E22-230/400/900T22U Product Specification

230/400/900MHz 22dBm

LoRa Wireless Module USB Interface



成都亿佰特电子科技有限公司

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Ⅰ Product Overview

1.1 Product Description

E22-230T22U, E22-400T22U, E22-900T22U is a new generation of LoRa wireless spread spectrum module, this series module is based on SEMTECH company's new generation of LoRa spread spectrum chip design of wireless serial port module. It has a variety of transmission modes, respectively working in 220.125MHz ~ 236.125MHz (default 230.125MHz), 410.125 MHz ~ 493.125MHz (default 433.125MHz), 850.125 ~ 930.125MHz (default 868.125MHz), LoRa spread spectrum technology, 5V IO port voltage, using USB standard package, easy for users to develop and use. Communication compatible with E22-230T/400T/900T series products, support baud rate 1200 ~ 115200 bps.

E22-230T22U, E22-400T22U, E22-900T22U adopt a new generation of LoRa spread spectrum technology, the program transmission distance is longer, faster; Support wireless configuration, carrier monitoring, automatic relay, communication key, upgrade firmware and other functions, support subcontracting length setting, can provide customized development services.

Note: The above diagram is the product diagram of E22-230T22U module, E22-400T22U and E22-900T22U only have different frequency bands.



1.2 Features

- The new LoRa spread spectrum modulation technology based on the new generation of LoRa RF chip developed by SEMTECH company brings longer communication distance and stronger anti-interference ability.
- Support automatic relay networking, multi-level relay for ultra-long distance communication, and multiple networks running simultaneously in the same area.
- Support for user-set communication keys, and cannot be read, greatly improving the confidentiality of user data.
- Supporting LBT function, listening to channel environment noise before sending, which can greatly improve the communication success rate of the module in harsh environment.
- Support RSSI signal strength indication function for evaluating signal quality, improving communication network and ranging.
- Support wireless parameter configuration, send command packets through wireless, remote configuration or read wireless module parameters.

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- Support for fixed-point transmission, broadcast transmission, channel monitoring.
- E22-400T22U supports global license-free ISM 433MHz band and supports 470MHz meter reading band.
- Communication distance up to 5km under ideal conditions.
- Parameter power-down saving, the module will work according to the set parameters after re-powering.
- Support for IAP firmware upgrade function.
- Efficient watchdog design, in case of abnormality, the module will restart automatically and can continue to work according to the previous parameter settings.
- E22-230T22U supports data transmission rates from 2.4k to 15.6kbps.
- E22-400T22U supports data transfer rates from 2.4k to 62.5kbps.
- E22-900T22U supports data transfer rates of 2.4k to 62.5kbps.
- USB standard interface, plug and play.
- Supports 4.8 to 5.5V power supply, and any power supply greater than 5V can ensure the best performance.
- Industrial-grade standard design, supporting long time use under -40～+85℃.
- SMA antenna interface, can be easily connected to external antennas.
- Baud rate support 1200, 2400, 4800, 9600 (default), 19200, 38400, 57600, 115200 bps.
- Communication compatible with E22-230T/400T/900T series products.

1.3 Application Scenarios

- Home security alarms.
- Smart home as well as industrial sensors, etc..
- Wireless alarm security systems.
- Building automation solutions.
- Healthcare products.
- Advanced Metering Infrastructure(AMI)
- Automotive industry applications.

Ⅱ Specification parameters

2.1 RF parameters

RF parameters	Parameter Value			Remark
	E22-230T22U	E22-400T22U	E22-900T22U	
Operating Frequency	220.125MHz～236.125MHz	410.125～493.125 MHz	850.125～930.125MHz	E22-400T22U supports ISM band
Transmitting power	22dBm			Software adjustable, need user to develop their own settings
Acceptance sensitivity	-122dBm			Air rate 2.4 kbps
FIFO	240 Byte			Packets of 32/64/128/240 bytes can be sent by command
Modulation method	LoRa			New generation LoRa modulation technology

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Measured distance	5 Km	Clear and open environment, antenna gain 5dBi, antenna height 2.5m, air rate 2.4kbps

2.2 Hardware Parameters

Hardware Parameters	Parameter Value			Remark
	E22-230T22U	E22-400T22U	E22-900T22U	
Communication Interface	USB			-
Packaging method	DIP			-
Interface method	USB			-
Dimension	45.3*27.8*11.2mm			±0.2mm, plus housing with cap
Antenna Form	SMA-K			Male threaded bore, equivalent impedance approx. 50Ω
Product net weight	8.4g			±0.2g

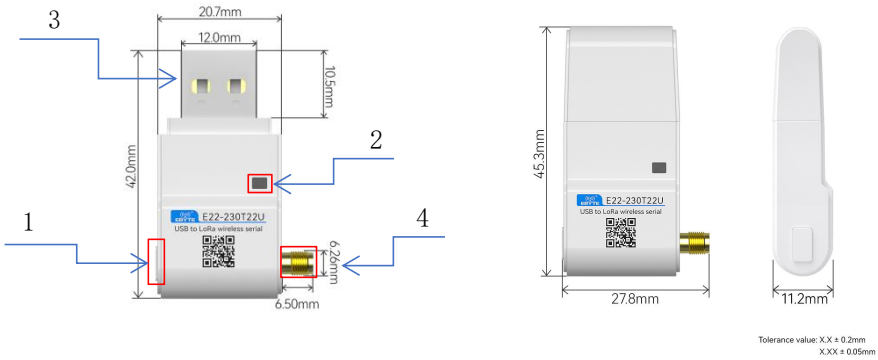
2.2 Electrical parameters

E22-230T22U/E22-400T22U/E22-900T22U					
Electrical parameters	Minimum value	Typical value	Maximum value	Unit	Remark
Supply Voltage	4.8	5	5.5	V	≥5.0V guaranteed output power Over 5.5V permanently burns out the module
Emission current	-	110	-	mA	Instantaneous power consumption
Receiving current	-	14	-	mA	-
Operating temperature	-40	20	85	℃	Industrial grade design
Working humidity	10	60	90	%	-
Storage temperature	-40	20	85	℃	-

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Ⅲ Product size and hardware description



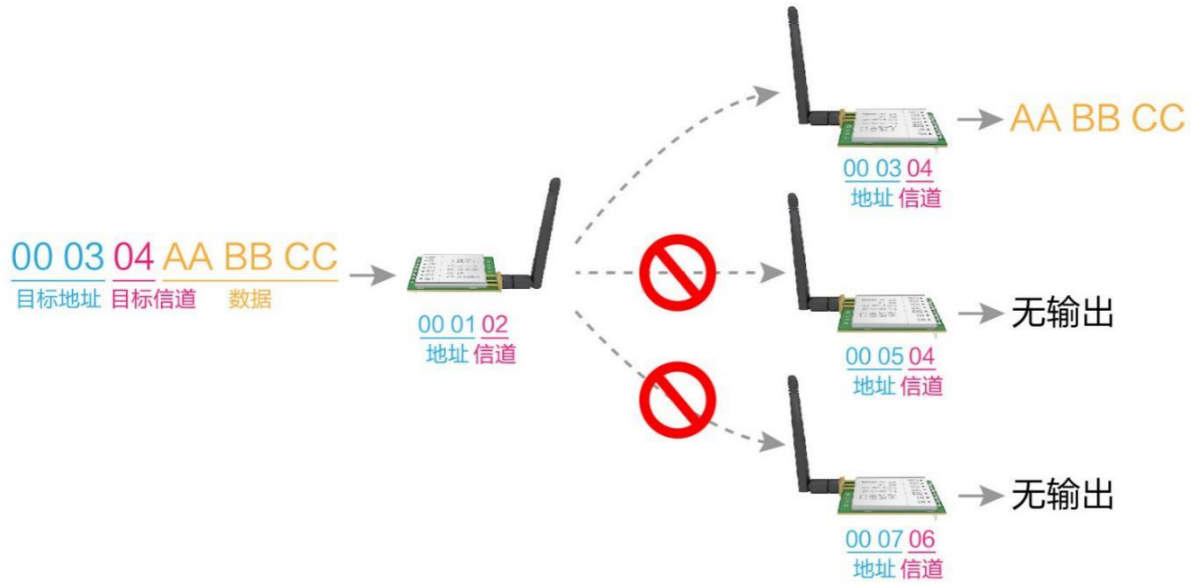
Serial number	Name	Function Description
1	Tactile switch	For mode switching, long press for more than 1.5s, after releasing the button, the mode is switched
2	Dual color LED	Used to indicate the mode and module status, green constant light indicates transmission mode, green flashing indicates data transmission process; red constant light indicates configuration mode, red flashing indicates command response process.
3	USB interface	Data exchange and power supply
4	SMA-K interface	SMA-K (male thread inner hole),antenna interface

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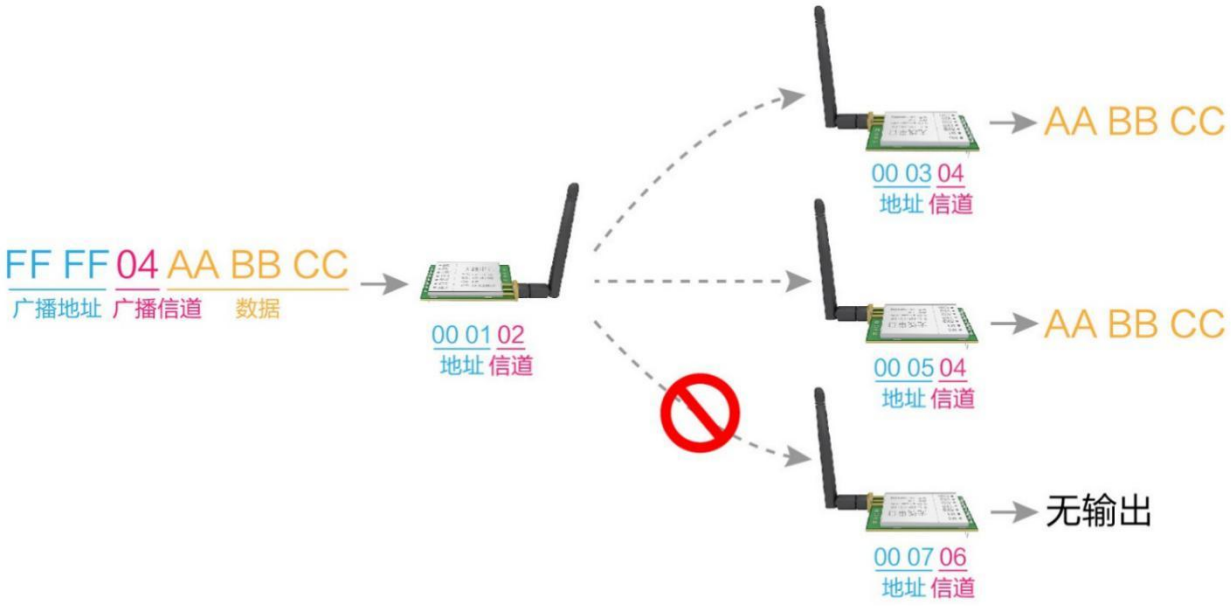
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Ⅳ Detailed explanation of functions

4.1 Targeted launch



4.2 Broadcast transmission



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4.3 Broadcast Address

- Example: Set the address of module A to 0xFFFF and the channel to 0x04.
- When module A is transmitting (same mode, transparent transmission mode), all receiving modules under 0x04 channel can receive data for broadcasting purpose.

4.4 Listening Address

- Example: Set the address of module A to 0xFFFF and the channel to 0x04.
- When module A acts as a receiver, it can receive all the data under 0x04 channel to achieve the purpose of listening.

4.5 Module Reset

- After the module is powered on, the indicator light behaves in red and carries out a hardware self-test, as well as setting the working mode according to the user parameters.
  During this process, the red indicator is always on, and when it is finished, the green indicator is always on and it enters the transmission mode to start normal operation;.
  Therefore, users need to wait for the green indicator to be always on as the starting point for the module to work normally.

4.6 Module Status Detail

- The two-color LED is used to indicate the module's operating mode and operating status.
- It indicates if the module is transmitting data, or responding to a received command, or if the module is in the process of initializing a self-test.

4.6.1 Module power-up initialization process

- The module power-on indicator behaves red, indicating that the mode is in the power-on initialization self-test process.
- After the module initialization self-test is completed, the indicator switches from red to green, indicating that the self-test is completed and the mode enters transmission mode (after the module is powered on and reset, it enters transmission mode).

4.6.2 Wireless transmit indication

- buffer empty: the data in the internal 1000-byte buffer, are written to the wireless chip (automatic packetization).
  when the green indicator is always on, the user even initiates data less than 1000 bytes, which will not overflow.
  When the green indicator blinks, the buffer is not empty: the data in the internal 1000-byte buffer, not

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all written to the wireless chip and open to transmit, at this time the module may be waiting for the end of the user data timeout, or is in the process of wireless sub-packet launch.

Note: When the green light is on, it does not mean that all the serial data of the module has been emitted through wireless, or the last packet of data is being emitted.

4.6.3 Modules are in the process of being configured

- The red indicator is always on when the module is in configuration mode.
- When the module receives a command, the red indicator flashes when it responds to the received command.

4.6.4 Module mode switching process

- Switching mode process by light touch switch hardware.

1、Long press the light touch switch for more than 1.5s.

2、Release the light touch switch.

3、Exit the current task mode.

4、Enter the new mode task, the corresponding mode indication LED is always on, complete the mode switch.

- Switching mode process by mode switching command software.

1、Send mode switch command (mode switch command needs to be turned on in configuration mode before it can be used, and the function is turned off by default).

2、Exit the current task mode.

3、Enter the new mode task, the corresponding mode indication LED is always on, complete the mode switch.

4.6.5 Precautions

Serial number	Note on Indicator Light
1	the above function, the output low level takes priority, i.e.: the indicator flashes when any of the output low level conditions are met. When all low level conditions are not satisfied, the indicator is always on.
2	When the indicator flashes, it indicates that the module is busy and no work mode detection will be performed at this time.

VWorking mode

The module has 2 modes of operation, as detailed in the following table.

Mode	Indicator light	Indicator status	Model Introduction	Remark
Transfer Mode	Green	Always bright	Serial port open, wireless open, transparent transmission	Support special command over-the-air configuration

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Configuration Mode	Red	Always bright	User can access the registers through the serial port to control the operating status of the module	Requires configuration at 9600 baud rate

5.1 Mode Switching

Serial Number	Remark
1	● Users can switch the module working mode by tapping the switch or mode switching command. ● When the mode is changed: if the module is idle, it can start working according to the new mode after 1ms. ● If the module has serial data not yet finished transmitting through the wireless port, it can enter the new working mode only after the transmitting is finished. ● if the module receives wireless data and sends it out through the serial port, it needs to finish sending it before it can enter the new working mode. ● So the mode switching can only be effective when the mode is idle i.e. the mode indicator is always on, otherwise the switching will be delayed.
2	● For example, if a user enters a large amount of data continuously and switches modes at the same time, the switch mode operation at this time is invalid; the module will process all user data before performing a new mode detection.
3	● Similarly, any mode switch, which can take advantage of this feature, will automatically enter a new mode within 1ms after the module has processed the current mode event.
4	● This operation method is very flexible and efficient, designed exactly according to the user's MCU operation convenience, and can reduce the overall system workload as much as possible and improve the system efficiency.

5.2 Transmission mode

Type	When the green indicator is on, the module is in transmission mode
Launch	Users can input data through the serial port, the module will start the wireless transmitting, the transmitting process, the green light flashes.
Receiving	The module wireless receiving function is turned on, the wireless data received will be output through the serial port TXD pin, the receiving process, the green indicator flashes.

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5.3 Configuration Mode

Type	When the red indicator is on, the module is in configuration mode
Launch	Wireless transmit off
Receiving	Wireless reception off
Configuration	The user can access the registers and thus configure the module operating status, the command response process, and the red indicator flashes.

Ⅵ Register read/write control

6.1 Command Format

The list of supported commands in configuration mode (mode 2: M1=1, M0=0) is as follows (when set, only 9600, 8N1 format is supported):

Serial number	Command Format	Detailed description
1	Set register	Instruction: C0+start address+length+parameter Response: C1+start address+length+parameters Example 1: Configure the channel as 0x09 Command Start address Length Parameter Send: C0 05 01 09 Return: C1 05 01 09 Example 2: Configure module address (0x1234), network address (0x00), serial port (9600 8N1), air speed (2.4K) at the same time Send: C0 00 04 12 34 00 62 Return: C1 00 04 12 34 00 62

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2	Read register	Instruction: C1+start address+length Response: C1+start address+length+parameters Example 1: Read channel Command Start address Length Parameter Send：C1 05 01 Return: C1 05 01 09 Example 2: Read module address, network address, serial port, null speed (2.4K) at the same time Send: C1 00 04 Return: C1 00 04 12 34 00 62
3	Set temporary register	Instruction: C2 + start address + length + parameters Response: C1 + start address + length + parameters Example 1: Configure the channel as 0x09 Command Start address Length Parameter Send: C2 05 01 09 Return: C1 05 01 09 Example 2: Configure module address (0x1234), network address (0x00), serial port (9600 8N1), air speed (2.4K) at the same time Send: C2 00 04 12 34 00 62 Return: C1 00 04 12 34 00 62
5	Wireless Configuration	Command: CF CF + General command Response: CF CF + general response Example 1: Wireless configuration channel is 0x09 Wireless Command Header Command Start Address Length Parameter Send: CF CF C0 05 01 09 Return: CF CF C1 05 01 09 Example 2: Wireless simultaneously configure module address (0x1234), network address (0x00), serial port (9600 8N1), null speed (2.4K) Send: CF CF C0 00 04 12 34 00 62 Return: CF CF C1 00 04 12 34 00 62
6	Format error	Format Error Response FF FF FF

6.2 Register Description

Serial Number	Read and write	Name	Description	Remark
00H	Read and write	ADDH	ADDH（Default 0）	Module address high byte and low byte. Note: When the module address is equal to FFFF, it can be used as a broadcast and listening address, i.e.: the module will not be address
01H	Read and	ADDL	ADDL（Default 0）	

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<table>
<tr><td></td><td>write</td><td></td><td colspan="6"></td><td>filtered at this time</td></tr>
<tr><td>02H</td><td>Read and write</td><td>NETID</td><td colspan="6">NETID (Default 0)</td><td>Network address to distinguish between networks.
It should be set to the same when communicating with each other.</td></tr>
<tr><td rowspan="20">03H</td><td rowspan="20">Read and write</td><td rowspan="20">REG0</td><td>7</td><td>6</td><td>5</td><td colspan="3">UART Serial port rate (bps)</td><td rowspan="9">two modules communicating with each other, the serial port baud rates can be different and the checksums can be different.

When transmitting larger packets in succession, users need to consider data blocking and even possible loss due to the same baud rate.

It is generally recommended that both communicating parties have the same baud rate.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td colspan="3">The serial port baud rate is 1200</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td colspan="3">The serial port baud rate is 2400</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td colspan="3">The serial port baud rate is 4800</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td colspan="3">The serial port baud rate is 9600 (Default)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td colspan="3">The serial port baud rate is 19200</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td colspan="3">The serial port baud rate is 38400</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td colspan="3">The serial port baud rate is 57600</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td colspan="3">The serial port baud rate is 115200</td></tr>
<tr><td>4</td><td>3</td><td colspan="4">Serial port parity bits</td><td rowspan="5">The serial port mode can be different for both sides of the communication.</td></tr>
<tr><td>0</td><td>0</td><td colspan="4">8N1 (Default)</td></tr>
<tr><td>0</td><td>1</td><td colspan="4">8O1</td></tr>
<tr><td>1</td><td>0</td><td colspan="4">8E1</td></tr>
<tr><td>1</td><td>1</td><td colspan="4">8N1 (Equivalent 00)</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">1</td><td rowspan="2">0</td><td colspan="3">Wireless Air Speed (bps)</td><td rowspan="10">The air rate must be the same for both sides of the communication.
The higher the air rate, the lower the delay and the shorter the transmission distance.</td></tr>
<tr><td>E22-230T22U</td><td>E22-400T22U</td><td>E22-900T22U</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td colspan="3">2.4k</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td colspan="3">2.4k</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td colspan="3">2.4k (Default)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>2.4k</td><td>4.8k</td><td>4.8k</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>4.8k</td><td>9.6k</td><td>9.6k</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>9.6k</td><td>19.2k</td><td>19.2k</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>15.6k</td><td>38.4k</td><td>38.4k</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>15.6k</td><td>62.5k</td><td>62.5k</td></tr>
<tr><td rowspan="6">04H</td><td rowspan="6">Read and write</td><td rowspan="6">REG1</td><td>7</td><td>6</td><td colspan="4">Subcontracting settings</td><td rowspan="6">If the user sends data smaller than the packetization length, the output of the serial port at the receiving end is presented as uninterrupted continuous output.

When the user sends data larger than the packet length, the serial port</td></tr>
<tr><td>0</td><td>0</td><td colspan="4">240 Bytes (Default)</td></tr>
<tr><td>0</td><td>1</td><td colspan="4">128 Bytes</td></tr>
<tr><td>1</td><td>0</td><td colspan="4">64 Bytes</td></tr>
<tr><td>1</td><td>1</td><td colspan="4">32 Bytes</td></tr>
</table>

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						output at the receiving end will be divided into packets.
			5	RSSI Environmental Noise Enable		When enabled, the command C0 C1 C2 C3 can be sent in transmission mode Read register. Register 0x00 : current ambient noise RSSI. Register 0x01 : RSSI at the last received data (current channel noise is: dBm = -RSSI/2). Command format: C0 C1 C2 C3 + start address + read length. Return: C1 + address + read length + read valid value; e.g.: send C0 C1 C2 C3 00 01 return C1 00 01 RSSI (address can only start from 00)
			0	Disable (default)		
			1	Enable		
			4	3	Reserved	
			2	Software Mode Switching		If you do not want to use a light touch switch to switch the operating mode, you can enable this function and use a specific serial command to switch the mode. Format: C0 C1 C2 C3 02 + working mode Send C0 C1 C2 C3 02 00 to switch to pass-through mode Send C0 C1 C2 C3 02 01 to switch to configuration mode Return: C1 C2 C3 02 + working mode
			0	Disable (default)		
			1	Enable		
			1	0	Transmitting power	Power and current are non-linearly related, with the power supply being most efficient at maximum power. The current does not decrease in the same proportion as the power decreases.
			0	0	22dBm (Default)	
			0	1	17dBm	
			1	0	13dBm	
			1	1	10dBm	
05H	Read and write	REG2	E22-230T22U		Channel Control (CH) 0-64 represent a total of 65 channels respectively	Actual frequency of 230 band = 220.125 + CH*0.25M
			E22-400T22U		Channel Control (CH) 0-83 represent a total of 84 channels respectively	400 band actual frequency = 410.125 + CH *1M
			E22-900T22U		Channel Control (CH) 0-80 represent a total of 81 channels respectively	900 band actual frequency = 850.125 + CH *1M
06H	Read and wri	REG3	7	Enable RSSI bytes		When enabled, the module will follow an RSSI intensity byte when it receives wireless data and outputs it through the serial port TXD.
			0	Disable (default)		
			1	Enable		
			6	Transmission method		For fixed-point transmission, the

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<table>
<tr><td rowspan="8"></td><td rowspan="8">te</td><td rowspan="8"></td><td>0</td><td colspan="5">Transparent transmission (default)</td><td rowspan="2">module identifies the money three bytes of the serial data as: address high + address low + channel, and uses them as the wireless transmitting target.</td></tr>
<tr><td>1</td><td colspan="5">Fixed-point transmission</td></tr>
<tr><td>5</td><td colspan="5">Relay function</td><td rowspan="3">When the relay function is enabled, the module will initiate a forwarding if the destination address is not the module itself. To prevent data backhaul, it is recommended to use with fixed-point mode; i.e., the destination address is different from the source address.</td></tr>
<tr><td>0</td><td colspan="5">Disable relay function (default)</td></tr>
<tr><td>1</td><td colspan="5">Enable Relay Function</td></tr>
<tr><td>4</td><td colspan="5">LBT enable</td><td rowspan="3">When enabled, wireless data is listened before transmitting, which can avoid interference to a certain extent, but may bring data delay. The maximum dwell time of LBT is 2 seconds, and it will be forced to send out when it reaches two seconds.</td></tr>
<tr><td>0</td><td colspan="5">Disable (default)</td></tr>
<tr><td>1</td><td colspan="5">Enable</td></tr>
<tr><td>3</td><td>2</td><td>1</td><td>0</td><td colspan="2">Reserved</td><td></td></tr>
<tr><td>07H</td><td rowspan="2">Write</td><td>CRYPT_H</td><td colspan="6">Key High Byte (default 0)</td><td rowspan="2">Write-only, with reads returning 0. Used for encryption to avoid interception of over-the-air wireless data by similar modules. These two bytes will be used internally by the module as calculation factors to transform the over-the-air radio signal for encryption.</td></tr>
<tr><td>08H</td><td>Write</td><td>CRYPT_L</td><td colspan="6">Key low byte (default 0)</td></tr>
<tr><td>80H～86H</td><td>Read</td><td>PID</td><td colspan="6">Product information 7 bytes</td><td>Product information 7 bytes</td></tr>
</table>

6.3 Factory default parameters

Model	Frequency	Address	Signal Channel	Air Rate	Baud rate	Serial port format	Transmitting power	Default Parameters
E22-230T22U	230.125MHz	0x0000	0x28	2.4kbps	9600	8N1	22dbm	C0 00 09 00 00 00 62 00 28 03 00 00
E22-400T22U	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	22dbm	C0 00 09 00 00 00 62 00 17 03 00 00
E22-900T22U	868.125MHz	0x0000	0x12	2.4kbps	9600	8N1	22dbm	C0 00 09 00 00 00 62 00 12 03 00 00

Ⅶ Relay networking mode use

Seria	Relay mode description

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1 Number	
1	After setting the trunk mode through the configuration mode, switch to the general mode and the trunk starts to work.
2	ADDH,ADDL are no longer used as module addresses in relay mode, but are forwarded to the pair corresponding to the NETID respectively, and if one of the networks is received, it is forwarded to the other network. The relay's own network ID is invalid.
3	In relay mode, the relay module cannot send and receive data and cannot perform low-power operation.
4	The module resets the user parameters during the user reset.

Relay networking rules description.

1、Forwarding rules, relay can forward data in both directions between two NETIDs.

2、In relay mode, ADDH\ADDL is no longer used as a module address and forwarded as a NETID pair.

As pictured.

① Level 1 Relay

"Node 1" NETID is 08.

"Node 2" NETID is 33.

The ADDH\ADDL of relay 1 is 08, 33 respectively.

So the signal sent by node 1 (08) can be forwarded to node 2 (33)

Also node 1 and node 2 have the same address, so the data sent by node 1 can be received by node 2.

② Secondary Relay

The ADDH\ADDL of Relay 2 is 33, 05, respectively.

So Relay 2 can forward data from Relay 1 to network NETID: 05.

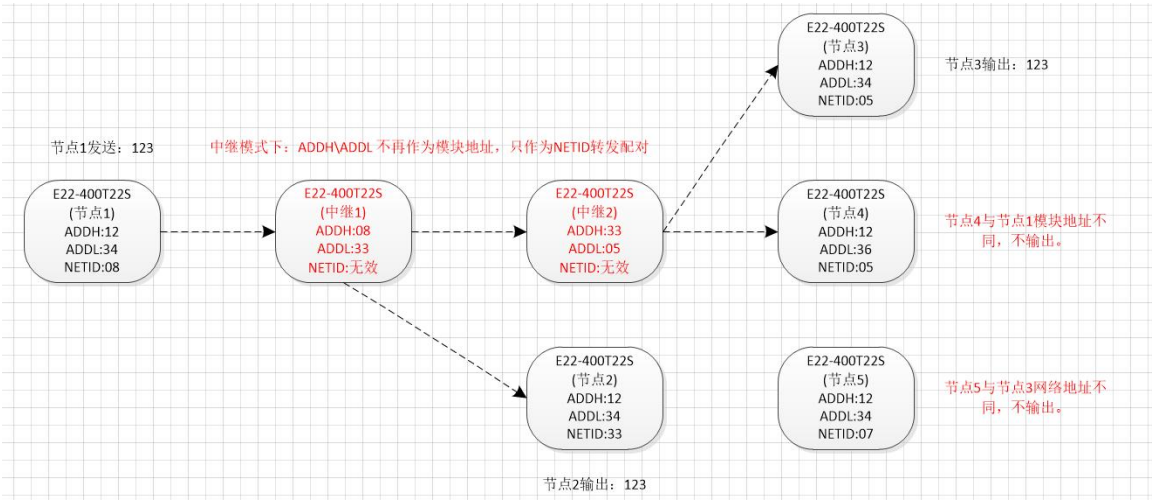
Thus, node 3 and node 4 can receive the node 1 data. Node 4 outputs data normally and node 3 has a different address from node 1, so it does not output data.

③ Two-way relay

As configured in the figure: the data sent by node 1 can be received by nodes 2 and 4, and the data sent by nodes 2 and 4 can be received by node 1.

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Ⅷ Upper computer configuration instructions

- The following figure shows the display interface of E22 configuration upper computer. Users can switch to the configuration mode by long press of the button for quick configuration and reading of parameters in the upper computer.



- In the configuration upper computer, the module address, frequency channel, network ID, and key are displayed in decimal mode; where each parameter takes the following value range.

  Network Address：0～65535

  Frequency Channel：0～83

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Network ID：0～255

Key：0～65535

- Users need to pay special attention when using the upper computer to configure the relay mode, because in the upper computer, the parameters are displayed in decimal mode, so the module address and network ID need to be filled in by converting the decimal;

  If the network ID entered at transmitter A is 02 and the network ID entered at receiver B is 10, the hexadecimal value 0X020A is converted to the decimal value 522 as the module address to be filled in by relay R when setting the module address.

  That is, the module address value that needs to be filled in at this time at the relay end R is 522.

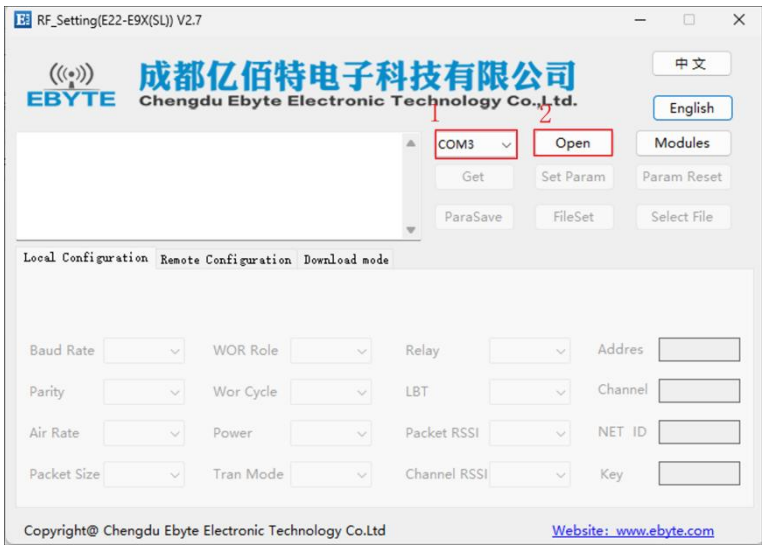
Ⅸ IAP firmware upgrade instructions

IAP (In Application Programming) is the online application programming, this module uses this method to upgrade the firmware online on the serial port. Meanwhile, this series module supports two ways to enter online upgrade mode: upper computer command and long press button.

- **Upgrading of upper computer commands**

1、to put the module into configuration mode by pressing the key (note: the baud rate in configuration mode is 9600).

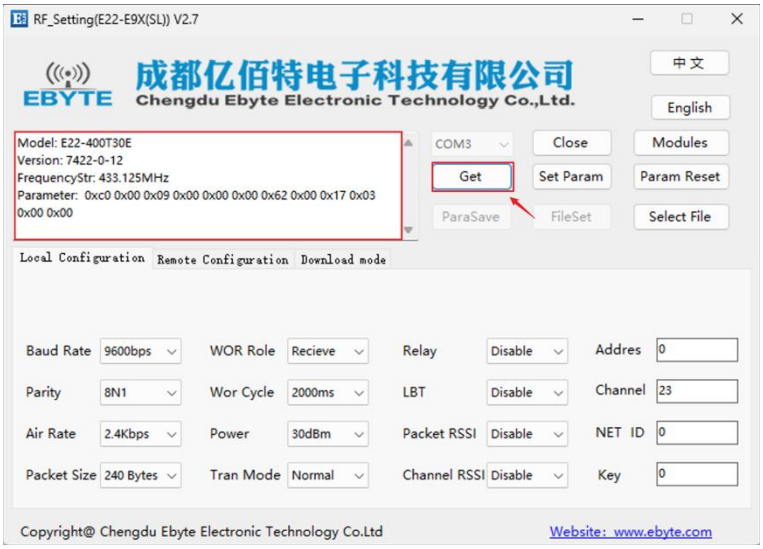
2、Open the official website to configure the upper computer "RF_Setting (E22-E9X (SL)) V2.7. exe", and select Serial Port > Open;



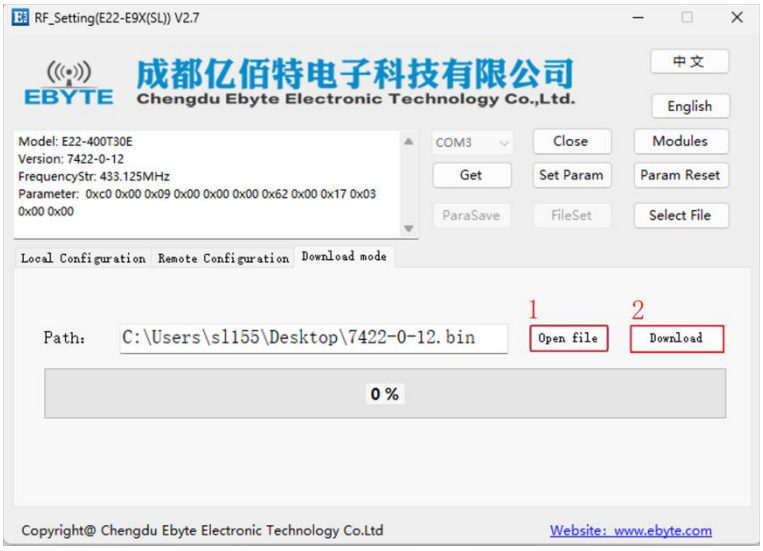
3、Click Get to view the module information in the left window of the upper computer;

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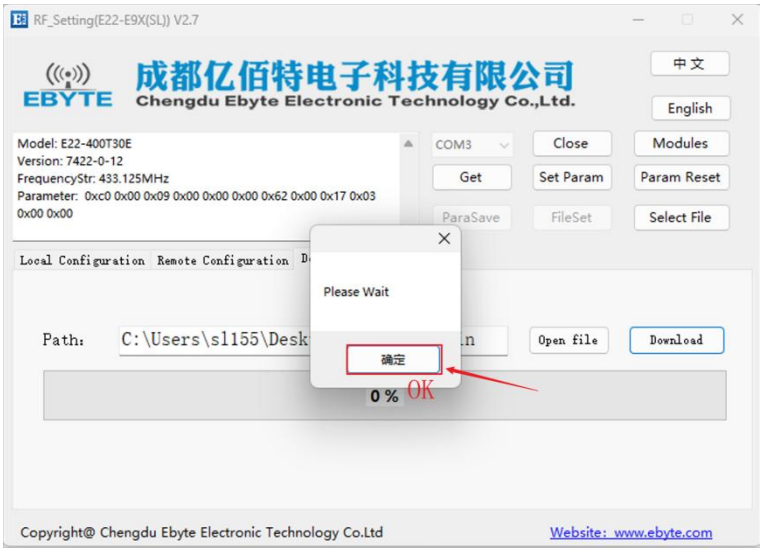
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4、Click Download mode > Click Open File (select Firmware. bin file)> Click Download;



5、Click 确定（OK），Firmware upgrade starts;



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6、Click 确定（OK），Firmware upgrade completed；



- **Long press the button to enter the upgrade mode**

1、Press the keys long before the module is powered on, and ensure that the keys are kept for at least 1s of continuous long press time after power on.

2、wait for the serial port continuous output "C" character (baud rate 115200) can release the button, according to the above "upper computer command upgrade" mode of operation;

3、Wait for the module to reset automatically and upgrade successfully.

Remark:

1、Press and hold the button for more than 1s when upgrading by button and then release the button.

2、the upper computer command upgrade logic: the upper computer send: "AT + IAP", the module reply: "AT + IAP = OK", wait for the module automatically reset into the IAP upgrade mode. The serial port output "C" character indicates that the module is waiting to receive the firmware bin file, after the host computer detects the character "C", it starts to send the bin file in packets automatically. After receiving, the module will automatically reset into the application and the upgrade is completed.

X Hardware Design

- Recommend using a DC regulated power supply to power the module with as small a ripple coefficient as possible, and the module needs to be reliably grounded.
- ; Please pay attention to the correct connection of the positive and negative terminals of the power supply, as a reversed connection may cause permanent damage to the module.
- Please check the power supply to ensure that it is between the recommended supply voltage, if it exceeds the maximum value it may cause permanent damage to the module.
- Please check the stability of the power supply, the voltage should not fluctuate significantly and frequently.

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- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin to have the whole machine conducive to long-term stable operation.
- modules should be as far as possible from the power supply, transformers, high-frequency alignments and other parts of the electromagnetic interference.
- High-frequency digital alignment, high-frequency analog alignment, power supply alignment must be avoided below the module, if it is really necessary to pass below the module, assuming that the module is soldered in the Top Layer, in the module contact part of the Top Layer pavement copper (all pavement copper and good grounding), must be close to the digital part of the module and alignment in the Bottom Layer.
- Assuming that the module is soldered or placed in the Top Layer, it is also wrong to run wires randomly in the Bottom Layer or other layers, which will affect the spurious and reception sensitivity of the module to varying degrees.
- Assuming that there are large electromagnetic interference devices around the module will also greatly affect the performance of the module, according to the strength of the interference is recommended to be properly away from the module, if the situation allows the appropriate isolation and shielding.
- Assuming that there are large electromagnetic interference alignments around the module (high-frequency digital, high-frequency analog, power supply alignments) will also greatly affect the performance of the module, according to the intensity of the interference, it is recommended to keep away from the module, and if the situation permits, appropriate isolation and shielding can be done.
- communication line if the use of 5V level, must be connected in series with 1k-5.1k resistors (not recommended, there is still a risk of damage).
- try to stay away from some of the physical layer is also 2.4GHz TTL protocol, for example: USB3.0.
- the antenna mounting structure has a big impact on the module performance, make sure the antenna is exposed and preferably vertically upwards.
- When the module is installed inside the case, you can use high quality antenna extension cable to extend the antenna to the outside of the case.
- The antenna must not be installed inside the metal case, it will cause the transmission distance to be greatly weakened.

XI Frequently Asked Questions

11.1 Unsatisfactory transmission distance

- A corresponding attenuation of communication distance when linear communication barriers exist.
- Temperature, humidity, and co-channel interference, which can lead to higher communication packet loss rates.
- The ground absorbs and reflects radio waves, and the test effect is poor near the ground.
- seawater has a very strong ability to absorb radio waves, so the seaside test effect is poor.
- metal objects near the antenna, or placed in a metal shell, signal attenuation will be very serious.
- Wrong setting of power register, too high setting of air rate (the higher the air rate, the closer the distance).
- the low voltage of the power supply at room temperature is lower than the recommended value, the lower the voltage the less power is generated

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- The use of antenna and module match the degree of poor or antenna itself quality problems.

11.2 Module is vulnerable to damage

- Please check the power supply to ensure that it is between the recommended supply voltages, as exceeding the maximum will cause permanent damage to the module.
- Please check the stability of the power supply, the voltage should not fluctuate significantly and frequently.
- Please ensure that the installation and use process anti-static operation, high-frequency devices electrostatic sensitivity.
- Please ensure that the installation and use process humidity should not be too high, some components are humidity-sensitive devices.
- If there is no special demand is not recommended to use at too high or too low temperature.

11.3 BER is too high

- Nearby interference with the same frequency signal, away from the source of interference or modify the frequency, channel to avoid interference.
- unsatisfactory power supply may also cause garbled codes, be sure to ensure the reliability of the power supply.
- Poor quality or too long extension cable or feeder line may also cause high BER.

XII Welding work instruction

12.1 Reflow Temperature

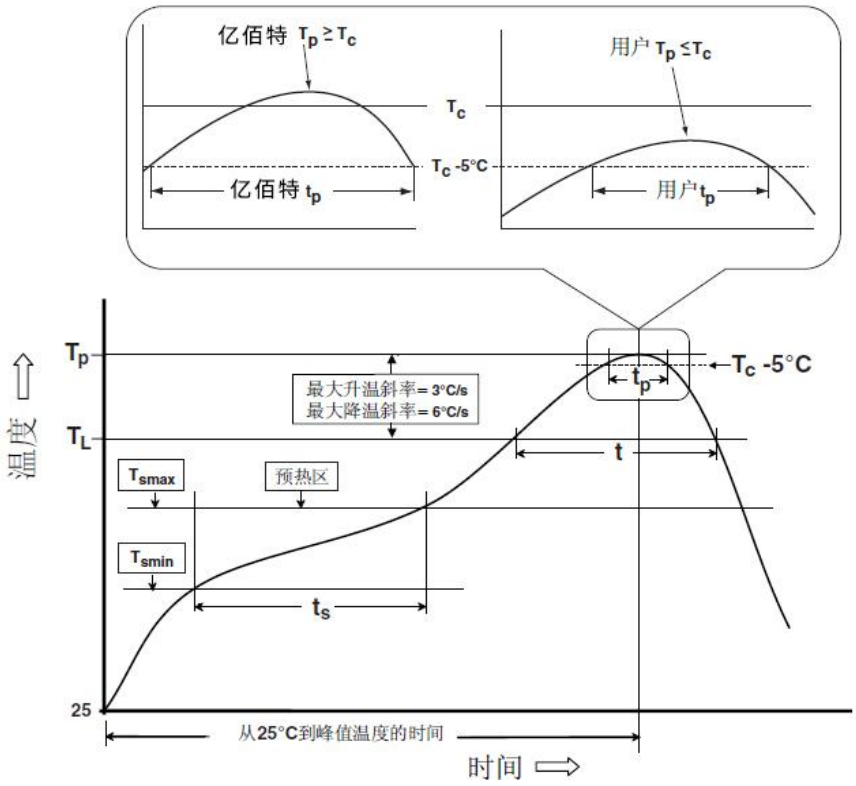
Reflow profile characteristics		Leaded process assembly	Lead-free process assembly
Preheat/hold	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin~Tsmin)	60-120 Seconds	60-120 Seconds
Slope of temperature increase (TL~Tp)		3℃/Second, Maximum value	3℃/Second, Maximum value
Liquid phase temperature (TL)		183℃	217℃
Hold time above TL		60~90 Second	60~90 Second

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Peak temperature of the package Tp	The user must not exceed the temperature indicated on the "Moisture Sensitivity" label of the product.	The user must not exceed the temperature indicated on the "Moisture Sensitivity" label of the product.
At the specified classification temperature (Tc) Time within 5℃ (Tp), See the chart below	20 Seconds	30 Seconds
Cooling slope (Tp~TL)	6℃/ Second, Maximum value	6℃/ Second, Maximum value
Room temperature to peak temperature time	6 minutes, Longest	8 minutes, Longest
※The peak temperature (Tp) tolerance of the temperature profile is defined as the upper limit of the user		

12.2 Reflow Profile



XIII Related Models

Model	Frequency Hz	Transmitting power dBm	Test Distance	Package form	Product Size mm	Communication

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			km			Interface
E22-230T22S	230M	22	5	SMD	16*26	TTL
E22-230T30S	230M	30	10	SMD	20*40.5	TTL
E22-400T22S	433/470M	22	5	SMD	16*26	TTL
E22-400T30S	433/470M	30	10	SMD	20*40.5	TTL
E22-900T22S	868/915M	22	5	SMD	16*26	TTL
E22-900T30S	868/915M	30	10	SMD	20*40.5	TTL
E22-400M22S	433/470M	22	7	SMD	14*20	SPI
E22-400M30S	433/470M	30	12	SMD	24*38.5	SPI
E22-900M22S	868/915M	22	7	SMD	14*20	SPI
E22-900M30S	868/915M	30	12	SMD	24*38.5	SPI

XIV Antenna Guide

14.1 Antenna Recommendations

Antenna is an important role in the communication process, often poor quality antenna will have a great impact on the communication system, so we recommend some antennas as supporting our wireless module and more excellent performance and reasonable price.

Model	Type	Frequency Hz	Interface	Gain dBi	Height mm	Feeders cm	Features
TX433-NP-4310	Flexible Antenna	433M	Welding	2.0	43.8*9.5	-	Built-in flexible, FPC soft antenna
TX433-JZ-5	Glue Stick Antenna	433M	SMA-J	2.0	52	-	Ultra Short Straight, Omni-directional Antenna
TX433-JZG-6	Glue Stick Antenna	433M	SMA-J	2.5	62	-	Ultra Short Straight, Omni-directional Antenna
TX433-JW-5	Glue Stick Antenna	433M	SMA-J	2.0	50	-	Bendable glue stick, omni-directional antenna
TX433-JWG-7	Glue Stick Antenna	433M	SMA-J	2.5	75	-	Bendable glue stick, omni-directional antenna
TX433-JK-11	Glue Stick Antenna	433M	SMA-J	2.5	110	-	Bendable glue stick, omni-directional

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							antenna
TX433-JK-20	Glue Stick Antenna	433M	SMA-J	3.0	210	-	Bendable glue stick, omni-directional antenna
TX433-XPL-100	Suction cup antenna	433M	SMA-J	3.5	185	100	Small suction cup antenna, cost effective
TX433-XP-200	Suction cup antenna	433M	SMA-J	4.0	190	200	Neutral suction cup antenna with low loss
TX433-XPH-300	Suction cup antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna, high gain
TX490-JZ-5	Glue Stick Antenna	470/490M	SMA-J	2.0	50	-	Ultra Short Straight, Omni-directional Antenna
TX490-XPL-100	Suction cup antenna	470/490M	SMA-J	3.5	120	100	Small suction cup antenna, cost effective

Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2022.11.17	Initial Version	Bin
1.1	2024.04.16	Content revision	Bin

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