



E104-BT52X User Manual

DA14531 BLE5.0 Low Power SMD Bluetooth module



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1. Overview

1.1 Introduction

E104-BT52X 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 ISM band.

The E104-BT52X module is developed by Chengdu Ebyte 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;
- E104-BT52X 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;
- 3rd generation IPEX (E104-BT52X)
- Supports Bluetooth parameter air configuration;
- The maximum communication distance: 50m (approximate)
- E104-BT52X Ultra-low power sleep, simultaneous advertising;
- Multiple masters and multiple slaves, and the maximum connection data is 2 slaves;
- E104-BT52X Supports transmit power modification. The maximum transmit power is 0.5dBm;
- 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 (°C)	-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 (°C)		-40	-	+85	Industrial design
Operating frequency (MHz)		2402	-	2480	For ISM band
Power consumption	E104-BT52X Tx current (mA)	-	4.0	-	Default parameter
	E104-BT52X Rx current (uA)	-	365	-	Default parameter
	E104-BT52X Sleep current (μA)	-	2	-	Default parameter
E104-BT52X TX power (dBm)		-10	-0.99	0.50	-
Receiving sensitivity (dBm)			-94		Air data rate 1Mbps

E104-BT52X Sleep advertising current(default)		9.44		Unit uA, default advertising gap 1S
E104-BT52X Sleep connection current(default)		61		Unit uA, default advertising gap 1S
E104-BT52X Wake-up advertising current (default)		403		Unit: uA, default advertising gap 1s
E104-BT52X Sleep without advertising current (default)		2		Unit: uA, default connection gap 500ms

Main parameter	Description	Remark
Distance	50m(E104-BT52X)	In open and clear air, height 2.0 meter; @-0.99dBm; Air data rate: 1Mbps
BLE protocol	BLE5.0	-
Communication interface	UART	-
Package	SMD	-
Size	10*10mm(E104-BT52X)	-
RF interface	Third generation IPEX (E104-BT52X)	Equivalent impedance approx. 50Ω
Weight	0.4±0.1g (E104-BT52X)	

3 Size and Pin Definition

E104-BT52X

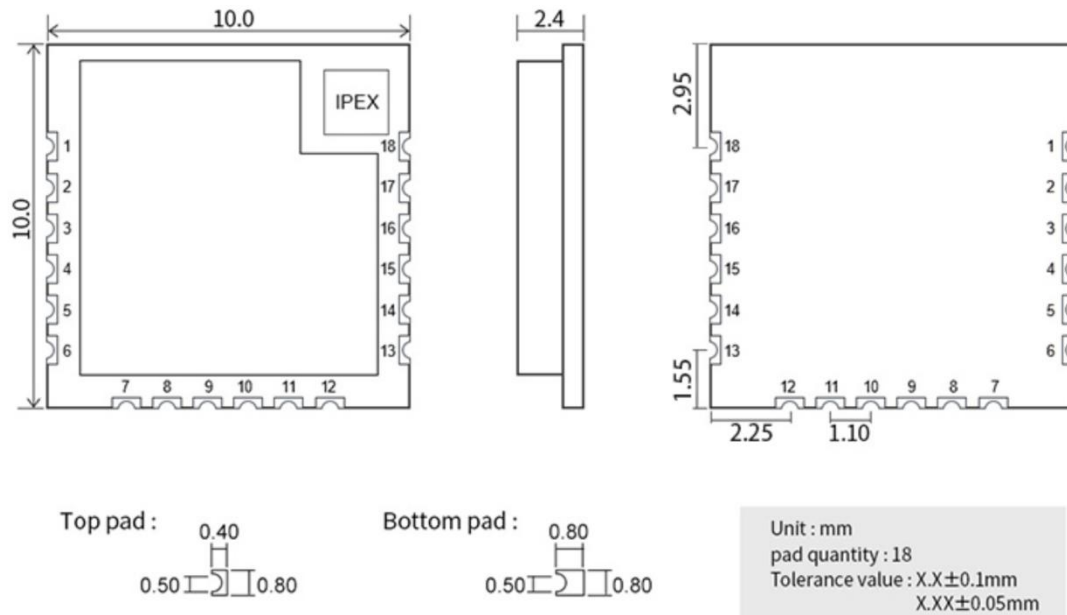


Table 3 Pin definition talble

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-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-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 Function Description

4.1 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.

4.1.1 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 meeting the condition filtering.

4.1.2 Slave

1. AT+ROLE=0 select slave mode
2. AT+ADV=1 to configure normal advertising mode
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. After receiving the host connection request, establish a Bluetooth connection to stop Bluetooth advertising and enter the data transmission mode.
5. For advertising data configuration, see 5.5 Advertising.

4.1.3 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.

4.2 Power supply mode

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

4.2.1 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).

4.2.2 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.

4.3 Data transmission mode

There are data transparent transmission and format transmission.

4.3.1 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"

4.3.2 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.

4.4 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.

4.5 Advertising

4.5.1 Common advertising info.

The advertising information includes “advertising” and “scanresponse”. Advertising is a broadcast report sent actively, while scanresponse 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.

4.5.2 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: 0201061AFF4C000215FDAFDA50693A4E24FB1AFCFC6EB076478252775848F00

Advertising (Old ibeacon data format table)

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

For example: 1AFF4C000215FDAFDA50693A4E24FB1AFCFC6EB076478252775848F00

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.

4.6 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 "+++".

4.7 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.

4.8 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

4.9 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

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.

5.1 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)

5.2 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

5.3 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	

5.4 Command sets

5.4.1 AT test command

Command	Response
AT	+OK
Note: none	

5.4.2 +++ 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.	

5.4.3 AT+EXIT exit AT command mode

Command	Response
AT+EXIT	+OK
Notes: None	

5.4.4 AT+RESET reset command

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

5.4.5 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;	

5.4.6 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	

5.4.7 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	

5.4.8 AT+DATABIT uart data bit

Command		Response
Inquiry	AT+DATABITS?	+OK=[para]
Set	AT+DATABITS=[para]	+OK: success +ERR=[NUM]: error
Parameter		
	para(ASCII)	Description
	0	5 data bit
	1	6 data bit
	2	7 data bit
	3	8 data bit
Note	Restart to take effect, save when power off	
For example,	AT+DATABITS=0	

5.4.9 AT+ROLE Bluetooth role

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

5.4.10 AT+DEVMANUF devise manufacturer

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

5.4.11 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.	

5.4.12 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 3d31 32 33 34 35 36 37 38 39 30; Adv data: 31 32 33 34 35 36 37 38 39 30	

5.4.13 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	

5.4.14 AT+IBCNVER iBeaconbroadcasting version command

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

5.4.15 AT+IBCNUUID iBeacon UUID command

Command		Response
Inquiry	AT+IBCNUUID?	+OK=[para1]
Set	AT+IBCNUUID=[para]	+OK: success +ERR=[NUM]: error
Parameter	para(HEX): 16 bit UUID	
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,	Set iBeacon UUID as “FDA50693A4E24FB1AFCFC6EB07647825” 41 54 2B 49 42 43 4E 55 55 49 44 3DFDA50693A4E24FB1AFCFC6EB07647825	

5.4.16 AT+MAJOR iBeacon Major command

Command		Response
Inquiry	AT+MAJOR?	+OK=[para]
Set	AT+MAJOR=[para]	+OK: success +ERR=[NUM]: error
Parameter	para(HEX): 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;	

5.4.17 AT+MINOR iBeacon Minor command

Command		Response
Inquiry	AT+Minor?	+OK=[para]
Set	AT+Minor=[para]	+OK: success +ERR=[NUM]: error
Parameter	para(ASCII): 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;	

5.4.18 AT+IPWR revise ibeacon 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;	

5.4.19 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;	

5.4.20 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	

5.4.21 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	

5.4.22 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	

5.4.23 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		

5.4.24 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	

5.4.25 AT+BONDDDEL delete bond MAC address

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

5.4.26 AT+SCAN scan

Command		Response
Inquiry	AT+SCAN?	+OK=[para]
Set	AT+SCAN=[para]	+OK: success +ERR=[NUM]: error
Parameter		
	para (ASCII)	Description
	0	Scan off
	1	Scan on (default)
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.	

5.4.27 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: $120 \times 0.625 = 75\text{ms}$	

5.4.28AT+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: $20 \times 0.625 = 12.5\text{ms}$	

5.4.29 AT+TRANMD transmission mode

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

5.4.30 AT+UUDSVR128 set service 128bit UUID

Command		Response
Inquiry	AT+UUDSVR128?	+OK=[para]
Set	AT+ UUDSVR128=[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	

5.4.31 AT+UUDSVR Bluetooth service UUID

Command		Response
Inquiry	AT+UUDSVR?	+OK=[para]
Set	AT+UUDSVR=[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.	

5.4.32 AT+UUDSLAVE SLAVE CHANNEL characteristic UUID

Command		Response
Inquiry	AT+UUDSLAVE?	+OK=[para]
Set	AT+UUDSLAVE=[para]	+OK: success +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 masterreceiving data.	

5.4.33 AT+UIDMAST MAST CHANNEL characteristic UUID command

Command		Response
Inquiry	AT+UIDMAST?	+OK=[para]
Set	AT+UID 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.	

5.4.34 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	

5.4.35 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	

5.4.36 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; E104-BT52PX does not support this command.	

5.4.37 AT+SLEEP enter sleep

Command		Response
Set	AT+SLEEP	+OK
Parameter	None	
Note	Take effect immediately; E104-BT52PX does not support this command.	

5.4.38 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 Quick start

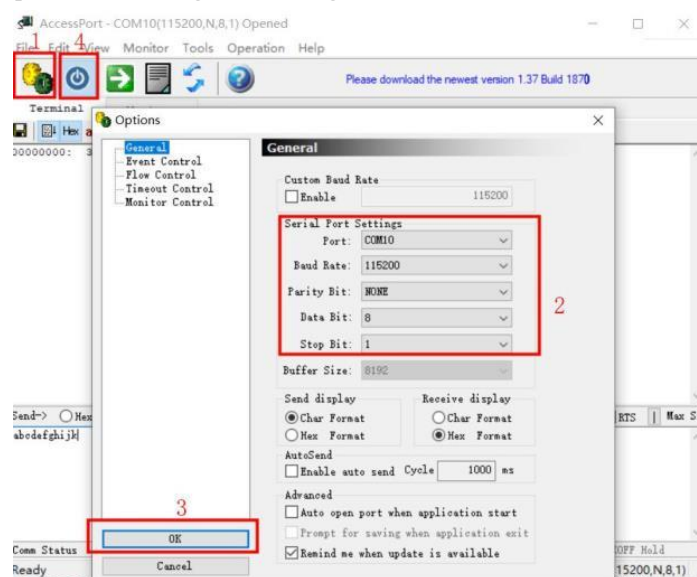
Software for debugging and parameter setting:

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

6.1 Configuration mode guidance

6.1.1 Serial port configuration

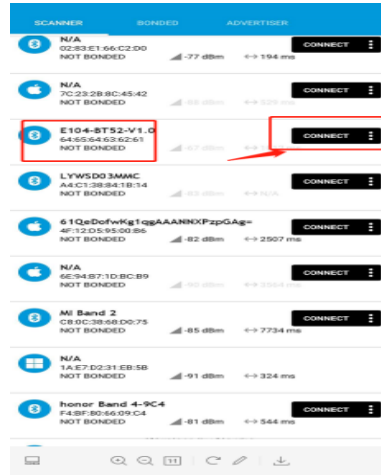
- Confirm whether the module is currently in configuration mode (if not connected, the module can be configured, if it is connected, you need to send "+++" through the serial port).
- Set XCOM serial port related configuration (default configuration: 115200, 8, 1, none, no flow empty), as shown below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



- Configure it according to AT command.

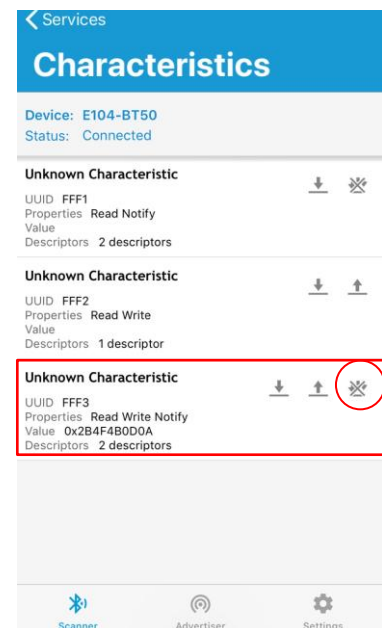
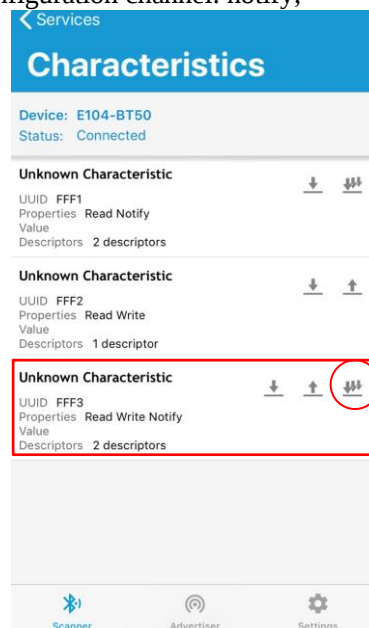
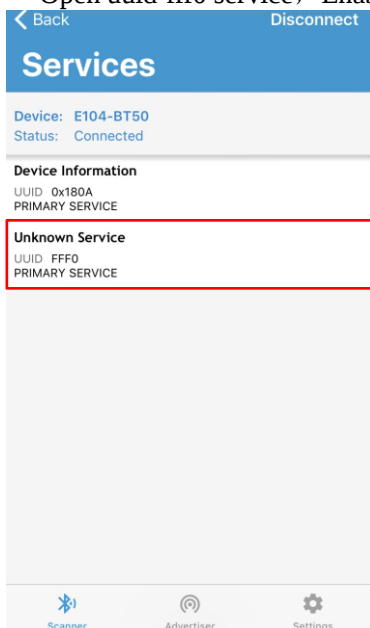
6.1.2 Configuration over air

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



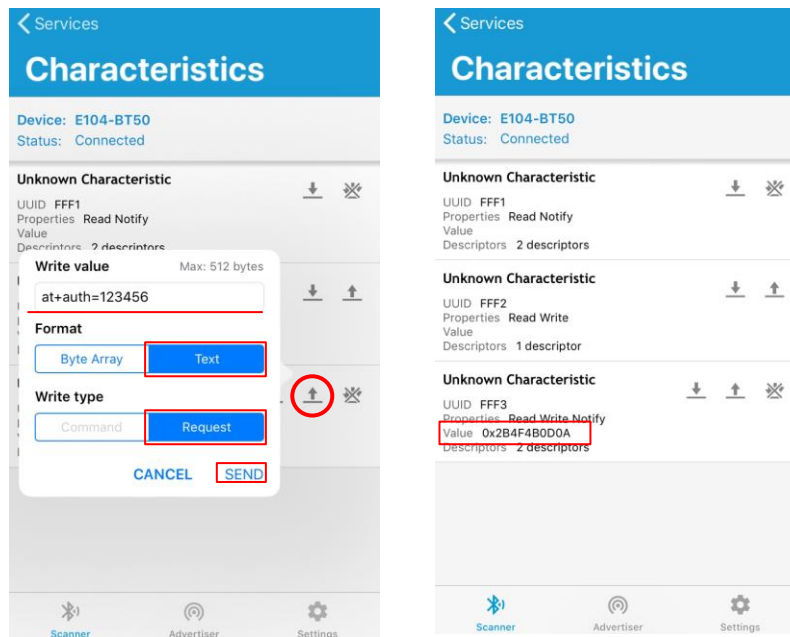
nRF connect scanning list

- 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

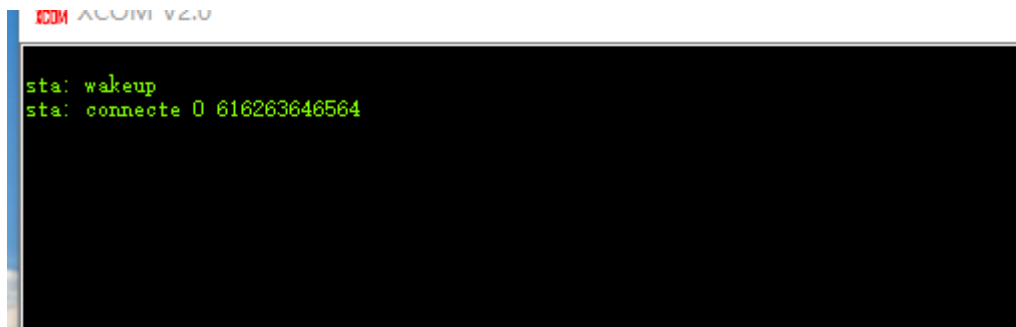
- Configure module according to 0 command table.

6.2 Data transmission

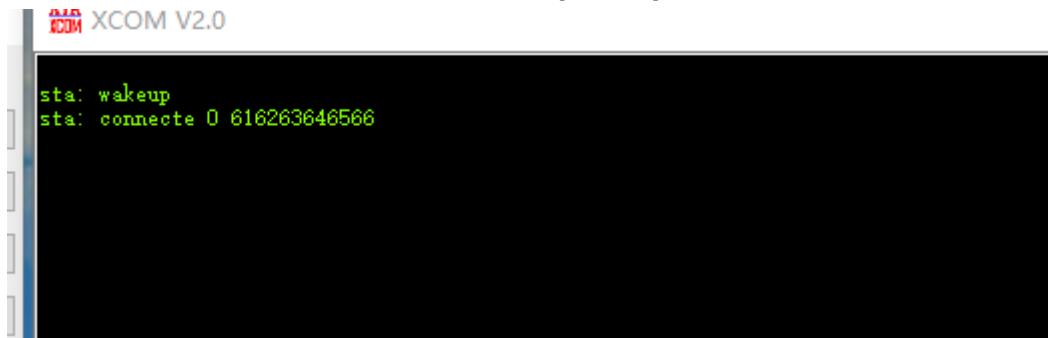
- For data transmission related instructions, see 5.3 Data Transmission Mode.
- Test Conditions:
- Configure one module as the master and one as the slave as described in the quick use guide for AT command list configuration mode;
- Software: XCOM.
- Other parameters are the default configuration.

6.2.1 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.



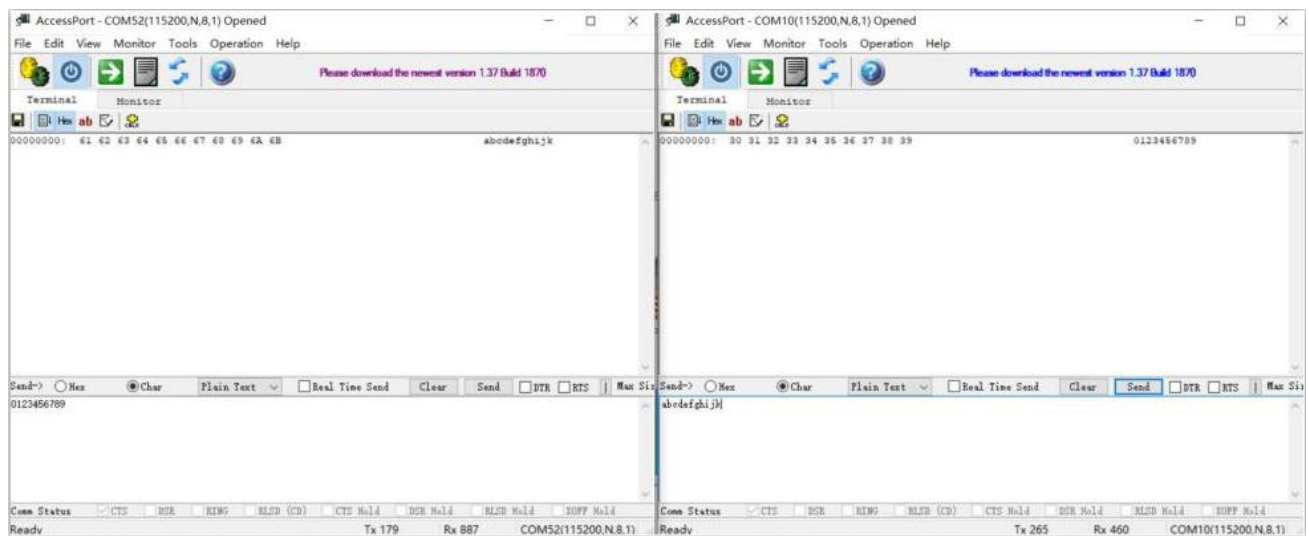
The master auto connects and prints once powered on



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;

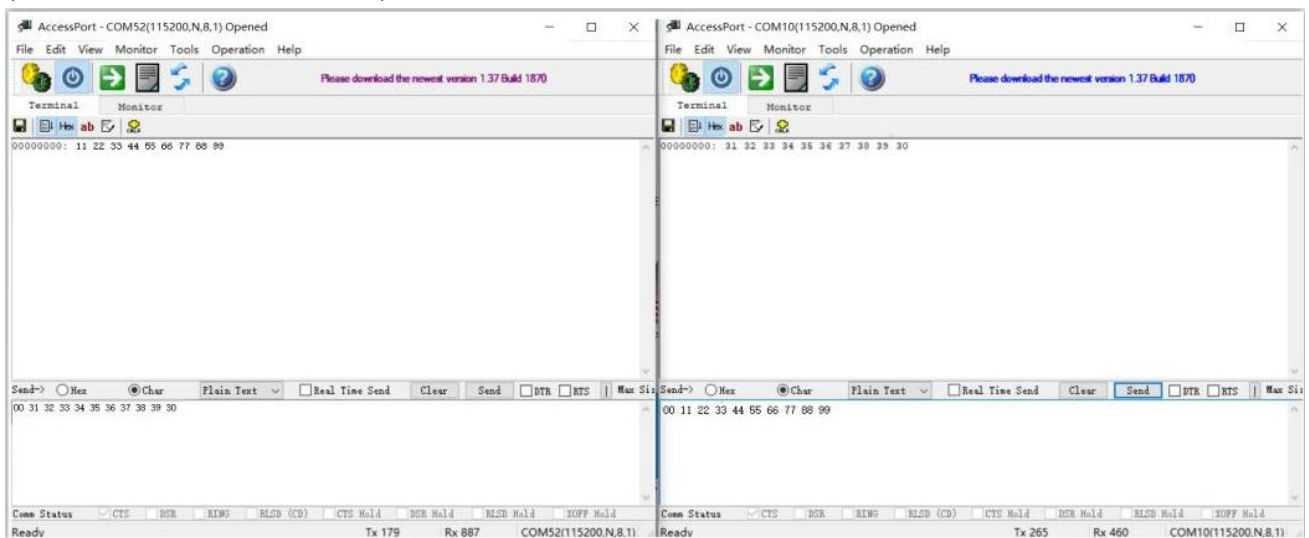
5.The slave sends data “abcdefghijk” to the master, the master receives “abcdefghijk”, as shown below;



The master sends transparent data

6.2.2 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.

7 FAQ

7.1 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.

7.2 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.

7.3 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.

8 FCC STATEMENT

Important Notice to OEM integrators

(Reference KDB 996369 D03 OEM Manual v01r01, KDB 996369 D04 Module Integration Guide v02)

1. Applicable FCC rules:

This device complies with part 15.247 of the FCC Rules. This module is limited to OEM installation ONLY.

2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).

3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.

4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are complaint with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

Important Note notice that any deviation(s) from the defined parameters of the antenna trace, as described by the

instructions, require that the host product manufacturer must notify to Chengdu Ebyte that they wish to change

the antenna trace design. In this case, a Class II permissive change application is required to be filed

by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text:

“Contains FCC ID: 2A8C3-E104BT52X” .

The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

(2) The transmitter module may not be co-located with any other transmitter or antenna.

(3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna type	Antenna Connector	Peak Gain
External Rod Antenna	SMA-K	4.41 dBi

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Information on test modes and additional testing requirements

1) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to retest all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions). 2) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters

where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

3) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected .

4) Additional testing, Part 15 Sub part B disclaimer: The device is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation. When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 for further general testing details. The product under test is set into a link/association with a partnering device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

List of applicable FCC rules

This module has been tested and found to comply with part 15.247 requirements for Modular Approval.

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuit), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

About us

Website: www.ebyte.com Sales: info@cdebyte.com Support: support@cdebyte.com

Tel: +86-28-61399028 Ext. 812 Fax: +86-28-64146160

Address: Building B2, Mould Industrial Park, 199# Xi-Qu Ave, West High-tech Zone, Chengdu, 611731, Sichuan, China



Chengdu Ebyte Electronic Technology Co.,Ltd.