E104-BT5005A User Manual

nRF52805 BLE5.0 Low energy Bluetooth to serial port module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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CONTENTS

CHAPTER 1 OVERVIEW 1
1.1 INTRODUCTION 1
1.2 FEATURES 1
1.3 APPLICATION SCENARIOS 2
CHAPTER 2 SPECIFICATIONS 2
2.1 LIMIT PARAMETERS 2
2.2 OPERATING PARAMETER 2
CHAPTER 3 SIZE AND PIN DEFINITION 4
CHAPTER 4 RECOMMENDED CONNECTION DIAGRAM 5
CHAPTER 5 BASIC OPERATION 5
5.1 ROLE DESCRIPTION 5
5.1.1 Master 6
5.1.2 Slave 6
5.1.3 Observer 7
5.2 POWER MODE 7
5.2.1 Low power mode 7
5.2.2 Wake mode 8
5.3 MAC ADDRESS BINDING 8
5.4 BROADCAST 8
5.4.1 General broadcast information 8
5.4.2 iBeacon Broadcast information 9
5.5 CONFIGURATION 9
5.6 DATA INDICATION 9
5.7 UUID DESCRIPTION 10
CHAPTER 5 AT COMMAND 11
6.1 INSTRUCTIONS 11
6.2 ERROR CODE 11
6.3 STATUS PRINTING 12
6.4 INSTRUCTION LIST 12
6.4.1 AT Test instruction 12
6.4.2 AT+RESET reset command 12
6.4.3 AT+RESTORE estore factory command 12
6.4.4 AT+BAUD serial port baud rate 13
6.4.5 AT+PARI Serial port check bit 13
6.4.6 AT+ROLE Bluetooth role 13
6.4.7 AT+DEVMANUF Modify vendor name 14
6.4.8 AT+DEVSERIAL Modify device serial number 14
6.4.9 AT+DEVMODEL Modify product model 14
6.4.10 AT+DEVHWER Modify the hardware version 15
6.4.11 AT+DEVSWVER Modify software version 15
6.4.12 AT+DEVID Modify device ID 15
6.4.13 AT+ADV Broadcast enable 15

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6.4.14 AT+ADVDAT Broadcast data 16
6.4.15 AT+ADVINTV Broadcast gap 16
6.4.16 AT+IBCNUUID iBeacon UUID Instruction 17
6.4.17 AT+MAJOR iBeacon Major Instruction 17
6.4.18 AT+MINOR iBeacon Minor Instruction 17
6.4.19 AT+IPWR Modify ibeacn tx_power 18
6.4.20 AT+NAME Broadcast device name 18
6.4.21 AT+CONPARAMS Connection gap configuration 18
6.4.22 AT+DISCON Disconnect instruction 19
6.4.23 AT+DATDLY Data output delay 19
6.4.24 AT+MAC Local MAC address 19
6.4.25 AT+PEERMAC Connect the device MAC 19
6.4.26 AT+BOND Binding enable 20
6.4.27 AT+BONDMAC Add binding MAC address 20
6.4.28 AT+BONDDEL Delete the MAC address specified by the binding 20
6.5.1 AT+SCAN Broadcast scan 21
6.5.2 AT+SCANINTV Scan gap 21
6.5.3 AT+SCANWND Scan window 21
6.5.4 AT+AUTOCONN Auto connect 22
6.5.5 AT+CONN Specify connection 22
6.5.6 AT+UUIDSVR128 Set up service 128bit UUID 22
6.5.7 AT+UUIDSVR Bluetooth service UUID 23
6.5.8 AT+UUIDCHARA1 SLAVE CHANNEL feature UUID 23
6.5.9 AT+UUIDCHARA2 MAST CHANNEL Feature UUID instructions 23
6.5.10 AT+VER Query software version number 23
6.5.11 AT+AUTH Air configuration authentication password 24
6.5.12 AT+UPAUTH Modify air authentication password 24
6.5.13 AT+PWR Transmit power 24
6.5.14 AT+SLEEP Sleep mode immediately 25
6.5.15 AT+LOGMSG Running status output 25
6.5.16 AT+FNAME Name filtering 25
6.5.17 AT+FRSSI Signal strength filtering 25
CHAPTER 6 QUICK USE 27
7.1 QUICK GUIDE TO CONFIGURATION MODE 27
7.1.1 Serial port configuration 27
7.1.2 Air configuration 28
7.2 DATA TRANSMISSION 29
7.2.1 Data transparent transmission 30
CHAPTER 8 HARDWARE DESIGN 31
CHAPTER 9 COMMON PROBLEM 32
9.1 INSUFFICIENT TRANSMISSION DISTANCE 32
9.2 MODULE IS EASILY DAMAGED 32
9.3 BIT ERROR RATE IS TOO HIGH 32
CHAPTER 10 WELDING OPERATION GUIDANCE 34

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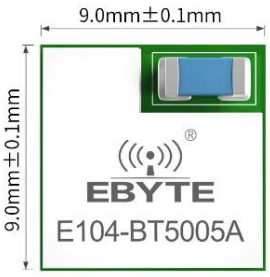
10.1 REFLOW TEMPERATURE 34
10.2 REFLOW SOLDERING CURVE 34
CHAPTER 11 RELATED MODELS 36
CHAPTER 12 BULK PACKAGING 37
REVISION HISTORY 38
ABOUT US 38

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Chapter 1 Overview

1.1 Introduction



E104-BT5005A is a serial to BLE Bluetooth master-slave integrated module based on 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-BT5005A module is developed by Chengdu Ebyte Electronic Technology Co., Ltd. based on NORDIC's nRF52805 chip. The module uses general AT commands to set parameters and is simple and quick to operate. The module only supports Bluetooth master, slave and observer modes. The module functionally supports low-power broadcast, data transparent transmission, and air configuration. Modules can be widely used in smart wear, home automation, home security, personal health care, smart home appliances, accessories and remote controls, automobiles, lighting, industrial Internet, smart data collection, smart control and other fields. Maximum support for data transmission with a baud rate of 460800bps.

1.2 Features

- Support Bluetooth BLE 5.0 protocol;
- Adjustable Bluetooth package length;
- Two working modes of configuration and transparent transmission;
- Automatic broadcast and automatic connection after startup;
- IBeacon and ordinary broadcast switching;
- Support serial wake-up;
- MAC binding connection, support RSSI and name filtering;
- Support serial port transparent transmission;
- Support multiple serial port modes and baud rates;
- Support custom 16-bit UUID and 128-bit UUID;
- With PCB onboard antenna, no external antenna is required;
- Support Bluetooth parameter air configuration function;
- The maximum communication distance is 70m (@4dBm, 2Mbps);
- Support ultra-low power sleep, simultaneous broadcasting;
- Support MAC address binding, the maximum binding data is 8 devices;
- Support two connection modes: manual connection and automatic connection;
- Support dynamic modification of transmit power. The maximum emission is 4dBm;
- Support sniffing function;
- The maximum MTU is 247bytes;
- Support 2M, 1M airspeed.

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1.3 Application scenarios

- Wireless meter reading and wireless sensing;
- Smart home
- Industrial remote control and telemetry;
- Intelligent buildings, intelligent buildings;
- Automated data collection;
- Health sensor
- Smart robot;
- Wireless sensing
- Electronic label;
- Intelligent control;

Chapter 2 Specifications

2.1 Limit parameters

Main parameters	Performance		Remark
	Min	Max	
Power supply voltage (V)	0	3.6	Over 3.6V will permanently burn the module
Blocking power (dBm)	-	10	Less likely to burn when used at close range
Working temperature (℃)	-40	+85	Industrial grade

2.2 Operating parameter

Main parameter		Performance			Remark
		Min	Type	Max	
Operating voltage（V）		1.7	3.3	3.6	≥3.3V can guarantee output power
Communication level (V)			3.3		Using 5V level is risky to burn
Working temperature (℃)		-40	-	+85	Industrial design
Operating frequency（Mhz）		2402	-	2480	ISM frequency band
Power	Emission current (mA)	-	7.2	-	-

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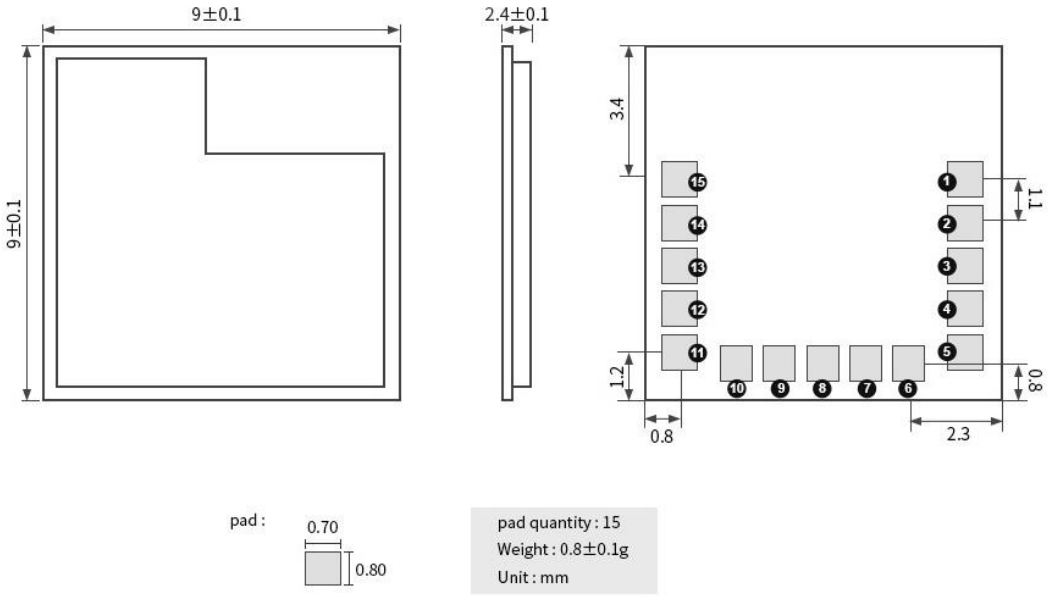
consumption	Receiving current (mA)	-	6.4	-	-
Maximum transmit power (dBm)		-3.5	3.8	4	-
Receiving sensitivity (dBm)		-	-96	-	Bluetooth® lowenergymode
Optional I / O		VIL/VIH	GND/0.84	GND/VCC	0.36/VCC
		VOL/VOH	GND/1.88	GND/VCC	0.47/VCC
Sleep broadcast current (default)		-	6	-	Unit: uA. The default broadcast interval is 1s
Wake-up broadcast current (default)		-	5.8	-	Unit: uA. The default broadcast interval is 1s
Wake up without broadcast current (default)		-	1.8	-	Unit: mA. The default connection gap is 500ms
Wake-up connection current (default)		-	3.3	-	Unit: mA.

Main parameter	Description	Remark
Reference distance	70m	Clear and open environment, height 2.0 meters; @4dBm; air speed: 2Mbps
Bluetooth protocol	BLE5.0	-
Communication Interface	UART	-
Package	SMD	-
Interface method	1.1 mm	-
Dimensions	9*9mm	-
Antenna	Ceramic antenna	Equivalent impedance is about 50Ω

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Chapter 3 Size and pin definition

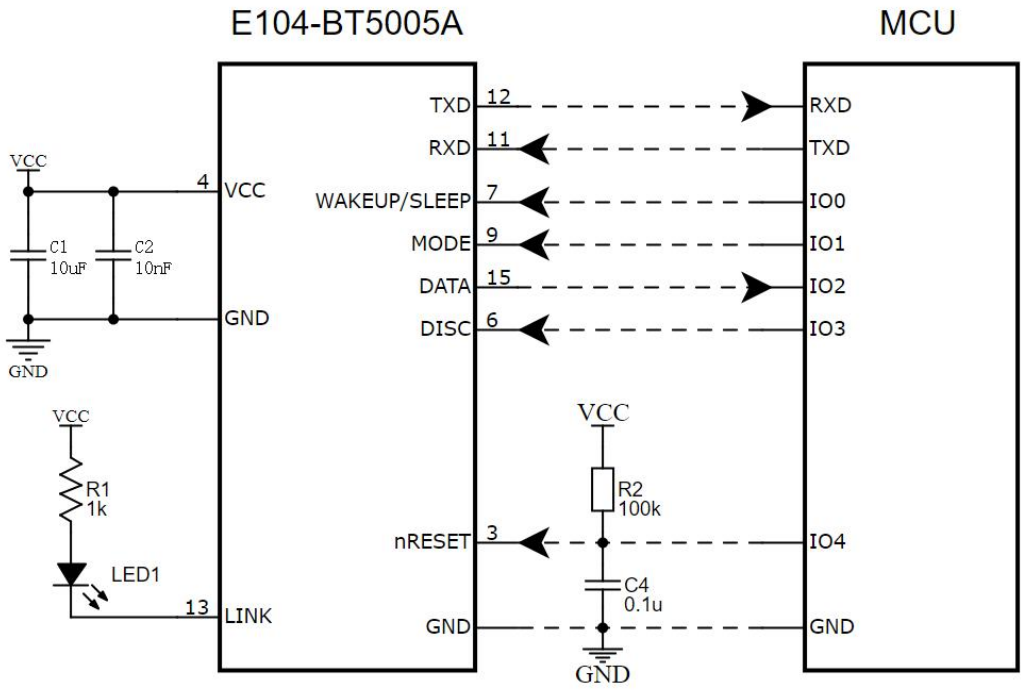


NO.	Pin item	Direction	Function	Application
1	SWDIO	--	--	--
2	SWCLK	--	--	--
3	P0.21/RST	I	Power reset	Active low
4	VCC	--	--	The power supply is positive, the recommended power supply voltage>=3.3V
5	GND	--	--	Power ground
6	DISC（P0.12）	I	Disconnect pin	Internal pull up. Active on falling edge
7	WKP（P0.05）	I	Wake-up pin	Wake up: falling edge;
8	P0.00	I/O	-	Sleep: rising edge.
9	MOD（P0.04）	I	Mode selection	General GPIO
10	P0.01	I/O	-	Low level: configuration mode;
11	RXD（P0.20）	I	UART RX pin	High level: transparent transmission mode.
12	TXD(P0.14)	O	UART TX pin	General GPIO
13	LINK (P0.16)	O	Connection Status	-
14	GND	--	--	
15	DATA (P0.18)	O	Data indication	Data indication pin, When the module outputs data through the serial port, the module sets the data pin to low level, indicating that data is being sent. The at instruction response does not change the state of the data pin.

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Chapter 4 Recommended connection diagram



Note: The sensor refers to connecting an external device to a pin with an input function, the peripheral device refers to connecting an external device to a pin with an output function, and the MODE and WAKEUP / SLEEP pins refer to The two control pins are connected to the corresponding level state. If the module needs to be woken up, the WAKEUP / SLEEP (WKP（P0.05）) pin should be connected to a low level, or a falling edge signal should be given to the pin 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 (MOD（P0.04）) pin.

Chapter 5 Basic Operation

5.1 Role description

The module supports three roles: master, slave, and observer.

The host supports connecting to other Bluetooth products of our company. When the module acts as a master, it only supports one slave. Only supports transparent data transmission. Support manual and automatic connection.

The module slave can be connected with other types of Bluetooth products of our company, and only supports one connection. The slave only supports transparent transmission.

The observer is only used to print the broadcast information of the ble devices around the module and cannot be connected.

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5.1.1 Master

1.AT+ROLE=1 to select the host role;
2. Command AT+SCAN=1 to turn on the host scan function;
3. Command AT+AUTOCONN to configure whether to automatically connect after power-on;
4. When set to manual connection, command AT+CONN to configure the connection to the specified device;
5. Print status information when the host connection status changes. See 6.3 Status Printing.

5.1.1.1 Conditional filtering

The device can be configured to filter by binding MAC address, service UUID, RSSI and NAME. The four filtering methods can be used at the same time, or individually enabled or disabled, but the service UUID filtering cannot be disabled.

- Service UUID filtering: The broadcast data of the slave must contain a 16-bit UUID field, and the UUID is 0xFFF0.
- MAC address filtering: If users need MAC address filtering, they need to enable MAC address filtering through AT+BOND=1, and add MAC addresses to the host through AT+BONDMAC. After the master scans the slave, if it is the same as the binding list MAC address and service UUID, the master automatically connects to the slave device.
- NAME filtering: The broadcast data of the slave must include a name field, and the name must be a full name. If it matches, it will automatically connect. The name matching method is partial matching. For example: Name filtering is enabled, and the filter name is "E104-BT50"; then "E104-BT50", "E104-BT501", and "E104-BT5011" can all be matched successfully, but "1E104-BT50", E104-BT5 Will be filtered out.
- RSSI filtering: The host can filter out modules that are less than the set filtering RSSI value.

5.1.1.2 Auto connect

If it is configured to automatically connect, it will automatically connect to the slave after the filter conditions are met.
If it is configured to connect manually, after scanning is turned on. The host will output the scanned device with matching UUID via UART (data format is shown in Figure 4, host output scan result data format). The user uses AT+CONN to connect to the designated slave device.

RSSI(Signal quality)	MAC
1byte	6byte

5.1.2 Slave

1. AT+ROLE=0 select slave mode
2. AT+ADV=1 configure normal broadcast mode

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3. The broadcast switch is configured to be on, and it will automatically enter the broadcast state after power-on, otherwise the stop broadcast device will not be found.
4. After receiving the host connection request, establish a Bluetooth connection to stop Bluetooth broadcasting and enter the data transparent transmission mode.
5. For broadcast data configuration, please refer to 5.5 Broadcast.

5.1.3 Observer

1. Command AT+ROLE=2 to select the observation mode (valid after restart)
2. After receiving the broadcast, print out all the contents of the broadcast package through the serial port.
3. The observer device cannot connect to any device.

The format is as follows:

LEN	MAC	RSSI	Advdata
1 byte	6byte	1byte	No more than 31 bytes

Note: LEN is the sum of MAC, RSSI, and broadcast data length.

4. The scan window and scan gap are consistent with the scan parameters.
5. During the AT command is valid.
6. The observer mode supports RSSI filtering, NAME filtering, and MAC address filtering (the MAC address module in the binding list allows output).
7. The observer module of this module can output broadcast response packets. Broadcast packet and broadcast response packet are divided into two data outputs.

5.2 Power mode

The module supports two power modes: low power consumption mode and wake-up mode.

5.2.1 Low power mode

The so-called low power consumption mode means that the BLE function continues to run after the module enters this mode, and peripherals other than the wake-up pin of the module are turned off. If you need lower power consumption, you can turn off broadcast and scan through AT commands, disconnect all connections, and set a longer broadcast gap, scan gap, and connection gap.

Enter low power consumption:

1. AT command "AT+SLEEP" immediately enters low power consumption mode;
2. AT command "AT+DISCSLEEP=1" set to enter low power consumption after disconnection;
3. Through the rising edge of pin WKP, and the high level is maintained for 200ms and above, it immediately enters low power consumption；

After the module enters low power consumption mode, it outputs "STA: sleep" through the serial port (LOGMSG does not turn off the output).

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Note: In the low-power mode, when the connection is not disconnected, such as ble receives air data, or when the connection status changes, the module temporarily wakes up and outputs the corresponding data, and immediately enters sleep after the data output is completed. At this time, low power consumption or wake-up will not output status data.

5.2.2 Wake mode

The so-called wake-up mode means that the peripherals required by the module are in a normal working state in this mode. After the module wakes up, it outputs the status "STA: wakeup".

Wake up：
Wake up immediately after the falling edge of WKP pin, and the low level is maintained for more than 200ms;
The serial port RX pin wakes up. Serial rx falling edge, and the low level is maintained at 50us and above, wake up immediately.

5.3 MAC Address binding

The module supports MAC address binding. If the MAC address binding function is enabled. The device only connects to devices with added MAC addresses.

5.4 Broadcast

5.4.1 General broadcast information

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.

5.4.1.1 Advertising

Fixed field	Len	Vendor field	Manufa data
020106	N	0xFF	Configurable, maximum 26 bytes
E.g.：020106< Len >FF< Manufa data >			

Users can only configure Manufa data field data.

5.4.1.2 Scan response

Len	固定	UUID	Len	固定	Device name
0x03	0x03	FFF0	N	0x09	Configurable, maximum 22bytes
E.g.： 0303FFF0<len>09< Device name >					

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Note: This data does not require user configuration.

5.4.2 iBeacon Broadcast information

1. Instructions to configure UUID, Major, Minor 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.

5.4.2.1 Advertising

iBeacon Prefix	UUID	Major	Minor	Tx-Power
9B	16B	2B	2B	1B
E.g.：	0201061AFF4C000215FDAFDA50693A4E24FB1AFCFC6EB07647825277	5848	F00	

5.5 configuration

The module supports two configuration methods: serial port configuration and air configuration. These two configuration methods are basically the same. Before the air configuration, the authentication password of AT+AUTH=123456 must be passed. After the authentication is passed, the module can use the air configuration. The air configuration authentication period is this connection, and re-authentication is required if the device is disconnected and reconnected.

The module is in configuration mode before the connection is established. The Mod pin is invalid.

After the connection is successful, determine whether the module is currently in configuration mode or data transmission mode according to the mod pin level. When mod is high, it is data transmission mode, when it is low, it is configuration mode.

When the Mod pin detects a valid change, the current state is latched. The hold time for each state change is more than 200ms valid.

The Mod pin does not affect the air configuration.

In configuration mode, the master sends data to “MAST CHANNEL”, and the slave returns “CONFIG BUSY” through “SLAVE CHANNEL”.

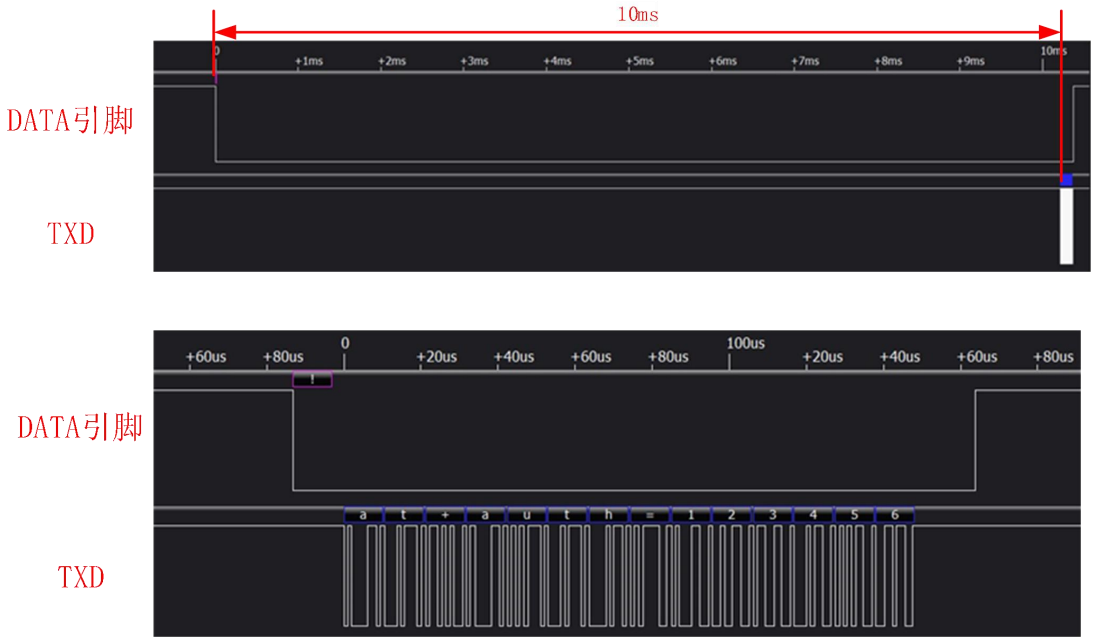
5.6 Data indication

When the module outputs data through the serial port, the module sets the DATA pin to low level, indicating that data is being sent. AT command response does not change the DATA pin state.

The module can turn on the data output delay through AT+DATALY=1. After the data output delay is turned on, the module first pulls the DATA pin and outputs data after 10ms.

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5.7 UUID Description

Service UUID	FFF0 (Configurable)		
Eigenvalues	UUID	Attributes	描述
SLAVE CHANNEL	FFF1 (configurable)	read / notify	The slave sends the data, and the master receives the data channel.
MAST CHANNEL	FFF2 (configurable)	read / write	The host sends data and the slave receives data channels
CONFIG CHANNEL	FFF3 (not configurable)	read / write / notify	Air configuration channel

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Chapter 5 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.

6.1 Instructions

- All AT commands do not need to add carriage return (\r), line feed (\n)
- The return result of the AT command ends with \r\n (except for the return of HEX)
- Command error response format +ERR=[NUM]. (NUM is ACSII)

6.2 Error Code

NUM	Description	wrong reason	Solution
0	AT is currently being parsed	The interval between two AT commands is too short	Properly increase the delay between two AT commands
1	Instruction does not exist	AT command characters are wrong	Check AT specified string
2	Parameter length error	1. The total length of AT command is wrong;	Check the parameters
3	Invalid parameter	2. The data length exceeds the range	Check the parameter value against the command
4	Air wake authentication failed	1. The parameter exceeds the value range	1、 1. Use the correct configuration password;
5	Current device role, this command is not supported	wrong password	2. Reset password via UART
6	unknown mistake		This command is forbidden in the current role
7	Save parameter error		
8	AT command exists, but the operation is not supported		
9	not connected		Contrast instructions. Confirm action
10	MAC address already exists	The module is not connected	
11	MAC list is full	The increased binding MAC address already exists	
12	MAC address does not exist	MAC address binding exceeds the maximum data supported by the module	
13	Connection failed	The deleted MAC ground does	

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		not exist	
14	Exceed the maximum number of current connections		1. Disconnect the connected device; 2. Modify the maximum number of connections;
15	Device does not exist		

6.3 Status printing

Status	**Print information**	
Connection succeeded	Slave	\r\nSTA:connected\r\n
	Host	\r\nSTA:connect,1,<MAC\r\n
Disconnect	Slave	\r\nSTA:disconnected\r\n
	Host	\r\nSTA:disconnect,1\r\n
System wake up	\r\nSTA:wakeup\r\n	
Sleep mode	\r\nSTA:sleep\r\n	

6.4 Instruction list

6.4.1 AT Test instruction

Instruction	React
AT	**+OK**
Description: None	

6.4.2 AT+RESET reset command

Instruction	React
AT+RESET	**+OK**
Description: effective immediately	

6.4.3 AT+RESTORE estore factory command

Instruction	React
AT+RESTORE	**OK**
Description: 1、 After resetting, it will restart automatically; 2、 In the process of restoring factory settings, any form of reset is prohibited, and the power off before the operation is completed is prohibited;	

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6.4.4 AT+BAUD serial port baud rate

Instruction		React
Inquire	**AT+BAUD?**	**+OK=[para]**
Setting	**AT+BAUD=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
parameter	para（ASCII）	Baud rate (bps)
	0	1200
	1	2400
	2	4800
	3	9600
	4	14400
	5	19200
	6	28800
	7	38400
	8	57600
	9	76800
	10	115200（default）
	11	230400
	12	250000
	13	460800
Description	Restart to take effect	
Example	AT+BAUD=10. Set the baud rate to 115200 HEX: 41,54,2B,42,41,55,44,3D,31,30	

6.4.5 AT+PARI Serial port check bit

Instruction		React
Inquire	**AT+PARI?**	**+OK=[para]**
Setting	**AT+PARI=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(ASCII)	**Description**
	0	No inspection (default)
	1	Even parity
Description	Restart to take effect, save when power off	
E.g.	AT+PARI=0	

6.4.6 AT+ROLE Bluetooth role

Instruction	React

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Inquire	AT+ROLE?	+OK=[para]
Setting	AT+ROLE =[para]	+OK：Done +ERR=[NUM]：Error
Parameter	Para(ASCII)	**Description**
	0	Slave (default)
	1	Host
	2	Observer
Description	Restart to take effect, save when power off	

6.4.7 AT+DEVMANUF Modify vendor name

Instruction		**React**
Inquire	AT+DEVMANUF?	+OK=[para]
Setting	AT+DEVMANUF =[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para (string): vendor name Factory default: CDEBYTE;	
Description	1、 Restart to take effect, save when power off 2、 The maximum length of the string is 32bytes	

6.4.8 AT+DEVSERIAL Modify device serial number

Instruction		**React**
Inquire	AT+DEVSERIAL?	+OK=[para]
Setting	AT+ DEVSERIAL =[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para (string): device serial number Factory default: 123456;	
Description	1、 Restart to take effect, save when power off 2、 Maximum string length 32bytes	

6.4.9 AT+DEVMODEL Modify product model

Instruction		**React**
Inquire	AT+DEVMODEL?	+OK=[para]
Setting	AT+ DEVMODEL =[para]	+OK：Done +ERR=[NUM]:Error
Parameter	para (string): device model Factory default: E104-BT50;	
Description	1、 Restart to take effect, save when power off	

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	2、 Maximum string length 32bytes

6.4.10 AT+DEVHWER Modify the hardware version

Instruction		React
Inquire	AT+DEVHWVER?	+OK=[para]
Setting	AT+ DEVHWVER =[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para (string): device hardware version Factory default: V1.0;	
Description	1、 Restart to take effect, save when power off 2、 Maximum string length 32bytes	

6.4.11 AT+DEVSWVER Modify software version

Instruction		React
Inquire	AT+DEVSWVER?	+OK=[para]
Setting	AT+ DEVSWVER =[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para (string): device software version Factory default: V1.0;	
Description	1、 Restart to take effect, save when power off 2、 Maximum string length 32bytes	

6.4.12 AT+DEVID Modify device ID

Instruction		React
Inquire	AT+DEVID?	+OK=[para]
Setting	AT+ DEVID =[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para (HEX): device ID; Factory default: <MAC> 00 00	
Description	1、 Restart to take effect, save when power off; 2、 Maximum length 8bytes.	

6.4.13 AT+ADV Broadcast enable

Instruction	React

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Inquire	AT+ADV?	+OK=[para]
Setting	AT+ADV=[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para（ASCII）	Description
	0	Turn off broadcast
	1	Normal broadcast (default)
	2	iBeacon Broadcast
Description	1、 Take effect immediately (if the broadcast is not turned on, or it is connected, it will take effect next time), save when power off; 2、 Only the slave supports broadcasting.	

6.4.14 AT+ADVDAT Broadcast data

Instruction		**React**
Inquire	AT+ADVDAT?	+OK=[para]
Setting	AT+ADVDAT=[para]	+OK：Done +ERR=[NUM]：Error
Setting (do not save)	AT+ADVDAT1=[para]	
Parameter	para(HEX): 1.Support ASCII, HEX 2.The length is not more than 26 bytes	
Description	● Take effect immediately (if broadcast is not turned on, or it is connected, it will take effect next time) Save when power off; ● The slave or master-slave integrated supports broadcasting, and other roles can still be configured;	
E.g.	1. Command: 41 54 2b 41 44 56 44 41 54 3d 31 32 33 34 35 36 37 38 39 30; 2. The broadcast data is: 31 32 33 34 35 36 37 38 39 30	

6.4.15 AT+ADVINTV Broadcast gap

Instruction		**React**
Inquire	AT+ADVINTV?	+OK=[para]
Setting	AT+ADVINTV=[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para(ASCII):32~16384 Default: 1600 (1S)	
Description	1、 Take effect immediately (if the broadcast is not turned on, or it will take effect next time if connected), save when power off 2、 Only the slave supports broadcasting, other roles can still be configured;	
E.g.	AT+ADVINTV=1600 Set the broadcast gap: 1600*0.625=1S	

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6.4.16 AT+IBCNUUID iBeacon UUID Instruction

Instruction		React
Inquire	AT+IBCNUUID?	+OK=[para1]
Setting	AT+IBCNUUID=[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para(HEX)：16-bit UUID	
Description	1、 Take effect immediately (if the broadcast is not turned on, or it is connected, it will take effect next time), save when power off; 2、 Only the slave device supports broadcasting, other roles can still be configured;	
E.g.	Set iBeacon UUID to "FDA50693A4E24FB1AFCFC6EB07647825" **AT+IBCNUUID**=FDA50693A4E24FB1AFCFC6EB07647825	

6.4.17 AT+MAJOR iBeacon Major Instruction

Instruction		React
Inquire	AT+MAJOR?	+OK=[para]
Setting	AT+MAJOR=[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para(ACSII)： 1~65535 Default：258 Note: major = 0x0201, actually 0x0102	
Description	1、 Take effect immediately (if the broadcast is not turned on, or it is connected, it will take effect next time), save when power off; 2、 Only the slave supports broadcasting, other roles can still be configured；	

6.4.18 AT+MINOR iBeacon Minor Instruction

Instruction		React
Inquire	AT+Minor?	+OK=[para]
Setting	AT+Minor=[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para(ACSII)： 1~65535 Default：772 Note: minor = 0x0403, actually 0x0304	
Description	1、 Take effect immediately (if the broadcast is not turned on, or it is connected, it will take effect next time), save when power off; 2、 Only the slave supports broadcasting, other roles can still be configured;	

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6.4.19 AT+IPWR Modify ibeacn tx_power

Instruction		React
Inquire	AT+IPWR?	+OK=[para]
Setting	AT+ IPWR =[para]	+OK：Done +ERR=[NUM]：Error
Parameter	para(ACSII)： -128~127 Default：0	
Description	1.Take effect immediately (if the broadcast is not turned on, or it is connected, it will take effect next time), save when power off; 2. Only the slave supports broadcasting, other roles can still be configured；	

6.4.20 AT+NAME Broadcast device name

Instruction		React
Inquire	AT+NAME?	+OK=[para]
Setting	AT+NAME=[para]	+OK：Done +ERR=[NUM]：Error
Setting((do not save))	AT+NAME1=[para]	
Parameter	para(HEX): broadcast device name, Broadcast name is not more than 22 bytes Default: E104-BT5005A	
Description	1、 Take effect immediately, save when power off; 2、 Only supported by the slave, other roles can still be configured;	

6.4.21 AT+CONPARAMS Connection gap configuration

Instruction		React
Inquire	AT+CONPARAMS?	+OK=[intv],[latency],[timeout]
Setting	**AT+ CONPARAMS = [intv],[latency],[timeout]**	**+OK：Done +ERR=[NUM]：Error**
Parameter	[intv] (ASCII): Connection gap, value range, 6~3200; [latency] (ASCII): Slave device delay. Value range, 0~499 [timeout] (ASCII): connection timeout, value range, 10~3200 Default value: 16, 0, 400	
Description	Take effect immediately, save when power off.	
Notice	1、 The connection timeout must be greater than the connection gap; 2、 Timeout *4> (1 + latency)* intv; 3、 Incorrect parameters will not be saved by the device. 4、 It is not recommended to modify the host connection gap.	

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E.g.	AT+CONPARAMS=16,0,400 Connection gap 16*1.25ms, slave device delay: 0, 16*1.25ms, connection timeout 400*1.25ms

6.4.22 AT+DISCON Disconnect instruction

Instruction		React
Disconnect	AT+DISCON	+OK：Done +ERR=[NUM]：Error
parameter	None	
Description	1.Effective immediately. 2.When the device is a slave, it only supports disconnecting all connections; 3.If the connection specified by para is not connected, the module still returns +OK	

6.4.23 AT+DATDLY Data output delay

Instruction		Answer
Inquire	**AT+DATDLY?**	**+OK=[para]**
Setting	**AT+DATDLY=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para（ASCII）	description
	0	shut down
	1	On (default)
Description	1. Take effect immediately, save when power off; 2. Refer to 5.6 data instructions for data output delay.	

6.4.24 AT+MAC Local MAC address

Instruction		Answer
Inquire	**AT+MAC?**	**+OK=[para]**
Parameter	para（HEX）:MACS Address E.g：F0E1D2C3B4A5	
Description	Take effect immediately, save when power off.	
E.g.	Command: AT+MAC? Return: 2B 4F 4B 3D FE 30 EE 50 35 DA Explanation: The local MAC address is DA 35 50 EE 30 FE Note: Output is small-endian mode output	

6.4.25 AT+PEERMAC Connect the device MAC

Instruction		Answer
Inquire	**AT+PEERMAC?**	**+OK=[para]：Done**

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		+ERR=[NUM]:Error
Parameter	para（HEX）:MACS Address	
Description	Take effect immediately, save when power off.	
E.g.	Command: AT+MAC? Return: 2B 4F 4B 3D FE 30 EE 50 35 DA Explanation: The local MAC address is FE 30 EE 50 35 DA	

6.4.26 AT+BOND Binding enable

Instruction		**Answer**
Inquire	**AT+BOND?**	**+OK=[para]**
Setting	**AT+BOND=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para（ASCII）	description
	0	Binding is off (default)
	1	Bind on
Description	Take effect immediately, save when power off	

6.4.27 AT+BONDMAC Add binding MAC address

Instruction		**Answer**
Inquire	**AT+BONDMAC?**	**+OK=[sum][[mac] [mac]…]**
Setting	**AT+BONDMAC=[mac]**	**+OK: Done** **+ERR=[NUM]：Error**
Parameter	**sum(HEX): the total number of currently bound MAC addresses;** **mac(HEX): 6bytes mac address;**	
Description	Take effect immediately, save when power off	
E.g.	Query: AT+BONDMAC? Return: B 4F 4B 3D 03 CC 34 27 1A 0C D4 3D AC 82 16 0F 58 D2 D4 C3 07 0E C4	
	Settings: 41 54 2B 42 4F 4E 44 4D 41 43 3D CC 34 27 1A 0C D4 Return: +OK	

6.4.28 AT+BONDDEL Delete the MAC address specified by the binding

Instruction		**Answer**
Instruction	**AT+BONDDEL=[mac]**	**+OK** **+ERR=[NUM]**
Instruction	**mac: 6bytes mac address**	
Instruction	1. Take effect immediately, save when power off.	

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	2. Delete all MAC addresses when the MAC address is (0xff, 0xff, 0xff, 0xff, 0xff, 0xff), otherwise delete the specified mac address;

6.5.1 AT+SCAN Broadcast scan

Instruction		Answer
Inquire	**AT+SCAN?**	**+OK=[para]**
Setting	**AT+SCAN=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para（ASCII）	description
	0	Turn off scan
	1	Turn on scanning (default)
Description	1. Take effect immediately, save when power off 2. If the current number of host connections has reached the maximum, no scanning will be started; 3. Scanning enable and disable only take effect in the role of host or observer.	

6.5.2 AT+SCANINTV Scan gap

Instruction		Answer
Inquire	**AT+SCANINTV?**	**+OK=[para]**
Setting	**AT+SCANINTV=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(ASCII):4~65535 Default：256	
Description	1. Take effect immediately, save when power off, 2. The scanning gap is not less than the scanning window 3. The slave does not support it, but it can still be set	
E.g.	AT+SCANINTV=256 Scan nap：256*0.625 = 160ms	

6.5.3 AT+SCANWND Scan window

Instruction		Answer
Inquire	**AT+SCANWND?**	**+OK=[para]**
Setting	**AT+SCANWND=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(ASCII): 4~65535 Default：128；	
Description	1. Take effect immediately, save when power off, 2. The scanning gap is not less than the scanning window 3. The slave does not support it, but it can still be set	

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E.g.	AT+SCANWND=128 Scan nap:128*0.625 = 80ms

6.5.4 AT+AUTOCONN Auto connect

Instruction		Answer
Inquire	**AT+AUTOCONN?**	**+OK=[para]**
Setting	**AT+ AUTOCONN =[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para（ASCII）	description
	0	Manual connection
	1	Auto connect (default)
Description	1. Effective immediately. Power-down save	

6.5.5 AT+CONN Specify connection

Instruction		Answer
Setting	**AT+ CONN = [mac]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	mac(hex): Specify the mac address to connect	
Description	1. Effective immediately. Does not save after power failure	

6.5.6 AT+UUIDSVR128 Set up service 128bit UUID

Instruction		Answer
Inquire	**AT+UUIDSVR128?**	**+OK=[para]**
Setting	**AT+ UUIDSVR128=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(HEX):16-bit uuid.	
Description	1. Restart takes effect and save when power off. 2. The second and third bytes are 16-bit uuid, and the value range is 1~65535; The 128 bits UUID, except for the second and third bytes, is also used for the slave channel, the master channel, and the basic UUID of the configuration channel. (For the description of uuid, refer to "BLUETOOTH SPECIFICATION Version 5.0 | Vol 3, Part B 2.5.1 UUID").	
E.g.	Set 128bit UUID： “11 22 33 44 55 66 77 88 99 00 aa bb cc dd ee ff”(HEX) AT（HEX）： 61 74 2b 75 75 69 64 73 76 72 31 32 38 3d 11 22 33 44 55 66 77 88 99 00 aa bb cc dd ee ff	

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6.5.7 AT+UUIDSVR Bluetooth service UUID

Instruction		Answer
Inquire	**AT+UUIDSVR?**	**+OK=[para]**
Setting	**AT+UUIDSVR=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(ASCII): UUID 1 ~ 65535	
Description	1. Restart to take effect. Save when power off. 2. For the host, the service UUID is a necessary condition for connection filtering, so when setting the host service UUID, it must be consistent with the slave, otherwise the connection cannot be established.	

6.5.8 AT+UUIDCHARA1 SLAVE CHANNEL feature UUID

Instruction		Answer
Inquire	**AT+UUIDCHARA1?**	**+OK=[para]**
Setting	**AT+UUID CHARA1=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(ASCII): 1 ~ 65535 65521	
Description	1.Restart takes effect. Save when power off. 2.Slave channel. Used to send data from the machine and receive data from the host.	

6.5.9 AT+UUIDCHARA2 MAST CHANNEL Feature UUID instructions

Instruction		Answer
Inquire	**AT+UUIDCHARA2?**	**+OK=[para]**
Setting	**AT+UUID CHARA2=[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(ASCII): 1 ~ 65535； 65522	
Description	1.Restart takes effect. Save when power off. 2.Slave channel. Used to send data from the machine and receive data from the host.	

6.5.10 AT+VER Query software version number

Instruction		Answer
Inquire	**AT+VER?**	**+OK=[para]**
Parameter	para:version number	
Description	Effective immediately	

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E.g.	Command: AT+VER? Return: +OK=1.0.0

6.5.11 AT+AUTH Air configuration authentication password

Instruction		Answer
Setting	**AT+AUTH =[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(HEX):6-byte password	
Description	This directive is only used for air certification. Default password: 123456	
E.g.	AT+AUTH=123456	

6.5.12 AT+UPAUTH Modify air authentication password

Instruction		Answer
Inquire	**AT+UPAUTH?**	**+OK=[para]**
Setting	**AT+UPAUTH =[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para(HEX):6-byte password	
Description	Effective immediately. Power-down save	

6.5.13 AT+PWR Transmit power

Instruction		Answer
Inquire	**AT+ PWR?**	**+OK=[para]**
Setting	**AT+ PWR =[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	**para**(ASCII)	**val**
	0	4 dBm
	1	3 dBm
	2	0 dBm（Default）
	3	-4 dBm
	4	-8 dBm
	5	-12 dBm
	6	-16 dBm
	7	-20 dBm
	8	-40 dBm
Description	Effective immediately. Power-down save	

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6.5.14 AT+SLEEP Sleep mode immediately

Instruction		Answer
Setting	**AT+SLEEP**	**+OK**
Parameter	no	
Description	Effective immediately.	

6.5.15 AT+LOGMSG Running status output

Instruction		Answer
Inquire	**AT+LOGMSG?**	**+OK=[para]**
Setting	**AT+LOGMSG =[para]**	**+OK：Done** **+ERR=[NUM]：Error**
Parameter	para（ASCII）	description
	0	Off (default)
	1	Turn on
Description	Effective immediately. Power-down save	

6.5.16 AT+FNAME Name filtering

Instruction			Answer
Inquire	**AT+FNAME?**		**+OK=[en],[name]**
Setting	**AT+FNAME =[en],[name]**		**+OK：Done** **+ERR=[NUM]：Error**
Parameter	En	En	Description
		0	Disallow name filtering
		1	Enable name filtering
	Name	name. Used for name filtering during host scan connection;	
Description	1. Effective immediately. Power-down save		

6.5.17 AT+FRSSI Signal strength filtering

Instruction			Answer
Inquire	**AT+FRSSI?**		**+OK=[en],[pwr]**
Setting	**AT+FRSSI =[en],[pwr]**		**+OK：Done** **+ERR=[NUM]：Error**
Parameter	En	En	Instruction
		0	Disable signal strength filtering

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		1	Use signal strength filtering
	pwr	Signal strength. Value range: -128 to 127	
Description	1. Take effect immediately, save when power off. 2. Only the master role is valid, but the slave can also be configured;		
E.g	➢ Set signal strength filter to -90; AT+FRSSI=1, -90 ➢ Turn off signal strength filtering. AT+FRSSI=0,-90.		

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Chapter 6 Quick Use

Recommended software for debugging/testing:

- C-side serial port tool-XCOM.exe;
- Mobile ble debugging APP-nRF connect.

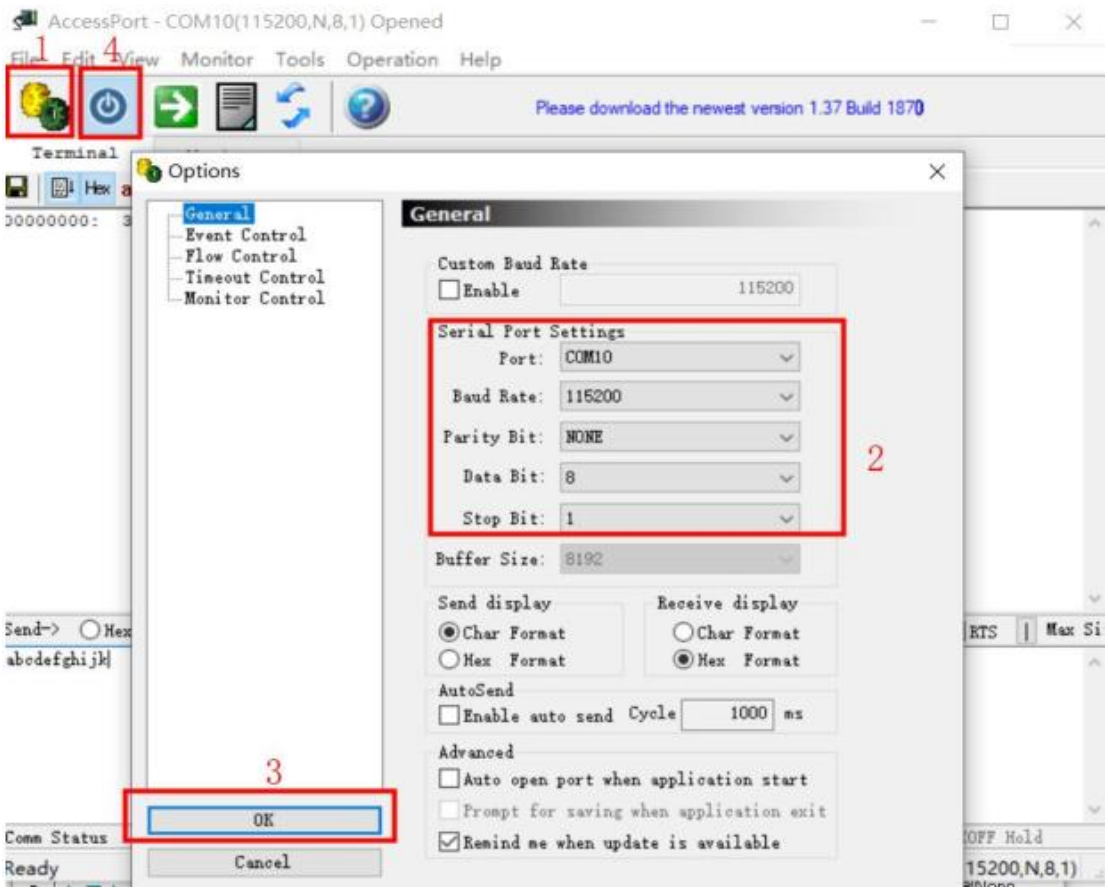
7.1 Quick Guide to Configuration Mode

7.1.1 Serial port configuration

- Confirm whether the module is currently in configuration mode (pulling the MOD pin low to enter configuration)
- Set XCOM string related configuration (default configuration: 115200, 8, 1, none, no flow empty), as shown in the following chart:

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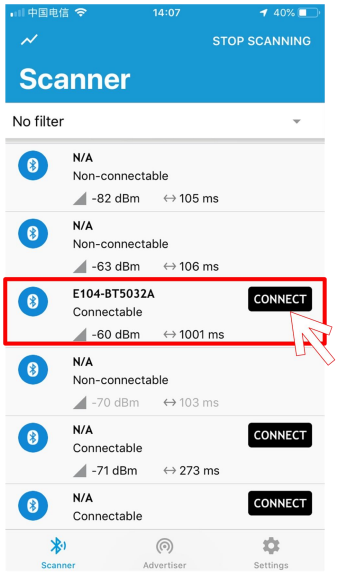
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- Configure the module according to the instructions shown in the at instruction list

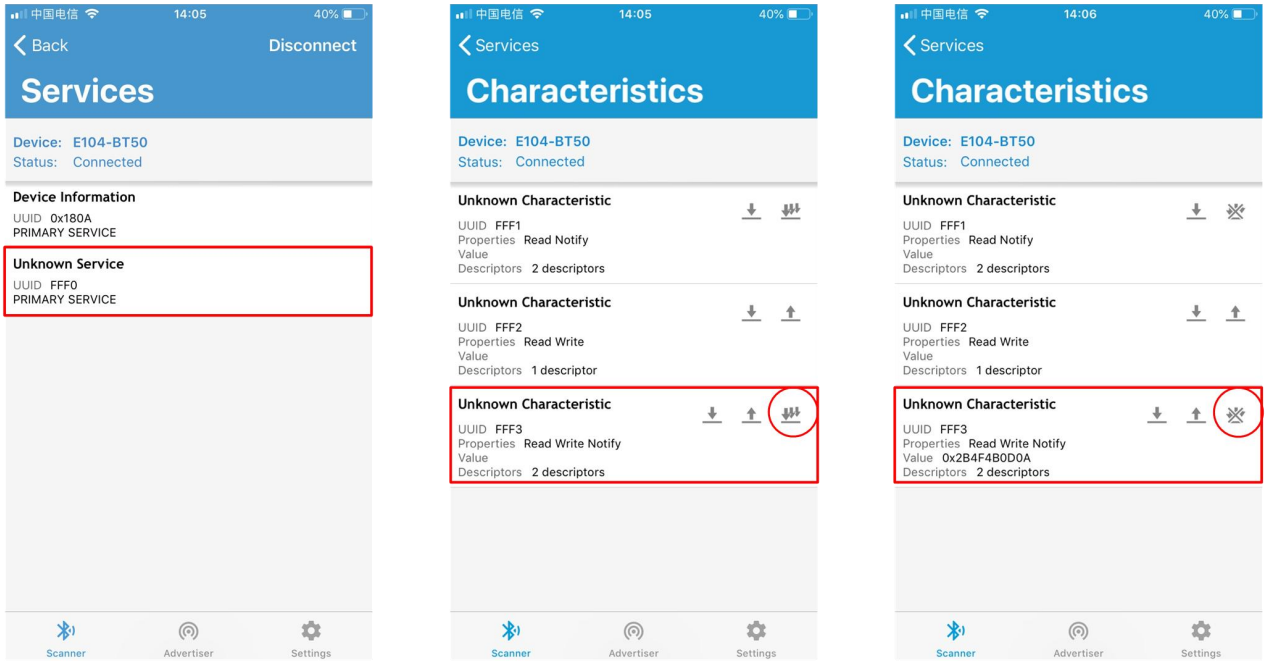
7.1.2 Air configuration

- The air configuration can only be used when the module is a slave.
- Open the app "nRF connect", start scanning the device, and find the "E104-BT5005A" connection module;

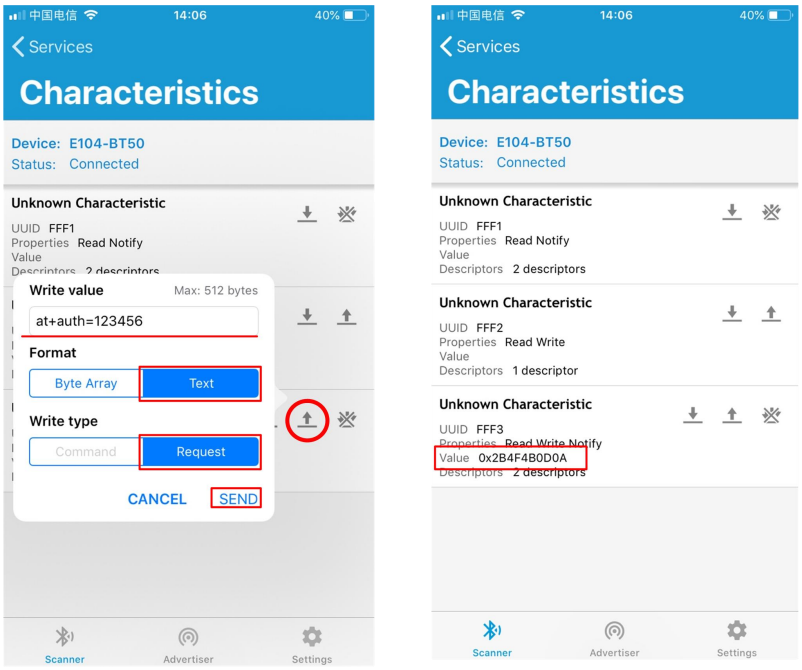


- Open the uuid fff0 service and enable the configuration channel notiy;

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- Send the authentication command (at+auth=123456), the module returns "0x2befeb0d0a" to indicate successful authentication;



- Configure the module according to the instructions shown in the 6.4 instruction list;

7.2 Data transmission

For data transmission related instructions, see 5.3 Data Transmission Mode.

Test Conditions:

- Configure one module as the master and one module as the slave as described in the 7.1 Configuration Mode Quick Use Guide;

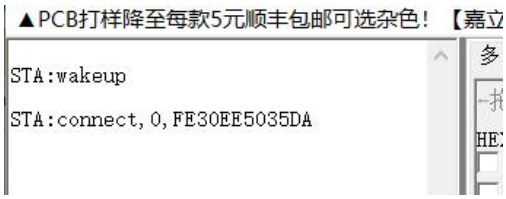
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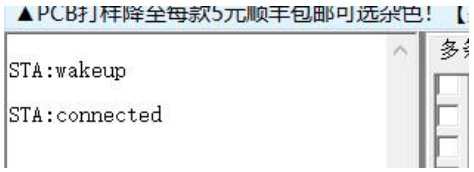
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- Test software: SSCOM.
- Other parameters are the default configuration.

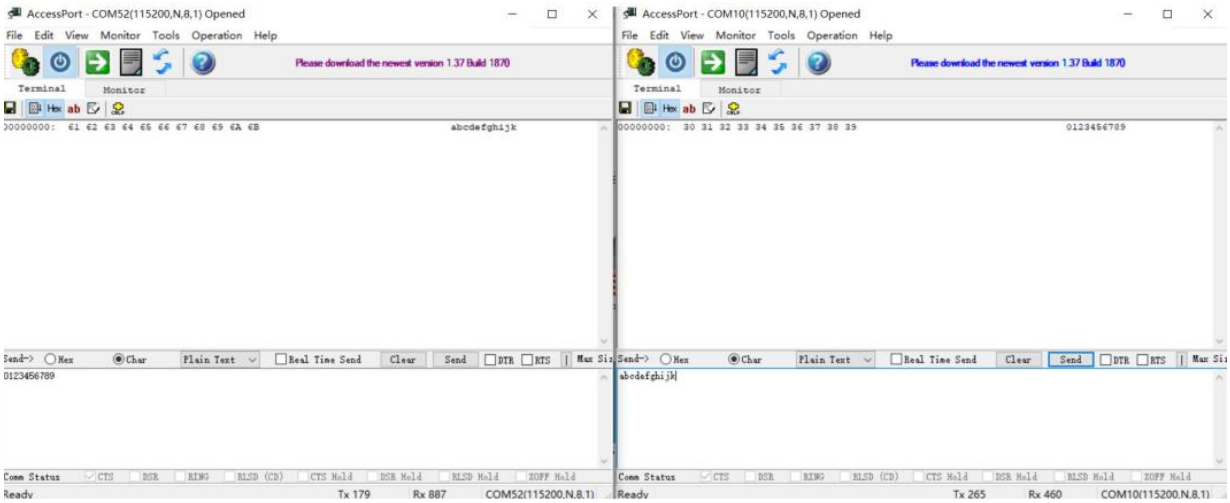
7.2.1 Data transparent transmission

1. The module is powered on. Enable logmsg printing for master and slave (at+logmsg=1);
2. After the host is successfully connected, it will print "STA:connect,0,619AA43CBAF3"; the slave will print "STA:connected". The LINK pin is low. As shown in Figure 7 5, the master machine is powered on and automatically connected to print, and Figure 7 6 Slave is powered on and automatically connected to print. The value before the MAC address in the host print information is the slave handle in the host, and the first byte of format transmission comes from this.





3. The master sends the data "0123456789" to the slave, and the slave receives the data as "0123456789" (as shown in Figure 7: Master data transmission diagram)
4. The slave sends the data “abcdefghijk” to the master, and the master receives the data as “abcdefghijk” (as shown in Figure 7: Master data transparent transmission diagram)；



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Chapter 8 Hardware design

- 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 grounded reliably;
- 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 between 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% of the 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 pass 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 (all 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), it will also greatly affect the performance of the module. According to the intensity of the interference, it is recommended to stay away from the module. Appropriate isolation and shielding;
- 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.

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Chapter 9 Common problem

9.1 Insufficient transmission distance

- 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 higher the air speed, the closer the distance);
- 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 poor matching degree of the antenna and the module or the quality of the antenna itself.

9.2 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 at too high or too low temperature.

9.3 Bit error rate is too high

- There is co-channel signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference；

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- Unsatisfactory power supply may also cause garbled codes. Ensure the reliability of the power supply；
- Poor or too long extension cords and feeders will also cause high bit error rates.

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Chapter 10 Welding Operation Guidance

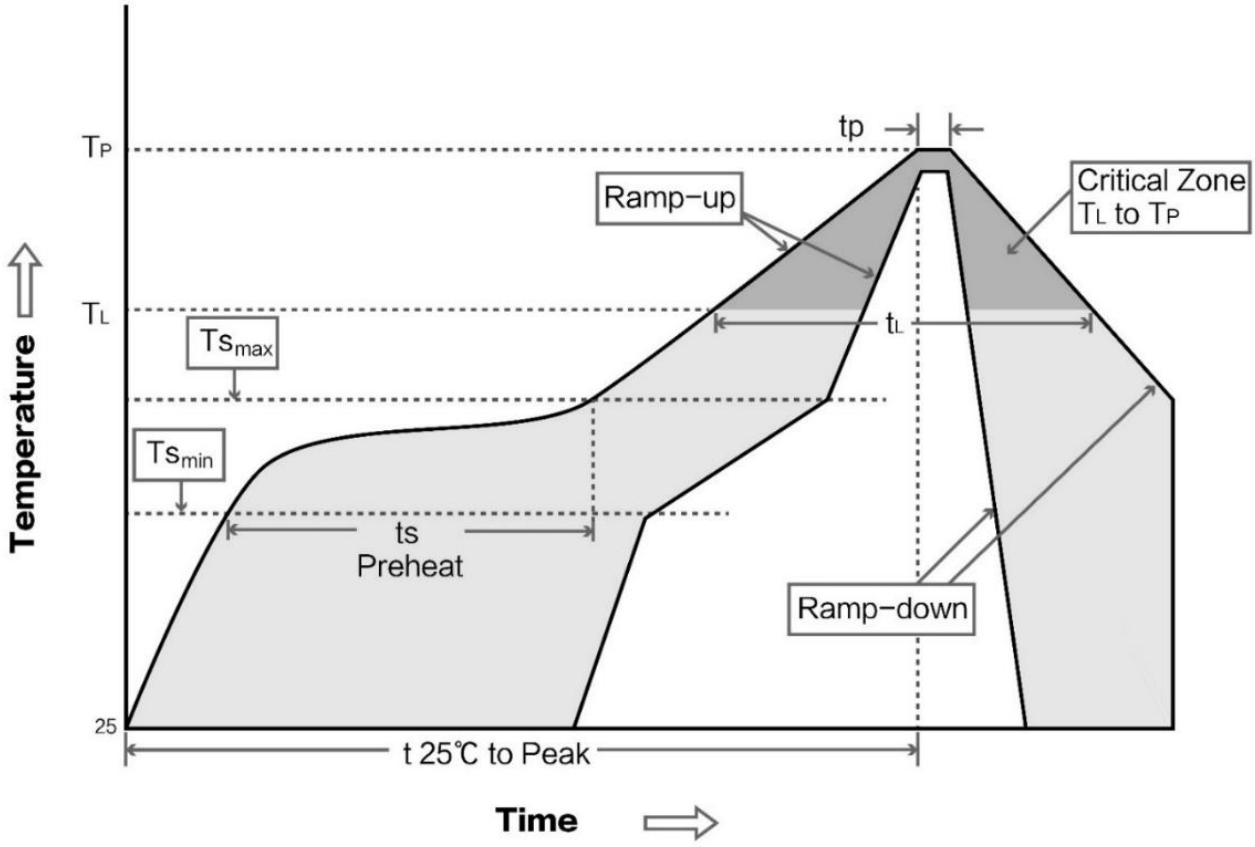
10.1 Reflow Temperature

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

10.2 Reflow soldering curve

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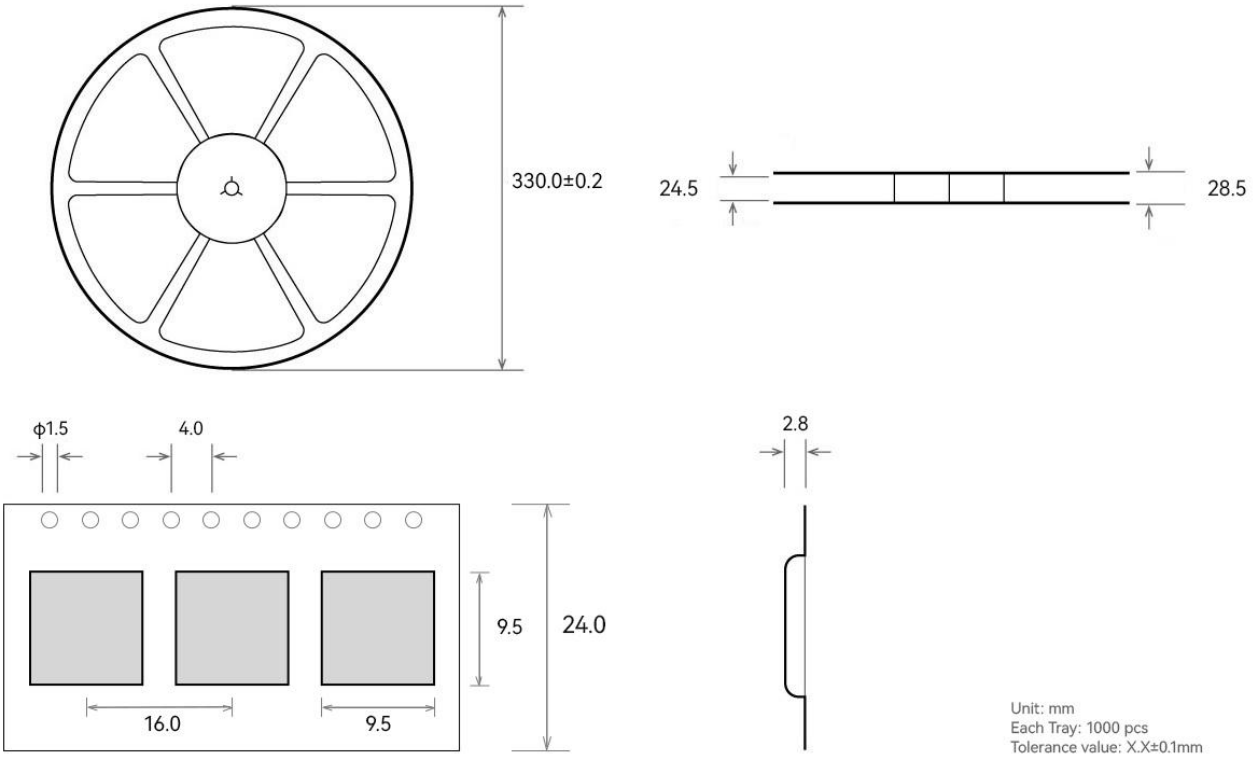
Chapter 11 Related Models

Models	IC	FrequencyHz	Power dBm	Interface	Protocol BLE	Size mm	Antenna	Feature
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	Lowest power consumption High-speed continuous transmission Sniffing
E72-2G4M04S2B	CC2640	2.4G	2	TTL	4.2	14*23	PCB/IPX	Built-in ARM dual core Multi-role mode
E104-2G4U04A	CC2540	2.4G	0	USB	4.0	18*59	PCB	Dongle Protocol analyzer
E104-BT5032A	nRF52810	2.4G	0	UART	5.0	11.5 * 16	Ceramic antenna	Low power consumption, transparent transmission

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Chapter 12 Bulk packaging



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Revision history

Version	Date	Description	Issued by
1.0	2020-9-4	initial version	Ren
1.1	2020-10-20		Ren
1.2	2022-08-31	Error correction	Bin
1.3	2022-09-22	Error correction	Bin
1.4	2022-12-28	Error correction	Bin
1.5	2023-04-13	Error correction	Bin
1.6	2023-07-19	Error correction	Bin
1.7	2024-01-16	Error correction	Bin
2.0	2024-07-08	Error correction	Bin

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