	Chip capacitor 0402 2PF B 50V (RoHS)	1	C433	B3A
148	3101050200010	Chip capacitor 0402 2PF B 50V (RoHS)	1	C428	B3A
149	3199052290000	Chip capacitor 0402 2.2PF B 50V Hi-Q (RoHS)	1	C502	B2B
150	3101052490010	Chip capacitor 0402 2.4PF B 50V (RoHS)	1	C130	B3E
151	3101052490010	Chip capacitor 0402 2.4PF B 50V (RoHS)	1	C432	B3A
152	3101050300000	Chip capacitor 0402 3PF B 50V (RoHS)	1	C434	B3A
153	3101053690000	Chip capacitor 0402 3.6PF B 50V (RoHS)	1	C421	B3B
154	3101053690000	Chip capacitor 0402 3.6PF B 50V (RoHS)	1	C501	B2B
155	3101050400010	Chip capacitor 0402 4PF B 50V (RoHS)	1	C148	B3E
156	3101050400010	Chip capacitor 0402 4PF B 50V (RoHS)	1	C545	B3H
157	3199054790000	Chip capacitor 0402 4.7PF C 50V (RoHS)	1	C430	B3A
158	3101050600010	Chip capacitor 0402 6PF B 50V (RoHS)	1	C439	B2F
159	3101050700010	Chip capacitor 0402 7PF B 50V (RoHS)	1	C149	B4F



160	3101050700010	Chip capacitor 0402 7PF B 50V (RoHS)	1	C406	B2F
161	3101050900000	Chip capacitor 0402 9PF B 50V (RoHS)	1	C112	B3F
162	3101051000020	Chip capacitor 0402 10PF J 50V (RoHS)	1	C103	B5G
163	3101051000020	Chip capacitor 0402 10PF J 50V (RoHS)	1	C104	B4G
164	3101051000020	Chip capacitor 0402 10PF J 50V (RoHS)	1	C107	B3E
165	3101051000020	Chip capacitor 0402 10PF J 50V (RoHS)	1	C211	T4E
166	3101051200020	Chip capacitor 0402 12PF J 50V (RoHS)	1	C544	B3H
167	3101051200020	Chip capacitor 0402 12PF J 50V (RoHS)	1	C423	B3B
168	3101051500020	Chip capacitor 0402 15PF J 50V (RoHS)	1	C106	B4E
169	3101051500020	Chip capacitor 0402 15PF J 50V (RoHS)	1	C638	T2E
170	3101051500020	Chip capacitor 0402 15PF J 50V (RoHS)	1	C639	T2F
171	3101051500020	Chip capacitor 0402 15PF J 50V (RoHS)	1	C530	T2H
172	3101052200010	Chip capacitor GRM36C0G220J50PT 22PF J 50V (RoHS)	1	C517	B2G
173	3101052400010	Chip capacitor 0402 24PF J 50V J (RoHS)	1	C538	B3I
174	3101053300000	Chip capacitor 0402 33PF J 50V (RoHS)	1	C526	B3H
175	3101053900000	Chip capacitor 0402 39PF J 50V (RoHS)	1	C418	B3B
176	3101054700010	Chip capacitor 0402 47PF J 50V (RoHS)	1	C404	B2E
177	3101055600000	Chip capacitor 0402 56PF J 50V (RoHS)	1	C415	B3D
178	3101055600000	Chip capacitor 0402 56PF J 50V (RoHS)	1	C306	B4H
179	3101058200000	Chip capacitor 0402 82PF J 50V (RoHS)	1	C529	T3H
180	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C117	B3F
181	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C119	T4F
182	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C121	T5F
183	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C122	B3F
184	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C124	T5F
185	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C125	T5F
186	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C131	B4E
187	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C202	B2E
188	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C407	B3F
189	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C411	B2F
190	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C614	T3G
191	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C629	T4E
192	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C523	B2H
193	3101051010030	Chip capacitor 0402 100PF J 50 (RoHS)	1	C512	B2B
194	3101051810000	Chip capacitor 0402 180PF J 50V (RoHS)	1	C507	B2G
195	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C142	B3E
196	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C147	B3F
197	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C150	B3F
198	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C209	T5D
199	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C307	B4H
200	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C308	B3H
201	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C309	B3H
202	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C403	T2B
203	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C405	B2E
204	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C416	B3D
205	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C424	B2D
206	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C426	T2B
207	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C440	B3B
208	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C443	T2B
209	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C444	T3B
210	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C445	T2A
211	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C446	T2B
212	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C447	T2B
213	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C504	B2G
214	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C524	B2H

215	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C601	T3A
216	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C611	T3E
217	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C622	T4G
218	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C623	T4A
219	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C624	T4B
220	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C625	T4A
221	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C626	T4B
222	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C631	T2E
223	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C632	T2D
224	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C633	T2C
225	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C636	T2E
226	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C641	T1B
227	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C644	T2D
228	3101054710010	Chip capacitor 0402 470PF K 50V (RoHS)	1	C542	B3H
229	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C102	B5G
230	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C105	B4E
231	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C120	B4H
232	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C126	B4H
233	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C133	B2E
234	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C139	B3E
235	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C141	B2E
236	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C145	B3E
237	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C216	T3D
238	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C219	T3D
239	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C412	B2D
240	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C413	B3D
241	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C417	B2C
242	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C425	B2B
243	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C427	B2B
244	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C539	B3I
245	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C541	B3H
246	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C546	B2G
247	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C604	B4C
248	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C605	T2E
249	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C608	T4C
250	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C616	T2G
251	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C617	T4C
252	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C619	T2H
253	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C620	T2H
254	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C640	T4C
255	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C648	T2G
256	3101051020010	Chip capacitor 0402 1000PF K 50V (RoHS)	1	C651	T4D
257	3101054720000	Chip capacitor 0402 4700PF K 50V (RoHS)	1	C310	B4H
258	3101054720000	Chip capacitor 0402 4700PF K 50V (RoHS)	1	C204	T4E
259	3101054720000	Chip capacitor 0402 4700PF K 50V (RoHS)	1	C647	T5E
260	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C138	B2E
261	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C437	B3B
262	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C438	T2A
263	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C540	B3I
264	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C607	T4C
265	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C635	T2E
266	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C637	T2F
267	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C645	T4B
268	3101051030020	Chip capacitor 0402 0.01UF K 25V (RoHS)	1	C646	T4B
269	3101052230000	Chip capacitor 0402 0.022UF K 16V (RoHS)	1	C212	T4E

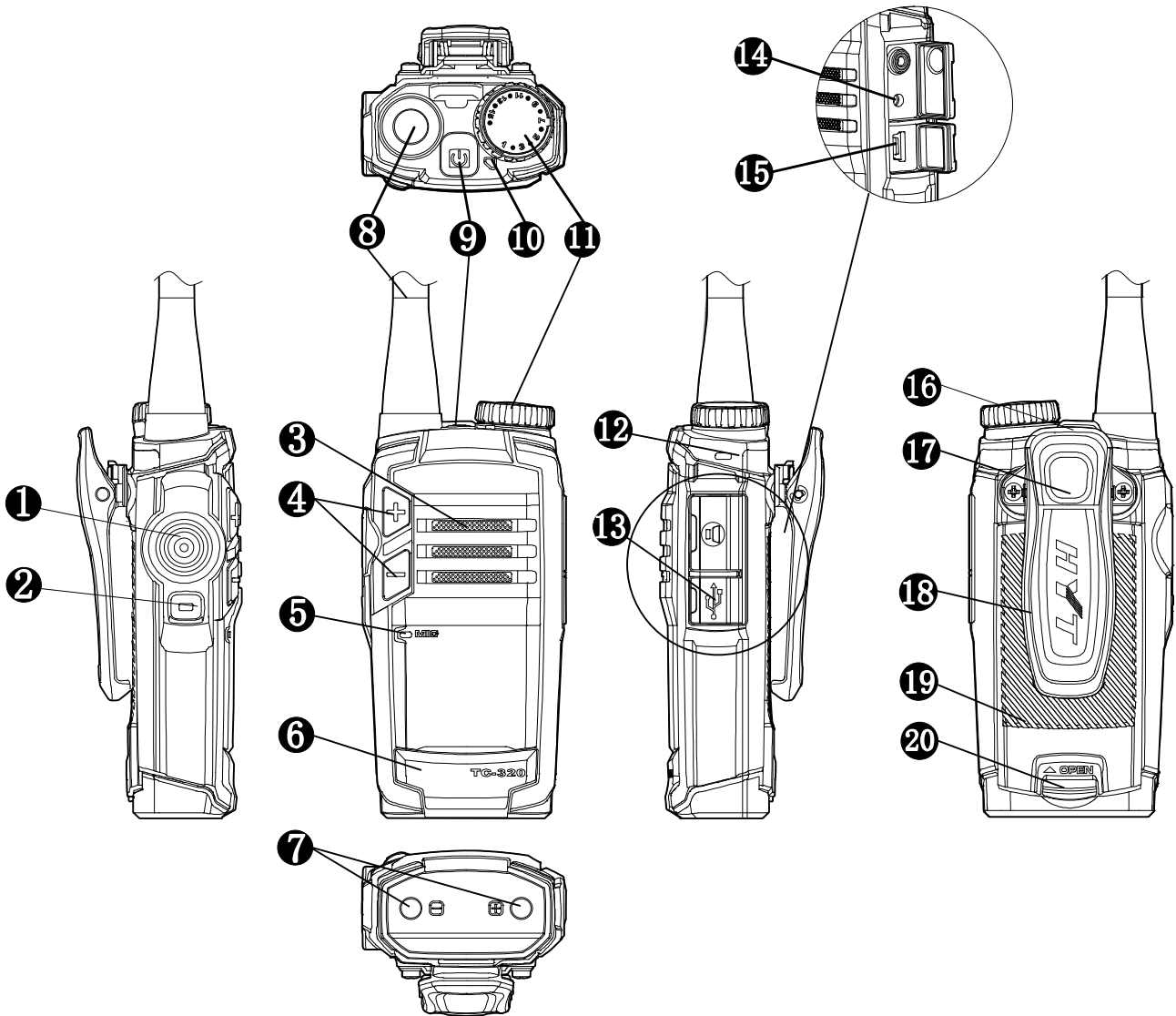
270	3101052230000	Chip capacitor 0402 0.022UF K 16V (RoHS)	1	C642	T3G
271	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C101	B3F
272	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C123	B5H
273	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C127	B4G
274	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C134	B3E
275	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C135	B2F
276	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C146	B3F
277	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C217	T2D
278	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C218	T2D
279	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C304	T3A
280	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C311	T3A
281	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C312	T3A
282	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C313	T3A
283	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C408	B3F
284	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C422	T2B
285	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C436	B3B
286	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C441	T3B
287	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C520	B4H
288	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C528	T3H
289	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C603	B4C
290	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C536	B2G
291	3101051040060	Chip capacitor 0402 0.1UF K 16V (RoHS)	1	C220	T3D
292	3101052240010	Chip capacitor 0402 0.22UF Z 10V (RoHS)	1	C118	B4G
293	3101052240010	Chip capacitor 0402 0.22UF Z 10V (RoHS)	1	C208	T5D
294	3101052240010	Chip capacitor 0402 0.22UF Z 10V (RoHS)	1	C213	T4E
295	3101052240010	Chip capacitor 0402 0.22UF Z 10V (RoHS)	1	C215	B4F
296	3101052240010	Chip capacitor 0402 0.22UF Z 10V (RoHS)	1	C519	T3H
297	3101053340010	Capacitor 0402 0.33UF X5R K 6.3V (RoHS)	1	C301	T3A
298	3101053340010	Capacitor 0402 0.33UF X5R K 6.3V (RoHS)	1	C316	T3B
299	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C203	T4E
300	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C207	T4E
301	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C315	B4H
302	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C547	B3H
303	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C627	T4E
304	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C628	T4E
305	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C630	T3E
306	3101051050000	Chip capacitor 0402 1UF K 6.3V (RoHS)	1	C634	T2E
307	3101061500010	Chip capacitor 0603 15PF J 50V (RoHS)	1	C419	B2B
308	3101061020000	Chip capacitor 0603 1000PF K 50V (RoHS)	1	C435	B2A
309	3101064730000	Chip capacitor 0603 0.047uF K 16V (RoHS)	1	C116	B5E
310	3101065630000	Chip capacitor 0603 0.056uF K 50V (RoHS)	1	C114	B4F
311	3101064740000	Chip capacitor 0603 0.47UF K 25V (RoHS)	1	C302	T3B
312	3101061050020	Chip capacitor 0603 1UF K 25V (RoHS)	1	C609	T4C
313	3101061050020	Chip capacitor 0603 1UF K 25V (RoHS)	1	C610	T4B
314	3101061050020	Chip capacitor 0603 1UF K 25V (RoHS)	1	C615	T2G
315	3101061050020	Chip capacitor 0603 1UF K 25V (RoHS)	1	C621	T2H
316	3101062250000	Chip capacitor 0603 2.2UF K 10 (RoHS)	1	C618	T4C
317	3104071050070	Tantalum capacitor 0805 1UF M 16V (RoHS)	1	C420	B2C
318	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C128	B4G
319	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C140	B3E
320	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C201	T2E
321	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C206	T4E
322	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C210	B3F
323	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C305	T3A
324	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C442	T3A

325	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C602	B5B
326	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C606	T5D
327	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C643	T4C
328	3104074750070	Tantalum capacitor 0805 4.7UF M 10V (RoHS)	1	C132	B4G
329	3104081550030	Tantalum capacitor 1206 1.5UF M 16V (RoHS)	1	C115	B5E
330	3102992000040	Trimmer capacitor 3.2*2.5*1.25mm (RoHS)	1	TC101	B3E
331	3210305479000	Multi-layer chip inductor 0402 4.7nH (RoHS)	1	L513	B1E
332	3210305829000	Multi-layer chip inductor 0402 8.2nH (RoHS)	1	L514	B3H
333	3210305150010	Multi-layer chip inductor 0402 15nH (RoHS)	1	L508	B3H
334	3210305150010	Multi-layer chip inductor 0402 15nH (RoHS)	1	L511	B3H
335	3210305150010	Multi-layer chip inductor 0402 15nH (RoHS)	1	L504	B2H
336	3210305220000	Multi-layer chip inductor 0402 22nH (RoHS)	1	L111	B4F
337	3210305220000	Multi-layer chip inductor 0402 22nH (RoHS)	1	L401	B2E
338	3210305220000	Multi-layer chip inductor 0402 22nH (RoHS)	1	L416	B2F
339	3210305270000	Multi-layer chip inductor 0402 27nH (RoHS)	1	L402	B2F
340	3210305330000	Multi-layer chip inductor 0402 33nH (RoHS)	1	L503	B2H
341	3210305390000	Multi-layer chip inductor 0402 39nH (RoHS)	1	L516	T2H
342	3212105470000	Multi-layer chip inductor 0402 47nH (RoHS)	1	L404	B3F
343	3210305101000	Multi-layer chip inductor 0402 100nH (RoHS)	1	L505	B3H
344	3210306229000	Multi-layer chip inductor 0603 2.2nH (RoHS)	1	R414	B3C
345	3210306479000	Multi-layer chip inductor 0603 4.7nH LQG1 (RoHS)	1	L405	B2D
346	3210306479000	Multi-layer chip inductor 0603 4.7nH LQG1 (RoHS)	1	L408	B3D
347	3213306561000	Multi-layer chip inductor 0603 0.56uH (RoHS)	1	L411	B2B
348	3213306102000	Multi-layer chip inductor 0603 1uH MLF160 (RoHS)	1	L110	B4G
349	3213306102000	Multi-layer chip inductor 0603 1uH MLF160 (RoHS)	1	L201	T4D
350	3213306222000	Multi-layer chip inductor 0603 2.2uH MLF1 (RoHS)	1	L509	B3H
351	3213306332000	Multi-layer chip inductor 0603 3.3uH MLF1 (RoHS)	1	L102	B4E
352	3213306332000	Multi-layer chip inductor 0603 3.3uH MLF1 (RoHS)	1	L103	B4E
353	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L101	B4E
354	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L106	B2E
355	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L107	B4H
356	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L108	B4G
357	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L109	B4H
358	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L417	B2E
359	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L602	T2E
360	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L603	T3D
361	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L605	T4E
362	3221506601000	Chip ferrite bead 0603 600Ω±25% (RoHS)	1	L606	T4E
363	3221507600000	Chip ferrite bead 0805 60Ω±25% (RoHS)	1	L410	B3B
364	3221507600000	Chip ferrite bead 0805 60Ω±25% (RoHS)	1	L601	T3B
365	3221507600000	Chip ferrite bead 0805 60Ω±25% (RoHS)	1	L607	T4B
366	3221507221000	Chip ferrite bead 0805 220Ω±25% (RoHS)	1	L407	B3D
367	3231301250000	Air-core inductor E2-0.30*1.2*5TL (RoHS)	1	L406	B3D
368	3210108230010	Bobbin inductor 1206 23nH LQW31 (RoHS)	1	L104	B3E
369	3210209102010	Bobbin inductor 1210 1uH LQH32M (RoHS)	1	L415	B2A
370	3231351630000	Air-core inductor E2-0.35*1.6*3TR (RoHS)	1	L501	B2B
371	3231351640000	Air-core inductor E2-0.35*1.6*4TL (RoHS)	1	L412	B3A
372	3231351640000	Air-core inductor E2-0.35*1.6*4TL (RoHS)	1	L413	B3A
373	3231351640000	Air-core inductor E2-0.35*1.6*4TL (RoHS)	1	L414	B3A
374	3231351650000	Air-core inductor E2-0.35*1.6*5TL (RoHS)	1	L409	B3B
375	3304060300050	Varactor HVC350BTRF-E R (RoHS)	1	D101	B4E
376	3304060300050	Varactor HVC350BTRF-E R (RoHS)	1	D102	B4E
377	3304040200000	Varactor BB179 SOD523 P (RoHS)	1	D103	B3E
378	3303020100020	Switching diode MA2S11100L SS- (RoHS)	1	D104	B3E
379	3303030800040	Switching diode 1SS356 SOD-323 35V 100mA (RoHS)	1	D401	B2B

380	3303030800040	Switching diode 1SS356 SOD-323 35V 100mA (RoHS)	1	D501	B2B
381	3303060300010	Switching diode HVC131TRF-E RENESAS (RoHS)	1	D105	B3E
382	3307110100080	LED KPT-1608SGC (RoHS)	1	D601	T4A
383	3307110100080	LED KPT-1608SGC (RoHS)	1	D603	B5A
384	3307110100060	LED KPT-1608SURC (RoHS)	1	D602	T4A
385	3307110100060	LED KPT-1608SURC (RoHS)	1	D604	B5A
386	3309030600000	Noise Clipping Diode RSA6.1EN (RoHS)	1	D605	T4B
387	3309030600000	Noise Clipping Diode RSA6.1EN (RoHS)	1	D606	T4D
388	3399990000080	Zener diode EDZTE616.8B SOD-523 (RoHS)	1	D506	T3I
389	3399990000080	Zener diode EDZTE616.8B SOD-523 (RoHS)	1	D610	T4H
390	3399990000080	Zener diode EDZTE616.8B SOD-523 (RoHS)	1	D402	B2D
391	3399990000080	Zener diode EDZTE616.8B SOD-523 (RoHS)	1	D301	T3A
392	3399990000080	Zener diode EDZTE616.8B SOD-523 (RoHS)	1	D607	B4C
393	3399990000080	Zener diode EDZTE616.8B SOD-523 (RoHS)	1	D608	B4D
394	3411002000020	Transistor 2SC5343EG (RoHS)	1	Q101	B2E
395	3404002000000	Transistor PRF957 (RoHS)	1	Q102	B3F
396	3403008000010	Transistor DTC114EE(TL) (RoHS)	1	Q103	B2F
397	3403008000010	Transistor DTC114EE(TL) (RoHS)	1	Q405	T2B
398	3403008000010	Transistor DTC114EE(TL) (RoHS)	1	Q604	T2G
399	3401002000990	Transistor 2SC5108-Y(TE85L) (RoHS)	1	Q104	B4F
400	3401002000990	Transistor 2SC5108-Y(TE85L) (RoHS)	1	Q504	B3H
401	3418001000010	Transistor AT-41511-TR1G (RoHS)	1	Q503	B2H
402	3401001000490	Transistor 2SA1832-GR(TE85L) (RoHS)	1	Q201	T3D
403	3503020000030	FET 2SK1824-T1-A (RoHS)	1	Q202	T2D
404	3408002000030	Transistor 2SC4226-R24-A (RoHS)	1	Q401	B2F
405	3408002000030	Transistor 2SC4226-R24-A (RoHS)	1	Q505	B3H
406	3502010000130	FET 2SK3078(TE12L) (RoHS)	1	Q402	B3D
407	3515990000000	FET RQA0002DNSTB (RoHS)	1	Q403	B3C
408	3403007000020	Transistor DTA114YE(TL) (RoHS)	1	Q404	T2B
409	3410001000020	Transistor 2SA1745 (RoHS)	1	Q601	T2G
410	3410001000020	Transistor 2SA1745 (RoHS)	1	Q602	T2H
411	4301080000020	Momentary contact switch SKRTLAE0 (RoHS)	1	SW601	T3A
412	4301080000090	Momentary contact switch SKQMAQE010 (2.55N) (RoHS)	1	SW604	T1B
413	4301080000090	Momentary contact switch SKQMAQE010 (2.55N) (RoHS)	1	SW605	T1D
414	5205005000020	MINI USB jack 5P (RoHS)	1	J201	B4D
415	5205006000010	Audio accessory jack LGK1503 (RoHS)	1	J202	B4C
416	3602999000000	Audio amplifier AP4890 BTL 1W (RoHS)	1	U301	T3A
417	3605008005070	Dual operational amplifier NJM2904V J (RoHS)	1	U401	T2B
418	41003201001B0	RF PCB (with IC JTB32304) B (RoHS)	1	U501	B3G
419	3610999000060	SCM SRT3210 100Pin (RoHS)	1	U601	T3F
420	3609049000010	IC LDO regulator RT9011PP (RoHS)	1	U602	T4C
421	3612031000510	Memory AT24C16AN-10SU-2 (RoHS)	1	U603	T4G
422	3615042000010	Charge management IC (RoHS)	1	U604	T4D
423	3609006000000	Reset IC R3112Q271A-TR-F (RoHS)	1	U605	T5E
424	3701212540030	TCXO 21.25MHz (RoHS)	1	XT101	B4G
425	41003203000G0	PCB FR4 4L 4P (RoHS)	1	PCB	
426	6201648000000	VCO shielding mask 0.30mm 00 (RoHS)	1		
427	6201651000000	Filter shielding mask 0.20mm 00 (RoHS)	1		
428	7000183000000	Heat-sinking module 3*5mm 00 (RoHS)	1		
429	3701327610060	Clock Crystal 32.768KHz SSP-T7F 12.5pF 20ppm (RoHS)	1	X601	T2F

# Adjustment Description

## Parts Overview



(1) PTT (Push-to-Talk) Key	(2) SK (programmable key)	(3) Speaker	(4) Volume Control Keys [+] / [-]
(5) Microphone	(6) Nameplate	(7) Charging Terminal	(8) Antenna
(9) Power On/Off Key	(10) Channel/Status Indicator	(11) Channel Selector Knob	(12) Charge Indicator
(13) Accessory Jack Cover	(14) Audio Accessory Jack	(15) MINI USB Jack	(16) Strap Hole
(17) Screw of Belt Clip	(18) Belt Clip	(19) Rear Cover	(20) Battery Latch

## Required Test Instruments:

Radio communication test set	1 set
10V/3A regulated DC power supply	1 set
Digital voltmeter	1 set
Ammeter	1 set

## Preparations:

Place the board to be tested on the test fixture (please ensure good connection between each test point and the fixture), and connect the board to a power supply with DC voltage of 3.8V.

## Wired Clone

### 1. Instructions:

- (1) Connect two radios with a cloning cable and power on the source radio while holding down **SK** on it. The radio will enter Wired Clone mode in 2 seconds. Then power on the target radio to enter normal mode;
- (2) In Wired Clone mode, press **SK** on the source radio to switch between User Clone mode and Factory Clone mode (check Factory Clone mode when programming, or you will fail to switch.);
- (3) Press **PTT** key to clone data to the target radio. You can clone the data to multiple target radios in the same way.

### 2. LED Indications:

- (1) During the cloning process, LED solidly glows red; once it finishes, LED will solidly glow green.
- (2) Clone errors:
  - a. User clone. Once clone begins, frequency band and Model ID will be checked. LED glows orange for 2 seconds and then goes out to indicate a failed check. If the check is successfully carried out but error data clone occurs, LED will flash orange. In this situation, press any key other than the **Radio On/Off** Key to turn it off.
  - b. Factory clone. If error data clone occurs, LED will flash orange. In this situation, press any key other than the **Radio On/Off Key** to turn it off. Repress **PTT** to initiate a new clone process.
- (3) Target radio status: LED solidly glows green during the cloning process and goes out once it finishes.

**3. Difference between Factory Clone Mode and User Clone Mode:**

- (1) User Clone Mode: Only clone the data of user mode. Test parameters like adjustment frequency, adjustment items and base band parameter will not be cloned.
- (2) Factory Clone Mode: Clone all the data excluding serial No.

**4. Instructions:**

- (1) Error will occur when data is cloned without cable connection. Please refer to 2-(2).
- (2) Error may occur during test data clone in Factory Clone mode if you wrongly press the side key and switch into User Clone mode (LED flashes red once).
- (3) If battery of the source radio runs low in clone mode, red LED will flash and low battery alert will be given as well.

**Adjustment** (\*Note: Users only need to adjust the Narrow Bandwidth mode.)**1. Description of Adjustment Procedures:**

- (1) Simultaneously hold down **PTT**, **SK** and **Power On/Off** Key for more than 4s to enter adjustment mode (orange LED flashes). After the keys are released, the radio will enter the adjustment item in this mode (the item entered depends on the position where the **Channel Selector** Knob locates). And LED will flash red or green according to the Rx and Tx status of the adjustment item.
- (2) Or connect the programming cable to the radio for real-time adjustment in PC mode.

**2. Description of Adjustment Items:****(1) Wide/Narrow Bandwidth Switch and Frequency Switch in an Adjustment Item:**

In an adjustment item, short press **SK** to switch between wide and narrow bandwidth. The default adjustment point is the 1st frequency (low frequency) of current bandwidth. After selecting a bandwidth, short press (no longer than 1s) **PTT** to switch among different frequencies.

**(2) Adjustment Items Include:****Tx Items:**

Tx Frequency Tolerance and VCO Lock Voltage.

Note: These items are adjusted outside the adjustment mode via hardware.

Tx Low Power, CDCSS Wave, CDCSS Deviation, CTCSS Deviation (low), CTCSS Deviation (medium), CTCSS Deviation (high), Tx Low Voltage Threshold and Max. Deviation. Note: These items are adjusted inside the adjustment mode via software.



**Rx Items:**

VCO Lock Voltage (outside the mode), Squelch and Rx Low Voltage Threshold.

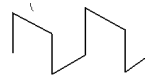
**3. Specific Operations and Requirements:**

(1) Conventional Adjustment Items (outside the adjustment mode): Tx Frequency Tolerance, VCO Lock Voltage.

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

Item	Condition	Test		Adjustment		Specifications / Remarks
		Test Instrument	Test point	Part	Method	
Tx Frequency Tolerance	Rotate the Channel Selector Knob to CH1 and press PTT to transmit.	Communication Test Set	Antenna	VR101	Adjust VR101 with ceramic tuning tool to control the center frequency within the error range.	≤150Hz
VCO Tx Lock Voltage	Rotate the Channel Selector Knob to CH3 and press PTT to transmit.	Digital Voltmeter	CV	TC101	Adjust TC101 with ceramic tuning tool until the lock voltage meets the requirements.	1.9V~2.3V
	Rotate the Channel Selector Knob to CH1 and press PTT to transmit.				Check	≥0.5V
VCO Rx Lock Voltage	Rotate the Channel Selector Knob to CH3.			TC101	Check	1.9V~2.3V
	Rotate the Channel Selector Knob to CH1.				Check	≥0.5V

(2) Adjustment in the Adjustment Mode (Note: Make sure the antenna or load is connected before adjustment; rotate the Channel Selector knob to save the adjusted values automatically.)

Item		Condition	Test		Adjustment		Specification/Remarks
			Test Instrument	Test point	Part	Method	
Transmitting Power	Low Power	Rotate the Channel Selector Knob to CH1 and select low frequency.	Communication Test Set / Ammeter	Antenna Connector		Press <b>[+]</b> or <b>[-]</b> key to adjust the output power, and rotate the Channel Selector Knob to save it.	0.5W±0.1W I≤0.8A
CDCSS Waveform	Narrow Bandwidth	Rotate the Channel Selector Knob to CH3 and “wide bandwidth” and “low frequency” are selected.	Communication Test Set BPF: <20Hz~300Hz	Antenna	VR601 adjustment	Adjust the waveform to make it similar to square waveform.	
CDCSS Deviation	Narrow Bandwidth	Rotate the Channel Selector Knob to CH4 and “wide bandwidth” and “low frequency” are selected.				Press <b>[+]</b> or <b>[-]</b> key to make adjustments until the CDCSS deviation meets the requirements.	350~550Hz

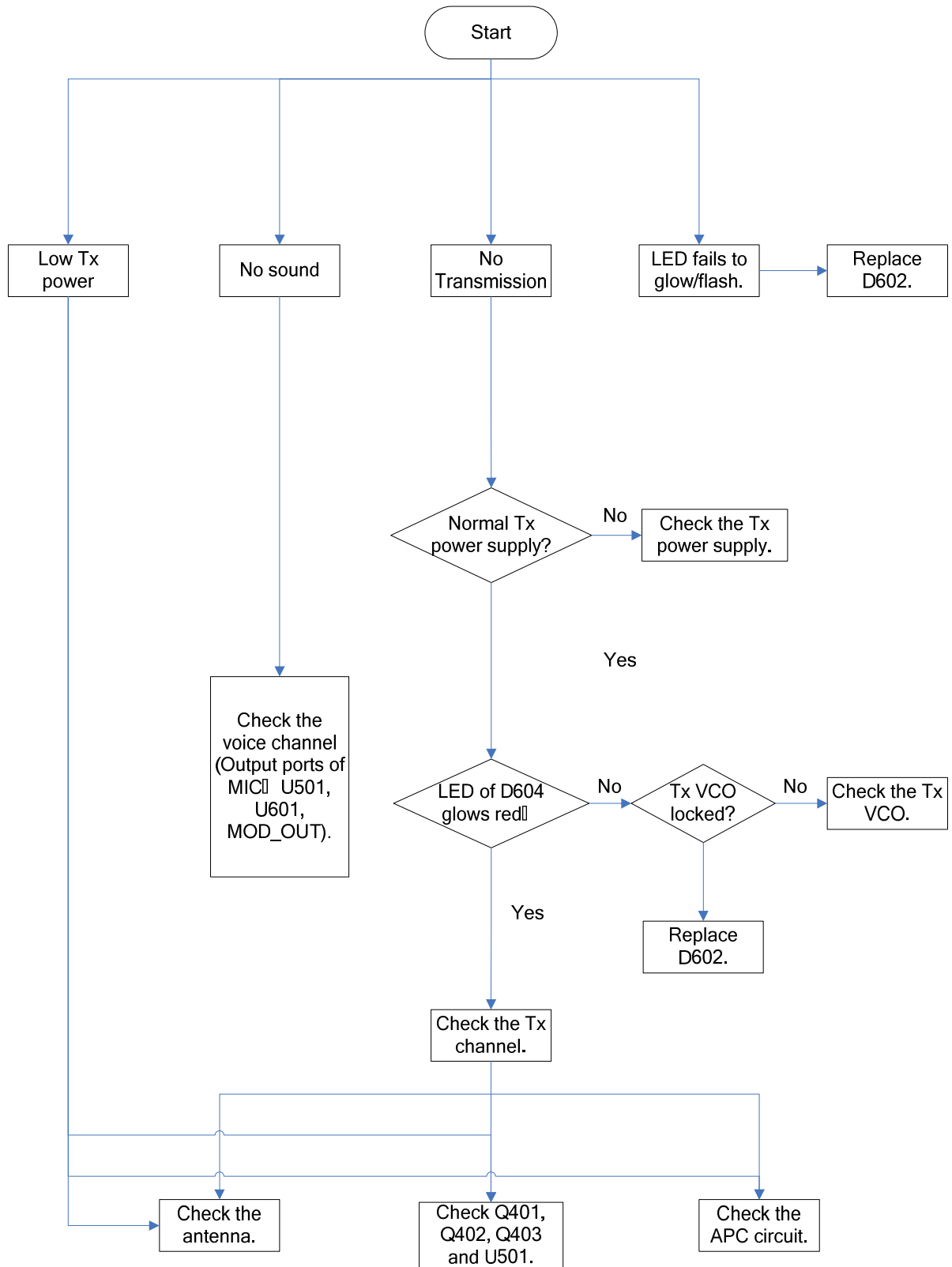
CTCSS Deviation	Narrow Bandwidth	On CH5, CH6 and CH7, short press SK key to enter “narrow bandwidth”, and short press PTT key to switch between different frequencies.	Communication Test Set :<20Hz~300Hz	Antenna		Use <b>[+]</b> or <b>[-]</b> key to make slight adjustments until the CTCSS deviation meets the requirements.	350~550Hz
Max. deviation	Narrow Bandwidth	Rotate the <b>Channel Selector Knob</b> to CH9; Short press <b>SK</b> key to switch to “narrow band”.	Communication Test Set <20Hz~15kHz AF:1kHz 120mV	Antenna Earpiece Socket		Use <b>[+]</b> or <b>[-]</b> key to ensure that the specifications meet the requirements.	1.7~2.3KHz
Modulation Sensitivity	Narrow Bandwidth	Rotate the <b>Channel Selector Knob</b> to CH9; Short press <b>SK</b> key to switch to “narrow band”.	Communication Test Set <20Hz~15kHz AF:1kHz 13±3mV			Check	1.5KHz
TX Low Voltage Threshold	Rotate the <b>Channel Selector Knob</b> to CH8.		Digital Voltmeter	Power Supply port	Power Supply	Adjust output voltage of the power supply to 3.45V, and press UP or DOWN key to sample the current value.	Alert tone will be given with red LED flashing when TX voltage is 3.40-3.50V.

(3) Rx Circuit Adjustment

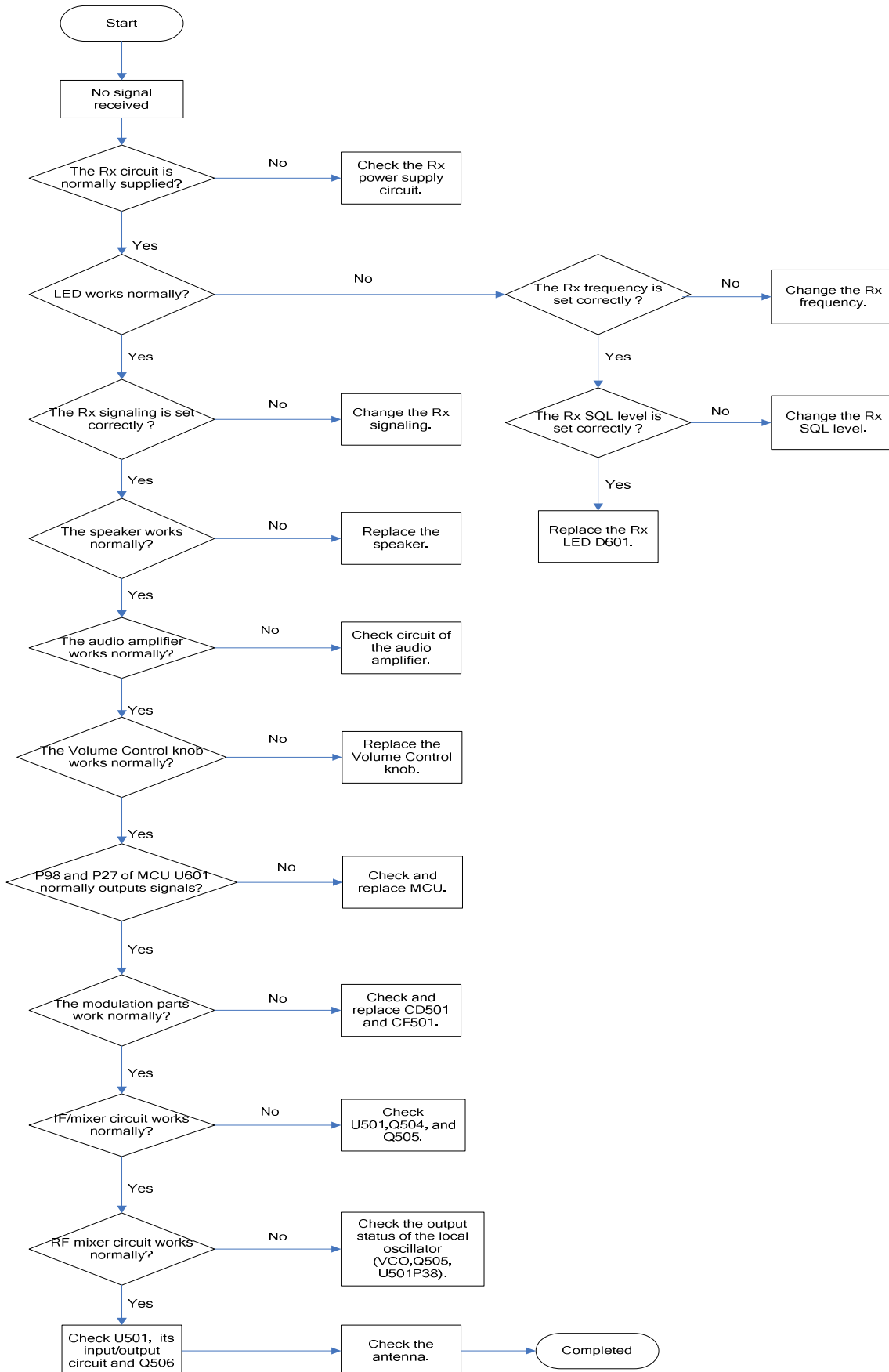
Items		Condition	Test Instrument	Part		Method	Specification/Remarks
Squelch On	Narrow	Short press <b>SK</b> to enter “narrow band”. Press <b>[+]</b> and <b>[-]</b> key to adjust squelch level. Short press <b>PTT</b> key to switch the frequency.	Communication Test Set SSG:-118dBm MOD:1KHz DEV: 1.5KHz Filter: 0.3-3KHz	Antenna Earpiece Socket		Adjust the output signals of SSG to the squelch level. Rotate the <b>Channel Selector Knob</b> to set the value after three-point adjustment.	Squelch level(5): -120±1dBm
Squelch Off	Narrow	Short press <b>SK</b> to enter “narrow band”. Press <b>[+]</b> and <b>[-]</b> key to adjust squelch level. Short press <b>PTT</b> key to switch the frequency.	Communication Test Set SSG:-118dBm MOD:1KHz DEV: 1.5KHz Filter: 0.3~ 3KHz	Antenna Earpiece Socket		Adjust the output signals of SSG to the squelch level. Rotate the <b>Channel Selector Knob</b> to set the value after three-point adjustment.	Squelch level(5): -121±1dBm
RX Low Voltage Threshold	Rotate the Channel Selector knob to CH12.		Digital Voltmeter	Power Supply port	Power Supply	Adjust output voltage of the power supply to 3.57V, and press UP or DOWN key to sample the current value.	Alert tone will be given with red LED flashing when TX voltage is 3.52-3.62V.
Sensitivity	Narrow	High, medium, low frequency out of the mode	Communication Test Set SSG:-118dBm MOD:1KHz DEV: 1.5KHz Filter: 0.3~ 3KHz	Antenna Earpiece Socket		Check	-118dBm or above

# Troubleshooting Flow Chart

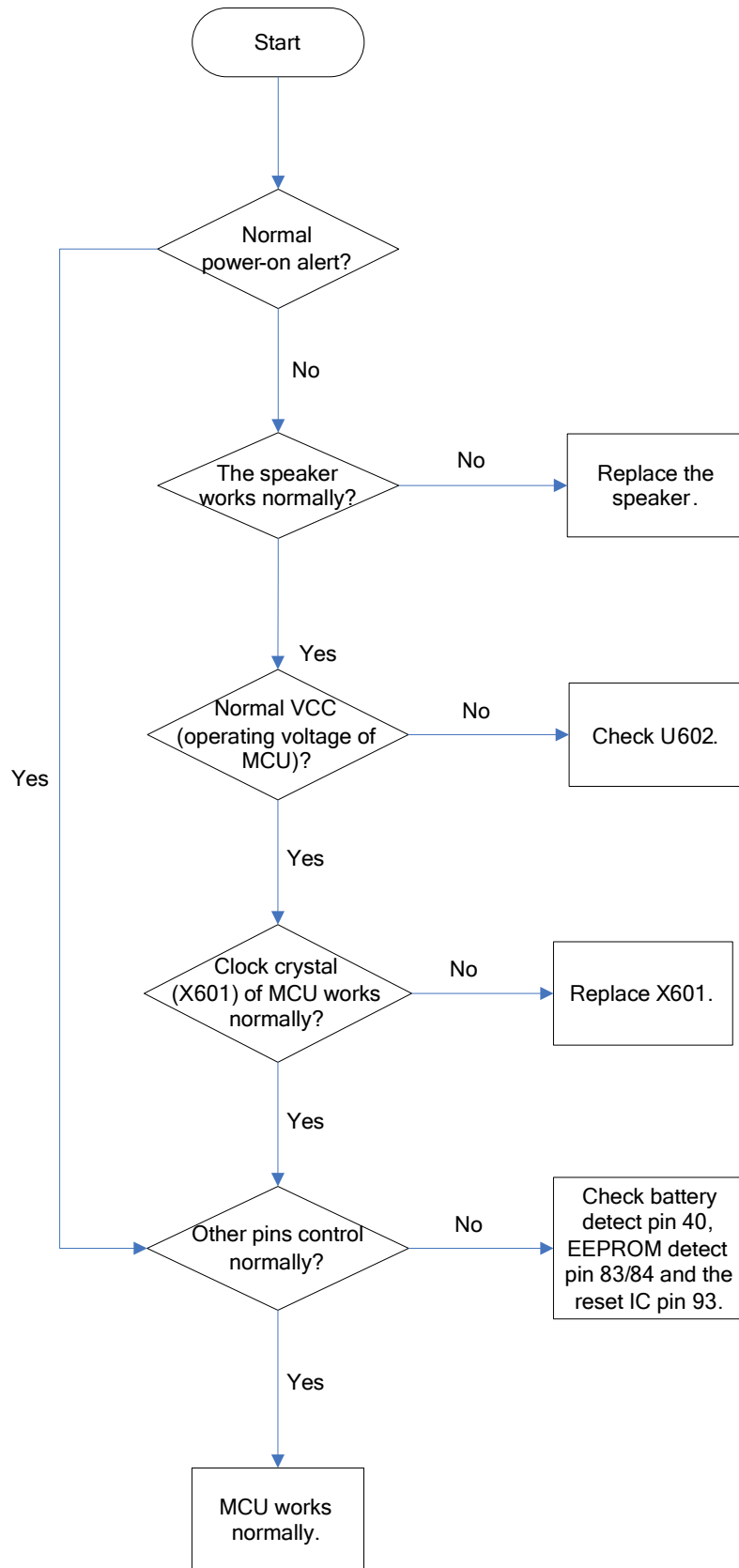
## Transmit Circuit



**Receive Circuit**



# MCU

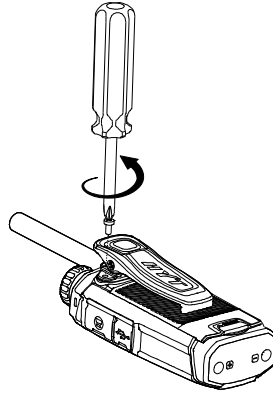




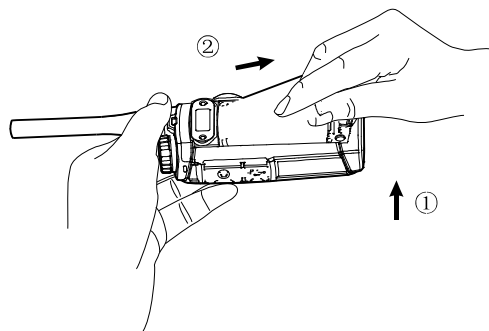
# Disassembly and Assembly

## Disassembly

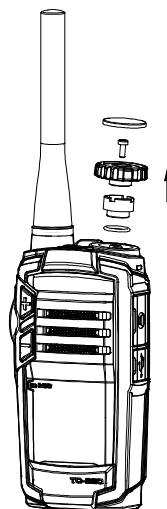
1. Power off the radio;
2. Remove the belt clip.



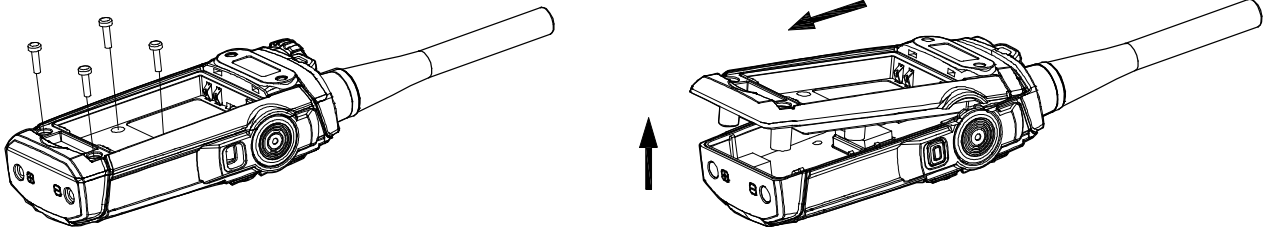
3. Remove the battery
  - a. Push the battery latch upwards;
  - b. Remove the battery cover;
  - c. Take out the battery by lifting its bottom side.



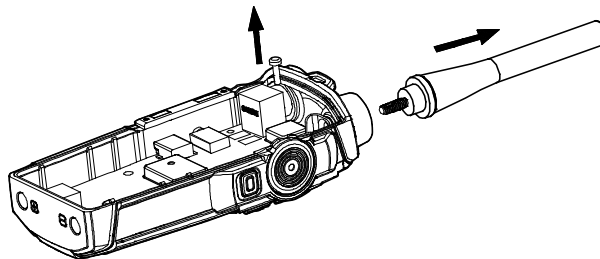
4. Remove the Channel Selector Knob, nut and waterproof ring
  - a. Deattach the Channel Selector Knob Cover;
  - b. Unfasten the screw;
  - c. Remove Channel Selector Knob;
  - d. Remove the nut and waterproof ring.



5. Disassemble chassis of the radio
  - a. Unfasten the 4 screws on the chassis;
  - b. Lift the bottom of the chassis;
  - c. Pull the chassis out.

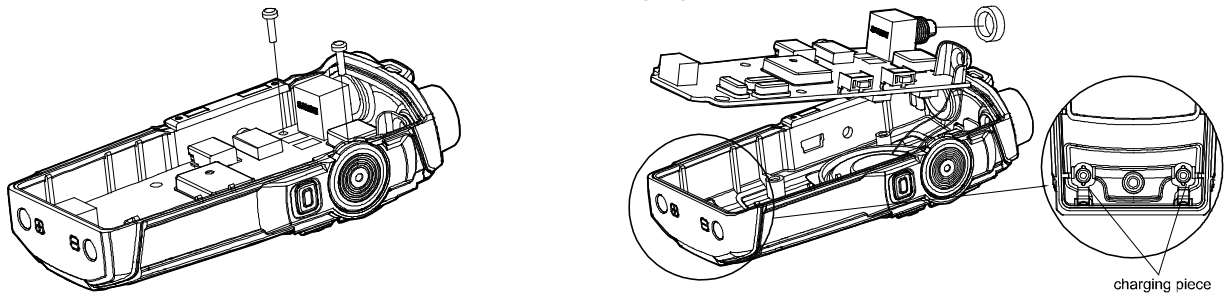


6. Remove the antenna
  - a. Unfasten the fixing screw of antenna;
  - b. Deattach the antenna.



7. Disassemble the main PCB
  - a. Remove the two fixing screws on the PCB;
  - b. Remove the PCB and supporting ring of the Channel Selector Knob.

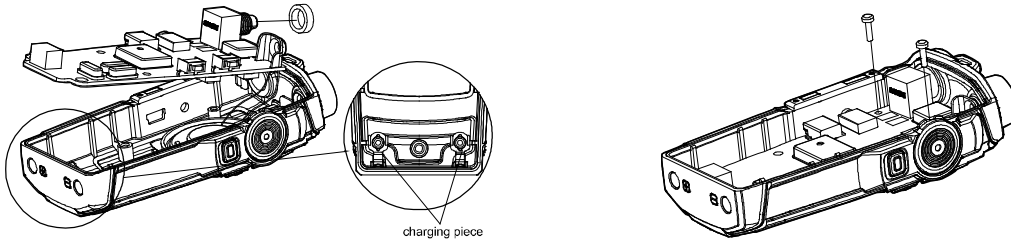
**Note:** Take care of the speaker cable and the charging piece at the bottom.



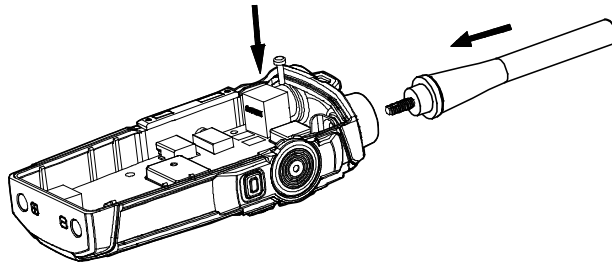
**Assembly**

1. Install the main PCB
  - a. Make sure that the speaker is well connected, and the charging piece on the bottom is correctly installed;
  - b. Install the supporting ring of the Channel Selector Knob;
  - c. Attach the main PCB;
  - d. Attach and secure two screws (take care to control the torsion force within 0.8-1.2kgf);

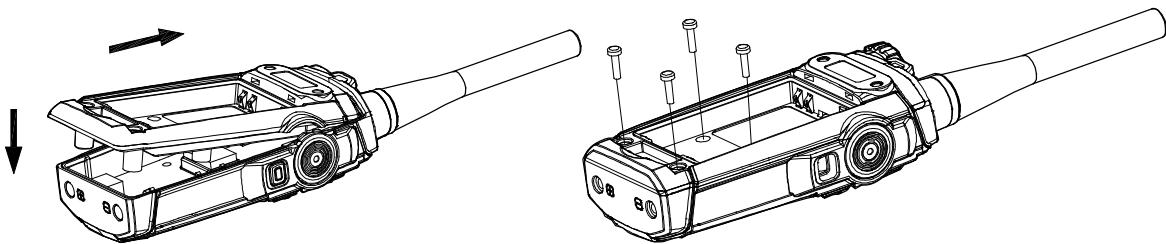
**Note:** don't damage the speaker cable during installation.



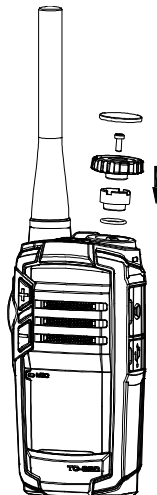
2. Assemble the antenna
  - a. Attach the antenna properly;
  - b. Fasten the fixing screw of antenna;



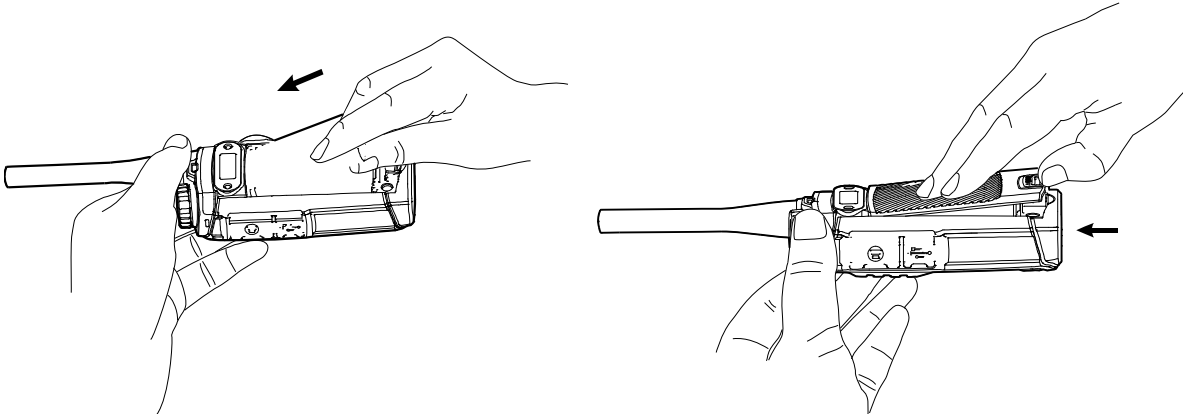
3. Assemble the chassis
  - a. Assemble the chassis
  - b. Attach and secure the four fixing screws (take care to control torsion force within 1.2-1.5kgf).



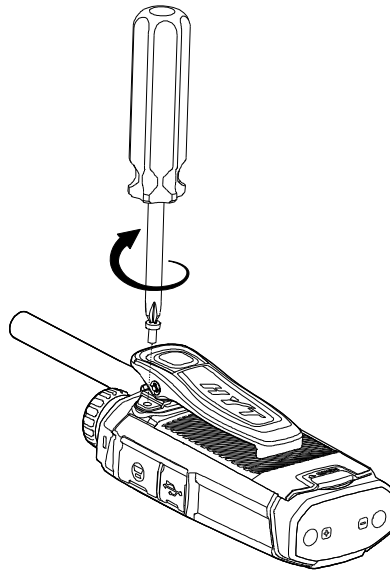
4. Assemble the nuts and Channel Selector Knob on the top
  - a. Attach and secure the nuts on the top of the radio (with a waterproof ring);
  - b. Attach the Channel Selector Knob;
  - c. Attach and secure the fixing screws;
  - d. Attach and secure the Channel Selector Knob Cover.



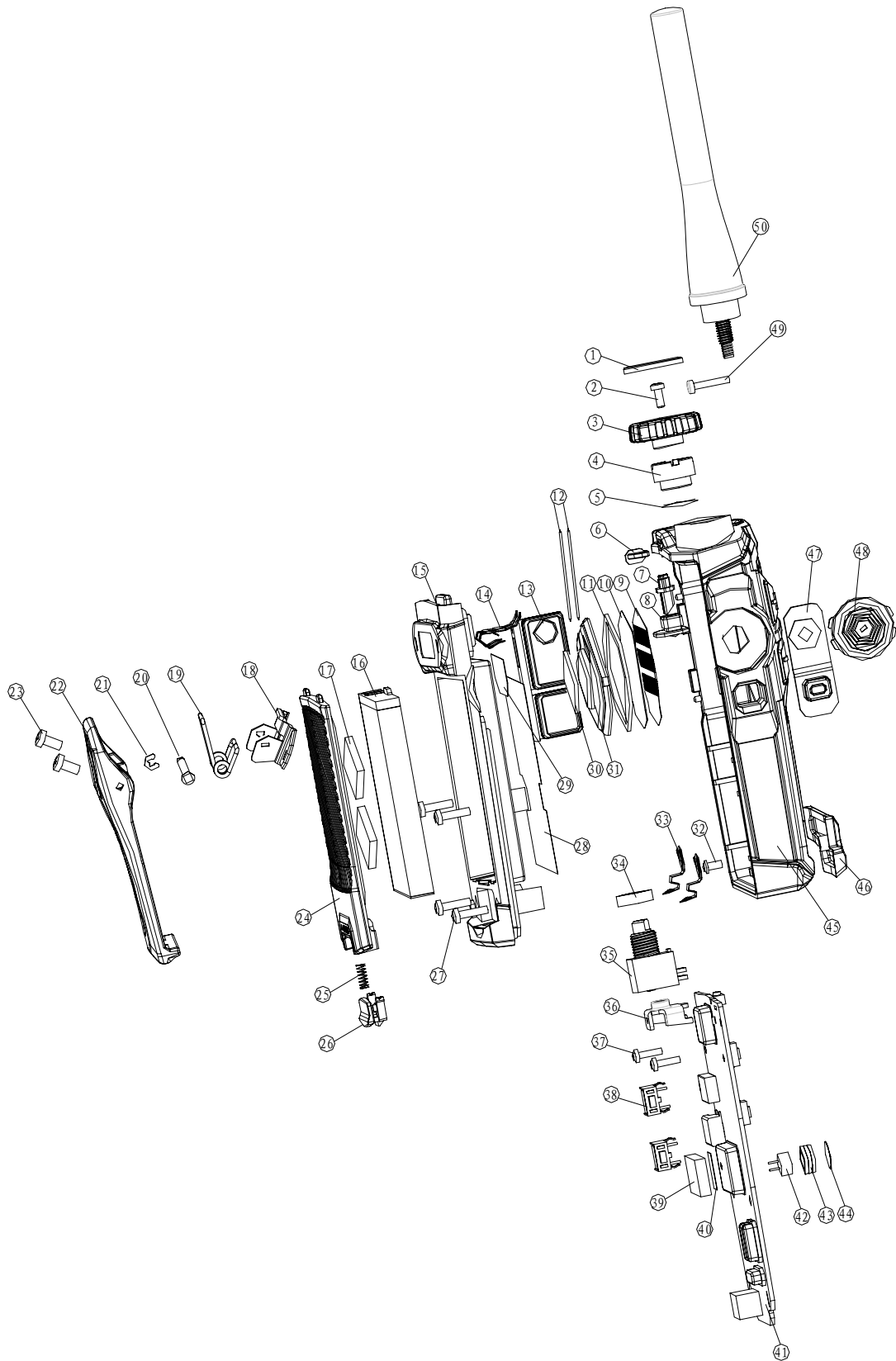
5. Attach the battery
  - a. Insert the battery;
  - b. Attach the battery cover.



6. Attach the belt clip



# Exploded View



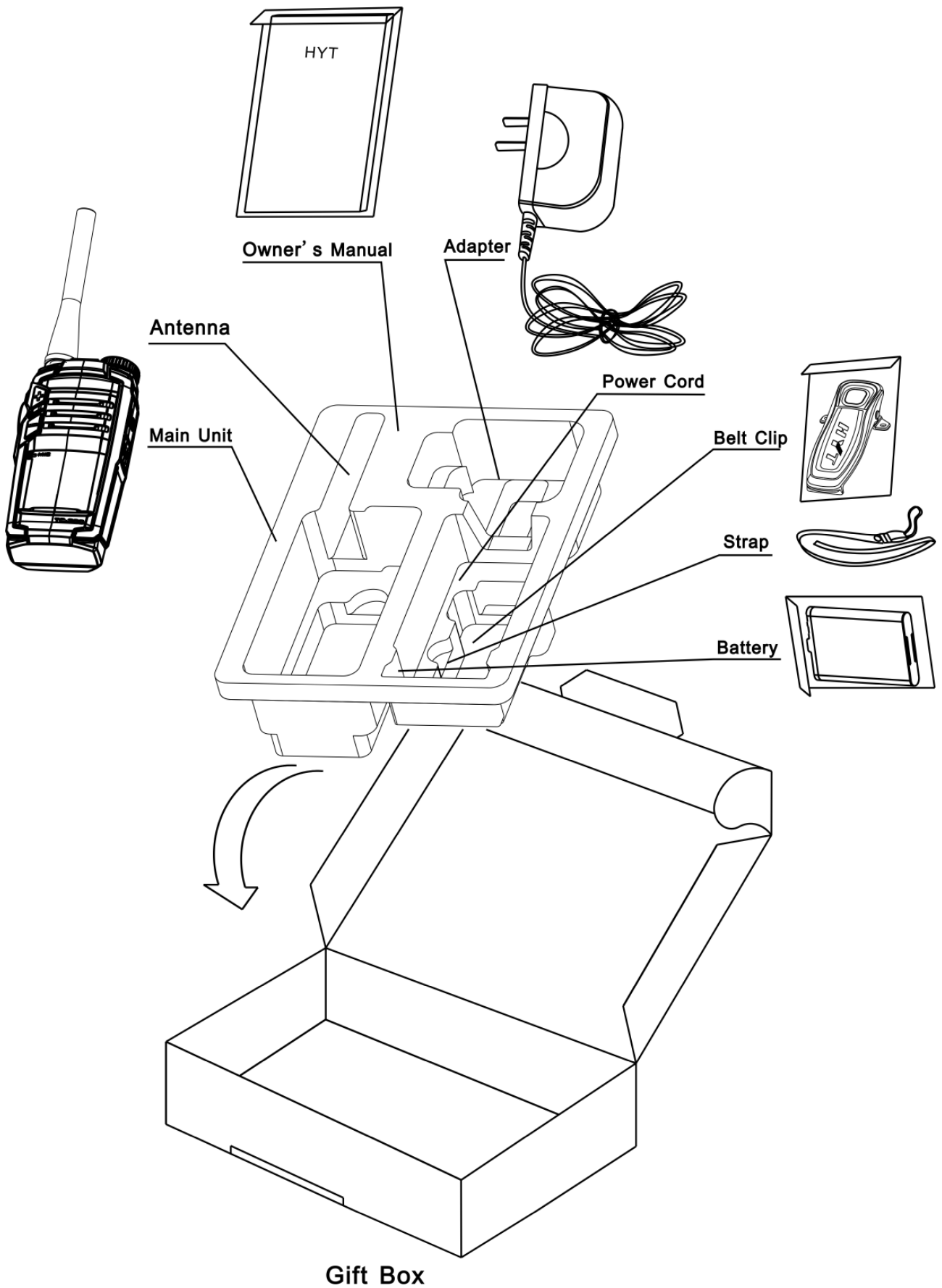
## TC-320 446MHz Parts List 2

No.	Part No.	Items	Qty. (PCS)
1	6201658001010	Encoder knob cover (RoHS)	1
2	7102006000000	Machine Screw M2.0*6.0mm	1
3	6000718100000	Encoder knob (RoHS)	1
4	7206007400000	Fixing nut of Encoder switch (RoHS)	1
5	6100335000000	O_RING for antenna (RoHS)	1
6	6000737000010	Light guide (charge LED) (RoHS)	1
7	6000736000000	Light guide (signal indicator) (RoHS)	1
8	6100363000000	POWER key (RoHS)	1
9	6201644000000	Felt speaker (steel) (RoHS)	1
10	7400229000000	Felt speaker (cloth) (RoHS)	1
11	7500250000000	Speaker washer (RoHS)	1
12	4210038000000	Cable (RoHS)	2
13	6000739000000	Accessory Jack Cover (RoHS)	1
14	6201643000000	Battery discharging piece (RoHS)	2
15	6000734000010	Radio Chassis (RoHS)	1
16		Li-ion battery pack (RoHS)	1
17	7500249000000	Sponge pad for battery cover (RoHS)	2
18	6201796000000	Belt clip dome (RoHS)	1
19	7000205000000	Spring of Belt clip (RoHS)	1
20	7000206000000	Bolt of belt clip (RoHS)	1
21	7000181000000	Fender washer (RoHS)	1
22	6000836000010	Belt clip (RoHS)	1
23	7102505000200	Machine screw M2.5*4.80mm(RoHS)	2
24	6000733000000	Battery Cover (RoHS)	1
25	7000179000000	Spring of battery latch (RoHS)	1
26	6000738000000	Battery Latch (RoHS)	1
27	7102008020100	Self-tapping screw PT2.0*8.0mm (RoHS)	4
28	7600036000000	Shield of main unit (RoHS)	1
29	7400233000000	PCB shield (RoHS)	1
30	7400034000000	Speaker insulation pad (RoHS)	1
31	5001000000090	Speaker (RoHS)	1
32	7101904020200	Self-tapping screw (Version 2.0) ST1.9*4.0mm (RoHS)	1
33	6201671000000	Charging piece (RoHS)	2
34	7209802800000	Supporting ring of encoder switch (RoHS)	1
35	4304030000030	Gray code band switch (RoHS)	1
36	6201830000000	446 MHz Antenna bracket (RoHS)	1
37	7101704020100	Self-tapping screw ST1.7*4.0mm (RoHS)	2
38	4301040000060	PTT switch (RoHS)	2

<b>39</b>	7600037000000	Conductive sponge (RoHS)	1
<b>40</b>	7600020000000	3M Embossed copper foil (RoHS)	1
<b>41</b>		Main PCB(RoHS)	1
<b>42</b>	5002230000010	MIC (RoHS)	1
<b>43</b>	6100111000010	Silica rubber mic bushing (RoHS)	1
<b>44</b>	7400077000000	Mic net (RoHS)	1
<b>45</b>	6000732001000	Front case (RoHS)	1
<b>46</b>	6300062001010	Decorative sheet (zink alloy) (RoHS)	1
<b>47</b>	6100365000000	PTT key (silica rubber ) (RoHS)	1
<b>48</b>	6000735000010	PTT key yellow (RoHS)	1
<b>49</b>	7101700300000	Self-tapping screw ST1.9*4.0mm (RoHS)	1
<b>50</b>		446 MHz Antenna (RoHS)	1

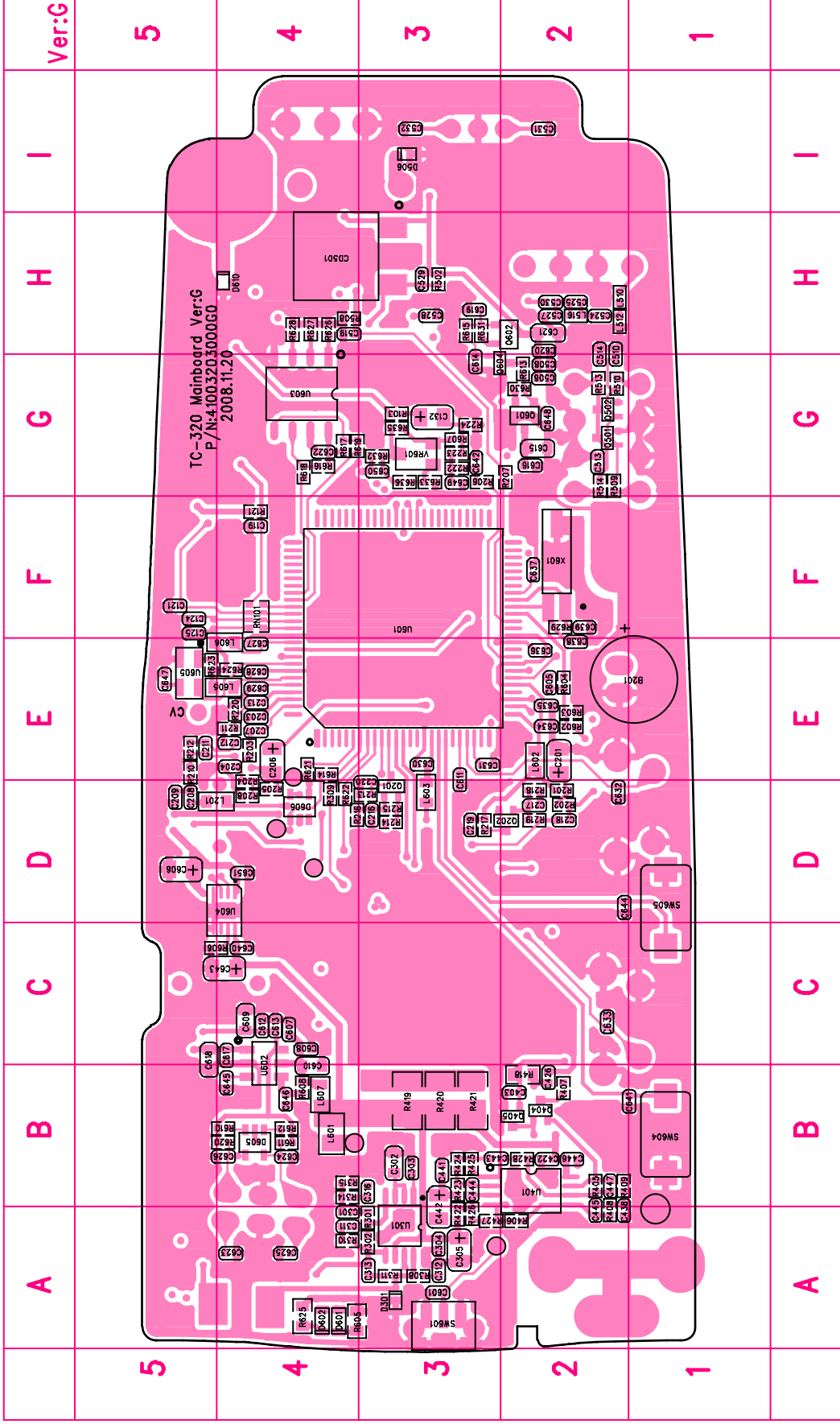
**Note: Parts that are not marked with material number may vary with radio frequency band.**

**Packing Diagram**

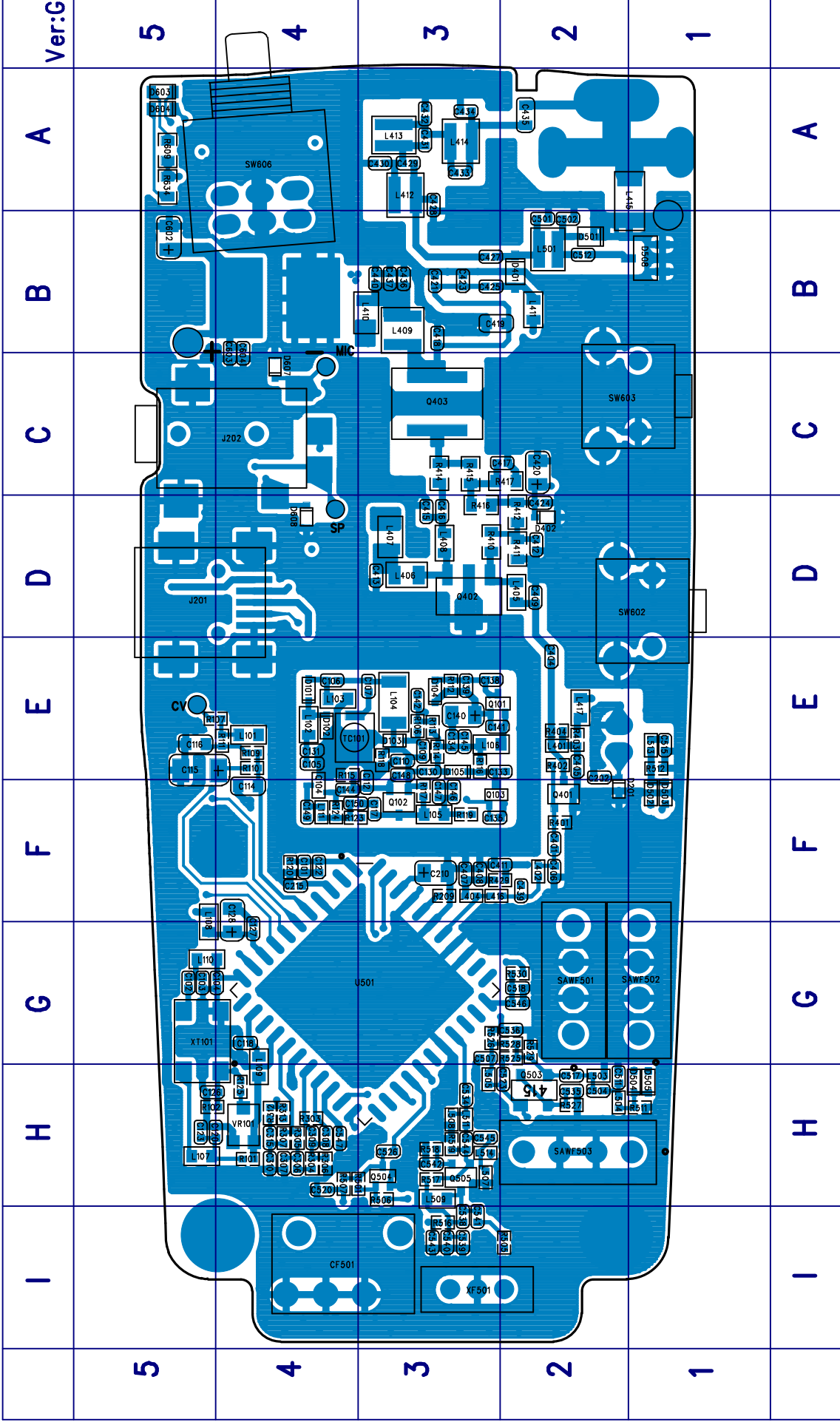




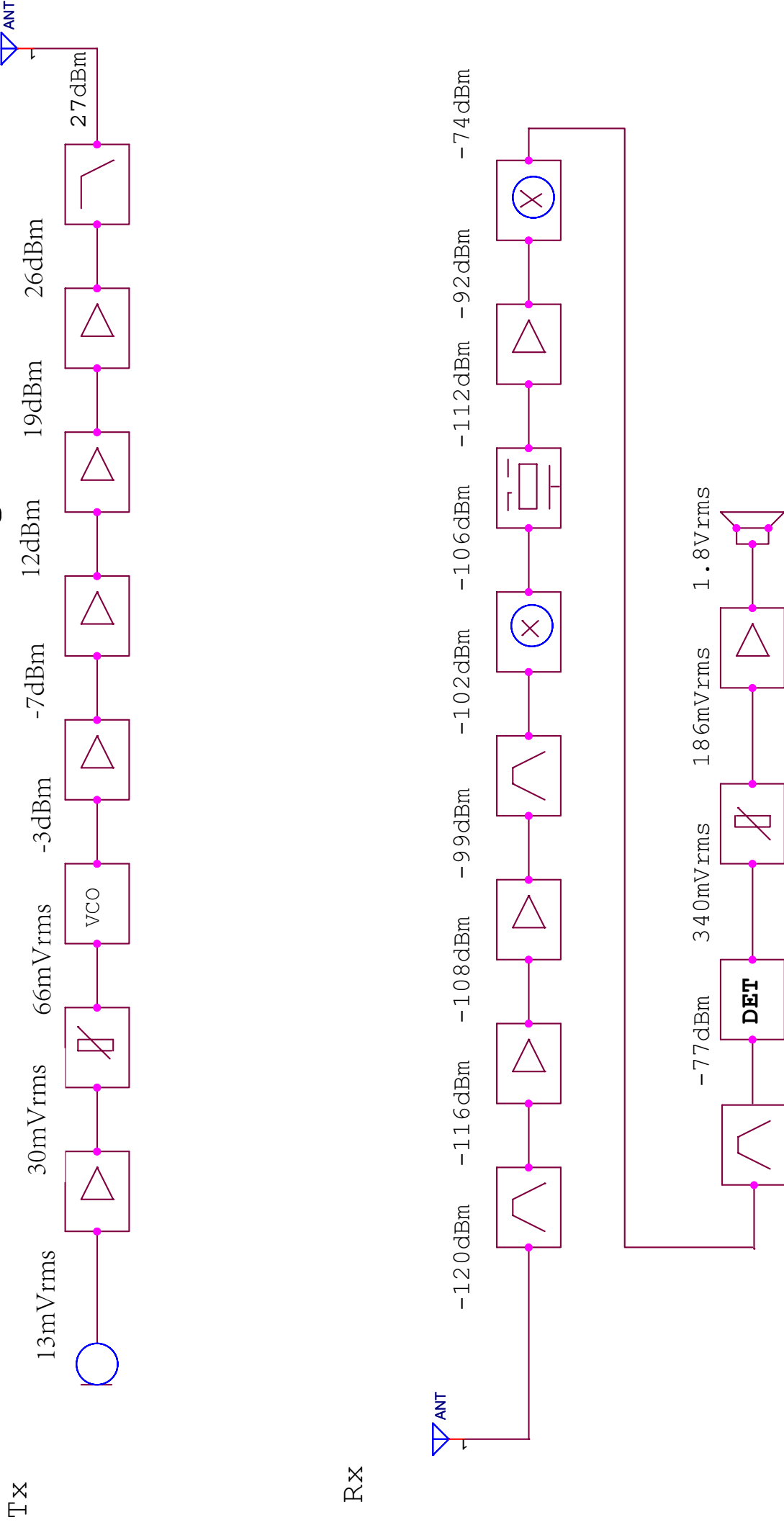
# TC-320 446MHz PCB View Top Layer



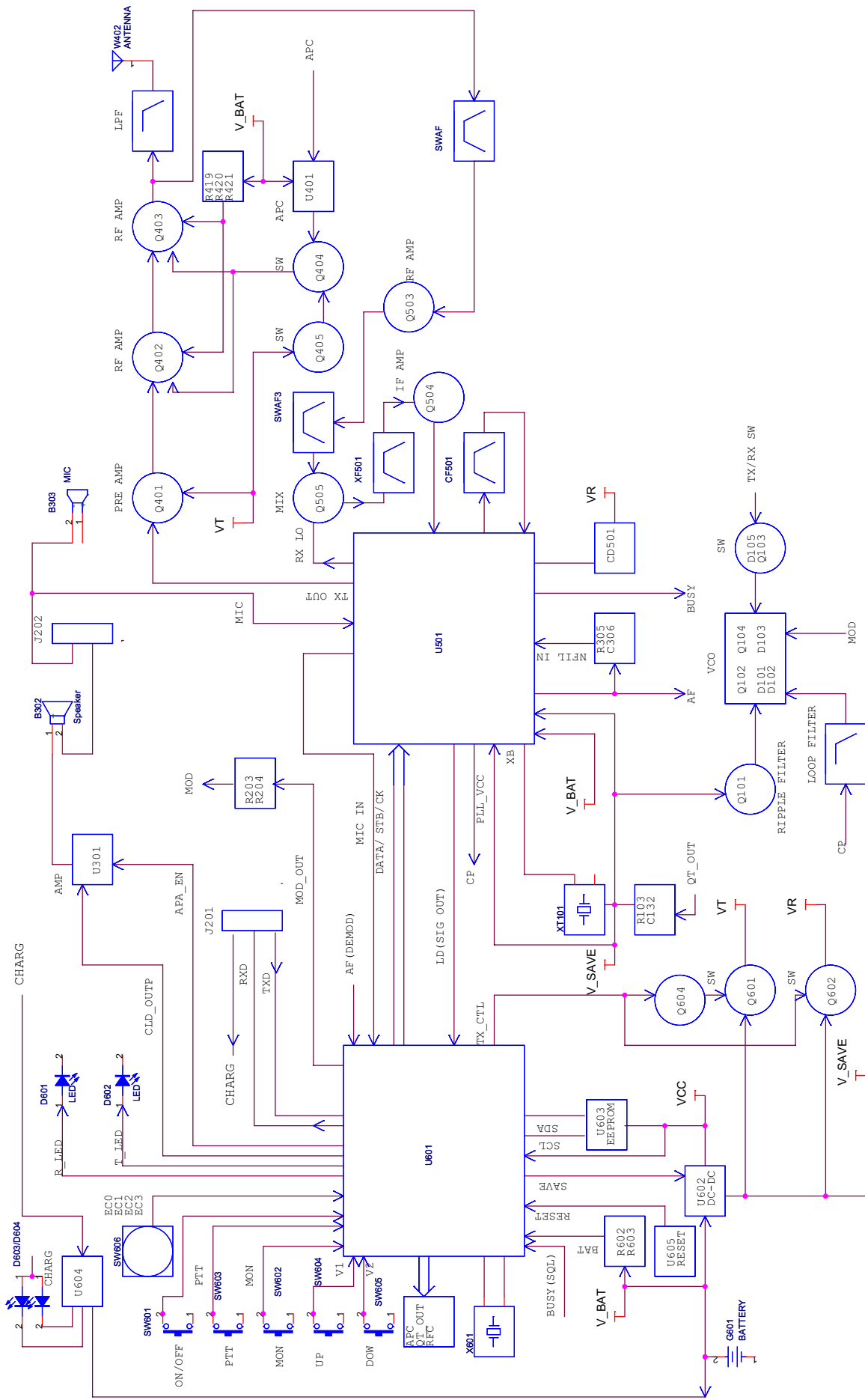
TC-320 446MHz PCB View  
Bottom Layer



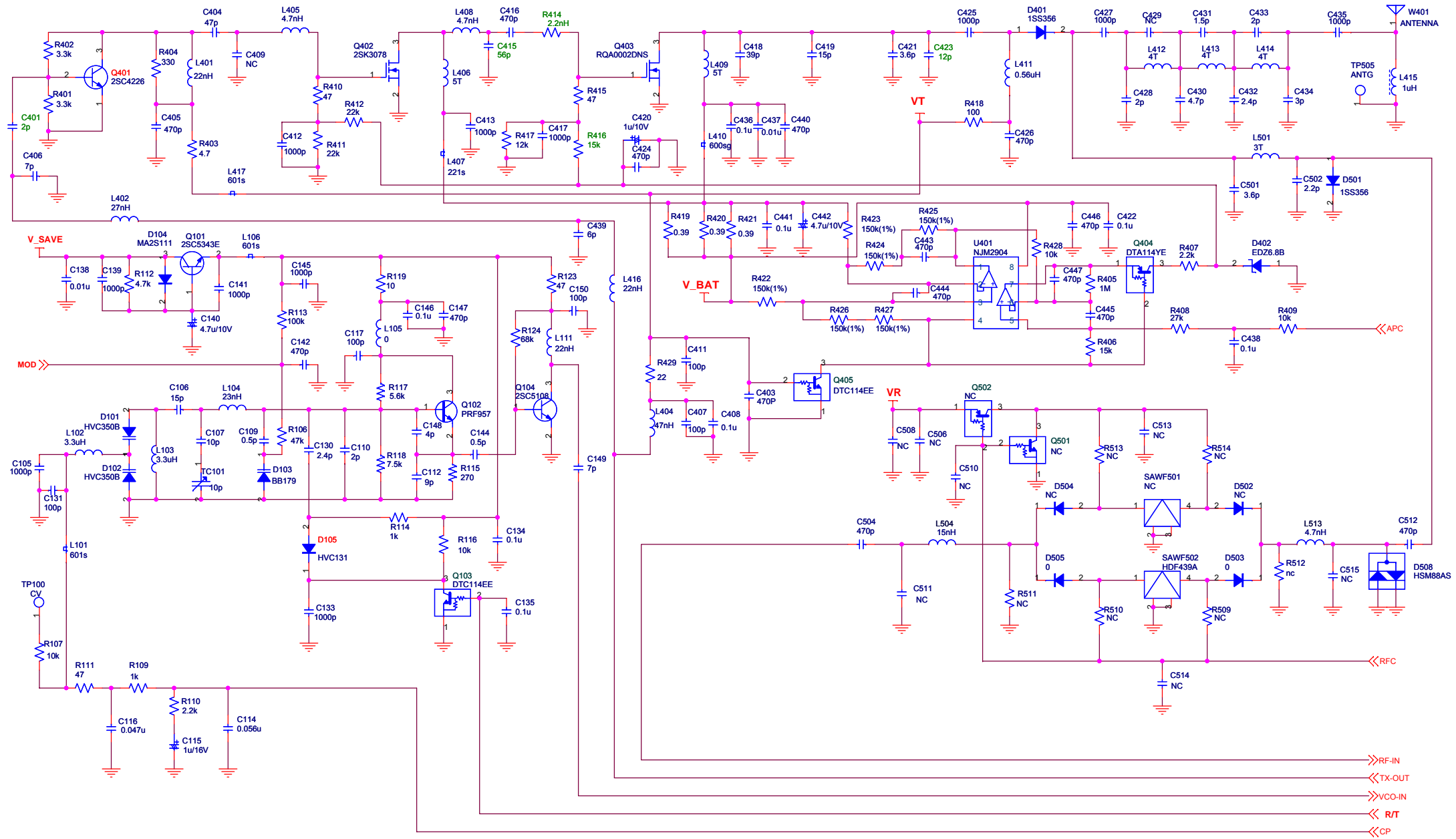
# TC-320 446MHz Level Diagram



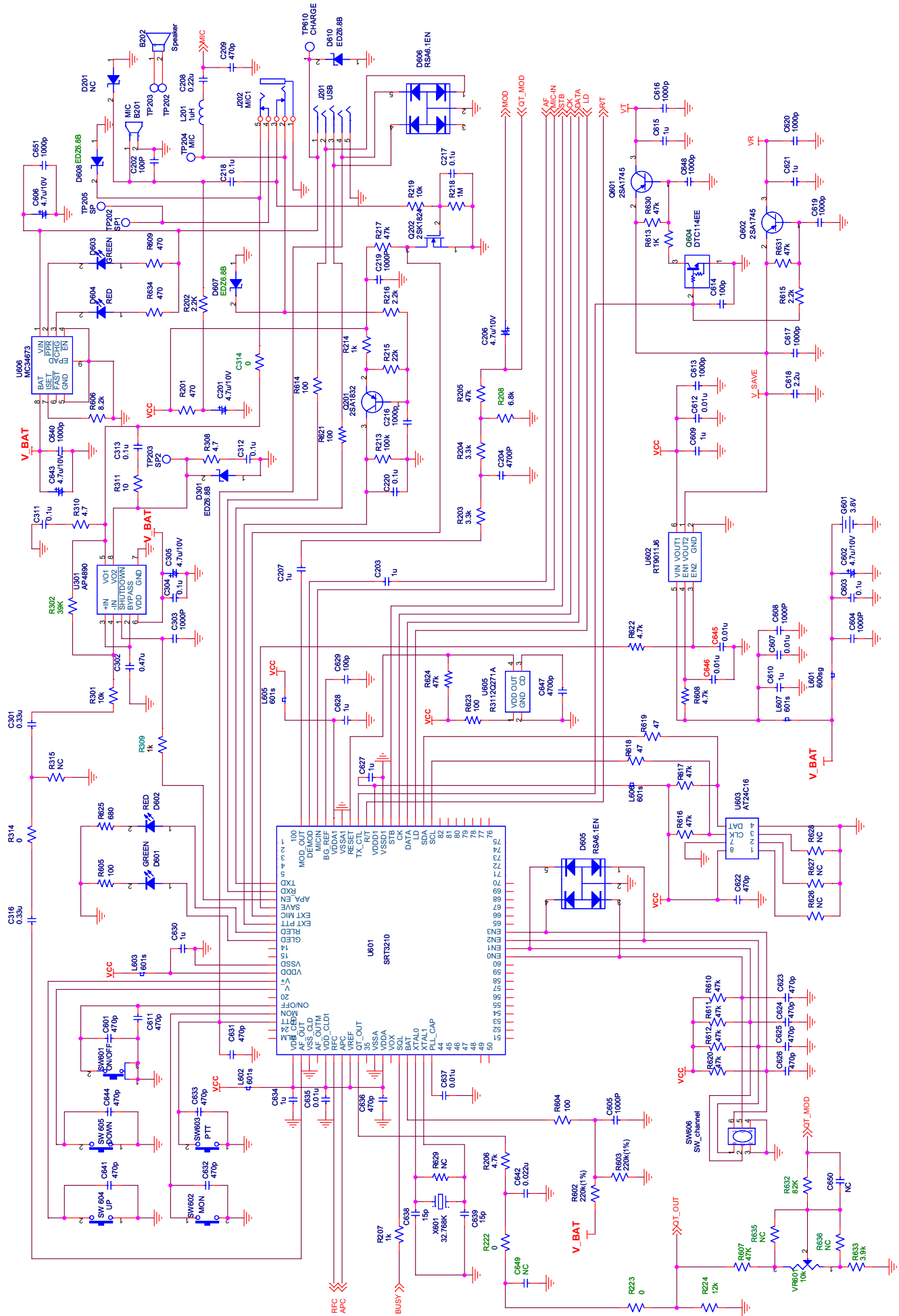
# TC-320 446MHz Block Diagram



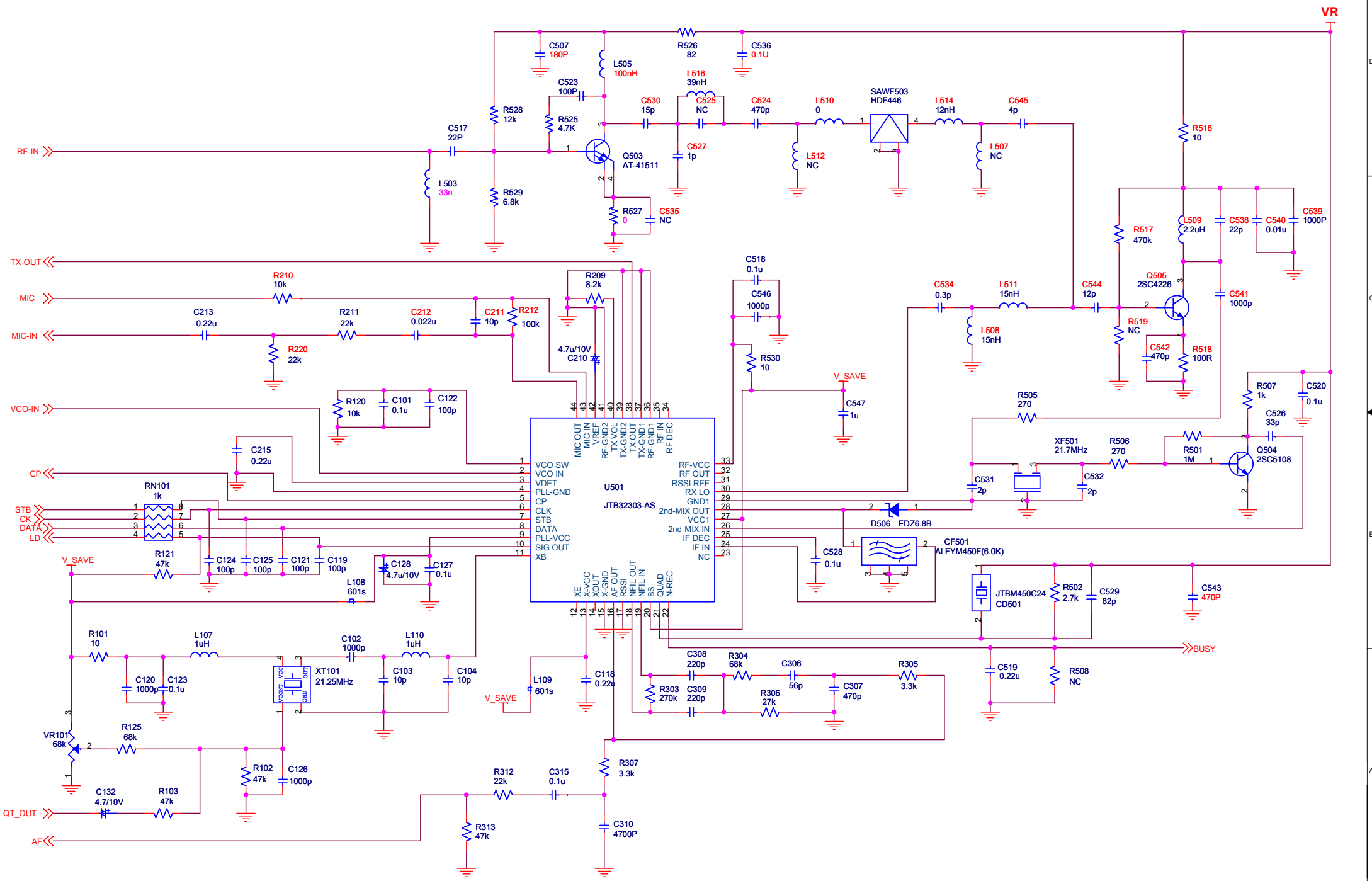
# TC-320 446MHz Schematic Diagram (RF)



# TC-320 446MHz Schematic Diagram (CPU)



# TC-320 446MHz Schematic Diagram (PLL)



**Specifications**

<b>General Specifications</b>	
Frequency Range	446.00625-446.09375MHz
Channel Capacity	16
Channel Spacing	12.5KHz
Operating Voltage	3.8V DC
Battery	1100mAh Li-Ion battery
Battery Life (5-5-90 duty cycle)	About 8 hours
Operating Temperature	-20℃~+55℃
Dimensions(H×W×D) (with battery, without antenna)	100mm×48mm×27mm
Weight (with antenna & battery)	135g
Frequency Stability	±2.5ppm
<b>Receiver</b>	
Sensitivity	≤0.28μV
Selectivity	≥55dB
Intermodulation	≥55dB
Spurious Response Rejection	≥60dB
Rated Audio Power Output	0.4W (Speaker impedance: 8 ohm)
Rated Audio Distortion	≤5% (0.4W)
<b>Transmitter</b>	
RF Power Output	0.5W
Spurious and Harmonics	≤-36dBm
Modulation Limiting	≤2.5KHz
FM Noise	≥34dB
Modulation Distortion	≤5%

**NOTE:** All the above specifications and designs are 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 designs are subject to change without notice due to continuous technology development. Changes which may occur after publication are highlighted by Revision History contained in Service Manual.

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