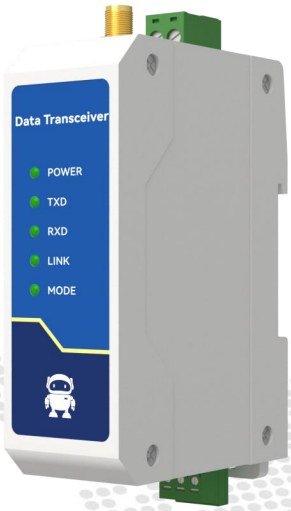
Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual



E95-DTU(xxxLN22-485)

LoRaWan Node Data Transceiver

CLASS-A/CLASS-C

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1. Product Overview

1.1 Product Introduction



The E95-DTU (xxxLN22-485) is a wireless data transmission node radio designed with LoRaWAN technology. It supports CLASS-A/CLASS-C node types and both ABP and OTAA network access methods. The E95-DTU (400LN22-485) supports the EU433/CN470 standards of LoRaWAN 1.0.3 , and the E95-DTU (900LN22-485) supports the EU868/US915/AU915/AS923/IN865/KR920/RU864 standards of LoRaWAN 1.0.3 . The DTU provides an RS485 interface, allowing users to access a standard LoRaWAN network through AT commands or simple configuration on a host computer . It supports transparent transmission and script-based timed data collection. It uses a plastic housing, a DIN-rail mounting structure, and supports a wide voltage input range of 8 to 28 V (DC). LoRa spread spectrum technology will bring a longer communication distance and has the advantage of strong anti-interference ability.

1.2 Features

★ Under ideal conditions, the communication distance can reach 5km;
★ E95-DTU (400LN22-485) supports LoRaWAN 1.0.3 EU433/CN470 standards;
★ E95-DTU (900LN22-485) supports LoRaWAN 1.0.3 EU868 /US915/AU915/AS923/IN865/KR920/RU864 standards;
★ Supports Class A and Class C equipment types;
★ Support ABP/OTAA two network access methods;
★ Support transparent transmission and script timing data collection function;
★ The maximum transmit power can reach 22 dBm, adaptive according to the protocol ;
★ Support AT commands and host computer configuration , which makes it more convenient to use;
★ Adopt flame-retardant plastic shell and guide rail installation structure, which makes installation convenient and efficient;
★ Simple and efficient power supply design, supports power adapter or cable pressing, 8~28V (DC) wide voltage supply;
★ Working temperature range: -40℃～+85℃, adaptable to various harsh working environments, a true industrial-grade product;
★ Multiple protection functions such as power reverse connection protection, over connection protection, antenna surge protection, etc. greatly increase the reliability of The DTU;
★ Communication ports and power interfaces adopt isolation and high protection;

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Note ① : E95-DTU(xxxLN22-485) represents: E95-DTU(400LN22-485) , E95-DTU(900LN22-485)

1.3 Terms and Definitions

1.3.1 LoRa

LoRa is a type of LPWAN communication technology. Its full name is Long Range Radio, which means "long-range radio" in Chinese. LoRa mainly operates in the ISM brand global free frequency band, mainly including: 433MHz, 470MHz, 868MHz, 915MHz and other frequencies, and has the characteristics of low power consumption, long distance and low cost.

1.3.2 LoRaWAN

The LoRaWAN protocol standard is a low-power wide area network (LPWAN) standard based on an open-source MAC layer protocol, released by the LoRa Alliance. The LoRa Alliance is an open, non-profit organization founded in March 2015 by Semtech. The LoRaWAN protocol supports a star network topology, consisting primarily of LoRaWAN nodes, gateways (also known as base stations), and servers (including network servers, network control, and application servers).

LoRaWAN divides LoRaWAN nodes into three categories: A/B/C:

- **Bidirectional transmission terminal (Class A)** :

Class A terminals implement two short downlink receive windows immediately following each uplink, enabling bidirectional transmission. Terminals schedule transmission slots based on their own communication needs, with minimal variation based on random timing (i.e., the ALOHA protocol). This Class A operation provides applications with the lowest power consumption, requiring only a short downlink transmission from the server following the terminal's uplink. Any downlink transmission from the server at any other time must wait for the next uplink from the terminal.

- **Bidirectional transmission terminal with designated receive time slots (Class B):**

Class B devices have more receive slots. In addition to the random receive windows of Class A, Class B devices also open receive windows at designated times. To ensure these windows are open at designated times, the device must receive a time-synchronized beacon from the gateway. This allows the server to know when the device is listening.

- **Bidirectional transmission terminal (Class C) that maximizes receive time slots:**

Class C terminals keep their receive windows open almost constantly, closing them only briefly to send data. Class C terminals consume more power than Class A and Class B terminals, but they also offer the shortest latency from server to terminal.

Note: E95-DTU (xxxLN22-485) supports Class A and Class C devices .

1.3.3 ADR

ADR stands for Adaptive Data Rate. In a LoRaWAN network system, to maximize the battery life of end devices and overall network capacity, the LoRaWAN network server manages the data rate and RF output of each end device individually through an adaptive data rate (ADR) algorithm. Through ADR technology, the server automatically updates the data rate of each node in the LoRaWAN system based on the node's signal reception capabilities, with lower rates for longer distances and higher rates for shorter distances. This maximizes the network's effective bandwidth and carrying capacity in practical applications.

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1.3.4 Lo RaWAN Application Model Diagram

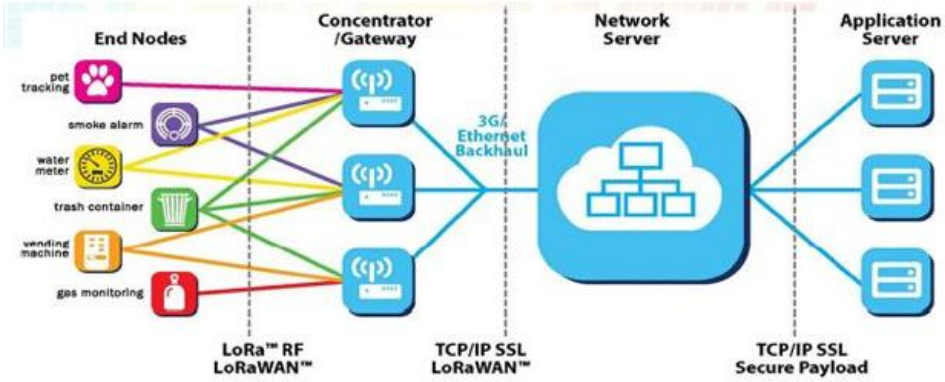


Figure 1 LoRaWAN application diagram

The complete LoraWan network system consists of nodes, gateways, Lora NetWork Servers, and application servers. Nodes are generally designed with Lora chips; gateways are designed with the SX1301 provided by Semtech; Lora NetWork Servers currently have open source chirpstack or commercial TTN (The Things Network) in the industry, which users can build themselves; application servers are custom designed and developed by users and are mainly used to exchange application data with the Lora NetWork Server.

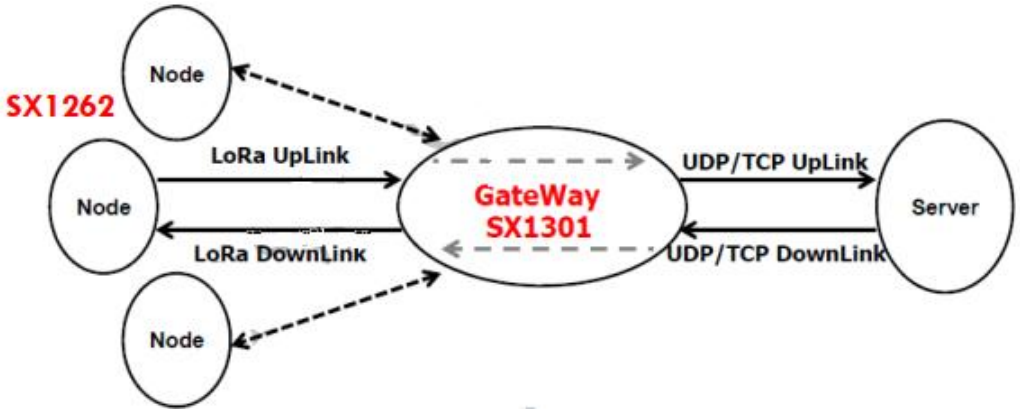


Figure 2 Application structure diagram

1.4 Quick Start

① You need to prepare one E95-DTU (xxxLN22-485) , one antenna, one DC 8V~28V power adapter, one USB to RS485 converter (or other converter), and one cable (including a 3- pin 3.81 male Phoenix connector).

② First, install the antenna on the digital radio. Then power on the DTU through the power adapter and connect the cables, A+ to A and B- to B.



③ Finally, connect the computer to the data transmission node radio via USB to RS485 (or other methods);

④ Start the serial port debugging assistant, select the serial port baud rate as 9600bps (default) and 8N1, and then configure the

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network parameters through AT commands or the host computer (which can be downloaded from the Ebit official website. For the use and introduction of the host computer, please refer to Chapter 8 of this article for detailed configuration software). 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.

⑤ Access Demo:

- This demonstration kit uses the E95-DTU (400LN22-485) device as a node and the Ebyte E870-L470LG12 as a gateway to access the free ChirpStack Application Server test server for communication testing;
- First, build the chirpstack server by yourself, connect to the gateway and then configure the server node parameters chirpstack to build ;

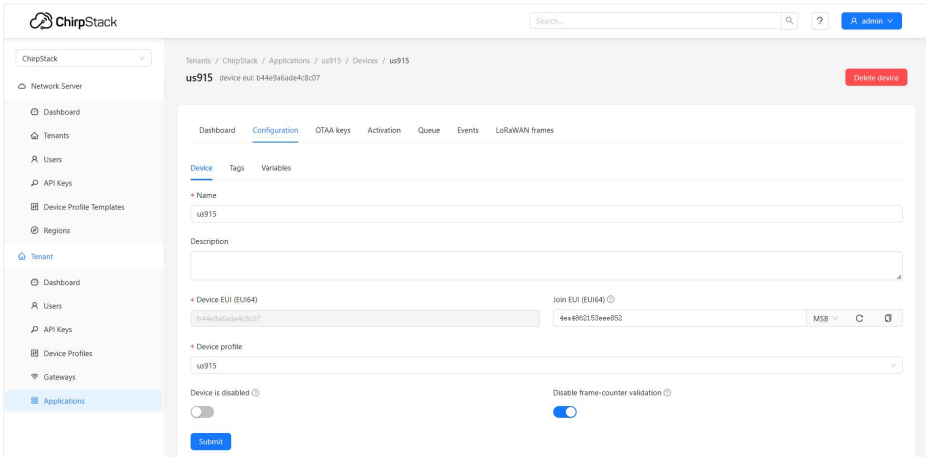


Figure 3 Server access interface

- the node end using the US915 frequency band OTAA access method are as follows:
  - First select the corresponding serial port to open, and then read the basic parameters.



Figure 4 Upper computer parameter reading interface

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- First set the working frequency band and then set the OTAA network access parameters: APPEUI corresponds to the join EUI on chirpstack, DEVEUI corresponds to the Device EUI on chirpstack , and APPKEY corresponds to the OTAA keys-->Application key on chirpstack .

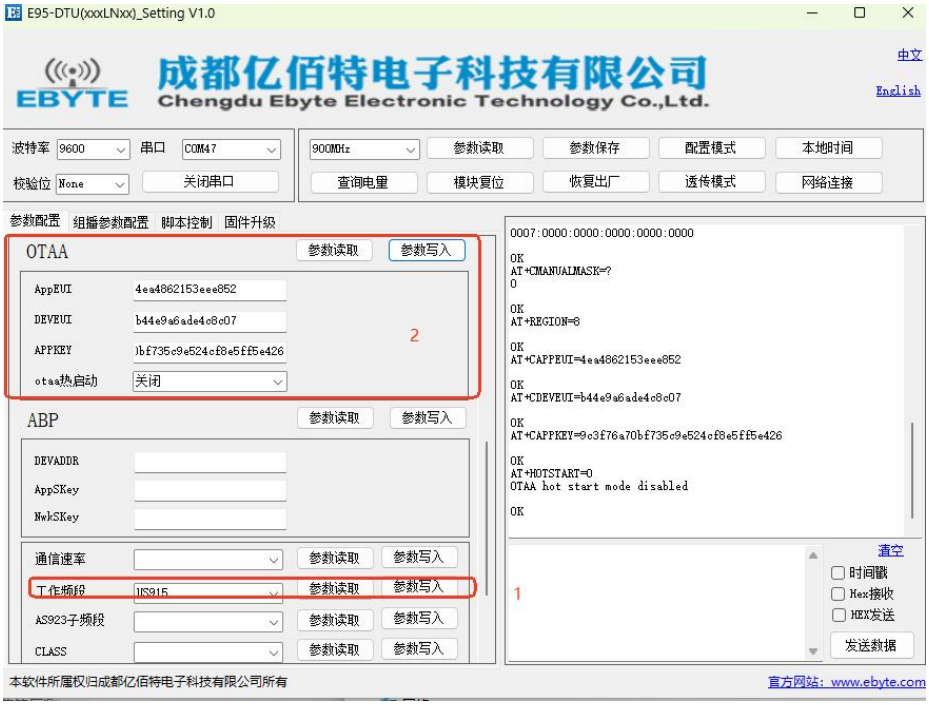


Figure 5 OTAA parameter setting interface

- After the configuration is complete, connect to the network. If the network connection fails, open the log to check whether the sending frequency is correct. If the network connection is successful, the link light will be on .



Figure 6 Network access interface

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➢ Switch to transparent transmission mode to send and receive data .



Figure 7 Transparent data sending interface

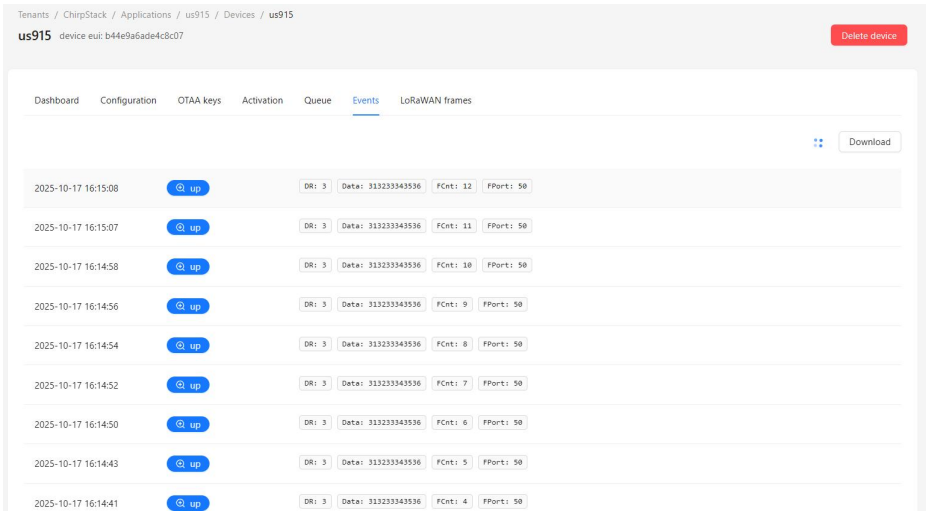


Figure 8 Server data receiving interface

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➢ The default mode is class A. Data can only be sent in the window after uploading data. Enter the data to be sent in the device's Queue and click enqueue to send it .

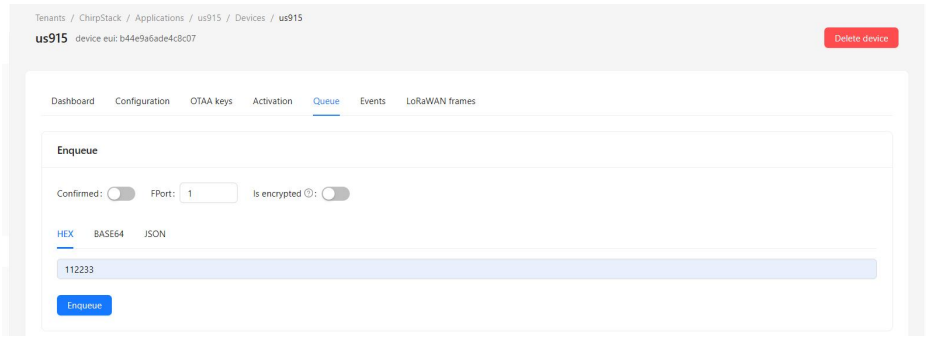


Figure 9 Server data delivery interface



Figure 10 Serial Port Assistant receives data

➢ Enable class C in chirpstack, then enter the configuration mode of DTU to enable class C. After powering on again, you need to send a packet of arbitrary data first, and then the server can send data consistently.



Figure 11 Class-c enabled

Note 1: For TTN device creation and corresponding configuration process, please refer to the "LORAWAN Node + Gateway TTN Server Configuration Tutorial"

Note 2: The DTU has a power-off saving mode function (the factory default setting is transparent transmission mode).

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1.5 Script Collection

Step 1: Open the host computer and enter the configuration mode, click on the query script configuration. By default, there is no setting and the data part is empty.



Figure 12 Script configuration interface

Step 2: Fill in the data for the ID1 and ID2 scripts and write them. After writing, click Enable for Script 1 and Script 2. After configuration is complete, the device enters transparent transmission mode and begins outputting periodically . Connect the serial port to a serial port tool with a response function to simulate the sensor response . You can see that the device transmits the response data to the server.

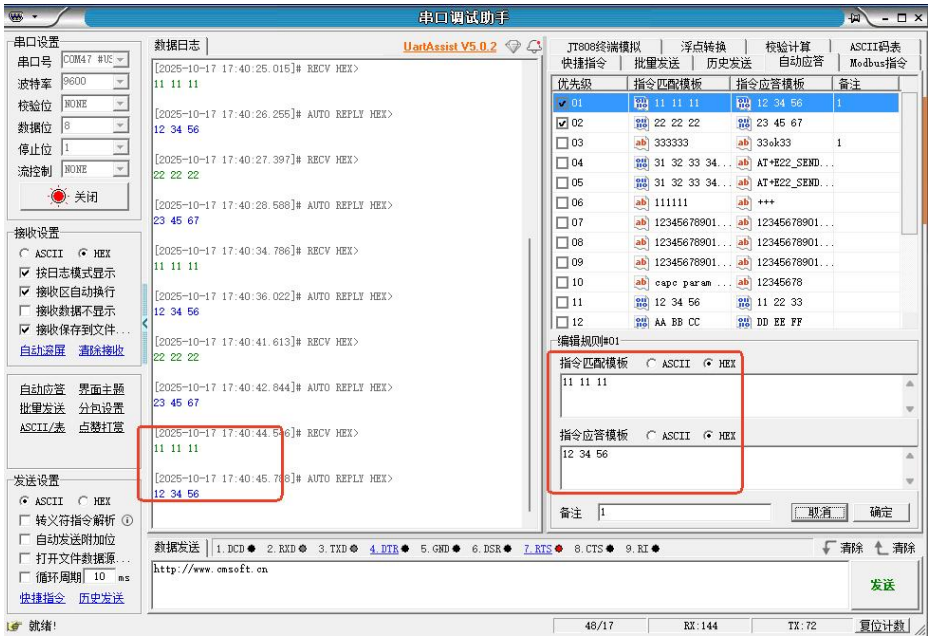


Figure 13 Data periodic sending interface

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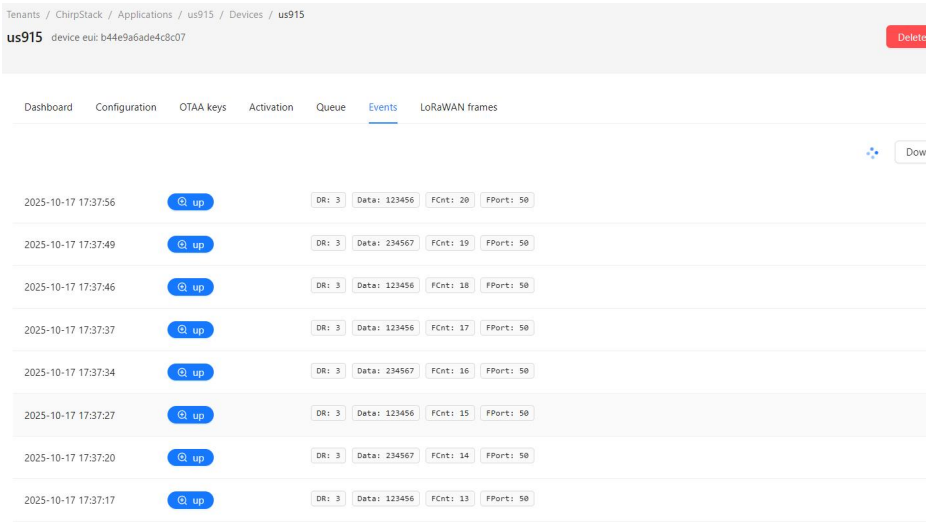
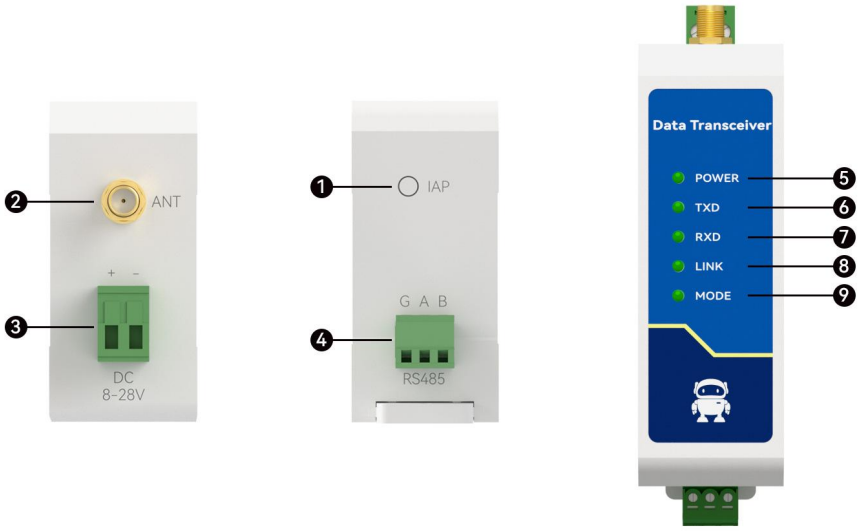


Figure 14 Server data receiving interface

1.6 Description of each component



Serial number	name	Function	illustrate
1	IAP	Firmware online upgrade button	Press and hold for about 2 seconds before powering on. The module will immediately enter the upgrade mode after powering on , and the serial port will print "C" at the same time.
2	ANT	RF interface	SMA-K, external threaded inner hole.
3	Power interface①	+ (VCC)	Power positive (DC 8~28V)
		- (GND)	Power ground
4	Communication	RS485 signal A	RS485 signal A
		RS485 signal B	RS485 signal B

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Serial number	name	Function	illustrate
	interface②	GND	signal ground
5	POWER	Power indicator	Lights up when the power is on , the color is red
6	TXD	Send indicator light	and flashes when sending data
7	RXD	Receive indicator	will flash when receiving data .
8	LINK	Network status indicator	The light is off when not connected to the network, and the orange light is on when connected to the network
9	MODE	Working mode indicator light	The configuration mode light is off, and the transparent transmission mode light is on

Note:

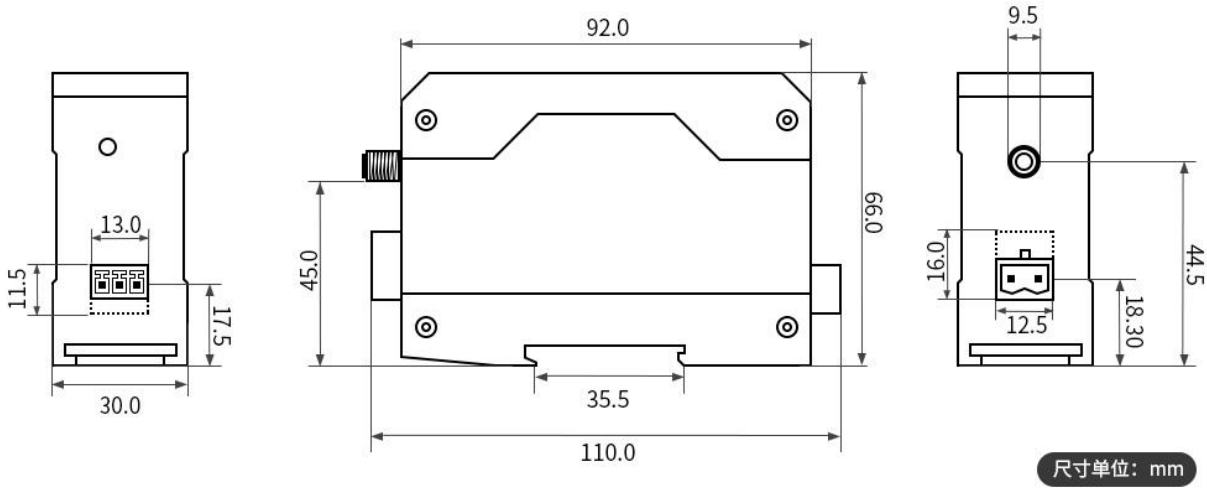
①Power interface: Use 8~28V (DC) power supply, and the connection port uses terminal blocks (2 pins, 5.08mm pitch) for connection.

②Communication interface: Use the terminal block (3 pins, 3.81mm pitch) to connect to the device via RS485. The connection details are shown in the following table:

Serial number	Standard Definition	Function	illustrate
1	G	signal ground	Anti-interference, grounding
2	A	RS485 bus A interface	RS485 interface A is connected to device A interface
3	B	RS485 bus B interface	RS485 interface B is connected to device B interface

★ Note: If communication problems occur when connecting The DTU to multiple devices, but not to a single device, try connecting a 120Ω resistor in parallel between the 485_A and 485_B terminals.

1.7 Installation dimensions



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2. Technical Parameters

2.1 Model Specifications

Model specifications	Operating frequency	Transmit power	Reference distance	Air speed
	Hz	dBm	km	bps
E95-DTU(400LN22-485)	LoRaWAN 1.0.3 EU433/CN470 standard protocol	twenty two	5	Adaptive
E95-DTU(900LN22-485)	LoRaWAN 1.0.3 EU868 /US915/AU915/AS923/IN865/KR920/RU864 standard protocols	twenty two	5	Adaptive

★ Note: Sunny weather, open space with no obstructions, 12V/1A power supply, 5dBi suction cup antenna, antenna height approximately 2 meters, using factory default parameters.

2.2 General Specifications

Serial number	project	Specification	illustrate
1	Product size	92*66*30 mm	See Section 1.5 for installation dimensions.
2	Product weight	95 g	Weight tolerance 5g
3	Operating temperature	-40℃～+85℃	Industrial grade
4	Voltage range	8～28V（DC）	It is recommended to use 12V or 24V
5	Communication interface	RS485	3.81 mm terminal blocks
6	Baud rate	Factory default 9600	Baud rate range: 1200～115200

2.4 Transmit Power Level

Model specifications	0 (factory default)	1	2	3
E95-DTU(400LN22-485)	22dBm	17dBm	14dBm	10dBm
E95-DTU(900LN22-485)				

★ Note: The lower the transmit power, the shorter the transmission distance, but the operating current does not decrease proportionally. It is recommended to use the maximum transmit power.

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2.6 Current parameters

Model specifications	Emission current mA			
	8V	12V	24V	28V
E95-DTU(400LN22-485)	≈95	≈64	≈33	≈29
E95-DTU(900LN22-485)				

★ Note: The output power is set to the maximum. It is recommended to retain more than 50% current margin when selecting the power supply, which is conducive to the long-term stable operation of The DTU.

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3. Command Access Demonstration

The demo kit includes: E95-DTU (xxxLN22-485) as a node and E890 as a gateway to access the free TTN (TheThingsNetwork) test server for communication testing; baud rate 9600bps 8N1

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

- +++ //Enter configuration mode
- AT+RESTORE //Restore default configuration, not required for first use (if DEVEUI, APPEUI, APPKEY have been changed after logging in to the network)
- AT+REGION=5 //eu868 frequency band
- AT+CDEVEUI=70B3D57ED0063EC9 //Set deveui
- AT+CAPPEUI=000000000000000 //Set appeui
- AT+CAPPKEY=2000000000000000000000000000001 //Set appkey
- AT+CJOIN=1:0 //otaa network access, automatically access the network without power on
- AT+TRANSPARENT //Enter transparent transmission
- On TTN, the gateway information is as follows:

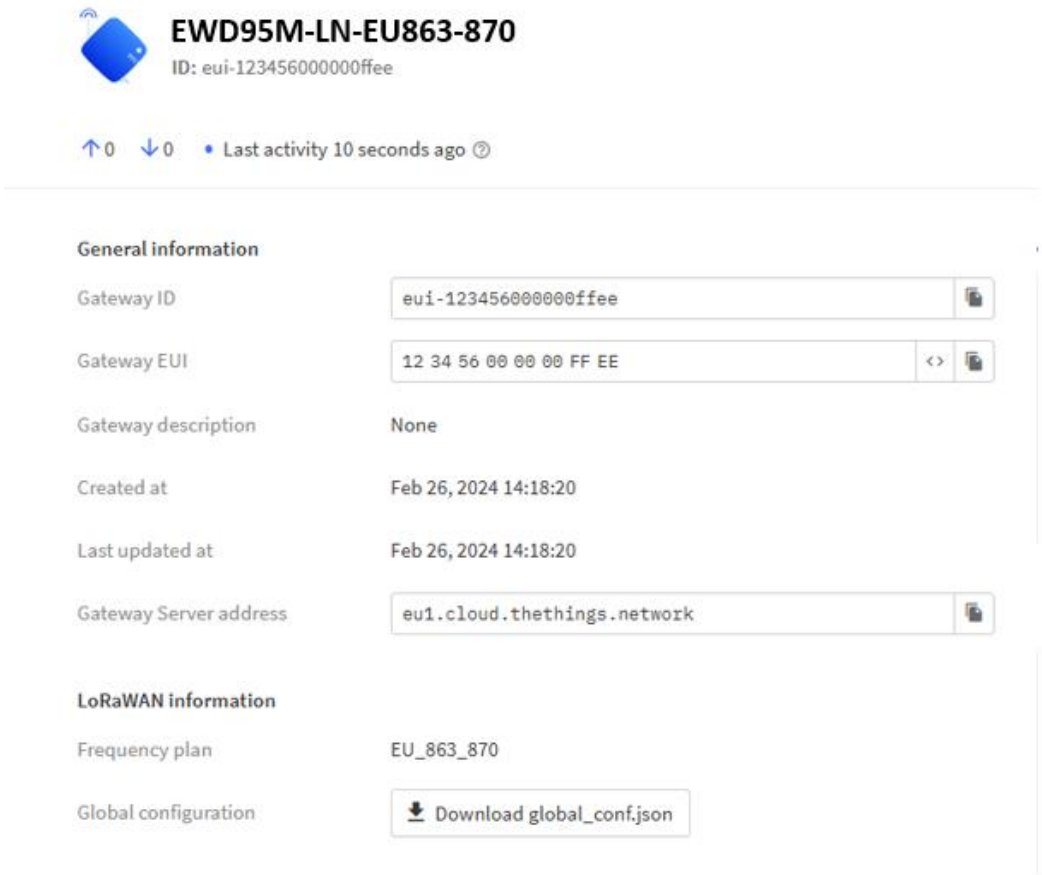


Figure 15 Gateway information

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- The gateway data is as follows:

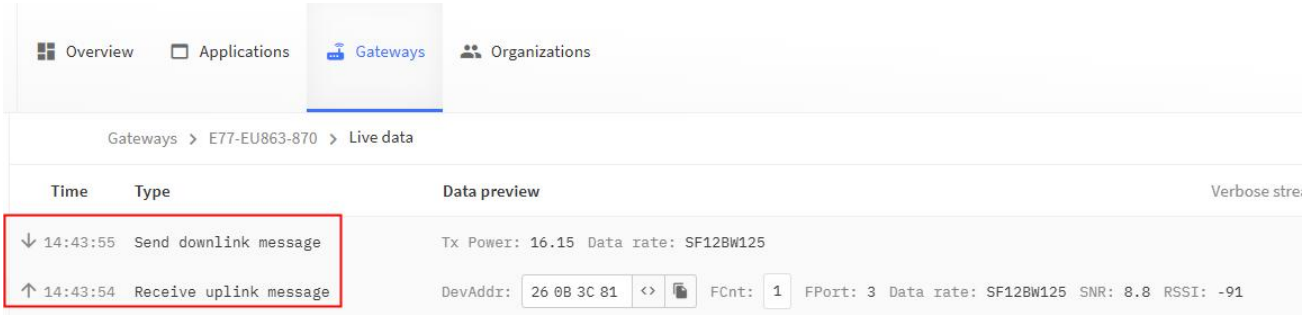


Figure 16 Gateway data

- The node is in transparent transmission mode and sends data directly: 112233
- TTN node data records are as follows:

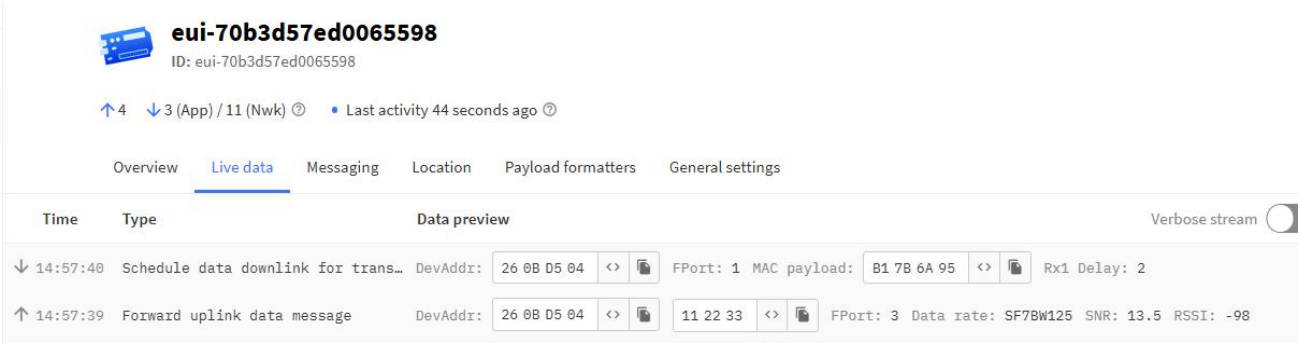


Figure 17 TTN node data record

- Node serial port:

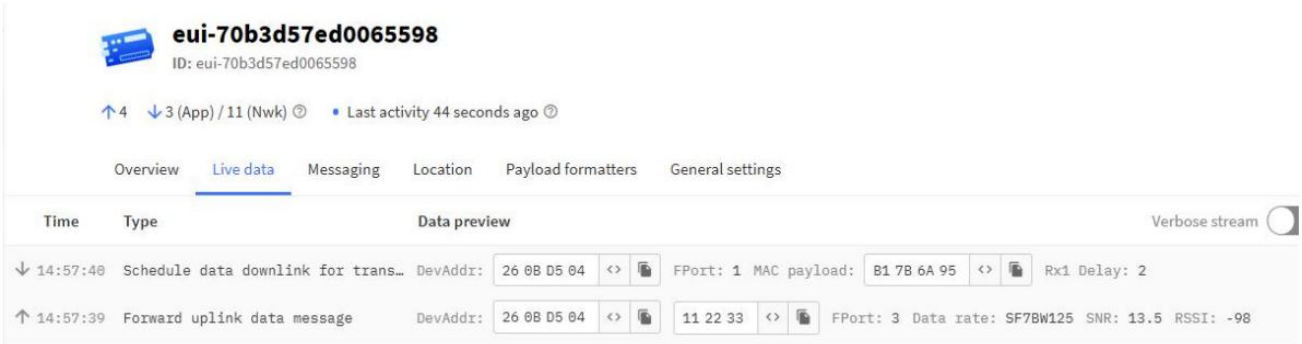


Figure 18 Node serial port

Note: For TTN device creation and corresponding configuration process, please refer to the "LORAWAN Node + Gateway TTN Server Configuration Tutorial"

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4. AT commands

4.1 Instruction Format

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

: Command prefix

CMD: Control command

[op]: instruction operator. It can be the following:

“=”: indicates parameter setting.

“?”: Indicates querying the parameters of the setting command.

“<empty>”: indicates execution of instructions.

“=?”: Indicates the current value of the query parameter.

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

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

4.2 AT Command Set

instruction	Description (General Command)
AT	Test Instructions
AT+VER	Read lorawan version information
AT+FWCODE	Read software code
AT+DEVTYPE	Read device model
AT+LOGLEVEL	Set the log level
AT+UART	Set the serial port baud rate and parity bit
AT+IAP	IAP Upgrade
AT+LTIME	Get local time
AT+RESTORE	Restore default parameters
AT+CSAVE	Save current parameters
AT+RST	Command reset
AT+BAT	Check battery level
AT+REGION	Setting regional options
AT+CCLASS	Set the device type
AT+DUTYCYCLE	Set whether to enable the duty cycle
AT+CTXP	Set the transmit power
AT+CAPPEUI	Set up APPEUI (for OTAA network access)
AT+CDEVEUI	Set up DEVEUI (for OTAA network access)
AT+CAPPKEY	Set APPKEY (for OTAA network access)
AT+CNWKSKEY	Set NWKSKEY (for ABP network access)
AT+CAPPSKEY	Set APPSKEY (for ABP network access)
AT+CDEVADDR	Set up DEVADDR (for ABP network access)
AT+CJOIN	Network access

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instruction	Description (General Command)
AT+SEND	Sending Data
AT+CNWKID	Set the port number
AT+LINKC	Query link status
AT+CFREQBANDMASK	Set the channel mask
AT+CADR	Setting Airspeed Adaptation
AT+CDATARETE	Set airspeed
AT+CJN1DL	Set the rx1 time for network access
AT+CJN2DL	Set the time to join the network rx2
AT+CRX1DL	Set rx1 time
AT+CRX2DL	Set rx2 time
AT+CRX2FQ	Set the rx2 receiving frequency
AT+TRANSPARENT	Enter transparent transmission mode
+++	Exit transparent transmission mode
AT+SENDCFG	Transparent transmission configuration
AT+SCFG	Script configuration
AT+SEN	Script Enablement
AT+HB	Heartbeat packet configuration
AT+FASTSEND	Quick Send Configuration
AT+HOTSTART	OTAA hot start

4.3 AT command description

Command characters	Command Type	Command format	response
AT (Test)	Execute instructions	AT	OK
	Example	AT OK	
	illustrate	Test whether the AT command is normal	
Command characters	Command Type	Command format	response
VER (read protocol related information)	Test Command	AT+VER?	AT+VER Get the FW version
	Query Command	AT+VER= ?	APPLICATION_VERSION:<version> L2_SPEC_VERSION:<version> RP_SPEC_VERSION: <version>
	Parameter Description	APPLICATION_VERSION: SDK version number L2_SPEC_VERSION: lorawan version RP_SPEC_VERSION: lorawan regional version	
	Return value description		

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	Example	AT+VER=? APPLICATION_VERSION: V1.3.0 L2_SPEC_VERSION: V1.0.4 RP_SPEC_VERSION: V2-1.0.1 OK	
	Precautions	-	
Command characters	Command Type	Command format	response
FWCODE (Read software code)	Test Command	AT+FWCODE?	AT+FWCODE Get firmware code OK
	Query Command	AT+FWCODE=?	FWCODE=<code> OK
	Parameter Description	<code>: software code	
	Return value description		
	Example	AT+FWCODE=? FWCODE=748 3 -1-10 OK	
	Precautions	-	
Command characters	Command Type	Command format	response
DEVTYPE (Read device model)	Test Command	AT+DEVTYPE?	AT+DEVTYPE Get Device type
	Query Command	AT+DEVTYPE=?	DEVTYPE=<type> OK
	Parameter Description	<type>: device model	
	Return value description		
	Example	AT+DEVTYPE=? DEVTYPE= E95-DTU(400LN22-485) OK	
	Precautions	-	
Command characters	Command Type	Command format	response
LOGLEVEL (Set log level)	Test Command	AT+LOGLEVEL?	AT+LOGLEVEL=<Level><CR>. Set the log Verbose Level=[0:Off, 1:On] OK
	Query Command	AT+LOGLEVEL=?	<Level> OK
	Setting	AT+LOGLEVEL=<Level>	OK

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	Commands		
	Parameter Description	<Level> : Log level	
	Return value description	Range: 0-1, 0 is off, 1 is on	
	Example	AT+LOGLEVEL=1 OK AT+LOGLEVEL=? 1 OK	
	Precautions	The default level is 0, and it will not be saved after power failure.	
Command characters	Command Type	Command format	response
UART (Set baud rate)	Test Command	AT+UART?	AT+UART=<baud>:<parity>. Get or Set Uart baud and parity OK
	Query Command	AT+UART=?	<baud> : <parity> OK
	Setting Commands	AT+UART= <baud> : <parity>	OK
	Parameter Description	<baud> : baud rate [0-2] 0 : 2400 1 : 4800 2 : 9600 <parity> : check digit [0-2] 0 : 8N1 1 : 8E1 2 : 8O1	
	Return value description		
	Example	AT+UART=2:0 OK AT+UART=? 2:0 OK	
	Precautions	Re-power on to take effect	
Command characters	Command Type	Command format	response
IAP (Online Upgrade)	Test Command	AT+IAP?	AT+IAP IAP Upgrade OK
	Execute Command	AT+IAP	AT+IAP=OK
	Parameter Description	-	
	Return value description		
	Example	AT+IAP	

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		AT+IAP = OK C C C	
	Precautions	User IAP upgrade does not require this command to be executed. You can use our matching upgrade host to send	
Command characters	Command Type	Command format	response
LTIME (Get local time)	Test Command	AT+LTIME?	AT+LTIME Get the local time in UTC format OK
	Query Command	AT+LTIME=?	LTIME:<h><m><s> on day/month/year/ OK
	Parameter Description	h: hour m: minutes s: seconds	
	Return value description		
	Example	AT+LTIME=? LTIME:00h00m00s on 01/01/1970 OK	
	Precautions	Each power-on starts at 00h00m00s on January 1, 1970	
Command characters	Command Type	Command format	response
RESTORE (Restore default configuration)	Test Command	AT+RESTORE?	AT+RESTORE: Restore EEPROM Factory Settings OK
	Execute Command	AT+RESTORE	OK
	Parameter Description	-	
	Return value description		
	Example	AT+RESTORE OK	
	Precautions	-	
Command characters	Command Type	Command format	response
CSAVE (Save parameters)	Test Command	AT+CSAVE?	AT+CSAVE: Store current context to EEPROM OK
	Execute Command	AT+CSAVE	NVM DATA STORED OK
	Parameter Description	-	
	Return value description		
	Example	AT+CSAVE	

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		NVM DATA STORED OK	
	Precautions	-	
Command characters	Command Type	Command format	response
AT+RST (Restart module)	Test Command	AT+RST ?	AT+RST Trig a MCU reset OK
	Setting Commands	AT+RST	OK
	Parameter Description	-	
	Return value description		
	Example	AT+RST OK	
	Precautions	After receiving this command, the communication module replies OK and restarts the communication module. Before the restart is complete, it will no longer receive any subsequent AT commands.	
Command characters	Command Type	Command format	response
BAT (Battery level)	Test Command	AT+BAT?	AT+BAT Get the battery Level in mV OK
	Query Command	AT+BAT=?	<value>
	Parameter Description	<value>: Current power supply voltage, in mv	
	Return value description		
	Example	AT+BAT=? 3300 OK	
	Precautions	-	
Command characters	Command Type	Command format	response
REGION (Set the operating frequency band)	Test Command	AT+REGION?	AT+REGION=<BandID><CR>. Get or Set the Active Region BandID=[0:AS923, 1:AU915, 2:CN470, 4:EU433, 5:EU868, 6:KR920, 7:IN865, 8:US915, 9:RU864] OK
	Query Command	AT+REGION=?	<region> OK
	Setting Commands	AT+REGION=<region>	OK

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	Parameter Description	<region>: Regional Standards	
	Return value description	0:AS923 1:AU915 2:CN470 4:EU433 5:EU868 6:KR920 7:IN865 8:US915 9:RU864	
	Example	AT+REGION=? 5:EU868 OK AT+REGION=5 OK	
	Precautions	You need to set it before joining, and use AT+RESTORE to restore the default configuration before switching regions.	
Command characters	Command Type	Command format	response
CCLASS (Set Class)	Test Command	AT+CCLASS?	AT+CCLASS=<Class><CR>. Get or Set the Device Class=[A, C] OK
	Query Command	AT+CCLASS=?	+CCLASS:<class> OK
	Setting Commands	AT+CCLASS=<class>	OK
	Parameter Description	<class>: A, Class A mode, receiving only opens a window after sending C, Class C mode, reception is always on	
	Return value description		
	Example	AT+CCLASS=C ：+EVT:SWITCH_TO_CLASS_C OK //Not connected to the network AT+CCLASS=C AT_NO_NETWORK_JOINED	
	Precautions	The network access is CLASS A. If you want to switch to CLASS C, you need to execute it after the network access, otherwise an error will be reported.	
Command characters	Command Type	Command format	response
DUTYCYCLE (Set duty cycle)	Test Command	AT+DUTYCYCLE?	AT+DUTYCYCLE=<DutyCycle><CR>. Get or Set the ETSI DutyCycle=[0:disable, 1:enable] - Only for testing

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	Query Command	AT+DUTYCYCLE=?	<DutyCycle> OK
	Setting Commands	AT+DUTYCYCLE== <DutyCycle>	OK
	Parameter Description	<DutyCycle> 0: Disable ETSI duty cycle 1: Enable ETSI duty cycle	
	Return value description		
	Example	AT+DUTYCYCLE = 0 OK	
	Precautions	After turning on DCS, the data transmission frequency complies with the lorawan protocol standard, and the duty cycle is generally 1%. After sending a packet of data at low airspeed, it takes a long time to send the next packet.	
Command characters	Command Type	Command format	response
CTXP (Setting transmit power)	Test Command	AT+CTXP?	+CTXP: “ value ” OK
	Query Command	AT+CTXP=?	+CTXP:<value> OK
	Setting Commands	AT+CTXP=<value>	OK
	Parameter Description	<value>: The sending power, the factory value is 0, different regional standards, the maximum power is different	
	Return value description	0 - 17dBm 1 - 15dBm 2 - 13dBm 3 - 11dBm 4 - 9dBm 5 - 7dBm 6 - 5dBm 7 - 3dBm	
	Example	AT+CTXP=1 OK	
	Notice	The power here is the standard of cn470, which varies in different regions. See Appendix 2	
Command characters	Command Type	Command format	response
CAPPEUI (**Set up AppEUI**)	Test Command	AT+CAPPEUI?	AT+CAPPEUI=<XXXXXXXXXXXXXXXX><CR>. Get or Set the App Eui
	Query Command	AT+CAPPEUI=?	<appeui> OK
	Setting Commands	AT+CAPPEUI=<appeui>	OK
	Parameter Description	<appeui>: node AppEUI Length 8 bytes, format hexadecimal	

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	Return value description		
	Example	AT+CAPPEUI=AABBCCDD00112233 OK	
	Precautions	Parameters are automatically saved after entering the network	
Command characters	Command Type	Command format	response
CDEVEUI (Set up DEVEUI)	Test Command	AT+CDEVEUI?	AT+CDEVEUI=<XXXXXXXXXXXXXXXX><CR>. Get or Set the Device EUI OK
	Query Command	AT+CDEVEUI=?	+CDEVEUI:<deveui> OK
	Setting Commands	AT+CDEVEUI=<deveui>	OK
	Parameter Description	<deveui>: node DevEUI Length 8 bytes, format hexadecimal	
	Return value description		
	Example	AT+CDEVEUI? +CDEVEUI=AABBCCDD00112233 OK	
	Precautions	The current parameters will be automatically saved after entering the network	
Command characters	Command Type	Command format	response
CAPPKEY (**Set AppKey**)	Test Command	AT+CAPPKEY?	AT+CAPPKEY=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX><CR>: Get or Set the Application Key OK
	Query Command	AT+CAPPKEY=?	<APPKEY> OK
	Setting Commands	AT+CAPPKEY =<APPKEY>	OK
	Parameter Description	<APPKEY>: Node APPKEY Length: 16 bytes, format: hexadecimal	
	Return value description		
	Example	AT+CAPPKEY= 20000000000000000000000000000001 OK	
	Precautions	The current parameters will be automatically saved after entering the network	
Command characters	Command Type	Command format	response
CDEVADDR (**Set DevAddr**)	Test Command	AT+CDEVADDR?	AT+CDEVADDR=<XX:XX:XX:XX><CR>. Get or Set the Device address

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			OK
	Query Command	AT+CDEVADDR=?	+CDEVADDR:<DEVADDR> OK
	Setting Commands	AT+CDEVADDR =<DEVADDR>	OK
	Parameter Description	<DEVADDR>: Node DevAddr Length: 4 bytes, format: hexadecimal	
	Return value description		
	Example	AT+CDEVADDR=00:11:22:33 OK	
	Precautions	Used when ABP, the current parameters will be automatically saved after entering the network	
Command characters	Command Type	Command format	response
CAPPSKEY (Set **AppSKey**)	Test Command	AT+CAPPSKEY?	AT+CAPPSKEY=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX><CR>: Get or Set the Application Session Key OK OK
	Query Command	AT+CAPPSKEY=?	<appskey> OK
	Setting Commands	AT+CAPPSKEY= =<appskey>	OK
	Parameter Description	<appskey>: node AppSKey Length: 16 bytes, format: hexadecimal	
	Return value description		
	Example	AT+CAPPSKEY= 20000000000000000000000000000001 OK	
	Precautions	Used when ABP, the current parameters will be automatically saved after entering the network	
Command characters	Command Type	Command format	response
CNWKSKEY (**Set NwkSKey**)	Test Command	AT+CNWKSKEY?	AT+CNWKSKEY=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX><CR>: Get or Set the Network Session Key OK
	Query Command	AT+CNWKSKEY=?	<nwkskey> OK
	Setting Commands	AT+CNWKSKEY=<nwkskey>	OK
	Parameter Description	<nwkskey>: Node NwkSKey Length: 16 bytes, format: hexadecimal	
	Return value description		
	Example	AT+CNWKSKEY= 20000000000000000000000000000001	

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		OK	
	Precautions	Used when ABP, the current parameters will be automatically saved after entering the network	
Command characters	Command Type	Command format	response
CNWKID (Set Network ID)	Test Command	AT+CNWKID?	AT+CNWKID=<NwkID><CR>. Get or Set the Network ID=[0..127] OK
	Query Command	AT+CNWKID=?	<nwkid> OK
	Setting Commands	AT+CNWKID=<nwkid>	OK
	Parameter Description	<nwkid>: Network ID	
	Return value description		
	Example	AT+CNWKID=? 0 OK	
	Precautions	No need to set	
Command characters	Command Type	Command format	response
CFREQBANDMASK (Set mask)	Test Command	AT+CFREQBANDMASK?	AT+CFREQBANDMASK Set channel frequency band mask
	Query Command	AT+CFREQBANDMASK=?	<mask0>:<mask1>:<mask2>:<mask3>:<mask4>:<mask5> OK
	Setting Commands	AT+CFREQBANDMASK=<mask0>:<mask1>:<mask2>:<mask3>:<mask4>:<mask5>	OK
	Parameter Description	<mask>: The frequency mask on which the network may operate. One mask represents 16 channels, and mask0 represents the lower 16 channels. For details, see the LoRaWAN access specification. Only cn470, au915, and us915 need to be set	
	Return value description		
	Example	AT+CFREQBANDMASK= 0007 : 0000 : 0000 : 0000 : 0000 : 0000 OK	
Command characters	Command Type	Command format	response
CJOIN (Set Join)	Test Command	AT+CJOIN?	AT+CJOIN=<Mode>:<autojoin><CR>. Join network with Mode=[0:ABP, 1:OTAA] OK
	Setting Commands	AT+CJOIN=<mode>:<auto_join>	If the input is legal, it will first return OK and then start automatic authentication. The authentication result is returned. +EVT:JOINED Authentication successful +EVT:JOIN FAILED Authentication failed

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	Parameter Description Return value description	<mode>: Network access mode 0: ABP mode. This mode does not require network access. Executing this command only switches the local state. 1: OTAA mode, access the network over the air <auto_join>: Whether to automatically join the network after power on	
	Example	AT+CJOIN=1:0 OK +EVT:JOINED	
Command characters	Command Type	Command format	response
SEND (**Sending data**)	Test Command	AT+SEND?	AT+SEND=<Port>:<Ack>:<Payload><CR>. Send binary data with the application Port=[1..199] and Ack=[0:unconfirmed, 1:confirmed] OK
	Setting Commands	AT+SEND=<Port>:<Nbtarns>:<Ack>:<Payload><CR>	+EVT:SEND_CONFIRMED +EVT:RX_1, PORT 0, DR 3, RSSI -49, SNR 10 AT_NO_NETWORK_JOINED AT_DUTYCYCLE_RESTRICTED
	Parameter Description Return value description	<Port>: port number <Nbtarns>: Maximum number of retransmissions when there is ACK <Ack>: Whether to enable the response <Payload>: Hexadecimal data, two digits constitute one byte	
	Example	AT+SEND=3:1:1:112233 ：+EVT:SEND_CONFIRMED +EVT:RX_1, PORT 0, DR 3, RSSI -47, SNR 11	
	Precautions	Access the network first, then send data	
Command characters	Command Type	Command format	response
CADR (Set rate adaptation)	Test Command	AT+CADR?	AT+CADR=<ADR><CR>. Get or Set the Adaptive Data Rate setting ADR=[0:off, 1:on] OK
	Query Command	AT+CADR=?	+CADR:<value> OK
	Setting Commands	AT+CADR=<value>	OK
	Parameter Description Return value description	<value>： As follows: 0: Disable ADR 1: Enable ADR	
	Example		
	Precautions	Enabled by default	
Command characters	Command Type	Command format	response

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CDATARATE (**Set the communication rate**)	Test Command	AT+CDATARATE?	+CDATARATE: “ value ” OK
	Query Command	AT+CDATARATE=?	+CDATARATE:<value> OK
	Setting Commands	AT+CDATARATE =<value>	OK
	Parameter Description	<value>： CN470 is as follows: Rate value range: 0-5	
	Return value description	0 → (SF12, BW125) 1 →(SF11, BW125) 2 →(SF10, BW125) 3 → (SF9, BW125) 4 → (SF8, BW125) 5 → (SF7, BW125)	
	Example	AT+CDATARATE=1 OK	
	Precautions	It needs to be set before sending data. It will be invalid after enabling ADR. That is, it is necessary to set AT+CADR=0 before configuring the speed. The speed range may be different in different regions. See Appendix 1	
Command characters	Command Type	Command format	response
LINKC (**Verify Network Connectivity**)	Test Command	AT+LINKC?	AT+LINKC. Piggyback a Link Check Request to the next uplink
	Execute Command	AT+LINKC	OK
	Parameter Description	-	
	Return value description		
	Example	AT+LINKC OK	
	Precautions	After executing this command, the server will send a response message after the next uplink	
Command characters	Command Type	Command format	response
CJN1DL (Set the network access rx1 window delay)	Test Command	AT+CJN1DL?	AT+CJN1DL=<Delay><CR>. Get or Set the Join Accept Delay between the end of the Tx and the Join Rx Window 1 in ms
	Query Command	AT+CJN1DL?	<Delay> OK
	Setting Commands	AT+CJN1DL=<Delay>	OK
	Parameter Description	<Delay> Gets or sets the Join-Accept Delay (in milliseconds) between the end of Tx and Join-Rx window 1	

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	Return value description		
	Example	AT+CJN1DL= 1000	
	Notice	-	
Command characters	Command Type	Command format	response
CJN2DL (Set the rx2 window delay for network access)	Test Command	AT+CJN2DL?	AT+CJN2DL=<Delay><CR>. Get or Set the Join Accept Delay between the end of the Tx and the Join Rx Window 2 in ms
	Query Command	AT+CJN2DL?	<Delay> OK
	Setting Commands	AT+CJN 2 DL=<Delay>	OK
	Parameter Description	<Delay> Gets or sets the Join-Accept Delay (in milliseconds) between the end of Tx and Join-Rx window 2	
	Return value description		
	Example	AT+CJN 2 DL= 2000	
	Notice	Rx2_delay=rx1_delay+1000 ms	
Command characters	Command Type	Command format	response
CRX1DL (set rx1 window delay)	Test Command	AT+ CRX1DL ?	AT+CRX1DL=<Delay><CR>. Get or Set the delay between the end of the Tx and the Rx Window 1 in ms
	Query Command	AT+ CRX1DL ?	<Delay> OK
	Setting Commands	AT+ CRX1DL =<Delay>	OK
	Parameter Description	<Delay> Gets or sets the delay between Tx end and Rx window 1, in ms	
	Return value description		
	Example	AT+CJN 2 DL= 2000	
	Notice	No need to set it up, once it is set up on the server, the module will be automatically synchronized	
Command characters	Command Type	Command format	response
CRX2DL (set rx2 window delay)	Test Command	AT+ CRX2DL ?	AT+CRX1DL=<Delay><CR>. Get or Set the delay between the end of the Tx and the Rx Window 2 in ms
	Query Command	AT+ CRX2DL ?	<Delay> OK
	Setting Commands	AT+ CRX2DL =<Delay>	OK
	Parameter	<Delay> Gets or sets the delay between Tx end and Rx window 2, in ms	

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	Description		
	Return value description		
	Example	AT+C RX2DL = 3000	
	Notice	No need to set, once set on the server, the module will automatically synchronize, Rx2_delay=rx1_delay+1000 ms	
Command characters	Command Type	Command format	response
CRX2FQ (Set receive window 2 frequency)	Test Command	AT+ CRX2FQ ?	AT+CRX2FQ=<Freq><CR>. Get or Set the Rx2 window Freq in Hz OK
	Query Command	AT+ CRX2FQ ?	<Freq> OK
	Setting Commands	AT+ CRX2FQ= <Freq>	
	Parameter Description	<Freq> , the second receive window frequency	
	Return value description		
	Example	AT+ CRX2FQ= 869525000	
	Precautions	Generally, it does not need to be set. It will automatically change when switching regions. If it does not match the server and gateway after the modification, it will cause communication failure	
Command characters	Command Type	Command format	response
TRANSPARENT (Enter transparent transmission mode)	Execute Command	AT+TRANSPARENT=<MOD>	OK
	Parameter Description	MOD:1 transparent transmission mode	
	Return value description		
	Example	TRANSPARENT=1	
Command characters	Command Type	Command format	response
+++ (Exit transparent transmission mode)	Order	+++	OK
	Example Precautions	+++	
Command characters	Command Type	Command format	response
SENDCFG (Transparent	Test Command	AT+SENDCFG?	AT+SENDCFG=<Port>:<Confirmed><CR>. Get or Set the default send configuration Port=[1..223] and

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transmission configuration)			Confirmed=[0:unconfirmed, 1:confirmed] OK
	Query Command	AT+SENDCFG=?	<Port>:<Confirmed> OK
	Setting Commands	AT+ SENDCFG= <Port>:<Confirmed><CR>	OK
	Parameter Description	<Port>: The port number used for transparent transmission <Confirmed>: 0: Transparent transmission mode uses non-confirmed packets 1: Transparent transmission mode uses confirmation packet	
	Return value description		
	Example	AT+ SENDCFG=50:1	
	Precautions	Configure the port number used by the transparent transmission mode lock and the sending packet mode	
Command characters	Command Type	Command format	response
SCFG (Script configuration)	Test Command	AT+SCFG?	AT+SCFG=<ID>,<Format>,<Port>,<Period>,<Timeout>,<Data><CR>. Configure script [ID:1-16, Format:0=HEX/1=ASCII, Port:1-199, Period:10-86400s,Timeout:100-5000ms] OK
	Query Command	AT+SCFG=? Query all script configurations	S1:Fmt=<Format>,Port=1,Period=<Period>,Timeout=<Timeout>,Len=<len>,Data=<Data> S2:Fmt=<Format>,Port=3,Period=<Period>,Timeout=<Timeout>,Len=<len>,Data=<Data> .....omitted S16:Fmt=<Format>,Port=16,Period=<Period>,Timeout=<Timeout>,Len=<len>,Data=<Data>
		AT+SCFG=<ID> Query the script configuration of a specified ID	<ID>,<Format>,<Port>,<Period>,<Timeout>,<Data> OK
	Setting Commands	AT+SCFG=<ID>,<Format>,<Port>,<Period>,<Timeout>,<Data>	OK
	Parameter Description	<ID>: script ID number, 1-16 <Format>; Set the data format 0=HEX/1=ASCII <Port>;lorwan data port number, the port number corresponds to the id, and it can distinguish which script is responding to the data. <Period>: script execution period. 10-86400s <Timeout>: The script waits for a response timeout of 100-5000ms	
	Return value description		

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		<Data>: script data, each script can store up to 40 bytes of data	
	Example	AT+SCFG=AT+SCFG=1,0,1,10,500,111111 //Set script 1 cycle to 10s, wait timeout to 500ms, hex data to 0x11,0x11,0x11	
	Precautions	1. The script execution cycle is at least 10 seconds. Try to stagger the script execution cycles. If multiple scripts are scheduled at the same time, they will be executed in order of ID. 2. The script takes a long time to wait for the response and send data in response, so the script cycle will be slightly longer than the setting. 3. The data returned within the script response cycle will be sent using the set port. If the timeout occurs, the data will be transmitted normally. 4. Script	
Command characters	Command Type	Command format	response
SEN (Script enabled)	Test Command	AT+SEN?	AT+SEN=<ID>,<Enable><CR>. Enable/Disable script [ID:1-16, Enable:0=Disable/1=Enable] OK
	Query Command	AT+SEND=? Query all enabled	S1: <Enabled> S2: <Enabled> ...omitted S15: <Enabled> S16: <Enabled>
		AT+SEND=<ID> Query the corresponding ID enable	<ID>,<Enable>
	Setting Commands	AT+SEN=<ID>,<Enable>	OK
	Parameter Description	<ID>: script ID <Enable>: Script enable Enable: 0=Disable/1=Enable]	
	Return value description		
	Example	AT+SEND=1,1	
	Precautions	After the script is enabled, it needs to work in transparent mode after entering the network.	
Command characters	Command Type	Command format	response
HB (Heartbeat packet configuration)	Test Command	AT+HB?	：AT+HB=<Enable>,<Format>,<Period>,<Data><CR>. Configure heartbeat [Enable:0/1, Format:0=HEX/1=ASCII, Period:10-86400s] OK
	Query Command	AT+HB=?	<Enable>,<Format>,<Period>,<Data> OK
	Setting	<Enable>,<Format>,<Period>,	OK

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	Commands	<Data>	
	Parameter Description Return value description	<Enable>: Whether to enable the heartbeat packet <Format>: Heartbeat packet data format, 0 hex, 1 ascii <Period>: Heartbeat packet period <Data>: Heartbeat packet data, maximum length 40 bytes	
	Example	AT+HB=1,0,60,112233 OK	
	Precautions	The heartbeat packet is the data that the device actively uploads according to the set period after joining the network.	
Command characters	Command Type	Command format	response
FASTSEND (Quick Send Configuration)	Test Command	AT+FASTSEND?	AT+FASTSEND=<0|1><CR>. Get or Set fast send mode [0:Disable, 1:Enable] OK
	Query Command	AT+FASTSEND=?	<0|1> OK
	Setting Commands	AT+FASTSEND=<0|1>	OK
	Parameter Description Return value description	0: Enable fast sending 1: Turn off quick send	
	Example	AT+FASTSEND=0	
	Precautions	1、Only works when sending non-response data 2、The receiving window will be closed after the start, and it will end immediately after the sending is completed, and the downlink data cannot be received 3、Sending too fast will violate the duty cycle requirements of Lorwan	
Command characters	Command Type	Command format	response
HOTSTART (OTAA hot boot configuration)	Test Command	AT+HOTSTART?	AT+HOTSTART=<0|1><CR>. Get or Set OTAA hot start mode [0:Disable, 1:Enable] OK
	Query Command	AT+HOTSTART=?	<0|1> OK
	Setting Commands	AT+HOTSTART=<0|1>	OK
	Parameter Description Return value description	0: Enable OTAA hot start 1: Disable OTAA hot boot	
	Example	AT+HOTSTART=1	

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	Precautions	After being turned on and reset or powered on again, data can be sent without reconnecting to the network This function is only available after chirpstack turns off frame counting. TTN will detect frame synchronization and cannot be used.

5. Data rate of each frequency band

EU433/EU868/RU864/AS923:

Data rate	Configuration	Represents the physical data rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6	LoRa: SF7 / 250 kHz	11000
7	FSK: 50 kbps	50000
8 ~ 15	RFU	

CN470/KR920:

Data rate	Configuration	Represents the physical data rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6 ~ 15	RFU	

US915:

Data rate	Configuration	Represents the physical data rate [bit/s]
0	LoRa: SF10 / 125 kHz	980
1	LoRa: SF9 / 125 kHz	1760
2	LoRa: SF8 / 125 kHz	3125
3	LoRa: SF7 / 125 kHz	5470
4	LoRa: SF8 / 500 kHz	12500
5 ~ 7	RFU	
8	LoRa: SF12 / 500 kHz	980
9	LoRa: SF11 / 500 kHz	1760

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10	LoRa: SF10 / 500 kHz	3900
11	LoRa: SF9 / 500 kHz	7000
12	LoRa: SF8 / 500 kHz	12500
13	LoRa: SF7 / 500 kHz	21900
14 ~ 15	RFU	

★ Note: 0-4 is up, 8-13 is down

AU915:

Data rate	Configuration	Represents the physical data rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6	LoRa: SF8 / 500 kHz	12500
7	RFU	RFU
8	LoRa: SF12 / 500 kHz	980
9	LoRa: SF11 / 500 kHz	1760
10	LoRa: SF10 / 500 kHz	3900
11	LoRa: SF9 / 500 kHz	7000
12	LoRa: SF8 / 500 kHz	12500

★ Note: 0-6 is up, 8-12 is down

IN865:

Data rate	Configuration	Represents the physical data rate [bit/s]
0	LoRa: SF12 / 125 kHz	250
1	LoRa: SF11 / 125 kHz	440
2	LoRa: SF10 / 125 kHz	980
3	LoRa: SF9 / 125 kHz	1760
4	LoRa: SF8 / 125 kHz	3125
5	LoRa: SF7 / 125 kHz	5470
6	RFU	RFU
7	FSK: 50 kbps	50000
8 ~ 15	RFU	RFU

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6. Maximum power of each frequency band

Note: The actual power will be 2.15dBm less than the set value. This is because the loRaWAN protocol also takes the antenna gain into account.

EU868: By default, the maximum value MaxEIRP is +16dBm.

Transmit power	Configuration
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB

US915:

Transmit power	Configuration
0	30 dBm - 2*TXpower
1	28 dBm
2	26 dBm
3 ~ 9	-
10	10 dBm
11 ~ 15	RFU

★ Note: The protocol stipulates that the maximum power of the module is 22dbm

AU915:

By default, the maximum value MaxEIRP is +30dBm.

Transmit power	Configuration
0	MaxEIRP
1 ~ 10	MaxEIRP - 2*TXPower
11 ~ 10	RFU

★ Note: The protocol stipulates that the maximum power of the module is 22dBm

KR920:

By default, the maximum value MaxEIRP is +14dBm.

Transmit power	Configuration
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB

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Transmit power	Configuration
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB

AS923:

By default, the maximum value MaxEIRP is +16dBm.

Transmit power	Configuration
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8 ~ 15	RFU

IN865:

By default, the maximum value MaxEIRP is +30dBm.

Transmit power	Configuration
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8	MaxEIRP - 16 dB
9	MaxEIRP - 18 dB
10	MaxEIRP - 20 dB
11 ~ 15	RFU

★ Note: The protocol stipulates that the maximum power of the module is 22dBm

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RU864:

By default, the maximum value MaxEIRP is +16dBm.

Transmit power	Configuration
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB

CN470:

By default, the maximum value MaxEIRP is +19.15 dBm.

Transmit power	Configuration
0	MaxEIRP
1	MaxEIRP 2 dB
2	MaxEIRP 4 dB
3	MaxEIRP 6 dB
4	MaxEIRP 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB
8 ~ 15	RFU

EU433:

By default, the maximum value MaxEIRP is +12.15 dBm.

Transmit power	Configuration
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB
4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6 ~ 15	RFU

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7. Maximum transmit load for each frequency band

Note: In the following table, M represents the length of the message with MAC header, and N represents the maximum length of data sent without MAC header.

EU868:

Data rate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8 ~ 15	-	-

US915:

Data rate	M	N
0	19	11
1	61	53
2	133	125
3	250	242
4	250	242
5 ~ 7	Not Defined	Not Defined
8	61	53
9	137	129
10	250	242
11	250	242
12	250	242
13	250	242
14 ~ 15	Not Defined	Not Defined

AU915:

Data rate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	Not Defined	Not Defined
8	61	53

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Data rate	M	N
9	137	129
10	250	242
11	250	242
12	250	242
13	250	242
14 ~ 15	Not Defined	Not Defined

KR920:

Data rate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6 ~ 15	Not Defined	Not Defined

AS923:

Data rate	Uplink MAC payload size (M)		Downlink MAC payload size (N)	
	UplinkDwellTime = 0	UplinkDwellTime = 1	DownlinkDwellTime = 0	DownlinkDwellTime = 1
0	59	N/A	59	N/A
1	59	N/A	59	N/A
2	59	19	59	19
3	123	61	123	61
4	250	133	250	133
5	250	250	250	250
6	250	250	250	250
7	250	250	250	250
8	RFU		RFU	

IN865:

Data rate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8 ~ 15	-	-

RU864:

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Data rate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	230	222
5	230	222
6	230	222
7	230	222
8 ~ 15	-	-

CN470:

Data rate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6 ~ 15	-	-

EU433:

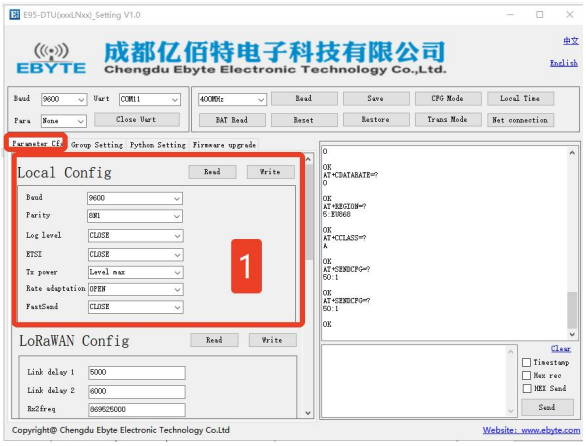
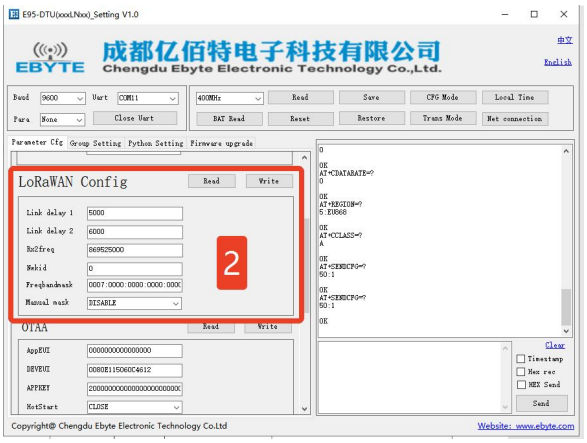
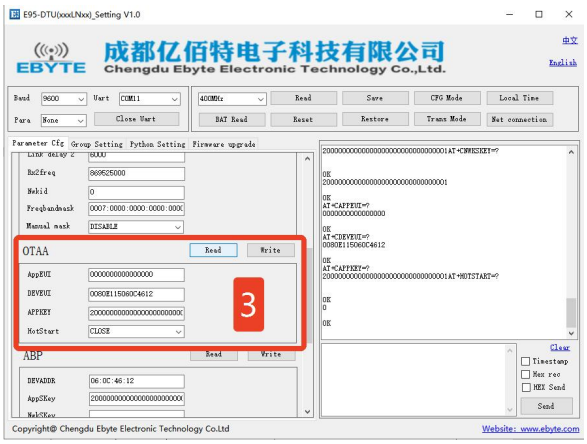
Data rate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8 ~ 15	-	-

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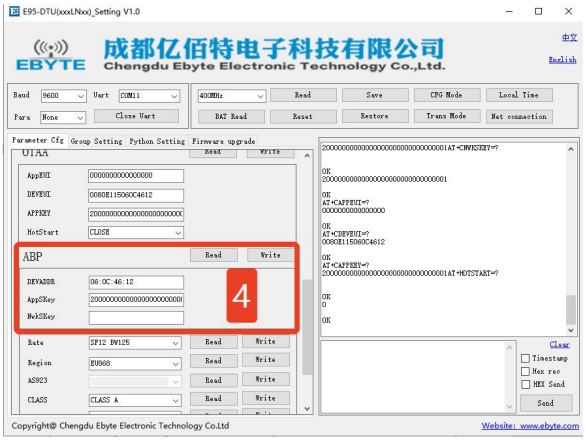
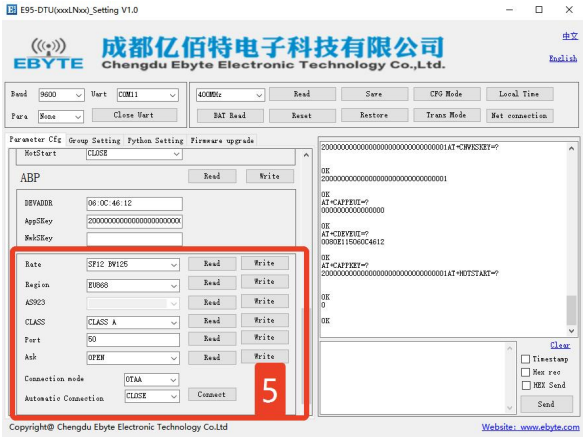
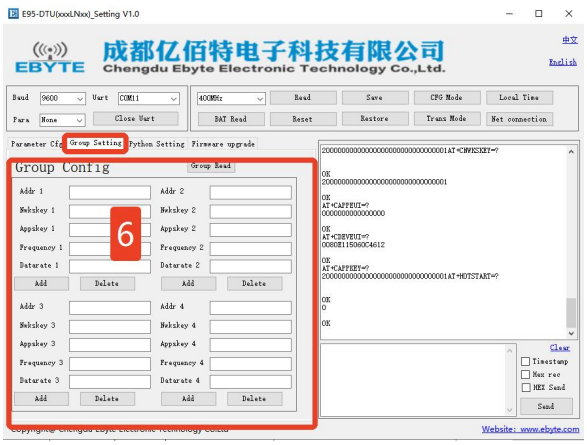
8. Detailed explanation of configuration software

following table shows the E95-DTU configuration host computer display interface, through which users can quickly configure and read parameters.

Configuration software parameter configuration diagram	Content Notes
	**1. Parameter configuration → Local configuration:** ●Baud rate: baud rate configuration ●Check digit: Configure the serial port check digit ●Log level: Print debug log ●ETSI Duty Cycle: Enable ETSI ●Transmit power: power configuration ●Rate Adaptation: Rate Configuration ●Fast Send: Enable fast send
	**2. Parameter configuration → L0RaWAN configuration:** ●Network access delay 1: Network access delay ●Network access delay 2: Network access delay ●rx2 receiving frequency: receiving frequency ●Network ID: Network ID ●Mask: Mask ●Manual mask: Enable manual mask
	**3. Parameter Configuration → OTAA:** ●AppEUI: Application Identifier ●DEVEUI: device identifier ●APPKEY: Application key ●otaa hot start: hot start

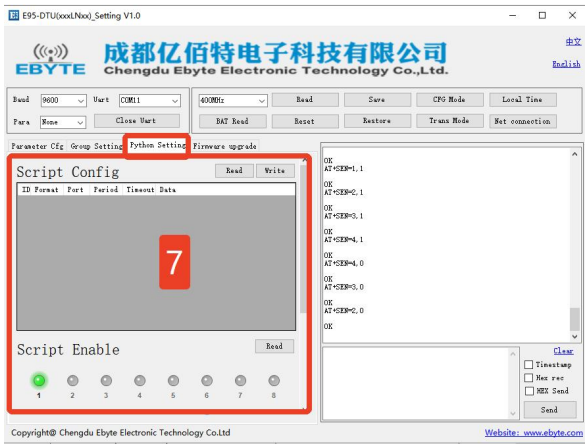
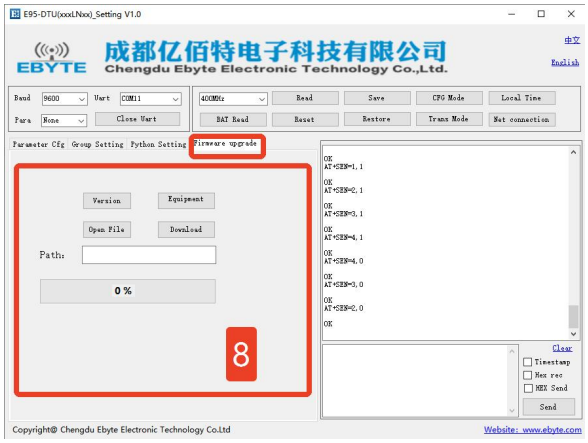
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Configuration software parameter configuration diagram	Content Notes
	**4. Parameter configuration → ABP:** ●DEVADDP: device address ●AppSKey: application session key ●NwkSKey: Network session key
	**5. Parameter configuration → Mode selection:** ●Communication rate: Set the communication rate ●Working frequency band: set frequency band ●AS923 sub-band: AS923 band settings ●CLASS: Node type ●Port number: Set the port number ●Answer mode: Set the answer mode ●Network access mode: Set the network access mode, including OTAA and ABP ●Automatic network access; Set automatic network access
	**6. Multicast parameter configuration → Multicast configuration:** ●Multicast address: Multicast address ●Nwkskey: Network session key ●Appskey: application session key ●Receiving frequency: receiving frequency ●Multicast airspeed: communication rate

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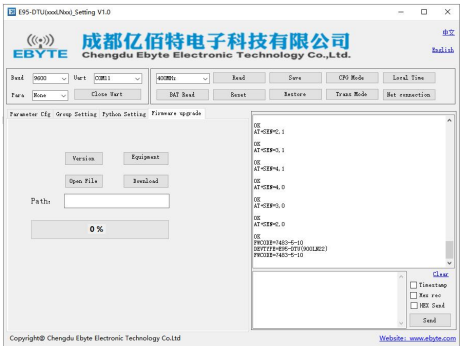
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Configuration software parameter configuration diagram	Content Notes
	**7. Script Control → Script Configuration:** ●Script configuration: You can read the current script configuration of the module. If you need to modify the line later, just double-click the line to enter the configuration page. ●Script enable: light on start
	**8. Firmware upgrade: Use our company's dedicated upgrade firmware to upgrade the firmware**

★ Notice:

(1) E95 - DTU LN series supports serial port firmware upgrades. If special after-sales support is required, please contact us to obtain the corresponding firmware for upgrade.

(2) - to-RS485 converter to connect the DTU . Before powering on the device, press and hold the firmware upgrade button (**AIP**) for about 2 seconds. The module will immediately enter upgrade mode upon power-up , and the serial port will display "C." Then , connect the DTU using the host configuration tool provided on our official website, select Firmware Upgrade, click "Open File," select the appropriate firmware, and then click Start Download. When the "Please Wait" prompt appears, click OK. Wait 5 seconds for the "Upgrade Mode" to be confirmed, and the download will begin. The download is complete when the progress bar reaches 100%. After completion, manually close and reopen the serial port to reread the parameters.

Firmware online upgrade button	Configuration software upgrade firmware
	

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IX . Related Products

Product Model	Interface Type	Operating frequency MHz	Transmit power dBm	Communication distance km	Features
E870-L470LG11	WAN port	470~510M	27	3	Full-duplex LoRaWAN standard protocol gateway
E870-L470LG12	WAN port	470~510M	27	3	Full-duplex LoRaWAN standard protocol gateway
E870-L868LG12	WAN port	EU868,IN865,RU864	27	3	Full-duplex LoRaWAN standard protocol gateway
E870-L915LG12	WAN port	US915,AU915,AS923 ,KR920	27	3	Full-duplex LoRaWAN standard protocol gateway

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10. Precautions for use

1. For OTAA network access, please check whether the APPKEY, DEVKEY, and DEVEUI parameters are consistent with the server settings. Also, check whether the node frequency band, gateway frequency band, and server frequency band are consistent.
2. If the module has been successfully connected to the network, and the APPKEY, DEVKEY, and DEVEUI parameters have been changed, you need to use AT+RESTORE to reset the parameters before resetting them as a new node.
3. When using ABP communication, the server will record the module's fcnt (frame count) each time it goes up. If it is less than the previous value, communication will fail. The module will not save each fcnt, as this will cause significant loss of flash memory. When using TTN, you need to reset the MAC parameters each time, and when using chirpstack, you need to check the "ignore frame" option.
4. The otaa network access shows devnoce to small, which only appears in version 1.0.4. The devnoce will increase by one each time the network is accessed. This module will record it. However, if the module restores the default parameters, the devnonce of the corresponding server needs to be manually set to 0;
5. Do not operate this radio in flammable places (such as coal mines) or near explosive and dangerous objects (such as detonators).
6. A suitable DC regulated power supply should be selected, which should have strong anti-high-frequency interference ability, small ripple, and sufficient load capacity; it is best to have overcurrent, overvoltage protection and lightning protection functions to ensure the normal operation of the digital radio.
7. Do not use the device in an environment that exceeds the environmental characteristics of the digital radio, such as in an environment with high temperature, humidity, low temperature, strong electromagnetic field, or high dust.
8. Do not keep the digital radio in full-load transmission state continuously, otherwise the transmitter may burn out.
9. The ground wire of the digital radio should be well connected to the ground wire of the external device (such as PC, PLC, etc.) and the ground wire of the power supply, otherwise it is easy to burn out the communication interface, etc.; never plug or unplug the serial port when it is powered on.
10. When testing a digital radio, a matching antenna or a 50Ω dummy load must be connected to prevent damage to the transmitter. If an antenna is connected, the distance between the human body and the antenna should be more than 2 meters to avoid injury. Do not touch the antenna during transmission.
11. Wireless data transmission stations often have different communication distances in different environments. The communication distance is often affected by temperature, humidity, obstacle density, obstacle volume, and electromagnetic environment. To ensure stable communication, it is recommended to reserve a communication distance margin of more than 50%.
12. If the measured communication distance is not ideal, we recommend analyzing the antenna quality and installation method to improve the communication distance. You can also contact support@cdebyte.com for assistance.
13. When selecting a power supply, in addition to retaining a 50% current margin as recommended, you should also pay attention to the ripple not exceeding 100mV.

11. Important Statement

1. Ebyte reserves the final right of interpretation and modification of all contents in this manual.
2. Due to the continuous improvement of the product hardware and software, this manual may be changed without prior notice. The latest version of the manual shall prevail.

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12. Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2025-10-16	Initial version	ALL

Contact 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

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Web: https://www.cdebyte.com

Address: B5 Mould Industrial Park, 199# Xiqu Ave, High tech Zone, Chengdu, Sichuan, China



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