E70-433NW14S User Manual

433MHz Star Network SMD Wireless Module

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CONTENT

1. Overview

1.1 Introduction

E70-433NW14S is the star network module, operating at 433MHz, based on originally imported TI CC1310 and 15.4-Stack protocol, with coordinator and terminal as a whole. The module features with long range and high-speed transmission modes. Maximum 200 nodes can send data to one coordinator. Use industry-standard AT commands for operating configuration, which greatly simplifies user operations. With stable batch production, the module is suitable for various wireless communication network applications.

E70-433NW14S is the first 433MHz wireless module which meets IEEE 802.15.4 in China and solves a series of problems caused by the traditional 433MHz module. Users will no longer spend more effort to deal with complex network protocols, which greatly reduces the difficulty of customer development and shortens the user's development cycle. The protocol guarantees the stability and packet rate of the entire wireless communication system.

E70-433NW14S strictly follows design standards of FCC, CE, CCC and meets various RF certification requirements for exporting.

1.2 Features

- Communication distance tested is up to 2.5km
- Maximum transmission power of 25mW, software multi-level adjustable;
- Support the global license-free ISM 433MHz band;
- Support air date rate of 5kbps～50kbps;
- Support CSMA/CA, Carrier multi - channel interception technology which can avoid collision effectively
- Maximum 200 nodes, no need to deal with complicated protocol.
- Adopting AES128 data encryption, Ensure the reliability of data packets.
- Supports DSSS technology, like LoRa, better than GFSK.
- Low power consumption for battery supplied applications;
- Can achieve up to 115200bps continuous frame unlimited-packet length transmission
- Support 2.2V~3.8V power supply, power supply over 3.3V can guarantee the best performance;
- Industrial grade standard design, support -40 ~ 85 °C for working over a long time;
- IPEX access point, stamp hole is optional, facilitate user secondary development, facilitate integration.

1.3 Application

- Home security alarm and remote keyless entry;
- Smart home and industrial sensors;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial-grade remote control;

- Health care products;
- Advanced Meter Reading Architecture(AMI);
- Automotive industry applications.

2. Specification and parameter

2.1 Limit parameter

Main parameter	Performance		Remarks
	Min.	Max.	
Power supply（V）	0	3.8	Voltage over 3.8V will cause permanent damage to module
Blocking power（dBm）	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature（℃）	-40	85	

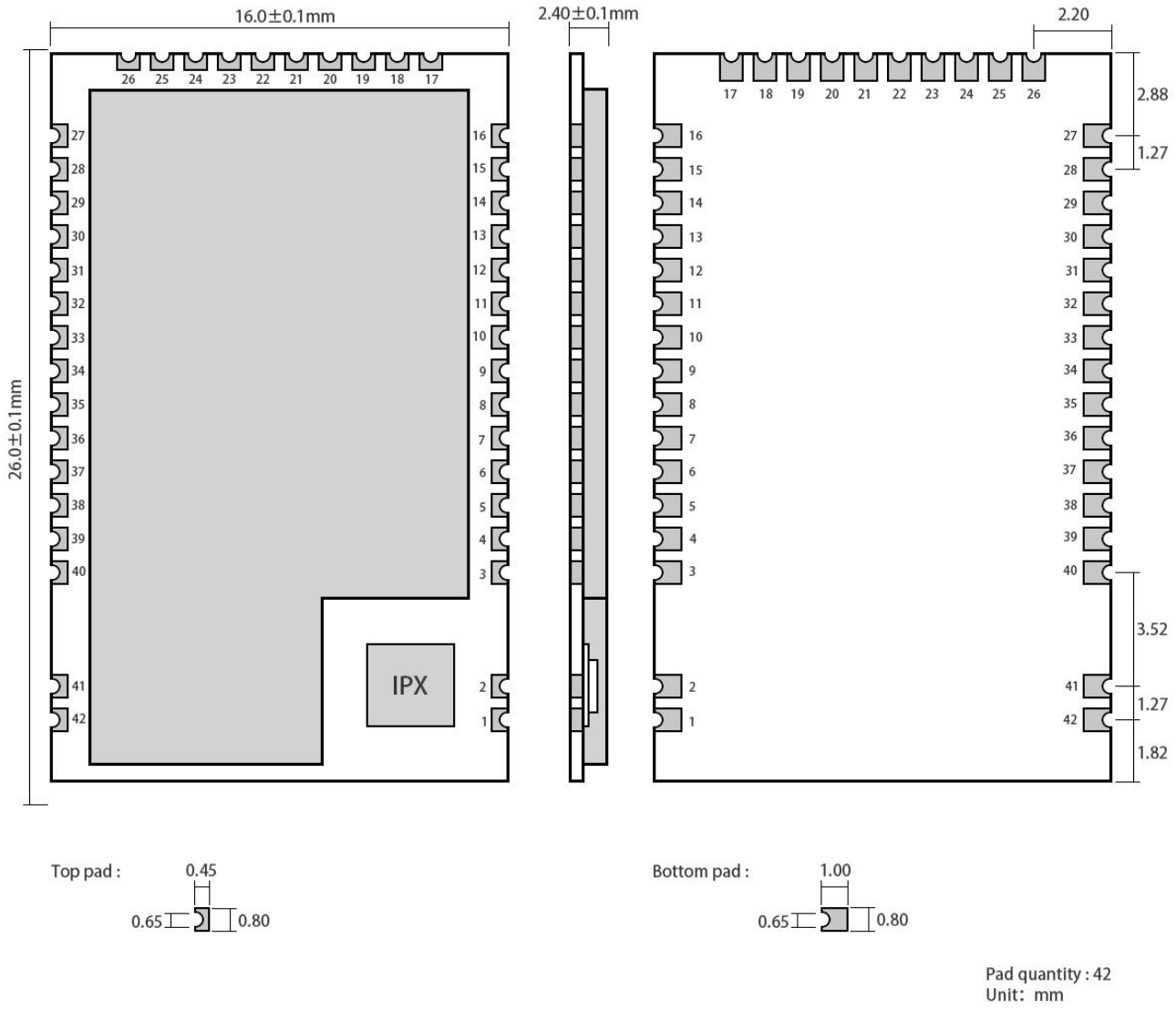
2.2 Operating parameter

Main parameter		Performance			Remark
		Min	Typ.	Max.	
Operating voltage（V）		2.2	3.3	3.8	≥3.3 V ensures output power
Communication level（V）			3.3		For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	-	85	Industrial design
Operating frequency（MHz）		431	-	446.5	Support ISM band
Power consumption	Transmitting current [mA]		37		Instant power consumption
	Receiving current [mA]		8		
	Turn-off current [μA]		2		Software is shut down
Max Tx power（dBm）		13.6	14.0	15.3	
Receiving sensitivity（dBm）		-109	-110	-111	Air data rate is 5kbps
Air data rate（bps）		5k	5k	50k	Controlled via user's programming

Main parameter	Description	remark
Distance for reference	2500m	Test condition：clear and open area, antenna gain: 5dBi, antenna height: 2.5m， air data rate: 5kbps
TX length	Transmission mode specification	See transmission mode for details
Buffer	512 Byte	A single packet may not exceed 128 bytes

Modulation	GFSK	
Communication interface	UART	
Package	SMD	
Connector	1.27mm	
Size	16*26mm	
Antenna	IPX/Stamp hole	50 ohm impedance

3 Size and pin definition



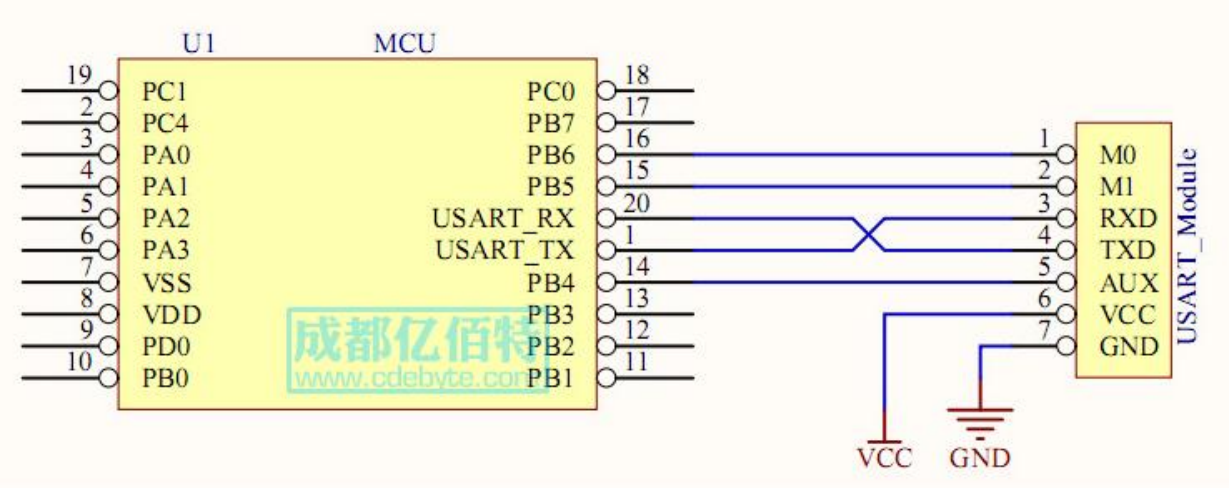
No.	Pin item	Pin direction	Application
1	GND	Ground	Ground electrode
2	ANT		Antenna (50Ω characteristic impedance)

3	NC	Reserved pin	Reserved, to be floated
4	NC	Reserved pin	Reserved, to be floated
5	NC	Reserved pin	Reserved, to be floated
6	NC	Output	Internal MCU controlled LNA pin, valid in high level,（to be floated）
7	NC	Output	Internal MCU controlled PA pin, valid in high level, （to be floated）
8	NC	Reserved pin	Reserved, to be floated
9	NC	Reserved pin	Reserved, to be floated
10	NC	Reserved pin	Reserved, to be floated
11	NC	Reserved pin	Reserved, to be floated
12	NC	Reserved pin	Reserved, to be floated
13	NC	Reserved pin	Reserved, to be floated
14	NC	Reserved pin	Reserved, to be floated
15	NC	Input	M2, M1, M0 together decide the 8 kinds of working modes; An external 1k protective resistor shall be connected in series when in use.
16	GND	Ground	Ground electrode
17	M0	Input	M2, M1, M0 together decide the 8 kinds of working modes; An external 1k protective resistor shall be connected in series and a 1M pull-up resistor shall be added when in use. (Cannot be floated, but it can be grounded when not used)
18	M1	Input	M2, M1, M0 together decide the 8 kinds of working modes; An external 1k protective resistor shall be connected in series and a 1M pull-up resistor shall be added when in use. (Cannot be floated, it can be grounded when not used)
19	RXD	Input	TTL serial port input connecting to external TXD pin. It can be configured as open-drain or high pull input, please refer to Parameter setting. An external 1k protective resistor shall be connected in series when in use.
20	TXD	Output	TTL serial port output connecting to external RXD input pin. It can be configured as open-drain or push-pull input, please refer to Parameter setting. An external 1k protective resistor shall be connected in series when in use.
21	TMSC	Input	JTAG TMSC
22	TCKC	Input	JTAG TCKC

23	NC	Reserved pin	Reserved, to be floated
24	NC	Reserved pin	Reserved, to be floated
25	AUX	Output	It is used to indicate the operation status of module, for user to wake up the external MCU, the module outputs low level during self-checking and initialization at power on, it can be configured as open-drain output or pull-up output, please refer to parameter setting part. An external 1k protective resistor shall be connected in series when in use. (can be floated)
26	VCC		Power positive reference, Power supply 2.1V ~ 3.8V DC
27	GND	Ground	Ground electrode
28	ACK	Reserved pin	Reserved, to be floated
29	NC	Reserved pin	Reserved, to be floated
30	NC	Reserved pin	Reserved, to be floated
31	NC	Reserved pin	Reserved, to be floated
32	RESET	Input	Reset pin, valid in low level
33	NC	Reserved pin	Reserved, to be floated
34	NC	Reserved pin	Reserved, to be floated
35	LINK	Reserved pin	Reserved, to be floated
36	NC	Reserved pin	Reserved, to be floated
37	NC	Reserved pin	Reserved, to be floated
38	NC	Reserved pin	Reserved, to be floated
39	NC	Reserved pin	Reserved, to be floated
40	NC	Reserved pin	Reserved, to be floated
41	GND	Ground	Ground electrode
42	GND	Ground	Ground electrode

- This product can achieve Pin compatibility, Pin to Pin replacement

4 Connect to MCU



No.	Description（STM8L MCU）
1	The UART module is TTL level., please collect with MCU.
2	For some MCU works at 5VDC, it may need to add 4-10K pull-up resistor for the TXD & AUX pin.

5 Firmware Transmitting mode

5.1 Transparent transmission

	Format	Values
When the coordinator is set to transparent transmission, the coordinator will send broadcast message. At this time, all non-dormant nodes in the entire network will receive data.		

5.2 Short address transmission

	Format	Values
Coordinator short address transmission format: short address + valid data 00 00 or FF FF are broadcast address		
Coordinator	HEX	Sending：00 01 AA BB CC
Node A address 00 01	HEX	Receiving：AA BB CC
Node B address 00 02	HEX	Null
Node C address 00 03	HEX	Null
Coordinator	HEX	FF FF AA BB CC
Node A address 00 01	HEX	AA BB CC

Node B address 00 02	HEX	AA BB CC
Node C address 00 03	HEX	AA BB CC

5.3 Long address transmission

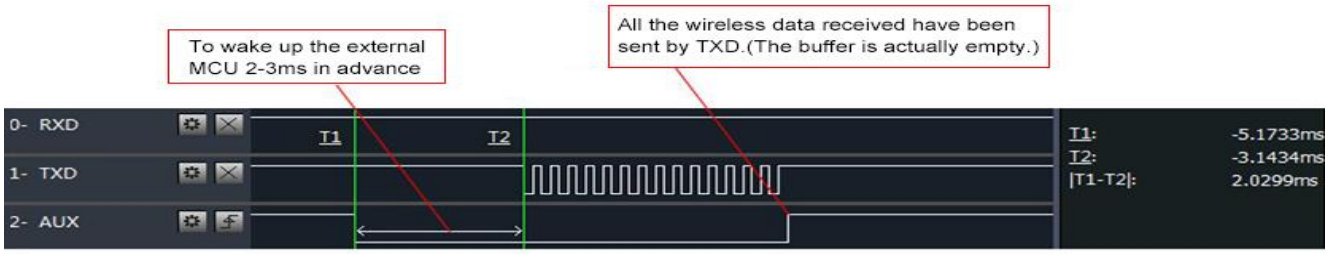
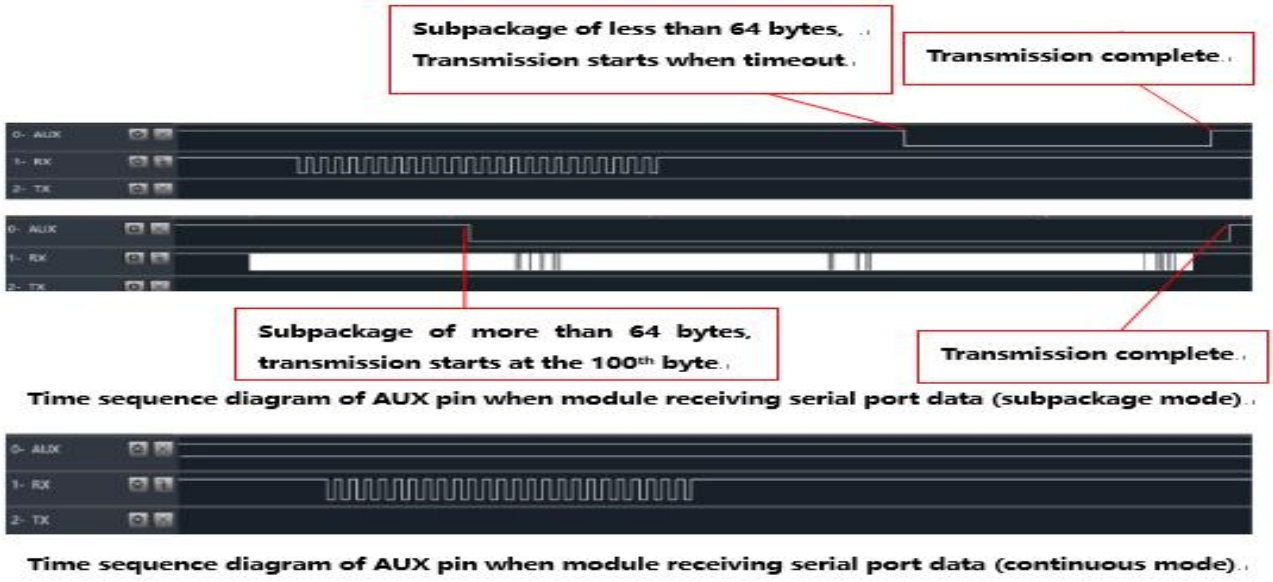
	Format	Values
Coordinator short address transmission format: short address + valid data 00 00 00 00 00 00 00 00 or FF FF FF FF FF FF FF FF are broadcast address;		
Coordinator	HEX	Sending：0A 01 AA 45 65 13 12 44 AA BB CC
Node A address: 0A 01 AA 45 65 13 12 44	HEX	Receiving：AA BB CC
Node B address： 0D 55 18 42 1A 27 29 64	HEX	Null
Node C address: A4 78 02 46 B5 1C 5A 02	HEX	Null
Coordinator	HEX	FF FF FF FF FF FF FF FF AA BB CC
Node A address: 0A 01 AA 45 65 13 12 44	HEX	AA BB CC
Node B address: 0A 01 AA 45 65 13 12 44	HEX	AA BB CC
Node C address: 0A 01 AA 45 65 13 12 44	1 HEX	AA BB CC

6.Device status

No	Description（STM8L MCU）
1	The UART module is TTL level.
2	For some MCU works at 5V DC, it may need to add 4-10K pull-up resistor for the TXD & AUX pin.

6.1 AUX description

It can indicate whether there are data that are yet to send via wireless way, or whether all wireless data has been sent through UART, or whether the module is still in the process of self-check initialization.

No.	Description
1	【Indication of UART output】can be used to wake up external MCU.  Timing Sequence Diagram of AUX when TXD pin transmits
2	【Indication of wireless transmitting】 1.The length of the buffer is 512 bytes, and the single packet must not exceed 128 bytes, when Aux=1, users can transmit data continuously within 128 bytes. 2.When AUX = 1, it means that all the UART data of the module have been transmitted already.  Time sequence diagram of AUX pin when module receiving serial port data (subpackage mode) Time sequence diagram of AUX pin when module receiving serial port data (continuous mode)

6.2 LINK description

- The LINK pin indicates the current network status, after the node is connected to the network, the current pin is pulled low. The external device can query the device network status through the pin level. In the coordinator mode, the pin indicates if the module establishes the network normally.

6.3 ACK description

- The ACK pin is used to indicate the status of the last user's data transmission. Before transmitting, the pin is pulled

low. After the transmission is successful, the pin is pulled high. The user can use this pin state to judge if the data has arrived successfully. This pin function cannot indicate the coordinator to send broadcast message.

- Note: In 802.15.4 protocol, the device will use the CSMA/MA technology to access the channel before sending data. When the receiving device receives the data, the returned ACK does not have this mechanism. This means that even if the receiving device can receive data in extreme conditions, sending device ACK pin indicates that the last data transmission failed.

7.Operating mode

	M1	M0	Description	Remarks
Coordinator mode	0	0	Set up a network to manage network node information	Transfer data according to input and output modes
Normal node	0	1	Send and receive data at any time	High real-time performance
Dormant node	1	0	Low-power reception, sending data at any time	Receive delay, send need to wake up the serial port
Sleep mode	1	1	Cannot send and receive data, system sleeps	The fixed baud rate is 115200 8N1

7.1.Coordinator mode

If the user configures the operating mode 4,（M0=0,M1=0）or the user configures the operating mode as 0, the module works in the coordinator mode. In the coordinator mode, the coordinator can set up the network, coordinator is the central node of the network, there must be a coordinator in the network.

The coordinator configurable data input mode is:

Broadcast transmission. When configured to broadcast, all non-dormant devices on the entire network will receive data. The ACK pin indicates transmission successfully all the time.

Short address transmission, when configured to short address transmission, the user must specify the short address before sending data.
Long address transmission. When configured to long address transmission, the user must specify the long address before sending data.

7.2.Normal node

If the user configures the operating mode 4,（M0=0,M1=1）or the user configures the operating mode as 1, the module works in the normal node mode. In the normal node mode, the data can be received and sent in real time. It is suitable for

application with low power consumption but high real-time requirement.

7.3.Dormant node

If the user configures the operating mode as 4, M0=1,M1=0, or the user configures the operating mode as 2, the module works in the dormant node mode, the device request if there is data transmitted by coordinator according to the user-configured sleep period , The non-broadcast data sent by the coordinator will be temporarily stored inside the coordinator. The device is in low power consumption during the sleep period. If the sleep node wants to send data actively, the user should send no more than two bytes to wake up the device. After the byte data is used to wake up the device and the wake-up byte is sent, the user needs to wait for more than 100ms to send the real data. After the wake-up byte is sent, the user needs to wait for 100ms to send the real data and the wake-up data will be discarded. After the device was waken up, the module will open the serial port, receiving AT command, if more than 2 seconds, there is no data input, the module will close serial port and go to sleep.The sleep node is suitable for applications where the user requires high power consumption but does not require high real-time data.

7.4 Configuration mode

When M0=1,M1=1,the device will switch to configuration mode. In the this mode, the serial port parameters are: 115200, 8N1, and the average operating current is 2uA. In this mode, the module cannot send and receive data. When the external AT instruction is configured, needs the serial port to send no more than two bytes data to wake up the device .After the wake-up byte is sent, the user needs to wait for 100ms to send the real data and the wake-up data will be discarded. After the device was waken up, the module will open the serial port, receiving AT command, if more than 2 seconds, there is no data input, the module will close serial port and go to sleep. The next AT command requires the user to resend the wake-up byte.

7.5 Mode switching

No	Remarks
1	The user can decide the operating mode by the combination of M1 and M0
2	In any work mode, the user can configure the operating mode through the AT command
3	When M0=1,M1=1, the serial port parameters are 115200, 8N1(fixed)

8.Quick start

8.1 Communication between normal node and coordinator

Coordinator configuration

Open the serial port assistant, select the serial port corresponding to the device, and set the serial port parameters (default is 115200, 8N1)

Enter "+++" without line breaks to enter the AT command mode. When receiving "Enter AT Mode", the AT mode is successfully entered. As shown in Figure 5-1:

Enter "AT+HELP" with line breaks to see all instructions. As shown in Figure 1:

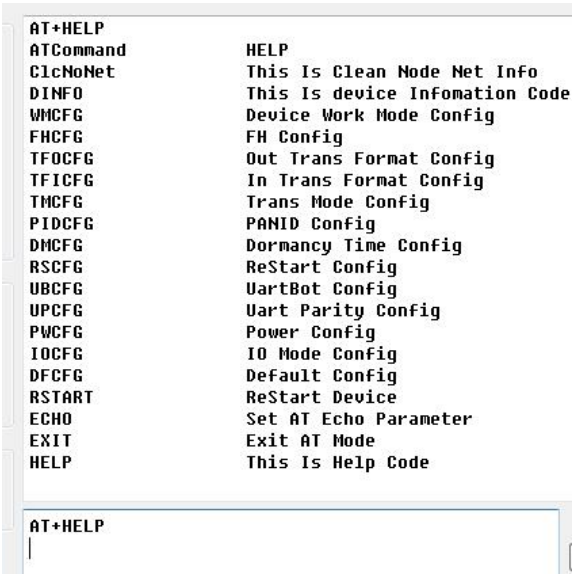


Figure 1

Then enter "AT+WMCFG=0" with line breaks to configure the device as the coordinator mode, as shown in Figure 2:

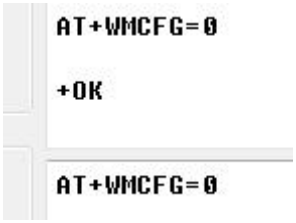


Figure 2

Then enter “AT+RSTART” to restart the device with a line break. The coordinator configuration is complete. As shown in Figure 3:

Figure 3

Normal node configuration

Open the serial port assistant and select the serial port corresponding to the device. Set the baud rate to 115200, the data bit to 8 bits, the parity bit to none, the stop bit to 1 bit, and the flow control is disabled, open the serial port.

Enter "+++" without line breaks to enter the AT command mode. When receiving “Enter AT Mode", the AT mode is successfully entered.

Enter "AT+HELP" with line breaks to see all instructions. As shown in Figure 4:

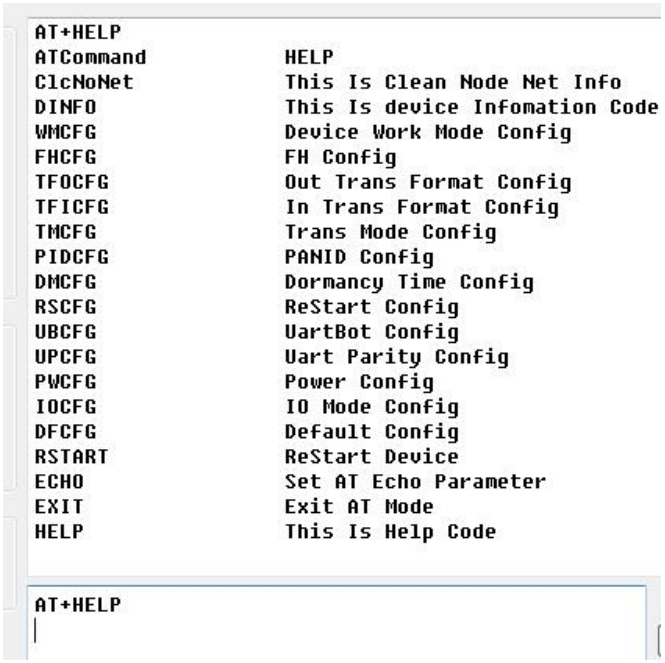


Figure 4

Then enter "AT+WMCFG=1" with line breaks to configure the device as the coordinator mode, as shown in Figure 5:

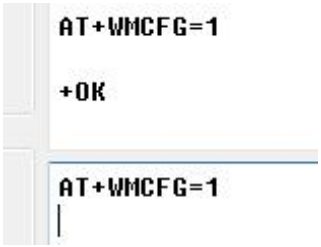


Figure 5

Then enter “AT+RSTART” to restart the device with a line break. The coordinator configuration is complete.

As shown in Figure 5-6:

Figure 6

Network transmission data transmission

When the configuration is complete, the coordinator restarts and the DIO11 pin is asserted low, indicating that the coordinator has started and is running. After an normal node device starts up, it will have a network access time of 10 to 20 seconds. When the network access is completed, the DIO11 pin will be set to low level, indicating that the

network access is successful.

After waiting for the device to access the network successfully, the coordinator enters to AT mode, enters the command "AT+DINFO=ALLNODE" with a newline character, the coordinator will return the short address and long address of all the nodes that have already entered the network and recorded. As shown in Figure 5-7:

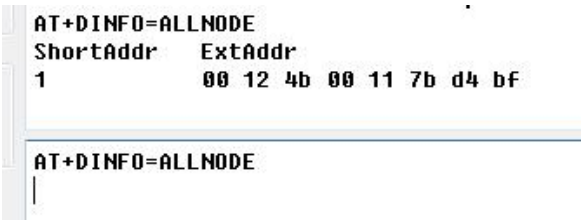


Figure 7

At this time, use “AT+EXIT” to exit the AT command mode with a newline character, and reclaim “Exit AT Mode” to exit AT mode. Next can transfer data, as shown in Figure 8:

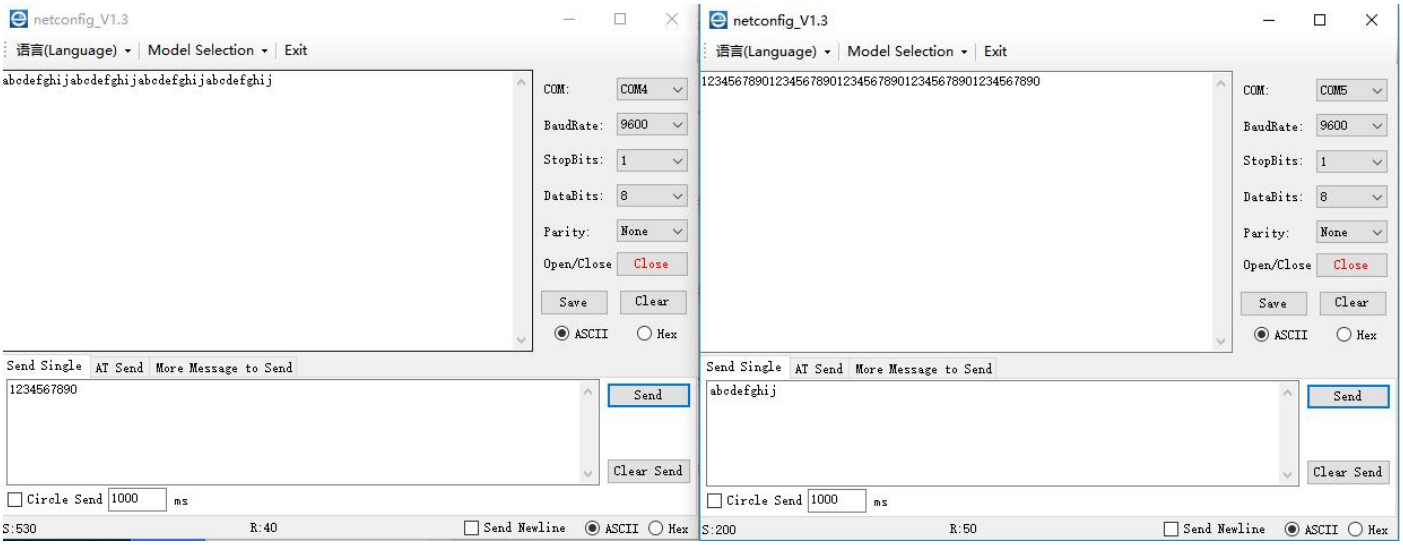


Figure 8

The coordinator and node devices can communicate with each other normally.

9. ATC Command

When the serial port enters AT mode, it needs to open the serial port assistant, set the serial port (default parameter) baud rate 115200, data bit 8 bit, stop bit 1 bit, open the serial port, input "+++" without carriage return. All parameter settings will reply "\r\n+OK\r\n".

<table>
<tr><td rowspan="3">1</td><td colspan="2">Enters” +++” into AT Command</td></tr>
<tr><td>+++</td><td>Parameter Description:
Nonparametric
Response:
Enter AT Mode</td></tr>
<tr><td colspan="2">Example：+++</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">Note: 1. The AT command can be used only after entering the AT command mode
2. After entering the AT command mode, the AT command mode can be used again only after exiting the AT command mode, reset or restart the module
3. When writing this instruction, the serial debugging assistant must be set not to send new lines; writing other AT commands must be set to send new lines.</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">AT+EXIT Exit AT command mode</td></tr>
<tr><td>AT+EXIT</td><td>Parameter Description:
Null
Response:
Exit AT Mode</td></tr>
<tr><td colspan="2">Example：AT+EXIT</td></tr>
<tr><td colspan="3">Note: AT commands are invalid after exiting AT command mode</td></tr>
<tr><td rowspan="3">3</td><td colspan="2">AT+HELP Help command</td></tr>
<tr><td>AT+HELP</td><td>Parameter Description:
Null
Response:
All instructions and help information</td></tr>
<tr><td colspan="2">Example：AT+HELP</td></tr>
<tr><td rowspan="4">4</td><td colspan="2">AT+ WMCFG Setting /Querying working mode (reboot valid)</td></tr>
<tr><td>AT+ WMCFG =?</td><td>Description:
Gets working mode
Response：
WMCFG：4</td></tr>
<tr><td>AT+ WMCFG =Value</td><td>Description:
Value：0~4
0，Coordinator；
1, Normal node;
2, Dormant Node；
3, Sleep mode；
4, (factory default), dial switch control</td></tr>
<tr><td colspan="2">Example：AT+ WMCFG =4</td></tr>
<tr><td colspan="3">Note: 1. After setting a new mode, it needs to be reset or power off and restart</td></tr>
<tr><td rowspan="3">5</td><td colspan="2">AT+DINFO Get facility information</td></tr>
<tr><td>AT+DINFO=ALLNODE</td><td>Description:
Query the short and long address of all node, and return by UART.
It works only when the device works in the coordinator mode</td></tr>
<tr><td>AT+DINFO=SELFS</td><td>Description:
Get short address and return by UART</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>AT+DINFO=SELFE</td><td>Description:
Get long address and return by UART</td></tr>
<tr><td colspan="2">Example：AT+DINFO=SELFE</td></tr>
<tr><td rowspan="3">6</td><td colspan="2">AT+ TFOCFG Setting/Querying output format configuration (reboot valid)</td></tr>
<tr><td>AT+ TFOCFG=?</td><td>Description:
Gets output format configuration
Response：
TFOCFG:0</td></tr>
<tr><td>AT+ TFOCFG=Value</td><td>Description:
Value：0~7
0：Output: valid data (transparent transmission)）
1： Output: Valid Data +Long Address
2：Output: Valid Data +Short Address
3：Output: Valid Data+RSSI
4：Output：Valid Data+Long Address+Short Address
5：Output：Valid Data+Long Address+RSSI
6：Output：Valid Data+Short Address+RSSI
7：Output：Valid Data+Long Address+Short Address+RSSI</td></tr>
<tr><td colspan="3">Example：AT+ TFCFG=0</td></tr>
<tr><td rowspan="3">7</td><td colspan="2">AT+ TFICFG Setting/Querying input transmission format configuration (reboot valid)</td></tr>
<tr><td>AT+ TFICFG=?</td><td>Description:
Gets input transmission format configuration
Response：
TFICFG:0</td></tr>
<tr><td>AT+ TFICFG=Value
（This instruction is valid for coordinator only）</td><td>Description:
Value：0~2
0：Input Broadcast(Only the coordinator works)
1：Input Short Address+Data (0x0000 0xfff) are broadcast address
2：Input Long Address+Data
（0x000000000000 0xffffffffffffffff）are broadcast address</td></tr>
<tr><td colspan="3">Example：AT+TFICFG=0</td></tr>
<tr><td rowspan="2">8</td><td colspan="2">AT+TMCFG Setting/Querying transport mode configuration (reboot valid)</td></tr>
<tr><td>AT+TMCFG=?</td><td>Description:
Gets transport mode configuration
Response：
TMCFG:0</td></tr>
</table>

<table>
<tr><td rowspan="3"></td><td>AT+TMCFG=Value</td><td>Description：
Value：0 or 1
0：Long Range mode，LRM
1：Standard transmission mode, GFSK</td></tr>
<tr><td colspan="2">Example：AT+TMCFG=0
Note: The coordinator and node should have the same transmission mode before they can access the network.</td></tr>
<tr><td rowspan="4">9</td><td colspan="2">AT+ PIDCFG Setting/Querying PANID configuration（reboot valid）</td></tr>
<tr><td>AT+PIDCFG=?</td><td>Description:
Gets PANID configuration
Response：
PIDCFG:65535</td></tr>
<tr><td>AT+PIDCFG=Value</td><td>Description:
Value:0~65535</td></tr>
<tr><td colspan="2">Example：AT+PIDCFG=65535
Note: The node can only join the same network as its PANID (any network can be added when it is configured as 65535)</td></tr>
<tr><td rowspan="4">10</td><td colspan="2">AT+ DMCFG Setting/Querying dormancy time configuration(reboot valid)</td></tr>
<tr><td>AT+DMCFG=?</td><td>Description:
Gets dormancy time configuration
Response:
DMCFG:0~60</td></tr>
<tr><td>AT+DMCFG=Value</td><td>Description: Configure wakeup period of sleep node
Value: dormant time, per unit second (S). 0~60 S.
Note: When configured as 0, the node will never wake up, that is, the node cannot receive data but can upload data</td></tr>
<tr><td colspan="2">Example：AT+DMCFG=0</td></tr>
<tr><td rowspan="5">11</td><td colspan="2">AT+RSCFG Setting/Querying the reboot parameter configuration
(reboot valid)</td></tr>
<tr><td>AT+RSCFG=?</td><td>Description:
Gets the reboot parameter configuration
Response：
RSCFG:0</td></tr>
<tr><td>AT+RSCFG=Value</td><td>Description:
Value：0 or 60~65535（S）
When the value less than 60s, the system judges 60, equals 0s, does not restart</td></tr>
<tr><td colspan="2">Example：AT+RSCFG=0</td></tr>
<tr><td colspan="2">Note: This parameter can be used for node disconnection detection. It is recommended to open it.</td></tr>
<tr><td>12</td><td colspan="2">AT+UBCFG Setting /Querying the baud rate parameter (reboot valid)</td></tr>
</table>

	AT+UBCFG=?	Description： Obtains the baud rate parameter Response： UBCFG:7
	AT+UBCFG=Value	Description： Value:0~7 0：1200 1：2400 2：4800 3：9600 4：19200 5：38400 6：57600 7：115200
	Example：AT+UBCFG=7	
13	**AT+UPCFG** Setting /Querying the device parity parameter(reboot valid)	
	AT+UPCFG=?	Description Gets the device parity parameter Response： UPCFG:0
	AT+UPCFG=Value	Description： Value:0~2 0：None 1：Odd parity 2：Even parity
	Example：AT+UPCFG=0	
14	**AT+PWCFG** Setting /Querying the power parameter(reboot valid)	
	AT+PWCFG=?	Description： Gets the power parameter Response： PWCFG:3
	AT+PWCFG=Value	Description： Value:0~3 0：Polar Altitude 1：High 2：Medium

<table>
<tr><td></td><td></td><td>3：Low</td></tr>
<tr><td></td><td colspan="2">Example：AT+ PWCFG=3</td></tr>
<tr><td rowspan="4">15</td><td colspan="2">AT+IOCFG Setting /Querying the IO parameter</td></tr>
<tr><td>AT+IOCFG=?</td><td>Description：
Gets the IO parameter
Response：
IOCFG:0</td></tr>
<tr><td>AT+IOCFG=Value</td><td>Description：
Value：0 or 1
0：Push-pull
1：open-drain</td></tr>
<tr><td colspan="2">Example：AT+IOCFG=0</td></tr>
<tr><td rowspan="3">16</td><td colspan="2">AT+DFCFG Restore the default parameter</td></tr>
<tr><td>AT+DFCFG</td><td>Description：Null
Restore the default parameter</td></tr>
<tr><td colspan="2">Example：AT+DFCFG</td></tr>
<tr><td rowspan="3">17</td><td colspan="2">AT+RSTART Device Restart</td></tr>
<tr><td>AT+RSTART</td><td>Description：Null
Device Restart</td></tr>
<tr><td colspan="2">Example：AT+RSTART</td></tr>
<tr><td rowspan="4">18</td><td colspan="2">AT+ECHO Sets up the AT instruction to turn off the back display</td></tr>
<tr><td>AT+ECHO=Value</td><td>Description:
Value:0 or 1
1：Close the echo
0：Open the echo</td></tr>
<tr><td colspan="2">Example：AT+ECHO=1</td></tr>
<tr><td colspan="2">Note：This setting only applies when the power is turned on. After the restart, the default settings are restored and the echo is enabled by default.</td></tr>
<tr><td rowspan="3">19</td><td colspan="2">AT+VER Reading the version number</td></tr>
<tr><td>AT+VER</td><td>Description:</td></tr>
<tr><td colspan="2">Example：AT+VER</td></tr>
<tr><td rowspan="3">20</td><td colspan="2">AT+CLINFO Clearing network information</td></tr>
<tr><td>AT+CLINFO</td><td>Description:</td></tr>
<tr><td colspan="2">Example：AT+CLINFO</td></tr>
<tr><td></td><td colspan="2">Note: The network cannot be re-established after the module is cleared (this command can clear all the information when the number of coordinator node devices reaches 50).</td></tr>
</table>

<table>
<tr><td rowspan="4">21</td><td colspan="2">AT+TLCFG Setting/Querying the concurrency performance parameter (reboot valid)</td></tr>
<tr><td>AT+TLCFG=?</td><td>Description:
Gets the concurrency performance parameter
Response：
TLCFG:0</td></tr>
<tr><td>AT+TLCFG=value</td><td>Description:
Value:0~3
0：Low concurrency
1：Medium concurrency
2：High concurrency
3：Highest concurrency</td></tr>
<tr><td colspan="2">Example: AT+ TLCFG =0
(Note: This parameter is mainly used to configure the concurrency performance of the module. That is, when various nodes concurrently transmit data, the maximum number of nodes is supported. The higher the performance, the greater the number of concurrent systems, but the delay in sending data. The average power consumption of the nodes will increase; the lower the performance, the higher the real-time performance of the data sent by the nodes, but the data may be lost when the environment has large interference or multiple nodes transmit simultaneously.)</td></tr>
</table>

10. Hardware design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible, and the module needs to be reliably grounded.;
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure it is within the recommended voltage otherwise when it exceeds the maximum value the module will be permanently damaged;
- Please check the stability of the power supply, the voltage can not be fluctuated frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so the whole machine is beneficial for long-term stable operation.;
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference.;
- High-frequency digital routing, high-frequency analog routing, and power routing must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer;
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees;
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done;

- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done.
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from some physical layers such as TTL protocol at 2.4GHz , for example: USB3.0;
- The mounting structure of antenna has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good antenna extension cable to extend the antenna to the outside;
- The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

11 FAQ

11.1 Communication range is too short

- The communication distance will be affected when obstacle exists.
- Data lose rate will be affected by temperature, humidity and co-channel interference.
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground.
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea.
- The signal will be affected when the antenna is near metal object or put in a metal case.
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance).
- The power supply low voltage under room temperature is lower than 2.5V, the lower the voltage, the lower the transmitting power.
- Due to antenna quality or poor matching between antenna and module.

11.2 Module is easy to damage

- Please check the power supply source, ensure it is 2.0V~3.6V, voltage higher than 3.6V will damage the module.
- Please check the stability of power source, the voltage cannot fluctuate too much.
- Please make sure antistatic measure are taken when installing and using, high frequency devices have electrostatic susceptibility.
- Please ensure the humidity is within limited range, some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

11.3 BER(Bit Error Rate) is high

- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and

channel to avoid interference;

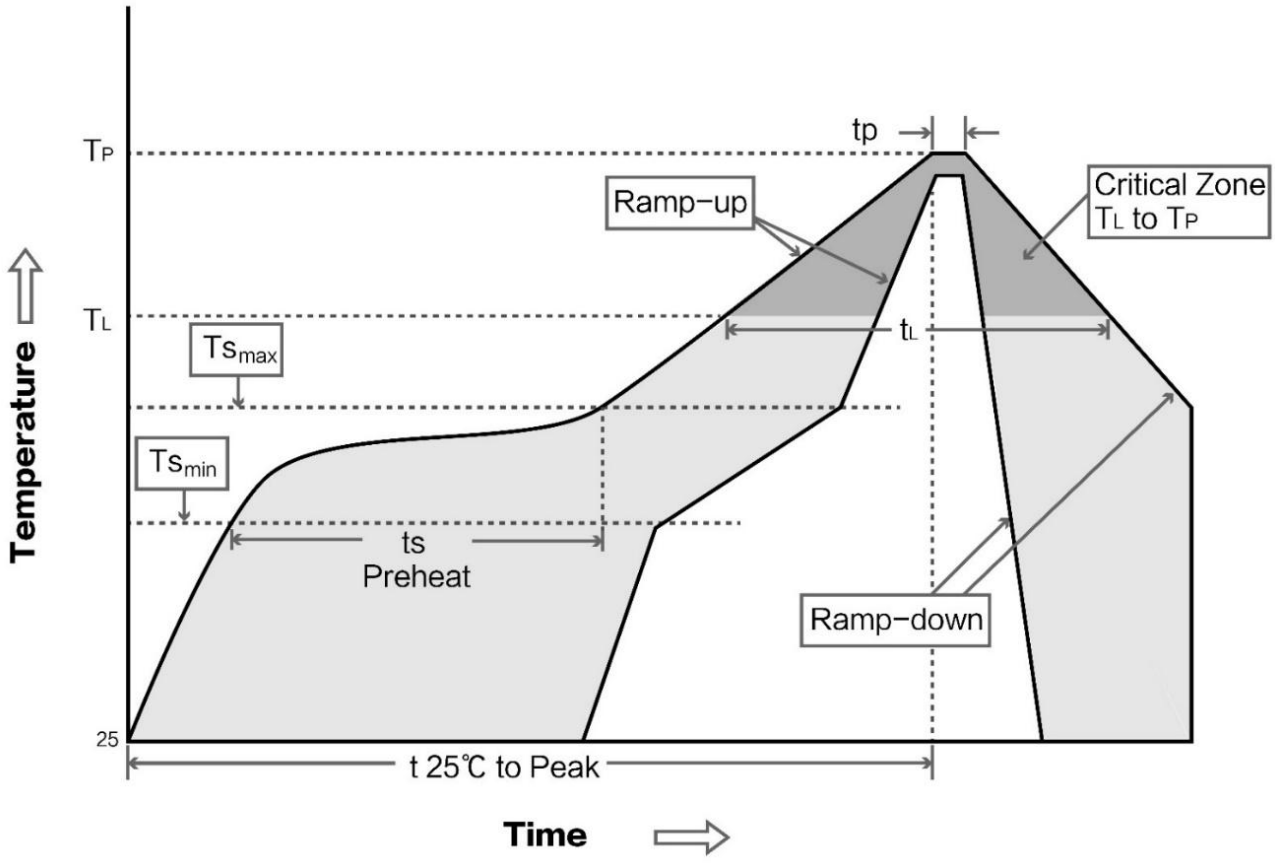
- Poor power supply may cause messy code. Make sure that the power supply is reliable.
- The extension line and feeder quality are poor or too long, so the bit error rate is high;

12.Production guidance

12.1.Reflow Soldering Temperature

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	3℃/second max	3℃/second max
Liquidous Temperature (TL)	183℃	217℃
Time（tL）Maintained Above（TL）	60-90 sec	30-90 sec
Peak temperature（Tp）	220-235℃	230-250℃
Average ramp-down rate（Tp to Tsmax）	6℃/second max	6℃/second max
Time 25℃ to peak temperature	6 minutes max	8 minutes max

12.2 **Reflow Soldering Curve**



13. E70 Serial

Model No.	Core IC	Frequency Hz	Tx power dBm	Distance km	Data Rate	Package	Size mm	Interface
E70-433NW30S	-	433M	30	6.5	2.5k~168k	SMD	24 * 38.5	IPEX/Stamp hole
E70-433NW14S	-	433M	14	2.5	2.5k~168k	SMD	16 * 26	IPEX/stamp hole

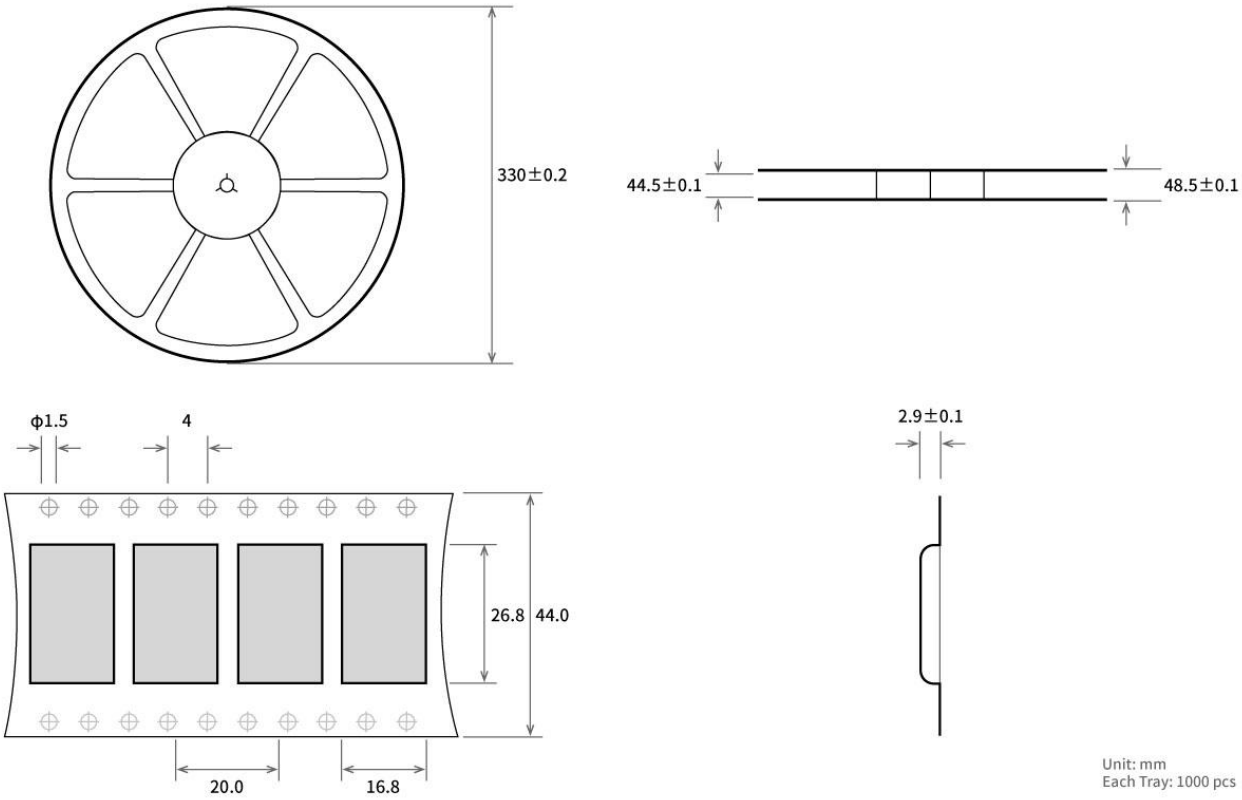
14. Antenna recommendation

14.1 Antenna recommendation

The antenna is an important role in the communication process. A good antenna can largely improve the communication system. Therefore, we recommend some antennas for wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequency Hz	Interface	Gain dBi	Height	Cable	Function feature
TX433-NP-4310	Soft PCB antenna	433M	SMA-J	2	43.8*9.5mm	-	Built-in flexibility, FPC soft antenna
TX433-JW-5	Rubber antenna	433M	SMA-J	2	50mm	-	Flexible &omnidirectional
TX433-JWG-7	Rubber antenna	433M	SMA-J	2.5	75mm	-	Flexible &omnidirectional
TX433-JK-20	Rubber antenna	433M	SMA-J	3	210mm	-	Flexible &omnidirectional
TX433-JK-11	Rubber antenna	433M	SMA-J	2.5	110mm	-	Flexible &omnidirectional
TX433-XP-200	Sucker antenna	433M	SMA-J	4	19cm	200cm	Sucker antenna, High gain
TX433-XP-100	Sucker antenna	433M	SMA-J	3.5	18.5cm	100cm	Sucker antenna, High gain
TX433-XPH-300	Sucker antenna	433M	SMA-J	6	96.5cm	300cm	Car carrying Sucker antenna, High gain
TX433-JZG-6	Rubber antenna	433M	SMA-J	2.5	52mm	-	Short straight &omnidirectional
TX433-JZ-5	Rubber antenna	433M	SMA-J	2	52mm	-	Short straight &omnidirectional
TX490-XP-100	Sucker antenna	490M	SMA-J	50	12cm	100cm	Sucker antenna, High gain
TX490-JZ-5	Rubber antenna	490M	SMA-J	50	50mm	-	Short straight &omnidirectional

15. Package for batch order



Revision history

version	Date	Description	Issued by
1.00	2018-01-08	initial version	huaa
1.10	2018-04-16	content updating	huaa
1.20	2018-05-24	content updating	Huaa
1.21	2018-07-20	name change	Huaa
1.30	2018-10-29	module separating	Huaa

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