

# LoRaWAN Configuration Guide

## User Manual

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## Document Information

This document was created to help set up Peplink LoRaWAN gateway functionality. The guide provides step by step guides on how to connect gateways using LoRa Basics™ Station or the Semtech UDP Packet Forwarder to some of the most popular LoRaWAN Network Servers (LNS).

## Naming Conventions

The term **downlink device** or **endpoint device** is used in this document to refer to a LoRaWAN end device that connects to a LoRaWAN Gateway. The **Gateway** in turn, connects to a LoRaWAN server.

## Revision History

Version	Date	Description of change
1.0.0	Dec 29, 2021	Initial release.
1.2.0	Jan 31, 2023	Updated overview section Added configuration examples for Senet server. Updated B20x WEB configuration screenshots. Updated The Things Network configuration examples.
1.3.0	Feb 8, 2023	Added configuration examples for AWS IoT Core.

## Hardware Description

### Standard Kit Contents for LoRaWAN FlexModule Mini

1x LoRaWan FlexModule Mini  
1x Antenna

Balance 20X SD-WAN router is sold separately. For more information please refer Peplink WEB pages:

- [Balance 20X](#)
- [LoRaWan FlexModule Mini](#)

### How to reset Balance 20X to factory default settings

- Hold the reset button for 5-10 seconds. Once the LED status light turns RED, the reset button can be released.

### Balance 20X default login

The default WEB login settings are:

- User: admin
- Password: admin
- IP address: 192.168.1.1

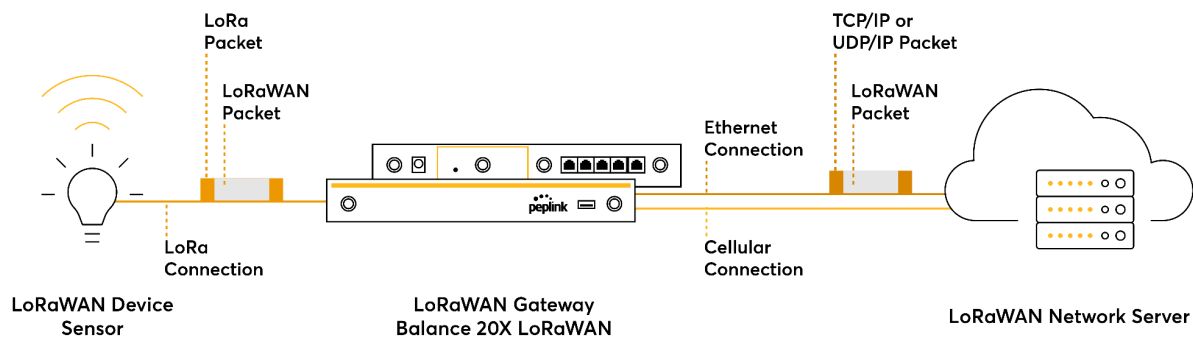
## Overview

### LoRa and LoRaWAN

**LoRaWAN** is a low-power wide-area network (LPWAN) protocol optimized for low power end devices and long distance transmissions that functions on LoRa technology. It is best suited for small-sized payload transmissions (e.g. sensor data). The LoRaWAN specification is open so anyone can set up and operate a network.

**LoRa** is a physical layer protocol. It operates in a license-free radio frequency spectrum. Depending on a country or a region the different spectrum range is available to use. The unique thing about LoRa is related to its spread spectrum modulation which allows it to achieve a very long-range communication at the cost of a narrow bandwidth.

The typical LoRaWAN solution consists of three components: end device (sensor) Gateway (converting RF to IP) and a server.



Peplink SW WAN routers with reliable backhaul connectivity stands in the center of the whole solution. The purpose of this guide is to provide the basic steps on how to get it started. This guide details the configurations of several of the most common LoRaWAN scenarios and provides step-by-step explanations to help you get started if you are new to LoRaWAN.

\*Note: Certain 3rd party solutions were used (e.g. Senet, The Things Network) during the creation of this document. It is important to note that the 3rd party WEB UI pages used in this document may look different in the future.

### Frequency Band selection

Peplink has two SKU options for LoRaWAN FlexModule Mini. The supported bands are listed below:

- EXM-MINI-LORA-EU > EU868, IN865, RU864
- EXM-MINI-LORA > US915, AU915, AS923, AS925, KR920

## Getting Started with Senet

### Requirements

- LoRaWAN FlexModule Mini.
- Balance 20X router.
- LoRaWAN sensor (in our example we used Dragino LHT65).
- Senet account.

Note: The LoRaWAN FlexModule Mini comes in two options: EU868 and US915. Please make sure you order the correct one for your region.

## Set up LoRa Basics™ Station packet forwarder

### Step 1. Enable LoRaWAN protocol on your router

1. On your Peplink router's web admin page, go to the **Advanced** tab along the top bar.
2. Find the **LoRaWAN** tab along the left navigation bar.
3. In **LoRaWAN** settings, tick the **Enable** checkbox and write down the **Gateway EUI**, this will be needed for registering a gateway later on.

The screenshot shows the Peplink router's web admin interface. The top navigation bar includes tabs: Dashboard, SFC Protect, Network, **Advanced**, AP, System, and Status. The left sidebar has a menu with categories: Advanced, NAT Mappings, and QoS. Under the 'Advanced' category, 'LoRaWAN' is selected and highlighted with a red box. The main content area displays the 'LoRaWAN Settings' form. The 'Enable' checkbox is checked with a blue checkmark. The 'Gateway EUI' field contains the value '0016C001FF18F55B', which is highlighted with a red box and a red arrow. Other fields include 'Region' (EU), 'Protocol' (Basics™ Station), 'Server' (LoRaWAN Network Server (LNS)), 'Network Mode' (Private), 'Antenna Gain' (3 dBi), and 'Cable Loss' (0 dBi). A 'Save' button is located at the bottom right of the form.

### Step 2. Add gateway to the Senet server

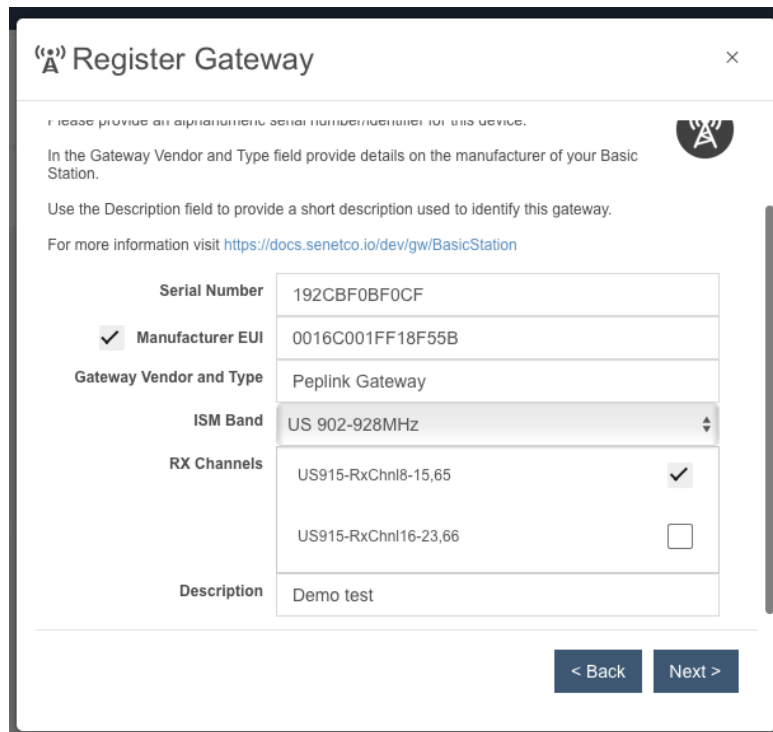
1. In our example we are using Senet Developer Portal. Opening an account for testing purposes is free of charge. [Here](#) is the link to begin with.
2. Click on plus sign and select register gateway as in picture below.

The screenshot shows the Senet Developer Portal dashboard. The top navigation bar includes the Senet logo and a 'Dashboard' tab. The main content area displays two large cards: '0 Gateways' and '0 Devices'. Below these cards, there is a 'Devices & Gateways' section. In this section, a blue plus sign button is highlighted with a red box. A dropdown menu is open below the plus sign, showing two options: 'Register Gateway' and 'Register Device'. The 'Register Gateway' option is highlighted with a red box.



3. Gateway registration has several steps and you will be asked to fill up certain fields. We will cover the most important ones.

- **Gateway Type**, select **Semtech Basic Station**.
- **Gateway information:**
  - Serial number: add Peplink router S/N without dashes. Instead of xxxx-xxxx-xxxx you should enter xxxxxxxxxxxxxx.
  - Manufacturer EUI: add Peplink Gateway EUI (see Step 1).
  - Gateway Vendor and Type: enter Peplink Gateway name.
  - ISM band: select based on your region.
  - RX Channels: select preferred LoRaWAN channel. The example is for the US region and for testing purposes we select US915-RxChnl8-15,65. Other regions might have a single channel only.
  - Description: additional notes about gateway.



**Register Gateway**

Please provide an alphanumeric serial number/identifier for this device.

In the Gateway Vendor and Type field provide details on the manufacturer of your Basic Station.

Use the Description field to provide a short description used to identify this gateway.

For more information visit <https://docs.semtech.io/dev/gw/BasicStation>

Serial Number	192CBF0BF0CF	
<input checked="" type="checkbox"/> Manufacturer EUI	0016C001FF18F55B	
Gateway Vendor and Type	Peplink Gateway	
ISM Band	US 902-928MHz	
RX Channels	US915-RxChnl8-15,65	<input checked="" type="checkbox"/>
	US915-RxChnl16-23,66	<input type="checkbox"/>
Description	Demo test	

< Back    Next >

- Installation information: fill up based on your installation.

Once completed, review the information. If it is correct and then click **Done**.

### Step 3. Connect your gateway to the Senet server

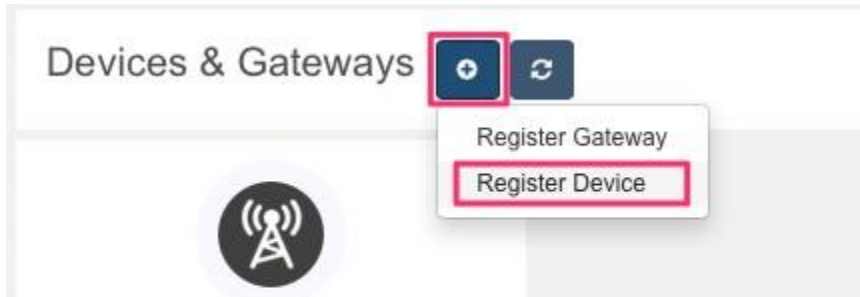
1. Download a TLS Certificate provided by Senet. It can be downloaded [here](#).
2. On your Peplink router, go to the **Advanced** tab along the top bar.
3. Find **LoRaWAN** settings along the left navigation bar and enter the following settings:
  - Protocol: **Basic Station**.
  - Server: **LoRaWAN Network Server (LNS)**.
  - Server address: **collector.senetco.io**
  - Port: **6042**
  - Server Certificate (pem encoded): copy the TLS Certificate provided by Senet.
  - Gateway Authorization: Select **None**.
  - Network Mode: **Public**.
  - Antenna Gain: enter your antenna Gain (for Peplink antenna enter 2).
  - Cable loss: enter cable loss if there is a cable between antenna and LoRa module
4. Click **Save** and **Apply Changes**. Below you will find a Balance 20x configuration example for your reference.

The screenshot shows the Peplink Advanced settings page. The left sidebar contains a navigation menu with categories like Advanced, NAT Mappings, QoS, Firewall, Routing Protocols, Remote User Access, and Misc. Settings. The 'LoRaWAN' option is selected under the Advanced category. The main content area displays the 'LoRaWAN Settings' form with the following fields:

LoRaWAN Settings	
Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001FF18F55B
Region	FCC
Protocol	Basics™ Station
Server	LoRaWAN Network Server (LNS) collector.senetco.io Port 6042 <input checked="" type="checkbox"/> Require certificate
Server Certificate (pem encoded)	<pre> b3QgQ0ExGzAZBgNVBAMTEkdsb2JhbFNPZ24gUm9vdCBDQTAEw050DA5MDEXMjA w MDBaFw0yODAxMjg0MjAwMDBaMFcxZzAJBgNVBAYTAkFMRkwFwYDVQQKEwBHBG9l YWxTaWduIG52LXNhMRwwDgYDVQQLewdSb290IENBMRSwGYYDQDExHbG9lYW xT aWduIFJvb3QgQ0EwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBAQDaDuaZ jc6j40+Kfvvxi4Mla+pIH/EqsLmVEQS98GPR4mdmzxzdztIK+6NIY6arymAZavp xy0Sy6scTHAHOt0KMM0VJU/43dSMUBUc71DuxC73/OIS8pF94G3VNTCOXkNz8kHp 1Wrsok6Vjk4bwY8IGlbKk3Fp1S4bInMm/k8yuX9ifUSPJ4ltbcdG6TRGHRjcdG snUOhugZitVtNV4FpWi6cgKOOvyJBnPC1STE4U6G7weNLWLBYY5d4ux2x8gkasJ U26Qzns3dLwR5EIUWMWea6xrKEmCMgZK9FGqkqjWZCrXgzT/LCrBbBIDSgeF59N8 9IFo7+ryUp9/k5DPAGMBAAAGJQJBAMA4GA1UdDwEB/wQEAwIBBjAPBgNVHRMBAf8E BTADAQH/MB0GA1UdDgQWBRRge2YaRQ2XyolQL30EzTSo//z9SAnBgkqhkiG9w0B AQUFAAOCAQEA1nPnE920I2/7LqivjTFKDK1fPxsncwrvQmeU79rXqoRSLbICKOz yj1hTdNGCbM+w6DjY1Ub8rrvrTnhQ7k4o+YviiY776BQVvnGcV04zcQLCFGU5Gz 38NfINUyVRRBnMRddWQVDf9VM0yGj/8N7yy5Y0b2qvzfvGn9LhJIZJrGlCm7ymP AbEVtQwdpf5pLGkkeB6zpxxxYu7KyJesF12KwvhHhm4qxFYxldBniYUr+WymXUad DKqC5JIR3XC321Y9YeRq4VzW9v493kHMB65JUr9TU/Qr6cf9tveCX4XSQRjbgBME HMUfpiBvFSDJ3gyICh3WZIXI/EjJKSZp4A== -----END CERTIFICATE----- </pre>
Gateway Authorization	None
Network Mode	<input type="radio"/> Private <input checked="" type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

#### **Step 4. Add Device (sensor)**

1. Click on plus sign and select register gateway as in picture below.



2. For Device registration you will need to fill up certain fields.
  - Device EUI
  - Join EUI
  - Application Key
  - Description (Optional)
  - Device Type (default type is Other)
  - Click the **Supports Senet Packet** check-box if the end device supports the Senet Packet Format. For supported devices please contact Senet support.
  - Device Notes (Optional)
  - Click **Register New Device** once finished
3. Depending on your sensor, you may need to activate the device (join network). To connect the LHT65 sensor, begin by pressing the ACT button 5 times quickly. This will deactivate the end device and it will display a solid RED LED for 5 seconds. Press and hold the ACT button for more than 3 seconds and a GREEN LED should blink 5 times. The device will begin operating and initiate connection to the LoRaWAN network. The GREEN LED will turn a solid green for 5 seconds after it successfully joins the network.

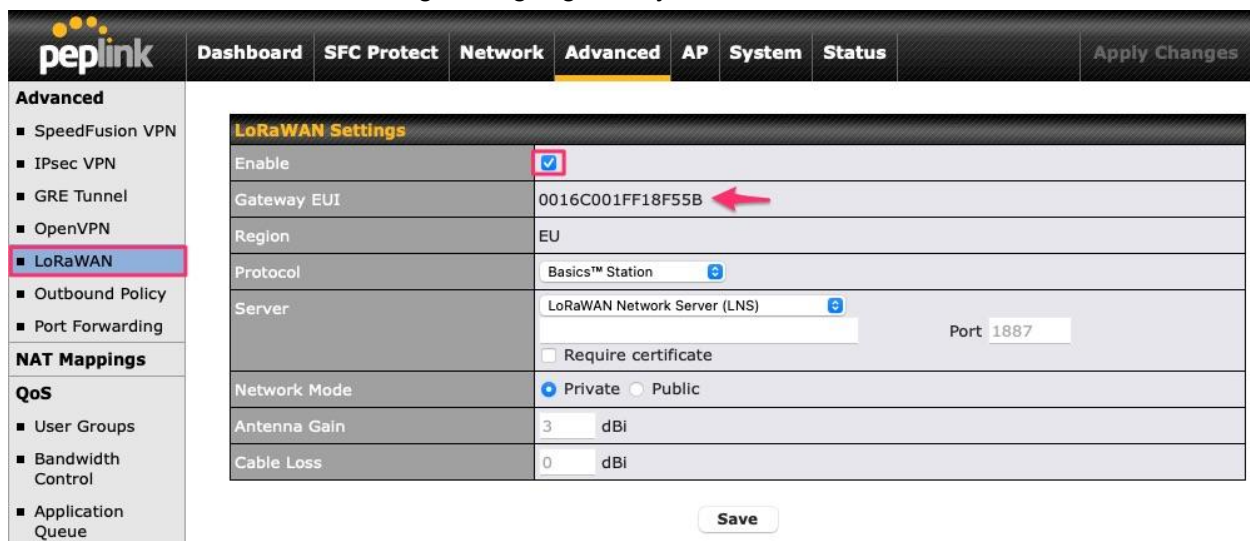
## Set up UDP Packet Forwarder

Important: UDP packet forwarder is not recommended and suggested to use only for testing purposes. Semtech Basic Station option provides a better security and channel plan configuration through the Network Server, while Semtech Packet Forwarder uses unsecured UDP communication and any channel plan configuration should be done manually through the Gateway.

Note: The steps for adding sensors and connecting to data visualization is identical to the UDP Packet forwarder type and therefore are not covered here. You may refer to Steps 4 of the previous section.

### Step 1. Get a LoRaWAN Gateway EUI

1. On your Peplink router's web admin page, go to the **Advanced** tab along the top bar.
2. Find the **LoRaWAN** tab along the left navigation bar.
3. In **LoRaWAN** settings, tick the **Enable** checkbox and write down the **Gateway EUI**, as this will be needed for registering a gateway later on.

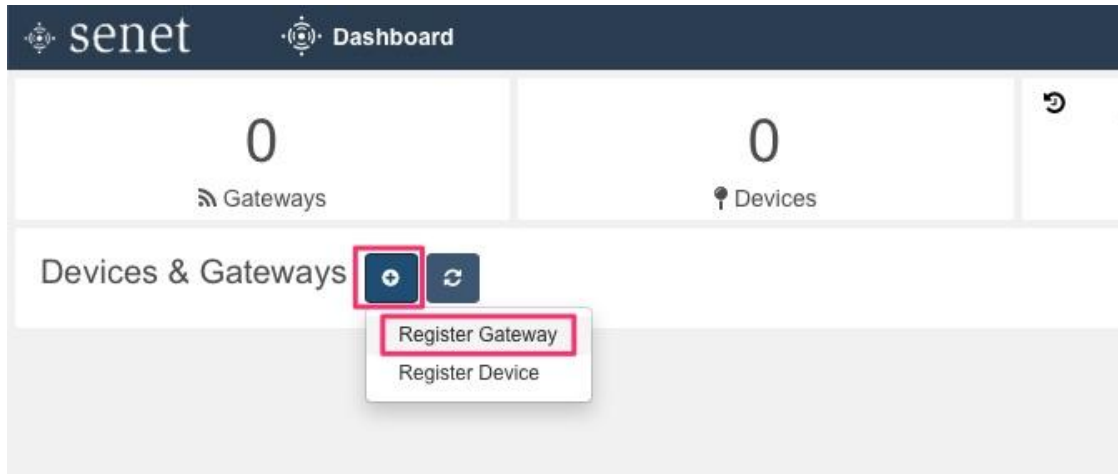


LoRaWAN Settings	
Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001FF18F55B
Region	EU
Protocol	Basics™ Station
Server	LoRaWAN Network Server (LNS)
	<input type="checkbox"/> Require certificate
Network Mode	<input checked="" type="radio"/> Private <input type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

Save

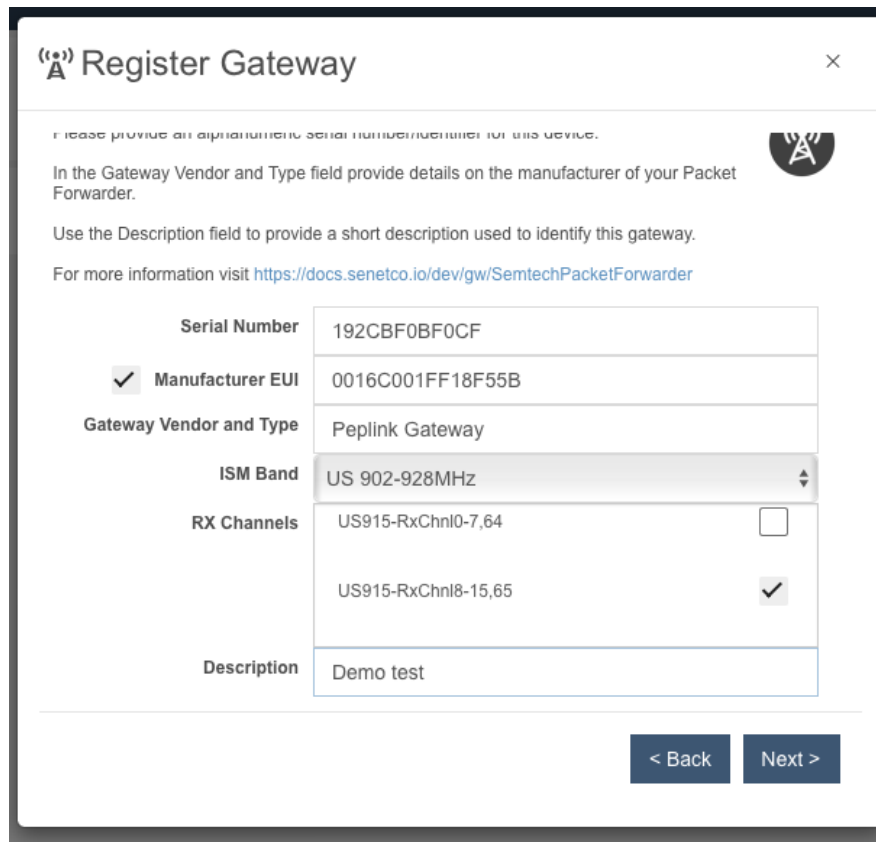
## **Step 2. Add gateway to the Senet server**

1. In our example we are using Senet Developer Portal. Opening an account for testing purposes is free of charge. [Here](#) is the link to begin with.
2. Click on plus sign and select register gateway as in picture below.



3. Gateway registration has several steps and you will be asked to fill up certain fields. We will cover the most important ones.

- **Gateway Type**, select **Semtech Packet Forwarder**.
- **Gateway information:**
  - Serial number: add Peplink router S/N without dashes. Instead of xxxx-xxxx-xxxx you should enter xxxxxxxxxxxx.
  - Manufacturer EUI: add Peplink Gateway EUI (see Step 1).
  - Gateway Vendor and Type: enter Peplink Gateway name.
  - ISM band: select based on your region.
  - RX Channels: select preferred LoRaWAN channel. The example is for the US region and for testing purposes we select US915-RxChnl8-15,65. Other regions might have a single channel only.
  - Description: additional notes about gateway



**Register Gateway**

Please provide an alphanumeric serial number/identifier for this device.

In the Gateway Vendor and Type field provide details on the manufacturer of your Packet Forwarder.

Use the Description field to provide a short description used to identify this gateway.

For more information visit <https://docs.senetco.io/dev/gw/SemtechPacketForwarder>

Serial Number	192CBF0BF0CF	
<input checked="" type="checkbox"/> Manufacturer EUI	0016C001FF18F55B	
Gateway Vendor and Type	Peplink Gateway	
ISM Band	US 902-928MHz	
RX Channels	US915-RxChnl0-7,64	<input type="checkbox"/>
	US915-RxChnl8-15,65	<input checked="" type="checkbox"/>
Description	Demo test	

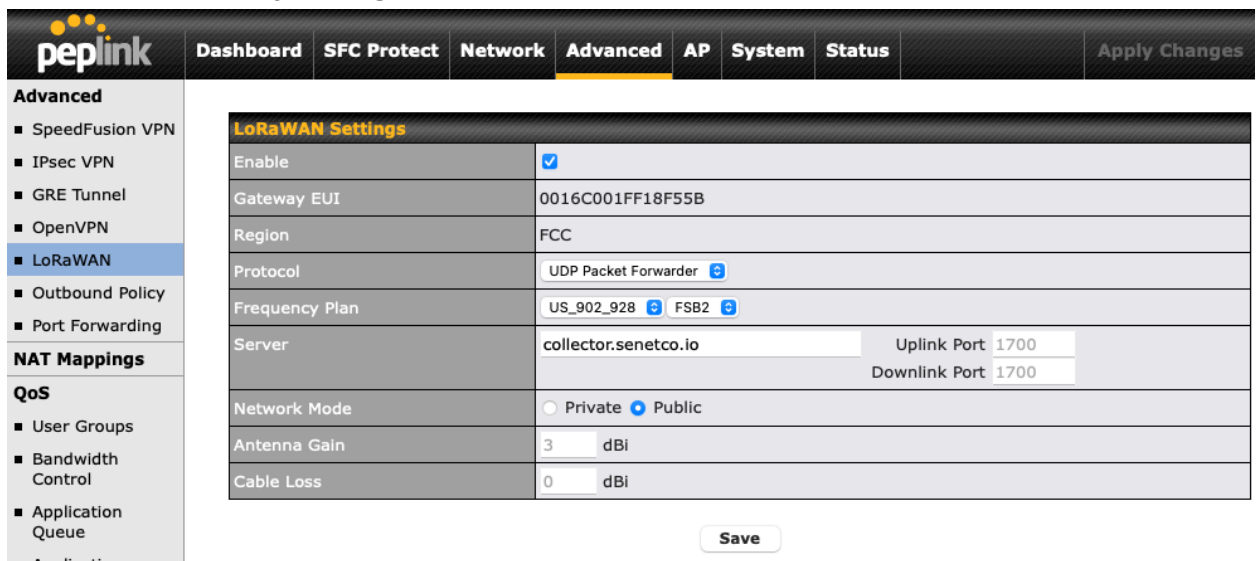
< Back    Next >

- Installation information: fill up based on your installation.

On your final steps review the information if it is correct and then click **Done**.

### Step 3. Connect your gateway to the Senet

1. On your Peplink router, go to the **Advanced** tab along the top bar.
2. Find **LoRaWAN** settings along the left navigation bar and enter the following settings:
  - Protocol: **UDP Packet Forwarder**
  - Frequency plan: should match the selected in Senet settings.
  - Server: collector.senetco.io
  - Uplink Port/Download Port: 1700
  - Network Mode: **Public**
  - Antenna Gain: enter your antenna Gain. (for Peplink antenna enter 2).
  - Cable loss: enter cable loss if there is a cable between antenna and LoRa module.
3. Click **Save** and **Apply Changes**.



LoRaWAN Settings	
Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001FF18F55B
Region	FCC
Protocol	UDP Packet Forwarder
Frequency Plan	US_902_928 FSB2
Server	collector.senetco.io
	Uplink Port 1700 Downlink Port 1700
Network Mode	<input type="radio"/> Private <input checked="" type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

Save

## Getting Started with AWS IoT Core

### Requirements

- LoRaWAN FlexModule Mini.
- Balance 20X router.
- LoRaWAN sensor (in our example we used Dragino LHT65).
- AWS account.

Notes 1: The LoRaWAN FlexModule Mini comes in two options: EU868 or US915. Please make sure you order the correct one for your region.



## Setup AWS

If you don't have an AWS account, refer to the instructions in the guide [here](#). The relevant sections are **Sign up for an AWS account** and **Create a user and grant permissions**.

### **Step 1. Setup overview**

The high-level steps to get started with AWS IoT Core for LoRaWAN are as follows:

1. Setup AWS
2. Onboard your Gateway
3. Onboard your Device(s)
  - a. Verify device and service profiles
  - b. Set up a Destination to which device traffic will be routed and processed by a rule.

These steps are detailed below. For additional details, refer to the AWS [LoRaWAN developer guide](#).

### **Step 2. Preparation**

Refer to the [online guide](#) for steps required prior to onboarding your gateway. Also, make sure Peplink router is running 8.3.0 or later Firmware version.

### **Step 3. Frequency Band selection and Role setup**

Peplink LoRaWAN FlexModule Mini comes in two SKU versions listed. Make sure you choose the one which is suitable for your region:

- EXM-MINI-LORA-EU: EU868, IN865, RU864
- EXM-MINI-LORA: US915, AU915, AS923, AS925, KR920

Refer to the [online guide](#) for information on selecting an appropriate frequency band.

Follow the instructions in the section **Add an IAM role to allow the Configuration and Update Server (CUPS) to manage gateway credentials** in the [online guide](#).

### **Step 4. Add the LoRaWAN Gateway**

To register the Gateway with AWS IoT Core for LoRaWAN, follow the steps in this [online guide](#) under the section Add a gateway using the console.

## Add a LoRaWAN Device to AWS IoT

### **Step 1. Preparation**

Refer to the instructions in the section **Before onboarding your wireless device** in the [online guide](#).

### **Step 2. Verify Profiles**

AWS IoT Core for LoRaWAN supports device profiles and service profiles. Device profiles contain the communication and protocol parameter values the device needs to communicate with the network server. Service profiles describe the communication parameters the device needs to communicate with the application server.

Some pre-defined profiles are available for device and service profiles. Before proceeding, verify that these profile settings match the devices you will be setting up to work with AWS IoT Core for LoRaWAN. For more details, refer to the section **Add profiles to AWS IoT Core for LoRaWAN** in the [online guide](#).

### **Step 3. Set up a Destination for device traffic**

Because most LoRaWAN devices don't send data to AWS IoT Core for LoRaWAN in a format that can be consumed by AWS services, traffic must first be sent to a Destination. A Destination represents the AWS IoT rule that processes a device's data for use by AWS services. This AWS IoT rule contains the SQL statement that selects the device's data and the topic rule actions that send the result of the SQL statement to the services that will use it.

For more information, refer to the [online guide](#) (sections titled **Add a destination using the console** and **Create an IAM role for your destinations**). Also refer to **Create rules to process LoRaWAN device messages** in the [online guide](#).

### **Step 4. Add device**

Then follow the instructions in the section **Add your wireless device to AWS IoT Core for LoRaWAN** [here](#).

## Set up the Gateway

### Step 1. Set up Gateway hardware

Peplink Balance 20X is a SD-WAN branch router with an option to add LoRaWAN gateway functionality using a LoRaWAN FlexModule Mini.

Note: LoRaWAN FlexModule Mini must be inserted when Balance 20X power is turned off.



Balance 20X delivers excellent routing throughput with an embedded cellular modem, making it an easy to use, all-in-one router for indoor deployments. It is easy to install and configure using a WEB based user-friendly interface.

For LoRaWAN gateway, internet connection is a must so that it could transmit messages received from end devices. Peplink Router Balance 20X has several WAN options:

- Cellular connectivity
- Ethernet

Ethernet connection also supports Virtual WAN (license needed) which allows connecting several WAN options separated by using VLAN.

To turn on the Balance 20X router, please plug in the power supply (AC/DC adapter is supplied with the device). Once the **Status** LED becomes green, the device is ready for configuration. You connect to device WEB based GUI or use InControl for configuration.

## **Step 2. Set up Gateway Software**

Once the LoRaWAN FlexModule Mini is inserted into Balance 20X, no need to make any additional configuration to enable LoRaWAN gateway functionality.

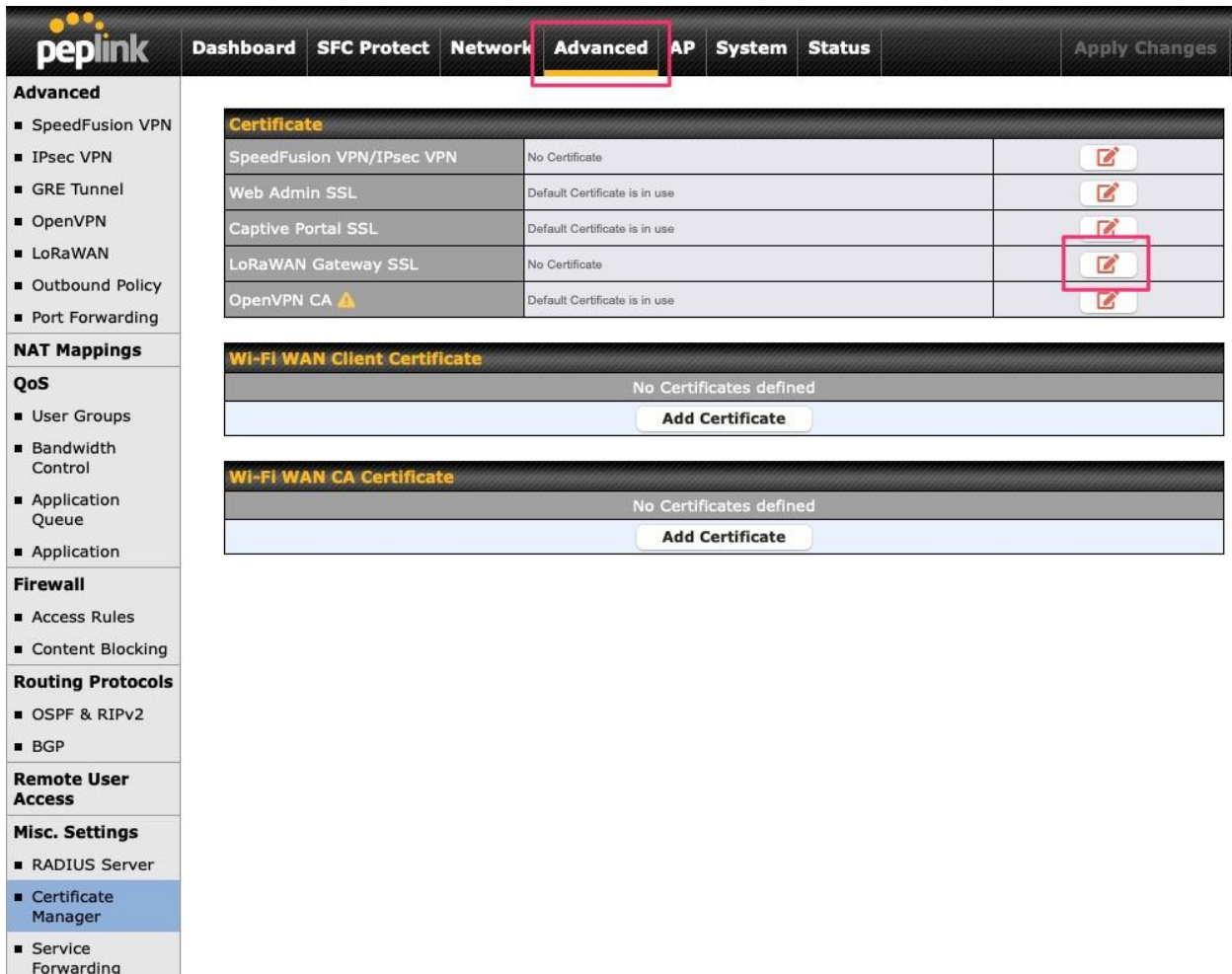
IMPORTANT: make sure Balance 20X is running 8.3.0 or newer FW version. Please go [here](#), to download the latest FW version and the latest configuration manual.

## **Additional Software References**

In case there will be any additional questions, we suggest visiting the Peplink community page which can be found [here](#).






### Step 3. Configure the Gateway device

1. On your Peplink router's web admin, navigate to the **Advanced** tab along the top navigation bar.
2. Open up the **Certificate Manager** settings along the left navigation bar.
3. Click on the Edit icon for the **LoRaWAN Gateway SSL**.



The screenshot shows the Peplink web admin interface. The top navigation bar includes tabs for Dashboard, SFC Protect, Network, **Advanced** (highlighted with a red box), AP, System, and Status. An 'Apply Changes' button is on the right. The left sidebar lists various settings categories: Advanced (SpeedFusion VPN, IPsec VPN, GRE Tunnel, OpenVPN, LoRaWAN, Outbound Policy, Port Forwarding), NAT Mappings, QoS (User Groups, Bandwidth Control, Application Queue, Application), Firewall (Access Rules, Content Blocking), Routing Protocols (OSPF & RIPV2, BGP), Remote User Access, Misc. Settings (RADIUS Server, **Certificate Manager** (highlighted), Service Forwarding).

The main content area shows the **Certificate** section with a table of certificates:

Certificate		
SpeedFusion VPN/IPsec VPN	No Certificate	
Web Admin SSL	Default Certificate is in use	
Captive Portal SSL	Default Certificate is in use	
LoRaWAN Gateway SSL	No Certificate	 (highlighted with a red box)
OpenVPN CA ⚠	Default Certificate is in use	

Below the table are two sections for adding certificates:

**Wi-Fi WAN Client Certificate**  
No Certificates defined  
[Add Certificate](#)

**Wi-Fi WAN CA Certificate**  
No Certificates defined  
[Add Certificate](#)

4. Open the **Private key** file (.key) with a text editor and copy and paste all of the text into the **Private Key** field.
5. Open the **Gateway certificate** file (\*.pem) and copy and paste all of the text into the **Local Public Key Certificate** field.

**LoRaWAN Gateway SSL Certificate**

Private Key (pem encoded)

```
Res+SfNtVez/X/UgCA+9Io3/mnHY6e2biHbQwIw8VYH88C/g/OSbipys6
YSp4oRK
DST6jHP9zIZfkVgGGQb6YluZzAWxn4hvK8wBwHECgYBStUg8FE4FgHx3
EOJj1mMz
qEjauZMDF2MGHW+G1VGhI8VbgnGwf8/PltnSXWdQFyJzFkdHshJLdFY
JZbJa6le
JyHq8GnGakSnFBaWcFy1UKSbJCy+rJyzQ28rjhX8T11W/fInlDMlqEkDK
tsSr9C
HyTUR12Yw06+ywcrdR2Q1wKbgBDI7IDUlq1vprOq28JY7PR2wxfKQeGP
6UzNgWp9
uxqRlqApG2bs1wC81IS/eXeIUuSd1feDTG9D3V7hRy86JgdH/H5zXrgRH
W8sh88z
5Yo2PjkhKsi94MSyKgNYDqRqEUEO3tbNgrwQxPe35NsGhw0ZL4eXnbI8
UKvY/zab
LvGhAoGADKJNicGmOxk6IXKAIVMF9c3Ddch/bFK3wX/qQs94zXMnFel
QfDK6ct5
alukQJuv6pecmgzElvIUmx24K5/AM9Kn+9N17NxoRr3YatOBGJvRZODI
v1LLmbx
rPm9Rb4Ion9JAdN097JZe8nfjG9Lbv8nq8q3lIEa9pb+QaXn0ow=
-----END RSA PRIVATE KEY-----
```

☐ This key is encrypted

Local Public Key Certificate (pem encoded)

**Note: Certificate is not transferable**

```
wu476GV
DQhqrOJt2w9FojSusin3Kdy79Jkw2F0dbR36HLS4IcVmqQnI87oGQZ
YFRydJ/
p78CAwEAAnaNgMf4wHwYDVR0JBgwwFoAUwILtoNcvkxkFDri23JNDsh
ioswHQYD
VR0BBYEFJ6ECCBJpZ+0t1AXIdutWSWxErMawGA1UdEwEB/wQCMA
AwDgYDVR0P
AQH/BAQDAgeAMA0GCSqGSIb3DQEBCwUAAI8BAQAL32E7bN/DsQI/h
ww2CTfsQfDj
C2/WILJS6dMDIHr3+c4dq3WBJBRaUH90TFIFUYkCCNdG4uj/hyTVK1yR
ytuwCiv
8wm9YUJ7kODaUuo3JA3hMMUHTX3IvIpeNAU2kuGIqas118+PVVfkOc6
m+EFxSXJA
QhI+FLIGOSBmb5ou+FQoI0SGvMI5p9IemZDY6ZFaX+KRUsBR6izUBZ
w4YKEECpm
u2oBL4yuWgumBniXvD2yUeK+t2wbWUepng2XIK755Ax7Ts8zadJeywk
UqYnQEmJj
UrJxN34bvlZtWZmepJpENwls5E19n9v2711MeCk3/F/oNLSnaRIX+QS6
55n
-----END CERTIFICATE-----
```

Show Details

Save and Apply Cancel


- Click on **Save and Apply**.
- Navigate to **LoRaWAN** settings along the left navigation bar.
- Select the **Protocol** named **Basic™ Station**.
- Copy the **CUPS** endpoint into the **Configuration and Update Server (CUPS)** field. Copy the URL address without the protocol and port information as shown in the example below.

- <https://A13OLAKIPIUABS.cups.lorawan.us-east-1.amazonaws.com:443>

Note: The address is provided by AWS and may differ depending on a region.

- Enter port 443
- Tick the checkbox **Require certificate**.
- Open the **CUPS certificate (\*.trust)** with a text editor and copy and paste all of the text into the **Server Certificate** field.
- Change the **Gateway Authorization** to **Certificate**.
- For **Network Mode**, select **Public**.

15. Enter your antenna Gain (for Peplink antenna enter 2).
16. Enter cable loss if there is a cable between antenna and LoRa module
17. Click on **Save** and **Apply Changes**.



[Dashboard](#)
[SFC Protect](#)
[Network](#)
[Advanced](#)
[AP](#)
[System](#)
[Status](#)
[Apply Changes](#)

**Advanced**

- SpeedFusion VPN
- IPsec VPN
- GRE Tunnel
- OpenVPN
- LoRaWAN**
- Outbound Policy
- Port Forwarding

**NAT Mappings**

**QoS**

- User Groups
- Bandwidth Control
- Application Queue
- Application

**Firewall**

- Access Rules
- Content Blocking

**Routing Protocols**

- OSPF & RIPv2
- BGP

**Remote User Access**

**Misc. Settings**

- RADIUS Server
- Certificate Manager
- Service Forwarding
- Service

**LoRaWAN Settings**

Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001F1104D70
Region	FCC
Protocol	Basics™ Station
Server	Configuration and Update Server (CUPS) A13OLAKIPIUABS.cups.lorawan.us-ea: Port 443 <input checked="" type="checkbox"/> Require certificate
Server Certificate (pem encoded)	<pre> y8+IbNBtKTrID30892t2OGPZNMCom15cAICyL1I/9of5JUOG52kbUpqQ4XHj2C0N Tm/2yEnZtvMaVq4rtNQU68/7JuMauh2WLmo7WJSJR1b/JaCTcFOD2oR0FMNnngRo Ot+OQFodSk7PQ5E751bWAHDLUu57fa4657wx+UX2wmDPE1kCK4DMNEffud6QZW0 C zyyRpqbn3oUYSXxmTqM6bam17jQuug0DuDPfR+uxa40I2ZvOgdFFRjKWcIfeAg5J Q4W2bHO7ZOphQazJ1FTfhy/HirImzJ9ZVGif/L4qL8RVHHVAYBeFAIU5i38FAGMB AAGjgFAwge0wDwYDVR0TAQH/BAUwAwEB/zAOBgNVHQ8BAf8EBAMCAYYwHQYDVR0 O BBYEFJxfAN+qAdcwKziIorhtSpzyEZGDMB8GA1UdIwQYMBaAFL9ft9HO3R+G9FtV rNzXEMIOqYjnME8GCCsGAQUFBwEBBEMwQTAcBggrBgEFBQcwAYYQaHR0cDovL28u c3MyLnVzLzAhBggrBgEFBQcwAoYVaHR0cDovL3guc3MyLnVzL3guY2YyMUYGA1Ud HwQFMBoW6GAZ0BeGFWh0dHA6Ly9zLnNzMi51cy9yLmNyYDARBgNVHSAECjA1MAYG BFUdIAAwDQYJKoZIhvcNAQELBQADggEBACMD44pXyn3pF3IM8R5V/cxTbj5HD9/G VfKyBDbtgB9TxFO0KGu+x1X8Z+rLP3+QsjPNG1gQggL4+C/1E2DUBc7xgQjB3ad1 l08YuW3e95ORCLp+QCztweq7dp4zBncdDQh/U90bZKuCJ/Fp1U1ervShw3WnWEQt 8jxwmKy6abaVd38PMV4s/KCHOkdP8Hif9BRUpJVeEXgSYCfOn8J3/yNTd126/+pZ 59vPr5KW7ySaNRBnJHGDn2Z9J8Z3/VyVOEVqQdZe4O/UI5GjLIAZHYcSNPYeehu VsyuLAOQ1xk4meTKCRlb/weWskh/NEnfVqn3sF/tm+2MR7cwA130A4w= -----END CERTIFICATE----- </pre> <a href="#">Show Details</a>
Gateway Authorization	Certificate
Network Mode	<input type="radio"/> Private <input checked="" type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

Save

#### **Step 4. Connect the Gateway and verify the connection status**

Follow the instructions in the [online guide](#) to connect your gateway to AWS IoT Core for LoRaWAN.

Navigate to **Gateways**, where all of your gateways are displayed. In the column **Last uplink received**, you should see a timestamp.

AWS IoT > Manage > LPWAN devices > Gateways

Gateways (1) Info Edit Delete Add gateway

< 1 >

Gateway ID	Name	Description	Last uplink received
<input type="radio"/> f889a125-4717-41d4-9e37-201aaf1120ac	Peplink Gateway Test	-	February 07, 2023, 14:38:23 (UTC+0200)

#### **Step 5. Verify device connection status**

In our example, we will use the LHT65 Temperature & Humidity sensor. To connect the LHT65 sensor, begin by pressing the ACT button 5 times quickly. This will deactivate the end device and it will display a solid RED LED for 5 seconds. Press and hold the ACT button for more than 3 seconds and a GREEN LED should blink 5 times. The device will begin operating and initiate connection to the LoRaWAN network. The GREEN LED will turn a solid green for 5 seconds after it successfully joins the network.

Navigate to **Devices**, where all of your devices are displayed. In the column **Last uplink received At**, you should see a timestamp.

AWS IoT > Manage > LPWAN devices > Devices

LoRaWAN Sidewalk

LoRaWAN devices (1) Info Edit Delete Add wireless device

Find LoRaWAN devices

Device ID	Name	Destination	Last Uplink Received At	Arn	DevEUI
<input type="radio"/> 4e4ed6e2-d2ec-4071-ae0f-f...	LoRaWAN device test	LoRaWAN_device_destination	2023-02-07T12:47:44.81438...	arn:aws:iotwireless:us-east-1:...	a8404142...



## Building a sample IoT Solution

For details, please check the [AWS guide](#) online. The guide will list the steps necessary to build a real-time dashboarding solution for visualizing connection quality data from your LoRaWAN end devices. After deploying the sample solution in your AWS account, you will be able to access the following Grafana dashboards:



## Getting Started with The Things Network /The Thing Industries

### Requirements

- LoRaWAN FlexModule Mini.
- Balance 20X router.
- LoRaWAN sensor (in our example we used Dragino LHT65).
- The Things Networks or The Things Industries account.

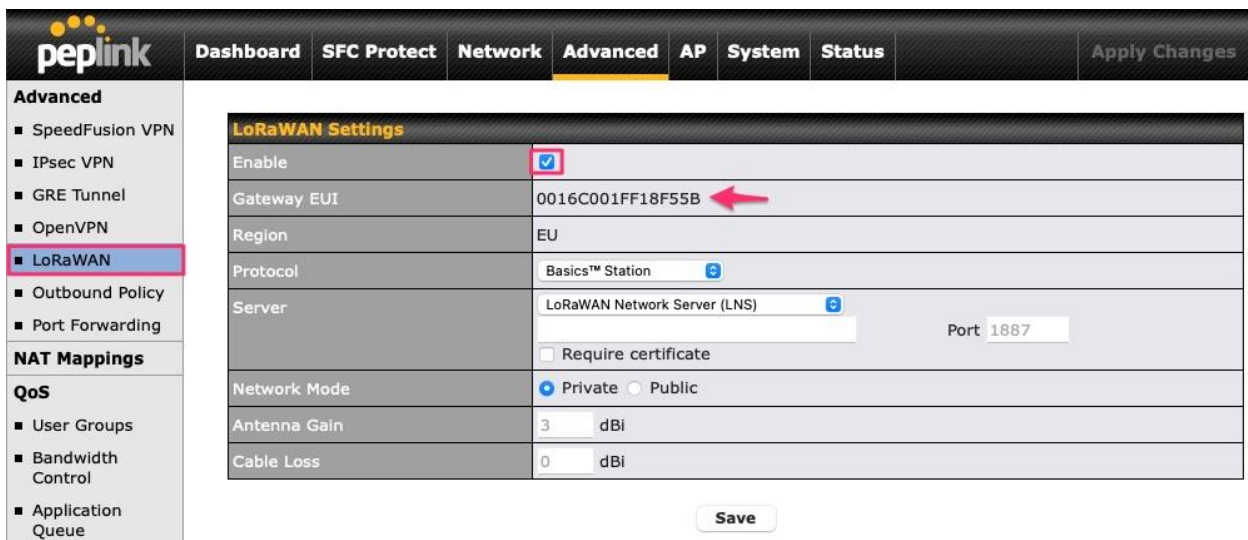
Note 1: The LoRaWAN FlexModule Mini comes in two options: EU868 and US915. Please make sure you order the correct one for your region.

Note 2: In this example we provide The Things Network public server configuration examples. The Things Industries configuration WEB based UI configuration is very similar.

## Set up LoRa Basics™ Station packet forwarder

### Step 1. Enable LoRaWAN protocol on your router

1. On your Peplink router's web admin page, go to the **Advanced** tab along the top bar.
2. Find the **LoRaWAN** tab along the left navigation bar.
3. In **LoRaWAN** settings, tick the **Enable** checkbox and write down the **Gateway EUI**, this will be needed for registering a gateway later on.



LoRaWAN Settings	
Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001FF18F55B
Region	EU
Protocol	Basics™ Station
Server	LoRaWAN Network Server (LNS)
	<input type="checkbox"/> Require certificate
Network Mode	<input checked="" type="radio"/> Private <input type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

Port 1887

Save

## Step 2. Add gateway to the TTN server

1. In this example we will use The Things Network account. To create a new visit [TheThingsNetwork.org](https://console.cloud.thethings.network/)  
Once registered, you will be able to see a **Console** tab at the top of your screen (or go to <https://console.cloud.thethings.network/>).
2. Choose an appropriate server
3. Click on **Go to gateways**
4. Select **Register Gateway**.
  - Enter the **Gateway EUI** and then click **Confirm**.
  - Select a **Frequency plan** according to your region.
  - You may change your **Gateway ID**. This can be any name that you want to use to identify the gateway.
  - Mark **Require authenticated connection**, **Generate API key for CUPS** and **Generate API key for LNS** checkboxes.
  - When you are finished, click on **Register gateway** at the bottom of the page.

### Register gateway

Register your gateway to enable data traffic between nearby end devices and the network.  
Learn more in our guide on [Adding Gateways](#).

Gateway EUI ?

00 16 C0 01 FF 18 F5 5B

Reset

Gateway ID ? \*

eui-0016c001ff18f55b-test

Gateway name ?

Peplink Gateway

Frequency plan ? \*

United States 902-928 MHz, FSB 2 (used by TTN)

☒ **Require authenticated connection** ?

Choose this option eg. if your gateway is powered by [LoRa Basic Station](#)

☒ **Generate API key for CUPS** ?

☒ **Generate API key for LNS** ?

Share gateway information

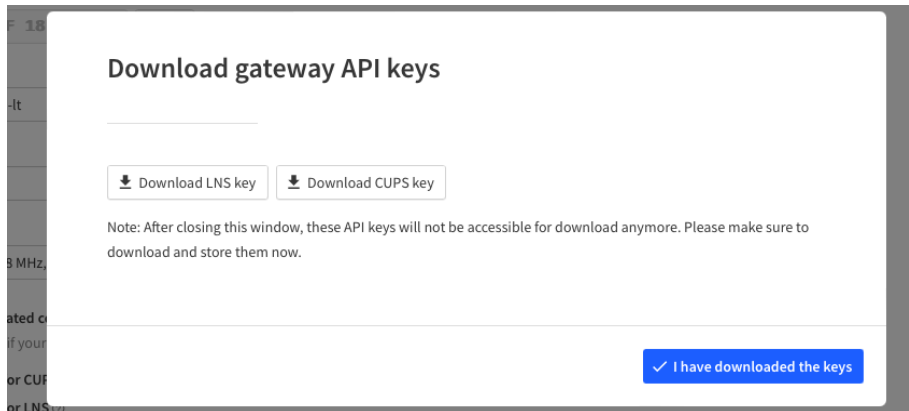
Select which information can be seen by other network participants, including [Packet Broker](#)

☒ **Share status within network** ?

☒ **Share location within network** ?

Register gateway

5. On your next step a new window with CUPS and LNS keys will show up. Save them for Gateway configuration.



### **Step 3. Connect your gateway to the TTN cloud server**

1. Download a common root SSL certificate used in The Things Stack, issued by trusted certificate authorities (CAs). You can find them from *The Things Network* [page](#). For our example we used **ISRG Root X1** certificate.
2. On your Peplink router, go to the **Advanced** tab along the top bar.
3. Find **LoRaWAN** settings along the left navigation bar and enter the following settings:
  - Protocol: **Basic Station**.
  - Server: **Configuration and Update Server CUPS**.
  - Server address: copy the address from your created gateway on TTN.
  - Server Certificate (pem encoded): copy the downloaded **ISRG Root X1** certificate.
  - Gateway Authorization: Select **Token** and then copy CUPS key from Step 1 (item 5).
  - Network Mode: **Public**.
  - Antenna Gain: enter your antenna Gain (for Peplink antenna enter 2).
  - Cable loss: enter cable loss if there is a cable between antenna and LoRa module
4. Click **Save** and **Apply Changes**. Below you will find a Balance 20x configuration example for your reference.

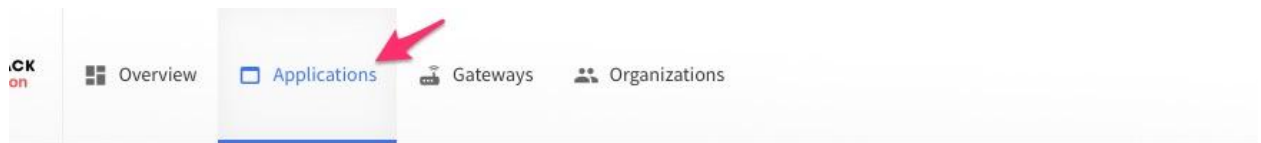
LoRaWAN Settings	
Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001FF18F55B
Region	FCC
Protocol	Basics™ Station
Server	Configuration and Update Server (CUPS) nam1.cloud.thethings.network <span style="float: right;">Port 443</span> <input checked="" type="checkbox"/> Require certificate
Server Certificate (pem encoded)	<pre> B5T0Y3HsLuJvW5IB4YlCNHlsdu87kGJ55tukmi8mxdAQ4Q7e2RCOFvu396j3x+UC B5IPNgiv5+I3lg02dZ77DnKxHZu8A/IJBdiB3QW0KtZB6awBdpUKD9jf1b0SHzUv KBds0pjBqAlkd25HN7rOrFleaJ1/ctaJxQZBKT5ZPt0m9STJEadao0xAH0ahmbWn OlFuhjuefXKnEgV4We0+UXgVCwOPjdAvBbI+e0ocS3MFEVzG6uBQE3xDk3SzynTn jh8BCNAw1FtxNrQHusEwMFxIt4I7mKZ9YIqioymCzLq9gwQbooMDQaHwBfEbwrBw qHyGO0aoSCqI3Haadr8faqU9GY/rOPNk3sgrDQoo//fb4hVC1CLQJ13hef4Y53CI rU7m2Ys6xt0nUW7/vGT1M0NPAGMBAAGjQjBAMA4GA1UdDwEB/wQEAWIBBjAPBgNV HRMBAf8EBTADAQH/MB0GA1UdDgQWBRR5tFnme7bl5AFzgAiIyBpY9umbbjANBgkq hkiG9w0BAQsFAAOCAgEAVR9YqbyyqFDQDLHYGmkGjYkIrGF1XIPu+ILiaS/V9IZL ubhzEFnTIZd+50xx+7LSYK05qAvqFyFWWhfQDlnrzuBZ6brJFe+GnY+EgPbk6ZGQ 3BebYhtF8GaV0nxvwuo77x/Py9auJ/GpsMiu/X1+mvoiBOv/2X/qkSsisRcOj/KK NFtY2PwByVS5uCbMiogziUwthDyC3+6WVwW6LLv3xLftTjuCvjHIInNzktHCgKQ5 ORAZI4JMPJ+GslWYHb4phowim57iaztXOoJwTdwJx4nLCgdNbOhdjsnvzqvHu7Ur TkXWStAmzOVyyghqpZXjFaH3pO3JLF+I+/+sKAIuvtd7u+Nxe5AW0wdeRIN8NwdC jNPElpzVmbUq4JUagEiuTDkHszxHpFKVK7q4+63SM1N95R1NbdWhscdCb+ZAJzVc oyi3B43njTOQ5yOf+1CceWxG1bQVs5ZufpsMijq4UI0/1lvh+wjChP4kqKOJ2qxq 4RgqsahDYVvTH9w7jXbyLeiNdd8XM2w9U/t7y0Ff/9yi0GE44Za4rF2LN9d11TPA mRGunUHBcnWEvgJBQI9nJEiU0Zsnvgc/ubhPgXRR4Xq37Z0j4r7g1SgEEZwxAS7d emyPxgcYxn/eR44/KJ4EBs+IVDR3veyJm+kXQ99b21/+jh5Xos1AnX5IltreGCC= -----END CERTIFICATE----- </pre> <a href="#">Show Details</a>
Gateway Authorization	Token NNSXS.4C7OGLSXQTIQ443ZRM5IFEZMAQLW32QUX4MYDUA.5JG7W4N Q5VLT4XATFXHXQKRXGW2IVBGLL2ISOGY3IJSBNVWYAPAQ
Network Mode	<input type="radio"/> Private <input checked="" type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

- Go to the console page on *The Things Network* and navigate to the **Gateways** tab. Once there, you should be able to see that your gateway is connected to the network.

<div> <div>Overview</div> <div>Applications</div> <div>Gateways</div> <div>Organizations</div> </div> <div> <div>Community</div> <div>No SLA applicable</div> </div>				
<div>Gateways (1)</div> <div> <div>Search</div> <div>Register gateway</div> </div>				
ID	Name	Gateway EUI	Status	Created at
eui-0016c001ff18f55b-test	Peplink Gateway	00 16 C0 01 FF 18 F5 5B	Connected	26 minutes ...

## Step 4. Add Device (sensor)

1. Create a new application in the TTN console by navigating to the **Applications** tab and clicking **Create application**.
2. Enter an **Application ID**. The other fields are optional.
3. Click on **Create application**.



### Create application

Within applications, you can register and manage end devices and their network data. After setting up your device fleet, use one of our many integration options to pass relevant data to your external services.

Learn more in our guide on [Adding Applications](#).

Application ID \*

Application name

Description

Optional application description; can also be used to save notes about the application

4. Once the application has been created, you will be directed back to your application page. Click on **End Devices** (left side menu), then click the **Register end device** button.

- In our example, we will use the Dragino LHT65 Temperature and Humidity sensor. When registering a sensor or an end device, you may choose either **From The LoRaWAN Device Repository** or **Manually**. Displayed below is a screenshot of when the sensor is selected through the Repository.

### End device type

#### Input Method

- ☒ Select the end device in the LoRaWAN Device Repository
- ☐ Enter end device specifics manually

#### End device brand \*

Dragino Technolog... | ▼

#### Model \*

LHT65 | ▼

#### Hardware Ver. \*

Unknown ... | ▼

#### Firmware Ver. \*

1.8 | ▼

#### Profile (Region) \*

US\_902\_928 | ▼



#### LHT65

LoRaWAN Specification 1.0.3, RP001 Regional Parameters 1.0.3 revision A, Over the air activation (OTAA), Class A

LoRaWAN Temperature & Humidity sensor

[Product website](#) | [Data sheet](#)

#### Frequency plan \*

United States 902-928 MHz, FSB 2 (used by TTN) | ▼



- The **Frequency plan**, **JoinEUI (AppEUI)**, **DevEUI** and **AppKey** are provided with the end device. The **End Device ID** can be any value. Once completed, click the **Register end device** button to register your device. Displayed below is a screenshot with filled sensor data.

#### Provisioning information

JoinEUI ⓘ \*

A8 40 41 00 00 00 01 00

Reset

This end device can be registered on the network

DevEUI ⓘ \*

A8 40 41 42 E1 84 AF 6C

Generate 0/50 used

AppKey ⓘ \*

42 72 4E 79 8B EC C8 27 71 EA FB 46 2E C9 3A A4

Generate

End device ID ⓘ \*

eui-a8404142e184af6c

This value is automatically prefilled using the DevEUI


#### After registration

- ☒ View registered end device
- ☐ Register another end device of this type

Register end device

- Depending on your sensor, you may need to activate the device (join network). To connect the LHT65 sensor, begin by pressing the ACT button 5 times quickly. This will deactivate the end device and it will display a solid RED LED for 5 seconds. Press and hold the ACT button for more than 3 seconds and a GREEN LED should blink 5 times. The device will begin operating and initiate connection to the LoRaWAN network. The GREEN LED will turn a solid green for 5 seconds after it successfully joins the network.

- Once the sensor joins the network, you will be able to see uplink messages from your end device in the **Live Data** field. See the screenshot below.


**eui-a8404142e184af6c**  
ID: eui-a8404142e184af6c

↑ 1 ↓ n/a • Last activity 38 seconds ago

[Overview](#)
[Live data](#)
[Messaging](#)
[Location](#)
[Payload formatters](#)
[Claiming](#)
[General settings](#)

**General information**

End device ID	eui-a8404142e184af6c	
Frequency plan	United States 902-928 MHz, FSB 2 (used by T...	
LoRaWAN version	LoRaWAN Specification 1.0.3	
Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A	
Created at	Jan 24, 2023 14:38:43	


**Hardware**

Brand	dragino
Model	lht65
Hardware version	_unknown_hw_version_
Firmware version	1.8

**Live data**
[See all activity →](#)

- ↑ 14:39:34 Forward uplink data message DevAddr: 26 0C 0A 06 <> Pa...
- ↑ 14:39:34 Successfully processed data message DevAddr: 26 0C 0A 06 <>
- ↓ 14:39:29 Schedule data downlink for transmission on Gateway Server Dev...
- ✎ 14:39:29 Update end device [ "activated\_at" ]
- ↑ 14:39:29 Forward uplink data message DevAddr: 26 0C 0A 06 <> Pa...
- ↑ 14:39:29 Decode uplink data message failure TypeError: Value is not ok

**Location**
[Change location settings →](#)



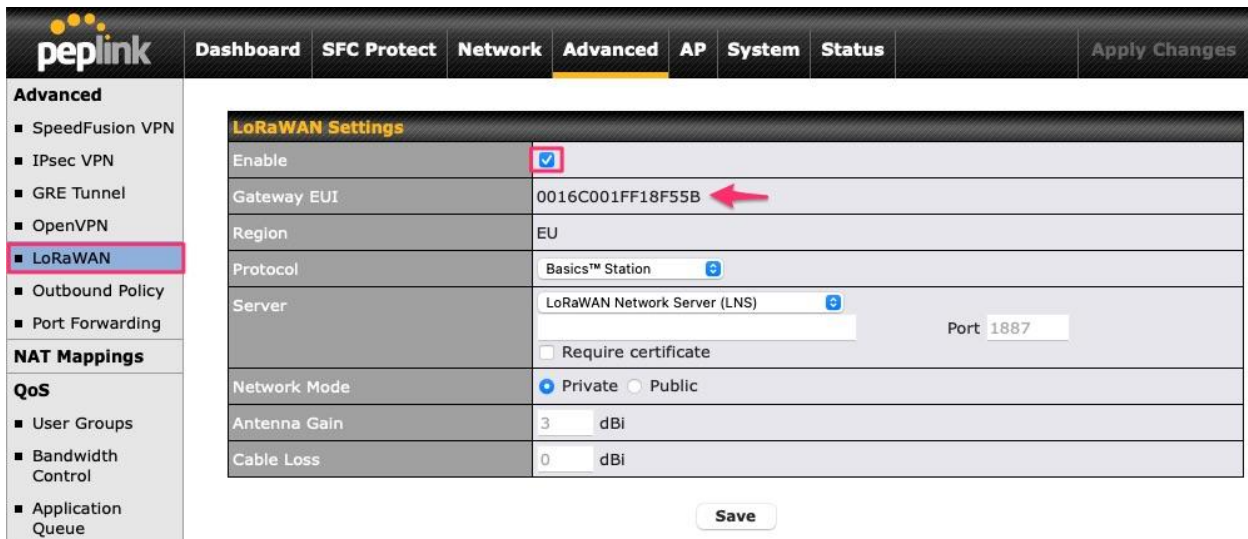
## Set up UDP Packet Forwarder

Important: UDP packet forwarder is not recommended and suggested to use only for testing purposes. Semtech Basic Station option provides a better security and channel plan configuration through the Network Server, while Semtech Packet Forwarder uses unsecured UDP communication and any channel plan configuration should be done manually through the Gateway.

Note: The steps for adding sensors and connecting to data visualization is identical to the UDP Packet forwarder type and therefore are not covered here. You may refer to Steps 4 of the previous section.

### Step 1. Get a LoRaWAN Gateway EUI

4. On your Peplink router's web admin page, go to the **Advanced** tab along the top bar.
5. Find the **LoRaWAN** tab along the left navigation bar.
6. In **LoRaWAN** settings, tick the **Enable** checkbox and write down the **Gateway EUI**, this will be needed for registering a gateway later on.



LoRaWAN Settings	
Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001FF18F55B
Region	EU
Protocol	Basics™ Station
Server	LoRaWAN Network Server (LNS)
	<input type="checkbox"/> Require certificate
Network Mode	<input checked="" type="radio"/> Private <input type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

Save

## Step 2. Add gateway to the TTN server

1. In this example we will use The Things Network account. To create a new visit [TheThingsNetwork.org](https://console.cloud.thethings.network/)  
Once registered, you will be able to see a **Console** tab at the top of your screen (or go to <https://console.cloud.thethings.network/>).
2. Choose an appropriate server.
3. Click on **Go to gateways**.
4. Select **Register Gateway**.
  - Enter the **Gateway EUI** and then click **Confirm**.
  - Select a **Frequency plan** according to your region.
  - You may change your **Gateway ID**. This can be any name that you want to use to identify the gateway.
  - Do **NOT** check **Require authenticated connection**.
  - When you are finished, click on **Register gateway** at the bottom of the page.

### Register gateway

Register your gateway to enable data traffic between nearby end devices and the network.

Learn more in our guide on [Adding Gateways](#).

Gateway EUI ?

00 16 C0 01 FF 18 F5 5B Reset

Gateway ID ? \*

eui-0016c001ff18f55b

Gateway name ?

Peplink Gateway

Frequency plan ? \*

United States 902-928 MHz, FSB 2 (used by TTN) | v

☐ **Require authenticated connection** ?

Choose this option eg. if your gateway is powered by [LoRa Basic Station](#)

**Share gateway information**

Select which information can be seen by other network participants, including [Packet Broker](#)

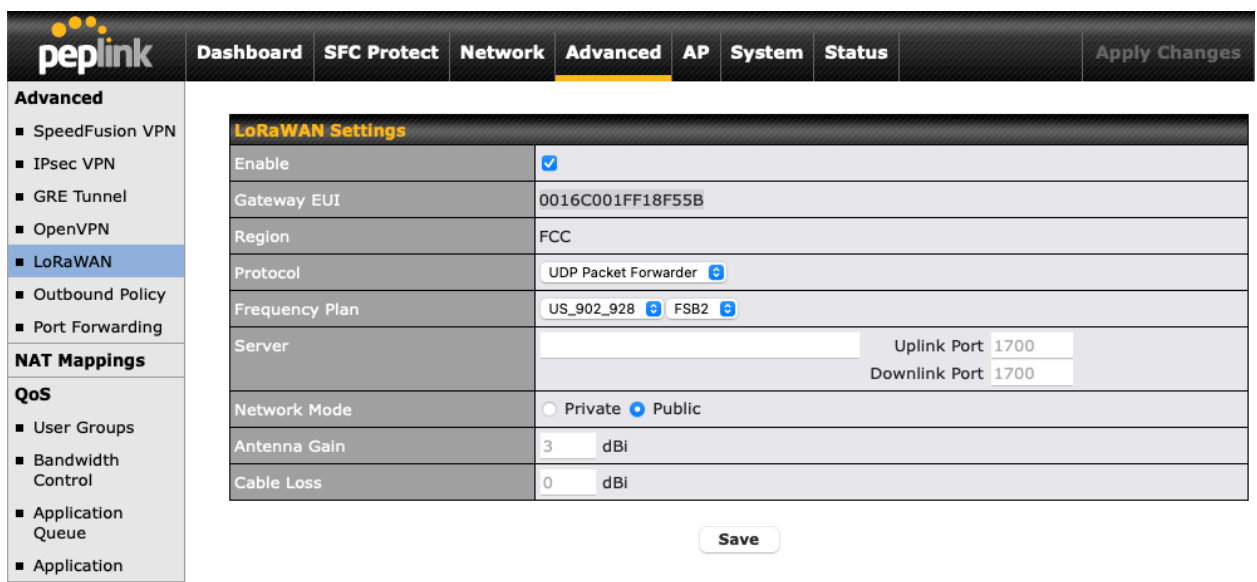
☒ **Share status within network** ?

☒ **Share location within network** ?

**Register gateway**

### Step 3. Connect your gateway to the TTN server

1. On your Peplink router, go to the **Advanced** tab along the top bar.
2. Find **LoRaWAN** settings along the left navigation bar and enter the following settings:
  - Protocol: **UDP Packet Forwarder**
  - Frequency plan: should match the selected in TTN settings
  - Server: copy the address from your created gateway on TTN
  - Network Mode: **Public**
  - Antenna Gain: enter your antenna Gain (for Peplink antenna enter 2).
  - Cable loss: enter cable loss if there is a cable between antenna and LoRa module
3. Click **Save** and **Apply Changes**.



LoRaWAN Settings	
Enable	<input checked="" type="checkbox"/>
Gateway EUI	0016C001FF18F55B
Region	FCC
Protocol	UDP Packet Forwarder
Frequency Plan	US_902_928 FSB2
Server	Uplink Port 1700 Downlink Port 1700
Network Mode	<input type="radio"/> Private <input checked="" type="radio"/> Public
Antenna Gain	3 dBi
Cable Loss	0 dBi

Save

4. Go to the console page on *The Things Network* and navigate to the **Gateways** tab. Once there, you should be able to see that your gateway is **Connected** to the network.



ID	Name	Gateway EUI	Status	Created at
eui-0016c001ff18f55b	Peplink Gateway	00 16 C0 01 FF 18 F5 5B	Connected	11 minutes...

## Debugging

For debugging purposes go to **Dashboard**, then click on the **Status** button in the **LoRaWAN** section. On a new window, next to the **Event log** text press on **Click to show**. This will open an Event log page. See pictures below for more details.

The screenshot shows the Peplink dashboard with the **Status** tab selected. The **LoRaWAN Status** window is open, displaying various configuration details. The **Event log** field at the bottom has a **Click to show** button highlighted with a red box.

LoRaWAN Status	
Gateway EUI	16c001ff1e183e
Last event time	Fri May 06 13:29:19 +00 2022
Last sensor seen	85c4cf (Fri May 06 13:49:27 +00 2022)
Frequency plan	EU868
RX Channels/Bandwidth	868.100MHz/125.000kHz 868.300MHz/125.000kHz 868.500MHz/125.000kHz
TX Channels/Bandwidth	867.100MHz/125.000kHz 867.300MHz/125.000kHz 867.500MHz/125.000kHz 867.700MHz/125.000kHz 867.900MHz/125.000kHz
Antenna gain	0 dBi
Cable loss	0 dB
Network	Public
Protocol	Basics™ Station, CUPS
Ports	443
Event log	<a href="#">Click to show</a>

LoRaWAN Event Log page view shown below.

The screenshot shows the Peplink dashboard with the **Status** tab selected. The **LoRaWAN Event Log** window is open, displaying a list of event log entries. The **Event Log** option is selected in the left sidebar.

LoRaWAN Event Log	
May 06 13:52:35	> {"msgtype":"updf","MHdr":64,"DevAddr":638270071,"FCtrl":128,"FCnt":1191,"FOpts":"","FPort":2,"FRMPayload":"DA612D6123EEE49F02598E","MIC":929071641,"RefTime":0.000000,"DR":0,"Freq":868100000,"upinfo":{"rctx":0,"xtime":34902898317685388,"gpstime":0,"fts":-1,"rssi":-58,"snr":9.25,"rxtime":1651845156.024738}}
May 06 13:52:35	DEVICE updf mhdr=40 DevAddr=26083A77 FCtrl=80 FCnt=1191 mic=929071641 (24 bytes)
May 06 13:52:35	DEVICE RX 868100000 DR0 SF12/BW125 snr=9.2 rssi=-58 xtime=0x7c0000531a30fc -
May 06 13:49:27	< {"msgtype":"dnmsg","DevEui":"00-00-00-00-00-00-00-00","regionid":1,"dnmode":"updn","dC":0,"diid":42249,"pdu":"60cfc485008b00000df9e99f4f080354ff0001a27cb087","priority":1,"RxDelay":1,"RX1DR":0,"RX1Freq":868100000,"xtime":34902898317685388,"rctx":0}8310997168,"rctx"
May 06 13:49:27	> {"msgtype":"updf","MHdr":64,"DevAddr":8766671,"FCtrl":129,"FCnt":0,"FOpts":"","FPort":2,"FRMPayload":"A C9E2557D8F7FF1AE2AF3D","MIC":2036387697,"RefTime":0.000000,"DR":0,"Freq":868100000,"upinfo":{"rctx":0,"xtime":34902898317685388,"gpstime":0,"fts":-1,"rssi":-54,"snr":7,"rxtime":1651844967.365606}}
May 06 13:49:27	DEVICE updf mhdr=40 DevAddr=0085C4CF FCtrl=81 FCnt=0 mic=2036387697 (25 bytes)
May 06 13:49:27	DEVICE RX 868100000 DR0 SF12/BW125 snr=7.0 rssi=-54 xtime=0x7c000047db728c -
May 06 13:49:21	< {"msgtype":"dnmsg","DevEui":"00-00-00-00-00-00-00-00","regionid":1,"dnmode":"updn","dC":0,"diid":20027,"pdu":"20c14b838e64f2202a1ac6dfb3839f4ef346bf336394b079bb1dbd2b45f3b154bc","priority":1,"RxDelay":5,"RX1DR":5,"RX1Freq":868300000,"xtime":34902898310997168,"rctx":0}5,0],[11,125,0],[10,125,0],[9,125,0],[8,125,0],[7,125,0],[7,250,0],[0,0,0],[-1,0,0],[-1,0,0],[-1,0,0],[-1,0,0],[-1,0,0],[-1,0,0],[-1,0,0],[-1,0,0]],"sx1301_conf"
May 06 13:49:20	> {"msgtype":"jreq","MHdr":0,"JoinEui":"A0-00-00-00-00-00-01-00","DevEui":"A8-40-41-E1-71-83-4C-1F","DevNonce":38247,"MIC":1413695051,"RefTime":0.000000,"DR":5,"Freq":868300000,"upinfo":{"rctx":0,"xtime":34902898310997168,"gpstime":0,"fts":-1,"rssi":-52,"snr":13.5,"rxtime":1651844960.660307}}

## Troubleshooting

Most typical issues are related to:

- Mistaken certificates (e.g. mixed certificates Private key file (.key) with Gateway certificate.
- Incorrect CUPS or LNS server IP address.
- Private Network mode is selected. Make sure you select a Public one.

## Firmware updates

- On your Peplink router's web admin page, go to the **System** tab along the top bar.
- Find the **Firmware** tab along the left navigation bar.
- Click the **Check for Firmware** button to see if there is newer Firmware available.
- Alternatively, a Device Firmware upgrade can also be done via Peplink InControl management system. Check the [Peplink WEB](#) page for more information.