ZigBee Ad Hoc Network Wireless Modem

E800-DTU(Z2530-485-27) User Manual

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1. Introduction

1.1. Product Introduction

The E800-DTU (Z2530-485-27) is a ZigBee-based wireless modem with various functions such as transparent transmission, protocol transmission, and AT configuration etc. As a communication medium, wireless data transmission modem has certain scope of application same as fiber, microwave and bright line. It provides real-time, reliable data transmission of monitoring signals in private networks under special conditions, featuring low cost, convenient installation and maintenance, strong diffraction ability, flexible networking structure and long coverage, and suitable for the occasions with many points while scattered and complex geographical environment. It can be connected to data terminals such as PLC, RTU, rain gauge and level gauge.

1.2. Features

★ All core components are original imported, Compared with the current imported wireless modem, it features the most advanced, the smallest and has the best price.

★ Different transmit power are available, and all technical indicators meet European industrial standards.

★ With a temperature compensated crystal, the frequency stability is better than ±2ppm.

★ Operating temperature range: -40 to +85 DEG C, adapt to the harsh working environment, the real industrial products.

★ All aluminum alloy casing, compact size, easy installation, good heat dissipation; perfect shielding design, good electromagnetic compatibility and strong anti-interference ability.

★ Multiple protection functions such as reverse power protection, over-current protection, and antenna surge protection greatly increase the reliability of the radio.

★ Powerful software features, all parameters, such as power, frequency, address ID, etc., can be programmed.

★ Built-in watchdog, and precise time layout, once an exception occurs, the module will automatically restart, and can continue to work according to the previous parameter settings.

1.3. Characteristics

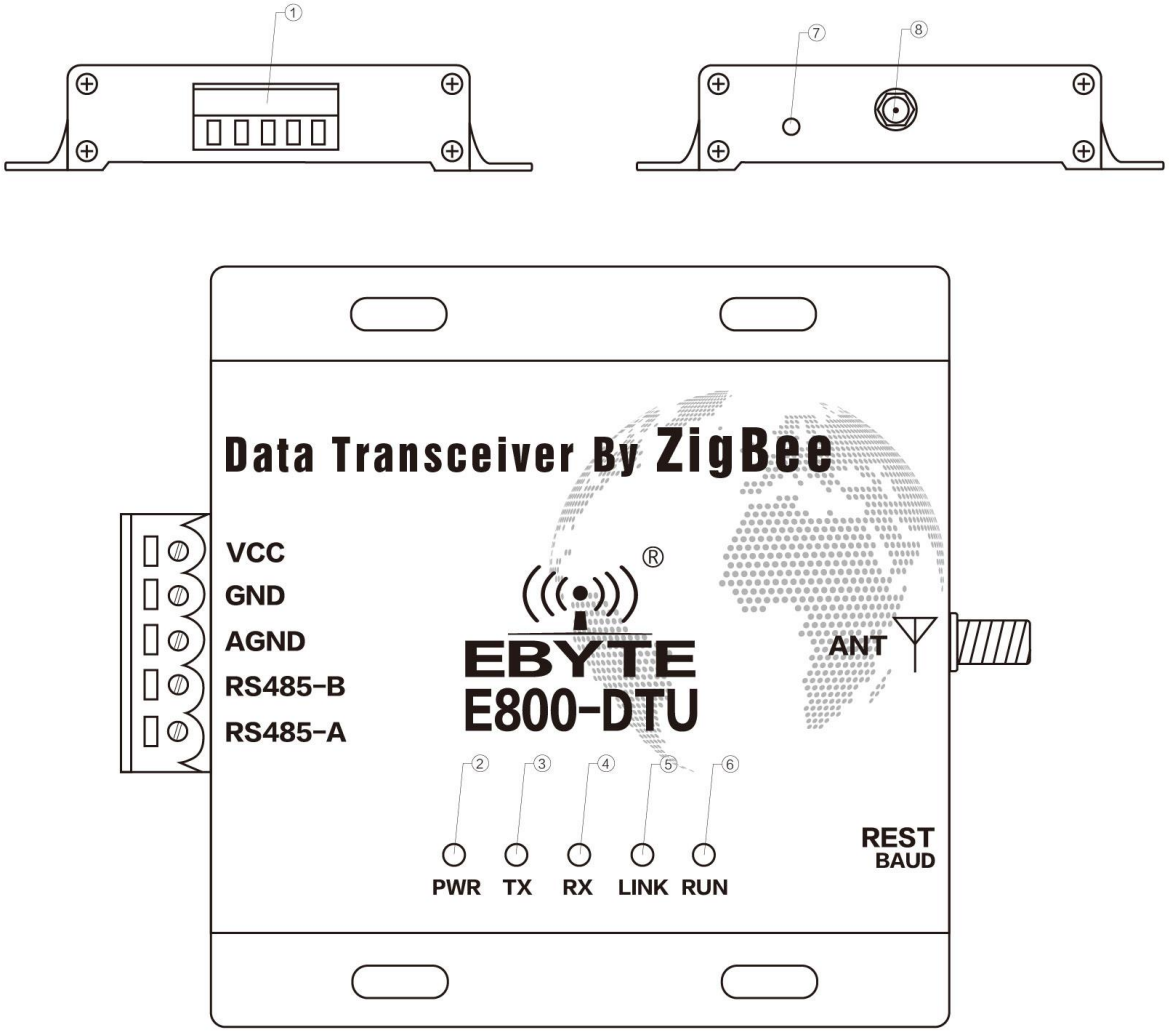
No.	Characteristics	Description
1	Role switching	The user can use the serial port command to let the device switch between the three types of coordinator, router and terminal.
2	Automatic networking	Supports power-on automatic networking. The coordinator automatically builds up the network by power, and the terminals and routers automatically search and join the network.
3	Network self-healing	Lost network automatic reconnection function. The network intermediate node is lost, and other networks automatically join or maintain the original network. (The isolated node automatically joins the original network, and the non-isolated node maintains the original network.) The coordinator is lost and there are non-isolated nodes in the original network. The coordinator can join the network again or the coordinator of the original PAN_ID set by the same user can join the original network.
5	Data retention time setting	In the state of the coordinator and router, the user can set the data storage time and use it in conjunction with the terminal in the sleep mode to save the data of the terminal device and send the data to the terminal after the terminal wakes up. Save up to 3 pieces of data, if it is exceeded, automatically clear the first data! After the data is saved, the data heap is automatically cleared.
6	Automatic resend	In single broadcast(point transmission) mode, when the device fails to send to the next node, it automatically retransmits every message three times.
7	Automatic routing	The module supports network routing function. Routers and coordinators carry network data routing functions, and users can form multi-hop networks.
8	Support encryption protocol	The module uses AES 128-bit encryption to change network encryption and anti-listening. Users can change the network key by themselves, and the devices with the same network key can communicate normally.
9	Support Serial Port Configuration	Module built-in serial instructions, users can configure (view) the parameters and functions of the module through the serial instructions.
10	Multi-type data communication	Supports all-network broadcast, multicast and on-demand (single broadcast) functions. Several transmission methods are also supported in broadcast and single broadcast modes, please refer to the details.
11	Multiple working mode selection	It supports three working modes: transparent transmission mode, semi-through mode, protocol mode, and user can switch freely.
12	Channel change	Supports 16 channel changes from 11 to 26 (2405~2480MHZ), and different channels correspond to different frequency bands.
13	Network PAN_ID change	Any switch of the network PAN_ID, the user can customize the PAN_ID to join the corresponding network or automatically select the PAN_ID to join the network.
14	Serial Port Baud Rate Change	The user can set the baud rate up to 1M, default digit is 8 bits, stop bit is 1 bit, no parity bit.
15	Short address collection	The user can find the corresponding short address according to the module MAC address (unique, fixed) that has joined the network.
16	Instruction format switching	This module supports AT command and HEX command, which are easy to configure.
17	Module reset	The user can reset the module through the serial port command.
18	One-click Recovery Baud Rate	This module supports one-button recovery of baud rate. This function can be used when the user forgets the baud rate. The default baud rate is 115200.
19	Restore factory settings	Users can restore the factory settings of the module through serial port commands.

1.4. Serial Products

SN.	Model Number	RF Chip	Frequency Hz	Air Data Rate bps	Power dBm	Interface	Distance km	Antenna Interface
1	E800-DTU (Z2530-485-27)	CC2530	2.4G	250K	27	RS485	2.5	SMA-K
2	E800-DTU (Z2530-485-20)	CC2530	2.4G	250K	20	RS485	1.0	SMA-K
★ The E18 modules can communicate with the above model★								

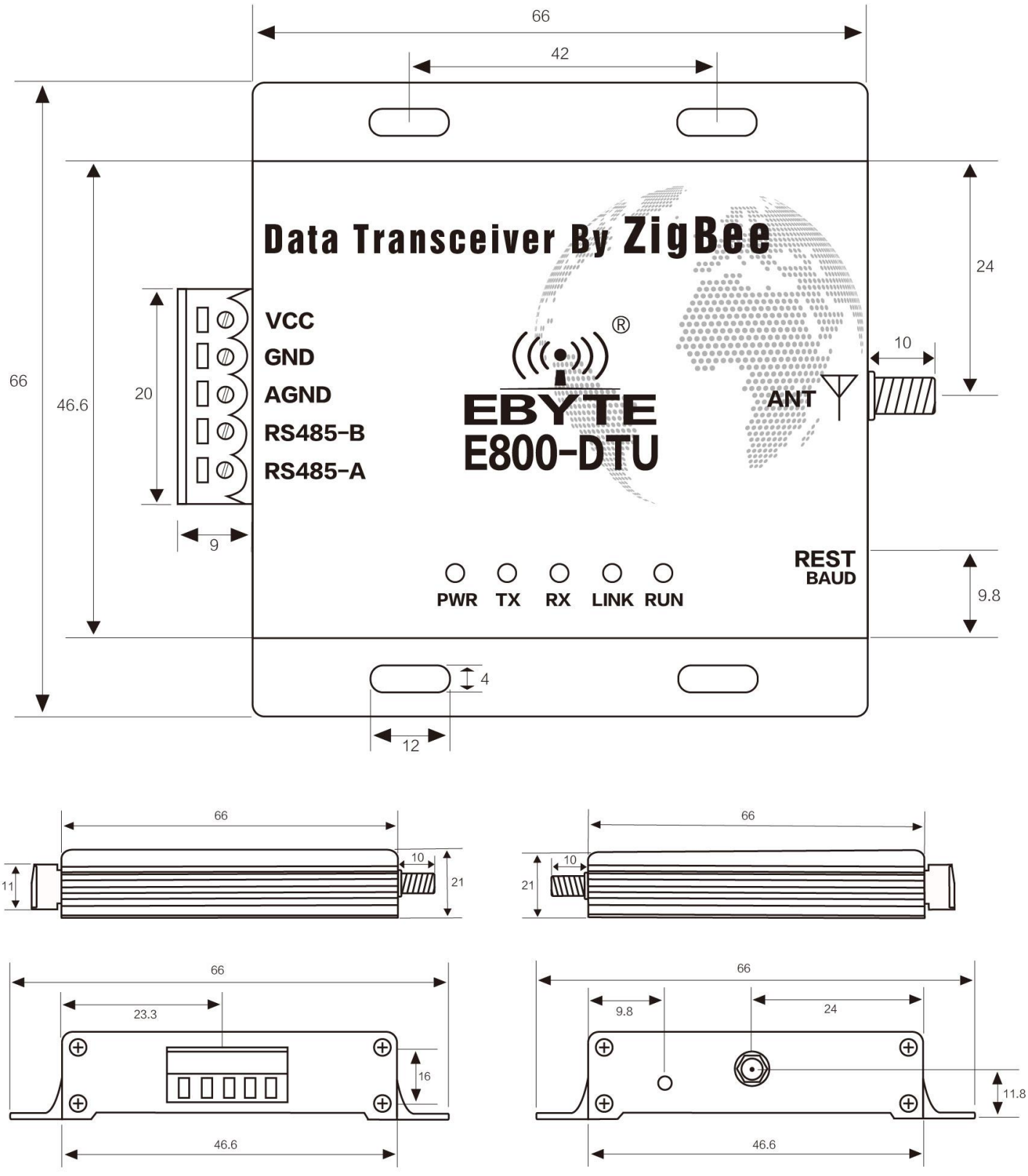
2. Installation Size

2.1. Department instructions



Pin No.	Name	Function	Description
1	3.81mm Terminals	Communication interface power interface	Standard RS-485 interface and crimped power interface
2	PWR-LED	Power Indicator	Red, always on when the power is turned on
3	TX-LED	Sending indicator	Yellow, flashing when sending data
4	RX-LED	Receiving indicator	Yellow, flashing when receiving data
5	LINK-LED	Connection indicator	Red, be off when connected to the network, always on when there is no network.
6	RUN-LED	Running lights	Red, system operation instructions, extinguish means normal operation, constant light means running error.
7	Baud Rate Reset Switch	Tact Switch	Press and reset the baud rate(115200)
8	Antenna interface	SMA-K interface	External thread, 10mm long, characteristic impedance 50Ω

2.2. Product Size

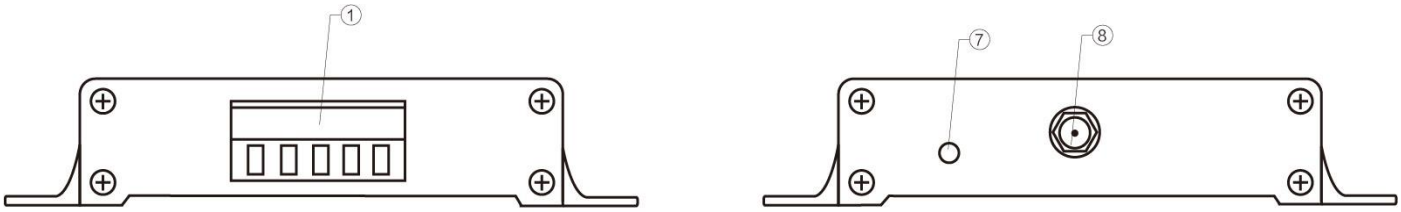


单位：毫米

3. Interface Definition

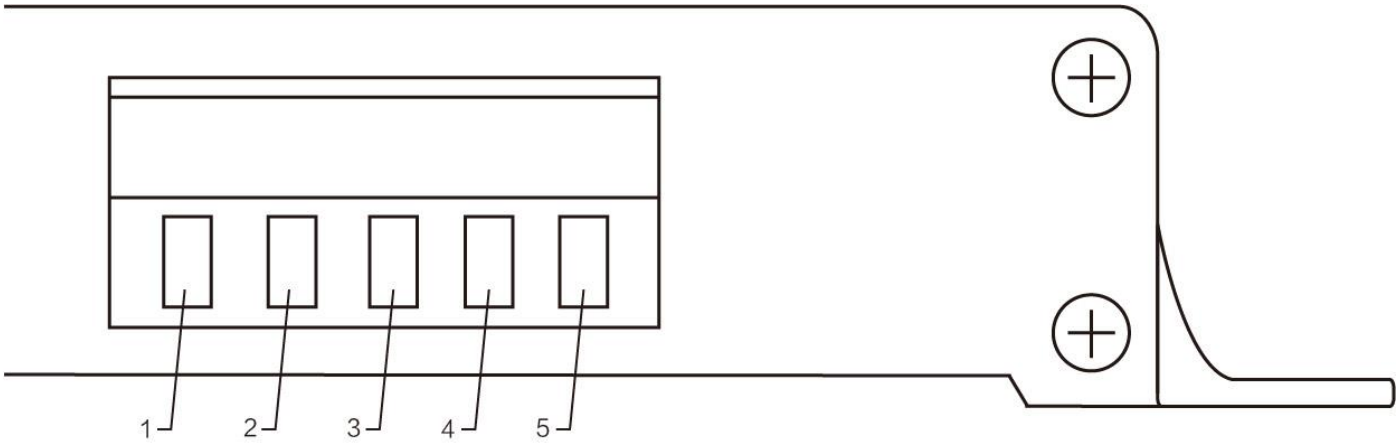
3.1. Power Interface Description

The user needs to use the VCC and GND terminal in ① to supply power. The E800-DTU can be powered by 8~28V DC. It is recommended to use 12V or 24V DC power supply.



3.2. RS485 Interface Description

The E800-DTU (Z2530-485-27) uses the RS485 communication protocol. How to connect the communication cable, please select the corresponding interface crimping wire in the ① 3.81mm terminal block. See below for details.



Pin No.	Definition	Function	Description
1	VCC	Crimp power connector, positive	8~28V DC, 12V or 24V is recommended
2	GND	Crimp power connector, positive	The negative pole of the power supply is connected to the system and the housing.
3	AGND	Common ground interface	It can be connected with the grounding end of external equipment, or can not be processed.
4	RS485-B	Serial port terminal	Externally connected to the B of other RS485 devices
5	RS485-A	Serial port terminal	Externally connected to the A of other RS485 devices

★ Note: The modem will be poor communication when connecting multiple devices, while connecting a single device is not, please try to parallel connect 120Ω resistor between 485_A terminal and 485_B terminal.

4. Function

4.1. Working Mode

Mode	Node Type	Description	Data communication display mode
Mode1 (Transparent transmission mode)	Coordinator	Serial data is transmitted to non-sleeping devices in the network through broadcasting.	Data carrier formats can be configured by instructions: 1. Display the mac address of sender 2. 2Display the short address of sender 3. Display the RSSI value of the shortest path of the message (Configure display mode as no display and any one or more display modes)
	Router	The serial port data is transparently transmitted to the coordinator through on-demand. (Note: The end device cannot receive the transparent data of mode 1 in sleep mode)	
	Terminal		
Mode 2 (Semi-transparent mode)	Coordinator	The module transmits in a full protocol according to the fixed format of the data transmission.On-demand, broadcast, multicast are available. Please refer to "HEX Data Communication Instructions" for details.	
	Router	The serial data is transparently transmitted to the coordinator via on-demand.	
	Terminal		
Mode3 (Protocol mode)	Coordinator	The module transmits in a full protocol according to the fixed format of the data transmission.On-demand, broadcast, multicast are available. Please refer to "HEX Data Communication Instructions" for details.	N/A
	Router		
	Terminal		
Note: Only mode 3 can be selected for GPIO function configuration. Any mode can communicate with each other without affecting each other.			

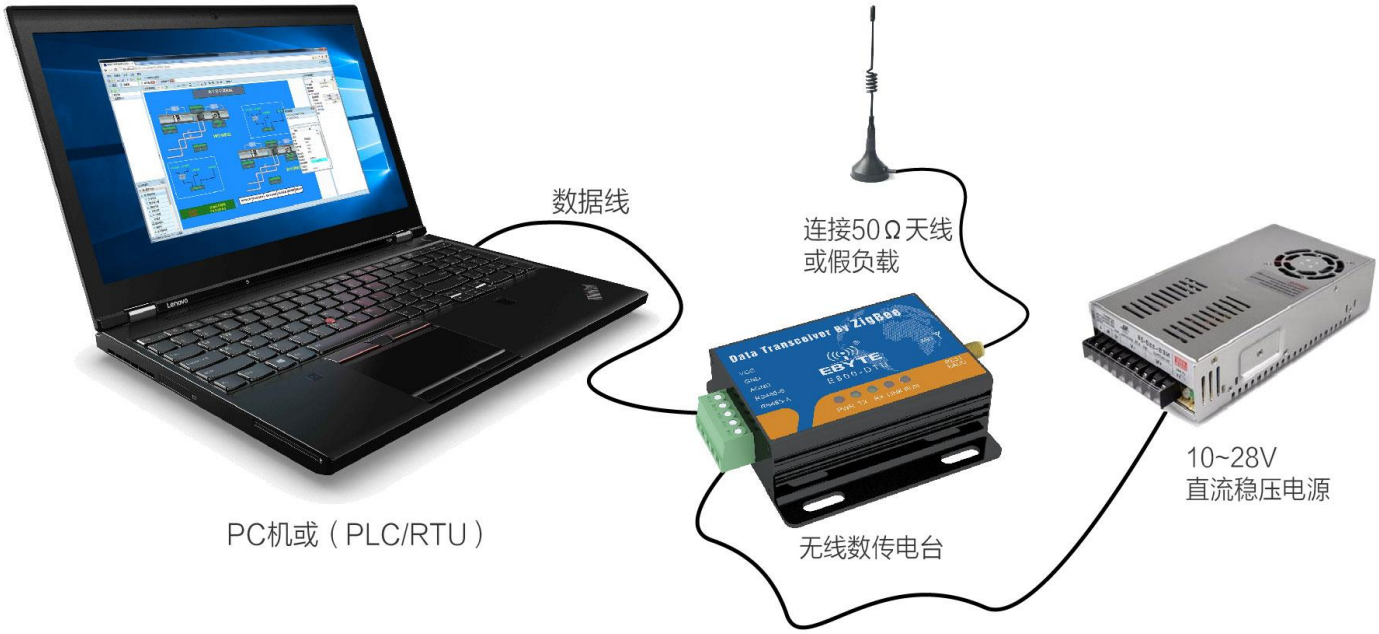
4.2. Introduction to protocol mode communication

No.	Usage method	Description
1	Broadcast	In the case of joining the network, users can broadcast on the whole network according to the instructions (divided into three broadcast modes) 1、Broadcast mode 1 ——The message is broadcast to all devices in the network. 2、Broadcast mode 2 ——The message is broadcast to devices that only receive on (except sleep mode). 3、Broadcast mode 3 ——The message is broadcast to all full-featured devices (routers and coordinators).
2	Group broadcast	In the case of joining the network, users can multicast all the non-dormant devices in the network.
3	point broadcast	In the case of joining the network, users can communicate with devices on the network in a short address according to the command (divided into three broadcast modes) 1、Transparent transmission—— (No information carried) 2、Short address method—— (Short address as the carried information) 3、MAC address method—— (MAC address as the carried information)
Note: Please refer to the “HEX Data Communication Instructions” for details.		

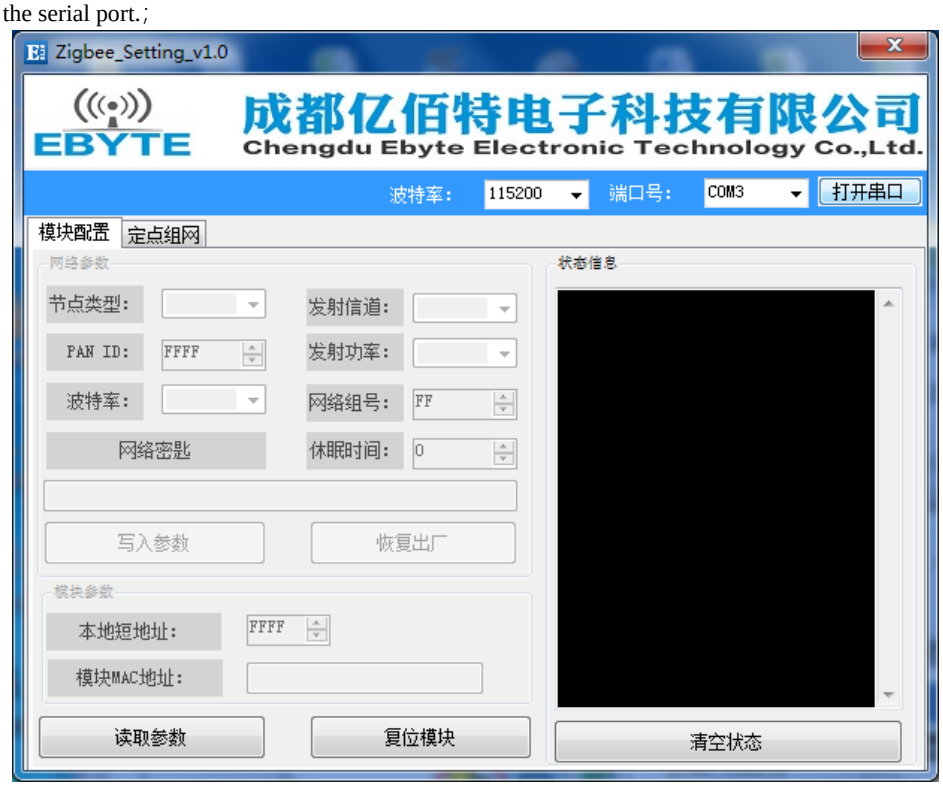
5. Quick Start

5.1. Use Connection Diagram

ZigBee ad hoc network module is simple and easy to use. In order to let users be familiar with this products quickly, this section will guide users to configure and communicate in various modes through simple configuration. The default operation mode is mode 3 (protocol mode).



5.2. Network formation and communication

No.	Note
1	【Create network】： ① Connect the Zigbee-DTU through USB to RS485 board. ② Open the PC software "Zigbee_Setting_V1.1", select the port number, set the serial baud rate (default 115200), and open the serial port.;  ③ Click “Read Parameters‘’ to read module parameters  ④ Select the node type as the coordinator and write the parameters. Wait for the coordinator to start creating the network, and the user can view the module parameters. Configure network parameters：(PAN ID is automatic when it’s FFFFFF)

Read parameters after the network is built:

⑤ Choose another module and set it as a router or terminal according to the same steps (the module default as a terminal, users don't need to configure, our test is a terminal).

2

【Communication test】:

① Click “fixed point networking” of coordinator and terminal in the host computer. The corresponding communication information can be shown:

Coordinator:

Terminal:

② Point broadcast In order to facilitate user' observation, this experiment is HEX transmission mode.
If you do not know the device address, please enter the corresponding MAC address and click to get the network address. The short address of coordinator is 0.

③ In three modes, enter any content in the sending area and click send.
transparent transmission:

Coordinator to terminal:

Terminal to coordinator:

Network address:

Coordinator to terminal:

Terminal to coordinator:

MAC address:

Coordinator to terminal:

Coordinator to terminal:

Group broadcast:

Broadcast:（The broadcast only performs in mode one, the whole network broadcast mode experiment, and users test other modes themselves.）

Data function transmission needs to embody its own characteristics in the case of multi-node network, users can test themselves!

6. User instruction set

For user convenience, the E800-DTU (Z2530-485-27) module uses two instruction formats, the AT command format and the HEX command format. This DTU defaults as the HEX command mode, in this mode, serial assistant is used to send +++ instructions and enter the temporary AT instruction mode. AT command can be used to configure, input AT + EXIT to exit temporary AT command.

Note：

1 Prompt information for serial data format error

HEX command format ： F7 FF

AT command format ： +ERROR<CR><LF>

2 Prompt information for coordinator device building network：

HEX command format ： FF FF

AT command format ： Builded network<CR><LF>

3 Prompt information for devices joining the network

HEX command format ： FF AA

AT command format ： Joined network<CR><LF>

4 Prompt information for module device has no network or lost network

HEX command format ： FF 00

AT command format ： No network<CR><LF>

5 <CR> means：0x0D

6 <LF>means：0x0A

6.1. HEX Instruction Set

Instruction description	Instruction format	Instruction examples
Read device type	Send：FE 01 01 FF Return：FB dev_type	Send：FE 01 01 FF Return：FB 02
Read network status	Send：FE 01 02 FF Return：FB nwk_state	Send：FE 01 02 FF Return：FB 01
Read network PAN_ID	Send：FE 01 03 FF Return：FB pan_id	Send：FE 01 03 FF Return：FB 02 F4
Read network key	Send：FE 01 04 FF Return：FB key	Send：FE 01 04 FF Return：FB 11 13 15 17 19 1B 1D 1F 10 12 14 16 18 1A 1C 1D
Read short address of local network	Send：FE 01 05 FF Return：FB ShortAddr	Send：FE 01 05 FF Return：FB F2 EF
Read local MAC address	Send：FE 01 06 FF Return：FB Mac_Addr	Send：FE 01 06 FF Return：FB 89 6C 50 09 00 4B 12 00
Read short address of parent network	Send：FE 01 07 FF Return：FB Coor_shortAddr	Send：FE 01 07 FF Return：FB 00 00
Read MAC address of parent node	FE 01 08 FF Return：FB Coor _Mac_Addr	Send：FE 01 08 FF Return：FB 20 39 EA 0A 00 4B 12 00
Read Network Group Number	Send：FE 01 09 FF Return：FB group	Send：FE 01 09 FF Return：FB 01
Read communication channel	Send：FE 01 0A FF Return：FB channel	Send：FE 01 0A FF Return：FB 0B
Read transmitting power	Send：FE 01 0B FF Return：FB txpower	Send：FE 01 0B FF Return：FB 04
Read serial port baud rate	Send：FE 01 0C FF Return：FB baud	Send：FE 01 0C FF Return：FB 09
Read sleep state (terminal node is valid)	Send：FE 01 0D FF Return：FB sleep_time	Send：FE 01 0D FF Return：FB 05
Read the save time of node data (router and coordinator are valid)	Send：FE 01 0E FF Return：FB 1E	Send：FE 01 0E FF Return：FB 1E
Read all data of the device	Send：FE 01 FE FF Return：FB all_info	Send：FE 01 FE FF Return: FB 02 01 02 F4 11 13 15 17 19 1B 1D 1F 10 12 14 16 18 1A 1C 1D F2 EF 89 6C 50 09 00 4B 12 00 00 00 20 39 EA 0A 00 4B 12 00 01 0B 04 09 05
Get the short address of any MAC address in the network	Send：FE 09 10 Mac_Addr FF Return：FB shortAddr	Send：FE 09 10 AF 99 E9 0A 00 4B 12 00 FF Return：FB 08 35
Read remote/local GPIO input and output status	Command：FE 04 20 addr gpiox FF Return：FB 20 addr In/Out	FE 04 20 F9 DE 04 FF
Read remote/local GPIO level	Command：FE 04 21 addr gpiox FF Return：FB 21 addr In/Out level	FE 04 21 FF FF 04 FF
Read remote/local PWM status	Command：FE 04 22 addr 22 FF Return：FB 22 addr period duty1 duty2 duty3 duty4 duty5	FE 04 22 FFFF 22 FF
Read remote/local ADC status	Command：FE 04 23 addr pin FF Return：FB 23 addr adc_value	FE 04 23 FF FF 01 FF

6.2. HEX parameter description

6.2.1. Network type

dev_type: 00 coordinator
01 router
02 terminal（default）

6.2.2. Network Status

nwk_state: 00 No network
01 Network exists

6.2.3. Network PAN_ID

pan_id: 0000~FFFE fixed network PAN_ID
FFFF stochastic network PAN_ID

6.2.4. Network Keys

key: 16-bit network key

6.2.5. Network short address

ShortAddr: 2 Byte address

6.2.6. MAC address

Mac_Addr: 8 Byte address

6.2.7. Parent node network short address

Coor_shortAddr: 2 Byte address

6.2.8. Parent node MAC address

Coor_Mac_Addr: 8 Byte address

6.2.9. Network group number

group: Group number range 1~99（default 1）

6.2.10. Network Channel

channel: Channel range 11~26（default 11）

6.2.11. Transmit power

txpower:

Power parameter txpower comparison table without PA/with PA

txpower	power (dBm)
00	-3 / 7
01	-1.5 / 19
02	0 / 22

txpower	Power (dBm)
03	2.5 / 24
04	4.5 / 27 （default）
05	

6. 2. 12. Serial Port Baud Rate

baud：

Baud rate parameters comparison table

baud	Baud rate
00	2400
01	4800
02	9600
03	14400
04	19200
05	38400
06	43000
07	57600

baud	Baud rate
08	76800
09	115200（default）
0A	128000
0B	230400
0C	256000
0D	460800
0E	921600
0F	1000000

6. 2. 13. Sleep time

sleep_time： 0 Sleep state is off（default）

Others（1~250） Sleep mode is turned on. Sleep_time unit S (seconds)

6. 2. 14. Parent node save time

time： Range 0~120（default 30），Unit: S（Seconds）

6. 2. 15. User gpio parameters

（1）gpio Port

gpiox：

User gpio port comparison table

gpiox	00	01	02	03	04	05	06	07	08	09
GPIO	P0_0	P0_1	P0_2	P0_3	P0_4	P0_5	P0_6	P2_0	P2_1	P2_2

For example ： When the GPIO parameter is 2, the corresponding pin position is P_2.

When the gpio parameter is 8, the corresponding pin position is P2_1.

（2）gpio Input and output status

in/out： 1 Input status

0 Output status

（3）gpio state value（Invalid configuration input status）

level： 0 Low level

1 High level

2 turn

6.2.16. User pwm parameters

(1) pwm port

pwmx:

User pwm port comparison table

pwmx	duty1	duty2	duty3	duty4	duty5
GPIO	P0_2	P0_3	P0_4	P0_5	P0_6

(2) pwm cycle

period: (0~FFFF)

Cycle time (Unit 1 = 62.5ns)

(3) pwm duty cycle time

dutyx: (0~FFFF):

duty cycle time (Unit 1 = 62.5ns)

6.2.17. User ADC parameters

(1) adc passageway

adcx:

User adc channel comparison table

adcx	0	1	2	3	4	5	6
GPIO	P0_0	P0_1	P0_2	P0_3	P0_4	P0_5	P0_6

(2) adc state value

adc_state: 0 ADC Enable

1 ADC Turn off

(3) adc sample value

adc_value: 0~0X0CE4 (0~3300) Unit mV

6.2.18. Peripheral addr parameter description

(1) Peripheral function address

addr:

FFFF View/configure local information

0~FFF8 View/configure information of network address addr

FFFE、FFFD、FFFC Device view/configure information that can receive broadcasts

---FFFE Broadcast to all devices in the network

---FFFD Broadcast to idle receiving devices (Except for sleeping devices)

---FFFC Broadcast to the coordinator and router

6.2.19. All information

（1）All information

all_info：

Info. identification	（Info. lengt（Info. location））	Info. description
dev_type	（1 Byte（0） ）	Device type
nwk_state	（1 Byte（1） ）	Network status
pan_id	（2 Byte（2~3））	Network PAN_ID
key	（16 Byte（4~20））	Network key
ShortAddr	（2 Byte（21~22））	Network short address
Mac_Addr	（8 Byte（23~30））	MAC address
Coor_shortAddr	（2 Byte（31~32））	Network short address of parent node
Coor_Mac_Addr	（8 Byte（33~40））	MAC address of parent node
group	（1 Byte（41））	Network group number
channel	（1 Byte（42））	communication channel
txpower	（1 Byte（43））	Transmit power
baud	（1 Byte（44））	Serial port baud rate
sleep_time	（1 Byte（45））	sleep state

Examples of detailed parameters：

all_info：

02 01 02 F4 11 13 15 17 19 1B 1D 1F 10 12 14 16 18 1A 1C 1D F2 EF 89 6C 50 09 00 4B 12 00 00 00 20 39 EA 0A 00 4B 12 00 01 0B 04 09 05

- device type： 02 （terminal）
- Network state： 01 （already existed in network）
- Network PANID： 02 F4 （PAN_ID=0X02F4）
- Network key： 11 13 15 17 19 1B 1D 1F 10 12 14 16 18 1A 1C 1D
- Short address of local network ： F2 EF （Short Address=0XF2EF）
- Local MAC address： 89 6C 50 09 00 4B 12 00
- Short Address of parent node： 00 00（Short Address=0X0000）
- MAC address of parent node： 20 39 EA 0A 00 4B 12 00
- Network group number： 01 （Network group number 1）
- Network channel： 0B （channel 11）
- Transmit power： 04 （Transmit power 4.5dBm）
- Serial port baud rate： 09 （Baud rate 115200）
- Sleep time： 05 （Sleep state is on, sleep time is 5s）

（Note: Parent node retention time is not included in all information. If you need to configure or query, please use the corresponding instructions separately.）

6.3. HEX data communication description

6.3.1. Command Format Description

（Note: Only for all nodes of Mode 3 or coordinators of Mode 2）

Command（COM）1Byte	Data Length（LEN）1Byte	Data content（DATA）
FC	LEN	DATA

6.3.2. Detailed parameter description

DATA parameter description：

（1）**Broadcast data**（data is the content ready to send）

Command：01+type+data

parameter description：type

01：Broadcast mode 1 ——The message is broadcast to all devices in the network

02：Broadcast mode 2 ——The message is broadcast to devices that only reception on (except sleep mode) .

03：Broadcast mode 3 ——The message is broadcast to all full-function devices(routers and coordinators)

Example： FC 05 01 02 31 32 33

Example explanation： Sending HEX data to network broadcast in broadcast mode 2：0X31 0X32 0X33

（2）**Group braodcast data**（data is the content ready to send）

Command：02+ group+data

parameter description：group

0~99：Multicast number of message in group broadcast

Example： FC 05 02 01 31 32 33

Example explanation： Send HEX data to network group number 1：0X31 0X32 0X33

（3）Point broadcast（**single broadcast）data**（data is the content ready to send）

Command：03+ type +addr+data

parameter description： type **（Coordinator in Mode 2，the parameter is invalid and can be set any value ）**

01：Transparent transmission mode（No carry information）

02：Short address mode（Carrying information as a short address）

03：MAC address mode（Carrying information as MAC address）

parameter description： addr： Network short address valid point broadcast （single broadcast） address 0x0000—0xFFF8）

Example： FC 07 03 01 AB CD 31 32 33

Example explanation： Send HEX data carrying a short address to a device with a network address of 0XADCD：0X31 0X32 0X33

6.4. AT Instruction set

6.4.1. AT+DEV

Function： Query/configure device types

Format：

Query

Send：AT+DEV= type

Return：+OK<CR><LF>

Configure

Send：AT+DEV=?

Return：DEV= type<CR><LF>

Parameter： type

C Coordinator

R Router

E terminal

Example： AT+DEV=C

Default： DEV=E

6.4.2. AT+EXIT

Function： Exit temporary AT command。（It is valid when the P1_6 pin is pulled low to enter the AT command.）

Format：configure

send：AT+EXIT

return：+OK<CR><LF>

example： AT+EXIT

6.4.3. AT+MODE

Function： Query/Configure Work Mode

Format： query

send：AT+MODE=?

return：MODE=type<CR><LF>

Configure

send：AT+MODE=mode

return：+OK<CR><LF>

Parameters： mode

1 Mode 1 （Transparent mode）

2 Mode 2 （Semi-transparent mode）

3 Mode 3 （Protocol mode）

Example： AT+MODE=3

Default： MODE=3

6.4.4. AT+RMODE

Function： Query/Configure communication Display Mode

Format：query

send：AT+RMODE=?

return：RMODE=type<CR><LF>

configure

send：AT+RMODE=type

return：+OK<CR><LF>

Parameter： rmode（1 on 0 off ； value：0-7 ）

0bit ： Show MAC address of sender

1bit ： Show short address of sender

2bit ： Show the RSSI value of the shortest path of the message

Example： AT+RMODE=0

Default： RMODE=0

6.4.5. AT+NWK

Function： Query device type

Format：query

send：AT+NWK=?

return：NWK=nwk_state<CR><LF>

Parameter： nwk_state

0 No network

1 network existed

Example： AT+NWK=?

6.4.6. AT+PANID

Function： Query/configure network PANID

Format： query

send：AT+PANID=?

return：PANID=panid<CR><LF>

configure

send：AT+PANID=mode

return：+OK<CR><LF>

parameters： panid

0000-FFFE fixed PANID

FFFF random PANID

Example： AT+ PANID=0XA1B2

6.4.7. AT+KEY

Function： Query/configure network key

Format：query

send：AT+KEY=?

return：KEY=key<CR><LF>

configure

send：AT+PANID=mode

return：+OK<CR><LF>

parameters： key

The network key of 16 Byte

Example： AT+ KEY=01030507090B0D0F00020406080A0C0D

Default： KEY=01030507090B0D0F00020406080A0C0D

6.4.8. AT+SHORT_ADDR

Function： Query local network address

Format： query

send：AT+SHORT_ADDR =?

return：SHORT_ADDR=shortaddr<CR><LF>

Parameter： shortaddr

0000-FFFF network short address

Example： AT+SHORT_ADDR=?

6.4.9. AT+MAC_ADDR

Function： Query/configure network PANID

Format：query

send：AT+MAC_ADDR=?

return：MAC_ADDR=macaddr<CR><LF>

Parameter： macaddr

8 Byte MAC address（The only IEEE ID）

Example： AT+MAC_ADDR=?

6.4.10. AT+COOR_SHORT_ADDR

Function： Query the short address of parent node

Format：query

send：AT+COOR_SHORT_ADDR=?

return：COOR_SHORT_ADDR=macaddr<CR><LF>

Parameter： macaddr

8 Byte MAC address（the only IEEE ID）

Example： AT+COOR_SHORT_ADDR=?

6.4.11. AT+COOR_MAC_ADDR

Function： Query the MAC address of parent node

Format： query

send：AT+COOR_MAC_ADDR=?

return：COOR_MAC_ADDR=macaddr<CR><LF>

Parameter： macaddr

8 Byte MAC address（The only IEEE ID）

Example： AT+COOR_MAC_ADDR=?

6.4.12. AT+GET_SHORT_ADDR

Function： Query the short addresses of any MAC device in network

Format：query

send：AT+GET_SHORT_ADDR=macaddr

return：GET_SHORT_ADDR=shoraddr<CR><LF>

Parameter： macaddr

8 Byte MAC address（The only IEEE ID）

shoraddrt

The queryed short address of device

Example： AT+GET_SHORT_ADDR=4B805A3D25741200

6.4.13. AT+GROUP

Function： Query/configure network group number

Format：query

send：AT+GROUP=?

return：GROUP=group<CR><LF>

configure

send：AT+GROUP=group

return：+OK<CR><LF>

Parameter： group（0~99）

local group number

Example： AT+GROUP=group

Default： GROUP=1

6.4.14. AT+CH

Function： Query/configure Wireless Channel

Format：query

send：AT+CH=?

return：CH=ch<CR><LF>

configure

send：AT+CH=ch

return：+OK<CR><LF>

Parameters： ch（11~26）

Wireless channel

Example： AT+CH=11

Default： CH=11

6.4.15. AT+TXPOWER

Function： Query/configure wireless transmit power

Format：query

send：AT+TXPOWER=?

return：CH=txpower<CR><LF>

configure

send：AT+TXPOWER=txpower

return：+OK<CR><LF>

Parameter： txpower（0~4）

transmit power（Refer to the power comparison table for details.）

Example： AT+TXPOWER=4

Default： TXPOWER=4

6.4.16. AT+UART

Function： Query/configure serial port baud rate

Format： query

send：AT+UART=?

return：UART=baud<CR><LF>

configure

send：AT+UART=baud

return：+OK<CR><LF>

Parameter： baud（0~15）

serial port baud rate（Refer to the power comparison table for details）

Example： AT+UART=9

Default： UART=9

6.4.17. AT+SLEEP

Function： Query/Configure sleep mode of device（Valid for terminal）

Format：query

send：AT+SLEEP=?

return：SLEEP=sleep<CR><LF>

configure send：AT+SLEEP=sleep

return：+OK<CR><LF>

Parameter： sleep

0 Turn off sleep mode

1~250 sleep mode is on，Sleep time is 1~250s

Example： AT+SLEEP=0

Default： SLEEP=0

6.4.18. AT+DATA_TIME

Function： Query/configure data save time（valid for router and coordinator）

Format： query

send：AT+DATA_TIME=?

return：DATA_TIME=data_time<CR><LF>

configure

send：AT+SLEEP=data_time

return：+OK<CR><LF>

Parameter： data_time

0~120 data save time，Unit:S

Example： AT+DATA_TIME=30

Default： DATA_TIME=30

6.4.19. AT+SOFT_ID

Function： Query firmware version number

Format：query

send：AT+SOFT_ID=?

return：SOFT_ID=soft_id<CR><LF>

Parameter： soft_id

firmware version number

Example： AT+SOFT_ID=?

6.4.20. AT+RESET

Function： Device reset

Format： configure

send：AT+RESET

return：+OK<CR><LF>

Example： AT+ RESET=?

6.4.21. AT+RESTORE

Function： Restore factory settings

Format： configure

send：AT+RESTORE

return：+OK<CR><LF>

Example： AT+RESTORE=?

6.4.22. AT+GPIO_PUT

Function： Configure remote/local GPIO input/output mode

Format：configure

send：AT+GPIO_PUT=addr,gpiox,inout

return：+OK<CR><LF>

Parameter： addr

0000~FFF8 remote short address device

FFFF loval device

gpiox (0~9)

GPIO port number

input

0 Output status

1 Input status

Example： AT+GPIO_PUT=1AC0,5,0

6.4.23. AT+RGPIO_PUT

Function： Read remote/local GPIO input and output mode

Format： configure

send：AT+RGPIO_PUT=addr,gpiox

return：RGPIO_PUT=addr,input<CR><LF>

Parameter： addr

0000~FFF8 remote short address device

FFFF local device

gpiox (0~9)

GPIO port number

input

0 Output state

1 Input state

Example： AT+RGPIO_PUT=1AC0,5

6.4.24. AT+GPIO_LEVEL

Function： Read remote/local GPIO input and output mode

Format： configure

send：AT+GPIO_LEVEL=addr,gpiox,level

return：+OK<CR><LF>

Parameter： addr

0000~FFF8 remote short address device

FFFF local device

gpiox (0~9)

GPIO local device

level

0 High level

1 Low level

2 turn

Example： AT+GPIO_LEVEL=1AC0,5,2

6.4.25. AT+RGPIO_LEVEL

Function： Read remote/local GPIO input and output mode

Format: read

send：AT+RGPIO_LEVEL=addr,gpiox

return：RGPIO_LEVEL=addr,input,level<CR><LF>

Example： addr

0000~FFF8 remote short address device

FFFF local device

gpiox (0~9)

GPIO port number

input

0 Output state

1 Input state

level

0 High Level

1 Low Level

Example： AT+RGPIO_LEVEL=1AC0,5

6.4.26. AT+PWM

Function： Configure remote/local PWM input and output modes

Format: Configure

send：AT+PWM= addr,period,duty1, duty2,duty3,duty4,duty5

return：+OK<CR><LF>

Parameters： addr

0000~FFF8 remote short address device

FFFF local device

period (Unit 1 = 62.5ns)

0~65535 cycle

duty1

0 turn off

Others Channel 1 is a square wave with a 50% duty cycle

duty2~ duty5 （0~65535 Unit 1 = 62.5ns）

The PWM of the channel is closed when the pulse width time of the corresponding channel number is 0 or greater than the period.

Example： AT+ PWM=1AC0,1000,1,500,500,0,500

6.4.27. AT+RPWM

Function： Read remote/local PWM input and output mode

Format: read

send：AT+RPWM=addr

return：RPWM=addr,period,duty1,duty2,duty3,duty4,duty5<CR><LF>

Parameter： addr

0000~FFF8 remote short address device

FFFF local device

period (unit 1 = 62.5ns)

0~65535 cycle

duty1

0 turn off

Others Channel 1 is a square wave with a 50% duty cycle

duty2~ duty5 （0~65535 Unit 1 = 62.5ns）

The PWM of the channel is closed when the pulse width time of the corresponding channel number is 0 or greater than the period.

Example： AT+RPWM=1AC0

6.4.28. AT+ADC

Function： Read remote/local ADC input

Format: read

send：AT+ADC=addr,adcx

return：ADC=addr,val<CR><LF>

Parameter： addr

0000~FFF8 remote short address device

FFFF local device

adcx （0~6）

ADC channel

val （0~3300）

Current acquisition voltage value in mV (millivolts)

Example： AT+ADC=1AC0,5

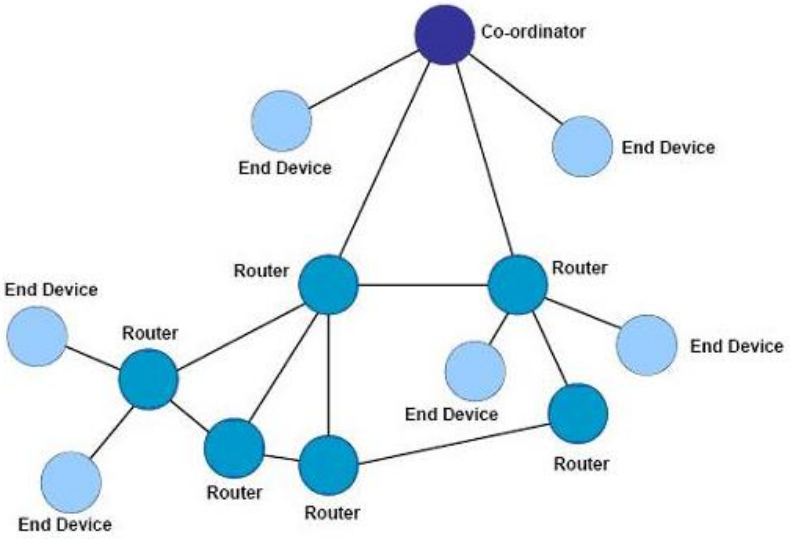
7. User's Notes

7.1. ZigBee Network Role and Notices

No.	Description
1	This module uses ZigBee network, which consists of a coordinator and any other devices (routers and terminals).
2	It features self-organization, self-routing and multi-hop network. (Default support network depth is 5, total number of sub-nodes is 20, number of sub-routing nodes is 6)
3	The parent node (coordinator and router) can save data for the sleep terminal. The save time can be set by the user (default 30s, range 0~120s).
4	Only the terminal device has a sleep function within 250. The user can set it by itself, and the default is 0 (sleep mode is off). Note: It is recommended that the sleep time must be less than the parent node data save time, otherwise it will affect data reception.
5	Short Address is used in network communication. Note: Short address is randomly allocated when the device joins the network. The long address of the device Mac Address is the only fixed one. If the device does not know the short address, it can search the Short Address in the network through the corresponding instructions according to Mac Address, then to carry out point-to-point communication.
6	The coordinator is unique in the network and the short address is fixed at 0000.
7	If the point broadcast address is FFFF, FFFD, or FFFC, it corresponds to three broadcast modes.
8	When the network parameter PANID is FFFF, it is automatically allocated. If the device PANID is different, it cannot be networked.
9	It cannot join the network if the network key are different. The network keys are all open, users cannot get correct air data through software capture.
10	All devices in the network have broadcasting function on. Multiple devices broadcasting at the same time or broadcasting at a higher frequency of a single device may cause serious network congestion. Please try to avoid this situation.
11	Modules do not need to join this group when group broadcast, and the group broadcast to any group directly according to the communication method. After the group broadcast, the local group number won't be changed because of different group broadcast number.
12	The PWM function and sleep mode in the network cannot be used at the same time. Please turn off the sleep mode before turning on the pwm function.
13	It can be awaken by serial port after the sleep mode. Remark: In the sleep state, the first frame data awoken by the serial port is invalid.
14	In the ZigBee network communication, the single-packet data transmission period can not be too fast (generally recommended to be more than 1 second), or it may cause data loss. （ if there's too much nodes in the network, the too fast broadcast cycle may case the unstable network.）
Remark: Please refer to the 《E18_Software_Datasheet_CN_V2.0Communication Protocol Specification》 for detailed function parameters.	

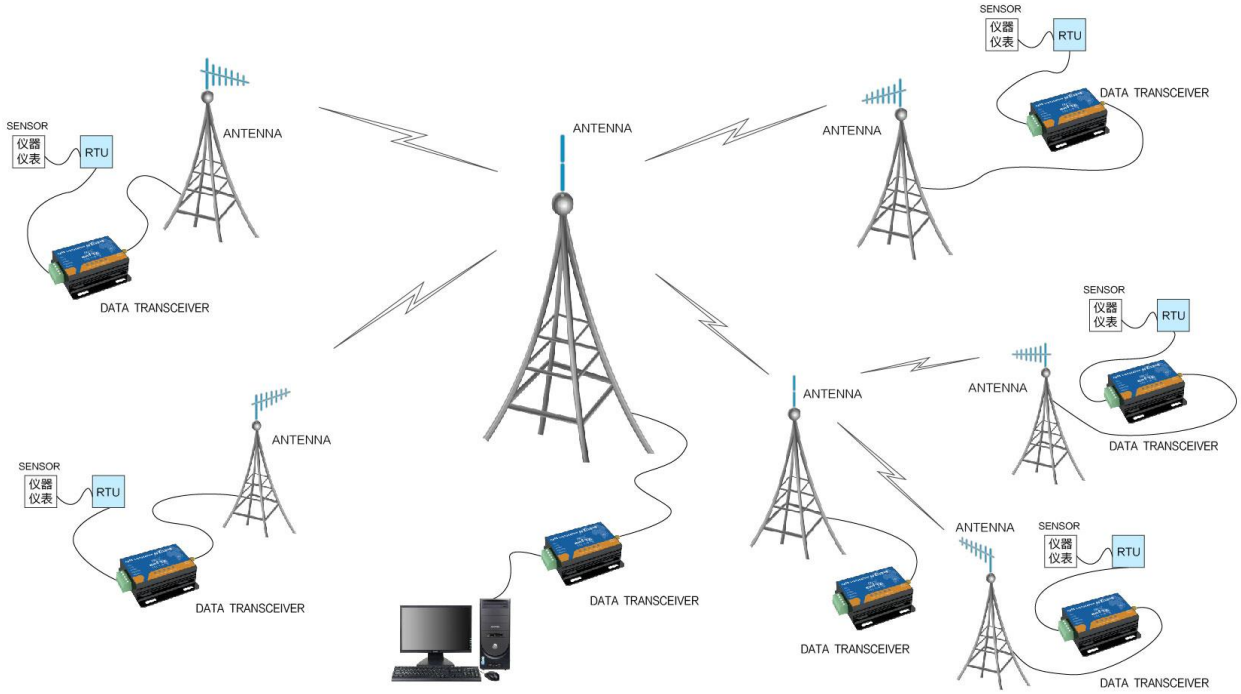
7.2. Network structure

The network structure of this module is a mesh network structure.（MESH）
The network of the MESH topology has powerful functions. The network can communicate by means of "multi-level hopping"; the topology can also form an extremely complex network; the network also has self-organizing and self-healing functions;



8. Practical applications

Ebyte data Transmitter is suitable for all kinds of point-to-point, point-to-multipoint wireless data transmission systems, such as smart home, IoT renovation, power load monitoring, distribution automation, hydrology and water condition monitoring, water pipe network monitoring, urban street lamp monitoring, air defense alarm control, railway signal monitoring, railway water supply centralized control, oil supply and gas pipeline network monitoring, GPS positioning system, remote meter reading, electronic hanging scale, automatic target reporting, seismic forecasting, fire prevention, environmental monitoring and other industrial automation systems. As shown below:



9. Notice for Usage

1. In some flammable places (such as coal mines) or near explosive dangerous objects (such as detonators for detonation), this product should not be operated.
2. Suitable DC regulated power supply should be selected, requiring strong anti-high frequency interference ability, small ripple, and sufficient carrying capacity; it is better to have over-current, over-voltage protection and lightning protection functions to ensure the normal operation of the product..
3. Do not use in working environment beyond the environmental characteristics of product, such as high temperature, humidity, low temperature, strong electromagnetic field or large dust environment.
4. Don't let the product continuously be in full load state, otherwise it may burn the transmitter.
5. The ground wire of the product should be well connected with the ground wire of the external device (such as PC, PLC, etc.) and the power supply. Otherwise, it is easy to burn out the communication interface; do not plug or unplug the serial port.
6. When testing the product, it must be connected with a matching antenna or a 50Ω dummy load, otherwise it will easily damage the transmitter; if the antenna is connected, the distance between the human body and the antenna should preferably exceed 2 meters to avoid injury; do not touch the antenna when transmitting.
7. In different environment it has different transmission distance, which affected by temperature, humidity, obstacle density, obstacle volume, electromagnetic environment; In order to ensure stable communication, it is recommended to reserve more than 50% communication distance margin.
8. If the measured communication distance is not ideal, it is suggested to improve the communication distance by analyzing the antenna quality and the installation mode of the antenna. You can also contact support@cdebyte.com for help.
9. When selecting the power supply, pls note to keep 50% of the current margin and the ripple should not exceed 100mV.

10. Important Statement

1. All rights to interpret and modify this manual belong to Ebyte.
2. This manual will be updated based on the upgrade of firmware and hardware, please refer to the latest version.
3. Please refer to our website for new product information.

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