E77-400M22S Product Specifications

STM32WLE5　410/510MHz　SoC SMD LoRa Module

Chengdu Ebyte Electronic Technology Co.,Ltd.

Catalog

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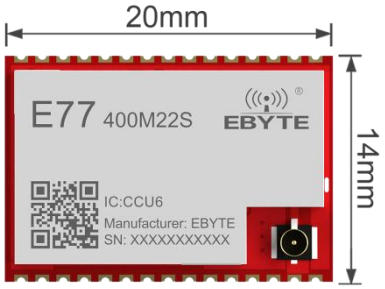
Chapter 1 Overview

1.1 Introduction



E77-400M22S is based on ST's newly launched STM32WLE5CCU6 (ARM Cortex-M4 + LoRa) SoC wireless communication module. It has the characteristics of remote communication, low standby power consumption, strong anti-interference ability, rich interface resources, strong processing ability and small size. . And it is suitable for 433/470MHz frequency band SMD LoRa wireless module, using industrial-grade high-precision 32.768KHz and 32MHz crystal oscillator.

The E77-400M22S wireless communication module requires secondary development by the user, and can be widely used in the Internet of Things industry, especially suitable for the application development of LoRaWAN.

1.2 Features

- Under ideal conditions, the communication distance can reach 5.6km;
- The maximum transmit power is 21.5dBm, and the software is multi-level adjustable;
- Support global license-free ISM 868/915MHz frequency band;
- New SF5~12SF spreading factor introduced to support dense network;
- Support 1.8~3.6V power supply, and the best performance can be guaranteed if the power supply is greater than 3.3V;
- The external crystal oscillator uses 32.768KHz, 32MHz high-precision industrial-grade crystal oscillator;
- 14.0*20.0*2.7mm small size SMD package, which is conducive to system integration development;
- Industrial standard design, support long-term use at -40 ~ +85 ℃;
- Dual antennas are optional (IPEX/stamp hole), which is convenient for users' 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;
- Advanced Meter Reading Architecture (AMI);
- Automotive industry applications.

Chapter 2 Specifications

2.1 RF parameters

RF parameters	parameters	Notes
Working frequency	410~510 MHz	Support ISM band
Power	0~21.5 dBm	The software is adjustable, and users need to develop their own settings
eceive sensitivity	-118 dBm	GFSK, air speed1.2kbps
preading factor	5~12	——
Measured distance	5600m	Clear and open environment, maximum power, antenna gain 3.5dBi, height 2m, airspeed 1.2kbps

2.2 Hardware parameters

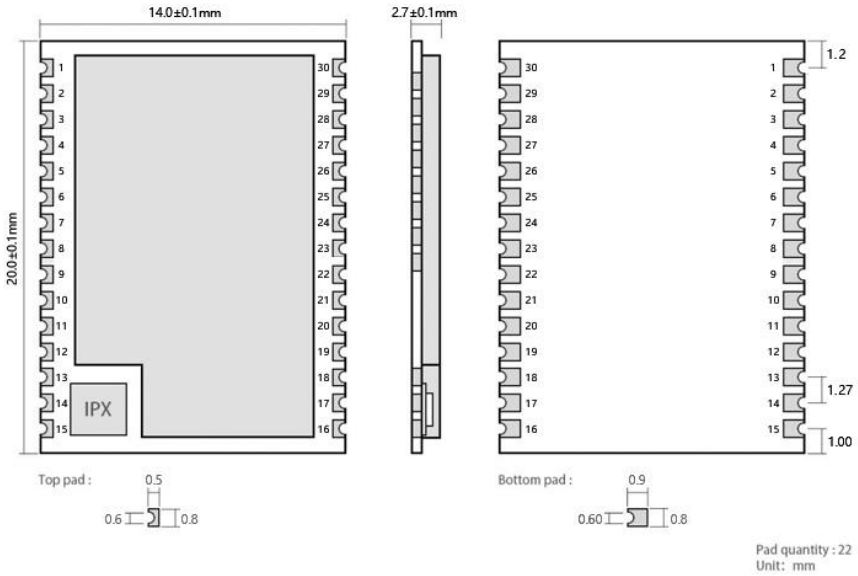
Hardware parameters	parameters	Notes
IC full name	STM32WLE5CCU6	——
core	Cortex-M4	——
FLASH	256 KB	——
RAM	64 KB	——
Crystal frequency	32MHz/32.768KHz	External crystal
Size	14 * 20 mm	——
Antenna Interface Type	IPEX/Stamp Hole	Equivalent Impedance Approx.50Ω
Communication interface	UART、SPI、I²C、GPIO、ADC	Users need to develop their own settings
Package	Patch stamp hole	——

2.2 Electrical parameters

Electrical parameters	Min	Typical value	Max	Unit	condition
Voltage	1.8	3.3	3.6	V	≥3.3V Guaranteed output power Exceeding 3.6V will permanently burn the module
communication level	-	3.3	-	V	Using 5.0V TTL is recommended to add level conversion
Emission current	-	128	-	mA	Instantaneous power consumption
receive current	-	14	-	mA	——
leep current	-	2	-	μA	software shutdown

Operating temperature	-40	20	85	℃	——
Working humidity	10	60	90	%	——
Storage temperature	-40	20	125	℃	——

Chapter 3 Mechanical Dimensions and Pin Definition



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pin number	pin name	Pin direction	Pin use
1	PB3	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
2	PB4	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
3	PB5	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
4	PB6	Input /Output	USART1_TX
5	PB7	Input /Output	USART1_RX
6	PB8	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
7	PA0	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
8	PA1	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
9	PA2	Input /Output	LP_USART2_TX
10	PA3	Input /Output	LP_USART2_RX
11	PA4	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)

12	PA5	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
13	GND	Input /Output	Ground wire, connected to the power reference ground
14	ANT	Input /Output	Antenna interface, stamp hole (50Ω characteristic impedance)
15	GND	Input /Output	Ground wire, connected to the power reference ground
16	PA8	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
17	NRST	Input /Output	Chip reset trigger input pin, active low (built-in 0.1uF ceramic capacitor)
18	PA9	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
19	PA12	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
20	PA11	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
21	PA10	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
22	PB12	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
23	PB2	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
24	PB0	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
25	PA15	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
26	PC13	Input /Output	Configurable general-purpose IO port (see STM32WLE5CCU6 manual for details)
27	GND	Output	Ground wire, connected to the power reference ground
28	VDD	Input	Power supply, range 1.8~3.6V (recommended to add external ceramic filter capacitor)
29	PA13	Input	SWDIO program download
30	PA14	Input	SWCLK program download

Note 1: PA6 and PA7 pins are used as the internal control RF switch of the module, PA6 = RF_TXEN, active low level; PA7 = RF_RXEN, active high level.

Note 2: The PC14-OSC32_IN and PC15-OSC32_OUT pins have been connected to a 32.768KHz crystal oscillator inside the module for users to choose and use during secondary development.

Note 3: The OSC_IN and OSC_OUT pins have been connected to a 32MHz crystal oscillator inside the module for users to choose and use during secondary development.

Chapter 4 Basic Operations

4.1 Hardware Design

- It is recommended to use a DC regulated power supply to power the module, the power supply ripple coefficient should be as small as possible, and the module should be reliably grounded;
- Please pay attention to the correct connection of the positive and negative poles of the power supply, such as reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that it is between the recommended power supply voltage, if exceeding the maximum value will cause permanent damage to the module;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so that the whole machine can work stably for a long time;
- The module should be kept away from the parts with large electromagnetic interference such as power supply, transformer and high-frequency wiring as far as possible;
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the underside of the module. If it is absolutely necessary to pass under the module, assuming that the module is soldered on the Top Layer, lay copper on the Top Layer of the contact part of the module. Copper and well grounded), must be close to the digital part of the module and routed on the Bottom Layer;
- Assuming that the module is soldered or placed on the Top Layer, it is also wrong to arbitrarily route wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;
- Assuming that there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. If the situation allows, appropriate isolation and shielding can be done;
- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. Proper isolation and shielding;
- If the communication line uses 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from some TTL protocols whose physical layer is also 2.4GHz, for example: USB3.0;
- The antenna installation structure has a great influence on the performance of the module. Be sure to ensure that the antenna is exposed, preferably vertically upward. When the module is installed inside the casing, a high-quality antenna extension cable can be used to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal shell, which will greatly weaken the transmission distance.
- It is recommended to add a 200R protection resistor to the RXD/TXD of the external MCU.

4.2 Software writing

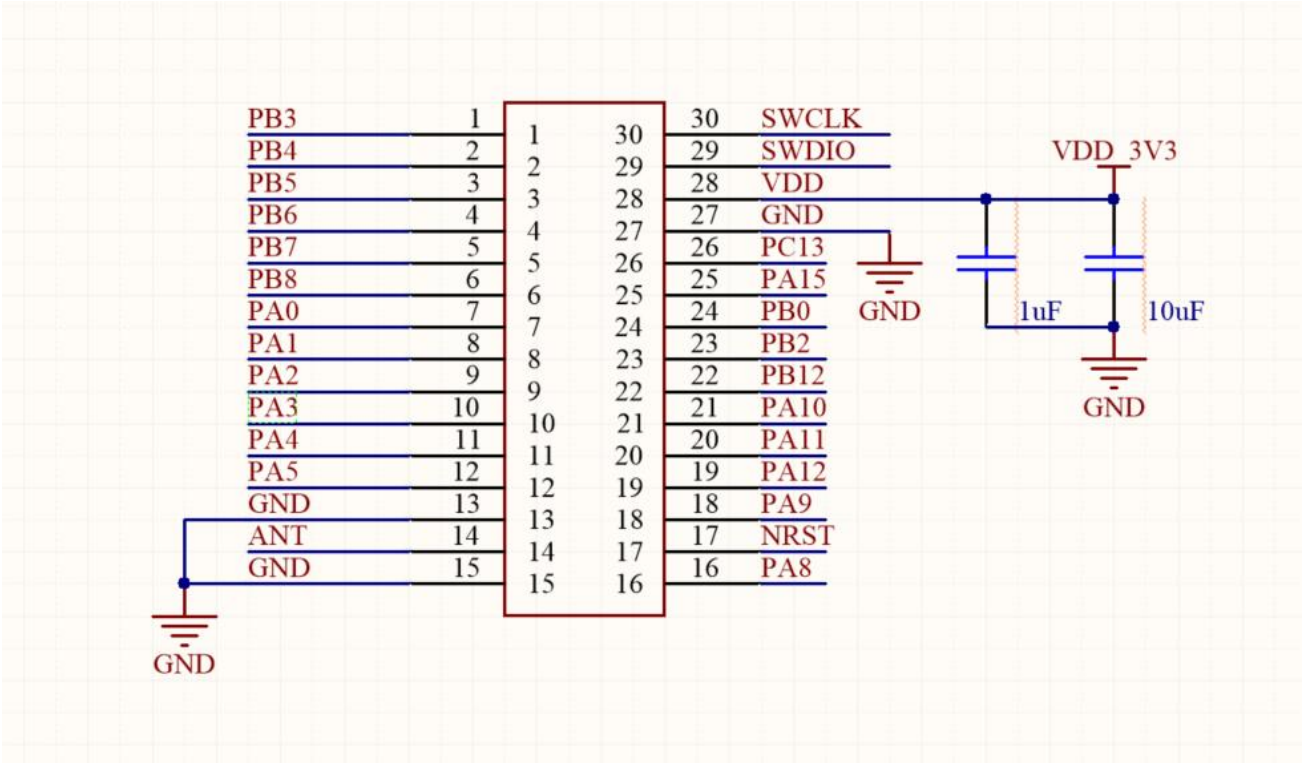
- Please refer to the E77-400M22S DEMO routine provided by Chengdu Ebyte official website, this routine only

demonstrates the simple transceiver function under LoRaTM modulation and demodulation mode;

- For LoRaWANTM development, please download and refer to the instructions in ST's stm32cubewl library file, and use the stm32cubemx software to generate the protocol stack project of the relevant development platform;
- The PA6 and PA7 pins are used as the internal control RF switch of the module. PA6 = RF_TXEN, active low level; PA7 = RF_RXEN, active high level. In general, it is not recommended to enable RX and TX at the same time. When transmitting, TX is enabled and RX is not enabled. When receiving, RX is enabled and TX is not enabled.

Chapter 5 Basic Applications

5.1 basic circuit



Chapter 6 Frequently Asked Questions

6.1 The transmission distance is not ideal

- When there is a straight line communication obstacle, the communication distance will be correspondingly attenuated;
- Temperature, humidity, and co-channel interference will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect close to the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- There are metal objects near the antenna, or placed in a metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly, and the air rate is set too high (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 lower the output power;
- The antenna used is poorly matched with the module or the quality of the antenna itself is a problem.

6.2 Module is easily damaged

- Please check the power supply to ensure that it is between the recommended power supply voltage, if exceeding the maximum value will cause permanent damage to the module;
- Please check the stability of the power supply, the voltage should not fluctuate frequently;
- Please ensure anti-static operation during installation and use, and high-frequency components are electrostatically sensitive;
- Please ensure that the humidity during installation and use should not be too high, and some components are humidity-sensitive devices;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

6.3 Bit error rate too high

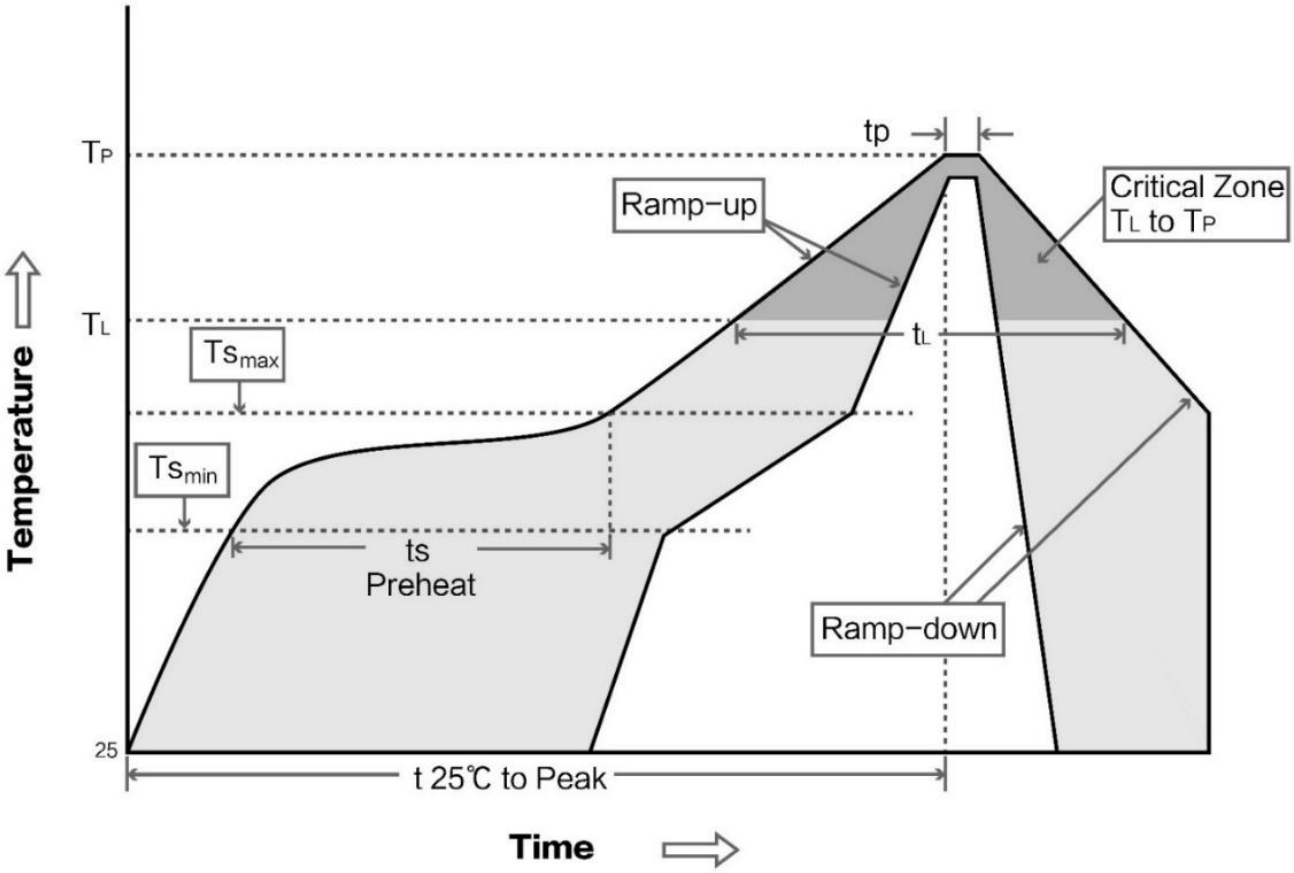
- There is co-frequency signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- The clock waveform on the SPI is not standard, check whether there is interference on the SPI line, and the SPI bus line should not be too long;
- Unsatisfactory power supply may also cause garbled characters, be sure to ensure the reliability of the power supply;
- Poor quality or too long extension cables and feeders can also cause high bit error rates.

Chapter 7 Welding Operation Instructions

7.1 Reflow soldering temperature

Profile Feature	Curve feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Minimum preheat temperature	100℃	150℃
Preheat temperature max (Tsmax)	maximum preheat temperature	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheat time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	average rate of ascent	3℃/second max	3℃/second max
Liquidous Temperature (TL)	liquidus temperature	183℃	217℃
Time（tL）Maintained Above（TL）	time above liquidus	60-90 sec	30-90 sec
Peak temperature（Tp）	peak temperature	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	average rate of descent	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25° C to peak temperature	6 minutes max	8 minutes max

7.2 eflow Soldering Curve



Chapter 8 Related Models

Mode	IC	Frequency Hz	Power dBm	Distance km	Package	Size mm	Interface
E22-400M22S	SX1268	433/470M	22	7	SMD	14*20	SPI
E22-900M22S	SX1262	868/915M	22	7	SMD	14*20	SPI
E22-400M30S	SX1268	433/470M	30	12	SMD	24*38.5	SPI
E22-900M30S	SX1262	868/915M	30	12	SMD	24*38.5	SPI
E22-230T22S	SX1262	230M	22	5	SMD	16*26	TTL
E22-400T22S	SX1268	433/470M	22	5	SMD	16*26	TTL
E22-900T22S	SX1262	868/915M	22	5	SMD	16*26	TTL
E22-230T30S	SX1262	230M	30	10	SMD	25*40.5	TTL
E22-400T30S	SX1268	433/470M	30	10	SMD	25*40.5	TTL
E22-900T30S	SX1262	868/915M	30	10	SMD	25*40.5	TTL

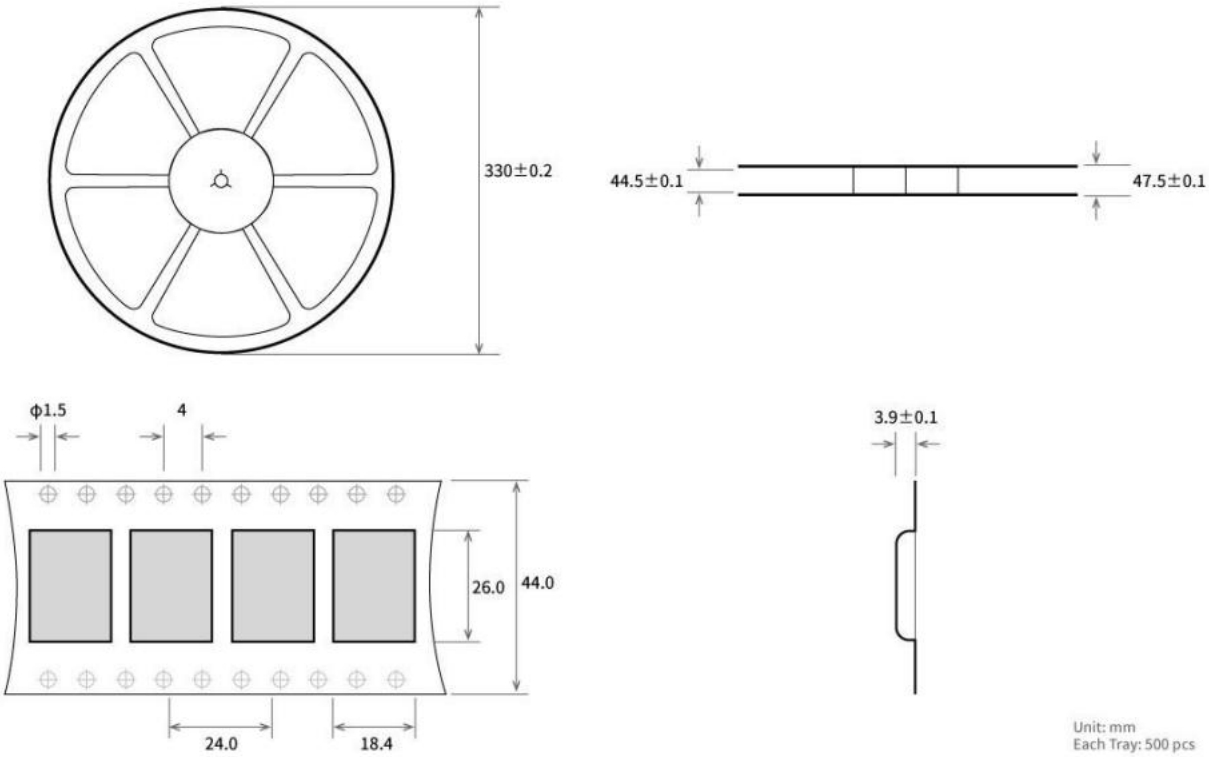
Chapter 9 Antenna Guidelines

9.1 Antenna recommendation

Antennas play an important role in the communication process, and often inferior antennas will have a great impact on the communication system. Therefore, our company recommends some antennas as antennas with excellent performance and reasonable price for our wireless modules.

Mode	Type	Frequency Hz	Interface	Gain dBi	Height mm	feeder cm	Features
TX433-PCB-4310	flexible antenna	433M	焊接	2.0	43.8*9.5	5.3	Built-in flexible, FPC soft antenna
TX433-JZ-5	Rubber antenna	433M	SMA-J	2.0	52	-	Ultra-short straight, omnidirectional antenna
TX433-JZG-6	Rubber antenna	433M	SMA-J	2.5	62	-	Ultra-short straight, omnidirectional antenna
TX433-JW-5	Rubber antenna	433M	SMA-J	2.0	50	-	Bend glue stick, omnidirectional antenna
TX433-JWG-7	Rubber antenna	433M	SMA-J	2.5	75	-	Bend glue stick, omnidirectional antenna
TX433-JK-11	Rubber antenna	433M	SMA-J	2.5	110	-	Bendable glue stick, omnidirectional antenna
TX433-JK-20	Rubber antenna	433M	SMA-J	3.0	210	-	Bendable glue stick, omnidirectional antenna
TX433-XPL-100	Suker Antenna	433M	SMA-J	3.5	185	100	Small suction cup antenna, cost-effective
TX433-XP-200	Suker Antenna	433M	SMA-J	4.0	190	200	Neutral suction cup antenna, low loss
TX433-XPH-300	Suker Antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna, high gain
TX490-XPL-100	Suker Antenna	470/490M	SMA-J	3.5	120	100	Large suction cup antenna, high gain

Chapter 10 Bulk Packaging



Revise History

Version	Revision Date	Revision Notes	Maintenance man
1.0	2022-6-13	Manual release	Ning

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