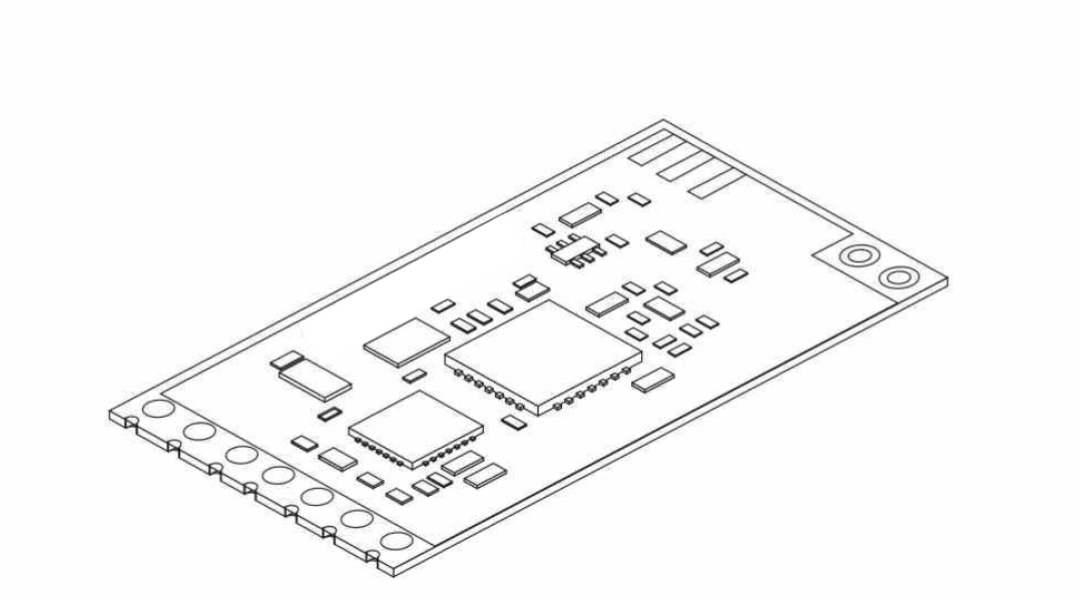
HW-LW -M200

Product Specification V2.02



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Preface

Thank you for using our HM-LW-M200 terminal module series. The module based on LoRa spread spectrum modulation technology with built-in LoRawan protocol to provide TTL serial port and GPIO. The terminal products embed with this module is free configuration, fast to form a LPWAN with our HP-LW-G500 and HP-LW-G300 gateway conveniently thus to achieve ultra long distance wireless transmission.
Please read this document carefully before using, and the contents of this manual will also be modified according to the needs of development.

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List of Illustrations

1. Built-in LoraWAN Protocol Description

LoRa is one of LPWAN communications technology. It is a super long distance wireless transmission scheme based on spread spectrum technology that adopted and promoted by Semtech.

LoRawan™ is a LPWAN (Low Power Wide Area Network) standard based on open source Mac layer protocol launched by Lora alliance. This technology can provide local, national even global networks for battery powered wireless devices.

According to different applications, LoRawan™ can be divided into Class A and Class C these two operation modes. Each module only embeds one mode, so users can chose according to the different application scenarios.

- Class A: Apply to the terminal product applications with battery powered mostly uplink data.

The terminal equipment of Class A gets the lowest power consumption when the terminal sends a uplink transmission signal, the server can communicate with the downlink very quickly. At any time, the server's downlink communication is only after the uplink communication.

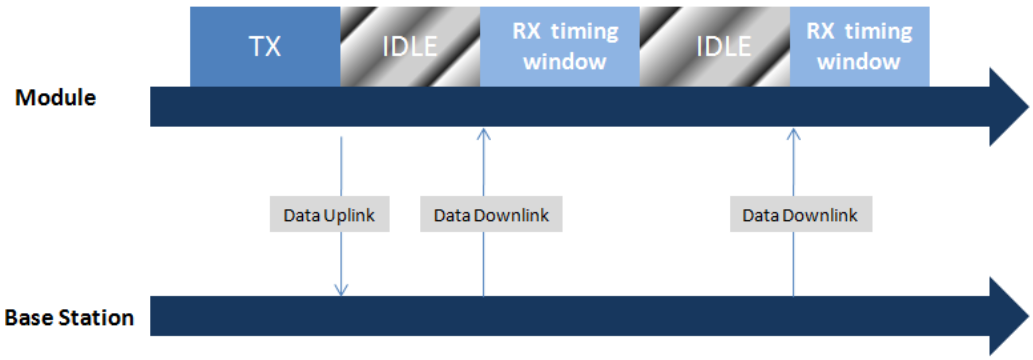


Chart 1 Working Timing Window of Class A

- Class C: Apply to terminal product applications with external power supply and real-time or frequent downlink data.

Class C has a two-way communication terminal with the largest receiving slot. This type of terminal continues to open the receiving window, only when the transmission is closed.

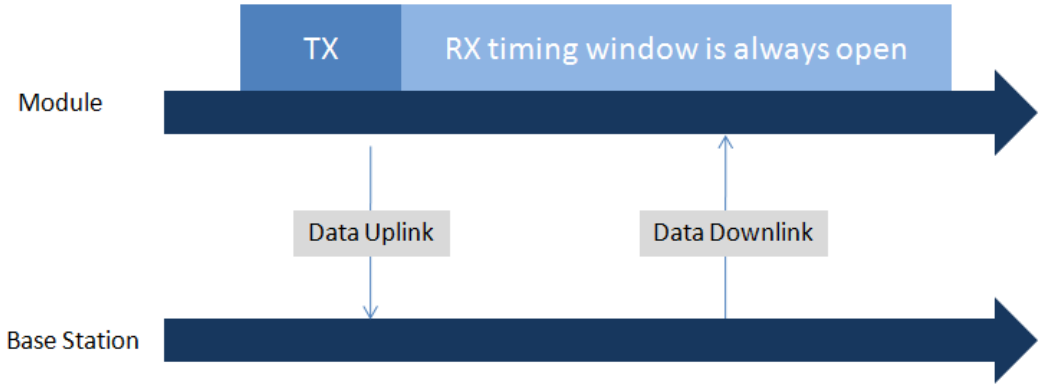


Chart 2 Working Timing Window of Class C

2. Interface Application Description

2.1 Function Block Diagram

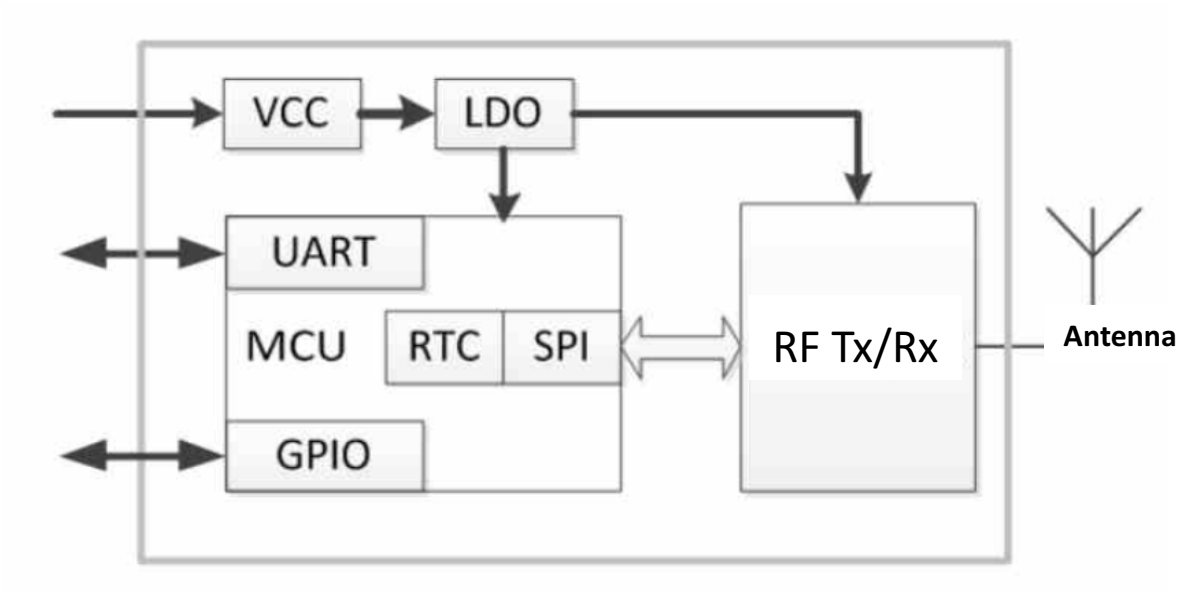


Chart 3 Hardware Function Block Diagram

2.2 Pin Assign Diagram

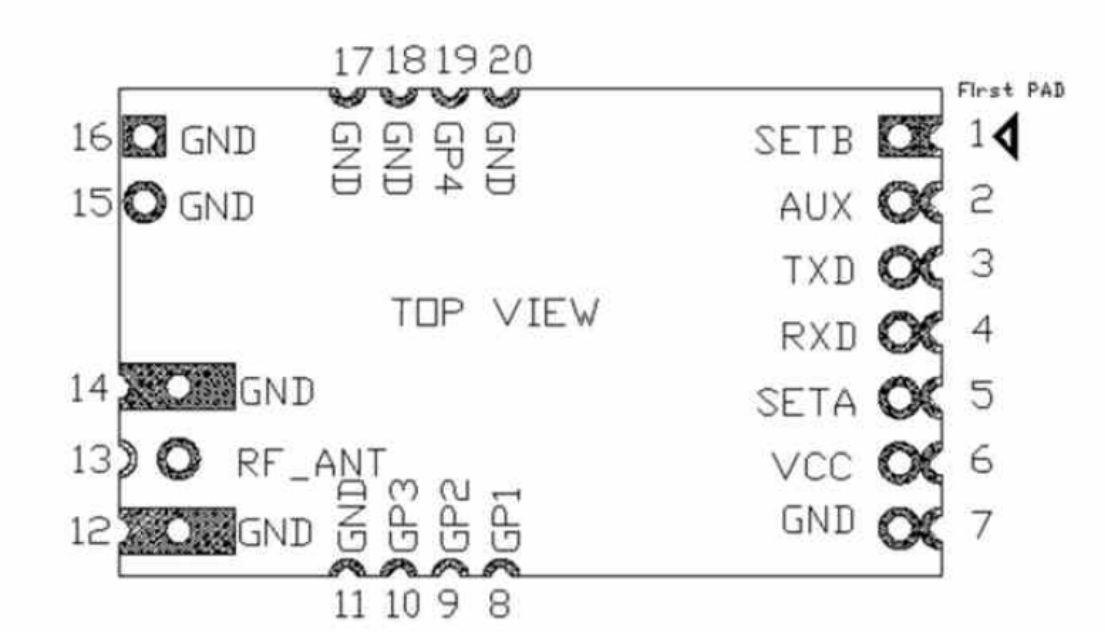


Chart 4 Diagram (Top View)

2.3 Pin Description

Pin Name	Pin No.	IO	Description	Remark
Power interface				
VCC	6	I	According to different hardware to choose input voltage, support DC5V (3.5~5.5V) and DC3.3V (2.6~3.6V). Default: 3.3V	requires to have instantaneous discharge capacity greater than 150mA so as to avoid the power supply voltage restarting when radio frequency emission is launched
GND	7, 11, 12, 14, 15, 16, 17, 18, 20		Ground	Pin7 is a power groud and must be grounded
Serial Port				
TXD	3	O	TTL level, data transmission	
RXD	4	I	TTL level, data receive	
GPIO				
SETA	5	I	external interrupt signal, low level active, detected falling edge, serial port RXD ready to receive data, detected rising	

			edge, serial port stop receiving	
SETB	1	O	module output, serial port TXD to send data, falling edge effective, serial TXD send data completed, rising edge effective	MCU of receiving side need to set as edge detected interruption
AUX	2	I	module input, enter configuration mode interrupt signal, falling edge effective	use of electronic products that are not convenient for repower
GP1, GP2, GP3, GP4	8, 9 10, 19	I/O	NC	
ANT				
RF_ANT	13		wireless signal antenna interface, 50 Ω impedance	suggested to resave the antenna matching component on the board

Table 1. PIN Description

2.4 Serial Port Hardware Connection

- The module's GPIO interface SETA and SETB have weak internal pull-up resistors. It is recommended that external pull ups should be reserved;
- The module's serial port RXD and TXD have weak internal pull-up resistors. It is recommended that external pull ups should be reserved;
- The user's upper computer can be directly connected to the module, and the interface level is consistent with the IO level 3.3V of the module to avoid leakage due to differential voltage. (the module with LDO output 3.3V)

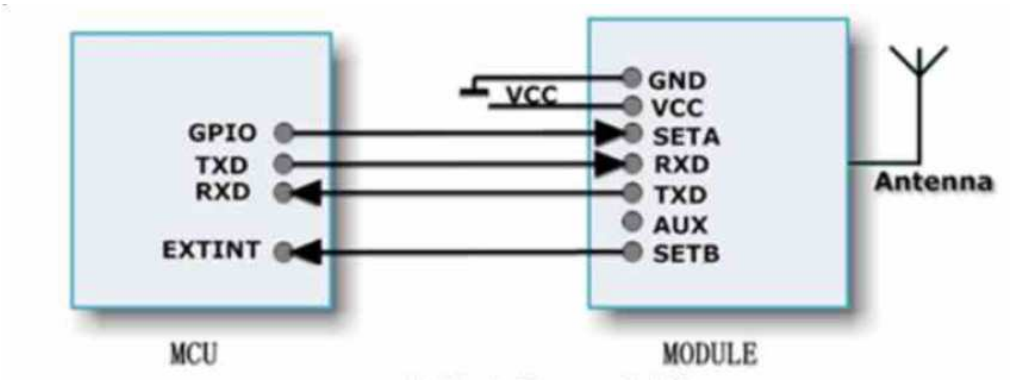


Chart 5 Connection Diagram of Module and MCU

2.5 Operation Mode

There are four operation modes: joint network, sleep (the Class C application has no sleep), data transmitting, and data receiving.

3. Specification & Parameter

Table 2 Specification & Parameter of Module

Model No.	HW-LW-M200
Module Diagram	
Size	32*19*2.5mm (SMA connector not include)
Modulation Technique	Chirp Spread Spectrum
Center Frequency	Customizable
Working Band	433MHz/470MHz/510MHz/868MHz/915MHz/923MHz
Channel Bandwidth	125/250KHz Configurable
Transmission Speed	0.25~50kbps
Radio Frequency Power	20dBm (max)
Receiving Sensitivity	-143dBm@SF12/125KHz
Protocol	LoRaWAN V1.0.2
Consumption	Standby: 5uA@5V/3.5uA@3.3V (Class A)/10mA; TX:130mA; RX: 10mA
Working Voltage	DC3.3V (2.6~3.6V) ; DC5V (3.5~5.5V)
Coverage Range	City: 2km; Suburb: 5km
IO Interface	GPIO*3, Serial port*2, Pin pitch: 2.54mm
Antenna Interface	SMA Connector pad, Stamp hole welding pad, Through hole welding pad
Antenna	Omnidirectional/orientated, suggest spring antenna for small space
Working Temperature	-40℃~85℃
Working Humidity	10%~90%RH (non-condensing)

4. Structure Size & Encapsulation

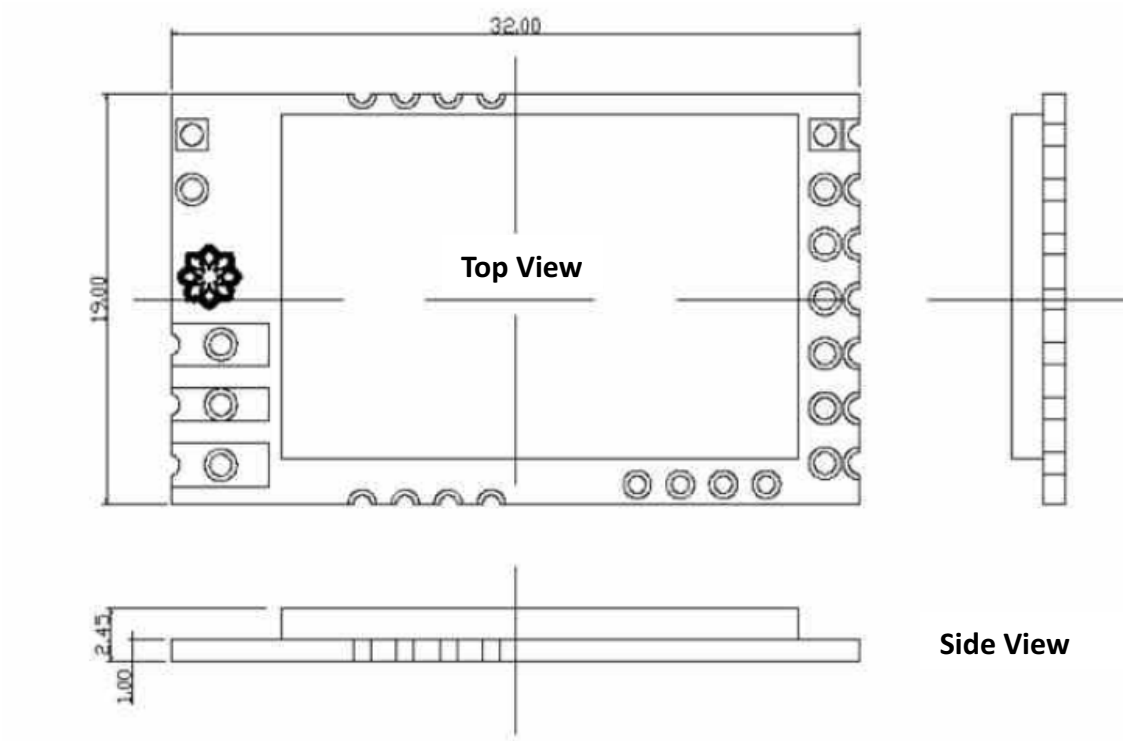
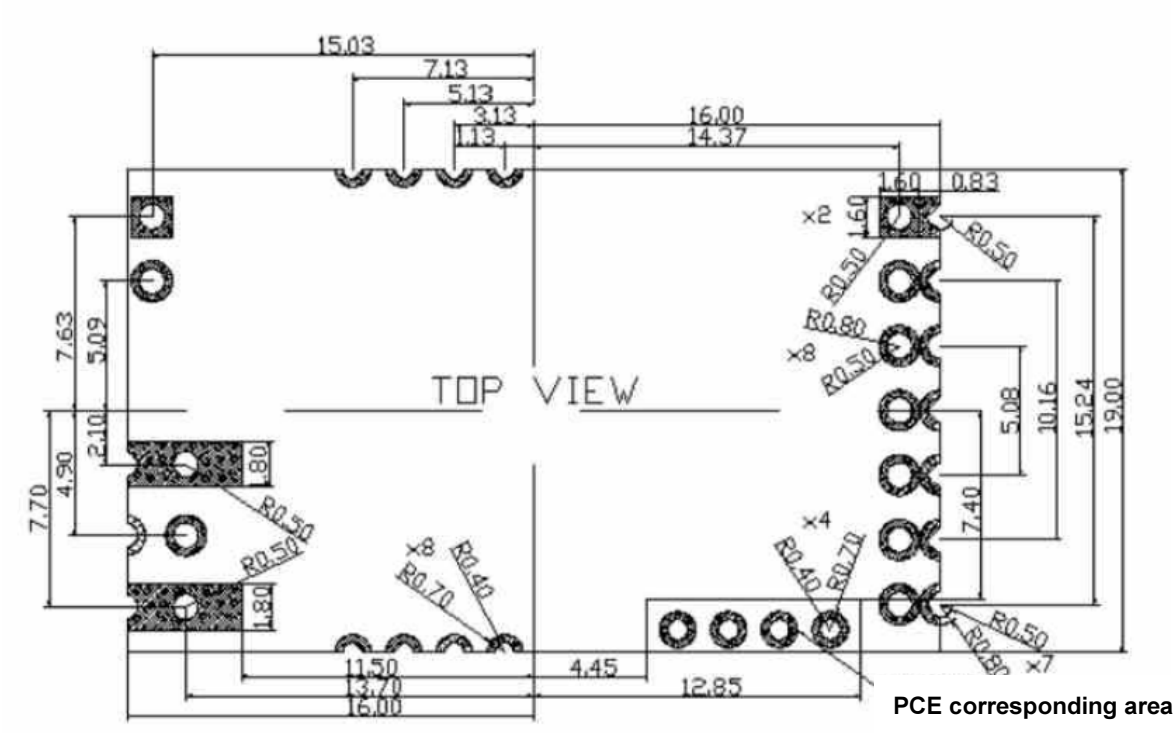


Chart 6 Structure Diagram



PCE corresponding area cannot be exposed to copper

Chart 7 PIN Size of BOTTOM Solder Pad
(18 semicircular stamp holes for SMT solder)

5. Design Reference of Antenna Matching Circuit

Because of the low frequency, long wave length, the band width of the spring antenna and the frequency deviation caused by the influence of the surrounding structure environment, it is suggested that the SMT soldering mode is adopted in the design of the application terminal products (especially the antenna built-in) circuit. The double L type or π type antenna matching circuit is added to the motherboard layout, and the 50 Ω characteristic impedance control of the micro strip line of the circuit is done well. Later, by adjusting the antenna matching value, the antenna can get better performance and enhance the wireless communication distance of the

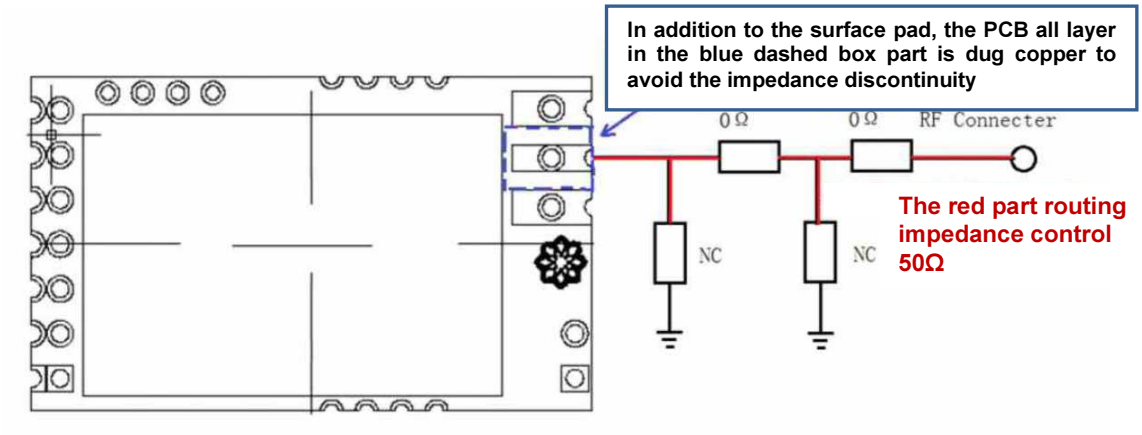


Chart 8 Antenna Matching Circuit

6. AT Instruction Set Description

Refer to **"AT Instruction Set Description-V.x.x.x"**

FAQ

1. **The difference between Class A and Class C operation mode?**

   In simple terms, the working state of M200 in Class C operation mode is can be only transmitting or receiving. It is apply to applications that requiring frequent downlink control and a certain requirement for timeliness. . The shortcoming is the power consumption for in receiving state the continuous power consumption of about 10mA.

   The receiving window of the Class A operation mode is opened only after transmitting, the time is very short, and then goes into sleep state. It is dedicated to the low power consumption and power saving application. When the data is needed, the data queue should be pushed down first. After the gateway receives the uplink data from the module, it pushes down the line data immediately.

2. Why the module M200 is so large in size?

Large size is compatible with more installation methods. Many traditional FSK solutions are limited to PCB area. The modules need to be soldered through the pins. The antenna needs to be directly welded to the module, or the SMA is welded on the module. Some products need to use SMT technology to facilitate production, so as to avoid manual welding.

3. Why does the module M200 do not recommend SMT welding?

Because in China, the frequency of the unauthorized frequency band is very low, the antenna has a long wavelength, and the monopole antenna (such as the spring antenna) is generally used. In order to give full play to the long distance communication characteristic of Lora, the performance of the antenna is also very important. The monopole antenna usually matches the antenna to make better performance. Please refer to the design reference of the antenna matching circuit in this document. In addition, the up and down frequency interval of CN470~510MHz band is greater than that of 10MHz, the frequency band has 40MHz bandwidth, and the full band coverage is done. The performance of the antenna is much worse than the 2MHz bandwidth of the 433MHz Band. It is more necessary to match the antenna to match the antenna performance.

4. Can the antenna of the module M200 be universal?

The antenna is a whole machine performance, which changes with the area of the main board, the material of the shell, and the environment in which the antenna is located. If the customer wants to share a certain antenna, it needs to adjust the matching device parameters of the antenna to fit in.

5. What should be paid attention to when installing M200 modules?

The characteristic of wireless communication is that the communication is unstable because of the influence of the environment, that is, the decline of the signal quality between the modules and the gateways will be weakened. This requires a certain allowance for the quality of the wireless signal in the actual installation. Below is a reference:

Spread spectrum factor (Reg Modulation Cfg)	Spread spectrum factor (Chip/ Symbol)	Signal-to-noise ratio of LoRa Mediator (SNR)
7	128	-7.5dB
8	256	-10 dB
9	512	-12.5 dB
10	1024	-15 dB
11	2048	-17.5 dB
12	4096	-20 dB

6. What is the average power of the module M200?

Because the LoRawan protocol does not have the page mechanism in GSM, it is not the active data of the upper computer MCU except for the 6 small time intervals. The M200 module is usually in sleep state. This requires the client to build a cycle time current model based on its application.

7. Why is the module M200 recommended to send 45 bytes?

The 45 byte satisfies the applications of SF12 and basically meets the information needs of most sensors. Fewer bytes will shorten the time of transmitting, and facilitate the transmission of wireless signals in the air, so as to achieve better wireless communication effect.

Maximum Payload Size

DataRate	Configuration	Maximum Payload Size(bytes)
0	LoRa: SF12 / 125 kHz	51
1	LoRa: SF11 / 125 kHz	51
2	LoRa: SF10 / 125 kHz	51
3	LoRa: SF9 / 125 kHz	115
4	LoRa: SF8 / 125 kHz	222
5	LoRa: SF7 / 125 kHz	222
6	LoRa: SF7 / 250 kHz	222
7	FSK: 51 kbps	222
8..15	RFU	

8. How is the ADR mechanism of the module M200 worked out?

The default configuration of the M200 module is ADR ON, SF7~SF12, which is automatically adapted by server according to the data byte length and signal quality reported on the module. If there is a special need, please provide information to facilitate the configuration when come out of the factory and, of course, users can also change configuration on the network management platform.

9. Access node capacity of the gateway

The access capacity of a system is the ability of a gateway to receive packets in a given time. Theoretically, a single gateway has eight receive channels, which can receive up to 1500 packets per day in full compliance with the LoRawan protocol. If the frequency of each sensor's packet is one per hour, the number of sensors that a single gateway can access is up to 80000 at a network load rate of 10%. Of course, this is just a theoretical value. In fact, the number of terminals that the gateway can access is ultimately related to the packet frequency, the packet size and the communication rate, and the field wireless network environment.

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