Chengdu Ebyte Electronic Technology Co.,Ltd

Wireless Modem

User Manual

EWD95M-xxxLN22(xxx)



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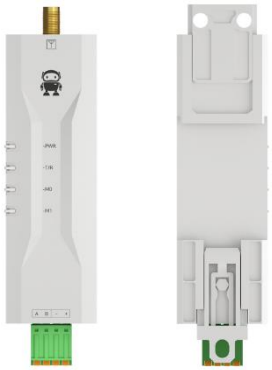
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1 Product Overview

1.1 Brief Introduction



EWD95M-xxxLN22(xxx)① is a wireless digital transmission node radio designed with LoRaWAN technology, supports CLASS-A/CLASS-C node type, supports ABP/OTAA two kinds of network access, EWD95M-400LN22(xxx) working band 410~510MHZ. Support LoRaWAN 1.0.3 EU433/CN470 standard EWD95M-900LN22(xxx) working band 868~930MHZ, support LoRaWAN 1.0.4 EU868/US915/AU915/AS923/IN865/KR920/RU864 standard, radio provides transparent RS485 The radio provides transparent RS485/RS232 interface, users can simply configure through the AT command to access the standard LoRaWAN network, using plastic shell, rail mounting structure, support for 8 ~ 28V (DC) wide voltage input.LoRa spread spectrum technology will bring a longer communication distance, and has the advantage of strong anti-jamming ability.

Wireless digital transmission radio as a communication medium, and optical fiber, microwave, open wire, has a certain scope of application: it provides real-time, reliable data transmission of monitoring signals in the special network under certain special conditions, with low cost, easy to install and maintain, strong ability to bypass the shooting, flexible network structure, far coverage, suitable for more points and scattered, complex geographic environments and other occasions, and can be used in conjunction with PLC, RTU, rain gauge, liquid level meter, etc.. It can be connected with PLC, RTU, rain gauge, liquid level meter and other data terminals.

1.2 Features

- Under ideal conditions, the communication distance is up to 3.5km with LoRaWAN standard firmware;
- EWD95M-400LN22(xxx) supports global license-free ISM 433/470MHz band;
- EWD95M-400LN22(xxx) supports LoRaWAN 1.0.3 EU433/CN470 standard;
- EWD95M-900LN22(xxx) supports global license-free ISM 868/915MHz band;
- EWD95M-900LN22(xxx) supports LoRaWAN 1.0.4 EU868/US915/AU915/AS923/IN865/KR920/RU864 standards;
- Supports Class A and Class C device types;
- Support ABP/OTAA two types of network access;
- EWD95M-xxxLN22(xxx) has a maximum transmit power of 21.5dBm, which is adjustable in multiple levels by software;
- Support AT command, more convenient to use;
- Ultra-small size, size 80*28*28.5mm, easy and fast installation;
- Adopting flame retardant plastic shell, rail mounting structure, easy and efficient installation;
- Simple and efficient power supply design, support power adapter or voltage line method, support 8～28V (DC) power supply;
- Operating temperature range:-40℃～+85℃, adapting to various severe working environments, real industrial grade products;
- Multiple protection functions such as power reverse connection protection, over connection protection, antenna surge

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protection, etc. greatly increase the reliability of the radio;

- Communication ports, power supply interfaces are isolated and highly protected;
- Built-in watchdog, and precise time layout, once an exception occurs, the radio will automatically restart, and can continue to work in accordance with the previous parameter settings.

Notes: EWD95M-xxxLN22(xxx) stands for: EWD95M-400LN22(485), EWD95M-900LN22(485), EWD95M-400LN22(232), EWD95M-900LN22(232)

1.3 Quick Start

① You need to prepare 1 piece each of EWD95M-xxxLN22(xxx), antenna, DC 8V~28V power adapter, USB to RS232/RS485 (or other ways), and connecting cable (including 4PIN 3.81 Phoenix terminal male).

② First install the antenna for the digital radio. Firstly, install the antenna to the DTU and connect the DTU with the power adapter, and connect the wires, A+/TX to A/T, B-/RX to B/R.



③ Finally, connect the computer to the digital transmission node radio through USB to RS232/RS485 (or other ways);

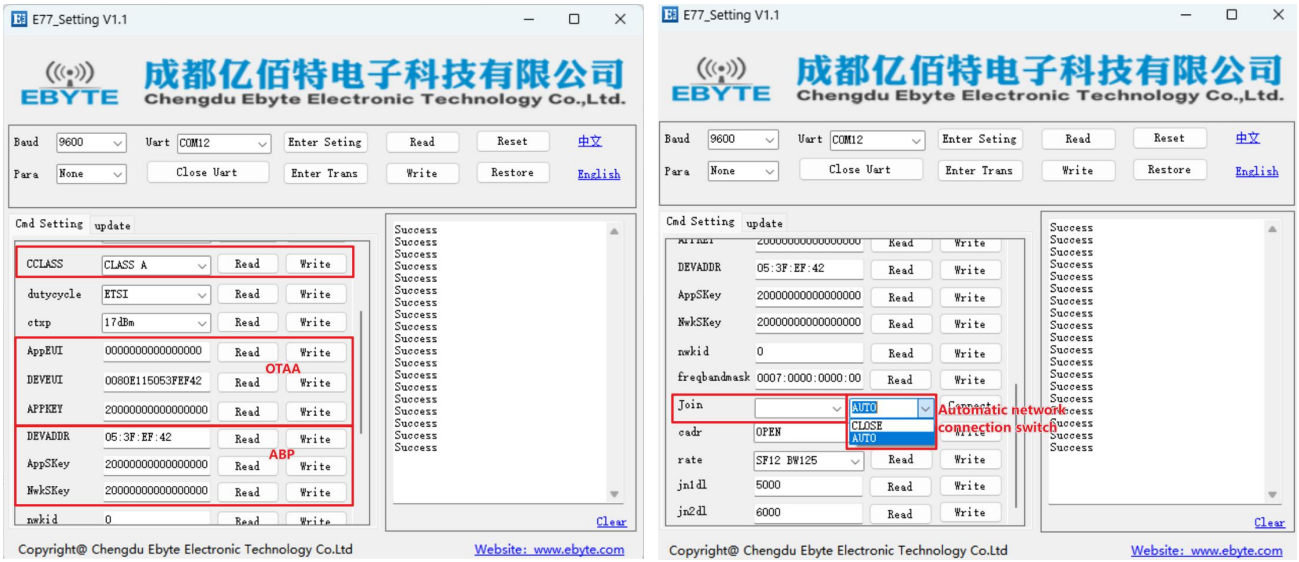
④ Start the serial port debugging assistant, select the serial port baud rate of 9600bps (default), 8N1, through the AT command or the host computer to configure the parameters of the network, the device will automatically send a request to enter the network, and the nearby gateway accepts the request to realize the device into the network.

⑤ Access demonstration:

This demo kit uses EWD95M-400LN22(xxx) device as a node and E890-470LG11 as a gateway to access the free ChirpStack Application Server test server to do communication test;

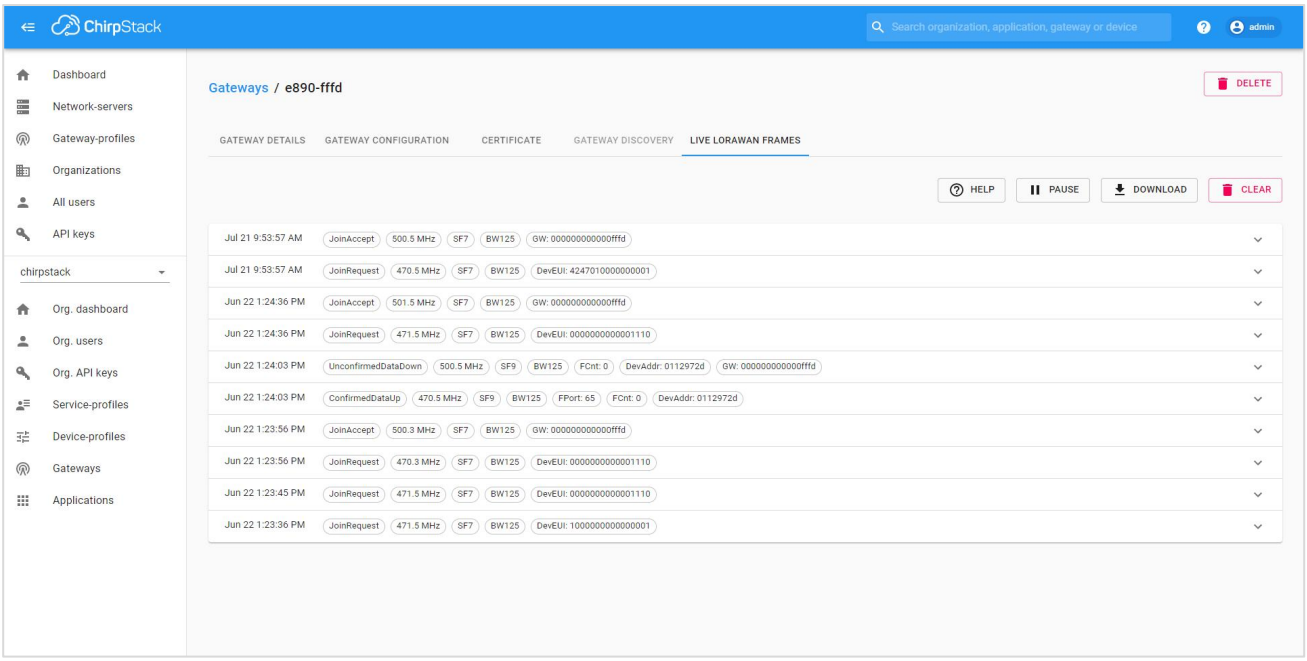
The corresponding settings of the OTAA access method at the node end are shown as follows：

Write the access parameters through the host computer：

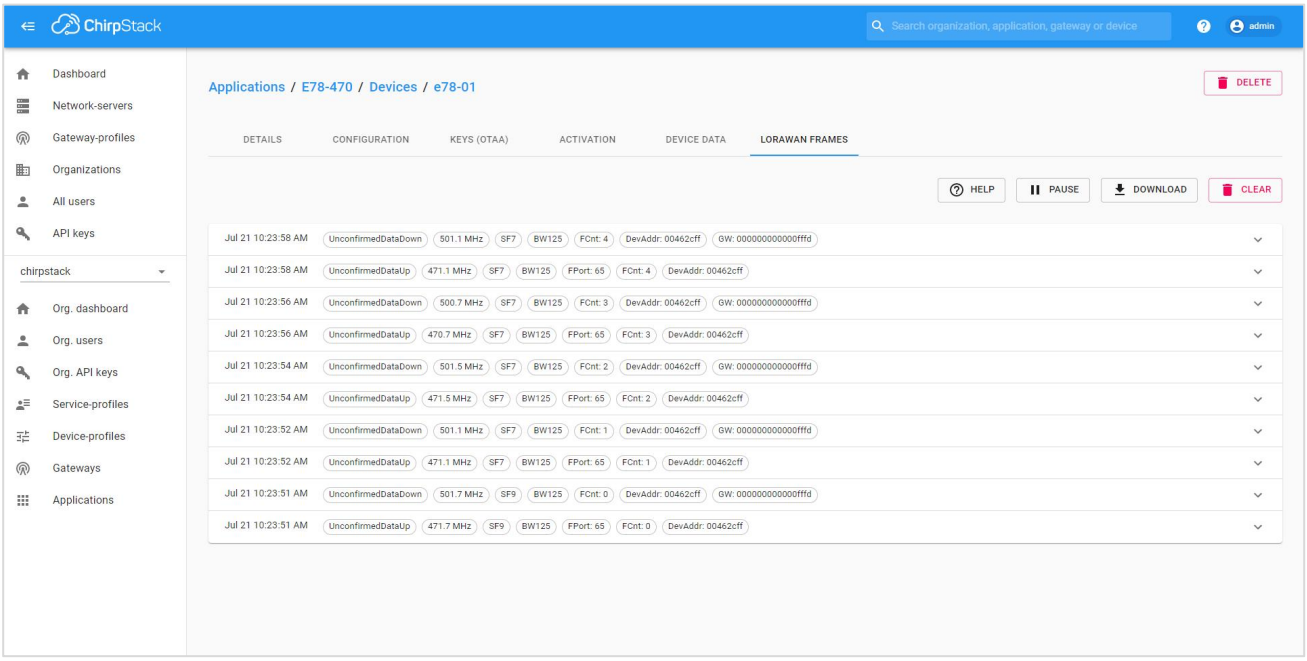


On the ChirpStack Application Server, the gateway data records are shown below:

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The ChirpStack Application Server node data records are shown below:



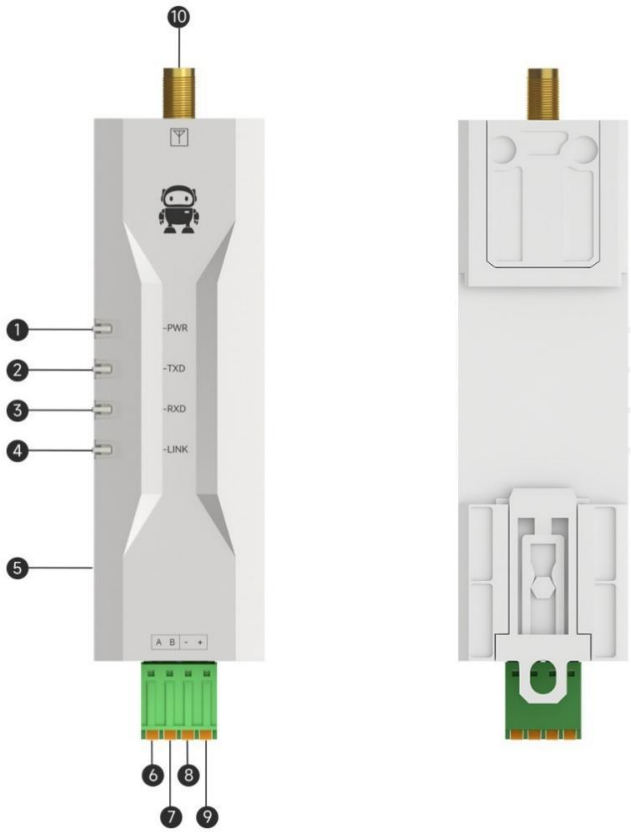
Note 1: Please refer to “LORAWAN Node + Gateway TTN Server Configuration Tutorial” for TTN creation device and corresponding configuration process.

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1.4 Description of Departments

1.4 .1 RS485 interface



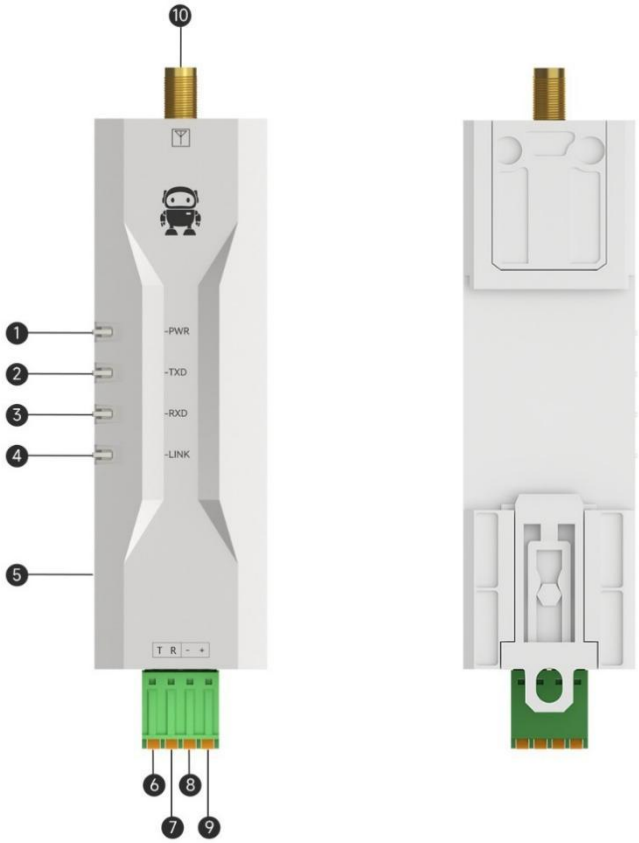
Serial No.	Name	Function	Instruction
1	PWR	Power indicator	Lights up when power is turned on
2	TXD	Send Indicator	Blinking when sending data
3	RXD	Receiving indicator	Blinking when receiving data
4	LINK	Entry Indicator	Always on after entering the network
5	IAP	Firmware Upgrade Button	Press to enter IAP mode when powering up
6	A	RS485 Signal A	RS485 Signal A
7	B	RS485 Signal B	RS485 Signal B
8	-	GND	Power ground
9	+	VCC	Power Positive (DC 8~28V)
10	ANT	RF interface	SMA-K, male threaded bore.

- The EWD95M-xxxLN22(xxx) can be powered by a 8 to 28V (DC) power supply, and the wiring ports are connected using terminal blocks.

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1.4 .2 RS232 interface



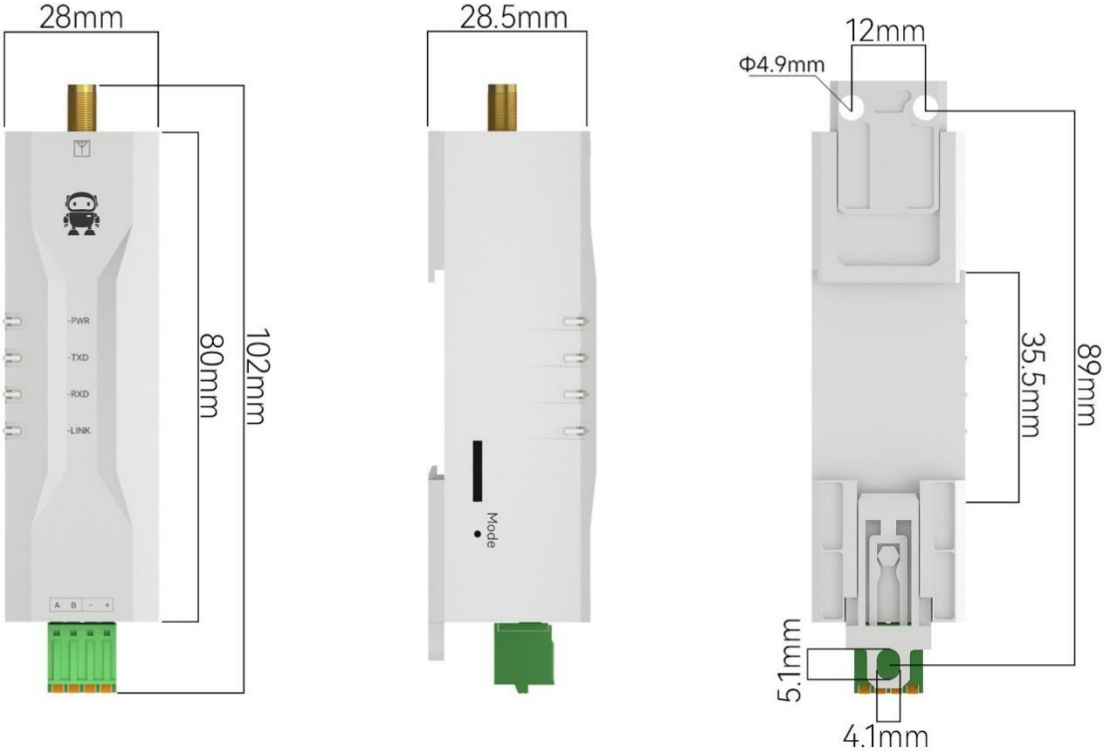
Serial No.	Name	Function	Instruction
1	PWR	Power indicator	Lights up when power is turned on
2	TXD	Send Indicator	Blinking when sending data
3	RXD	Receiving indicator	Blinking when receiving data
4	LINK	Entry Indicator	Always on after entering the network
5	IAP	Firmware Upgrade Button	Press to enter IAP mode when powering up
6	T	RS232 bus TX interface	RS232-TX interface
7	R	RS232 bus RX interface	RS232-RX interface
8	-	VCC	Power ground
9	+	GND	Power positive (DC 8~28V)
10	ANT	RF interface	SMA-K, External threaded bore

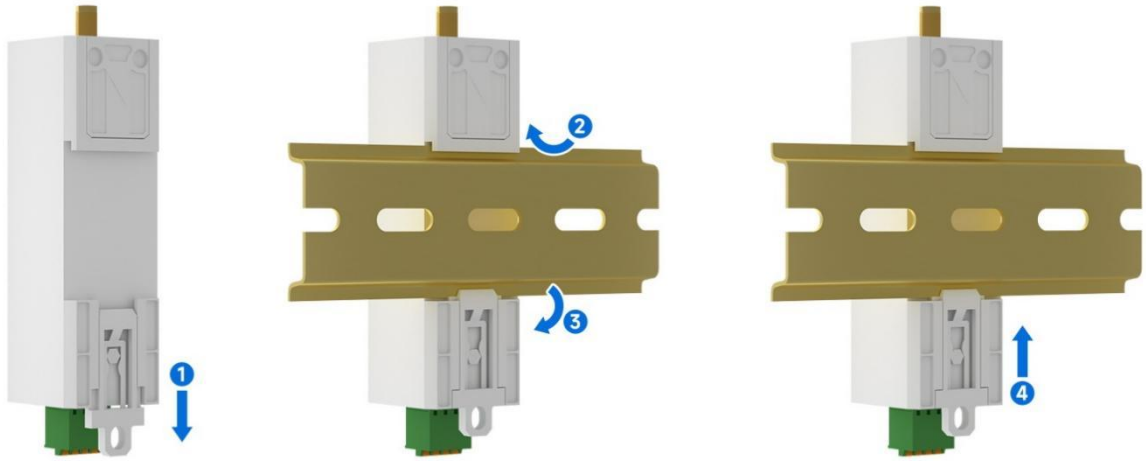
- The EWD95M-xxxLN22(xxx) can be powered by a 8 to 28V (DC) power supply, and the wiring ports are connected using terminal blocks.

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1.5 Installation Dimensions





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2 Technical indicators

2.1 Model Specification

Model Specification	Working frequency	Transmitter power	Reference distance	Airspeed	Technical characteristics
	Hz	dBm	km	bps	
EWD95M-400LN22(485)	410～510M	22	3.5	adaptive	LoRaWAN protocol
EWD95M-400LN22(232)					
EWD95M-900LN22(485)	850～930M	22	3.5	adaptive	LoRaWAN protocol
EWD95M-900LN22(232)					

Note: Sunny weather, open environment without obstruction, 12V/1A power supply, 5dBi suction cup antenna, antenna height of 2 meters from the ground, using factory default parameters.

2.2 General Specification Parameters

Serial No.	Item	specification	Instruction
1	Product Size	80*28*28.5mm	See mounting dimensions for details
2	Product weight	32g	Weight tolerance 2g
3	Working temperature	-40℃～+85℃	Industrial grade
4	Voltage range	8～28V（DC）	12V or 24V recommended for DC versions
5	Communication interface	RS485/RS232	RS485 or RS232
6	Baud rate	Factory default 9600	Baud rate range 1200 to 115200
7	Address code	Factory default 0	Total 65536 address codes can be set

2.3 Transmit power level

Model Specification	0 (factory default)	1	2	3
EWD95M-400LN22(xxx)	22dBm	17dBm	14dBm	10dBm

2.4 Current parameter

Model Specification	Emission current mA		Receiving current mA	
	12V	24V	12V	24V
EWD95M-400SL22(xxx)	55	32	6.4	3.0
EWD95M-900SL22(xxx)	67	36	6.0	3.0

- Note: The output power is set to maximum, and it is recommended to keep more than 50% current margin when selecting the power supply, which is conducive to the long-term and stable operation of the radio.

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3 Terms and definitions

3.1 LoRa

LoRa is a kind of LPWAN communication technology, the full name is Long Range Radio, the Chinese meaning is “long-distance radio”; LoRa mainly works in the ISM brand global free band, mainly including: 433MHz, 470MHz, 868MHz. 915MHz and other frequency points with low power consumption, long distance, low cost, 915MHz and other frequency points, with low power consumption, long distance, low cost characteristics.

3.2 LoRaWan

The LoRaWAN protocol standard is a low-power WAN standard based on the open-source MAC layer protocol released by the LoRa Alliance, an open, not-for-profit organization led by Semtech in March 2015.The LoRaWAN protocol supports a star-shaped network topology, and its network components mainly include: LoRaWAN nodes, gateways, servers (including Network Server, Network control, Application Server), and base stations. LoRaWAN protocol supports star-shaped network topology, and its network composition mainly includes: LoRaWAN nodes, gateway (Gateway), Server (including Network Server, Network control, Application Server).

LoRaWAN categorizes LoRaWAN nodes into A/B/C categories:

- Bidirectional Transmission Terminal (Class A):

Class A terminals realize bi-directional transmission by following two short downlink reception windows immediately after each uplink. The terminal schedules transmission time slots based on its own communication needs, with small variations on a random time basis (i.e., ALOHA protocol). This Class A operation provides the application with the lowest power consumption terminal system, requiring the application to perform the server's downlink transmission only a short time after the terminal's uplink transmission. Downlink transmissions made by the server at any other time have to wait for the terminal's next uplink.

- Delineate the bidirectional transmission terminals that receive the time slots (Class B):

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

- Bidirectional transmission terminals that maximize the reception time slot (Class C):

Class C terminals basically keep the receive window open all the time and only close it briefly when transmitting.Class C terminals will consume more power than Class A and Class B, but at the same time have the shortest latency for downlinking from the server to the terminal.

Note: The EWD95M-xxxLN22(xxx) supports both Class A and Class C device types;

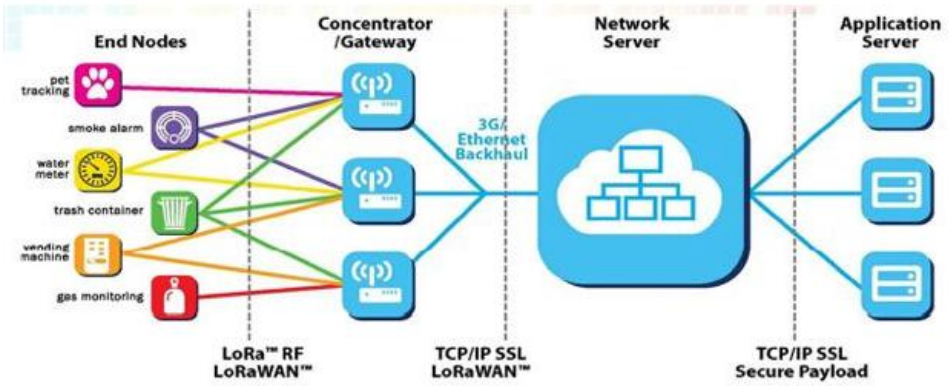
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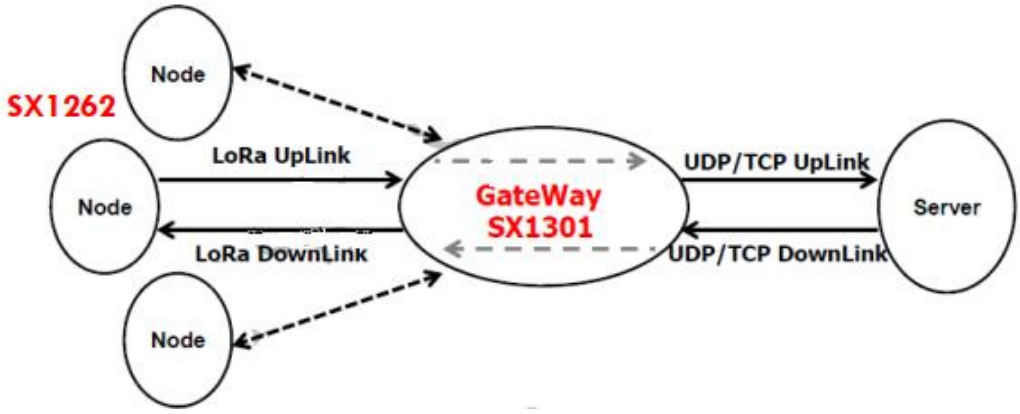
3.3 ADR

ADR is known as Adaptive Data Rate. In loRaWan network system, in order to maximize the battery life of terminal devices and the overall network capacity, LoRaWAN network server manages the data rate and RF output of each terminal device through the adaptive data rate (ADR) algorithm, through ADR technology, LoRaWAN system, the server automatically updates the setting of the node's signal reception ability according to the node's Through ADR technology, the server in the LoRaWAN system automatically updates the rate of the set node according to the node's signal reception ability, and the rate is low when the distance is far, and high when the distance is close, which greatly improves the effective bandwidth and bandwidth capacity of the network in practical applications.

4 LoraWan Application Model Diagram



The complete LoraWan network system consists of: nodes, gateways, Lora NetWork Server, application servers, nodes are generally designed by the LORA chip; gateway provided by semtech SX1301 design; Lora NetWork Server now the industry has an open source loraserver or commercial TTN (), users can build their own; application servers are customized by the user design and development, mainly used for data exchange with the Lora NetWork Server applications. The ThingsNetwork), users can build their own; application server is customized by the user design and development, mainly used for data exchange with Lora NetWork Server applications.

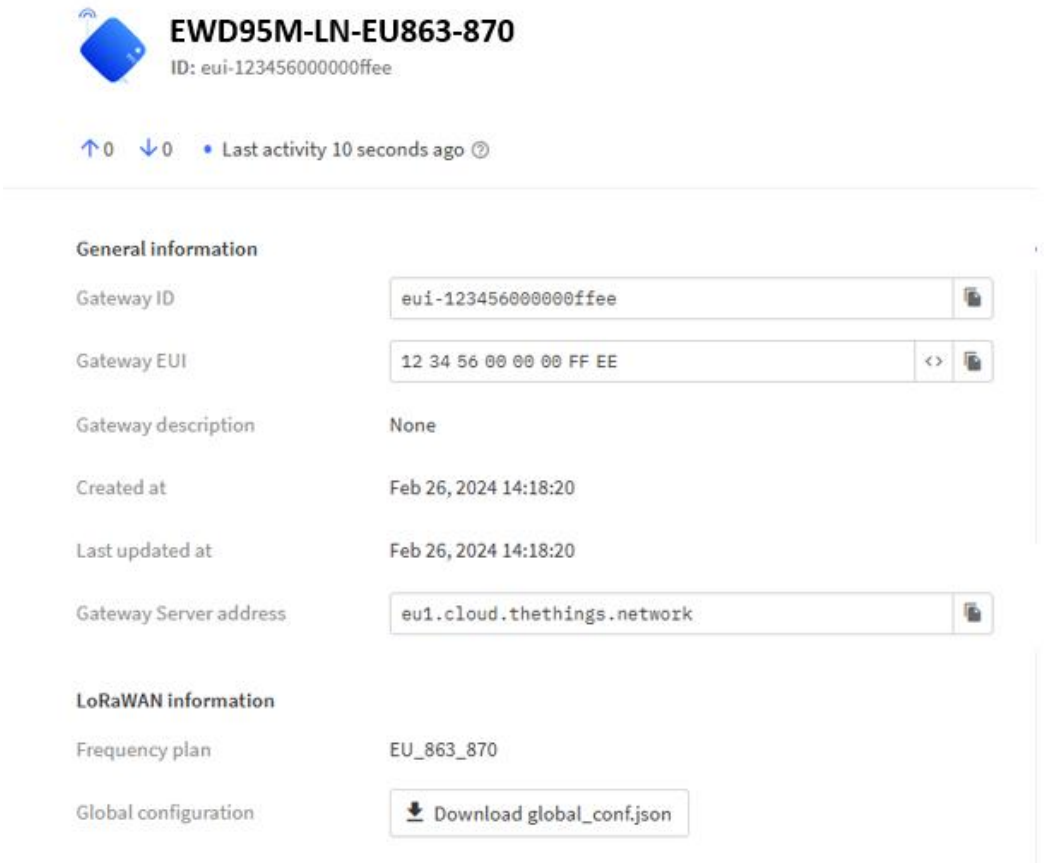


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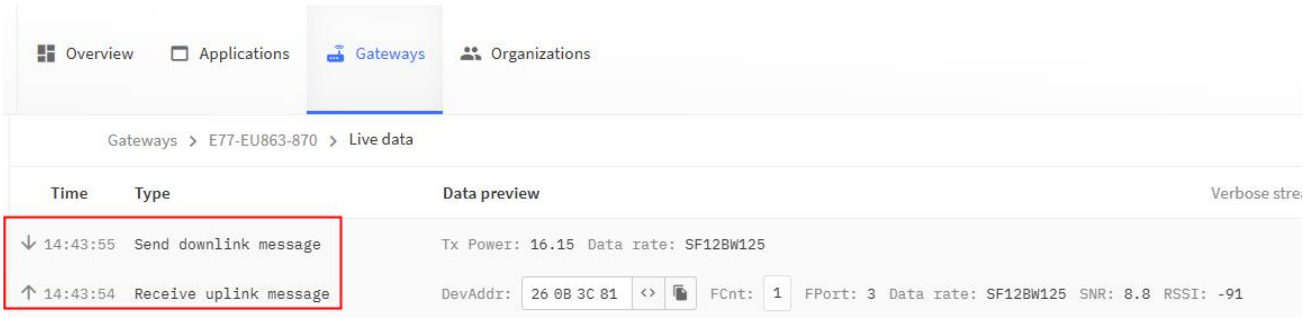
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5 Access Demonstration

This demo kit is: EWD95M-xxxLN22 (xxx) as a node, E890 as a gateway to access the free TTN (TheThingsNetwork) test server to do communication tests; serial port using pin 9, 10, LP_USART2_TX serial port, baud rate 9600bps 8N1
The corresponding settings for the OTAA access method on the node side are shown below.
AT+RESTORE //Restore the default configuration.
AT+REGION=5 //eu868 frequency band
AT+CDEVEUI=70B3D57ED0063EC9 //set deveui
AT+CAPPEUI=0000000000000000 //Set up appeui
AT+CAPPKEY=20000000000000000000000000000000 //set appkey
AT+CJOIN=1:0 //otaa into the network, not power automatically into the network
On TTN, the gateway information is shown below:



The gateway data is shown below:

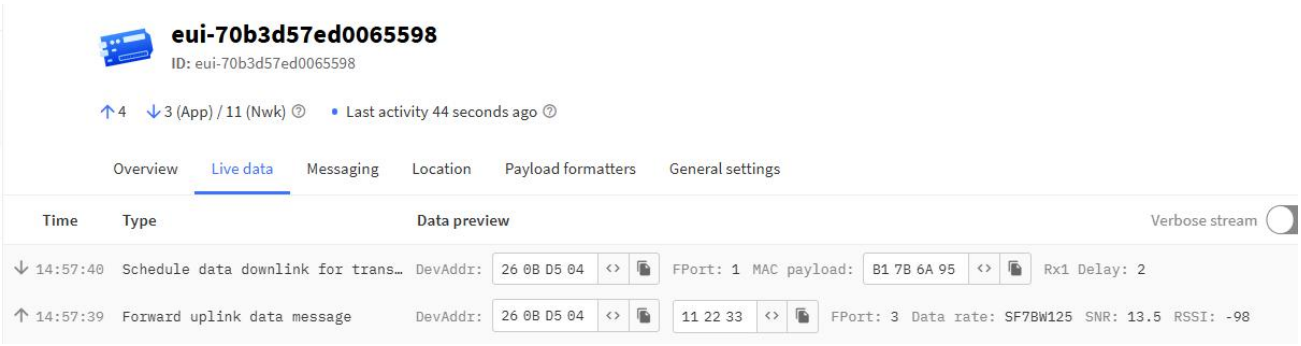


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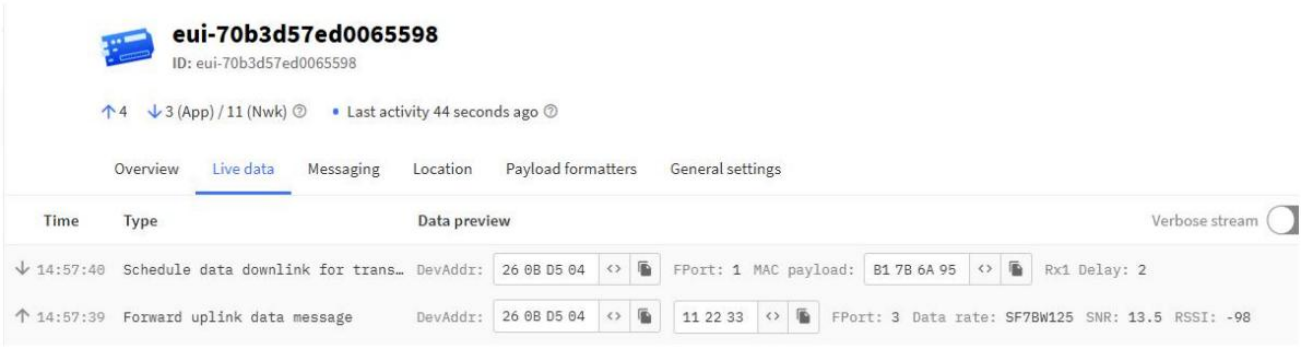
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The TTN node data record is shown below:

AT+SEND=3:1:1:112233 //Send data Parameter 1: port number Parameter 2: maximum number of retransmissions Parameter 3: ack answer Parameter 4: hex data.



Node serial port end:



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

6 AT Command

6.1 Command format

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

: command prefix

CMD: control command character

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

“=": indicates parameter setting.

“?” : Indicates a query to set the parameters of the command.

“<empty>": indicates execution of the instruction.

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

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

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

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6.2 AT instruction set

Command	Description (Generic Command)
AT	Test instruction
AT+VER	Read information about lorawan version
AT+FWCODE	Read software code
AT+DEVTYPE	Read device model
AT+LOGLEVEL	Setting the log level
AT+UART	Setting 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	Query power level
AT+REGION	Setting Regional Options
AT+CCLASS	Setting the device type
AT+DUTYCYCLE	Set whether to turn on duty cycle
AT+CTXP	Setting the Transmit Power
AT+CAPPEUI	Setting up APPEUI (for OTAA inbound use)
AT+CDEVEUI	Setting up DEVEUI (OTAA inbound use)
AT+CAPPKEY	Set APPKEY (for OTAA inbound use)
AT+CNWKSKEY	Setting NWKSKEY (for ABP entry use)
AT+CAPPSKEY	Setting the APPSKEY (for ABP entry use)
AT+CDEVADDR	Setting DEVADDR (for ABP entry use)
AT+CJOIN	Enter a network
AT+SEND	Send data
AT+CNWKID	Setting the port number
AT+LINKC	Check Link Status
AT+CFREQBANDMASK	Setting the channel mask
AT+CADR	Set Airspeed Adaptive
AT+CDATARETE	Set airspeed
AT+CJN1DL	Setting the incoming rx1 time
AT+CJN2DL	Setting the incoming rx2 time
AT+CRX1DL	Setting the rx1 time
AT+CRX2DL	Setting the rx2 time
AT+CRX2FQ	Setting the rx2 receive frequency

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6.3 AT Instruction Description

Command character	**Command Type**	**Command format**	**Responsive**
AT(Test)	Executable instruction	AT	OK
	Typical example	AT OK	
	Clarification	Test the AT command for correctness	
Command character	Command Type	Command format	Responsive
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	
	Description of the return value		
	Example	AT+VER=? APPLICATION_VERSION: V1.3.0 L2_SPEC_VERSION: V1.0.4 RP_SPEC_VERSION: V2-1.0.1 OK	
	Note	-	
Command character	Command Type	Command format	Responsive
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 coding	
	Description of the return value		
	Example	AT+FWCODE=? FWCODE=7483-1-10 OK	
	Note	-	
Command character	Command Type	Command format	Responsive
DEVTYPE	Test command	AT+DEVTYPE?	AT+DEVTYPE Get Device type

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(Read device model)	Query command	AT+DEVTYPE=?	DEVTYPE=<type> OK
	Parameter description	<type>： Equipment Model	
	Description of the return value		
	Example	AT+DEVTYPE=? DEVTYPE=EWD95M-400LN22(485) OK	
	Note	-	
Command character	Command Type	Command format	Responsive
LOGLEVEL (Setting the 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
	Setup Command	AT+LOGLEVEL=<Level>	OK
	Parameter description	<Level>: Log level Range: 0-1, 0 off,1 on	
	Description of the return value		
	Example	AT+LOGLEVEL=1 OK AT+LOGLEVEL=? 1 OK	
	Note	Default level 0, power down does not save	
Command character	Command Type	Command format	Responsive
UART **(Setting the 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
	Setup Commands	AT+UART=<baud>:<parity>	OK
	Parameter description	<baud>: baud rate [0-2] 0 : 2400 1 : 4800 2 : 9600 <parity>: parity bit [0-2] 0 : 8N1	
	Description of the return value		

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		1 : 8E1 2 : 8O1	
	Example	AT+UART=2:0 OK AT+UART=? 2:0 OK	
	Note	Re-power up to take effect	
Command character	Command Type	Command format	Responsive
IAP (Online Upgrade)	Test command	AT+IAP?	AT+IAP IAP Upgrade OK
	execute a command	AT+IAP	AT+IAP=OK
	Parameter description	-	
	Description of the return value		
	Example	AT+IAP AT+IAP = OK C C C	
	Note	User IAP upgrades do not need to execute this command, use our matching upgrade host will send.	
Command character	Command Type	Command format	Responsive
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 DD/MM/YYYY/ OK
	Parameter description	h: hours m: minutes s: seconds	
	Description of the return value		
	Example	AT+LTIME=? LTIME:00h00m00s on 01/01/1970 OK	
	Note	Each power-up starts on January 1, 1970, 00h00m00s.	
Command character	Command Type	Command format	Responsive
RESTORE (Restore Default	Test command	AT+RESTORE?	AT+RESTORE: Restore EEPROM Factory Settings OK

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Configuration)	execute command	AT+RESTORE	OK
	Parameter description	-	
	Description of the return value		
	Example	AT+RESTORE OK	
	Note	-	
Command character	Command Type	Command format	Responsive
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	-	
	Description of the return value		
	Example	AT+CSAVE NVM DATA STORED OK	
	Note	-	
Command character	Command Type	Command format	Responsive
AT+RST (Reboot Module)	Test command	AT+RST?	AT+RST Trig a MCU reset OK
	Setup Command	AT+RST	OK
	Parameter description	-	
	Description of the return value		
	Example	AT+RST OK	
	Note	After the communication module receives this command and replies OK, it restarts the communication module. No further AT commands are received until the reboot is complete.	
Command character	Command Type	Command format	Responsive
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 supply voltage, unit mv	

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	Description of the return value		
	Example	AT+BAT=? 3300 OK	
	Note	-	
Command character	Command Type	Command format	Responsive
REGION (Setting 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
	Setup Command	AT+REGION=<region>	OK
	Parameter description	<region>： regional standard 0:AS923 1:AU915 2:CN470 4:EU433 5:EU868 6:KR920 7:IN865 8:US915 9:RU864	
	Description of the return value		
	Example	AT+REGION=? 5:EU868 OK AT+REGION=5 OK	
	Note	You need to set it up before joining, and use AT+RESTORE to restore the default configuration before switching regions.	
Command character	Command Type	Command format	Responsive
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>

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			OK
	Setup Command	AT+CCLASS=<class>	OK
	Parameter description	<class>: A,Class A mode, receive only opens a window after sending C,Class C mode, receive always open	
	Description of the return value		
	Example	AT+CCLASS=C ：+EVT:SWITCH_TO_CLASS_C OK // not yet in the network AT+CCLASS=C AT_NO_NETWORK_JOINED	
	Note	The network are CLASS A into the network, if you want to switch to CLASS C need to be executed after the network, otherwise it will report an error.	
Command character	Command Type	Command format	Responsive
DUTYCYCLE (Setting the Duty Cycle)	Test command	AT+DUTYCYCLE?	AT+DUTYCYCLE=<DutyCycle><CR>. Get or Set the ETSI DutyCycle=[0:disable, 1:enable] - Only for testing
	Query command	AT+DUTYCYCLE=?	<DutyCycle> OK
	Setup Command	AT+DUTYCYCLE==<DutyCycle>	OK
	Parameter description	<DutyCycle 0: turn off ETSI duty cycle 1: Enable ETSI duty cycle	
	Description of the return value		
	Example	AT+DUTYCYCLE = 0 OK	
	Note	When DCS is turned on, the data sending frequency follows the lorawan protocol standard, the duty cycle is usually 1%, and after sending a packet of data at low airspeed, you have to wait for a long time before sending the next packet.	
Command character	Command Type	Command format	Responsive
CTXP (Setting the Transmit Power)	Test command	AT+CTXP?	+CTXP:“value” OK
	Query command	AT+CTXP=?	+CTXP:<value> OK
	Setup Command	AT+CTXP=<value>	OK
	Parameter description	<value>： For the transmission power size, the factory value is 0, different regional standards, the maximum power is different.	

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	Description of the return value	0 - 17dBm 1 - 15dBm 2 - 13dBm 3 - 11dBm 4 - 9dBm 5 - 7dBm 6 - 5dBm 7 - 3dBm	
	Example	AT+CTXP=1 OK	
	Note	Here power is standardized for cn470 and varies from region to region, see Appendix 2.	
Command character	Command Type	Command format	Responsive
CAPPEUI (**Set AppEUI**)	Test command	AT+CAPPEUI?	AT+CAPPEUI=<XXXXXXXXXXXXXXXX><CR>. Get or Set the App Eui
	Query command	AT+CAPPEUI=?	<appeui> OK
	Setup Command	AT+CAPPEUI=<appeui>	OK
	Parameter description	<appeui>: node AppEUI Length 8 bytes, format hexadecimal	
	Description of the return value		
	Example	AT+CAPPEUI=AABBCCDD00112233 OK	
	Note	Parameters are automatically saved after entering the network.	
Command character	Command Type	Command format	Responsive
CDEVEUI (Set DEVEUI)	Test command	AT+CDEVEUI?	AT+CDEVEUI=<XXXXXXXXXXXXXXXX><CR>. Get or Set the Device EUI OK
	Query command	AT+CDEVEUI=?	+CDEVEUI:<deveui> OK
	Setup Command	AT+CDEVEUI=<deveui>	OK
	Parameter description	<deveui>: node DevEUI Length 8 bytes, format hexadecimal	
	Description of the return value		
	Example	AT+CDEVEUI? +CDEVEUI=AABBCCDD00112233 OK	
	Note	The current parameters are automatically saved after entering the	

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		network.	
Command character	Command Type	Command format	Responsive
CAPPKEY (**Set AppKey**)	Test command	AT+CAPPKEY?	AT+CAPPKEY=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX><CR>: Get or Set the Application Key OK
	Query command	AT+CAPPKEY=?	<APPKEY> OK
	Setup Command	AT+CAPPKEY =<APPKEY>	OK
	Parameter description	<APPKEY>: node APPKEY Length 16 bytes, format hexadecimal	
	Description of the return value		
	Example	AT+CAPPKEY=20000000000000000000000000000001 OK	
	Note	The current parameters are automatically saved after entering the network.	
Command character	Command Type	Command format	Responsive
CDEVADDR (**Set DevAddr**)	Test command	AT+CDEVADDR?	AT+CDEVADDR=<XX:XX:XX:XX><CR>. Get or Set the Device address OK
	Query command	AT+CDEVADDR=?	+CDEVADDR:<DEVADDR> OK
	Setup Command	AT+CDEVADDR =<DEVADDR>	OK
	Parameter description	<DEVADDR>: node DevAddr Length 4 bytes, format hexadecimal	
	Description of the return value		
	Example	AT+CDEVADDR=00:11:22:33 OK	
	Note	Used during ABP, the current parameters will be saved automatically after entering the network	
Command character	Command Type	Command format	Responsive
CAPPSKEY (Set **AppSKey**)	Test command	AT+CAPPSKEY?	AT+CAPPSKEY=<XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX><CR>: Get or Set the Application Session Key OK OK

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	Query command	AT+CAPPSKEY=?	<appskey> OK
	Setup Command	AT+CAPPSKEY==<appskey>	OK
	Parameter description	<appskey>: node AppSKey Length 16 bytes, format hexadecimal	
	Description of the return value		
	Example	AT+CAPPSKEY=20000000000000000000000000000001 OK	
	Note	It is used during ABP, and the current parameters are automatically saved after entering the network.	
Command character	Command Type	Command format	Responsive
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
	Setup Command	AT+CNWKSKEY=<nwkskey>	OK
	Parameter description	<nwkskey>: node NwkSKey Length 16 bytes, format hexadecimal	
	Description of the return value		
	Example	AT+CNWKSKEY=20000000000000000000000000000001 OK	
	Note	It is used during ABP, and the current parameters are automatically saved after entering the network.	
Command character	Command Type	Command format	Responsive
CNWKID (Setting the 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
	Setup Command	AT+CNWKID=<nwkid>	OK
	Parameter description	<nwkid>： Internet ID	

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	Description of the return value		
	Example	AT+CNWKID=? 0 OK	
	Note	Can be used without setting	
Command character	Command Type	Command format	Responsive
CFREQBAND MASK （ Setting the mask ）	Test command	AT+CFREQBAND MASK?	AT+CFREQBANDMASK Set channel frequency band mask
	Query command	AT+CFREQBAND MASK=?	<mask0>:<mask1>:<mask2>:<mask3>:<mask4>:<mask5> OK
	Setup Command	AT+CFREQBAND MASK=<mask0>:<mask1>:<mask2>:<mask3>:<mask4>:<mask5>	OK
	Parameter description	<mask>: Frequency mask where the network may work, one mask represents 16 channels, mask0 represents low 16 channels, see LoRaWAN access specification for details. Only cn470,au915,us915 need to set it.	
	Description of the return value		
	Example	AT+CFREQBANDMASK=0007:0000:0000:0000:0000:0000 OK	
Command character	Command Type	Command format	Responsive
CJOIN (Set Join)	Test command	AT+CJOIN?	AT+CJOIN=<Mode>:<autojoin><CR>. Join network with Mode=[0:ABP, 1:OTAA] OK
	Setup Command	AT+CJOIN=<mode>:<auto_join>	If the input is legal, first return OK, then start the automatic authentication and return the authentication result. +EVT:JOINED Authentication Succeeded +EVT:JOIN FAILED Authentication failed.
	Parameter description	<mode>:Networking mode 0:ABP mode, this mode actually does not need to enter the network, the execution of this command is only to switch the local state 1:OTAA mode, over-the-air join. <auto_join>:whether to power on and automatically join the network	
	Description of the return value		
	Example	AT+CJOIN=1：0 OK +EVT:JOINED	
Command character	Command Type	Command format	Responsive

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SEND (**Send 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
	Setup Command	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	<Port>:port number <Nbtarns>:Maximum number of retransmissions when ACK is available <Ack>:whether to enable answer <Payload>:Hexadecimal data, two bits is one byte	
	Description of the return value		
	Example	AT+SEND=3:1:1:112233 ：+EVT:SEND_CONFIRMED +EVT:RX_1, PORT 0, DR 3, RSSI -47, SNR 11	
	Note	Enter the network first, then send the data.	
Command character	Command Type	Command format	Responsive
CADR （ Setting Rate Adaptive ）	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
	Setup Command	AT+CADR=<value>	OK
	Parameter description	<value>: as follows. 0:ADR off 1:ADR on	
	Description of the return value		
	Example		
	Note	Enabled by default	
Command character	Command Type	Command format	Responsive
CDATARATE (Setting the communication rate)	Test command	AT+CDATARATE?	+CDATARATE:“value” OK
	Query command	AT+CDATARATE=?	+CDATARATE:<value> OK
	Setup Command	AT+CDATARATE=<value>	OK
	Parameter description	<value>: as follows. Rate value range: 0-5	

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	Description of the return value	0 →(SF12，BW125) 1 →(SF11，BW125) 2 →(SF10，BW125) 3 →(SF9，BW125) 4 →(SF8，BW125) 5 →(SF7，BW125)	
	Example	AT+CDATARATE=1 OK	
	Note	Need to be set before sending data, disabled after enabling ADR, i.e. need to set AT+CADR=0 before configuring the rate, the airspeed value range may be different in different areas, see Appendix 1	
Command character	Command Type	Command format	Responsive
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	-	
	Description of the return value		
	Example	AT+LINKC OK	
	Note	After executing this command, the server will send an answer message after the next uplink.	
Command character	Command Type	Command format	Responsive
CJN1DL (Setting the incoming 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
	Setup Command	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	
	Description of the return value		
	Example	AT+CJN1DL=1000	
	Note		
Command character	Command Type	Command format	Responsive

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CJN2DL (Setting the incoming rx2 window delay)	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
	Setup Command	AT+CJN2DL=<Delay>	OK
	Parameter description	<Delay> Gets or sets the Join-Accept Delay (in milliseconds) between the end of Tx and Join-Rx window 2	
	Description of the return value		
	Example	AT+CJN2DL=2000	
	Note	Rx2_delay=rx1_delay+1000 ms	
Command character	Command Type	Command format	Responsive
CRX1DL(Setting the 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
	Setup Command	AT+CRX1DL=<Delay>	OK
	Parameter description	<Delay> Gets or sets the delay between the end of Tx and Rx window 1 in ms	
	Description of the return value		
	Example	AT+CJN2DL=2000	
	Note	You don't have to set it up, it's set up on the server and the module will be automatically synchronized.	
Command character	Command Type	Command format	Responsive
CRX2DL(Setting the 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
	Setup Command	AT+CRX2DL=<Delay>	OK
	Parameter description	<Delay> Gets or sets the delay between the end of Tx and Rx window 2 in ms	
	Description of the return value		

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	Example	AT+CJN2DL=3000	
	Note	You don't need to set it, it is set on the server, the module will be synchronized automatically, Rx2_delay=rx1_delay+1000 ms	
Command character	Command Type	Command format	Responsive
CRX2FQ (Setting the 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
	Setup Command	AT+CRX2FQ=<Freq>	
	Parameter description	<Freq>, Second receiver window frequency	
	Description of the return value		
	Example	AT+CRX2FQ=869525000	
	Note	Generally do not need to set, switch region automatically change, modified with the server and gateway mismatch will lead to failure of communication	

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7 Data rates for each frequency band

EU433/EU868/RU864/AS923:

Data rate	Configurations	Represents 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	Configurations	Represents 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	Configurations	Represents 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
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	

0-4 is the upside, 8-13 is the downside

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AU915:

Data rate	Configurations	Represents 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

0-6 up, 8-12 down

IN865:

Data rate	Configurations	Represents 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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8 Maximum power for each frequency band

Note: The actual power will be 2.15dbm less than the set value, this is due to the lorawan protocol which counts the antenna gain as well.

EU868:

By default, the maximum MaxEIRP is +16 dBm.

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

Protocol specifies a maximum module power of 22dbm

AU915:

By default, the maximum MaxEIRP is +30dBm.

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

The protocol specifies a maximum module power of 22 dBm.

KR920:

By default, the maximum MaxEIRP is +14 dBm.

Transmit power	Configurations
0	MaxEIRP
1	MaxEIRP - 2 dB
2	MaxEIRP - 4 dB
3	MaxEIRP - 6 dB

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4	MaxEIRP - 8 dB
5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB

AS923:

By default, the maximum MaxEIRP is +16 dBm.

Transmit power	Configurations
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 MaxEIRP is +30 dBm.

Transmit power	Configurations
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

The protocol specifies a maximum module power of 22dBm.

RU864:

By default, the maximum MaxEIRP is +16 dBm.

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

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5	MaxEIRP - 10 dB
6	MaxEIRP - 12 dB
7	MaxEIRP - 14 dB

CN470:

By default, the maximum MaxEIRP is +19.15 dBm.

Transmit power	Configurations
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	Configurations
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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9 Maximum transmit load for each frequency band

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

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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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 load size (M)		Downstream MAC load 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:

Data rate	M	N
0	59	51
1	59	51

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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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10 Firmware Upgrade Instructions

EWD95M series DTU supports serial firmware upgrade, when you need special after-sales support, you can contact us to get the corresponding firmware for upgrade.

Upgrade method: Use USB to RS232/RS485 tool to connect DTeconnect DTU through the upper computer configuration tool provided by our official website, select update, click “Open File” button to select the corresponding firmware, and then click to start the download, when there is a Please Wait box, click to confirm, wait for 5 seconds to confirm that it enters the upgrade mode, and then start the download. When the “Please Wait” prompt box appears, click “Confirm” and wait for 5 seconds to confirm that it enters the upgrade mode and starts downloading, and then wait for the progress bar to reach 100% to complete the download. After finishing, please manually close and open the serial port again to re-read the parameters.



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11 Related Products

Product Model	Interface Type	Working frequency MHz	Transmit power dBm	Communication distance km	Features
E870-L470LG11	WAN	470~ 510M	27	3	Full-duplex LoRaWAN standard protocol gateway
E870-L470LG12	WAN	470~ 510M	27	3	Full-duplex LoRaWAN standard protocol gateway
E870-L868LG12	WAN	EU868,IN865,RU864	27	3	Full-duplex LoRaWAN standard protocol gateway
E870-L915LG12	WAN	US915,AU915, AS923,KR920	27	3	Full-duplex LoRaWAN standard protocol gateway
E90-DTU(900L20)-V8	RS232 RS485	862～930	20	3	LoRa spread spectrum, anti-interference over long distances
E90-DTU(433L37)-V8	RS232 RS485	410～441	37	20	LoRa spread spectrum, anti-interference over long distances
E90-DTU(433L20)-V8	RS232 RS485	410～441	20	3	LoRa spread spectrum, anti-interference over long distances
E90-DTU(433L30)-V8	RS232 RS485	410～441	30	8	LoRa spread spectrum, anti-interference over long distances
E95-DTU(433L20-485)-V8	RS485	410～441	20	3	LoRa spread spectrum, anti-interference over long distances
E95-DTU(433L30-485)-V8	RS485	410～441	30	8	LoRa spread spectrum, anti-interference over long distances
E96-DTU(433L20-485)-V8	RS485	410～441	20	3	LoRa spread spectrum, anti-interference over long distances
E96-DTU(433L30-485)-V8	RS485	410～441	30	8	LoRa spread spectrum, anti-interference over long distances
E800-DTU(400SL20-485)-V8	RS485	410～441	20	3	LoRa spread spectrum, anti-interference over long distances
E800-DTU(400SL30-485)-V8	RS485	410～441	30	8	LoRa spread spectrum, anti-interference over long distances

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12 Precautions for use

1. If OTAA has entered the network, please check whether APPKEY,DEVKEY,DEVEUI parameters are the same as the server settings, and whether the node band, gateway band, and the server settings are the same. 2;

2. If this module has been successfully connected to the network, and the parameters APPKEY,DEVKEY,DEVEUI have been changed, it is necessary to use AT+RESTORE to reset the parameters and then set them again after re-entering the network as a new node;

3. When using ABP to communicate, the server will record the fcnt (frame count) of each uplink of the module, if it is less than the value of the last time, the communication will not be possible. The module is not going to save the fcnt every time, if so the loss of flash is very big. When using TTN, you need to reset the MAC parameter every time, and when using chirpstack, you need to check the Ignore frame technique;

4. otaa network display devnoce to small, this is version 1.0.4 will appear, each time the network devnoce will be added to one, this module will record, but if the module restores the default parameters, then the corresponding server devnonce need to be manually set to zero;

5. this radio should not be operated when it is near some flammable places (such as coal mine shaft) or explosive hazardous objects (such as detonator for detonation).

6. Use a suitable DC voltage regulator power supply, which should have strong resistance to high-frequency interference, small ripple, and sufficient load capacity; it is better to have the functions of over-current, over-voltage protection, and lightning protection, etc., so as to ensure the normal operation of the digital transmission radio.

7. Do not use the digital radio in the working environment beyond its environmental characteristics, such as high temperature, humidity, low temperature, strong electromagnetic field or dusty environment.

8. Do not allow the digital radio to continuously transmit at full load, otherwise the transmitter may be burned out.

9. The ground wire of the digital radio should be well connected with the ground wire of the external equipment (such as PC, PLC, etc.) and the ground wire of the power supply, otherwise it is easy to burn out the communication interface, etc.; do not plug or unplug the serial port with electricity.

10. when testing the digital transmission radio, it must be connected with matching antenna or 50Ω dummy load, otherwise it is easy to damage the transmitter; if it is connected with antenna, it is better to keep the human body away from the antenna for more than 2 meters to avoid harming, and never touch the antenna when it is transmitting.

11. wireless digital transmission radios often have different communication distance in different environments, the communication distance is often affected by temperature, humidity, density of obstacles, volume of obstacles and electromagnetic environment; in order to ensure stable communication, it is recommended to reserve more than 50% of the communication distance.

12. If the measured communication distance is not satisfactory, it is recommended to analyze and improve the communication distance from the antenna quality and antenna installation method. Also can contact support@cdebyte.com to seek help.

13. When selecting the power supply, in addition to the need to reserve 50% of the current margin according to the recommendation, more attention should be paid to its ripple should not exceed 100mV.

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13 Important statement

1. EBYTE reserves the right of final interpretation and modification of all contents of this manual.
2. Due to the continuous improvement of the hardware and software of the product, this manual may be changed without further notice, and the latest version of the manual should prevail.

Revision history

Version	Date	Description	Issued by
1.0	2024-11-26	Initial version	Lei
1.1	2025-06-17	Fix error description	Lei
1.2	2026-7-28	Fix error description	Hao

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