EWM22A-400RxxD User Manual

433/470MHz 20/30dBm New Generation LoRa Wireless Module



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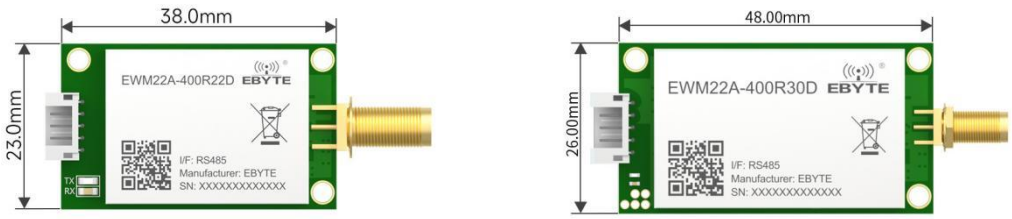
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1 Introduction

1.1 Brief Introduction

EWM22A-400RxxD is a new generation of LoRa wireless data transmission module, which is based on SEMTECH high-performance RF chip and RS485 interface module, with multiple transmission modes, working in the frequency band (410.125-493.125MHz) (default 433.125MHz), supporting DC 5V power supply, and can be used with E22-T series in the same frequency band for low-power applications. It supports DC 5V power supply and can be used with E22-T series in the same frequency band for low power consumption applications.

EWM22A-400RxxD adopts the new generation of LoRa spread spectrum technology, with faster speed, lower power consumption, and smaller size; it supports Wake-on-Air, Wireless Configuration, Carrier Listening, Auto Relay, Communication Key, etc., and supports sub-packet length setting, and can provide customized development services. The following 2 modules are of different power, but the frequency band is the same and the package is different.



1.2 Features

- Adopts the new generation of LoRa spread spectrum modulation technology, which brings longer communication distance and stronger anti-interference ability;
- Adopts RS485 interface mode, RS485 interface devices for data transmission is more convenient;
- Supports online firmware upgrade, updating firmware is more convenient;
- Supports AT command, which is more convenient to use;
- Supports automatic relay networking, multi-level relay is suitable for ultra-long-distance communication, the same area to run multiple networks running at the same time;
- Ssupports users to set their own communication key and cannot be read, which greatly improves the confidentiality of user data;
- Supports LBT function, listening to the environmental noise before sending, which can greatly improve the success rate of communication of the module in harsh environments;
- Supports RSSI signal strength indication function, which is used to evaluate the signal quality, improve the communication network, and range measurement;
- Supports wireless parameter configuration, sending command packets wirelessly to remotely configure or read wireless module parameters;
- Supports Wake-on-Air, i.e., ultra-low power consumption function for battery-powered application solutions;
- Supports fixed-point transmission, broadcast transmission, and channel listening;
- Supports global license-free ISM 433MHz band, and supports 470MHz meter reading band;

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- Communication distance is up to 10km under ideal conditions;
- Parameters are saved when power down, and the module will work according to the set parameters after power up again;
- Internal watchdog, automatic reset and resume work in case of accident;
- Supports 2.4K～62.5Kbps wireless transmission rate (air rate);
- Supports 2.7~5.5V power supply, more than 5V power supply can ensure the best performance;
- Industrial-grade standard design, support -40～+85 ℃ long time use;
- Module maximum transmit power up to 1W (30dBm), transmission farther and more stable.

1.3 Application

- Agricultural intelligent irrigation and environmental testing;
- Photovoltaic power plant monitoring and distributed photovoltaic system management, etc;
- home security alarms and remote keyless entry;
- Smart home as well as industrial sensors, etc;
- wireless alarm security systems;
- building automation solutions;
- wireless industrial grade remote controls;
- healthcare products;
- Advanced Meter Reading Architecture (AMI).

2 Specification

2.1 RF parameters

RF Parameters	unit	Model Number		Remarks
		EWM22A-400R22D	EWM22A-400R30D	
Maximum Transmit Power	dBm	22.0	30.0	-
Receiving Sensitivity	dBm	-129	-132	-
Reference Distance	km	5	10	Clear and open, antenna gain 5dBi, antenna height 2.5 meters, air rate 2.4kbps.
Operating Frequency Band	MHz	410.125～493.125	410.125～493.125	Support ISM band
Air Rate	bps	2.4K～64.5K	2.4K～64.5K	User programmable control

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Transmit length	Btye	240	240	Command-set packetized 32/64/128/240 byte sends

2.2 Electrical parameters

Electrical parameters		unit	Model Number		Remarks
			EWM22A-400R22D	EWM22A-400R30D	
operating voltage		V	4.5～5.5	4.5～5.5	Output power is guaranteed at ≥5V, above 5.5V there is a risk of burning the module.
power wastage	Transmit Current	mA	110	Instantaneous power consumption	Instantaneous power consumption
	Receive Current	mA	22	-Power Consumption	-
	Sleep Current	uA	750	≥5V for guaranteed output power	-
temperature	Operating Temperature	℃	-40～+85		Industrial Grade Design
	Storage Temperature	℃	-40～+85		Industrial Grade Design

2.3 Hardware parameters

Hardware Parameters	Model Number		Remarks
	EWM22A-400R22D	EWM22A-400R30D	
Crystal Frequency	32MHz	32MHz	Industrial Grade High Precision Crystals
Modulation mode	LoRa	LoRa	New generation LoRa modulation technology
Interface mode	PH2.0	PH2.0	Pitch 2.0mm, with pre-drilled 2.54mm hole
Communication interface	RS485 Interface	RS485Interface	-
Transmit length	240 Byte	240 Byte	Packetized 32/64/128/240 byte transmission can be set by commands.
Package	Pin type	Pin type	-

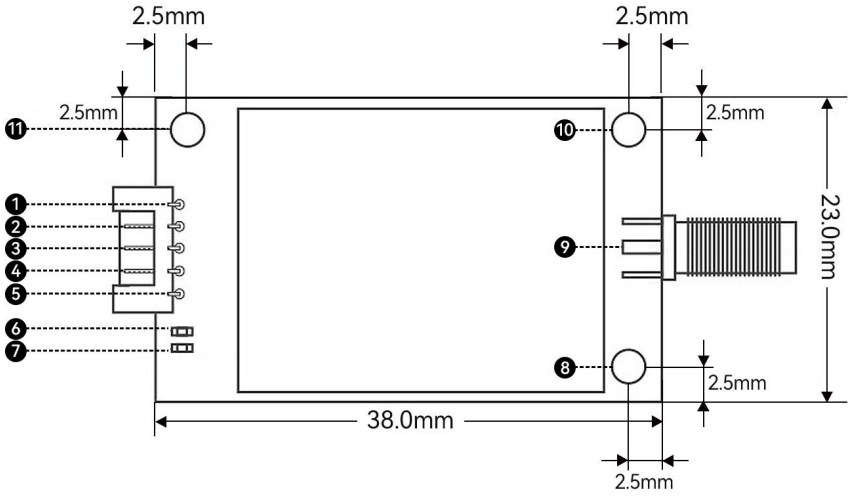
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Cache Capacity	1000Byte	1000Byte	-
Antenna Interface	SMA-K	SMA-K	Equivalent impedance approx. 50Ω
Dimension	38*23mm	26*48mm	±0.2mm
Net Weight	7.1g	8.9g	±0.2g

3 Mechanical Dimensions and Pin Definitions

3.1 EWM22A-400R22D Mechanical Dimensions and Pin Definitions



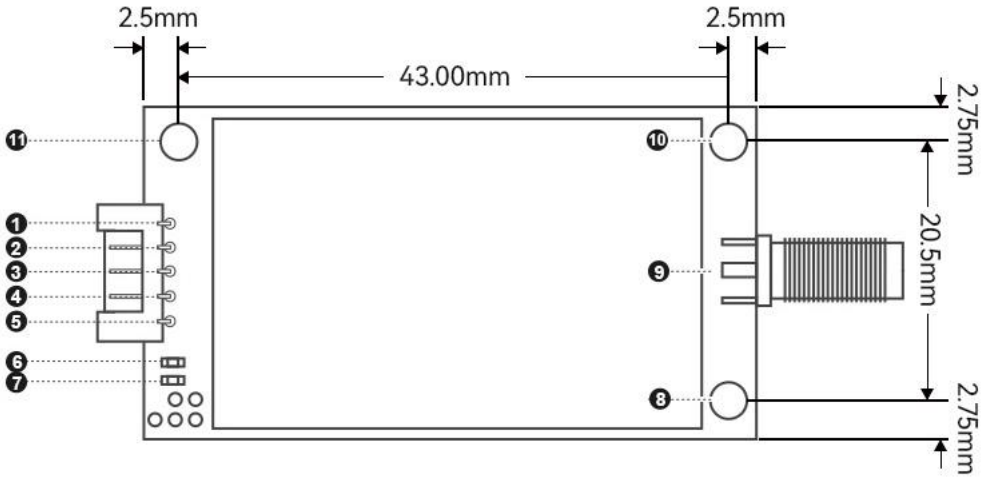
Pin No.	Pin Name	Pin orientation	Pin Usage
1	VCC	Input	Module power supply positive reference, voltage range: 4.5~5.5V DC
2	GND	-	Module ground
3	485A	Input/Output	RS485 interface A, external RS485 device A
4	485B	Input/Output	RS485 interface B, external RS485 equipment B
5	STB	Outputs	Essentially AUX, it is the module busy status indication, please refer to section 5.3 STB details.
6	Send Indicator	-	Green, indicator light blinks when data is being sent
7	Receive Indicator	-	Blue, indicator light blinks when data is being received
8	Fixed Hole	-	Fixing hole (diameter 2.8mm)

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9	Radio Frequency Interface	-	SMA-K, equivalent impedance approx. 50Ω
10	Fixed Hole	-	Fixed hole (2.8mm diameter)
11	Fixed Hole	-	Fixed hole (2.8mm diameter)

3.2 EWM22A-400R30D Mechanical Dimensions and Pin Definitions

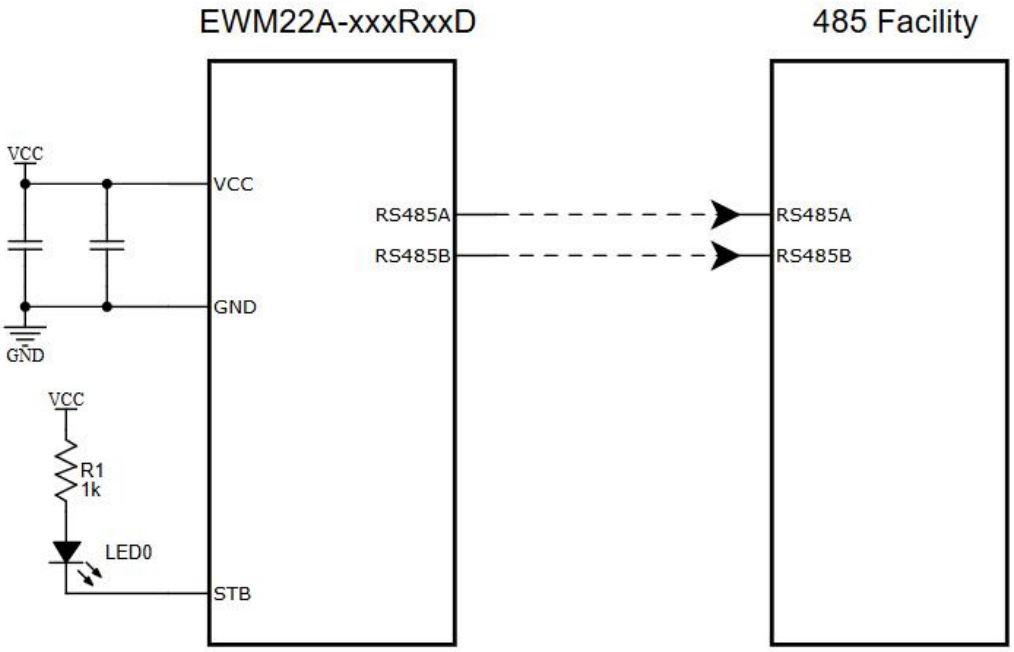


Pin No.	Pin Name	Pin orientation	Pin Usage
1	VCC	Input	Module power supply positive reference, voltage range: 4.5~5.5V DC
2	GND	-	Module ground
3	485A	Input/Output	RS485 interface A, external RS485 device A
4	485B	Input/Output	RS485 interface B, external RS485 equipment B
5	STB	Outputs	Essentially AUX, is the module busy status indication, please refer to section 5.3 STB details
6	Send Indicator	-	Green, the indicator blinks when data is being sent.
7	Receive Indicator	-	Blue, blinking when data is being received.
8	Fixed Hole	-	Fixing hole (diameter 2.75mm)
9	Radio Frequency Interface	-	SMA-K, equivalent impedance approx. 50Ω
10	Fixed Hole	-	Fixed hole (2.75mm diameter)
11	Fixed Hole	-	Fixed hole (2.75mm diameter)

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4 Recommended Connectivity Charts



No	Brief connection description of the module and 485 devices
1	RS485 interface A, external RS485 device A; RS485 interface B, external RS485 device B
2	STB pin can be connected in series with an indicator (note that the series current-limiting resistor), used as a module to indicate normal operation; can also not be connected.
3	The 433MHz/470MHz antenna can be directly connected to the RF interface.

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5 Functions in detail

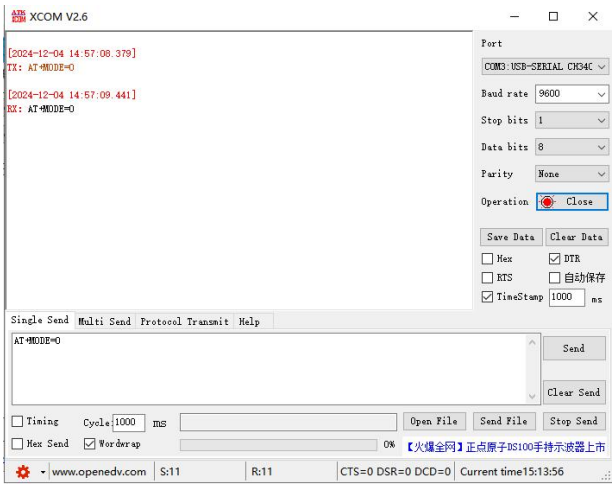
5.1 Working mode

The module has four modes of operation, and mode changes are made in the configuration mode according to AT commands or using the host computer, as detailed in the table below:

Mode (0-3)	**AT Command**	Mode Introduction	Remarks
0 Transmission mode	AT+MODE=0	Serial open, wireless open, transparent transmission	Support special command over-the-air configuration
1 WOR mode	AT+MODE=1	Can be defined as WOR sender and WOR receiver.	Wake-on-Air support
2 Configuration mode	AT+MODE=2	User can access the registers through the serial port to control the module's operating status.	
3 Deep Sleep	AT+MODE=3	Module goes to sleep	

5.1.1 Transmission mode use (operating mode 0, AT+MODE=0)

Users can change the mode by using the upper computer software developed by EVERBUILT, or use the serial port assistant XCOM to send the mode modification command AT+MODE=0 to change;

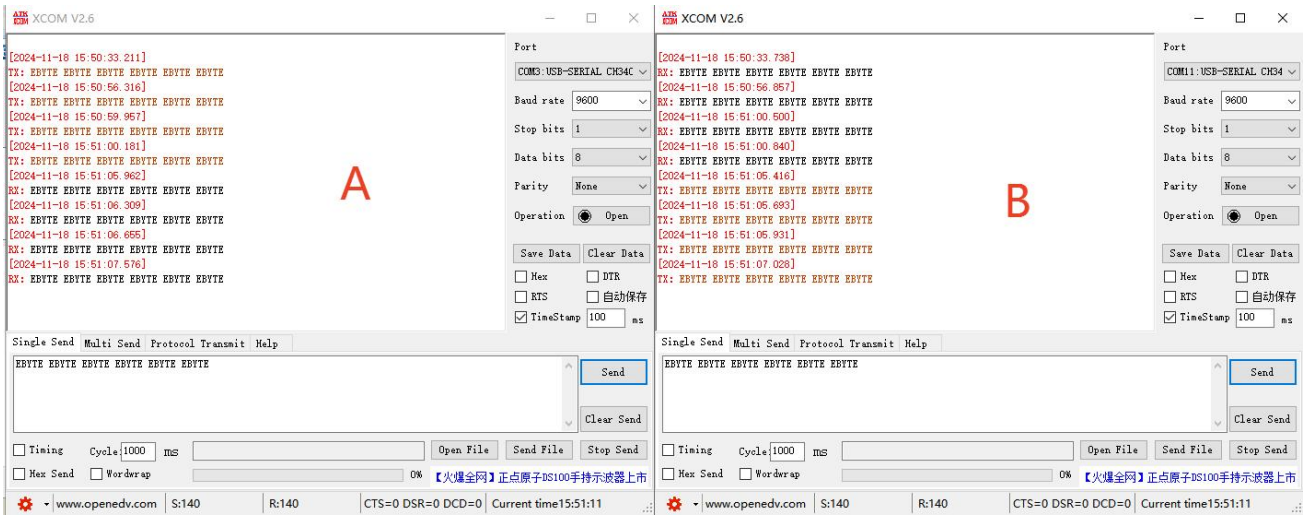
host computer	XCOM
	

Note: The steps to change the mode using the upper computer are shown in the figure on the left: select the corresponding serial port terminal → open the serial port → read the parameters (provided that it is in the configuration mode to be read) → click on the pass-through mode → the print message that the mode has been changed appears.

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Transparent Transmission Function: What you send is what you get, you can use the serial port assistant to communicate with each other (the factory default parameters are the same, and the transmission methods are transparent transmission), the examples are as follows:



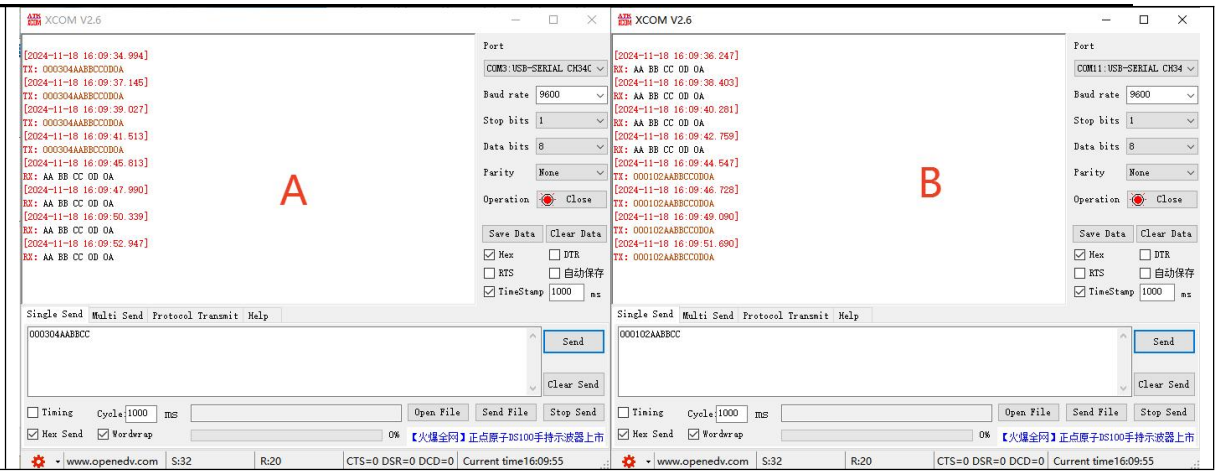
Schema

Fixed-point transmission function: Fixed data format for data sending and receiving, in the form of format: target address + target channel + data, effectively avoiding the occurrence of partial interference.

No	Steps in the use of targeted launches
1. Modify the parameters of the module through the upper computer needle or serial port assistant: Modify the address and channel of the module in the configuration mode, and change the transparent transmission mode to fixed-point transmission, and finally write the parameters to complete the modification.	

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2. Module working mode is replaced by general mode: A module parameter is edited as 000304AABBCC to be sent to B module, and similarly B module sends data as 000102AABBCC. (Transmission data format in fixed-point mode is: target address+target channel+data)	

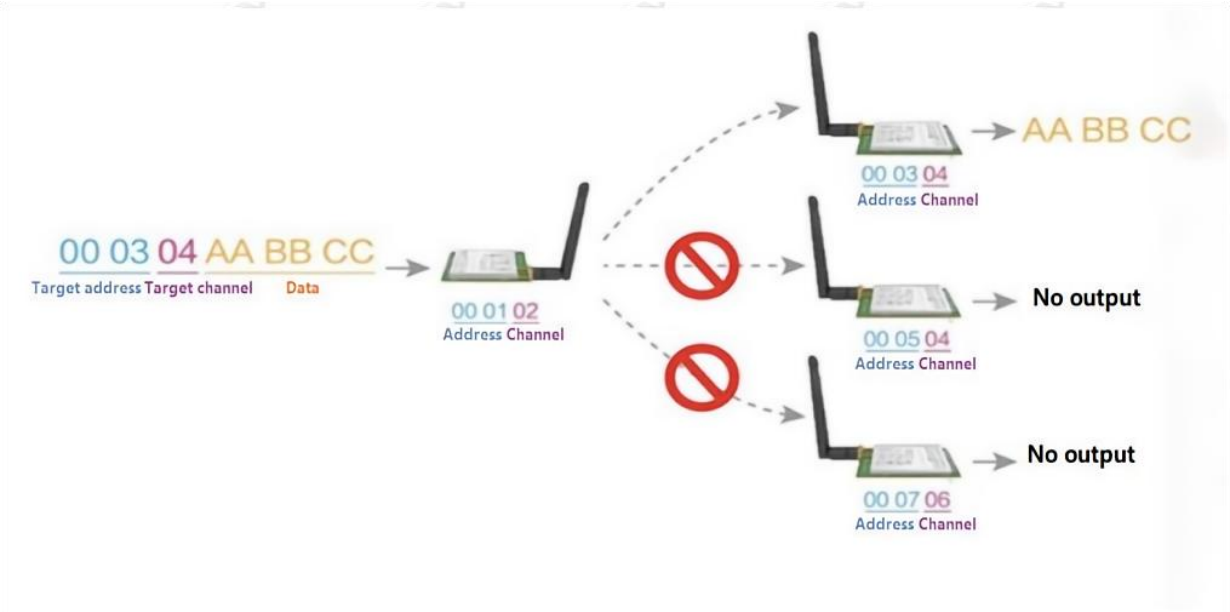


Fig. 1 Schematic diagram of fixed-point transmission

broadcast function:

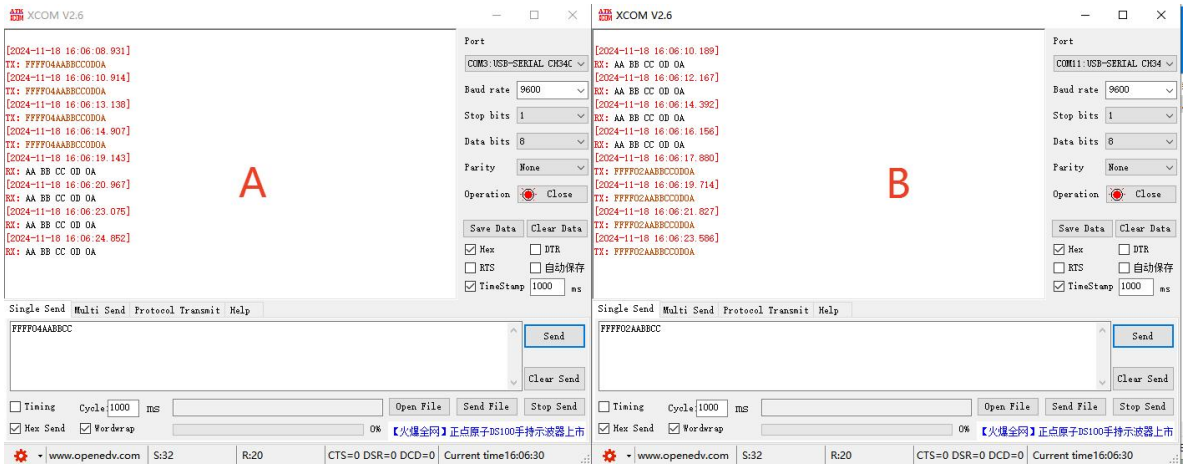
1)Set module A address to 0xFFFF and channel to 0x04. When module A is used as transmit (same mode, transparent transmission or fixed-point transmission method), all the receiving modules under 0x04 channel can receive the data to achieve the purpose of broadcasting.

2) sets the address of module A to 0xFFFF and the channel to 0x04. When module A acts as a receive, it can receive all the data under channel 0x04 for listening purpose.

No	Steps for the use of fixed-point radio transmissions

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1. Modify the parameters of the module through the upper computer: Modify the address and channel of the module under the configuration mode, change the transparent transmission mode to fixed-point transmission, and finally write the parameters to complete the modification.	
2. Module working mode is replaced by general mode: A module parameter is edited as FFFF04AABBCC and sent to B module, and similarly B module sends data as FFFF02AABBCC. (The format of transmission data in fixed-point broadcasting mode is: broadcasting address+target channel+data)	

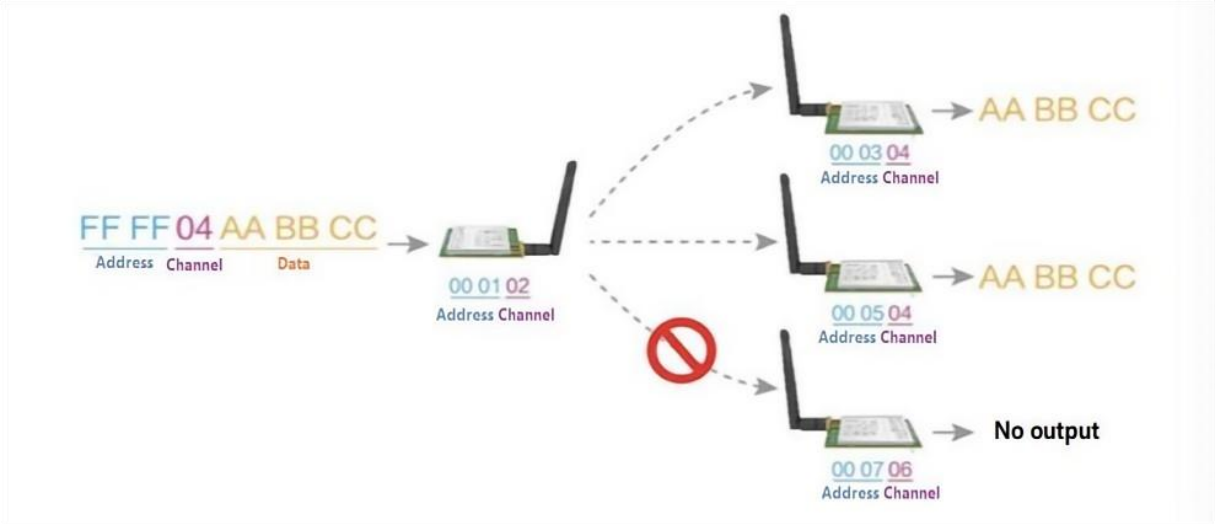


Fig. 2 Schematic diagram of fixed-point broadcast transmission

Relay Networking Mode: Relay networking forwards data between source and target nodes through relay nodes, realizing the expansion of network coverage and the improvement of communication reliability.

No	Trunking Mode Description

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1	After setting the relay mode through the configuration mode, switching to the general mode, the relay starts to work.
2	In relay mode ADDH,ADDL is no longer used as module address, but corresponds to NETID to forward pairing respectively, and if it receives one of the networks, it will forward to the other network;
3	The network ID of the repeater itself is invalid.
4	In relay mode, the repeater module cannot send and receive data and cannot perform low-power operation.

Trunking Networking Rules Description:

1, forwarding rules, relay can forward data in both directions between two NETIDs.

2. In relay mode, ADDH\ADDL is no longer used as a module address and is forwarded as a NETID pair.

As shown in the figure:

① Level 1 relay

“Node 1” NETID is 08.

“Node 2” NETID is 33.

The ADDH\ADDL of relay 1 is 08 and 33 respectively.

So the signal sent by node 1 (08) can be forwarded to node 2 (33)

Meanwhile, node 1 and node 2 have the same address, so the data sent by node 1 can be received by node 2.

② Secondary Relay

The ADDH\ADDL of relay 2 is 33, 05 respectively.

So relay 2 can forward data from relay 1 to network NETID: 05.

Thus node 3 and node 4 can receive node 1 data. Node 4 outputs data normally, and node 3 has a different address from node 1, so it does not output data.

③ Bidirectional Relay

As configured in the figure: the data sent by node 1 can be received by nodes 2 and 4, and the data sent by nodes 2 and 4 can be received by node 1.

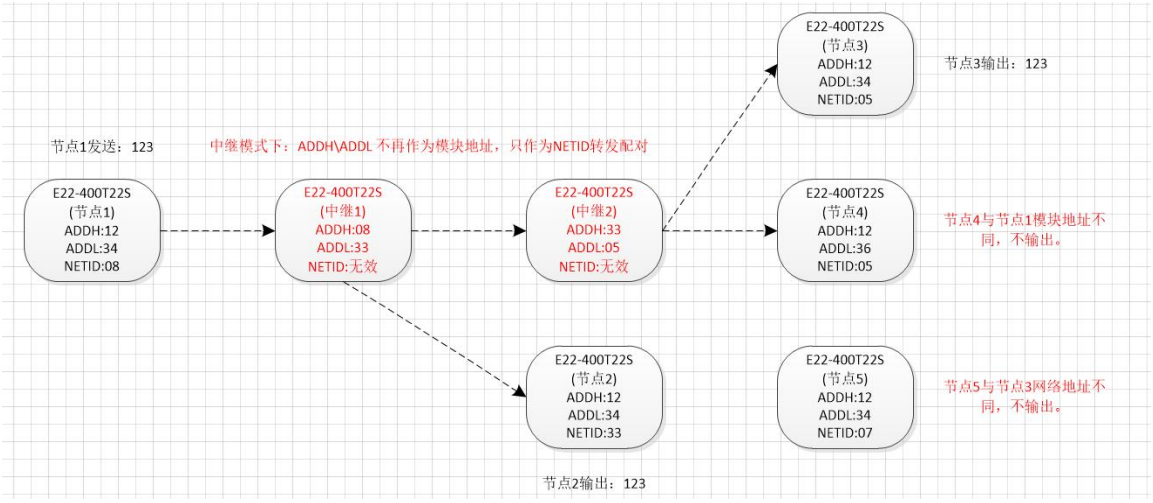
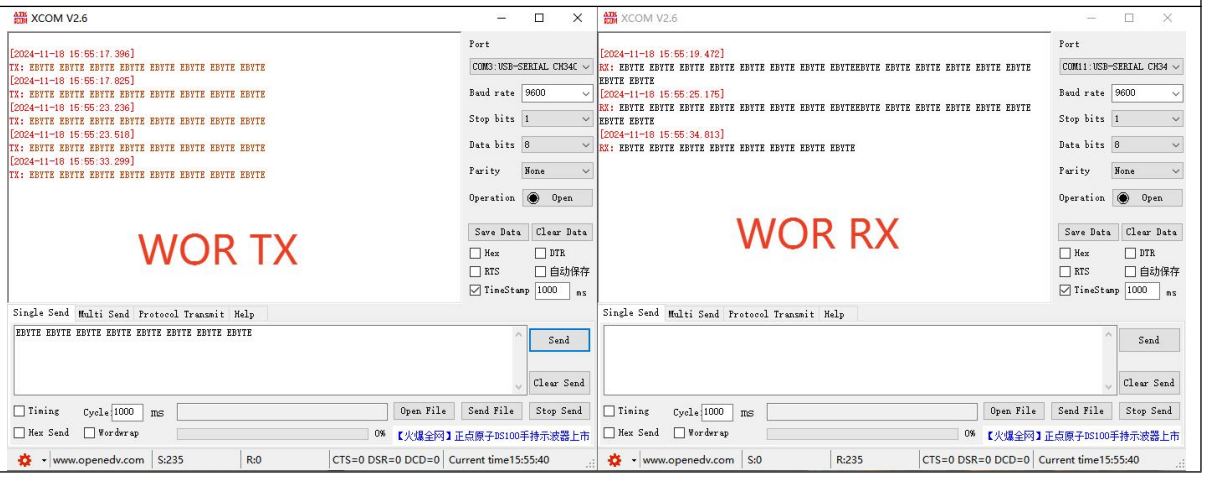


Figure 3 Example diagram of relay mode

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5.1.2 WOR mode use (operating mode 1, AT+MODE=1)

No	Steps for using WOR mode
1. Users can change the mode by using the host computer software developed by EVERBUILT, or use the serial port assistant XCOM to send the mode modification instruction AT+MODE=1 to change, for detailed instruction modification, please refer to Chapter 7 of this document.	
2. The working mode of the module is changed to WOR mode: the WOR receiver module sends data to the WOR receiver module, but the WOR receiver module cannot send data to the sender.	

5.1.3 Configuration mode use (operating mode 2, AT+MODE=2)

1) The following figure module configuration upper computer display interface, the user can select the configuration mode in the upper computer for rapid configuration and reading of parameters.

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2) In the configuration of the upper computer, the module address, frequency channel, network ID, and key are in decimal display mode; where each parameter takes the value range:

Network address: 0～65535

Frequency channel: 0 to 81

Network ID: 0～255

Key: 0～65535

3) Users need to pay special attention when using the upper computer to configure the relay mode, because in the upper computer, each parameter is decimal display mode, so the module address and network ID need to be filled in by converting the system;

For example, if the network ID inputted by transmitter A is 02, and the network ID inputted by receiver B is 10, then when relay R sets the module address, it will convert the hexadecimal value 0X020A to the decimal value 522 as the module address filled by relay R. That is to say, at this time, relay R needs to fill in the module address;

That is, at this time, the relay R needs to fill in the module address value of 522.

The following figure shows the display interface of the EWM22A-400RxxD to enter the configuration using the serial port debugging assistant. The specific flow is as follows:

(1) Send the command “FA FD 5A 9D 30 19 2F 69” through the serial port within 5 seconds after the module is powered on;

(2) Wait for the lower computer to answer the command “EA ED 1C DB 76 5F AB 35”, and then send the command “55 AA 5A 9D 30 19 42 FA” through the serial port within 5 seconds;

(3) Wait for the lower computer to answer the command “AA 55 E2 25 88 A1 94 16”, and enter the configuration mode at the same time;

If any of the above steps does not receive the next step command or answer for more than 500ms, both parties will decide to enter the configuration mode failed.

Note: When the user does not click “Query”/“Setup” command, the host computer needs to send the device connection confirmation command every 4 seconds: 0xE6,0xE6,0xE6, the module receives the command in the configuration mode, 0xE6,0xE6,0xE6, the module receives the command in the configuration mode. 0xE6,0xE6,0xE6, the module in configuration mode receives 0xA1,0xA1,0xA1. This mechanism is used for both sides to confirm each

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other whether the connection is normal or not, and the module will be judged to have timeout if it does not receive the command or connection confirmation command for more than 10 seconds.

When the upper computer times out, it will re-send the handshake command and the configuration button turns gray; when the module times out, it will automatically exit the configuration mode and enter the transmission mode.



Command Parsing:

Fixed header	Random number	CRC16 checksum
2 bytes	4 bytes	2 bytes

Upper computer instruction: fixed header: fixed hex 0xFA,0xFD

Random number: Randomly get 4 bytes of hexadecimal data

CRC16 checksum: Modbus CRC16 checksum of the fixed header and random number.

Example: FA FD 5A 9D 30 19 2F 69

Lower command: Fixed header: Fixed hex 0xEA 0xED

Random number iso-or: extract the random number of handshake command, and iso-or with the high and low bits of CRC16 of handshake command in turn;

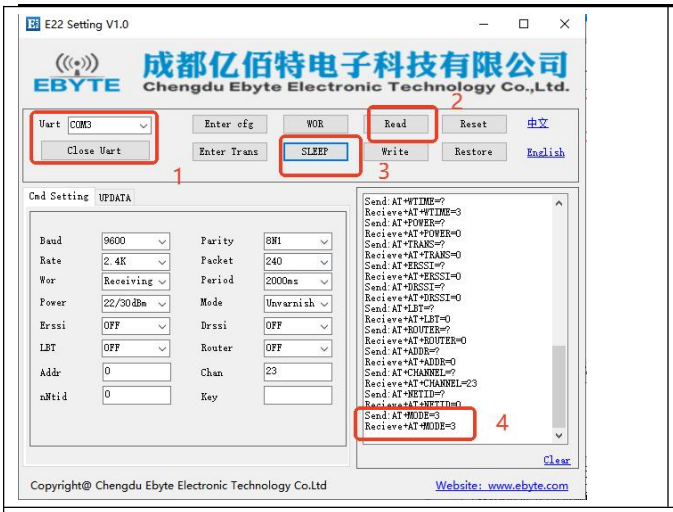
CRC16 checksum: Modbus CRC16 checksum of fixed header and random number dissimilarity value;

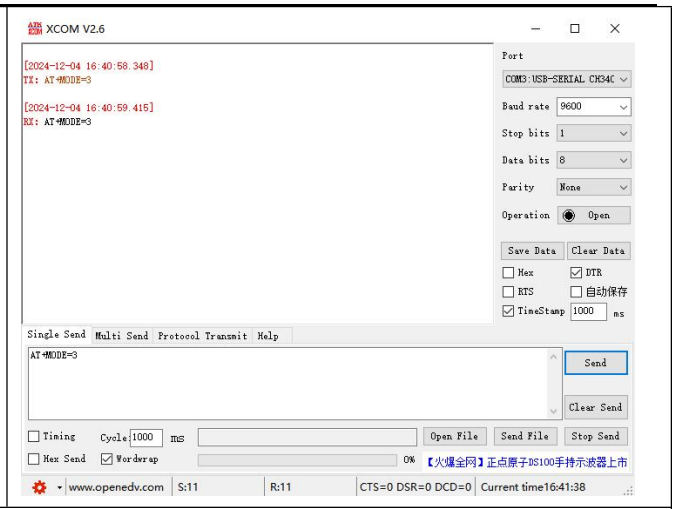
5.1.4 Sleep mode (operating mode 3, AT+MODE=3)

upper computer	XCOM

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Note: The steps to change the mode using the upper computer are shown in the figure on the left: select the corresponding serial port terminal → open the serial port → read the parameters (provided that it is in the configuration mode to be read) → click on the pass-through mode → the print message that the mode has been changed appears.

5.2 Module reset

After the module is reset, the AUX will output a low level and perform a hardware self-test, as well as set the working mode according to the user parameters;

During this process, AUX keeps low level, and when it is finished, AUX outputs high level, and it starts to work normally after determining the working mode according to the instruction issued, e.g., sending instruction AT+MODE=0/1/2/3;

Therefore, the user needs to wait for the rising edge of AUX as the starting point of normal operation of the module.

5.3 STB in detail

STB Detailed Note: STB is essentially AUX, for the module's busy status indication, the following AUX are STB!

5.3.1 Power-on startup indication

1) The whole startup process after power-on (entering the mode working state) takes about 16ms.

2)After power-on VCC is established, AUX does not indicate busy state (low level) immediately, this is because the internal microcontroller also needs some start-up time.

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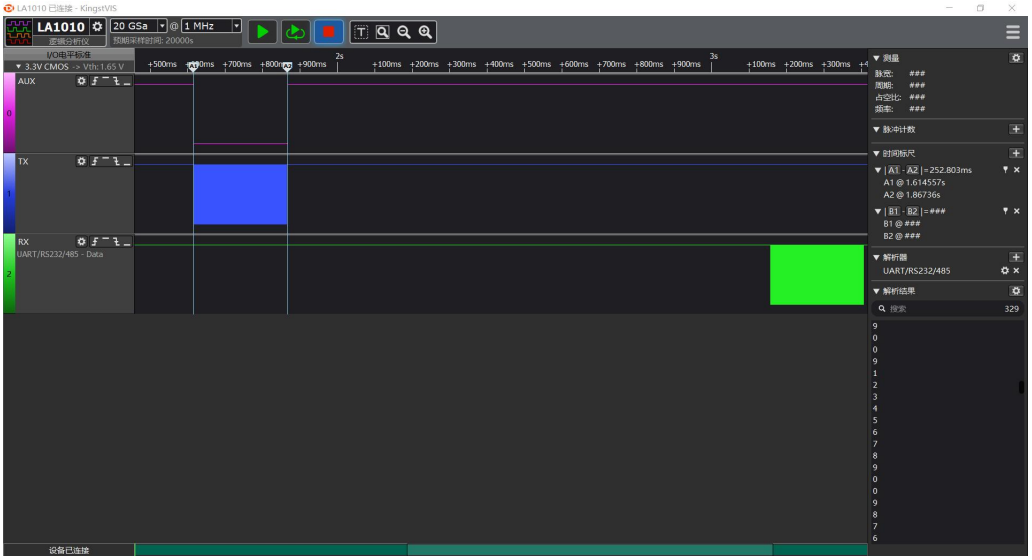


Figure 4 Power-on startup timing diagram

5.3.2 Serial data output indication

1) When the receiving module receives a wireless packet, it will indicate a busy state (low level) through the AUX pin before giving data from the wired serial port;

2) Used to wake up the external MCU in hibernation;



AUX Timing Diagram for Outgoing Data from Module Serial Port

5.3.3 Wireless Transmission Indicator

1) When the module is in idle state (non-sleeping), if the user inputs data to the module, it will start to indicate the busy state (low level) only when the first byte of the serial packet is recognized and received by the module. Depending on the serial port baud rate, there is a one-byte delay difference, and the user program needs to pay attention to the AUX detection logic.

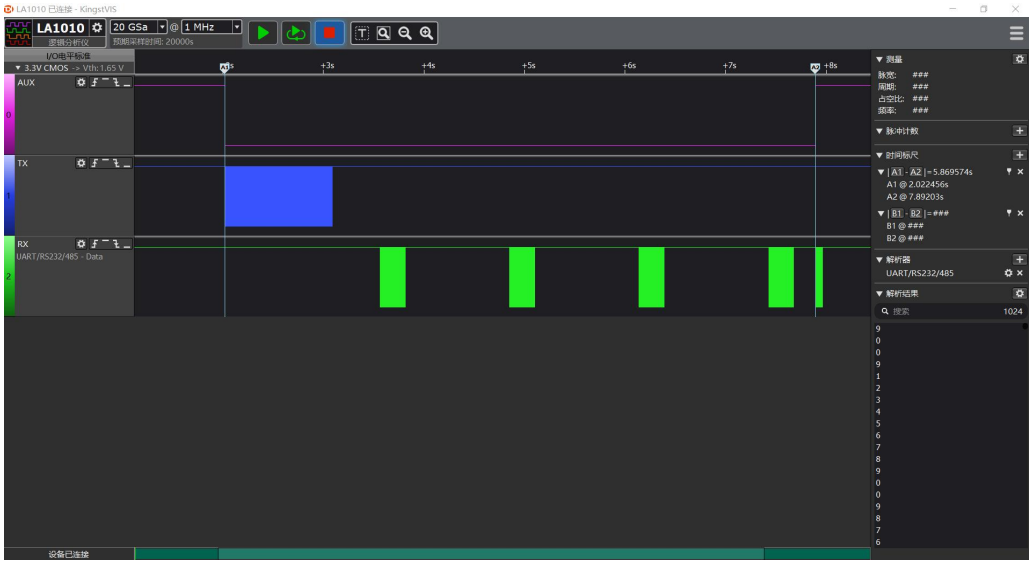
2) Buffer Empty: The data in the internal 1000 byte buffer are written to the wireless chip (automatic packetization);

When AUX=1 when the user continuously initiates less than 1000 bytes of data, it will not overflow;

When AUX = 0 when the buffer is not empty: internal 1000-byte buffer data, not yet all written to the wireless chip and open the launch, at this time the module may be waiting for the end of the user's data timeout, or are wireless sub-packet launch.

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AUX timing diagram when the module receives data from the serial port

5.3.4 Switching Mode

The AUX indicates a busy state when the module is switched in all modes, as shown in the table below:

Original operating mode	Switching Mode	**EWM22A-XXXTXXX switching time (ms)**
Sleep mode	Transmission Mode	9～11
	WOR Mode	9～11
	Configuration Mode	9～11
Transmission Mode	Sleep mode	9～11
	WOR Mode	9～11
	Configuration Mode	9～11
Configuration Mode	Sleep Mode	9～11
	Transmission Mode	9～11
	WOR Mode	9～11
WOR mode	Sleep Mode	9～11
	Transmission Mode	9～11
	Configuration Mode	9～11

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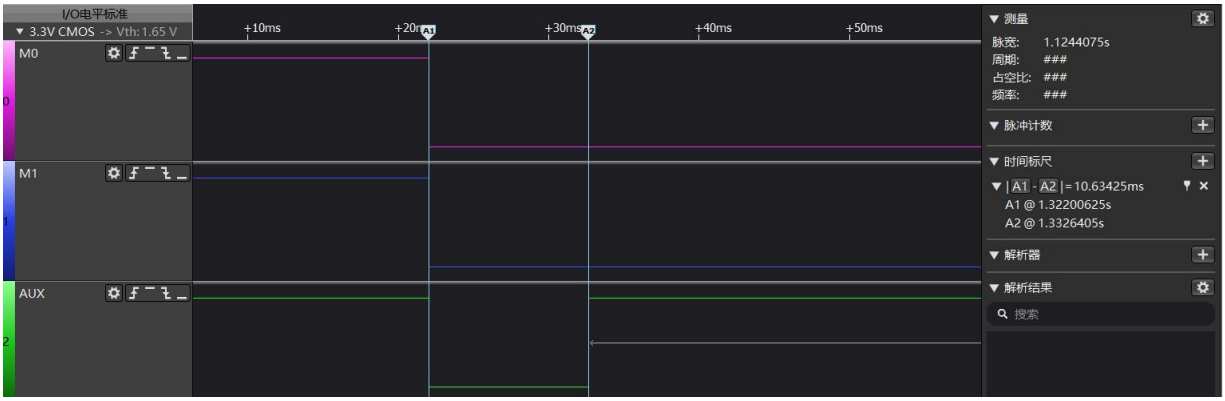


Fig. 5 Mode switching timing diagram

5.3.5 Caveat

No	STB Precautions
1	For function 1 and function 2 above, the output low level is prioritized, i.e.: when any of the output low level conditions are satisfied, STB outputs low level;
2	When all low level conditions are not satisfied, AUX outputs high level.
3	When AUX outputs low level, it indicates that the module is busy, and no working mode detection will be performed at this time;
4	When the module AUX output high level within 1ms, will complete the mode switching work.
5	After the user switches to a new working mode, at least 2ms after the rising edge of AUX is required before the module will really enter the mode;

5.4 Wireless transceiver indicator

- Wireless is in the transmit state, the transmit indicator will be lit.
- The wireless is in the receive state and the receive indicator will be lit.

6 Register read/write control

6.1 Command format

The list of supported commands in the configuration mode (Mode 2: AT+MODE=2) is as follows (at the time of setup, only 9600, 8N1 format is supported):

No	Command format	Explanation

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1	Setup Registers	Instruction: C0 + start address + length + parameters Response: C1 + start address + length + parameters Example 1: Configure the channel as 0x09 Command Start address Length Parameters Send: C0 05 01 09 Return: C1 05 01 09 Example 2: Configure module address (0x1234), network address (0x00), serial port (9600 8N1) and airspeed (1.2K) at the same time Send: C0 00 04 12 34 00 61 Return: C1 00 04 12 34 00 61
2	Read registers	Command: C1 + start address + length Response: C1 + start address + length + parameters Example 1: Read channel Command Start address Length Parameters Send: C1 05 01 Return: C1 05 01 09 Example 2: Read module address, network address, serial port, airspeed at the same time Send: C1 00 04 Return: C1 00 04 12 34 00 61
3	Setting Temporary Registers	Command: C2 + start address + length + parameters Response: C1 + start address + length + parameters Example 1: Configure channel as 0x09 Command Start address Length Parameters Send: C2 05 01 09 Return: C1 05 01 09 Example 2: Configure module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (1.2K) simultaneously Send: C2 00 04 12 34 00 61 Return: C1 00 04 12 34 00 61
4	Wireless Configuration	Command: CF CF + regular command Response: CF CF + regular response Example 1: Wireless configuration channel is 0x09 Wireless Command Header Command Start Address Length Parameters Send: CF CF C0 05 01 09 Return: CF CF C1 05 01 09 Example 2: Wireless configure module address (0x1234), network address (0x00), serial port (9600 8N1), airspeed (1.2K) simultaneously Send: CF CF C0 00 04 12 34 00 61 Return: CF CF C1 00 04 12 34 00 61
5	formatting error	Format Error Response FF FF FF FF

6.2 Register description

No	Read Write	Name	Description	Remark

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<table>
<tr><td>00H</td><td>Read/ Write</td><td>ADDH</td><td colspan="4">ADDH (default 0)</td><td rowspan="2">Module address high byte and low byte;
Note: When the module address is equal to FFFF, it can be used as the broadcast and listen address, i.e.: at this point the module will not perform address filtering</td></tr>
<tr><td>01H</td><td>Read/ Write</td><td>ADDL</td><td colspan="4">ADDL (default 0)</td></tr>
<tr><td>02H</td><td>Read/ Write</td><td>NETID</td><td colspan="4">NETID (default 0)</td><td>Network address for distinguishing networks;
When communicating with each other, they should be set to the same.</td></tr>
<tr><td rowspan="19">03H</td><td rowspan="19">Read/ Write</td><td rowspan="19">EG0</td><td>7</td><td>6</td><td>5</td><td>UART serial port rate (bps)</td><td rowspan="10">Two modules communicating with each other can have different serial port baud rates and different checksums;

When transmitting larger data packets continuously, the user needs to consider the data blocking brought by the same baud rate, and may even be lost;

It is generally recommended that the baud rates of the two communicating parties are the same.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Serial port baud rate of 1200</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Serial port baud rate of 2400</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Serial port baud rate of 4800</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Serial port baud rate of 9600 (default)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Serial baud rate of 19200</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Serial baud rate is 38400</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Serial baud rate is 57600</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Serial port baud rate is 115200</td></tr>
<tr><td>4</td><td>3</td><td colspan="2">Serial port parity bit</td><td rowspan="5">The serial port modes can be different on both sides of the communication;</td></tr>
<tr><td>0</td><td>0</td><td colspan="2">8N1 (default)</td></tr>
<tr><td>0</td><td>1</td><td colspan="2">8O1</td></tr>
<tr><td>1</td><td>0</td><td colspan="2">8E1</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">8N1 (00 equivalent)</td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>Wireless Air Rate (bps)</td><td rowspan="10">The air rate must be the same on both sides of the communication;

The higher the air rate, the lower the delay and the shorter the transmission distance.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Air Rate 2.4k</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Air Rate 2.4k</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Air Rate 2.4k (default)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Air Rate 4.8k</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Air Rate 9.6k</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Air Rate 19.2k</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Air Rate 38.4k</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Air Rate 62.5k</td></tr>
<tr><td rowspan="5">04H</td><td rowspan="5">Read/ Write</td><td rowspan="5">REG1</td><td>7</td><td>6</td><td colspan="2">Packetization Settings</td><td rowspan="5">If the data sent by the user is less than the packet length, the output of the serial port at the receiving end is presented as uninterrupted continuous output;

If the data sent by the user is larger than the packet length, the serial port at the receiving end will output in packets.</td></tr>
<tr><td>0</td><td>0</td><td colspan="2">240 bytes (default)</td></tr>
<tr><td>0</td><td>1</td><td colspan="2">128 bytes</td></tr>
<tr><td>1</td><td>0</td><td colspan="2">64 bytes</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">32 bytes</td></tr>
</table>

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<table>
<tr><td rowspan="15"></td><td rowspan="15"></td><td rowspan="15"></td><td>5</td><td colspan="3">RSSI Ambient Noise Enable</td><td rowspan="3">When enabled, command C0 C1 C2 C3 can be sent in transmit mode or WOR transmit mode Command Read Register;
Register 0x00 : Current ambient noise RSSI;
Register 0X01 : RSSI of the last received data.
(The current ambient noise is: dBm = -(256 - RSSI));
Instruction format: C0 C1 C2 C3 + start address + read length;
return: C1 + address + read length + read the effective value; such as: send C0 C1 C2 C3 00 01
Return C1 00 01 RSSI (address can only start from 00)

Translated with www.DeepL.com/Translator (free version)</td></tr>
<tr><td>0</td><td colspan="3">Disable (default)</td></tr>
<tr><td>1</td><td colspan="3">Enable</td></tr>
<tr><td>4</td><td>3</td><td colspan="2">reservations</td><td></td></tr>
<tr><td>2</td><td colspan="3">Software Mode Switching</td><td rowspan="3">If you use our host computer to configure the parameters, the bit will be turned off voluntarily. If you do not want to use the M0 M1 pin to switch the working mode, you can You can enable this function and use specific serial commands to switch the mode.
Format: C0 C1 C2 C3 02 + working mode
Send C0 C1 C2 C3 02 00 to switch to pass-through mode.
Send C0 C1 C2 C3 02 01 to toggle to WOR mode
Send C0 C1 C2 C3 02 02 to switch to configuration mode
Send C0 C1 C2 C3 02 03 Switch to sleep mode
Return: C1 C2 C3 02 + WOR mode
Note: When this function is enabled, the configuration mode still supports 9600 baud rate.</td></tr>
<tr><td>0</td><td colspan="3">Disable (default)</td></tr>
<tr><td>1</td><td colspan="3">Enable</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">0</td><td colspan="2">firing power</td><td rowspan="5">Power and current are non-linearly related, and the power supply is most efficient at maximum power;

Current does not decrease in the same proportion as power decreases.</td></tr>
<tr><td>EWM22A-400R22D</td><td>EWM22A-400R30D</td></tr>
<tr><td>0</td><td>0</td><td>22dBm （default）</td><td>30dBm （default）</td></tr>
<tr><td>0</td><td>1</td><td>17dBm</td><td>27dBm</td></tr>
<tr><td>1</td><td>0</td><td>13dBm</td><td>24dBm</td></tr>
<tr><td>1</td><td>1</td><td>10dBm</td><td>21dBm</td></tr>
<tr><td>05H</td><td>Read/ Write</td><td>REG2</td><td colspan="4">Channel Control (CH)
0-83 represent a total of 84 channels respectively</td><td>Actual frequency = 410.125 + CH * 1M</td></tr>
</table>

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			(for 400 band)				
06H	Read/ Write	REG3	7	Enable RSSI bytes			When enabled, the module receives wireless data, which will follow an RSSI intensity byte when output through the serial port TXD. The current packet RSSI is: dBm = -(256 - RSSI)
			0	Disable (default)			
			1	Enable			
			6	Transmission Method			For fixed-point transmission, the module recognizes the first three bytes of the serial data as: address high + address low + channel, and uses them as the wireless transmit target.
			0	Transparent transmission (default)			
			1	Fixed-point transmission			
			5	Relay Function			When the relay function is enabled, the module will initiate a forwarding if the destination address is not the module itself; In order to prevent data backhauling, it is recommended to be used in conjunction with fixed-point mode; i.e., the destination address is different from the source address.
			0	Disable relay function (default)			
			1	Enable relay function			
			4	LBT Enable			When enabled, wireless data will be listened to before transmitting, which can avoid interference to some extent, but may bring data delay; The maximum dwell time of LBT is 2 seconds, and it will be forced to send out when it reaches two seconds.
			0	Disable (default)			
			1	Enable			
			3	WOR mode transceiver control			Valid only for mode 1; 1. wor's receive mode, the module can modify the delay time after wakeup, the default time is 0; 2. the receiver needs to send the command C0 09 02 03 E8 in the configuration mode (C0 is the write command, 09 is the address of the register initiator, 02 is the length, 03 E8 is the delay time set, the maximum FFFF is 65535ms, set to 0 to turn off the wake-up delay). 3. Data can be sent within the delay time. Translated with www.DeepL.com/Translator (free version)
			0	WOR receiver (default)			
			1	Operates in WOR listen mode, see below for listen period (WOR period), which saves significant power consumption.			
			2	1	0	WOR cyclicality	Valid only for mode 1; Cycle time T= (1+WOR)*500ms, the maximum is 4000ms and the minimum is 500ms; The longer the period time between WOR listening intervals, the lower the average power consumption, but the higher the data delay; Both sender and receiver must agree (very important)
			0	0	0	500ms	
			0	0	1	1000ms	
			0	1	0	1500ms	
			0	1	1	2000ms	
			1	0	0	2500ms	
			1	0	1	3000ms	
			1	1	0	3500ms	
			1	1	1	4000ms	
07H	Write	CRYPT_H	Key high byte (default 0)				Write only, read returns 0; Used for encryption to avoid interception of over-the-air wireless data by similar
08H	Write	CRYPT	Key low byte (default 0)				

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		_L		modules; The module will internally use these two bytes as a calculation factor to transform and encrypt the over-the-air wireless signal.
80H～86H	Read	PID	7 bytes of product information	7 bytes of product information Note: Please refer to section 7.1 AT+DEVTYPE=? Query command is more convenient.

6.3 Factory Default Parameters

Model number	**EWM22A-400R22D、EWM22A-400R30D Factory Default Parameter Values：C0 00 09 00 00 00 62 00 23 03 00 00**						
Model number	frequency	address	channel	airspeed	baud	Serial Port Format	firing power
EWM22A-400R22D	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	22dbm
EWM22A-400R30D	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	30dbm

7 AT Commands

- Using AT instructions for parameter configuration or querying needs to be done in the configuration mode;
- AT instructions are used in the configuration mode. AT instructions are divided into three categories in total: command instructions, setup instructions and query instructions;
- Users can pass “AT+HELP=?” Query to the AT instruction set supported by the module, the baud rate adopted by AT instruction is 9600 8N1;
- Will be limited when the input parameters exceed the range, please do not let the parameters exceed the range to avoid unknown situation.

7.1 AT command table

7.1.1 Command instruction

Command instruction	Description	Example	Example Description
AT+IAP(Use caution, see this article for details 7.3 Serial Port Upgrade Firmware Precautions)	Entering IAP upgrade mode	AT+IAP	Entering IAP upgrade mode
AT+RESET	Device reboot	AT+RESET	Device reboot

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AT+DEFAULT	Configuration parameters are restored to default and the device reboots	AT+DEFAULT	Configuration parameters are restored to default and the device reboots

7.1.2 Setup instruction

Setup instruction	Description	Example	Example Description
AT+UART=baud,parity	Setting the Baud Rate and Checksum	AT+UART=3,0	Set baud rate to 9600, 8N1
AT+RATE=rate	Setting the air rate	AT+RATE=7	Set the air rate to 62.5K
AT+PACKET=packet	Set packet length	AT+PACKET=0	Set the packet to 240 bytes
AT+WOR=role	Set WOR role	AT+WOR=0	Set to receive by WOR
AT+WTIME=wtime	Set WOR period	AT+WTIME=0	Set the WOR period to 500ms
AT+POWER=power	Setting the transmission power	AT+POWER=0	Set the transmit power to 30dBm
AT+TRANS=trans	Setting the Transmission Mode	AT+TRANS=1	Set to fixed point mode
AT+ROUTER=router	Setting the relay mode	AT+ROUTER=1	Set to relay mode
AT+LBT=lbt	Setting the Listen Before Talk function switch	AT+LBT=1	Set to on, refer to section 6.2 LBT enable for details.
AT+LBR=lrssi,ltime	Setting the RSSI determination threshold and maximum wait time for LBT function	AT+LBR=-60,2000	Set the detection judgment threshold to -60dBm and the maximum delay time to 2 seconds
AT+ERSSI=erssi	Setting the ambient noise RSSI switch	AT+ERSSI=1	Set on, refer to section 6.2 RSSI ambient noise function for details.
AT+DRSSI=data_rssi	Setting the receive data RSSI switch	AT+DRSSI=1	Receive data RSSI function on
AT+ADDR=addr	Set module address	AT+ADDR=1234	Set the module address to 1234
AT+CHANNEL=channel	Sets the module operating channel	AT+CHANNEL=23	Set the channel as 23
AT+NETID=netid	Setting the Network ID	AT+NETID=2	Set the network ID to 2
AT+KEY=key	Setting the module key	AT+KEY=1234	Set module key to 1234
AT+DELAY=delay	Setting the WOR delayed sleep time	AT+DELAY=1000	Set WOR delayed sleep time to 1000ms.
AT+SWITCH=switch	Setting the software toggle mode switch	AT+SWITCH=1	Setting on and allowing software switching
AT+SWITCH=switch	Setting the software switching mode switch	AT+SWITCH=1	Set on in configuration mode to allow software switching.
AT+MODE=mode	Switching the operating mode	AT+MODE=0	Switch to pass-through mode
AT+UAUX=uaux	Setting the AUX(STB)	AT+UAUX=0	Switch to serial port cache status

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	indication mode		indication mode

7.1.3 Query Instructions

Query Instructions	Description	Example	Example Description
AT+HELP=?	Query AT Command Table		Return to AT Command Table
AT+DEVTYPE=?	Query Module Model Number	DEVTYPE=EWM22A-400R22D	Return to Module Model Number
AT+FWCODE=?	Query Firmware Code	FWCODE=7453-0-21	Return to Firmware Version
AT+UART=?	Query baud rate and checksum	AT+UART=3,0	Returns baud rate as 9600, 8N1
AT+RATE=?	Query Air Rate	AT+RATE=7	Returns the air rate as 62.5K
AT+PACKET=?	Query Packet Length	AT+PACKET=0	Return packet is 240 bytes
AT+WOR=?	Query WOR Role	AT+WOR=0	Return to WOR receive
AT+POWER=?	Query Transmit Power	AT+POWER=0	Return to transmit power of 22dBm/30dBm
AT+TRANS=?	Query Transmit Mode	AT+TRANS=1	Return to fixed point mode
AT+ROUTER=?	Query Relay Mode	AT+ROUTER=1	Return to relay mode
AT+LBT=?	Query Listen Before Talk function switch	AT+LBT=1	Return to LBT switch status
AT+LBR=?	Query LBT judgment parameter	AT+LBR=-55,2000	Returns the judgment parameter
AT+ERSSI=?	Query ambient noise RSSI switch	AT+ERSSI=1	Return to ambient noise switch status
AT+DRSSI=?	Query RSSI output	AT+DRSSI=1	Returns the channel RSSI function on
AT+ADDR=?	Query module address	AT+ADDR=1234	Return to module address 1234
AT+CHANNEL=?	Query Module Operating Channel	AT+CHANNEL=23	Return frequency is 433.125M
AT+NETID=?	Query Network ID	AT+NETID=2	Returns the network ID as 2
AT+KEY=?	Query Module Key	不支持读取(安全考虑)	Returns ERR
AT+DELAY=?	Query WOR delayed sleep time	AT+DELAY=1000	Returns WOR delayed sleep time to 1000ms.
AT+SWITCH=?	Query software switching mode switch	AT+SWITCH=0	Software switching mode off
AT+MODE=?	Query current working	AT+MODE=0	Returns the current

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	mode (all modes can be queried)		pass-through mode

7.2 AT Parameter Analysis

When the serial port receives the correct command, the serial port will return "Command = OK", otherwise it will return "=ERR"

Command parameter	Meaning of parameter
Baud（serial port baud rate）	0:1200 1:2400 2:4800 3:9600 4:19200 5:38400 6:57600 7:115200
Parity（serial port parity bit）	0:8N1 1:8O1 2:8E1 3:8N1
Rate（airspeed）	0:2.4K 1:2.4K 2:2.4K 3:4.8K 4:9.6K 5:19.2K 6:38.4K 7:62.5K
Packet（Packet length）	0:240 1:128 2:64 3:32
Role（WOR character）	0:Receive 1:Send
Period/WTIME（WOR cyclicality）	0:500ms 1:1000ms 2:1500ms 3:2000ms 4:2500ms 5:3000ms 6:3500ms 7:4000ms
Power（firing power）	0:22dBm/30dBm 1:17dBm/27dBm 2:13dBm/24dBm 3:10dBm/21dBm
Trans（sending method）	0:Transparent 1:Fixed point
Router（relay mode）	0:off 1:on
LBT(listen before talk)	0:off 1:on
Lrssi	LBT function detects RSSI threshold -128~0
Ltime	Maximum wait time for LBT function detection 1~65535ms
Erssi(environment RSSI)	0:Off 1:On
Data_rssi（digital RSSI）	0:off 1:on
Addr（module address）	Module address 0~65535 (decimal)
400MHz Channel（module channel）	Module channel 0~83 (decimal)
Netid（Net ID）	Module Network 0~255 (decimal)
Key（Key）	Module Key 0~65535 (decimal)
Delay（WOR delayed sleep）	Delay Sleep 0~65535 (decimal)
SWITCH（Software switching mode switch）	0: off; 1: on
Mode(operating mode)	0: Transmission mode 1: WOR mode 2: Configuration mode 3: Sleep mode
Uaux	0: Serial buffer empty indication mode 1: Wireless transmission completion indication mode

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7.3 Serial Port Upgrade Firmware Notes

- If customers need to upgrade the firmware, they need to find the corresponding BIN file provided by the official, and then use the upper computer provided by the official to upgrade the firmware, generally users do not need to upgrade the firmware, please do not use the "AT+IAP" command instruction.
- Please do not use "AT+IAP" command. sends "AT+IAP" command in configuration mode to enter upgrade mode.
- After enters the upgrade mode, the baud rate will be automatically switched to 115200 until it exits automatically, during which a log will be output.

7.3.1 Steps for upgrading the upper computer

- Upgrade of Upper Unit Commands

1, by changing the host computer or serial port assistant XCOM to make the module into the configuration mode (Note: the baud rate in the configuration mode is 9600);

2, open the official website to configure the host computer "E22 Setting V1.0", choose to select the serial port → open the serial port → read the parameters → select the firmware upgrade → click to open the file, and select the required upgrade firmware → click to download;



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8 Hardware design

- It is recommended to use a DC regulated power supply to power this module, the power supply ripple factor is as small as possible, and the module needs to be reliably grounded;
- Please pay attention to the correct connection of the positive and negative terminals of the power supply, such as reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that it is between the recommended supply voltages, if it exceeds the maximum value it may cause permanent damage to the module;
- Please check the power supply stability, the voltage should not fluctuate significantly and frequently;
- In the design of power supply circuit for the module, it is often recommended to retain more than 30% of the margin, there is the whole machine is conducive to long-term stable work;
- Module should be as far away as possible from the power supply, transformers, high-frequency alignments and other electromagnetic interference in the larger part;
- High-frequency digital alignment, high-frequency analog alignment, power supply alignment must be avoided below the module, if you really need to go through the module below, assuming that the module is welded in the Top Layer, the Top Layer in the contact part of the module to lay the ground copper (all paved with copper and a good ground), it must be close to the digital part of the module and alignment in the Bottom Layer;
- Assuming that the module is soldered or placed in the Top Layer, it is also wrong to randomly route the module in the Bottom Layer or any other layer, which will affect the spuriousness of the module as well as the reception sensitivity to varying degrees;
- Assuming that there is a large electromagnetic interference around the module device will also greatly affect the performance of the module, according to the intensity of the interference is recommended to stay away from the module, if the situation permits you can do appropriate isolation and shielding;
- Assume that there is a large electromagnetic interference around the module alignment (high-frequency digital, high-frequency analog, power supply alignment) will also greatly affect the performance of the module, according to the intensity of the interference is recommended to be appropriate away from the module, if the situation permits you can do appropriate isolation and shielding;
- Communication line if you use 5V level, must be connected in series with 1k-5.1k resistor (not recommended, there is still a risk of damage);
- Try to stay away from some TTL protocols where the physical layer is also 2.4GHz, e.g. USB3.0;
- The antenna mounting structure has a big impact on the module performance, make sure the antenna is exposed and preferably vertically upward;
- When the module is installed inside the chassis, use a good quality antenna extension cable to extend the antenna to the outside of the chassis;
- The antenna must not be installed inside the metal shell, which will lead to a great weakening of the transmission distance.

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9 Common problems

9.1 Unsatisfactory transmission distance

- When there are linear communication barriers, the communication distance will decay accordingly;
- Temperature, humidity, and co-channel interference, which will lead to higher communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test results are poorer near the ground;
- Seawater has a strong ability to absorb radio waves, so the effect of the seaside test is poor;
- Metal objects near the antenna, or placed in a metal shell, the signal attenuation will be very serious;
- Wrong power register setting, air rate setting is too high (the higher the air rate, the closer the distance);
- Low voltage of power supply at room temperature is lower than the recommended value, the lower the voltage the lower the hair power;
- The use of antenna and module matching degree is poor or the antenna itself quality problems.

9.2 Modules are fragile

- Please check the power supply to ensure that it is between the recommended supply voltages, if it exceeds the maximum value it will cause permanent damage to the module;
- Please check the power supply stability, the voltage can not be substantial frequent fluctuations;
- Please ensure that the installation and use process anti-static operation, high-frequency device electrostatic sensitivity;
- Please ensure that the installation and use of the process of humidity should not be too high, part of the components for humidity-sensitive devices;
- If there is no special demand is not recommended to be used at too high or too low a temperature.

9.3 BER is too high

- Near the same frequency signal interference, away from the source of interference or modify the frequency and channel to avoid interference;
- Poor power supply may also cause garbled code, be sure to ensure the reliability of the power supply;
- Extension cords, feeder cords of poor quality or too long, can also cause high BER.

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10 Welding instructions

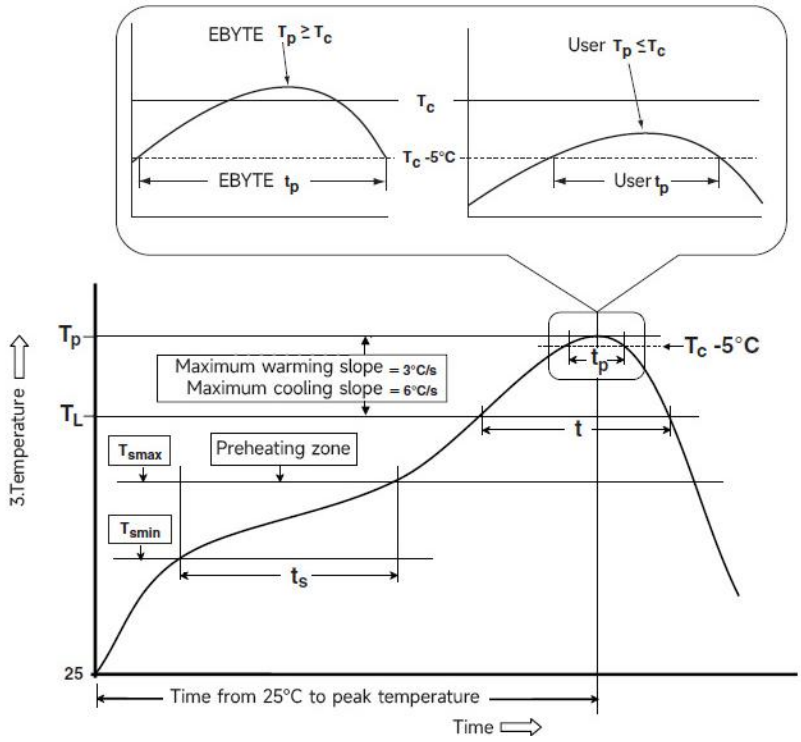
10.1 Reflow Profile Characteristics

Reflow Profile Characteristics		Leaded process assembly	Lead-free process assembly
Preheating/Holding	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin~Tsmin)	60-120 秒	60-120 秒
Temperature rise slope (TL~Tp)		3°C/sec, max	3°C/sec, max.
Liquid phase temperature (TL)		183℃	217℃
Holding time above TL		60~90 seconds	60~90 seconds
Encapsulation peak temperature Tp		The user must not exceed the temperature indicated on the product's “Moisture Sensitivity” label.	The user must not exceed the temperature indicated on the product's “Moisture Sensitivity” label.
Time (Tp) within 5°C of the specified classification temperature (Tc), see the following graph		20 seconds	30 seconds
Cooling slope (Tp~TL)		6°C/sec, max.	6°C/sec, max.
Time from room temperature to peak temperature		6 minutes, max.	8 minutes, max.
※The peak temperature (Tp) tolerance of the temperature profile is defined as the user's upper limit.			

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10.2 Reflow temperature

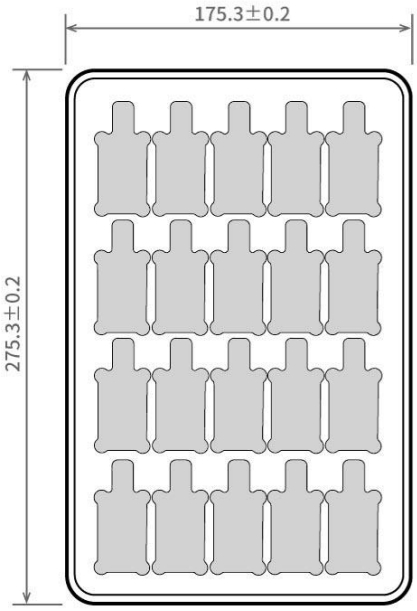


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13 Batch packing method

13.1 Batch packing method





Unit: mm
Each Layer: 20 pcs
Each Package: 5 layers

Revision history

Version	Date	Description	Issued by
1.0	2024.11.25	Initial version	Hao
1.1	2026.03.26	error correction	Bin

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