LoRaWAN Sensor Node

Multi-interface Platform for Connecting Sensors

UC11-N1

V1.2

Contents

1. Preface

Thank you for choosing Ursalink UC11-N1. This user guide will present in detail all the functions and features of the product. The UC11-N1 is designed for both industrial and commercial applications and helps devices stay connected. The product should be used under the guidance of this user guide, referring to parameters and technical specifications. The UC11-N1 is a compact, high-performance device that offers LoRaWAN connectivity for remote access and easy management of machines and equipment over the LoRaWAN gateway.
We bear no liability for property loss or physically injury arising from abnormal or incorrect usage of this product.

2. Introduction

UC11-N1 is a smart wireless module featuring LoRaWAN protocol. Supporting the most widely used industrial communication network protocols. UC11-N1 covers industries like industrial automation, building automation and smart agricultural applications, to provide network capability in remote or factory floor environments. It can also connect 4-20mA analog devices, the most commonly deployed devices in industrial environments.

This user guide is intended to provide detailed technical specifications and explanations to basic users as well as the technically-minded groups. It is a live document, and will be updated from time to time. Please ensure that you have the latest version, by checking our website at: https://www.ursalink.com/en/documents-download/
Note: Please contact Ursalink or the original battery manufacturer to replace the battery!

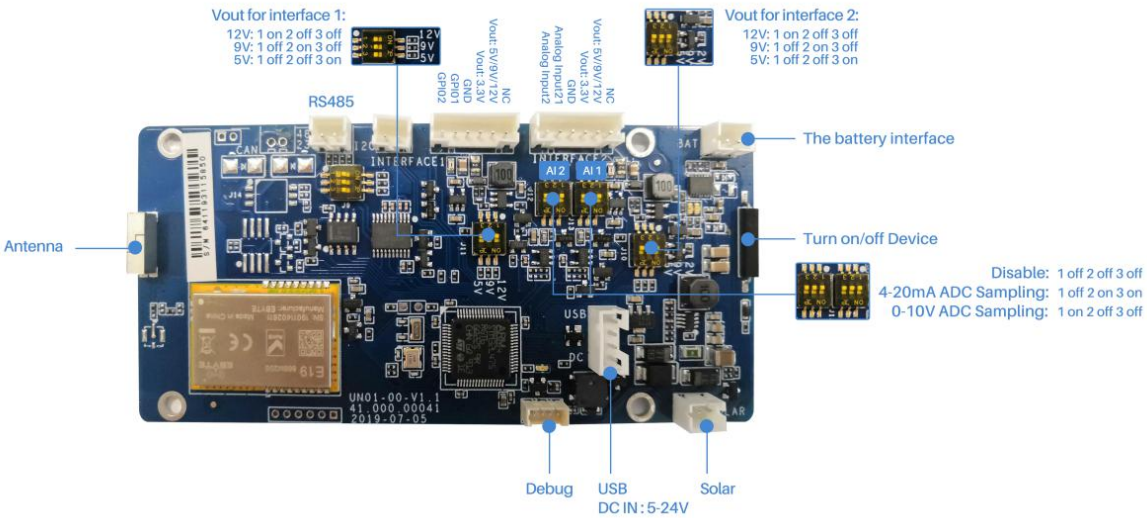
2.1 Features

- Add or change a device probe in seconds
- Multiple interfaces including serial and I/O
- Multiple power supply option: battery, DC or solar
- Battery life: 5 years life under LoRaWAN Class A mode
- Support Frequency: CN470/EU868/US915/EU433/AU915/AS923/KR920/IN865/RU864
- Robust waterproof IP67 enclosure
- LoRa wireless module included, up to 11km communicate range

2.2 Parameters

Parameter Item	Reference Scope
Interface 1	2 x GPIO: Digital Input (0-3.3v) or Digital Output (0-3.3v) 1 x RS485 1 x 3.3 V output 1 x 5/9/12 V output switchable
Interface 2	2 x Analog input (4-20mA or 0-10v) 1 x 3.3 V output 1 x 5/9/12 V output switchable
Frequency Band	EU 433, CN 470-510, EU 863-870, US 902-928, AU 915-928, KR 920-923
Operating Temperature	-40° C to +70° C (-40° F to +158° F)
Power Supply	1.19000mhA replaceable Li-SOCL2 battery 2.5-24 VDC with 5000mhA battery backup 3.Solar powered with 5000mhA battery
Dimensions	120.1 x 120.1 x 55.4 mm
Ingress Protection	IP67

2.3 Terminal Description



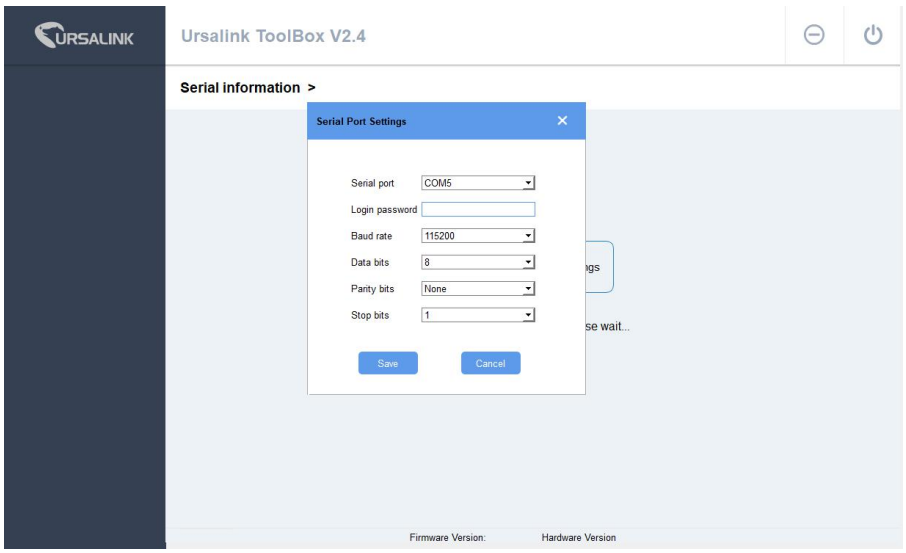
2.4 Turn on/off the Device

Put a magnet close to the reed switch to turn on or turn off the device.
Buzzer rings for 2 seconds: power on.
Buzzer rings for 6 seconds: power off.

3. Configuration via PC

3.1 Configuration via ToolBox

Follow these steps:
Step 1: Connect the Ursalink UC11-N1 to PC via USB port.
Step 2: Power on the Ursalink UC11-N1.
Step 3: Run the Ursalink ToolBox.

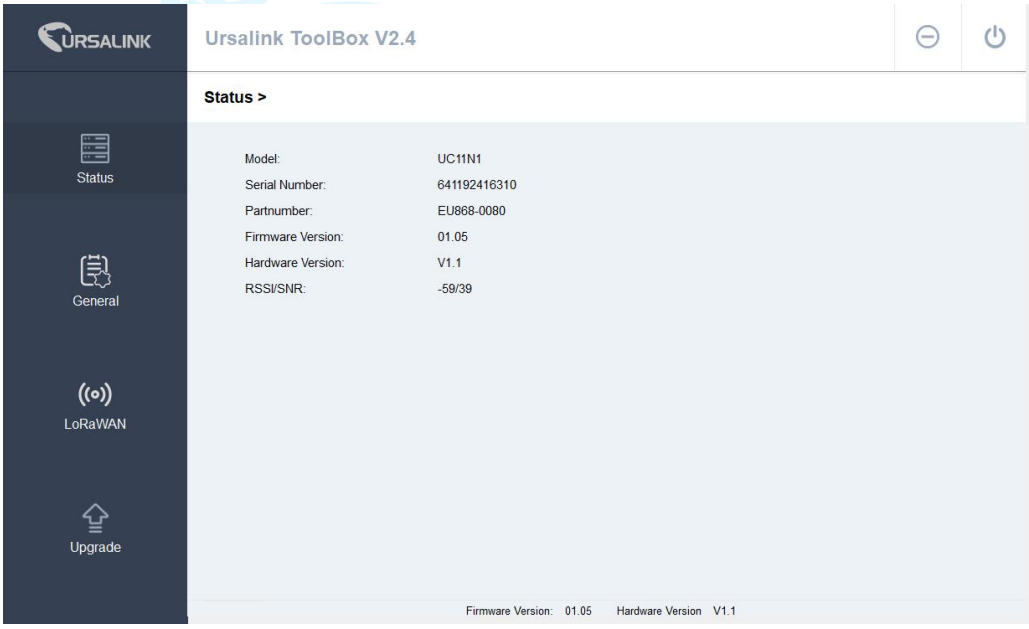


Serial Port Settings		
Item	**Description**	**Default**
Serial Port	Select the serial port for data transmission.	Null
Login Password	Enter the correct password to login.	123456
Baud Rate	Select from "9600", "57600", "115200".	57600
Data Bit	Select from "5", "7", "8".	8
Parity Bit	Select from "Even", "Odd", "None".	None
Stop Bit	Select from "1", "2".	1

If the serial port parameter is correct, it will display: Serial port is connected.

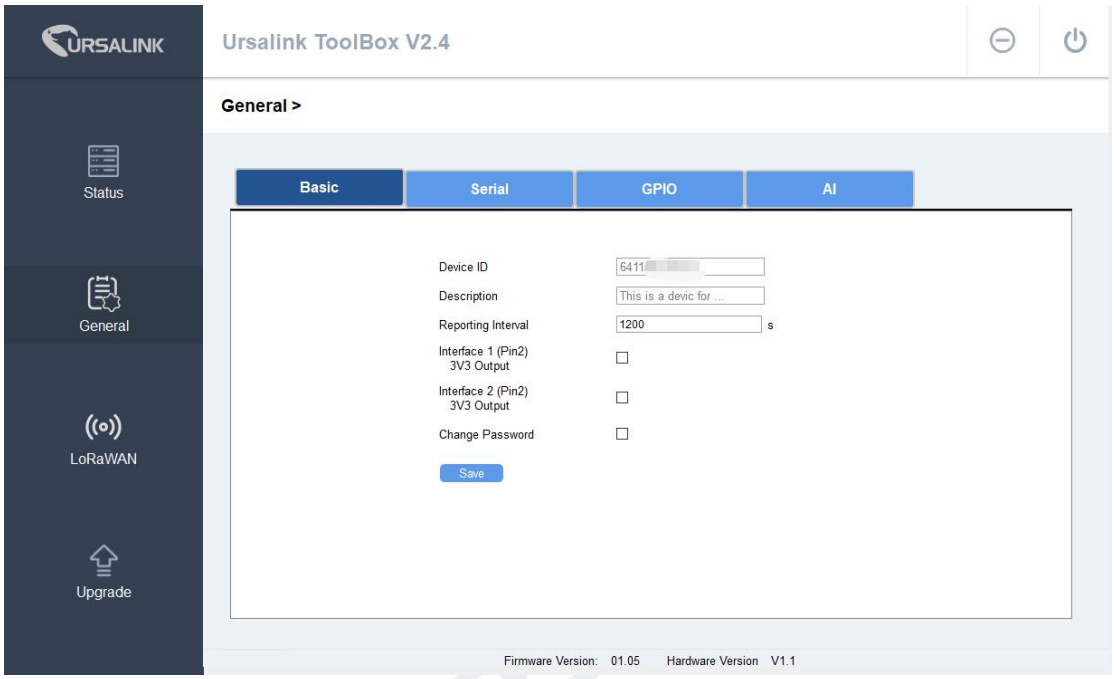
3.2 Status

Click "Status" to see the basic status information of this device:



3.3 General

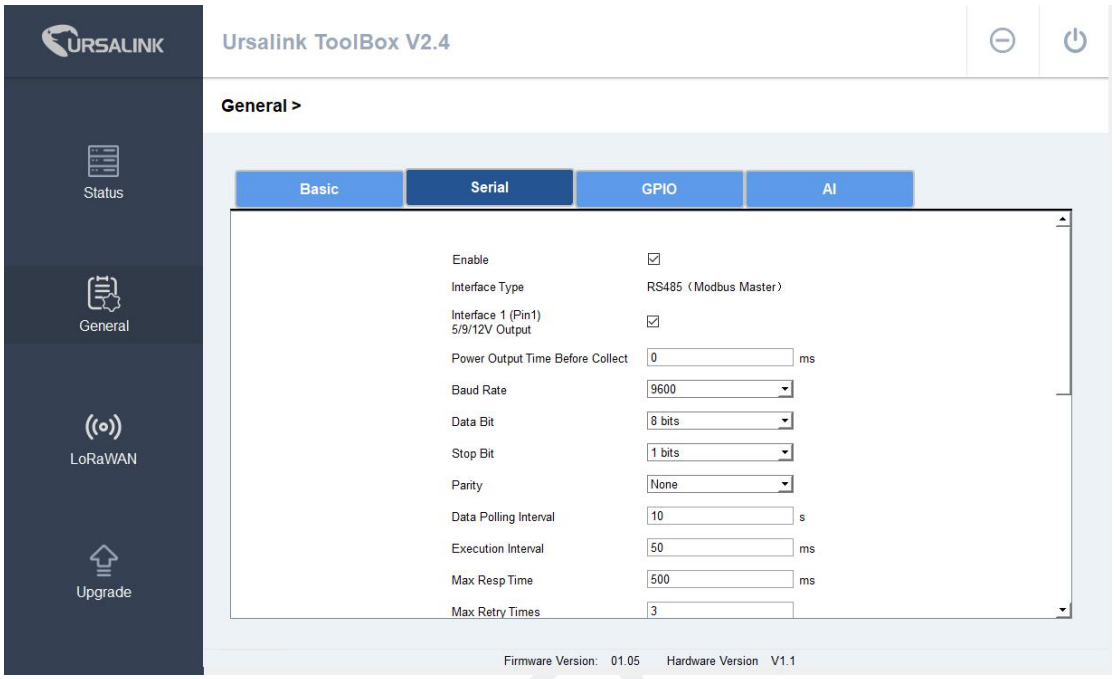
3.3.1 Basic



Basic Settings		
Item	**Description**	**Default**
Device ID	Show the Serial Number of this device.	The identifier of this device.
Description	Enter the description of this device.	Null
Reporting Interval	The UC11-N1 reports the collected data at regular intervals. Range: 30-86400 (s)	1200
Interface 1 (Pin2)3V3 Output	Enabled: UC11-N1 will provide power to device connected to Interface 1(pin2). Voltage is 3.3V.	Disabled
Interface 2 (Pin2)3V3 Output	Enabled: UC11-N1 will provide power to device connected to Interface 2(pin2). Voltage is 3.3V	Disabled
Change Password	Enable: Change Toolbox login password.	Disabled

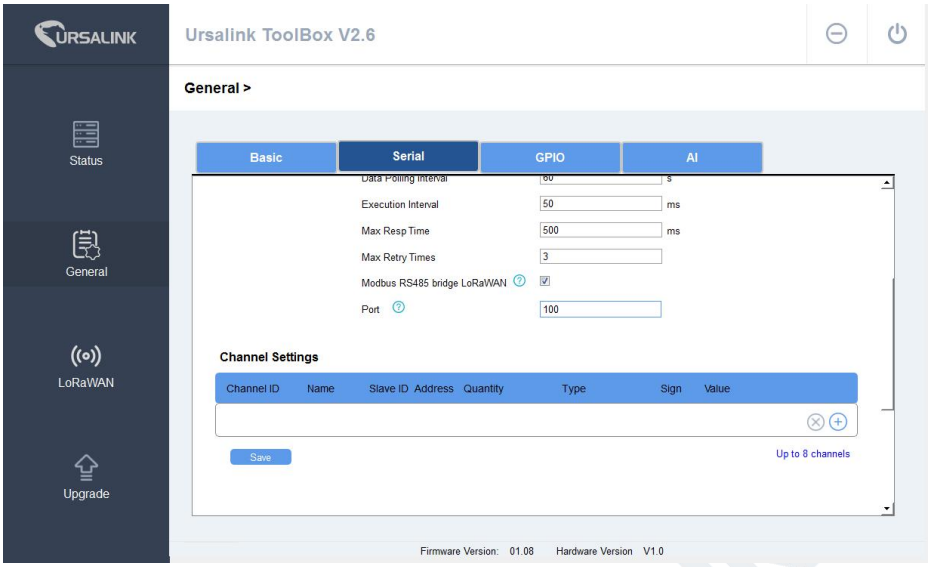
3.3.2 Serial

On this page, you can enable the serial ports and set the parameters of RS485(Modbus Master).



RS485 Settings		
Item	**Description**	**Default**
Enable	Enable/disable RS485.	Enable
Interface Type	Show the interface type.	RS485 (Modbus Master)
Interface 1(Pin 1) 5v/9v/12v Output	Enable: UC11-N1 will provide power to device connected to Interface 1(pin1). Voltage is 5V, 9V or 12V.	Disabled
Power Output Time Before Collect	If the time is set 100ms, then before collecting data from end nodes, UC11-N1 will provide power for end nodes for 100ms. Range:1-5000(ms). Note: With this feature being enabled, the power consumption will increase.	None
Baud Rate	Select from "9600", "57600", "115200".	9600
Data Bits	Select from "5", "7", "8".	8

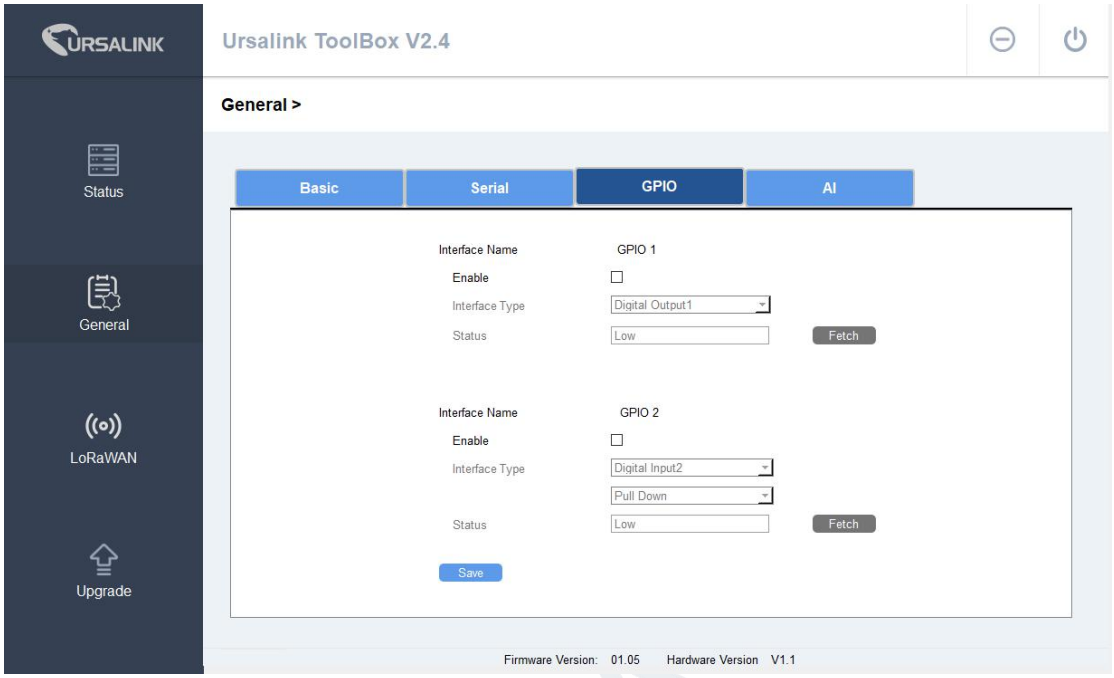
Stop Bits	Select from "1", "2".	1
Parity Bits	Select from "Even", "Odd", "None".	None
Data Polling Interval	Set the interval for reading remote channels. When the read cycle ends, the new read cycle begins until this interval over . If it is set to 0, the device will restart the new read cycle after all channels have been read. Range: 0-86400(s).	0
Execution Interval(ms)	The execution interval between each command. Range: 10-1000.	50
Max Resp Time(ms)	Set the maximum response time that the UC11-N1 waits for the response to the command. If the device does not get a response after the maximum response time, it's determined that the command has timed out. Range: 10-1000.	500
Max Retry Times	Set the maximum retry times after it fails to read, range: 0-5.	3
Modbus RS485 bridge LoRaWAN	Enable this mode to collect data from slave devices and then send it to Network Server via LoRaWAN. This mode also has the capability to change the behaviour of the ModBus device by writing into its registers.	Disable
Port	Enter the LoRaWAN frame port for transparent transmission between UC11-N1 and Network Server. Range: 2-84,86-223.	Null



Channel Settings		
Item	**Description**	**Default**
Channel ID	Assign the channel for the slave device, 8 channels selectable.	Null
Name	Set the name to identify the remote channel. It cannot be blank.	Null
Slave ID	Set Modbus slave ID.	Null
Address	The starting address for reading.	Null
Quantity	Set read how many digits from starting address.	Null
Type	Read command, options are "Coil", "Discrete", "Holding Register (INT16)", "Input Register (INT16)", "Holding Register (INT32)" and "Holding Register (Float)".	Holding Register (INT16)
Sign	Identify whether this channel is signed. Default: Unsigned.	Null
Value	Show the data which read from this slave device.	Null
Fetch	Click to read the data from this slave device.	Null

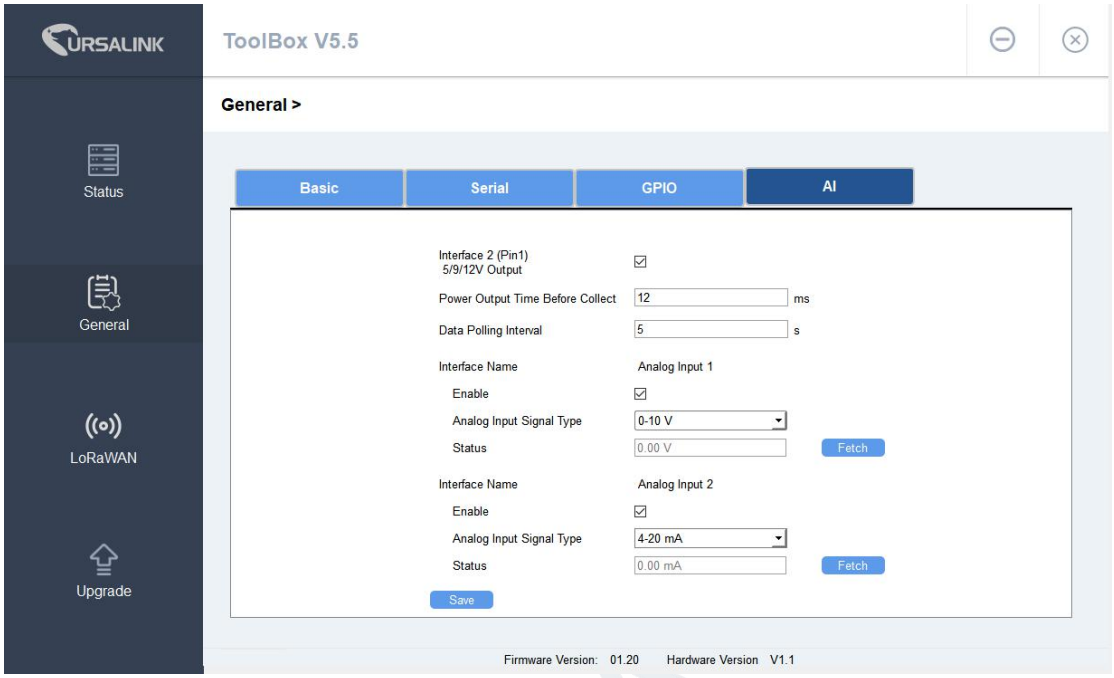
You could click to add a channel or click to delete a channel.

3.3.3 GPIO

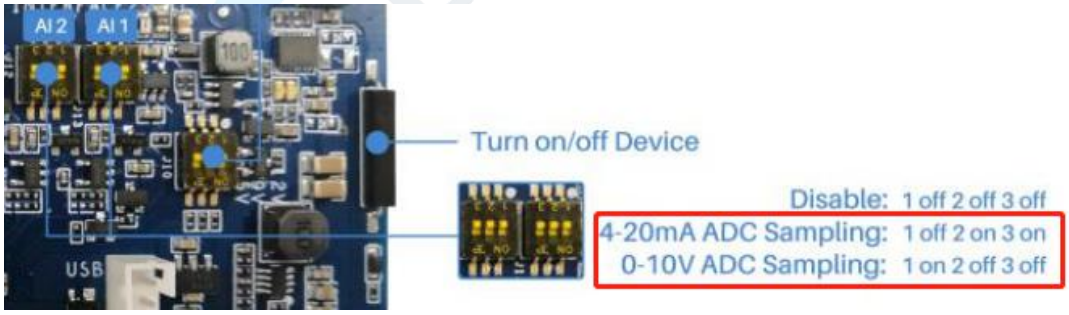


GPIO Settings		
Item	**Description**	**Default**
Interface Name	Show the name of this interface.	Null
Enable	Click to enable this interface.	Disable
Interface Type	Choose from:Digital Input,Digital Output Digital Input: This GPIO will be used as Digital Input. Then you will need to select the initial state of this digital input form “Pull Up”(High), “Pill Down”(Low). Digital Output: This GPIO will be used as Digital Output.	Digital Input1
Status	Show the current status of this interface. Click “Fetch” to fetch the latest status.	Null

3.3.4 AI



Note: Please adjust the ADC sampling DIP switch on PCB to the corresponding mode before changing the type of analog input signal.

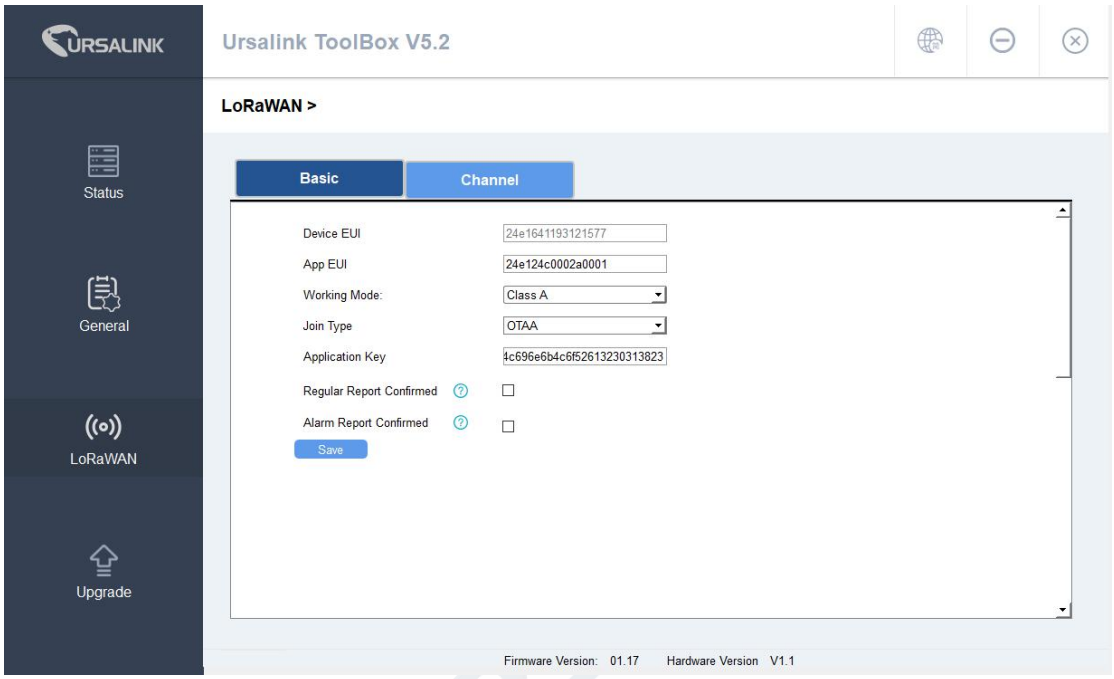


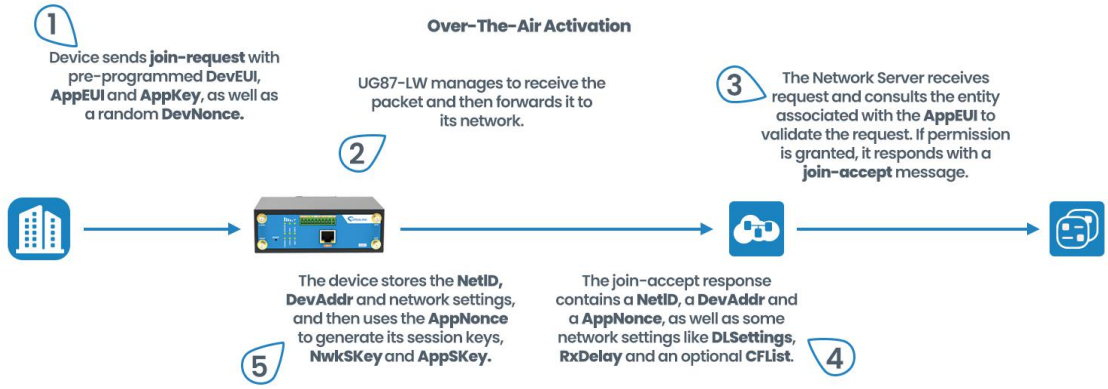
AI Settings		
Item	**Description**	**Default**
Interface 2(Pin 1) 5v/9v/12v Output	Enable: UC11-N1 will provide power to device connected to Interface 1(pin1). Voltage is 5V, 9V or 12V.	Disabled
Power Output Time Before	If the time is set to 100ms, then before collecting data from end nodes,	1-5000

Collect	UC11-N1 will provider power for end nodes for 100ms. Range:1-5000(ms). Note: With this feature being enabled, the power consumption will increase.	
Data Polling Interval	Set the interval for reading analog input. Range: 5-3600(s).	5
Interface Name	Show the name of this interface.	Null
Enable	Click to enable this interface.	Disable
Analog Input Signal Type	Select from: “4-20 mA”, “0-10 V”.	4-20 mA
Status	Show the current value of this interface. Click “Fetch” to fetch the latest value of this analog input.	Null

3.4 LoRaWAN

3.4.1 Basic-OTAA



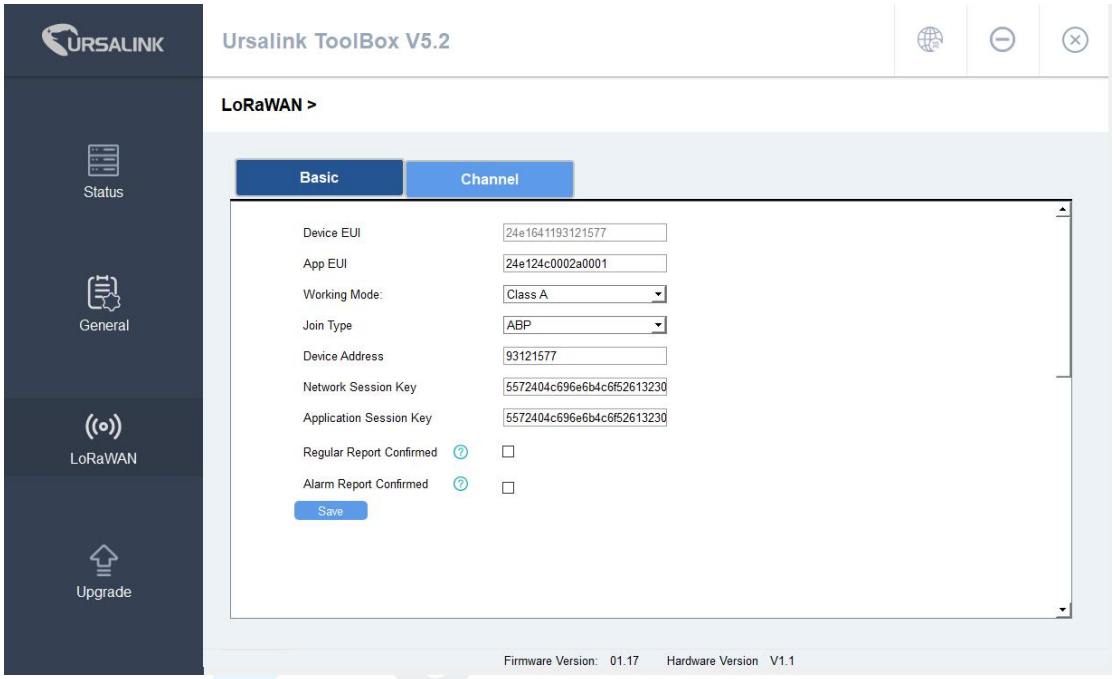


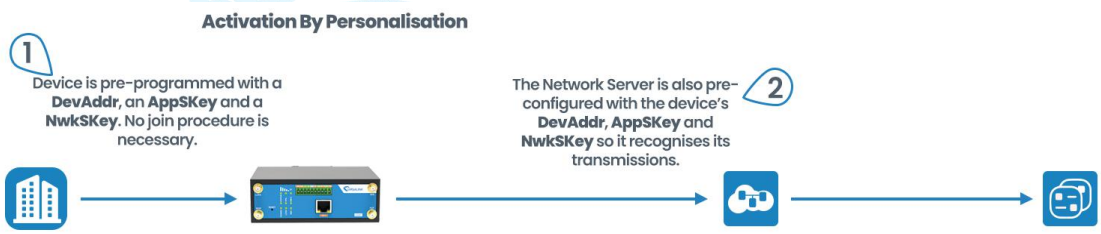
Basic Settings-OTAA		
Item	**Description**	**Default**
Device EUI	Show the identifier of this device.	the identifier of this device.
App EUI	Enter the application EUI.The Network Server receives	24E124C00

	request and consults the entity associated with the APPEUI to validate the request.If permission is granted, it responds with a join-accept message.	02A0001
Working Mode	Show the working mode of the device. UC11-N1: Null. UC11-N1-DC: Select from: “Class A” , “Class C”. Class A :Class A operation is the lowest power end-device system. Class C: Class C end-device will use more power to operate than Class A but they offer the lowest latency for server to end-device communication.	Class A
Join Type	Select from: "OTAA" and "ABP". OTAA:Over-the-Air Activation. For over-the-air activation, end-devices must follow a join procedure prior to participating in data exchanges with the network server. An end-device has to go through a new join procedure every time it has lost the session context information. ABP: Activation by Personalization. Under certain circumstances, end-devices can be activated by personalization. Activation by personalization directly ties an end-device to a specific network by-passing the join request - join accept procedure.	OTAA
Application Key	Enter the application key. Whenever an end-device joins a network via over-the-air activation, the application key is used to derive the Application Session key.	5572404c696e6b4c6f5261323031 3823
Regular Report Confirmed	After sending the regular report packet to the network server, if the device does not receive ACK bit from the network server, then the device will resend the packet. Note: If the device doesn't receive ACK for a long time, the device will resend regular report confirmed packets 3 times at most.	Disabled
Alarm Report Confirmed	After sending the attribute package or alarm packet or battery packet to the network server, if the device does not receive ACK bit from the Network Server, then the device will resend the packet.	Disabled

	Note: If you doesn't receive ACK for a long time, the device will resend alarm report packets or battery packets 3 times at most. However, the device will resend attribute package all the time.	

3.4.2 Basic-ABP





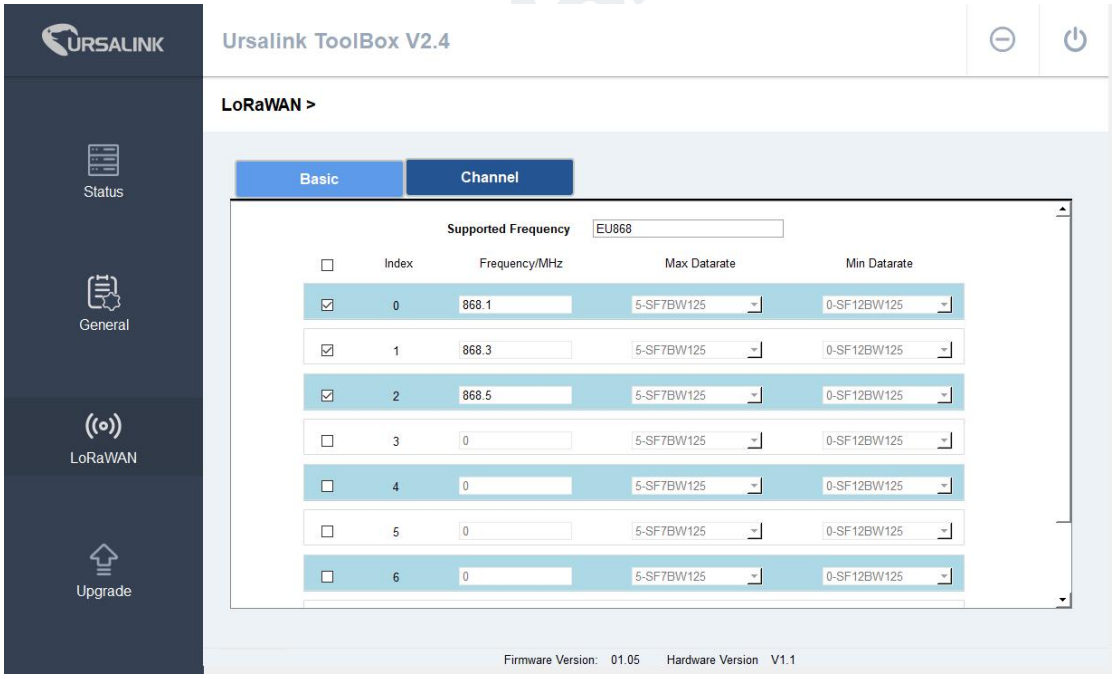
Basic Settings-ABP		
Item	**Description**	**Default**
Device EUI	Show the identifier of this device.	the identifier of this device.
App EUI	Enter the application EUI.The Network Server receives request and consults the entity associated with the	24E124C0002A0001

	APPEUI to validate the request.If permission is granted, it responds with a join-accept message.	
Working Mode	Show the working mode of the device. UC11-N1: Null. UC11-N1-DC: Select from: “Class A” , “Class C”. Class A :Class A operation is the lowest power end-device system. Class C: Class C end-device will use more power to operate than Class A but they offer the lowest latency for server to end-device communication.	Class A
Join Type	Select from: "OTAA" and "ABP". OTAA:Over-the-Air Activation. For over-the-air activation, end-devices must follow a join procedure prior to participating in data exchanges with the network server. An end-device has to go through a new join procedure every time it has lost the session context information. ABP: Activation by Personalization. Under certain circumstances, end-devices can be activated by personalization. Activation by personalization directly ties an end-device to a specific network by-passing the join request - join accept procedure.	OTAA
Device Address	Enter the device address. The device address identifies the end-device within the current network.	The last 8 digits number of SN
Network Session Key	Enter the network session key of the device. The network session key specific for the end-device. It is used by the end-device to calculate the MIC or part of the MIC (message integrity code) of all uplink data messages to ensure data integrity.	5572404c696e6b4c6f5261323031 3823
Application Session Key	Enter the application session key of the device. The AppKey is an application session key specific for the end-device. It is used by both the application server and the end-device to encrypt and decrypt the payload field of application-specific data messages.	5572404c696e6b4c6f5261323031 3823
Regular Report Confirmed	After sending the regular report packet to the network server, if the device does not receive ACK bit from the	Disabled

	network server, then the device will resend the packet. Note: If the device doesn't receive ACK for a long time, the device will resend regular report confirmed packets 3 times at most.	
Alarm Report Confirmed	After sending the attribute package or alarm packet or battery packet to the network server, if the device does not receive ACK bit from the Network Server, then the device will resend the packet. Note: If you doesn't receive ACK for a long time, the device will resend alarm report packets or battery packets 3 times at most. However, the device will resend attribute package all the time.	Disabled

3.4.3 Channel

On this page, you can view all of the supported LoRa frequencies and setup the channel frequency used for receiving and sending data.

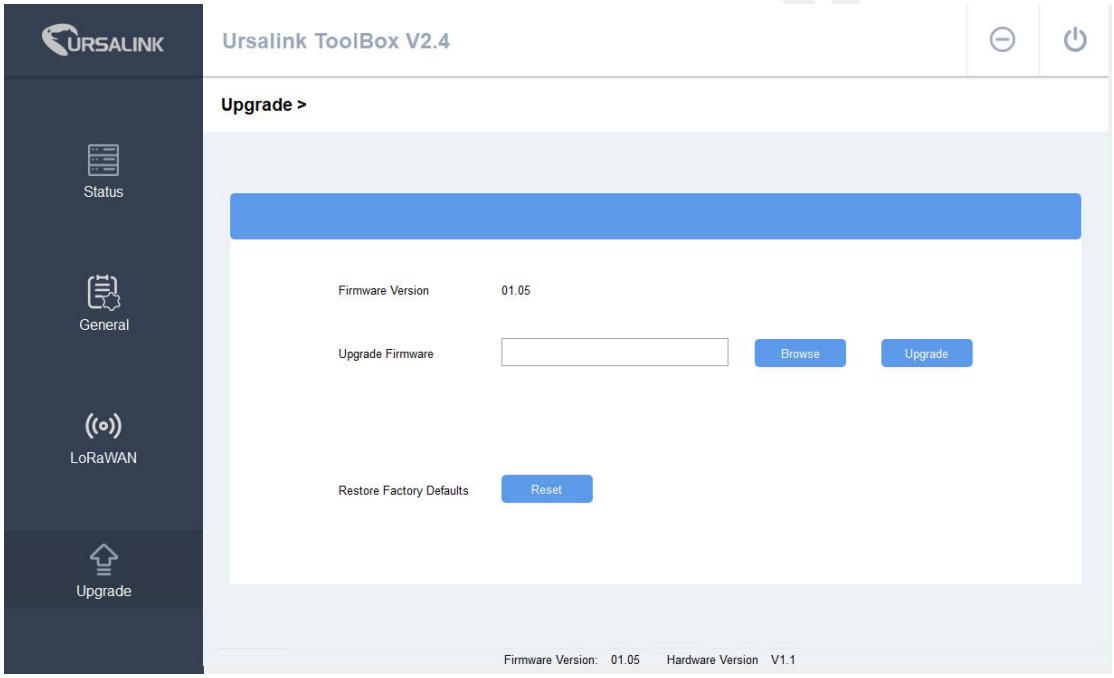


Note: Make sure that you have configured the corresponding channel on the gateway.
E.g. If you have configured a 923.2 MHz channel on UC11-N1, then you have to configure a 923.2 MHz channel on gateway as well.

Multi Channels Setting

Enable	Index	Radio	Frequency/MHz
☑	0	Radio 0	923.2
☑	1	Radio 0	923.4
☑	2	Radio 0	923.6
☑	3	Radio 1	922.2
☑	4	Radio 1	922.4
☑	5	Radio 1	922.6
☑	6	Radio 1	922.8
☑	7	Radio 1	923.0

3.5 Upgrade



Step 1: Connect UC11-N1 to PC via the USB port.
Step 2: Run the Ursalink ToolBox and go to "Upgrade".
Step 3: Click "Browse" and select the correct firmware file from the PC.
Step 4: Click "Upgrade" and the device will check if the firmware file is correct. If it's correct, the firmware will be imported to the device, and the device will reboot after upgrading is completed.

Note: Any operation on Ursalink ToolBox is not allowed during upgrading, otherwise the upgrading will be interrupted, or even the device will break down.

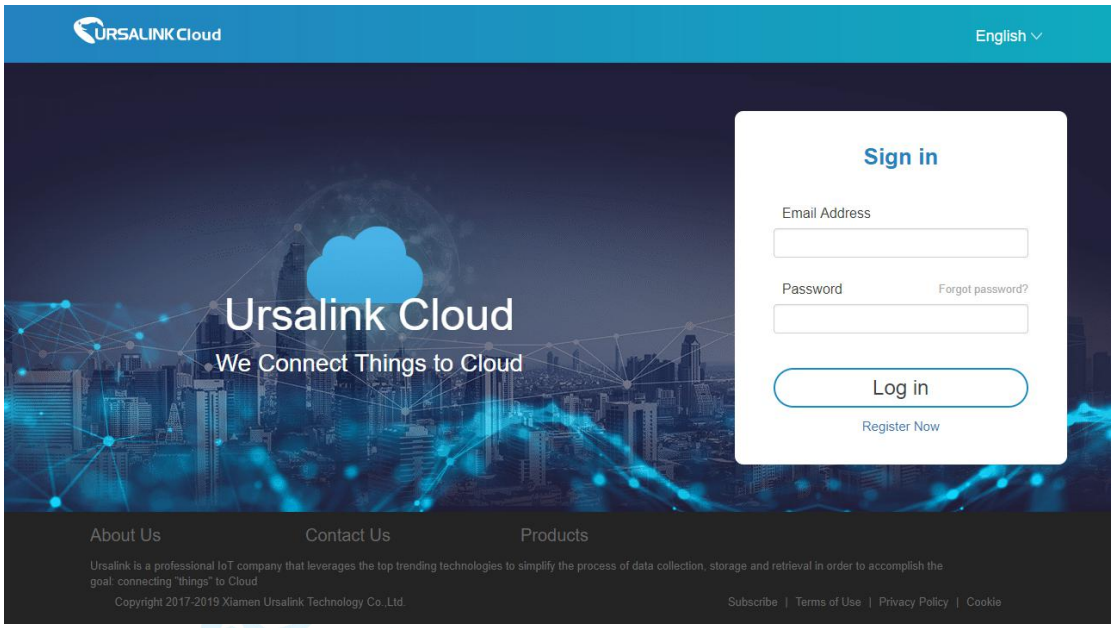
4.Configuration via Ursalink Cloud

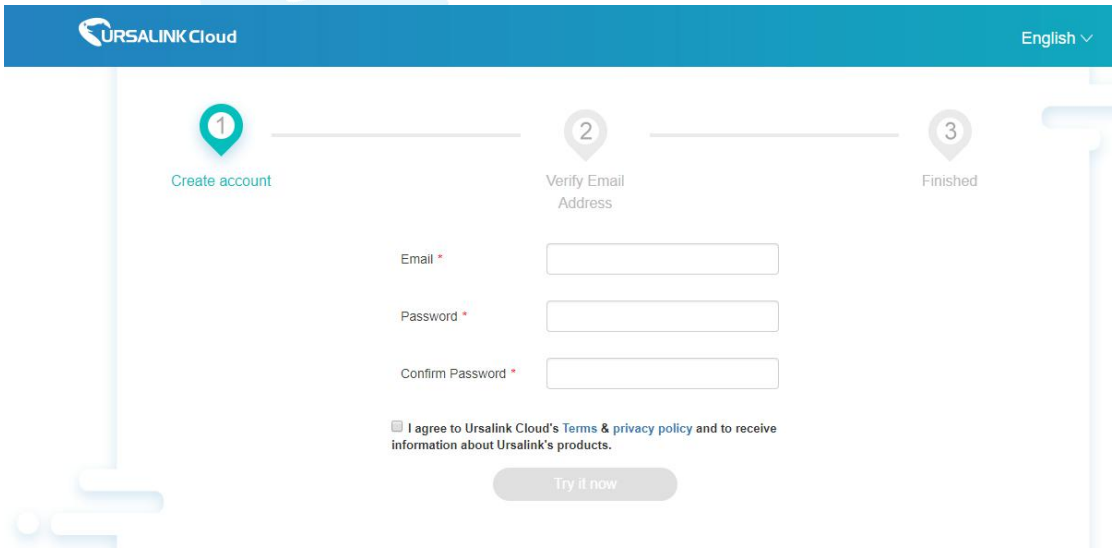
4.1 Account Setup

To set up an account with Ursalink Cloud, follow these steps:

1. Go to : https://cloud.ursalink.com/login.html to register a Ursalink Cloud account .
2. Log in to Ursalink Cloud after the email has been verified.

Note: It is important that you have access to the verified email address before proceeding.

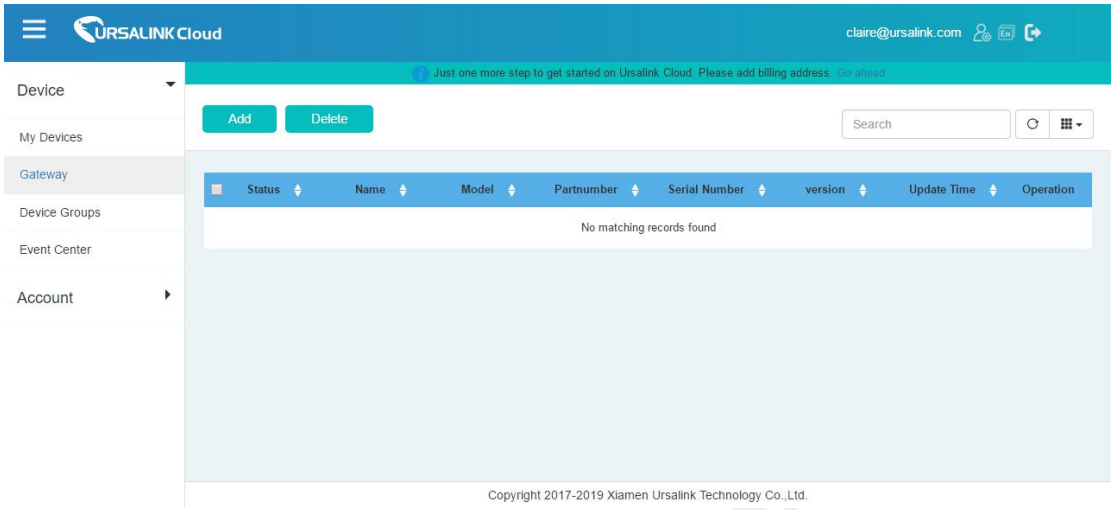




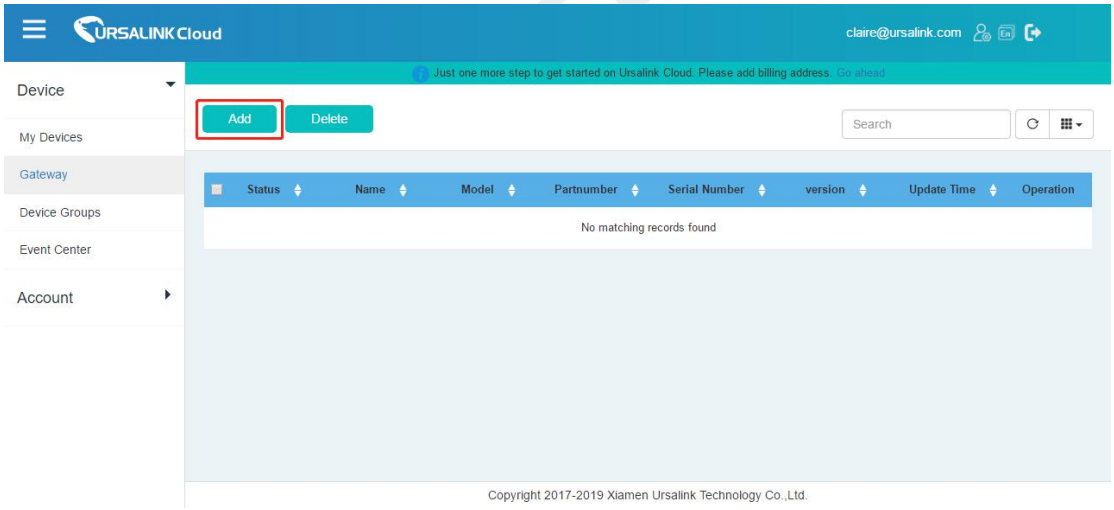
4.2 Add a Ursalink LoRaWAN Gateway

To add your Ursalink gateway to the Ursalink Cloud, please follow these steps:

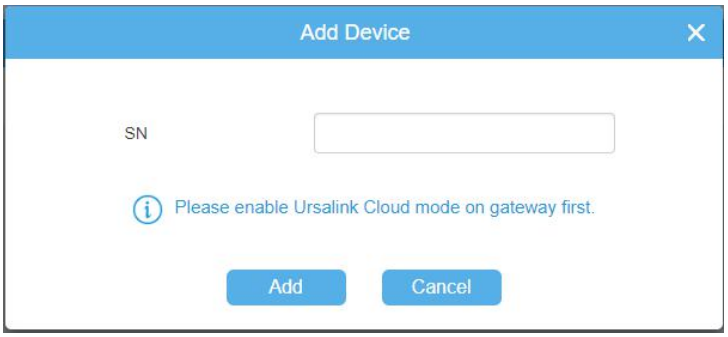
1. On the main page, click "Gateway".



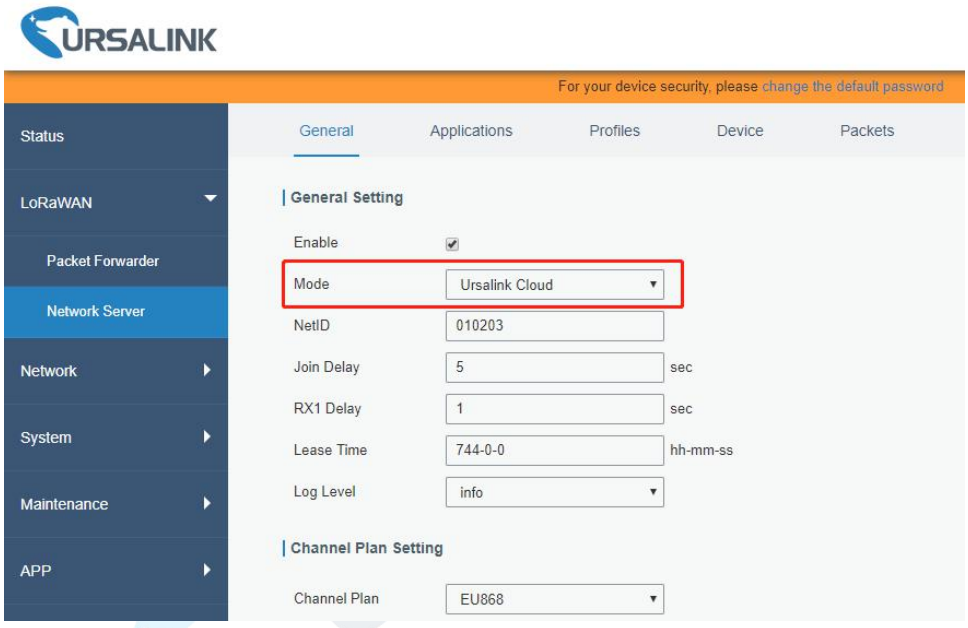
2. On the gateway page, click "Add" to add a gateway.



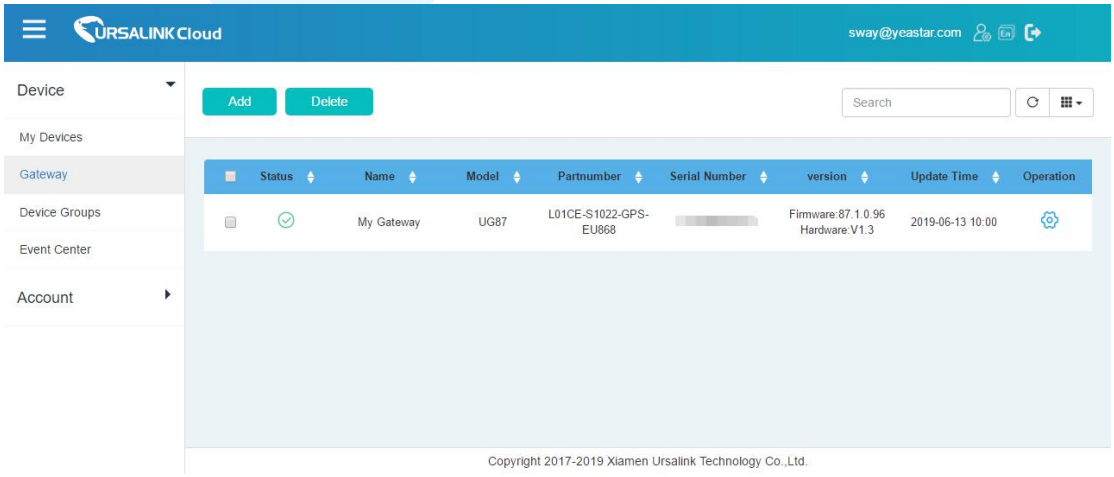
Enter the correct SN of the gateway and click “Add”. You can find your gateway SN either on the label on the bottom of the device or on the web GUI .



Note: Please make sure the working mode is Ursalink Cloud.



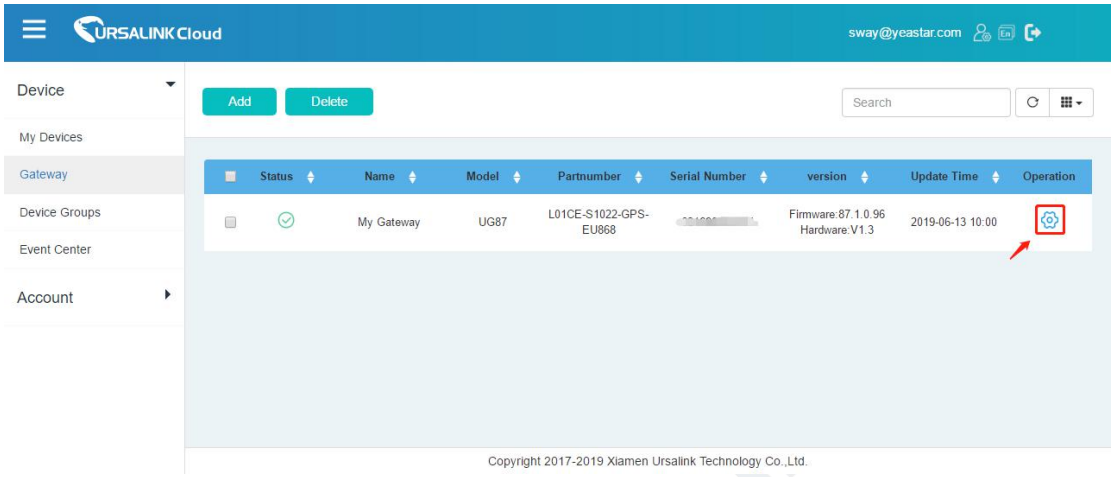
Once the device has been added successfully, You will see the device in the list.



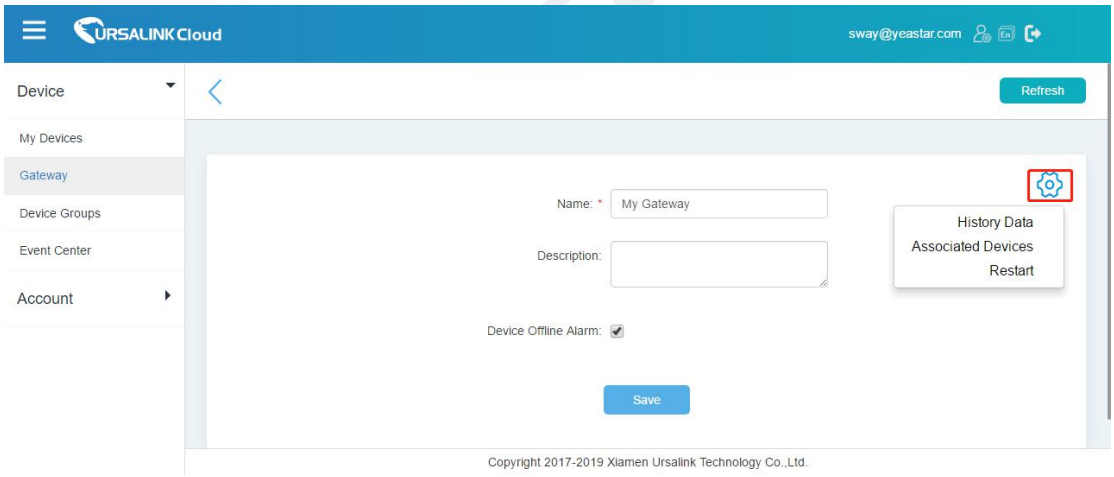
4.3 Add Devices to Ursalink Cloud

To add a UC11-N1 to Ursalink Cloud, please follow these steps:

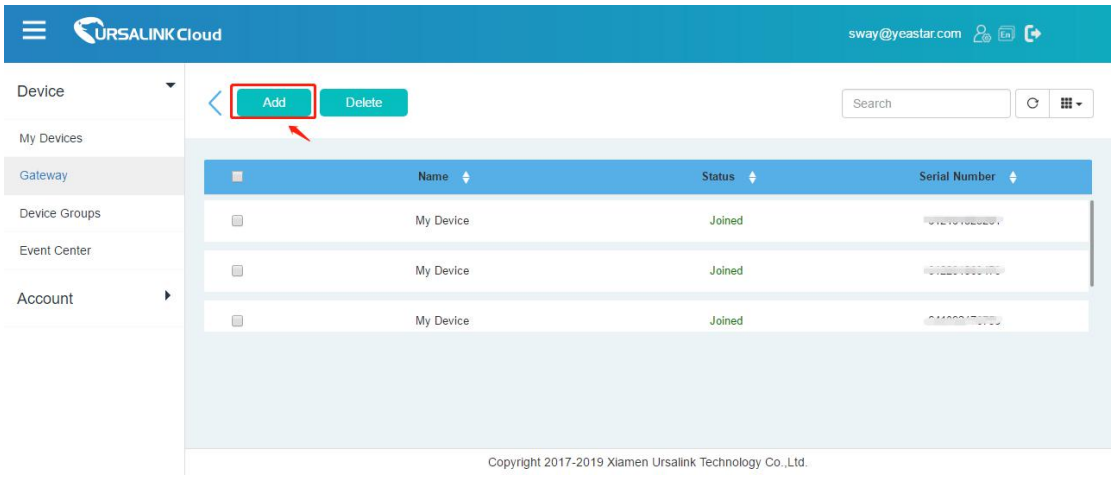
1. Click  to go to the configuration page of this gateway.



2. Click  then click “Associated Devices” .

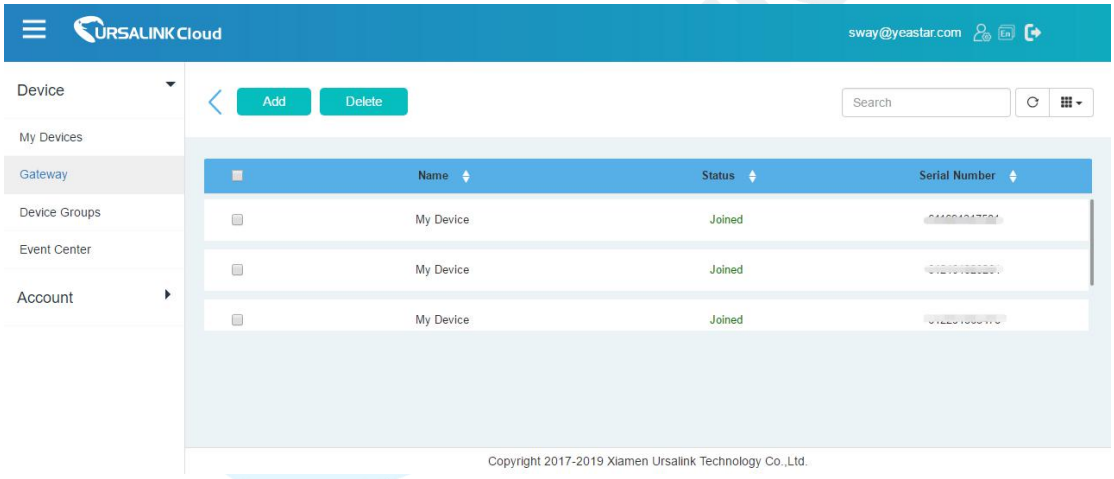


3. Click ”Add” to add a UC11-N1 to this gateway.



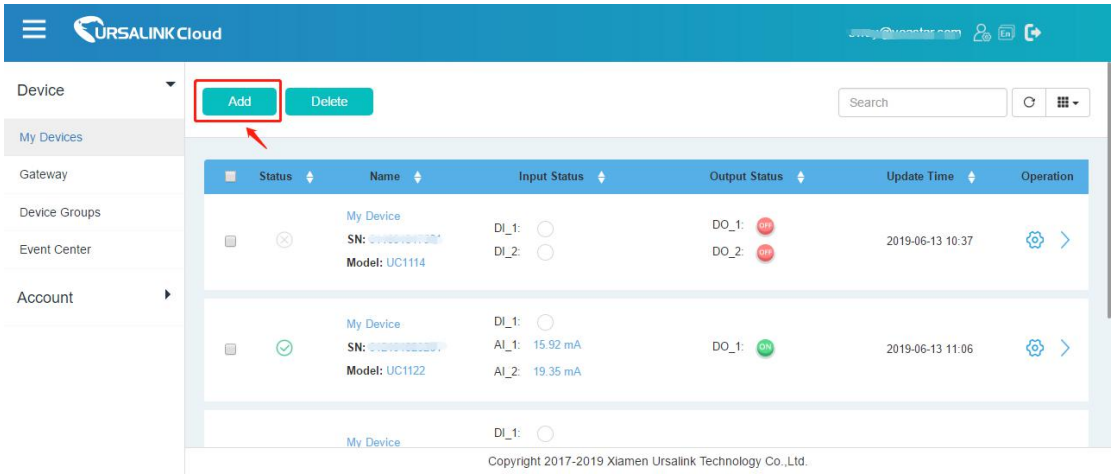
4. Enter the correct SN of the UC11-N1, and then click ”Add”. The device SN can be found on the bottom of the device.

5. Once the device has been added successfully, You will see the device in the list.



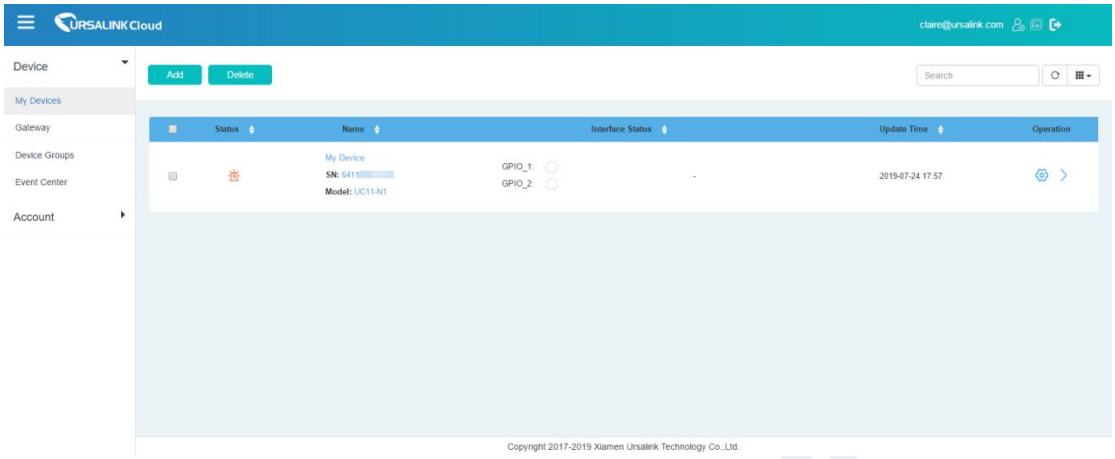
You can also add UC11-N1 directly to the main page, please follow these steps:

1. Click “Add” on the upper left corner.



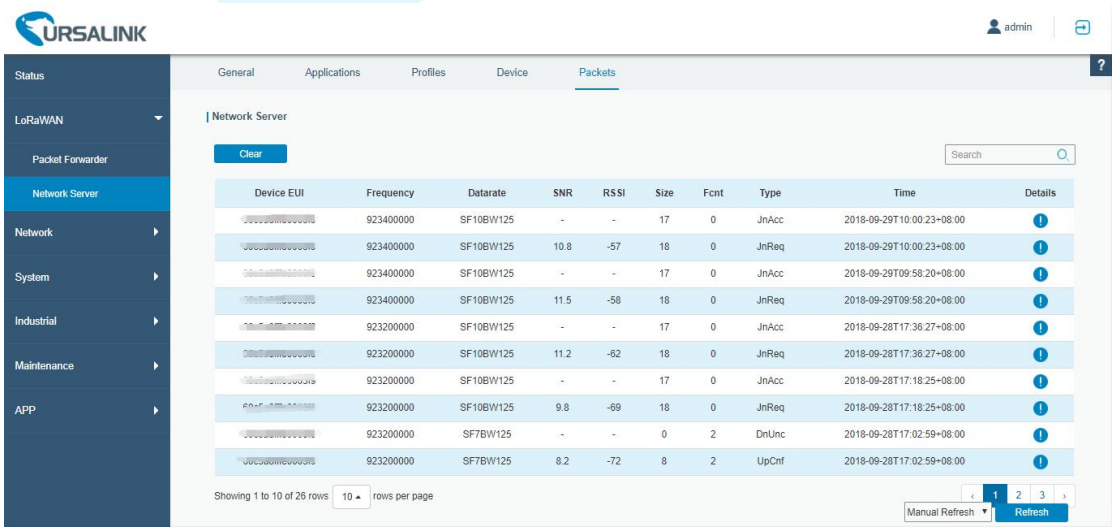
2. Enter the correct SN of UC11-N1 and select the correct gateway to which this UC11-N1 will be added. Then click “Add”.

3. Once the device has been added successfully, You will see the device in the list.

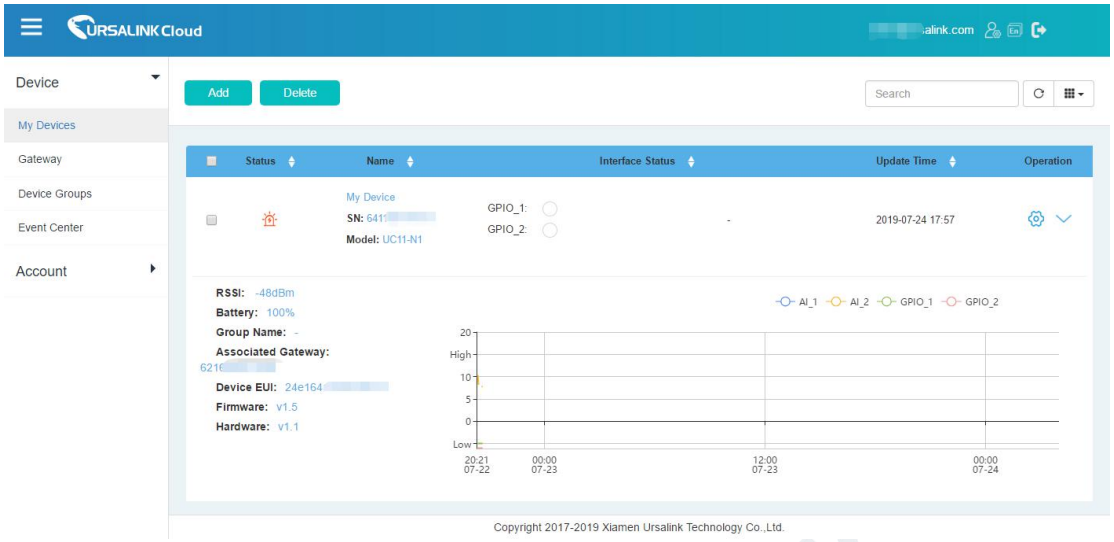


4.4 Check the Data of UC11-N1

Click “LoRaWAN”->”Network Server”->”Packets” to view the data transmission.

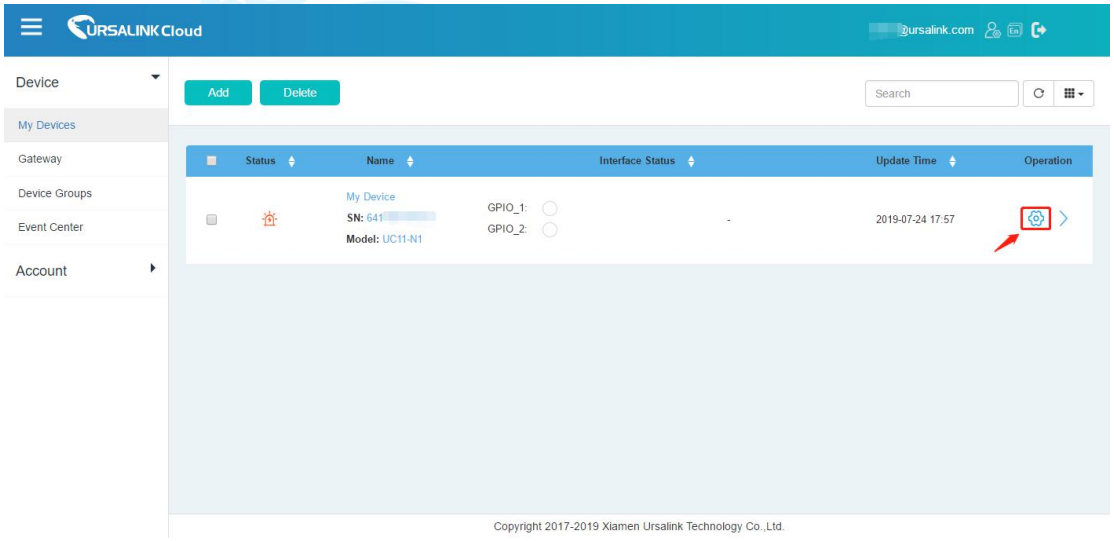


You can see the basic status of the UC11-N1 on the Ursalink Cloud main page.



4.5 Configure UC11-N1 via Ursalink Cloud

Click  to go to the configuration page of UC11-N1. You can edit the basic information of the device on this page.



4.5.1 Basic Settings

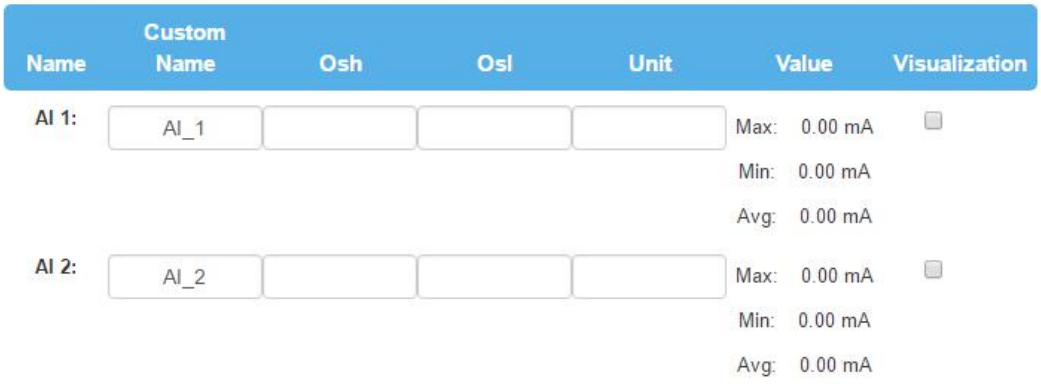
General Settings		
Item	**Description**	**Default**
Device Name	Enter the custom name of this device.	My device
Application Key	Enter the application key. Whenever an end-device joins a network via over-the-air activation, the application key is used for derive the Application Session key.	5572404c696e6b4c6f5261323031 3823
Description	The description of the device.	--
Reporting Interval	The interval of sending data to Ursalink Cloud.	20min
Device Offline Alarm	The device will send an alert if disconnected.	Enabled
Low Battery Alarm	The device will send an alert if battery is less than 20%.	Enabled

4.5.2 Interface Settings

Note:
Before checking GPIO data on Ursalink Cloud, you need to configure UC11-N1 via ToolBox and enable correspondent GPIO, and set port type for GPIO as digital input or digital output.

GPIO Settings		
Item	**Description**	**Default**
Name	Show the name and the type of this interface.	GPIO x (Digital

		Input x)
Custom Name	Enter the custom name of this interface.	GPIO_1
Value	Show the latest value of this interface.	Null
Visualization	Enable: The interface's name and value will be shown on the home page. Disable: The interface's name and value will not be shown on the home page.	Disable



Note:

Before checking AI data on Ursalink Cloud, you need to configure UC11-N1 via ToolBox and enable correspondent AI.

AI Settings		
Item	**Description**	**Default**
Name	Show the name and the type of this interface.	AI 1
Custom Name	Enter the custom name of this interface.	AI_1
Osh	High limit of the scale for the scaled output value.	Null
Osl	Low limit of the scale for the scaled output value.	Null
Unit	Enter the unit for the scaled output value.	Null
Value	Show the latest value of this interface.	Null
Visualization	Enable: The interface's name and value will be shown on the home page. Disable: The interface's name and value will not be shown on the home page.	Disable

The following variables are pertinent to the scaling formula:

Ov = scaled output value

Iv = analog input value

Osh = high limit of the scale for the scaled output value

Osl = low limit of the scale for the scaled output value

Ish = high limit of the scale for the analog input value

Isl = low limit of the scale for the analog input value

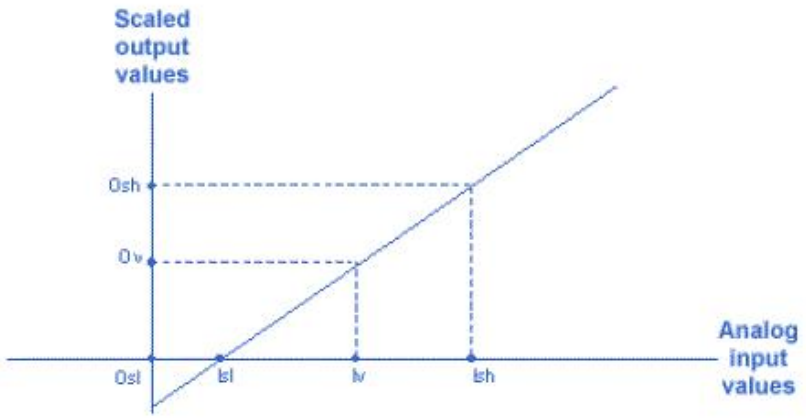
The scaling scheme can be diagrammed as follows:

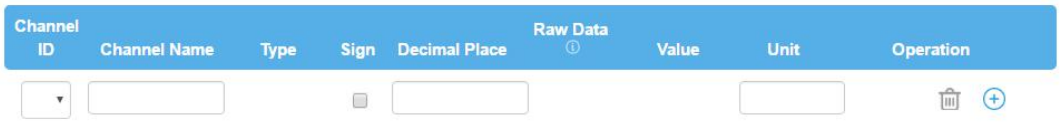
The following formula for calculating the scaled value can be derived from the diagram:

Ov = [(Osh – Osl) * (Iv -Isl) / (Ish – Isl)] + Osl

Which can be rewritten as:

Ov = [(Osh -Osl)/(Ish-Isl)/(Ish -Isl)] + Osl





Note:

Before checking channel data on Ursalink Cloud, you need to configure UC11-N1 in Toolbox and create channel on Ursalink Cloud. The channel ID of channels on Toolbox and Ursalink Cloud should be correspondent.

Channel Settings		
Item	**Description**	**Default**
Channel ID	Assign the channel for the slave device. 8 channels selectable.	Null
Channel Name	Set the name to identify the remote channel. It cannot be blank.	Null

Type	Read command, options are "Coil", "Discrete", "Holding Register (INT16)", "Input Register (INT16)", "Holding Register (INT32)" and "Holding Register (Float)".	Holding Register (INT16)
Sign	To identify whether this channel is signed. Default: Unsigned.	Null
Decimal Place	To indicate a dot in the read into the position of the channel. For example: if the channel raw data is 204d, and a Decimal Place is equal to 2, then the actual value is 12.34.	Null
Raw Data	Show the raw data of this channel (Hex).	Null
Value	Show the conversion results (Dec).	Null
Unit	Enter the unit for the channel's value.	Null

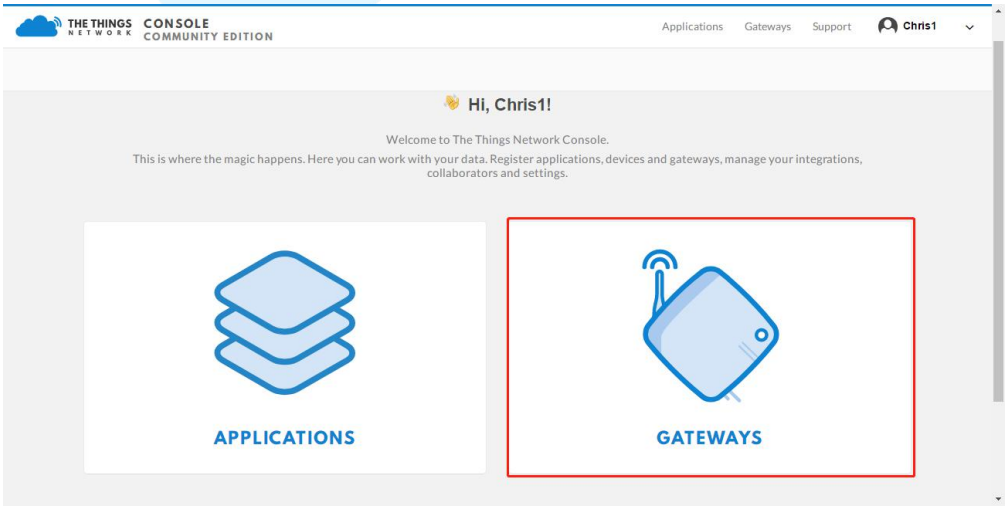
5.Configuration via TTN

5.1 Add a LoRaWAN Gateway to The Things Network

5.1.1 Register Your Gateway in The Things Network

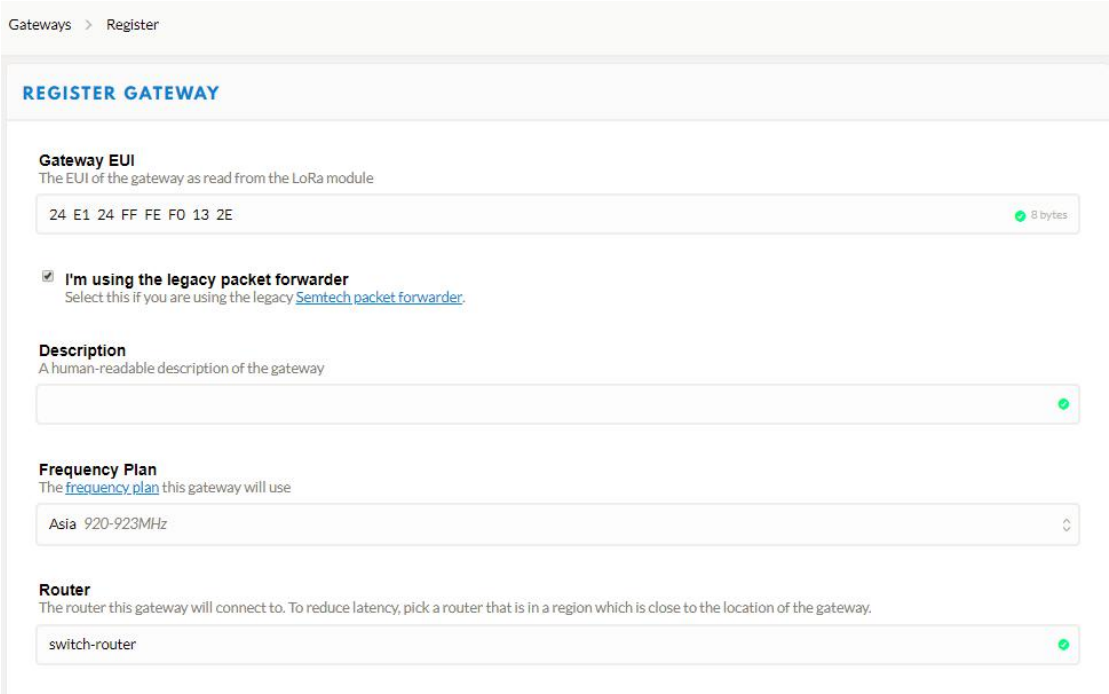
To register your gateway with the The Things Network, please follow these steps:

1. Click "GATEWAYS" on the console screen.



2. Click "register gateway".

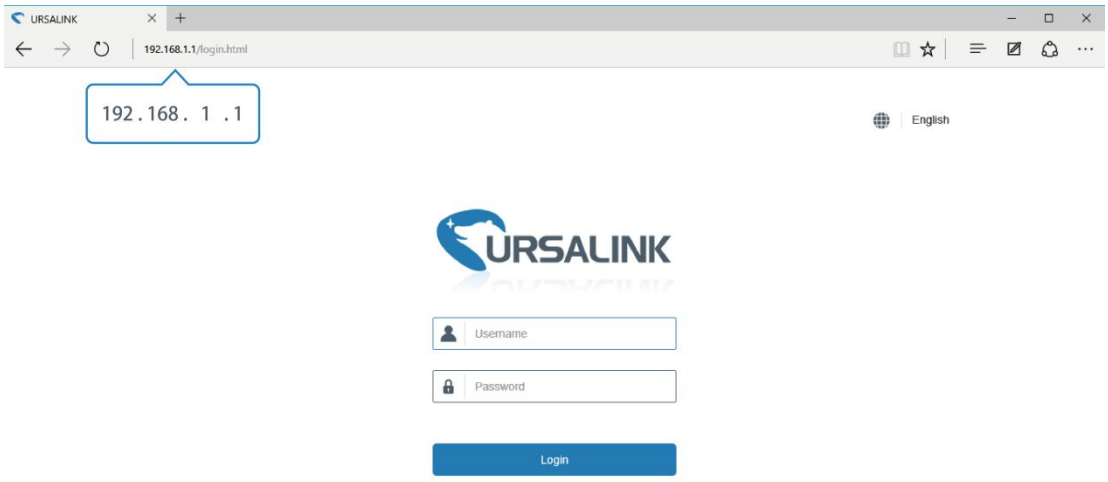
3. Enter the gateway information.



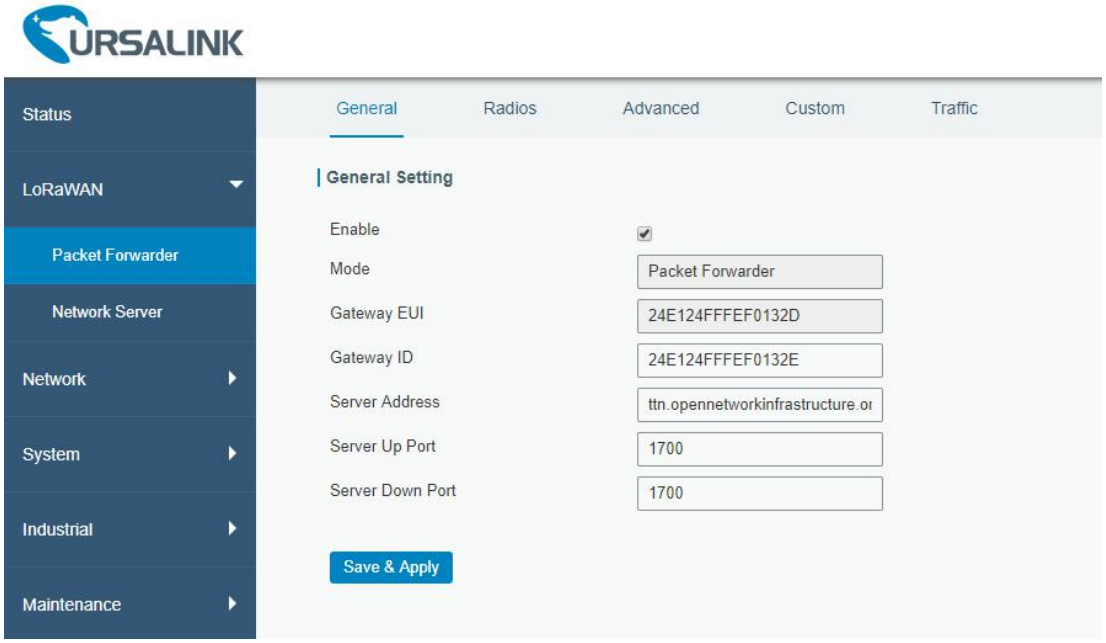
5.1.2 Connect Ursalink Gateway to The Things Network

To connect your gateway to TTN , please follow these steps:

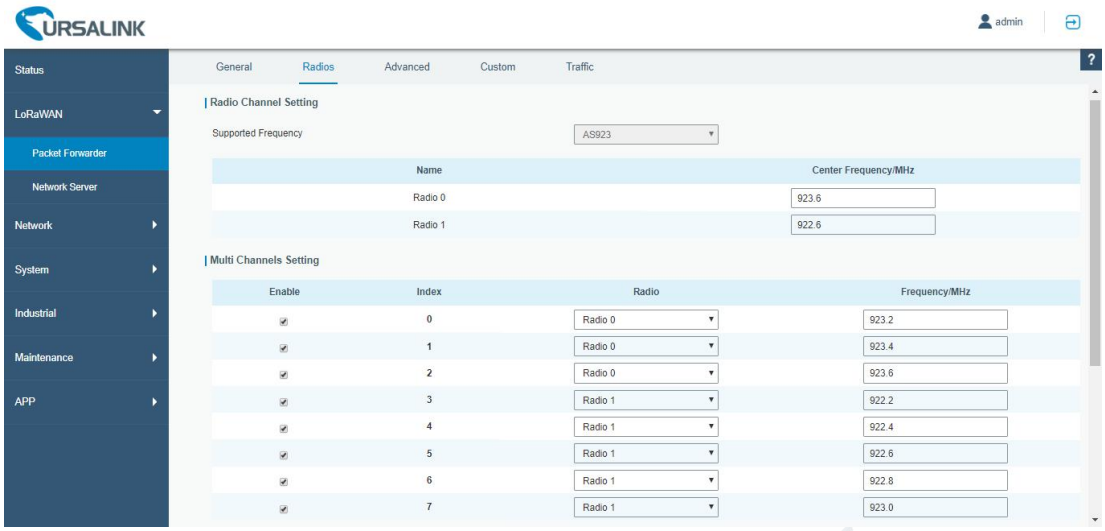
1. Log in gateway web GUI.



2. Click “LoRaWAN” → “Packet Forwarder” → “General” to configure the general setting.



3. Click “Radios” to configure the center frequency and channels.



5.2 Add UC11-N1 to The Things Network

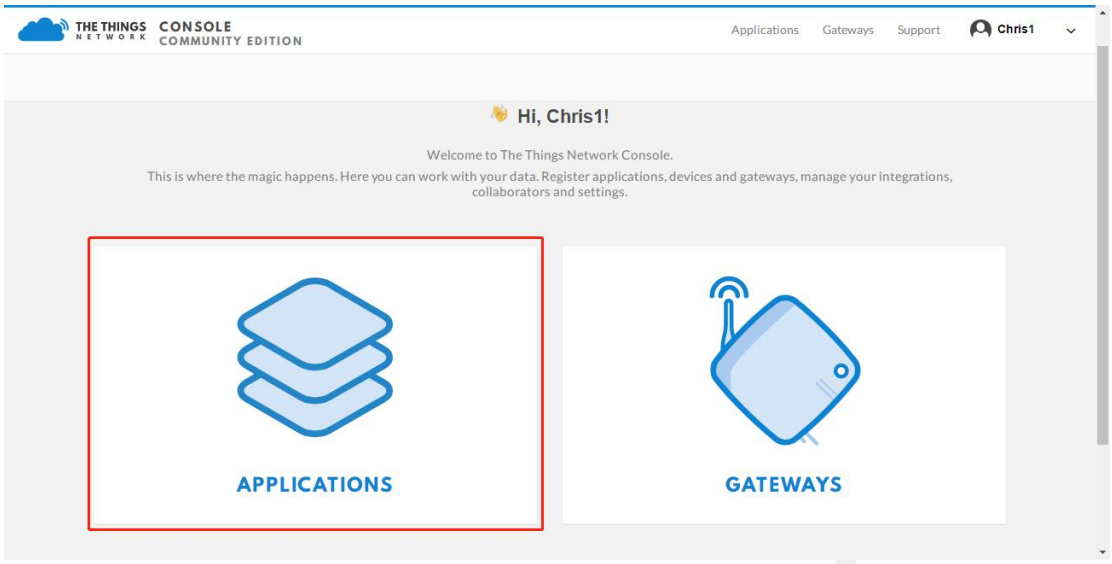
5.2.1 Create an Application in The Things Network

TTN server uses Applications to create groups of devices.

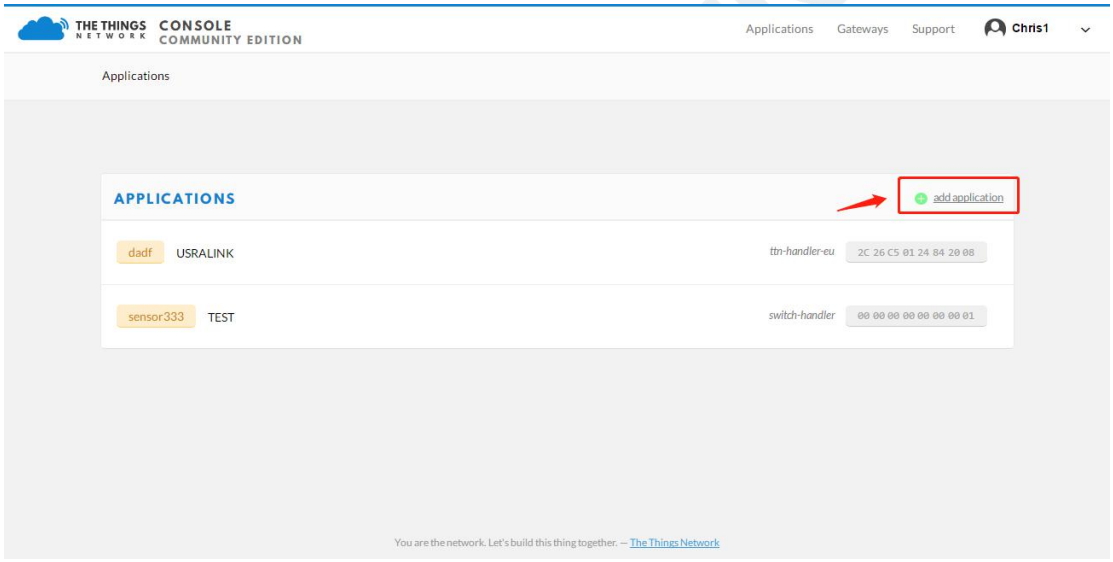
Gateways are associated with user account but not Applications. All gateways connected to TTN servers forward all LoRaWAN data traffic to the TTN message router. The TTN network server filters LoRa traffic by Application ID so that the data is routed to the correct user/application and users are only able to access data from devices registered to their account.

To add an application, follow these steps:

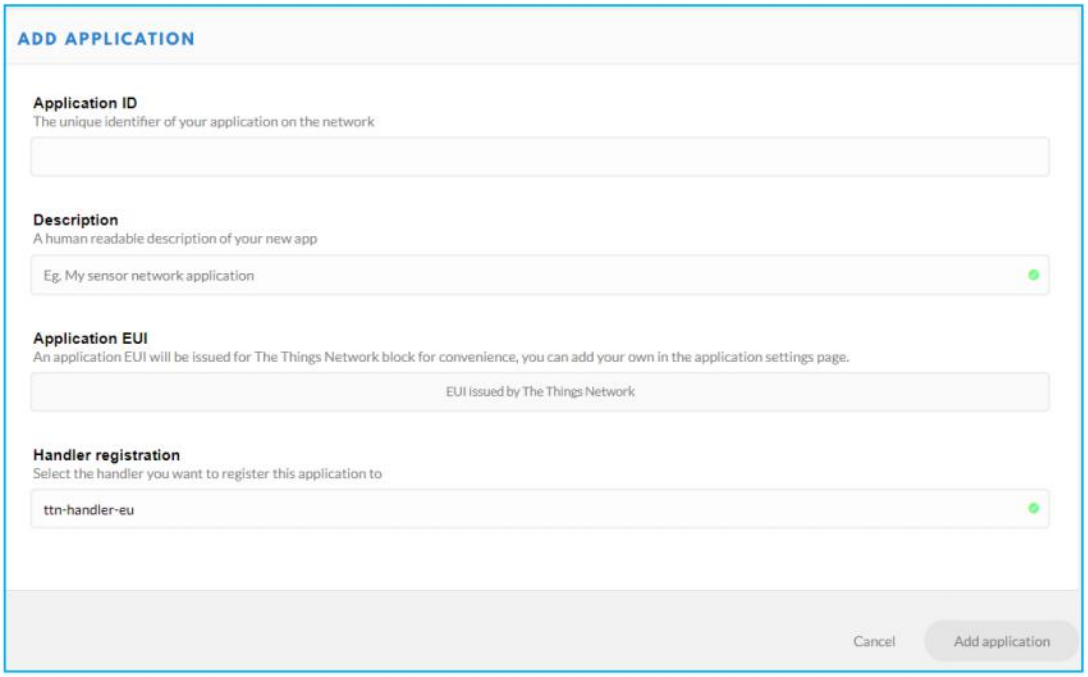
1. Click “APPLICATIONS” located on the Console page.



2. Click “add application” .



3. Fill in the information of Application. Handler Registration is the same as previous in Gateway registration.



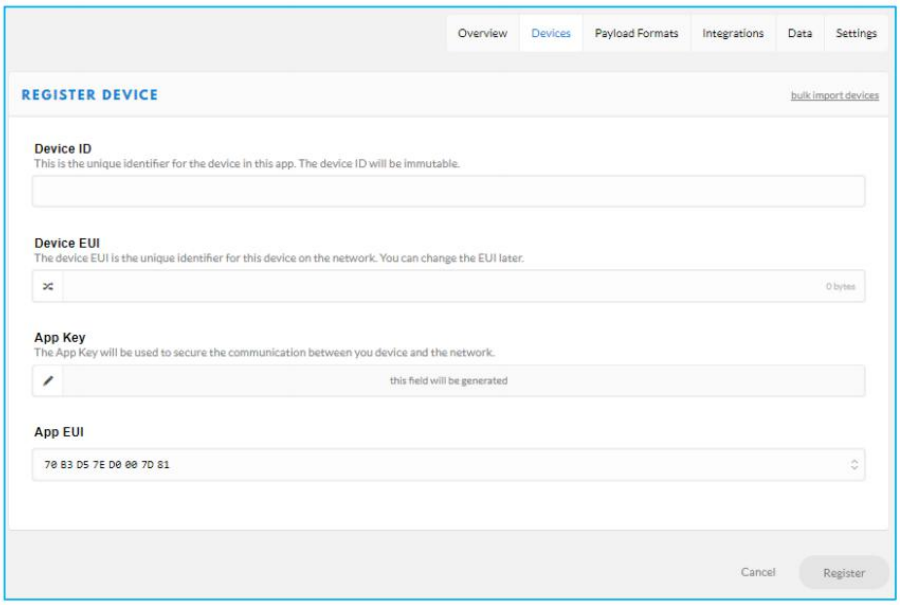
5.2.2 Add Devices to the Application

To add a UC11-N1 to the Application ID recently established, follow these steps:

1. Click “Register Device” under Devices in the application overview page.
2. Enter the Device ID. This ID must be unique on the user’s account.

We recommend using the convention dev (for device), followed by the device Dev EUI. For instance, if the device has a Dev EUI of 0025ca000000000f then the Device ID is dev-0025ca000000000f.

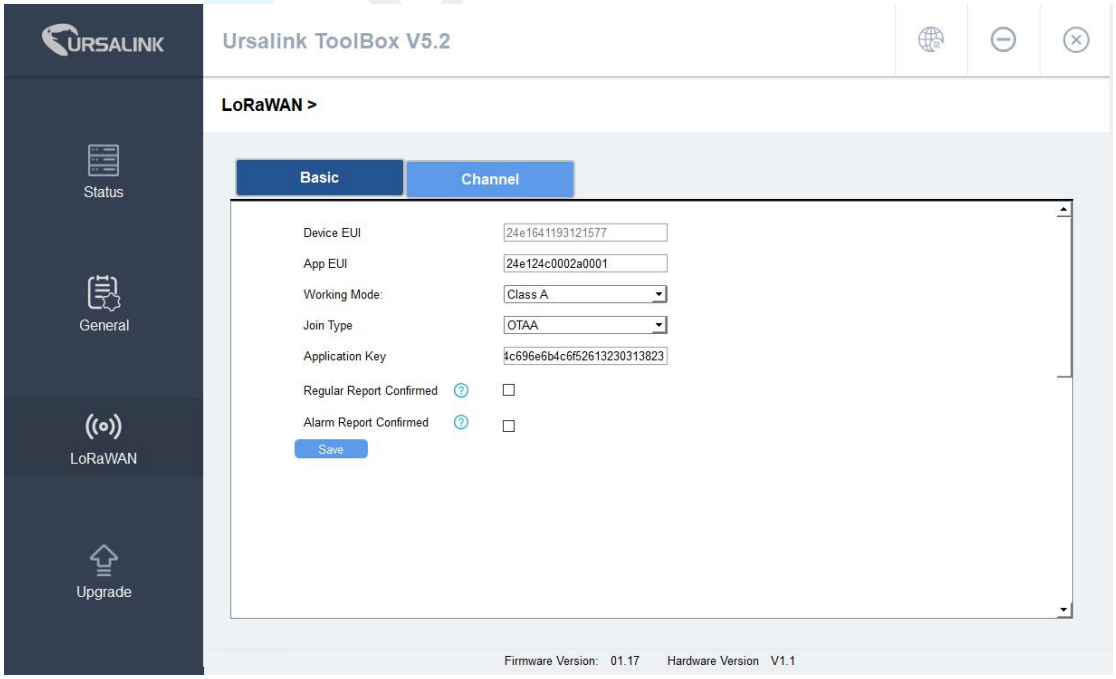
3. Enter the Device EUI, App EUI and App Key of UC11-N1.



4. Click “Register” to complete registration.

5.2.3 Configure UC11-N1

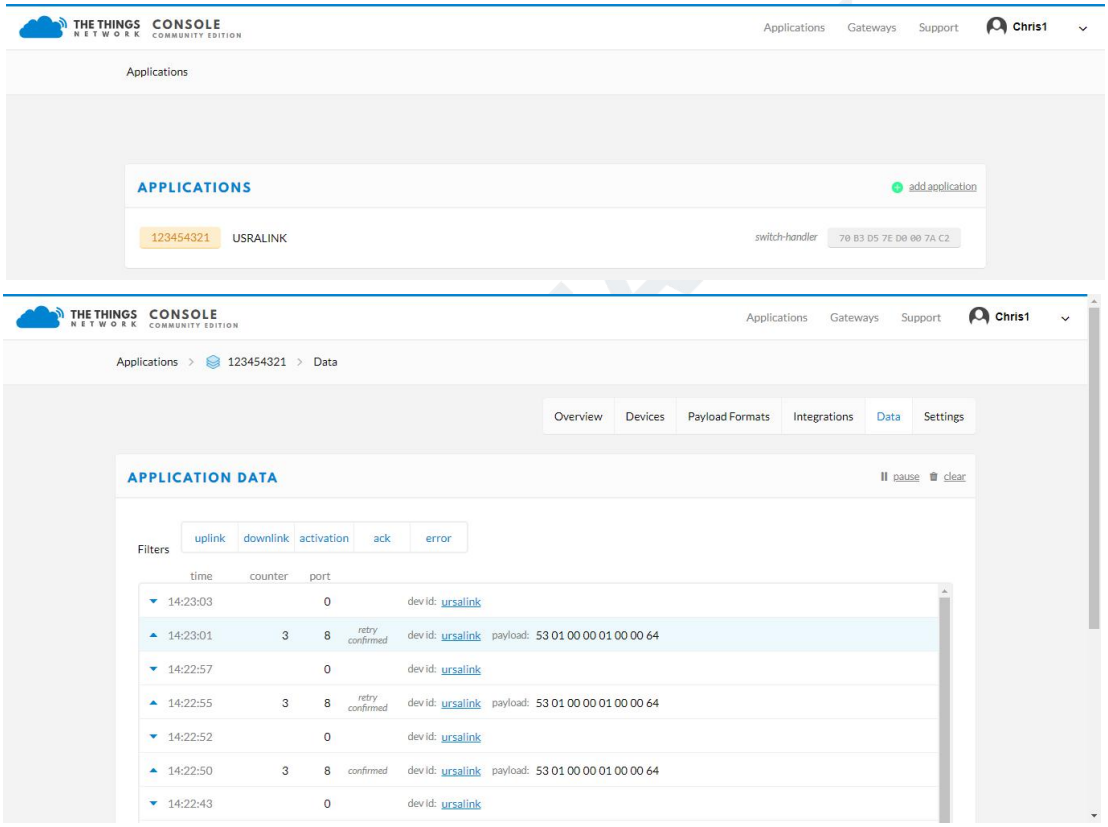
Connect UC11-N1 to PC and configure it via Toolbox.



5.3 Check Data Transmission on The Things Network

1. Click “Gateways” to check the Gateways status.

2. Click “Applications” and select the Applications, then go to “Data”, you can find the data from UC11-N1.



-End-