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Shenzhen DTK Electronics Co., Ltd

Zigbee Module User Guide

V5.7

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1、DRF Series Zigbee Module Features






DRF series of ZigBee modules currently include DRF1605, DRF1605H, DRF2617A, DRF2618A, DRF2619A and supporting baseboard, which is based on TI's CC2530F256 chip running ZigBee2007/PRO agreement, it has all the features of the ZigBee protocol, which is different from other types of ZigBee module (which may not run Full ZigBee2007 agreement, the agreement needed 256K FLASH space).




Join network automatically when power on is the main features of ZigBee modules. Product development requirements for the current bear market is characterized by rapid change, DTK launch a self-forming, power-to-use ZigBee modules, users do not need to understand the complexity of the ZigBee protocol, all of the ZigBee protocol processing part, within the ZigBee module automatically, the user only needs to transmit data via the serial port, is currently on the market the most simple way to use ZigBee applications 。

The Main Feature:

- DRF series of ZigBee modules can be understood as the image of "wireless RS232 connection", so use this module as simple as using a RS232 cable
- Easy to use: do not consider the ZigBee protocol, transparent serial data transmission;
- Automatic network: all the modules at power-up self-forming, Coordinator automatically assigns addresses to all nodes;
- Simple data transfer:
- Transparent serial data transmission: Coordinator receives the data from the serial port will be automatically sent to all nodes, a node receives the data from the serial port will be automatically sent to the Coordinator.
- Point to Point transmission: through the serial port can be in any data transmission between nodes, data transfer format: 0xFD (data transmission command) + 0x0A (data length) + 0x73 0x79 (destination address) + 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x10 (data were 0x0A Bytes);
- Unique IEEE address: DRF series modules use the TI CC2530F256 chips, the factory has own IEEE address, users do not need to purchase separately address IEEE, IEEE address (MAC address) can be identified as a ZigBee module;
- Users can change the node type: the user can change the module type through the serial port command (Coordinator or Router)
- Users can change the radio channel: the user can change the module's radio channel through the serial port command

DRF Products:

TYPE	MODEL	FEATURES	PICTURE
ZigBee Module	DRF1605	<ul style="list-style-type: none"> ● UART Interface (TX & RX) to Zigbee ● Built-in RS485 direction control, RS485 chip can directly drive 	
	DRF1605H	<ul style="list-style-type: none"> ● UART Interface (TX & RX) to Zigbee ● Built-in RS485 direction control, RS485 chip can directly drive ● High power module, the distance can reach 1600M 	
	DRF2617A	<ul style="list-style-type: none"> ● RS232 Interface, Serial Port to Zigbee ● High power module, the distance can reach 1600M 	
	DRF2618A	<ul style="list-style-type: none"> ● USB B Type ● High power module, the distance can reach 1600M 	
	DRF2619A	<ul style="list-style-type: none"> ● RS485 Interface, Serial Port to Zigbee ● High power module, the distance can reach 1600M 	

Base Board	DRF1605-USB	<ul style="list-style-type: none"> ● Use with DRF1605 or DRF1605H, change the UART (TX RX) interface to USB port 	
	DRF1605-RS485A	<ul style="list-style-type: none"> ● Use with DRF1605 or DRF1605H, change the UART (TX RX) interface to RS485 port 	
	DRF1605-RS232A	<ul style="list-style-type: none"> ● Use with DRF1605 or DRF1605H, change the UART (TX RX) interface to RS232 port 	

2、DRF Zigbee Module's Network

Zigbee network node has three network forms: **Coordinator**, **Router**, **End Device**.

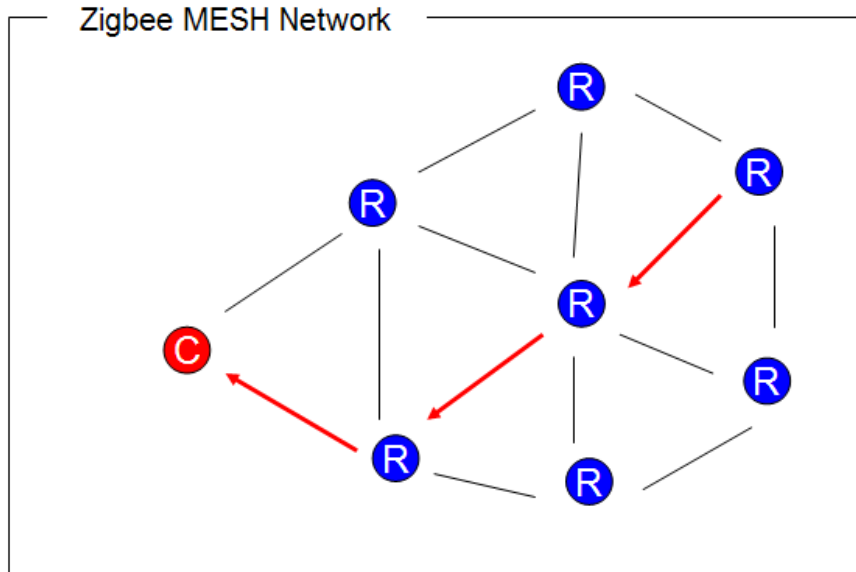
- **Coordinator:** used to create a Zigbee network, when a node joins, the assigned address to the child node, Coordinator usually defined as a device does not power down, no low-power state for the module DRF1605, DRF1605H, DRF2617A, DRF2618A, DRF2619A. Each Zigbee network needs and only needs a Coordinator, different networks PAN ID (network ID) should not, if there is room for two in the same Coordinator, PAN ID if they are the same as the original, and the latter on the power of the Coordinator of PAN ID will automatically add one to avoid PAN ID conflict.
- **Router:** responsible for forwarding data packets to find the most suitable routing path, when a node is added, the node can assign an address; Router is usually defined as a power supply device, not a low power state for the module DRF1605, DRF1605H, DRF2617A, DRF2618A, DRF2619A. Each Zigbee network may require more than one Router, Router can each send and receive data can also forward data when a network all by the Coordinator (1 unit) and Router (more) form, this network is the real MESH network (network like network), each node sends all the data is automatically routed to reach the target node.
- **When a ZigBee network formation (MESH network):**

Router to obtain the address (Short Address) is constant, can be used as point to point data transmission using the address;

Even if power-down Coordinator, Router still maintaining the network, so between the Router and the Router is still able to communicate;

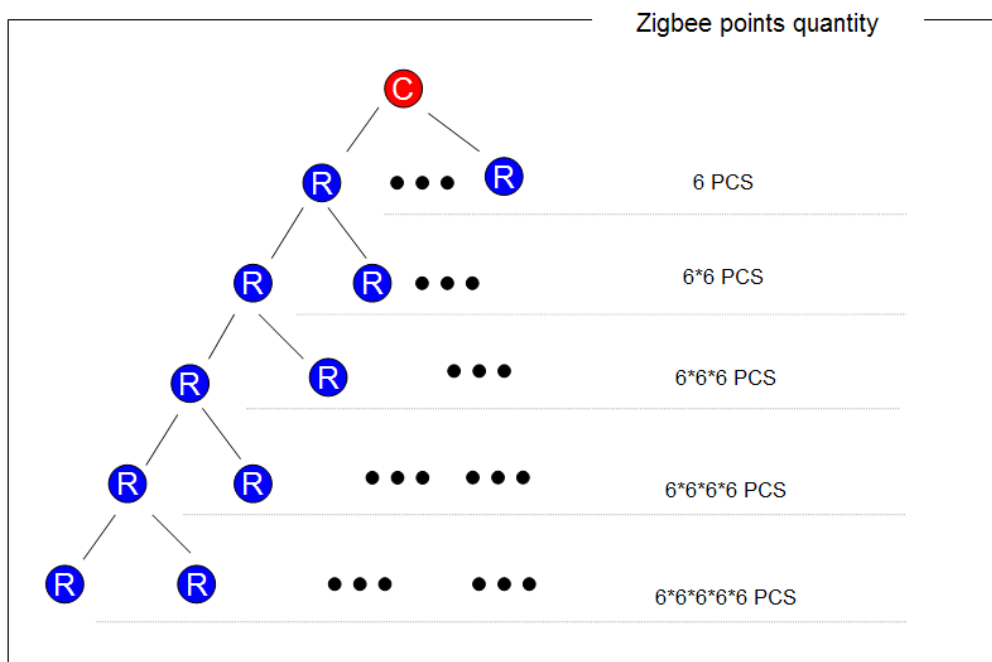
Coordinator power-down even when there are new nodes added, still able to get through the existing Router address, join the network;

Router is usually referred to as FFD (Full Function Device) (all-nodes)



Network nodes:

1 Coordinator + n Router, supports a total of 9331 nodes:



Zigbee MESH (mesh) is characterized by

- 1, the network consists of a Coordinator + n Router
- 2, each node both send and receive data, can also act as a router, forwarding data
- 3, the network can be any communication between nodes, even if all other nodes off (including the Coordinator), these two nodes can communicate
- 4, each node within the network (Coordinator, Router) are maintained with the network function, as long as one node is running, the new node can join the network by this node
- 5, node joins, the automatic distribution of the Zigbee network address, and keep the same address
- 6, route calculation is automatic forwarding of data does not depend so join the network node through which

Zigbee network networking and network testing

Basic concepts:

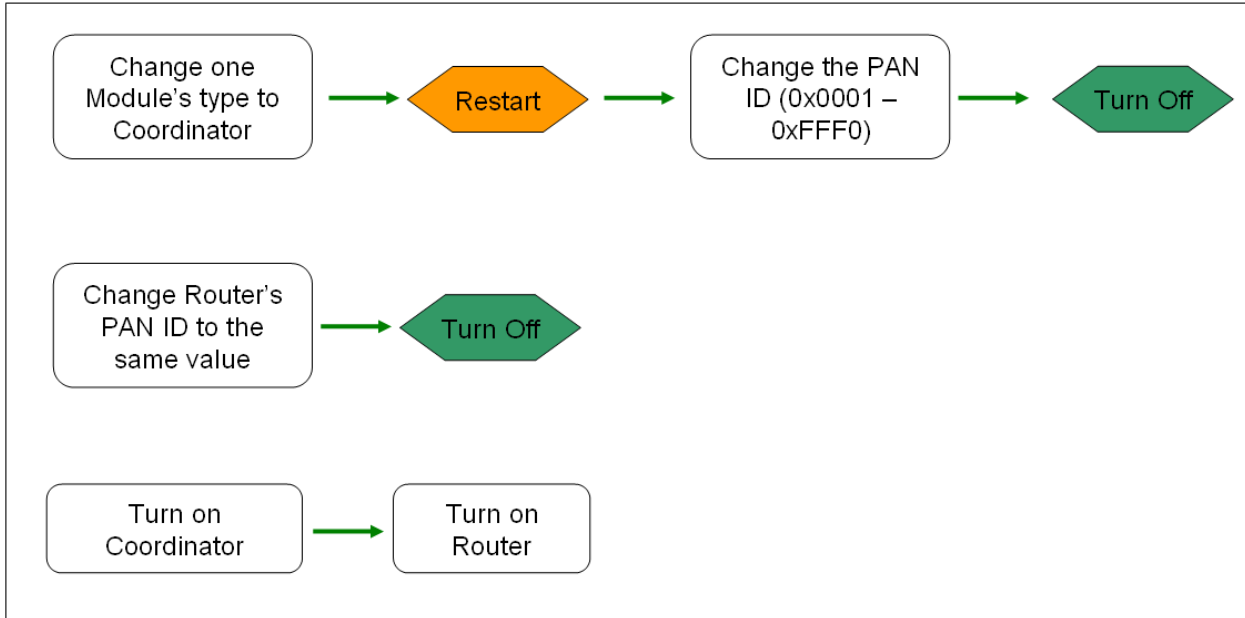
Zigbee module has two types of nodes, namely Coordinator (master) and Router (from node)
 Each Zigbee network consists of a Coordinator (master) and N-Router (from node)
 With a Zigbee network, all nodes must have the same channel and PAN ID (network ID)

Module factory default configuration:

Module factory all of the node type Router (from node), PAN ID = 0x199B, channels = 22 (2460MHz)

First use process:

- Choose one module and change it to Coordinator (using the configuration software), than restart it
- Change the Coordinator's PAN ID to your set of values (such as 0x1234) (range: 0x0001 - 0xFF00), mainly to prevent conflicts with the default values (default is 0x199B), than power off it.
- Change the Router's PAN ID to the same value (just look for the network with the same PAN ID) (or to 0xFFFF, automatically search for any network), than power off it.
- Turn on the Coordinator first (a long bright light, a light flash)
- Than open the other Router's power supply (two lights flash), about 3 seconds, can automatically join the network (two long bright light)



Change the network:


- 1, if you want the Router to join a new network, change the Router's PAN ID to new (same as Coordinator or 0xFFFF), then restart it, it can join new network automatically.
- 2, Do not try to be a Coordinator to join an existing network, even if you can join the network is not strong, Coordinator may withdraw from power-down after reboot network;
- 3, when a network is running properly, do not try to re-set the Coordinator's PAN ID, even if the same PAN ID,

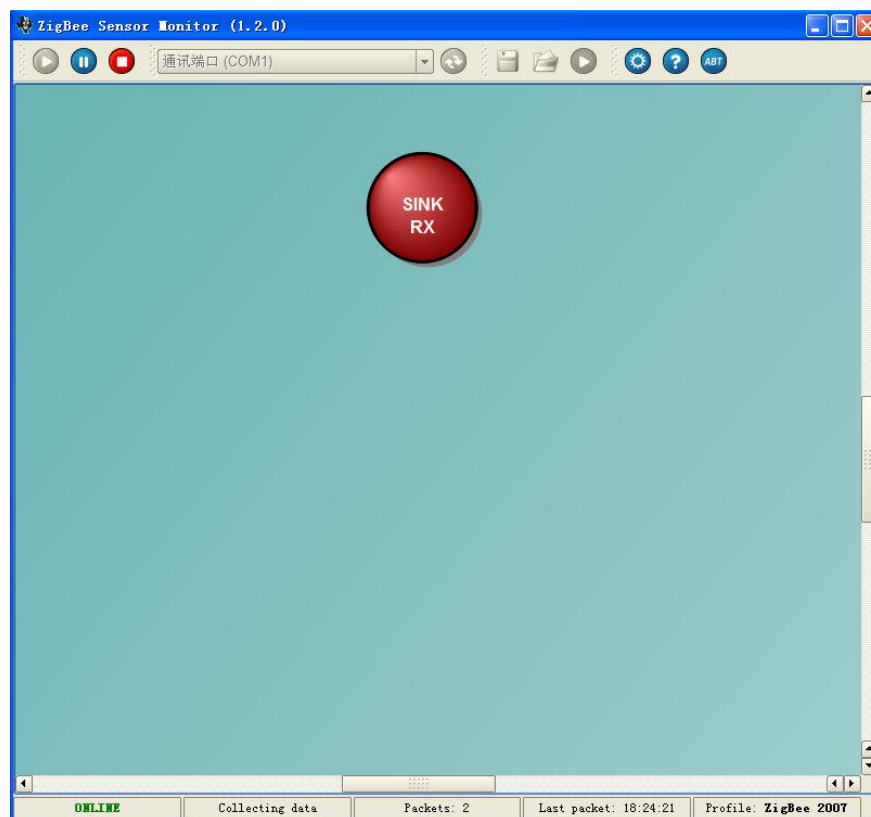
because the Coordinator after the restart, scan to the same PAN ID of the network, its PAN ID will automatically +1 to avoid PAN ID conflict.

In order to visualize the process of ZigBee network building, DRF1601/1602/DRF1605/DRF1605H set compatible with TI's Sensor Monitor software, through TI's Sensor Monitor software to monitor and test the module's network connection.

Users can download the software at the TI website: <http://www.ti.com/cn/litv/zip/swrc096d>

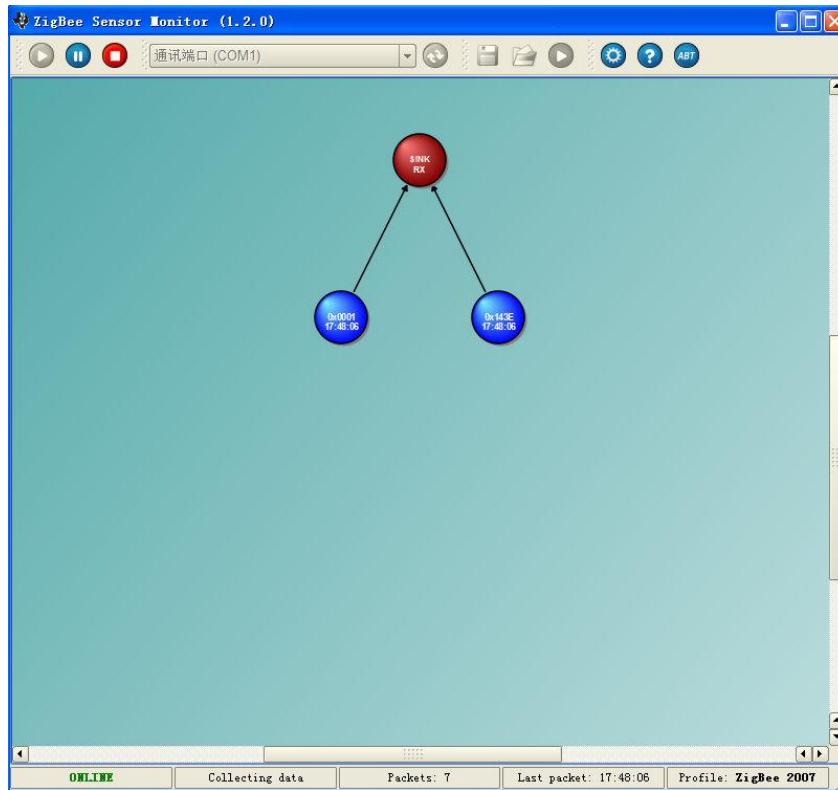
(1), Take a Coordinator connect to PC through the serial port, open the Sensor Monitor Software and click the

RUN icon  to run, then you can see that the icon turns red Coordinator, said the Coordinator and the PC successful connection. (Note: TI Sensor Monitor software only supports serial baud rate of 38400)

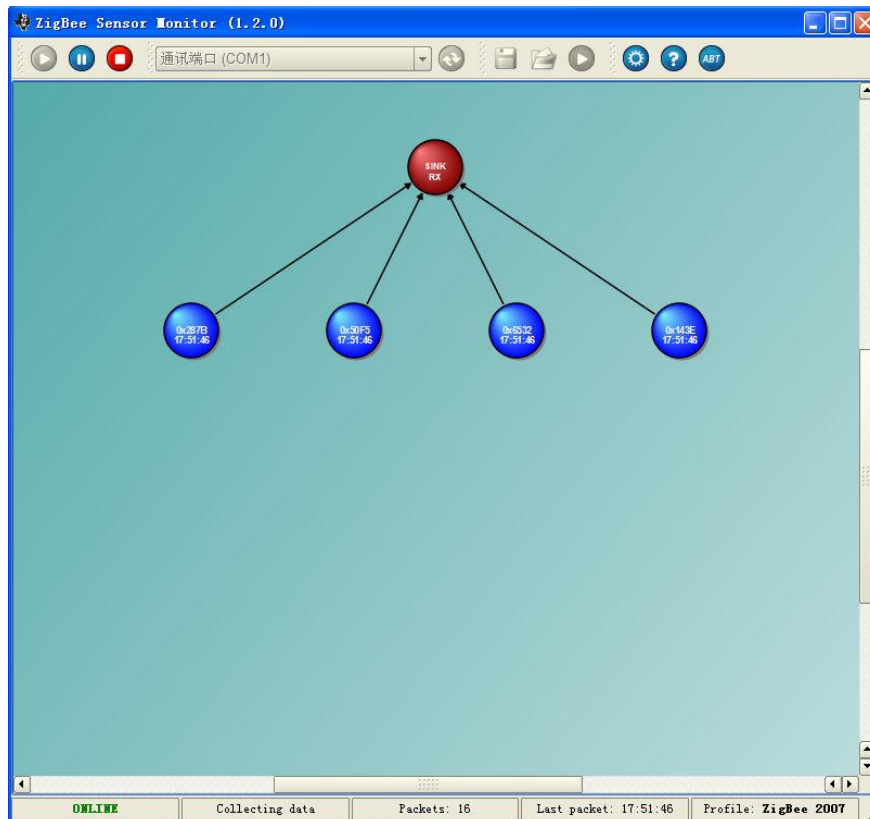


(2), Take a Router module and power on, click the TEST button, this time, Router module sends an test data to Coordinator, Coordinator will send the data via the serial port to the PC, and TI Sensor Monitor software will display this Router point, as shown:

(DRF1605 / DRF1605H the TEST button is J2- Pin3 (SW1), short it with grand)

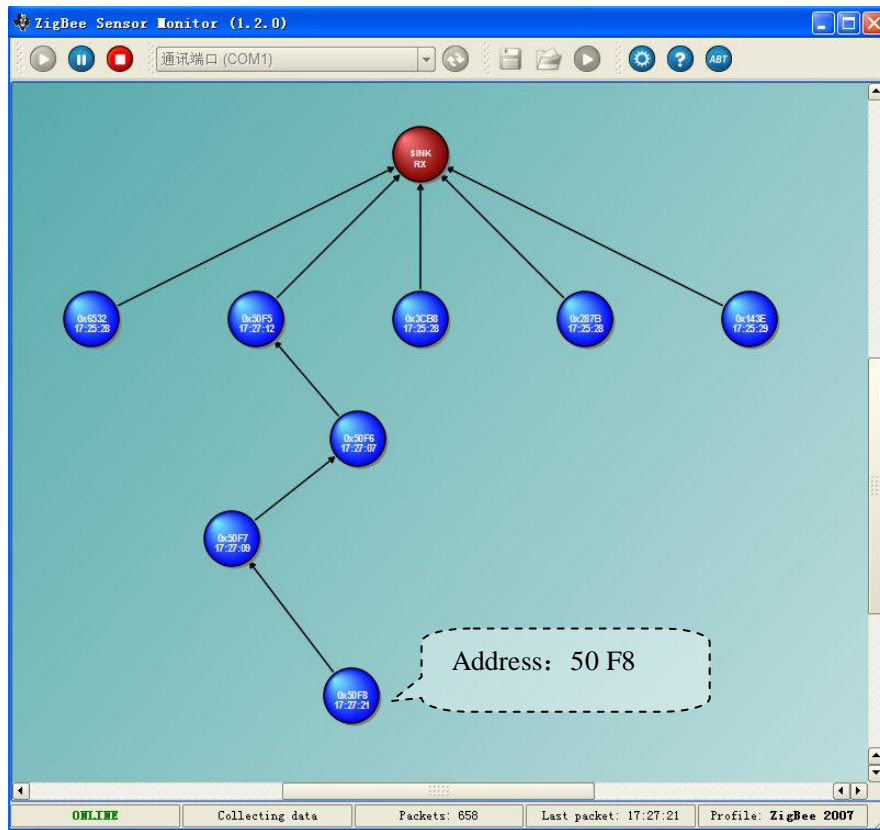


(3) Similarly, take others Router module power on, they will automatically find and join the network, press the TEST button, after the network is structured as follows:

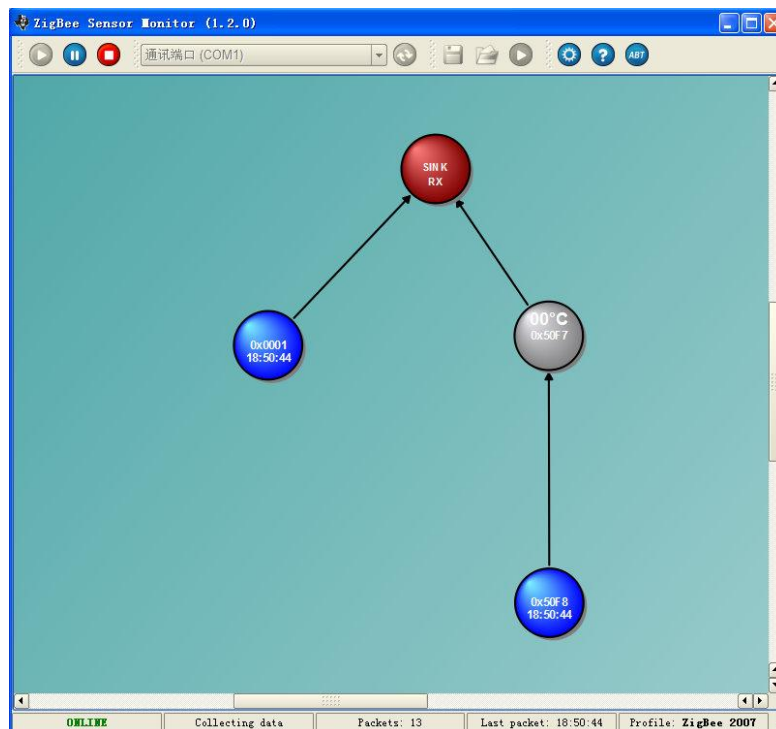


(4), Coordinator can directly assign six Router's address, after it, other Routers can join network through the

first 6 points, each of Router can assign 6 address to other Routers and allow them to join network.



These Routers which assigned address by front Routers, not affect by the front Routers, don't care them is in power on or power off, all Router can calculate data path automatically.



3、 DRF Series Zigbee Module's Data Transmission

There are two method to send data:

(1), transparent data transmission:

Just need the first byte is not transmitted 0xFE, 0xFD or 0xFC, then automatically enter transparent data transmission mode;

Coordinator from the serial data received will be sent automatically to all nodes;

A node receives the data from the serial port will be automatically sent to the Coordinator;

(2), point to point data transmission:

Zigbee network between nodes within any, can be point to point transfer instructions, to transmit data;

Format: 0xFD + destination address + data length + data

1, transparent data transmission: (Are the most important functions for DRF series Zigbee module)

(1), if the first byte is not 0xFE, 0xFD or 0xFC, then automatically enter transparent data transmission mode;

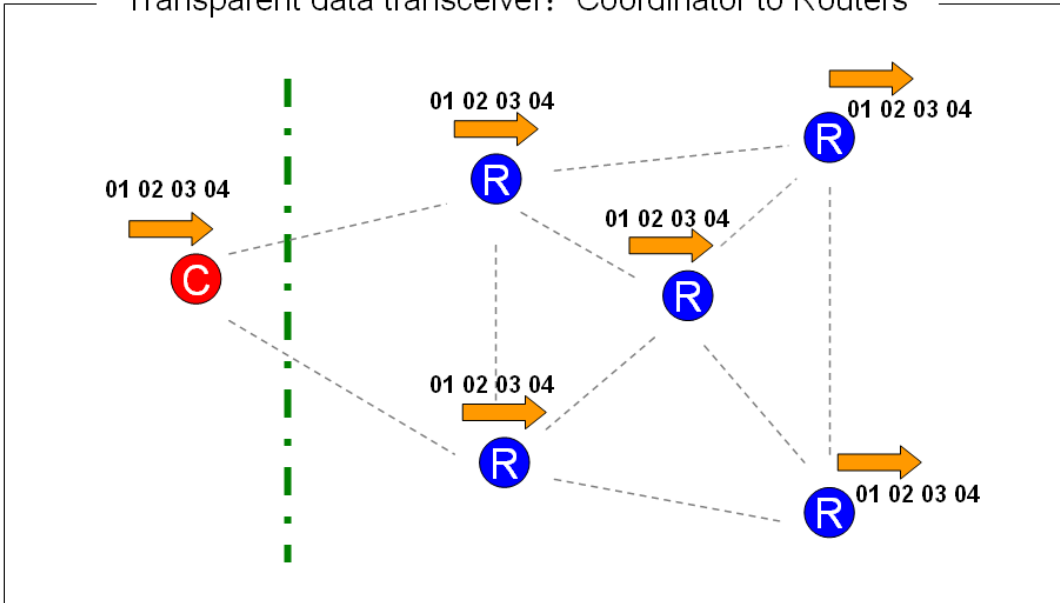
(Extension: the packet header and not the same as instruction set, also as a transparent data transmission, but suggested that when the user using data transparent transmission function, the first byte of data packets set a non 0xFE, 0xFD, or 0xFC, such as 0xA7)

(2), Coordinator of the data received from the serial port will be automatically sent to all nodes; a node receives the data from the serial port will be automatically sent to the Coordinator;

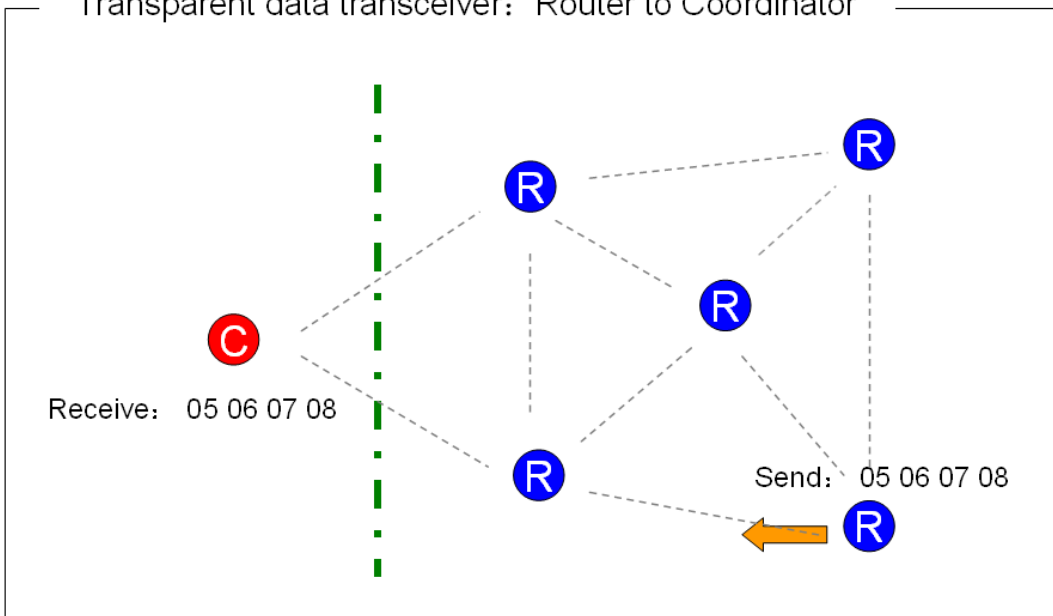
(3), between any node and Coordinator, similar to the cable connected directly (in most cases, a Coordinator and a Router can instead of a RS232 cable directly);

(4), to support variable-length packets (without setting), the maximum does not exceed 256 bytes / packet, the packet is generally recommended that each application within 32 bytes.

Transparent data transceiver: Coordinator to Routers



Transparent data transceiver: Router to Coordinator



Transparent data transmission performance:

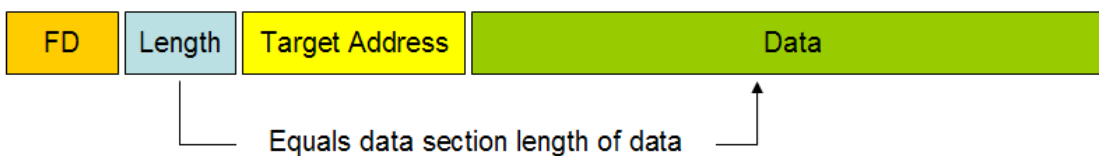
Direction	Length of Data Package	Fastest Interval
Router → Coordinator	16 Bytes	20 ms
	32 Bytes	20 ms
	64 Bytes	20 ms
	128 Bytes	50 ms
	256 Bytes	200 ms
	> 256 Bytes	Can't Send
Coordinator → Router	16 Bytes	100 ms
	32 Bytes	100 ms
	64 Bytes	100 ms
	128 Bytes	200 ms
	256 Bytes	500 ms
	> 256 Bytes	Can't Send
Test conditions: 1, room temperature, laboratory conditions 2, inter-module distance of 2 meters, a good signal 3, 38400 baud rate (the most preferred baud rate) 4, continuous send, receive, 100K bytes, error-free, continuous testing 10 times 5, test software: serial debugging assistant SSCOM3.2		

With the increase of the distance between modules, the transfer rate will be reduced
 Coordinator sends to Router is broadcast, transmit rate will be slower
 General application, recommended that each packet of 32 bytes each transfer interval 200-300ms

2, point to point data transmission:

Send Format:

Data transfer instructions (0xFD) + data length + destination address + data(up to 32 Bytes)



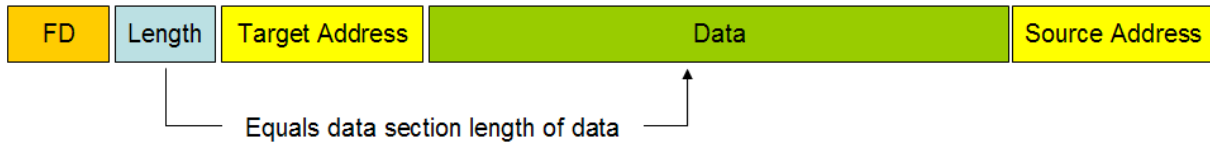
Example:

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

- FD: Data transfer instructions
- 0A: Data Length, 10 Bytes
- 14 3E: Destination Address
- 01 02 03 04 05 06 07 08 09 10: Data

Receive data format:

Receive all the data that from the sender, and add two bytes at the last for source address



Example:

FD 0A 14 3E 01 02 03 04 05 06 07 08 09 10 50 F5

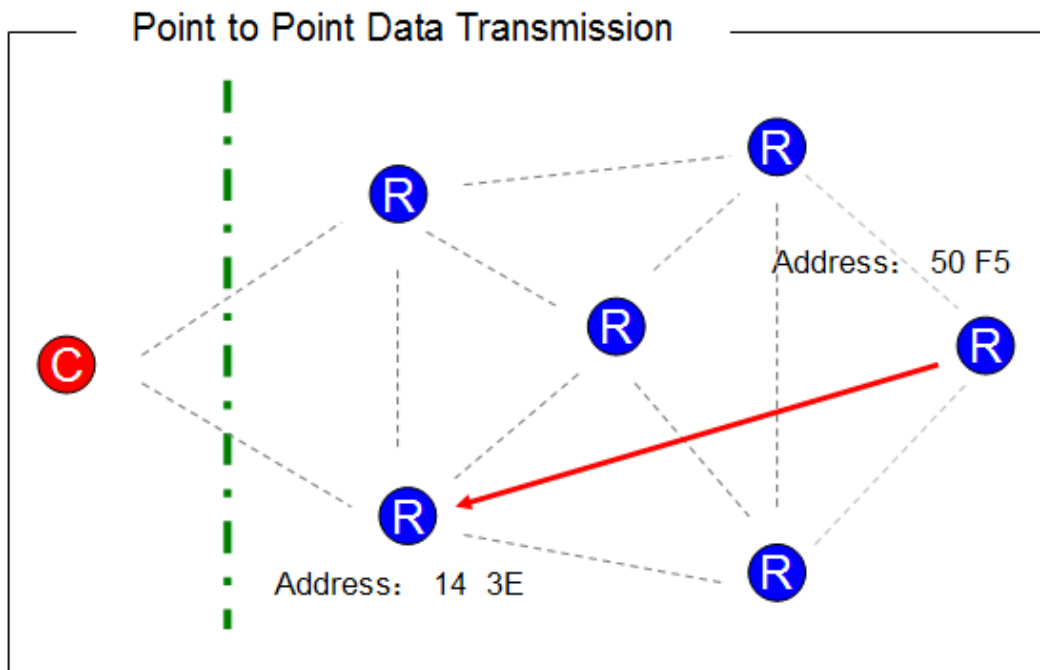
FD: Data transfer instructions

0A: Data Length, 10 Bytes

14 3E: Destination Address for sender and the self address for receiver

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

50 F5: Source address



Point to point data transmission can be send between any points in the network:

- Even Coordinator power off, the point to point data transmission also can send between Routers.
- After Router joined the network, the address (Short Address) will not change;
- Length of the byte data area must be equal to the length of the data, or data transmission errors (as a transparent transmission, sent to the Coordinator);
- Up to 32 bytes of data area, or data transmission errors (as a transparent transmission, sent to the Coordinator);
- Destination address = 0xFF 0xFF, was broadcast transmission, will be sent to all nodes within the network;
- Destination address = 0x00 0x00, then sent to the Coordinator

Point to point data transfer performance:

Direction	Length of Data Package	Fastest Interval
Router → Router	32 Bytes	40 ms
Coordinator → Router	32 Bytes	40 ms
Router → Coordinator	32 Bytes	40 ms
Test conditions: 1, room temperature, laboratory conditions 2, inter-module distance of 2 meters, a good signal 3, 38400 baud rate (the most preferred baud rate) 4, continuous send, receive, 100K bytes, error-free, continuous testing 10 times 5, test software: serial debugging assistant SSCOM3.2		

4、Setting Instruction for DRF Series Zigbee Module

NO.	Instruction	Function	Return	Restart?
1	FC 02 91 01 XX XX XY (XY =The sum for the first 6 Bytes and keep low 8 Bit , same as follow)	Set the module's PAN ID to a specific value XX XX 1, If Setting the PAN ID to FF FF If It's Coordinator, restart automatically generate a new PAN ID If It's Router, after restarted then will research new network and join automatically Can not be set to FF FE 2 resetting after the PAN ID (or the same value after reset) If the Coordinator, will clear the network nodes have been joined If Router, Clear has joined the network, find and re-join the network	XX XX Example: Input: FC 02 91 01 12 34 D6 Return: 12 34	Yes
2	FC 00 91 02 (Canceled)			Yes
3	FC 00 91 03 A3 B3 XY	Read PAN ID	PAN ID Value 1, If it's a Router and not join network, is FF FE 2, Coordinator's value as setting value	No
4	FC 00 91 04 C4 D4 XY	Read Short Address	Short Address 1, If it's a Router and not join network, is FF FE 2, Coordinator's Short Address always is 00 00	No
5	FC 00 91 05 (Canceled)			No
6	FC 01 91 06 XX F6 XY	Set the module's serial port baud rate XX = 01: 9600 XX = 02: 19200 XX = 03: 38400 XX = 04: 57600 XX = 05: 115200	00 00 09 06 00 00 00 01 09 02 00 00 00 03 08 04 00 00 00 05 07 06 00 00 01 01 05 02 00 00	Yes
7	FC 00 91 07 97 A7 XY	Test module's serial port baud rate	If the serial port baud rate is correct, return to: 01 02 03 04 05 If the serial port baud rate error, no return	No

8	FC 00 91 08 A8 B8 XY	Read MAC Address	MAC Address (8 Bytes) Example: 00 12 4B FF 56 78 FE FF	No
9	FC 00 91 09 A9 C9 XY	Setting Module to Coordinator (PAN ID change to: 19 9B)	If Setting correct, return: 43 6F 6F 72 64 3B 00 19	Yes
10	FC 00 91 0A BA DA XY	Setting Module to Router (PAN ID change to: 19 9B)	If Setting correct, return: 52 6F 75 74 65 3B 00 19	Yes
11	FC 00 91 0B CB EB XY	Read Module's point type (Coordinator or Router)	If it's Coordinator, return 43 6F 6F 72 64 69 If it's Router, return 52 6F 75 74 65 72	No
12	FC 01 91 0C XX 1A XY	Setting module's radio channel: XX = 0B: Channel 11, 2405MHz XX = 0C: Channel 12, 2410MHz XX = 0D: Channel 13, 2415MHz XX = 0E: Channel 14, 2420MHz XX = 0F: Channel 15, 2425MHz XX = 10: Channel 16, 2430MHz XX = 11: Channel 17, 2435MHz XX = 12: Channel 18, 2440MHz XX = 13: Channel 19, 2445MHz XX = 14: Channel 20, 2450MHz XX = 15: Channel 21, 2455MHz XX = 16: Channel 22, 2460MHz XX = 17: Channel 23, 2465MHz XX = 18: Channel 24, 2470MHz XX = 19: Channel 25, 2475MHz XX = 1A: Channel 26, 2480MHz	Return: 00 08 00 00 0B 00 10 00 00 0C 00 20 00 00 0D 00 40 00 00 0E 00 80 00 00 0F 00 00 01 00 10 00 00 02 00 11 00 00 04 00 12 00 00 08 00 13 00 00 10 00 14 00 00 20 00 15 00 00 40 00 16 00 00 80 00 17 00 00 00 01 18 00 00 00 02 19 00 00 00 04 1A	Yes
13	FC 00 91 0D 34 2B XY	Read module's Radio Channel	Return: 00 00 08 00 52 0B 00 00 10 00 52 0C 00 00 20 00 52 0D 00 00 40 00 52 0E 00 00 80 00 52 0F 00 01 00 00 52 10 00 02 00 00 52 11 00 04 00 00 52 12 00 08 00 00 52 13 00 10 00 00 52 14 00 20 00 00 52 15 00 40 00 00 52 16	No

			00 80 00 00 52 17 01 00 00 00 52 18 02 00 00 00 52 19 04 00 00 00 52 1A	
14	FC 01 91 64 58 XX XY	Setting Module's transfer mode XX = 01, Transparent transfer XX = 02, Transparent transfer and add short address at the end of data package XX = 03, Transparent transfer and add MAC address at the end of data package	Return: Correct: 06 07 08 09 0A XX Error: 16 17 18 19 1A FF	
15	FC 00 91 87 6A 35 XY	Module Restart	Module Restart	

XY =The sum for the first 6 Bytes and keep low 8 Bit

User also can use Zigbee Module configure software to Setting Zigbee Module

