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RS485 to LoRaWAN Converter

USR-DR206

User Manual

V2.0

Be Honest & Do Best

Your Trustworthy Smart Industrial IoT Partner

Content

1. Introduction

USR-DR206 is a new generation of LoRaWAN end node based on the SX126x chip from Semtech. It converts RS485 data to standard LoRaWAN wireless network, simplifying IoT installations and reducing installation/maintenance costs.

This product adheres to industrial standards, supports a wide temperature and voltage range, and has undergone multiple rigorous environmental tests. Equipped with dual hardware and software watchdogs and self-recovery mechanisms for faults, it can adapt to various industrial scenarios and operate reliably even in harsh environments.

With Standard LoRaWAN technology, It is widely applied to scenarios requiring a large number of wireless network connections, long-distance wireless data collection, control, and maintenance, such as smart metering, valve control, smart factories, energy monitoring, environmental monitoring, smart agriculture, smart fire protection, and smart cities.

1.1. Features

Stable & Reliable

- V0-rated flame-retardant material ensures the product's safe use, with a PC+ABS material construction that is lightweight and portable.
- Operating temperature range from -40°C to 85°C, suitable for a wide range of environments.
- Wide voltage design with DC 8-24V input, featuring reverse polarity protection for the power supply.
- Built-in hardware watchdog for stable operation around the clock, ensuring no system crashes.
- DIN rail mounting is easy to setup and wire, occupying minimal space.

Standard LoRaWAN Protocol

- Flexible network apology, capable of connecting to other standard LoRaWAN gateway.
- Extensive connectivity, suitable for large-scale scenarios with multiple terminal connections.
- Standard activation methods: OTAA and ABP.
- Multiple frequency is optional: CN470/AU915.
- Class C protocol, efficient data transmission.
- ADR technology, dynamic adjustment to improve efficiency.

Advanced Features

- LBT technology to improve communication success rates.
- Rich indicators for real-time observation of signal quality.
- The heartbeat keep-alive mechanism maintains the status of the LoRaWAN network, enhancing the reliability

of the wireless connection.

1.2. Specification

Specifications of USR-DR206 are as follows:

Items	Description
Processor	32-bit, FM33LG043
Power Supply	DC: 8-24V, 2-pin terminal blocks, reverse polarity protection, surge protection
Working Current	Sending data: 45mA@12V, Receiving data: 11mA @12V
Serial port	
No.	1 x RS485
Baud rates	RS485: 1200 ~ 115200bps
Data bits	7, 8
Stop bits	1, 2
Parity	NONE, ODD, EVEN
LoRaWAN	
Radio Chip	SX126x
Frequency	USR-DR206-CN470，470-510MHz USR-DR206-AU915，902-928MHz
Tx Power	21±0.5dBm, default value: 19dBm(CN470)/20dBm(AU915)
Rx Sensitivity	'-140dBm @0.268Kbps
Activation Method	OTAA/ABP Class C
Coverage distance	Max 5.5KM Test conditions: clear weather, open field of view, maximum power 22±0.5dBm, antenna gain 3.5dBi, height greater than 2m.
Antenna	Female SMA Connector, 2±1 dBi
Physical Property	
Casing material	V0 flame retardant, IP30 protection
Dimensions	109.66*64.67*28mm(L x W x H, terminal block are included)
Installation	Din rail mounting
EMC	Surge protection: level 3, IEC61000 ESD protection: level 3, IEC61000

	EFT protection: level 3, IEC61000
Operating temperature	-40℃ ~ +85℃
Storage temperature	-40℃ ~ +125℃
Operating humidity	10% ~ 90% RH, non-condensing
Storage humidity	5% ~ 90% RH, non-condensing
Software Function	
Heartbeat data	√, it's disabled by default
Multicast	√
User Configuring	Config utility, AT command
Others	
Reload	Pinhole reset button
APPROVALS	
Regulatory	CE/RED*, RoHS*, WEEE*, FCC*

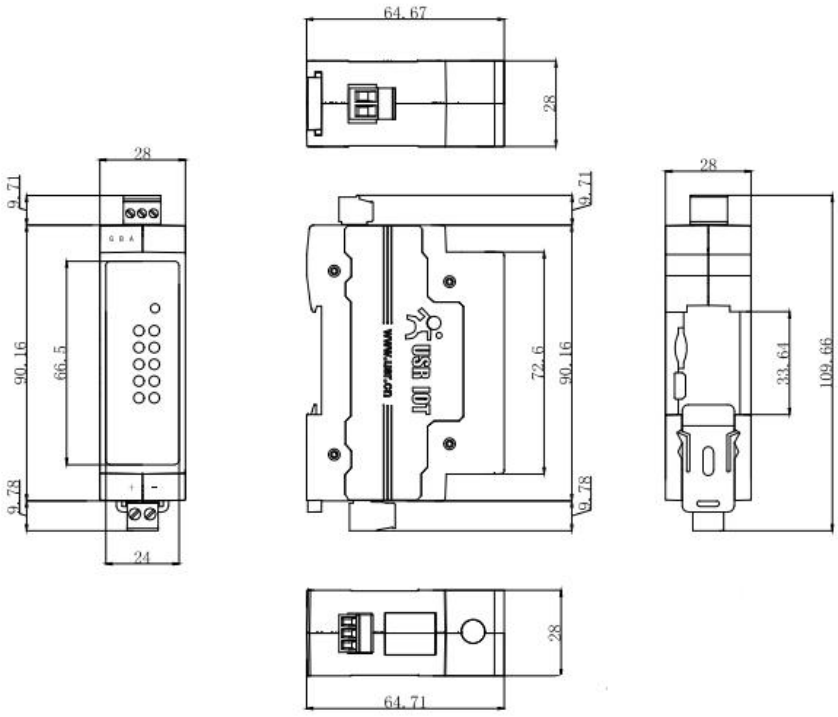
1.3. Indicator status description

Table 1. Indicator Status

Name	Description
PWR	ON: power on, OFF: power off
WORK	0.5Hz flashing frequency after the system boot up.
Link	ON: Get connected with LoRaWAN gateway and the signal is very good. OFF: Not connected with LoRaWAN gateway. Flashing(1s): the signal is good. Flashing(3s): the signal is weak.
TXD	Flashing when sending data.
RXD	Flashing when receiving data.

1.4. Dimensions

Unit: mm



2. Brief introduction of LoRaWAN protocol

2.1. LoRaWAN protocol

LoRaWAN (Long Range Wide Area Network) is a low power wide area network (LPWAN) communication protocol designed for the Internet of Things (IoT). It is based on LoRa technology to achieve long-distance, low-power wireless communication through spread spectrum modulation, which is suitable for iot applications that require long-distance data transmission. The LoRaWAN standard has been recognized as an LPWAN global standard by the International Telecommunication Union (ITU), the specialized agency of the United Nations responsible for information and communication technologies (ICTs).

The LoRaWAN network architecture includes terminal devices, gateways and network servers. The end devices are usually sensors or smart meters that communicate with the gateway via the LoRaWAN protocol. The gateway receives data from multiple end devices and transmits this data over the Internet to a network server for processing and analysis. Web servers are responsible for managing the network, processing data, and ensuring data security.

The advantage of LoRaWAN is that it can cover a wide geographical area, while supporting the connection of a large number of devices, low power consumption, high capacity, low cost, flexibility and scalability, no carrier charges, etc., for smart cities, industrial automation, environmental monitoring, smart agriculture and other scenarios is very ideal choice.

2.2. LoRaWAN apology

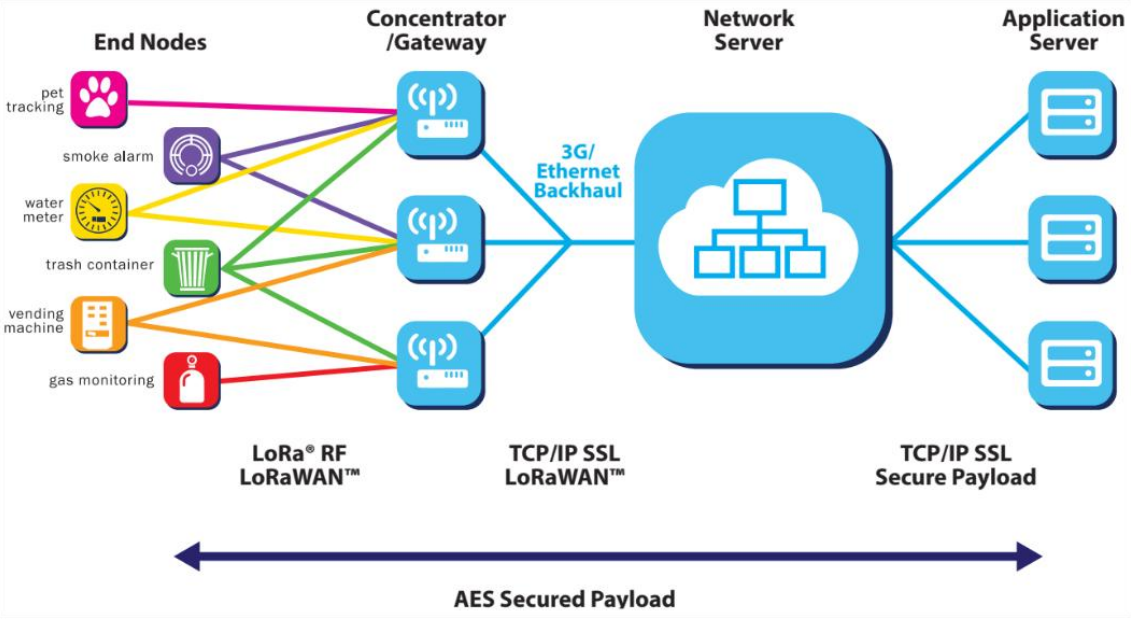
The LoRaWAN Network topology is a star structure, consisting of four parts: End Node (EDs), gateway (GWs), Network Server (NS), and Application Server (Application Server). The star network topology is adopted between the gateway and the node, the node is networked to the gateway, the network server processes the information between the gateway and the node, and the application server acts as the receiving end or the collecting end for remote data acquisition and management.

Nodes: Also known as terminal devices, are devices that connect physical sensors to the network and send data to a gateway via LoRa wireless communication.

Gateway: A device that connects nodes to network servers, receives and forwards data from nodes, and manages and configures nodes.

Network server: also known as NS server, processing LoRaWAN network layer related data, mainly including MAC commands, area parameters and adaptive rate (ADR), etc., the main role is to provide network connection, device management and data processing capabilities for node devices in LoRaWAN network. (Our USR-LG280 gateway supports built-in NS server)

Application server: can also be understood as a user management platform, processing terminal device data, data collection/remote management of devices, etc.



2.3. Mode of LoRaWAN end node

End devices in a LoRaWAN network come in three classes: Class A, Class B and Class C. While end devices can always send uplinks at will, the device's class determines when it can receive downlinks. The class also determines a device's energy efficiency. The more energy efficient a device, the longer the battery life.

➢ **Class A End Devices**

The LoRaWAN protocol relies on an Aloha-type network. In this type of network, end devices are allowed to transmit arbitrarily.The key characteristic of Class A is that communication is initiated only by the end device. Downlink messages from the network server are queued until the next time an uplink message is received from the end device and a receive window(Rx) is opened. This design is specifically geared toward applications that require downlink communication in response to an uplink, or that can schedule downlinks ahead of time with fairly loose latency requirements.

➢**Class B End Devices**

End devices in Class B mode provide for regularly-scheduled receive windows, in addition to those that open whenever a Class A-style uplink is sent to the server. For this to work, a time-synchronized beacon is broadcast periodically by the network via the gateways. The end device must periodically receive one of these network beacons so that it can align its internal clock with the network.

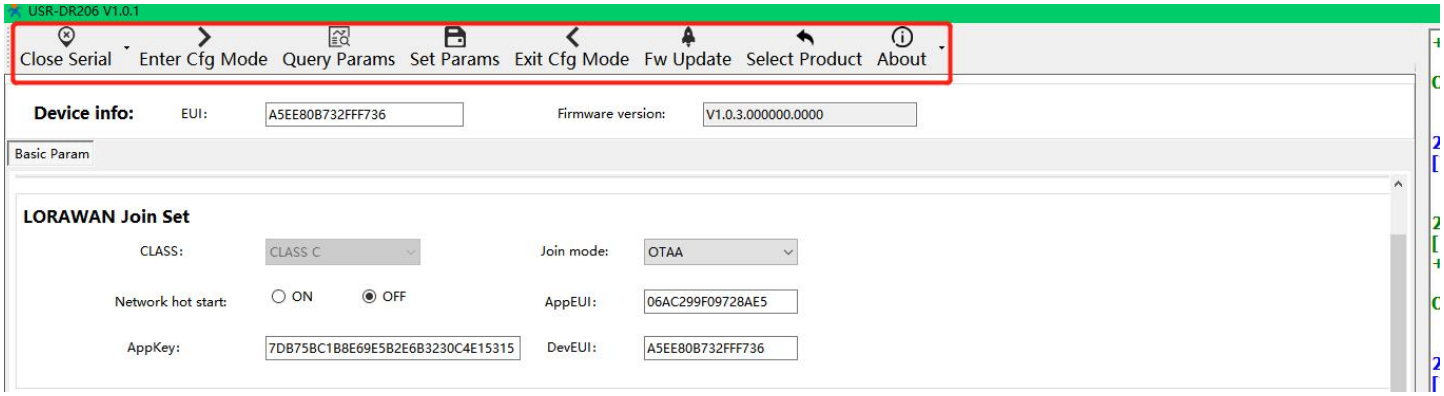
➢**Class C End Devices**

End devices in Class C mode are used when extremely low power consumption is not an issue and latency needs to be minimized. The server-side application determines that it is managing class C devices during the join procedure.

Note: USR-DR206 supports class C mode only for now.

3. Parameters introduction

3.1. Config utility



Serial Config: Select serial parameters to communicate with the the LoRaWAN end node.

Enter Cfg Mode: After entering this mode, users can set parameters of the device via this utility or AT command.

Query Params: Query all parameters of the LoRaWAN end node device.

Set Params: Click this button to write the changed settings to the device.

Exit Cfg Mode: After clicking this button, the device is in data transmission mode.

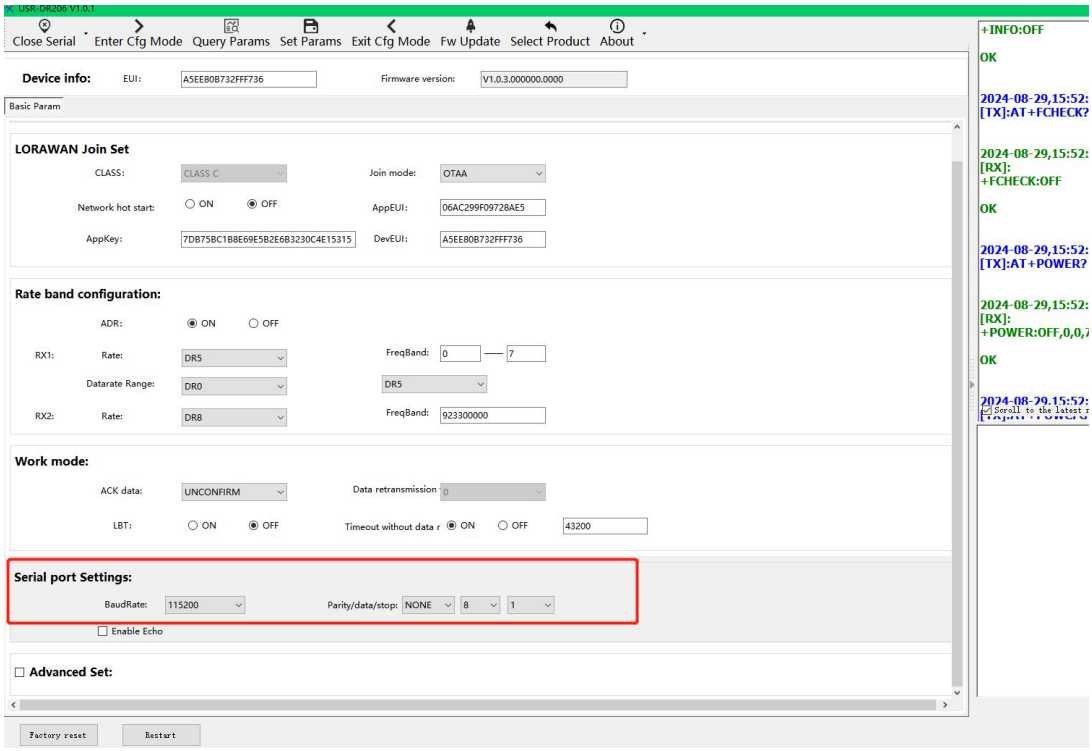
Fw Update: Upgrading firmware of the device, users can upgrade the firmware via serial port.

Select Product: Select model, protocol, and language in this page.

3.2. Basic parameters of serial port

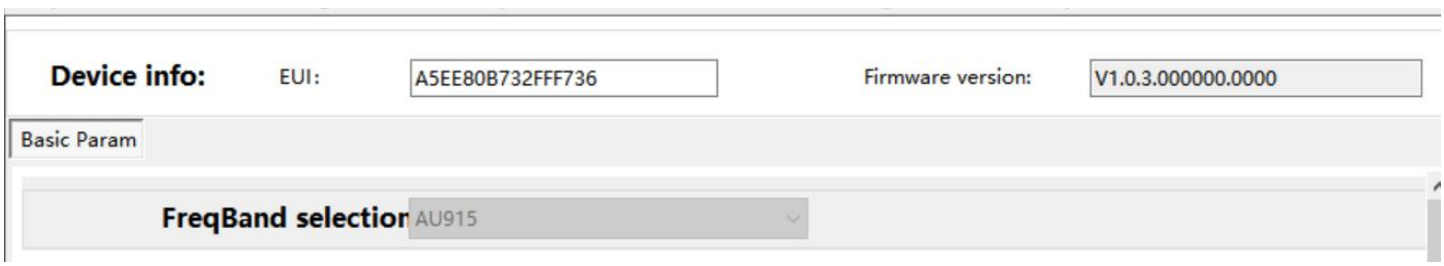
Serial parameters of USR-DR206 must be consistent with the serial device. Serial port parameters include basic parameters and framing parameters.

Item	Parameter
Baud rate	1200~115200bps
Data bit	7, 8
Stop bit	1,2
Check bit	NONE EVEN ODD



3.3. Device information

After querying the settings of device, users can check the EUI, firmware, and the frequency.



3.4. LORAWAN join set

●OATT activation methods

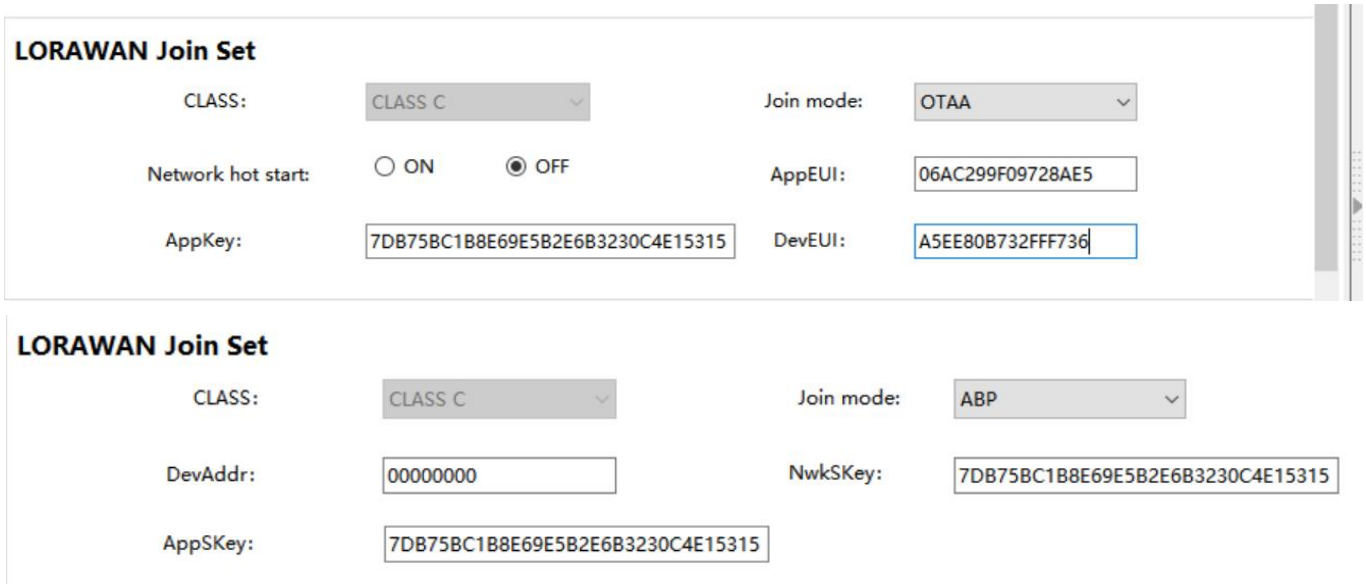
OTAA(Over-The-Air Activation) is a device joining mechanism that allows devices to join a LoRaWAN network without pre-configured network information. The OTAA process offers a secure and flexible method for registering and activating new devices.

●ABP activation methods

ABP (Activation By Personalization) is a device joining mechanism that allows devices to join the LoRaWAN network directly using pre-configured network information. Compared to OTAA, ABP does not require key exchange over the air, thus providing a faster way to join the network, but it may compromise some security aspects.

Items	Description	Default Value
CLASS	The working mode of device.	CLASS C
Join mode	OATT or ABP.	OTAA
Network hot start	Once enabled, after the node successfully joins the network, the registration context is saved, and after a reset, there is no need to re-JOIN to resume LoRaWAN communication.	OFF
APP EUI	Identify applications within the LoRaWAN network (8 bytes in length), with each device required to have uniqueness to avoid conflicts.	06AC299F09728AE x
AppKey	Used for device joining and data encryption (16 bytes in length), ensures that the data transmitted between the device and the Network Server (NS) is encrypted, thereby safeguarding the confidentiality and integrity of the data.	7DB75BC1B8E69E5 B2E6B3230C4E153 1x
DevEUI	The device address used for ABP joining uniquely identifies the device's address within the LoRaWAN network.	A5EE80B732FFF73 x
DevAddr	The device address used for ABP joining uniquely identifies the device's address within the LoRaWAN network.	00000000

NwkSkey	Used for encrypting and decrypting data at the network layer.	7DB75BC1B8E69E5B2E6B3230C4E1531x
APPSKey	Used for encrypting and decrypting data at the application layer.	7DB75BC1B8E69E5B2E6B3230C4E1531x



3.5. Rated band configuration

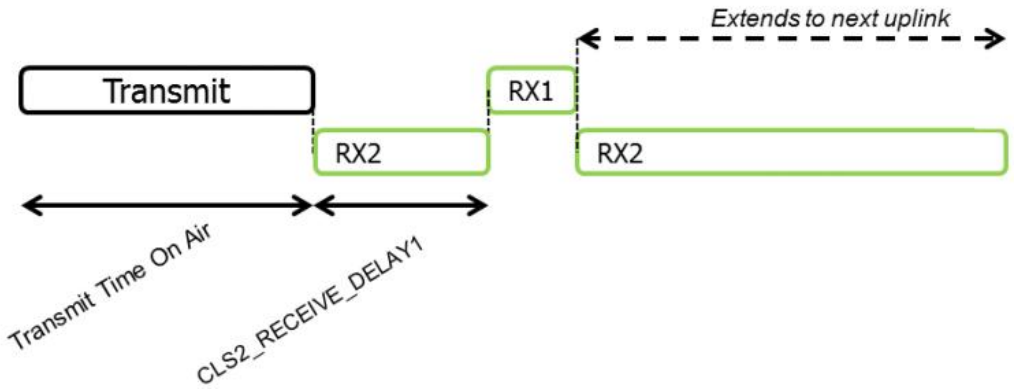
➢ **ADR:** Optimize network performance by dynamically adjusting the transmission parameters of the terminal devices, such as data rate and transmission power. The network server calculates the optimal parameters based on the uplink data from the devices (such as Received Signal Strength Indicator RSSI and Signal-to-Noise Ratio SNR), and notifies the devices to adjust via downlink messages. It is recommended to enable this process.

➢ **Receive windows Rx1/Rx2**: for Class C device,it has 2 receive windows:Rx1 and Rx2.

It opens a short receive window (Rx1) and, if no downlink is received during that period, it opens a second receive window (Rx2). The start time of Rx1 begins after a fixed amount of time following the end of the uplink transmission. Typically, this delay is one second.

The RX2 window is open until they send the next transmission back to the server. Therefore, they can receive a downlink in the RX2 window at almost any time. A short window at the RX2 frequency and data rate is also opened between the end of the transmission and the beginning of the RX1 receive window(the 1 second delay),

as illustrated in the following figure.

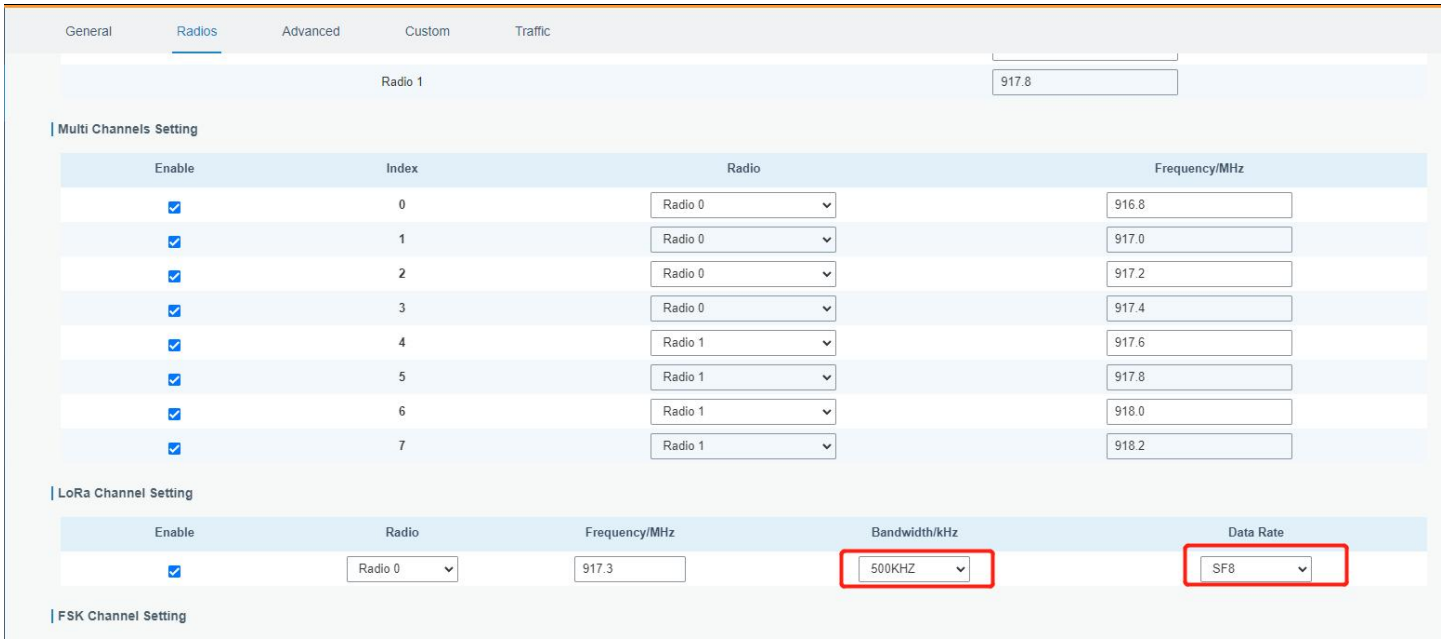


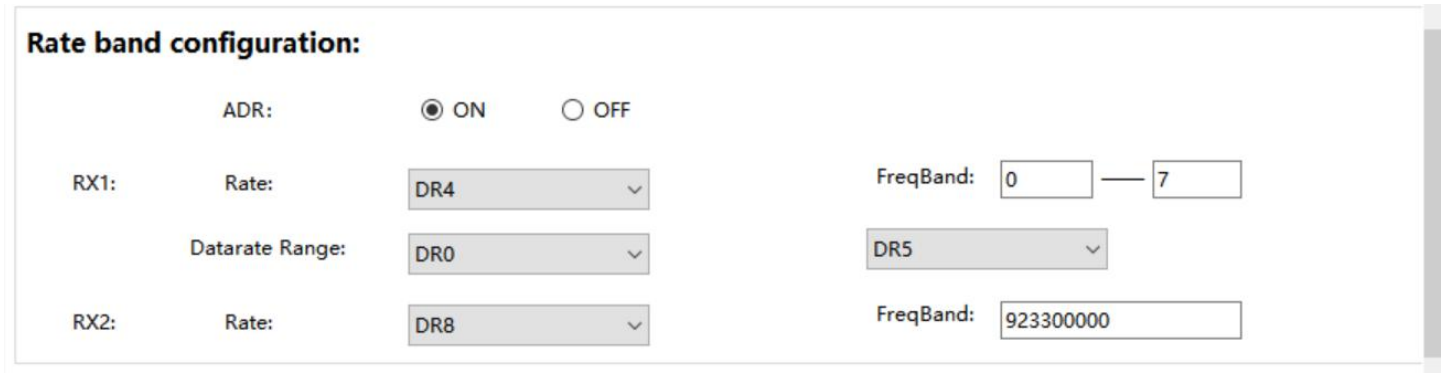
➢Data Rate: The data rate of the RX1 window is typically one less than the uplink data rate. For instance, if the gateway's LoRa channel is set to DR5, then the data rate for our node's RX1 window can be set to 4. Refer to the data rate table for details.

Data Rate（DR）	Spreading Factor（SF）	Bandwidth（BW）
DR0	SF12	125kHz
DR1	SF11	125kHz
DR2	SF10	125kHz
DR3	SF9	125kHz
DR4	SF8	125kHz
DR5	SF7	125kHz

➢Data Rate Range: DR0-DR5

If the gateway's radio frequency end is set to a bandwidth of 125kHz and SF7, corresponding to DR5, it is recommended to set the nodes to a lower setting, opting for DR4.





Frequency Band: It is consistent with the multi-channel setting of the gateway. For convenience, we set the frequency band here using the serial number. Please refer to the table for the serial number and corresponding frequency band

Up link channel: total 64 channels, 0-63, each channel is 200 kHz apart.

Down link channel: total 8 channels, 0-7, each channel is 600 kHz apart.

Up link channel

Channel Number	Frequency (MHz)	Bandwidth (kHz)	Data Rates (DR)	Spreading Factors (SF)	Center Frequency (MHz)
0	915.2	125	DR0 to DR3	SF10BW125 to SF7BW125	915.2
1	915.4	125	DR0 to DR3	SF10BW125 to SF7BW125	915.4
2	915.6	125	DR0 to DR3	SF10BW125 to SF7BW125	915.6
3	915.8	125	DR0 to DR3	SF10BW125 to SF7BW125	915.8
4	916.0	125	DR0 to DR3	SF10BW125 to SF7BW125	916.0
5	916.2	125	DR0 to DR3	SF10BW125 to SF7BW125	916.2
6	916.4	125	DR0 to DR3	SF10BW125 to SF7BW125	916.4
7	916.6	125	DR0 to DR3	SF10BW125 to SF7BW125	916.6
8	916.8	125	DR0 to DR3	SF10BW125 to SF7BW125	916.8
...	...	125	...	...	...
63	927.8	125	DR0 to DR3	SF10BW125 to SF7BW125	927.8

Down link channel

Channel Number	Frequency (MHz)	Bandwidth (kHz)	Data Rates (DR)	Spreading Factors (SF)	Center Frequency (MHz)
0	923.3	500	DR8 to DR13	SF12BW500 to SF7BW500	923.3

1	923.9	500	DR8 to DR13	SF12BW500 to SF7BW500	923.9
2	924.5	500	DR8 to DR13	SF12BW500 to SF7BW500	924.5
3	925.1	500	DR8 to DR13	SF12BW500 to SF7BW500	925.1
4	925.7	500	DR8 to DR13	SF12BW500 to SF7BW500	925.7
5	926.3	500	DR8 to DR13	SF12BW500 to SF7BW500	926.3
6	926.9	500	DR8 to DR13	SF12BW500 to SF7BW500	926.9
7	927.5	500	DR8 to DR13	SF12BW500 to SF7BW500	927.5

Multi channel of the gateway: it's corresponding to channel 8-15.

3.6. Work mode

- Messages from end devices to the network and application servers and vice versa may be unconfirmed or confirmed.

Unconfirmed message: when a device sends an unconfirmed message, it does not require an acknowledgement from the server.

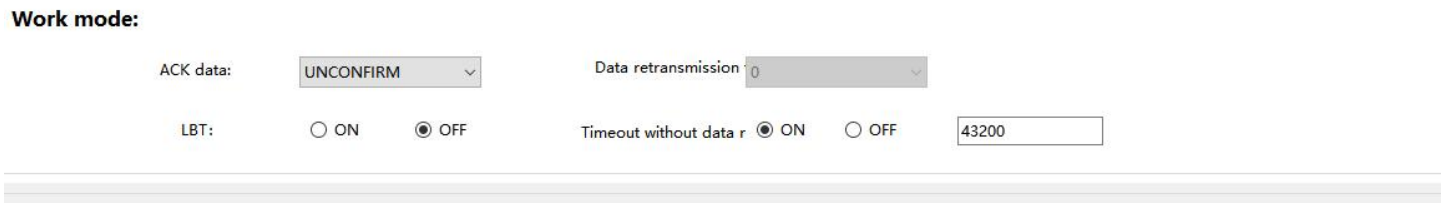
Confirmed message: when sending a confirmed message, the end device requires that the message be acknowledged as received by the network server.

- Data re-transmission:

In CONFIRM mode, you can choose the number of retries according to your own needs.

In UNCONFIRM mode, after the sender sends the data packet, it does not require an acknowledgment (ACK) from the recipient. Once the data packet is sent, the sender will not retry regardless of whether it is successfully received or not. This reduces network load and improves communication efficiency, but if there is packet loss, it may not be detected.

- LBT: Listen Before Talk can reduce data conflicts in the air and improve the success rate of wireless data transmission.



3.7. Advanced set

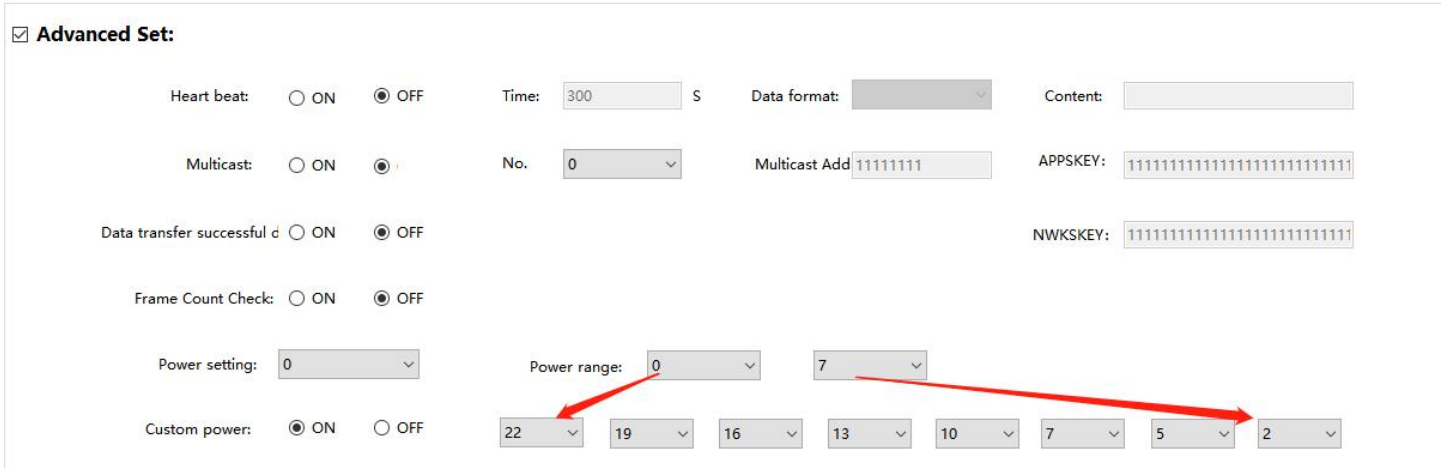
- Heart beat: after enabled this function, the end nodes will upload heart beat data in hex or ASCII format to the server at set intervals. The default value is off. Time range: 30-65536 seconds, content length: 1-50 bytes.
- Multicast: it allows a gateway to send data to multiple devices at the same time, the main advantage of the multicast mode is its ability to improve network efficiency and reduce the time and resources required for the gateway to send the same message.

  No.: the group number of the multicast.

  Multicast add: address of multicast.

  APPSKEY:

  NWKSKEY:
- Data flag: only available in COMFIRM mode, when server sends ACK message to the end device, it always send SNR and RSSI information, and the USR-DR206 send the SNR and RSSI to serial device via serial port.
- Frame Count Check: used to ensure the security and integrity of data transmission. The frame counter is applied in both main directions of the LoRaWAN protocol—uplink (device to gateway) and downlink (gateway to device) communication.
- Power setting: By selecting the sequence number to set the power, you can choose a sequence number from 0 to 7.
- Custom power:After enabling, you can set the power value.

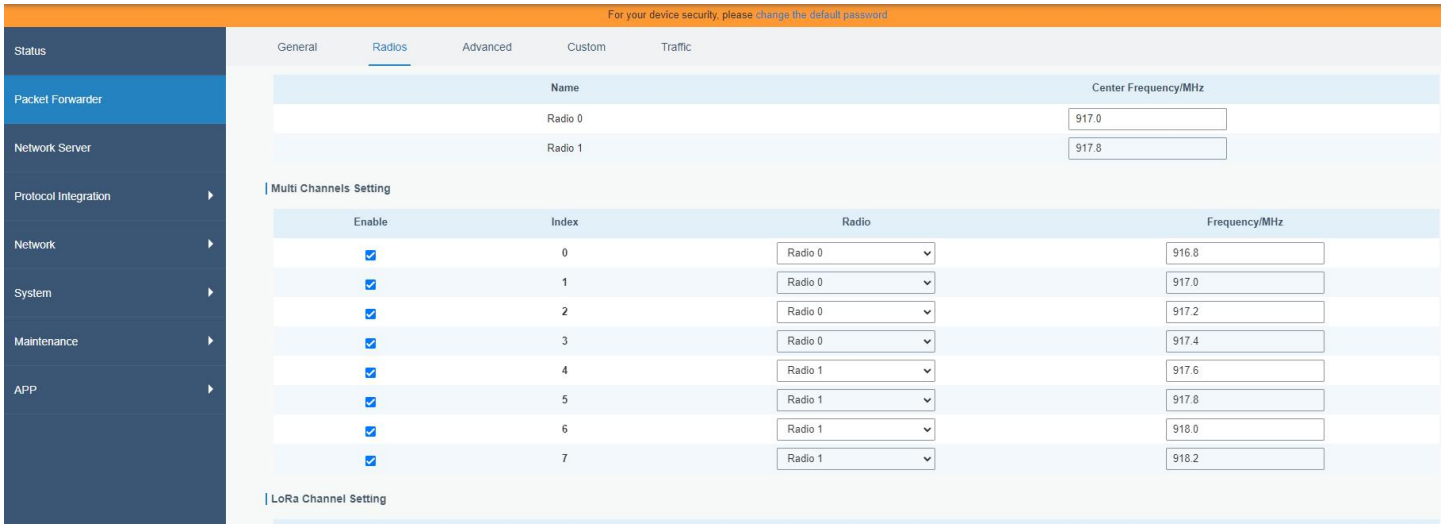


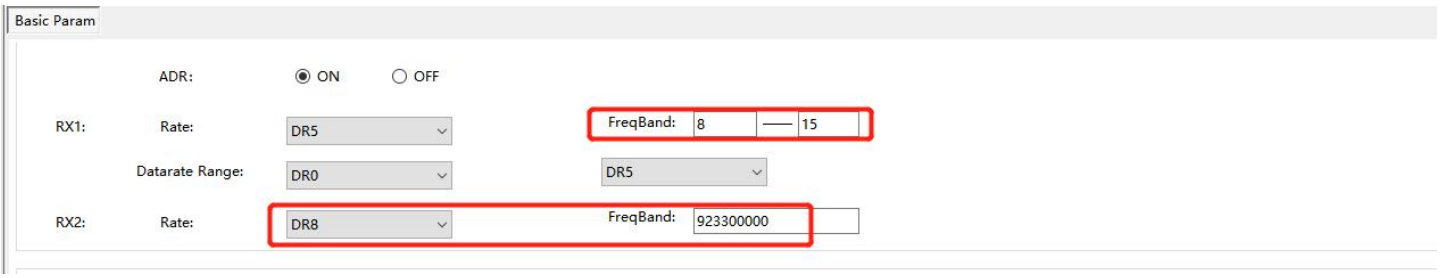
As shown in the figure: Set to use a power level of 22dBm for data transmission; if we turn on the ADR function (1), the node will transmit at a power level of 22dBm when it first joins the network, after which the

gateway will dynamically adjust the power of the node device within the (0-7 sequence number power range); if the ADR function is turned off, the node will continue to transmit data at a power level of 22dBm.

4. Data Transmission

4.1. Radio settings



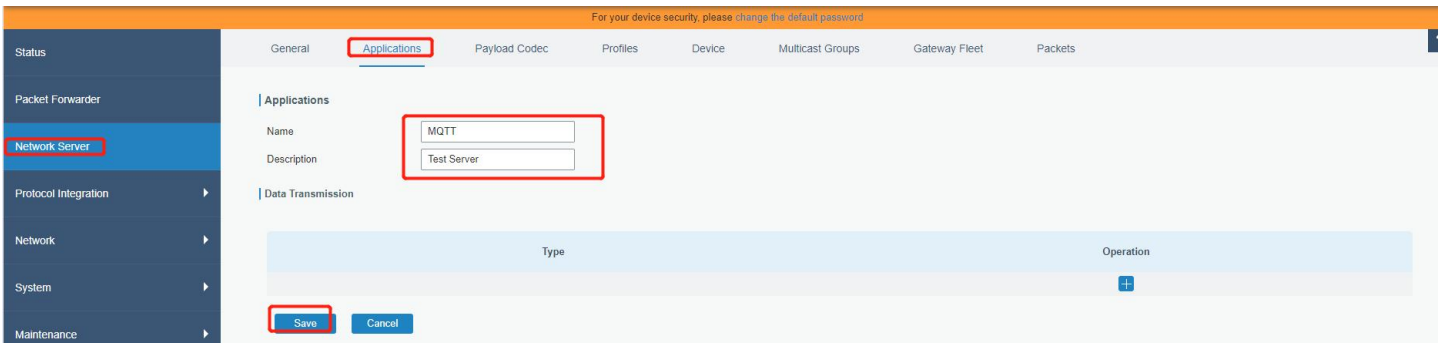


4.2. Add device

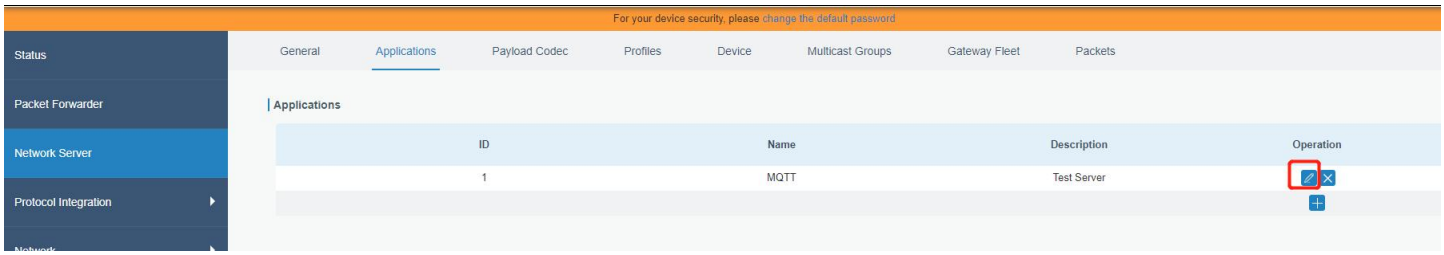
USR-LG280 can connect to the third private server. It support MQTT, HTTP, HTTPS, BACnet/IP protocol.

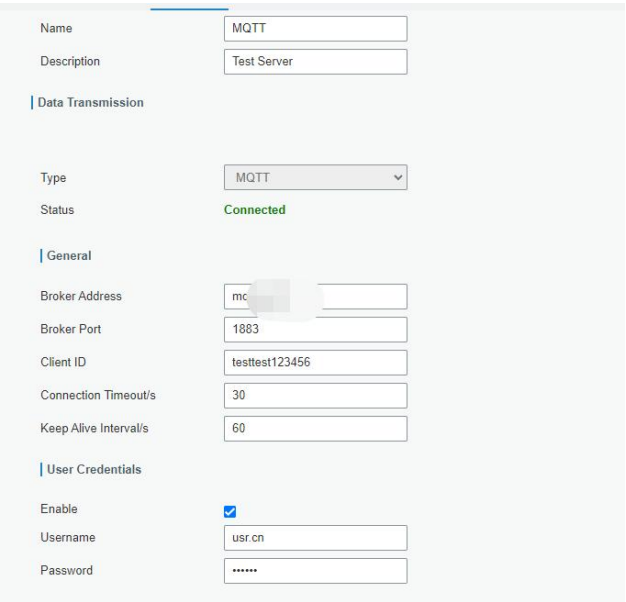
4.2.1. Add application in the gateway

In this doc, add application in MQTT protocol.



Then re-edit the application, and add the basic MQTT settings.



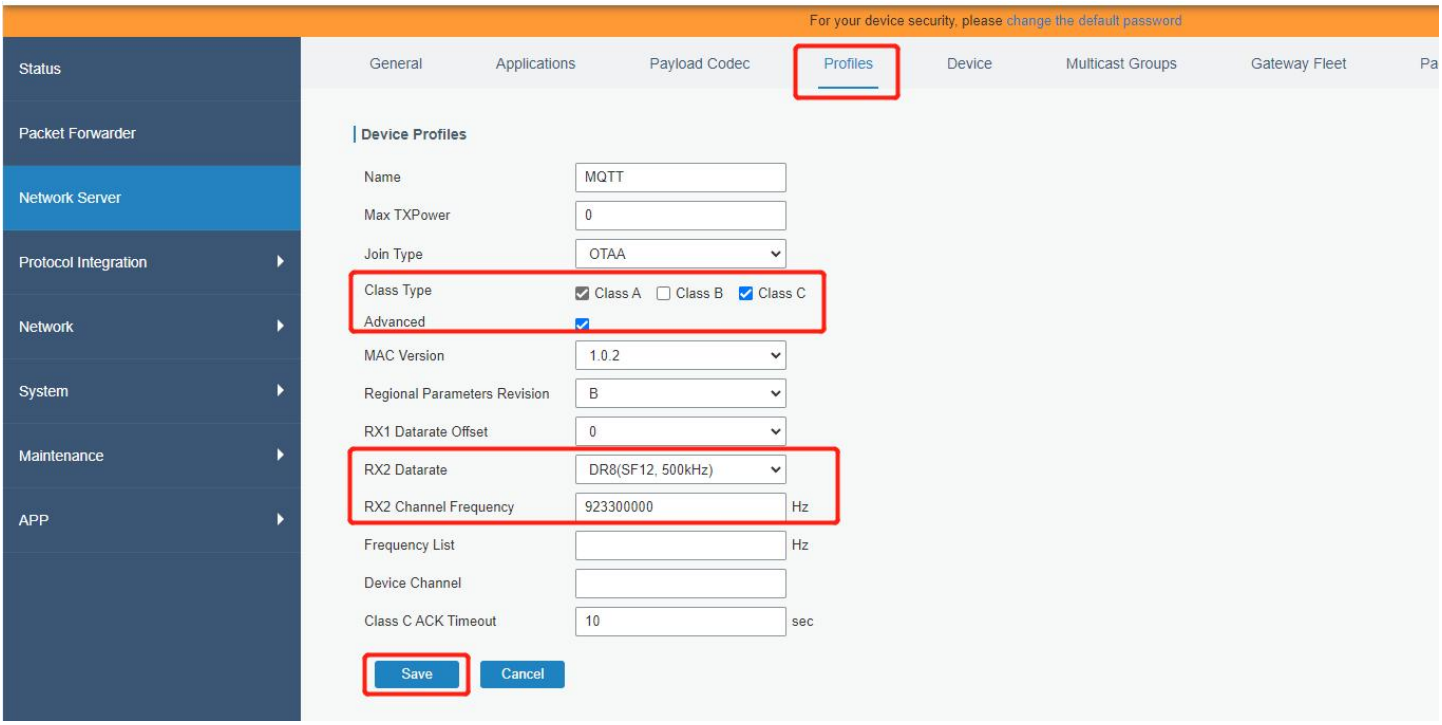


Items	**Description**
Broker address	Enter the address of the MQTT broker
Broker port	Enter the port of the MQTT broker
Client ID	Enter the client ID
Connection Timeout	The device will re-connect to MQTT broker if the server is not connected within the specified time.
Keep Alive Interval	
User Credentials	Whether to enable the user credential
Username	Should be consistent with that of the server
Password	Should be consistent with that of the server
TLS	Whether to enable the TLS
Mode	CA signed: Need to upload the CA certificate

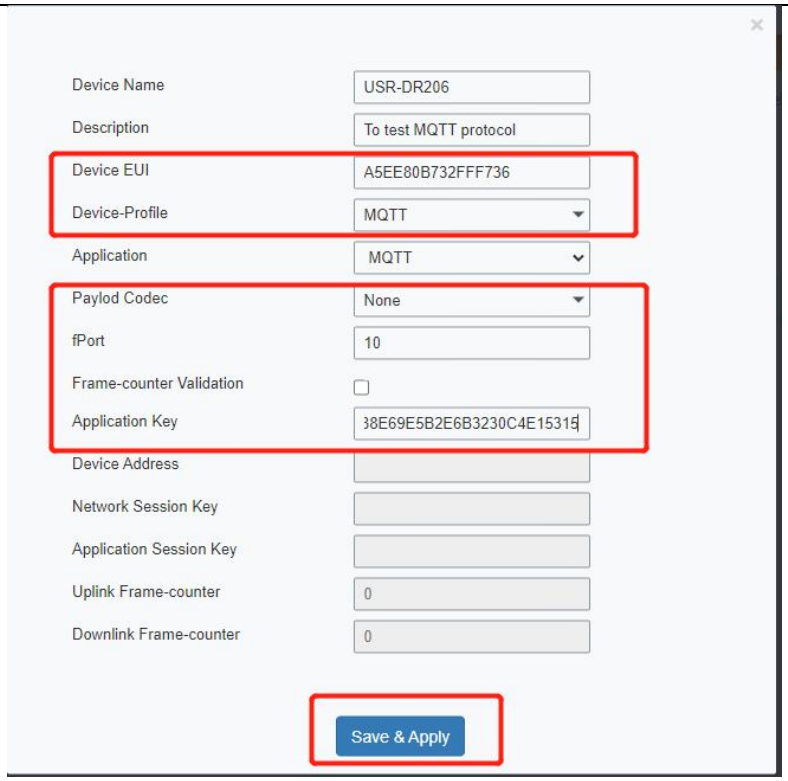
	Self signed: need to upload the relevant certificate
Topic of Uplink	The publish topic of MQTT. The topic can be customized. Example: /PUSR/uplink/test /PUSR/uplink/test/123
Topic of Downlink	The subscribe topic of MQTT. The last level must be /$deveui Example: /PUSR/test/123/$deveui /PUSR/test/$deveui
Topic of Multicast downlink	The subscribe topic of MQTT for multicast

4.2.2. OATT activation

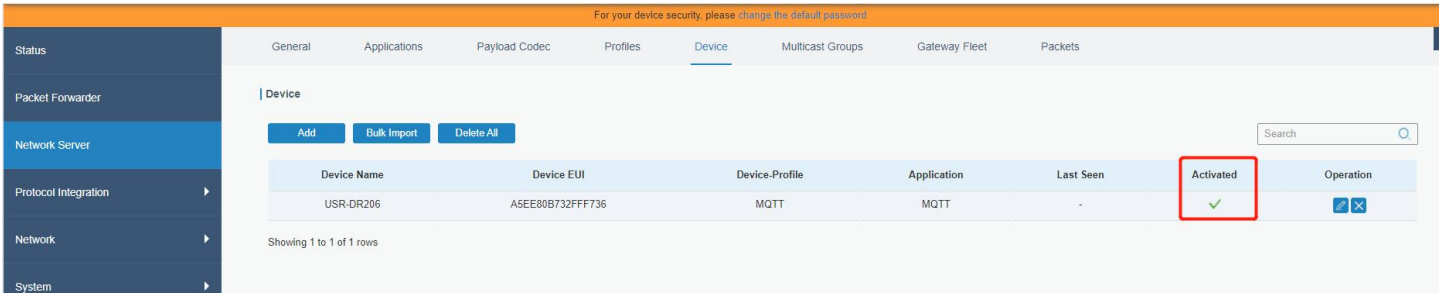
Add new profile. Please refer to the manual of the gateway to know more about the parameters.



Add device



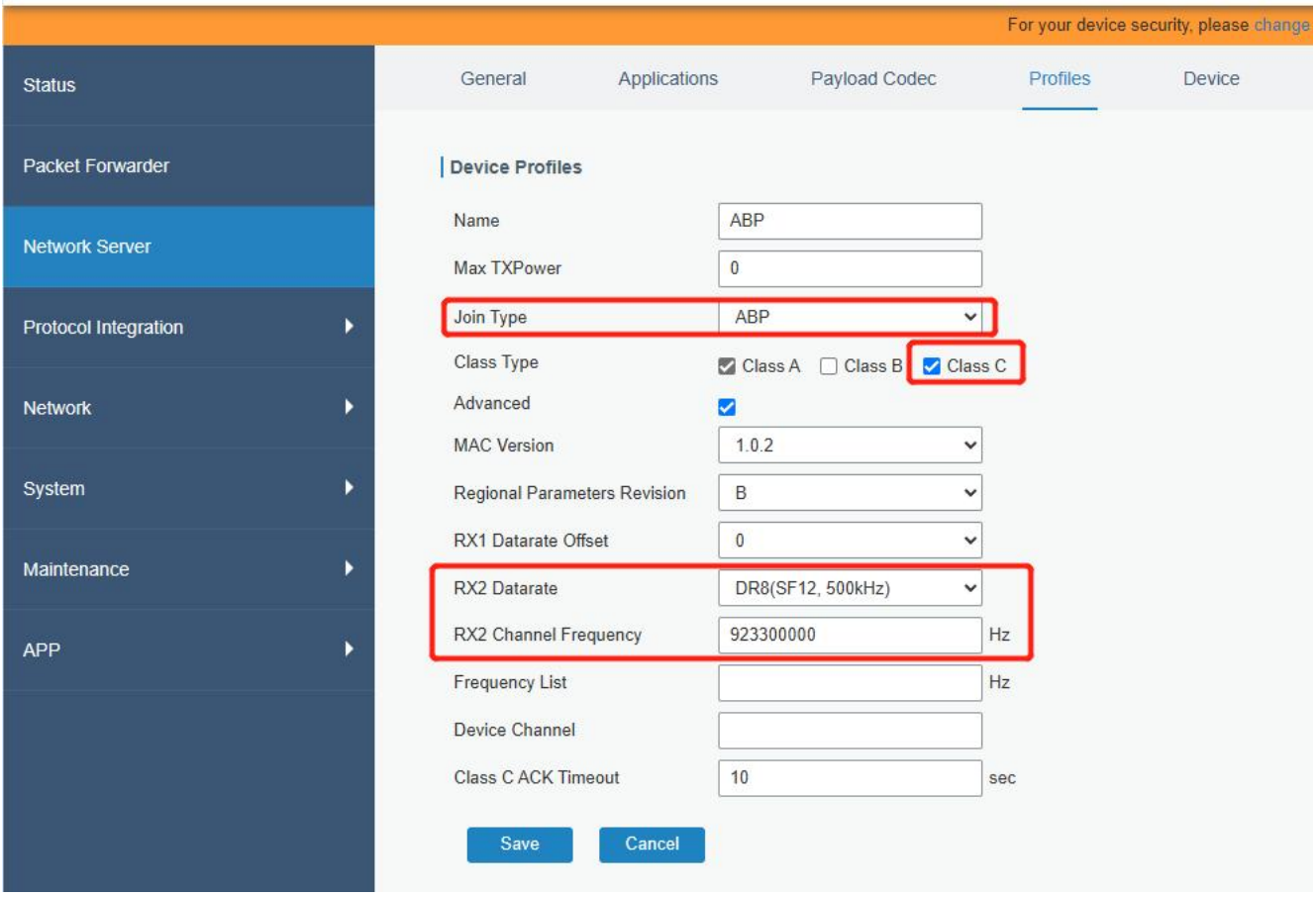
The device is activated.



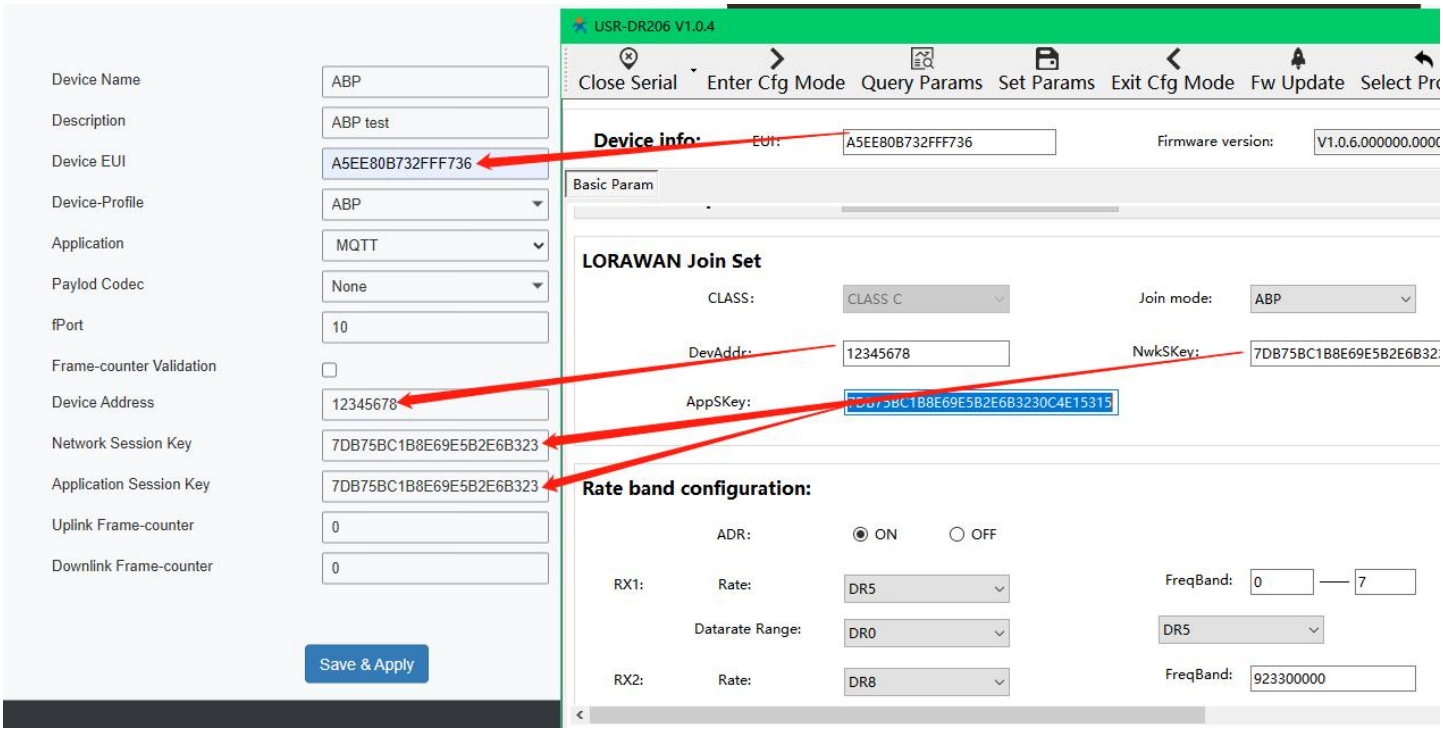
4.2.3. ABP activation

4.2.3.1. Add Profiles

End nodes access to the network of gateway in ABP mode, users can set the parameters in the following picture.



4.2.3.2. Add device



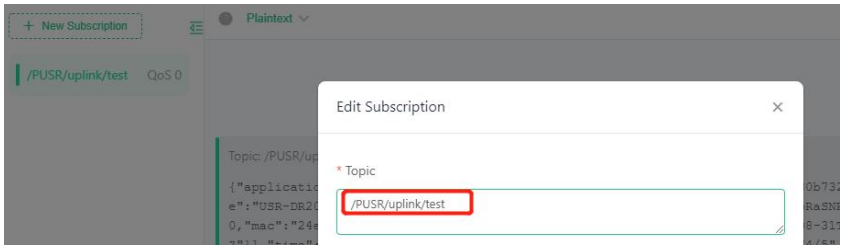
4.3. Communication test

4.3.1.1. Send data from serial to MQTT

Send ASCII data “123” from serial device to MQTT side, and the MQTT software receive the following data. The

data in the red box in the data in Base 64.

Note: the subscribe topic should be the same with the uplink topic of the gateway



Received data in MQTT software:

{"applicationID":"1","applicationName":"MQTT","data":"Nzg5","devEUI":"a5ee80b732fff736","deviceName":"USR-DR206","fCnt":3,"fPort":10,"rxInfo":[{"altitude":0,"latitude":0,"loRaSNR":13.8,"longitude":0,"mac":"24e124fffefa610a","name":"Local Gateway","rssi":-40,"time":"2024-08-30T10:31:43.086279Z"}],"time":"2024-08-30T10:31:43.086279Z","txInfo":{"adr":true,"codeRate":"4/5","dataRate":{"bandwidth":125,"modulation":"LORA","spreadFactor":7},"frequency":917400000}}

Parsing the content in the following format:

{

"applicationID":"1",

"applicationName":"MQTT",

"data":"Nzg5", //The data in Base 64 format

"devEUI":"a5ee80b732fff736",

"deviceName":"USR-DR206",

"fCnt":3, // the frame counter

"fPort":10, //Application port

"rxInfo": //

[{

"altitude":0, // The altitude of the gateway

"latitude":0, // The latitude of the gateway

"loRaSNR":13.8, // Value of SNR

"longitude":0, // The longitude of the gateway

"mac":"24e124fffefa610a", //MAC address of the gateway

"name":"Local Gateway",

"rssi":-40, //Signal strength

"time":"2024-08-30T10:31:43.086279Z"

}],

"time":"2024-08-30T10:31:43.086279Z",

"txInfo":

{

"adr":true, // If enable the ADR

"codeRate":"4/5", //code rate

"dataRate":

{

"bandwidth":125, //Band width of the gateway

"modulation":"LORA",

"spreadFactor":7

},

"frequency":917400000

}

}

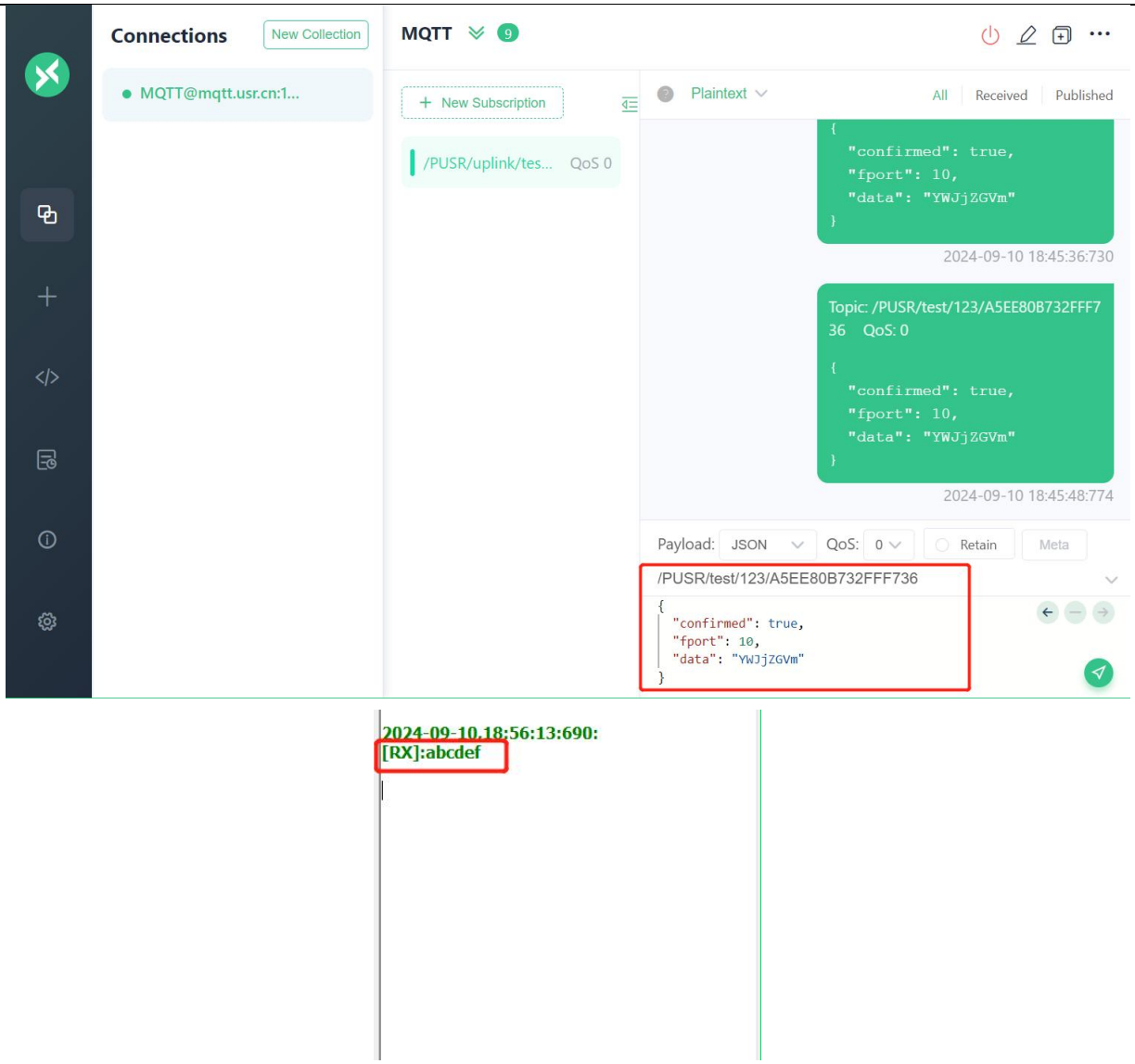
4.3.1.2. Send data from MQTT to serial

When send data from MQTT to end node, the publish topic should be like: /PUSR/test/123/A5EE80B732FFF736, the /PUSR/test/123 is kept with the configured downlink data topic on LG280, /A5EE80B732FFF736 is the device EUI of the USR-DR206.

The sending data format from MQTT:

```
{
  "confirmed": true,  // Enable the message confirm function
  "fport": 10,  //The port of end device, it's always be 10
  "data": "YWJjZGVm"    // In ASCII format: abcdef
}
```

The data received in the serial port is abcedf, like in the following picture.

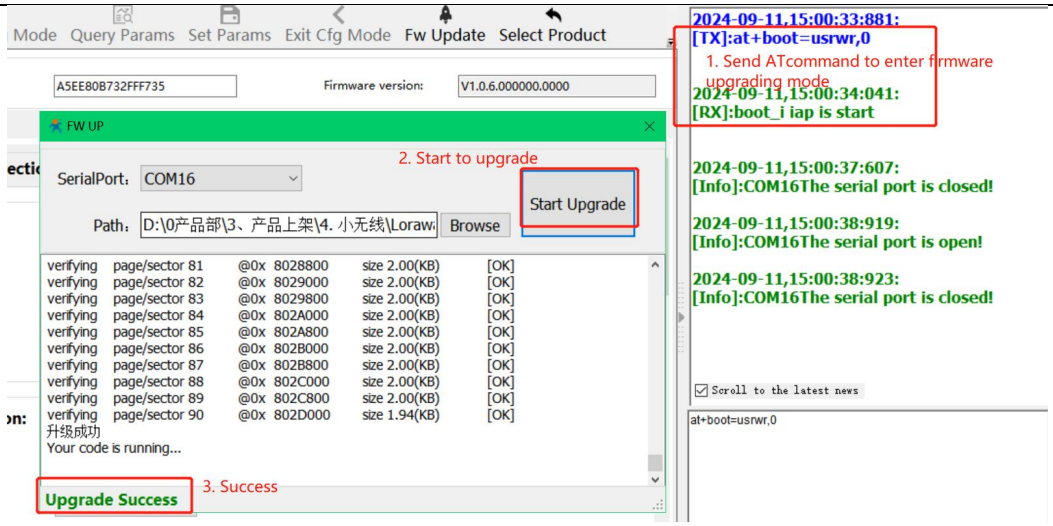


5. Firmware Upgrading

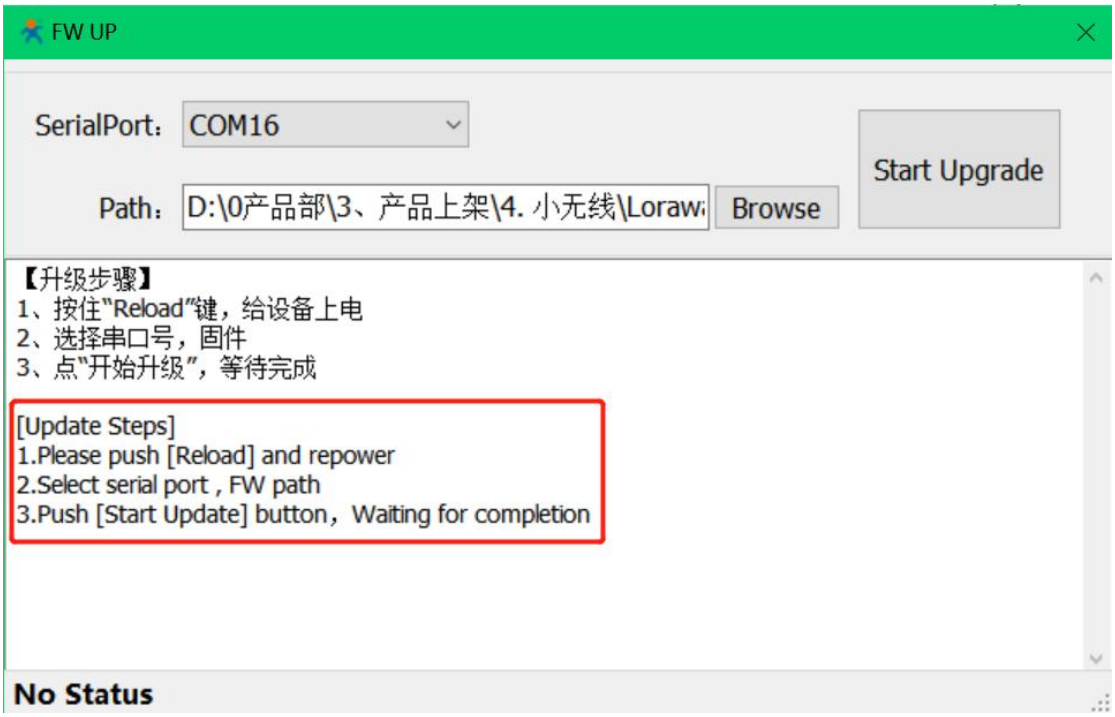
LoRaWAN setup tool downloading:

USR-DR206/216 supports firmware upgrading via RS485 serial port. There are 2 methods to enter firmware upgrading mode:

1. Send AT+boot=usrwr,0 to enter firmware upgrading mode, the start to upgrade



2. Press reload button, and then power on USR-DR206 device, then click the "Start Upgrade" button to upgrade.



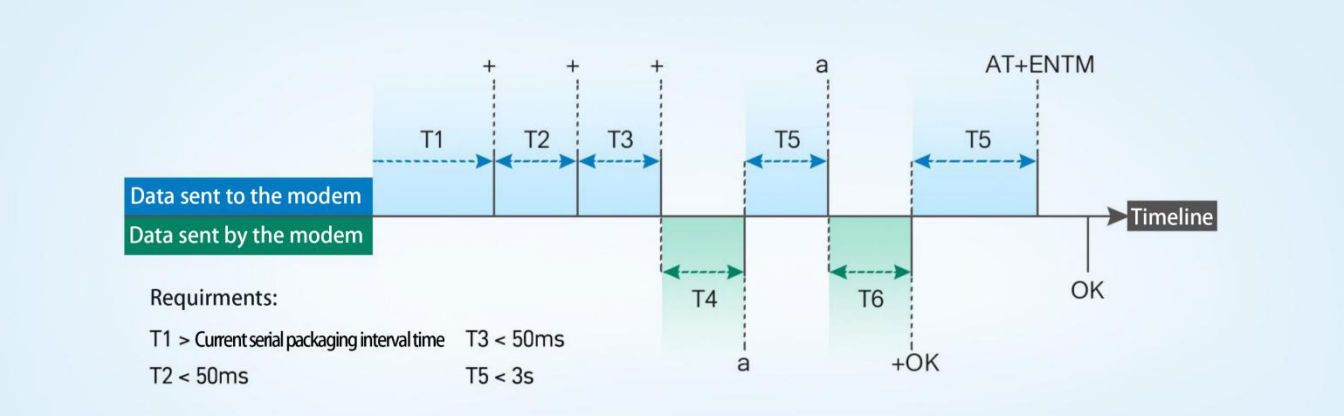
6. AT commands

AT command is used for controlling modem, for USR devices in transparent mode normally, you must enter AT command mode at first, then you can send AT commands to configure or query the parameter settings. After setting all parameters, restart the modem to make the settings take effect. Every time the modem restart will work in work mode rather AT command mode.

Every AT command must add character carriage return <CR> and line feed <LF>. In Hex, <CR> is 0x0D <LF> is 0x0A.

For detailed AT commands, please check the AT commands set.

6.1. AT command settings



➢Enter AT command mode:

1.Send “+++” from the serial port, it will be a “a” returned.

2.Do not send any data within a serial port packaging interval before sending "+++".

3.After receiving “a” , send another “a” within 3s.

4.Receiving “+ok” means the device has changed to AT command mode.

5.Then can send AT commands to the device.

➢Exit AT command mode:

1. Send “AT+ENTM” from the serial port.
2. Receiving “+ok” means the device has exited AT command mode.

6.2. Error status of AT command

Response code	Description	Example
OK	Response is successful	
ERR-1	Invalid command format	The AT command does not end with a return line feed
ERR-2	Invalid command	AT+VER1
ERR-3	Invalid operator	
ERR-4	The Parameters are not invalid	
ERR-5	Operation not allowed	

6.3. Format of AT command

Type	AT command format	Description	Example

0	AT+CMD? <CR><LF>	query parameter	AT+VER? <CR><LF>
1	AT+CMD <CR><LF>	query parameter	AT+VER<CR><LF>
2	AT+CMD=para <CR><LF>	setting parameters	AT+CH=66<CR><LF>

6.4. AT command set

No.	Command	Description
1	ENTM	Exit AT command
2	E	Module AT command echo settings
3	Z	Restart module
4	CFGTF	Save current settings as default
5	RELD	Restore device to settings
6	VER	Module firmware version
7	AT+REGION	Query area frequency band
8	AT+LBT	Set/query signal interference detection function
9	AT+ RFTO	Set/query no data restart time
10	AT+FCHECK	Set/Query Frame Count Check Switch
11	UART	Set/query serial port parameters
12	AT+CONFIRM	Set/query uplink transmission type (confirm retransmission times)
13	AT+JOIN	Set/query device network access mode (network access mode hot start)
14	AT+KEEPALIVE	Set/query keep alive consecutive ACK packet threshold
15	AT+HEARTCFG	Set/query heartbeat function parameters
16	AT+DEVEUI	Setup/Query Device EUI -For Customer Use
17	AT+APPEUI	Set/query device application service ID
18	AT+APPKEY	Set/Query Device Application Service Key
19	AT+APPSKEY	Set/Query Device Application Session Key (ABP)
20	AT+NWKSKEY	Set/Query Device Network Session Key (ABP)
21	AT+DEVADDR	Set/query device access address (ABP)
22	AT+MULTICAST	Set/query multicast group parameters
23	AT+PORT	Set/query port number
24	AT+CLASS	Set/query working mode
25	AT+RX2	Settings/Query Configuration Window 2
26	AT+DATARATE	Setup/Query Configuration Window 1 Transfer Rate
27	AT+POWER	Setup/Query Configuration Window 1 Transmit Power Level
28	AT+POWCFG	Settings/Query Configuration Window 1 Custom Transmit Power Table Contents
29	AT+ADRCFG	Set/query ADR-rate parameters
30	AT+INFO	Set/Query Interaction Success ID DTU> Confirm>
31	AT+CHMASK	Set/query access channel

6.5. Description of AT command

6.5.1. AT+ENTM

➢Function: Exit command mode, restore original working mode;

➢Format:

◆set

AT+ENTM<CR><LF>

<CR><LF>OK<CR><LF>

➢Parameter: None

6.5.2. AT+E

➢Function: Set/query LoRa data transmission terminal AT command echo setting

➢Format:

◆inquire

AT+E <CR><LF>

<CR><LF>+E:<ON/OFF><CR><LF>OK<CR><LF>

◆set

AT+E=<para><CR><LF>

<CR><LF>OK<CR><LF>

➢Parameters:**para**

◆ON: turns on echo (default), echoes commands entered under AT command

◆OFF: In AT command mode, input commands are not echoed.

➢Note: This setting is not saved when power is off.

6.5.3. AT+Z

➢Function: Restart LoRa data transmission terminal

➢Format:

◆ set

AT+Z<CR><LF>

<CR><LF>OK<CR><LF>

➢Parameter: None

When this command is executed correctly, the LoRa data transmission terminal restarts.

6.5.4. AT+CFGTF

➢Function: copy the currentconfiguration parameters to the user default factory configuration;

➢Format:

◆ set

AT+CFGTF<CR><LF>

<CR><LF>+CFGTF:SAVED<CR><LF>OK<CR><LF>

➢Parameters:

◆ SAVED: Save successfully

6.5.5. AT+RELD

➢Function: Restore LoRa data transmission terminal configuration parameters to user factory configuration parameters

➢Format:

◆ set

AT+RELD<CR><LF>

<CR><LF>REBOOTING<CR><LF>

◆ Parameter: None

This command restores LoRa data transmission terminal configuration parameters to user factory settings, and then automatically restarts.

6.5.6. AT+VER

➢Function: Query LoRa data transmission terminal firmware version

➢Format:

◆ inquire

AT+VER<CR><LF>

<CR><LF>+VER:<ver><CR><LF>OK<CR><LF>

➢ Parameters:

ver: Firmware version

6.5.7. AT+REGION

➢Function: Query the regional frequency band used by the equipment

➢Format:

◆ inquire

AT+REGION<CR><LF>

<CR><LF>+REGION:<para><CR><LF>OK<CR><LF>

➢ Parameters:

<para>:CN470、EU868、AU915

6.5.8. AT+LBT

➢Function: Set/query signal interference detection function

➢Format:

◆ Inquiry:

AT+LBT<CR><LF>

<CR><LF>+LBT:<para><CR><LF>OK<CR><LF>

◆ Settings:

AT+LBT=<para><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para>:ON/OFF

6.5.9. AT+RFTO

➢Function: Set/query no data restart time

➢Format:

◆ Inquiry:

AT+RFTO<CR><LF>

<CR><LF>+RFTO:<para><CR><LF>OK<CR><LF>

◆ Settings:

AT+RFTO=<para><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para>: 300-86400s Default 43200s;0 Turn off this feature

6.5.10. AT+FCHECK

➢Function: Set/query frame count check switch

➢Format:

◆ Inquiry:

AT+FCHECK<CR><LF>

<CR><LF>+FCHECK:<para><CR><LF>OK<CR><LF>

◆ Settings:

AT+FCHECK=<para><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para>: Function switch Default: OFF; Selectable ON, OFF

6.5.11. AT+UART

➢Function: Set/query serial port parameters

➢Format:

◆ Inquiry:

AT+UART<CR><LF>

<CR><LF>+UART:<para1>,<para2>,<para3>,<para4><CR><LF>OK<CR><LF>

◆ Settings:

AT+UART=<para1>,<para2>,<para3>,<para4><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>: Baud rate: 1200-115200(default)

<para2>: Data bits: 8(default), 7

<para3>: Stop bit: 1(default), 2

<para4>: Check bits: NONE(default), ODD, EVEN

6.5.12. AT+CONFIRM

➢Function: Set/query uplink transmission type (confirm retransmission times)

➢Format:

◆ Inquiry:

AT+CONFIRM<CR><LF>

<CR><LF>+CONFIRM:<status>,<status2><CR><LF>OK<CR><LF>

◆ Settings:

AT+CONFIRM=<status1>{{,<status2>}}<CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: uplink transmission acknowledgement type (default: 0)

0 - UnConfirmed message

1 - Confirmed message

<status2>: Number of transmissions (default: 0)

Value range (integer): 0~15

Note: {{, status2>}} means that the current parameter can be omitted. If this parameter is configured, the format is as follows

AT+XXX=<status1>,<status2>

When status2> is set, it takes effect if and only if status1 ==1

6.5.13. AT+JOIN

➢Function: Set/query device network access mode (network access mode hot start)

➢Format:

◆ Inquiry:

AT+JOIN<CR><LF>

<CR><LF>+JOIN:<status1>,<status2><CR><LF>OK<CR><LF>

◆ Settings:

AT+JOIN=<status1>,<status2><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: Device access mode (default: OTAA)

OTAA/ABP

<status2>: Network access warm start mode (default: OFF)

OFF/ON

6.5.14. AT+KEEPALIVE

➢Function: Set/query keepalive consecutive ACK packet threshold

➢Format:

◆ Inquiry:

AT+KEEPALIVE<CR><LF>

<CR><LF>+KEEPALIVE:<status1><CR><LF>OK<CR><LF>

◆ Settings:

AT+KEEPALIVE=<status1><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: ACK packet threshold (default 32); threshold range: 1~255

6.5.15. AT+HEARTCFG

➢Function:Set/query heartbeat function parameters

➢Format:

◆ Inquiry:

AT+HEARTCFG<CR><LF>

<CR><LF>+HEARTCFG:<status1>,<status2>,<status3>,<status4><CR><LF>OK<CR><LF>

◆ Settings:

AT+KEEPALIVE=<status1>,<status2>,<status3>,<status4><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: function switch (default OFF)

ON -Open

OFF -OFF

<status2>: heartbeat cycle_s (default: 300)

Value range: 30~65535

<status3>: Heartbeat content type

HEX/hex

ASCII/ascii

<status4>: Heartbeat content

Enter the content according to status3>(actual content maximum 50 bytes, minimum 1 byte)

==hex: ascii indicates hex value

Command length range 2~100(length is a multiple of 2)

==ascii:

Command length range 1~50

6.5.16. AT+DEVEUI

➢Function: Equipment EUI

➢Format:

◆ Inquiry:

AT+DEVEUI<CR><LF>

<CR><LF>+DEVEUI:<status1><CR><LF>OK<CR><LF>

◆ Settings:

AT+DEVEUI=<status1><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: Equipment Unique Identifier (default: MES system generated)

xxxx: Note that there are no spaces

Note: Length 8 bytes (format hex)

6.5.17. AT+APPEUI

➢Function: Set/query device application service ID

➢Format:

◆ Inquiry:

AT+APPEUI<CR><LF>

<CR><LF>+APPEUI:<status1><CR><LF>OK<CR><LF>

◆ Settings:

AT+APPEUI=<status1><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: Device Application Service ID (default: 000000000000)

xxxxx:Note that there are no spaces

Note: Length 8bytes (format hex)

6.5.18. AT+APPKEY

➢Function: Set/query device application service key

➢Format:

◆ Inquiry:

AT+APPKEY<CR><LF>

<CR><LF>+APPKEY:<status1><CR><LF>OK<CR><LF>

◆ Settings:

AT+APPKEY=<status1><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status 1>: Device Application Service ID (default:

00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

000000000000000000000000000000000000000000000000000000000

xxxx

Note: Length 16bytes (format hex)

6.5.19. AT+APPSKEY

➢Function: Set/Query Device Application Session Key (ABP)

➢Format:

◆ Inquiry:

AT+APPSKEY<CR><LF>

<CR><LF>+APPSKEY:<status1><CR><LF>OK<CR><LF>

◆ Settings:

AT+APPSKEY=<status1><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<status 1>: Device Application Service ID (default:

00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

000000000000000000000000000000000000000000000000000000000

xxxx

Note: Length 16 bytes (format hex)

6.5.20. AT+NWKSKEY

➢Function: Set/query device network session key (ABP)

➢Format:

◆ Inquiry:

AT+NWKSKEY<CR><LF>
<CR><LF>+NWKSKEY:<status1><CR><LF>OK<CR><LF>

◆ Settings:
AT+NWKSKEY=<status1><CR><LF>
<CR><LF>OK<CR><LF>

➢ Parameters:

<status 1>: Device Application Service ID (default:

00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

00000000000000000000000000000000000000000000000000000000

xxxx

Note: Length 16 bytes (format hex)

6.5.21. AT+DEVADDR

➢Function: Set/query device access address (ABP)
➢Format:

◆ Inquiry:
AT+DEVADDR<CR><LF>
<CR><LF>+DEVADDR:<status1><CR><LF>OK<CR><LF>

◆ Settings:
AT+DEVADDR=<status1><CR><LF>
<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: Device Application Service ID (default: 0000000)

xxxx: Note that there are no spaces

Note: Length 4 bytes (format hex)

6.5.22. AT+MULTICAST

➢Function: Set/query multicast group parameters
➢Format:

◆ Inquiry:
AT+MULTICAST<CR><LF>
<CR><LF>+MULTICAST:0,<status2>,<addr0>,<mc0_appskey>,<mc0_nwkskey>
1,<status2>,<addr1>,<mc1_appskey>,<mc1_nwkskey>
2,<status2>,<addr2>,<mc2_appskey>,<mc2_nwkskey>
3,<status2>,<addr3>,<mc3_appskey>,<mc3_nwkskey>OK<CR><LF>OK<CR><LF>

◆ Settings:
AT+MULTICAST=<status1>,<status2>{{,<addr>,<mc_appskey>,<mc_nwkskey>}}<CR><LF>
<CR><LF>OK<CR><LF>

➢ Parameters:

<status1>: Group No.[0][1][2][3]

<status2>: multicast group switch 0: OFF 1: ON addr>: multicast group address

Length 4 bytes (format hex)(described using ascii: 8 bytes long)

<mc_appskey>: multicast group application session key

Length 16 bytes (format hex)(description using ascii: 32 bytes long)

<mc_nwkskey>: multicast group network session key

Length 16 bytes (format hex)(description using ascii: 32 bytes long)

Note: {{, addr>, mc_appskey>, mc_nwkskey>}}

Indicates that the current parameter may not be included

6.5.23. AT+PORT

➢Function: Set/query port number

➢Format:

◆ Inquiry:

AT+PORT<CR><LF>

<CR><LF>+PORT:<para1><CR><LF>OK<CR><LF>

◆ Settings:

AT+PORT=<para1><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>: Indicates the starting number of the incoming channel, range: 1-223

6.5.24. AT+CLASS

➢Function: Set/query working mode

➢Format:

◆ Inquiry:

AT+CLASS<CR><LF>

<CR><LF>+CLASS:<para1><CR><LF>OK<CR><LF>

◆ Settings:

AT+CLASS=<para1><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>: indicates operating mode, 0: CLASS A, 1: CLASS B, 2: CLASS C

6.5.25. AT+RX2

➢Function: Settings/Query Configuration Window 2

➢Format:

◆ Inquiry:

AT+RX2<CR><LF>

<CR><LF>+RX2:<para1>,<para2><CR><LF>OK<CR><LF>

◆ Settings:

AT+RX2=<para1>,<para2><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>: Rate 0-5 for RX2 Default: DR5 (SF7 BW125)

0 - DR0 (SF12 BW125)

1 - DR1 (SF11 BW125)

2 - DR2 (SF10 BW125)

3 - DR3 (SF9 BW125)

4 - DR4 (SF8 BW125)

5 - DR5 (SF7 BW125)

<para2>: Indicates the frequency of RX2, default: 501700000

6.5.26. AT+DATARATE

➢Function: Set/Query Configuration Window 1 Transmission Rate

➢Format:

◆ Inquiry:

AT+DATARATE<CR><LF>

<CR><LF>+DATARATE:<para1>,<min>,<max><CR><LF>OK<CR><LF>

◆ Settings:

AT+DATARATE=<para1>,{{<min>,<max>}}<CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>: Indicates the rate of RX1 (default: 5)

0 - DR0 (SF12 BW125)

1 - DR1 (SF11 BW125)

2 - DR2 (SF10 BW125)

3 - DR3 (SF9 BW125)

4 - DR4 (SF8 BW125)

5 - DR5 (SF7 BW125)

<min>: 0~5 (default: 0)

<max>:0~5 (default: 5)

Note:

When setting parameters, min and max can not be set, just set the first parameter.

min <= max、min <= para1 <= max

0<=min<=5、0<=max<=5;

6.5.27. AT+POWER

➢Function: Set/Query Configuration Window 1 Transmit Power Level

➢Format:

◆ Inquiry:

AT+POWER<CR><LF>

<CR><LF>+POWER:<enlist>,<power>,<max>,<min><CR><LF>OK<CR><LF>

◆ Settings:

AT+POWER=<enlist>,<power>,<max>,<min><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<enlist>: Custom wattmeter enable

OFF: uses standard protocol power with a maximum power of 17dBm

ON: Use custom wattmeters

<power>: indicates default tx power (default: 0 -max)

0 - 7

<max>: indicates tx maximum power (default: 0)

0 - 7

<min>: indicates tx minimum power (default: 7)

0 - 7

Note: min >= power max = power

min >= max

6.5.28. AT+POWCFG

➢Function: Set/query configuration window 1 Custom transmit power table content

➢Format:

◆ Inquiry:

AT+POWCFG<CR><LF>

<CR><LF>+POWCFG:<power0>,<power1>,<power2>,<power3>,<power4>,<power5>,<power6>,<power7><CR><LF>OK<CR><LF>

◆ Settings:

AT+POWCFG=<power0>,<power1>,<power2>,<power3>,<power4>,<power5>,<power6>,<power7><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<power0>: Maximum power in power meter,[range: 22~9]

Only this content can be configured. If there is no subsequent parameter configuration, the subsequent content will be reduced by 2 step by step, ranging from [22~16].

<Power1>: Range 21 - 8

<Power2>: Range 20~7

<Power3>: Range 19 - 6

<Power4>:[Range 18~5]

<Power5>:[Range 17~4]

<Power6>:[Range 16~3]

<power7>: Minimum power in power meter,[range 15~2]

Note: power0~7>: power0 ~ 7 decreases gradually

The number of configuration instructions can only be 1 or 8.

6.5.29. AT+ADRCFG

➢Function: Set/query ADRs parameters of adaptive rate

➢Format:

◆ Inquiry:

AT+ADRCFG<CR><LF>
<CR><LF>+ADRCFG:<para1>,<para2>,<para3><CR><LF>OK<CR><LF>

◆ Settings:

AT+ADRCFG=<para1>,<para2>,<para3><CR><LF>
<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>:ON/OFF Enabled/Disabled Default: Enabled--Speed control for non-acknowledgement frames

<para2>: ADR_ACK_LIMIT defaults to 64 Range: 1-65535

<para3>: ADR_ACK_DELAY defaults to 32 Range: 1-65535

6.5.30. AT+RTCSYNC

➢Function: Query RTC timestamp remote synchronization

➢Format:

◆ Inquiry:

AT+RTCSYNC<CR><LF>
<CR><LF>+RTCSYNC:<param><CR><LF>OK<CR><LF>

◆ Settings:

AT+RTCSYNC=<param><CR><LF>
<CR><LF>OK<CR><LF>

➢ Parameters:

<param>: Real-time synchronization of gateways

xxxx-xx-xx 00:00:00

Note: successful execution, the gateway timestamp can be synchronized to the device, and the timestamp can be parsed and configured locally.

There is timeout mechanism, that is, send completion request instruction, wait for 3.5 seconds (2*rx1delay+1000+500), if no response packet is received, output RECV-TIMEOUT.

This command needs to be executed when the network access is completed. If the network access is not completed or the channel is busy, the SENT-FAIL is returned.

6.5.31. AT+INFO

➢Function: Set/query interactive success identification DTU> Confirm>

➢Format:

◆ Inquiry:

AT+INFO<CR><LF>
<CR><LF>+INFO:<param><CR><LF>OK<CR><LF>

◆ Settings:

AT+INFO=<param><CR><LF>
<CR><LF>OK<CR><LF>

➢ Parameters:

<param>: Interactive success flag switch, ON/OFF

limiting condition

DTU (late differentiation)

Interactive data prompt for port0 only

Includes MAC interaction, network access information, ACK

6.5.32. AT+CHMASK

➢Function: Set/query access channel

➢Format:

◆ Inquiry:

AT+CHMASK<CR><LF>

<CR><LF>+CHMASK:<para1>,<para2><CR><LF>OK<CR><LF>

◆ Settings:

AT+CHMASK=<para1>,<para2><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>: Indicates the starting number of the incoming channel, ranging from 0 to 95

<para2>: Indicates the end label of the incoming channel, ranging from 0 to 95

Note:

8 channels at most, e.g. AT+CHMASK= 0, 7 means enabling channels 0-7 [CH0-CH7]

At least 1 channel can be set, e.g. AT+CHMASK= 0, 0 means enabling channel 0 [CH0]

where para1 para2, para2-para1 =7

6.5.33. AT+CHMASK (915MHz)

➢Function: Set/query access channel

➢Format:

◆ Inquiry:

AT+CHMASK<CR><LF>

<CR><LF>+CHMASK:<para1>,<para2><CR><LF>OK<CR><LF>

◆ Settings:

AT+CHMASK=<para1>,<para2><CR><LF>

<CR><LF>OK<CR><LF>

➢ Parameters:

<para1>: Indicates the starting number of the incoming channel, ranging from 0 to 63

<para2>: Indicates the end label of the incoming channel, range: 0-63

Note:

8 channels at most, e.g. AT+CHMASK= 0, 7 means enabling channels 0-7 [CH0-CH7]

At least 1 channel can be set, e.g. AT+CHMASK= 0, 0 means enabling channel 0 [CH0]

where para1 para2, para2-para1 =7

6.5.34. AT+DWELL

➢Function: Settings/Query Window 1 Link Stay Switch

➢Format:

◆ Inquiry:

AT+DWELL<CR><LF>

<CR><LF><datarate_limit>,<updwell>,<downdwell><CR><LF>OK<CR><LF>

◆ Settings:

AT+DWELL=<datarate_limit>,<updwell>,<downdwell><CR><LF>

<CR><LF>OK<CR><LF>

- Parameters:

<datarate_limit>

Speed limit at open dwell time default:2, 0-5>

<updwell>

Upward dwell time configuration default:0, 0, 1>

<downdwell>

Downward dwell time configuration default:0, 0, 1>

7. Q&A

7.1. LoRaWAN protocol supported by DR206 device

LoRaWAN 1.0.3 is currently supported.

7.2. DR206 equipment can support frequency bands and corresponding regions

product model	support band	suitable area	remark
USR-DR206-CN470	470-510MNz	China	
USR-DR206-AU915	915-928MHz	Australia, South America	US915, AS923-1/2/3/4, KR920, can be customized by contacting technical support or sales consulting

Note: US915: United States; AS923 -1: Southeast Asia (such as Japan, Thailand, Vietnam, Malaysia, Taiwan, Hong Kong, new Zealand, etc.); AS923 -2: South Korea, Indonesia, Austria, etc.; AS923 -3: India, Bangladesh, Sri Lanka, etc.; KR920: South Korea.

7.3. Node devices cannot be activated after they are added to NS server?

(1)If the NS server node in the gateway is used, refer to the relevant instructions in this manual for the steps of the gateway. Check whether the parameter setting is abnormal. In addition, check whether the gateway is added to the built-in NS of the gateway, as follows.

(2)If you use other gateways or external NS servers, the basic parameters are similar. For specific settings, please refer to the product description of the other party.

7.4. Node equipment works in Class C mode and cannot receive downlink data from RX2.

Please check whether the RX2 data rate of the module end matches the NS end.

7.5. Node device switches ABP from OTAA, devaddr is set, and reset does not take effect.

It is usually recommended to switch the module after restoring the factory settings to prevent the module from disabling the configuration due to reasons such as opening the hot start.

7.6. What if the node equipment has a high downlink packet loss rate through Class C RX2?

The default RX2 downlink data rate is DR0, and a long TOA time is easy to cause data collision, which can improve the RX2 downlink data rate.

7.7. When testing node equipment, in order to ensure communication quality, what range of received signal strength is required

RSSI greater than-110 and SNR greater than-5 are recommended

7.8. How to check whether the node device is successfully connected to the network?

DTU can be viewed by indicator light or command (AT+CHECKJOIN); module can be viewed by STAT pin or command (AT+CHECKJOIN).

7.9. How to check the signal quality between gateway and node?

You can select the data transmission success display function through the upper computer advanced function, and the success identification (RSSI, SNR value) will be returned after data upload, or use the command (AT+INFO) to turn on this function.

7.10. Transmission distance is not ideal

The antenna is placed inside the metal shell or in the basement, and the signal will be attenuated, which will cause the signal to be close.

When there are too many straight line communication obstacles, the communication distance will be attenuated.

Heavy fog or rainy days will affect signal transmission and lead to high packet loss rate.

Test close to the ground, the effect is not good, generally 2 meters above the ground.

Poor antenna and equipment matching or poor antenna gain results in close communication distance.

7.11. Equipment damaged in use

Before use, be sure to confirm whether the power supply meets the recommended power supply. If it exceeds the maximum value, it may burn out the equipment.

During installation and use, pay attention to the anti-static of the equipment to prevent damage during certain high frequencies.

Power supply stability, minimize fluctuations, such as large fluctuations, may cause damage during the period

Do not use it unnecessarily in the space with too low temperature. In addition, pay attention to the short circuit caused by water dew and corrosive gas.

7.12. Data transmission interference

There are other devices in the same frequency band nearby, change channels or stay away from interference

The poor quality of antenna feeder and extension line leads to wrong code in signal transmission

the noise generate on that backplane interferes with data reception

Unreasonable power settings, non-compliance with regulations, resulting in garbled code

8. Contact Us

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