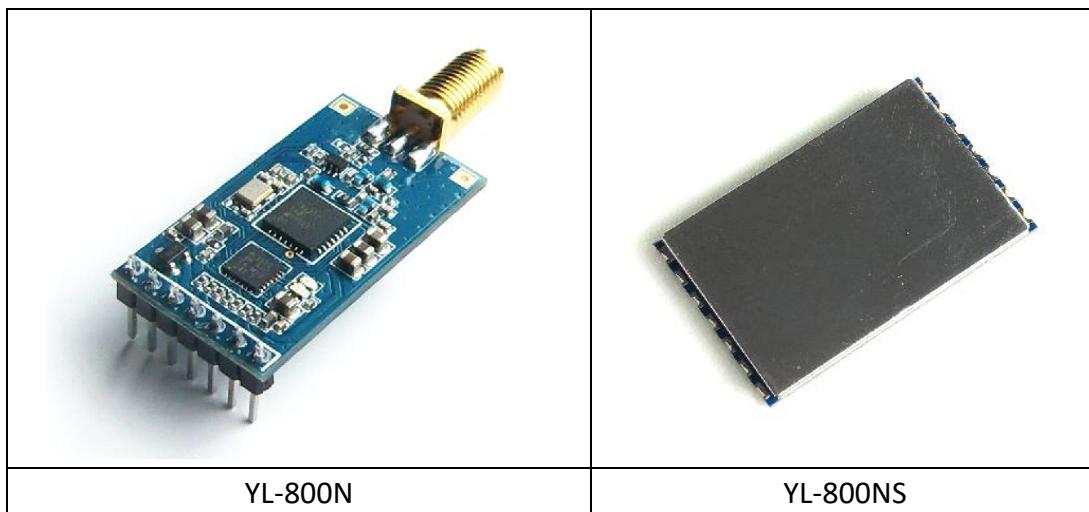


## 扩频通讯 Mesh 自组网模块 YL-800N 规格书



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## YL-800N

Spread spectrum communication Mesh self-organizing network module YL-800N specification

## YL-800N

## YL-800NS

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## 一、 模块简介

YL-800N 是分布式 MESH 网络无线自组网模块，工作在 433M 免费频段(其它频段定制)，采用最新的扩频跳频技术，内部进行自动扩频计算和前导 CRC 纠错处理。标准发射功率最大为 100mW (20dBm)，发射电流瞬间<120mA，接收电流为<18mA，工作电压范围 3.3v~5v；模块的射频芯片基于扩频跳频技术，在稳定性、抗干扰能力以及接收灵敏度上都超越现有的 GFSK 模块。

MESH 是分布式的对等网状网络，能够充分利用网络中的路由冗余，具有优异的网络自愈性、稳定性和极佳的数据吞吐量，其组网耗时很短，所有的设备上电即工作，支持 7 级路由，网络覆盖范围达到 7 公里以上。物理层采用了很多先进的无线通信技术如跳频、自适应速率、安全可靠的全网自组网技术、交织纠错编码等；链路层采用智能的碰撞避免算法，具有优异的抗干扰能力。

## 二、 模块特点

- 中等功率发射，最大 100mW (20dBm)，可调节；
- LoRa 扩频技术，TTL 接口半双工通讯，空中收 /发转换；
- 内嵌 MESH 分布式自组网协议，每次通讯都有多重握手确认，确保数据稳定；
- 工作频段：433MHz 申请频段；
- 接收灵敏度最低-148dBm，开阔地空旷传输距离 1500-2500 米；
- 发射工作电流小于 100mA；待机工作电流 18mA；
- 通信频率任意设置，8 个辅助信道，自动跳频，有效避免干扰；
- 通讯协议转换及射频收发切换自动完成，用户无须干预，简单易用；
- 通讯速率 1.2kbps -115.2kbps，用户可通过软件配置；
- 生产免调试，宽电压范围工作：3.3V-5V，工业级应用；

## 三、 技术参数

参数	最小值	典型值	最大值	单位
工作电压	3.3	5	5	V
工作温度	-40	25	85	°C
载波频率	410	433	480	MHz
输出功率	0		20	dBm
接收灵敏度		-132	-148	dBm
发射电流			100	mA
待机电流		18	20	mA
调制速率	2.4	9.6	115.2	Kbps
收发转发时间		300		μs

### First, the module introduction

YL-800N is a distributed MESH network wireless ad hoc network module, working in the 433M free frequency band (other Band customization), using the latest spread spectrum frequency hopping technology, internal automatic spread spectrum calculation and preamble CRC deal with. Standard transmit power is up to 100mW (20dBm), and the emission current is instantaneously <120mA, receiving current For <18mA, the operating voltage range is 3.3v~5v; the module's RF chip is based on spread-spectrum frequency hopping technology and is stable. Sex, anti-jamming capability and receiving sensitivity are beyond the existing GFSK modules.

MESH is a distributed peer-to-peer mesh network that can make full use of routing redundancy in the network. Different network self-healing, stability and excellent data throughput, the networking time is very short, all devices Electricity is working, supporting 7-level routing, and the network coverage is more than 7 kilometers. The physical layer uses a lot of Advanced wireless communication technologies such as frequency hopping, adaptive rate, secure and reliable network-wide self-organizing network tec Error coding, etc.; the link layer uses an intelligent collision avoidance algorithm with excellent anti-interference ability.

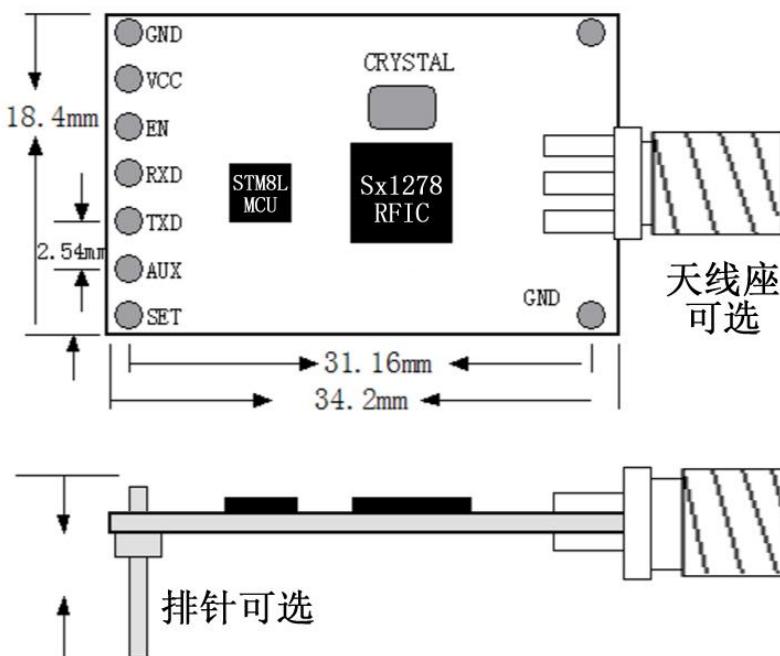
### Second, the module features

- Medium power transmission, maximum 100mW (20dBm), adjustable;
- LoRa spread spectrum technology, TTL interface half-duplex communication, air receive/transmit conversion;
- Built-in MESH distributed ad hoc network protocol, each communication has multiple handshake confirmation to ensure data stability;
- Working frequency band: 433MHz application frequency band;
- The receiving sensitivity is at least -148dBm, and the open space is 1500-2500 meters;
- The transmitting working current is less than 100mA; the standby working current is 18mA;
- The communication frequency is set arbitrarily, 8 auxiliary channels, automatic frequency hopping, effectively avoiding interference;
- Communication protocol conversion and RF transceiver switching are automatically completed, users do not need to intervene, easy to use;
- Communication speed 1.2kbps -115.2kbps, users can configure through software;
- Production free debugging, wide voltage range operation: 3.3V-5V, industrial grade application;

### Third, technical parameters

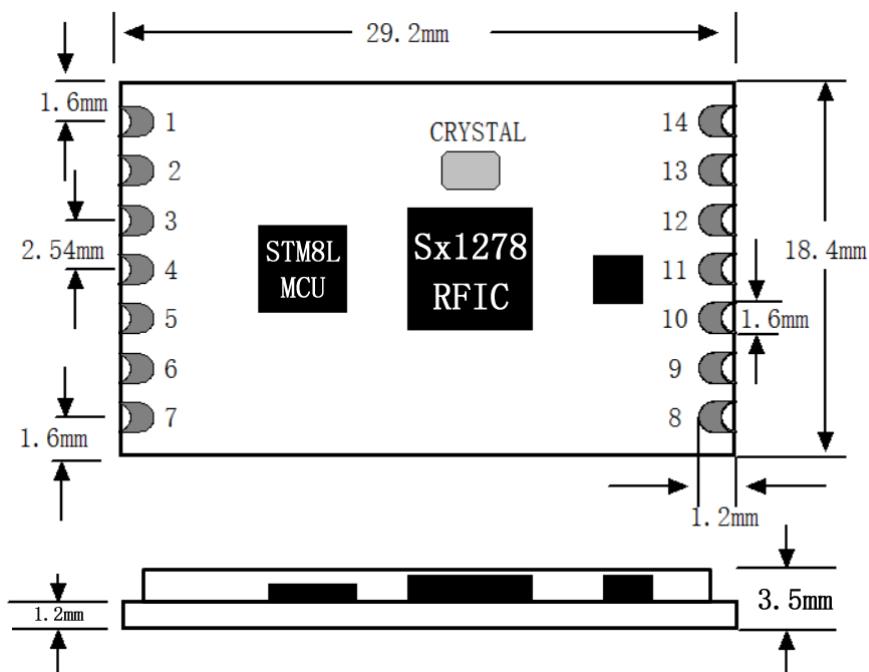
parameter	Minimum value		unit
Operating Voltage	3.3	5	V
Operating temperature	-25	85	°C
Carrier frequency	410	433	MHz
Output Power	0	20	dBm
Receiving sensitivity	-132	-148	dBm
Emission current		100	mA
stand-by current	18	20	mA
Modulation rate	2.4	9.6	Kbps
Transceiver forwarding time	300		ms

#### 四、 尺寸结构



YL-800N 尺寸结构图

尺寸结构 PCB 文件下载: <http://www.rf-module.cn/updow/2016227113426415.rar>



YL-800NS 尺寸结构图

PCB 封装图 [http://www.rf-module.cn/updow/YL-800S\\_Package\\_diagram.rar](http://www.rf-module.cn/updow/YL-800S_Package_diagram.rar)

YL-800N

Fourth, the size structure

YL-800N size structure

Size structure PCB file download: <http://www.rf-module.cn/updow/2016227113426415.rar>

YL-800NS size structure diagram

PCB package drawing [http://www.rf-module.cn/updow/YL-800S\\_Package\\_diagram.rar](http://www.rf-module.cn/updow/YL-800S_Package_diagram.rar)

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## 五、 管脚定义

序号	名称	管脚功能
1	GND	电源地 (与用户设备共地)
2	VCC	3.3~5V
3	EN	无需连接
4	RXD	UART 输入, 3.3TTL
5	TXD	UART 输出, 3.3TTL
6	ACT	无需连接
7	SET	低电平参数恢复默认

## 六、 参数配置软件



下载地址：<http://www.rf-module.cn/updow/201656103052876.rar>

YL-800N

Five, pin definition

Serial number	Pin name	Pin function
1	GND	Power ground (shared with user equipment)
2	VCC	3.3~5V
3	EN	No connection required
4	RXD	UART input, 3.3TTL
5	TXD	UART output, 3.3TTL
6	ACT	No connection required
7	SET	Low level parameter restore default

Sixth, parameter configuration software

Download address: <http://www.rf-module.cn/updow/201656103052876.rar>

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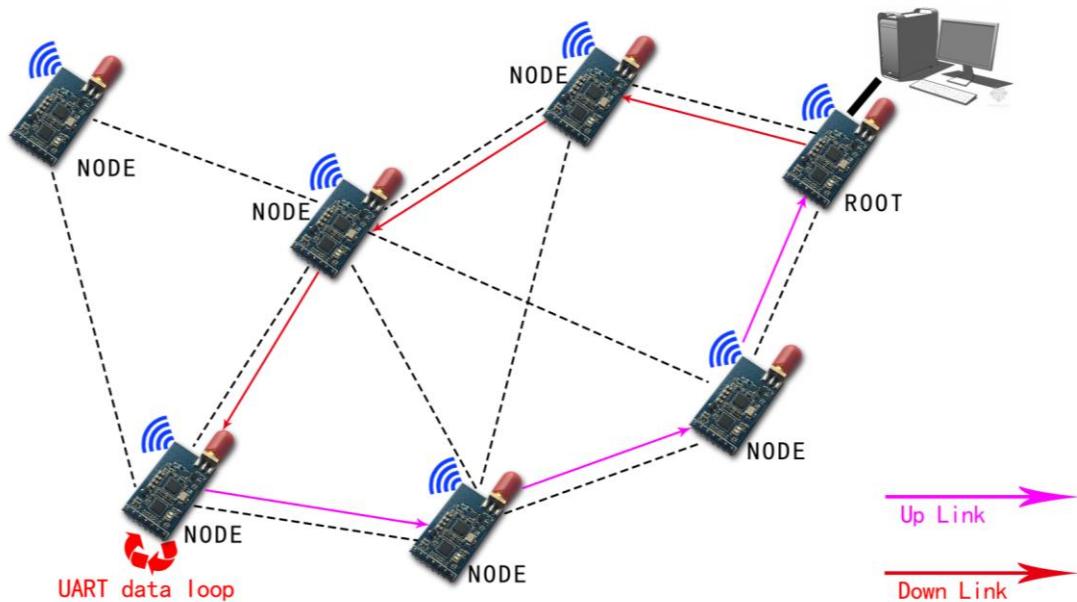
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YL-800N

VII. **YL-800N** typical networking application

## 七、 YL-800N典型组网应用

一个基本的 MESH 网络由多个节点（SLAVE OR NODE）模块和一个集中器（MASTER OR ROOT）模块组成。SLAVE 模块和 MASTER 模块之间进行双向数据交互，报文可以由 SLAVE 模块进行多次中继。由 MASTER 到 SLAVE 的数据流称为下行，反之为上行。下行数据传输方式为广播(MASTER 发送的数据所有节点都能收到)；上行数据传输方式为单播(SLAVE 发送的数据到最近的 MASTER 上)路由的选择都是自动完成的. 注意如果有多个集中器 MASTER，那么 SLAVE 传输数据会自动上传到最近通信过的 MASTER，其它 MASTER 不能收到。



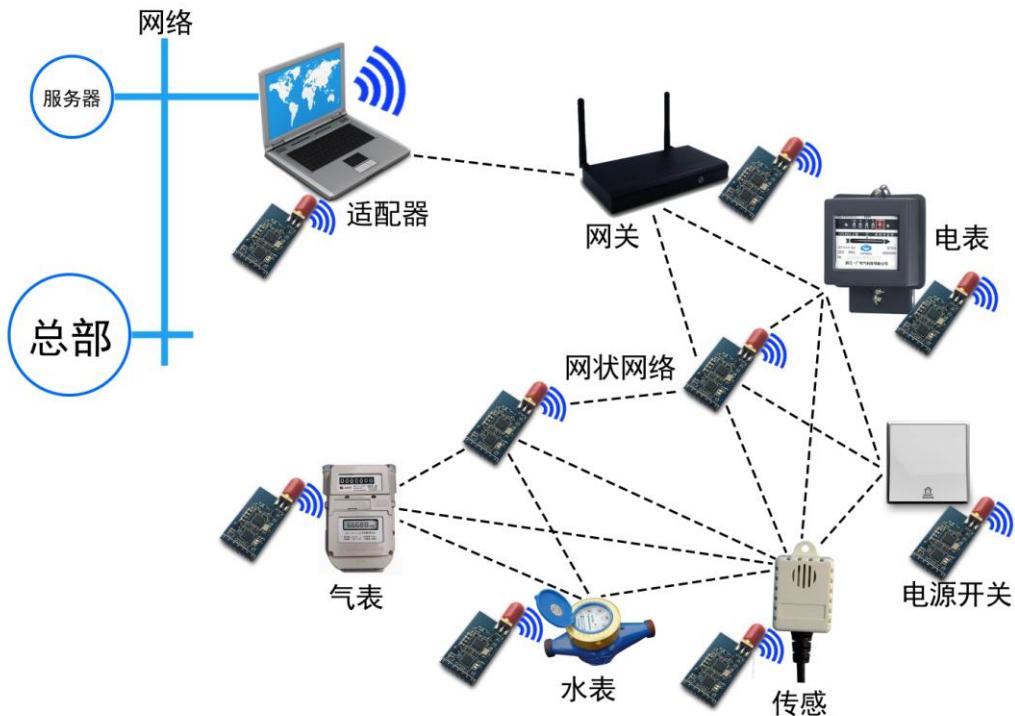
MESH 组网数据传递示意图

仅用 YL-800N 模块便可以轻松组建最小 2 个点到成千上万点的 MESH 网络。MESH 是完全分布式的对称网络，理论上只需要单一的设备类型即可。但为了无缝兼容用户的现有协议，报文格式是透明传输的。在很多应用下，用户的报文并没有包含数据流向的信息（上、下行），这样会导致某些实际问题。因此，MESH 网络定义了两类组网设备：节点和集中器。节点泛指是受控设备如仪表、传感器、开关等；集中器泛指是控制设备如网关、遥控器等。在本文中，用节点和集中器来代替具体应用的设备名称。一个 MESH 网络可以包含多个集中器和多个节点设备。YL-800N 模块既可以作为节点设备也可以作为网关设备。所有组网设备上电便工作，不需要网络初始化过程，路由会自动按需建立，自动维护，不需要人工干预。其组网示意图如下所示：

A basic MESH network consists of multiple nodes (SLAVE OR NODE) modules and a concentrator (MASTER OR ROOT) module. Two-way data communication between the SLAVE module and the MASTER module Mutual, the message can be relayed multiple times by the SLAVE module. The data flow from MASTER to SLAVE is called the next Line, and vice versa. The downlink data transmission mode is broadcast (all data sent by MASTER can be received. To); the uplink data transmission mode is unicast (the data sent by SLAVE to the nearest MASTER) The selection is done automatically. Note that if there are multiple concentrators MASTER, SLAVE will transfer data from Uploaded to the recently communicated MASTER, other MASTER can not receive.

#### MESH network data transfer diagram

With the YL-800N module, it is easy to set up a minimum of 2 points to thousands of MESH networks. MESH is a fully distributed symmetric network. In theory, only a single device type is required. But for no The seam is compatible with the user's existing protocol, and the message format is transparently transmitted. In many applications, the user's message is There is no information (upstream and downstream) that includes the flow of data, which can lead to some practical problems. Therefore, MESH The network defines two types of networking devices: nodes and concentrators. Nodes are generally referred to as controlled devices such as meters, sensors, Switches, etc.; concentrators generally refer to control devices such as gateways, remote controls, and the like. In this article, using nodes and concentrators Replace the device name of the specific application. A MESH network can contain multiple concentrators and multiple node settings Ready. The YL-800N module can be used as both a node device and a gateway device. Power on all networking devices Work, no network initialization process is required, routing will be automatically established on demand, automatic maintenance, no manual Intervention. Its networking diagram is as follows:



YL-800N 组网示意图

采用 YL-800N 模块可以轻松组建性能优异、成熟稳定的分布式自组网 MESH 网络，代表了自组网技术的最先进水平，可以代替有线、点对多点和集中式组网方式，极大扩大网络覆盖范围和网络的健壮性，并且能够有效降低设备成本和维护成本。

YL-800N 模块应用在自组网领域如传感网络、无线抄表、智能家居等领域，具有明显的技术优势和价格优势。比如，采用 YL-800N 的无线抄表方案，可以仅需要发送一条广播报文就可以在很短时间之内实现全网仪表的集抄，不需要对单个仪表进行一一抄读，大大节省了抄读的时间。在没有外来干扰和孤立节点的情况下，MESH 无线抄表的方案的单次全网抄收成功率达到 100%。

## 八、 MESH分布式路由协议简介

移动自组网（MANET）是多个具有路由功能的移动节点组成的多跳网络，数据的传输需要多个节点的协作才能完成，因此路由协议是 MANET 中至关重要的一部分。与传统有线网络相比，MANET 有自己的特点，如分布式控制、动态变化的网络拓扑结构、无线传输带宽和节点能力有限、安全性差、路由生存时间短等。

理想的 MANET 路由协议应该具有以下特点：

1. 分布式路由算法；分布式算法更适合于无中心的分布式控制网络。
2. 自适应能力强；可适应快速变化的网络拓扑结构。



YL-800N

YL-800N networking diagram

With the YL-800N module, it is easy to build a distributed, self-organizing network MESH with excellent performance and mature stability. Network, representing the most advanced level of ad hoc networking technology, can replace wired, point-to-multipoint and centralized networking. Ways to greatly expand network coverage and network robustness, and can effectively reduce equipment costs and dimensions. Protect the cost.

The YL-800N module is used in the field of self-organizing networks such as sensor networks, wireless meter reading, smart homes, etc. Has obvious technical advantages and price advantages. For example, using the YL-800N wireless meter reading solution, you can only need to send a broadcast message to achieve the collection of the entire network instrument in a short time, no need to. The instruments are read one by one, which greatly saves the time of reading. In the absence of external interference and isolated nodes. Under the circumstance, the single-network copying success rate of the MESH wireless meter reading program reaches 100%.

#### Eight, **MESH** distributed routing protocol introduction

Mobile Ad Hoc Network (MANET) is a multi-hop network composed of multiple mobile nodes with routing functions. The transmission of the data requires the cooperation of multiple nodes to complete, so the routing protocol is crucial in MANET. Compared with traditional wired networks, MANET has its own characteristics, such as distributed control and dynamic change. Network topology, limited wireless transmission bandwidth and node capabilities, poor security, short route life. Wait.

The ideal MANET routing protocol should have the following characteristics:

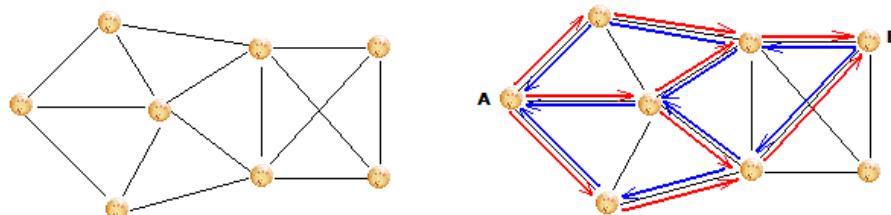
1. Distributed routing algorithm; distributed algorithm is more suitable for a distributed control network without center.
2. Strong adaptive ability; adapt to rapidly changing network topology.

3. 无环路；无环路是任何路由协议的基本要求，可以避免路由错误和带宽浪费。
4. 路由计算与维护控制开销少；用最小的控制开销做到最完整、最强大的功能是所有路由协议共同努力的目标。
5. 适应于大规模网络；健壮性、可扩展性好。

单路径路由协议并不适合 MANET，有以下原因：

1. 无线网络结点移动性高，带宽资源有限，而且连接中断率高，导致网络分裂机会高。单径路由算法开销太大，收敛速度慢。
2. 路由需要通过洪泛技术来进行建立，而当节点移动导致原来路由失效后，单径路由的维护也需要洪泛，会占用网络带宽，当网络中有中等数量甚至大量的路由需要维护时，频繁的全网洪泛使得按需路由协议的路由控制开销非常大。
3. 单径路由协议没有考虑公平性，倾向于把重的负载分布到源-目的节点的最短路径的节点上，无法很好地获取和跟踪整个网络的拓扑信息。
4. 单径路由协议数据的发送只利用一条路径，无法并行或并发地发送数据，导致网络传输率较低，延迟增加，网络负载不平衡，造成网络拥塞。

MANET 中从任何一个源节点到目的节点的路径通常会有多条，而且节点具有随机移动性，整个网络的拓扑结构经常变化。采用多径路由协议可以克服上述单径路由协议的不足，可以充分利用网络资源，平衡网络负载，改善通讯性能，避免网络震荡。MESH 采用私有按需轻量动态多径路由协议，该协议是针对硬件资源条件苛刻的移动自组网设计的，适用于移动速度快、拓扑结构变化快的无线网络。该路由协议可以最大限度减小路由建立和维护过程的开销，能够在多条路径并行进行数据报文的发送，可以感知网络拓扑结构的变化并对路由进行更新不需要进行洪泛，在不同路由之间无缝切换。主要特点有：每个节点维护尽可能多的路由信息；没有路由回路；路由稳定性好、建立速度快；能够维护充分利用无线信号的冗余，时时刻刻进行路由的维护和更新，没有额外开销；路由选择算法权衡了很多因素如距离矢量、信号能量、链路质量和电池电压等；对网络拓扑结构的变化很敏感，路由能够动态迅速达到最优；网络吞吐量高；支持 7 级路由，网络规模大。



MESH 多径路由示意图

3. No loop; no loop is the basic requirement of any routing protocol, avoiding routing errors and bandwidth waste.
4. Less routing calculation and maintenance control; the most complete and powerful work with minimal control overhead. Can be the goal of all routing protocols working together.
5. Adapt to large-scale networks; robust and scalable.

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

1. The wireless network node has high mobility, limited bandwidth resources, and high connection interruption rate, resulting in network points. The chance of splitting is high. The single-path routing algorithm has too much overhead and slow convergence.
2. The route needs to be established through flooding technology, and when the node moves to invalidate the original route. The maintenance of single-path routing also needs to be flooded, which will occupy network bandwidth. When there is a medium amount in the 1 When a large number of routes need to be maintained, frequent network flooding makes the routing control of the on-demand routing protocol of The sales are very large.
3. Single-path routing protocols do not consider fairness and tend to distribute heavy load to the source-destination node. On the short path node, the topology information of the entire network cannot be well obtained and tracked.
4. Single-path routing protocol data is sent using only one path, and data cannot be sent in parallel or concurrently. As a result, the network transmission rate is low, the delay is increased, and the network load is unbalanced, causing network congestion.

There are usually multiple paths from any source node to the destination node in MANET, and the nodes have With random mobility, the topology of the entire network changes frequently. Multipath routing protocol can overcome the above single Insufficient routing protocols can fully utilize network resources, balance network load, improve communication performance, and avoid Free of network shocks. MESH uses a private on-demand lightweight dynamic multipath routing protocol for hardware resources. Designed for demanding mobile ad hoc networks, it is suitable for wireless networks with fast moving speed and fast topology changes. Network. The routing protocol minimizes the overhead of the route establishment and maintenance process and can be in multiple paths. Parallel data packet transmission, which can sense changes in network topology and update routing To flood, seamlessly switch between different routes. The main features are: each node maintains as much as possible Routing information; no routing loop; good routing stability, fast establishment; able to maintain full use of wireless Redundancy of signals, maintenance and update of routes at all times, no additional overhead; routing algorithm rights Balance many factors such as distance vector, signal energy, link quality and battery voltage; for network topology The change is very sensitive, the route can be dynamically and quickly optimized; the network throughput is high; support 7-level routing, network The scale of the network is large.

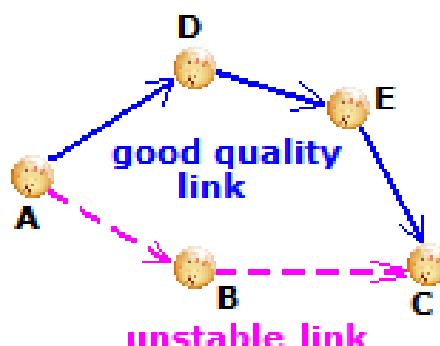
MESH multipath routing diagram

The MESH multipath routing diagram is shown above. The network topology diagram is shown on the left and the black line represents the section The link between the points. On the right side, the data link is established between points A and B, and the red line is the path from point A to point B. The blue line is the reverse path. The establishment of the route is realized by flooding, and there is no closed loop between multiple routes, allowing more The paths intersect. Each node will select as many nodes as its next hop route, datagram Text can be dynamically switched between multiple paths and can be transmitted in parallel. Dead route detection, new route discovery,

MESH 多径路由示意图如上所示，网络拓扑结构图如左侧所示，黑线代表节点间的链路。右侧为的 A 和 B 两点建立的数据链路，红线为从 A 到 B 点的路径，蓝线为逆向路径。路由的建立通过洪泛实现，多条路由间没有闭环回路、允许多条路径相交。每个节点都会选择尽可能多的节点作为自己的下一跳路由，数据报文可以在多条路径之间动态切换，能够并行传输。失效路由检测、新路由发现、网络拓扑结构的变化通过监听相邻节点间的握手报文来感知，不需要进行洪泛也不需要额外的开销。包括源节点在内的所有节点仅需要寻找自己的下一跳中继节点，而不需要确定整条路径，因此该路由协议开销很小，适合拓扑结构快速变化的移动网络，能够迅速发现即时最佳路由，支持 7 级路由的大规模网络。

MESH 路由协议会综合多种选择算法进行路由的筛选，包括距离矢量、信号质量（链路状态）和节点剩余电量 – 类 MMBCR (Min-Max Battery Cost Routing)。距离矢量算法根据目的地的远近来决定的路径，每个节点都会维护一张矢量表，表中列出了当前已知的到每个目标的最佳距离。节点可以根据这张矢量表，选择比自己更接近目的地的节点作为转发路由。根据距离矢量算法可以找到两个节点间的最近路径，但不一定是最佳路径。

不同于有线的网络，对于 MANET 来说无线信号容易受外界干扰的影响，造成数据链路生存时间短、稳定性差的特点。路由协议必须能够正确选择信号质量好、链路稳定的路径才能保证网络的稳定性、实时性、可靠性和抗干扰能力。MESH 路由协议能够迅速探测多条路由的即时链路质量，能在极短时间内选择出最佳链路质量的路径做路由，并且在必要时可以选择次最近路径作为路由。MESH 链路状态算法路由选择示意图如下所示，A 可以通过 B 中继到 C 既 A-B-C 但该条路径受到干扰为不稳定链路，同时 A 到 C 有另外一条链路质量好的路径 A-D-E-C。选择 A-B-C 这条路径虽然距离更近，但是由于链路不稳定性报文的接收成功率很低，会大大增加报文的重发概率耗费大量时间。而如果选择 A-D-E-C，虽然距离会远一些，但是能保证报文传输的可靠性和实时性。



MESH 链路状态算法路由选择示意图

另外对于 MANET 来说，路由选择需要充分考虑节点电池的电量，应尽可能

The change of the network topology is sensed by listening to handshake packets between adjacent nodes, and no flooding is required.

No extra overhead is required. All nodes, including the source node, only need to find their own next hop relay section.

Point, without determining the entire path, so the routing protocol has a small overhead and is suitable for rapid change of topology

The mobile network is able to quickly discover the best-in-class route and support large-scale networks with 7-level routing.

The MESH routing protocol combines multiple selection algorithms for routing, including distance vectors and signals.

Quality (link status) and node remaining power – Class MMBCR (Min-Max Battery Cost Routing).

The distance vector algorithm determines the path according to the distance of the destination, and each node maintains a vector table.

The table lists the currently known best distances to each target. The node can choose according to this vector table.

A node that is closer to the destination than itself is used as a forwarding route. Two nodes can be found according to the distance vector algorithm

The closest path between, but not necessarily the best path.

Unlike wired networks, wireless signals are susceptible to external interference for MANET.

The data link has the characteristics of short survival time and poor stability. Routing protocols must be able to correctly select signal quality

A good, stable link path can guarantee the stability, real-time, reliability and anti-interference ability of the network.

The MESH routing protocol can quickly detect the instantaneous link quality of multiple routes and can select it in a very short time.

The path with the best link quality is routed, and the next most recent path can be selected as the route if necessary. MESH

The link state algorithm routing diagram is as follows, A can relay through B to C both ABC but the clause

The path is disturbed by an unstable link, and A to C have another path ADEC with good link quality.

Selecting ABC This path is closer, but the success rate of receiving the link instability message is very high.

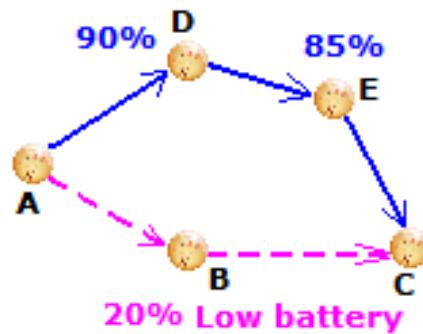
Low, it will greatly increase the probability of retransmission of the message and take a lot of time. And if you choose ADEC, although the distance

It will be farther away, but it can guarantee the reliability and real-time of message transmission.

#### MESH link state algorithm routing diagram

In addition, for MANET, routing needs to fully consider the power of the node battery, as far as possible

避开电池电量低的节点进行路由。MESH 路由协议采用类 MMBCR 算法，会自动选择剩余电量相对大的节点做路由。MESH 节点剩余电量路由选择算法示意图如下所示，A 可以通过 B 中继到 C 既 A-B-C 但 B 节点的剩余电量低，同时 A 到 C 有另外一条稍远的路径 A-D-E-C，路径中的节点剩余电量较高。选择 A-B-C 这条路径虽然距离更近，但是会很快耗尽 B 节点的电量。如果选择 A-D-E-C，虽然距离会远一些，但是增加整个网络的使用寿命减小系统的维护费用。



MESH 节点剩余电量路由选择示意图

MESH 路由协议是针对 MANET 设计的理想路由协议，具有分布式、健壮、自愈能力强、轻量、多径、无环路、组网规模大、适合移动网络等特点。

## 九、模块配置说明

1. 模块的用户接口模式分为二种：16 进制命令模式、透明模式；
2. 模块的设备类型分为二种：主模块（集中器模块）和从模块（节点模块），可通过指令进行修改
3. 主模块在透明模式时，串口收到的数据透明地发送给所有的从模块；从模块在透明模式时，串口收到的数据透明地发送给其发送过数据的主模块。
4. 在透明模式时，输入“+++”时不会被透明发送，而是将用户接口模式切换到 16 进制命令模式，此时模块能够响应命令
5. 应该将缺省的设备类型改为从模块类型，因为用户使用时一般从模块数量大于主模块。
6. 用户可以使用多种方式组网：
  - ① 完全对等的非透明组网模式

所有模块之间没有主从关系，完全对等，纯 MESH 网络，模块类型一致，用户接口模式一致但都是非透明模式；在此种组网模式下，所有模块都可用 16 进制命令发送广播数据或者单播数据；发送单播数据时需要提供目标模块地址；发送广播数据时目标地址为 0xFFFF 即可。模块可以 16 进制命令模式或 AT 命令模

## YL-800N

Avoid routing with low battery nodes. The MESH routing protocol uses the MMBCR-like algorithm and automatically Select a node with a relatively large remaining capacity to route. Schematic diagram of the remaining power routing algorithm for MESH nodes As shown below, A can relay through B to C, both ABC but the remaining power of the B node is low, while A to C have Another slightly longer path, ADEC, has higher residual power in the nodes in the path. Choose ABC this road Although the path is closer, it will quickly drain the power of the B node. If you choose ADEC, although the distance Will be farther away, but increasing the life of the entire network reduces the maintenance cost of the system.

## Schematic diagram of remaining battery routing for MESH nodes

MESH routing protocol is an ideal routing protocol designed for MANET, with distributed, robust and self-contained The ability is strong, lightweight, multi-path, no loop, large network size, suitable for mobile networks.

## Nine, module configuration instructions

1. The user interface mode of the module is divided into two types: hexadecimal command mode and transparent mode.
2. The device type of the module is divided into two types: the main module (concentrator module) and the slave module (node module). Can be modified by instructions
3. When the main module is in transparent mode, the data received by the serial port is transparently sent to all slave modules; the slave module In transparent mode, the data received by the serial port is transparently sent to the main module that sent the data.
4. In transparent mode, when "+++" is entered, it will not be sent transparently, but the user interface mode will be switched to Hexadecimal command mode, at which point the module can respond to commands
5. The default device type should be changed to the slave module type, because the user usually has a large number of modules. In the main module.
6. Users can use a variety of ways to network:
  - 1 fully peer-to-peer non-transparent networking mode
 

There is no master-slave relationship between all modules, completely peer-to-peer, pure MESH network, the module type is the same, User interface mode is consistent but all non-transparent mode; in this networking mode, all modules are available in 16 Command to send broadcast data or unicast data; need to provide the target module address when sending unicast data; Send the broadcast data to the target address of 0xFFFF. Modules can be in hexadecimal command mode or AT command mode

式按規定协议格式接收到广播或者单播数据，并且获知发送数据的源模块地址。用户设备需要发送单播数据则需要管理其它模块的通讯短地址。

② 完全对等的透明组网模式

所有模块之间没有主从关系，完全对等，纯透明传输网络，可完全代替市场上常见透传模块。模块类型一致并都为主模块类型，用户接口模式一致并都为透明模式。

在此种组网模式下，每个模块串口接收到数据，都透明的广播发送到其它的模块，模块接收到别的模块发送的数据为纯透明的应用数据。用户设备只能发广播数据，不需要管理其它模块的通讯短地址。

③ 主从式非透明组网模式

一个模块为主模块，其它模块都为从模块，主从模块之间通讯，从模块之间一般不需要通讯，用户接口模式一致但都是非透明模式。

此种组网模式实际上与第①种相同，从模块之间虽没有通讯需求但是可以相互通讯。

④ 主从式透明组网模式

一个模块为主模块，其它模块都为从模块，主从模块之间通讯，从模块之间一般不需要通讯，用户接口模式一致并且都是非透明模式。

在此种组网模式下，主模块串口收到的数据，都被透明地广播发送到其它模块，而从模块串口收到的数据，会被透明地单播发送到主模块。模块接收到别的模块发送的数据为纯透明的应用数据。用户设备不需要管理其它模块的通讯短地址。

⑤ 主从式半透明组网模式

一个模块为主模块，其它模块都为从模块，主从模块之间通讯，从模块之间一般不需要通讯。主模块用户接口模式为非透明模式，而从模块的用户接口模式都是透明模式。

在此种组网模式下，主模块既可以发送广播又可以向每个从模块发送单播数据，数据到从模块将透明地从串口送出，从模块串口收到的数据，会被透明的单播发送到主模块，主模块收到后将按照主模块接口模式按规定的协议格式送出。从用户设备为被动设备不需要做任何改动，不需要管理仍何信息；主用户设备需要管理从模块的通讯短地址。

## 十、 数据收发测试（16进制命令模式）

按典型应用电路将YL-800N与电脑连接好，数据的收发测试可以通过设置软件实现，先读取模块参数，读取参数成功后就可以正常发送数据了，在软件上填好要发送的目标模块地址以及数据（16进制，中间要有空格），点发送，如果外界有目标地址存在就会显示发送SUCCESS，如果没有对应的地址就会显示发送FAIL，如下图：

Receive broadcast or unicast data in the specified protocol format, and know the source module address of the transmitted data.

If the user equipment needs to send unicast data, it needs to manage the communication short address of other modules.

#### 2 fully peer-to-peer transparent networking mode

There is no master-slave relationship between all modules, completely peer-to-peer, pure transparent transmission network, which can completely re  
Common transparent transmission module.

The module types are the same and are the main module type. The user interface mode is consistent and both are transparent.  
Ming mode.

In this networking mode, each module receives data from the serial port and sends a transparent broadcast to other modules.

Module, the module receives data sent by other modules as pure transparent application data. User equipment can only be widely distributed  
Broadcast data, no need to manage the communication short address of other modules.

#### 3 master-slave non-transparent networking mode

One module is the main module, the other modules are slave modules, the master-slave modules communicate with each other, and between the mo  
Communication is generally not required, and the user interface mode is consistent but all are non-transparent.

This networking mode is actually the same as the first one. Although there is no communication requirement between the modules, it can be phased  
Mutual communication.

#### 4 master-slave transparent networking mode

One module is the main module, the other modules are slave modules, the master-slave modules communicate with each other, and between the mo  
Communication is generally not required, the user interface mode is consistent and both are non-transparent.

In this networking mode, the data received by the serial port of the main module is transparently broadcasted to other modules.

The block, while the data received from the module's serial port, is transparently unicast to the main module. Module receives something else

The data sent by the module is purely transparent application data. User equipment does not need to manage communication shorts of other modules  
site.

#### 5 master-slave translucent networking mode

One module is the main module, the other modules are slave modules, the master-slave modules communicate with each other, and between the mo  
Communication is generally not required. The main module user interface mode is non-transparent mode, and the slave user interface mode

Both are transparent modes.

In this networking mode, the master module can send broadcasts and send unicast numbers to each slave module.

According to the data, the slave module will be transparently sent out from the serial port, and the data received from the module serial port will be trans  
The broadcast is sent to the main module, and after receiving the main module, it will be sent according to the specified protocol format according to the  
No need to make any changes from the user equipment to the passive device, no need to manage what information remains; the primary user equipment  
To manage the short address of the communication from the module.

#### X. test data transceiver (**hexadecimal** command mode)

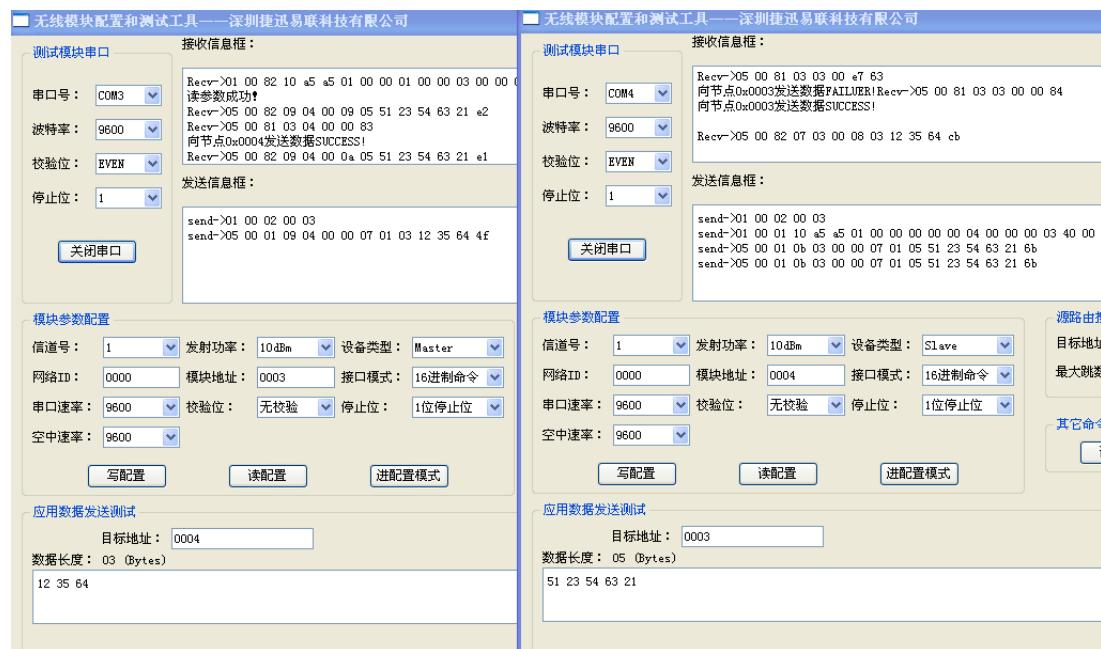
Connect the YL-800N to the computer according to the typical application circuit. The data transmission and reception test can be set by soft.

Implementation, first read the module parameters, after reading the parameters successfully, you can send data normally, fill in the software

Good to send the target module address and data (hexadecimal, there must be spaces in the middle), point to send, if outside

If the target address exists, it will display the sending SUCCESS. If there is no corresponding address, it will be displayed and sent.

FAIL, as shown below:

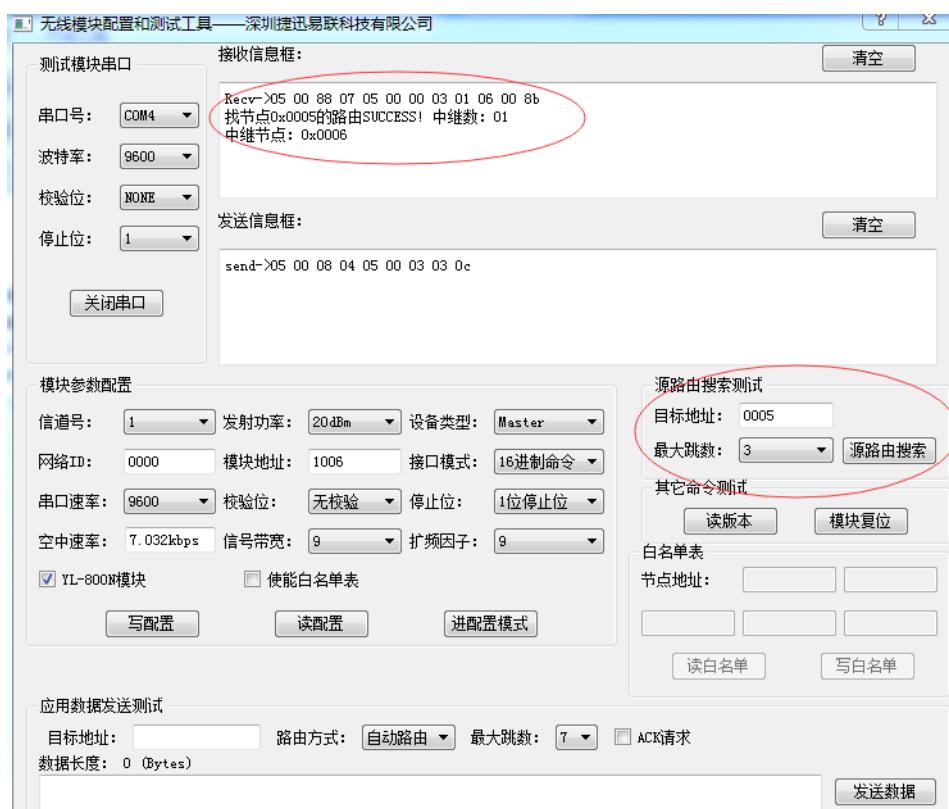


### 中继查询测试：

模块具有自动路由的功能，假如在网络存在一个中心和节点为 0005 和 0006 地址的模块，中心模块与 0005 节点通讯不上，那么只要把 0006 置于他们之间，则 0006 起到路由的功能，中心与 0005 就能通讯成功。

也可以通过设置软件的命令查找源路由的方式观察如下图：

查找 0005，中继数为 01，通过 0006 来中继数据：



Relay query test:

The module has the function of automatic routing, if there is a center and nodes in the network are 0005 and 0006. The module of the address, the central module does not communicate with the 0005 node, so just put 0006 between them, Then 0006 functions as a route, and the center and 0005 can communicate successfully.

You can also observe the following figure by setting the software command to find the source route:

Find 0005, the number of relays is 01, and the data is relayed through 0006:

## 十一、无线升级程序

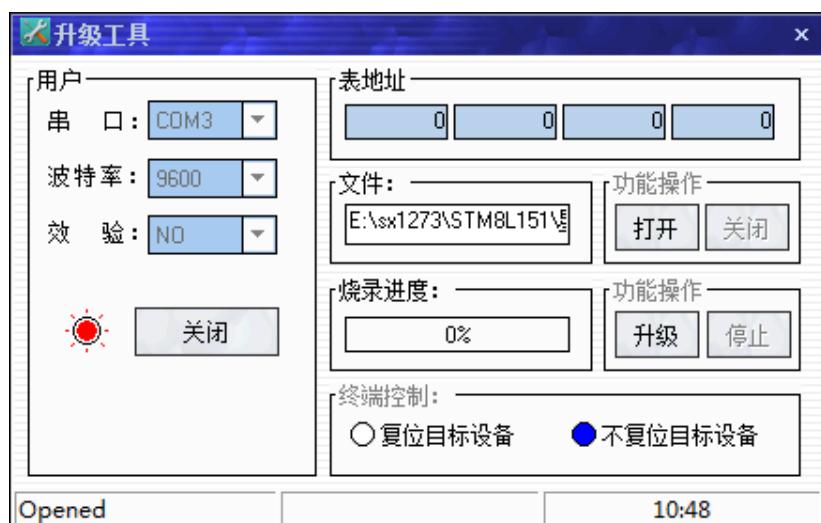
YL-800N/YL-800NS模块从V2.49版本开始集成了无线升级功能，这样方便客户在线升级和修改程序。

需要准备工具：

YL-800T标准模块；PC电脑和PC端软件以及升级的程序bin文件；要升级的模块和连接线。

升级流程：

(一) 把YL-800T模块和电脑连接好。打开升级软件，选择YL-800T模块连接的串口号。调入要升级的程序文件，选择不复位升级。如下图所示：



升级工具软件下载地址：

[http://www.rf-module.cn/updow/lora\\_module\\_update\\_tool.rar](http://www.rf-module.cn/updow/lora_module_update_tool.rar)

注：软件上面的表地址不需要理会，这个是升级其它模块才会用到。

(二) 把要升级的模块设置成升级模式，方法就是通过串口发送命令给模块。

命令发码： 01 00 08 08 64 6F 77 6E 6C 6F 61 64 15

模块回码： 64 6F 77 6E 6C 6F 61 64

此时模块进入下载模式，并且红灯开始闪烁。

(三) 点击升级按键。模块就开始升级，此时模块红灯和蓝灯交替闪烁。升级完成后，模块会自动启动，并且运行正常程序。

注：模块升级不会擦除原先设置的参数，所以升级之后的参数和升级之前是一样的。如果升级不成功，可以重新升级。如果程序升级错了，或升级的不是我们公司提供的程序，那么模块就要返回公司维修。

## YL-800N

XI, wireless upgrade program

The YL-800N/YL-800NS module integrates the wireless upgrade function from the V2.49 version, which is convenient for customers.  
Upgrade and modify the program online.

Need to prepare tools:

YL-800T standard module; PC computer and PC software and upgraded program bin file; module to be upgraded  
Blocks and connectors.

Upgrade process:

(1) Connect the YL-800T module to the computer. Open the upgrade software and select the YL-800T module to connect.  
Serial port number. Load the program file to be upgraded and choose not to reset the upgrade. As shown below:

Upgrade tool software download address:

[Http://www.rf-module.cn/updow/lora\\_module\\_update\\_tool.rar](http://www.rf-module.cn/updow/lora_module_update_tool.rar)

Note: The table address above the software does not need to be taken care of, this is used to upgrade other modules.

(2) Set the module to be upgraded to the upgrade mode by sending commands to the module through the serial port.

Command code: 01 00 08 08 64 6F 77 6E 6C 6F 61 64 15

Module code: 64 6F 77 6E 6C 6F 61 64

At this point the module enters the download mode and the red light begins to flash.

(3) Click the Upgrade button. The module starts to upgrade, and the module red and blue lights flash alternately. Rise

After the level is completed, the module will start automatically and run the normal program.

Note: Module upgrade will not erase the parameters originally set, so the parameters after the upgrade are the same as before the upgrade.

of. If the upgrade is not successful, you can upgrade again. If the program upgrade is wrong, or the upgrade is not our public

The program provided by the company, then the module will return to the company for repair.

## 十二、 16进制模式的应用举例及协议解析

### 1、 自动路由数据帧格式

字节:1	1	1	1	2	1	1	1	N	变长	1
帧类型	帧序号	命令类型	负荷长度	目标地址	ACK请求	发送半径	路由参数	数据长	用户数据	效验
帧头				帧负荷						

数据举例：05 00 01 0A 02 00 00 07 01 04 12 34 56 78 01

帧类型：05 表示发送用户数据

帧序号：00

命令类型：01 表示应用数据发送请求

负荷长度：0A 是指从负荷长度后一个字节到效验前一个字节的个数

目标地址：02 00 表示发送的目标地址是 00 02

ACK 请求：00 表示无需 ACK 应答

发送半径：07 表示最大 7 跳

发现路由参数：01 表示自动路由的方式，用户不需要干预组网的过程

数据长：04 表示用户有 4 个字节的数据需要发送

用户数据：12 34 56 78 四个字节

效验：01 XOR 效验值

### 2、 源路由数据帧格式（源路由是强制路由，走固定路径，一般建议不使用）

表 1

字节:1	1	1	1	N
帧类型	帧序号	命令类型	负荷长度	帧负荷
帧头				见表 2

表 2

字节:2	1	1	1	1	N*2	1	变长
目标地址	应用层 ACK 请求	发送半径	发现路 由参数	中继数 N	中继列表	用户数据长	用户数据
				源路由域			
帧负荷							

数据举例：05 00 01 11 05 00 00 07 03 03 01 00 02 00 03 00 04 12 34 56 78 1F

帧类型：05 表示发送用户数据

帧序号：00

命令类型：01 表示应用数据发送请求

负荷长度：11 是指从负荷长度后一个字节到效验前一个字节的个数

YL-800N

Applications XII **hexadecimal** mode of example and protocol analysis

**1**, automatic routing data frame format

Byte : <b>1</b>	<b>1</b>	<b>1</b>	<b>1 2</b>	<b>1</b>	<b>1 1</b>	N becomes longer		
frame	frame command	dad	aims	ACK	send	routing data	user	effect
Types of Serial numbers	of length	address	request	radius	parameter	long	data	Test
Frame header				Frame load				

Example of data: 05 00 01 0A 02 00 00 07 01 04 12 34 56 78 01

Frame type: 05 means to send user data

Frame number: 00

Command type: 01 indicates application data sending request

Load length: 0A refers to the number of bytes from the length of the load to the number of bytes before the test

Destination address: 02 00 indicates that the destination address sent is 00 02

**ACK** request: 00 means no ACK response required

Send radius: 07 means maximum 7 hops

Discovery routing parameters: 01 indicates the way of automatic routing. The user does not need to intervene in the networking process.

Data length: 04 means the user has 4 bytes of data to send.

User data: 12 34 56 78 four bytes

Validation: 01 XOR Validation Value

**2**, source routing data frame format ( **source routing is mandatory routing, take a fixed path, generally recommended not to use** )

Table 1

Byte : <b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	N
Frame type	frame number	command	type	load length
Frame header				Frame load

See Table 2

Table 2

Bytes: 2	1	1	1	1	N*2	1	lengthen
aims	Application key	Discovery relay	number	N relay list	User data long user data		
address	ACK request	radius	By parameter	Source routing domain			
Frame load							

Example of data: 05 00 01 11 05 00 00 07 03 03 01 00 02 00 03 00 04 12 34 56 78 1F

Frame type: 05 means to send user data

Frame number: 00

Command type: 01 indicates application data sending request

Load length: 11 refers to the number of bytes from the length of the load to the first byte before the test

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Destination address: 05 00 means the destination address sent is 00 05

**ACK** request: 00 means no ACK response required

**目标地址:** 05 00 表示发送的目标地址是 00 05

**ACK 请求:** 00 表示无需 ACK 应答

**发送半径:** 07 表示最大 7 跳

**发现路由参数:** 03 表示源路由发送方式, 必须指定中继数和中继列表; 其中 **01 00 02 00 03 00** 表示的是中继列表

**数据长:** 04 表示用户有 4 个字节的数据需要发送

**用户数据:** 12 34 56 78 四个字节

**效验:** 01 XOR 效验值

## 2. 接收数据应用格式

05	00	82	08	10	00	43	04	EE	EE	EE	EE	D8
应用数据	帧序号	命令类型 读配置信息应答	长度	节点地址 标识	场强数值越小信号越强	数据长度	DATA 数据	校验				

## 十三、16进制指令列表（相关命令可以参考设置软件直接生成）

### 1、通用帧格式

#### 1.1 帧格式

字节:1	1	1	1	变长	1
帧类型	帧序号	命令类型	负荷长度	负荷数据	帧校验
帧头				帧负荷	帧尾

#### 1.2 帧头说明

##### 1.2.1 帧类型

帧类型用来标识不同的应用帧类型。标准帧类型定义如下:

类型标识	类型名称	说明
0x01	模块配置	用于读写模块的配置参数等
0x02	MAC 层测试	用于测试组网协议 MAC 层功能
0x03	NET 层测试	用于测试组网协议网络层功能
0x04	调试信息	用于设置或读出一些调试测试信息等
0x05	应用数据	用于组网协议应用层使用接口

注意：“MAC 层测试”和“NET 层测试”类型功能仅在协议栈开发测试期间使用，成品模块中关闭。

##### 1.2.2 帧序号

帧序号域当前保留未使用, 值固定为 0x00。

Send radius: 07 means maximum 7 hops

The discovery route parameter: 03 indicates the source route sending mode. You must specify the number of trunks and the relay list. Among them, 01 00 02 00 03 00 indicates the relay list

Data length: 04 means the user has 4 bytes of data to send.

User data: 12 34 56 78 four bytes

Validation: 01 XOR Validation Value

## 2. Receive data application format

05 00	82	08 10 00	43	04 EE EE EE EE D8
should			Field strength	number
use	frame	Command type	long	Node address
sequen	Read	configuration letter	The smaller	according to
number	degree	Identificatio	the more	DATA data
Interest response	Strong	the signal	strong	school
according to	degree			Test

## XIII, hexadecimal Instruction List (Related command set software directly generated)

### 1 , general frame format

#### 1.1 frame format

Byte: 1	1	1	1	length	1
Frame type frame number command type load length load data frame check					
Frame header			Frame load End of frame		

#### 1.2 frame header description

##### 1.2.1 Frame Type

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

Type identifier	type name	Description
0x01	Module configuration	parameters for reading and writing modules, etc.
0x02	MAC layer test	is used to test the networking protocol MAC layer function.
0x03	NET layer test	is used to test networking protocol network layer function
0x04	Debug information	Used to set or read some debugging test information, etc.
0x05	Application data	Used by the networking protocol application layer to use the interface.

Note: The "MAC Layer Test" and "NET Layer Test" type functions are only used during protocol stack development testing.

Closed in the finished module.

##### 1.2.2 Frame number

The frame sequence number field is currently unused and the value is fixed at 0x00.

### 1.2.3 命令类型

命令类型域在各种不同的帧类型标识下有不同的定义，参见“2、个别类型帧格式”。

### 1.2.4 负荷长度

负荷长度域指示上边帧格式中帧负荷部分的长度，即从本域之后到帧校验之前的部分的字节数。本协议最大负荷长度为 128 字节。

## 1.3 帧负荷

帧负荷部分的格式由不同的帧类型及帧类型下不同的命令类型决定。参见“2、个别类型帧格式”。

## 1.4 帧尾

帧尾域为 1 个字节的异或校验。此校验值为从帧头第一个字节(帧类型字节)开始到校验字节之前所有字节异或运算的结果。检查时全帧所有字节异或运算结果为 0 即为校验正确。

## 2、个别类型帧格式

### 2.1 模块配置类型

模块配置类型的标识为 0x01。模块配置类型下各命令类型定义如下：

命令类型标识	命令功能说明
0x01	写配置信息请求
0x81	写配置信息应答
0x02	读配置信息请求
0x82	读配置信息应答
0x06	读版本信息请求
0x86	读版本信息应答
0x07	模块复位请求
0x87	模块复位应答

#### 2.1.1 写配置信息请求

写配置信息请求命令用于给无线模块设置一些相关的工作参数。写配置信息请求命令的帧负荷部分格式定义如下：

##### 帧内容

Byte:2	1	1	1	1	2	2	2	1	1	2
配置标志	信道号	RF发射功率	用户接口模式	设备类型	网络标识	节点标识	保留	保留	串口参数	空中速率
帧负荷部分										

##### 配置标志

没有意义，模块内部用来检查是否有初始化的缺省配置，值固定为 0xA5A5。

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## 1.2.3 Command Type

The command type field has different definitions under various frame type identifiers, see "2, individual type frames format".

## 1.2.4 Load length

The load length field indicates the length of the frame payload portion of the upper frame format, that is, from the domain to the frame check. The number of bytes in the previous part. The maximum load length of this protocol is 128 bytes.

## 1.3 frame load

The format of the frame payload portion is determined by different frame types and different command types under the frame type. See "2. Individual type frame format".

## 1.4 frame tail

The frame end field is a 1-byte XOR check. This check value is the first byte from the frame header (frame type byte) The result of an exclusive OR operation of all bytes before starting to check the byte. Check all bytes in the full frame XOR operation If it is 0, the verification is correct.

## 2 , individual type frame format

## 2.1 module configuration type

The module configuration type is identified as 0x01. The command types under the module configuration type are defined as follows:

Command Type Identification	Command Function Description
0x01	Write configuration information request
0x81	Write configuration information response
0x02	Read configuration information request
0x82	Read configuration information response
0x06	Read version information request
0x86	Read version information response
0x07	Module reset request
0x87	Module reset response

## 2.1.1 Write configuration information request

The Write Configuration Information Request command is used to set some relevant operating parameters for the wireless module. The format of the frame payload portion of the request command is defined as follows:

## Frame content

Byte: 2	1	1	1	1	2	2 2 1 1	2
Configurati	on channel	RF emission	User connectiv	Device	The inter	node	Guard
Sign	number	power	Port mode	Types of	Identificati	Identificati	Industrial
					on stay	on stay	potential
							parameter
							Frame load section

## Configuration flag

It doesn't make sense. The module internally checks to see if there is an initial configuration that is initialized. The value is fixed at 0xA5A5.

## 信道号

无线模块工作信道号，范围为 0—8，缺省值为 1。

0=431M, 1= 432M, 2=429M, 3=433M, 4=436M, 5=434M, 6=437M, 7 =435M

## RF 发射功率

默认值是最大功率。

## 用户接口模式

模块串口与用户交互的工作模式，0：16 进制命令模式；1：透明模式；

## 设备类型

模块在应用中工作模式，0：从设备；1：主设备，缺省值为 0（从设备）。

## 网络标识

无线模块组网的网络标识，相同网络标识的无线模块属于同一个网络，只有同一个网络内的模块才能够互相通讯。网络标识的值的范围为 0x0000~0xFFFF，缺省值为 0x0000。

## 节点标识

无线模块作为一个网络节点，有一个节点标识，或称作节点地址。节点标识的值的范围为 0x0000~0xFFFF，0xFFFF 保留用作广播地址。模块出厂时的节点标识取模块出厂序列号的低 2 个字节，所以模块缺省的节点标识一般不重复。

## 空中速率（由信号带宽和扩频因子决定）

出厂扩频因子和信号带宽都为 9，相当于模块空中的调制速率 7K，建议客户不修改。由于组网模块的延时大，如客户修改需计算得空中速率大于 7K，过低的话收发延时过大，影响组网内部协议的判定，从而导致网络不稳定。

## 串口参数

模块串口的运行参数。其格式定义如下：

串口参数格式：

Bit: 1	2	1	4
停止位	校验位	保留	波特率

停止位：0：1 位停止位；1：2 位停止位，缺省值是 0；

校验位：0：无校验；1：奇校验；2：偶校验，缺省值是 2；

波特率：1：1200；2：2400；3：4800；4：9600 5：14400；6：19200；7：28800；8：38400；9：57600；10：76800；11：115200；12：230400，缺省值为 4。

### 2.1.2 写配置信息应答

写配置信息应答为向模块发送写配置信息请求命令之后，模块回复的应答，其帧负载部分定义如下：

1
返回状态
帧负载

**Channel number**

The working channel number of the wireless module ranges from 0 to 8. The default value is 1.

0=431M, 1= 432M, 2=429M, 3=433M, 4=436M, 5=434M, 6=437M, 7=435M

**RF transmit power**

The default is the maximum power.

**User interface mode**

The working mode of the module serial port interacting with the user, 0:16 command mode; 1: transparent mode;

**Equipment type**

The module works in the application mode, 0: slave device; 1: master device, the default value is 0 (slave device).

**Network identification**

The network identifier of the wireless module networking, the wireless modules of the same network identifier belong to the same network, only Modules in the same network can communicate with each other. The value of the network identifier ranges from 0x0000 to 0xFFFF.

The default is 0x0000.

**Node identifier**

The wireless module acts as a network node and has a node identifier, or node address. Node identifier

The range of values is 0x0000~0xFFFF, and 0xFFFF is reserved for broadcast address. Node label when the module is shipped

The module is identified as the lower 2 bytes of the factory serial number, so the default node ID of the module is generally not repeated.

**Air rate (determined by signal bandwidth and spreading factor)**

The factory spread spectrum factor and signal bandwidth are both 9, which is equivalent to the module's air modulation rate of 7K.

Do not modify. Due to the large delay of the networking module, if the customer needs to calculate the air rate is greater than 7K, it is too low.

If the sending and receiving delay is too large, it will affect the judgment of the internal protocol of the networking, which will lead to network instability.

**Serial port parameter**

The operating parameters of the module serial port. Its format is defined as follows:

**Serial port parameter format:**

Bit: 1            2            1            4

Stop bit check bit retention baud rate

Stop bit: 0:1 stop bit; 1:2 stop bit, default value is 0;

Check digit: 0: no parity; 1: odd parity; 2: even parity, the default value is 2;

Baud rate: 1:1200; 2: 2400; 3: 4800; 4: 9600 5: 14400; 6: 19200;

28800; 8:38400; 9:57600; 10:76800; 11:115200; 12:230400, default

Is 4.

**2.1.2 Write configuration information response**

Write configuration information response is a response replied by the module after sending a write configuration information request command to the module.

The frame load portion is defined as follows:

1
Return status
Frame load

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**Return status**

Write the configuration information request command execution results, the status code is defined as follows:

**User interface return status code definition**

Status value	Definition
--------------	------------

返回状态

写配置信息请求命令执行的结果，状态代码定义如下表：  
用户接口返回状态码定义

状态值	定义说明
0x00	成功
0x01	异或校验错误
0x02	测试帧发送错误
0x03	命令错误
0x04	信息设置错误
0x05	长度错误
0x06	写 Flash 失败错误

### 2.1.3 读配置信息请求

读配置信息请求用于读出模块中的配置参数，命令的帧负荷部分为空，帧头帧尾部分参见“1、通用帧格式”，命令的帧类型标识及命令标识参见“2.1 模块配置类型”。

### 2.1.4 读配置信息应答

读配置信息应答为模块收到读配置信息请求命令后返回的配置信息。读配置信息应答命令的帧负荷部分与“2.1.1 写配置信息请求”命令的帧负荷部分定义完全相同。

### 2.1.5 读版本信息请求

读版本信息请求用于读出模块中固件的版本信息，命令的帧负荷部分为空，帧头帧尾部分参见“1、通用帧格式”，命令的帧类型标识及命令标识参见“2.1 模块配置类型”中定义。

### 2.1.6 读版本信息应答

读版本信息应答为模块收到读版本信息请求命令后返回的固件版本信息。其帧负荷部分定义如下：

Byte: 1	1	1	1	1	1	1	1
主版本号	次版本号	修订版本号	硬件类型代码	编译日期日	编译日期月	编译日期年	设备类型
帧负载							

注意：当前硬件类型代码域与设备类型域保留未使用。

### 2.1.7 模块复位请求

0x00 success  
0x01 XOR check error  
0x02 test frame transmission error  
0x03 command error  
0x04 Information setting error  
0x05 length error  
0x06 Write Flash failed error

#### 2.1.3 Reading Configuration Information Request

The read configuration information request is used to read the configuration parameters in the module, and the frame payload portion of the command header is defined with the frame payload portion of the "2.1.1 Write Configuration Information Request". For the end of the frame header, see "1. Common Frame Format". For the frame type identifier and command identifier of the command, see "2.1 Modules. Set type."

#### 2.1.4 Reading Configuration Information Response

The read configuration information response is the configuration information returned by the module after receiving the read configuration information request. The frame payload portion of the message response command is defined with the frame payload portion of the "2.1.1 Write Configuration Information Request". All the same.

#### 2.1.5 Read version information request

The read version information request is used to read the version information of the firmware in the module, and the frame load portion of the command header is defined with the frame load portion of the "2.1.1 Write Configuration Information Request". For the end of the frame header, see "1. Common frame format". For the frame type identifier and command identifier of the command, see "2.1 Modes. Defined in the block configuration type".

#### 2.1.6 Read version information response

The read version information response is the firmware version information returned by the module after receiving the read version information request. The frame payload portion is defined as follows:

Byte: 1	1	1	1	1	1	1	1	1
Major version	Secondary version	revision	edit	Hardware type	Compilation date	Compilation day	Compilation device	
number	This number	This number	Code	Date	Period	Year	Types of	
			Frame load					

Note: The current hardware type code field and device type field are left unused.

#### 2.1.7 Module Reset Request

模块复位请求用于使无线模块进行软复位。此命令的帧负荷部分为空，帧头帧尾部分参见“1、通用帧格式”，命令的帧类型标识及命令标识参见“2.1 模块配置类型”中定义。

### 2.1.8 模块复位应答

模块复位应答为模块收到模块复位请求命令后返回的执行状态信息。其帧负荷部分定义如下：

1
返回状态
帧负荷

返回状态代码定义与“2.1.2 写配置信息应答”部分中定义相同。

注意：当命令执行程序时，模块复位，外部接收到不模块复位应答命令。

## 2.2 调试信息类型

调试信息类型的标识为 0x04。调试信息类型下各命令类型定义如下：

命令类型标识	命令功能说明
0x01	写访问控制列表请求
0x81	写访问控制列表应答
0x02	读访问控制列表请求
0x82	读访问控制列表应答

### 2.2.1 写访问控制列表请求

### 2.2.2 写访问控制列表应答

### 2.2.3 读访问控制列表请求

### 2.2.4 读访问控制列表应答

## 2.3 应用数据类型

应用数据类型的标识为 0x05。应用数据类型下各命令类型定义如下：

命令类型标识	命令功能说明
0x01	应用数据发送请求
0x81	应用数据发送应答
0x82	应用数据接收指示
0x08	源路由路由发现请求
0x88	源路由路由发现应答

### 2.3.1 应用数据发送请求

应用数据发送请求命令用于外部设备经过无线组网模块发送数据。此命令的帧负荷部分定义如下：

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The module reset request is used to soft reset the wireless module. The frame payload portion of this command is empty, the frame header For the end of the frame, see "1. Common Frame Format". For the frame type identifier and command identifier of the command, see "2.1 Modules. Defined in the type.

### 2.1.8 Module Reset Response

The module reset response is the execution status information returned by the module after receiving the module reset request command. Its frame is negative. The load part is defined as follows:

1
Return status
Frame load

The return status code definition is the same as defined in the "2.1.2 Write Configuration Information Response" section.

Note: When the command executes the program, the module is reset and the external module does not receive the module reset response command.

## 2.2 Debug information type

The identifier of the debug information type is 0x04. The command types under the debug information type are defined as follows:

Command type identifier	Command function description
0x01	Write access control list request
0x81	Write access control list response
0x02	Read access control list request
0x82	Read access control list response

### 2.2.1 Write Access Control List Request

### 2.2.2 Write Access Control List Reply

### 2.2.3 Reading Access Control List Requests

### 2.2.4 Read Access Control List Response

## 2.3 Application Data Type

The identifier of the application data type is 0x05. The command types under the application data type are defined as follows:

Command type identifier	Command function description
0x01	Application data sending request
0x81	Application data sending response
0x82	Application data reception indication
0x08	Source route discovery request
0x88	Source route discovery response

### 2.3.1 Application Data Send Request

The application data sending request command is used by an external device to send data through the wireless networking module.

The order of this command. The frame payload portion is defined as follows:

Bytes:2	1	1	1	1	N*2	1	变长
目标地址	应用层 ACK 请求	发送半径	发现路由参数	中继数 N	中继列表	应用业务数据单元长度	应用业务数据单元
				源路由域			
帧负荷							

### 目标地址

数据发送目标节点的 2 字节短地址（低字节在前），如果是 0xFFFF，则为广播发送。

### 应用层 ACK 请求

为 1 时，使用协议 APS 层端到端的确认重传机制；为 0 时则不使用。建议在应用层对端应用设备有响应时，不使用此功能。

### 发送半径

数据转发最大跳数，当前组网协议最大跳数值为 7（可定制）。

### 发现路由参数

0：禁止路由发现，如果路由表中没有到目标节点的路由则发送失败；

1：自动路由发现，如果路由表中有到目标节点的路由则使用，没有则自动寻找路由；

2：强制路由发现；无论路由表中有没有到目标节点的路由，都寻找新路由；

3：使用源路由。

### 源路由域

当前边发现路由参数为 3 时，则源路由域存在，否则源路由域不存在。

**中继数 N：**从源节点到目标节点所经过的中继节点的数（不包括源和目的），值得范围为 0~6；

**中继列表：**从源节点到目标节点所经过的中继节点的短地址。离目标近的节点地址在前，离源近的节点地址在后，短地址低字节在前。

### 应用业务数据单元长度：

即要发送的应用数据单元的长度。由于当前物理层的最大负载长度为 127，在除去 MAC 层、NET 层、APS 各层的包头长度之后，不使用源路由时，此长度的最大值为 111；使用源路由时，此长度最大值为 109-N\*2（N 为中继数）。

### 应用业务数据单元

要被发送到目标节点的应用数据单元。

#### 2.3.2 应用数据发送应答

模块收到应用数据发送请后命令后，执行完数据发送命令后向外回复的应答。其帧负荷部分格式定义如下：

2	1
目标地址	返回状态
帧负荷	

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Bytes:	2	1	1	1	N*2	1	lengthen
Target area site	Application layer	ACK request	radius	Discovery road By parameter	relay Number N List	Number of applications	business
					Source routing domain	Unit length	Data unit
Frame load							

**target address**

The 2-byte short address of the data transmission destination node (lower byte first), if it is 0xFFFF, it is wide Broadcast to send.

**Application layer ACK request**

When 1, the end-to-end acknowledgment retransmission mechanism of the protocol APS layer is used; if it is 0, it is not used. Recommended in This feature is not used when the application layer peer device responds.

**Send radius**

The maximum number of hops for data forwarding. The maximum hop value of the current networking protocol is 7 (customizable).

**Discover routing parameters**

0: Route discovery is disabled. If there is no route to the destination node in the routing table, the transmission fails.

1: Automatic route discovery, if there is a route to the destination node in the routing table, it is used automatically.

**Looking for a route;**

2: Forced route discovery; look for new routes regardless of whether there is a route to the destination node in the routing table;

3: Use source routing.

**Source routing domain**

If the current route is found to be 3, the source routing domain exists. Otherwise, the source routing domain does not exist.

Number of relays N : number of relay nodes (excluding source and destination) that pass from the source node to the destination node, The range of value is 0~6;

Relay list: The short address of the relay node that passes from the source node to the destination node. a section close to the target

The dot address is in the front, the node address close to the source is after, and the short address low byte is first.

**Application business data unit length:**

That is, the length of the application data unit to be sent. Since the current physical layer has a maximum load length of 127,

This length is used when the source route is not used after removing the header length of the MAC layer, NET layer, and APS layer.

The maximum value is 111; when using source routing, the maximum length is 109-N\*2 (N is the number of relays).

**Application business data unit**

The application data unit to be sent to the target node.

**2.3.2 Application Data Send Reply**

After the module receives the application data to send the post-command command, after the data transmission command is executed, the external r answer. Its frame load part format is defined as follows:

2	1
Destination address return status	
Frame load	

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**target address**

That is, the target node address in the corresponding application data transmission request command.

**Return status**

The return status indicates the execution result of the application data transmission request command.  
 The value of the return status is defined as follows table:

## 目标地址

即为相应的应用数据发送请求命令中的目标节点地址。

## 返回状态

返回状态指示应用数据发送请求命令的执行结果。返回状态的值定义如下表：

状态值	定义说明
0x00	成功
0xE1	异或校验错误
0xE4	安全检查失败
0xE5	MAC 帧超长错误
0xE6	无效参数
0xE7	未收到 ACK
0xEA	发送机正忙
0xC1	网络层无效参数
0xC2	无效请求
0xC7	未找到路由
0xD1	缓冲区忙
0xD2	APS 层未收到 ACK
0xD3	APS 帧超长

0xE<sub>x</sub> 返回为 MAC 层的错误码，0xC<sub>x</sub> 返回为网络层的错误码，0xD<sub>x</sub> 返回为 APS 层错误码。

注意：在未使用 APS 层 ACK 请求机制的数据传输中，即使返回码为成功，并不意味着数据就成功地传输到了目标地址，而只是意味着数据正常的发送到了下一跳。

### 2.3.3 应用数据接收指示

应用数据接收指示被用于，无线模块协议栈应用层收到从空中发给本节点的数据帧时用此命令从串口发送到外部设备。此命令的帧负载部分格式为：

2	1	变长
源地址	应用服务数据单元长度	应用服务数据单元
帧负载		

#### 源地址

接收到应用数据的发送源地址。

#### 应用服务数据单元长度

接收到的应用服务数据单元长度。

#### 应用服务数据单元

接收到的应用服务数据单元。

Status value	Definition
0x00	success
0xE1	XOR check error
0xE4	security check failed
0xE5	MAC frame long error
0xE6	invalid parameter
0xE7	did not receive ACK
0xEA	transmitter is busy
0xC1	network layer invalid parameter
0xC2	invalid request
0xC7	no route found
0xD1	buffer busy
0xD2	APS layer did not receive ACK
0xD3	APS frame is too long

0xEx returns the error code of the MAC layer, 0xCx returns the error code of the network layer, 0 Dx returns the APS Layer error code.

Note: In the data transmission without the APS layer ACK request mechanism, even if the return code is successful, it is not Means that the data is successfully transferred to the target address, but only means that the data is sent to the next one. jump.

### 2.3.3 Application data receiving indication

The application data receiving indication is used, and the application module of the wireless module protocol stack is sent from the air to the node. Use this command to send data frames from the serial port to an external device. The format of the frame payload portion of this command is:

2	1	lengthen
Source address application service data unit length application service data unit		
Frame load		

source address

The source address of the application data received.

Application service data unit length

The length of the application service data unit received.

Application service data unit

The received application service data unit.

### 2.3.4 源路由路由发现请求

源路由路由发现请求命令被用于发起查找能够到达目标节点的源路由(中继地址列表)。此命令的帧负载部分格式如下:

2	1	1
目标地址	发送半径	发现路由参数
帧负荷		

#### 目标地址

查找路由的目标节点的地址。

#### 发送半径

路由中继转发的最大跳数。本协议定义最大值为 7 (可定制)。

#### 发现路由参数

与“应用数据发送请求”命令中的定义相同，但在本命令中固定为 3，即源路由发现。

### 2.3.5 源路由发现应答

源路由发现应答命令为无线模块执行完源路由发现请求命令后向外部设备返回执行结果。此命令的帧负载部分格式如下:

2	1	1	1	N*2
目标地址	返回状态	发现路由参数	中继数 N	中继列表
源路由				
帧负荷				

#### 目标地址

返回源路由条目的目标地址。

#### 返回状态

返回状态指示源路由发现请求命令的执行结果。返回状态的值与“2.3.2 应用数据发送应答”中返回状态的值的定义相同。

#### 发现路由参数

与“应用数据发送请求”命令中的定义相同，但在本命令中固定为 3，即源路由发现。

#### 源路由

当前边返回状态的值为 0x00 (成功) 时，源路由域存在。

**中继数 N:** 返回源路由的中继节点的数量。

**中继列表:** 返回源路由的中继节点的地址，越靠近目标节点的地址在前，越靠近源节点的地址在后，地址都是低字节在前，高字节在后。

## 十四、 天线选配

天线系统是无线通讯的重要组成部分，良好的天线系统，能够极大提高无线通讯效果，事半功倍。

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## 2.3.4 Source Route Discovery Request

The source route discovery request command is used to initiate a lookup of the source route that can reach the destination node (relay) Address list). The format of the frame payload portion of this command is as follows:

2	1	1	
Destination address sending radius discovery routing parameter			
Frame load			

## target address

Find the address of the destination node of the route.

## Send radius

Maximum number of hops for route relay forwarding. This protocol defines a maximum of 7 (customizable).

## Discover routing parameters

Same as the definition in the "Application Data Send Request" command, but fixed to 3 in this command, that is, the source road

## Discovered by.

## 2.3.5 Source Route Discovery Response

The source route discovery response command is sent to the external device after the wireless module executes the source route discovery request c Returns the execution result. The format of the frame payload portion of this command is as follows:

2	1	1	1	N*2	
Relay number N relay list					
Destination address return status discovery parameters					
Source routing					
Frame load					

## target address

Returns the destination address of the source route entry.

## Return status

The return status indicates the execution result of the source route discovery request command. Return status value with "2.3.2 application

The value of the return status in the Data Send Reply is the same.

## Discover routing parameters

Same as the definition in the "Application Data Send Request" command, but fixed to 3 in this command, that is, the source road

## Discovered by.

## Source routing

The source routing domain exists when the value of the current edge return status is 0x00 (success).

Number of Relays N : The number of relay nodes that return the source route.

Relay list: The address of the relay node that returns the source route. The closer to the address of the target node, the more

After the address near the source node is followed, the address is the low byte first and the high byte later.

## Fourteen, antenna matching

The antenna system is an important part of wireless communication, a good antenna system can greatly improve wireless The communication effect is twice the result with half the effort.

			
弹簧天线	胶棒天线	折叠胶棒天线	小吸盘天线
1.5dBi	2.0dBi	3.0dBi	3.5dBi
长度 4cm	长度 5cm	长度 6cm	高 12cm, 线长 1~5m

提示：在允许安装的情况下，建议尽量采用高增益天线，天线安装时与地平线垂直效果最佳。  
如果自行配置天线，需要注意频率匹配，阻抗  $50\Omega$ ，驻波比越小越好。天线规格以实物为准。  
使用内置弹簧天线时，用户可提供整套完整的产品给我公司匹配专用弹簧天线。

## 十五、 应用领域

- ✓ 四表集抄：水表、电表、气表、热表等无线抄表；
- ✓ 智慧农业：灌溉控制、农田数据采集、温室大棚监测；
- ✓ 智能家居：无线开关、智能灯泡、家电控制、智能锁；
- ✓ 手持设备：点菜机、手抄机、扫描枪、对讲机；
- ✓ 智能交通：交通信号灯无线遥控、路灯集中控制系统；
- ✓ 数据发送：电子看板、LED 显示屏、油价屏、货架标签；
- ✓ 数据采集：电子衡器、粮情测控、水文水利监测；
- ✓ 安防系统：无线报警器、电子围栏、摄像机云台控制；
- ✓ 智慧城市：楼宇节能、暖通控制、井盖防盗监控、车位管理；
- ✓ 医疗管理：老人呼叫器、婴儿监护仪、医疗设备仪表监测；
- ✓ 会议设备：投票表决器、评分评价器、抢答器、无线音箱；
- ✓ 资产管理：人员定位监测、物资设备定位监测；
- ✓ 无线传感：温度、湿度、压力、液位、震动等无线传感；
- ✓ 工控系统：PLC 数据传输、自动化控制；
- ✓ 能源管理：火力、水力、风力、光伏发电等变电站维护；
- ✓ 穿戴设备：手表、狗环、耳标、胸牌、挂件；

声明：本公司保留未经通知随时更新本产品使用手册的最终解释权和修改权！

Spring antenna	Glue stick antenna	Folding glue stick antenna	Small suction cup antenna
1.5dBi	2.0dBi	3.0dBi	3.5dBi
Length 4cm	Length 5cm	Length 6cm	12cm high, line length 1~5m

Tip: When it is allowed to install, it is recommended to use a high-gain antenna as much as possible.

Line vertical effect is best.

If you configure the antenna yourself, you need to pay attention to the frequency matching, the impedance is  $50\Omega$ , and the smaller the standing wave r antenna Specifications are subject to the actual product.

When using the built-in spring antenna, users can provide a complete set of products to our company to match the dedicated spring days. line.

#### Fifteen, application areas

- ✓ Four-table copy: wireless meter reading such as water meter, electric meter, gas meter, heat meter;
- ✓ Smart agriculture: irrigation control, farmland data collection, greenhouse monitoring;
- ✓ Smart home: wireless switch, smart light bulb, home appliance control, smart lock;
- ✓ Handheld equipment: a la carte machine, hand-held machine, scanner, walkie-talkie;
- ✓ Intelligent transportation: wireless remote control of traffic lights, centralized control system for street lights;
- ✓ Data transmission: electronic signage, LED display, oil price screen, shelf label;
- ✓ Data collection: electronic weighing, grain monitoring and control, hydrology and water monitoring;
- ✓ Security system: wireless alarm, electronic fence, camera pan/tilt control;
- ✓ Smart City: Building energy saving, HVAC control, manhole cover anti-theft monitoring, parking space management;
- ✓ Medical management: elderly callers, baby monitors, medical equipment instrumentation monitoring;
- ✓ Conference equipment: voting device, rating evaluator, responder, wireless speaker;
- ✓ Asset management: personnel location monitoring, material equipment positioning monitoring;
- ✓ Wireless sensing: wireless sensing such as temperature, humidity, pressure, liquid level, vibration, etc.;
- ✓ Industrial control system: PLC data transmission, automatic control;
- ✓ Energy management: maintenance of substations such as firepower, hydropower, wind power, and photovoltaic power generation;
- ✓ Wearable equipment: watches, dog rings, ear tags, badges, pendants;

Disclaimer: The company reserves the right to interpret and modify the manual of this product at any time without notice!