SenseCAP T2000 Tracker

User Guide

V1.0

 www.seeedstudio.com

Content

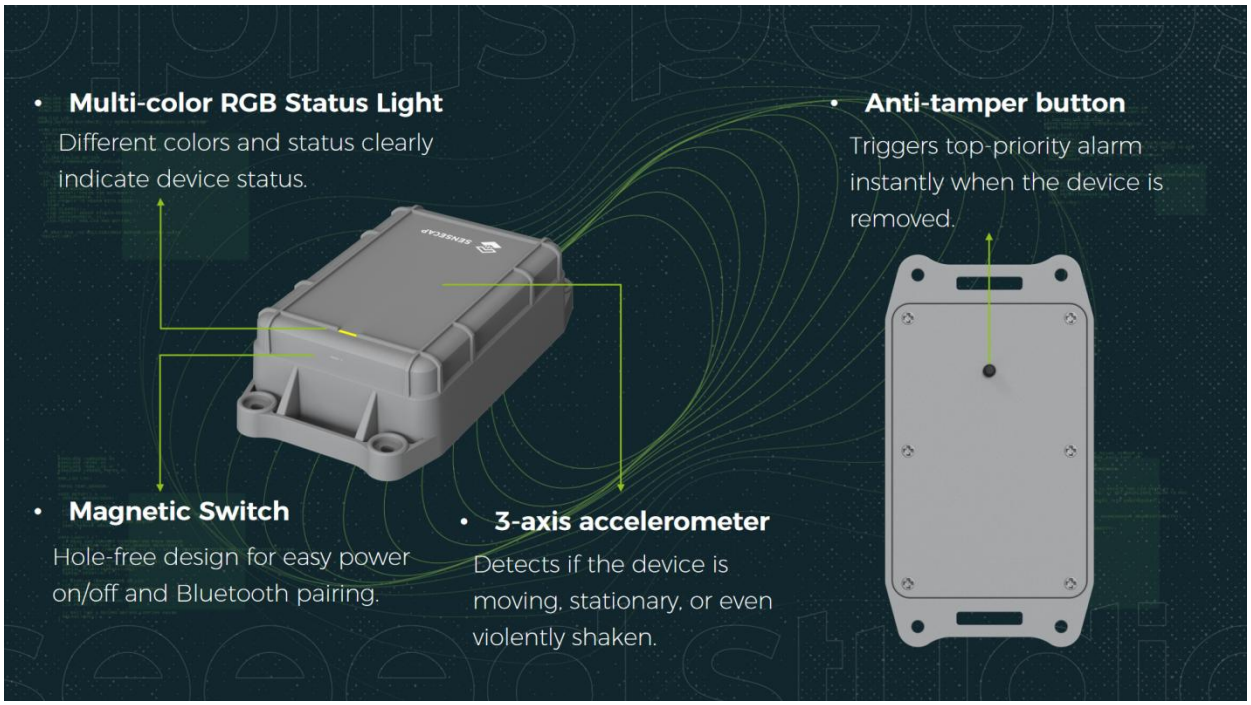
1 Introduction

SenseCAP T2000 Tracker, an industrial-grade LoRaWAN® asset tracker, supports GNSS, Bluetooth and Wi-Fi positioning for reliable tracking across indoor and outdoor environments. It features IP67 protection, a built-in 3-axis accelerometer that detects the motion status, and an anti-tamper button that triggers a top-priority alarm if the device is removed. The T2000-A and T2000-B support long-lasting battery operation and are now also ATEX certified, while the solar-powered T2000-C with a rechargeable battery ensures continuous outdoor use, making the series ideal for long-term, maintenance-free asset tracking.

1.1 Features

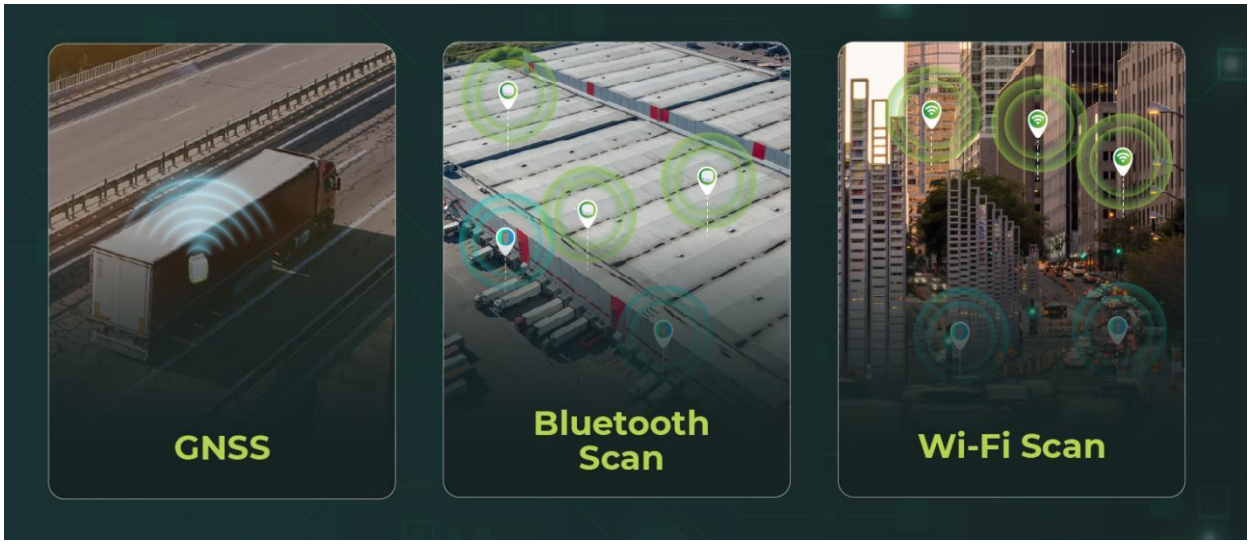
- **Device Interaction**

The T2000 is designed with intuitive interactions for an excellent user experience.



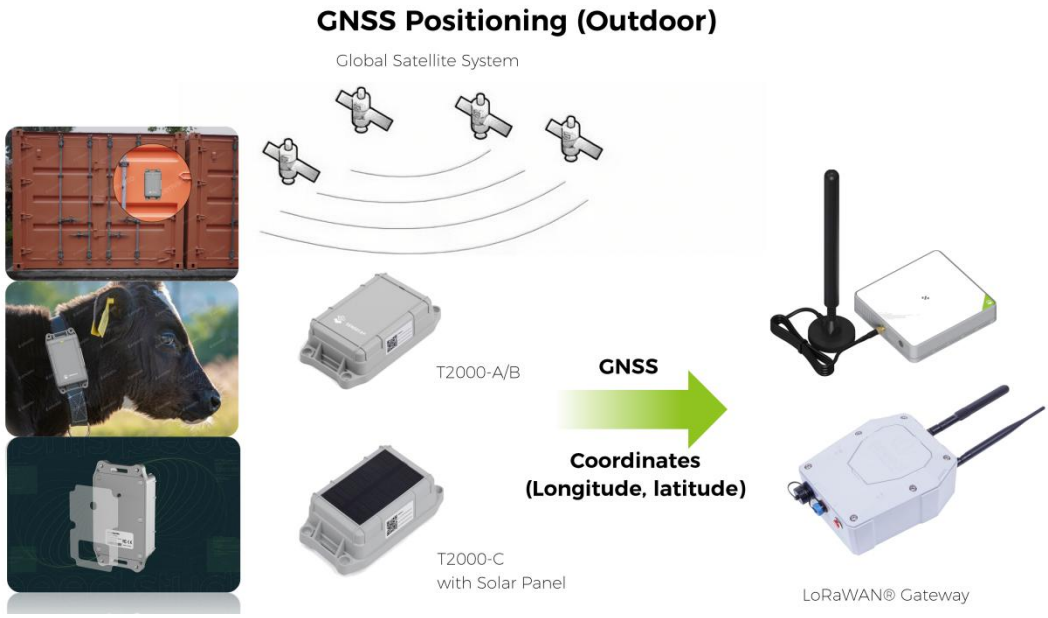
- **Precise Tracking**

The T2000 Series provides reliable and continuous asset tracking across diverse environments. It supports multiple positioning methods including GNSS, BLE, and Wi-Fi. It can automatically selects the appropriate method based on signal availability, enabling flexible and seamless monitoring in different deployment scenarios.



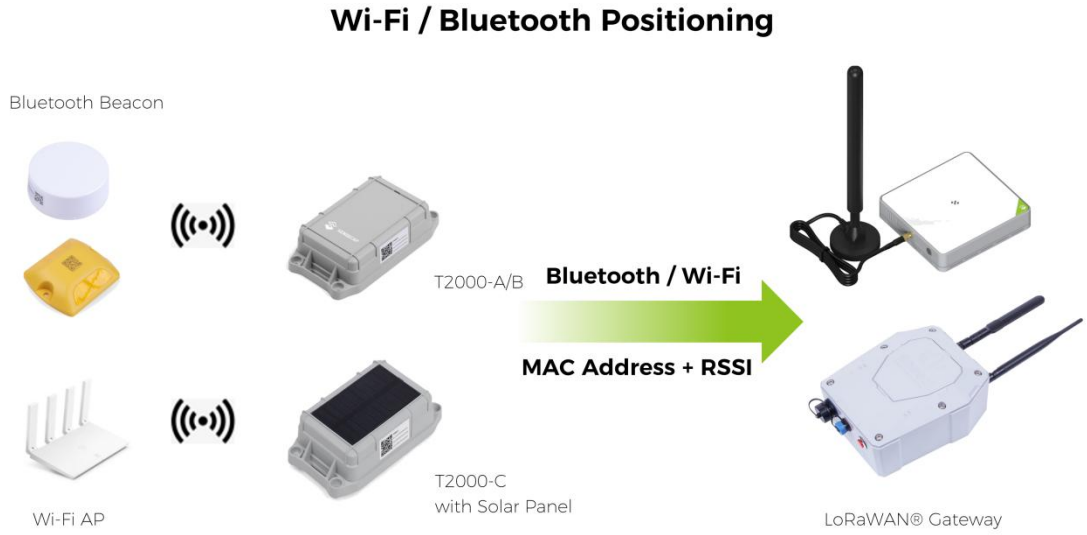
1. Outdoor GNSS Positioning

- High-performance GNSS module delivering meter-level accuracy (5–10 m)
- Supports global multi-constellation: GPS, BeiDou, Galileo and GLONASS



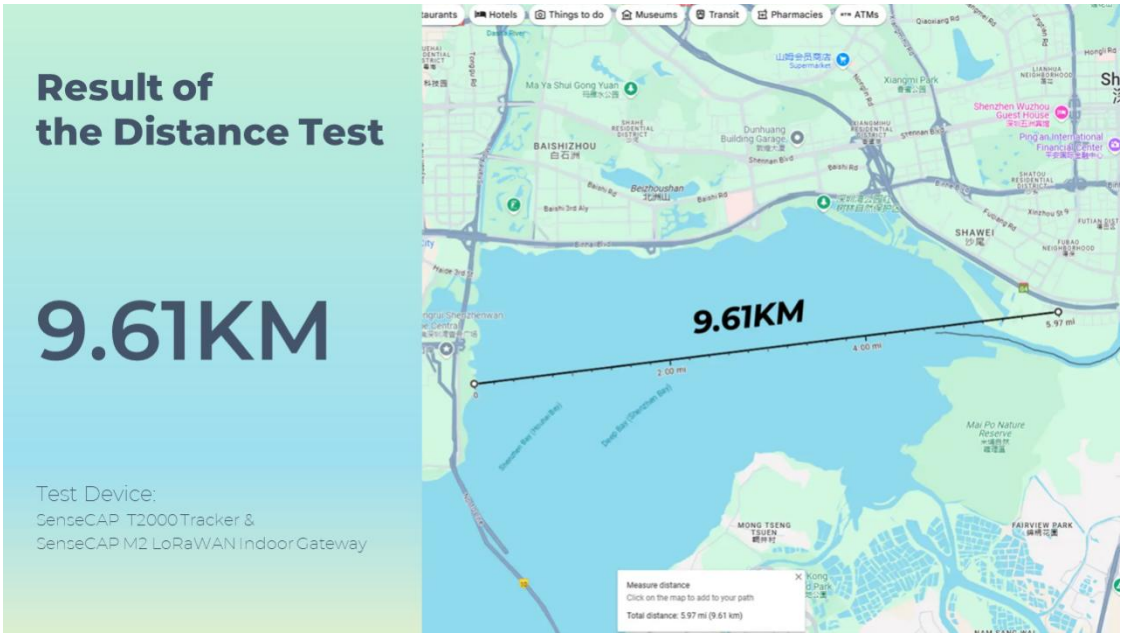
2. BLE & Wi-Fi Positioning

- Tracker scans the MAC addresses and RSSI of nearby Wi-Fi / Bluetooth signals
- Data is uploaded via LoRaWAN to the application server
- The application server calculates the real geographical location based on the MAC addresses and signal strengths (RSSI)



- **Long-Range LoRaWAN® Connectivity**

Our devices achieve communication ranges of up to 9.6 km in open environments through LoRaWAN® technology. Engineered for harsh conditions, they deliver consistent and reliable data transmission even in remote locations, ensuring stable and continuous network connectivity for critical applications.



- **Years of Battery Life**

T2000-A / T2000-B

Built with a 8000 mAh battery, allowing them to operate for over one year when using GNSS with hourly uplinks. With longer uplink intervals, their battery life can extend up to 7~9 years, providing long-term reliability for various deployment scenarios.

T2000-C (with Solar Panel)

Equipped with a 0.5 W solar panel and a 4000 mAh rechargeable battery, the T2000-C supports multi-year, low-maintenance operation under regular sunlight and moderate uplink intervals.

*Actual battery life varies with uplink interval, positioning mode, and deployment environment. Use the Battery Life Calculator for details.

		T2000-A (8000mAh)								
Work Mode		GNSS Only			Bluetooth Only			GNSS + Bluetooth		
Upload Interval		1h	12h	24h	1h	12h	24h	1h	12h	24h
Battery life (Day)	EU868	454.22	2655.6	3404.26	1257.37	4102.56	4413.79	386.24	2442.75	3232.32
	US915	505.53	2794.76	3516.48	3535.91	4604.32	4671.53	487.8	2746.78	3478.26

- **Active Safety**

Anti-Tamper Alert: Once installed, the rear anti-tamper button remains engaged. The moment the device is removed, it instantly triggers a top-priority alarm to protect your core assets.

Vibration & Movement Detection: Built-in 3-axis accelerometer, monitoring for suspicious activity in real-time, preventing incidents before they escalate.

Instant Notifications: Delivers critical alerts directly to your phone within seconds, empowering you to act immediately.

- **Offline Data Storage**

The device features robust local storage, capable of securely holding up to 1,000 data records. Even if the LoRaWAN network becomes temporarily unavailable, it continues logging data without interruption.

Assuming the device remains continuously out of LoRaWAN coverage,

1. At an uplink interval of 1 hour, it can retain approximately up to 41 days of historical data.
2. At an uplink interval of 12 hours, it can store over 500 days of historical data.
3. At an uplink interval of 24 hours, it can retain more than 1000 days of historical data.

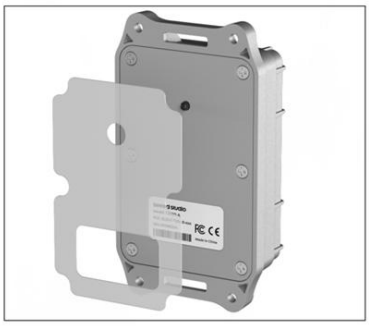
Once the device moves back into an area with LoRaWAN coverage, it will automatically transmit all previously stored records, ensuring that your data remains complete and never gets lost.

- **Multiple installation methods**

The T2000 tracker offers versatile installation methods to suit diverse tracking needs. It can be securely mounted with screws, making it ideal for use on containers and trucks. For livestock monitoring, the device can be firmly secured with a strap. Additionally, it can be easily attached using a double-sided 3M sticker for quick and reliable placement.

Mount with Screws

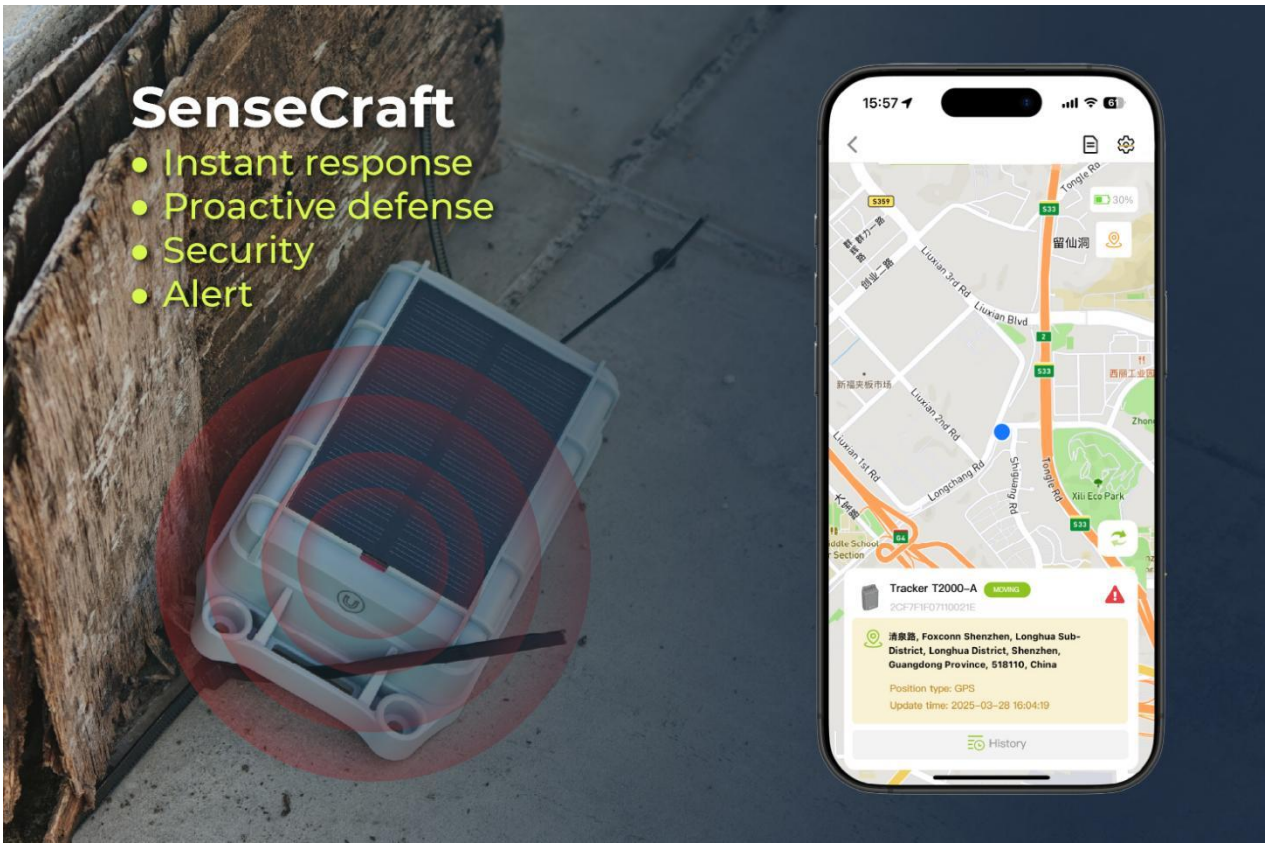
Secure with a Strap



Attached With
Double Sided 3M Sticker

- **All-in-One Software Platform Management**

Seamlessly integrated with the SenseCraft App, providing an end-to-end solution from QR code activation and Bluetooth configuration to real-time map tracking, remote parameter setup, and alarm management.



2 Specification

2.1 Model Specification

We provide three different solutions for users, and comes in three versions: A, B and C.

T2000-A/T2000-B: Designed for extreme environments with a robust 8000mAh built-in battery, and IP67-rated protection. Both support GNSS and Bluetooth positioning, with the T2000-B offering expanded positioning capabilities through the addition of WiFi scanning technology.

T2000-C: Combining a 4000mAh rechargeable battery with a 0.5W solar panel for extended operational life. It supports GNSS and Bluetooth positioning and maintains reliable performance in temperatures from -20˚C to 60˚C, all while providing the same IP67 protection as the other models.

Parameter	SenseCAP T2000-A	SenseCAP T2000-B	SenseCAP T2000-C
Operating Temperature	-40 ~ 85˚C		-20 ~ 60˚C (Charging: 0-45˚C)
Power Supply	Built-in Li/$SOCl_2$ Battery		Built-in Rechargeable Battery + 0.5W Solar Panel
Battery Capacity	8000mAh		4000mAh
Positioning Mode	· GNSS · BLE	· GNSS · BLE · Wi-Fi	· GNSS · BLE
IP Rating	IP67、ATEX	IP67、ATEX	IP67

2.2 General Parameters

Parameter	Specification
Product Model	T2000-A/B
LoRa Chip	SX1262
LoRa Frequency Band	EU868, US915, IN865, AU915, AS923, KR920, RU864
Positioning Method	**GNSS:** L76K GPS L1 C/A, QZSS L1: 1575.42 MHz GLONASS L1: 1602.5625 MHz BeiDou B1: 1561.098 MHz **BLE:** nRF52840 Bluetooth 5.0 [T1000-B Only] **WiFi:** ESP8684 Passive Scan
Power Supply	Primary Battery
Battery Type / Capacity	Li/SOCI2 (ER18505) / 8000mAh
Enclosure Material	PC+10% Glass Fiber
3-Axis Accelerometer	3-Axis Accelerometer to detect movement
Protection Rating	IP67 / ATEX
Dimensions	117 × 65 × 30 mm

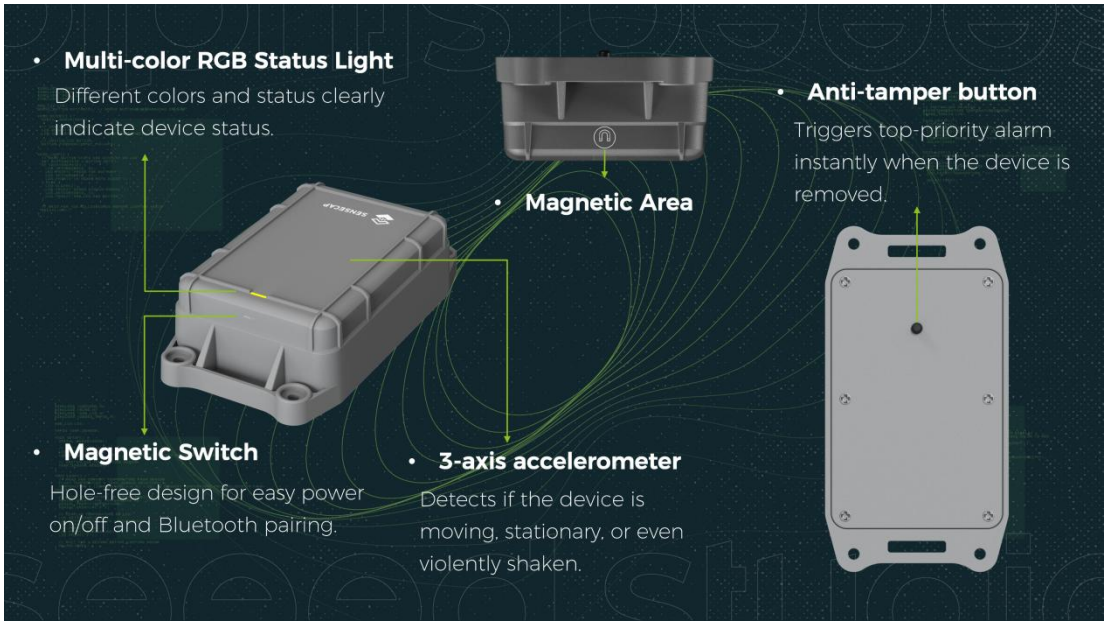
Parameter	Specification
Weight	180g

Parameter	Specification
Product Model	T2000-C
LoRa Chip	SX1262
LoRa Frequency Band	EU868, US915, IN865, AU915, AS923, KR920, RU864
Positioning Method	**GNSS:** L76K GPS L1 C/A, QZSS L1: 1575.42 MHz GLONASS L1: 1602.5625 MHz BeiDou B1: 1561.098 MHz **BLE:** nRF52840 Bluetooth 5.0
Power Supply	0.5W Solar Panel + Rechargeable battery
Battery Type / Capacity	Ternary lithium battery (INR18500np) / 4000mAh
Enclosure Material	PC+10% Glass Fiber
3-Axis Accelerometer	3-Axis Accelerometer to detect movement
Protection Rating	IP67
Dimensions	117 × 65 × 30 mm
Weight	180g

3 Get Started with SenseCAP T2000 Tracker

3.1 Hardware Overview

- **Exploded View**



T2000-A/B Exploded View

T2000-C with Solar Panel Exploded View

- **Operating Environment**

SenseCAP T2000 Tracker is designed to operate reliably within a specific temperature range to ensure stable performance and battery safety. Please make sure the device is used and charged within these temperature ranges to avoid performance degradation or battery issues.

Parameter	T2000-A / T2000-B	T2000-C with Solar Panel
Operating Temperature	-40 ˚C ~ 85 ˚C	-20 ˚C ~ 60 ˚C
Charging Temperature	/	**0 ˚C ~ 45 ˚C**

3.2 Device Functions

3.2.1 Work Mode

To apply to different scenarios, there are several different working modes on the SenseCAP T2000 tracker, which you can choose according to your needs.

Work Mode	Description	Scene
Standby Mode	Only heartbeat packets are uploaded, just includes battery info. The location can be obtained using the LoRa downlink command.	If you need to locate the device for a long time and the device can run for a long time before being charged, the cloud platform can issue a location request command to locate the device.

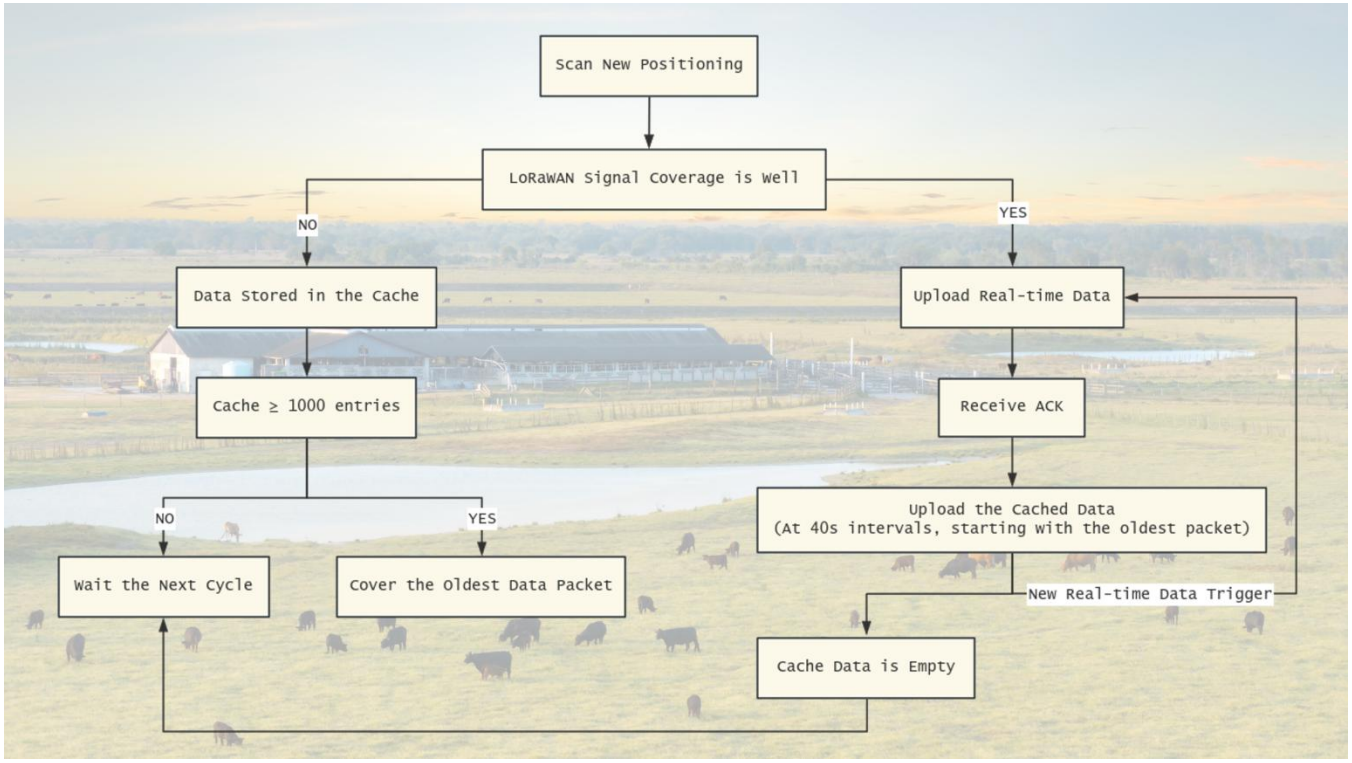
Work Mode	Description	Scene
Periodic Mode	Set an interval at which the device periodically uploads location, 3-axis accelerometer data, and battery info.	Recommended for most scenarios ● Asset tracking ● Livestock monitoring
Event Mode	Adjust the upload interval based on the 3-axis accelerometer sensors, including motion events, motionless timeout, and shock events. The device will upload location, 3-axis accelerometer data and battery info whenever an event is triggered.	It is recommended when you need to monitor the movement status of the tracking object.

3.2.2 Sensor Function

The SenseCAP T2000 Tracker is equipped with 3-Axis Accelerometer.

- You can choose to enable or disable the sensor in the SenseCraft App (disabled by default).
- You can configure the corresponding thresholds for the 3-axis accelerometer based on your application needs, motion/motionless event and shock event are triggered.

3.2.3 Data Cache



- The device can cache data, which can be enabled through Bluetooth configuration by opening Location Data Cache. The device uploads confirmation packets. When the LoRaWAN signal coverage is weak or there is no network coverage, the device cannot receive an ACK when uploading data. In this case, the data will be saved and entered the next cycle. When the device successfully uploads data at some point, it will send offline data.
- The device uploads the real-time location data first. Once the platform returns an ACK for that uplink, the tracker begins uploading the cached data stored locally, starting from the oldest entries to avoid overwriting newer data.
- The cache-uplink interval has been set to 40s. Cached data will be sent continuously at this interval until either a new real-time location uplink is triggered or the platform stops returning ACKs during the process.
- The maximum number of data that can be cached is **1000 records**.
- Click the Clear Cache button will clear all cached data.

3.2.4 Button Function

- **Magnetic Attachment Instructions**

Status	Action
Power On	Bring the magnet close to the sensor area and tap 4 times quickly. Power on succeeds when the green light turns on
Power Off	Bring the magnet close to the sensor area and tap 4 times quickly. Power on succeeds when the green light turns on
Bluetooth On	Bring the magnet close to the sensor area and tap 2 times quickly. Bluetooth scanning is enabled when the blue light flashes
Bluetooth Off	Bring the magnet close to the sensor area and tap 2 times quickly

- **LED Status Indicator**

Status	LED Color	Indicator Mode
Power ON	Green	Solid 1 s
Power OFF	Green	Solid 1 s
Joining Network	Green	Breathing
Join Success	Green	Fast blink 5 times
Join Fail	Red	Fast blink 5 times
Bluetooth Search	Blue	Slow blink
Bluetooth Connected	Blue	Solid
Tamper Alarm	Red	Rapid blink

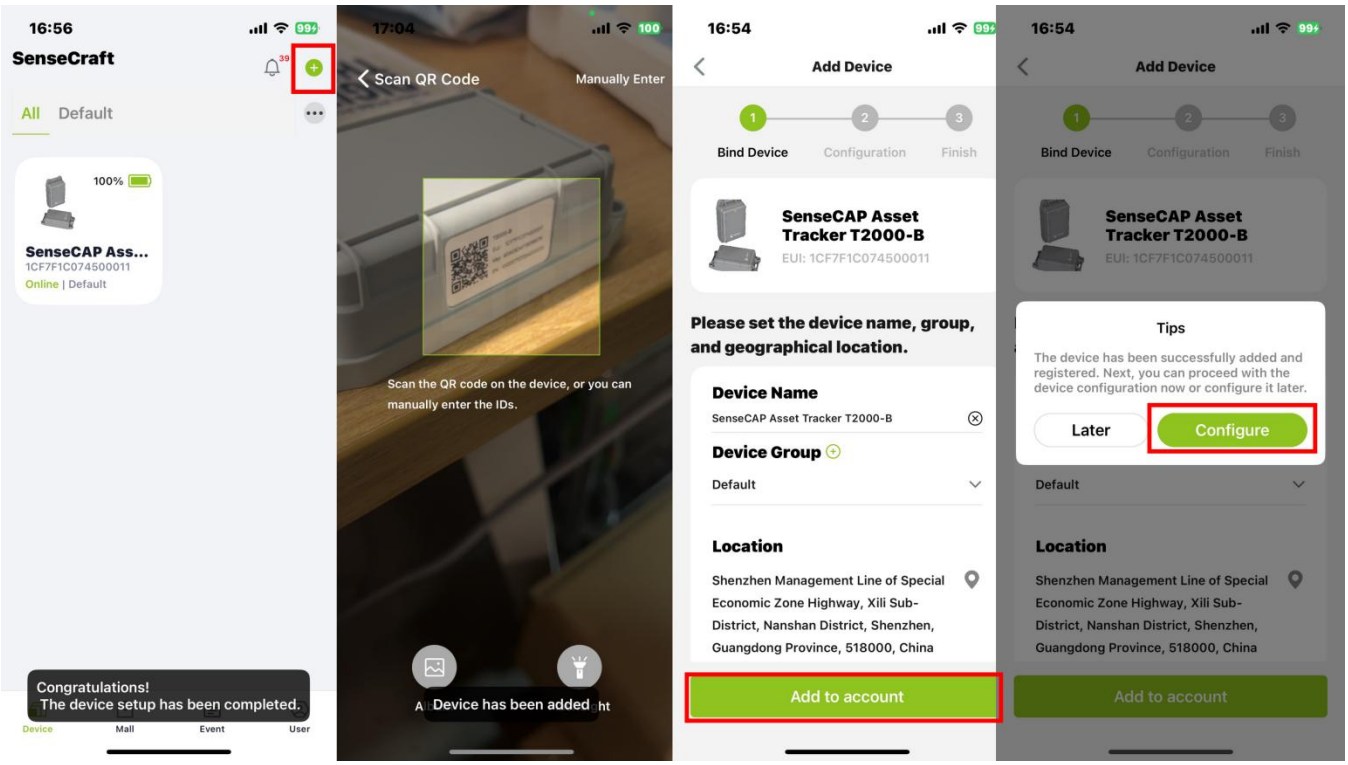
Status	LED Color	Indicator Mode
Firmware Updating	Green	Slow blink
Enter DFU Mode	Green	Solid

3.3 Get Started

3.3.1 Connect to SenseCraft App

1. Download and open the SenseCraft App (iOS App Store / Android Google Play)

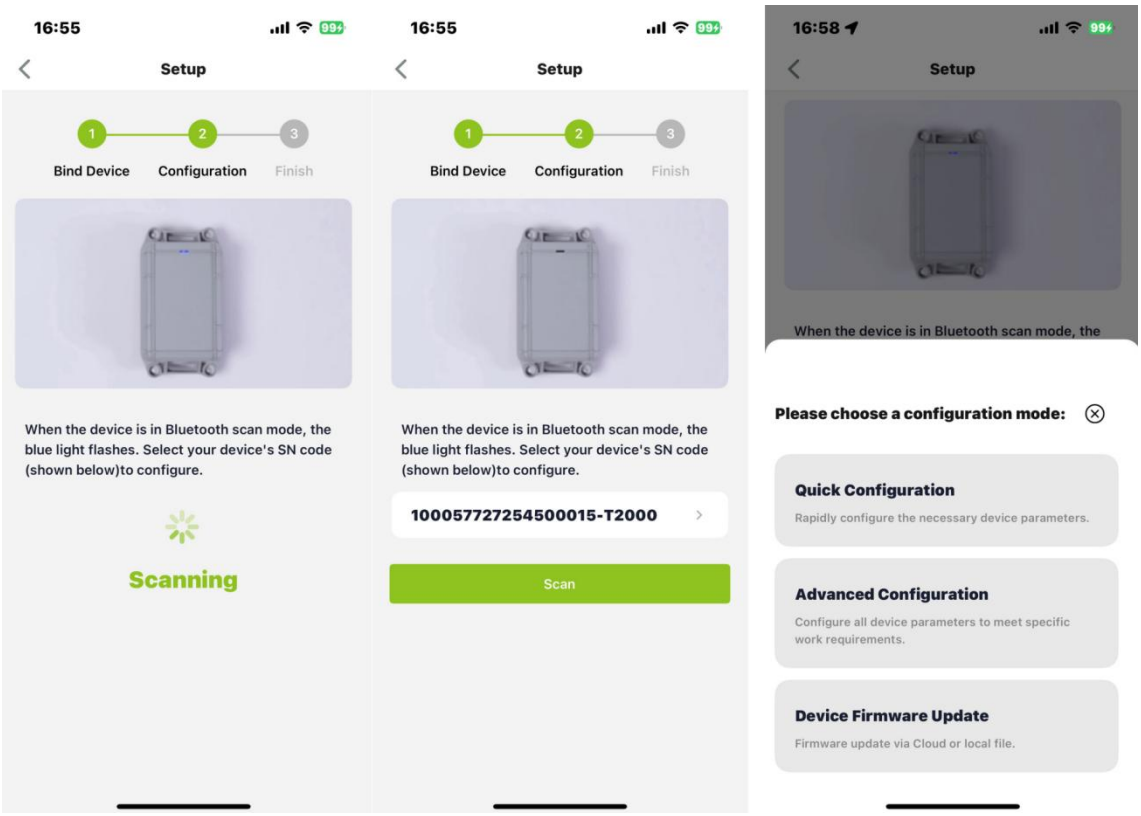
2. Log in and tap “+” to scan the device QR code to add the device



3. Bring the magnet close to the sensor area and tap 4 times quickly to turn it on, then tracker will enter the Bluetooth pairing automatically (if the tracker has powered on, tap 2 times quickly to manually enter Bluetooth pairing), and select device by SN.

There are 2 configuration modes:

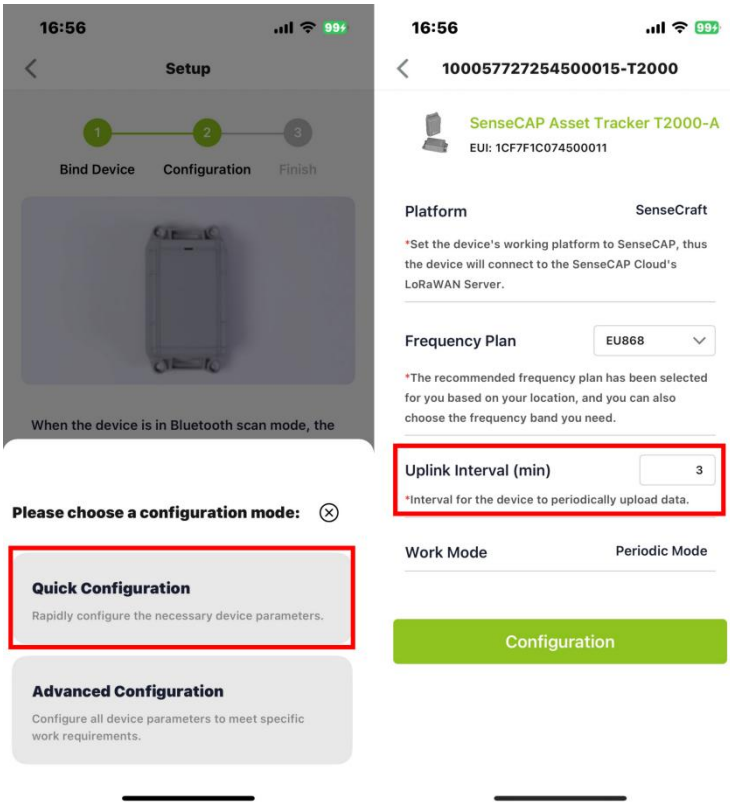
- **Quick Configuration:** For quick start, you can select quick config the basic parameters
- **Advanced Configuration:** To set more parameters please check the following steps.



3.3.2 Quick Configuration

For Quick Configuration, you only need to setup the following parameters:

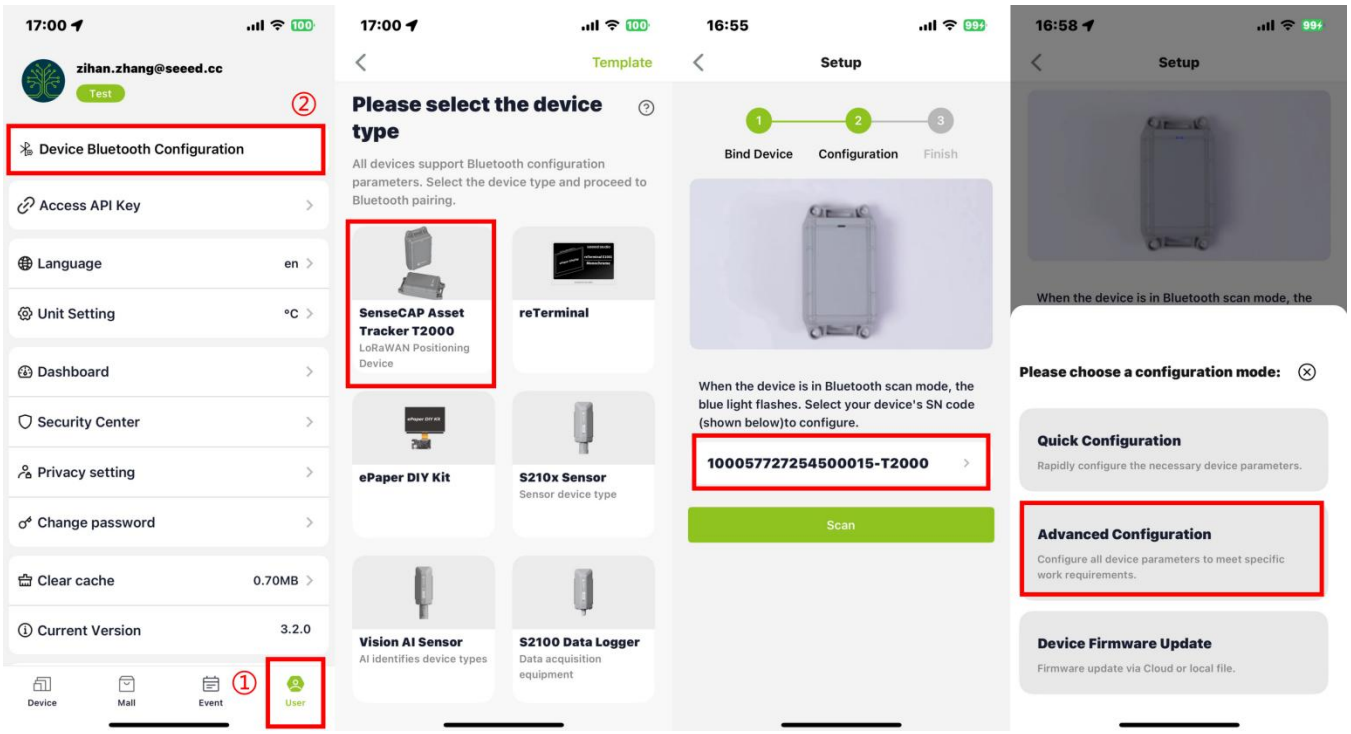
- **Frequency:** it should be same as your gateway.
- **Uplink interval:** The uplink interval of Periodic Mode (default mode), you can set other mode via “Device Bluetooth Configuration” on “User” page.



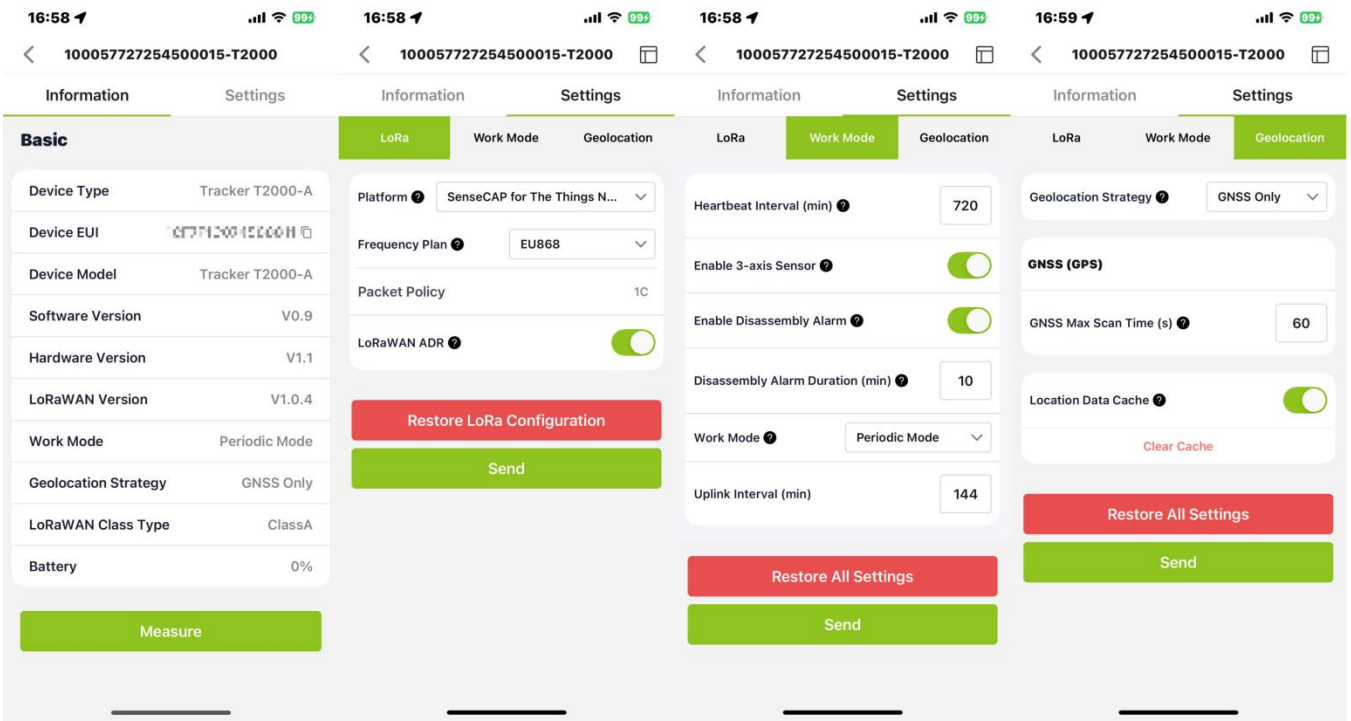
Tracker will try to join LoRaWAN network after exiting the Bluetooth pairing mode, the green breathing light flashes when trying to join the network, and flashes 5 times quickly if the network is successfully joined.

3.3.3 Advanced Configuration

- Open the APP and click Device Bluetooth Configuration in the User page. Then select SenseCAP Asset Tracker T2000 to enter Setup to config the tracker.
- Follow the steps above to enter the Bluetooth pairing mode.
- Select the device by S/N (S/N is on the label of the device) and choose Advanced Configuration. Then, the basic information of the tracker will be displayed after entering.



There are four configuration pages in total.



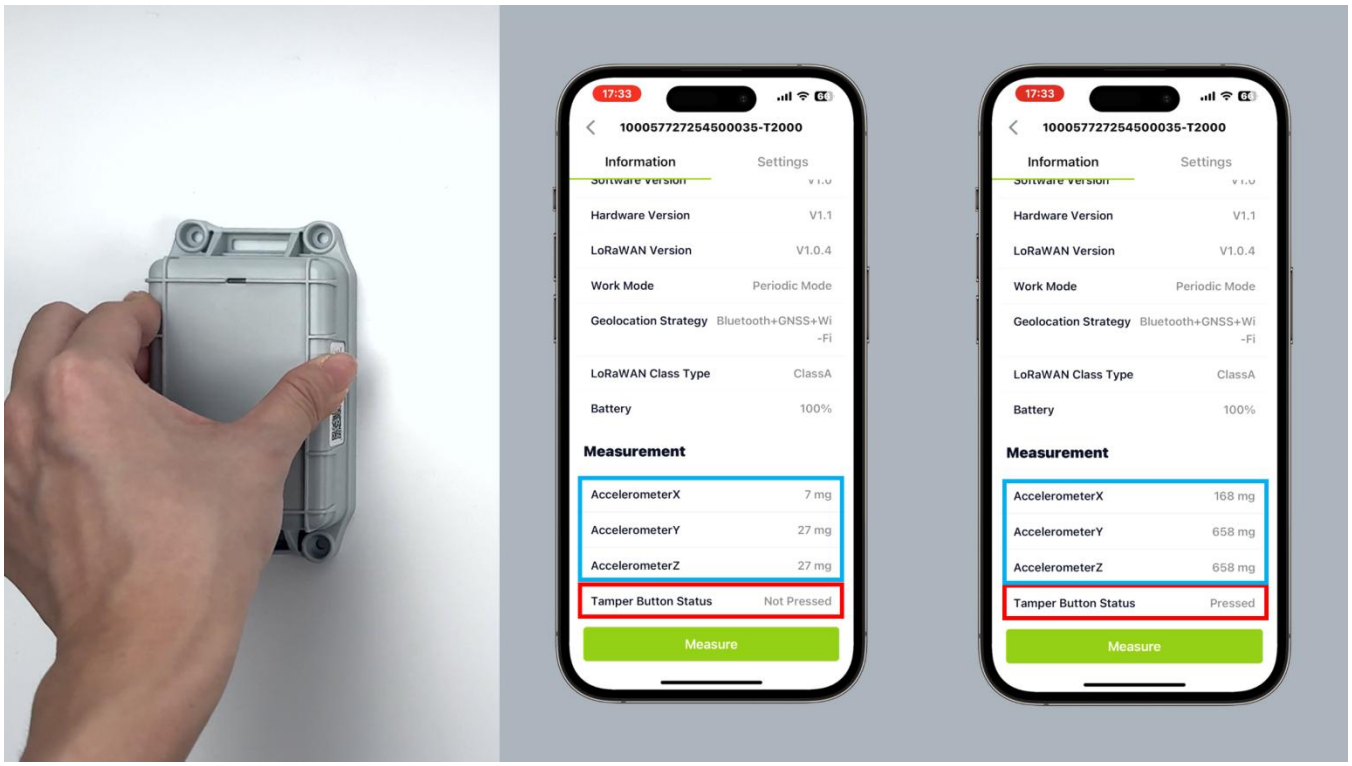
Click the Measure in the Information - Basic page, then you will get the sensor values:

1. **3-Axis Accelerometer (X / Y / Z Values)**

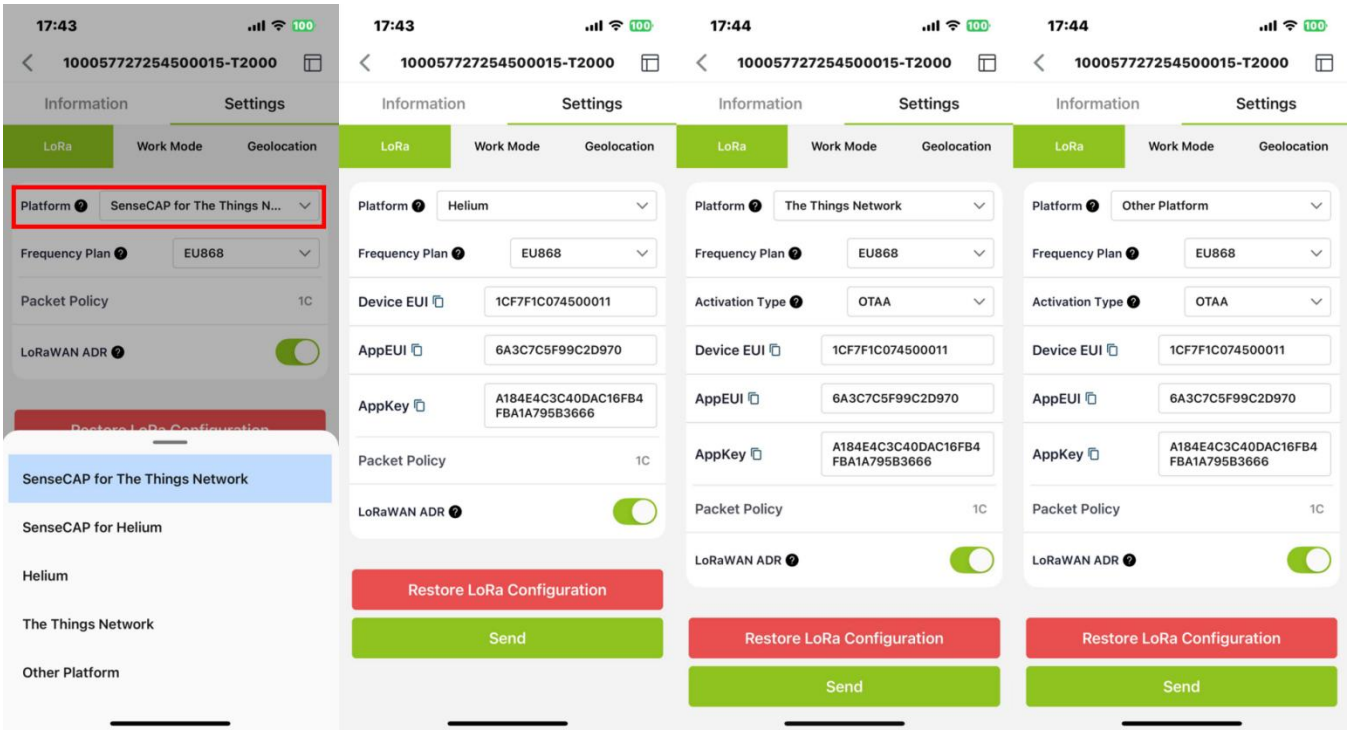
- The device reports acceleration values along the X, Y and Z axes. These readings help users understand the device's posture, movement or vibration status during operation or installation.

2. **Tamper Button Status**

- **Pressed:** the device is securely installed
- **Not Pressed:** the device is not fully mounted or has been removed



3.3.3.1 LoRa Parameters Setup



1. Platform

Platform	Description
SenseCAP for The Things Network	Default platform. It must be used with SenseCAP Gateway. SenseCAP builds a proprietary TTN server that enables sensors to be used out of the box when paired with an SenseCAP gateway. SenseCAP Outdoor Gateway SenseCAP Indoor Gateway
SenseCAP for Helium	When there is the Helium network coverage, data can upload via Helium. Devices run on a private Helium console of SenseCAP. Users do not need to create devices on Helium console, out of the

	box with SenseCraft App and Portal. Helium Coverage
Helium	Connect device to your public Helium console
The Things Network	Connect device to your TTN(TTS) server
Other Platform	Other LoRaWAN Network Server

2. Frequency Plan

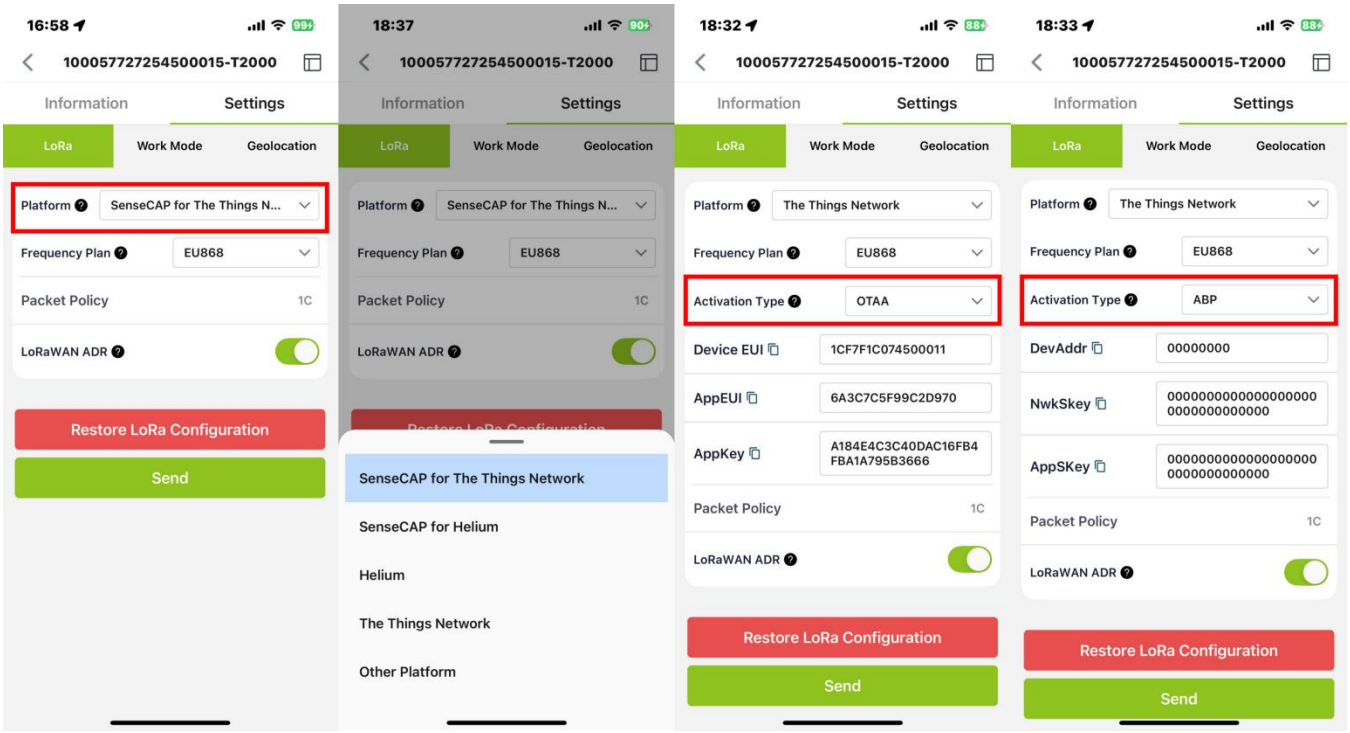
Trackers are manufactured to support universal frequency plan from 863MHz~928MHz. Every single device can support 8 frequency plans, including EU868, US915, AU915, AS923-1-TTN, AS923-2-TTN, IN865, KR920 and RU864.

Parameters	Description	
Frequency Plan	EU868 / US915 / AU915 / KR920 / IN865 / AS923-1 / AS923-2 / RU864	Default EU868
Packet Policy	1C	LoRaWAN use confirm packet
LoRaWAN ADR	Default open	LoRaWAN parameters, default open is recommended
Restore LoRa Configuration	When “Platform” switches back to SenseCAP from another platform, LoRa parameters (EUI/App EUI/	You can use this function when you need to restore LoRa parameters to factory

	App Key etc.) need to be restored	defaults

NOTE: If you are unsure which frequency band is required in your area, please consult our technical support team or refer to RP002-1.0.0 LoRaWAN® Regional Parameters for detailed regional frequency information.

3. Activation Type



The sensor supports two network access modes, OTAA by default.

Parameter	Description
OTAA (default)	Over The Air Activation, it joins the network through Device EUI, App EUI, and App Key.

Parameter	Description
ABP	Activation By Personalization, it joins the network through DevAddr, NwkSkey, and AppSkey.

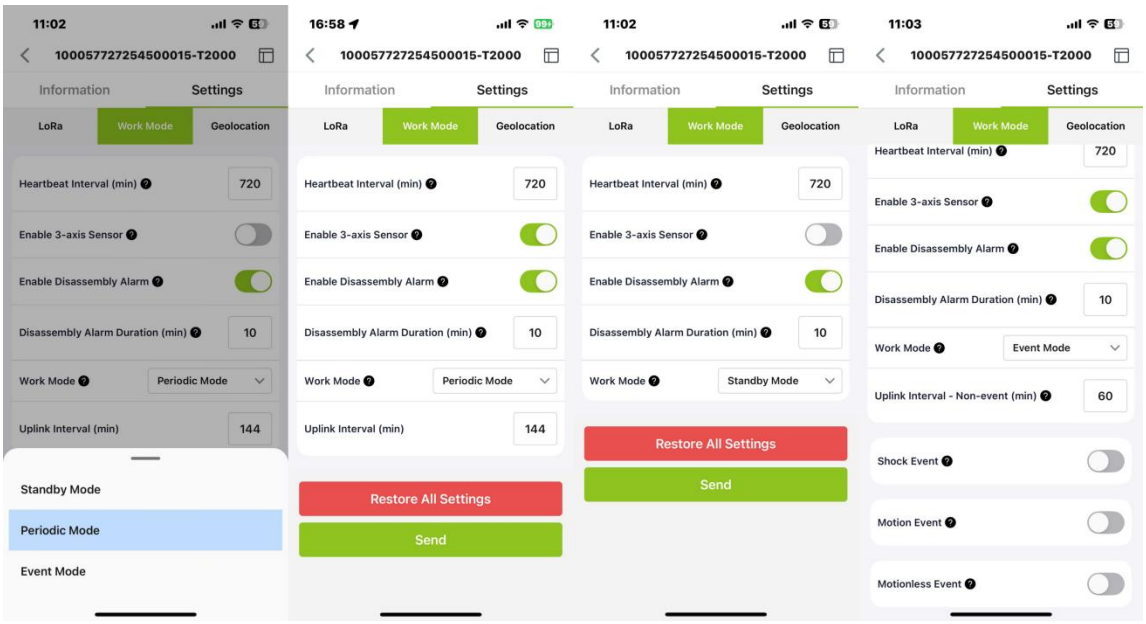
The device uses OTAA to join the LoRaWAN network by default. So, it can set the device EUI, App EUI and App Key.

Parameter	Type
Device EUI	16, hexadecimal from 0 ~ F
App EUI	16, hexadecimal from 0 ~ F
App Key	32, hexadecimal from 0 ~ F

NOTE: When using the SenseCAP platform, the EUI, APP EUI and APP Key are fixed and are the same as the sensor label.
When the sensor is selected to be used with a public platform such as Helium or TTN, the EUI will not change, and the sensor will generate a new fixed App EUI and App Key for network access.
To obtain EUI information in batches, please contact our sales team.

3.3.3.2 Work Mode Setup

Please setup the work mode according to your needs.



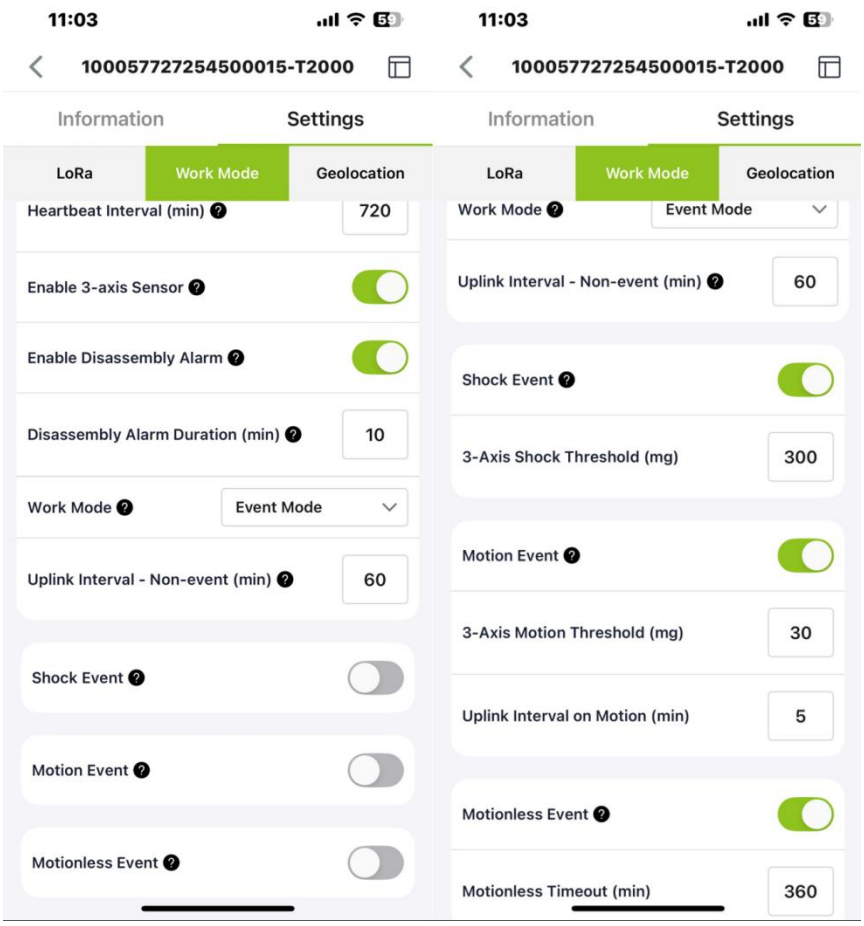
Parameters	Description	Default / Note
Heartbeat Interval	When no data is uploaded by the device within the heartbeat interval, a heartbeat packet will be triggered. This packet only contains battery information.	Default 720 minutes.
Enable 3-axis Sensor	If this switch is turned on, 3-axis sensor will be collected and uploaded, but it will increase power consumption.	Off by default.
Enable Disassembly Alarm	If this switch is turned on, the device activates an alarm when the device is removed after installation.	Enabled by default.
Disassembly	This parameter specifies how	This setting is only visible

Alarm Duration(min)	long the device keeps reporting after a Disassembly Alarm is triggered, sending one real-time position packet with the alarm event every minute.	when Enable Disassembly Alarm is turned on. Default 3 minutes.
Work Mode	**Standby Mode**	Uploads heartbeat packets (battery level only) based on the heartbeat interval.
	Periodic Mode	Location and sensor data are uploaded according to the uplink interval.
	Event Mode	Set threshold trigger conditions based on measured values such as movement and shock, and adjust the uplink interval when no event is triggered.
Uplink Interval (min)	**Periodic Mode**	Periodically locates and uploads data. Default 60 minutes. Higher frequency increases power consumption.
Restore All Settings	Restore all configuration parameters to factory settings, including LoRa, Work Mode, and Geolocation.	

For Event Mode, there are three events:

Event Mode	Description	
Uplink Interval – Non-event (min)	This is the upload interval when no events are triggered.	Default 60 minutes. Range: 1~10080 min.
Shock Event	When the shock event is enabled, the shock of the tracker will trigger a data report, including the shock event, location, and sensor data.	Off by default.
	3-Axis Motion Threshold (mg)	Default is 300. When the acceleration exceeds 300mg, the shock event is triggered.
Motion Event	When the acceleration exceeds the set value, the device starts to move, and when there is no movement for 2 minutes, the device movement stops. Set the upload interval according to the start movement and stop movement.	Off by default.
	3-Axis Motion Threshold (mg)	Default is 30. When the acceleration exceeds 30mg, determine that the device is in motion, when it is 2 minutes below this value,

		determine that the device is in motionless.
	Uplink Interval on Motion(min)	Set the upload interval for the current state when the device is in motion.
Motionless Event	When the device is stationary in a location for more than a certain amount of time, a stationary timeout event is triggered.	
	Motionless Timeout(min)	Default is 360 minutes.



3.3.3.3 Geolocation Mode Setup

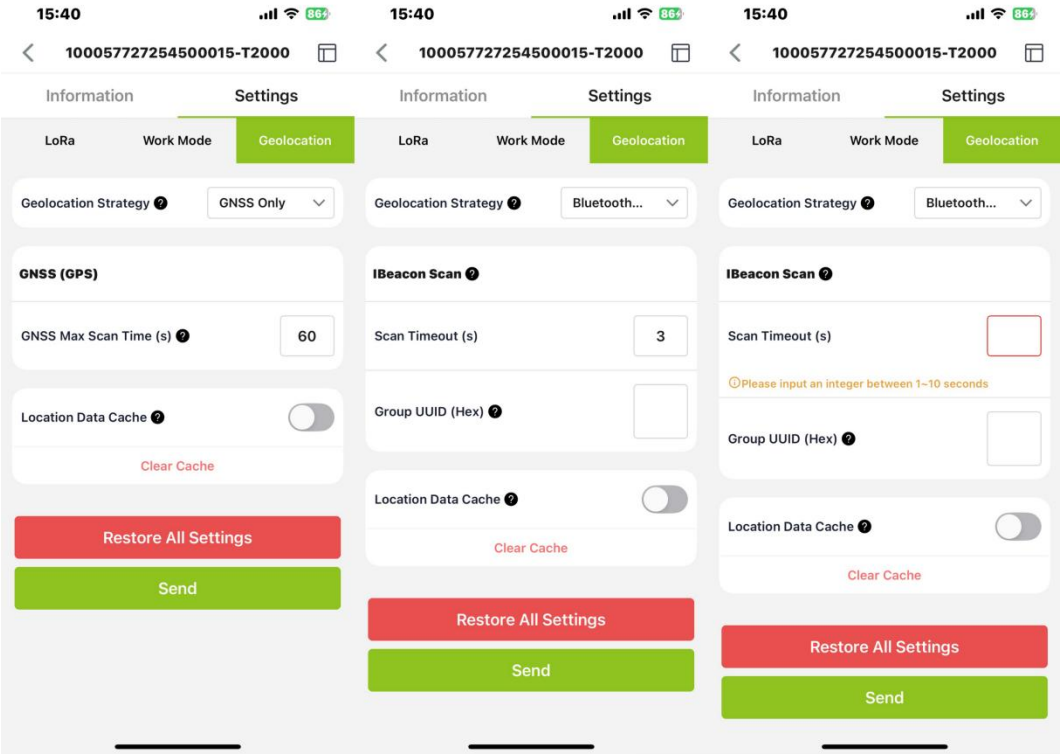
The tracker supports positioning via GNSS, Wi-Fi (Only T2000-B support), and Bluetooth.

- **GNSS :** The longitude and latitude can be directly obtained through GPS and other satellite positioning, then upload data via LoRa.
- **Wi-Fi :** Passive scanning, uploads the scanned 5 MAC addresses via LoRa.
- **BLE :** Uploads the scanned 5 MAC addresses of Beacon via LoRa.

Geolocation Strategy	Description	
Geolocation Strategy	GNSS Only	Default use GNSS. Only GNSS is used for position.
	Wi-Fi Only	Only Wi-Fi scans are used for position.
	Bluetooth Only	Only Bluetooth scans are used for position.
	GNSS + Wi-Fi	Use GNSS before Wi-Fi. If GNSS fails, then use Wi-Fi in one geolocation cycle.
	GNSS + Bluetooth	Use GNSS before Bluetooth. If GNSS fails, then use Bluetooth in one geolocation cycle.
	Wi-Fi + GNSS	Use Wi-Fi before GNSS. If Wi-Fi fails, then use GNSS in one geolocation cycle.
	Bluetooth + GNSS	Use Bluetooth before GNSS. If

		Bluetooth fails, then use GNSS in one geolocation cycle.
	Bluetooth + Wi-Fi	Use Bluetooth before Wi-Fi. If Bluetooth fails, then use Wi-Fi in one geolocation cycle.
	Bluetooth + Wi-Fi + GNSS	Use Bluetooth, Wi-Fi and GNSS for positioning in turn (switch to the next type of positioning after one type of positioning fails).
GNSS Max Scan Time(s)	The maximum time to spend waiting for the GNSS to get a coarse position fix.	Default is 60s. It is not recommended to modify, the longer of the time, the bigger of power consumption.
iBeacon Scan Timeout(s)	Under Bluetooth positioning, the maximum time for the device to scan surrounding Bluetooth beacons to obtain a coarse position fix.	Default is 3s. Range 1~10s.
Group UUID (Hex)	It allows the tracker to only scan and report Bluetooth beacons whose UUIDs match the specified pattern, helping filter out irrelevant beacons.	Set UUID Filter, up to 16 bytes. For example, if set as '01 02 03 04' it will filter beacons with the pattern '01 02 03 04 xx xx ...'

Location Data Cache	When it can't upload data via LoRa, the data is saved locally(up to 1000 records) and uploaded when the LoRa coverage is recovered.	Off by default.
Clear Cache	Clear all historical cache data.	

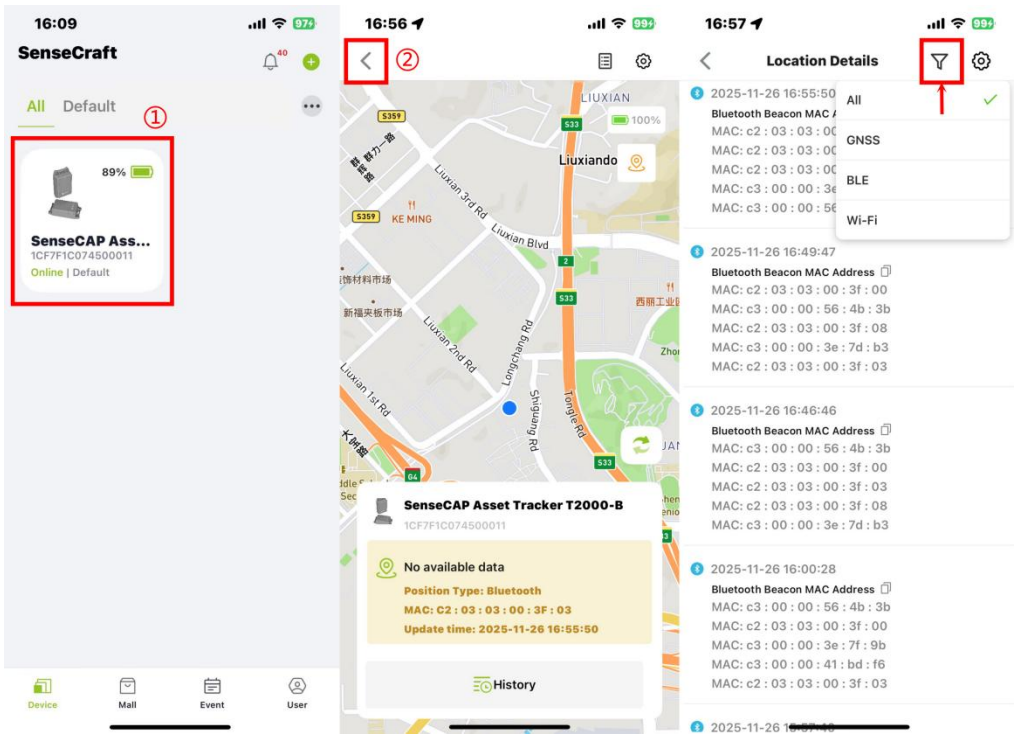


After all parameters are configured, click “Send”. If no parameter needs to be modified, exit Bluetooth configuration, and return to the home page. At this point, the device initiates a LoRa network access request.

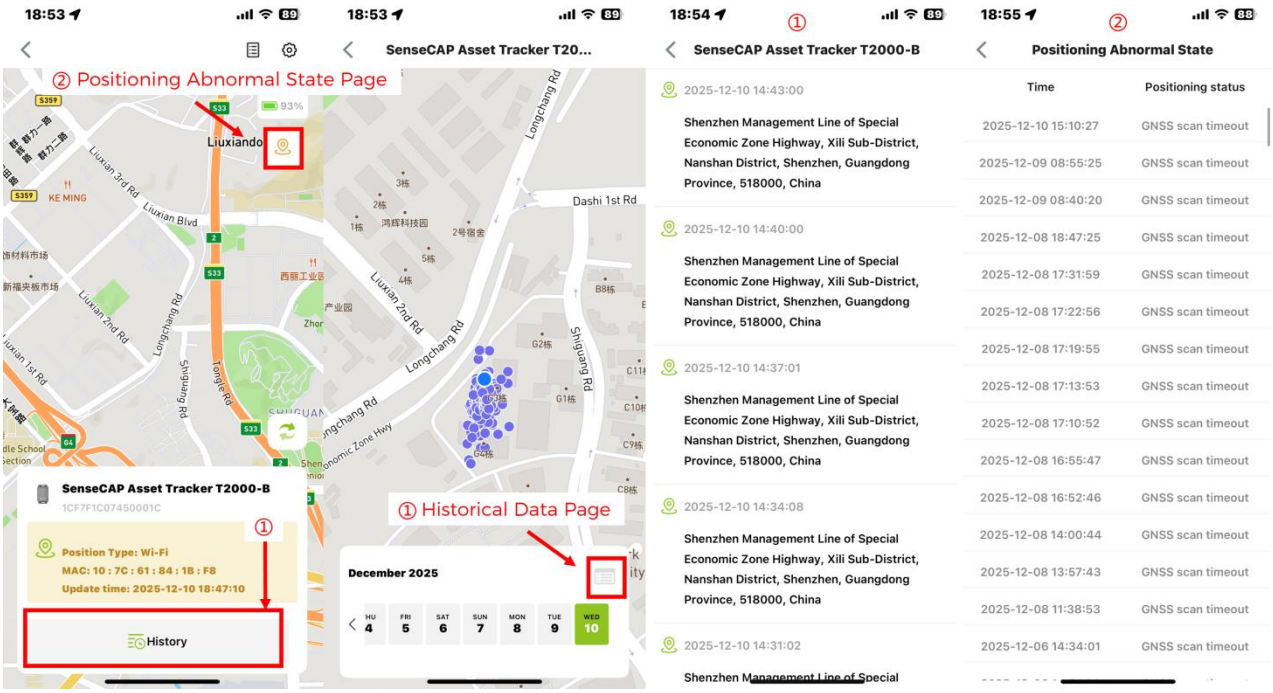
3.3.4 Device Data View

- **SenseCraft App**

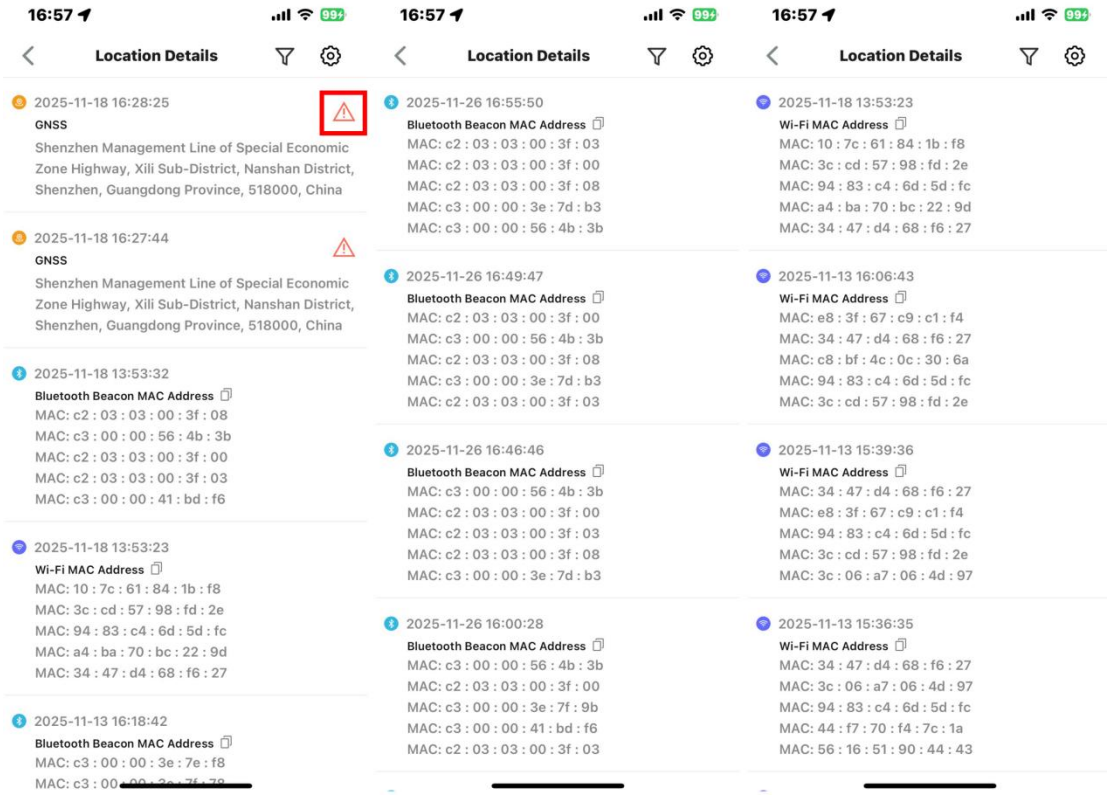
Check the Location on the APP. After binding the device, enter the device page and click the button in the upper right corner to view the historical location data of the device. Click on the filter to choose to view location data under positioning modes such as 'All/GNSS/BLE/Wi-Fi'.



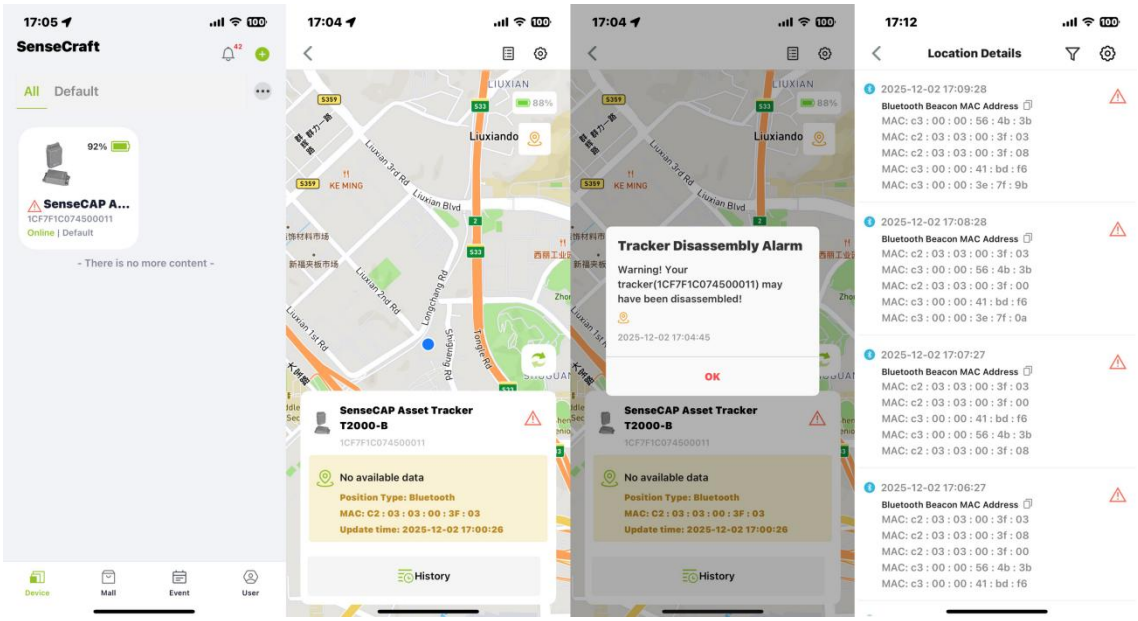
Click History, you can view all historical positioning data for a selected date. Click the positioning icon in the upper-right corner to view all Positioning Abnormal records. When GNSS, Wi-Fi or Bluetooth scanning times out, the related event will be shown on this page.



If the device triggers a Disassembly Alarm, a red alarm icon will be displayed next to each data packet during the triggering period.



When the disassembly alarm is trggered, a alarm notification message would be sent to your phone. Also, the disassembly alarm will appear on both the Device and Details pages in the APP, along with a notification window, which helps users quickly check the device's status.

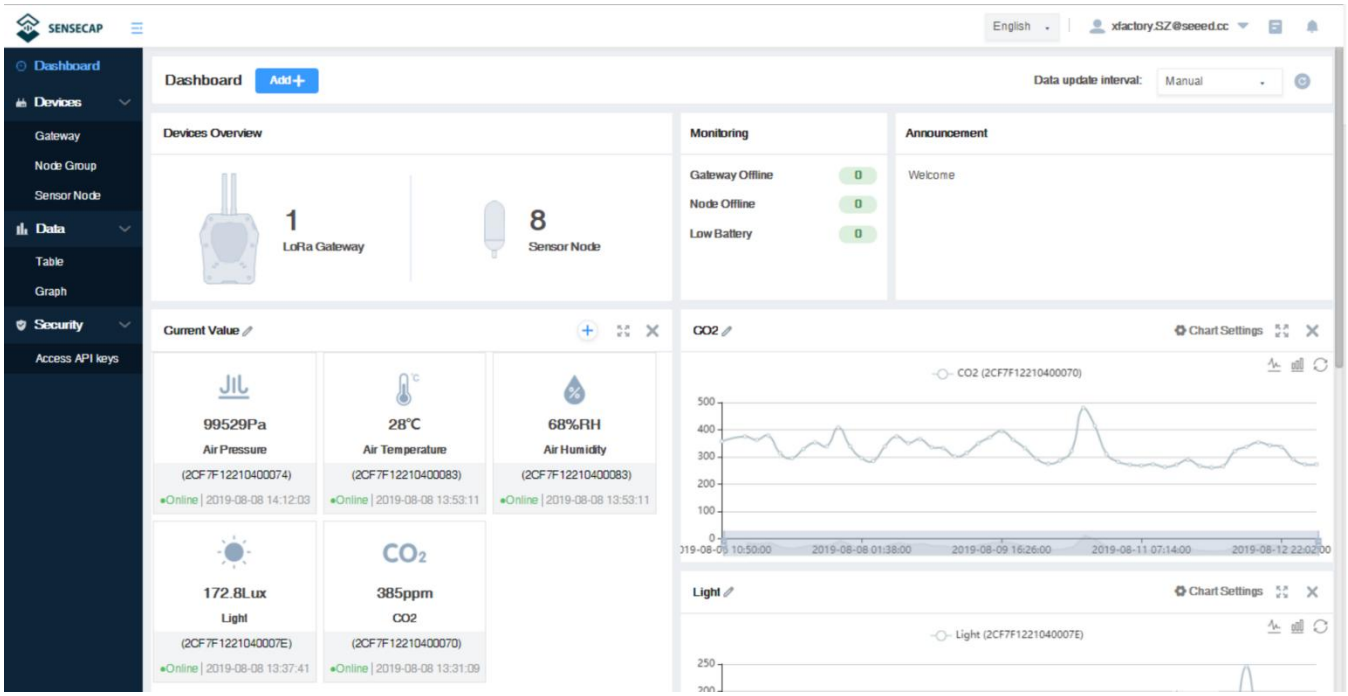


- **SenseCAP Portal**

The main function of the SenseCAP Portal is to manage SenseCAP devices and store data. It is built on Azure, a secure and reliable cloud service from Microsoft. Users can

apply for an account and bind all devices to this account. The SenseCAP Portal provides a web portal and API. The web portal includes Dashboard, Device Management, Data Management, and Access Key Management. The API is open to users for further development.

- **Dashboard:** Including Device Overview, Announcement, Scene Data, and Data Chart, etc.
- **Device Management:** Manage SenseCAP devices.
- **Data Management:** Manage data, including Data Table and Graph section, providing methods to search for data.
- **Subaccount System:** Register subaccounts with different permissions.
- **Access Key Management:** Manage Access Key (to access API service), including Key Create, Key Update, and Key Check.



Log in SenseCAP Portal

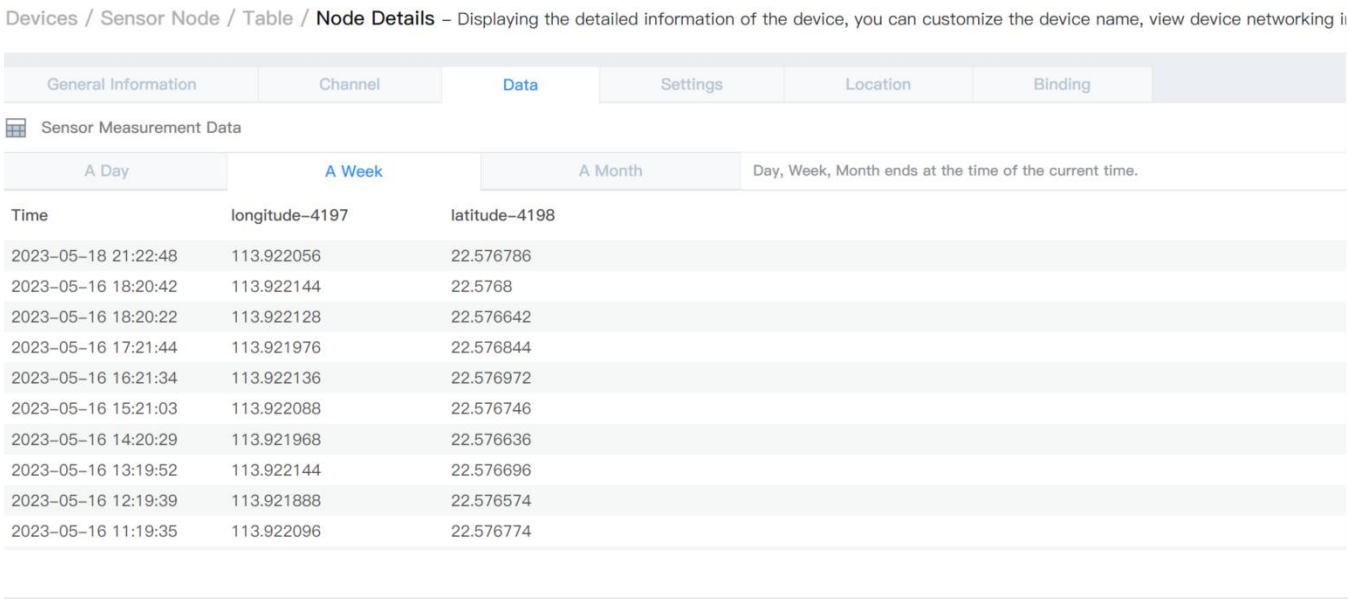
If you have created an account through the APP, you can log in directly.

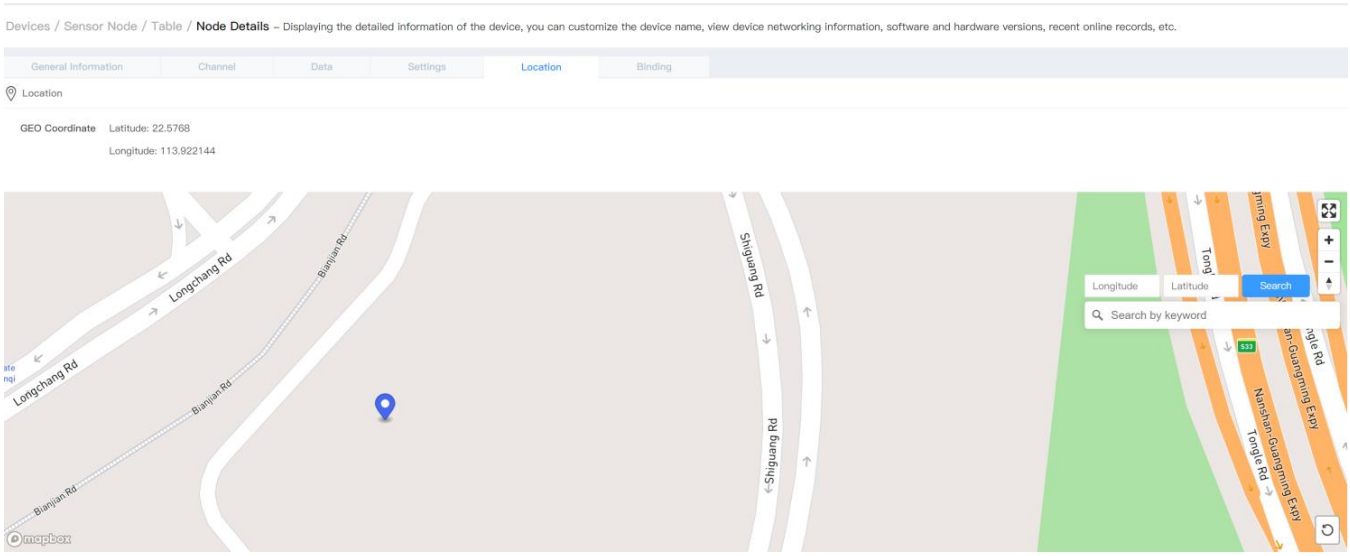
1. Select register account, enter email information, and click "register", the registered email will be sent to the user's mailbox

2. Open the "SenseCAP..."Email, click the jump link, fill in the relevant information, and complete the registration

3. Return to the login interface and complete the login

4. Check SenseCAP Portal User Guide for more details.



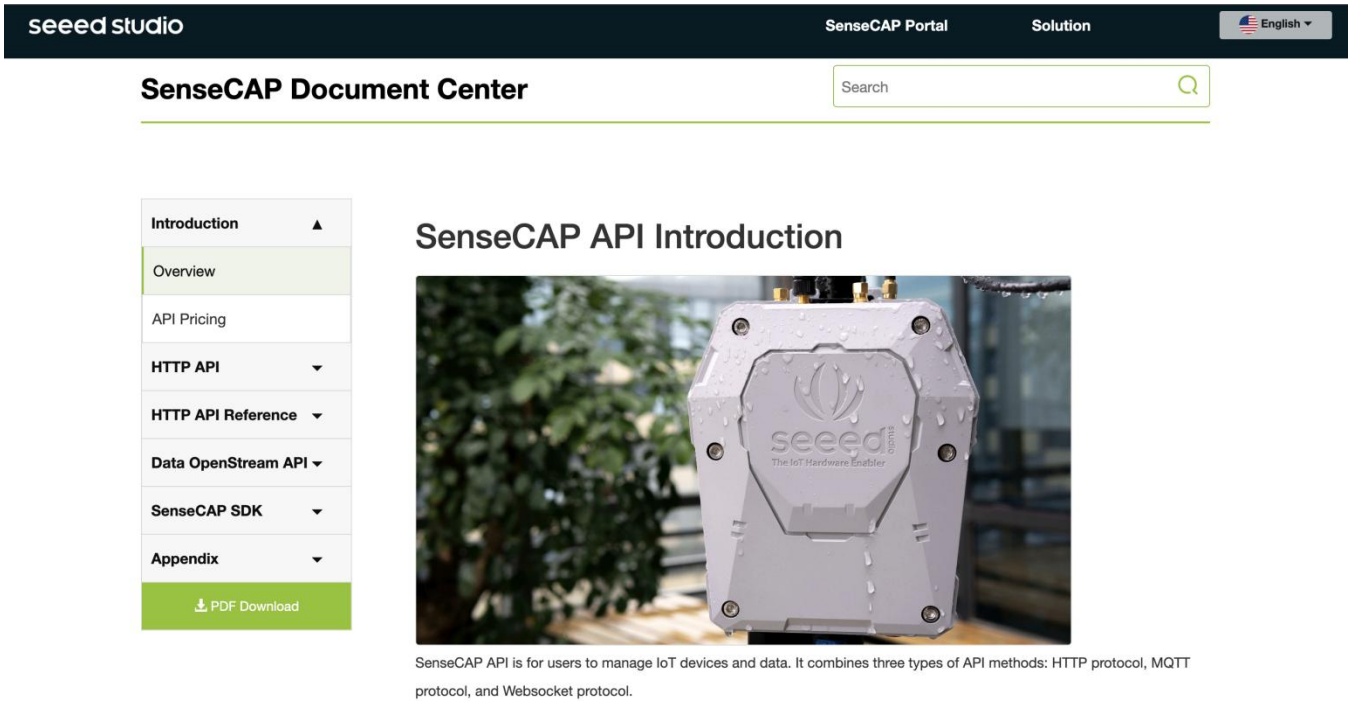


3.4 SenseCAP API

SenseCAP API is for users to manage IoT devices and data. It includes 3 types of API methods: HTTP protocol, MQTT protocol, and Websocket protocol.

- With HTTP API, users can manage LoRa devices, to get raw data or historical data.
- With MQTT API, users can subscribe to the sensor's real-time measurement data through the MQTT protocol.
- With Websocket API, users can get real-time measurement data of sensors through Websocket protocol.

Please check API User Guide for more details.



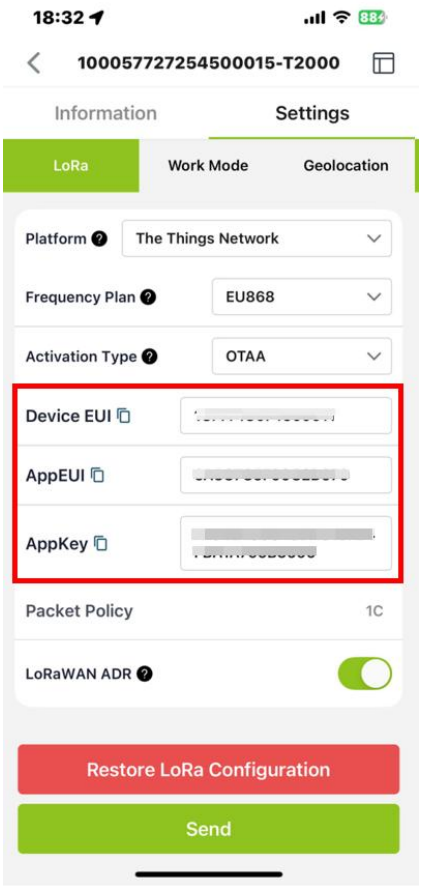
4 Integrated with LoRaWAN Network Server

4.1 Connect to The Things Network

The Things Network (TTN) is a global, open-source IoT platform built on LoRaWAN®, offering low-power and long-range wireless connectivity. It is supported by The Things Stack (TTS), a LoRaWAN® network server that provides secure device management and data routing. In this chapter, we will guide users to connect the SenseCAP T2000 Tracker to The Things Network.

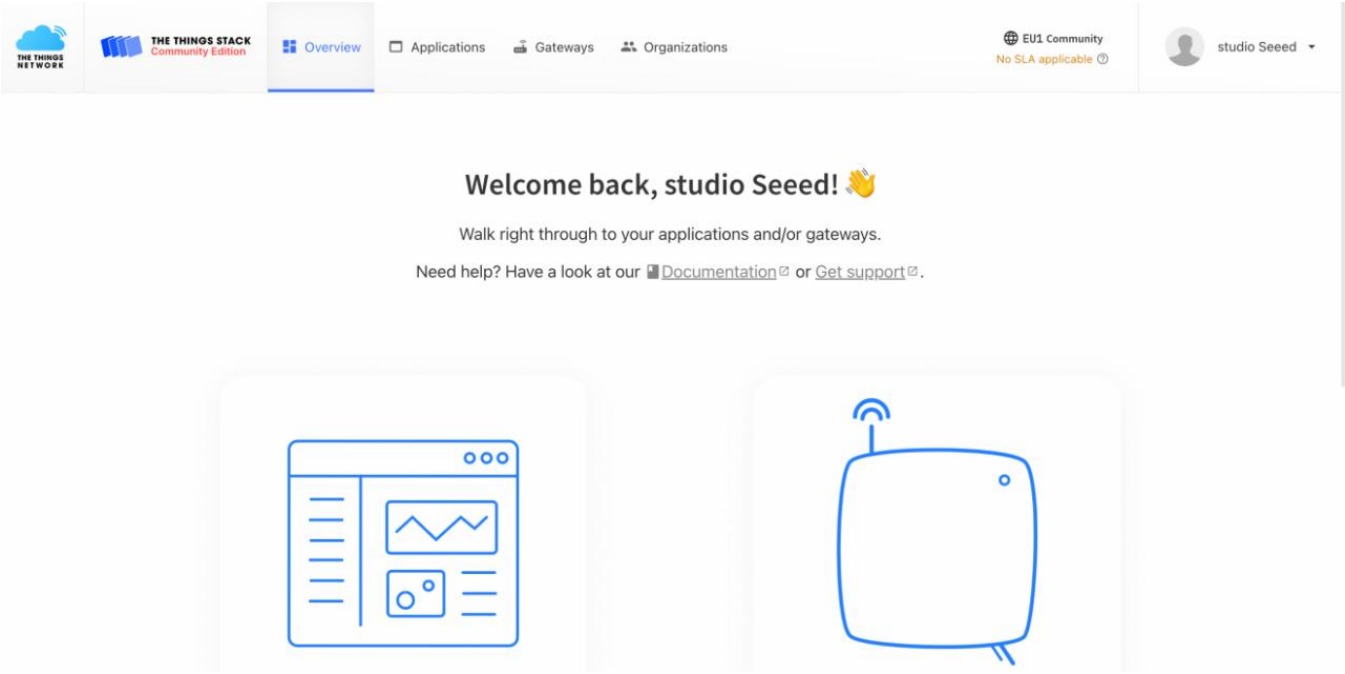
Before connecting to the TTS, you need to configure the basic parameters of your device on SenseCraft APP, check Quick Start for more details.

Set the platform to The Things Network, and then copy the Device EUI / AppEUI / AppKey. And then add devices manually in The Things Stack.



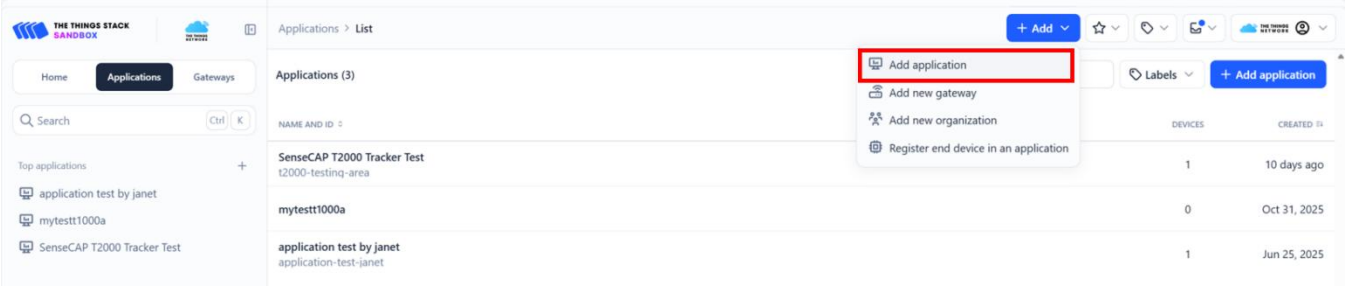
The Things Stack(TTS) is an enterprise grade LoRaWAN network server, built on an open-source core. The Things Stack allows you to build and manage LoRaWAN networks on your own hardware or in the cloud.

To begin, register an account on The Things Network.

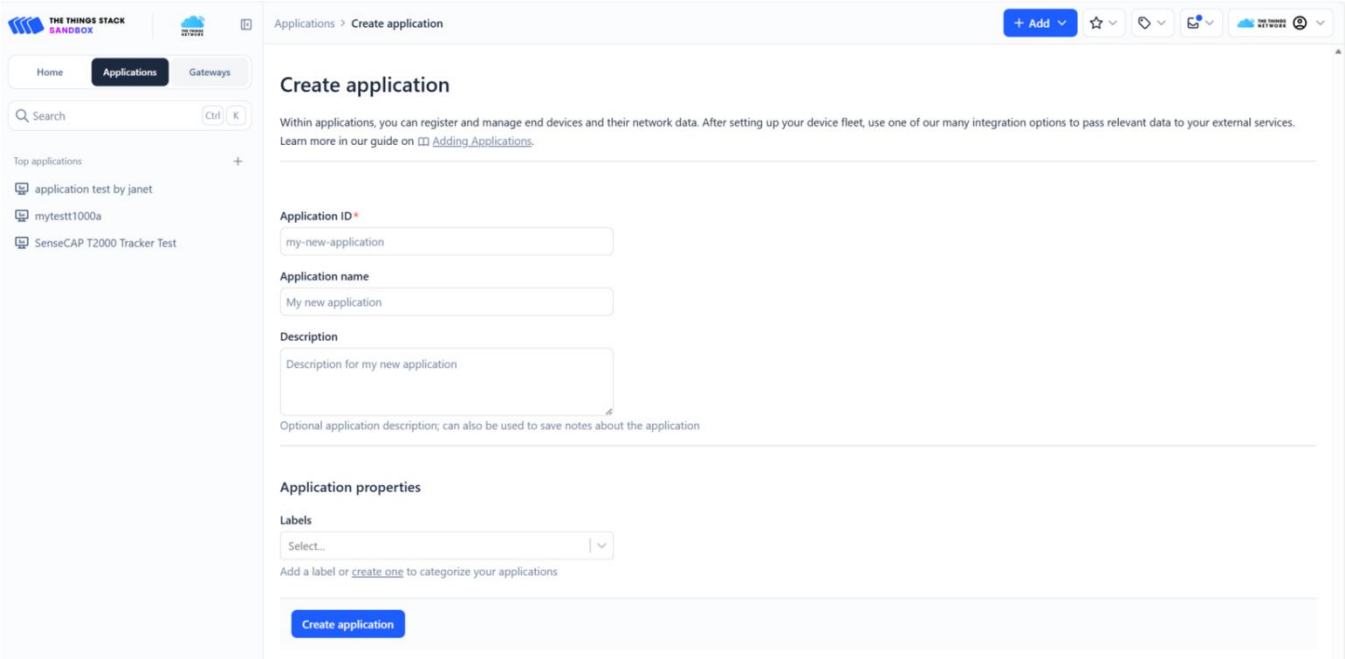


Step 1: Create an Application

Navigate to Applications page, click Add application.

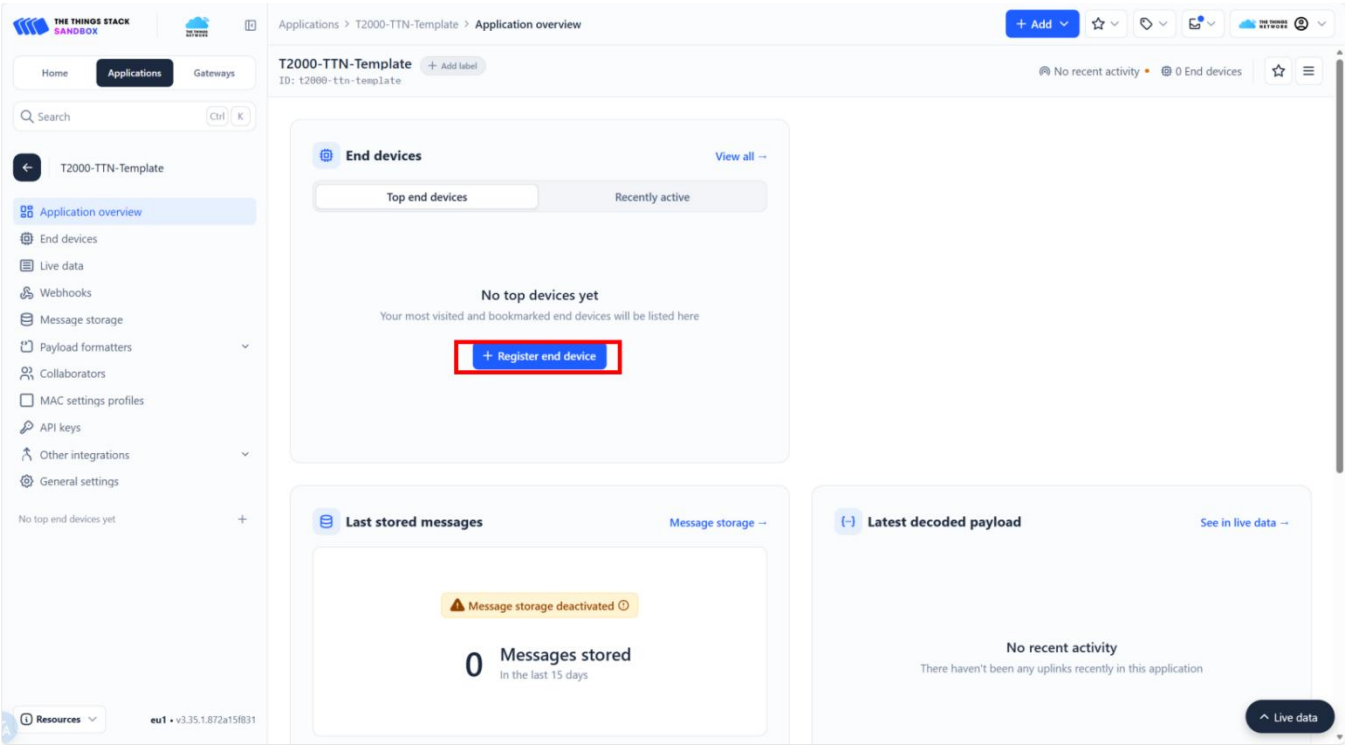


Enter an Application ID, Application name, click Create application to save your changes.



Step 2: Register the Device

After the application was created, click Register end device.

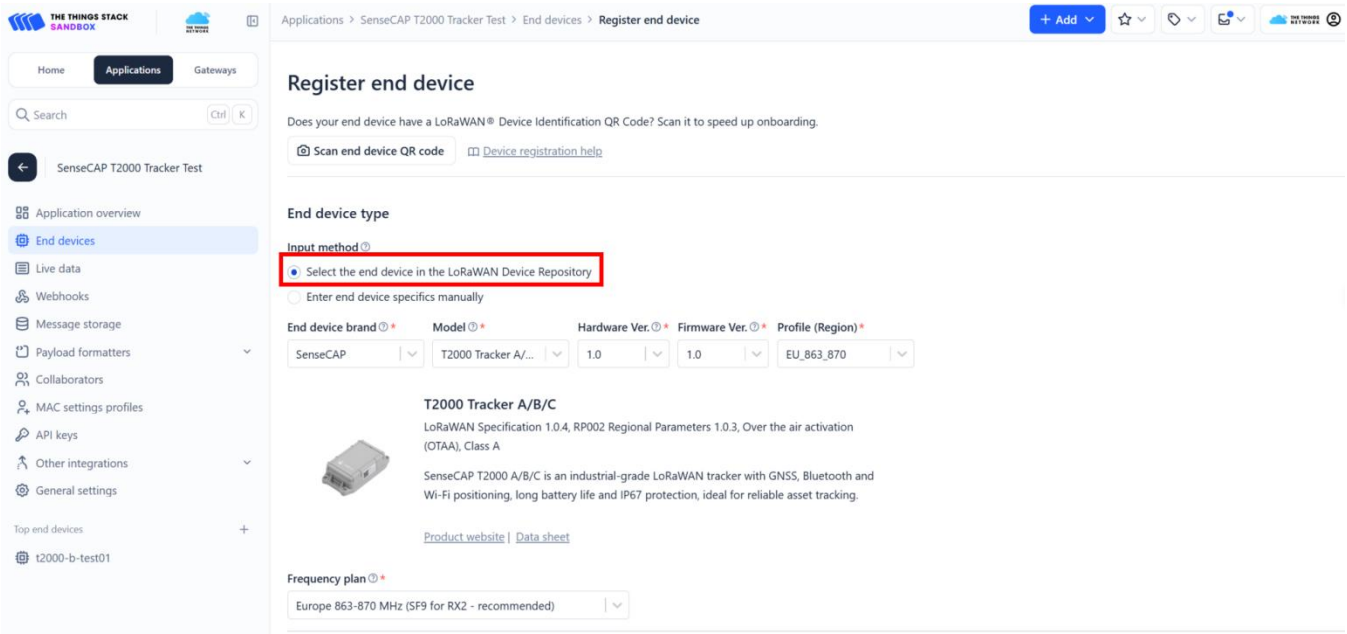


There are two ways for users to register an end device:

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

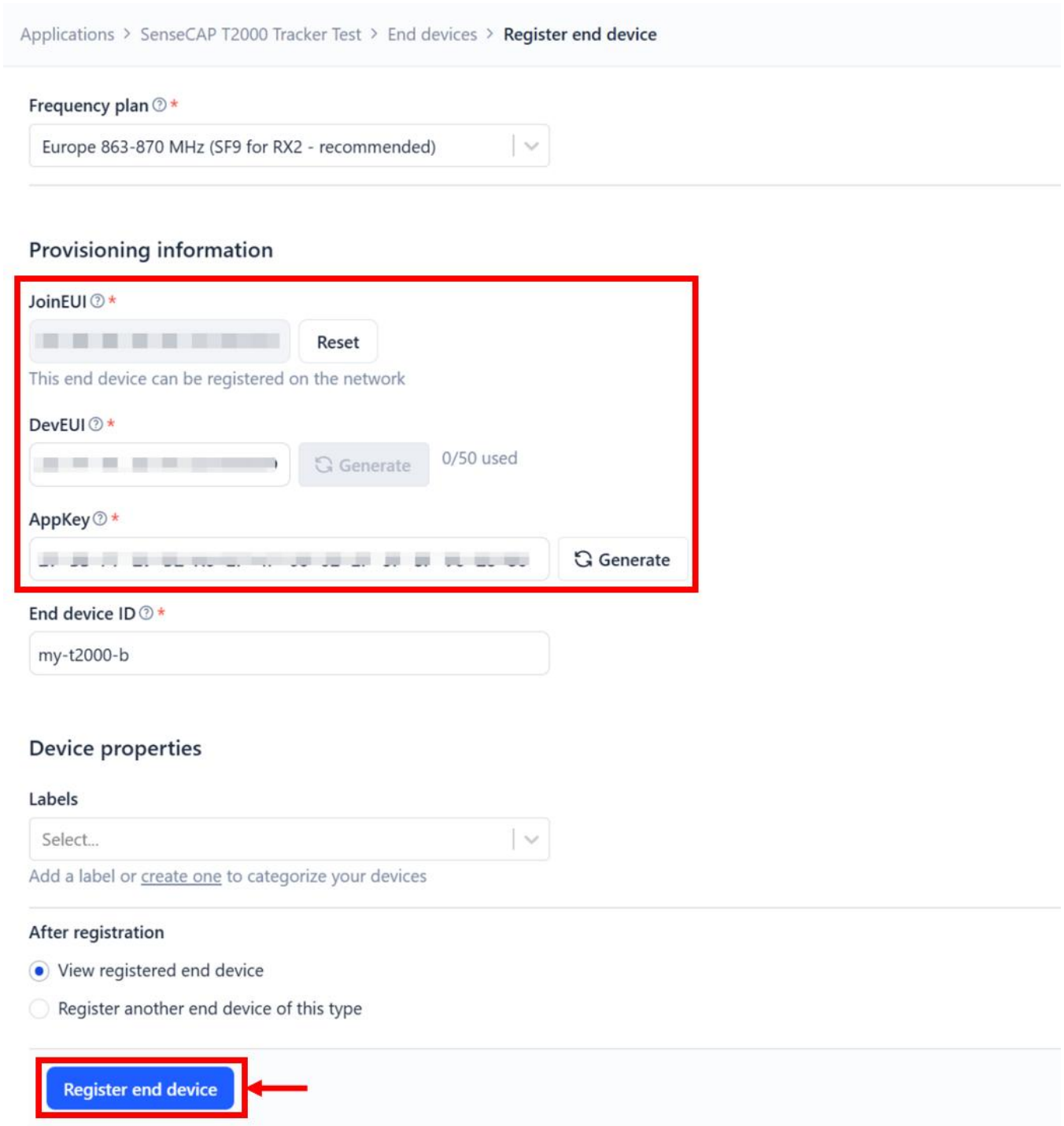
1. Select the end device in the LoRaWAN Device Repository

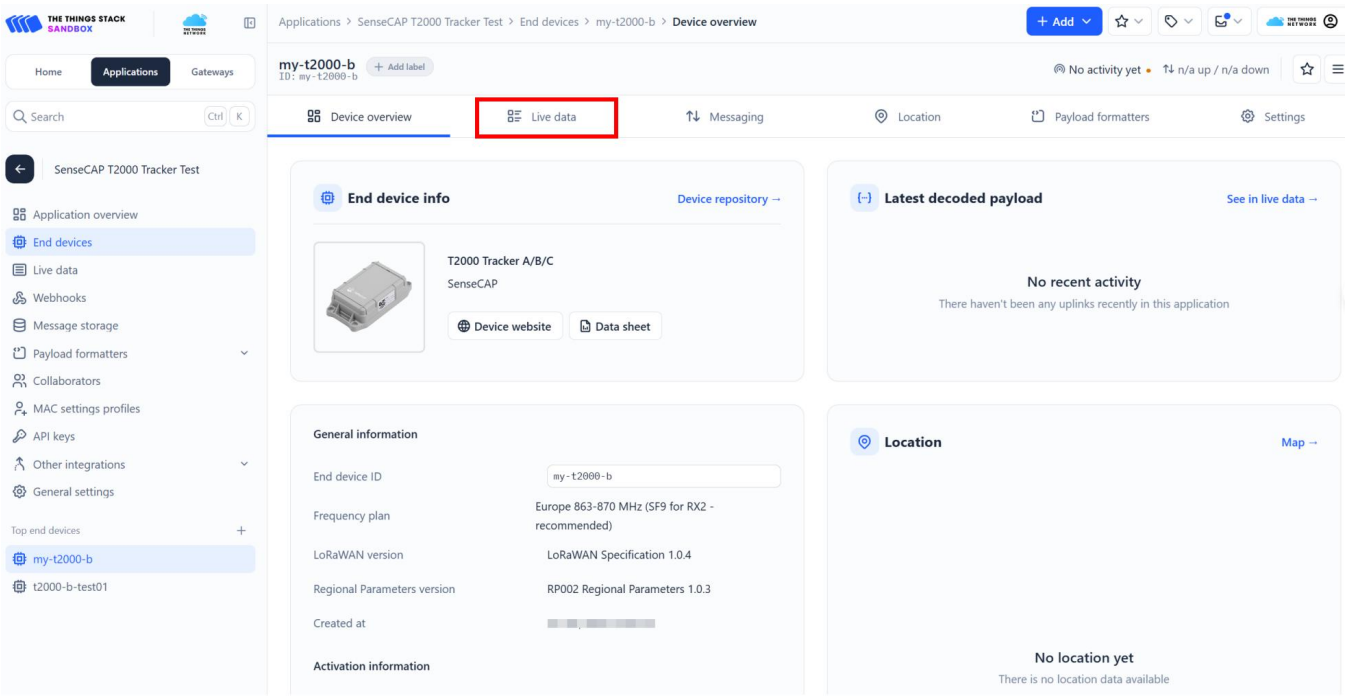
Choose the Select the end device in the LoRaWAN Device Repository.
Select SenseCAP and select T2000 Tracker A/B/C Model.
Keep the Software and Hardware version as default, and select the corresponding Profile(Region) according to the band setting of the device.



Choose an appropriate Frequency Plan. Your device and gateway must use the same frequency plan to communicate.
Paste the Device EUI / AppEUI / AppKey from the SenseCraft App, and then click Register end device.

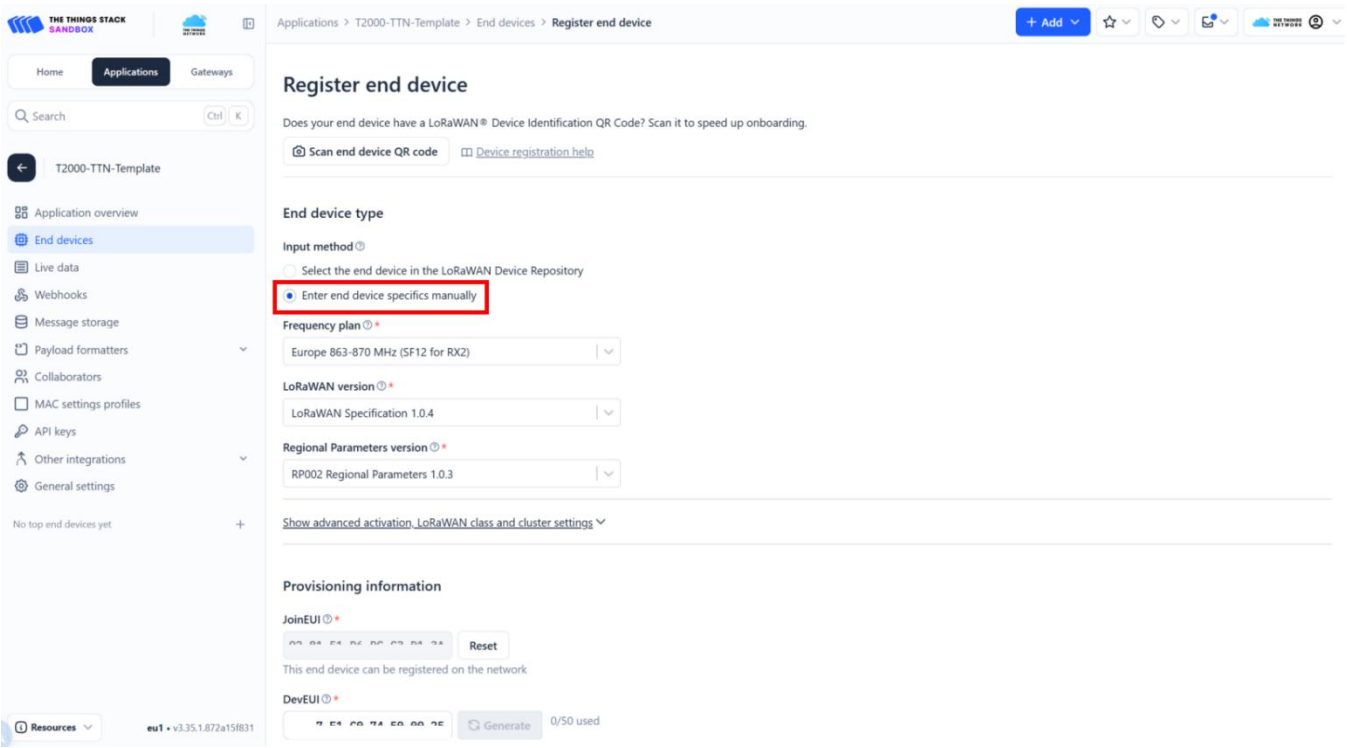
> NOTE: The "JoinEUI" above is simliar to "AppEUI".





2. Enter end device specifics manually

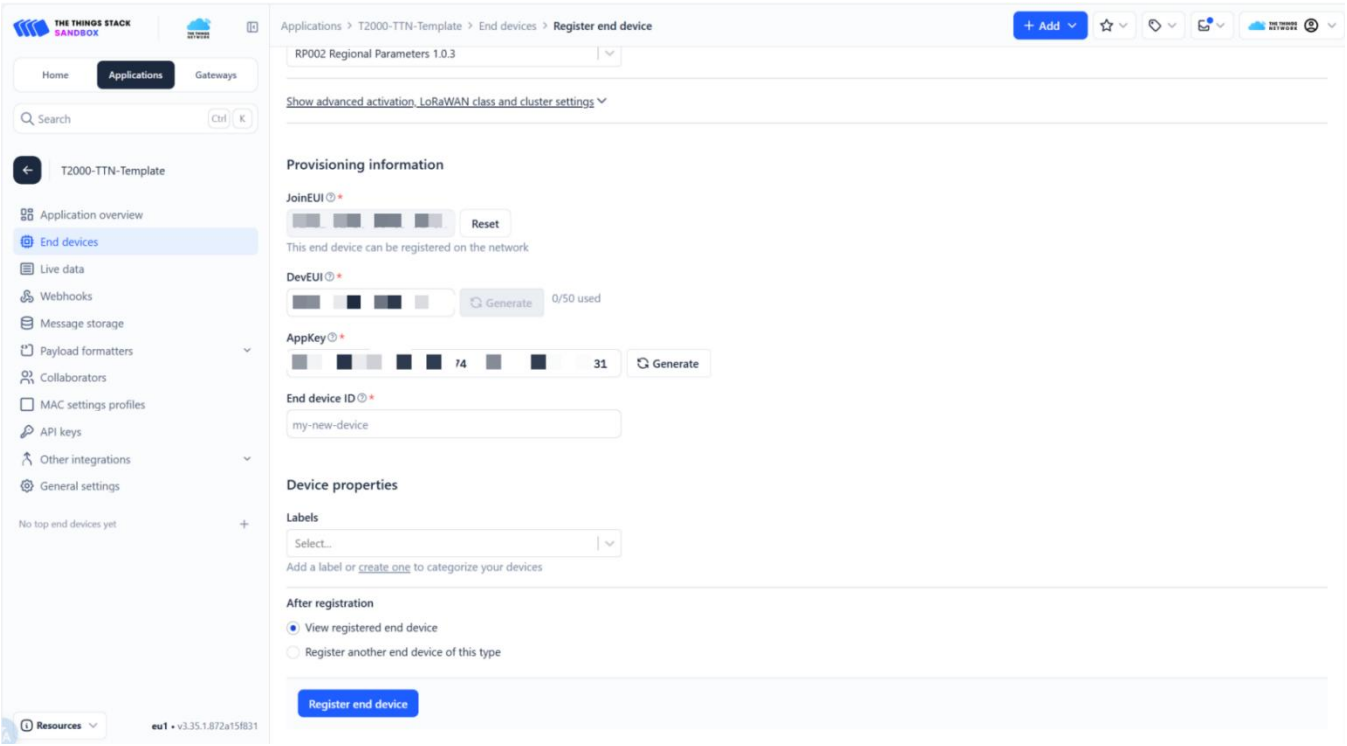
Alternatively, you can choose the Enter end device specifics manually. And please refer to the information below to ensure entering the following information correctly.



Choose an appropriate Frequency Plan. Your device and gateway must use the same frequency plan to communicate.

INFO: Select LoRaWAN Version and Regional Parameters version fields for your specific device.
LoRaWAN version: LoRaWAN Specification 1.0.4
Regional Parameters version: RP002 Regional Parameters 1.0.3

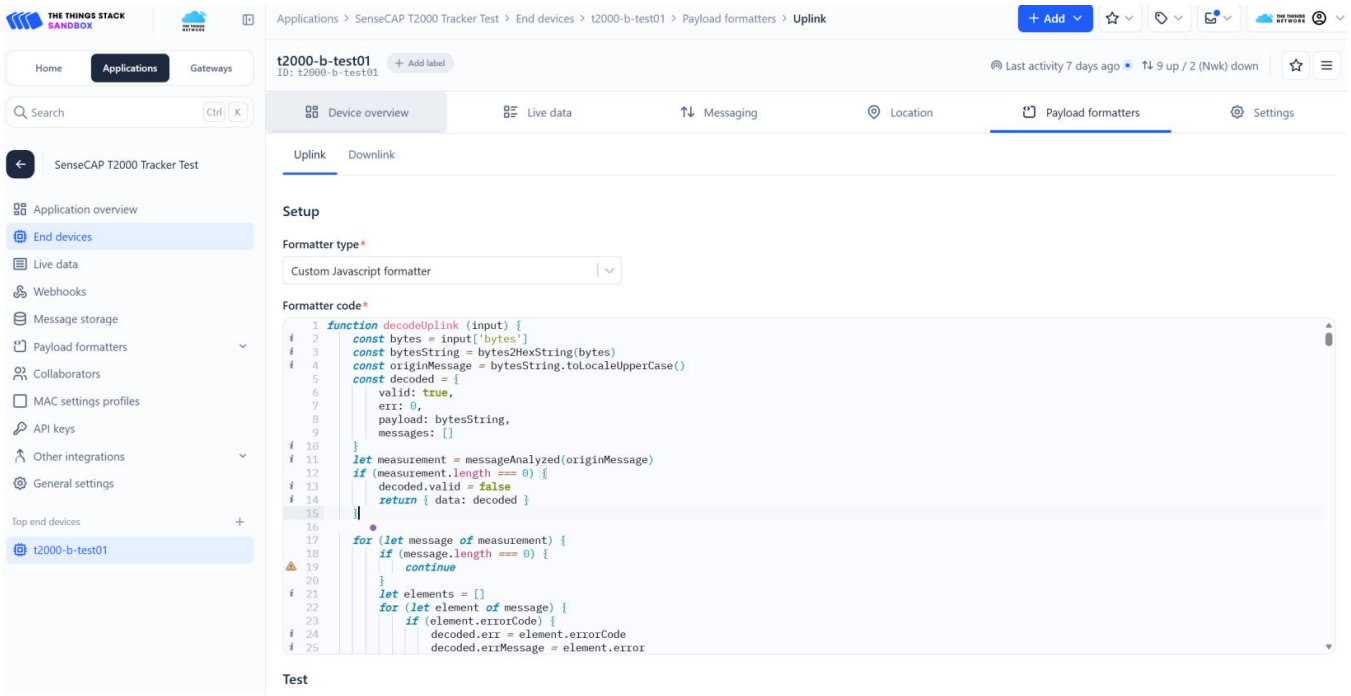
Paste the Device EUI / AppEUI / AppKey from the SenseCraft App, and then click Register end device.



Then upload the Payload Formatter.

Navigate to Payload Formatters page, choose Custom Javascript Formatter. Fill in the Formatter code with the decoder below and save changes:

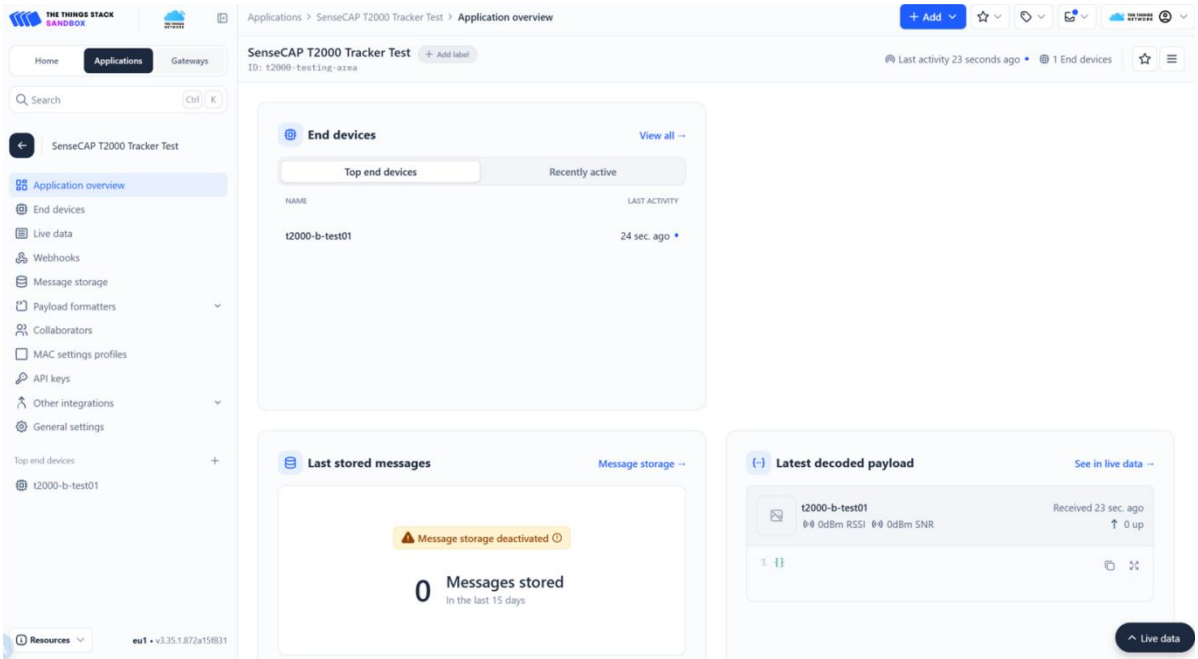
For TTN(ChirpStack V4): SenseCAP T2000 Tracker Decoder for TTN



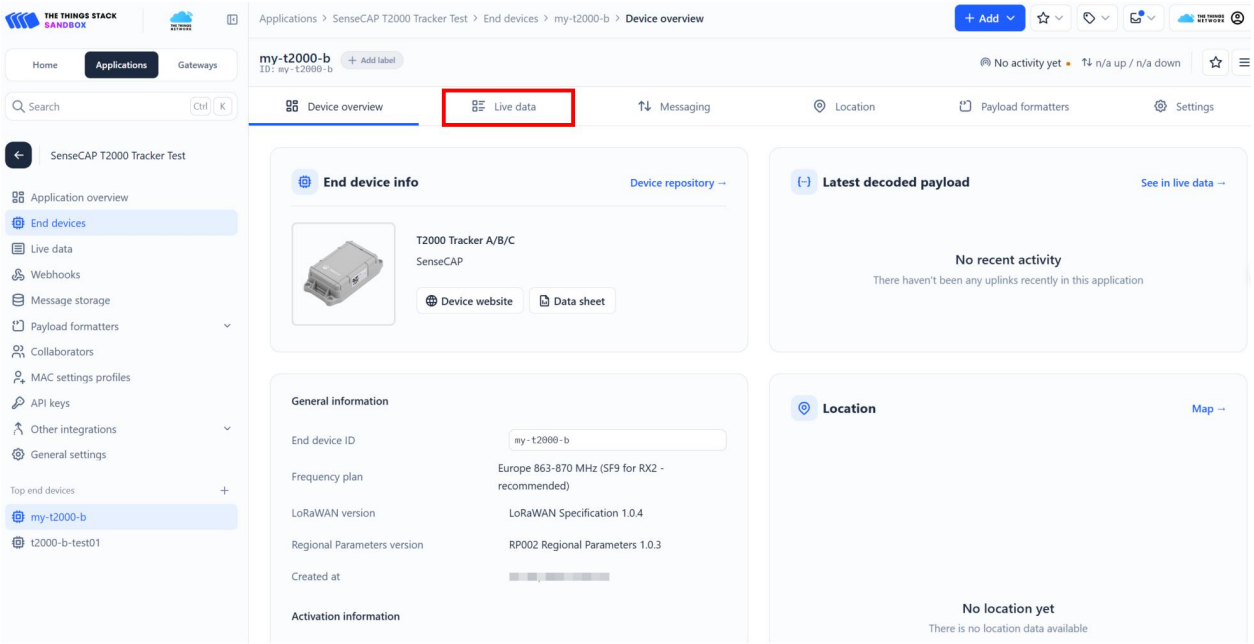
Step 3: Check the Data

When the device tries to connect to the network, the green breathing light will flash. If the device joins the network successfully, the green light will flash 5 times quickly.

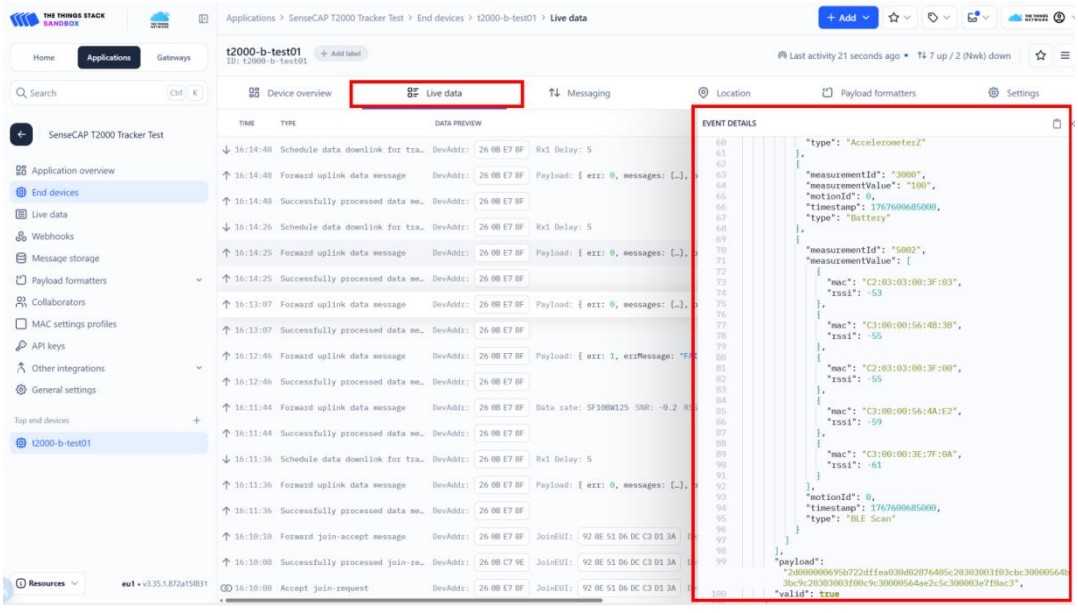
You can check the device's activity in the Application overview page.



Click the end device, then check the Live data. When you see the message below, your device has successfully join the network.



Then you can check the data on the TTS console.

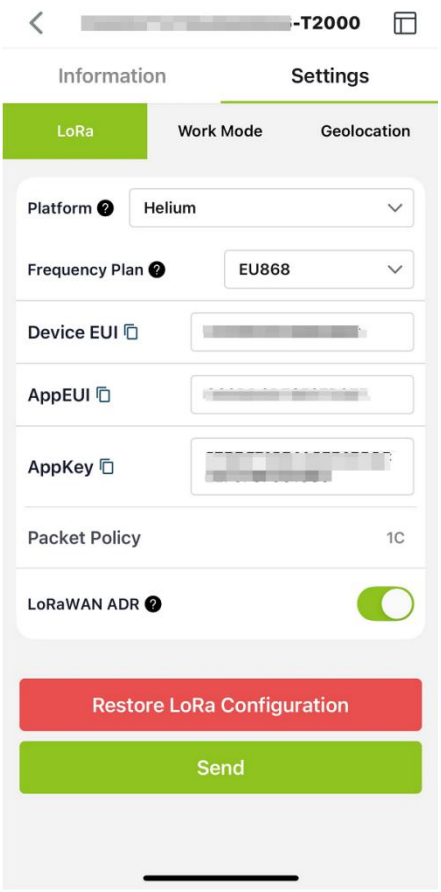


4.2 Connecting to Helium

Helium console is a management platform in the Helium network for registering, configuring, and routing data from LoRaWAN devices, enabling rapid IoT deployment. This section will teach you how to quickly integrate your device into Helium.

Before connecting to Helium, you need to configure the basic parameters of your device on SenseCraft APP, check Get Started for more details.

Set the platform to Helium, and then copy the Device EUI/App EUI/App Key.



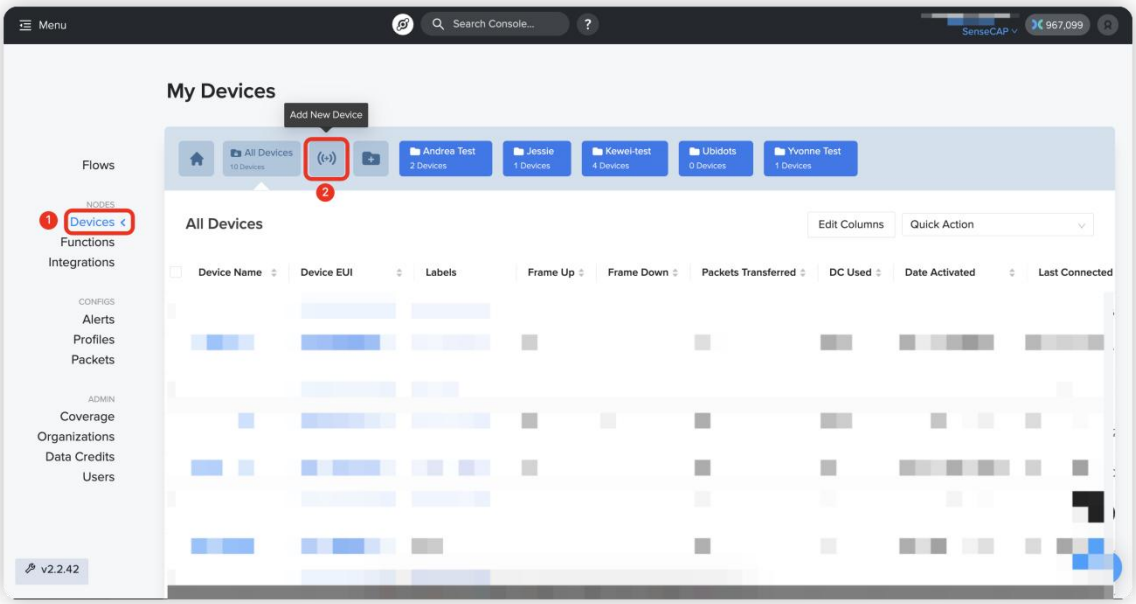
Helium Console Configuration

NOTE: The Helium console is no longer open for new accounts. The description for how to connect a T2000 to the Helium Console remains here for users that already have an account. For new users, please refer to the **ChirpStack LNS steps** below or

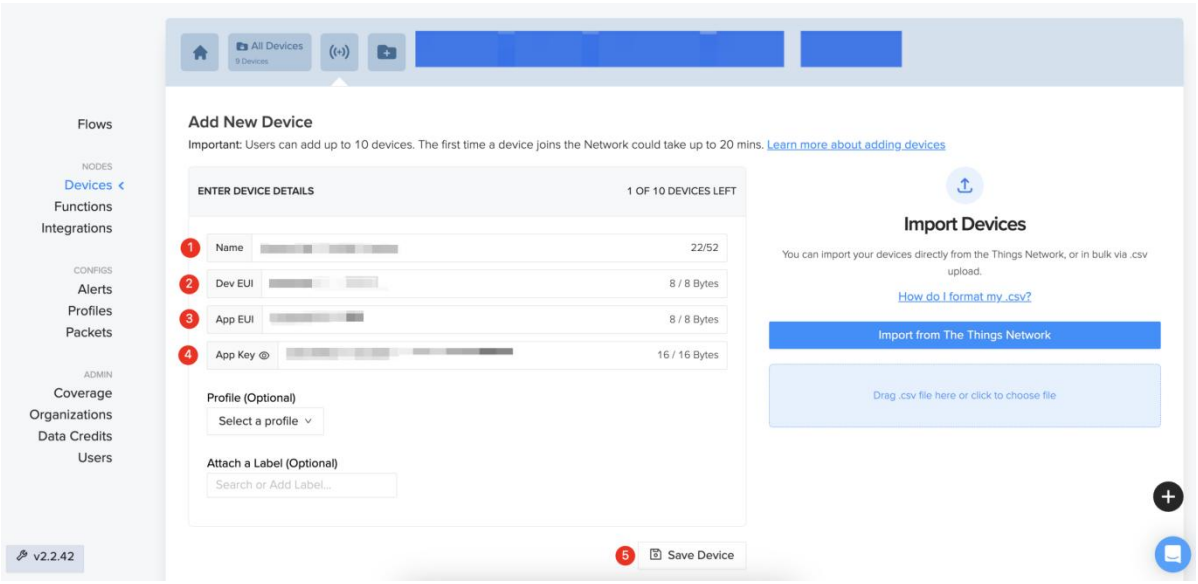
determine the necessary steps for your particular LNS based on the two existing examples here.

Step 1: Add New Device

Log into your Helium console, then go to Devices section and click on Add device button.

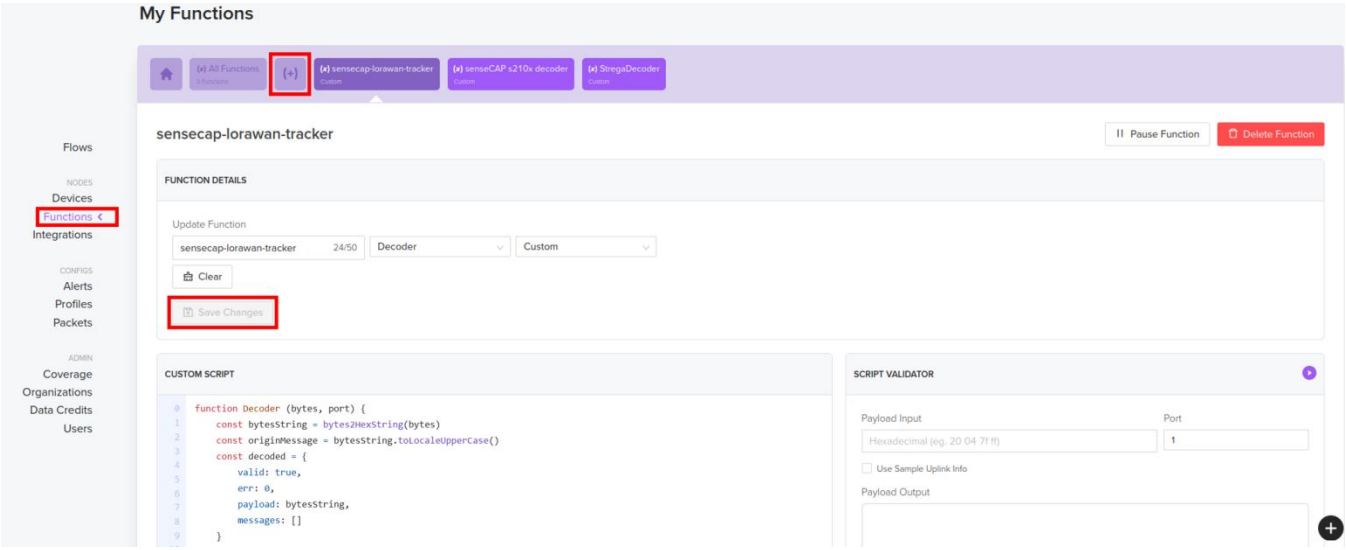


Fill the required fields such as the **device name, the LoRaWAN credentials**, etc. Then click the Save Device button.



Step 2: Create the Decoder Function

The next step is to setup the function that will decode the raw bytes into a human readable form.
Head to Function tab on the panel at the left side. Then click the Add New Function button and give it a name:



Copy the following code to fill in the CUSTOM SCRIPT and then save the changes.

Decoder for Helium

Step 3: Check the Data

When the device tries to connect to the network, the green breathing light will flash. If the device joins the network successfully, the green light will flash 5 times quickly.

Then you can check the data on the Helium console.

- **ChirpStack LNS**

For new users, to receive the data from a device on the Helium network it must be associated with an LNS (LoraWAN Network Server), typically use one of the public LNSs, many of which use **ChirpStack**, but it's also possible to connect one's own LNS to Helium.

For those familiar with the general process the TL;DR; is:

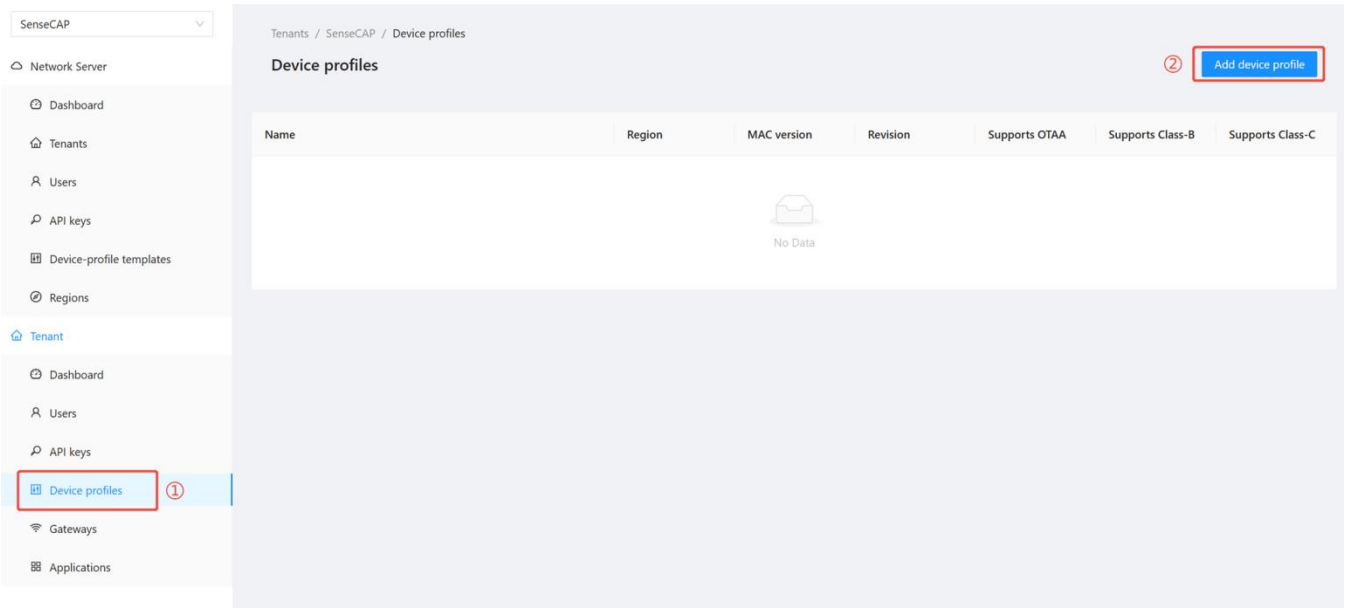
- create an device profile with the appropriate region and the codec (see source below)

- create device with devEUI, appKey, and a app_eui variable with the AppEUI, all three values coming from the SenseCraft App

Step 1: Add Device Profile

The first step is to add a device profile for the T2000 Tracker to your ChirpStack LNS. This tells the LNS how to decode the packets it receives from a T2000 as well as a number of other settings.

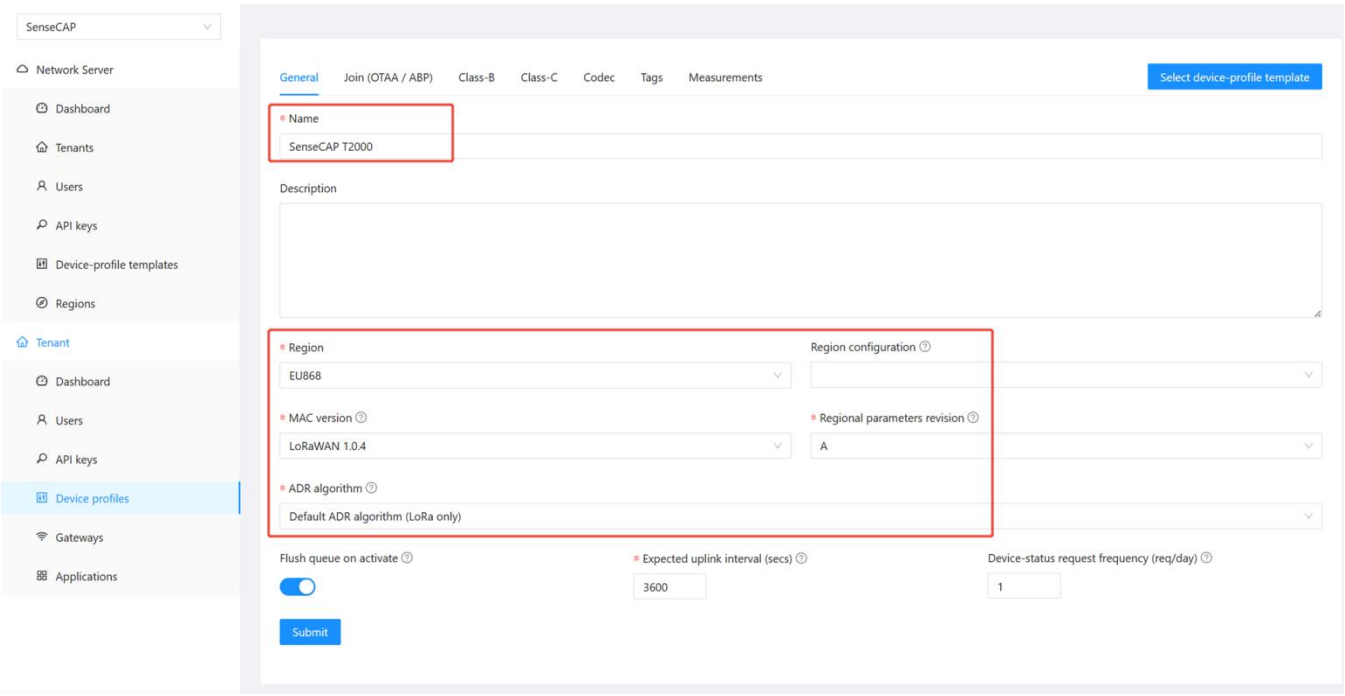
In the ChirpStack dashboard select the Device Profiles and click Add device profile.



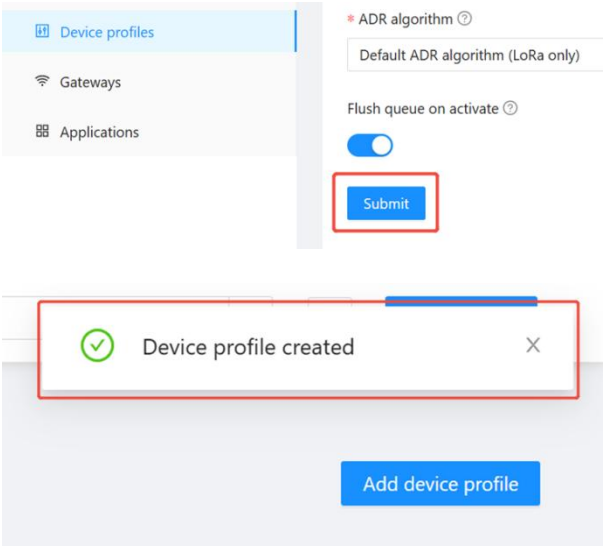
On the general tab, enter a device profile name you will recognize and select the appropriate region parameters.

> NOTE: LoRaWAN MAC version: 1.0.4

The expected uplink interval can be set too, the main thing it controls is when the LNS user interface shows the device as active vs. inactive. It has no effect on the delivery of packets through the LNS.

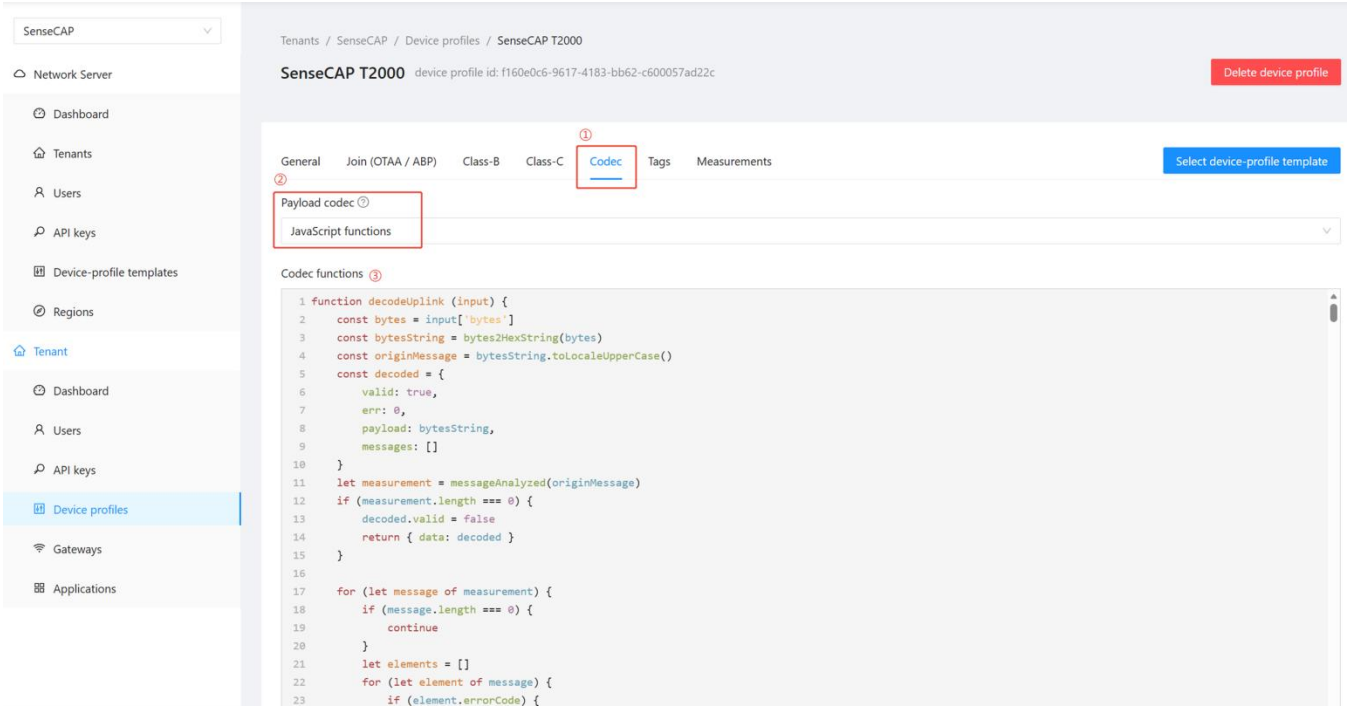


Click Submit, then you can see Device profile created.



On the Codec tab select JavaScript functions and enter the codec:

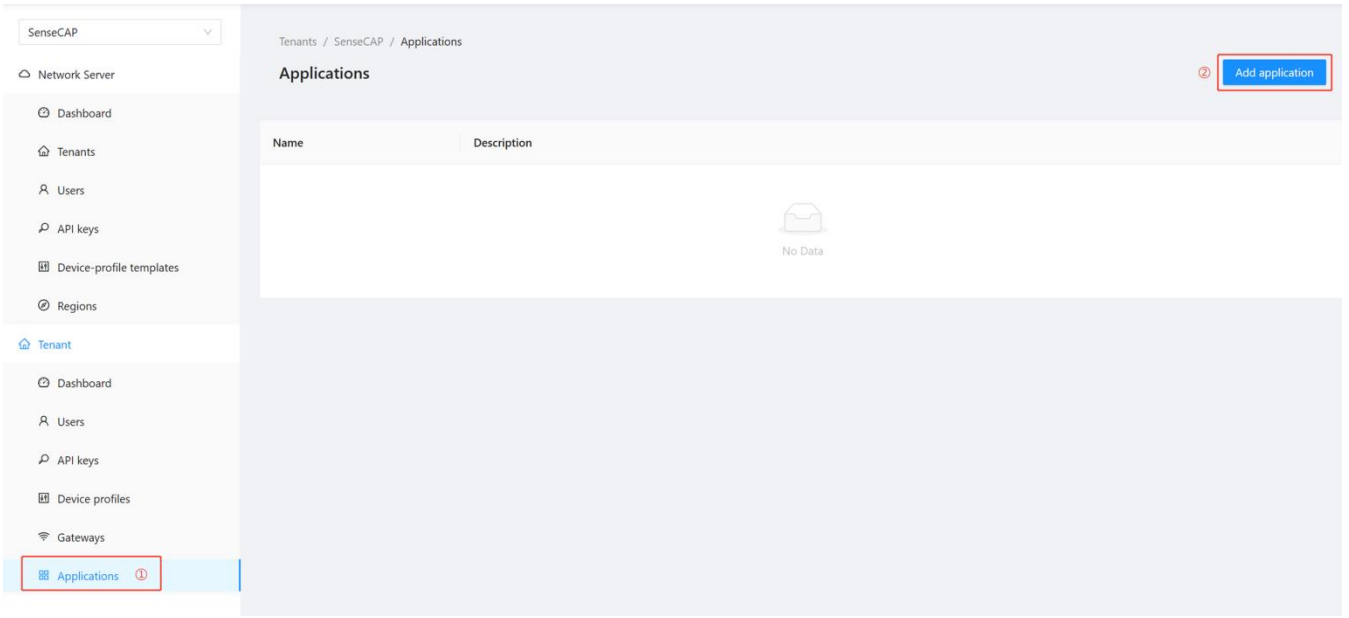
[Decoder for Chirpstack V4]

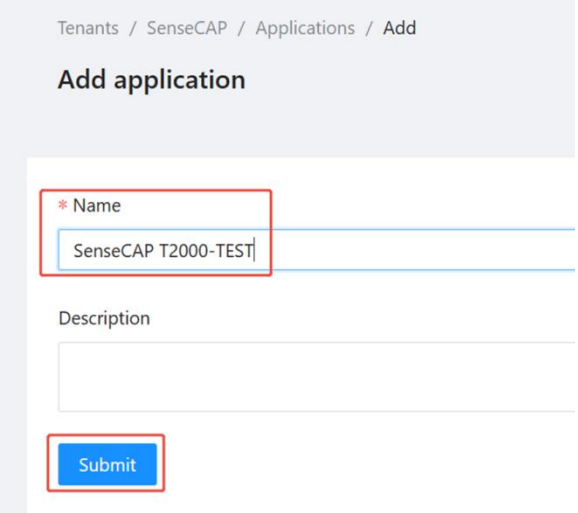


Step 2: Add Application and Your Device

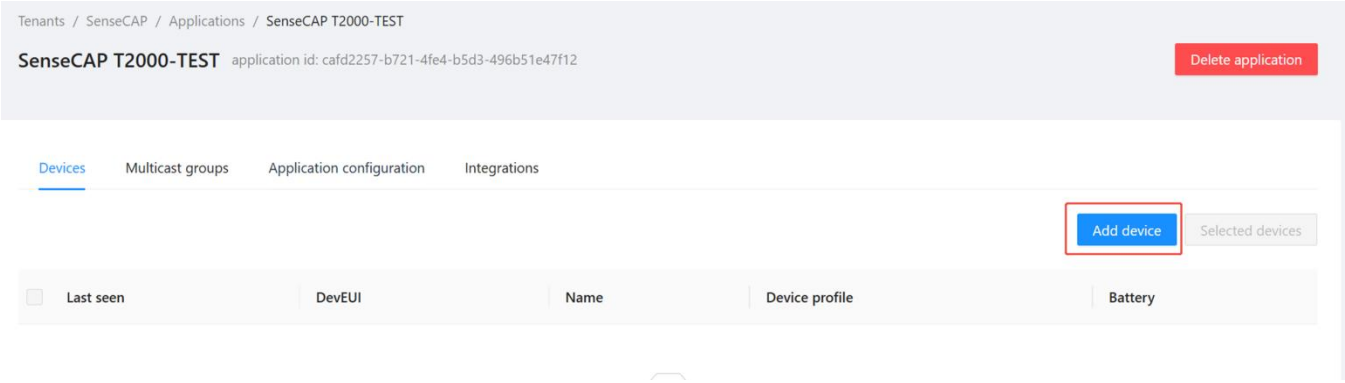
The next step is to create an application and add actual devices to it.

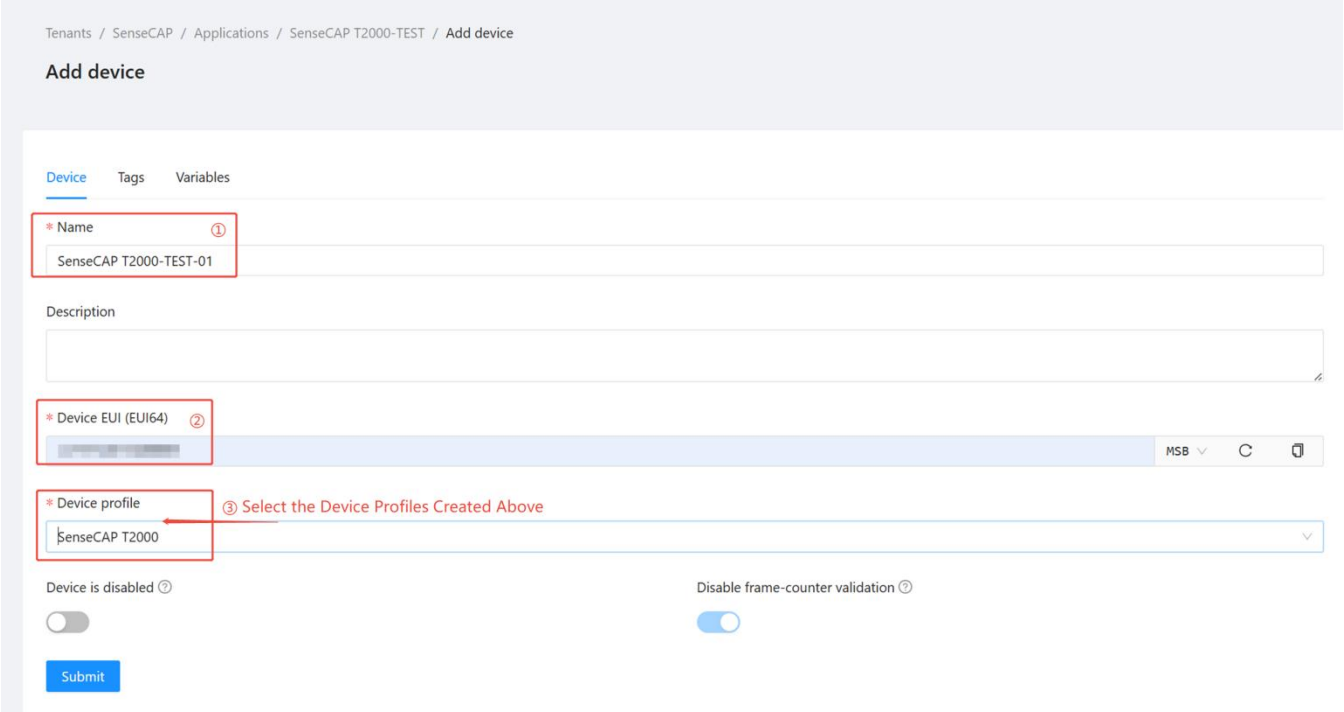
Go to the Applications section and add a new application.



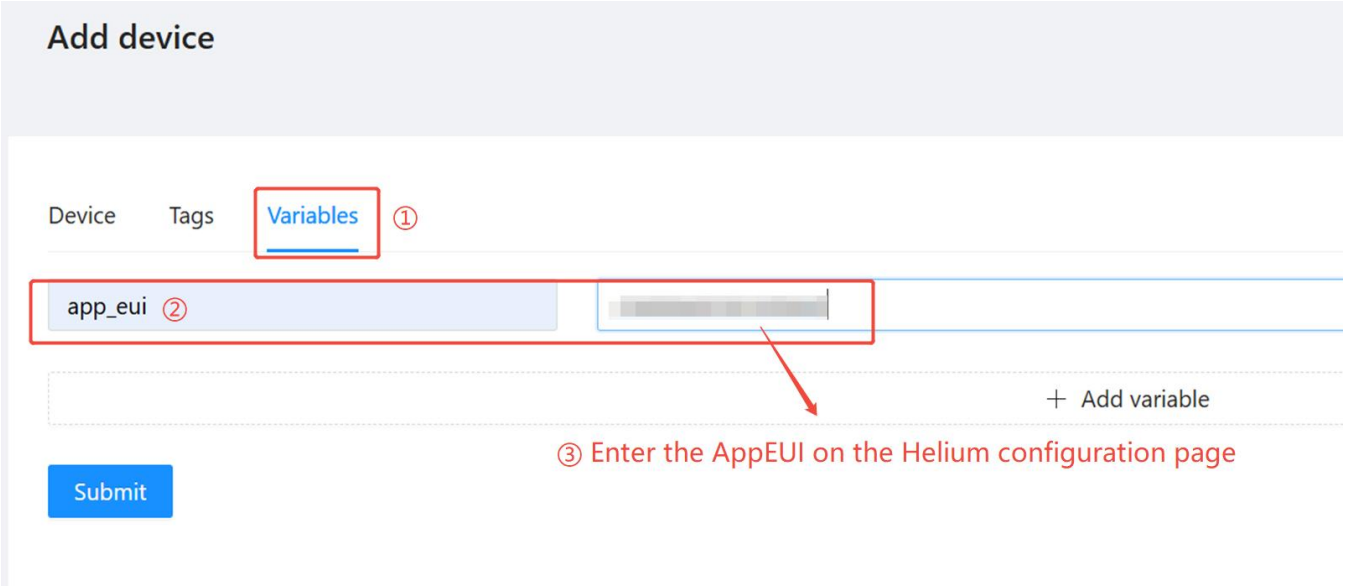


Then add a device to the application and enter the devEUI as captured in the SenseCraft App earlier.

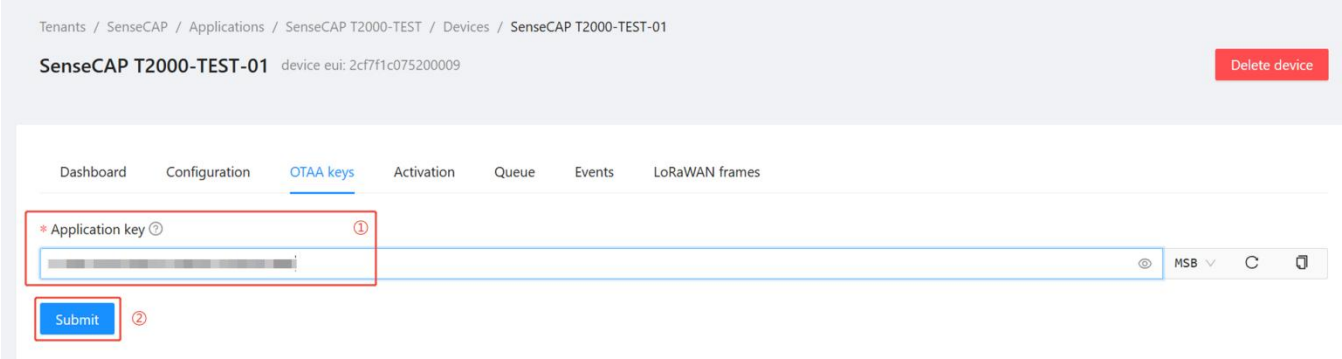




On the variables tab add a variable called app_eui with the AppEUI from the SenseCraft app as value:



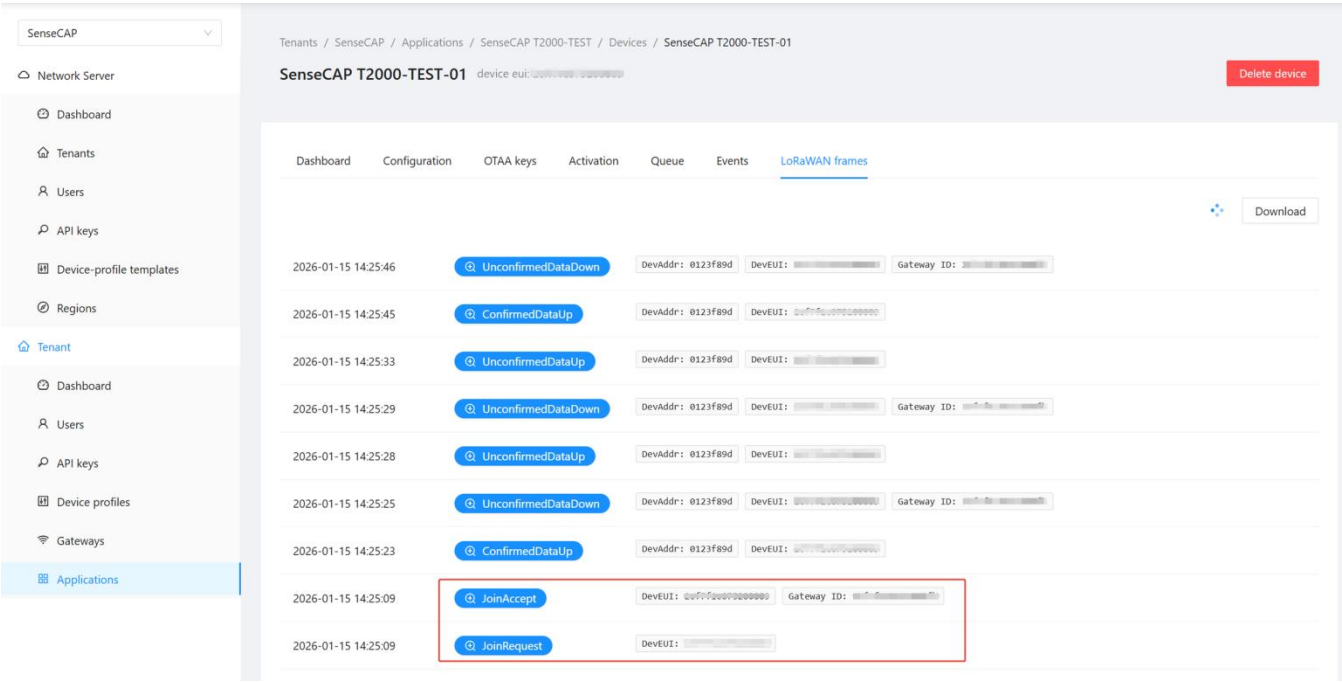
Hitting submit will bring up a page asking for the AppKey, again as captured earlier using the SenseCraft app.



Step 3: View the Device Connection

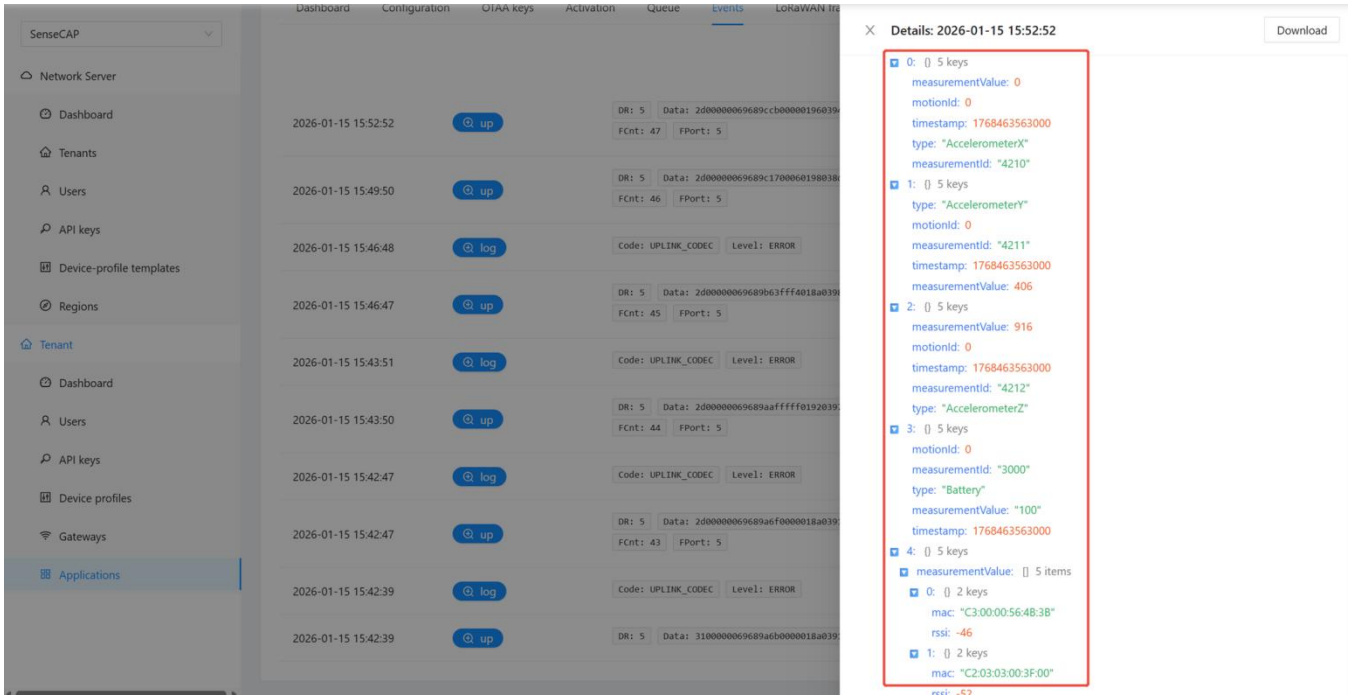
On the LoRaWAN frames tab you will see a spinner and then packets show up as they are received/sent.

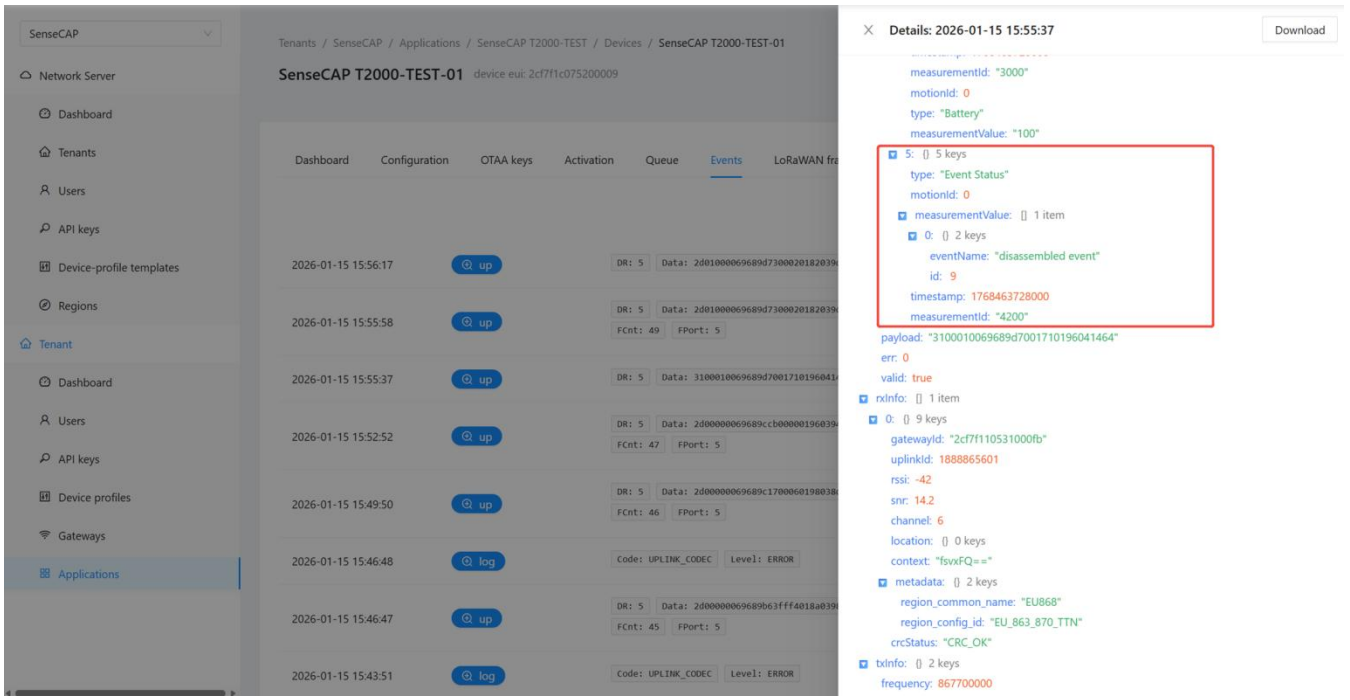
When you see JoinAccept and JoinRequest, it indicates that the T2000 has successfully joined the network.



Once the join process has been performed the T1000 sends data. The LNS responds back with some information about the network frequencies and such, but subsequent to that there should only be uplinks with data.

On the Events page, you can view the decoded data from the device.





Resource

[SenseCAP T2000 Tracker Decoder for Helium]

4.3 Connect to AWS IoT Core

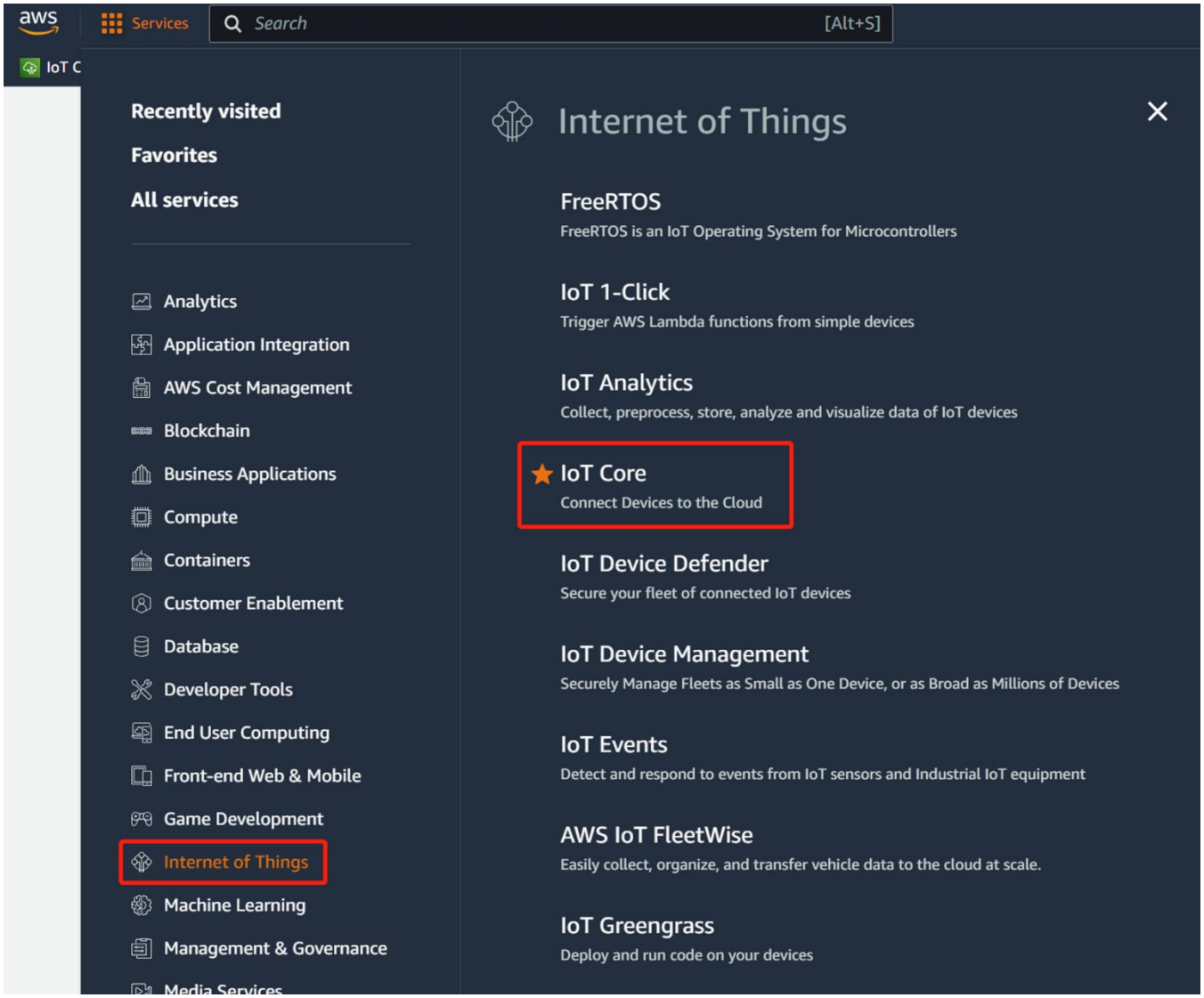
AWS IoT provides the cloud services that connect your IoT devices to other devices and AWS cloud services. AWS IoT provides device software that can help you integrate your IoT devices into AWS IoT-based solutions. If your devices can connect to AWS IoT, AWS IoT can connect them to the cloud services that AWS provides.

Login to AWS IoT console

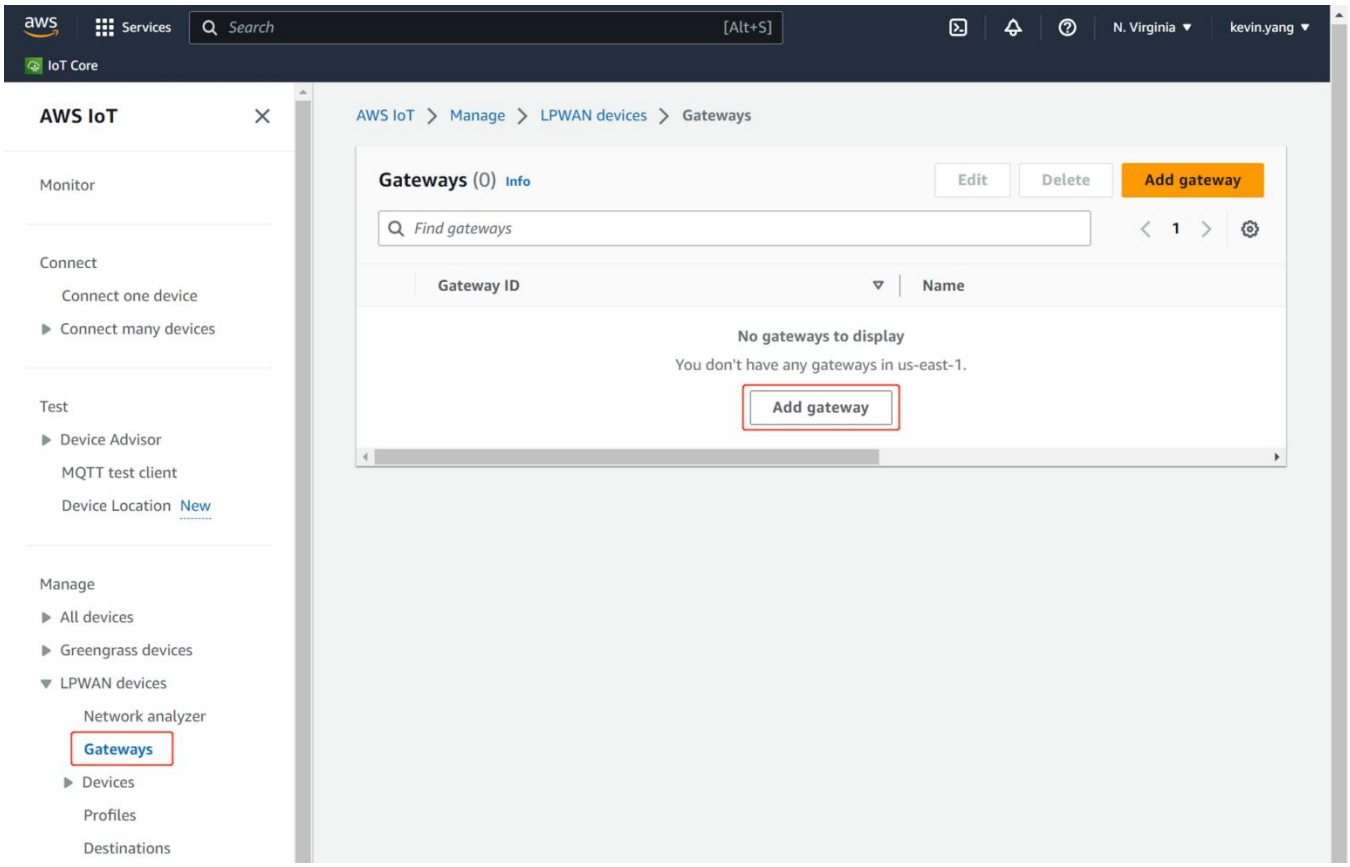
INFO: If you do not have an AWS account, click here to create one.

4.3.1 Add Gateway

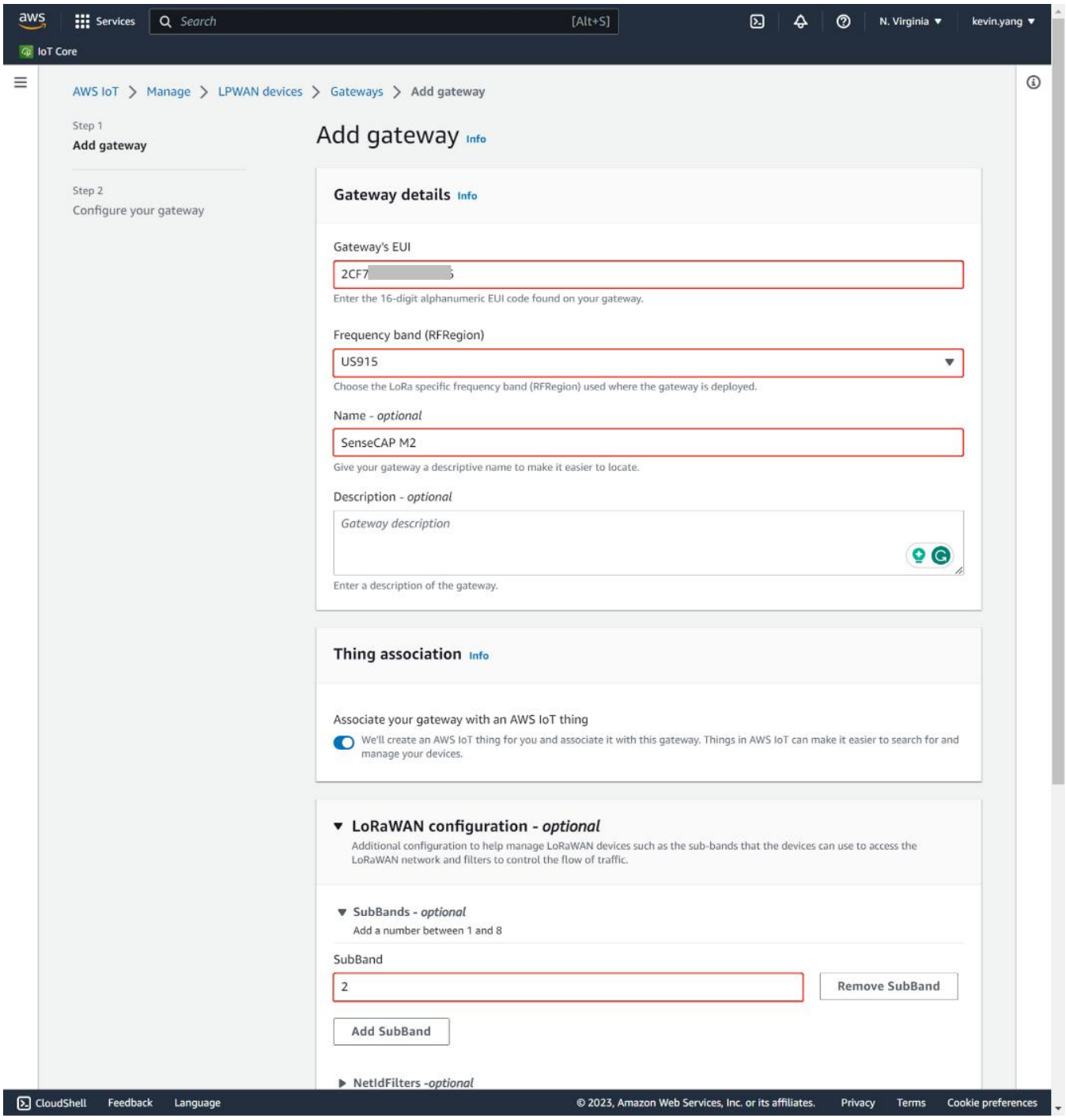
Navigate to Internet of Things, then click IoT Core.



On the left menu, select LPWAN devices → Gateways, click Add gateway



Gateway's EUI: The EUI of your gateway, you can find it on the device label.
Frequency: The gateway's frequency band.
Name: Name your gateway(optional)
SubBand: Optionally, you can also specify LoRaWAN configuration data such as the subbands that you want to use and filters that can control the flow of traffic. For more information, see Configure position of wireless resources with AWS IoT Core for LoRaWAN.

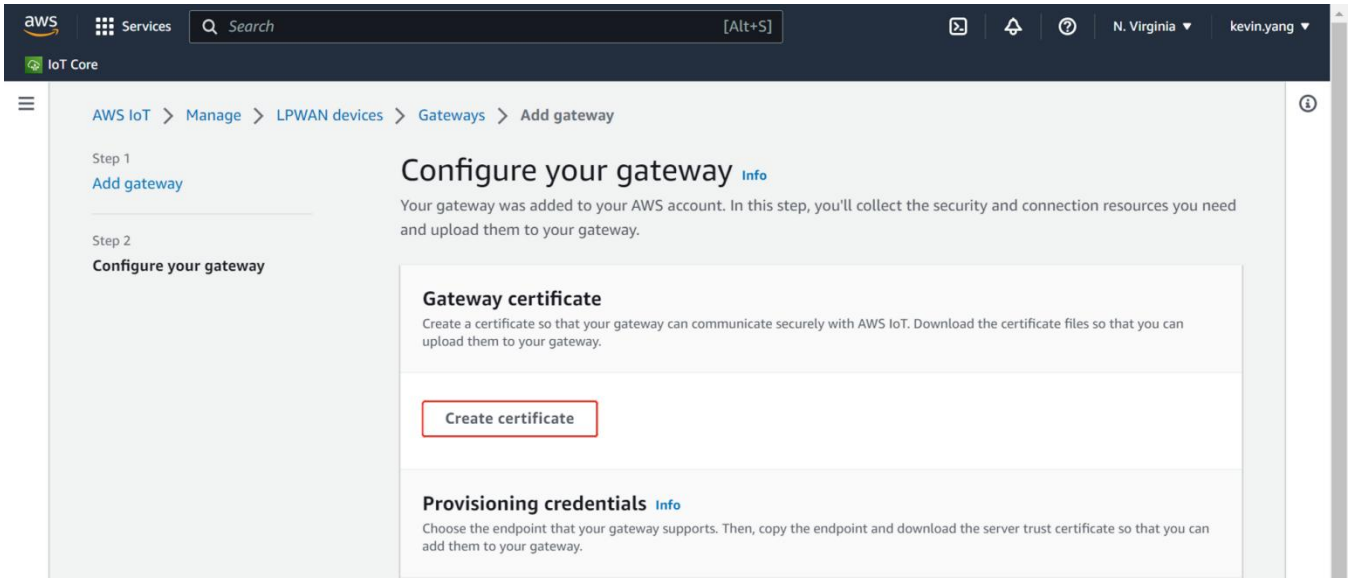


4.3.2 Configure your gateway

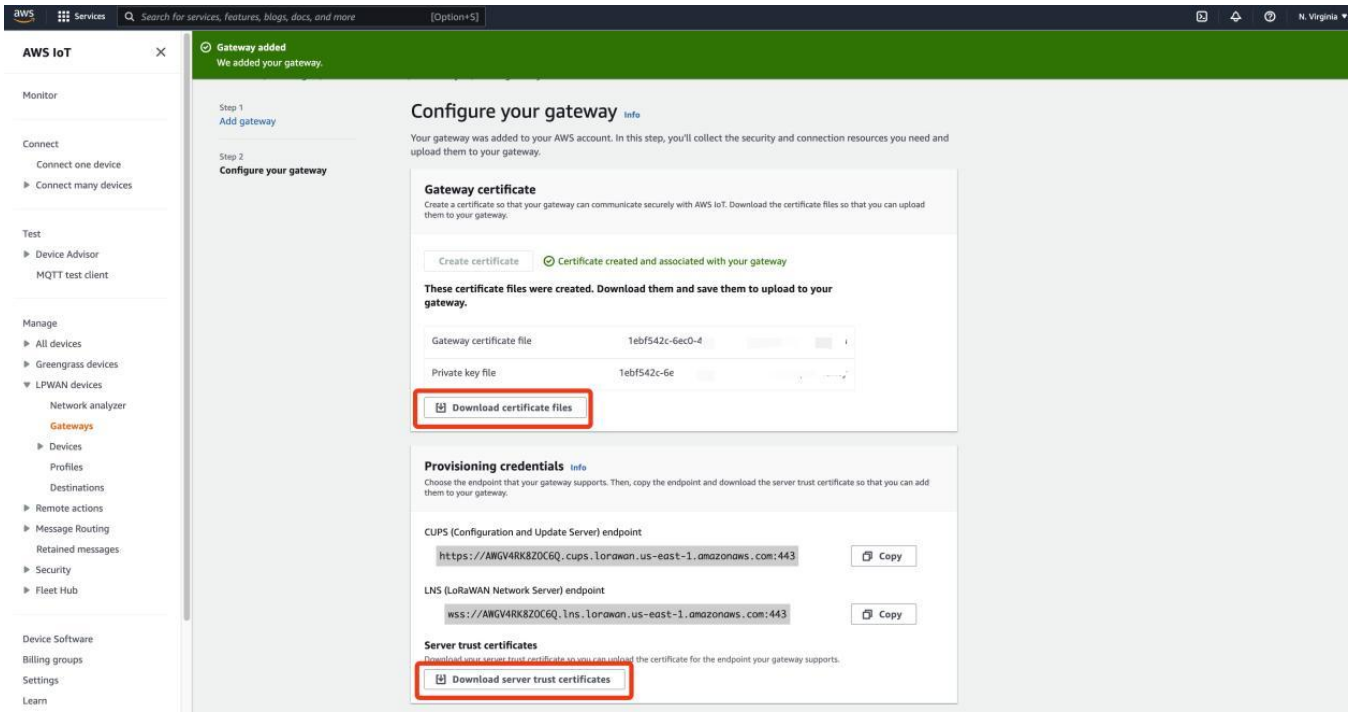
- **Gateway Certificate**

To authenticate your gateway so that it can securely communicate with AWS IoT, your LoRaWAN gateway must present a private key and certificate to AWS IoT Core for LoRaWAN.

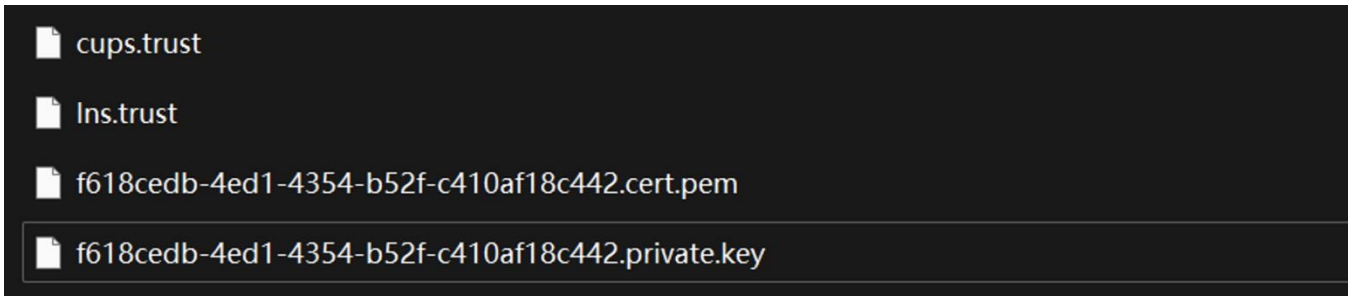
Click Create certificate.



Download and save the certificate files and the server trust certificates.



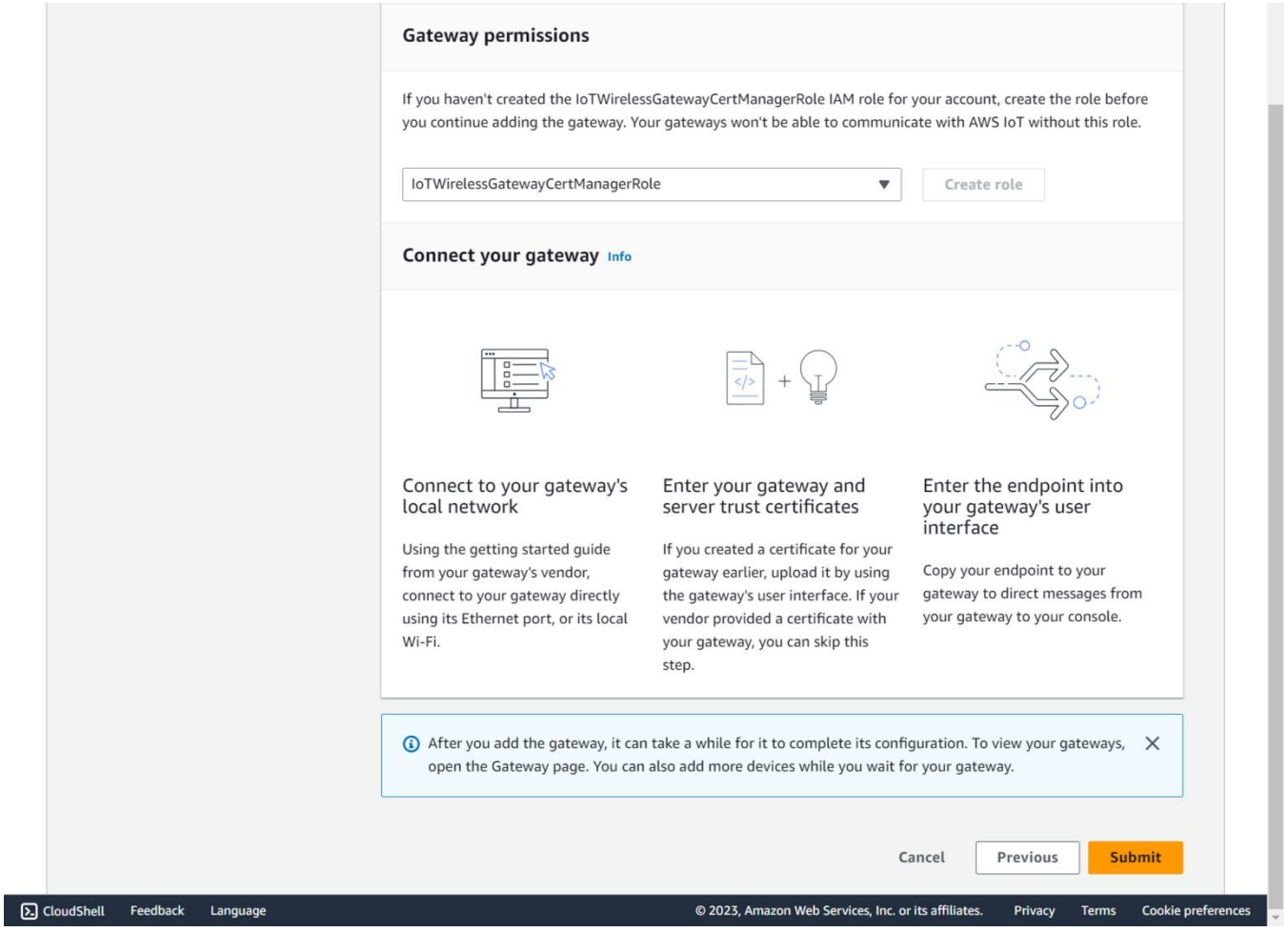
There shoule be four files inside, you'll use them later to configure the gateway.



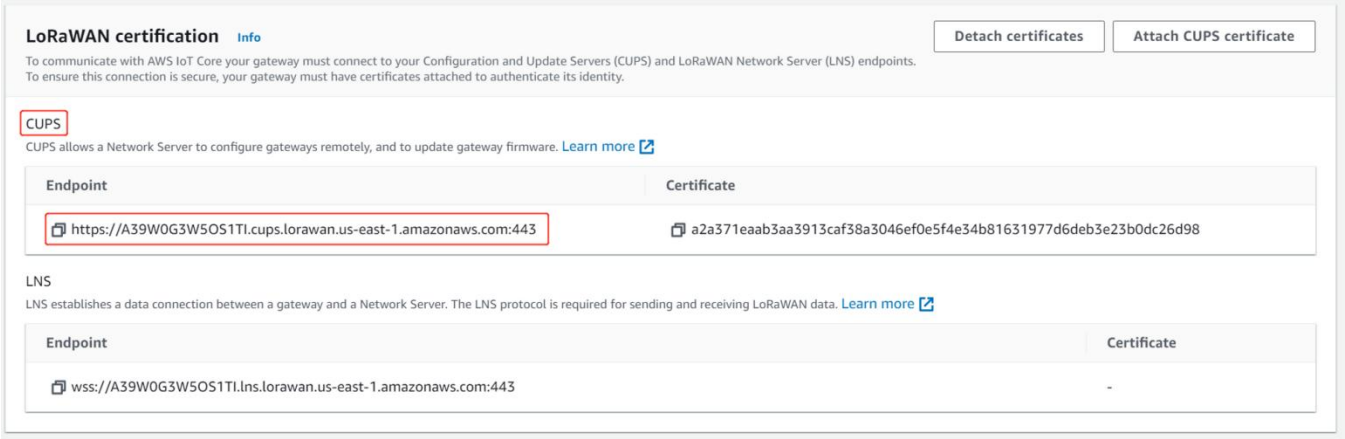
- **Gateway Permission**

If you haven't created the IoTWirelessGatewayCertManagerRole IAM role for your account, create the role before you continue adding the gateway. Your gateways won't be able to communicate with AWS IoT without this role.

Choose the Role: IoT Wireless Gateway Cert Manager Role, then submit the configuration.



Copy the CUPS URL, we will use it in the next step.

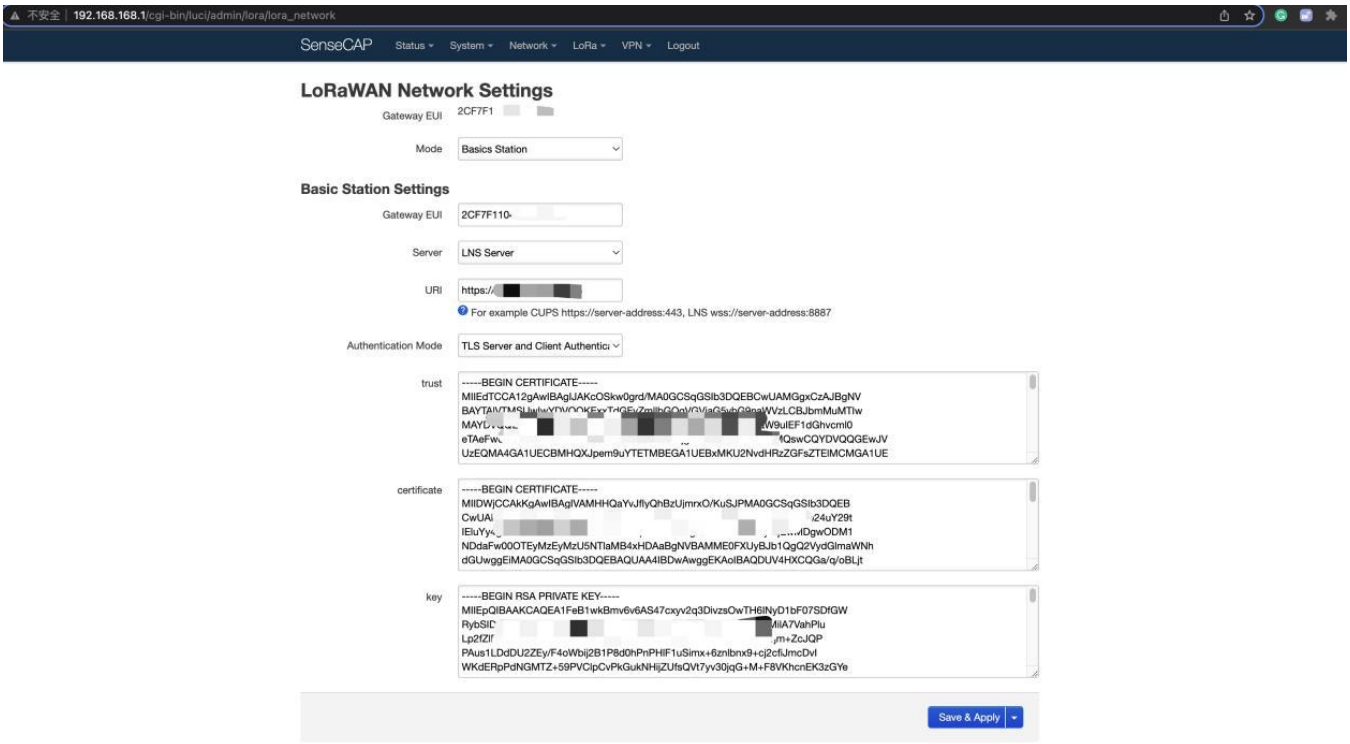


- **Gateway Configuration**

Login to the Luci configure page of the gateway, check Get_Started for more details.

Navigate to LoRa > LoRa Network.

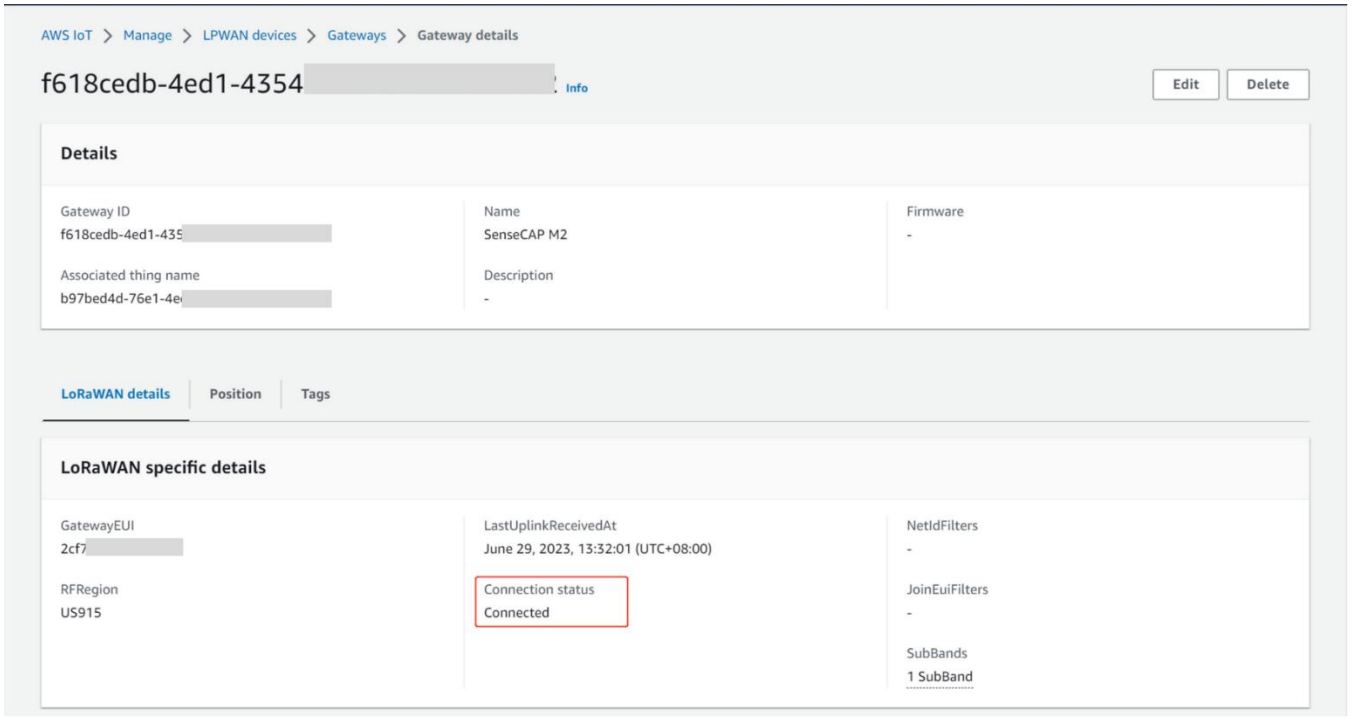
Mode: Basic Station
Gateway EUI: Your gateway eui
Server: CUPS Server
URL: The CUPS URL we copied before
Authentication Mode: TLS Server and Client Authentication



Copy the content of the certificate file we downloaded before(the certificate can be opened in text form).

Navigate to the Gateways page and choose the gateway you've added.

In the LoRaWAN specific details section of the Gateway details page, you'll see the connection status and the date and time the last uplink was received.



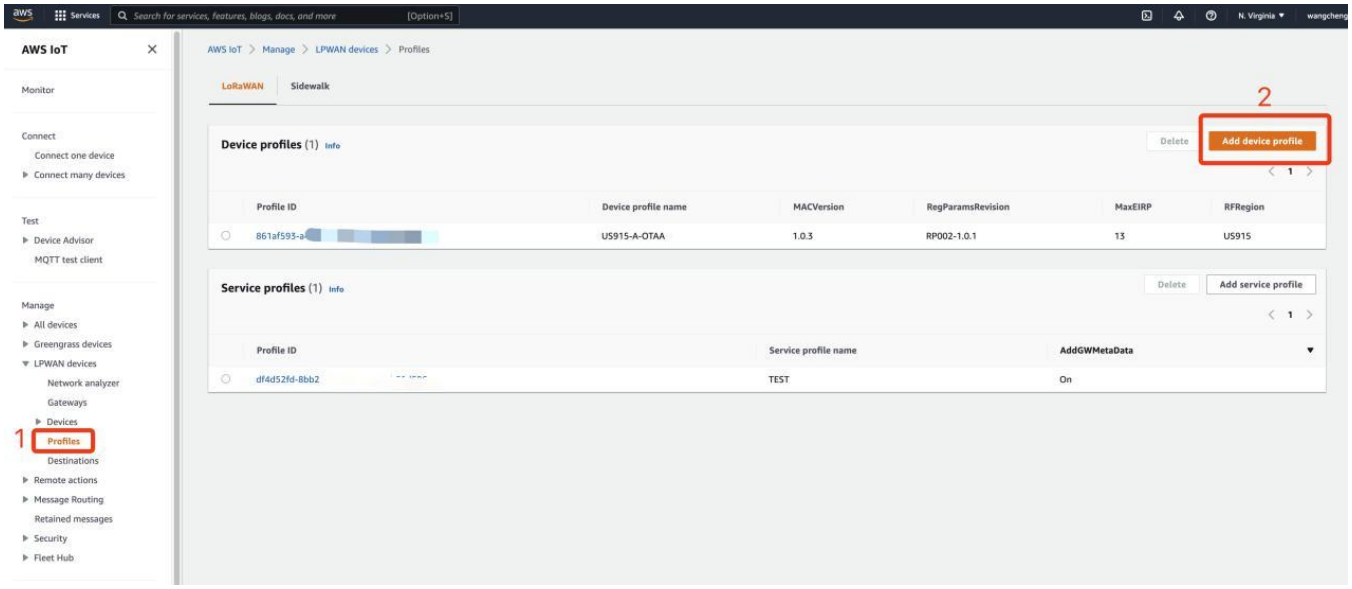
4.3.3 Add Profiles

Device and service profiles can be defined to describe common device configurations. These profiles describe configuration parameters that are shared by

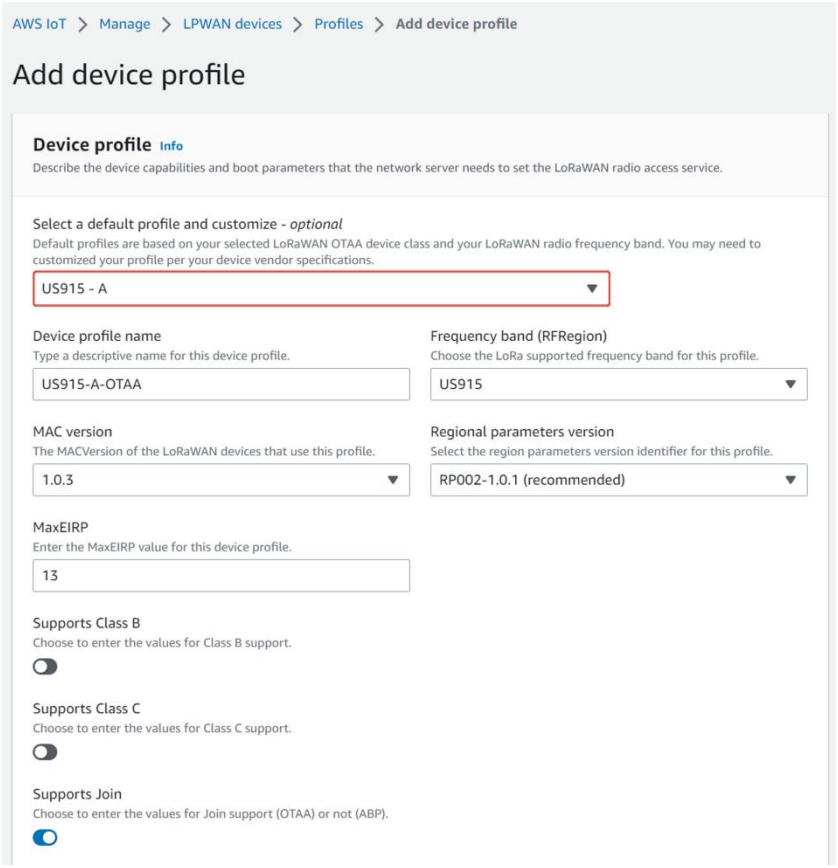
devices to make it easier to add those devices. AWS IoT Core for LoRaWAN supports device profiles and service profiles.

- **Add Devices Profiles**

Navigate to Devices > Profiles, click Add device profile.

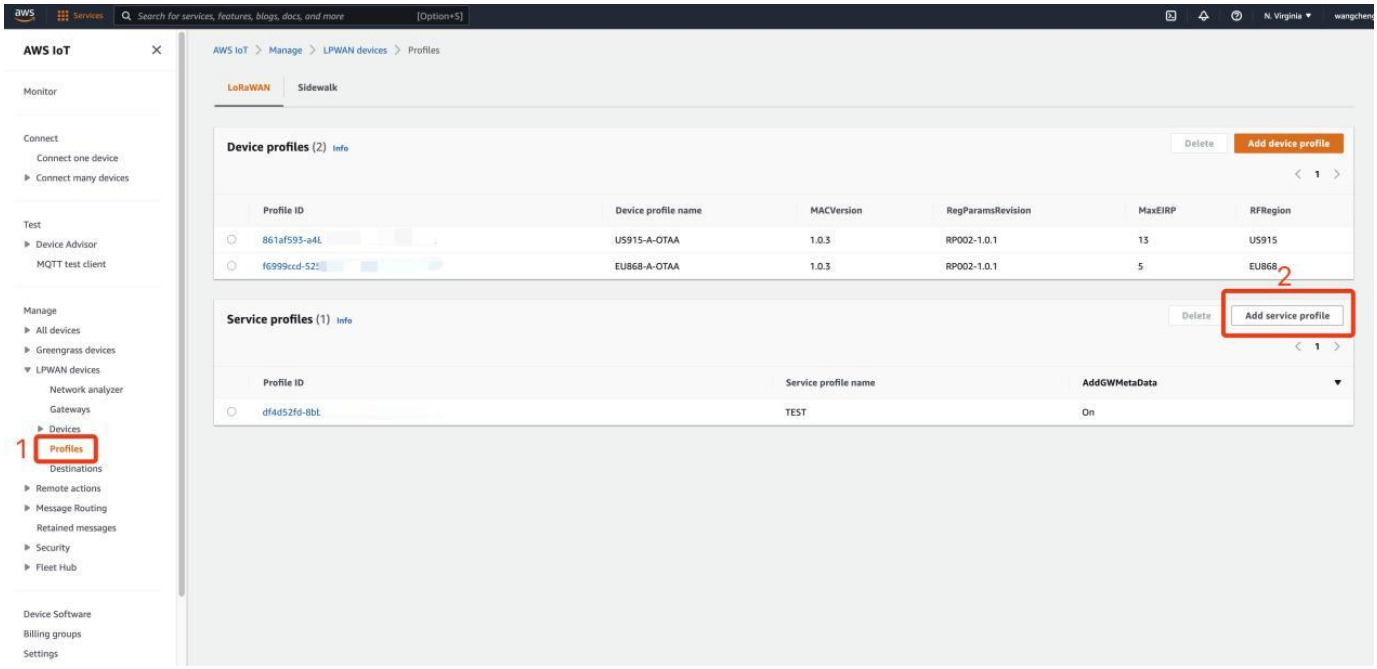


Provide a Device profile name, select the Frequency band (RfRegion) that you're using for the device and gateway, and keep the other settings to the default values.

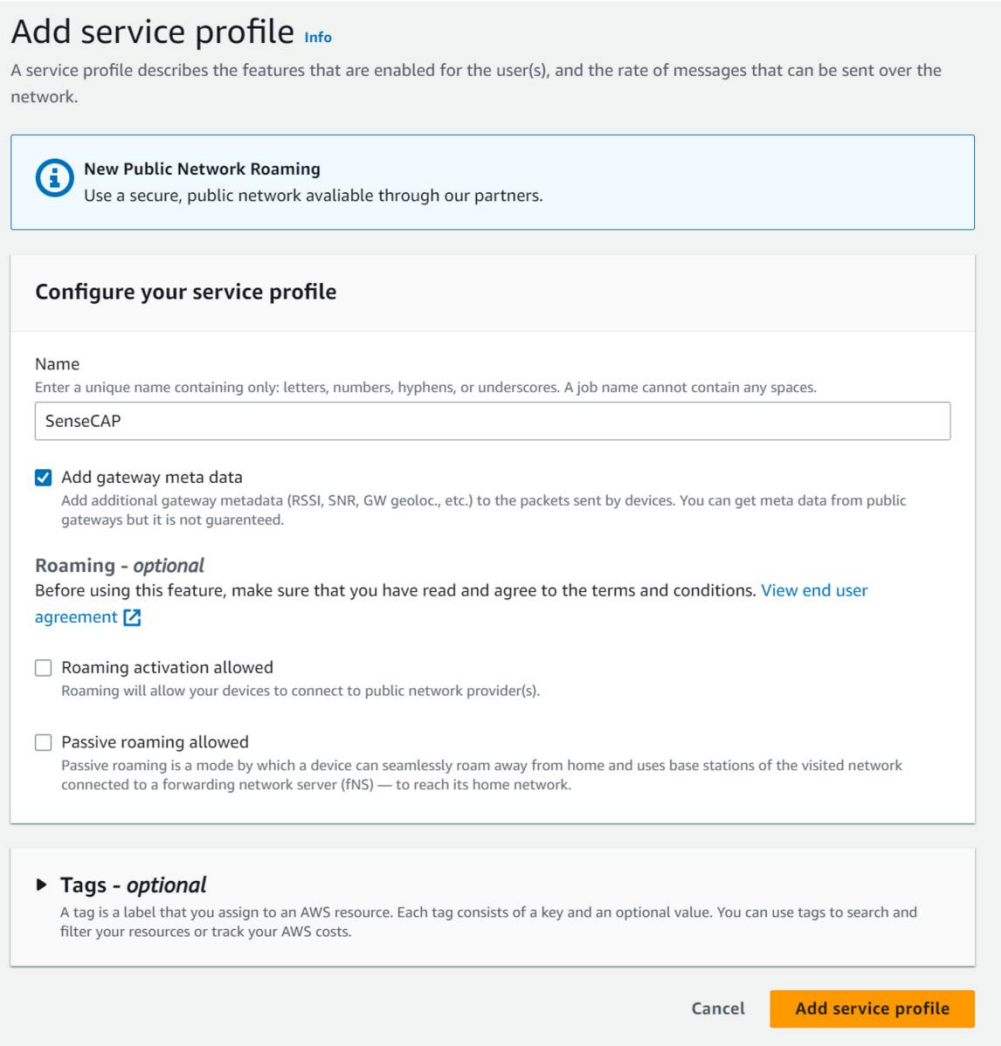


- **Add Service Profiles**

Navigate to Devices > Profiles, click Add service profile

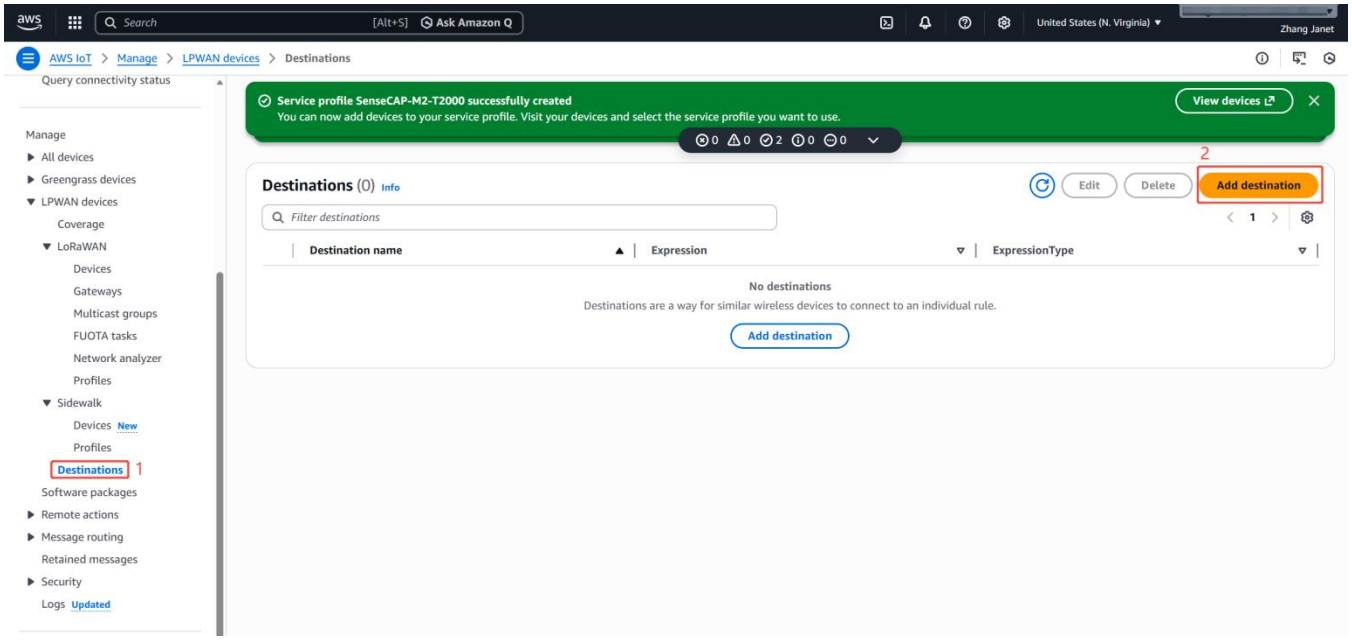


It's recommend that you leave the setting Add gateway meta data enabled so that you'll receive additional gateway meta data for each payload, such as RSSI and SNR for the data transmission.



- **Add Destination**

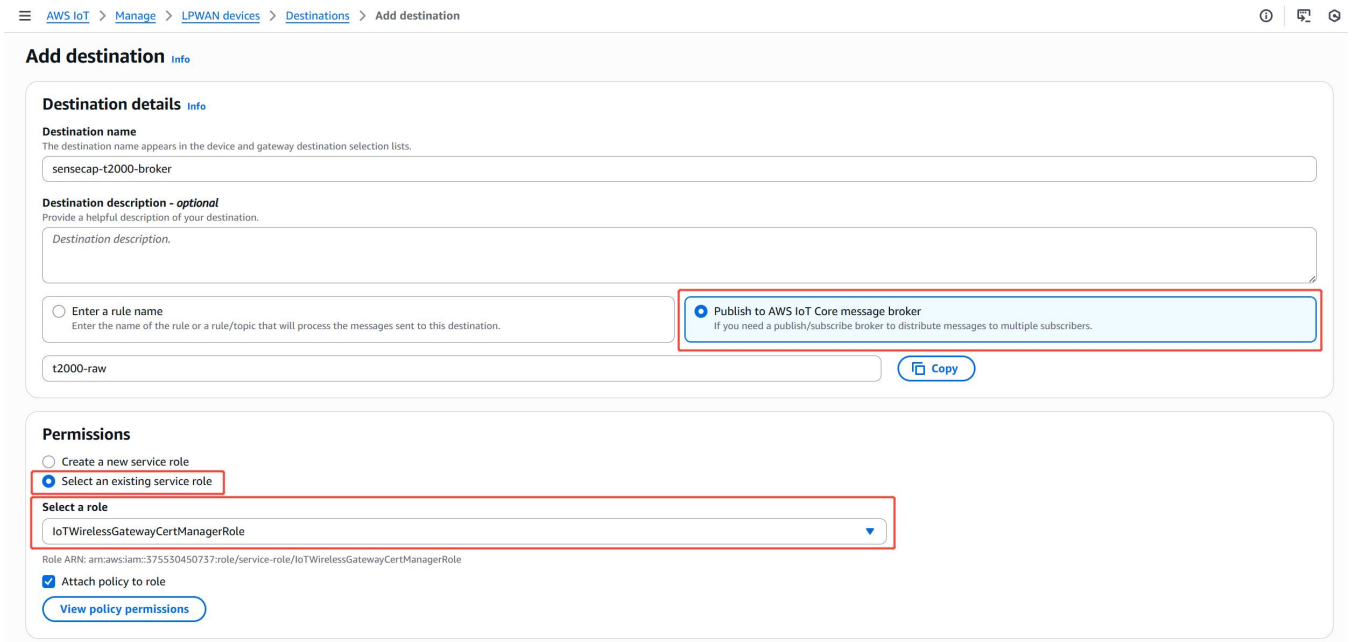
Navigate to LPWAN Devices > Destination, click Add destination.



Here select Publish to AWS IoT Core Message Broker and name the destination's MQTT topic

Permissions: Select an existing service role > IoT Wireless Gateway Cert Manager Role

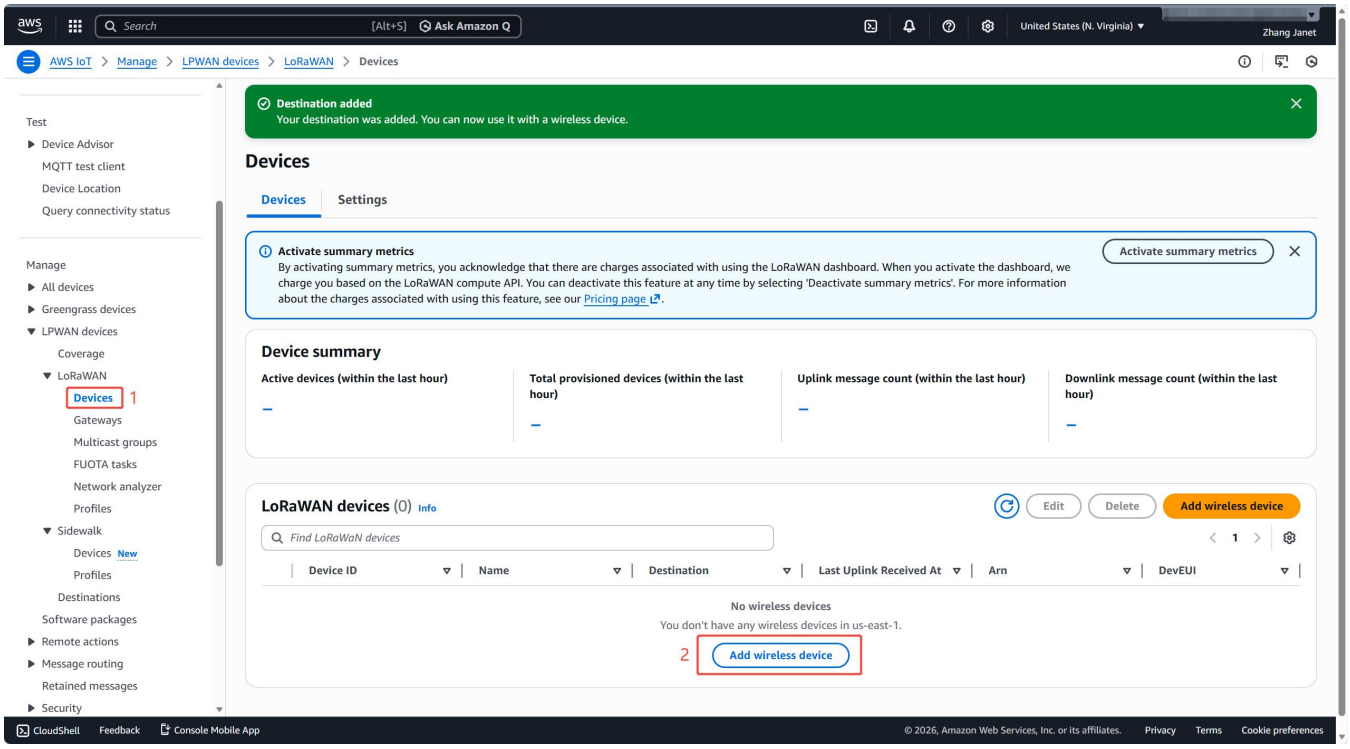
INFO: A destination name can only have alphanumeric, - (hyphen) and _ (underscore) characters and it can't have any spaces.



4.3.4 Add LoRaWAN Devices

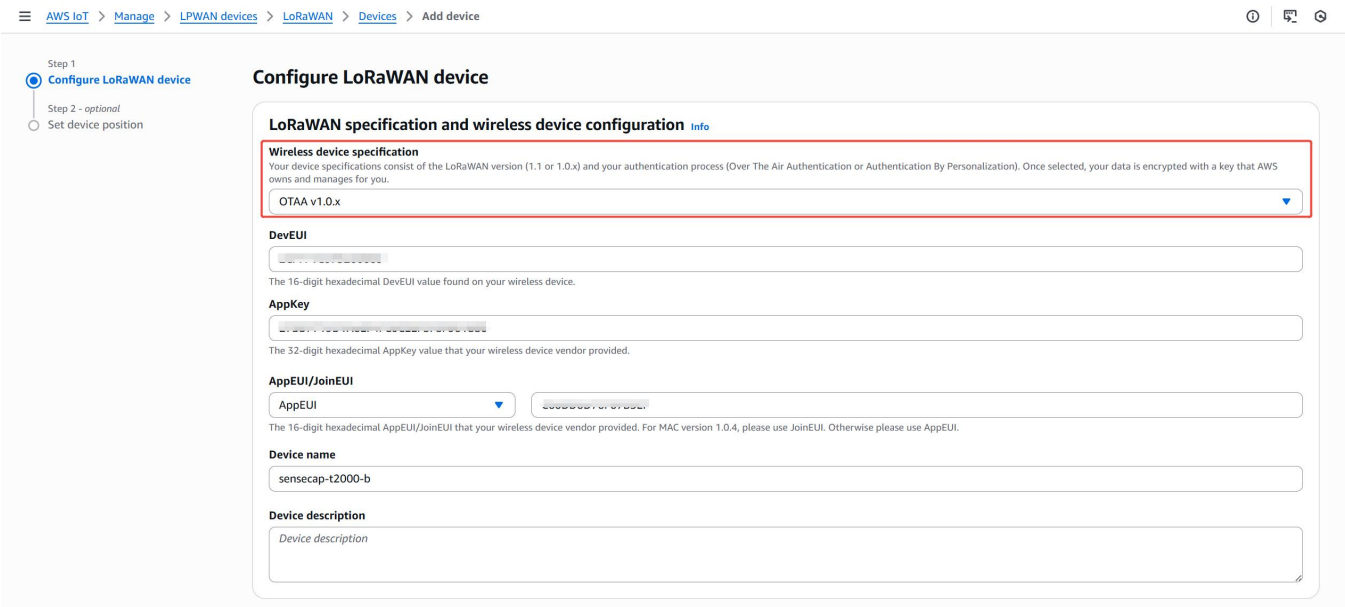
- **Add Wireless Device**

Navigate to LPWAN devices > LoRaWAN> Devices, click Add wireless device.

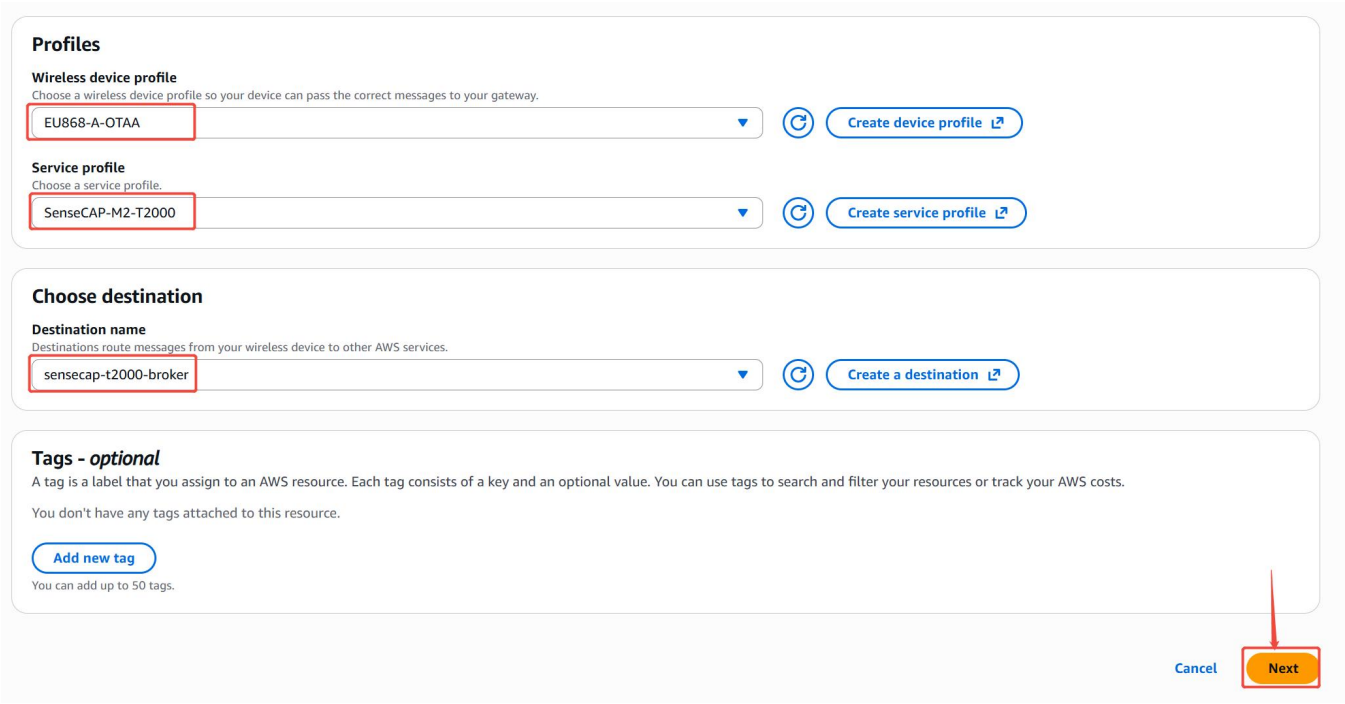


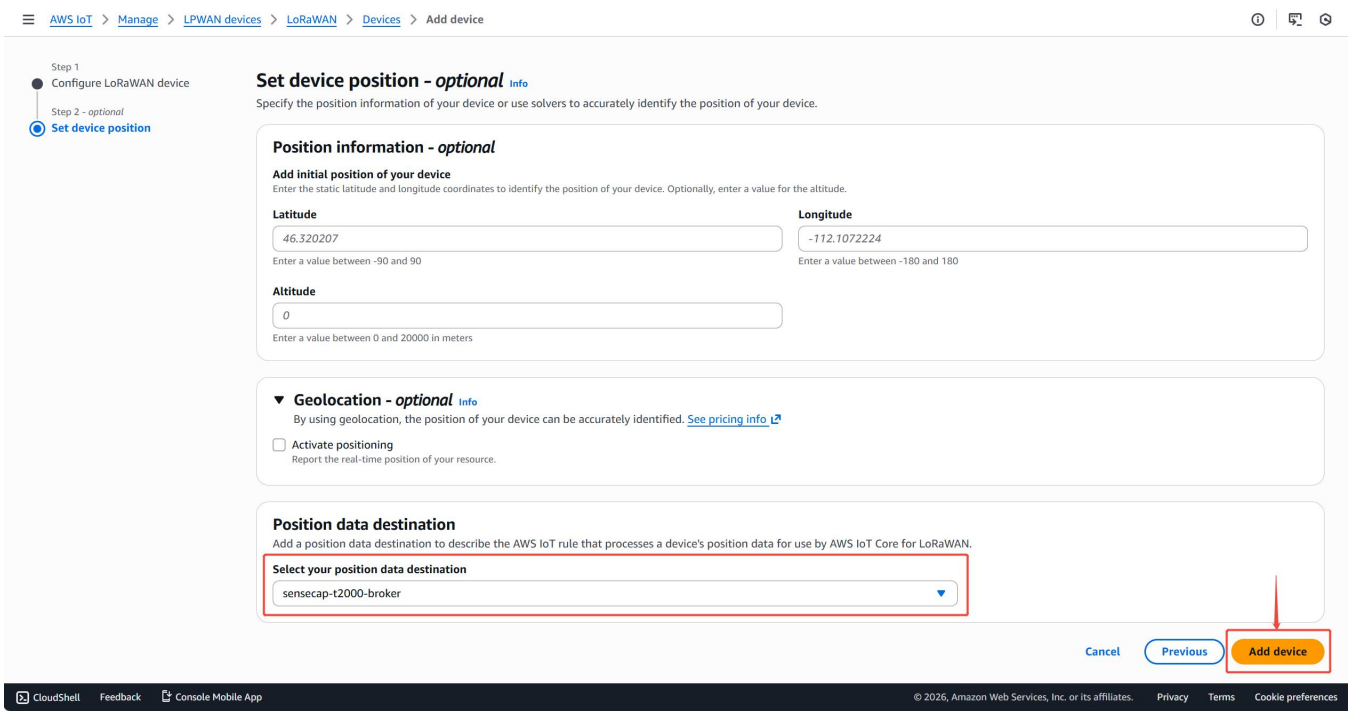
Wireless device specification: OTAA v1.0x

DevEUI / AppEUI / AppKey: can be found in the SenseCraft APP, check Get_Started for more details.



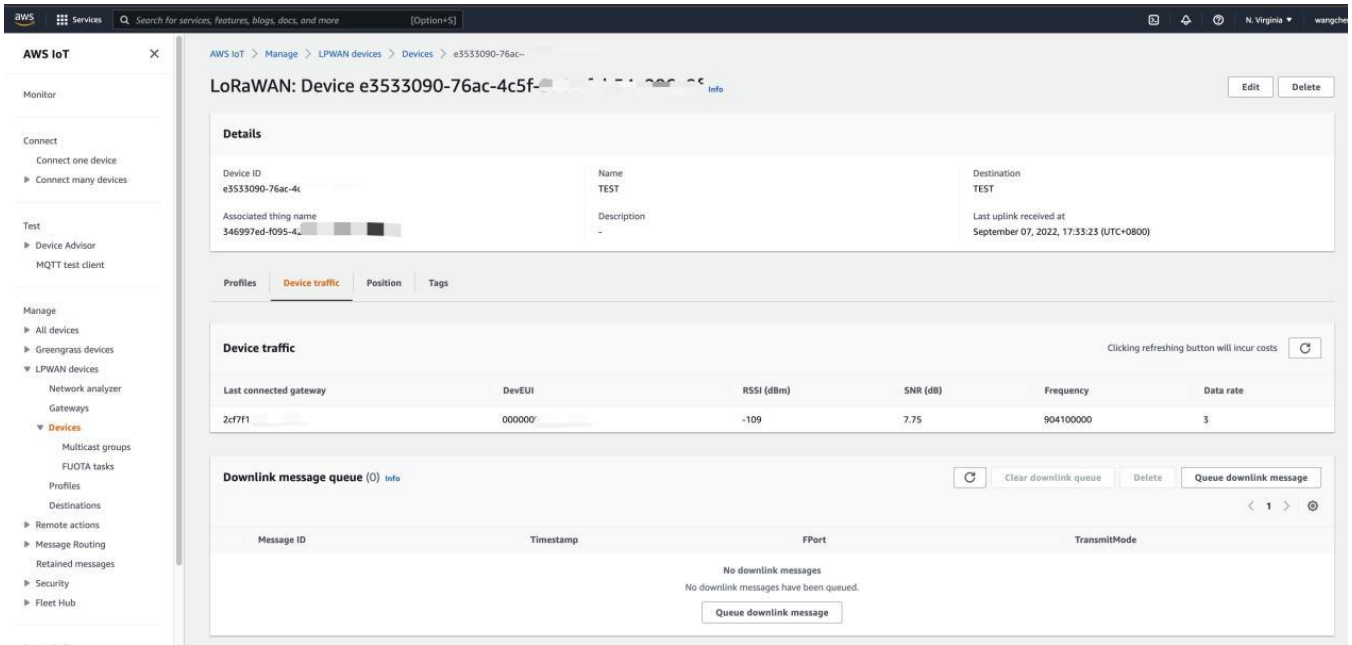
Select the device profile and destination you created in the previous step.





Navigate to the Devices page and choose the device you added before.

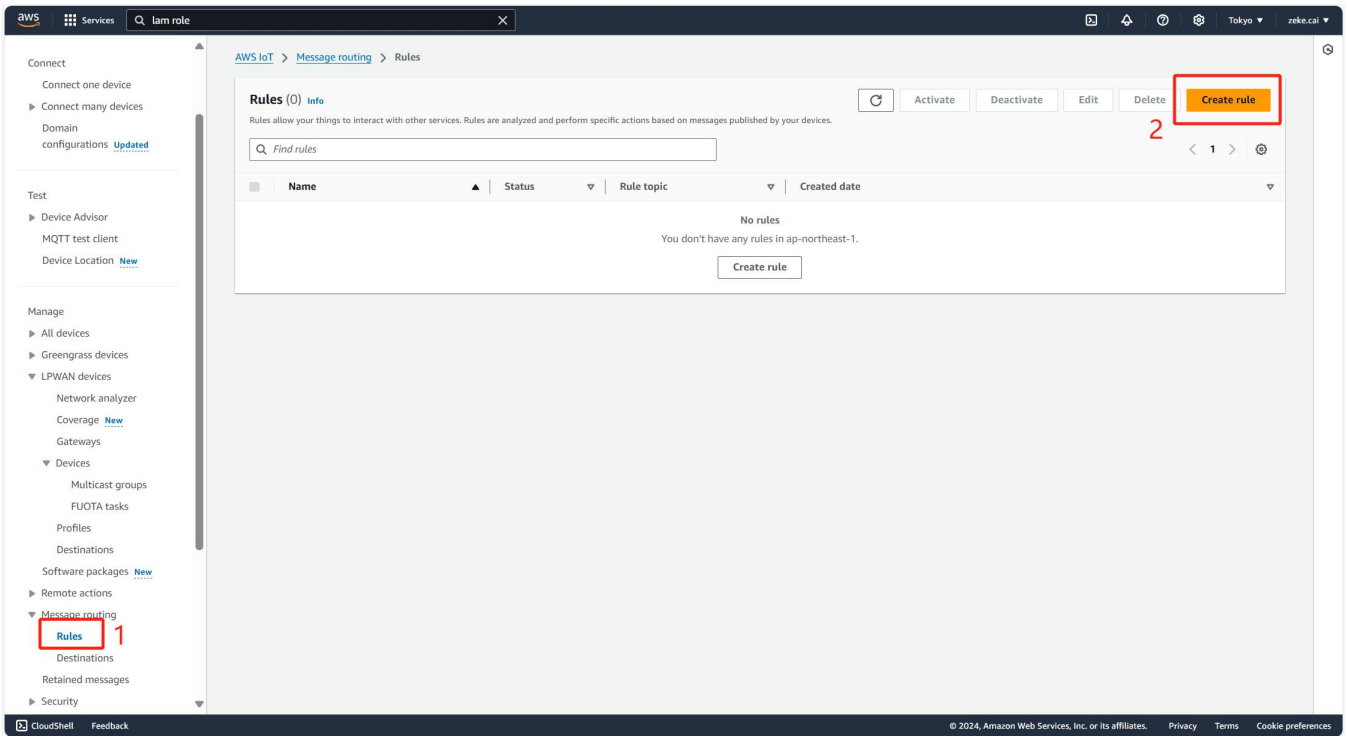
In the Details section of the Wireless devices details page, you'll see the date received.



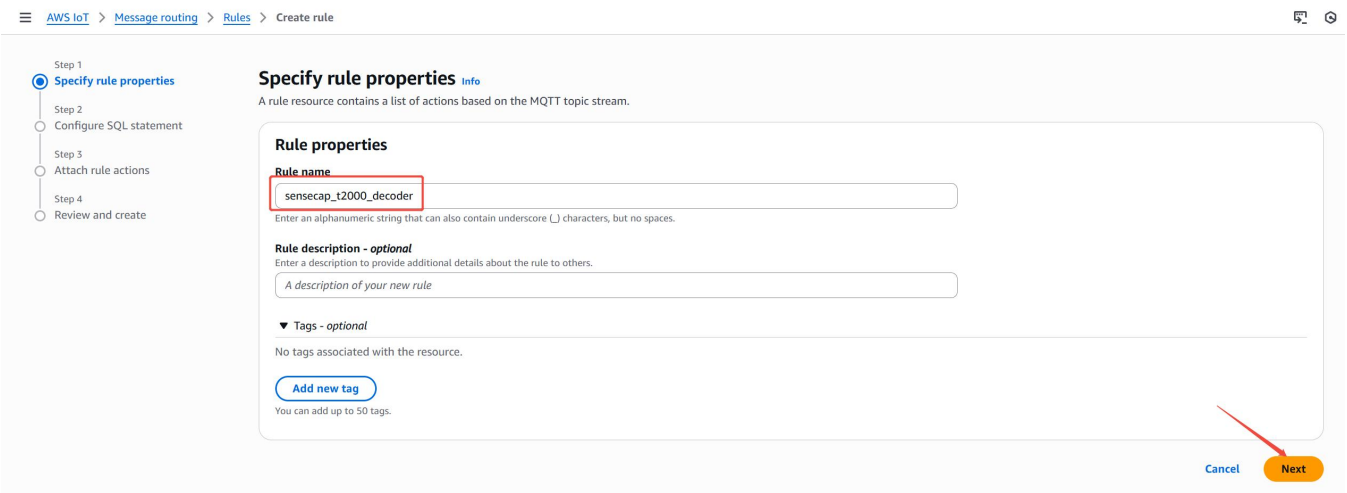
4.3.5 Configure the decoder

- **Create Message Rules**

Navigate to Message routing tab → Rules, and click Create Rule button.

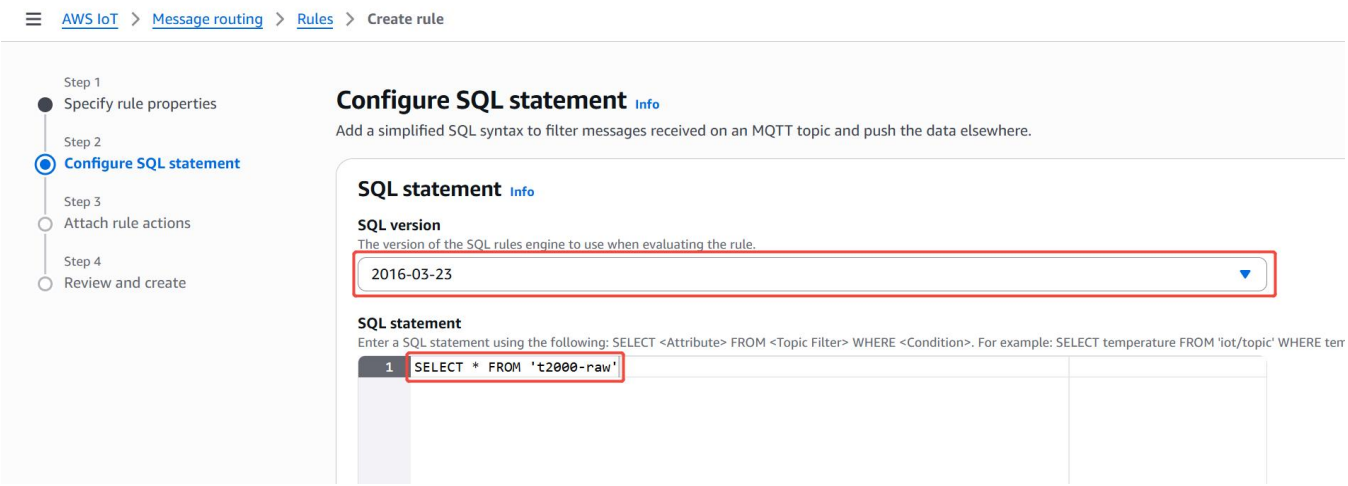


Name your rule and submit it.

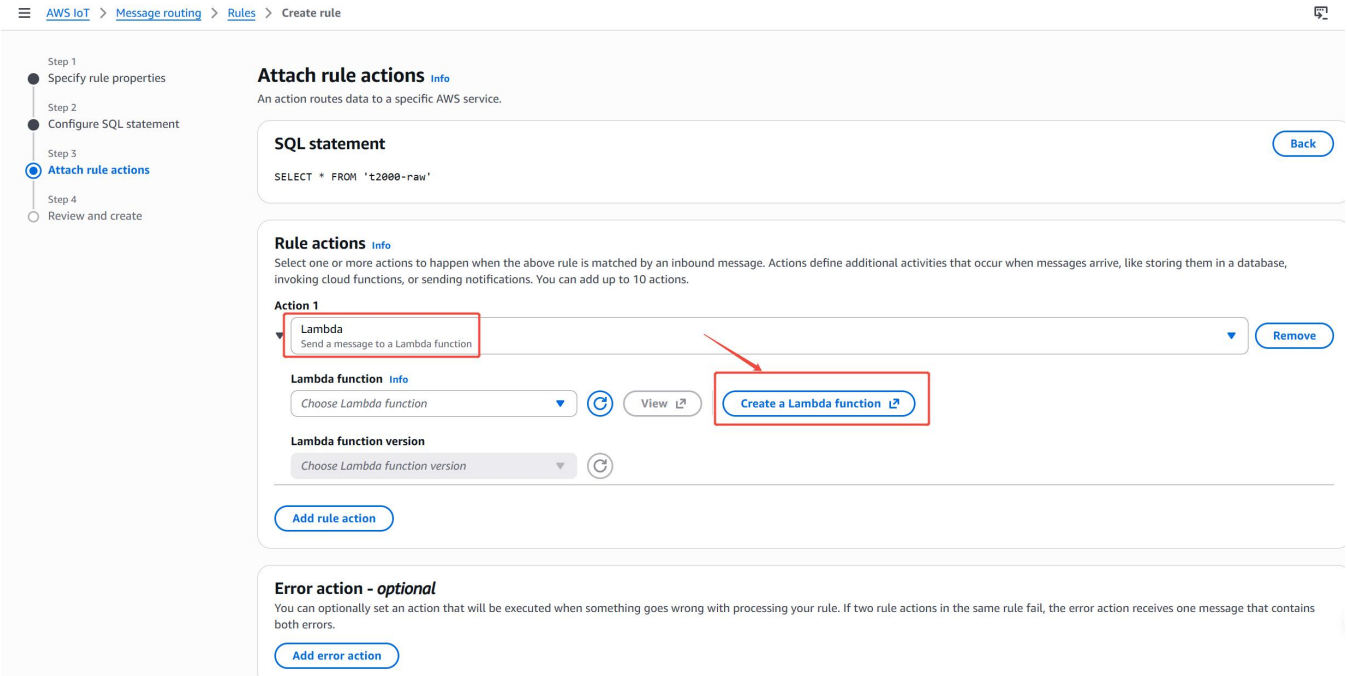


SQL version: 2016-03-23
SQL statement: SELECT * FROM **"YourDestinationTopic"**

Here we fill in t2000-raw according to Add Destination

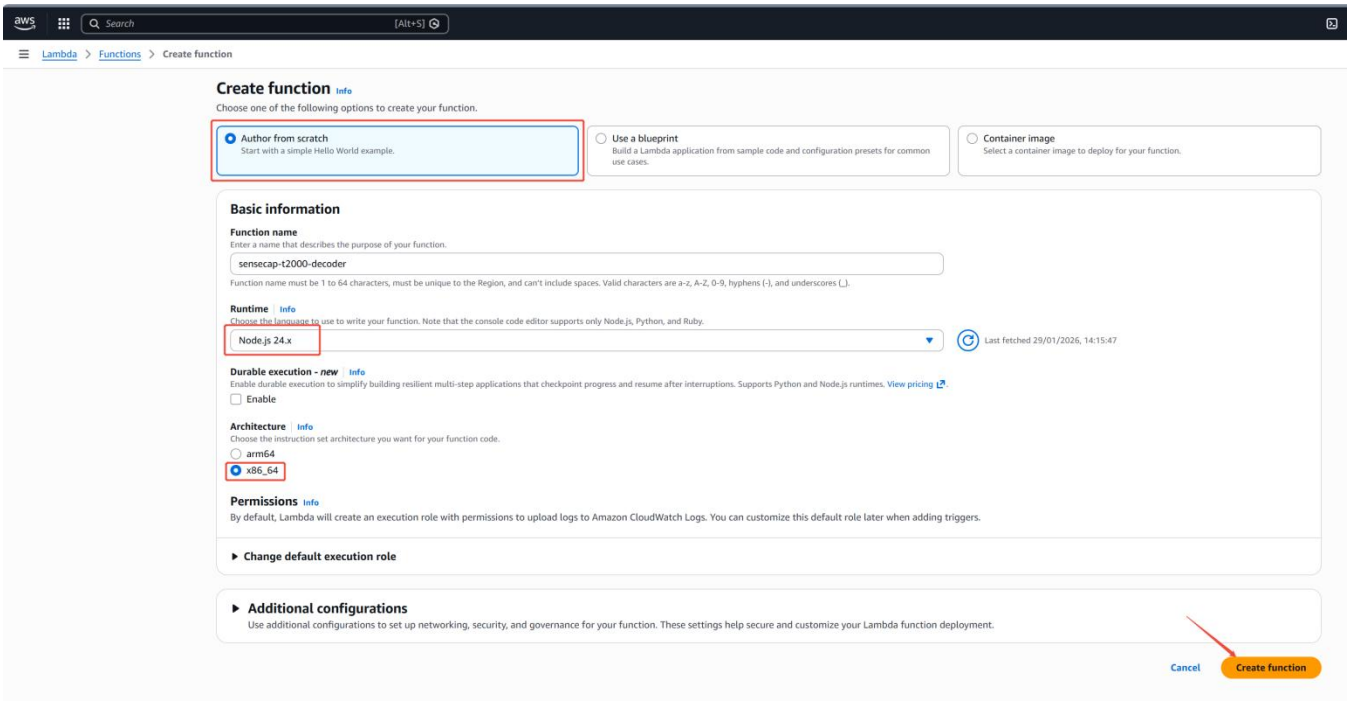


Scroll down to Rule actions section, and select Lambda from Action 1, then click Create a Lambda function.



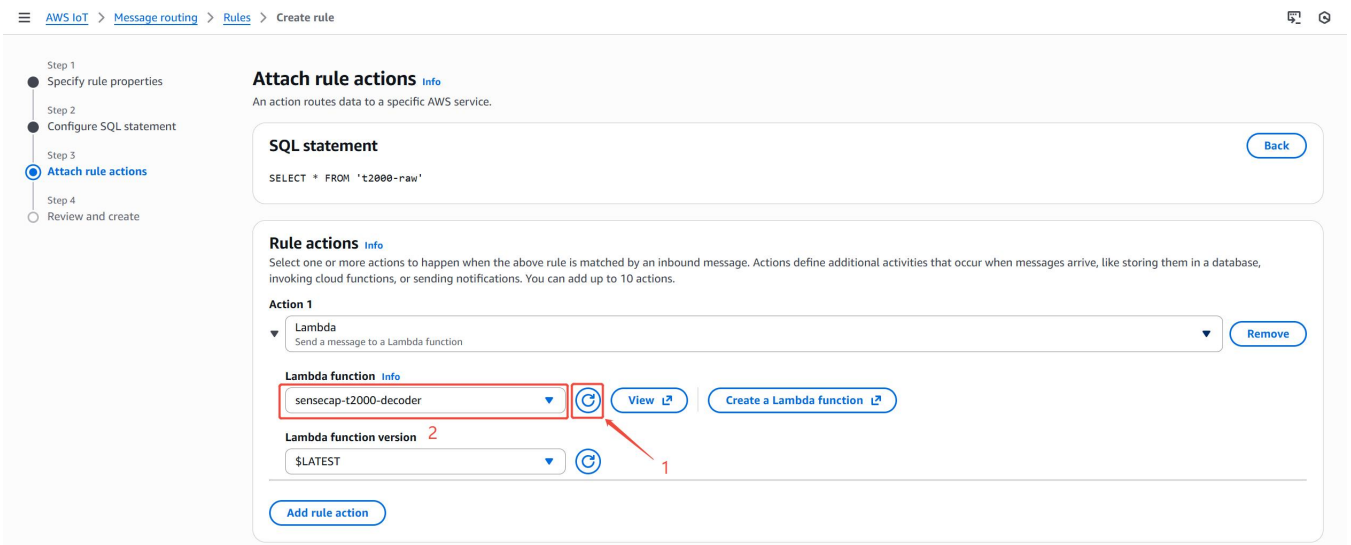
Function name: Name your function.
Runtime: Node.js 24.x
Architexture: x86_64

Click Create function button to create a new function.

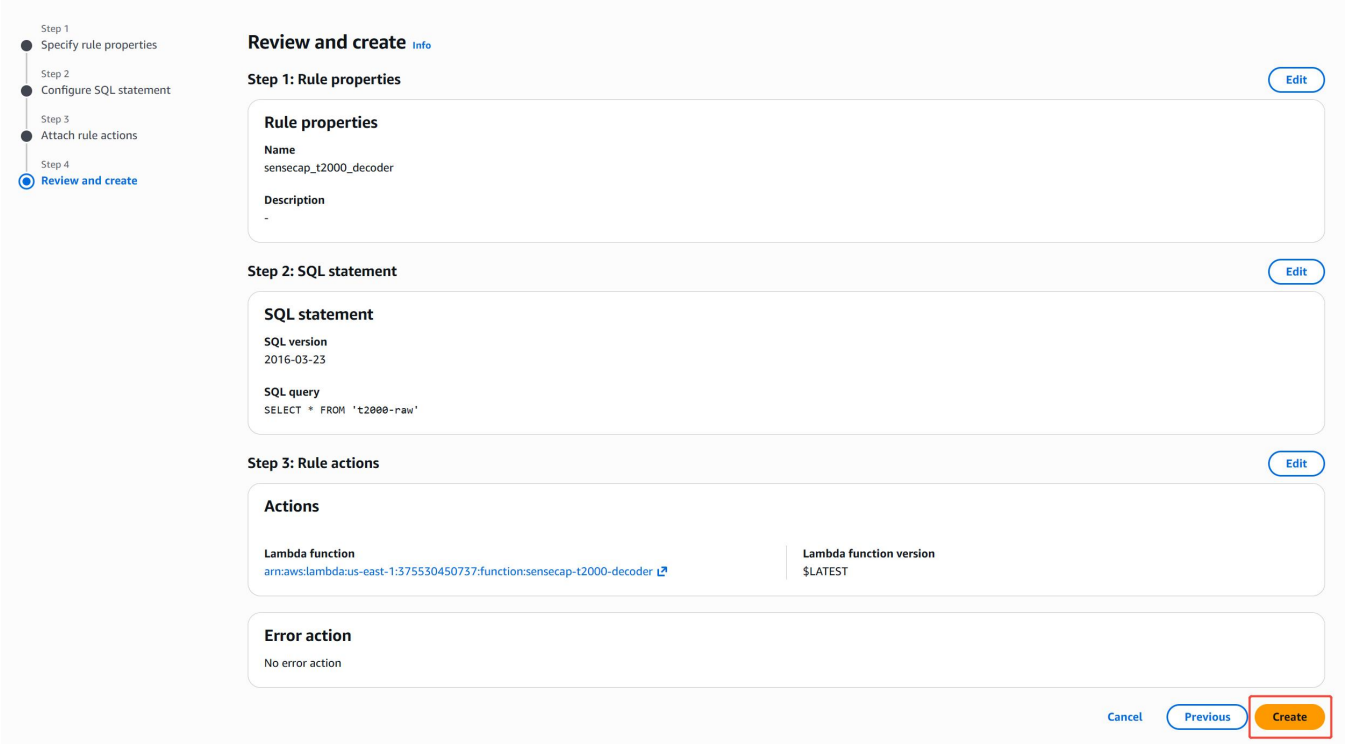


After creating the function, it goes to the function's config page. We will configure it later so just go back to the rules page.

Click the Refresh button and select the Lambda function you create before. Then click Next to Step 4.



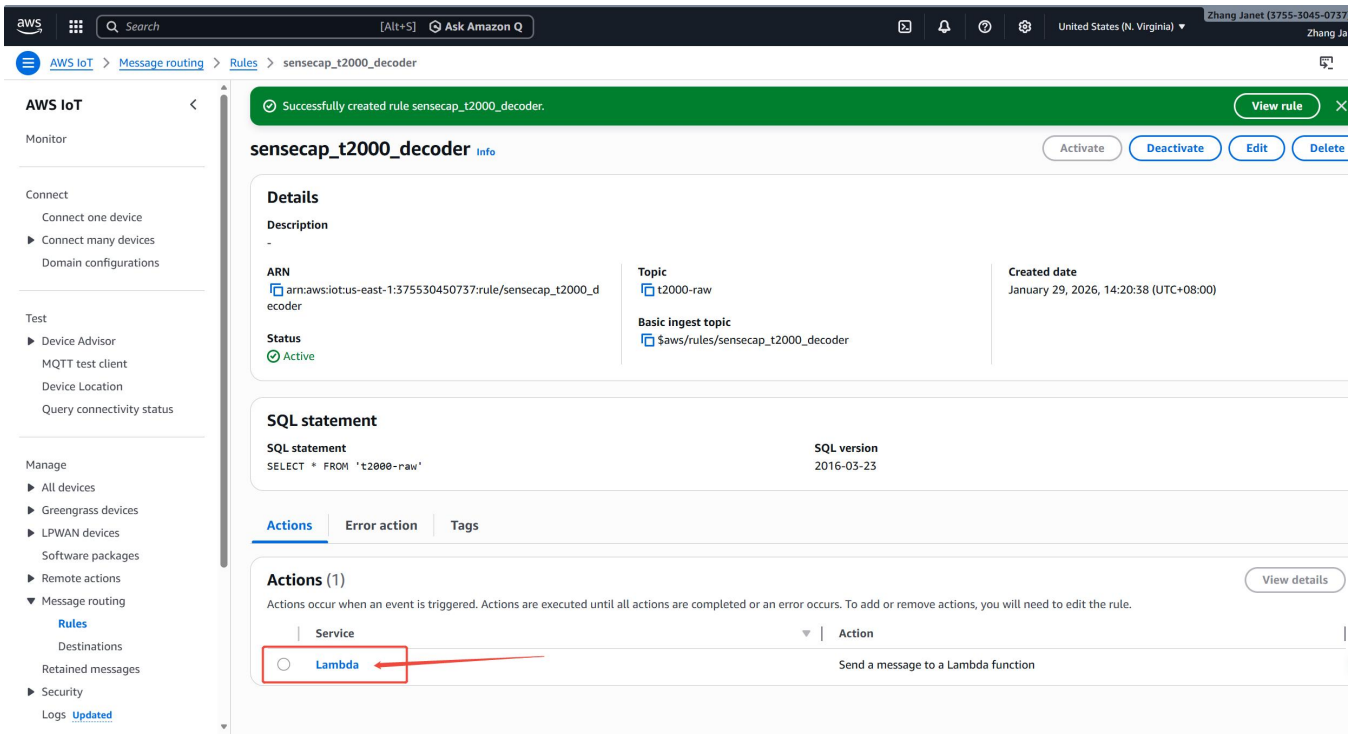
Check that all details of the rule are correct, then click Create to create the rule.

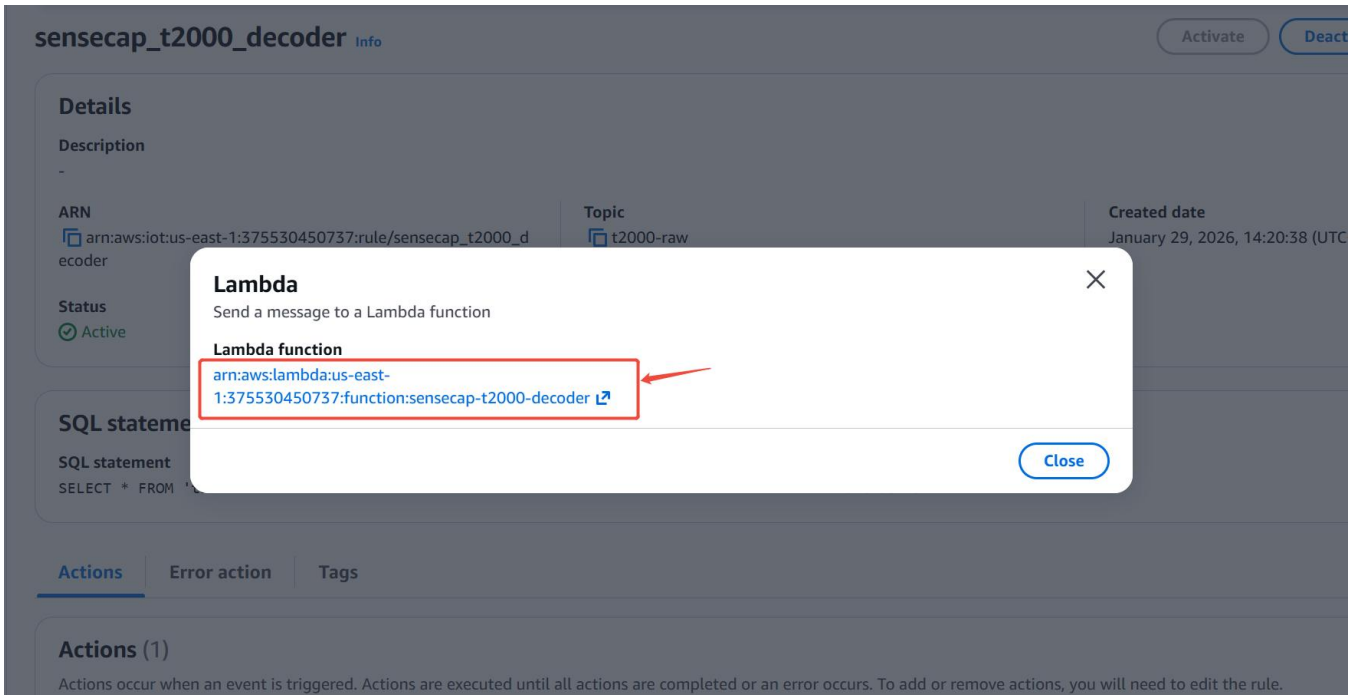


- **Configure the Lambda Function**

Back to Message routing tab → Rules, select the rule you created before.

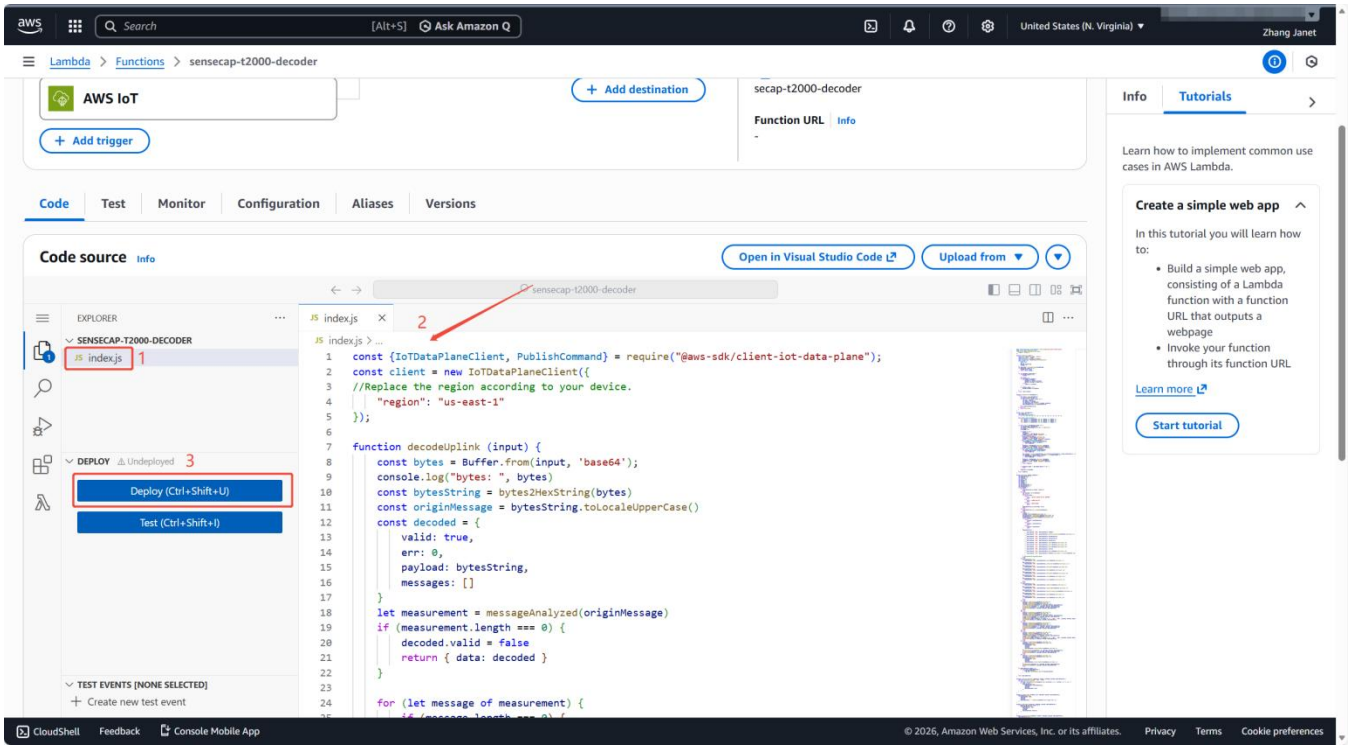
Click Lambda from Actions and then click the link to go to the Lambda function configuration page.



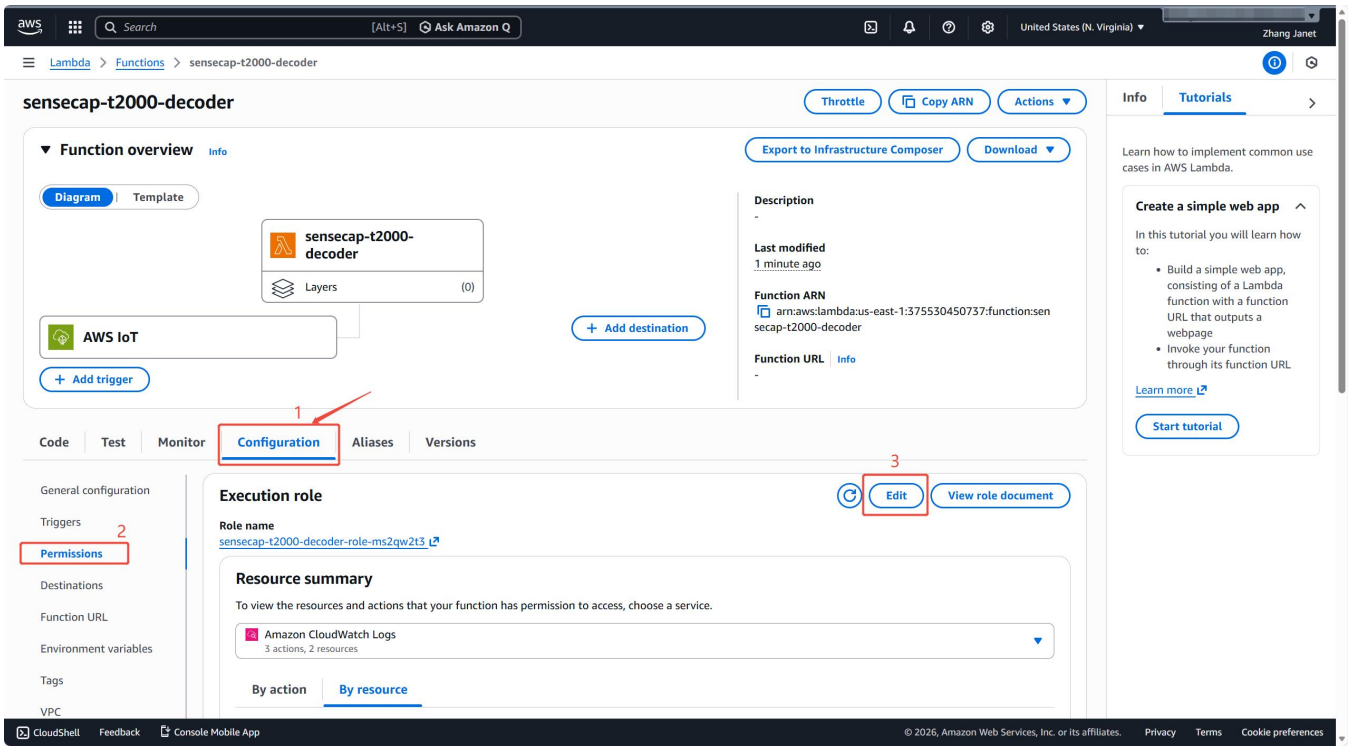


On the following funcition config page, rename the index.mjs file to index.js, remove all the code and replace it with the script from Resource, then click Deploy button.

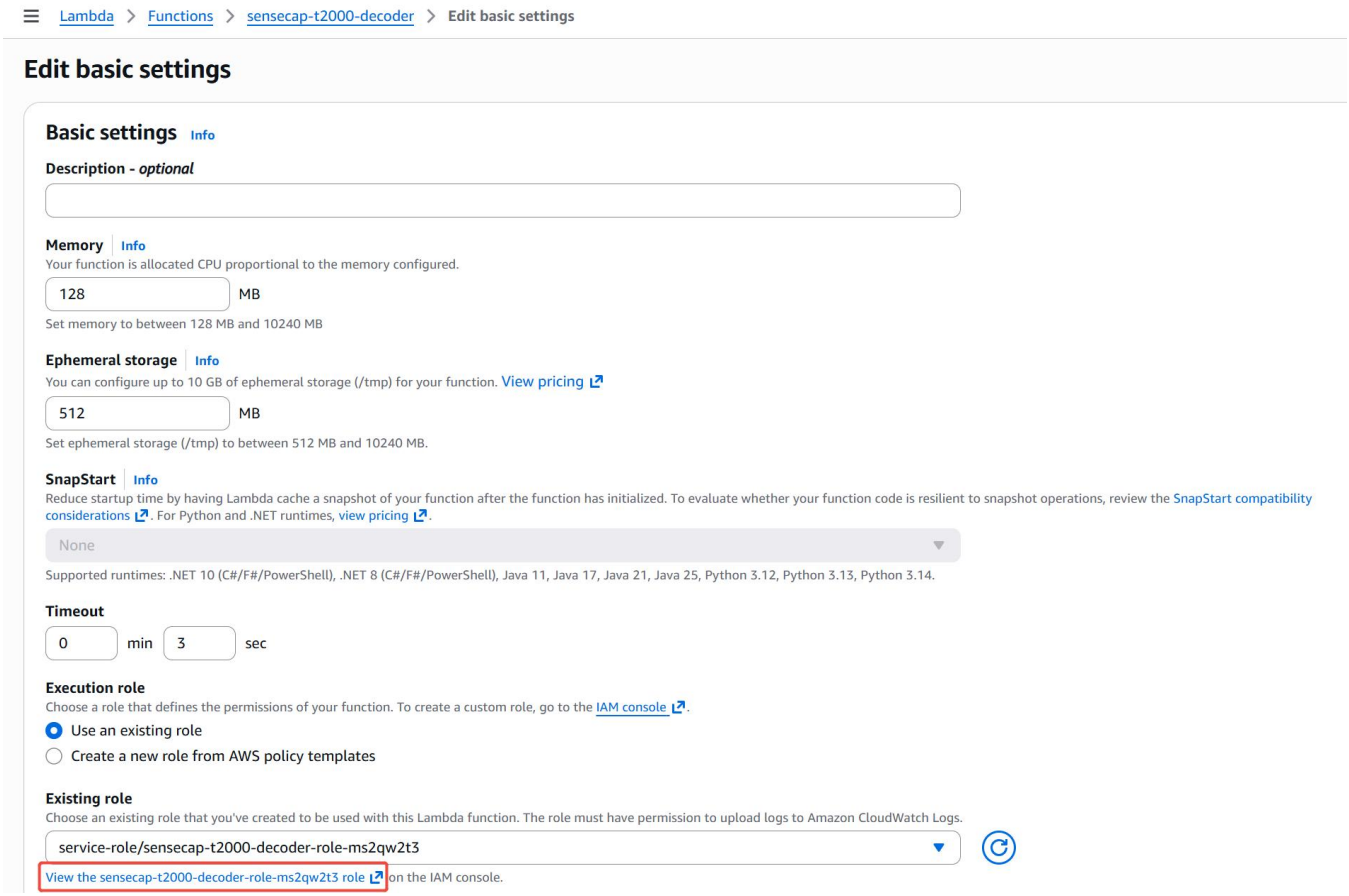
Decoder for AWS



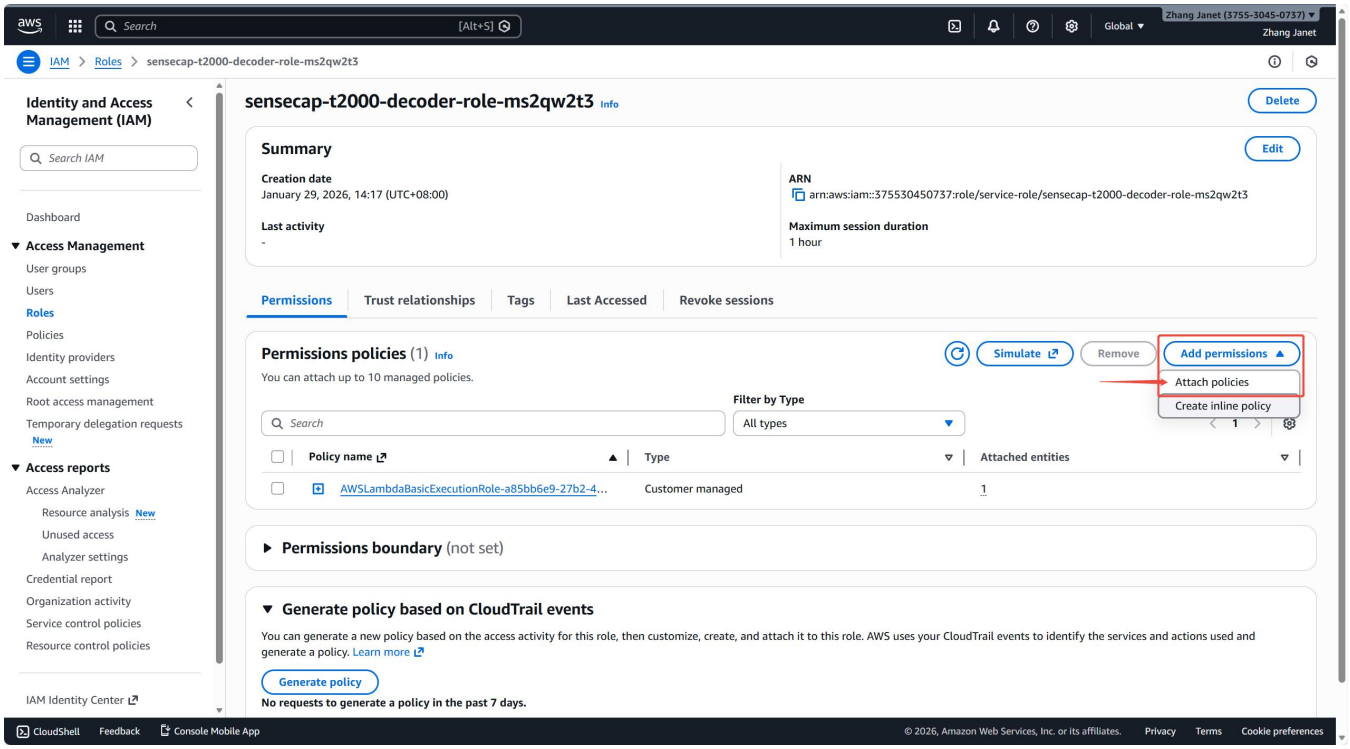
After configuring the decoder, Click Configuration → Permissions → Edit.



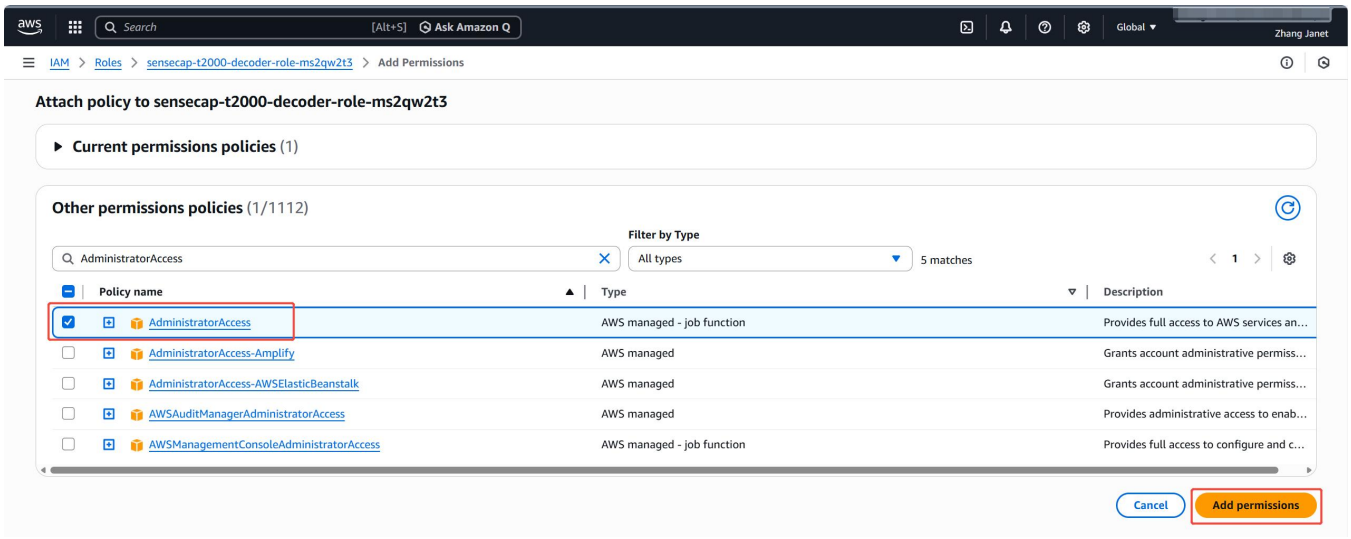
Click View the xxxxxxxxxx role at the bottom.



Click Add permissions → Attach policies.

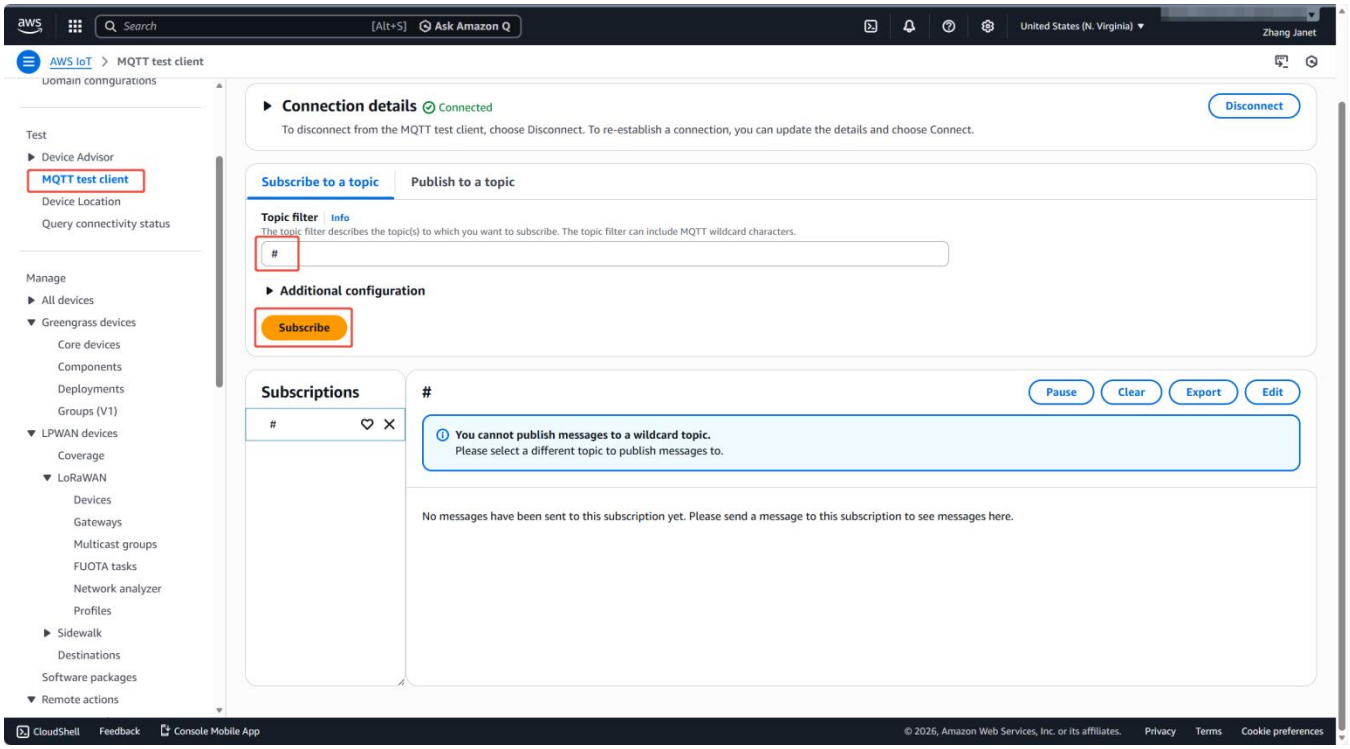


Search AdministratorAccess, check the box left it, and then click Add Permissions.

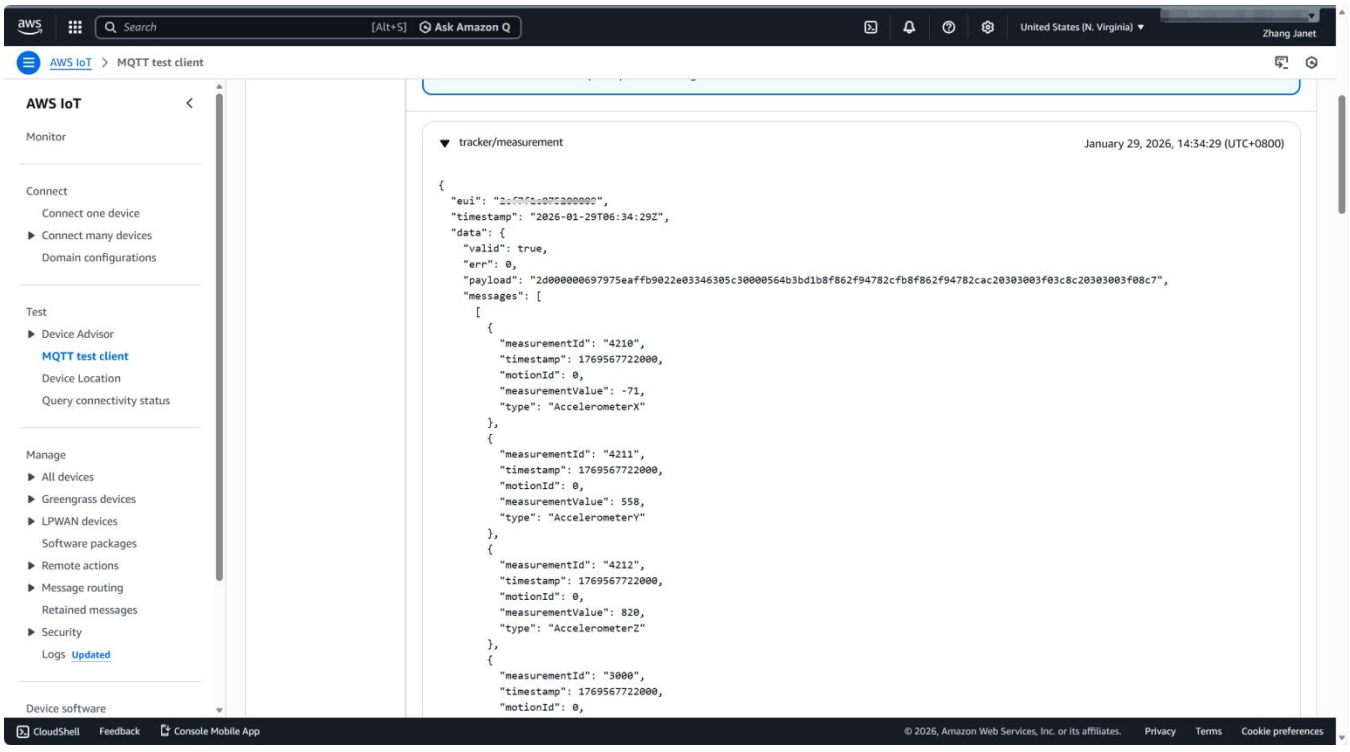


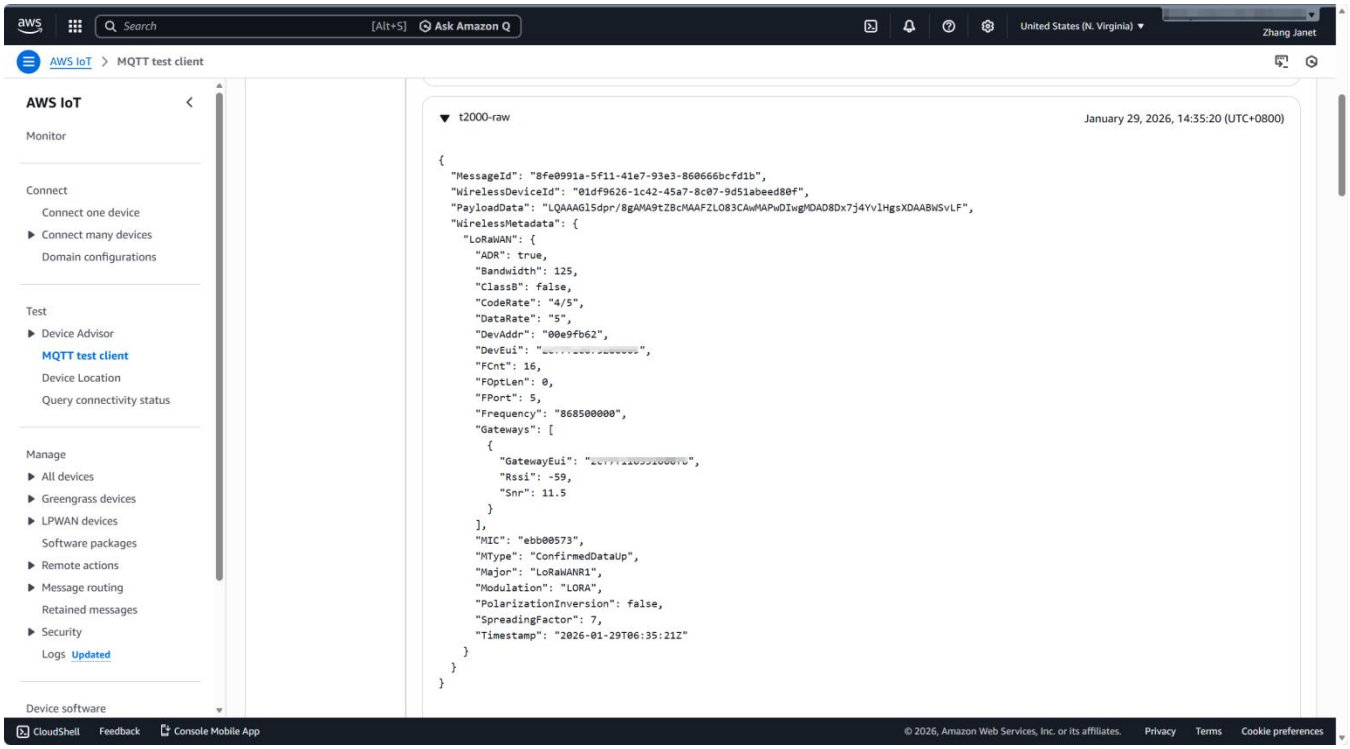
- **Check the data**

Check the data on page MQTT test client, input # and click Subscribe button, you will see the data.



The raw payload of T2000 Tracker publish from t2000-raw and the decoded data publish from tracker/measurement.





4.3.6 Resource

SenseCAP T2000 Tracker Decoder for AWS

5 Payload Format

5.1 Uplink Packet Parsing

The tracker data protocol provides different packets to correspond to different information, and the number of bytes of each packet may vary. The structure of the frame is shown in the image below. The frame content is sent in big-endian byte order.

Data ID	Data Value
1 byte	50 bytes (Max)

Data ID: Function number.
Data Value: Position, sensor data and other information.

5.1.1 Power-on Packet (0x27)

The power-on packet is sent by the device immediately after booting. It contains the current configuration parameters and device status. The frame ID is `0x27`, and the total length is 46 bytes.

0x27	Byte2	Byte3~4	Byte5~6	Byte7	Byte8	Byte9~10	Byte11~12
ID	Battery Level	Software Version	Hardware Version	Work Mode	Positioning Strategy	Heartbeat Interval	Periodic Mode Uplink Interval

Byte13~14	Byte15	Byte16	Byte17	Byte18	Byte19~20	Byte21~22
Event Mode Uplink Interval	Enable 3-Axis Accelerometer	Enable Disassembly Alarm	GNSS Scan Timeout	Enable Motion Event	3-Axis Motion Threshold	Uplink Interval On Motion

Byte23	Byte24~25	Byte26	Byte27~28	Byte29	Byte30	Byte31~46
Enable	Motionless	Enable	3-Axis	iBeacon	UUID	UUID Filter

Byte23	Byte24~25	Byte26	Byte27~28	Byte29	Byte30	Byte31~46
Motionless Event	Timeout	Shock Event	Shock Threshold	Scan Timeout (s)	Filter Valid Bytes	(16 Bytes)

Raw Payload Example

27 56 0100 0101 01 08 02d0 003c 003c 00 01 3c 00 001e 0005 00 0168 00 012c 03 00 00000000000000000000000000000000

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	27	27 is the packet ID
2	Battery Level	uint8	56	0x56 = 86(DEC) The battery level is 86%
3~4	Software Version	uint16	0100	0x0100 = v1.0 The software version is v1.0
5~6	Hardware Version	uint16	0101	0x0101 = v1.1 The hardware version is v1.1
7	Work Mode	uint8	01	01 = Periodic Mode 00: Standby Mode 01: Periodic Mode 02: Event Mode
8	Positioning Strategy	uint8	00	07 = 0x07, means the device use Bluetooth + Wi-Fi + GNSS positioning strategy 00: Only GNSS 01: Only Wi-Fi 02: Wi-Fi + GNSS 03: GNSS + Wi-Fi

Byte	Value	Type	Raw Data	Description
				04: Only Bluetooth 05: Bluetooth + Wi-Fi 06: Bluetooth + GNSS 07: Bluetooth + Wi-Fi + GNSS 08: GNSS + Bluetooth
9~10	Heartbeat Interval	uint16	02d0	0x02D0 = 720 minutes
11~12	Periodic Mode Uplink Interval	uint16	003c	0x003C = 60 minutes
13~14	Event Mode Uplink Interval	uint16	003c	0x003C = 60 minutes
15	Enable 3-Axis Accelerometer	uint8	00	00: Disable 01: Enable
16	Enable Disassembly Alarm	uint8	01	00: Disable 01: Enable
17	GNSS Scan Timeout	uint8	3c	0x3C = 60 seconds
18	Enable Motion Event	uint8	00	00: Disable 01: Enable
19~20	3-Axis Motion Threshold	uint16	001e	0x001e = 30 mg
21~22	Uplink Interval On Motion	uint16	0005	0x05 = 5 minutes
23	Enable Motionless Event	uint8	00	0x00: Disable 0x01: Enable
24~25	Motionless	uint16	0168	0x0168 = 360 minutes

Byte	Value	Type	Raw Data	Description
	Timeout			
26	Enable Shock Event	uint8	00	00: Disable 01: Enable
27~28	3-Axis Shock Threshold	uint16	012c	0x012c = 300 mg
29	iBeacon Scan Timeout (s)	uint8	03	0x03 = 3 seconds
30	UUID Filter Valid Bytes	uint8	00	Number of valid bytes in UUID filter (0–16)
31~46	UUID Filter	16 bytes	00000000000000000000000000000000	16-byte Bluetooth UUID filter. Only first N bytes (defined by byte30) are meaningful

5.1.2 Periodic Mode Packet (0x28)

The periodic mode parameters packet contains the current work mode configuration. The frame ID is 0x28, and the total length is 30 bytes.

0x28	Byte2	Byte3	Byte4~5	Byte6~7	Byte8~9	Byte10	Byte11	Byte12	Byte13	Byte14	Byte15~30
ID	Work Mode	Positioning Strategy	Heartbeat Interval	Uplink Interval	Event Mode Uplink Interval	Enable 3-Axis Accelerometer	Enable Disassembly Alarm	GNSS Scan Timeout	iBeacon Scan Timeout	UUID Filter Valid Bytes	UUID Filter (16 Bytes)

Raw Payload Example

28 01 07 02d0 003c 003c 01 00 3c 0a 10 00000000000000000000000000000000

Byte	Value	Type	Raw Data	Description

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	28	28 is the packet ID
2	Work Mode	uint8	01	01 = Periodic Mode 00: Standby Mode 01: Periodic Mode 02: Event Mode
3	Positioning Strategy	uint8	07	07 = 0x07, means the device use Bluetooth + Wi-Fi + GNSS positioning strategy 00: Only GNSS 01: Only Wi-Fi 02: Wi-Fi + GNSS 03: GNSS + Wi-Fi 04: Only Bluetooth 05: Bluetooth + Wi-Fi 06: Bluetooth + GNSS 07: Bluetooth + Wi-Fi + GNSS 08: GNSS + Bluetooth
4~5	Heartbeat Interval	uint16	02d0	0x02D0 = 720 minutes
6~7	Uplink Interval	uint16	003c	0x003C = 60 minutes
8~9	Event Mode Uplink Interval	uint16	003c	0x003C = 60 minutes When no event is triggered, data will be uploaded every 60 minutes.
10	Enable 3-Axis Accelerometer	uint8	01	00: Disable 01: Enable
11	Enable	uint8	00	00: Disable

Byte	Value	Type	Raw Data	Description
	Disassembly Alarm			01: Enable
12	GNSS Scan Timeout	uint8	3c	0x3C = 60 seconds
13	iBeacon Scan Timeout	uint8	0a	0x0A = 10 seconds
14	UUID Filter Valid Bytes	uint8	10	Number of valid bytes in UUID filter (0–16)
15~30	UUID Filter	16 bytes	00000000000000000000000000000000	16-byte Bluetooth UUID filter. Only first N bytes (defined by byte14) are meaningful

5.1.3 Event Mode Packet (0x29)

The event parameters packet contains the motion, motionless, and shock event configuration settings. The frame ID is 0x29, and the total length is 12 bytes.

0x29	Byte2	Byte3~4	Byte5~6	Byte7	Byte8~9	Byte10	Byte11~12
ID	Enable Motion Event	3-Axis Motion Threshold	Uplink Interval On Motion	Enable Motionless Event	Motionless Timeout	Enable Shock Event	3-Axis Shock Threshold

Raw Payload Example

29 01 0064 001e 01 012c 00 012c

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	29	29 is the packet ID
2	Enable Motion Event	uint8	01	00: Disable 01: Enable

Byte	Value	Type	Raw Data	Description
3~4	3-Axis Motion Threshold	uint16	0064	0x0064 = 100 mg
5~6	Uplink Interval On Motion	uint16	001e	0x001E = 30 minitues
7	Enable Motionless Event	uint8	01	0x00: Disable 0x01: Enable
8~9	Motionless Timeout	uint16	012c	0x012C = 300 minitues
10	Enable Shock Event	uint8	00	0x00: Disable 0x01: Enable
11~12	3-Axis Shock Threshold	uint16	0000	0x012c = 300 mg

5.1.4 Heartbeat Packet (0x2A)

The heartbeat packet is sent periodically by the device to report its current status. It contains basic device information and sensor states. The frame ID is 0x2A, and the total length is 6 bytes.

0x2A	Byte2	Byte3	Byte4	Byte5	Byte6
ID	Battery Level	Work Mode	Positioning Strategy	Enable 3-Axis Accelerometer	Enable Disassembly Alarm

Raw Payload Example

2a 56 01 07 01 00

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	2A	2A is the packet ID
2	Battery Level	uint8	56	0x56 = 86(DEC) The battery level is 86%
3	Work Mode	uint8	01	01 = Periodic Mode 00: Standby Mode

Byte	Value	Type	Raw Data	Description
				01: Periodic Mode 02: Event Mode
4	Positioning Strategy	uint8	07	07 = 0x07, means the device use Bluetooth + Wi-Fi + GNSS positioning strategy 00: Only GNSS 01: Only Wi-Fi 02: Wi-Fi + GNSS 03: GNSS + Wi-Fi 04: Only Bluetooth 05: Bluetooth + Wi-Fi 06: Bluetooth + GNSS 07: Bluetooth + Wi-Fi + GNSS 08: GNSS + Bluetooth
5	Enable 3-Axis Accelerometer	uint8	01	00: Disable 01: Enable
6	Enable Disassembly Alarm	uint8	00	00: Disable 01: Enable

5.1.5 GNSS Location Data Packet (Accelerometer On, 0x2B)

The GPS location data packet contains GNSS positioning data along with accelerometer and battery information. The frame ID is 0x2B, and the total length is 23 bytes.

0x2B	Byte2~3	Byte4	Byte5~8	Byte9~10	Byte11~12	Byte13~14	Byte15~18	Byte19~22	Byte23
ID	Event Status	Motion ID	UTC Timestamp	Accelerometer X	Accelerometer Y	Accelerometer Z	Longitude	Latitude	Battery Level

Raw Payload Example

2b 0100 00 694b3dc6 032f fffe 0241 06ca5098 01587ee4 62

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	2B	2B is the packet ID
2~3	Event Status	uint16	0100	0x0100 = disassembled event Bit 0: false Bit 1: Start moving event Bit 2: End movement event Bit 3: Motionless event Bit 4: Shock event Bit 5: Temperature event Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: 0x0001: Start moving event 0x0002: End movement event 0x0004: Motionless event 0x0008: Shock event 0x0010: Temperature event 0x0020: Light event 0x0040: SOS event 0x0080: Press once event 0x0100: Disassembled event
4	Motion ID	uint8	00	0: Does not need to be recorded as a specific motion. 1~255: Positioning data reported under the same motion status (same ID refers to the same motion)
5~8	UTC Timestamp	uint32	694b3dc6	0x694B3DC6 = 1766538694(DEC) seconds Convert it to UTC Time: 2025-12-24 01:11:34

Byte	Value	Type	Raw Data	Description
9~10	Accelerometer X	int16	032f	0x032F = 815 mg
11~12	Accelerometer Y	int16	fffe	0xFFFE = -2 mg
13~14	Accelerometer Z	int16	0241	0x0241 = 577 mg
15~18	Longitude	uint32	06ca5098	0x06CA5098 = 113,922,200 → 113.922200°
19~22	Latitude	uint32	01587ee4	0x01587EE4 = 22,576,868 → 22.576868°
23	Battery Level	uint8	62	0x62 = 98%

5.1.6 Wi-Fi Location Data Packet (Accelerometer On, 0x2C)

The Wi-Fi location packet contains Wi-Fi scan results along with accelerometer and battery information. The frame ID is 0x2C, and the total length is dynamic based on the number of Wi-Fi access points scanned (23 + (n-1) * 7 bytes, where n is the number of MAC-RSSI pairs).

0x2C	Byte 2~3	Byte 4	Byte5~8	Byte9~10	Byte11~12	Byte13~14	Byte 15	Byte 16	Byte17 +(n-1)*7 ~ Byte23 +(n-1)*7
ID	Event Status	Motion ID	UTC Timestamp	Accelerometer X	Accelerometer Y	Accelerometer Z	Battery Level	MAC-RSSI Count (n)	MAC-RSSI Pairs (n)

MAC-RSSI Format

Byte0~5	Byte6
MAC Address (6 bytes)	RSSI (int8)

Raw Payload Example

`2c 0000 00 69685f82 0004 0015 03e5 64 05 107c61841bf8 e4 3447d468f627 e1 a4ba70bc229d d3 9483c46d5dfc d2 4c10d567b467 d0`

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	2C	2C is the packet ID
2~3	Event Status	uint16	0000	`0x0000` = No events triggered Bit 0: false Bit 1: Start moving event Bit 2: End movement event Bit 3: Motionless event Bit 4: Shock event Bit 5: Temperature event Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: `0x0001`: Start moving event `0x0002`: End movement event `0x0004`: Motionless event `0x0008`: Shock event `0x0010`: Temperature event `0x0020`: Light event `0x0040`: SOS event `0x0080`: Press once event `0x0100`: Disassembled event
4	Motion ID	uint8	00	`0`: Does not need to be recorded as a specific motion.

Byte	Value	Type	Raw Data	Description
				1~255: Positioning data reported under the same motion status (same ID refers to the same motion)
5~8	UTC Timestamp	uint32	69685f82	0x69685F82 = 1768447874(DEC) seconds Convert it to UTC Time: 2026-01-15 03:31:14
9~10	Accelerometer X	int16	0004	0x0004 = 4 mg
11~12	Accelerometer Y	int16	0015	0x0015 = 21 mg
13~14	Accelerometer Z	int16	03e5	0x03E5 = 997 mg
15	Battery Level	uint8	64	0x64 = 100%
16	MAC-RSSI Count (n)	uint8	05	Number of Wi-Fi access points detected (n = 5)
17~23	MAC-RSSI Pair 1	7 bytes	107c61841bf8e4	MAC: 10:7C:61:84:1B:F8, RSSI: 0xE4 = -28 (int8)
24~30	MAC-RSSI Pair 2	7 bytes	3447d468f627e1	MAC: 34:47:D4:68:F6:27, RSSI: 0xE1 = -31 (int8)
31~37	MAC-RSSI Pair 3	7 bytes	a4ba70bc229dd3	MAC: A4:BA:70:BC:22:9D, RSSI: 0xD3 = -45 (int8)
38~44	MAC-RSSI Pair 4	7 bytes	9483c46d5dfcd2	MAC: 94:83:C4:6D:5D:FC, RSSI: 0xD2 = -46 (int8)
45~51	MAC-RSSI Pair 5	7 bytes	4c10d567b467d0	MAC: 4C:10:D5:67:B4:67, RSSI: 0xD0 = -48 (int8)

5.1.7 BLE Location Data Packet (Accelerometer On,0x2D)

The BLE location packet contains Bluetooth scan results along with accelerometer and battery information. The frame ID is `0x2D`, and the total length is dynamic based on the number of Bluetooth devices scanned (23 + (n-1) * 7 bytes, where n is the number of MAC-RSSI pairs, maximum n = 5).

0x2D	Byte 2~3	Byte 4	Byte5~8	Byte9~10	Byte11~12	Byte13~14	Byte 15	Byte 16	Byte17 +(n-1)*7 ~ Byte23 +(n-1)*7
ID	Event Status	Motion ID	UTC Timestamp	Accelerometer X	Accelerometer Y	Accelerometer Z	Battery Level	MAC-RSSI Count (n)	MAC-RSSI Pairs (n)

MAC-RSSI Format

Byte0~5	Byte6
MAC Address (6 bytes)	RSSI (int8)

Raw Payload Example

`2d 0000 00 69686032 fff9 0015 03df 64 05 c30000564b3b ce c20303003f00 ce 588c81a0fbf2 cc c20303003f03 cb c30000564af2 c7`

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	2D	2D is the packet ID
2~3	Event Status	uint16	0000	`0x0000` = No events triggered Bit 0: false Bit 1: Start moving event Bit 2: End movement event

Byte	Value	Type	Raw Data	Description
				Bit 3: Motionless event Bit 4: Shock event Bit 5: Temperature event Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: 0x0001: Start moving event 0x0002: End movement event 0x0004: Motionless event 0x0008: Shock event 0x0010: Temperature event 0x0020: Light event 0x0040: SOS event 0x0080: Press once event 0x0100: Disassembled event
4	Motion ID	uint8	00	0: Does not need to be recorded as a specific motion. 1~255: Positioning data reported under the same motion status (same ID refers to the same motion)
5~8	UTC Timestamp	uint32	69686032	0x69686032 = 1768448050(DEC) seconds Convert it to UTC Time: 2026-01-15 03:34:10
9~10	Accelerometer X	int16	fff9	0xFFF9 = -7 mg
11~12	Accelerometer Y	int16	0015	0x0015 = 21 mg

Byte	Value	Type	Raw Data	Description
13~14	Accelerometer Z	int16	03df	0x03DF = 991 mg
15	Battery Level	uint8	64	0x64 = 100%
16	MAC-RSSI Count (n)	uint8	05	Number of Bluetooth devices detected (n = 5, maximum 5)
17~23	MAC-RSSI Pair 1	7 bytes	c30000564b3bce	MAC: C3:00:00:56:4B:3B, RSSI: 0xCE = -50 (int8)
24~30	MAC-RSSI Pair 2	7 bytes	c20303003f00ce	MAC: C2:03:03:00:3F:00, RSSI: 0xCE = -50 (int8)
31~37	MAC-RSSI Pair 3	7 bytes	588c81a0fbf2cc	MAC: 58:8C:81:A0:FB:F2, RSSI: 0xCC = -52 (int8)
38~44	MAC-RSSI Pair 4	7 bytes	c20303003f03cb	MAC: C2:03:03:00:3F:03, RSSI: 0xCB = -53 (int8)
45~51	MAC-RSSI Pair 5	7 bytes	c30000564af2c7	MAC: C3:00:00:56:4A:F2, RSSI: 0xC7 = -57 (int8)

5.1.8 GNSS Location Data Packet (Accelerometer Off, 0x2E)

The GNSS location data packet contains GPS positioning data along with battery information. The frame ID is 0x2E, and the total length is 17 bytes.

0x2E	Byte2~3	Byte4	Byte5~8	Byte9~12	Byte13~16	Byte17
ID	Event Status	Motion ID	UTC Timestamp	Longitude	Latitude	Battery Level

Raw Payload Example

2e 0100 01 64f1a2b3 06ca5098 01587ee4 62

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	2E	2E is the packet ID

Byte	Value	Type	Raw Data	Description
2~3	Event Status	uint16	0000	0x0000 = No events triggered Bit 0: false Bit 1: Start moving event Bit 2: End movement event Bit 3: Motionless event Bit 4: Shock event Bit 5: Temperature event Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: 0x0001: Start moving event 0x0002: End movement event 0x0004: Motionless event 0x0008: Shock event 0x0010: Temperature event 0x0020: Light event 0x0040: SOS event 0x0080: Press once event 0x0100: Disassembled event
4	Motion ID	uint8	00	0: Does not need to be recorded as a specific motion. 1~255: Positioning data reported under the same motion status (same ID refers to the same motion)
5~8	UTC Timestamp	uint32	64f1a2b3	0x64f1a2b3 = 1693557427(DEC) seconds Convert it to UTC Time: 2023-09-01 08:37:07
9~12	Longitude	uint32	06ca5098	0x06CA5098 = 113,922,200 → 113.922200°

Byte	Value	Type	Raw Data	Description
13~16	Latitude	uint32	01587ee4	0x01587EE4 = 22,576,868 → 22.576868°
17	Battery Level	uint8	62	0x62 = 98%

5.1.9 Wi-Fi Location Data Packet (Accelerometer Off, 0x2F)

The Wi-Fi location data packet contains Wi-Fi scan results along with battery information. The frame ID is 0x2F, and the total length is dynamic based on the number of Wi-Fi access points scanned (17 + (n-1) * 7 bytes, where n is the number of MAC-RSSI pairs, maximum n = 5).

0x2F	Byte2~3	Byte4	Byte5~8	Byte9	Byte10	Byte11+(n-1)*7 ~ Byte16+(n-1)*7
ID	Event Status	Motion ID	UTC Timestamp	Battery Level	MAC-RSSI Count (n)	MAC-RSSI Pairs (n)

MAC-RSSI Format

Byte0~5	Byte6
MAC Address (6 bytes)	RSSI (int8)

Raw Payload Example

2f 0000 00 69685f82 64 05 107c61841bf8 e4 3447d468f627 e1 a4ba70bc229d d3 9483c46d5dfc d2 4c10d567b467 d0

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	2F	2F is the packet ID
2~3	Event Status	uint16	0000	0x0000 = No events triggered Bit 0: false Bit 1: Start moving event Bit 2: End movement event Bit 3: Motionless event Bit 4: Shock event

Byte	Value	Type	Raw Data	Description
				Bit 5: Temperature event Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: 0x0001: Start moving event 0x0002: End movement event 0x0004: Motionless event 0x0008: Shock event 0x0010: Temperature event 0x0020: Light event 0x0040: SOS event 0x0080: Press once event 0x0100: Disassembled event
4	Motion ID	uint8	00	0: Does not need to be recorded as a specific motion. 1~255: Positioning data reported under the same motion status (same ID refers to the same motion)
5~8	UTC Timestamp	uint32	69685f82	0x69685F82 = 1768447874(DEC) seconds Convert it to UTC Time: 2026-01-15 03:31:14
9	Battery Level	uint8	64	0x64 = 100%
10	MAC-RSSI Count (n)	uint8	05	Number of Wi-Fi access points detected (n = 5, maximum 5)
11~17	MAC-RSSI Pair 1	7 bytes	107c61841bf8e4	MAC: 10:7C:61:84:1B:F8, RSSI: 0xE4 = -28 (int8)

Byte	Value	Type	Raw Data	Description
18~24	MAC-RSSI Pair 2	7 bytes	3447d468f627e1	MAC: 34:47:D4:68:F6:27, RSSI: 0xE1 = -31 (int8)
25~31	MAC-RSSI Pair 3	7 bytes	a4ba70bc229dd3	MAC: A4:BA:70:BC:22:9D, RSSI: 0xD3 = -45 (int8)
32~38	MAC-RSSI Pair 4	7 bytes	9483c46d5dfcd2	MAC: 94:83:C4:6D:5D:FC, RSSI: 0xD2 = -46 (int8)
39~45	MAC-RSSI Pair 5	7 bytes	4c10d567b467d0	MAC: 4C:10:D5:67:B4:67, RSSI: 0xD0 = -48 (int8)

5.1.10 BLE Location Data Packet (Accelerometer Off, 0x30)

The BLE location data packet contains Bluetooth scan results along with battery information. The frame ID is 0x30, and the total length is dynamic based on the number of Bluetooth devices scanned (17 + (n-1) * 7 bytes, where n is the number of MAC-RSSI pairs, maximum n = 5).

0x30	Byte2~3	Byte4	Byte5~8	Byte9	Byte10	Byte11+(n-1)*7 ~ Byte16+(n-1)*7
ID	Event Status	Motion ID	UTC Timestamp	Battery Level	MAC-RSSI Count (n)	MAC-RSSI Pairs (n)

MAC-RSSI Format

Byte0~5	Byte6
MAC Address (6 bytes)	RSSI (int8)

Raw Payload Example

30 0000 00 69686032 64 05 c30000564b3b ce c20303003f00 ce 588c81a0fbf2 cc c20303003f03 cb c30000564af2 c7

Byte	Value	Type	Raw Data	Description

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	30	30 is the packet ID
2~3	Event Status	uint16	0000	0x0000 = No events triggered Bit 0: false Bit 1: Start moving event Bit 2: End movement event Bit 3: Motionless event Bit 4: Shock event Bit 5: Temperature event Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: 0x0001: Start moving event 0x0002: End movement event 0x0004: Motionless event 0x0008: Shock event 0x0010: Temperature event 0x0020: Light event 0x0040: SOS event 0x0080: Press once event 0x0100: Disassembled event
4	Motion ID	uint8	00	0: Does not need to be recorded as a specific motion. 1~255: Positioning data reported under the same motion status (same ID refers to the same motion)
5~8	UTC Timestamp	uint32	69686032	0x69686032 = 1768448050(DEC) seconds Convert it to UTC Time:

Byte	Value	Type	Raw Data	Description
				2026-01-15 03:34:10
9	Battery Level	uint8	64	0x64 = 100%
10	MAC-RSSI Count (n)	uint8	05	Number of Bluetooth devices detected (n = 5, maximum 5)
11~17	MAC-RSSI Pair 1	7 bytes	c30000564b3bce	MAC: C3:00:00:56:4B:3B, RSSI: 0xCE = -50 (int8)
18~24	MAC-RSSI Pair 2	7 bytes	c20303003f00ce	MAC: C2:03:03:00:3F:00, RSSI: 0xCE = -50 (int8)
25~31	MAC-RSSI Pair 3	7 bytes	588c81a0fbf2cc	MAC: 58:8C:81:A0:FB:F2, RSSI: 0xCC = -52 (int8)
32~38	MAC-RSSI Pair 4	7 bytes	c20303003f03cb	MAC: C2:03:03:00:3F:03, RSSI: 0xCB = -53 (int8)
39~45	MAC-RSSI Pair 5	7 bytes	c30000564af2c7	MAC: C3:00:00:56:4A:F2, RSSI: 0xC7 = -57 (int8)

5.1.11 Positioning Status Packet with Accelerometer (0x31)

The positioning status packet contains the positioning status along with accelerometer data, event status, and battery information. The frame ID is 0x31, and the total length is 15 bytes.

0x31	Byte2	Byte3~4	Byte5~8	Byte9~10	Byte11~12	Byte13~14	Byte15
ID	Positioning Status	Event Status	UTC Timestamp	Accelerometer X	Accelerometer Y	Accelerometer Z	Battery Level

Raw Payload Example

31 00 0100 694b3db0 003a 039d fe84 62

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	31	31 is the packet ID
2	Positioning Status	uint8	00	0x00: locate successful. 0x01: The GNSS scan timed out. 0x02: The Wi-Fi scan timed out. 0x03: The Wi-Fi + GNSS scan timed out. 0x04: The GNSS + Wi-Fi scan timed out. 0x05: The Bluetooth scan timed out. 0x06: The Bluetooth + Wi-Fi scan timed out. 0x07: The Bluetooth + GNSS scan timed out. 0x08: The Bluetooth + Wi-Fi + GNSS scan timed out. 0x09: Location Server failed to parse the GNSS location. 0x0A: Location Server failed to parse the Wi-Fi location. 0x0B: Location Server failed to parse the Bluetooth location. 0x0C: Failed to parse location due to the poor accuracy. 0x0D: Time synchronization failed. 0x0E: Failed due to the old Almanac. 0x0F: The GNSS + Bluetooth scan timed out.
3~4	Event Status	uint16	0000	0x0000 = No events triggered Bit 0: false Bit 1: Start moving event Bit 2: End movement event Bit 3: Motionless event Bit 4: Shock event Bit 5: Temperature event

Byte	Value	Type	Raw Data	Description
				Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: 0x0001: Start moving event 0x0002: End movement event 0x0004: Motionless event 0x0008: Shock event 0x0010: Temperature event 0x0020: Light event 0x0040: SOS event 0x0080: Press once event 0x0100: Disassembled event
5~8	UTC Timestamp	uint32	694B3DB0	0x694B3DB0 = 1766538672(DEC) seconds Convert it to UTC Time: 2025-12-24 01:11:12
9~10	Accelerometer X	int16	003a	0x003A = 58 mg
11~12	Accelerometer Y	int16	039d	0x039D = 925 mg
13~14	Accelerometer Z	int16	fe84	0xFE84 = -380 mg
15	Battery Level	uint8	62	0x62 = 98%

5.1.12 Positioning Status Packet (Accelerometer Off, 0x32)

The positioning status packet contains the positioning status along with event status and battery information. The frame ID is 0x32, and the total length is 9 bytes.

0x32	Byte2	Byte3~4	Byte5~8	Byte9
ID	Positioning Status	Event Status	UTC Timestamp	Battery Level

Raw Payload Example

32 00 0100 694b3db0 62

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	32	32 is the packet ID
2	Positioning Status	uint8	00	0x00: locate successful. 0x01: The GNSS scan timed out. 0x02: The Wi-Fi scan timed out. 0x03: The Wi-Fi + GNSS scan timed out. 0x04: The GNSS + Wi-Fi scan timed out. 0x05: The Bluetooth scan timed out. 0x06: The Bluetooth + Wi-Fi scan timed out. 0x07: The Bluetooth + GNSS scan timed out. 0x08: The Bluetooth + Wi-Fi + GNSS scan timed out. 0x09: Location Server failed to parse the GNSS location. 0x0A: Location Server failed to parse the Wi-Fi location. 0x0B: Location Server failed to parse the Bluetooth location. 0x0C: Failed to parse location due to the poor accuracy. 0x0D: Time synchronization failed. 0x0E: Failed due to the old Almanac. 0x0F: The GNSS + Bluetooth scan timed out.
3~4	Event Status	uint16	0100	0x0000 = No events triggered Bit 0: false

Byte	Value	Type	Raw Data	Description
				Bit 1: Start moving event Bit 2: End movement event Bit 3: Motionless event Bit 4: Shock event Bit 5: Temperature event Bit 6: Light event Bit 7: SOS event Bit 8: Press once event Bit 9: Disassembled event Convert to hexadecimal: 0x0001: Start moving event 0x0002: End movement event 0x0004: Motionless event 0x0008: Shock event 0x0010: Temperature event 0x0020: Light event 0x0040: SOS event 0x0080: Press once event 0x0100: Disassembled event
5~8	UTC Timestamp	uint32	694B3DB0	0x694B3DB0 = 1766538672(DEC) seconds Convert it to UTC Time: 2025-12-24 01:11:12
9	Battery Level	uint8	62	0x62 = 98%

5.2 Downlink Packet, FPort=5

The tracker supports LoRaWAN to downlink some commands to adjust parameters. If the device is hibernated, the downlink command takes effect the next time the device wakes up to upload data.

Due to the LoRaWAN Class A, where downlink windows only open following an uplink, commands are not real-time. For instance, if the reporting interval is set to 10 minutes, it may take up to 10 minutes for the device to receive the downlink command during its next transmission window.

Note: FPort=5

5.2.1 Request Device Status Packet (0x8F)

0x8F
ID

Example:

8F: Request the latest device status and location packet.

5.2.2 Setting Work Mode & Positioning Strategy (0x90)

0x90	Byte2	Byte3	Byte4~5	Byte6~7	Byte8~9
ID	Work Mode	Positioning Strategy	Heartbeat Interval	Periodic Mode Uplink Interval	Event Mode Uplink Interval

Byte10	Byte11	Byte12	Byte13	Byte14	Byte15~30
Enable 3-Axis Accelerometer	Enable Disassemble Alarm	GNSS Scan Timeout(S)	iBeacon Scan Timeout(S)	UUID Filter Valid Byte	UUID Filter

Note:
Heartbeat Interval / Periodic Mode Uplink Interval / Event Mode Uplink Interval unit: minutes

Example:

90 01 01 02d0 0014 0005 01 01 1e 0a 10 00000000000000000000000000000000

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	90	90 is the packet ID

Byte	Value	Type	Raw Data	Description
2	Work Mode	uint8	01	01 = Periodic Mode 00: Standby Mode 01: Periodic Mode 02: Event Mode
3	Positioning Strategy	uint8	01	00: Only GNSS 01: Only Wi-Fi 02: Wi-Fi + GNSS 03: GNSS + Wi-Fi 04: Only Bluetooth 05: Bluetooth + Wi-Fi 06: Bluetooth + GNSS 07: Bluetooth + Wi-Fi + GNSS 08: GNSS + Bluetooth
4~5	Heartbeat Interval	uint16	02d0	0x02D0 = 720 minutes
6~7	Periodic Mode Uplink Interval	uint16	0014	0x0014 = 20 minutes
8~9	Event Mode Uplink Interval	uint16	0005	0x0005 = 5 minutes When no event is triggered, data will be uploaded every 5 minutes.
10	Enable 3-Axis Accelerometer	uint8	01	00: Disable 01: Enable
11	Enable Disassembly Alarm	uint8	01	00: Disable 01: Enable
12	GNSS scan timeout	uint8	1E	0x1E = 30 seconds

Byte	Value	Type	Raw Data	Description
13	iBeacon scan timeout	uint8	0A	0x0A = 10 seconds
14	UUID Filter Valid Bytes	uint8	10	Number of valid bytes in UUID filter (0–16)
15~30	UUID Filter	16 bytes	00000000000000000000000000000000	16-byte Bluetooth UUID filter. Only first N bytes (defined by byte30) are meaningful

5.2.3 Setting Event Mode Threshold (0x91)

0x91	Byte2	Byte3~4	Byte5~6	Byte7	Byte8~9
ID	Enable Motion Event	3-Axis Motion Threshold	Uplink Interval On Motion	Enable Motionless Event	Motionless Timeout

Byte10	Byte11~12
Enable Shock Event	3-Axis Shock Threshold

Example:

91 01 001e 0005 01 01 2c

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	91	91 is the packet ID
2	Enable Motion Event	uint8	01	00: Disable 01: Enable
3~4	3-Axis Motion Threshold	uint16	001e	0x001E = 30 mg When the acceleration exceeds 30 mg, the device determines it is in motion

Byte	Value	Type	Raw Data	Description
5~6	Uplink Interval On Motion	uint16	0005	0x0005 = 5 minutes When motion is detected, the reporting interval is 5 minutes
7	Enable Motionless Event	uint8	01	00: Disable 01: Enable
8~9	Motionless Timeout	uint16	012c	0x012C = 300 minutes If the device remains stationary for more than 300 minutes, a motionless event will be triggered
10	Enable Shock Event	uint8	01	00: Disable 01: Enable
11~12	3-Axis Shock Threshold	uint16	012c	0x012C = 300 mg When the acceleration exceeds 300 mg, the shock event will be triggered

5.2.4 Request Device Status Packet (0x92)

0x92
ID

Example:

92: Force a GNSS location fix.

5.2.5 Setting Work Mode & Positioning Strategy & Event Mode Threshold (0x97)

0x97	Byte2	Byte3	Byte4~5	Byte6~7	Byte8~9
ID	Working Mode	Positioning Strategy	Heartbeat Interval	Periodic Mode Uplink Interval	Event Mode Uplink Interval

Byte10	Byte11	Byte12	Byte13	Byte14	Byte15~30
Enable 3-Axis Accelerometer	Enable Disassembly Alarm	GNSS Scan Timeout	iBeacon Scan Timeout	UUID Filter Valid Bytes	UUID Filter

5.2.5.1 Motion Event Settings

Byte31	Byte32~33	Byte34~35
Enable Motion Event	3-Axis Motion Threshold	Uplink Interval On Motion

5.2.5.2 Motionless Event Settings

Byte36	Byte37~38
Enable Motionless Event	Motionless Timeout

5.2.5.3 Shock Event Settings

Byte39	Byte40~41
Enable Shock Event	3-Axis Shock Threshold

Example:

`97 01 02 003c 001e 000a 01 01 0a 05 10 00000000000000000000000000000000 01 001e 0005 01 012c 01 012c`

Byte	Value	Type	Raw Data	Description
1	Frame ID	uint8	97	97 is the packet ID
2	Work Mode	uint8	01	00: Standby Mode 01: Periodic Mode 02: Event Mode
3	Positioning Strategy	uint8	02	00: Only GNSS 01: Only Wi-Fi

Byte	Value	Type	Raw Data	Description
				02: Wi-Fi + GNSS 03: GNSS + Wi-Fi 04: Only Bluetooth 05: Bluetooth + Wi-Fi 06: Bluetooth + GNSS 07: Bluetooth + Wi-Fi + GNSS 08: GNSS + Bluetooth
4~5	Heartbeat Interval	uint16	003c	0x003C = 60 seconds
6~7	Periodic Mode Uplink Interval	uint16	001e	0x001E = 30 seconds
8~9	Event Mode Uplink Interval	uint16	000a	0x000A = 10 minutes When no event is triggered, data will be uploaded every 10 minutes.
10	Enable 3-Axis Accelerometer	uint8	01	00: Disable 01: Enable
11	Enable Disassembly Alarm	uint8	01	00: Disable 01: Enable
12	GNSS Scan Timeout	uint8	0a	0x0A = 10 seconds
13	iBeacon Scan Timeout	uint8	05	0x05 = 5 seconds
14	UUID Filter Valid Bytes	uint8	10	0x10 = 16 bytes
15~30	UUID Filter	byte[16]	00000000000000000000000000000000	UUID filter value (16 bytes)

Byte	Value	Type	Raw Data	Description
31	Enable Motion Event	uint8	01	00: Disable 01: Enable
32~33	3-Axis Motion Threshold	uint16	001e	0x001E = 30 mg
34~35	Uplink Interval On Motion	uint16	0005	0x0005 = 5 minutes When motion is detected, the reporting interval is 5 minutes
36	Enable Motionless Event	uint8	01	00: Disable 01: Enable
37~38	Motionless Timeout	uint16	012c	0x012C = 300 minutes
39	Enable Shock Event	uint8	01	00: Disable 01: Enable
40~41	3-Axis Shock Threshold	uint16	012c	0x012C = 300 mg

6 FAQ

6.1 Location Related

- **What is the typical GNSS positioning accuracy of the T2000?**

Under open-sky conditions, the GNSS positioning accuracy of the T2000 typically reaches meter-level accuracy.

Test results show a CEP50 (Circular Error Probable 50%) of approximately **5–7 meters**, meaning that more than half of the location points fall within this range from the true position.

Actual positioning accuracy may vary depending on environment, satellite visibility, and installation conditions etc.

- **Why does GNSS positioning sometimes show drift, or no GNSS latitude and longitude data?**

GNSS accuracy can be affected by several environmental factors:

1. Buildings, trees, or other obstacles blocking satellite signals.
2. Multipath effects caused by signal reflections from walls or metal surfaces.
3. Electromagnetic interference from nearby electronic equipment.
4. Poor antenna orientation or installation location.

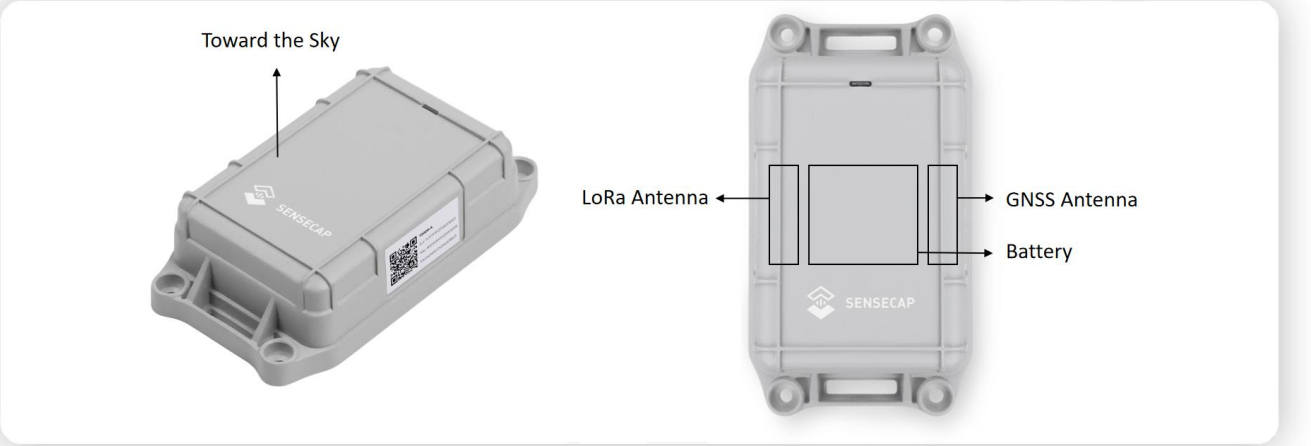
In some cases, the device may not report GNSS latitude and longitude data because the GNSS scanning has timed out. This status can be seen in the uplink payload, where the **positioning status** field will display **"GNSS scan timeout"** due to the same environmental conditions mentioned above.

For best results, please install the device in an open outdoor area with a clear view of the sky.

- **How should the T2000 be installed to achieve the best GNSS performance?**

1. Place the device in an open environment with minimal obstruction to satellite signals.

2. Ensure the GNSS antenna area faces upward toward the sky.
3. Avoid installing the device near large metal objects or dense structures.
4. Avoid covering the device or placing it inside sealed metal enclosures.



- **Why doesn't Wi-Fi or Bluetooth location display on the SenseCraft App map?**

Wi-Fi and Bluetooth location requires a third-party map parsing service, which must be invoked by users for parsing. Currently, the SenseCraft App supports GNSS positioning display only.

For more details on GNSS positioning, please refer to the blog: How Accurate is the SenseCAP T2000 GNSS Positioning?

6.2 Battery Related

- **What is the difference between T2000-A/B and T2000-C battery?**

T2000-A/B

1. Powered by an 8000mAh primary battery.
2. Designed for long-term deployment without recharging.

T2000-C

1. Powered by a 4000mAh rechargeable battery.
2. Equipped with a 0.5W solar panel for continuous outdoor operation.

3. Suitable for deployments where sunlight is available and maintenance needs to be minimized.

- **How efficient is the solar charging on the T2000-C?**

  The T2000-C uses a 0.5W solar panel with a rechargeable battery to support long-term outdoor operation.

  The solar panel can generate up to about 60mA charging current, producing roughly 60mAh of energy per hour under good sunlight conditions.(this data is for reference only)

- **What factors affect the solar charging efficiency?**

Solar charging performance can vary depending on:

1. Sunlight exposure and intensity
2. Panel orientation and installation angle
3. Shading from nearby objects
4. Dust, dirt, or debris on the solar panel
5. Ambient temperature (battery charging works between 0–45˚C)

For best performance, install the device in a location with direct sunlight and periodically check the panel surface.

- **Can the T2000-C operate continuously with solar power?**

In low-power configurations (such as longer uplink intervals), solar charging can even maintain or increase battery level during daily operation.

However, frequent reporting intervals (for example, every 1 minute) may consume more power than the solar panel can replenish.

For more detailed analysis of the solar charging performance, please refer to the following blog: How Efficient Is the Solar Charging on the SenseCAP T2000-C?

The estimated battery life can be calculated using the following Battery Life Calculator.

