E104-BT10-IPX User Manual

TLSR8269F512 UART SMD SIG Mesh Module

Chengdu Ebyte Electronic Technology Co.,Ltd.

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1、 Overview

1.1 Brief Introduction

E104-BT10-IPX is a Bluetooth mesh network module designed and manufactured by Ebyte Electronic Technology Co., Ltd., which conforms to the sig mesh V1.0 standard. The single network can accommodate up to 10922 node devices. The device automatically remembers network information after entering the network. Completion in 1 second; mobile APP can be connected to the network by any node to realize remote control of mesh network; it can easily realize intranet broadcast or transparent transmission of any fixed point data, the maximum single packet data for transparent transmission supports 80 bytes; conforms to sig standard HSL (H: Hue, S: Saturation, L: lightness) model, one-click implementation of the lighting control application scenario. Ideal for IoT information collection, large-scale networking communication scenarios, smart home applications, etc.

1.2 Features

- With IPX antenna ， transmission distance in open and clear air is up to 50 meter
- Max TX power of +8dbm, can be configured to different level
- UART baud rate can be configured
- Communication channel is 37、38、39
- No central node（gateway）
- Remember network info, automatically entering network once power on
- Entering network once power on in 1 second
- Entering network via phone APP available
- Max networking node is 10922
- Support SIG MESH Generic model
- Support SIG MESH HSL light control model
- Serial port data transparent transmission model can be customized
- Self-defined low power (Non-standard) available
- UART wake up available

1.3 Application

- Smart home；
- Building automation；
- Light control；
- Wireless sensor network；
- IoT.

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2、 Specification and Parameter

2.1 Limit parameter

Main Parameter	Performance		Note
	Min	Max	
Voltage supply [V]	0	3.6	Voltage over 3.6V will cause permanent damage to module
Blocking power [dBm]	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature [℃]	-40	+85	-

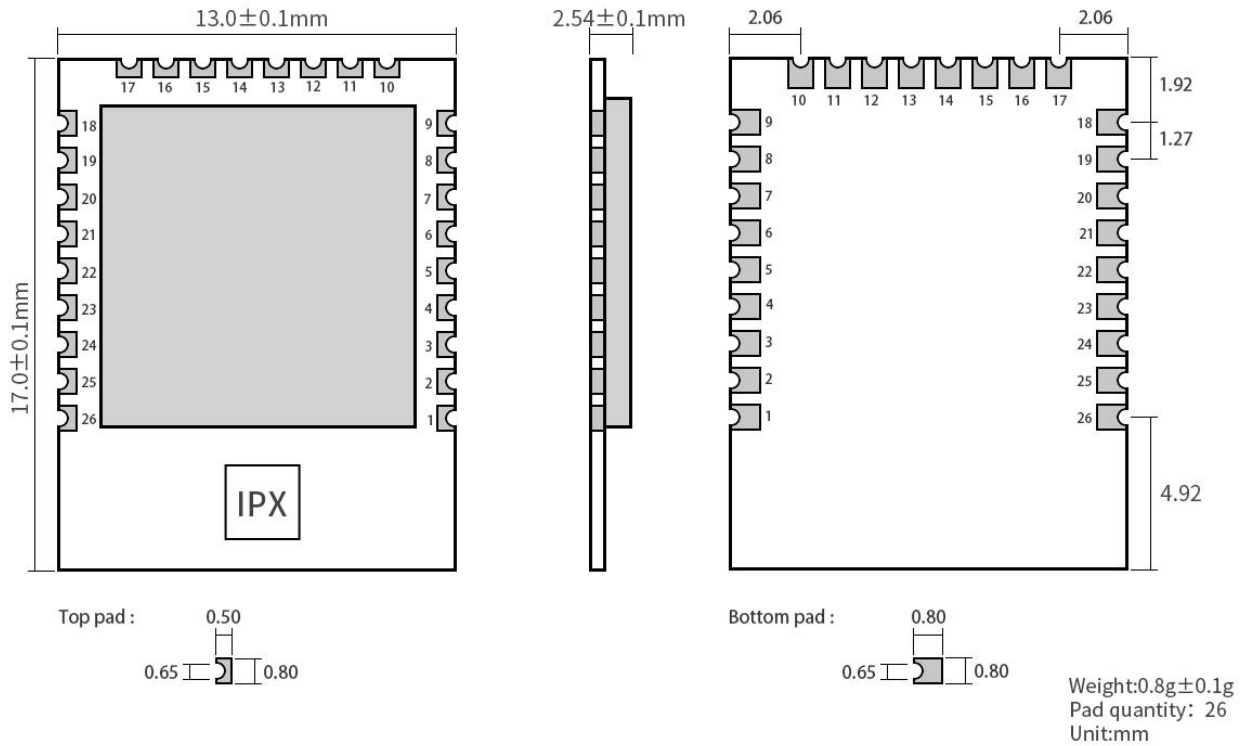
2.2 Operating parameter

Main parameter		Performance			Note
		Min	Typ	Max	
Voltage supply [V]		1.9	3.3	3.6	≥3.3 V ensures output power
Communication level [V]		-	3.3	-	For 5V TTL, it may be at risk of burning down
Operating temperature [℃]		-40	-	+80	
Frequency [MHz]		2400		2483.5	ISM band
Power consumption	Transmitting current（mA）	-	29	-	Instant power consumption
	Receiving current（mA）	-	29	-	-
	Stand-by current(uA)		1.6		
Transmitting power [dBm]		-	8.0	-	-
Receiving sensitivity [dBm]		-88	-92	-97	Air data rate is 1Mbps
Communication rate	GFSK（bps）	--	1M	--	-

Main parameter	Description	Note
Distance	50m	Test condition：clear and open area, antenna height: 2.5m，air data rate: 1Mbps
FIFO	80byte	Max. Transmitting length per packet
Crystal oscillator	16MHz	-
Modulation	GFSK	GFSK Mode
Package	SMD	-
Connector	1.27mm	-
Interface	UART	4800～230400bps
Size	19*13mm	-

Antenna	IPX	50Ω Impedance

2.3 Dimension and Pin Definition



No.	Pin item	Pin direction	Application
1	GND	-	Ground, connecting to power source reference ground
2	PE0	PWM output	Corresponds to green indicator of SIGMESH HSL
3	PE1	PWM output	Corresponds to red indicator of SIGMESH HSL
4	DM	-	GPIO
5	DP	-	GPIO
6	PA0	-	GPIO
7	PA1	-	GPIO
8	PA3	-	GPIO
9	PA4	-	GPIO
10	PA7	-	GPIO
11	SWS	-	Program download interface
12	PB1	-	GPIO
13	PB4	output	Networking indicator, when succeed pin outputs high level
14	PB5	-	GPIO
15	PB6	PWM output	Corresponds to blue indicator of SIGMESH HSL
16	PB7	-	GPIO

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17	TXD	output	UART TX pin for transmitting
18	RXD	input	UART RX pin for receiving
19	VCC	-	Power supply, 1.9V ~ 3.6V (recommend to add external ceramic filter capacitor)
20	GND	-	Ground, connecting to power source reference ground
21	PC5	-	GPIO
22	PC4	-	GPIO
23	PD2	-	GPIO
24	PD3	wake up	To wake up in low power mode and only valid in low level
25	RST	input	Chip reset initiation input pin, valid under low level
26	GND	-	Ground, connecting to power source reference ground

3、 Basic Operation

3.1 Hardware design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible, and the module needs to be reliably grounded;
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure it is within the recommended voltage otherwise when it exceeds the maximum value the module will be permanently damaged;
- Please check the stability of the power supply, the voltage can not be fluctuated frequently;
- When designing current supply circuit, 30% margin is recommended to be remained so as to ensure long-term stable operation of the whole module;
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees;
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done;
- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference.If necessary, appropriate isolation and shielding can be done;
- Try to stay away from some physical layers such as TTL protocol at 2.4GHz , for example: USB3.0;
- The module must not be installed inside metal shield, which will greatly reduce the transmission distance.

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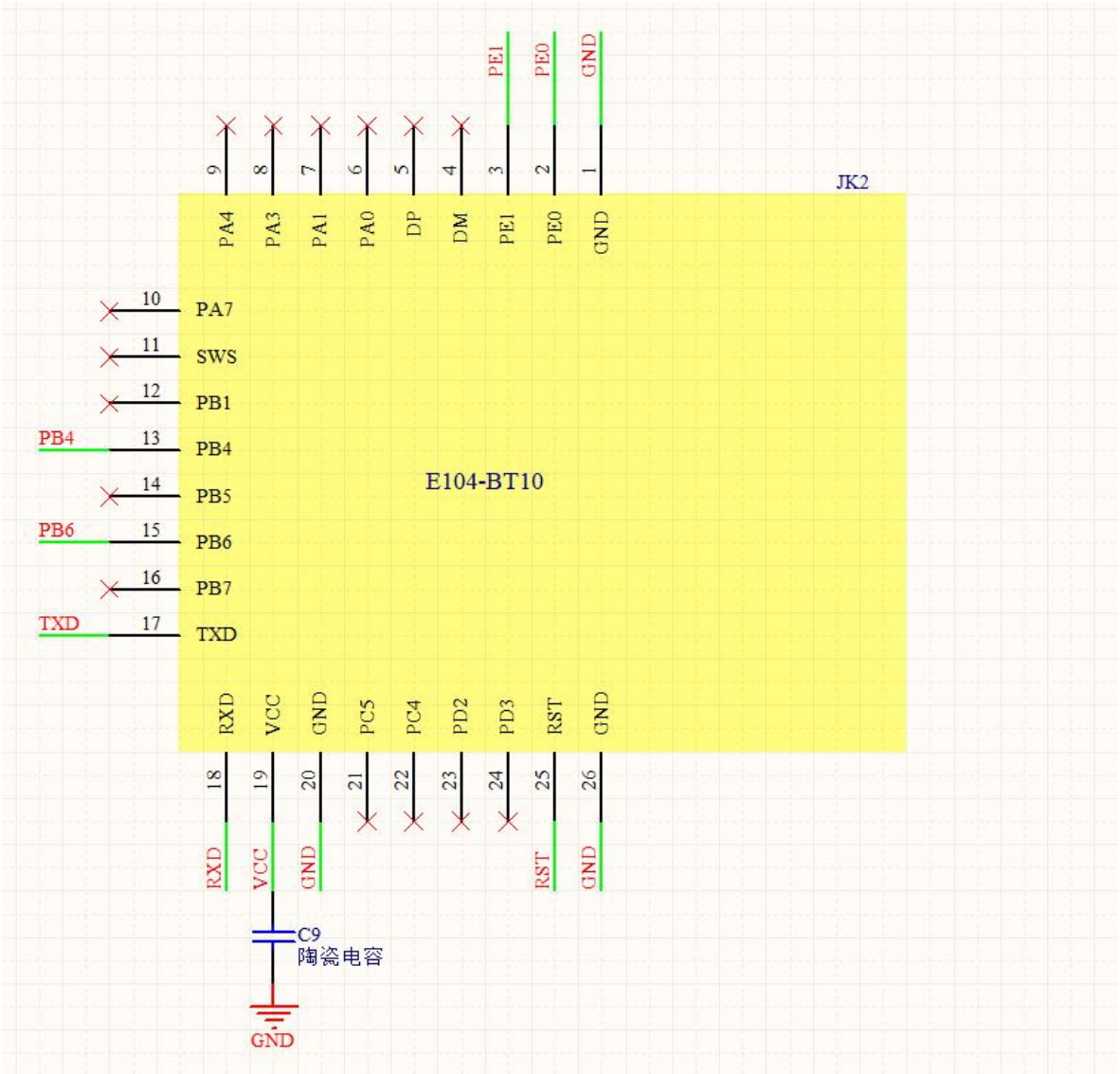
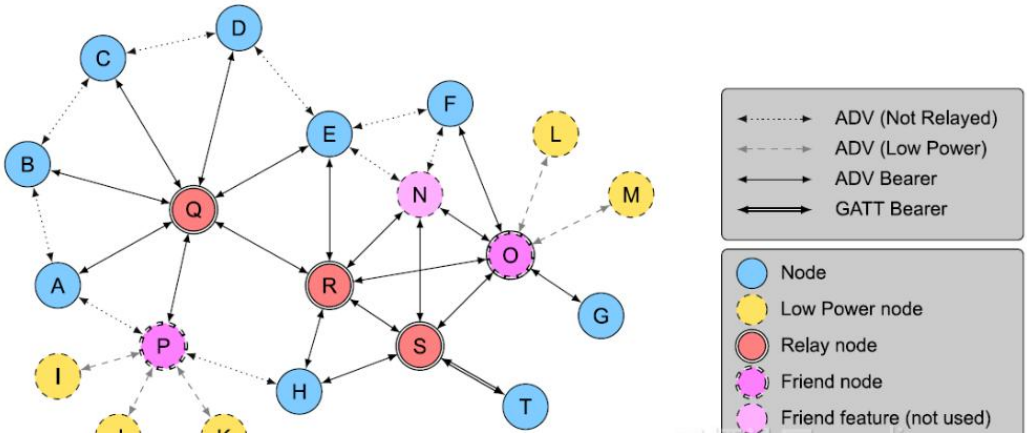
3.2 Circuit Diagram



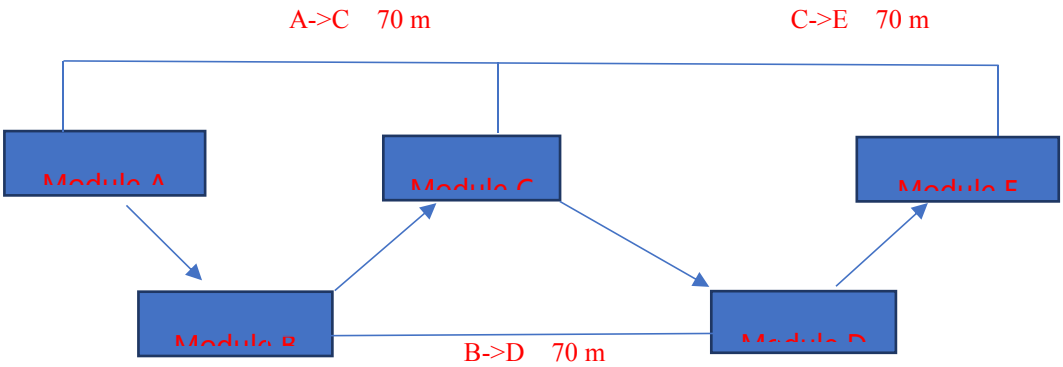
As shown，to connect VCC，GND，TX，RX, then communication test can be conducted.

4、 Function introduction

MESH network is shown as below



The best advantage of this module is that it can repeater any data in the network. Any module works as a repeater. When as a repeater, it can receive data at the same time. The coverage of the module data signal is about 50 meters. The following figure is a function diagram of repeater for user's reference.



Interpret the above simulation application scenario:

The distance from module A to module C is 70 meters, which is beyond the transmission distance of 50 meters of the module. Therefore, the A module cannot directly send data to the C module. If module B is placed between the A module and the C module, then the data will be repeatered by B and then received by C.

Module A needs to send data to the entire network. Modules B, C, D, and E need to receive data from A. Then A module sends data by broadcast address (0XFFFF).

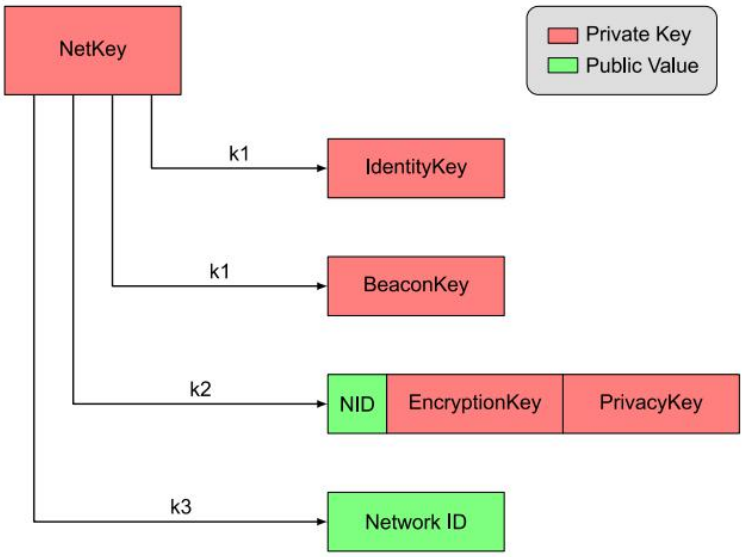
If the A module needs to send the specified data to the E module, just fill in the address of the E module at the address in the data format (see the instruction format for details), but the E module is 140 meters away from the A module, and the data cannot be directly transmitted. As long as these modules belong to the same network, the data will be transmitted to module E with the following link, A sends data to B, B to C, C to D, and D to E.

4.1Basic concept

Here we introduce and explain some words used in SIG mesh.

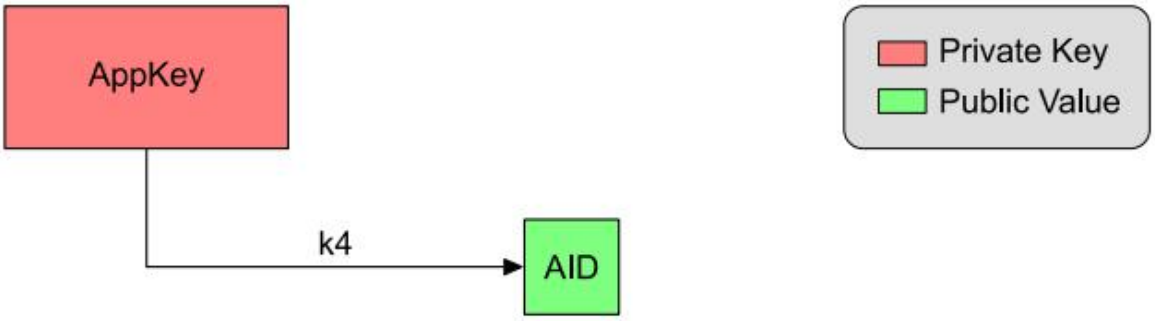
4.1.1 Network Key（NetKey）

Network keys are used to protect network layer communications. It is a key generated using a random number generator that meets the requirements of the core specification.（see details from Mesh Profile3.86）



4.1.2 Application key（AppKey）

Application keys are used to protect the upper transmission layer. Generated using a compatible random number generator, the application key identifier (AID) is used to identify the application key（See details from Mesh Profile3.86）



4.1.3 Device role

In SIG MESH protocol , roles include **node、low power node、relay node、friend node、proxy node. Related functions are as explained below,**

Node： An edge node in the entire mesh network. It has the ability to receive and transmit data, but cannot work as a repeater.

Low power node: Low-power nodes, due to the existence of the friend node, the low-power nodes do not need to always send or listen to the data packets on the broadcast channel, and only need to query whether there is data on the friend node. (not supported at this time)

Relay node： It is the core node of the network layer to extend network coverage. After receiving the data packet sent by other nodes, it determines whether it needs to be forwarded according to the judgment condition of the network protocol.

Friend node：The low power node can establish a friendly connection with the friend node. As the proxy node of the low power node, when the data of the low power node is reached, it can be cached in the Friend node, waiting for the low power node to query and obtain.

Proxy node: A proxy node that accepts information through a bearer layer (broadcast bearer layer or GATT bearer layer) and resends the message through another broadcast bearer layer or GATT bearer layer. It plays a key role in the process of non-mesh low-power Bluetooth devices becoming members of the Bluetooth mesh network. The fundamental purpose of the proxy node is to perform bearer layer conversion. It enables conversion from the broadcast bearer layer to the GATT bearer layer and vice versa. Therefore, devices that do not support the broadcast bearer layer can send and receive various Bluetooth mesh messages through the GATT connection. The E104-BT10N-IPX supports the proxy node function, and the mobile terminal APP can implement mesh network control (the data compression package includes the APP related SDK for the customer to develop).

A single device supports only one role. In EBYTE solution, our module supports two roles: the provisioning node and the mesh node. The provisioning node is the device responsible for networking. The mesh node is the repeater node that sends and receives data and forwards data.

There are four connection methods in SIG_mesh：

1、 ADV（Not Relayed）:That is, there is no connection with the relay capability. This situation applies to the fact that two nodes send and receive messages to each other, but without relay capability, data packets cannot be forwarded.

2、 ADV（Lower power）：That is, a low-power broadcast connection. Used to send and receive data packets between the low power node and the friend node. On this connection, the low power node will initiate a request to establish a connection with the friendship, and query the friend node for its own data packet.

3、 ADV Bearer：Broadcast forwarding connection. The broadcast message can be sent and received between the two nodes based on the broadcast forwarding, and can be forwarded as a relay. (Our products work on this connection)

4、 GATT Bearer：For nodes without ADVbearer capability, they can also participate in the MESH network, and send and receive proxy PDUs on the GATT connection with other nodes through the proxy protocol.

Devices supported include provision and mesh.

Provision node： It is a special node and is the initiator of the entire network. Also known as gateway. It adds unnetworked devices to the mesh network. The Provision node provides provision data to the unprovisioned device, including netkey, appkey, and the unicast address corresponding to each element of the device.

Mesh nodes：plays role of node、relay node 、friend node、proxy node. It is very convenient.

4.1.4 Model

There are many models in SIG MESH. There are three element addresses in the module. Each address can be bound to multiple models. Each row in the table below is a model. The HSL model is specially bound with three addresses for in the HSL model, you need to control the brightness, saturation, and color temperature.

Model name	Model ID	
Health Server	0002	Main address
Health Client	0003	
SIG_MD_FW_UPDATE_S	FE00	
SIG_MD_FW_UPDATE_C	FE01	
SIG_MD_FW_DISTRIBUT_S	FE02	
SIG_MD_OBJ_TRANSFER_S	FF00	
SIG_MD_OBJ_TRANSFER_C	FF01	
Generic OnOff Server	1000	

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Generic Level Server	1002	
Generic Default Transition Time Server	1004	
Generic Power OnOff Server	1006	
Generic Power OnOff Setup Server	1007	
Light Lightness Server	1300	
Light Lightness Setup Server	1301	
Light HSL Server	1307	
Light HSL Setup Server	1308	
VENDOR_MD_OSPF_S（transparent transmission model ID）	00000211	
Generic Level Server	1002	Main address+1
Light HSL Hue Server	130A	
Generic Level Server	1002	Main address+2
Light HSL Saturation Server	130B	

4.1.5 Address (unicast), Element(element)

An address corresponds to an element, and there are three elements, we can call it the element address, which is the unique address assigned to the node by the provision device during the provisioning process. In the same mesh network, each node device may have multiple addresses. However, a model in each device can only have one address, but different models can be bound to one address in the subsequent mesh network communication process. The device is relying on this address to find other devices.

E104_BT10G is for the Provision role.

E104_BT10N is for the node role

4.2 Specific instruction

4.2.1 Networking introduction

E104_BT10 includes E104_BT10G, E104_BT10N， E104_BT10G （provisioner）， E104_BT10N （node），E104_BT10G is the initiator of the whole network and it is unique in the network.

Using E104_BT10G to put E104_BT10N into the netwokr of E104_BT10G. Both E104_BT10G and E104_BT10N are necessary.

4.2.2 Node networking process and status indication

Environment：Serial debugging assistant（baud rate 115200，8N1）

Hardware preparation：one E104_BT10G，one and more E104_BT10N.

Software setting： E104_BT10G need to set netkey，APPkey（see more from command 3.1.1）which need to be set. The

values cannot be the same between different networks, because E104_BT10G will assign netkey to E104_BT10N and bind APPkey when networking.

Networking process steps and results

The formation of the entire network is completely automatic. The user only needs to give the "Add Node to Network" command on the serial port. The networking process takes up to 30 seconds, but usually it takes 10 seconds to 20 seconds to succeed.

Step 1. Start networking.

Use the serial port assistant hexadecimal to send the "device access network" command (see manual 3.1.10). The indicator of E104_BT10G lights up. When it is lit, it means that the process of networking has started. Go to step 2.

Step 2. Scan the surrounding equipment

After our E104_BT10G receives the "Add Node to Network" command, the indicator lights up. At this time, E104_BT10G will search for E104_BT10N devices that can be networked. The search time is 10 seconds. If it is within 10 seconds. If the networkable device is successfully scanned, go to step 3. Otherwise, the E104_BT10G indicator will go out. The serial port will return the error code of the device that has not been scanned to the network (see manual 3.1), and the networking process will end.

Step 3. Assign Netkey

The timeout period for assigning netkey is 10 seconds. If netkey is successfully assigned within 10 seconds, go to step 4. Otherwise, the indicator will go out. The serial port will return the error code for assigning netkey failure (see details from 3.1) and terminate the networking process.

Step 4. Bind Appkey

The timeout period for binding the APPkey is 10 seconds. If the APPkey is successfully bound within 10 seconds, the serial port will return data in the following format.

Length（0B）	Data head（40）	Operation code（09）	MAC(6 byte)	Element address（two byte）	Element quantity（03）
Row： 0B	40	09	EA FD CD BA FE DF	00 04	03

The entire network can be used normally.

If the binding of appkey fails, the serial port returns the error code of binding APPkey or APPkey timeout (see details from 3.1). When the network is finished, E104_BT10G will be restarted. If this happens, please execute manual section 2.3.

The above two error return processing methods can be found in the 2.3

4.2.3 Networking whitelist

The whitelist function is MAC filtering. Our whitelist has a total of 8 levels of depth, that is, MAC filtering for up to eight devices. This function is based on the fact that the eight levels of depth have an index, as long as you go to this. The MAC is written inside, then the index is valid, then this function is enabled. We have the delete command. The user can delete the whitelist and restore the index value to 0. Then the whitelist will not take effect. Network devices can be grouped into the network (see 3.1.7 for details)

4.2.4 Network exception and processing

There are two failure scenarios. Type one: fail to assign netkey; Type two: fail to bind APPkey.

The solution to assign netkey failure is as follows:

To deal with the failure to assign netkey, user needs to repeat the above networking process.

The solution to the failure to bind APPkey is as follows:

Method 1. If the user knows which E104_BT10N device is used, directly restore the E104_BT10N device to the factory (see details from 3.1.17) and repeat the above networking process again.

Method 2: The serial port reads the next networking address "A" of E104_BT10G (see details from 3.1.6), and then uses the SIGmesh command to delete the device whose node address is "A minus 3" (see details from3.2 SIG message), and the above networking process is repeated again.

4.2.5 Remove nodes

The instruction to delete a node can only be sent by E104_BT10G of the current network, and it returns. If it is not deleted, it is not returned.

See the manual (3.2 SIG message) for instructions and usage details.

4.3 Data format

All data exchanged by the serial port, including parameter configuration, network control, and data transparent transmission, meet the following format requirements. Any remaining data will be considered invalid and the module will not respond. The parameter configuration is used for parameter configuration of the current module, the SIG message is a standard mesh control message defined by sig, and the transparent transmission message is defined by Ebyte.

Length（1byte HEX）	Effective load（N byte HEX）
N	Parameter configuration SIG message Transparent transmission message

4.3.1Parameter configuration

The configuration data is used to read and write various parameter information of the module and the device access operation. The format is as follows:

	command（1byte）	**Operation code（1 byte）**	**Data（N byte）**
Transmitting	0xC0	0~255	Request data
Receiving	0x40	0~255	Respond data

Notes: The correct configuration operation gets the corresponding response data. If the configuration error returns an error code, as follows

Error code	Explain
0xFF	Invalid parameter
0xFE	Busy operation

0xFD	Invalid command
0xFC	Networking device not scanned
0xFB	Parameter obtain failure
0xFA	Assign netkey failure
0xF9	Bind Appkey overtime
0xF8	Bind Appkey failure
0XF7	Last networking not finished

1. NetKey configuration

Key is for network ID assigned by provisioner，format is as follows

	Operation code	Parameter
Request	0x00	Configure 16 bytes of NetKey data
Respond	0x00	Return configured 16 bytes of NetKey data
For example	Request：12 C0 00 11223344556677889900112233445566 Respond：12 40 00 11223344556677889900112233445566	
Notes： 1、suitable for E104-BT10G-IPX 2、After configuration, the system will restart once		

2.To read NetKey

	Operation code	Parameter
Request	0x01	/
Respond	0x01	Return configured 16 bytes of NetKey data
For example	Request：02 C0 01 Respond：12 40 00 11223344556677889900112233445566	
Notes：This is for reading configured NetKey		

3.AppKey configuration

	Operation code	Parameter
Request	0x02	Configure 16 bytes of AppKey data
Respond	0x02	Return configured 16 bytes of AppKey data
For example	Request：12 C0 02 11223344556677889900112233445566 Respond：12 40 02 11223344556677889900112233445566	
Notes：		

1、Suitable for E104-BT10G-IPX 2、After configuration, the system will restart once

4. To read AppKey

	Operation code	Parameter
Request	0x03	Read 16 bytes of AppKey data
Respond	0x03	Return configured 16 bytes of AppKey data
For example	Request：02 C0 03 Respond：12 40 02 11223344556677889900112233445566	
Notes： 1、Suitable for E104-BT10G-IPX 2、This is for reading configured AppKey		

5.Networking address configuration

	Operation code	Parameter
Request	0x04	Configure the unicast address for networking next time（2 bytes）
Respond	0x04	Return the currently configured unicast address for networking （2 bytes little-end mode）
For example	Request：04 C0 04 0007 Respond：04 40 04 0700	
Notes： 1、Suitable for E104-BT10G-IPX 2、Configure the unicast address for networking next time		

6.To read networking address

	Operation code	Parameter
Request	0x05	/
Respond	0x05	Return address for networking next time
For example	Request：02 C0 05 Respond：04 40 05 0007	
Notes： 1、Suitable for E104-BT10G-IPX 2、Return address for networking next time		

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7.Networking filter configuration

	Operation code	Parameter
Request	0x06	Serial number +MAC address of allowed device
Respond	0x06	MAC address of allowed device
For example	Request：09 C0 06 00 112233445566 Respond：33 40 06 01 112233445566 00…00（00...00 means space for unbound MAC）	
Notes： 1、Suitable for E104-BT10G-IPX 2、 Return started serial number and joined MAC		

8.To delete networking filter

	Operation code	Parameter
Request	0x07	Serial number to be deleted（1 byte）
Respond	0x07	Serial number +MAC address of deleted device
For example	Request：03 C0 07 00 Respond：33 40 07 00 1234567890AB 00…00（00...00 means space for unbound MAC）	
Notes： 1、Suitable for E104-BT10G-IPX 2、 Return deleted serial number and MAC		

9.To read networking filter

	Operation code	Parameter
Request	0x08	/
Respond	0x08	Return started serial number and joined MAC
For example	Request：02 C0 08 Respond：33 40 08 01 112233445566 00…00，00…00（means space for unbound MAC）	
Notes： 1、Suitable for E104-BT10G-IPX 1、Return started serial number and MAC		

10.Device enters network

	Operation	Parameter

	code	
Request	0x09	/
Respond	0x09	Return MAC of networking device and assigned unicast address and element numbers
For example	Request：02 C0 09 Respond：0B 40 09 112233445566 0004 03	
Notes： 1、Suitable for E104-BT10G-IPX 2、Return MAC of networking device and assigned unicast address and element numbers		

11.Baud rate configuration

	Operation code	Parameter
Request	0x0E	Baud rate serial number to be configured（range: 0x00~0x07）
Respond	0x0E	Return the current baud rate serial number
For example	Command	Baud rate serial number notes
	03 C0 0E xx	Xx is baud rate serial number to be configured（0x00~0x07） 00：230400 01：128000 02：115200 03：76800 04：57600 05：19200 06：9600 07：4800
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX 2、For example 3 C0 0E 02，when succeed, return 03 40 0E 02, if exceed range, return 03 40 0E FF		

12. To read baud rate

	Operation code	Parameter	
Request	0x0F	/	
Respond	0x0F	Return the current baud rate serial number	
For example	Command	Return	Notes
	02 C0 0F	03 40 0F xx	Xx is baud rate number 00：230400 01：128000

			02：115200 03：76800 04：57600 05：19200 06：9600 07：4800
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX			

13.Power configuration

	Operation code	Parameter
Request	0x12	Power number to be configured（range:0x00~0x0A）
Respond	0x12	Return configured power number
For example	Command	Notes
	03 C0 12 xx	Xx is baud rate serial number to be configured（0x00~0x0A） 00：+8dBm 01：+4dBm 02：0dBm 03：-4dBm 04：-10dBm 05：-14dBm 06：-20dBm 07：-24dBm 08：-28dBm 09：-30dBm 0A：-37bBm
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX		

14.To read power

	Operation code	Parameter	
Request	0x13	/	
Respond	0x13	Return the current power number	
For example	Command	Return	Notes
	02 C0 13	03 40 13 xx	Xx is power number 00：+8dBm 01：+4dBm 02：0dBm 03：-4dBm

			04：-10dBm 05：-14dBm 06：-20dBm 07：-24dBm 08：-28dBm 09：-30dBm 0A：-37bBm
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX			

15.To read MAC

	Operation code	Parameter
Request	0x11	/
Respond	0x11	Return current MAC address of device
For example	Request：02 C0 01 Respond：08 40 F0 112233445566	
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX		

16.To restart device

	Operation code	Parameter
Request	0x14	/
Respond	0x14	Return operation status value
For example	Request：02 C0 14 Respond：03 43 14 00	
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX 2、Status value 00 means succeed		

17.Restore factory setting

	Operation code	Parameter
Request	0x15	/
Respond	0x15	/
For example	Request：02 C0 15 Respond：03 43 15 00	
Notes：		

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1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX 2、Status value 00 means succeed

18. To obtain software version number

	Operation code	Parameter
Request	0x16	/
Respond	0x16	software version number
For example	Request：02 C0 16 Respond：04 40 16 10 00	
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX 2、software version number is an unique value		

19.To obtain main address of current device

	Operation code	Parameter
Request	0x0B	/
Respond	0x0B	Return main address of current E104-BT10N-IPX device
For example	Request：02 C0 0B Respond：05 40 0B 01 0004	
Notes： 1、Suitable for E104-BT10G-IPX and E104-BT10N-IPX 2、return unicast address of E104-BT10N-IPX device in current network		

20. Set whether enter sleep and timeout for entering sleep

	Operation code	Parameter
Request	0x17	/
Respond	0x17	Set whether E104-BT10N-IPX enter sleep and timeout for entering sleep
For example	Request：03 c0 17 05 Respond：03 40 18 05	
Notes： 1、 Suitable for E104-BT10N-IPX 2、 Set parameter 05 to the sleep timeout after the serial port stops working.， unit: S, range: 0X01-0XFF， parameter 00 means do not enter sleep.		

21. Query whether enter sleep and timeout for entering sleep

	Operation code	Parameter
Request	0x18	/
Respond	0x18	Query whether E104-BT10N-IPX enter sleep and timeout for entering sleep
For example	Request：02 c0 18 Respond：03 40 18 05	
Notes： 1、 Suitable for E104-BT10N-IPX 2、 Query parameter 05 for the sleep timeout after the serial port stops working，unit : S, range: 0X01-0XFF，		

4.3.2 SIG Message

E104-BT10 supports SIG generic model and Lighting HSL model control (refer to Mesh Profile and Mesh Model for details about SIG message).SIG message follows format below：

Transmitting			
Command（1 byte）	**Target address（2 byte）**	**Sig mesh message**	
0xC1	Main address of target device	Request	
Receiving			
Command（1 byte）	**Target address（2 byte）**	**Original address（2 byte）**	**Sig mesh message**
0x41	Main address of target device	Main address of original device	Respond

For example：1、Generic onoff control：

Control device with main address 0004, outputting high level without latency	
Request	09 C1 0004 8202 01000000
Respond	08 41 0004 0001 8204 01
Control device with main address 0004, outputting low level without latency	
Request	09 C1 0004 8202 00000000
Respond	08 41 0004 0001 8204 00

2、Delete node control：

Remove nodes with main address 0004 out of current network（E104-BT10G-IPX starts control）	
Request	09 C1 0004 8202 01000000
Respond	08 41 0004 0001 8204 00

4.3.3 Transparent transmission

E104-BT10-IPX supports transparent transmission of user data. The maximum length of serial port sub-package is 80 bytes. (Mesh under-transport single-package maximum payload is 8 bytes. Data larger than 8 bytes will be automatically sub-packet and sent. The whole mesh network efficiency is not high in packet transmission. it is recommended to send data within a single limit of 8 bytes), the data format is as follows:

Transmitting			
Command（1 byte）	**Target address（2 byte）**	**Data**	
0xC2	Main address of target device	Valid data	
Receiving			
Command（1 byte）	**Target address（2 byte）**	**Original address（2 byte）**	**Data**
0x42	Main address of target device	Main address of original device	Valid data

For example：device 0001 send hex data “00112233445566778899” to device 004

Transmitting	09 C2 0004 00112233445566778899
Receiving	08 42 0004 0001 00112233445566778899

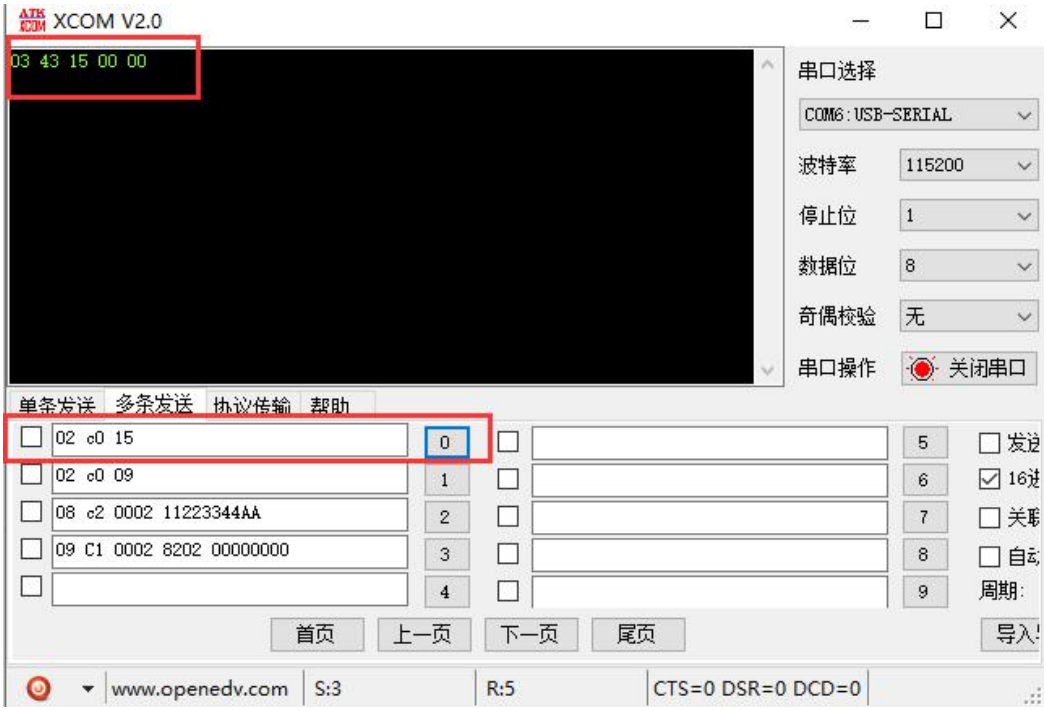
5、Quick start

This chapter introduces how E104-BT10-IPX forms network， and how to control transmitting and receiving of network message.

5.1 Restore factory setting

Send the following command 02 C0 15 (Restore factory setting) Then there are a return, 03 43 15 00 (sometimes the value returned after restarting or restoring the factory may be one more byte, ignore it. See the FF of the mesh device as shown below)

Baud rate: 115200, 8N1, do not press enter to start new line.



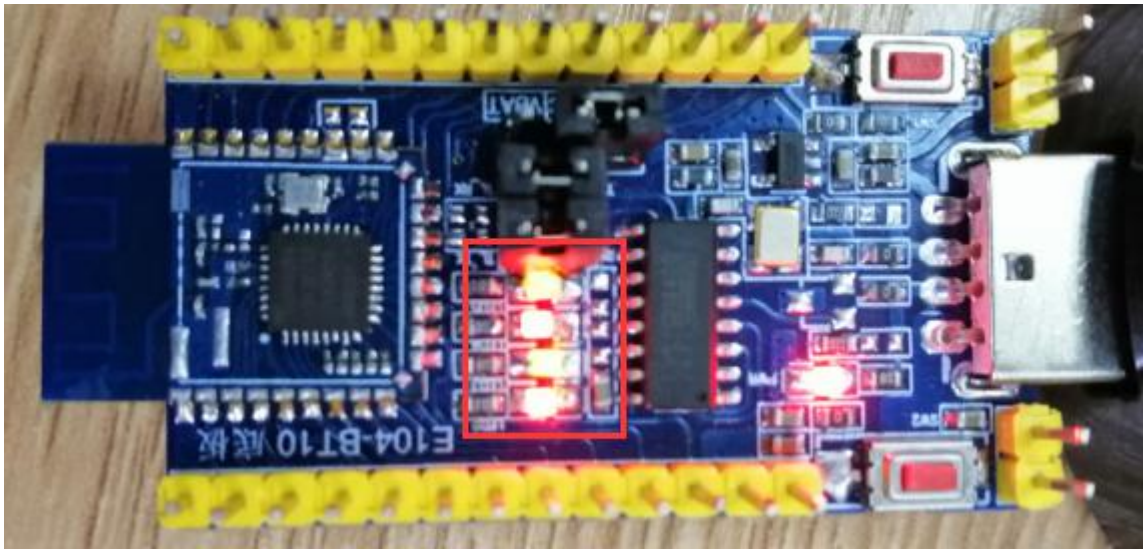
5.2 Enter network

E104-BT10G-IPX test board and E104-BT10N-IPX are respectively plugged into the computer USB interface (PC needs to install USB serial drive, see the data compression package), open the serial debugging assistant to select the baud rate 115200bps, 8 data bits, no parity, 1 stop bit, select hexadecimal transmission. The E104-BT10G-IPX terminal edits and sends the "Device Access" command 02 C0 09. When E104-BT10N-IPX enters the network successfully, the indicator light is constant. E104-BT10G-IPX receives 0B 40 09EAFD CDBAFEAD 0007 03, where EAFDCDBAFEAD indicates successful network access equipment. The MAC address 0007 indicates the device's main address (see 2.3 for the format description). The device is successfully connected to the network.

5.3 SIG Message

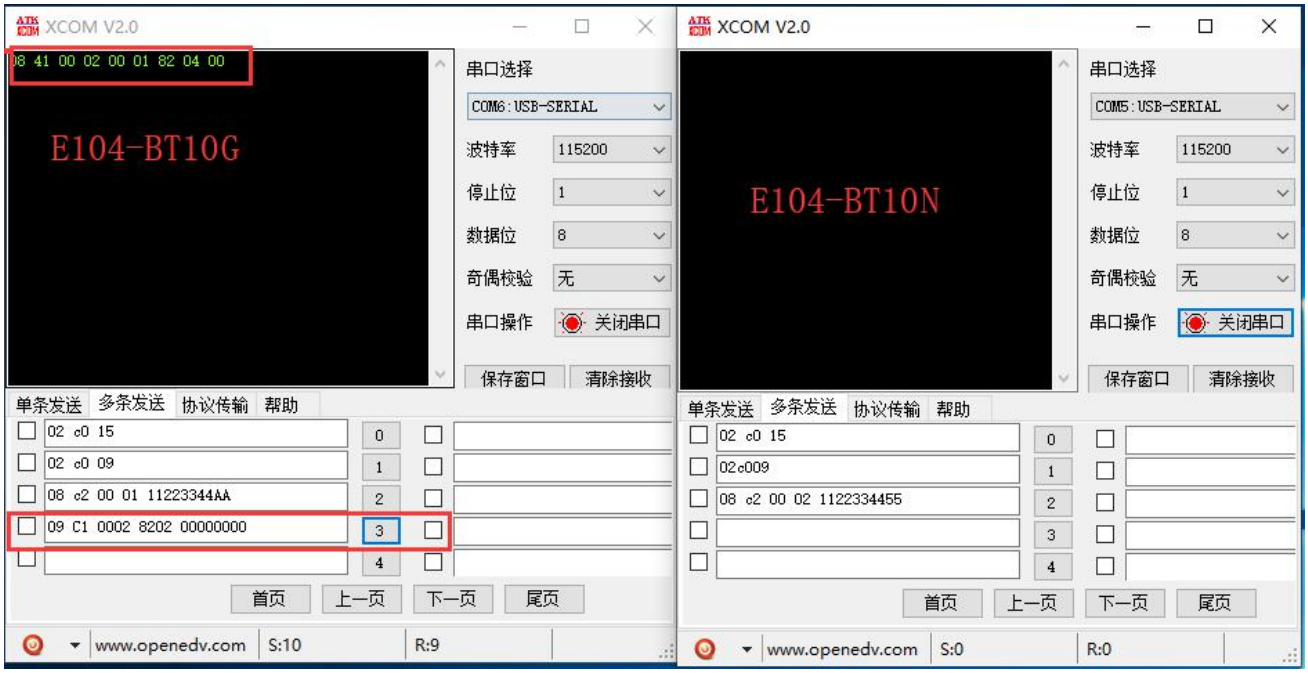
E104-BT10G-IPX send command to turn on light（generic onoff command）see details from 3.2（see details from Mesh Model 3.2.1.2 Generic OnOff Set）

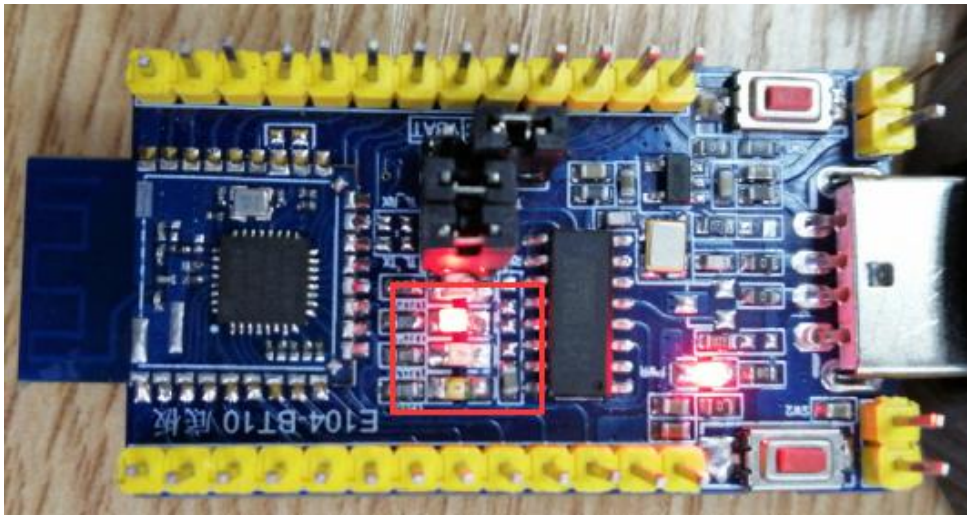
Transmitting	09 C1 0004 8202 01000000
Respond	08 41 0004 0001 8204 01



E104-BT10G-IPX send comand to turn off light（generic onoff command）see details from 3.2（see details from Mesh Model 3.2.1.2 Generic OnOff Set）

Transmitting	09 C1 0004 8202 00000000
Respond	08 41 0004 0001 8204 00





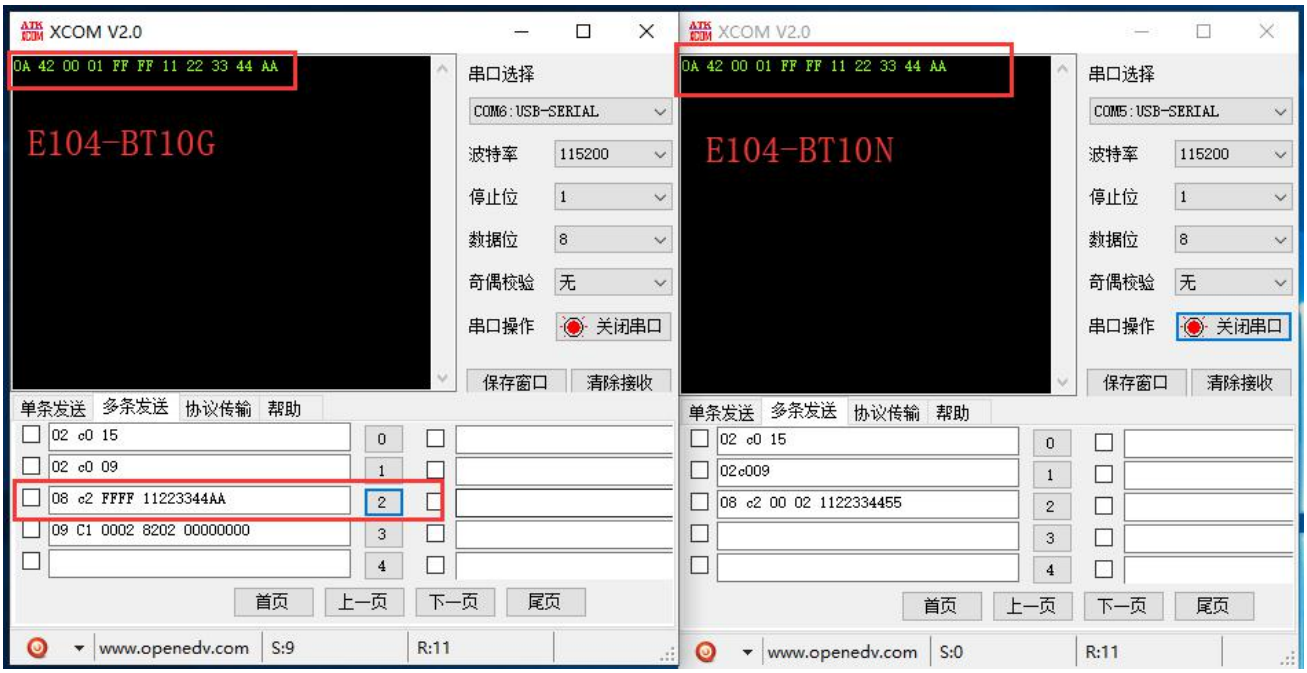
5.4Transparent transmission

5.4.1 Broadcast transmission

Device 0001 broadcasts “11223344AA” in hex format

See 3.3， input target address as FFFF ， all device in the network can receive data

Transmitting	08 c2 FFFF 11223344AA
Receiving	08 0A 42 0001 FFFF 11223344AA

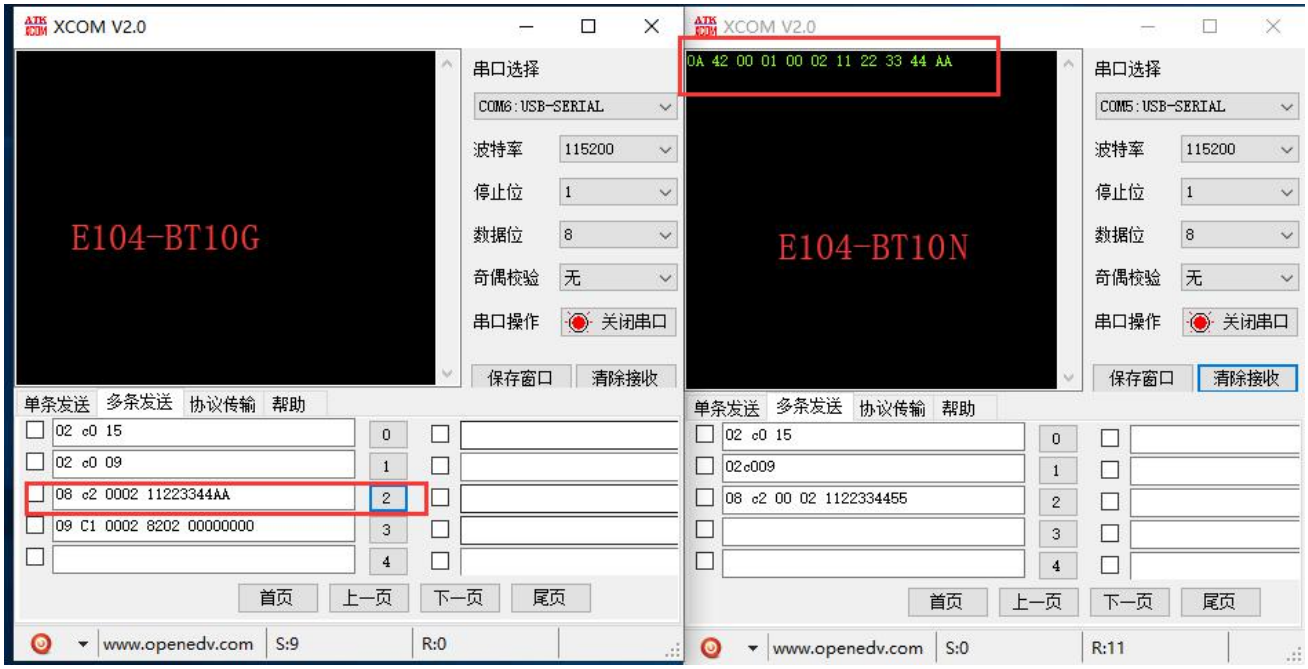


5.4.2 Fixed point transmission

For example：Device 0001 sends “11223344AA” in hex format to device 001

See details from 3.3

Transmitting	08 c2 0002 11223344AA
Receiving	08 0A 42 0001 FFFF 11223344AA



5.5 Low power

Entering the sleep mode (refer to 4.3.1.20-4.3.1.21) requires configuration parameter instructions. It can be awakened by setting the 24 pin low, or it can be awakened by sending any data through the serial port (wake data will be discarded).

6、FAQ

6.1 Communication range 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.
- Seawater 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).
- When the power supply at room temperature is lower than the recommended low voltage, the lower the voltage is, the lower the transmitting power is.

6.2 Module is easy to damage

- Please check the power supply and ensure it is within the recommended range. Voltage higher than the peak will lead to a permanent damage to the module.
- Please check the stability of power supply and ensure the voltage not to fluctuate too much.
- Please make sure anti-static measures are taken when installing and using, high frequency devices have electrostatic susceptibility.
- Please ensure the humidity is within limited range for some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

6.3 Bit error rate is too high

- When there are co-channel signal interference nearby, be away from interference sources or modify frequency and channel to avoid interference;
- The clock waveform on the SPI is not standard. Check whether there is interference on the SPI line. The SPI bus should not be too long.
- Unfavorable power supply may cause messy code. Make sure that the power supply is reliable.

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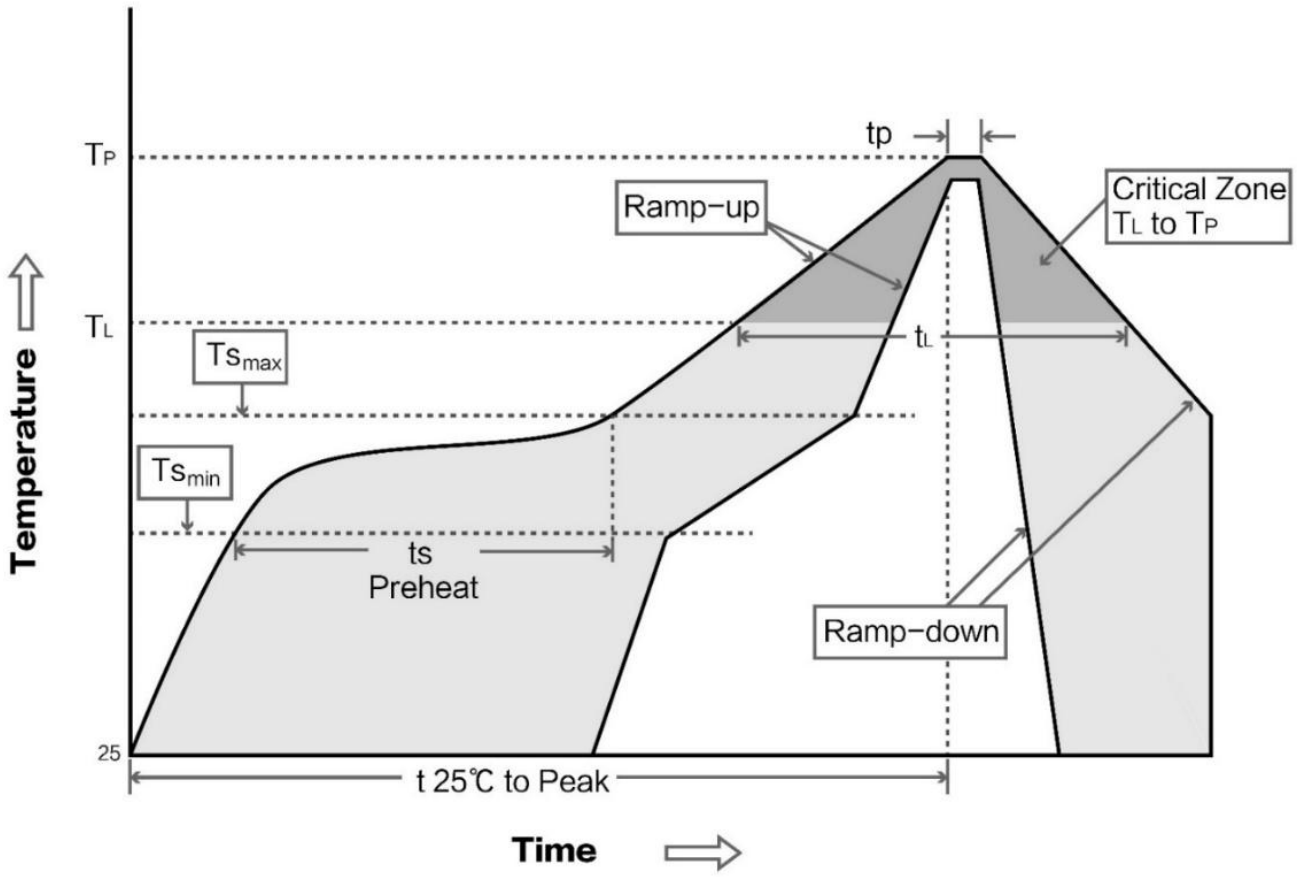
7、Production Guidance

7.1 Reflow Soldering Curve

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

7.2 Reflow Soldering Curve



8、Series product

Model	IC	Frequency	TX power	Distance	Size	Package	Interface
		Hz	dBm	m	mm		
E104-BT10	TLSR8269F512	2.4G	8	50	19*13	SMD	TTL

Revision history

Version	Date	Description	Operator
1.0	2019-4-12	Initial Version	-
1.2	2019-11-11	Function update	Ren

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