E78-470LN22S（6601）

ASR6601 Wireless module

Contents

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1.　Product Overview

1.1 Introduction

　　The E78-470LN22S(6601) series is a standard LoraWan node module designed and produced by Chengdu EBYTE Electronic Technology Co., Ltd., with operating band CN470 to 510MHZ,supporting 　CLASS 　-A/CLASS-C node type that supports both ABP/OTAA access, while the module features a variety of low-power modes, with a standard UARTfor external communicationinterfaces and AT for users The instructions are simply configured to access the standard LoraWan In the network, it's a great choice for current IoT applications.

1.2 Application

- Smart home and industrial sensors, etc.
- Security system, positioning system;
- Wireless remote control, drones;
- Wireless game remote control;
- Healthcare products;
- Wireless voice, wireless headphones;
- Automotive applications.

2　Specifications

2.1 Main parameters

Product model	Core IC	size	The net weight of the module	Operating temperature	Working humidity	Storage temperature
E78-470LN22S(6601)	ASR6601CB	20* 14*2.91 mm	1.3±0.1g	-40～85℃	10%～90%	-40～125°C

2.2 Working parameters

The parameter category	Min	Type	Max	unit

Emission current(Lora@2.4kbps).	110	120	130	mA
Receive current(Lora@2.4kbps).	13	14	15	mA
Turn off the current	2.4	2.5	2.6	uA
Transmit power	21.0	21.2	21.8	dBm
Receive sensitivity	-139	-140	-140	dBm
TCXO crystal	32	32	32	MHZ
TCXO crystal voltage configuration	1.8	1.8	3.3	V
Recommended operating band	470	470/490/510	510	MHZ
The supply voltage	2.5	3.3	3.7	V
Communication level	2.5	3.3	3.7	V

| The main parameter	description	remark
Reference distance	5600m	Clear and open, antenna height 2 meters, air rate 1kbps
Crystal frequency	32MHz	-
Modulation	LoRa	GFSK Mode ， FLRC Mode，LoRa Mode
How to encapsulate	SMA	-
Interface mode	1.27mm	-
The communication interface	SPI	0 ~ 10Mbps
Form factor	20*14mm	-
Antenna interface	IPEX/stamp hole	with an equivalent impedance of about 50Ω

2.3 Parameter description

● In the design of power supply circuits for modules, it is often recommended to retain more than 30% of the margin, the whole machine is conducive to long-term stable work;

● The current required at the moment of transmission is large but often because the emission time is very short, the total energy consumed may be smaller;

● When the customer uses the external antenna, the resistance matching degree of the antenna and the module at different frequency points will affect the size of the transmit current to varying degrees.

● The current consumed by the RF chip when it is in a purely receiving state is called the receiving current, and some RF chips with communication protocols or the developers have loaded some of the self-developed protocols on top of the machine, which may result in a large receiving current for the test;

● Currents in a purely received state are often mA-level, and the "receiving current" at the level of μA requires the

developer to process it through software;

- Turn off the power flow is often much smaller than the power supply part of the whole machine in the empty consumption of the current, do not have to be too demanding;

- Because the material itself has some error, a single LRC element has an errorof ±0.1%, but hesitating to use multiple LRC elements in the entire RF circuit, there will be a cumulative error situation, resulting in differences between the transmit current and the receiving current of different modules;

- Reducing the transmit power can reduce power consumption to some extent, but reducing the transmit power emission for a number of reasons can reduce the internal.

3. Mechanical Dimensions and Pin Definitions

## 3.1 E78-470LN22S(6601) dimensions drawing
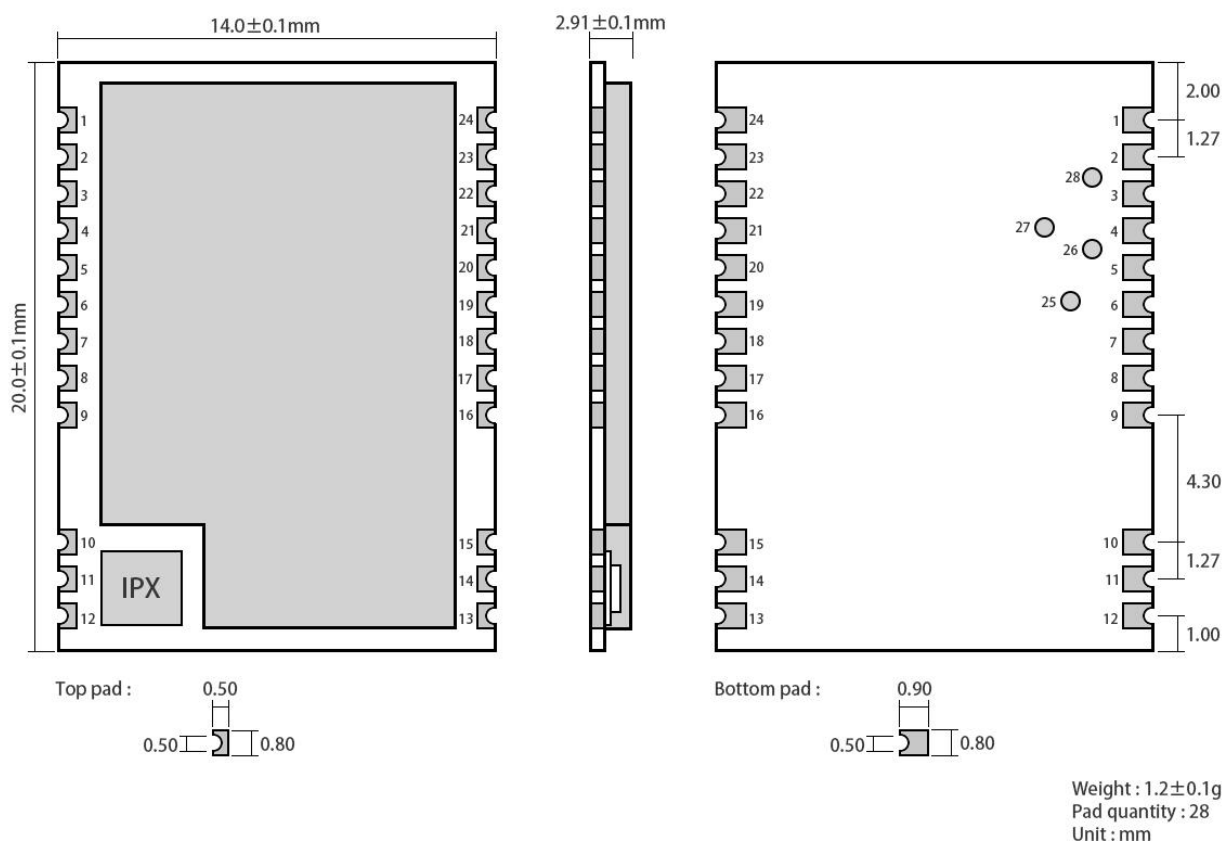
3.2 Pin definition

Pin number	The pin name	Pin direction	Pin use
1	GND	-	ground wire, connected to the power reference
2	VCC	-	Power supply, range 2.5V to 3.7V(ceramic filter capacitor is recommended externally).
3	SETB	-	Wake-up pins with low power
4	DIO1	Input/output	NC(reserve pin).
5	BUSY	Input/output	NC(reserve pin).
6	I2C_SDA	Input/output	NC(reserve pin).
7	I2C_SCL	Input/output	NC(reserve pin).
8	UART_CTS	Input/output	NC(reserve pin).
9	UART_RTS	Input/output	NC(reserve pin).
10	GND	-	ground wire, connected to the power reference

11	ON	-	Antenna interface, stamp hole(50 ohm characteristic impedance).
12	GND	-	ground wire, connected to the power reference
13	GND	-	ground wire, connected to the power reference
14	GND	-	ground wire, connected to the power reference
15	GND	-	ground wire, connected to the power reference
16	XRES	input	The external reset pin
17	ADC_IN	input	NC(reserve pin).
18	THE	Input/output	NC(reserve pin).
19	SILK	Input/output	NC(reserve pin).
20	UART_RX	Input/output	UART RX pin
21	UART_TX	Input/output	UART TX pin
22	SWD_DATA	Input/output	SWD Data pin
23	SWD_CLK	Input/output	SWD Clock pin
24	GND	-	ground wire, connected to the power reference
25	SPI_MISO	Input/output	The SPI MISO test point, which is internally connected and cannot be used as an external SPI
26	SPI_NSS	Input/output	The SPI NSS test point, which is internally connected and cannot be used as an external SPI
27	SPI_MOSI	Input/output	The SPI MOSI test point, which is internally connected and cannot be used as an external SPI
28	SPI_SCK	Input/output	The SPI SCK test point, which is internally connected, cannot be used as an external SPI
★ For pin definitions, software drivers, and communication protocols for modules, see ASR's officialASR6601 Datasheet ★			

3.3 Recommended connection diagram
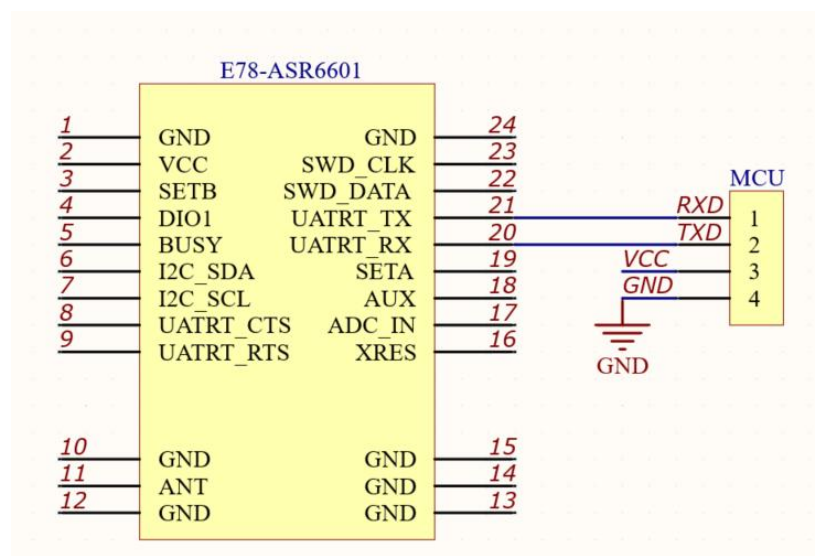
4.   Terms and Definitions

2.1 LoRa

LoRa   is one of the LPWAN communication technologies, known as Long Range Radio,Chinese meaning "long-range radio";   Company;

LoRa's main brandISM is available in the global free bands: 433MHz,   470MHz,   868MHz, 915MHz, and more.

Features: Low power consumption, long distance, low cost.

2.2 The LoRaWAN

LoRa Alliance is an   open, non-profit organization led by   Semtech in March 2015   The Federation publishes a low-power WAN standard based on an open source MAC layer protocol: the   LoRaWAN   protocol standard.

Network topology: Star structure Network

composition: LoRa module, gateway (gateway or base station),   Server(including Network).   Server,Network control,Application   Server）。

LoRaWAN   classes LoRa nodes into three categories: A/B/C

● Two-way transmission terminal (Class A):

Class A's terminal follows two short downstream receive windows after each upstream to   enable two-way transmission.   Terminals schedule transmission time slots based on their own communication needs, with small variations (i.e. ALOHA   protocols)based on randomtime.   This Class A operation provides the lowest power consumption terminal system for the application,   requiring only the application to carry out the downstream transmission of the server for a very short period of time after the terminal is transmitted upstream.   Downlinks made by the server at any other time have to wait for the next upstream of the terminal.

● Two-way transmission terminal (Class B)that delineates the receive timeslot:

Class B's terminals will have more receive time slots.   In addition to Class A's random receive window,   the Class B device   opens another receive window at a specified time. In order for the terminal to open the receive window at a specified time, the terminal needs to receive a time-synchronized beacon (Beacon)from thegateway.   This allows the server to know when the terminal is listening.

● Two-way transmission terminal (Class C)to maximize the reception timeslot:

Class C's terminal is basically always open and the receive window is closed only briefly when sent.   Class C's terminals consume more power than Class A and Class B,   but at the same time have the shortest latency from the server to the terminals.

Note:The E78-470LN22S(6601) supports Class AandClass C device types.

2.3 ADR

ADR Chinese is called adaptive data rate. In loraWan network systems, to maximize end device battery life and overall network capacity,LoRaWAN network servers manage each end device data rate and RF output separately through the

AdaptiveData Rate(ADR)algorithm Through ADR technology,LORAWAN system, the server automatically updates the rate of the node according to the signal reception capacity of the node, the distance is low, the distance is the high rate, so that in practical application, the greater the effective bandwidth and load capacity of the network.

5. LORAWAN Application Model Diagram
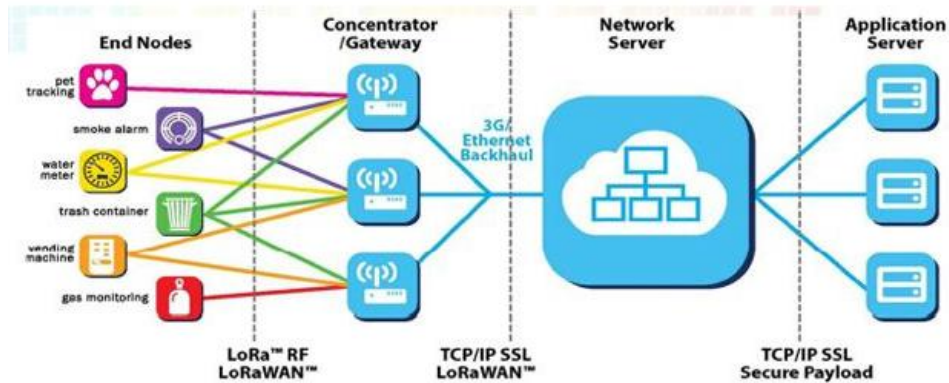
The complete LoraWan network system consists of nodes, gateways,Lora NetWork Server,application servers, nodes typically designed by LORA chips, and gateways by Semtech SX1301 Design;Lora NetWork Server now has open source loraserver or commercial TTN(The   T). hingsNetwork)that users can build on their own, and application servers are developed by user-defined designs and are primarily used for data exchange with Lora NetWork Server applications.
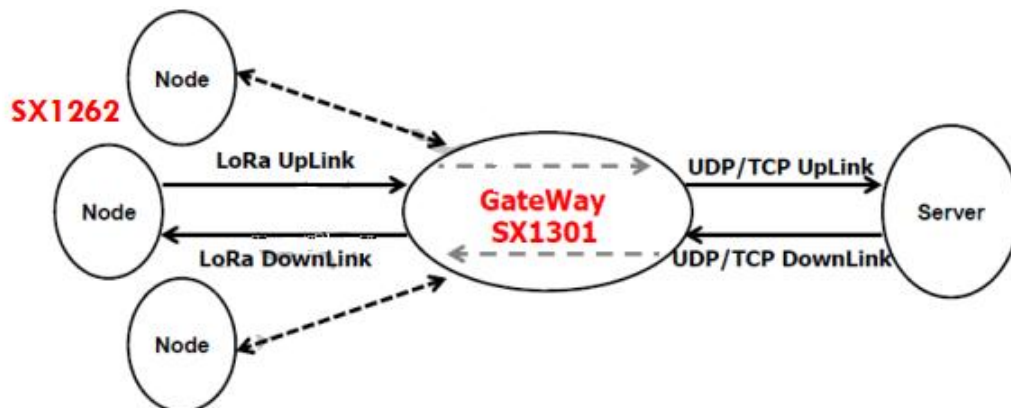
6.   Access Demo

The demo suite is:E78-470LN22S(6601) as node,E890 as gateway access free TTN(TheThingsNetwork)test server for communicationtesting;   The OTAA access mode is set as follows:

On TTN, the gateway data record is as follows:

The TTN node data record is as follows:
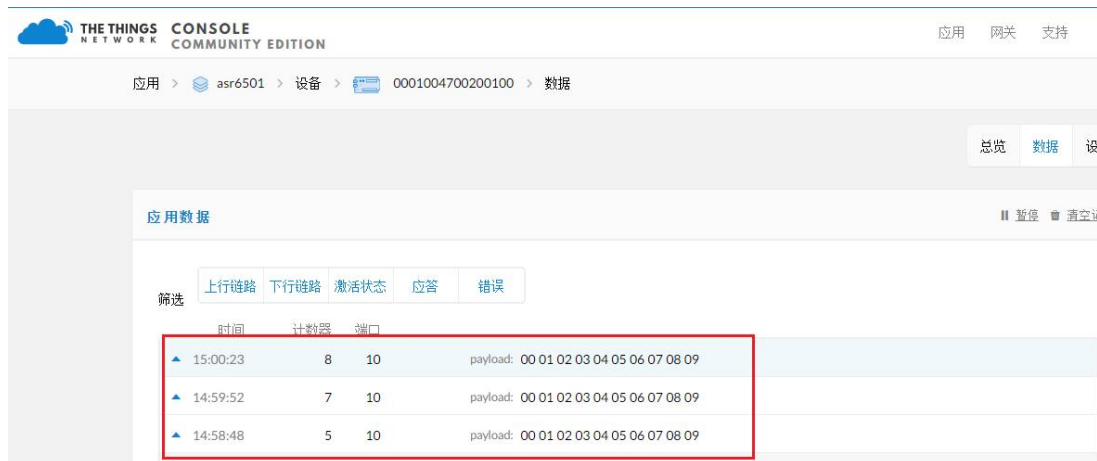
An example of access in transmission mode looks like this:
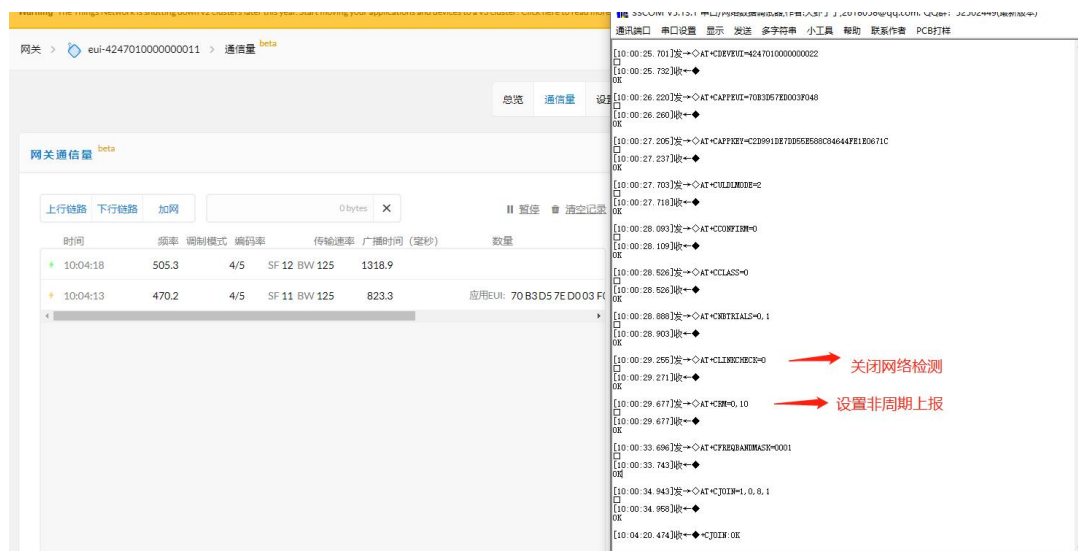
App   Server receives data in transmission mode:
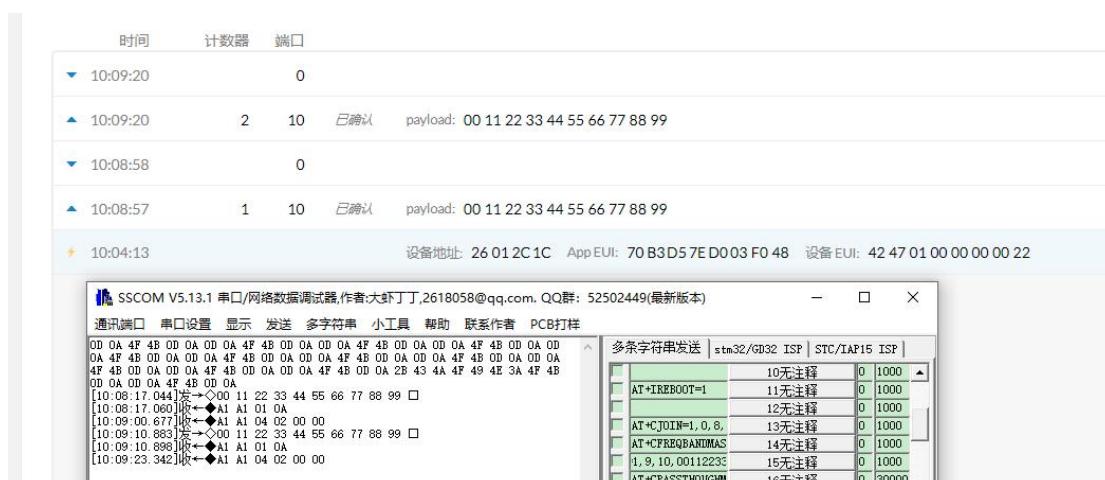
Note:TTN Create Devices and Corresponding Configuration Process Refer to theLORAWAN Node and Gateway TTN

Server Configuration Tutorial

7.   AT Command

a)   Directive format:

<CMD>[op][para1, para2, para3,…]<CR><LF>

: Command prefix

CMD: Control indicator

[op] : The instruction operator. It can be:

      ✔ ""

      ✔"?" : Represents the current value of the query parameter.

      ✔"": indicates the execution of instructions.

      ✔"=?" : Represents the parameters of the query setup instruction.

[para-n] : Represents the value of the set parameter, or specifies the parameter to query

<CR><LF>：return line break，ASCII 0x0D 0x0A

Commands	Description (Universal Command)
CGMI	Read the manufacturer id
CGMM	Read the module ID
CGMR	Read the version ID
CGSN	Read the product serial number identification
CGBR	Set the Baud Rate for UART
CJOINMODE	Set Read Join mode(OTAA, ABP).
CDEVEUI	Set the read DevEUI(whenOTAA is on the net).
CJOINMODE	Set Read Join mode(OTAA, ABP).
CDEVEUI	Set the read DevEUI(whenOTAA is on the net).
CAPPEUI	Set up read AppEUI(whenOTAA is on the net).
CAPPKEY	Set up Read AppKey(whenOTAA is on the net).
CDEVADDR	Set to read DevAddr(whenABP is on the network).
CAPPSKEY	Set up Read AppSkey(whenABP is on the internet).
CNWKSKEY	Set read NwkSkey(whenABP is on the net).
CFREQBANDMASK	Set the Read Frequency Point Mask(FreqBandMask).
CULDLMODE	Set the read Ul/Dl mode (same or heterofrequency).
CWORKMODE	Set read working mode (normal operating mode).
CCLASS	Set the read class type (ClassA/C).
CBL	Read the power level
CSTATUS	Read node status
CJOIN	Launch OTAA networking
DTRX	Send the received data frame
DRX	Get the most recently received data from Rx buffer and empty Rx buffer
CPASSTHOUGHMODE	Enter through mode
command	Description(MAC-related configuration commands).
CCONFIRM	Set the type of message sent (confirm or unconfirm) to read
CAPPPORT	Set up read application layer Port
CDATARATE	Set the read data rate
CRSSI	Gets the RSSI value of the channel
CNBTRIALS	Set to read the NbTrans parameter
CRM	Set the read upload mode
CTXP	Set the read send power
CLINKCHECK	Enable Link check
CADR	Enable or turn off ADR;
CRXP	Set the read receive window parameters
CRX1DELAY	Sets the delay for reading TX and RX1
CSAVE	Save the configuration
CRESTORE	Restore the default configuration
IREBOOT	The system resets

Command	The	The command format	response

character	command type		
CGMI (Read **the manufacturer's identity).**	Query command	AT+CGMI?	+CGMI=<manufacturer> OK
	The description of the parameter	< manufacturer>: Manufacturer's logo	
	Returns the value description		
	example	AT+CGMI? +CGMI=Ebyte OK	-
	Note the item		
Command character	The command type	The command format	response
CGMM (Read **the module ID).**	Query command	AT+CGMM?	+CGMM=<model> OK
	The description of the parameter	<model>: Module id	
	Returns the value description		
	example	AT+CGMM? +CGMM=E78-470LN22S(6601) OK	
	Precautions	-	
Command character	The command type	The command format	response
CGMR (Read **version ID).**	Query command	AT+CGMR?	+CGMR=<revision> OK
	The description of the parameter	<revision>: Version No	
	Returns the		

	value description		
	example	AT+CGMR? +CGMR=V4.4 OK	-
	Precautions	-	
Command character	The command type	The command format	response
CGSN (Read **the product serial number identification).**	Query command	AT+CGSN?	+CGSN=\<sn> OK
	The description of the parameter	\<sn>: Product serial number identification	
	Returns the value description		
	example	AT+CGSN? +CGSN=0539349E00032523 OK	
	Precautions		
Command character	The command type	The command format	response
CGBR (Set **Baud Rate).**	Query command	AT+CGBR?	+CGBR=\<baud> OK
	Set the command	AT+CGBR=\<baud>	OK
	The description of the parameter	\<baud>:　Product serial number identification	
	Returns the value description		
	example	AT+CGBR=9600 OK	
	Precautions	Baud range:1200 to9600bps,defaultBaud rate 9600;	
Command character	The command type	The command format	response
CJOINMODE	Test	AT+CJOINMODE=?	+CJOINMODE:"mode"

(Set **join** mode).	command		OK
	Query command	AT+CJOINMODE?	+CJOINMODE:<mode> OK
	Set the command	AT+CJOINMODE=<mode>	OK
	The description of the parameter	< mode>: node Join mode 0:OTAA 1:ABP	
	Returns the value description		
	example	AT+CJOINMODE=0 OK	
	Precautions	Different mode nodes are accessed in different ways,abP use this instruction setting before sending data.	
Command character	The command type	The command format	response
CDEVEUI (Set **DevEUI).**	Test command	AT+CDEVEUI=?	+CDEVEUI=<DevEUI:length is 16>
	Query command	AT+CDEVEUI?	+CDEVEUI:<vrange> OK
	Set the command	AT+CDEVEUI=<mode>	OK
	The description of the parameter	< mode>: node DevEUI	
	Returns the value description		
	example	AT+CDEVEUI=AABBCCDD00112233 OK	
	Precautions	Set or read DevEUIand return Y1Y2... Y8, 16 feed format, value 8 bytes.	
Command character	The command type	The command format	response
CAPPEUI (Set **up AppEUI).**	Test command	AT+CAPPEUI=?	+CAPPEUI=<AppEUI:length is 16>
	Query command	AT+CAPPEUI?	+CAPPEUI:<value> OK
	Set the	AT+CAPPEUI=<value>	OK

	command		
	The description of the parameter	<value>： 节点 AppEUI	
	Returns the value description		
	example	AT+CAPPEUI=AABBCCDD00112233 OK	
	Precautions	OTAA uses, sets, or reads appEUIto return Y1Y2... Y8, 16 feed format, value 8 bytes.	
Command character	The command type	The command format	response
CAPPKEY (Set **up AppKey).**	Test command	AT+CAPPKEY=?	+CAPPKEY=<AppKey:length is 32>
	Query command	AT+CAPPKEY?	+ CAPPKEY:<value> OK
	Set the command	AT+CAPPKEY =<value>	OK
	The description of the parameter	<value>： 节点 AppEUI	
	Returns the value description		
	example	AT+CAPPKEY=AABBCCDD00112233AABBCCDD00112233 OK	
	Precautions	OTAA uses, sets, or reads AppKeyto return Y1Y2... Y16, 16 feed format, valued at 16 bytes.	
Command character	The command type	The command format	response
CDEVADDR (Set **DevAddr).**	Test command	AT+CDEVADDR=?	+CDEVADDR=<DevAddr:length is 8，Device address of ABP mode>
	Query command	AT+CDEVADDR?	+CDEVADDR:<value> OK
	Set the command	AT+CDEVADDR =<value>	OK
	The	<value>: node DevAddr	

	description of the parameter	
	Returns the value description	
	example	AT+CDEVADDR=00112233 OK
	Precautions	ABP uses, sets, or reads DevAddr,returning Y1Y2... Y4, 16 format, valued at 4 bytes.

Command character	The command type	The command format	response
CAPPSKEY (Set up **AppSKey).**	Test command	AT+CAPPSKEY=?	+CAPPSKEY=<AppSKey:length is 32>
	Query command	AT+CAPPSKEY=<value>	+CAPPSKEY:<value> OK
	Set the command	AT+CDEVADDR =<value>	OK

	The description of the parameter	<value>: node AppSKey
	Returns the value description	
	example	AT+CAPPSKEY=AABBCCDD00112233AABBCCDD00112233 OK
	Precautions	ABP uses, sets, or reads AppSKey,returning Y1Y2... Y16, 16 feed format, valued at 16 bytes.

Command character	The command type	The command format	response
CNWKSKEY (Set **NwkSKey)**	Test command	AT+CNWKSKEY=?	+CNWKSKEY =<NwkSKey:length is 32>
	Query command	AT+CNWKSKEY?	+CNWKSKEY:<value> OK
	Set the command	AT+CNWKSKEY=<value>	OK
	The description of the parameter	<value>：节点 NwkSKey

	Returns the value description		
	example	AT+CNWKSKEY=AABBCCDD00112233AABBCCDD00112233 OK	
	Precautions	ABP uses, sets, or reads NwkSKey,returning Y1Y2**...** Y16, 16 feed format, valued at 16 bytes.	
CFREQBANDMASK (Set **the band mask).**	The command type	The command format	response
	Test command	AT+CFREQBANDMASK=?	+CFREQBANDMASK:"mask" OK
	Query command	AT+CFREQBANDMASK?	+CFREQBANDMASK:<mask> OK
	Set the command	AT+CFREQBANDMASK=<mask >	OK
	The description of the parameter	< mask>: Frequency point masks that the network may work with, 16bit for 16 frequency groups, as detailed in the LoRaWAN access specification. e.g. 0-7 channels, corresponding mask 0001, 8-15 channel corresponding mask 0002,16- Channel 23 corresponds to a mask of 0004, and so on.	
	Returns the value description	The frequency for a specific channel needs to be viewed by the region protocol, e.g. 0-7 channels in CN470 corresponding to: 470.3MHz, 470.5MHz, 470.7MHz, 470.9MHz, 471.1MHz, 471.3MHz, 471.5MHz, 471.7MHz。	
	example	AT+CFREQBANDMASK=0001 OK	
	Precautions	You need to set it up before join.	
Command character	The command type	The command format	response
CULDLMODE (Set **up and down the same frequency).**	Test command	AT+CULDLMODE=?	+CULDLMODE:"mode" OK
	Query command	AT+CULDLMODE?	+CULDLMODE:<mode> OK
	Set the command	AT+CULDLMODE=<mode>	OK
	The description of the parameter	<mode>： 1: Same frequency mode 2: Hetero-frequency mode	
	Returns the value description		

	example	AT+CULDLMODE=2 OK	
	Precautions	You need to set up before Join	
Command character	The command type	The command format	response
CWORKMODE (Set **working mode).**	Test command	AT+CWORKMODE=?	+CWORKMODE:"mode" OK
	Query command	AT+CWORKMODE?	+CWORKMODE:<mode> OK
	Set the command	AT+CWORKMODE=<mode>	OK
	The description of the parameter	<mode>： 2: Normal working mode	
	Returns the value description		
	example	AT+CWORKMODE=2 OK	
	Precautions	You need to set it before Join, and the default is normal working mode. Currently only working mode is supported	
Command character	The command type	The command format	response
CCLASS (Set **Class).**	Test command	AT+CCLASS=?	+CCLASS:"class","branch","para1","para2", "para3" ,"para4" OK
	Query command	AT+CCLASS?	+CCLASS:<class> OK
	Set the command	AT+CCLASS=<class>	OK
	The description of the parameter	<class>： 0:classA	
	Returns the value description	2:classC	
	example	AT+CCLASS=2 OK	

	Precautions	You need to set it before Join, which defaults to classA	
Command character	The command type	The command format	response
CSTAUS (Query **the current state of the device).**	Test command	AT+CSTAUS=?	+CSTATUS:"status" OK
	Query command	AT+CSTATUS?	+CSTATUS:<status> OK
	The description of the parameter	<status>： 00 - No data operation 01 - Data sent 02 - Data delivery failed	
	Returns the value description	03 - Data sent successfully 04 - JOIN succeeds (only in the first JOIN process). 05 - JOIN fails (only in the first JOIN procedure). 06 - Network may be abnormal (LinkCheck result). 07 - Send data successfully, no downstream 08 - Send data successfully, with a downstream	
	example	AT+CSTATUS? +CSTATUS=03 OK	
	Precautions	Query the current state of the device	
Command character	The command type	The command format	response
CJOIN (Set **Join).**	Test command	AT+CJOIN=?	+CJOIN:<ParaTag1>,[ParaTag2],… [ParaTag4] OK
	Query command	AT+CJOIN?	+CJOIN:<ParaValue1>,[ParaValue2],... [Para Value4] OK
	Set the command	AT+CJOIN=<ParaValue1>, [ParaValue2],… . [ParaValue4]	If the input is legitimate, first return OK,then start automatic authentication, return authentication results. CJOIN: OK Authentication Success andCJOIN: FAIL Authentication Failed
	The description of the	<ParaTag1>， [ParaTag2]，......[ParaTag4] : Authentication parameters 1, 2,... 4 the name; [ParaValue1] ， [ParaValue2], ... [ParaValue4] : Authentication parameters	

	parameter	1, 2,... The parameter value of 4;
	Returns the value description	< ParaTag1 >, which indicates that join operations are performed, paraTag1 value range: 0 - Stop JOIN 1 - Start JOINand restart the JOIN processonce. For modules that enable hot start, doing so clears the saved JOIN context parameters. [ParaTag2] Indicates yes or no enable automatic JOIN functionality. The factory value is 1,and ParaTag2 value range: 0 - Turn off auto JOIN 1 - Auto JOIN Join. is automatically activated when the module enters transmission mode [ParaTag3] Represents join periods, value range: 7 to 255 in s. Factory default: 8. [ParaTag4] Represents the maximum number of JOIN attempts, ParaTag4 value range: 1 to 255
	example	AT-CJOIN=1,1,10,8(set JOIN parameter: Enable auto JOIN, JOIN period of 10s,maximum 8 attempts). OK +CJOIN:OK
	Precautions	You need to set up before Join

Command character	The command type	The command format	response
DTRX (Send **receiving data).**	Test command	AT+DTRX=?	+DTRX:[confirm],[nbtrials],<Length>,<Payload> OK
	Set the command	AT+DTRX=[confirm], [nbtrials],<Length>, <Payload> OK+SEND:TX_LEN OK+SENT:TX_CN	OK+SEND:TX_LEN OK+SENT:TX_CNT OK+RECV:TYPE,PORT,LEN,DATA 或者 ERR+SEND:ERR_NUM ERR+SENT:TX_CNT
	The description of the parameter	confirm and nbtrials see the appropriate AT instructions, valid only for this send, optional. Length:represents the number of strings; The length of bytes allowed to be transmitted varies at different rates (see LoRaWan Protocol), and 0	
	Returns the value description	means to send empty packets. Payload: 16 feed (2 characters for 1 number); Return value: 1. How to tell if the data transmission was successful?	

		Confirm type data:
		Each time you send a frame of data, you should have an answer message. When module timed out Does not receive an answer message, if the maximum number is not reached, it will be retried again until the maximum number of times has not received the downstream message, which is a failure, and output
		The ERR-SENT message. During this time, if the answer message is received at the end of transmission, it is successful and outputs OK-SEND,OK-SENT, and OK-RECV messages.
		Unconfirm type data:
		No downstream response is requested after the data is sent, and the OK-SEND, OK-SENTmessage is returned atthe end of each transfer.　If you receive the downstream data, you send a OK-RECV message.
		2, data send status prompt
		OK-SEND:TX_LEN indicates that the data send request was successful, TX_LEN:　1Byte,the length of the data sent
		OK-SENT: TX_CNT indicates that the data was sent successfully, TX_CNT: 1Byte,the number of times the data wassent.
		ERR-SEND: ERR_NUM indicates that the data send request failed, as indicated by ERR_NUM.　ERR_NUM：　1Byte,
		0- Not on the net
		1- Communication is busy and the request failed to be sent
		2- The data length exceeds the current sendable length, sending only MAC commands
		ERR-SENT: TX_CNT indicates that the data was sent failed, the maximum number of transfers,　TX_CNT:　1Byte,the number of datatransmissions.
		OK-RECV: TYPE, PORT, LEN, DATA data received successfully (received answer message or active downstream data).
		TYPE:　1Byte,downstream transfer type
		Bit0：　0-unconfirm，　1-confirm
		Bit1:　0-非 ACK,　1-ACK
		Bit2:　0- Not carried,　1- Carry, indicating whether the LINK command answer is carried in the downstream data
		Bit3:　0- Untrauped,　1- Carry, indicates whether the TIME command answer is carried in the downstream data, and only if the bit is 1 means that the time synchronization was successful
		Bit4 toBit7: Default 0,reserved
		PORT:　1Byte,downstream transport port
		LEN:　1Byte,downstream data length
		DATA:　nByte,downstream data, this field does not exist when LEN is 0.
	example	AT-DTRX=1,2,10,0123456789
		OK-SEND:03
		OK-SENT:01
		OK-RECV:02,01,00

		indicates that the confirm data was successfully sent, and the valid data received by the service should be "0123456789"and received a downstream confirmation.	
	Precautions	Enter the network first, and then send the data	
Command character	The command type	The command format	response
DRX (**Receiving data**).	Test command	AT+DRX=?	+DRX:<Length>,<Payload> OK
	Query command	AT+DRX?	+DRX:<Length>,<Payload> OK
	The description of the parameter	Return value: Length: 0 for empty packets; Payload: 16 feed string data; OK:Receive packets without exceptions;	
	Returns the value description		
	example	AT+DRX? OK	
	Precautions	Receive packets from the received buffer and empty the received buffer;	
Command character	The command type	The command format	response
CPAS TRUESMODE (Transmission **Mode**).	Test command	AT+CPASSTHOUGHMODE=?	+CPASSTHOUGHMODE:[mode],[confirm],[nbtrials]
	Set the command	AT+CPASSTHOUGHMODE=[mode],[confirm],[nbtrials]	OK
	The description of the parameter	mode enters transmission mode when 1. confirm and nbtrials see the appropriate AT instructions, valid only for this send, and re-entry after exit needs to be reset.	

OK means to enter transmission mode.

Returns the value description under Transmission Mode:

Frame head	Status bit 1byte	1byte	1byte	nbyte
A1 A1	00(not on the net).	\	\	\
	01(Send data).	The send length	\	\
	02(data sent).	\	\	\
	03(Send timeout,unconfirm msg does not return this).	The number of times the timeout was sent	\	\
	04(Send successfully, receive server return value,unconfirm msg does not have this return).	The port number	The length of the data received (no data is sent when 0 is 0).	Data is sent (this bit is not valid when the data length is 0).
	05(Exit transmission mode).	\	\	\
	FF(data is too long).	\	\	\

The "Returns the value description" label spans the left portion of this table.

example	AT instruction mode: AT+CPASSTHOUGHMODE=1,1,8 OK Transmission mode (hex): 00 11 22 33 44 55 66 77 88 99 A1 A1 01 0A A1 A1 04 02 00 00

Precautions	1. The module must be in the network state beforesending the data, otherwise the data cannot be sent and the return value of A1 A1 00 will be received.
	    2. When the moduleis waiting for a response from the server, it cannot exit transmission mode and needs to wait for the server to respond or send a timeout before sending a .hex:2B 2B 2B Exit transmission mode.
	    3, beforeentering transmission mode, please set AT-CMR-0, 10(using non-periodic reporting),AT-CLINKCHECK-0(not enabling network verification).

Command character	The command type	The command format	response
CCONFIRM (Set **upstream transport type).**	Test command	AT+CCONFIRM=?	+CCONFIRM:"value" OK
	Query command	AT+CCONFIRM?	+DRX:<Length>,<Payload> OK
	Set the command	AT+CCONFIRM =<value>	OK
	The description of the parameter	<value>: Here's how. 0: UnConfirmed up message 1: Confirmed up message	
	Returns the value description		
	example	AT+CCONFIRM=1 OK	
	Precautions	You need to set it up before you can send the data	
Command character	The command type	The command format	response
CAPPPORT (Set **up the upstream data side slogan).**	Test command	AT+CAPPPORT=?	+CAPPPORT:"value" OK
	Query command	AT+CAPPPORT?	+CAPPPORT:<value> OK
	Set the command	AT+CAPPPORT=<value>	OK
	The description of the parameter	<value>: Port used, the data format is 10 feed and the factory value is 10. Value range: 1 to 223; Note: Port: 0x00 is LoRaWAN's MAC command	
	Returns the value description		
	example	AT+CAPPPORT=10 OK	
	Precautions	You need to set it up before you can send the data	
Command character	The command type	The command format	response
CDATARATE (Set **the**	Test command	AT+CDATARATE=?	+CDATARATE:"value" OK

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communication rate).	Query command	AT+CDATARATE?	+CDATARATE:\<value\> OK
	Set the command	AT+CDATARATE =\<value\>	OK
	The description of the parameter	\<value\>: Rate value, factory value of 3,value range: 0 - SF12， BW125 1 - SF11， BW125	
	Returns the value description	2 - SF10， BW125 3 - SF9， BW125 4 - SF8， BW125 5 - SF7， BW125	
	example	AT+CDATARATE=1 OK	
	Precautions	Before sending data, you need to set it up so that it fails after ADR	
Command character	The command type	The command format	response
CRSSI (Query **channel signal strength**).	Test command	AT+CRSSI=?	+CRSSI OK
	Query command	AT+CRSSI FREQBANDIDX?	+CRSSI: 0:\<Channel 0 rssi\> 1:\<Channel 1 rssi\> … 7:\<Channel 7 rssi\> OK
	The description of the parameter	\<FREQBANDIDX\>: Represents the number of the band, starting at 0, and the group number 1A2 is 1 Returns RSSIfor 8 channels in aband.	
	Returns the value description		
	example	AT+CRSSI 1? +CRSSI: 0:-157 1:-157 2:-157 3:-157 4:-157 5:-157 6:-157	

Command character	The command type	The command format	response
		7:-157 OK	
	Precautions		
	The command type	The command format	response
CNBTRIALS (Set **the number of sends**).	Test command	AT+CNBTRIALS=?	+CNBTRIALS: **"MType","value"** OK
	Query command	AT+CNBTRIALS?	+CNBTRIALS:\<MType\>,\<value\> OK
	Set the command	AT+CNBTRIALS=\<MType\>,\<value\>	OK
	The description of the parameter	\<MType\>:0:unconfirm package, 1:confirm package. \<value\>: For the maximum number of sends, the value range: 1 to 15;	
	Returns the value description		
	example	AT+CNBTRIALS=1,2 OK	
	Precautions	You need to set it up before you can send the data	
Command character	The command type	The command format	response
CRM **(Set the report mode).**	Test command	AT+CRM=?	+CRM:"reportMode","reportInterval" OK
	Query command	AT+CRM?	+CTXP:\<reportMode\>,[reportInterval] OK
	Set the command	AT+CTXP=\<reportMode\>,[reportInterval]	OK
	The description of the parameter	\<reportMode\>: 0- Non-periodic reporting data; 1- Cycle reporting data; \<reportinterval\>: This parameter is only available when periodic reporting data is made. The interval at which the data is reported periodically, single-bit: s. For different DR,the minimum allowed periods are different, defined by	
	Returns the value description		

| | | the periodic level, as shown in the following table. |
| | | Rate s cycle (s) s. . . level LV1 LV2 |

		Rate		LV1	LV2
		DR0		150	300
		DR1		75	150
		DR2		35	70
		DR3		15	30
		DR4		10	20
		DR5		5	10
	example	AT+CRM=1,10 OK			
	Precautions	You need to set it up before you can send the data			
Command character	The command type	The command format	response		
CTXP (Set **the send power).**	Test command	AT+CTXP=?	+CTXP:"value" OK		
	Query command	AT+CTXP?	+CTXP:<value> OK		
	Set the command	AT+CTXP=<value>	OK		
	The description of the parameter	<value>: Factory value is 0 for the send power size 0 - 17dBm 1 - 15dBm 2 - 13dBm			
	Returns the value description	3 - 11dBm 4 - 9dBm 5 - 7dBm 6 - 5dBm 7 - 3dBm			
	example	AT+CTXP=1 OK			
	Precautions	You need to set it up before you can send the data			
Command character	The command type	The command format	response		
CLINKCHECK **(Verify Network** Connection).	Test command	AT+CLINKCHECK=?	+CLINKCHECK:"value" OK		
	Set the command	AT+CLINKCHECK=<value>	OK		
	The description of the	<value>: Enable control 0 for Link Check **-** not Link Check 1 **-** Once Link Check			

	parameter	2 - The module automatically carries the linkcheck command in each upstream packet.	
	Returns the value description	Return OK, set successfully If X1 is 1,after waiting a while, a second response message is returned in the following format: +CLINKCHECK:Y0，Y1，Y2，Y3，Y4 YO represents Link Check result: ● 0 - Indicates that this Link Check execution was successful ● Non-0 - indicates that this Link Check execution failed Y1 is DemodMargin Y2 is NbGateways Y3 is the RSSI for this downside Y4 is the SNR for this downside	
	example	AT+CLINKCHECK=1 OK **+**CLINKCHECK: 0，0，1，-68，8	
	Precautions	You need to set it up before you can send the data	
Command character	The command type	The command format	response
CADR (Set **the number of sends).**	Test command	AT+CADR=?	+CADR:"value" OK
	Query command	AT+CADR?	+CADR:<value> OK
	Set the command	AT+CADR=<value>	OK
	The description of the parameter	<value>: Here's what. ADR enables control with a factory value of 1 0 - ADR does not enable	
	Returns the value description	1 - ADR enable	
	example	AT+CADR=1 OK	
	Precautions	You need to set it up before you can send the data. Turn on ADRbydefault.	
Command character	The command	The command format	response

	type		
CRXP (Set **the receive window parameters**).	Test command	AT+CRXP=?	+CRXP:"RX1DRoffest","RX2DataRate"," RX2Frequency " OK
	Query command	AT+CRXP?	+CRXP:<RX1DRoffest>,<RX2DataRate>, <RX2Frequency> OK
	Set the command	AT+CRXP=<RX1DRoffest>,<R X2DataRate>,<RX2Frequency >	OK
	The description of the parameter	<RX1DRoffest>,<RX2DataRate>,<RX2Frequency>详過 LoRaWAN 协议。	
	Returns the value description		
	example	AT+CRXP=1,1,471000000 OK	
	Precautions	You need to set it up before you can send the data. Do not set the default value	
Command character	The command type	The command format	response
CRX1DELAY (set the number of sends).	Test command	AT+CRX1DELAY=?	+CRX1DELAY:"Delay" OK
	Query command	AT+CRX1DELAY?	+CRX1DELAY:<Delay> OK
	Set the command	AT+CRX1DELAY=<Delay>	OK
	The description of the parameter	Delay: How long does it take to open the RX1 windowafter sending in s;	
	Returns the value description		
	example	AT+CRX1DELAY=2	

		OK	
	Precautions	Set how long to open the RX1 window after sending, before sending data. The protocol default is not set.	
Command character	The command type	The command format	response
CSAVE (Save **MAC parameter settings**).	Test command	AT+CSAVE=?	+CSAVTHIS REASON
	Set the command	AT+CSAVE	OK
	The description of the parameter	<MType>:0:unconfirm package, 1:confirm package. <value>: For the maximum number of sends, the value range: 1 to 15;	
	Returns the value description		
	example	The command saves the configuration parameters to EERPOM/FLASH After executing the AT-RESET command, the module initializes and runs the network using the new MAC configuration parameters.	
	Precautions	You need to save the data before you send it	
Command character	The command type	The command format	response
CRESTORE **(Recover MAC default parameter).**	Test command	AT+CRESTORE=?	+CRESTORE OK
	Set the command	AT+CRESTORE	OK
	The description of the parameter	The command restores the MAC default configuration parameters to EERPOM/FLASH.	
	Returns the value description		
	example	AT+CRESTORE OK	
	Precautions		
Command character	The command type	The command format	response
IREBOOT	Test	AT+IREBOOT=?	+IREBOOT:"Mode"

(Restart **the module).**	command		OK
	Set the command	AT+IREBOOT=<mode>	OK
	The description of the parameter	< mode>: Restart mode; 0: Restart the communication module immediately. 1: Wait until the wireless frames currently being sent within the communication module are complete before restarting.	
	Returns the value description		
	example	AT+IREBOOT=1 OK	
	Precautions	When the communication module receives the instruction, it restarts the communication module after returning OK. No subsequent AT instructions are received until the restart is complete.	

8. FAQ

8.1 Communication distance is very short

- When there is a straight-line communication barrier, the communication distance will be attenuated accordingly;
- Temperature, humidity, the same frequency interference, will lead to increased rate of packet loss;
- Ground absorption, reflection of radio waves, near the ground test effect is poor;
- Sea water has a very strong ability to absorb radio waves, so the seaside test effect is poor;
- There are metal objects near the antenna, or placed in the metal shell, the signal decay will be very serious;
- The power register is set incorrectly and the air rate is set too high (the higher the air rate, the closer the distance);
- The lower the power supply voltage at room temperature is lower than the recommended value, the lower the voltage, the smaller the power;
- The use of antennas to match modules is poor or the antenna itself is of poor quality.

8.2 Modules are easy to be damaged

- Check the power supply to ensure that the module will be permanently damaged between recommended values if the maximum value is exceeded;
- Please check the stability of the power supply, the voltage can not fluctuate significantly and frequently;
- Make sure that the installation uses the process anti-static operation, high-frequency device static sensitivity;
- Make sure that the installation process humidity should not be too high, some components are humidity sensitive devices;
- Use at too high or too low a temperature is not recommended if there are no special needs.

Important statement

- Eyre reserves the right to final interpretation and modification of all contents of this specification;
- As the hardware and software of the product continue to improve, this manual may change without notice, and should eventually be based on the latest version of the specification;
- Users of this product need to pay attention to the product dynamics on the official website, so that users can get the latest information about this product in a timely manner.

Revised history

version	The revision date	Revised description	Maintainer
1.0	2021-9-15	The initial version	Linson
2.2	2022-8-29	Bug fixes	Yan

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