



# E22-XXXT37S Product Specification

SX126X 230/433/470MHz 5W LoRa Wireless Module



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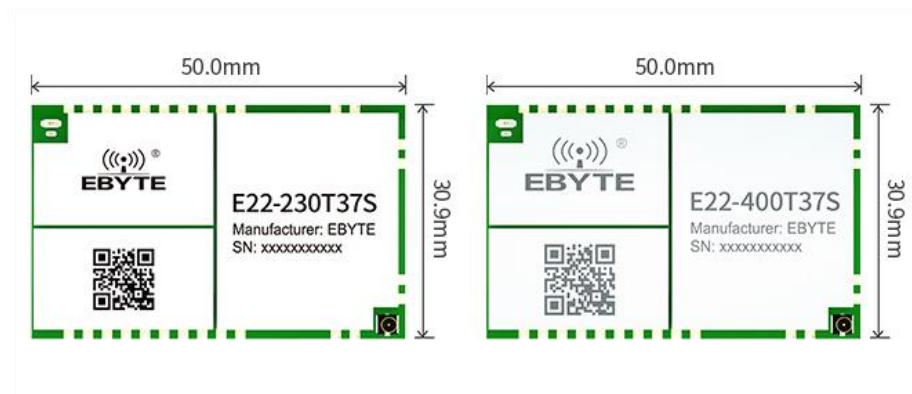
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# I Product Introduction

## 1.1 Product Description

E22-XXXT37S is a new generation of LoRa wireless module, wireless serial module (UART) based on SX126X RF chip, with multiple transmission modes, working in 230/433/470MHz band, LoRa spread spectrum technology, TTL level output, supporting 4.5V - 15V power supply voltage.

E22-XXXT37S adopts the new generation LoRa spread spectrum technology, compared with the traditional SX1278 solution, SX126X is farther, faster, lower power consumption and smaller; it supports wake-up on air, wireless configuration, carrier listening, automatic relay, communication key and other functions, supports sub-packet length setting, and can provide custom development services.



## 1.2 Features

- Develop new LoRa spread spectrum modulation technology based on SX126X, bringing longer communication distance and stronger anti-interference capability;
- supports auto-relay networking, multi-level relay for ultra-long distance communication, and multiple networks running simultaneously in the same area;
- supports user-set communication key and cannot be read, which greatly improves the confidentiality of user data;
- supports LBT function to listen to the channel environment noise before sending, which can greatly improve the communication success rate of the module in harsh environment;
- supports RSSI signal strength indication function for evaluating signal quality and improving communication network;
- supports wireless parameter configuration, which can remotely configure or read wireless module parameters by sending command packets wirelessly;
- supports over-the-air wake-up, i.e., ultra-low power consumption function, for battery-powered application solutions;
- support for fixed-point transmission, broadcast transmission, and channel monitoring;
- supports deep hibernation in the full power supply range, the power consumption of the whole machine in this mode is less than 10uA;

- supports global license-free ISM 433MHz band and 230/470MHz meter reading band;
- Module built-in PA+LNA, communication distance up to 25km under ideal conditions;
- parameters are saved at power-down, and the module will work according to the set parameters after re-powering;
- efficient watchdog design, once the abnormality occurs, the module will restart automatically and can continue to work according to the previous parameter settings;
- supports data transmission rate from 0.3K to 62.5kbps;
- support 4.5 ~ 15V wide voltage power supply, the full power supply range can guarantee 37dBm power output;
- industrial standard design, support -40 ~ +85 °C under long time use;
- module power up to 5W (37dBm), farther and more stable transmission.
- module built-in under-voltage, overvoltage warning function and built-in warning LED.
- module built-in over-temperature protection function, automatically stop transmitting after exceeding the maximum temperature of the module.
- module bottom reserved matrix pads, convenient for secondary development of heat dissipation treatment.

## 1.3 Application Scenarios

- home security alarms and remote keyless entry;
- Smart home as well as industrial sensors, etc.;
- wireless alarm security systems;
- building automation solutions;
- wireless industrial grade remote controls;
- Healthcare products;
- Advanced Meter Reading Architecture (AMI);
- Applications for the automotive industry.

## II Specification parameters

### 2.1 Limit parameters

Main parameters	Performance		Remarks
	Minimum value	Maximum value	
Supply voltage (V)	4.5	15	Exceeding 15V may permanently burn out the module
Blocking Power (dBm)	–	10	High power RF please do not close communication
Operating temperature (°C)	–40	+85	Industrial Grade

### 2.2 Working parameters

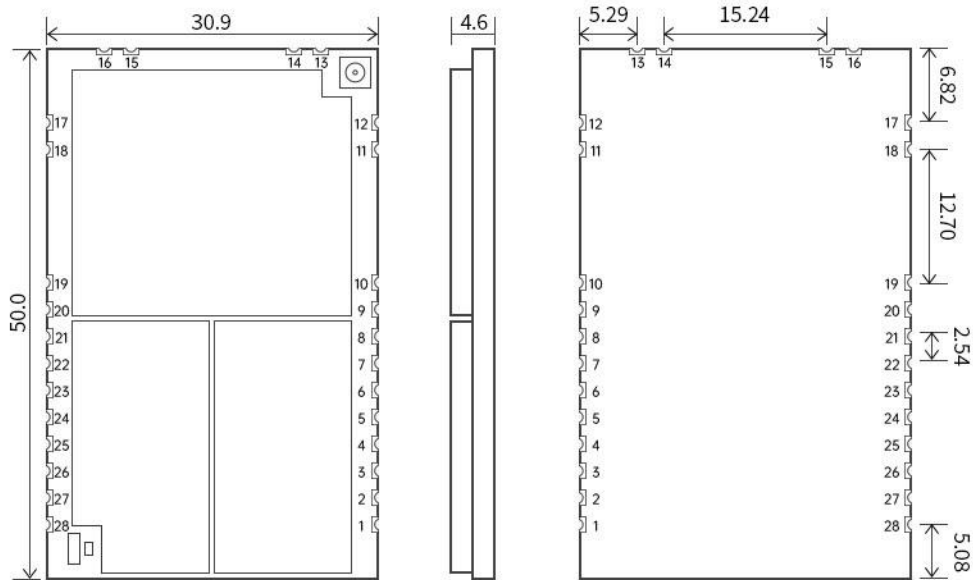
Main parameters		Model			Remarks
		E22-230T37S	—	E22-400T37S	
		Minimum value	Typical values	Maximum value	
Chip Solutions		SX1262	–	SX1268	–
Operating voltage (V)		4.5	5~12V	15	≥4.5V can guarantee the output power, the lower the voltage the higher the supply current
Communication level (V)		–	3.3	–	Using 5V level may risk burnout, need to use level conversion circuit
Operating temperature (°C)		–40	–	85	Industrial grade design
Operating frequency band (MHz)		220.125~236.125 MHz	–	410.125~493.125	ISM band support
Power consumption	5V transmit current (mA)	2900	3100	3300	50 Ohm impedance test, impedance mismatch may lead to high current, use 5V power supply please provide at least 3.5A output power supply
	12V transmitting current (mA)	900	1100	1300	50 Ohm impedance test, impedance mismatch may lead to high current, use 12V power supply please provide at least 1.5A output power supply
	Receiving current (mA)	38	43	48	Power supply voltage: 12V DC
	Dormant current (uA)	–	2	–	Software shutdown
Maximum transmit power (dBm)		36	37	38	–
Receiving Sensitivity		–126	–128	–130	Air speed 2.4 kbps



(dBm)				
Air Rate (bps)	0.3k	2.4k	62.5k	User-programmed control
Reference Distance	25km			Clear and open, antenna gain 5dBi, antenna height 2.5m
Launch length	240 Byte			Packets of 32/64/128/240 bytes can be sent by command
Cache capacity	1000 Byte			-
Modulation method	LoRa			Next generation LoRa modulation technology
Communication Interface	UART serial port			TTL level
Packaging method	SMD			SMD
Interface method	2.54mm			-
Dimension	50*30.9mm			-
RF Interface	IPEX/Stamp Holes			Characteristic impedance approx. 50 ohms



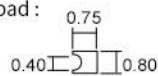
### III Mechanical dimensions and pin definition



Top pad :



Bottom pad :



Unit : mm  
pad quantity : 56  
Tolerance value : X.X±0.1mm  
X.XX±0.05mm

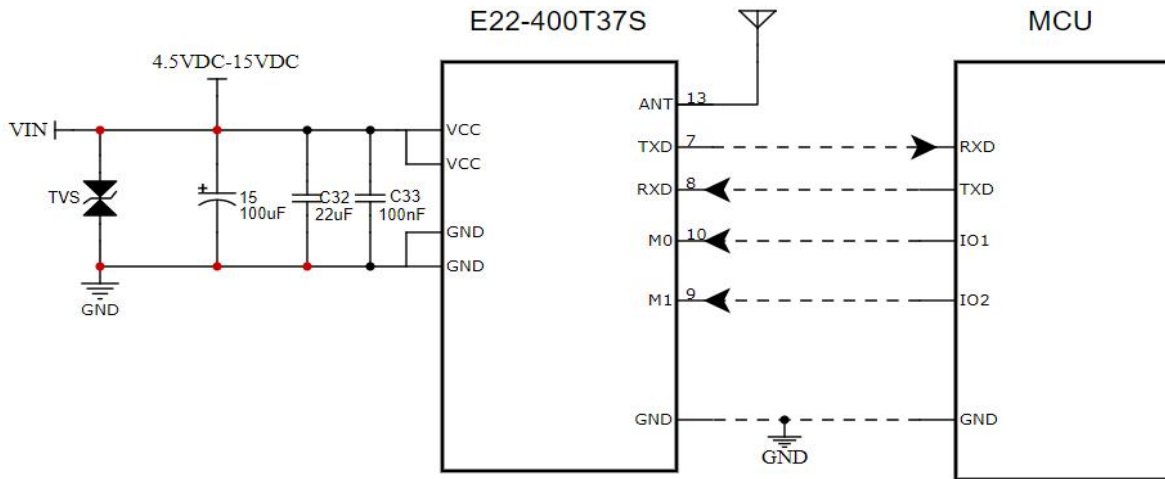
Serial number	Pins	Pin Direction	Remarks
1	GND	Input	Module Ground
2	GND	Input	Module Ground
3	VCC	Input	Module power supply positive reference, voltage range: 4.5 to 15V DC
4	VCC	Input	Module power supply positive reference, voltage range: 4.5 to 15V DC
5	RESET	Input	Module reset pins
6	AUX	Output	Used to indicate the module operating status; user wakes up the external MCU and outputs low during power-on self-test initialization level; (can be suspended)
7	TXD	Output	TTL serial output, connected to the external RXD input pin;
8	RXD	Input	TTL serial input, connected to the external TXD output pin;
9	M1	Input (very weak pull-up)	and M0 work together to determine the 4 modes of operation of the module (not suspended, grounded if not in use)
10	M0	Input (very weak pull-up)	Works with M1 to determine the 4 operating modes of the module (not suspended, can be grounded if not in use)
11	GND	Input	Module Ground
12	GND	Input	Module Ground
13	ANT	Output	Antenna interface (high frequency signal output, 50 Ohm characteristic impedance)

14	GND	Input	Module Ground
15	GND	Input	Module Ground
16	GND	Input	Module Ground
17	GND	Input	Module Ground
18	GND	Input	Module Ground
19	GND	Input	Module Ground
20	STATE	Output	Module status indication output, if not used suspension processing is sufficient.
21	485-EN	Input/output	The enable control pin of the external 485 chip can be used if it is not suspended for processing.
22	NC	-	No need to care, overhanging treatment.
23	NC	-	No need to care, overhanging treatment.
24	NC	-	No need to care, overhanging treatment.
25	SWDIO	-	No need to care, overhanging treatment.
26	SWCLK	-	No need to care, overhanging treatment.
27	GND	Input	Module Ground
28	3.3V	-	No need to care, overhanging treatment.

Note: The module must be connected to the 50-ohm impedance antenna when sending, no-load sending may cause permanent damage to the module!

## IV Recommended Connecting Diagram

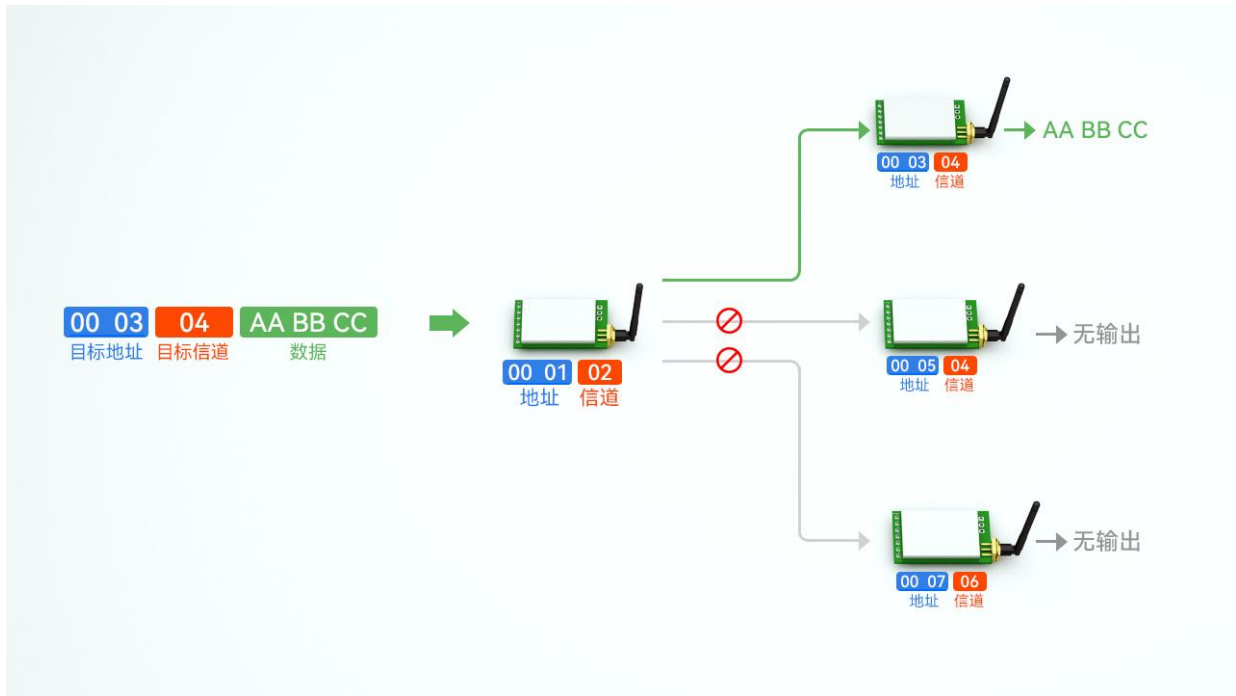
E22-230/400T37S circuit schematic



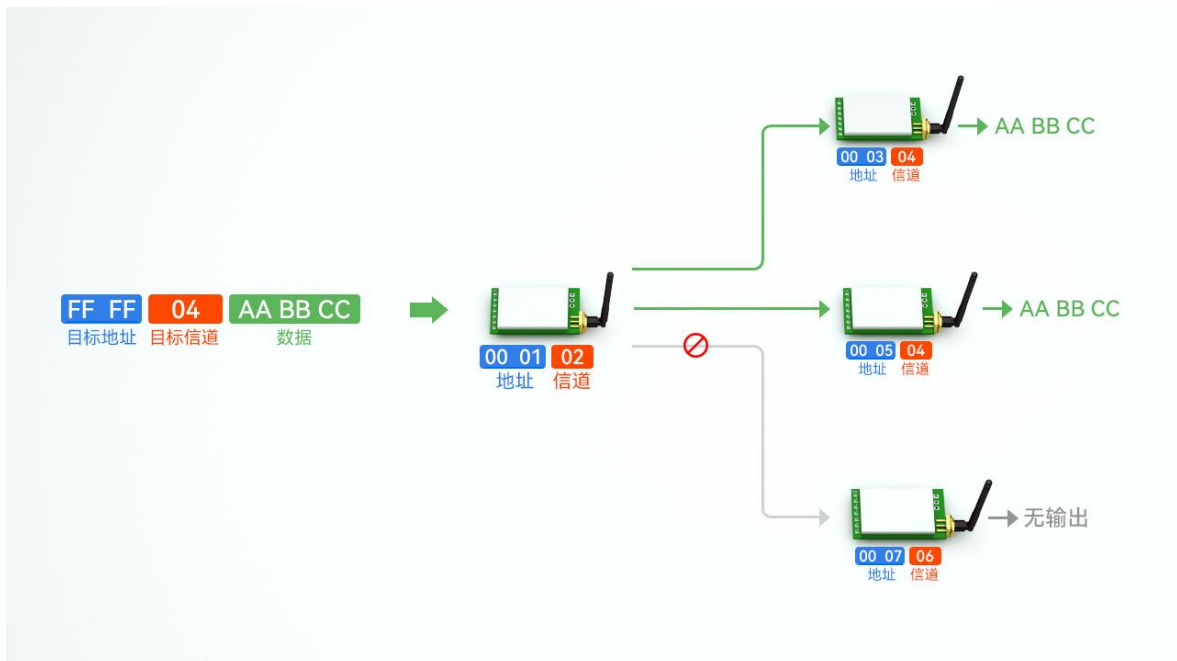
Serial Number	Module and microcontroller brief connection instructions (above diagram with STM8L microcontroller as an example)
1	The wireless serial module is TTL level, please connect with MCU of TTL level.
2	Use 5V microcontroller, please do level conversion.
3	The power input needs to add a capacitor of not less than 47uF, and the capacitor ESR needs to be as low as possible to increase the module stability.
4	Power protection devices can be added according to actual needs.

## V Detailed explanation of functions

### 5.1 Fixed-point transmission



### 5.2 Broadcast transmission



## 5.3 Broadcast Address

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

## 5.4 Listening Address

- Example: Set Module A address to 0xFFFF and channel to 0x04.
- When module A is used as receive, it can receive all data under 0x04 channel for the purpose of listening.

## 5.5 Module Reset

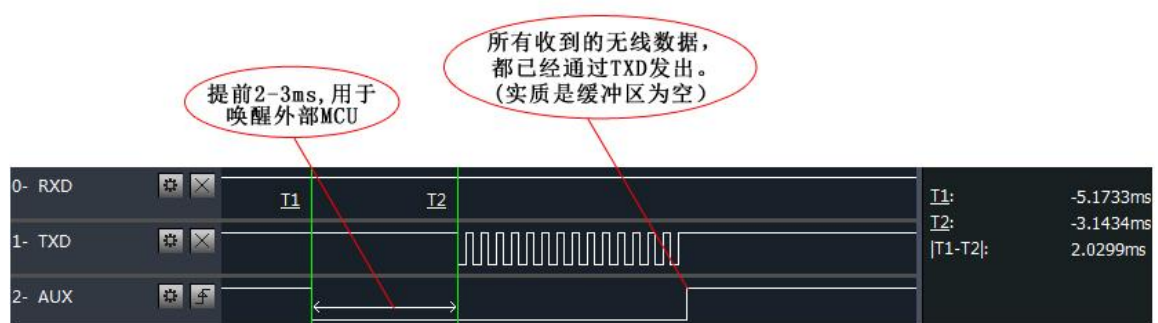
- Immediately after the module is powered up, the AUX will output a low level and perform a hardware self-test, as well as set the operating mode according to the user parameters;  
During this process, AUX remains low, and when it is finished, AUX outputs high and starts to work normally according to the working mode formed by the combination of M1 and M0;  
Therefore, the user needs to wait for the rising edge of AUX as the starting point for the normal operation of the module.

## 5.6 AUX detailed explanation

- AUX is used for wireless transceiver buffer indication and self-test indication.
- It indicates whether the module has data that has not yet been transmitted out through the wireless, or whether it has received wireless data that has not all been sent out through the serial port, or whether the module is in the process of initializing the self-test.

### 5.6.1 Serial data output indication

- For waking up an external MCU in hibernation;



模块串口外发数据时, AUX引脚时序图

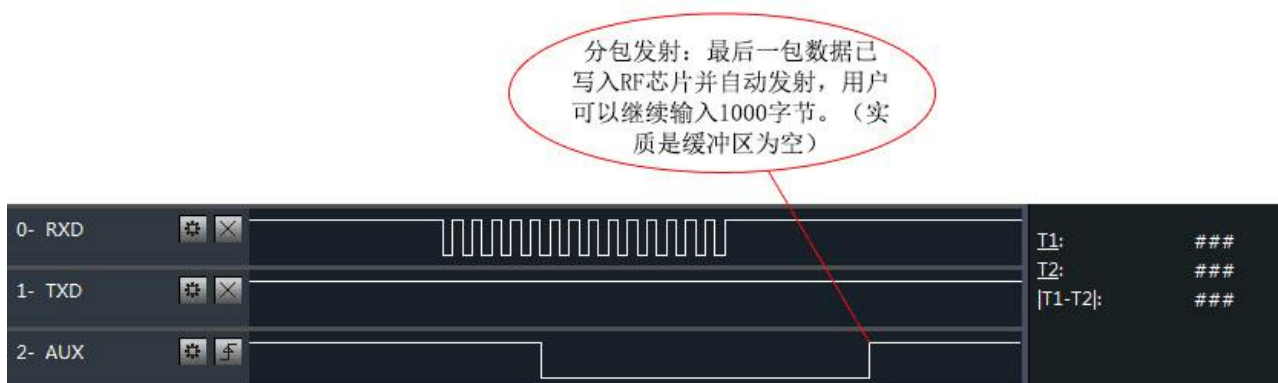
### 5.6.2 Wireless transmit indication

- buffer empty: data in the internal 1000-byte buffer, all written to the wireless chip (automatic packetization);

When AUX=1 the user initiates less than 1000 bytes of data continuously, without overflow;

When AUX=0 buffer is not empty: the data in the internal 1000-byte buffer, not all written to the wireless chip and open to transmit, at this time the module may be waiting for the user data to end timeout, or is in the process of wireless sub-packet transmission.

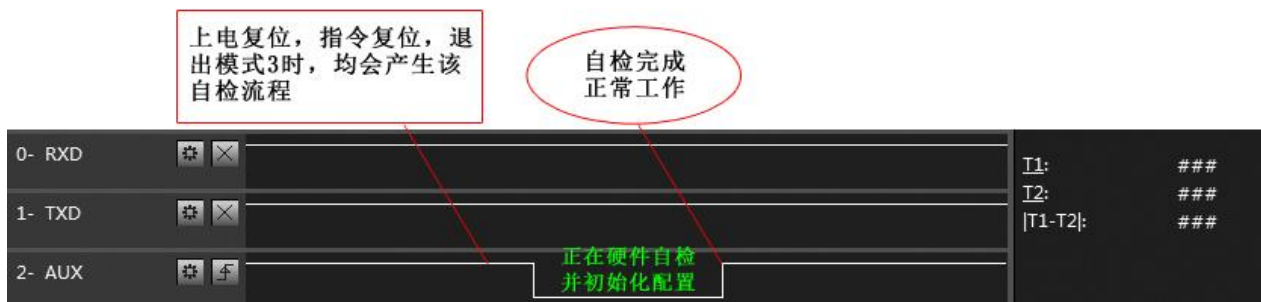
[Note]: When AUX=1, it does not mean that all the serial data of the module has been emitted through wireless, or the last packet of data is being emitted.



模块接收串口数据时，AUX引脚时序图

### 5.6.3 Modules are in the process of being configured

- Only when resetting and exiting hibernation mode;



自检期间，AUX引脚时序图

### 5.6.4 Attention

Serial Number	AUX Notes
1	For function 1 and function 2 above, the output low level takes precedence, i.e., the AUX outputs low when any of the output low level conditions are met; When all low level conditions are not satisfied, AUX outputs high level.
2	When the AUX output low level, it means the module is busy, no working mode detection will be done at this time; When the module AUX output high level within 1ms, it will finish the mode switching work.
3	After the user switches to a new operating mode, at least 2ms of the rising edge of AUX is required before the module will actually enter that mode; If AUX stays high, then the mode switch will take effect immediately.

4	The module resets the user parameters when the user goes from mode 3 (sleep mode) to other modes or during a reset, during which the AUX output goes low.
5	Due to the characteristics of LoRa modulation method, the information transmission time delay is much longer compared to FSK. It is recommended that customers should not transmit large data volume at low airspeed to avoid communication abnormalities caused by data loss due to data buildup.

## 5.7 Detailed explanation of abnormal work status log printing.

1. The STATE indicator/status indication pins will blink/level according to the following table depending on the specific abnormal operating status.

Abnormal working condition	Threshold for determining abnormal states	Indicator blinking condition
Undervoltage	Supply voltage $<4.5V \pm 0.2V$	500ms blink once/level flip
Overpressure	Supply voltage $>15V \pm 0.2V$	1s blink once/level flip
Overheating	Module temperature $>120^{\circ}C$	2s blink once/level flip
Overpressure and overheating	Supply voltage $>15V$ and module temperature $>120^{\circ}C$	Always bright

2. The module will temporarily shut down the RF transmitting function in abnormal working condition until it restores to normal working condition and then it will restart to open the transmitting.

3. The module will print a cyclic log (can be turned on/off) every 500ms in the abnormal state to inform the user of the current abnormal working status, and the format of the printed log is shown in the following table:

Abnormal working condition	Print Log Format
Undervoltage	FF FF FF 01
Overpressure	FF FF FF 02
Overheating	FF FF FF 03
Overpressure and overheating	FF FF FF 04

Exception log printing enable bit (bit 2 of command register 04H) 0: off 1: on Default is 0 (off)

## VI Working mode

The module has four operating modes, set by pins M1 and M0; details are shown in the following table:

Mode (0-3)	M1	M0	Model Introduction	Remarks
0 Transfer Mode	0	0	Serial port open, wireless open, transparent transmission.	Supports special command over-the-air configuration.
1 WOR Mode	0	1	It can be defined as a WOR sender and a WOR receiver.	Over-the-air wake-up support.
2 Configuration Mode	1	0	The user can access the registers through the serial port to control the operating status of the module.	
3 Deep Dormancy	1	1	The module goes into hibernation.	

### 6.1 Mode Switching

Serial Number	Remarks
1	<ul style="list-style-type: none"> <li>Users can combine M1 and M0 high and low levels to determine the module working mode. 2 GPIOs of MCU can be used to control the mode switching;</li> <li>When changing M1, M0: if the module is idle, it can start working according to the new mode after 1ms;</li> <li>If the module has serial data not yet finished transmitting through wireless, it can enter the new working mode only after the transmitting is finished;</li> <li>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;</li> <li>So mode switching can only be effective when AUX output 1, otherwise it will delay the switching.</li> </ul>
2	<ul style="list-style-type: none"> <li>For example, if the user continuously inputs a large amount of data and switches modes at the same time, the switching mode operation at this time is invalid; the module will process all the user data before performing a new mode detection;</li> <li>So the general recommendation is: detect the AUX pin output state and wait for 2ms after the output goes high before switching.</li> </ul>
3	<ul style="list-style-type: none"> <li>When the module is switched from other modes to hibernate mode, if there is data that has not yet been processed;</li> <li>The module will process this data (both incoming and outgoing) before it enters sleep mode. This feature can be used for fast hibernation to save power; for example, if the transmitter module works in mode 0, the user initiates the serial data "12345" and then does not have to wait for the AUX pin to be idle (high), it can directly switch to hibernation mode and hibernate the user's main MCU immediately, and the module will automatically send all the user's data automatically go into hibernation within 1ms after being sent via wireless;</li> <li>Thus saving the working time of MCU and reducing power consumption.</li> </ul>
4	<ul style="list-style-type: none"> <li>Similarly, any mode switching can take advantage of this feature. After the module has processed the current mode event, it will automatically enter the new mode within 1ms; thus saving the user the work of querying the AUX, and it can achieve the purpose of fast switching;</li> <li>For example, switching from transmit mode to receive mode; the user MCU can also switch modes by going to sleep in advance before the mode switch and using the external interrupt function to get the AUX</li> </ul>



	change.
5	<ul style="list-style-type: none"> <li>This operation method is very flexible and efficient, designed exactly according to the user's MCU operation convenience, and can minimize the workload of the whole system, improve system efficiency and reduce power consumption.</li> </ul>

## 6.2 General mode (mode 0)

Type	When M0 = 0 and M1 = 0, the module operates in mode 0
Transmit	The user can input data through the serial port and the module will start the wireless transmission.
Receiving	The module's wireless receive function is turned on, and the wireless data received will be output through the TXD pin of the serial port.

## 6.3 WOR mode (mode 1)

Type	When M0 = 1 and M1 = 0, the module operates in mode 1
Transmit	When defined as a transmitter, a wake-up code is automatically added for a certain amount of time before transmitting.
Receiving	Data can be received normally, and the receive function is equivalent to mode 0.

## 6.4 Configuration mode (mode 2)

Type	When M0 = 0 and M1 = 1, the module operates in mode 2
Transmit	Wireless transmit off
Receiving	Wireless reception off
Configuration	User can access registers to configure module operating status

## 6.5 Deep sleep mode (mode 3)

Type	When M0 = 1 and M1 = 1, the module operates in mode 3
Transmit	Unable to transmit wireless data.

Receiving	Unable to receive wireless data.
Notice	When going from sleep mode to other modes, the module will reconfigure the parameters and AUX is kept low during the configuration; When finished, it outputs high level, so users are recommended to detect the rising edge of AUX.

## VII Register read/write control

### 7.1 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	<p>Instruction: C0+start address+length+parameter Response: C1+start address+length+parameters</p> <p>Example 1: Configure the channel as 0x09 Command Start address Length Parameter Send: C0 05 01 09 Return: C1 05 01 09</p> <p>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 61 Return: C1 00 04 12 34 00 61</p>
2	Read register	<p>Instruction: C1+start address+length Response: C1+start address+length+parameters</p> <p>Example 1: Read channel Command Start address Length Parameter Send: C1 05 01 Return: C1 05 01 09</p> <p>Example 2: Read module address, network address, serial port and airspeed at the same time Send: C1 00 04 Return: C1 00 04 12 34 00 61</p>
3	Set temporary register	<p>Instruction: C2 + start address + length + parameters Response: C1 + start address + length + parameters</p> <p>Example 1: Configure the channel as 0x09 Command Start address Length Parameter Send: C2 05 01 09 Return: C1 05 01 09</p> <p>Example 2: Configure module address (0x1234), network address (0x00), serial port (9600 8N1), null speed (2.4K) at the same time Send: C2 00 04 12 34 00 61 Return: C1 00 04 12 34 00 61</p>

5	Wireless Configuration	<p>Command: CF CF + General command Response: CF CF + general response</p> <p>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</p> <p>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 61 Return: CF CF C1 00 04 12 34 00 61</p>
6	Format error	<p>Format Error Response FF FF FF</p>

## 7.2 Register Description

Serial Number	Read ing and writ ing	Name	Description	Remarks
00H	Read /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 filtered at this time
01H	Read /Write	ADDL	ADDL(Default 0)	
02H	Read /Write	NETID	NETID(Default 0)	。 Network address to distinguish between networks; It should be set to the same when communicating with each other.
03H	Read /Write	REG0	7 6 5 UART serial port rate (bps)	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 possibly even loss due to the same baud rate;
			0 0 0 Serial port baud rate of 1200	
			0 0 1 Serial port baud rate of 2400	
			0 1 0 Serial port baud rate of 4800	
			0 1 1 Serial port baud rate of 9600 (Default)	
			1 0 0 Serial port baud rate of 19200	
			1 0 1 Serial port baud rate of 38400	
			1 1 0 Serial port baud rate of 57600	

04H	Read /Write	REG1	1	1	1	Serial port baud rate of 115200		It is generally recommended that both sides of the communication have the same baud rate.
			4	3	Serial port parity bits			The serial port mode can be different for both sides of the communication;
			0	0	8N1 (Default)			
			0	1	8O1			
			1	0	8E1			
			1	1	8N1 (Equivalent to 00)			
			2	1	0	Wireless Air Rate E22-400T37S	Wireless Air Rate E22-230T37S	The air rate must be the same on both sides of the communication;  The higher the air rate, the lower the delay and the shorter the transmission distance.
			0	0	0	Air rate 0.3K	Air rate 0.3K	
			0	0	1	Air rate 1.2K	Air rate 1.2K	
			0	1	0	Air rate 2.4k (Default)	Air rate 2.4k (Default)	
			0	1	1	Air rate 4.8k	Air rate 4.8k	
			1	0	0	Air rate 9.6k	Air rate 9.6k	
			1	0	1	Air rate 19.2k	Air rate 15.6k	
			1	1	0	Air rate 38.4k	Air rate 15.6k	
			1	1	1	Air rate 62.5k	Air rate 15.6k	
			7	6	Subcontracting settings			If the user sends data less than the packet length, the serial output at the receiving end is presented as uninterrupted continuous output;
			0	0	240 bytes (default)			
			0	1	128 bytes			
			1	0	64 bytes			
			1	1	32 bytes		If the user sends data larger than the packet length, the serial port at the receiving end will split the packet output.	
5	RSSI Ambient noise enable					Enable command (subpacket setting, transmit power as default parameter, configuration mode): C0 04 01 20; When enabled, the command C0 C1 C2 C3 can be sent in transmit mode or WOR send mode Read register; Register 0x00 : Current ambient noise RSSI; Register 0x01 : RSSI at the last received data (current channel noise is:		
0	Disable (default)							
1	Enable							

						dBm = - (256 - RSSI)); 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)
			4	3	Reserved	The logs are printed in different formats according to different abnormal operating states, see section 5.7, Abnormal Operating State Log Printing for details.
			2	Abnormal operating status log printing enable		
			0	Disable (default)		
			1	Enable		
			1	0	Transmitting power	The module has no power staging.
			0	0	37dBm(default)	
			0	1	37dBm	
			1	0	37dBm	
			1	1	37dBm	
05H	Read /Write	REG2	Channel Control (CH) 0-83 represent a total of 84 channels respectively.			Actual frequency = 410.125 + CH *1M /220.125+CH*1M
06H	Read /Write	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 module identifies the money three bytes of the serial data as: address high + address low + channel, and uses them as the wireless transmitting target.
			0	Transparent transmission (default)		
			1	Fixed-point transmission		
			5	Relay function		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.
			0	Disable relay function (default)		
			1	Enable Relay Function		
			4	LBT enable		When enabled, wireless data is listened before transmitting, which can avoid interference to a certain extent, but may
			0	Disable (default)		
			1	Enable		

							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.			
			3	WOR mode transceiver control			Valid only for mode 1;			
			0	WOR receiver (default) Working in WOR listening mode, see below for the listening period (WOR cycle), can save a lot of power consumption.			1. wor’s receive mode, the module can modify the delay time after wake-up, the default time is 0; 2. the receiver needs to send the command C0 09 02 03 E8 in configuration mode (C0 is the write command, 09 is the host initiator address, 02 is the length, 03 E8 is the set delay time, the maximum FFFF that is 65535ms, set to 0 to turn off the wake-up delay time). 3. Data can be sent within the delay time			
				1	WOR transmitter The module sends and receives open and adds a certain time wake-up code when transmitting data.					
			2		1	0	WOR Cycle		Valid only for mode 1;	
			0	0	0	500ms		cycle time T= (1+WOR)*500ms, maximum 4000ms, minimum 500ms;		
			0	0	1	1000ms				
			0	1	0	1500ms				
			0	1	1	2000ms				
			1	0	0	2500ms		the longer the WOR listening interval cycle time, the lower the average power consumption, but the greater the data delay;		
			1	0	1	3000ms				
			1	1	0	3500ms				
				1	1	1	4000ms		Sending and receiving sides must be consistent (very important)	
			07H	Write	CRYPT_H	Key High Byte (default 0)				Write-only, with reads returning 0; Used for encryption to avoid interception of over-the-air wireless data by similar modules;
			08H	Write	CRYPT_L	Key low byte (default 0)				These two bytes will be used internally by the module as calculation factors to transform the over-the-air radio signal for encryption.
80H~86H	Read	PID	Product information 7 bytes				Product information 7 bytes			

### 7.3 Factory default parameters.

Model	Factory default parameter values: 00 00 00 62 00 17 03 00 00						
Module Model	Frequency	Address	Signal Channel	Air rate	Baud rate	Serial port format	Transmitting power
E22-400T37S	410.125~493.125MHz	0x0000	0x17	2.4kbps	9600	8N1	37dbm
E22-400T37S	220.125~236.125 MHz	0x0000	0x17	2.4kbps	9600	8N1	37dbm

## VIII Trunking mode use

Serial Number	Relay mode description
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 repeater 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 repeater'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 when the user goes from mode 3 (sleep mode) to other modes or during a reset, during which the AUX output goes low.

Trunking networking rules description:

- 1、Forwarding rules, trunk 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 shown in the figure:

#### ① Level 1 trunk

"Node 1" NETID is 08.

"Node 2" NETID is 33.

The ADDH/ADDL of trunk 1 is 08 and 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.

#### ②Secondary Relay

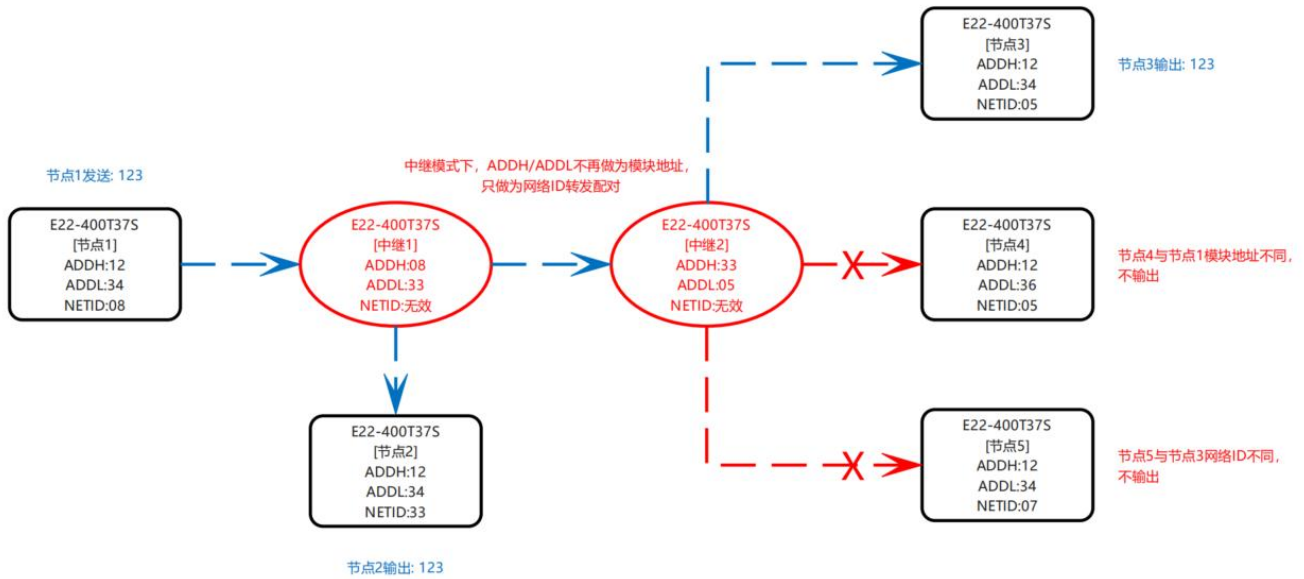
The ADDH\ADDL of relay 2 is 33, 05 respectively.

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

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

#### ③Two-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.





## IX Upper computer configuration instructions

- The following figure shows the display interface of the E22-400T37S configuration upper computer. Users can switch to command mode through M0 and M1 for quick configuration and reading of parameters at the upper computer.



- In the configuration of the upper computer, the module address, frequency channel, network ID, key are decimal display mode; where each parameter takes the following value range:

Network address: 0 to 65535

Frequency channel: 0~83

Network ID: 0~255

Key: 0 to 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 in decimal display mode, so the module address and network ID need to be filled in by converting the decimal;

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

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

## 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 positive and negative power supply, if the reverse connection will directly lead to permanent damage to the module, it is recommended to add anti-reverse connection circuit to the design.
- Please check the power supply to ensure that it is between the recommended supply voltage, if it exceeds the maximum value it will cause permanent damage to the module;
- Please check the power supply stability, the voltage should not fluctuate significantly and frequently;
- When designing power supply circuits for modules, it is often recommended to retain more than 30% margin to have the whole machine facilitate long-term stable operation;
- modules should be as far away 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;
- assumes that the module is soldered or placed in the Top Layer, in the Bottom Layer or other layers of random alignment is also wrong, will affect the module's spurious and reception sensitivity to varying degrees
- assumes 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 recommended appropriate away from the module, if the situation allows 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 strength of the interference, it is recommended to move away from the module, if the situation allows the appropriate isolation and shielding can be done;
- communication line if using 5V level, must be connected in series with 1k-5.1k resistors (not recommended, there is still a risk of damage);
- antenna mounting structure has a large impact on module performance, make sure the antenna is exposed and preferably vertically up;
- When the module is installed inside the housing, a good quality antenna extension cable can be used to extend the antenna to the outside of the housing;
- The antenna must not be installed inside the metal case, it will cause the transmission distance to be greatly weakened.

## X1 Frequently Asked Questions

### 11.1 Unsatisfactory transmission distance

- when there is a linear communication barrier, the communication distance will be attenuated accordingly;
- temperature, humidity, and co-channel interference, which can lead to higher communication packet loss rates;
- absorption and reflection of radio waves by the ground, and poorer test results close to the ground;
- sea water has a very strong ability to absorb radio waves, so the seaside test effect is poor;
- antenna near a metal object, or placed in a metal shell, the 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 power supply at room temperature is lower than the recommended value, the lower the voltage the less power is generated;
- use antenna and module match poorly or the antenna itself quality problems.

### 11.2 The module is vulnerable to damage.

- Please check the power supply to ensure that it is between the recommended supply voltages, as exceeding the maximum can cause permanent damage to the module;
- please check the power supply stability, 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 should not be too high humidity, some components are humidity-sensitive devices;
- If there is no special demand is not recommended to use in too high, too low temperature.

### 11.3 BER is too high

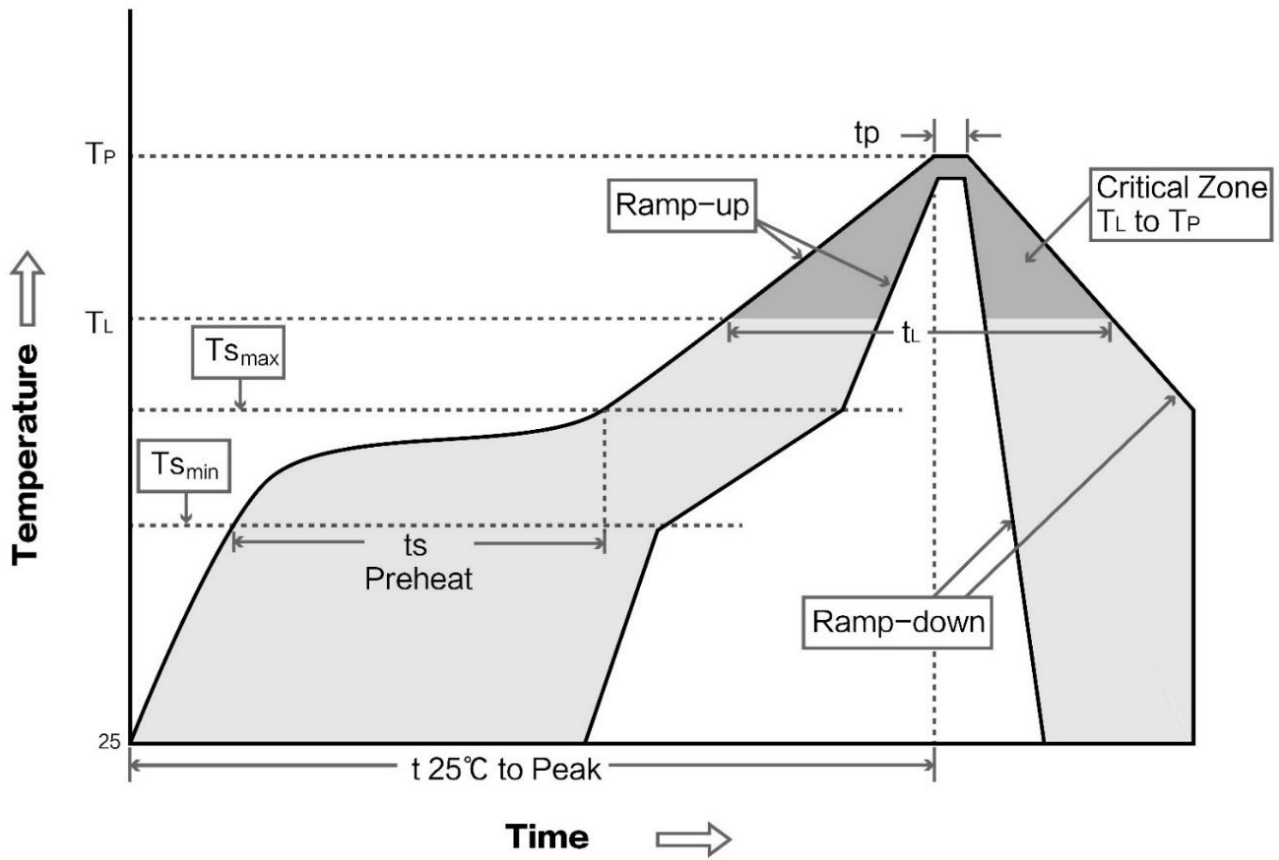
- nearby interference with the same frequency signal, away from the source of interference or modify the frequency, channel to avoid interference;
- unsatisfactory power supply may also cause garbled code, be sure to ensure the reliability of the power supply;
- Poor quality or too long extension cable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

## XII Welding work instruction

### 12.1 Reflow Temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Tin Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (T <sub>smin</sub> )	Minimum preheating temperature	100℃	150℃
Preheat temperature max (T <sub>smax</sub> )	Maximum preheating temperature	150℃	200℃
Preheat Time (T <sub>smin</sub> to T <sub>smax</sub> ) (t <sub>s</sub> )	Warm-up time	60-120 sec	60-120 sec
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	Average rise rate	3℃/second max	3℃/second max
Liquidous Temperature (T <sub>L</sub> )	Liquid phase temperature	183℃	217℃
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	Time above the liquid phase line	60-90 sec	30-90 sec
Peak temperature (T <sub>p</sub> )	Peak temperature	220-235℃	230-250℃
Average ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )	Average drop rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25° C to peak temperature	6 minutes max	8 minutes max

## 12.2 Reflow Profile



## XIII Relevant models

Product Model	Chip	Frequency Hz	Transmitting power dBm	Testing distance km	Package Form	Product Size mm	Communication Interface
<a href="#">E22-400T22S</a>	SX1268	433/470M	22	5	SMD	16*26	UART
<a href="#">E22-400T22D</a>	SX1268	433/470M	22	5	DIP	21*36	UART
<a href="#">E22-400T30S</a>	SX1268	433/470M	30	10	SMD	20*40.5	UART
<a href="#">E22-400T30D</a>	SX1268	433/470M	30	10	DIP	24*43	UART
<a href="#">E22-900T22S</a>	SX1262	868/915M	22	5	SMD	16*26	UART
<a href="#">E22-900T22D</a>	SX1262	868/915M	22	5	DIP	21*36	UART
<a href="#">E22-900T30S</a>	SX1262	868/915M	30	10	SMD	20*40.5	UART
<a href="#">E22-900T30D</a>	SX1262	868/915M	30	10	DIP	24*43	UART
<a href="#">E22-400T33D</a>	SX1268	433/470M	33	12	DIP	37*60	UART

## XIV Antenna Guide

### 14.1 Antenna Recommendation

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.

Product Model	Type	Frequency Hz	Interface	Gain dBi	Height mm	Feeder cm	Features
<a href="#">TX433-NP-4310</a>	flexible antenna	433M	Soldering	2.0	43.8*9.5	—	Built in flexible, FPC soft antenna
<a href="#">TX433-JZ-5</a>	Rubber rod antenna	433M	SMA-J	2.0	52	—	Ultra short straight type, omnidirectional antenna
<a href="#">TX433-JZG-6</a>	Rubber rod antenna	433M	SMA-J	2.5	62	—	Ultra short straight type, omnidirectional antenna
<a href="#">TX433-JW-5</a>	Rubber rod antenna	433M	SMA-J	2.0	50	—	Bending rubber rod, omnidirectional antenna
<a href="#">TX433-JWG-7</a>	Rubber rod antenna	433M	SMA-J	2.5	75	—	Bending rubber rod, omnidirectional antenna
<a href="#">TX433-JK-11</a>	Rubber rod antenna	433M	SMA-J	2.5	110	—	Bendable glue stick, omnidirectional antenna
<a href="#">TX433-JK-20</a>	Rubber rod antenna	433M	SMA-J	3.0	210	—	Bendable glue stick, omnidirectional antenna
<a href="#">TX433-XPL-100</a>	sucker antenna	433M	SMA-J	3.5	185	100	Small suction cup antenna, cost-effective
<a href="#">TX433-XP-200</a>	sucker antenna	433M	SMA-J	4.0	190	200	Neutral suction cup antenna, low loss
<a href="#">TX433-XP-300</a>	sucker antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna with high gain
<a href="#">TX490-JZ-5</a>	Rubber rod antenna	470/490M	SMA-J	2.0	50	—	Ultra short straight type, omnidirectional antenna
<a href="#">TX490-XPL-100</a>	sucker 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	2023-5-1	Initial Version	Yan

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