E78-868LN22S(6601)

ASR6601 Wireless module

Chengdu Ebyte Electronic Technology Co.,Ltd.

Contents

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1. Product Overview

1.1 Introduction

E78-868LN22S (6601) series of products is the Chengdu EBYTE Electronic Technology Co., Ltd. design and production of the standard LoraWan node module, operating band EU863to 870MMHZ, support CLASS - A/CLASS-C node type, support ABP /OTAA two ways to access the network, at the same time, the module has a variety of low-power modes, external communication interface using standard UART, With easy configuration of AT instructions, users can access the standard LoraWan network, 2000 is the perfect 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	Nand weight	Operating temperature	Operating humidity	Storage temperature
E78-868LN22S(6601)	ASR6601CB	20* 14*2.8 mm	1.2g	-40 ~ 85℃	10% ~ 90%	-40 ~ 125°C

2.2 Working parameters

The parameter	Min	Type	Max	unit

category				
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	850	868/900/915	925	MHZ
The supply voltage	2.5	3.3	3.7	V
Communication level	2.5	3.3	3.7	V

main parameters	Ddescription	remark
Reference distance	5600m	Clear and open, antenna height 2 meters, air rate 1kbps
Crystal frequency	32MHz	-
Modulation	LoRa(recommendation)	GFSK Mode ，FLRC Mode，LoRa Mode
Packing method	SMD	-
Interface method	1.27mm	-
Communication Interface	SPI	0～10Mbps
Dimensions	20*14mm	-
Antenna interface	IPEX/PCB	The default PCB antenna, the equivalent impedance is about 50Ω

2.3 Parameter description

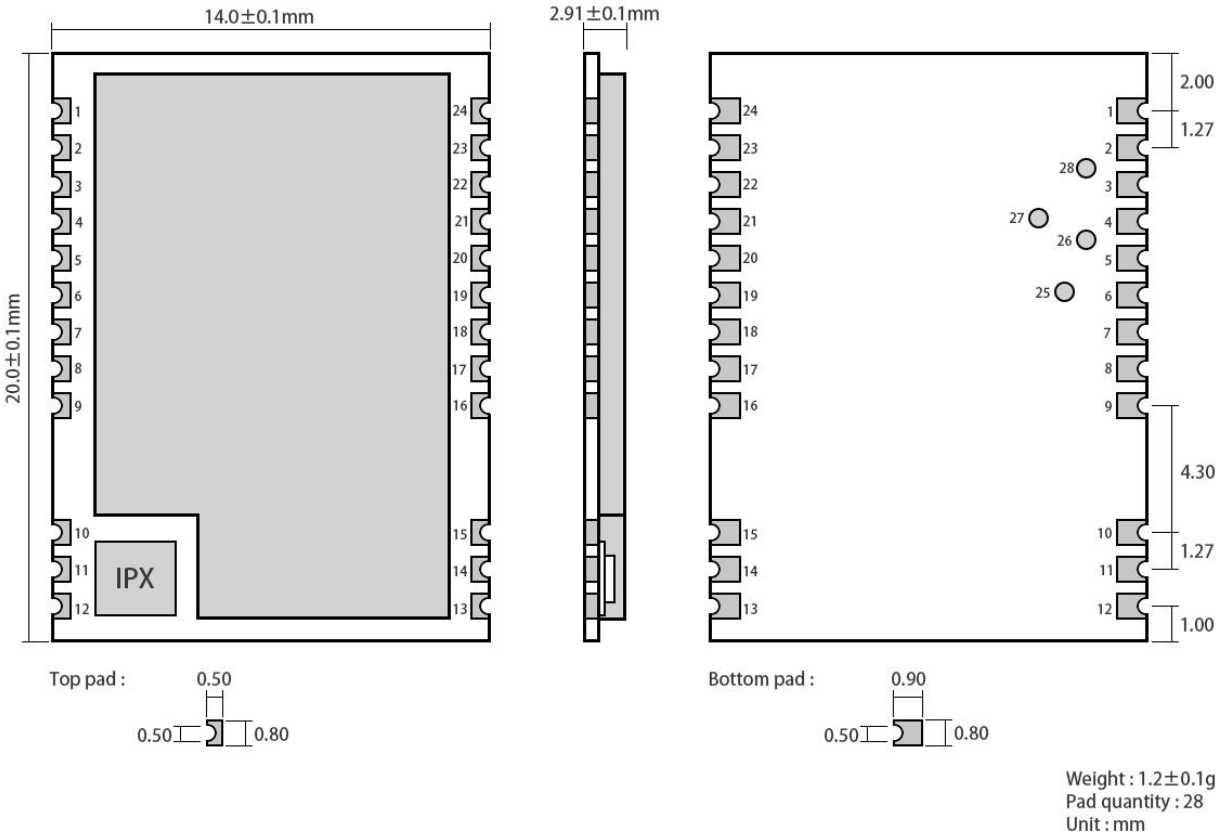
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% margin, and the whole machine is conducive to long-term stable operation;
- The current required at the moment of launch is relatively large, but often because the launch time is extremely short, the total energy consumed may be smaller;
- When the customer uses an external antenna, the impedance matching degree between the antenna and the module at different frequency points will affect the size of the emission current to different degrees;
- The current consumed when the RF chip is in a purely receiving state is called the receiving current. Some RF chips with communication protocols or the developers have loaded some self-developed protocols on the whole machine,

which may cause the receiving current of the test to be too large;

- The shutdown current is often much smaller than the current consumed by the power supply part of the whole machine at no load, so it is not necessary to be excessively demanding;
- Because the material itself has a certain error, a single LRC component has an error of ±0.1%, but hesitate to use multiple LRC components in the entire RF loop, there will be a situation of error accumulation, resulting in a difference between the transmit current and the receive current of different modules;
- Reducing the transmission power can reduce power consumption to a certain extent, but for many reasons, reducing the transmission power transmission will reduce the efficiency of the internal PA.

3. Mechanical Dimensions and Pin Definition

3.1 E78-868LN22S(6601) dimension drawing

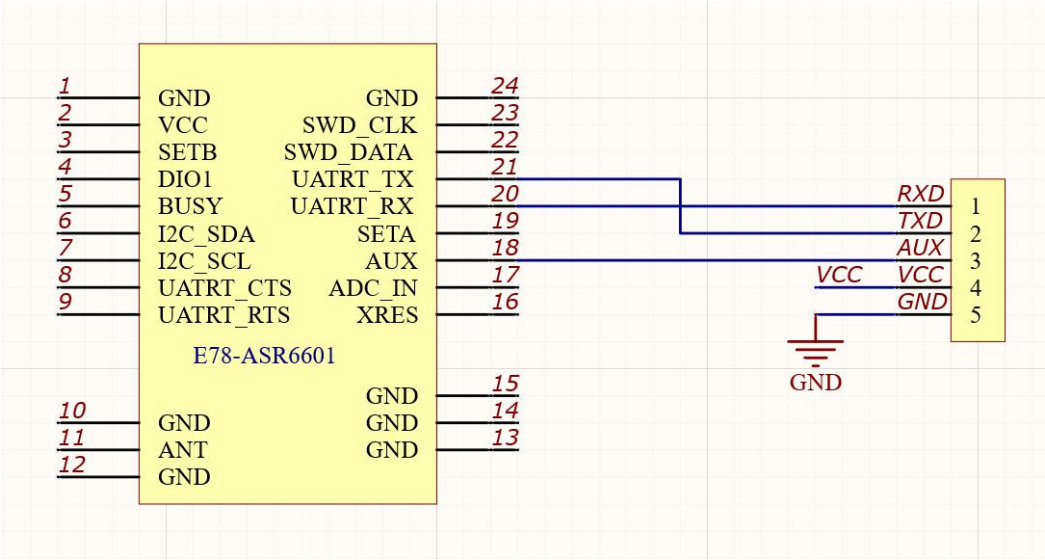


3.2 Pin definition

Pin number	Pin name	Pin direction	Pin usage
1	GND	-	Ground wire, connected to the power reference ground
2	VCC	-	Power supply, range 2.5V~3.7V (recommend to add ceramic filter capacitor)
3	SETB	-	Low-power wake-up pin
4	DIO1	Input/output	NC（reserved pin）
5	BUSY	Input/output	NC（reserved pin）
6	I2C_SDA	Input/output	NC（reserved pin）
7	I2C_SCL	Input/output	NC（reserved pin）
8	UART_CTS	Input/output	NC（reserved pin）
9	UART_RTS	Input/output	NC（reserved pin）
10	GND	-	Ground wire, connected to the power reference ground
11	ON	-	Antenna interface, stamp hole (50 ohm characteristic impedance)
12	GND	-	Ground wire, connected to the power reference ground
13	GND	-	Ground wire, connected to the power reference ground
14	GND	-	Ground wire, connected to the power reference ground
15	GND	-	Ground wire, connected to the power reference ground
16	XRES	Input	External reset pin
17	ADC_IN	Input	NC（reserved pin）
18	THE	Input/output	NC（reserved pin）
19	SILK	Input/output	NC（reserved 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 ground
25	SPI_MISO	Input/output	SPI MISO test point is internally connected and cannot be used as an external SPI
26	SPI_NSS	Input/output	SPI NSS test point is internally connected and cannot be used as an external SPI
27	SPI_MOSI	Input/output	SPI MOSI test point is internally connected and cannot be used as an external SPI

28	SPI_SCK	Input/output	SPI SCK test point is internally connected and cannot be used as an external SPI
★ For the pin definition, software driver and communication protocol of the module, please refer to ASR official 《ASR6601 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, means "long distance radio";

The company that currently dominates the technology is semtech abroad;

LoRa's main ISM brand is in the global free band: 433MHz, 470MHz, 868MHz, 915MHz, etc.

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

2.2 LoRaWAN

The LoRa Alliance is an open, non-profit organization led by Semtech in March 2015. The Alliance released a low-power wide area network standard based on the open source MAC layer protocol: the LoRaWAN protocol standard.Network topology: star structureNetwork composition: LoRa module, gateway (Gateway or base station), Server (including Network Server, Network control, Application Server). LoRaWAN divides LoRa nodes into three categories: A/B/C:

- Two-way transmission terminal (Class A):

The Class A terminal will follow two short downlink receiving windows immediately after each uplink to achieve two-way transmission. The terminal arranges the transmission time slot based on its own communication requirements, with small changes on the basis of random time (that is, the ALOHA protocol). This Class A operation provides the application with the lowest power consumption terminal system, and only requires the application to perform the server's downlink transmission within a short time after the terminal's uplink transmission. Downlink transmission by the server at any other time has to wait for the next uplink of the terminal.

- Two-way transmission terminal with designated receiving time slot (Class B):

Class B terminals will have more receiving time slots. In addition to the random receiving window of Class A, Class B devices will also open other receiving windows at the specified time. In order for the terminal to open the receiving window at a specified time, the terminal needs to receive a time synchronization beacon (Beacon) from the gateway. This allows the server to know when the terminal is listening.

- Two-way transmission terminal that maximizes the receiving time slot (Class C):

The Class C terminal basically keeps the receiving window open all the time, and only closes it briefly when sending. Class C terminals consume more power than Class A and Class B, but at the same time, the delay from the server to the terminal is also the shortest.

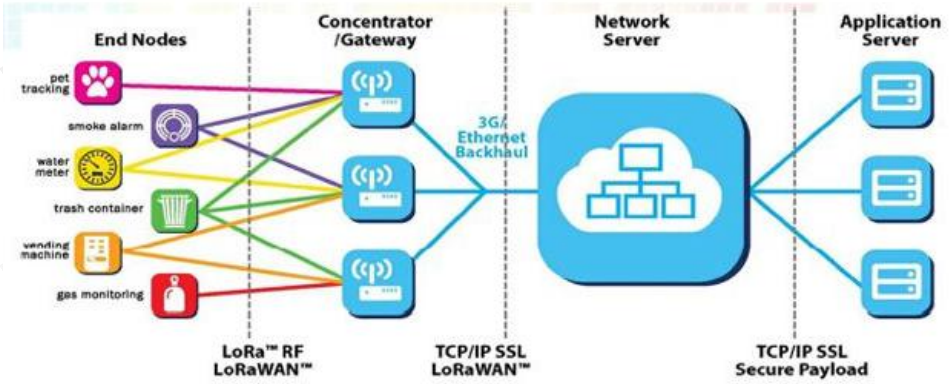
Note: E78-868LN22S(6601) supports Class A and Class C equipment types;

2.3 ADR

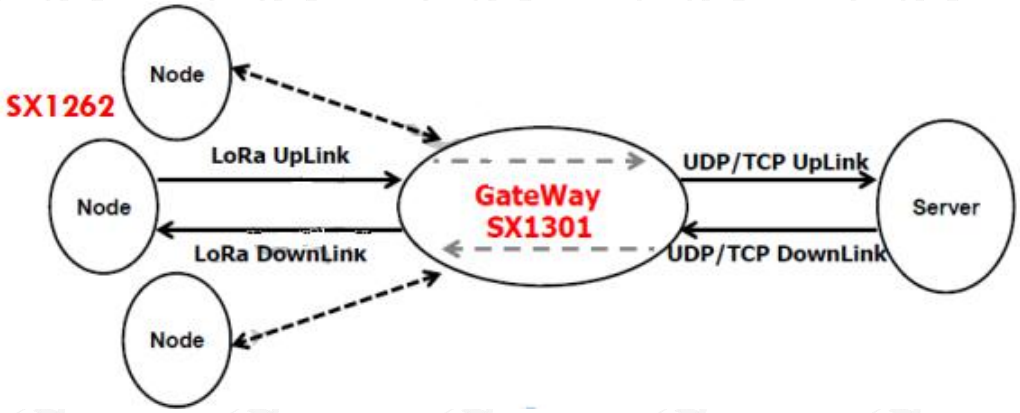
ADR is called adaptive data rate. In the loraWan network system, in order to maximize the battery life and overall network capacity of the terminal device, the LoRaWAN network server manages the data rate and RF output of each terminal device through the adaptive data rate (ADR) algorithm. Through the ADR technology, In the LORAWAN system, the server automatically updates and sets the speed of the node according to the signal receiving ability of the node. The

speed is low when the distance is far away, and the speed is high when the distance is close. This greatly improves the effective bandwidth and load capacity of the network in practical applications.

5. LORAWAN Application Model Diagram



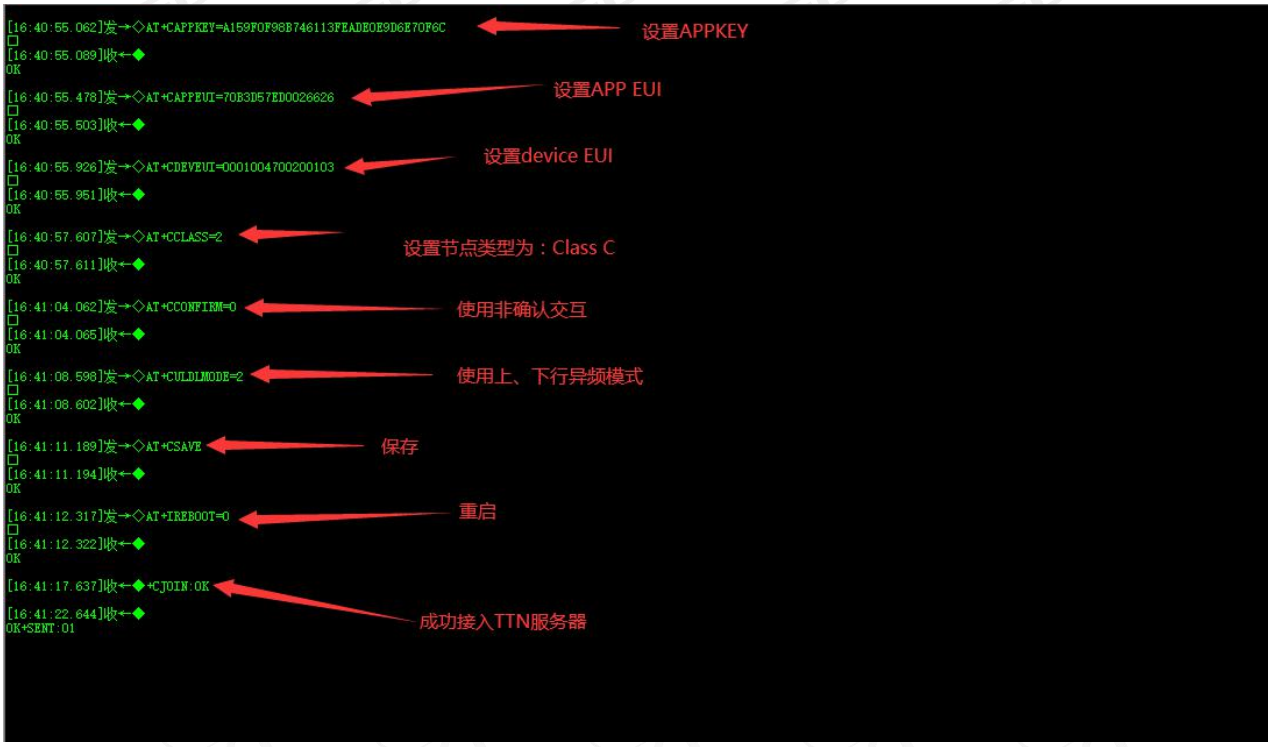
The complete LoraWan network system consists of nodes, gateways, Lora NetWork Server, and application servers. The nodes are generally designed by LoRa chip; the gateway is designed by SX1301 provided by semtech; Lora NetWork Server now has open source loraserver or commercial TTN (The ThingsNetwork), users can build by themselves; the application server is designed and developed by users, mainly used to exchange application data with Lora NetWork Server.



6. Access Demo

This demo kit is: E78-868LN22S (6601) as a node, E890 as a gateway to access the free TTN (TheThingsNetwork) test server for communication testin;

The corresponding settings of the node-side OTAA access method are as follows:

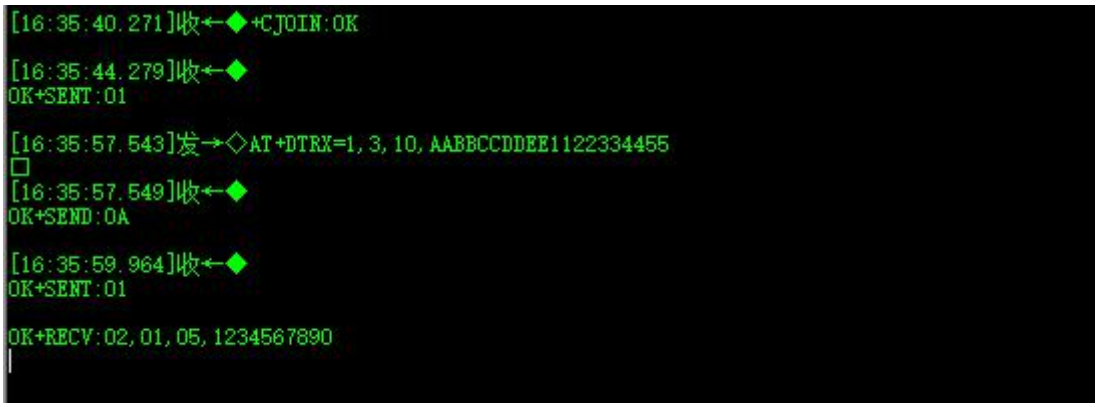


On TTN, the gateway information is as follows:

The gateway data is shown below:

The TTN node data record is as follows：

Node serial port：



Note: Please refer to "LORAWAN Node + Gateway TTN Server Configuration Tutorial" for TTN creation equipment and corresponding configuration procedures

7. AT Command

1. Directive format:

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

: Command prefix

CMD: Controls the indicator

(op): The instruction operator. It can be:

- ✓ ""
- ✓ “?” : Represents the current value of the query parameter.
- ✓ "":Indicates the execution of the instruction.
- ✓ “=? ” : 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 to read DevEUI (when OTAA is on the net)
CJOINMODE	Set read Join mode (OTAA, ABP)
CDEVEUI	Set to read DevEUI (when OTAA is on the net)
CAPPEUI	Set up read AppEUI (when OTAA is on the internet)
CAPPKEY	Set up read AppKey (when OTAA is online)
CDEVADDR	Set to read DevAddr (when ABP is on the net)
CAPPSKEY	Set up read AppSkey (when ABP is on the internet)
CNWKSKEY	Set to read NwkSkey (when ABP is on the grid)
CFREQBANDMASK	Set up a read frequency point mask (FreqBandMask)
CULDLMODE	Set read Ul/Dl mode (same or different frequencies)
CWORKMODE	Set read mode (normal mode)
CCLASS	Set read class type (Class A/C)
CBL	Read the power level
CSTATUS	Read node status
CJOIN	Launch OTAA access
DTRX	Send the received data frame
DRX	Get the most recently received data from Rx buffer and empty Rx buffer
command	Description (MAC-related configuration commands)
CCONFIRM	Set the type of read send message (confirm or unconfirm)
CAPPPORT	Set up read app layer Port
CDATARATE	Set the read data rate
CRSSI	Gets the RSSI value of the channel
CNBTRIALS	Set read NbTrans parameters
CRM	Set the read upload mode
CTXP	Set the read send power
CLINKCHECK	Enable Link check
CADR	Enable or disable ADR
CRXP	Set the read receive window parameters
CRX1DELAY	Set the delay for reading TX and RX1
CSAVE	Save the configuration
CRESTOREMAC	Restore the default configuration
IREBOOT	The system resets
CLPM	System low power settings
ECHO	Serial instruction echo configuration

Command character	The command type	The command format	response
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	
	Precautions		
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=E78-868LN22S(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=SF V1.0 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 to 460800bps	

Command character	The command type	The command format	response
CJOINMODE (Set **join mode).**	Test command	AT+CJOINMODE=?	+CJOINMODE:“mode” OK
	Query command	AT+CJOINMODE?	+CJOINMODE:<mode> OK
	Set the command	AT+CJOINMODE=<mode>	OK
	The description of the parameter	< mode >: nodeJoin mode 0:OTAA 1:ABP	
	Returns the value description		
	example	AT+CJOINMODE=0 OK	
	Precautions	Different mode nodes are accessed in different ways, abP please 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:<value> OK
	Set the command	AT+CDEVEUI=<mode>	OK
	The description of the parameter	< mode >: node DevEUI	
	Returns the value description		
	example	AT+CDEVEUI? +CDEVEUI=AABBCCDD00112233 OK	
	Precautions	Set or read DevEUIand return Y1Y2**...** Y8, 16 feed format, value 8 bytes.	
Command character	The command	The command format	response

	type		
CAPPEUI (Set **up AppEUI).**	Test command	AT+CAPPEUI=?	+CAPPEUI=<AppEUI:length is 16>
	Query command	AT+CAPPEUI?	+CAPPEUI:<value> OK
	Set the command	AT+CAPPEUI=<value>	OK
	The description of the parameter	<value >: Node 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 >: Node AppEUI	
	Returns the value description		
	example	AT+CAPPKEY=AABBCCDD00112233AABBCCDD00112233 OK	
	Precautions	OTAA when using, setting up, or reading AppKey,returns Y1Y2**...** Y16, 16 feed format, value 16 bytes.	
Command character	The command type	The command format	response
CDEVADDR	Test	AT+CDEVADDR=?	+CDEVADDR=<DevAddr:length is 8， Device

(Set **DevAddr).**	command		address of ABP mode>
	Query command	AT+CDEVADDR?	+CDEVADDR:<value> OK
	Set the command	AT+CDEVADDR =<value>	OK
	The description of the parameter	<value >: node DevAddr	
	Returns the value description		
	example	AT+CDEVADDR=00112233 OK	
	Precautions	ABP uses, sets, or reads DevAddrto return Y1Y2**...** Y4, 16 feed format, value 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, value 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 >: node NwkSKey	
	Returns the value description		
	example	AT+CNWKSKEY=AABBCCDD00112233AABBCCDD00112233 OK	
	Precautions	ABP when using, setting or reading NwkSKey,returning Y1Y2... Y16, 16 feed format, value 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, 16bits for 16 frequency groups, see The LoRaWAN access specification. For example: 0-7 channel, the corresponding mask is 0001, 8-15 channel corresponding mask is 0002, and so on	
	Returns the value description		
	example	AT+CFREQBANDMASK=0001 OK	
	Precautions	You need to set it up before Youin.	
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	<mode>：	

	description of the parameter	1: Same frequency mode 2: Hetero-frequency mode	
	Returns the value description		
	example	AT+CULDLMODE=2 OK	
	Precautions	You need to set it up before Youin	
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	Before Join needs to be set, default to normal working mode. Currently, only normal 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	<class>： 0:classA 2:classC	

	parameter		
	Returns the value description		
	example	AT+CCLASS=2 OK	
	Precautions	Before Join needs to set, the default is 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 03 - Data sent successfully 04 - JOIN success (only in the first JOIN process) 05 - JOIN failure (only in the first JOIN process) 06 - Network May Be Abnormal (Link Check Results) 07 - Send data successfully, no downstream 08 - Send data successfully, with a downstream	
	Returns the value description		
	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],... [ParaValue4] OK
	Set the command	AT+CJOIN=<ParaValue1>，[ParaValue2],….[ParaValue4]	If the input is legal, first return OK, then start automatic authentication, return authentication results. CJOIN: OK Authentication Success - CJOIN: FAIL Authentication Failed

	The description of the parameter	<ParaTag1>， [ParaTag2]，..... ParaTag4: Authentication Parameter 1, 2,..... 4 the name; [ParaValue1]，[ParaValue2]，..... ParaValue4: Authentication Parameter 1, 2,..... The parameter value of 4;	
	Returns the value description	< ParaTag1 >, represents the range of ParaTag1 values for performing THEIN operations: 0 - Stop JOIN 1 - Start JOIN and restart the JOIN process. For modules that enable hot start, doing so clears the saved JOIN context parameters. ParaTag2 indicates whether the AUTO function is enabled. Factory value is 1, ParaTag2 value range: 0 - Turn off automatic JOY 1 - The automatic JOIN. module automatically starts JOIN. when it enters transmission mode ParaTag3 represents the MAIN period, with values ranging from 7 to 255 in s. Factory default: 8. ParaTag4 represents the maximum number of JOIN attempts, and paraTag4 values range from 1 to 255	
	example	AT-CJOIN=1,1,10,8 (SET THE MAIN parameter: enable automatic JOIN, JOIN cycle of 10s, maximum number of attempts 8 times) OK +CJOIN:OK	
	Precautions	You need to set it up before Youin	
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 from rate to rate (see LoRaWan Protocol), and 0 indicates	

	Returns the value description	that empty packets are sent. Payload: 16 feed (2 characters for 1 number); Return value: 1, how to judge whether the data sent successfully? Confirm type data: Each time you send a frame of data, you should have an answer message. When the module timed out and did not receive an answer message, it will try again if the maximum number is not reached, until the maximum number of times is not received, which is a failure, and output The ERR-SENT message. During this period, if the answer message transmission is completed, it is successful and the OK-SEND, OK-SENT, and OK-RECV messages are output. Unconfirm type data: No downstream answer is requested after the data is sent, and the OK-SEND, OK-SENT message is returned at the end of each transfer. If downstream data is received, a OK-RECV message is sent again. 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, number of data sent. ERR-SEND: ERR_NUM indicates that the data send request failed, as indicated by the ERR_NUM. ERR_NUM： 1Byte， 0- Not online 1- Communication is busy and the request failed to be sent 2- The data length exceeds the current sendable length and only mac commands are sent ERR-SENT: TX_CNT indicates that the data was sent failed, with the maximum number of transfers, TX_CNT: 1Byte, and the number of data transmissions. OK-RECV: TYPE, PORT, LEN, DATA data reception success (received answer message or active downstream data) TYPE: 1Byte, downstream transfer type Bit0： 0-unconfirm， 1-confirm Bit1: 0-Non-ACK, 1-ACK Bit2: 0-Unarmed, 1-Carry, indicating whether the LINK command answer is carried in the downstream data Bit3: 0-Carry, 1-Carry, indicating whether the TIME command answer is carried in the downstream data, only if the bit is 1 means that the time synchronization was successful Bit4 to Bit7: Default 0, reserved PORT: 1Byte, downstream 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 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: No exceptions to receive packets;	
	Returns the value description		
	example	AT+DRX? OK	
	Precautions	Receive packets from the receiving buffer and empty the receiving buffer;	
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 what. 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 **upstream data port number).**	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 >: Using port, the data format is 10 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 communicatio n rate).**	Test command	AT+CDATARATE=?	+CDATARATE:“value” OK
	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 2 - SF10， BW125 3 - SF9， BW125 4 - SF8， BW125 5 - SF7， BW125	
	Returns the value description		
	example	AT+CDATARATE=1 OK	
	Precautions	The data needs to be set up before it can be invalidated after ADR	
Command character	The command type	The command format	response
CRSSI	Test	AT+CRSSI=?	+CRSSI

(Query **channel signal strength).**	command		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 RSSI returns 8 channels in a band.	
	Returns the value description		
	example	AT+CRSSI 1? +CRSSI: 0:-157 1:-157 2:-157 3:-157 4:-157 5:-157 6:-157 7:-157 OK	
	Precautions		
Command character	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 reporting 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.	
	Returns the value description	The time interval between periodic reporting of data, in s. For different DR, the minimum allowed periods are different, defined by the periodic level, as shown in the following table. Rate/cycle (s)/grade 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	<value >: Factory value is 0 for the transmit power size 0 - 17dBm	

	of the parameter Returns the value description	1 - 15dBm 2 - 13dBm 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 parameter	<value >: Enable Control 0 for Link Check **-** Not Enable Link Check 1 **-** Perform Link Check2 once - the module automatically carries the linkcheck commandin each upstream packet.	
	Returns the value description	Return OK and set successfully. If X1 is 1, after a period of waiting, a second response message is returned in the following format: +CLINKCHECK:Y0， Y1， Y2， Y3， Y4 YO represents the 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	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>,<RX2DataRate>,<RX2Frequency>	OK
	The description of the parameter	<RX1DRoffest>,<RX2DataRate>,<RX2Frequency>详#协议。	
	Returns the value description		
	example	AT+CRXP=1,1,868000000 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 after sending open the RX1 window, 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=?	+CSAVE OK
	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
CRESTOREMAC **(Recover MAC default parameter).**	Test command	AT+CRESTOREMAC=?	+CRESTOREMAC OK
	Set the command	AT+CRESTOREMAC	OK
	The description of the parameter	The command restores the MAC default configuration parameters to EERPOM/FLASH.	
	Returns the value description		
	example	AT+CRESTOREMAC OK	
	Precautions		
Command character	The command type	The command format	response
IREBOOT (Restart **the**	Test command	AT+IREBOOT=?	+IREBOOT:"Mode" OK

module).	Set the command	AT+IREBOOT=<mode>	OK
	The description of the parameter	< mode >: restart mode; 0: Restart the communication module immediately. 1: Wait for the wireless frames currently being sent within the communication module to complete before restarting.	
	Returns the value description		
	example	AT+IREBOOT=1 OK	
	Precautions	After the communication module receives the instruction, it replies to OK and restarts the communication module. No subsequent AT instructions are received until the restart is complete.	
Command character	The command type	The command format	response
CLPM (Enable **low power consumption).**	Test command	AT+CLPM=?	+CLPM:"Mode" OK
	Set the command	AT+CLPM=<mode>	OK
	The description of the parameter	< mode >: Low power mode 1: The device enters low power consumption	
	Returns the value description		
	example	AT+CLPM=1 OK	
	Precautions	After entering low power consumption, the serial instruction can be sent again to wake up; Because the UART starting bytes may transmit incorrectly when transmitting above 40kbps, AT-CLPM-0 may be recognized as an error and **returned to the**"CME ERROR"and itis recommended to use "0000000D00D0A" (16-in) for wake-up	
Command character	The command type	The command format	response

<table>
<tr><td rowspan="5">ECHO
(Instruction
echo).</td><td>Query command</td><td>AT+ECHO?</td><td>+ ECHO:"Mode"
OK</td></tr>
<tr><td>Set the command</td><td>AT+ECHO=<mode></td><td>OK</td></tr>
<tr><td>The description of the parameter</td><td colspan="2" rowspan="2">< mode >: instruction echo;
0: Directive to turn off echo.
1: Directive Open Echo .</td></tr>
<tr><td>Returns the value description</td></tr>
<tr><td>example</td><td colspan="2">AT+ECHO =1
OK</td></tr>
<tr><td></td><td>Precautions</td><td colspan="2">The open echo instruction returns the corresponding configuration instruction, which is powered off and not saved</td></tr>
</table>

8. FAQ

8.1 Communication distance is very short

- When there is a straight-line communication barrier, the communication distance decays accordingly。
- Temperature, humidity, and concourse interference can lead to increased packet loss rates。
- The ground absorbs and reflects radio waves, and the test effect near the ground is poor。
- Sea water has a strong ability to absorb radio waves, so the seashore test results are poor。
- There are metal objects near the antenna, or the signal decay can be very severe if placed in a metal shell。
- Power register setting is wrong, air rate setting is too high (higher air rate, closer distance)。
- The lower the power supply voltage at room temperature is lower than the recommended value, the lower the voltage, the lower the power。
- The use of antennas to match modules is poor or the antenna itself is of poor quality。

8.2 Module is easy to be damaged

- Check the power supply to ensure that the module is permanently damaged between recommended values if the maximum value is exceeded。
- Check the stability of the power supply and the voltage does not fluctuate significantly or frequently。
- Make sure that the installation is using process anti-static operation and that the high-frequency device is static sensitive。
- Make sure that the process humidity should not be too high for installation and that 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

- Ebyte reserves the right to final interpretation and modification of all contents of this specification。
- This manual is subject to change without notice due to continuous improvement of the hardware and software of the product and should ultimately be subject to 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。

Revision history

version	The revision date	Revised description	Maintainer
1.0	2021-9-15	The initial version	Linson

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