E220-xxxTxxx Product Specification Sheet

AT commands 20/30dBm LoRa wireless module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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1.Product Overview

1.1 Product Introduction

E220- T series modules are a new generation of LoRa wireless modules. This series of UART modules is developed based on SEMTECH high-performance RF chips , has multiple transmission modes, operates in the 400 MHz and 900 MHz bands , features LoRa spread spectrum technology, TTL level output, and is compatible with 3.3V I/O port voltage.
E220- T series modules adopt the latest generation of LoRa spread spectrum technology . LoRa™ direct sequence spread spectrum technology offers advantages such as longer communication distance, strong anti-interference capabilities, and extremely high security. Its maximum transmit power reaches 30dBm, and it features a PA power amplifier and an LNA low-noise amplifier, thereby improving communication stability and extending communication distance. Industrial-grade standards ensure its stability and consistency. Currently in stable mass production, it is widely used in industries such as metering, IoT upgrades, and smart homes .
The following diagram shows eight modules with different power, frequency bands, and packages. It is only an appearance illustration . For detailed parameters , please refer to the E220-T series product selection comparison in section 2.1 .



图 1：E220-400T22D



图 2：E220-400T22S



图 3：E220-900T22D



图 4：E220-900T22S

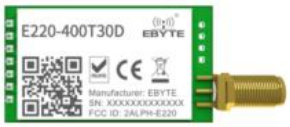


图 5：E220-400T30D



图 6：E220-400T30S



图 7：E220-900T30D



图 8：E220-900T30S

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;
- Supports multiple frequency bands: 433 / 868/915MHz (customizable) ;
- Supports serial port firmware upgrades , making maintenance more convenient;
- It supports both HEX and AT command systems , allowing users to choose flexibly .
- It supports users setting their own communication keys, which cannot be read, greatly improving the confidentiality of user data;
- Supports RSSI signal strength indication function for evaluating signal quality;
- It supports over-the-air wake-up, which is an ultra-low power consumption function suitable for battery-powered applications.
- Supports fixed-point transmission and broadcast transmission;
- 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

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is restored;

- Built-in watchdog timer automatically resets and resumes operation in case of an accident;

1.3 Application Scenarios

- Home security alarm and remote keyless entry;
- Smart home and industrial sensors, etc.;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial-grade remote control;
- Healthcare products;
- Advanced Meter Reading Architecture (AMI) .

2.Specifications

2.1 Comparison of E220-T Series Products

Category	Product Model	Carrier frequency ① Hz	Transmit power ② dBm	Test distance ③ km	Packaging	Product dimensions (mm)	Antenna type ④
433MHz band module	E220-400T22S	410～493M	twenty two	5	surface mount	16*26	IPEX -1 / Stamp Hole
	E220-400T22D	410～493M	twenty two	5	direct plug	21*36	SMA-K
	E220-400T30S	410～493M	30	10	surface mount	40.5*25	IPEX -1 / Stamp Hole
	E220-400T30D	410～493M	30	10	direct plug	43*24	SMA-K
868/915MHz Frequency band module	E220-900T22S	850～930M	twenty two	5	surface mount	16*26	IPEX -1 / Stamp Hole
	E220-900T22D	850～930M	twenty two	5	direct plug	21*36	SMA-K
	E220-900T30S	850～930 M	30	10	surface mount	40.5*25	IPEX -1 / Stamp Hole
	E220-900T30D	850～930 M	30	10	direct plug	43*24	SMA-K

Note:

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

(2)Transmit power ②: 22dBm=158mW/30dBm=1000mW, error range ±1dBm, power is adjustable in multiple levels.

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For details of power levels, please see Chapters 6 and 7 of this document .

(3)Test distance ③: Clear and open, airspeed 2.4kbps, antenna height 2 meters (for reference only, actual measurement is recommended);

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

(5)Modules in the same frequency band can communicate with each other.

2.2 Basic parameters

- The E220-T series 22dBm low-power modules are: E220-400T22D, E220-400T22S, E220-900T22D, and E220-900T22S.
- The E220-T series 30dBm high-power modules are: E220-400T30D, E220-400T30S, E220-900T30D, and E220-900T30S.

2.2.1Basic parameters

Conditions: Tc=25℃, VCC=5.0V, 433MHz/868MHz/915MHz

parameter	describe
Modulation method	Next-generation LoRa modulation technology
Interface method	1.27mm stamp hole / 2.54mm pin header insert ; the stamp hole is a patch module, and the pin header is a through-hole module.
Communication interface	UART serial port (3.3V)
launch length	200 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. For detailed instructions, please refer to Chapter 6 of this document.
Packaging method	Surface mount /plug-in
Cache capacity	400 Byte
Work environment	
Operating temperature	-40℃～+85℃, industrial grade standard
Operating humidity	10-90%RH
Storage temperatur	-40℃～+125℃

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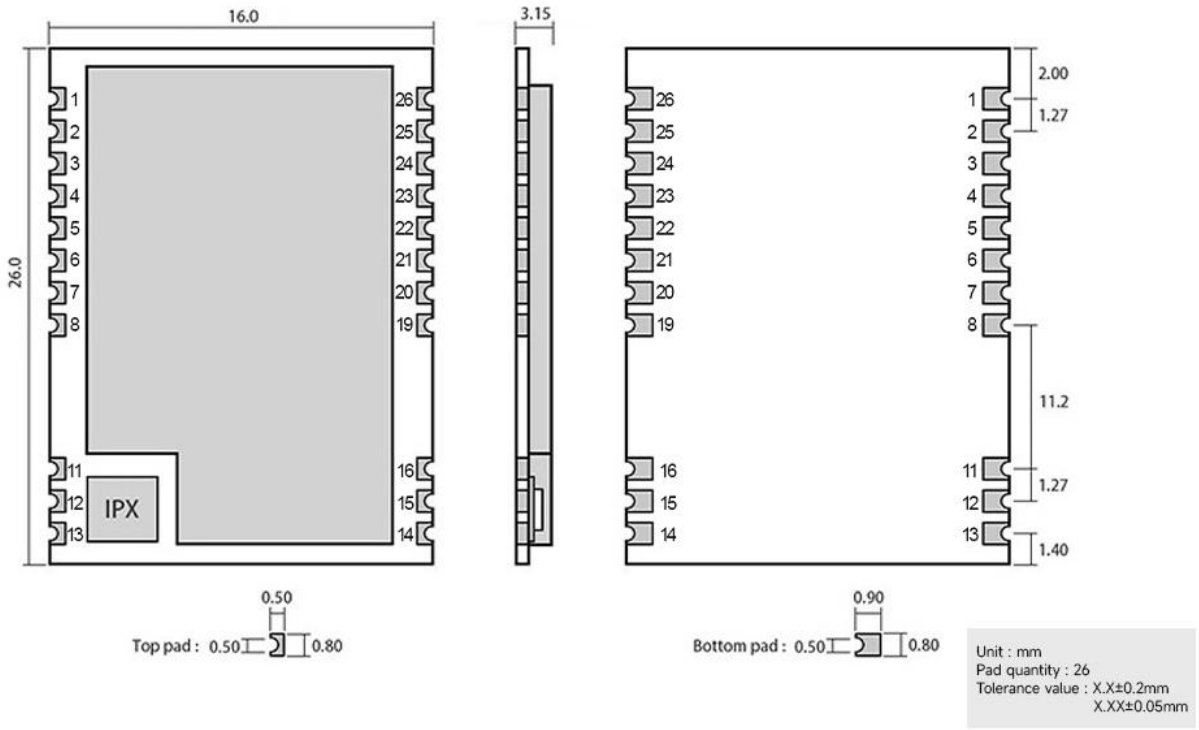
parameter	describe
e	
RF parameters	
Transmit power	22dBm = 158mW, power adjustable in multiple levels. See Chapters 6 and 7 of this document for details.
	30dBm = 1000mW, power adjustable in multiple levels. See Chapters 6 and 7 of this document for details.
Operating frequency band	410 MHz ~ 493 MHz, frequency band customization supported
	850MHz～930MHz, frequency band customization supported
Receiver sensitivity	-126dBm, airspeed 2.4kbps@SF11, suitable for E220-T series 22dBm low-power modules
	- 1 31 dBm, airspeed 2.4 kbps @ SF11, suitable for E220-T series 30 dBm high-power modules
air speed	2.4 - 62.5 Kbps, with multi-level adjustable air speeds; see Chapters 6 and 7 of this document for details.
Blocking power	10dBm
Electrical parameters	
Power supply voltage	Output power can be guaranteed for modules with a voltage range of 2.6 to 5.5V and a 30dBm output voltage of ≥5V. Output power can be guaranteed for modules with a voltage range of ≥3.3V. Modules exceeding 5.5V will be permanently burned out.
Communication level	3.3 V
Emission current	90～110mA, instantaneous power consumption @22dBm, suitable for E220-T series 22dBm low power modules
	460～620mA, instantaneous power consumption @30dBm, suitable for E220-T series 30dBm high power modules
Received current	≈8mA, suitable for E220-T series 22dBm small power modules
	≈13mA, suitable for E220-T series 30dBm high-power modules
Dormant current	≈3uA

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3.Mechanical dimensions and pin definitions

3.1 E220-400/900T22S Mechanical Dimensions and Pin Definitions



Pin number	Pin Name	Pin direction	Pin Applications
1	RESET	enter	Module reset pin. Low level triggers reset, and the pull-low time needs to be greater than 100us; It is strongly recommended that users connect to a microcontroller to reset and restore operation in case of an accident.
2	GND	-	Module ground wire
3	NC	-	Unsupported foot (please keep it suspended in the air)
4	NC	-	Unsupported foot (please keep it suspended in the air)
5	NC	-	Unsupported foot (please keep it suspended in the air)
6	NC	-	Unattended pins (programming pins; it is recommended to bring them out if possible for easier future maintenance or firmware customization).
7	NC	-	Unattended pins (programming pins; it is recommended to bring them out if possible for easier future maintenance or firmware customization).
8	GND	-	Module ground wire
11	GND	-	Module ground wire
12	ANT	-	antenna

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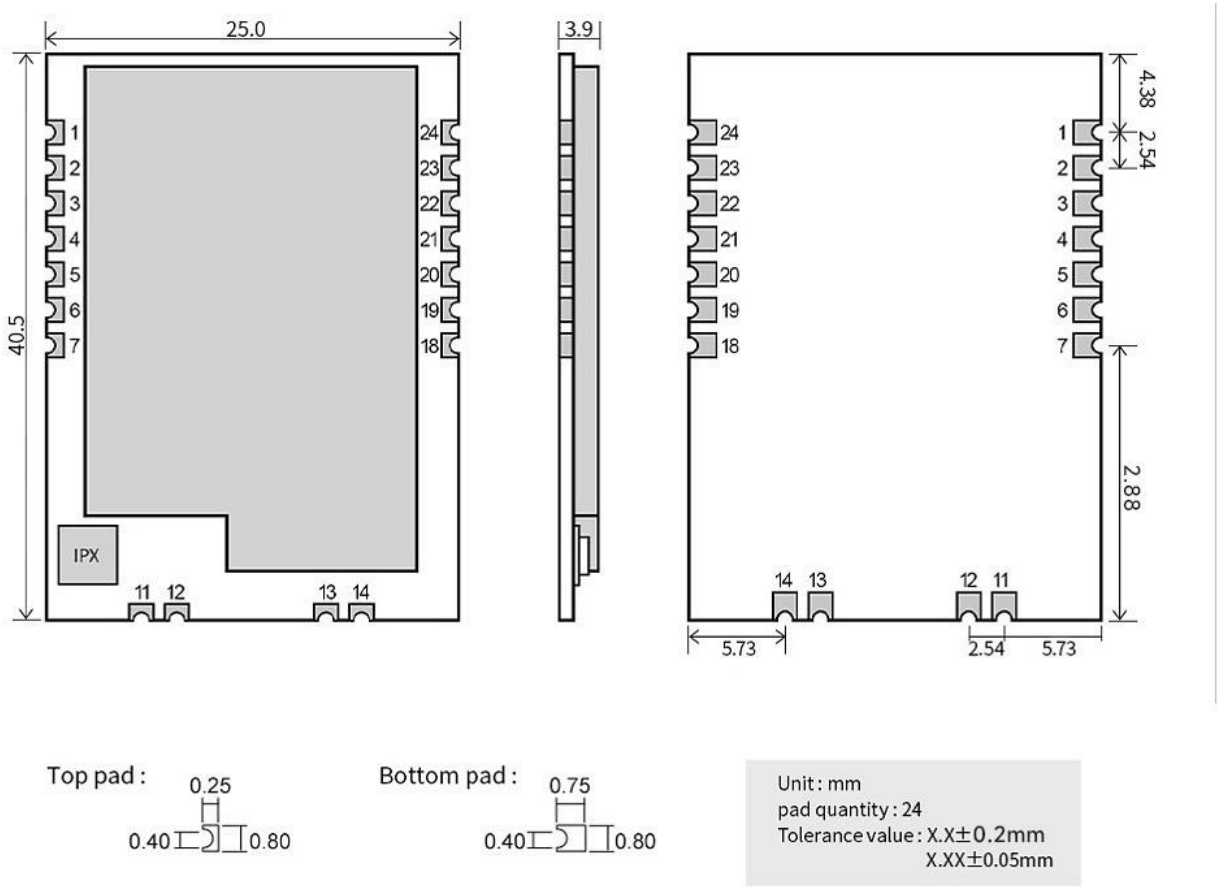
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Pin number	Pin Name	Pin direction	Pin Applications
13	GND	-	Module ground wire
1 4	GND	-	Module ground wire
15	GND	-	Module ground wire
16	GND	-	Module ground wire
19	GND	-	Module ground wire
20	M0	Input (very weak pull-up)	In conjunction with M1, it determines the module's four operating modes (cannot be left floating).
twenty one	M1	Input (very weak pull-up)	In conjunction with M0, it determines the module's four operating modes (cannot be left floating).
twenty two	RXD	enter	3.3V serial port input, connected to the external TXD output pin;
twenty three	TXD	Output	3.3V serial port output, connected to the external RXD input pin;
twenty four	AUX	Output	Indicates the module's working status (can be left floating). During normal operation, a low level on this pin indicates a busy state, and a high level indicates an idle state. It is not recommended to use this pin to drive external devices or pull down this pin. Otherwise, if the module detects that the AUX pin is continuously pulled low by an external source during power-up, it may be forced into upgrade mode and fail to work properly. For details, please see the explanation in Chapter 5 .
25	VCC	-	Module power supply (please refer to the electrical parameters section)
26	GND	-	Module ground wire

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3.2 E220-400/900T30S Mechanical Dimensions and Pin Definitions



Pin number	Pin Name	Pin direction	Pin Applications
1	GND	enter	Module ground wire
2	VCC	enter	Module power supply (please refer to the electrical parameters section)
3	AUX	Output	Indicates the module's working status (can be left floating). During normal operation, a low level on this pin indicates a busy state, and a high level indicates an idle state. It is not recommended to use this pin to drive external devices or pull down this pin. Otherwise, if the module detects that the AUX pin is continuously pulled low by an external source during power-up, it may be forced into upgrade mode and fail to work properly. For details, please see the explanation in Chapter 5 .
4	TXD	Output	3.3V serial port output, connected to the external RXD input pin;
5	RXD	enter	3.3V serial input, connected to the external TXD output pin;
6	M1	Input (very weak pull-up)	In conjunction with M0, it determines the module's four operating modes (cannot be left floating).
7	M0	Input (very weak	In conjunction with M1, it determines the module's four operating

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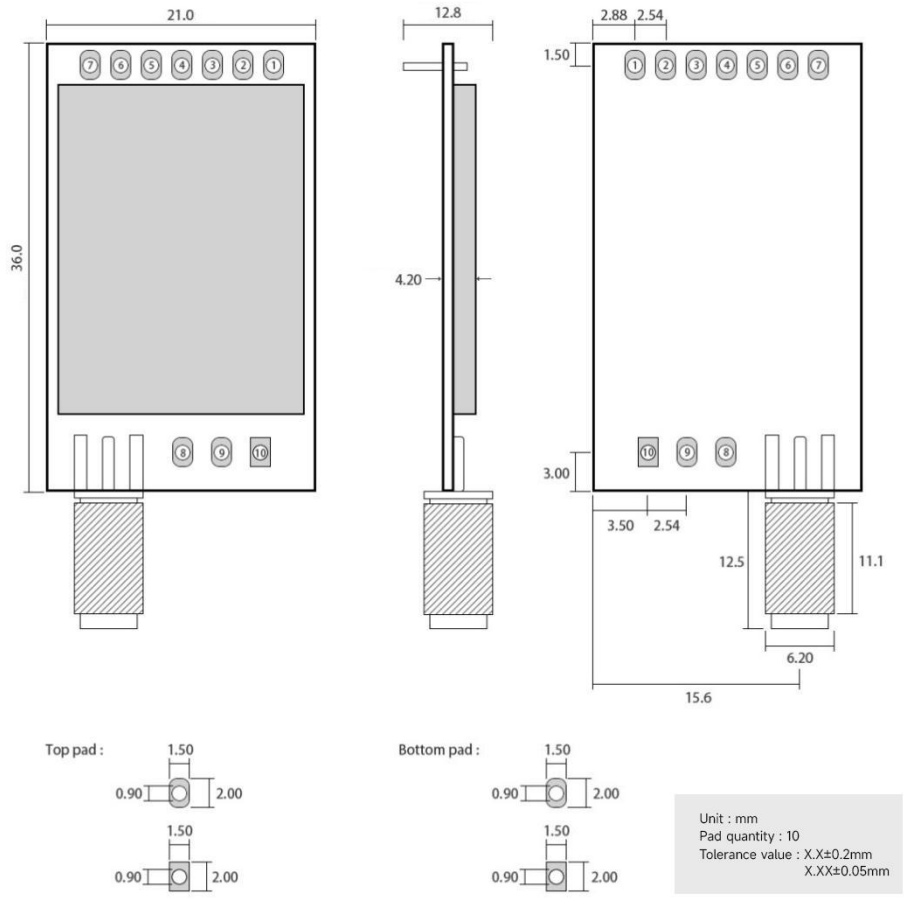
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Pin number	Pin Name	Pin direction	Pin Applications
		pull-up)	modes (cannot be left floating).
11	ANT	Output	Antenna interface (high-frequency signal output, 50 ohm characteristic impedance)
12	GND	-	Fixed
13	GND	-	Fixed
14	GND	-	Fixed
18	NC		Unattended pins (programming pins; it is recommended to bring them out if possible for easier future maintenance or firmware customization).
19	NC		Unattended pins (programming pins; it is recommended to bring them out if possible for easier future maintenance or firmware customization).
20	NC		Unsupported foot (please keep it suspended in the air)
twenty one	NC		Unsupported foot (please keep it suspended in the air)
twenty two	RESET	enter	Module reset pin. A low-level signal triggers the reset, and the pull-low time must be greater than 100μs. It is strongly recommended that users connect to a microcontroller to reset and restore operation in case of an accident.
twenty three	GND	-	Fixed
twenty four	NC		Unsupported foot (please keep it suspended in the air)

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3.3 E220-400/900T22D Mechanical Dimensions and Pin Definitions



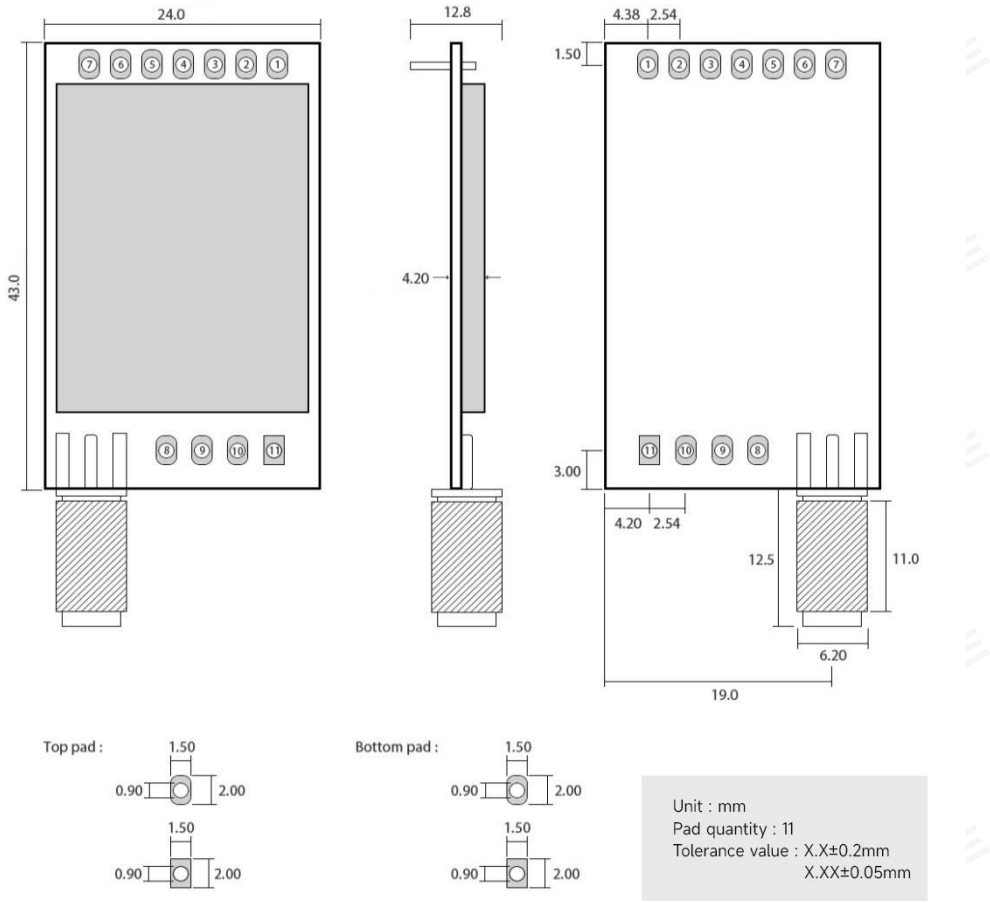
Pin number	Pin Name	Pin direction	Pin Applications
1	M0	Input (very weak pull-up)	In conjunction with M1, it determines the module's four operating modes (cannot be left floating).
2	M1	Input (very weak pull-up)	In conjunction with M0, it determines the module's four operating modes (cannot be left floating).
3	RXD	enter	3.3V serial port input, connected to the external TXD output pin;
4	TXD	Output	3.3V serial port output, connected to the external RXD input pin;
5	AUX	Output	Indicates the module's working status (can be left floating). During normal operation, a low level on this pin indicates a busy state, and a high level indicates an idle state. It is not recommended to use this pin to drive external devices or pull down this pin. Otherwise, if the module detects that the AUX pin is continuously pulled low by an external source during power-up, it may be forced into upgrade mode and fail to work properly. For details, please see the explanation in Chapter 5 .
6	VCC	enter	Module power supply (please refer to the electrical parameters section)
7	GND	enter	Module ground wire

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Pin number	Pin Name	Pin direction	Pin Applications
8	Fixing hole	-	Fixing hole
9	Fixing hole	-	Fixing hole
10	Fixing hole	-	Fixing hole

3.3 E220-400/900T30D Mechanical Dimensions and Pin Definitions



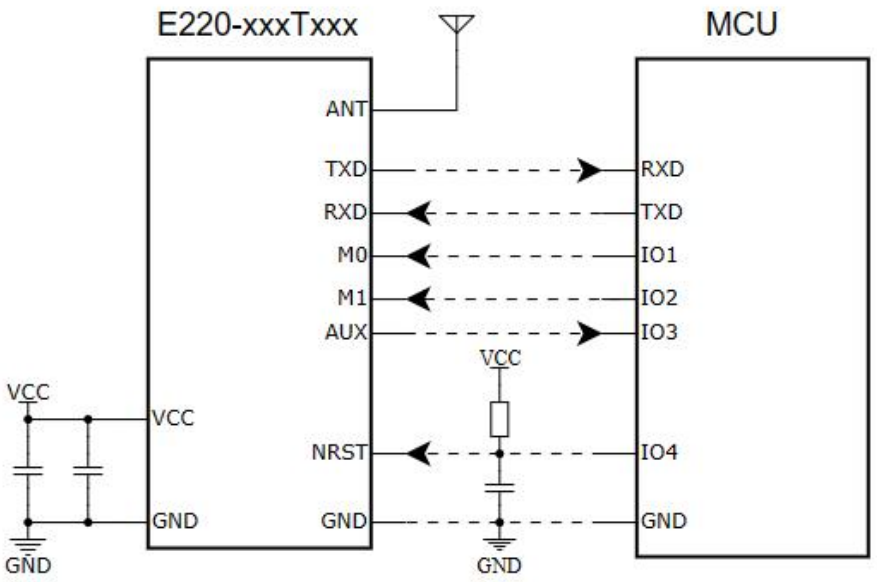
Pin number	Pin Name	Pin direction	Pin Applications
1	M0	Input (very weak pull-up)	In conjunction with M1, it determines the module's four operating modes (cannot be left floating).
2	M1	Input (very weak pull-up)	In conjunction with M0, it determines the module's four operating modes (cannot be left floating).
3	RXD	enter	3.3V serial port input, connected to the external TXD output pin;
4	TXD	Output	3.3V serial port output, connected to the external RXD input pin;
5	AUX	Output	Indicates the module's working status (can be left floating). During normal operation, a low level on this pin indicates a busy state, and a high level indicates an idle state. It is not recommended to use this pin to drive external devices or pull

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Pin number	Pin Name	Pin direction	Pin Applications
			down this pin. Otherwise, if the module detects that the AUX pin is continuously pulled low by an external source during power-up, it may be forced into upgrade mode and fail to work properly. For details, please see the explanation in Chapter 5 .
6	VCC	enter	Module power supply (please refer to the electrical parameters section)
7	GND	enter	Module ground wire
8	Fixing hole	-	Fixing hole
9	Fixing hole	-	Fixing hole
10	Fixing hole	-	Fixing hole
11	Fixing hole	-	Fixing hole

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.

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Serial Number	Precautions
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	It is not recommended to use the AUX pin to drive external components, such as LEDs or relays, as they will not function if continuously pulled low by an external source during power-on.
5	(Optional) For surface mount modules, consider bringing out the module's programming pins for easier future maintenance or firmware customization.
6	(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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5.Functional Details

- In this chapter, pin M1M0 is described as having a 0 indicating a low level and a 1 indicating a high level.
- If you are using software to switch modes, please refer to Chapter 7, AT+MODE command.

5.1 Working Mode

The module has four operating modes, which are set by pins M1 and M0 , as detailed in the table below:

Pattern (0-3)	M1	M0	Mode Introduction	Remark
0 Transmission Mode	0	0	Serial port enabled, wireless enabled, transparent transmission.	—
1 WOR Sending Mode	0	1	WOR sends data, WOR receives data	Supports over-the-air wake-up
2 WOR receiving mode	1	0	WOR send closed, WOR receive data	—
3. Sleep Mode	1	1	Configurable parameters	—

5.1.1Transmission mode used , mode 0 (M1, M0 pins set to 0,0).

5.1.1.1 Quick Use of Transparent Transmission

What you send is what you get; you can communicate with each other using a serial port assistant (factory default parameters are all the same, and the transmission method is transparent transmission). An example is shown below:

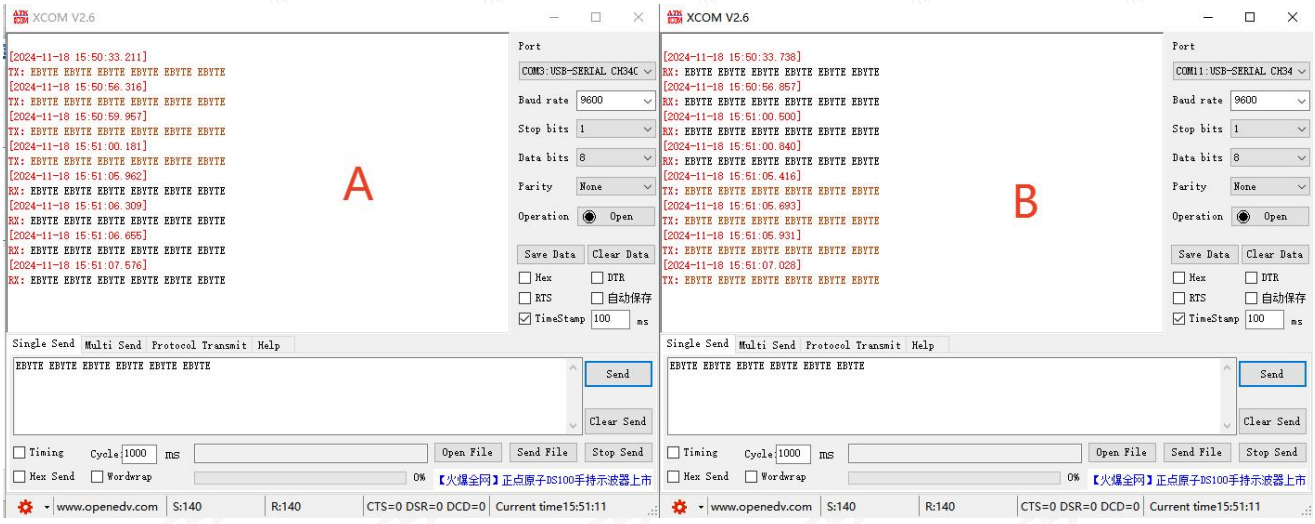


Figure 1. Schematic diagram of bidirectional transmission and reception

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5.1.1.2 Fixed-point transmission for quick use (specifying the destination address and channel)

Data is sent and received using a fixed data format: target address + target channel + data , which effectively avoids some interference.

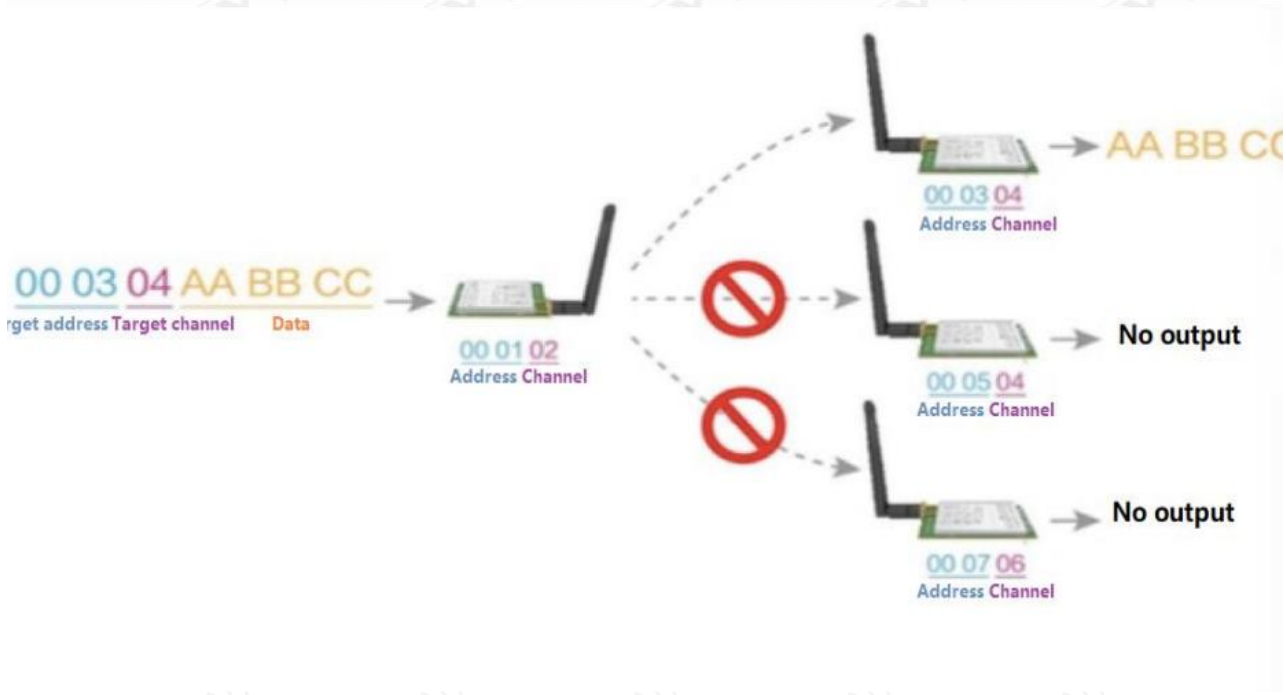


Figure 2 Schematic diagram of fixed-point transmission

Operating steps:

Step 1: Modify the module parameters via the host computer: Modify the module address and channel in configuration mode (M1, M0 pins set to 1, 1), change the transparent transmission mode to fixed-point transmission, and finally write the parameters to complete the modification.

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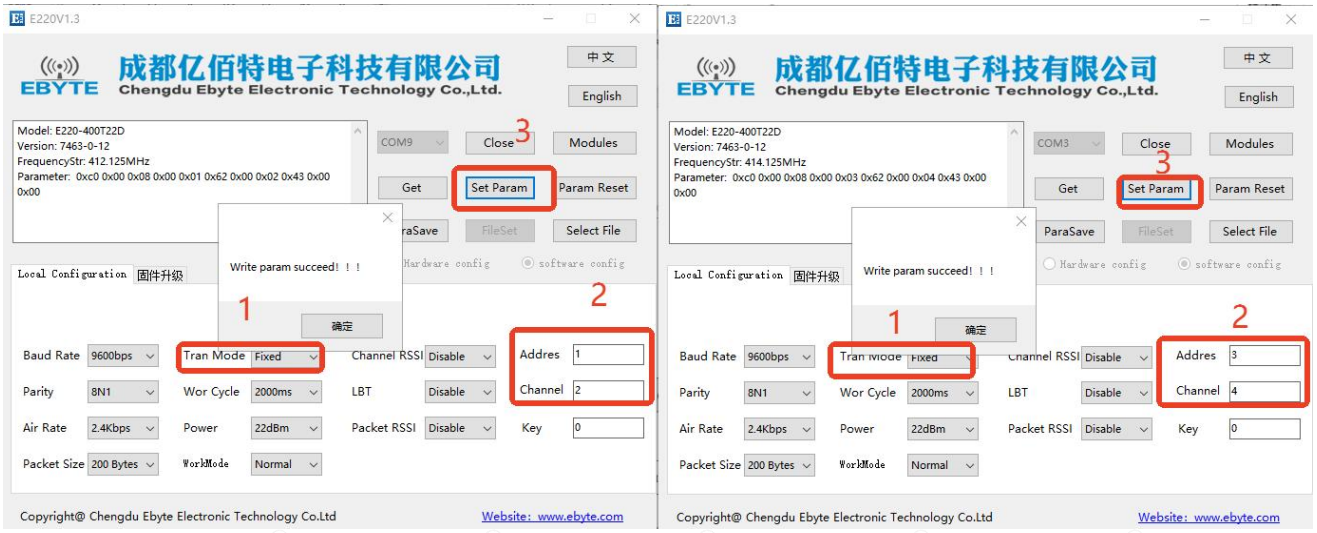


Figure 3 Host computer interface

Step 2: Change the module's working mode to normal mode: Edit the parameters of module A to 000304AABBCC and send them to module B. Similarly, module B sends data as 000102AABBCC. (In fixed-point mode, the data transmission format is: target address + target channel + data).

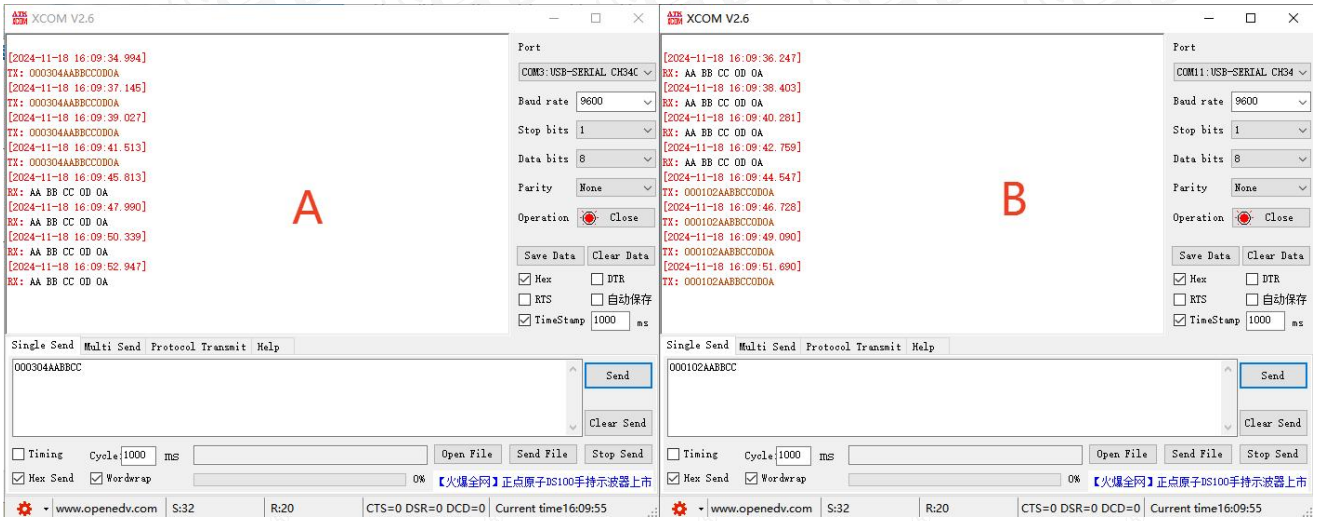


Figure 4 Data transmission diagram

5.1.1.3 Quick Use of Broadcast

- Set the address of module A to 0xFFFF and the channel to 0x04 . When module A is used as the transmitter (in the same mode, either transparent transmission or fixed-point transmission), all receiving modules under channel 0x04 can receive the data, achieving the purpose of broadcasting.
- Set the address of module A to 0xFFFF and the channel to 0x04. When module A acts as a receiver, it can receive all

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data under channel 0x04, achieving the purpose of monitoring.



Figure 5. Schematic diagram of fixed-point broadcast transmission

Operating steps:

Step 1: Modify the module parameters via the host computer: In configuration mode (M1, M0 pins set to 1, 1), modify the module address and channel, change the transparent transmission mode to fixed-point transmission, and finally write the parameters to complete the modification.

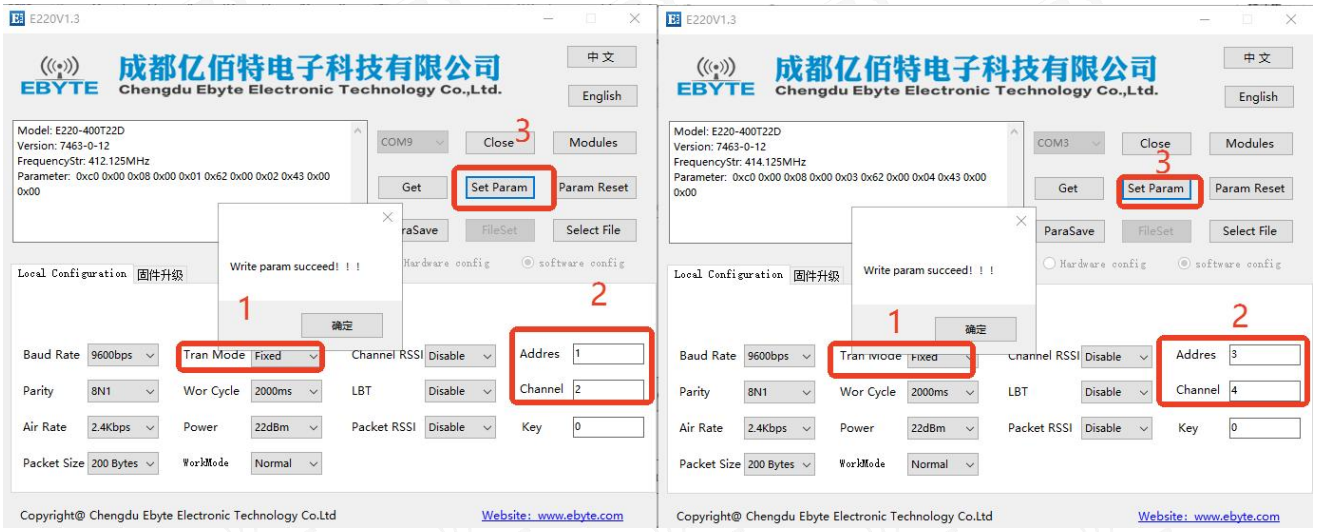


Figure 6 upper computer interface diagram

Step 2: Change the module's working mode to normal mode: Edit the parameters of module A to FFFF04AABBCC and send them to module B. Similarly, module B sends data as FFFF02AABBCC. (In fixed-point broadcast mode, the data transmission format is: broadcast address + target channel + data).

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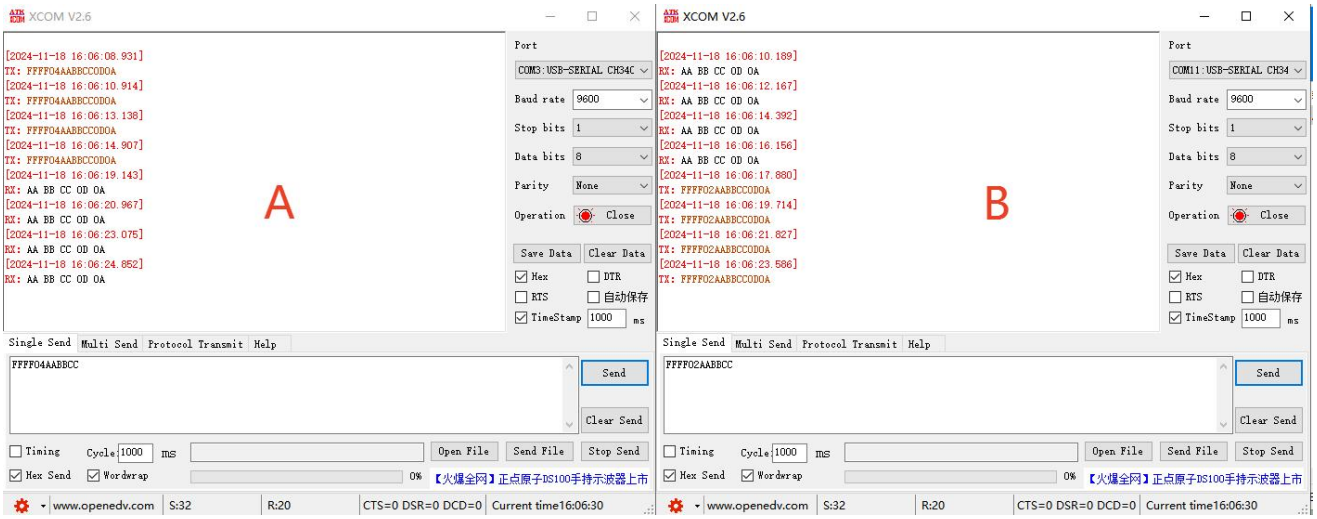


Figure 7 Data transmission diagram

5.1.2WOR mode is used , mode 1 & mode 2 (M1, M0 pins are set to 0, 1 ; M1, M0 pins are set to 1 , 0).

5.1.2.1 Quick Use of Transparent Transmission

Operating steps:

Step 1: Modify the mode using the M1 and M0 pins. Setting the pins of module A to 0 or 1 enables WOR transmit mode, and setting the pins of module B to 1 or 0 enables WOR receive mode.

Step 2: After the module's working mode 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.

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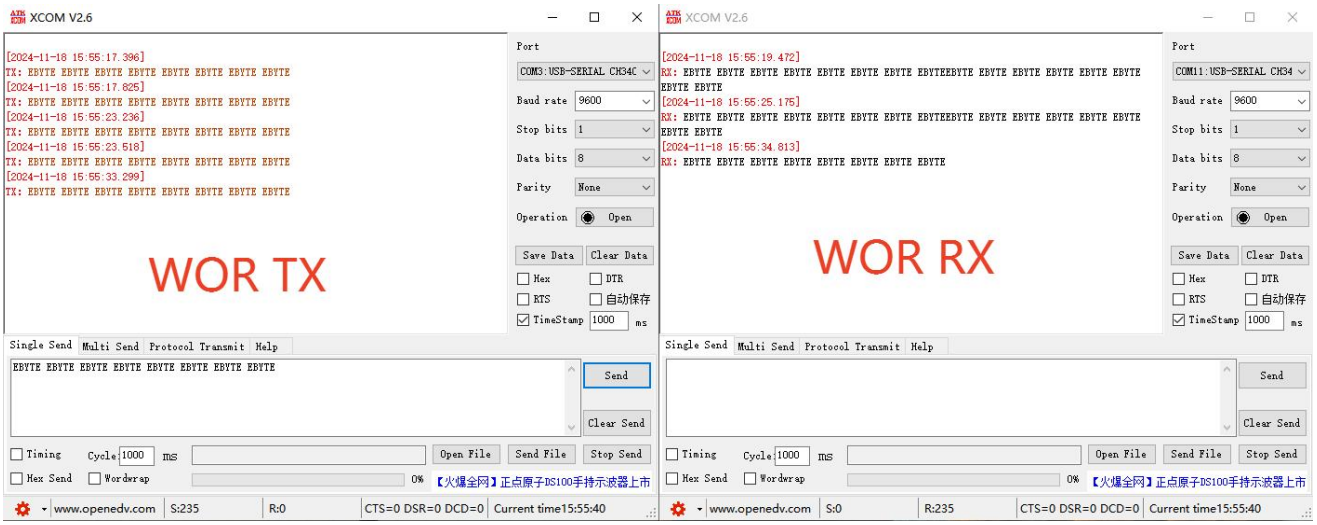


Figure 8 Data transmission diagram

5.1.3Hibernation configuration mode is used , mode 3 (M1, M0 pins are set to 1, 1).

5.1.3.1 Quick Use of Configuration Tools

The module configuration interface shown below is displayed on the host computer. Users can switch to command mode via M0 and M1 to quickly configure and retrieve parameters on the host computer.

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Figure 9 upper computer interface

- In the host computer configuration, the module address, frequency channel, and key are all displayed in decimal format; for the value range of each parameter, please refer to the specific parameters for different product models in the registers in section 6.3.

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5.2 AUX Timing

5.2.1 Power-on start indication

Conditions: Tc = 25° C, VCC = 5 V

Para meter	describe	Typical value	unit
T1	The entire startup process after the module's VCC is powered on takes a certain amount of time (entering the working mode, which is then operable by the user).	16	ms
T2	After the module's VCC is powered on, the AUX input will first pull low for a delay. It does not immediately indicate a busy state (low level) because the internal microcontroller also needs a certain startup time. Note: At the beginning of T2, the AUX pin is in an internal pull-up input state. If it is detected to be pulled low externally for more than 1 second (e.g., by an external pull-down resistor or shorted to GND), it will be forced into upgrade state and unable to send or receive wireless data and configuration commands normally. For more details, please refer to the firmware upgrade section.	5	ms

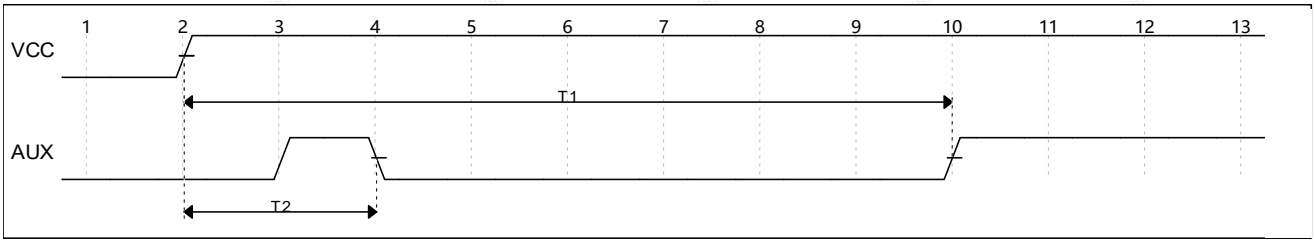


Figure 10 Power-on timing diagram

5.2.2 Serial Port Data Output Indicator

Conditions: Tc = 25° C, VCC = 5 V

Para meter	describe	Typical value	unit
T1	After the module has finished receiving air data packets, the AUX signal goes low to indicate the microcontroller's readiness time to the external user. It can also be used as a wake-up signal, suitable for some low-battery power applications.	3	ms
T2	The module outputs the time interval between two consecutive packets of air data.	0 or	ms

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Para meter	describe	Typical value	unit
	The first scenario: The sending end is transmitting data in a super-packet loop, and the air speed is much greater than the receiving end's serial port speed. In this case, the serial port output data of the receiving end module will exhibit a packet-merging effect (T2=0), and the length of a single serial port output data can exceed the user-set packet length. This is suitable for applications where Modbus reads multiple registers from the slave device and responds. The second scenario: The sending end is transmitting data in a multi-packet loop, but both the air speed and the serial port baud rate are slow (e.g., air speed 2.4 Mbps, serial port 9600 Mbps by default). In this case, the air transmission time is relatively long, so the receiving end will output data packets in segments at intervals.	Tx (Single packet in-flight time)	

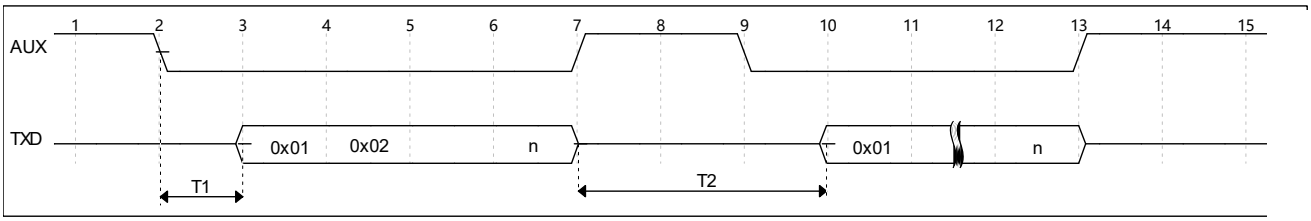


Figure 11 Serial port data output timing diagram

5.2.3 Wireless Transmission Indicator

Tc = 25° C, VCC = 5 V

para meter	describe	Typical value	unit
n	The internal buffer capacity of the module's serial port (maximum data length that can be transmitted at one time). When the data to be transmitted in the buffer exceeds the user-defined packet length (default 200 bytes), it will be automatically split into packets for wireless transmission.	400	Byte
T1	The AUX indicator displays the delay time when the module's serial port receives data. The module only starts indicating a busy state (pulled low) after the first byte of the serial data packet is recognized and received. Therefore, the delay time is related to the serial port baud rate (default 9600bps).	1	ms
T2	Module cache idle state AUX indicator delay (high) time In the first scenario: if the data length transmitted by the user to the module is less than the packet length (default 200 bytes), then T2 is the serial port	3 or	ms

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para meter	describe	Typical value	unit
	reception time frame break delay, with a default frame break time of 3 bytes (related to the serial port baud rate , default 9600). As soon as the frame break countdown ends, the AUX pin is immediately pulled high to indicate that the buffer is idle, and the over-the-air transmission process is triggered at the same time (under default conditions, AUX will not indicate the wireless transmission busy process; for more settings, please refer to the AT+UAUX command). The second scenario: When the data length sent to the module exceeds the packet length , T2 represents the total over-the-air transmission time (related to the over-the-air rate). That is, during serial port reception, once the packet length is reached, the over-the-air transmission process is immediately triggered (LoRa over-the-air transmission is relatively time-consuming). Subsequent packet transmissions are repeated multiple times (related to the data length) until all data in the receive buffer has been sent, at which point the AUX pin is pulled high to indicate that the buffer is empty.	Tx (Airborne transmission time)	

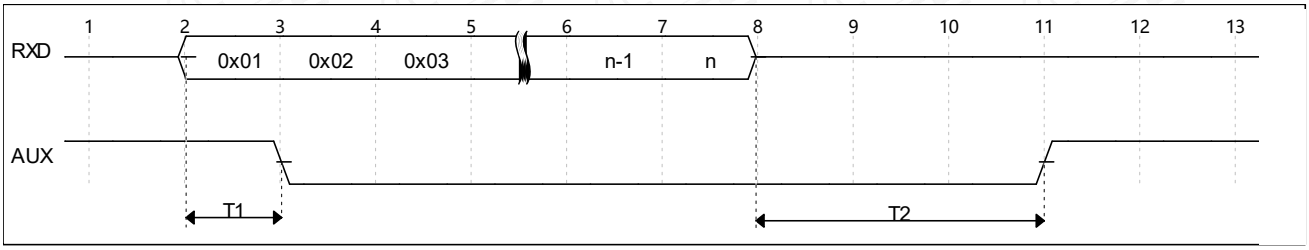


Figure 12 Wireless Transmission Timing Diagram

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5.2.4Switch mode

When the module switches between all modes, the AUX input will indicate a busy state, as shown in the table below:

Original working mode	Switch mode	T1 switching time (ms)
Transmission mode	WOR Sending Mode	9～11
	WOR receiving mode	9～11
	hibernation mode	9～11
WOR Sending Mode	Transmission mode	9～11
	WOR receiving mode	9～11
	hibernation mode	9～11
WOR receiving mode	Transmission mode	9～11
	WOR Sending Mode	9～11
	hibernation mode	9～11
hibernation mode	Transmission mode	9～11
	WOR Sending Mode	9～11
	WOR receiving mode	9～11

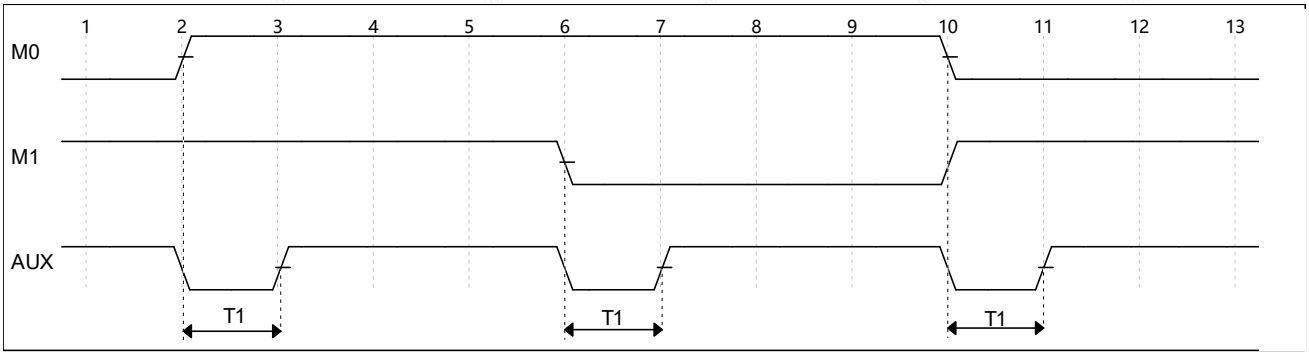


Figure 13 Mode switching timing diagram

5.2.4 Precautions

Serial Number	AUX Precautions

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Serial Number	AUX Precautions
1	When the AUX output is low, it indicates that the module is busy, and no working mode detection will be performed at this time .
2	If AUX remains high, the mode switch will take effect immediately.
3	When a user moves from mode 3 (configuration mode) to another mode or during a reset, the module will reset the user parameters, during which the AUX output will be low.

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5.3 Serial port firmware upgrade

● If the customer needs to upgrade the firmware, they need to find the corresponding BIN file provided by the official website and then use the host computer provided by the official website to upgrade the firmware. Under normal circumstances, users do not need to upgrade the firmware and should not use the "AT+IAP" command .

● The necessary pins for the upgrade must be brought out (M1, M0, AUX, TXD, RXD, VCC, GND). Then, send the "AT+IAP" command in configuration mode to enter the upgrade mode. If you need to exit the IAP upgrade mode, you need to keep the power on and wait for 60 seconds. The program will exit automatically. Otherwise, even if you restart, it will enter the upgrade mode indefinitely.

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

5.3.1 Upgrade the host computer quickly

● Enter configuration mode by changing M0 and M1 (Note: the baud rate in configuration mode is 9600); open the configuration host computer and select the firmware upgrade tab.

● To configure the host computer, open the official website, select Serial Port → Open Serial Port → Read Parameters → Select Firmware Upgrade → Click Open File and select the firmware to be upgraded → Click Download.



Figure 14 Firmware upgrade interface

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6.Register Read/Write Control

6.1 HEX Command Format

Configuration mode (Mode 3 : M1=1, M0= 1), the supported command list is as follows (**when setting, the serial port only supports 9600, 8N1 format**):

Serial Number	Instruction format	Detailed description
1	Set registers	Instruction: C0 + starting address + length + parameters Response: C1 + starting address + length + parameters Example 1: Configure channel as 0x09 Instruction start address length parameter send: C0 04 01 09 return: C1 04 01 09 Example 2: Simultaneously configure module address (0x1234), serial port (9600 8N1), and airspeed (2.4K). Send: C0 00 03 12 34 62 Return: C1 00 03 12 34 62
2	Read registers	Instruction: C1 + starting address + length Response: C1 + starting address + length + parameters Example 1: Reading the channel Instruction start address length parameter send: C1 04 01 09 return: C1 04 01 09 Example 2: Simultaneously read module address, serial port, and airspeed. Send: C1 00 03 Return: C1 00 03 12 34 62
3	Set temporary register	Instruction: C2 + starting address + length + parameters Response: C1 + starting address + length + parameters Example 1: Configure channel as 0x09 Instruction start address length parameter send: C2 04 01 09 return: C1 04 01 09 Example 2: Simultaneously configure module address (0x1234), serial port (9600 8N1), and airspeed (2.4K). Send: C2 00 03 12 34 62

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Serial Number	Instruction format	Detailed description
		Return: C1 00 03 12 34 62
4	Formatting error	Format error response FF FF FF

6.2 Register Function Overview

address	name	Bit							
		bit 7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
00h	ADDH	Communication address [15:8]							
01h	ADDL	Communication address [7:0]							
02h	REG0	Serial port baud rate [2:0]			Serial port verification type [1:0]		Wireless transmission rate [2:0]		
03h	REG1	Serial port packet length [1:0]		Environmental RSSI	reserve	reserve	Soft cutting mode	Wireless transmission power [1:0]	
04h	REG2	Channel control [7:0]							
05h	REG3	Data RSSI	Transmission method	reserve	Listen first, then speak	reserve	Airborne wake-up cycle [2:0]		
06h	CRYPT_H	Wireless data encryption key [15:8]							
07h	CRYPT_L	Wireless data encryption key [7:0]							

- For register software architecture design, please refer to the E220-xxxTBL-SC series sample code (available in the download section of the relevant page), see e220_demo.h for details.

6.3E220-400/900Txxx Register Description

Serial Number	Reading and writing	name	describe	Remark
00H	Reading/Wr	ADDH	ADDH (default 0)	The high and low bytes of the module address;

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<table>
<tr><td></td><td>iting</td><td></td><td colspan="5"></td><td rowspan="2">Note: When the module address is equal to FFFF, it can be used as a broadcast and listening address; that is, the module will not perform address filtering in this case.</td></tr>
<tr><td>01H</td><td>Reading/Writing</td><td>ADDL</td><td colspan="5">ADDL (default 0)</td></tr>
<tr><td rowspan="20">0 2 H</td><td rowspan="20">Reading/Writing</td><td rowspan="20">EG0</td><td>7</td><td>6</td><td>5</td><td>UART serial port speed (bps)</td><td rowspan="9">Two modules that communicate with each other can have different serial port baud rates and different verification methods.
When sending large data packets in succession, users need to consider the data blocking caused by the same baud rate, which may even result in data loss.
It is generally recommended that both communicating parties use the same baud rate.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>The serial port baud rate is 1200.</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>The serial port baud rate is 2400.</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>The serial port baud rate is 4800.</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>The serial port baud rate is 9600 (default).</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>The serial port baud rate is 19200.</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>The serial port baud rate is 38400.</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>The serial port baud rate is 57600.</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>The serial port baud rate is 115200</td></tr>
<tr><td>4</td><td>3</td><td colspan="2">Serial port check bit</td><td rowspan="5">The serial port modes of the two communicating parties can be different;</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 (equivalent to 00)</td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>Wireless air speed (bps)</td><td rowspan="9">The air speeds of both communicating parties must be the same;
The higher the air speed, the lower the latency and the shorter the transmission distance.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Air speed 2.4k</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Air speed 2.4k</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Air speed 2.4k (default)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Air speed 4.8k</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Air speed 9.6k</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Air speed 19.2k</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Air speed 38.4k</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Air speed 62.5k</td></tr>
<tr><td rowspan="5">0 3 H</td><td rowspan="5">Reading/Writing</td><td rowspan="5">REG1</td><td>7</td><td>6</td><td colspan="2">Subcontracting settings</td><td rowspan="5">When the data sent by the user is less than the packet length, the serial port output of the receiving end will be a continuous output without interruption.
If the data sent by the user exceeds the packet length, the receiving end's serial port will output the data in packets.</td></tr>
<tr><td>0</td><td>0</td><td colspan="2">200 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></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>5</td><td colspan="3">RSSI Ambient Noise Enable</td><td rowspan="3">Once enabled , the C0 C1 C2 C3 instruction can be sent to read registers in either transmit mode or WOR send mode;
Register 0x00: Current ambient noise RSSI;
Register 0X01: RSSI of the last received data (current channel noise is: dBm = -(256 - RSSI));
Instruction format: C0 C1 C2 C3 + starting address + read length;
Return value: C1 + address + read length + valid value; e.g., sending C0 C1 C2 C3 00 01 Returns to C1 00 01 RSSI (addresses can only start from 00).</td></tr>
<tr><td></td><td></td><td></td><td>0</td><td colspan="3">Disabled (default)</td></tr>
<tr><td></td><td></td><td></td><td>1</td><td colspan="3">Enable</td></tr>
<tr><td></td><td></td><td></td><td>4</td><td>3</td><td colspan="2">reserve</td><td rowspan="4">If you use our host computer configuration parameters, this bit will be automatically disabled. If you do not want to use the M0 and M1 pins to switch operating modes, you can enable this function and use specific serial port commands to switch modes.
Format: C0 C1 C2 C3 02 + Working Mode
Send C0 C1 C2 C3 02 00 to switch to transparent transmission mode.
Send C0 C1 C2 C3 02 01 to switch to WOR send mode.
Send C0 C1 C2 C3 02 02 to switch to WOR receive mode.
Send C0 C1 C2 C3 02 03 to switch to sleep mode.
Return: C1 C2 C3 02 + Working Mode
Note: Even after enabling this feature, the hibernation mode (configuration) still only supports a serial port baud rate of 9600.</td></tr>
<tr><td></td><td></td><td></td><td>2</td><td colspan="3">Software mode switching</td></tr>
<tr><td></td><td></td><td></td><td>0</td><td colspan="3">Disabled (default)</td></tr>
<tr><td></td><td></td><td></td><td>1</td><td colspan="3">Enable</td></tr>
<tr><td></td><td></td><td></td><td rowspan="5">1</td><td rowspan="5">0</td><td>Transmit power</td><td></td><td rowspan="5">The relationship between power and current is non-linear; the power supply efficiency is highest at maximum power.
The current does not decrease proportionally as the power decreases.</td></tr>
<tr><td></td><td></td><td></td><td>E220-400T22S
E220-400T22D
E220-900T22S
E220-900T22D</td><td>E220-400T30S
E220-400T30D
E220-900T30S
E220-900T30D</td></tr>
<tr><td></td><td></td><td></td><td>22 dBm (default)</td><td>30 dBm (default)</td></tr>
<tr><td></td><td></td><td></td><td>17 dBm</td><td>2 7dBm</td></tr>
<tr><td></td><td></td><td></td><td>13 dBm</td><td>24 dBm</td></tr>
<tr><td></td><td></td><td></td><td>10 dBm</td><td>21 dBm</td></tr>
<tr><td>0 4 H</td><td>Readi</td><td>REG2</td><td colspan="4">Channel control (CH)</td><td>of the 400 MHz band = 410.125 + CH * 1M</td></tr>
</table>

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	ng/Writing		0-83 represent a total of 84 channels (applicable to the 400 GHz band). 0-80 represent a total of 81 channels (applicable to the 900 GHz band).				of the 900 MHz band = 850.125 + CH * 1M
0 5 H	Reading/Writing	REG3	7	Enable RSSI bytes (packet RSSI)			Once enabled, the module receives wireless data, outputs it via the serial port TXD, and then follows it with an RSSI strength byte.
			0	Disabled (default)			
			1	Enable			
			6	Transmission method			During point-to-point transmission, the module identifies the first three bytes of the serial port data as: address high + address low + channel, and uses them as the wireless transmission target.
			0	Transparent transmission (default)			
			1	Fixed-point transmission			
			5	Reserved			
			4	LBT Enable			Once enabled, it will listen for data before wireless data transmission, which can avoid interference to some extent, but may cause data delay. The maximum dwell time for LBT is 2 seconds; it will be forcibly activated once the two-second duration is reached.
			0	Disabled (default)			
			1	Enable			
			3	Reserved			
			2	1	0	WOR cycle	Only applicable to Mode 1; The period T = (1 + WOR) * 500ms, with a maximum of 4000ms and a minimum of 500ms; The longer the WOR monitoring interval, the lower the average power consumption, but the greater the data latency. Both the sender and receiver must agree (this is 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	
0 6 H	Write	CRYPT_H	High byte of the key (default 0)				Write-only, read returns 0; Used for encryption to prevent over-the-air wireless data from being intercepted by similar modules; The module will use these two bytes as a calculation factor to transform and encrypt the airborne wireless signal.
0 7 H	Write	CRYPT_L	Low byte of the key (default 0)				
08H	read	Version	Product information (1 byte)				Product information (1 byte) Note: Please refer to section 7.1 for a more convenient way to search for the command AT+DEVTYPE=?

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6.4 Register factory default parameters

model	400MHz band module factory default parameter values: C0 00 09 00 00 62 00 17 03 00 00 900MHz band module factory default parameter values: C0 00 09 00 00 62 00 12 03 00 00						
Module model	frequency	address	Channel	air speed	baud rate	Serial port format	Transmit power
E220-400T22S E220-400T22D	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	22dbm
E220-400T30S E220-400T30D	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	30dbm
E220-900T22S E22 0 -900T 22 D	868.125MHz	0x0000	0x12	2.4kbps	9600	8N1	22 dBm
E22 0 -900T30 S E22 0 -900T30D	868.125MHz	0x0000	0x12	2.4kbps	9600	8N1	30 dBm

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7. AT Commands

- Parameter configuration or querying using AT commands must be done in configuration mode (the serial port in configuration mode is forcibly fixed to 9600 8N1);
- In software versions (7463-0-14) and earlier, a newline character is not required at the end of AT commands entered by the user.
- Software versions (7463-0-15) and later automatically recognize the carriage return and line feed character at the end of user AT commands, and will still recognize them even if a carriage return and line feed character is not added.
- An AT command recognition or execution error will result in the response " =ERR ".
- 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.

7.1 General instructions

7.1.1 AT+RESET soft reboot

Instruction format	AT+RESET
Execution Example	Send: AT+RESET Response: =OK
Feature Description	Software version (7463-0-15) and earlier will not respond = OK The "OK" response is only added in software versions (7463-0-16) and later. The actual reset process will only begin after an OK response (=OK). Please wait approximately 30ms before proceeding to the next step.

7.1.2 AT+DEFAULT restores factory settings

Instruction format	AT+DEFAULT
Execution Example	Send: AT+DEFAULT 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.

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7.1.3 Use AT+DEVTYPE to query product model

Instruction format	AT+DEVTYPE=?
Execution Example	Send: AT+DEVTYPE=? Response: DEVTYPE=E22 0 -400T 30S
Feature Description	Product Series: E220 Operating frequency band: 400 (400/900) Maximum power: 30 (22/30/33)

7.1.4 Use AT+FWCODE to query software version

Instruction format	AT+FWCODE=?
Execution Example	Send: AT+FWCODE=? Response: FWCODE=74 6 3-0- 17
Feature Description	Major version number: 7463 Branch number: 0 Minor version number: 17 (incrementing from 10)

7.1.5 Enable AT+SWITCH software switching of working mode

Instruction format	AT+SWITCH=<on_off>
Setup Example	Send: AT+SWITCH=0 Response: =OK
Query Example	Send: AT+SWITCH=? Response: AT+SWITCH=0
Parameter Description	<on_off> : Switch 0. Off (default) 1. Turn on
Feature Description	The factory default setting is off; use the M0M1 pin to switch the operating mode (hard-switching). After activation, the M0M1 pin remains usable; hard switching/soft switching is determined by the last trigger. After enabling, restart the system for it to take effect. Once enabled, you can use AT+MODE to specify the working mode (soft cut), and the working mode number will be saved immediately after each soft cut.

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	After startup, software versions (7463-0-14) and earlier will use the M0M1 hardware mode as the initial operating mode after a power outage and restart. After startup, software versions (7463-0-15) and later will use the last soft-slice save mode number as the initial working mode after a power outage and restart. After being shut down, the system will use the M0M1 hardware mode as its initial operating mode upon power failure and restart.

7.1.6 AT+MODE Software Switching for Operating Mode

Instruction format	AT+MODE=<mode>
Setup Example	Send: AT+MODE=0 Response: AT+MODE=0
Query Example	Send: AT+MODE=? Response: AT+MODE=0
Parameter Description	<mode> : Working mode number 0 Transmission Mode 1. Wake-up call mode (WOR Tx) 2. Wake-up over the air receiver mode (WOR Rx) 3. Hibernation and Configuration Modes
Feature Description	It can only be used after enabling via AT+SWITCH. Can be used in any working mode The actual mode switch will only begin after the user responds (=OK). Please wait approximately 15ms before proceeding to the next step. Please read the AT+SWITCH feature description.

7.1.7 AT+UAUX Wireless AUX Indicator Enable

Instruction format	AT+UAUX=<on_off>
Setup Example	Send: AT+UAUX=0 Response: =OK
Query Example	Send: AT+UAUX=? Response: AT+UAUX=0
Parameter Description	<on_off> : Switch 0. Off (default) 1. Turn on
Feature Description	Software version (7463-0-14) and earlier versions do not support this command, and by default, AUX will indicate the wireless transmission process (lower during transmission). Software versions (7463-0-15) and later have AUX enabled by default, which does not indicate the

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	wireless transmission process (to help some users transmit data packets faster). To ensure compatibility with previous versions' AUX timings, please enable AUX.

7.1.8 AT+ADDR Communication Address (Match Filtering)

Instruction format	AT+ADDR=<address>
Setup Example	Send: AT+ADDR=0 Response: =OK
Query Example	Send: AT+ADDR=? Response: AT+ADDR=0
Parameter Description	<address> : Communication address 0 - 65535
Feature Description	Default address 0 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. 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).

7.1.9 AT+CHANNEL Communication Channel (Carrier Frequency)

Instruction format	AT+CHANNEL=<ch>	
Setup Example	Send: AT+CHANNEL=0 Response: =OK	
Query Example	Send: AT+CHANNEL=? Response: AT+CHANNEL=0	
Parameter Description	<ch> : Communication channel 0 - 83 E22 0-400T 22D , E22 0-400T 22D E220-400T30D , E220-400T30S	<ch> : Communication channel 0 - 80 E22 0-9 00T 22D , E22 0-9 00T 22D E22 0 - 90 0T30D , E22 0 - 9 00T30 S
Feature Description	Products on different frequency bands have different channel ranges; please pay attention to the differences. actual carrier frequency corresponding to the 400 MHz band channel = 410.125 MHz + ch * 1MHz actual carrier frequency corresponding to the 900 GHz band channel = 850.125 MHz + ch * 1MHz	

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7.1.10 AT+KEY Communication Password (Data Encryption)

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

7.1.11 AT+UART Serial Port Baud Rate and Checksum

Instruction format	AT+UART=<baud>,<parity>
Setup Example	Send: AT+UART=3,0 Response: =OK
Query Example	Send: AT+UART=? Response: AT+UART=3,0
Parameter Description	<baud> : Serial port baud rate 0 1200bps 1 2400bps 2 4800bps 3 9600bps (default) 4 19200bps 5 38400bps

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	6 57600bps 7 115200bps <parity> : Serial port verification type 0 No validation None (default) 1 Odd parity 2 Even parity
Feature Description	In configuration mode (M0M1 Mode 3), force fix 9600 8N1. The change will take effect after switching working modes.

7.1.12 AT+PACKET Serial Port Packet Length

Instruction format	AT+PACKET=<len>
Setup Example	Send: AT+PACKET=0 Response: =OK
Query Example	Send: AT+PACKET=? Response: AT+PACKET=0
Parameter Description	<len> : Serial port data packet length 0 200 bytes (default) 1 128 bytes 2 64 bytes 3 32 bytes
Feature Description	If the user-input data is less than the set length during serial port reception, it will be processed according to the timeout and frame-breaking method, and then packaged and transmitted wirelessly. During serial port reception, when the user-input data reaches the set length, it will be immediately packaged and wirelessly transmitted. 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.

7.1.13 AT+URXT Serial Port Frame Drop Conditions

Instruction format	AT+URXT=<byte>
Setup Example	Send: AT+URXT=3 Response: =OK
Query Example	Send: AT+URXT=? Response: AT+URXT=3
Parameter Description	<byte> : byte time 1 - 255
Feature	By default, serial port timeout frame interruption is handled based on 3-byte intervals.

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Description	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. 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.

7.1.14 AT+RATE Wireless Transmit/Receive Rate

Instruction format	AT+RATE=<rate>
Setup Example	Send: AT+RATE=2 Response: =OK
Query Example	Send: AT+UART=? Response: AT+UART=2
Parameter Description	<rate> : air speed 0 2.4Kbps 1 2.4Kbps 2 2.4Kbps (default) 3 4.8Kbps 4 9.6Kbps 5 19.2Kbps 6 38.4Kbps 7 62.5Kbps
Feature Description	The higher the air speed, the lower the communication latency (shorter transmission time), but the worse the receiving sensitivity (shorter communication distance).

7.1.15 AT+TRANS Wireless Transmission Method (Pass-through/Fixed Point)

Instruction format	AT+TRANS=<mode>
Setup Example	Send: AT+TRANS=0 Response: =OK
Query Example	Send: AT+TRANS=? Response: AT+TRANS=0
Parameter Description	<mode> : Transmission mode 0 Transparent transmission (default) 1. Fixed-point transmission
Feature Description	Point-to-point transmission processes the first three bytes of user input data specially. The first and second bytes are identified as the target communication address, and the third byte is identified as the

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	target communication channel (automatic channel switching). After the fixed-point transmission completes the data transmission, it automatically switches back to the original channel.

7.1.16 AT+LBT Listen Before Activation Enable (Avoidance)

Instruction format	AT+LBT=<on_off>
Setup Example	Send: AT+LBT=0 Response: =OK
Query Example	Send: AT+LBT=? Response: AT+LBT=0
Parameter Description	<on_off> : Switch 0. Off (default) 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. For specific LBT settings, please refer to the AT+LBR command.

7.1.17 AT+LBR Listen Before Send Judgment Condition

Instruction format	AT+LBR=<rssi>,<timeout>
Setup Example	Send: AT+LBR=-55,2000 Response: =OK
Query Example	Send: AT+LBR=? Response: AT+LBR=-55,2000
Parameter Description	<rssi> : Signal strength threshold (dBm) 0 - (-128) <timeout> : Maximum timeout (milliseconds) 0 - 65535
Feature Description	Software versions (7463-0-14) and earlier do not support this command, but the default parameters are the same, fixed at -55dBm and 2000ms.

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7.1.18 AT+WTIME Over-the-Air Wake-up Cycle

Instruction format	AT+WTIME=<timeout>
Setup Example	Send: AT+WTIME=3 Response: =OK
Query Example	Send: AT+WTIME=? Response: AT+WTIME=3
Parameter Description	<timeout> : Sleep time 0 500ms 1 1000ms 2 1500ms 3 2000ms (default) 4 2500ms 5 3000ms 6 3500ms 7 4000ms
Feature Description	The longer the receiver's sleep time during over-the-air wake-up, the lower the average power consumption, but the greater the communication latency. Software versions (7463-0-11) and earlier do not support this instruction. Please use the HEX instruction to set the register instead.

7.1.19 AT+ERSSI Ambient Signal Strength

Instruction format	AT+ERSSI=<on_off>
Setup Example	Send: AT+ERSSI=0 Response: =OK
Query Example	Send: AT+ERSSI=? Response: AT+ERSSI=0
Parameter Description	<on_off> : Switch 0. Off (default) 1. Turn on
Feature Description	RSSI Ambient Noise Enable " section in the register description description chapter and use hexadecimal instructions to read the data.

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7.1.20 AT+DRSSI Received Data Packet Signal Strength

Instruction format	AT+DRSSI= <on_off>
Setup Example	Send: AT+DRSSI=0 Response: =OK
Query Example	Send: AT+ERSSI=? Response: AT+ERSSI=0
Parameter Description	<on_off> : Switch 0. Off (default) 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. Conversion example: Assuming the additional signal strength data is 0xC4 (-60dBm), the hexadecimal value 0xC4 is 196 in decimal. RSSI = -(256 - 196) = -60 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.

7.1. 21 AT+POWER Power Levels

Instruction format	AT+POWER = <Power>	
Setup Example	Send: AT+POWER=0 Response: AT+POWER=0	
Query Example	Send: AT+POWER=? Response: AT+POWER=0	
Parameter Description	<Power> : Power E22 0-400T30S , E22 0-4 00T30D , E22 0-9 00T30D , E22 0-900T30S 0 30dBm (default) 1 27dBm	<Power> : Power E22 0-400T 22S , E22 0-400T 22D , E22 0-900T 22D , E22 0 - 9 00T 22S 0 22dBm (default)

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	2 24dBm 3 21dBm	1 17dBm 2 14dBm 3 10dBm
Feature Description	-	

7.2 Signaling testing (certification)

7.2.1 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.

E-Best assumes no liability for any damages arising from failure to comply with relevant operating or design specifications. E-Best 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, E-Best shall not be liable for any damages suffered as a result of using features under development, whether or not such damages were foreseeable.

7.2.2 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+UFREQ	Carrier frequency adjustment (starting frequency, channel spacing)
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

8.Hardware Design

- It is recommended to use a DC regulated power supply to power this module, with the power supply ripple

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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.
- 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.

9.Frequently Asked Questions

9.1 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).

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- 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.

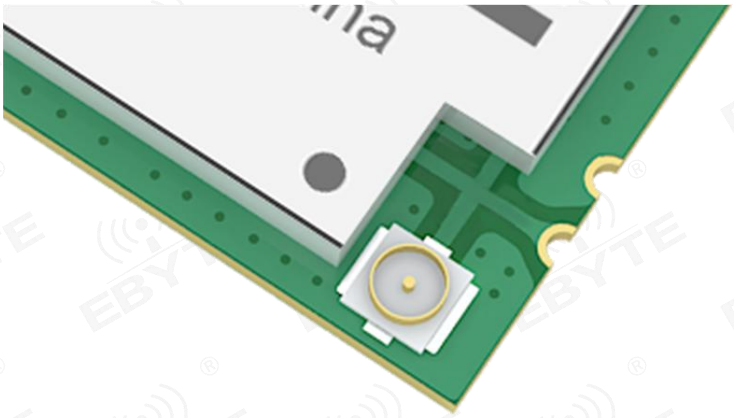
9.2 Module is easily damaged

- 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.
- 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.

9.3 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.

9.4 Antenna Selection



Both the IPEX interface and the stamp hole interface are enabled simultaneously; either the IPEX interface or the stamp hole interface can be selected arbitrarily.

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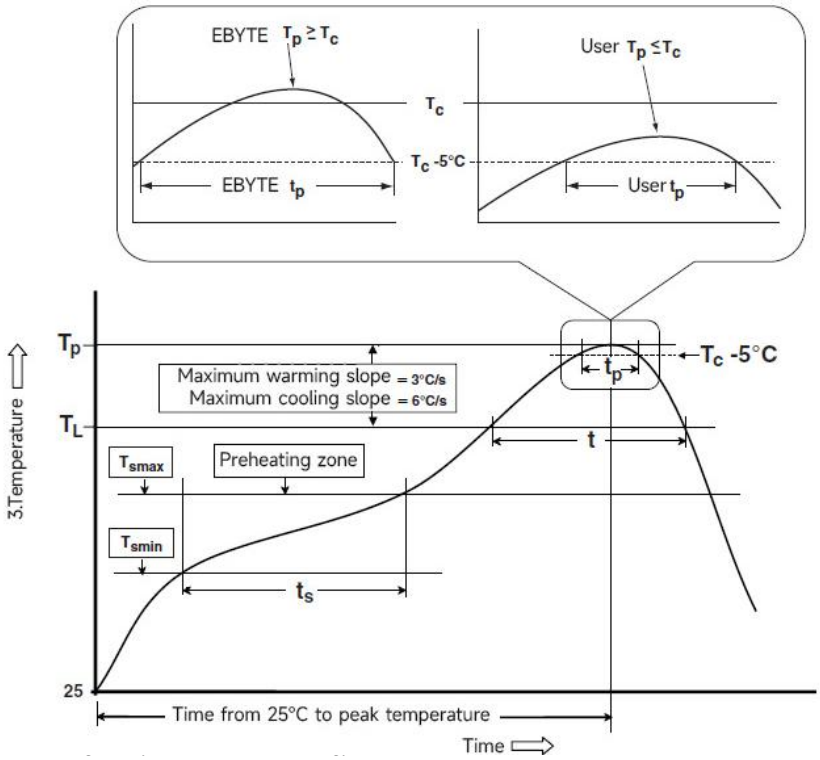
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10.Welding Operation Instructions

10.1 Reflow soldering temperature

Reflow soldering profile characteristics		Lead-based assembly	Lead-free assembly
Preheating/Insulation	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (T _{smax})	150℃	200℃
	Time (T smin ~ T smin)	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℃
T L above the holding time		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.
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.			

10.2 Reflow Soldering Profile



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11.Related Models

Product Model	carrier frequency Hz	Transmit power dBm	Test distance (km)	Packaging	Product dimensions (mm)	Communication interface
E22-400M22S	433/470M	twenty two	7	patch	14*20	SPI
E22-400M30S	433/470M	30	12	patch	24*38.5	SPI
E22-900M22S	868/915M	twenty two	7	patch	14*20	SPI
E22-900M30S	868/915M	30	12	patch	24*38.5	SPI

12. Antenna Guide

12.1 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
TX433-JZG-6	Glue rod antenna	433M	SMA-J	2.5	62	-	Ultra-short straight omnidirectional antenna
TX433-JW-5	Glue rod antenna	433M	SMA-J	2.0	50	-	Bending a rubber rod, omnidirectional antenna
TX433-JWG-7	Glue rod antenna	433M	SMA-J	2.5	75	-	Bending a rubber rod, omnidirectional antenna
TX433-JK-11	Glue rod antenna	433M	SMA-J	2.5	110	-	Bendable rubber rod, omnidirectional antenna
TX433-XPL-100	Suction Cup Antenna	433M	SMA-J	3.5	185	100	Miniature suction cup antenna, cost-effective
TX433-XP-200	Suction Cup Antenna	433M	SMA-J	4.0	190	200	Neutral suction cup antenna, low loss
TX433-XPH-300	Suction Cup Antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna, high gain
TX490-JZ-5	Glue rod antenna	470/490M	SMA-J	2.0	50	-	Ultra-short straight omnidirectional antenna

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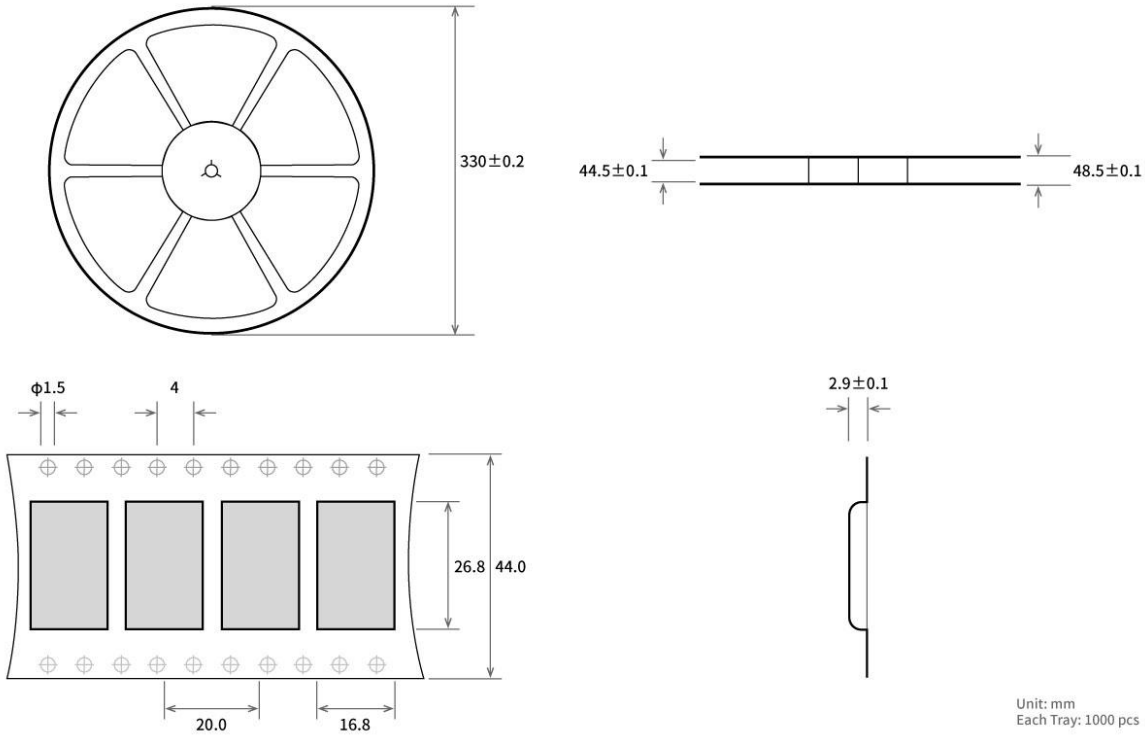
Product Model	type	Frequency band (Hz)	interface	Gain (dBi)	Height (mm)	Feeder (cm)	Features
TX490-XPL-100	Suction Cup Antenna	470/490M	SMA-J	3.5	120	100	Miniature suction cup antenna, cost-effective
TX868-JKS-IPX20	Glue rod antenna	868M	IPEX-1	3.0	197	200	Bendable rubber rod, omnidirectional antenna
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	1 5 5	150	Bendable rubber rod, omnidirectional antenna
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	2 6 0	100	Miniature suction cup antenna, cost-effective

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13.Bulk Packaging Methods

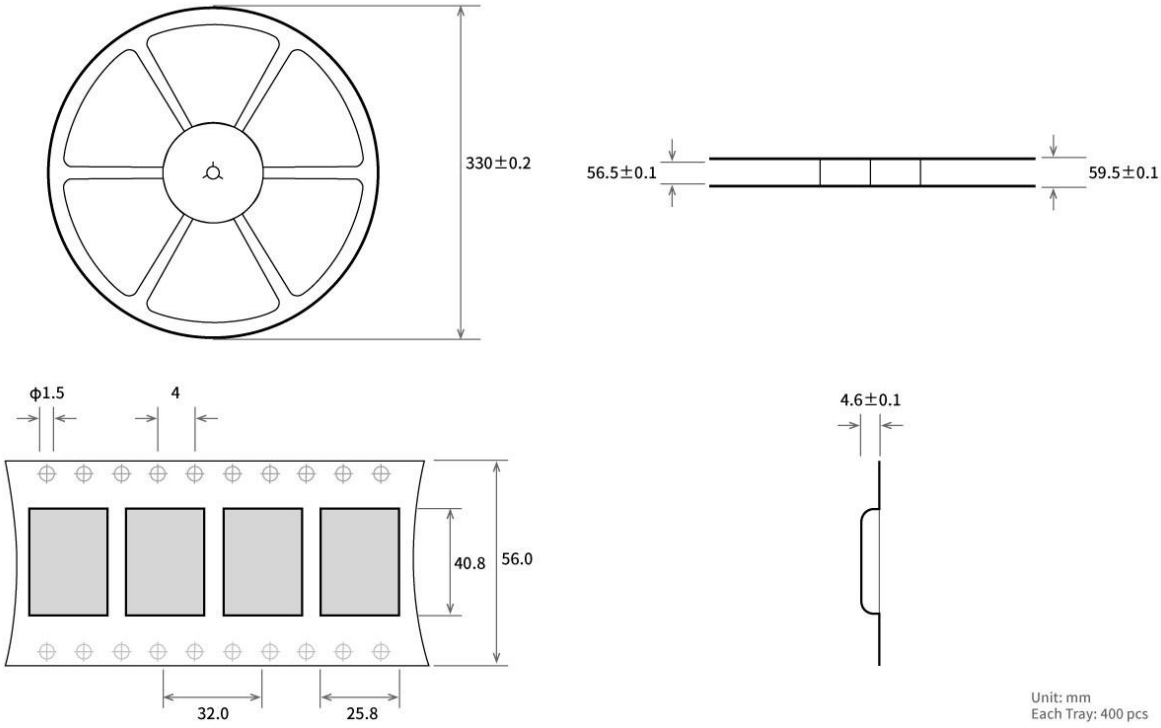
13.1 E220-400/900T22S Bulk Packaging Method



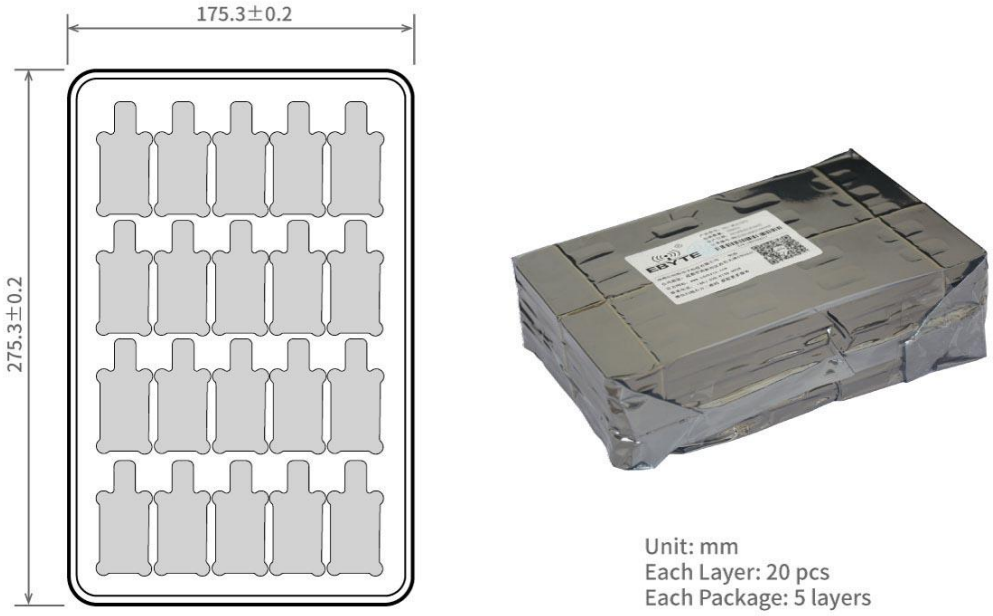
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13.2 E220-400/900T30S Bulk Packaging Method



13.3 E220-400/900TxxD Bulk Packaging Method



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Revision History

Version	Revision Date	Revision Notes	maintainer
1.0	2024-12-25	Initial version	Hao
1.1	2025-02-21	Error command correction	Hao
1.2	2025-06-10	Content correction	Hao
1.3	2025-06-26	Content correction	Hao
1.4	2025-8-6	Content correction	Hao
1.5	2025-10-24	Content integration	Hao
1.6	2026-5-29	Content correction	Hao
1.7	2026-9-2	Content correction	Hao

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