ZigBee Module User Guider

V4.0

DTK Electronics Products

DRF1601   DRF1602   DRF1605   USB Board（Use with DRF1605）   RS485 Board（Use with DRF1605）

Catalog

1. DRF Series Zigbee Module Advantage:

DRF Series Zigbee Module include DRF1601, DRF1602 and DRF1605, it use TI-CC2530F256 chip, and have ZigBee 2007/PRO protocol inside.

Create network automatically is the mainly specification for DRF series ZigBee Module, this can quick customer's products to marketing. Customers not need to learn ZigBee protocol and can use ZigBee advantage at their products.

The Advantage:

1, Create network automatically

At the first using, when DRF1600 Zigbee Module power on, the Router can search and join network automatically, after the first using, all the network point can keep this network status, no mater you turn on of turn off these points, all of them will keep in the network.

2, Very easy to use

At the most situations, two Zigbee points just as one RS232 (or UART) cable, using Zigbee Module not need driver or API.

3, Simply data transmission

The data received from UART at Coordinator can send to all point automatically.

The data received from UART at Router can send to Coordinator automatically.

Data transceiver can be at any points, just need one instruction.
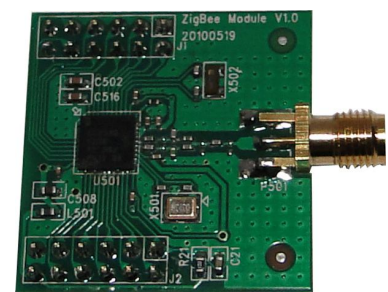
DRF Series Products：

Type	Specification
DRF1601	RS232，Debug interface，10 IO，2 LED for Active and TX/RX，TEST & RESET key
DRF1602	As above and housing
DRF1605	All IO for CC2530, UART interface (TX, RX for 3.3V TTL), little size fit for embedded application
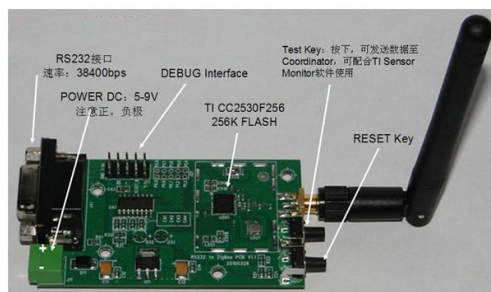
DRF1601   DRF1602   DRF1605

2. The parameters for DRF series Zigbee module

DRF1601

Electronics

Input Power：DC 5-12V

Temperature：-40^{0}C --85^{0}C

Interface: RS232

UART brand rate：38400bps（Default），Selectable 9600bps, 19200bps, 38400bps, 115200bps。

Wireless Frequency：2.4GHz

Wireless Protocol：ZigBee2007 /PRO

Transfer Distance：400 meters for in sighted distance
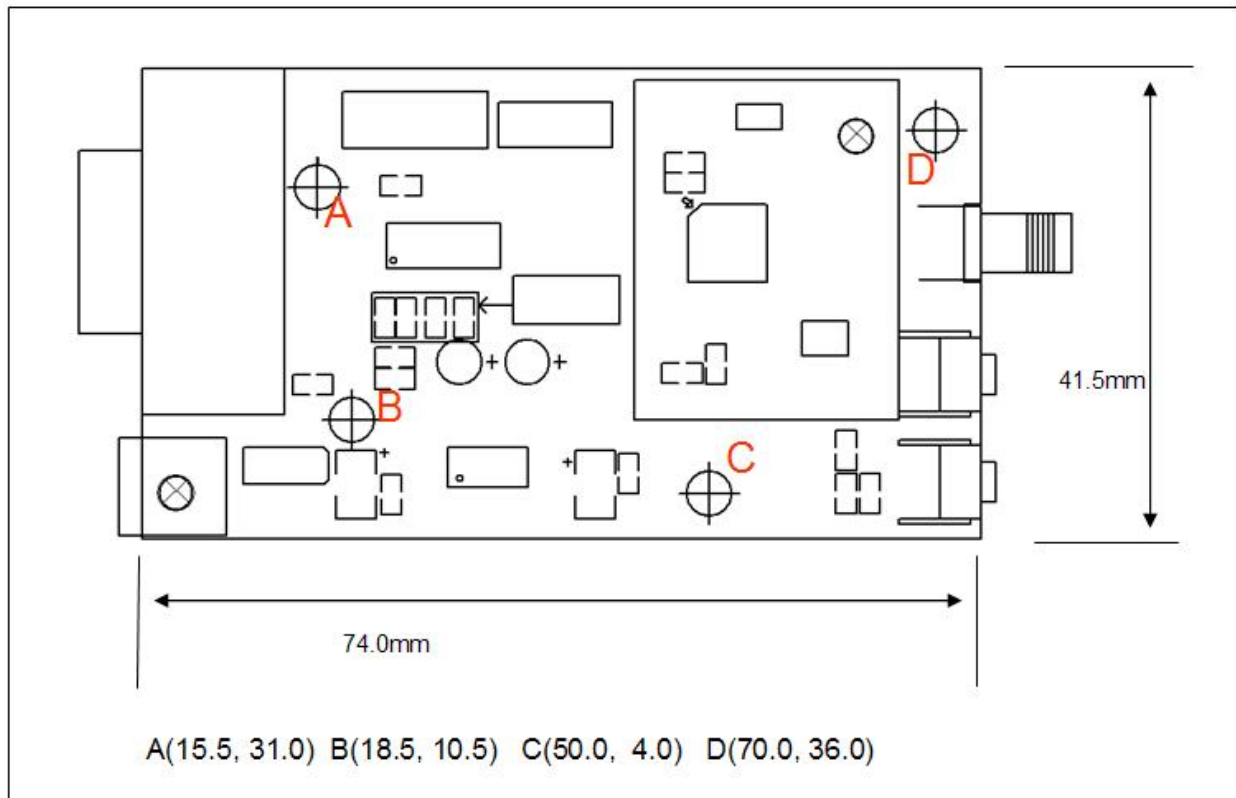
MAX send current：34mA
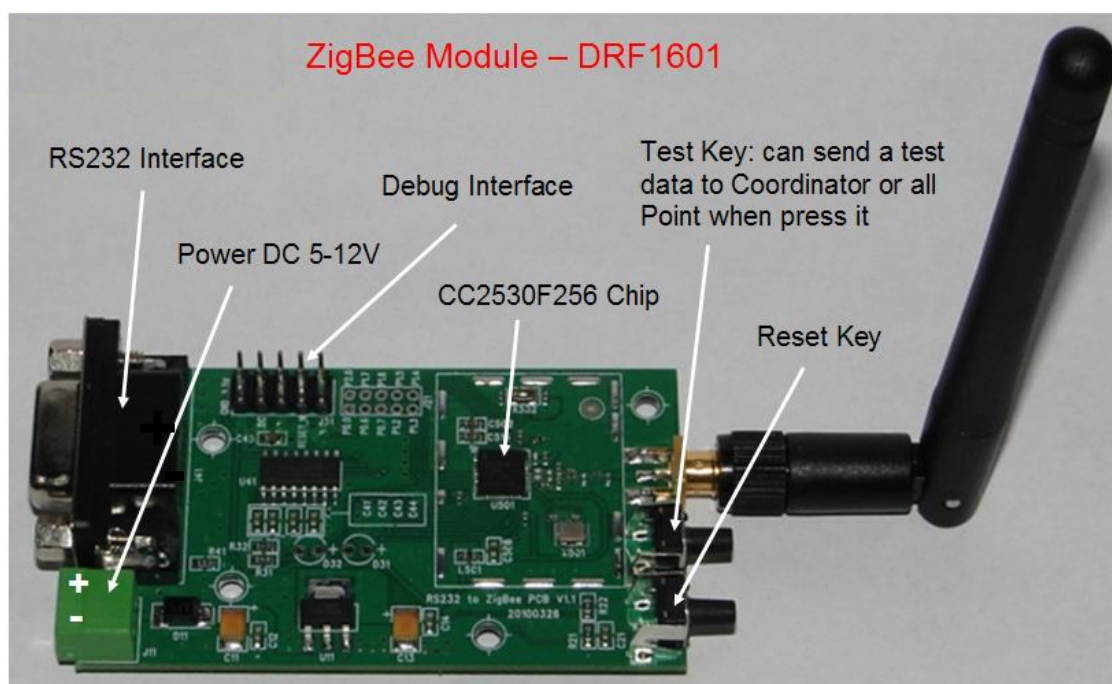
MAX receiving current：25mA

Receiving sensitivity：-96dBm

Chips：CC2530F256，256KFLASH

Mechanism

A(15.5, 31.0) B(18.5, 10.5) C(50.0, 4.0) D(70.0, 36.0)

Size: 74 * 41.5 mm

3，Inner structure

RS232

Debug Interface

CC2530F256

Power: DC 5-12V

LED Indicate:
-- Active (D31)
-- TX/RX (D32)

TEST Key

RESET Key

ZigBee Module – DRF1601

RS232 Interface

Power DC 5-12V

Debug Interface

CC2530F256 Chip

Test Key: can send a test data to Coordinator or all Point when press it

Reset Key

DRF1602

Electronics

Input Power：DC 5-12V

Temperature：-40^{0}C --85^{0}C

Interface: RS232

UART brand rate：38400bps（Default），Selectable 9600bps, 19200bps, 38400bps, 115200bps。

Wireless Frequency：2.4GHz

Wireless Protocol：ZigBee2007 /PRO

Transfer Distance：400 meters for in sighted distance

MAX send current：34mA
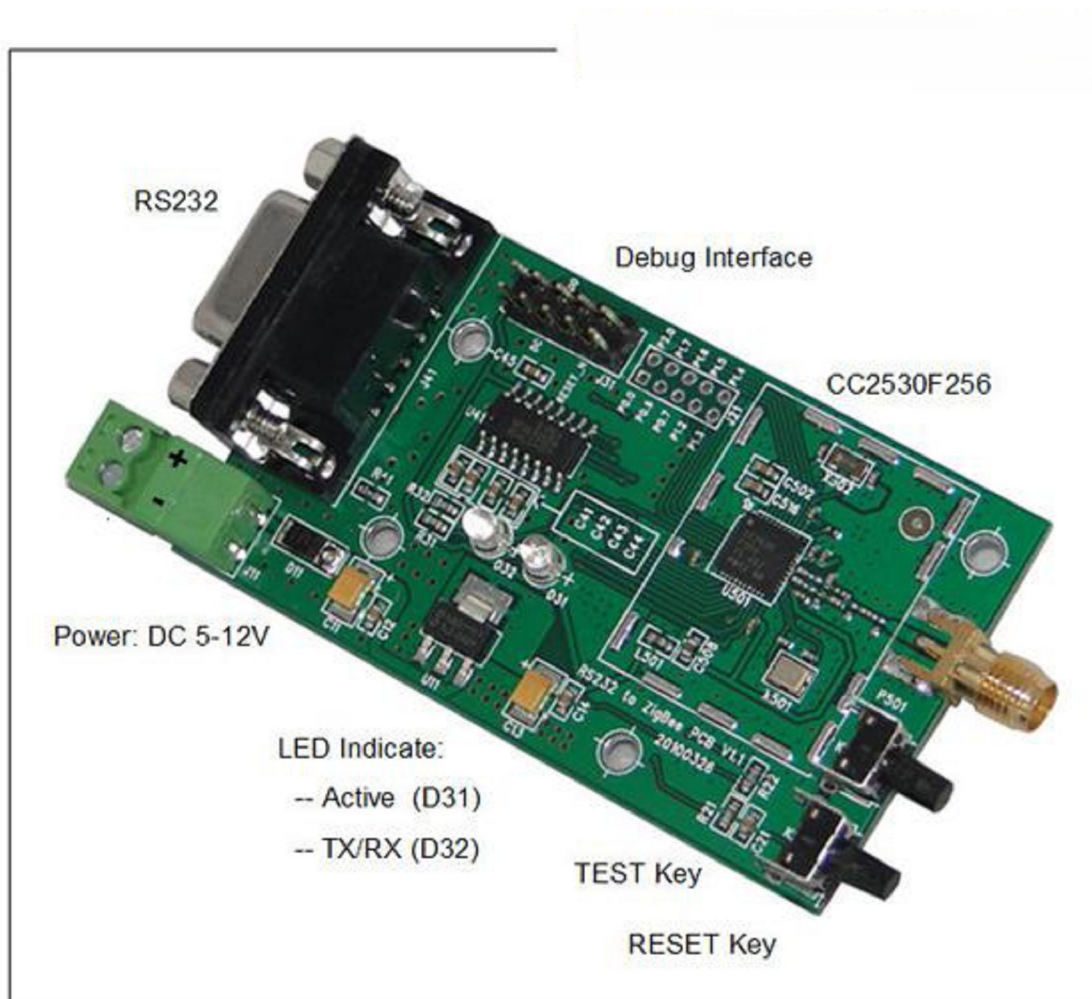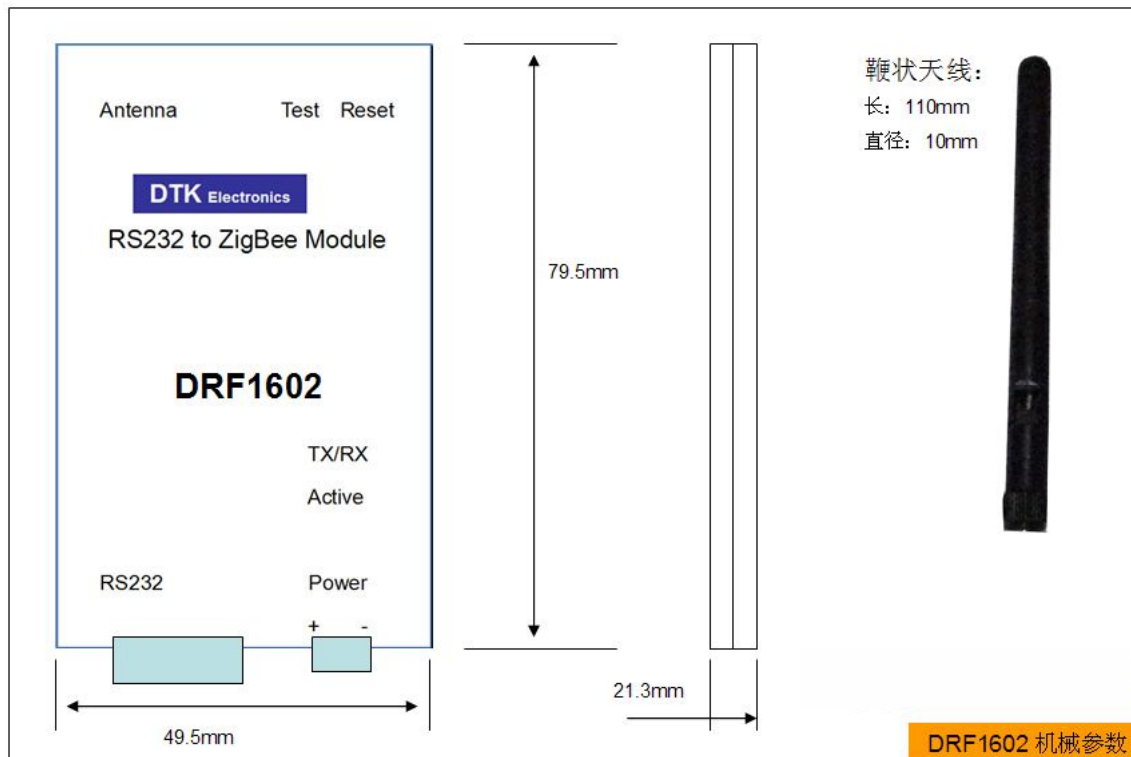
MAX receiving current：25mA
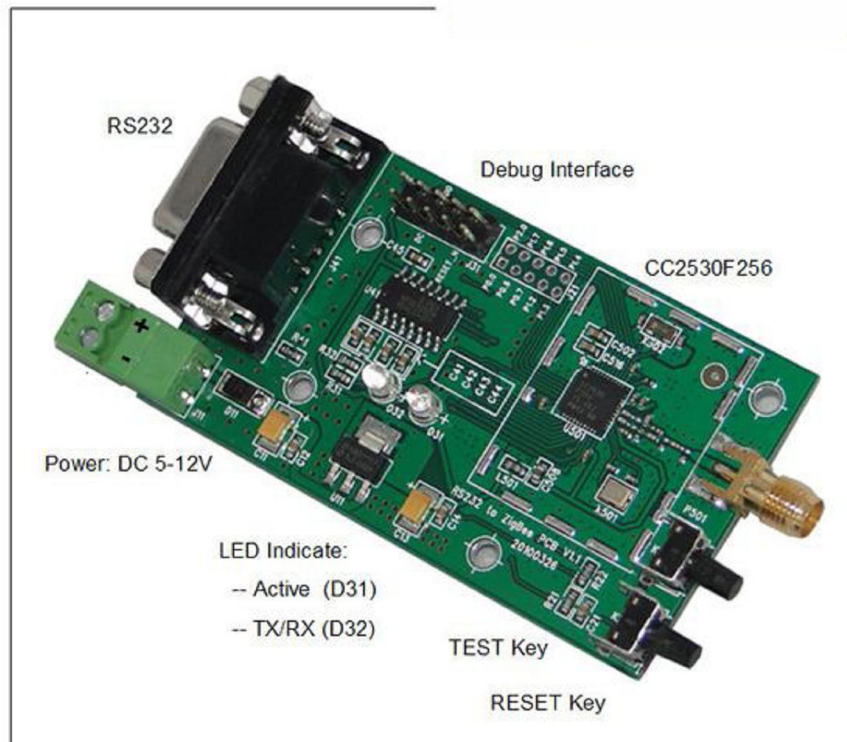
Receiving sensitivity：-96dBm

Chips：CC2530F256，256KFLASH

Mechanism

DRF1602 Size：79.5 * 49.5 * 21.3mm

Inner structure

(As same as DRF1601)

Outside

DRF1605

Electronics

Input Power：**DC 3.3V**

Temperature：-40^{0}C --85^{0}C

Interface: UART, 3.3V (TTL or 3.3V CMOS)

UART brand rate：38400bps（Default），Selectable 9600bps, 19200bps, 38400bps, 115200bps。

Wireless Frequency：2.4GHz

Wireless Protocol：ZigBee2007 /PRO
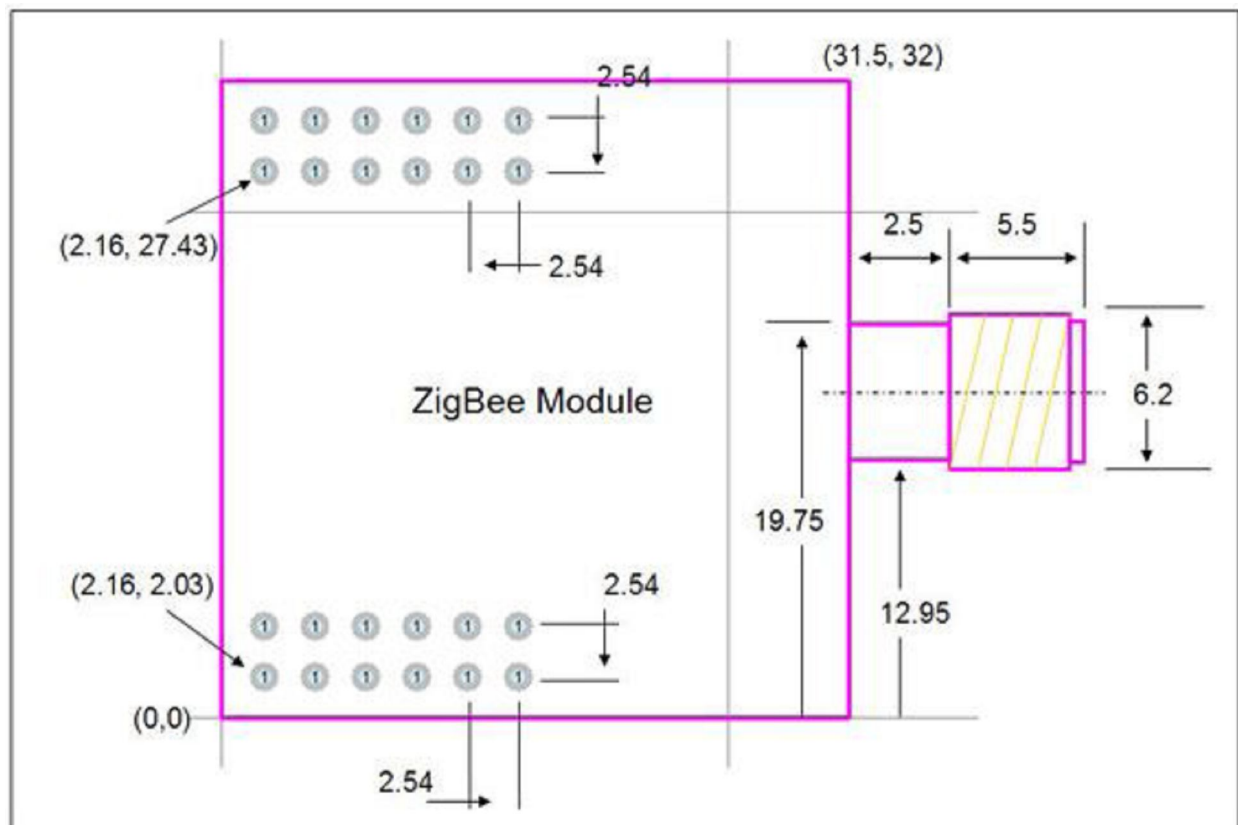
Transfer Distance：400 meters for in sighted distance

MAX send current：34mA
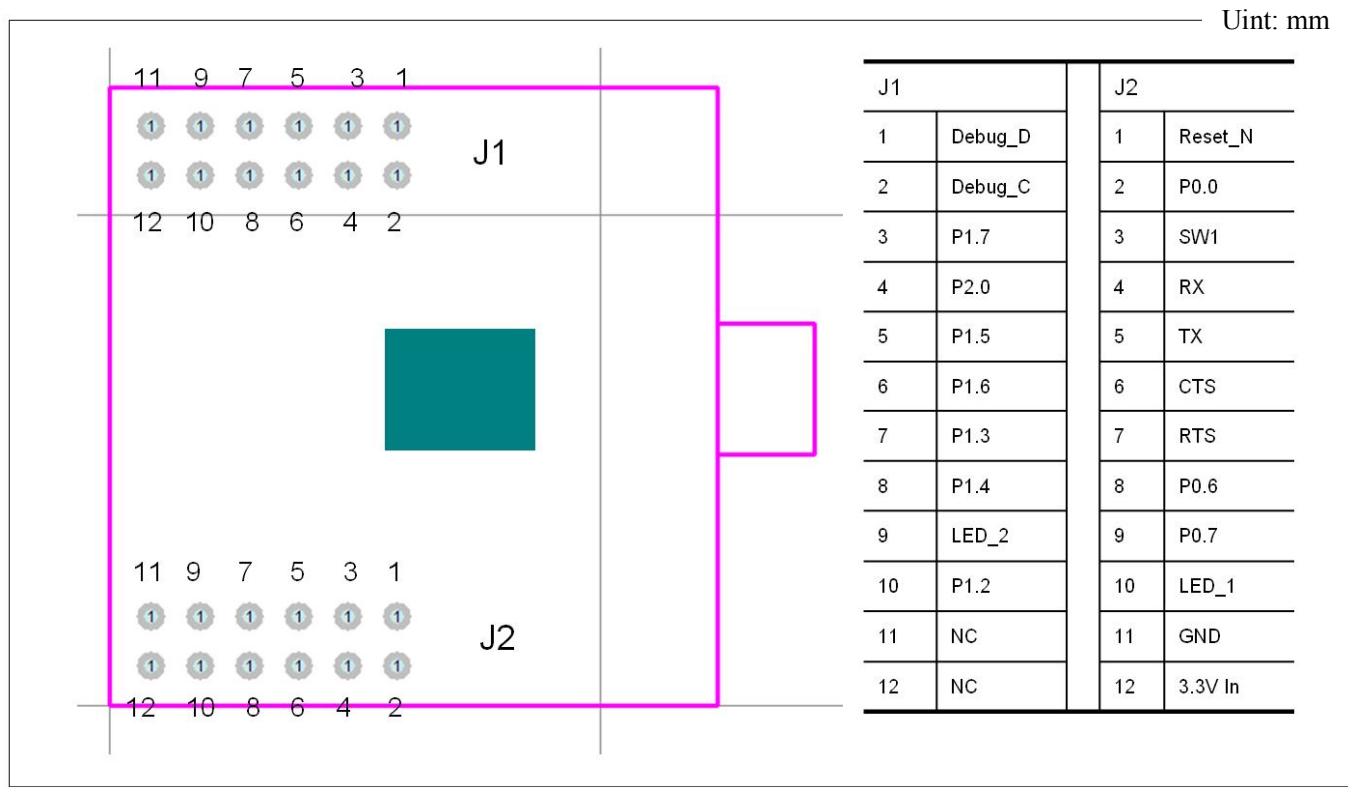
MAX receiving current：25mA

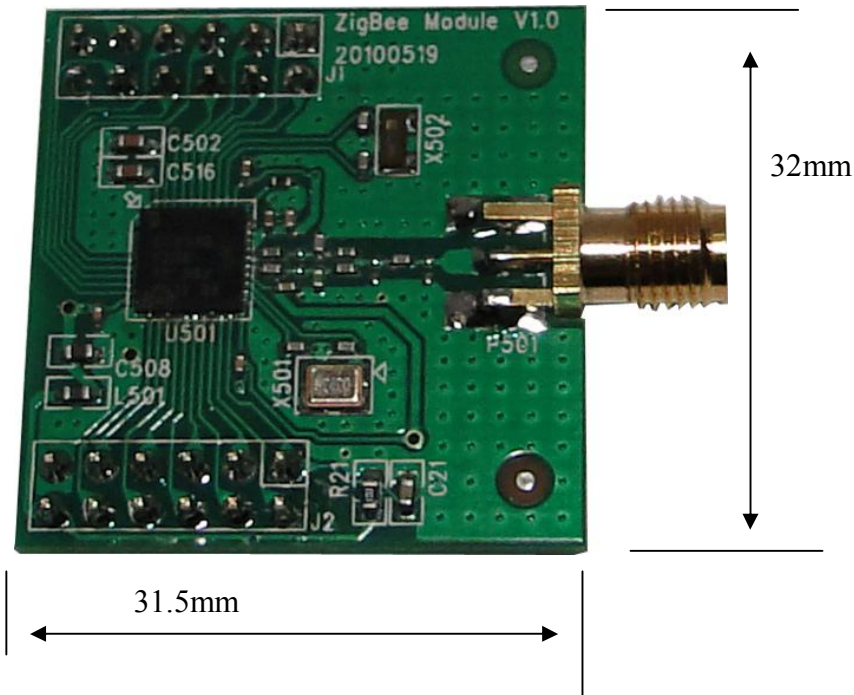Receiving sensitivity：-96dBm

Chips：CC2530F256，256KFLASH

Mechanism

Unit: mm

DRF1605 Pin definition

Uint: mm

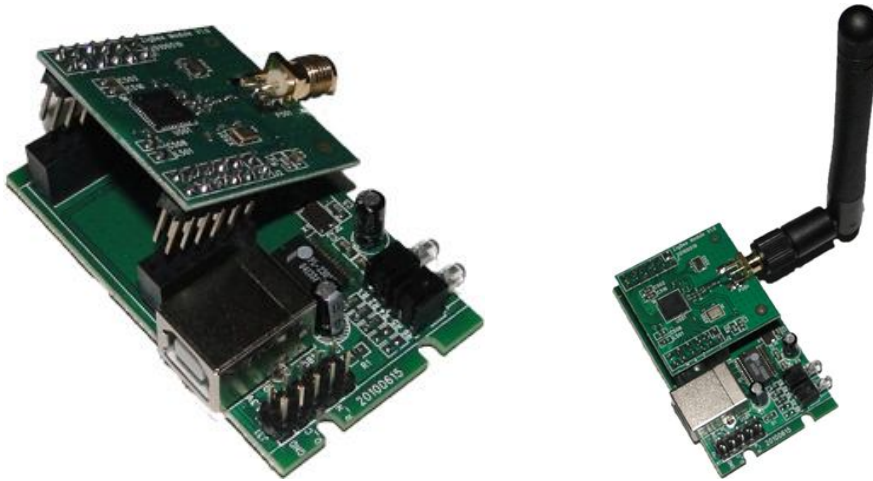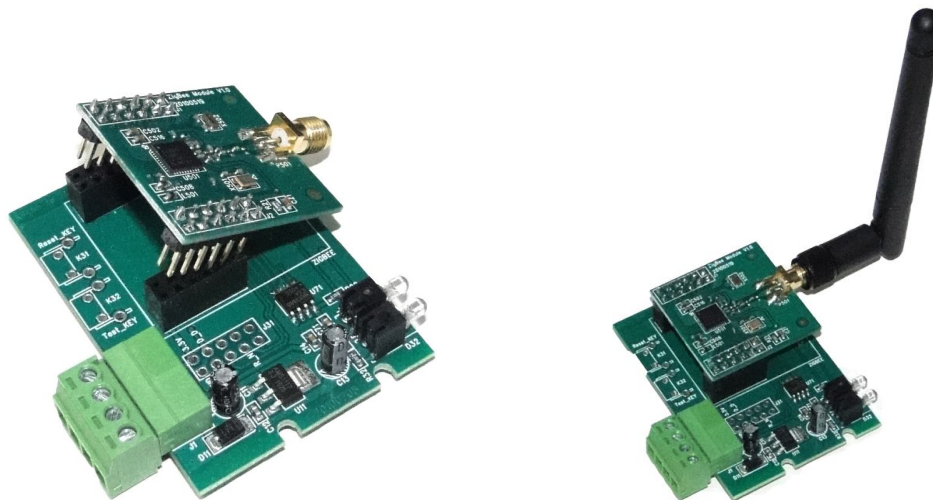| J1			J2	
1	Debug_D		1	Reset_N
2	Debug_C		2	P0.0
3	P1.7		3	SW1
4	P2.0		4	RX
5	P1.5		5	TX
6	P1.6		6	CTS
7	P1.3		7	RTS
8	P1.4		8	P0.6
9	LED_2		9	P0.7
10	P1.2		10	LED_1
11	NC		11	GND
12	NC		12	3.3V In

Outside

32mm

31.5mm

The advantage for DRF1605

Customer can use it with ZigBee USB mother board as follow, this function as USB to Zigbee.
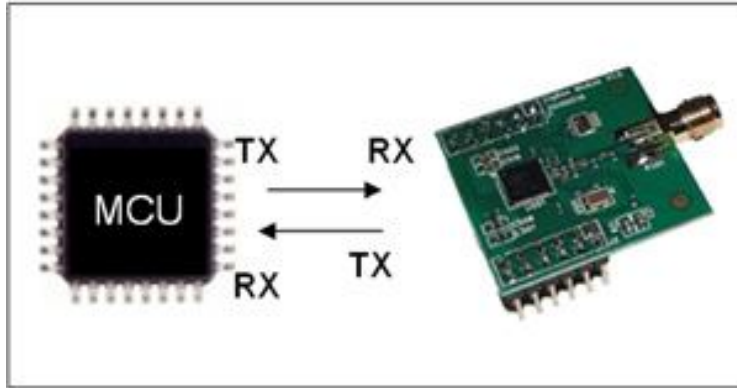

Customer can use it with RS485 mother board, this function as RS485 to Zigbee.

As the pin distance is 2.54mm or 2.54*n, thus it can connector to versatile board

Any MCU can connect to this module, just need MCU has UART (TX & RX @ 3.3V).

3, How to create network for ZigBee Module

## The point type for Zigbee network:
There are three point type for Zigbee network: Coordinator, Router and End Device.

Coordinator: Used to create a Zigbee network and assign address to Router or End Device when them join this network, Coordinator used as all powered on device, at one Zigbee network only need one Coordinator, Coordinator use PAN ID to differentiate other network, the networks which have different PAN ID can't conflict at one space.

Router: Can receive and send data, can resend data as other points bridge, Router also have keep a Zigbee network function, and Router can assign address to others points when them join this network. Normally, Router also called as FFD (Full Function Device.

End Device: this point only can receive and send data, at most situations, this type of point defined as battery powered device, can periodically weak up to receive or send data.

DTK Zigbee Module's main function is data transceiver, so our Zigbee Module only have Coordinator and Router points, when a Zigbee network include one Coordinator and n Routers, this Zigbee network normally called as MESH network, as follow:
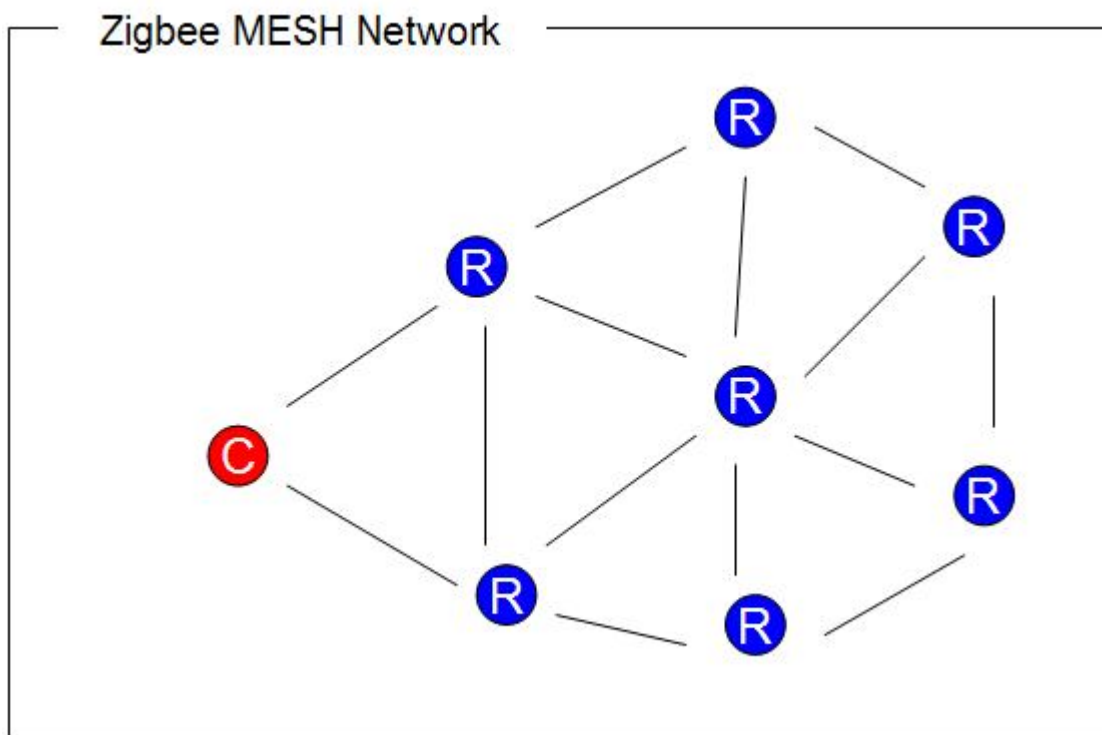
So, when you order Zigbee Module, we will send you 1 Coordinator and n PCS Routers as default configure.

To crates a Zigbee network:
1, turn on the Coordinator;
2, turn on other Routers, these Router can search and join this network automatically;

**To view the network structure at TI Sensor Monitor Software**

1, Connect the Coordinator to PC, than run the TI Sensor Monitor, select the right COM port and click RUN, than, you will see a red point, this is Coordinator
(This software can download at: http://www.ti.com/cn/litv/zip/swrc096d
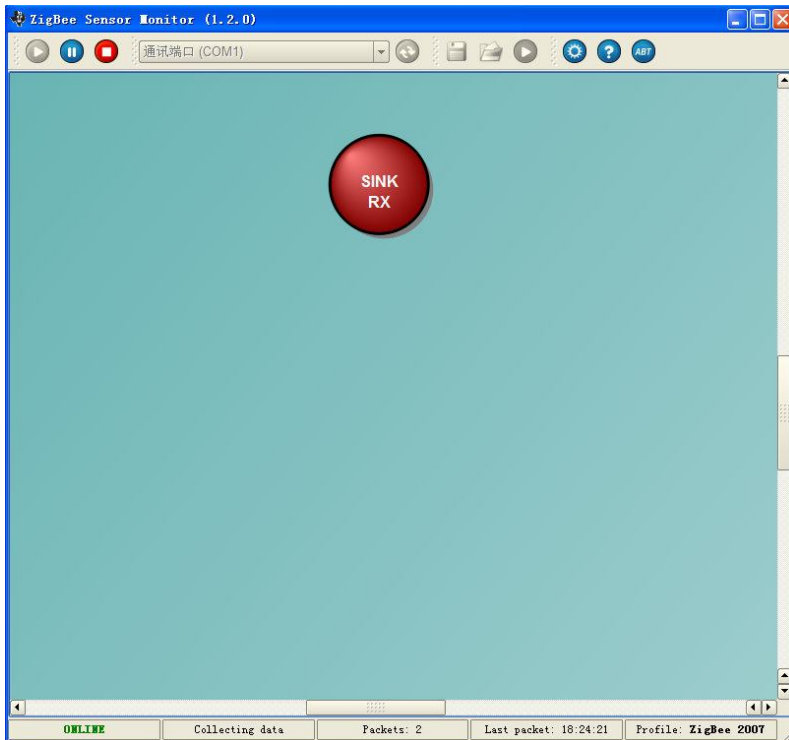
2, turn on one Router, if it's the first use, this Router can search and join this network automatically, the two LED blink than lighting, after this, than press the TEST Key, you will see a blue point at Sensor Monitor, this is a Router point
(at DRF1605, the TEST key is J2-PIN3)
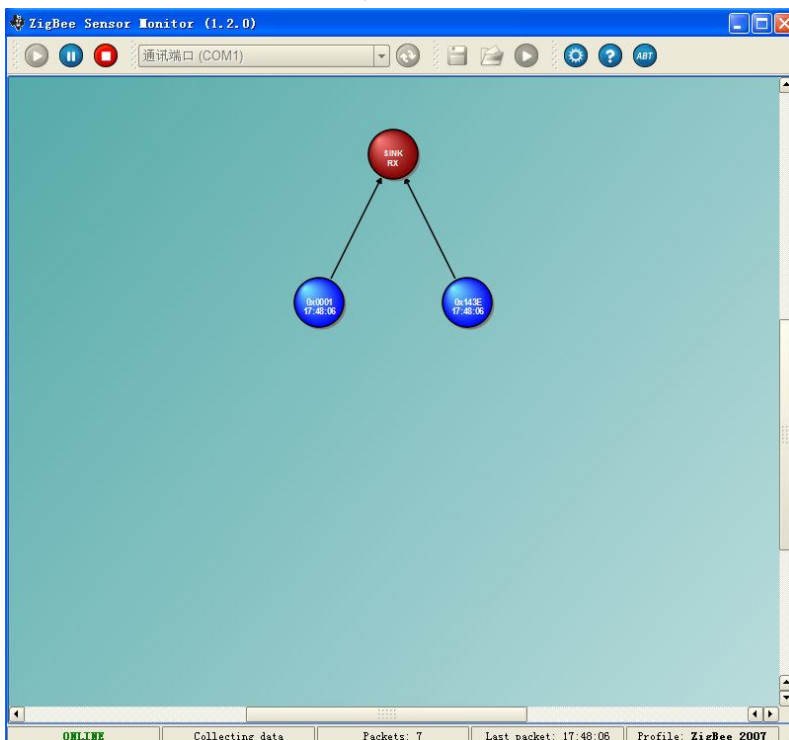
3, same as above, turn on others Routers and press the TEST key, you will see some others Router point.
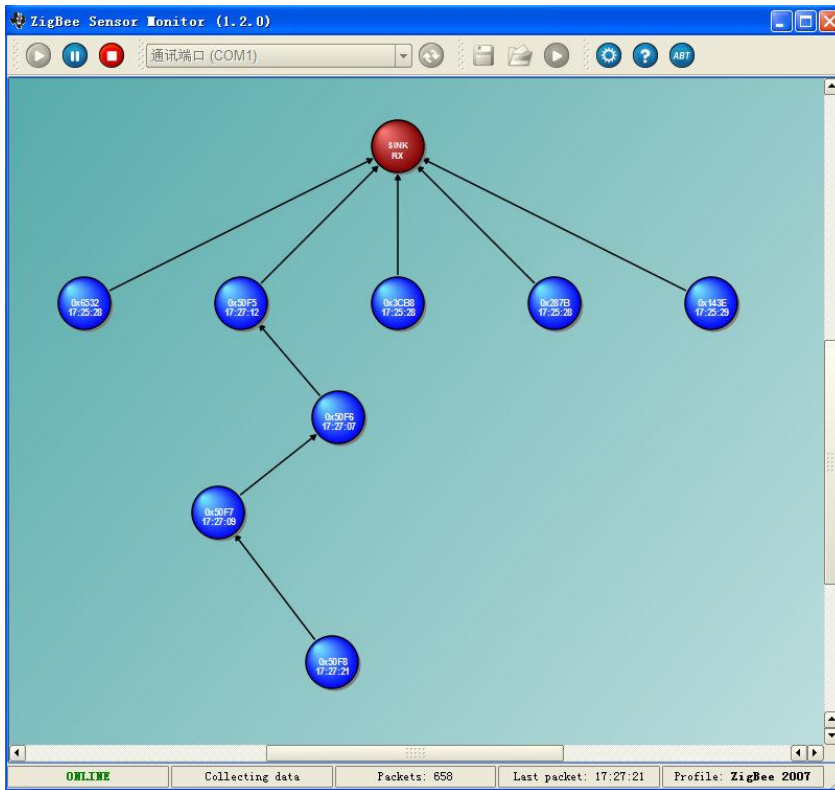

The MESH network points quantity:

One Coordinator can allow 6 Routers join this network directly and assign address to them.

Every Router can allow other 6 Routers to join this network directly.

Total 6 layers Router can allow joining this network.
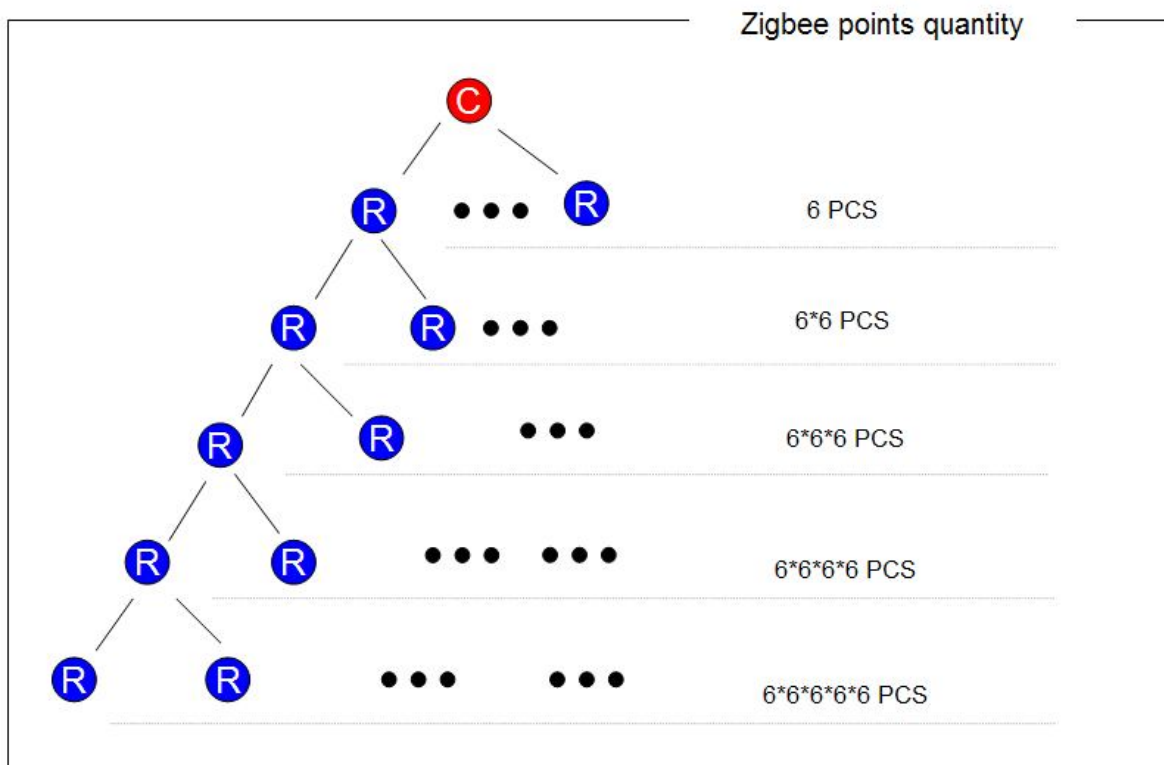
The MESH network characteristic

When a Router joined network, he will get a address (Short Address), and this address will keep if this point always in this network.
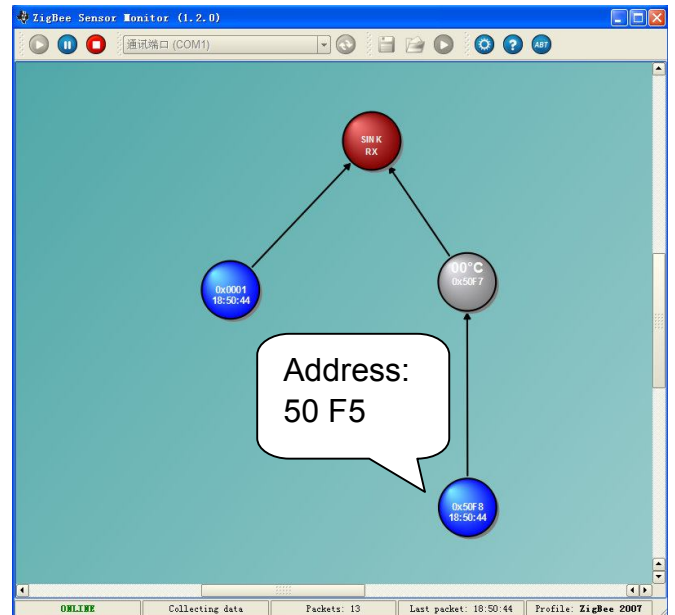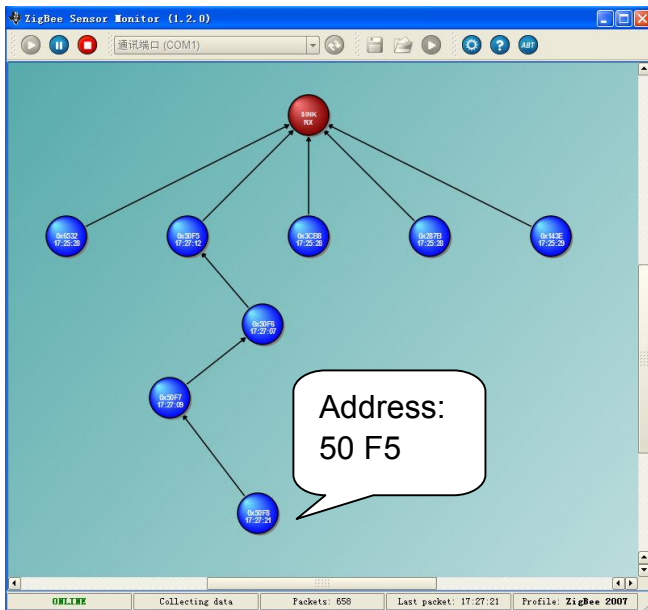
In this network, any points can communication

Even Coordinator turn off, other powered points also can communication.

Even Coordinator turn off, a new Router also can join this network through a Router which joined.

4, How to transmitter data using DRF series ZigBee Module

There are two data transceiver method: transparent transceiver and point to point transceiver

Transparent transceiver:
The data received from UART at Coordinator, will send to all point automatically
The data received from UART at Router can send to Coordinator automatically.

Point to point transceiver:
Only one instruction can send data between any two points

Transparent transceiver (The main function for DRF1600 Zigbee Module)
1, if the fist data byte is not 0xFE, 0xFD or 0xFC, than the data package will be send as transparent data
2, the data received from UART at Coordinator, will send to all point automatically, the data received from UART at Router can send to Coordinator automatically.
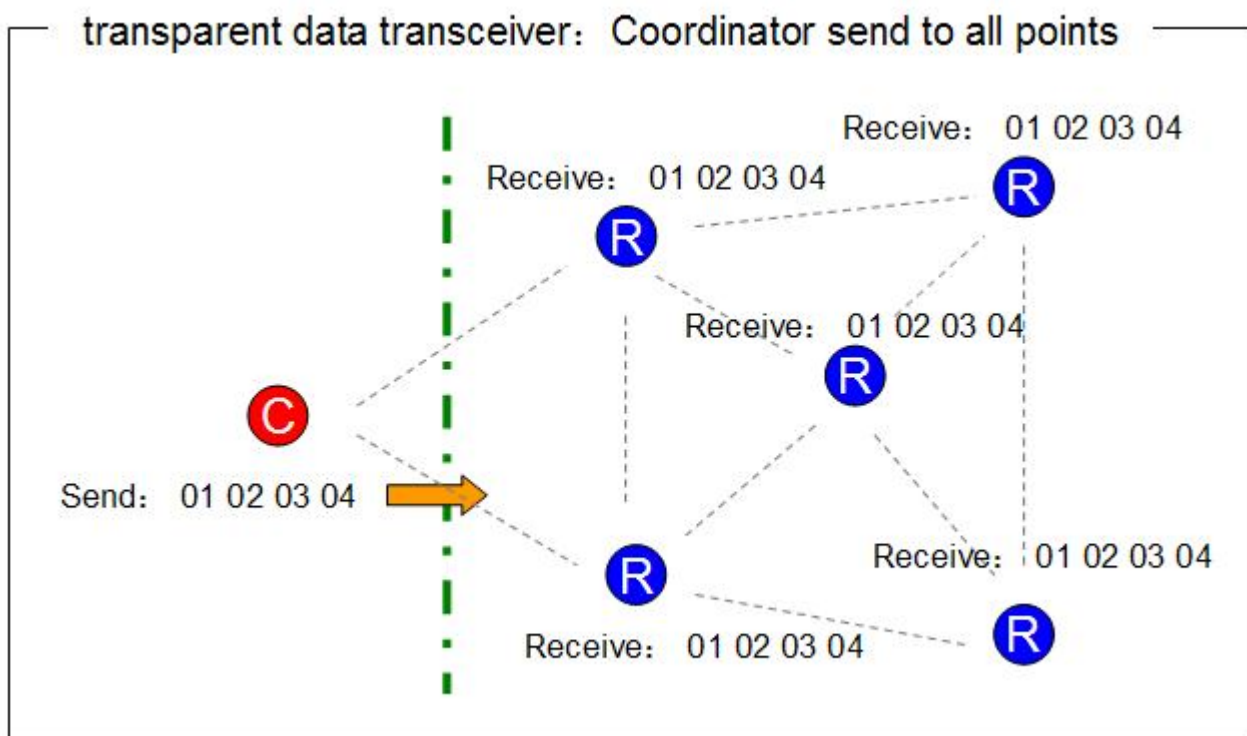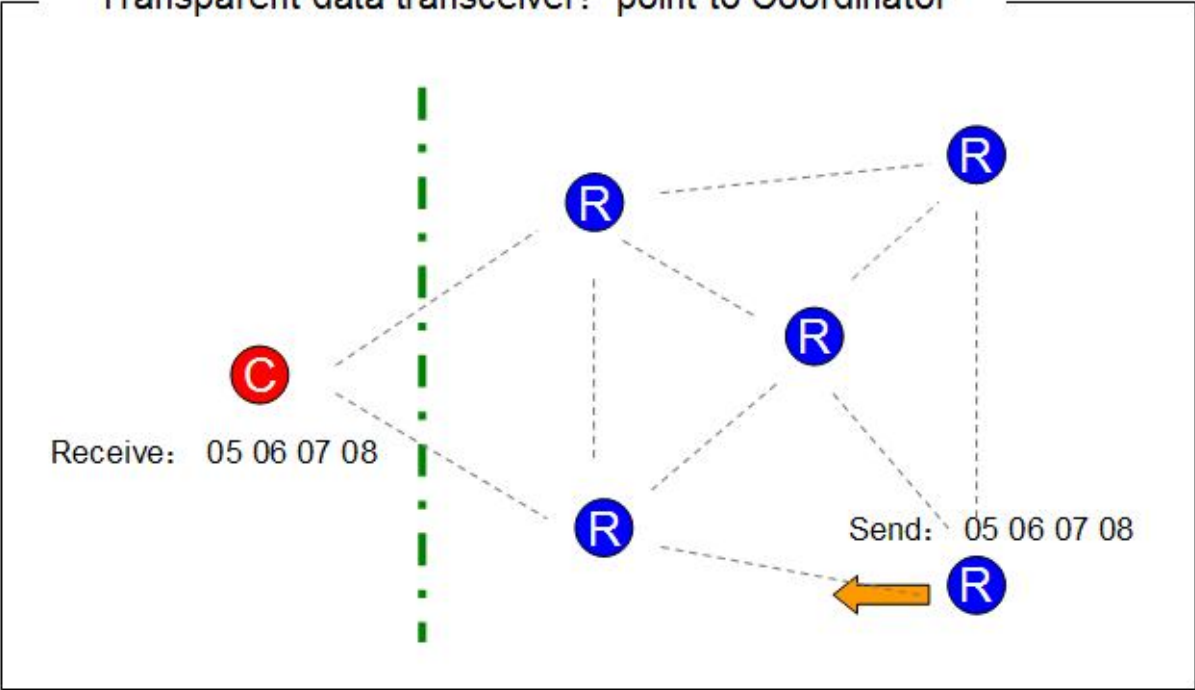3, the MAX data package length is 256 Bytes.

Data transparent 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 Condition： 1， at room temperature, the laboratory condition 2， module distance between 2 meters, signal is good 3， Baud Rate: 38400bps 4， continuous sending, receiving 100K bytes, no error, consecutive testing 10 times 5， test software: serial port debug assistant SSCOM3.2		

With the transmission distance between modules increases, the transmission rate can be decreased Coordinator to Router is sent to broadcast way to send, the transmission rate will be slow General application, suggested that each packet 32 bytes, interval 200-300ms transmission

Point to point transceiver:

Send command formats:

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

FD	Length	Target Address	Data

Equals data section length of data
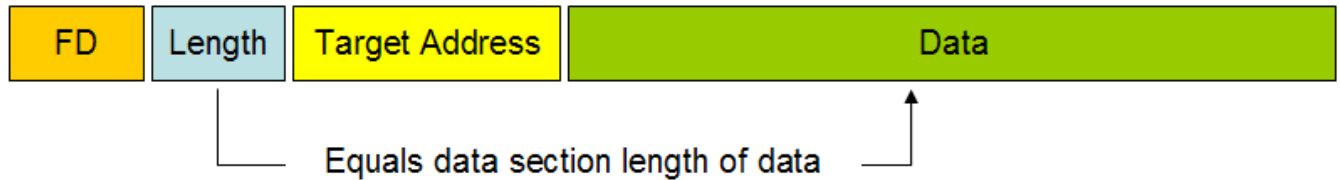
Example：

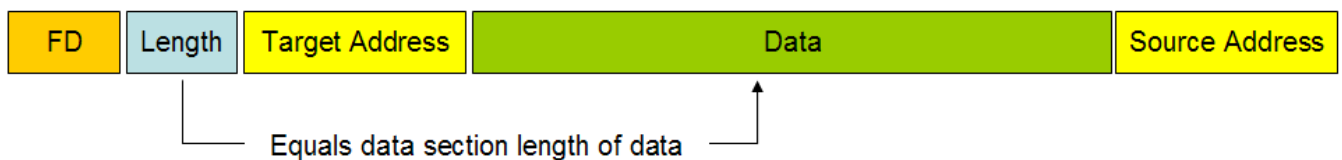FD 0A 14 3E 01 02 03 04 05 06 07 08 09 10

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

Received data formats:

Data transfer instructions (0xFD) + data length + target address + data (up to 32 Bytes) + Source Address

FD	Length	Target Address	Data	Source Address

Equals data section length of data

Example：

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

FD：Data transfer instructions
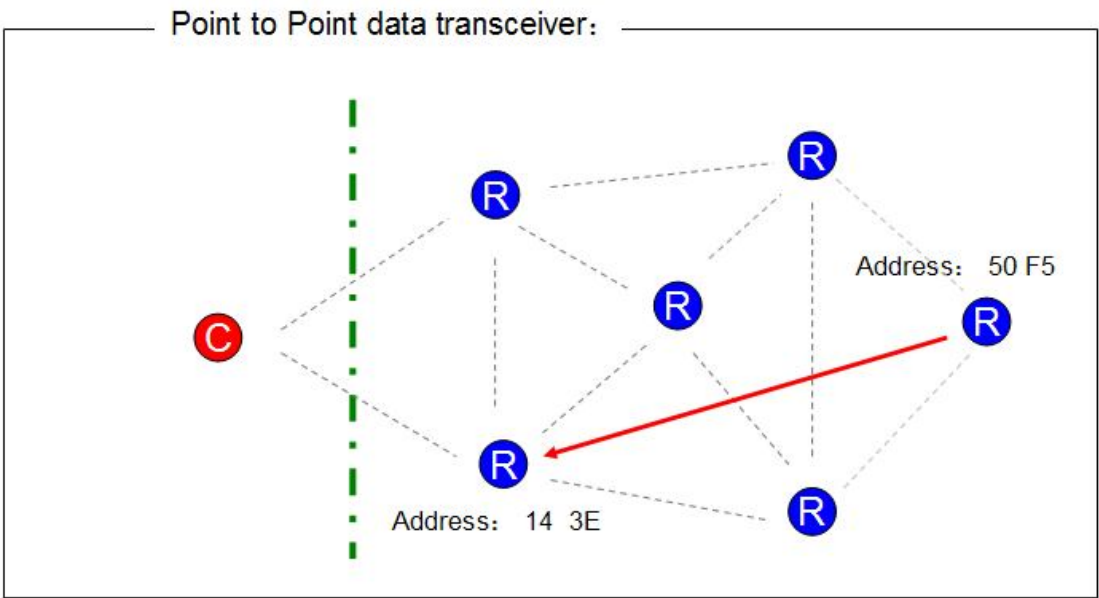0A：length，10 Bytes
14 3E：Target Address
01 02 03 04 05 06 07 08 09 10：Data
50 F5: Source Address

The above introduced the data send from 50F5 to 143E, as picture

Point to Point data transceiver:

Point to Point data transceiver performance:

Direction	Length of data package	Fastest interval
Router → Router	32 Bytes	40 ms
Coordinator → Router	32Bytes	40 ms
Router → Coordinator	32Bytes	40 ms
Test Condition： 6， at room temperature, the laboratory condition 7， module distance between 2 meters, signal is good 8， Baud Rate: 38400bps 9， continuous sending, receiving 100K bytes, no error, consecutive testing 10 times test software: serial port debug assistant SSCOM3.2		

The Target Address = 0xFFFF, broadcast send to all points
The Target Address = 0x0000, send to Coordinator

5, The setting for DRF series ZigBee Module

（**All the data as follow is HEX format, and all setting will available after reset the module**）

NO	Instruction	Function	Return	Need Reset ?
1	FC 02 91 01 XX XX XY XY=(FC+02+91+01+XX+XX)*0x00FF	Set the PAN ID to value XX XX If set to FF FF: 　Coordinator: after restart, set to a random value 　Router: search network and join Can't set to FF FE	XX XX Example: Input：FC 02 91 01 12 34 D6 Return：12 34	Y
2	FC 00 91 02 (canceled)			
3	FC 00 91 03 A3 B3 XY	Read PAN ID	PAN ID value 1, If out off network, the value will is 0xFFFE.	N
4	FC 00 91 04 C4 D4 XY	Read Short Address	Short Address	N
5	FC 00 91 05 (canceled)			N
6	FC 01 91 06 XX F6 XY	Set 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	Y
7	FC 00 91 07 97 A7 XY	Test UART Baud Rate	If right, return：01 02 03 04 05 If Error, no return	N
8	FC 00 91 08 A8 B8 XY	Read MAC Address	8 Bytes MAC Address Example：00 12 4B FF 56 78 FE FF	N

You can use the Zigbee Module Configure software:
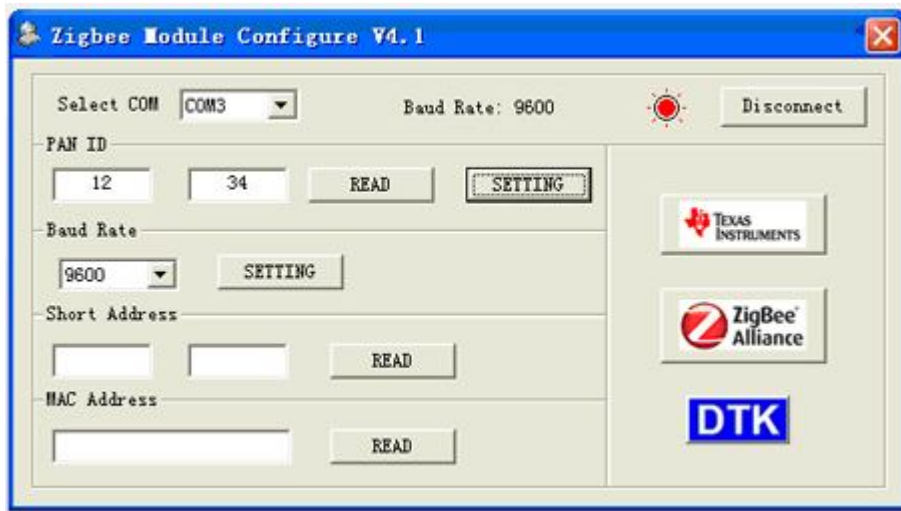
5, Order Information

There are 3 type of ZigBee point at network as Coordinator, Router and End Device. We programmed different firmware in these modules before delivery, so, you need select how many Coordinator, Router or End Device do you need.

As normal, one Zigbee net work just need one Coordinator, End Device just can send and receive data, Router has all the functions at End Device and route data.

So, as recommends, if you just want to create one Zigbee network, you can select 1 Coordinator + n Routers.