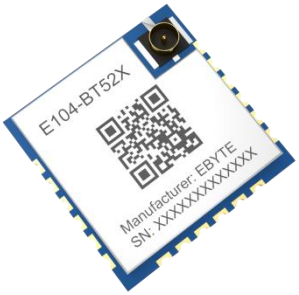
E104-BT52/E104-BT52X User Manual

DA14531 BLE5.0 Low Power SMD BLE to Serial Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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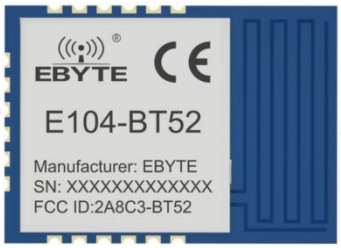
1. Overview

1.1 Introduction

E104-BT52 is a serial to BLE Bluetooth master-slave integrated module based on BLE 5.0. It is small in size and low in power consumption, working at 2.4GHz.

The E104-BT52/E104-BT52X module is developed by Chengdu Yibate Electronic Technology Co., Ltd. based on the DA14531 chip developed by dialog. The module uses the universal AT instruction to set parameters, which is simple and quick to operate. The module only supports Bluetooth host, slave, master-slave integration and observer mode. The module supports low-power broadcast, transparent data transmission and over-the-air configuration. The module can be widely used in intelligent wearable, home automation, home security, personal health care, intelligent home appliances, accessories and remote control, automotive, lighting, industrial Internet, intelligent data acquisition, intelligent control and other fields. The maximum support baud rate of 460800bps data transmission.



1.2 Feature

- BLE 5.0 protocol;
- Adjustable Bluetooth package length;
- Two working modes: configuration and transparent transmission;
- Automatic advertising and automatic connection after startup;
- IBeacon and ordinary advertising switching;
- Supports serial port wake-up;
- Good for MAC binding connection, the maximum binding number is 3 devices;
- Serial port transparent and format transmission;
- Multiple serial port modes and baud rates;
- Custom 16-bit UUID and 128-bit UUID available;
- Support PCB on-board antenna (E104-BT52) and 3rd generation IPEX (E104-BT52X)
- Supports Bluetooth parameter air configuration;
- The maximum communication distance:

  E104-BT52 90m (@2.5dBm, 1Mbps);

  E104-BT52X 130m (@2.5dBm, 1Mbps);
- Ultra-low power sleep, simultaneous advertising;
- Multiple masters and multiple slaves, and the maximum connection data is 2 slaves;
- Supports transmit power modification. The maximum transmit power is 2.5dBm;
- With sniffing function;

- The maximum MTU is 244bytes;

1.3 Applications

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

2 Specification and Parameter

2.1 Limit parameter

Main parameter	Performance		Remark
	Min	**Max**	
Power supply（V）	0	3.6	Over 3.6V damages module
Blocking power（dBm）	-	10	Low probability of burnout when modules are used in short distance
Operating temperature（℃）	-40	+85	Industrial grade

2.2 Operating parameter

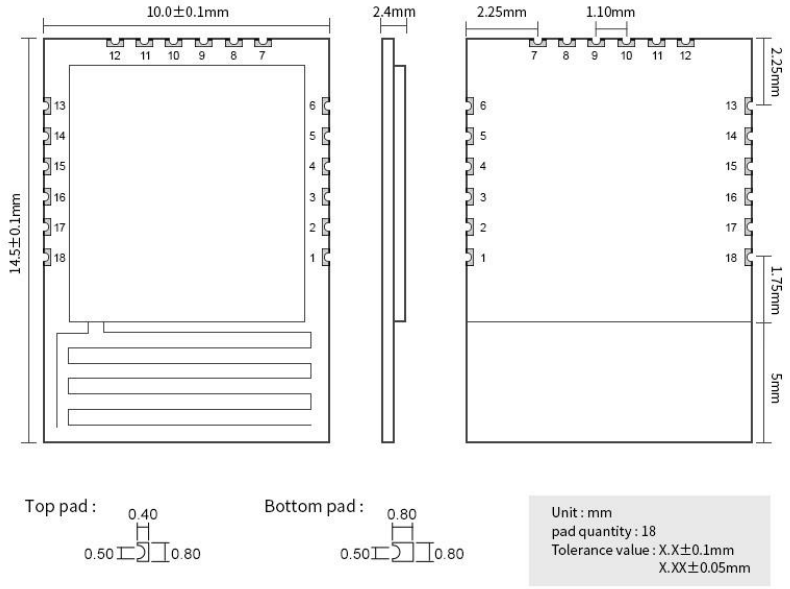
Main parameter		**Performance**			**Remark**
		Min	**Typ**	**Max**	
Operating voltage（V）		2.1	3.3	3.6	≥3.3V ensures performance
Communication level（V）		-	3.3	-	5V will damage modules
Operating temperature（℃）		-40	-	+85	Industrial design
Operating frequency（MHz）		2402	-	2480	For ISM band
Power consumption	Tx current（mA）	-	4.0	-	Default parameter
	Rx current（mA）	-	-	-	-
	Sleep current（μA）	-	2	-	Default parameter
TX power（dBm）		-19.5	0	2.5	-

Receiving sensitivity（dBm）		-94		Air data rate 1Mbps
Sleep advertising current(default)		9.44		Unit uA, default advertising gap 1S
Sleep connection current(default)		61		Unit uA, default advertising gap 1S
Wake-up advertising current (default)		403		Unit：uA, default advertising gap 1s
Sleep without advertising current (default)		2		Unit：uA, default connection gap 500ms

Main parameter	Description	Remark
Distance	90m（E104-BT52） 130m(E104-BT52X)	In open and clear air, height 2.0 meter; @2.5dBm; Air data rate：1Mbps
BLE protocol	BLE5.0	
Communication interface	UART	-
Package	SMD	-
Size	14.5*10mm（E104-BT52) 10*10mm（E104-BT52X)	-
RF interface	PCB on board antenna（E104-BT52) Third generation IPEX (E104-BT52X)	Equivalent impedance approx. 50Ω
weight	1.2±0.1g（E104-BT52) 0.4±0.1g（E104-BT52X)	

3 Size and Pin Definition

E104-BT52



E104-BT52X

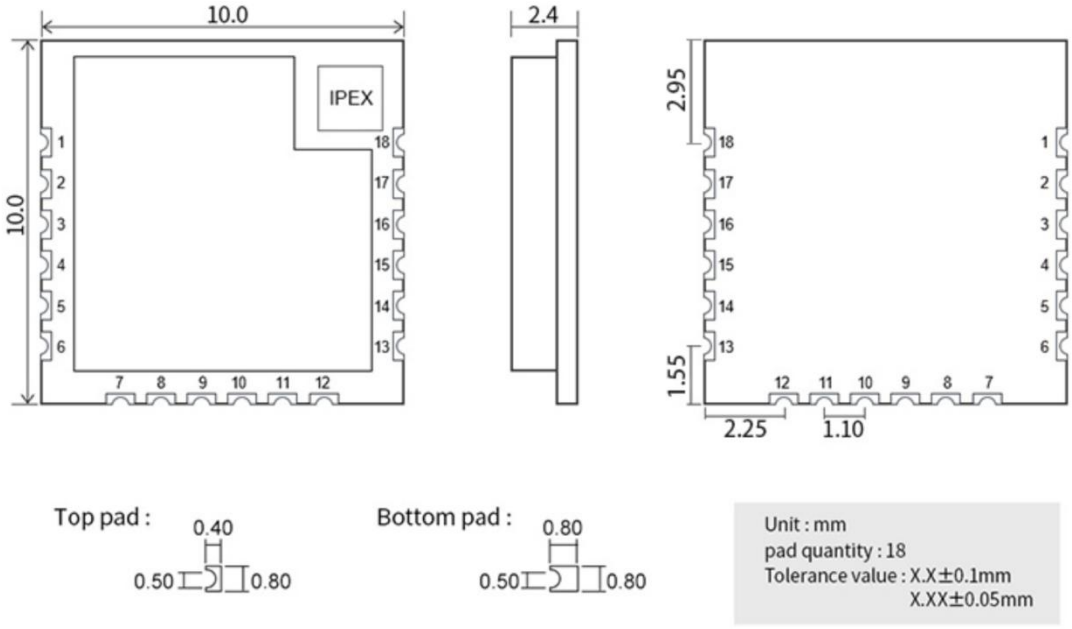
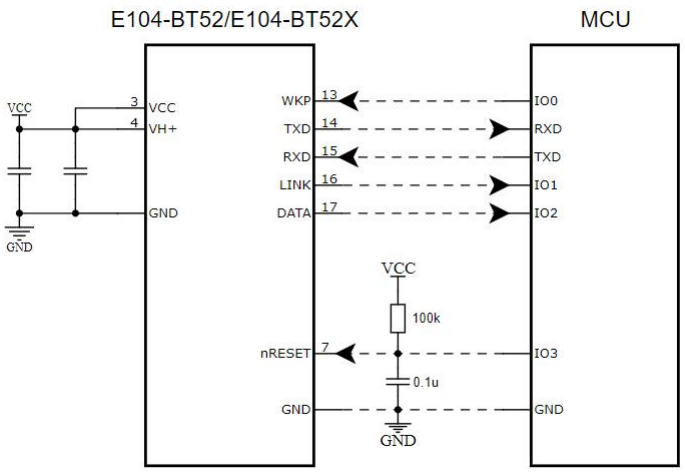


Table 3 Pin definition talble

Pin NO.	Item	Direction	Function	Remark
1	GND	Input	Ground	
2	VL-	--	Low voltage power supply	Low voltage supply pins, no need to concern
3	VCC	Input	Power positive	Power positive (to be shorted to pin 4 "VH+" when used)
4	VH+	Input	Power positive	Power positive (to be shorted to pin 3 “VCC” when used)
5	GND	Input	Ground	
6	GND	Input	Ground	
7	RST	Input	Reset pin	Reset in low level（take effective in 500ms）
8	DIO1	Input	SWDIO	SWDIO，JTAG interface, no need to concern
9	NC	--	NC	no need to concern
10	CLK	Input	SWCLK	SWCLK，JTAG interface, no need to concern
11	NC	--	NC	no need to concern
12	GND	Input	Ground	Ground
13	WKP	Input	Wake up pin	Wake up：falling edge；Sleep：rising edge
14	TXD	Output	UART	UART output
15	RXD	Input	UART	UART Input
16	LINK	Output	Link status	Bluetooth linked：high level Bluetooth not linked：low level
17	DATA	Output	Data	Data indication pin Note: Receive Bluetooth data: When there is Bluetooth data in the air to send out through the TXD pin of E104-BT52/E104-BT52X, the DATA pin will be pulled high. After a frame of data is sent, the pin will be pulled low again. Send Bluetooth data: After the RXD pin of E104-BT52/E104-BT52X receives the data, the DATA pin cache BUFF size of 1024 bytes. As long as there is data in the BUFF that has not been sent out via Bluetooth, the DATA pin will be pulled high. It will be pulled low again until the data in the BUFF is completely transmitted. The user can use the above description to do data framing.
18	GND	Input	Ground	Ground

4 Basic operation

4.1 Recommended circuit diagram



5 Function Description

5.1 Role description

The module supports four roles: master, slave, observer, and master-slave integration.
The host can connect to other Bluetooth products of the company. When a module acts as a host, it can connect up to two slaves. When a module is a slave, it can be connected by up to two hosts. When a module acts as a master-slave integrated role, it can be connected to one slave and one host at the same time. Support pass-through broadcast, format transmission. Automatic connection.
This module can be connected with other Bluetooth products of the company to support transparent transmission.
The observer is only used to print BLE device broadcast information around the module and cannot be connected.

5.1.1 Master

1. AT+ROLE=1 select master mode

2. Command AT+SCAN=1, start master scanning function

3. Support multi-master and multi-slave connection. Up to 2 slaves can be connected.

4. Print status information when the host connection status changes. See status printing.

5.1.1.1 Master connection method

Condition filtering
The device can be configured to filter by binding MAC address and service UUID.

UUID filtering is based on the content filtering configured by AT+UUIDSVR, and the filtering conditions cannot be turned off. If MAC address filtering is not enabled, the master will automatically connect to the slave when the MAC address matches and the service UUID matches.

If users need MAC address filtering, add MAC addresses to the device 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.

Auto connection
The master automatically connects to the slave device after metting the condition filtering.

5.1.2 Slave

1. AT+ROLE=0 select slave mode
2. 2. AT+ADV=1 to configure normal advertising mode
3. 3. The advertising switch is configured to be on, and it will automatically enter the advertising state after power-on. If the advertising switch is configured to be off, the device will not be found after power-on.

4. 4. After receiving the host connection request, establish a Bluetooth connection to stop Bluetooth advertising and enter the data transmission mode.
5. 5. For advertising data configuration, see 5.5 Advertising.

5.1.3 Observer

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

Check format below

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

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

1. The scan window and scan gap are consistent with the scan parameters.
2. The AT command is valid during the period.

5.2 Power supply mode

There are low power consumption mode: low power consumption mode and wake-up mode.

5.2.1 Low power consumption 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 in this mode. If you need lower power consumption, you can turn off advertising and scan through AT commands, disconnect all connections, and set a longer advertising 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+ONSLEEP=1" power on immediately enters low power consumption;
3. Enter low power consumption through the rising edge of pin WKP;

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

Note: In the low-power mode, the serial port output is valid , but input is not available.

5.2.2 Wake-up 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 method:

1. Wake up immediately through the falling edge of WKP pin;
2. The serial port RX pin wakes up: The serial port RX falling edge, and the low level remains at 50us and above, wake up immediately.

5.3 Data transmission mode

There are data transparent transmission and format transmission.

5.3.1 Data transparent transmission

The so-called data transparent transmission means that the data received by the serial port is sent to the other device through BLE without any processing, and the data received by BLE is sent through the serial port without any processing.

Command setting: "AT+TRANMD"

5.3.2 Format transmission

The so-called format transmission refers to: the data sent to the module through the serial port and the data sent to the serial port from the module must conform to the defined format for transmission.

The serial port sends "AT+TRANMD=0" to the device to switch it to format transmission. The data format is as

Slave No.	Valid data
1byte	Max: 243bytes
0~1	

➪ Slave number: 0~1 is the target device number. This number comes from the "STA:connect,1<mac>" printed by the device after the successful connection between the slave and the master.

➪ If the connection specified by the slave number does not exist, the module directly discards the packet data.

5.4 MAC address binding

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

5.5 Advertising

5.5.1 Common advertising info.

The advertising information includes “advertising” and “scan response”. Advertising is a broadcast report sent actively, while scan response is a broadcast report responded after receiving a host scan request.

Advertising

Fixed field	Len	Manufacturing field	Manufa data
020106	N	0xFF	configurable，maximum 26 byte

For example：020106< Len >FF< Manufa data >

Only Manufa data is configurable by users.

Scan response

Len	fixed	UUID	Len	fixed	Device name
0x03	0x03	FFF0	N	0x09	configurable, maximum 22 byte

For example ： 0303FFF0<len>09< Device name >

Note: Users do not need to configure it.

5.5.2 iBeacon advertising info.

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

Advertising (New ibeacon data format table)

iBeacon Prefix	UUID	Major	Minor	Tx-Power
9B	16B	2B	2B	1B

For example：0201061AFF4C000215FDAFDA50693A4E24FB1AFCFC6EB0764782527758 48F00

Advertising (Old ibeacon data format table)

iBeacon Prefix	UUID	Major	Minor	Tx-Power
6B	16B	2B	2B	1B

For example：1AFF4C000215FDAFDA50693A4E24FB1AFCFC6EB0764782527758 48F00

Note: From software version 7212-1-12 onwards, new ibeacon broadcast rules are enabled and default as the new version broadcasts. Newly developed products are suggested to be parsed with the new version of broadcast. Older versions of broadcast will be discontinued in the future. For compatibility reasons, we provide the "AT+IBCNVER" command to switch and query the ibeacon broadcast version, see the AT command table for details.

5.6 Configuration

There are two configuration methods: serial port configuration and air configuration. The 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 is allowed to use the air configuration. The air configuration authentication cycle is this connection, and re-authentication is required if the device is disconnected and reconnected.

The module is in configuration mode by default if it is not connected. And if the module is connected, you can enter the configuration mode by sending "+++".

5.7 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.

5.8 UUID description

Service UUID	FFF0（configurable）		
characteristic value	UUID	property	description
SLAVE CHANNEL	FFF1（configurable）	read / notify	The channel for the slave sending the data, and the master receiving the data.
MAST CHANNEL	FFF2（ configurable）	read / write	The channel for the master sending the data and the slave receiving the data.
CONFIG CHANNEL	FFF3（not configurable）	read / write / notify	Air configuration channel

5.9 Status or event printing

Command AT+LOGMSG to enable the serial port printing function of status information. Status information includes: connected, disconnected, wake up, and sleep. The format is as follows:

Status	Printing info.
Connection successfully	\r\n STA:connect\r\n
Disconnect	\r\n STA:disconnect\r\n
System wake up	\r\n STA:wakeup\r\n
Sleep mode	\r\n STA:sleep\r\n

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.

6.1 Command description

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

6.2 Error code

NUM	Description	Error reason	Solution
1	Command not exist	AT command string contains error	Check AT specified data string
2	Parameter length error	1、 AT command length sum error； 2、Data length is beyond the correct range	Check parameter
3	Invalid parameter	1、Parameter exceed value range	Check the parameter value according to the command

6.3 Status printing

Status	Printing info.	
Connect successfully	slave	\r\nSTA:connect,1,<MAC\r\n
	master	\r\nSTA:connect,1,<MAC\r\n
Disconnect	slave	\r\nSTA:disconnect\r\n
	master	\r\nSTA:disconnect,1\r\n
System wake up	\r\nSTA:wakeup\r\n	
Sleep mode	\r\nSTA:sleep\r\n	

6.4 Command sets

6.4.1 AT test command

Command	Response

AT	+OK
Note: none	

6.4.2 +++ enter AT command mode

Command	Response
+++	**enter_at_mode**
Notes：When disconnected, the module is in AT mode by default and there is no response when sending this command; You need to use this command to enter AT mode when module is connected.	

6.4.3 AT+EXIT exit AT command mode

Command	Response
AT+EXIT	**+OK**
Notes: None	

6.4.4 AT+RESET reset command

Command	Response
AT+RESET	**+OK**
Note：take effect immediately	

6.4.5 AT+RESTORE restore to factory setting

Command	Response
AT+RESTORE	**OK**
Note： 1. After resetting, it will restart automatically; 2. During the process of restoring factory settings, any form of reset is prohibited, and the power off before the operation is completed is prohibited;	

6.4.6 AT+BAUD baud rate

Command		Response
Inquiry	**AT+BAUD?**	**+OK=[para]**

Set	**AT+BAUD=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter		

para（ASCII）	Baud rate (bps)
0	2400
1	4800
2	9600
3	14400
4	19200
5	38400
6	57600
7	115200（default）
8	230400
9	460800

Note	Take effect immediately
For example,	AT+BAUD=7. Baud rate is 115200 HEX: 41 54 2B 42 41 55 44 3D 37

6.4.7 AT+PARI uart parity bit

Command		Response
Inquiry	**AT+PARI?**	**+OK=[para]**
Set	**AT+PARI=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter		

para(ASCII)	description
0	None（default）
1	Even

Note	Restart to take effect, save when power off
For example,	AT+PARI=0

6.4.8 AT+DATABIT uart data bit

Command		Response
Inquiry	**AT+DATABITS?**	**+OK=[para]**

<table>
<tr><td>Set</td><td>AT+DATABITS=[para]</td><td>+OK：success
+ERR=[NUM]：error</td></tr>
<tr><td>Parameter</td><td colspan="2"><table><tr><td>para(ASCII)</td><td>Description</td></tr><tr><td>0</td><td>5 data bit</td></tr><tr><td>1</td><td>6 data bit</td></tr><tr><td>2</td><td>7 data bit</td></tr><tr><td>3</td><td>8 data bit</td></tr></table></td></tr>
<tr><td>Note</td><td colspan="2">Restart to take effect, save when power off</td></tr>
<tr><td>For example,</td><td colspan="2">AT+DATABITS=0</td></tr>
</table>

6.4.9 AT+ROLE Bluetooth role

<table>
<tr><td colspan="2">Command</td><td>Response</td></tr>
<tr><td>Inquiry</td><td>AT+ROLE?</td><td>+OK=[para]</td></tr>
<tr><td>Set</td><td>AT+ROLE =[para]</td><td>+OK：success
+ERR=[NUM]：error</td></tr>
<tr><td>Parameter</td><td colspan="2"><table><tr><td>Para(ASCII)</td><td>Description</td></tr><tr><td>0</td><td>Slave（default）</td></tr><tr><td>1</td><td>Master</td></tr><tr><td>2</td><td>Observer</td></tr><tr><td>3</td><td>Salve and master as one</td></tr></table></td></tr>
<tr><td>Note</td><td colspan="2">Restart to take effect, save when power off</td></tr>
</table>

6.4.10 AT+DEVMANUF devise manufacturer

<table>
<tr><td colspan="2">Command</td><td>Response</td></tr>
<tr><td>Inquiry</td><td>AT+DEVMANUF?</td><td>+OK=[para]</td></tr>
<tr><td>Set</td><td>AT+DEVMANUF =[para]</td><td>+OK：success
+ERR=[NUM]：error</td></tr>
<tr><td>Parameter</td><td colspan="2">para(string): MANUF name
Default:CDEBYTE;</td></tr>
<tr><td>Note</td><td colspan="2">1. Restart to take effect, save when power off
2. Maximum string length is 32bytes</td></tr>
</table>

6.4.11 AT+ADV enable advertising

Command	Response

Inquiry	**AT+ADV?**	**+OK=[para]**
Set	**AT+ADV=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para（ASCII）	Description
	0	Turn off
	1	Turn on（default）
	2	iBeacon
Note	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. The slave or master-slave integrated supports broadcasting.	

6.4.12 AT+ADVDAT advertising data

Command		Response
Inquiry	**AT+ADVDAT?**	**+OK=[para]**
Set	**AT+ADVDAT=[para]**	**+OK：success**
		+ERR=[NUM]：error
Parameter	para(HEX): 1、Support ASCII、HEX 2、Length is less than 26 bytes.	
Note	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. The slave or master-slave integration supports broadcasting, and other roles can still be configured;	
For example,	Command：41 54 2b 41 44 56 44 41 54 3d 31 32 33 34 35 36 37 38 39 30； Adv data：31 32 33 34 35 36 37 38 39 30	

6.4.13 AT+ADVINTV advertising interval

Command		Response
Inquiry	**AT+ADVINTV?**	**+OK=[para]**
Set	**AT+ADVINTV=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(ASCII):20~10240 default：1000（1S）	
Note	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. The slave or master-slave integrated supports broadcasting, other roles can still be configured;	
For example,	**AT+ADVINTV=1000**	

6.4.14 AT+IBCNVER iBeacon broadcasting version command

<table>
<tr><td colspan="2">Command</td><td>Response</td></tr>
<tr><td>Inquiry</td><td>AT+IBCNVER?</td><td>+OK=[para]</td></tr>
<tr><td>Set</td><td>AT+IBCNVER=[para]</td><td>+OK：success
+ERR=[NUM]：error</td></tr>
<tr><td>Parameter</td><td colspan="2"><table><tr><td>para（ASCII）</td><td>Description</td></tr><tr><td>0</td><td>Old version iBeacon broadcasting</td></tr><tr><td>1</td><td>New version iBeacon broadcasting（default）</td></tr></table></td></tr>
<tr><td>Note</td><td colspan="2">1.Take effect immediately , save when power off
2.For new version iBeacon broadcasting, iBeacon Prefix contains 9 bytes; while old version only contains 6 bytes
3.Software version 7212-1-12 supports this command</td></tr>
<tr><td>For example,</td><td colspan="2">AT+ADVINTV=1</td></tr>
</table>

6.4.15 AT+IBCNUUID iBeacon UUID command

<table>
<tr><td colspan="2">Command</td><td>Response</td></tr>
<tr><td>Inquiry</td><td>AT+IBCNUUID?</td><td>+OK=[para1]</td></tr>
<tr><td>Set</td><td>AT+IBCNUUID=[para]</td><td>+OK：success
+ERR=[NUM]：error</td></tr>
<tr><td>Parameter</td><td colspan="2">para(HEX)：16 bit UUID</td></tr>
<tr><td>Note</td><td colspan="2">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. The slave or master-slave integrated supports broadcasting, other roles can still be configured;</td></tr>
<tr><td>For example,</td><td colspan="2">Set iBeacon UUID as “FDA50693A4E24FB1AFCFC6EB07647825”
41 54 2B 49 42 43 4E 55 55 49 44 3DFDA50693A4E24FB1AFCFC6EB07647825</td></tr>
</table>

6.4.16 AT+MAJOR iBeacon Major command

<table>
<tr><td colspan="2">Command</td><td>Response</td></tr>
<tr><td>Inquiry</td><td>AT+MAJOR?</td><td>+OK=[para]</td></tr>
<tr><td>Set</td><td>AT+MAJOR=[para]</td><td>+OK：success
+ERR=[NUM]：error</td></tr>
<tr><td>Parameter</td><td colspan="2">para(HEX)： 0X0001-0XFFFF
default：</td></tr>
<tr><td>Note</td><td colspan="2">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;</td></tr>
</table>

6.4.17 AT+MINOR iBeacon Minor command

Command		Response
Inquiry	**AT+Minor?**	**+OK=[para]**
Set	**AT+Minor=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(ACSII)： 0X0001-0XFFFF default：	
Note	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;	

6.4.18 AT+IPWR revise ibeacn tx_power

Command		Response
Inquiry	**AT+IPWR?**	**+OK=[para]**
Set	**AT+ IPWR =[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(HEX)： 0-0XFF default：0	
Note	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;	

6.4.19 AT+NAME advertising device name

Command		Response
Inquiry	**AT+NAME?**	**+OK=[para]**
Set	**AT+NAME=[para]**	**+OK：success** **+ERR=[NUM]：error**
Set **（Do not save）**	**AT+NAME1=[para]**	
Parameter	para(HEX): advertising device name, Advertising device name is not more than 20 bytes default：E104-BT52-V2.0	
Note	1. Take effect immediately, save when power off; 2. Only supported by the slave, other roles can still be configured;	

6.4.20 AT+ CONINTV connection interval configuration

Command	Response

Inquiry	**AT+CONINTV?**	**+OK=[para]**
Set	**AT+CONINTV =[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	[para]（ASCII) : connection interval，value range，10~2500； Default：20ms	
Note	Take effect immediately, save when power off.	
Note	1. The connection timeout must be greater than the connection intervals; 2. The device will not receive and save the incorrect parameters . 3. It is not recommended to modify the master’s connection intervals.	
For example,	**AT+CONINTV=20** Connection interval 20ms	

6.4.21 AT+DISCON disconnect command

Command		Response
Set	**AT+DISCON=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(ASCII) | Description 0~1 | Disconnect specified connection	
Note	1、Take effect immediately 2、if para specified connection is not connected, the modules will return: index device no connect	

6.4.22 AT+MAC local MAC address

Command		Response
Inquiry	**AT+MAC?**	**+OK=[para]**
Parameter	para（HEX）:MAC address For example：F0E1D2C3B4A5	
Note	Take effect immediately, save when power off.	
For example,	command：AT+MAC? Return：2B 4F 4B 3D FE 30 EE 50 35 DA Explain：local MAC address is FE 30 EE 50 35 DA	

6.4.23 AT+CONINFO connection device info.

Command		Response
Inquiry	**AT+CONINFO=[Para0]**	**+OK=[Para1]：success**

			+ERR=[NUM]: error
Parameter	Para0(ASCII)	Description	Para1（ASCII）: connected device role + connected device MAC address + send data to the handle of the connected device
	0~1	Connection number	
Note	Effective immediately. Sending data to the handle of the connected device is only valid when our device is the master.		
For example,	Command：AT+CONNIFO=0		

6.4.24 AT+BONDMAC add bound MAC address

Command		Response
Inquiry	**AT+BONDMAC?**	**+OK=[sum][[mac] [mac]…]**
Set	**AT+BONDMAC=[mac]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	**sum(HEX):** sum of currently bound MAC address； **mac(HEX)：** 6bytes mac address;	
Note	1. Take effect immediately, save when power off 2. When no MAC address is bound, no data will be returned	
For example,	Inquiry：AT+BONDMAC? Return: 2B 4F 4B 3D 03 CC 34 27 1A 0C D4 3D AC 82 16 0F 58 D2 D4 C3 07 0E C4	
	Set：41 54 2B 42 4F 4E 44 4D 41 43 3D CC 34 27 1A 0C D4 Return：+OK	

6.4.25 AT+BONDDEL delete bond MAC address

Command		Response
Set	**AT+BONDDEL=[mac]**	**+OK** **+ERR=[NUM]**
Parameter	**mac：6 bytes mac address**	
Note	1、 Take effect immediately, save when power off 2、 Delete specific mac address	

6.4.26 AT+SCAN scan

Command		Response
Inquiry	**AT+SCAN?**	**+OK=[para]**
Set	**AT+SCAN=[para]**	**+OK：success** **+ERR=[NUM]：error**

Parameter	<table><tr><td>para（ASCII）</td><td>Description</td></tr><tr><td>0</td><td>Scan off</td></tr><tr><td>1</td><td>Scan on (default)</td></tr></table>
Note	1.Take effect immediately, save when power off 2. If the current number of master connections has reached the maximum, then no longer start scanning; 3. Scan enable and disable take effect in roles other than the slave.

6.4.27 AT+SCANINTV scan interval

Command		Response
Inquiry	**AT+SCANINTV?**	**+OK=[para]**
Set	**AT+SCANINTV=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(ASCII):20~6000 default：100	
Note	1. Take effect immediately, save when power off 2. The scanning interval is not less than the scanning window 3. The slave does not support it, but it can still be set	
For example,	AT+SCANINTV=120 Scan interval：120*0.625 = 75ms	

6.4.28AT+SCANWND scan window

Command		Response
Inquiry	**AT+SCANWND?**	**+OK=[para]**
Set	**AT+SCANWND=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(ASCII): 20~65535 default：80；	
Note	1. Take effect immediately, save when power off 2. The scanning interval is not less than the scanning window 3. The slave does not support it, but it can still be set	
For example,	AT+SCANWND=20 Scan window：20*0.625 = 12.5ms	

6.4.29 AT+TRANMD transmission mode

Command		Response
Inquiry	**AT+TRANMD?**	**+OK=[para]**

Set	**AT+ TRANMD =[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para（ASCII） 0 1	description Not transparent transmission（default） Transparent transmission
Note	1、 Take effect immediately, save when power off	

6.4.30 AT+UUIDSVR128 set service 128bit UUID

Command		Response
Inquiry	**AT+UUIDSVR128?**	**+OK=[para]**
Set	**AT+ UUIDSVR128=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(HEX):16 bit uuid.	
Note	1.Take effect immediately, save when power off 2.The second and third byte are16 bit uuid, range from 1~65535; 3.The 128 bits UUID (except for the second and third bytes) is also used for the basic UUID of the slave channel, the master channel, and the configuration channel. (For the description of uuid, refer to <<BLUETOOTH SPECIFICATION Version 5.0 | Vol 3, Part B 2.5.1 UUID>>).	
For example,	Set 128bit UUID： “11 22 33 44 55 66 77 88 99 00 aa bb cc dd ee ff”(HEX) AT command is（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	

6.4.31 AT+UUIDSVR Bluetooth service UUID

Command		Response
Inquiry	**AT+UUIDSVR?**	**+OK=[para]**
Set	**AT+UUIDSVR=[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para(HEX):0-FFFF default：FFF0	
Note	1、Take effect immediately, save when power off 2、For the master, the service UUID is a necessary condition for connection filtering, so when setting the master service UUID, it must be consistent with the slave, otherwise the connection cannot be established.	

6.4.32 AT+UUIDSLAVE SLAVE CHANNEL characteristic UUID

Command		Response
Inquiry	**AT+UUIDSLAVE?**	**+OK=[para]**
Set	**AT+UUIDSLAVE=**	**+OK：success**

	[para]	**+ERR=[NUM]：error**
Parameter	para(HEX): 0-FFFF Default：FFF1	
Note	1. Take effect immediately, save when power off 2. Slave channel. Used to send data from the slave and the master receiving data.	

6.4.33 AT+UUIDMAST MAST CHANNEL characteristic UUID command

Command		Response
Inquiry	**AT+UUIDMAST2?**	**+OK=[para]**
Set	**AT+UUID CHARA2= [para]**	**+OK：success +ERR=[NUM]：error**
Parameter	para(HEX): 0-FFFF； Default：FFF2	
Note	1.Take effect immediately, save when power off 2.Master channel. The master sends data and the slave receives data.	

6.4.34 AT+AUTH Air configuration authentication password

Command		Response
Set	**AT+AUTH =[para]**	**+OK：success +ERR=[NUM]：error**
Parameter	para(HEX): 6 byte password	
Note	1.Only for air configuration authentication password 2.Default password：123456	
For example,	AT+AUTH=123456	

6.4.35 AT+UPAUTH modify air configuration authentication password

Command		Response
Inquiry	**AT+UPAUTH?**	**+OK=[para]**
Set	**AT+UPAUTH =[para]**	**+OK：success +ERR=[NUM]：error**
Parameter	para(HEX): 6 byte password	
Note	Take effect immediately, save when power off	

6.4.36 AT+ONSLEEP sleep when power on

Command		Response
Inquiry	**AT+ONSLEEP?**	**+OK=[para]**

Set	**AT+ONSLEEP =[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para（ASCII） / Description 0 / Off(default) 1 / On	
Note	Take effect immediately, save when power off	

6.4.37 AT+SLEEP enter sleep

Command		Response
Set	**AT+SLEEP**	**+OK**
Parameter	None	
Note	Take effect immediately	

6.4.38 AT+LOGMSG operating status output

Command		Response
Inquiry	**AT+LOGMSG?**	**+OK=[para]**
Set	**AT+LOGMSG =[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	para（ASCII） / Description 0 / Off(default) 1 / On	
Note	Take effect immediately, save when power off	

6.4.39 AT+PWR TX power

Command		Response
Inquiry	**AT+ PWR?**	**+OK=[para]**
Set	**AT+ PWR =[para]**	**+OK：success** **+ERR=[NUM]：error**
Parameter	**para(**ASCII**)** / Description 0 / 2.5 dBm 1 / 1.5 dBm 2 / 0 dBm（default）	

	3	-2 dBm
	4	-5 dBm
	5	-7 dBm
	6	-13.5 dBm
	7	-19.5 dBm
Note	Take effect immediately, save when power off	

6.4.40 AT+MTU Set Bluetooth single packet length

Command		Response
Inquiry	AT+ MTU?	+OK=[para]
Set	AT+MTU =[para]	+OK：success +ERR=[NUM], error
Parameter	Para MTU value, Min is 23，max is 244.	
Note	1. Take effect immediately, save when power off 2. Due to the control byte，when set MTU=247，actual 244 bytes will be sent each packet	

6.4.41 AT+VER inquiry software version number

Command		Response
Inquiry	AT+VER?	+OK=[para]
Set	\	\
Parameter	Para：Current software version number	
Note	1. Only for inquiry 2.Software version 7212-1-12 onward supports this command	
For example	TX：AT+VER? Return：+OK=7212-1-12	

7 Quick start

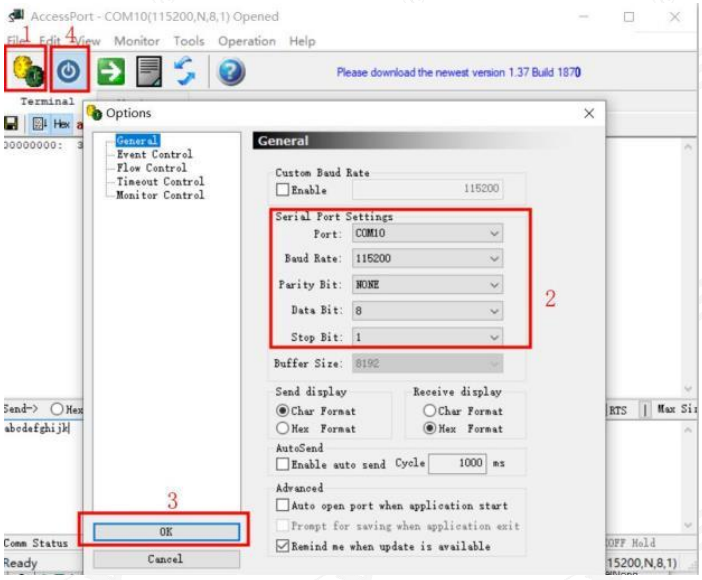
Software for debugging and parameter setting：

- PC serial tool - XCOM.exe;
- Phone ble debugging APP - nRF connect

7.1 Configuration mode guidance

7.1.1 Serial port configuration

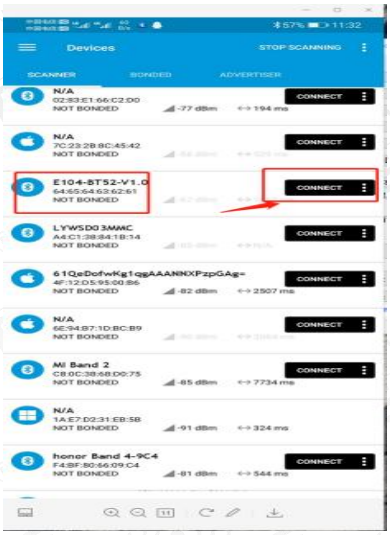
- Confirm whether the module is currently in configuration mode (if not connected, the module can be configured, if it is connected, you need to send "+++" through the serial port).
- Set XCOM serial port related configuration (default configuration: 115200, 8, 1, none, no flow empty), as shown below XCOM parameter configuration diagram;



- Configure it according to AT command.

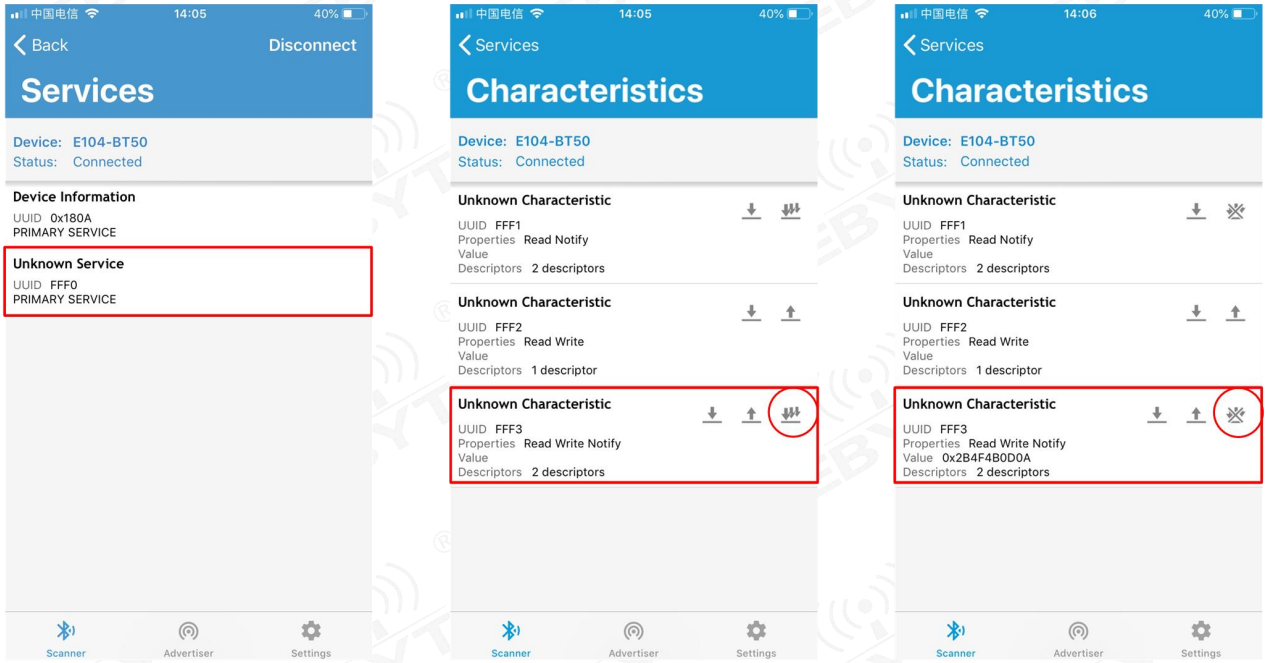
7.1.2 Configuration over air

- Only for module that works as a slave.
- Open app “nRF connect”, start scanning， find “E104-BT52” and connect to it.



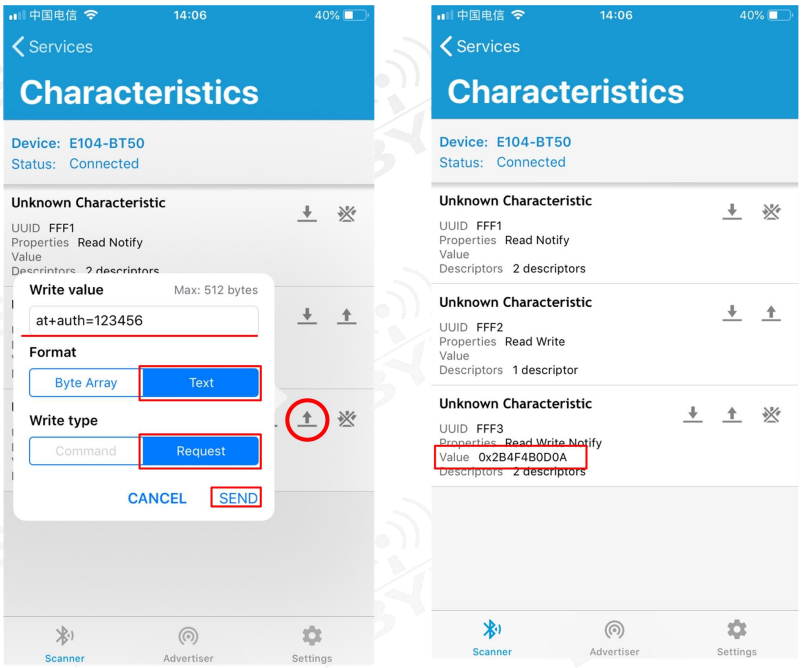
nRF connect scanning list

- Open uuid-fff0 service，Enable configuration channel: notify;



nRF connect、Enable configuration channel: notify

- Send authenticate command（at+auth=123456），module returns “0x2befeb0d0a” means success；



Over air configuration authentication

- Configure module according to 6.4 command table.

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 as the slave as described in the quick use guide for AT command list configuration mode;
- Software: XCOM.
- Other parameters are the default configuration.

7.2.1 Data transparent transmission

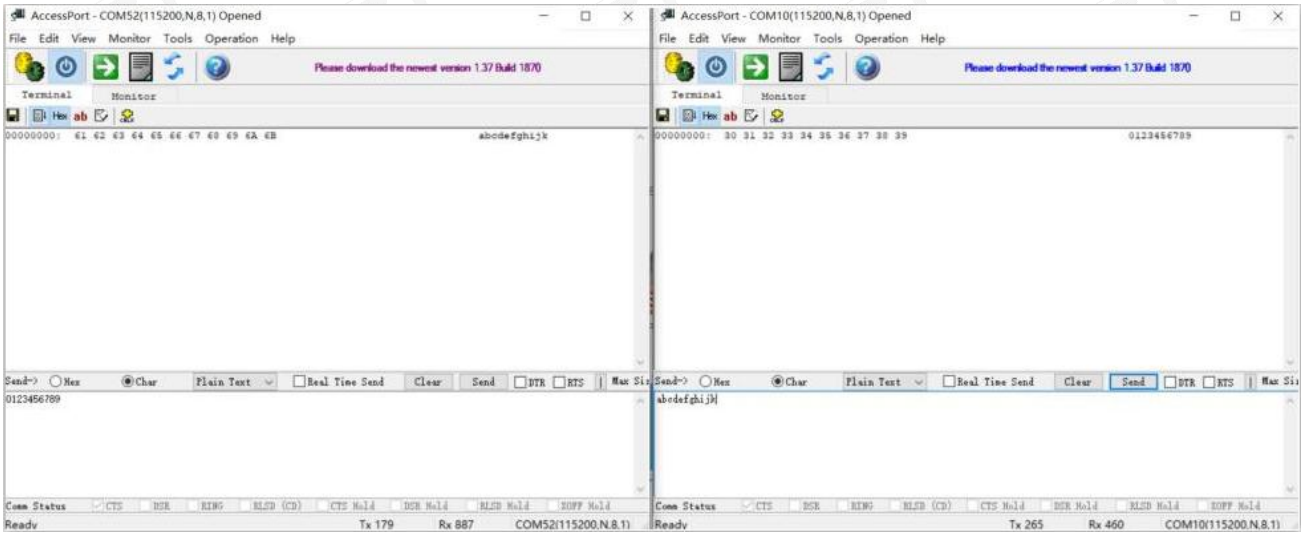
1. Power on the module. Enable logmsg printing both for master and slave (at+logmsg=1);
2. Set both master and slave module as transparent transmission mode (AT+TRANMD=1).
3. After the master successfully connecting, it will print "sta: connecte 0 616263646564"; the slave will print sta: connecte 0 616263646566". The LINK pin is high. As shown in below figure, the master is automatically connected and printed; The slave is powered on and automatically print. The value before the MAC address in the information printed by the master is the slave handle in the master, and the first byte of the format transmission comes from this.

The master auto connects and prints once powered on

The slave auto connects and prints once powered on

4.The master sends data “0123456789” to the slave， the slave receives “0123456789”, as shown below；

5.The slave sends data “abcdefghijk” to the master， the master receives “abcdefghijk”, as shown below；

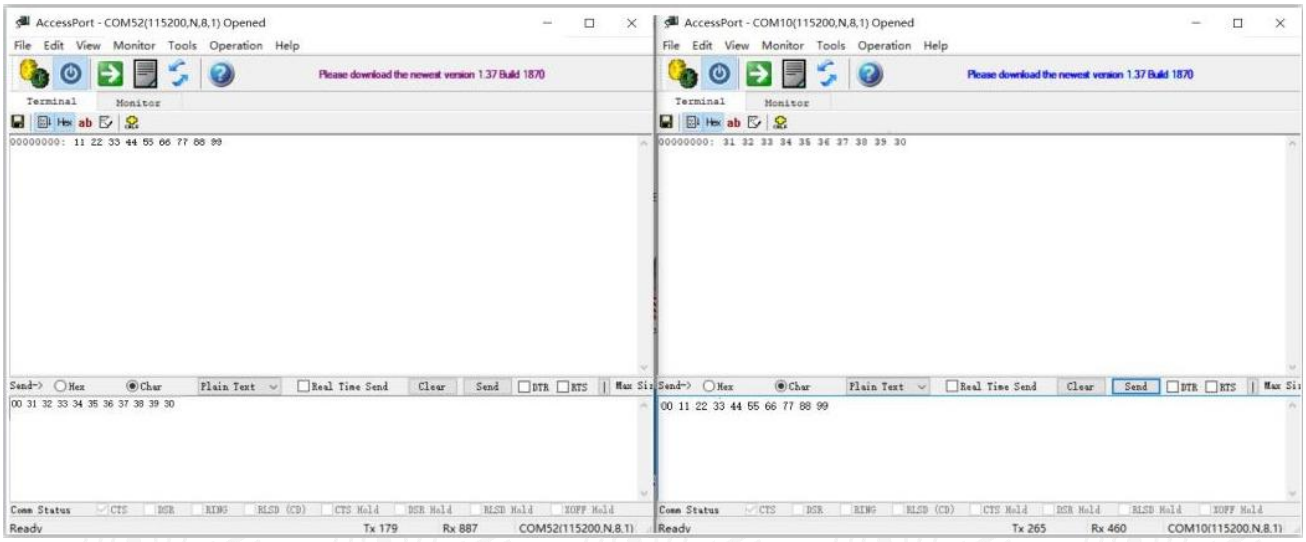


The master sends transparent data

7.2.2 Format transmission

1. Same as Step 1 of 7.2.1 Data Transparent Transmission;
2. Set to format transmission (default format transmission, set command "AT+TRANMD=0")
3. Same as Step 3 of 7.2.1 Data Transparent Transmission;
4. The effective data sent by the master to the slave is "0123456789" (ASCII). The format transmission data is packed "00 30 31 32 33 34 35 36 37 38 39" (HEX). At this time, the data received by the slave is "0123456789" ("30 31 32 33 34 35 36 37 38 39"). Such

as



5 The slave sends the data “11 22 33 44 55 66 77 88 99” (hex) to the master, and the data received by the master is “11 22 33 44 55 66 77 88 99” (HEX), as long as the format transmission is turned on. The first byte is sending IDX. Both the host and the slave can use different transmission modes but the input needs to meet the transmission rules.

8 FAQ

8.1 Communication distance is too short

- The communication distance will be affected when obstacle exists;
- Data lose rate will be affected by temperature, humidity and co-channel interference;
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground;
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea;
- The signal will be affected when the antenna is near metal object or put in a metal case;
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance);
- The power supply low voltage under room temperature is lower than recommended value, the lower the voltage, the lower the transmitting power;
- Due to antenna quality or poor matching between antenna and module.

8.2 Module is easy to damage

- Please check the power supply source, ensure it is between the recommended supply voltage, voltage higher than the maximum will damage the module.
- Please check the stability of power source, the voltage cannot fluctuate too much;
- Please make sure antistatic measure are taken when installing and using, high frequency devices have

electrostatic susceptibility;

- Please ensure the humidity is within limited range, some parts are sensitive to humidity;
- Please avoid using modules under too high or too low temperature.

8.3 BER(Bit Error Rate) is high

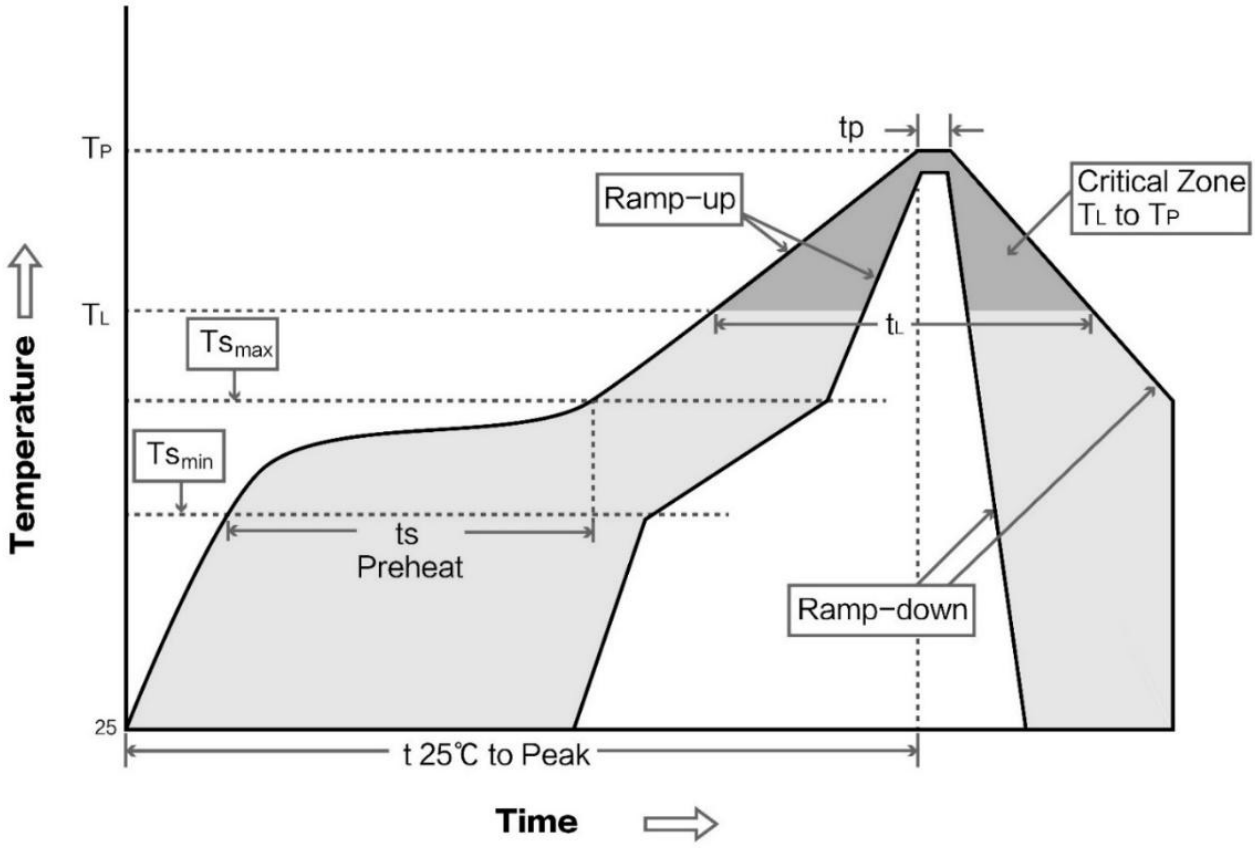
- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- Poor power supply may cause messy code. Make sure that the power supply is reliable;
- The extension line and feeder quality are poor or too long, so the bit error rate is high.

9 Welding instruction

9.1 Reflow soldering temperature

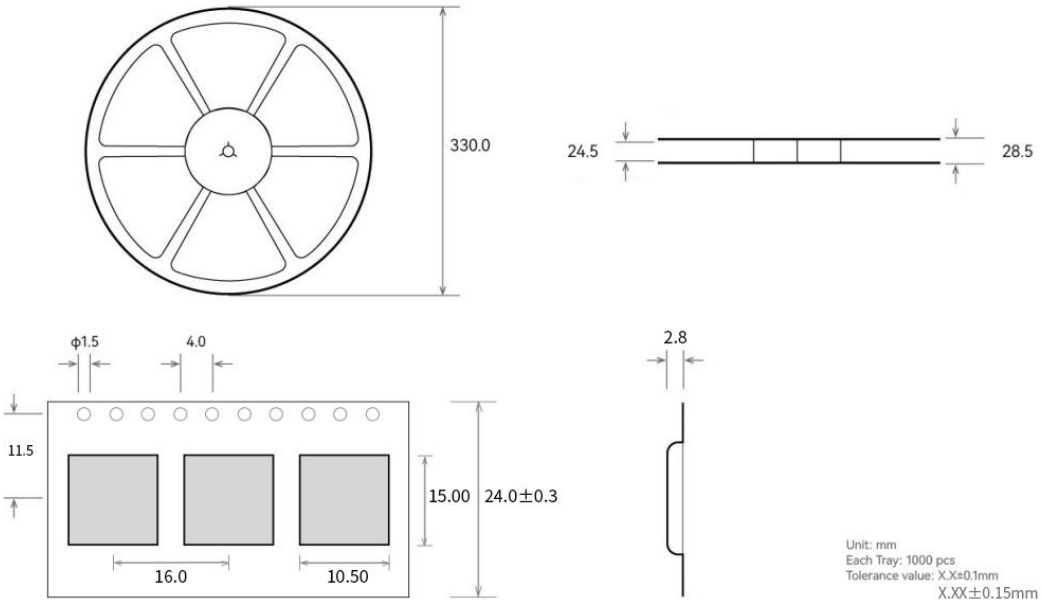
Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (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

9.2 Reflow soldering curve

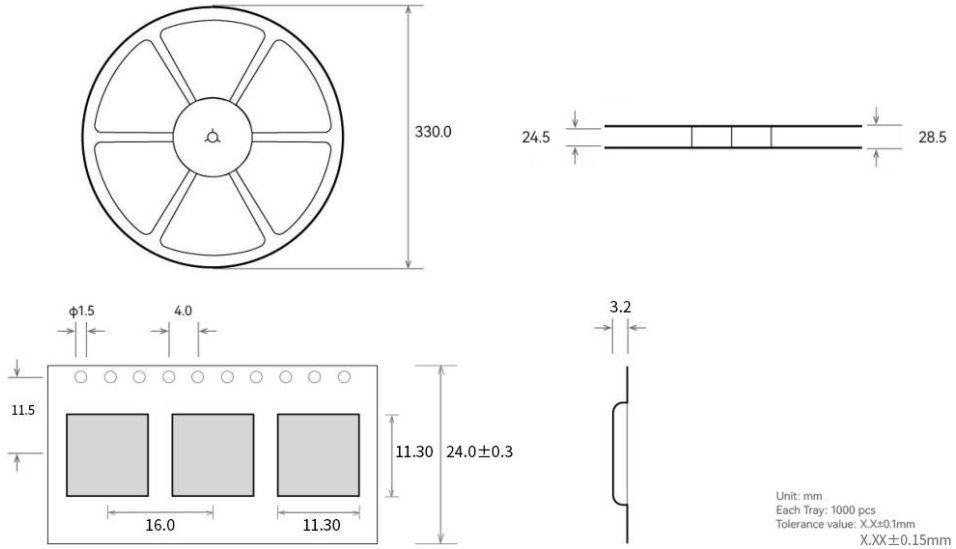


10 Package

E104-BT52



E104-BT52X



11 Related Model

Model No.	Chip	Frequency Hz	TX power dBm	Communication 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, requires secondary development
E73-2G4M04S1A	nRF52810	2.4G	4	I/O	4.2/5.0	17.5*28.7	PCB/IPX	Hardware resources, requires secondary development
E73-2G4M04S1B	nRF52832	2.4G	4	I/O	4.2/5.0	17.5*28.7	PCB/IPX	Hardware resources, requires secondary development
E73-2G4M08S1C	nRF52840	2.4G	8	I/O	4.2/5.0	13*18	PCB/IPX	Hardware resources, requires secondary development
E73-2G4M04S1D	nRF51822	2.4G	4	I/O	4.2	17.5*28.7	PCB/IPX	Hardware resources, requires secondary development
E104-BT01	CC2541	2.4G	0	I/O	4.0	14*22	PCB	Hardware resources, requires secondary development
E104-BT02	DA14580	2.4G	0	TTL	4.2	14*22	PCB	The lowest power, High speed continuous transmission, Sniff
E72-2G4M04S2B	CC2640	2.4G	2	TTL	4.2	14*23	PCB/IPX	Built-in ARM dual core Multiple role mode
E104-2G4U04A	CC2540	2.4G	0	USB	4.0	18*59	PCB	Dongle Protocol Analyzer
E104-BT5010A	nRF52810	2.4G	0	UART	5.0	11.5 * 16	ceramic antenna	Low power, transparent transmission

Revision history

Version	Date	Description	Issued by
1.0	2022-10-12	Consolidation Manual	Bin
1.1	2023-03-30	Error corrected	Bin
1.2	2023-05-09	Error corrected	Bin
1.3	2023-09-13	Error corrected	Bin
1.4	2024-03-29	Error corrected	Bin
1.5	2024-04-22	Error corrected	Bin
1.6	2024-06-18	Error corrected	Bin
1.7	2024-08-07	Modify the broadcast device name size limit	Bin

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