LoRaWAN

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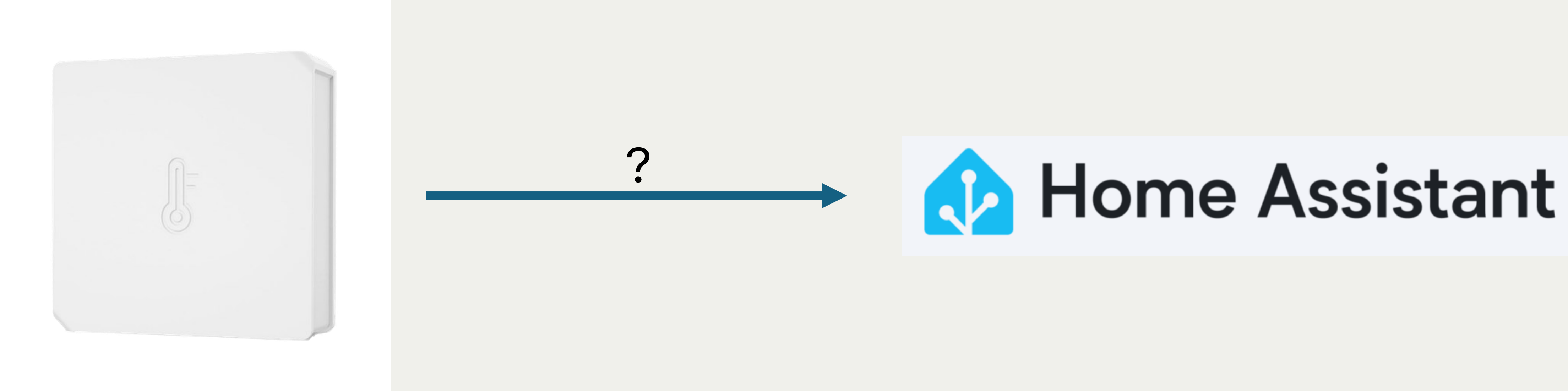
Lehrstuhl Informations- und Kommunikationsdieste

Inhalt

- Was ist LoRaWAN und wozu können wir es gebrauchen?
- Wie kann ich fertige Sensoren in ein LoRaWAN einbinden?
- Wie kommen Sensordaten zum Zielort?
- LoRaWAN Hardware zum selbermachen?

Beispiel: Temperatursensor



?

Home Assistant

Beispiel: Temperatursensor

WLAN

- Sehr gute Verfügbarkeit
  - Haben wir vermutlich alle zu Hause

- Aber:
  - Hoher Energieverbrauch
  - Hohe Latenzen bei Deep Sleep durch Verbindungsaufbau
  - Reichweite

Beispiel: Temperatursensor

ZigBee/Z-Wave/Homematic/…

- Energieverbrauch und Latenzen typischerweise besser
- Aber:
    - Benötigen Gateway
    - Reichweite
        - Kann durch zusätzliche Router (z. B. schaltbare Steckdosen) verbessert werden.

Problem der Reichweite

Beispiel Ich:

- Altbau: brauche **Überflutungssensor** im Keller
- Wohne im Dachgeschoss
- Kein WLAN und kein ZigBee im Keller

Beispiel: Überflutungssensor

Mobilfunk

- Reichweite durch Netzabdeckung
- Aber:
  - Energieverbrauch
  - Kosten

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Beispiel: Überflutungssensor

LoRaWAN

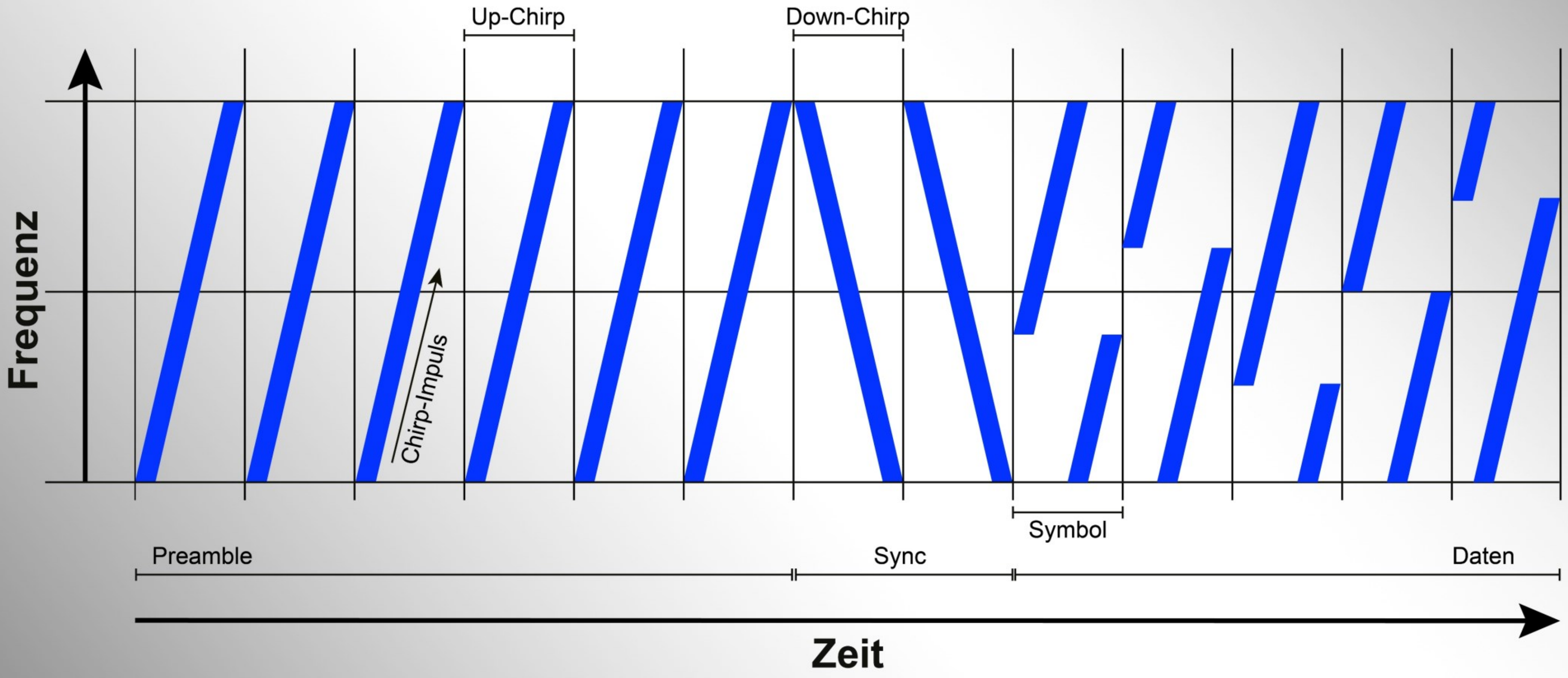
- (Sehr) hohe Reichweite
- Geringer Energieverbrauch, perfekt für Batteriebetrieb

- Aber?
    - später

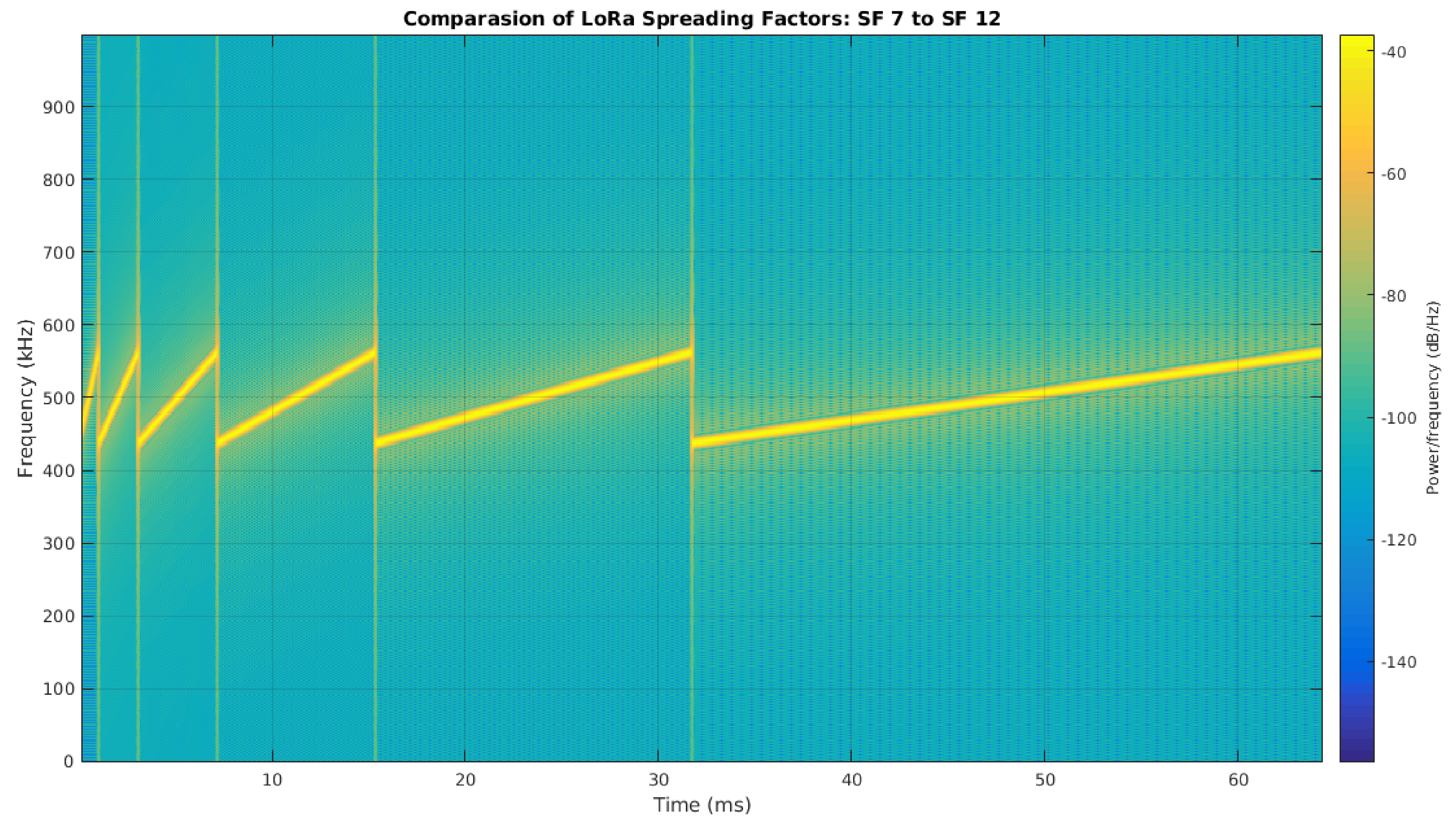
LoRaWAN =
LoRa + WAN

LoRa

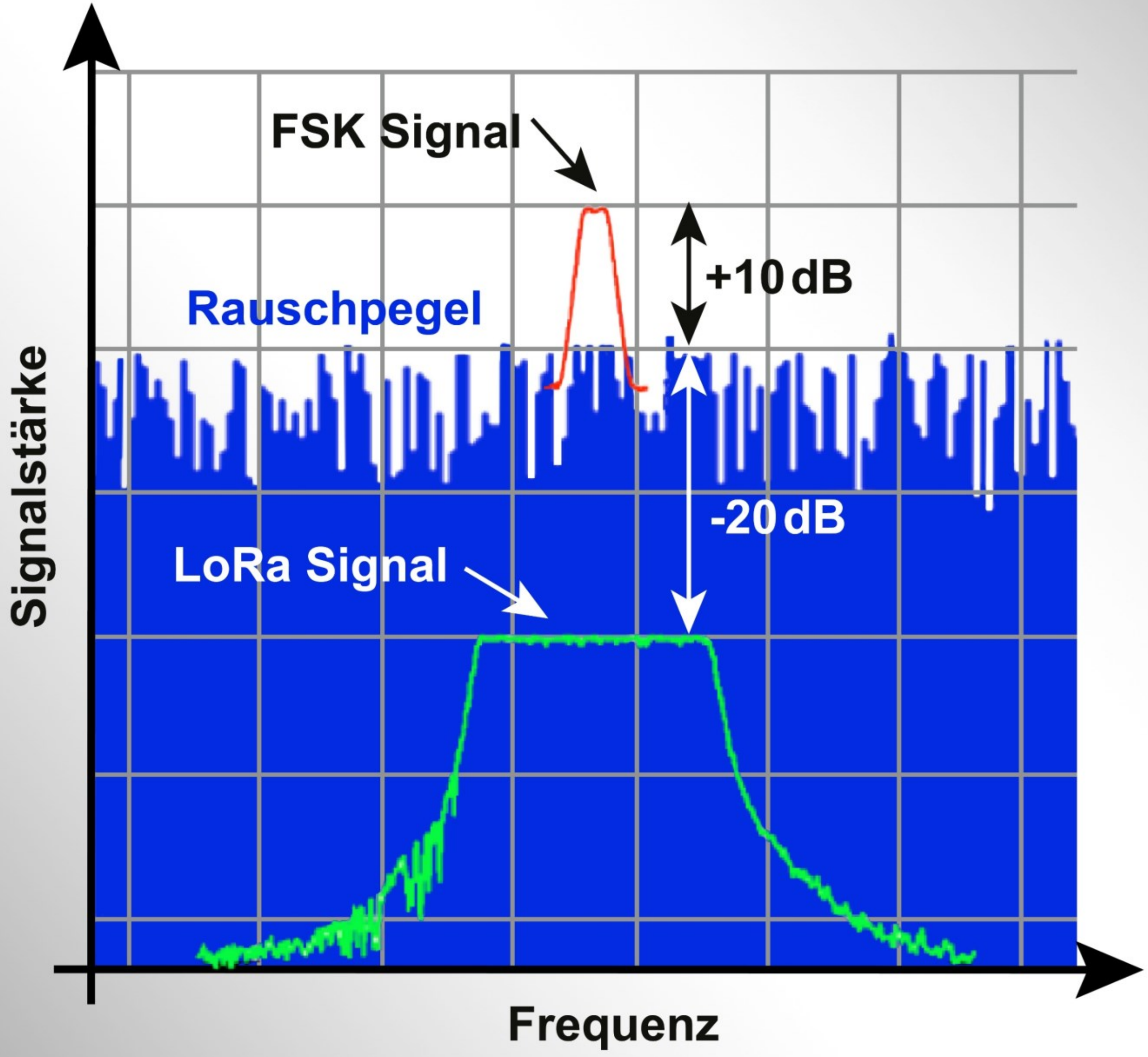
- Kurz für *Long Range*, entwickelt von Semtech
- Physical Layer: Bitübertragung, keine Adressierung o.ä.
- Modulation: Chirp Spread Spectrum
- 433 MHz, 868 MHz, 2.4 GHz



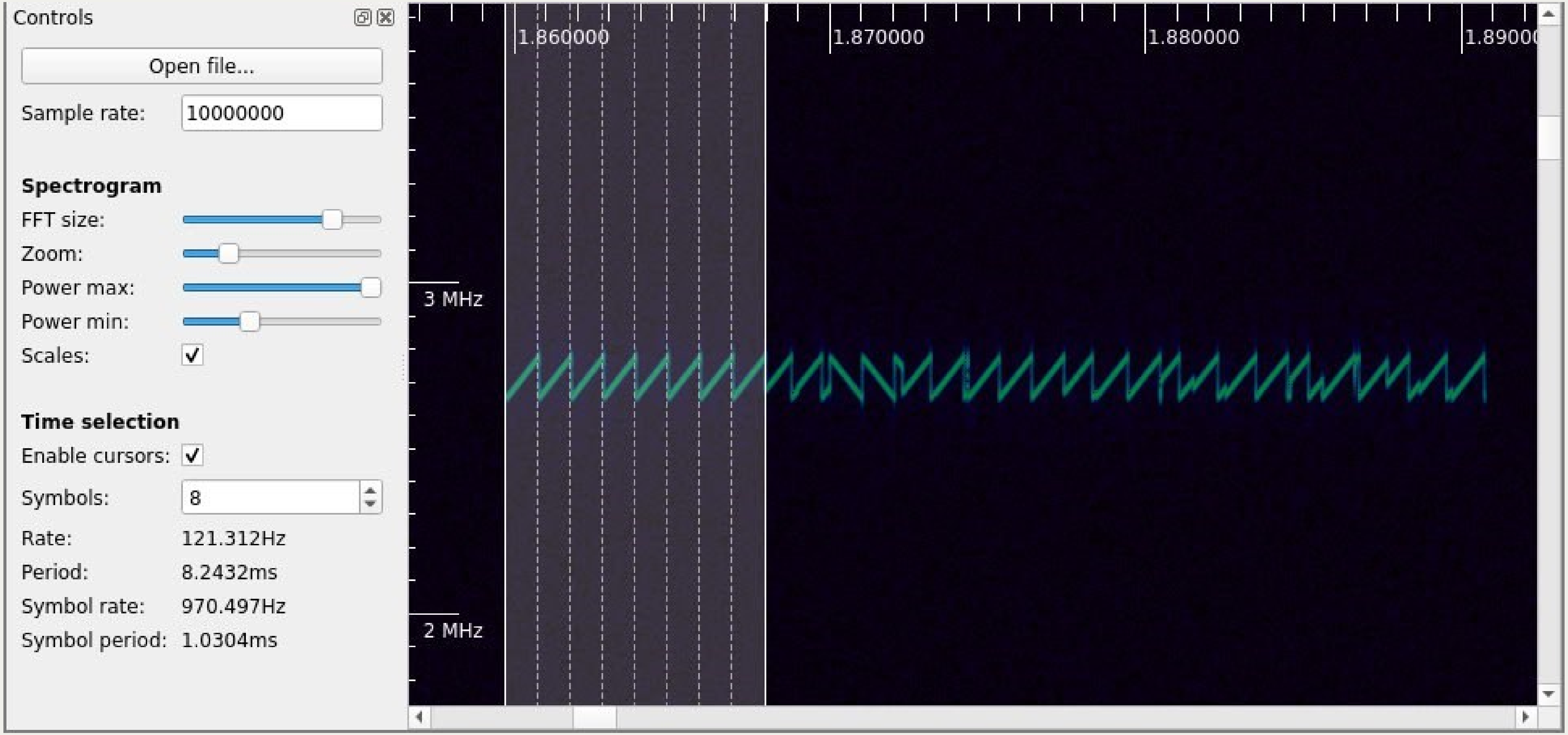
https://www.schmidiger.ch/blog/lora-funktechnologie-wie-gut-ist-sie-wirklich



https://www.sghoslya.com/p/lora-is-chirp-spread-spectrum.html



https://www.schmidiger.ch/blog/lora-funktechnologie-wie-gut-ist-sie-wirklich



Sample rate: 10000000

Spectrogram

FFT size:

Zoom:

Power max:

Power min:

Scales: ☑

Time selection

Enable cursors: ☑

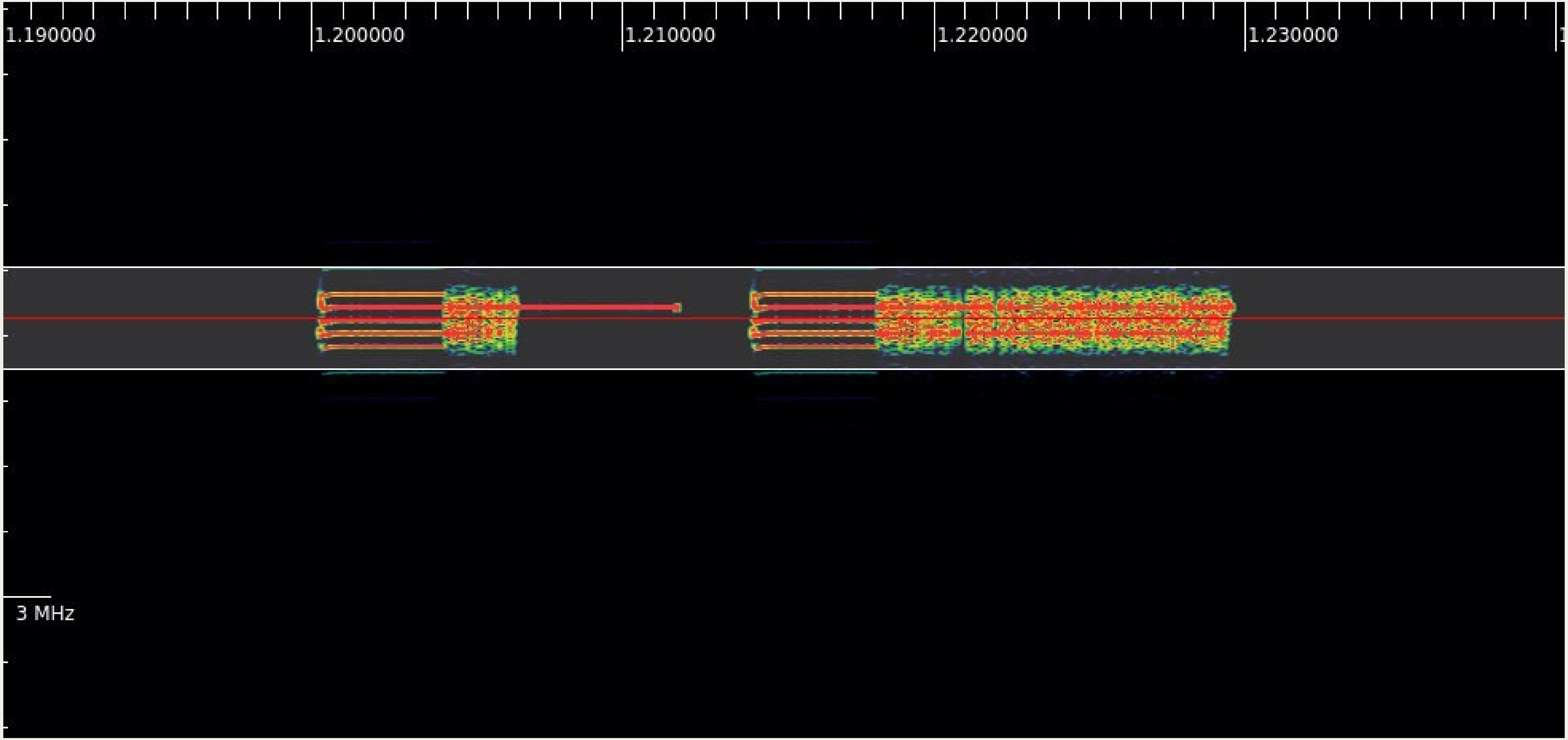
Symbols: 8

Rate: 121.312Hz

Period: 8.2432ms

Symbol rate: 970.497Hz

Symbol period: 1.0304ms

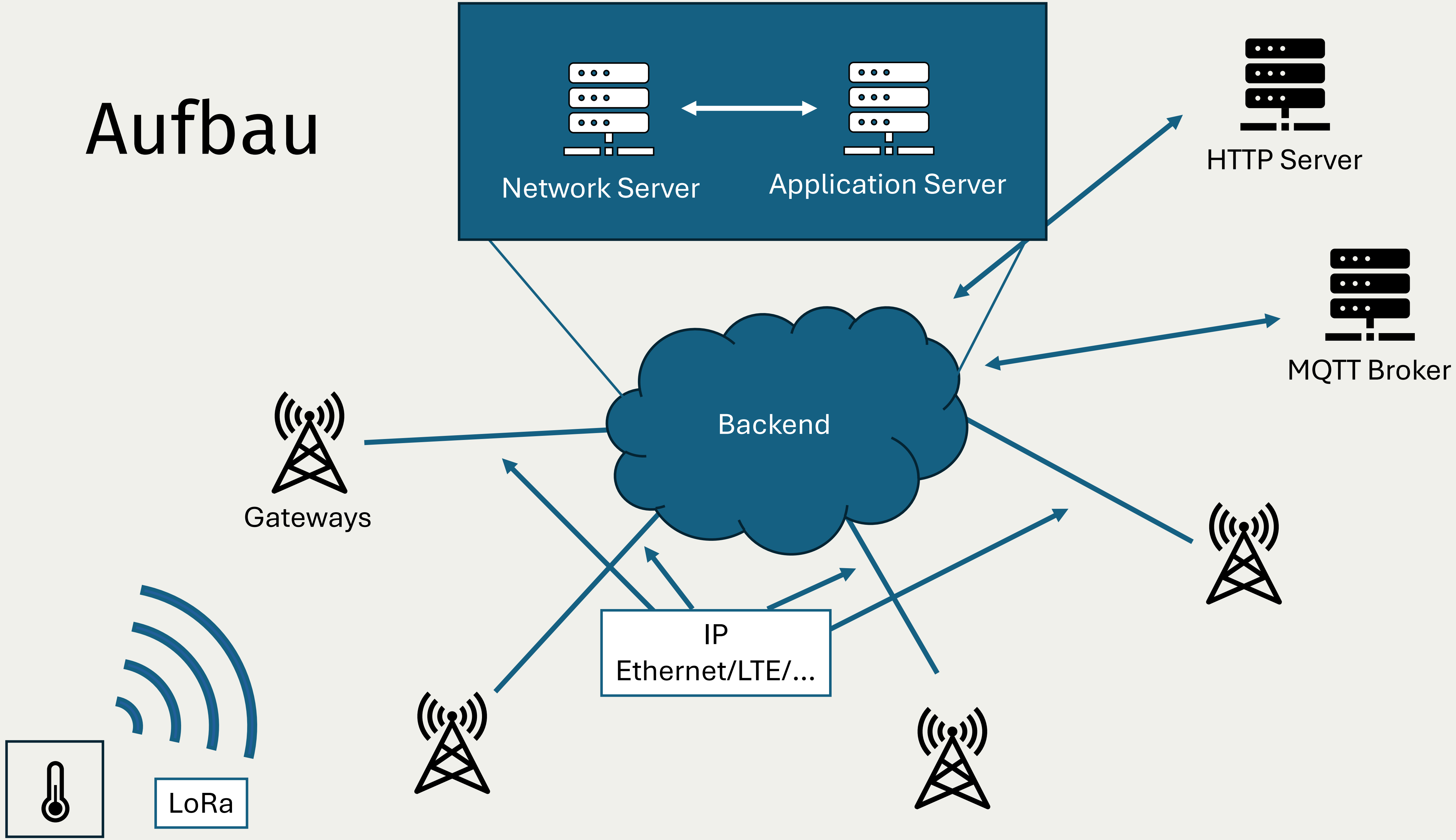

1.190000
1.200000
1.210000
1.220000
1.230000
3 MHz

LoRaWAN

Auf LoRa aufbauend:

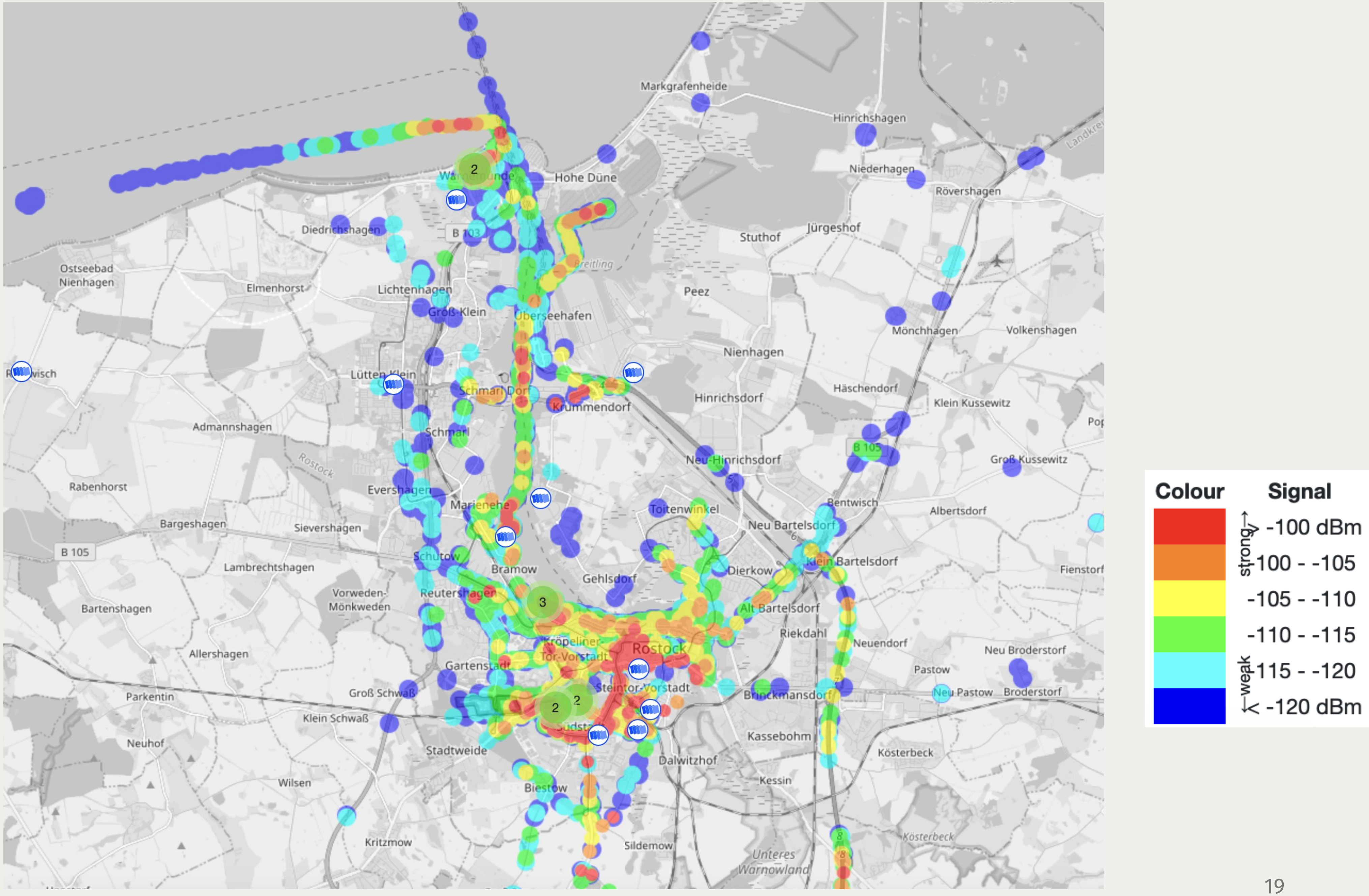
- Netzwerkaufbau
- Adressierung von Geräten und Netzwerk
- Verwaltung von Netzwerkschlüsseln für Integritätssicherung und Verschlüsselung
- Integration von Anwendungen, die gesammelte Daten nutzen

Aufbau


Network Server
Application Server
HTTP Server
MQTT Broker
Backend
Gateways
IP
Ethernet/LTE/...
LoRa

The Things Network

- Communitybasiertes Netzwerk
- Backend betrieben durch The Things Industries
- Gateways durch Community betrieben
- Kostenlose Nutzung mit Fair Use Policy und ohne SLA
- Netzabdeckung siehe https://ttnmapper.org


Colour
Signal
-100 dBm
-100 - -105
-105 - -110
-110 - -115
-115 - -120
-120 dBm
strong
weak
Markgrafenheide
Hinrichshagen
Niederhagen
Rövershagen
Warnemünde
Hohe Düne
Diedrichshagen
B 103
Stuthof
Jürgeshof
Ostseebad Nienhagen
Elmenhorst
Lichtenhagen
Breitling
Peez
Groß Klein
Überseehafen
Mönchhagen
Volkenshagen
Nienhagen
Lütten Klein
Schmarl Dorf
Krummendorf
Hinrichsdorf
Häschendorf
Klein Kussewitz
Admannshagen
Schmarl
Neu Hinrichsdorf
B 105
Groß Kussewitz
Rabenhorst
Evershagen
Marienehe
Toitenwinkel
Bentwisch
Albertsdorf
Bargeshagen
Sievershagen
Neu Bartelsdorf
B 105
Schutow
Klein Bartelsdorf
Lambrechtshagen
Bramow
Gehlsdorf
Dierkow
Fienstorf
Vorweden-Mönkweden
Reutershagen
Alt Bartelsdorf
Bartenshagen
Riekdahl
Neuendorf
Kröpeliner-Tor-Vorstadt
Rostock
Allershagen
Gartenstadt
Neu Broderstorf
Pastow
Steintor-Vorstadt
Parkentin
Groß Schwaß
Brinckmansdorf
Neu Pastow
Broderstorf
Klein Schwaß
Neuhof
Südstadt
Kassebohm
Stadtweide
Kösterbeck
Dalwitzhof
Wilsen
Biestow
Kessin
Kritzmow
Sildemow
Unteres Warnowland
2
3
2
2

Hinrichshagen
Warnemünde
Hohe Düne
Niederhagen
Rövershagen
Behnkenh
Diedrichshagen
B 103
Stuthof
Jürgeshof
Breitling
ebad
agen
Elmenhorst
Lichtenhagen
Groß-Klein
Überseehafen
Peez
Mönchhagen
Volkenshagen
Nienhagen
Lütten Klein
Schmarl Dorf
Krummendorf
Hinrichsdorf
Häschendorf
Klein Kussewitz
Poppendorf
Admannshagen
Schmarl
B 105
Neu-Hinrichsdorf
Groß Kussewitz
Rostock
enhorst
Evershagen
Marienehe
Toitenwinkel
Bentwisch
Albertsdorf
Bargeshagen
Sievershagen
Neu Bartelsdorf
Schutow
Klein Bartelsdorf
Ste
Lambrechtshagen
Bramow
Gehlsdorf
Dierkow
Fienstorf
Vorweden-Mönkweden
Reutershagen
Alt Bartelsdorf
artenshagen
Riekdahl
Thulendo
Neuendorf
Kröpeliner-Tor-Vorstadt
Rostock
Neu Broderstorf
Allershagen
Gartenstadt
Pastow
Steintor-Vorstadt
Parkentin
Groß Schwaß
Brinckmansdorf
Neu Pastow
Broderstorf
Klein Schwaß
Südstadt
Kassebohm
Neuhof
Stadtweide
Kösterbeck
Dalwitzhof
Wilsen
Kessin
Biestow
Kritzmow
Kösterbeck
Unteres Warnowland
Silbersdorf
Hohen Schwarfs
Bliesekow
Stäbelow
Groß Stove
Klein Stove
L 191
Petschow
Papendorf
Fahrenholzer Wald
Niendorf
L 10


Fehmarn
Burg auf Fehmarn
Kadetrinne
Nationalpark Vorpommersche Boddenlandschaft
Kernzone
Darßer Urwald
Zingst
Barth
Stralsund
Garz
Graal-Müritz
Ribnitz-Damgarten
Rostocker Heide
Richtenberg
Franzburg
Marlow
Kühlungsborn
Rerik
Bad Doberan
Rostock
Kröpelin
Bad Sülze
Tribsees
Grimmen
Sanitz
A 20
Neubukow
A 19
Tessin
Poel
Klütz
Schwaan
Gnoien
Loitz
Laage
Colour
Signal
strong
> -100 dBm
-100 - -105
-105 - -110
-110 - -115
-115 - -120
weak
< -120 dBm

Sensor mit Netzwerk verbinden

- Dragino LWL02 Überflutungssensor

- Notwendige Schritte:
  1. Anwendung anlegen
  2. Sensor hinzufügen

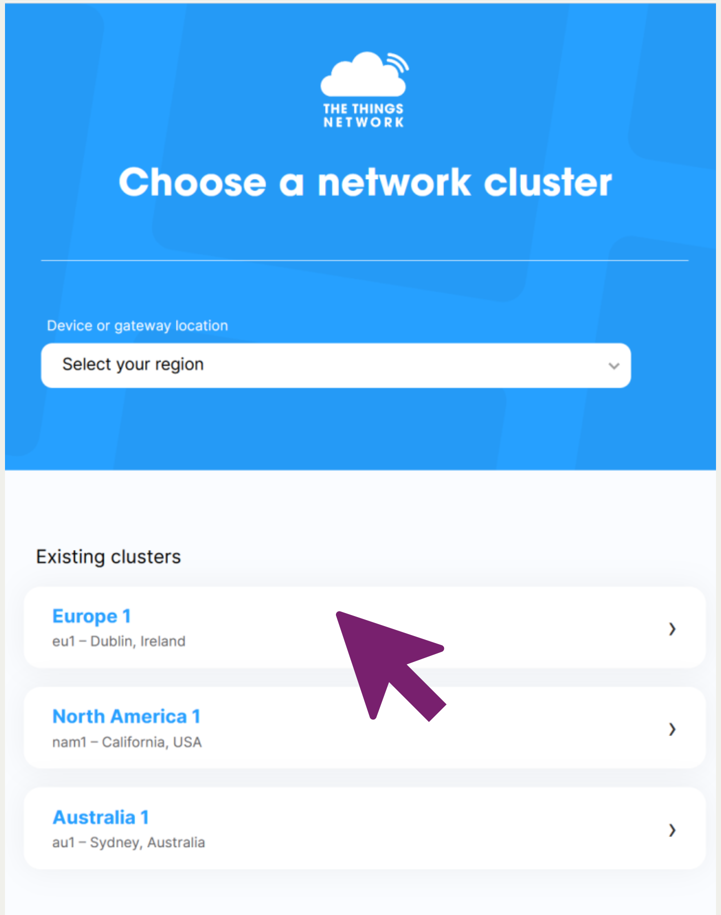
Anwendung?

- Enthält ein oder mehrere Endgeräte
- Dekodieren der Nutzdaten von Endgeräten
  - Für alle Endgeräte
  - Oder pro Endgerät
- Bestimmt, was mit den Nutzdaten passiert

Sensor mit Netzwerk verbinden

Registrieren und los

→ https://console.cloud.thethings.network/



Choose a network cluster

Device or gateway location

Select your region

Existing clusters

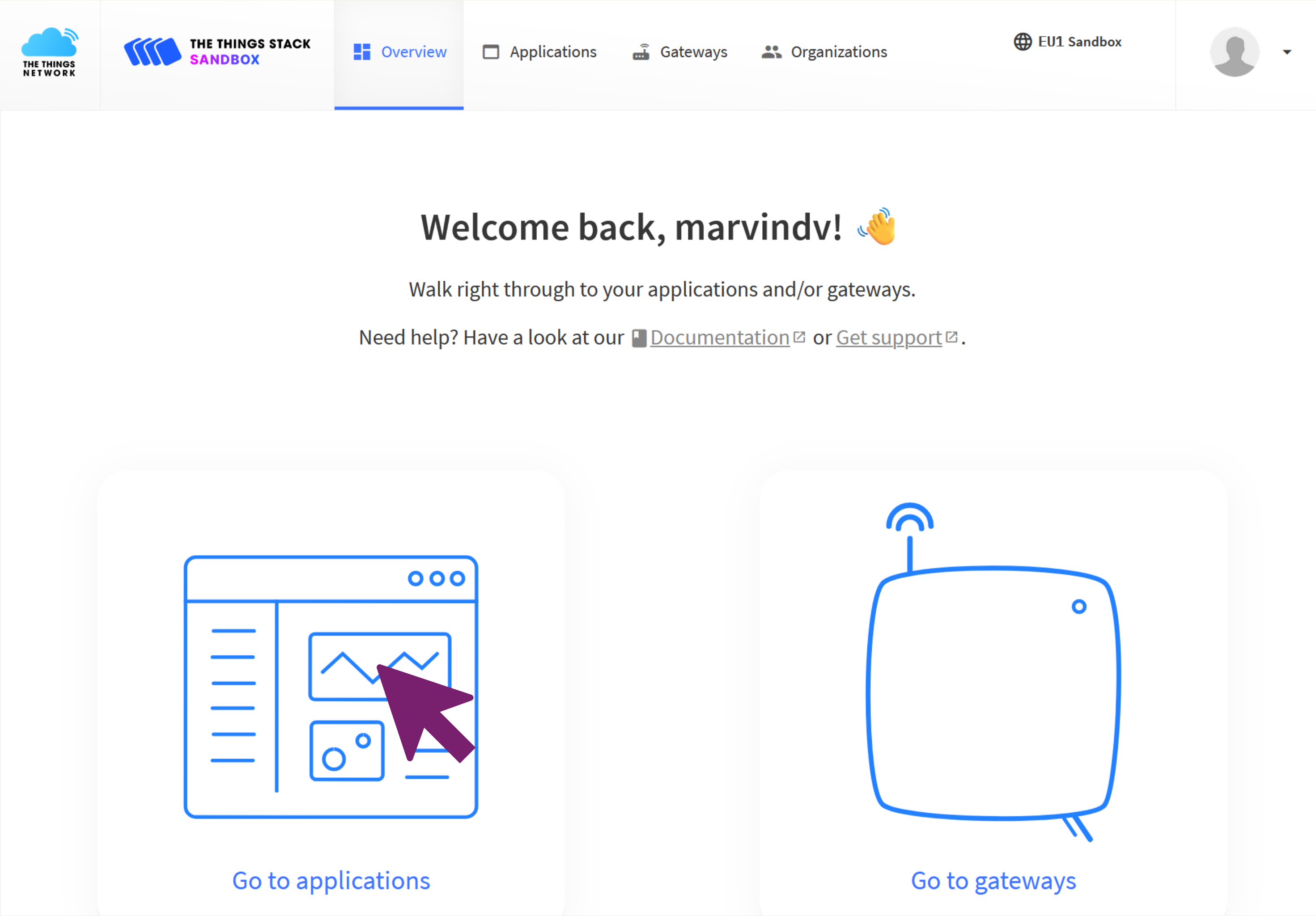
Europe 1
eu1 – Dublin, Ireland

North America 1
nam1 – California, USA

Australia 1
au1 – Sydney, Australia

Sensor mit Netzwerk verbinden

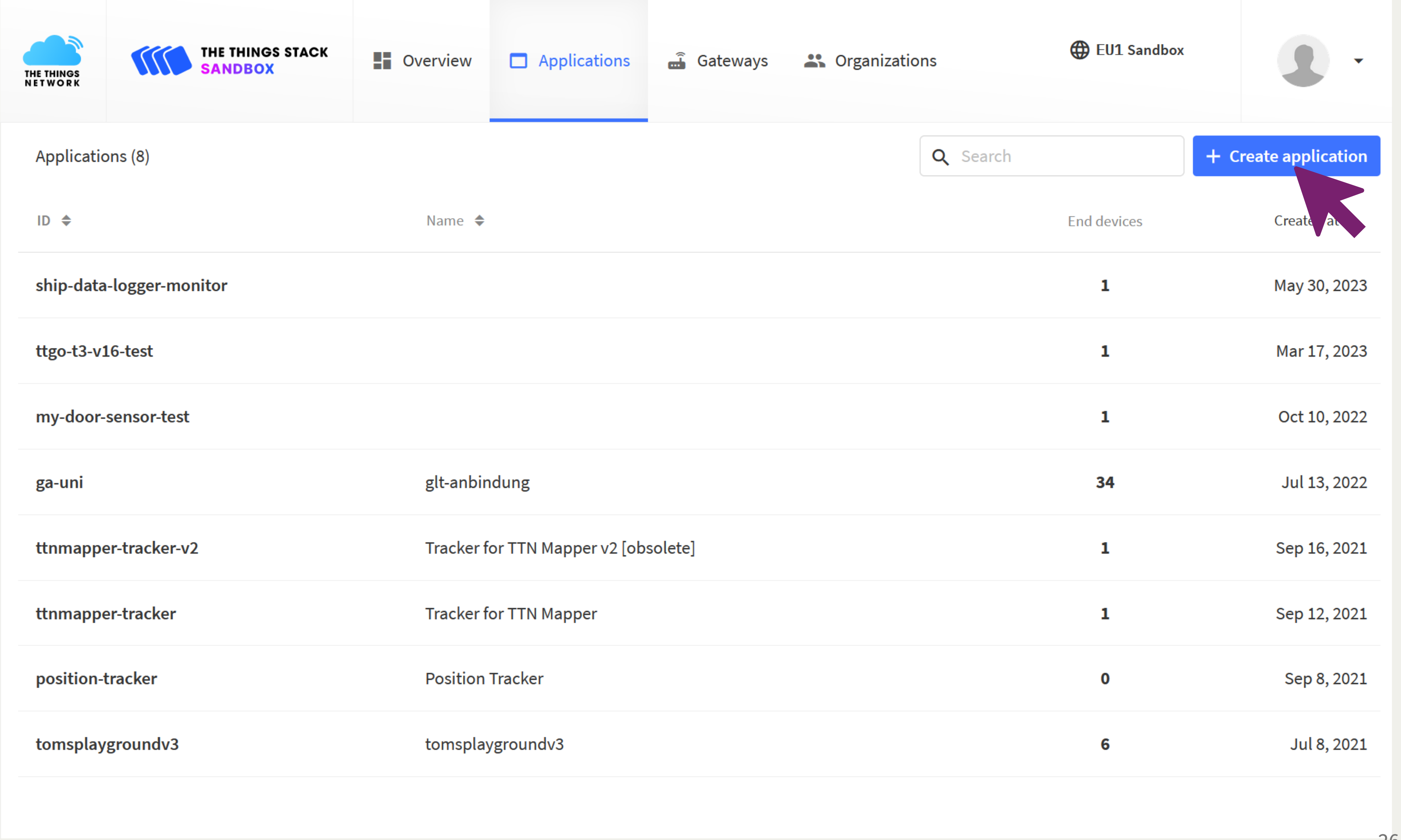
Anwendung anlegen



Welcome back, marvindv! 👋

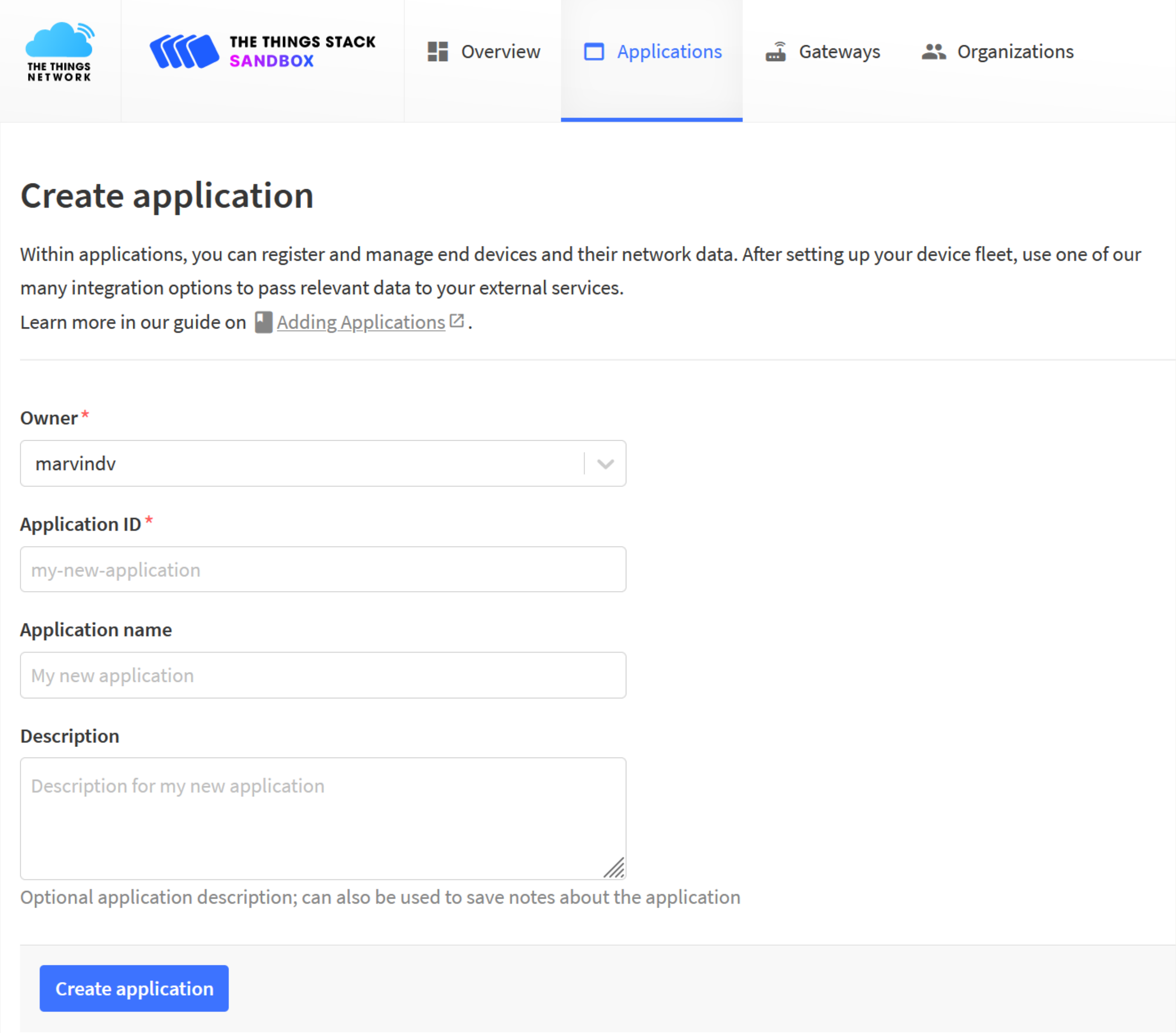
Walk right through to your applications and/or gateways.

Need help? Have a look at our Documentation or Get support.



Applications (8)

ID	Name	End devices	Create at
ship-data-logger-monitor		1	May 30, 2023
ttgo-t3-v16-test		1	Mar 17, 2023
my-door-sensor-test		1	Oct 10, 2022
ga-uni	glt-anbindung	34	Jul 13, 2022
ttnmapper-tracker-v2	Tracker for TTN Mapper v2 [obsolete]	1	Sep 16, 2021
ttnmapper-tracker	Tracker for TTN Mapper	1	Sep 12, 2021
position-tracker	Position Tracker	0	Sep 8, 2021
tomsplaygroundv3	tomsplaygroundv3	6	Jul 8, 2021



Create application

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

Learn more in our guide on Adding Applications.

Owner *

marvindv

Application ID *

my-new-application

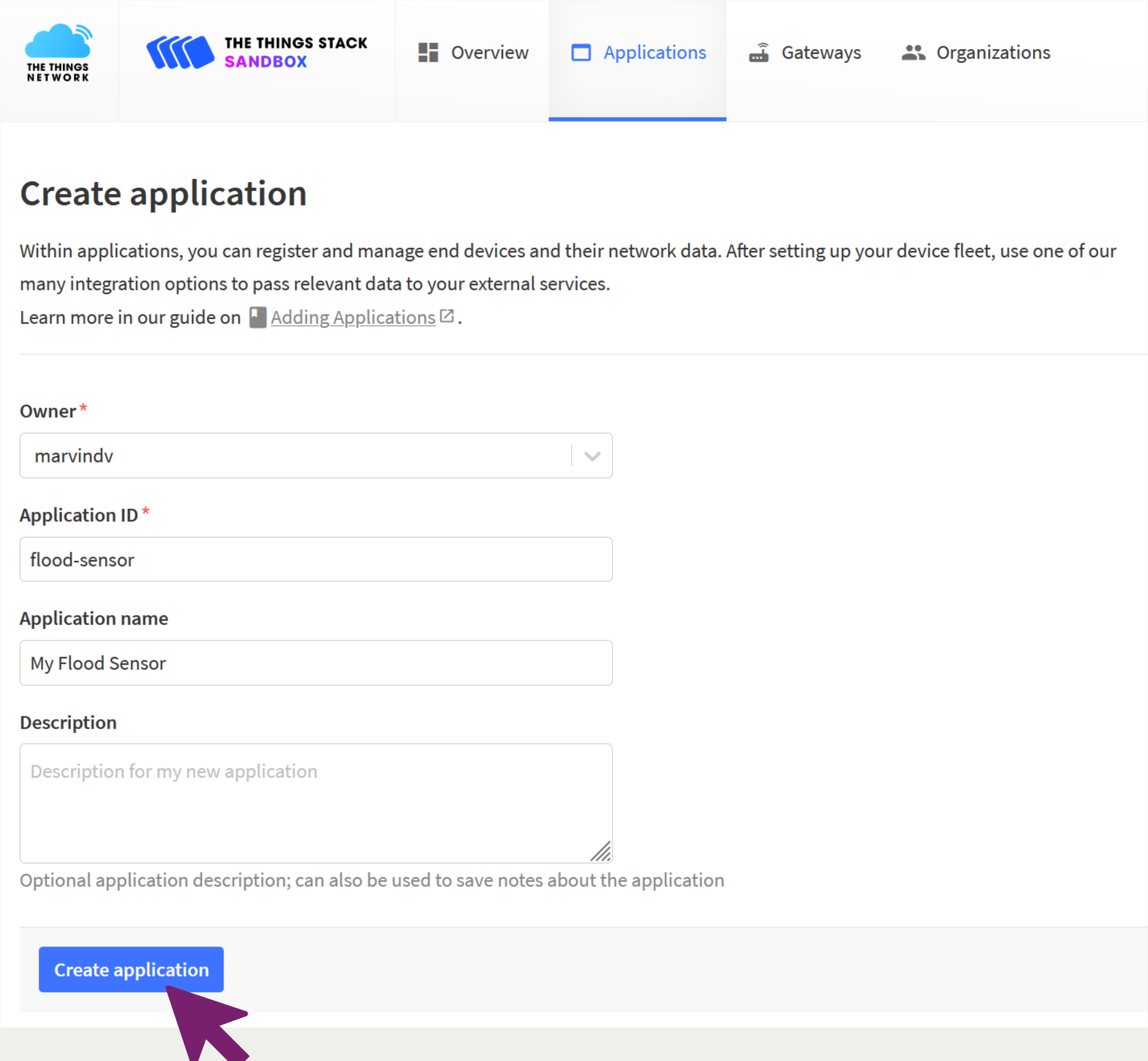
Application name

My new application

Description

Description for my new application

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



Create application

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

Learn more in our guide on Adding Applications.

Owner *

marvindv

Application ID *

flood-sensor

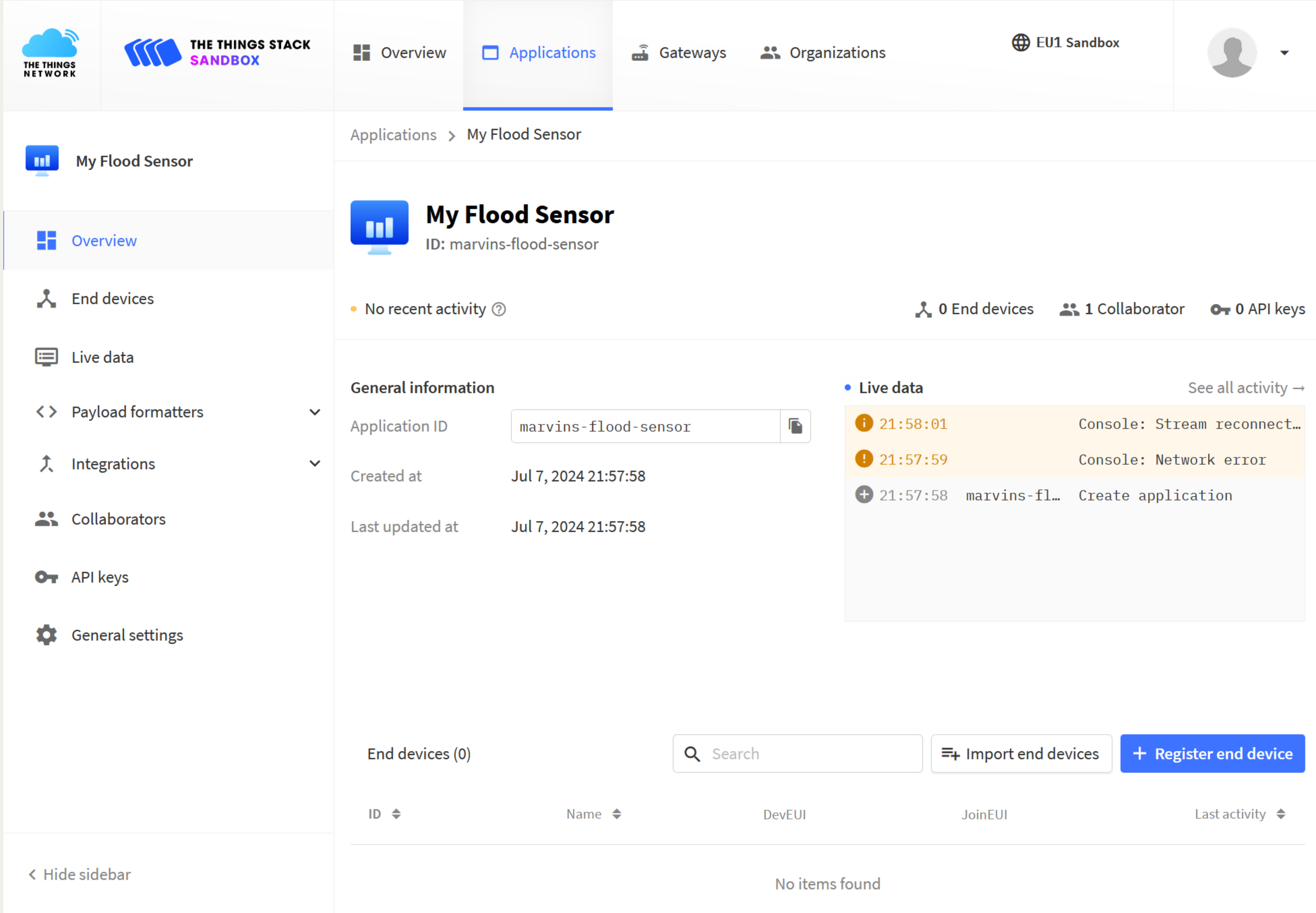
Application name

My Flood Sensor

Description

Description for my new application

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



My Flood Sensor

ID: marvins-flood-sensor

No recent activity

0 End devices · 1 Collaborator · 0 API keys

General information

Application ID	marvins-flood-sensor
Created at	Jul 7, 2024 21:57:58
Last updated at	Jul 7, 2024 21:57:58

Live data

```
21:58:01                 Console: Stream reconnect…
21:57:59                 Console: Network error
21:57:58  marvins-fl…    Create application
```

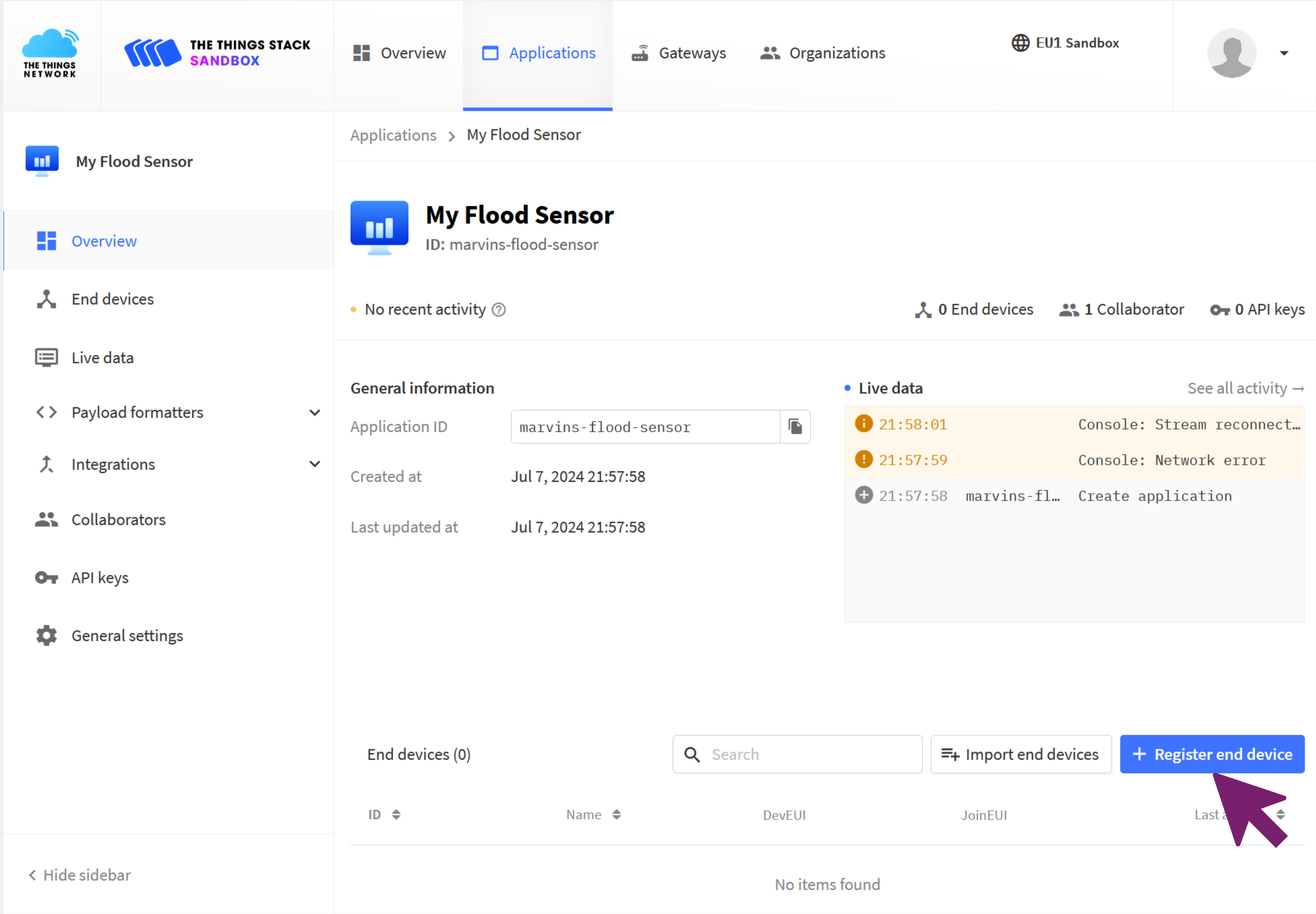
End devices (0)

ID	Name	DevEUI	JoinEUI	Last activity

No items found

Sensor mit Netzwerk verbinden

Endgerät hinzufügen



My Flood Sensor

ID: marvins-flood-sensor

General information

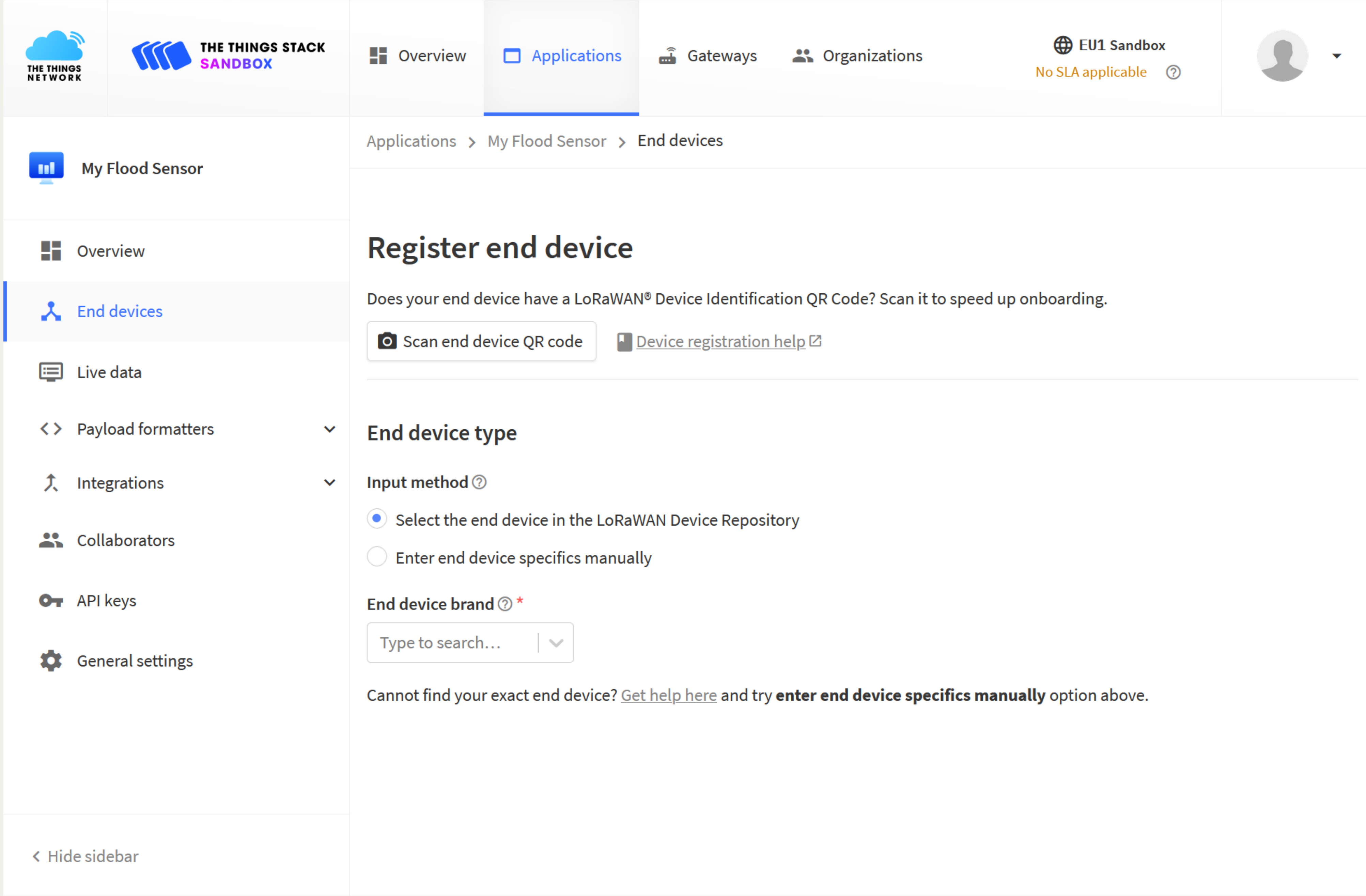
Application ID	marvins-flood-sensor
Created at	Jul 7, 2024 21:57:58
Last updated at	Jul 7, 2024 21:57:58

Live data

```
21:58:01              Console: Stream reconnect…
21:57:59              Console: Network error
21:57:58  marvins-fl… Create application
```

End devices (0)

No items found



Register end device

Does your end device have a LoRaWAN® Device Identification QR Code? Scan it to speed up onboarding.

End device type

Input method

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

End device brand *

Cannot find your exact end device? Get help here and try **enter end device specifics manually** option above.

Applications > My Flood Sensor > End devices

Register end device

Does your end device have a LoRaWAN® Device Ident

End device type

Input method

● Select the end device in the LoRaWAN Device Rep

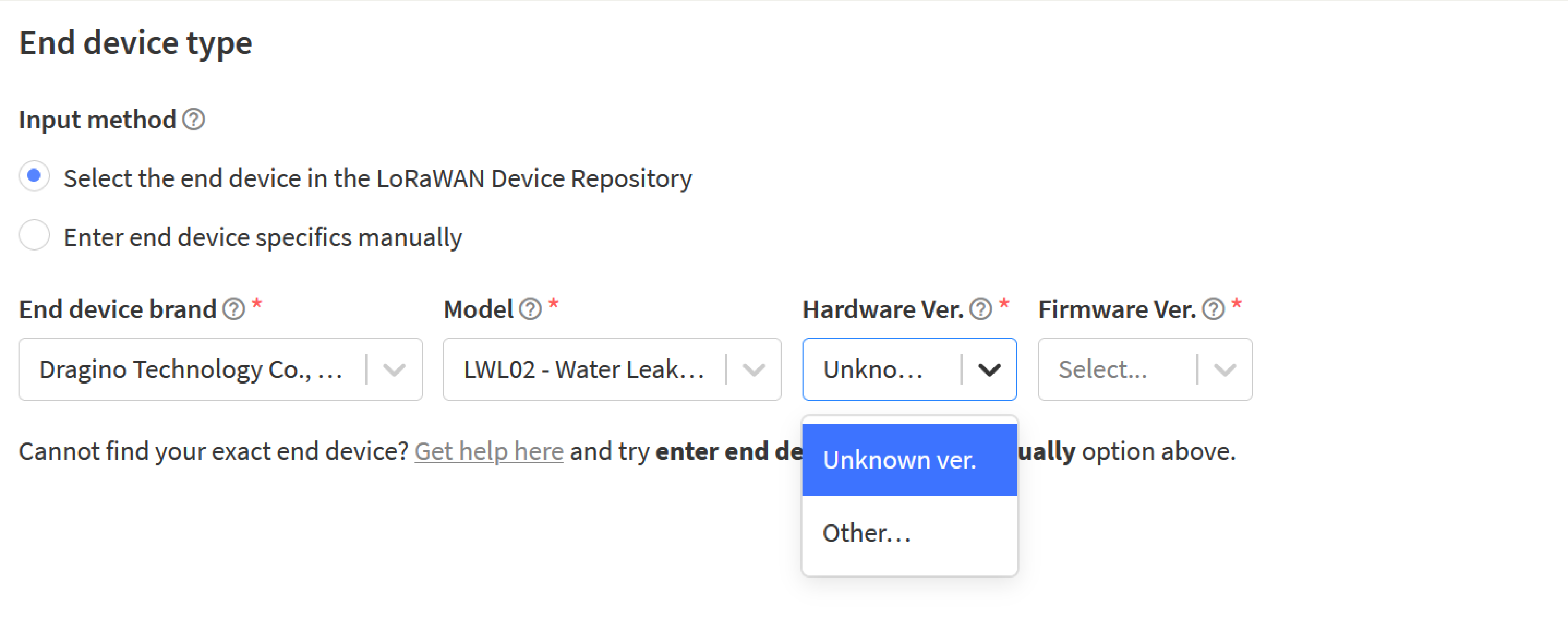
○ Enter end device specifics manually

End device brand *

Cannot find your exact end device? Get help here and try **enter end device specifics manually** option above.

**Registration Key,
Please keep it safely.**

DEV EUI: A8404196E184F95A
APP EUI: A840410000000107
APP KEY: 8FA[redacted]
SN: LDS02491802



End device type

Input method ⓘ

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

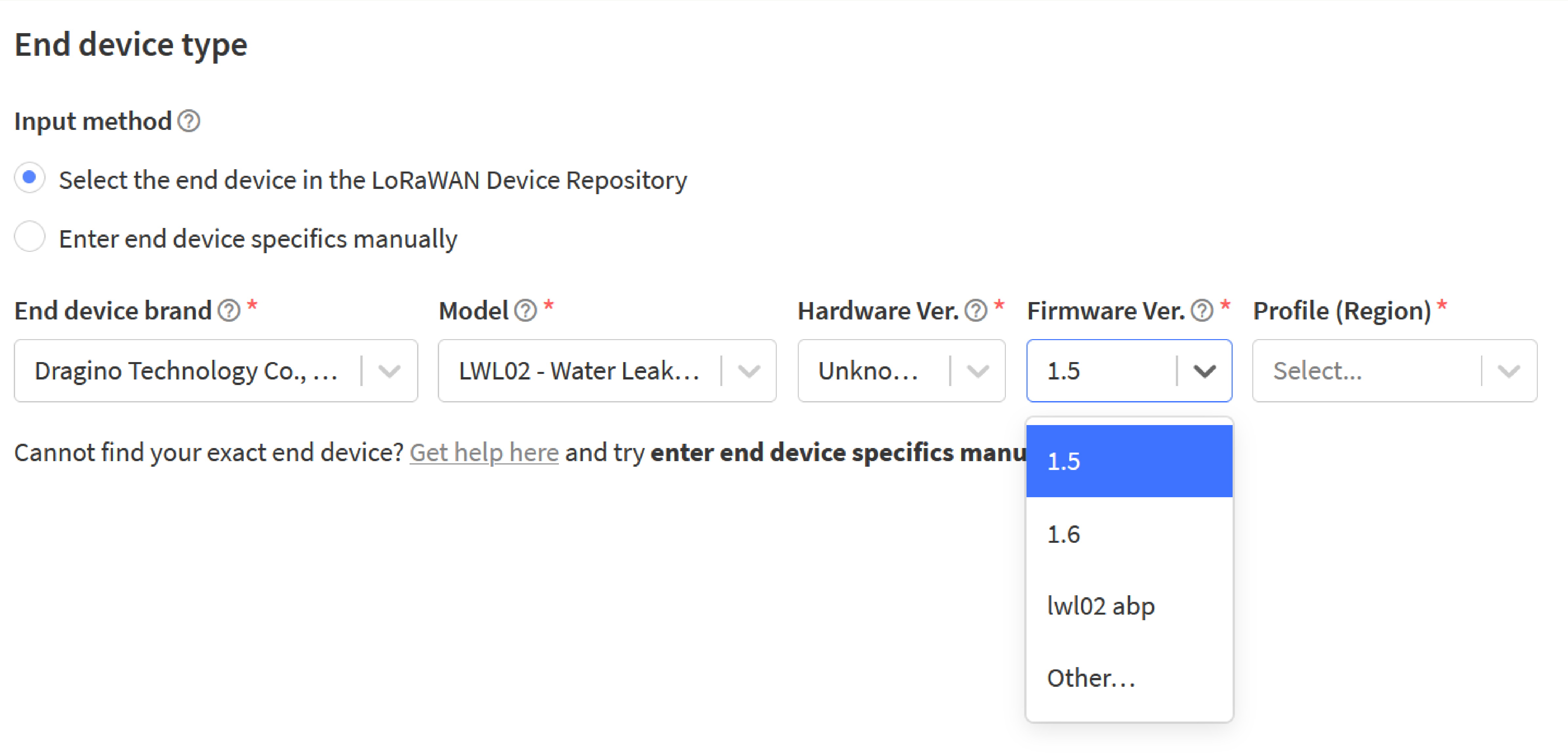
End device brand: Dragino Technology Co., …

Model: LWL02 - Water Leak…

Hardware Ver.: Unkno…

Firmware Ver.: Select...

Cannot find your exact end device? Get help here and try **enter end de**… **ually** option above.



End device type

Input method ⓘ

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

End device brand ⓘ *: Dragino Technology Co., …

Model ⓘ *: LWL02 - Water Leak…

Hardware Ver. ⓘ *: Unkno…

Firmware Ver. ⓘ *: 1.5

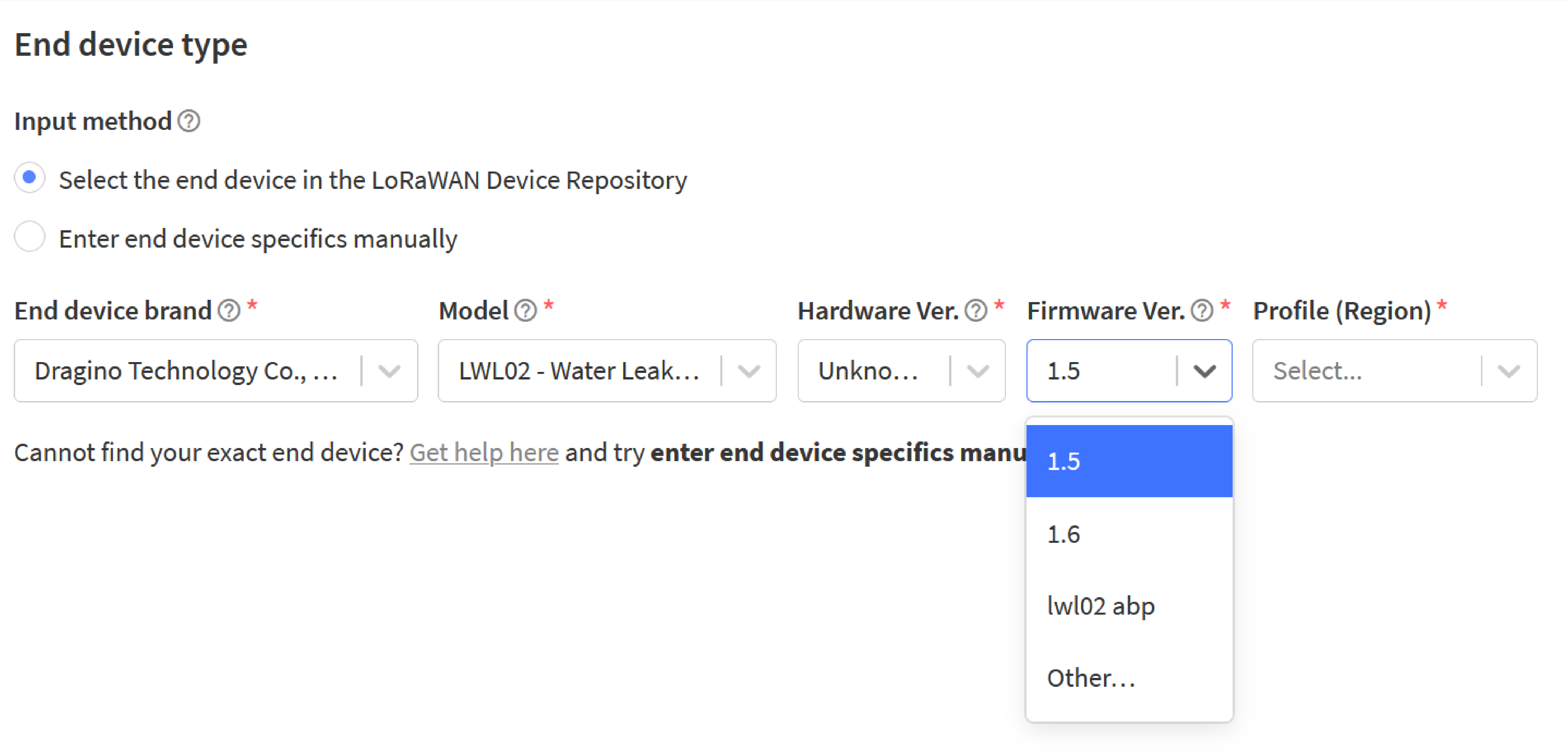
Profile (Region) *: Select...

Cannot find your exact end device? Get help here and try **enter end device specifics manu**

Sensor mit Netzwerk verbinden

- ABP – Activation by Personalization
  - Schlüssel in Firmware des Gerätes hinterlegt
  - Werden mit Netzwerk geteilt
  - Kein weiterer Join notwendig

- OTAA – Over the Air Activation
  - Vor Datenübertragung Join-Prozess, bei dem Session Key ausgehandelt wird



End device type

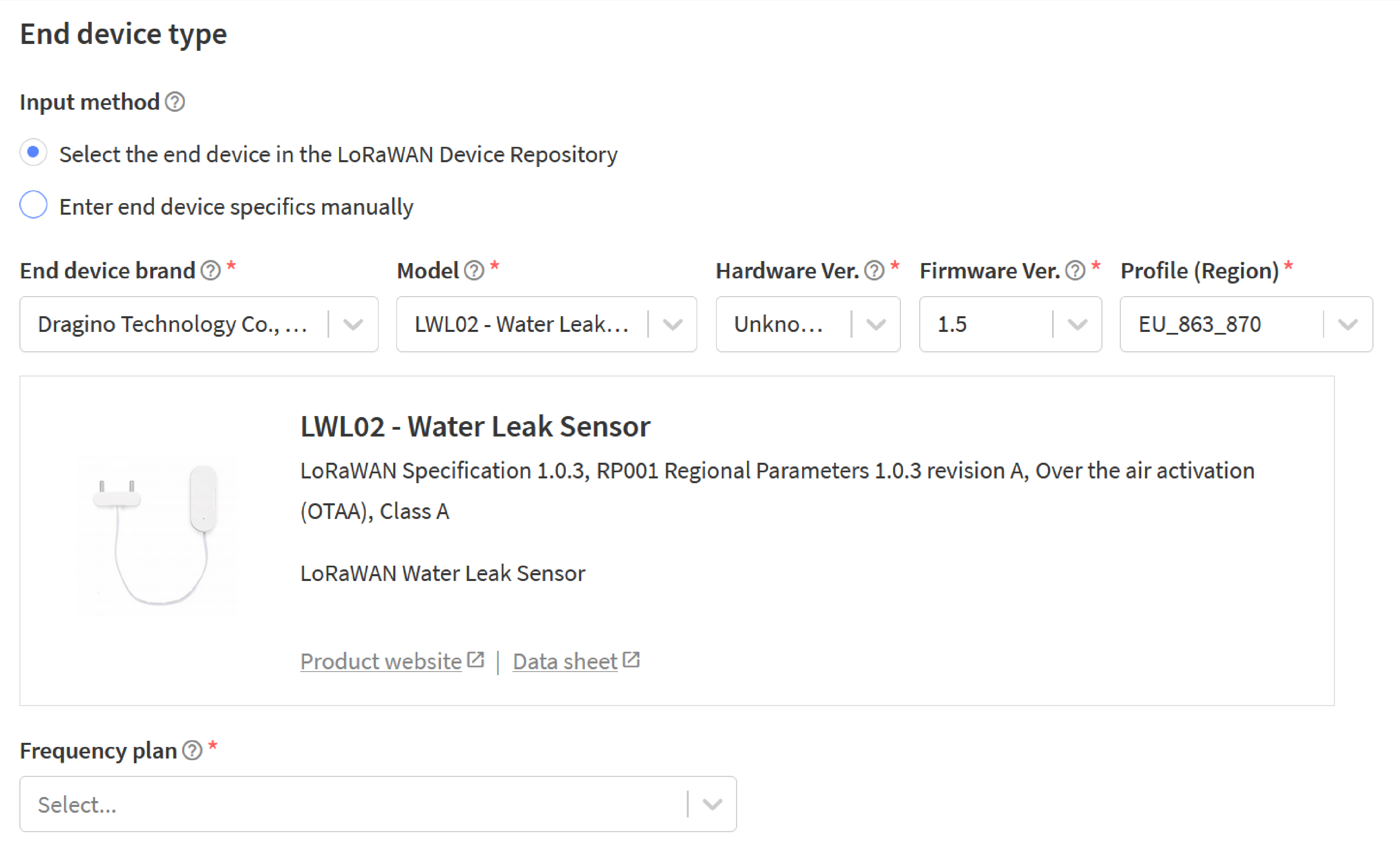
Input method ⓘ

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

End device brand ⓘ *	**Model** ⓘ *	**Hardware Ver.** ⓘ *	**Firmware Ver.** ⓘ *	**Profile (Region)** *
Dragino Technology Co., …	LWL02 - Water Leak…	Unkno…	1.5	Select...

Cannot find your exact end device? Get help here and try **enter end device specifics manu**



End device type

Input method ?

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

End device brand ? *
Dragino Technology Co., …

Model ? *
LWL02 - Water Leak…

Hardware Ver. ? *
Unkno…

Firmware Ver. ? *
1.5

Profile (Region) *
EU_863_870

LWL02 - Water Leak Sensor

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

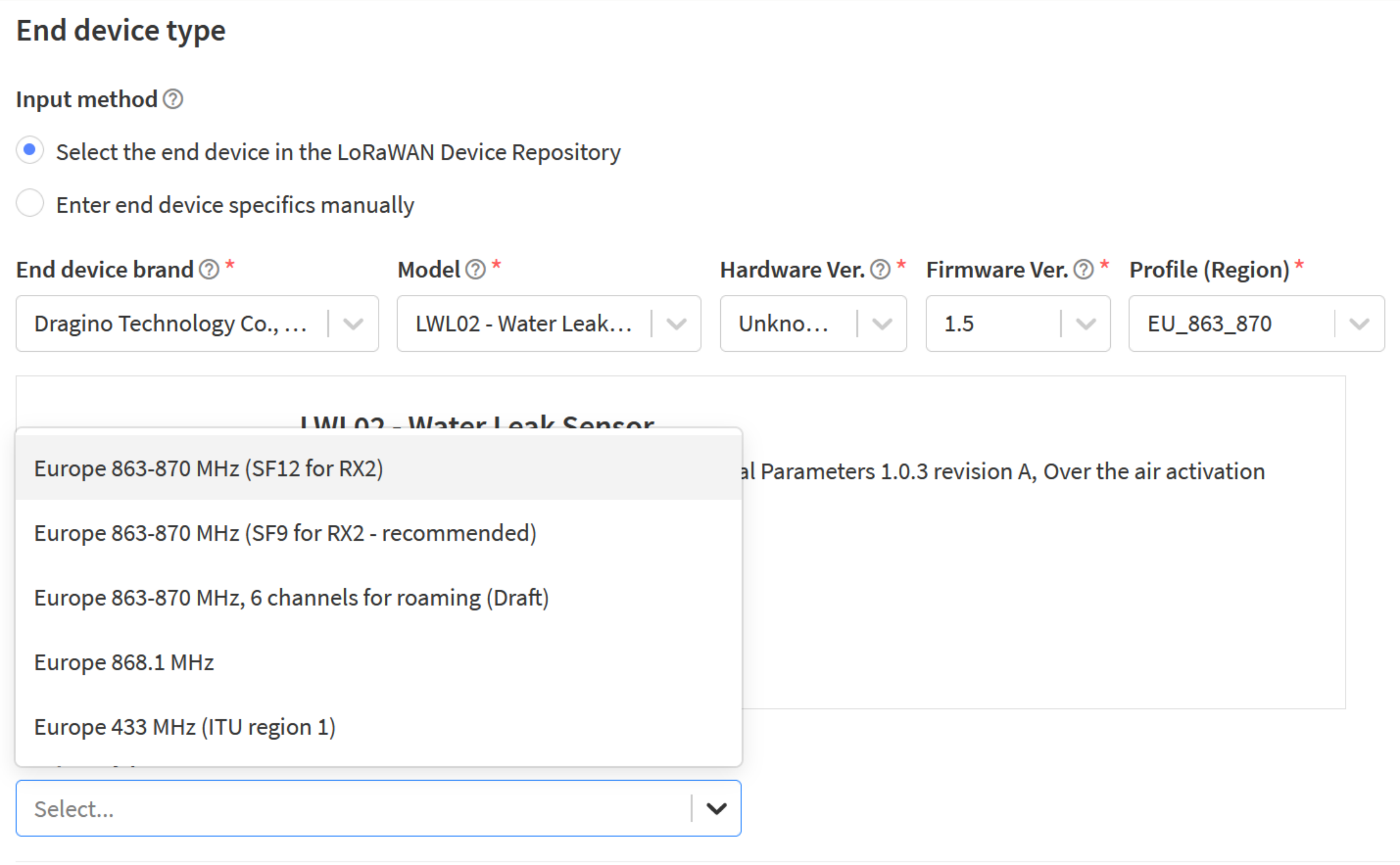
LoRaWAN Water Leak Sensor

Product website | Data sheet

Frequency plan ? *
Select...

Sensor mit Netzwerk verbinden

Endgerät hinzufügen



End device type

Input method

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

End device brand *	**Model** *	**Hardware Ver.** *	**Firmware Ver.** *	**Profile (Region)** *
Dragino Technology Co., …	LWL02 - Water Leak…	Unkno…	1.5	EU_863_870

LWL02 - Water Leak Sensor

al Parameters 1.0.3 revision A, Over the air activation

- Europe 863-870 MHz (SF12 for RX2)
- Europe 863-870 MHz (SF9 for RX2 - recommended)
- Europe 863-870 MHz, 6 channels for roaming (Draft)
- Europe 868.1 MHz
- Europe 433 MHz (ITU region 1)

Select...

End device type

Input method

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

End device brand *

Dragino Technology Co., …

LWL

LoRa

(OTA

LoRa

Prod

Frequency plan *

Europe 863-870 MHz (SF9 for RX

Provisioning information

JoinEUI *

-- -- -- -- -- -- -- --

To continue, please enter the JoinEUI of the end device so we can determine onboarding options

Registration Key,
Please keep it safely.

DEV EUI: A8404196E184F95A
APP EUI: A840410000000107
APP KEY: 8FA[redacted]
SN: LDS02491802

End device type

Input method

● Select the end device in the LoRaWAN Device Repository

○ Enter end device specifics manually

End device brand *: Drag
Model *:
Hardware Ver. *: Unkno…
Firmware Ver. *: 1.5
Profile (Region) *: EU_863_870

What is this?

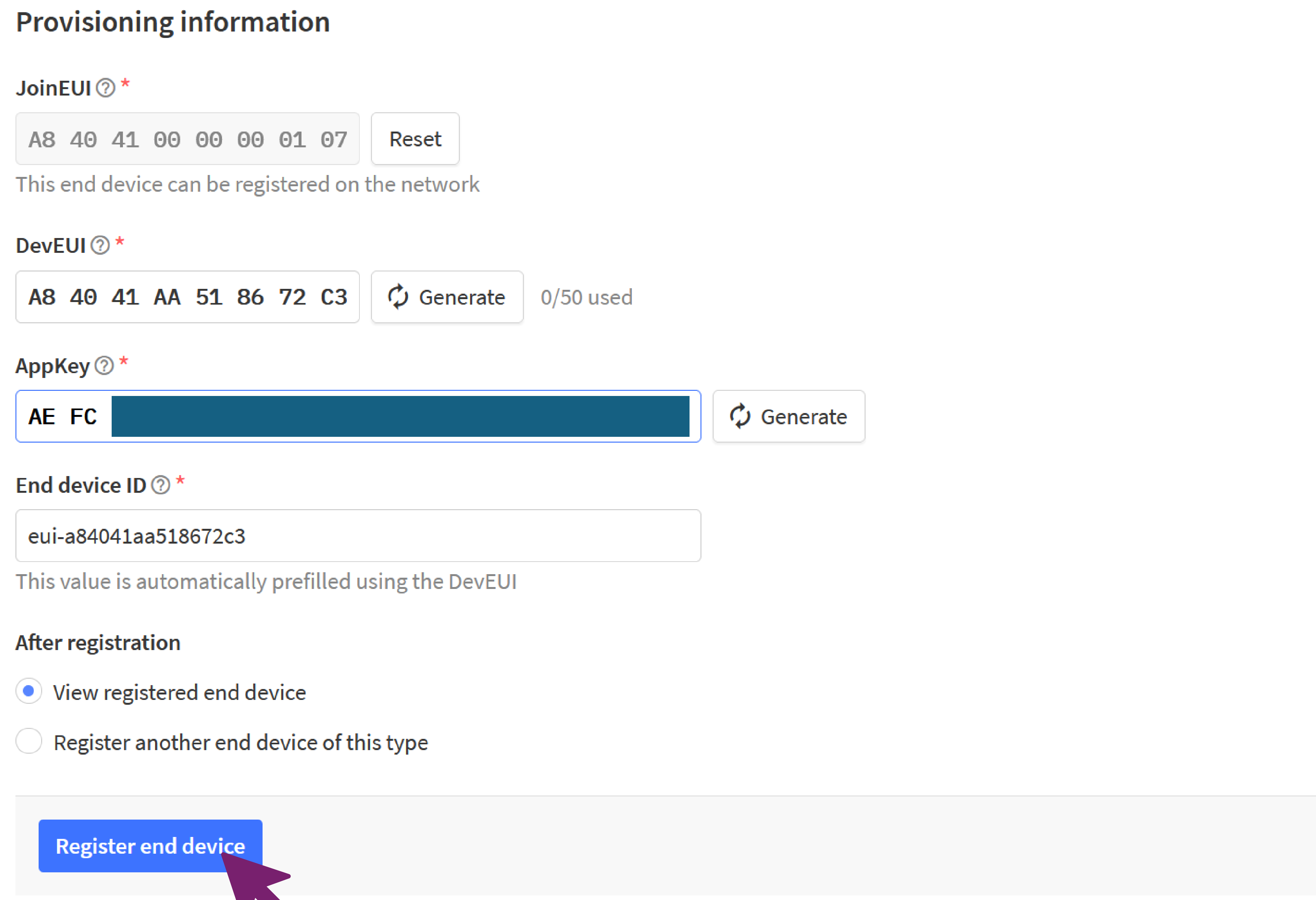
The JoinEUI (formerly called AppEUI) is a 64 bit extended unique identifier used to identify the Join Server during

Registration Key,
Please keep it safely.

DEV EUI: A8404196E184F95A
APP EUI: A840410000000107
APP KEY: 8FA[redacted]
SN: LDS02491802

Se

E



Provisioning information

JoinEUI ⓘ *

A8 40 41 00 00 00 01 07

This end device can be registered on the network

DevEUI ⓘ *

A8 40 41 AA 51 86 72 C3

0/50 used

AppKey ⓘ *

AE FC [redacted]

End device ID ⓘ *

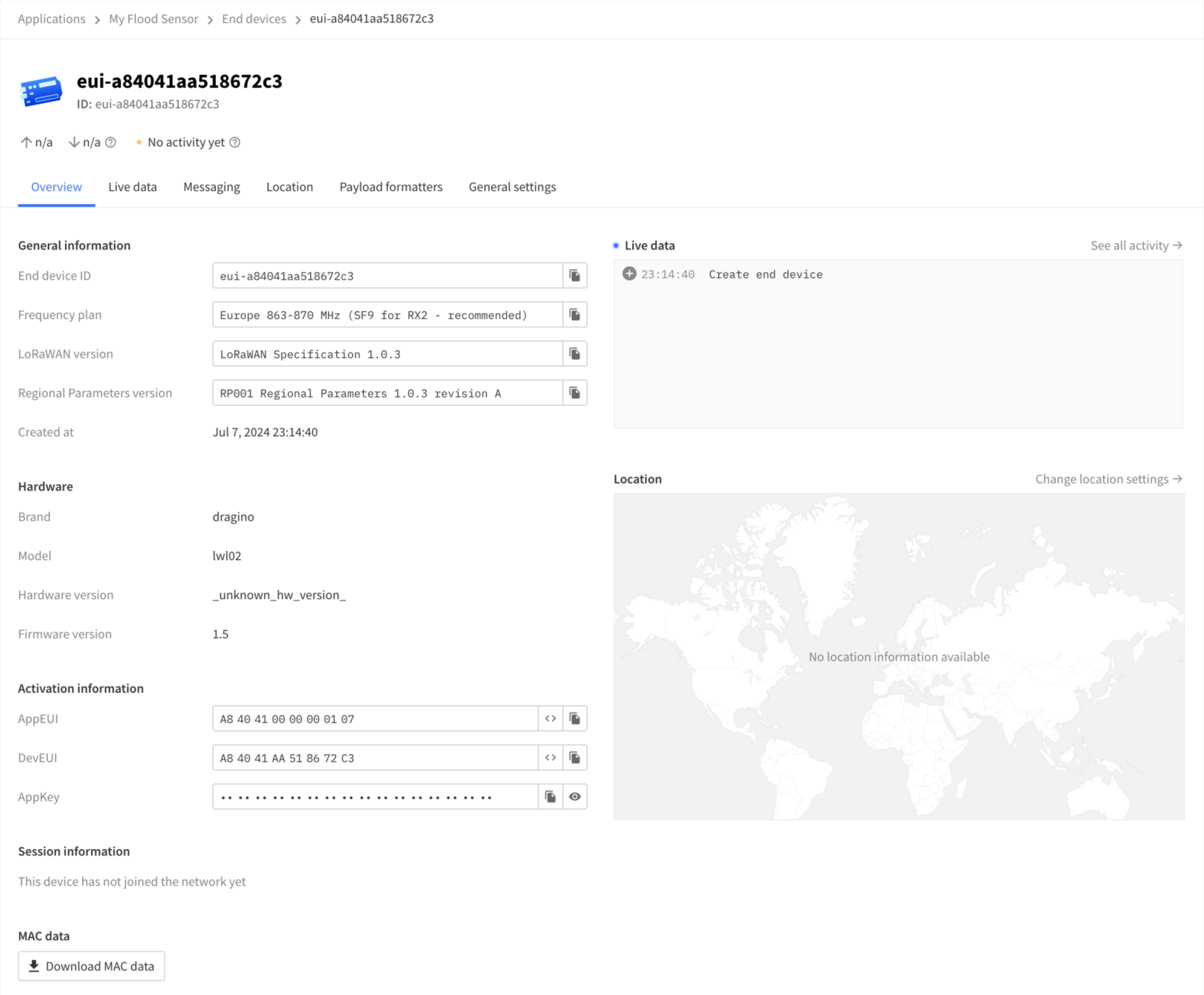
eui-a84041aa518672c3

This value is automatically prefilled using the DevEUI

After registration

● View registered end device

○ Register another end device of this type



eui-a84041aa518672c3

ID: eui-a84041aa518672c3

↑ n/a ↓ n/a · No activity yet

General information

End device ID: eui-a84041aa518672c3

Frequency plan: Europe 863-870 MHz (SF9 for RX2 - recommended)

LoRaWAN version: LoRaWAN Specification 1.0.3

Regional Parameters version: RP001 Regional Parameters 1.0.3 revision A

Created at: Jul 7, 2024 23:14:40

Hardware

Brand: dragino

Model: lwl02

Hardware version: _unknown_hw_version_

Firmware version: 1.5

Activation information

AppEUI: A8 40 41 00 00 00 01 07

DevEUI: A8 40 41 AA 51 86 72 C3

AppKey: •• •• •• •• •• •• •• •• •• •• •• •• •• •• •• ••

Session information

This device has not joined the network yet

MAC data

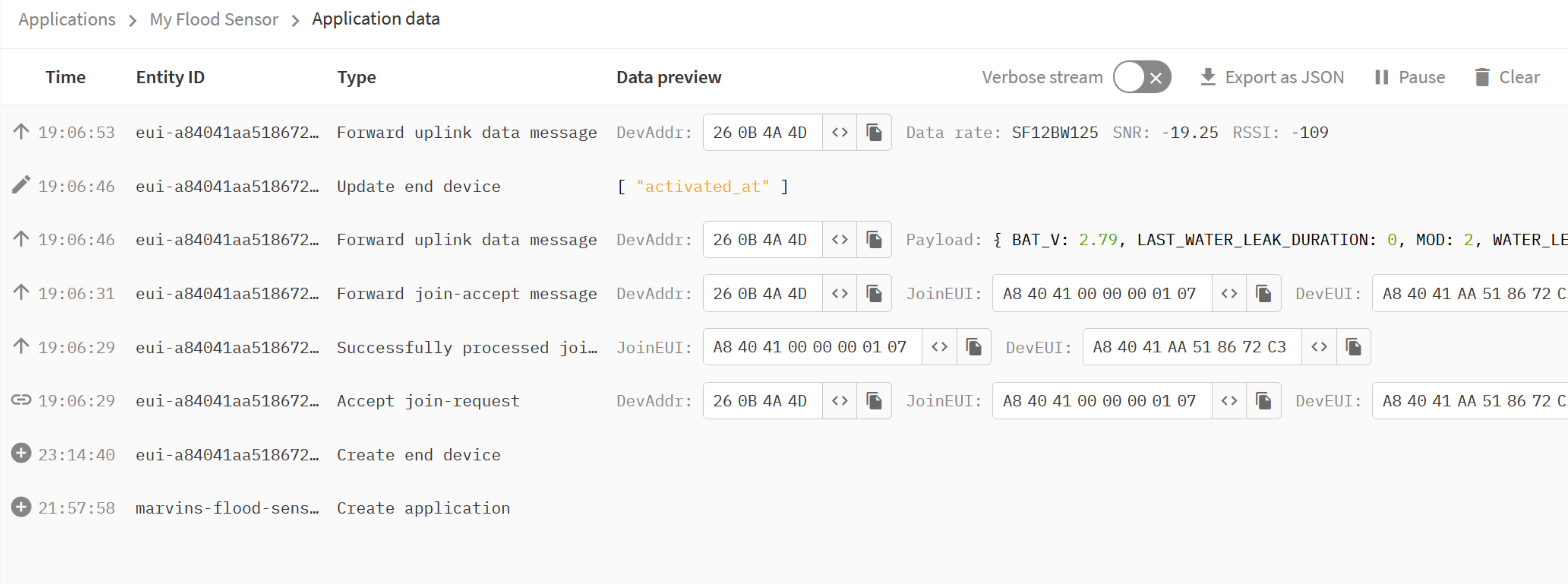
Live data

```
23:14:40  Create end device
```

Location

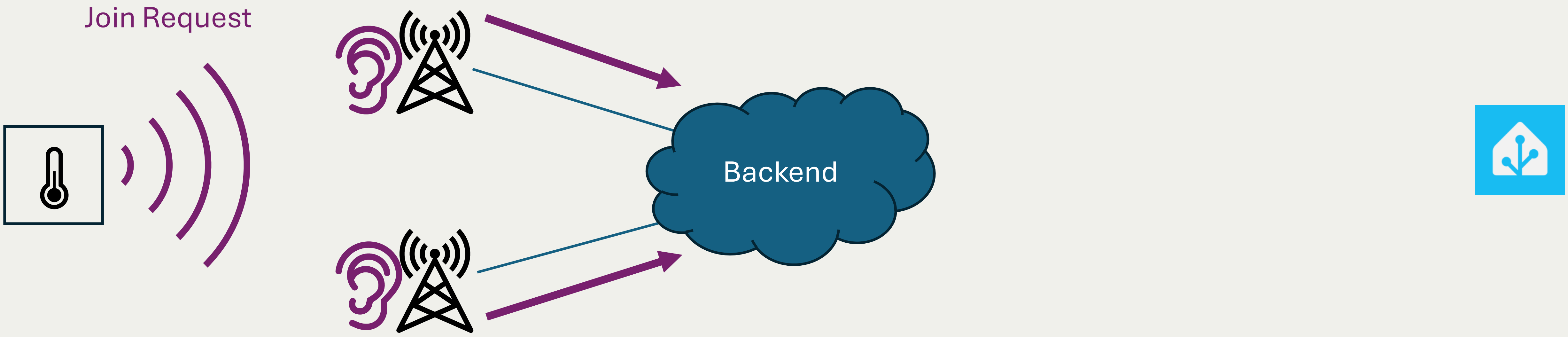
No location information available

```
19:06:31   eui-a84041…   Forward join-accept message
19:06:29   eui-a84041…   Successfully processed join-request
19:06:29   eui-a84041…   Accept join-request
23:14:40   eui-a84041…   Create end device
21:57:58   marvins-fl…   Create application
```



Time	Entity ID	Type	Data preview
19:06:53	eui-a84041aa518672…	Forward uplink data message	DevAddr: 26 0B 4A 4D Data rate: SF12BW125 SNR: -19.25 RSSI: -109
19:06:46	eui-a84041aa518672…	Update end device	["activated_at"]
19:06:46	eui-a84041aa518672…	Forward uplink data message	DevAddr: 26 0B 4A 4D Payload: { BAT_V: 2.79, LAST_WATER_LEAK_DURATION: 0, MOD: 2, WATER_LE
19:06:31	eui-a84041aa518672…	Forward join-accept message	DevAddr: 26 0B 4A 4D JoinEUI: A8 40 41 00 00 00 01 07 DevEUI: A8 40 41 AA 51 86 72 C
19:06:29	eui-a84041aa518672…	Successfully processed joi…	JoinEUI: A8 40 41 00 00 00 01 07 DevEUI: A8 40 41 AA 51 86 72 C3
19:06:29	eui-a84041aa518672…	Accept join-request	DevAddr: 26 0B 4A 4D JoinEUI: A8 40 41 00 00 00 01 07 DevEUI: A8 40 41 AA 51 86 72 C
23:14:40	eui-a84041aa518672…	Create end device	
21:57:58	marvins-flood-sens…	Create application	

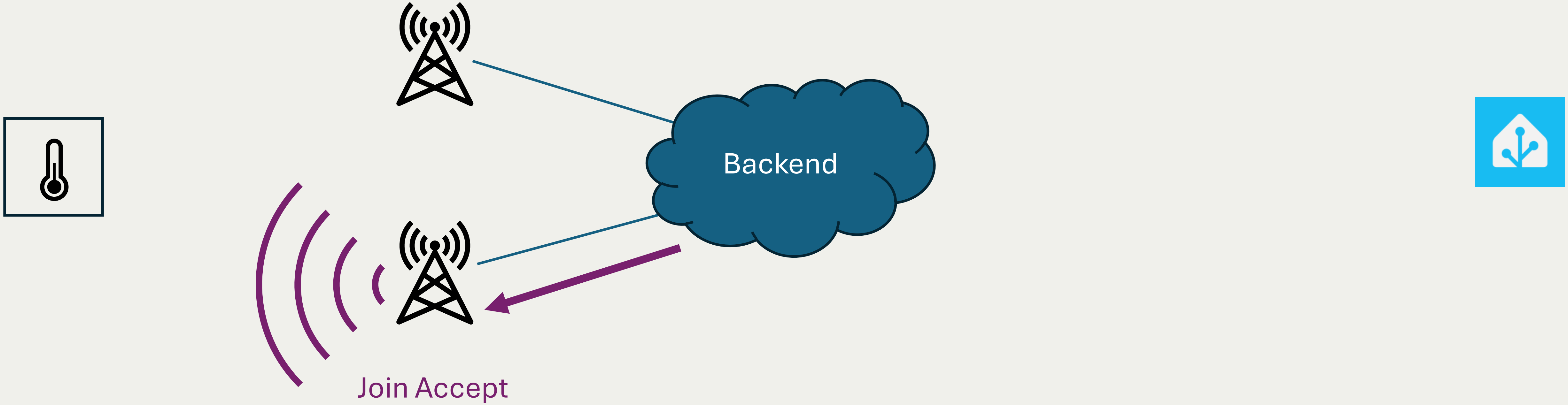
Sensordaten in mein Home Assistant



Join Request

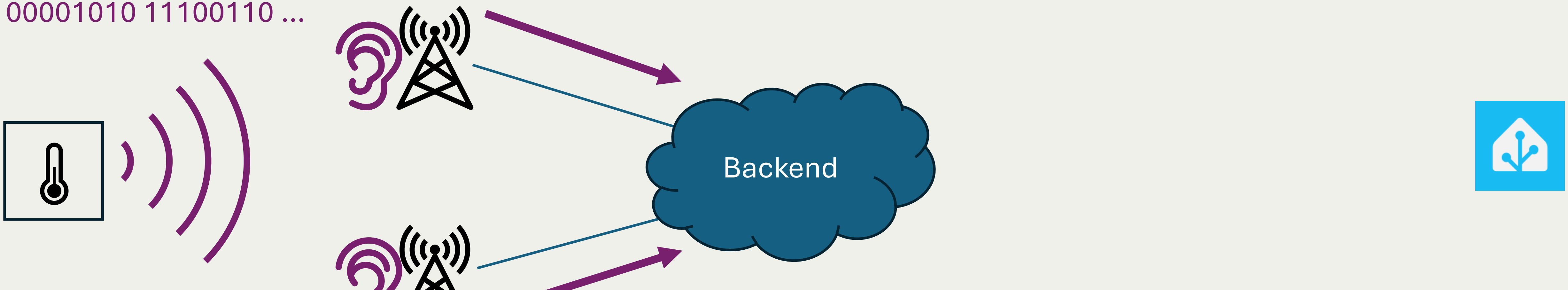
Backend

Sensordaten in mein Home Assistant

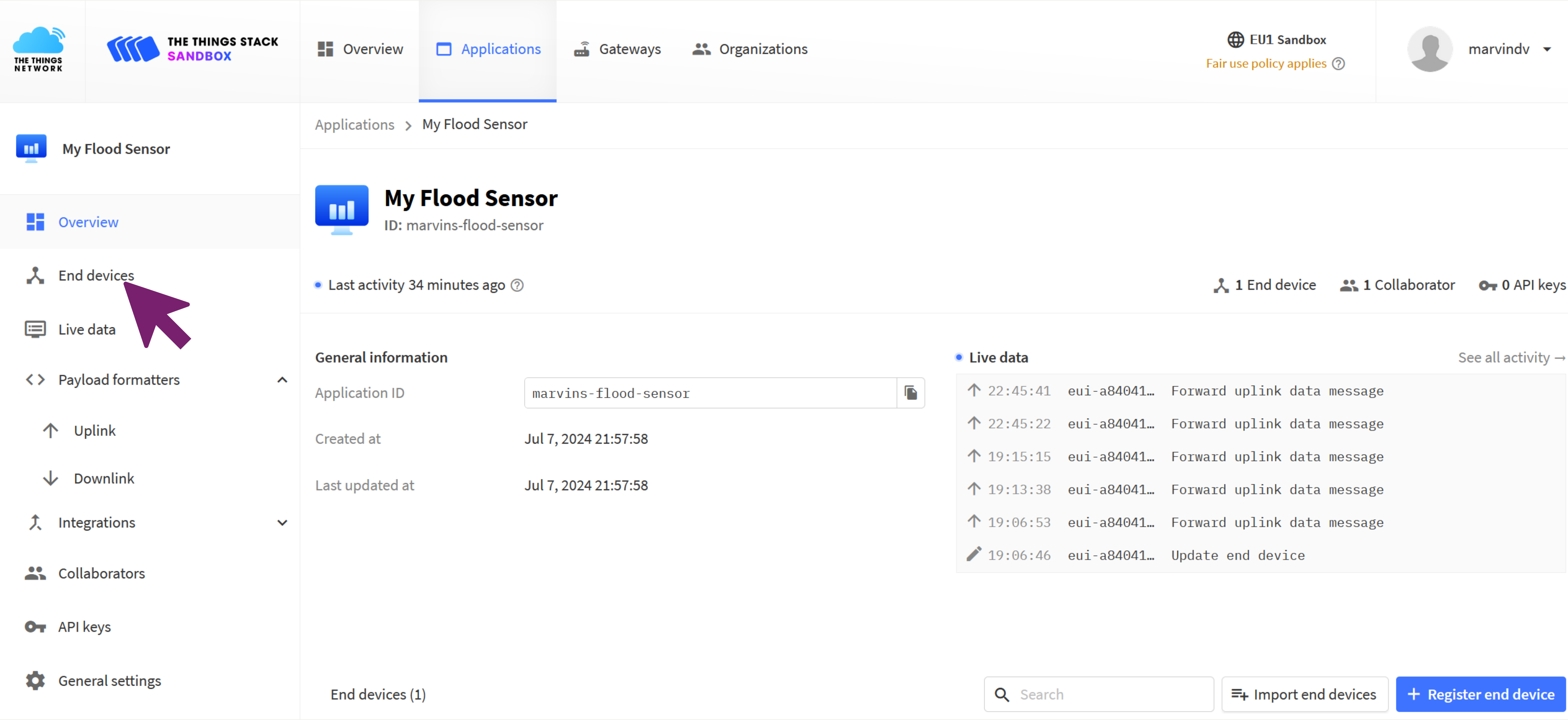


Sensordaten in mein Home Assistant

Uplink
00001010 11100110 ...



```
{
  "BAT_V": 2.79,
  "LAST_WATER_LEAK_DURATION": 0,
  "MOD": 2,
  "WATER_LEAK_STATUS": 0,
  "WATER_LEAK_TIMES": 2
}
```



My Flood Sensor

ID: marvins-flood-sensor

Last activity 34 minutes ago

1 End device 1 Collaborator 0 API keys

General information

Application ID: marvins-flood-sensor

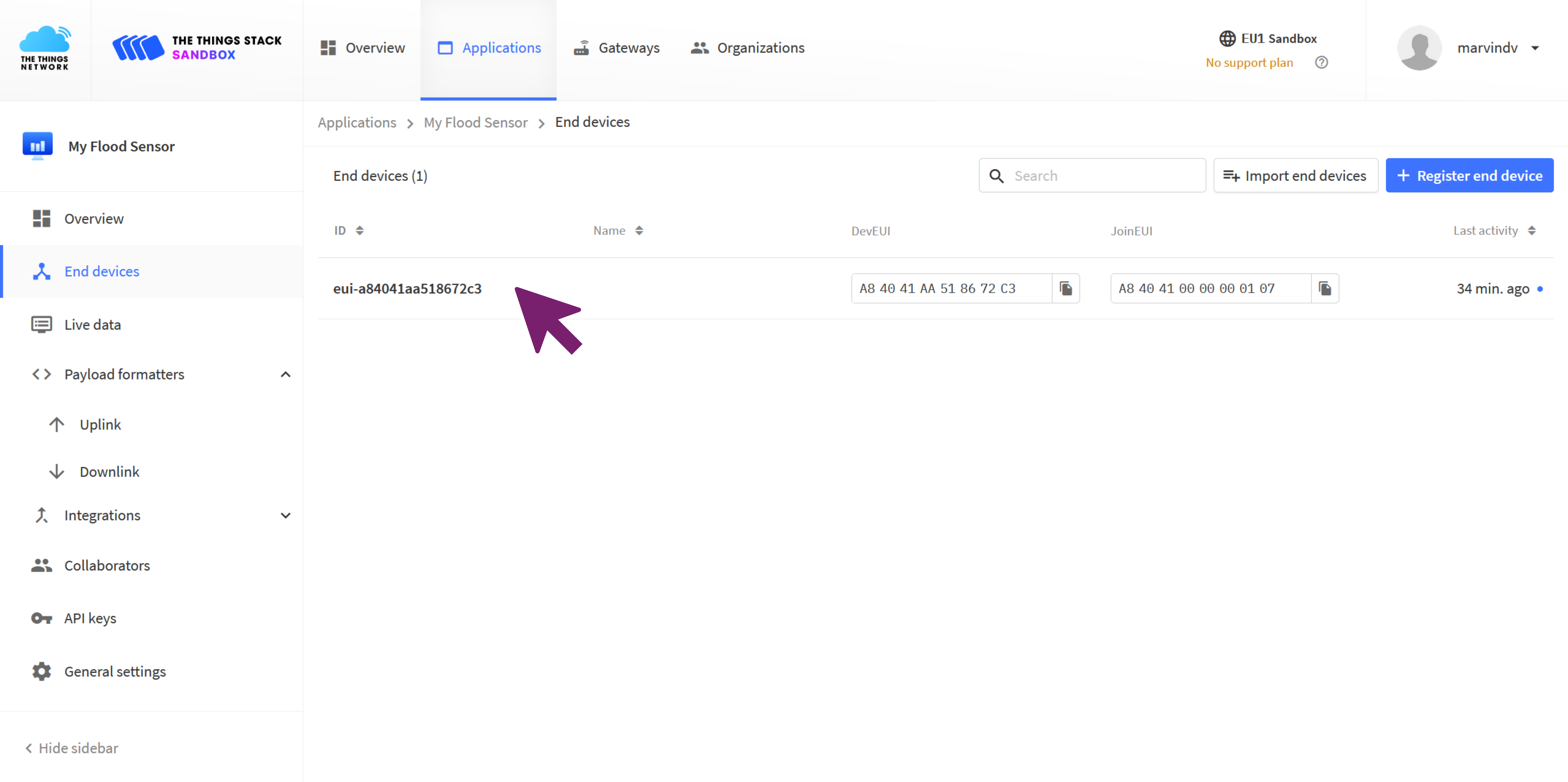
Created at: Jul 7, 2024 21:57:58

Last updated at: Jul 7, 2024 21:57:58

Live data

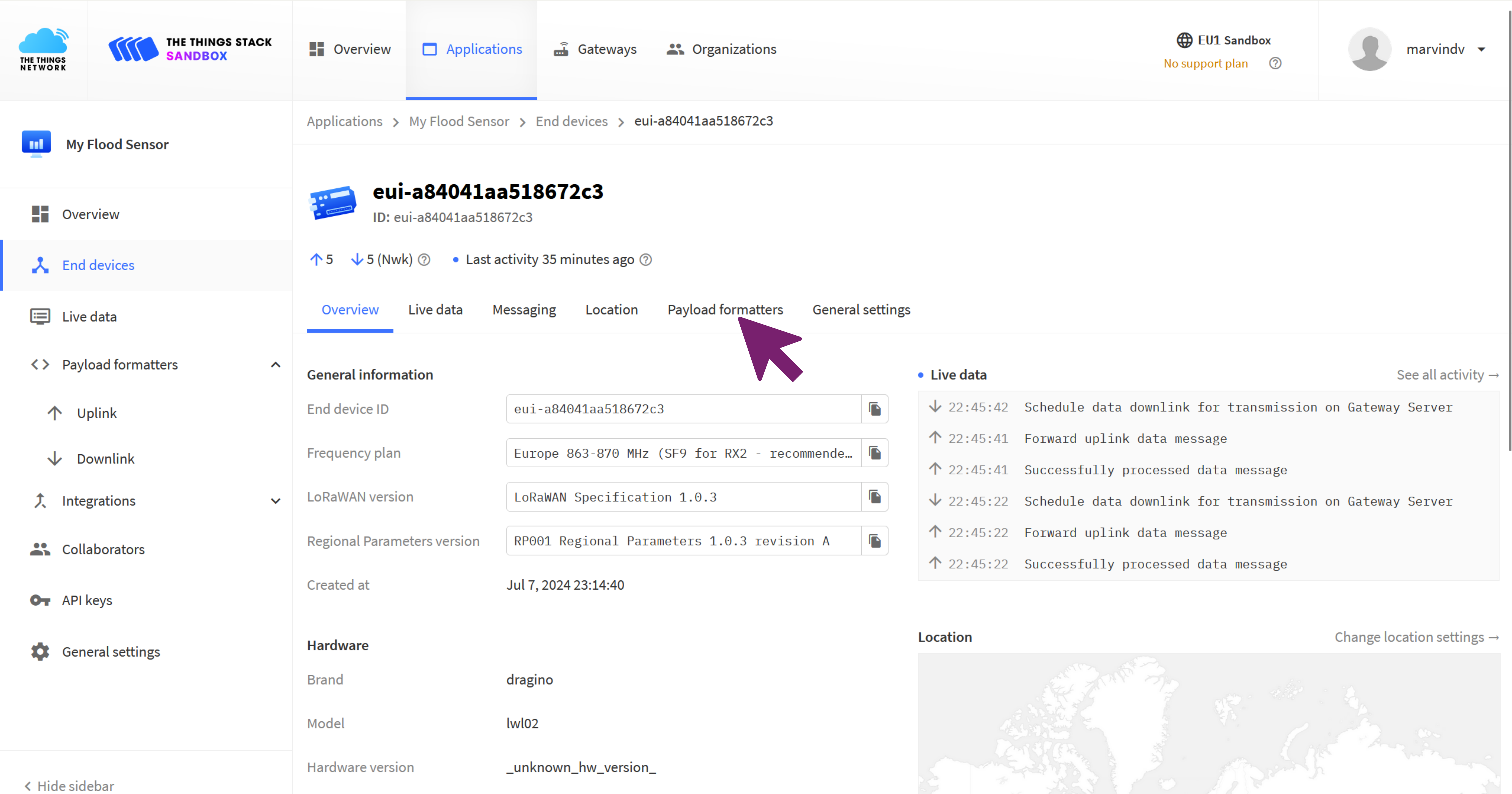
```
22:45:41  eui-a84041…  Forward uplink data message
22:45:22  eui-a84041…  Forward uplink data message
19:15:15  eui-a84041…  Forward uplink data message
19:13:38  eui-a84041…  Forward uplink data message
19:06:53  eui-a84041…  Forward uplink data message
19:06:46  eui-a84041…  Update end device
```

End devices (1)



End devices (1)

ID	Name	DevEUI	JoinEUI	Last activity
eui-a84041aa518672c3		A8 40 41 AA 51 86 72 C3	A8 40 41 00 00 00 01 07	34 min. ago ●



eui-a84041aa518672c3

ID: eui-a84041aa518672c3

↑5 ↓5 (Nwk) • Last activity 35 minutes ago

General information

End device ID	eui-a84041aa518672c3
Frequency plan	Europe 863-870 MHz (SF9 for RX2 - recommende…
LoRaWAN version	LoRaWAN Specification 1.0.3
Regional Parameters version	RP001 Regional Parameters 1.0.3 revision A
Created at	Jul 7, 2024 23:14:40

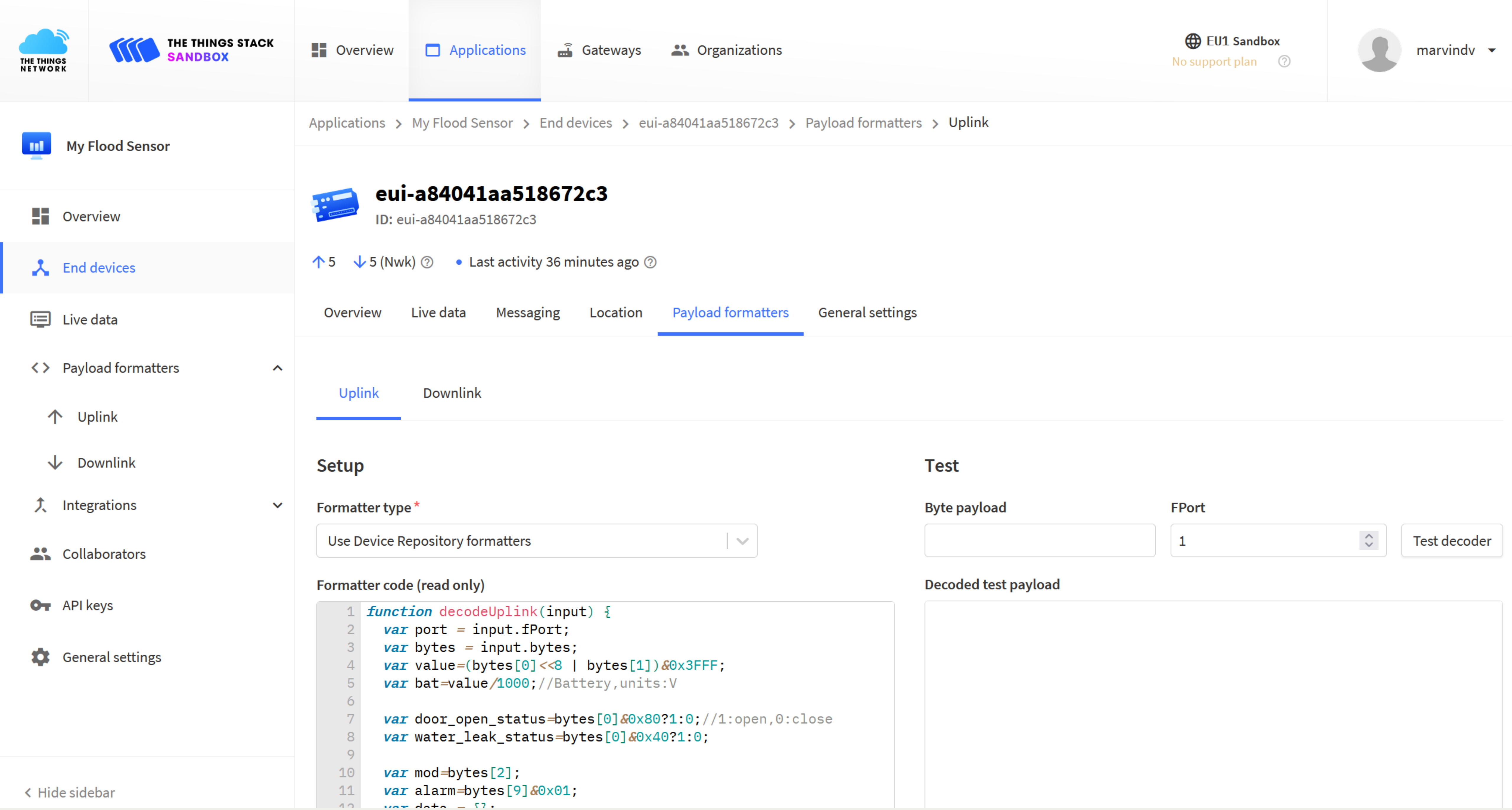
Hardware

Brand	dragino
Model	lwl02
Hardware version	_unknown_hw_version_

Live data

```
↓ 22:45:42  Schedule data downlink for transmission on Gateway Server
↑ 22:45:41  Forward uplink data message
↑ 22:45:41  Successfully processed data message
↓ 22:45:22  Schedule data downlink for transmission on Gateway Server
↑ 22:45:22  Forward uplink data message
↑ 22:45:22  Successfully processed data message
```

Location



eui-a84041aa518672c3

ID: eui-a84041aa518672c3

Setup

Formatter type*: Use Device Repository formatters

Formatter code (read only)

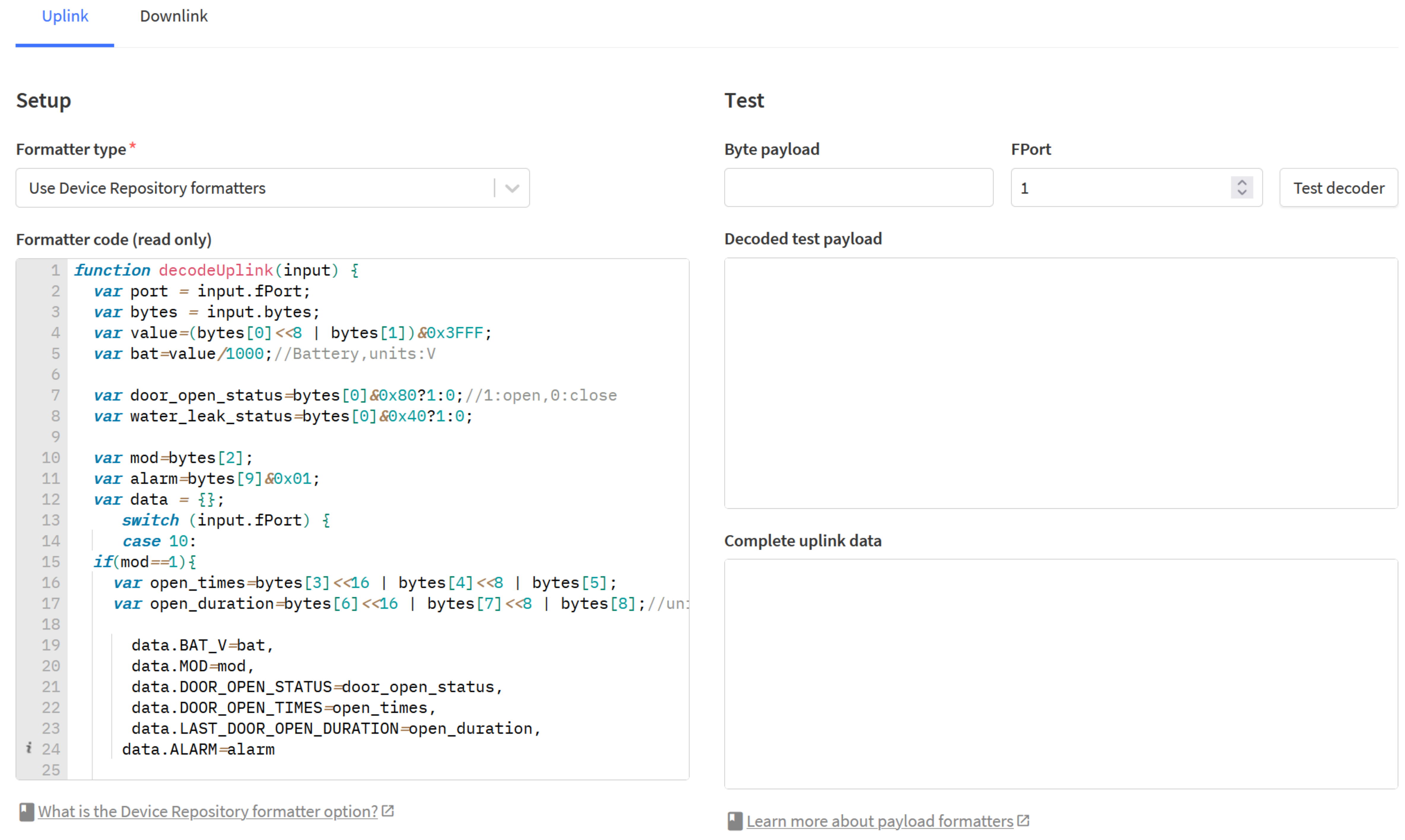
```
function decodeUplink(input) {
  var port = input.fPort;
  var bytes = input.bytes;
  var value=(bytes[0]<<8 | bytes[1])&0x3FFF;
  var bat=value/1000;//Battery,units:V

  var door_open_status=bytes[0]&0x80?1:0;//1:open,0:close
  var water_leak_status=bytes[0]&0x40?1:0;

  var mod=bytes[2];
  var alarm=bytes[9]&0x01;
  var data = {};
```

Test

Byte payload:

FPort: 1

Decoded test payload



Setup

Formatter type *

Use Device Repository formatters

Formatter code (read only)

```
function decodeUplink(input) {
  var port = input.fPort;
  var bytes = input.bytes;
  var value=(bytes[0]<<8 | bytes[1])&0x3FFF;
  var bat=value/1000;//Battery,units:V

  var door_open_status=bytes[0]&0x80?1:0;//1:open,0:close
  var water_leak_status=bytes[0]&0x40?1:0;

  var mod=bytes[2];
  var alarm=bytes[9]&0x01;
  var data = {};
     switch (input.fPort) {
     case 10:
  if(mod==1){
    var open_times=bytes[3]<<16 | bytes[4]<<8 | bytes[5];
    var open_duration=bytes[6]<<16 | bytes[7]<<8 | bytes[8];//un

      data.BAT_V=bat,
      data.MOD=mod,
      data.DOOR_OPEN_STATUS=door_open_status,
      data.DOOR_OPEN_TIMES=open_times,
      data.LAST_DOOR_OPEN_DURATION=open_duration,
     data.ALARM=alarm

```

What is the Device Repository formatter option?

Test

Byte payload

FPort

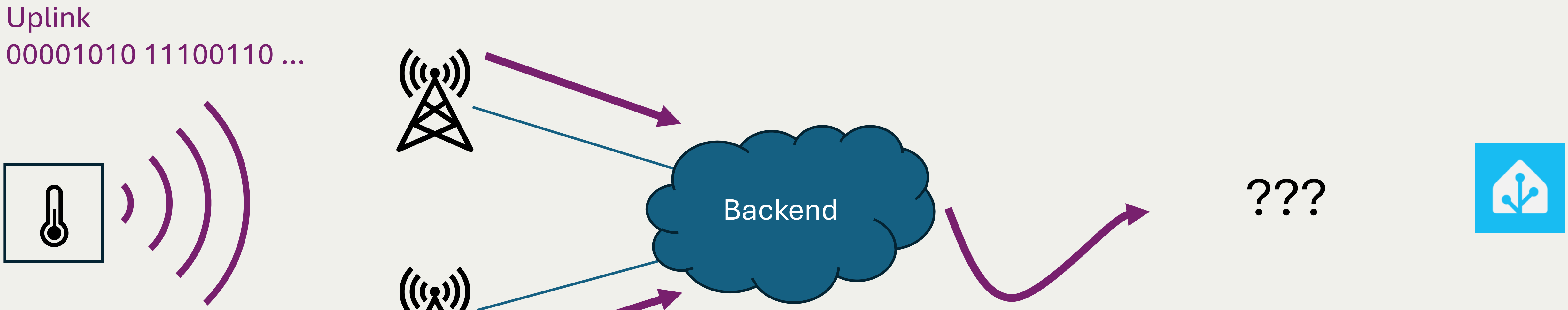
1

Decoded test payload

Complete uplink data

Learn more about payload formatters

Sensordaten in mein Home Assistant

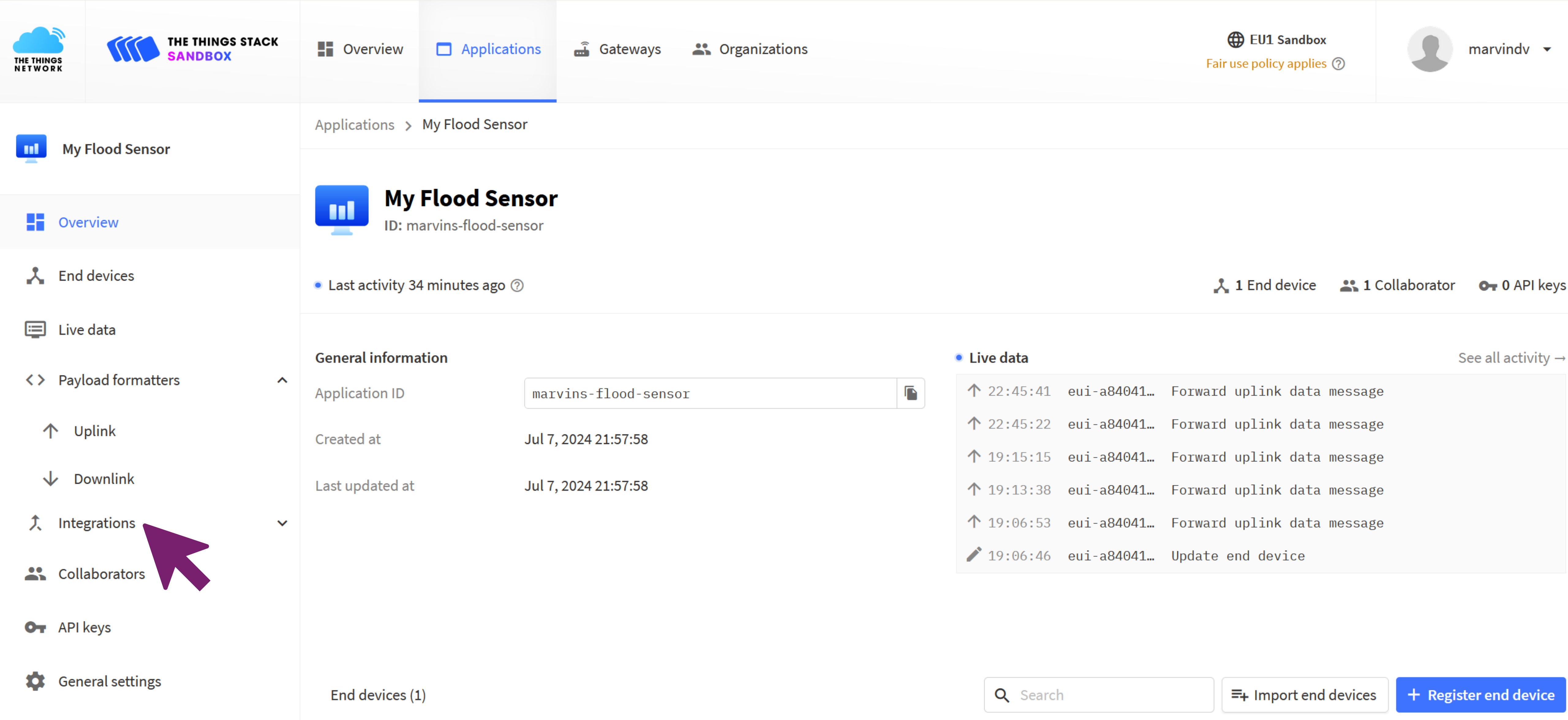


Uplink
00001010 11100110 ...

Backend

???

{
  "BAT_V": 2.79,
  "LAST_WATER_LEAK_DURATION": 0,
  "MOD": 2,
  "WATER_LEAK_STATUS": 0,
  "WATER_LEAK_TIMES": 2
}



My Flood Sensor

ID: marvins-flood-sensor

Last activity 34 minutes ago

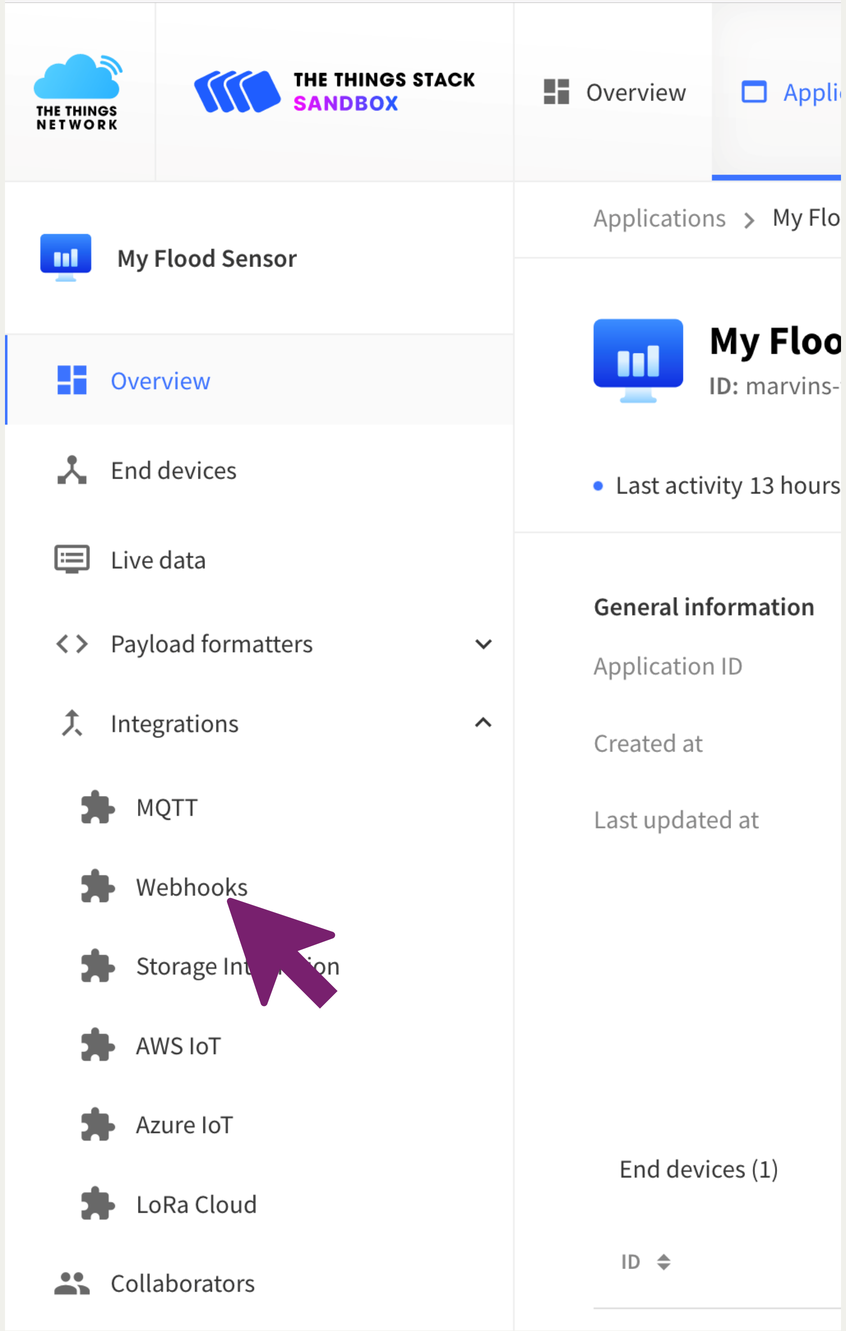
General information

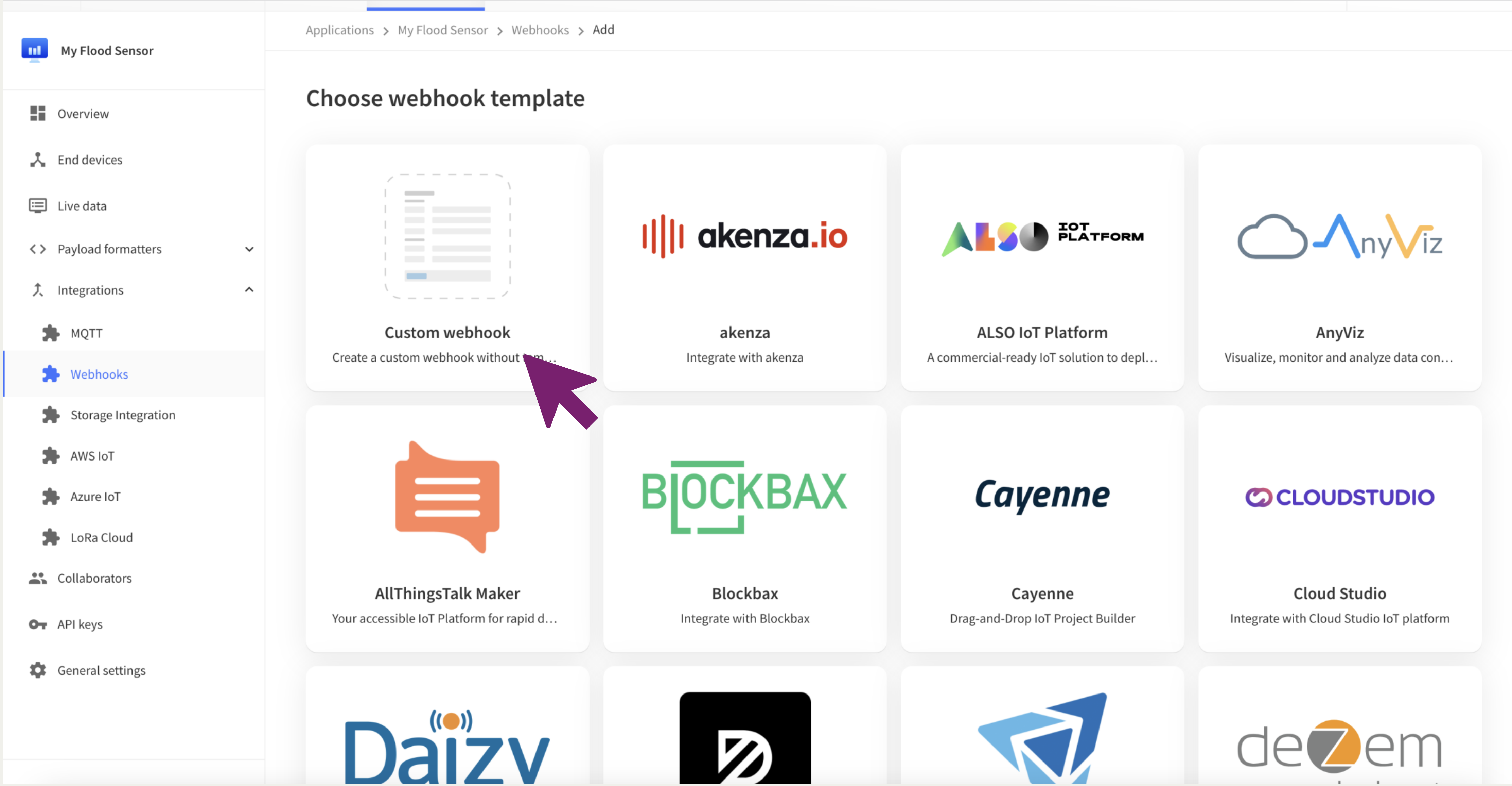
Application ID	marvins-flood-sensor
Created at	Jul 7, 2024 21:57:58
Last updated at	Jul 7, 2024 21:57:58

Live data

```
↑ 22:45:41  eui-a84041…  Forward uplink data message
↑ 22:45:22  eui-a84041…  Forward uplink data message
↑ 19:15:15  eui-a84041…  Forward uplink data message
↑ 19:13:38  eui-a84041…  Forward uplink data message
↑ 19:06:53  eui-a84041…  Forward uplink data message
  19:06:46  eui-a84041…  Update end device
```

End devices (1)


THE THINGS NETWORK
THE THINGS STACK
SANDBOX
Overview
Appli
Applications
My Flo
My Flood Sensor
Overview
End devices
Live data
Payload formatters
Integrations
MQTT
Webhooks
Storage Int ion
AWS IoT
Azure IoT
LoRa Cloud
Collaborators
My Floo
ID: marvins-
Last activity 13 hours
General information
Application ID
Created at
Last updated at
End devices (1)
ID



Choose webhook template

Custom webhook
Create a custom webhook without tem…

akenza
Integrate with akenza

ALSO IoT Platform
A commercial-ready IoT solution to depl…

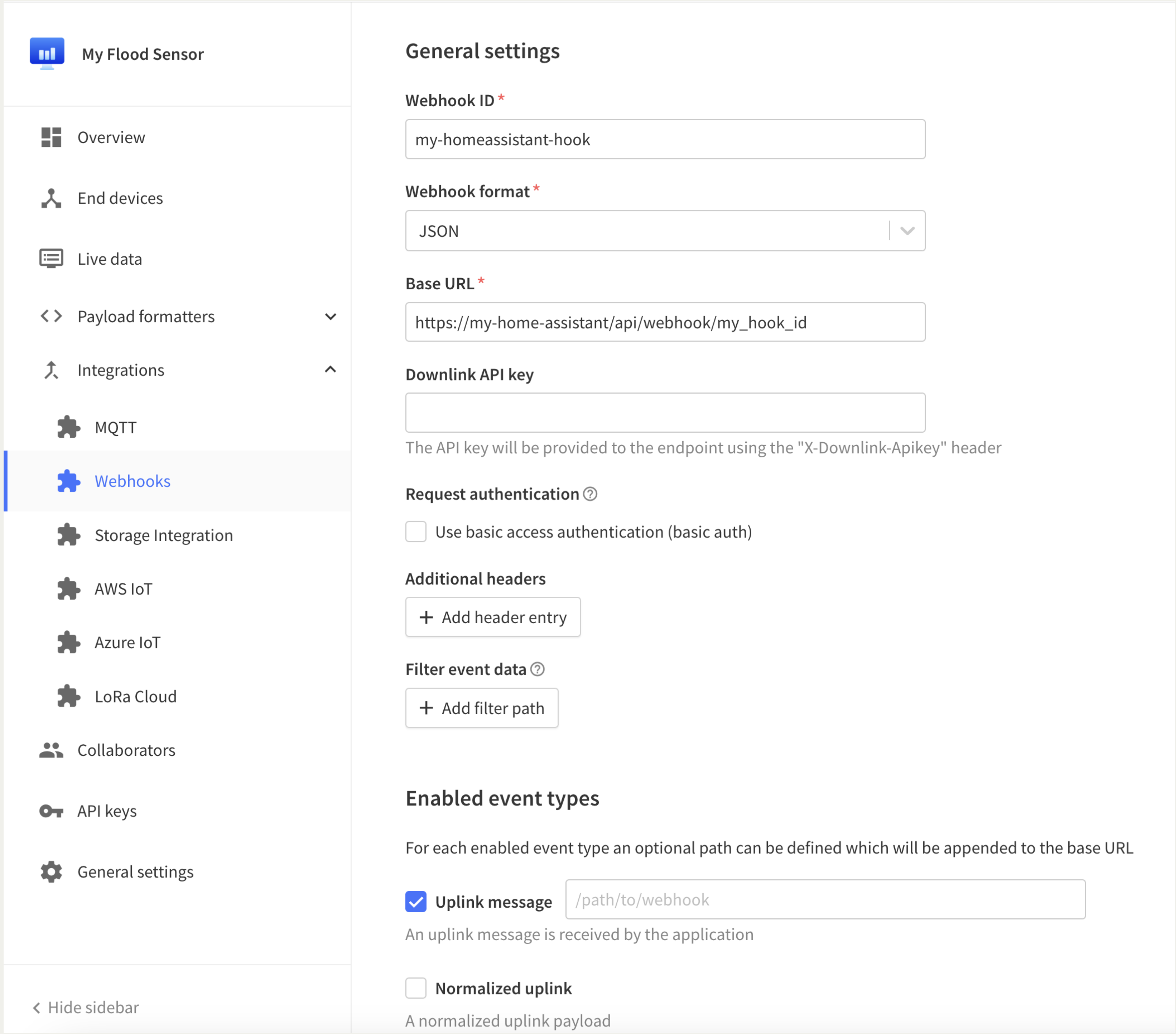
AnyViz
Visualize, monitor and analyze data con…

AllThingsTalk Maker
Your accessible IoT Platform for rapid d…

Blockbax
Integrate with Blockbax

Cayenne
Drag-and-Drop IoT Project Builder

Cloud Studio
Integrate with Cloud Studio IoT platform



General settings

Webhook ID *

my-homeassistant-hook

Webhook format *

JSON

Base URL *

https://my-home-assistant/api/webhook/my_hook_id

Downlink API key

The API key will be provided to the endpoint using the "X-Downlink-Apikey" header

Request authentication

☐ Use basic access authentication (basic auth)

Additional headers

Filter event data

Enabled event types

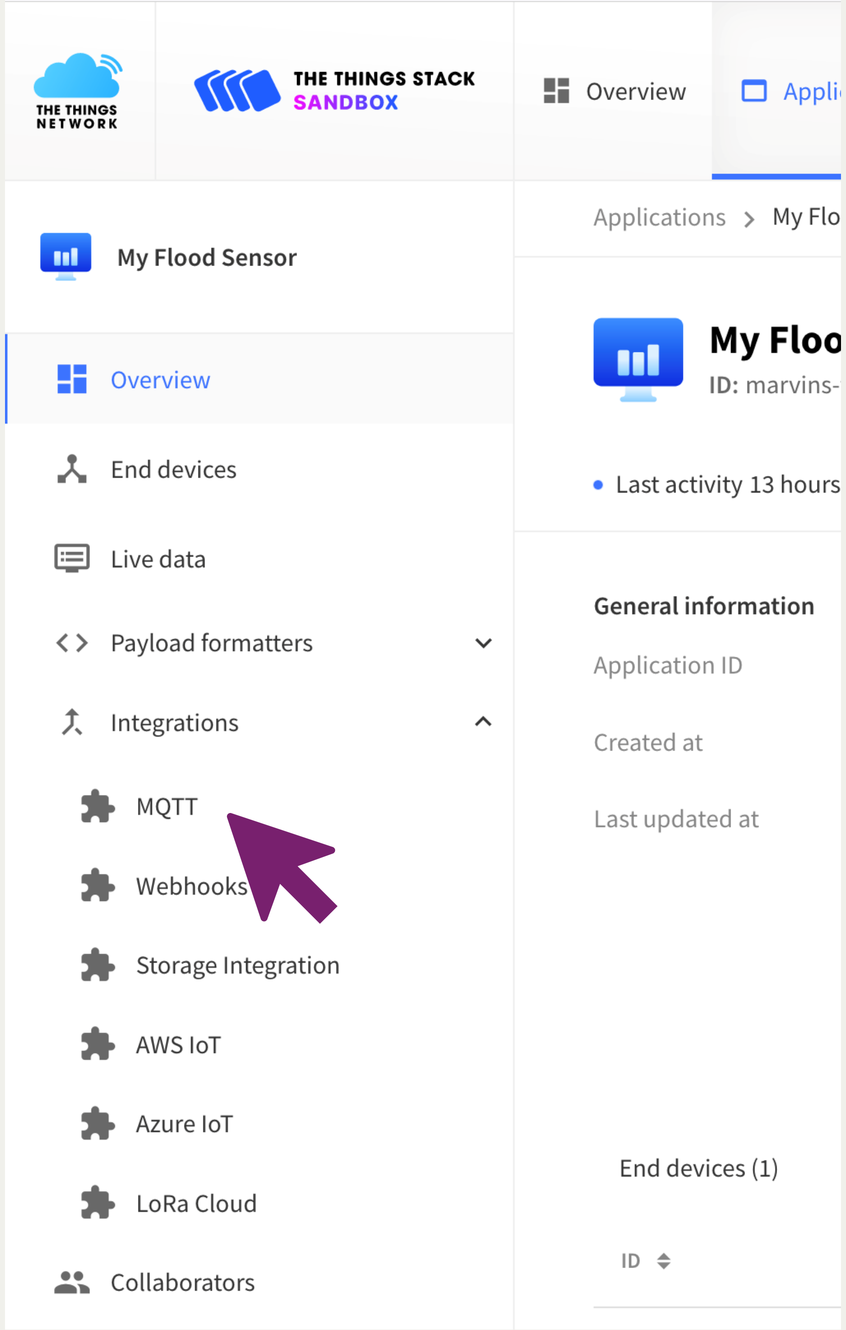
For each enabled event type an optional path can be defined which will be appended to the base URL

☑ **Uplink message** /path/to/webhook

An uplink message is received by the application

☐ **Normalized uplink**

A normalized uplink payload



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SANDBOX
Overview
Appli
Applications > My Flo
My Flood Sensor
Overview
End devices
Live data
Payload formatters
Integrations
MQTT
Webhooks
Storage Integration
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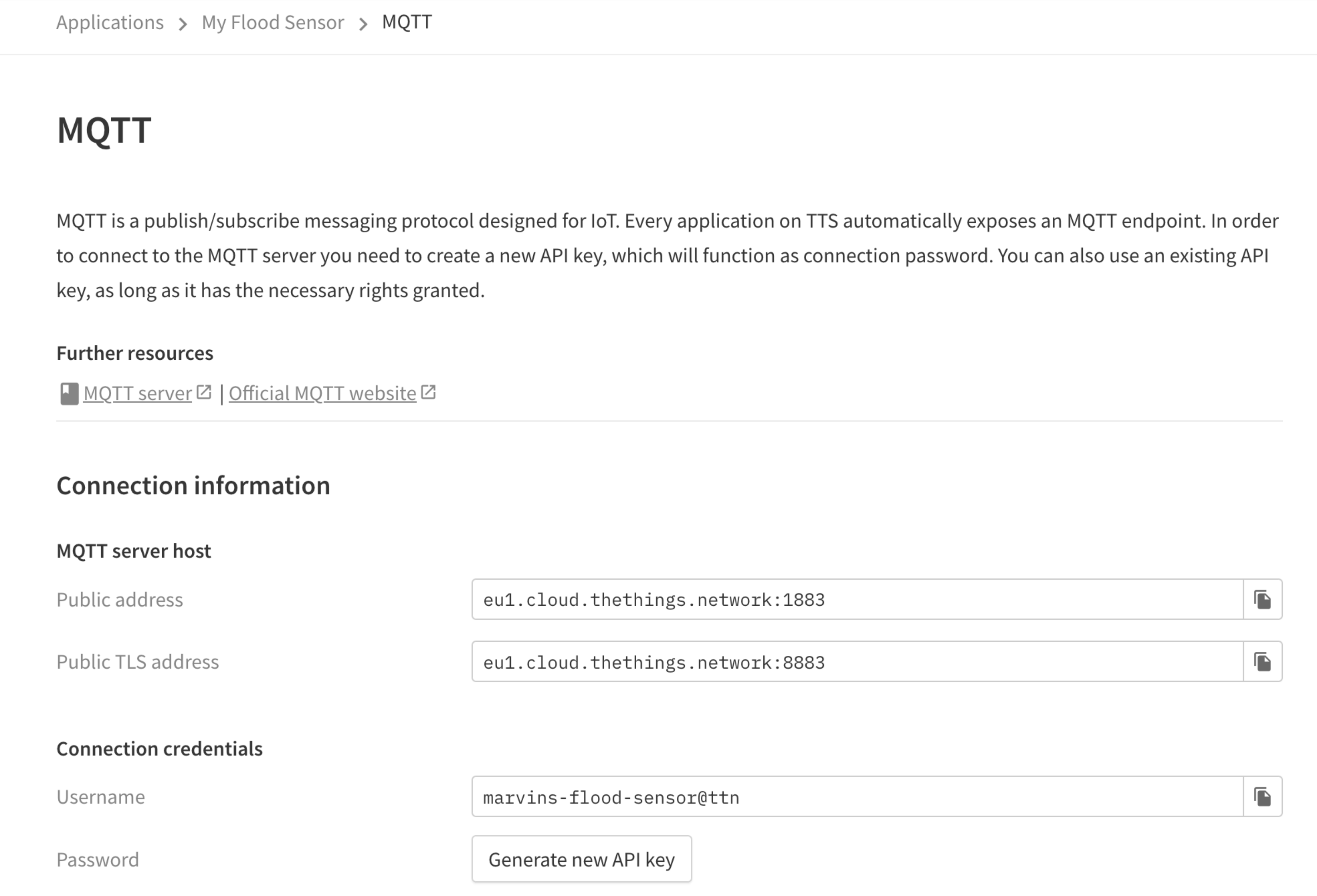
Azure IoT
LoRa Cloud
Collaborators
My Floo
ID: marvins-
Last activity 13 hours
General information
Application ID
Created at
Last updated at
End devices (1)
ID



Applications > My Flood Sensor > MQTT

MQTT

MQTT is a publish/subscribe messaging protocol designed for IoT. Every application on TTS automatically exposes an MQTT endpoint. In order to connect to the MQTT server you need to create a new API key, which will function as connection password. You can also use an existing API key, as long as it has the necessary rights granted.

Further resources

MQTT server | Official MQTT website

Connection information

MQTT server host

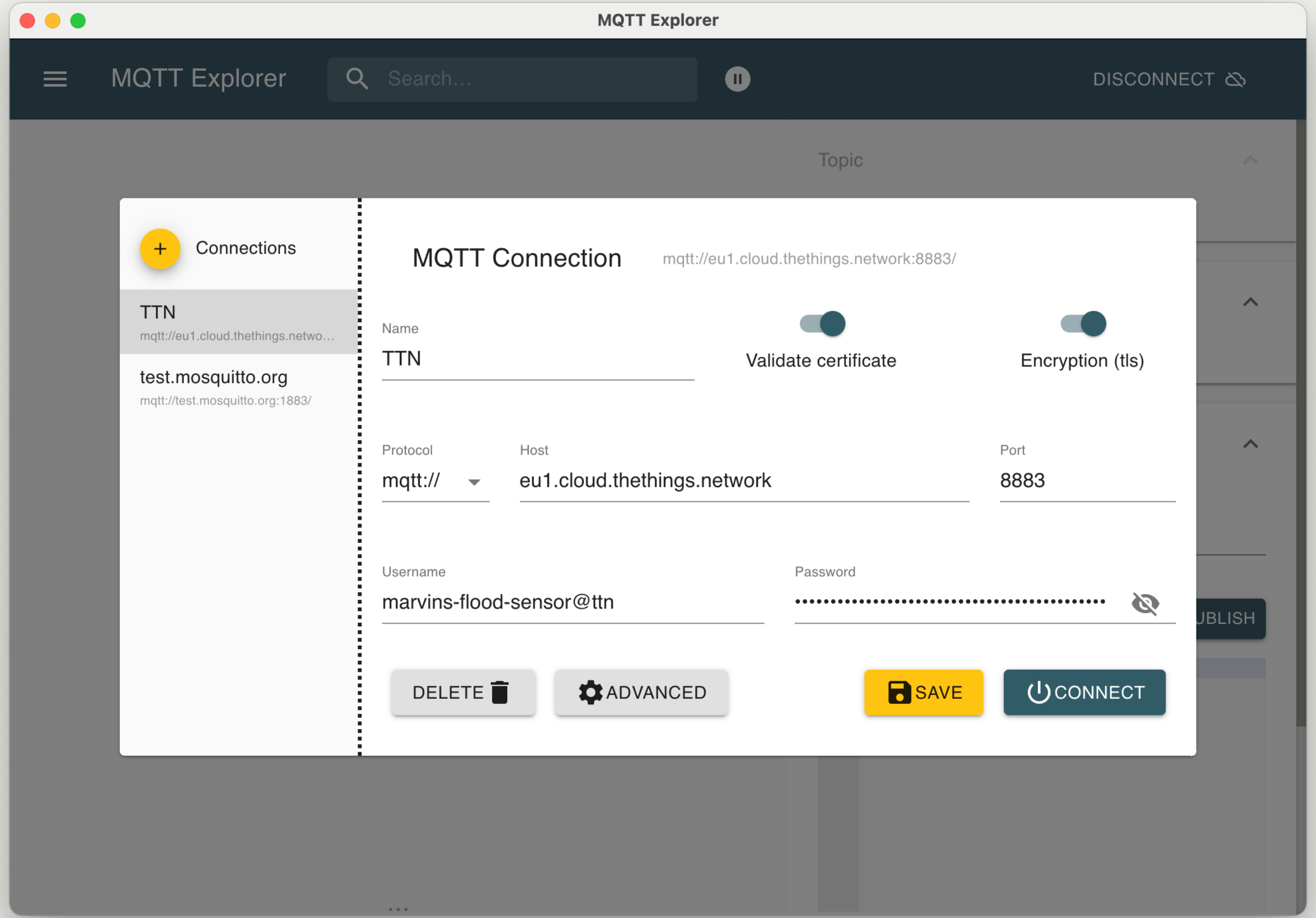
Public address: `eu1.cloud.thethings.network:1883`

Public TLS address: `eu1.cloud.thethings.network:8883`

Connection credentials

Username: `marvins-flood-sensor@ttn`

Password: Generate new API key



MQTT Connection mqtt://eu1.cloud.thethings.network:8883/

Name: TTN

Validate certificate: on

Encryption (tls): on

Protocol: mqtt://

Host: eu1.cloud.thethings.network

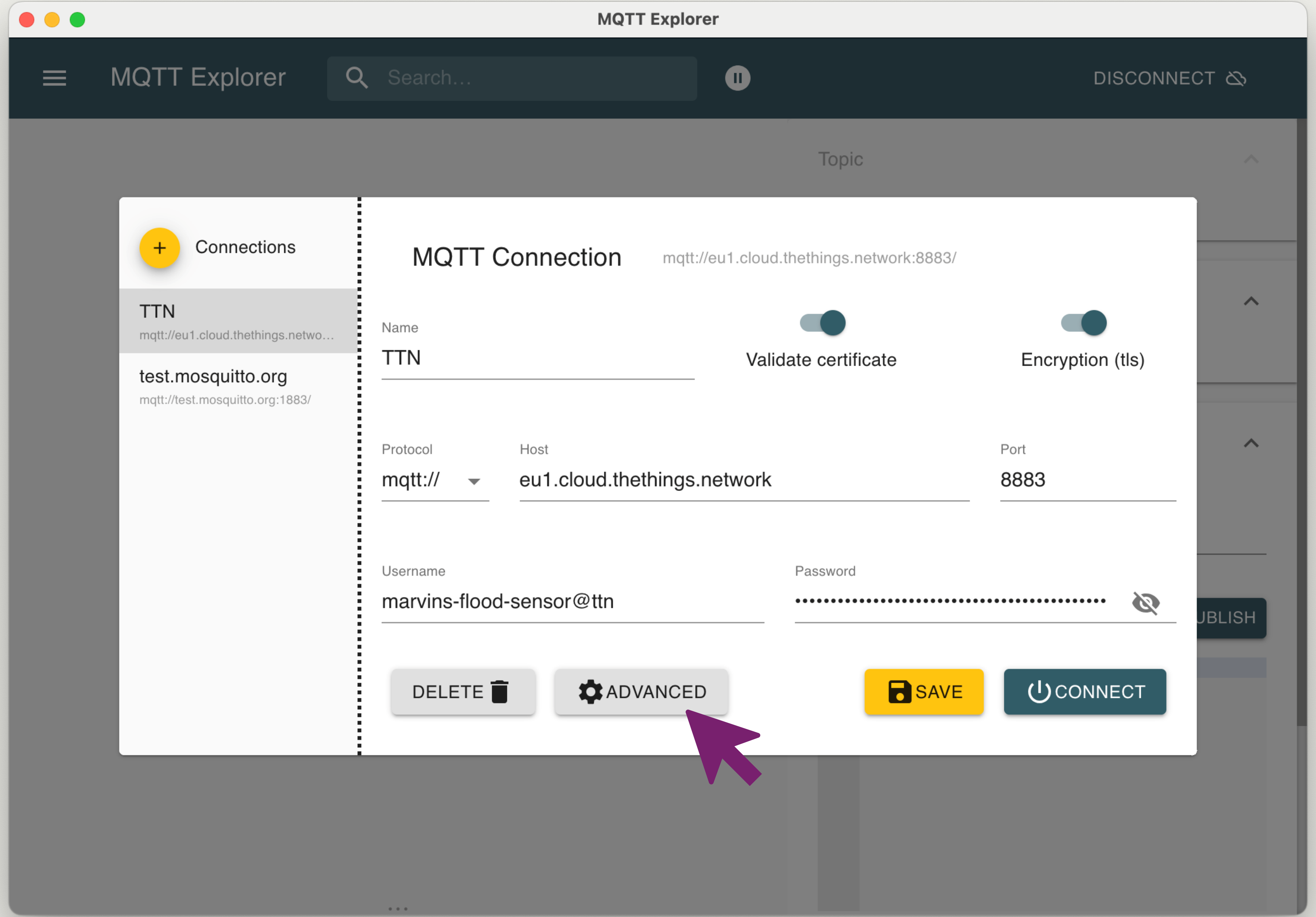
Port: 8883

Username: marvins-flood-sensor@ttn

Password: ••

MQTT Integration

- Topic für Uplinks:
  - v3/{application id}@{tenant id}/devices/{device id}/up
- Siehe https://www.thethingsindustries.com/docs/integrations/mqtt/
- Zum Beispiel
  - v3/marvins-flood-sensor@ttn/devices/eui-a84041aa518672c3/up
  - v3/marvins-flood-sensor@ttn/devices/#/up



MQTT Connection mqtt://eu1.cloud.thethings.network:8883/

Name: TTN

Validate certificate: ●

Encryption (tls): ●

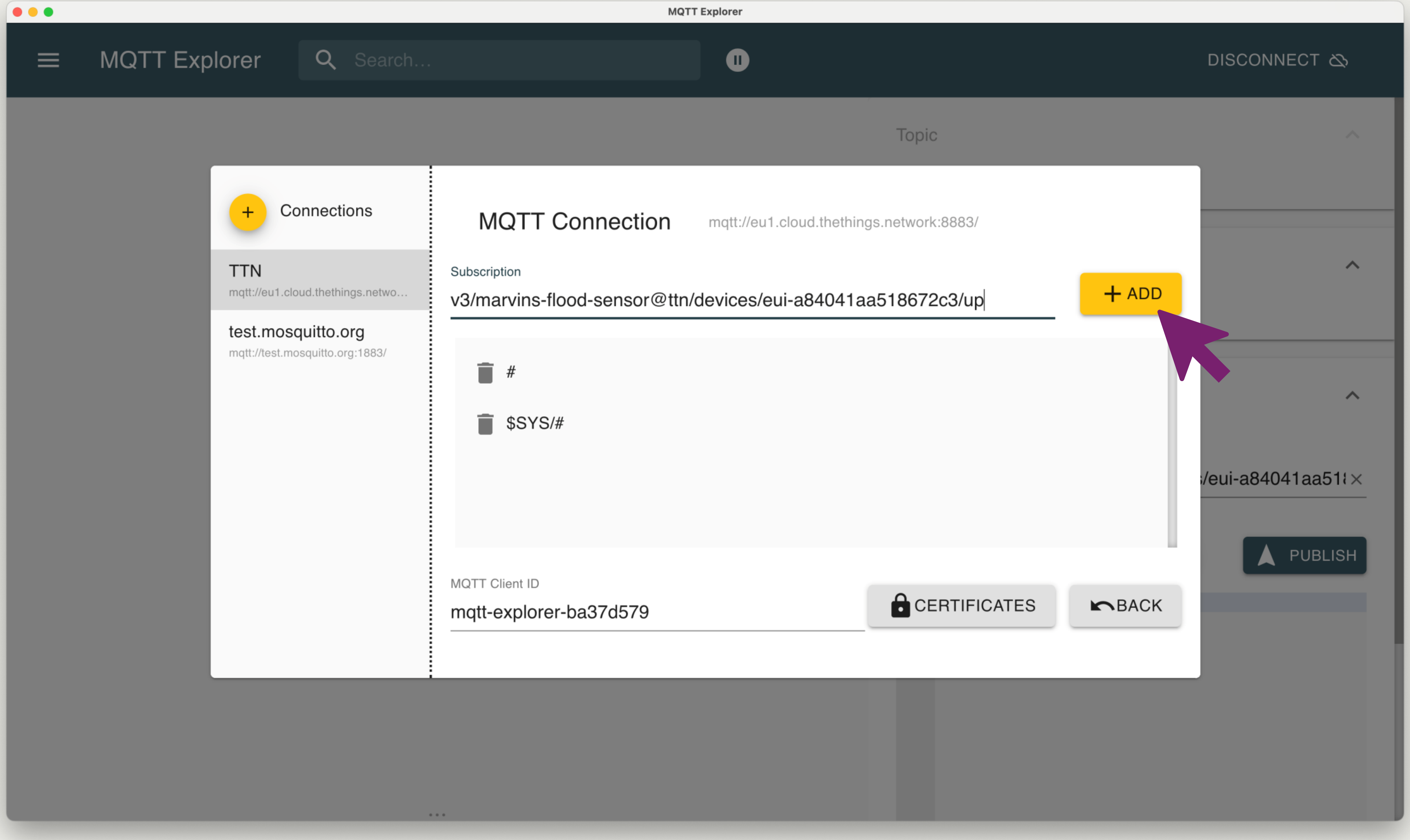
Protocol: mqtt://

Host: eu1.cloud.thethings.network

Port: 8883

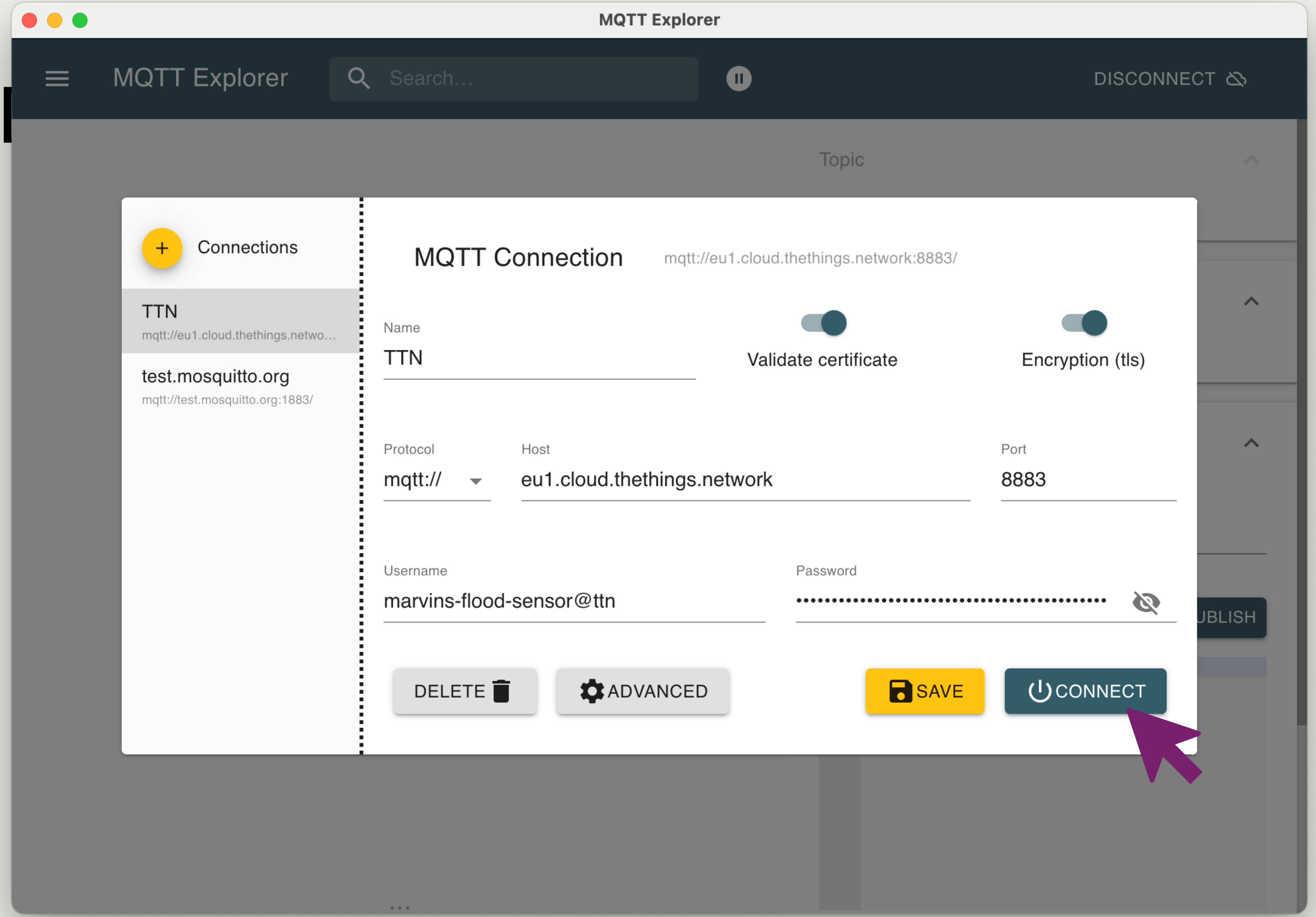
Username: marvins-flood-sensor@ttn

Password: ••



Subscription: v3/marvins-flood-sensor@ttn/devices/eui-a84041aa518672c3/up

MQTT Client ID: mqtt-explorer-ba37d579



MQTT Connection mqtt://eu1.cloud.thethings.network:8883/

Name: TTN

Validate certificate: on

Encryption (tls): on

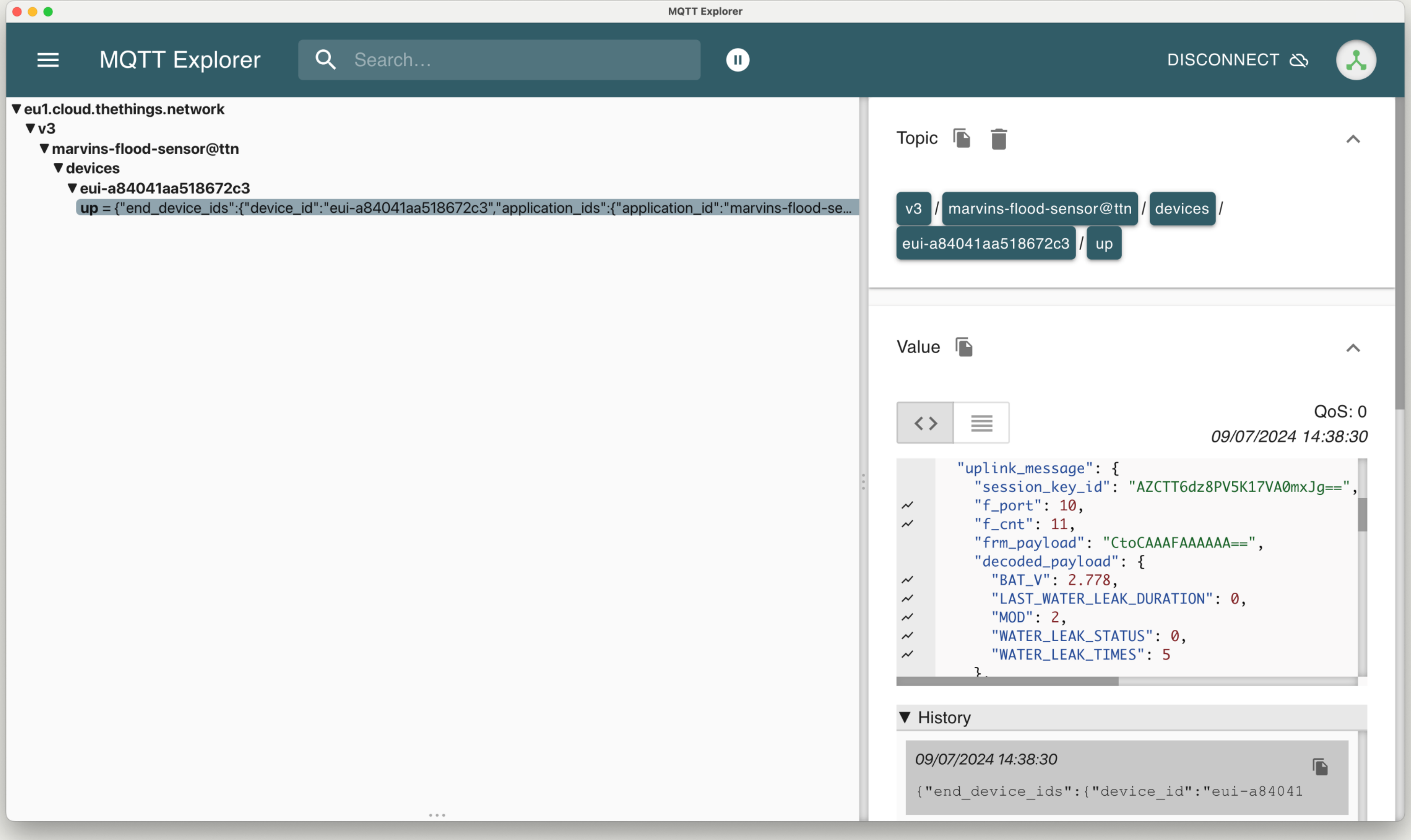
Protocol: mqtt://

Host: eu1.cloud.thethings.network

Port: 8883

Username: marvins-flood-sensor@ttn

Password: ••



▼ eu1.cloud.thethings.network
  ▼ v3
    ▼ marvins-flood-sensor@ttn
      ▼ devices
        ▼ eui-a84041aa518672c3
          up = {"end_device_ids":{"device_id":"eui-a84041aa518672c3","application_ids":{"application_id":"marvins-flood-se…

v3 / marvins-flood-sensor@ttn / devices / eui-a84041aa518672c3 / up

09/07/2024 14:38:30

```
  "uplink_message": {
    "session_key_id": "AZCTT6dz8PV5K17VA0mxJg==",
    "f_port": 10,
    "f_cnt": 11,
    "frm_payload": "CtoCAAAFAAAAAA==",
    "decoded_payload": {
      "BAT_V": 2.778,
      "LAST_WATER_LEAK_DURATION": 0,
      "MOD": 2,
      "WATER_LEAK_STATUS": 0,
      "WATER_LEAK_TIMES": 5
```

09/07/2024 14:38:30

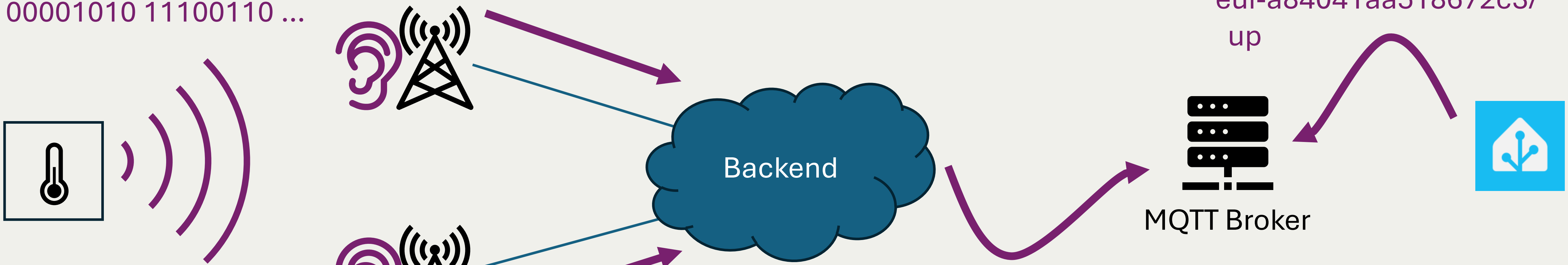
`{"end_device_ids":{"device_id":"eui-a84041`

Informationen über LoRaWAN Pakete

- Quelle des Datenpaketes
- Gateways
- Siehe Code Editor

Daten vom Sensor zu meinem Heim

Uplink
00001010 11100110 …

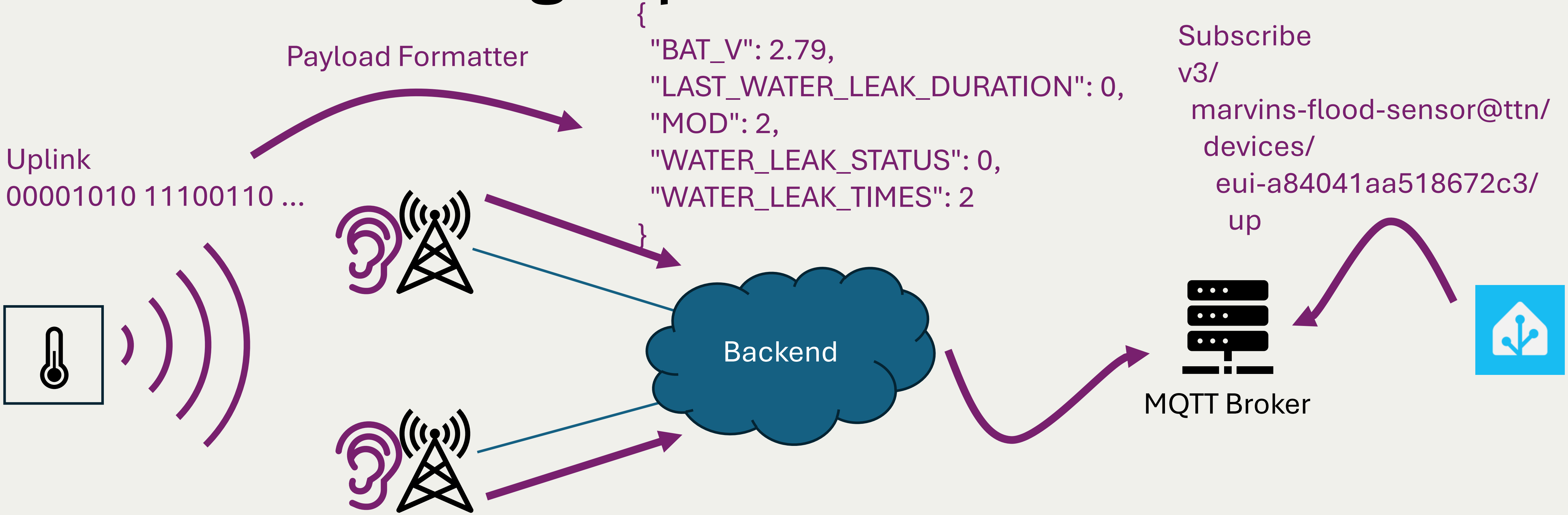


Subscribe
v3/
  marvins-flood-sensor@ttn/
    devices/
      eui-a84041aa518672c3/
        up

```
{
 "BAT_V": 2.79,
 "LAST_WATER_LEAK_DURATION": 0,
 "MOD": 2,
 "WATER_LEAK_STATUS": 0,
 "WATER_LEAK_TIMES": 2
}
```

Durchatmen …

Wiederholung: Uplink



Payload Formatter

```
{
  "BAT_V": 2.79,
  "LAST_WATER_LEAK_DURATION": 0,
  "MOD": 2,
  "WATER_LEAK_STATUS": 0,
  "WATER_LEAK_TIMES": 2
}
```

Subscribe
v3/
marvins-flood-sensor@ttn/
devices/
eui-a84041aa518672c3/
up

Uplink
00001010 11100110 ...

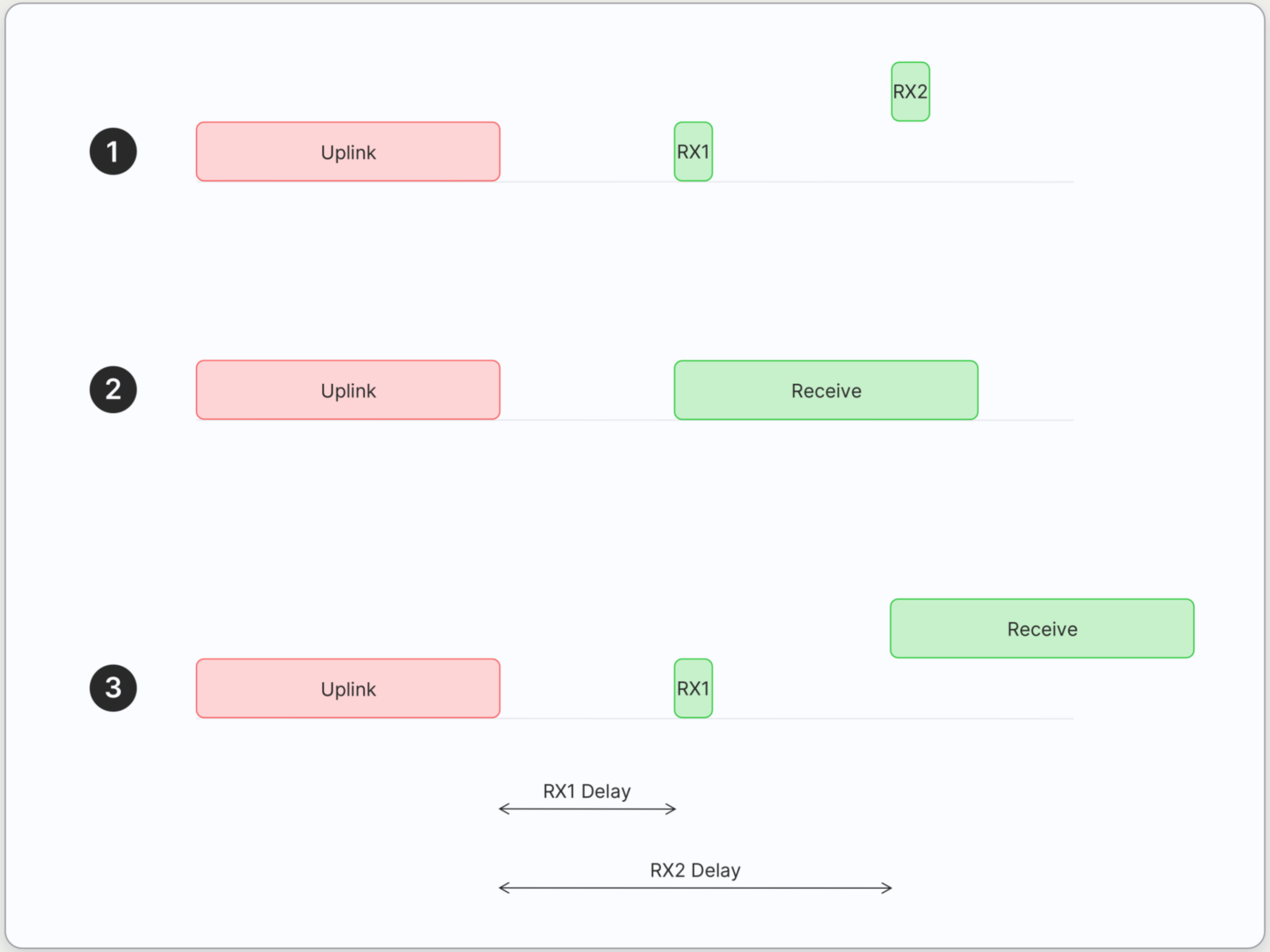
Backend

MQTT Broker

Und die Rückrichtung?

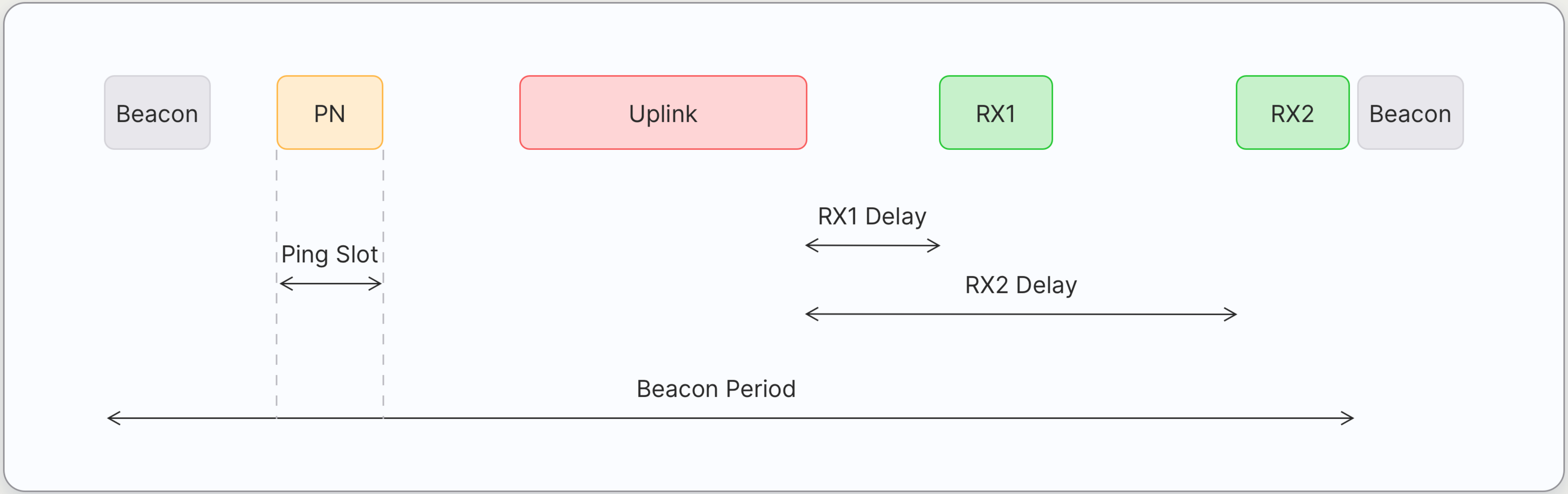
- Downlink
- Durchführung Abhängig von Geräteklasse
  - Class A
  - Class B
  - Class C

Class A



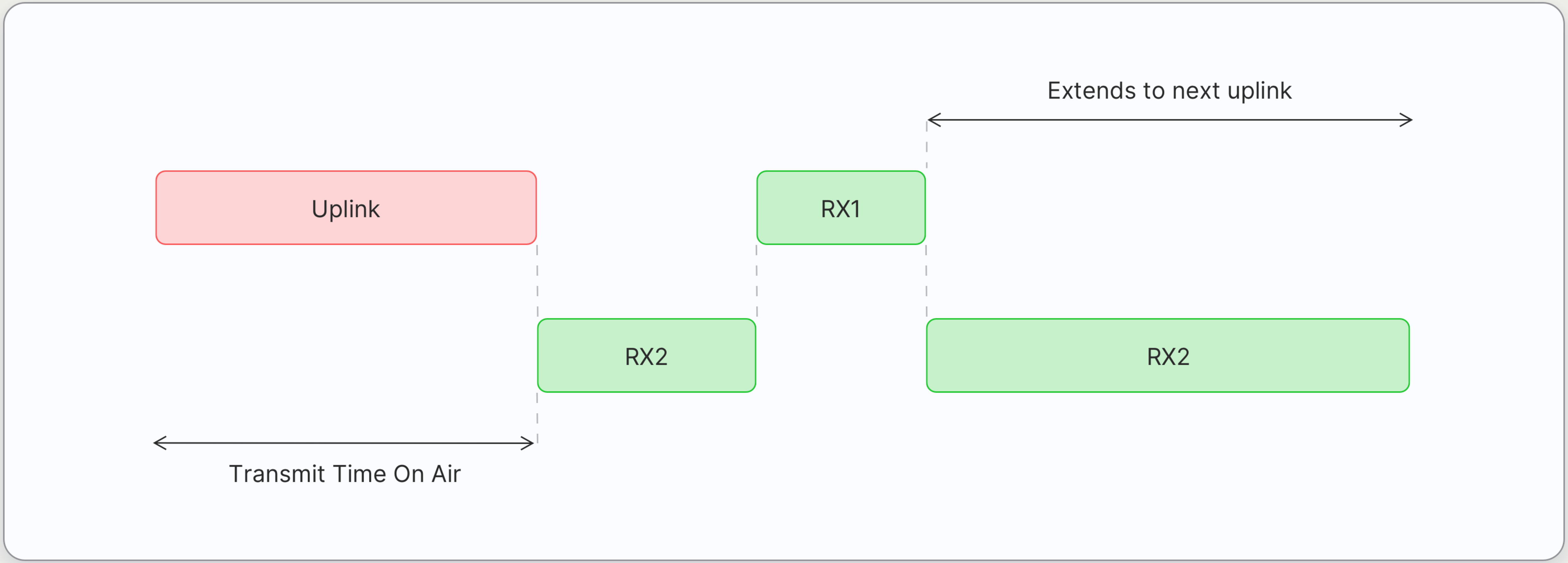
https://www.thethingsnetwork.org/docs/lorawan/classes/

Class B



https://www.thethingsnetwork.org/docs/lorawan/classes/

Class C



https://www.thethingsnetwork.org/docs/lorawan/classes/

Schedule Downlink

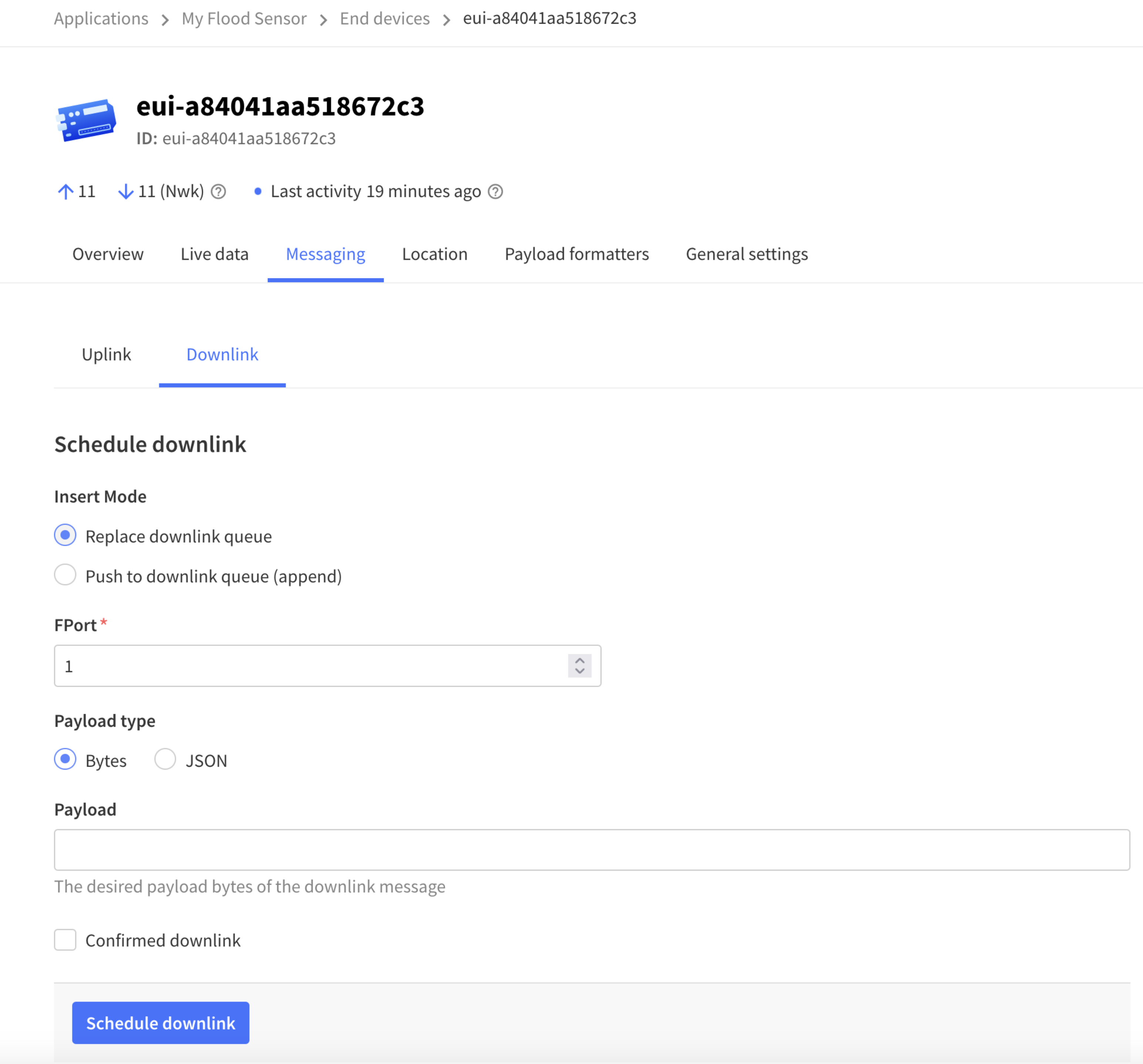
- Publish auf

  ```
  v3/app1@tenant1/devices/dev1/down/push
  ```

  mit

  ```
  {
    "downlinks": [{
      "f_port": 15,
      "frm_payload": "vu8=",
      "priority": "NORMAL”
    }]
  }
  ```

Sche



eui-a84041aa518672c3

ID: eui-a84041aa518672c3

Schedule downlink

Insert Mode

● Replace downlink queue

○ Push to downlink queue (append)

FPort *

1

Payload type

● Bytes ○ JSON

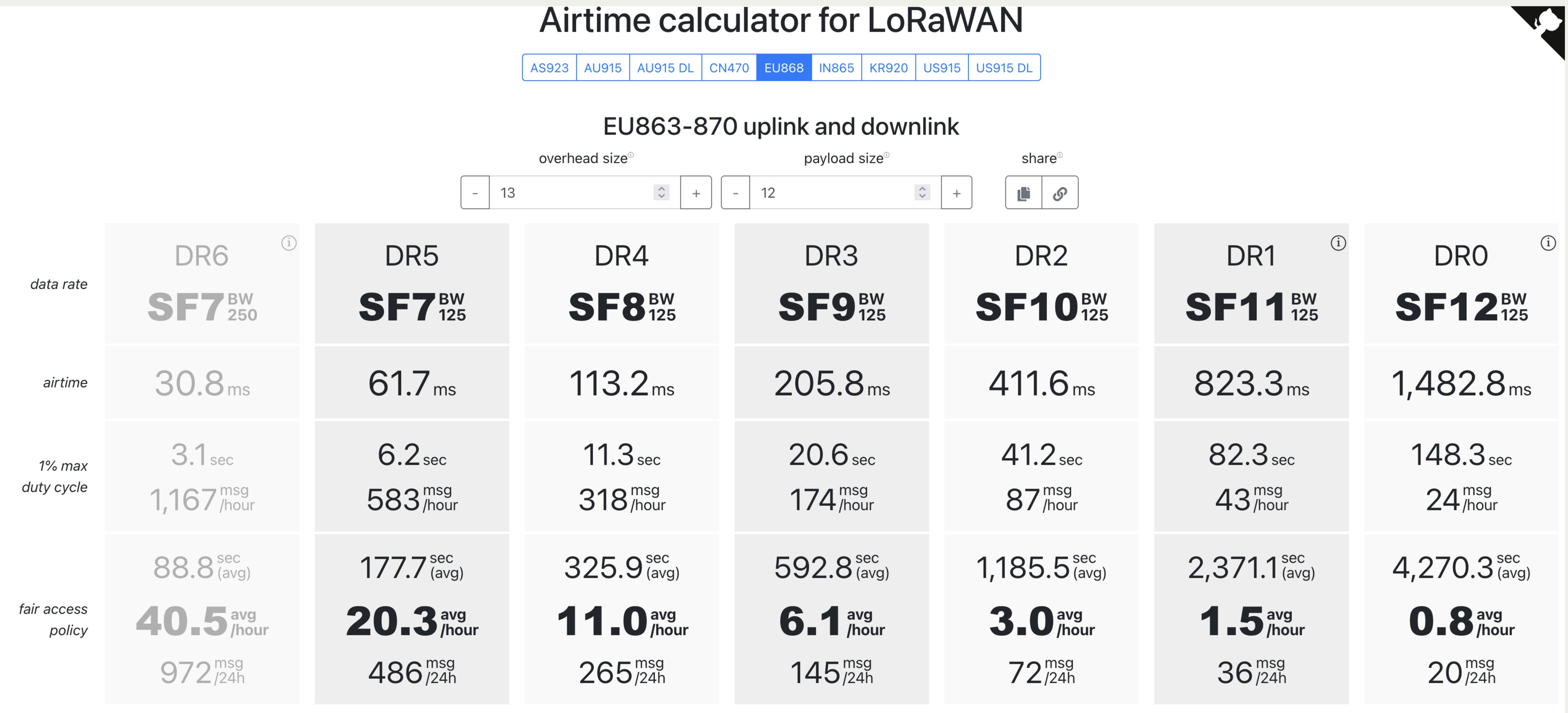
Payload

The desired payload bytes of the downlink message

☐ Confirmed downlink

Die Einschränkungen

- Datenrate: 0,3 – 22 kbit/s
- Duty Cycle
  - Grob: 1%
  - Genauer: https://www.thethingsnetwork.org/docs/lorawan/duty-cycle/#maximum-duty-cycle
- Fair Use Policy
  - Gilt für “The Things Stack Sandbox” i.e. kostenloses TTN
  - Für jedes Endgerät gilt:
    - Uplink Airtime 30s alle 24h
    - Max. 10 Downlink Nachrichten pro 24h



Airtime calculator for LoRaWAN

EU863-870 uplink and downlink

overhead size: 13

payload size: 12

	DR6	DR5	DR4	DR3	DR2	DR1	DR0
data rate	**SF7** BW 250	**SF7** BW 125	**SF8** BW 125	**SF9** BW 125	**SF10** BW 125	**SF11** BW 125	**SF12** BW 125
airtime	30.8 ms	61.7 ms	113.2 ms	205.8 ms	411.6 ms	823.3 ms	1,482.8 ms
1% max duty cycle	3.1 sec 1,167 msg /hour	6.2 sec 583 msg /hour	11.3 sec 318 msg /hour	20.6 sec 174 msg /hour	41.2 sec 87 msg /hour	82.3 sec 43 msg /hour	148.3 sec 24 msg /hour
fair access policy	88.8 sec (avg) **40.5** avg /hour 972 msg /24h	177.7 sec (avg) **20.3** avg /hour 486 msg /24h	325.9 sec (avg) **11.0** avg /hour 265 msg /24h	592.8 sec (avg) **6.1** avg /hour 145 msg /24h	1,185.5 sec (avg) **3.0** avg /hour 72 msg /24h	2,371.1 sec (avg) **1.5** avg /hour 36 msg /24h	4,270.3 sec (avg) **0.8** avg /hour 20 msg /24h

https://avbentem.github.io/airtime-calculator/ttn/eu868

Gateways

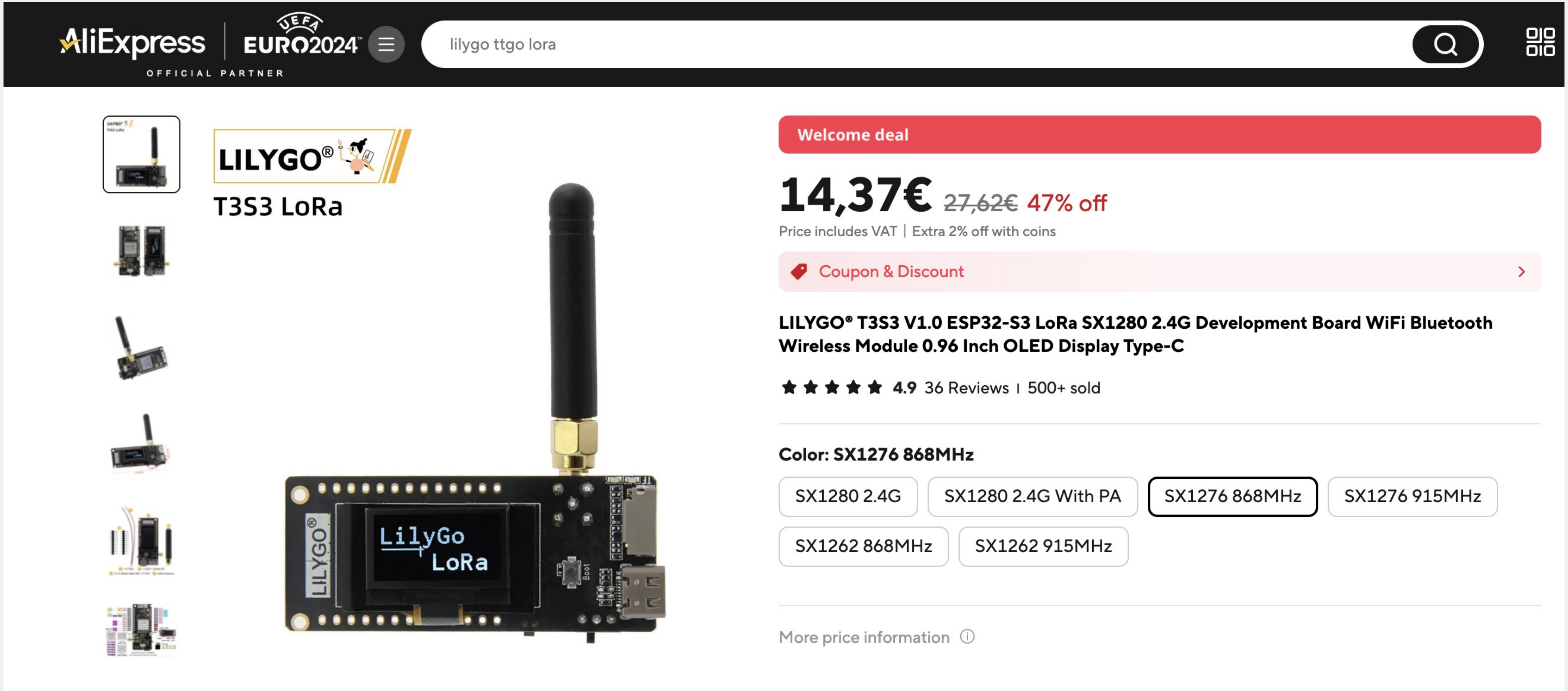
- Transceiver, die auf 8 bis 10 Kanälen mit SF7 bis SF12 gleichzeitig hören
- Selbst bauen vs. fertig kaufen

Eigenes LoRaWAN Gerät

- Empfehlung für den Einstieg:
    - https://github.com/mcci-catena/arduino-lmic
- Aufpassen bei der LoRa-Chip Wahl:
    - SX1262 nicht kompatibel
    - Mögliche Alternative https://github.com/ngraziano/LMICPP-Arduino
- Siehe “Overview of LoRaWAN Libraries [HowTo]”: https://www.thethingsnetwork.org/forum/t/overview-of-lorawan-libraries-howto/24692

- https://avbentem.github.io/airtime-calculator/ttn/eu868 ‼

Eigenes LoRaWAN Gerät



Welcome deal

14,37€ ~~27,62€~~ 47% off

Price includes VAT | Extra 2% off with coins

Coupon & Discount

LILYGO® T3S3 V1.0 ESP32-S3 LoRa SX1280 2.4G Development Board WiFi Bluetooth Wireless Module 0.96 Inch OLED Display Type-C

★★★★★ 4.9 36 Reviews | 500+ sold

Color: SX1276 868MHz

SX1280 2.4G | SX1280 2.4G With PA | SX1276 868MHz | SX1276 915MHz | SX1262 868MHz | SX1262 915MHz

More price information ⓘ

Reichweite

Extreme Beispiele:

- https://ttnmapper.org/devices/?device=eui-70b3d57ed0056493&startdate=2024-06-24&enddate=2024-06-30&gateways=on&lines=on&points=on
- https://ttnmapper.org/devices/?device=eui-70b3d57ed0056493&startdate=2024-05-07&enddate=2024-05-14&gateways=on&lines=on&points=on
- 201km: https://www.youtube.com/watch?v=adhWIo-7gr4
    - SF12

Hilfreiche Links

- Große Auswahl an fertigen LoRaWAN Endgeräten und Gateways: https://iot-shop.de/
- Eigenes LoRaWAN inkl. eigene Gateway Hardware: https://www.chirpstack.io/
- Beispiel LoRa-LoRa Kommunikation (ohne LoRaWAN): https://git.hack-hro.de/oyla/heltec-lora-radiohead-communication-minimal-example