E104-BT51A Datasheet

CC2640R2L BLE5.0

Low Power Consumption

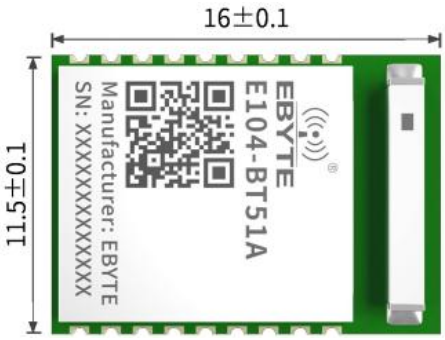
Bluetooth to serial port module

Chengdu Ebyte Electronic Technology Co.,Ltd.

CONTENTS

1. Introduction

1.1 Module Introduction



E104-BT51A is a serial port to BLE Bluetooth slave node module that supports Bluetooth protocol version 5.0. It is small in size and low in power consumption. It works in the 2.4GHz frequency band.

The E104-BT51A module is a serial-to-BLE Bluetooth module developed by Chengdu Ebyte Electronic Technology Co., Ltd. based on TI's CC2640R2L chip. The module uses AT commands to set parameters, simple operation and convenient configuration. The module only supports Bluetooth slave mode. The module functionally supports low-power broadcast with changeable content, variable baud rate data transparent transmission and file transmission, support for air command configuration, IO port switch level setting, frequency And cycle variable PWM output, support AD analog quantity acquisition, Bluetooth battery voltage service. Modules can be widely used in smart wear, home automation, home security, personal health care, smart home appliances, accessories and remote controls, automotive electronics, lighting industry, industrial Internet, smart data collection, smart control and other fields. The module supports the maximum baud rate of 921600bps and the 2M PHY air rate of Bluetooth 5.0.

1.2 Features

- Support Bluetooth BLE 5.0 protocol;
- Supports adjustable Bluetooth package length;
- Support two working modes of configuration and transparent transmission;
- Support automatic broadcast and automatic connection after startup;
- Support IBeacon and ordinary broadcast switching;
- Support broadcast data can be set;
- Support MAC address binding;
- Support multiple serial port modes and baud rate;
- Support custom 16-bit UUID and 128-bit UUID;
- Support Bluetooth parameter air configuration;
- The maximum communication distance is 50m;
- Support ultra-low power consumption sleep mode, and synchronously broadcast data and maintain connection;
- Support IO port level output;
- Support PWM output with variable frequency period;
- Support ADC analog quantity acquisition;
- Support battery voltage detection service;
- Support 2M, 1M airspeed;
- The maximum value of MTU data transmission unit is 230 bytes;
- With ceramic antenna, no external antenna is required;

1.3 Applications

- Wireless meter reading wireless sensor
- Smart home
- Industrial remote control, telemetry
- Smart buildings, smart buildings
- Automatic data collection
- Health sensor
- Smart wearable devices
- Smart robot
- Wireless sensing
- Electronic label
- Intelligent control

2. Parameters

2.1 Limit parameters

Table 2-1 Limit parameter table

Para. Name	Values		Spec.
	Min	Max	
Power Volatge（V）	0	3.8	Over 3.8V will permanently burn the module
Blocking power（dBm）	-	10	It is less likely to burn when used at close range
Working Temp（℃）	-40	+85	Industrial grade

2.2 Working Parameters

Table 2-2 Limit parameter table

Para. Name		Values			Spec.
		Min	Typical	Max	
Working voltage (V)		1.8	3.3	3.8	≥3.3V can guarantee output power
Communication level (V)			3.0		Using 5V level is risky to burn
Working temperature (℃)		-40	-	+85	Industrial design
Working frequency (MHz)		2402	-	2480	Support ISM frequency band
Power	Emission current (mA)	-	11.5	-	@5dBm
	Receiving current (mA)	-	7.5	-	
	Sleep current (μA)	-	2	-	Standby
Maximum transmit power (dBm)		4.5	5	5.5	
Receiving sensitivity (dBm)		-95	-96	-97	Air rate is 1Mbps
Sleep broadcast current (default)		-	18.72	-	Unit: uA. Broadcast gap is 1s
Wake up broadcast current (default)		-	1581	-	Unit: uA. Broadcast gap is 1s
Wake up without broadcast current (default)		-	1440	-	Unit: uA.
Wake-up connection current (default)		-	1450	-	Unit: uA. Connection gap 1s
Sleep connection current (default)		-	4.76	-	Unit: uA. Connection gap 1s

2.3 Hardware Parameters

Name	Description	Spec.
Reference distance	50m	Clear and open environment, 1.5 meters in height
Launch length	128Byte	
Bluetooth protocol	BLE5.0	
Communication Interface	UART serial port	
Packaging method	SMD	
Interface method	1.27 mm	
Dimensions	16*11.5mm	
Antenna type	Ceramic antenna	Equivalent impedance is about 50Ω

3. Hardware size and pin definition

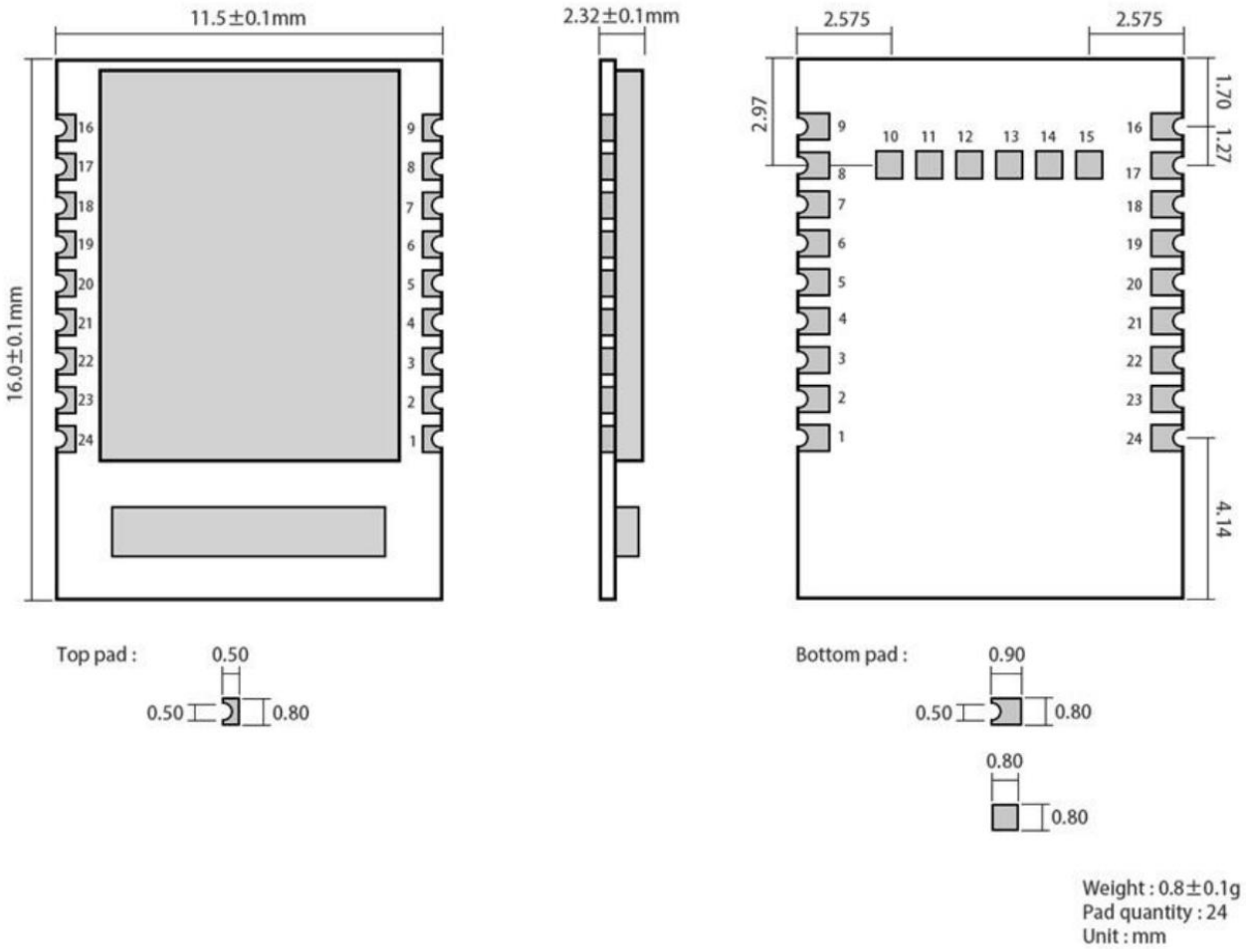


Table 3-1 Mechanical size and pin definition

Pin No.	Pin Name	Pin Type	Pin Function	Pin Specifications
1	GND	Input	Power ground wire	-
2	NC	-	NC	-
3	NC	-	NC	-
4	MODE	Input	Mode selection	Falling edge: configuration mode. Rising edge: transparent transmission mode.
5	WAKEUP/ SLEEP	Input	Wake-up pin	Wake-up: falling edge. Sleep: rising edge.
6	DIO_2	Output	OUTPUT0	User GPIO output pin 0
7	LINK	Output	Connection Status	Bluetooth connection: low level. Bluetooth no connection: high level
8	DATA	Output	Data indication	Data indication pin
9	GND	-	Power ground	-
10	TMSC	-	NC	Hang in the air, customers don’t need to care
11	TCKC	-	NC	Hang in the air, customers don’t need to care
12	DIO_6	Output	OUTPUT1	User GPIO output pin 1

13	DIO_5	Output	PWM0	User PWM output pin 0
14	DIO_7	Output	PWM1	User PWM output pin 1
15	DIO_8	Input	ADC2	Bluetooth service battery voltage acquisition pin
16	GND	-	Power ground	Power ground
17	VCC	-	Power is positive	Power is positive
18	RXD	Input	UART RX pin	-
19	TXD	Output	UART TX pin	-
20	DIO_12	Output	ADC0	ADC acquisition pin 0
21	DIO_13	Input	ADC1	ADC acquisition pin 1
22	nRESET	Input	Power reset	Active low
23	NC	-	-	-
24	NC	-	-	-

4. Pin Connections for Programming

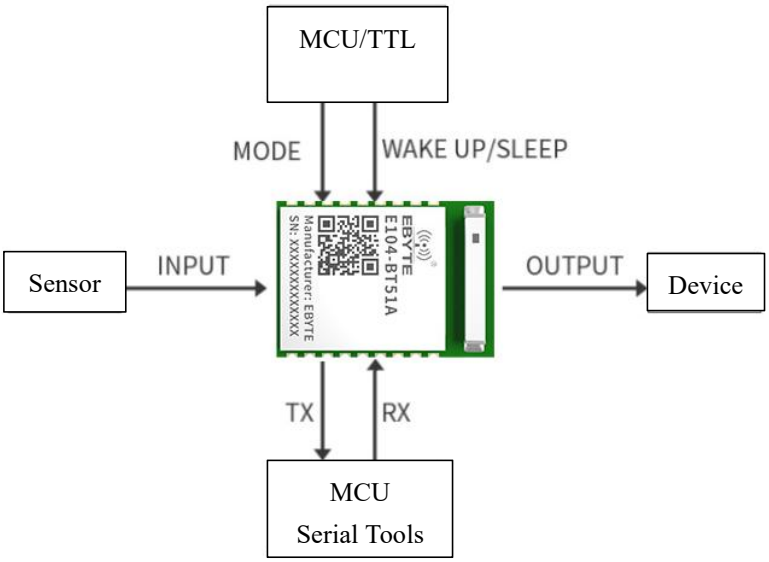


Figure 4-1 Connection diagram

Note: The sensor refers to connecting the external device to the pin with the input function, the peripheral refers to the external connection to the pin with the output function, the MODE and WAKEUP/SLEEP pins refer to the need to use this The two control pins are connected to the corresponding level state. If you need to wake up the module, connect the WAKEUP/SLEEP pin to the low level, or give the pin a falling edge signal in time. If you need to switch between AT configuration mode and transparent transmission mode, you need to give the corresponding edge of the MODE pin.

5. Working Mode

5.1 Power Mode

The power mode is to perform different operations on WAKEUP/SLEEP, and the working state (power consumption) of the module will have different changes. The rising edge enters the low-power mode, and the falling edge enters the wake-up mode.

Description of WAKEUP/SLEEP pin operation: 1), the pin detects the edge signal; 2), the pin has an edge latch function, that is, the level of the pin will change with the external edge. For example, the pin initialization defaults to high level (low power consumption mode). Later, the pin can only detect the falling edge signal. If the module wakes up after the falling edge signal is detected, the pin becomes low at this time and only the rising edge can be detected. Edge signal; 3). The above-mentioned high level and low level during power-on refer to the period from the moment of power-on to the completion of the normal initialization of the module that the pins need to be maintained at high or low levels.

5.1.1 Low power mode

Low power consumption mode means that the BLE function will continue to run after the module enters this mode, and the module will turn off peripherals other than wake-up pins and indicator function pins, such as PWM and IO output. If you need a lower power consumption setting, you can use the AT command to turn off the broadcast, disconnect, and set a longer broadcast gap and connection gap.

There are two ways to enter low power consumption: command entry and pin entry.

1. Send the AT command "AT+SLEEP" to immediately enter the low power consumption mode;
2. Enter low power consumption by keeping the rising edge of the WAKEUP pin for 100ms and above

The module will actively detect the WAKEUP/SLEEP pin when it is powered on. If it is high, it will directly enter the low power consumption (SLEEP) mode after power-on, and if it is low, it will enter the wake-up (WAKEUP) mode after power-on. The WAKEUP/SLEEP pin is initialized to a high level by default. If no operation is performed on this pin, the module will enter the low power consumption (SLEEP) mode when powered on.

After the module enters low power consumption mode, if LOGMSG is turned on, it will output: sleep. During the low-power mode, if the broadcast is turned on, the broadcast will continue. If the device is connected, the connection will not be disconnected. After receiving BLE Bluetooth data during the connection, the device will actively wake up and print the received through the serial port Data, after printing, continue to enter the low power consumption mode. If you want to send data during the low power consumption period, you need to give the WAKEUP pin a falling edge level that lasts for more than 100ms to wake up the device before sending data.

5.1.1 Wake-Up mode

Wake-up mode means that the peripherals of the module work normally and remain active continuously without closing the serial port. At this time, the module continues to receive serial port data, and the power consumption is high.

If the device needs to wake up in low power consumption mode, give the WAKEUP pin a falling edge that lasts longer than 100ms, and the module will wake up. After waking up, if LOGMSG is turned on, it will output: wakeup.

Note: AT configuration and data transparent transmission must ensure that the module is in the wake-up mode, otherwise the module cannot receive the data from the serial port (TX) pin.

5.2 Data valid indication

In the transparent transmission mode, after Bluetooth receives the data, it is transmitted through the serial port. In order to ensure that the external MCU can receive the data correctly, the user can set the delayed output data through the "AT+DELAYDATA=1" command. After the output, the DATA pin of the module will output a low level 10ms before sending the data to wake up the external MCU. After 10ms, the data starts to be sent and the DATA pin is pulled high. as the picture shows:

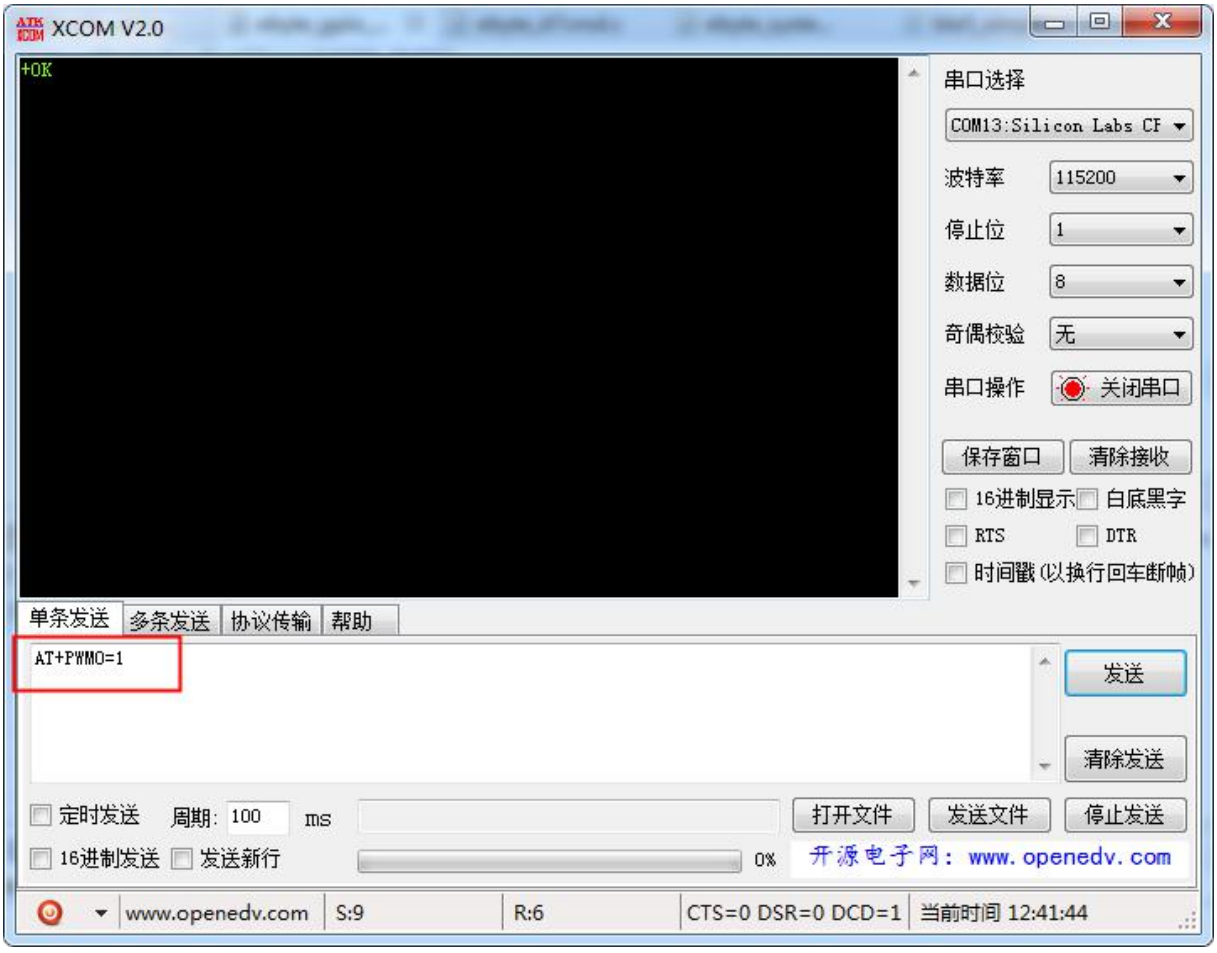
5.3 GPIO Level output

The E104-BT51A module has two IO output pins. For some places where level signal control is required, the GPIO level state can be set by the AT command "AT+OUTGPIO=[para]". The user can use the E104-BT51A module as The controller can control some devices without adding an additional MCU, which can directly control the device through the module, which saves more resources for the user and reduces the amount of code development for the user, which is convenient and quick to use. To set GPIO output, please refer to instruction 6.40 to set and read IO output.

5.4 PWM Output

The E104-BT51A module takes into account the comprehensiveness of the user's use. In some cases, the level control mode may not meet the requirements and cannot achieve precise control. Therefore, the E104-BT51A module has two PWM output pins. The user can according to their own needs. Set the period and duty cycle of PWM to achieve the control purpose. Set PWMx enable by AT command "AT+PWMx=1", set PWMx cycle (frequency) by AT command "AT+PERIODx=[para]", set PWMx by AT command "AT+DUTYx=[para]" The unit of duty cycle, duty cycle and period (frequency) is us, so you need to pay attention to the duty cycle not to be greater than the period when using it. After changing the PWM frequency, you need to re-set the duty cycle according to the specific value. When the user uses the E104-BT51A module for PWM control, there is no need to add an additional MCU and can directly control the PWM waveform through the module output, which saves more resources for the user and reduces the amount of code development for the user, which is convenient and quick to use. For details on setting PWM enable, please refer to 6.41 Setting and Reading PWM Enable. For setting PWM output period, please refer to 6.42 Setting and Querying PWM Output Period. For more details, please refer to 6.43 Setting and Querying PWM Duty Cycle. PWM output example:

Send AT command: AT+PWM0=1, turn on PWM0 baud rate, and output a PWM square wave with a default period of 100us and a duty cycle of 50us



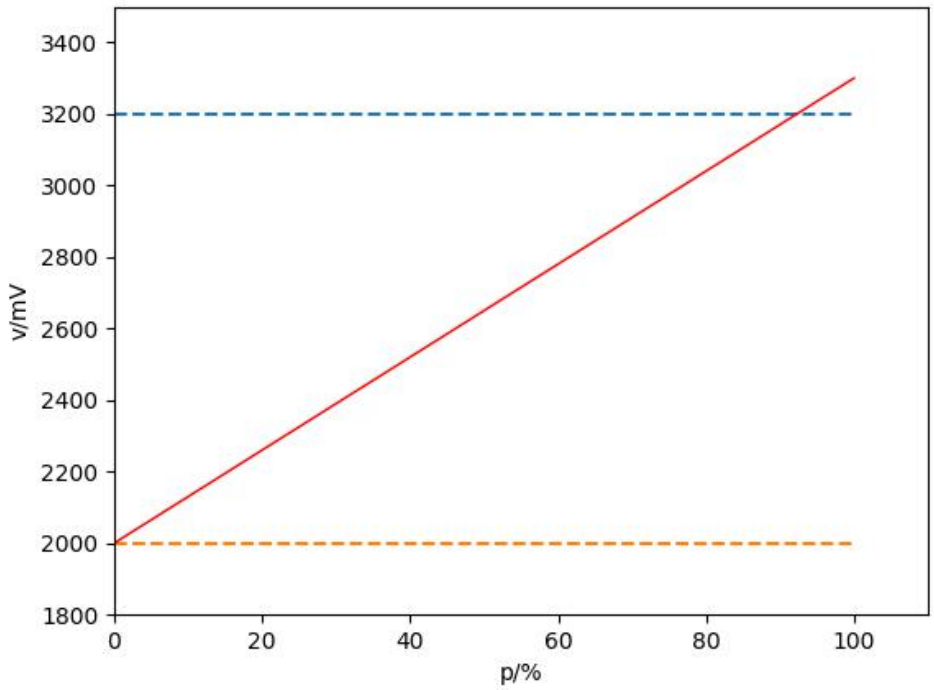
5.5 ADC Collection

In order to adapt to a wider range of data acquisition, the E104-BT51A module adds two 12-bit precision ADC acquisition channels. The reference voltage is a fixed ref of 4.3V. Use the command "AT+ADCx?" to read the ADC value of the ADCx pin. Decimal display, the user can calculate the voltage Vx to be measured according to the formula. Formula: ref/4096 =Vx /ADC. For details of reading ADC sampling value, please refer to instruction 6.44 to query ADC sampling value.

How to use: This module does not need to do voltage division or other operations, just connect the target to be tested to the detection pins (DIO_12, DIO_13), and then supply ground to the module.

5.6 Battery voltage service

In order for the E104-BT51A module to obtain the battery voltage in time and display it intuitively in mobile phones or other devices, this module adds battery voltage services. You only need to connect specific ADC collection pins to the corresponding battery pins. The device will automatically collect battery voltage data on a regular basis, calculate the corresponding percentage according to the user's preset voltage upper and lower limits, and update it to the Bluetooth service in real time to wait for other host devices to obtain data. The user can calculate the corresponding voltage value based on the ratio updated by the Bluetooth service. We use p to represent the percentage of battery service, Btmax to represent the set battery full voltage value, and Btmin to represent the minimum battery voltage. In order to make the calculation more accurate, mV is used as the unit, that is, the 3.2v voltage value is converted to 3200 before participating in the calculation. The voltage/ratio characteristic curve is shown below. Calculation formula: p = (v – Btmin)/(Btmax-Btmin). The actual voltage value can be calculated according to the p of the battery into the formula. (Note: Btmax and Btmin are the values set by AT, here 3200 and 2000 are just examples). For details on setting Btmax and Btmin, please refer to instruction 6.45 to set and read the maximum battery voltage, 6.46 to set and query the minimum battery voltage.



How to use: This module does not need to do voltage division or other operations, just connect the positive electrode of the battery to the detection pin (DIO_8), and then supply ground to the module.

5.7 MAC address binding

The E104-BT51A module supports the MAC binding function. When the binding connection address is set from the module, the binding enable is turned on, and the host MAC address is retrieved before accepting the host connection request to see if it is a binding address. When the address is matched successfully, the connection is possible Established, otherwise the slave will continue to broadcast. For setting instructions, please refer to 6.25 to read MAC binding status, enable and disable MAC binding, and to set the binding address, please refer to 6.26 to read and set binding MAC.

5.8 Bluetooth maximum packet length MTU configuration

MTU is the abbreviation of the communication term Maximum Transmission Unit (Maximum Transmission Unit, MTU), which refers to the maximum data packet size (in bytes) that can pass on a certain layer of a communication protocol. The parameter of maximum transmission unit is usually related to the communication interface (network interface card, serial port, etc.).

The E104-BT51A module supports the Bluetooth 5.0 long packet standard. The maximum single packet data packet length of Bluetooth can be configured through the AT command "AT+MTU=xx". The default is 200 bytes, and 27~230 bytes are optional. The packet length can be increased. To realize the large-packet data transmission of Bluetooth, please refer to 6.27 Query and Set MTU Length for the setting instructions.

Note: After the packet length is configured, it will take effect the next time the Bluetooth connection is made. Since some hosts do not support parameter change requests initiated by slaves, it is possible that the set MTU length does not take effect after connection. This is normal.

5.9 UUID Configuration

The module supports flexible configuration of UUID, can command "AT+ UUIDTYPE=1" to enable 128-bit UUID function, and customize transparent transmission service by command "AT+ +SVRUUID=xx", "AT+READUUID=xx", "AT+WRITEUUID=xx" UUID, receiving characteristic field UUID, sending characteristic field UUID, where xx represents the hexadecimal number. For the specific setting method, please refer to 6.28 Query and Set Transparent Transmission Service UUID Length. This function can solve the problem of mismatch with APP communication UUID, meet more custom requirements, and have a wider practicability.

5.10 Broadcast data switching

E104-BT51A broadcasts are divided into ordinary broadcasts and iBeacon broadcasts, and support commands can be configured to select the broadcast mode.

Common broadcast packet format:

The broadcast information includes advertising and scan respone. Advertising is a broadcast report sent actively, and scan respone is a broadcast report that is responded to after receiving a host scan request.

Advertising:

Fixed Code	Len	Manufctr. Code	Manufctr. data
020106	N	0xFF	Configurable, maximum 26 bytes
Example:0201061AFF4C000215524144495500 4E4554574F524B53434F00010002D2			

See 6.7 for setting broadcast data contentScan response:

Len	16 Digit UUID	UUID	Len	Broadcast Name	Device name
0x03	0x03	Configurable	N	0x09	Configurable, up to 25 bytes
Example:0303F0FF1009453130342D4254303034					

iBeacon broadcast packet format:

1. Instructions to configure UUID, Major, Minor, TXPWR respectively
2. Command AT+ADV=2 to configure to work in iBeacon broadcast mode and broadcast immediately
3. Bluetooth connection is not supported in iBeacon broadcast mode

Advertising:

iBeacon Prefix	UUID	Major	Minor	TXPWR
9B	16B	2B	2B	1B
Example:0201061AFF4C000215FDA50693A4E24FB1AFCFC6EB07647825 2775848F00				

Because the iBeacon broadcast data format is fixed, only the Majo, Minor and TXPWR parts can be modified. For details on setting the iBeacon data content, please refer to 6.9 Inquiry and Setting IBeacon Major Broadcast Data.

5.11 Configuration by App.

Air configuration refers to the wireless configuration operation of the module instead of using the serial port debugging assistant, directly using the mobile phone APP program BLE test tool. The E104-BT51A module supports air configuration. The air configuration channel we open is the main service FFF3 under FFF0, this channel The following features support read, write and notification. E104-BT51A opens some IO port output settings, PWM settings and other operations, that is, users can use the air configuration mode to cooperate with IO output settings, and PWM settings for some control operations.

Air configuration method:

1. After the connection of the slave is established, the host (mobile phone APP) sends AT commands through the Bluetooth service feature "CONFIG CHANNEL" to configure the module parameters over the air. (The configuration channel of E104-BT51A is FFF3 under the main service FFF0).
2. "Air configuration" requires password authentication, command "AT+AUTH=xxx" to send authentication information, Bluetooth service feature "CONFIG CHANNEL" sends authentication command AT+AUTH, after successful authentication, you can enter the configuration state
3. The authentication is successful and remains valid until the connection is disconnected.
4. The MODE pin has no effect on the air configuration process.
5. The air configuration is applicable to all AT commands.

5.12 Status or Event printing

1. Command AT+LOGMSG to configure the status information serial port printing function

2. Status information includes: connected, disconnected, awakened, sleep.

The format is as follows:

status	Print information
connection succeeded	STA:connection \r\n
Disconnect	STA:disconnection \r\n
System wake up	wakeup\r\n
Sleep mode	sleep\r\n

1. Connection indication: LINK pin outputs low level after Bluetooth connection is established, and LINK pin outputs high level after Bluetooth connection is disconnected.

5.13 AT Configuration

The MODE pin controls the AT configuration mode or transparent transmission mode of the module. During the connection period, the rising edge enters the transparent transmission mode, and the falling edge enters the AT mode.

The module defaults to the AT command mode when it is not connected. At this time, the serial port data will be processed as AT commands (the module is in wake-up mode); when the module is connected, if you want to perform AT configuration, you need to give MODE (DIO_0)) A falling edge signal greater than 100ms on the pin, the module enters the AT configuration mode after detecting the falling edge, the serial port data will not be transparently transmitted, and will be treated as an AT command. After the configuration is completed, give the MODE pin a rising edge greater than 100ms Along the signal, the module enters the transparent transmission mode.

6. AT Command

Note: Before sending operation instructions, first ensure that the module is in wake-up mode, otherwise it will not be able to receive configuration instructions.

1. Instructions:

1. All AT commands do not need to add carriage return (\r), line feed (\n)

2. The return result of AT command ends with \r\n

3. The AT command format is "AT+xxx" such as:

Send the command "AT+NAME?" to query the device name

2. Command return

return code	Meaning
1	Instruction does not exist
2	Command length is wrong (such as query device name: AT+NAME?, if sent as: AT+NAME? 123, the length is wrong)
3	Invalid parameter (parameter range error)
4	PWM duty cycle is greater than period
5	PWM period range error
6	Air configuration password authentication failed
7	Change the length of the air configuration password is wrong
8	UUID configuration error
9	unknown mistake
11	AT operation failed
12	Wrong binding MAC address length
13	Invalid operation when the device is not connected
14	Invalid MAC address

3、Default Parameters

E104-BT51	Equipment name	E104-BT51A_V1.0
	Broadcast data	CDEBYT
	Air configuration password	123456
	version number	V1.0
	IBC_Major	1027
	IBC_Minor	507
	2-byte service UUID	0xF0, 0xFF
	16-byte service UUID	0x00,0x01,0x02,0x03,0x04,0x05,0x06,0x07, 0x08,0x09,0x0a,0x0b,0x0c,0x0d,0x0e,0x0f
	2 bytes client UUID1	0xF1, 0xFF
	16 bytes UUID1	0x01,0x01,0x02,0x03,0x04,0x05,0x06,0x07, 0x08,0x09,0x0a,0x0b,0x0c,0x0d,0x0e,0x0f
	2 bytes client UUID2	0xF2, 0xFF
	16 bytes UUID2	0x02,0x01,0x02,0x03,0x04,0x05,0x06,0x07, 0x08,0x09,0x0a,0x0b,0x0c,0x0d,0x0e,0x0f

	Check Digit	0
	Stop bit	1
	Baud rate	115200
	Broadcast type	Ordinary broadcast
	TXPWR (RSSI)	0
	Broadcast gap	250ms
	Maximum connection gap	40ms
	Minimum connection gap	40ms
	Connection timeout	5s
	Default UUID type	2 bytes
	Transmit power	0dBm
	Status printing	Turn on
	MTU length	200
	MAC binding enable	shut down
	MAC binding address	0x01, 0x01, 0x01, 0x01, 0x01, 0xc0
	Delay output enable	shut down
	PWM period	100us
	PWM duty cycle	50us
	GPIO output	Low level (0)

6.1 AT command Test

Command	Reply	specification
AT	+OK	Module in AT command mode

6.2 Read and configure baud rate

Command	Reply	specification
Send:AT+BAUD?	+OK=[para]	para:0~D 0=1200 1=2400 2=4800 3=9600 4=14400 5=19200 6=28800 7=38400 8=57600 9=76800
Set:AT+BAUD=[para]	+OK:success +ERR=[NUM]: failure	

		A=115200 B=230400 C=460800 D=921600
Notice: Setting only takes effect after re-power, and will be saved for next power on		

6.3 Read and configure stop bit

Command	Reply	specification
Send:AT+STOPB?	+OK=[para]	para:0,1 ASCII 0:1 stop bit 1:2 stop bit
Setting:AT+STOPB=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on		

6.4 Read and set serial port check digit

Command	Reply	specification
Send:AT+?	+OK=[para]	para:0,1,2 0: No inspection; 1: Even parity 2: Odd check;
Setting:AT+PARI=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on		

6.5 Set and read the length of serial port data

Command	Reply	specification
Send:AT+DATALEN?	+OK=[para]	para:2,3 2: Data length 7 3: Data length 8
Setting:AT+DATALEN=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on		

6.6 Check the current broadcast status, turn on ordinary broadcast, IBeacon broadcast, and turn off broadcast

Command	Reply	specification
Send:AT+ADVEN?	+OK=[para]	para:0、1、2 0:Turn off broadcasting 1:Ordinary Broadcasting 2:iBeacon Broadcasting
Setting:AT+ADVEN=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on		

6.7 Query and set general broadcast data (saved when power off)

Command	Reply	specification
Send:AT+ADVDATA?	+OK=[para]	para: 1. Support ASCII, HEX 2. The length is not more than 26 bytes
Setting:AT+ADVDATA=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on,Can be sent in string form or hexadecimal For example, change to the string "CDEBYT": AT+ADVDATA=CDEBYT For example, change to hexadecimal "313233A4B5": 41542B4144564441543D 313233A4B5		

6.8 Query and set general broadcast data (settings are not saved after power off)

Command	Reply	specification
Send:AT+ADVDATA1?	+OK=[para]	para: 1. Support ASCII, HEX 2. The length is not more than 26 bytes
Setting:AT+ADVDATA1=[para]	+OK:Success +ERR=[NUM]:Failure	
Note: The setting will take effect in the next broadcast and will not be saved after power off.Can be sent in string form or hexadecimal For example, change to the string "CDEBYT": AT+ADVDATA=CDEBYT For example, change to hexadecimal“313233A4B5”: 41542B4144564441543D 313233A4B5		

6.9 Query and set IBeacon Major broadcast data

Command	Reply	specification
Send:AT+IBCMAJOR?	+OK=[para]	para:0~65535
Setting:AT+IBCMAJOR=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on		

6.10 Query and set IBeacon Minor broadcast data

Command	Reply	specification
Send:AT+IBCMINOR?	+OK=[para]	para:0~65535
Setting:AT+ IBCMINOR =[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on		

6.11 Query and set iBeacon UUID

Command	Reply	specification
Send:AT+IBCUUID?	+OK=[para]	para:16 位 UUID
Setting:AT+IBCUUID=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on For example: setting iBeacon UUID 为“FDA50693A4E24FB1AFCFC6EB07647825” 41 54 2B 49 42 43 4E 55 55 49 44 3D FDA50693A4E24FB1AFCFC6EB07647825		

6.12 Query and set IBCTXPWR

Command	Reply	specification
Send:AT+ IBCTXPWR?	+OK=[para]	para:-128~127
Setting:AT+ IBCTXPWR =[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on		

6.13 Read and set the device name (save the setting after power off)

Command	Reply	specification
Send:AT+NAME?	+OK=[para]	para:Broadcast device name, Broadcast name is not more than 25 bytes
Setting:AT+NAME=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on,Can be sent in string form or hexadecimal For example, set the string "E104-BT51":AT+NAME=E104-BT51 For example, set to hexadecimal "31323334":41 54 2B 4E 41 4D 45 3D 31323334		

6.14 Read and set the device name (settings are not saved after power off)

Command	Reply	specification
Send:AT+NAME1?	+OK=[para]	para:Broadcast device name, Broadcast name is not more than 25 bytes
Setting:AT+NAME1=[para]	+OK:Success +ERR=[NUM]:Failure	
Note: The setting will take effect in the next broadcast and will not be saved after power off.Can be sent in string form or hexadecimal For example, set the string "E104-BT51":AT+NAME=E104-BT51 For example, set to hexadecima"31323334":41 54 2B 4E 41 4D 45 3D 31323334		

6.15 Read the software version number

Command	Reply	specification
Send:AT+VERSION?	+OK=[para]	para: version number
Description:take effect immediately		

6.16 Read and set broadcast gap

Command	Reply	specification
Send:AT+ADVINTV?	+OK=[para]	para:32~16000 ie.:para=1600 Actual gap:1600*0.625ms=1s
Setting:AT+ADVINTV=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting takes effect for next broadcasting, and will be saved for next power on		

6.17 Read and set the minimum connection gap

Command	Reply	specification
Send:AT+CONMININTV?	+OK=[para]	para: 6~3200 ie .:8 8*1.25ms=10ms
Setting:AT+CONMININT=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: The settings will take effect the next time you connect, and the settings will be saved after power off Note: The minimum connection gap must be less than or equal to the maximum connection gap, and less than the timeout time*8		

6.18 Read and set the maximum connection gap

Command	Reply	specification
Send:AT+CONMAXINTV?	+OK=[para]	para: 6~3200 ie:8 8*1.25ms=10ms
Setting:AT+CONMAXINTV=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: The settings will take effect the next time you connect, and the settings will be saved after power off Note: The maximum connection gap must be greater than or equal to the minimum connection gap, and less than the timeout time*8		

6.19 Read and set timeout

Command	Reply	specification
Send:AT+ CONTIMEOUT?	+OK=[para]	para: 10~3200 ie:500 500*10ms=5s
Setting:AT+CONTIMEOUT=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: The settings will take effect the next time you connect, and the settings will be saved after power off Note: The connection timeout should be greater than (maximum and minimum connection gap)/8		

6.20 Setting and query delay times

Command	Reply	specification
Send:AT+CONLATENCY?	+OK=[para]	para: 0~500
Setting:AT+CONLATENCY=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: The settings will take effect the next time you connect, and the settings will be saved after power off Notice: Number of delays * connection gap <connection timeout		

ie:CONMAXINTV*1.25ms* CONLATENCY < CONTIMEOUT*10

6.21 Disconnect current connection

Command	Reply	specification
Send:AT+DISCON	+OK	
Description: Take effect immediately, and can only be used when connected, otherwise an error will be returned		

6.22 Query current connection status

Command	Reply	specification
Send:AT+CONSTA?	+OK=[para]	para: Connected:Connection established Disconnect:Connection Disconnected
Description:take effect immediately		

6.23 Query local MAC address

Command	Reply	specification
Send:AT+MAC?	+OK=[para]	para:MAC Address ie:F0E1D2C3B4A5
Note: MAC address is displayed as hexadecimal ASCII		

6.24 Query the MAC address of the connected device

Command	Reply	specification
Send:AT+PEERMAC?	+OK=[para]	para:MAC address ie:F0E1D2C3B4A5
Description:take effect immediately,It can only be used when connecting, otherwise an error will be returned and the MAC address will be displayed as hexadecimal ASCII		

6.25 Read MAC binding status, open and close MAC binding

Command	Reply	specification
Send:AT+BONDEN?	+OK=[para]	para:0,1 0: binding off 1:binding on
Setting:AT+ BONDEN =[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on		

6.26 Read and set binding MAC

Command	Reply	specification
Send:AT+BONDMAC?	+OK=[para]	para:MAC address ie:F0E1D2C3B4A5
Setting:AT+BONDMAC=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on，Follow the small segment mode, that is, after the high bit of the MAC address, the MAC address is displayed as hexadecimal ASCII For example, set the bound MAC to "F0E1D2C3B4A5": 41 54 2B 42 4F 4E 44 4D 41 43 3D F0E1D2C3B4A5		

6.27 Query and set MTU length

Command	Reply	specification
Send:AT+MTU?	+OK=[para]	para:27~230
Setting:AT+MTU=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: The settings will take effect the next time you connect, and the settings will be saved after power off		

6.28 Query and set the UUID length of the transparent transmission service

Command	Reply	specification
Send:AT+UUIDTYPE?	+OK=[para1]	Para1: 0、1 0:2 bytes UUID 1:16 bytes UUID
Setting:AT+UUIDTYPE=[para1]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on		

6.29 Query and set Bluetooth service UUID

Command	Reply	specification
Send:AT+SVRUUID?	+OK=[para2]	Para1: UUID code UUID is in HEX form
Setting:AT+SVRUUID=[para2]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on, according to the UUID length setting, follow the little-endian mode, the high bit is in the back For example, set the two-byte UUID to "FFFO": 41 54 2B 55 55 49 44 53 56 52 3D F0FF For example, the sixteen-byte UUID is "11223344556677889900AABBCCDDEEFF": 41 54 2B 55 55 49 44 53 56 52 3D FFEEDDCCBBAA00998877665544332211		

6.30 Query and set Bluetooth reading service UUID

Command	Reply	specification
Send:AT+READUUID?	+OK=[para1]	Para1:UUID code
Setting:AT+READUUID=[para1]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on For example, set the two-byte UUID to "FFF1": 41 54 2B 55 55 49 44 43 48 41 52 31 3D F1FF For example, the sixteen-byte UUID is "112233445566778899 00AABBCCDDEEF1": 41 54 2B 55 55 49 44 53 56 52 3D F1EEDDCCBBAA00998877665544332211		

6.31 Query and set Bluetooth write service UUID

Command	Reply	specification
Send:AT+WRITEUUID?	+OK=[para1]	Para1:UUID code
Setting:AT+WRITEUUID=[para1]	+OK:Success +ERR=[NUM]:Failure	
Notice: Setting only takes effect after re-power, and will be saved for next power on For example, set the two-byte UUID to "FFF2": 41 54 2B 55 55 49 44 43 48 41 52 32 3D F2FF For example, the sixteen-byte UUID is "112233445566778899 00AABBCCDDEEF2": 41 54 2B 55 55 49 44 53 56 52 3D F2EEDDCCBBAA00998877665544332211		

6.32 Query, close, open serial port delay

Command	Reply	specification
Send:AT+DELAYDATA?	+OK=[para]	para:0、1 0: off 1: on
Setting:AT+DELAYDATA=[para]	+OK:Success +ERR=[NUM]:Failure	
Description:take effect immediately，setting is saved after power off		

6.33 Reset Command

Command	Reply	specification
AT+RESET	+OK	N/A
Description:take effect immediately，setting is saved after power off		

6.34 Restore Factory Setting

Command	Reply	specification
AT+RESTORE	+OK	N/A
Description:take effect immediately，The parameters set by the user are all changed to the factory parameters and restarted		

6.35 Authentication air configuration password

Command	Reply	specification
Authentication:AT+AUTH =[para]	+OK:Success +ERR=[NUM]:Failure	para:6 bytes password
Description: 1. The password cannot be changed before the authentication is successful. 2. This command is only used for air configuration, other methods have no practical meaning.		

6.36 Update and query the air configuration password

Command	Reply	specification
Send:AT+UPAUTH?	+OK:Success +ERR=[NUM]:Failure	para:6 bytes password
Update:AT+UPAUTH=[para]		
Note: The next time you enter the air configuration, it will take effect, and the settings will be saved after power off		

6.37 Query and set transmit power

Command	Reply	specification
Send:AT+ TRANSPWR?	+OK=[para]	para: 0~9 0:-21dBm 1:-18dBm 2:-15dBm 3:-12dBm 4:-9dBm 5:-6dBm 6:-3dBm 7:0dBm 8:1dBm 9:2dBm A:3dBm B:4dBm
Setting:AT+ TRANSPWR =[para]	+OK:Success +ERR=[NUM]:Failure	

		C:5dBm
Description:take effect immediately，and the settings will be saved after power off		

6.38 Go to sleep mode immediately

Command	Reply	specification
Send:AT+SLEEP?	STA:sleep	
Description:take effect immediately，If the broadcast is not turned off, the broadcast interval is the wake-up time to continue the broadcast, and the pin wakes up		

6.39 Query and set printing status

Command	Reply	specification
Send:AT+LOGMSG?	+OK=[para]	para: 0、1 0:off 1:On
Setting:AT+LOGMSG=[para]	+OK:Success +ERR=[NUM]:Failure	
Description:take effect immediately，and the settings will be saved after power off		

6.40 Set and read IO output

Command	Reply	specification
Send:AT+OUTGPIO?	+OK=[para]	para: 0~F (Hexadecimal code)
Setting:AT+OUTGPIO=[para]	+OK:Success +ERR=[NUM]:Failure	
Description:take effect immediatelyand the settings will be saved after power off		

OUTGPIO0, OUTGPIO1: Parameter 0, means all are low level; 1, means OUTGPIO0 output high, OUTGPIO1 output low; parameter 2, means OUTGPIO0 output low, OUTGPIO1 output high; parameter 3, means OUTGPIO0, OUTGPIO1 output high;

6.41 Set and read PWM enable

Command	Reply	specification
Send:AT+PWMx?	+OK=[para]	x: serial number para: 0 Turn off PWM 1 Turn on PWM
Setting:AT+PWMx=[para]	+OK:Success +ERR=[NUM]:Failure	
Description:take effect immediatelyand the settings will be saved after power off。For example, set PWM1 to open: AT+PWM1=1		

6.42 Set and query PWM output period

Command	Reply	specification
Send:AT+PERIODx?	+OK=[para]	para: 10~300000 unit us x: indicates the serial number
Setting:AT+PERIODx=[para]	+OK:Success +ERR=[NUM]:Failure	
1、 Description: 2、 1. Take effect immediately and the settings will be saved after power off. 3、 The two PWM output frequencies can be different.		

6.43 Set and query PWM duty cycle

Command	Reply	specification
Send:AT+DUTYx?	+OK=[para]	para: 0~ PERIODx unit us x: indicates the serial number
Setting:AT+ DUTYx =[para]	+OK:Success +ERR=[NUM]:Failure	
Description: 1. Take effect immediately and the settings will be saved after power off. 2. The two PWM output frequencies can be different, and the duty cycle can also be different.		

6.44 Query ADC sampling value

Command	Reply	specification
Send:AT+ADCx?	+OK=[para]	para: 0~4096 x: indicates the serial number
Setting:AT+ ADCx =[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: 12-bit ADC acquisition, the output is displayed in decimal		

6.45 Set and read the maximum battery voltage

Command	Reply	specification
Send:AT+ BATMAX?	+OK=[para]	para: BATMIN~3800 (Unit:mV)
Setting:AT+BATMAX=[para]	+OK:Success +ERR=[NUM]:Failure	
NoticeSet according to the battery's full voltage		

Since the operating voltage of the chip is limited to 1.8V~3.8V, the maximum BATMAX is 3800.

6.46 Set and query the minimum battery voltage

Command	Reply	specification
Send:AT+ BATMIN?	+OK=[para]	para: 1800~BATMAX (Unit:mV)
Setting:AT+BATMIN=[para]	+OK:Success +ERR=[NUM]:Failure	
Notice: Set according to the minimum voltage of the battery		

Since the operating voltage of the chip is limited to 1.8V~3.8V, the maximum BATMIN is 1800.

6.47 Checking RSSI

Command	Reply	specification
Send:AT+RSSI?	+OK=[para] +ERR=[NUM]	para: -128~127
Description:take effect immediately, Can only be used when connecting, otherwise an error will be returned		

7. UUID Details

7.1 Ebyte data transmission UUID

Channel name	UUID	HANDLE	Type	Specification
EBYTE DATA SERVICE	0xFFF0 (default)	31	-	This channel is a custom serial port transceiver channel
BLE DATA BUFF	0xFFF1 (default)	33	Read only, notification	This channel is for the module to receive serial data and return it to the Bluetooth host in a notified manner. The maximum data length of a single packet is 251 bytes.
CENTER DATA BUFF	0xFFF2 (default)	37	Read, write	Notice: If the host is an Android or iPhone, you need to enable the notification function to receive the module data.
BLE DATA CONFIG	0xFFF3 (default)	40	Read, write	This channel is the data transmission channel on the host side, and the data length of a single packet is limited to a maximum of 251 bytes.

7.2 Standard battery voltage service UUID

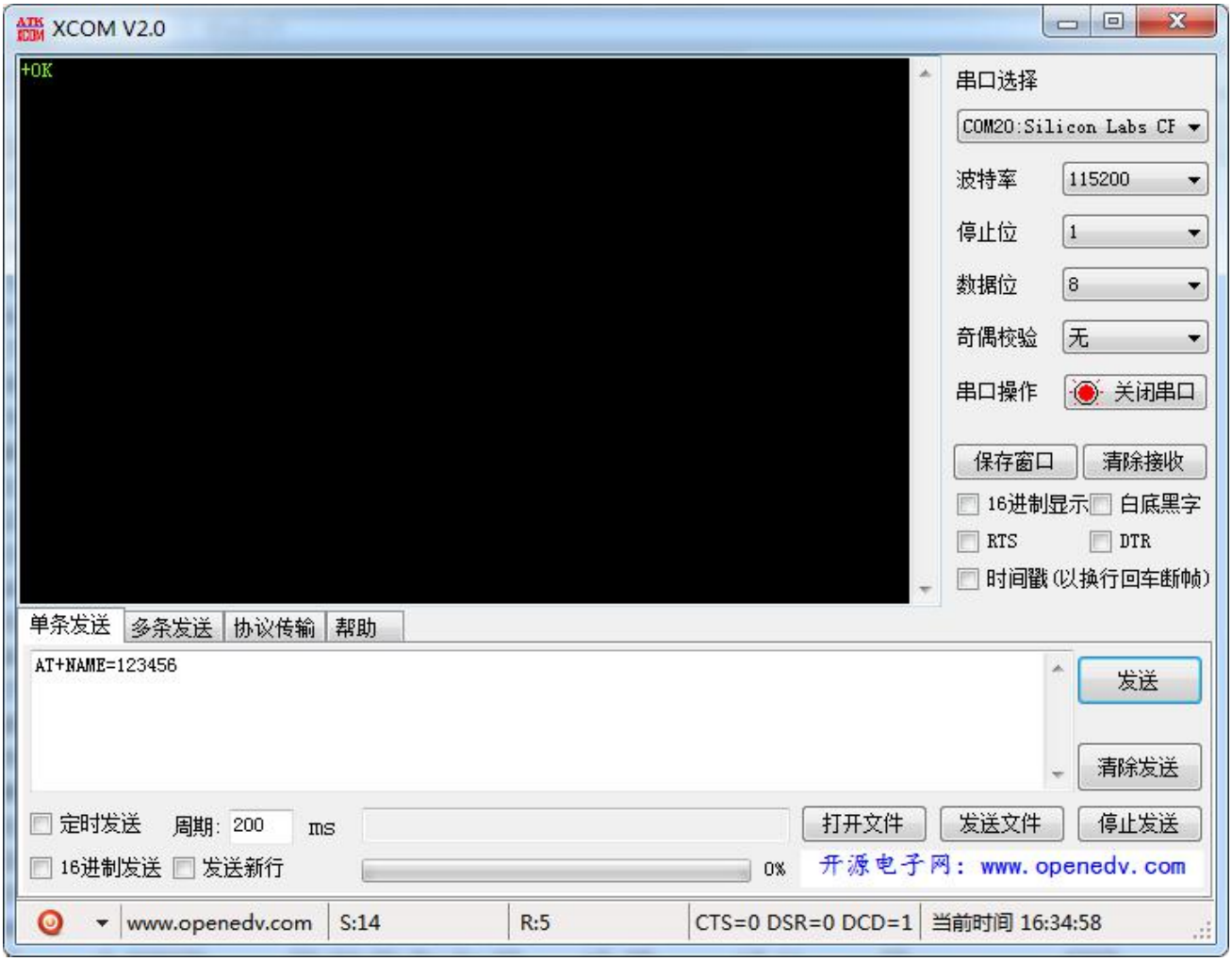
Channel name	UUID	HANDLE	Type	Specification
BATTERY SERVICE	0x180F	43	-	This channel serves UUID for the standard battery voltage specified by the Bluetooth Alliance
Battery Level	0x2a19	45	notification	This channel is the battery voltage level of the Bluetooth standard

8. How to use.

8.1 Guide for configuration mode

Use the PC-side XCOM serial assistant software to demonstrate the configuration mode, or use other software with serial port sending and receiving.

1. Open the "XCOM V2.0.exe" software, find the corresponding serial port number, open it, and select the parameters according to the default values.
2. Configure the relevant parameters according to the operation instructions in Chapter 6, here is a demonstration of setting the device name.
3. Because the air configuration mode involves the use of transparent transmission, please refer to 8.2 Quick Guide for Transparent Transmission and Air Configuration Mode for the air configuration mode.



8.2 Guide for transparent transmission and air configuration mode

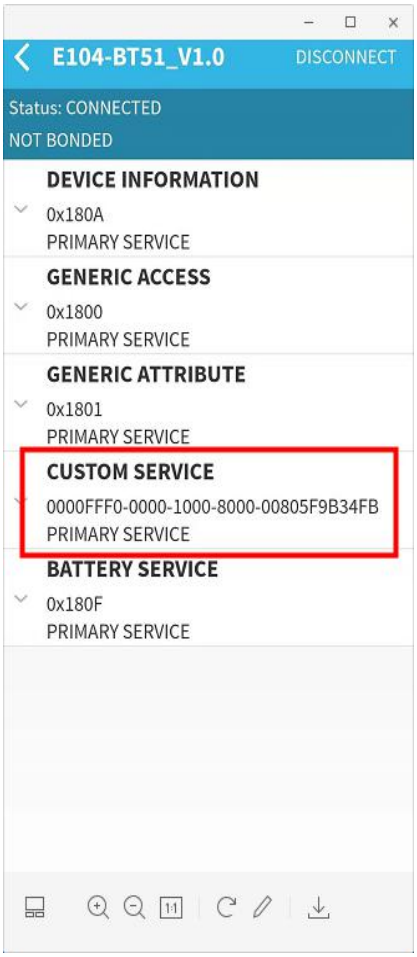
Note: The following demonstration uses the E104-BT51_V1.0 module. The data transparent transmission function is the same except that the name is different from E104-BT51A_V1.0.

Use an Android phone (system version 4.3 or higher) or an Apple iPhone 4s or higher phone or an Ipad with BLE function to connect and communicate with the module. The example here is demonstrated with an Android phone.

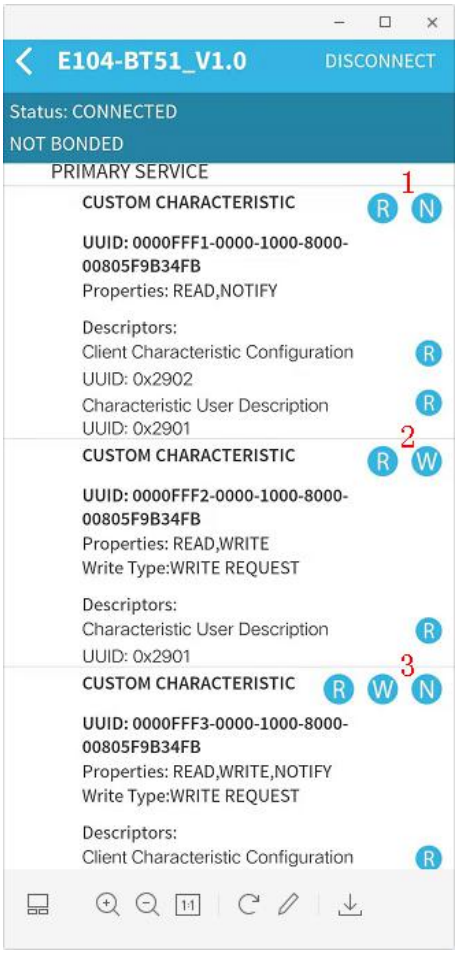
1. Search for "BLE Scanner" in the app store, download and install it. (Tips: some app stores can't find it, you can go to Baidu to download) After the installation is successful, perform step 2.

2. After successfully installing the APP in step 1, open "BLE Scanner", find the E104-BT51A_V1.0 module, click E104-BT51A_V1.0 and connect the module. After the connection is successfully established, the 5 service lists on the right will appear (tips: if the connection fails or the service list cannot be refreshed, it is usually the reason for the mobile APP, then exit and re-establish the connection), and perform step 3 after success , Otherwise continue to step 2.

3. If the operation in step 2 is successful, click the service in the red box in the left picture to enter the custom transparent transmission service of Ebyte. After success, the interface shown on the right will appear, enter step 4, otherwise continue to step 3.



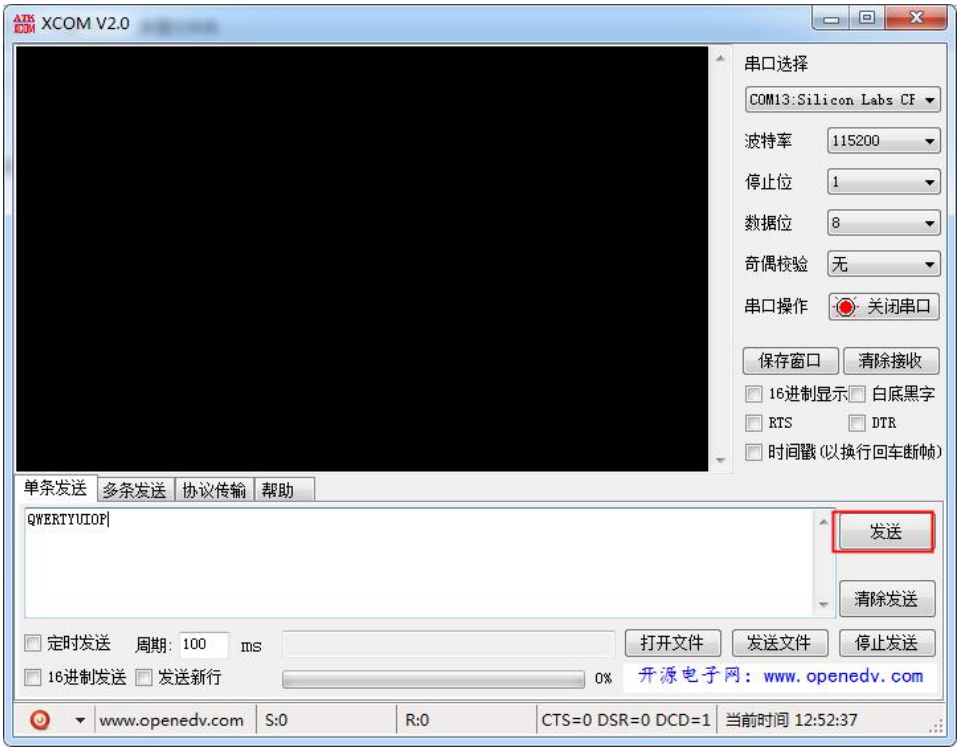
E104-BT51 service list

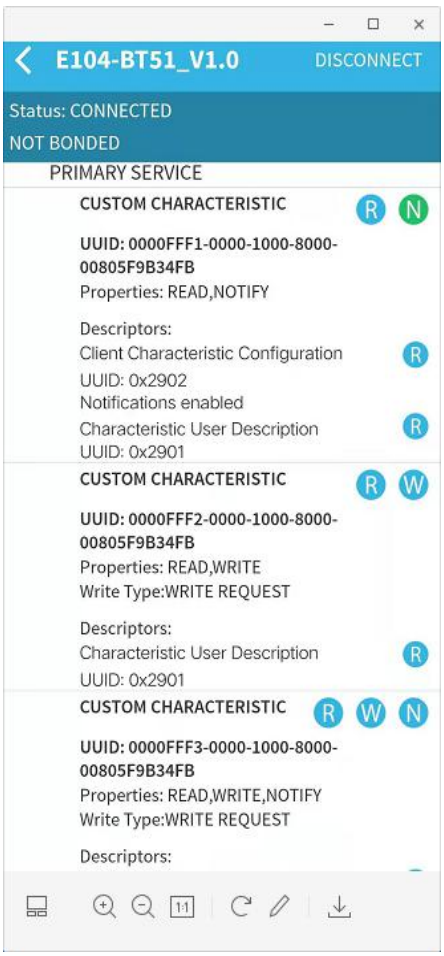


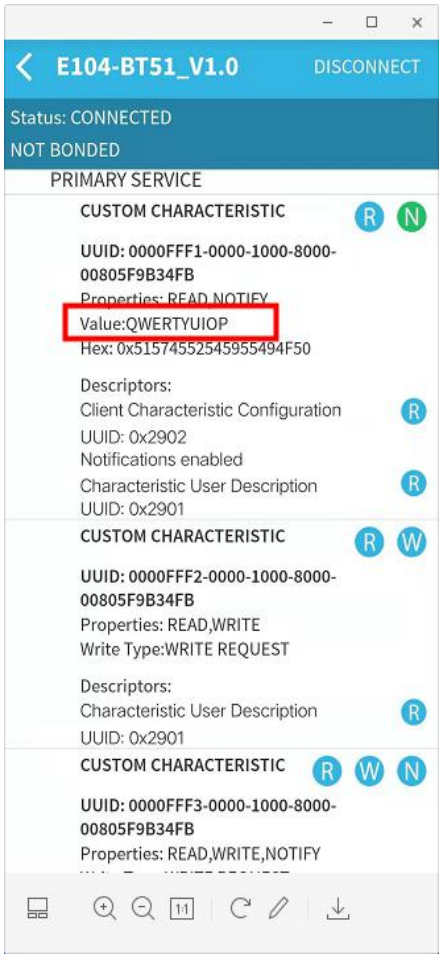
E104-BT51 transparent transmission channel

The figure1 is the notification channel, 2 is the write channel, and 3 is the air configuration channel.

4. After the third step is successful, click to enter service 1, and then click the ON button. Use the serial port assistant to send data, the red part is the data content received by the serial port, and the module sends a notification to the mobile APP.

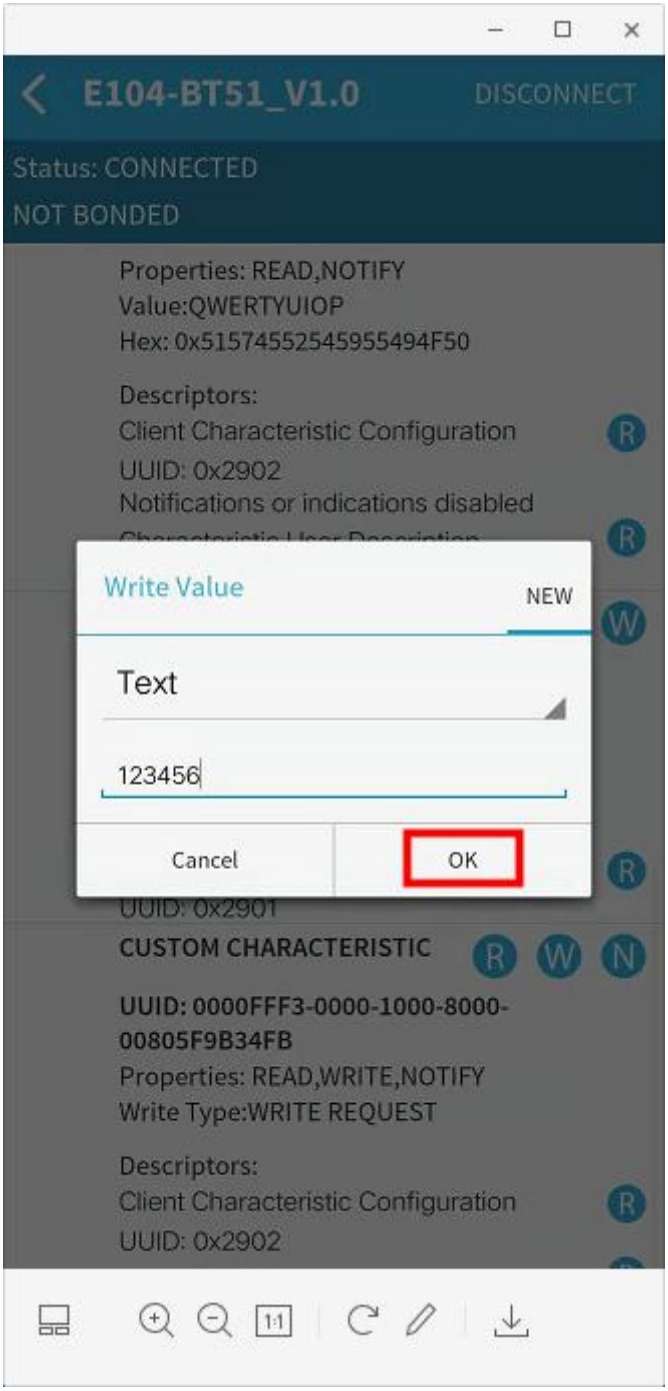




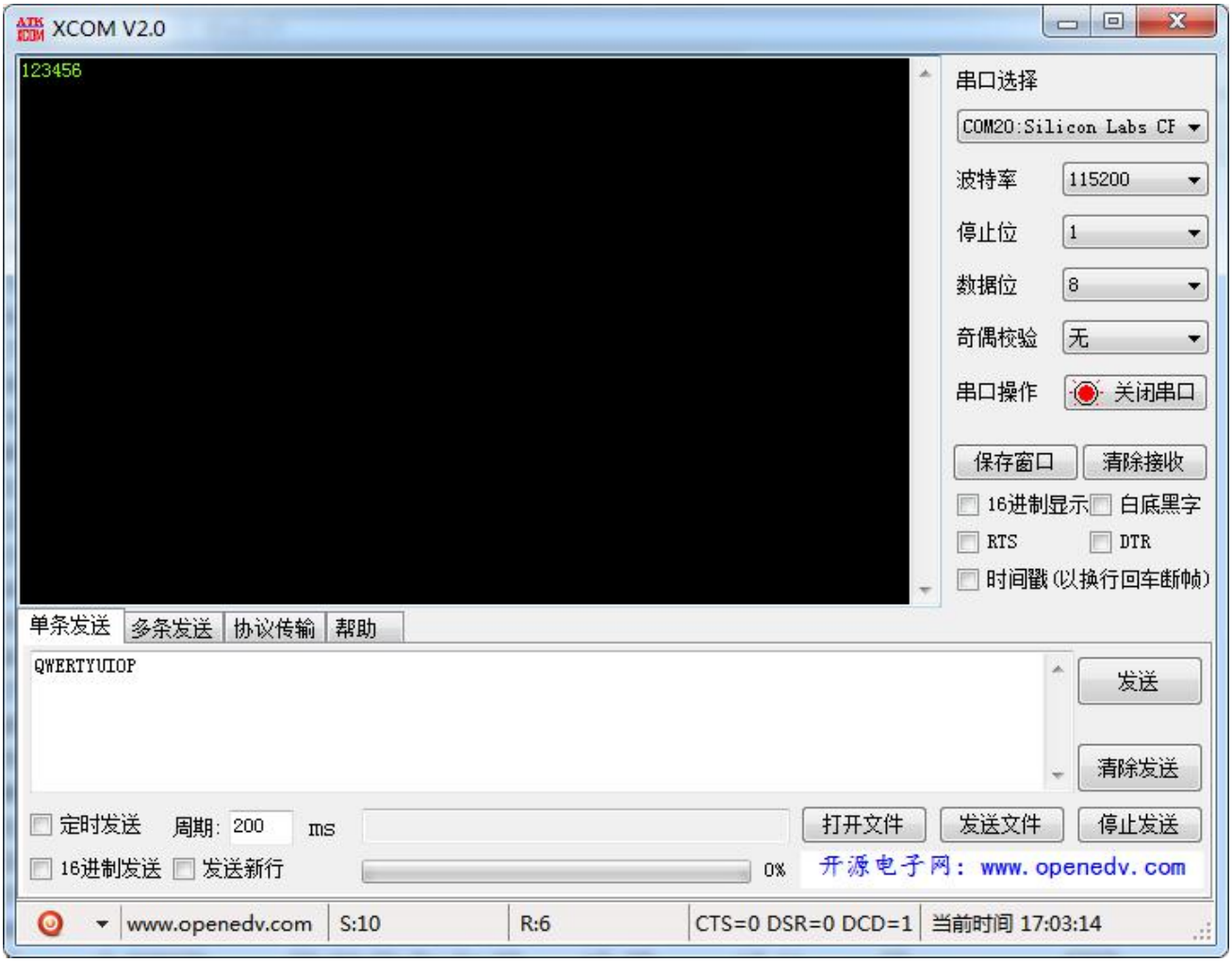


Open the notification of the mobile app Mobile APP receives data

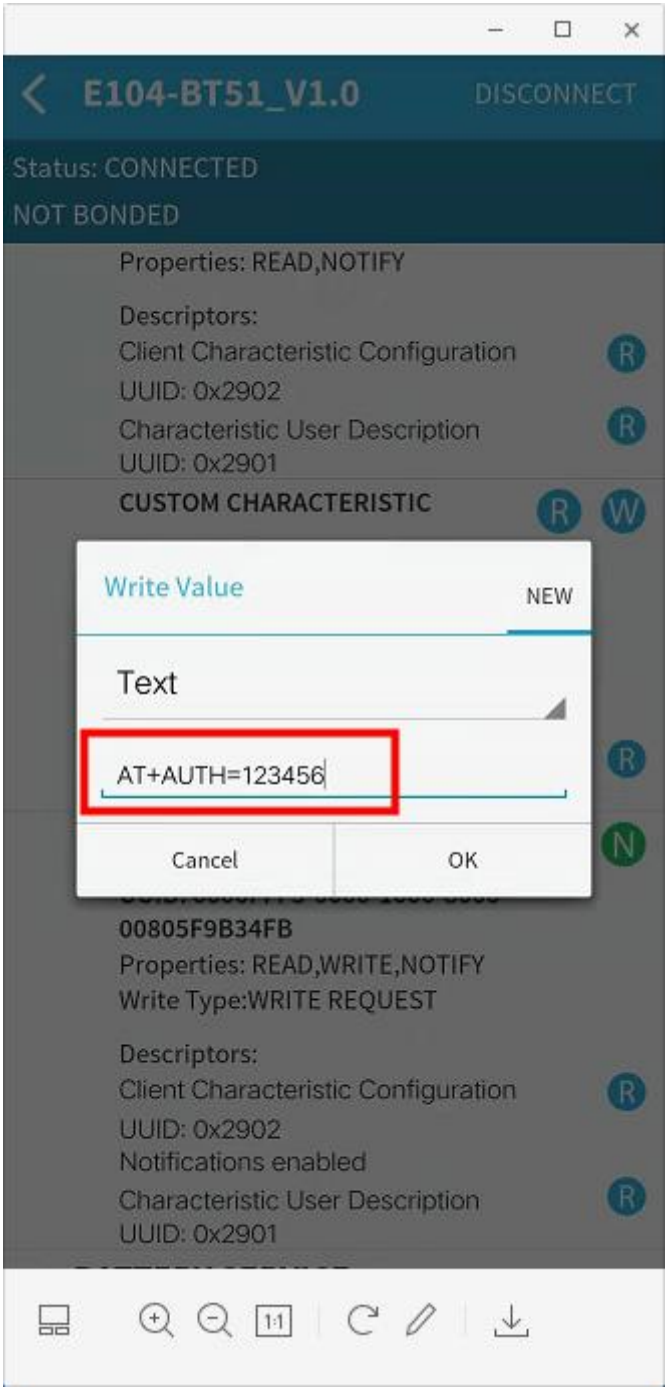
5. Click the W button of Service 2 in the third step as shown in the figure to enter the write operation. After editing the content, click OK to send the data, and check the data sent by the mobile APP to the module on the serial port assistant.



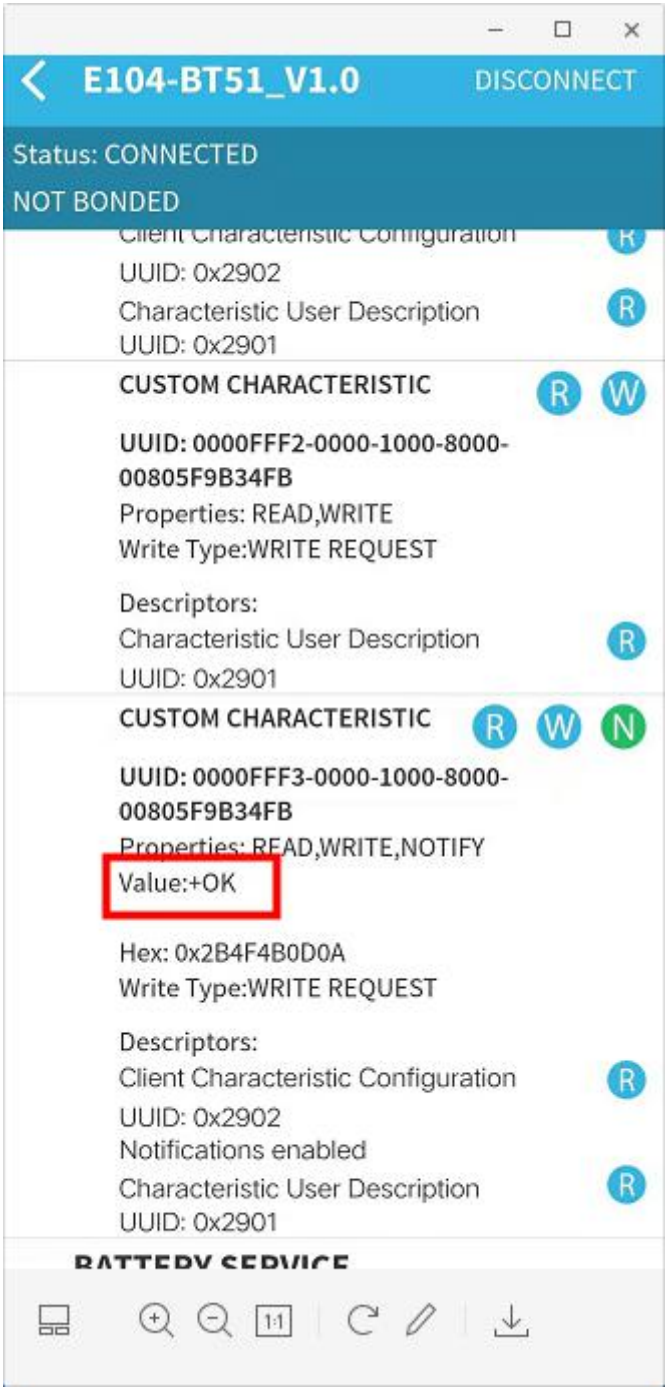
Mobile APP to send data



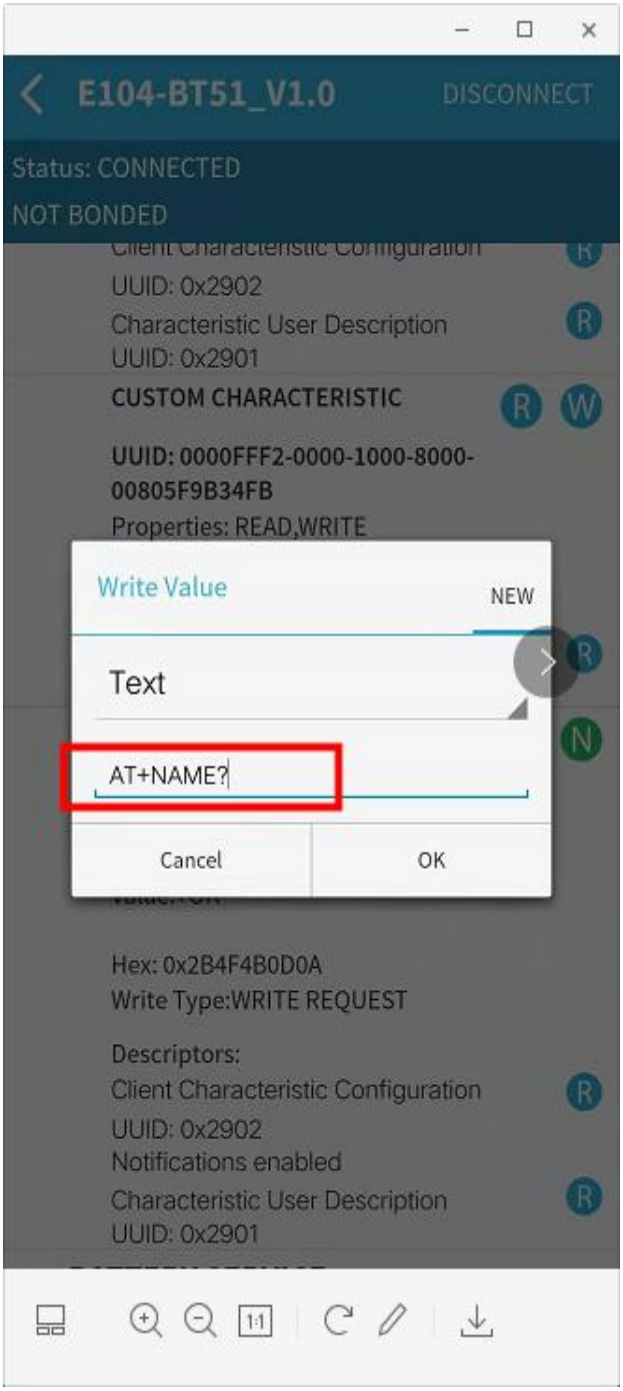
6. Air configuration, click the N button in service 3 to open the air configuration notification function, and then click the W button to enter the air configuration mode. When configuring in the air, you need to verify the password (tips: you need to pay attention to all characters when editing the control configuration password. The input must be characters in English mode, otherwise an error will be reported).

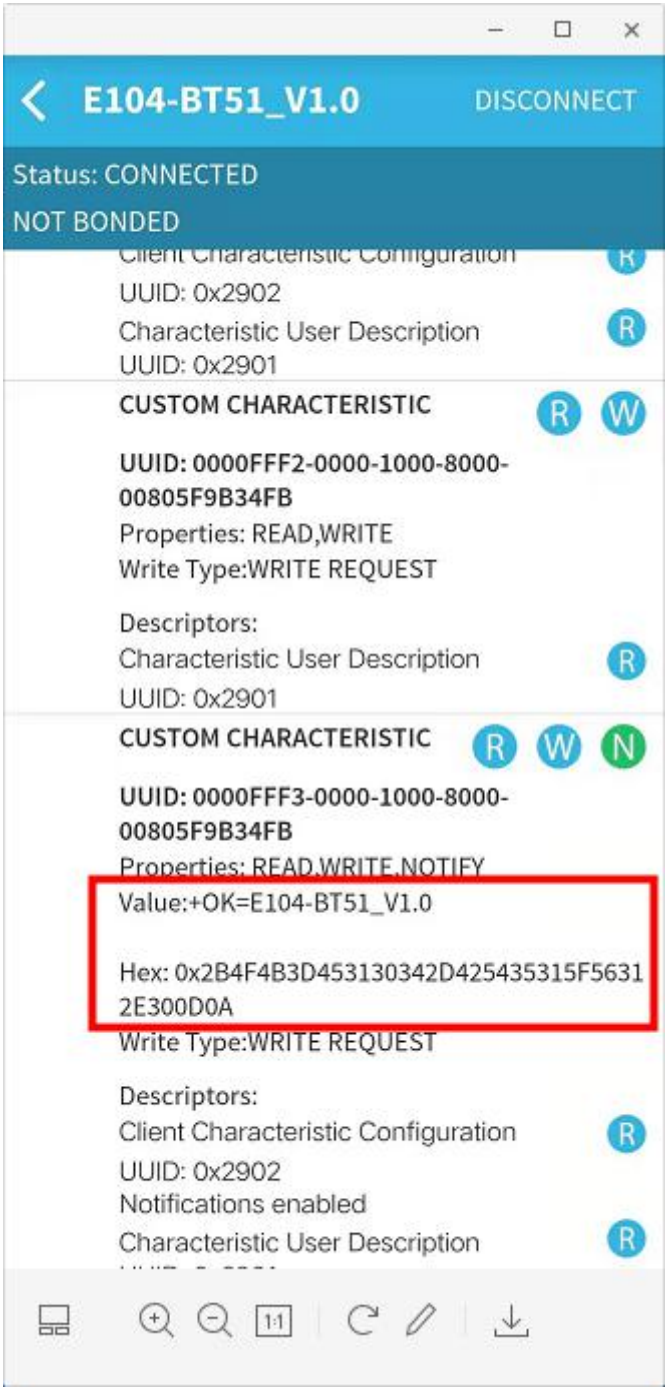


After passing the air configuration password authentication, return +OK to start configuration.



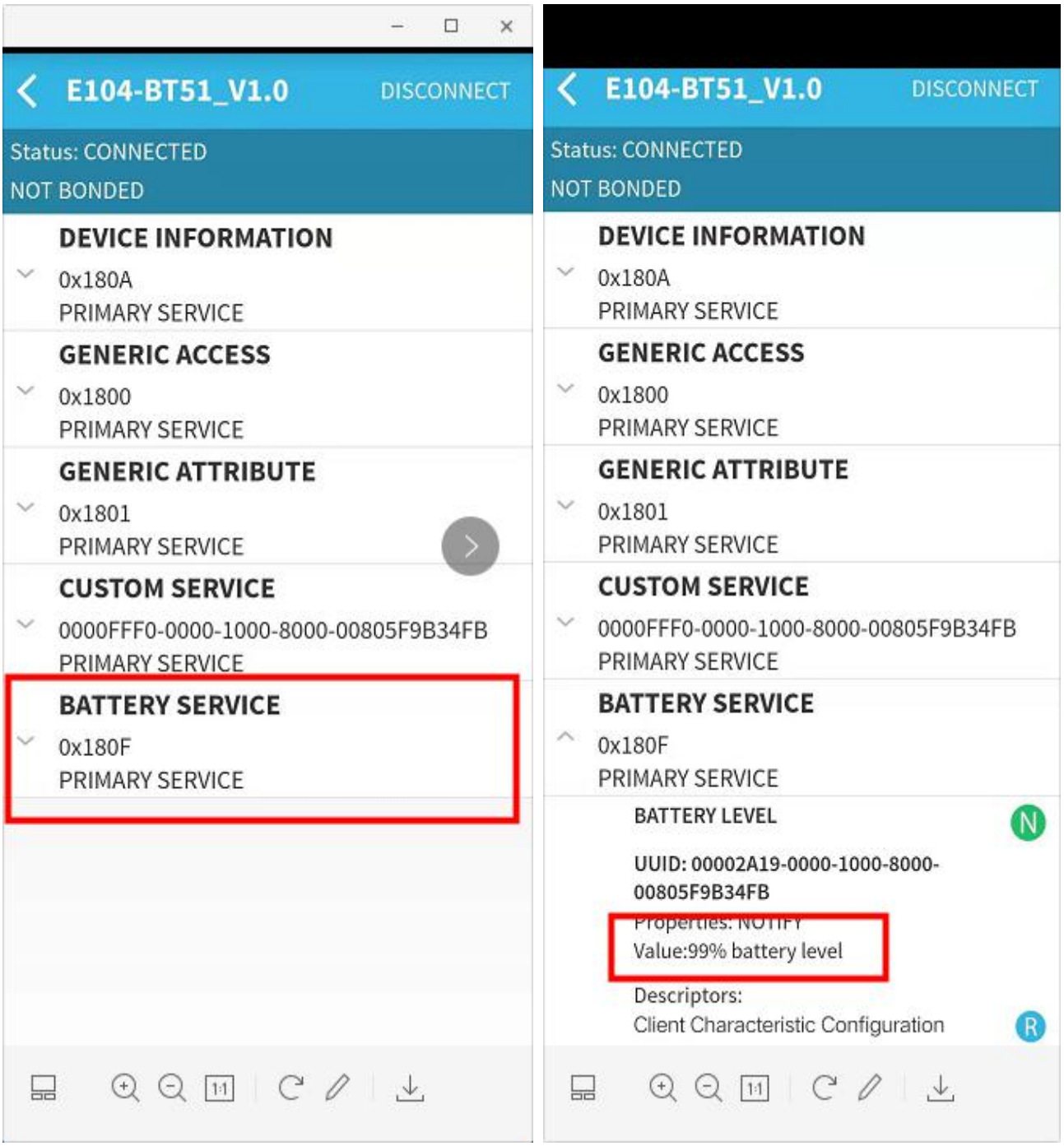
After the password authentication is successful, you will get the return message "+0K". At this point, you can perform air configuration, here is a demonstration of reading the device name.


E104-BT51_V1.0
DISCONNECT
Status: CONNECTED
NOT BONDED
UUID: 0x2902
Characteristic User Description
UUID: 0x2901
CUSTOM CHARACTERISTIC
UUID: 0000FFF2-0000-1000-8000-00805F9B34FB
Properties: READ,WRITE
Write Value
NEW
Text
AT+NAME?
Cancel
OK
Hex: 0x2B4F4B0D0A
Write Type:WRITE REQUEST
Descriptors:
Client Characteristic Configuration
UUID: 0x2902
Notifications enabled
Characteristic User Description
UUID: 0x2901


E104-BT51_V1.0
DISCONNECT
Status: CONNECTED
NOT BONDED
UUID: 0x2902
Characteristic User Description
UUID: 0x2901
CUSTOM CHARACTERISTIC
UUID: 0000FFF2-0000-1000-8000-00805F9B34FB
Properties: READ,WRITE
Write Type:WRITE REQUEST
Descriptors:
Characteristic User Description
UUID: 0x2901
CUSTOM CHARACTERISTIC
UUID: 0000FFF3-0000-1000-8000-00805F9B34FB
Properties: READ,WRITE,NOTIFY
Value:+OK=E104-BT51_V1.0
Hex: 0x2B4F4B3D453130342D425435315F56312E300D0A
Write Type:WRITE REQUEST
Descriptors:
Client Characteristic Configuration
UUID: 0x2902
Notifications enabled
Characteristic User Description

8.3 Bluetooth battery service user guide

Connect the battery voltage collection pin (34) of the module to the battery to be tested. After connecting the device according to section 8.2, click on battery service, and then click the N button under service to turn on the notification function. The module will continue to collect the percentage of battery voltage Send to APP, the battery range can be set to the maximum and minimum according to the full voltage of the battery. For details, see 6.46 Setting, Reading the Maximum Battery Voltage and 6.47 Setting, and Querying the Minimum Battery Voltage.



9. Hardware Notices for Users

- It is recommended to use a DC stabilized power supply to supply power to the module, the power ripple coefficient should be as small as possible, and the module should be reliably grounded;
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, it will cause permanent damage to the module;
- Please check the stability of the power supply, and the voltage should not fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% margin, and the whole machine is conducive to long-term stable operation;
- The module should be as far away as possible from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital wiring, high-frequency analog wiring, and power wiring must avoid the bottom of the module. If it is necessary to go under the module, assuming that the module is soldered to the Top Layer, place copper on the Top Layer of the contact part of the module. Copper and well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming that the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;
- Assuming that there are devices with large electromagnetic interference around the module, it will greatly affect the performance of the module. According to the intensity of the interference, it is recommended to stay away from the module. If the situation permits, proper isolation and shielding can be done;
- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power wiring) will greatly affect the performance of the module, according to the intensity of the interference, it is recommended to stay away from the module, if the situation permits Appropriate isolation and shielding;
- If the communication line uses 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from part of the physical layer that is also 2.4GHz TTL protocol, such as: USB3.0;
- The antenna installation structure has a great impact on the performance of the module. Make sure that the antenna is exposed, preferably vertically upward. When the module is installed inside the case, a high-quality antenna extension cable can be used to extend the antenna to the outside of the case;
- The antenna must not be installed inside the metal shell, which will greatly reduce the transmission distance.

10. FAQ

10.1 Transmission distance is not ideal

- When there is a straight line communication obstacle, the communication distance will be attenuated accordingly;
- Temperature, humidity, and co-frequency interference will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test results near the ground are poor;
- Sea water has a strong ability to absorb radio waves, so the seaside test results are poor;
- If there is a metal object near the antenna or placed in a metal shell, the signal attenuation will be very serious;
- The power register setting is wrong, the air speed setting is too high;
- The low voltage of the power supply at room temperature is lower than the recommended value, the lower the voltage, the lower the power output;
- The matching degree of the antenna and the module is poor or the quality of the antenna itself is problematic.

10.2 Module is easily damaged

- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, it will cause permanent damage to the module;
- Please check the stability of the power supply, and the voltage should not fluctuate greatly and frequently;
- Please ensure anti-static operation during installation and use, and high-frequency components are electrostatically sensitive;
- Please ensure that the humidity during installation and use should not be too high, and some components are humidity sensitive devices;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

10.3 Bit error rate is too high

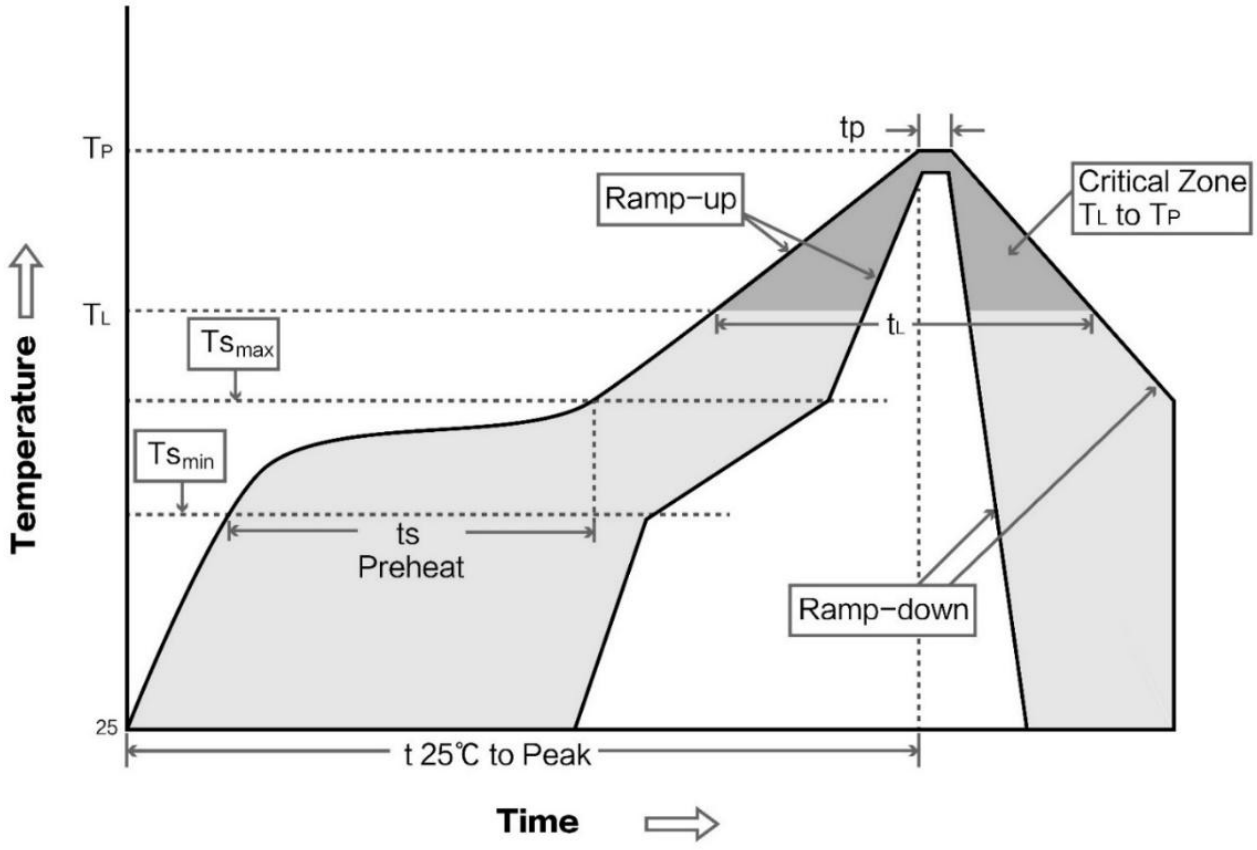
- There is co-frequency signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- Unsatisfactory power supply may also cause garbled codes. Ensure the reliability of the power supply;
- Poor or too long extension cables and feeders can also cause high bit error rates.

11. Guide for Soldering work

11.1 Reflow soldering temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Min preheating temp.	100℃	150℃
Preheat temperature max (Tsmax)	Mx preheating temp.	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ramp-up rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temp.	183℃	217℃
Time （tL） Maintained Above （TL）	Time below liquid phase line	60-90 sec	30-90 sec
Peak temperature （Tp）	Peak temp.	220-235℃	230-250℃
Aveage ramp-down rate （Tp to Tsmax）	Aveage ramp-down rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time to peak temperature for 25℃	max 6 minutes	max 8 minutes

11.2 Reflow soldering curve

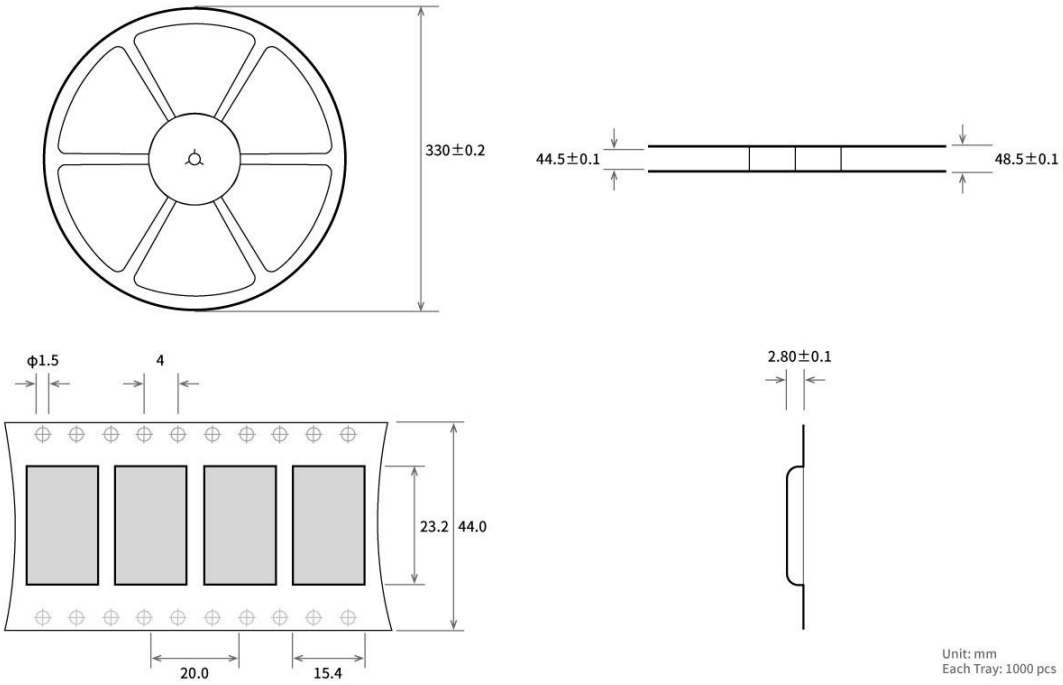


12. Similar Models

Model	Chipset	Freq. Hz	Tx Powe dBm	Com Interface	BLEVersion	Size mm	Antenna Type	Features
E72-2G4M05S1B	CC2640	2.4G	5	I/O	4.2	17.5*28.7	PCB/IPX	Hardware resources, secondary development
E73-2G4M04S1A	nRF52810	2.4G	4	I/O	4.2/5.0	17.5*28.7	PCB/IPX	Hardware resources, secondary development
E73-2G4M04S1B	nRF52832	2.4G	4	I/O	4.2/5.0	17.5*28.7	PCB/IPX	Hardware resources, secondary development
E73-2G4M08S1C	nRF52840	2.4G	8	I/O	4.2/5.0	13*18	PCB/IPX	Hardware resources, secondary development
E73-2G4M04S1D	nRF51822	2.4G	4	I/O	4.2	17.5*28.7	PCB/IPX	Hardware resources, secondary development
E104-BT01	CC2541	2.4G	0	I/O	4.0	14*22	PCB	Hardware resources, secondary development
E104-BT02	DA14580	2.4G	0	TTL	4.2	14*22	PCB	The industry's lowest power consumption, high-speed continuous transmission
E72-2G4M04S2B	CC2640	2.4G	2	TTL	4.2	14*23	PCB/IPX	Built-in dual-core ARM, multi-role mode
E104-2G4U04A	CC2540	2.4G	0	USB	4.0	18*59	PCB	Dongle, protocol analyzer

E104-BT05	TSLR8266	2.4G	0	I/O	4.2	10*14.5	PCB	Low power consumption, transparent transmission, IO acquisition, IO output, PWM output
E104-BT51	CC2640R2F	2.4G	5	I/O	5.0	17.5*28.7mm	PCB	BLE5.0, 2MPHY, low power consumption, battery service, transparent transmission, PWM output, IO output, IO acquisition, ADC acquisition

13. Packaging for Mass Orders



14. Revision history

Version	Date	Remark	By
1.0	2019-12-11	Initial Version	Ren
1.1	2020-12-18	Format Change	Ren

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