Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual



EWD181-Z20(232&485) User Manual

All rights to interpret and modify this manual belong to
Chengdu Ebyte Electronic Technology Co., Ltd.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Contents

Disclaimer 5
1 Product Introduction 6
1.1 Product Introduction 6
1.2 Features 6
1.3 Product Features 6
1.4 Introduction to device types 8
1.4.1 Coordinator 8
1.4.2 Router 8
1.4.3 End - Device 8
1.5 Application Scenario 9
2 Specifications 10
2.1 Interface Description 10
2.2 Product Dimensions 12
2.3 Specifications 13
2.3.1 Operating parameters 13
2.3.2 Electrical parameters 13
2.3.3 Hardware Parameters 13
3 Working Mode 14
4 Communication Methods 17
5 Quick Start 17
5.1 Establishing a network 17
5.2 Communication Test 20
5.2.1 Coordinator transmits data to network terminals (on-demand communication) 20
5.2.2 Coordinator transmits data to network terminals (multicast communication) 23
6 User Instruction Set 26
6.1 Command Format 26
6.2 AT Commands 27
6.2.1 Local MAC Address: 27
6.2.2 Network Status 27
6.2.3 Networking 27
6.2.4 Network Roles 28
6.2.5 Network Channel 28
6.2.6 PANID (Network ID) 29
6.2.7 Network Short Address 30
6.2.8 Network Key 30
6.2.9 Group (Multicast) Control 31
6.2.10 Extended Network ID (EPANID) 31
6.2.11 Reset 32
6.2.12 System Printing 32
6.2.13 Heartbeat Packet Period 32
6.2.14 Transmit power 33
6.2.15 Firmware Version 33

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.2.16 Returning a short address based on a MAC address 34
6.2.17 Exiting the Network 34
6.2.18 Factory Reset 34
6.2.19 Coordinator closes the network configuration 35
6.2.20 Exit command mode (exit HEX/AT mode to transmission mode) 35
6.2.21 Serial port mode configuration 35
6.2.22 Target Address 36
6.2.23 Destination Port 37
6.2.24 Transmission Mode 37
6.2.25 Sleep Mode 38
6.2.26 Custom Number 39
6.2.27 Network Access Node Table 39
6.2.28 Enumerating Nodes 40
6.2.29 Deleting a Node 41
6.3 HEX Commands - Local Configuration 41
6.3.1 Local MAC Address: 41
6.3.2 Network Status 42
6.3.3 Networking 42
6.3.4 Network Roles 43
6.3.5 Network Channel 43
6.3.6 PANID (Network ID) 44
6.3.7 Network Address 44
6.3.8 Network Key 45
6.3.9 Group (Multicast) Control 45
6.3.10 Extended PANID 46
6.3.11 Reset 47
6.3.12 System Printing 47
6.3.13 Heartbeat Packet Period 47
6.3.14 Transmit power 48
6.3.15 Firmware Version 48
6.3.16 Returning a short address based on a MAC address 48
6.3.17 Exiting the Network 49
6.3.18 Factory Reset 49
6.3.19 Coordinator closes the network configuration 50
6.3.20 Exit command mode (exit HEX/AT mode to transfer mode) 50
6.3.21 Serial port mode configuration 50
6.3.22 Target Address 51
6.3.23 Destination Port 52
6.3.24 Transmission Mode 52
6.3.25 Sleep Mode 53
6.3.26 Custom Number 54
6.3.27 Network Node Table 54
6.3.28 Enumerating Nodes 55
6.3.29 Deleting a Node 55

6.4 Asynchronous Commands and System Printing Information 55
6.4.1 Module startup 56
6.4.2 Network Connection Status 56
6.4.3 Monitoring equipment access to the network 57
6.4.4 Monitoring equipment off-grid 58
6.4.5 Device Enumeration Notification 59
6.5 Remote Control Commands 60
6.5.1 Sending data using HEX command 60
6.5.2 HEX command receiving data 62
6.5.3 HEX command reception response command 63
6.5.4 Remote query configuration parameters 64
6.5.5 Receive remote query configuration parameters 65
6.5.6 Receiving Heartbeat Packets 66
6.5.7 Remotely modify configuration parameters 67
6.5.8 Remote Configuration Parameter Response 69
Chapter 7 User Notice 70
7.1 ZigBee Network Roles and Considerations 70
7.2 Network Structure 71
Revision history 72
About us 72

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Disclaimer

EBYTE reserves all rights to this document and the information contained herein. Products, names, logos and designs described herein may in whole or in part be subject to intellectual property rights. Reproduction, use, modification or disclosure to third parties of this document or any part thereof without the express permission of EBYTE is strictly prohibited.

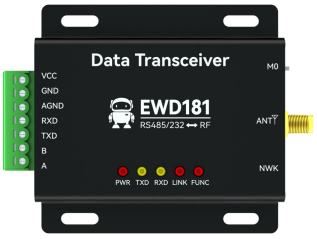
The information contained herein is provided “as is” and EBYTE assumes no liability for the use of the information. No warranty, either express or implied, is given, including but not limited, with respect to the accuracy, correctness, reliability and fitness for a particular purpose of the information. This document may be revised by EBYTE at any time. For most recent documents, visit www.cdebyte.com.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

1 Product Introduction

1.1 Product Introduction

The EWD181-Z20 (232/485) is a wireless modem based on ZigBee 3.0 technology, offering multiple functions including transparent transmission and protocol transmission. As a communication medium, wireless data modem, like optical fiber, microwave, and open-wire, has a limited scope of application: it provides real-time, reliable data transmission of monitoring signals within private networks under certain special conditions. It features low cost, easy installation and maintenance, strong diffraction resistance, flexible networking, and long coverage. It is suitable for applications with numerous and dispersed points and complex geographical environments. It can be connected to data terminals such as PLCs, RTUs, rain gauges, and liquid level gauges.



1.2 Features

★ All core components are imported. Compared with similar imported digital radios, it has the most advanced functions, the smallest size and the best price.

★ Transmission power options are available.

★ Working temperature range: -40℃～+85℃, adaptable to various harsh working environments, a true industrial-grade product.

★ All-aluminum alloy shell, compact size, easy installation, good heat dissipation; perfect shielding design, good electromagnetic compatibility, strong anti-interference ability.

★ Multiple protection functions such as power reverse connection protection, over connection protection, antenna surge protection, etc. greatly increase the reliability of the radio.

★ Powerful software functions, all parameters can be set through programming: such as power, frequency, address ID, etc.

★ Built-in watchdog, with precise time layout, once an abnormality occurs, the module will automatically restart and continue to work according to the previous parameter settings.

1.3 Product Features

● Automatic networking: The coordinator automatically establishes a network when powered on, and terminals and routers automatically search and join the network.

● Network self-healing: If an intermediate node in the network is lost, other networks will automatically join or remain in the original network (isolated nodes will automatically join the original network, and routing nodes will remain in the original network); if the coordinator is lost and there are non-isolated nodes in the original network, they can rejoin the network after the coordinator is started.

● Ultra-low power consumption: When the device is in terminal state, it can be set to low power

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

consumption mode. The device sleep time can be changed according to the user's usage time. In low power consumption mode, the standby power consumption is less than 2uA. During the parent node data storage time, the device can receive the messages it should receive within the user-set time.

- Automatic retransmission: In unicast (on-demand) mode, the device automatically retransmits a message if it fails to be sent to the next node. Each message can be retransmitted three times, with one retransmission every six seconds.
- Automatic routing: The module supports network routing function; the router and coordinator carry the network data routing function, and users can perform multi-hop networking.
- Encryption protocol: The module adopts AES 128-bit encryption function, which can encrypt the network and prevent monitoring;
- Serial port configuration: The module has built-in serial port commands, and users can configure (view) the module's parameters and functions through issuing serial port commands.
- Multi-type data communication: supports network-wide broadcast, multicast and on-demand (unicast) functions; also supports several transmission methods in broadcast and unicast modes.
- Multiple working mode selection: supports transparent transmission mode, semi-transparent transmission mode, and protocol mode, three working modes, users can switch freely.
- Channel change: supports 16 channel changes (2405-2480MHZ) such as 11-26, and different channels correspond to different frequency bands.
- Network PAN_ID change: Any switch of network PAN_ID. Users can customize PAN_ID to join the corresponding network or PAN_ID will be automatically selected to join the network.
- Serial port baud rate change: Users can set the baud rate up to 230400. The default number of bits is 8, the stop bit is 1, and there is no parity bit.
- Short address search: Users can find the corresponding short address based on the MAC address (unique, fixed) of the module that has joined the network.
- Instruction format switching: This module supports two instruction modes: AT instructions and HEX instructions, which are easy for users to configure and switch.
- Module reset: Users can reset the module through serial port commands.
- Restore factory settings: Users can restore the module to factory settings through serial port commands.
- Network node management: The coordinator can record the nodes connected to the network, enumerate the information of the connected nodes, delete unnecessary nodes, and facilitate the automated management of networked devices.
- The coordinator device, router, and terminal node are integrated into one design, and can switch between modes through commands.
- Dual serial ports: Both serial ports support data transmission, AT commands, HEX commands, and the

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

two serial ports can be used independently without interfering with each other.

- Possessing a national invention patent certificate, invention name: A method for interconnecting wireless transparent transmission modules based on ZigBee3.0 Patent number: ZL 2019 1 1122430.X



1.4 Introduction to device types

ZigBee technology is a short-range, low-complexity, low-power, low-speed, and low-cost bidirectional wireless communication technology. In a ZigBee network, there are three logical device types: Coordinator, Router, and End-Device. A ZigBee network consists of a Coordinator, multiple Routers, and multiple End-Device devices, supporting star, tree, mesh, and hybrid network topologies.

1.4.1 Coordinator

The coordinator is responsible for initiating the entire network and is the first device on the network. It selects a channel and a network ID (also known as a PAN ID, or Personal Area Network ID) and then initiates (establishes) the entire network. The coordinator also assists in establishing security and application layer bindings within the network.

Note that the coordinator's role primarily involves network startup and configuration. Once this is complete, the coordinator acts like a router (or simply disappears). Due to the distributed nature of the ZigBee network, subsequent network operation is no longer dependent on the coordinator's presence. If new devices wish to join the network, the coordinator still needs to keep track of them and allocate resources; otherwise, the new device will be unable to join the network.

1.4.2 Router

The main functions of a router are: allowing other devices to join the network, multi-hop routing, and assisting its own sub-terminal dormant devices in communication. Usually, a router is expected to be always active, so it must be powered by the mains. However, when using a network mode such as a tree group, the router is allowed to operate once at a certain interval, so that it can be powered by a battery.

1.4.3 End-Device

The end device has no specific responsibility to maintain the network structure, it can sleep and wake up, so it

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

can be a battery-powered device.

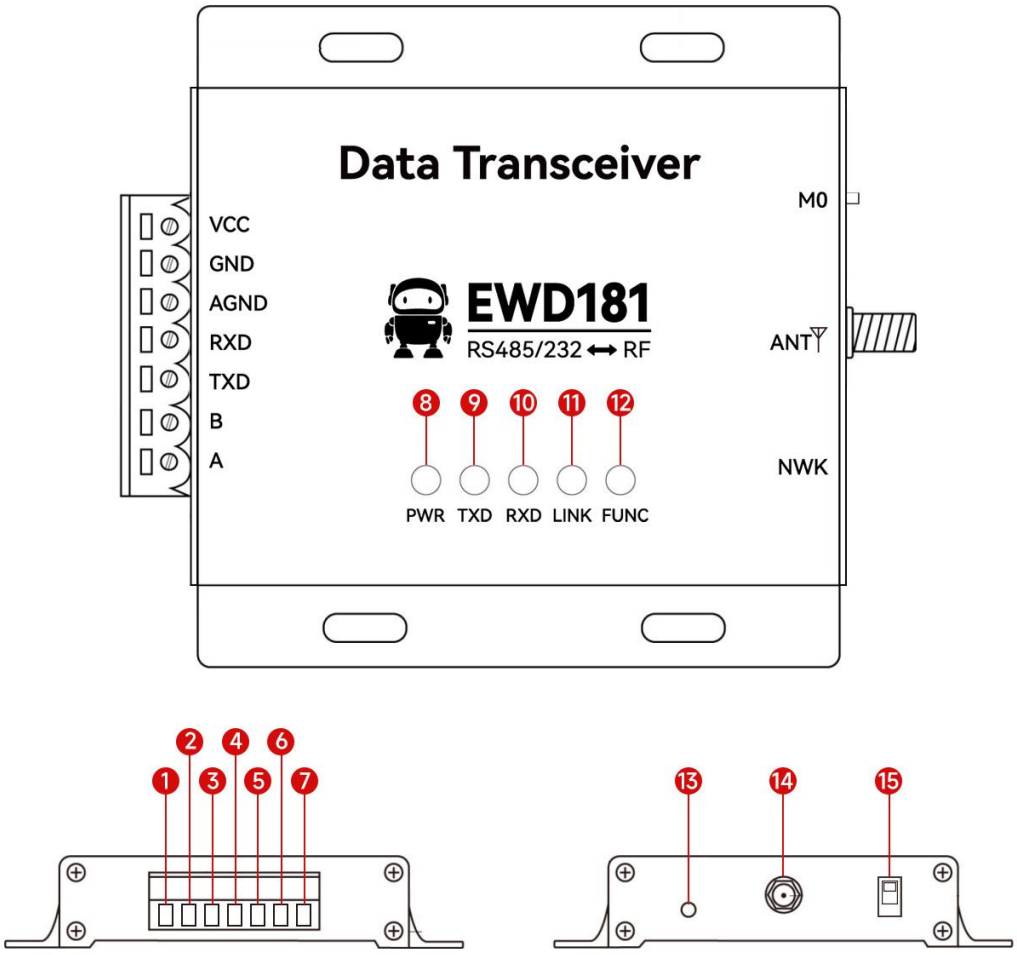
1.5 Application Scenario

- Smart home and industrial sensors, etc.
- Security systems, positioning systems;
- Wireless remote control, drone;
- Healthcare products;
- Wireless voice, wireless headphones;
- Automotive industry applications.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2 Specifications

2.1 Interface Description



Interface Description:

Serial number	name	Function	illustrate
1	VCC	Press-wire power interface, positive	DC 8~28V, 12V or 24V is recommended
2	GND	Press-wire power interface, negative	The negative pole of the power supply is connected to the system ground and the casing
3	AGND	Public interface	Can be connected to the ground terminal of external equipment or not
4	RXD	Serial port terminal	Receiving port, connected to the transmitting end of other devices

5	TXD	Serial port terminal	Transmitter port, connected to other device receiving end
6	RS485-B	Serial port terminal	B port for connecting to other RS485 devices
7	RS485-A	Serial port terminal	A terminal for connecting to other RS485 devices
8	PWR-LED	Power indicator	Red, always on when the power is on
9	TXD-LED	Send indicator light	Yellow, flashing when sending data
10	RXD-LED	Receiving indicator	Yellow, flashing when receiving data
12	FUNCL-LED	-	Reserved lights
11	LINK-LED	See indicator light description for details.	See indicator light description for details.
13	NWK	Network configuration button	One-click network configuration or use commands to configure the network
1 4	ANT (antenna interface)	SMA-K interface	External thread inner hole, length 8 mm, characteristic impedance 50Ω
15	M0	Mode switch	Dial up for router mode , dial down for coordinator mode

Note:

1. The user needs to use the VCC terminal and GND terminal in ① to supply power. An 8~28V DC power supply can be used, and a 12V or 24V DC power supply is recommended.

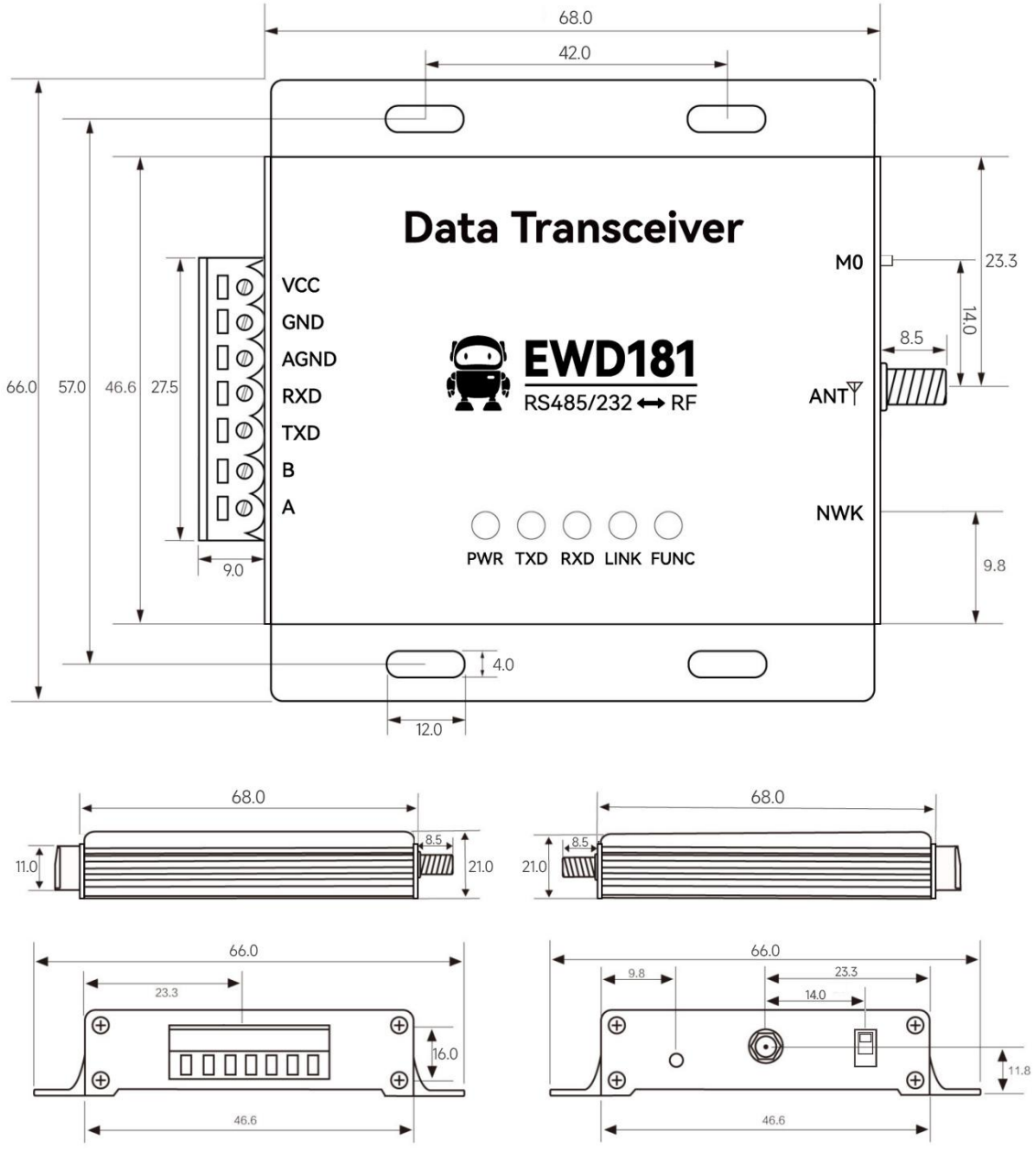
2. If the radio has communication problems when connected to multiple devices, but not when connected to a single device, try connecting a 120Ω resistor in parallel between the 485_A and 485_B terminals.

Indicator light description:

Serial number	name	Radio Status	Indicator status	Remark
11	LINK-LED (red)	No network	Extinguished	-
		Network configuration in progress - Coordinator or router opens the network	1Hz flashing	-
		Network configuration in progress - a router or terminal that is not connected to the network is joining the network	10Hz flicker	-
		The router or terminal network has been successfully joined.	2Hz flashing for 3 seconds then steady on	-
		The network connection is normal	Constantly on	-
		Network establishment/join failure	Extinguished	-
		The terminal node is offline	5Hz flashing, 3 times per second	-

2.2 Product Dimensions

Serial number	Name	Describe	Remark
1	size	68*66*21mm	No antenna included
2	weight	64g	Error value ±5g



Unit : mm
Tolerance value:X.X±0.2mm

2.3 Specifications

2.3.1 Operating parameters

Main parameters	Unit	Parameter value	Remark
Operating frequency band	GHz	2.400 ~ 2.480	Support ISM band
Transmit power	dBm	20	-
Blocking power	dBm	0 ~ 10.0	The probability of burning is lower when used at close range
Matching impedance	Ω	50	Equivalent impedance
Measured distance	km	1.3	In a clear and open environment, the antenna gain is 5dBi , the height is 2.5 meters, and the air data rate is 250kBps .

2.3.2 Electrical parameters

Electrical parameters	Unit	Parameter value	Remark
Operating voltage	V	+8 ~ +28V DC	It is recommended to use 12V or 24V power supply
Emission current	mA	138 @20dBm	12V power supply
Receive current	mA	twenty two	Network status
Operating temperature	℃	-40 ~ +85	Industrial grade
Storage temperature	℃	-40 ~ + 125	-

2.3.3 Hardware Parameters

Main parameters		Parameter value	Remark
Data packet length	Transparent transmission	150 Bytes	-
	Fixed-point broadcast/multicast	75 Bytes	-

	Fixed-point unicast	128 Bytes	-
Support Agreement		ZigBee 3.0	-
Communication interface		RS485/RS232	3.81mm terminal block
Antenna interface		SMA-K	External thread inner hole

3 Working Mode

Working Mode		Illustrate
Transmission Mode	**Transparent transmission mode**	**Data sending:** The UART directly inputs the message to be transmitted, and the module directly sends the data. If the module is not connected to a network, it cannot send data. The destination of the data is determined by the module's configuration parameters "Destination Address" and "Destination Port". It can be configured as unicast, multicast, or broadcast. After turning on "Print network prompt information", the sent data will return "OK\r\n", "FAIL\r\n", "ERROR\r\n" to indicate the sending result. **Data reception:** After the networked module receives the data message, it directly prints out all the data messages via UART. **Mode switch:** Enter "+AT" to enter AT command mode Enter "+++" to enter HEX command mode
	Semi-transparent transmission mode	**Data sending:** The UART input format is "To" + data message. The "To" field consists of three bytes: the first two bytes are the "destination address" (little-endian format), and the third byte is the "destination port." These two parameters are used in the same way as the "destination address" and "destination port" configuration parameters, but do not change their settings. **Data reception:** After the networked module receives the data message, the UART prints the format of "who sent the data + data message". The "who sent the data" consists of three bytes, including two bytes of "source address"

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

		(little endian format) and one byte of "source port". **Mode switch:** Enter "+AT" to enter AT command mode. Enter "+++" to enter HEX command mode.
AT command mode		**Mode Description:** In this mode, AT commands are used to configure and query the module. Each AT command has its own corresponding HEX command. There are three functions of AT commands: execution, query and configuration **Execution:** The command format is "AT+command name" without any symbols or parameters at the end, for example, "AT+JOIN". System log information such as "OK\r\n" and "FAIL\r\n" is returned. **Query type:** Enter the command "AT+command name?" followed by a "?", for example, "AT+NWK?". This command returns the current value of the configuration parameter corresponding to the command. The format is "command name=parameter value" followed by a carriage return and line feed, for example, "NWK=1\r\n". **Profile:** Enter the command in the format of "AT+command name=command parameter", for example "AT+NWK=1". The return command format is "command name=parameter value", indicating whether the parameter setting is valid. If the returned parameter is not equal to the set parameter, it means that the setting is invalid. **Mode switch:** Enter "AT+EXIT" to exit the transfer mode, or wait for 1 minute without entering any AT commands to exit the transfer mode. When exiting the AT command mode, the UART prints the prompt "EXIT_AT\r\n".
HEX command mode		**Mode Description:** HEX commands are divided into two categories according to their functions: local commands and remote commands. Each local command has its own corresponding AT command. **Command format:** The three formats for command input, command return, and asynchronous receive begin with FE, FB, and FC, respectively. The

	second byte of the command is the command frame length, the third byte is the command category, the fourth byte is the command code, and the fifth and subsequent bytes are the command parameters. The last byte of the command is the AA terminator. The command length includes the third byte through the last byte, AA. Each input command must trigger a corresponding return command. If there is no return command, it means the module may be abnormal. **Local commands:** The local commands of HEX commands have corresponding AT commands. When the parameters of HEX commands are empty, the execution or query effect of the same AT commands is triggered. **Remote Commands:** Remote commands require waiting for Zigbee wireless transmission, and the delay in returning commands is slightly longer than that of local configuration commands. The parameters of remote commands include the destination address and destination port, which can be arranged into unicast, multicast, and broadcast modes, just like the destination address and destination port in transparent transmission mode. Remote commands can be used for data transmission, remote configuration, and remote query. Remote configuration and remote query trigger asynchronous receive commands. If it is a multicast or broadcast, multiple asynchronous receive commands may be triggered. **Asynchronous reception:** Asynchronous receive commands include the following messages: data sent by other modules in HEX command mode; return messages from remote configuration and remote query, as well as heartbeat packets from other modules; and system notification messages such as network disconnection.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

4 Communication Methods

Serial number	Communication method	Describe
1	broadcast	After joining the network, users can broadcast to the entire network according to the instructions (divided into three broadcast modes) 1. Broadcast mode 1 - the message is broadcast to all devices in the entire network; 2. Broadcast mode 2 - the message is broadcast only to devices that have enabled reception (except those in sleep mode); 3. Broadcast Mode 3 - The message is broadcast to all full-function devices (routers and coordinators). The target short address is 0xFFFC (broadcast mode 3), 0xFFFD (broadcast mode 2), 0xFFFF (broadcast mode 1), and the target port is 0x01 or 0xFF
2	Multicast	When joining a network, users can broadcast multicasts to all non-dormant devices on the network. Non-dormant devices that receive multicasts must join a group. A device can join multiple groups at the same time and can also freely leave a specific group. The target short address is the group ID (Group ID), and the target port is 0x00
3	On Demand	When joining the network, users can communicate with devices in the network individually using short addresses according to the instructions. The target short address is the other party's short address, and the target port is 0x01

5 Quick Start

To help users quickly familiarize themselves with the radio, this section will guide users through simple configuration in conjunction with a host computer to build a ZigBee network, enabling configuration and communication in various modes. The operating mode is HEX command mode. (Note: AT command mode cannot be used for host computer configuration.)

5.1 Establishing a network

1. Prepare two EWD181-Z20 (232/485) as the coordinator and terminal node respectively;
2. Open the host computer software, select the port number, set the serial port baud rate (default 115200), and open the serial port;

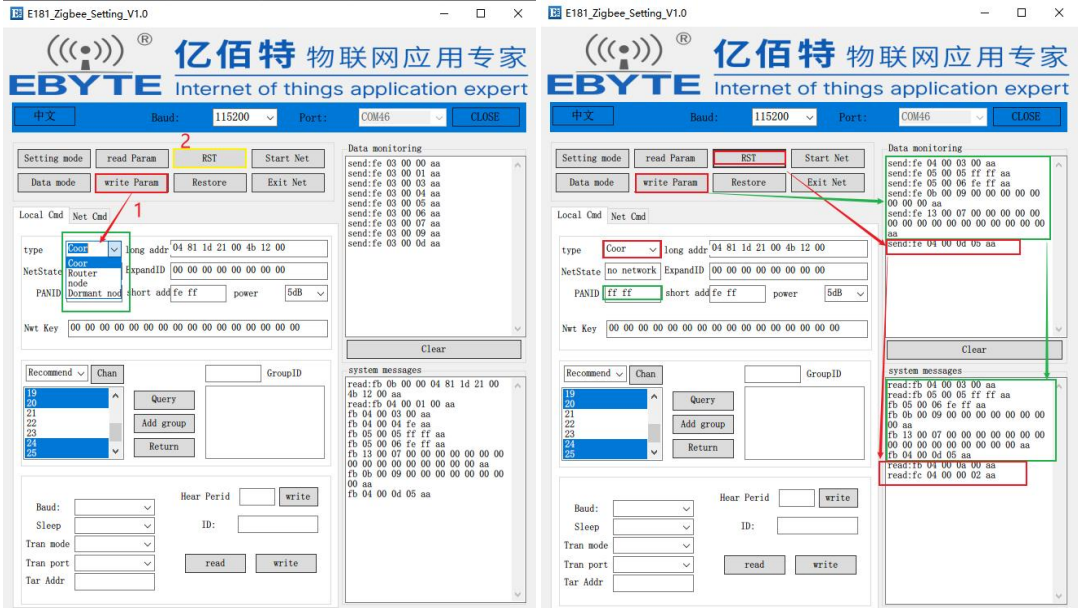
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



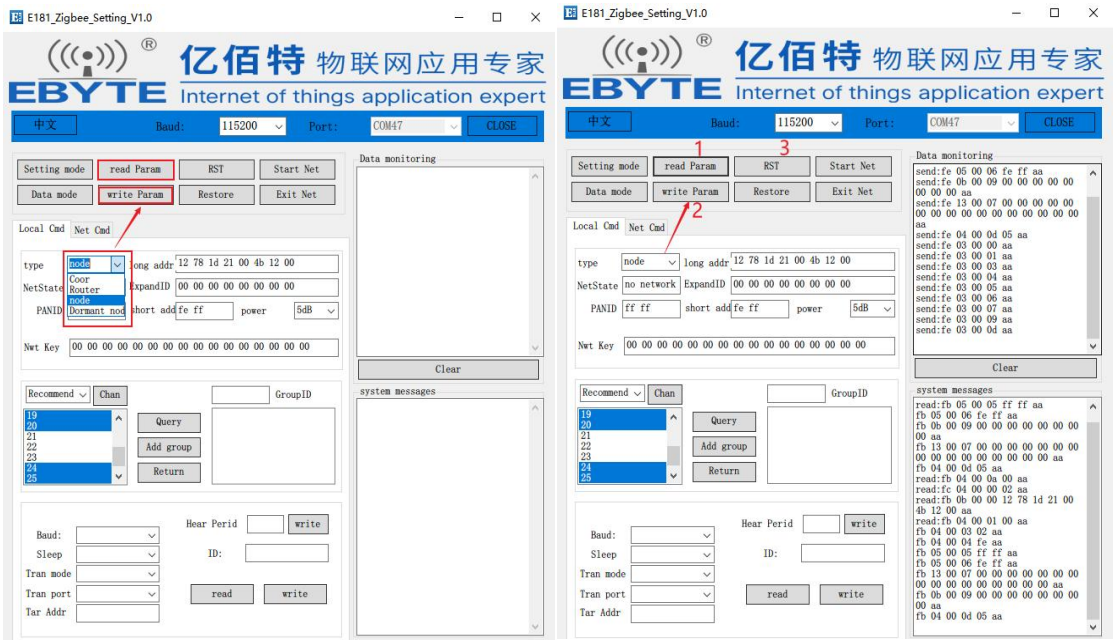
3. Click to enter configuration, read parameters, and read the corresponding DTU parameters.



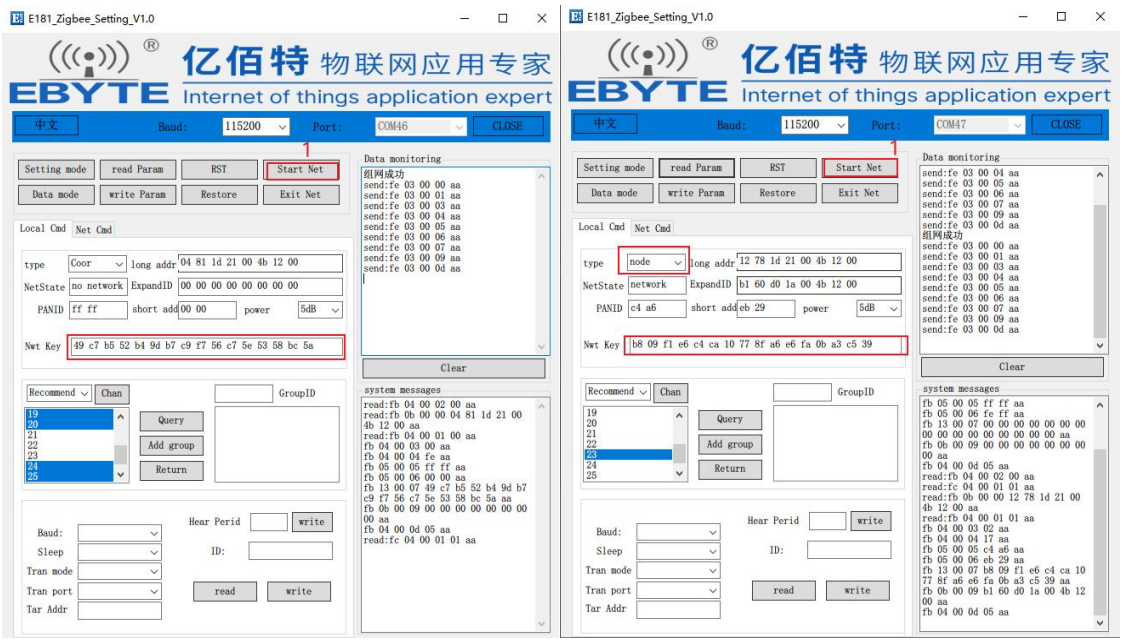
4. Select the node type as coordinator and write the parameters. Then click Restart DTU to read as coordinator successfully, read the parameters again, click Configure Network and wait for the coordinator to start building the network. The user can view the module parameters. After the network is built, read the parameters: Configure network parameters : (When PAN ID isFFFFF , it isautomaticPAN ID ）



5. Select another module and follow the same steps to set it as a terminal or dormant terminal (the module is a dormant terminal by factory default and needs to be set. In this experiment, it is a terminal).



6. After configuring the terminal, click Configure Network, read the parameters PANID\Network Key and obtain them successfully (consistent with the coordinator), and the network is successfully established.

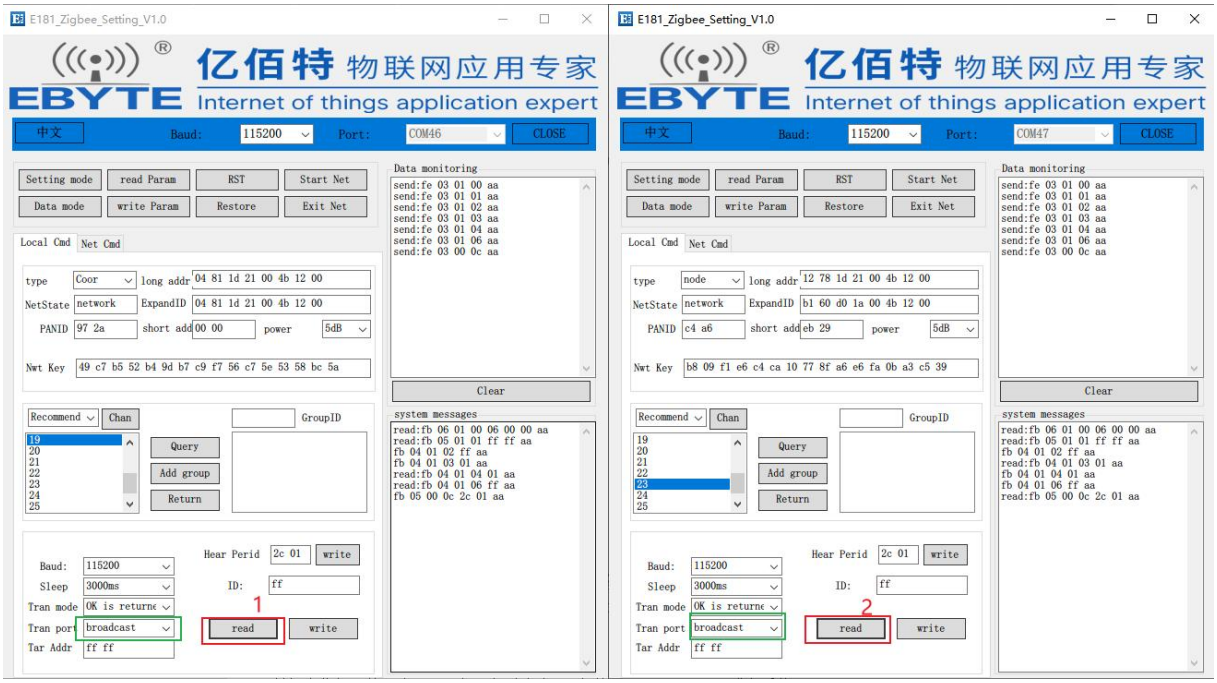


5.2 Communication Test

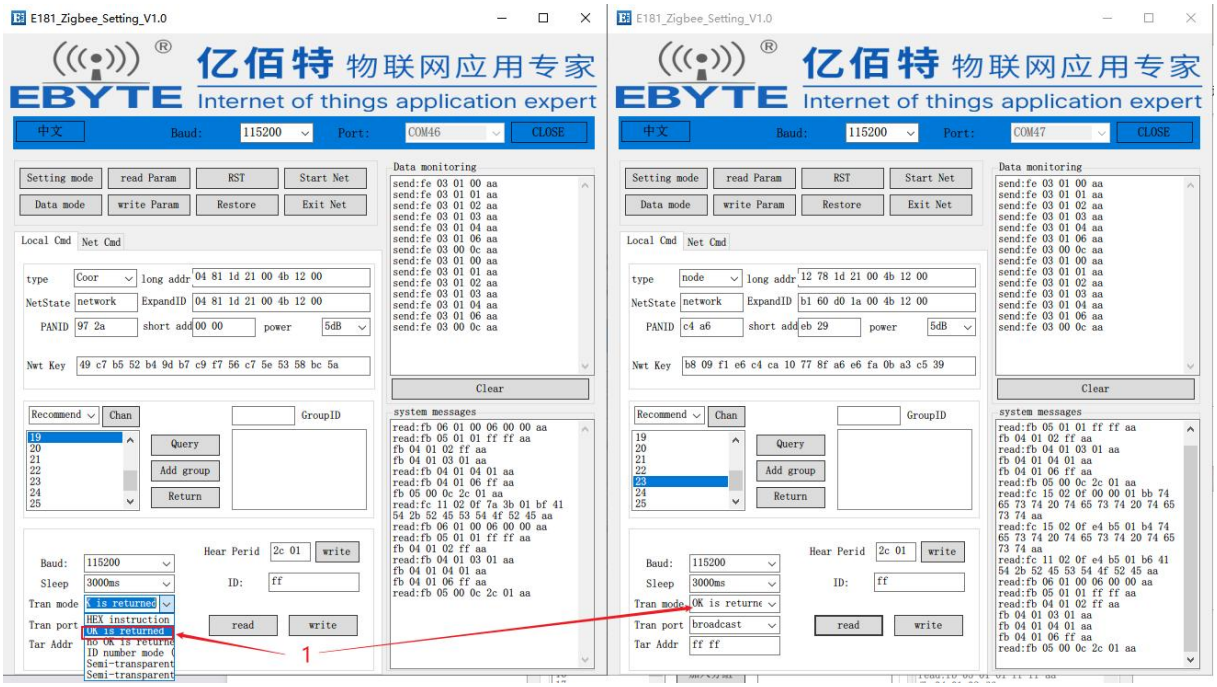
5.2.1 Coordinator transmits data to network terminals (on-demand communication)

Coordinator:

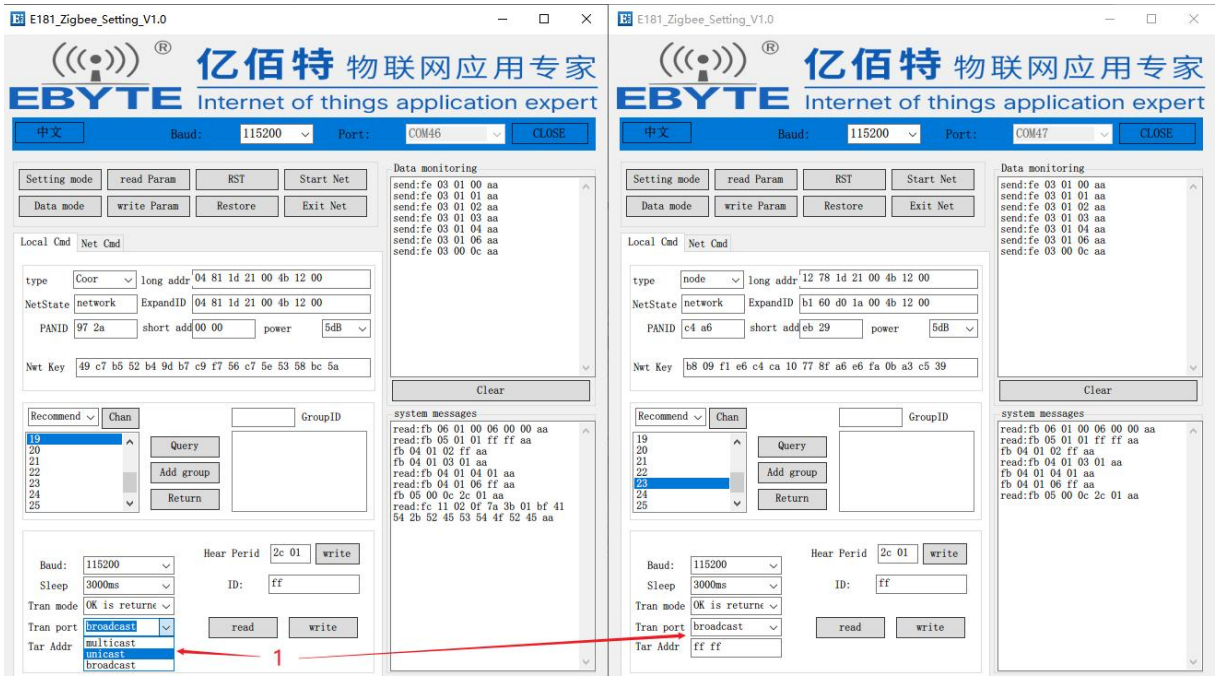
1. Click to read parameters



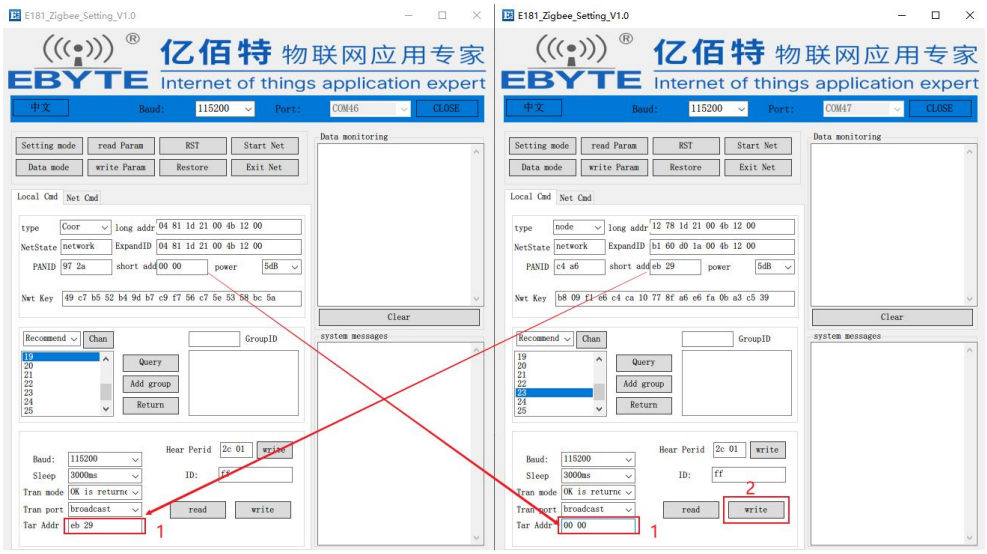
2. Select transparent transmission mode (mode 1)



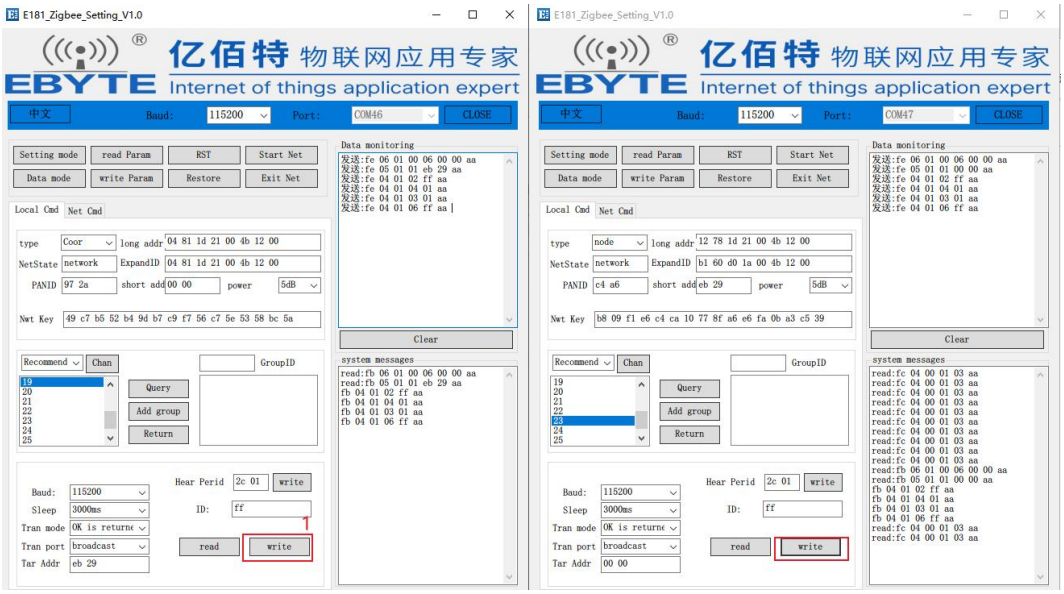
3. Select transparent transmission protocol (unicast)



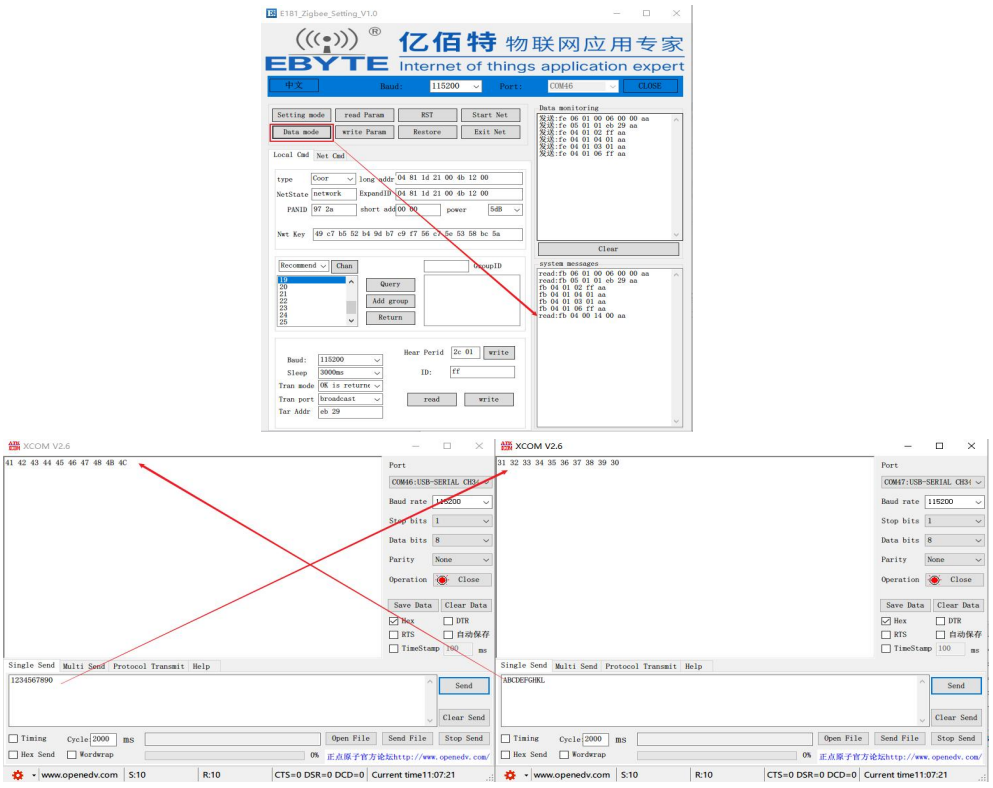
4. Fill in the target address (short address of the network terminal)



5. Click Write Parameters



6. Finally, click to enter the transmission mode, turn off the host computer, and use the serial port tool to perform communication testing



5.2.2 Coordinator transmits data to network terminals (multicast communication)

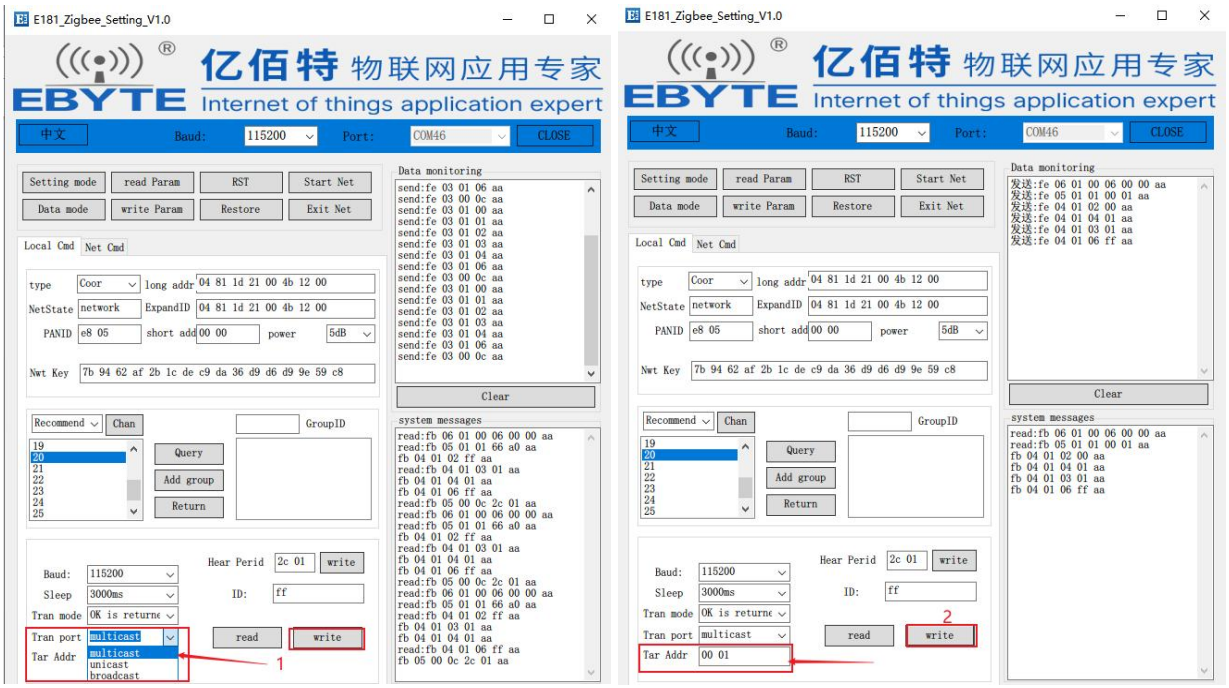
1. the nodes that need to be multicasted on the basis of unicast . For example, add terminal A and



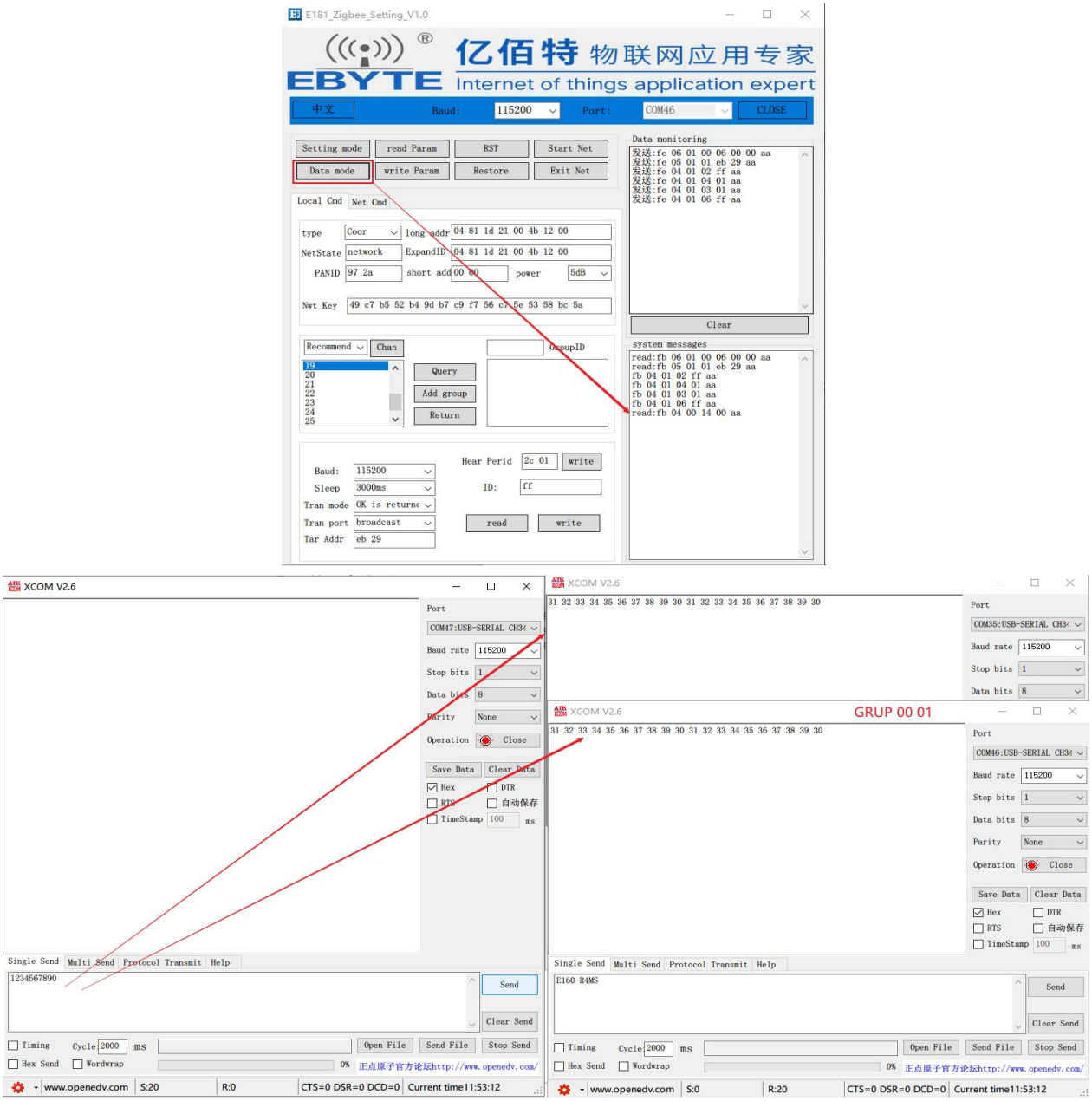
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

terminal B to group 00 01.

2. The coordinator selects multicast and fills in the group number



3. Click on the transmission mode, turn off the host computer, use the serial port tool to open the corresponding serial port, and perform communication test



6 User Instruction Set

To facilitate user usage, EWD181-DTU uses two command formats, namely AT command format and HEX command format.

The module defaults to transmission mode. Enter +AT to enter AT command mode, and enter +++ to enter HEX command mode. When executing AT commands, do not use a line break at the end.

6.1 Command Format

The basic format of HEX command:

HEX commands have three input and output methods:

- Input command: 0xFE + frame length (1 byte) + command type (1 byte) + command code (1 byte) + command parameters ((frame length - 3) bytes) + 0xAA
- Return command: 0xFB + frame length (1 byte) + command type (1 byte) + command code (1 byte) + command parameters ((frame length - 3) bytes) + 0xAA. Each input command generates only one return command.
- Receive command: 0xFC + frame length (1 byte) + command type (1 byte) + command code (1 byte) + command parameters ((frame length - 3) bytes) + 0xAA. The receive command includes network status information, receive data, etc.

The basic format of AT commands:

- The basic format of AT commands is "AT+command name", and AT commands are divided into three input formats: execution format, query format, and configuration format.
- Execution type: "AT+command name", followed by nothing, including characters or symbols, such as "AT+JOIN". Execution type commands return status values such as "OK\r\n" and "ERROR\r\n".
- The query format is: "AT+command name?", which is the command name followed by the ASC character '?', for example, "AT+NWK?". The execution format returns the command name in the format of "command name=parameter value\r\n", for example, "NWK=1\r\n".
- Configuration format: "AT+command name=configuration value", with '=' following the command name, for example, "AT+CH=25". The execution format returns a value in the format "command name=parameter value\r\n", for example, "CH=25\r\n". If the returned parameter value is not equal to the configured value, it indicates that the parameter value is incorrect and the configuration is invalid.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.2 AT Commands

AT commands are used to configure the module. The input format is "AT+command keyword". The symbol "=" or "?" after the keyword indicates configuration, query, etc. respectively. If there is no symbol after the keyword, the command operation is executed.

6.2.1 Local MAC Address:

<table>
<tr><td colspan="3">AT command: local MAC</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ MAC ?</td><td>MAC=mac_asc \r\n</td></tr>
<tr><td>parameter</td><td colspan="2">mac_asc: The ASCII format of the MAC address, consisting of eight two-digit characters separated by ":", for example, 00:12:4B:00:1A:D0:60:E3. The ASCII format MAC address is output in MSB big-endian format.</td></tr>
<tr><td>illustrate</td><td colspan="2">none</td></tr>
<tr><td>Example</td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ MAC ?</td><td>MAC= 00:12:4B:00:1A:D0:60:E3 \r\n</td></tr>
</table>

6.2.2 Network Status

<table>
<tr><td colspan="3">AT command: network status</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ NWK ?</td><td>NWK = nwk _asc \r\n</td></tr>
<tr><td>parameter</td><td colspan="2">nwk_asc: Network status, in ASCII format, ranging from 0 to 2.
<table>
<tr><td>nwk_asc (ASCII format)</td><td>state</td></tr>
<tr><td>0</td><td>No network</td></tr>
<tr><td>1</td><td>Network established</td></tr>
<tr><td>2</td><td>Network established but disconnected</td></tr>
</table></td></tr>
<tr><td>illustrate</td><td colspan="2">none</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ NWK ?</td><td>NWK = 1 \r\n</td></tr>
</table>

6.2.3 Networking

AT command: Networking		
	enter	return

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>implement</td><td>AT+ JOIN</td><td>status_asc\r\n</td></tr>
<tr><td>parameter</td><td colspan="2">status_asc : Network status, in ASCII format.
<table>
<tr><td>status_asc (ASCII format)</td><td>state</td></tr>
<tr><td>OK</td><td>Operation is effective</td></tr>
<tr><td>JOINED</td><td>Network established</td></tr>
<tr><td>INVALID</td><td>Invalid operation</td></tr>
</table></td></tr>
<tr><td>illustrate</td><td colspan="2">1. The coordinator executes this command for the first time to create a network. It then executes this command to open the network and accept new devices to join.
2. This command is valid for routers, terminal nodes, and dormant terminals that are not connected to the network. It is invalid for routers that are connected to the network.
3. Returning OK only means that the network has started, not that the network has been successfully established. To determine whether the network is successful, use "Query Network Status" or open "System Print" mode.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>implement</td><td>AT+ JOIN</td><td>OK \r\n</td></tr>
</table>

6.2.4 Network Roles

<table>
<tr><td colspan="3">AT Commands: Network Roles</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+DEV?</td><td>DEV=dev_asc\r\n</td></tr>
<tr><td>set up</td><td>AT+DEV=dev_asc</td><td>DEV=dev_asc\r\n</td></tr>
<tr><td>parameter</td><td colspan="2">dev_asc: Network role, ASCII code format.
<table>
<tr><td>dev_asc (ASCII format), uppercase letters are valid</td><td>Network Role</td></tr>
<tr><td>C</td><td>Coordinator</td></tr>
<tr><td>R</td><td>Router (default)</td></tr>
<tr><td>E</td><td>Endpoint</td></tr>
</table></td></tr>
<tr><td>illustrate</td><td colspan="2">1. The coordinator module and router module cannot switch roles, but the terminal node and dormant terminal can switch roles with each other.
2. After modifying the network role, you need to restart the module to take effect.
3. Modifying the role after networking will cause network disconnection and network clearing.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+DEV ?</td><td>DEV= S \r\n</td></tr>
<tr><td>set up</td><td>AT+DEV= R</td><td>DEV= R \r\n</td></tr>
</table>

6.2.5 Network Channel

<table>
<tr><td colspan="3">AT command: network channel</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
</table>

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>Query</td><td>AT+CH?</td><td>CH=ch_asc\r\n</td></tr>
<tr><td>set up</td><td>AT+CH=ch_asc</td><td>CH=ch_asc\r\n</td></tr>
<tr><td>implement</td><td></td><td></td></tr>
<tr><td>parameter</td><td colspan="2">ch_asc: channel, ASCII code format, maximum value 255.
<table>
<tr><td>ch_asc (ASCII format)</td><td>Channel</td></tr>
<tr><td>11~26</td><td>Fixed scanning of a single channel</td></tr>
<tr><td>254</td><td>Simultaneously scan channels 11, 14, 15, 19, 20, 24, and 25</td></tr>
<tr><td>255</td><td>Scan channels 11 to 26 simultaneously (default)</td></tr>
<tr><td>other</td><td>Invalid channel, do not change the current value</td></tr>
</table></td></tr>
<tr><td>illustrate</td><td colspan="2">1. Set the channel to the scanning channel during networking, not the real channel.
2. The coordinator can establish a network using a fixed channel
3. Routers, terminal nodes, and dormant terminals scan a single channel and preferentially join the channel coordinator. If there is no suitable coordinator for the channel, they may join other channel coordinators.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ CH?</td><td>CH= 255 \r\n</td></tr>
<tr><td>set up</td><td>AT+ CH = 11</td><td>CH= 11 \r\n</td></tr>
</table>

6.2.6 PANID (Network ID)

<table>
<tr><td colspan="3">AT command: PANID</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+PANID?</td><td>PANID=panid_asc\r\n</td></tr>
<tr><td>set up</td><td>AT+PANID=panid_asc</td><td>PANID=panid_asc\r\n</td></tr>
<tr><td>implement</td><td></td><td></td></tr>
<tr><td>parameter</td><td colspan="2">panid_asc: Network ID, in ASCII format, representing 4 hexadecimal digits.
<table>
<tr><td>panid_asc (ASCII format)</td><td>PANID</td></tr>
<tr><td>0xFFFF</td><td>Random PANID (default)</td></tr>
<tr><td>other</td><td>Fixed PANID</td></tr>
</table></td></tr>
<tr><td>illustrate</td><td colspan="2">1. The coordinator generates a random PANID or a fixed PANID.
2. After setting a fixed PANID, routers, terminal nodes, and dormant terminals can only join the coordinator of the PANID.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ PANID?</td><td>PANID= 0xFFFF \r\n</td></tr>
<tr><td>set up</td><td>AT+ PANID = 0x3E44</td><td>PANID= 0x3E44 \r\n</td></tr>
</table>

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.2.7 Network Short Address

<table>
<tr><td colspan="3">AT command: network address</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ADDR?</td><td>ADDR=addr_asc\r\n</td></tr>
<tr><td>parameter</td><td colspan="2">addr_asc: Network short address, ASCII code format, representing 4 hexadecimal numbers .
<table>
<tr><td>addr_asc (ASCII format)</td><td>Short URL</td></tr>
<tr><td>0xFFFE</td><td>Invalid short address, no network (default).</td></tr>
<tr><td>0x0000</td><td>Coordinator short address.</td></tr>
<tr><td>0x0001~0xFFF7</td><td>Valid short address, non-coordinator (networking).</td></tr>
<tr><td>0xFFF8~0xFFFF</td><td>The address is reserved and will not appear.</td></tr>
</table></td></tr>
<tr><td>illustrate</td><td colspan="2">1. When no network is established, the network address is 0xFFFE.
2. After the coordinator establishes the network, its own network address is 0x0000. The network addresses of routers, terminal nodes, and dormant nodes are assigned by the coordinator after they join the network, and the coordinator does not have the authority to set or modify them.
3. 0xFFFC, 0xFFFD, and 0xFFFF are broadcast addresses, and 0xFFF8 to 0xFFFB are reserved addresses. These addresses are not assigned to any device.
4. When the number of networks reaches a high level, there will be a certain probability that the network addresses of two nodes are the same, and the network address will jump.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ADDR?</td><td>ADDR= 0xECFF \r\n</td></tr>
</table>

6.2.8 Network Key

<table>
<tr><td colspan="3">AT command: Network key</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+KEY?</td><td>KEY=key_asc\r\n</td></tr>
<tr><td>parameter</td><td colspan="2">key_asc: Network key, in ASCII format, representing 32 hexadecimal digits.</td></tr>
<tr><td>illustrate</td><td colspan="2">The coordinator randomly generates a key when establishing a network. Routers, end nodes, and dormant terminals obtain keys from the coordinator after joining it. The key for modules not in a network is "00000000000000000000000000000000".</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+KEY?</td><td>KEY= EE23333E1DFE6E6C7EB0155B3D99B404 \r\n</td></tr>
</table>

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.2.9 Group (Multicast) Control

AT command: group (multicast) control		
	enter	return
Query added groups	AT+GROUP?	GROUP=group_list_asc\r\n
Join Group	AT+GROUP=1,group_id_asc	GROUP=group_list_asc\r\n
Exit Group	AT+GROUP=0,group_id_asc	GROUP=group_list_asc\r\n
parameter	group_id_asc: Group ID, ASCII format , representing 4 hexadecimal digits. For example, "0x0001", the valid range is "0x0001~0xFFFE" group_list_asc: Group list, in ASCII format, representing four hexadecimal numbers. For example, "[0x0001,x0002]". Arrays are separated by commas. If the device is not in any group, the "[]" is empty.	
illustrate	1. After a non-sleep device joins a group, it can receive multicast messages sent by any device to the group. 2. Dormant terminal nodes cannot receive multicast messages. 3. Each device can only join 8 different groups at most.	
Example		
	enter	return
Query added groups	AT+GROUP?	GROUP= [0x0001] \r\n, when not joining any group, returns GROUP= [] \r\n
Join Group	AT+GROUP=1, 0x0002	GROUP= [0x0001,0x0002] \r\n
Exit Group	AT+GROUP=0, 0x0001	GROUP= [0x0002] \r\n

6.2.10 Extended Network ID (EPANID)

AT command: Extended PANID		
	enter	return
Query	AT+EPANID?	EPANID=epanid_asc\r\n
set up	AT+EPANID=epanid_asc	EPANID=epanid_asc\r\n
parameter	epanid_asc: Extended network ID, in ASCII format, representing 16 hexadecimal digits, for example "EF0FC532004B1200".	
illustrate	1. The default value of the extended PANID is "0000000000000000". After the coordinator creates a network, it uses its own MAC (LSB little-endian format) as the extended PANID. The coordinator can freely set a different extended PANID each time it is restored to factory settings to indicate that the network created this time is different from the previous one. 2. Routers, terminal nodes, and dormant terminals can freely join any coordinator using the default extended PANID. After setting an extended PANID, they can only join the coordinator of that	

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

	extended PANID.	
Example		
	enter	return
Query	AT+EPANID?	EPANID= EF0FC532004B1200 \r\n
set up	AT+EPANID= EF0FC532004B1200	EPANID= EF0FC532004B1200 \r\n

6.2.11 Reset

AT command: reset		
	enter	return
implement	AT+RESET	status_asc\r\n
parameter	status_asc (ASCII format)	state
	OK	Operation is effective
illustrate	After returning to "OK", the system will reset.	
Example		
	enter	return
implement	AT+RESET	OK\r\n

6.2.12 System Printing

AT command: system print		
	enter	return
Query	AT+MSG?	MSG=msg_asc\r\n
set up	AT+MSG=msg_asc	MSG=msg_asc\r\n
parameter	msg_asc: single character in ASCII format, 0 or 1	
	msg_asc (ASCII format)	System Printing
	0	Off (default)
	1	Open
illustrate	This function can turn on or off the system printing information in transmission mode.	
Example		
	enter	return
Query	AT+MSG?	MSG= 0 \r\n
set up	AT+MSG= 1	MSG= 1 \r\n

6.2.13 Heartbeat Packet Period

AT command: heartbeat packet period		
	enter	return
Query	AT+HEART?	HEART=heart_asc\r\n
set up	AT+HEART=heart_asc	HEART=heart_asc\r\n

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

parameter	heart_asc: heartbeat packet period, ASCII code format, represents a decimal number, value range 1~65535, default value 300, unit is seconds
illustrate	1. The content of the heartbeat packet is the module's ZCL attribute "custom ID number". The coordinator can output and print the heartbeat packet in HEX command mode. 2. When the heartbeat packet period is set to 65535, the heartbeat packet is turned off.

Example

	enter	return
Query	AT+HEART?	HEART= 300 \r\n
set up	AT+HEART= 180	HEART= 180 \r\n

6.2.14 Transmit power

AT command: transmit power

	enter	return
Query	AT+POWER?	POWER=power_asc\r\n
set up	AT+POWER=power_asc	POWER=power_asc\r\n

parameter: power_asc: Transmit power value, ASCII code format, range 0~5, default value 5.

power_asc	Power value (dBm)
0	-5
1	0
2	10
3	14
4	17
5	20

illustrate: none

Example

	enter	return
Query	AT+POWER?	POWER= 5 \r\n
set up	AT+POWER= 0	POWER= 0 \r\n

6.2.15 Firmware Version

AT command: Firmware version

	enter	return
Query	AT+FWCODE?	FWCODE=wcode_asc\r\n
parameter	fwcode_asc: Firmware version string, such as "7515-0-10".	
illustrate	none	

Example

	enter	return
Query	AT+FWCODE?	FWCODE= 7515-0-10 \r\n

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.2.16 Returning a short address based on a MAC address

AT command: return short address based on MAC address		
	enter	return
set up	AT+QRYADDR=mac_asc_input	MAC= mac_asc,ADDR=addr_asc\r\n
parameter	mac_asc_input: MAC address, in ASCII format, represented by 16 hexadecimal digits, with ":" separating each two hexadecimal digits, for example, "00:12:4B:00:32:C5:0F:EF". The MAC address entered in ASCII format is in MSB big-endian format. mac_asc: Returns the MAC address in ASCII format, representing 16 hexadecimal digits. Each hexadecimal digit is separated by a ":", for example, "00:12:4B:00:32:C5:0F:EF". The MAC address entered in ASCII format is in MSB big-endian format. addr_asc: Returns a short address in ASCII format, representing 4 hexadecimal digits, such as "0x1234".	
illustrate	1. If the device corresponding to the MAC address is not found, the short address "0xFFFE" is returned. 2. If the corresponding device is found, the command will be returned immediately. If the corresponding device is not found, the command will be returned after about 6 seconds.	
Example		
	enter	return
Query	AT+QRYADDR= 00:12:4B:00:32:C5:0F:EF	MAC= 00:12:4B:00:32:C5:0F:EF ,ADDR= 0x1234 \r\n

6.2.17 Exiting the Network

AT command: exit network			
	enter	return	
implement	AT+LEAVE	status_asc\r\n	
parameter	status_asc (ASCII format)	state	
	OK	Operation is effective	
	NO_NWK	Currently not connected to the network	
illustrate	none		
Example			
	enter	return	
implement	AT+LEAVE	OK\r\n	

6.2.18 Factory Reset

AT command: restore to factory settings		
	enter	return

implement	AT+RESTORE	status_asc\r\n
parameter	status_asc (ASCII format)	state
	OK	Operation is effective
illustrate	none	
Example		
	enter	return
implement	AT+RESTORE	OK\r\n

6.2.19 Coordinator closes the network configuration

AT command: Coordinator turns off network configuration		
	enter	return
implement	AT+CLOSE	status_asc\r\n
parameter	status_asc (ASCII format)	state
	OK	Operation is effective
illustrate	none	
Example		
	enter	return
implement	AT+CLOSE	OK\r\n

6.2.20 Exit command mode (exit HEX/AT mode to transmission mode)

AT command: Coordinator turns off network configuration		
	enter	return
implement	AT+EXIT	status_asc\r\n
parameter	status_asc (ASCII format)	state
	OK	Operation is effective
illustrate	none	
Example		
	enter	return
implement	AT+EXIT	OK\r\n

6.2.21 Serial port mode configuration

AT command: serial port mode configuration		
	enter	return
Query	AT+ UART ?	UART=uart_asc_0,uart_asc_1,uart_asc2 \r\n
set up	AT+UART=uart_asc_0,uart_asc_1,uart_asc2	UART=uart_asc_0,uart_asc_1,uart_asc2 \r\n

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>parameter</td><td>uart_asc_0: baud rate, ASC format, range 0~7<table><tr><td>uart_asc_0 (ASC format)</td><td>Baud rate</td></tr><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>4800</td></tr><tr><td>2</td><td>9600</td></tr><tr><td>3</td><td>19200</td></tr><tr><td>4</td><td>38400</td></tr><tr><td>5</td><td>57600</td></tr><tr><td>6</td><td>115200 (default)</td></tr><tr><td>7</td><td>230400</td></tr></table>uart_asc_1: stop bit, ASC format, range 0~1<table><tr><td>uart_asc_ 1 (ASC format)</td><td>Stop bits</td></tr><tr><td>0</td><td>1 bit (default value)</td></tr><tr><td>1</td><td>2bit</td></tr></table>uart_asc2 : check digit, ASC format, range 0~2<table><tr><td>uart_asc_ 2 (ASC format)</td><td>Check digit</td></tr><tr><td>0</td><td>No validation (default)</td></tr><tr><td>1</td><td>Odd parity</td></tr><tr><td>2</td><td>Even parity</td></tr></table></td></tr>
<tr><td>illustrate</td><td>1. This setting triggers automatic restart
2. If the parameter setting exceeds the maximum value, directly apply the maximum value. For example, if the baud rate is set to 8, the baud rate is forced to be set to 7, which corresponds to 230400.</td></tr>
<tr><td colspan="2">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ UART ?</td><td>UART= 6,0,0 \r\n</td></tr>
<tr><td>set up</td><td>AT+UART= 7,1,2</td><td>UART= 7,1,2 \r\n</td></tr>
</table>

6.2.22 Target Address

AT command: target address		
	enter	return
Query	AT+ DSTADDR ?	DSTADDR=dstaddr_asc \r\n
set up	AT+DSTADDR=dstaddr_asc	DSTADDR=dstaddr_asc \r\n

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

parameter	dstaddr_asc: transparent transmission destination address ASCII code format, 4-character hexadecimal format starting with "0x", for example "0x1234"
illustrate	The target address in transparent transmission mode, the default value is "0xFFFF", which means broadcast mode.

Example		
	enter	return
Query	AT+ DSTADDR ?	DSTADDR= 0xFFFF \r\n
set up	AT+DSTADDR= 0x1234	DSTADDR= 0x1234 \r\n

6.2.23 Destination Port

AT command: target port		
	enter	return
Query	AT+ DSTEP ?	DSTEP=dstep_asc \r\n
set up	AT+DSTEP=dstep_asc	DSTEP=dstep_asc \r\n
parameter	dstep_asc: Transparent transmission target port ASCII code format, 2-character hexadecimal format starting with "0x", such as "0xFF"	

dstep_asc (ASCII format)	Destination Port Description
0x00	Multicast
0x01	Unicast
0x02~0xFE	reserve
0xFF	Broadcast (default)

illustrate	1. When multicasting, the destination port is set to 0x00 and the destination address is set to the corresponding group number. 2. It is recommended to set the destination port to 0x01 for unicast and 0xFF for broadcast.

Example		
	enter	return
Query	AT+ DSTEP ?	DSTEP= 0xFF \r\n
set up	AT+DSTEP= 0x01	DSTEP= 0x01 \r\n

6.2.24 Transmission Mode

AT command: transmission mode		
	enter	return
Query	AT+ MODE ?	MODE=mode_asc \r\n

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>set up</td><td colspan="2">AT+MODE=mode_asc</td><td>MODE=mode_asc \r\n</td></tr>
<tr><td>parameter</td><td colspan="3">mode_asc: Transmission mode ASCII code format, decimal format.<table>
<tr><td>mode_asc
(ASCII code)</td><td>Transmission Mode</td></tr>
<tr><td>0</td><td>Direct sending mode: no routing forwarding. The sending distance depends on the module power. It cannot be sent to dormant devices.</td></tr>
<tr><td>1 (default)</td><td>Transparent transmission: Input data is sent directly to the target defined by the target address and target port.</td></tr>
<tr><td>2</td><td>Transparent transmission with automatic retransmission: Same as mode 1, with automatic retransmission mechanism. After turning on "system printing", the delay can be seen from the return information.</td></tr>
<tr><td>3</td><td>Semi-transparent transmission: The first three bytes of the input data are the target address (HEX format LSB little-endian format) and the target port, and the subsequent data is the message content to be transmitted.</td></tr>
<tr><td>4</td><td>Translucent transmission with automatic retransmission: Same as mode 3, with automatic retransmission mechanism. After turning on "system printing", the delay can be seen from the return information.</td></tr>
<tr><td>5</td><td>Custom ID Host Transmit Mode: The first byte of the input transparent transmission message is the slave's 8-bit "Custom ID," defined by the slave's 8-bit ID number set via the "Custom ID" AT command or HEX command. The host will send the transparent transmission message to the slave in unicast format. This mode has the following advantages: 1. Only the module with the corresponding custom ID can receive the message. 2. The host's transmission avoids broadcast storms and significantly reduces latency. 3. The host's transmission is not affected by the "Destination Address" and "Destination Port" parameters.</td></tr>
<tr><td>6</td><td></td></tr>
</table></td></tr>
<tr><td>illustrate</td><td colspan="3">none</td></tr>
<tr><td colspan="4">Example</td></tr>
<tr><td></td><td colspan="2">enter</td><td>return</td></tr>
<tr><td>Query</td><td colspan="2">AT+ MODE ?</td><td>MODE= 1 \r\n</td></tr>
<tr><td>set up</td><td colspan="2">AT+MODE= 0</td><td>MODE= 0 \r\n</td></tr>
</table>

6.2.25 Sleep Mode

AT command: sleep mode		
	enter	return
Query	AT+ SLEEP ?	SLEEP=sleep_asc \r\n
set up	AT+SLEEP=sleep_asc	SLEEP=sleep_asc \r\n

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>parameter</td><td>sleep_asc: sleep mode ASCII code format, decimal format, range 0~6 or 60.<table><tr><td>sleep_asc (ASCII code)</td><td>Sleep mode</td></tr><tr><td>0</td><td>Always dormant and no synchronization occurs with the parent node.</td></tr><tr><td>1~6 (default 1)</td><td>Wake up every 1 to 6 seconds to receive parent node data.</td></tr><tr><td>60</td><td>Wake up every 60 seconds and synchronize parent node records.</td></tr></table></td></tr>
<tr><td>illustrate</td><td>1. Dormant nodes need to receive data. The setting range is 1 to 6. The larger the value, the worse the real-time performance of received data and the higher the packet loss rate.
2. If it is set to 0 or 60, data cannot be received, but the low power consumption effect is better.
3. The sleep mode of the sleeping node can be modified dynamically, waking up frequently during the time period when data needs to be received, and sleeping for a long time during the time period when data does not need to be received.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>AT+ SLEEP ?</td><td>SLEEP = 1 \r\n</td></tr>
<tr><td>set up</td><td>AT+ SLEEP = 0</td><td>SLEEP = 0 \r\n</td></tr>
</table>

6.2.26 Custom Number

AT command: custom number		
	enter	return
Query	AT+ MBID ?	MBID=mbid_asc \r\n
set up	AT+ MBID =mbid_asc	MBID=mbid_asc \r\n
parameter	mbid_asc: ASCII code format of the custom number, ranging from 0 to 255, with the default value being 255.	
illustrate	The custom number will be included in the heartbeat packet and transmitted to the coordinator using the ZCL protocol.	
Example		
	enter	return
Query	AT+ MBID ?	MBID = 255 \r\n
set up	AT+ MBID = 1	MBID = 1 \r\n

6.2.27 Network Access Node Table

AT command: Network node table		
	enter	return
Query a single	AT+ NODE=node_idx	NODE= node_idx , ADDR= addr_asc ,MAC= mac_asc \r\n
Search All	AT+ NODE?	OK\r\n NODE= 0 , ADDR= addr_asc_0 ,MAC= mac_asc_0 \r\n …

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

		NODE= n , ADDR= addr_asc_n ,MAC= mac_asc_n \r\n
parameter	node_idx : The serial number of the node entering the network, valid from 0 to 199. addr_asc: short address of the node entering the network, 0x0000 to 0xFFF0 is valid mac_asc: MAC address of the access node short address of the nth node entering the network MAC address of the nth access node	
illustrate	Query a single access node and output the access node corresponding to the access node serial number. If there is no access node with this serial number or the access node has been deleted, the corresponding short address and MAC address are invalid values. Query all networked nodes. The module continuously outputs all networked nodes and automatically skips the sequence numbers of deleted nodes.	
Example		
	enter	return
Query a single	AT+ NODE= 0	NODE= 0 ,ADDR= 0xF21F ,MAC= A4.C1.38.FB.C0.6C.76.D4 \r\n
Search All	AT+NODE?	NODE= 0 ,ADDR= 0x0000 ,MAC= A4.C1.38.C6.FE.D2.18.CA \r\n NODE= 1 ,ADDR= 0xD047 ,MAC= A4.C1.38.05.91.57.5B.32 \r\n NODE= 2 ,ADDR= 0xB64B ,MAC= A4.C1.38.FF.42.B9.C1.A2 \r\n

6.2.28 Enumerating Nodes

AT command: Enumerate nodes		
	enter	return
Enumerate Nodes	AT+ ENUM=mac_addr	ENUM= mac_addr , ADDR= addr_asc \r\n
parameter	mac_asc: MAC address of the access node. addr_asc : short address of the node entering the network, 0x0000 to 0xFFF0 is valid.	
illustrate	When a node first joins the network, the coordinator automatically outputs its enumeration information, which is printed out using the "enumeration notification" command (in both AT and HEX command formats). This command is only necessary to re-enumerate devices if the host computer does not have the node's first network access information saved.	
Example		
	enter	return
Query	AT+ ENUM= A4:C1:38:FB:C0:6C:76:D4	ENUM = A4:C1:38:FB:C0:6C:76:D4,ADDR=0xF21F \r\n

6.2.29 Deleting a Node

AT command: delete node		
	enter	return
Deleting a Node	AT+ DEL=mac_asc	OK \r\ nor FAIL\r\n
parameter	mac_asc: MAC address of the deleted node.	
illustrate	If the deleted node exists in the table of connected nodes, it will return OK. The coordinator will send a kick command regardless of whether the node is in the table. If the coordinator receives node data that is not in this table, it can use this command to delete it.	
Example		
	enter	return
Query	AT+DEL= A4:C1:38:FF:42:B9:C1:A2	OK \r\n

6.3 HEX Commands - Local Configuration

Each HEX command starts with FE, the second byte is the command length, the third byte is the command type, the fourth byte is the command code, and the fifth byte and the following are the input command parameters. Each HEX command ends with AA, and the command length includes the command end AA.

Each HEX command has a return command. The return command starts with FB. The second byte is the command length. The third byte is the command type, which is the same as the input command. The fourth byte is the command code, which is the same as the input command. The fifth byte and the following are the return command parameters. Each HEX command ends with AA, and the command length includes the command end AA.

6.3.1 Local MAC Address:

HEX command: local MAC		
	enter	return
Query	FE 03 00 00 AA	FB 0B 00 00 mac_hex AA
parameter	mac_hex: 8-byte HEX array of the MAC address, for example, E3 60 D0 1A 00 4B 12 00. The HEX format MAC address is output in LSB little-endian format.	
illustrate	none	
Example		
	enter	return

Query	FE 03 00 00 AA	FB 0B 00 00 E3 60 D0 1A 00 4B 12 00 AA

6.3.2 Network Status

HEX command: Network status		
	enter	return
Query	FE 03 00 01 AA	FB 0 4 00 0 1 nwk _hex AA
parameter	nwk_hex: Network status, HEX format, range 00~02 nwk_hex (HEX format) / state 00 / No network 01 / Network established 02 / Network established but disconnected	
illustrate	none	
Example		
	enter	return
Query	FE 03 00 01 AA	FB 04 00 01 01 AA

6.3.3 Networking

HEX command: Networking		
	enter	return
implement	FE 03 00 02 AA	FB 0 4 00 0 2 status _hex AA
parameter	status_hex: network status, HEX format status_hex (ASCII format) / state 00 / Operation is effective FF / Invalid operation	
illustrate	1. The coordinator executes this command for the first time to create a network. It then executes this command to open the network and accept new devices to join. 2. This command is valid for routers, terminal nodes, and dormant terminals that are not connected to the network. It is invalid for routers that are connected to the network. 3. If "Operation Valid" is returned, it only means that the network has started, not that it has been successfully established. To determine whether the network is successful, use "Query Network Status" or receive asynchronous commands.	
Example		
	enter	return
implement	FE 03 00 02 AA	FB 04 00 02 00 AA

6.3.4 Network Roles

<table>
<tr><td colspan="3">HEX command: Network role</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 00 03 AA</td><td>FB 04 00 03 dev_hex AA</td></tr>
<tr><td>set up</td><td>FE 04 00 03 dev_hex AA</td><td>FB 04 00 03 dev_hex AA</td></tr>
<tr><td>parameter</td><td colspan="2">dev_hex: network role, HEX format, range 00~03<table><tr><td>dev_hex (HEX format)</td><td>Network Role</td></tr><tr><td>00</td><td>Coordinator (default)</td></tr><tr><td>01</td><td>router</td></tr><tr><td>02</td><td>Endpoint</td></tr></table></td></tr>
<tr><td>illustrate</td><td colspan="2">1. The coordinator module and router module cannot switch roles, but the terminal node and dormant terminal can switch roles with each other.
2. After modifying the network role, you need to restart the module for it to take effect.
3. Modifying the role after networking will cause network disconnection and network clearing.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 00 03 AA</td><td>FB 04 00 03 03 AA</td></tr>
<tr><td>set up</td><td>FE 04 00 03 01 AA</td><td>FB 04 00 03 01 AA</td></tr>
</table>

6.3.5 Network Channel

<table>
<tr><td colspan="3">HEX command: Network channel</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 00 04 AA</td><td>FB 04 00 04 ch_hex AA</td></tr>
<tr><td>set up</td><td>FE 04 00 04 ch_hex AA</td><td>FB 04 00 04 ch_hex AA</td></tr>
<tr><td>parameter</td><td colspan="2">ch_hex: channel, maximum value FF.<table><tr><td>ch_hex (HEX format)</td><td>Channel</td></tr><tr><td>0B~1A</td><td>Fixed scanning of a single channel</td></tr><tr><td>FE</td><td>Simultaneously scan channels 11, 14, 15, 19, 20, 24, and 25</td></tr><tr><td>FF</td><td>Scan channels 11 to 26 simultaneously (default)</td></tr><tr><td>other</td><td>Invalid channel, do not change the current value</td></tr></table></td></tr>
<tr><td>illustrate</td><td colspan="2">1. Set the channel to the scanning channel during networking, not the real channel.
2. The coordinator can establish a network using a fixed channel
3. Routers, terminal nodes, and dormant terminals scan a single channel and preferentially join the channel coordinator. If there is no suitable coordinator for the channel, they may join other</td></tr>
</table>

	channel coordinators.	
Example		
	enter	return
Query	FE 04 00 04 AA	FB 04 00 04 FF AA
set up	FE 04 00 04 0B AA	FB 04 00 04 0B AA

6.3.6 PANID (Network ID)

HEX command: PANID		
	enter	return
Query	FE 03 00 05 AA	FB 05 00 05 panid _hex AA
set up	FE 05 00 05 panid_hex AA	FB 05 00 05 panid _hex AA
parameter	panid_hex: PANID in HEX format, LSB little endian format. For example, "0x1234" is "34 12" in HEX instruction. panid _hex (HEX format) / PANID FF FF / Random PANID (default) other / Fixed PANID	
illustrate	1. The coordinator generates a random PANID or a fixed PANID. 2. After setting a fixed PANID, routers, terminal nodes, and dormant terminals can only join the coordinator of the PANID.	
Example		
	enter	return
Query	FE 03 00 05 AA	FB 05 00 05 FF FF AA
set up	FE 05 00 05 44 3E AA	FB 05 00 05 44 3E AA

6.3.7 Network Address

HEX command: network address		
	enter	return
Query	FE 03 00 06 AA	FB 04 00 06 addr_hex AA
parameter	addr_hex: Network address in HEX format, LSB little endian format. For example, "0x1234" is "34 12" in the HEX instruction. addr_hex (HEX format) / Short URL FE FF / Invalid short address, no network (default) 00 00 / Coordinator short address. 01 00 ~ F7 FF / Valid short address, non-coordinator (networking). F8 FF ~ FF FF / The address is reserved and will not	

		appear.
illustrate	1. When no network is established, the network address is "FE FF". 2. After the coordinator establishes the network, its own network address is "00 00". The network addresses of routers, terminal nodes, and dormant nodes are assigned by the coordinator after they join the network, and the coordinator does not have the authority to set or modify them. 3. "FC FF", "FD FF", and "FF FF" are broadcast addresses, and "F8 FF" to "FF FF" are reserved addresses. These addresses are not assigned to any device. 4. When the number of networks reaches a high level, there will be a certain probability that the network addresses of two nodes are the same, and the network address will jump.	
Example		
	enter	return
Query	FE 03 00 06 AA	FB 04 00 06 FF EC AA

6.3.8 Network Key

HEX command: Network key		
	enter	return
Query	FE 03 00 07 AA	FB 13 00 07 key_hex AA
parameter	key_hex: 16-byte key, which can be treated as an array "uint8 key[16]".	
illustrate	The coordinator randomly generates a key when establishing a network. Routers, end nodes, and dormant terminals obtain the key from the coordinator after joining it. The key for modules not in a network is an array of 16 "00s."	
Example		
	enter	return
Query	FE 03 00 07 AA	FB 13 00 07 EE 23 33 3E 1D FE 6E 6C 7E B0 15 5B 3D 99 B4 04 AA

6.3.9 Group (Multicast) Control

HEX command: group (multicast) control		
	enter	return
Query added groups	FE 03 00 08 AA	FB len 00 08 group_list_hex AA
Join Group	FE 06 00 08 01 group_id_hex AA	FB len 00 08 group_list_hex AA
Exit Group	FE 06 00 08 00 group_id_hex AA	FB len 00 08 group_list_hex AA

parameter	group_id_hex: Group ID, in HEX format, LSB little-endian format. For example, the group ID "0x0001" is "01 00" in the HEX instruction. len: The length of the returned command is variable, and the actual value is determined by the content length of group_list_hex. group_list_hex: Group number list, which can be treated as a uint16 array. For example, if the group number is "[0x0001, 0x0002]", it will be "01 00 02 00" in the HEX command. If the module is not added to any group, this field is empty and contains no content.
illustrate	1. After a non-sleep device joins a group, it can receive multicast messages sent by any device to the group. 2. Dormant terminal nodes cannot receive multicast messages.

Example		
	enter	return
Query added groups	FE 03 00 08 AA	FB 05 00 08 01 00 AA
Join Group	FE 06 00 08 01 02 00 AA	FB 07 00 08 01 00 02 00 AA
Exit group	FE 06 00 08 00 01 00 AA	FB 03 00 08 AA

6.3.10 Extended PANID

HEX command: Extended PANID		
	enter	return
Query	FE 03 00 09 AA	FB 0B 00 09 epanid_hex AA
set up	FE 0B 00 09 epanid_hex AA	FB 0B 00 09 epanid_hex AA
parameter	epanid_hex: Extended PANID in HEX format, totaling 8 bytes, for example "EF 0F C5 32 00 4B 12 00".	
illustrate	1. The default value of the extended PANID is "00 00 00 00 00 00 00 00". After the coordinator creates a network, it uses its own MAC (LSB little-endian format) as the extended PANID. The coordinator can freely set a different extended PANID after each factory reset to indicate that the network created this time is different from the previous one. 2. Routers, terminal nodes, and dormant terminals can freely join any coordinator using the default extended PANID. After setting an extended PANID, they can only join the coordinator of that extended PANID.	

Example		
	enter	return
Query	FE 03 00 09 AA	FB 0B 00 05 EF 0F C5 32 00 4B 12 00 AA
set up	FE 0B 00 09 EF 0F C5 32 00 4B 12 00 AA	FB 0B 00 05 EF 0F C5 32 00 4B 12 00 AA

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.3.11 Reset

<table>
<tr><td colspan="3">HEX command: reset</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>implement</td><td>FE 03 00 0A AA</td><td>FB 04 00 0A status_hex AA</td></tr>
<tr><td>parameter</td><td colspan="2"><table><tr><td>status_hex (HEX format)</td><td>state</td></tr><tr><td>00</td><td>Operation is effective</td></tr></table></td></tr>
<tr><td>illustrate</td><td colspan="2">none</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>implement</td><td>FE 03 00 0A AA</td><td>FB 04 00 0A 00 AA</td></tr>
</table>

6.3.12 System Printing

<table>
<tr><td colspan="3">HEX command: system print</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 00 0B AA</td><td>FB 04 00 0B msg_hex AA</td></tr>
<tr><td>set up</td><td>FE 04 00 0B msg_hex AA</td><td>FB 04 00 0B msg_hex AA</td></tr>
<tr><td>parameter</td><td colspan="2">msg_hex: single-byte parameter, 00 or 01<table><tr><td>msg_hex (HEX format)</td><td>System Printing</td></tr><tr><td>00</td><td>Off (default)</td></tr><tr><td>01</td><td>Open</td></tr></table></td></tr>
<tr><td>illustrate</td><td colspan="2">This function can turn on or off the system printing information in transmission mode.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 00 0B AA</td><td>FB 04 00 0B 00 AA</td></tr>
<tr><td>set up</td><td>FE 04 00 0B 01 AA</td><td>FB 04 00 0B 01 AA</td></tr>
</table>

6.3.13 Heartbeat Packet Period

<table>
<tr><td colspan="3">HEX command: heartbeat packet period</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 00 0C AA</td><td>FB 05 00 0C heart_hex AA</td></tr>
<tr><td>set up</td><td>FE 05 00 0C heart_hex AA</td><td>FB 05 00 0C heart_hex AA</td></tr>
<tr><td>parameter</td><td colspan="2">heart_hex: 2-byte HEX format value, LSB little-endian format, range "01 00" to "FF FF", default "2C 01" (converted decimal = 300), unit is seconds.</td></tr>
<tr><td>illustrate</td><td colspan="2">1. The content of the heartbeat packet is the module's ZCL attribute "custom ID number". The coordinator can output and print the heartbeat packet in HEX command mode.
2. When the heartbeat packet period is set to "FF FF", the heartbeat packet is turned off.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
</table>

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Query	FE 03 00 0C AA	FB 05 00 0C 2C 01 AA
set up	FE 05 00 0C B4 00 AA	FB 05 00 0C B4 00 AA

6.3.14 Transmit power

HEX command: transmit power		
	enter	return
Query	FE 03 00 0D AA	FB 04 00 0D power_hex AA
set up	FE 04 00 0D power_hex AA	FB 04 00 0D power_hex AA
parameter	power_hex: Single byte in HEX format, corresponding to the module transmit power. The range is 00~05, corresponding to -5~20dBm, and the default value is 05.	
illustrate	This function can turn on or off the system printing information in transmission mode.	
Example		
	enter	return
Query	FE 03 00 0D AA	FB 04 00 0D 05 AA
set up	FE 04 00 0D 00 AA	FB 04 00 0D 00 AA

power_asc	Power value (dBm)
00	-5
01	0
02	10
03	14
04	17
05	20

6.3.15 Firmware Version

HEX command: Firmware version		
	enter	return
Query	FE 03 00 0E AA	FB 04 00 0E fwcode_hex AA
parameter	fwcode_hex: A single byte in HEX format represents the firmware version, a total of 4 bytes.	
illustrate	none	
Example		
	enter	return
Query	FE 03 00 0E AA	FB 04 00 0E 5B 10 02 0A AA

6.3.16 Returning a short address based on a MAC address

HEX command: Return short address based on MAC address		
	enter	return
set up	FE 0B 00 10 mac_hex_input AA	FB 0D 00 10 mac_hex addr_hex AA

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

parameter	mac_hex_input: Enter the MAC address in HEX format, LSB little endian format, for example "EF 0F C5 32 00 4B 12 00" mac_hex: Returns the HEX format of the MAC address, with LSB in little-endian format, for example, "EF 0F C5 32 00 4B 12 00" addr_hex: Returns the short address in HEX format, LSB little-endian format. For example, the address 0x1234 is represented as "34 12" in the HEX command.
illustrate	1. If the device corresponding to the MAC address is not found, the short address "FE FF" is returned. 2. If the corresponding device is found, the command will be returned immediately. If the corresponding device is not found, the command will be returned after about 6 seconds.

Example		
	enter	return
set up	FE 0B 00 10 EF 0F C5 32 00 4B 12 00 AA	FB 0D 00 0E EF 0F C5 32 00 4B 12 00 34 12 AA

6.3.17 Exiting the Network

HEX command: Exit the network		
	enter	return
implement	FE 03 00 11 AA	FB 04 00 11 status_hex AA
parameter	status_hex (HEX format)	state
	00	Operation is effective
illustrate	none	

Example		
	enter	return
implement	FE 03 00 11 AA	FB 04 00 11 00 AA

6.3.18 Factory Reset

HEX command: restore to factory default		
	enter	return
implement	FE 03 00 12 AA	FB 04 00 12 status_hex AA
parameter	status_hex (HEX format)	state
	00	Operation is effective
illustrate	none	

Example		
	enter	return
implement	FE 03 00 12 AA	FB 04 00 12 00 AA

6.3.19 Coordinator closes the network configuration

HEX command: Coordinator closes network configuration		
	enter	return
implement	FE 03 00 13 AA	FB 04 00 13 status_hex AA
parameter	status_hex (HEX format)	state
	00	Operation is effective
illustrate	none	
Example		
	enter	return
implement	FE 03 00 13 AA	FB 04 00 13 00 AA

6.3.20 Exit command mode (exit HEX/AT mode to transfer mode)

HEX command: Coordinator closes network configuration		
	enter	return
implement	FE 03 00 14 AA	FB 04 00 14 status_hex AA
parameter	status_hex (HEX format)	state
	00	Operation is effective
illustrate	none	
Example		
	enter	return
implement	FE 03 00 14 AA	FB 04 00 14 00 AA

6.3.21 Serial port mode configuration

HEX command: serial port mode configuration		
	enter	return
Query	FE 03 01 00 AA	FB 06 01 00 uart_hex_arry AA
set up	FE 06 01 00 uart_hex_arry AA	FB 06 01 00 uart_hex_arry AA

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>parameter</td><td>uart_hex_arry: 3-byte array, HEX format

uart_hex_arry[0]: baud rate, range 00~07
<table><tr><td>uart_hex_arry[0] (HEX format)</td><td>Baud rate</td></tr><tr><td>00</td><td>2400</td></tr><tr><td>01</td><td>4800</td></tr><tr><td>02</td><td>9600</td></tr><tr><td>03</td><td>19200</td></tr><tr><td>04</td><td>38400</td></tr><tr><td>05</td><td>57600</td></tr><tr><td>06</td><td>115200</td></tr><tr><td>07</td><td>230400</td></tr></table>
uart_hex_arry[1]: stop bit, range 00~01
<table><tr><td>uart_hex_arry[1] (HEX format)</td><td>Stop bits</td></tr><tr><td>00</td><td>1 bit</td></tr><tr><td>01</td><td>2bit</td></tr></table>
uart_hex_arry[2] : check digit, range 00~2
<table><tr><td>uart_hex_arry[2] (HEX format)</td><td>Check digit</td></tr><tr><td>00</td><td>No verification</td></tr><tr><td>01</td><td>Odd parity</td></tr><tr><td>02</td><td>Even parity</td></tr></table></td></tr>
<tr><td>illustrate</td><td>1. This setting triggers automatic restart
2. If the parameter setting exceeds the maximum value, the maximum value is directly applied. For example, if the baud rate is set to "08", the baud rate is forced to be set to "07", which corresponds to 230400.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 01 00 AA</td><td>FB 06 01 00 06 00 00 AA</td></tr>
<tr><td>set up</td><td>FE 06 01 00 07 01 02 AA</td><td>FB 06 01 00 07 01 02 AA</td></tr>
</table>

6.3.22 Target Address

HEX command: target address		
	enter	return
Query	FE 03 01 01 AA	FB 05 01 01 dstaddr_hex AA
set up	FE 05 01 01 dstaddr_hex AA	FB 05 01 01 dstaddr_hex AA

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

parameter	dstaddr_hex: transparent transmission destination address HEX format, LSB little endian format, for example, the address 0x1234 is "34 12" in the command
illustrate	The target address in transparent transmission mode. The default value is "FF FF", which means broadcast mode.

Example		
	enter	return
Query	FE 03 01 01 AA	FB 05 01 01 FF FF AA
set up	FE 05 01 01 34 12 AA	FB 05 01 01 34 12 AA

6.3.23 Destination Port

HEX command: target port		
	enter	return
Query	FE 03 01 02 AA	FB 04 01 02 dstep_hex AA
set up	FE 05 01 02 dstep_hex AA	FB 04 01 02 dstep_hex AA
parameter	dstep_hex: Transparent transmission target port HEX format.	
illustrate	1. When multicasting, the destination port is set to 00 and the destination address is set to the corresponding group number. 2. It is recommended to set the destination port to 01 for unicast and FF for broadcast.	

dstep_asc (ASCII format)	Destination Port Description
00	Multicast
01	Unicast
02~FE	reserve
FF	Port broadcast (default)

Example		
	enter	return
Query	FE 03 01 02 AA	FB 04 01 02 FF AA
set up	FE 04 01 02 01 AA	FB 04 01 02 01 AA

6.3.24 Transmission Mode

HEX command: transfer mode		
	enter	return
Query	FE 03 01 03 AA	FB 04 01 03 mode_hex AA
set up	FE 05 01 03 mode_hex AA	FB 04 01 03 mode_hex AA

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>parameter</td><td>mode_hex: Transmission mode HEX format.<table>
<tr><td>mode_hex (HEX format)</td><td>Transmission Mode</td></tr>
<tr><td>00</td><td>Direct sending mode: no routing forwarding. The sending distance depends on the module power. It cannot be sent to dormant devices.</td></tr>
<tr><td>01 (default)</td><td>Transparent transmission: Input data is sent directly to the target defined by the target address and target port.</td></tr>
<tr><td>02</td><td>Transparent transmission with automatic retransmission: Same as mode 1, with automatic retransmission mechanism. After turning on "system printing", the delay can be seen from the return information.</td></tr>
<tr><td>03</td><td>Semi-transparent transmission: The first three bytes of the input data are the target address (HEX format LSB little-endian format) and the target port, and the subsequent data is the message content to be transmitted.</td></tr>
<tr><td>04</td><td>Translucent transmission with automatic retransmission: Same as mode 3, with automatic retransmission mechanism. After turning on "system printing", the delay can be seen from the return information.</td></tr>
<tr><td>05</td><td>Custom ID Host Transmit Mode: The first byte of the input transparent transmission message is the slave's 8-bit "Custom ID," defined by the slave's 8-bit ID number set via the "Custom ID" AT command or HEX command. The host will send the transparent transmission message to the slave in unicast format. This mode has the following advantages: 1. Only the module with the corresponding custom ID can receive the message. 2. The host's transmission avoids broadcast storms and significantly reduces latency. 3. The host's transmission is not affected by the "Destination Address" and "Destination Port" parameters.</td></tr>
<tr><td>06</td><td>Custom number host sending mode with retransmission: same as mode 5, with automatic retransmission</td></tr>
</table></td></tr>
<tr><td>illustrate</td><td>none</td></tr>
<tr><td colspan="2">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 01 03 AA</td><td>FB 04 01 03 01 AA</td></tr>
<tr><td>set up</td><td>FE 04 01 03 00 AA</td><td>FB 04 01 03 00 AA</td></tr>
</table>

6.3.25 Sleep Mode

HEX command: Sleep mode		
	enter	return
Query	FE 03 01 04 AA	FB 04 01 04 sleep_hex AA
set up	FE 05 01 04 sleep _hex AA	FB 04 01 04 sleep_hex AA

<table>
<tr><td>parameter</td><td>sleep_hex: sleep mode HEX format, range 00~06 or 3C.<table><tr><td>sleep_hex (HEX format)</td><td>Sleep mode</td></tr><tr><td>00</td><td>Always dormant and no synchronization occurs with the parent node.</td></tr><tr><td>01~06 (default 01)</td><td>Wake up every 1 to 6 seconds to receive parent node data.</td></tr><tr><td>3C</td><td>Wake up every 60 seconds and synchronize parent node records.</td></tr></table></td></tr>
<tr><td>illustrate</td><td>none</td></tr>
<tr><td colspan="2">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 01 04 AA</td><td>FB 04 01 04 01 AA</td></tr>
<tr><td>set up</td><td>FE 04 01 04 00 AA</td><td>FB 04 01 04 00 AA</td></tr>
</table>

6.3.26 Custom Number

<table>
<tr><td colspan="3">HEX command: custom number</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 01 06 AA</td><td>FB 04 01 06 mbid_hex AA</td></tr>
<tr><td>set up</td><td>FE 05 01 06 mbid_hex AA</td><td>FB 04 01 06 mbid_hex AA</td></tr>
<tr><td>parameter</td><td colspan="2">mbid_hex: HEX format of custom number, ranging from 00 to FF, default is FF.</td></tr>
<tr><td>illustrate</td><td colspan="2">The custom number will be included in the heartbeat packet and transmitted to the coordinator using the ZCL protocol.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 03 01 06 AA</td><td>FB 04 01 06 FF AA</td></tr>
<tr><td>set up</td><td>FE 04 01 06 01 AA</td><td>FB 04 01 06 01 AA</td></tr>
</table>

6.3.27 Network Node Table

<table>
<tr><td colspan="3">HEX command: Network node table</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
<tr><td>Query</td><td>FE 0 5 00 17 node_idx AA</td><td>FB 0F 00 17 node_idx addr_hex mac_hex AA</td></tr>
<tr><td>parameter</td><td colspan="2">node_idx : The serial number of the node entering the network, 2- byte HEX format value, LSB little endian format, ranging from "00 00" to "C7 00".
addr_hex: short address of the node entering the network, 2- byte HEX format value, LSB little endian format, range "00 00" to "F0 FF".
mac_hex: MAC address of the access node, 8-byte HEX value, LSB little-endian format.</td></tr>
<tr><td>illustrate</td><td colspan="2">Query the nodes connected to the network on the coordinator, and you can also find the parent node and child node on the router.</td></tr>
<tr><td colspan="3">Example</td></tr>
<tr><td></td><td>enter</td><td>return</td></tr>
</table>

Query	FE 0 5 00 17 00 00 AA	FB 0F 00 1 7 00 00 34 12 EF 0F C5 32 00 4B 12 00 AA

6.3.28 Enumerating Nodes

HEX command: Enumerate nodes		
	enter	return
Query	FE 0B 00 18 mac_hex AA	FB 0D 00 18 mac_hex addr_hex AA
parameter	mac_hex: MAC address of the access node, 8-byte HEX value, LSB little-endian format. addr_hex: short address of the node entering the network, 2- byte HEX format value, LSB little endian format, range "00 00" to "F0 FF".	
illustrate	When a node first joins the network, the coordinator automatically outputs its enumeration information, which is printed out using the "enumeration notification" command (in both AT and HEX command formats). This command is only necessary to re-enumerate devices if the host computer does not have the node's first network access information saved.	
Example		
	enter	return
Query	FE 0B 00 18 D4 76 6C C0 FB 38 C1 A4 AA	FB 0D 00 18 D4 76 6C C0 FB 38 C1 A4 1F F2 AA

6.3.29 Deleting a Node

HEX command: delete node		
	enter	return
delete	FE 0B 00 19 mac_hex AA	FB 04 00 19 status AA
parameter	mac_hex: MAC address of the access node, 8-byte HEX value, LSB little-endian format. status: execution status, 00 = deletion successful, other values = not in the table	
illustrate	The deleted node returns a success status if it exists in the table of networked nodes. The coordinator will send a kick command regardless of whether the node is in the table. If the coordinator receives node data that is not in this table, it can use this command to delete it.	
Example		
	enter	return
delete	FE 0B 00 19 A2 C1 B9 42 FF 38 C1 A4 AA	FB 04 00 19 00 AA

6.4 Asynchronous Commands and System Printing Information

Asynchronous commands are used to indicate external events of the module. In HEX command mode, commands starting with FC are printed. In data transmission or AT command mode, system printing must be enabled. External events are converted into corresponding log information.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.4.1 Module startup

<table>
<tr><td>Command Name</td><td>Module startup</td></tr>
<tr><td>HEX Commands</td><td>FC 04 00 00 boot_hex AA</td></tr>
<tr><td>HEX parameters</td><td>boot_hex: boot code, 1 byte
<table>
<tr><td>boot_hex</td><td>Startup Mode</td></tr>
<tr><td>00</td><td>Power on</td></tr>
<tr><td>01</td><td>Button reset</td></tr>
<tr><td>02</td><td>Watchdog soft reset</td></tr>
</table></td></tr>
<tr><td>HEX Command Examples</td><td>Press the module reset button
FC 04 00 00 01 AA</td></tr>
<tr><td>System Printing</td><td>BOOT= boot_log \r\n</td></tr>
<tr><td>System printing parameters</td><td>boot_log: corresponding startup mode
<table>
<tr><td>boot_log</td><td>Startup Mode</td></tr>
<tr><td>PWR_ON</td><td>Power on</td></tr>
<tr><td>RESET</td><td>Button reset</td></tr>
<tr><td>WDT</td><td>Watchdog soft reset</td></tr>
</table></td></tr>
<tr><td>System printing example</td><td>Press the module reset button
“BOOT= RESET \r\n”</td></tr>
</table>

6.4.2 Network Connection Status

<table>
<tr><td>Command Name</td><td>Network connection status</td></tr>
<tr><td>HEX Commands</td><td>FC 04 00 01 nwk_status_hex AA</td></tr>
<tr><td>HEX parameters</td><td>nwk_status_hex: network connection status, 1 byte
<table>
<tr><td>nwk_status_hex</td><td>Network connection status</td></tr>
<tr><td>00</td><td>Screening failed</td></tr>
<tr><td>01</td><td>Network successfully joined/network opened</td></tr>
<tr><td>02</td><td>Restore network connection</td></tr>
<tr><td>03</td><td>Orphan nodes (offline)</td></tr>
<tr><td>04</td><td>Leave the network</td></tr>
</table></td></tr>
<tr><td>HEX Command</td><td>The terminal node is offline:
FC 04 00 01 04 AA</td></tr>
</table>

<table>
<tr><td>Examples</td><td></td></tr>
<tr><td>System Printing</td><td>nwk_status_log \r\n</td></tr>
<tr><td>System printing parameters</td><td>nwk_status_log: corresponding startup mode
<table>
<tr><td>boot_log</td><td>Network connection status</td></tr>
<tr><td>NWK_FAIL</td><td>Screening failed</td></tr>
<tr><td>NWK_JOINED</td><td>Network successfully joined/network opened</td></tr>
<tr><td>NWK_LINK</td><td>Restore network connection</td></tr>
<tr><td>NWK_ORPHAN</td><td>Orphan nodes (offline)</td></tr>
<tr><td>NWK_LEAVE</td><td>Leave the network</td></tr>
</table></td></tr>
<tr><td>System printing example</td><td>The terminal node is offline:
"NWK_ORPHAN\r\n"</td></tr>
<tr><td>illustrate</td><td>1. When the coordinator opens the network, it will print the "Network Successful" status.
2. Orphan nodes only occur in terminal nodes and dormant terminals. As long as there are coordinators and routers, terminal nodes and dormant terminals can restore connections.
3. For modules that have been connected to the network, as long as they do not actively exit the network, they will immediately trigger "restoring network connection" or become orphaned nodes after being powered on again.</td></tr>
</table>

6.4.3 Monitoring equipment access to the network

<table>
<tr><td>Command Name</td><td>Monitoring equipment access to the network</td></tr>
<tr><td>HEX Commands</td><td>FC 0E 00 02 join_mac_hex join_addr_hex join_mode_hex AA</td></tr>
<tr><td>HEX parameters</td><td>join_mac_hex: 8 bytes, MAC address of the networked device, LSB little-endian format.

join_addr_hex: 2 bytes, network address of the device joining the network, LSB little endian format.

join_mode_hex: 1 byte, network joining mode.
<table>
<tr><td>join_mode_hex</td><td>Network access mode</td></tr>
<tr><td>0</td><td>First time joining the network</td></tr>
<tr><td>1</td><td>Device online notification</td></tr>
</table></td></tr>
<tr><td>HEX Command Examples</td><td>A device with a MAC address of 00:12:4B:00:1A:D0:60:E3 joins the network and is assigned a network address of 0xECFF.
FC 0E 00 03 E3 60 D0 1A 00 4B 12 00 FF EC 00 AA</td></tr>
</table>

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td>System Printing</td><td>join_mode_asc MAC= mac_asc ,ADDR= addr_asc \r\n</td></tr>
<tr><td>System printing parameters</td><td>join_mode_asc: network joining mode, string format<table><tr><td>join_mode_asc</td><td>Network access mode</td></tr><tr><td>JOIN</td><td>First time joining the network</td></tr><tr><td>LINK</td><td>Device online notification</td></tr></table>mac_asc: Specifies the ASCII code string of the MAC address. Each character is separated by a hyphen (:), for example, "00:12:4B:00:1A:D0:60:E3".

addr_asc: The network address of the networked device, in ASCII format, hexadecimal data starting with "0x", such as "0xECFF"</td></tr>
<tr><td>System printing example</td><td>A device with a MAC address of 00:12:4B:00:1A:D0:60:E3 joins the network and is assigned a network address of 0xECFF.
" JOIN MAC= 00:12:4B:00:1A:D0:60:E3 ,ADDR= 0xECFF \r\n"</td></tr>
<tr><td>illustrate</td><td>1. When any device accesses the network for the first time, the coordinator will output "First access to the network" and both the coordinator and the router will output "Device online notification".
2. When a device that has been connected to the network is restarted, the coordinator and router will receive a "device online notification".</td></tr>
</table>

6.4.4 Monitoring equipment off-grid

Command Name	Monitoring equipment off-grid
HEX Commands	FC 0B 00 03 dev_mac_hex AA
HEX parameters	dev_mac_hex: 8 bytes, MAC address of the off-network device, LSB little-endian format.
HEX Command Examples	The device with MAC address 00:12:4B:00:1A:D0:60:E3 has left the network. FC 0B 00 03 E3 60 D0 1A 00 4B 12 00 AA
System Printing	LEAVE=mac_asc\r\n
System printing parameters	mac_asc: Specifies the ASCII code string of the MAC address. Each character is separated by a hyphen (:), for example, "00:12:4B:00:1A:D0:60:E3".
System printing example	The device with MAC address 00:12:4B:00:1A:D0:60:E3 has left the network. "LEAVE= 00:12:4B:00:1A:D0:60:E3 "

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

illustrate	none

6.4.5 Device Enumeration Notification

Command Name	Monitoring equipment access to the network
HEX Commands	FC 13 00 0 4 finish_flag endpoint_hex mac_hex addr_hex profile_hex device_hex AA
HEX parameters	finish_flag: end flag, 1 byte, indicating the last enumeration information of this node. sn_hex: Device enumeration serial number, 9 bytes, LSB format. A node can be identified as multiple virtual devices, such as a data transparent transmission interface and a PWM interface. The device enumeration serial number can be used to uniquely identify the virtual device. addr_hex: short address, 2 bytes, LSB format, the network short address of the node. endpoint_hex: port number, 1 byte, port number on the node. There may be multiple enumeration information for the same node. profile_hex: protocol profile, 2 bytes, used to mark the communication protocol type, and the data transmission device is "04 01". device_hex: device type, 2 bytes, used to identify the function of the node. The wireless module is "00 F0".
HEX Command Examples	A device with a MAC address of A4:C1:38:FB:C0:6C:76:D4 joins the network and is assigned a network address of 0xF21F. FC 13 00 04 01 01 D4 76 6C C0 FB 38 C1 A4 1F F2 04 01 00 F0 AA
系统打印	DEVICE ENUM:\r\n SN=sn_asc\r\n ADDR=addr_asc\r\n EP=endpoint_asc\r\n Profile=profile_asc\r\n Device ID=device_asc\r\n (EUNM FINISH: mac _asc \r\n)
System printing parameters	sn_asc : Device enumeration serial number, a 9 -digit hexadecimal number. A node can be identified as multiple virtual devices, such as a data transmission interface and a PWM interface. The device enumeration serial number can be used to uniquely identify the virtual device. addr_asc: The node's network short address. endpoint_asc: port number. There may be multiple enumeration information for the same node. profile_asc: Protocol profile, used to mark the communication protocol type, and the data transmission device is "0x0104". device_asc: device type, used to identify the function of the node. The wireless module is "0xF000". mac_asc : MAC address of the node, used to indicate that all enumeration information of the node has been printed.
System printing example	DEVICE ENUM:\r\n SN= A4 C1 38 FB C0 6C 76 D4 01 \r\n ADDR= 0xF21F \r\n

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

	EP= 0x01 \r\n Profile = 0x0104 \r\n Device ID = 0xF000 \r\n EUNM FINISH: A4:C1:38:FB:C0:6C:76:D4 \r\n
illustrate	1. The coordinator will automatically identify the enumeration information when the node first joins the network. The coordinator can output the enumeration information by turning on the debugging function in HEX instruction mode or transmission command mode. 2. If you missed the automatic enumeration information when the node first joined the network, you can use the "enumerate nodes" command of AT or HEX command to get the node enumeration information again.

6.5 Remote Control Commands

Remote control commands are used for wireless control between devices, including wireless communication. Remote control commands only have HEX command format, not AT command format. Therefore, remote control commands have good backward compatibility .

6.5.1 Sending data using HEX command

HEX command to send data		
Function	In HEX command mode, data is sent to the specified target device. The data message and transmission mode are compatible.	
Command format	enter	return
	FE len 02 0F dst_addr dst_ep ack_mode send_data AA	FB 04 02 0F rf_status AA

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

parameter

Enter the command parameters:

len: The frame length is one byte and is determined by the entire command parameter.

dst_addr: destination address, 2 bytes, LSB little endian format. In multicast mode, the destination address is the LSB little endian format of the group number.

dst_addr (HEX format)	Target address sending method
00 00 ~ F7 FF	Unicast mode
F8 FF ~ FB FF	reserve
FC FF	Broadcast to coordinator, router
FD FF	Broadcast to coordinators, routers, and end nodes (non-sleeping)
FF FF	Broadcast to all devices, including dormant terminals

dst_ep: destination port, 1 byte

dst_ep (HEX format)	Destination port sending mode
00	Multicast
01	Unicast
02 ~ FE	reserve
FF	Port broadcast

ack_mode: response mode, 1 byte

ack_mode (HEX format)	Answer Mode
00	Receive asynchronous response command. Receiving asynchronous response command means that the data is sent to the correct target.
01	Asynchronous response commands are not received, but the underlying layer generates automatic retransmissions, and the return command may be delayed significantly.
02	Asynchronous response commands are not received, and the underlying layer does not generate automatic retransmissions.

send_data: The data message sent, the number of bytes of the data message = len-5, that is, excluding dst_addr, dst_ep, ack_mode and frame tail.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td></td><td>Returns the command's parameters:
rf_status: Send result<table><tr><td>rf_status (HEX format)</td><td>Send results</td></tr><tr><td>00</td><td>Sent successfully</td></tr><tr><td>01</td><td>Invalid send</td></tr><tr><td>10~13</td><td>Module memory overflow (input data speed exceeds wireless transmission speed)</td></tr><tr><td>B7</td><td>Data retransmission failed (response mode 1, return command delay increased, about 18 seconds)</td></tr><tr><td>C2</td><td>The module is not connected to the Internet or is offline.</td></tr><tr><td>CD</td><td>The sending destination does not exist</td></tr><tr><td>E1</td><td>Data packets are interfered with by other wireless signals</td></tr><tr><td>E9</td><td>Data packet loss</td></tr><tr><td>F0</td><td>The data sent to the dormant terminal has timed out.</td></tr><tr><td>Other values</td><td>Unknown error</td></tr></table></td></tr>
<tr><td>Remarks</td><td>1. Use this command to send to the target device. If the target device is running in transmission mode, it will directly output the data in "send_data". If the target device is running in HEX command mode, it will use HEX command format to output the received content.
2. Due to the multiple routing forwarding mechanisms in a Zigbee network, sending data in response mode 0 allows for asynchronous response commands to be received. This response allows you to determine if the target device has received the data and if it is the correct target device. Sending data in response mode 1 allows you to directly determine if the data has reached the target based on the "rf_status" value in the return command. However, this response has a significant delay, and it is impossible to determine if the target device is the correct one.</td></tr>
<tr><td>Command Examples</td><td>Send the data packet "31 32 33 34 35 36 37 38 39 30" to the device with the network address "0xE4E5" using unicast (destination port = 1) and disabling retransmission. The return command indicates "successful transmission".

Send command: FE 11 02 0F E5 E4 01 00 31 32 33 34 35 36 37 38 39 30 AA
Return command: FB 04 02 0F 00 AA</td></tr>
</table>

6.5.2 HEX command receiving data

HEX command to receive data	
Function	In HEX command mode, the module receives data transmitted by other modules and outputs the received content in HEX command format.
Command format	Asynchronous reception
	FC len 02 0F src_addr src_ep rx_rssi rx_data AA

parameter	**Parameters for asynchronous commands:** len: The frame length is one byte and is determined by the entire command parameter. src_addr: source address, 2 bytes, LSB little endian format. dst_ep: source port, 1 byte. rx_rssi: data signal strength, 1 byte, converted to singed char format and then converted, for example, FF is converted to -1dmb. rx_data: received data message
Remarks	none
Command Examples	The data packet "31 32 33 34 35 36 37 38 39 30" is received from the device 0xE4E5. The other party uses port 1 (data transmission port) to send this data packet. The signal strength RSSI of this data packet is 0xED, which is converted to -19dBm. Receive command: FC 11 02 0F E5 E4 01 ED 31 32 33 34 35 36 37 38 39 30 AA

6.5.3 HEX command reception response command

HEX command receiving response command	
Function	Receiving the response command from the other device indicates that the other device has received the data.
Command format	Asynchronous reception
	FC 08 02 0B src_addr src_ep rx_rssi status AA
parameter	**Parameters for asynchronous commands:** src_addr: source address, 2 bytes, LSB little endian format. dst_ep: source port, 1 byte. rx_rssi: data signal strength, 1 byte, converted to singed char format and then converted, for example, FF is converted to -1dmb. status: Response status, 1 byte, used to determine whether the other device supports data transmission function.

status (HEX)	Status Description
00	The other device supports data transmission
other	The other device does not support data transmission

Remarks	If a response command with a status other than 00 is received, it is possible that other illegal devices have entered the network. The probability of this occurring is extremely low.
Command	After sending a data packet to device 0xE4E5, a response command is received from the other

Examples	party. The signal strength of the other party's port 1 is 0xED = 19dmb, and the status is 00, indicating that the other party supports data transmission. Receive: FC 08 02 0B E5 E4 01 ED 00 AA

6.5.4 Remote query configuration parameters

<table>
<tr><td colspan="3">Remote query configuration parameters</td></tr>
<tr><td>Function</td><td colspan="2">Remotely query the configuration parameters of the other device, support broadcast query or multicast query, one command to query multiple devices, the query results are received in asynchronous commands.</td></tr>
<tr><td rowspan="2">Command format</td><td>enter</td><td>return</td></tr>
<tr><td>FE 07 02 00 dst_addr dst_ep attr_id AA</td><td>FB 04 02 00 rf_status AA</td></tr>
<tr><td>parameter</td><td colspan="2">
Enter the command parameters:
dst_addr: destination address, 2 bytes, LSB little endian format. In multicast mode, the destination address is the LSB little endian format of the group number.
<table>
<tr><td>dst_addr (HEX format)</td><td>Target address sending method</td></tr>
<tr><td>00 00 ~ F7 FF</td><td>Unicast mode</td></tr>
<tr><td>F8 FF ~ FB FF</td><td>reserve</td></tr>
<tr><td>FC FF</td><td>Broadcast to coordinator, router</td></tr>
<tr><td>FD FF</td><td>Broadcast to coordinators, routers, and end nodes (non-sleeping)</td></tr>
<tr><td>FF FF</td><td>Broadcast to all devices, including dormant terminals</td></tr>
</table>
dst_ep: destination port, 1 byte
<table>
<tr><td>dst_ep (HEX format)</td><td>Destination port sending mode</td></tr>
<tr><td>00</td><td>Multicast</td></tr>
<tr><td>01</td><td>Unicast</td></tr>
<tr><td>02 ~ FE</td><td>reserve</td></tr>
<tr><td>FF</td><td>Port broadcast</td></tr>
</table>
attr_id: The configuration parameter code to be queried, 2 bytes, LSB little endian format. This configuration item is the same as the configuration item in the AT command.
<table>
<tr><td>addr_id (HEX format)</td><td>Corresponding parameters</td></tr>
<tr><td>00 00</td><td>Serial port mode configuration (baud rate, stop bit, parity bit)</td></tr>
<tr><td>01 00</td><td>Transparent transmission target address</td></tr>
<tr><td>02 00</td><td>Transparent transmission target port</td></tr>
<tr><td>03 00</td><td>Transmission Mode</td></tr>
<tr><td>04 00</td><td>Sleep mode</td></tr>
<tr><td>06 00</td><td>Custom number</td></tr>
</table>
</td></tr>
</table>

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

<table>
<tr><td></td><td>Returns the command's parameters:
rf_status: Send result<table>
<tr><td>rf_status (HEX format)</td><td>Send results</td></tr>
<tr><td>00</td><td>Sent successfully</td></tr>
<tr><td>01</td><td>Invalid send</td></tr>
<tr><td>10~13</td><td>Module memory overflow (input data speed exceeds wireless transmission speed)</td></tr>
<tr><td>B7</td><td>Data retransmission failed (response mode 1, return command delay increased, about 18 seconds)</td></tr>
<tr><td>C2</td><td>The module is not connected to the Internet or is offline.</td></tr>
<tr><td>CD</td><td>The sending destination does not exist</td></tr>
<tr><td>E1</td><td>Data packets are interfered with by other wireless signals</td></tr>
<tr><td>E9</td><td>Data packet loss</td></tr>
<tr><td>F0</td><td>The data sent to the dormant terminal has timed out.</td></tr>
<tr><td>Other values</td><td>Unknown error</td></tr>
</table></td></tr>
<tr><td>Remarks</td><td>Parameters of command class = 01 in HEX command support remote query</td></tr>
<tr><td>Command Examples</td><td>Broadcast query target short address of all modules in the network
Send command: FE 08 02 00 FF FF FF 01 00 AA
Return command: FB 04 02 00 00 AA</td></tr>
</table>

6.5.5 Receive remote query configuration parameters

<table>
<tr><td colspan="2">Receive remote query configuration parameters</td></tr>
<tr><td>Function</td><td>After sending a remote query command, the query result is received. For broadcast or multicast queries, multiple query results may be received at the same time.</td></tr>
<tr><td rowspan="2">Command format</td><td>Asynchronous reception</td></tr>
<tr><td>FC len 02 00 src_addr src_ep rx_rssi attr_id data_type attr_data AA</td></tr>
<tr><td>parameter</td><td>Parameters for asynchronous commands:
len: The frame length is one byte and is determined by the entire command parameter.

src_addr: source address, 2 bytes, LSB little endian format.

dst_ep: source port, 1 byte.

rx_rssi: data signal strength, 1 byte, converted to singed char format and then converted, for example, FF is converted to -1dmb.

attr_id: The configuration parameter code to be queried, 2 bytes, LSB little endian format. This configuration item is the same as the configuration item in the AT command.<table>
<tr><td>addr_id (HEX format)</td><td>Corresponding parameters</td></tr>
<tr><td>00 00</td><td>Serial port mode configuration (baud rate, stop bit, parity bit)</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>01 00</td><td>Transparent transmission target address</td></tr>
<tr><td>02 00</td><td>Transparent transmission target port</td></tr>
<tr><td>03 00</td><td>Transmission Mode</td></tr>
<tr><td>04 00</td><td>Sleep mode</td></tr>
<tr><td>06 00</td><td>Custom number</td></tr>
</table>

data_type: data type, 1 byte, corresponding to the data size of the configuration parameter.
<table>
<tr><td>data_type</td><td>Data Type</td><td>Data size (bytes)</td></tr>
<tr><td>20</td><td>uint8</td><td>1</td></tr>
<tr><td>twenty one</td><td>uint16</td><td>2</td></tr>
<tr><td>twenty two</td><td>uint24</td><td>3</td></tr>
<tr><td>twenty three</td><td>uint32</td><td>4</td></tr>
</table>

attr_data: configuration parameter value, the data size is determined by data_type</td></tr>
<tr><td>Remarks</td><td>none</td></tr>
<tr><td>Command Examples</td><td>The query result returned by the device at 0xE4E5 is received. The data type of the query parameter 0x0001 (transparent transmission target address) is 0x21 (uint16 type) and the value is 0xFFFF.
Receive command: FC 0C 02 00 E5 E4 01 EE 01 00 twenty one FF FF AA</td></tr>
</table>

6.5.6 Receiving Heartbeat Packets

<table>
<tr><td colspan="2">Receive heartbeat packets</td></tr>
<tr><td>Function</td><td>The coordinator receives the node heartbeat packet</td></tr>
<tr><td>Command format</td><td>Asynchronous reception</td></tr>
<tr><td></td><td>FC len 02 0A src_addr src_ep rx_rssi attr_id data_type attr_data AA</td></tr>
<tr><td>parameter</td><td>Parameters for asynchronous commands:
len: The frame length is one byte and is determined by the entire command parameter.

src_addr: source address, 2 bytes, LSB little endian format.

dst_ep: source port, 1 byte.

rx_rssi: data signal strength, 1 byte, converted to singed char format and then converted, for example, FF is converted to -1dmb.

attr_id: The configuration parameter code to be queried, 2 bytes, LSB little endian format. This configuration item is the same as the configuration item in the AT command.
<table>
<tr><td>addr_id (HEX format)</td><td>Corresponding parameters</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>00 00</td><td>Serial port mode configuration (baud rate, stop bit, parity bit)</td></tr>
<tr><td>01 00</td><td>Transparent transmission target address</td></tr>
<tr><td>02 00</td><td>Transparent transmission target port</td></tr>
<tr><td>03 00</td><td>Transmission Mode</td></tr>
<tr><td>04 00</td><td>Sleep mode</td></tr>
<tr><td>06 00</td><td>Custom number</td></tr>
</table>

data_type: data type, 1 byte, corresponding to the data size of the configuration parameter.
<table>
<tr><td>data_type</td><td>Data Type</td><td>Data size (bytes)</td></tr>
<tr><td>20</td><td>uint8</td><td>1</td></tr>
<tr><td>twenty one</td><td>uint16</td><td>2</td></tr>
<tr><td>twenty two</td><td>uint24</td><td>3</td></tr>
<tr><td>twenty three</td><td>uint32</td><td>4</td></tr>
</table>

attr_data: configuration parameter value, the data size is determined by data_type</td></tr>
<tr><td>Remarks</td><td>none</td></tr>
<tr><td>Command Examples</td><td>A heartbeat packet with the address 0xECFF is received. The heartbeat packet carries parameter 0x0006 (custom number), the data type is 0x20 (uint8), and the value is 0xFF.
Receive command: FC 0B 02 00 FF EC 01 E0 06 00 20 FF AA</td></tr>
</table>

6.5.7 Remotely modify configuration parameters

<table>
<tr><td colspan="3">Remote query configuration parameters</td></tr>
<tr><td>Function</td><td colspan="2">Remotely query the configuration parameters of the other device, support broadcast query or multicast query, one command to query multiple devices, the query results are received in asynchronous commands.</td></tr>
<tr><td rowspan="2">Command format</td><td>enter</td><td>return</td></tr>
<tr><td>FE len 02 01 dst_addr dst_ep attr_id data_type attr_data AA</td><td>FB 04 02 01 rf_status AA</td></tr>
</table>

parameter

Enter the command parameters:

len: Command length is determined by attr_data

dst_addr: destination address, 2 bytes, LSB little endian format. In multicast mode, the destination address is the LSB little endian format of the group number.

dst_addr (HEX format)	Target address sending method
00 00 ~ F7 FF	Unicast mode
F8 FF ~ FB FF	reserve
FC FF	Broadcast to coordinator, router
FD FF	Broadcast to coordinators, routers, and end nodes (non-sleeping)
FF FF	Broadcast to all devices, including dormant terminals

dst_ep: destination port, 1 byte

dst_ep (HEX format)	Destination port sending mode
00	Multicast
01	Unicast
02 ~ FE	reserve
FF	Port broadcast

attr_id: The configuration parameter code to be modified, 2 bytes, LSB little endian format. This configuration item is the same as the configuration item in the AT command.

data_type: data type, 1 byte, corresponding to the data size of the configuration parameter.

data_type	Data Type	Data size (bytes)
20	uint8	1
twenty one	uint16	2
twenty two	uint24	3
twenty three	uint32	4

attr_data: configuration parameter value, see table

Remotely modify the attr_id, data_type and corresponding attr_data value range of the configuration parameter command

Parameter name	attr_id	data_type	attr_data value range
Serial port mode configuration (baud rate, stop bit, parity bit)	00 00	uint24	attr_data[0] = [0:7] attr_data[1] = [0:1] attr_data[2] = [0:2]
Transparent transmission target address	01 00	uint16	0x0000~0xFFFF (little-endian format)
Transparent transmission target	02 00	uint8	0x00~0xFF

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

	port			
	Transmission Mode	03 00	uint8	0x00~0x04
	Sleep mode	04 00	uint8	0x00~0x06 or 0x3C
	Custom number	06 00	uint8	0x00~0xFF
	Returns the command's parameters: rf_status: Send result
	rf_status (HEX format)	Send results
	00	Sent successfully
	01	Invalid send
	10~13	Module memory overflow (input data speed exceeds wireless transmission speed)
	B7	Data retransmission failed (response mode 1, return command delay increased, about 18 seconds)
	C2	The module is not connected to the Internet or is offline.
	CD	The sending destination does not exist
	E1	Data packets are interfered with by other wireless signals
	E9	Data packet loss
	F0	The data sent to the dormant terminal has timed out.
	Other values	Unknown error
Remarks	Parameters with command class = 01 in the HEX command support remote query.
Command Examples	Broadcast sets the target short address of all modules in the network to 0x0000 Send command: FE 08 02 01 FF FF FF 01 00 twenty one 00 00 AA Return command: FB 04 02 01 00 AA

6.5.8 Remote Configuration Parameter Response

HEX command receiving response command	
Function	Receive response commands for modifying configuration parameters. When broadcasting modifications, modification commands returned by multiple devices will be received.
Command format	Asynchronous reception
	FC len 02 01 src_addr src_ep rx_rssi status attr_id AA
parameter	**Parameters for asynchronous commands:** len: frame length = 08 or 0A. src_addr: source address, 2 bytes, LSB little endian format. dst_ep: source port, 1 byte.

<table>
<tr><td></td><td>rx_rssi: data signal strength, 1 byte, converted to singed char format and then converted, for example, FF is converted to -1dmb.

status: Response status, 1 byte, used to determine whether the other device supports data transmission function.
<table><tr><td>status (HEX)</td><td>Status Description</td></tr><tr><td>00</td><td>Modification successful</td></tr><tr><td>86</td><td>Parameter number that does not exist</td></tr><tr><td>87</td><td>Parameter data range is incorrect</td></tr><tr><td>88</td><td>This parameter is read-only.</td></tr><tr><td>8D</td><td>data_type error</td></tr><tr><td>other</td><td>Modification failed for unknown reason</td></tr></table>
attr_id: configuration parameter number. If the modification fails, the response command will contain the parameter number.</td></tr>
<tr><td>Remarks</td><td>If a response command with a status other than 00 is received, it is possible that other illegal devices have entered the network. The probability of this occurring is extremely low.</td></tr>
<tr><td>Command Examples</td><td>The device with address 0xE4E5 returns a message indicating that the parameters have been modified successfully.
Receive: FC 08 02 01 E5 E4 01 ED 00 AA</td></tr>
</table>

Chapter 7 User Notice

7.1 ZigBee Network Roles and Considerations

Serial number	describe
1	This module uses ZigBee network networking, which consists of a coordinator and any other devices (routers and terminals)
2	It has self-organization, self-routing, and network multi-hop functions. (The default supported network depth is 30, the total number of sub-nodes is 20, and the number of sub-routing nodes is 6)
3	Parent node devices (coordinators and routers) can save data for dormant terminals for 7 seconds.
4	Only terminal devices have a sleep function. The sleep time is user-configurable, with a maximum of 60 seconds and a default of 1, meaning a wakeup time of 1 second . Since the parent node only stores data for 7 seconds, a setting of 0 seconds will cause the device to never wake up. Setting it to a time greater than 6 seconds will cause the device to wake up every 60 seconds. Setting it to 0 or

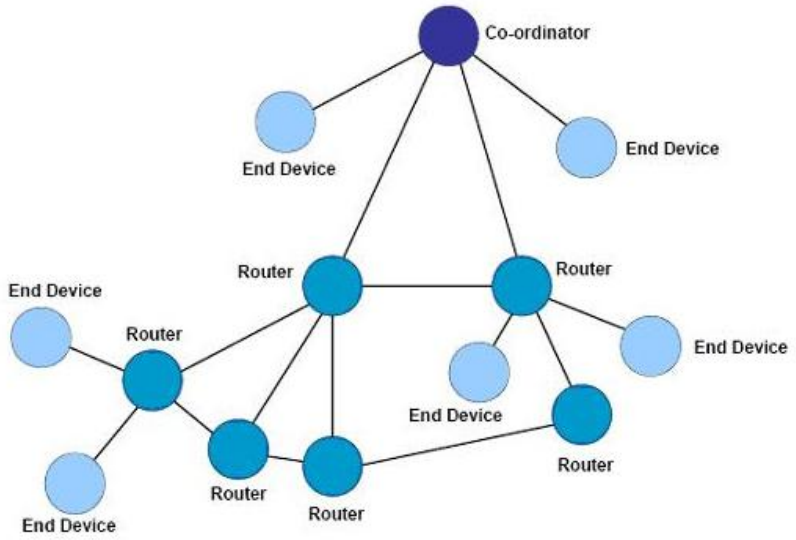
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

	60 seconds will disable data reception, ensuring the ultimate in low power consumption.
5	ShortAddress communication is used for network communication. Note: The short address is randomly assigned when the device joins the network. The device's MacAddress is the only fixed address. If you don't know the short address, you can use the corresponding instructions to find the ShortAddress in the network based on the MacAddress and then conduct point-to-point communication.
6	The coordinator is unique in the network and its short address is fixed to 0000.
7	If the on-demand address is FFFF, FFFD, or FFFC, it corresponds to three broadcast modes respectively.
8	When the network parameter PANID is FFFF, it is automatically assigned. If the device PANID is different, the network cannot be established.
9	The network key is randomly generated by the coordinator each time it is restored to factory settings. Routers and terminals cannot set keys. They use the key of the coordinator they join.
10	All devices on the network have enabled broadcasting. Multiple devices broadcasting simultaneously or a single device broadcasting at a high frequency may cause serious network congestion. Please try to avoid this situation.
11	The module does not need to join the group when multicasting. It can directly multicast to any group according to the communication method. A module can join multiple multicasts at the same time, and the local group number will not change due to different multicast numbers.
1 2	After entering sleep mode, the device can be awakened through the serial port or the wake-up pin. Note: In sleep mode, the first frame of data after the serial port wakes up is invalid. It is recommended that the first frame of data be a single byte 00, and subsequent data be sent within 5ms~100ms.
1 3	a ZigBee network , the transmission cycle for a single packet should not be too fast (generally recommended to be above 1 second)This may cause data loss. (Note that if there are too many nodes in the network, a too fast broadcast cycle may cause network instability.)

7.2 Network Structure

The network structure of this module is a mesh network structure (MESH)
The network with MESH topology has powerful functions, and the network can communicate through "multi-hop" mode; This topology can also form extremely complex networks; the network also has self-organization and self-healing capabilities; The recommended ratio of routers to terminal nodes is no less than 1:10;

Network Mesh



Revision history

Version	Date	Description	Issued by
1.0	2025-06-25	Initial version	Hao

About us

Technical support: support@cdebyte.com

Documents and RF Setting download link: https://www.cdebyte.com

Thank you for using Ebyte products! Please contact us with any questions or suggestions: info@cdebyte.com

---

Web: https://www.cdebyte.com

Address: B5 Mould Industrial Park, 199# Xiqu Ave, High tech Zone, Chengdu, Sichuan, China

EBYTE® Chengdu Ebyte Electronic Technology Co.,Ltd.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000