E22-230T30D User Manual

SX1262 230MHz 1W LoRa Wireless Module

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Contents

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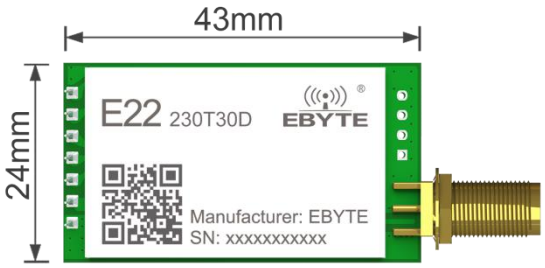
1 Introduction

1.1 Brief Introduction



E22-230T30D is a new generation of LoRa wireless module, based on the wireless serial port module (UART) of SEMTECH's SX1262 radio frequency chip, with a variety of transmission methods, working in the (220.125 ~ 236.125MHz) frequency band (default 230.125MHz), LoRa spread spectrum technology , TTL level output, compatible with 3.3V and 5V voltage.

E22-230T30D adopts a new generation of LoRa spread spectrum technology. Compared with the traditional SX1276 solution, the SX1262 solution has a longer transmission distance, faster speed, lower power consumption and smaller size; it supports air wake-up, wireless configuration, carrier monitoring, automatic middle It supports functions such as follow-up and communication key, supports sub-package length setting, and can provide customized development services.

1.2 Features

- Based on SX1262, a new LoRa spread spectrum modulation technology is developed, which brings longer communication distance and stronger anti-interference ability;
- Support automatic relay networking, multi-level relay is suitable for ultra-long-distance communication, and multiple networks run in the same area at the same time;
- Support users to set the communication key by themselves, and it cannot be read, which greatly improves the confidentiality of user data;
- Support LBT function, monitor the channel environmental noise before sending, which can greatly improve the communication success rate of the module in harsh environments;
- Support RSSI signal strength indicator function for evaluating signal quality, improving communication network, and ranging;
- Support wireless parameter configuration, send command data packets wirelessly, configure or read wireless module parameters remotely;
- Support air wake-up, that is, ultra-low power consumption, suitable for battery-powered applications;
- Support fixed-point transmission, broadcast transmission, channel monitoring;
- Support deep sleep, the power consumption of the whole machine in this mode is about 2uA;
- Support 230MHz power frequency band, the penetration and diffraction ability is stronger than 433MHz;
- The module has built-in PA+LNA, and the communication distance can reach 10km under ideal conditions;
- The parameters are saved after power-off, and the module will work according to the set parameters after power-on again;
- Efficient watchdog design, once an exception occurs, the module will restart automatically, and can continue to work according to the previous parameter settings;
- Support data transmission rate from 0.3k to 15.6kbps;
- Support 3.3 ~ 5.5V power supply, more than 5V power supply can ensure the best performance;
- Industrial-grade standard design, support long-term use at -40 ~ +85 ℃;

- Dual antennas are optional (IPEX/stamp hole), which is convenient for secondary development and integration.

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);
- Automotive industry applications.

2 Specifications

2.1 Limit Parameters

Main parameters	Performance		Remarks
	Minimum value	Maximum value	
Supply voltage (V)	0	5.5	Permanent module burnout above 5.5V
Blocking Power (dBm)	-	10	Less probability of burnout with close use
Operating temperature (℃)	-40	+85	Industrial Grade

2.2 Working Parameters

Main parameters		Performance			Remarks
		Minimum value	Typical values	Maximum value	
Operating voltage (V)		3.3	5.0	5.5	≥5.0V for guaranteed output power
Communication level (V)			3.3		Use of 5V TTL recommended plus level shift
Operating temperature (℃)		-40	-	+85	Industrial grade design
Operating frequency band (MHz)		220.125	-	236.125	ISM band support
Power consumption	Emission current (mA)		530		Instantaneous power consumption
	Receiving current (mA)		17		

	Dormant current (uA)		2		Software shutdown
Maximum transmit power (dBm)		29.5	30.0	30.5	
Receiving Sensitivity (dBm)		-146	-147	-148	Air speed 2.4kbps
Air Rate (bps)		0.3k	2.4k	15.6k	User-programmed control

Main parameters	Description	Remarks
Reference Distance	10km	Clear and open, antenna gain 5dBi, antenna height 2.5m, air rate 2.4kbps
Launch length	240 Byte	Packets of 32/64/128/240 bytes can be sent by command
Cache capacity	1000 Byte	
Modulation method	LoRa	Next generation LoRa modulation technology
Communication Interface	UART serial port	TTL level
Packaging method	SMD	
Interface method	Stamp hole	Spacing 2.54mm
Dimension	25*40.5mm	
RF Interface	IPEX/Stamp Hole	Equivalent impedance about 50Ω

3 Mechanical Dimensions and Pin Definitions

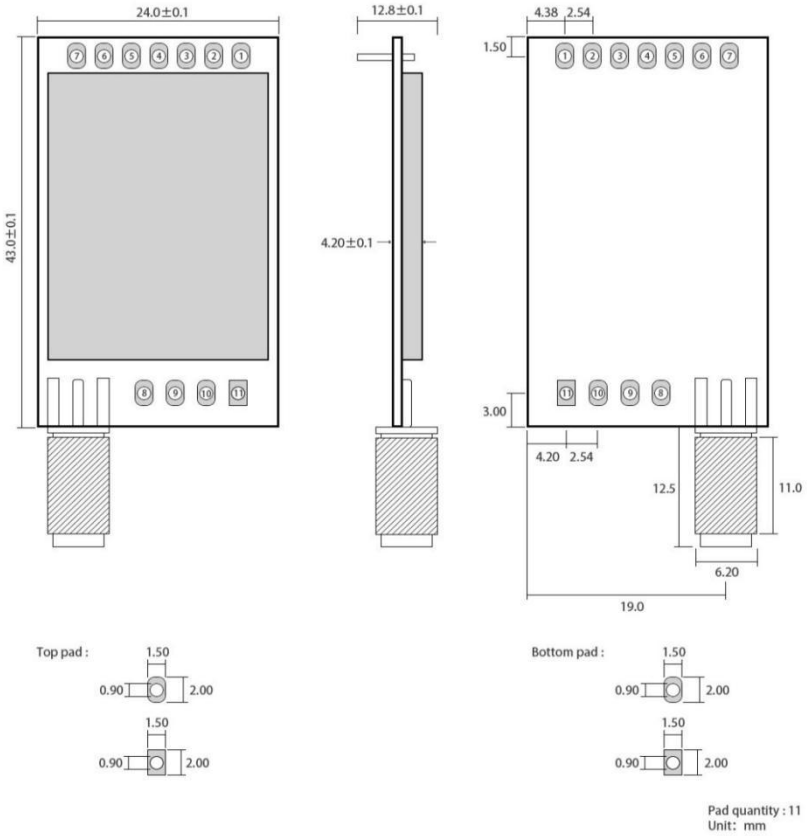


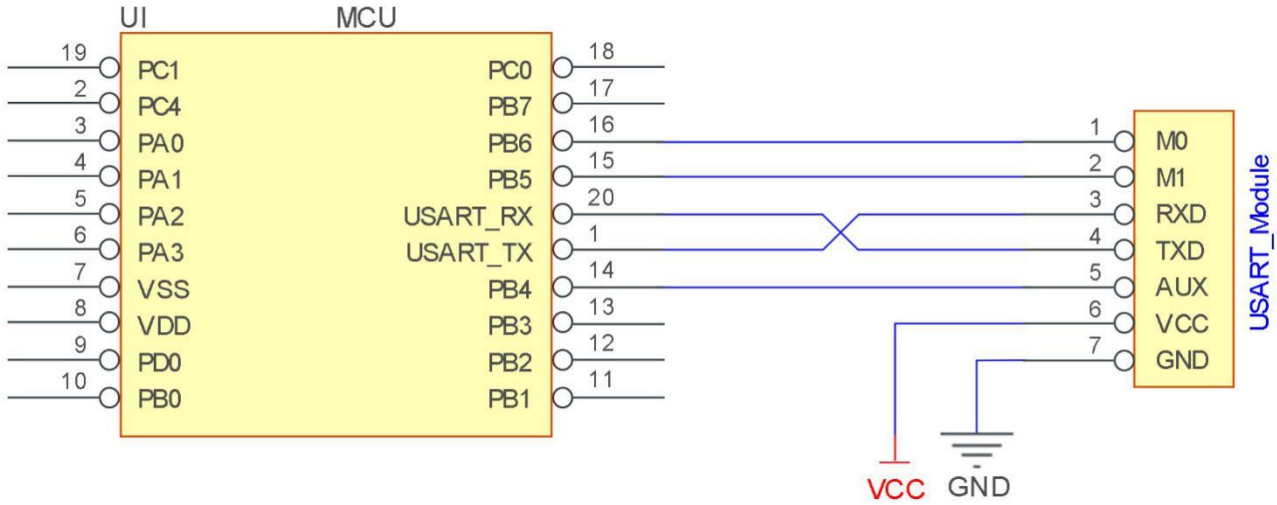
Figure 3-1 Mechanical dimensions and pin definition

Table 3-1 Pin definition table

Pins Serial number	Pins Name	Pin Orientation	Pin Usage
1	M0	Input (very weak pull-up)	Work with M1 to determine the 4 modes of operation of the module (not suspended, can be grounded if not in use)
2	M1	Input (very weak pull-up)	Work with M0 to determine the 4 modes of operation of the module (not suspended, grounded if not in use)
3	RXD	Input	TTL serial input, connected to the external TXD output pin.
4	TXD	Output	TTL serial output, connected to the external RXD input pin.
5	AUX	Output	Used to indicate the working status of the module; user wakes up the external MCU and outputs low during power-on self-test initialization; (can be suspended)
6	VCC	Input	Module power supply positive reference, voltage range: 3.0 to 5.5V DC
7	GND	Input	Module Ground
8	Fixing hole	-	Fixing hole
9	Fixing hole	-	Fixing hole

10	Fixing hole	-	Fixing hole

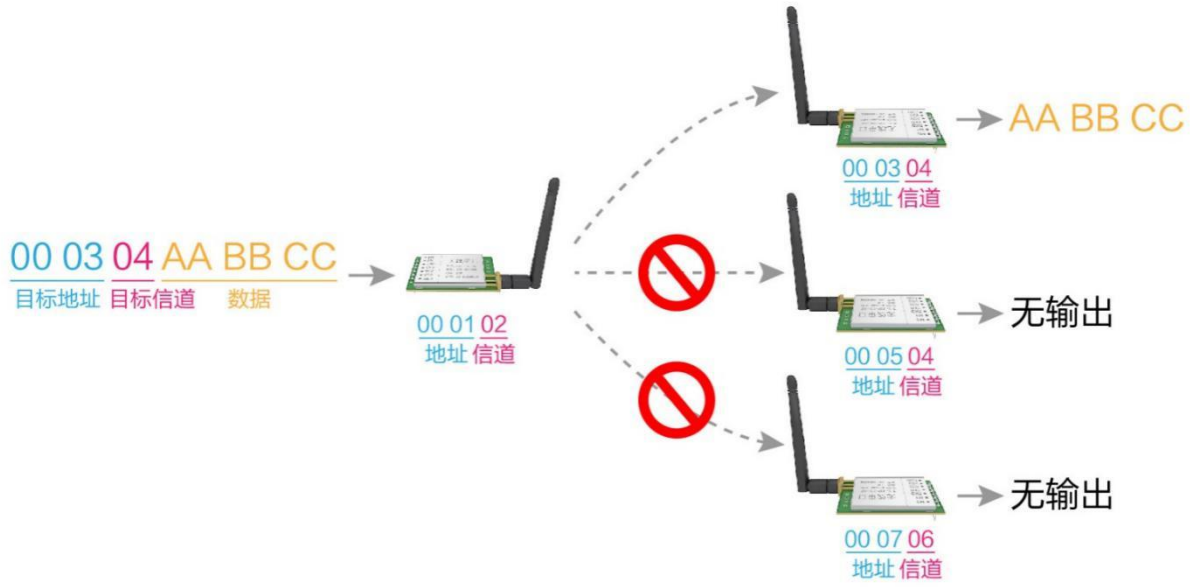
4 Recommended Connecting Diagram



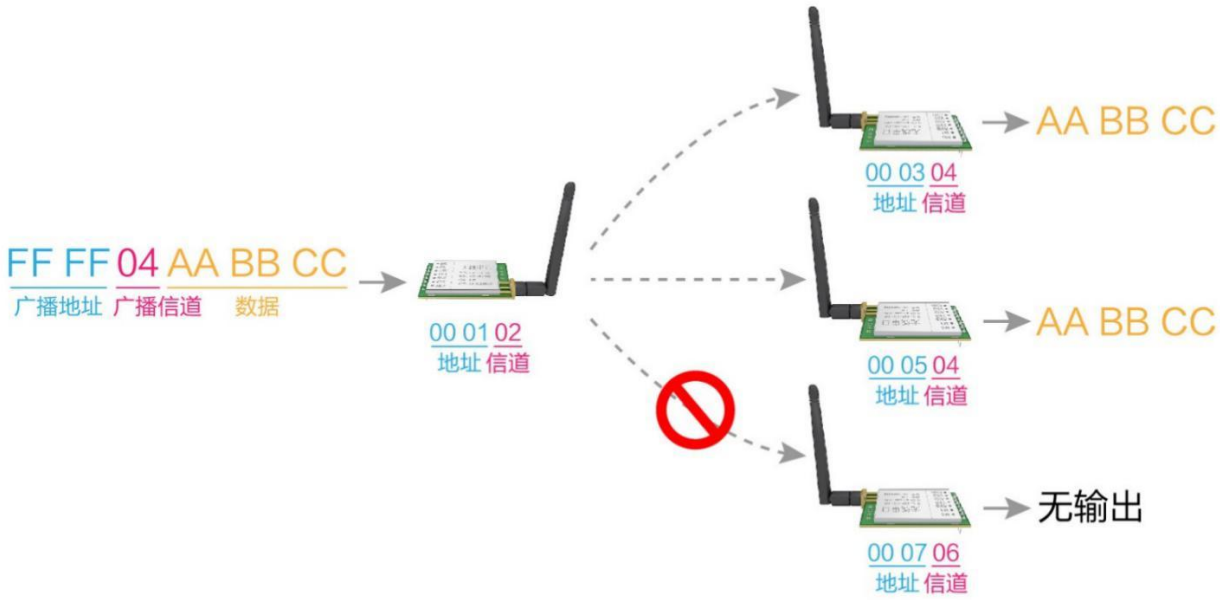
Serial number	Module and microcontroller brief connection instructions (above diagram with STM8L microcontroller as an example)
1	The wireless serial module is TTL level, please connect with MCU of TTL level.
2	Some 5V microcontrollers may need to add 4~10K pull-up resistors to the TXD and AUX pins of the module.

5 Function Details

5.1 Fixed Point Launch



5.2 Broadcast Transmission



5.3 Broadcast Address

- Example: Set module A address to 0xFFFF and channel to 0x04.
- When module A is transmitting (same mode, transparent transmission method), all receiving modules under 0x04 channel can receive the data for broadcasting purpose.

5.4 Listening Address

- Example: Set module A address to 0xFFFF and channel to 0x04.
- When module A acts as a receiver, it can receive all the data under 0x04 channel for the purpose of listening.

5.5 Module Reset

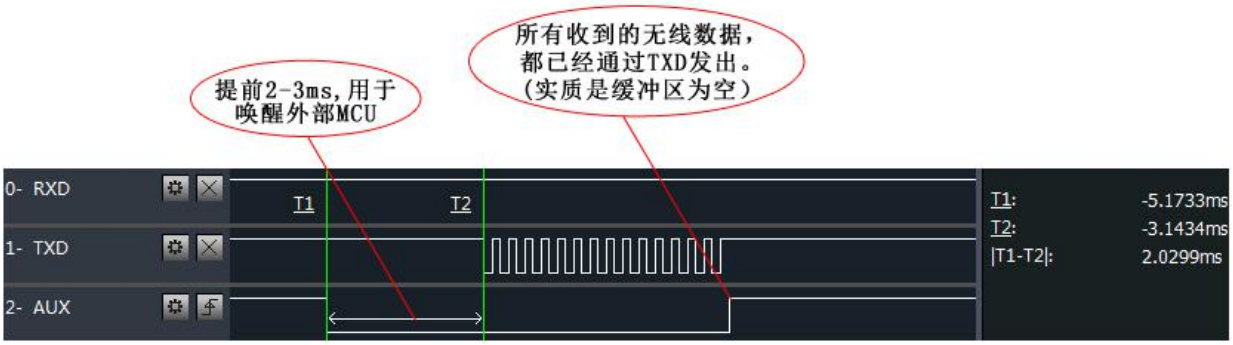
- Immediately after the module is powered up, the AUX will output a low level and perform a hardware self-test, as well as set the operating mode according to user parameters.
- During this process, AUX is kept low, and when it is finished, AUX outputs high and starts to work normally according to the working mode formed by the combination of M1 and M0
- Therefore, the user needs to wait for the rising edge of AUX as the starting point for the module to work properly

5.6 AUX Explained

- AUX is used for wireless transceiver buffer indication and self-test indication.
- It indicates whether the module has data that has not yet been transmitted out through the wireless, or whether it has received wireless data that has not all been sent out through the serial port, or whether the module is in the process of initializing the self-test.

5.6.1 Serial data output indication

- For waking up an external MCU in hibernation.

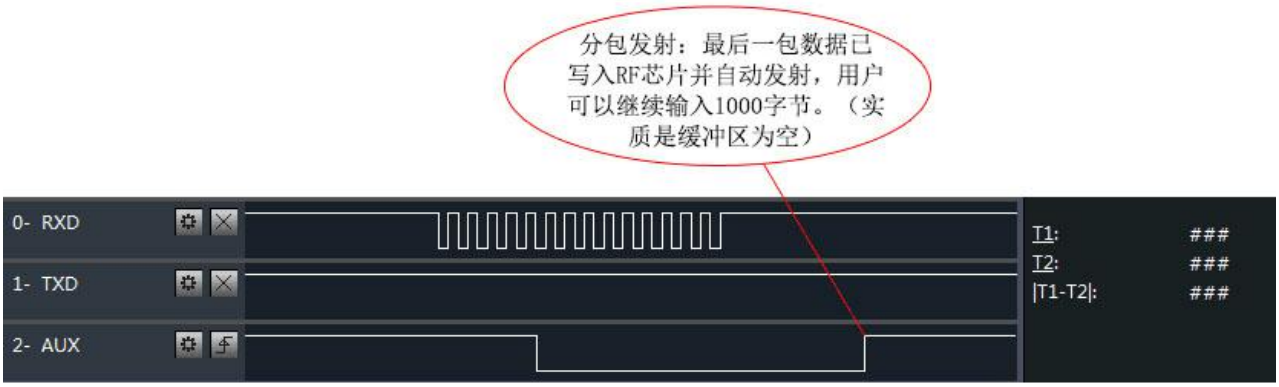


模块串口外发数据时，AUX引脚时序图

5.6.2 Wireless transmitting indication

- Buffer Empty: the data in the internal 1000 byte buffer, all written to the wireless chip (automatic packet splitting).
- When AUX=1 the user initiates less than 1000 bytes of data continuously without overflow.
- Buffer is not empty when AUX=0: the data in the internal 1000-byte buffer has not yet been fully written to the wireless chip and turned on to transmit, at which time the module may be waiting for the end of user data timeout, or is in the process of wireless sub-packet transmission.

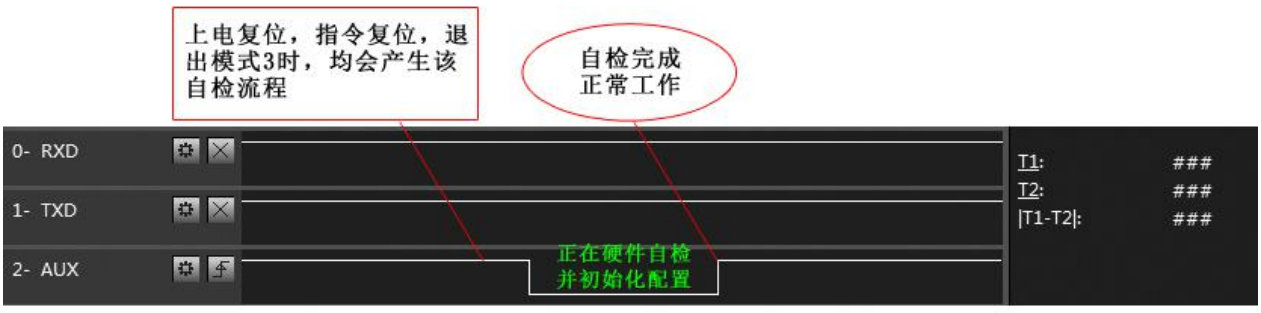
【Note】: AUX=1 does not mean that all serial data of the module have been transmitted through the wireless, or the last packet of data may be in the process of transmitting.



模块接收串口数据时，AUX引脚时序图

5.6.3 Modules are in the process of being configured

- Only when resetting and exiting sleep mode.



自检期间，AUX引脚时序图

5.6.4 Cautions

Serial number	AUX Notes

1	For functions 1 and 2 above, output low takes precedence, i.e., the AUX outputs low if any of the output low conditions are met. When all low conditions are not met, the AUX outputs high.
2	When the AUX output is low, it means that the module is busy and no working mode detection will be performed at this time When the module AUX output high level within 1ms, it will complete the mode switching work.
3	After the user switches to a new operating mode, at least 2ms of the rising edge of the AUX is required before the module will actually enter that mode. If the AUX stays high, then the mode switch will take effect immediately.
4	The module resets the user parameters when the user goes from mode 3 (sleep mode) to other modes or during reset, during which the AUX output goes low.
5	Due to the characteristics of LoRa modulation method, the information transmission delay is much longer than FSK, such as at 1.2kbps airspeed, the 100 bytes transmission delay is about 1.5 seconds, so it is recommended that customers should not carry out large data transmission at low airspeed to avoid data loss caused by data buildup and abnormal communication.

6 Working mode

The module has four operating modes, set by pins M1 and M0; details are shown in the following table.

Mode (0-3)	M1	M0	Model Introduction	Remarks
0 Transfer mode	0	0	Serial port open, wireless open, transparent transmission	Support special command over-the-air configuration
1 WOR mode	0	1	Can be defined as WOR sender and WOR receiver	Over-the-air wake-up support
2 Configuration mode	1	0	User can access the registers through the serial port to control the operating status of the module	
3 Deep dormancy	1	1	Module goes into hibernation	

Serial number	Remarks
1	● Users can combine M1 and M0 high and low levels to determine the module working mode. 2 GPIOs of MCU can be used to control mode switching. ● When changing M1, M0: if the module is idle, after 1ms, it can start working according to the new mode. ● If the module has serial data that has not yet finished transmitting over the wireless, it will not be able to enter a new operating mode until after it has finished transmitting. ● If the module receives wireless data and sends it out through the serial port, it needs to be sent out before it can enter a new operating mode. ● So mode switching can only be effective when AUX output 1, otherwise it will delay the switching.
2	● For example, if a user enters a large amount of data continuously and switches modes at the same time, the switch mode operation at this time is invalid; the module will process all user data before performing a new mode detection. ● So the general recommendation is: detect the AUX pin output status and wait for 2ms after the output goes high before switching.
3	● When the module is switched from other modes to hibernate mode, if there is data that has not been processed. ● The module will process this data (both incoming and outgoing) before entering sleep mode. This feature can be used for fast hibernation to save power; for example, if the transmitter module works in mode 0, the user initiates the serial data "12345" and then does not have to wait for the AUX pin to be idle (high level), it can directly switch to hibernation mode and hibernate the user's main MCU immediately, and the module will automatically put all the user data into hibernation within 1ms after it is sent through wireless. automatically go into hibernation within 1ms after being sent through wireless. ● This saves the MCU's operating time and reduces power consumption.
4	● Similarly, any mode switching can take advantage of this feature. After the module has processed the current mode event, it will automatically enter the new mode within 1ms; thus saving the user the work of querying the AUX, and it can achieve the purpose of fast switching. ● For example, switching from transmit mode to receive mode; the user MCU can also switch modes by going to sleep in advance before the mode switch and using the external interrupt function to get the AUX change.
5	● This operation method is very flexible and efficient, designed exactly according to the user's MCU operation convenience, and can reduce the overall system workload as much as possible, improve system efficiency and reduce power consumption.

6.1 Mode Switching

6.2 General Mode (Mode 0)

Type	When M0 = 0 and M1 = 0, the module operates in mode 0
Launch	The user can input data through the serial port and the module will start the wireless transmission.

Receiving	The module's wireless reception function is turned on, and the wireless data received will be output through the TXD pin of the serial port.

6.3 WOR Mode (Mode 1)

Type	When M0 = 1 and M1 = 0, the module operates in mode 1
Launch	When defined as the transmitter, the wake-up code will be automatically added for a certain period of time before transmitting
Receiving	Can receive data normally, receive function is equivalent to mode 0

6.4 Configuration Mode (Mode 2)

Type	When M0 = 0 and M1 = 1, the module operates in mode 2
Launch	Wireless transmit off
Receiving	Wireless reception off
Configuration	User can access registers to configure module operating status

6.5 Deep Sleep Mode (Mode 3)

Type	When M0 = 1 and M1 = 1, the module operates in mode 3
Launch	Unable to transmit wireless data.
Receiving	Unable to receive wireless data.
Attention	When going from sleep mode to other modes, the module reconfigures the parameters and the AUX remains low during the configuration. Output high when finished, so users are recommended to detect the rising edge of AUX

7 Register Read/Write Control

7.1 Command Format

The list of supported commands in configuration mode (mode 2: M1=1, M0=0) is as follows (when set, only 9600, 8N1 format is supported).

Serial number	Command Format	Detailed description
1	Set register	Instruction: C0+start address+length+parameter Response: C1 + start address + length + parameters Example 1: Configure the channel as 0x09 Instruction Start Address Length Parameter Send: C0 05 01 09 Return: C1 05 01 09 Example 2: Configure the module address (0x1234), network address (0x00), serial port (9600 8N1), and air speed (1.2K) at the same time Send: C0 00 04 12 34 00 61 Return: C1 00 04 12 34 00 61
2	Read register	Instruction: C1+start address+length Response: C1 + start address + length + parameters Example 1: Reading the channel Instruction Start Address Length Parameter Send: C1 05 01 Return: C1 05 01 09 Example 2: Simultaneous reading of module address, network address, serial port, airspeed Send: C1 00 04 Return: C1 00 04 12 34 00 61
3	Set temporary register	Instruction: C2 + start address + length + parameters Response: C1 + start address + length + parameters Example 1: Configure the channel as 0x09 Instruction Start Address Length Parameter Send: C2 05 01 09 Return: C1 05 01 09 Example 2: Configure the module address (0x1234), network address (0x00), serial port (9600 8N1), and air speed (1.2K) at the same time Send: C2 00 04 12 34 00 61

		Return: C1 00 04 12 34 00 61
5	Wireless Configuration	Command: CF CF + regular command Response: CF CF + regular response Example 1: Wireless configuration channel is 0x09 Wireless Command Header Command Start Address Length Parameter Send: CF CF C0 05 01 09 Return: CF CF C1 05 01 09 Example 2: Wireless simultaneous configuration of module address (0x1234), network address (0x00), serial port (9600 8N1), air speed (1.2K) Send: CF CF C0 00 04 12 34 00 61 Return: CF CF C1 00 04 12 34 00 61
6	Format error	Format Error Response FF FF FF

7.2 Register Description

<table>
<tr><th>Serial number</th><th>Reading and writing</th><th>Name</th><th colspan="5">Description</th><th>Remarks</th></tr>
<tr><td>00H</td><td>Read/Write</td><td>ADDH</td><td colspan="5">ADDH (default 0)</td><td rowspan="2">Module address high byte and low byte.
Note: When the module address is equal to FFFF, it can be used as a broadcast and listening address, i.e.: the module will not be address filtered at this time</td></tr>
<tr><td>01H</td><td>Read/Write</td><td>ADDL</td><td colspan="5">ADDL (default 0)</td></tr>
<tr><td>02H</td><td>Read/Write</td><td>NETID</td><td colspan="5">NETID (default 0)</td><td>Network addresses, which are used to distinguish networks.
When communicating with each other, they should be set to the same.</td></tr>
<tr><td rowspan="11">03H</td><td rowspan="11">Read/Write</td><td rowspan="11">REG0</td><td>7</td><td>6</td><td>5</td><td colspan="2">UART serial port rate (bps)</td><td rowspan="11">Two modules that communicate with each other, the serial port baud rate can be different and the checksum can be different.

When transmitting larger packets in succession, users need to consider data blocking and possibly even loss due to the same baud rate.

It is generally recommended that both sides of the communication have the same baud rate.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td colspan="2">Serial port baud rate of 1200</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td colspan="2">Serial port baud rate of 2400</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td colspan="2">Serial port baud rate of 4800</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td colspan="2">Serial port baud rate of 9600 (default)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td colspan="2">Serial port baud rate of 19200</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td colspan="2">Serial port baud rate of 38400</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td colspan="2">Serial port baud rate of 57600</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td colspan="2">Serial port baud rate of 115200</td></tr>
<tr><td>4</td><td>3</td><td colspan="3">Serial port parity bits</td><td>The serial mode can be different on both sides of</td></tr>
</table>

			0	0	8N1 (default)		the communication.
			0	1	8O1		
			1	0	8E1		
			1	1	8N1 (equivalent to 00)		
			2	1	0	Wireless Air Speed (bps)	The air rate must be the same on both sides of the communication. The higher the air rate, the lower the delay and the shorter the transmission distance.
			0	0	0	Air speed 0.3k	
			0	0	1	Airspeed 0.6k	
			0	1	0	Airspeed 1.2k	
			0	1	1	Airspeed 2.4k (default)	
			1	0	0	Air speed 4.8k	
			1	0	1	Airspeed 9.6k	
			1	1	0	Airspeed 15.6k	
			1	1	1	Airspeed 15.6k	
04H	Read/Write	REG1	7	6	Subcontracting settings		If the user sends data smaller than the packet length, the serial output at the receiving end is presented as uninterrupted continuous output. If the user sends data larger than the packet length, the serial port at the receiving end will split the packet output.
			0	0	240 bytes (default)		
			0	1	128 bytes		
			1	0	64 bytes		
			1	1	32 bytes		
			5	RSSI Environmental Noise Enable			When enabled, the command C0 C1 C2 C3 can be sent in transmit mode or WOR send mode Read register. Register 0x00 : Current ambient noise RSSI. Register 0X01 : RSSI of the last received data (Current channel noise is: dBm = -(256 - RSSI). Command format: C0 C1 C2 C3 + start address + read length. Returns: C1 + address + read length + read valid value. For example: send C0 C1 C2 C3 00 01 Return C1 00 01 RSSI **(address can only start from 00)**
			0	Disable (default)			
			1	Enable			
			4	3	2	Reserved	
			1	0	Transmitting power		Power and current are non-linearly related, and the power supply is most efficient at maximum power. The current does not decrease in the same proportion as the power decreases.
			0	0	30dBm (default)		
			0	1	27dBm		
			1	0	24dBm		
			1	1	21dBm		
05H	Read/Write	REG2	Channel Control (CH) 0-64 represent a total of 65 channels respectively				Actual frequency = 220.125 + CH * 0.25M

06H	Read/Write	REG3	7	Enable RSSI bytes			When enabled, the module receives wireless data, which will follow an RSSI intensity byte when output through the serial port TXD.
			0	Disable (default)			
			1	Enable			
			6	Transmission method			For fixed-point transmission, the module identifies the first three bytes of the serial data as: address high + address low + channel, and uses them as the wireless transmitting target.
			0	Transparent transmission (default)			
			1	Fixed-point transmission			
			5	Relay function			When the relay function is enabled, the module will initiate a forwarding if the destination address is not the module itself. To prevent data backhaul, it is recommended to use with fixed-point mode; i.e., the destination and source addresses are different.
			0	Disable relay function (default)			
			1	Enable Relay Function			
			4	LBT enable			When enabled, wireless data is listened to before it is transmitted, which can avoid interference to some extent, but may introduce data delays. The maximum dwell time of LBT is 2 seconds, and it will be forced to issue when it reaches two seconds.
			0	Disable (default)			
			1	Enable			
			3	WOR mode transceiver control			Only valid for mode 1; After the WOR receiver receives the wireless data and outputs it through the serial port, it will wait for 1000ms before entering the WOR again. During this period, the user can input the serial port data and return it through the wireless; Each serial port byte will refresh 1000ms time; The user must initiate the first byte within 1000ms.
			0	WOR receiver (default) The transceiver is turned on, and a wake-up code for a certain period of time is added when transmitting data.			
			1	WOR transmitter The module cannot transmit data and works in the WOR monitoring mode. The monitoring period is shown below (WOR period), which can save a lot of power consumption.			
			2	1	0	WOR Cycle	Valid only for mode 1. Cycle time T= (1+WOR)*500ms, maximum 4000ms, minimum 500ms. The longer the WOR listening interval cycle time, the lower the average power consumption, but the greater the data latency. Both sending and receiving parties must agree (very important)
			0	0	0	500ms	
			0	0	1	1000ms	
			0	1	0	1500ms	
			0	1	1	2000ms	
			1	0	0	2500ms	
			1	0	1	3000ms	
			1	1	0	3500ms	
			1	1	1	4000ms	

07H	write	CRYPT_H	Key High Byte (default 0)	Write only, read returns 0. for encryption to avoid interception of over-the-air wireless data by similar modules. These two bytes are used internally by the module as computational factors to transform and encrypt the over-the-air radio signal.
08H	write	CRYPT_L	Key low byte (default 0)	
80H ~ 86H	Read	PID	Product information 7 bytes	Product information 7 bytes

7.3 Factory Default Parameters

Model	**Factory default parameter value: C0 00 00 62 00 28**						
Module Model	Frequency	Address	Signal Channel	airspeed	Baud rate	Serial port format	Transmitting power
E22-230T30D	230.125MHz	0x0000	0x28	2.4kbps	9600	8N1	30dbm

8 Use of Relay Networking Mode

Serial number	**Relay mode description**
1	After setting the trunk mode through the configuration mode, switch to the general mode and the trunk starts to work.
2	relay mode ADDH, ADDL are no longer used as module addresses, but are forwarded to the pair corresponding to the NETID respectively, and if one of the networks is received, it is forwarded to the other network. The network ID of the repeater itself is invalid.
3	In relay mode, the relay module cannot send and receive data and cannot perform low-power operation.
4	The module resets the user parameters when the user goes from mode 3 (sleep mode) to other modes or during reset, during which the AUX output goes low.

Relay networking rule description.

1、forwarding rules, the trunk can forward data in both directions between two NETIDs.

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

As pictured.

①One level relay

"Node 1" NETID is 08.

"Node 2" NETID is 33.

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

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

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

②Secondary trunking

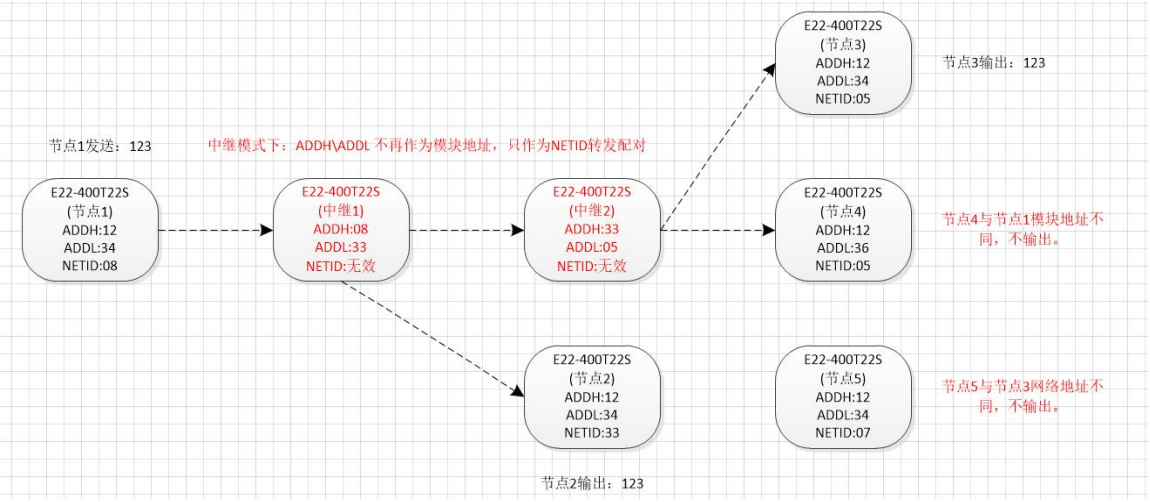
The ADDH\ADDL of relay 2 is 33, 05, respectively.

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

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

③Two-way relay

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



9 Host Computer Configuration Instructions

- The following figure shows the display interface of the E22-230T22S configuration upper computer. Users can switch to command mode through M0 and M1 for quick configuration and reading of parameters at the upper computer.

- In the configuration upper computer, the module address, frequency channel, network ID, and key are displayed in decimal mode;

where each parameter takes the following value range.

Network address：0 ~ 65535

Frequency channel: 0 to 83

Network ID：0 ~ 255

Key: 0 to 65535

- Users need to pay special attention when using the upper computer to configure the relay mode, because in the upper computer, the parameters are displayed in decimal mode, so the module address and network ID need to be filled in by converting the decimal.

If the network ID entered at transmitter A is 02 and the network ID entered at receiver B is 10, the hexadecimal value 0X020A is converted to the decimal value 522 as the module address to be filled in by relay R when setting the module address.

That is, the module address value that needs to be filled in at this time is 522 at the relay end R.

10 Hardware Design

- It is recommended that the module be powered by a DC regulated power supply with as small a ripple coefficient as possible, and that the module be reliably grounded.
- Please pay attention to the correct connection of positive and negative power supply, such as reverse connection may lead to permanent damage to the module.
- Please check the power supply to ensure that it is between the recommended supply voltages, as exceeding the maximum will cause permanent damage to the module.
- Please check the stability of the power supply, the voltage should not fluctuate significantly and frequently.
- When designing power supply circuits for modules, it is often recommended to retain more than 30% margin to have the whole machine facilitate long-term stable operation.
- Modules should be as far away as possible from power supplies, transformers, high-frequency alignments and other parts with high electromagnetic interference.
- High-frequency digital alignment, high-frequency analog alignment, power supply alignment must be avoided below the module, if it is necessary to pass below the module, assuming that the module is soldered in the Top Layer, in the module contact part of the Top Layer laying copper (all laying copper and good grounding), must be close to the digital part of the module and alignment in the Bottom Layer.
- Assuming that the module is soldered or placed in the Top Layer, it is also wrong to run random wires in the Bottom Layer or other layers, which will affect the spurious and reception sensitivity of the module to varying degrees.
- Assuming that there is a large electromagnetic interference devices around the module will also greatly affect the performance of the module, according to the strength of the interference is recommended to be properly away from the module, if the situation allows appropriate isolation and shielding can be done.
- Assuming that there is a large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power supply alignment) will also greatly affect the performance of the module, according to the strength of the interference is recommended to be properly away from the module, if the situation allows appropriate isolation and shielding.
- Communication line must be connected in series with 1k-5.1k resistors if using 5V level (not recommended, still risk of damage).
- Try to stay away from some TTL protocols whose physical layer is also 2.4GHz, e.g. USB3.0.
- The antenna mounting structure has a large impact on the performance of the module, make sure that the antenna is exposed and preferably vertically upward.
- When the module is mounted inside the enclosure, a quality antenna extension cable can be used to extend the antenna to the

outside of the enclosure.

- The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

11 Common Questions

11.1 Unsatisfactory transmission distance

- When there are linear communication barriers, the communication distance is attenuated accordingly.
- Temperature, humidity, co-channel interference, which can lead to increased communication packet loss.
- The ground absorbs and reflects radio waves and is less effective for testing close to the ground.
- Seawater has a very strong ability to absorb radio waves, so the seaside test is poor.
- metal objects near the antenna, or placed in a metal case, signal attenuation will be very serious.
- Wrong setting of the power register, too high setting of the air rate (the higher the air rate, the closer the distance).
- The low voltage of the power supply at room temperature is lower than the recommended value, and the lower the voltage the less power is generated.
- Use antenna and module match poorly or antenna itself quality problems.

11.2 Module is vulnerable to damage

- Please check the power supply to ensure that it is between the recommended supply voltages, as exceeding the maximum will cause permanent damage to the module.
- Please check the stability of the power supply, the voltage should not fluctuate significantly and frequently.
- Please ensure that the installation and use of the process of anti-static operation, high-frequency devices electrostatic sensitivity.
- Please ensure that the installation and use process humidity should not be too high, some components are humidity sensitive devices.
- It is not recommended to use at too high or too low temperature if there is no special need.

11.3 BER is too high

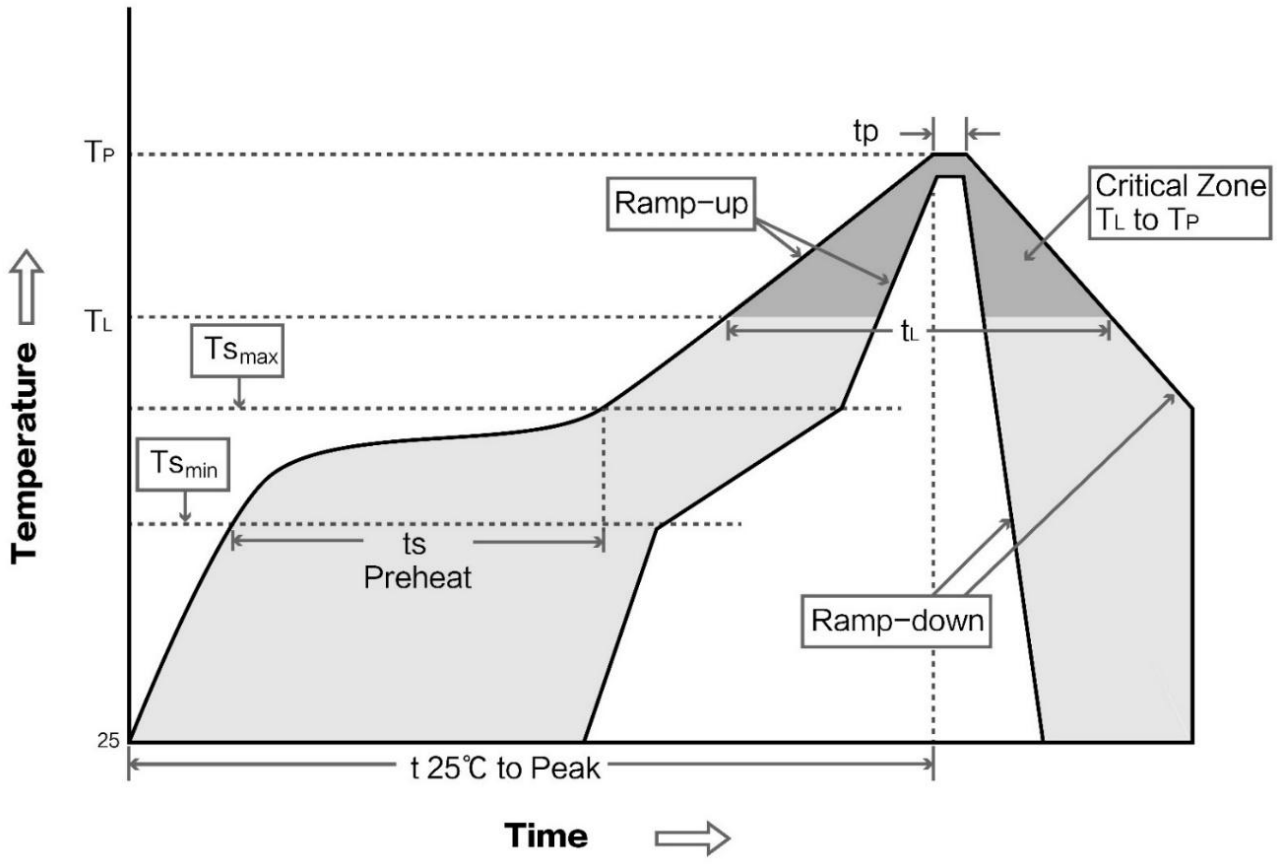
- If there is interference from the same frequency signal nearby, stay away from the interference source or modify the frequency or channel to avoid the interference.
- Poor power supply may also cause garbled code, be sure to ensure the reliability of the power supply.
- Poor quality or too long extension cords and feeders can also cause high BER.

12 Welding Work Instruction

12.1 Reflow Temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	Minimum preheating temperature	100°C	150°C
Preheat temperature max (Tsmax)	Maximum preheating temperature	150°C	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Warm-up time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average rise rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temperature	183℃	217℃
Time (tL) Maintained Above (TL)	Time above the liquid phase line	60-90 sec	30-90 sec
Peak temperature (Tp)	Peak temperature	220-235°C	230-250°C
Aveage ramp-down rate (Tp to Tsmax)	Average decline rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25°C to peak temperature	6 minutes max	8 minutes max

12.2 Reflow Profile



13 Related Models

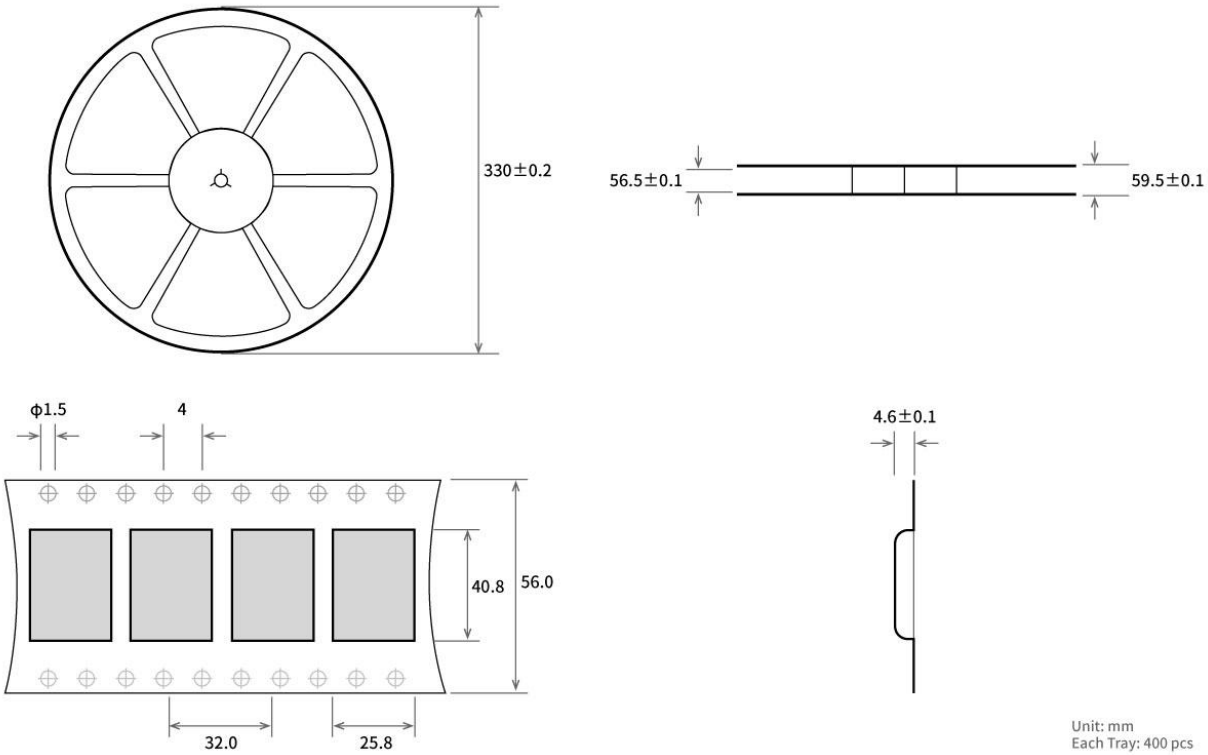
Product Model	Chip Solutions	Carrier frequency Hz	Transmitting power dBm	Test Distance km	Package form	Product Size mm	Communication Interface
E22-230T22S	SX1262	230M	22	5	SMD	16*26	TTL
E22-230T30D	SX1262	230M	30	10	SMD	20*40.5	TTL
E22-400T22S	SX1268	433/470M	22	5	SMD	16*26	TTL
E22-400T30S	SX1268	433/470M	30	10	SMD	20*40.5	TTL
E22-900T22S	SX1262	868/915M	22	5	SMD	16*26	TTL
E22-900T30S	SX1262	868/915M	30	10	SMD	20*40.5	TTL
E22-400M22S	SX1268	433/470M	22	7	SMD	14*20	SPI
E22-400M30S	SX1268	433/470M	30	12	SMD	24*38.5	SPI
E22-900M22S	SX1262	868/915M	22	7	SMD	14*20	SPI
E22-900M30S	SX1262	868/915M	30	12	SMD	24*38.5	SPI

14 Antenna Recommendations

Antenna is an important role in the communication process, often poor quality antenna will have a great impact on the communication system, so we recommend some antennas as supporting our wireless module and more excellent performance and reasonable price.

Product Model	Type	Frequency Band Hz	Interface	Gain dBi	Height mm	Feeders cm	Functional Features
TX230-JK-11	Glue Stick Antenna	433M	SMA-J	2.5	110	-	Bendable glue stick, omni-directional antenna
TX230-JK-20	Glue Stick Antenna	433M	SMA-J	3.0	210	-	Bendable glue stick, omni-directional antenna
TX230-XP-200	Suction cup antenna	433M	SMA-J	4.0	350	200	Neutral suction cup antenna with low loss
TX230-XPH-300	Suction cup antenna	433M	SMA-J	5.5	745	300	Large suction cup antenna, high gain

15 Bulk Packaging



Revision history

Versions	Revision Date	Revision Notes	Maintaining people
1.0	2018-01-08	initial version	huaa
1.1	2018-04-16	Content update	huaa
1.2	2018-05-24	name change	Huaa
1.3	2018-07-20	Model split	Huaa
1.4	2018-10-23	Content update	Ray
1.5	2019-04-03	Content update	Ray
1.6	2020-04-15	error correction	du
1.7	2020-05-15	14.1 The antenna frequency band is changed from 433 to 230	du
1.8	2020-06-10	bugfix	Linson
1.9	2020-11-26	initial version	huaa

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