E180-Z6907A User Manual

TLSR8269 2.4GHz ZigBee

SoC Wireless Module

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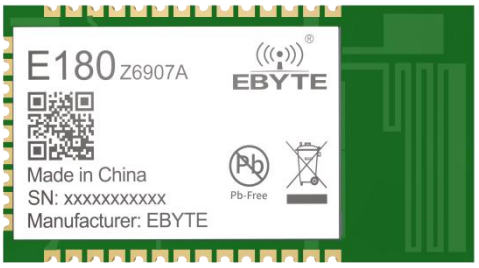
1. Overview

1.1 Brief introduction



E180-Z6907A is a small-sized, low power consumption, high reliability, ZIGBEE module operating in the 2.4GHz frequency band based on TELINK TLSR8269 wireless SOC, which is designed and produced by Chengdu Ebyte . The chip comes with a 32-bit high-performance MCU up to 48Mhz. The transmit power can reach up to 7dBm.

TLSR8269 is a wireless microcontroller for smart home, IoT transformation and industrial automation. Its network characteristics belong to ZIGBEE 3.0 standard and provide a complete application integration solution based on IEEE802.15.4 standard ISM band.

E180-Z6907A was certified by a series of authoritative RF instruments, combined with years of market experience and the actual needs of users in this industry, it integrates the extremely complex communication protocols of wireless products into the built-in SoC, supports serial port transparent transmission mode, It also integrates self-organizing network function, provides multi-channel configurable ADC, IO, PWM interface.

1.2 Features

- Centralized network management: ZIGBEE 3.0 security standard centralized network access mechanism, data security and reliability;
- Interoperability: Compliant with zigbee 3.0 standard network mechanism, compatible with network protocols such as ZHA;
- Large capacity: 512K flash, 32K RAM, network nodes can be extended to more than 100;
- Role switch: Users can switch freely between the end-device and sleep- end-device via UART command.
- Support a variety of network topology: point-to-point, star network, MESH network;
- Network self-healing: when network intermediate nodes are lost, other networks automatically join or maintain the original network;
- Address search: User can find the corresponding short address according to the MAC address of the added network node, and can also find the corresponding long address of each node in network according to the short address of the node;
- Data security: Integrated with ZigBee 3.0 security communication standard, the network contains multi-level security keys;
- UART configuration: Module built-in UART commands, users can configure (view) the parameters and functions of module via UART command.
- Change network PAN_ID: Network PAN_ID switch freely. Users can define PAN_ID to join the corresponding network by themselves or automatically select PAN-ID to join the network.
- GPIO control: Local/remote GPIO level control，there are 3 IO for users to select.
- PWM control :Local/remote PWM control function，there are 4 PWM channels for users to select.
- ADC control: Read local/remote ADC, there are 5 ADC channels for users to select.

- Onekey recovery of baud rate: The module supports onekey recovery of baud rate when users forget the baud rate. The baud rate is 115200(default).
- Serial port receiving wake-up: Support serial port receiving wake-up function. When the module is in sleep state, it will wake up when receiving a frame of data less than or equal to 10 bytes. This data is wake-up frame used for wake-up module and will not be treated as data processing;
- Module restore: Users can restore the module via UART commands.
- Recover factory setting: Users can recover the factory setting via UART commands.
- Configuration over air: Users can use the configuration over air command to remotely configure other devices in network.

1.3 Device type introduction

There are four types of logical devices in ZigBee Network: Coordinator, Router, End-Device, and Sleep-End-Device. A ZigBee network consists of one Coordinator and multiple Routers and multiple End-Devices (the end nodes can be divided into Sleep-End-Device and End-Device).This product only supports End-Device (non-sleep end) and Sleep-End-Device (sleep end) two device types, Coordinator and Router two types use E180-ZG120A / B products from our company.

1.3.1 End-Device

The main task of the device is to send and receive messages, and other nodes are not allowed to connect with the devices. The End-device is always in working state, and can receive and transmit data at any time.

1.3.2 Sleep-End-Device

The Sleep-End-Device enters the sleep state when there is no data receiving and sending, and the sleep current is as low as about 16uA.

When wireless data transmission or command operation is needed, wake-up frame shall be sent through serial port first, and the length shall be 10 bytes (it is recommended to wake up with “FF FF FF FF FF FF FF FF FF FF” 10 bytes of "FF"). , The wake-up time lasts for the Uart_holdtime time, during which the serial port data (configuration command, payload) can be processed. When a frame of serial port data is successfully received, the wake-up timeout counter will be refreshed, and the wake-up duration will go further by Uart_holdtime, otherwise the device will go to sleep again. Uart_holdtime defaults to 1000ms and supports HEX command to change its value.

Sleep terminal wakeup can also be awakened through the function pin WAKE. WAKE defaults to high level. Pull down the WAKE pin to wake up the module continuously, and release the WAKE pin to restore the default high level and the module resumes sleep.

When there is data needs to be received, it is received through periodic wake-up. The longer the wake-up cycle is set, the later the reception will be. The wake-up cycle must be set less than 30 seconds. If you only need to upload data, you can set the wake-up cycle to be greater than 30 seconds or longer to reduce power consumption (default is 5 minutes), such as battery powered sensors.

1.4 Application

- Smart home and industrial sensors；
- Security system and positioning system;
- Wireless remote control, UAV;
- Wireless game remote control;
- Health care products；
- Wireless voice, wireless headphones；
- Meter reading architecture (AMI);
- Automotive industry applications;
- Building automation solutions;
- Automation application of agricultural greenhouse.

2. Technical parameter

2.1 Limit parameter

Main parameter	Performance		Remark
	Min	Max	
Voltage supply（V）	1.9	3.6	nanent damage to module
Blocking power（dBm）	-	10	Chances of burn is slim when modules are used in short distance
Working temperature（℃）	-40	+85	Industrial grade

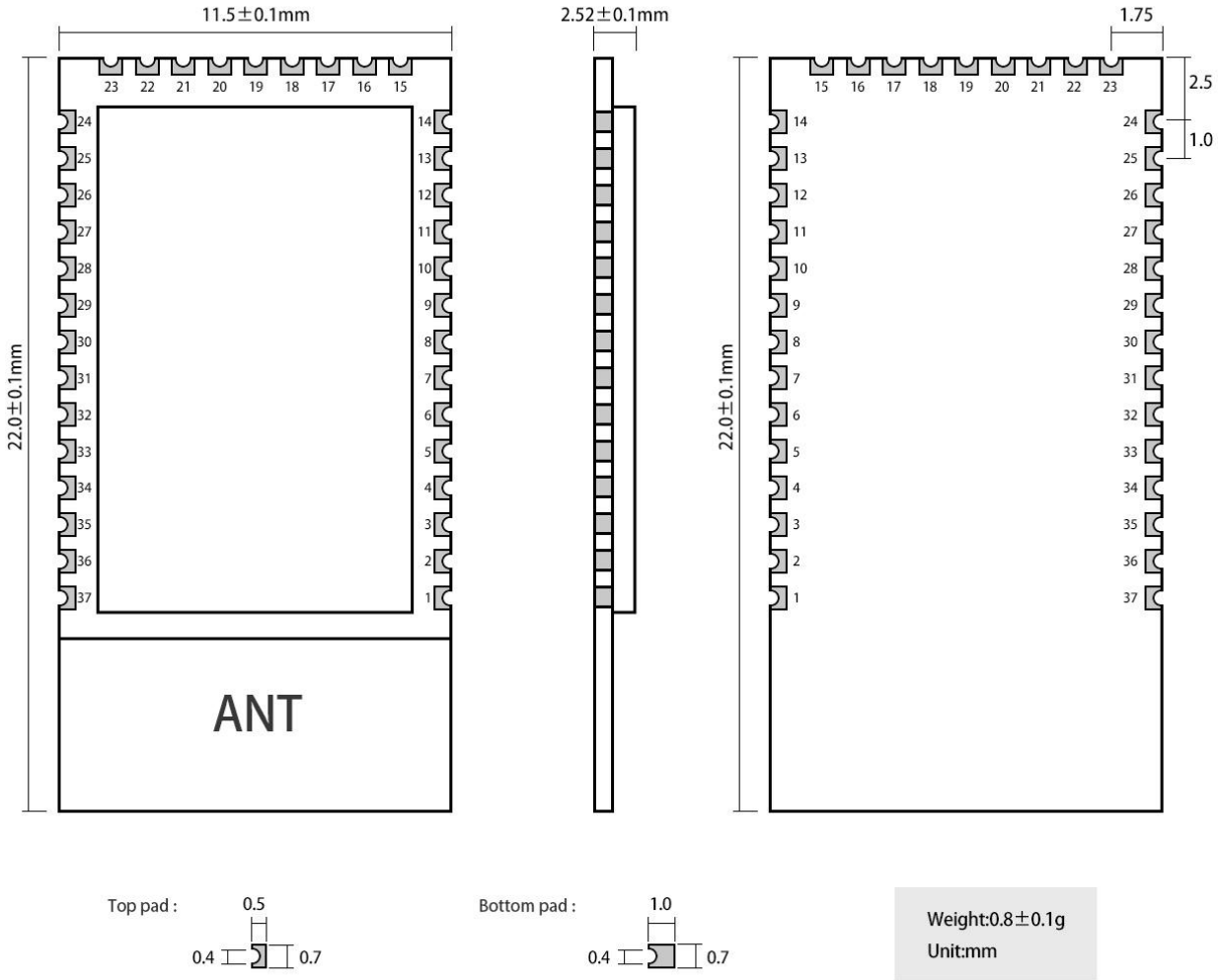
2.2 Operating parameter

Main parameter		Performance			Remark
		Min.	Typ.	Max.	
Operating voltage（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
Working temperature（℃）		-40	-	+85	Industrial design
Frequency（MHz）		2405	-	2480	Support ISM band
Po we r co	TX current（mA）		40		Instant power consumption
	RX current（mA）		35		
	Sleep current（μA）		16.5		Software shutdown

nsumption					
Max Tx power（dBm）			7		
Air data rate（bps）			250kbps		

Main parameter	Description	Remark
Distance for reference	130m	Between two points (ZigBee network supports routing multi hop function, and the transmission distance can be extended by increasing the router).
Protocol	Zigbee 3.0	
Packing	SMD	
Connector	1.27mm	Stamp hole
IC	TELINK TLSR8269	
FLASH	512KB	
RAM	32KB	
Core	32 bit MCU	
Size	11.5*22mm	
Antenna	PCB	50 ohm impedance

3. Size and pin definition



Pin No.	Pin item	Pin direction	Application
1	NC	-	Reserve，floated
2	GND	-	Ground, connected to power supply reference ground
3	PD2	Input	Reserve
4	PC4	Input	WAKE pin is mainly used to wake up the sleeping terminal. It is high level when power is on. When the pin is pulled low externally, the sleeping terminal device will be woken up.
5	TX	Output	UART TX pin
6	RX	Input	UART RX pin
7	NC	-	Reserve，directly suspended
8	NC	-	Reserve，directly suspended

9	PD3	Input	Working mode switching pin. When the pull-down time is longer than 500ms, the working mode is switched.
10	PE2	Input	UART_BAUD_RESET pin is used to reset the device baud rate. The power-on default is high level. In any mode, if this pin is pulled lower for more than 1000ms, the serial port parameters of the module will be restored to the default 115200.
11	PE0	Output	ACK pin is used to indicate the last user data transmission status. This pin is pulled low before the transmission is started, and the pin is pulled high after the transmission is successful.
12	PE3(GPIO0)	Input/Output	GPIO input/output port 0
13	VCC	-	Module power supply positive reference voltage, voltage range
14	GND	-	Ground, connected to power supply reference ground
15	PA1(GPIO1)	Input/Output	GPIO input/output port 1
16	NC	-	Reserve，floated
17	NC	-	Reserve，floated
18	PA7	Output	AUX pin indicates the current working status of the device. When the pin is low level, it indicates that the device is busy, and high level indicates that the device is idle.
19	PE1(GPIO2)	Input/Output	GPIO input/output port 2
20	NC	-	Reserve，floated
21	PB1(ADC1)	Input	ADC detection port 1
22	PB5(ADC2)	Input	ADC detection port 2
23	PB6(ADC3)	Input	ADC detection port 3
24	PB7(ADC4)	Input	ADC detection port 4
25	NC	-	Reserve，floated
26	SWS	-	Reserve
27	PB4(PWM0)	Output	PWM output port 0
28	PA3(PWM2)	Output	PWM output port 2
29	PC5(PWM3)	Output	PWM output port 3
30	PA4	Output	LINK pin shows current network state, high level means access to network
31	NC	-	Reserve，floated
32	PA0(PWM1)	Output	PWM output port 1
33	NC	-	Reserve，floated
34	NC	-	Reserve，floated
35	NC	-	Reserve，floated
36	GND	Input/Output	Ground, connected to power supply reference ground
37	nRESET	Input	Reset pin

4. Operation mode

4.1 Transmission mode

When the module enters the transmission mode, any data received by the serial port will be sent out by wireless. The transmission mode is wireless communication between network nodes, including unicast, broadcast, multicast, etc.

4.2 Configuration mode

When the module enters the configuration mode, the data received by the serial port defaults to the configuration command, which configures and operates the function of the device. In the configuration mode, the data received by the serial port is regarded as the hex command.

4.3 Mode switch

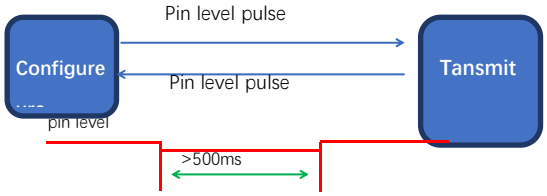
4.3.1 Command switch

The module power on initialization defaults to the transmission mode

In transmission mode, when the serial port receives "2A 2D 2E" character, it will enter the configuration mode. After entering the configuration mode successfully, it will return "7A 7D 7E " character. In configuration mode, when the serial port of the module receives "2F 2C 2B " character, the module exits the configuration mode and enters the transmission mode, and returns "7F 7C 7B" character after entering the transmission mode successfully.

4.3.2 Pin switch

Working mode switch pin PD3, internal configuration pull-high resistance input mode, power on default high level, in any mode, when mode switch pin PD3 is pulled low more than 500ms, the module working mode switch, as shown in the figure below:



5. Transmission mode

5.1 Data transmission mode

The data transmission mode includes unicast, broadcast and multicast.

5.1.1 Broadcast mode

In broadcast mode, the sending device sends the data received by the serial port to each node in network (not Sleep-End-device), and all non-sleeping devices in network will receive data.

5.1.2 Multicast mode

In multicast mode, first set the group number (for grouping) for the devices in network. The sending device must specify the target group number (to which group to send the data). Then the sending device will send the data received by the serial port to the network, and the devices with the same group number (not Sleep-End-device) in network will receive the data.

5.1.3 Unicast Mode

In unicast mode, devices in network point to point communicate through network address , and the transmitting device sends the received serial port data to the target address device, and the target address device can return an ACK to the transmitting device to indicate that the data has been received after receiving the data. .(ACK function is not available in sleep Sleep-End-device node)

5.2 Receiving data output method

The receiving data output mode refers to a manner in which the serial port outputs data after the module receives the wireless data;

5.2.1 Transparent output

If the output mode of the configuration device is transparent output, the module will output the original data through the serial port after receiving the wireless data;

5.2.2 Data + short address

When the output mode is data + short address, after receiving the wireless data, the serial port will output the

original data + the short address of the sending device;

5.2.3 Data+Long address

When the output mode is data + long address, after receiving the wireless data, the serial port will output the original data + the long address of the sending device;

5.2.4 Data+RSSI

When the output mode is data + RSSI, after the module receives the wireless data, the serial port will output the original data + receive the RSSI value of the data packet;

5.2.5 Data+short address+RSSI

When the output mode is data + short address + RSSI, after receiving the wireless data, the serial port will output the original data + the short address of the sending device + the RSSI value of the received data packet;

5.2.6 Data+long address+RSSI

When the output mode is data + long address + RSSI, after receiving the wireless data, the serial port will output the original data + the long address of the sending device + the RSSI value of the received data packet;

Note: The maximum packet length supported by the sender for a single packet is 72 bytes.

6.Application function and command configuration

6.1 Function pin

6.1.1 LINK

LINK pin indicates the current network status, after the device is successfully connected to the network, the current pin is pulled high. When the device has no network or the parent node is lost, this pin is pulled low. The external device can query the device network status through the pin level.

6.1.2 WAKE

The WAKE pin is mainly used to wake up the dormant terminal. It defaults to a high level when it is powered on. When the pin is externally pulled down, the dormant terminal device will continue to be awakened. When the pin is released externally, it will return to high level and enter sleep; Sleep time is determined by the duration of the external

pull down of this pin; for non-sleeping devices, this pin is meaningless;

6.1.3 AUX

The AUX pin indicates the current working status of the device. When the pin is low, the device is busy; when the pin is high, the device is idle; when the device receives data, the module will pull the AUX pin low after AUX_delaytime, and the serial port will start outputting Data, used to wake up the external control device, AUX_delaytime is 4ms by default, which can be changed by the serial port command, and the customer can decide according to the wake-up time of the main chip;

6.1.4 ACK

ACK pin is used to indicate the status of the last user data transmission, The pin is pulled low before the transmission is started. After the transmission is successful, the pin is pulled high. Users can judge whether the data is successfully arrived by the status of the pin. This pin function does not instruct the coordinator to send a broadcast message(Only works in non-Sleep-End).

6.1.5 UART_BAUD_RESET

UART_BAUD_RESET pin is used to reset the baud rate, The default level is high when the device is powered on. In any mode, the pin of the module is pulled low for more than 1000ms. The serial port parameters will be restored to the default 115200 and 8N1.

Function pin	Pin port
LINK	PA4
WAKE	PC4
AUX	PA7
ACK	PE0
UART_BAUD_RESET	PE2

6.2 Wireless remote configuration function

The module supports remote configuration function. The 2-byte wireless configuration ID is identified by A8 8A by default. Users can modify the remote configuration ID. When the first two bytes of wireless air data received by the module are wireless configuration ID, the module judges that the data packet is a remote configuration command and executes the corresponding command operation. The data packet will not be output through the serial port. Remote configuration of Sleep-end -device needs to wake up first.

6.3 Functional parameter description

The module provides a wide range of configurable parameters that can be flexibly adapted to the actual application needs to build different forms of network.

Configuration information	Attribute	Parameter range	Function Description
PANID	Read/write	0x0000～0xFFFF	The PANID is the network identifier of ZIGBEE and is used to determine the identity of the network to which it belongs. All devices in the same network must have the same PANID. When the end-device or router is configured as 0xFFFF, it can join any network that already exists on the same channel；
Local network address	Read	0x0000～0xFFFF	It is used to distinguish each node in network. Each device is in the same network. The local network address must be unique. When the network is not added, the network address of the device is 0xFFFF. After joining, the short address of the device is allocated by the coordinator. The coordinator is fixed at: 0x0000;
Network status	Read	0、2	Indicates the network status of the current device, including no network, successfully joining the network;
Target network address	Read/write	0x0000～0xFFFF	The current device communication destination (short address) can be switched at any time through configuration commands;
Local MAC address	Read	64bitMAC	The MAC address assigned by this module network cannot be changed by user (re-entry network to change);
Target MAC address	Read/Write	64bitMAC	In fixed-point mode, use long address to send;
Device type	Read/Write	E、S	They are: end-device and sleep end-device;
Channel	Read/Write	CH11～26	The physical channel through which ZIGBEE works;
Transmit mode	Read/Write	0、1、2、3、4、5	The transmission modes of the configuration module are: broadcast mode, multicast mode, short address on demand mode, long address on demand mode, protocol on demand, and protocol multicast. For details, please see the corresponding mode function introduction;
Output mode	Read/Write	0、1、2、3、4、	Data output mode of the configuration module:配 Transparent transmission; Data + short address; Data + long address;

		5	Data + RSSI; Data + short address + RSSI; Data + long address + RSSI;
Transmit power	Read/Write	-37dbm～7dbm	Module output power: high power consumption requirements, where the distance is not required, the transmission power can be reduced to save average power consumption;
Remote configuration ID	Read/Write	2 byte	A8 8A；It is used to determine whether the data received by the air in the air is a remote configuration command. Customers can change the unlimited configuration ID according to the requirements. The default is A8 8A;
Local network group number	Read/Write	0～255	Used to configure the group number of the device in network;
Target network group number	Read/Write	0～255	Group number corresponding to the target when configuring device multicast;
Wake-up period (sleep time)	Read/Write	0～2010s	It is used to configure the wake-up period of the end-device sleep device. The larger the period is, the lower the overall power consumption is, but the greater the delay of receiving data is;
Lost parent node reconnection period	Read/Write	1～255 minutes	When the parent node is lost (the coordinator is powered down), the end-device reconnects the previous network at regular intervals;
Maximum times of reconnections	Read/Write	1～255 times	After the parent node is lost, the maximum times of reconnections, if it has not been reconnected successfully, clears the previous network information, rescans the new network, and the scanning period is equal to the reconnection period;
IO status	Read/Write	High/Low	Access/control module level status of the GPIO channel;
PWM	Read/Write	1～500ms	Access/control module duty cycle and period of the PWM channel;
ADC value	Read	0～3300mv	Read the ADC value of the device, where 0 channel can read the device power voltage value;

6.5 HEX User instruction set

6.5.1 Instruction rule

Local serial port read format:

Network parameter reading FE LEN CMD FF

Peripheral parameter reading FE LEN CMD CHANNEL FF

FE :fixed head

LEN: Actual length of DATA

CMD: Actual named ID

CHANNEL: Channel selection for PWM, ADC, GPIO read

FF：Command terminator

Read return format：FB CMD DATA

FB : fixed head

CMD: Command ID

DATA: parameter

Local serial port configuration format：FD LEN CMD DATA FF

FD : fixed head

LEN: Actual length of DATA

CMD: Actual named ID

DATA: Actual parameter

FF：Command terminator

Configuration return：FA CMD

FA: fixed head

CMD: Command ID

Return when reading / configuring access: F7 FF does not exist the information / reading / configuration / format failed

Wireless remote reading/ configuration format: add the wireless configuration ID before the instruction format of local serial port mode

The default is A8 8A (The value can be modified), for example:

The configuration format is A8 8A FD LEN CMD DATA FF

Parameter reading format: A8 8A FE LEN CMD (CHANNEL) FF

Network operation format：F5 LEN CMD DATA FF

F5 : fixed head

LEN: Actual length of DATA

CMD: Actual named ID

DATA: Actual parameter

FF：Command terminator

Configuration return：FC CMD STATUS

FC: Fixed head

CMD: Actual named ID

Status: 00 operation succeeded

01 operation failed

6.5.2 Read instruction set

Command description	Command ID	Command format	Command example
Read device type	01	Send： FE 01 01 FF Return： FB 01 dev_type	Send： FE 01 01 FF Return： FB 01 03
Read network state	02	Send： FE 01 02 FF Return： FB 02 nwk_state	Send： FE 01 02 FF Return： FB 02 02
Read network PAN_ID	03	Send： FE 02 03 FF Return： FB 03 pan_id	Send： FE 02 03 FF Return： FB 03 FE 5B
Read local network short address	05	Send： FE 02 05 FF Return： FB 05 Short_Addr	Send： FE 02 05 FF Return： FB 05 F6 FA
Read local MAC address	06	Send： FE 08 06 FF Return： FB 06 Mac_Addr	Send： FE 08 06 FF Return： FB 06 1F 1C 21 FE FF 57 B4 14
Read short address of parent node	07	Send： FE 02 07 FF Return： FB 07 Coor_shortAddr	Send： FE 02 07 FF Return： FB 07 00 00
Read short MAC address of parent node	08	Send： FE 08 08 FF Return： FB 08 Coor _Mac_Addr	Send： FE 08 08 FF Return：FB 08 0C 46 0C FE FF 9F FD 90
Read network group number	09	Send： FE 01 09 FF Return： FB 09 group	Send： FE 01 09 FF Return： FB 09 01
Read communication channel	0A	Send： FE 01 0A FF Return： FB 0A channel	Send： FE 01 0A FF Return： FB 0A 0B
Read transmit power	0B	Send： FE 01 0B FF Return： FB 0B txpower	Send： FE 01 0B FF Return： FB 0B 0A
Read UART baud rate	0C	Send： FE 01 0C FF Return： FB 0C baud	Send： FE 01 0C FF Return： FB 0C 09
Read sleep time	0D	Send： FE 01 0D FF Return： FB 0D sleep_time	Send： FE 01 0D FF Return： FB 0D 54
Read target short network address	23	Send：FE 02 23 FF Return： FB 23 Dec_ShortAddr	Send： FE 02 23 FF Return： FB 23 00 00
Read target network group number	24	Send： FE 01 24 FF Return： FB 24 Dec_netid	Send： FE 01 24 FF Return： FB 24 00
Read target long address	25	Send：FE 08 25 FF Return： FB 25 Dec_mac	Send： FE 08 25 FF Return： FB 25 0A 1C 21 FE FF 57 B4 14
Read system transmitting mode	26	Send： FE 01 26 FF Return： FB 26 send_mode	Send： FE 01 26 FF Return： FB 26 02
Read data output mode	27	Send： FE 01 27 FF Return： FB 27 out_mode	Send：FE 01 27 FF Return： FB 27 00

The reconnection period of the parent node lost the network	29	Send: FE 01 29 FF Return: FB 29 net_rejoinperiod	Send: FE 01 29 FF Return: FB 29 05
The maximum number of times the parent node lost network reconnection	30	Send: FE 01 30 FF Return: FB 30 net_rejoincount	Send: FE 01 30 FF Return: FB 30 05
Read wireless configuration ID	31	Send: FE 02 31 FF Return: FB 31 header	Send: FE 02 31 FF Return: FB 31 A8 8A
Read all device data	FE	Send: FE 2F FE FF Return: FB FE all_info	Send: FE 2F FE FF Return: FB FE 03 02 FE 5B F6 FA 1F 1C 21 FE FF 57 B4 14 00 00 0C 46 0C FE FF 9F FD 90 01 0B 0A 09 54 00 00 00 0A 1C 21 FE FF 57 B4 14 02 00 FF 05 05 A8 8A
Read remote/local GPIO level	20	Command: FE 03 20 GpioId FF Return: FB 20 GpioId In/Out level	Send: FE 03 20 00 FF Return: FB 20 00 01 01
Read remote/local PWM parameter	21	Command: FE 06 21 PWMId FF Return: FB 21 PWMId start/stop Period Period duty duty	Send: FE 06 21 00 FF Return: FB 21 00 01 0A 3E 63 50
Read local /remote ADC state	22	Command: FE 03 22 adcid FF Return: FB 22 adcid voltage1 voltage2	Send: FE 03 22 00 FF Return: FB 22 00 0C E4
Read end-device node numbers of the parent node	32	Command: FE 01 32 FF Return: FB 32 child_count	Send: FE 01 32 FF Return: FB 32 0A
Read end-device node schedule of the parent node	33	Command: FE 0E 33 FF Return: FB 33 index dev_type Short_Addr Mac_Addr	Send: FE 0E 33 FF Return: FB 33 00 03 FE 5B 0A 1C 21 FE FF 57 B4 14
Read the firmware version number	34	Command: FE 03 34 FF Return: FB 34 FirmwareVersion	Send: FE 03 34 FF Return: FB 34 82 69 01

Read the delayed printing time of AUX wake up external MCU serial port in wireless receiving state	35	Send: FE 01 35 FF Return: FB 35 AUX_delaytime	Send: FE 01 35 FF Return: FB 35 04
Read UART wake up keep time	36	Send: FE 01 36 FF Return: FB 36 Uart_holdtime	Send: FE 01 36 FF Return: FB 36 64
Read port info.	37	Send: FE 05 37 FF Return: FB 37 Endpoint_info	Send: FE 05 37 FF Return: FB 37 01 FE B0 05 04

Read link key of trust center	38	Send： FE 10 38 FF Return： FB 10 TrustCentLinkKey	Send： FE 10 38 FF Return： FB 38 5A 69 67 42 65 65 41 6C 6C 69 61 6E 63 65 30 39

6.5.3 Configuration instruction set

Configure device type	Send：FD 01 01 dev_type FF Return：FA 01	Send：FD 01 01 03 FF Return：FA 01
Configure PAN_ID	Send：FD 02 03 pan_id FF Return：FA 03	Send：FD 02 03 FE 5B FF Return：FA 03
Configure the network group number	Send：FD 01 09 group FF Return：FA 09	Send：FD 01 09 01 FF Return：FA 09
Configure communication channel	Send：FD 01 0A channel FF Return：FA 0A	Send：FD 01 0A 0B FF Return：FA 0A
Configure transmit power (0-10 corresponding power)	Send：FD 01 0B txpower FF Return：FA 0B	Send：FD 01 0B 0A FF Return：FA 0B
Configure serial port baud rate	Send：FD 01 0C baud FF Return：FA 0C	Send：FD 01 0C 09 FF Return：FA 0C
Configure sleep time (end-device valid)	Send：FD 01 0D sleep_time FF Return：FA 0D	Send：FD 01 0D 54 FF Return：FA 0D
Configure the target network short address	Send：FD 02 23 dec_addr FF Return：FA 23	Send：FD 02 23 00 00 FF Return：FA 23
Configure the target network group number	Send：FD 01 24 netid FF Return：FA 24	Send：FD 01 24 00 FF Return：FA 24
Configure target long address	Send：FD 08 25 dec_mac FF Return：FA 25	Send：FD 08 25 0A 1C 21 FE FF 57 B4 14 FF Return：FA 25
Configure system sending mode	Send：FD 01 26 mode FF Return：FA 26	Send：FD 01 26 02 FF Return：FA 26
Configure the data output mode of the module	Send：FD 01 27 mode FF Return：FA 27	Send：FD 01 27 00 FF Return：FA 26
Configure to open centralized network time(Coordinator is valid, this module does not support it)	Send：FD 01 28 time FF Return：FA 28	Send：FD 01 28 FF FF Return：FA 28
Configure the period of rejoin after the end-device node loses the parent node.	Send：FD 01 29 time FF Return：FA 29	Send：FD 01 29 05 FF Return：FA 29
The maximum rejoins times after the end-device node loses the parent node	Send：FD 01 30 time FF Return：FA 30	Send：FD 01 30 05 FF Return：FA 30
Configure the wireless remote	Send：FD 02 31 header FF	Send：FD 02 31 A8 8A FF

configuration ID	Return：FA 31	Return：FA 31
Configure all network parameters	Send：FD 1A FE all_info FF Return：FA FE	Send：FD 1A FE 03 FE 5B 01 0B 0A 09 54 00 00 00 0A 1C 21 FE FF 57 B4 14 02 00 FF 05 05 A8 8A FF Return：FA FE
Configure Remote/Local GPIO Input and Output Status	Command：FD 03 20 GpioId In/Out level FF Return：FA 20	Send：FD 03 20 00 01 01 FF Return：FA 20
Configure remote/local PWM status	Command：FD 06 21 PwmId start/stop Period1 Period2 duty1 duty2 FF Return：FA 21	Send：FD 06 21 00 FF 03 65 02 48 FF Return：FA 21
Device restart	Send：FD 00 12 FF Return：FA 12	Send：FD 00 12 FF Return：FA 12
Restore factory settings	Send：FD 00 13 FF Return：FA 13	Send：FD 00 13 FF Return：FA 13

Read the delayed printing time of AUX wake up external MCU serial port in wireless receiving state	Send：FD 01 35 AUX_delaytime FF Return：FA 35	Send：FD 01 35 04 FF Return：FA 35
Read UART wake up keep time	Send：FD 01 36 Uart_holdtime FF Return：FA 36	Send：FD 01 36 64 FF Return：FA 36
Read port info.	Send：FD 05 37 Endpoint_info FF Return：FA 37	Send：FD 05 37 01 FE B0 05 04 FF Return：FA 37
Read link key of trust center	Send：FD 10 38 TrustCentLinkKey FF Return：FA 38	Send：FD 10 38 5A 69 67 42 65 65 41 6C 6C 69 61 6E 63 65 30 39 FF Return：FA 38

6.5.4 Network operation instruction set

Open network	Send：F5 01 40 01 FF Return：FC 40 00	Send：F5 01 40 01 FF Return：FC 40 00
Leave Network	Send：F5 01 40 02 FF Return：FC 40 00	Send：F5 01 40 02 FF Return：FC 40 00
Create network	Send：F5 01 40 03 FF	Send：F5 01 40 03 FF

	Return：FC 40 00	Return：FC 40 00

6.6 HEX Parameter description

6.6.1 System transmitting mode

mode：

0x00 Broadcast（default）；

0x01 (need to configure the target group number in configuration mode first);

0x02 Transparent transmission on demand + short address (need to configure the target short address in configuration mode);

0x03 transparent transmission on demand + long address (need to configure the target long address in configuration mode);

0x04 protocol on demand + short address (the first two bytes in the transmission mode are the short address of the target device network);

0x05 protocol multicast (the first byte in the transmission mode is the target network group number);

6.6.2 Receiving data output mode

mode：

0x00 transparent transmission（default)；

0x01 data+short address；

0x02 data+long address；

0x03 data+RSSI;

0x04 data+short address+RSSI；

0x05 data+long address+RSSI；

Note: the maximum package length is 72

6.6.3Network node type

dev_type：

0x03 End-device(Default)

0x04 Sleep-End-device

Changing the configuration of a node type takes effect after restart. If node type device is configured in normal operation, it will leave the current network in a no-network state. After restart, it will switch to the changed node type. The sleep-end-device supports the serial port receive pin wake-up function. The wake-up frame byte length is less than or equal to 10 bytes. It is recommended to use“FF FF FF FF FF FF FF FF FF FF”10 bytes of "FF" wake up.

6.6.4 Network state

nwk_state：

0x00 No network

0x02 Joined the network

6.6.5 Network PAN_ID

pan_id：

0x0000～0xFFFE fixed network PAN_ID

0xFFFF stochastic network PAN_ID

PANID Parameters need to be configured before setting up or joining the network

6.6.6 Network short address

Short_Addr：2 Byte Address randomly assigned by coordinator

6.6.7 MAC address

Mac_Addr： 8 Byte

6.6.8 Short address of parent node

Coor_shortAddr：2 Byte Short address of the parent node of the current node, if it is coordinator, it should be 0x0000

6.6.9 Parent node MAC address

Coor_Mac_Addr：8 Byte The parent node's long address of the current node

6.6.10 Network group number

group：Group number range 0x01～0xFF（Default 1）

6.6.11 Network channel

Channel：Channel range 0x0B(11)～0x1A(26)（default 11 channels）

Channel The parameters need to be configured before entering the network or establishing a network.

6.6.12 Transmit power

txpower：Transmit power level（default 7dBm）

Adjustable range -37dbm,-30dbm ,-27.5dbm,-23.3dbm,-18.8dbm,-13.6dbm,-9.5dbm,-4.3dbm,-0.6dbm,5dbm,7dbm

txpower	Transmit power level	Buad	Baud rate

00	7dbm（default）	06	-18.6dbm
01	5dbm	07	-23.3dbm
02	-0.6dbm	08	-27.5dbm
03	-4.3dbm	09	-30dbm
04	-9.5dbm	0A	-37dbm
05	-13.6dbm		

6.6.13 Serial port baud rate

Baud rate parameters baud comparison table:

Buad	Baud rate	Buad	Baud rate
01	4800	08	76800
02	9600	09	115200（default）
03	14400	0A	128000
04	19200	0B	230400
05	38400	0C	256000
06	50000	0D	460800
07	57600		

To change the baud rate configuration of serial communication, you need to restart the device, and the changed baud rate will take effect.

6.6.14 Sleep time

sleep_time：（1～60）Sleep wake-up cycle indicates 1 ～ 60 Unit (s)
（61～255）Sleep wake-up cycle indicates 60+(sleep_time-60）*10 Unit (s)
Default 60s（60）

6.6.15 Storage time of parent node

Time: The parent node saves the data of its child nodes for 30 seconds. If any end-device node needs to accept the parent node data of the parent node, the configuration of the sleep time cannot be longer than 30 seconds.

6.6.16 Period of network reconnection after loss of parent node

Rejoin period: （1～255）Reconnection period range 1～255 Unit: minute Default 5 minutes

6.6.17 The maximum number of attempts to reconnect

Rejoin maxcount: （1～255）Maximum range of reconnections 1～255 times

Note: After the maximum number of rejoin attempts, if the previous network has not been restored, the previous network information will be cleared. The power consumption of the new network scanned by Rejoin period is higher than that of the network before the restoration. Therefore, for devices with high power consumption requirements, the two parameters of rejoin period and Rejoin maxcount need to be set larger by default, both of which are set to 5 by default.

6.6.18Wireless remote configuration ID

Remote Header: 0x0000 indicates the wireless network configuration is turned off, 0x0001～0xFFFFindicates the remote configuration is turned on, and the default setting is 0xA88A(0xA8 0x8A).

6.6.19 User gpio parameter

Gpio: Format of peripheral configuration data（3 Byte）： GpioId In/Out level。
gpioid : Channel ID

Channel ID	GPIO Port
00	PE3 Port
01	PA1 Port
02	PE1 Port

In/Out: Channel output / input mode
0 Output
1 Input
level: Channel Level state
0 Low level
1 High level
2 Flip
Note: When configured as input, the level indicates the input level value is 0 (low level) or 1 (high level). When the output is configured, the level indicates 0 (low level), 1 (high level), 2 (Level flip) output.

6.6.20 User pwm parameter

Pwm : Peripheral configuration data format（6 Byte）： PwmId start/stop Period1 Period2 duty1 duty2
PwmId : Channel ID

Channel ID	PWM GPIO Port
0x00	PB4 Port
0x01	PA0 Port
0x02	PA3 Port
0x03	PC5 Port

start/stop: Start/stop channel PWM output
0xFF Start PWM
0x00 Stop PWM

period: pwm period time (unit 1 = 1ms)

Recommended setting range: 0x02 ～ 0x1f4

Period1 High 8 bits of period

Period2 Low 8 bits of period

duty: pwm duty cycle time (unit 1 = 1ms)

Can be set from 0x01 to 0x1f3

duty1 High 8 bits of the duty cycle

duty2 Low 8 bits of the duty cycle

Note: The period value must be greater than duty cycle duty, and the difference between the recommended period and the duty cycle duty is greater than 2ms. If the period is less than the duty cycle, the system default cycle period is equal to twice the duty cycle duty, and the duty cycle here represents the high level time.

6.6.21 User adc parameter

Adc Peripheral read data format（3 Byte）：adcid voltage1 voltage2

adcid：ADC channel ID

Channel ID	ADC GPIO Port
0x00	VDD Power supply voltage detection
0x01	PB1 Port
0x02	PB5 Port
0x03	PB6 Port
0x04	PB7 Port

Voltage：Read ADC channel voltage value（ Unit: mV）

Detectable range 0x0000～0x0E74 （0～3700）

voltage 1 Indicates high 8 digits

voltage 2 Indicates low 8 bits

For example, Read value：voltage =0x0C voltage =0xE4

Then voltage value is：voltage =0x0CE4

Note: If the power supply voltage is the highest 3.3V, the detection range of the ADC can reach 3.3V.

6.6.22 Configure all network parameters

all_info：FD 1A FE 03 FE 5B 01 0B 0A 09 54 00 00 00 0A 1C 21 FE FF 57 B4 14 02 00 FF 05 05 A8 8A FF

Node type 03；Network short address FE 5B； Network group number 01； Channel 0B；Transmitting power 0A；Baud rate 09； Sleep time 54； Target network short address 00 00；Target network group number 00； Target long address 0A 1C 21 FE FF 57 B4 14；System transmitting mode 02；Data output mode 00；Network open time FF(coordinator is valid and this module does not support) ；rejoin period 05；rejoin times 05；Wireless ID A8 8A；

6.6.23 Read all network parameters

all_info：FB FE 03 02 FE 5B F6 FA 1F 1C 21 FE FF 57 B4 14 00 00 0C 46 0C FE FF 9F FD 90 01 0B 0A 09 54 00 00 00 0A 1C 21 FE FF 57 B4 14 02 00 FF 05 05 A8 8A

Node type 03； Network status 02； Network short address FE 5B; Local network short address F6 FA；Local MAC address 1F 1C 21 FE FF 57 B4 14；Parent node network short address 00 00； Parent node MAC address 0C 46 0C FE FF 9F FD 90； Network group 01；Channel 0B；Transmitting power 0A；Baud rate 09；sleep time 54；Target network short address 00 00； Target network group 00；Target long address 0A 1C 21 FE FF 57 B4 14；System transmitting mode 02； Data output mode 00； Network open time FF(coordinator is valid and this module does not support)；rejoin period 05； rejoin times 05；Wireless ID A8 8A；

6.6.24 Configure the delayed printing time of AUX wake up external MCU serial port in wireless receiving state

AUX_delaytime: 1～255 unit is ms, the default parameter is 4ms, that is, after the module receives wireless data, first pull down the AUX pin to wake up the external MCU, and then delay 4ms to output the serial port data to the external MCU.

6.6.25 Configure serial port wake-up hold time

Uart_holdtime: The unit of 1～255 is 10ms, the default parameter is 100, that is, the serial port will keep waking up for 100*10ms after waking up, and then going to sleep after 1000ms.

6.6.26 Configure endpoint information

Endpoint_info：data format of 5 bytes are endpoint clusterId_H clusterId_L profileId_H profileId_L
Default is endpoint 0x01, clusterId 0xfeb0, profileId 0x0504

endpoint	clusterId		profileId	
	clusterId_H	clusterId_L	profileId_H	profileId_L
01	FE	B0	05	04

6.6.27 Set Link key of trust center

TrustCentLinkKey：data length of 16 bytes, default key of ZigBee alliance is
0x5A 0x69 0x67 0x42 0x65 0x65 0x41 0x6C
0x6C 0x69 0x61 0x6E 0x63 0x65 0x30 0x39
Take effect once restart

Note: Only the connected device holding the same link key (LinkKey) as the trust center (coordinator) can it connect to the network of the trust center (coordinator), and the trust center (coordinator) transmits the network key to the connected device , The connected device completes the process of joining the network to obtain the network key for normal communication.

6.6.28 firmware version number

Firmware_version: 82 69 01

82 69 means 8269 chip of Telink

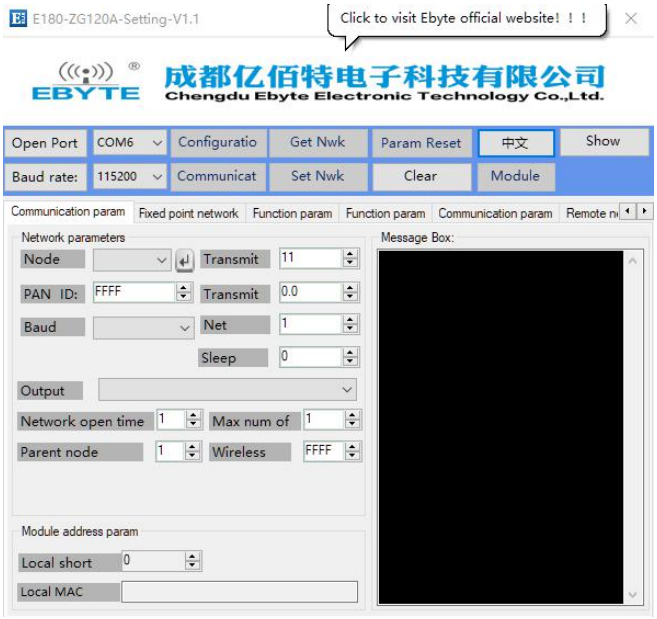
01 means firmware version number

7. Quick start

7.1 Establish a ZigBee network quickly

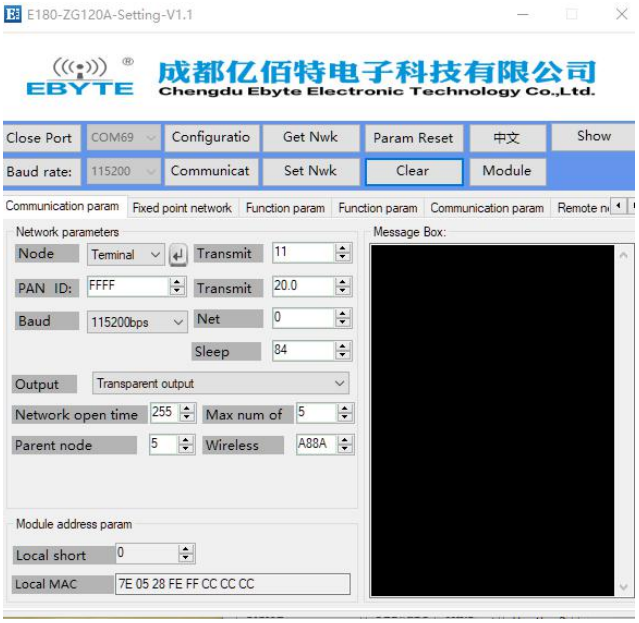
Quickly and easily establish a ZigBee network via PC software（Create network by E180-ZG120A / B). The steps are as follows:

(1) Connect Zigbee ad hoc module via USB to UART converter, open host computer software “E180-ZG120A-Setting v1.2” , as shown in the screenshot below, select port number and set baud rate as 115200(default), then open port.

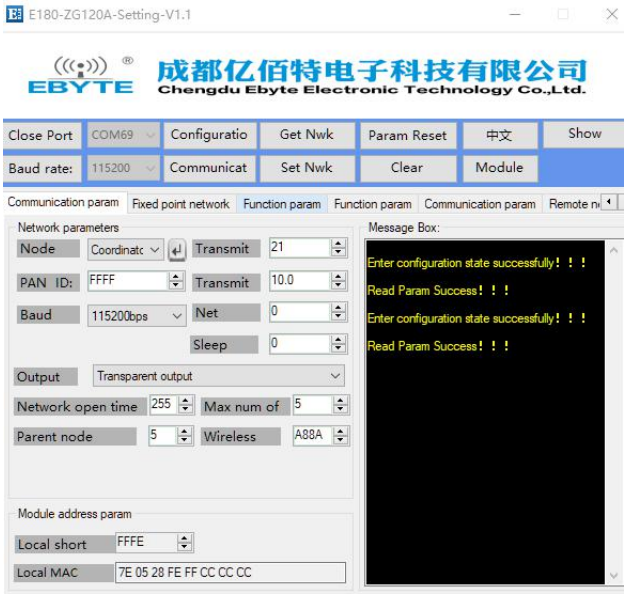


(2) After the serial port is opened, first click “Enter Configuration Mode”, the message box prompts “Enter the configuration status successfully, read parameter successfully”. The main network parameters include: the node type

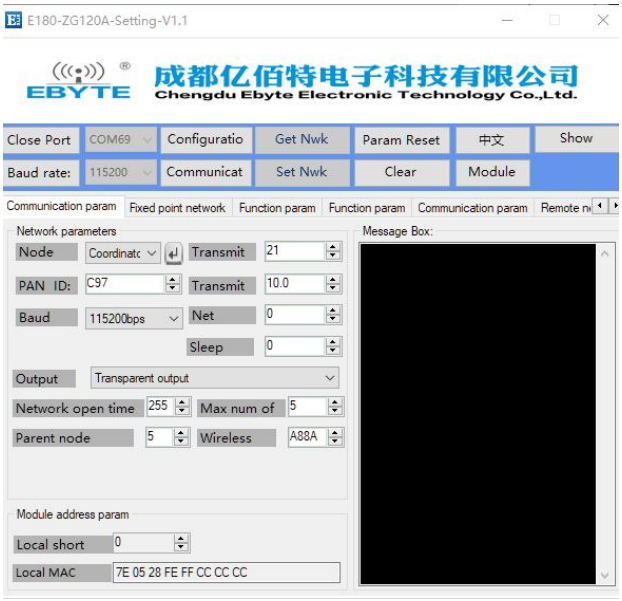
defaults to the end-device, channel 11(default), PAN ID random (default), transmit power is 10 (default).(The maximum can be configured to 20)



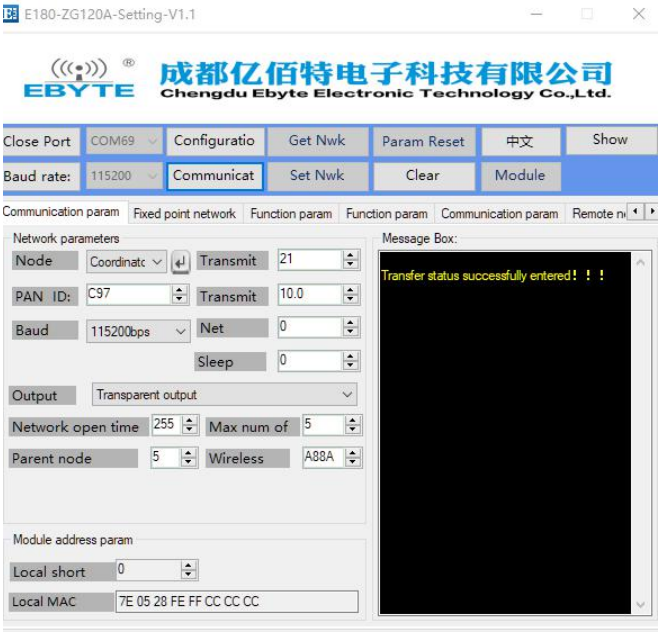
（3）Modify node type to coordinator, and click the Enter button, the message box prompts "Configure device type successfully". The general ZigBee 3.0 network is established by the coordinator node, so the factory default end-device node type needs to be changed to the coordinator before establishing the network.



(4) After the node type is successfully written, modify the ZigBee network required for establishing some network parameters (you can also use the default value without modifying the parameters). Modify the channel, network PANID and transmit power. After modifying the parameters, click “Write Network Parameters”. ", the message box will prompt "Write parameters successfully".

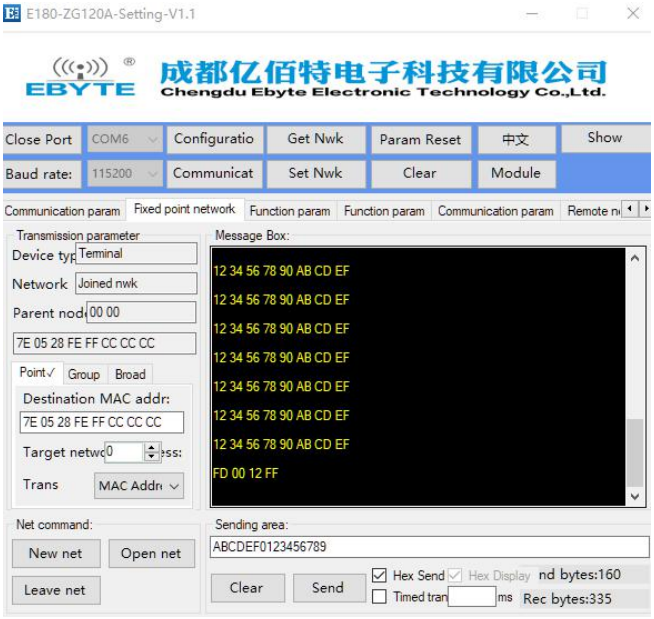


(5) After the node type is modified, the module needs to be restarted to take effect. Click “Module Restart”, and the message box prompts “Module restart successful”.



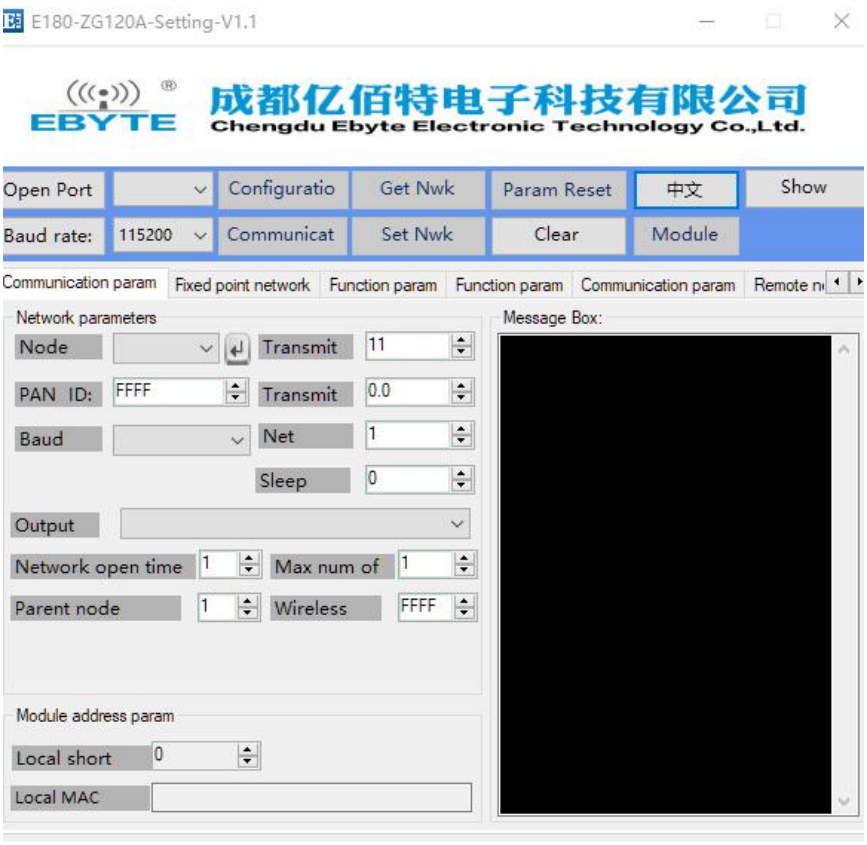
(6) After the module restarts, the transfer mode is entered by default. At this time, click “Enter Configuration Mode” again, the message box prompts “Enter the configuration status successfully, read parameters successfully”. It can be seen that the parameters read are the previously modified parameters, indicating that the network parameters are modified successfully.

(7) Select the fixed-point networking interface, display the network status as "joined network". The coordinator network is successfully created.

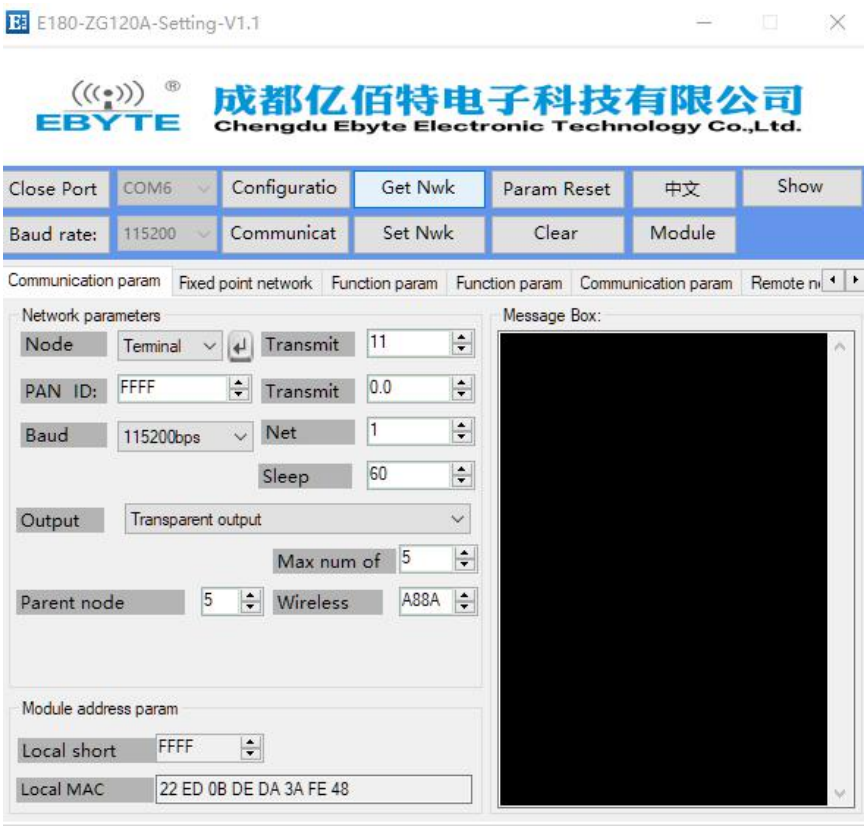


7.2 Join a ZigBee network quickly

(1) Open the host computer software "E180-Z6907A-Setting v1.2", select the port number and set the serial port baud rate, and open the serial port.



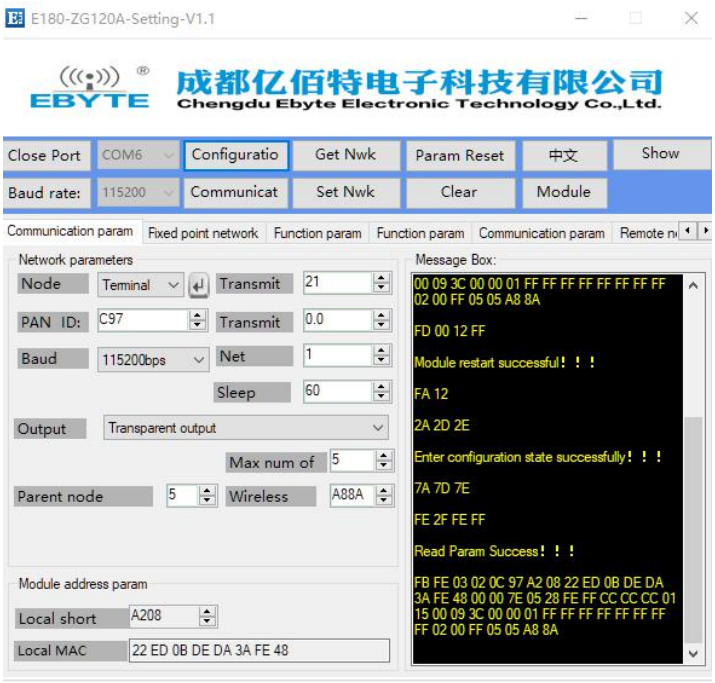
(2) After the serial port is opened, first click “Enter Configuration Mode”, the message box prompts “Enter the configuration status successfully, read parameters successfully”. The main network parameters include: the node type defaults to the end-device, the channel 11 (default), the PAN ID defaults randomly, and the transmit power is default 0 (7dbm).



(3) Modify the node type as sleep-end-device, click the Enter button, the message box prompts "Configure device type is successful", modify the network parameters, its PAN ID and transmit channel parameters must be the same as the network to be joined, click "Write network parameters", the message box prompts "Write parameters successfully."

(4) Click "Module Restart", the message box prompts "Module restart is successful", click "Enter configuration mode", the message box prompts "Enter configuration status is successful, read parameters successfully", confirm whether the read PAN ID and transmit channel parameters are the modified value before.(PAN ID of the established network coordinator).

(5) Select the fixed-point networking interface and display the network status as “joined network”, indicates sleep-end-device node has joined the network created by the former coordinator.



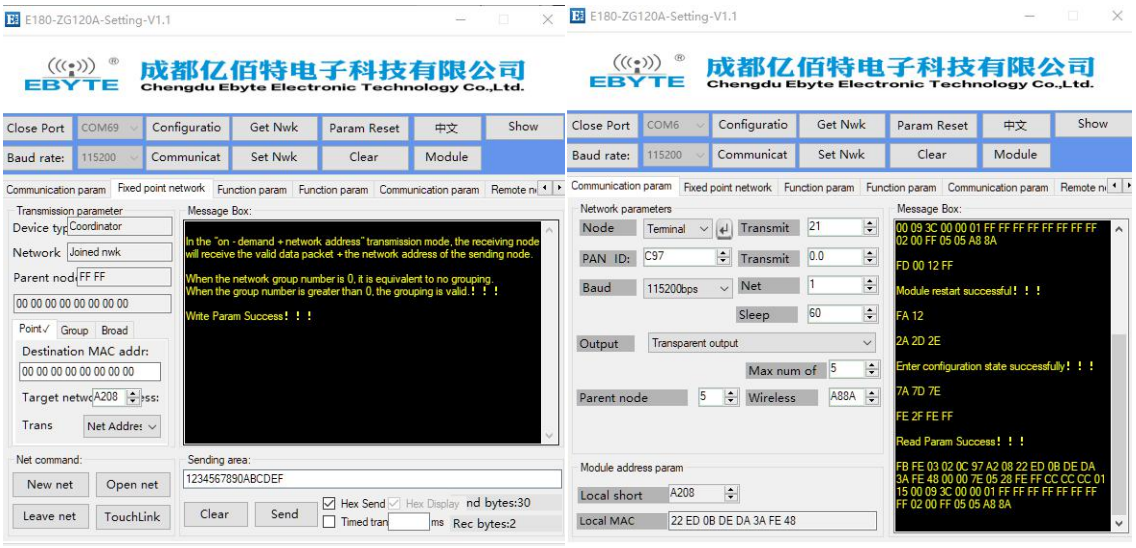
Similarly, the end-device node also join the ZigBee network according to the above method. If the node type does not need to be added to another ZigBee network, the Enter button  next to the node type configuration also needs to be clicked. Write the parameters after modifying the network parameters, and finally restart to join the new ZigBee network.

7.3 ZigBee Network communication test

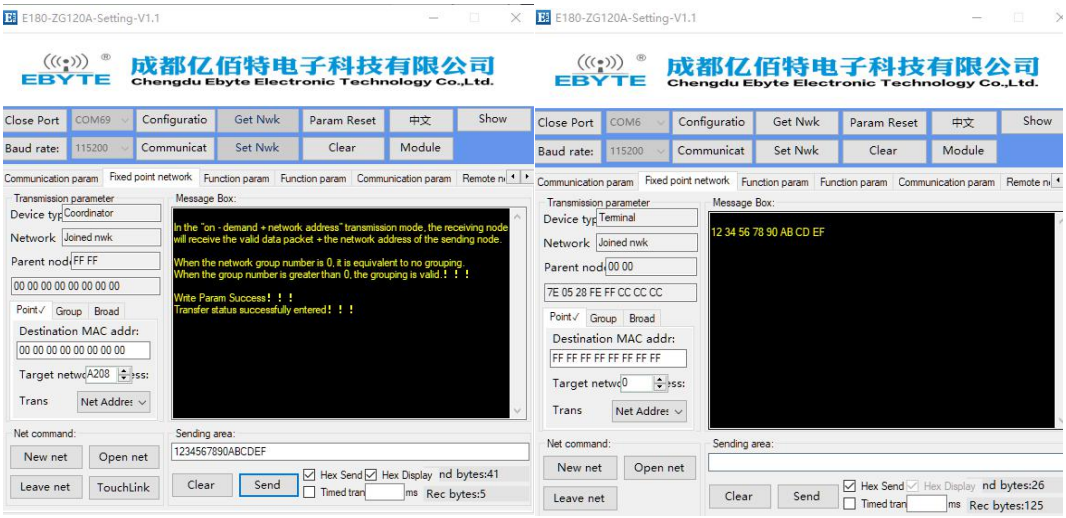
7.3.1 Unicast test

7.3.1.1Unicast between end-device and coordinator in the form of short address

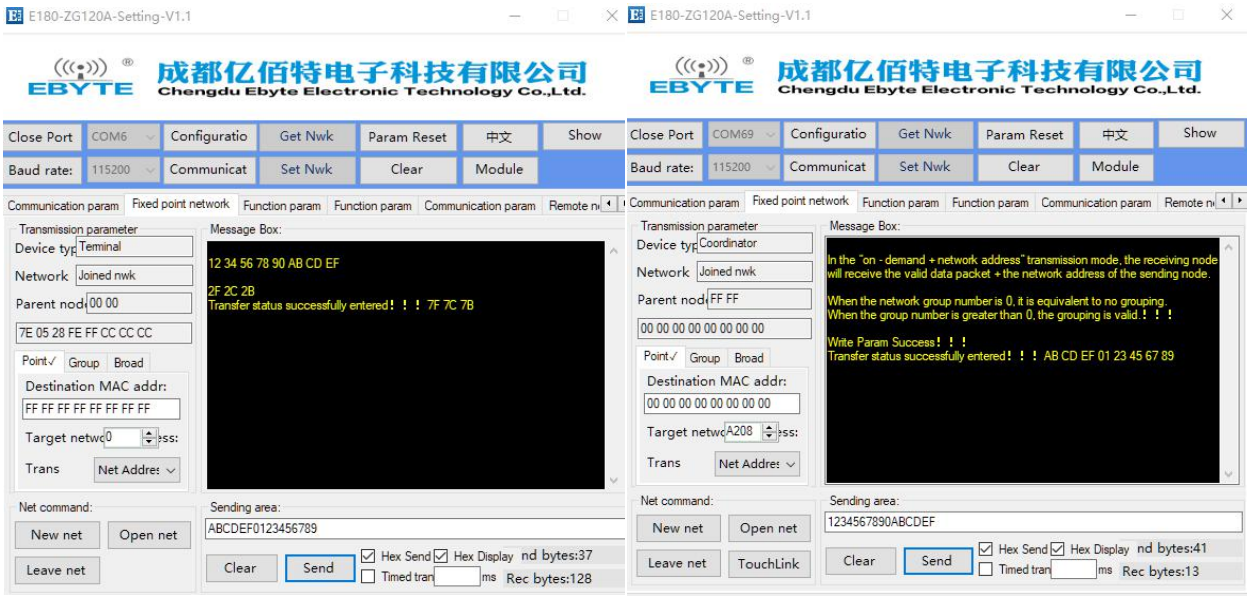
(1）Enter the configuration mode, configure the target network address, and modify the target network address of the coordinator (the coordinator uses E180-ZG120) to the local short address(0xFCFA) of the end-device.The target network address of the end-device is 0 by default. 0 is the coordinator's network short address (the coordinator's network short address is always 0). It does not need to be modified at this time. If the end-device communicates with the non-coordinator node, it needs to be modified (modified to the destination node's network local short address), click "write network parameter" after modification.



（2）After the target address between nodes is configured, click "enter transmission mode", and the message box will prompt "enter transmission mode successfully". Before communication, confirm whether the module is in transmission mode, and only in the transmission mode can the communication be realized. Input the data to be sent in the sending area, click send, and the received data can be seen in the end-device node message box.



（3）Similarly, End-device unicast to Coordinator



7.3.1.2 Unicast in long address form between end-device and coordinator

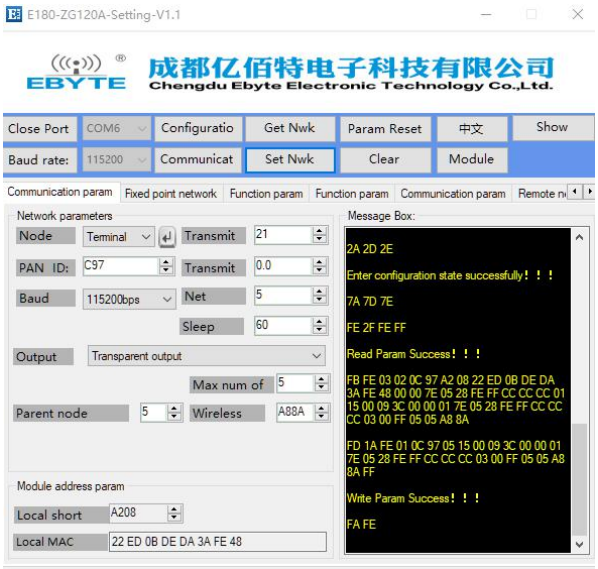
(1) Before communication, enter the configuration mode first, configure the target MAC address. The coordinator end configures the target MAC address as the long MAC address of the end-device, and the end-device end configures the target MAC address as the long MAC address of the coordinator.

(2) After the target MAC address is configured, the transmission mode needs to be configured. Change the "network address (short address)" to "MAC address", and then write the parameters again. At this time, the target address is configured to unicast in the form of MAC address.

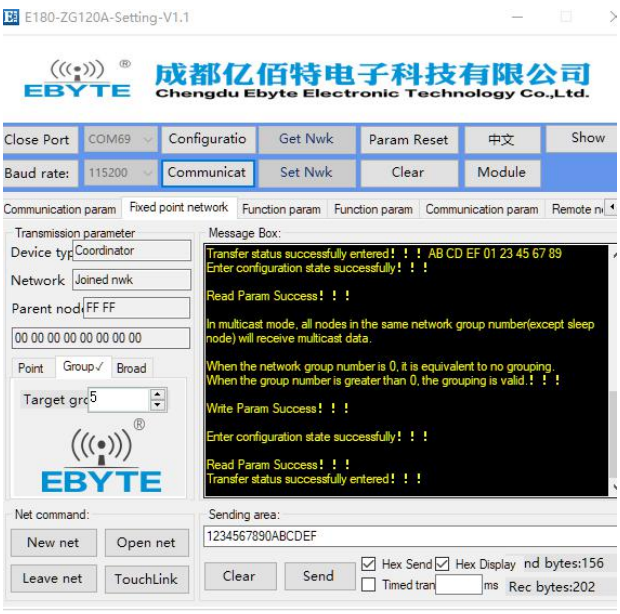
(3) After completing the above parameter configuration, click to enter the transmission mode, communicate in the transmission mode.

7.3.2 Multicast test

(1) For example, if the end-device device is the receiving end, click "enter configuration mode", modify the network group number to "5", and then write the parameters. The message box will prompt "write parameters successfully". At this time, group ID 5 is assigned to the end-device.



(2) For example, if the coordinator is the sender, click "enter configuration mode" to enter the fixed-point networking, select the multicast mode, and the message box will prompt "under multicast mode, all nodes with the same group number in the network will receive multicast data", modify the target group number to "5", and then write the parameter, and the message box will prompt "write the parameter successfully".

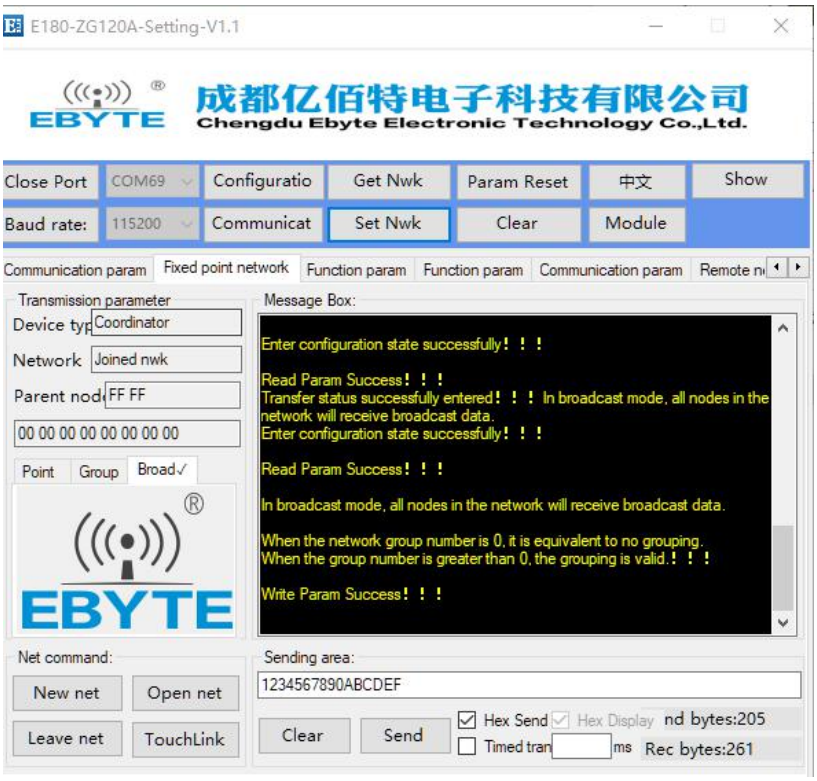


(3) Enter the transmission mode, the message box will prompt "enter the transmission mode successfully", and then carry out multicast data communication.

(3) The end-device receiver enters the configuration mode, changes the network group number to "4", and writes the parameter. At this time, because the network group number is not "5", the coordinator multicast data cannot be received.

7.3.3 Broadcast test

(1) For example, when the coordinator broadcasts, click "enter configuration mode", enter fixed-point networking, select broadcast mode, and then write parameters. The message box prompts "write parameters successfully".



(2) Enter the transmission mode, the message box will prompt "enter the transmission mode successfully", and then broadcast data communication, at this time, all nodes in the network will receive data, including the sending node.

8. FAQ

8.1 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.
- 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 2.5V, 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, ensure it is in the recommended supply voltage, voltage higher than the maximum will damage the module.
- Please check the stability of power supply, 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 Bit error rate is too 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 can also cause high bit error rate

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