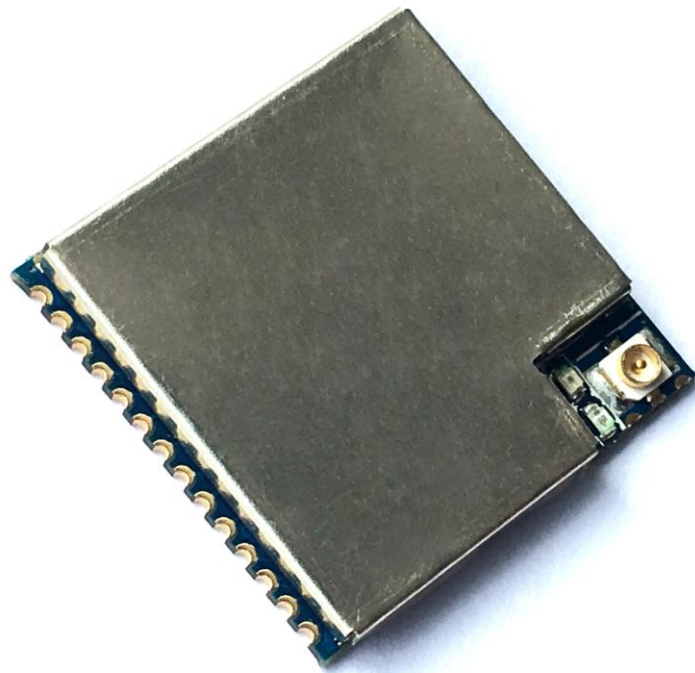

Spread Spectrum Wireless MESH Networking

Module RF1276MN

— Distributed MESH Networking —

Instruction Manual

Version: V1.0



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1、 Product Overview

RF1276MN is a high-performance, low power consumption, long distance micropower wireless MESH network module, the embedded wireless MESH network protocol, the MESH is distributed peer-to-peer MESH network, can make full use of the network routing redundancy, excellent self-healing network, stability, and excellent data throughpu.The networking time is very short.It can work as long as it is connected to the power supply, supporting level 7 routing, network coverage reached more than 10 km.

The physical layer adopts many advanced wireless communication technologies such as frequency-hopping, self-adaptive rate, safe and reliable full-network self-networking technology, interwoven error correction coding, etc. The link layer adopts intelligent collision avoidance algorithm with excellent anti-interference ability.

2、 Product Feature

- Based on LoRa™ spread spectrum modulation technology.
- 380-510MHz, 868MHz and 902-928MHz Free application frequency band
- Production without debugging,3.3 -5.5V wide voltage range, can be customized for 2.1-3.6V
- Micropower emission, standard power is 100mw,Seven levels can be set

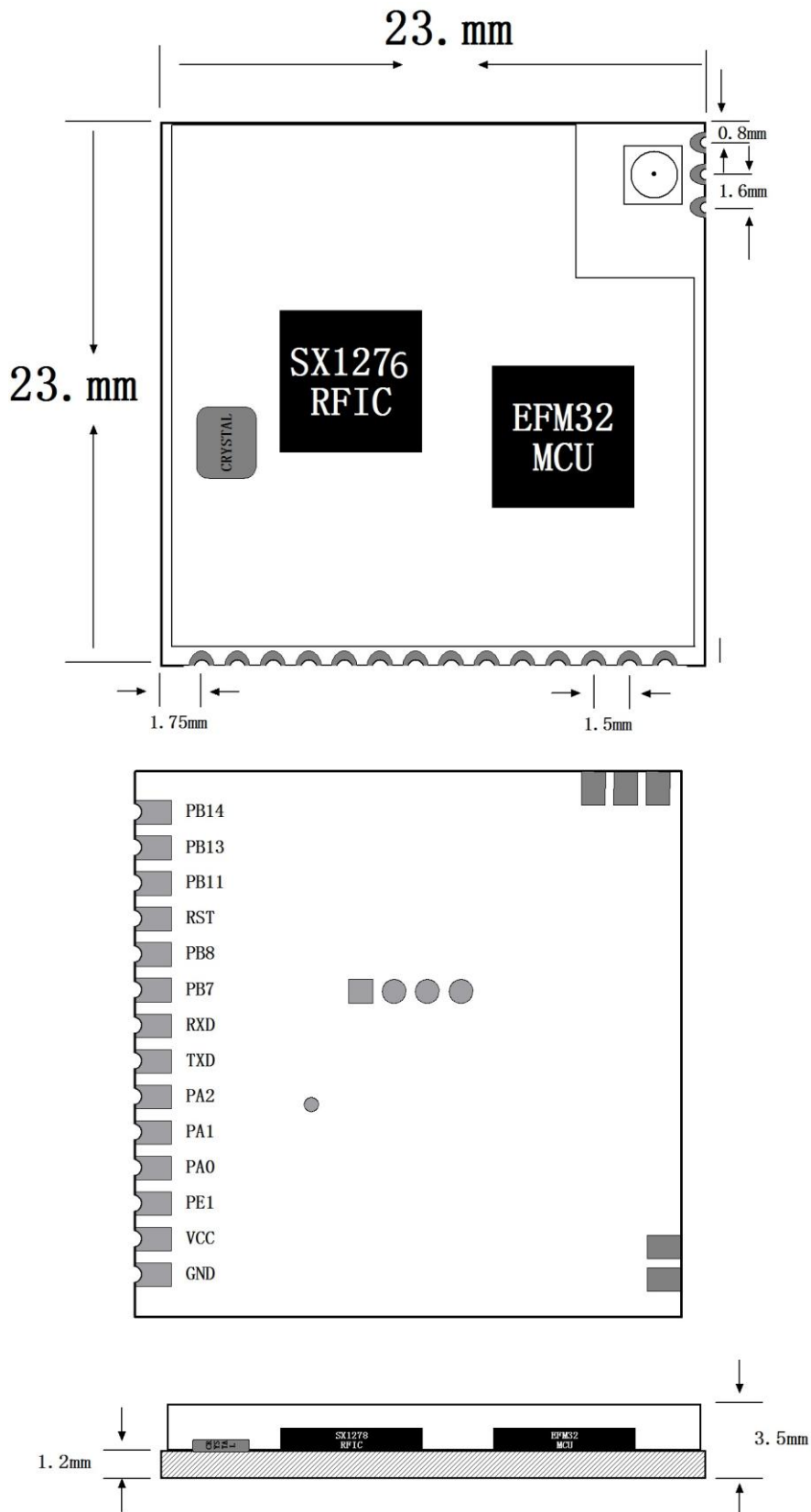
Level	1	2	3	4	5	6	7
Power	2.5mw	5mw	9mw	18mw	35mw	64mw	100mw

- Receiving sensitivity up to -148dBm,Maximum launch power +20dBm
- Adopt high efficiency forward error correction coding technology and frequency hopping mechanism, strong anti-interference ability, low error rate.
- MESH protocol hierarchical processing, provides a stable link.
- Distributed routing, a mesh network completely.
- Work as long as it is connected to the power supply,only needs to be done for the first time communication network function, establish a routing table.
- Module parameters can be set by software or microcontroller command flexibly
- 1.5mm standard half hole welding disk, easy for embedded installation.
- Built-in watchdog to ensure long-term reliable and stable operation.
- Open space single effective communication distance can be 2~ 4km.

3、 Application Fields

- ✓ Smart home,smart transport ,sensor network
- ✓ Industrial automation, agricultural modernization, intelligent building;
- ✓ Water, electricity, gas and warm meter automatic centralized meter reading system;
- ✓ Water conservancy, oil field, mine, meteorological information acquisition equipment;
- ✓ Street lamp control system,grid monitoring, wind-solar hybrid system
- ✓ Industrial equipment data wireless transmission ,industrial environmental monitoring;
- ✓ Everything else needs to be wireless instead of wired.

4. Dimensions & Construction



5、Pin Definition

Number	Pin Symbol	Pin Function	Pin Description
1	PB14	GPIO	Reserved IO port
2	PB13	GPIO	Reserved IO port
3	PB11	GPIO	Reserved IO port
4	RST	Hardware reset	Low level reset hardware
5	PB8	GPIO	Reserved IO port
6	PB7	GPIO	Reserved IO port
7	RXD	Data entry pin	Level data input foot, connect the user's TXD.
8	TXD	Data output pin	Level data output foot, connect the user's RXD.
9	PA2	GPIO	Reserved IO port
10	PA1	GPIO	Reserved IO port
11	PA0	GPIO	Reserved IO port
12	PE1	GPIO	Reserved IO port
13	VCC	Power supply	Power range 4.5V-5.5V(customized 2.1-3.6V)
14	GND	电源地	GND (usually connected to the user's GND.)

Note: TXD,RXD 3.3V level, if the user's MCU is 5V, it is suggested to make level conversion for stability,.

6、Technical Parameters

Modulation Mode:	LoRa™ spread spectrum.
Working Frequency:	380-510MHz, 868MHz and 902-928MHz
Transmission Power:	20dBm.
Receiving Sensitivity:	-148dbm.
Serial Port Speed:	1200bps ~ 57600bps (default 9600bps)
Interface Check:	8E1/8O1/8N1 (optional)
Working Voltage:	3.3 ~ 5.5V (customized 2.1 ~ 3.6v) (output 20dBm)
Emission Current:	less than 120mA (transmitting power 20dBm)
Receiving Current:	less than 15.2mA.
Forwarding Time:	200ms
Working Temperature:	-40 ~ +80 °C (industrial level)
Working Humidity:	10% ~ 90% relative humidity, no condensation.

7、 Network Introduction and Application.

7.1 Introduction of Group Network Jump

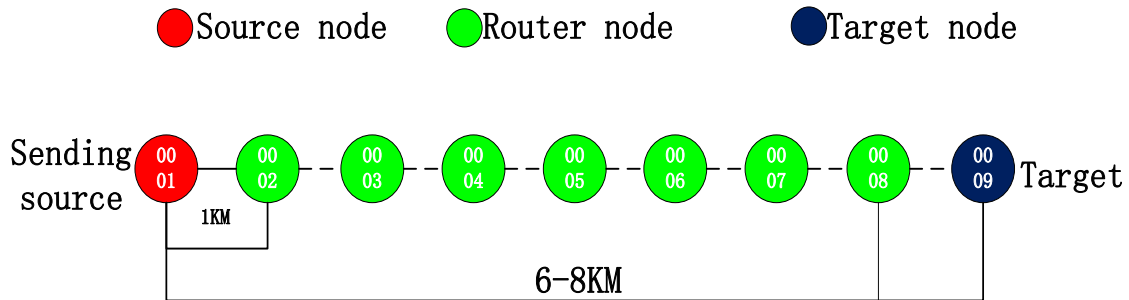


Figure 7.1 Seven - level eight - hop network schematic diagram

Description: The seven - level eight - hop network refers to the data sent by the source to the final destination, which passes through seven routing nodes on the way. If the distance between the two points is 1km, the transmission distance of a network can reach 6-8km or even further. And each participant in the network can be the target of communication.

7.2 Introduction of Networking Applications.

A basic MESH network consists of multiple node modules(slave or node) and a concentrator module(master or root).The slave module and master module have two-way data interaction, which can be repeated by the slave module several times.The data flow from master to slave is called down and vice versa.The downstream data transmission mode is broadcast (all nodes can receive the data sent by the master);Uplink data transmission mode is unicast (slave sends data to the nearest master) ,the selection of routing is done automatically. If you have more than one concentrator master, the slave transfer data will automatically upload to the recently communicated master, and the other master will not receive it.

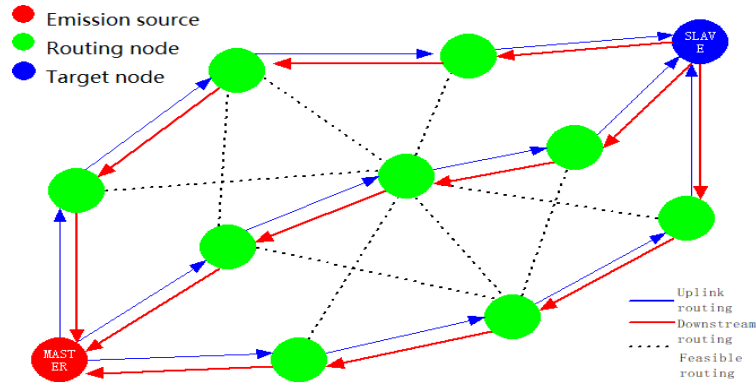


Figure 7.2.1 MESH network data transmission schematic diagram

With the RF1276MN module, you can easily build a MESH network with a minimum of 2 points or up to thousands of points. MESH network is a completely distributed symmetric network, only a single device type can be used in theory. Because it is a distributed peer network, there is no center or node in the whole network, and all nodes have equal rights in the network.

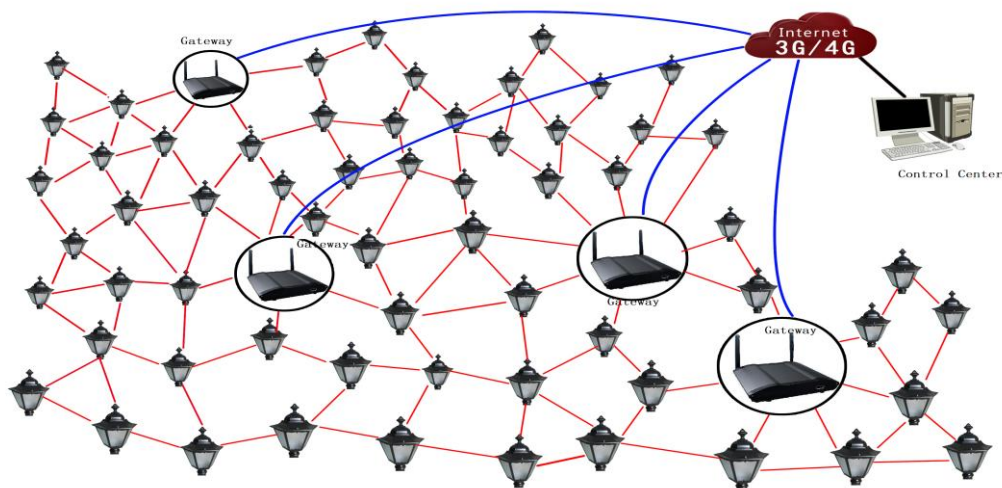


Figure 7.2.2 RF1276MN module network application schematic diagram

The RF1276MN module can easily form good performance, mature and stable distributed ad-hoc network MESH network, represents the most advanced level, ad-hoc network technology can replace the cable, point to multipoint and centralized network mode, greatly expand the network coverage and network robustness, and can effectively reduce the equipment cost and maintenance cost.

The RF1276MN module is applied in the field of self-organizing network, such as sensor network, wireless meter reading, smart home, etc., which has obvious technical advantage and price advantage. For example, the RF1276MN of wireless meter reading scheme, can only need to send a broadcast message within a very short time to realize the entire network instrument set copy, don't need to copy to read one by one, a single instrument greatly saved copy reading time. In the absence of

external interference and isolated nodes, the success rate of single-time net copying of MESH wireless meter is 100%.

8、 Introduction to Distributed Routing Protocol

Mobile ad-hoc network (MANET) is a multiple of mobile nodes have routing function multiple hops network, data transmission needs collaboration of multiple nodes to complete, so part of the routing protocol in MANET is crucial. Compared with the traditional wired network, MANET has its own characteristics, such as distributed control, the dynamic change of network topology, the wireless transmission bandwidth and node ability is limited, poor security, routing with short survival time, etc. The ideal MANET routing protocol should have the following characteristics.:

- Distribution of the law, distributed algorithm: more suitable for decentralized distributed control network.
- Strong adaptability: adaptable to rapidly changing network topology.
- No loop: no loop is the basic requirement of any routing protocol, which can avoid routing errors and bandwidth waste.
- Low cost of routing calculation and maintenance control: the most complete and powerful function with minimal control overhead is the goal of all routing protocols to work together.
- Suitable for large-scale network; good robustness and extensibility.

The single-path routing protocol is not suitable for MANET, for the following reasons:

1. Wireless network node mobility is high, bandwidth resources are limited, and the connection interrupt rate is high, resulting in high network splitting opportunity. Single path routing algorithm is too expensive and slow to converge.
2. Routing need to be established by flooding technology, and when the nodes move led to the original route expires, The maintenance of single path routing also requires flood, which will occupy network bandwidth. when the network has a number of medium and even a large number of routing need maintenance, frequent tech-oriented flood makes on-demand routing protocol routing control overhead is very large.
3. Single path routing protocol does not take fairness into account , tend to take heavy load distribution to the source to destination node on the nodes of the shortest path, unable to get well and track the entire network topology information.
4. Single path routing protocol data sent using only one path, unable to send data in parallel or concurrently, It leads to low network transmission rate, increasing delay time and unbalancing network load, resulting in network congestion.

The path of the MANET from any source node to the destination node is usually multiple, and the nodes have random mobility, so the topology of the entire network changes frequently. The multi-path

routing protocol can overcome the disadvantages of the single path routing protocol, and can make full use of network resources, balance network load, improve communication performance and avoid network shock. MESH by private on-demand lightweight dynamic multipath routing protocols, this protocol is for hardware resources strict mobile ad-hoc network design, suitable for mobile speed, fast wireless network topology changes. Routing protocol can maximum limit reduce routing overhead, establish and maintain process can be in multiple paths in parallel data packets to send, can sense the change of network topology and right by the updated without the need for flood, seamless switching between different routing. The main features are as follows: each node maintains as much routing information as possible; There is no routing loop; Good route stability and fast establishment; Capable of maintaining full use of wireless signal redundancy, constantly routing maintenance and update, no additional overhead; The routing algorithm weighs many factors such as distance vector, signal energy, link quality and battery voltage, etc. It is very sensitive to the change of network topology structure, and the routing can be optimized quickly. High network throughput; Support 7-level routing, network size.

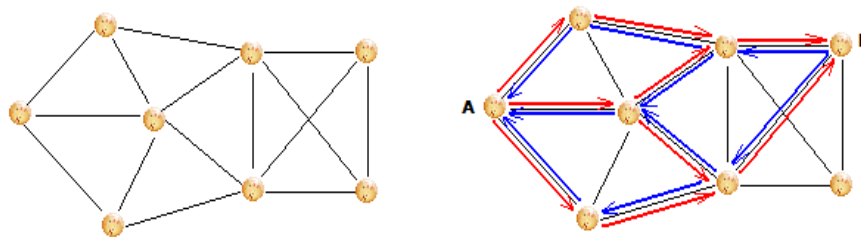


Figure 8.1 Multipath schematic diagram

MESH multipath routing schematic diagram as shown above, network topology diagram as shown on the left, black line represents the link between nodes. The right side is the data link established by A and B, the red line is the path from A to B, and the blue line is the reverse path. The route is built through flood, and there is no closed loop between multiple paths, allowing multiple paths to intersect. Each node chooses as many nodes as possible for its next hop route, and the data message can be dynamically switched between multiple paths and can be transmitted in parallel. Failure routing detection, new path discovery, network topology change by listening to the handshake between adjacent nodes to perceive, neither need to carry out flood or additional overhead. All nodes, including source node, only need to look for his next hop relay nodes, and don't need to make sure the whole path. Therefore, the cost of routing protocol is very small, which is suitable for the fast changing mobile network of topology structure. It can quickly find the real-time best route, and support the large-scale network of 7 level routes.

MESH Routing protocol combines multiple selection algorithms for Routing, including distance vector, signal quality (link state) and node residual power - MMBCR (Min-Max Battery Cost Routing). The distance vector algorithm determines the path based on the distance of the destination,

and each node maintains a vector table, which lists the best distance from the current known target to each target. Nodes can choose nodes that are closer to the destination than themselves as forwarding routes based on this vector table. According to the distance vector algorithm, the shortest path between two nodes can be found, but it is not necessarily the best path.

Unlike wired networks, for MANET, wireless signals are easily affected by external interference, resulting in short survival time and poor stability of data link. The routing protocol must be able to correctly select the path with good signal quality and link stability to ensure the stability, real time, reliability and anti-interference ability of the network. MESH routing protocol can quickly detect multiple routing instant link quality, can choose the best link quality path in a very short time as routing path, and can choose closest path as routing path when necessary. MESH link-state routing algorithm diagram as shown below, A through B relay to C is A - B - C path interference for unstable link, but this is also A to have another link quality good path C A - D - E - C. Although the path of a-b-c is closer, the success rate of the receiving of the link instability message is very low, which will greatly increase the probability of retransmission of the message. However, if a-d-e-c is selected, although the distance is far away, it can guarantee the reliability and real-time performance of the message transmission.

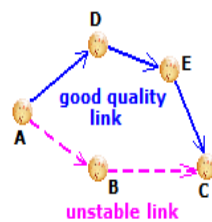


Figure 8.2 MESH Link state algorithm route selection schematic diagram

In addition, for MANET, routing selection needs to fully consider the power of the node battery, and should avoid the nodes with low battery power. MESH routing protocol adopts MMBCR algorithm, which will automatically select the nodes with relatively large amount of power to route. MESH node routing algorithm diagram as shown below, soc can B relay to C is A - B - C but node B remaining power is low, at the same time A to C with another A bit far from the path of A - D - E - C, path of nodes in the remaining power is higher. The choice of A-B-C is closer, but it will soon run out of B. If you choose a-d-e-c, although the distance is far away, it will increase the service life of the whole network and reduce the maintenance cost of the system.

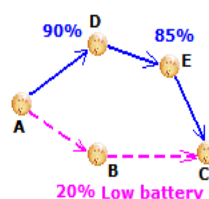


Figure 8.3 MESH node residual power routing schematic diagram

MESH routing protocol is an ideal routing protocol for MANET design. It has the characteristics of distributed, robust, self-healing capability, light weight, multi-path, no loop, large network scale and suitable for mobile network.

9、Parameter Configuration

After connecting the module to the computer, we can modify the parameters through the computer software of our company, or send the command setting directly through the user's SCM, and refer to the computer communication protocol.

9.1 Hardware Connection

- 1、 Confirm the interface level of the module,TTL.
- 2、 Switch the computer serial port to the corresponding level and then connect the module,as shown in figure 9.1.

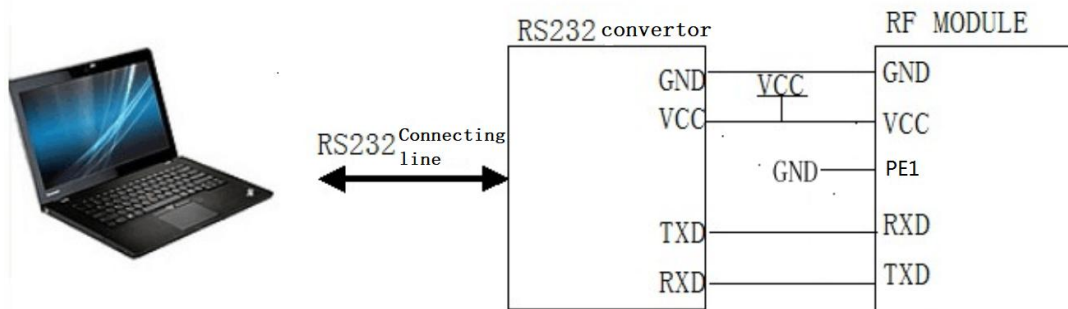


Figure 9.1 Wireless module and computer connection diagram (TTL)

9.2 Parameter Configuration

First, the serial port parameters of the module can be confirmed, and the serial port parameters can be obtained through the serial debugging assistant. Method is to open the serial debugging assistants, choose corresponding port, port parameter is set to 9600 BPS, no check, 8 data bits, 1 stop bit, connection module, A power supply will send the current serial port parameters of the module and display it on the debugging assistant.as shown in figure 9.2.1.

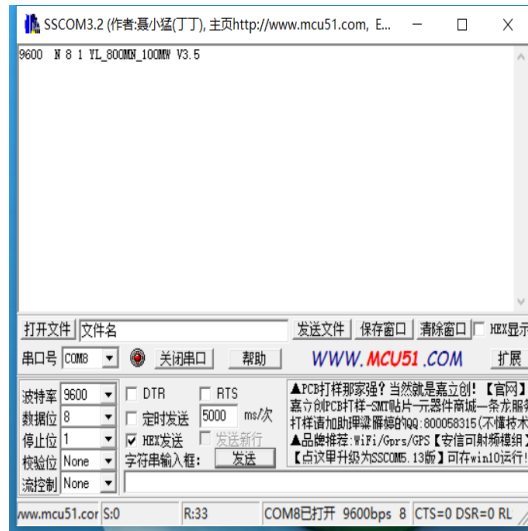
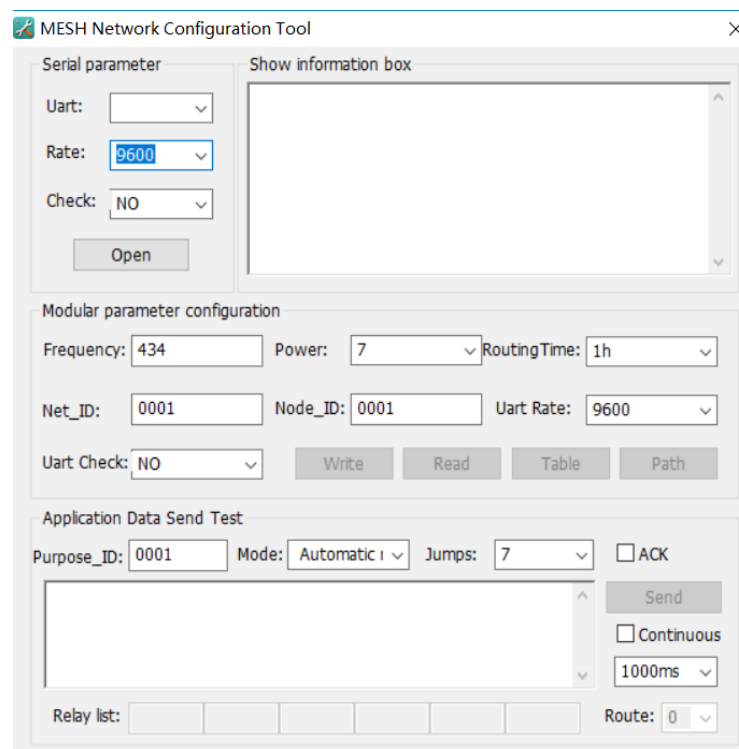
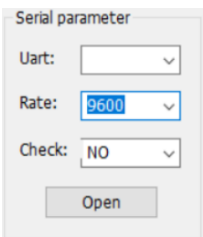
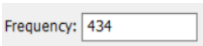

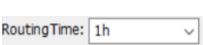
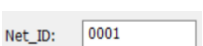
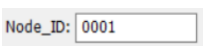
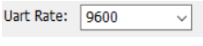
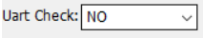
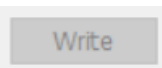
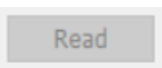
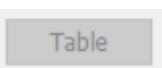
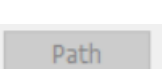



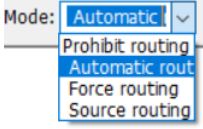
Figure 9.2.1 Use serial debugging assistant to obtain the current serial port parameters and software version

9.3 The User interface of MESH Network configuration RF tool.



9.4 Configuration RF tool Description

Graphic Symbol	Name	Function Description
	Serial parameter	Open the module to connect the COM port corresponding to the computer, select the same serial port parameter as the module to read or write module parameters normally.
	Frequency configuration	According to the user demand, can set the module's launch frequency. Note: this parameter should avoid the multiple frequency of 32M, otherwise it will affect the communication distance.
	Power configuration	According to the user's demand, the transmitting power can be set by itself, and the higher the power, the farther the transmission distance is.
	Routing Time	The effective routing path stored in the module does not occur during the setting time, and the path will be cleared automatically at the end of the lifetime.
	Network ID configuration	Can be configured as 1~65535; Only modules under the same network address can communicate.
	Node ID configuration	Can be configured as 1~65535; As an identifier in the network.
	Uart rate	The default is 9600bps, configured to be the same as the connection device (the baud rate read by the serial debugging assistant).
	Uart check	The default is uncheckable, configured to be the same as the connection device.
	Writing configuration	Write the parameters in the current software page to the module.
	Reading configuration	Read the configuration read configuration
	View routing	The node, the next level and the target node of the node are displayed graphically. Easy user view path (detailed below)
	Check path	The complete network path structure is displayed graphically or graphically. Note: this feature can only be viewed in the source module (detailed below)
	Destination Address	Communication object identification code.

	Routing Type	<p>Prohibit routing:No routing is prohibited.</p> <p>Automatic routing : After First communication save the path successfully , no secondary search network process.</p> <p>Forced routing: Every time thereis a process of finding a network when sending the date</p> <p>Source routing:Transmitted by the set path.</p>
<input type="checkbox"/> ACK	ACK request	Enable ACK reply after check.(Not recommended)
<input type="button" value="Send"/>	Sending data	Sending data
<input type="checkbox"/> Continuous <input type="text" value="1000ms"/>	Sending data continuously	Sending data continuously(optional interval)
<input type="button" value="Relay list"/>	Source routing path configuration	According to the requirement, the routing path will be filled in. The module will push the data according to the set path, and the maximum can be set to 6 routes.

9.4.1 Check the Routing Function

The following is the entire routing process for the 00 01 source sending data to the target of 00 03, of which 00 02 is the routing node between the source and target.

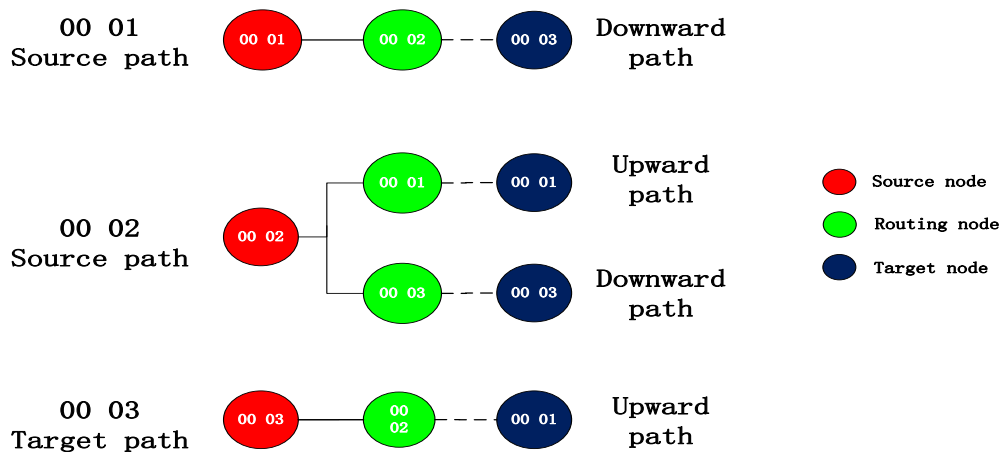


Figure9.4.1 Routing diagram

Explanation:Each participant in the network can view the local node, the next hop node, and the final destination node through the "view route" function in the upper computer.

9.4.2 Check the Full Routing Path Functionality.

The following is the entire routing process from the source to the target of 0001, of which 00 02-00 08 is the routing node between the source and target.



Figure9.4.2 Full path diagram

Explanation: the source module in the network can view the route of the entire path and the field strength between the two points through the "full path" in the upper computer. The larger the field strength, the stronger the signal.

Note: The customer can use this function to make the routing table of the whole network on the MCU.

10、 Instruction Parse

10.1 Frame Format

10.1.1 General Frame Format

Frame Type	Frame Number	Command Type	Load Length	Load	Check
1 byte	1 byte	1 byte	1 byte	N byte	1 byte
Frame Header				Frame Load	Frame Tail

10.1.2 Frame Header Instruction

10.1.2.1 Frame Type

The frame type is used to identify different application frame types. The standard type is defined as follows:

Frame Type	Type Name	Instruction
0x01	Module parameter	read and write the internal parameters
1 0x05	Application Data	Used for networking protocol application layer interfaces.

10.1.2.2 Frame Number

The frame number is currently unused and the value is fixed to 0x00.

10.1.2.3 Command Type

The command type has different definitions under various frame type identifiers, and the specific reference is as follows:

As in the frame type 0X01, the command type has the following meanings:

Command Type	Command Instruction
0x01	Write configuration information request.
0x81	Write configuration information reply.
0x02	Read the configuration information requests.
0x82	Read the configuration information reply.
0X03	Read the routing table request
0X83	Read the routing table reply
0x06	Read the version information request
0x86	Read the version information reply
0x07	Reset the module request
0x87	Reset the module reply
0X08	Read the entire routing table require
0X88	Read the entire routing table reply

For example, the command type in frame type 0X05 has the following meaning:

Command Type	Command Instruction
0x01	Routing data request
0x81	Routing data reply

10.1.2.4 Load Length

The load length domain refers to the length of the frame load part in frame format, that is, the sum of all bytes from the time of the field to the frame check. The maximum load length of this agreement is 117 bytes.

10.1.3 Frame Load

The frame load part refers to all parts of the frame in the frame format after the load length, and the format is determined by different types of frames and different types of commands. The specific format is as follows:

10.1.3.1 Configure the Data Frame Load.

Configuration Flag	Transmitting Frequency	Transmitting Power	Routing Lifetime	Network ID	Node ID	Port Rate	Port Check
2byte	3byte	1byte	1byte	1byte	1byte	1byte	1byte
Frame Load							

10.1.3.2 Prohibit

Routing、Automatic Routing and Mandatory Routing Data Request Frame Load Format

Destination Address	ACK Request	Sending radius	Routing Type	Data Length	Data
2byte	3byte	1byte	1byte	1byte	N byte
Frame Load					

10.1.3.3 Source Data Request Frame Load Format

Destination Address	ACK Request	Sending radius	Routing Type	Repeater Number	Repeater List	Data Length	Data
2byte	3byte	1byte	1byte	1byte	1byte	N*2byte	N byte

Note: The frame types of other operation modules are relatively simple, and are introduced in detail later.

10.1.3.4 Frame Tail

The frame tail is one byte or checksum. This checksum is the result of all the byte differences or operations before the first byte (the frame type byte) starts from the frame header to the check byte. Check the entire frame of all the byte or the result of the operation is 0 is correct.

10.2 Configure the Operation Command Frame Format

10.2.1 Read and Write the Configuration Information Request

10.2.1.1 Read the Configuration Information Request

Request	01 00 02 0D A5 A5 00 00 00 00 00 00 00 00 00 00 00 0E
Reply	01 00 82 0D A5 A5 6D 00 12 07 17 00 01 00 01 03 00 E2

Sending Data instruction:

01: Data type, read and write parameters data types.

00: Frame number, fixed "00"

02: Read the configuration information request

0D: Load length

A5 A5: Represents the head, fixed configuration flag

00 00 00: Transmitting frequency

00: Transmitting power

00: Routing lifetime, 0-23 Each represents 1 to 24 hours

00 00: Network ID

00 00: Node ID

00: Port rate 0-1200、1-2400、2-4800、3-9600、4-19200、5-57600、6-115200

00: Port check 00-NO、01-ODD、02-EVEN

0E: Check

Receiving Data instruction:

- 01: Data type, read and write parameters data types.
- 00: Frame number, fixed "00"
- 82: Read the configuration information reply
- 0D: Load length
- A5 A5: Represents the head, fixed configuration flag
- 6D 00 12: Transmitting frequency
- 07: Transmitting power
- 17: Routing lifetime, 0-23 Each represents 1 to 24 hours
- 00 01: Network ID
- 00 01: Node ID
- 03: Port rate 0-1200、1-2400、2-4800、3-9600、4-19200、5-57600、6-115200
- 00: Port check 00-NO、01-ODD、02-EVEN
- E2: Check

10.2.1.2 Write the Configuration Information Request

Request	01 00 01 0D A5 A5 6D 00 12 07 17 00 01 00 01 03 00 61
Reply	01 00 81 0D A5 A5 6D 00 12 07 17 00 01 00 01 03 00 E1 39 36 30 30 20 20 4E 20 38 20 31 20 59 4C 5F 38 30 30 4D 4E 5F 31 30 30 4D 57 20 56 33 2E 35 0D 0A

Sending Data Instruction:

- 01: Data type, read and write parameters data types
- 00: Frame number, fixed "00"
- 01: Write the configuration Information request
- 0D: Load length
- A5 A5: Represents the head, fixed configuration flag
- 6D 00 12: Transmitting frequency
- 07: Transmitting power
- 17: Routing lifetime, 0-23 Each represents 1 to 24 hours
- 00 01: Network ID
- 00 01: Node ID
- 03: Port rate 0-1200、1-2400、2-4800、3-9600、4-19200、5-57600、6-115200
- 00: Port check 00-NO、01-ODD、02-EVEN
- 61: Check

Receiving Data Instruction:

- 01: Data type, read and write parameters data types
- 00: Frame number, fixed "00"
- 81: Write the configuration information reply
- 0D: Load length
- A5 A5: Represents the head, fixed configuration flag

6D 00 12: Transmitting frequency

07: Transmitting power

17: Routing lifetime, 0-23 Each represents 1 to 24 hours

00 01: Network ID

00 01: Node ID

03: Port rate 0-1200、1-2400、2-4800、3-9600、4-19200、5-57600、6-115200

00: Port check 00-NO、01-ODD、02-EVEN

E1: Check

Note: The rest of the code, click to cancel Hex code display, will appear version information. This is because the module restart will send version information to the serial port.

10.2.2 Read the Routing Information Request

The following is the routing table of 00 01 and directly to 00 02.

Request	01 00 03 00 02
Reply	01 00 83 3C 00 01 02 1D 00 02 00 00 02 7D 51 01 00

Sending Data Instruction:

01: Data type, read and write parameters data types

00: Frame number, fixed "00"

03: Read the routing information request

00: Load length

02: Check

Receiving Data Instruction:

01: Data type, read and write parameters data types

00: Frame number, fixed "00"

83: Read the routing information reply

3C: Routing table maximum storage path.

00 01: Node ID

02 1D: Load length

00 02: Target address

00: Routing information, 00- routing efficiency, 01- routing discovery, 02- route discovery failure, 03- routing invalid.

00 02: Next jump address

7D 51 01 00: The remaining lifetime of the routing, the unit is s, minus one number per second. If this number is "0", the module will automatically delete the path.

Note: the above content is only part of the content, the remaining content format is the same, or is filled with "FF".

10.2.3 Read the Version Information Request

request	01 00 06 00 07
reply	01 00 86 18 59 4C 5F 38 30 30 4D 20 56 31 2E 30 20 32 30 31 37 2D 30 39 2D 30 35 00 D1

Sending Data Instruction:

01: Data type, read and write parameters data types

00: Frame number, fixed "00"

06: Read the Version Information Request

00: Load Length

07: Check

Receiving Data Instruction:

01: Data type, read and write parameters data types

00: Frame number, fixed "00"

83: Read the Version Information Request

18: Load Length

The rest of the code, click to cancel Hex code display, will appear version information.

D1:Check

10.2.4 Reset Request

Request	01 00 07 00 06
Reply	01 00 87 01 00 87 39 36 30 30 20 20 4E 20 38 20 31 20 59 4C 5F 38 30 30 4D 4E 5F 31 30 30 4D 57 20 56 33 2E 35 0D 0A

Sending Data Instruction:

01: Data type, read and write parameters data types

00: Frame number, fixed "00"

07: Reset request

00: Load length

06: Check

Receiving Data Instruction:

01: Data type, read and write parameters data types

00: Frame number, fixed "00"

87: Reset reply

01: Load length

00: load

87: Check

The rest of the code, click to cancel Hex code display, will appear version information, This is because the module restart will send version information to the serial port.

10.3 Application Data Frame Format

10.3.1 Prohibit Routing、 Automatic Routing and Mandatory Routing Data Frame Load Format

Frame Type	Frame Number	Command Type	Load Length	Target Address	ACK Request	Sending Radius	Routing Type	Data	User's Data	Check
1byte	1byte	1byte	1byte	2byte	1byte	1byte	1byte	1byte	N byte	1 byte
Frame Header				Frame Load						XOR

Example: 05 00 01 09 00 02 00 07 01 03 AA AA AA A0

Frame Type: 05 -Sending user's data

Frame Number: 00 -Fixed

Command Type: 01 -Sending the application data request

Load Length: 09- The number of bytes from one byte after the load length byte to one byte that before the check byte.

Target Address: 00 02

ACK Request: 00—No ACK reply、01--ACK reply

Sending Radius: 07

Routing Style: 00—Prohibit Routing、01—Automatic Routing、02—Mandatory

Routing、03—Source Routing

Data Length: 03

User Data: AA AA AA

Check: A0

10.3.2 Source Routing Data Frame Load Format

Frame Type	Frame Number	Command Type	Load Length	Target Addr	ACK Request	Sending Radius	Routing Type	Repeat Number	Repeat List	Data Length	User Data	Check
------------	--------------	--------------	-------------	-------------	-------------	----------------	--------------	---------------	-------------	-------------	-----------	-------

				ess		s		r			a	
1 byte	1 byte	1 byte	1 byte	2 byte	1 byte	1 byte	1 byte	1 byte	N*2 byte	1 byte	N byte	1 byte
Frame Header				Frame Load								XOR

Example: 05 00 01 10 00 02 00 07 03 03 00 03 00 04 00 05 03 AA AA AA BA

Frame Type: 05 -Sending user's data

Frame Number: 00 -Fixed

Command Type: 01 -Sending the application data request

Load Length: 10- The number of bytes from one byte after the load length byte to one byte that before the check byte.

Target Address: 00 02

ACK Request: 00—No ACK reply、01--ACK reply

Sending Radius: 07

Routing Style: 00—Prohibit Routing、01—Automatic Routing、02—Mandatory

Routing、03—Source Routing

Repeater Number: 03—00 03、00 04、00 05

Data Length: 03 Sending 3 bytes

User Data: AA AA AA

Check: BA

11、Wireless Upgrade

The RF1276MN module integrates wireless upgrade functions so that customers can upgrade and modify them online.The operation method is described as follows.

Preparation Tool:

1: RF1276T standard module, transmitting upgrade program (mediation tool), a RF1276MN module to be upgraded.

2: Computer、software、upgrade program

3: Relative modules,connecting lines

Procedure:

Select the serial number of the RF1276T standard module connection, and the program to be upgraded is no longer upgraded.The following figure shows.

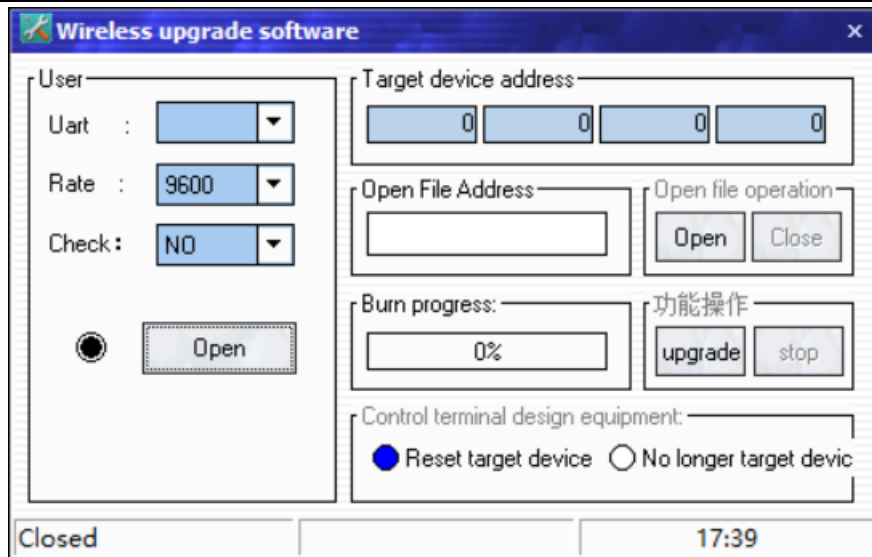


Figure 11.1 Upgrade tool interface diagram

Note: the table address on the software does not need to be addressed. This is for upgrading other modules.

Then, to upgrade the RF1276MN module to upgrade mode, the method is to send commands to the module via serial port.

Command Code: 01 00 09 08 64 6f 77 6e 6c 6f 61 64 14

Reply Code: 01 00 89 01 00 89

The module enters the download mode and finally clicks the upgrade button. The module will start to upgrade. After the upgrade is completed, the module will start automatically and normal procedures will be carried out.

Note: The whole process of module upgrade will not erase the setting parameters of the module. So the updated parameters are the same parameters as before the upgrade. In the upgrade process, if the upgrade is not successful, it can be upgraded. If the program is wrong, or the upgrade is not our company, then the module will return to the company for maintenance.

12、 Antenna Selection

The antenna is an important part of the communication system. The performance of the antenna directly affects the index of the communication system, and the user must pay attention to its performance when selecting the antenna. There are generally two aspects:

- (1) antenna type -- whether the radio coverage of the antenna meets the system design requirements;
- (2) electrical performance -- the frequency bandwidth, gain, impedance and rated power of the antenna meet the requirements of the system design. Generally, the impedance of the antenna is 50, and the standing wave ratio is less than 1.2.

Our company offers a variety of antenna solutions, the user selects according to the actual situation, in order to achieve the best transmission effect.



13、 Notes

Considering the complexity of air transmission and the inherent characteristics of wireless data transmission, we should pay attention to the following problems.

1) data delay

Because wireless communication transmitted from terminal to receive a certain amount of data, or wait for some time no began to launch the new data, wireless transmitter to the receiver of wireless communication there are a few tens of milliseconds to delay (specific delay by serial port rate, air rate and packet size), from wireless communication receiver to terminal equipment also need a certain amount of time, but also under the condition of delay time is fixed.

2) flow control

In order to ensure the data integrity, please try to compress the packet size of single sent, avoid the data overflow due to insufficient cache, and reduce the probability of packet loss.

3) error control

The RF1276MN module has strong anti-interference ability, but under extreme conditions, it is inevitable to receive poor reception or packet loss. At this point, customers can increase the development of the link layer protocol of the system, such as increasing the loss of packet retransmission function, which can improve the reliability and flexibility of wireless network.

14、 Attentions

- (1) when installing the module, the position of the antenna should not be too close to the MCU of your product to prevent interference;
- (2) when power supply is supplied, please confirm that the ground line of the module is connected to the ground wire of your product;
- (3) when working normally, do not touch the module and the antenna part so as to achieve the best transmission effect.

15、Eliminate of Frequent Malfunction

Note: if the LED light is always on, this should not be ignored because the module has a protection program and will automatically recover. If it is often bright, find out why. The receiving and receiving of LED light is not normal. The customer needs to send the data again.

Fault phenomenon	Fault Reason	Solution
Low transmission distance	Complex environment and many obstacles.	Use in an open environment with a high antenna or lead to the outside.
	Bad weather, such as haze, rain, snow, dust and so on.	Avoid using in inclement weather, or replace high power modules.
	The antenna does not match and the antenna gain is small.	Select the matching antenna and try to use the high gain antenna.
	High transmission rate	Reduced communication rate, including serial port rate and air speed.
	There may be a similar frequency or strong magnetic or power interference.	Replace the channel or away from the source.
Unable to communicate properly	Incorrect connection	Refer to the manual wiring diagram for correct wiring.
	Poor contact	Reconnect the power cord and signal wire, and weld as securely as possible.
	The module does not match the level of the device.	Match TTL/RS232/RS485 interface.
	The module does not match the device parameters.	Reconfigure parameters, baud rate, check, e
	The parameters between receive and receive modules do not match.	Reconfiguration parameters, frequency, channel, air speed, etc.
	Large data throughout	Subcontract transmission, or replacement of higher performance modules.
	The module level conversion chip is burnt.	Replace RS232, RS485 chip.
	The module body has been corrupted.	Replace the new module

RF1276MN Mesh LoRa module

	The user's device has been damaged.	Switch to a wireless module after the cable test is successful.
High Error Rate	There is interference with the same frequency signal nearby.	Stay away from interference sources or modify frequency and channel avoidance.
	The antenna feedback system does not match well.	Replace the good antenna feedback system.
	Serial port or air baud rate setting is incorrect.	Device rate, module serial port rate, module air transmission rate are the same.
	Excessive communication rate	Communicate rate as low as possible, especially in the air.
	Large power ripple	Replace the stable power supply.
	The interface cable is too long.	Replace the cable or shorten the cable length.
LED Light is Always on when the Module is Sent and Received.	When the module sends the data, the power is under voltage.	Improve power performance
	The module RF chip has been damaged.	Replace module
	The antenna is poor in wave ratio.	Replace antenna

Statement: The company reserves the right of final interpretation and modification of the manual of this product without notice.