EBYTE Wireless Data Transceiver

E800-DTU(Z2530-2G4-20)

ZigBee Ad Hoc Network

User Instruction Manual

This manual may change with the continuous improvement of the product. Please refer to the latest version of the instruction.

1. Introduction

1.1 Brief introduction

E800-DTU(Z2530-2G4-20) is a wireless data transceiver based on ZigBee technology with function of transparent transmission, protocol transmission, AT configuration, etc. Wireless data transceiver working as a communication medium, as well as the fiber, microwave, the same line, has a certain scope of application: it provides some special conditions in the private network monitoring signal real-time, reliable data transmission, with the features of low cost, convenient installation and maintenance, diffraction ability, flexible network structure, range of coverage, suitable for the occasion of dot and scatter, complex geographical environment , connecting with PLC, RTU, rain gauge, level gauge and other data terminals.

1.2 Function Features

❖ All the core components are imported originally , compared with the current imports of digital transceiver , we are the most advanced, most cost effective and the smallest one.

❖ Transmission power is optional, all technical indicators have met the European industry standards.

❖ Use temperature compensation circuit, the frequency stability is better than ±2PPM.

❖ With operating temperature range: -40 ℃ ~ +85 ℃, adapting to a variety of harsh working environment.

❖ All with aluminum alloy shell, compact, easy installation, good heat dissipation; perfect shielding design, good electromagnetic compatibility and strong anti-interference ability.

❖ Power reverse protection, over-protection, antenna surge protection and other multiple protection functions, greatly increase the reliability of the transceiver.

❖ Powerful software features, all parameters can be programmed to set: such as power, frequency, air data rate, address ID, etc.

❖ Ultra-low power consumption, standby current is 20mA (the power consumption of power saving mode and sleep mode is lower), the transmitting current ≤ 350A (1W).

❖ With watchdog and accurate time layout, in the event of an exception, the module will automatically restart and continue to follow the previous parameters to operate.

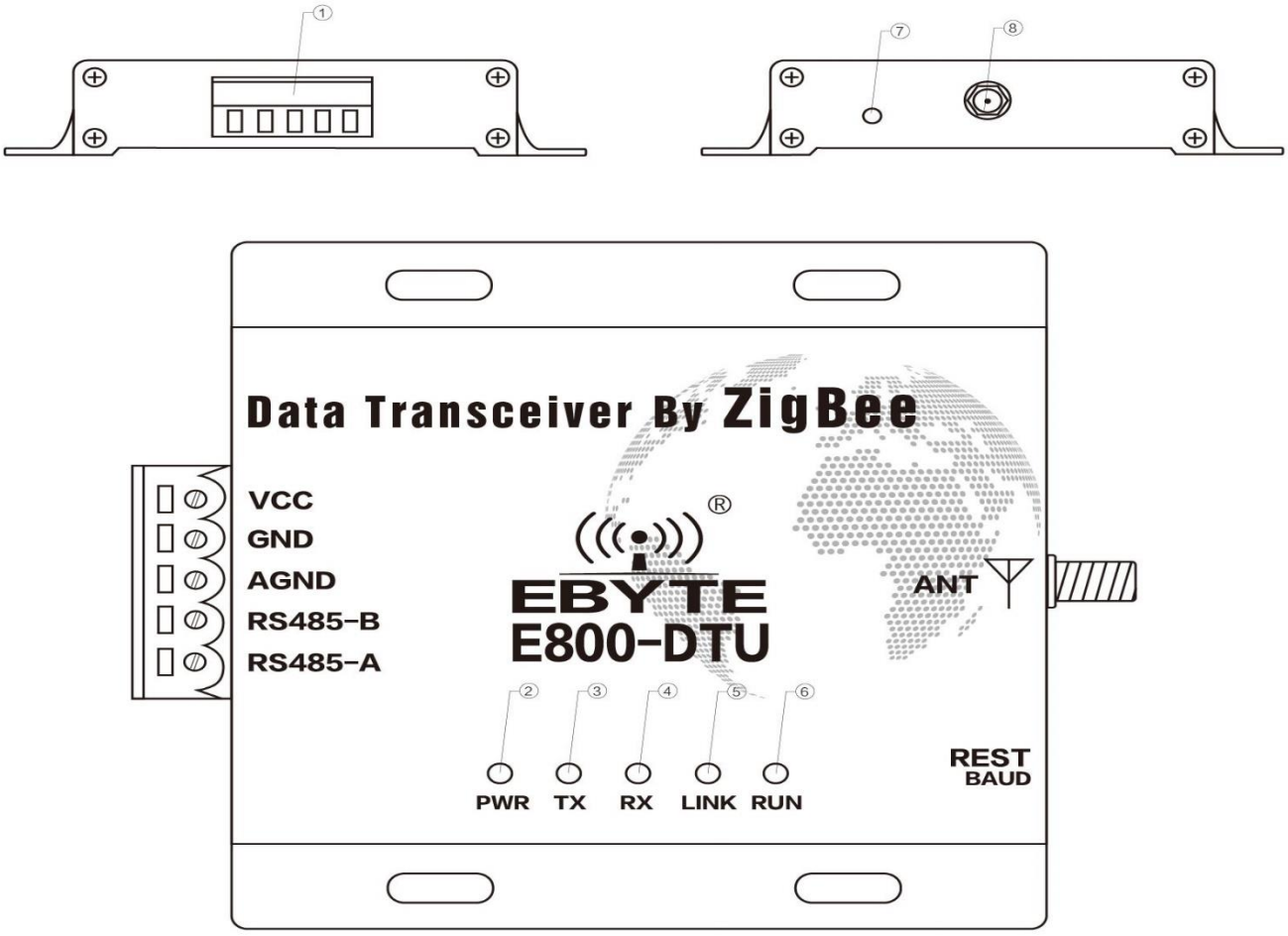
1.3Product Features

No.	Feature	Description
1	Role switch	Users can switch freely between the coordinator, router and end device via UART command.
2	Automatic	Support power-on automatic networking. The coordinator automatically sets up the network, the

	networking	end device and the router automatically searches and joins the network.
3	Network self-healing	Automatically reconnect when losing network. When intermediate node in network is lost, other networks automatically join or maintain the original network. (Isolated nodes automatically join the original network, non-isolated nodes maintain the original network.) When the coordinator is lost and non-isolated nodes exist in the original network, the coordinator can join the network again or coordinator of the original network PAN_ID set by the same user join the original network.
4	Ultra low power consumption	The device can be set as low power mode in the end state. Sleep time of the device can be changed according to the user's using time. The standby power consumption in the low power mode is less than 2uA. In the father node data storage time, all messages can be received within the time set by users.
5	Configuration for data storage time	When device is in the coordinator and router state, the user can set their own data storage time, and work with end device in sleep mode to save data for the end device, and sent data to the end device when it wakes up. Data saved is up to 3 data packets, if exceeded, it will automatically clear the first data! After the data is saved, the data heap is automatically cleared.
6	Automatic retransmission	In unicast mode, the device will automatically retransmit when failed to send to next node, and the number of retransmission per message is three.
7	Automatic routing	The module supports network routing. Router and coordinator have network data routing function, users can conduct multi-hopping networking.
8	Support encryption protocol	The module uses AES 128 bit encryption function, can change the network encryption and prevent monitoring. Users can change the network key by themselves. Only devices with the same network key can start normal networking communication.
9	Support UART configuration	Module has built-in UART commands, the user can configure (view) the parameters and functions of module via UART command .
10	Communication for various types of data	Support broadcasting, multicasting and unicasting in the entire network. In the broadcast and unicast mode, it also supports several transmission methods, please refer to <E18 v1.2 communication protocol> for the details.
11	Change channel	It supports change of 16 channels ranging from 11 to 26（2405~2480MHZ）, different channels have different frequency.
12	Change network PAN_ID	Free switch of network PAN_ID. Users can define PAN_ID to join the corresponding network by themselves or automatically select PAN-ID to join the network.
13	Change UART baud rate	Users can set baud rate by themselves which can be as high as 1M, it is 8 bits by default without parity bit.
14	Search short address	Users can find out corresponding short address according to the (unique and fixed) MAC address of module that already joined network.
15	Command format switch	The module supports AT command and HEX command for users' easy configuration and switch. The physical location is P1.6.
16	Module restore	Users can restore the module via UART commands.
17	Onekey recovery of baud rate	The module supports onekey recovery of baud rate when users forget the baud rate. The baud rate is 115200(default), physical location is P1.7.
18	Recover factory setting	Users recover the factory setting via UART commands.

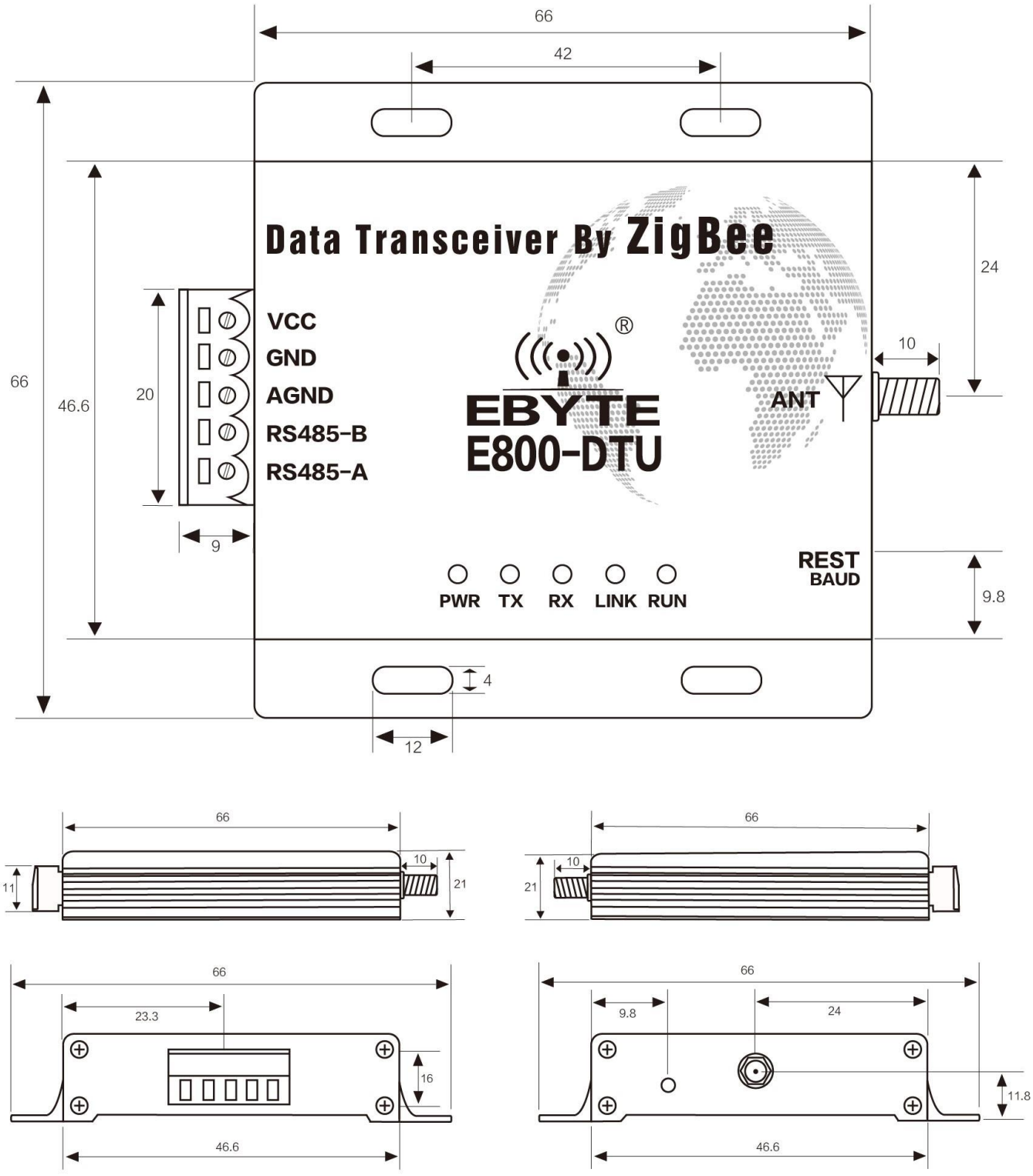
2. Installation Dimension

2.1 Pin description



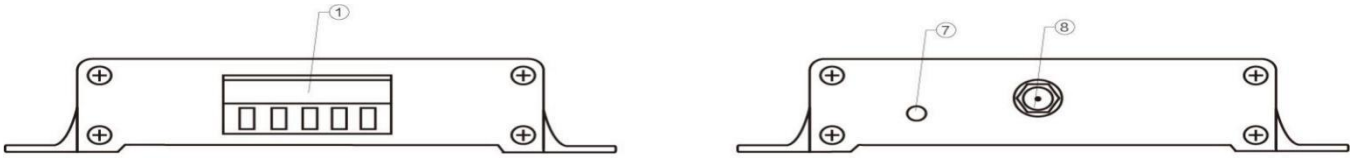
Pin NO.	Name	Function	Description
1	3.81mm terminal block	UART interface/ Power supply interface	Standard RS-232&485 interface/ Screwing power supply interface
2	PWR-LED	Power LED	Red, lit when the power is on
3	TX-LED	Transmit LED	Yellow, blinks when sending data
4	RX-LED	Receive LED	Yellow, blinks when reveiving data
5	LINK-LED	Link LED	Red, lit when no network, off when network connected
6	RUN-LED	Run LED	Red, system operating Indicator, lit when running error, off when running properly
7	Baud Rate Reset	Tact switch	Reset baud rate(115200)
8	Antenna interface	SMA-K interface	External thread, 10mm, 50 Ω characteristic impedance

2.2 Dimension



3. Interface definition

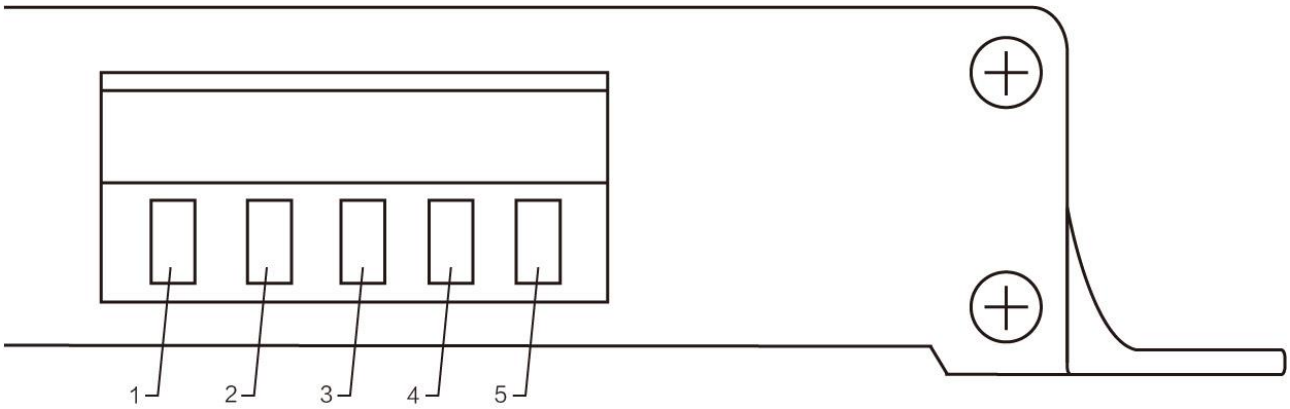
3.1 Power interface definition



Users can choose ① the VCC and GND terminal power supply, E800-DTU(Z2530-2G4-20) can use 8~ 28V DC power supply, but it is recommended to use 12V or 24V DC power supply.

3.2 RS485 interface definition

E800-DTU(Z2530-2G4-20) uses RS485 as communication protocol. How to connect the cable? Choose the corresponding interface in ① 3.81mm terminal block, details below:



Pin NO.	Definition	Function	Description
1	VCC	Screwing power interface, positive	8 ~ 28V DC, 12V or 24V(recommended)
2	GND	Screwing power interface, negative	The power supply negative pole is connected to the system ground and the housing
3	AGND	Public ground	Connected to ground of other devices or not connection
4	RS485-B	Serial port terminal	RS-485: Connected to RS 485 device interface B
5	RS485-B	Serial port terminal	RS-485: Connected to RS 485 device interface A

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

4. Function module

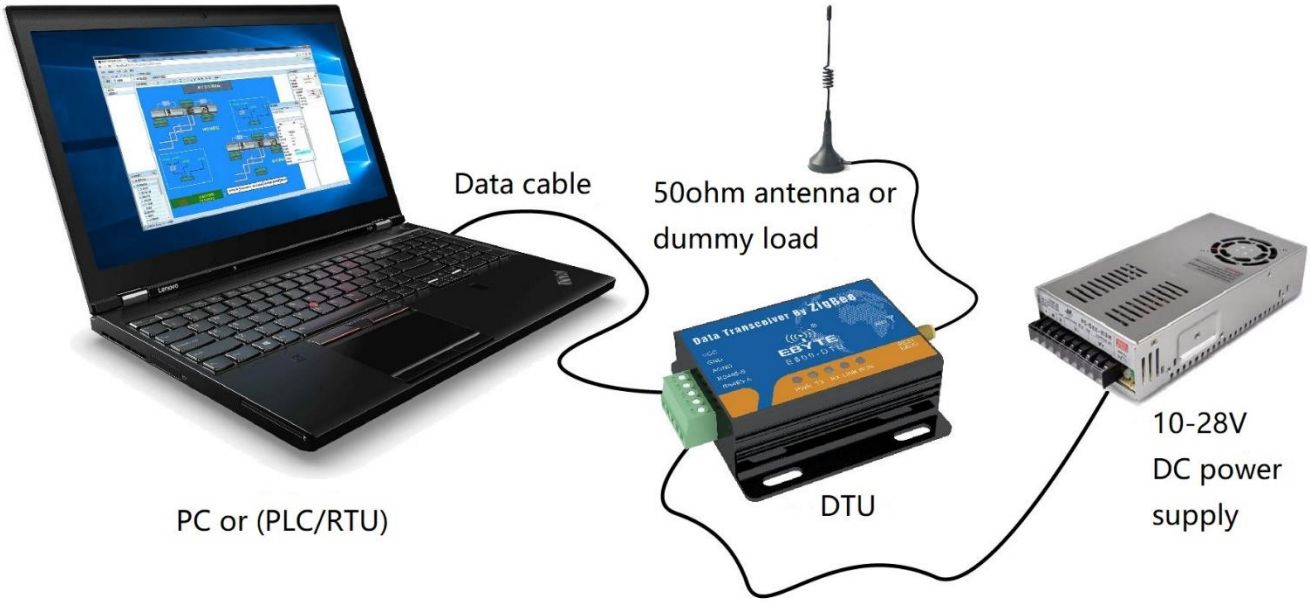
4.1. Operating mode

<table>
<tr><th>Mode</th><th>Node type</th><th>Description</th><th>Data communication display mode</th></tr>
<tr><td rowspan="3">Mode 1 (Transparent mode)</td><td>Coordinator</td><td>Serial data will be transmitted to modules not in sheep by broadcasting.</td><td rowspan="5">Data format can be configured by command:
1 Display Mac address of transmitter
2 Display Mac address of transmitter
3 Display RSSI value of message shortest path
(Display mode can be configured to no display, one mode display or multiple modes display)</td></tr>
<tr><td>Router</td><td rowspan="2">Serial data will be transmitted to coordinators by point to point.
(Note: Terminal can not receive the data in sleep mode)</td></tr>
<tr><td>Terminal</td></tr>
<tr><td rowspan="3">Mode 2 (Half-transparent mode)</td><td>Coordinator</td><td>Data will be transmitted according to the fixed format protocol of data transmission, There are point to point, broadcast, multicast transmission ways. Please refer to “HEX data communication description“ for details.</td></tr>
<tr><td>Router</td><td rowspan="2">Serial data will be transmitted to coordinators by point to point.</td></tr>
<tr><td>Terminal</td></tr>
<tr><td rowspan="3">Mode 3 (Protocol mode)</td><td>Coordinator</td><td rowspan="3">Data will be transmitted according to the fixed format protocol of data transmission, There are point to point, broadcast, multicast transmission ways. Please refer to “HEX data communication description“ for details.</td><td rowspan="3">None</td></tr>
<tr><td>Router</td></tr>
<tr><td>Terminal</td></tr>
<tr><td colspan="4">Note：User can only operate Mode 3 to configure GPIO function. Communication between arbitrary modes can communicate with each other and not affect each other。</td></tr>
</table>

4.2 Brief introduction of protocol mode

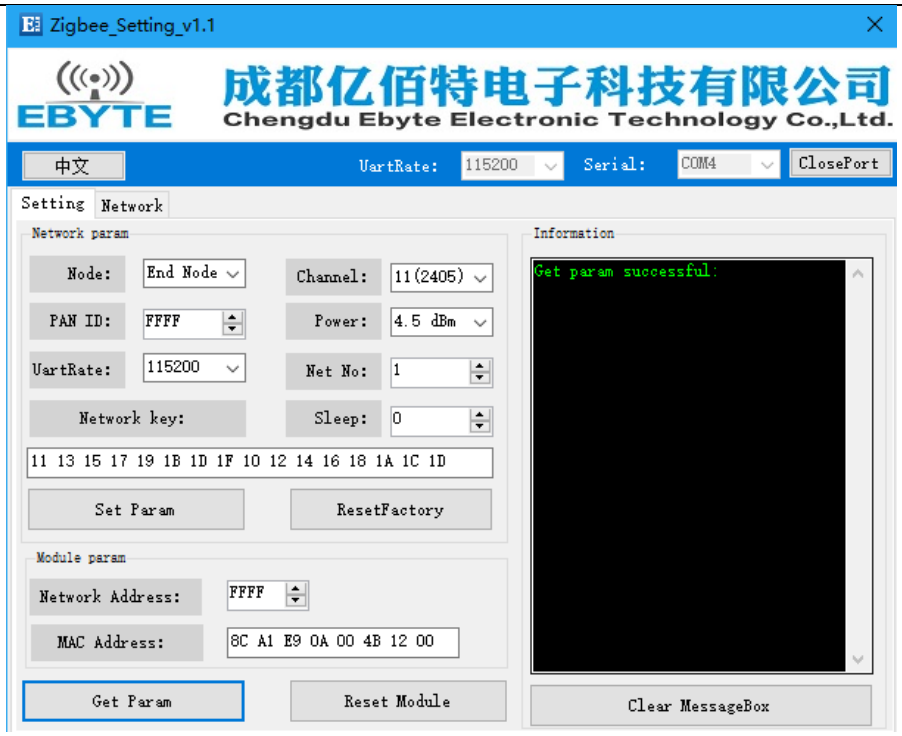
<table>
<tr><th>No.</th><th>Mode</th><th>Description</th></tr>
<tr><td>1</td><td>Broadcast</td><td>User can broadcast on the whole network according to command when connecting network (3 modes):
1、Mode 1 ——Broadcast to all modules.
2、Mode 2 ——Broadcast to modules in the receiving mode (except sleep mode).
3、Mode 3 ——Broadcast to full function modules (Coordinator and Router).</td></tr>
<tr><td>2</td><td>Multicast</td><td>Multicast to all modules (not in sleep mode) when connecting network.</td></tr>
<tr><td>3</td><td>Point to point</td><td>Module can communicate with other devices by short address according to command when connecting network (3 modes):
1、Transparent transmission ——no information
2、Short address ——the information is short address
3、Mac address ——the information is MAC address</td></tr>
<tr><td colspan="3">Notes: Please refer to “HEX data communication description“ for details.</td></tr>
</table>

5. Quick Start



★ Note: programming can only be carried on in a specific mode(see above), if fails, please confirm the work mode.

No.	Notes
1	【Construct network】: ①.Connect Zigbee ad hoc module via USB to UART converter. ②.Open host computer software "Zigbee_Setting_V1.1", select Com port and set baud rate as 115200(default), then open port;  ③.Click read parameter to read corresponding module parameter.

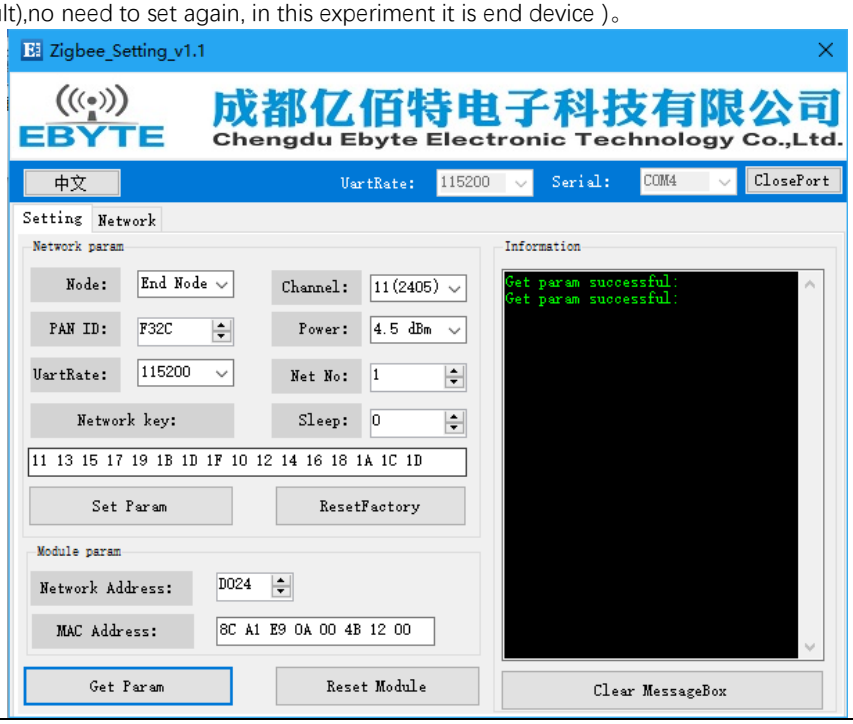


④.Select node type as coordinator, write in parameter. Wait the coordinator to start constructing network and users can check module parameter.

Set network parameter: (when PAN ID is FFFF, it is automatic PAN ID)

Read parameter when network is constructed:

⑤.Select another module, set it as the router or end device following the same steps (module is set as end device when leave factory (default),no need to set again, in this experiment it is end device)。



2	【Communication test】： ①.Click “fixed networking”of the coordinator and end device of the host computer. Corresponding info. is available to be viewed. Coordinator:  End device:  ②. For users’ convenience to observe, in this experiment it is HEX transmitting mode. If the device address is unknown, please input corresponding mac address and click get network address. The short address of coordinator is 0.

③.Input random content in these 3 modes, click start.

Transparent transmission:

From coordinator to end device:

From end device to coordinator:

Network address:

From coordinator to end device:

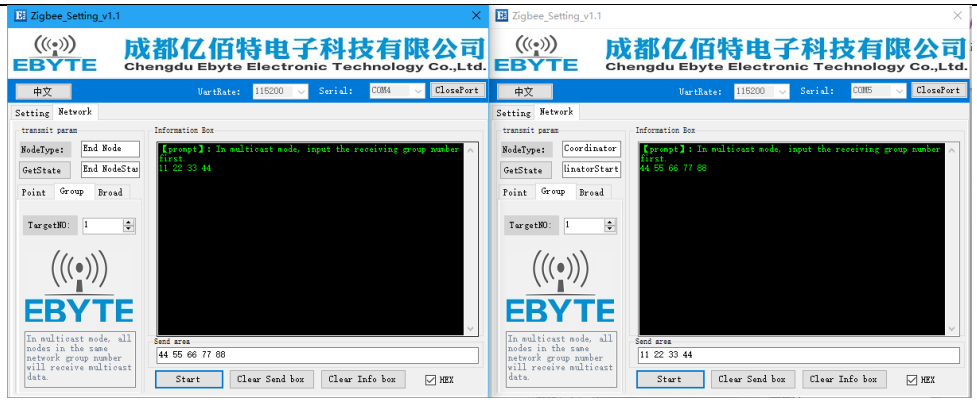
From end device to coordinator:

MAC address:

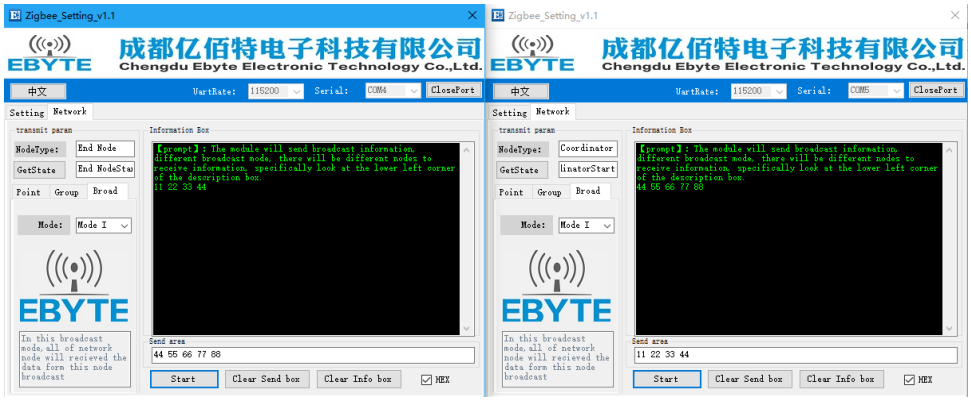
From coordinator to end device:

From end device to coordinator:

Multicast:



Broadcast ： (broadcast only conduct Mode 1, the entire network conduct broadcast mode experiment, other modes test by themselves)



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

6. User Command Set

For the convenience of users, E800-DTU(Z2530-2G4-20) has two command formats, AT and HEX, default HEX. In this mode, user can transmit “+++” with serial port assistant to be in temporary AT command mode, then can configure with AT command and exit AT command mode by transmitting “AT+EXIT”.

Note:

1. Serial data format error message
   HEX command mode: F7 FF
   AT command mode: +ERROR<CR><LF>
2. Coordinator building network message
   HEX command mode: FF FF
   AT command mode: Builded network<CR><LF>
3. Module joining the network message
   HEX command mode: FF AA
   AT command mode: Joined network<CR><LF>
4. Module no network message
   HEX command mode: FF 00
   AT command mode: No network<CR><LF>
5. <CR>: 0x0D
6. <LF>: 0x0A

6.1 HEX command Set

Description	Format	Example
Read device type	Transmit：FE 01 01 FF Return：FB dev_type	Transmit：FE 01 01 FF Return：FB 02
Read network state	Transmit：FE 01 02 FF Return：FB nwk_state	Transmit：FE 01 02 FF Return：FB 01
Read network PAN_ID	Transmit：FE 01 03 FF Return：FB pan_id	Transmit：FE 01 03 FF Return：FB 02 F4
Read network key	Transmit：FE 01 04 FF Return：FB key	Transmit：FE 01 04 FF Return：FB 11 13 15 17 19 1B 1D 1F 10 12 14 16 18 1A 1C 1D
Read local short address	Transmit：FE 01 05 FF Return：FB ShortAddr	Transmit：FE 01 05 FF Return：FB F2 EF
Read local Mac address	Transmit：FE 01 06 FF Return：FB Mac_Addr	Transmit：FE 01 06 FF Return：FB 89 6C 50 09 00 4B 12 00
Read father node short address	Transmit：FE 01 07 FF Return：FB Coor_shortAddr	Transmit：FE 01 07 FF Return：FB 00 00
Read father node Mac address	FE 01 08 FF Return：FB Coor _Mac_Addr	Transmit：FE 01 08 FF Return：FB 20 39 EA 0A 00 4B 12 00
Read network group no.	Transmit：FE 01 09 FF Return：FB group	Transmit：FE 01 09 FF Return：FB 01
Read communication channel	Transmit：FE 01 0A FF Return：FB channel	Transmit：FE 01 0A FF Return：FB 0B
Read transmission power	Transmit：FE 01 0B FF Return：FB txpower	Transmit：FE 01 0B FF Return：FB 04
Read serial baudrate	Transmit：FE 01 0C FF Return：FB baud	Transmit：FE 01 0C FF Return：FB 09
Read sleep state (vaild for terminal)	Transmit：FE 01 0D FF Return：FB sleep_time	Transmit：FE 01 0D FF Return：FB 05
Read data storage time (valid for router and coordinator)	Transmit：FE 01 0E FF Return：FB 1E	Transmit：FE 01 0E FF Return：FB 1E
Read all datas	Transmit：FE 01 FE FF Return：FB all_info	Transmit：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
Read arbitrary short address of Mac address	Transmit：FE 09 10 Mac_Addr FF Return：FB shortAddr	Transmit：FE 09 10 AF 99 E9 0A 00 4B 12 00 FF Return：FB 08 35
Read remote /local GPIO input/output state	Command：FE 04 20 addr gpiox FF Return：FB 20 addr In/Out	FE 04 20 F9 DE 04 FF
Read remote /local GPIO input/output level	Command：FE 04 21 addr gpiox FF Return：FB 21 addr In/Out level	FE 04 21 FF FF 04 FF

Description	Format	Example
Read remote /local PWM state	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 state	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

Network type

dev_type： 00 coordinator
01 router
02 terminal（default）

Network state

nwk_state： 00 no network
01 network

Network PAN_ID

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

Network key

key： 16 bytes network key

Network short address

ShortAddr： 2 Byte address

Network MAC address

Mac_Addr： 8 Byte address

Father node short address

Coor_shortAddr： 2 Byte address

Father node Mac address

Coor_Mac_Addr： 8 Byte address

Network group no.

group： 1~99（default 1）

Network chananel

channel： 11~26（default 11）

Transmission power

txpower：

txpower contrast with PA / without PA

txpower	power (dBm)
00	-3 / 16
01	-1.5 / 17
02	0 / 19

txpower	power (dBm)
03	2.5 / 20
04	4.5 / 20 （default）
05	

Serial baudrate

baud：

baudrate contrast

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

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

Sleep time

sleep_time： 0 sleep mode closed（default）

1~250 sleep mode opened sleep time is sleep_time /S (second)

Father node storage time

time： 0~120（default 30）, unit S（second）

GPIO parameter

(1) GPIO port

gpiox：

GPIO contrast

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 gpio parameter is 2，the pin is P0_2

When gpio parameter is 8，the pin is P2_1

(2) GPIO input/output state

in/out： 1 input

0 output

(3) GPIO state value（configuration input state invalid）

level： 0 low

1 high

2 flipping

PWM parameter

(1) PWM port

pwmx：

PWM port contrast

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

(2) pwm cycle

period： (0~FFFF)

cycle tim（unit 1 = 62.5ns）

(3) pwm duty cycle

dutyx： (0~FFFF)：

duty cycle time （unit 1 = 62.5ns）

ADC parameter

(1) ADC channel

adcx：

ADC channel contrast

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 disable

(3) adc sampling value

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

Peripherals addr parameter

(1) Peripherals address

addr:

FFFF	inquire/configure local info
0~FFF8	inquire/configure info of whose network address is addr
FFFE、FFFD、FFFC	inquire/configure info of which received broadcasting data

---FFFE broadcast to all modules

---FFFD broadcast to free modules (except sleeping modules)

---FFFC broadcast to coordinators and routers

All information

(1) all_info:

Identification	(Length (position))	Description
dev_type	(1 Byte (0))	Device type
nwk_state	(1 Byte (1))	Network state
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))	Father node short address
Coor_Mac_Addr	(8 Byte (33~40))	Father node MAC address
group	(1 Byte (41))	Network group no.
channel	(1 Byte (42))	Communication channel
txpower	(1 Byte (43))	Transmission power
baud	(1 Byte (44))	Serial baudrate
sleep_time	(1 Byte (45))	Sleep mode

Example for parameter:

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 (existing network)
- Network PAN_ID: 02 F4 (PAN_ID=0X02F4)
- Network key: 11 13 15 17 19 1B 1D 1F 10 12 14 16 18 1A 1C 1D
- Local short address: F2 EF (Local short Address=0XF2EF)
- Local MAC address: 89 6C 50 09 00 4B 12 00
- Father node short address: 00 00 (Short Address=0X0000)
- Father node MAC address: 20 39 EA 0A 00 4B 12 00
- Network group no.: 01 (1)
- Communication channel: 0B (11)
- Transmission power: 04 (4.5dBm)
- Serial baudrate: 09 (115200)
- Sleep mode: 05 (5 seconds)

(Note: Father node storage time is not included, if needs inquire or configuration, please use independent command)

HEX communication description

Command format description

(Note：It is applicable only to the nodes in mode 3 or coordinator in mode 2)

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

Parameter description

DATA parameter description：

（1）**Broadcasting data**（content to be sent)

command：01+type+data

parameter description：type

01：mode 1 ——broadcast to all modules
02：mode 2 ——broadcast to free modules（except sleeping modules)
03：mode 3 ——broadcast to coordinators and routers

e.g：FC 05 01 02 31 32 33

description：broadcasting HEX data in mode2：0X31 0X32 0X33

（2）**Multicasting data**（content to be sent)

command：02+ group+data

parameter description：group

0~99：number

e.g：FC 05 02 01 31 32 33

description：transmit HEX data to network group no.1：0X31 0X32 0X33

（3）**Point to point transmission**（content to be sent)

command：03+ type +addr+data

parameter description： type （for coordinator in mode 2，it's invalid，it can be set to any value)

01：transparent transmission mode（no info.)
02：short address mode（short message info.)
03：MAC address mode（MAC message info.)

note：addr：network short address valid address: 0x0000—0xFFF8.

e.g：FC 07 03 01 AB CD 31 32 33

description：transmit HEX data point to point with short address to device whose network address is 0XADCD：0X31 0X32 0X33

AT Command Set

AT+DEV

Function：inquire /configure device type

Format：

inquire

transmit：AT+DEV= type

return：+OK<CR><LF>

configure

transmit：AT+DEV=?

return：DEV= type<CR><LF>

Parameter： type

C coordinator

R router

E terminal

e.g：AT+DEV=C

Default：DEV=E

AT+EXIT

Function：exit temporary AT command（valid when pull low P1_6 pin to be in AT mode）

Format：

configure

transmit：AT+EXIT

return：+OK<CR><LF>

e.g：AT+EXIT

AT+MODE

Function：inquire /configure operating mode

Format：

Inquire

transmit：AT+MODE=?

return：MODE=type<CR><LF>

configure

transmit：AT+MODE=mode

return：+OK<CR><LF>

Parameter：mode

1 mode 1 （transparent transmission mode）

2 mode 2 （half transparent transmission mode）

3 mode 3 （protocol mode）

e.g：AT+MODE=3

default：MODE=3

AT+RMODE

Function：inquire /configure communication display mode

Format：

inquire

transmit：AT+RMODE=?

return：RMODE=type<CR><LF>

configure

transmit：AT+RMODE=type

return：+OK<CR><LF>

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

0bit ： transmitter's Mac address'

1bit ： transmitter's short address'

2bit ： RSSI value of message shortest path

e.g： AT+RMODE=0

default： RMODE=0

AT+NWK

Function： inquire network state

Format：

inquire

transmit：AT+NWK=?

return：NWK=nwk_state<CR><LF>

Parameter： nwk_state

0 no network

1 existing network

e.g： AT+NWK=?

AT+PANID

Function： inquire /configure network PANID

Format：

inquire

transmit：AT+PANID=?

return：PANID=panid<CR><LF>

configure

transmit：AT+PANID=mode

return：+OK<CR><LF>

Parameter： panid

0000-FFFE fixed PANID

FFFF random PANID

e.g： AT+ PANID=0XA1B2

AT+KEY

Function： inquire /configure network key

Format：

inquire

transmit：AT+KEY=?

return：KEY=key<CR><LF>

configure

transmit：AT+PANID=mode

return：+OK<CR><LF>

Parameter： key

16 Byte network key

e.g： AT+ KEY=01030507090B0D0F00020406080A0C0D

Default： KEY=01030507090B0D0F00020406080A0C0D

AT+SHORT_ADDR

Function： inquire /configure local network address

Format：

inquiry

transmit：AT+SHORT_ADDR =?

return：SHORT_ADDR=shortaddr<CR><LF>

Parameter： shortaddr

0000-FFFF network short address

e.g： AT+SHORT_ADDR=?

AT+MAC_ADDR

Function： inquiry/configure network PANID

Format：

inquiry

transmit：AT+MAC_ADDR=?

return：MAC_ADDR=macaddr<CR><LF>

Parameter： macaddr

8 Byte MAC address（unique IEEE ID）

e.g： AT+MAC_ADDR=?

AT+COOR_SHORT_ADDR

Function： inquiry father node network short address

Format：

inquiry

transmit：AT+COOR_SHORT_ADDR=?

return：COOR_SHORT_ADDR=macaddr<CR><LF>

Parameter： macaddr

8 Byte short address（unique IEEE ID）

e.g： AT+COOR_SHORT_ADDR=?

AT+COOR_MAC_ADDR

Function： inquiry father node network MAC address

Format：

inquiry

transmit：AT+COOR_MAC_ADDR=?

return：COOR_MAC_ADDR=macaddr<CR><LF>

Parameter： macaddr

8 Byte MAC address（unique IEEE ID）

e.g： AT+COOR_MAC_ADDR=?

AT+GET_SHORT_ADDR

Function： inquiry any MAC device short address

Format：

inquiry

transmit：AT+GET_SHORT_ADDR=macaddr

return：GET_SHORT_ADDR=shoraddr<CR><LF>

Parameter：macaddr

8 Byte MAC address（unique IEEE ID）

shoraddrt

short address

e.g：AT+GET_SHORT_ADDR=4B805A3D25741200

AT+GROUP

Function：inquiry/configure network group no.

Format：

inquiry

transmit：AT+GROUP=?

return：GROUP=group<CR><LF>

configure

transmit：AT+GROUP=group

return：+OK<CR><LF>

Parameter：group（0~99）

Local group no.

e.g：AT+GROUP=group

Default：GROUP=1

AT+CH

Function：inquiry/configure communication channel

Format：

inquiry

transmit：AT+CH=?

return：CH=ch<CR><LF>

configure

transmit：AT+CH=ch

return：+OK<CR><LF>

Parameter：ch（11~26）

wireless channel

e.g：AT+CH=11

Default：CH=11

AT+TXPOWER

Function：inquiry/configure transmission power

Format：

inquiry

transmit：AT+TXPOWER=?

return：CH=txpower<CR><LF>

configure

transmit：AT+TXPOWER=txpower

return：+OK<CR><LF>

Parameter：txpower（0~4）

transmission power

e.g：AT+TXPOWER=4

Default：TXPOWER=4

AT+UART

Function：inquiry/configure baudrate

Format：

inquiry

transmit：AT+UART=?

return：UART=baud<CR><LF>

configure

transmit：AT+UART=baud

return：+OK<CR><LF>

Parameter：baud（0~15）

serial baudrate

e.g：AT+UART=9

Default：UART=9

AT+SLEEP

Function：inquiry/configure sleep mode (valid for terminal)

Format：

inquiry

transmit：AT+SLEEP=?

return：SLEEP=sleep<CR><LF>

configure

transmit：AT+SLEEP=sleep

return：+OK<CR><LF>

Parameter：sleep

0 close sleep mode

1~250 open sleep mode，time is 1~250 seconds

e.g：AT+SLEEP=0

Default：SLEEP=0

AT+DATA_TIME

Function：inquiry/configure data storage time (valid for coordinator and router)

Format：

inquiry

transmit：AT+DATA_TIME=?

return：DATA_TIME=data_time<CR><LF>

configure

transmit：AT+SLEEP=data_time

return：+OK<CR><LF>

Parameter： data_time

0~120 data storage time，unit: second

e.g： AT+DATA_TIME=30

Default： DATA_TIME=30

AT+SOFT_ID

Function： inquiry/configure soft id

Format： inquiry

transmit：AT+SOFT_ID=?

return：SOFT_ID=soft_id<CR><LF>

Parameter： soft_id

software id

e.g： AT+SOFT_ID=?

AT+RESET

Function： reset

Format： configure

transmit：AT+RESET

return：+OK<CR><LF>

e.g： AT+ RESET=?

AT+RESTORE

Function： restore factory settings

Format： configure

transmit：AT+RESTORE

return：+OK<CR><LF>

e.g： AT+RESTORE=?

AT+GPIO_PUT

Function： configure remote/local GPIO input/output mode

Format： configure

transmit：AT+GPIO_PUT=addr,gpiox,inout

return：+OK<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

e.g： AT+GPIO_PUT=1AC0,5,0

AT+RGPIO_PUT

Function： read remote/local GPIO input/output mode

Format：

configure

transmit：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

e.g： AT+RGPIO_PUT=1AC0,5

AT+GPIO_LEVEL

Function： read remote/local GPIO input/output mode

Format：

configure

transmit：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 port number

level

0 high level

1 low level

2 flipping

e.g： AT+GPIO_LEVEL=1AC0,5,2

AT+RGPIO_LEVEL

Function： read remote/local GPIO input/output mode

Format：

read

transmit：AT+RGPIO_LEVEL=addr,gpiox

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

Parameter： addr

0000~FFF8 remote short address device

FFFF local device

gpiox (0~9)

GPIO port number

input

0 output number

1 input number

level

0 high level

1 low level

e.g： AT+RGPIO_LEVEL=1AC0,5

AT+PWM

Function： configure remote/local GPIO input/output mode

Format：

configure

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

return：+OK<CR><LF>

Parameter： addr

0000~FFF8 remote short address device

FFFF local device

period (unit 1 = 62.5ns)

0~65535 cycle

duty1

0 closed

other channel 1 square wave of 50% duty cycle

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

the positive pulse duration of the corresponding channel, PWM is closed when it is 0 or greater than the cycle

e.g： AT+ PWM=1AC0,1000,1,500,500,0,500

AT+RPWM

Function： read remote/local PWM input/output mode

Format：

read

transmit：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 closed

other channel 1 square wave of 50% duty cycle

duty2~ duty5 (0~65535 单位 1 = 62.5ns)

the positive pulse duration of the corresponding channel, PWM is closed when it is 0 or greater than the cycle

e.g： AT+RPWM=1AC0

AT+ADC

Function： read remote/local ADC input amount

Format：

read

transmit：AT+ADC=addr,adcx

return：ADC=addr,val<CR><LF>

Parameter： addr

0000~FFF8 remte short address device

FFFF local device

adcx （0~6）

ADC channel

val （0~3300）

current acquisition voltage value， unit: mV

e.g： AT+ADC=1AC0,5

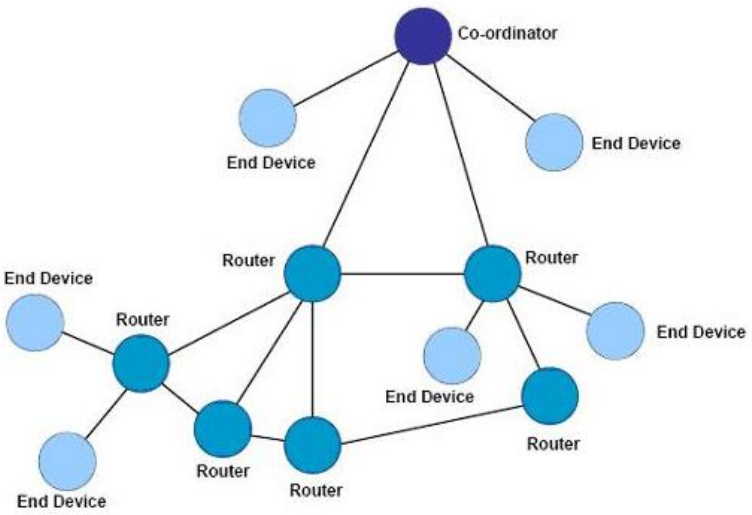
7. User Instruction

7.1.Network role and notice

No.	Description
1	Module uses Zigbee ad hoc networking, consisting of one coordinator and random other devices(routers and end-devices)
2	It has self-organization, self-routing and network multi-hopping function (By default the network depth is 5, there are 20 son nodes and 6 son router nodes in total)
3	The father node device (coordinator and router) can save data for the end-devices in sleep. The save time can be set by the user (by default it is 30 seconds, ranging from 0 to 120 seconds).
4	Only the end device has the sleep function, sleeping within 250S, the user can set by themselves, the default 0 (with sleep mode off). Note: The recommended sleep time must be less than the data storage time of father node , otherwise it will affect the data reception.
5	In network communication Short Address communication is used. Note: The short address is randomly distributed when the device joins the network, the long address of MacAddress is the only fixed one, if the short address is unknown, the network Short Address can be found via corresponding commands according to the MacAddress , and point to point communication is conducted.
6	Coordinator is unique in the network, the short address is 0000.
7	If unicast address is FFFF， FFFD， FFFC， then it corresponds to three broadcast mode.
8	When PANID is FFFF, it means automatic distribution. Networking can not be realized if PANID is different.

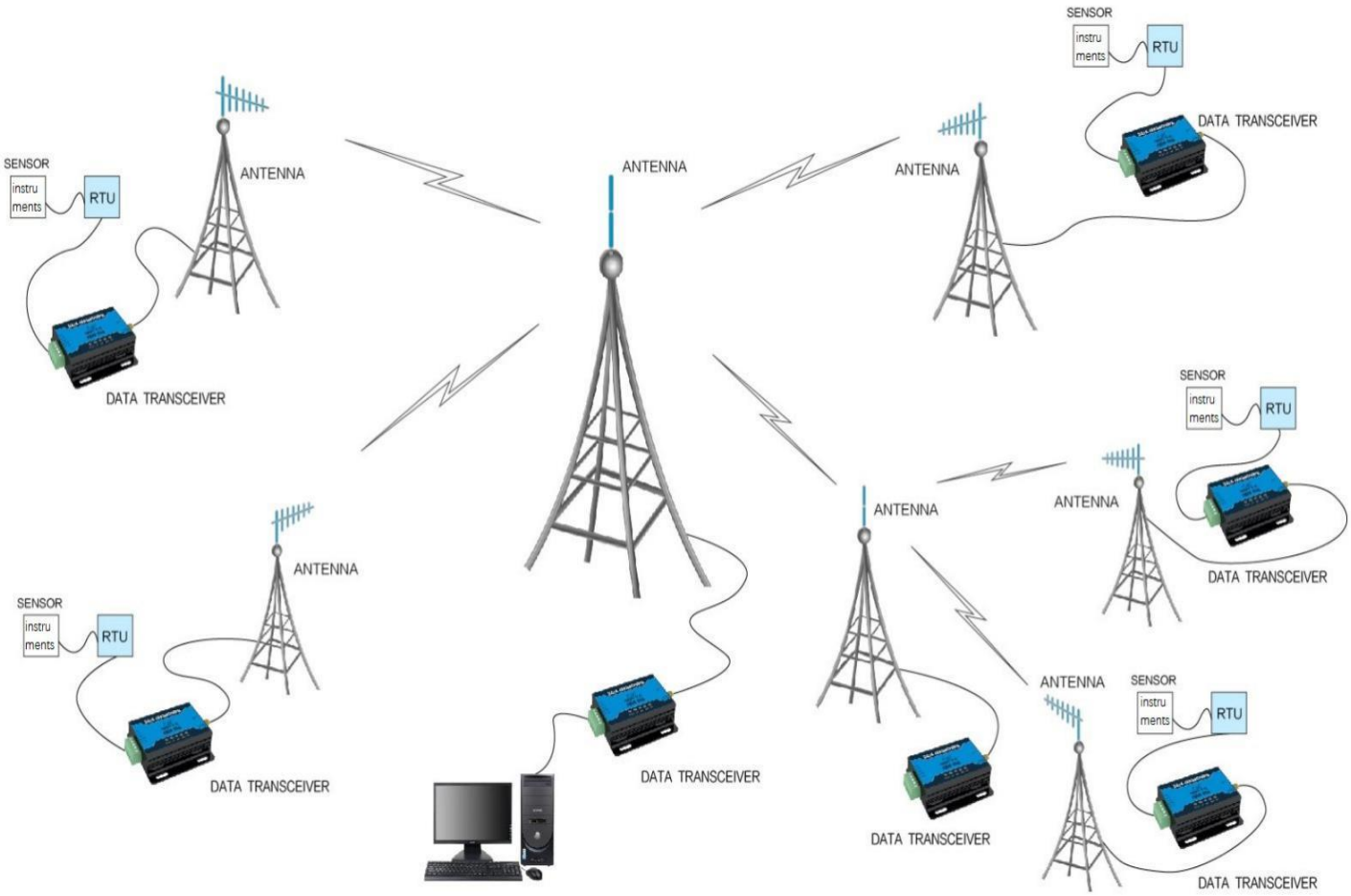
9	When network keys are not the same the network can not be joined. The module network key of the module remains open, the user can not get the correct air data via software packet capture .
10	All devices in the network have opened broadcast function. Multiple devices broadcasting at the same time or a single device broadcasting at a higher frequency will lead to a serious network congestion. Please try to avoid this situation.
11	When multicasting module does not need to join the group,but be directly multicasted to any group according to communication usage guidance. After the multicast, the local group number will not change due to different multicast number.
12	PWM function and sleep mode can not be used at the same time in network, please turn off the sleep mode before turn on PWM function .
13	After sleep mode, it can be waked up via the serial port(UART). Note: In the sleep state, the first frame of data waked up via UART is invalid.
14	In the Zigbee network, single package data transmission can not be too fast(recommended more than 1s), because the data may be lost. (Note, it may cause network instability when the nodes is too many and transmission is too fast)
Notes: see more in <Zigbee setting software instruction>	

7.2.Network structure

The network structure of module is MESH network
MESH network topology network has a powerful function, the network can communicate via "multi-level hopping"; the topology can also form a very complex network; network also has self-organization, self-healing function.
   **Network structure diagram**

8. Practical application Fields

The data transceiver of CDEBYTE is applied for all kinds of point to point, one point to multiple points wireless data transmission system, such as smart home, Internet of things transformation, power load monitoring, distribution network automation, hydrological and hydrological forecasting, water pipe network monitoring, urban street lamps Monitoring, air defense alarm control, railway signal monitoring, centralized control of railway water supply, oil supply pipe network monitoring, GPS system, remote meter reading, electronic crane, automatic reporting, seismic forecasting, fire prevention, environmental monitoring and other industrial automation system, as shown below:



9. Note

1. Please keep the warranty card of the equipment which includes the factory number (and important technical parameters) and is important for user's future maintenance and new equipment.

2. Transceiver during the warranty period, if the quality of the product itself rather than man-made damage or lightning and other natural disasters caused by damage, enjoys free warranty; please do not repair by yourself, the problem and please contact with our company when problem occurring, we offer the first-class after-sales service.

3. Please do not operate the transceiver in some flammable places such as coal mines or near explosive atmospheres (such as detonators).

4. Please use the appropriate DC power supply, high frequency interference ability, small ripple, and enough load capacity are required; it’s better to have over current, over voltage protection and lightning protection and other functions to ensure that transceiver working properly.

5. Please do not use it in the working environment beyond the transceiver environmental characteristics, such as high temperature, humidity, low temperature, strong electromagnetic fields or dust larger environment.

6. Please do not continuously keep transceiver to transmit in full capacity, or the transmitter might be damaged.

7. Please connect the ground with the external ground of the power supply (such as PC, PLC, etc.), otherwise it is easy to burn out the communication interface; do not plug the interface with power supplying.

8. When testing, please connect the antenna or 50 Ω load, otherwise transceiver will be damaged easily ;the distance from the antenna is better than 2 meters, so as to avoid harm, please do not touch the antenna when transmitting.

9. Wireless data transceiver has different communication distance in different environments, communication distance is influenced by temperature, humidity, obstacle density, obstacle volume and electromagnetic environment; in order to ensure stable communication, it is recommended to reserve at least 50 % of the communication distance.

10. When communication distance is not perfect, it is recommended to improve the antenna quality and the installation mode of the antenna. You can send mail to support@cdebyte.com for support.

11. When choosing power supply, it is recommended to keep at least 50% current left and the ripple must not exceed 100mV.

10. Important statement

1. CDEBYTE reserves the right of final interpretation and modification of all the contents of this manual.

2. As the hardware and software products continuously improving, this manual may subject to change without notice, please refer to the latest version.

3. Everyone is responsible for protecting the environment: to reduce the use of paper, we only provide electronic documents of the English manual, if necessary, please go to our official website to download; In addition, for special requirements, we agree to offer certain amount of documents according to order quantity, not every data transceiver are supplied with one manual, please understa

CDEBYTE after-sales technical support: support@cdebyte.com
For file download and more product information, please visit:www.cdebyte.com/en/
Thank you for using the CDEBYTE products! Any questions or suggestions, please contact: support@cdebyte.com

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