# SEMTECH

# LoRa Edge™ Tracker Reference Design Evaluation User Guide

# ("User Guide")

**July 2020**

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# LoRa Edge<sup>TM</sup> Tracker Reference Design Evaluation Kit Welcome

## Welcome!

The LoRa EdgeTM Tracker Reference Design Evaluation Kit ("Kit") is a portable reference Kit designed to introduce the LR1110 tracking capabilities with LoRa Cloud Services integrated with premium and showcase LoRaWAN network coverage around a building or site and to accelerate solution development for a wide range of stakeholders. The self-contained nature of this reference Kit makes it easy to set up, take down, and move a network in a matter of minutes.

Users can determine a gateway's range of coverage by moving the location of the sensors to different places around a building. Furthermore, solution developers can focus on providing customer value through data collection and analysis by using off-the-shelf hardware available from external suppliers.

The GPS location data of each tracker is displayed on a dashboard that users can access through a web browser. The dashboard shows the type of displays that can be created with the data collected (See Figure 15 and Figure 16). The URL for the dashboard, and how to locate the login credentials for your Kit, are explained in the *Getting Started* section of this guide.

**Note:** This Kit does not allow direct access to the underlying data or the ability to change the LoRaWAN network server (LNS) to which the gateways are connected. If those features are desired requirements, please contact Support at TrackerSupport@tago.io.

## What is in the Kit?

The Kit contains the following items:

- 2 LR1110-based Tracking Devices
    - Tracker on/off magnets (2) (not pictured)
    - Toolset for battery door removal (not pictured)
    - Extra batteries (not pictured)
- 1 LoRaWAN gateway with Ethernet backhaul
    - Power brick with cable
    - LoRa antenna with adapter (1)
    - Ethernet cable (1)

*Figure 2: LoRaWAN gateway with 3G/4G LTE (Cellular) backhaul*

## System Overview

The LoRa Edge[TM] Tracker Reference Design Evaluation kit demonstrates and highlights the various aspects of a LoRaWAN asset tracking system. The elements used in this system are highlighted in the following diagram.
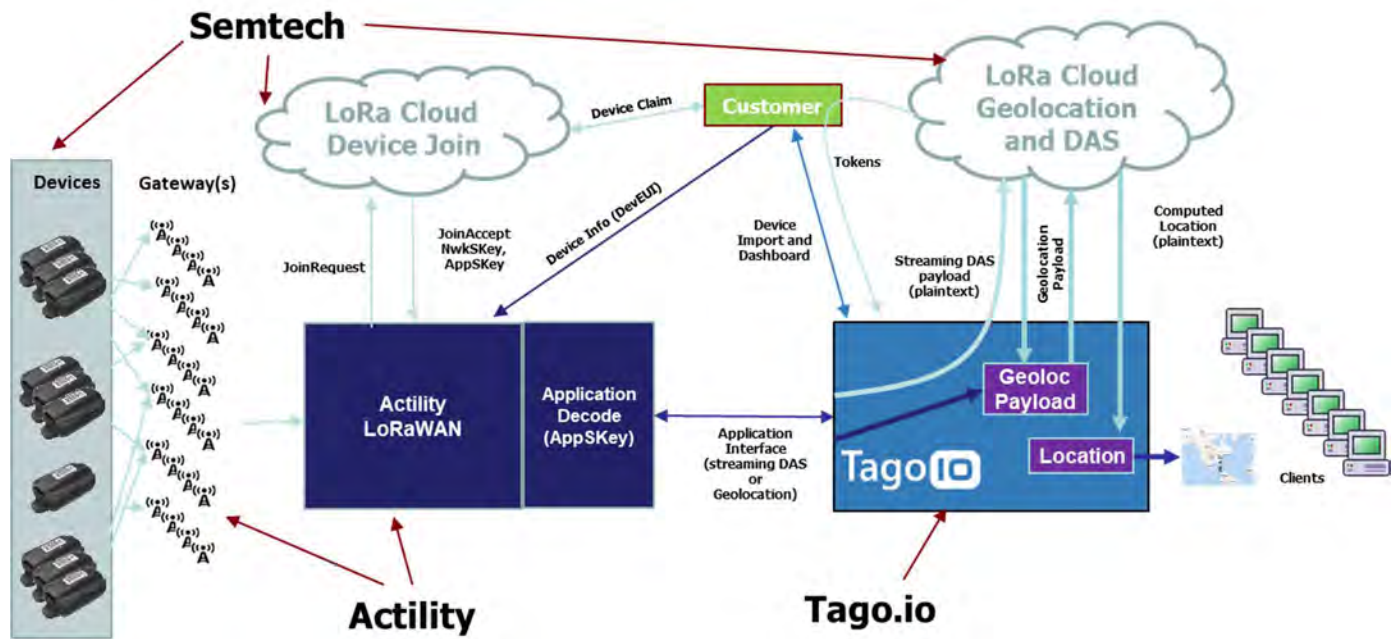
The data flow proceeds from the LR1110 Tracking devices through the provided gateway in the kit to the Actility LoRaWAN network server. This server manages the LoRaWAN network Join process through the LoRa Cloud™ Device Join Server and once the LR1110 devices have joined the network, the Actility LoRaWAN server is the conduit for data to and from the application service hosted by Tago.io. The Tago.io service provides the interface to the position computation engine hosted on the LoRa Cloud™ Device & Application and Geolocation Services and then provides tracking data for the devices available through a web browser. Each part of this system is independently scalable to any size application as might be deployed. This demonstration is the end-to-end deployment example of the latest LoRa® tracking solutions.

Not pictured is the Mobile Device Command and Control application that can run on IOS or Android devices that can talk directly to the LR1110 Trackers to initialize and prepare them for operation.

## Setting up the Kit Hardware

### Gateway Connections

The gateway body has multiple connectors for antennas and cables. The following table describes those connections.

| ANT 1 | GPS antenna connector (N-type female) |
|---|---|
| Ethernet | Power-over-Ethernet connector |
| ANT 2 | 3G/4G antenna connector (N-type female) |
| ANT 3 | 915/868 MHz LoRa antenna connector (N-type female) |
| 3G/4G | Access port for 3G/4G SIM card |
| ANT 4 | 915/868 MHz antenna connector (not connected) |

*Figure 3: Gateway connections*

## About the Gateway

The ODU gateway is an 8-channel LoRaWAN-compliant gateway with external antennas. This gateway has the following features:

- Support for LoRa Basics™ Station
- Gateway ping
- Support for LoRaWAN 1.0.2 or higher
- 8+ LoRa channels
- External antenna (for greater range)
- Indoor/Outdoor form factor
- Modular support for 3G/4G
- Optional features (Not supported out-of-the-box)
  - GNSS/precise timing support (for GNSS aiding messages/synchronized downlinks)
  - Outdoor mounting support
  - IP67 rating for outdoor mounting

## Gateway Setup

To set up the gateway, follow the steps below.

**Note:** Do not connect power until all antenna connections are complete.

### Step 1: Connect the adapter to the LoRa antenna



*Figure 4: Adapter connection*

### Step 2: Connect the LoRa antenna to the gateway (ANT3)



*Figure 5: Connecting the LoRa antenna to the gateway*

**Step 3: Connect the Ethernet cable to the gateway**



*Figure 6: Connecting the Ethernet cable to the gateway*

**Step 4: Connect the Ethernet cable to the power brick.**
**NOTE:** Do not connect Ethernet plug to the jack on the right



*Figure 7: Ethernet cable connected to the power brick*

**Step 5: Connect the Cellular antenna (ANT2)**



*Figure 8: Connecting the Cellular antenna to the gateway*

**Step 6: (Optional) Connect the GPS cable to the GPS Antenna**
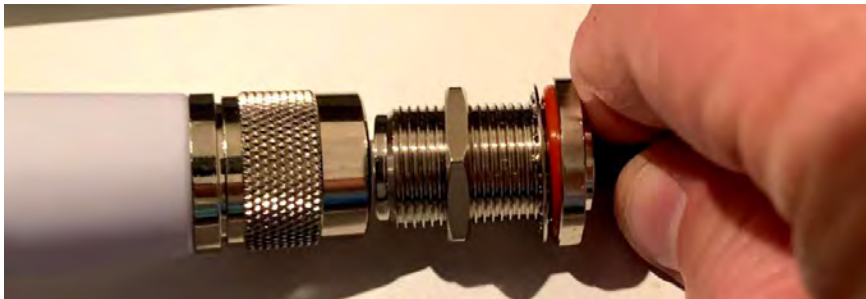


*Figure 9: Connecting the GPS cable to the GPS antenna*

**Step 7: (Optional) Connect the GPS cable to the gateway (ANT1)**



*Figure 10: Connecting the GPS cable to the gateway*

**Step 8: Connect the power brick to a power source.**



*Figure 11: Connecting mains cable to power brick*

**Step 9: Verify and test. Check the LED on the power brick.**

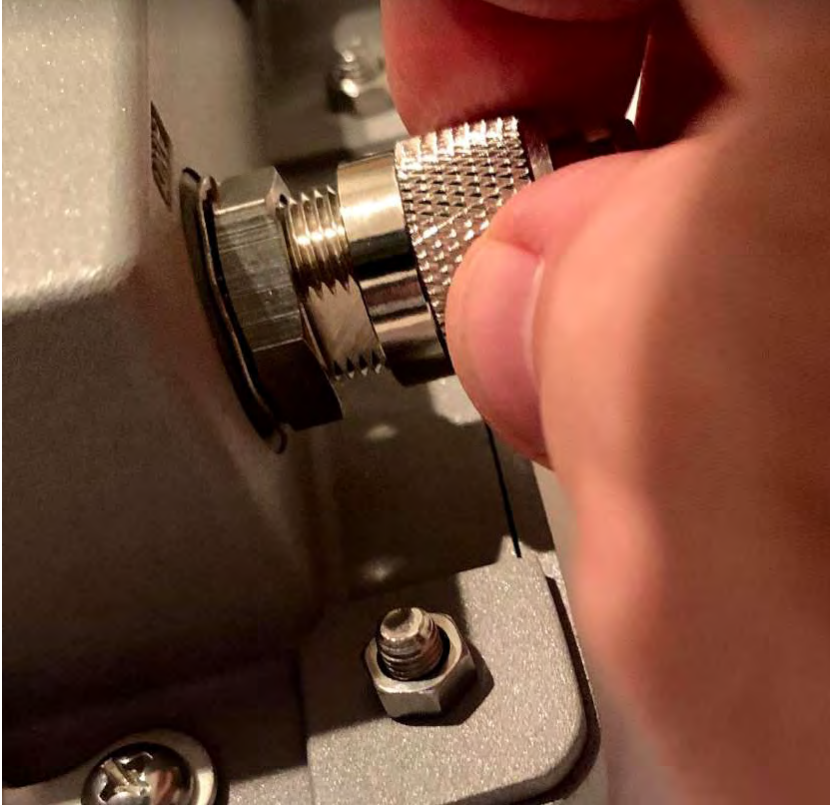The LED will be green when power is supplied to the gateway.



*Figure 12: Green LED on Power Brick Means Gateway is Powered*

## Gateway SIM and Data Connectivity

The gateway is provided with a SIM card for cellular backhaul. This includes 1GB of free data service, which should be adequate for about one year of operation. If you need more data, you will need to sign up for a cellular service plan and provide a replacement SIM card. The SIM card can be accessed through the clear, sealed access port (the 3G/4G port in Figure 7) on the side of the gateway with the LoRa antenna.

# Getting the Kit Online

There are a few steps involved in getting your LR1110 Trackers online for the first time. The process of setting up the devices will be illustrative of the overall setup and system configuration. By following the steps outlined below, you should be up-and-running in less than 30 minutes.

## Creating the LoRa Cloud™ Portal Account

Before a LR1110 Tracker device can be claimed however, you first must have an account on the LoRa Cloud™. To setup your account, navigate in a browser to https://www.loracloud.com. On that page you will see a "Get Started" button.
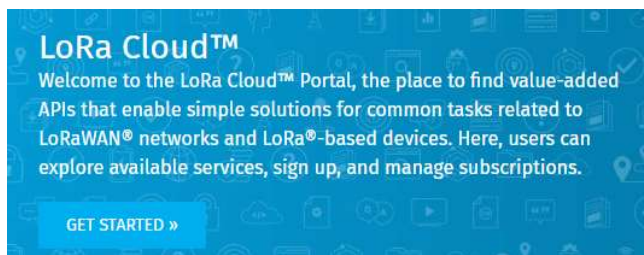


You will be presented with an option to create an account. Use your email address and create a password.
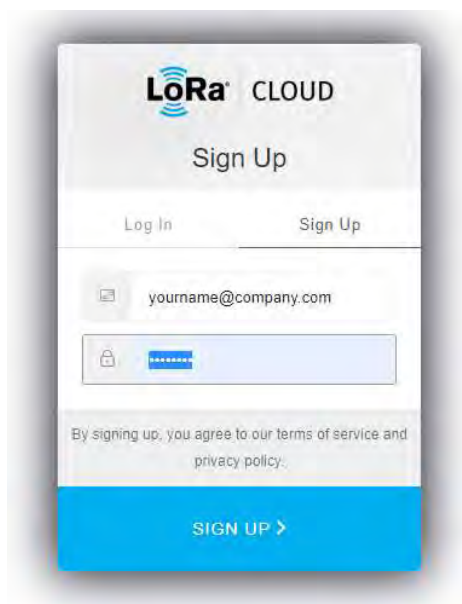


You will be sent a confirmation email for the account. Click on the confirmation link in the email and you will be taken to the login page. After logging into your new account, you will need to accept the Terms & Conditions of Usage and your account activation will be complete.

## Claiming a device

To claim a device, first you start off on the LoRa Cloud™ Device Join portal at https://www.loracloud.com/portal/join_service. From there, select the "Devices" link on the left pane and you will be presented with a Join Server page. Under the "Devices" header, you will be presented with two options to "Claim Individual Device" or "Bulk Upload (CSV)". As was previously discussed, you can get the required information for each LR1110 Tracker device directly from the modem API. If you select the "Claim Individual Device" you will be presented with a form that looks like this:

Enter the EUI and the PIN (Claim) retrieved from the modem and press "Claim Device". If the EUI and PIN are matched in the LoRa Cloud™ Device Claim system, it will be added to your available devices. You could have also used the "Bulk Upload(CSV)" option to provide the LoRa Cloud™ Device Join service with the information that you entered on the form; however, it would need to be in a file with the provided format on that page.

The last method for claiming a device is using the Application Owner API of the LoRa Cloud™ Device Join Server. This provides a secure REST interface to upload the claim information (specifically the "claim_devices" endpoint). This interface is documented at:
https://www.loracloud.com/documentation/join_service?url=appo_api.html

## On boarding - Network Server Specific

For the LoRa Cloud™ Device Join Server to handle the Join of the device, it needs to be associated with the Network Server that will route the traffic to and from the device. Since you may want to setup one set of devices for one LoRaWAN network server. The diagram below shows two configuration setup examples. In the top example, a block of devices will be configured for LoRaWAN Network Server 1 (LNS_1) the Join Requests for devices received from that LNS for a claimed device will use the application configuration logic for appo-::a in the system. This is set on the LoRa Cloud™ Device Join Network Servers configuration page or through the Application Owner API documented here (https://www.loracloud.com/documentation/join_service?url=appo_api.html).

The second configuration setup example allows for devices to come through one of two different LNS endpoints for the same application definition.
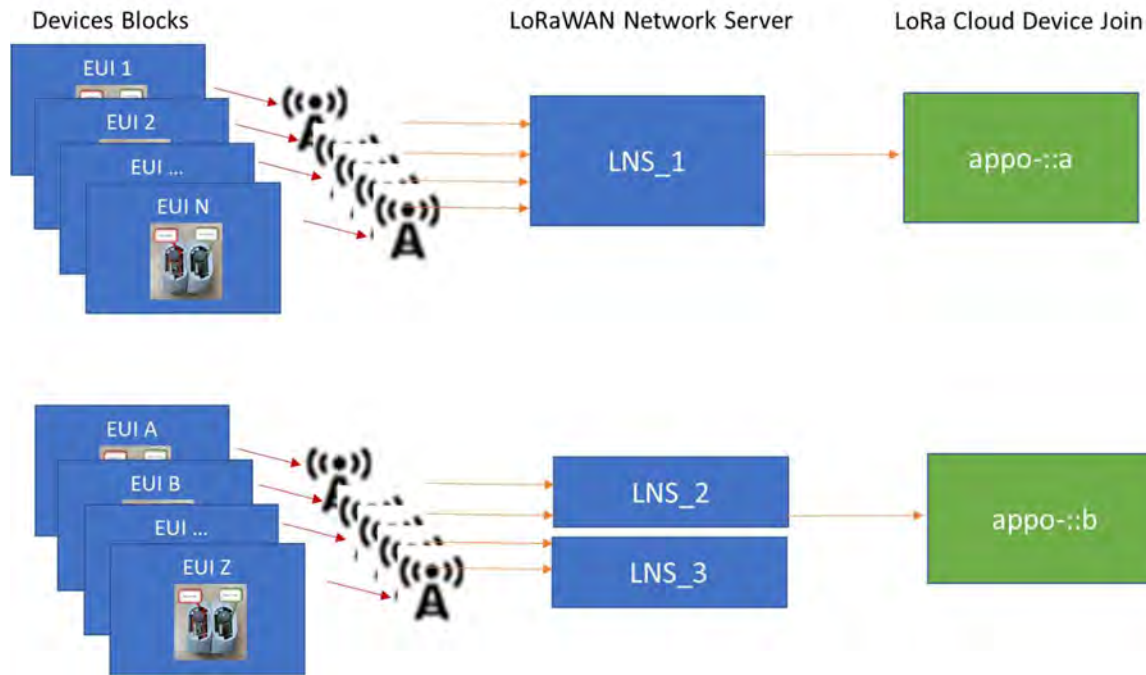
The purpose of mapping the Registered Network Server to a specific Application Owner is so that specific parameters can be setup for handling data when operating with that LNS. There are three common settings for each Application definition: name, wrapkey and nslist. The name is an arbitrary string to represent the application. The wrapkey is a specific token used for encrypting the AppSKey from the LoRaWAN session (the unencrypted AppSKey is used for encrypting the LoRaWAN payload data between the device and Application Server in LoRaWAN). The wrapkey can be null indicating that the AppSKey will be passed from the LoRaWAN Network Server to the Application Server unencrypted. For more information on working with the AppSKey, please see the documentation at https://www.loracloud.com/documentation/join_service?url=appskey.html. The nslist is a list of LoRaWAN network servers that will be associated with this Application Owner configuration.

Once the Network Servers are configured for a particular Application Owner on the LoRa Cloud™ Device Server, then the device Join process can be performed. The LoRaWAN Network server that sees the Join Request from the claimed device will forward this onto the LoRa Cloud™ Device Join Service. It will securely access the root keys for the device, processing this on a HSM[1] which derives the session keys and returns them along with the Join Response to the Network Server. If a wrapkey is defined for the Application associated with the Network Server, the AppSKey is returned encrypted otherwise, it will be in plaintext. The LoRaWAN Network Server will send the Join Response to the device. Once a data message is sent after the Join Response to the LoRaWAN Network Server, the joining will be complete and the device will be configured for operation on that LNS.

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[1] HSM stands for Hardware Security Module. A HSM is a dedicated piece of computer equipment with a defined API that allows for the processing and distribution of secure keys and tokens in a completely self-contained device. The workings of the HSM are beyond the scope of this document.

NS=Network Server        AS=Application Server        JS=Join Server
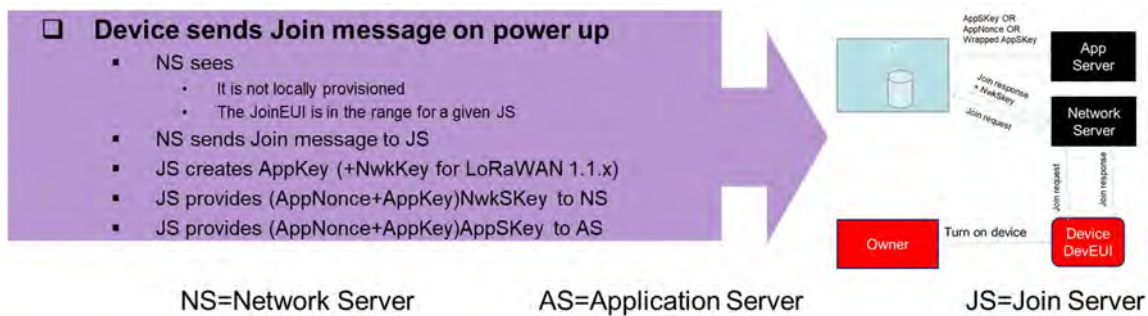
## Selecting the Actility Network Server on the LoRa Cloud™ Device Join Server

Once the owner has been established, you must select the Network Server on the LoRa Cloud™ Device Join Server. To do this, go to the "NETWORK SERVERS" link on the left and on the Network Servers page select the Actility ThingsPark Wireless DEV1 and hit "ADD". Currently the "Owner Context" for these devices is not defined.



## Creating the LoRa Cloud™ Device & Application Service (DAS)

In order to utilize the DAS for your LR1110 Trackers, you must create an Application Owner and then create a token that will be added to the transmission of the data to the DAS.

To create an owner that can use the DAS, first login to your LoRa Cloud™ account (https://www.loracloud.com) and select the "LoRa Cloud™ Device and Application Services". There is a "Manage Owners" page accessible from the main DAS page. On the "Manage Owners" page you will create an owner or owners and then set the currently active owner. The active owner is where you will define tokens with the properties you need. A token can have at least one, up to all of the following permissions:

- Add/Delete Devices
- Deliver Uplinks
- Issue Device Requests
- List/Read Device State
- Add/Delete Tokens
- List Tokens

When you add a token, you select its permissions. Once set, the permissions of the token cannot be changed but a token can be renamed or deleted at any time. You will use a defined token will be to access the various commands available in the DAS API to add new devices and list current devices. You can even list and add new tokens if the token you use has sufficient permission. One of the most important uses of the token will be to transmit and receive data to and from the DAS. This token will be needed for the provisioning on the Tago.io account interface.

### Adding Devices

Devices are managed either through the DAS API or directly from the LoRa Cloud™ Device & Application Services (DAS) web portal. The "Manage Devices" link is used to add devices for a specific owner application. The only necessary information to add a device to the list of managed devices is the EUI; you can add the EUIs of the two LR1110 Trackers at the same time or one at a time.

### The LoRa Cloud™ Geolocation

The LoRa Basics™ Modem-E has built-in features for geolocation. This information can be sent to the LoRa Cloud™ Geolocation API for estimating the location the device. When gateways receive a data packet transmitted by LoRa Basics™ Modem-E devices, they also generate metadata such as received signal-strength, signal-to-noise ratio and time of arrival. When this metadata from the gateways is assembled into a suitable query, and transmitted via the LoRa Cloud™ Geolocation API, the service is able to calculate the location of the device.

### Types of Service

There are three localization technologies available: LoRa, Wi-Fi and GNSS. The LoRa method uses signal strength, signal timing and other meta data from the device signals to calculate a location. Similarly, the Wi-Fi method uses signal strength of Wi-Fi Access Points within range of the device to estimate the location of the device. Finally, the LoRa Basics™ Modem-E has the ability to measure timing information from multiple GNSS satellite sources to estimate the position based on those signals.

### Subscription Level and Tokens

There are different levels of subscription for the LoRa Cloud™ Geolocation service depending on the monthly traffic levels that will be utilized by a given application. Each account will have two default tokens, primary and secondary. The combined traffic associated with both tokens will be accumulated. The accumulated totals will count towards the monthly total. For the introductory free tier, up to 1000

locations can be computed every month. Paid plan quotas range from the hundreds of thousands to many millions. See the link https://www.loracloud.com/portal/geolocation/subscription_management for further information on pricing plans.

## Getting Localization Results

To utilize the LoRa Cloud™ Geolocation API, the LR1110 Tracker will provide scan information for LoRa® signals, Wi-Fi scan or GNSS measurements. The LoRa® signals and Wi-Fi scan will be passed through the provided gateway, to the LNS and then onto the cloud systems which will compute location and display them on a map (discussed later).

## Getting Almanac Data for GNSS Aiding

GNSS operates by utilizing ranging measurements from a satellite to a receiver (in this case the LR1110 Tracker device). The acquisition of the signals can be improved by providing information about the GNSS satellites and the currently local conditions.  The LoRa Cloud™ Device & Application Service (DAS) allows for timing information to be provided to the LR1110 Tracker through the clock synchronization protocol. Additionally, there are two supported levels of almanac aiding to provide GNSS satellite predictions. The two almanacs are the "efficient" (i.e., compact) almanac as well as the full almanac. The efficient approach is optimized for lower communication bandwidth. Over time, the true satellite positions diverge from the fixed Almanac parameters, which requires them to be updated. DAS is designed to allow for those updates on a regular basis.

## Creating your LoRa Cloud™ Geolocation Application Token

The Geolocation Application Token is provided at: https://www.loracloud.com/portal/geolocation/token_management. This will be needed for the provisioning on the Tago.io account interface.

## Setup and Operation of the LR1110 Trackers

The LR1110 Trackers are shipped with batteries outside of the unit so that they will not transmit while in transport. This section will provide the instructions for the setup of the device, pairing it with its initialization phone application and connecting to the services it supports.

## Download and Install Bluetooth Phone Application

The first step in setting up your devices is to download, install and run the Bluetooth Phone application that enables the initial configuration of the LR1110 Tracker device. The LR1110 Tracker application is available on Google Play for Android under the name "LR1110" or via the APK provided on a thumb drive.  For IOS users, search the App Store for "LR1110" and download and install the application. Once the application is downloaded to your phone, run the application.

## Putting Batteries in the LR1110 Tracker

The process for putting the supplied batteries in the Tracker as follows; first remove the four screws from back cover from the device using a T8 Torx head screwdriver:



Next, insert the batteries in the desired orientation:

Make sure that the batteries are oriented in the correct direction lining up the "+" and "-" symbols on the device:



Place the bottom plate back on the device and secure all four screws completely.

## Using the IOS/Android Bluetooth Application

The application will present a screen like the following on startup:



Place the provided magnet with the notch-side down against the oval hole on the device:

Then place the flat side of the magnet directly against the device. This should cause a RED LED to light up.

At this point, the LR1110 Tracker is in pairing mode.

## Pairing LR1110 Tracker with Bluetooth
Once the LR1110 Tracker is in pairing mode press the "pair" button the on application screen:
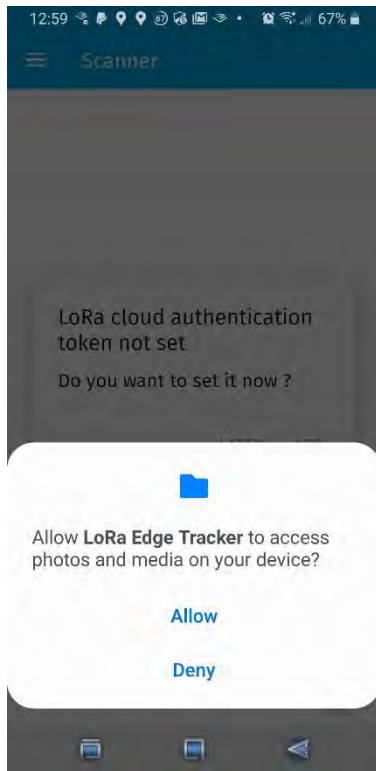
This should quickly pair the phone to the LR1110 Tracker showing the following:
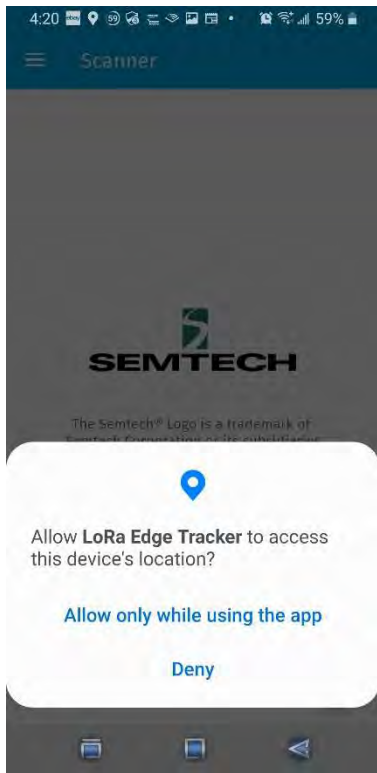
## Setting up the Application to Retrieve Aiding

In order to achieve aided GNSS acquisition, you need to bridge from the device to the LoRa Cloud™ DAS. Upon launching, you will be asked for permissions for photos and media (please allow).



Setting the LoRa Edge Tracker….device location

Select "Allow only while using the app"

Select a connected device

Create a QR code for the DAS token:

1) Login to the LoRa Cloud™ website (https://loracloud.com)
2) Go to  LoRa Cloud™ Device & Application Service>Manage Tokens
3) Copy the value of your created token
4) Create a QR code with https://www.qrstuff.com/ (or similar)
5) On the mobile application, when asked for LoRa Cloud Authentication, allow the app to take a picture of your created QR code
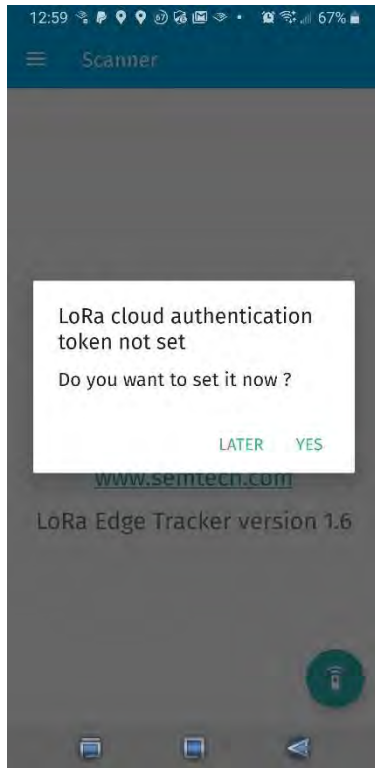


## Application Features and Functions

There are a number of features and functions of the mobile application. It has the ability to update both the LR1110 Tracker application firmware on the device as well as the modem firmware. If there are updates for either, the mobile device application will indicate it on the section "Versions and FOTA"
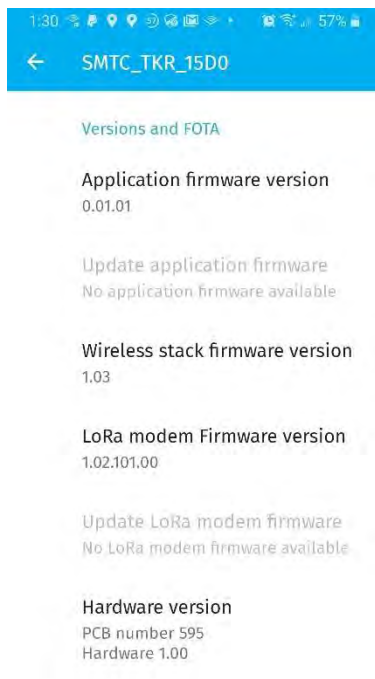
If you want to use GNSS estimation for the LR1110 Tracker, it must be enabled by checking the "GNSS feature" box on the application (you might need to scroll down past the "LoRaWAN" section):
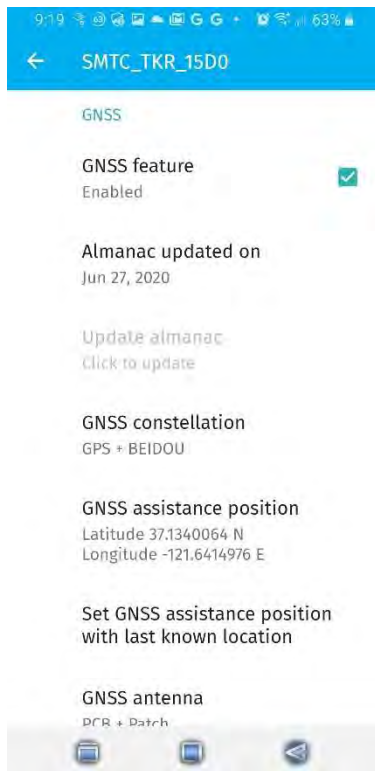


You can set the device to receive aiding information at your approximate location. Note that the input will take "+" for positive latitude (North) and "-" for negative latitude (South). Similarly for positive longitude use "+" for positive (East) and "-" for negative (West). The display will ALWAYS should "N" or "E" after

latitude or longitude respectively, even if you are at Southern latitudes or Western longitudes. The "-" sign however, takes precedent.
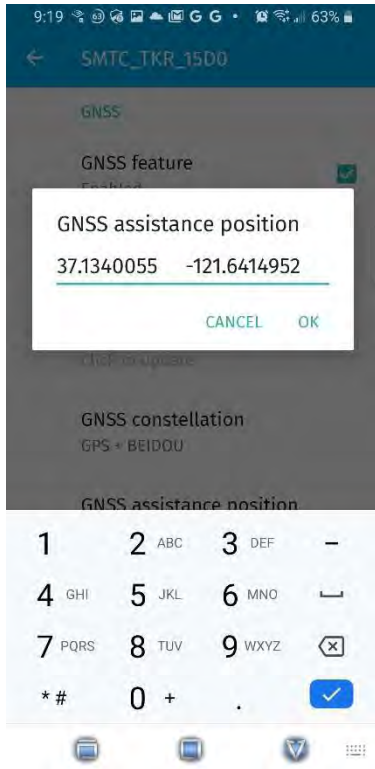


To enable Wi-Fi scanning, you must check the "Wi-Fi Feature" box:
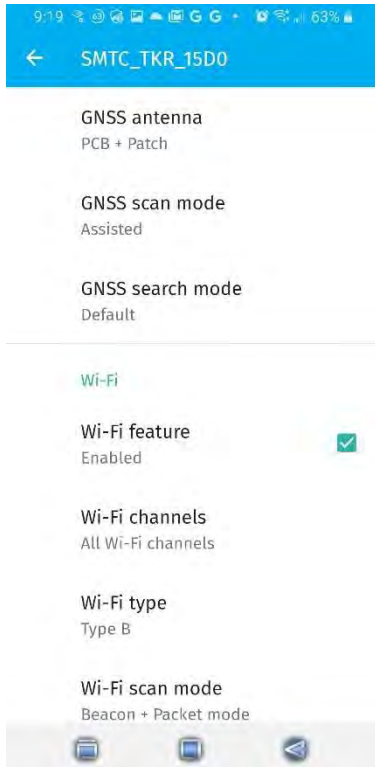
You can also change a variety of Wi-Fi scan settings with the application including, the number of retries, the maximum number of returned APs, the Wi-Fi type and the Wi-Fi timeout in milliseconds.

In the "Miscellaneous" section of the application you can control a variety of features including "Airplane Mode", Use accelerometer, the TX regular and Low duty cycles and a full reset of the device.
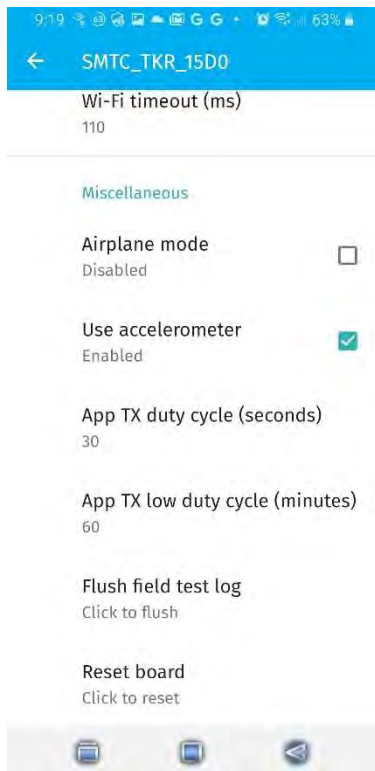
## Add Devices and Map Location

Once the gateway and tracking devices are turned on, when you connect to the online web interface the device should report be visible on the **Device Settings** page, and should show an updated time, similar to the example shown in Figure 13.



| Device | Device ID | Update rate  ? | Est. battery life | Battery | Signal strength | Last message |
|--------|-----------|----------------|-------------------|---------|-----------------|--------------|
| ● 2B-76 | 🖊 58-A0-CB-00-00-20-2B-76 | Low | High | 🔋 | ..l | 2020-02-07 09:22:05 |
| ● 2C-4F | 🖊 58-A0-CB-00-00-20-2C-4F | Medium (default) | Medium | 🔋 | ..l | 2020-01-28 17:34:45 |
| ● 2C-9A | 🖊 58-A0-CB-00-00-20-2C-9A | Lowest | Highest | 🔋 | ..l | 2020-02-07 09:22:05 |
| ● Gateway 04-93 | 🖊 58-A0-CB-80-04-93 | N/A | N/A | N/A | .ıl | 2020-01-28 17:08:13 |
| ● Gateway 09-B3 | 🖊 58-A0-CB-80-09-B3 | N/A | N/A | N/A | ..l | 2020-01-31 19:12:30 |

*Figure 13 – Devices and Gateway Reporting Example*

## Using the Web Dashboard

To begin, log in by scanning the QR code below or, using your web browser (Chrome preferred), navigate to https://lordevelopers.semtech.com/resources/developer-kits/assetracking-kit



*Figure 14 - Scan to log in*

From this page you can log in to the kit and get information about its setup and use. To log in directly, go to https://assetracking-kit.semtech.com/signin. Note that your login credentials can be found either on the inside cover of the Kit box, or on the device data sheet provided with the Kit.

Once you log in to the website, two views will be available: the **Device Tracking** view and the **Device Settings** view. In the Device Tracking view, the location of each tracking device is plotted on a map. From there, you can extract the time histories of the location data. Use the Device Settings view to designate a nickname for each device and to see the current status of devices and the gateway.

## Device Tracking View

At the center of the Device Tracking view is a map showing the locations of the enabled tracking devices. To the right of the map, in the **Trackers** pane, is a list of the available trackers. To turn the display of a given tracker on or off, toggle the "eye" icon ( ). To zoom in on the latest position for a given tracker, click the "target" icon ( ).
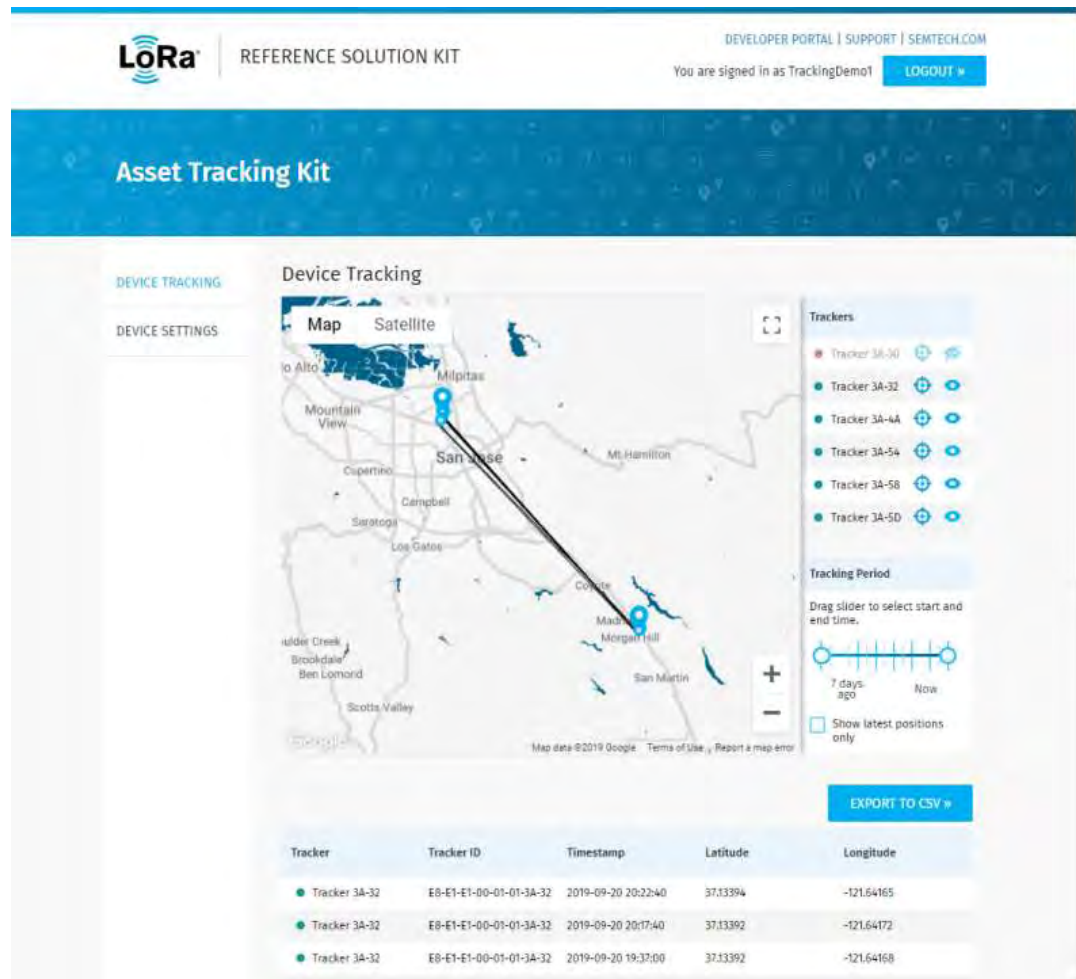


*Figure 15. Device Tracking view*

Below the list of trackers is the **Tracking Period** pane. You can select the period of time for which you want to see tracking data. You can choose to view data for any period between the last half-day up to the last seven days.

## Device Settings View

This view displays a list of trackers associated with your kit. Here, you can designate how often you want to each of them to send updated location information. You can also monitor estimated battery life and the signal strength of each tracker.

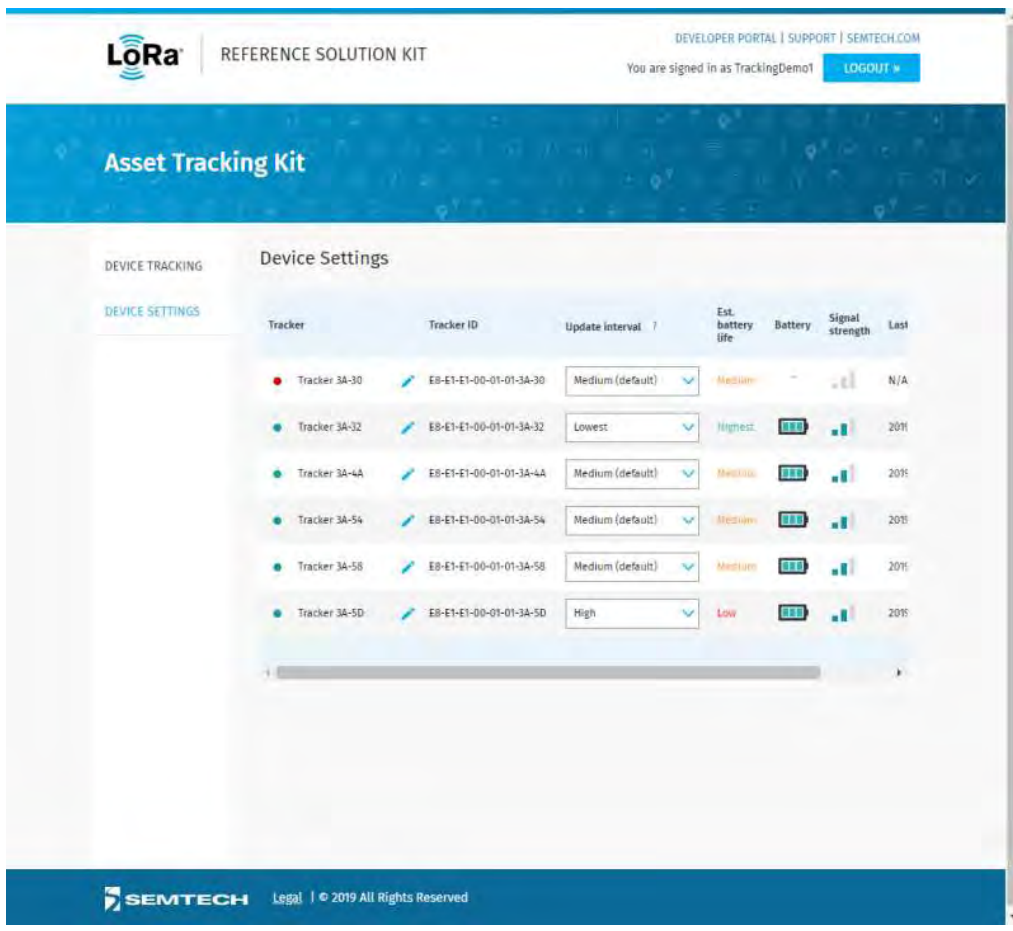*Figure 16. Device Settings view*

# Problems/Concerns

Direct any problems or concerns to [TrackerSupport@XYZ.com.](mailto:TrackerSupport@XYZ.com)

# Important Information: Warranty Disclaimer

The Kits are supplied for demonstration purposes only. Your use of the Kits for any purposes (e.g., commercial) is unauthorized by Semtech and at your own risk.

THE KITS ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND EXPRESSED OR IMPLIED. SEMTECH EXPRESSLY DISCLAIMS ALL WARRANTIES, EXPRESSED, IMPLIED OR OTHERWISE, INCLUDING WITHOUT LIMITATION, WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

## Product & Safety Instructions

Certain sensors contain magnets. **Keep away from ALL children!** Do not put in nose or mouth. Swallowed magnets can stick to intestines causing serious injury or death. Seek immediate medical attention if magnets are swallowed.

**Observe the following precautions to avoid a sensor explosion or fire:**

Do not drop, disassemble, open, crush, bend, deform, puncture, shred, microwave, incinerate, or paint the sensors, or other hardware.

Do not insert foreign objects into any opening on the sensors or gateways

Do not use the hardware if it has been damaged—for example, if cracked, punctured, or harmed by water.

Disassembling or puncturing the battery (whether integrated or removable) can cause an explosion or fire.

Do not dry the sensors or battery with an external heat source such as a microwave oven or hair dryer.

These products are not toys and contain small parts that can be dangerous to children under three years old. Do not allow children or pets to play with products.

Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled.

## Warnings

Do not place naked flame sources, such as lighted candles, on or near the equipment.

The battery should not be exposed to excessive heat such as sunshine, fire, or the like.

Do not dismantle, open, or shred battery pack or cells.

Do not expose batteries to heat or fire. Avoid storage in direct sunlight.

Do not short-circuit the battery. Do not store batteries in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.

Do not remove a battery from its original packaging until required for use.

Do not subject batteries to mechanical shock.

In the event of a battery leaking, do not allow the liquid to come in contact with skin or eyes. If contact has been made, wash the affected area with copious amounts of water, and seek medical advice.

Do not use any charger other than that specifically provided for use with the equipment.

Observe the plus (+) and minus (-) marks on the battery and equipment, and ensure correct use.

Do not use any battery which is not designed for use with the product.

Do not mix cells of different manufacture, capacity, size, or type within a device.

Keep batteries out of the reach of children.

Seek medical advice immediately if a battery has been swallowed.

Always purchase the correct battery for the equipment.

Keep batteries clean and dry.

Wipe the battery terminals with a clean, dry cloth if they become dirty.

Rechargeable batteries need to be charged before use. Always use the correct charger, and refer to the manufacturer's instructions or equipment manual for proper charging instructions.

Do not leave a rechargeable battery on prolonged charge when not in use.

## Notices

⚠️ Avoid exposing your sensors or batteries to very cold or very hot temperatures. Low or high temperature conditions may temporarily shorten the battery life or cause the sensors to temporarily stop working.

⚠️ Take care in setting up the gateway and other hardware. Follow all installation instructions in the User Guide. Failure to do so may result in injury.

⚠️ Do not install hardware equipment while standing in water or with wet hands. Failure to do so can result in electric shock or death. Use caution when setting up all electronic equipment.

⚠️ PROP 65 WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

⚠️ Cleaning: Use a clean, dry cloth or wipe to clean products. Do not use detergent or abrasive materials to clean the products, as this may damage the sensors.

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Hereby, Semtech declares that the radio equipment for the Asset Tracking Reference Kit is in compliance with Directive 2014/53/EU.

This device complies with Part 15 of the FCC Rules and license-exempt RSS Standards of Industry Canada.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

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This symbol means that according to local laws and regulations, your product should be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. Some collection points accept products for free. The separate collection and recycling of your product at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment.

## Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment of and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**FCC Caution:** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**IMPORTANT NOTE**

To comply with FCC and Industry Canada RF radiation exposure limits for general population, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times and must not be co-located or operating in conjunction with any other antenna or transmitter.


## Industry Canada statement

This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1) l'appareil ne doit pas produire de brouillage;

2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement


**RF Radiation Hazard Warning**

To ensure compliance with FCC and Industry Canada RF exposure requirements, this device must be installed in a location where the antennas of the device will have a minimum distance of at least 20 cm from all persons. Using higher gain antennas and types of antennas not certified for use with this product is not allowed. The device shall not be co-located with another

**Déclaration d'exposition aux radiations:**
Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les EtatUnis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.