# EWM226-900H30S Product Specification Sheet

## AT commands 868/915MHz LoRa Wireless Module



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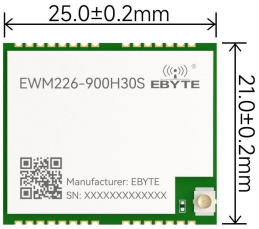
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# Chapter 1 Product Overview

## 1.1 Product Introduction

LoRa wireless frequency hopping data transmission module for lawnmowers designed based on LoRa spread spectrum technology . It has a maximum transmission power of 30 dBm, multiple transmission modes, operates in the 868/915MHz frequency band , and has TTL level output. It is suitable for applications such as lawnmowers and surveying .




## 1.2 Features and Functions

- It adopts a new generation of LoRa spread spectrum modulation technology, which has a longer communication distance and stronger anti-interference ability;
- multiple frequency bands including 868/915MHz (customizable) ;
- Supports fixed-frequency and frequency-hopping transmission modes;
- Supports one-to-many communication;
- Supports serial port firmware upgrades , making maintenance more convenient;
- It supports AT commands, making it convenient and quick for users to use ;
- It supports users setting their own communication keys, which cannot be read, greatly improving the confidentiality of user data;
- It supports LBT function, which listens to channel environmental noise before transmission, which can greatly improve the communication success rate of the module in harsh environments;
- Supports RSSI signal strength indication function for evaluating signal quality;
- Supports fixed-point transmission, broadcast transmission, and channel monitoring;
- The air transmission rate is adjustable in multiple levels;
- The parameters are saved after power failure, and the module will work according to the set parameters after power is restored;
- Built-in watchdog timer automatically resets and resumes operation in case of an accident;

## 1.3 Application Scenarios

- Lawn mower applications;
- Drone applications;
- Intelligent irrigation and environmental monitoring in agriculture;
- Photovoltaic power plant monitoring and distributed photovoltaic system management, etc.
- Smart home and industrial sensors, etc.;
- Building automation solutions;
- Wireless industrial-grade remote control .

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# Chapter 2 Specifications

## 2.1 Product Selection Comparison

| Product Model | Carrier frequency ① M Hz | Transmit power ② dBm | Test distance ③ km | Packaging | Product dimensions (mm) | Antenna type ④ |
|---|---|---|---|---|---|---|
| EWM226-900H30S | 860 ～ 930 | 30 | 5 | patch | 21.0 * 25.0 | IPEX 1st Generation / Stamp Hole |

Note:

(1)Carrier frequency ①: Frequency band range can be customized by the user;

(2)Transmit power ②: 30dBm, error range ±1dBm, power is adjustable in multiple levels, please see Chapter 6 of this article for details of power levels ;

(3)Test distance ③: Clear and open, airspeed 11kbps, antenna height 2 meters (for reference only, actual measurement is recommended);

(4)Antenna type ④: Equivalent impedance approximately 50Ω;

## 2.2 Basic parameters

Conditions: Tc = 25℃, VCC = 3.3 V, 868MHz/915MHz

| parameter | describe |
|---|---|
| Modulation method | LoRa |
| Interface method | 1.27mm stamp perforation |
| Communication interface | UART |
| Launch length | 240 bytes is the maximum capacity per packet . Packets exceeding this limit will be automatically split into smaller packets . This capacity can be adjusted via a host computer or command line. For detailed instructions, please refer to Chapter 6 of this document. |
| Packaging method | patch |
| Cache capacity | 1000 Btye |
| weight | 3.0g±0.1g |
| **Work environment** | |
| Operating temperature | -40℃～+85℃, industrial grade standard |
| Operating humidity | 10-90%RH |
| Storage temperature | -40℃～+125℃ |
| **RF parameters** | |
| Transmit power | 30dBm = 1000mW, power adjustable in multiple levels; detailed instructions can be found in Chapter 6 of this document. |
| Operating | 860MHz～930MHz, frequency band customization supported; see Chapter 6 of this document for detailed |

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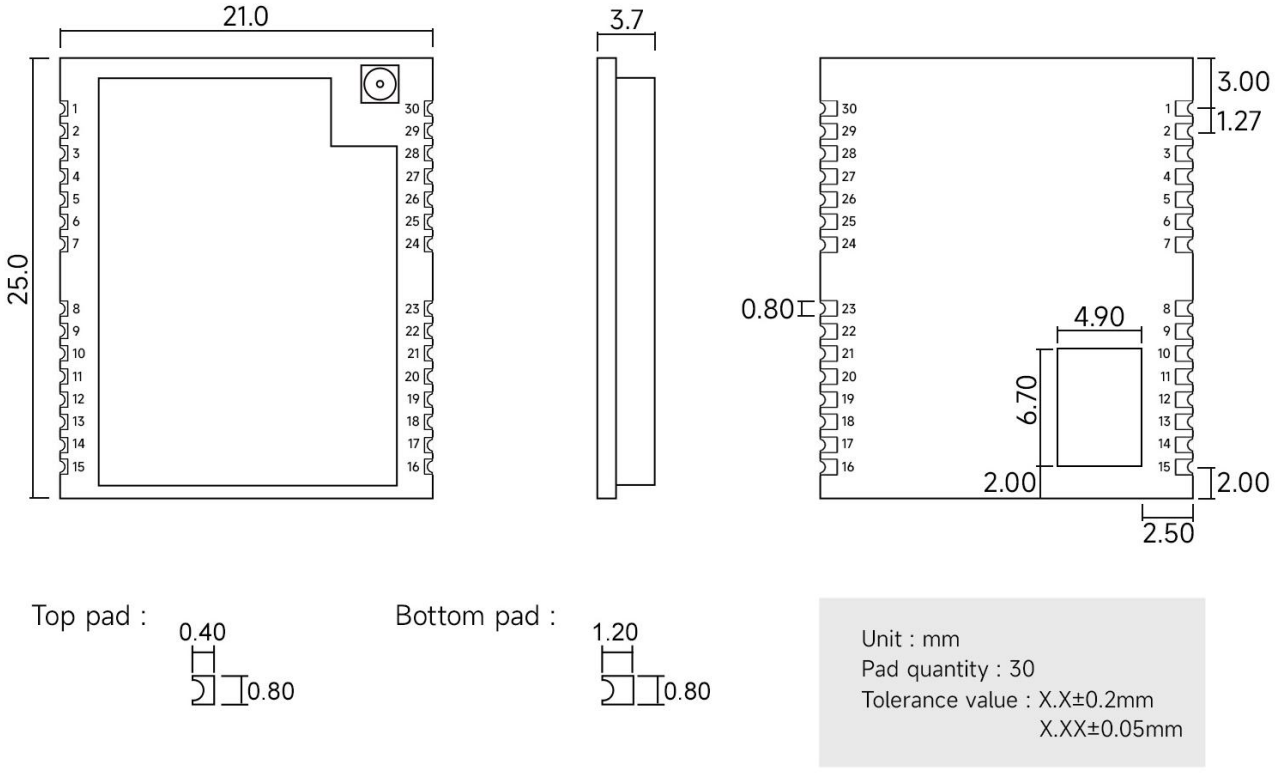


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| parameter | describe |
|---|---|
| frequency band | commands. |
| Receiving sensitivity | - 134dBm, airspeed 2.4kbps@SF11 |
| air speed | ranges from 11 to 62.5 Kbps, with multi-level adjustable air speeds. Detailed instructions can be found in Chapter Six of this document. |
| Blocking power | 10dBm |
| **Electrical parameters** | |
| Power supply voltage | 3.0～3.6V , ≥3.3V can guarantee output power, exceeding 3.6V will permanently burn out the module . |
| Communication level | 3.0 V |
| Emission current | ≈ 1000 mA , instantaneous power consumption, @30dBm |
| Received current | ≈13mA |

# Chapter 3 Mechanical Dimensions and Pin Definitions

## 3.1 Mechanical Dimensions and Pin Definitions




| Pin number | Pin Name | Pin direction | Pin Applications |
|---|---|---|---|
| 1 | GND | - | Module ground wire |
| 2 | TXD2 | - | The feet must be suspended in the air. |

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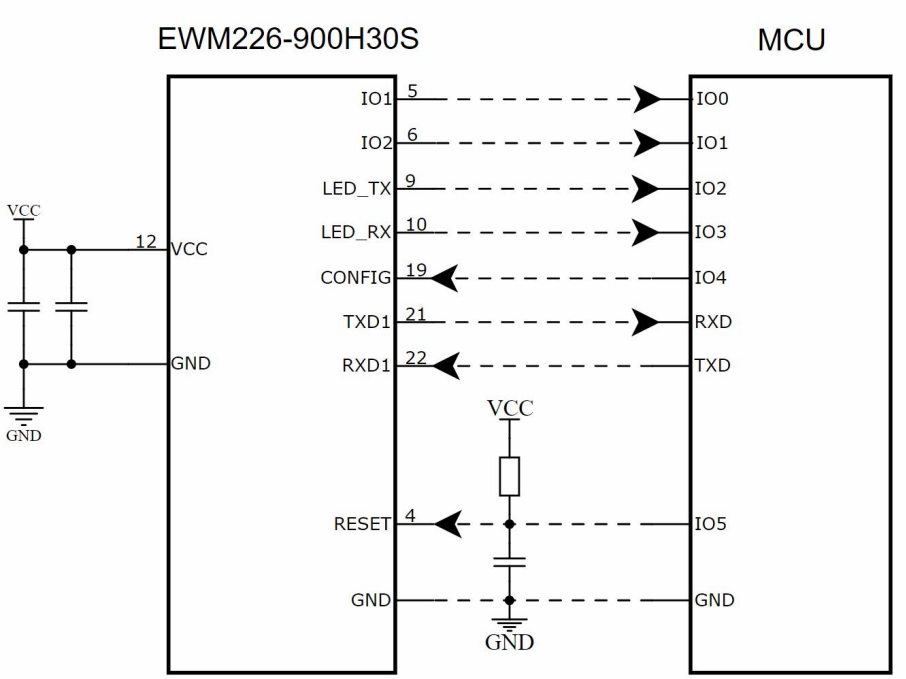

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| Pin number | Pin Name | Pin direction | Pin Applications |
|---|---|---|---|
| 3 | RXD2 | - | The feet must be suspended in the air. |
| 4 | RESET | enter | The module reset pin requires a low-level reset, and the pull-low time must be greater than 100μs. |
| 5 | IO1 | Output | The RXD1 buffer is an empty indicator pin; a high level indicates it is empty, and a low level indicates it is not empty. The size of each serial port data packet cannot exceed 1000 bytes. |
| 6 | IO2 | Output | The master-slave module synchronization indicator pin will output a 1Hz square wave signal after synchronization. |
| 7 | GND | - | Module ground wire |
| 8 | GND | - | Module ground wire |
| 9 | LED_TX | Output | The RF transmit indicator pin outputs a high level when transmitting data and a low level when idle. |
| 10 | LED_RX | Output | The RF receiver indicator pin outputs a high level when receiving data and a low level when idle. |
| 11 | GND | - | Module ground wire |
| 12 | VCC | enter | Power supply interface, DC 3.0 ~ 3.6V |
| 13 | VCC | enter | Power supply interface, DC 3.0 ~ 3.6V |
| 14 | GND | - | Module ground wire |
| 15 | GND | - | Module ground wire |
| 16 | GND | - | Module ground wire |
| 1 7 | SWDIO | - | The feet must be suspended in the air. |
| 1 8 | SWCLK | - | The feet must be suspended in the air. |
| 19 | CONFIG | enter | The mode configuration pin is low to enter configuration mode and high to enter transmission mode. |
| 20 | 1PPS | enter | 1PPS input pin |
| twenty one | TXD1 | Output | Serial output pin |
| twenty two | RXD 1 | enter | Serial input pin |
| twenty three | GND | - | Module ground wire |
| twenty four | GND | - | Module ground wire |
| 25 | NC | - | The feet must be suspended in the air. |
| 26 | NC | - | The feet must be suspended in the air. |
| 27 | RSV | - | Reserved pins must be left floating. |
| 28 | GND | - | Module ground wire |
| 29 | ANT | - | Antenna interface (50 ohms characteristic impedance) |
| 30 | GND | - | Module ground wire |

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# Chapter 4 Recommended Connection Diagram




| Serial Number | Precautions |
|---|---|
| 1 | The module has a 3.3V serial port and I/O pins. If the user is using a 5V microcontroller, level conversion needs to be considered. |
| 2 | It is strongly recommended to connect the RESET pin to avoid unexpected malfunctions or other special situations. |
| 3 | If you are considering adding an external switch to the module's VCC, please consider the leakage current of the external microcontroller's serial port; otherwise, the module will not be able to be turned off. |
| 4 | (Optional) For surface mount modules, consider bringing out the module's programming pins for easier future maintenance or firmware customization. |
| 5 | (Optional) Consider bringing out an additional interface for the module's serial port to facilitate future maintenance (can be upgraded online with PC tools). |

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# Chapter 5 Functional Details

- In this chapter , the CONFIG pin is described as follows: 0 represents a low level and 1 represents a high level.

## 5.1 Working Mode

The module has two operating modes, which are set by the CONFIG pin . Details are shown in the table below:

| Pattern ( 0-1 ) | CONFIG | Mode Introduction | Remark |
|---|---|---|---|
| 0 Configuration mode | 0 | Module parameter configuration | - |
| 1 Transmission Mode | 1 | Data transmission modes ( DUPLEX, TXONLY, RXONLY, HOP ) | Switch using the AT+MOD command. |

### 5.1.1 Transmission mode

#### 5.1.1.1 Quick Start Guide to DUPLEX Transfer

DUPLEX Mode: In this mode, bidirectional data transmission is possible (the module can both send and receive wireless data).

What you send is what you get; you can communicate with each other using a serial port assistant. An example is shown below:

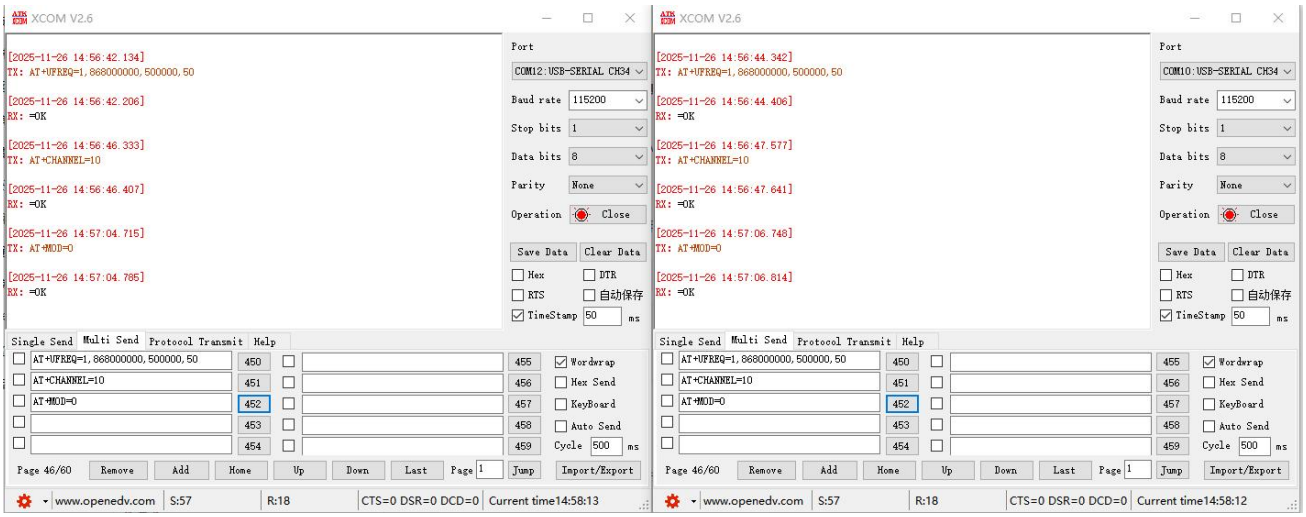
① Switch the CONFIG pin to configuration mode;

② AT+UFREQ =1,868000000,500000,50 (Configure fixed-frequency transmission, custom frequency start for reception, channel spacing, and number of channels);

③AT+CHANNEL=10 (Configure fixed-frequency transmit and receive frequency FREQ = 868000000 + 500000*10 Hz);

④AT+MOD=0 (Set the transfer mode to DUPLEX );

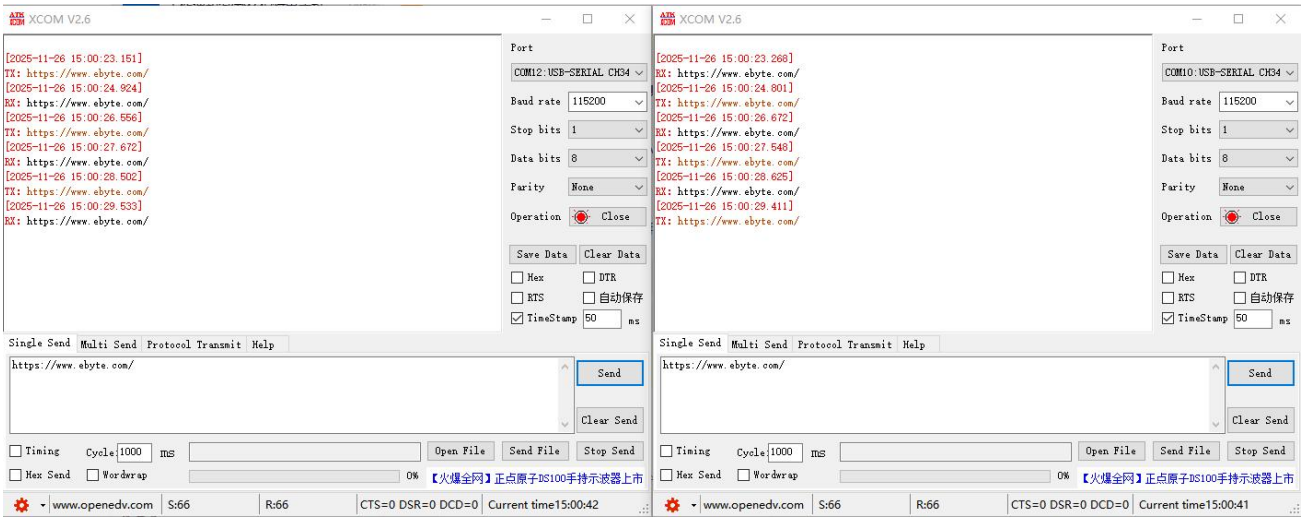
⑤ Simply switch the CONFIG pin to transmission mode.




Configuration diagram

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Communication diagram

### 5.1.1.2 Quick Use of TXONLY and RXONLY

TXONLY mode: In this mode, only data can be transmitted (the module can only transmit wireless data and cannot receive wireless data), and it needs to be used in conjunction with RXONLY or DUPLEX mode.

RXONLY mode: In this mode, the module can only receive data (it can only receive wireless data and cannot send wireless data). It needs to be used in conjunction with TXONLY or DUPLEX mode.

**T XONLY and RXONLY :**

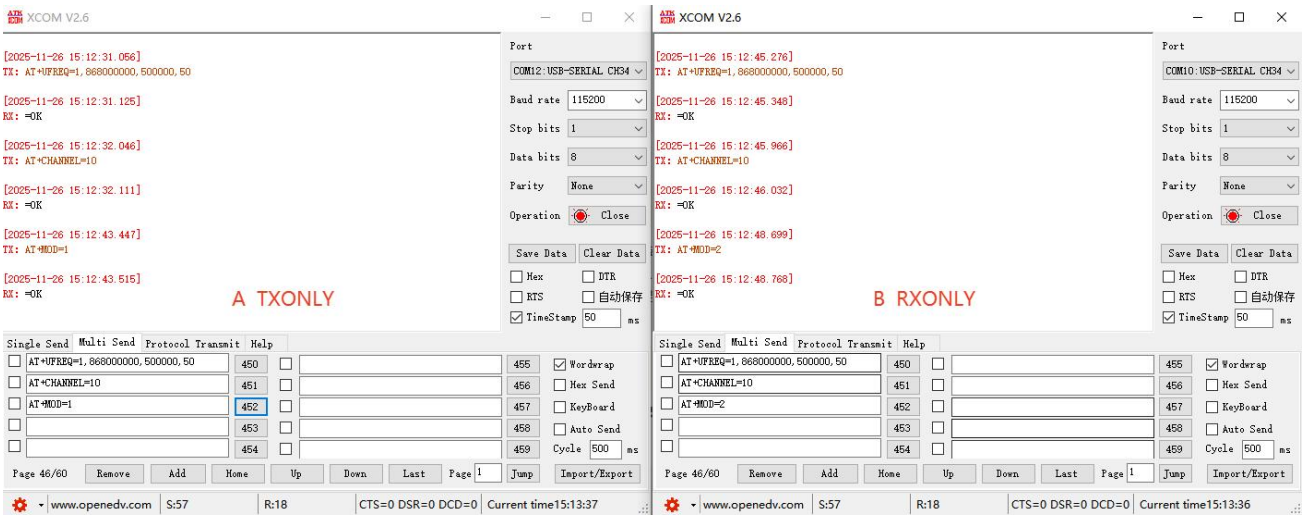
① Switch the CONFIG pin to configuration mode;

② AT+UFREQ =1,868000000,500000,50 (Configure fixed-frequency transmission, custom frequency start for reception, channel spacing, and number of channels);

③AT+CHANNEL=10 (Configure fixed-frequency transmit and receive frequency FREQ = 868000000 + 500000*10 Hz);

④ **Module A** : AT+MOD=1 (Set transmission mode to TXONLY ) **Module B** : AT+MOD=2 (Set transmission mode to RXONLY )

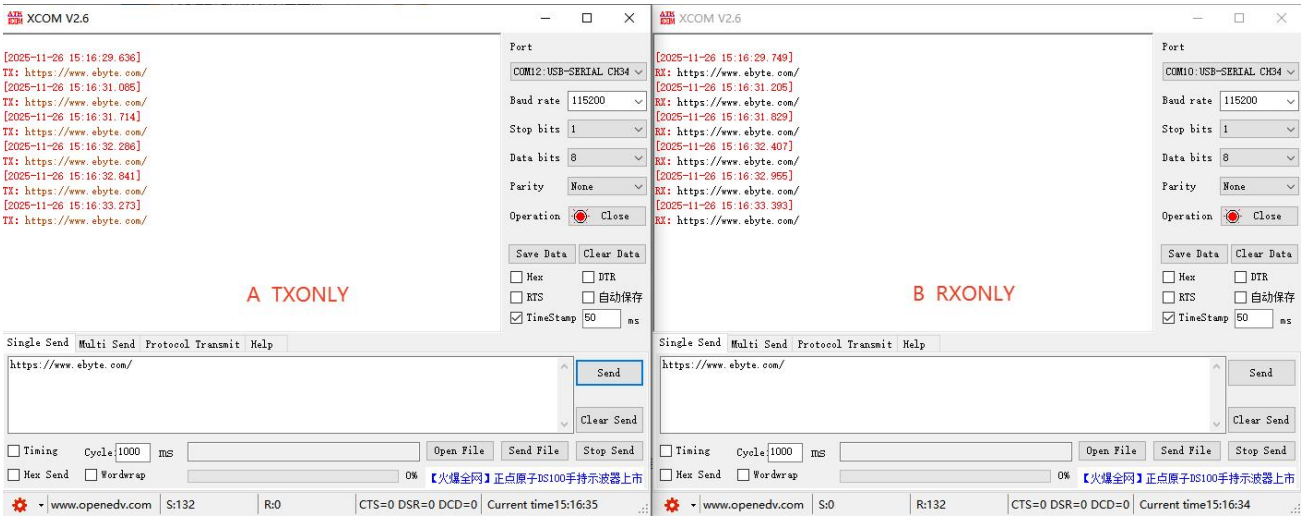
⑤ Simply switch the CONFIG pin to transmission mode.




Configuration diagram

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Communication diagram

### 5.1.1.3 Quick Use of HOP Mode

**Detailed explanation of frequency hopping mode parameters:**

**①AT+ROLE**

In HOP mode, master-slave role configuration supports one master and one slave, or one master and multiple slaves.

Master (host): After the CONFIG pin is switched to transmission mode, the host begins to send frequency hopping synchronization frame data at a frequency of once per second;

From the slave role (slave): After the CONFIG pin switches to transmission mode, the slave starts fast frequency hopping to search for master synchronization data until it receives normal master synchronization frame data, and then immediately begins synchronizing the master frequency hopping sequence. After synchronization is complete, the IO2 and LED_RX pins will synchronize the master output. At this time, the master and slave have completed frequency hopping synchronization, and the user can start data pass-through communication.

**②AT+FLIST**

In HOP mode, the frequency hopping list can be selected based on different countries and regions. (European, American, and Australian standards are supported; the master and slave devices must be consistent).

**③AT+PPS**

In HOP mode, the external pulse-per-second input enable switch is off by default, and the module's internal software clock automatically generates a synchronization pulse signal per second. If the user enables this switch, external hardware must be connected to the module's 1PPS pin to provide a stable synchronization pulse per second for the module's frequency hopping system (commonly used for PPS pin access in positioning devices).

**④AT+WTIME**

In HOP mode, the slave data return window time configuration is disabled by default, allowing only the master to transmit data to the slave. If a user needs the slave to return data to the master in HOP mode, both the master and slave must enable this window time and ensure it remains consistent. Users can adjust the return window according to their slave needs; a larger return window results in a larger amount of data returned by the slave, while conversely, the amount of data sent by the master will decrease accordingly. Users should adjust this based on their usage scenario.

**⑤AT+ADDR**

In all transmission modes, the module address configuration must ensure that the module addresses of both communicating parties are consistent; otherwise, communication will not be possible.

**⑥AT+KEY**

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In all transmission modes, the module data transmission key configuration must ensure that the module keys of both communicating parties are consistent; otherwise, communication will not be possible.

**Operating steps:**

- Example scenarios and steps are as follows:

①The CONFIG pin is switched to configuration mode;

②AT+MOD=3 (Set frequency hopping-HOP transmission mode);

③ **Module A** : AT+ROLE=1 (Set the frequency hopping transmission master role), **Module B** : AT+ROLE=0 (Set the frequency hopping transmission slave role);

④AT+FLIST=0 (Set the frequency hopping list to ensure consistency between master and slave roles);

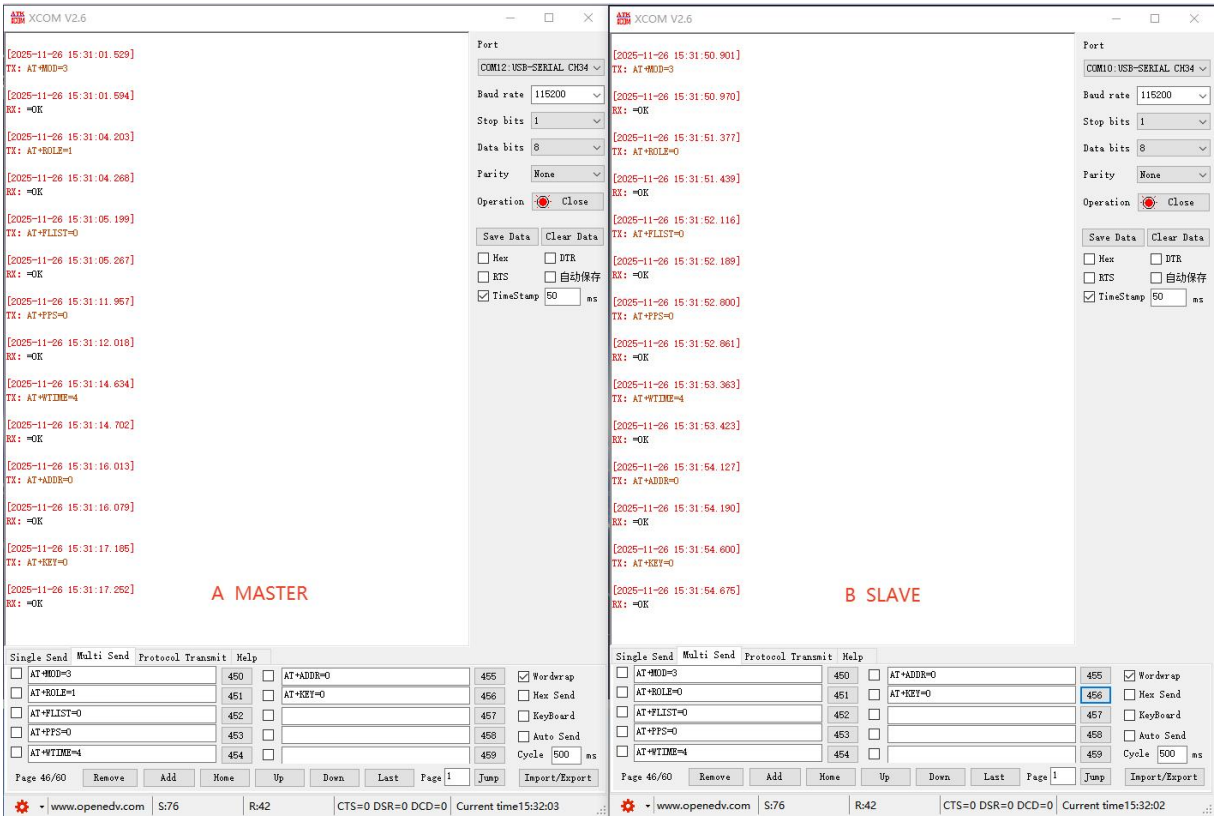
⑤AT+PPS=0 (Sets whether to enable hardware synchronization; requires external hardware support to ensure master-slave consistency).

⑥AT+WTIME=4 (Sets the slave data return cycle. The master and slave must maintain consistency. The longer the cycle, the more data the slave returns.)

⑦AT+ADDR=0 (Custom address, master and slave can broadcast to multiple slaves with consistent operation, but cannot send back to one slave from multiple slaves).

⑧AT+KEY=0 (Custom communication encryption, master and slave remain consistent, frequency hopping sequence is related to this);

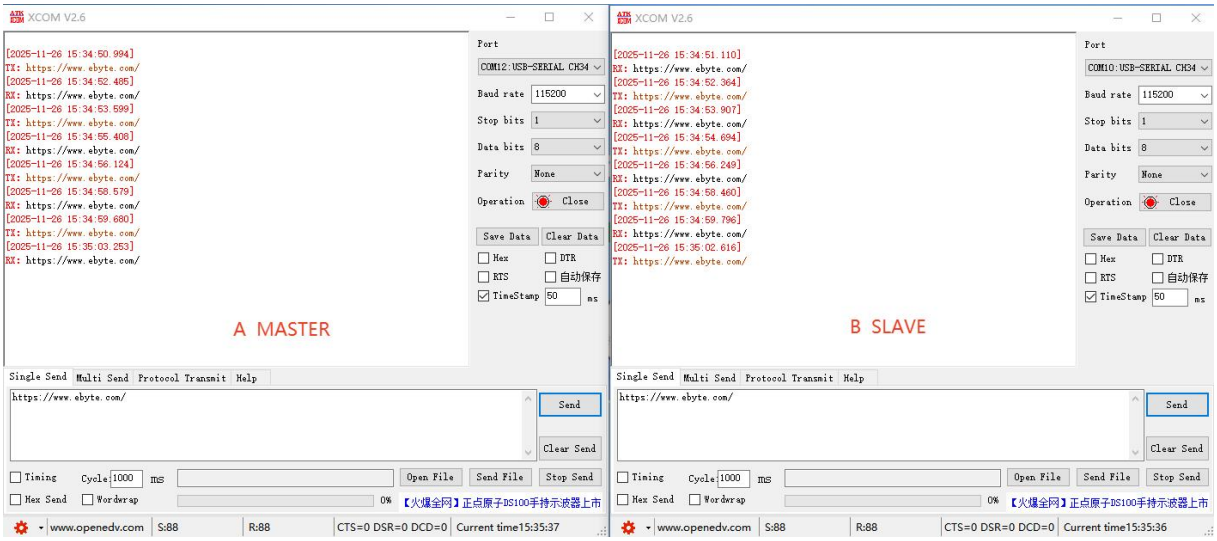
⑨ When the CONFIG pin is switched to transmission mode, the master and slave modules will start to synchronize automatically. After synchronization is completed, the master and slave IO2 pins will output a 1Hz square wave signal, and transparent data communication can begin.




Configuration diagram

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Communication diagram

## 5.2 Serial port firmware upgrade

① If customers need to upgrade the firmware, they need to contact the relevant person through the sales channel to obtain the corresponding upgrade package, and then use the host computer provided by EBITE to upgrade the firmware. Under normal circumstances, users do not need to upgrade the firmware, so please do not use the "AT+IAP" command .

② The necessary pins for the upgrade must be brought out (CONFIG, TXD, RXD, VCC, GND), and then the "AT+IAP" command should be sent in configuration mode to enter upgrade mode.

③ After entering upgrade mode, the baud rate will automatically switch to 115200 until it automatically exits, during which time logs will be output .

### 5.2.1 Upgrade your host computer quickly

Step 1: Enter configuration mode by changing CONFIG (Note: the baud rate in configuration mode is 115200); open the configuration host computer and select the firmware upgrade tab.

Step 2: Click "Read Parameters" to view module information in the left window of the host computer.

Step 3: Open the file (select the firmware.bin file) > Click Start Download.

Step 4: Click "Start Download". The firmware upgrade will begin and a message will appear indicating successful download upon completion.

Step 5: After the firmware upgrade is complete, reopen the serial port to confirm the read parameters.

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**upper computer interface diagram**

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# Chapter 6 AT Commands

- Parameter configuration or querying using AT commands must be done in configuration mode;
- Automatically recognizes the carriage return and newline character at the end of user AT commands, and still recognizes them even if no carriage return and newline character is added;
- An AT command recognition or execution error will result in an " =ERR " response.
- When the input parameters exceed the range, they will be restricted. Please do not allow the parameters to exceed the range to avoid unforeseen situations.

## 6.1 General instructions

### 6.1.1 AT+RESET soft reboot

| Instruction format | AT+RESET |
|---|---|
| Execution Example | Send: AT+RESET<br>Response: =OK |
| Feature Description | ● The actual reset process will only begin after the user responds (=OK). Please wait approximately 30ms before proceeding to the next step. |

### 6.1.2 AT+DEFAULT to restore factory settings

| Instruction format | AT+DEFAULT |
|---|---|
| Execution Example | Send: AT+DEFAULT<br>Response: =OK |
| Feature Description | ● After the response (=OK), in addition to parameter restoration, a restart process will be executed. Please wait approximately 30ms before proceeding to the next step. |

### 6.1.3 Use AT+DEVTYPE to query product model

| Instruction format | AT+DEVTYPE=? |
|---|---|
| Execution Example | Send: AT+DEVTYPE=?<br>Response: DEVTYPE=E WM226-900H30S |
| Feature Description | ● Product Series: EWM226<br>● Operating frequency band: 900<br>● Maximum power: 30 |

### 6.1.4 AT+FWCODE Query Software Version

| Instruction format | AT+FWCODE=? |
|---|---|
| Execution Example | Send: AT+FWCODE=?<br>Response: FWCODE= 7547-0-10 |
| Feature Description | ● Major version number: 7547<br>● Branch number: 0<br>● Minor version number: 10 (incrementing from 10) |

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### 6.1. 5 AT+ IAP Serial port firmware upgrade

| Instruction format | AT+IAP |
|---|---|
| Setup Example | Send: AT+IAP<br>Response: =OK |
| Query Example | Send: AT+IAP<br>Response: =OK |
| Parameter Description | none |
| Feature Description | ● Use with caution |

### 6.1. 6 AT+MOD Transmission Working Mode

| Instruction format | AT+MOD=<mode> |
|---|---|
| Setup Example | Send: AT+MOD=0<br>Response: =OK |
| Query Example | Send: AT+MOD=?<br>Response: AT+MOD=0 |
| Parameter Description | **<mode>** : Working mode number<br>0 DUPLEX (Fixed Frequency Transceiver Mode)<br>1 TXONLY (Fixed Frequency Single Transmission Mode)<br>2 RXONLY (Fixed Frequency Single Receiver Mode)<br>3 HOP (Frequency Hopping Mode) |
| Feature Description | ● DUPLEX, TXONLY, and RXONLY are fixed-frequency transmission modes.<br>● HOP is a frequency hopping transmission mode. |

### 6.1.7 AT+ADDR Communication Address (Match Filtering)

| Instruction format | AT+ADDR=<address> |
|---|---|
| Setup Example | Send: AT+ADDR=0<br>Response: =OK |
| Query Example | Send: AT+ADDR=?<br>Response: AT+ADDR=0 |
| Parameter Description | **<address>** : Communication address 0 - 65535 |
| Feature Description | ● Default address 0<br>● The address is not a radio frequency characteristic; it is merely an identifier carried within the data packet to help the receiving software logic determine whether to perform match filtering.<br>● The broadcast address is 65535. As a receiver, it can receive data from any address on the same channel (without filtering). As a sender, the data packets it sends carry the broadcast address, so the recipient will not filter them (broadcast data). |

### 6.1.8 AT+NETID Communication Network Code (Matching Filtering)

| Instruction format | AT+NETID=<net> |
|---|---|
| Setup Example | Send: AT+NETID=0<br>Response: =OK |
| Query Example | Send: AT+NETID=?<br>Response: AT+NETID=0 |
| Parameter Description | **<net>** : Communication network code 0-255 |
| Feature Description | ● Default network 0<br>● Network codes are not radio frequency characteristics; they are merely identifiers carried within data packets.<br>● Network codes have lower filtering priority than broadcast addresses. Even if the network codes are different, broadcast data can still be received.<br>● This instruction is reserved; customers do not need to use it at this time. |

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### 6.1.9 AT+CHANNEL Communication Channel (Carrier Frequency)

| Instruction format | AT+CHANNEL=<ch> |
|---|---|
| Setup Example | Send: AT+CHANNEL=0<br>Response: =OK |
| Query Example | Send: AT+CHANNEL=?<br>Response: AT+CHANNEL=0 |
| Parameter Description | Based on AT+UFREQ =p1,p2,p3,p4 configuration parameters |
| Feature Description | ● actual carrier frequency = p2 + **ch** * p3 (Hz) |

### 6.1.10 AT+KEY Communication Password (Data Encryption)

| Instruction format | AT+KEY=<key> |
|---|---|
| Setup Example | Send: AT+KEY=0<br>Response: =OK |
| Parameter Description | **<key>** : Encryption/decryption password 0 - 65535 |
| Feature Description | ● Default 0<br>● Unable to query (password cannot be read)<br>● Modules with inconsistent passwords cannot communicate (they cannot decode the correct data packets, fail verification, and are discarded). |

### 6.1.1 AT +UART Serial Port Baud Rate and Verification

| Instruction format | AT+UART=<baud>,<parity> |
|---|---|
| Setup Example | Send: AT+UART=3,0<br>Response: =OK |
| Query Example | Send: AT+UART=?<br>Response: AT+UART=3,0 |
| Parameter Description | **<baud>** : Serial port baud rate<br>0 1200bps<br>1 2400bps<br>2 4800bps<br>3 9600bps<br>4 19200bps<br>5 38400bps<br>6 57600bps<br>7 115200bps (default)<br><br>**<parity>** : Serial port verification type<br>0 No validation None (default)<br>1. Odd parity<br>2 Even parity |
| Feature Description | ● The change will take effect after switching working modes. |

### 6.1. 1 2 AT+PACKET Serial Port Packing Length

| Instruction format | AT+PACKET=<len> |
|---|---|
| Setup Example | Send: AT+PACKET=0<br>Response: =OK |
| Query Example | Send: AT+PACKET=?<br>Response: AT+PACKET=0 |
| Parameter Description | **<len>** : Serial port data packet length<br>0 240 bytes (default)<br>1 128 bytes<br>2 64 bytes<br>3 32 bytes |

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| | |
|---|---|
| Feature Description | ● If the user-input data is less than the set length during serial port reception, it will be handled as a timeout frame break, then packaged and transmitted wirelessly.<br>● During serial port reception, when the user-input data reaches the set length, it will be immediately packaged and wirelessly transmitted.<br>● Data exceeding the set length will continue to accumulate in the serial port buffer. After wireless transmission is complete, it will be split into packets according to the set length and transmitted in a cyclical manner.<br>● In HOP mode, it is recommended to keep the default values. |

### 6.1.1 3 AT +URXT Serial Port Frame Drop Conditions

| **Instruction format** | **AT+URXT=<byte>** |
|---|---|
| Setup Example | Send: AT+URXT=3<br>Response: =OK |
| Query Example | Send: AT+URXT=?<br>Response: AT+URXT=3 |
| Parameter Description | **<byte>** : byte time 1 - 255 |
| Feature Description | ● By default, serial port timeout frame interruption is handled based on 3-byte intervals.<br>● The time (per byte) varies at different baud rates. At a baud rate of 9600, it's approximately 1 millisecond per byte; at a baud rate of 115200, it's approximately 100 microseconds per byte.<br>● When some customers input data from their external microcontrollers via serial ports to the module, the data is discontinuous (e.g., due to RTOS task interruption). This exceeds the module's set byte time window, resulting in frame fragmentation and manifesting as segmented data packets at the receiving end. |

### 6.1.1 4 AT +RATE Wireless Transmit/Receive Rate

| **Instruction format** | **AT+RATE=<rate>** |
|---|---|
| Setup Example | Send: AT+RATE=2<br>Response: =OK |
| Query Example | Send: AT+RATE=?<br>Response: AT+RATE=2 |
| Parameter Description | **<rate>** : air speed<br>0 11Kbps (default)<br>1 19.2Kbps<br>2 62.5Kbps |
| Feature Description | ● The airspeed range varies depending on the frequency band; please pay attention to the differences.<br>● The higher the air speed, the lower the communication latency (shorter transmission time), but the worse the receiving sensitivity (shorter communication distance). |

### 6.1.1 5 AT+UFREQ Setting the operating frequency parameters

| **Instruction format** | **AT+UFREQ=<mode>** |
|---|---|
| Setup Example | Send: AT+UFREQ =1,868000000,500000,50<br>Response: =OK |
| Query Example | Send: AT+ UFREQ =?<br>Response: AT+ UFREQ = 1,868000000,500000,50 |
| Parameter Description | AT+UFREQ =p1,p2,p3,p4<br><p1> Enable custom switch: 0: Off; 1: On<br><p2> 868000000 Sets the module's starting operating frequency to 868MHz<br><p3> 500000 Channel spacing 500kHz<br><p4> 50 Maximum number of channels: 50 |
| Feature Description | ● After setting this parameter, it can be used in conjunction with the AT+CHANNEL command . |

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### 6.1.1 6 AT +LBT Listen before you speak (avoidance)

| Instruction format | AT+LBT=<on_off> |
|---|---|
| Setup Example | Send: AT+LBT=0<br>Response: =OK |
| Query Example | Send: AT+LBT=?<br>Response: AT+LBT=0 |
| Parameter Description | **<on_off>** : Switch<br>0. Off (default)<br>1. Turn on |
| Feature Description | ● When the LBT (Listen Before Talk) function is enabled, it will check whether the ambient signal strength is lower than a set threshold before each wireless data transmission. If the condition is met within the timeout period, wireless transmission will actually start. If the condition is still not met after the maximum timeout period, wireless transmission will be forcibly started.<br>● For specific LBT settings, please refer to the AT+LBR command. |

### 6.1.1 7 AT +LBR Listen-before-send Judgment Condition

| Instruction format | AT+LBR=<rssi>,<timeout> |
|---|---|
| Setup Example | Send: AT+LBR=-55,2000<br>Response: =OK |
| Query Example | Send: AT+LBR=?<br>Response: AT+LBR=-55,2000 |
| Parameter Description | **<rssi>** : Signal strength threshold (dBm) 0 - (-128)<br>**<timeout>** : Maximum timeout (milliseconds) 0 - 65535 |
| Feature Description | ● The default parameters are -55dBm and 2000ms. |

### 6.1.18 AT+ ROLE HOP characters

| Instruction format | AT+ROLE=<role> |
|---|---|
| Setup Example | Send: AT+ROLE=0<br>Response: =OK |
| Query Example | Send: AT+ROLE=?<br>Response: AT+ROLE=0 |
| Parameter Description | **<role>** ： character<br>0 Slave (default)<br>1. Host |
| Feature Description | ● Master-slave configuration in HOP mode |

### 6.1.19 AT+WTIME Slave Data Transmission Cycle

| Instruction format | AT+WTIME=<timeout> |
|---|---|
| Setup Example | Send: AT+WTIME=3<br>Response: =OK |
| Query Example | Send: AT+WTIME=?<br>Response: AT+WTIME=3 |
| Parameter Description | **<timeout>** : Sleep time<br>0. Off (default)<br>1 60ms<br>2 160ms<br>3 260ms<br>4 360ms |
| Feature Description | ● Both the master and the servant need to maintain consistency. |

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## 6.1.20 AT+ERSSI Ambient Signal Strength

| **Instruction format** | **AT+ERSSI=<on_off>** |
|---|---|
| Setup Example | Send: AT+ERSSI=0<br>Response: =OK |
| Query Example | Send: AT+ERSSI=?<br>Response: AT+ERSSI=0 |
| Parameter Description | **<on_off>** : Switch<br>0. Off (default)<br>1. Turn on |
| Feature Description | ● After enabling AT+ERSSI=1, you can send the hexadecimal command C0 C1 C2 C3 in transmission mode to read the registers;<br>Register 0x00: Current environmental noise RSSI;<br>Register 0x01: RSSI at the last received data (current environmental noise is: dBm = - (256 - RSSI));<br>Command format: C0 C1 C2 C3 + starting address + read length;<br>Return: C1 + address + read length + valid read value;<br>For example: Send C0 C1 C2 C3 00 01<br>Return: C1 00 01 RSSI (the address can only start from 00) |

## 6.1.2 1 AT+ DRSSI Received Data Packet Signal Strength

| **Instruction format** | **AT+DRSSI=<on_off>** |
|---|---|
| Setup Example | Send: AT+DRSSI=0<br>Response: =OK |
| Query Example | Send: AT+DRSSI=?<br>Response: AT+DRSSI=0 |
| Parameter Description | **<on_off>** : Switch<br>0. Off (default)<br>1. Turn on |
| Feature Description | ● When enabled, signal strength data (1 byte, hexadecimal, signed number) will be appended to the end of the received data packet.<br>● Conversion Example: Assuming the obtained additional signal strength data is 0xC4 (-60dBm), the hexadecimal value 0xC4 is 196 in decimal. The conversion formula is: RSSI = -(256 - 196) = -60<br>● If the distance between the sender and receiver is too short or the sender's power is too high, the received signal strength may be 0 (upper limit), please directly convert it to 0dBm. |

## 6.1.22 AT+HPASW High Power Switch

| Instruction format | AT+HPASW=<on_off> |
|---|---|
| Setup Example | Send: AT+HPASW=0<br>Response: =OK |
| Query Example | Send: AT+HPASW=?<br>Response: AT+HPASW=0 |
| Parameter Description | <on_off>: Switch<br>0. Off (default)<br>1. Turn on |
| Feature Description | Once activated, the module's maximum power can reach 30dBm. |

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## 6.1. 2 3 AT+POWER power rating

| | | |
|---|---|---|
| Instruction format | AT+POWER = **<Power>** | |
| Setup Example | Send: AT+POWER=0<br>Response: AT+POWER=0 | |
| Query Example | Send: AT+POWER=?<br>Response: AT+POWER=0 | |
| Parameter Description | **<Power>** : Power<br>**AT+HPASW=1**<br><br>0 30dBm (default)<br>1 27dBm<br>2 24dBm<br>3 21dBm | **<Power>** : Power<br>**AT+HPASW=0**<br><br>0 22dBm (default)<br>1 17dBm<br>2 14dBm<br>3 10dBm |
| Feature Description | - | |

## 6.1.24 AT+FLIST HOP Mode Frequency List

| **Instruction format** | **AT+FLIST =<on_off>** |
|---|---|
| Setup Example | Send: AT+FLIST=0<br>Response: =OK |
| Query Example | Send: AT+FLIST=?<br>Response: AT+FLIST=0 |
| Parameter Description | **<on_off>** : Switch<br>0. European Standard (Default)<br>1 US Standard<br>2. Australian regulations |
| Feature Description | ● European standard: 863MHz-870MHz<br>863200000, 863550000, 863900000, 864250000, 864600000,<br>864950000,865300000,865650000,866000000,866350000,<br>866700000,867050000,867400000,867750000,868100000,<br>868450000,868800000,869150000,869500000,869850000,<br><br>● US standard: 902MHz-928MHz<br>902500000,903010000,903520000,904030000,904540000,<br>905050000,905560000,906070000,906580000,907090000,<br>907600000,908110000,908620000,909130000,909640000,<br>910150000, 910660000, 911170000, 911680000, 912190000,<br>912700000,913210000,913720000,914230000,914740000,<br>915250000,915760000,916270000,916780000,917290000,<br>917800000,918310000,919330000,920350000,920860000,<br>918820000,919840000,921370000,921880000,922390000,<br>922900000,923410000,923920000,924430000,924940000,<br>925450000,925960000,926470000,926980000,927490000,<br><br>● Australian standard: 915MHz-928MHz<br>915500000,916200000,916900000,917600000,918300000,<br>919000000,919700000,920400000,921100000,921800000,<br>922500000,923200000,923900000,924600000,925300000,<br>926000000,926700000,927400000, |

## 6.1.25 AT+SYNCT HOP slave synchronization timeout

| **Instruction format** | **AT+SYNCT=<time>** |
|---|---|
| Setup | Send: AT+SYNCT=5 |

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| | |
|---|---|
| Example | Response: =OK |
| Query Example | Send: AT+SYNCT=?<br>Response: AT + SYNCT = 5 |
| Parameter Description | **<time>** : Timeout period 2 - 64 seconds |
| Feature Description | ● Default synchronization timeout is 5 seconds<br>● In HOP mode, after the master and slave devices complete synchronization, if the slave device does not receive synchronization frame data from the master device within the set timeout period, the slave device will automatically clear the synchronization state and re-enter the fast frequency hopping reception mode to begin resynchronization.<br>● Users are advised to use this with caution (keep the default settings). |

## 6.2 Signaling testing (certification)

### 6.2.1 Test Instruction Declaration

The AT command testing section is intended for use only as an aid in product certification (e.g., CE, FCC certification) and should not be used for other purposes.

Ebyte assumes no liability for any damages arising from failure to comply with relevant operating or design specifications. Ebyte endeavors to ensure the completeness, accuracy, and timeliness of features under development, but does not exclude the possibility of errors or omissions in such features. Unless otherwise agreed, no implied or statutory warranties are made regarding the use of features under development. To the maximum extent permitted by applicable law, Ebyte shall not be liable for any damages suffered as a result of using features under development, whether or not such damages were foreseeable.

### 6.2.2 Test Command List

- Detailed instructions and documentation can be obtained through Ebitech's sales channels.

| AT commands | Function Summary |
|---|---|
| AT+FPOWER | Fine-tuning of transmit power |
| AT+XCAP | Crystal oscillator calibration |
| AT+ULORAM | LoRa modulation parameters modification (SF spreading factor, BW transmit bandwidth, CR coding rate) |
| AT+OPTIMIZE | Low-rate optimization options |
| AT+SWAVE | Fixed-frequency continuous single-carrier transmission |
| AT+MWAVE | Fixed-frequency continuous modulation wave transmission |
| AT+TFHSS | Frequency hopping modulated wave transmission |
| AT+DUTYTX | Fixed-frequency continuous single-carrier/modulated wave duty cycle transmission |

# Chapter 7 Hardware Design

- It is recommended to use a DC regulated power supply to power this module, with the power supply ripple coefficient as small as possible, and the module must be reliably grounded;
- Please ensure the correct connection of the positive and negative power terminals. Reversing the connection may cause permanent damage to the module.
- Please check the power supply and ensure it is within the recommended voltage range. Exceeding the maximum value will cause permanent damage to the module.
- Please check the power supply stability; the voltage should not fluctuate significantly or frequently.
- When designing power supply circuits for modules, it is often recommended to retain a margin of more than 30% to ensure long-term stable operation of the entire unit.

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- The module should be kept as far away as possible from power supplies, transformers, high-frequency traces, and other parts with high electromagnetic interference.
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the area under the module. If it is absolutely necessary to run under the module, assuming the module is soldered on the Top Layer, lay ground copper on the Top Layer of the module contact area (all copper and well grounded), and run the traces close to the digital part of the module on the Bottom Layer.
- Assuming the module is soldered or placed in the Top Layer, it is also wrong to arbitrarily route traces in the Bottom Layer or other layers, as this will affect the module's stray emissions and receiver sensitivity to varying degrees.
- If there are devices around the module that cause significant electromagnetic interference, it will greatly affect the module's performance. Depending on the intensity of the interference, it is recommended to keep them away from the module. If possible, appropriate isolation and shielding can be implemented.
- If there are traces around the module that cause significant electromagnetic interference (high-frequency digital, high-frequency analog, power supply traces), it will greatly affect the module's performance. Depending on the intensity of the interference, it is recommended to keep them away from the module. If possible, appropriate isolation and shielding can be implemented.
- The antenna mounting structure has a significant impact on module performance; it is essential to ensure that the antenna is exposed and preferably vertically upward.
- When the module is installed inside the housing, a high-quality antenna extension cable can be used to extend the antenna to the outside of the housing.
- Antennas should never be installed inside a metal casing, as this will greatly reduce the transmission distance.

# Chapter 8 Frequently Asked Questions

## 8.1 Transmission distance is not ideal

- When there are obstacles in line-of-sight communication, the communication distance will be reduced accordingly;
- Temperature, humidity, and co-channel interference can all lead to increased packet loss rates in communications.
- The ground absorbs and reflects radio waves, and the test results are poor when the ground is close to the ground.
- Seawater has a strong ability to absorb radio waves, so testing results are poor at the seaside.
- If there are metal objects near the antenna, or if it is placed inside a metal casing, the signal attenuation will be very severe.
- Power register settings are incorrect; air speed is set too high (the higher the air speed, the shorter the distance).
- At room temperature, the power supply voltage is lower than the recommended value; the lower the voltage, the lower the power output.
- The antenna may be poorly matched with the module or have quality issues.

## 8.2 Module is easily damaged

- Please check the power supply and ensure it is within the recommended voltage range. Exceeding the maximum value will cause permanent damage to the module.
- Please check the power supply stability; the voltage should not fluctuate significantly or frequently.

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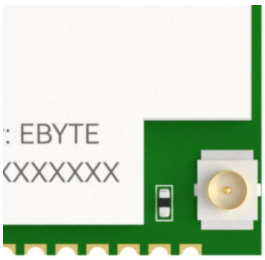

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- Please ensure anti-static operation during installation and use, as high-frequency devices are sensitive to electrostatic discharge.
- Please ensure that the humidity is not too high during installation and use, as some components are humidity-sensitive.
- Unless there are special requirements, it is not recommended to use it at excessively high or low temperatures.

## 8.3 The bit error rate is too high.

- If there is interference from a co-channel signal nearby, move away from the source of interference or change the frequency or channel to avoid the interference.
- An inadequate power supply can also cause garbled characters, so it is essential to ensure the reliability of the power supply.
- Poor quality or excessive length of extension lines or feeders can also lead to a high bit error rate.

## 8.4 Antenna Selection




**The IPEX interface and the stamp hole interface can be selected arbitrarily.**

# Chapter 9 Welding Operation Instructions

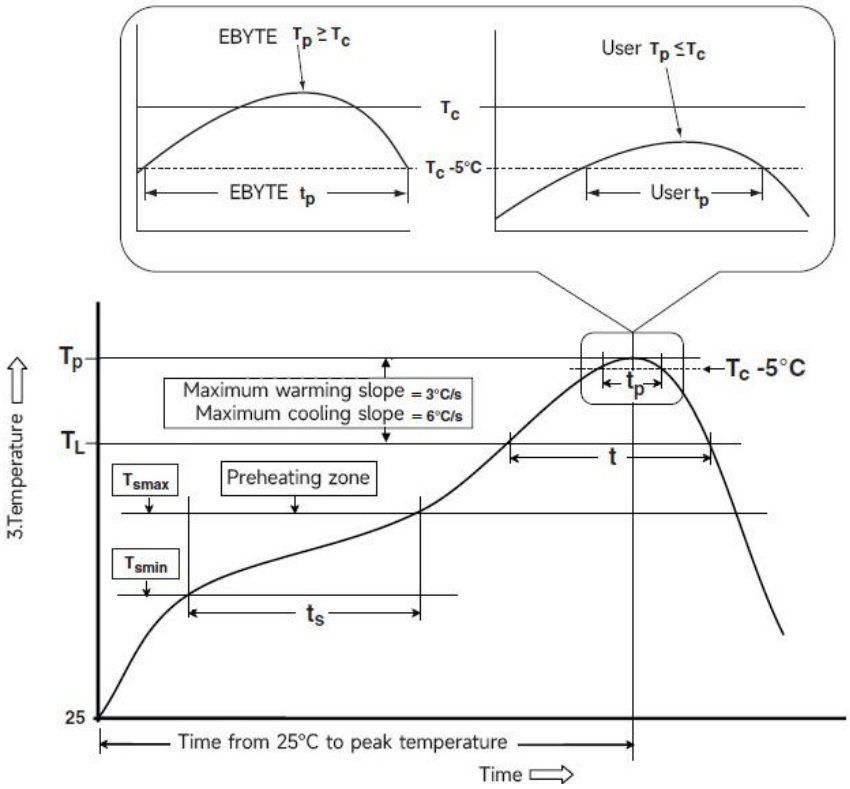
## 9.1 Reflow soldering temperature

| Reflow soldering profile characteristics | | Lead-based assembly | Lead-free assembly |
|---|---|---|---|
| Preheating/Insulation | Minimum temperature (Tsmin) | 100℃ | 150℃ |
| | Maximum temperature (Tsmax) | 150℃ | 200℃ |
| | Time (Tsmin~Tsmin) | 60-120 seconds | 60-120 seconds |
| Temperature rise slope (TL~Tp) | | 3℃/second, maximum value | 3℃/second, maximum value |
| Liquid phase temperature (TL) | | 183℃ | 217℃ |
| Duration above TL | | 60~ 90 seconds | 60~ 90 seconds |
| Package peak temperature Tp | | Users must not exceed the temperature specified on the product's "humidity sensitivity" label. | Users must not exceed the temperature specified on the product's "humidity sensitivity" label. |
| The time (Tp) within 5°C of the specified grading temperature (Tc) is shown in the figure below. | | 20 seconds | 30 seconds |
| Cooling slope (Tp~TL) | | 6℃/second, maximum value | 6℃/second, maximum value |
| Time from room temperature to peak temperature | | 6 minutes, the longest | 8 minutes, the longest |
| * The peak temperature (Tp) tolerance of the temperature profile is defined as the user's upper limit. | | | |

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## 9.2 Reflow Soldering Profile




# Chapter 10 Antenna Guide

## 1.0.1 Antenna Recommendation

Antennas play a crucial role in communication, and inferior antennas can often have a significant impact on communication systems. Therefore, our company recommends certain antennas that are high-performing and reasonably priced and compatible with our wireless modules.

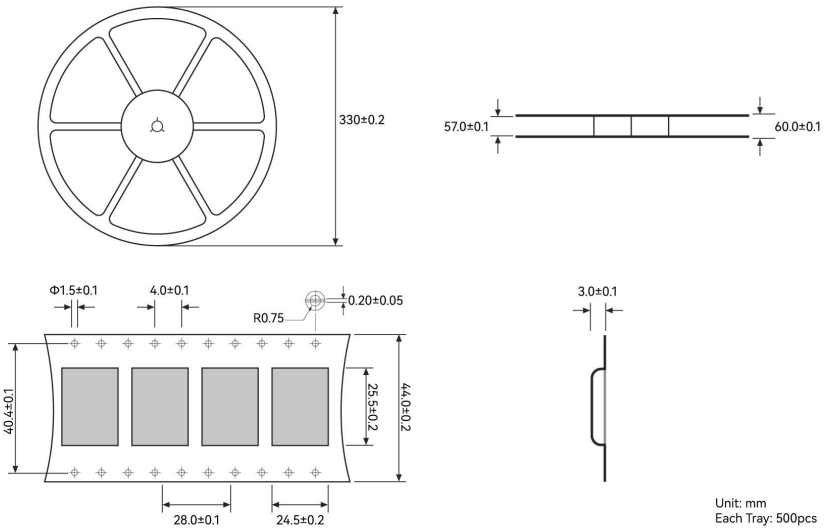
| Product Model | type | Frequency band (Hz) | interface | Gain (dBi) | Height (mm) | Feeder (cm) | Features |
|---|---|---|---|---|---|---|---|
| TX868-JKS-IPX20 | Glue rod antenna | 868M | IPEX-1 | 3.0 | 197 | 200 | Bendable rubber rod, omnidirectional antenna |
| TX868-JZLW-15 | Glue rod antenna | 868M | IPEX-1 | 3.0 | 165 | 150 | Bendable rubber rod, omnidirectional antenna |
| TX868-XPL-100 | Suction Cup Antenna | 868M | SMA-J | 3.5 | 290 | 100 | Miniature suction cup antenna, cost-effective |
| TX868-JKD-20 | Glue rod antenna | 868M | SMA-J | 3.0 | 170 | - | Bendable rubber rod, omnidirectional antenna |
| TX915-JKS-IPX20 | Glue rod antenna | 915M | IPEX-1 | 3.0 | 197 | 200 | Bendable rubber rod, omnidirectional antenna |
| TX915-JZLW-15 | Glue rod antenna | 915M | IPEX-1 | 3.0 | 155 | 150 | Bendable rubber rod, omnidirectional antenna |

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| Product Model | type | Frequency band (Hz) | interface | Gain (dBi) | Height (mm) | Feeder (cm) | Features |
|---|---|---|---|---|---|---|---|
| TX915-JKD-20 | Glue rod antenna | 915M | SMA-J | 3.5 | 200 | - | Bendable rubber rod, omnidirectional antenna |
| TX915-XPL-100 | Suction Cup Antenna | 915M | SMA-J | 3.5 | 260 | 100 | Miniature suction cup antenna, cost-effective |

# Chapter 11 Batch packaging method




# Revision History

| Version | Revision Date | Revision Notes | maintainer |
|---|---|---|---|
| 1.0 | 2025-11-29 | Initial version | Bin |
| 1.1 | 2026-03-12 | Optimize the descriptions of the AT+ERSSI, AT+RATE, and AT+DRSSI commands | Bin |
| 1.2 | 2026-07-07 | Content revision | Bin |

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