Setting Up Basics Station on The Things Stack v3

Sentrius RG1xx

Application Note *v2.0*

Revision History

Version	Date	Notes	Contributors	Approver
1.0	14 July 2020	Initial Release	Seokwoo Yoon	Chris Boorman
1.1	8 Aug 2020	Added steps for API Key Authentication	Ian Tracy	Chris Boorman
1.2	05 May 2021	Updated root certificate and references	Seokwoo Yoon	Chris Boorman
1.3	12 May 2021	url update	Chris Boorman	Chris Boorman
1.4	04 June 2021	Changed command to generate API key in Linux	Seokwoo Yoon	Chris Boorman
1.5	8 Feb 2022	Fixed typo in LNS setup section	Florian Baumgartl	Dave Drogowski
2.0	6 May 2025	Ezurio rebranding	Dave Drogowski	Dave Drogowski

Contents

1 Introduction

Ezurio's RG1xx firmware update v93.8.5.18 (GA5.0) introduced Semtech Basics Station as a forwarder, while removing the TTN and MQTT forwarder options.

This document describes how to configure the Sentrius™ gateway to use Basics Station along with The Things Stack v3 that can be categorized into the following two groups:

- The Things Network (TTN), The Things Stack (TTS) v3 - Community (TTN Community – TTS v3)
- The Thing Industries (TTI), The Things Stack (TTS) v3 – Enterprise' ('TTI Enterprise - TTS V3').

We mainly use TTI Enterprise – TTS V3 in this document but the steps remain the same for TTN Community – TTS v3 (we will note if there is a difference between these two).

The document demonstrates the setup with a RG191 (US version) gateway and an RS191 (US version) sensor.
The steps for using an RG186 and RS186 are similar; refer to notes detailed within where the EU version differs from US.

For more detailed information on how to use all the features of the Sentrius gateway, please see the Sentrius™ RG1xx User Manual, available from the documentation section at:
https://www.lairdconnect.com/wireless-modules/lorawan-solutions/sentrius-rg1xx-lora-enabled-gateway-wi-fi-ethernet

1.1 Product Overview

The Sentrius™ RG1xx Gateway from Ezurio is the ultimate in secure, scalable, robust LoRa solutions for end-to-end control of your private LoRaWAN network. Leveraging Ezurio's field-proven and reliable 50 Series wireless bridge certified module, it also offers enterprise dual-band Wi-Fi, BT v4.0 (BLE and Classic), and wired Ethernet for complete design freedom. Based on the Semtech SX1301/SX1257 chipset designs, it offers a LoRa range up to 10 miles and pre-loaded LoRa Packet Forwarder software, perfect for highly scalable, flexible IoT networks. The SentriusTM RG1xx Gateway works with Ezurio's **Sentrius™ RS1xx Series** LoRa+BLE certified modules for simple out-of-the-box integration and is compatible with 3rd party cloud and LoRa partners, as well as any LoRaWAN certified client devices.

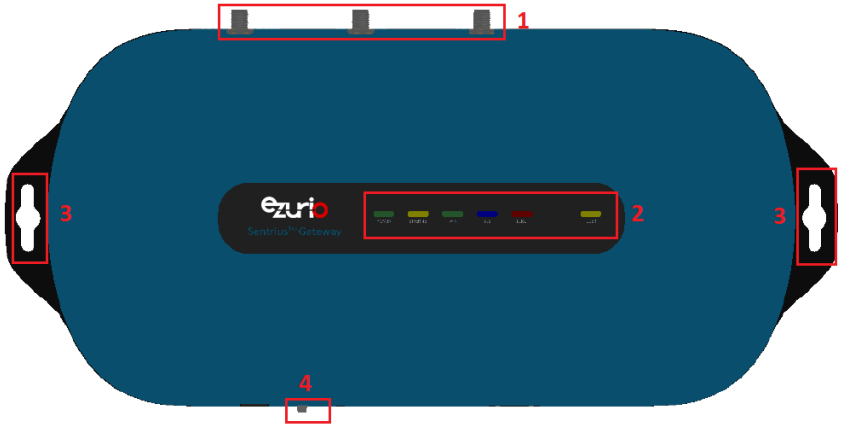


Figure 1: Top of the Sentrius™ RG1xx gateway

1. LoRa and Wi-Fi antennas
2. LEDs
3. Mounting holes
4. User button

Figure 2: Back panel of the Sentrius™ RG1xx gateway

1. DC power input
2. User button
3. Reset button
4. SD card slot
5. Ethernet connector

2 Connect the Hardware

2.1 Connect the Gateway

To use the gateway, you must power up the gateway and access the web interface via the Ethernet port. To do this, complete the following steps:

1. Follow the label on the box and connect the three antennas. Refer to Figure 3 for additional information.
2. Connect the power supply (see #2 in Figure 3).
3. Connect the gateway to your router (#3 in Figure 3) using the Ethernet cable (#1 in Figure 3).

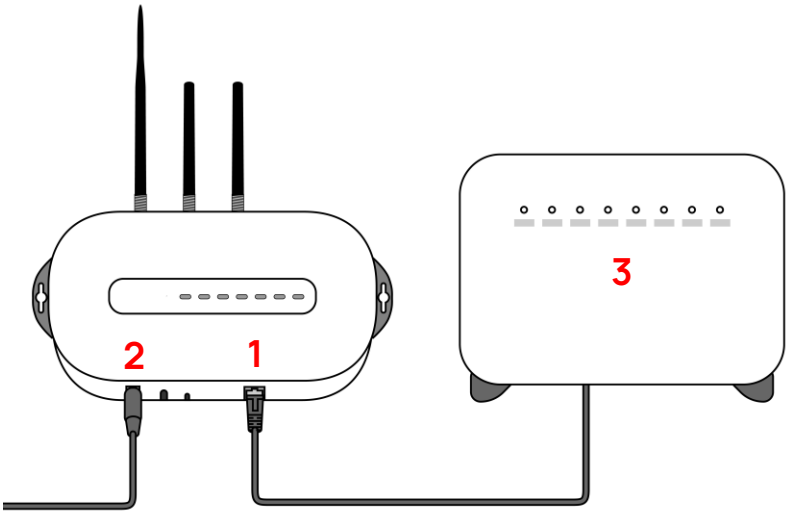
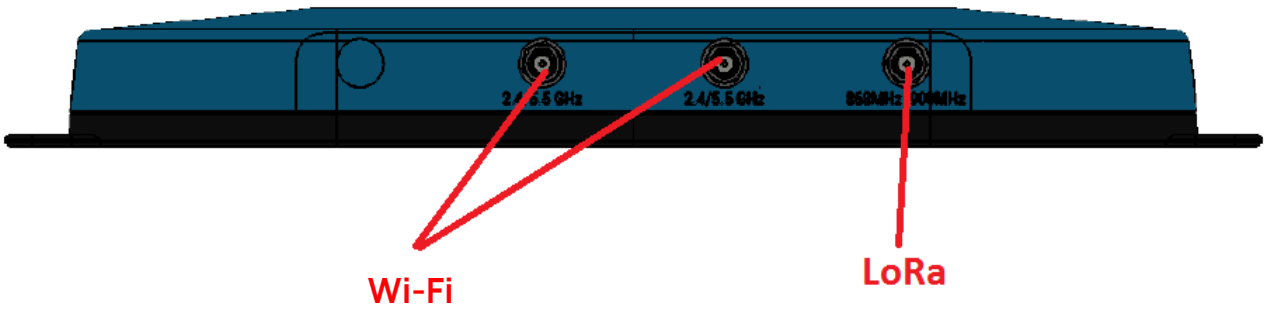


Figure 3: Connecting the gateway

2.1.1 Antenna Configuration

To configure the antenna properly, complete the following steps:

1. Attach the two shorter antennas to the 2.4/5.5 GHz (Wi-Fi) ports.
2. Attach the third and longer antenna to the 868 MHz/900 MHz (LoRa) port.



2.1.2 Wi-Fi Quick Config

The gateway includes a mode to allow you to configure without ethernet access, in the case that you wish to join a wireless network.

Apply power to the gateway and allow to start, then perform the following:

1. Depress and hold the user button (see #2 in Figure 3) for 7 seconds.
2. From a wirelessly enabled device perform a scan.
3. Connect to the access point rg1xx**29378B**, where *29378B* are the last six digits of the ethernet MAC address found on the label on the bottom of the gateway (Figure 3).

   The network is secured with WPA2 with a password that is the same as the SSID. We recommend that the default password is changed for security reasons. You can change the password on the Wi-Fi › Advanced web page.

   Upon logout or client disassociation, Wi-Fi Quick Config shuts down and normal operation resumes.

3 Log into the Gateway

To log into the gateway web interface, follow these steps:

1. Determine the last three bytes of your gateway's Ethernet MAC address. This can be found on the label on the bottom of the gateway; the last three bytes are highlighted (Figure 4).

Figure 4: Bottom label (Standard GW – Left, AS923 & AU915 Region Supported/Latest Version – Right)– last three bytes of the Ethernet MAC address highlighted

2. Enter the URL into the web browser to access the web interface. For example, for the gateway used in this guide, the URL is https://rg1xx**29378B**.local., where *29378B* are the last 6 digits of the Ethernet MAC address. In Wi-Fi quick config mode, the gateway can also be accessed via the IP address at https://192.168.1.1
3. Accept the self-signed security certificate in the browser.
4. Click **Advanced** (Figure 5).

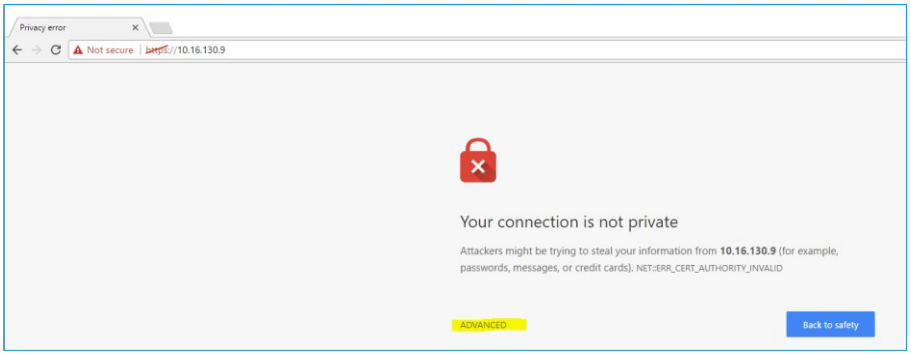


Figure 5: Web interface – first screen

5. Click **Proceed** (Figure 6).

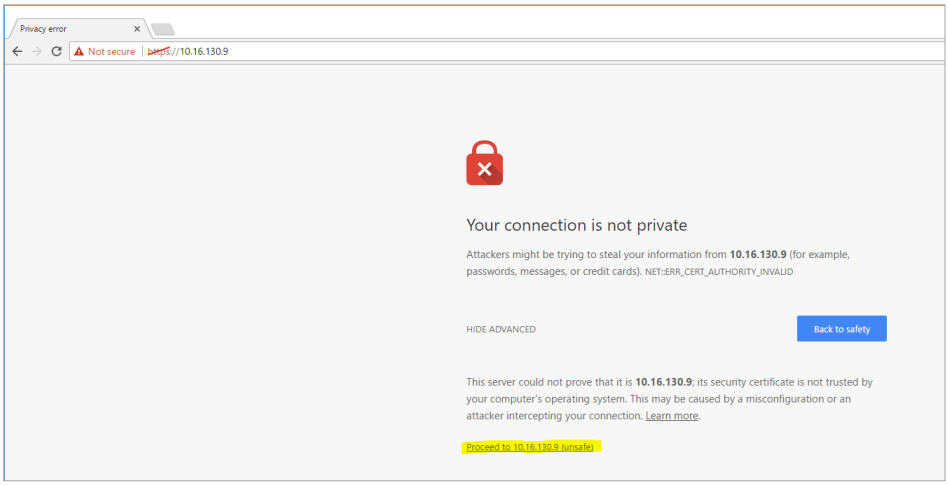


Figure 6: Web interface – second screen

6. Log on using the following default credentials (Figure 7):

   Username: sentrius
   Password: RG1xx

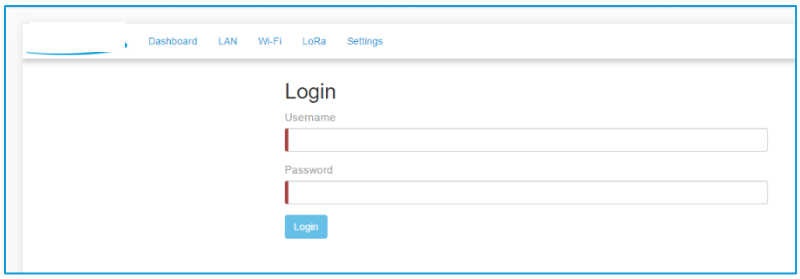


Figure 7: Gateway UI login screen

4 Connecting the Gateway to the Internet

4.1 Setting Up Ethernet

By default, the Ethernet port is set up for DHCP addressing. Connect the Ethernet cable to a network with internet access. If more advanced Ethernet configuration is needed, please see the Sentrius™ RG1xx User Manual in the documentation tab of the RG1xx product page at; https://www.lairdconnect.com/wireless-modules/lorawan-solutions/sentrius-rg1xx-lora-enabled-gateway-wi-fi-ethernet

4.2 Setting Up Wi-Fi

If Ethernet connection is made, this step is not necessary. By default, the Wi-Fi in the gateway is not configured to connect to a Wi-Fi network. You must access the web interface on the gateway via the Ethernet interface to setup the Wi-Fi connection.

To set up the Wi-Fi, follow these steps:

1. Once logged into the web interface, navigate to the Wi-Fi page (Figure 8).

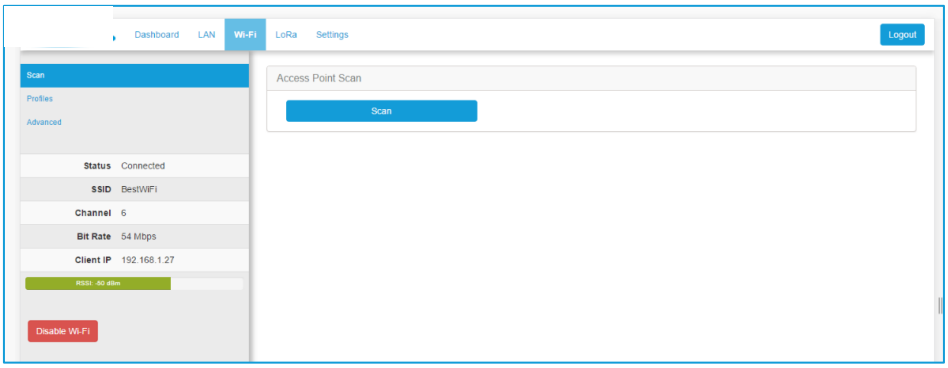


Figure 8: Wi-Fi page

2. To connect to a Wi-Fi network, click **Scan** to scan for nearby Wi-Fi networks (Figure 9). Scanning continues until you click **Stop** or select one of the scan results in the list.

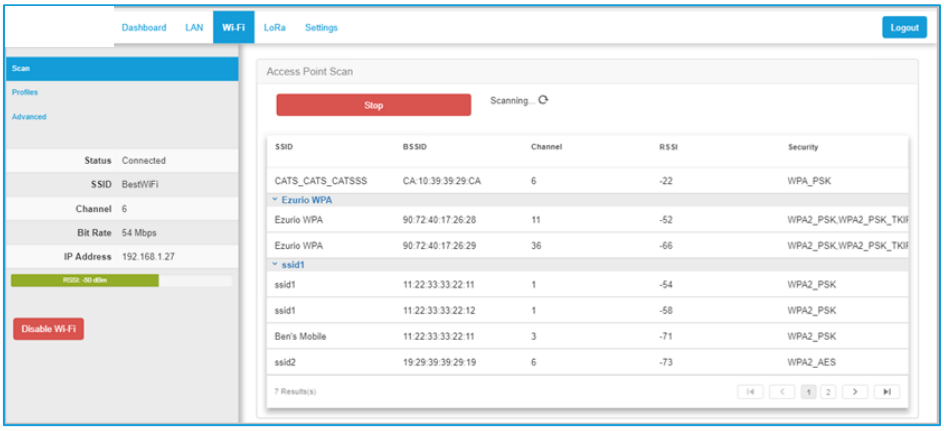


Figure 9: Wi-Fi scan results

3. Click on the applicable scan result.

4. Enter the information for the Wi-Fi network (Figure 10).

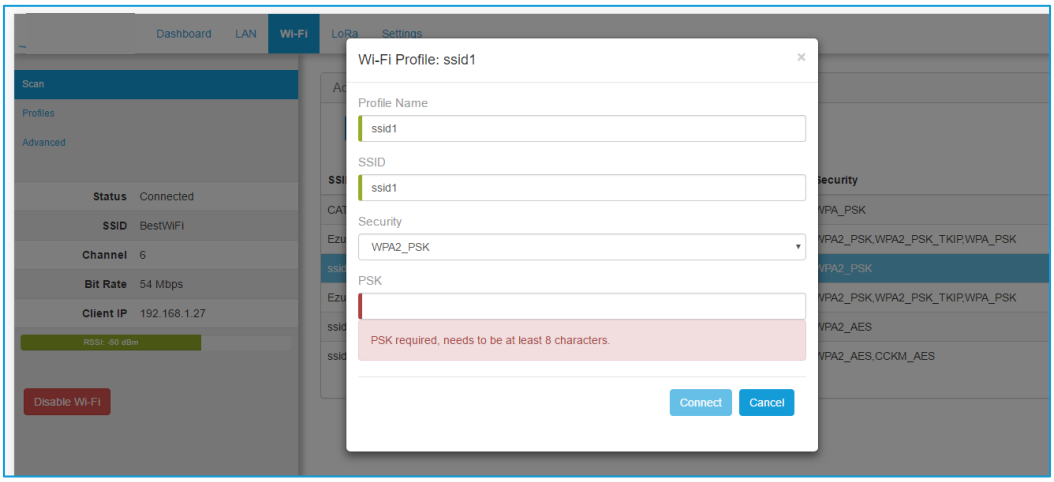


Figure 10: Wi-Fi profile dialog

5. Click **Connect**.

5 Configuration of Network Server

5.1 Prerequisites

The following are prerequisites:

- User account on The Things Stack (TTS) v3
- RG1xx gateway connected via ethernet or Wi-FI (steps outlined above) to have internet access

5.2 Configuration on The Things Stack (TTS)

5.2.1 Set Up a Gateway on The Things Stack

To set up a gateway on The Things Stack follow these steps:

1. In the main console page, select **Go to gateways**.

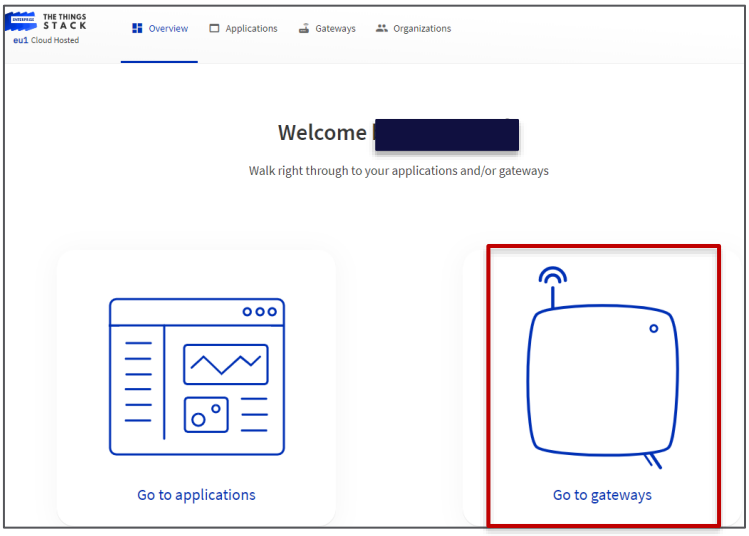


Figure 11: The Things Stack main console page

2. Click **Add gateway**.

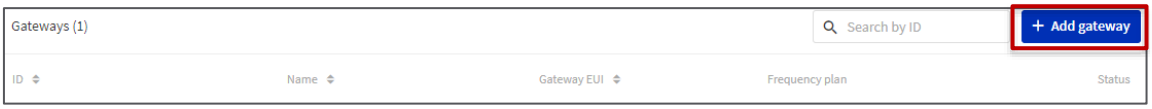


Figure 12: Add gateway

3. Give descriptive name as the *gateway-ID*.
4. Obtain *gateway EUI* from RG1xx's UI under LoRa tab.
5. **United States 902-928 Mhz, FSB 2 (TTN)** is used for *Frequency plan* in this example. Ezurio offers a variety of RG1xx models to support operation in various countries around the world. The following table shows the recommended channel plan settings for the Ezurio RG1xx model you are using.

Region	Ezurio RG1xx Part Number	TTN Frequency Plan
Australia (AU915)	455-00057	Australia 902-928 MHz, FSB 2 (TTN)
Australia (AS923)	455-00057	Asia 923-925 MHz (TTN Australia)
European Union	RG186 or 450-0190	Europe 863 - 870 MHz (TTN)
Hong Kong	455-00056	Asia 923-925 MHz
New Zealand	455-00055	Asia 923-925 MHz
North America	RG191 or 450-0191	United States 902-928 MHz, FSB 2 (TTN)
Singapore	455-00102	Asia 920-923 MHz
Taiwan	455-00054	Asia 923-925 MHz
United Kingdom	455-00028	Europe 863 - 870 MHz (TTN)

https://www.lairdconnect.com/wireless-modules/lorawan-solutions/sentrius-rg1xx-lorawan-gateway-wi-fi-ethernet-optional-lte-us-only

You can leave other fields as they are but feel free to change according to your preference.

6. Click **Create gateway**.

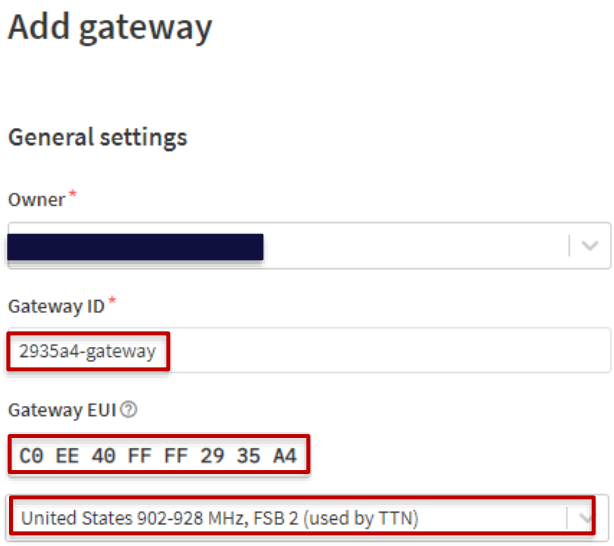


Figure 13: Gateway configuration page on The Things Stack

7. Create API keys for LNS by clicking **+Add API Key**.

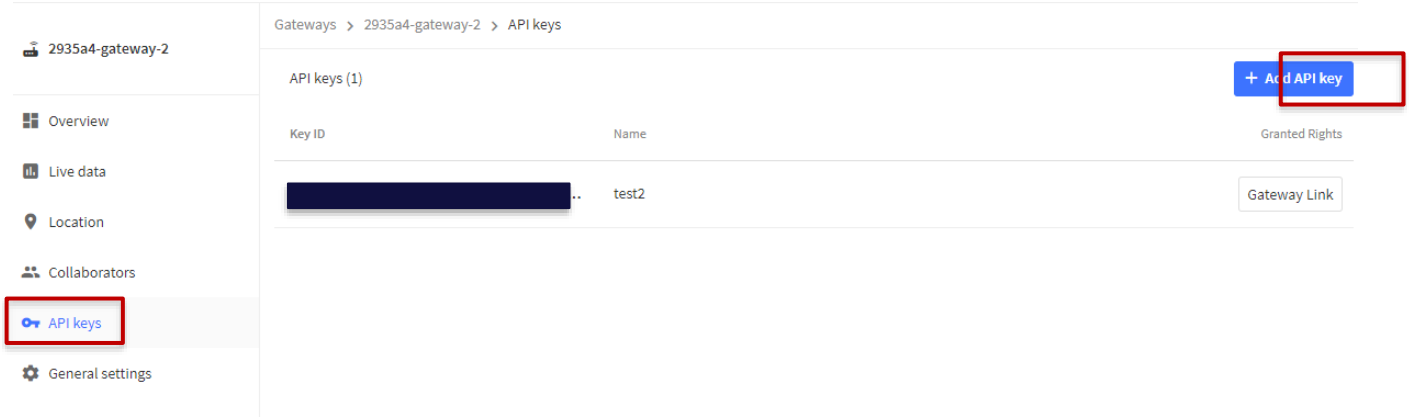


Figure 14 Generating API Key for gateway

8. Enter a name and choose '**Grant individual rights'** and '**Link as Gateway to a Gateway Server for traffic exchange, i.e. write uplink and read downlink'**. Then, click **Create API Key**.

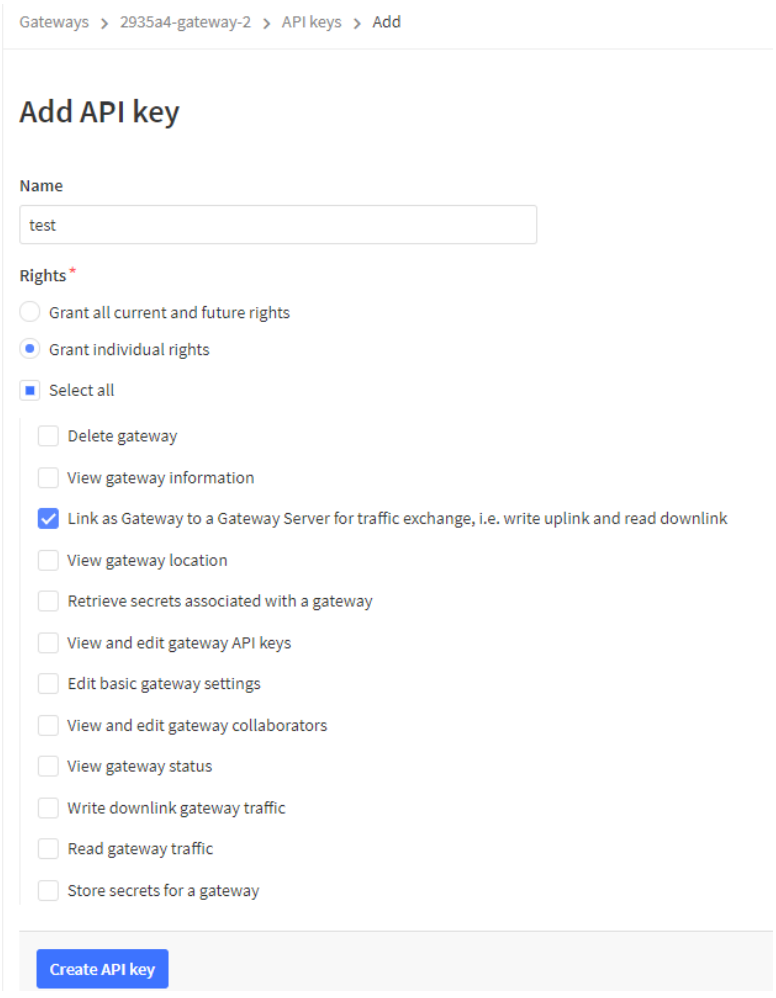


Figure 15: API Key configuration

9. On the next page, when prompted, copy the API key into your notes, as it will be used to generate the key file for the RG1xx later.

5.2.2 Create an Application on The Things Stack

To create an application on The Things Stack, follow these steps:

1. Click **Applications** on the main console page

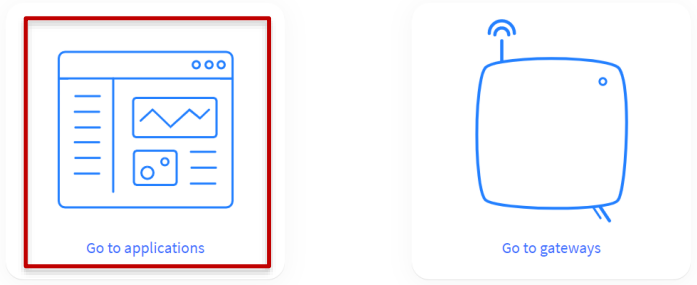


Figure 16: On the top of The Things Stack's console page

2. Click **Add application**.
3. Give a descriptive name as the *Application ID* and click **Create application**.

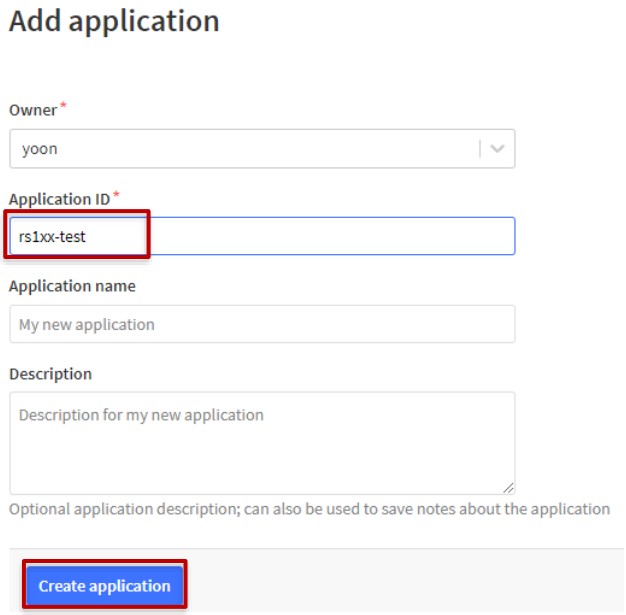


Figure 17: Configuration page for application on The Things Stack

5.2.3 Register End-Devices on The Things Stack

To register your end device on The Things Stack, follow these steps:

1. Click the application you just created under Applications tab.
2. Click **+ Add end device**

Figure 18: Add end device

3. Enter descriptive name as the *End Device ID*.
4. Select the end device
   - Brand: Laird Connectivity
   - Model: the model you have ('Sentrius RS1xx Temp-RH Sensor' is chosen in this example)
   - Choose Hardware version, Firmware version and Profile (region) after checking this information through Sentirus mobile app.

5. Select ***same frequency plan supported by the version of your gateway*** you are using. **United States 902-928 Mhz, FSB 2 (TTN)** is used for this example. You must use LoRa end-devices that match the country of operation of your gateway, and certified for the location they will be used in.

   Ezurio offers a wide variety of LoRaWAN sensors supporting a number of LoRa Alliance Regional Parameter regions alongside the local country radio regulatory requirements.
   https://www.lairdconnect.com/wireless-modules/lorawan-solutions/sentrius-rs1xx-lora-enabled-sensors

6. Click **Register end device**.

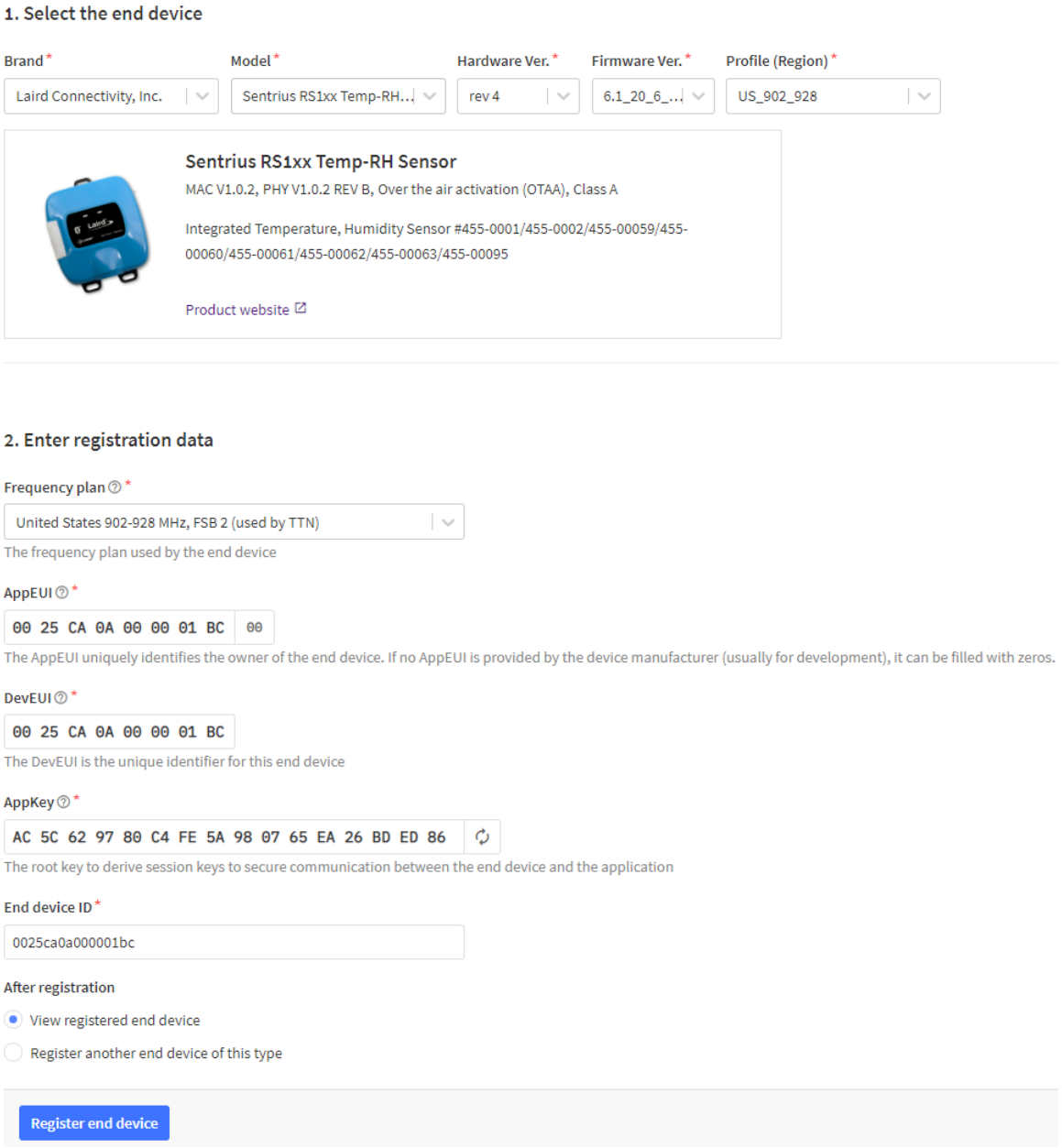


Figure 19: Configuration for end-device on The Things Stack

6 Basics Station Setup on Gateway

This section describes how to configure LNS and CUPS. You do not need to set up both LNS and CUPS together, but just one according to your need. That is, if you want to use CUPS, skip to section 6.2.

6.1 LNS setup

1. Click the **LoRa** tab in the main menu (Figure 20).
2. In left column, click **Forwarder** and choose **Semtech Basics Station** from the dropdown labeled *Mode*.
3. Click **Update**.

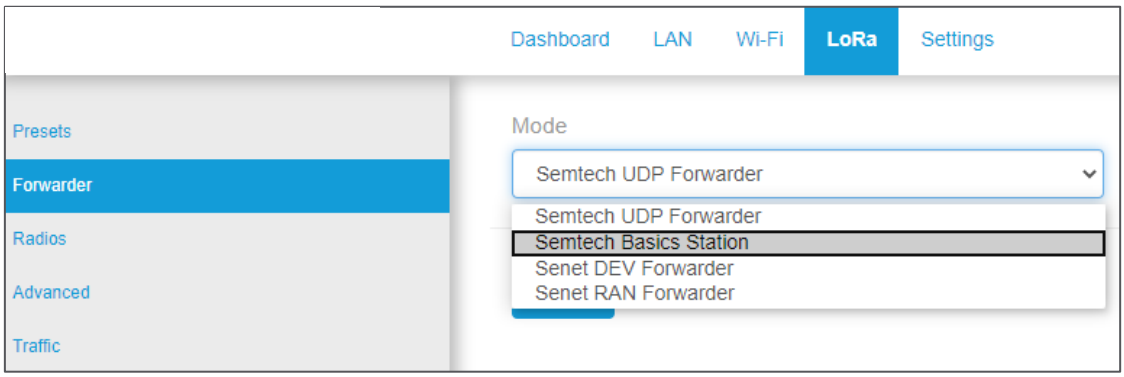


Figure 20: LoRa > Forwarder > Semtech Basics Station

4. Enter your address for the *LNS* (Figure 21). The format of LNS URL for 'TTI Enterprise - TTS V3' is usually;
   wss://<tenant-id>.<region>.cloud.thethings.industries:<port>
   TTI provides you with the URL including the tenant-id, region, and port. The default port number is 8887.

Note: If using 'TTN Community - TTS V3', the following URL can be used, depending on which region (EU, US, AU) the gateway is used.

- wss://eu1.cloud.thethings.network:8887
- wss://nam1.cloud.thethings.network:8887
- wss://au1.cloud.thethings.network:8887

---

5. Root certificates are available from https://www.thethingsindustries.com/docs/reference/root-certificates/.
   Download one of the following known working certificates for RG1xx:
   - ISRG Root X1 for 'TTN Community - TTS V3'
   - DST Root X3 for 'TTI Enterprise - TTS V3' (see 'Note' below)

Note: DST Root CA X3 by Lets Encrypt will expire on 29 September 2021, in advance of that expiration, The Things Industries are planning to switch The Things Stack Cloud TLS endpoints to ISRG Root X1 based certificates on **30 August 2021**

Alternatively, the *Minimal Certificate List* can be used if the strings between "-----END CERTIFICATE-----" and "-----BEGIN CERTIFICATE-----" are removed.
An example of the modified Minimal Certificate List can be downloaded from [HERE].

6. In *LNS Certificates*, click **Choose File** for *Server Certificate File* and **upload Certificate** (Figure 21)

7. Create a key file using the following command but replace NNSXS.xxxxx with gateway API Key that you generated in Section 5.2.1, step 9. The file must end with the proper CRNL sequence.

   In Windows Command Prompt

```
echo Authorization: Bearer NNSXS.xxxxx>tc.key
```

   In Linux

```
printf "Authorization: Bearer NNSXS.xxxxx\n">tc.key
```

In the *LNS Certificates* click **Choose File** for *Key File* and browse to the newly created file. Then, **upload Certificate**.

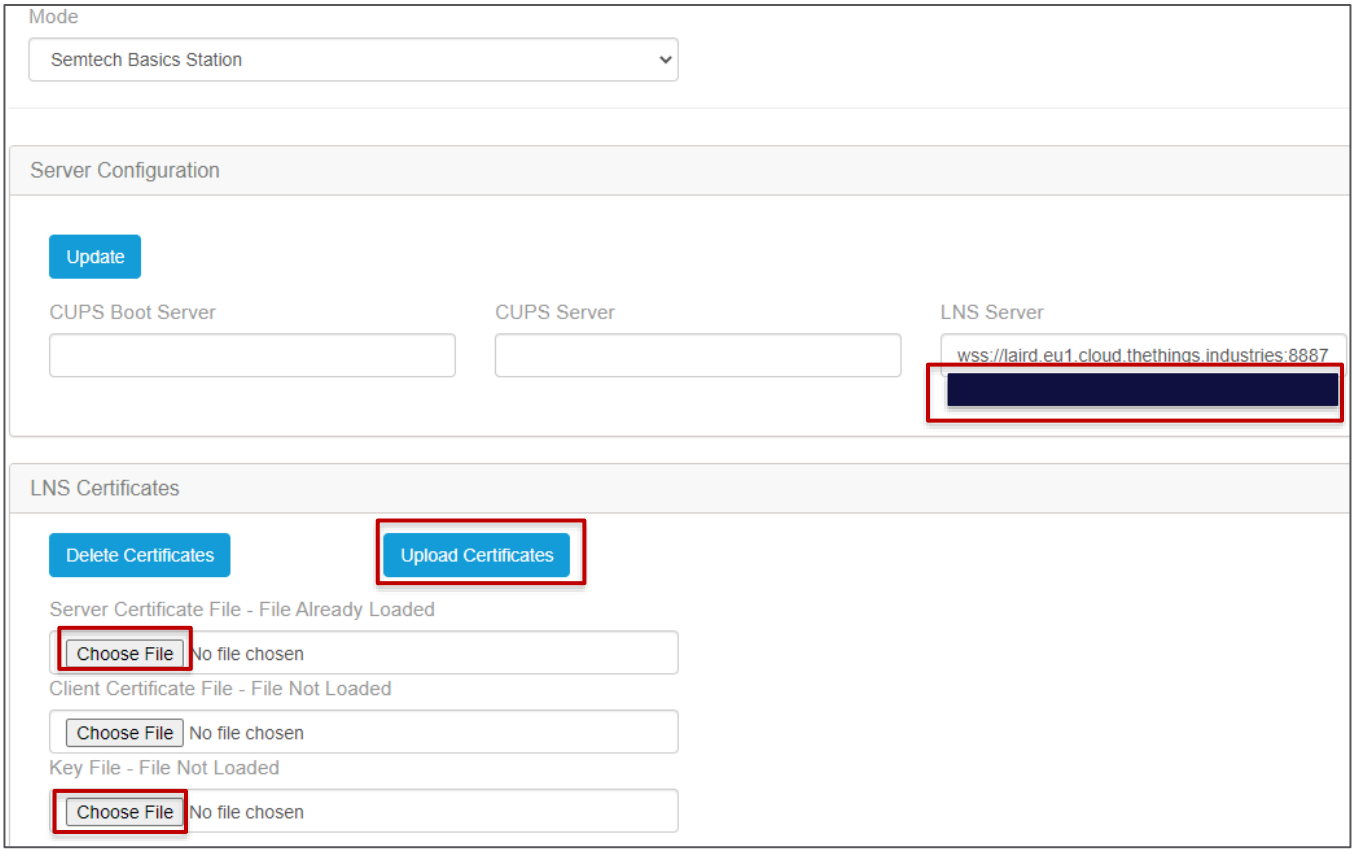


Figure 21: RG1xx Configuration page for Semtech Basics station

6.2 CUPS setup (Linux)

Alternatively, you can use a Configuration and Update Server (CUPS) to configure the LNS URL and certificates on the gateway. If using CUPS, the LNS credentials do not need to be configured, this will be done by the CUPS server.
You will need to install CLI provided by TTN first and then configure CUPS to send LNS API key. This setup is explained for Linux.
Refer to https://www.thethingsindustries.com/docs/getting-started/cli/installing-cli/ for installation on MacOS.

6.2.1 Install CLI in Linux

1. Open the `terminal` in Linux.
2. To install the `Package Manager`, run the below command in the `terminal`.

```
sudo snap install ttn-lw-stack
sudo snap alias ttn-lw-stack.ttn-lw-cli ttn-lw-cli
```

3. Create a file named `ttn-lw-cli.yml` by running the below command in `terminal`.

```
touch ttn-lw-cli.yml
```

To add configuration details, navigate to the https://www.thethingsindustries.com/docs/getting-started/cloud-hosted/addresses/ and enter the `tenant-id` and choose the `cluster` you want. After filling those details, you will see the configuration file details generated at the bottom of the page. Copy those CLI configuration details and paste them in the `ttn-lw-cli.yml` configuration file.

Note: If using 'TTN Community – TTS v3', refer to https://www.thethingsindustries.com/docs/getting-started/ttn/addresses/ to generate config file.

The following is an example for `ttn-lw-cli.yml` when `tenant-id` is `laird`.

```
oauth-server-address: 'https://laird.eu1.cloud.thethings.industries/oauth'

identity-server-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

gateway-server-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

network-server-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

application-server-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

join-server-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

device-claiming-server-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

device-template-converter-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

qr-code-generator-grpc-address: 'laird.eu1.cloud.thethings.industries:8884'

credentials-id: 'laird'
```

Note: The oauth-server-address and identity-server-grpc-address will be in the eu1 cluster even if you select the nam1 cluster.

4. Set path to configuration file into environment variable in order to connect to your deployment on `<tenant-id>.eu1.cloud.thethings.industries`.

```
export TTN_LW_CONFIG=/path/to/ttn-lw-cli.yml
```

Note: Before running the above command, please check the path of the ttn-lw-cli file and update in above command.

5. Use the following command to log in to your account. Also, ensure that the OAuth server address is your tenant address.

```
ttn-lw-cli login
```

6. It will generate link which you can open in a browser

```
INFO Revoking the old OAuth token...
INFO Opening your browser on https://<tenant-
id>.eu1.cloud.thethings.industries/oauth/authorize?client_id=cli&redirect_uri=local
-callback&response_type=code
WARN Could not open your browser, you'll have to go there yourself error=fork/exec
/usr/bin/xdg-open: permission denied
INFO After logging in and authorizing the CLI, we'll get an access token for future
commands.
INFO Waiting for your authorization...
```

7. Upon successful login, this message will appear in `terminal`

```
INFO Successfully got an access token.
```

6.2.2 Configure CUPS

1. Configure CUPS to send LNS API key. This setup will configure CUPS in The Things Stack to transmit LNS API key when a gateway connects. Replace "your-gateway-id" with your gateway ID in The Things Stack and "your-lns-api-key" with LNS API Key you generated in Section 5.2.1 step 7.

```
export GTW_ID="your-gateway-id"
export LNS_KEY="your-lns-api-key"
export SECRET=$(echo -n $LNS_KEY | xxd -ps -u -c 8192)
ttn-lw-cli gateways update $GTW_ID --lbs-lns-secret.value $SECRET
```

2. Create another gateway API for CUPS as instructed in Section 5.2.1 step 7, but choose the following rights for the API key.

- View gateway information
- Edit basic gateway settings
- Retrieve secrets associated with a gateway

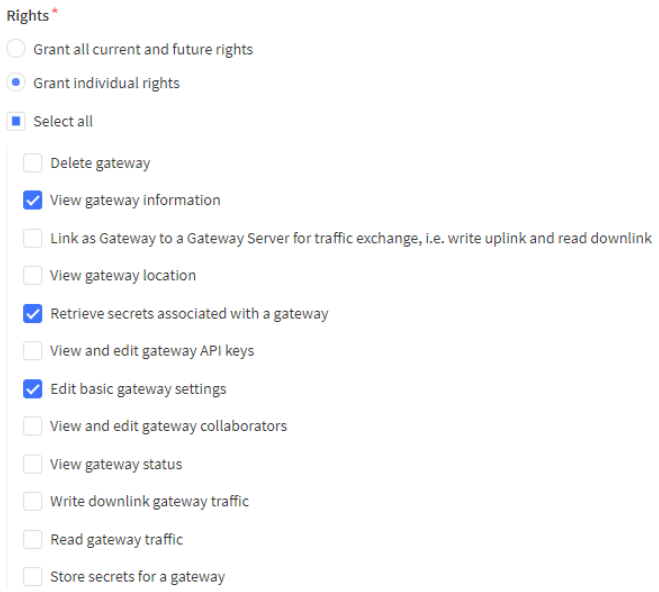


Figure 22: Rights for CUPS API Key

3. Create CUPS key file using CUPS key created in step 2

```
export CUPS_KEY="your-cups-api-key"
echo "Authorization: Bearer $CUPS_KEY" | perl -p -e 's/\r\n|\n|\r/\r\n/g'  >
cups.key
```

4. Set URL for CUPS server on RG1xx under LoRa > Forwarder.

https://<tenant-id>.<region>.cloud.thethings.industries:443

Note: If using 'TTN Community - TTS V3', the following URL can be used, depending on which region (EU, US, AU) the gateway is used.

- https://eu1.cloud.thethings.network:443
- https://nam1.cloud.thethings.network:443
- https://au1.cloud.thethings.network:443

Figure 23: CUPS Boot and CUP Server

5. Upload the same server certificate used for LNS to CUPS Certificates > Server Certificate and cups.key to key file.

- DST Root X3 for 'TTI Enterprise - TTS V3'

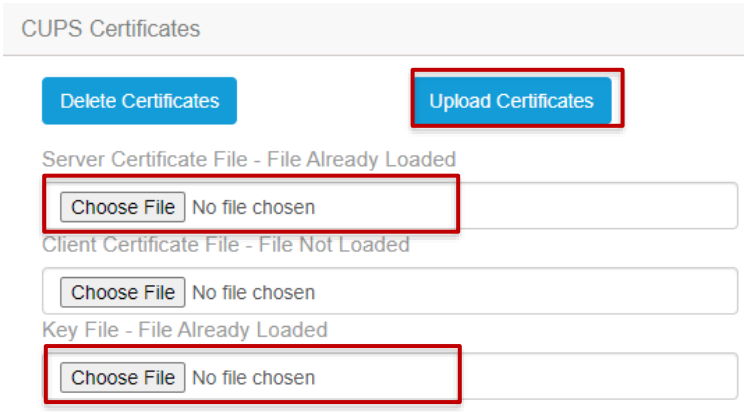


Figure 24: CUPS Configuration

7 Setting up RS1xx to send data to The Things Stack

7.1 Configuring RS1xx

Download Sentrius app from Google Play or Apple App store if you do not have the app yet.

1. Press physically Bluetooth button on RS1xx and it will start advertising with its Dev EUI and MAC address.
2. Start Sentrius mobile application. It will start scanning for RS1xx device.
3. Choose the target device in scan list to connect to it.
4. Click gear icon under LoRa Radio Settings and Info, and configure DevEUI, AppEUI and AppKey as well as Operating mode. (In this example, "Laird2" was used) Leave Channel Mask to sub-band 2.

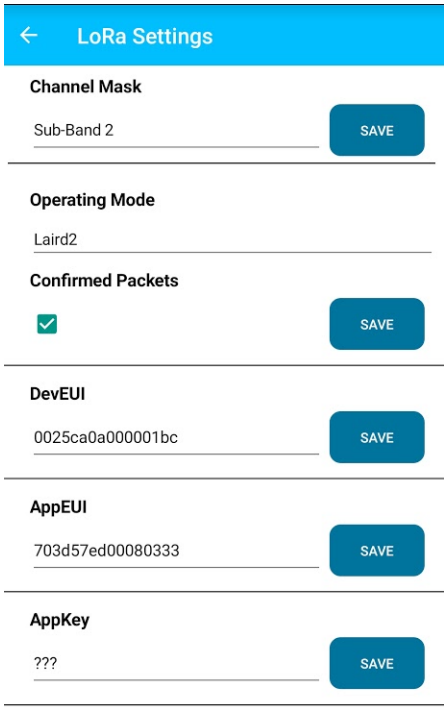


Figure 25: LoRa configuration in Sentrius mobile app

7.2 View RS1xx Data on The Things Stack (TTS)

To view RS1xx data on The Things Stack, do the following:

1. Click **Applications** at the top of The Things Stack console page.
2. Choose the application ID which contains the **end-device** you want to see the data from
3. Choose the **end-device** you want to see the data from and select 'Live data'
4. The TTN/TTI device repository contains device codecs for the Ezurio range of LoRaWAN Sentrius RS1xx sensors, meaning you'll see start seeing the decrypted data when the Laird or Laird 2 packet formats are selected on the sensor.
   When selecting Cayenne packet format on the sensor side, the console will still present decrypted data, however, you'll first need to select 'Payload formatters' and choose 'CayenneLPP', the 'Save changes.

   At the time of writing this, neither 'The Things Network TTS V3 – Community or The Thing Industries TTS V3 – Enterprise support the Cayenne integration which was available on the previous TTN/TTI v2 stack.

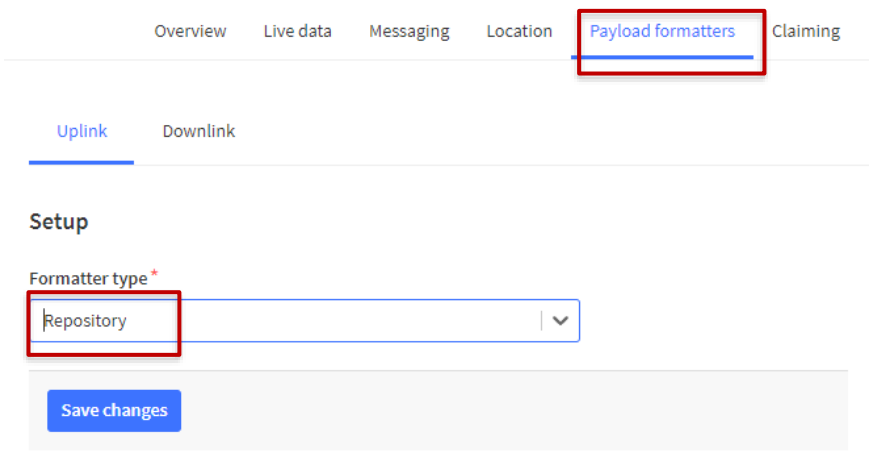


Figure 26: Payload formatter

5. Click **Live data** tab

Figure 27: Live data from RS1xx

1 Additional Information

Please contact your local sales representative or our support team for further assistance:

Headquarters	Ezurio 50 S. Main St. Suite 1100 Akron, OH 44308 USA
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