TEKTELIC COMMUNICATIONS INC.

GEOLOCATION SERVER
QUICK START GUIDE

DOCUMENT VERSION: 1.0

PRODUCT NAME: GEOLOCATION RESOLVER AND SERVER (GRS)

Revision History

Version	Date	Status	Editor	Comments
0.1	Aug 19, 2019	Draft	JP	Document created
0.2	Aug 22, 2019	Draft	PD	Document revised
0.3	Aug 22, 2019	Draft	JP	Formatting updated
0.4	Sept 9, 2019	Draft	JP	Formatting revised, Section headings changed, TOC updated
1.0	Sept 10, 2019	Released	PD	Document revised and released

Table of Contents

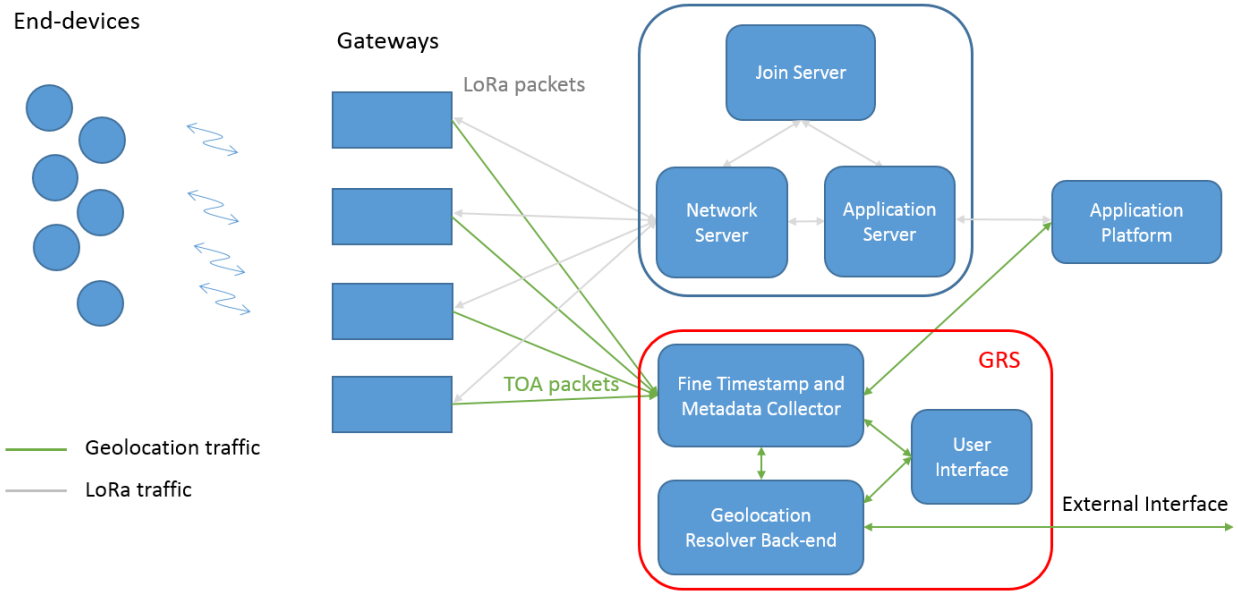
Table of Contents

1 Introduction

The Geolocation Resolver and Server (GRS) is made up of three main components:

1. Fine Timestamp and Metadata Collector (FTMC) which collects and keeps track of the time-of-arrival (TOA) packets originated from different devices and gateways and handles geolocation requests/responses.
2. the Geolocation Resolver (GR) back-end which runs the multilateration algorithm given a set of TOA packets.
3. User Interface (UI) that allows the user to configure and interact with the first two components.

The TOA packets carry the fine timestamps and other relevant metadata. A geolocation-enabled gateway generates a TOA packet upon receiving an UL frame. The TOA packets can be sent out to the GRS either directly from the gateway in what is called the Network Server Independent (NSI) architecture or they can be first sent to the network server and then to the GRS in what is called Network Server Dependent (NSD) architecture. The current version of the GRS only supports the NSI architecture which is the focus of this document. The figure below shows the GRS in an NSI architecture.



For further reference please see the document entitled Geolocation FAQ located in the TEKTELIC Support portal (navigate to KB -> Geolocation -> Geolocation FAQ and click on the attachments to see the PDF document).

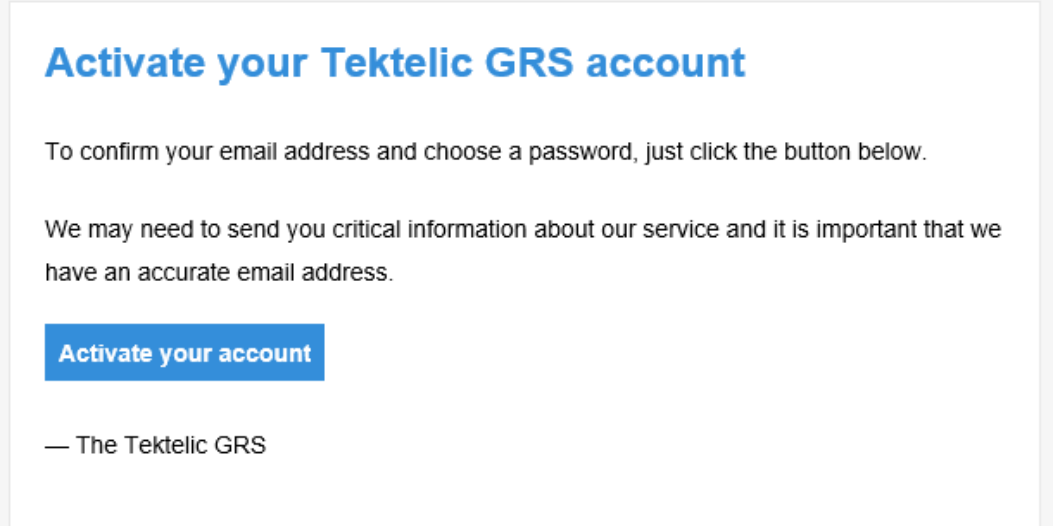
1.1 Hardware Requirements

The current version of the GRS only supports geolocation-enabled TEKTELIC gateways, i.e., the geolocation-enabled Macro gateways and the Mega gateways. Support for gateways from other vendors may be added in the future. After purchasing a Geolocation spec gateway, a software update may be required to install the latest geolocation packages. Please check with TEKTELIC if you have any questions regarding the current software load on your geolocation enabled gateways.

1.2 GRS Credentials

Access to the geolocation server can be requested through our customer support portal. If you do not have access to the TEKTELIC support portal you can sign up at https://support.TEKTELIC.com/portal/home.

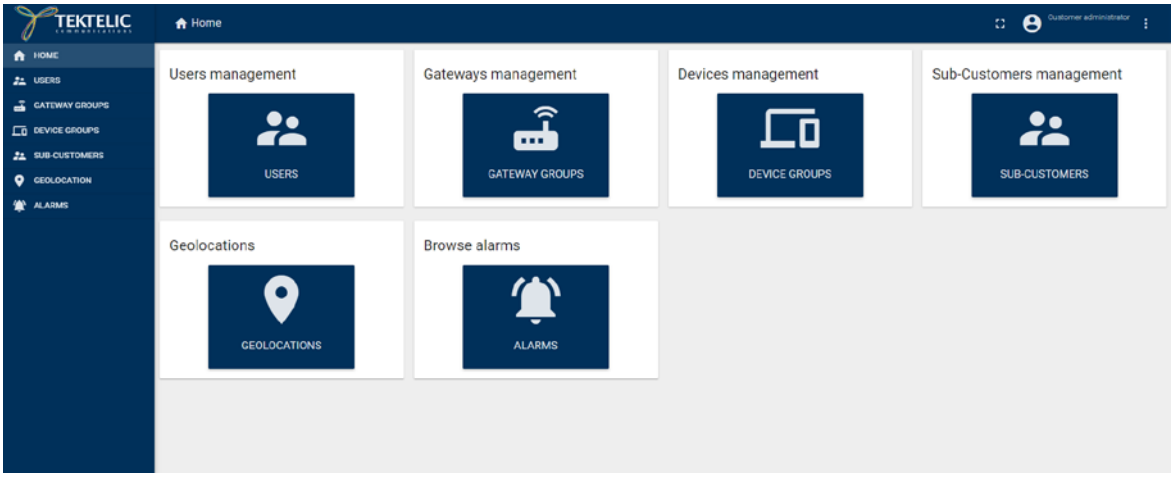
Once logged into your support portal account please create a ticket and request access to the TEKTELIC Geolocation Resolver Server (GRS). When this account is created you will be sent an email with a link to login.



1.3 User Interface

Generally, you will be provided a Customer Administrator account. The GRS home page for a Customer Administrator displays the following options: Users, Gateway Groups, Device Groups,

Sub-Customers, Geolocations, and Alarms. Note that these items are also displayed on the left-hand menu for easy access at any time.



Users: Use this function to create new user accounts for your network. You can create 4 different account types depending on the amount of access required.

- Customer Administrator – This level of access is able to:
  - Create and manage Gateway Groups.
  - Create and manage Device Groups.
  - Create and manage Sub-Customers.
  - Assign Device Groups to Sub-Customers
  - Geolocate own devices
- Customer User – Read Only access to Customer level.
- Sub-Customer Administrator- this level of access is able to:
  - Create and manage Device Groups.
  - Geolocate own devices.
- Sub-Customer User – Read only access to Sub-Customer level.

Gateway Groups: Navigate here to add/remove gateway groups and gateways within those groups and to monitor gateway activities

Device Groups: Navigate here to add/remove device groups and devices within those groups and to monitor device activities.

Sub-Customers: Add, delete or modify sub customer settings.

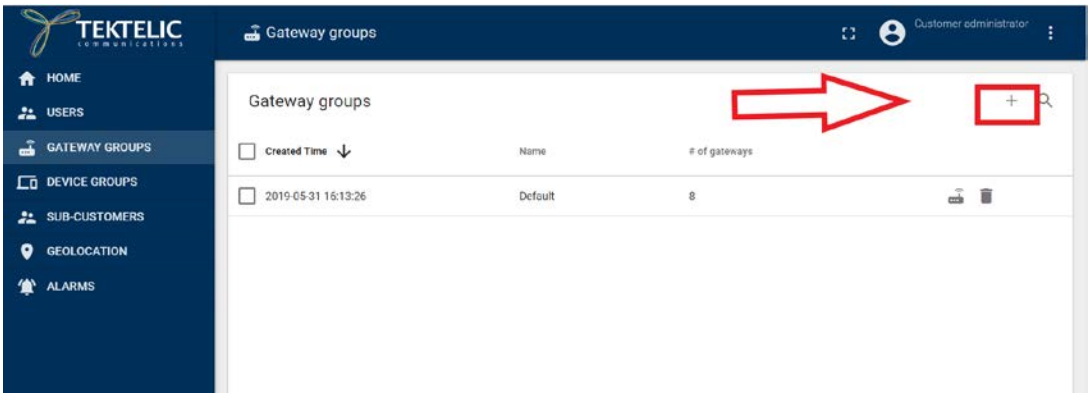
Geolocations: Navigate here to locate your devices on the map.

Alarms: This functionality is not currently in use on the GRS. Alarm functionality will be added in a later release.

2 Commissioning Gateways

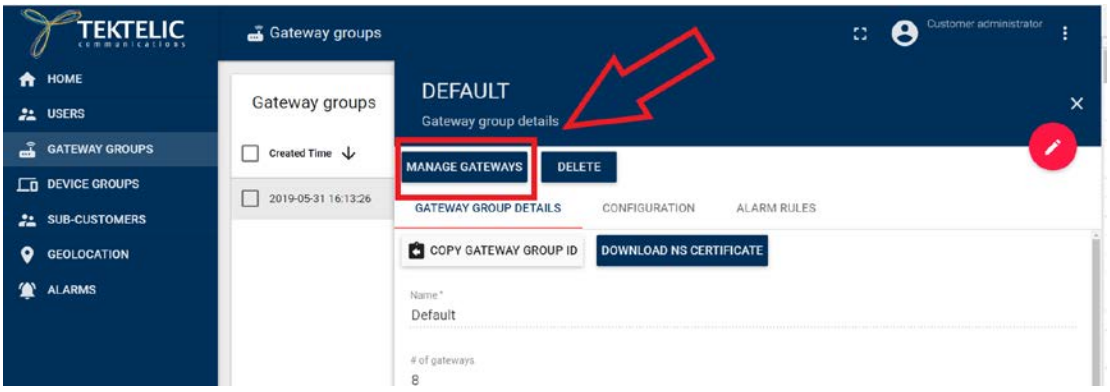
2.1 Creating Gateway Groups

Navigate to the Gateway Groups screen. To create a new gateway group, select “+” (Add Gateway group) in the top right corner. All Gateway groups require a name, but description is optional.

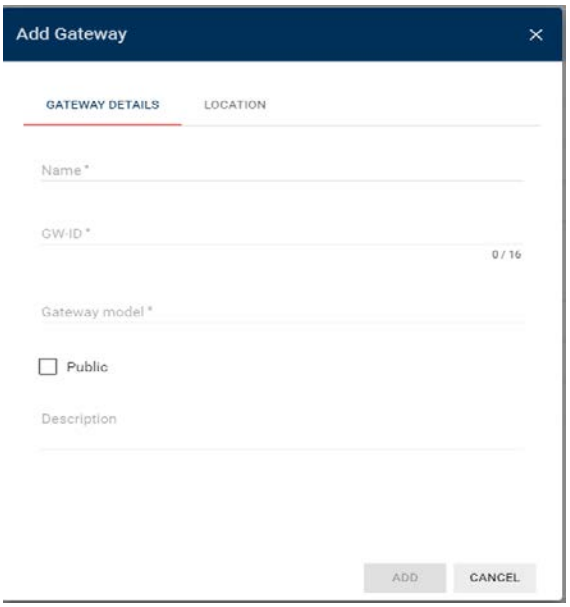


2.2 Adding Gateways

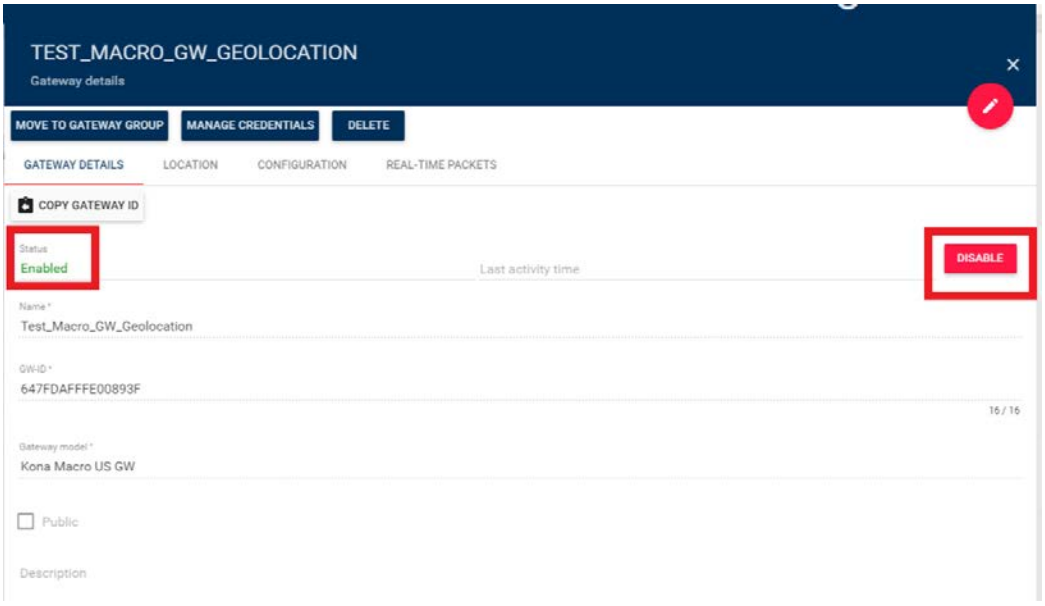
1. Click the gateway group you wish to edit and select the Manage Gateways button, and select the “+” icon in the top right corner, similar to creating gateway groups above.



2. Enter your Gateway Name (user defined) and GW-ID (GW EUI), and select your Gateway Model from the list. Verify the information is correct and then click the add button.



Your gateway is now added on the GRS. When a new gateway is added to the GRS, it is “Enabled” by default. The “enabled” status means that the TOA packets generated by that gateway will be used in the multilateration algorithm. If you wish to exclude a particular gateway from being used by the algorithm (e.g., to see the effect of various network geometries on location estimates, or for debugging), click on the gateway and select “Disable”.



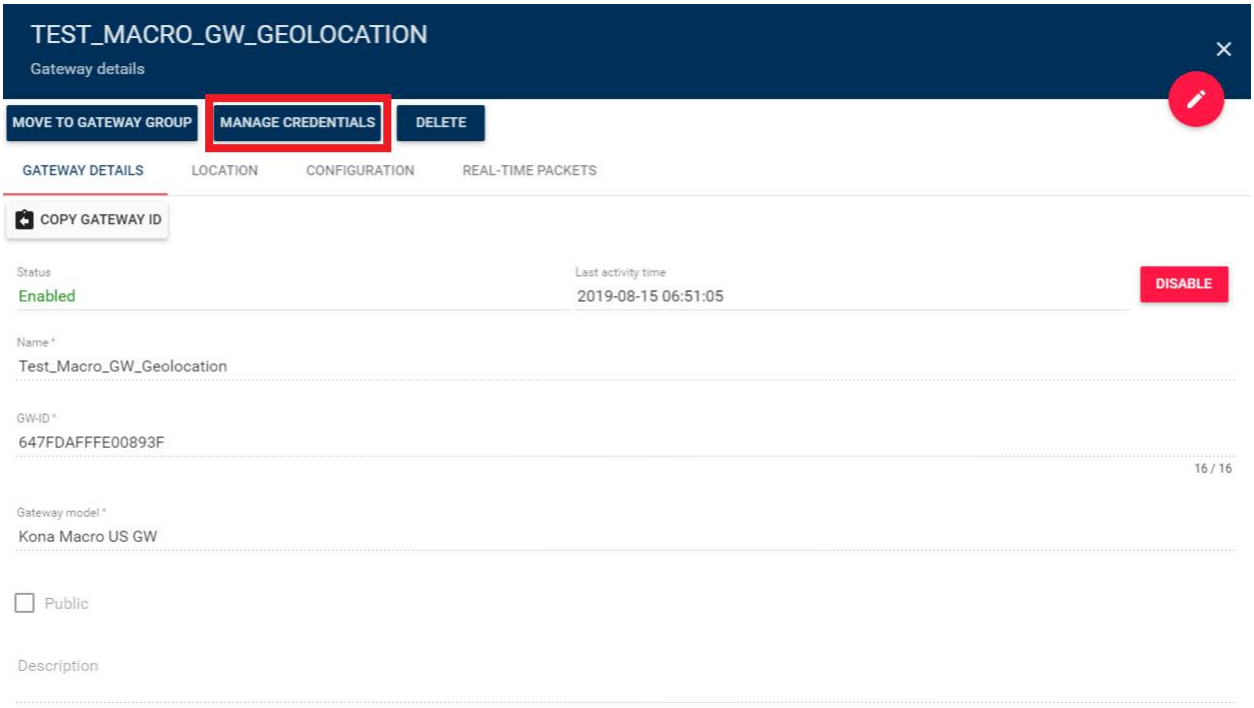
Geolocation requires at least 3 gateways in order to locate a device. Repeat the above steps for each gateway you would like to add.

2.3 Gateway Credentials

Once a gateway is added, its credentials on the GRS need to be configured to match those on the gateway. These are the credentials used by the MQTT bridge on the gateway to establish a connection to the GRS. The steps to configure these credentials are as follows:

1. Look for the geolocation server credentials in the gateway MQTT configuration file found at /etc/default/mqtt-bridge.conf. The username is by default the same as the GW EUI and the password is a pseudo-random sequence derived from the GW EUI.
2. In the GRS, open up the gateway details page by clicking on the gateway, click on the "Manage Credentials" button and enter the credentials from Step 1.

Alternatively, you can enter the gateway credentials generated by the GRS into the MQTT configuration file on the gateway.



3 Commissioning Devices

3.1 Creating Device Groups

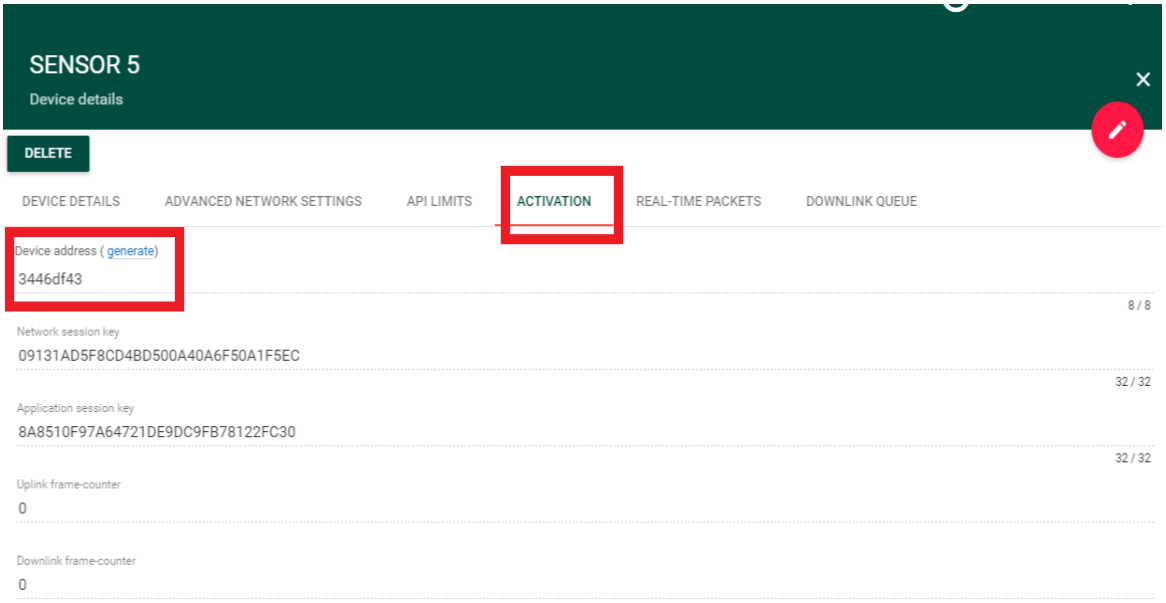
Device groups are like folders to keep your devices organized. All devices require a device group in order to be added to the GRS. This process is identical to the Gateway Group section above.

1. Navigate to the Device group screen
    - Select “+” (Add Device Group) in the top right corner
    - All a new Device Groups requires is a name. Enter the name and then select “add” button.

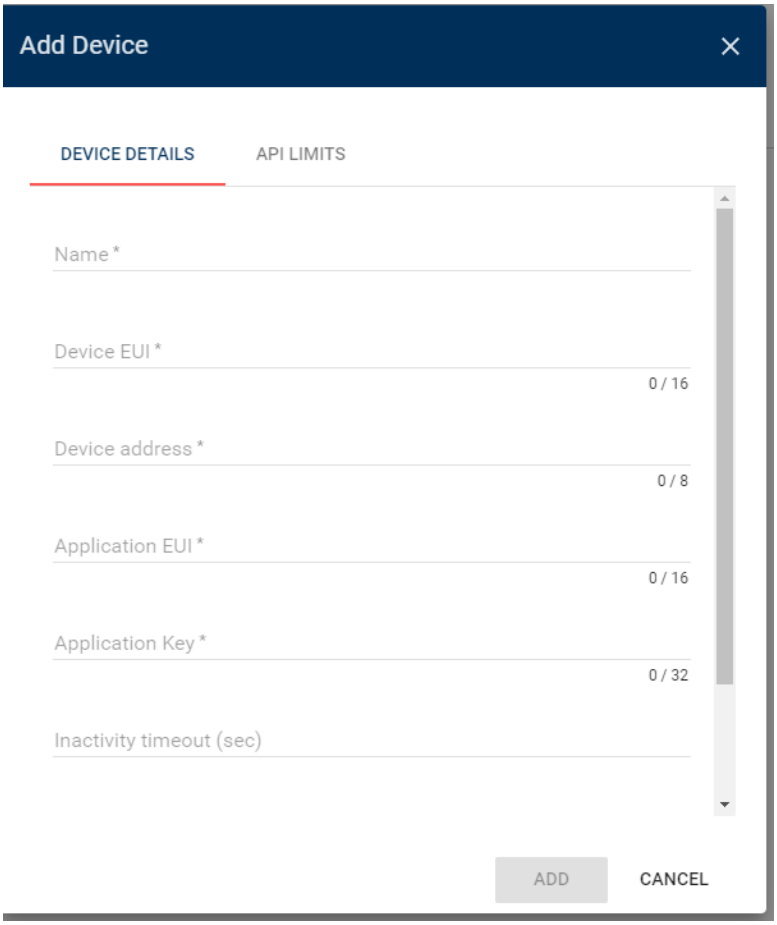
3.2 Adding Devices

As with the network server you will need the DevEUI (Device EUI), AppEUI (Application EUI), AppKey (Application Key) to commission a device. These commissioning values can be obtained from the device manufacturer. If you have a TEKTELIC device, you should have received these values in the box with your device. A Soft copy can also be sent upon request via the support portal.

In addition, you will also require the DevAddr (Device Address). This is obtained from the Network Server after the device is joined. In the case of TEKTELIC Network Server, this information is found by selecting the device (through Applications -> Manage Devices) and navigating to the activation tab. Please refresh the screen before reading the DevAddr value from the activation tab (this tab does not get automatically updated in case the DevAddr value changes as a result of a rejoin). Also note that, depending on the NS implementation, the DevAddr of a device may change every time it rejoins the NS. If that happens, the DevAddr field in the GRS must be updated to reflect the new value.



1. Navigate to the device group you wish to add a device to and press the “+” icon in the top right-hand corner.
2. Name your device and enter the correct commissioning information. Verify the information is correct and then click the add button.

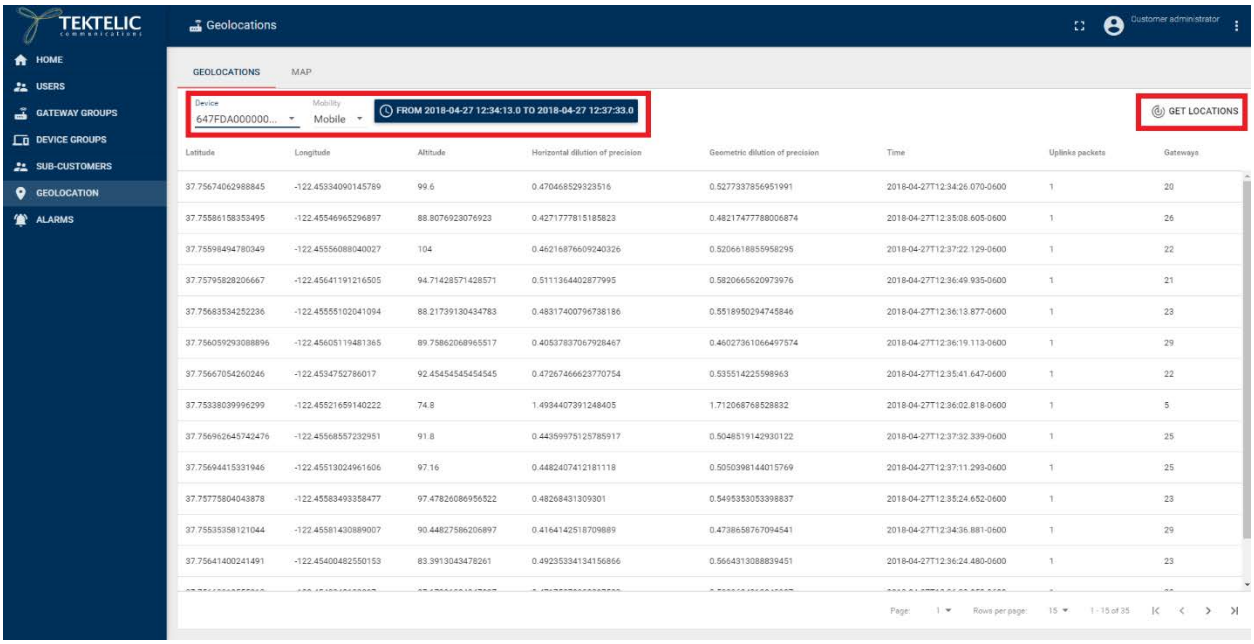

Add Device
DEVICE DETAILS
API LIMITS
Name *
Device EUI *
0 / 16
Device address *
0 / 8
Application EUI *
0 / 16
Application Key *
0 / 32
Inactivity timeout (sec)
ADD
CANCEL

4 Geolocation Results

The GRS provides two interfaces for locating the devices:

1. the Geolocation tab in the UI
2. An API that allows any application to send/receive geolocation requests/responses to/from the GRS (over HTTP or MQTT).

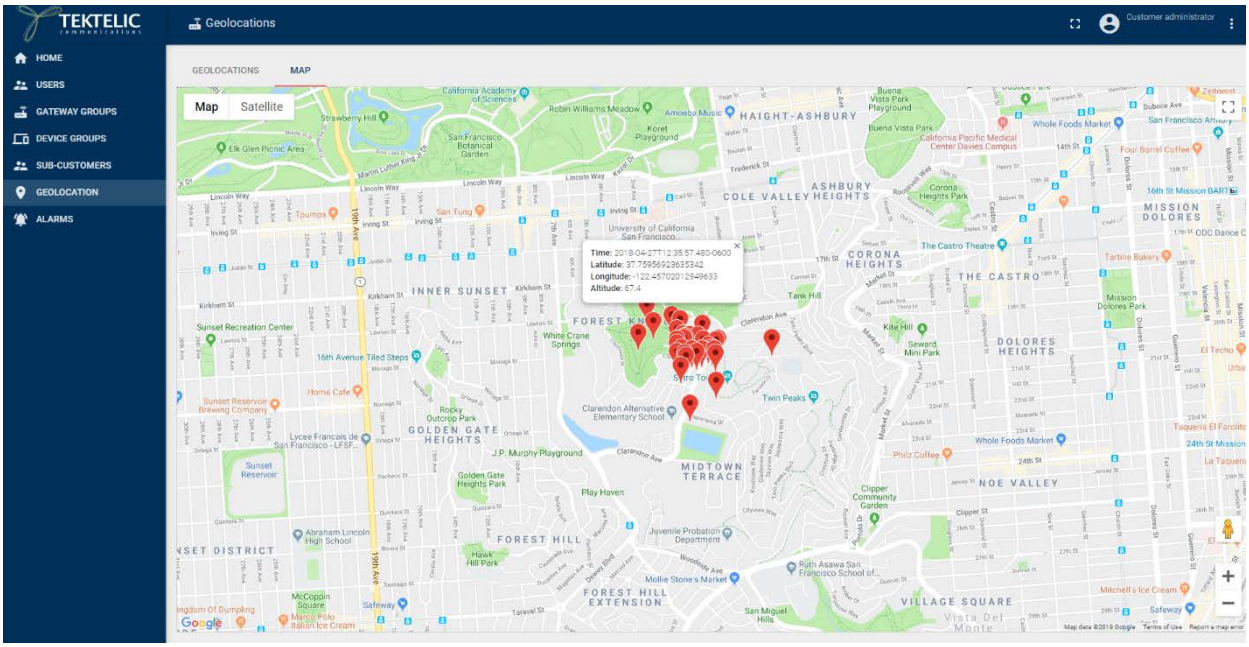
In this document, we will only cover the first method. The second method (i.e., the geolocation API) will be described in a separate document. To view the geolocation results using the UI, navigate to the Geolocation tab. Here you have an option to view your locations either as a list view or on a map. On the Geolocations, select a particular device from the drop-down menu. Then select a time interval within which you are interested to locate the device. The time interval can either be set in an absolute way (i.e., from time t1 to time t2) or relative to now (e.g., in the last 2 days). You can then indicate if the device is stationary or mobile. If a device is defined as mobile, the resolver will potentially return multiple location results, one for each UL frame received within the time interval of interest. However, if the device is defined as stationary, the resolver will use all UL frames received within the time interval of interest to calculate a single location for the device. Once you have selected the desired settings, press the “Get Locations” button in the top right of the screen.



The geolocation results are displayed in columns “Latitude”, “Longitude” and “Altitude”. The column “Gateways” indicates the number of gateways used to calculate the location estimate.

The column “Uplink packets” indicates the number of UL packets (UL frames) used to calculate the location estimate. This will be equal to 1 (by definition) when the device is indicated as mobile. However, it may be a number larger than 1 if the device is indicated as stationary. “Horizontal dilution of precision” (HDOP) and “Geometric dilution of precision” (GDOP) are indicators of your network geometry. The HDOP reflects the uncertainly in the estimated x and y coordinates while GDOP reflects the uncertainty in the estimated x, y, and t coordinates where t is the transmission time of the sensor which is calculated as a by-product of the multilateration algorithm but not shown in the resolver results. For both values a smaller number indicates less uncertainly. Ideally, a number less than 1 indicates ideal conditions.

From the map view, the reported locations of your selected device can be seen on a map layer. To view the coordinates of a particular location estimate, simply click the location to display the information window.

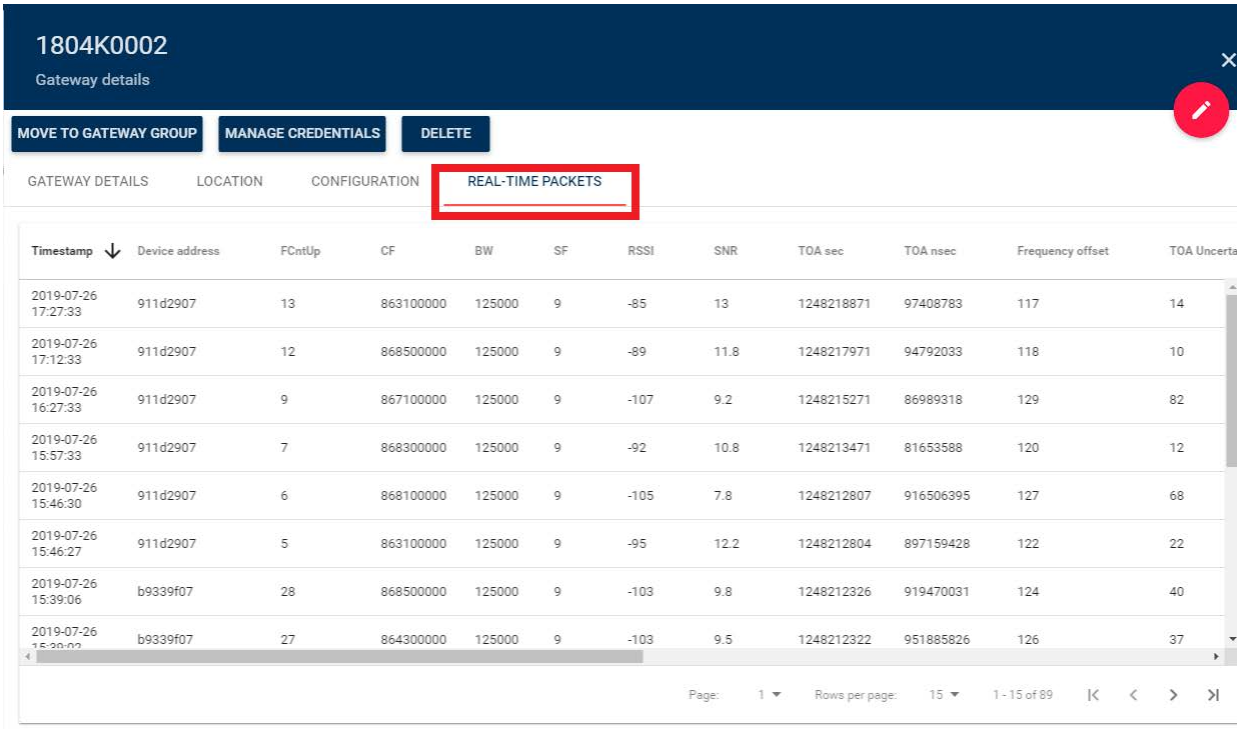


5 Troubleshooting and monitoring

A couple of tools are available in the GRS to monitor the gateways and the devices for troubleshooting purposes.

5.1 Gateway real-time packets

Navigate to the gateway details page (by clicking on a gateway group and then selecting a gateway) and click on the real-time packets tab. Here you can see all TOA packets (fine timestamp + metadata) generated by this gateway that are originated from any of the commissioned devices.

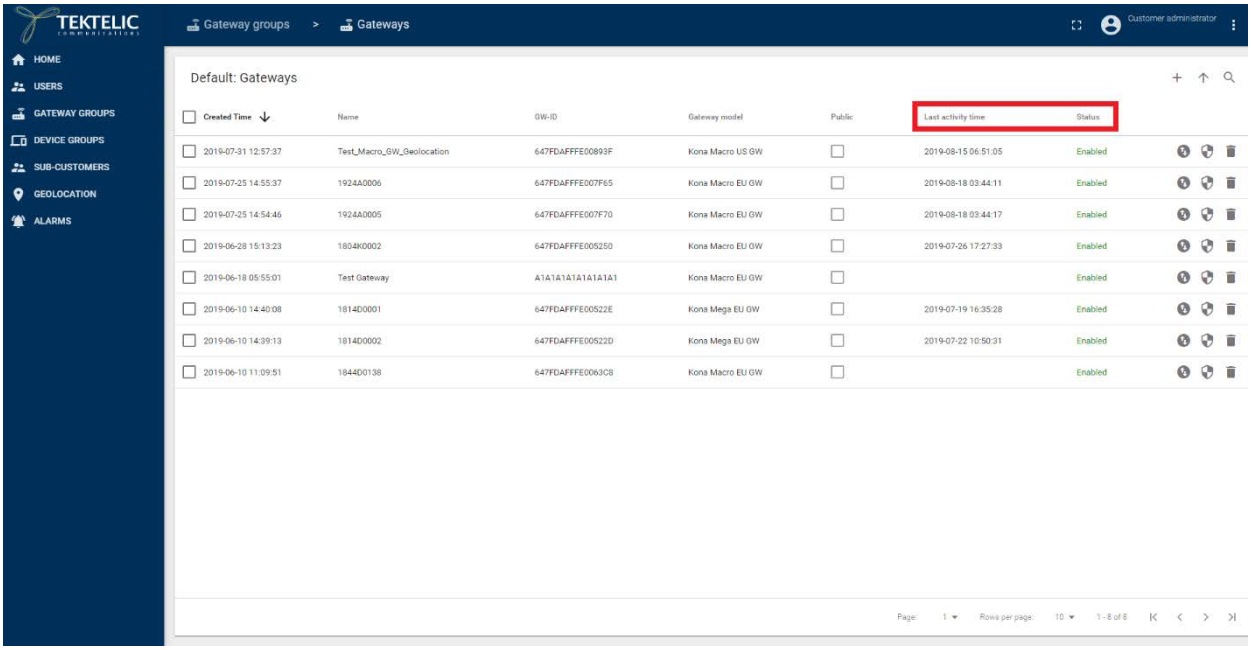


5.2 Gateway last activity time

Navigate to gateway groups and select a gateway group. Here you can see a list of all commissioned gateways. The column “Last activity time” shows the time instance at which the GRS received the most recent TOA packet from the gateway or the time instance at which the most recent MQTT connection was established between the gateway and the GRS. The “Last activity time” of the gateway can also be seen under the Gateway details page.

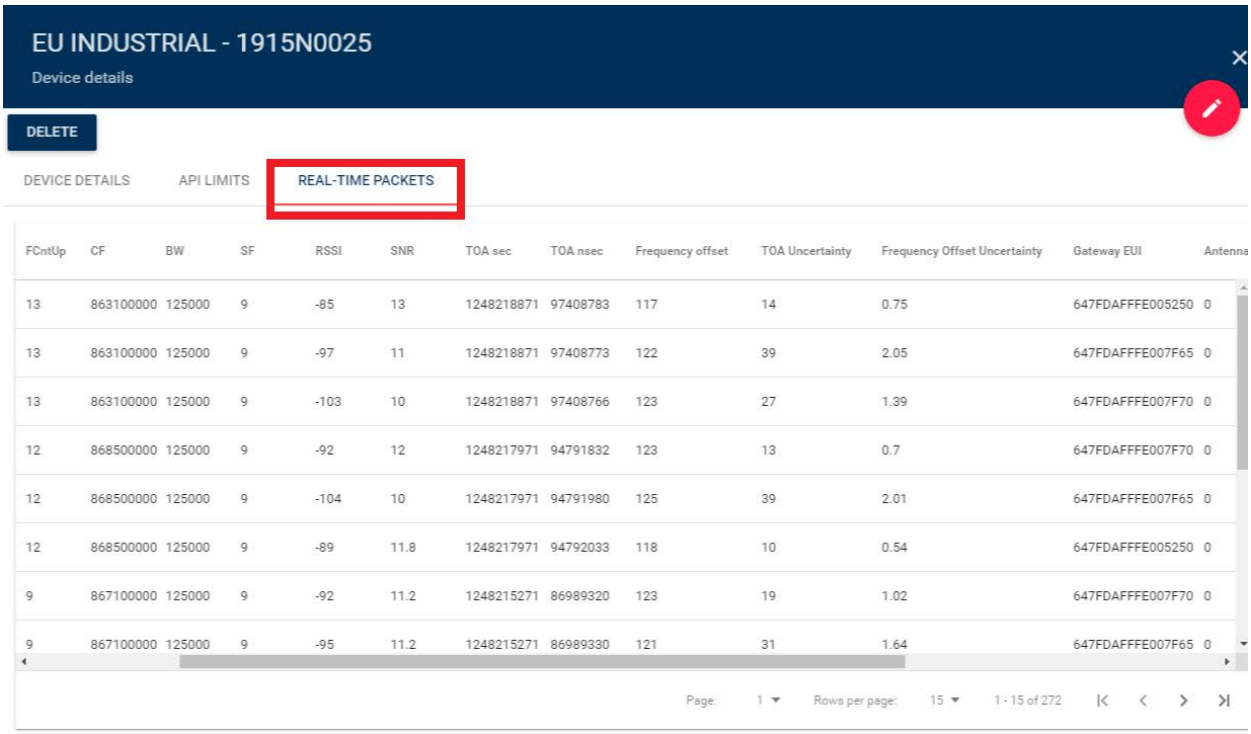
5.3 Gateway status

The column “Status” shows the Enabled/Disabled status of the gateway which is manually set by the GRS user as described in Section 4.2. Please note that this is different from the gateway status column in the TEKTELIC network server. The “status” of the gateway can also be seen under the Gateway details page.



5.4 Device real-time packets

Navigate to the Device details page (by clicking on a device group and then selecting a device) and click on the real-time packets tab. Here you can see all TOA packets (fine timestamp + metadata) associated with this device that are generated by any commissioned gateway.

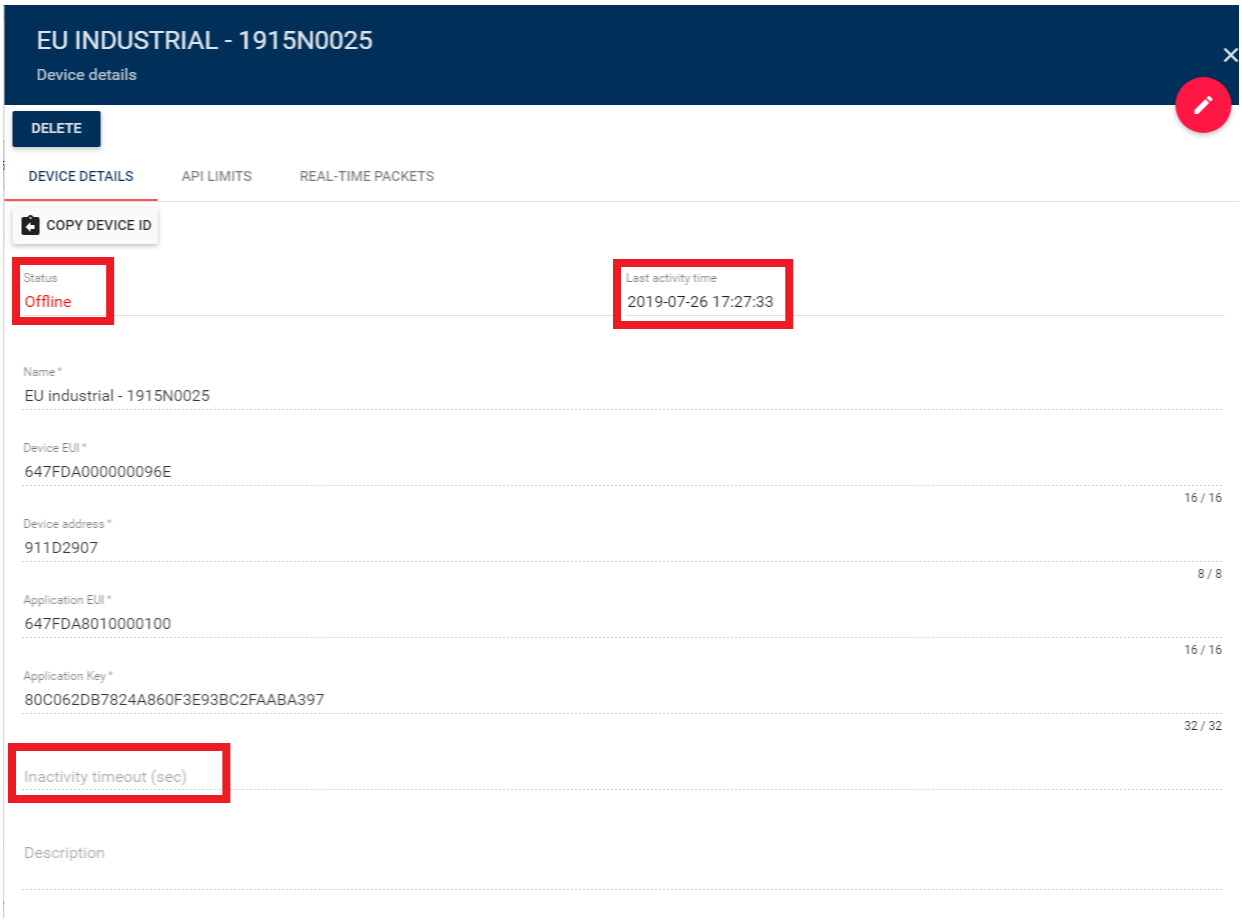


5.5 Device last activity time

Navigate to device groups and select a device group. Then click on a device to open up the device details page. Here you can see the “Last activity time” of the device which reflects the time instance at which the GRS received the most recent TOA packet originated from that device and generated by any of the commissioned gateways.

5.6 Device status

Navigate to device groups and select a device group. Then click on a device to open up the device details page. Here you can see the device “status” which can be either online or offline. The device status turns “online” if the current time minus the “last activity time” is less than “Inactivity timeout” threshold and turns offline otherwise. The “Inactivity timeout” is set to 5 minutes by default but can be configured by the user through the device details page. The device status can also be seen in the “Manage devices” page of a device group.


EU INDUSTRIAL - 1915N0025
Device details
DELETE
DEVICE DETAILS
API LIMITS
REAL-TIME PACKETS
COPY DEVICE ID
Status
Offline
Last activity time
2019-07-26 17:27:33
Name *
EU industrial - 1915N0025
Device EUI *
647FDA000000096E
16 / 16
Device address *
911D2907
8 / 8
Application EUI *
647FDA8010000100
16 / 16
Application Key *
80C062DB7824A860F3E93BC2FAABA397
32 / 32
Inactivity timeout (sec)
Description