Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual

E78-DTU(900LN22)

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Chapter One Product Overview

1.1. Brief introduction

The E78-DTU (900LN22) is a standard LoraWan node data transceiver designed and produced by Chengdu Ebyte Electronic Technology Co., Ltd. It is developed based on our E78-868LN22S/915LN22S module,the equipment supports EU868/IN865/RU864/US915/AU915/ Seven regional files of AS923/KR920 ; the device supports CLASS-A/CLASS-C node types, and supports ABP/OTAA two network access methods; the external communication interface of the station adopts RS485/ RS232 communication, and the user can simply configure it through AT commands or the host computer. It can be connected to the standard LoRaWAN network. At the same time, the radio has functions such as transparent transmission and active polling, supports serial port upgrade and remote configuration. It is an excellent choice for current IoT applications.

1.2. Features

- Support transparent transmission;
- Support active polling;
- Using LoRaWAN communication technology;
- Support automatic modbus CRC check;
- AT command/host computer/remote configuration;
- Support switching standard LoRaWAN region files;
- Support hardware reset;
- Serial port upgrade;
- Working temperature range: -40℃～+85℃, suitable for various harsh working environments, real industrial grade products.
- All aluminum alloy shell, compact size, easy installation, good heat dissipation; perfect shielding design, good electromagnetic compatibility, strong anti-interference ability.
- Power supply reverse connection protection, over-connection protection, antenna surge protection and other multiple protection functions greatly increase the reliability of the radio.

Chapter Two Quick Start

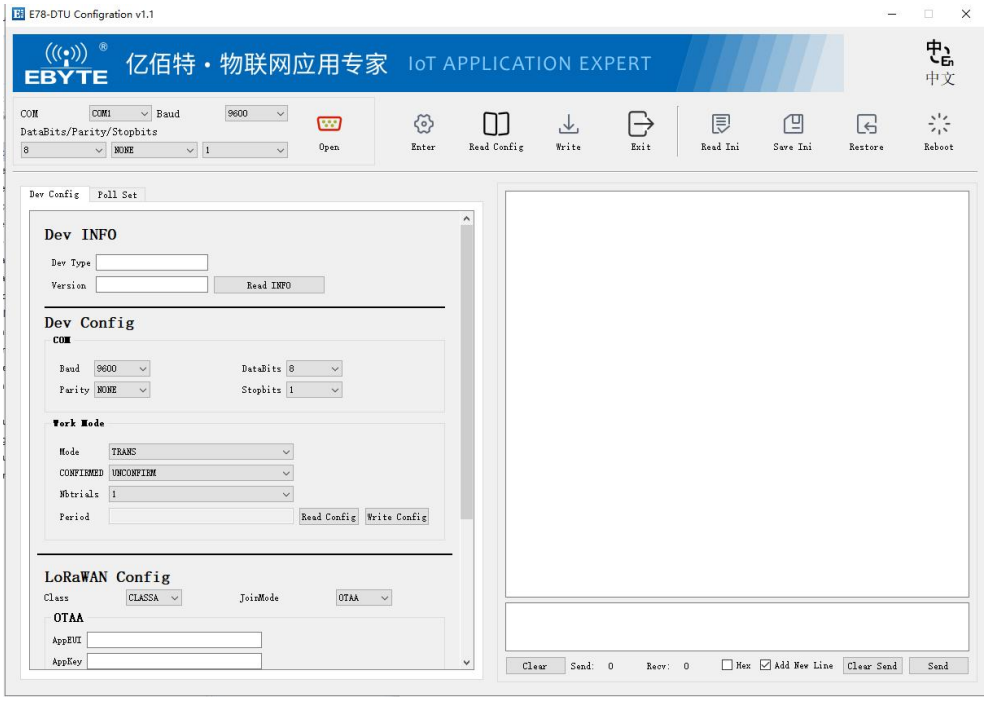
The following materials are required for this test:

E78-DTU, antenna, power adapter , 485 communication cable

1、 First install the antenna for E78-DTU, then install the power supply, and ensure that the status of the DIP switch is correct. The user can choose the crimping method or the power adapter for power supply according to the needs, and choose one of the two;

2、 Use USB to RS485 to connect the computer to E78-DTU;

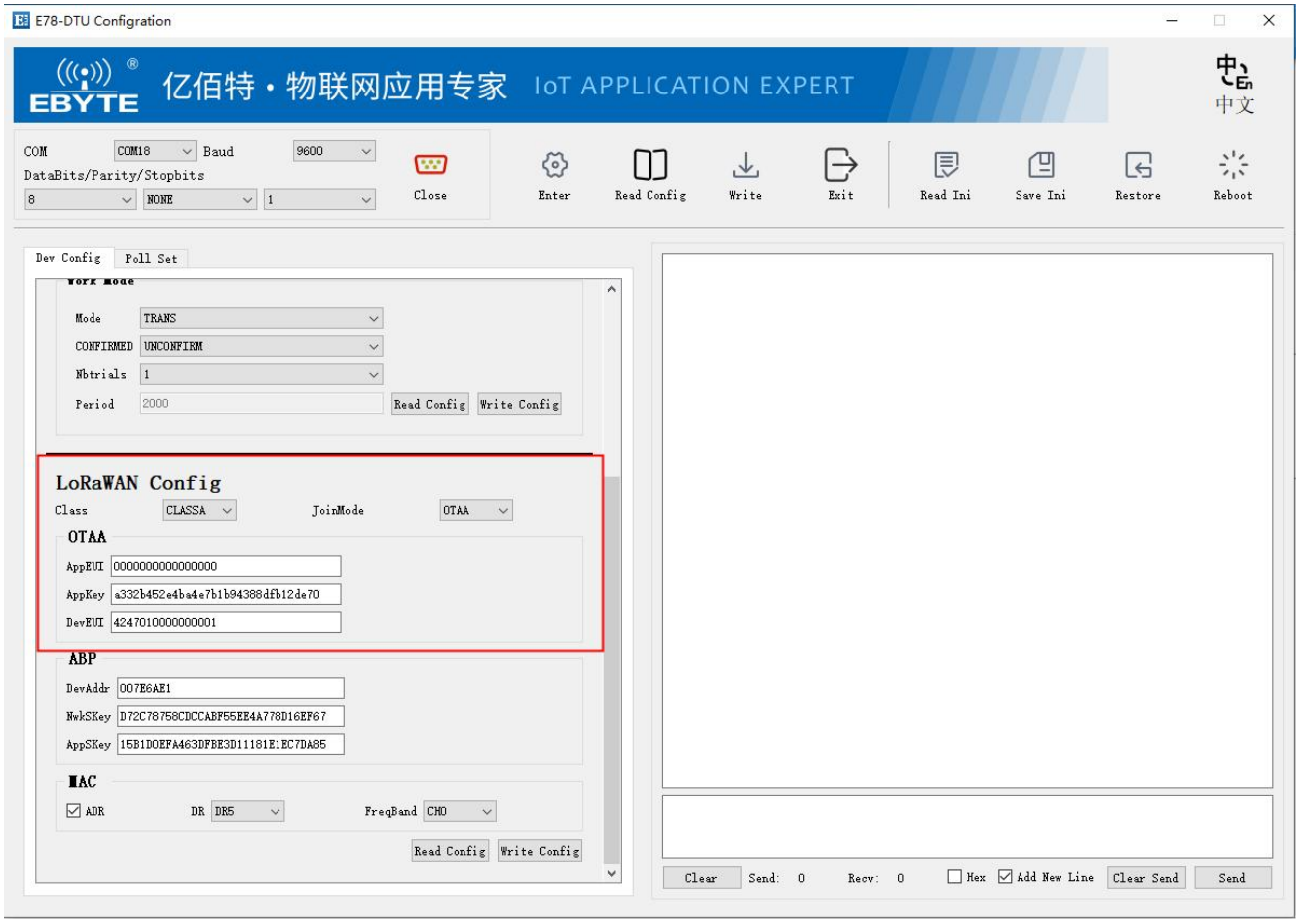
3、 Start a serial port debugging assistant, select the serial port baud rate as 9600bps, and check the mode as 8N1. After configuring the network access parameters through the AT command or the configuration tool (note: different types of devices have different region files, the default factory region file of the device is EU868 , if customers need to use other region files, they can switch region files by configuring AT commands through the serial port. For AT commands, see AT command configuration instructions), the device will automatically send a network access request, and the device can be connected to the network after the nearby gateway accepts the request.



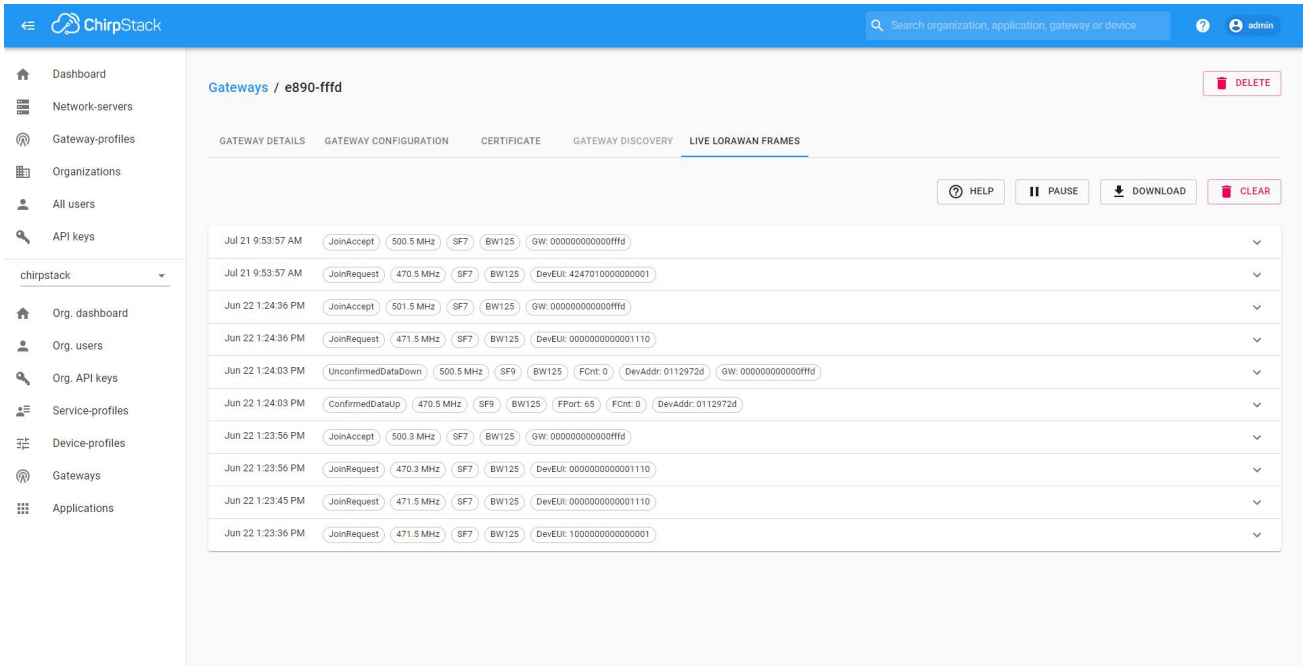
Access demo:

This demonstration kit uses E78-DTU (900LN22) as the node, and E890-868LG12 as the gateway to connect to the free ChirpStack Application Server test server for communication testing; the corresponding settings of the node-side OTAA access method are as follows:

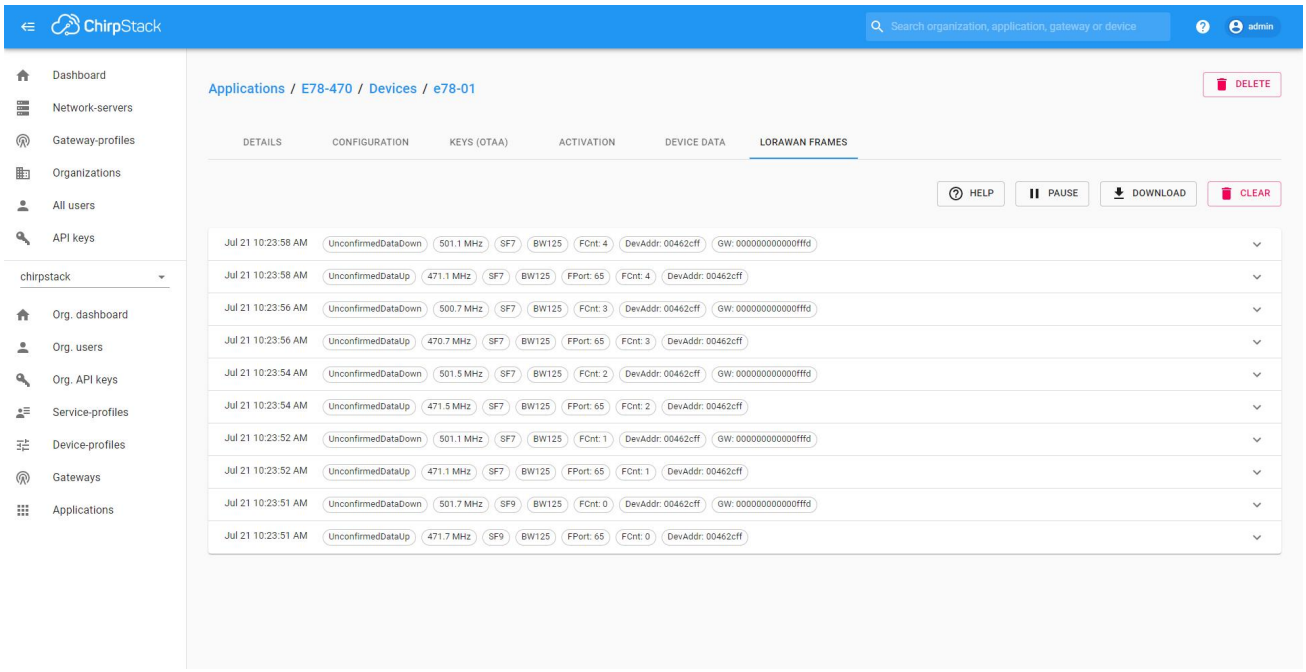
Write network access parameters through the configuration tool



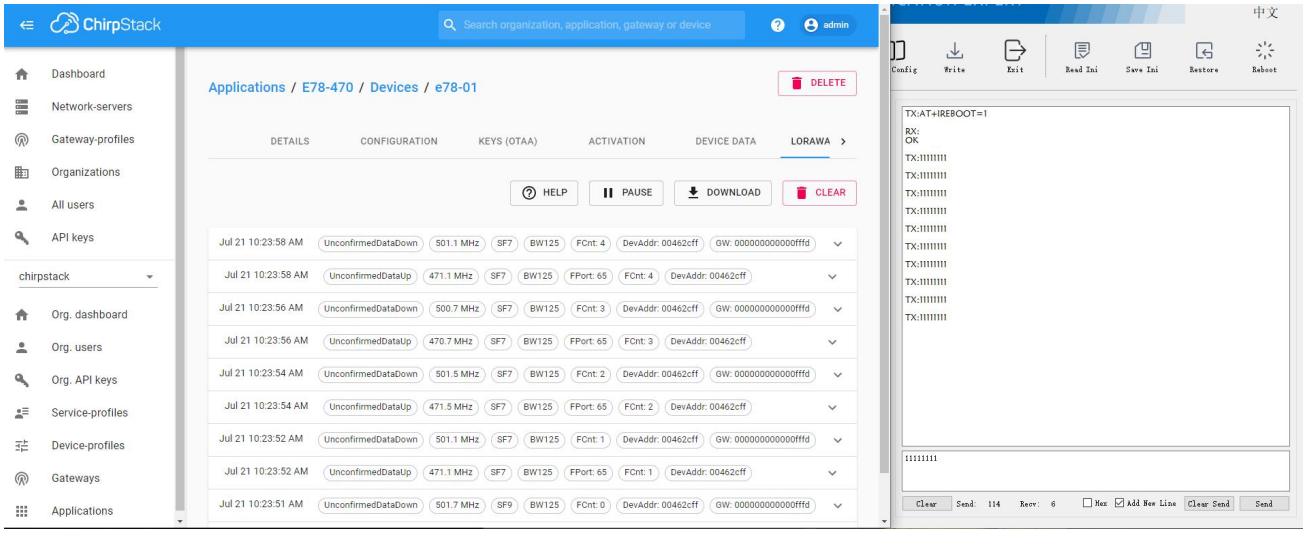
On ChirpStack Application Server, the gateway data records are as follows:



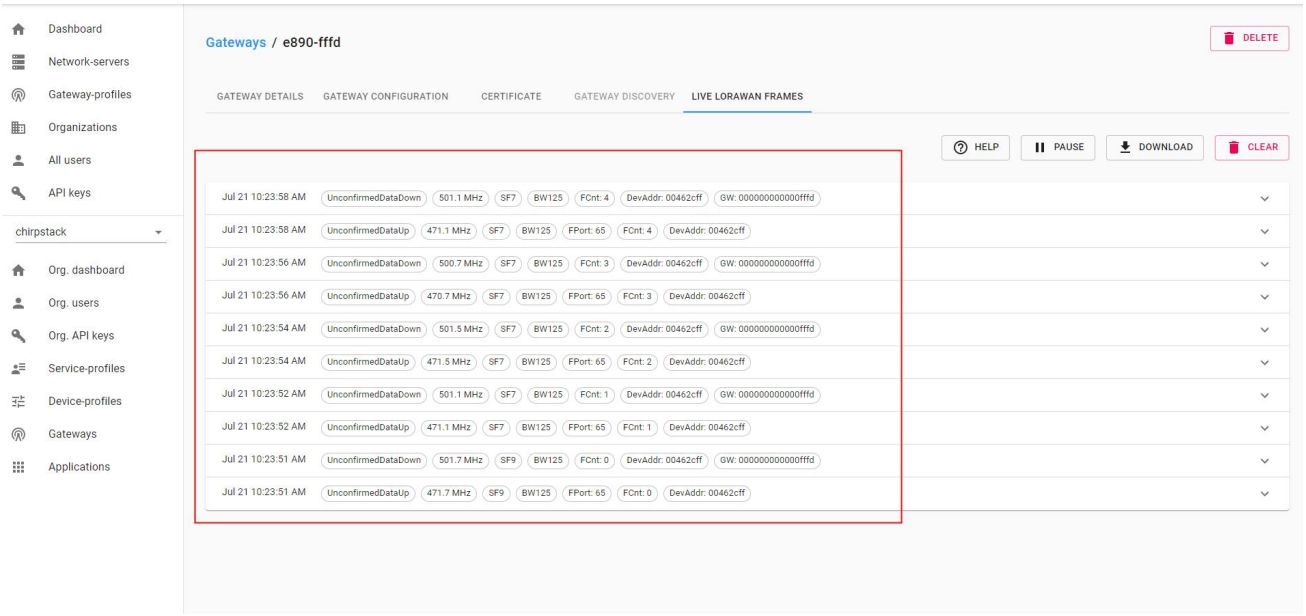
The node data records of ChirpStack Application Server are as follows:



An example of access under transparent transmission mode is as follows:



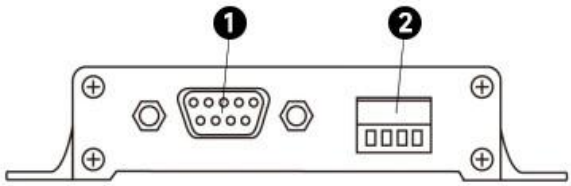
Under transparent transmission mode, APP server receives data below:

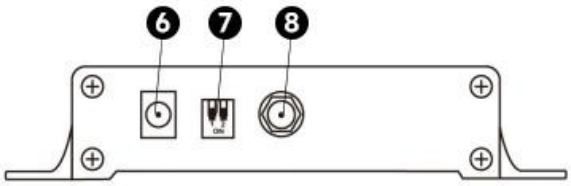


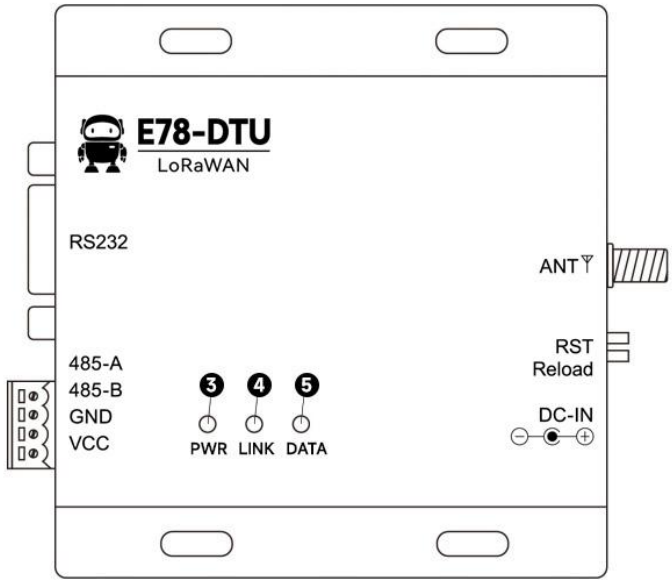
Note: Please refer to "LORAWAN Node + Gateway TTN Server Configuration Tutorial" for TTN device creation and corresponding configuration process

Chapter Three Installation Dimension

3.1 Description of each part

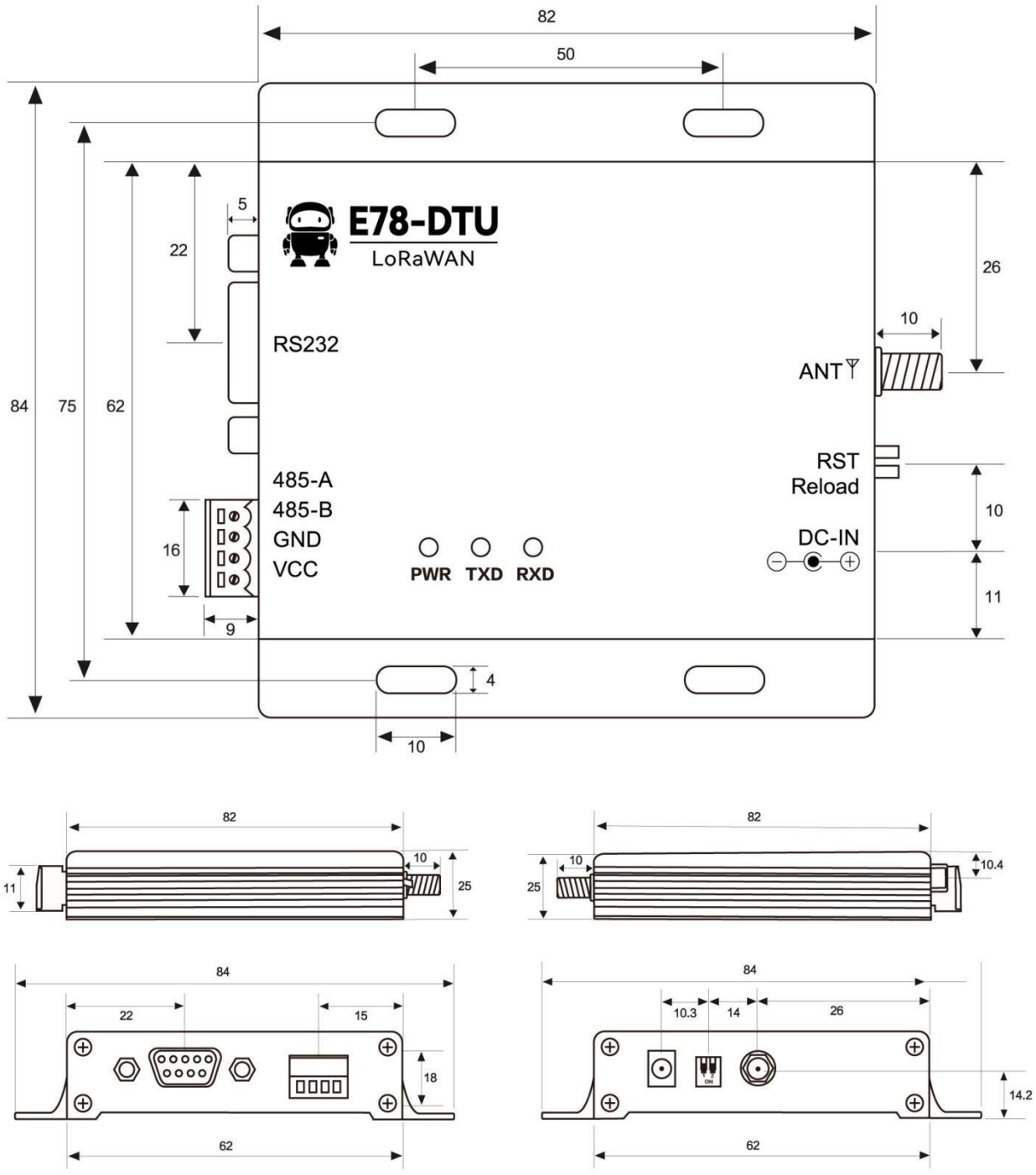






Pin number	Item	Features	Explanation
1	DB9 female socket	RS232 interface	Standard RS232 interface
2	3.81mm Phoenix terminal block	RS485, power interface	Standard RS485 interface and pressure line power interface
3	PWR-LED	Power Indicator	Red, always on when the power is on
4	LINK-LED	Status Link Indicator	Yellow, always on when connected to the gateway
5	DATA-LED	Data sending and receiving indicator	Yellow, flashing when sending and receiving data
6	DC -IN power interface	Power interface	In-line round hole, outer diameter 5.5mm, inner diameter 2.5mm
7	DIP switch	DIP switch	Reload (restore factory settings) and RST (reset) DIP switches
8	Antenna interface	SMA-K interface	External threaded inner hole, length 10mm, characteristic

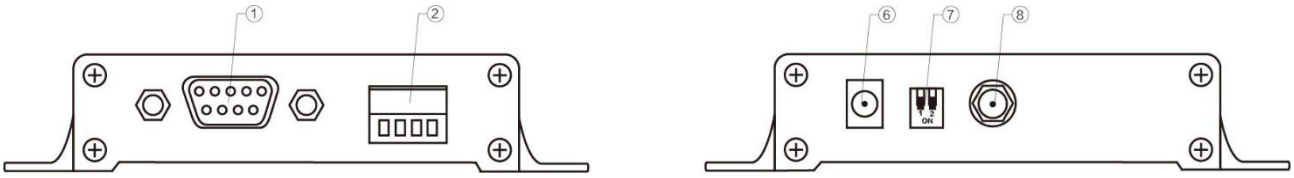
			impedance 50Ω



Unit: mm

Chapter Four Interface Definition

4.1 Power Interface Description



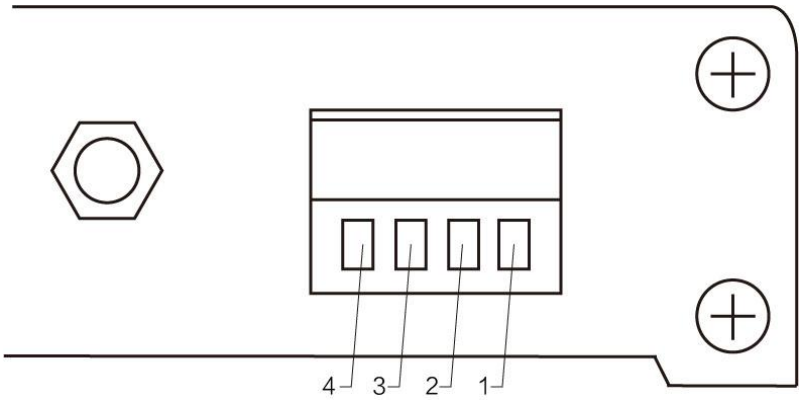
The user can choose ⑥ DC power interface to supply power, and use the interface to supply power for a power adapter with an outer diameter of 5.5mm and an inner diameter of 2.5mm;

It can also be powered by the VCC terminal and GND terminal in ②, just choose any one of the power supply methods;

E78-DTU can be powered by 8~28V DC power supply, 12V or 24V DC power supply is recommended.

4.2 RS485 interface definition

E78-DTU (900 LN22) can use the 485_A terminal and 485_B terminal in ② to connect to the A terminal and B terminal of the RS-485 of the device respectively.



Pin number	Standard definition	Features	Explanation
1	VCC	Crimp type power interface, positive	DC 8~28V, 12V or 24V is recommended
2	GND	Crimp type power interface, negative pole	The negative pole of the power supply is connected to the system ground and the shell
3	485_B	RS485 interface, B interface	RS485 interface B interface is connected with device B interface
4	485_A	RS485 interface, A interface	RS485 interface A interface is connected with device A interface

Chapter Five Technical Specifications

5.1 Model Specifications

Model Specifications	Working frequency	Transmit power	Reference distance	Specifications
	MHz	W	km	
E 78 -DTU(900LN22)	850~925	0.16W	3KM	LoRaWan standard

Note: Reference distance test environment: sunny weather, open environment without shelter, 12 V2A power supply, 5d B i gain suction cup antenna, the height of the antenna from the ground is 2 meters, and the factory default parameters are used.

5.2 General Specifications

Serial number	Item	Specification	Explanation
1	Product Size	100*84*25mm	See installation dimensions for details
2	product weight	120g	Weight tolerance 5 g
3	Operating temperature	-40℃～ 85 ℃	Meet the needs of industrial use
4	Antenna Impedance	50Ω	Standard 50Ω characteristic impedance
5	voltage range	8 ～ 28VDC	V or 24 V recommended
6	Current parameter	Emission current: 15mA@12V Waiting current: 10mA@12V	
7	Communication Interface	RS232/RS485	Standard DB9 socket /3.81 mm Phoenix terminal block
8	baud rate	Factory default 9600	
9	address code	Factory default 0	A total of 65536 address codes can be set

Chapter Six Working Mode

The device has two working modes. For normal communication, the radio is configured as transparent transmission mode; the default setting of the radio is also transparent transmission mode when it leaves the factory.

Category			Note

Transparent mode			In this mode, the communication between the device and the server can be realized
configuration mode			AT command configuration mode

6.1 Transparent transmission mode

Types	
Send	Users can input data through the serial port, and the module will start wireless transmission.
Receive	The wireless receiving function of the module is turned on, and the wireless data will be output through the TXD pin of the serial port after receiving the wireless data.

6.2 Configuration mode

Types	
Send	Send-off
Receive	Receive off
Configure	User can access registers to configure module working mode

Chapter Seven Detailed Function

7.1 Transparent transmission mode

In this mode, the device can configure the network access parameters through AT commands or the configuration tool. When the device successfully enters the network, the data communication between the device and the lorawan server is realized. When the LINK light is always on, user can communicate

7.2 Active polling

The active polling mode can be configured through the configuration software or AT command. This mode supports HEX mode, supports automatic modbus CRC check, and can be configured with 64 polling commands.

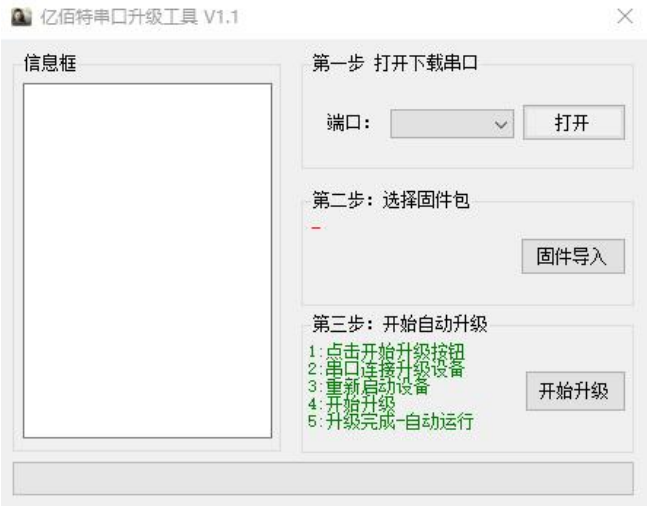
7.3 Remote configuration

After the device is successfully connected to the network, the lorawan server can issue instructions to configure parameters.

7. 4 Serial port upgrade

The firmware can be upgraded through the RS485 serial port. The specific demonstration is as follows:

Connect the device to the computer and turn on the upgrade on configuration software.

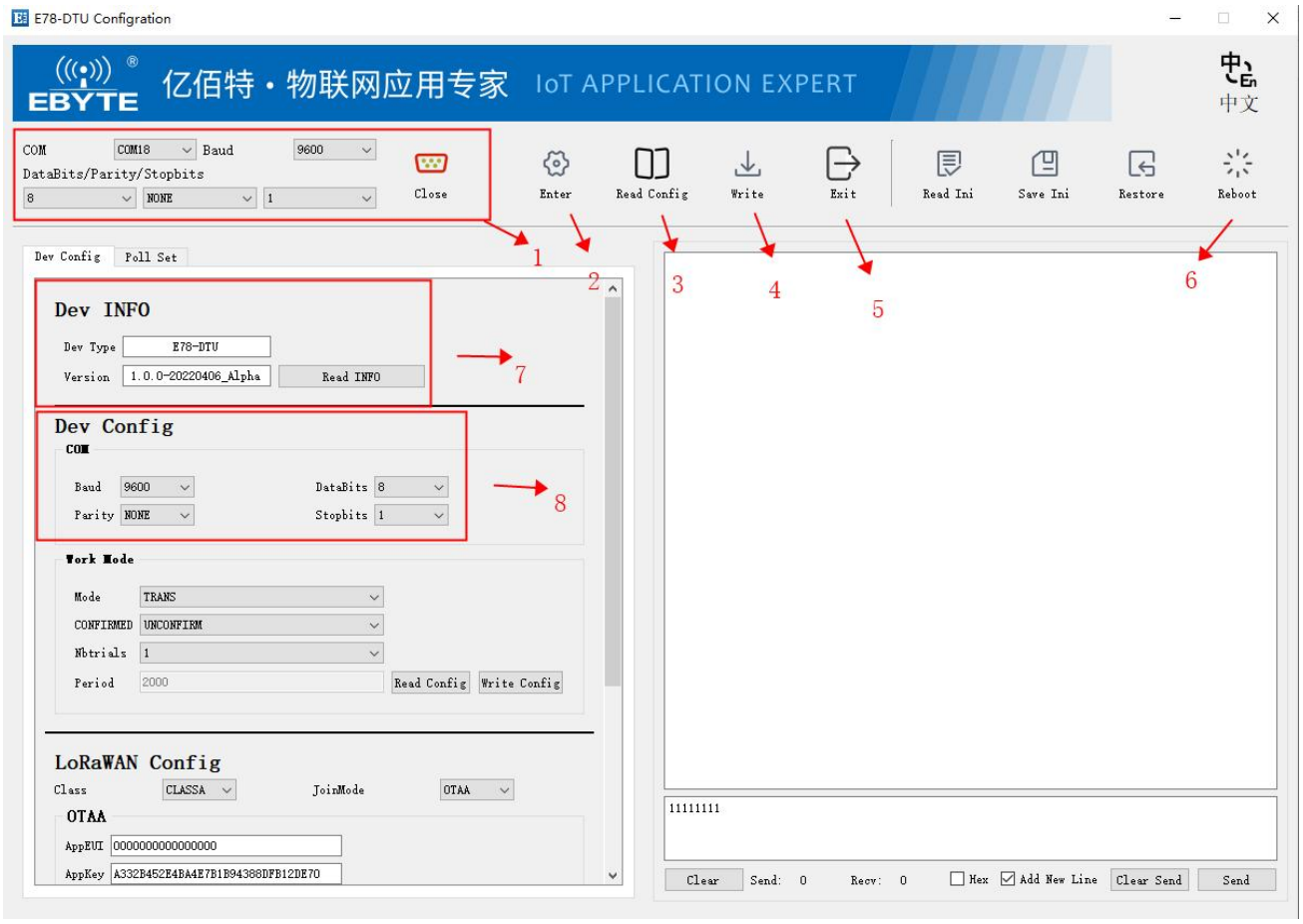


Select the corresponding port and open it, select the firmware package that needs to be upgraded, and click to start the upgrade after importing.

At this time, power on the device to be upgraded to upgrade itself.

Chapter Eight Configuration Tool Instructions

The parameters can be configured through the configuration tool, as shown in the following figure:



Arrow 1: In this area, select the port corresponding to the device and the baud rate data bit, parity bit, stop bit

Arrow 2: After selecting the appropriate port information, click to enter the configuration state

Arrow 3: After entering the configuration, click to read the device parameters

Arrow 4: After modifying the parameters, click to save the modified configuration

Arrow 5: Click to exit the configuration mode

Arrow 6: After entering the configuration, click to restart the device

Arrow 7: Read the parameters after entering the configuration to read the model and version information of the device

Arrow 8: After entering the configuration, modify the serial port parameter information of the device in this area, and restart the device after saving the
configuration

Arrow 9: Select the working mode in the drop-down box: TRANS is transparent transmission mode, POLL is polling mode

Arrow 10: Drop-down box to select whether to confirm the data

Arrow 11: Drop-down box to select the number of times a single packet of data is sent (1-8)

Arrow 12: Select the CLASS level of the device (CLASSA/CLASSC)

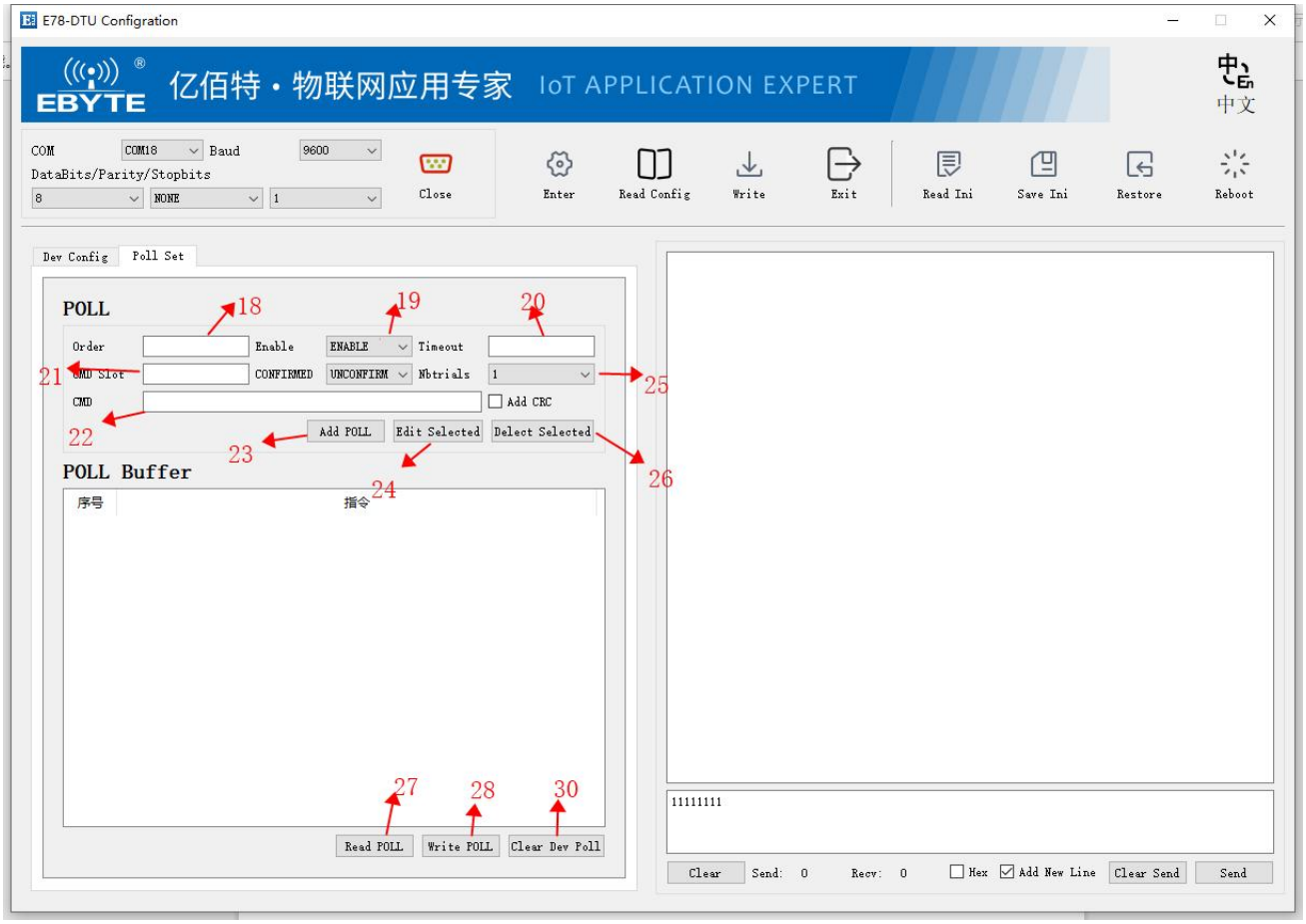
Arrow 13: Select the network access method of the device (OTAA/ABP)

Arrow 14: Enter network access parameters in OTAA mode in this area

Arrow 15: Enter network access parameters in ABP mode in this area

Arrow 16: Select the DR level or the previous ADR (automatic adjustment level)

Arrow 17: Select the frequency band (CH0-CH7) under the region file



Arrow 18: Set the serial number of the polling command

Arrow 19: Turn on or off a command enable

Arrow 20: Set the response timeout of this command (200-3000ms)

Arrow 21: Set the waiting time from executing the entire polling cycle to the next polling cycle (3000-50000ms)

Arrow 22: Enter the specific command to be polled in the input box

Arrow 23: Click to add instructions to the buffer

Arrow 24: Select the instruction in the buffer area and click to modify the instruction to synchronize the parameters to the setting area

Arrow 25: Set the number of command sending

Arrow 26: Select the buffer command and click the delete command to delete it

Arrow 27: Click to read the existing instructions of the device into the cache area

Arrow 28: Click to write the buffer instruction to the device

Arrow 30: Click to delete device directive

Chapter AT Command Configuration Instructions

a) Instruction format:

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

: command prefix

CMD: control command character

[op]: instruction operator. Can be the following:

- ✓ "=": Indicates parameter setting.
- ✓ "?": Indicates the current value of the query parameter.
- ✓ "": means to execute the command.
- ✓ "=?": Indicates querying the parameters of the setting command.

[para-n]: Indicates the set parameter value, or specifies the parameter to be queried

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

instruction	Description (common command)
CGMI	Read manufacturer's logo
CGMM	read module ID
CGMR	read version ID
CGSN	Read product serial number identification
CGBR	Set the baud rate of UART
CJOIN MODE	Set the read Join mode (OTAA, ABP)
CDEVEUI	Set to read DevEUI (when OTAA is connected to the network)
CJOIN MODE	Set the read Join mode (OTAA, ABP)
CDEVEUI	Set to read DevEUI (when OTAA is connected to the network)
CAPPEUI	Set to read AppEUI (when OTAA accesses the network)
CAPPKEY	Set to read AppKey (when OTAA accesses the network)
CDEV ADDR	Set to read DevAddr (when ABP is connected to the network)
CAPPSKEY	Set to read AppSkey (when ABP accesses the network)
CNWKSKEY	Set to read NwkSkey (when ABP accesses the network)
CFREQ BANDMASK	Set the read frequency point mask (FreqBandMask)
CULDL MODE	Set to read Ul/Dl mode (same frequency or different frequency)
CWORKMODE	Set the read working mode (normal working mode)
CCLASS	Set the read class type (Class A/C)
REGION CFG	Set to read region files (AS923/AU915/EU868/KR920/IN865/RU864/US915)
CBL	read battery level
CSTATUS	read node status
CJOIN	Initiate OTAA network access
DTRX	Send and receive data frames
DRX	Get the latest received data from the Rx buffer and clear the

	Rx buffer
CPASSTHOUGHMODE	Enter transparent transmission mode
Order	Description (MAC related configuration commands)
CCONFIRM	Set the type of read and send message (confirm or unconfirm)
CAPPPORT	Set to read the application layer Port
CDATARATE	Set the read data rate
CRSSI	Get the RSSI value of the channel
CNBTRIALS	Set read NbTrans parameters
CRM	Set the read reporting mode
CTXP	Set read transmit power
CLINK CHECK	Enable Link check
CADR	Enable or disable ADR; AT+CADR=1 enable, AT+CADR=0 disable, default is enable
CRXP	Set the parameters for reading the receiving window
CRX1DELAY	Set the delay for reading TX and RX1
CSAVE	save configuration
CRESTORE	restore default configuration
IREBOOT	system reset

Command character	Command type	Command format	Response
CGMI (**read the manufacturer's logo**)	query command	AT+CGMI?	+CGMI=<manufacturer> OK
	Parameter Description	<manufacturer>: Manufacturer ID	
	Return value description		
	Example	AT+CGMI? +CGMI=Ebyte OK	
	Precautions		
Command character	command type	command format	response
CGMM (**read module ID**)	Query command	AT+CGMM?	+CGMM=<model> OK
	Parameter Description	<model>: Module ID	
	Return value description		
	Example	AT+CGMM?	

		+CGMM=E78-470LN22S OK	
	Precautions		
Command character	command type	command format	response
CGMR (**read version ID**)	query command	AT+CGMR?	+CGMR=<revision> OK
	Parameter Description	<revision>: version number	
	Return value description		
	example	AT+CGMR? +CGMR=V4.4 OK	
	Precautions		
Command character	command type	Command format	Response
CGSN (**read product serial number identification**)	query command	AT+CGSN?	+CGSN=<sn> OK
	Parameter Description	<sn>: product serial number identification	
	Return value description		
	example	AT+CGSN? +CGSN=0539349E00032523 OK	
	Precautions		
command character	Command type	Command format	Response
CGBR (**set baud rate**)	Query command	AT+CGBR?	+CGBR=<baud> OK
	Set command	AT+CGBR=<baud>	OK
	Parameter Description	<baud>: product serial number identification	
	Return value description		
	Example	AT+CGBR=9600 OK	

	Precautions	Baud range: 1200~ 9600 bps, the default baud rate is 9600 ;	
Command character	command type	command format	response
REGION CFG (**set read locale file**)	Query command	AT+REGIONCFG?	+REGIONCFG:<region file> OK
	Set command	AT+REGIONCFG=<region file>	OK
	Parameter Description	<region file>: support AS923/AU915//EU868/KR920/IN865/RU864/US915	
	Return value description		
	example	AT+REGIONCFG=US915 OK	
Command character	Command type	command format	response
CJOIN MODE (**Set the Join method**)	Test command	AT+CJOINMODE=?	+CJOINMODE: " mode " OK
	query command	AT+C JOIN MODE?	+CJOINMODE:<mode> OK
	Set command	AT+CJOINMODE=<mode>	OK
	Parameter Description	<mode>: Node Join mode 0: OTAA 1:ABP	
	Return value description		
	Example	AT+CJOINMODE=0 OK	
	Precautions	Nodes in different modes have different network access methods. Please use this command to set ABP before sending data.	
Command character	Command type	command format	response
CDEVEUI (**Set DevEUI**)	Test command	AT+CDEVEUI=?	+CDEVEUI=<DevEUI:length is 16>
	Query command	AT+CDEVEUI?	+CDEVEUI:<value> OK
	Set command	AT+CDEVEUI=<mode>	OK
	Parameter Description	<mode>: Node DevEUI	
	Return value		

	description		
	example	AT+CDEVEUI=AABBCCDD00112233 OK	
	Precautions	Set or read DevEUI, return Y1Y2 **...** Y8, hexadecimal format, value 8 bytes.	
command character	command type	command format	response
CAPPEUI (**Set AppEUI**)	test command	AT+CAPPEUI=?	+CAPPEUI=<AppEUI:length is 16>
	query command	AT+CAPPEUI?	+CAPPEUI:<value> OK
	set command	AT+CAPPEUI=<value>	OK
	Parameter Description	<value>: Node AppEUI	
	Return value description		
	example	AT+CAPPEUI=AABBCCDD00112233 OK	
	Precautions	Used when OTAA, set or read AppEUI, return Y1Y2 **...** Y8, hexadecimal format, value 8 bytes.	
command character	command type	command format	response
CAPPKEY (**Set AppKey**)	test command	AT+CAPPKEY=?	+CAPPKEY=<AppKey:length is 32>
	query command	AT+CAPPKEY?	+ CAPPKEY:<value> OK
	set command	AT+CAPPKEY=<value>	OK
	Parameter Description	<value>: Node AppEUI	
	Return value description		
	example	AT+CAPPKEY=AABBCCDD00112233AABBCCDD00112233 OK	
	Precautions	Used in OTAA, set or read AppKey, return Y1Y2 **...** Y16, hexadecimal format, value 16 bytes.	
command character	command type	command format	response
CDEV ADDR (**set DevAddr**)	test command	AT+CDEVADDR=?	+CDEVADDR=<DevAddr:length is 8，Device address of ABP mode>

	query command	AT+CDEVADDR?	+CDEVADDR:<value> OK
	set command	AT+CDEVADDR=<value>	OK
	Parameter Description	<value>: Node DevAddr	
	Return value description		
	example	AT+CDEVADDR=00112233 OK	
	Precautions	Used in ABP, set or read DevAddr, return Y1Y2 **...** Y4, hexadecimal format, value 4 bytes.	
command character	command type	command format	response
CAPPSKEY (Set **AppSKey**)	test command	AT+CAPPSKEY=?	+CAPPSKEY=<AppSKey:length is 32>
	query command	AT+CAPPSKEY=<value>	+CAPPSKEY:<value> OK
	set command	AT+CDEVADDR=<value>	OK
	Parameter Description	<value>: Node AppSKey	
	Return value description		
	example	AT+CAPPSKEY=AABBCCDD00112233AABBCCDD00112233 OK	
	Precautions	Used in ABP, set or read AppSKey, return Y1Y2 ... Y16, hexadecimal format, value 16 bytes.	
command character	command type	command format	response
CNWKSKEY (**set NwkSKey**)	test command	AT+CNWKSKEY=?	+CNWKSKEY=<NwkSKey: length is 32>
	query command	AT+CNWKSKEY?	+CNWKSKEY:<value> OK
	set command	AT+CNWKSKEY=<value>	OK
	Parameter Description	<value>: Node NwkSKey	
	Return value description		

	example	AT+CNWKSKEY=AABBCCDD00112233AABBCCDD00112233 OK	
	Precautions	Used in ABP, set or read NwkSKey, return Y1Y2 ... Y16, hexadecimal format, value 16 bytes.	
CFREQ BANDMASK (**set band mask**)	command type	command format	response
	test command	AT+CFREQBANDMASK=?	+CFREQBANDMASK: "mask" OK
	query command	AT+CFREQ BANDMASK?	+CFREQBANDMASK:<mask> OK
	set command	AT+CFREQBANDMASK=<mask>	OK
	Parameter Description	<mask>: The frequency point mask that the network may work, 16bit corresponds to 16 frequency groups, see the LoRaWAN access specification for details. Such as: 0-7 channels, the corresponding mask is 0001, the corresponding mask of 8-15 channels is 0002, the corresponding mask of 16-23 channels is 0004 and so on . the frequency corresponding to the specific channel, you need to check the region protocol. For example, channels 0-7 correspond to: 470.3MHz, 470.5MHz, 470.7MHz, 470.9MHz, 471.1MHz, 471.3MHz, 471.5MHz, 471.7MHz in CN470 .	
	Return value description		
	example	AT+CFREQBANDMASK=0001 OK	
	Precautions	Need to be set before Join.	
command character	command type	command format	response
CULDL MODE (**Set the same and different frequencies for uplink and downlink**)	test command	AT+CULDLMODE=?	+CULDLMODE: " mode " OK
	query command	AT+CULDLMODE?	+CULDLMOD E:<mode> OK
	set command	AT+CULDLMODE=<mode>	OK
	Parameter Description	<mode>: 1: same frequency mode 2: Different frequency mode	
	Return value description		
	example	AT+CULDLMODE=2 OK	
	Precautions	Need to set before Join	
command character	command type	command format	response

CWORKMODE (**Set working mode**)	test command	AT+CWORKMODE=?	+CWORKMODE: " mode " OK
	query command	AT+CWORKMODE?	+CWORKMODE:<mode> OK
	set command	AT+CWORKMODE=<mode>	OK
	Parameter Description	<mode>: 2: Normal working mode	
	Return value description		
	example	AT+CWORKMODE=2 OK	
	Precautions	It needs to be set before Join, and the default is normal working mode. Currently only supports normal working mode	
command character	command type	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 command	AT+CCLASS=<class>	OK
	Parameter Description	<class>: 0:classA 2: classC	
	Return value description		
	example	AT+CCLASS=2 OK	
	Precautions	It needs to be set before Join, the default is classA	
command character	command type	command format	response
CSTAUS (**query the current status of the device**)	test command	AT+CSTAUS=?	+CSTATUS: " status " OK
	query command	AT+CSTATUS?	+CSTATUS:<status> OK
	Parameter Description	<status>: 00 – no data operation 01 – Data sending	
	Return value		

	description	02 – Failed to send data 03 – Data sent successfully 04 – JOIN succeeded (appears only in the first JOIN process) 05 – JOIN failed (appears only during the first JOIN process) 06 – The network may be abnormal (Link Check result) 07 – Send data successfully, no downlink 08 – Send data successfully, there is downlink	
	example	AT+CSTATUS? +CSTATUS=03 OK	
	Precautions	Query the current status of the device	
command character	command type	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 command	AT+CJOIN=<ParaValue1>, [ParaValue2],... [ParaValue4]	If the input is valid, it first returns OK, then starts automatic authentication , and returns the authentication result. +CJOIN:OK Authentication succeeded +CJOIN:FAIL Authentication failed
	Parameter Description	<ParaTag1>, [ParaTag2], ... [ParaTag4]: the names of authentication parameters 1, 2, ... 4; [ParaValue1], [ParaValue2], ... [ParaValue4]: the parameter values of authentication parameters 1, 2, ... 4; <ParaTag1>, means to execute the JOIN operation, the value range of ParaTag1: 0 – stop JOIN 1 – Start JOIN and start the JOIN process again. For a module with hot restart enabled, executing this operation will clear the saved JOIN context parameters. [ParaTag2] indicates whether to enable the automatic JOIN function. The factory value is 1, and the value range of ParaTag2: 0 – disable automatic JOIN 1 – Automatic JOIN. After the module enters the transparent transmission mode, it will automatically start the JOIN. [ParaTag3] indicates the JOIN period, the value range: 7~255, the unit is s. Factory default: 8.	
	Return value description		

		[ParaTag4] indicates the maximum number of JOIN attempts, the value range of ParaTag4: 1~255	
	example	AT+CJOIN=1,1,10,8 (Set JOIN parameters: enable automatic JOIN, JOIN period is 10s, maximum number of attempts is 8) OK +CJOIN:OK	
	Precautions	Need to set before Join	
command character	command type	command format	response
DTRX (**Send and receive data**)	test command	AT+DTRX=?	+DTRX:[confirm],[nbtrials],<Length>,<Payload> OK
	set 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 or ERR+SEND:ERR_NUM ERR+SENT:TX_CNT
	Parameter Description	Refer to the corresponding AT command for confirm and nbtrials, which are only valid for this sending and optional. Length: Indicates the number of character strings; see the access specification for details on the maximum value; the length of bytes allowed to be transmitted at different rates is different (see the LoRaWan protocol for details), and 0 means sending an empty data packet. Payload: Hexadecimal (2 characters represent 1 number); return value: 1. How to judge whether the data transmission is successful? Confirm type data: Each time a frame of data is sent, there should be a corresponding response message. When the module times out and does not receive a response message, it will retry again if the maximum number of times has not been reached. If no downlink message is received until the maximum number of times is reached, it will fail and output ERR+SENT message. During this period, if the transmission of the response message is received, it is considered successful, and the OK+SEND, OK+SENT and OK+RECV messages are output. Unconfirm type data: No downlink response will be requested after data is sent, and OK+SEND, OK+SENT messages will be returned at the end of each transmission. If downlink data is received, then send OK+RECV message. 2. Data sending status prompt	
	Return value description		

		OK+SEND: TX_LEN means the data sending request is successful, TX_LEN: 1Byte, the length of the sent data OK+SENT: TX_CNT means the data is sent successfully, TX_CNT: 1Byte, the number of times the data is sent. ERR+SEND:ERR_NUM indicates that the data sending request failed, and the reason is indicated by ERR_NUM. ERR_NUM: 1Byte, 0- not connected to the network 1- Communication is busy, sending request failed 2- The data length exceeds the current sendable length, only send the MAC command ERR+SENT: TX_CNT means that the data transmission failed, and the number of transmissions reached the maximum number, TX_CNT: 1Byte, the number of data transmissions. OK+RECV: TYPE, PORT, LEN, DATA data received successfully (received response message or active downlink data) TYPE: 1Byte, downlink transmission type Bit0 : 0-unconfirm, 1-confirm Bit1: 0-not ACK, 1-ACK Bit2: 0-not carried, 1-carried, indicating whether the LINK command response is carried in the downlink data Bit3: 0-not carried, 1-carried, indicating whether the TIME command response is carried in the downlink data, only when the bit is 1, it means that the time synchronization is successful Bit4~Bit7: Default 0, reserved PORT: 1Byte, downlink transmission port LEN: 1Byte, downlink data length DATA: nByte, downlink data, when LEN=0, this field does not exist.
	example	AT+DTRX=1,2,10,0123456789 OK+SEND:03 OK+SENT:01 OK+RECV:02,01,00 means the confirm data is sent successfully, the valid data received by the server should be " 0123456789 " , and Downlink acknowledgment received.	
	Precautions	First access the network, then send data	
command character	command type	command format	response
DRX (**receive data**)	test command	AT+DRX=?	+DRX:<Length>,<Payload> OK
	query command	AT+DRX?	+DRX:<Length>,<Payload> OK
	Parameter Description	Return value: Length: 0 means empty data packet; Payload: hexadecimal string data;	
	Return value		

<table>
<tr><td></td><td>description</td><td colspan="2">OK: received data packet without exception;</td></tr>
<tr><td></td><td>example</td><td colspan="2">AT+DRX?
OK</td></tr>
<tr><td></td><td>Precautions</td><td colspan="2">Receive data packets from the receive buffer, and clear the receive buffer;</td></tr>
<tr><td>command character</td><td>command type</td><td>command format</td><td>response</td></tr>
<tr><td rowspan="4">CPASSTHOUGHMODE (transparent mode)</td><td>test command</td><td>AT+CPASSTHOUGHMODE=?</td><td>+CPASSTHOUGHMODE:[mode],[confirm],[nbtrials]</td></tr>
<tr><td>set command</td><td>AT+CPASSTHOUGHMODE=[mode],[confirm],[nbtrials]</td><td>OK</td></tr>
<tr><td>Parameter Description</td><td colspan="2">When mode is 1, enter transparent transmission mode. Refer to the corresponding AT command for confirm and nbtrials, which are only valid for this transmission, and need to be reset after re-entering after exiting.</td></tr>
<tr><td>Return value description</td><td colspan="2">OK means to enter the transparent transmission mode.

Return value description in transparent transmission mode:
<table>
<tr><td>frame header</td><td>status bit 1byte</td><td>1byte</td><td>1byte</td><td>nbyte</td></tr>
<tr><td rowspan="7">A1
A1</td><td>00 (not connected to the network)</td><td>\</td><td>\</td><td>\</td></tr>
<tr><td>01 (send data)</td><td>send length</td><td>\</td><td>\</td></tr>
<tr><td>02 (data sending)</td><td>\</td><td>\</td><td>\</td></tr>
<tr><td>03 (send timeout, unconfirm msg does not return)</td><td>Send timeout times</td><td>\</td><td>\</td></tr>
<tr><td>04 (send successfully, received the server return value, unconfirm msg no such return)</td><td>The port number</td><td>Received data length (when it is 0, no data is sent)</td><td>Send data (this bit is invalid when the data length is 0)</td></tr>
<tr><td>05 (exit transparent transmission mode)</td><td>\</td><td>\</td><td>\</td></tr>
<tr><td>FF (data too long)</td><td>\</td><td>\</td><td>\</td></tr>
</table></td></tr>
<tr><td>example</td><td colspan="2">In AT command mode:
AT+CPASSTHOUGHMODE=1,1,8
OK
In transparent transmission mode (hexadecimal):</td></tr>
</table>

		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 connected to the network before sending data, otherwise the data cannot be sent and the return value of A1 A1 00 will be received. 2. When the module is waiting for the server to respond, it cannot exit the transparent transmission mode. It needs to wait for the server to respond or send overtime before sending +++ (hex: 2B 2B 2B) to exit the transparent transmission mode. 3. Before entering the transparent transmission mode, please set AT+CMR=0,10 (use aperiodic reporting), AT+CLINKCHECK=0 (disable network verification).	
command character	command type	command format	response
CCONFIRM (**Set Uplink Transmission Type**)	test command	AT+CCONFIRM=?	+CCONFIRM: " value " OK
	query command	AT+CCONFIRM?	+DRX:<Length>,<Payload> OK
	set command	AT+CCONFIRM=<value>	OK
	Parameter Description	<value>: as follows. 0: UnConfirmed up message 1: Confirmed up message	
	Return value description		
	example	AT+CCONFIRM=1 OK	
	Precautions	Need to set before sending data	
command character	command type	command format	response
CAPPPORT (**Set uplink data port number**)	test command	AT+CAPPPORT=?	+CAPPPORT: " value " OK
	query command	AT+CAPPPORT?	+CAPPPORT:<value> OK
	set command	AT+CAPPPORT=<value>	OK
	Parameter Description	<value>: as follows: The port used, the data format is decimal, the factory value is 10. Value range: 1~223; Note: Port: 0x00 is the MAC command of LoRaWAN	
	Return value description		
	example	AT+CAPPPORT=10 OK	
	Precautions	Need to set before sending data	
command	command	command format	response

<table>
<tr><td>character</td><td>type</td><td></td><td></td></tr>
<tr><td rowspan="6">CDATARATE
(Set communication rate)</td><td>test command</td><td>AT+CDATARATE=?</td><td>+CDATARATE: " value "
OK</td></tr>
<tr><td>query command</td><td>AT+CDATARATE?</td><td>+CDATARATE:<value>
OK</td></tr>
<tr><td>set command</td><td>AT+CDATARATE=<value></td><td>OK</td></tr>
<tr><td>Parameter Description</td><td colspan="2"><value>: as follows:
Rate value, the factory value is 3, the value range:</td></tr>
<tr><td>Return value description</td><td colspan="2">0 - SF12, BW125
1 - SF11, BW125
2 - SF10, BW125
3 - SF9, BW125
4 - SF8, BW125
5 - SF7, BW125</td></tr>
<tr><td>example</td><td colspan="2">AT+CDATARATE=1
OK</td></tr>
<tr><td>Precautions</td><td colspan="3">It needs to be set before sending data, and it will be invalid after ADR is enabled</td></tr>
<tr><td>command character</td><td>command type</td><td>command format</td><td>response</td></tr>
<tr><td rowspan="5">CRSSI
(query channel signal strength)</td><td>test command</td><td>AT+CRSSI=?</td><td>+CRSSI
OK</td></tr>
<tr><td>query command</td><td>AT+CRSSI FREQBANDIDX?</td><td>+CRSSI:
0:<Channel 0 rssi>
1:<Channel 1 rssi>
…
7:<Channel 7 rssi>
OK</td></tr>
<tr><td>Parameter Description</td><td colspan="2"><FREQBANDIDX>: Indicates the number of the frequency band, starting from 0, 1A2 group number is 1</td></tr>
<tr><td>Return value description</td><td colspan="2">Returns the RSSI of 8 channels in a frequency band.</td></tr>
<tr><td>example</td><td colspan="2">AT+CRSSI 1?
+CRSSI:
0:-157
1:-157
2:-157
3:-157
4:-157
5:-157
6:-157
7:-157
OK</td></tr>
</table>

	Precautions		
command character	command type	command format	response
CNBTRIALS (**Set the number of times to send**)	test command	AT+CNBTRIALS=?	+CNBTRIALS: " MType " , " value " OK
	query command	AT+CNBTRIALS?	+CNBTRIALS:<MType>,<value> OK
	set command	AT+CNBTRIALS=<MType>,<value>	OK
	Parameter Description	<MType>: 0: unconfirm package, 1: confirm package. <value>: It is the maximum sending times, value range: 1~15;	
	Return value description		
	example	AT+CNBTRIALS=1,2 OK	
	Precautions	Need to set before sending data	
command character	command type	command format	response
CRM (**Set reporting mode**)	test command	AT+CRM=?	+CRM: " reportMode " , " reportInterval " OK
	query command	AT+CRM?	+CTXP:<reportMode>,[reportInterval] OK
	set command	AT+CTXP=<reportMode>,[reportInterval]	OK
	Parameter Description	<reportMode>: 0- report data	
	Return value description	aperiodically; 1- report data periodically; <reportInterval>: This parameter is only available when reporting data periodically. The time interval for reporting data periodically, unit: s. For different DRs, the allowed minimum cycle is different, defined by the cycle level, as shown in the table below. Rate\Period(s)\Level 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	

<table>
<tr><td></td><td></td><td colspan="2">OK</td></tr>
<tr><td></td><td>Precautions</td><td colspan="2">Need to set before sending data</td></tr>
<tr><td>command character</td><td>command type</td><td>command format</td><td>response</td></tr>
<tr><td rowspan="7">CTXP
(set transmit power)</td><td>test command</td><td>AT+CTXP=?</td><td>+CTXP: " value "
OK</td></tr>
<tr><td>query command</td><td>AT+CTXP?</td><td>+CTXP:<value>
OK</td></tr>
<tr><td>set command</td><td>AT+CTXP=<value></td><td>OK</td></tr>
<tr><td>Parameter Description</td><td colspan="2"><value>: It is the sending power, the factory value is 0
0 - 17dBm</td></tr>
<tr><td>Return value description</td><td colspan="2">1 - 15dBm
2 - 13dBm
3 - 11dBm
4 - 9dBm
5 - 7dBm
6 - 5dBm
7 - 3dBm</td></tr>
<tr><td>example</td><td colspan="2">AT+CTXP=1
OK</td></tr>
<tr><td>Precautions</td><td colspan="2">Need to set before sending data</td></tr>
<tr><td>command character</td><td>command type</td><td>command format</td><td>response</td></tr>
<tr><td rowspan="5">CLINKCHECK
(verify network connection)</td><td>test command</td><td>AT+CLINKCHECK=?</td><td>+CLINKCHECK: " value "
OK</td></tr>
<tr><td>set command</td><td>AT+CLINKCHECK=<value></td><td>OK</td></tr>
<tr><td>Parameter Description</td><td colspan="2"><value>: enable control for Link Check
0 – disable Link Check</td></tr>
<tr><td>Return value description</td><td colspan="2">1 - Execute a Link Check
2 - The module automatically carries the linkcheck command in each uplink data packet.

Return OK, the setting is successful.
If X1=1, after waiting for a period of time, the second response message will be returned, the format is as follows:
+CLINKCHECK: Y0, Y1, Y2, Y3, Y4
YO means Link Check result:
● 0 - Indicates that the Link Check was executed successfully
● Non-zero - indicates that the current Link Check execution failed
Y1 is DemodMargin
Y2 is NbGateways</td></tr>
</table>

		Y3 is the RSSI of this downlink Y4 is the SNR of this downlink	
	example	AT+CLINKCHECK=1 OK + CLINKCHECK: 0, 0, 1, -68, 8	
	Precautions	Need to set before sending data	
command character	command type	command format	response
CADR (**Set the number of times to send**)	test command	AT+CADR=?	+CADR:"value" OK
	query command	AT+CADR?	+CADR:<value> OK
	set command	AT+CADR=<value>	OK
	Parameter Description	<value>: as follows. ADR enable control, the factory value is 1 0 - ADR disabled 1 - ADR enabled	
	Return value description		
	example	AT+CADR=1 OK	
	Precautions	Needs to be setup before sending data. ADR is enabled by default.	
command character	command type	command format	response
CRXP (**Set receive window parameters**)	test command	AT+CRXP=?	+CRXP: " RX1DRoffest " , " RX2DataRate " , " RX2Frequency " OK
	query command	AT+CRXP?	+CRXP:<RX1DRoffest>,<RX2DataRate>,<RX2Frequency> OK
	set command	AT+CRXP=<RX1DRoffest>,<RX2DataRate>,<RX2Frequency>	OK
	Parameter Description	<RX1DRoffest>, <RX2DataRate>, <RX2Frequency> see the LoRaWAN protocol for details.	
	Return value description		
	example	AT+CRXP=1,1,471000000	

		OK	
	Precautions	Needs to be setup before sending data. Do not set the default value	
command character	command type	command format	response
CRX1DELAY (**set the number of times to send**)	test command	AT+CRX1DELAY=?	+CRX1DELAY: “ Delay ” OK
	query command	AT+CRX1DELAY?	+CRX1DELAY:<Delay> OK
	set command	AT+CRX1DELAY=<Delay>	OK
	Parameter Description	Delay: how long to open the RX1 window after sending, unit: s;	
	Return value description		
	example	AT+CRX1DELAY=2 OK	
	Precautions	Set how long to open the RX1 window after sending, set before sending data. It is the protocol default value when not set.	
command character	command type	command format	response
CSAVE (**Save MAC parameter settings**)	test command	AT+CSAVE=?	+CSAVE OK
	set command	AT+CSAVE	OK
	Parameter Description	<MType>: 0: unconfirm package, 1: confirm package. <value>: It is the maximum sending times, value range: 1~15;	
	Return value description		
	example	This command saves the configuration parameters to EERPOM/FLASH. After executing the AT+RESET command, the module will use the new MAC configuration parameters for network initialization and operation.	
	Precautions	Need to save before sending data	
command character	command type	command format	response
CRESTORE (**restore MAC default parameters**)	test command	AT+CRESTORE=?	+CRESTORE OK
	set command	AT+CRESTORE	OK
	Parameter Description	This command restores MAC default configuration parameters to EERPOM/FLASH.	

	Return value description		
	example	AT+CRESTORE OK	
	Precautions		
command character	command type	command format	response
IREBOOT (**restart mod**)	test command	AT+IREBOOT=?	+IREBOOT: "Mode" OK
	set command	AT+IREBOOT=<mode>	OK
	Parameter Description	<mode>: restart mode; 0: Restart the communication module immediately. 1: Wait for the wireless frame currently being sent in the communication module to complete before restarting.	
	Return value description		
	example	AT+IREBOOT=1 OK	
	Precautions	After the communication module receives the command, it replies OK and restarts the communication module. Before the restart is complete, no subsequent AT commands will be received.	

important statement

1. Ebyte reserves the right of final interpretation and modification of all contents in this manual.
2. Due to the continuous improvement of the hardware and software of the product, this manual may be changed without prior notice, and the latest version of the manual shall prevail.
3. Protecting the environment is everyone's responsibility: In order to reduce the use of paper, only the Chinese part of this manual is printed, and the English manual only provides electronic documents. If necessary, please download from our official website; We only provide product manuals according to a certain proportion of the order quantity, not every digital radio station is matched one by one, please understand.

Revise history

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1.0	2023-01-11	first edition	LM

About Us

Technical support: support@cdebyte.com
Documents and RF Setting download link: https://www.cdebyte.com
Thank you for using Ebyte products! Please contact us with any questions or suggestions: info@cdebyte.com
---
Official hotline:028-61399028
Web: https://www.cdebyte.com
Address: Building B5, Mould Industrial Park, 199# Xiqu Ave, High-tech Zone, Chengdu, 611731, Sichuan, China

成都亿佰特电子科技有限公司
Chengdu Ebyte Electronic Technology Co.,Ltd.