Zigbee module User Guide

(Suit For Firmware V8.1 and above)

CC2630 series Zigbee modules:

DRF1609H (UART interface)

DRF2657C (RS232 interface)

DRF2659C (RS485 interface)

DRF2658C (USB interface)

DRF2670C (RJ45 network interface)

Zigbee positioning system and kit

The article is relatively long

- **Please select through the catalog and click on the corresponding content to read**
- **Or refer to the quick guide (general application is enough)**

Table of contents

1. Documentation and module firmware version description

date	content
2017.02.23	This document is published for the first time
2017.05.30	Module firmware version upgrade to V7.2/ V7.3: 1. Added End Device node settings: (1), End Device is a node without routing function; (2) Through commands, End Device can find out the three nearest Router nodes. This function is compatible with the positioning system of CC2530 series; 2. Added instructions for Router and End Device to inquire about signal strength; 3. Added the function of enabling encryption and password; 4. Added the point-to-point transmission function of custom address addressing; Instructions are backward compatible, V7.2/V7.3 version modules can still use the old configuration software (instructions); Data transmission, compatible with modules below V7.2 (can communicate with each other) Firmware version description: The even-numbered version of the firmware (such as V7.2) can use the onboard antenna and the external antenna, and the odd-numbered version of the firmware (such as V7.3) is usually suitable for products with a casing, and only the external antenna can be used.
2017.06.08	Instructions (modified for this document):

	INS05, read module parameters, X43-X48 is changed to: X42-X47
2017.06.10	Module firmware version upgrade to V7.4/ V7.5: Added in transparent transmission section: Transparent transmission + custom address Transparent transmission + short address Transparent transmission + MAC address
2017.06.28	Modify this documentation error: P52, P53: target address (short address) →target address (custom address) Added on P80: Remarks: For all write commands, the module needs to be restarted to take effect after writing. When the module receives a connection command or a read command, it will enter the configuration state and prohibit receiving data for one minute.
2017.08.02	Adjusted the version release rules, each version consists of 3 minor versions, such as X.1-X.3, X.4-X.6, X.7-X.9 like V7.4: It is a full-featured version, all parameters can be set, such as DRF1609H V7.5: It is a version with a shell, the antenna selection defaults to an external antenna, which cannot be set, such as DRF2659C V7.6: Zigbee gateway, node type = Coordinator, antenna selection = external antenna, baud rate = 115200, serial port format = 8-N-1, parameters that cannot be set, such as DRF2670C Released Zigbee gateway products and added instructions

	Released Zigbee positioning system and positioning card products, and added instructions for use The configuration software has been upgraded accordingly (adding the settings of the Zigbee gateway)
2017.08.23	Added supplementary content for Zigbee positioning system: Position card, position reference point, data node The corresponding firmware versions are: V7.4 (DRF1609H), V7.5 (products with shell), V7.6 (Zigbee gateway)
2017.12.13	Modification of document content (no modification for product): P63: Added: Coordinator must exist (power on) during point-to-point transmission. P104: Maximum data packet 256 bytes (previously 269 bytes, earlier versions)
2018.02.20	1. The module is upgraded to V7.7 (V7.7, V7.8, V7.9) version: V7.7: general version, full function, the product is DRF1609H V7.8: The version with shell products, only external antenna can be used, the products are DRF2657C, DRF2658C, DRF2659C V7.9: Zigbee gateway product, DRF2670C, node type = Coordinator, antenna selection = external antenna, baud rate = 115200, serial port format = 8-N-1, parameters that cannot be set 2. The module firmware is upgraded, and the transmission speed is increased;

	3. Routing optimization; 4. Production optimization; 5. This document is arranged in WORD, and the directory tree is updated for easy search
2018.05.26	1. The module is upgraded to V8.1 (V8.1, V8.2, V8.3) version, and three versions are released together each time, which are respectively applicable to DRF1609H, products with shells and Zigbee gateways; 2. Added the sleep function of End Device: send commands to End Device to enter low power consumption mode, and wake up by pulling down the FUNCTION button; 3. Added NN transmission (broadcast transmission) 4. Compatible with the wireless serial port function of DRF1607H (no routing, fast data transmission, not listed in this manual, please consult for details)
2018.07.18	Modify this document: Router、End Device receives the command to read parameters, and will not prohibit data reception After the Coordinator receives the command to read parameters, it will prohibit data reception for 1 minute All nodes, after receiving the connection module instructions, will enter the configuration state and prohibit receiving data for 1 minute Added MCU routines (send and receive data through Zigbee, STM32)

2019.04.26	Module upgrade to V8.4 version (V8.4, V8.5, V8.6): 1，Added the functions of wireless reading, modifying module parameters, and restarting the module (operated through the coordinator). The configuration software is in the "Zigbee network", and this function can be directly operated 2，performance optimization
2020.02.06	Module upgrade to V8.7 version (V8.7, V8. 8, V8. 9): 1，Added an instruction to automatically join the network (this instruction is equivalent to double-clicking the Function case three times) 2，Added single-chip bottom board and single-chip routines

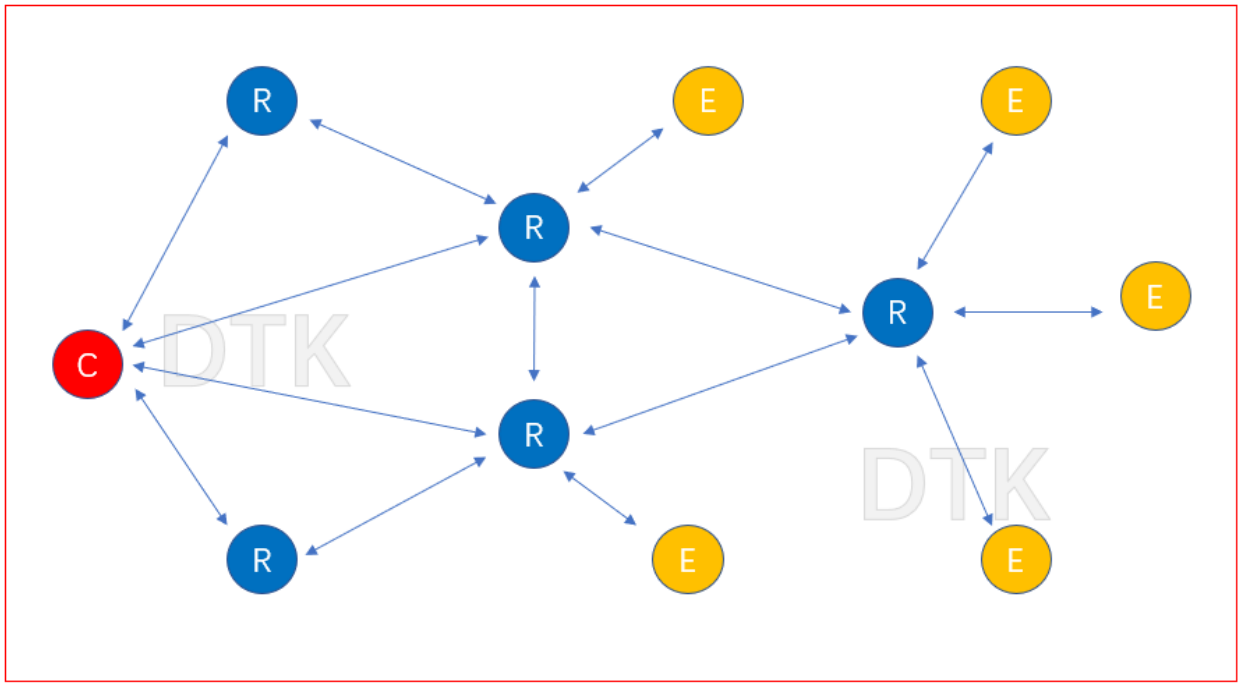
2. Zigbee module characteristics

2.1. Features of Zigbee module

- The main chip inside the module is CC2630 (dual-core ARM-32 -bit CPU chip)
- The signal amplification part is a dual-channel PA, and the onboard antenna and the external antenna have independent signal channels, which can be switched by software
- Modules can be set to:
  Coordinator: Coordinator (or main module), create a Zigbee network
  Router: router (slave module), with automatic routing function, sending and receiving data function
  end Device: terminal node (slave module), can send and receive data, no automatic routing, can enter dormant state
- From the module (Router, End Device) can automatically join the network by pressing the button, or can be set separately to join the network
- A Zigbee network can theoretically accommodate 65536 nodes (2-byte addresses)
- There is no limit to the routing depth (200 -level routing, which is basically equivalent to no limit)
- The short address remains unchanged, and a custom address can also be set. The module comes with an 8-byte MAC address
- Coordinator can be directly replaced
- Transparent transmission, maximum 269 bytes per packet
- Point-to-point transmission sent to any node
- The module control instructions are simple and the instructions are backward compatible
- Communication backward compatible

2.2. Brief introduction of Zigbee network

- Zigbee network is a master-slave structure network (or MESH network structure)
- Each Zigbee network consists of a Coordinator (coordinator), N Routers (routers) or N End Devices (terminal node) composition
- Coordinator: is the creator of the Zigbee network, must exist in a Zigbee network
- Router (router) can send and receive data, and can also provide automatic routing (automatic relay) for other nodes. The routing path is automatically obtained without user setting
- The automatic routing of the Router is dynamically maintained. When one of the paths fails, it will automatically jump to other available paths
- End Device (terminal node) has no routing function, can send and receive data, and can enter the sleep state through command setting to achieve the purpose of low power consumption



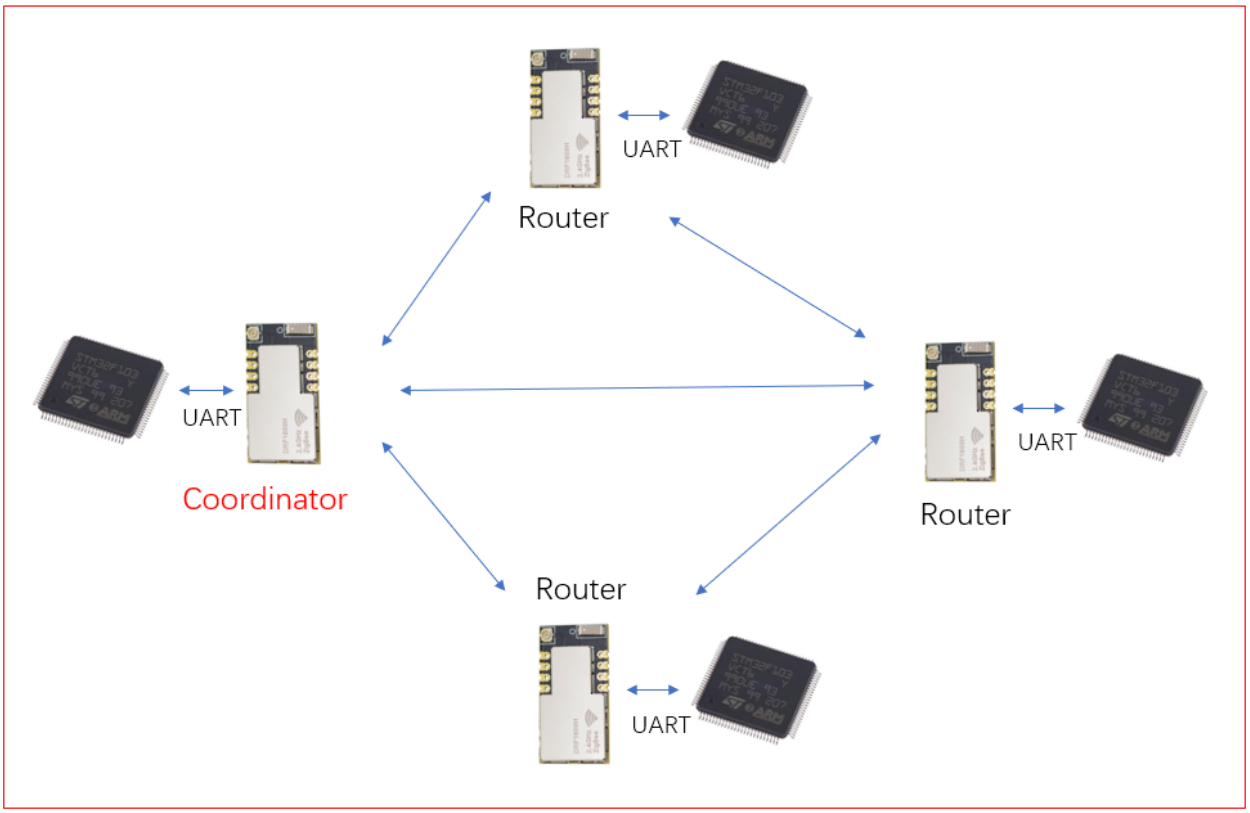
2.3. Application of Zigbee module

The main function of the Zigbee module is: a certain data received by the serial port is sent to the corresponding module through the Zigbee protocol, and the corresponding module outputs the data through the serial port after receiving the wireless data. That is, in simple terms, two Zigbee modules are equivalent to one serial cable.

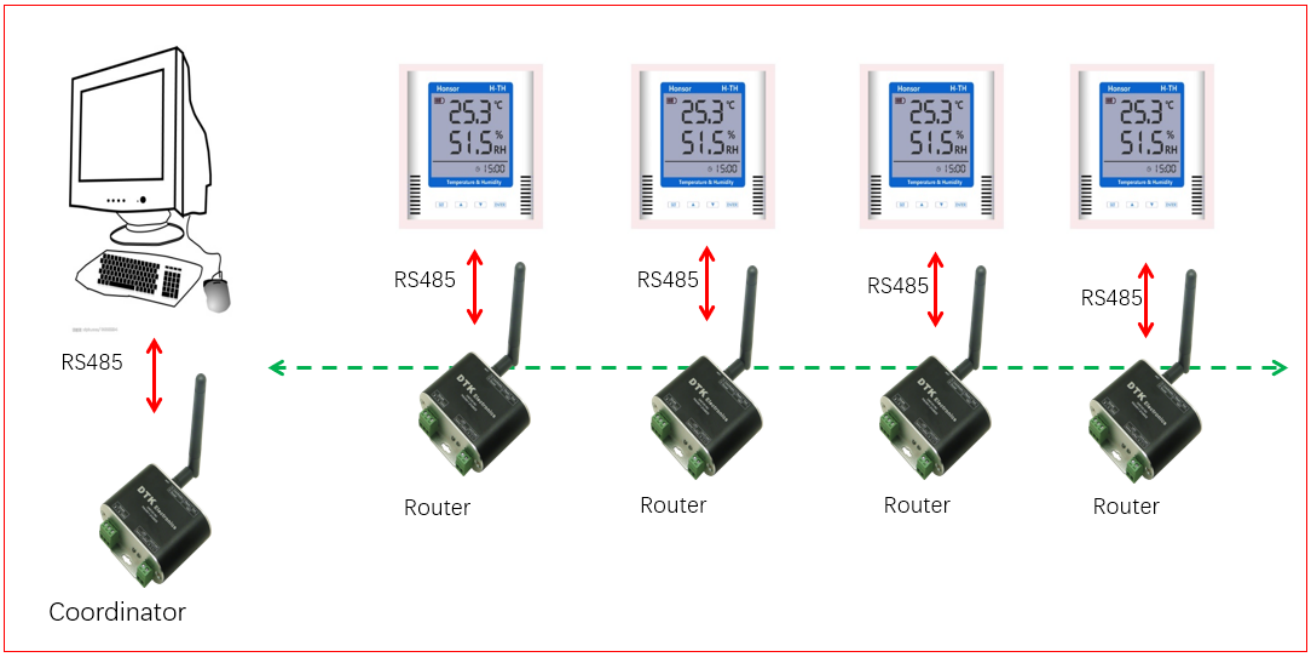
(Example 1): Serial port transparent transmission between MCUs:

One-to-one transparent transmission, in general, it can directly replace the serial port line between single-chip microcomputers

(Example 2): One-to-many transparent transmission between MCUs:



(Example 3): One-to-many transparent transmission between devices



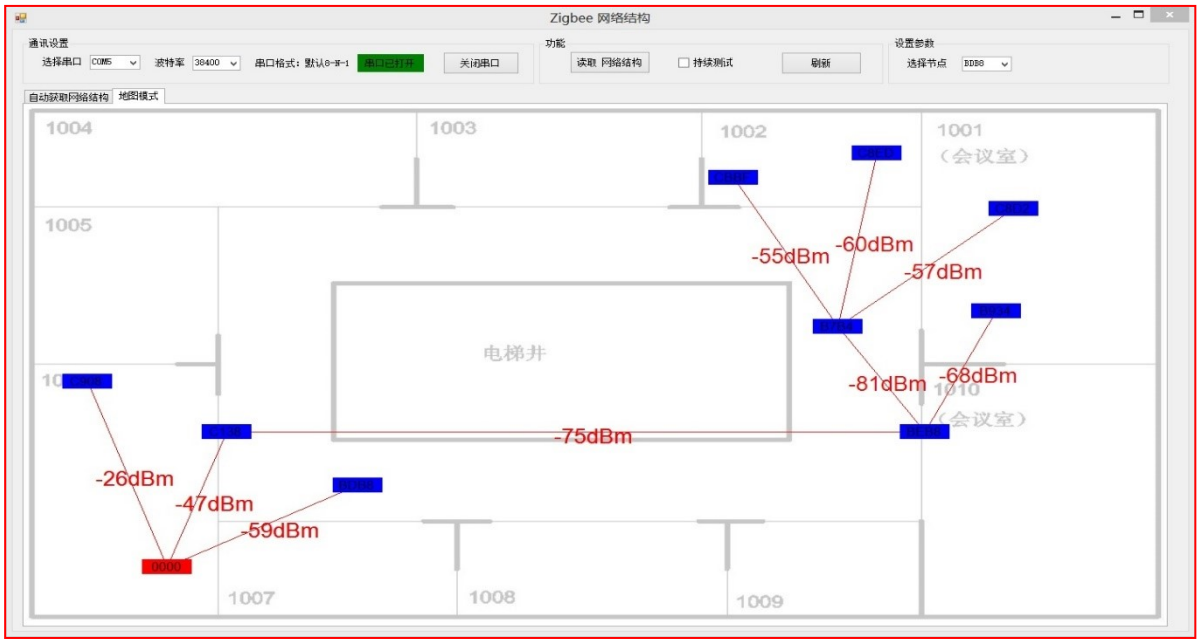
(Example 4): street light control,

Support 200 -level automatic routing. If you apply street lamp control in different directions, a network can connect up to 500 street lamps (controlling the on and off of street lamps)

2.4. Several practical functions

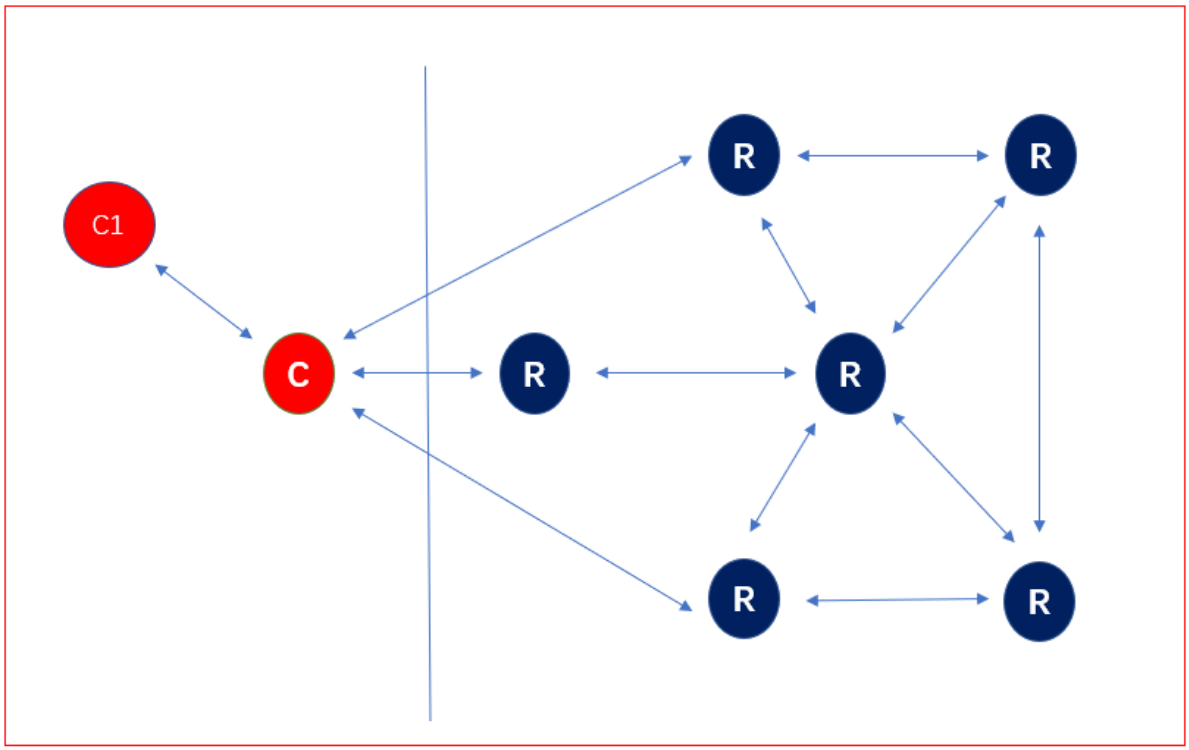
(2.4.1), read the network structure

The Zigbee module, combined with DTK application software, can clearly know the structure of the entire Zigbee network (the routing relationship of all nodes, and the signal strength between all nodes, which greatly facilitates user debugging and networking. **Compared with the first-generation product, this feature is a major innovation**



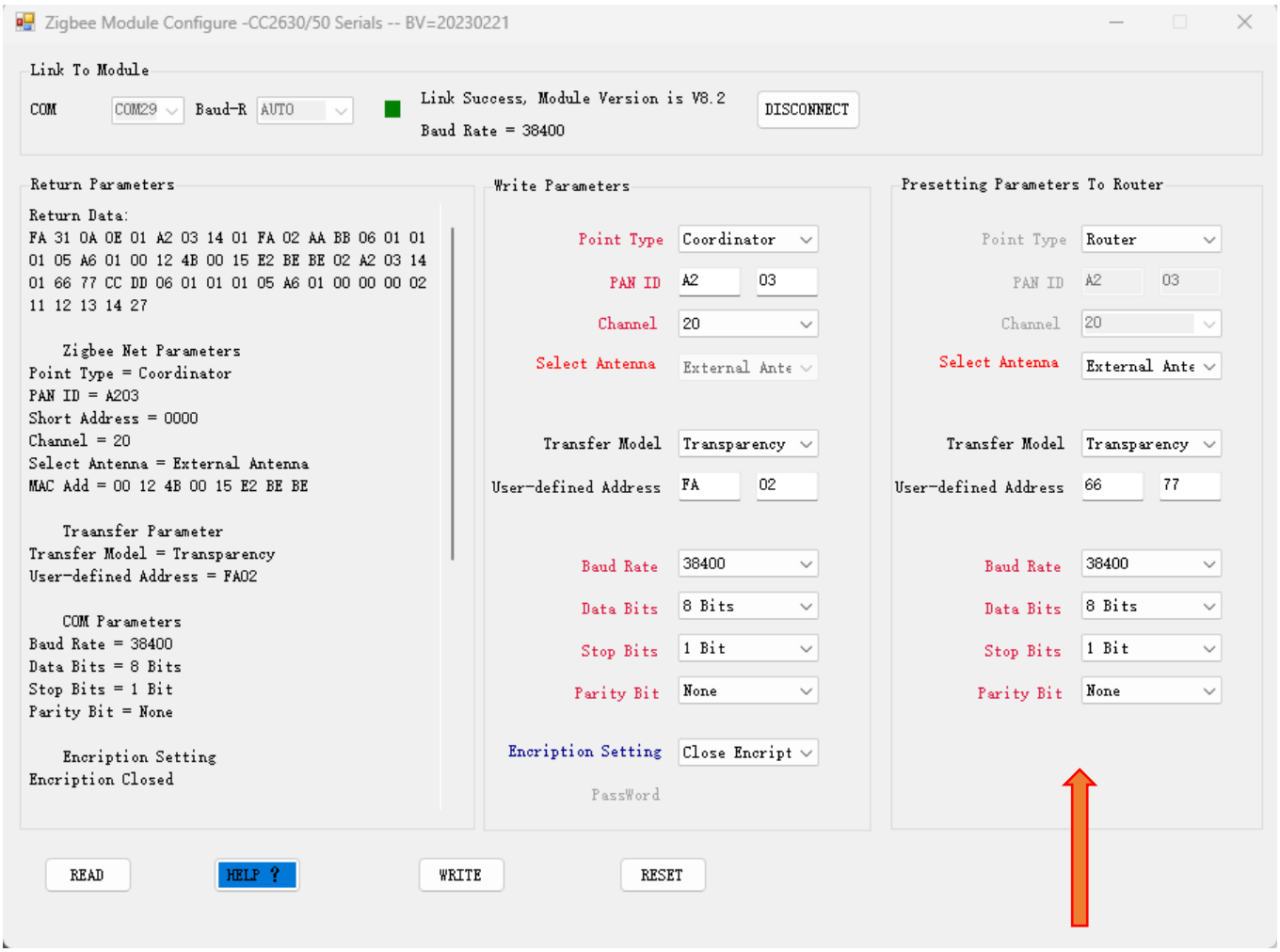
(2.4.2), Coordinator direct replacement

The Zigbee module solves the problem of replacing the coordinator of the first-generation product, and only needs to set the parameters of the new Zigbee module to be consistent with the parameters of the old Coordinator, that is, it can replace the original Coordinator;



(2.4.3), press the button to join the network (setup free)

When setting the coordinator, you can set Router's or End Device's parameters together ("preset parameters for the Router" in the configuration software), and during on-site construction, press the Router's or End Device's function key three times (within 1.2 second), then Router or End Device will start to automatically search for the network, and will automatically join the network after finding it, and get the "preset parameters for Router" from the coordinator.



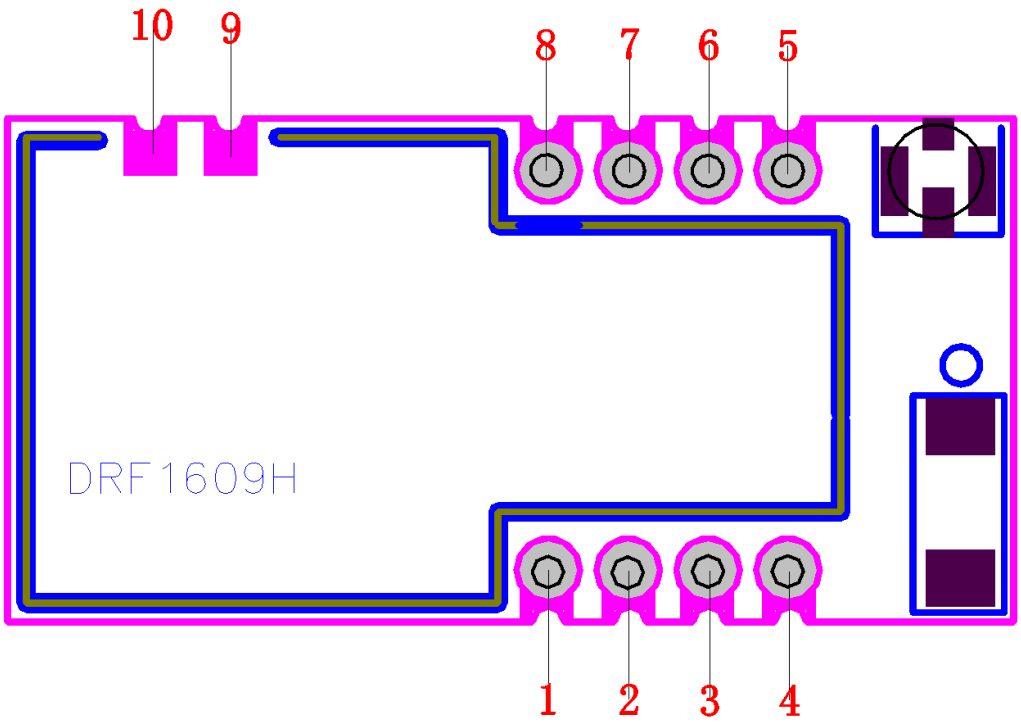
3. Zigbee module parameters

3.1, DRF1609H

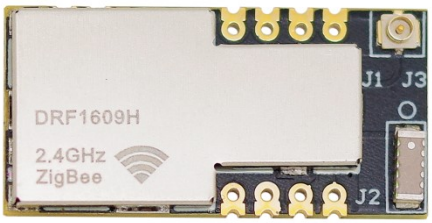
(3.1.1), electrical parameters

Input voltage	**DC 3.3V**
temperature range	-40 °C ~85 °C
Serial baud rate	38400bps (default), 1200bps, 2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps can be set
Serial format	8-N-1 (default), 8-E-1, 8-O-1 can be set
radio frequency	2.4GHz (24 0 0MHz), the user can change the channel (2405MHz~2480MHz, step size: 5MHz) through the serial port command, and the corresponding channel 11-26 is optional
Transmission distance	Visible, open, transmission distance 1600 meters
Working current	Average 25mA (@3.3V) , recommended power supply > 300mA Standby 18 mA, receive 20mA, transmit 200mA
Receiver sensitivity	-98dBm
main chip	TI CC2630F128
configurable node	Can be configured as Coordinator, Router, End Device
interface	3.3V UART

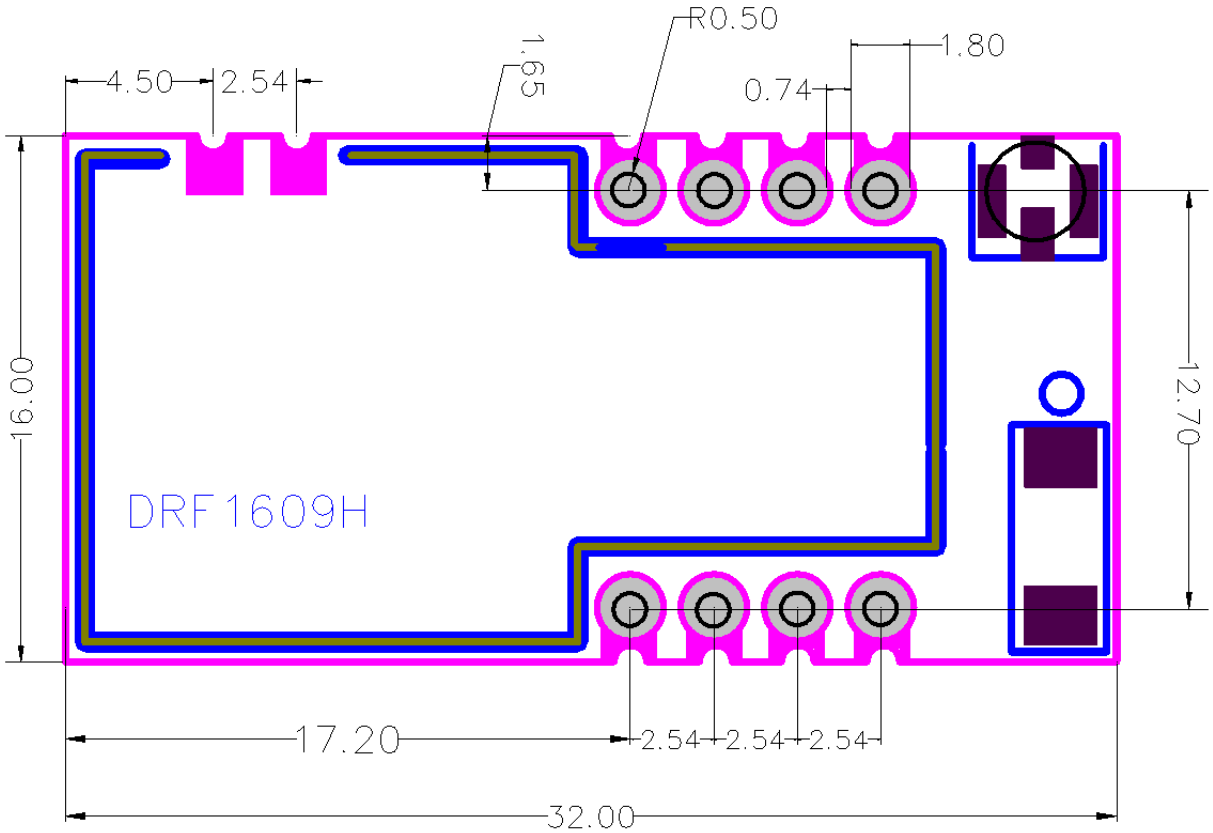
(3.1.2), PIN definition



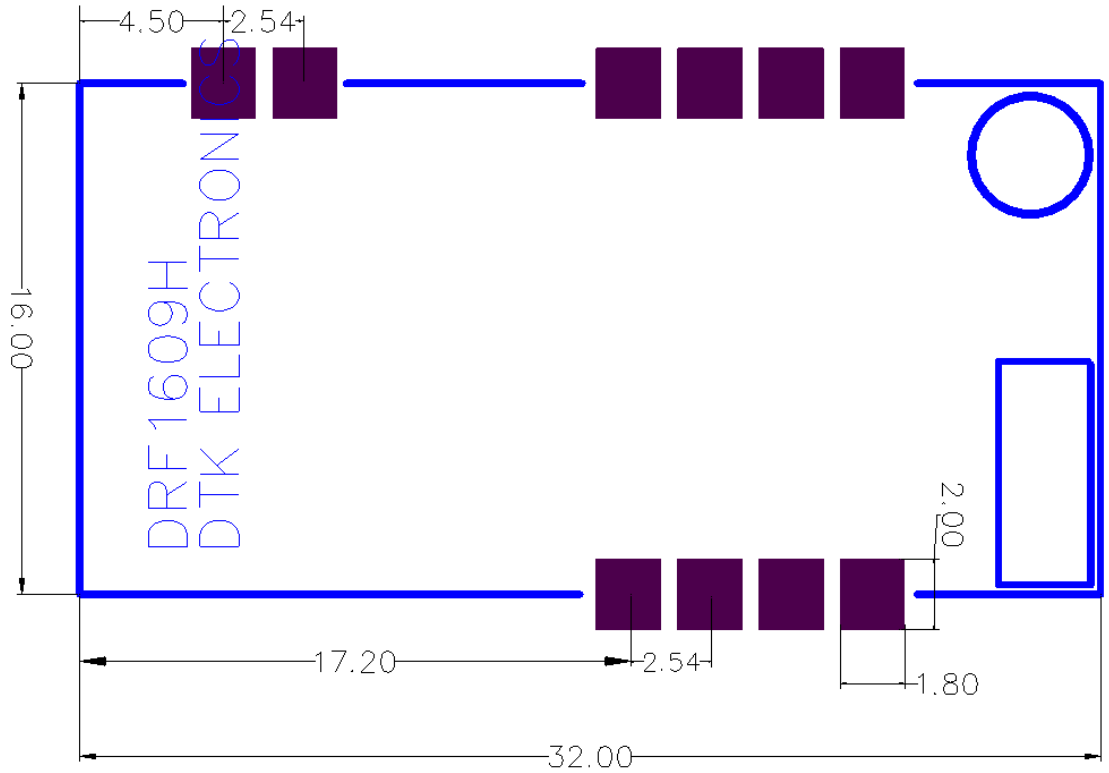
PIN	name	Function
1	VCC	3.3 V power supply
2	GND	power ground
3	RESET_N	Reset, low level reset
4	KEY	function button
5	TX	Serial TX
6	RX	Serial RX
7	LED3	LED light indicates data sending and receiving
8	LED4	LED lights indicate status
9	TMS	JTAG TMS
10	TCK	JTAG TCK



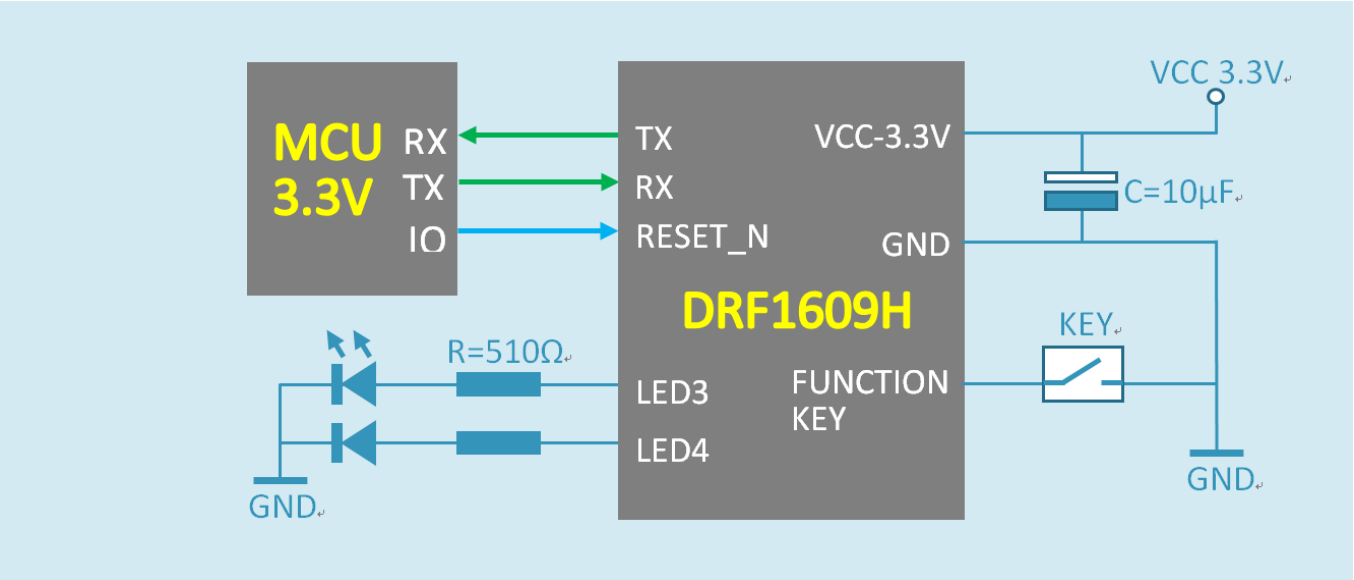
(3.1.3), module size and PCB package



DRF1609H PCB package (recommended):



(3.1.4), DRF1609H minimum application system



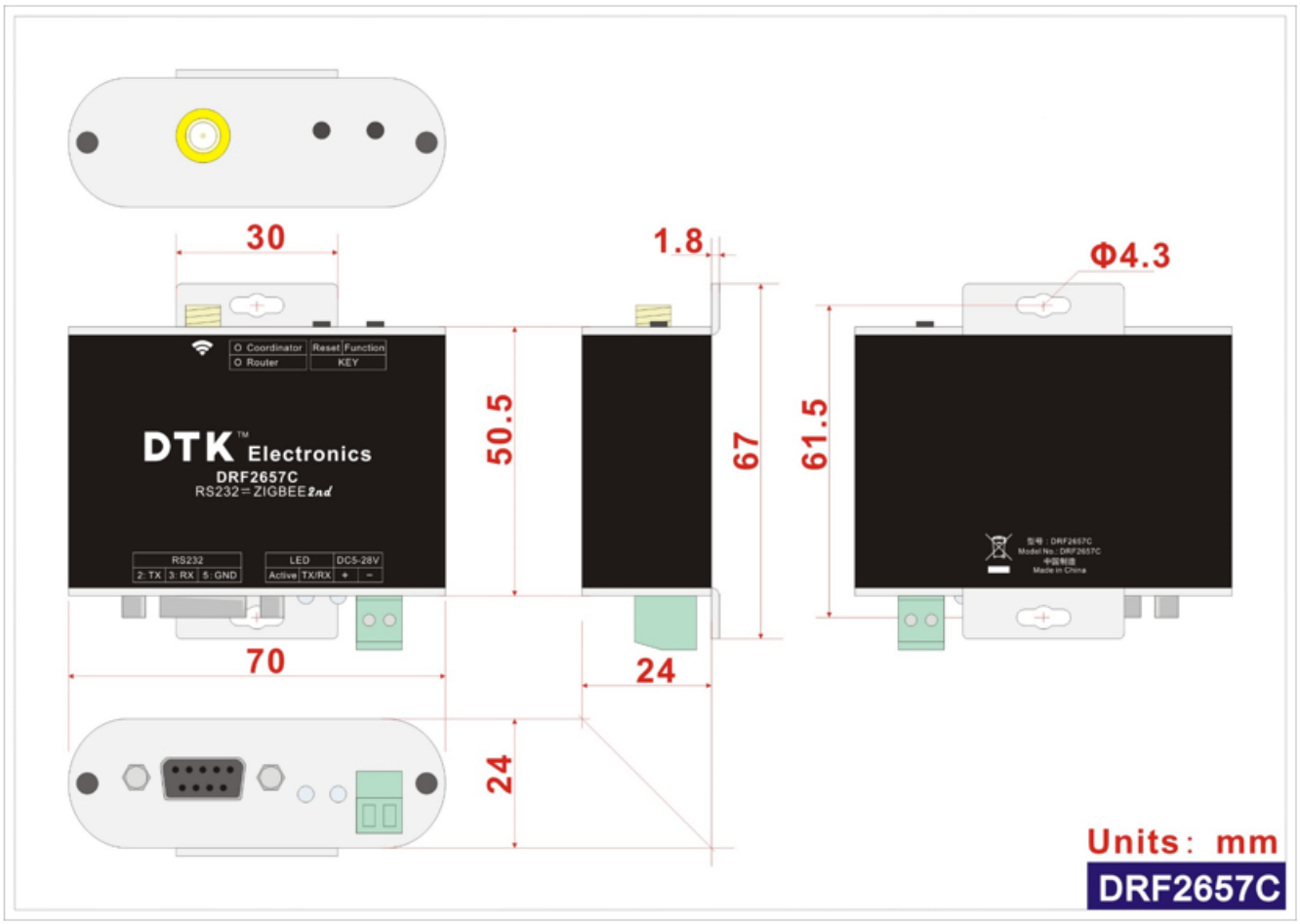
1. LED lights are not necessary. If you want to add LED lights, you must connect a 510Ω resistor in series;
2. RESET_N is not necessary, it can be controlled, low-level reset, reset time 5ms is enough, high-level normal operation;
3. The 10μF capacitor at the power supply terminal is not necessary, and a larger capacitor may be needed if the battery is used for power supply;
4. FUNCTION KEY is not necessary; it is recommended to connect it to facilitate the node to find the network by itself;
5. If the MCU is 5V working voltage, please add level conversion, otherwise the module will be burnt.

3.2、DRF2657C

Electrical parameters:

Input voltage	**DC 5-28V**
temperature range	-40°C ~ 85°C
Serial baud rate	38400bps (default), 1200bps, 2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps can be set
Serial format	8-N-1 (default), 8-E-1, 8-O-1 can be set
radio frequency	2.4GHz (24 0 0MHz), the user can change the channel (2405MHz~2480MHz, step size: 5MHz) through the serial port command, and the corresponding channel 11-26 is optional
Transmission distance	Visible, open, transmission distance 1600 meters
Working current	25 mA (@ 5 V) average, recommended power supply > 350 mA (@ 5 V) Standby 20 mA (@ 5 V), Receive 23 mA (@ 5 V), Transmit 200 mA (@ 5 V) Other voltage reference calculations: The inside of the module is a DC-DC power supply with an efficiency of about 80%.
Receiver sensitivity	-98dBm
main chip	TI CC2630F128
configurable node	Can be configured as Coordinator, Router, End Device
interface	RS232 (2: TX, 3: RX, 5: GND)

Dimensions:

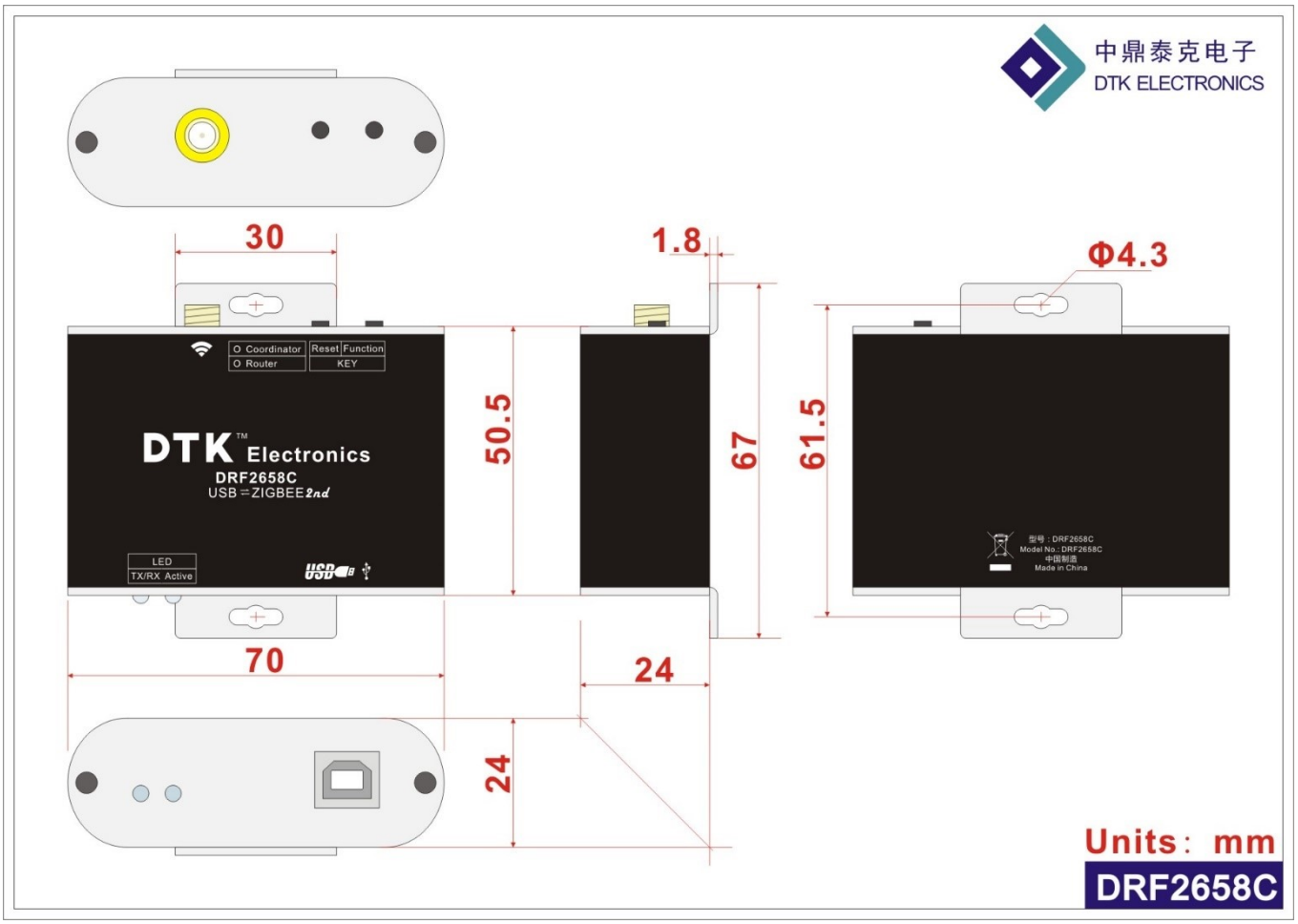


3.3, DRF2658C

Electrical parameters

Input voltage	**DC 5V**
temperature range	-40°C ~ 85°C
Serial baud rate	38400bps (default), 1200bps, 2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps can be set
Serial format	8-N-1 (default), 8-E-1, 8-O-1 can be set
radio frequency	2.4GHz (24 0 0MHz), the user can change the channel (2405MHz~2480MHz, step size: 5MHz) through the serial port command, and the corresponding channel 11-26 is optional
Transmission distance	Visible, open, transmission distance 1600 meters
Working current	25 mA (@ 5 V) average, recommended power supply > 350 mA (@ 5 V) Standby 20 mA (@ 5 V), Receive 23 mA (@ 5 V), Transmit 200 mA (@ 5 V)
Receiver sensitivity	-98dBm
main chip	TI CC2630F128
configurable node	Can be configured as Coordinator, Router, End Device
interface	USB (actually it is a USB to serial port, what you see in the computer is a serial port, the chip is CH340)

Dimensions:

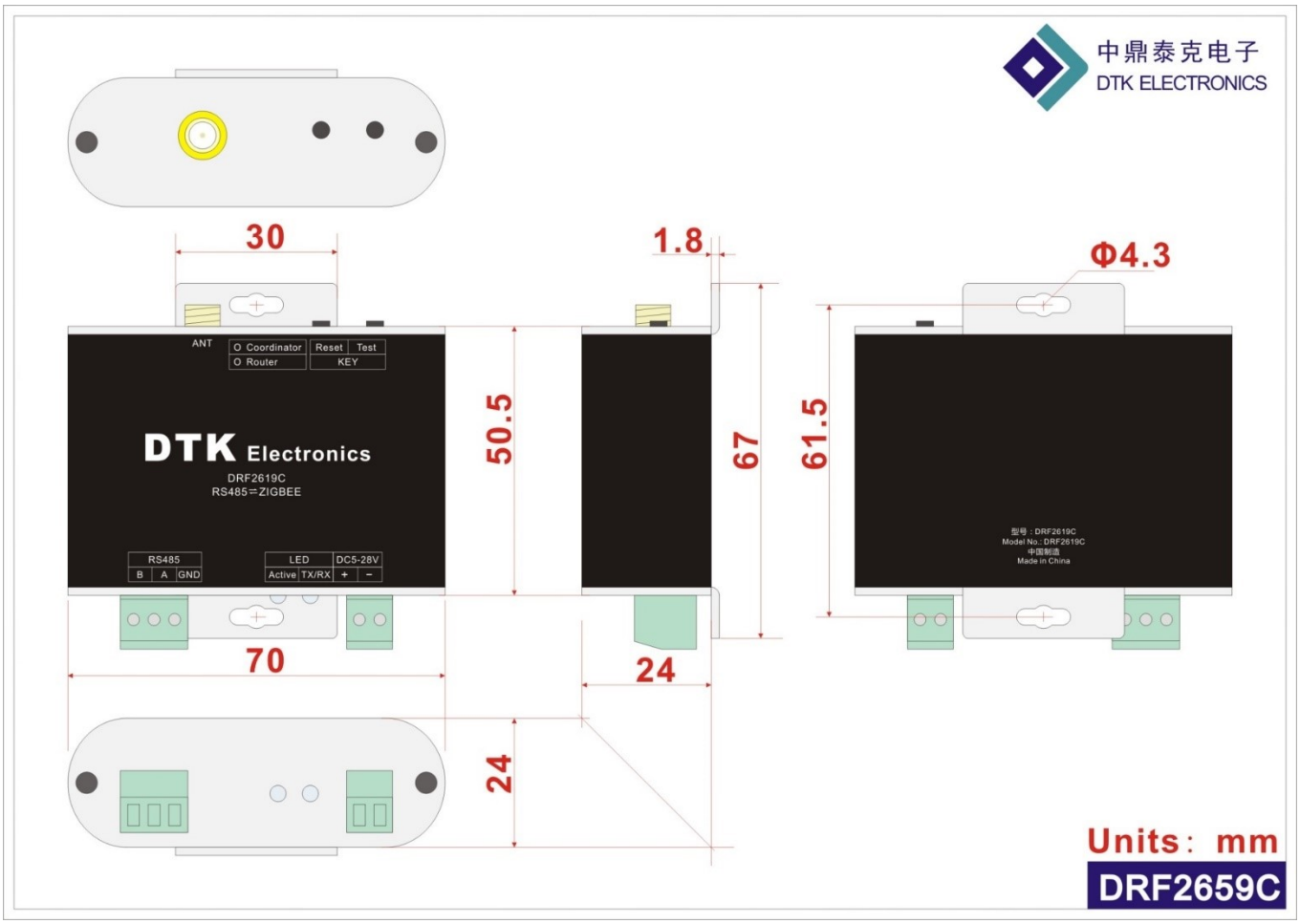

中鼎泰克电子
DTK ELECTRONICS
30
1.8
Φ4.3
O Coordinator
O Router
Reset
Function
KEY
DTK Electronics
DRF2658C
USB⇒ZIGBEE 2nd
LED
TX/RX Active
50.5
67
61.5
70
24
24
Units: mm
DRF2658C

3.4, DRF2659C

Electrical parameters:

Input voltage	**DC 5-28V**
temperature range	-40°C ~ 85°C
Serial baud rate	38400bps (default), 1200bps, 2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps can be set
Serial format	8-N-1 (default), 8-E-1, 8-O-1 can be set
radio frequency	2.4GHz (24 0 0MHz), the user can change the channel (2405MHz~2480MHz, step size: 5MHz) through the serial port command, and the corresponding channel 11-26 is optional
Transmission distance	Visible, open, transmission distance 1600 meters
Working current	25 mA (@ 5 V) average, recommended power supply > 350 mA (@ 5 V) Standby 20 mA (@ 5 V), Receive 23 mA (@ 5 V), Transmit 200 mA (@ 5 V) Other voltage reference calculations: The inside of the module is a DC-DC power supply with an efficiency of about 80%.
Receiver sensitivity	-98dBm
main chip	TI CC2630F128
configurable node	Can be configured as Coordinator, Router, End Device
interface	RS485

Dimensions:

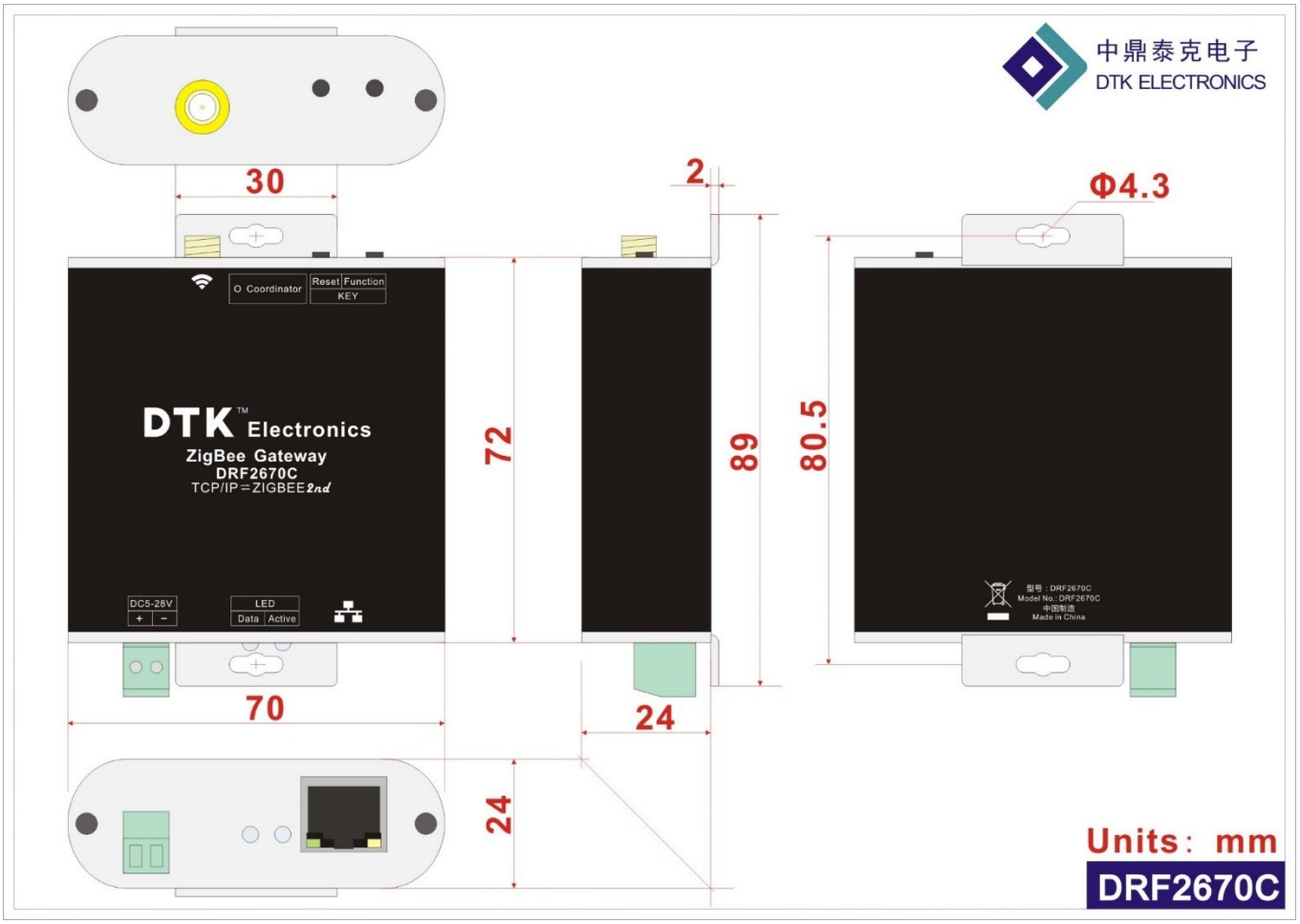

中鼎泰克电子
DTK ELECTRONICS
30
1.8
Φ4.3
ANT
O Coordinator
O Router
Reset
Test
KEY
DTK Electronics
DRF2619C
RS485=ZIGBEE
RS485
B A GND
LED
Active TX/RX
DC5-28V
+ −
50.5
67
61.5
70
24
24
Units: mm
DRF2659C


ANT
O Coordinator
O Router
Reset Function
KEY
DTK Electronics
DRF2659C
RS485=ZIGBEE
RS485
B A GND
LED
TX/RX Active
DC5-28V
+ −

3.5. DRF2670C (Zigbee gateway, Zigbee to TCP / IP)

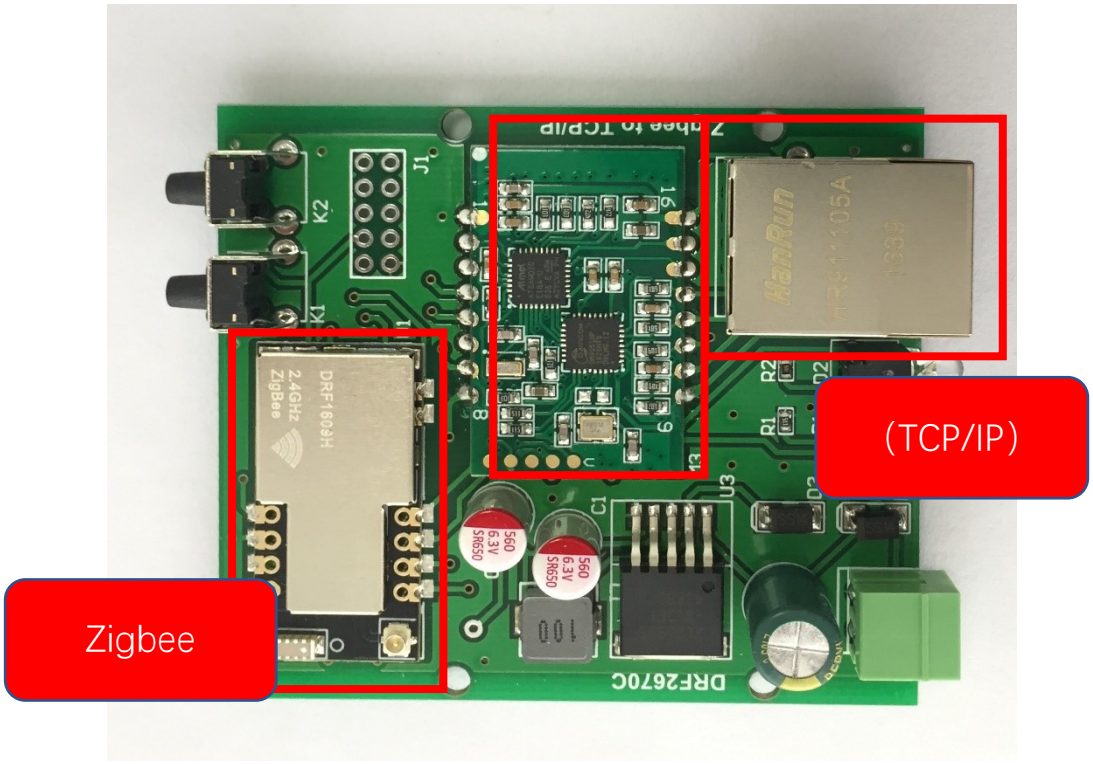
(3.5.1), electrical parameters and dimensions

Input voltage	**DC 5-28V**
temperature range	-40°C ~ 85°C
Serial baud rate	Only 115200bps
Serial format	8-N-1 only
radio frequency	2.4GHz (24 0 0MHz), the user can change the channel (2405MHz~2480MHz, step size: 5MHz) through the serial port command, and the corresponding channel 11-26 is optional
Transmission distance	Visible, open, transmission distance 1600 meters
Working current	200 mA (@ 5 V) average, recommended power supply > 600 mA (@ 5 V) Standby 190 mA (@ 5 V), Receive 195 mA (@ 5 V), Transmit 420 mA (@ 5 V) Other voltage reference calculations: The inside of the module is a DC-DC power supply with an efficiency of about 80%.
Receiver sensitivity	-98dBm, can only be set as an external antenna
main chip	TI CC2630F128
configurable node	Can only be configured as Coordinator
interface	RJ45 network interface


中鼎泰克电子
DTK ELECTRONICS
30
2
Φ4.3
O Coordinator
Reset Function
KEY
DTK™ Electronics
ZigBee Gateway
DRF2670C
TCP/IP=ZIGBEE2nd
DC5-28V
+ −
LED
Data Active
72
89
80.5
70
24
24
Units: mm
DRF2670C

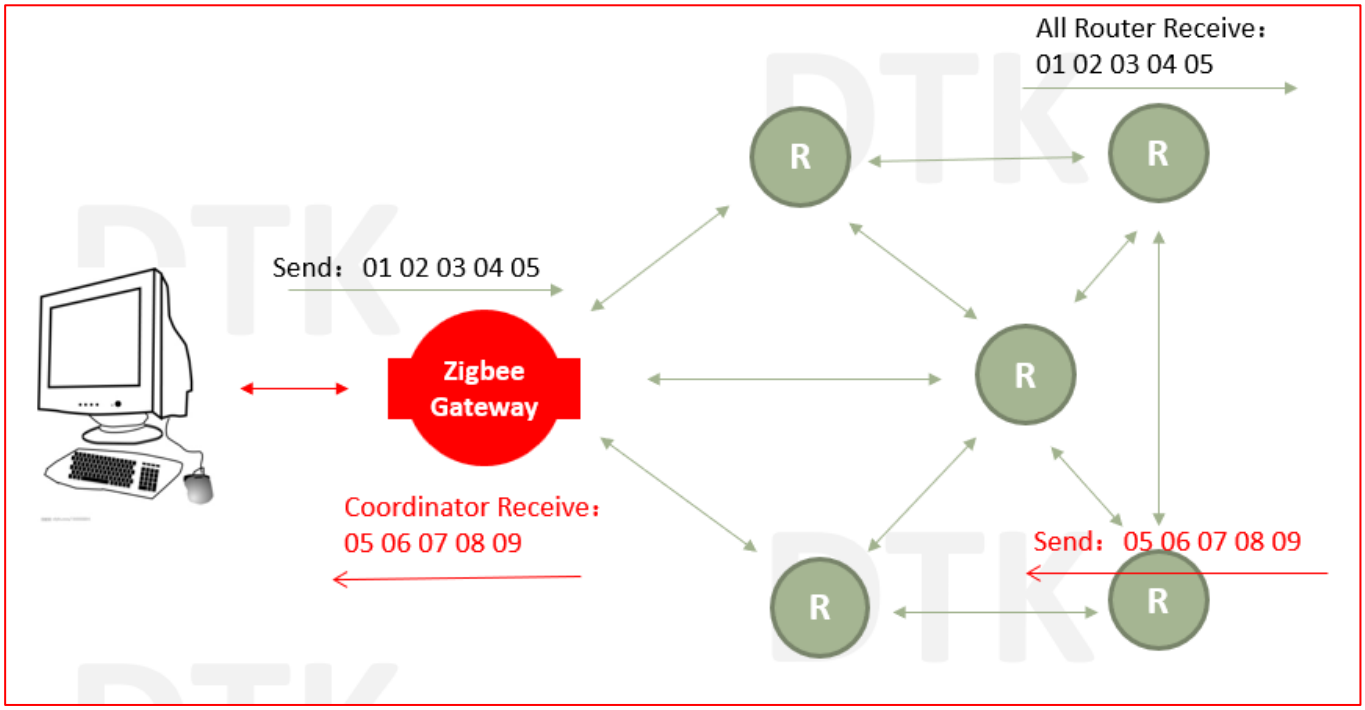
(3.5.2), Zigbee gateway structure

- Zigbee gateway is composed of Zigbee part + network part, and the two are connected through a serial port (UART);
- Zigbee works in the role of Coordinator;
- Zigbee wireless is sent to the network part through the serial port, the network part is converted into TCP/IP data, and sent to the target IP and port; the data received by the network port part is sent to Zigbee through the serial port, and Zigbee is converted into Zigbee wireless data, sent to Zigbee Net;
- Completely transparent transmission between Zigbee and the network



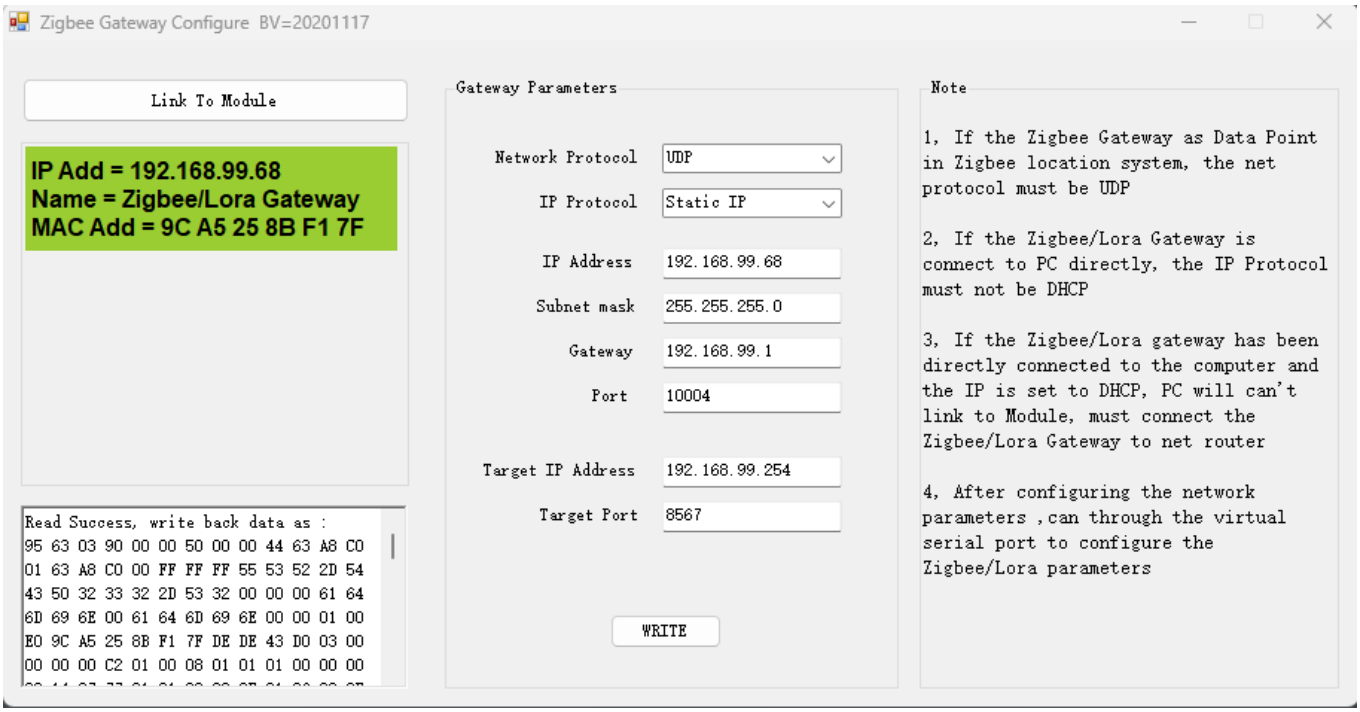
(3.5.3), the working method of Zigbee gateway: 1, directly connected to the computer for use

- Zigbee gateway always works in the coordinator role, and constitutes a Zigbee network with the Router
- Transparent transmission between network port and Zigbee
- On the computer side, you can run the virtual serial port program to virtualize the network port into a serial port, so that you can operate according to the serial port

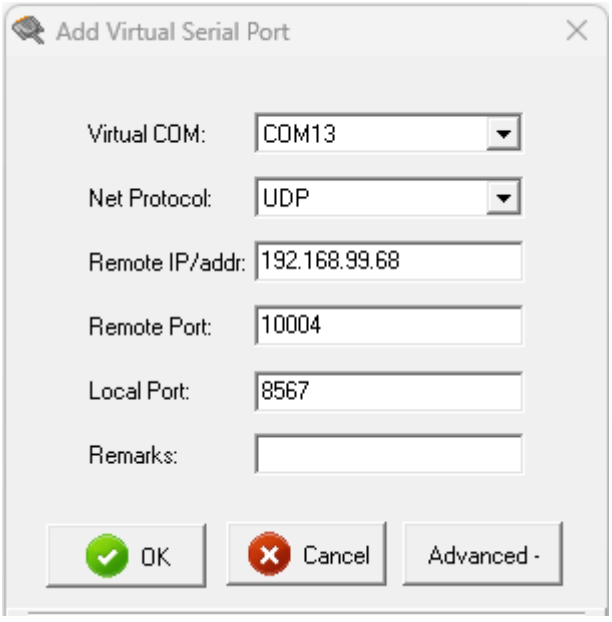


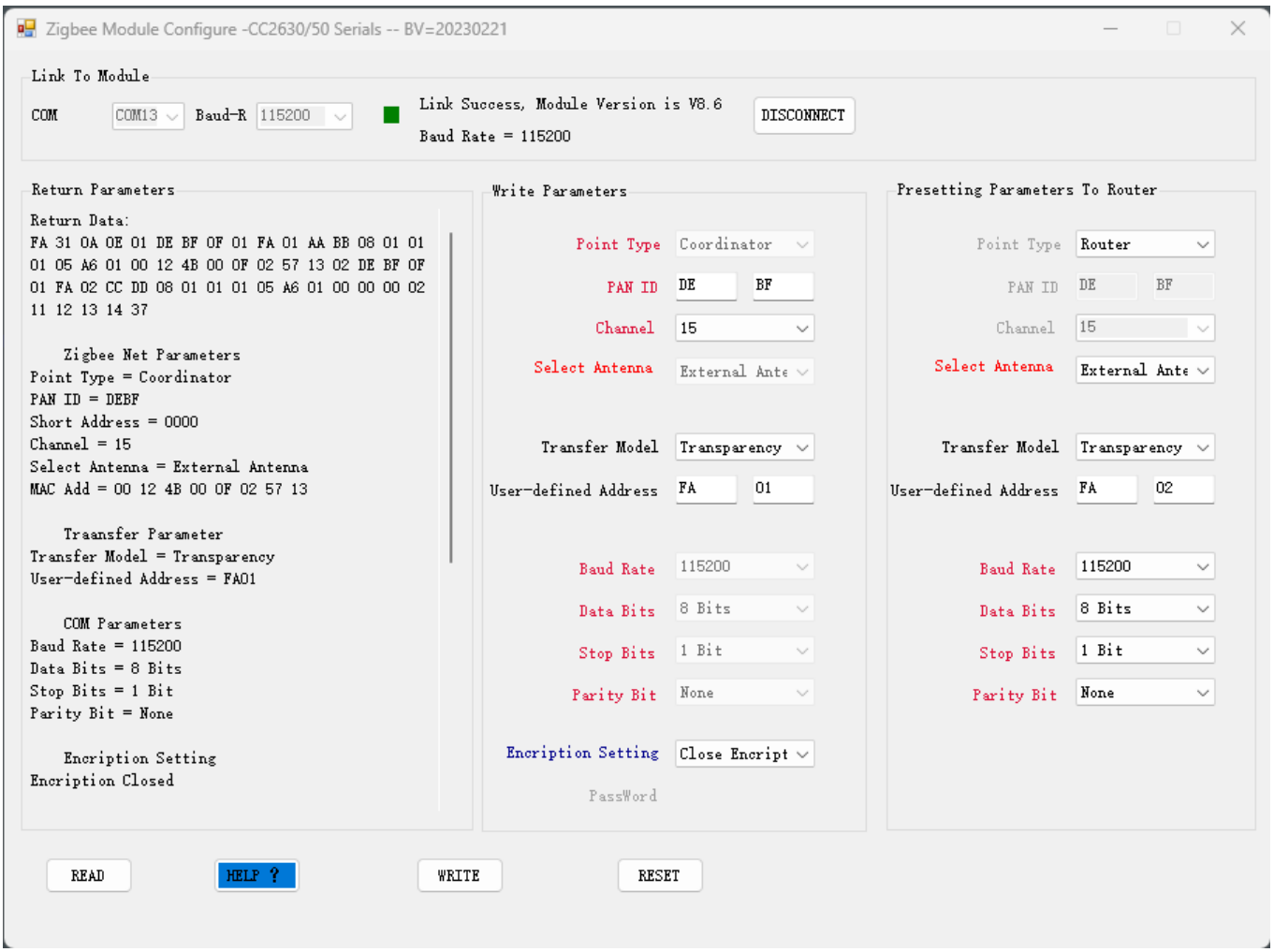
- When the Zigbee gateway is directly connected to the computer, the general configuration is:
  Module network protocol = UDP (do not configure as TCP Client)
  IP mode = static IP (do not configure as DHCP)

- The IP mode must not be configured as DHCP

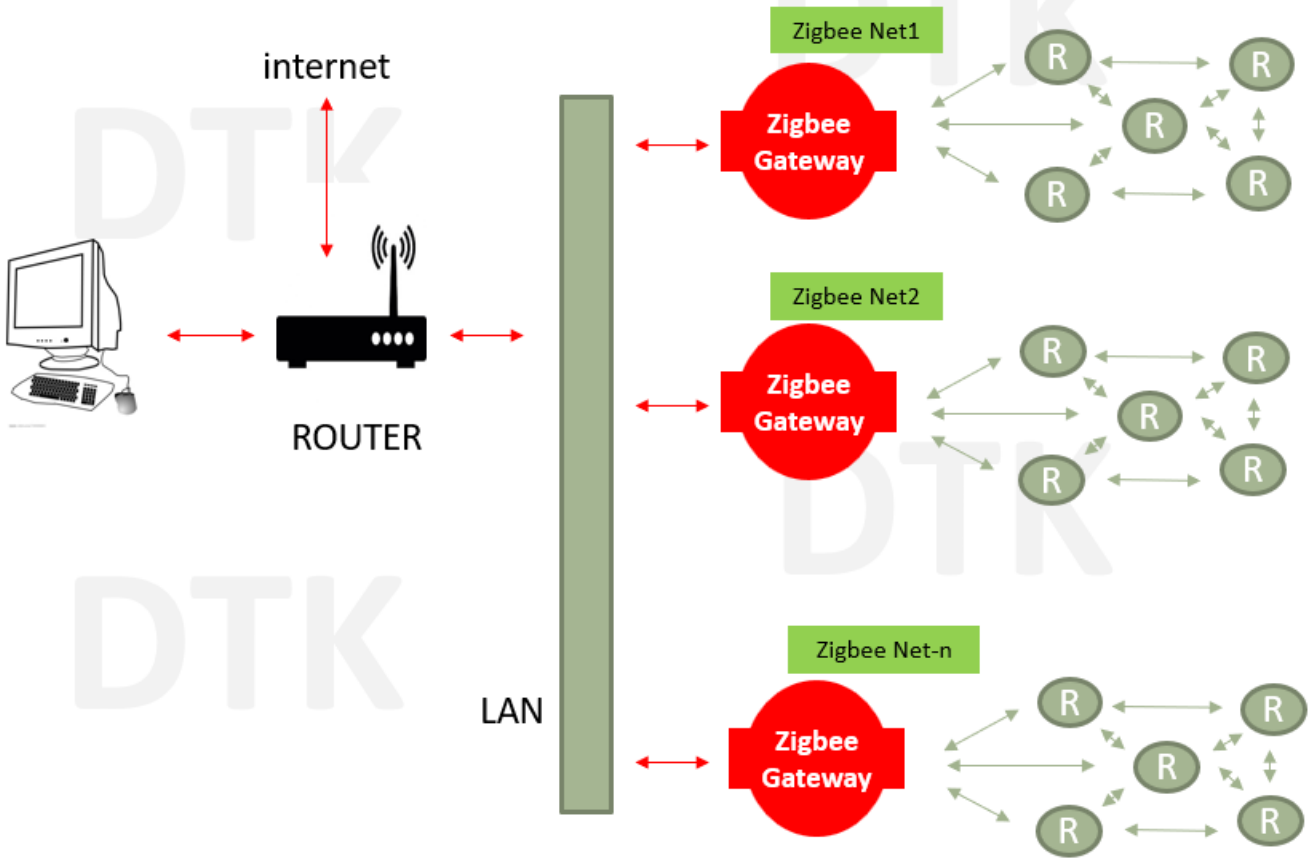


Run the "virtual serial port" software on the computer and virtualize this network port into a serial port, then you can operate this network port in the same way as a serial port, including setting some parameters of Zigbee




Zigbee Module Configure -CC2630/50 Serials -- BV=20230221
Link To Module
COM
COM13
Baud-R
115200
Link Success, Module Version is V8.6
Baud Rate = 115200
DISCONNECT
Return Parameters
Return Data:
FA 31 0A 0E 01 DE BF 0F 01 FA 01 AA BB 08 01 01
01 05 A6 01 00 12 4B 00 0F 02 57 13 02 DE BF 0F
01 FA 02 CC DD 08 01 01 01 05 A6 01 00 00 00 02
11 12 13 14 37
Zigbee Net Parameters
Point Type = Coordinator
PAN ID = DEBF
Short Address = 0000
Channel = 15
Select Antenna = External Antenna
MAC Add = 00 12 4B 00 0F 02 57 13
Traansfer Parameter
Transfer Model = Transparency
User-defined Address = FA01
COM Parameters
Baud Rate = 115200
Data Bits = 8 Bits
Stop Bits = 1 Bit
Parity Bit = None
Encription Setting
Encription Closed
Write Parameters
Point Type
Coordinator
PAN ID
DE
BF
Channel
15
Select Antenna
External Ante
Transfer Model
Transparency
User-defined Address
FA
01
Baud Rate
115200
Data Bits
8 Bits
Stop Bits
1 Bit
Parity Bit
None
Encription Setting
Close Encript
PassWord
Presetting Parameters To Router
Point Type
Router
PAN ID
DE
BF
Channel
15
Select Antenna
External Ante
Transfer Model
Transparency
User-defined Address
FA
02
Baud Rate
115200
Data Bits
8 Bits
Stop Bits
1 Bit
Parity Bit
None
READ
HELP ?
WRITE
RESET

(3.5.4), the working method of Zigbee gateway: 2, connect to the computer through the LAN to use



- When the Zigbee gateway is connected to the computer through a router, the general configuration is:
  Module network protocol = UDP, or TCP Client
  IP method = Static IP, or DHCP

Comparison of TCP and UDP methods:
If the Zigbee gateway is used as a data node of the Zigbee positioning system, the network protocol of the Zigbee gateway (data node) must be set to "UDP".

	TCP	**UDP**
advantage	Connection-based transmission mechanism, not easy to lose packets	No connection mechanism, suitable for high-frequency transmission of small-capacity data packets
shortcoming	The overhead of the network protocol is high, and sending information frequently in a short period of time can easily cause information congestion; due to the checksum and retransmission mechanism, the network overhead is further increased.	When the network is poor, the packet loss phenomenon is greater than that of TCP mode.

Static IP vs DHCP:
If the Zigbee gateway is directly connected to the computer, DHCP must not be used, because the computer generally cannot assign an IP address to the Zigbee gateway.

	Static IP	**DHCP**
advantage	Facilitate clear representation of a Zigbee gateway	The router dynamically assigns an IP address to the Zigbee gateway, and will not assign duplicate IP addresses
shortcoming	It is necessary to record the IP address that has been set, and the same IP address cannot be set in the same LAN	Unable to specify a certain Zigbee gateway DHCP must not be used, because the computer generally cannot assign an IP address to the Zigbee gateway

(3.5.5), Zigbee gateway use precautions

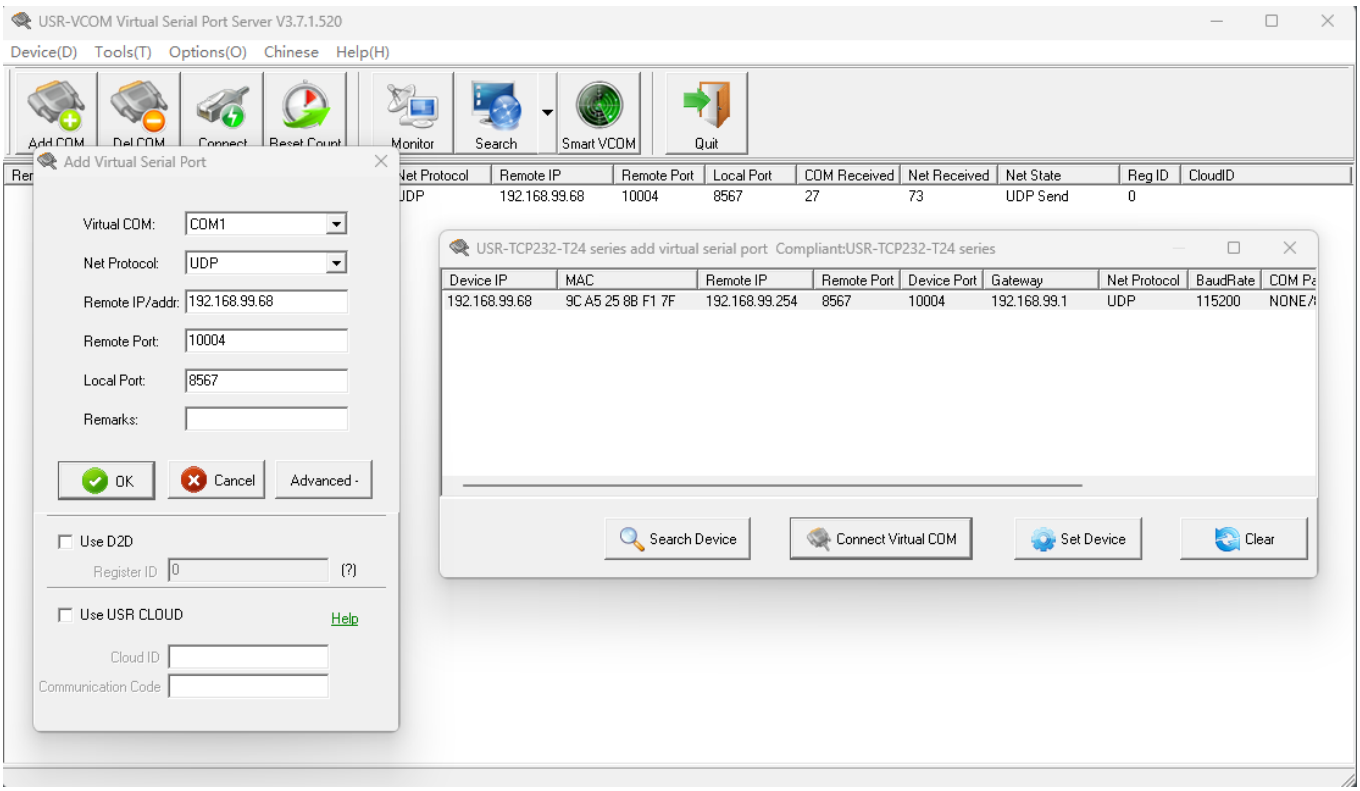
- Zigbee parameters of Zigbee gateway: node type = Coordinator, antenna selection = external antenna, baud rate = 115200, serial port format = 8-N-1, which cannot be set;
- If the Zigbee gateway is used as the data node of the positioning system, it needs to be set as: PAN ID=0xDEBF, channel =15;
- Zigbee gateway, a third-party UART -to- TCP/IP module is used. This module can be set as a TCP Server or UDP Server. However, considering the status of the Zigbee gateway in the Zigbee network, it is recommended that users only consider UDP and TCP Client network methods.
- Zigbee gateway currently does not provide cloud transparent transmission service, if users need this service, it is recommended:

(1), purchase DRF2657C RS232 interface (or DRF2659C RS485 interface) + serial port server (or RS232 to TCP/IP) module, and consult the corresponding supplier to obtain cloud transparent transmission service;

(2), purchase DRF2657C RS232 interface (or DRF2659C RS485 interface) + GPRS module (or 4G module), and consult the corresponding supplier to obtain cloud transparent transmission service;

(3.5.6), about the virtual serial port

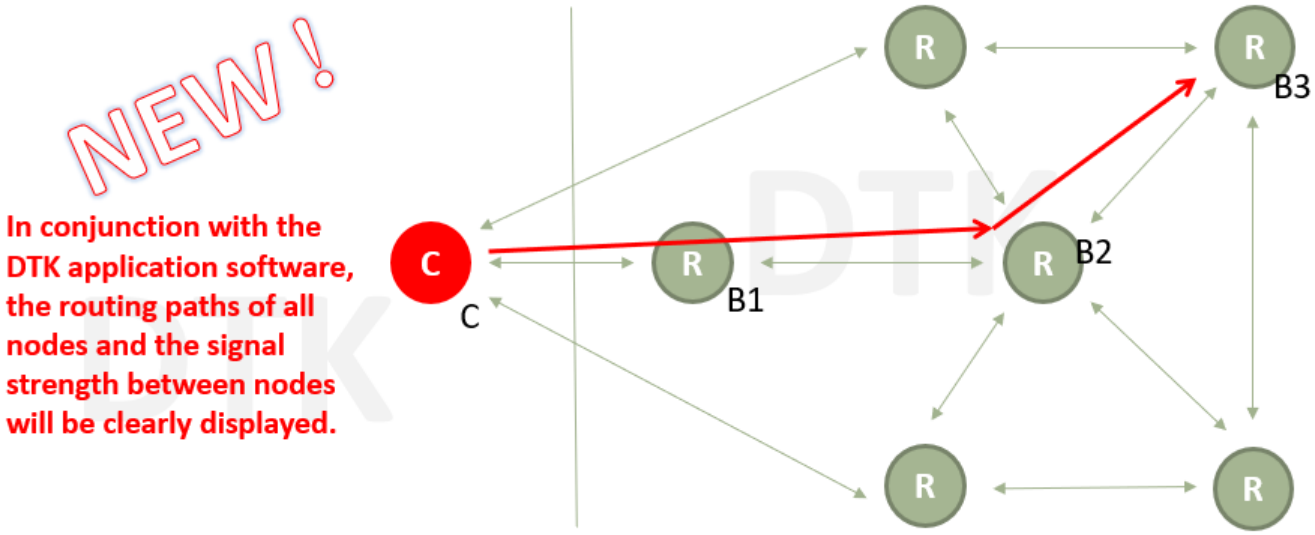
On the computer side, you can run the virtual serial port software to virtualize the network port into a serial port, so that you can operate the Zigbee gateway in the standard serial port mode, reducing the workload of network programming.
Currently, a third-party UART-to-TCP/IP module is used, and the virtual serial port software is provided by a third party.



4. Zigbee module setting and networking

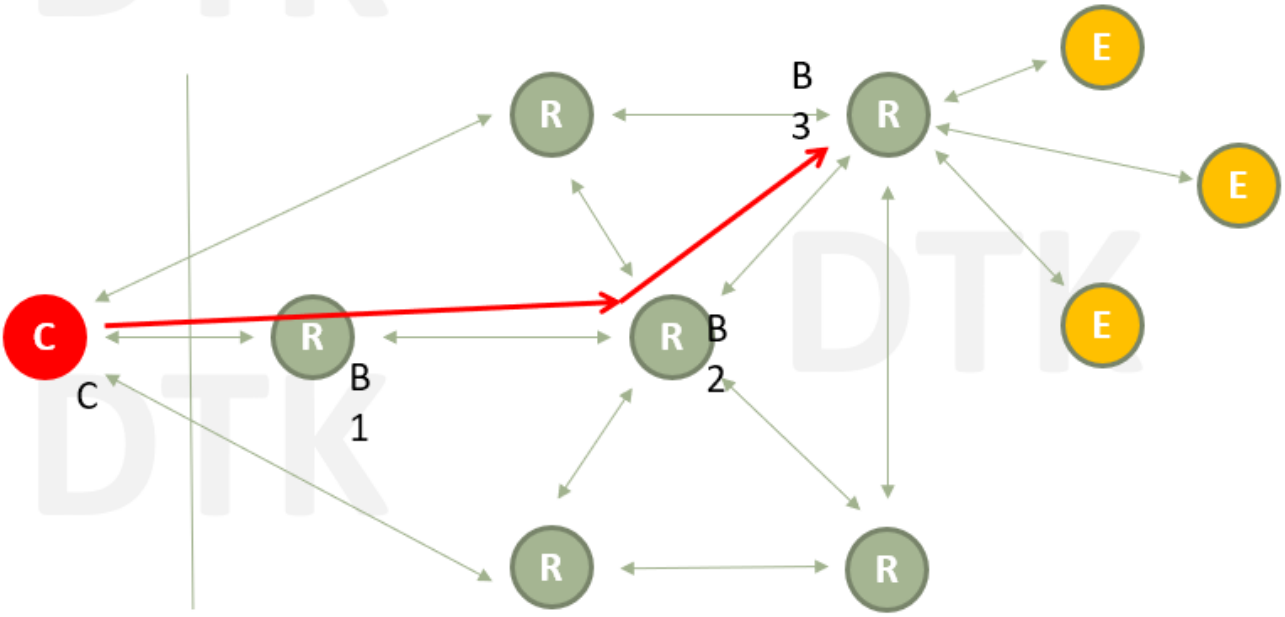
4.1, basic concepts (applicable to V8.1 and above):

- Zigbee network has three roles, respectively: Coordinator (coordinator), Router (router), End Device (terminal node), Coordinator is responsible for network creation and network maintenance, Router can automatically provide routing for other nodes, and can also send and receive data, End Device has no routing function, can send and receive data, and can enter sleep state;
- Zigbee network is a MESH structure network. A network consists of a Coordinator (coordinator, master module) and N Routers (routers, slave modules), N End Device (terminal node), all nodes have the same channel and PAN ID.
- MESH network is automatic routing and dynamic maintenance routing. In the figure, C communicates with B3. If it cannot be reached directly, it will automatically route the data to B3 through B1 and B2. Moreover, when B1 or B2 is damaged, it will automatically find new routing path



Basic concepts (new functions in V7.2/V7.3):

- V7.2/V7.3 newly added End Device node settings:
- End Device node does not have a routing function and can send and receive data like a Router;
- End Device can query the signal strength of the three nearest Routers. If the Router is used as a fixed point, End Device can be used as a positioning card;

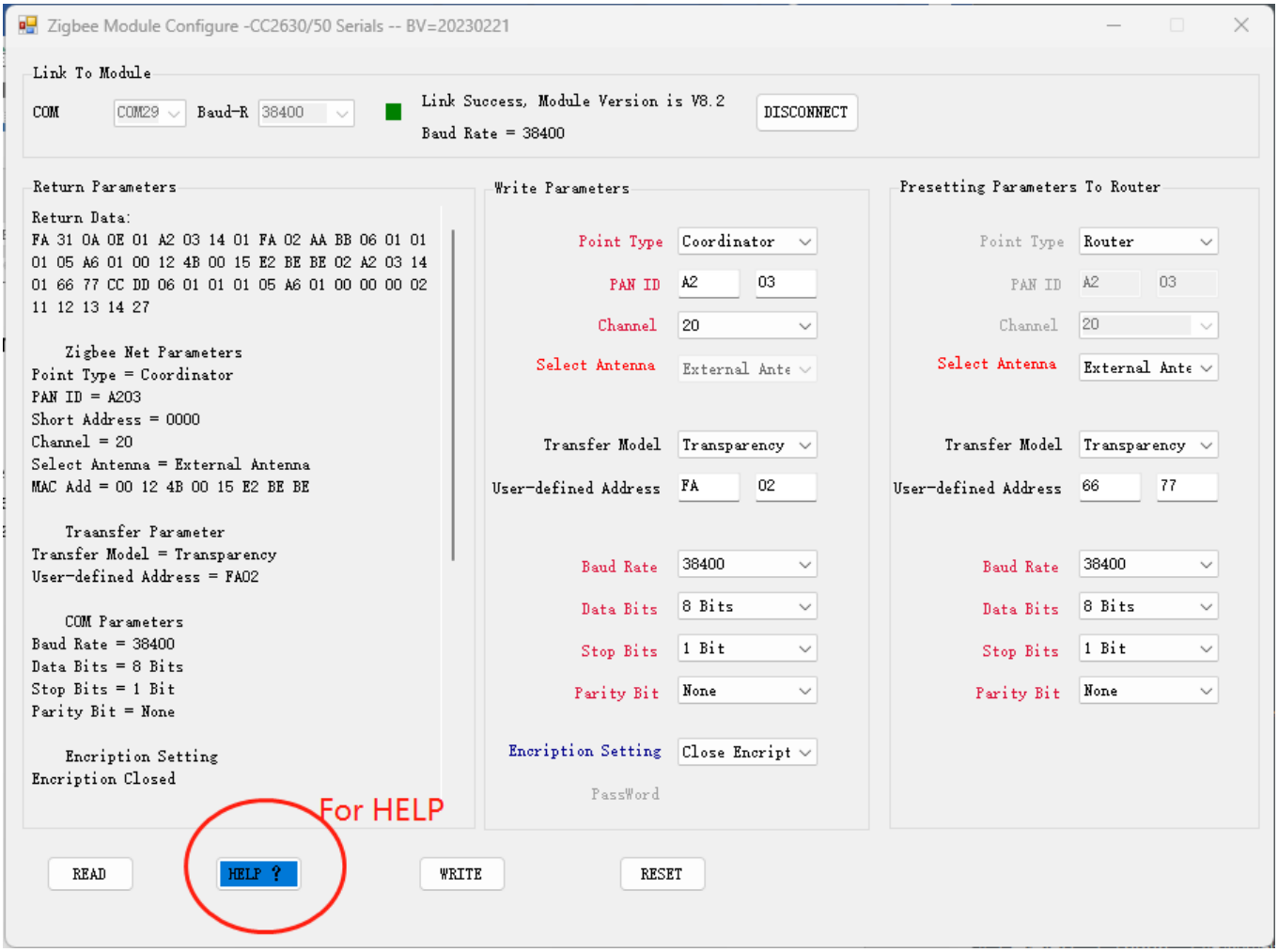


About End For the use of Device, refer to FAQ:
10.2: How to use End Device function.
10.6: How to use End Device sleep function.

4.2, Zigbee module networking:

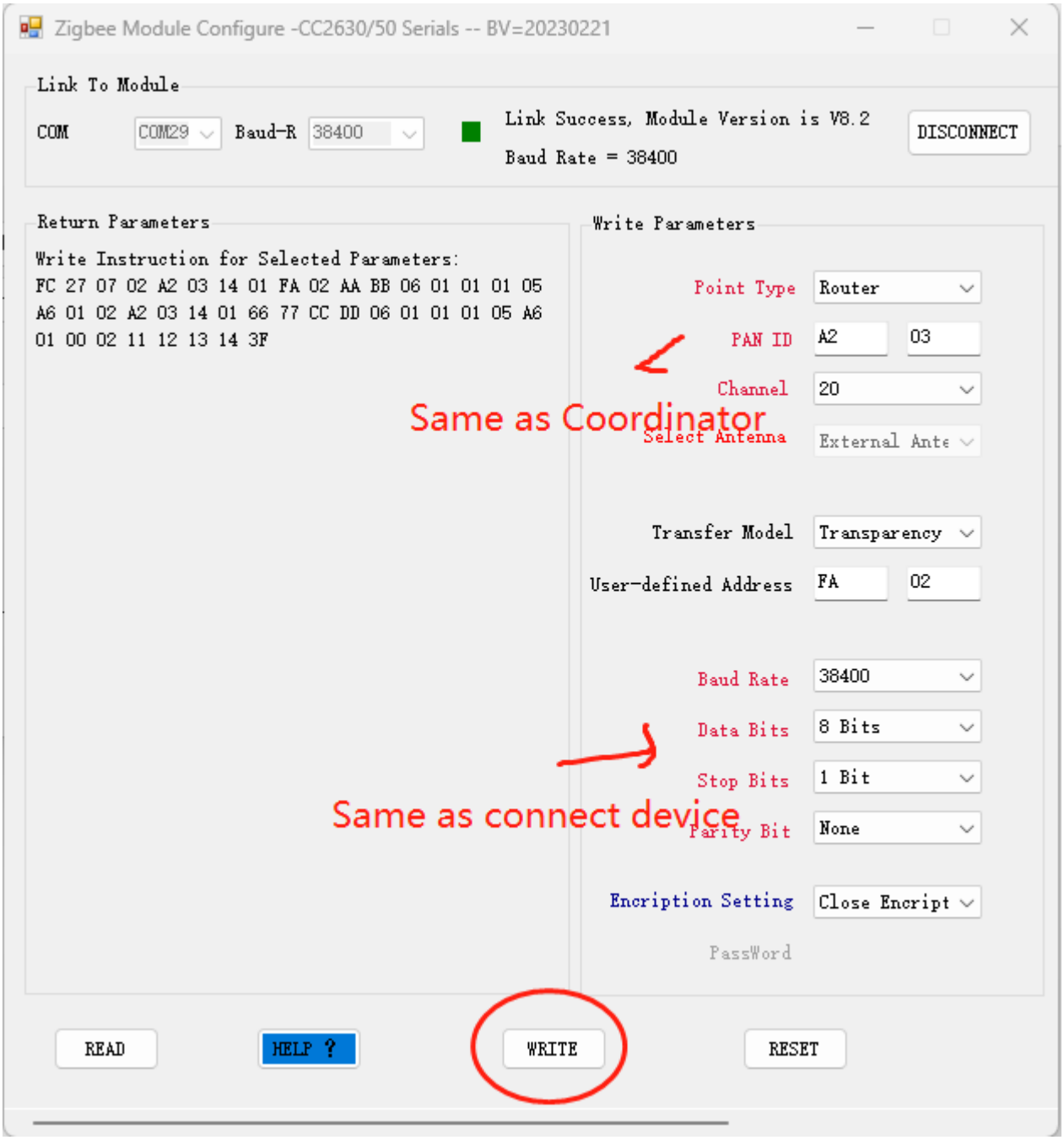
(4.2.1), set the coordinator

First set a module as Coordinator. (If you don't want to set Router or End separately Device, here you can also set the "preset parameters for Router", and then press the function key on the Router three times, the Router will automatically find the coordinator to join the network and obtain the preset parameters.



(4.2.2), set Router or End Device

Other modules are set to Router . The factory default of the module is Router . You don’ t need to set Router . Press the function key on the Router three times , and the Router will automatically find the Coordinator to join the network, and get the preset parameters from the Coordinator . parameters (such as baud rate), you need to set the Router separately .



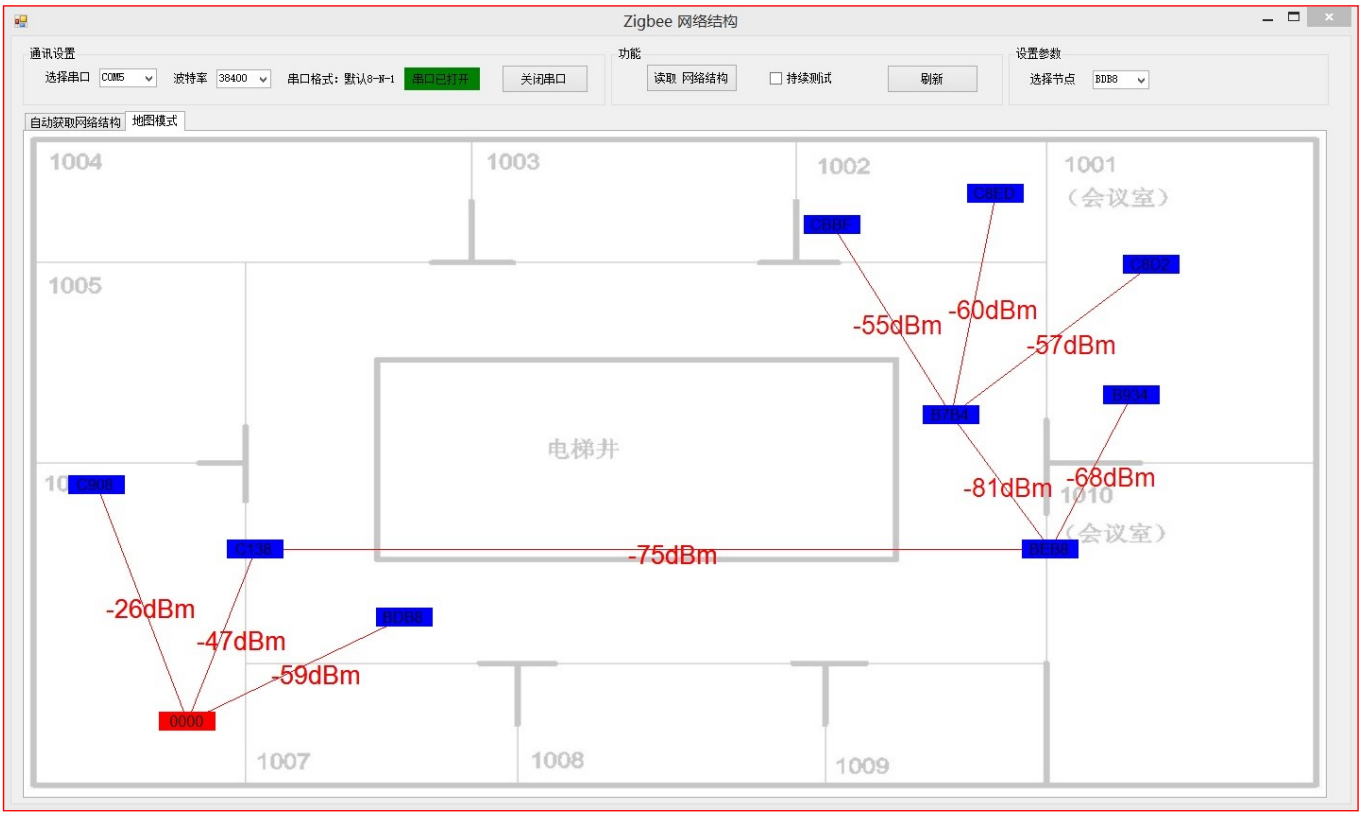
(4.2.3), Zigbee module status lights and button functions:

Coordinator (coordinator, main module)	
LED4	Long bright
LED3	When receiving wireless data, it will flash
Router (router, slave module)	
LED4	Not joined the network (looking for network), flash After joining the network, slow flashing Double-press the function key three times to start automatically joining the network, and flash quickly
LED3	When receiving wireless data, it will flash Press the function key, it will flash Double-press the function key three times to start automatically joining the network, and flash quickly

(4.4.4), after the networking is completed, you can observe the network structure through the DTK application software:

- Connect the Coordinator to the computer serial port (note that the baud rate can only be 38400, 57600 or 115200)
- Run DTK CC2630 software, choose Zigbee network
- Select "Map Mode"
- Click the right mouse button, select "Switch Map", and select your own map file (such as a jpg image)
- Click "Connect Module"
- Click "Read Network Structure" and drag the read node to the corresponding place on the map

Network structure: (very convenient for debugging, for places where communication is not possible, a Router can be added in the middle as an automatic route (automatic relay)



(4.4.5), Zigbee module encryption (newly added in V7.2/V7.3)

Zigbee module can be set to use encryption or not to use encryption, and can be set to 32 bits (4 bytes of encryption password),
Please refer to the setting instruction (INS**06)** for specific setting. (Communication refers to data transmission and joining the network)

5. Data transmission of Zigbee module

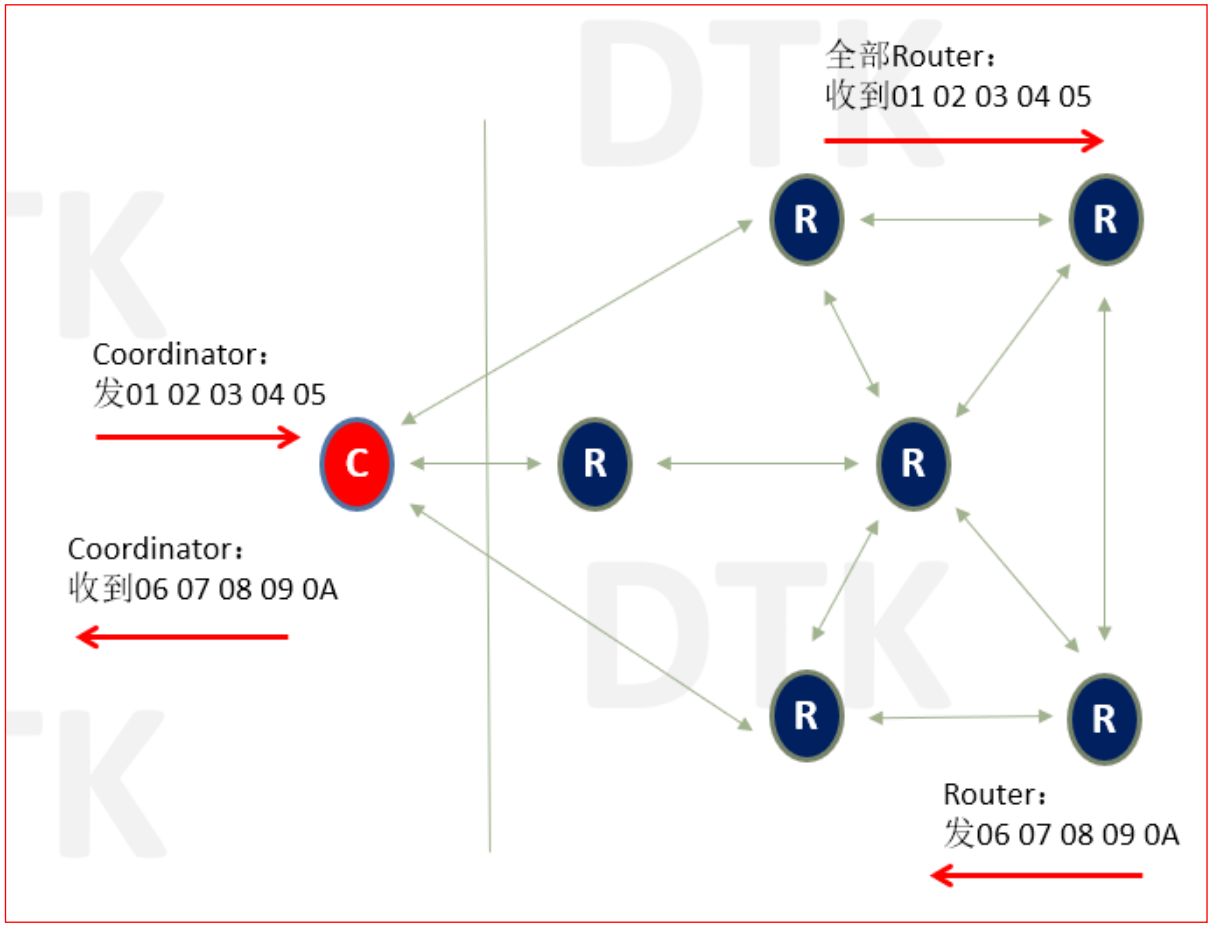
5.1, Zigbee module data transmission overview

Zigbee module has 2 data transmission methods:
1. Transparent transmission (the data will not be changed, and the modules are equivalent to serial lines):
(1), the data received by the coordinator from the serial port will be sent to all Routers intact, and output from the Router serial port;
(2), the data received by the Router from the serial port will be sent to the coordinator intact and output from the coordinator serial port;

2. Point-to-point transmission:
(1), Can be sent point-to-point to any node in a Zigbee network; short address can be used as the target address, and custom address can be used as the target address
(2), Broadcast to all nodes in the Zigbee network;

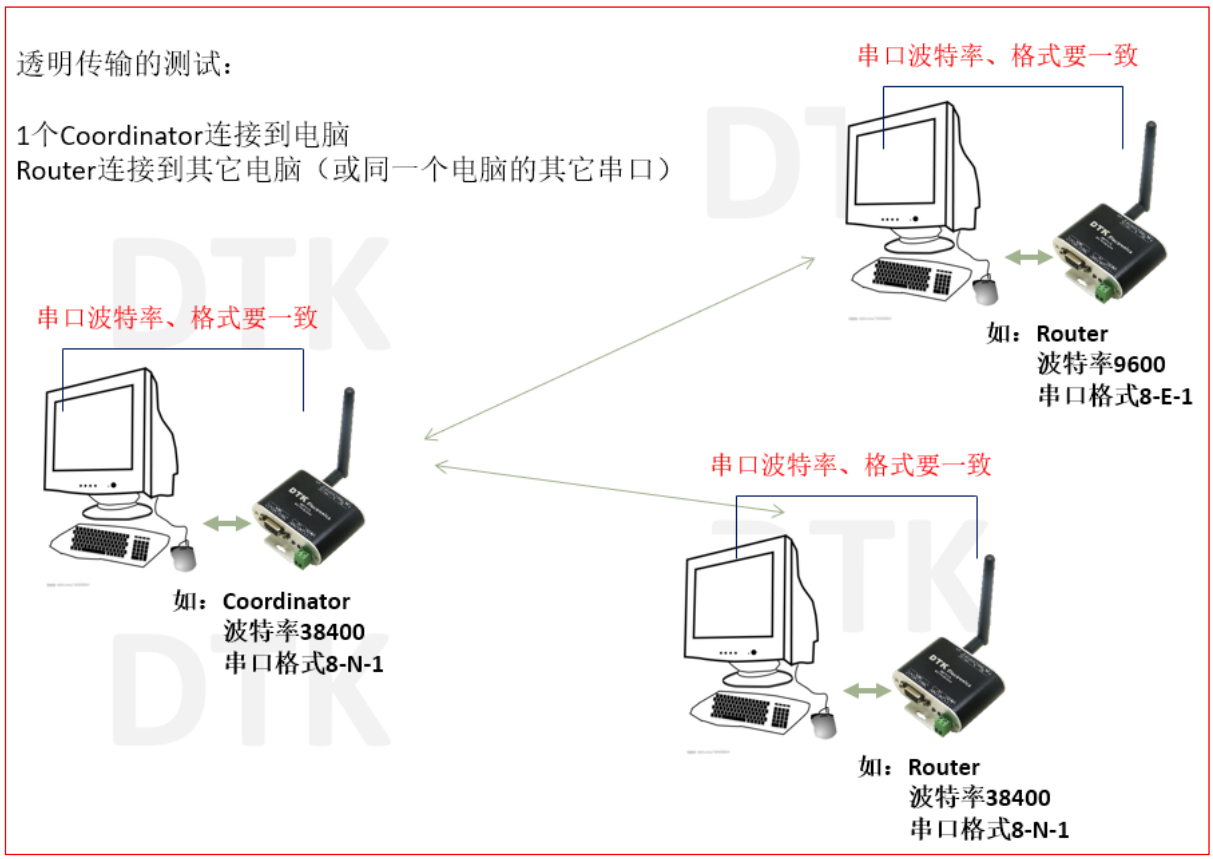
5.2, transparent transmission

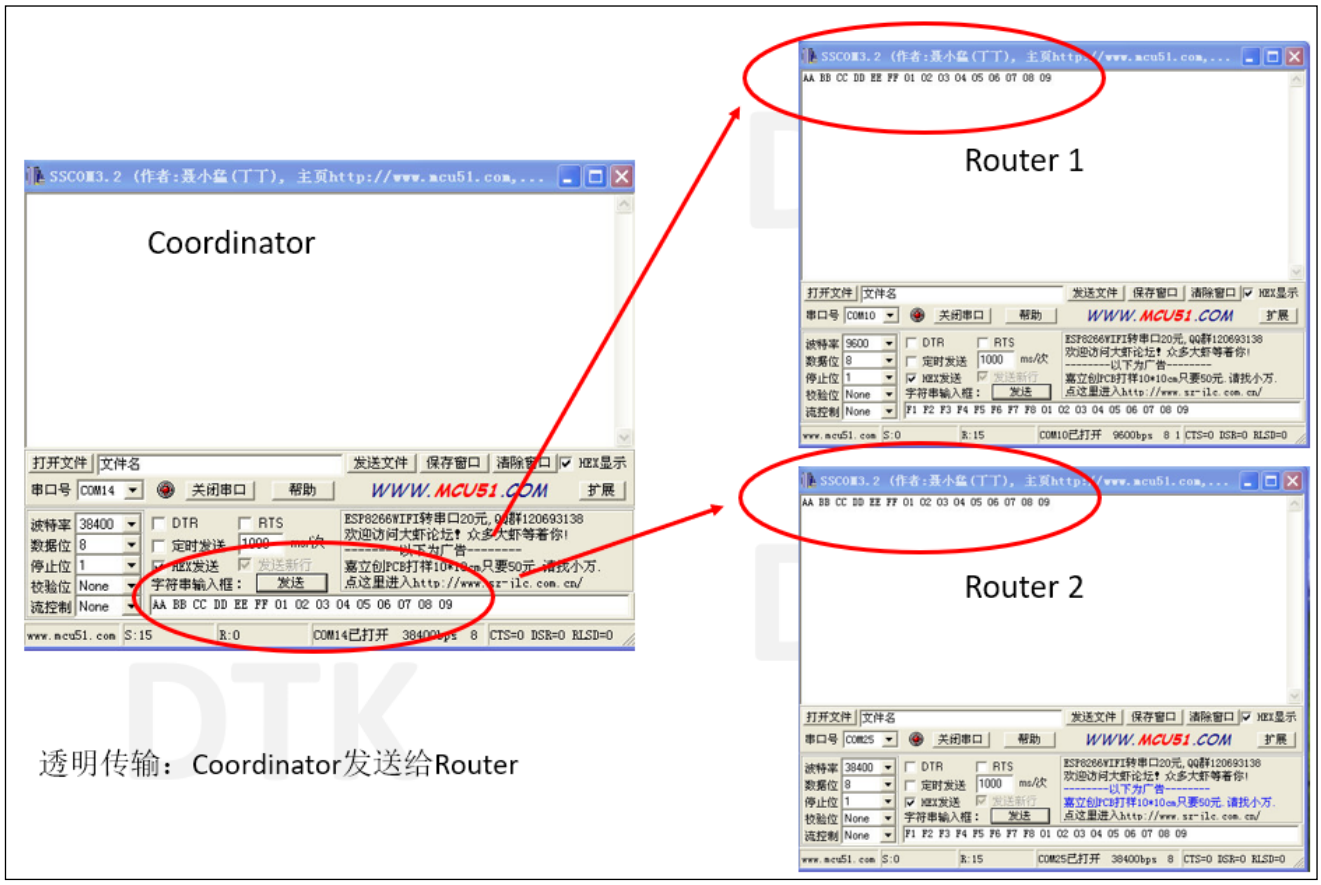
(1), the data received by the coordinator from the serial port will be sent to all Routers intact, and output from the Router serial port;
(2), the data received by the Router from the serial port will be sent to the coordinator intact and output from the coordinator serial port;
During this transmission process, the Router will automatically find the best routing path, and automatically provide a relay for data transmission (no user setting is required, just place it as required), and the transparent transmission between the Coordinator and the Router is equivalent to a serial port line, that is, the user does not need to modify the device or the host computer software at all, and can transform wired transmission into wireless transmission (and automatic routing)

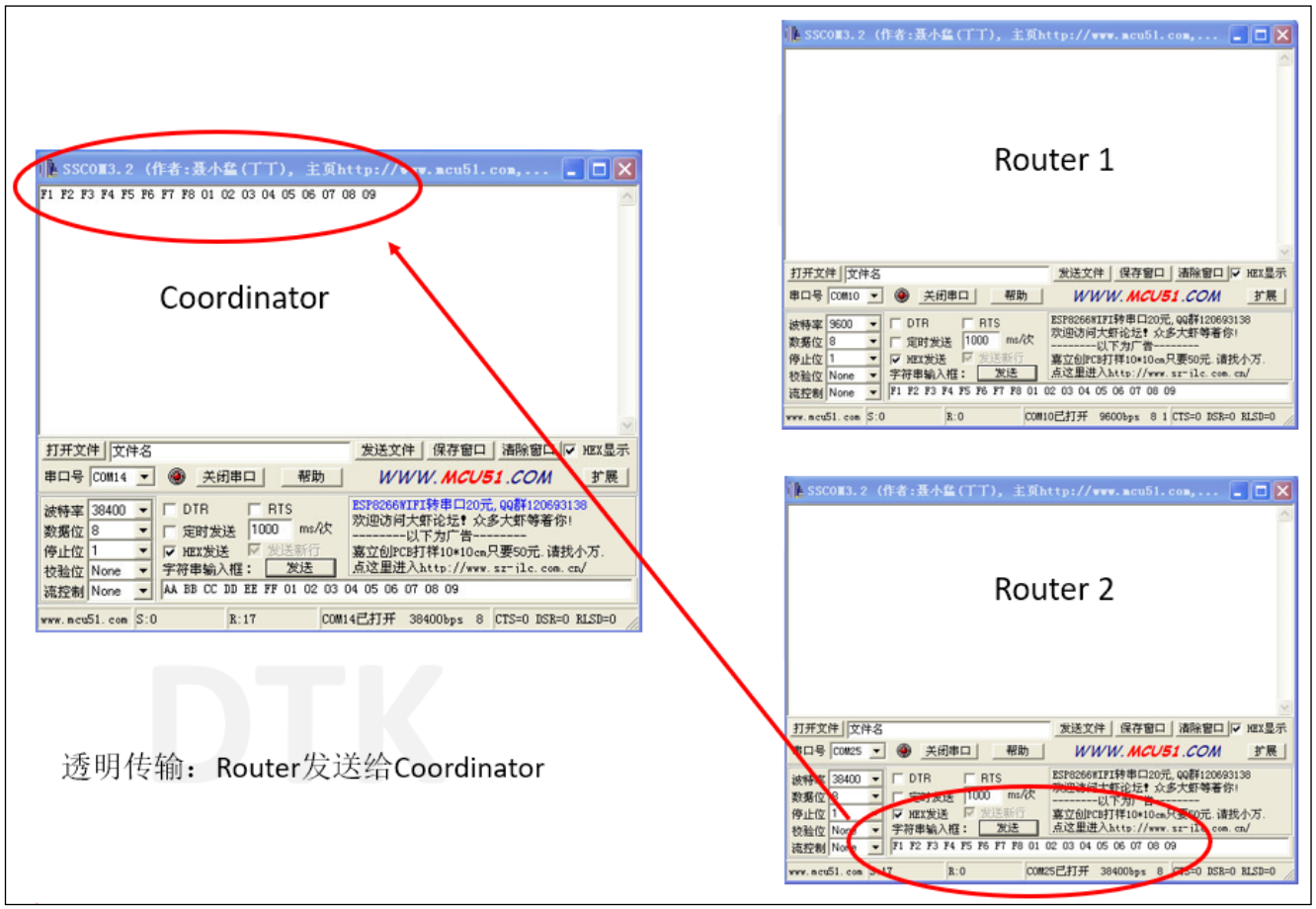


透明传输的测试：

1个Coordinator连接到电脑
Router连接到其它电脑（或同一个电脑的其它串口）




Coordinator
Router 1
Router 2
透明传输：Coordinator发送给Router


Coordinator
Router 1
Router 2
透明传输：Router发送给Coordinator

5.3, point-to-point transmission (short address as the target address)

Point-to-point is generally suitable for data transmission between Router and Router, which can be sent to any node or broadcast to all nodes

Send command format:

Data transfer instruction (**0xFD**) + data length + target address (short address) + data (up to 92 Bytes)

The data length supports variable length within 92 bytes.

Example: Data is transferred from 0x50F5 to 0x143E (the following are hexadecimal numbers)

Send: FD 0A 14 3E 01 02 03 04 05 06 07 08 09 10

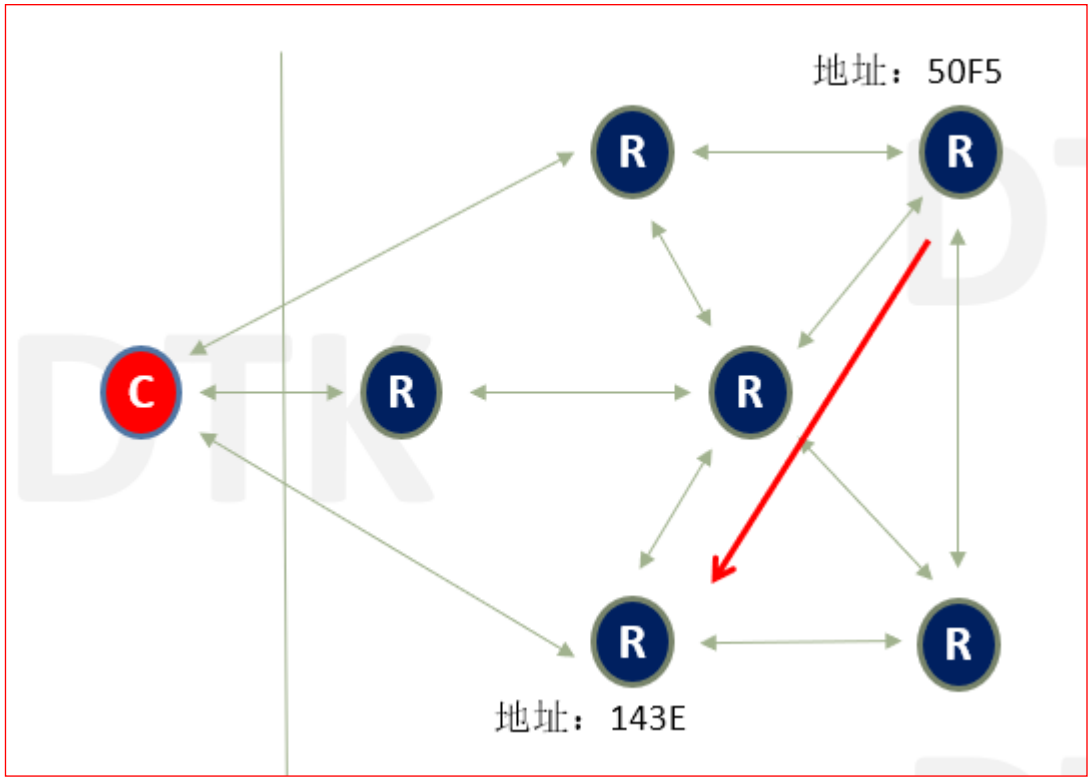
FD: data transmission instruction

0A: data length in the data area, a total of 10 bytes

14 3E: target address

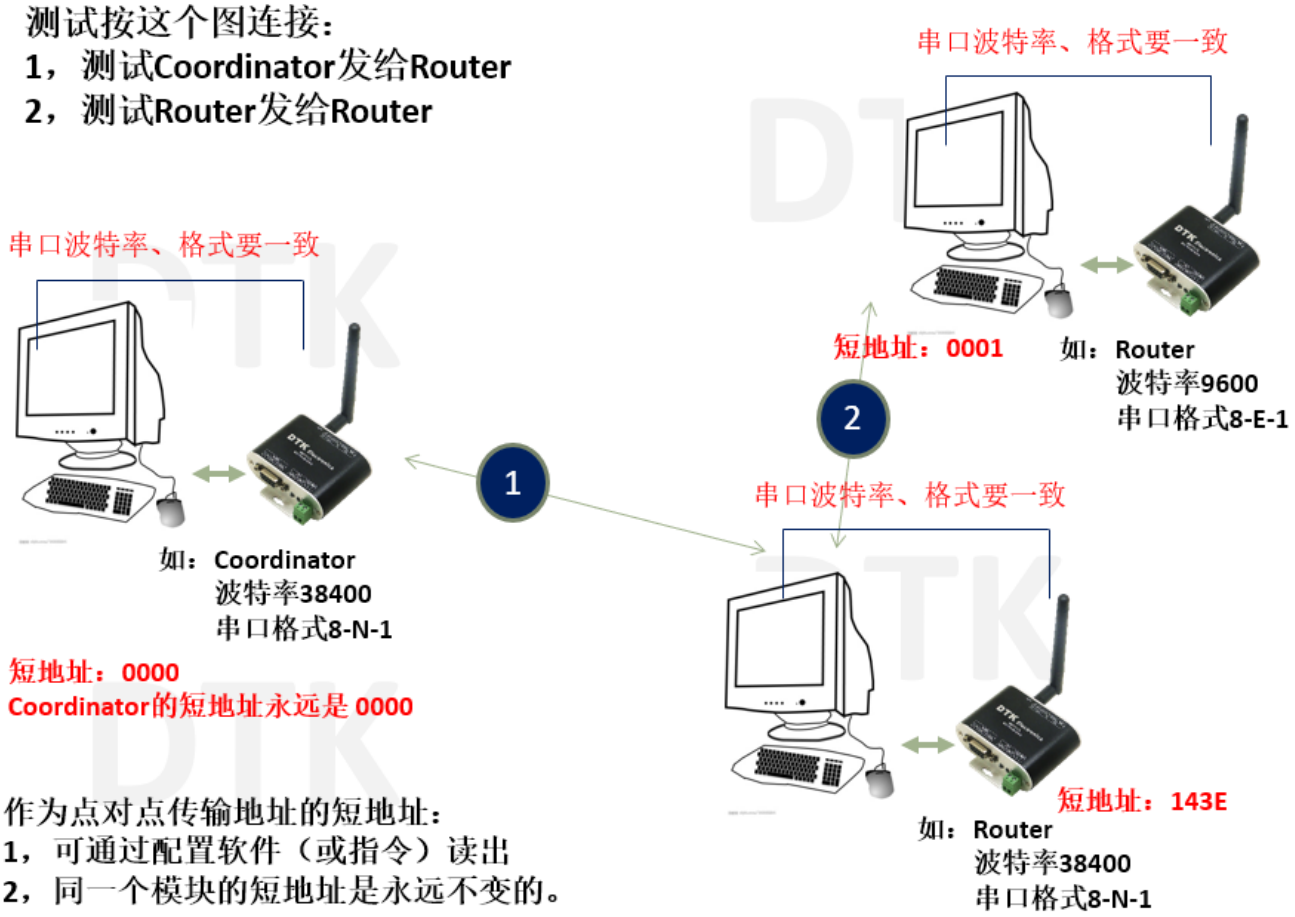
01 02 03 04 05 06 07 08 09 10: data

The received data is: FD 0A 14 3E 01 02 03 04 05 06 07 08 09 10 50 F5

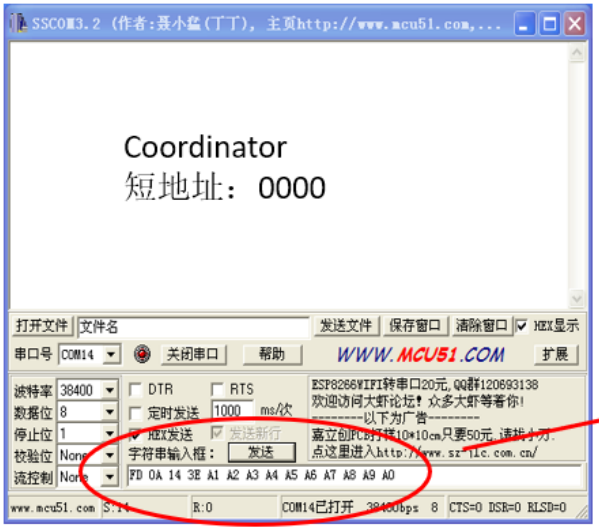


If the target address is FF FF, the broadcast is sent to all nodes.

测试按这个图连接：
1，测试Coordinator发给Router
2，测试Router发给Router

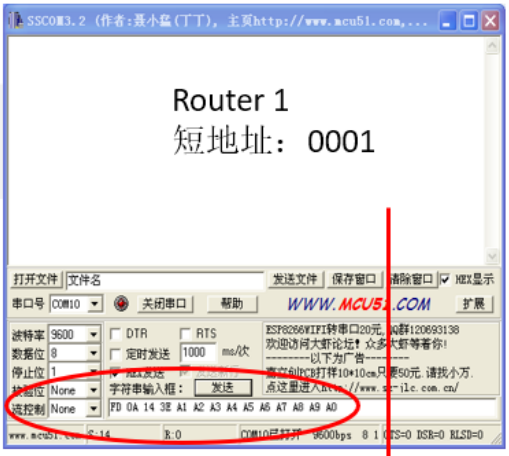


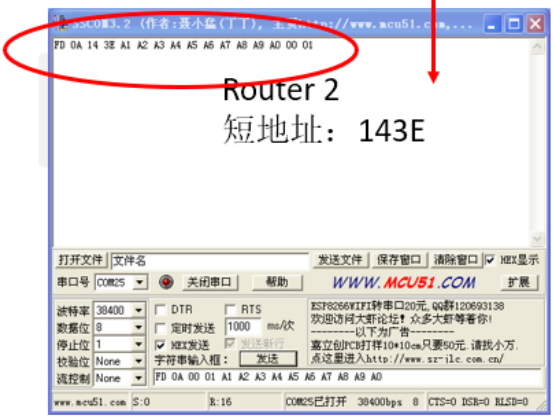
作为点对点传输地址的短地址：
1，可通过配置软件（或指令）读出
2，同一个模块的短地址是永远不变的。



点对点：Coordinator发给Router

（短地址以16进制数字表示）

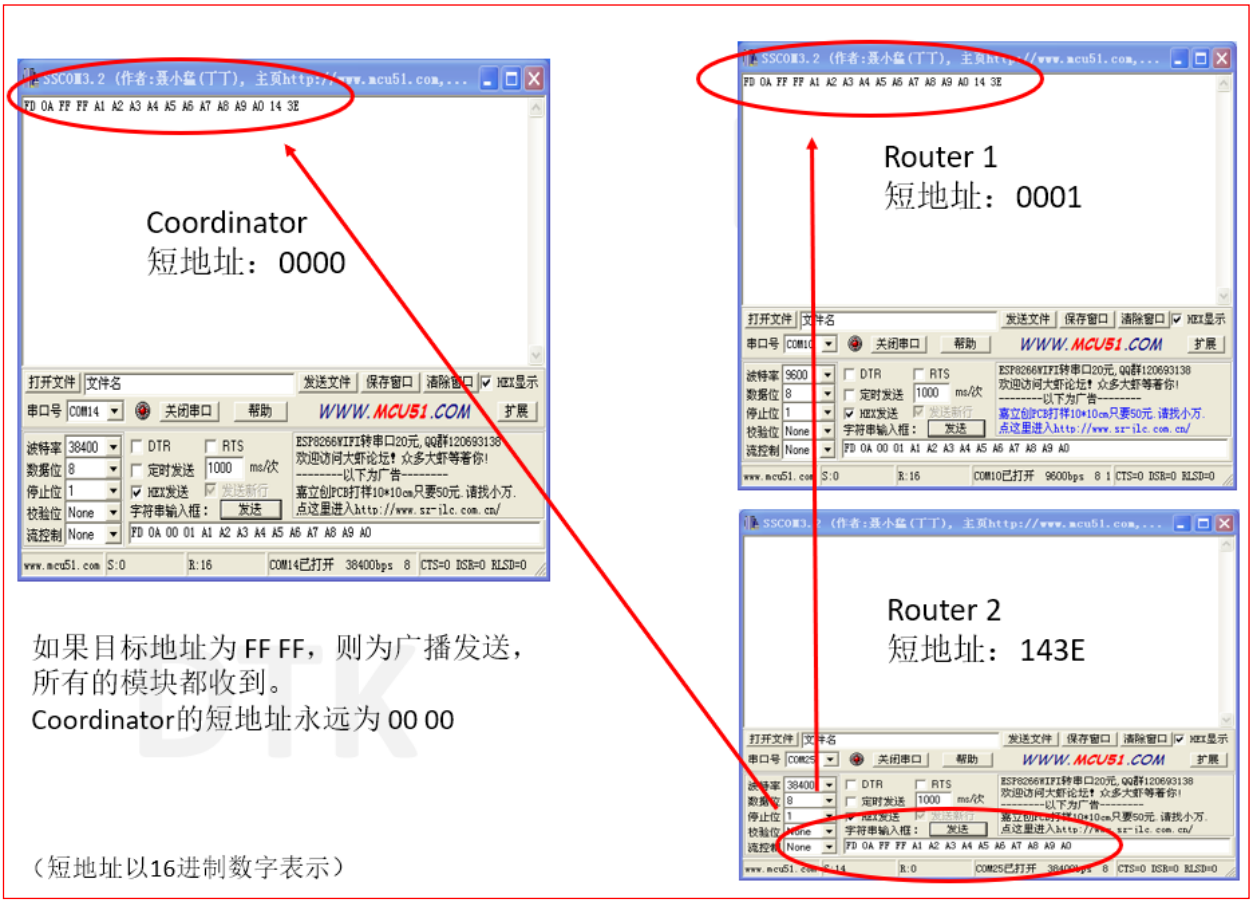




点对点 :Router 发给Router

点对点传输时，Coordinator必须存在（上电）。

（短地址以16进制数字表示）


Coordinator
短地址：0000
Router 1
短地址：0001
Router 2
短地址：143E
如果目标地址为 FF FF，则为广播发送，
所有的模块都收到。
Coordinator的短地址永远为 00 00
（短地址以16进制数字表示）

5.4, point-to-point transmission (custom address as the target address)

Point-to-point is generally suitable for data transmission between Router and Router, which can be sent to any node or broadcast to all nodes

Send command format:

Data transmission instruction (**0xED**) + data length + target address (custom address) + data (up to 92 Bytes)

The data length supports variable length within 92 bytes.

Example: Data is transferred from 0x50F5 to 0x143E (the following are hexadecimal numbers)

Send: ED 0A 14 3E 01 02 03 04 05 06 07 08 09 10

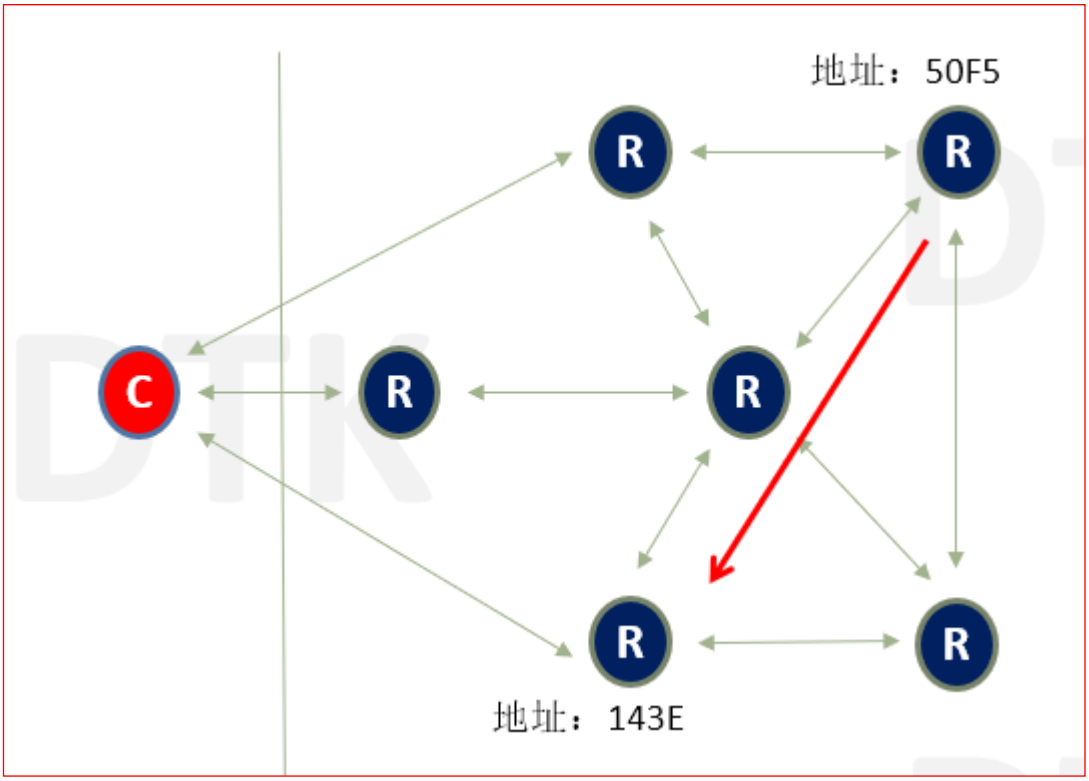
ED: data transmission instruction

0A: data length in data area, a total of 10 bytes

14 3E: target address

01 02 03 04 05 06 07 08 09 10: data

The received data is: ED 0A 14 3E 01 02 03 04 05 06 07 08 09 10 50 F5



5.5, point-to-point transmission (custom address as the target address, remove the header and tail of the packet)

Point-to-point is generally suitable for data transmission between Router and Router, which can be sent to any node or broadcast to all nodes

Send command format:

Data transfer instruction (**0x EC**) + data length + target address (custom address) + data (up to 92 Bytes)

The data length supports variable length within 92 bytes.

Example: Data is transferred from 0x50F5 to 0x143E (the following are hexadecimal numbers)

Send: EC 0A 14 3E 01 02 03 04 05 06 07 08 09 10

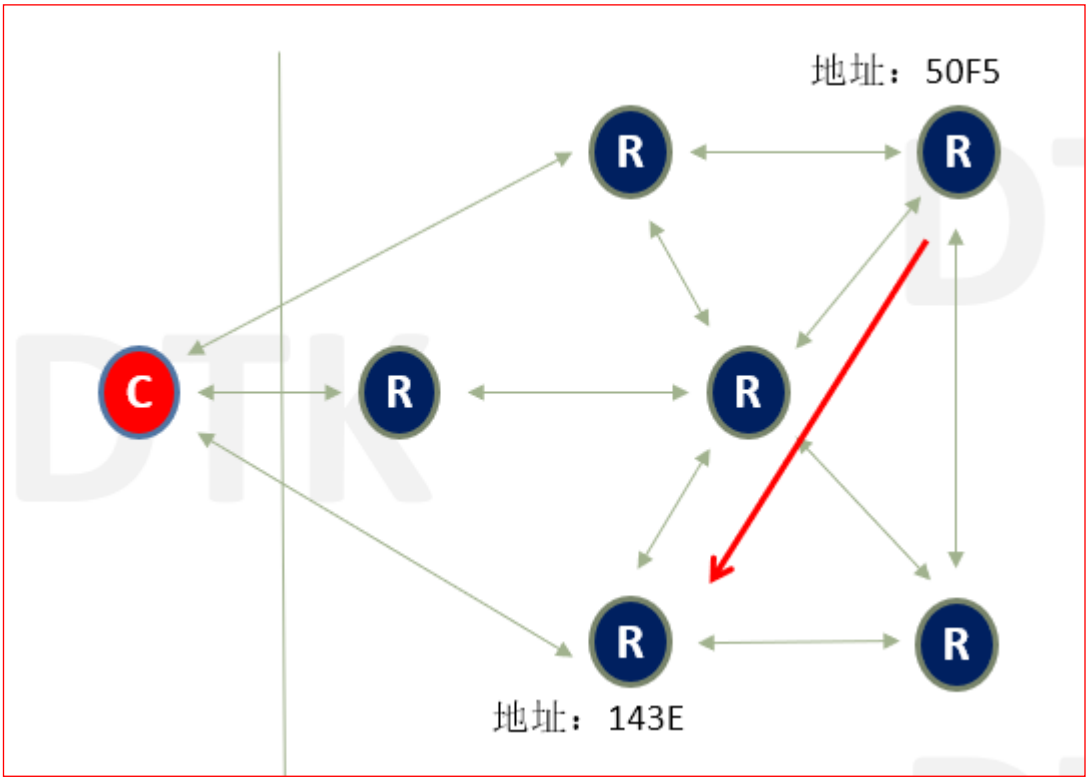
EC: data transmission instruction

0A: data length in the data area, a total of 10 bytes

14 3E: target address

01 02 03 04 05 06 07 08 09 10: data

The received data is: 01 02 03 04 05 06 07 08 09 10



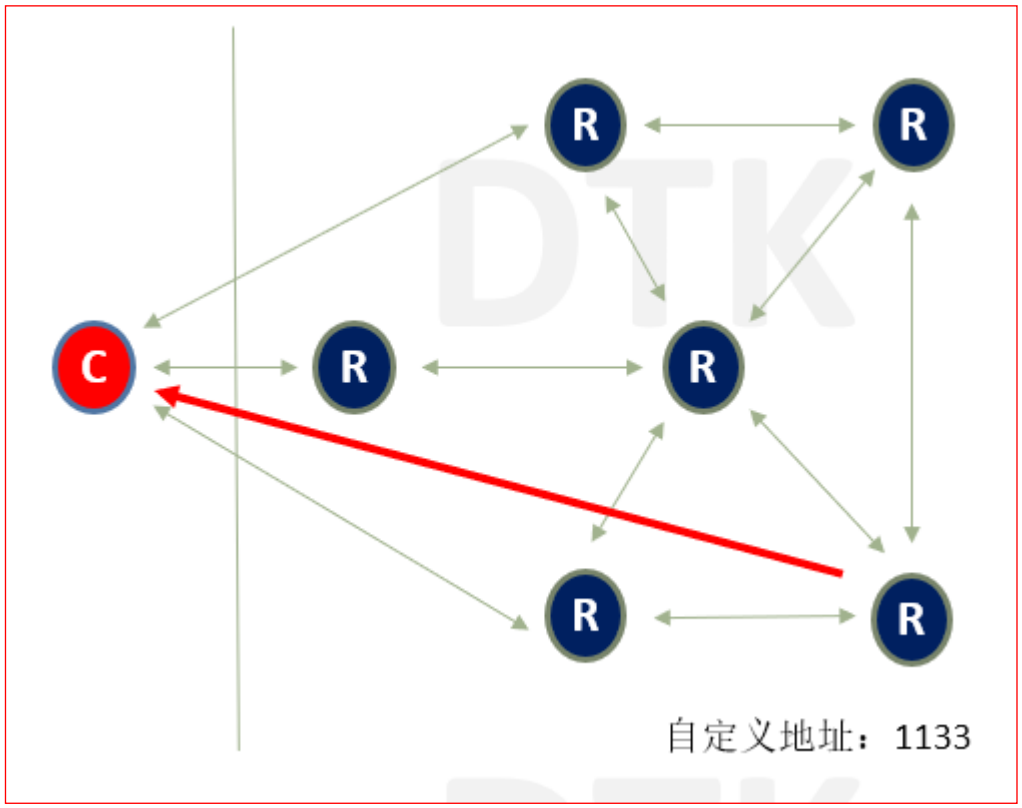
5.6, transparent transmission + custom address (this is a kind of transparent transmission)

This is a variant of transparent transmission, which mainly solves the problem of where the data comes from.
Set the transmission mode of a certain module to: transparent transmission + custom address
Then this module will add its own custom address (2 bytes) at the end of the data when the data is transparently transmitted, and send it together. The data received by the receiver is: data + custom address of the source node (2 bytes)
Example: send: 01 02 03 04 05 06 07 08 09 10

The received data is: 01 02 03 04 05 06 07 08 09 10 11 33

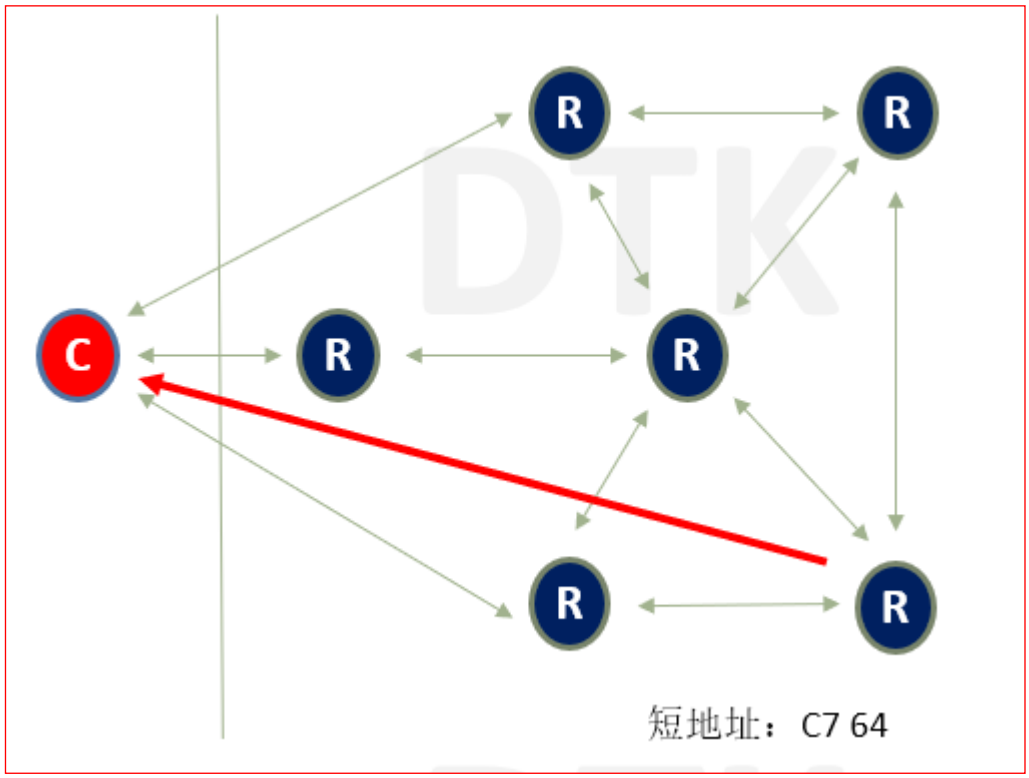
Data + custom address of source node (2 bytes)

The maximum length of the sent data is 259 bytes (plus 261 bytes for custom address)



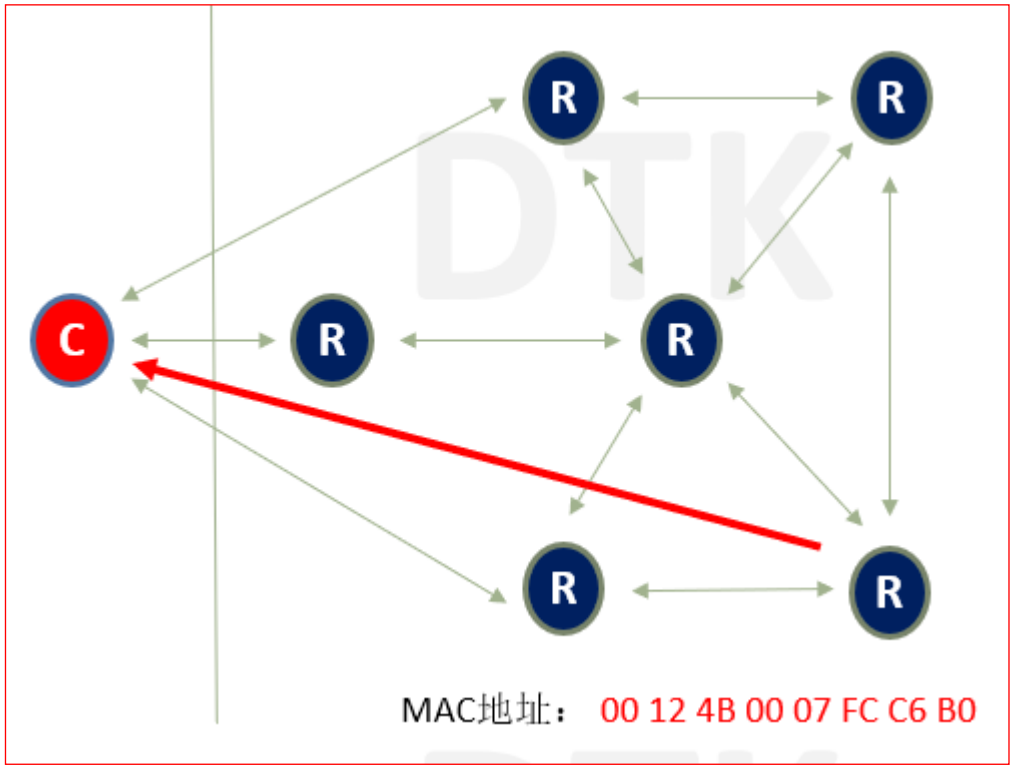
5.7, transparent transmission + short address (this is a kind of transparent transmission)

This is a variant of transparent transmission, which mainly solves the problem of where the data comes from. Set the transmission mode of a certain module to: transparent transmission + short address
2 bytes) at the end of the data when the data is transparently transmitted, and send it together. The data received by the receiver is: data + short address of the source node (2 bytes)
Example: send: 01 02 03 04 05 06 07 08 09 10
The received data is: 01 02 03 04 05 06 07 08 09 10 C 7 64
Data + short address of source node (2 bytes)
The maximum length of data sent is 259 bytes (261 bytes with short address)



5.8, transparent transmission + M AC address (this is a kind of transparent transmission)

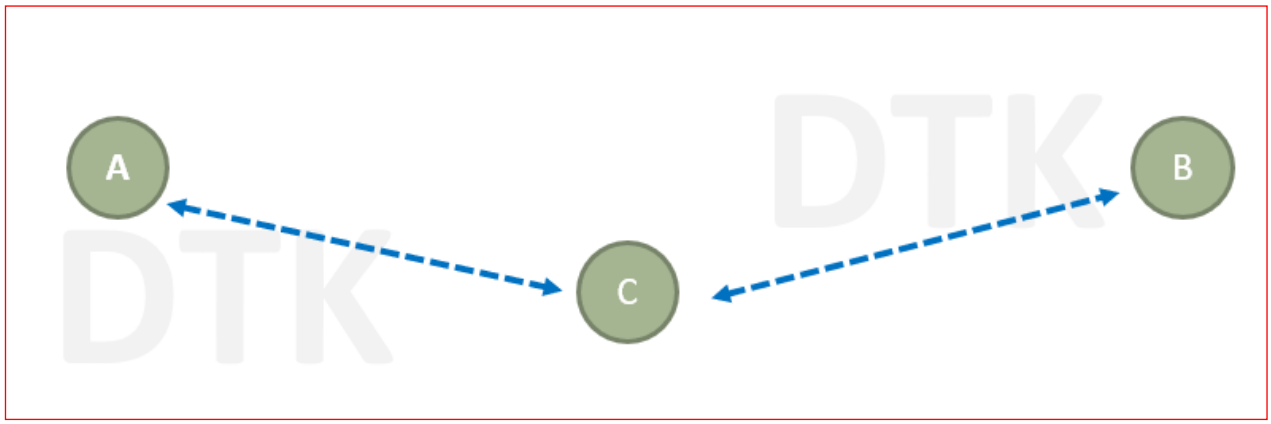
This is a variant of transparent transmission, which mainly solves the problem of where the data comes from. Set the transmission mode of a certain module to: transparent transmission + M AC address
MAC address (8 bytes) at the end of the data when the data is transparently transmitted, and send it together. The data received by the receiver is: data + MAC address of the source node (8 bytes)
Example: send: 01 02 03 04 05 06 07 08 09 10
The received data is: 01 02 03 04 05 06 07 08 09 10 00 12 4B 00 07 FC C6 B0
Data + MAC address of source node (8 bytes)
The maximum length of sent data is 259 bytes (plus M AC address is 267 bytes)

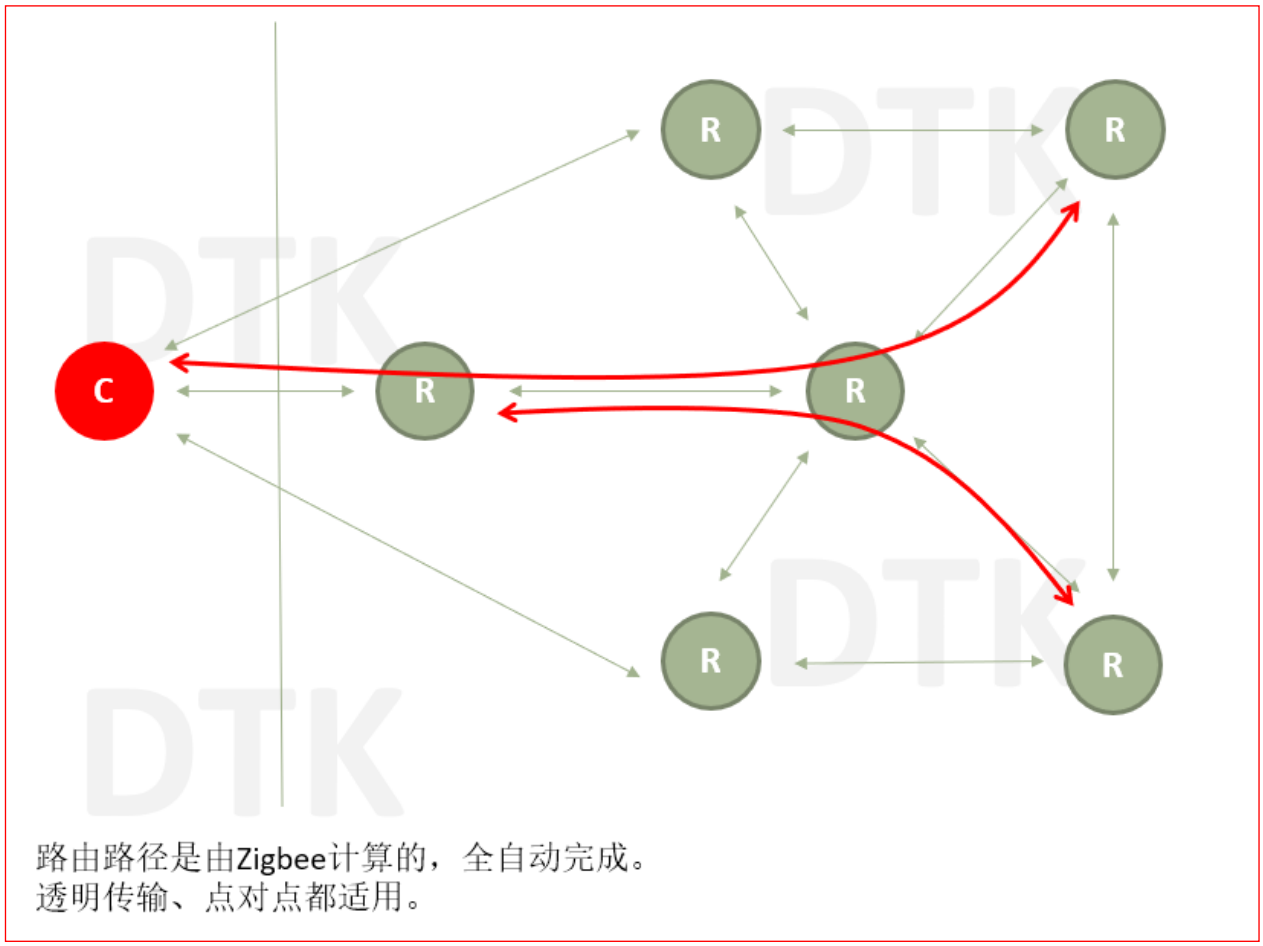


M AC address is globally unique

5.9, Routing of Zigbee module

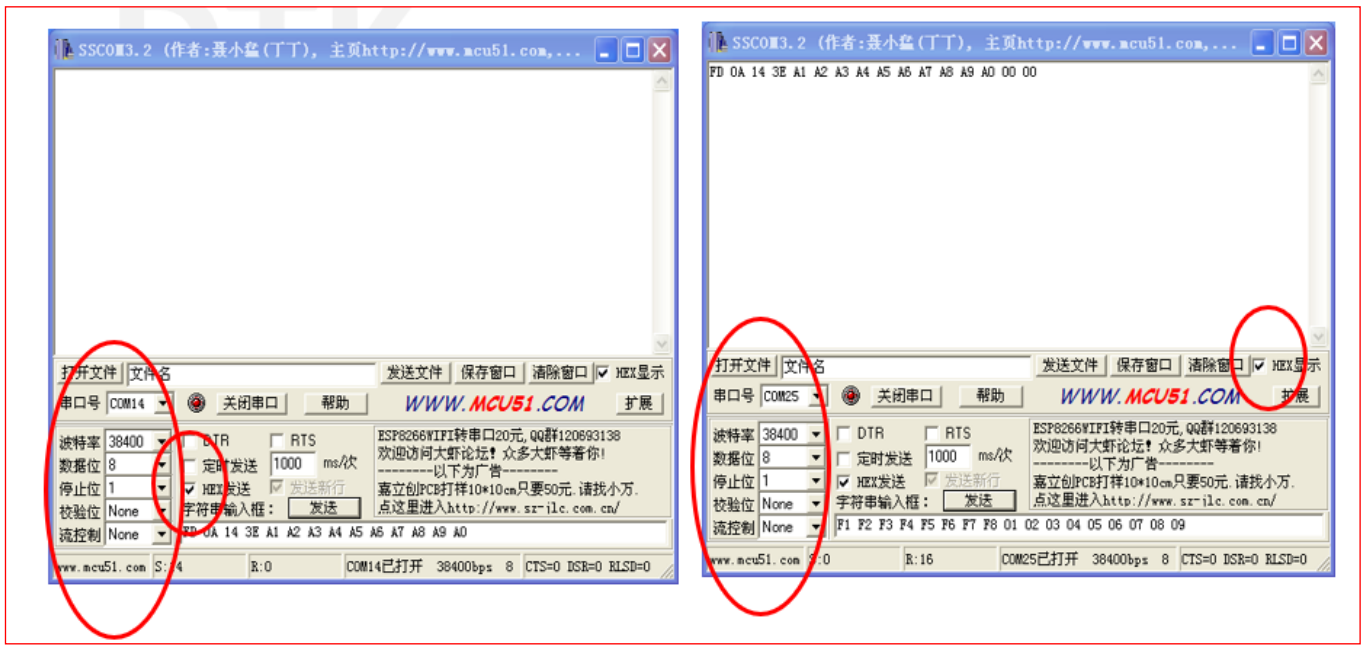
Zigbee module is completely automatic, suitable for transparent transmission and point-to-point transmission. Assumption: The distance between A and B modules is too far, so that A and B cannot communicate. At this time, just add a module C between A and B. If A, C, B and C can communicate, then C It can automatically act as a route between A and B.
C does not require special settings, only needs to join the network.





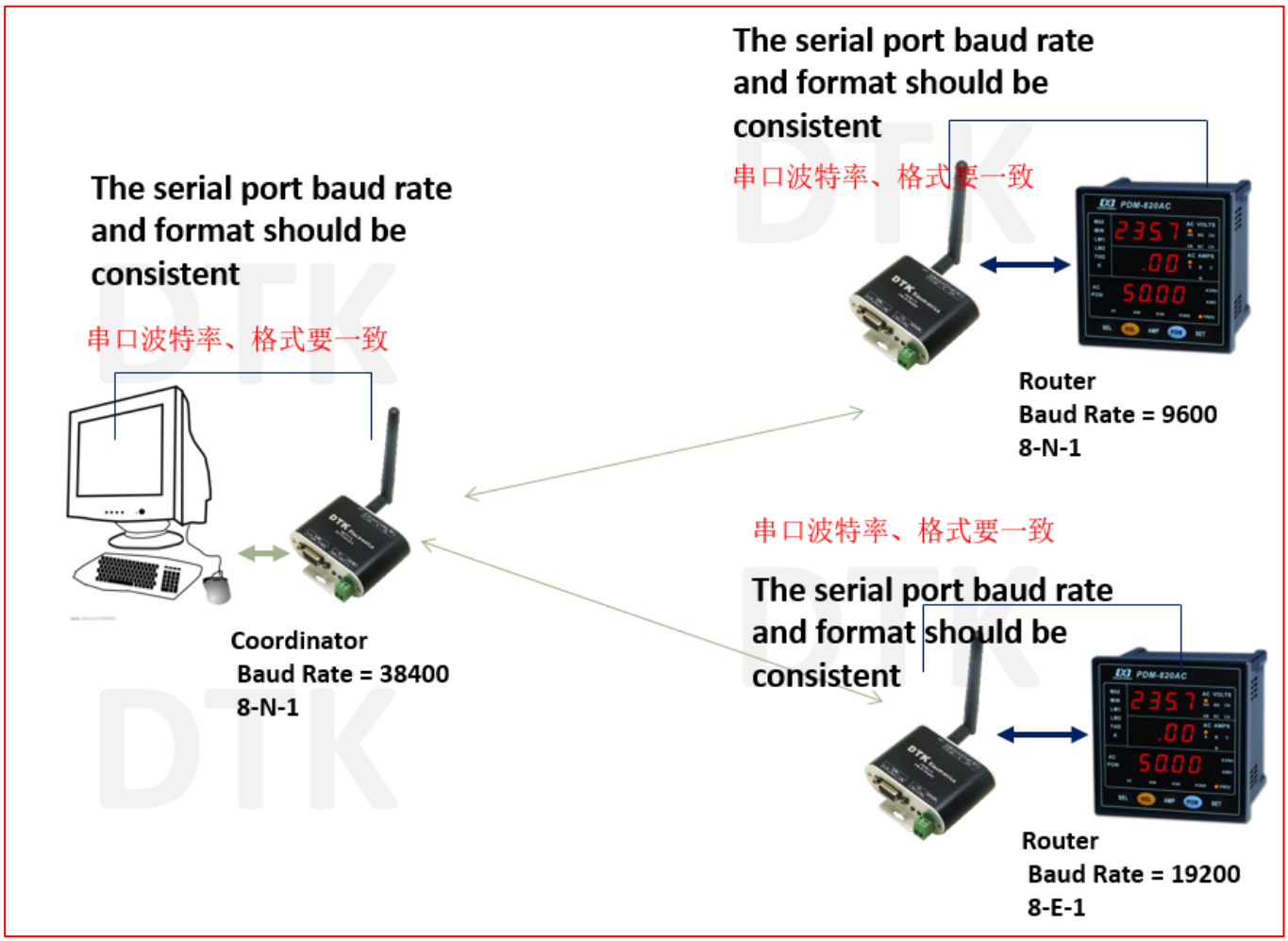
5.10, matters needing attention for serial port debugging assistant

1. If it is sent in hexadecimal (Hex), select hexadecimal to receive (check Hex to display);
   If the characters are sent (uncheck Hex to send), then the reception is also unchecked
2. The baud rate and serial port format of the serial port debugging assistant should be consistent with the connected Zigbee module;



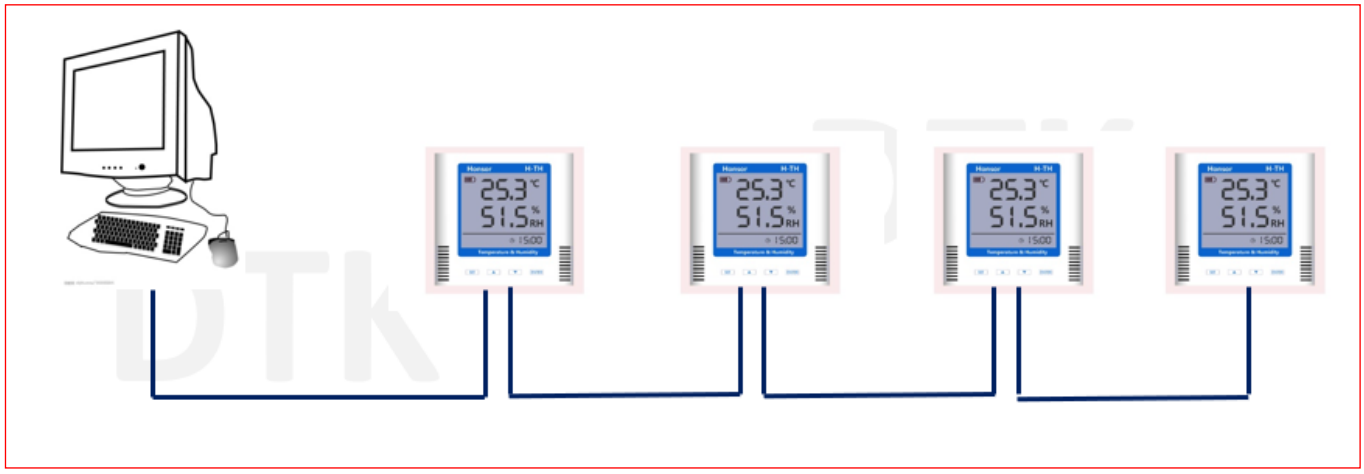
5.11, about baud rate (very important)

- The baud rate refers to: when two hardware devices are directly connected, the communication rate between them;
- Users don't need to care about the so-called " Zigbee air baud rate"
- Therefore: when a Zigbee module is connected to a device, the baud rate (and serial port format) between them must be the same, instead of requiring the baud rate of all Zigbee modules in a Zigbee network to be the same.

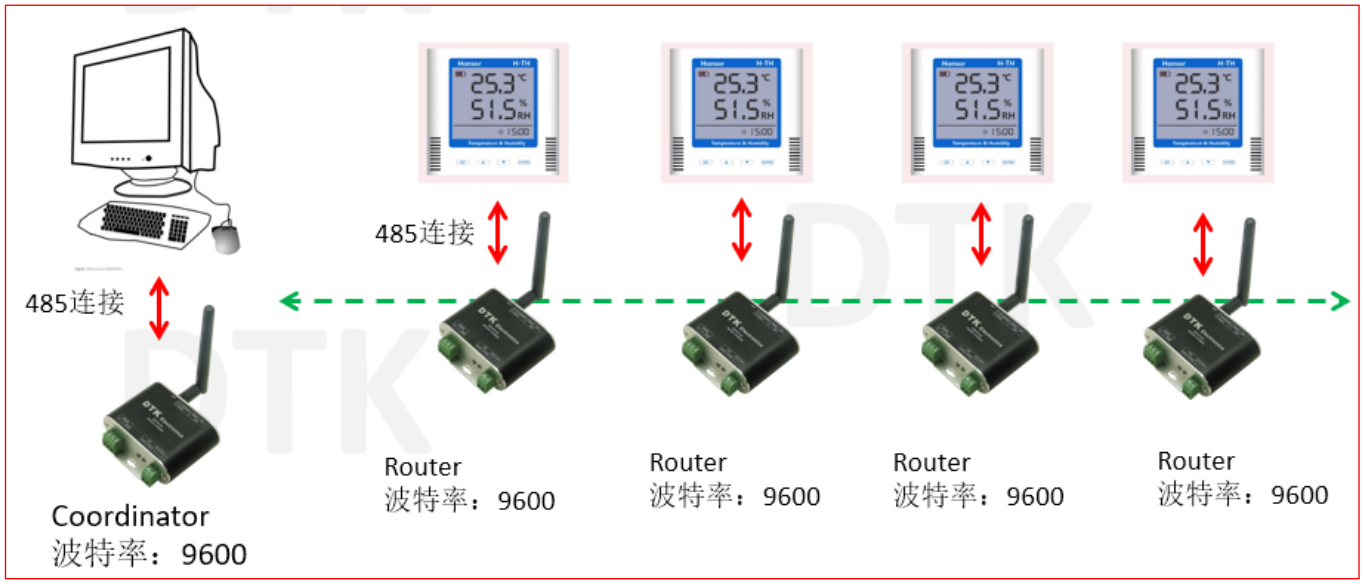


6. Networking example of Zigbee module

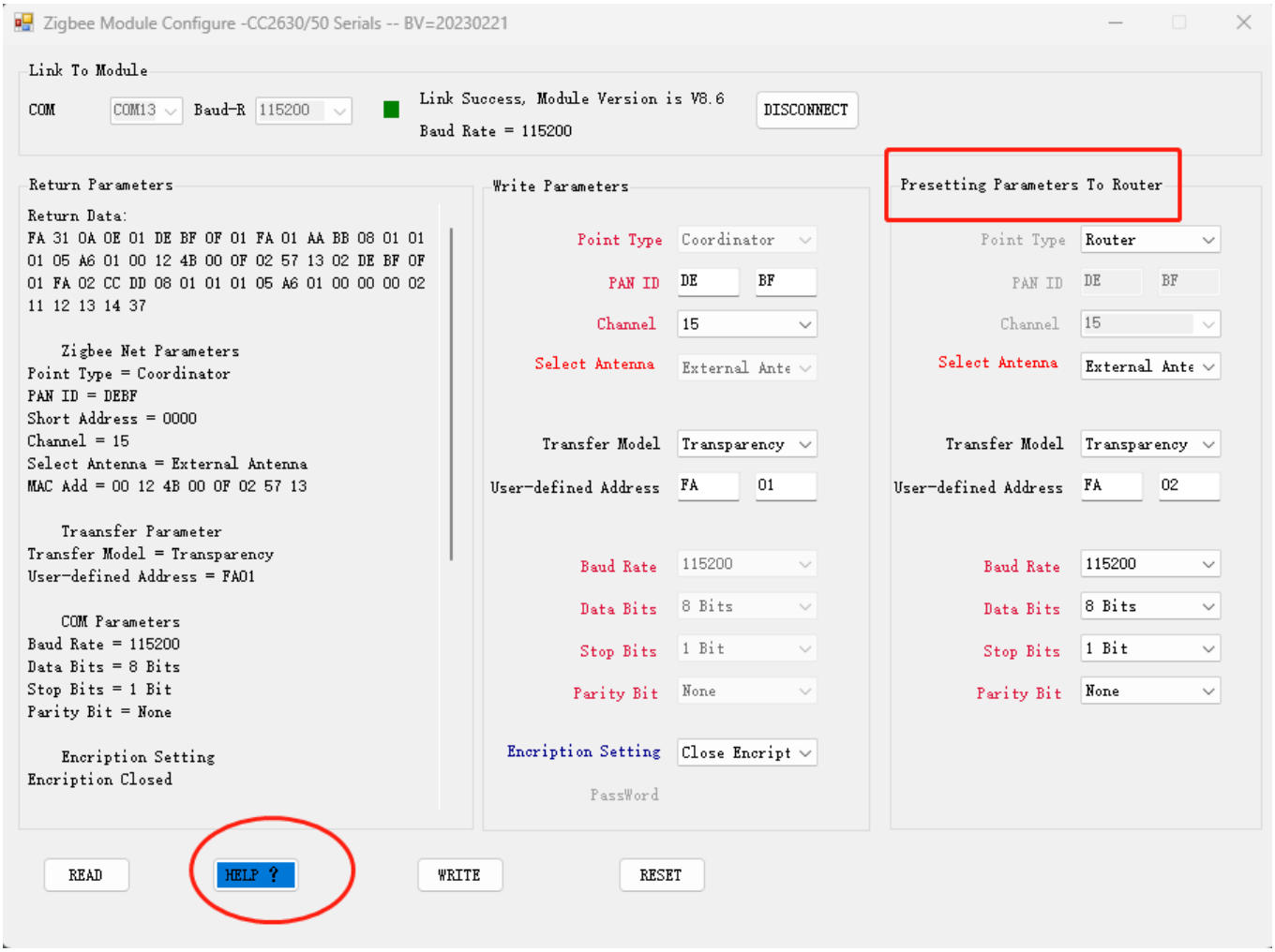
Suppose there is a wired temperature and humidity measurement and transmission system. We use the Zigbee module to connect and transform it into a wireless Zigbee network temperature and humidity measurement system:
A host computer is connected to 4 temperature and humidity measuring instruments (or temperature and humidity transmitters) through the RS485 bus:
The connection baud rate is 9600, MODBUS RTU protocol



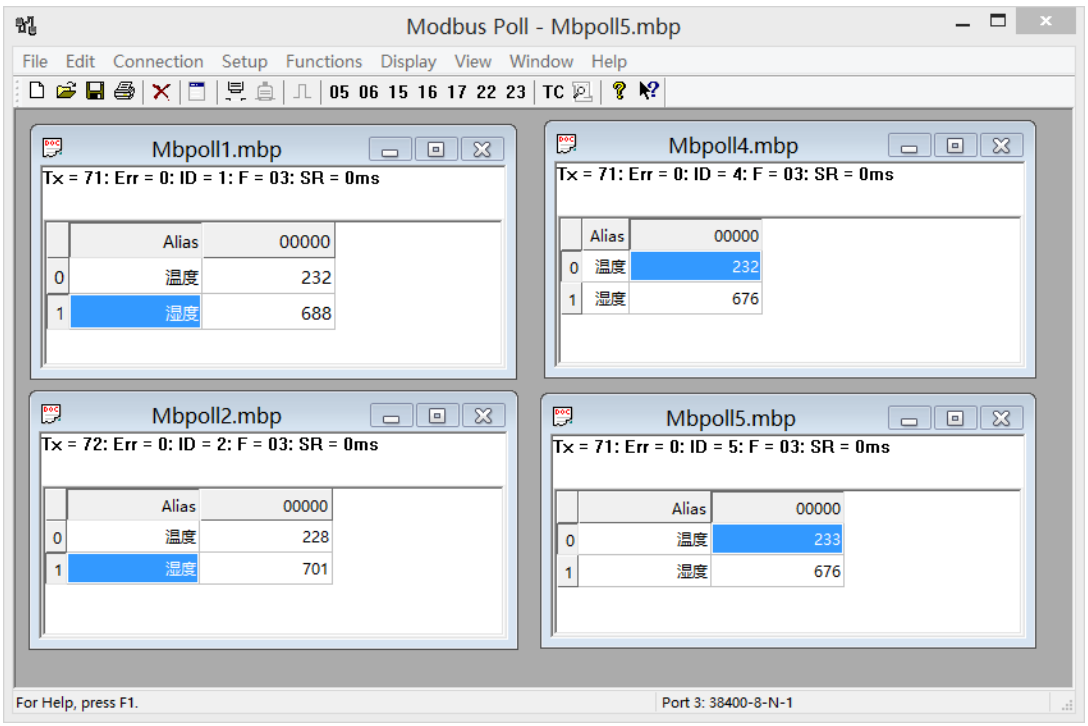
Transformation method:
1 module is set as Coordinator and connected to the host computer, 4 modules are set as Router and connected to temperature and humidity instrument
After the connection is completed, there is no need to modify the software of the host computer, nor to modify the device configuration. It is exactly the same as the wired method!



When configuring the Zigbee module, you only need to configure the coordinator. The Router module can automatically find the coordinator to join the network by pressing the function button 3 times, and obtain the preset parameters in the coordinator.

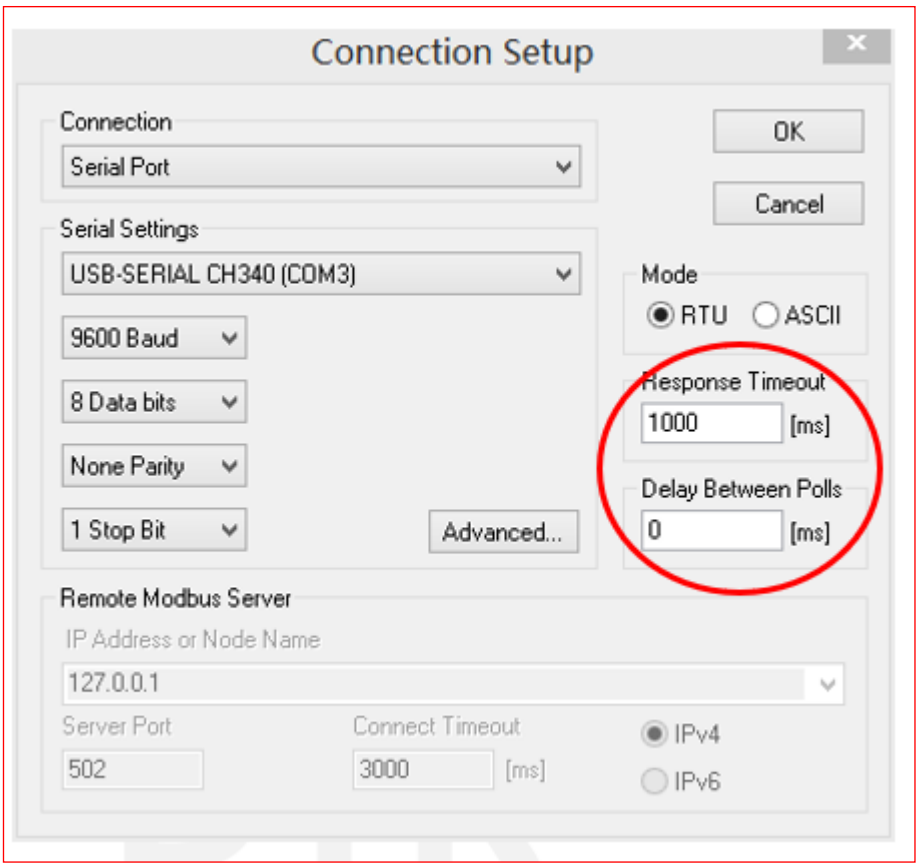


After the connection is completed, there is no need to modify the software of the host computer, nor to modify the device configuration. It is exactly the same as the wired method!



Due to the use of high-performance dual ARM-32- bit CPUs, high transmission performance can still be obtained after transformation:

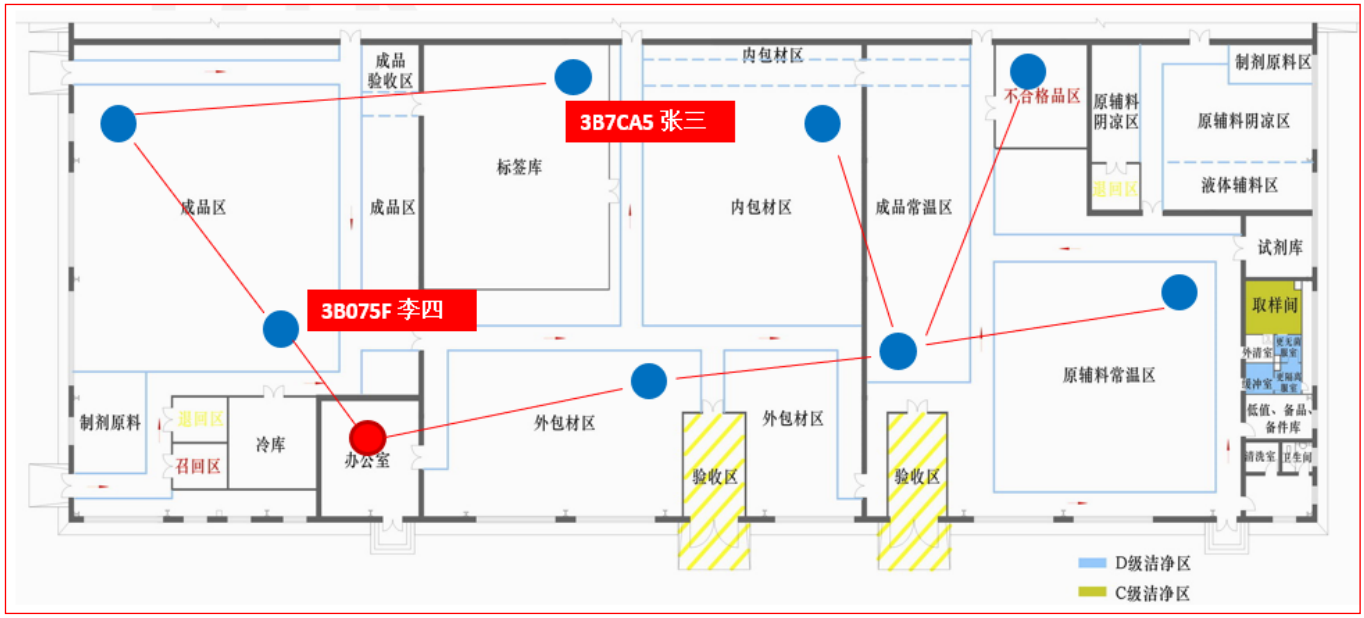
- Simple network, after receiving a piece of data, you can send the next command immediately;
- 50) or routing depth (more than 10 levels) in the network, a delay of 200MS should be set appropriately, and the timeout (Timeout) can be set to 2S, 3S or 5S
- Properly increasing the baud rate of the host computer (the coordinator connected to the host computer should also be the same), can reduce the processing time of the module occupied by the serial port, and help improve the efficiency of the entire network.



7. Zigbee positioning system

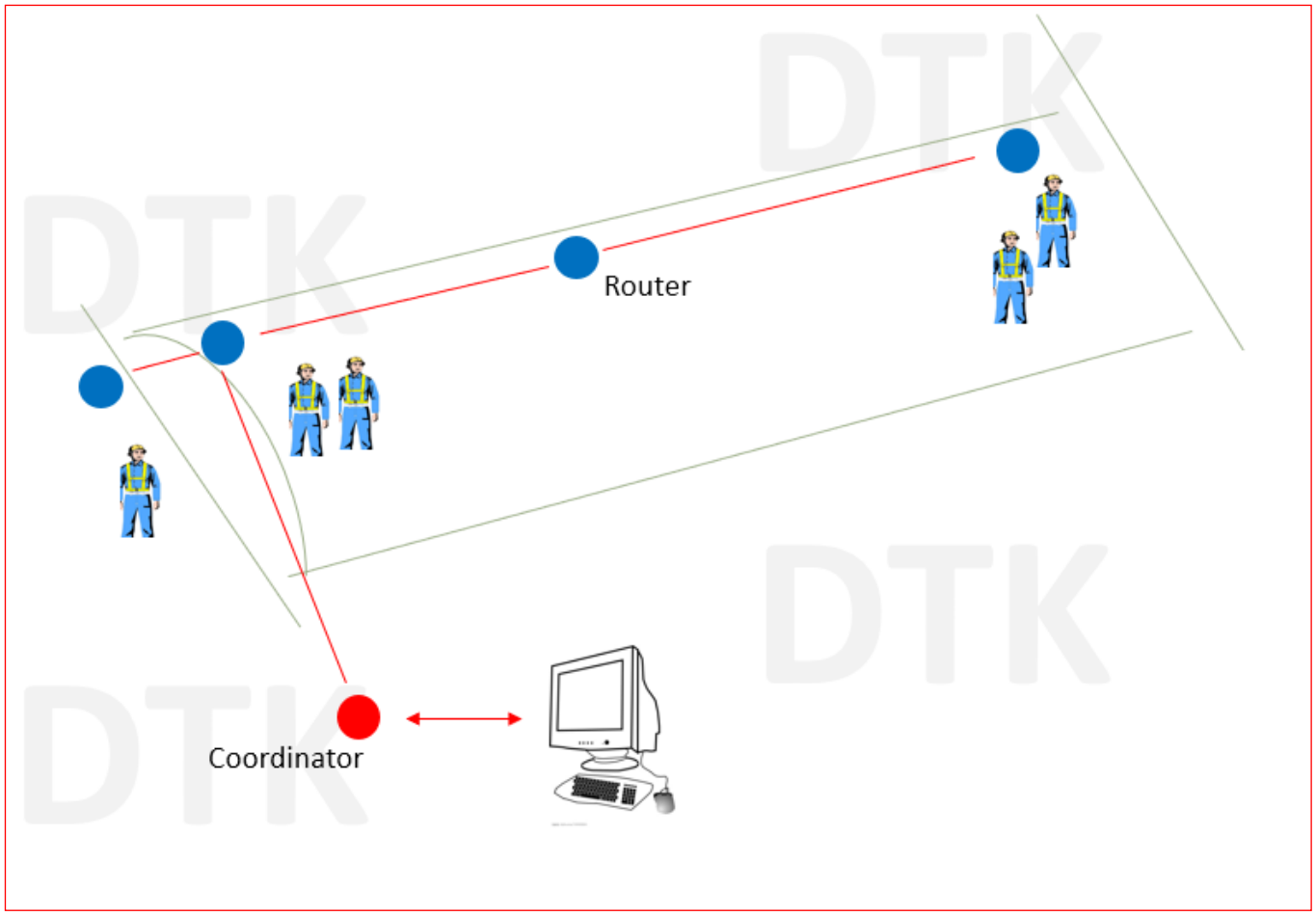
7.1, Overview of Zigbee Positioning System

Due to the ad hoc network and automatic routing features of the Zigbee network, a Zigbee network can cover a large area. In the area covered by the Zigbee network, the positioning card will continue to try to communicate with its surrounding Routers. Once the communication is established, the positioning card will report its location information (which Router is closest to it, and what is the signal value) to the Coordinator, Coordinator After receiving it in the background, the approximate location of the positioning card can be determined.



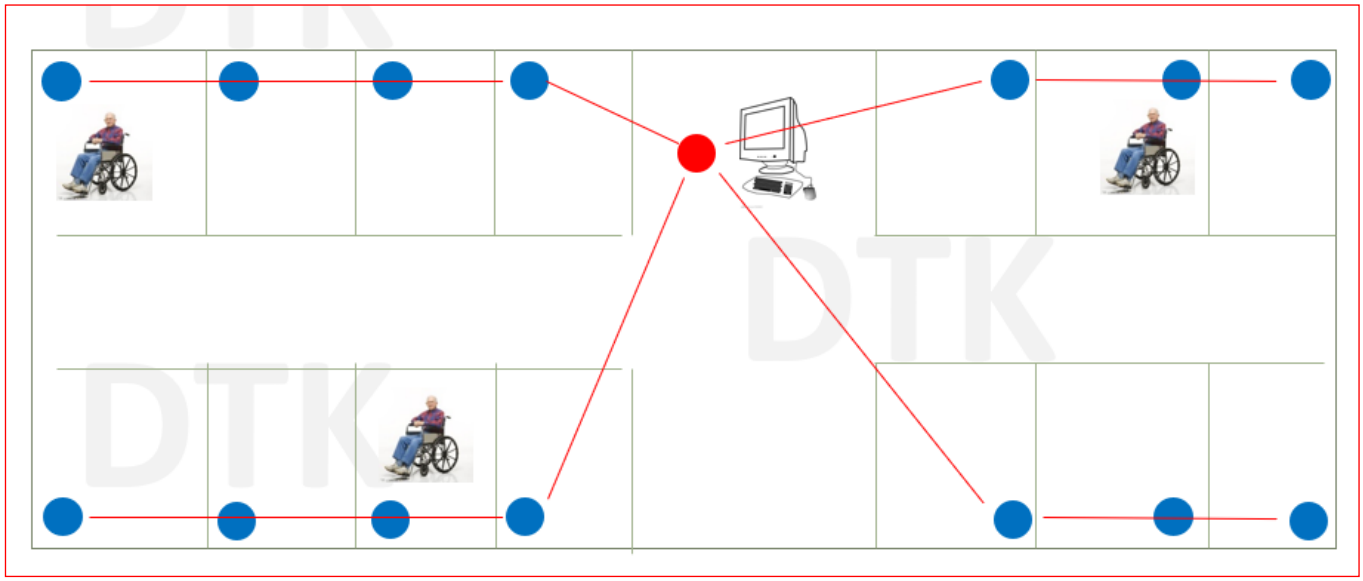
7.2, Zigbee positioning system example 1 (tunnel construction management)

(1), arrange a Router inside and outside the tunnel entrance, then it can detect whether people are inside or outside the tunnel
(2), if you place a Router on the working surface, you can detect the people working here
(3), an appropriate number of routes can be placed in the middle of the tunnel, so that all data can be transmitted wirelessly to the coordinator
(4), the entire system transmits data wirelessly, reducing construction difficulty



7.3, Example 2 of Zigbee positioning system (nursing home personnel management)

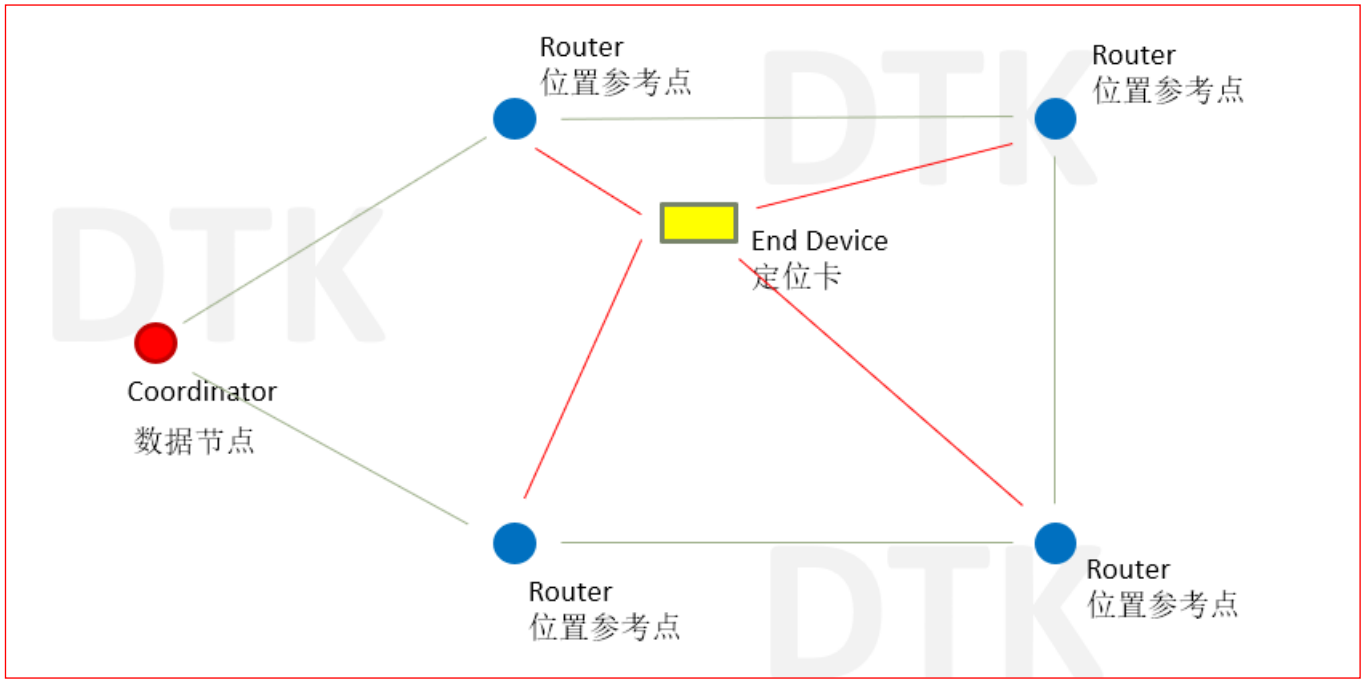
(1), arrange a Router in each room, then you can find out which room the person is in
(2), the Router in each room can route data between each other
(3), arrange a Coordinator at the nurse's desk, then the positioning data can be transmitted automatically
(4), the entire system transmits data wirelessly, reducing construction difficulty



7.4, Zigbee positioning system principle

In a Zigbee network, the Router is used as a fixed point (or position reference point, used to identify the position), and the End Device is used as a mobile point (positioning card). The positioning card will try to communicate with the surrounding position reference points and record the communication information. Signal strength, after comparing these signal strengths, the positioning card finds the three nearest Routers , and sends the data to the Coordinator (data node, or Zigbee gateway), and the background computer can monitor the position of the positioning card.

Zigbee positioning is not precise position positioning, it can only tell you which location reference point the positioning card is near.



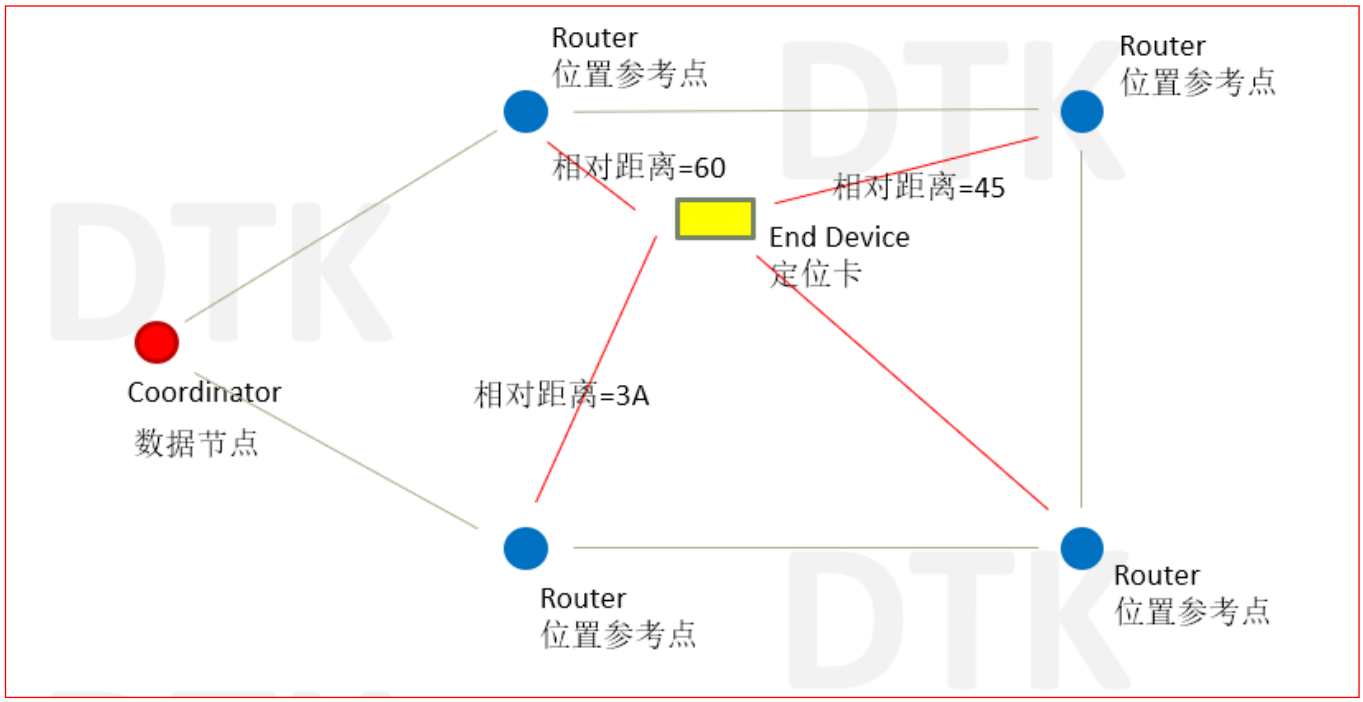
The positioning card (End Device) uses relative distance to indicate the distance from the position reference point (Router).

The essence of the relative distance is the signal strength, which is a value between 0-100 and has no unit. The larger the relative distance, the closer the positioning card is to the position reference point.

The upper computer software can determine the position of the positioning card by using the positioning card closest to a certain position reference point, or use the relative distance between the positioning card and the three position reference points to more accurately determine the position of the positioning card.

The positioning card (End Device) is represented by the card number, such as 3B120A (hexadecimal number)

Position reference point, represented by short address, such as 2AC7, 2348, 3F79.



the positioning card (End Device) generates positioning data, it will send the positioning data to the nearest position reference point (Router), and the Router will automatically route the positioning data to the coordinator, and then the upper computer software will display the position of the positioning card.
The positioning data format is as follows:

定位数据包（以下为16进制数字）											
	基本数据包					扩展数据包					
定义	包头	卡号	相对距离	位置参考点	校验和	包头	相对距离	位置参考点	相对距离	位置参考点	校验和
字节数	1	3	1	2	1	1	1	2	1	2	1
实例	FA	3B 12 0A	60	2A C7	A2	FB	45	23 48	3A	3F 79	E1
效验和	前面7个字节的和,保留低8位										
	前面15个字节的和,保留低8位										

When the battery voltage of the positioning card (End Device) is low, it will generate a low voltage alarm data packet, prompting to replace the battery
Low-voltage data packet: the first relative distance is **FF,** and the other bytes are the same

低电压报警数据包（以下为16进制数字）											
	基本数据包					扩展数据包					
定义	包头	卡号	相对距离	位置参考点	校验和	包头	相对距离	位置参考点	相对距离	位置参考点	校验和
字节数	1	3	1	2	1	1	1	2	1	2	1
实例	FA	3B 12 0A	FF	2A C7	41	FB	45	23 48	3A	3F 79	1F
效验和	前面7个字节的和,保留低8位										
	前面15个字节的和,保留低8位										

Example of location card data (the following are hexadecimal numbers):
FA 3B 12 0A 60 2A C7 A2 FB 45 23 48 3A 3F 79 E1
Indicates that the positioning card (3B120A) is closest to the position reference point (2AC7), and the relative distance is 60
The positioning card (3B120A) is the second closest to the position reference point (2348), and the relative distance is 45
The positioning card (3B120A) is the third closest to the position reference point (3F79), and the relative distance is 3A

Displayed on the positioning system DEMO software: 3B120A is near 2AC7

7.5, Composition and Construction of Zigbee Positioning System

Zigbee module purchased by the user can be used to build the Zigbee positioning system:

Data node (Coordinator): DRF2670C (network port) is recommended, DRF2657C, DRF2658C, DRF2659C can also be used

Setting parameters:
Node Type = Coordinator,
Baud rate = 115200, serial port format = 8-N-1,
PAN ID = DEBF, channel = 15

If DRF2670C is used, the network port parameters are set as:
network-protocol = UDP,
IP method = static IP,
IP address = generally 192.168.1.X,
Subnet mask = generally 255.255.255.0,
gateway =192.168.1.1,
port = 20108,
Target IP address = (the IP address of the computer receiving the data) is generally 192.168.1.X,
target port = 8567

Position reference point (Router): DRF2659C is recommended, and DRF2657C can also be used
Setting parameters: the same as the Coordinator, or press the Function button three times near the Coordinator to automatically join the network. The position reference point does not need to be connected to the data line, and it can be powered directly

Positioning card: You need to purchase a special positioning card (model DRF2607)

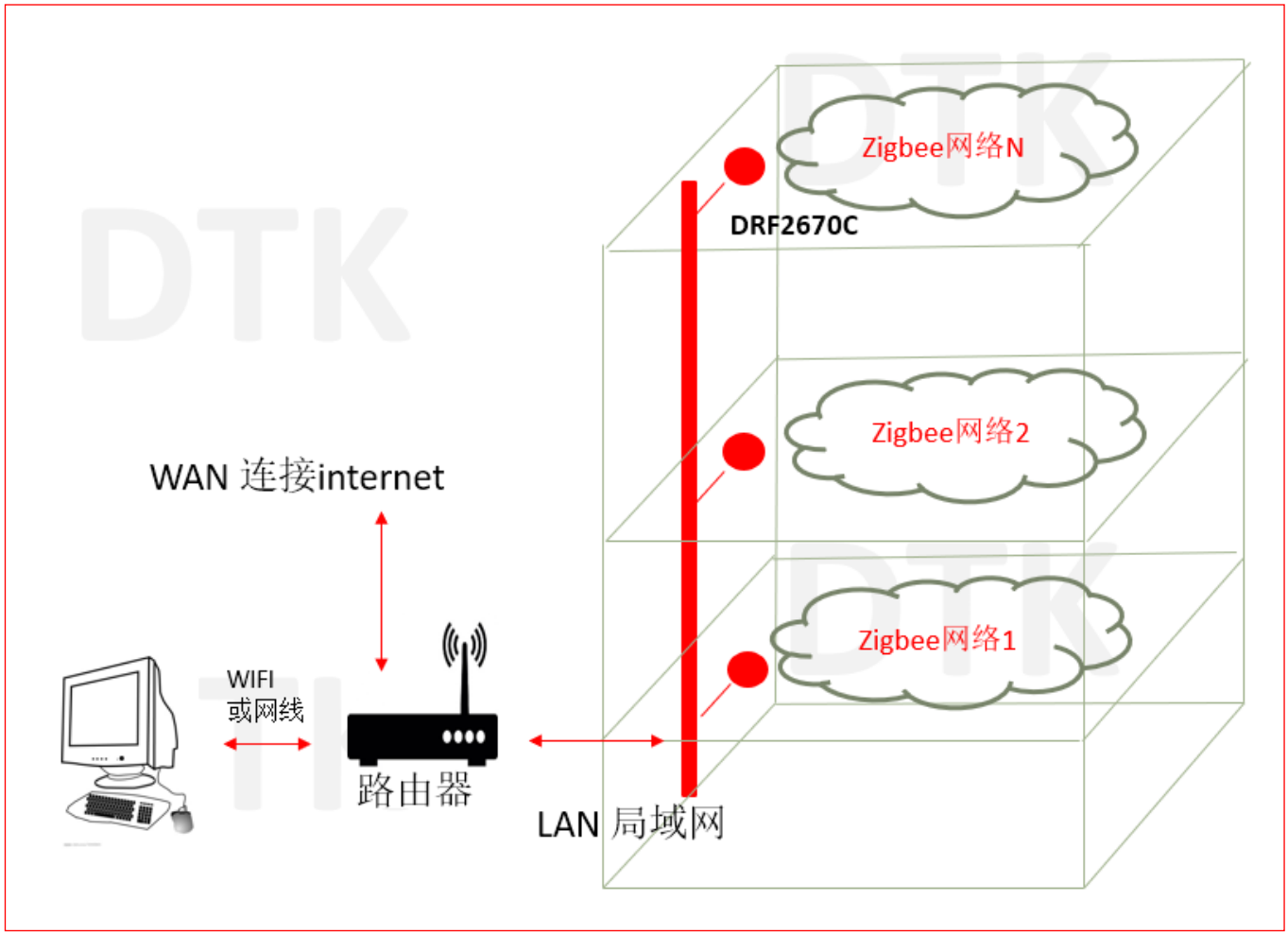
There is no data port, and the parameters cannot be set. The positioning card is a low-power device, and a 2450 button battery can be used for one year.

Users can also purchase a Zigbee positioning system kit, which is all set up and ready to use right out of the box:

Kit Contains: 1 Data Node (DRF2670C)
3 Position Reference Points (DRF2659C)
4 positioning cards (DRF2607A)
4 5V power supplies (gifted)

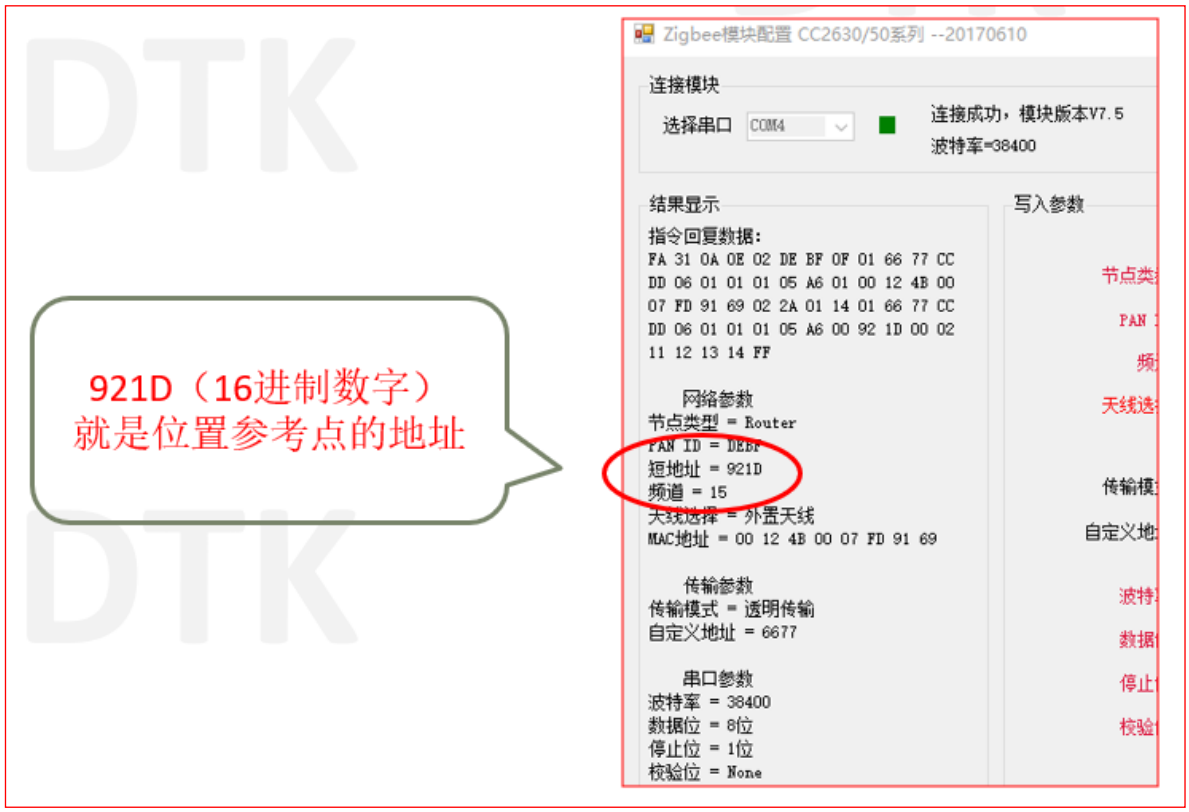
7.6, build a large Zigbee positioning system

DRF2670C, as the data node of the Zigbee positioning system, connects various small Zigbee networks through the network to form a large Zigbee positioning system

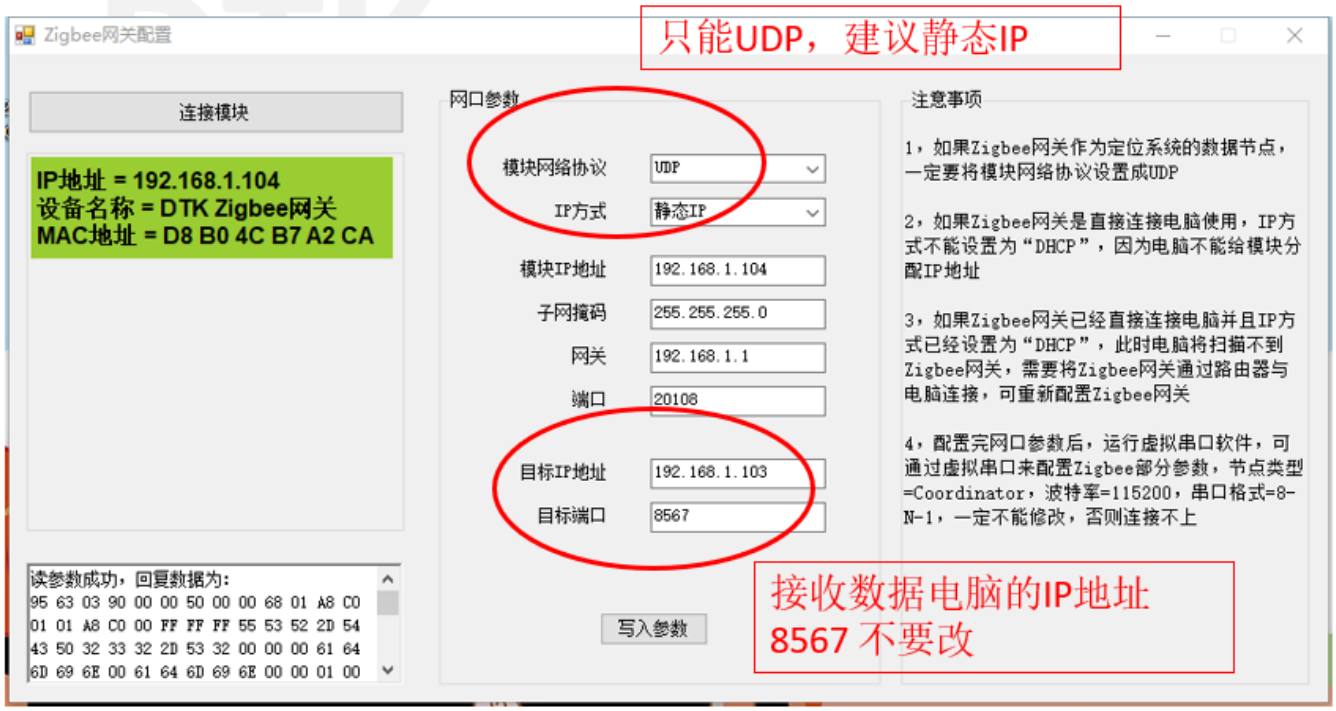


7.7, the use of Zigbee positioning system application software

(1), use the Zigbee configuration software to read the parameters of the position reference point, write down the short address, this is the address of the position reference point

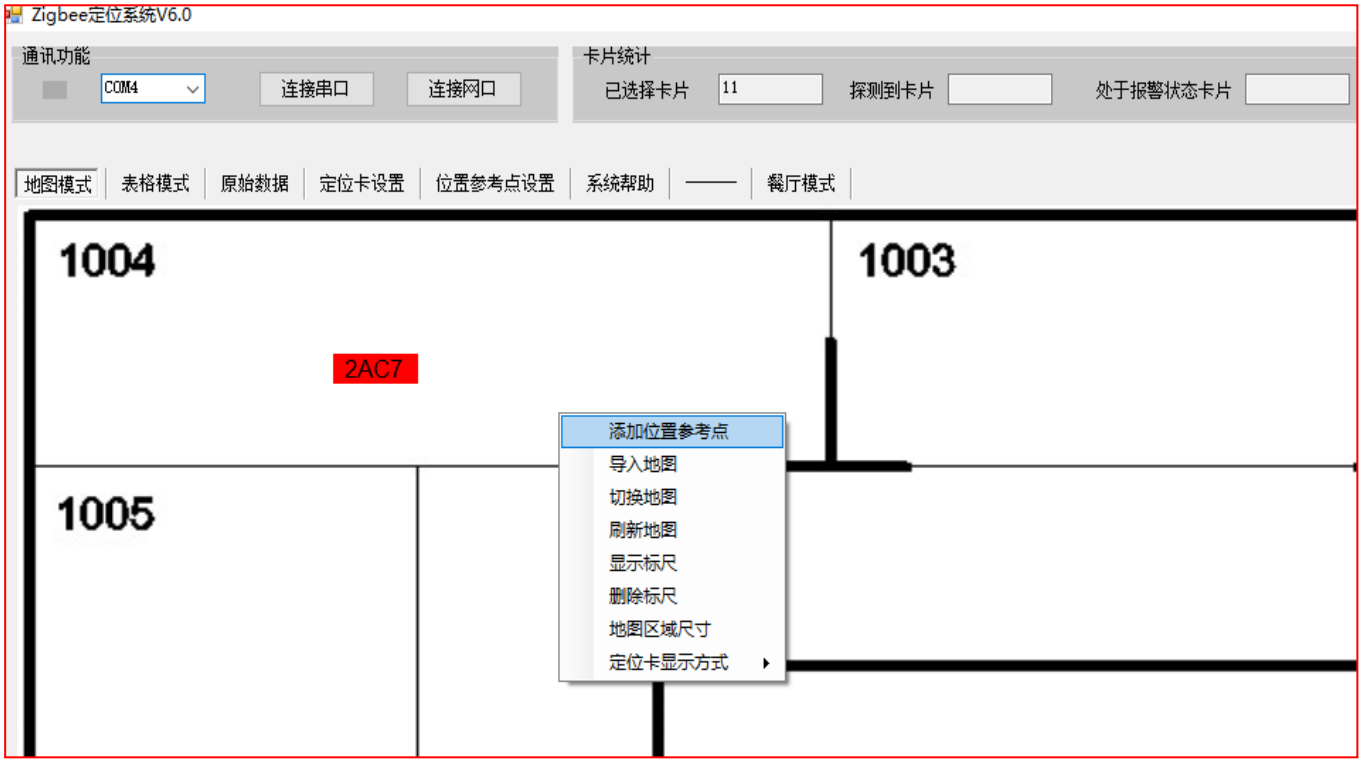


(2), connect the data node to the computer through the router (or directly connect to the computer). Assuming you purchased the " Zigbee Positioning Kit", the network parameters are set as shown below:

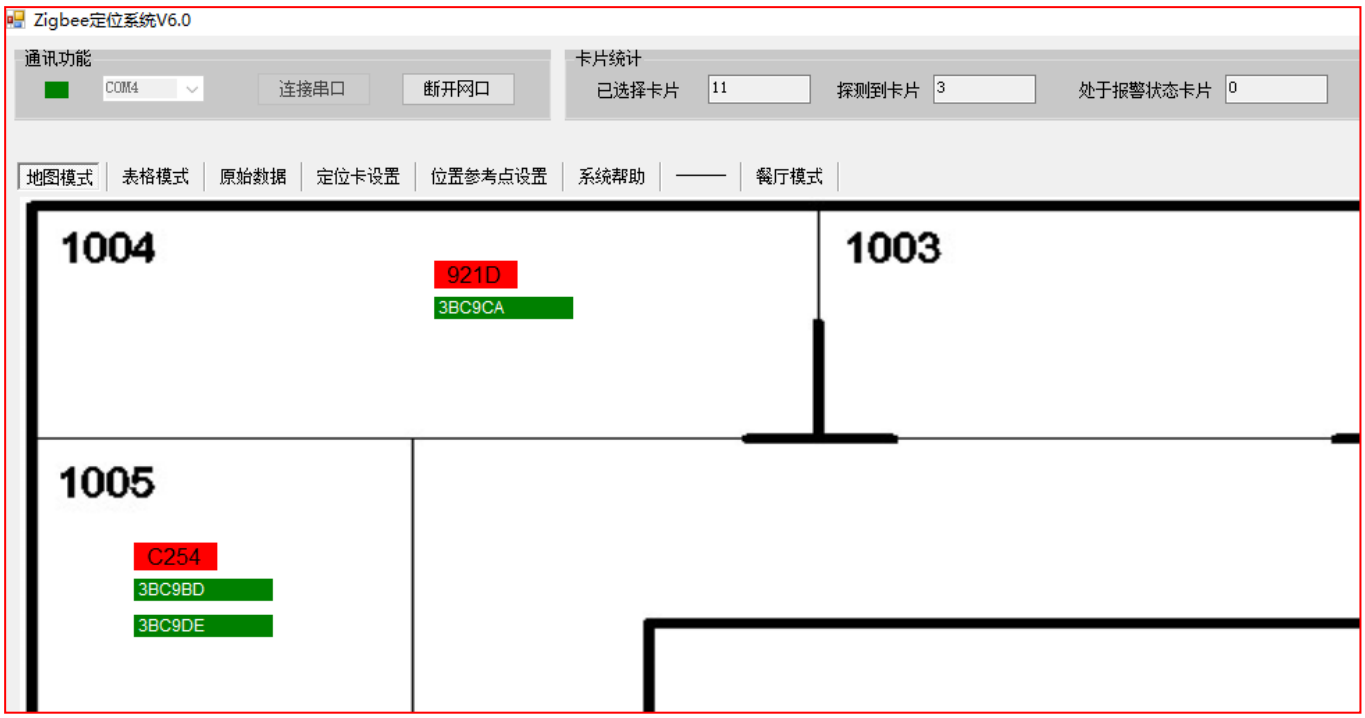


If the Zigbee module is used to build, the Zigbee parameters are set as shown below:

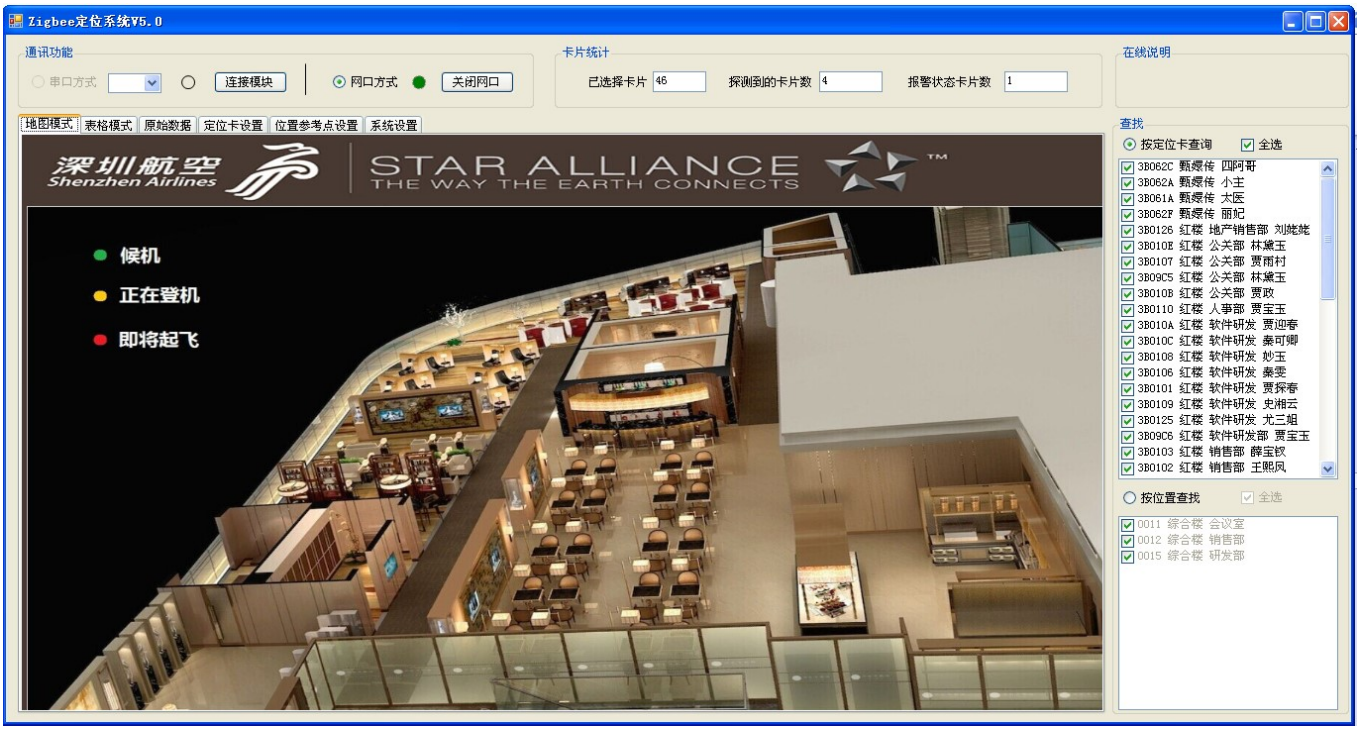
(3), run the Zigbee positioning system application software, in the map mode, click the right mouse button to add a position reference point



(4) Click "Connect Network Port", and you can see that 3BC9CA is near 921D (located in room 1004)



(5), users can import their own maps and build their own positioning systems without developing any code. The positioning system V6.0 has been successfully applied to "Shenzhen Airlines", as shown in the figure below:

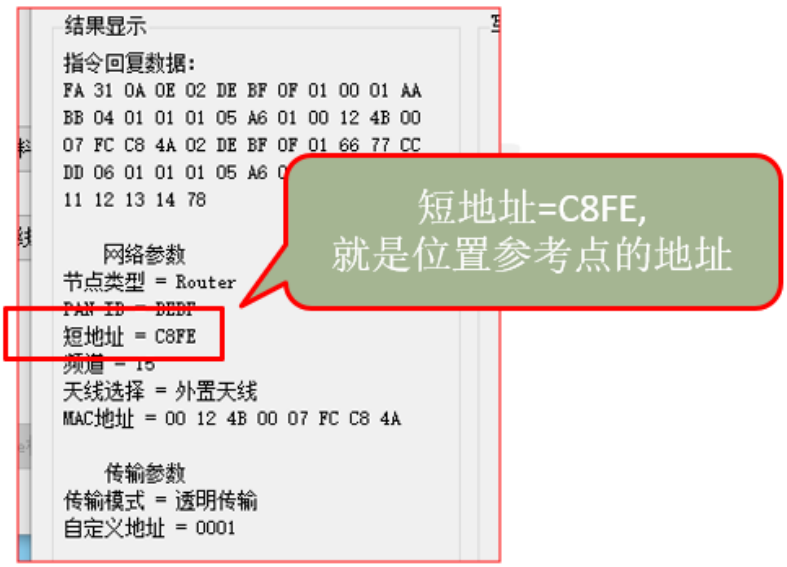

Zigbee定位系统V5.0
通讯功能
串口方式
连接模块
网口方式
关闭网口
卡片统计
已选择卡片 46
探测到的卡片数 4
报警状态卡片数 1
在线说明
地图模式
表格模式
原始数据
定位卡设置
位置参考点设置
系统设置
深圳航空 Shenzhen Airlines
STAR ALLIANCE
THE WAY THE EARTH CONNECTS
候机
正在登机
即将起飞
查找
按定位卡查询
全选
3B062C 甄嬛传 四阿哥
3B062A 甄嬛传 小王
3B061A 甄嬛传 太医
3B062F 甄嬛传 丽妃
3B0126 红楼 地产销售部 刘姥姥
3B010E 红楼 公关部 林黛玉
3B0107 红楼 公关部 贾雨村
3B09C5 红楼 公关部 林黛玉
3B010B 红楼 公关部 贾政
3B0110 红楼 人事部 贾宝玉
3B010A 红楼 软件研发 贾迎春
3B010C 红楼 软件研发 秦可卿
3B0108 红楼 软件研发 妙玉
3B0106 红楼 软件研发 秦雯
3B0101 红楼 软件研发 贾探春
3B0109 红楼 软件研发 史湘云
3B0125 红楼 软件研发 尤三姐
3B09C6 红楼 软件研发部 贾宝玉
3B0103 红楼 销售部 薛宝钗
3B0102 红楼 销售部 王熙凤
按位置查找
全选
0011 綜合楼 会议室
0012 綜合楼 销售部
0015 綜合楼 研发部

7.8, data node parameters: (DRF2670C (recommended), or DRF2659C, DRF2657C)

The data node is recommended to use DRF2670C (network interface, which can form a larger positioning system);
Zigbee parameters are set to: PAN ID=DEBF, channel =15, node type =Coordinator;

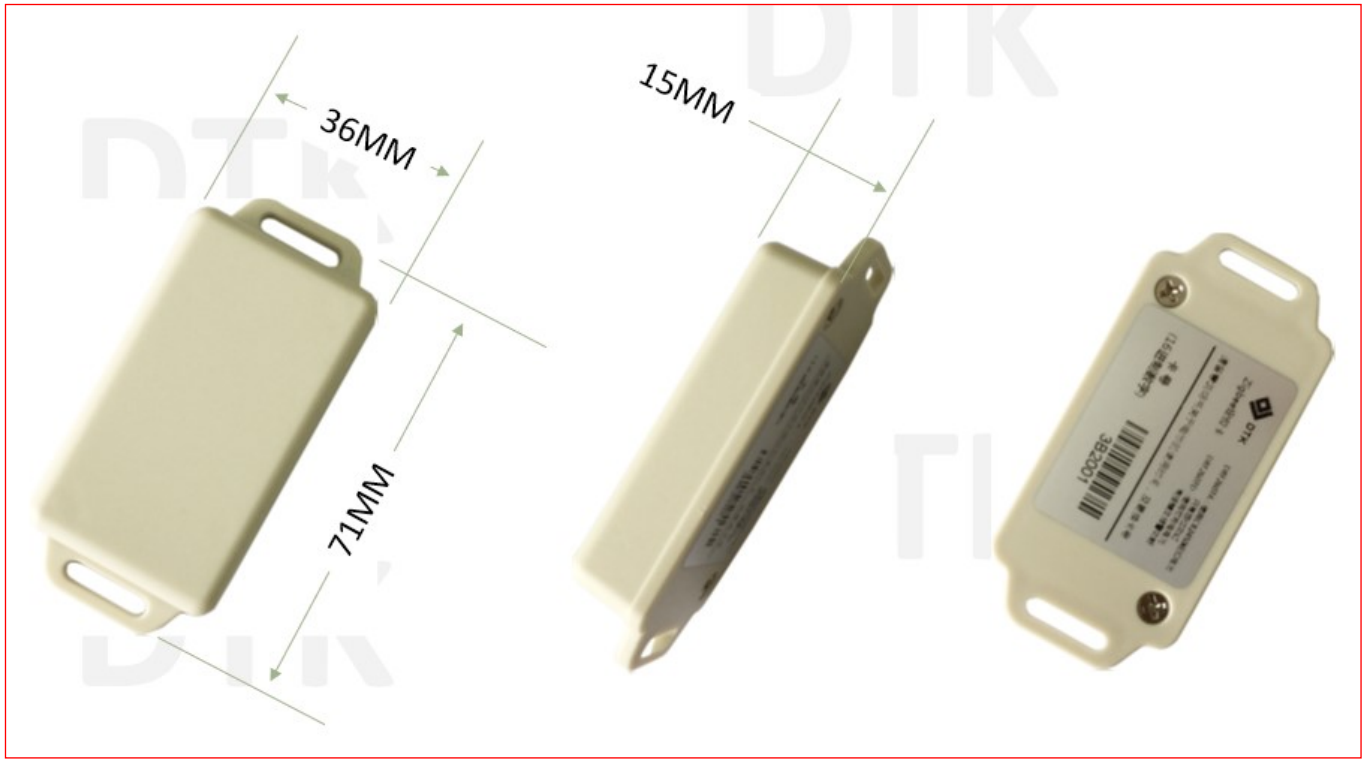
7.9, position reference point parameters: (DRF2659C or DRF2657C)

- The position reference point can be served by Zigbee module (such as DRF2659C , DRF2657C);
- Set to Router, PAN ID=DEBF, channel =15, node type =Router;
- The position reference point can carry out ordinary Zigbee data transmission at the same time;
- The address of the position reference point = the short address of the Zigbee module, read it out with the configuration software, and write it down; (Note: the data node must be turned on, the position reference point has been connected to the network, and the read short address is valid (not FFFE) .



7.10, positioning card parameters (DRF2607A)

- The positioning card is powered by a CR2450 button battery (500MAH), which can be used for three months
- generates positioning data every 5 seconds
- Positioning card wireless parameters: PAN ID=DEBF, channel =15, positioning card cannot be set
- Zigbee network has the function of Zigbee positioning system at the same time, just set the wireless parameters of Zigbee network to be consistent with the positioning card
- it transmits the positioning data to the data node (Coordinator) through the position reference point (Router)



8. Zigbee module performance and testing

8.1, Zigbee module performance (transparent transmission)

Inside the Zigbee protocol, 96 bytes of the user are a data frame, and the maximum sending data packet is 269 bytes. It will be divided into 3 data frames inside Zigbee. After reaching the target module, it will be restored to the original data and then output from the serial port;
Therefore, if the data packet sent by the user is less than 96 bytes each time, the best performance will be obtained.

Coordinator --》 Router	
最大数据包	269字节
数据包之间时间间隔	500MS
小容量数据包	32字节
数据包之间时间间隔	60MS

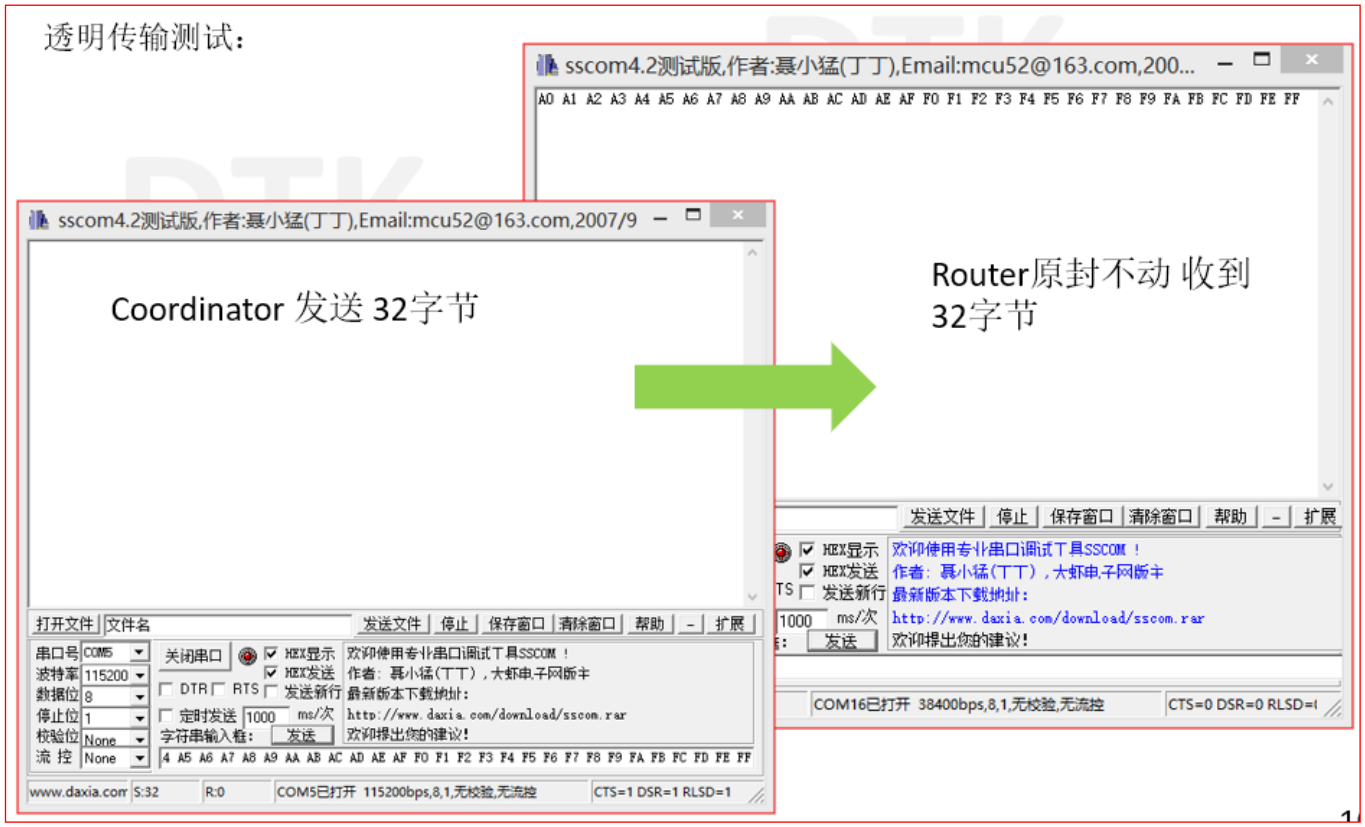
Router --》 Coordinator	
最大数据包	269字节
数据包之间时间间隔	500MS
小容量数据包	32字节
数据包之间时间间隔	50MS

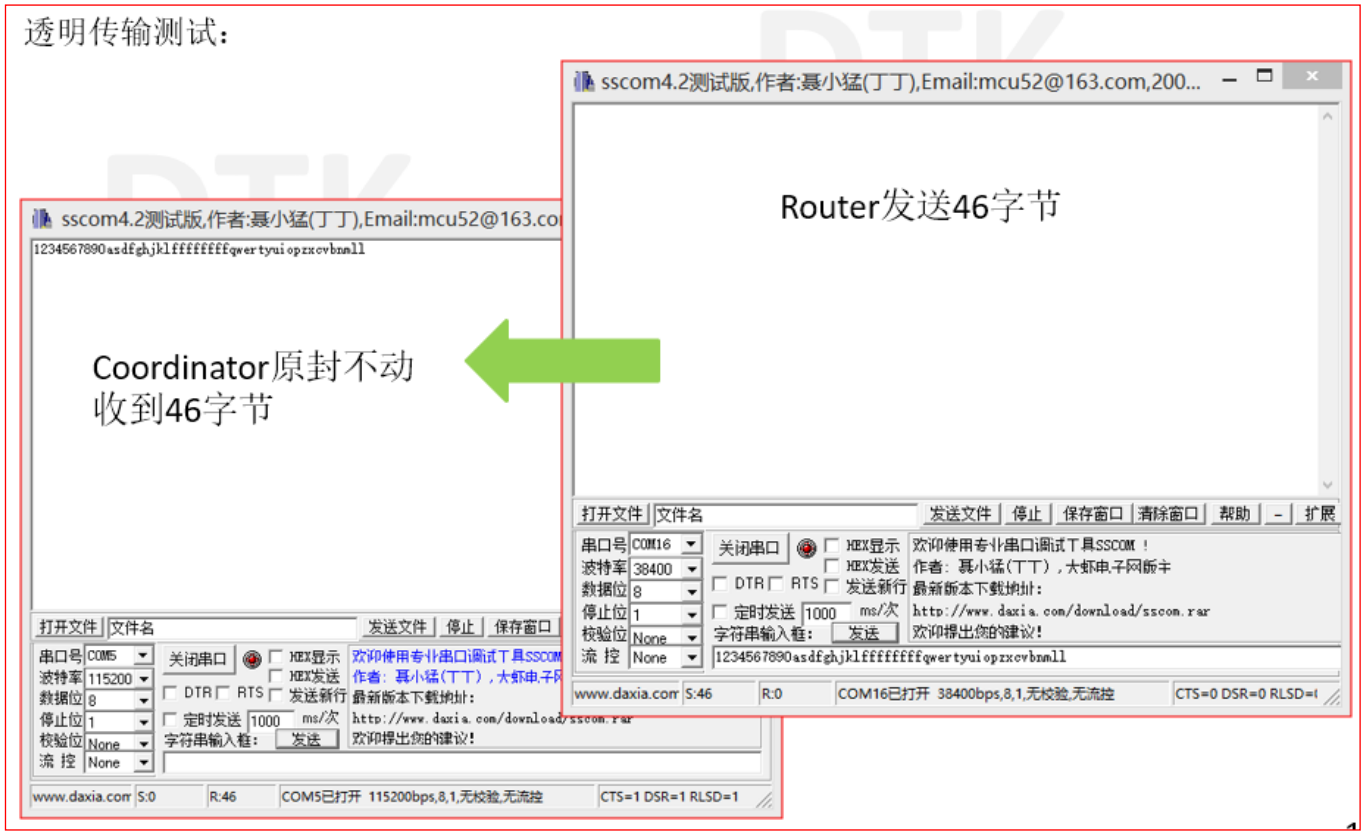
8.2, Zigbee module performance (point-to-point transmission)

- Inside the Zigbee protocol, 96 bytes of the user are a data frame, and point-to-point transmission can only process one data frame at a time;
- Therefore, the maximum data packet for point-to-point transmission is 96 bytes (including a 4- byte header, and the maximum user data is 92 bytes).

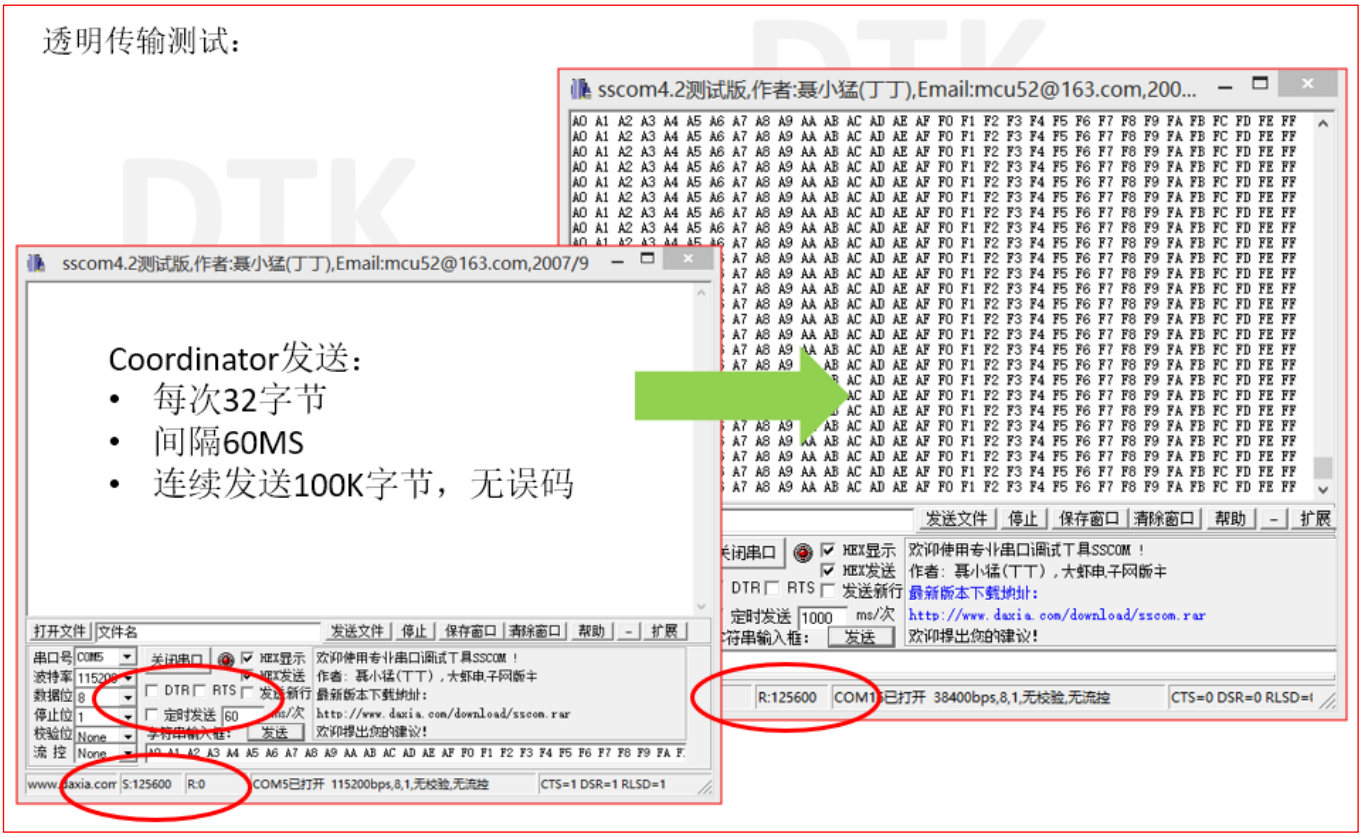
点对点传输	
最大数据包	96字节（含包头4个字节）
数据包之间时间间隔	50MS

8.3, transparent transmission test

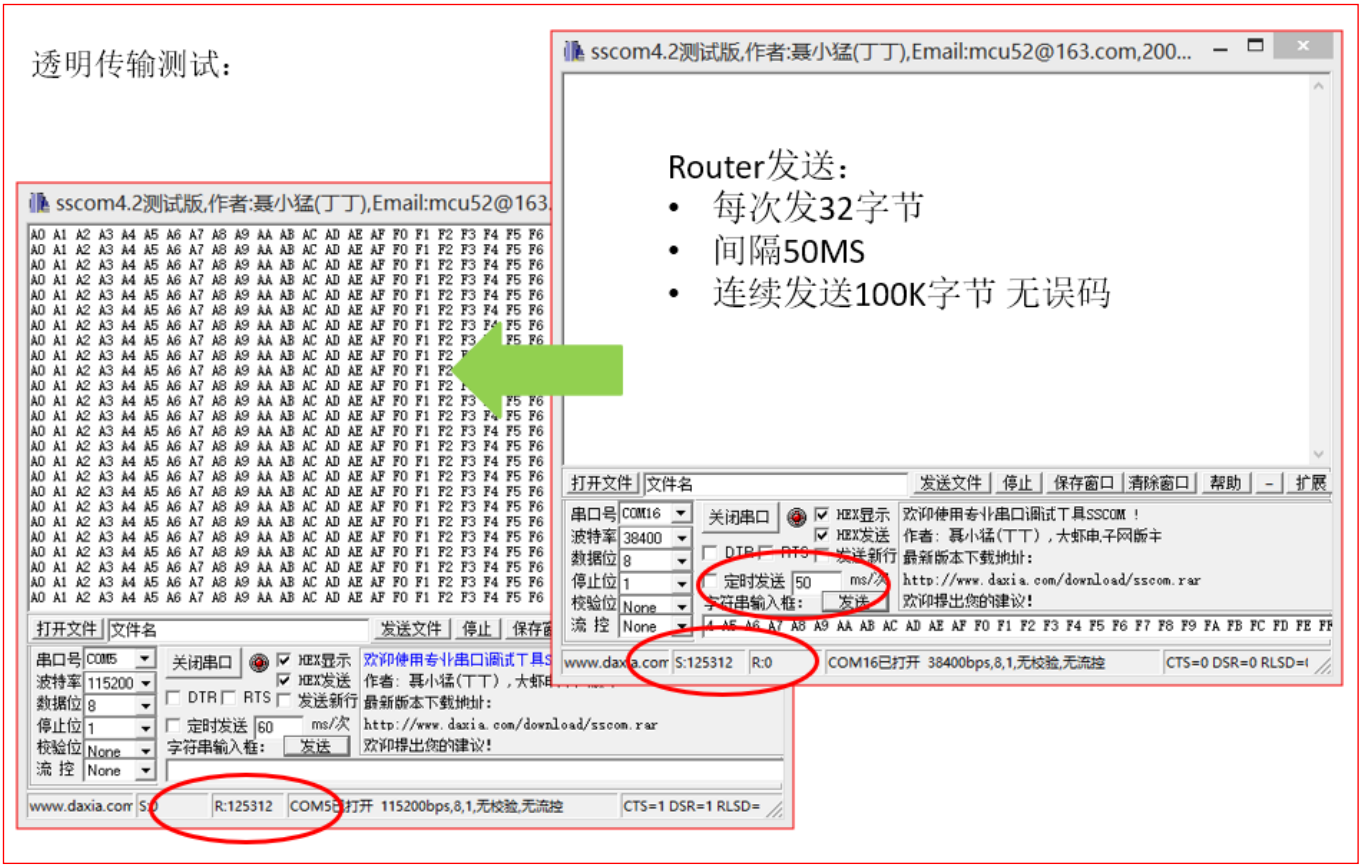




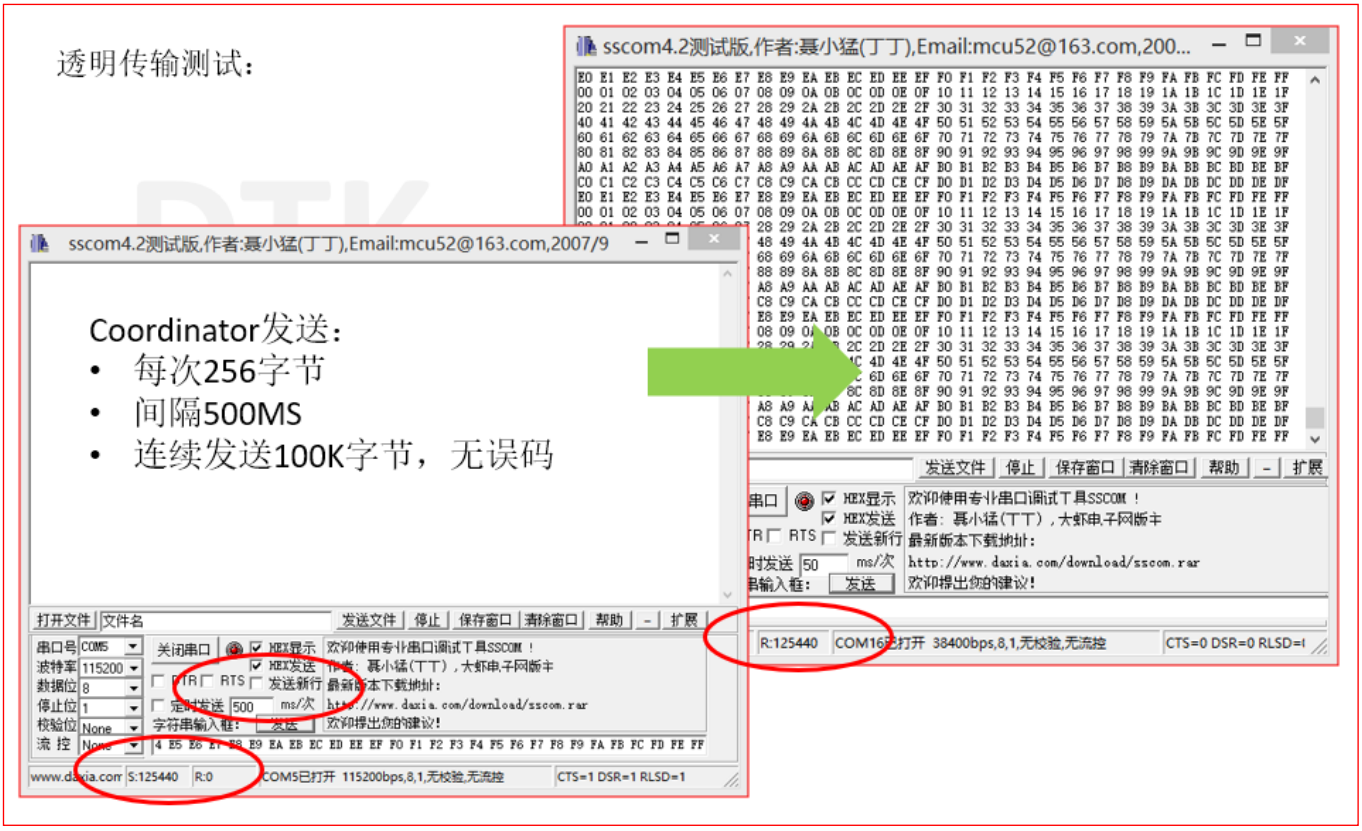
透明传输测试：



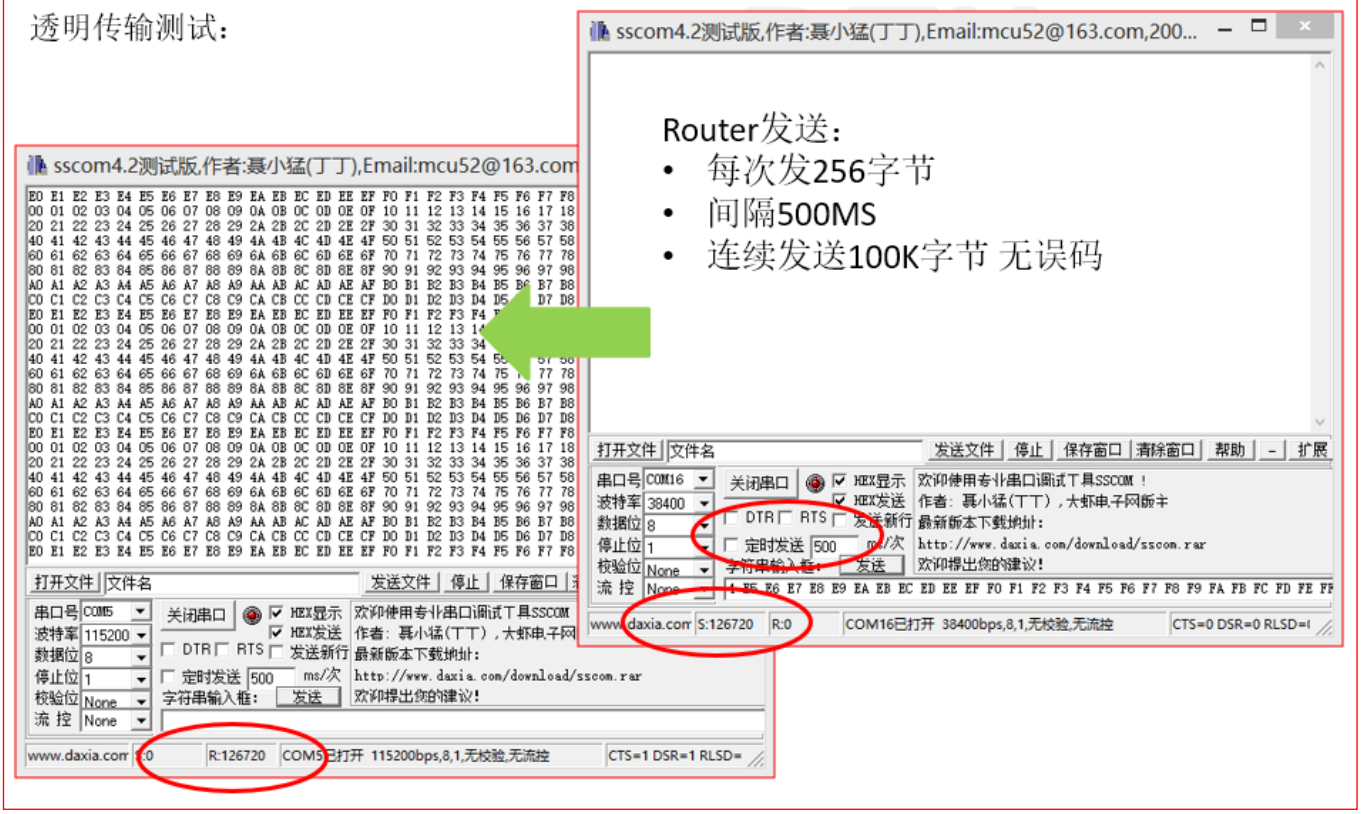
透明传输测试：



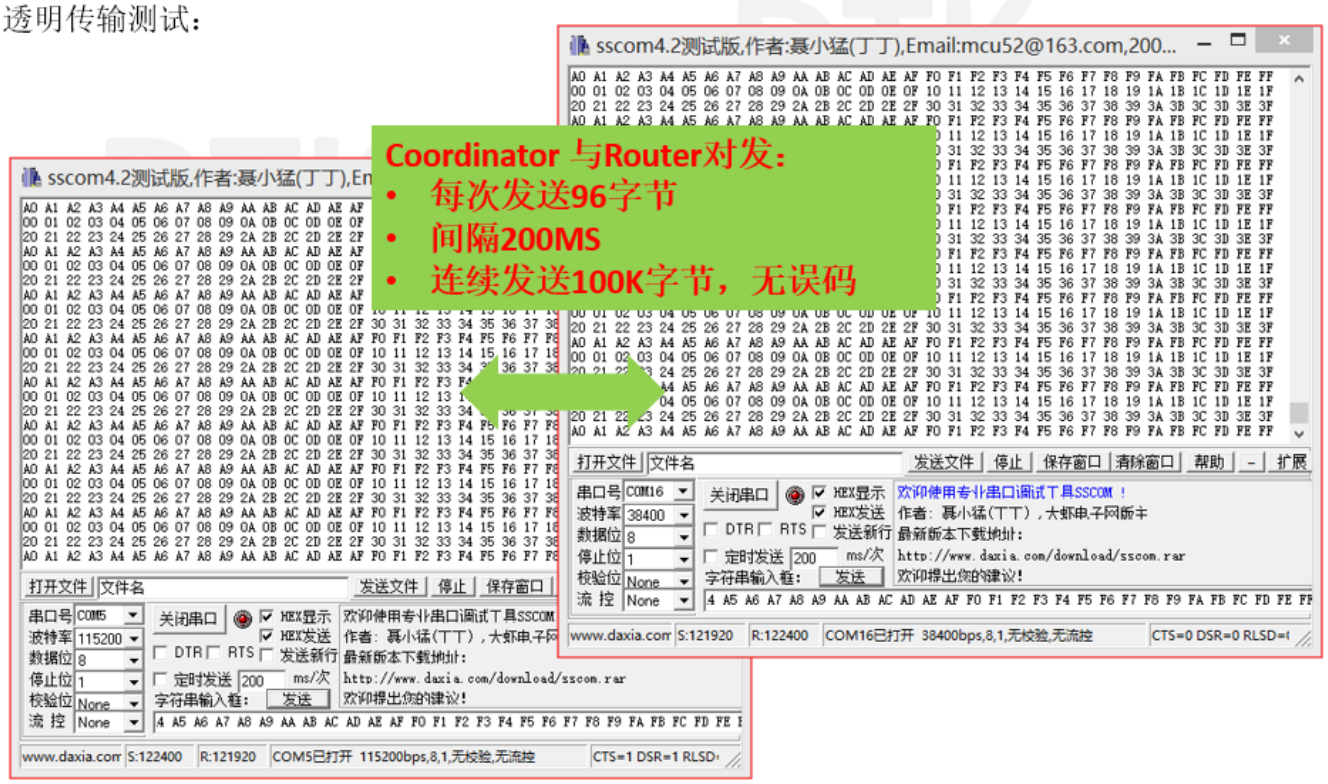
透明传输测试：



透明传输测试：

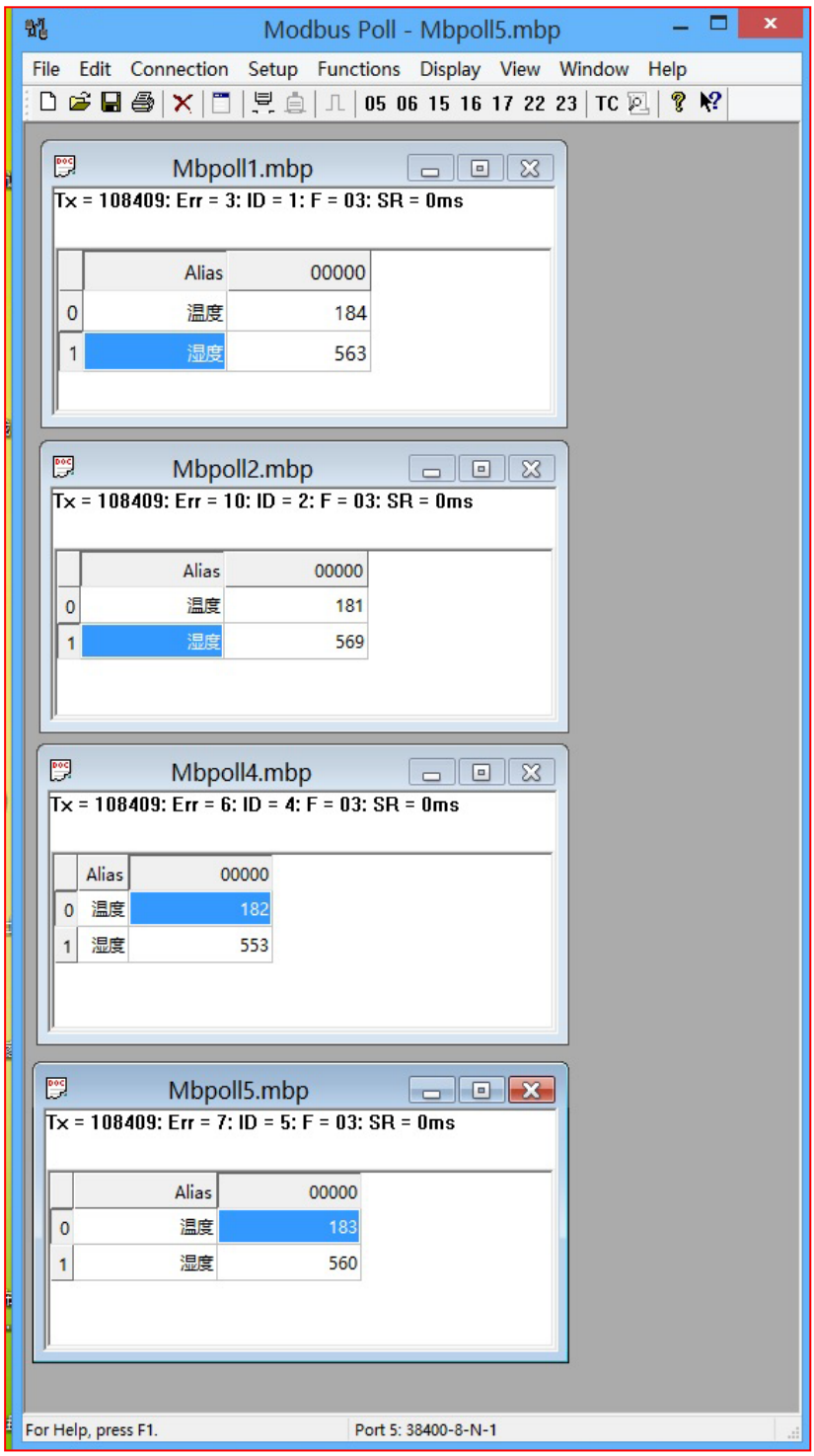


透明传输测试：


Coordinator 与Router对发：
• 每次发送96字节
• 间隔200MS
• 连续发送100K字节，无误码
sscom4.2测试版,作者:聂小猛(丁丁),Email:mcu52@163.com,200...
打开文件
文件名
发送文件
停止
保存窗口
清除窗口
帮助
扩展
串口号 COM16
关闭串口
波特率 38400
数据位 8
停止位 1
校验位 None
流 控 None
HEX显示
HEX发送
DTR RTS
发送新行
定时发送 200 ms/次
字符串输入框:
发送
欢迎使用专业串口调试工具SSCOM !
作者: 聂小猛(丁丁)，大虾申,子网版主
最新版本下载地址:
http://www.daxia.com/download/sscom.rar
欢迎提出您的建议!
www.daxia.com S:121920 R:122400 COM16已打开 38400bps,8,1,无校验,无流控 CTS=0 DSR=0 RLSD=0
sscom4.2测试版,作者:聂小猛(丁丁),En
串口号 COM5
波特率 115200
数据位 8
停止位 1
校验位 None
流 控 None
www.daxia.com S:122400 R:121920 COM5已打开 115200bps,8,1,无校验,无流控 CTS=1 DSR=1 RLSD

8.4, actual data transmission test (laboratory conditions, the best actual test)

Laboratory conditions, in the same room, test the transmission reliability in the best case
1 Coordinator, 4 Routers respectively connected to 4 temperature and humidity sensors (RS485 interface)
Coordinator connected to computer, baud rate 38400, Router connected to temperature and humidity sensor, baud rate 9600, popular Modbus Poll software test
Comprehensive bit error rate: 0.0059% , (100,000 uninterrupted tests)



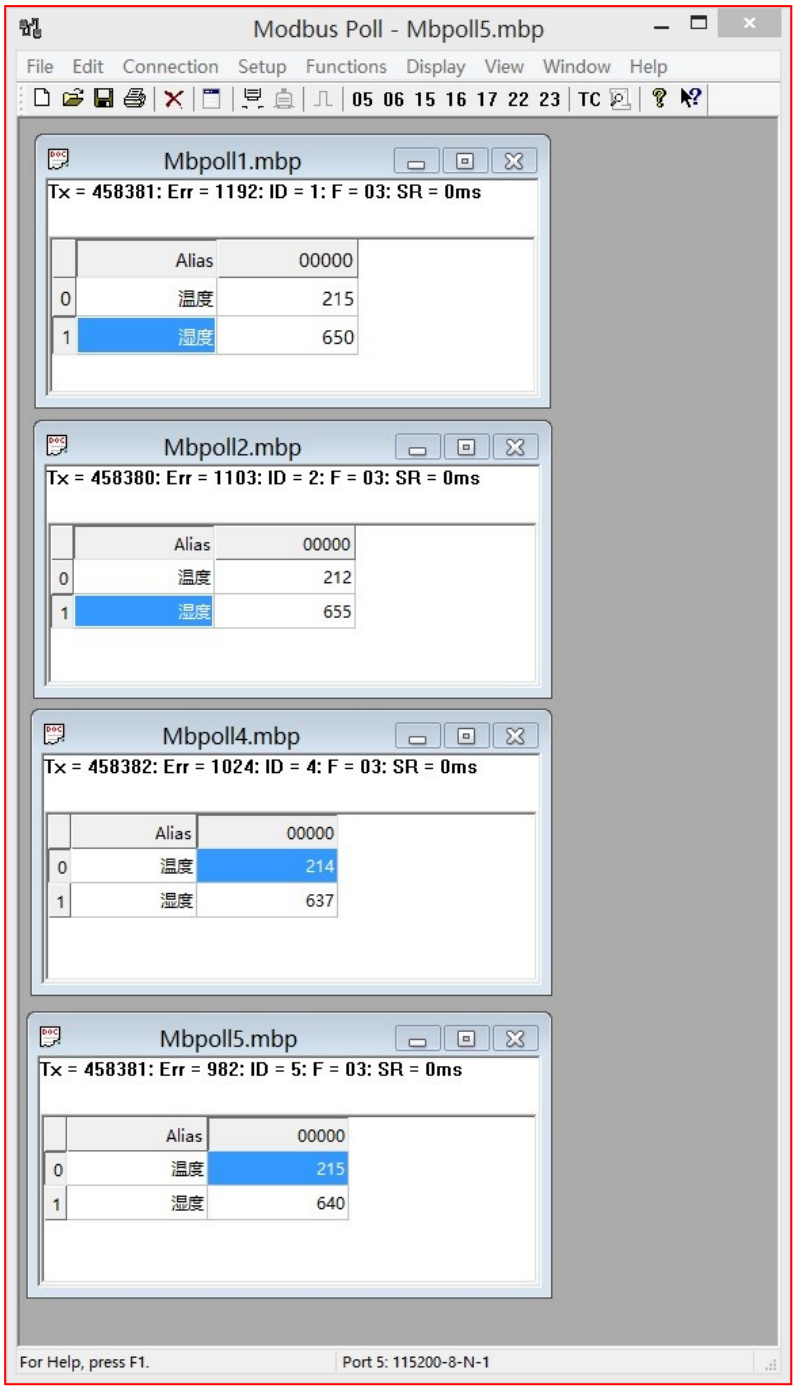
8.5, actual data transmission test (under normal conditions)

Office conditions, one room apart, WIFI (10 searched by mobile phone), and two other Zigbee networks, the test is the transmission reliability under normal circumstances.

1 Coordinator, 4 Routers are connected to 4 temperature and humidity sensors (RS485 interface), the Coordinator is connected to the computer, the baud rate is 115200

Router with temperature and humidity sensor, baud rate 9600, popular Modbus Poll software test.

Comprehensive bit error rate: 0.23% (i.e., 2.3 per thousand), (1.8 million uninterrupted tests)



9. Zigbee module instruction system

9.1, Command overview

CC2630 series Zigbee modules are currently shipped in V 8.1 /V 8 .2 /V 8.3 versions, and the commands are backward compatible.

Common instructions for each version	Connection module (INS01)
	Reboot module (INS02)
V7.0 /V7.1 commands	Read module parameters (INS03)
	Write module parameters (INS04)
Commands above V7.2 /V7.3	Read module parameters (INS05)
	Write module parameters (INS06)
	Querying the End Device Location (INS07)
	Query the signal strength of a node (Router, End Device) (INS08)
Commands above V8.1	Make End Device goes to sleep (Refer to 10.7 How to use End Device sleep function) command table is not listed
Commands above V8.4	Wireless reading of node parameters (INS09) The Coordinator is connected to the serial port, and the Router or End can be read wirelessly through the Coordinator Device parameters
	Modify node parameters wirelessly (INS10) The Coordinator is connected to the serial port, and the Router or End can be modified wirelessly through the Coordinator Device parameters
	Wireless reboot node (INS11) The Coordinator is connected to the serial port, and the Router or End can be restarted wirelessly through the Coordinator Device
Commands above V8.7	Start the node to automatically join the network command (INS12) To Router or End Device sends this command to start automatically joining

	the network, which is equivalent to pressing the Function button three times

Remark:

All write commands, after writing, the module needs to be restarted to take effect

When the module receives the connection command, it will enter the configuration state and prohibit wireless data reception for one minute.

9.2, link module instruction (INS01)

send	command header	instruction length	instruction	checksum
	FC	06	04 44 54 4B 52 46	81 (the sum of all the previous bytes is reserved for the lower 8 bits)

reply	command header	instruction length	set state	reply content	checksum
	FA	06	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	04 44 54 4B Software version (2 bytes) Software Version = Reply Bytes/10 If the setting fails (or setting is prohibited), only reply 04, and the instruction length is 02	The sum of all the previous bytes retains the lower 8 bits

Remarks: After the connection is successful, the module enters the setting state, and wireless data reception will be prohibited for 1 minute

Example:
Send: FC 06 04 44 54 4B 52 46 81
Reply: FA 06 0A 04 44 54 4B 00 46 37 (connected successfully), software version = 0x0046/10 = V7.0
FA 02 0B 04 0B (connection failed)
If the command is wrong, it will be sent as data (of course there is no reply)

9.3, restart module command (INS02)

send	command header	instruction length	command parameters	checksum
	FC	06	06 44 54 4B AA BB	50 (the sum of all the previous bytes is reserved for the lower 8 bits)

reply	command header	instruction length	set state	reply content	checksum
	FA	06	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	06 44 54 4B AA BB	58 (the sum of all the previous bytes is reserved for the lower 8 bits)

Example:
Send: FC 06 06 44 54 4B AA BB 50
Received: FA 06 0A 06 44 54 4B AA BB 58 (the module received the reset command successfully)
FA 06 0B 06 44 54 4B AA BB 5 9 (the module failed to receive the reset command)
After the module successfully receives the reset command, it will restart the module immediately.

9.4, read module parameter command (INS03, suitable for V7.0/V7.1 version firmware)

send	command header	instruction length	instruction	checksum
	FC	06	05 44 54 4B 52 46	82 (the sum of all the previous bytes is reserved for the lower 8 bits)

reply	command header	instruction length	set state	reply content	checksum
	FA	2B	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	05 + Read all parameters of the module (42 bytes)	The sum of all the previous bytes retains the lower 8 bits

Example:
Send: FC 06 05 44 54 4B 52 46 82
Re: FA 2B 0A 05 01 5A 76 14 01 00 01 AA BB 06 01 01 01 05 A6 01 00 12 4B 00 07 FC C9 E2 02 5A 76 14 01 0A 0B CC DD 04 01 01 01 05 A6 00 00 00 97
If the command is wrong, it will be sent as data (of course there is no reply)

Remark:
After the Coordinator reads successfully. It will enter the configuration state, prohibiting wireless data reception for 1 minute;

Router、End After the Device is read successfully. It will not enter the configuration state, and the data is sent and received normally.

Read all parameters of the module (42 bytes):

X0	X1 X2	X3	X4	X5 X6	X7 X8
Point Type 01：Coordinator 02：Router	PAN ID range：0001 – FF00	Channel range：0B – 1A	Trans model Default :01	Self Address range：0001 – FF00	reserve Default: AA BB

X9	X10	X11	X12	X13 X14	X15
Baud Rate 0x01：1200 0x02：2400 0x03：4800 0x04：9600 0x05：19200 0x06：38400 0x07：57600 0x08：1115200	Data Bits 01：8 Bits Not Modifiable	Stop Bit 01：Default 1 Not Modifiable	Parity 0x01：NONE 0x02：EVN 0x03：ODD	reserve : Default: 05 A6	Antenna Select 00：On board Ant 01：external Ant

X16 X17 X18 X19 X20 X21 X22 X23	备注	X24	X25 X26
MAC Add 8 Bytes（Only Read）	If the module is a coordinator, then starting from X24, it is a preset parameter for the Router If the module is a Router, the parameters read out from X24 are meaningless	Point Type 01：Coordinator 02：Router	PAN ID range：0001 – FF00

X27	X28	X29 X30	X31 X32	X33	X34
Channel range：0B – 1A	Trans Model Default :01 Not Modifiable	Self Address range：0001 – FF00	reserve default: CC DD	Baud rate 0x01：1200 0x02：2400 0x03：4800 0x04：9600 0x05：19200 0x06：38400 0x07：57600 0x08：1115200	Data Bit 01：8 bits Not Modifiable

X35	X36	X37 X38	X39	X40 X41
Stop Bit 01：1 bit Not Modifiable	Parity 0x01：NONE 0x02：EVEN 0x03：ODD	reserve Default: 05 A6	Antenna select 00：On board ant 01：external ant	Short address If the router's point address is FF FE, Indicates that the Router has not joined the network

9.5, Write module parameter command (INS04, suitable for V7.0/V7.1 version firmware)

	command header	instruction length	command parameter	checksum
send	FC	21	07 + Write all parameters of the module (32 bytes)	The sum of all the previous bytes retains the lower 8 bits

	command header	instruction length	set state	reply content	checksum
reply	FA	01	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	07	The sum of all the previous bytes retains the lower 8 bits

Example:
Send: FC 21 07 02 01 01 14 01 00 01 AA BB 06 01 01 01 05 A6 00 02 01 01 14 01 66 77 CC DD 06 01 01 01 05 A6 00 AA
Re: FA 01 0A 07 0C
If the command is wrong, it will be sent as data (of course there is no reply)

Write all parameters of the module (32 bytes)

X0	X1 X2	X3	X4	X5 X6	X7 X8
Point Type 01: Coordinator 02: Router	PAN ID range: 0001 – FF00	Channel range: 0B – 1A	Trans Model 01 Not Modifiable	Self Address range: 0001 – FF00	reserve Default: AA BB

X9	X10	X11	X12	X13 X14	X15
Baud Rate 0x01: 1200 0x02: 2400 0x03: 4800 0x04: 9600 0x05: 19200 0x06: 38400 0x07: 57600 0x08: 1115200	Data Bit 01: 8 Bits Not Modifiable	Stop Bit 01: 1 bit Not Modifiable	Parity 0x01: NONE 0x02: EVEN 0x03: ODD	reserve Default: 05 A6	Antenna select 00: On board ant 01: external ant

	备注	X16	X17 X18
	If the module is a Coordinator, then starting from X16, it is a preset parameter for the Router If the module is a Router, starting from X16, the parameters are meaningless but need to be written	Point Type 01: Coordinator 02: Router	PAN ID range: 0001 – FF00

X19	X20	X21 X22	X23 X24	X25	X26
Channel range: 0B – 1A	Trans Model 01 Not Modifiable	Self Address range: 0001 – FF00	reserve Default: CC DD	Baud Rate 0x01: 1200 0x02: 2400 0x03: 4800 0x04: 9600 0x05: 19200 0x06: 38400 0x07: 57600 0x08: 1115200	Data bit 01: 8 Bits Not Modifiable

X27	X28	X29 X30	X31
Stop Bit 01: 1 Bit Not Modifiable	Parity 0x01: NONE 0x02: EVEN 0x03: ODD	reserve Default: 05 A6	Antenna select 00: On board ant 01: External ant

9.6, read module parameter command (INS05, suitable for V7.2/V7.3 and above firmware)

send	command header	instruction length	instruction	checksum
	FC	06	0E 44 54 4B 52 46	8B (the sum of all the previous bytes and keep the lower 8 bits)

reply	command header	instruction length	set state	reply content	checksum
	FA	31	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	0E + Read all parameters of the module (48 bytes)	The sum of all the previous bytes retains the lower 8 bits

Example:
Send: FC 06 0E 44 54 4B 52 46 8B
Reply: FA 31 0A 0E 01 5A 76 14 01 00 01 AA BB 06 01 01 01 05 A6 01 00 12 4B 00 07 FC C9 E2 02 5A 76 14 01 0A 0B CC DD 04 01 01 01 05 A6 00 00 00 01 01 11 12 13 14 E3
If the command is wrong, it will be sent as data (of course there is no reply)

Remark:
After the Coordinator reads successfully. It will enter the configuration state, prohibiting wireless data reception for 1 minute;

Router、End After the Device is read successfully. It will not enter the configuration state, and the data is sent and received normally.

Read all parameters of the module (48 bytes):

X0	X1 X2	X3	X4	X5 X6	X7 X8
Point Type 01 : Coordinator 02 : Router 03 : End Device	PAN ID Range: 0001 – FF00	Channel Range: 0B – 1A	Transfer mode: 01 : transparent transmission 02 : Transparent transmission + custom address 03 : Transparent transmission + short address 04 : Transparent transmission + MAC address 05 : NN transmission	Custom address Range: 0001 – FF00	reserve Default:AA BB

X 9	X1 0	X 11	X12	X13 X14	X15
Baud Rate 0x01 : 1200 0x02 : 2400 0x03 : 4800 0x04 : 9600 0x05 : 19200 0x06 : 38400 0x07 : 57600 0x08 : 115200	Data Bit 01 : 8 bits Unchangeable	Stop Bit 01 : 1 bit Unchangeable	Parity 0x01 : NONE 0x02 : even 0x03 : Odd	reserve Default:05 A6	Antenna selection 00 : Onboard ant 01 : External ant

X 16 X17 X18 X19 X20 X21 X22 X23	Remark	X24	X25 X26
MAC address 8 bytes (read only)	If the module is a coordinator, then X24-X39 is a preset parameter for the Router If the module is a Router, then X24-X39, the parameters read out are meaningless	Point Type 02 : Router 03 : End Device	PAN ID Range: 0001 – FF00

X27	X28	X29 X30	X31 X32	X33	X34
Channel Range: 0B – 1A	Transfer mode: 01 : transparent transmission 02 : Transparent transmission + custom address 03 : Transparent transmission + short address 04 : Transparent transmission + MAC address 05 : NN transmission	Custom address Range: 0001 – FF00	reserve Default: CC DD	Baud Rate 0x01 : 1200 0x02 : 2400 0x03 : 4800 0x04 : 9600 0x05 : 19200 0x06 : 38400 0x07 : 57600 0x08 : 115200	Data Bit 01 : 8 data bits Unchangeable

X35	X36	X37 X38	X39	X40 X41
Stop Bit 01 : 1 bit Unchangeable	Parity 0x01 : NONE 0x02 : even 0x03 : Odd	reserve Default: 05 A6	Antenna selection 00 : Onboard antenna 01 : External Antenna	short address If the short address of Router or End Device is FF FE , it means that the node has not joined the network

X42	X43	X44 X45 X46 X47
internal use, meaningless	Whether to enable encryption: A1 : Encryption enabled Other: Encryption not enabled	Password: 4 byte password (32 bits), the default is 11 12 13 14

9.7, Write module parameter command (INS06, suitable for V7.2/V7.3 and above firmware)

send	command header	instruction length	command parameters	checksum
	FC	27	07 + Write all parameters of the module (38 bytes)	The sum of all the previous bytes retains the lower 8 bits

reply	command header	instruction length	set state	reply content	checksum
	FA	01	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	07	The sum of all the previous bytes retains the lower 8 bits

Example:
Send: FC 27 07 02 01 01 14 01 00 01 AA BB 06 01 01 01 05 A6 00 02 01 01 14 01 66 77 CC DD 06 01 01 01 05 A6 00 01 01 11 12 13 14 FC
Re: FA 01 0A 07 0C
If the command is wrong, it will be sent as data (of course there is no reply)

Write all parameters of the module (38 bytes)

X0	X1 X2	X3	X4	X5 X6	X7 X8
Point Type 01 : Coordinator 02 : Router 03 : End Device	PAN ID Range: 0001 – FF00	Channel Range: 0B – 1A	Transfer mode: 01 : transparent transmission 02 : Transparent transmission + custom address 03 : Transparent transmission + short address 04 : Transparent transmission + MAC address 05 : NN transmission	Customer address Range: 0001 – FF00	reserve Default: AA BB

X9	X10	X11	X12	X13 X14	X15
Baud Rate 0x01 : 1200 0x02 : 2400 0x03 : 4800 0x04 : 9600 0x05 : 19200 0x06 : 38400 0x07 : 57600 0x08 : 115200	Bata Bit 01 : 8 bits Unchangeable	Stop Bit 01 : 1 stop bit Unchangeable	Parity 0x01 : NONE 0x02 : even 0x03 : Odd	reserve Default: 05 A6	Antenna selection 00 : Onboard Antenna 01 : External Antenna

	Remark	X16	X17 X18
	If the module is a Coordinator , X16-X31 are preset parameters for Routers If the module is a Router , X16-X31 , the parameters are meaningless but need to be written	Point Type 02 : Router 03 : End Device	PAN ID Range: 0001 – FF00

X19	X20	X21 X22	X23 X24	X25	X26
Channel Range: 0B – 1A	Transfer mode: 01 : transparent transmission 02 : Transparent transmission + custom address 03 : Transparent transmission + short address 04 : Transparent transmission + MAC address 05 : NN transmission	Customer address Range: 0001 – FF00	Reserve Default: CC DD	baud rate 0x01 : 1200 0x02 : 2400 0x03 : 4800 0x04 : 9600 0x05 : 19200 0x06 : 38400 0x07 : 57600 0x08 : 115200	Data Bit 01 : 8 bits Unchangeable

X27	X28	X29 X30	X31
Stop Bit 01 : 1 stop bit Unchangeable	Parity 0x01 : NONE 0x02 : Even 0x03 : Odd	reserve Default: 05 A6	Antenna selection 00 : Onboard Antenna 01 : External Antenna

X32	X33	X34 X35 X36 X37
internal use, Write 01 by default	Whether to enable encryption A1 : Encryption enabled Other : no encryption used	Password, whether encryption is used or not, these 4 bytes must be written (Any 4 bytes can be used as a password)

9.8, query the End Device position command (INS07, suitable for V7.2/V7.3 and above firmware)

This command is compatible with CC2530 series positioning system (V6.0). The position of the End Device can be displayed through the positioning system application software.

send	command header	instruction length	command parameter	checksum
	FC	06	0B 44 54 4B 52 46	88 (the sum of all the previous bytes is reserved for the lower 8 bits)

reply	command header	Card number (3B + short address)	relative distance 1	Router1 short address	checksum
	FA	3B C9 22	49	CB F8	2C first 7 bytes

	command header	relative distance 2	Router2 short address	relative distance 3	Router3 short address	checksum
	Facebook	3E	CA 49	27	B9 34	B8 first 15 bytes

Example:
Send: FC 06 0B 44 54 4B 52 46 88
Re: FA 3B C9 22 49 CB F8 2C FB 3E CA 49 27 B9 34 B8
If the command is wrong, it will be sent as data (of course there is no reply)

Detailed explanation (the following are hexadecimal numbers):
FA 3B C9 22 49 CB F8 2C FB 3E CA 49 27 B9 34 B8
Card number: 3B C9 22 (C9 22 is the short address of End Device),
to Router node CB F8, the relative distance is 49
The second closest to Router node CA 49, the relative distance is 3E
The third closest to Router node B9 34, the relative distance is 27

If the Router node is placed at a fixed known location, the approximate location of the End Device can be estimated from this.
The relative distance is not the actual distance, there is no unit, and there is no functional correspondence with the actual distance. However, it is meaningful to compare the value of the relative distance. It is a simple

and effective positioning method to determine which Router the End Device is near based on the relative distance.

9.9, query the signal strength of the node (INS08, suitable for V7.2/V7.3 and above firmware)

send	command header	instruction length	command parameters	checksum
	FC	06	0C 44 54 4B 52 46	89 (the sum of all the previous bytes is reserved for the lower 8 bits)

reply	command header	instruction length	set state	reply content	checksum
	FA	04	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	How many times have you entered the route (1Byte) The short address of the last route (2 Bytes) The signal strength of the last route (1 Byte) (This is relative signal strength, range: 0-100)	The sum of all the previous bytes retains the lower 8 bits

Example:
Send: FC 06 0C 44 54 4B 52 46 89
Re: FA 04 0A **02 C9 22 31** 26
Send a query and receive a reply, indicating:
1, this node can communicate with the Coordinator,
2, what is the signal strength of the last routing communication.

If the command is wrong, it will be sent as data (of course there is no reply)

9.10, read node parameters wirelessly (INS09, suitable for V8.4 and above firmware)

(The Coordinator is connected to the serial port, and the Router or End is read wirelessly through the Coordinator Device parameter)

	command header	instruction length	command parameters	checksum
send	FC	06	10 44 54 4B X1 X2 X1 X2: short address of the target module	XY (the sum of all the previous bytes retains the lower 8 bits)

	command header	instruction length	set state	reply content	checksum
reply	FA	1E	0A: read successfully	10 + Read module parameters (29 bytes)	X Y The sum of all the previous bytes retains the lower 8 bits

- Example: (Wireless reading target short address is the parameter of C764 module)

Send: FC 06 10 44 54 4B C7 64 20

Reply data: FA 1E 0A 10 02 45 5F 14 01 12 34 CC DD 04 01 01 01 05 A6 02 00 12 4B 00 07 FC C6 B0 00 11 12 13 14 B0

- If the command is wrong, there is no reply;
- If there is no reply, it means that the target module does not exist or is read incorrectly;

无线读出模块全部参数（16进制数字）：

X0	X1 X2	X3	X4	X5 X6	X7 X8
节点类型 01：Coordinator 02：Router 03：End Device	PAN ID 范围：0001 – FF00	频道 范围：0B – 1A	传输模式： 01：透明传输 02：透明传输+自定义地址 03：透明传输+短地址 04：透明传输+MAC地址 05：N-N传输	自定义地址 范围：0001 – FF00	保留 默认写入AA BB

X9	X10	X11	X12	X13 X14	X15
波特率 0x01：1200 0x02：2400 0x03：4800 0x04：9600 0x05：19200 0x06：38400 0x07：57600 0x08：115200	数据位 01：默认8位数据位 不可修改	停止位 01：默认1位停止位 不可修改	校验位 0x01：无校验 0x02：偶校验 0x03：奇校验	保留 默认写入05 A6	天线选择 00：板载天线 01：外置天线

X16 X17 X18 X19 X20 X21 X22 X23	X24	X25 X26 X27 X28
MAC地址 8个字节（只读）	是否启用加密 A1：启用加密 其它：不使用加密	密码， 无论是否使用加密，该4个字节都存在

9.11, modify node parameters wirelessly (INS10, suitable for V8.4 and above firmware)

(The Coordinator is connected to the serial port, and the Router or End can be modified wirelessly through the Coordinator Device parameter)

	command header	instruction length	command parameters	checksum
send	FC	16	11 + 44 54 4B + X1 X2 + parameter (16 bytes)	X Y The sum of all the previous bytes retains the lower 8 bits

	command header	instruction length	set state	reply content	checksum
reply	FA	01	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	11	X Y The sum of all the previous bytes retains the lower 8 bits

◆ Example: (wirelessly modify the target short address to the parameters of the C764 module)

Send: FC 16 11 44 54 4B C7 64 02 45 9D 14 01 A1 A2 C3 C4 06 01 01 01 05 A6 01 A9

Re: FA 01 0A 11 16

If the command is wrong, it will be sent as data (of course there is no reply)
If no reply is received, it means that the target module does not exist or the parameter modification is wrong

Notice:
PAN ID and channel cannot be modified
The node type can only be changed to Router or End Device, cannot be modified to Coordinator
That is: After the parameters of the node are modified, they still stay in the network. If you want a module to join other networks, you can modify this module through the serial port alone, or let this module join a new network by pressing the button to join the network

无线修改模块全部参数（16进制数字）：

X0	X1 X2	X3	X4	X5 X6	X7 X8
节点类型 02：Router 03：End Device	PAN ID 范围：0001 – FF00	频道 范围：0B – 1A	传输模式： 01：透明传输 02：透明传输+自定义地址 03：透明传输+短地址 04：透明传输+MAC地址 05：N-N传输	自定义地址 范围：0001 – FF00	保留 默认写入AA BB

X9	X10	X11	X12	X13 X14	X15
波特率 0x01：1200 0x02：2400 0x03：4800 0x04：9600 0x05：19200 0x06：38400 0x07：57600 0x08：115200	数据位 01：默认8位数据位 不可修改	停止位 01：默认1位停止位 不可修改	校验位 0x01：无校验 0x02：偶校验 0x03：奇校验	保留 默认写入05 A6	天线选择 00：板载天线 01：外置天线

9.12, wireless restart node (INS11, suitable for V8.4 and above firmware)

(The Coordinator is connected to the serial port, and the Router or End can be restarted wirelessly through the Coordinator Device)

	command header	instruction length	command parameter	checksum
send	FC	0 7	15 44 54 4B X1 X2 A9 X1 X2: short address of the target module	XY (the sum of all the previous bytes retains the lower 8 bits)

	command header	instruction length	set state	reply content	checksum
reply	FA	01	0A: read successfully	15	X Y The sum of all the previous bytes retains the lower 8 bits

◆ Example: (Wireless restart target short address is C764 module)

Send: FC 07 15 44 54 4B C7 64 A9 CF

Re: FA 01 0A 15 1A

If the command is wrong, it will be sent as data (of course there is no reply)
If no reply is received, it means that the target module does not exist or the parameter modification is wrong

9.13, start the node to automatically join the network (INS12, suitable for V8.7 and above firmware)

(For Router or End Device sends this command to start automatically joining the network, which is equivalent to pressing the Function button three times)

send	command header	instruction length	command parameters	checksum
	FC	0 5	19 44 54 4B A C	XY (the sum of all the previous bytes retains the lower 8 bits)

reply	command header	instruction length	set state	reply content	checksum
	FA	01	0A: read successfully	1 9	X Y The sum of all the previous bytes retains the lower 8 bits

◆ Example:

Send: FC 05 19 44 54 4B AC A9

Re: FA 01 0A 19 1E

If the command is wrong, it will be sent as data (of course there is no reply)
If no reply is received, it means that the target module does not exist or the parameter modification is wrong

Recommendations:
After sending the command, you can wait for 10 seconds, and then send the "inquiry node signal strength (INS08) command", if the query is successful, it means that the module has joined the network.

10. Frequently asked questions about Zigbee modules

10.1, How to Debug a Zigbee Network

During the deployment of a Zigbee network, users often do not know whether a certain node has a good signal. Here are some common debugging methods:

- the function button on the Coordinator 3 times in a row. At this time, the Coordinator will continuously send test data. Observe the Data light on the Router or End Device. If it flashes continuously and quickly, it means that the node is receiving data well. If the light is not on, it means the node does not receive the data, you can add a Router node in front of the node as an automatic relay to try;

- Connect the Coordinator to the computer, and check which nodes are not connected through the "read network structure" of the configuration software, and try adding a Router node in front of the node as an automatic relay;

- For a single Router or End Device, it can be judged by querying the signal strength command (if the command returns, it means that the node can communicate with the Coordinator, and the signal strength of the last route can be given), this function is suitable for MCU+ after the node Display, signal strength can be given on the display

10.2, how to use End Device function

the End Device node:

1. End Device can send and receive data like Router, but it does not have the function of routing data:

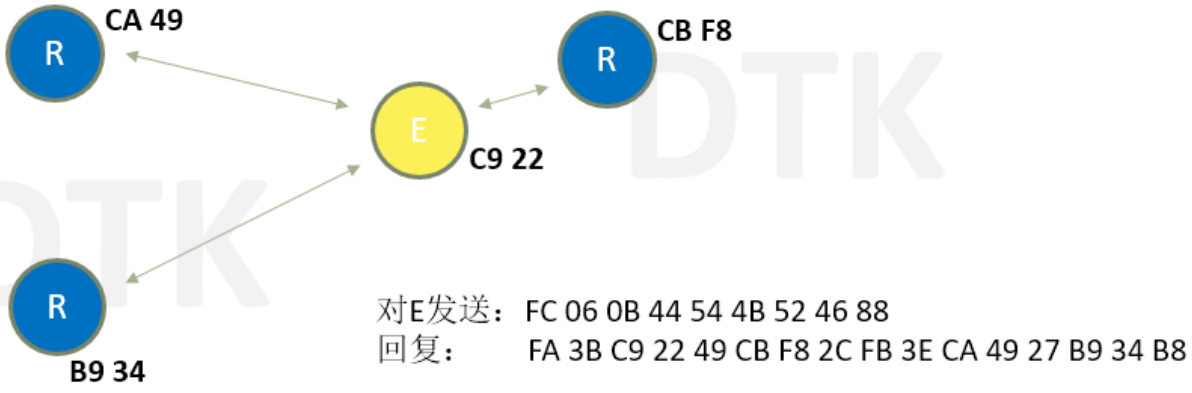
If a relatively small space (approximately all nodes can communicate directly with the Coordinator) and a large number of Zigbee nodes (such as more than 30) are placed, some nodes can be set as End Device. Since End Device has no routing function, it can be to a certain extent, the routing complexity and routing overhead of the entire network are reduced. (Generally, it is almost enough to set 10 Routers)

2. Query the signal strength between the three Routers closest to the End Device through the command, so as to roughly determine the End Device

Device position: (i.e.: End Device is used as a positioning card) This function is compatible with the CC2530 positioning system V6.0 function, and the End Device node is used as a mobile node. If all Router positions are fixed, through instructions, you can Find out which Router the End Device is closest to, so as to roughly determine the location of the End Device. This function is not precise positioning, but for some relatively simple applications (such as mine roadways, hospitals, nursing homes, etc.), we need to know which room it is in. It does not need to know which corner of the room it is, and it is still a simple, feasible, and low-cost positioning solution.

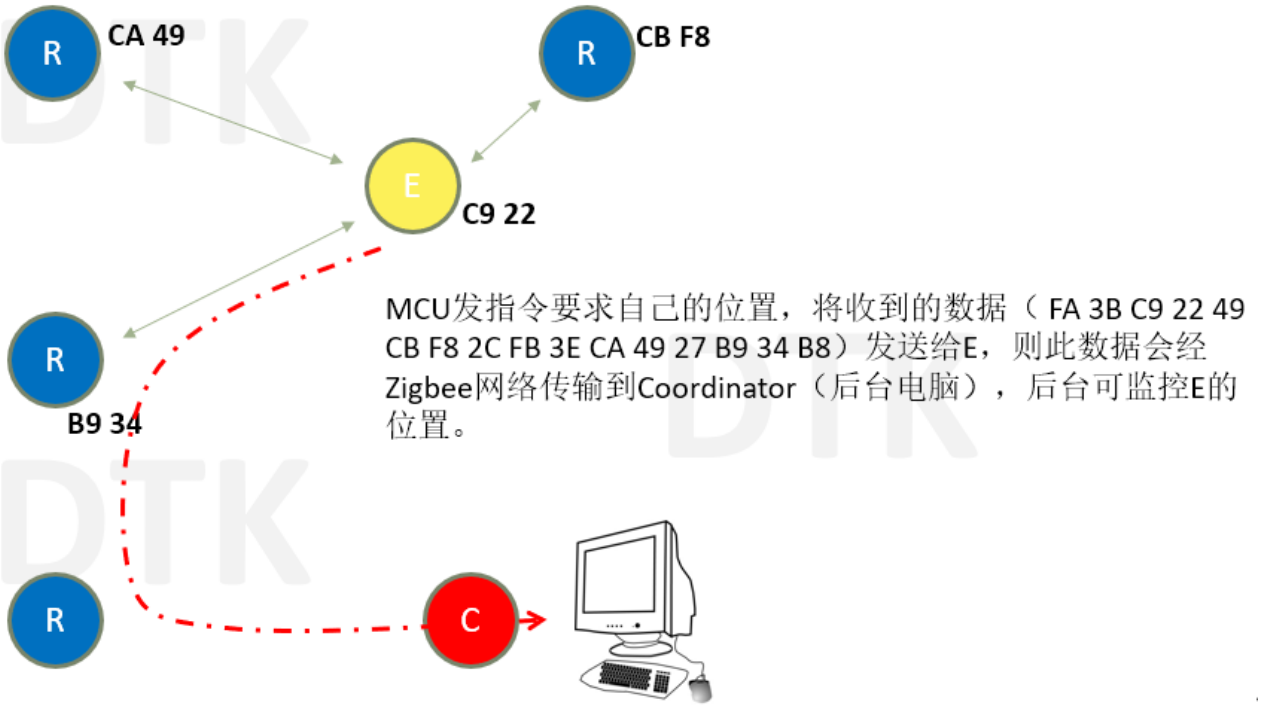
End Device的定位功能分二部分：
（1），End Device发现自己的位置（类似于自主导航）；
（2），后台监控End Device的位置（一般矿井、隧道等使用的定位系统）：

（1），End Device发现自己的位置（类似于自主导航）；



（2），后台监控End Device的位置（一般矿井、隧道等使用的定位系统）；

整个系统为无线解决方案，布设时，Router的路由级数一般不要超过15级，End Device的数量一般不超过200个（假设单个End Device每隔10秒钟产生一次定位数据）



10.3, Why can't my device connect with the wireless module

This question is relatively empty, not specific, and difficult to answer, but it is very common. There are problems with wireless modules, as well as problems with equipment and software. Please follow the steps below to solve it:

1. Confirm whether the Zigbee module network is correct:

There is one and only one Coordinator, and it has been opened;

After the Router or End Device is connected to the network, the Active light should flash slowly;

Use the "Read Network Structure" function to see if all nodes are in the network;

Press the function button on the Coordinator 3 times in succession to see if the Data light of the Router or End Device flashes quickly and evenly;

Connect the Coordinator and nodes to the computer, and use the serial port debugging assistant to send data to each other to see if it is correct;

2. Whether the baud rate of the Zigbee module and the equipment directly connected to it is consistent with the format of the serial port? From the user's point of view, a Zigbee network does not have the so-called "air baud rate", and does not require the serial port wave of each Zigbee module. Baud rates are the same, however, It is required that the Zigbee module and the devices directly connected to it have the same baud rate as the serial port format.

1

有线连接，波特率9600

用有线方式连接设备，读取数据正确，确定设备的波特率

2

无线连接

波特率
9600

Coordinator
波特率9600

Router
波特率9600

波特率
9600

电脑的波特率一般都是在应用软件里面设置，而不是在Windows里面设置

如果按下面波特率连接（将Coordinator的波特率设置得高一些，这样Coordinator的串口占用时间会少一些），有利于提高传输效率

无线连接

波特率
38400

Coordinator
波特率38400

Router
波特率9600

波特率
9600

电脑的波特率一般都是在应用软件里面设置，而不是在Windows里面设置

3. In some cases, it is really impossible to connect using the wireless module:

(1) Programs are written to the PLC wirelessly (because the program is generally large, the transmission capacity of the wireless mode is not enough);

(2), some devices transmit data too fast and cannot be connected:

Some original factory built-in application software, when using the device, usually "connect the device" (or "query the device"), especially for 485 devices, the query device will query from address 1 to address 254 , so the query speed is very fast , beyond the transmission capacity of the wireless module, and cannot be connected; however, in the normal process of collecting data, these devices can be used by appropriately extending the time interval of instructions, such as using various configuration software, Modbus Poll software ;

The wireless transmission process usually includes: serial port receiving data →analysis and packaging →to form a protocol frame for →wireless transmission, wireless receiving data →solution protocol →verification data →serial port output. This process is definitely slower than wired. If the data transmission is too fast, the wireless module cannot handle it;

(3), the application software of some devices has no baud rate setting, and the baud rate and serial port format of the device are not known, so it is difficult to connect with the wireless module;

(4) For some old-fashioned devices, the baud rate is too low (the module supports a minimum of 1200), or the variable baud rate setting is used to achieve the purpose of encryption, and such devices cannot be connected;

10.4, why the configuration software cannot connect to the module

1， Connection of DRF1609H

configuring the DRF1609H, a USB to UART adapter board is usually used to connect the DRF1609H to the computer

If you can't connect, you should focus on checking:

- Check the connection: TX-RX , RX-TX , GND-GND
- Make sure the power supply of DRF1609H is 3.3V
- Make sure the UART interface of USB to UART is 3.3V

  Usually PL2303 , CH340 , FDTI232 series chips all need to select UART as 3.3V

  CP2102 series chips generally do not need to select
- Or use DTK 's USB backplane

2. Connection of DRF2659C

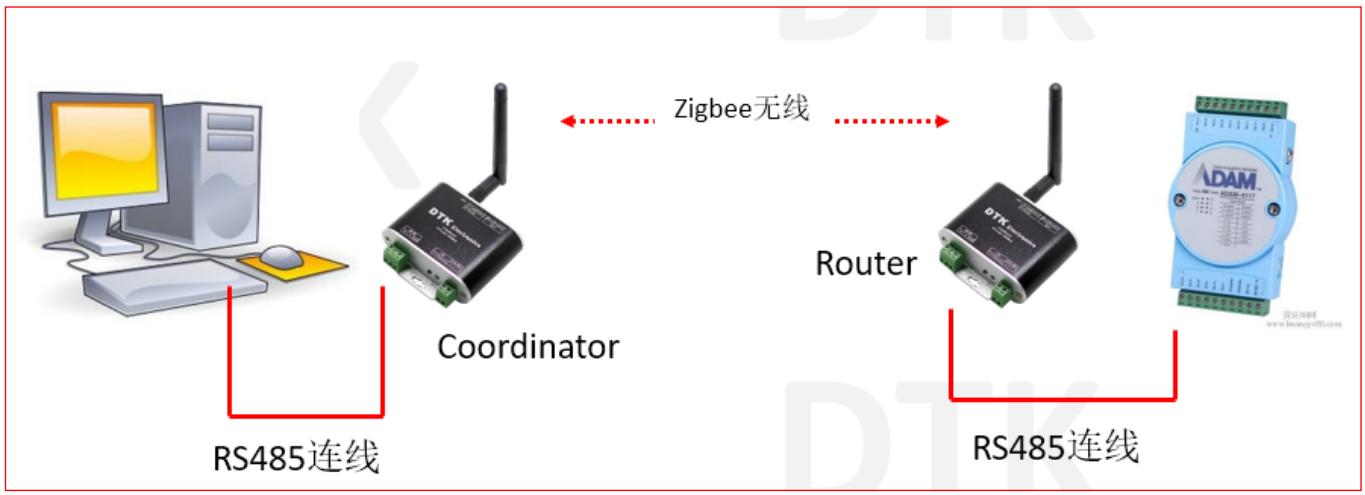
configuring DRF2659C , usually use USB to 485 conversion cable (or USB to 232)

If you can't connect, you should focus on checking:

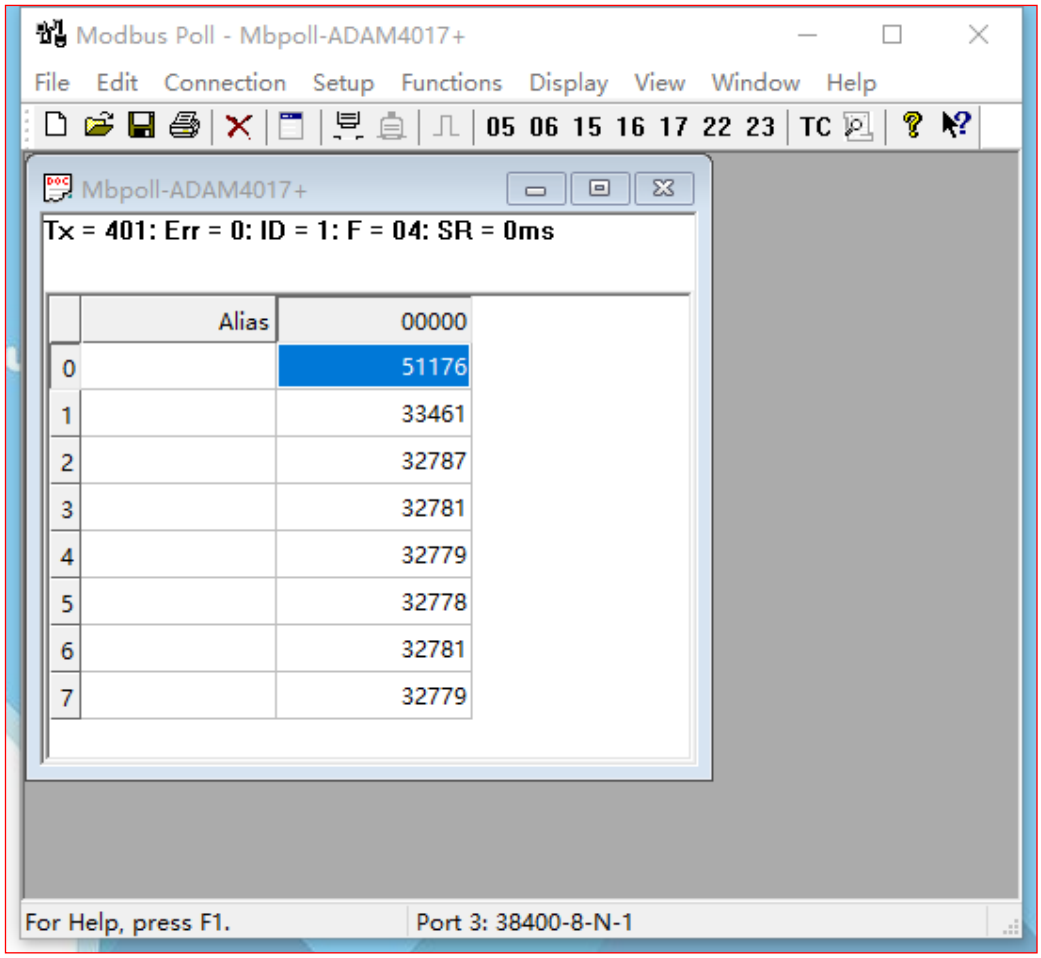
- Check wiring: AA (DATA+ - A), BB (DATA- - B)
- Make sure that the power supply of DRF2659C is within DC5-28V
- CH340 series chips usually do not support 115200 baud rate very well, so DRF2659C generally do not set it to 115200 baud rate
- If all DRF2659Cs cannot be connected, try another USB to RS485 cables

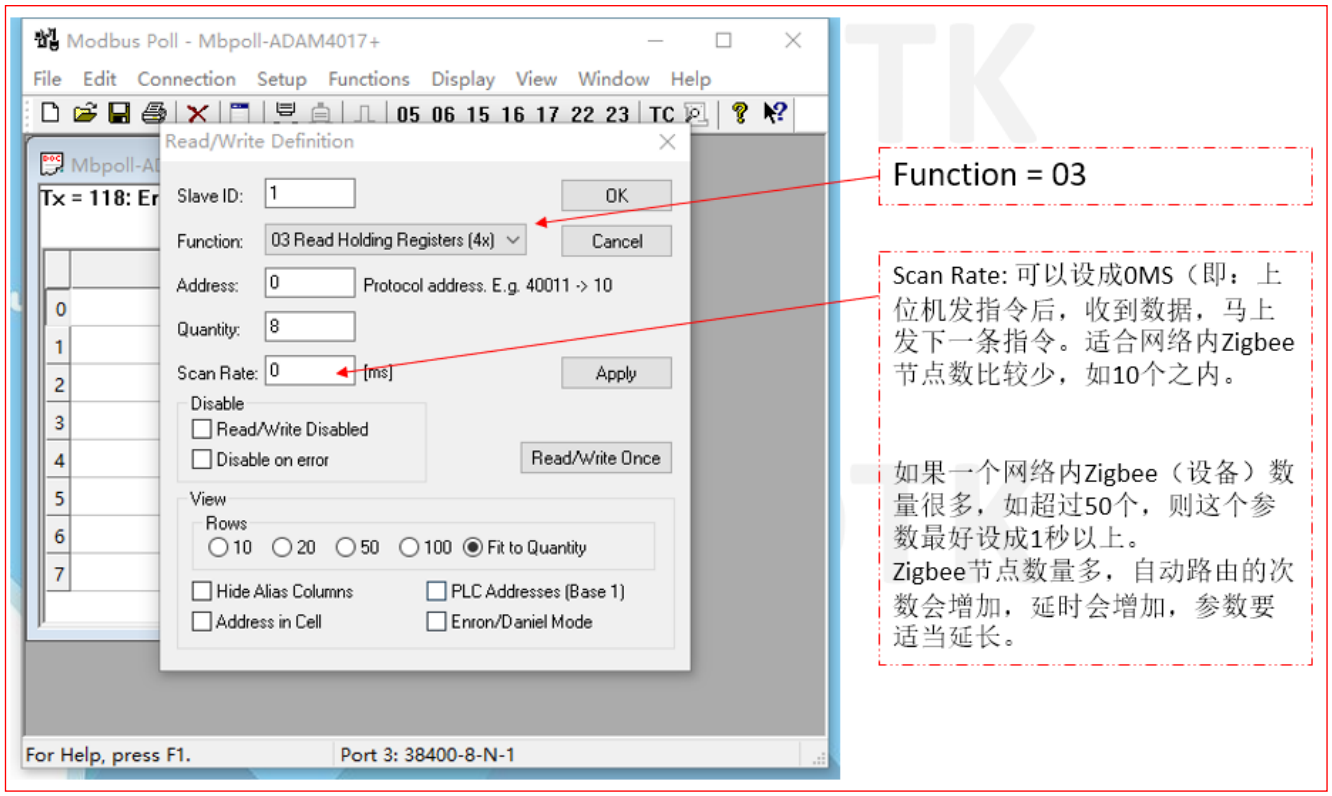
10.5, Zigbee module and ADAM 4017+ connection instance

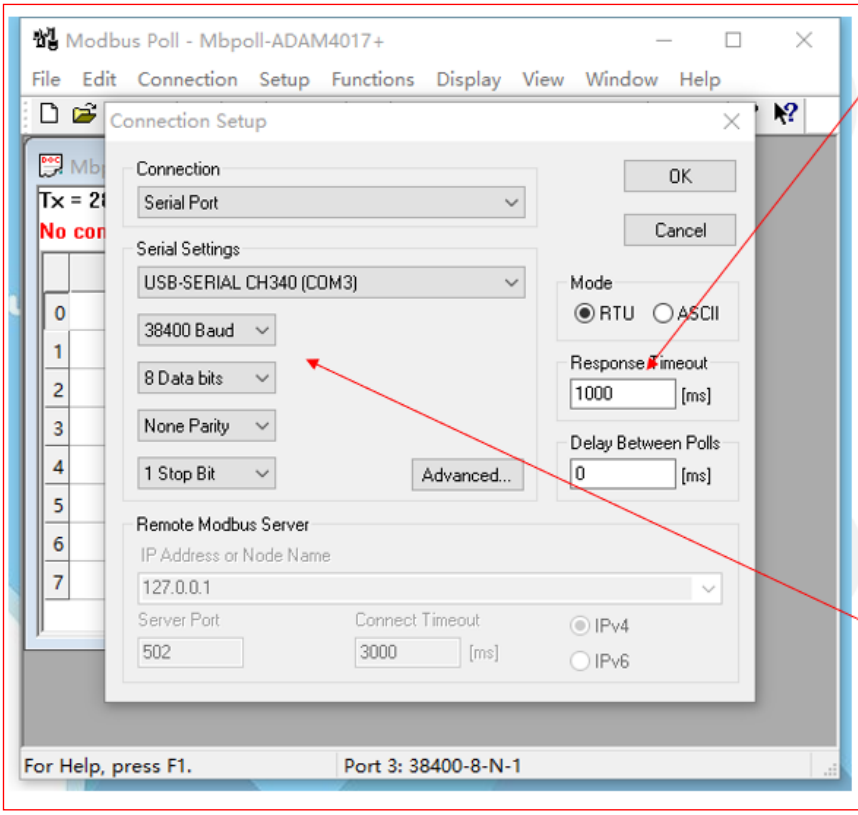
Connection diagram:



use Modbus Poll software testing:







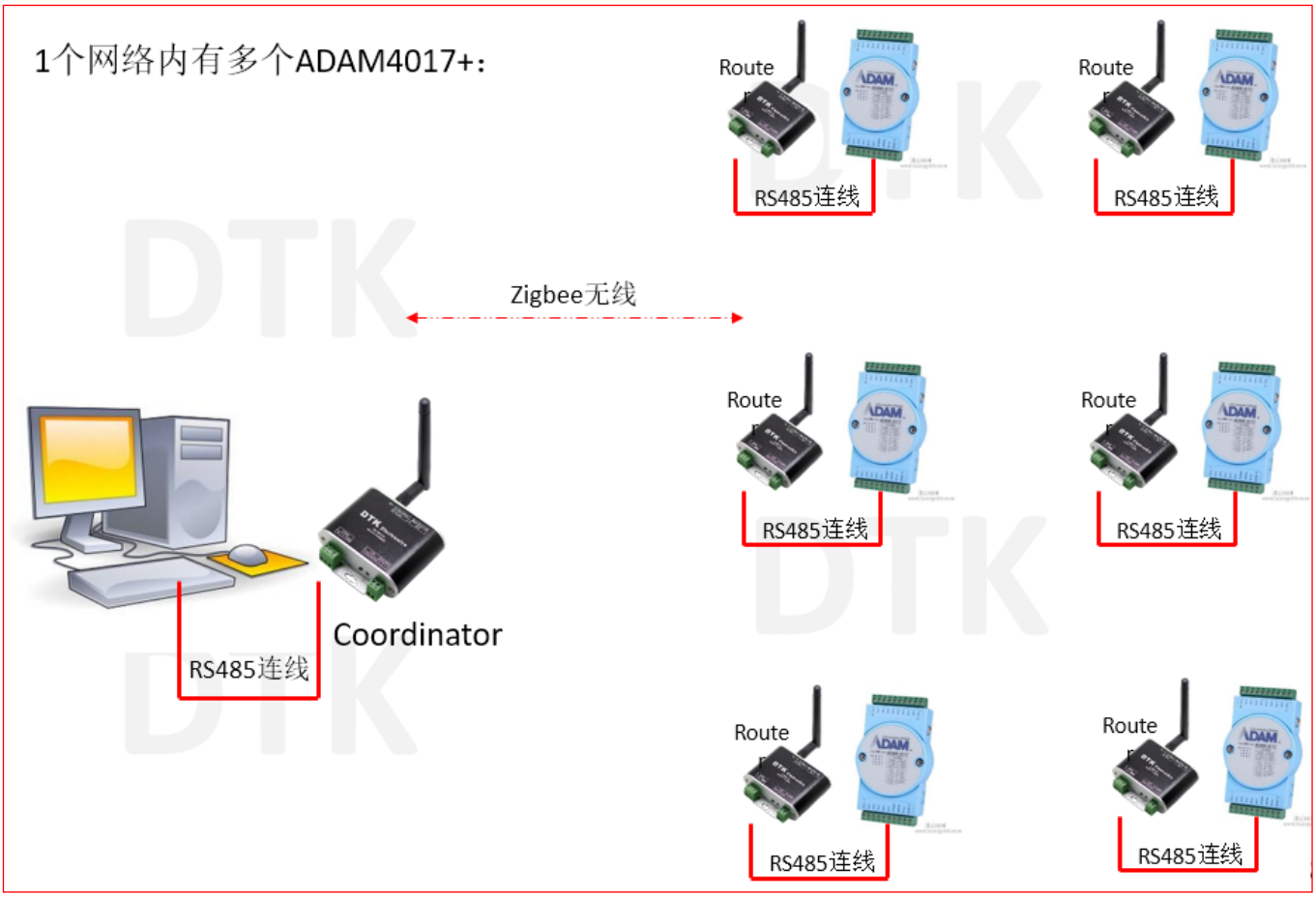
超时参数 = 1000MS

由于上位机发出指令后，Zigbee模块会打包、发送、路由、到达、解包、串口输出，相对于有线条件，延时会增加，所以超时参数一定要延长，一般可设为1秒以上。

超时=1秒，不是说询一个参数要1秒，超时1秒的含义是：上位机发送指令后，最多等待1秒，如果没有回复，则发送下一条指令。

串口参数，要与连接电脑的模块一致，在这里设置。

波特率指的是2个硬件设备之间，串口连线的通讯速率。没有空中波特率说法，不要求一个Zigbee网络内所有Zigbee模块波特率一致。



10.6, How to use End Device's sleep function:

(Applicable to firmware V8.1 and above, applicable to DRF1609H, not applicable to products with shells)

I. Overview

- The Zigbee module has three roles (three types of nodes): Coordinator (coordinator), Router (router), End Device (endpoint).
- Coordinator (coordinator), is the creator of the Zigbee network, and is responsible for the maintenance of the entire Zigbee network in real time, can send and receive data, each network must exist and only one Coordinator (coordinator), the Coordinator (coordinator) can send and receive data;
- Router (router), can send and receive data, and can automatically provide routing (relay) for other Zigbee modules;
- end Device (terminal node), which can send and receive data, cannot provide routing (relay) for other nodes, and can be set to enter the dormant state;

2. How to use

- Set the Zigbee module node type to End Device;
- Send an instruction to make the Zigbee module go to sleep (the following are hexadecimal numbers);

send	command header	instruction length	instruction	checksum
	FC	06	12 44 54 4B 43 4F	8 9 (The sum of all the previous bytes is reserved for the lower 8 bits)

reply	command header	instruction length	set state	reply content	checksum
	FA	01	0A: The setting is successful 0B: Setup failed 0C: Setting prohibited	12	The sum of all the previous bytes retains the lower 8 bits

- The Zigbee module immediately enters the sleep state, and when entering the sleep state, it will keep the task before entering (for example, if it is looking for a network before entering, it will continue to search for the network after leaving low power consumption)
- In sleep mode, pull down the FUNCTION key pin for 3 ms , then exit the sleep state immediately, and the serial port will output 3 bytes for confirmation: 0xFA 0x0A 0x60 (the sum of the first 2 bytes, the lower 8 bits are reserved).

3. Sleep parameters

- Sleep state current: about 5-6 uA on average, time to exit sleep state: 3 MS.

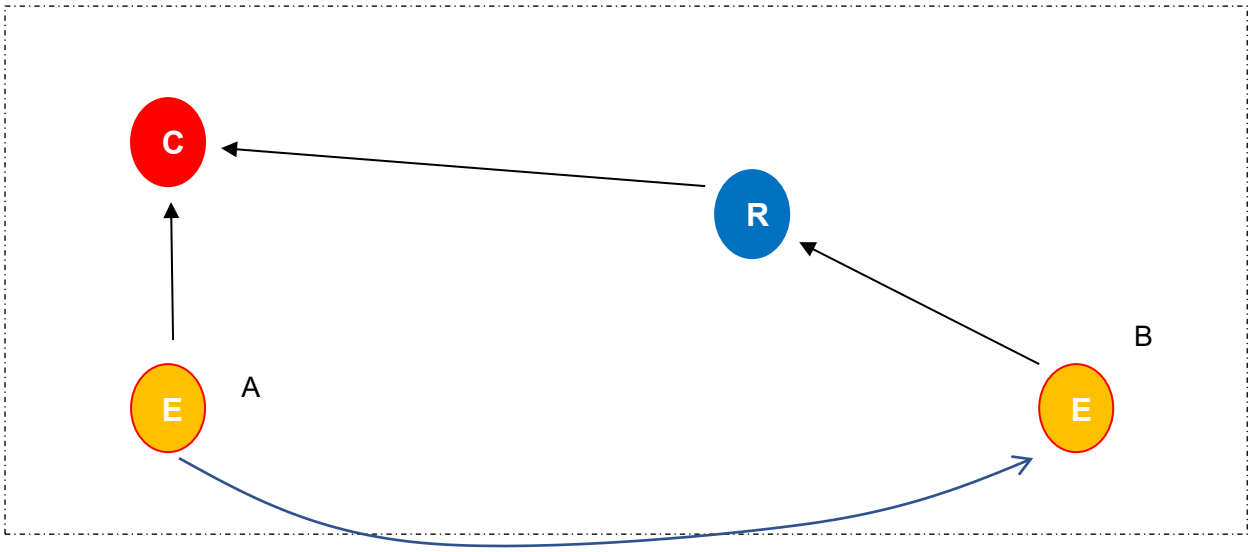
4. Precautions for using the sleep function:

- After exiting dormancy, enough time should be reserved for sending data. Reserved time = serial port transmission time + 10MS. If the baud rate is 9600 and 10 bytes are transmitted, the serial port takes up 9.6MS, and a total of 19.6MS needs to be reserved. , to enter the dormant state again;
- DRF1609H is equipped with PA, and the emission current can reach 200MA, but the duration is very short (10 bytes, about 0.4MS). If battery power is used, a capacitor of at least 10UF should be added to the power supply end of the module;

5. Routing problems using sleep:
As shown in the figure, assuming that E (End Device) is at point A, the sent data can reach C (Coordinator) directly. After sleeping, it moves from point A to point B, but cannot directly reach C. It must be automatically routed through R (Router) When reaching C, C will not receive the data sent by E at this time, because E has been in a dormant state and cannot update its own routing path.

6. Routing method to solve dormancy:
1, End After the device sleeps, it sends data in a point-to-point manner. Since the short address of the Coordinator is always 0x0000, it sends data in a point-to-point manner based on short address addressing: FD + data length+ 0x0000 (Coordinator short address) + data

2. Or, let E restart immediately after the hibernation is over, and it will automatically find a new routing path after restarting. Or keep E in the normal working state for more than 10 seconds to obtain a new routing path.



10.7, Zigbee module MCU routine (serial transceiver, STM32)

I. Overview

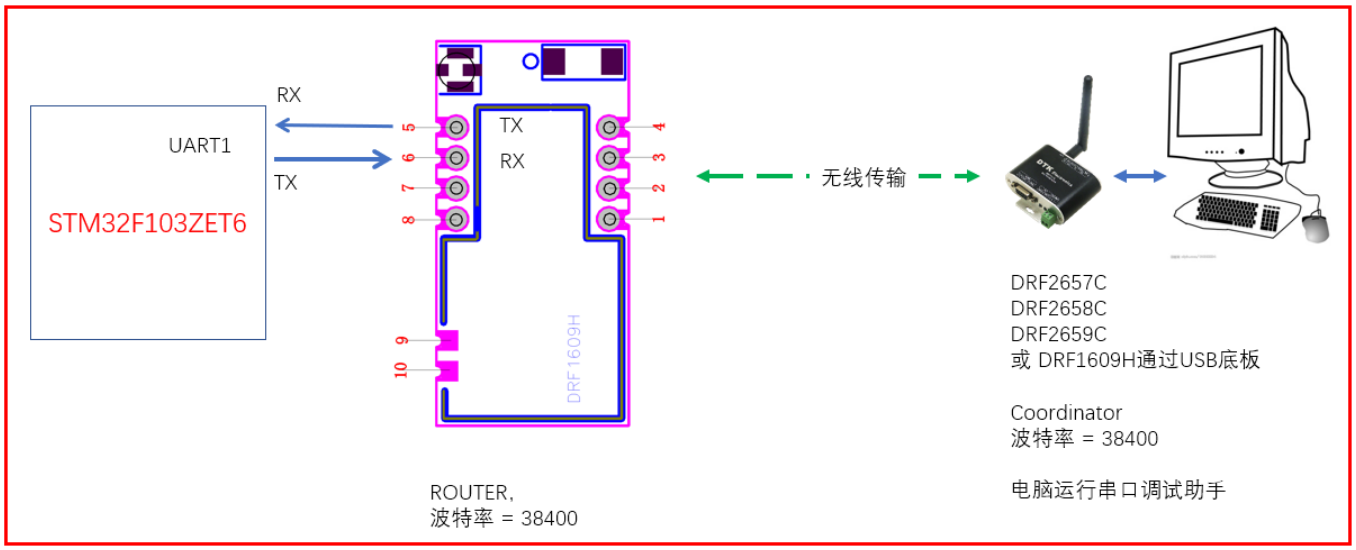
In fact, the Zigbee module does not have the so-called single-chip routines, because the Zigbee module is transparent transmission, what is sent by one board, the next board will receive what is intact, in fact, it is the serial port transceiver program of the single-chip microcomputer.

In order to facilitate user debugging, it is recommended: 1. First connect the product with a wired method; 2. Set the Zigbee module according to the manual; 3. Use the Zigbee module to directly replace the cable, and the user does not need to change the MCU program;

Of course, there is a microcontroller routine, which can facilitate the user to verify the design.

2. Detailed explanation of the Zigbee module routine

1. Hardware composition



2. Serial port receiving software process:

(1): TIMER3 enters an interrupt every millisecond;

(2): The serial port interrupt is set to interrupt every time a byte is received, and in the serial port interrupt, the data is received and saved;,

(3): If no new serial port data is received after 6MS, it is considered that the current data packet has been received;

3. Project software process:

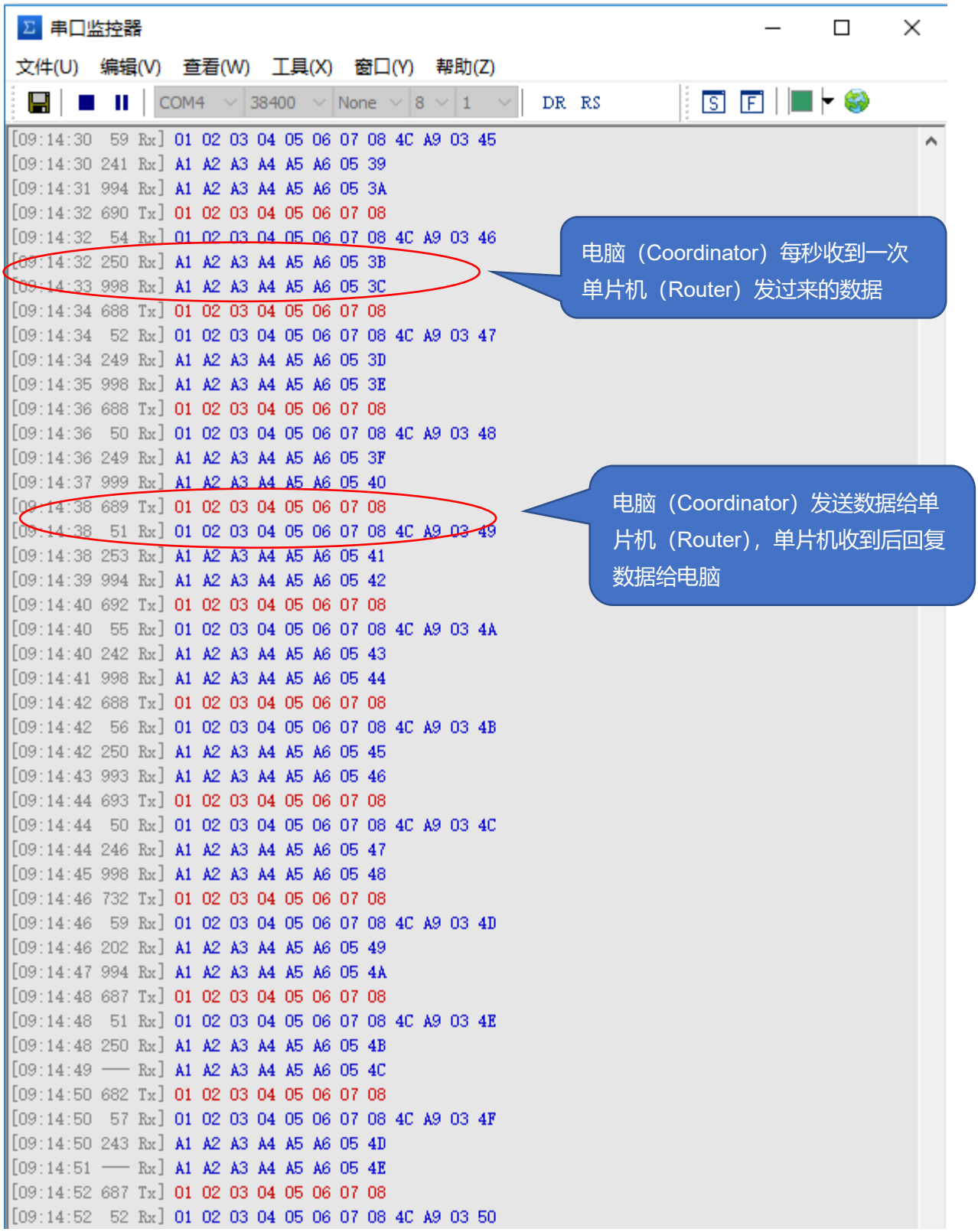
(1): Power on the MCU, first read the parameters of the Zigbee module, and write down the short address;

(2): The microcontroller sends a string of data every 1 second, and the last 2 bytes are incremented by 1 each time;

(3): If the MCU receives the data, it will be followed by the original data + 2 bytes short address + 2-byte sequence number, sent back;

4. The project is automatically generated by STM32Cube, and users can easily change it to other STM32 microcontrollers through STM32Cube.

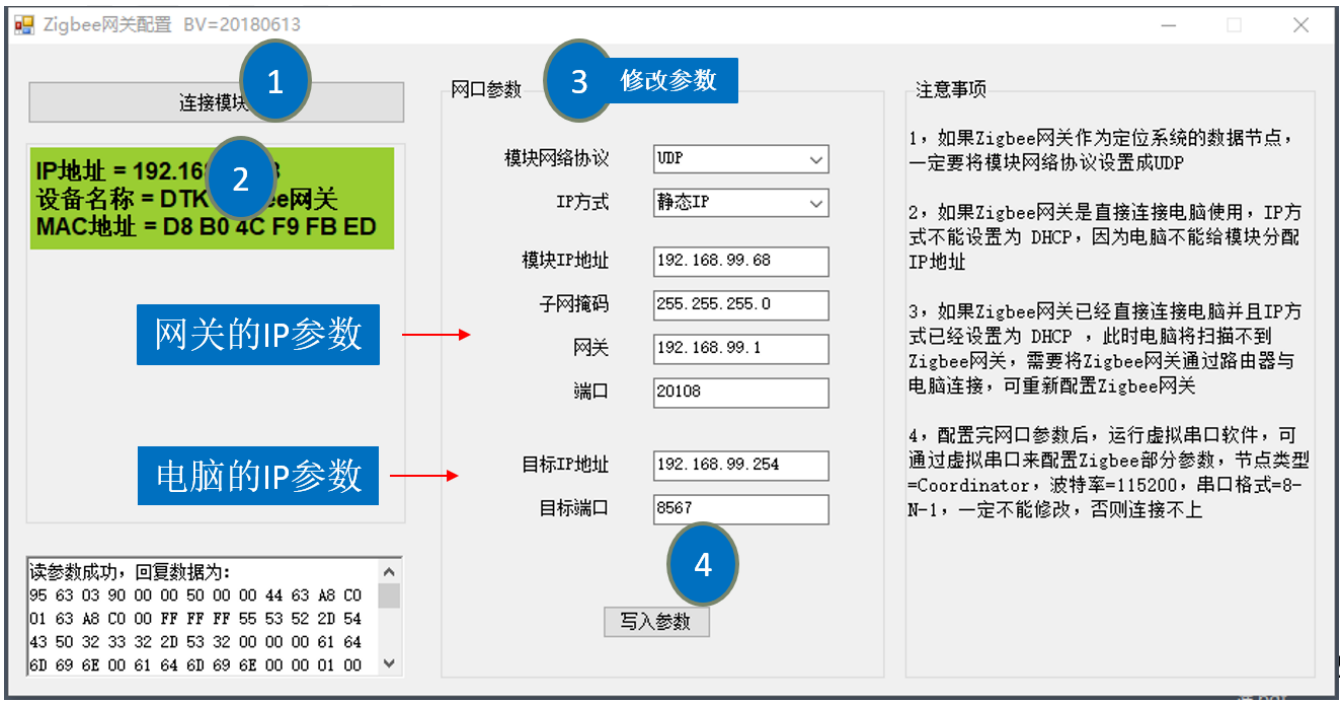
Run the serial port debugging assistant on the computer:



10.8, How to set Zigbee gateway (DRF 2670C)

1. Connect the Zigbee gateway (DRF2670C) to the computer (directly, or through a router or switch), and power on;

2. Open "Configuration Software" and →"Zigbee Gateway Configuration";
3. Click "Connect Module", and a green line will appear, indicating that the module has been found, click (read the module parameters);
4. Modify parameters, or write parameters.



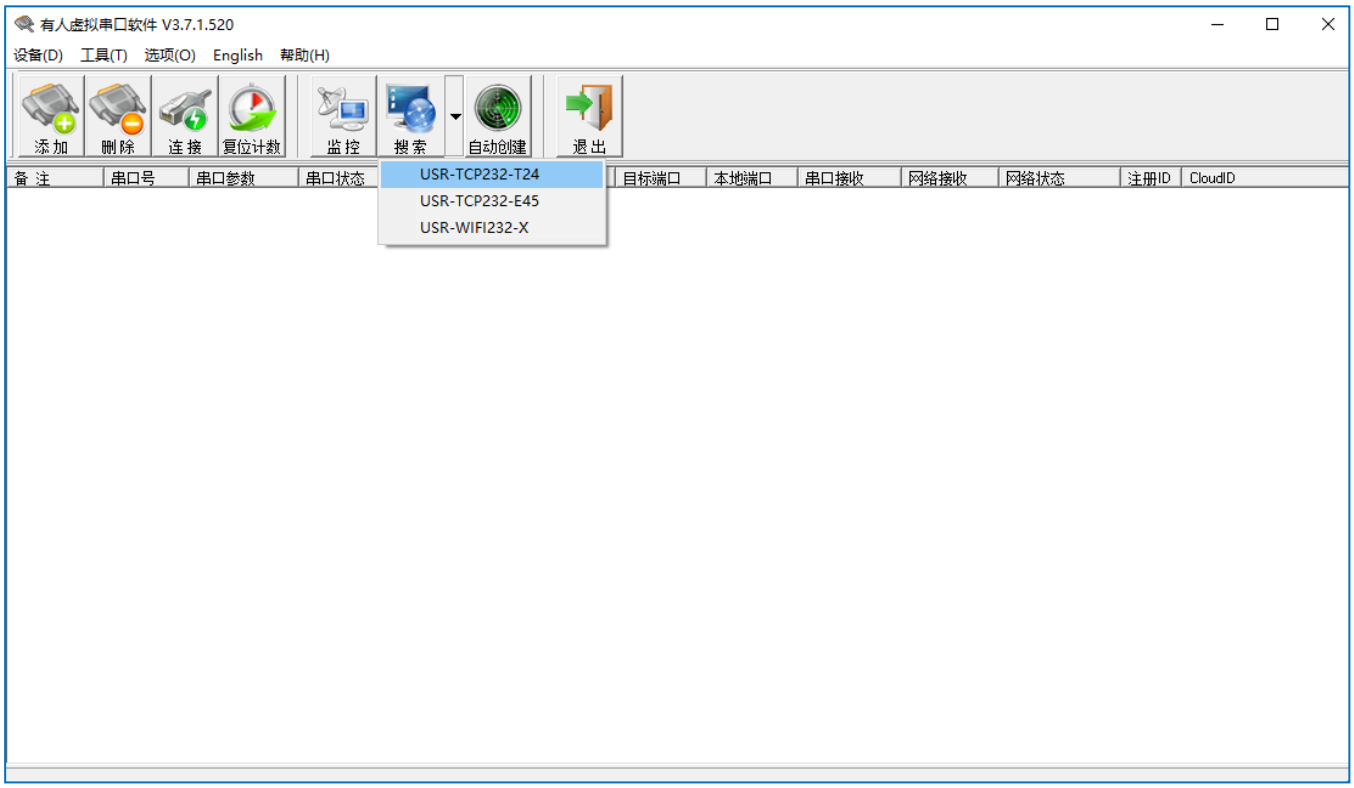
5. Set the parameters of the computer network port:
The IP address of the network port of the computer is the target IP of the module

6. The IP address of the gateway (DRF2670C) and the computer is the target IP of each other. If it is not clear, please read out the corresponding parameters and fill in the form below:

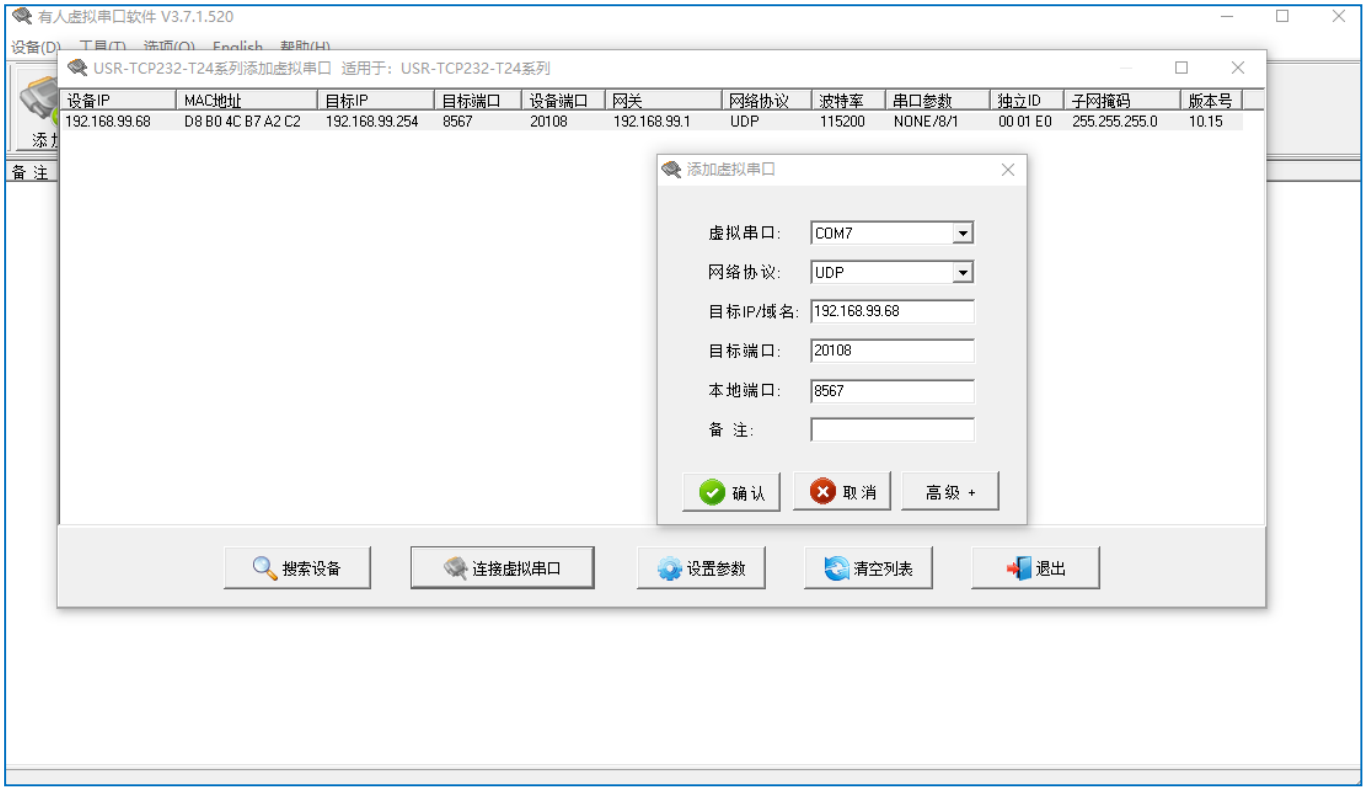
模块参数（DRF2670C）	
网络协议	UDP
IP方式	静态IP
模块IP地址	
子网掩码	
网关	
端口	
目标IP地址	
目标端口	

电脑参数（本地连接）	
IP地址	
子网掩码	
默认网关	

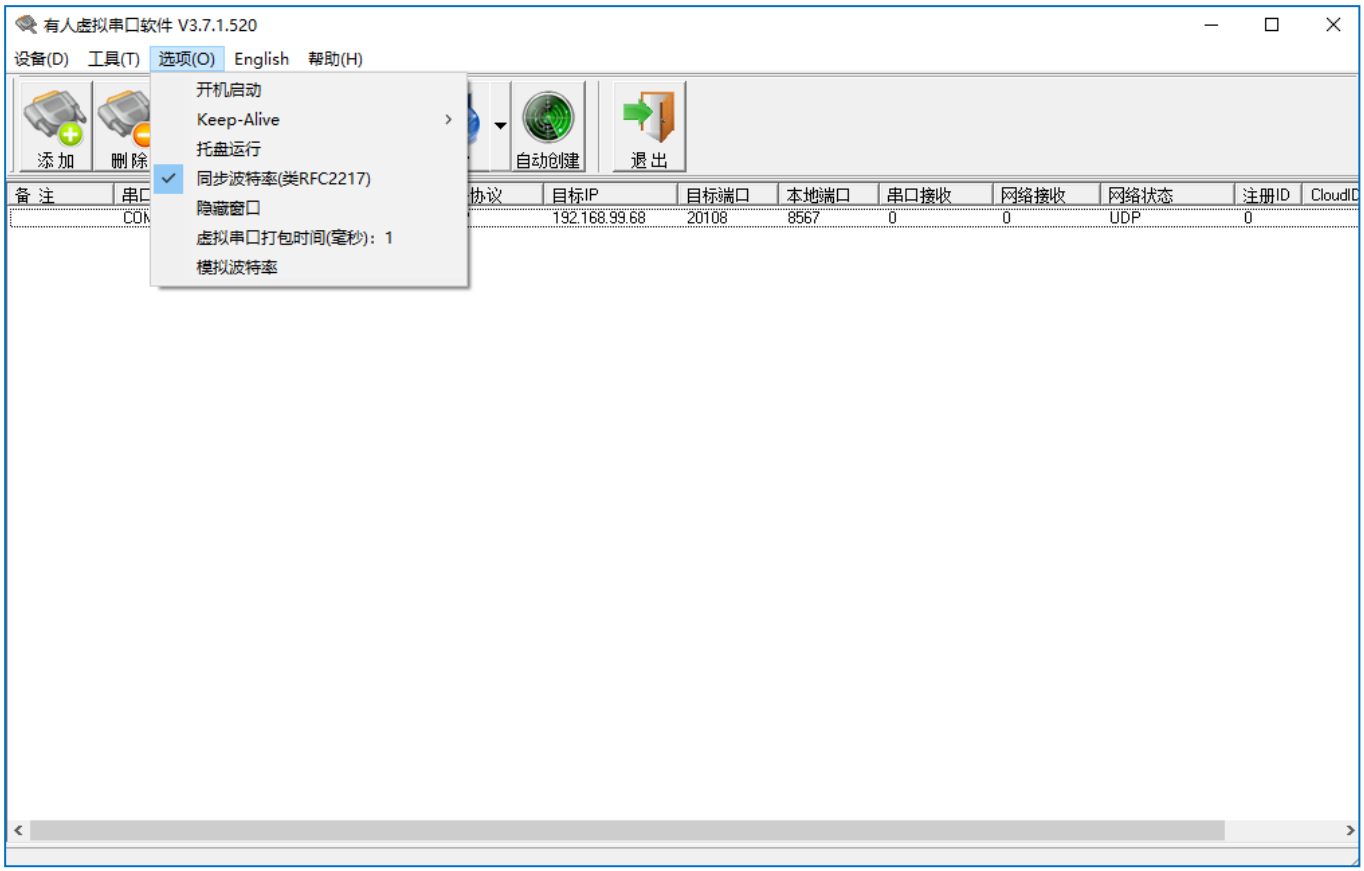
7. Run the "Virtual Serial Port Software" and click "Search":



8. Automatically search out DRF2670C , click "connect virtual serial port", fill in the parameters, and "confirm";

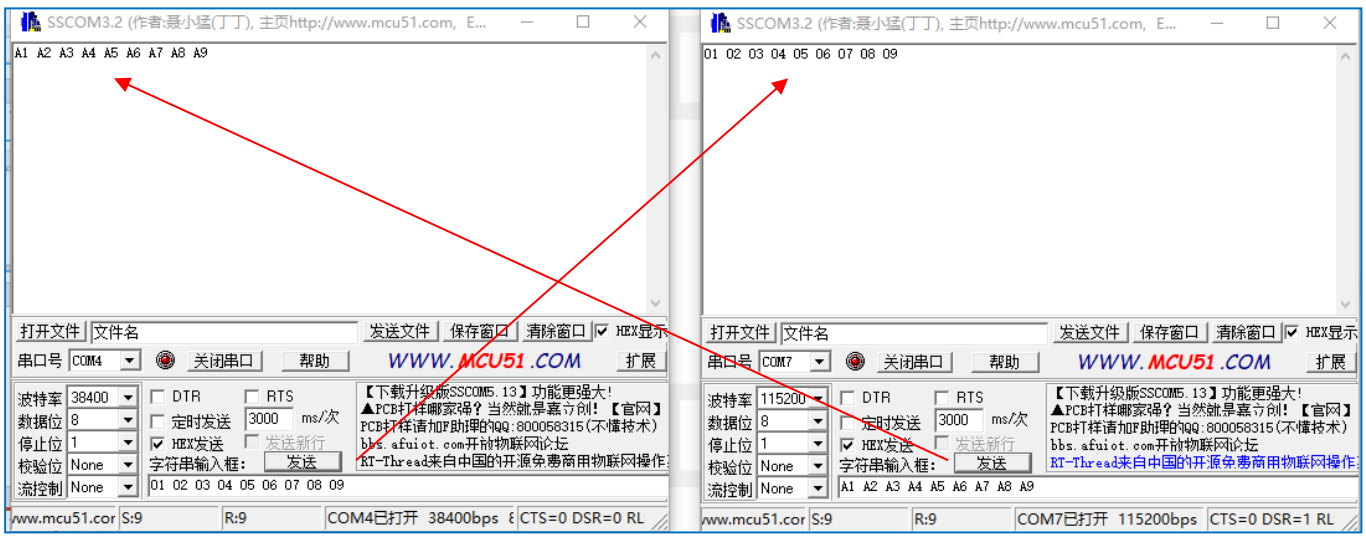


9 , the virtual serial port is successfully created, check "Synchronous Baud Rate";

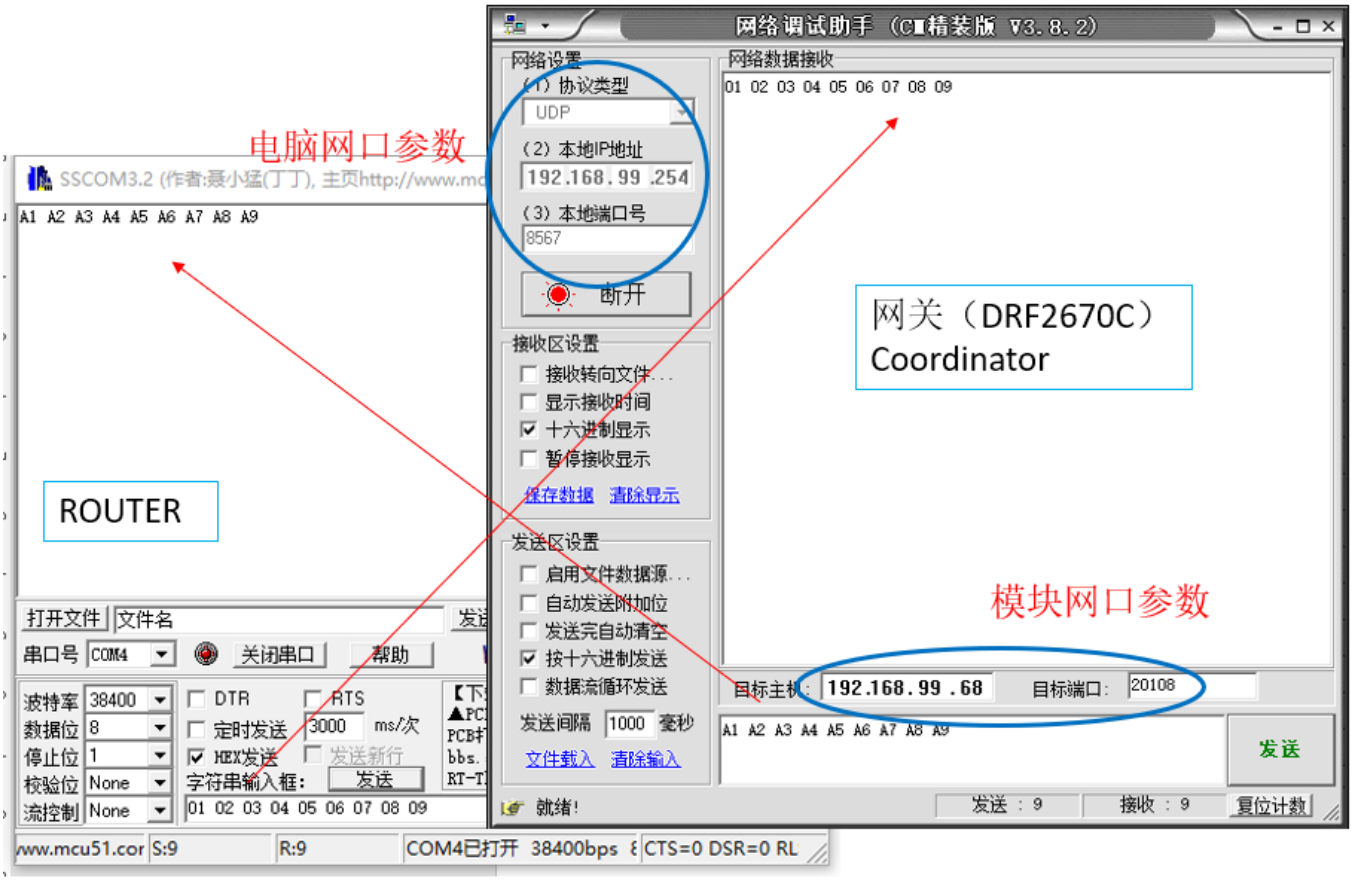


10. Use the configuration software to configure the Zigbee parameters of the gateway (DRF2670C) :

11. Use the serial port debugging assistant to send and receive data:

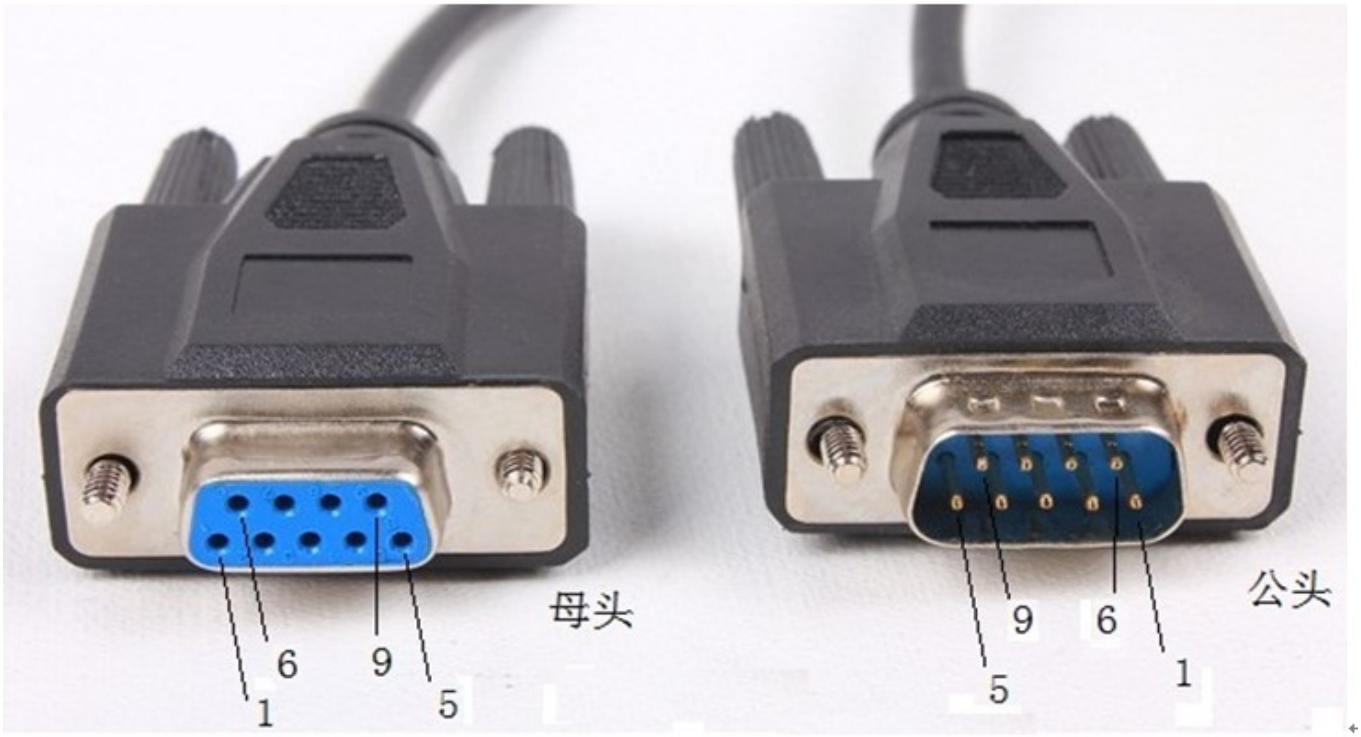


12. Use the network port debugging assistant to send and receive data:

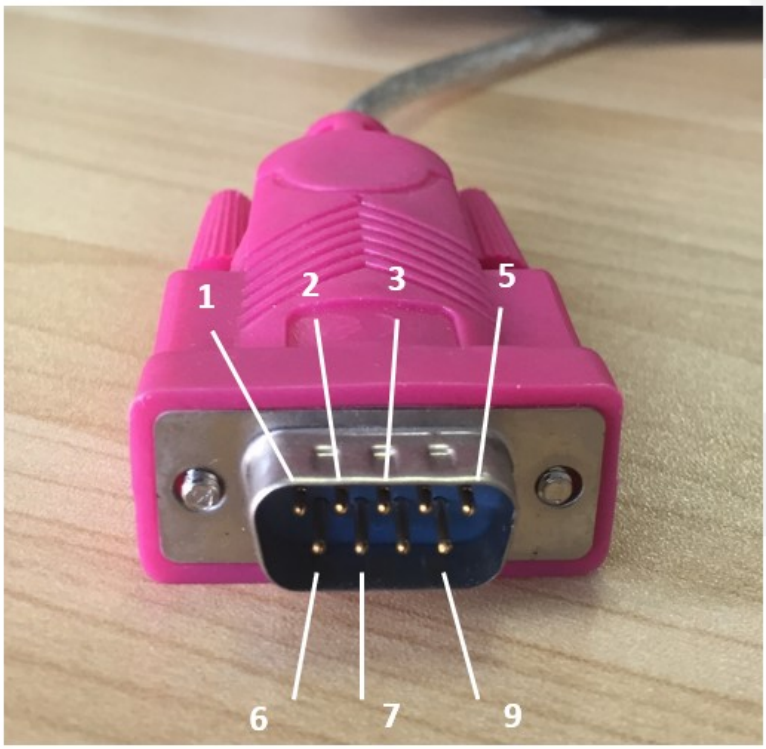

电脑网口参数
网络调试助手 (C■精装版 V3.8.2)
网络设置
(1) 协议类型
UDP
(2) 本地IP地址
192.168.99 .254
(3) 本地端口号
8567
断开
接收区设置
接收转向文件...
显示接收时间
十六进制显示
暂停接收显示
保存数据 清除显示
发送区设置
启用文件数据源...
自动发送附加位
发送完自动清空
按十六进制发送
数据流循环发送
发送间隔 1000 毫秒
文件载入 清除输入
网络数据接收
01 02 03 04 05 06 07 08 09
网关（DRF2670C）
Coordinator
模块网口参数
目标主机: 192.168.99 .68
目标端口: 20108
A1 A2 A3 A4 A5 A6 A7 A8 A9
发送
就绪!
发送 : 9
接收 : 9
复位计数
SSCOM3.2
A1 A2 A3 A4 A5 A6 A7 A8 A9
ROUTER
打开文件
文件名
串口号 COM4
关闭串口
帮助
波特率 38400
数据位 8
停止位 1
校验位 None
流控制 None
DTR
RTS
定时发送
3000
ms/次
HEX发送
发送新行
字符串输入框:
发送
01 02 03 04 05 06 07 08 09
www.mcu51.cor
S:9
R:9
COM4已打开 38400bps
CTS=0 DSR=0 RL

10.9, how to connect RS232 module (DRF2657C) and equipment

The RS232 interface is generally divided into male and female:



RS232 interface on the computer , or the USB to RS232 interface, is generally a male head:



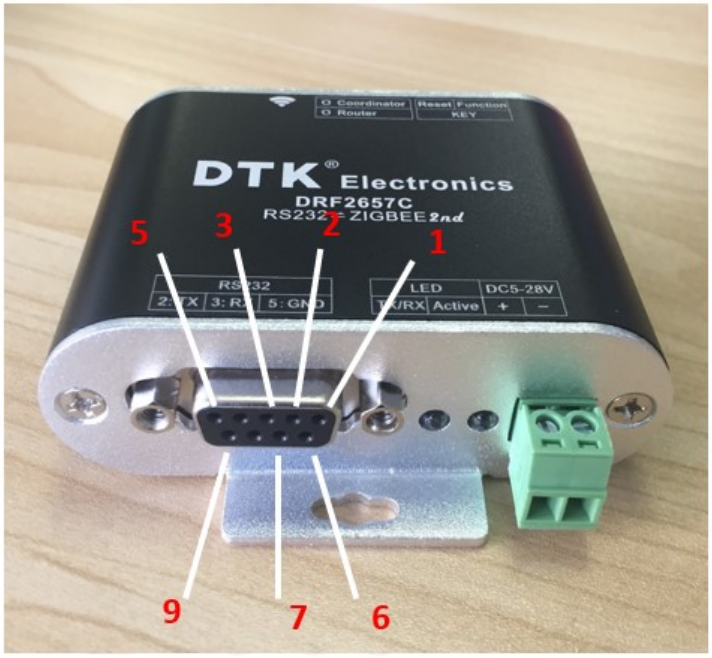
PIN脚定义（一定要连）：

2	RX
3	TX
5	GND

7：RTS
8：CTS
是硬件流控，一般不用

其它脚太古老，肯定不用。

The RS232 interface on the device , or the RS232 interface on the module (DRF2657C), is generally a female connector:



PIN脚定义（一定要连）：

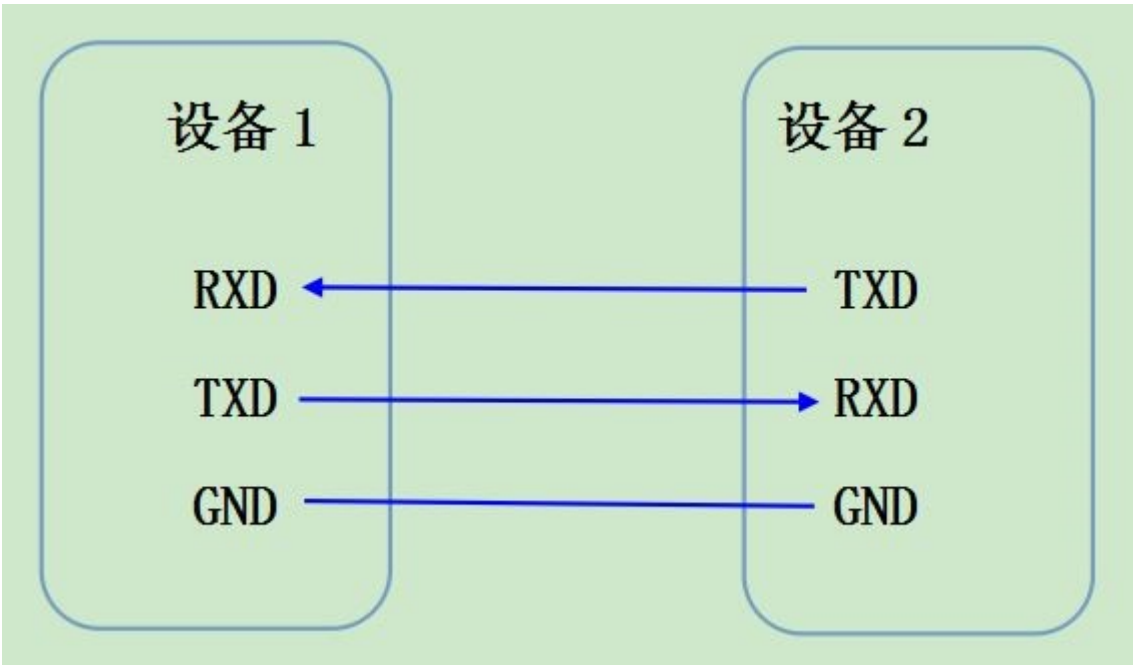
2	TX
3	RX
5	GND

7：CTS
8：RTS
是硬件流控，一般不用

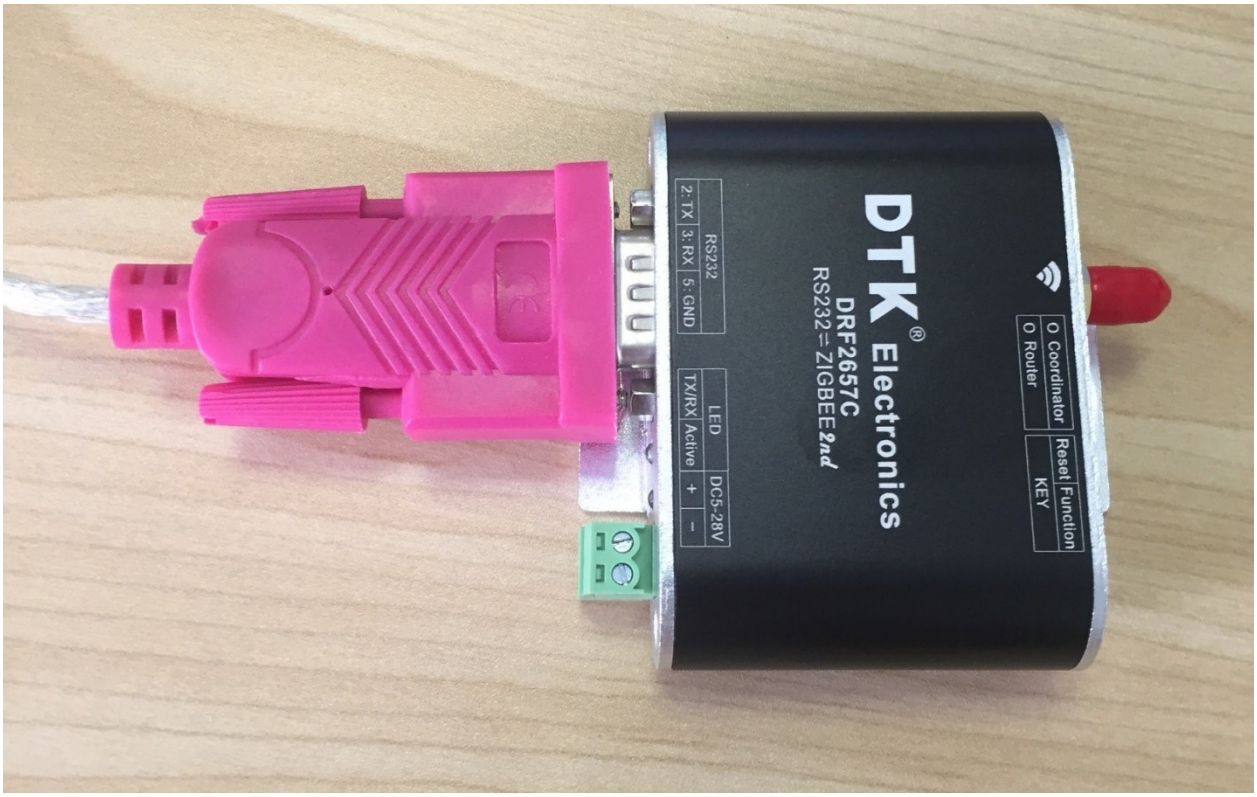
其它脚太古老，肯定不用。

DRF2657C只有2、3、5有定义，其它脚都不用接

RS232 no matter what kind of port, always connect according to the following figure:

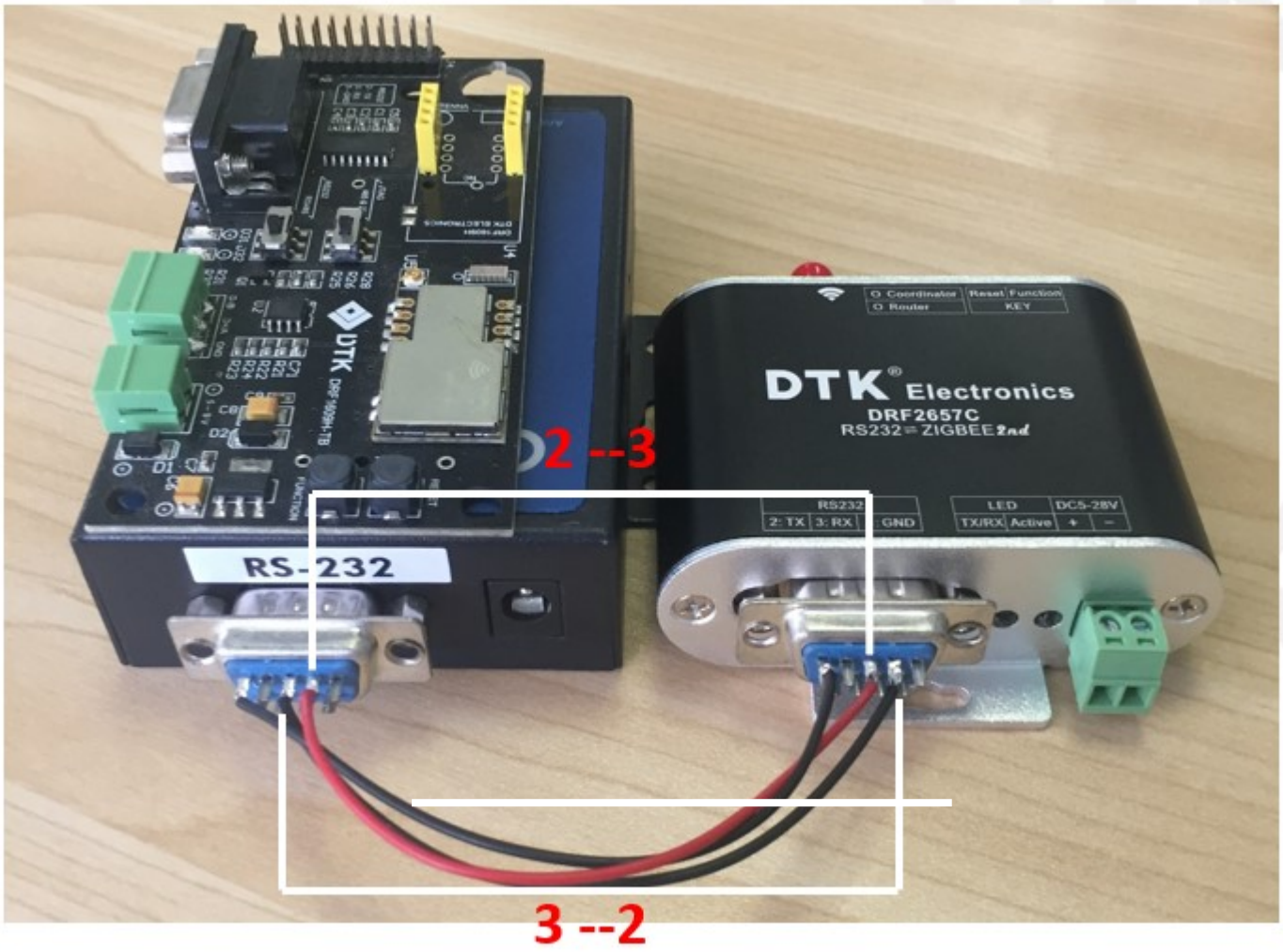


According to the above definition, there is a direct connection between the computer (or USB to RS232) and the module (DRF2657C):



The equipment is generally female (so that it can be directly connected to the computer), and the module is also female (directly connected to the computer), so the device and the module cannot be directly connected:

At this time, the module and the device should be cross-connected (2-3 , 3-2 , 5-5)
Its essence is still TX-RX , RX-TX , GND-GND

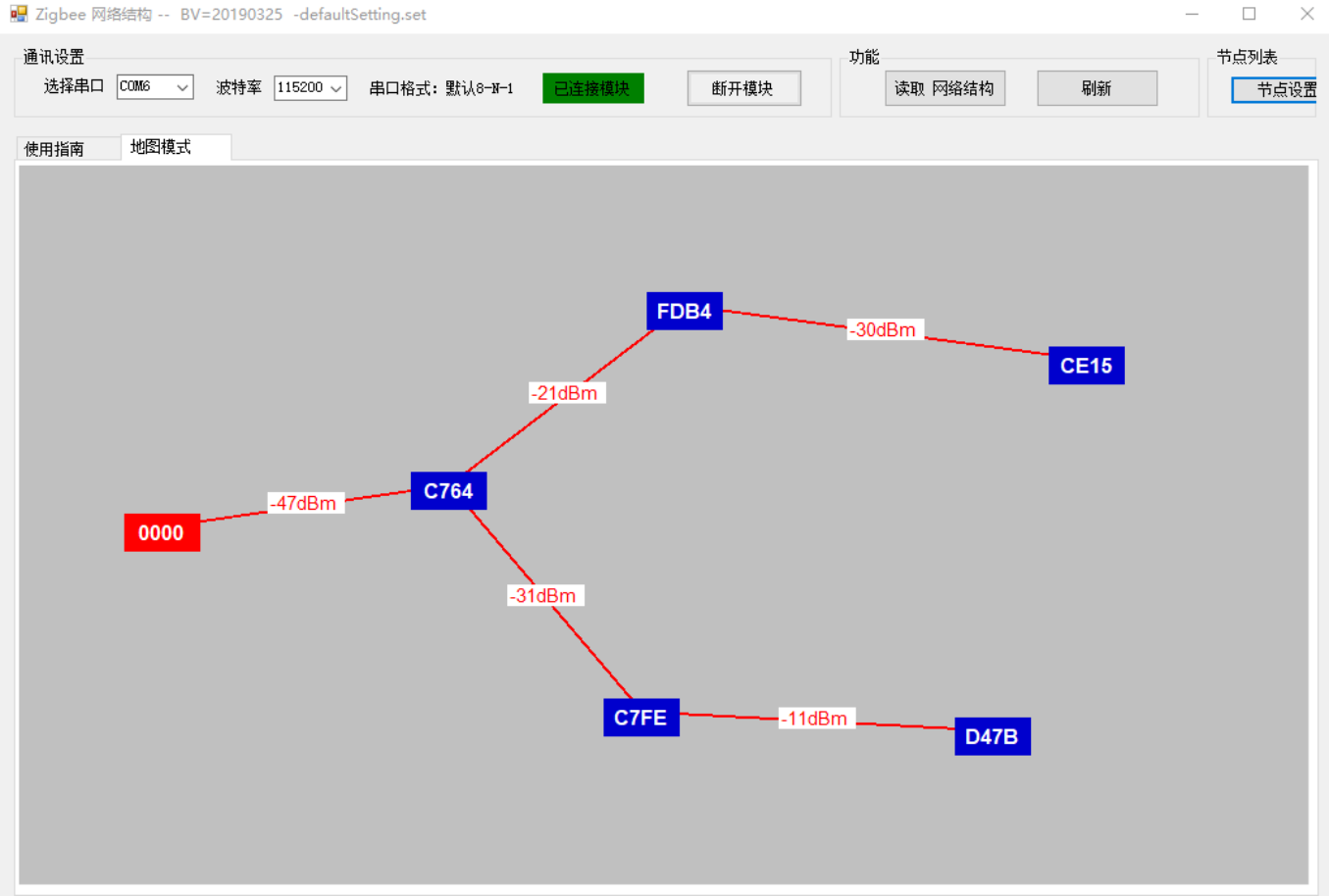

2 --3
DTK Electronics
DRF2657C
RS232 ZIGBEE 2nd
RS-232
3 --2

10.10, how to remotely modify nodes (Router, End Device) parameters

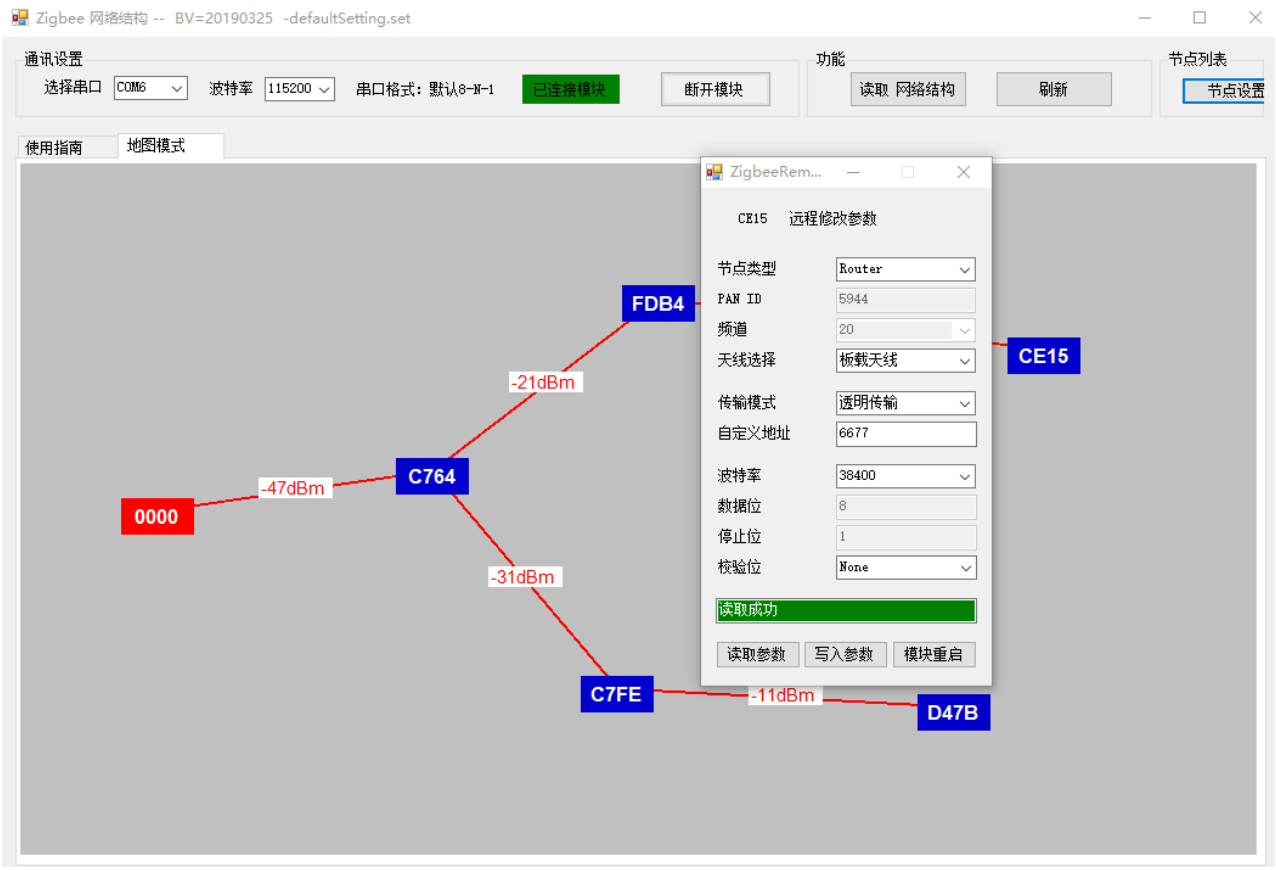
After a Zigbee network is established, all nodes in the network (Router, End Device) parameters
It can be modified directly by command (refer to the command list)
Modify directly in the "Zigbee Network" software

The following briefly describes the direct modification in the "Zigbee Network" software:

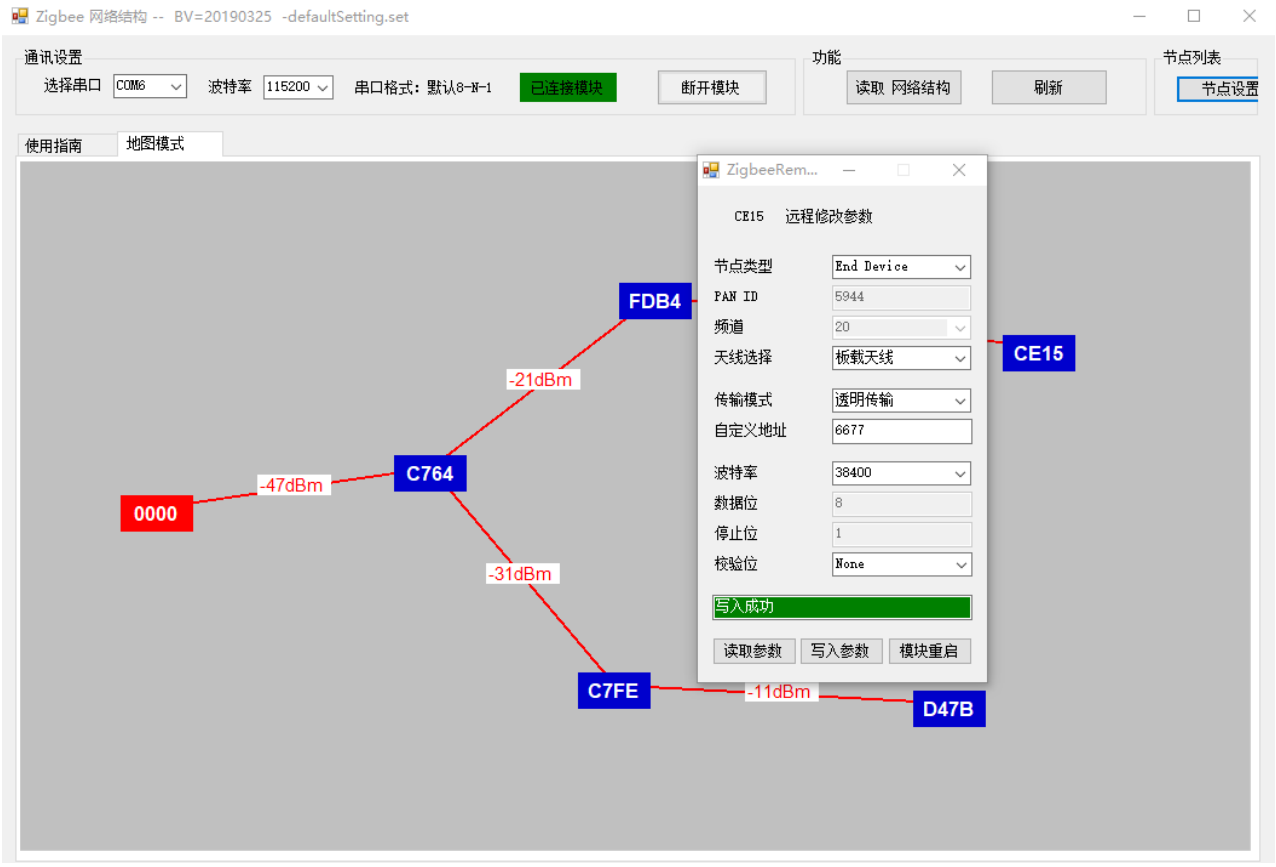
1, Open the configuration software, select "Zigbee network"
2, Coordinator connected to computer-→ Select serial port, baud rate→ Click "Connect Module" → Click "Read Network Structure "



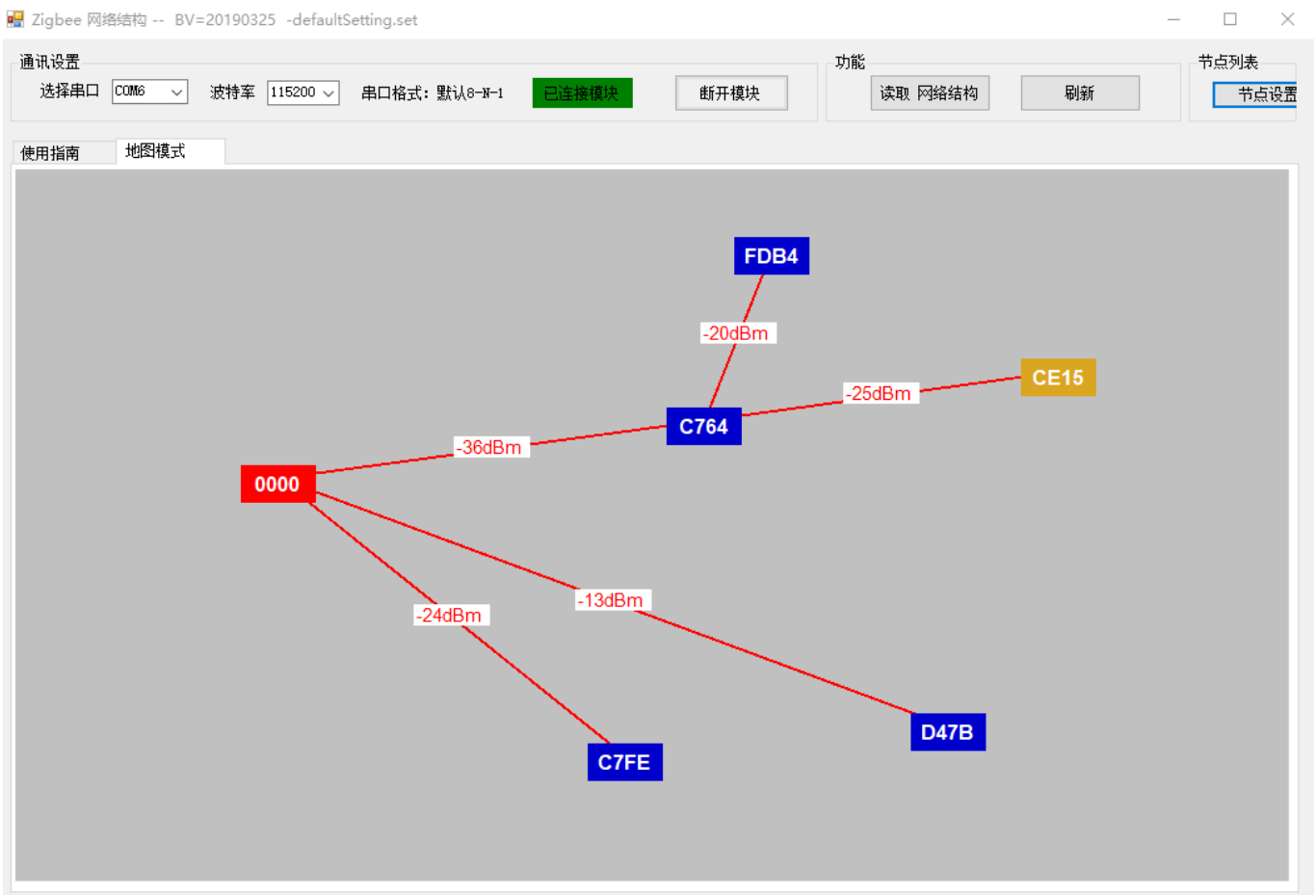
3, Wait for the network structure read to complete
4, Right-click the node to be modified
5, In the pop-up interface, you can read, modify, or restart the node



For example: modify the node type of CE15 node to: End Device



After modification, re-read the Zigbee network:


Zigbee 网络结构 -- BV=20190325 -defaultSetting.set
通讯设置
选择串口
COM6
波特率
115200
串口格式：默认8-N-1
已连接模块
断开模块
功能
读取 网络结构
刷新
节点列表
节点设置
使用指南
地图模式
FDB4
-20dBm
CE15
-25dBm
C764
-36dBm
0000
-13dBm
-24dBm
D47B
C7FE

11. Contact information

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