E70-433NW30S User Manual

433MHz 1W Star Network SMD Wireless Module



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1. Overview

1.1 Introduction



E70-433NW30S is a star networking module, operating in the 433MHz frequency band, with a transmission power of 1W; The module integrates the host (coordinator) and terminal, and has two transmission modes of long distance and high speed. A host (coordinator) supports up to 200 nodes to communicate with it. All operation configurations adopt the industry standard AT instructions, greatly simplifying user operations, and is applicable to a variety of wireless communication networking scenarios.

E70-433NW30S is the first 433MHz wireless module in China that can support 200 nodes concurrent. It solves a series of problems caused by the traditional 433MHz wireless modules which can not send data packet concurrently. After it can be concurrent, users do not need to expend energy to deal with complex networking protocols, which greatly reduces the development difficulty of customers and shortens the development cycle of users; Its protocol ensures the stability and packet acquisition rate of the entire wireless communication system.

E70-433NW30S strictly follows design standards of FCC, CE, CCC and meets various RF certification requirements for exporting.

1.2 Features

- Support CSMA/CA, which can avoid collision effectively.
- Maximum 200 nodes concurrent, no need to deal with complicated protocol for polling.
- Adopting AES128 data encryption, Ensure the reliability of data packets.
- Supports DSSS technology, like LoRa, better than GFSK.
- Nodes support low power consumption mode, suitable for battery supplied applications;
- Communication distance is up to 6.5km in certain condition.
- Maximum transmission power of 1W, multi-level adjustable TX power by software;
- Support the global license-free ISM 433MHz band;
- Support air date rate of 5kbps～50kbps;
- Support 3.3V~5.5V power supply, power supply over 5.0V 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.

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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	5.5	Voltage over 5.5V 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

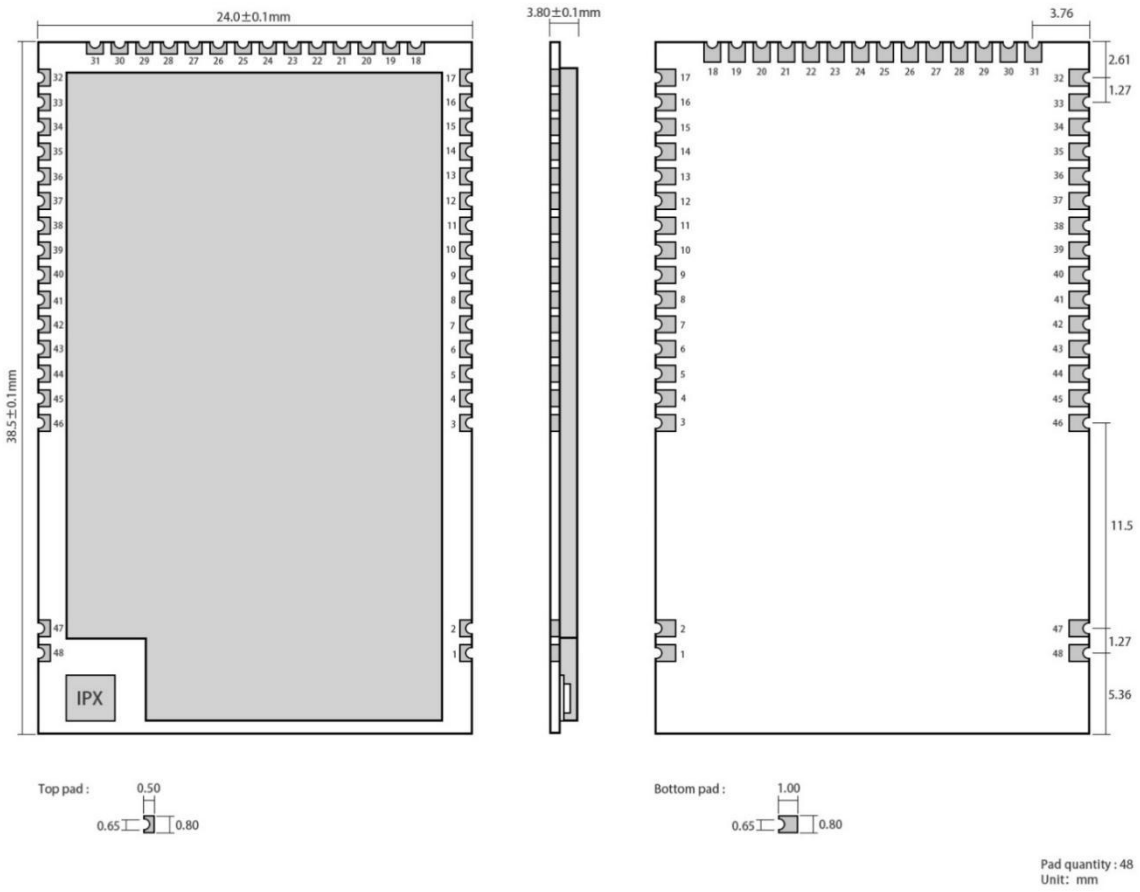
Main parameter		Performance			Remark
		Min	Typ.	Max.	
Operating voltage（V）		3.3	5.0	5.5	5 V is recommended
Communication level（V）			3.3		For 5V TTL, it has a risk of burning down
Operating temperature（℃）		-40	-	85	Industrial design
Operating frequency（MHz）		431	-	446.5	Support ISM band
Power consumption	Transmitting current [mA]		610		Instant power consumption
	Receiving current [mA]		13		
	Turn-off current [μA]		2		Software is shut down
Max Tx power（dBm）		29.6	30.0	31.3	
Receiving sensitivity（dBm）		-109	-110	-111	Air data rate is 5kbps
Air data rate（bps）		5k	5k	50k	Controlled via user’s programming

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Main parameter	Description	Remark
Distance for reference	6500m	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	24*38.5mm	
Antenna	IPX/Stamp hole	50 ohm impedance

3 Size and pin definition



No.	Pin item	Pin direction	Application
1	GND	ground	Ground electrode
2	GND	ground	Ground electrode
3	GND	ground	Ground electrode

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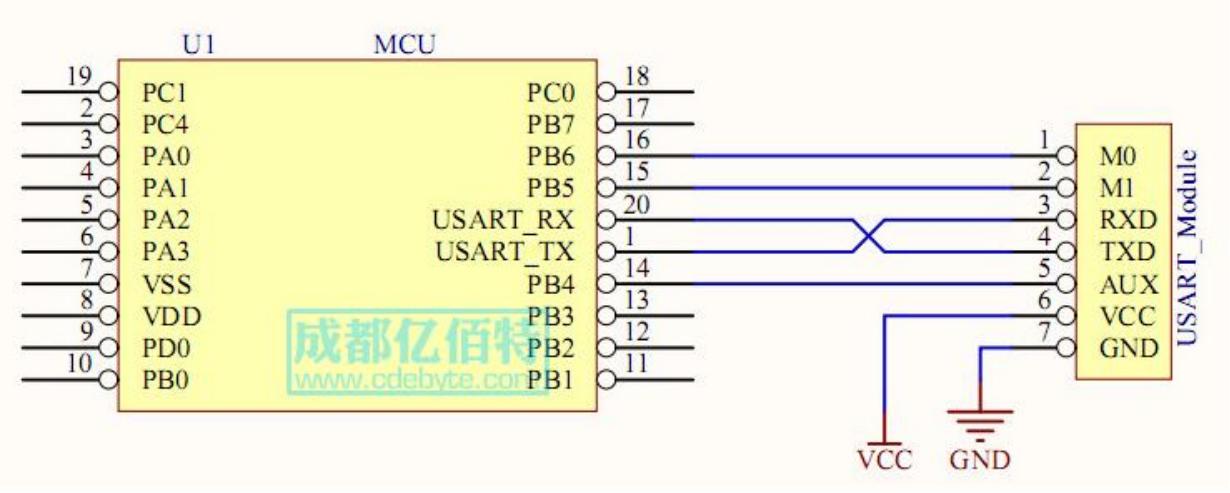
4	NC	Reserved pin	Reserved, to be floated
5	NC	Reserved pin	Reserved, to be floated
6	NC	Reserved pin	Reserved, to be floated
7	NC	Reserved pin	Reserved, to be floated
8	NC	Reserved pin	Reserved, to be floated
9	NC	Reserved pin	Reserved, to be floated
10	NC	Reserved pin	Reserved, to be floated
11	NC	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	Reserved pin	Reserved, to be floated
16	LINK	output	For indicating the current network connection status of the module, it can be configured as drain open circuit output or push-pull output. For details, please refer to the parameter setting, a 1K protection resistor shall be connected in series externally (it can be suspended).
17	GND	Ground	Ground electrode
18	NC	Reserved pin	Reserved, to be floated
19	NC	Reserved pin	Reserved, to be floated
20	NC	Reserved pin	Reserved, to be floated
21	NC	Reserved pin	Reserved, to be floated
22	TCKC	Input	JTAG TCKC
23	TMSC	Input	JTAG TMSC
24	RESET	Input	Module reset pin, low level effective
25	NC	Reserved pin	Reserved, to be floated
26	M0	Input	M1M0 The four working modes of the module are determined by the joint combination. When in use, a 1K protection resistor shall be connected in series externally, and a 1M pull-up resistor shall be added (it shall not be suspended, otherwise, it can be grounded).
27	M1	Input	M1M0 The four working modes of the module are determined by the joint combination. When in use, a 1K protection resistor shall be connected in series externally, and a 1M pull-up resistor shall be added (it shall not be suspended, otherwise, it can be grounded).
28	VCC		Power supply：3.3V ~ 5.5V DC
29	VCC		Power supply ：3.3V ~ 5.5V DC
30	GND	Ground	Ground electrode
31	GND	Ground	Ground electrode
32	ACK	Output	The user indicates the data transmission result of the module, which is pulled down before transmission and pulled up after success. It can be configured as drain open circuit output or push-pull output. When it is used, a 1K protection resistor should be connected externally in series (it can be suspended).
33	NC	Reserved pin	Reserved, to be floated

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34	NC	Reserved pin	Reserved, to be floated
35	NC	Reserved pin	Reserved, to be floated
36	RXD	Input	TTL UART inputs, connects to external (MCU, PC) TXD output pin. Can be configured as open-drain or pull-up input.
37	TXD	Output	TTL UART outputs, connects to external RXD (MCU, PC) input pin. Can be configured as open-drain or push-pull output
38	AUX	Output	The user indicates the network access status of the module, and the user notifies the external MCU, which can be configured as drain open circuit output or push-pull output. When using, a 1K protection resistor needs to be connected in series externally (can be suspended)
39	NC	Reserved pin	Reserved, to be floated
40	NC	Reserved pin	Reserved, to be floated
41	NC	Reserved pin	Reserved, to be floated
42	TX_EN	Output	Internal MCU control PA pin, high level effective, connected to pin 45
43	RX_EN	Output	Internal MCU control LNA pin, high level effective, connected to pin 44
44	RX_EN	Input	Internal LNA enable pin, high level effective, connected to pin 43
45	TX_EN	Input	Internal PA enable pin, high level effective, connected to pin 42
46	GND	Ground	Ground electrode
47	GND	Ground	Ground electrode
48	ANT		Antenna (50 ohm impedance)

4 Connect to MCU



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

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5 Firmware Transmitting mode

5.1 Transparent transmission

Summary
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	Summary
Coordinator short address transmission format: short address + valid data; 00 00 or FF FF are broadcast address		
Coordinator	HEX	Send：00 01 AA BB CC
Node A address 00 01	HEX	Receive：AA BB CC
Node B address 00 02	HEX	Receive: None
Node C address 00 03	HEX	Receive: None
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	Summary
Coordinator long address transmission format: long 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	Send：0A 01 AA 45 65 13 12 44 AA BB CC
Node A address: 0A 01 AA 45 65 13 12 44	HEX	Receivie：AA BB CC
Node B address： 0D 55 18 42 1A 27 29 64	HEX	Receive: None
Node C address: A4 78 02 46 B5 1C 5A 02	HEX	Receive: None
Coordinator	HEX	FF FF FF FF FF FF FF FF AA BB CC

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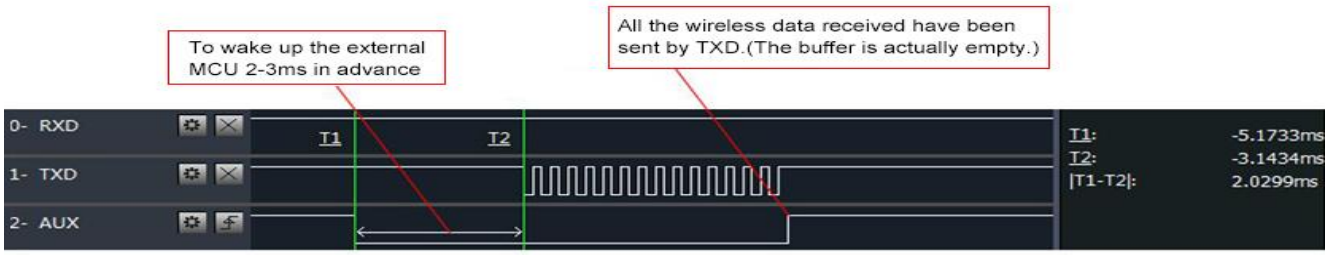
Node A address: 0A 01 AA 45 65 13 12 44	HEX	AA BB CC
Node B address: 0A 01 AA 45 65 13 12 44	HEX	AA BB CC
Node C address: 0A 01 AA 45 65 13 12 44	1 HEX	AA BB CC

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.

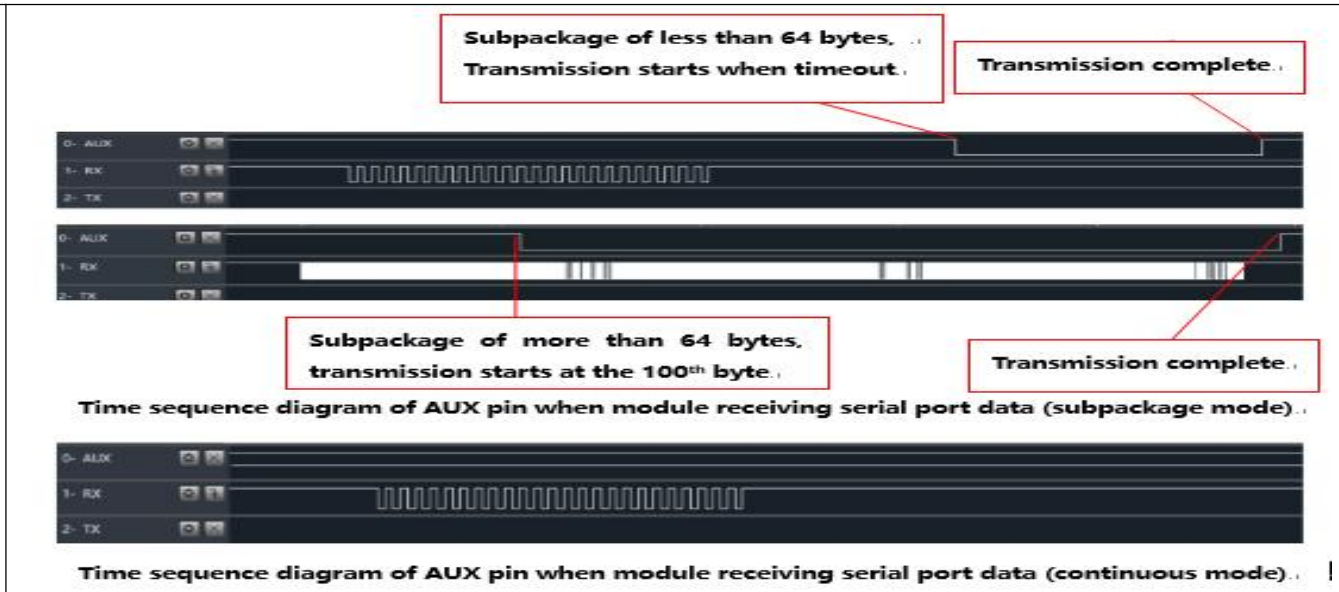
6.1 AUX description

It can indicate whether there are data that are not to be sent via wireless yet, 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. (Note: AUX indication has no delay in continuous transmission mode)  Timing Sequence Diagram of AUX when TXD pin transmits
2	【Indication of wireless transmitting】 1.The length of the buffer in the module 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 wirelessly.

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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: When 200 nodes sending data at the same time, 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. In extreme conditions, it means that even if the receiving device receive data normally, ACK pin of sending device will still indicate 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	Transfer data according to input and output modes

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			information	
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, need to wake up the serial port for sending data
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 (namely AT+ WMCFG =4, refer to Chapter 9), （M0=0,M1=0） or the user configures the operating mode as 0 (namely AT+ WMCFG =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 unconditionally indicates successful transmission.

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

7.2.Normal node

If the user configures the operating mode 4 (namely AT+ WMCFG =4, refer to Chapter 9), （M0=0,M1=1） or the user configures the operating mode as 1 (namely AT+ WMCFG =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 request of high real-time response and no request of low power consumption.

7.3.Dormant node

If the user configures the operating mode as 4 (namely AT+ WMCFG =4, refer to Chapter 9),, M0=1,M1=0, or the user configures the operating mode as 2 (namely AT+ WMCFG =2), the module works in the dormant node mode. In this 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 dormant node wants to send data actively, the user should send a data within two bytes to wake up the device. After the wake-up data is sent, the user needs to wait for more than 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 to receive AT command, if there is no data input within 2 seconds, the module will close serial port and go to sleep.The

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dormant node is suitable for applications where the user requires low power consumption and does not require high real-time response..

7.4 Configuration mode

At any time and in any mode, as long as the M0M1 combination is set to 11, the system will switch to the 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 or receive data. When using the external AT command to configure the module, the user serial port need to send any data within two bytes 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 there is no data input within 2 seconds, the module will close serial port and go to sleep. To use the next AT command, user need to resend a wake-up byte.

7.5 Mode switching

No	Remarks
1	In default, The user can decide the operating mode by changing the combination of M1 and M0
2	In any work mode, the user can configure the operating mode through the AT command (refer to Chapter 9)
3	In any working mode, when M0=1,M1=1, device enters sleep mode (low power consumption). the serial port parameters are 115200, 8N1(fixed)

8.Quick start

8.1 Communication between normal node and coordinator

8.1.1 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 5-1:

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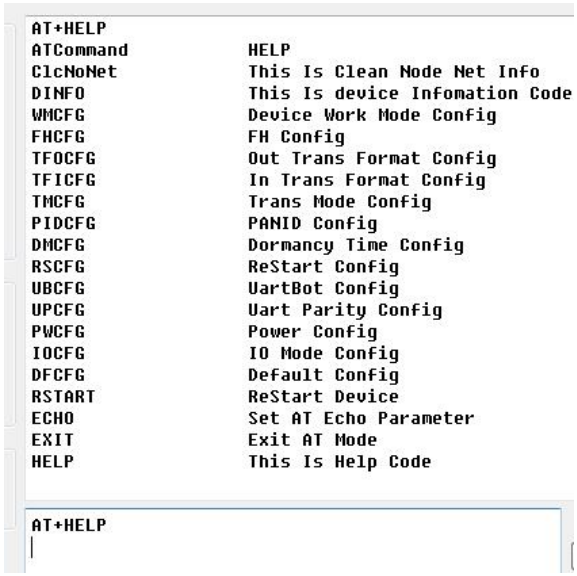


Figure 5- 1

Then enter "AT+WMCFG=0" with line breaks to configure the device as the coordinator mode, as shown in Figure 5-2:

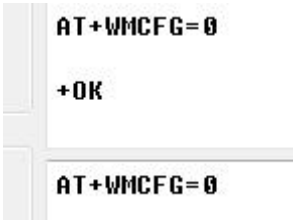


Figure 5-2

Then enter “AT+RSTART” with line breaks to restart the device. The coordinator configuration is complete. As shown in Figure 5-3:



Figure 5-3

8.1.2 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 5-4:

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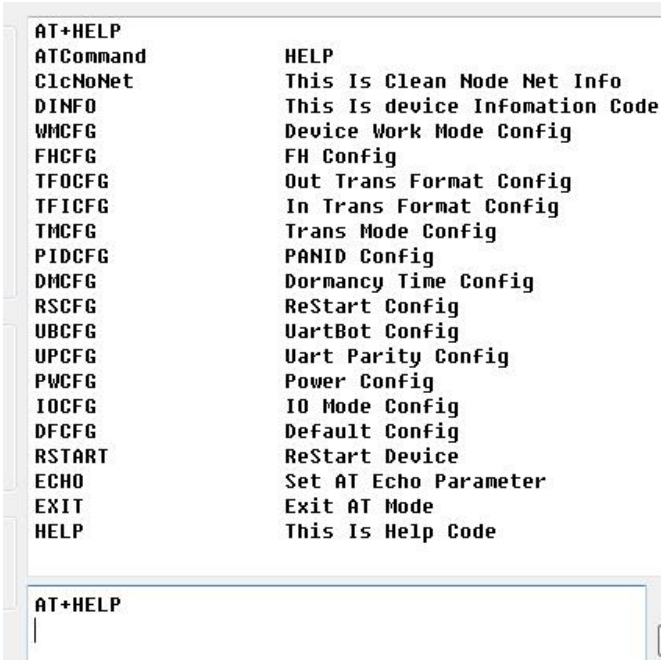


Figure 5-4

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

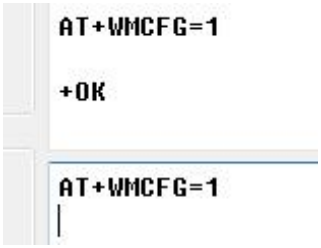


Figure 5-5

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

As shown in Figure 5-6:



Figure 5-6

Start up a Network and transmit data

When the configuration is complete, the coordinator restarts. when the LINK 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 5 to 20 seconds. When the network access is completed sucessfully, the LINK pin is in low level.

Data transmission as below:

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

9. AT 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, input "+++" without carriage return. All parameter settings will reply "\r\n+OK\r\n".

<table>
<tr><td rowspan="4">1</td><td colspan="2">Enters” +++” into AT Mode</td></tr>
<tr><td>+++</td><td>Parameter Description:
Nonparametric
Response:
Enter AT Mode</td></tr>
<tr><td colspan="2">Example：+++</td></tr>
<tr><td colspan="2">Note: 1. The AT command can be used only after entering +++
2. After entering the AT command mode, if you want to use +++ to enter the AT mode, you need to exit the AT 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="4">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="2">Note: AT commands are invalid after exiting AT command mode</td></tr>
<tr><td rowspan="2">3</td><td colspan="2">AT+HELP Help command</td></tr>
<tr><td>AT+HELP</td><td>Parameter Description:</td></tr>
</table>

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		Null Response: All instructions and help information
	Example：AT+HELP	
4	**AT+ WMCFG** Setting /Querying device working mode (restart to take effect)	
	AT+ WMCFG =?	Description: Gets current working mode Response： WMCFG：4
	AT+ WMCFG =Value	Description: Value：0~4 0，Coordinator； 1, Normal node; 2, Dormant Node； 3, Sleep mode； 4, (factory default), Pin control
	Example：AT+ WMCFG =4	
	Note: 1. After setting a new mode, it needs to be reset or power off and restart	
5	**AT+DINFO** Get device information	
	AT+DINFO=SELFS	Description: Get the short address itself and return by UART.
	AT+DINFO=SELFE	Description: Get the long address itself and return by UART
	Example：AT+DINFO=SELFE	
6	**AT+ TFOCFG** Setting/Querying output data format settings (restart to take effect)	
	AT+ TFOCFG=?	Description: Get current output format settings Response： TFOCFG:0
	AT+ TFOCFG=Value	Description: Value：0~7 0：Output: valid data (transparent transmission)） 1： Output: Valid Data +Long Address of the transmitter 2：Output: Valid Data +Short Address of the transmitter 3：Output: Valid Data+RSSI 4：Output：Valid Data+transmitter’s Long Address+transmitter’s Short Address

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		5：Output：Valid Data+transmitter’s Long Address+RSSI 6：Output：Valid Data+transmitter’s Short Address+RSSI 7：Output：Valid Data+transmitter’s Long Address+transmitter’s Short Address+RSSI
	Example：AT+ TFCFG=0	
7	**AT+ TFICFG** Setting/Querying input data format settings (restart to take effect)	
	AT+ TFICFG=?	Description: Gets input data format settings Response： TFICFG:0
	AT+ TFICFG=Value （This instruction is valid for coordinator only）	Description: Value：0~2 0：Input Broadcast(Only the coordinator works) 1：Input receiver’s Short Address+Data (0x0000 0xffff) are broadcast address 2：Input receiver’s Long Address+Data （0x000000000000 0xffffffffffffffff）are broadcast address
	Example：AT+TFICFG=0	
8	**AT+TMCFG** Setting/Querying transmission mode configuration (restart to take effect)	
	AT+TMCFG=?	Description: Gets curretn transmission mode configuration Response： TMCFG:0
	AT+TMCFG=Value	Description： Value：0 or 1 0：Long Range mode，LRM，Air rate of 5 kbps 1：Standard transmission mode，GFSK，Air rate of 50 kbps (factory default)
	Example：AT+TMCFG=0 Note: 1.The coordinator and node should have the same transmission mode before they can access the network. 2.When the transmission mode is set, the network information is cleared.	
9	**AT+ PIDCFG** Setting/Querying PANID configuration (restart to take effect)	
	AT+PIDCFG=?	Description: Gets PANID configuration Response： PIDCFG:65535
	AT+PIDCFG=Value	Description: Value:0~65535

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<table>
<tr><td></td><td colspan="2">Example：AT+PIDCFG=65535
Note: The node can only join the network which has same PANID as it (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 (restart to take effect)</td></tr>
<tr><td>AT+DMCFG=?</td><td>Description:
Gets dormancy time configuration
Response:
DMCFG:2~60</td></tr>
<tr><td>AT+DMCFG=Value</td><td>Description:
Value: dormant time, per unit second (S).
Note: When the value is smaller than 2, system will change it to 2. (min.2s).</td></tr>
<tr><td colspan="2">Example：AT+DMCFG=0</td></tr>
<tr><td rowspan="4">11</td><td colspan="2">AT+RSCFG Setting/Querying the parameter settings of auto restart
(reboot valid)</td></tr>
<tr><td>AT+RSCFG=?</td><td>Description:
Gets the auto restart parameter settings
Response：
RSCFG:0</td></tr>
<tr><td>AT+RSCFG=Value</td><td>Description:
Value：0 or 60~65535（S）
When the value is less than 60, the system judges as 60; when the value is 0, it does not restart</td></tr>
<tr><td colspan="2">Example：AT+RSCFG=0
Note: This parameter can be used for node disconnection detection. It is recommended to open it.</td></tr>
<tr><td rowspan="3">12</td><td colspan="2">AT+UBCFG Setting /Querying the baud rate parameter (restart to take effect)</td></tr>
<tr><td>AT+UBCFG=?</td><td>Description：
Obtains the baud rate parameter
Response：
UBCFG:7</td></tr>
<tr><td>AT+UBCFG=Value</td><td>Description：
Value:0~7
0：1200
1：2400
2：4800
3：9600
4：19200
5：38400
6：57600</td></tr>
</table>

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		7：115200
	Example：AT+UBCFG=7	
13	**AT+UPCFG** Setting /Querying the device parity parameter (restart to take effect)	
	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 (restart to take effect)	
	AT+PWCFG=?	Description： Gets the power parameter Response： PWCFG:3
	AT+PWCFG=Value	Description： Value:0~3 0：Extremely high 1：High 2：Medium 3：Low
	Example：AT+ PWCFG=3	
15	**AT+IOCFG** Setting /Querying the IO parameter (restart to take effect)	
	AT+IOCFG=?	Description： Gets the IO parameter Response： IOCFG:0
	AT+IOCFG=Value	Description： Value：0 or 1 0：Push-pull 1：open-drain
	Example：AT+IOCFG=0	
16	**AT+DFCFG** Restore the default parameter	

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<table>
<tr><td rowspan="2"></td><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 command takes effect after configuration, and will be saved after power off..</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="4">20</td><td colspan="2">AT+CLINFO Clearing network information of the module</td></tr>
<tr><td>AT+CLINFO</td><td>Description:</td></tr>
<tr><td colspan="2">Example：AT+CLINFO</td></tr>
<tr><td colspan="2">Note: The module cannot communicate after clearing the network. It needs to re-establish the network for communication. (thiscomman allows the user to clear all information when the number of node devices connected to the coordinator reaches 200.)</td></tr>
<tr><td rowspan="4">21</td><td colspan="2">AT+TLCFG Setting/Querying the concurrency performance parameter (restart to take effect)</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</td></tr>
</table>

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	delay in sending data and 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.)

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.

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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

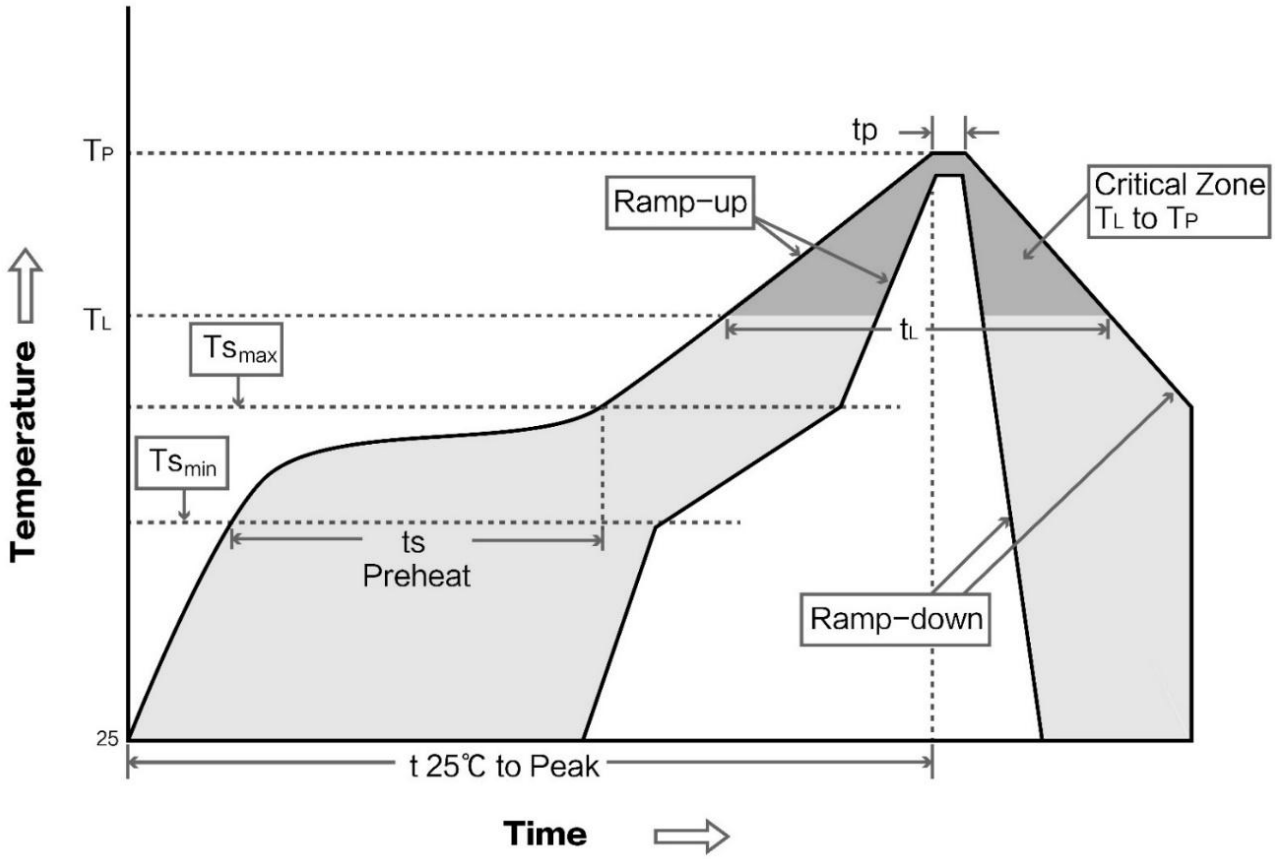
Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	100℃	150℃
Preheat temperature max (Tsmax)	150℃	200℃

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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 Series

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

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14. Antenna recommendation

14.1 Antenna recommendation

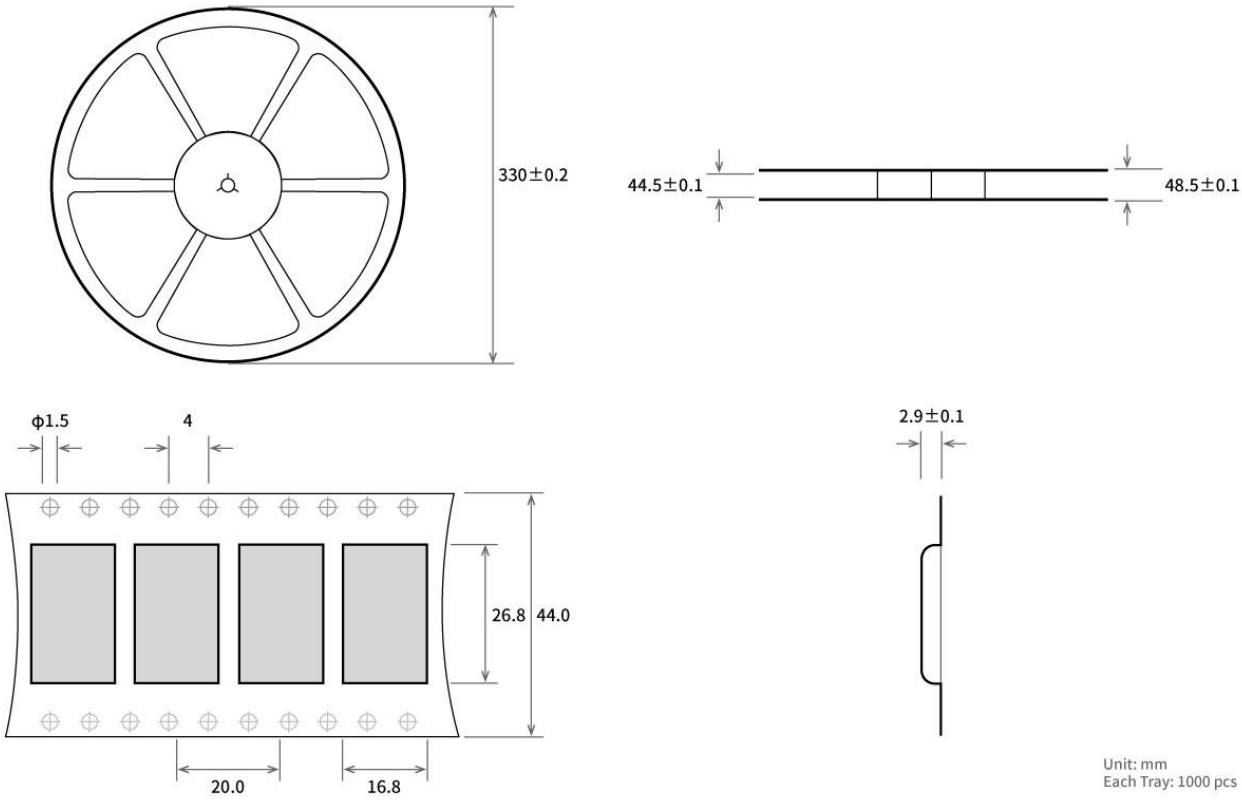
The antenna is an important role in the communication process. A good antenna can largely improve the communication system. Therefore, we recommend some antennas for wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequency	Gain	Size	Feeder Cable	Interface	Features
		Hz	dBi	mm	cm		
TX433-NP-4310	Soft antenna	433M	2.0	10x43	-	Welding	Built-in flexibility FPC soft antenna
TX433-JZ-5	Rubber antenna	433M	2.0	52	-	SMA-J	Short straight &omnidirectional
TX433-JZG-6	Rubber antenna	433M	2.5	62	-	SMA-J	Short straight &omnidirectional
TX433-JW-5	Rubber antenna	433M	2.0	50	-	SMA-J	Fixed bent, omnidirectional antenna
TX433-JWG-7	Rubber antenna	433M	2.5	70	-	SMA-J	Fixed bent, omnidirectional antenna
TX433-JK-11	Rubber antenna	433M	2.5	110	-	SMA-J	Flexible &omnidirectional
TX433-JK-20	Rubber antenna	433M	3.0	200	-	SMA-J	Flexible &omnidirectional
TX433-XPL-100	Sucker antenna	433M	3.5	185	100	SMA-J	Small sucker antenna, cost-effictive
TX433-XP-200	Sucker antenna	433M	4.0	190	200	SMA-J	Small sucker antenna, low loss
TX433-XPH-300	Sucker antenna	433M	6.0	965	300	SMA-J	Small sucker antenna, high gain

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15. Package for batch order



Revision history

Version	Date	Description	Issued by
1.0	2018-01-08	Initial version	huaa
1.1	2018-04-16	content updating	huaa
1.2	2018-07-20	name change	Huaa
1.3	2018-10-29	module separating	Huaa
1.4	2019-02-20	bug fixes	Ray
1.5	2019-03-29	bug fixes	Ray
1.6	2019-04-02	bug fixes	Ray
1.7	2019-04-02	bug fixes	Blue
1.8	2020-10-15	bug fixes	REN
1.9	2023-02-24	bug fixes	Hao
2.0	2024-10-17	Increase the air rate description	Ning

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