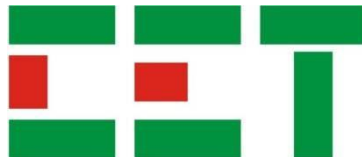# ND65

LoRaWAN Gateway

User Manual

Version: V1.0A

March 20, 2023

DRAFT

CET

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DANGER

This symbol indicates the presence of danger that may result in severe injury or death and permanent equipment damage if proper precautions are not taken during the installation, operation or maintenance of the device.

CAUTION

This symbol indicates the potential of personal injury or equipment damage if proper precautions are not taken during the installation, operation or maintenance of the device.

 DANGER

Failure to observe the following instructions may result in severe injury or death and/or equipment damage.

➢ Installation, operation and maintenance of the device should only be performed by qualified, competent personnel that have the appropriate training and experience with high voltage and current devices.

➢ Ensure that all power sources are turned OFF before performing any work on the device.

➢ Under no circumstances should the meter be connected to a power source if it is damaged.

➢ To prevent potential fire or shock hazard, do not expose the device to rain or moisture.

➢ Setup procedures must be performed only by qualified personnel familiar with the instrument and its associated electrical equipment.

Table of Contents

Chapter 1 Introduction

1.1 Overview

The ND65 is a robust 8-channel indoor LoRaWAN® gateway, adopting SX1302 LoRa chip and high-performance quad-core CPU, it supports more than2000 nodes connection. The ND65 has a line of sight of up to 10km and can cover about 2km in urbanized areas, ideally suited for smart offices, smart buildings and many other indoor applications. In addition to supporting multi-backhaul backups with Ethernet, WiFi and cellular, the ND65 is compatible with popular network servers. It has an integrated network server and Milesight IoT Cloud for easy deployment.

The following are the main features of the ND65:
- Industrial, Commercial and Utility Substation Metering
- Building, Factory and Process Automation
- Sub-metering and Cost Allocation

1.2 Features

- Quad-core industrial processor with large memory
- Equipped with SX1302 chip, handling a higher amount of traffic with lower consumption
- 8 half/full-duplex channels
- IP65 enclosure and industrial design for parts of outdoor applications
- Desktop, wall or pole mounting (optional)
- Multi-backhaul with Ethernet, cellular (4G/3G) and WiFi
- DeviceHub and Milesight IoT Cloud provide easy and centralized management of remote devices
- Enable security communication with multiple VPNs like IPsec/OpenVPN/L2TP/PPTP/DMVPN
- Compatible with mainstream network servers like TTN, ChirpStack, etc.
- Built-in network server and MQTT/HTTP/HTTPS API for easy and quick deployment
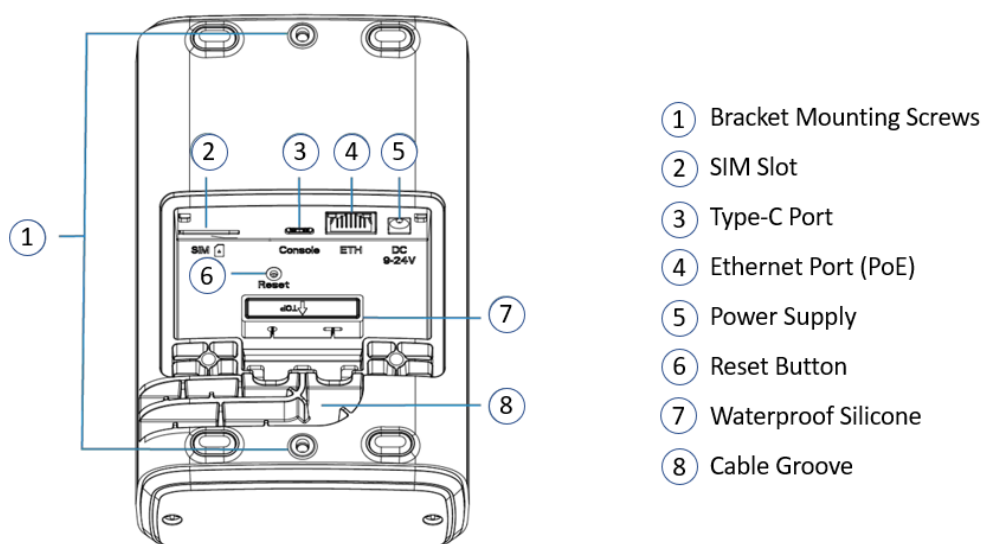- Embedded Python SDK for users' secondary development

1.3 Typical Application
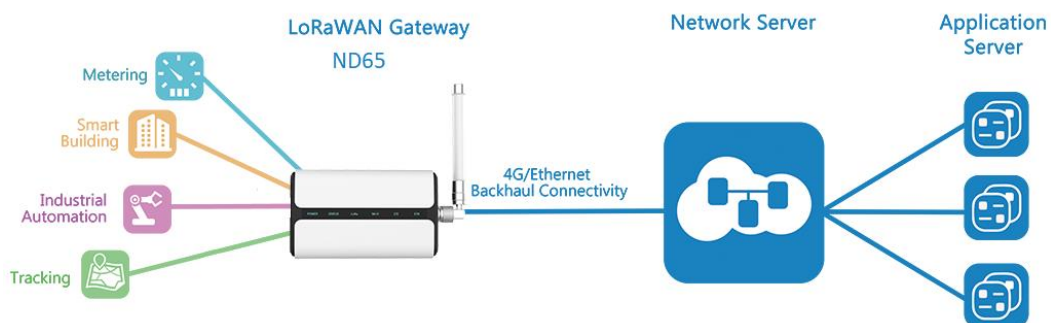
1.4 Front Panel LED Indicators

There are six LED indicators on the Front Panel as described in the table below.

Indicator	Color	Status	Description
POWER	Blue	Off	Power is off
		On	Power is on
STATUS	Blue	On	The device is running normally
	Red	On	The device is running abnormally
LoRa	Blue	On	Packet Forwarding mode is enabled
		Off	Packet Forwarding mode is disabled
WiFi	Blue	On	WiFi is enabled
		Off	WiFi is disabled
LTE (Cellular)	Blue	Off	SIM card is registering or fails to register, or no SIM cards are inserted
		Blinking slowly	SIM card has been registered and is ready for dial-up
		Blinking rapidly	SIM card has been registered and is dialing up now
		On	The SIM card has been registered and dialed up successfully
ETH (Ethernet Port)	Blue	Off	Disconnected
		On	Connected

1.5 Rear Panel

1. Bracket Mounting Screws
2. SIM Slot
3. Type-C Port
4. Ethernet Port (PoE)
5. Power Supply
6. Reset Button
7. Waterproof Silicone
8. Cable Groove

The following steps describe how to reset the ND65 using the **Reset** button:

1. When the LED indicators are all **On** (the LTE and ETH would be off if the Cellular and Ethernet are not equipped), press and hold on the **Reset** button for more than 5 seconds.

2. Release the **Reset** button when the LED indicators blink.

3. When the LED indicators are all On again, the reset operation is completed, and the ND65 is reset to factory default.
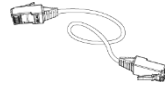
Chapter 2 Installation
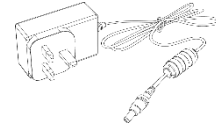
2.1 Package List

Before mounting the ND65, please check the package contents to ensure you have received all the items below.
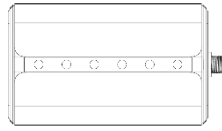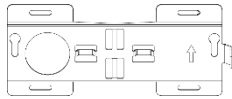

1 × ND65

1 × Ethernet Cable

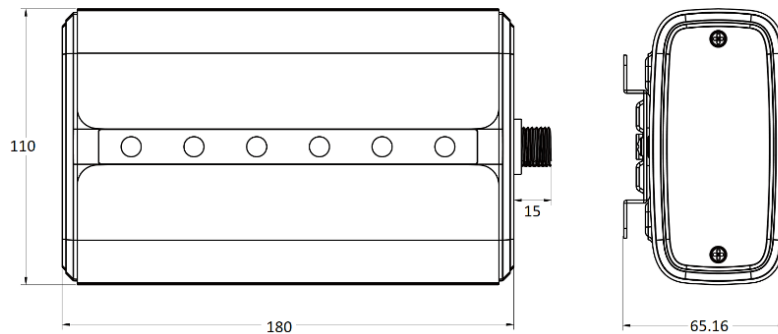1 × DC Jack Power Adapter

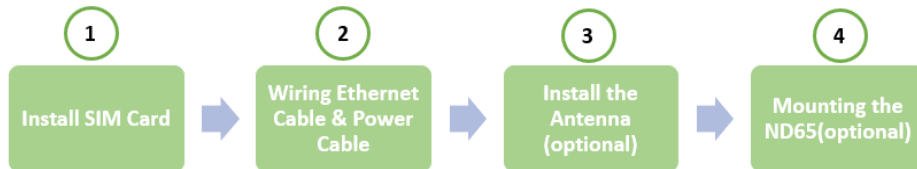1 × Mounting Bracket

Bracket Fixing Screws
4 × Wall Mounting Kits

1 × LoRa Antenna (optional)

2.2 Dimensions

Unit: mm

110

15

180

65.16

2.3 Mounting

| 1	2	3	4
Install SIM Card	Wiring Ethernet Cable & Power Cable	Install the Antenna (optional)	Mounting the ND65(optional)

2.3.1 Install SIM Card

Steps:
   a. Use a screwdriver to open the protective cover on the rear panel of ND65.
   b. Insert the SIM card into the device according to the direction icon on the device (see figure below).
   c. To take out the SIM card, push in the SIM card, and it will pop up automatically.

Notes:
1) The ND65 does not support hot plugging, and please turn off the power before inserting or taking off the SIM card.
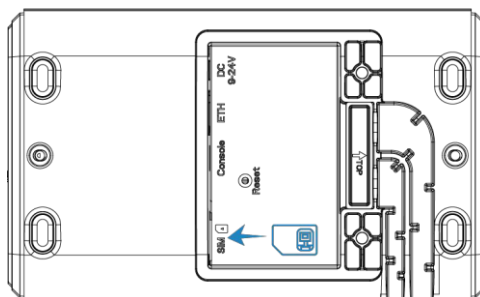
2.3.2 Wiring Ethernet Cable & Power Cable

Notes:
1) Do not connect the power before the Ethernet cable is connected correctly. Otherwise, PoE devices or Gateway may be damaged.
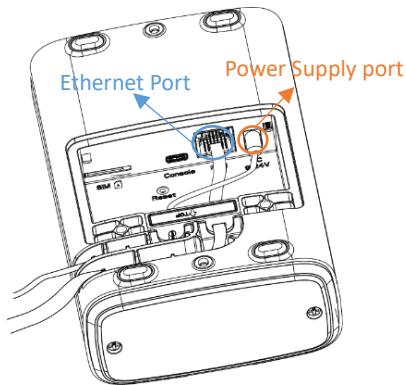

Steps:
1. Connect the Ethernet cable and power cable to the Ethernet Port and Power Supply port, respectively.
2. Pass two cables through the waterproof silicone and slid into the grooves.
3. Screw the protective cover back to the device.

2.3.3 Install the Antenna (optional)

Rotate the antenna into the antenna connector accordingly. The external antenna should always be installed vertically on a site for good signal status.
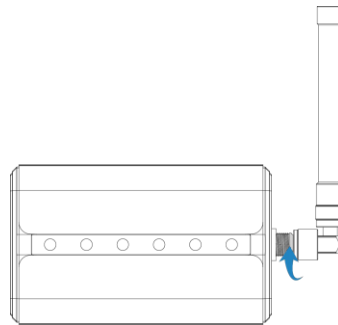

Notes:
1) Please do not let the front panel of the ND65 faces to walls if using an embedded LoRa antenna.

2.3.4 Mounting the ND65

The ND65 can be mounted to a wall or a pole. Before the installation, please make sure that the SIM card has been inserted, the antennas have been attached, and all cables have been installed properly.

2.3.4.1 Wall Mounting

1. Before installation, make sure that the desired position is marked.
2. Drill four 32 mm-depth holes with a 6 mm drill.
3. Insert four wall plugs into the holes respectively.
4. Install the mounting bracket horizontally to the wall and secure it using the wall mounting kits.
5. Secure the bracket fixing screws to the device's back panel, then hang the device to the mounting bracket on the wall.
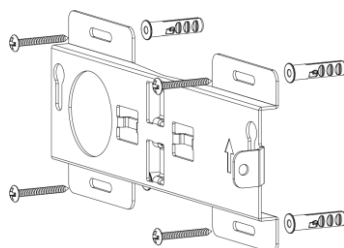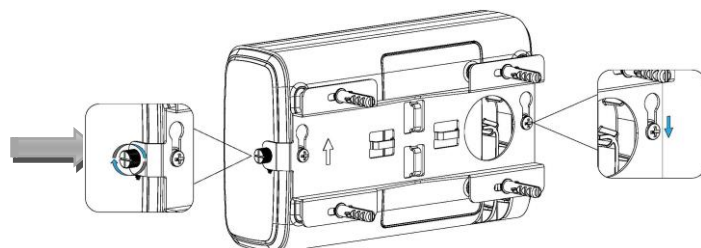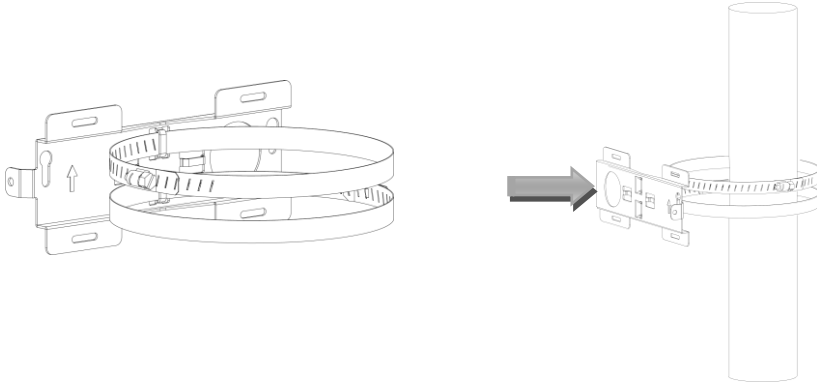

Steps 1-5   Step 6

2.3.4.2 Pole Mounting

1. Open the hose clamp by turning the locking mechanism counterclockwise.
2. Straighten the hose clamp, and slide it through the rectangular rings in the mounting bracket, and wrap the hose clamp around the pole.
3. Use a screwdriver to tighten the locking mechanism by turning it clockwise.

4. Screw the bracket fixing screws to the device's back panel, then hang the device to the mounting bracket on the pole.
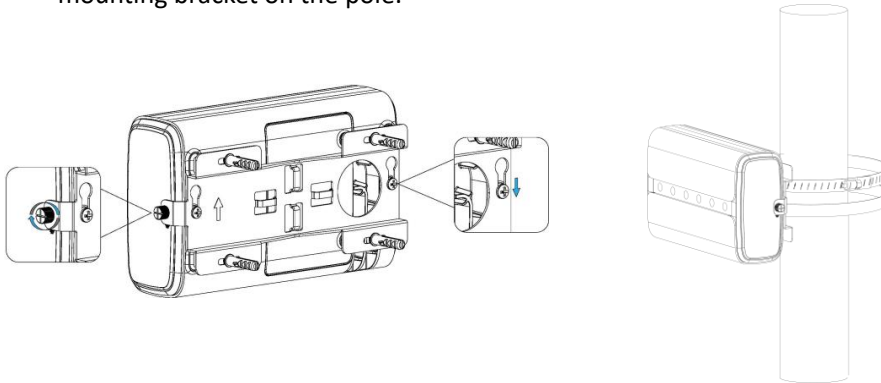
Chapter 3 Configure Device via Web Server

3.1 Web Accessing

The default IP addresses of the ND65's Ethernet Port and WIFI are 192.168.23.150 and 192.168.1.1, respectively.

3.1.1 Wireless Access

1. Power on the ND65.
2. Enable Wireless Network Connection on your computer and search for access point "Gateway_******" to connect it.
3. Open a Web browser on your PC (Chrome is recommended) and type the IP address 192.168.1.1 to access the web page.
4. Enter the username and password, and click "Login".

o Username: admin
o Password: password
If you enter the username or password incorrectly more than 5 times, the login page will be locked for 10 minutes.
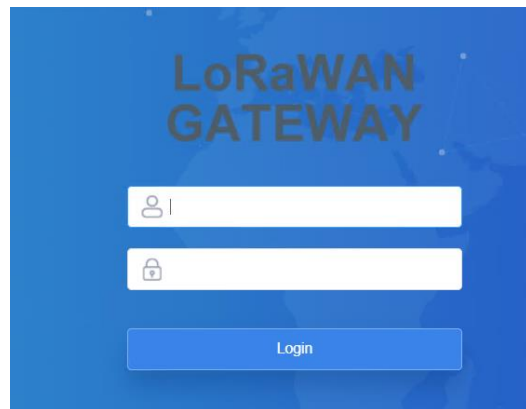
3.1.2 Wired Access

1. Setting PC's IP Address

a) To determine the PC's IP Address, click the Start icon ⊞, then the Settings button ⚙ on Windows 10 (for other MS Windows systems, please refer to this **link** for more instructions).
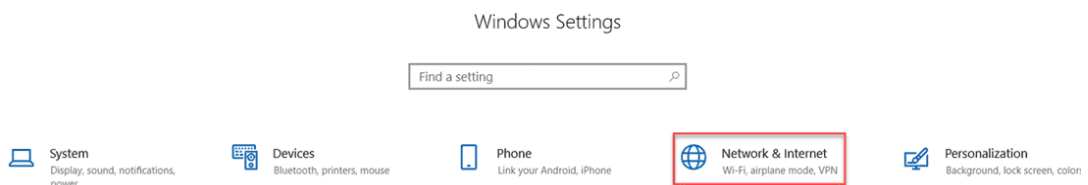

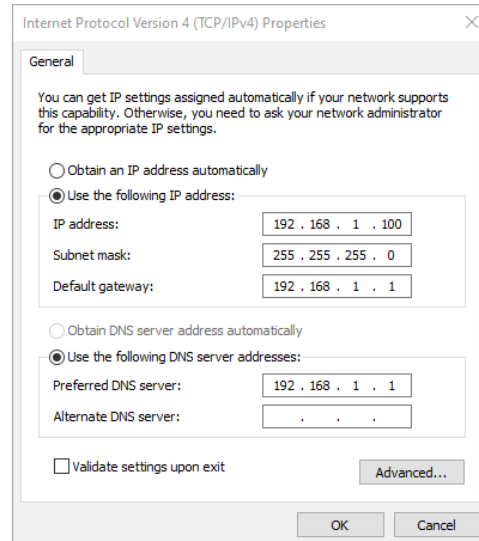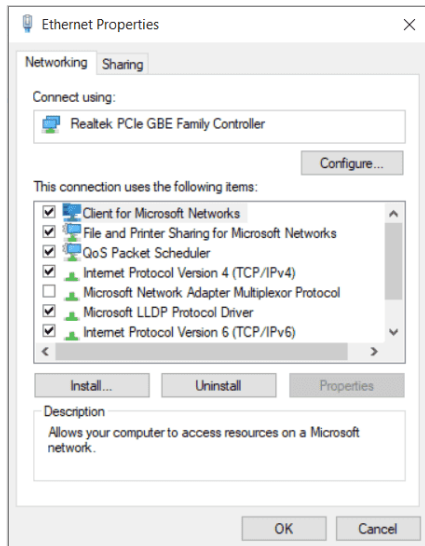**Figure 3-1 Settings > Network & Internet**

b) Click ⊕ **Network & Internet**, select **Change adapter options** and then find the appropriate Ethernet connection.
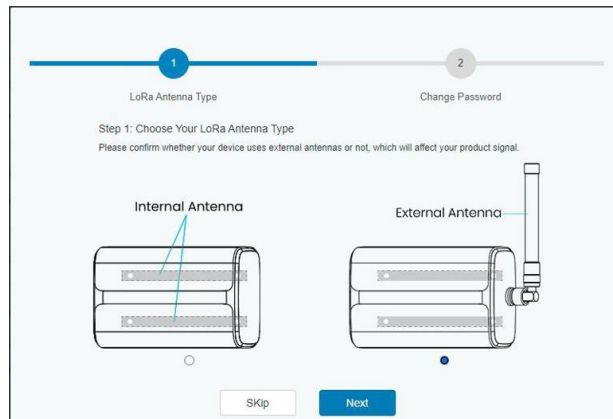

Figure 3-2 Network and Sharing Center

c) Right-click on it and select **Properties**. Then double-click on **Internet Protocol Version 4 (TCP/IPv4)** to show its IP configuration.

2. Accessing Web Interface

   a) Enter the IP Address of the ND65 (e.g.: https://192.168.1.23) in the Address area of **Google Chrome** and then press **<Enter>**.

   b) The user must log in to the Web interface to view data or change setup parameters.

      o Username: admin
      o Password: password
      If you enter the username or password incorrectly more than 5 times, the login page will be locked for 10 minutes.

3. Changing password. After logging into the web, it's suggested that you change the password for the sake of security.

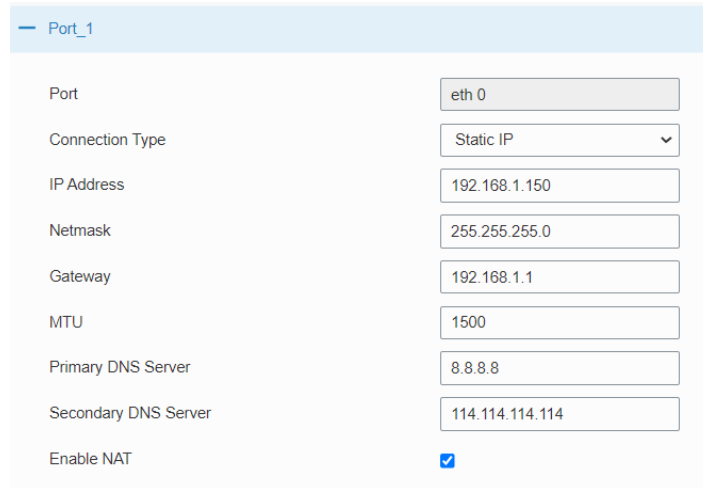4. You can check overview of the system information.

Notes:
- Region: LoRa Bands
- Uptime: normal operating time since the ND65 is switch on
- RAM: Random Access Memory
- Emmc: Embedded Multi Media Card

3.2 Network Connection

This section explains how to connect the Gateway to network via Ethernet port, WiFi or cellular.

3.2.1 Ethernet Connection

1. Click **Network > Interface > Port** on the left hand, and the following page allows users to select the connection type and configure the Ethernet port information.

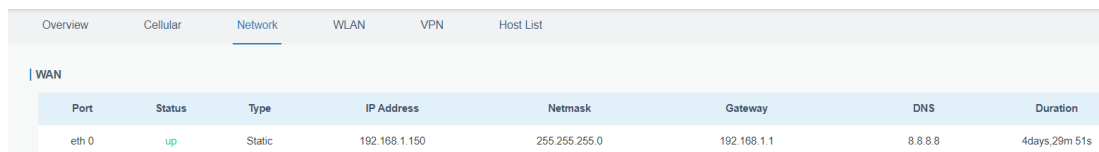| Port_1	
Port	eth 0
Connection Type	Static IP
IP Address	192.168.1.150
Netmask	255.255.255.0
Gateway	192.168.1.1
MTU	1500
Primary DNS Server	8.8.8.8
Secondary DNS Server	114.114.114.114
Enable NAT	☑

Notes:
1) MTU: Maximum Transmission Unit, the largest size frame or packet - in bytes or octets (eight-bit bytes) - that can be transmitted across a data link. Range: 46-1500. Default: 1500.
2) DNS Server: Domain Name Server. A DNS server is a computer server that contains a database of public IP addresses and their associated hostnames. In most cases, it resolves or translates those names to IP addresses as requested.
The Primary and Secondary DNS servers are used if one of them happens to fail, in which case the second is used to resolve the hostnames you enter.
3) Enable NAT: (Network Address Translation), mapping an internet protocol (IP) address to another by changing the header of IP packets while in transit via a router.

2. Click **Save & Apply** and the changes will take effect immediately.

3. Connect the ND65 to a router or a modem via the Ethernet port.

4. Log in to the web page via the newly assigned IP address and click **Status > Network** to check the Ethernet port status, where **up** represents the Ethernet Port is enabled.

Overview	Cellular	Network	WLAN	VPN	Host List		
| WAN							
Port	Status	Type	IP Address	Netmask	Gateway	DNS	Duration
eth 0	up	Static	192.168.1.150	255.255.255.0	192.168.1.1	8.8.8.8	4days,29m 51s

3.2.2 WiFi Connection

1. Click **Network > Interface** on the left hand and click **the WLAN** tab.

2. Click **Scan** to search for the WiFi access point.

Notes:
1) SSID: Service Set Identifier, is the identifier (name) that tells you which service set (or network) to join.

2) BSSID: Basic Service Set Identifier, and it's the MAC physical address of the access point or wireless router that is used to connect to the WiFi.

3. Select one WIFI and click **Join Network**.

4. Type the key of WiFi and click **Save**.

5. Click **Status > WLAN** to check WiFi connection status, where **Enabled** represents the ND65 is connected to the specified WiFi successfully.

3.2.3 Cellular Connection

1. Click **Network > Interface > Cellular** on the left hand and click the **Client** tab.
2. Enable the **Cellular** and fill in SIM card information like APN or PIN code.

3. Click **Save.**

4. Click **Status > Cellular** to check the WiFi connection status.

3.3 Packet Forwarder Configuration

The ND65 can function as a gateway and forward LoRaWAN data to the third party's LoRaWAN network servers. Here illustrates how to configure ND65 as a gateway.

1. Click **Packet Forwarder > General** on the left hand, and the following page appears.

Notes:

1. Gateway EUI: The EUI of the Gateway is derived from the first number, typically of the form **58A0CBxxxxxx**, printed on the top of the sticker below the QR code. For example, if that

number is **58A0CB800BE7**, insert **FFFE** after the first 6 characters to make it a 16-character Gateway EUI (e.g., 58A0CBFFFE800BE7).

2. Click ➕ to add a network server.

Enable	☑
Type	Semtech ▾
Server Address	eu1.cloud.thethings.network ▾
Port Up	1700
Port Down	1700

Save

3. Go to **Packet Forwarder > Radio** page to configure **Antenna Type**, **Center Frequency** and **Channels**. The channels of the gateway and network server should be consistent.

Click **Save & Apply** after the configuration.

| General | Radios | Advanced | Custom | Traffic |

| Antenna Type

Internal Antenna ○   External Antenna ◉

| Radio Channel Setting

Supported Freq	EU868 ▾

Noise Analyzer ▾

Name	Center Frequency/MHz
Radio 0	867.5
Radio 1	868.5

Multi Channels Setting

Enable	Index	Radio	Frequency/MHz
☑	0	Radio 1 ⌄	868.1
☑	1	Radio 1 ⌄	868.3
☑	2	Radio 1 ⌄	868.5
☑	3	Radio 0 ⌄	867.1
☑	4	Radio 0 ⌄	867.3
☑	5	Radio 0 ⌄	867.5
☑	6	Radio 0 ⌄	867.7
☑	7	Radio 0 ⌄	867.9

LoRa Channel Setting

Enable	Radio	Frequency/MHz	Bandwidth/kHz	Data Rate
☑	Radio 1 ⌄	868.3	250KHZ ⌄	SF7 ⌄

FSK Channel Setting

Enable	Radio	Frequency/MHz	Bandwidth/kHz	Data Rate
☑	Radio 1 ⌄	868.8	125KHZ ⌄	50000

Save & Apply

Notes:
1. The following ISM Bands are supported on the ND65:
   N865/RU864/EU868/US915/AU915/KR920/AS923-1/2/3/4
2. The table below lists the supported ISM Bands and the corresponding channel assignments.

ISM Band	Channel (MHz)
EU433	433.175, 433.375, 433.575, 433.775, 434.065, 434.265, 434.465, 434.665
CN470	471.9, 472.1, 472.3, 472.5, 472.7,472.9, 473.1, 473.3 (8~15)
EU868	868.1, 868.3, 868.5, 867.1, 867.3, 867.5, 867.7, 867.9
IN865	865.0625, 865.4025, 865.6025, 865.985, 866.185, 866.385, 866.585, 866.785
RU864	868.9, 869.1, 869.3, 867.3, 867.5, 867.7, 867.9, 868.1
AU915	916.8, 917, 917.2, 917.4, 917.6, 917.8, 918, 918.2 (8~15)
US915	903.9, 904.1, 904.3, 904.5, 904.7, 904.9,905.1, 905.3 (8~15)
KR920	922.1, 922.3, 922.5, 922.7, 922.9, 923.1, 923.3, 923.5
AS923	923.2, 923.4, 922, 922.2, 922.4 ,922.6, 922.8 ,923

4. Set advanced parameters via **the Advanced** tab, and then click **Save & Apply**.

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5. Click **Traffic** to view ND65's data communication, where **up** represents uplinks while **down** means downlinks.

Datarate: the rate at which data is transferred from one place to the other

Coderate: the proportion of the data-stream that is useful

RSSI: Received Signal Strength Indicator

SNR: Signal Noise Ratio

3.4 Configure ND65 as a Network Server

The ND65 can function as a network server, retrieve node data, and then transmit data to other cloud platforms.

1. Click **Packet Forwarder > General** on the left hand and make sure the embedded network server is enabled.

2. Click **the Radio** tab to configure **Antenna Type, Center Frequency** and **Channels**. Please refer to Packet-Forwarder Configuration.

3. Click **Network Server > General,** and enable the network server mode.

4. Click the **Application** tab to add a new application.

5. After saving the application, select HTTP, HTTPS or MQTT protocol and fill in corresponding server information to send data to another server.

6. Click the **Profiles** tab to add a new profile for the device.

7. Click **Add** to add LoRaWAN® node devices via the **Device** tab.

Click **Bulk Import** to add nodes in batches.

Click **Template Download** to download the template file and add device information to this file. The application and device profile should be consistent with what you will create on the web page.

```
ND65-20220906-1413-60.0.0.37-devices_example.csv - Notepad
File  Edit  Format  View  Help
name,description,deveui,application,deviceprofile,appkey,devaddr,appskey,nwkskey
24e1242191323266,,24e1242191323266,cloud,ClassC-OTAA,112233445566778899aa112233445566,,,
```

8. Click the **Packets** tab to check the packets from LoRaWAN® node devices. The type **UpCnf** means uplinks, while **DnUnc** means downlinks.

| General | Applications | Profiles | Device | Multicast Groups | Gateway Fleet | Packets |

| Send Data To Device

Device EUI	Type	Payload	Port	Confirmed	
0000000000000000	ASCII		85	☐	Send

| Send Data to Multicast Group

Multicast Group	Type	Payload	Port	
	ASCII		85	Send

| Network Server

| Clear | | | | | | | | | Search 🔍 |

Device EUI/Group	Gateway ID	Frequency	Datarate	RSSI/SNR	Size	Fcnt	Type	Time	Details
009569060000150A	24E124FFFEF1639E	868500000	SF7BW125	-/-	0	6924	DnUnc	2022-09-08 15:54:49+08:00	❗
009569060000150A	24E124FFFEF1639E	868500000	SF7BW125	-53/10.8	31	6886	UpCnf	2022-09-08 15:54:49+08:00	❗

Click **Details** to check the properties and load contents of packets.

Packet Details ✕

Dev Addr/Multicast Addr	06162C01
GwEUI	24E124FFFEF1639E
AppEUI	0102030405060708
Device EUI/Group Name	009569060000150A
Class Type	Class C
Immediately	false
Timestamp	2576026808
Type	DnUnc
Adr	true
AdrAcKReq	false
Ack	true
Fcnt	6924
Port	

GwEUI   =Gateway Identifier
AppEUI   = Application Identifier
Device EUI   = End-Device Identifier (Global Unique Node ID in IEEE EUI64 address)

Chapter 4 An Application Example

Here is an example to describe the necessary configuration to receive data from PMC-350-C via the ND65. Including:

- **PMC-350-C Device Setup**
  - o Install PMC-350-C driver and PMC-EasyConfig software
  - o Configure the PMC-350-C
  - o Set the Wiring Mode and enable Auto-Push
- **ND65 Gateway Configuration**
  - o Setup to make sure the PC and ND65 Gateway are in the same subnet
  - o LoRaWAN ND65 Gateway setup
    - a) Set Network Server Mode
    - b) Select a Region Radio Frequency
    - c) Add an application
    - d) Create a Device Profile
    - e) Add devices to LoRaWAN
    - f) Verify the sending status
  - o Cellular Connection

4.1 PMC-350-C Device Setup

1. Download and install the PMC-350-C driver and PMC-EasyConfig software, and please refer to the *PMC-EasyConfig(EN)* **and** *the PMC-350-C User Manual.*

2. Configure the PMC-350-C via the PMC-EasyConfig.

    Communication Setup is required for PMC-350-C on RS-485, LoRaWAN and LoRaWAN Auto-Push. See figure below.
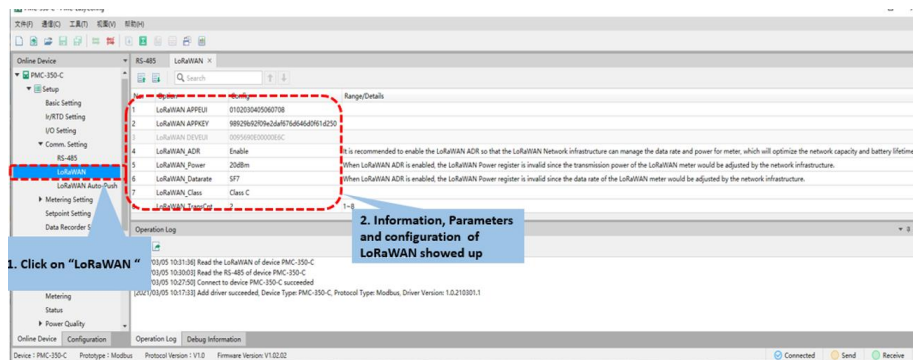
3. Set the Wiring Mode to DEMO under the **Setup > Basic Setting** before installing the meter to the target power system. Enable the **Auto-Push** under the **Setup > Comm. Setting > LoRaWAN Auto-Push**.
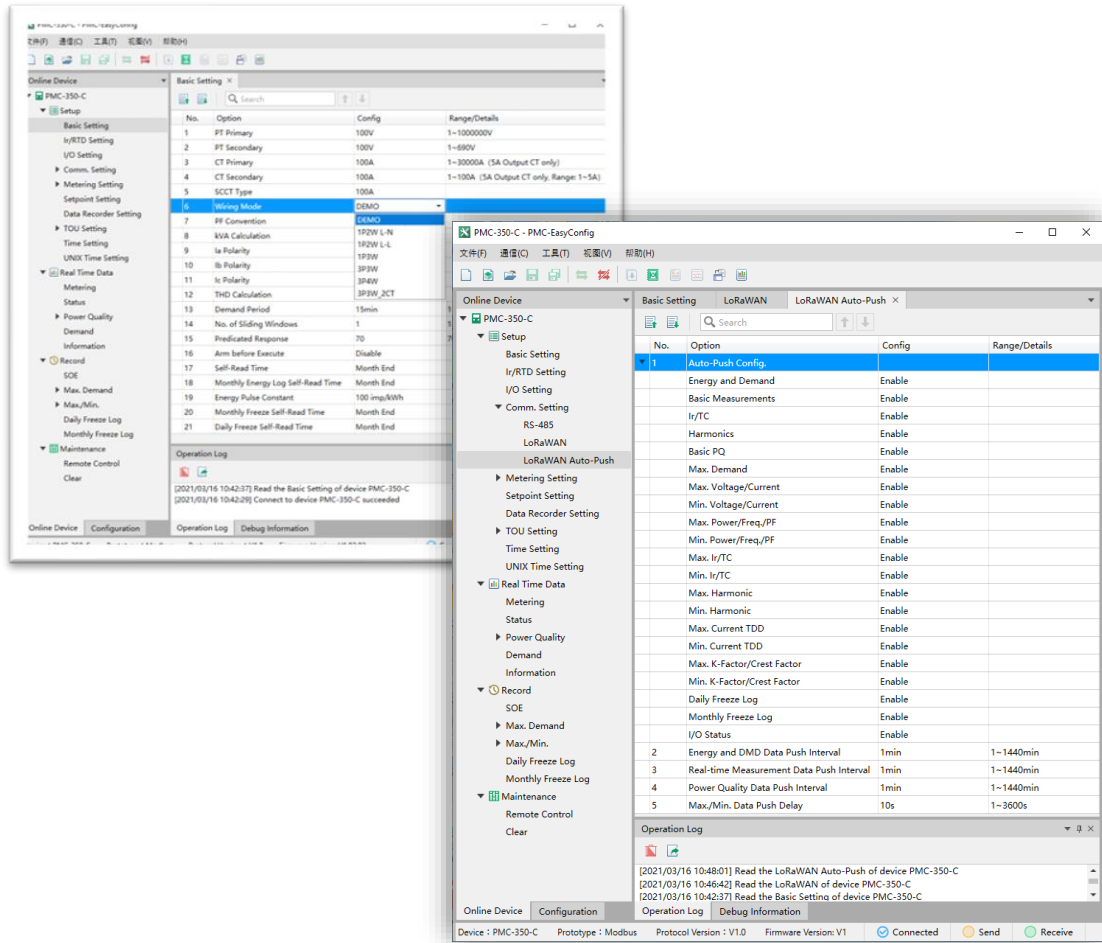
4.2 ND65 Gateway Configuration

1. Make sure the PC and ND65 Gateway are in the same subnet.

   Go to **Control Panel** > **Network and Internet** > **Network and Sharing Center** > **Ethernet** > **Properties** > **Internet Protocol Version 4 (TCP/IPv4)**, and assign a static IP with the same subnet of ND65 Gateway to the PC.
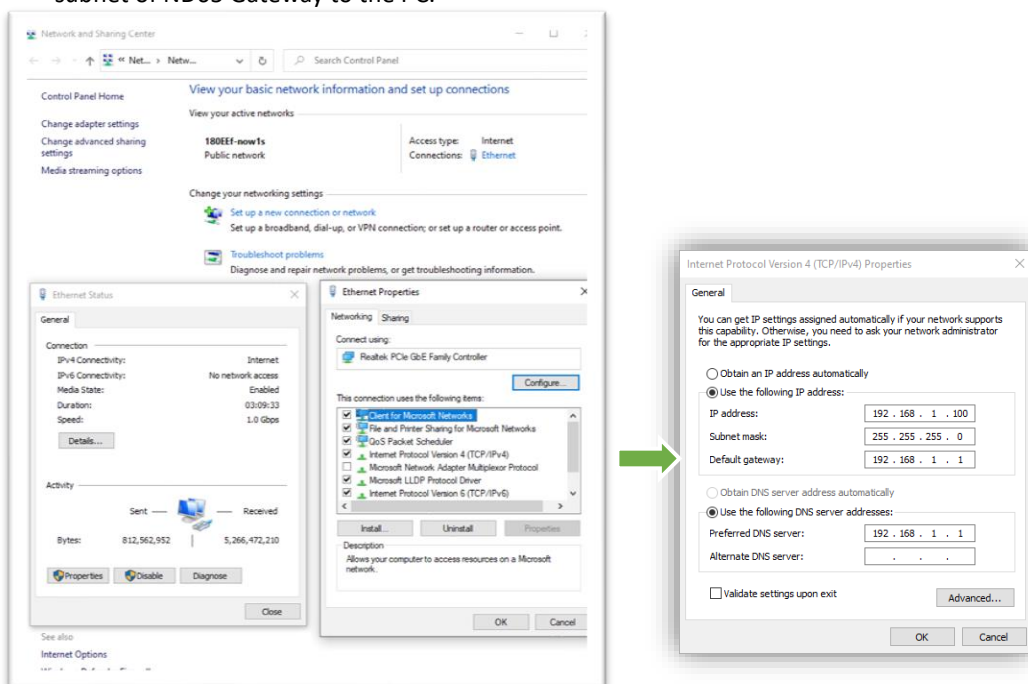
2. Set up the ND65 Gateway.

1) Login to the ND65 Web GUI. Open the browser on the PC and enter the ND65 IP address into the address bar to access the ND65 web.

2) Enable localhost on the **General** tab under **Packet Forwarder** and click **Save & Apply**. The ND65 build-in Network Server will receive data from PMC-350-C.
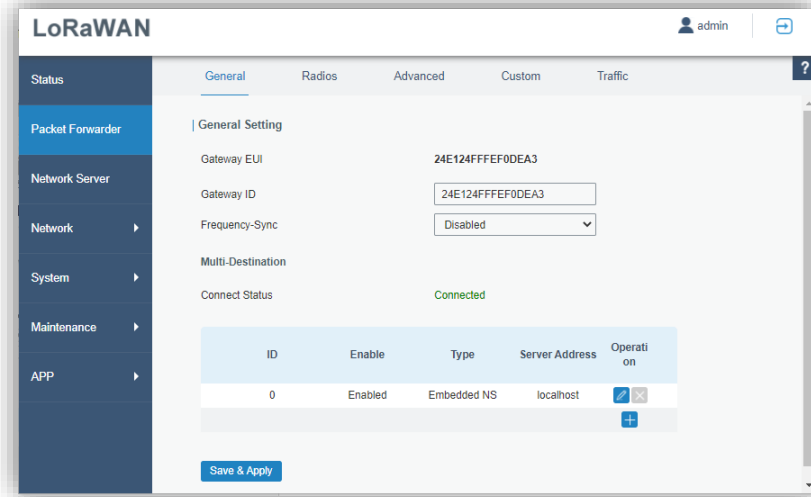
3) Click **Network Server** > **General** and select frequency band on **Channel Plan Setting**.
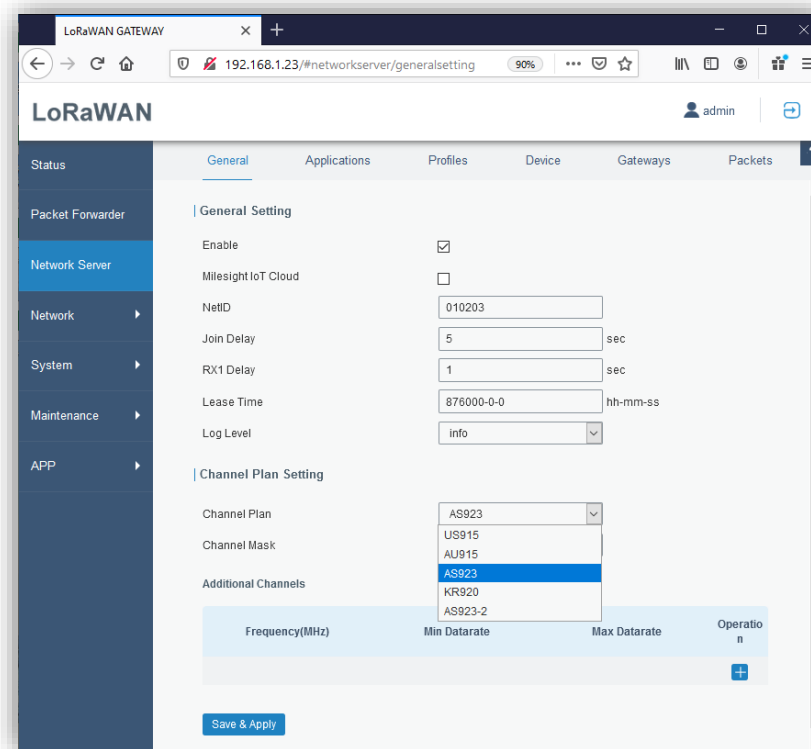
4) Add an application. Go to **Application** under **Network Server**, and click "+" on the **Operation** column to add an application. Type the receiver IP address on **Uplink data**, and save the setting.
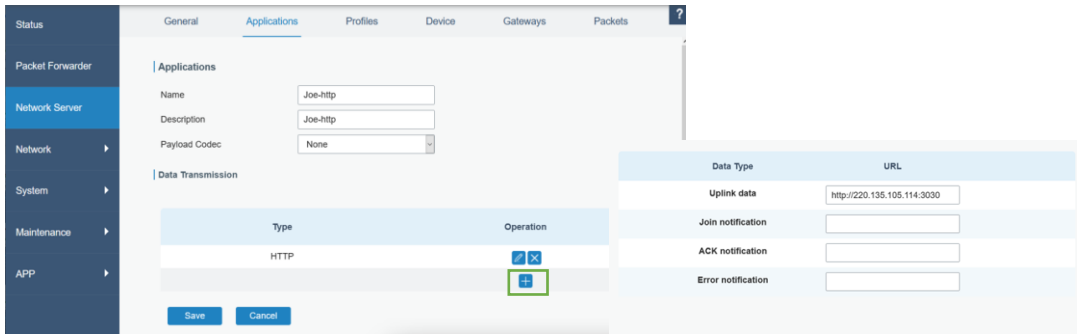
5) Create the Device Profile. Define a name for the device on the **Profiles** tab under **Network Server** and select **Class Type**. Click **Save**.
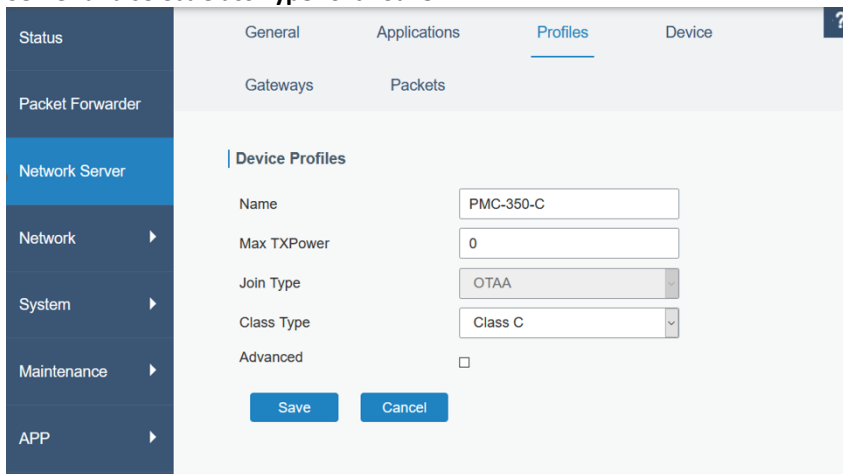
6) Add devices to LoRaWAN.

   a. Click **Add** under the **Device** tab.
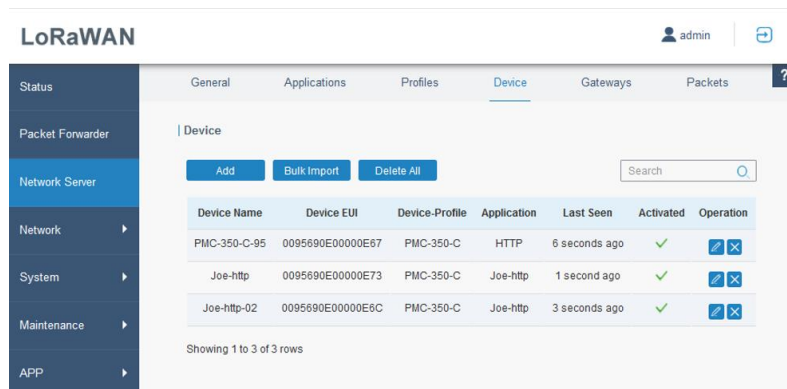
   b. Fill up the device information, and please refer to the label on the meter, like DevEUI, AppKey, Device Profile and Application. Click **Save & Apply**.

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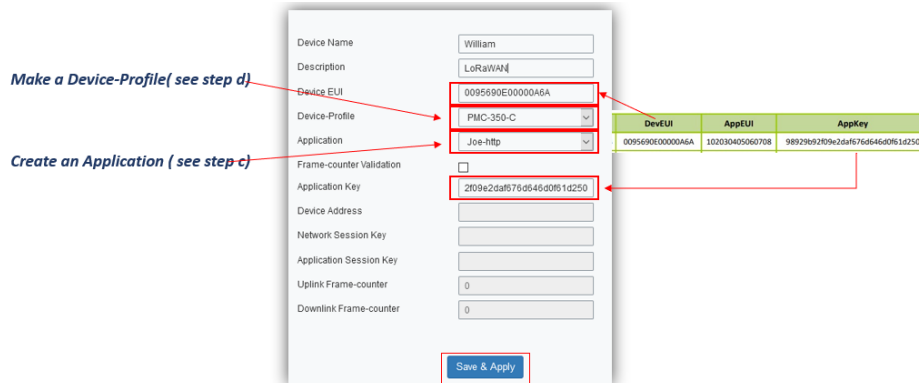
c. Go to **Packets** under **Network Server** to view the data status (sending/receiving). The Device EUI, communication frequency, sending time, data size and sending status are shown on **Packets**. The **UpCnf** indicates data packet uplink is confirmed.
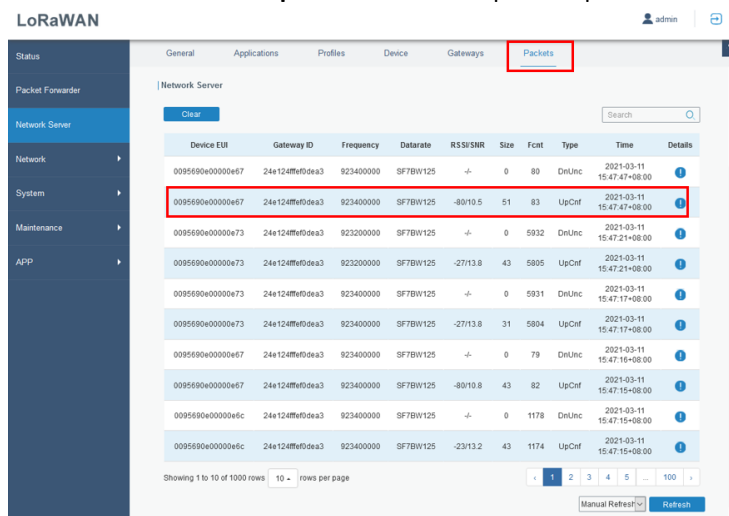
3. Setup Cellular Connection.

Click **Network > Interface > Cellular**, fill in the cellular parameters under **Cellular Setting** and SMS text/PDU mode under **SMS Settings**.
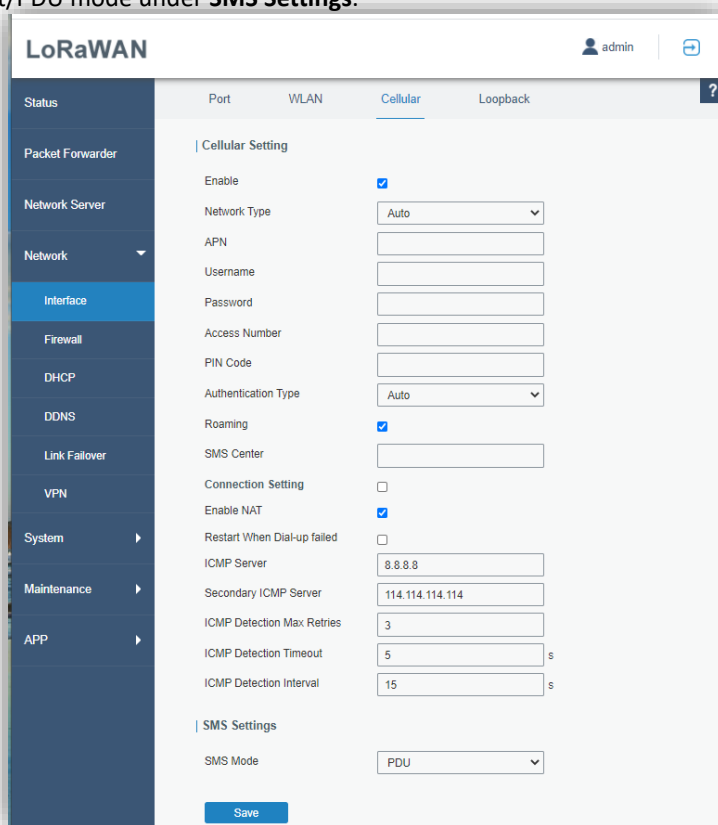
Please refer to the **General Settings** table for details.

General Settings		
Item	**Description**	**Default**
Enable	Check the option to enable the corresponding SIM card.	Enable
Network Type	Select from "Auto", "Auto 3G/4G", "4G Only" and "3G Only". Auto: connect to the network with the strongest signal automatically. 4G Only: connect to 4G network only. And so on.	Auto
APN	Enter the Access Point Name for cellular dial-up connection provided by local ISP.	Null
Username	Enter the username for cellular dial-up connection provided by local ISP.	Null
Password	Enter the password for cellular dial-up connection provided by local ISP.	Null
Access Number	Enter the dial-up center NO. For cellular dial-up connection provided by local ISP.	Null
PIN Code	Enter a 4-8 characters PIN code to unlock the SIM.	Null
Authentication Type	Select from "Auto", "PAP", "CHAP", "MS-CHAP", and "MS-CHAPv2".	Auto
Roaming	Enable or disable roaming.	Disable
SMS Center	Enter the local SMS center number for storing, forwarding, converting and delivering SMS message.	Null
Enable NAT	Enable or disable NAT function.	Enable
Restart When	When this function is enabled, the gateway will restart	Disabled

Dial-up failed	automatically if the dial-up fails several times.	
ICMP Server	Set the ICMP detection server's IP address.	8.8.8.8
Secondary ICMP Server	Set the secondary ICMP detection server's IP address.	114.114.114.114
ICMP Detection Max Retries	Set max number of retries when ICMP detection fails.	3
ICMP Detection Timeout	Set timeout of ICMP detection.	5
ICMP Detection Interval	Set interval of ICMP detection.	15
SMS Mode	Select SMS mode from "TEXT" and "PDU".	PDU

4. Check the cellular network status. Click on the **Cellular** tab under the **Status**, and the page of Modem Information and cellular Network Status of the Gateway will be shown.

Modem Information	
Item	**Description**
Status	Show corresponding detection status of module and SIM card.
Model	Show the model name of cellular module.
Version	Show the version of cellular module.
Signal Level	Show the cellular signal level.
Register Status	Show the registration status of SIM card.
IMEI	Show the IMEI of the module.
IMSI	Show IMSI of the SIM card.
ICCID	Show ICCID of the SIM card.
ISP	Show the network provider which the SIM card registers on.
Network Type	Show the connected network type, such as LTE, 3G, etc.
PLMN ID	Show the current PLMN ID, including MCC, MNC, LAC and Cell ID.
LAC	Show the location area code of the SIM card.
Cell ID	Show the Cell ID of the SIM card location.

| Network Status	
Item	**Description**
Status	Show the connection status of cellular network.
IP Address	Show the IP address of cellular network.
Netmask	Show the netmask of cellular network.
Gateway	Show the gateway of cellular network.
DNS	Show the DNS of cellular network.
Connection Duration	Show information on how long the cellular network has been connected.

4.3 Troubleshooting

1. **Ping**. Login to the ND65 web and click **Maintenance > Tools.** Click **Ping.**

    The figure left indicates IP Ping works, ND65 sent 4 packets to the application server, and 100% received in about 250ms, while the figure right represents the application server failed to respond to IP Ping.
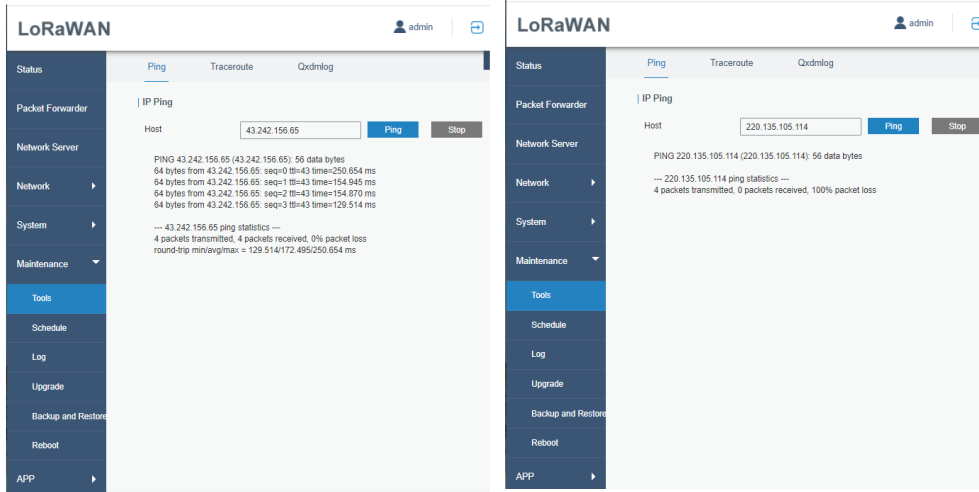
2. Traceroute. Traceroute is a tool for troubleshooting network routing failures. It sends packet data to the application server from the Gateway, finds out the hops (routers, switches, repeaters…) and how much time spend on each hop for the message passthrough.
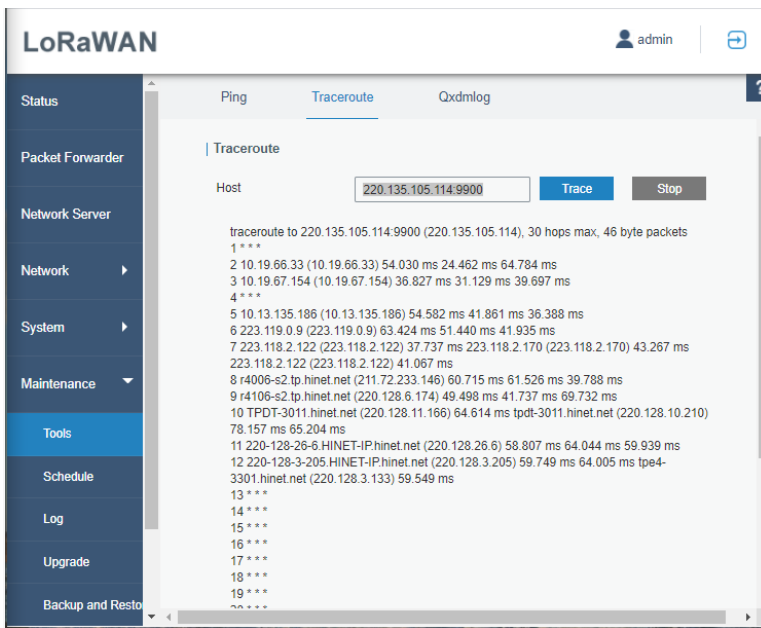
Appendix A Technical Specifications

Hardware	
CPU	Quad-core 1.5 GHz, 64-bit ARM Cortex-A53
Memory	512 MB DDR4 RAM
Flash	< 8 GB eMMC
LoRaWAN	
Antenna	
Standard	2 × Internal Antennas
Optional	1 × 50 Ω N-Female External Connector
ISM Bands	N470/IN865/EU868/RU864/US915/AU915/KR920/AS923-1/2/3/4
AS923-1	Australia, New Zealand, Malaysia, Hong Kong, Singapore, Taiwan, Thailand, Cambodia, etc.
AS923-2	Vietnam, Indonesia
AS923-3	Denmark, Norway, Saudi Arabia, etc.
AS923-4	Israel
KR920	South Korea
AU915	Australia, New Zealand, Argentina, Anguilla, Brazil
EU868	Europe, United Arab Emirates, etc.
Sensitivity	-140dBm Sensitivity @292bps
Tx Power	27dBm Max
Protocol	V1.0 Class A/Class C and V1.0.2 Class A/Class C
Ethernet	
Port	1 × RJ45 (PoE PD supported)
Physical Layer	10/100/1000 Base-T (IEEE 802.3)
Data Rate	10/100/1000 Mbps (Auto-Sensing)
Interface	Auto MDI/MDIX
Mode	Full or Half Duplex (Auto-Sensing)
WiFi	
Antenna	Internal Antenna
Standards	IEEE 802.11 b/g/n, 2.4GHz
Mode	AP or Client mode
Security	WPA/WPA2 authentication, WEP/TKIP/AES encryption
Tx Power	802.11b: 18 dBm +/-2.0 dBm (11 Mbps)
	802.11g: 15 dBm +/-2.0 dBm (6 Mbps)
	802.11g: 15 dBm +/-2.0 dBm (54 Mbps)
	802.11n@2.4 GHz: 14 dBm +/-2.0 dBm (MCS0_HT20)
	802.11n@2.4 GHz: 14 dBm +/-2.0 dBm (MCS7_HT20)
	802.11n@2.4 GHz: 13 dBm +/-2.0 dBm (MCS0_HT40)
	802.11n@2.4 GHz: 13 dBm +/-2.0 dBm (MCS7_HT40)
Cellular (Optional)	
Antenna	Internal Antenna
SIM Slot	1 (mini SIM-2FF)
Power Supply and Consumption	
Power Input	DC Jack Connector for 9-24 VDC power supply
	1 × 802.3 af PoE Input
Power Consumption	Typical 2.9 W, Max 4.2 W
Environmental Conditions	
Operating Temp.	-40°C to +70°C (-40°F to +158°F) Reduced Cellular Performance Above 60°C
Storage Temp.	-40°C to +85°C (-40°F to +185°F)
Humidity	0% to 95% (non-condensing) at 25°C/77°F
Ethernet Isolation	1.5 kV RMS
Mechanical Characteristics	
IP Rating	IP65
Dimensions	180 x 110 x 56.5 mm (7.09 x 4.33 x 2.22 in)

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