Instruction manual

Ranos dB 1 / Ranos dB 2

For firmware version 3.2.0 or higher

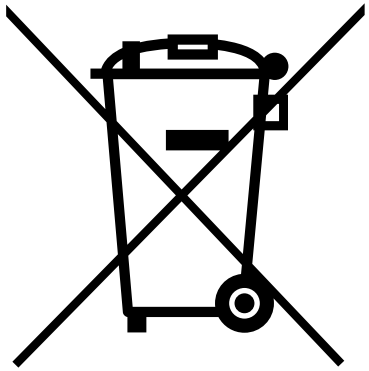
DSS
Dutch Sensor Systems

version 20221007

To all residents of the European Union Important environmental information about this product

This symbol on the device or the package indicates that disposal of the device after its lifecycle could harm the environment. Do not dispose of the unit (or batteries) as unsorted municipal waste; it should be taken to a specialized company for recycling. This device should be returned to your distributor or to a local recycling service. Respect the local environmental rules.

If in doubt, contact your local waste disposal authorities.



Thank you for choosing Dutch Sensor Systems. Please read the manual thoroughly before bringing this device into service. If the device was damaged in transit, do not install or use it and contact your dealer.

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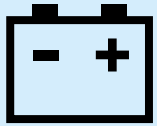
Safety Instructions

This device is not suited for children under the age of 16, and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning the use of the device in a safe way and understand the hazards involved. Children shall not play with the device. Cleaning and user maintenance shall not be made by children without supervision.



Batteries are electrochemically live at all times. Do not short circuit the battery terminals. Inspect the battery consignment for signs of transport damage. Ensure the consignment has all items listed on the delivery note or invoice, i.e. batteries, cables, shrouds etc. While unpacking each battery, take care not to drop anything on the terminals. Inspect each battery for physical damage such as cracks or distortion of the case and terminals.

General Guidelines

- Familiarise yourself with the functions of the device before actually using it.
- All modifications of the device are forbidden for safety reasons. Damage caused by user modifications to the device is not covered by the warranty.
- Only use the device for its intended purpose. Using the device in an unauthorised way will void the warranty.
- Damage caused by disregard of certain guidelines in this manual is not covered by the warranty and the dealer will not accept responsibility for any ensuing defects or problems.
- Neither Dutch Sensor Systems B.V. nor its dealers can be held responsible for any damage (extraordinary, incidental or indirect) – of any nature (financial, physical...) arising from the possession, use or failure of this product.
- Due to constant product improvements, the actual product appearance might differ from the shown images.
- Product images are for illustrative purposes only.
- Keep this manual for future reference.

Precautions

- Do not use screws of any other type or length from what is supplied.
- Install all rubber caps or connectors during outdoor use. All parts are rated IP67 or better, but only when mated to a connector or cap.
- Turn off the Ranos dB before storage.
- When storing the Ranos dB for a longer period of time, make sure the battery is fully charged and check the battery charge once every month.
- When disconnecting cables, always grasp the plug and do not pull the cable.
- When transporting the Ranos dB, especially with the battery installed, use an appropriate case or packaging.
- Do not clean the Ranos dB using solvents or chemicals.
- Take care that no electrically conductive objects are left inside of the Ranos dB.
- Dispose of the unit and of batteries only according to national and local regulations at the place of use.

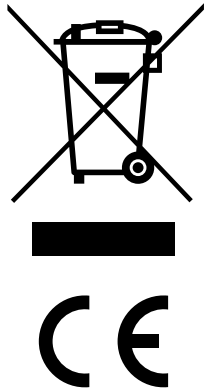
About this manual

- The instructions in this manual apply to the Dutch Sensor Systems Ranos dB 1 and Ranos dB 2 sound level meters with firmware 3.2.0 or higher.

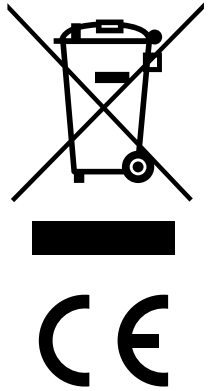
- The user manual, calibration manuals and additional information can be downloaded from the support section at: iotsoundsensor.com

Marking
Examples of CE Marking - Ranos dB

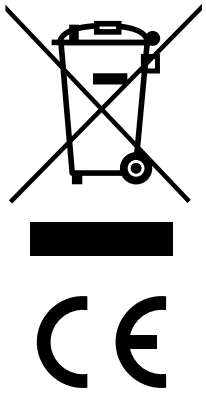
Model	Ranos dB 1 - V3.0.3
Serial no	123456
Applicable standard	Measurement accuracy according to IEC 61672-1:2014 en, performance class 1
Power rating	5VDC, 60mA max.
IP rating	IP67
Frequency range	LoRa 863-870MHz GNSS 1571-1606MHz
Manufacturer	Dutch Sensor Systems B.V. - Antennestraat 66, Almere, NL



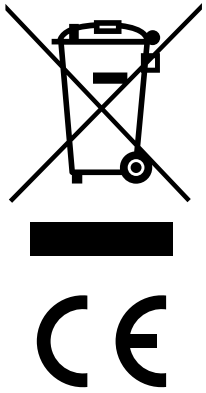
Model	Ranos dB 2 - V3.0.3
Serial no	123456
Applicable standard	Measurement accuracy according to IEC 61672-1:2014 en, performance class 2
Power rating	5VDC, 60mA max.
IP rating	IP67
Frequency range	LoRa 863-870MHz GNSS 1571-1606MHz
Manufacturer	Dutch Sensor Systems B.V. - Antennestraat 66, Almere, NL



Model	Ranos dB 1 - V3.0.3
Serial no	123456
Applicable standard	Measurement accuracy to IEC 61672-1:2014 en, performance class 1
Power rating	5VDC, 60mA max.
IP rating	IP67
Frequency range	LoRa 902-928MHz GNSS 1571-1606MHz
Manufacturer	Dutch Sensor Systems B.V. - Antennestraat 66, Almere, NL



Model	Ranos dB 2 - V3.0.3
Serial no	123456
Applicable standard	Measurement accuracy to IEC 61672-1:2014 en, performance class 2
Power rating	5VDC, 60mA max.
IP rating	IP67
Frequency range	LoRa 902-928MHz GNSS 1571-1606MHz
Manufacturer	Dutch Sensor Systems B.V. - Antennestraat 66, Almere, NL



General description
Discover the Ranos dB

The Ranos product range consists of two high accuracy, wireless outdoor sound level meters and cloud applications suitable for permanent and temporary installation anywhere around the world - without a wired power or data connection.

We supply the Ranos dB in a class 1 and a class 2 measurement accuracy version. The Ranos dB is powered by solar energy, works fully autonomously and has LoRa connectivity. This is why you can use this state-of-the-art device anywhere in the world. The housing is made of recyclable ABS material and is completely waterproof.

We offer a user friendly configuration app and a dashboard for device management, data collection and data visualization.

Highlights

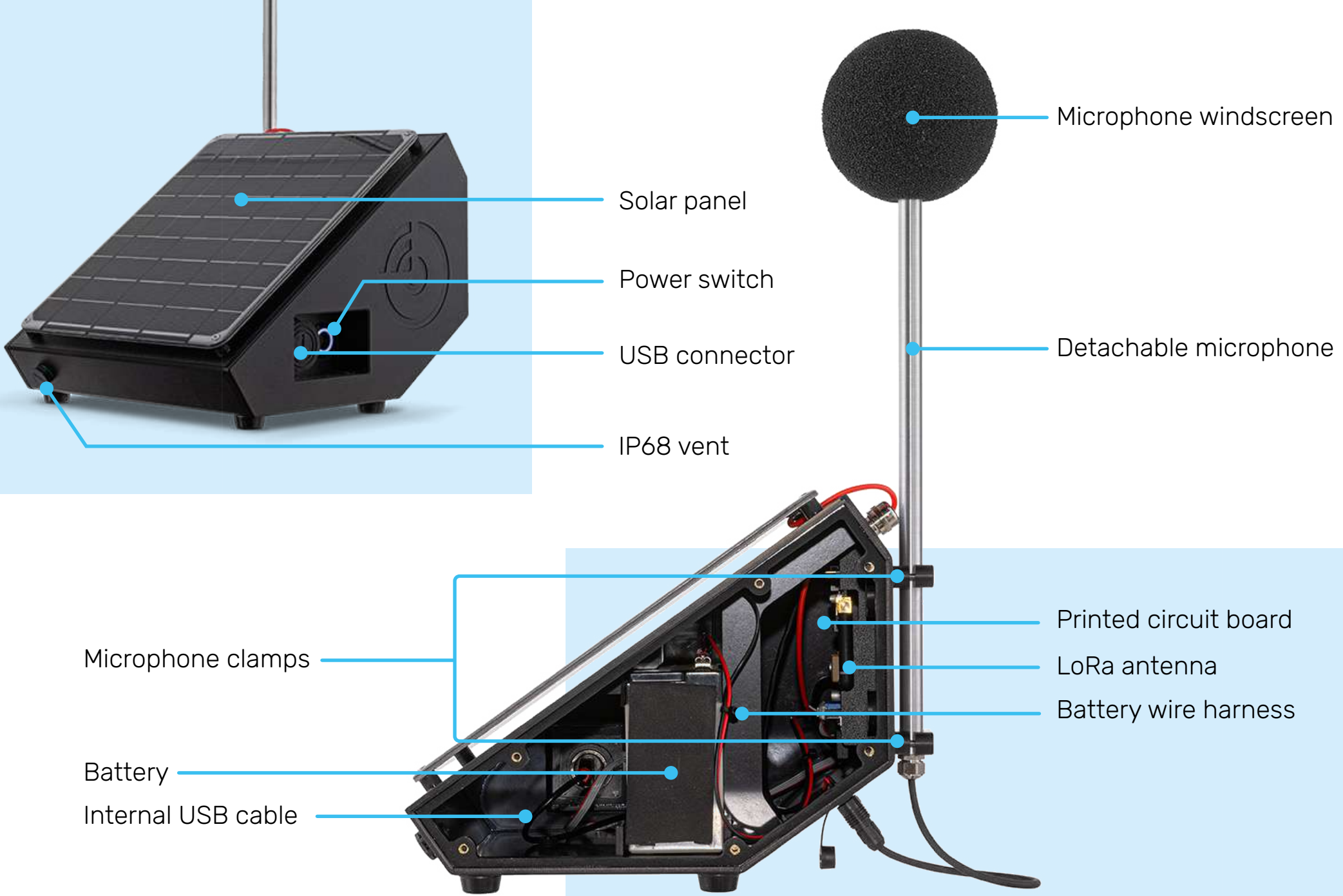
- High accuracy.
- 24/7/365 sound monitoring.
- 100% wireless.
- Useable all over the world.
- Environmentally friendly (zero emission, recyclable).
- Very low maintenance.
- Cloud applications.

Key features

- Measurement accuracy according to IEC 61672-1:2014 class 1 (dB 1) or class 2 (dB 2), validated by an accredited lab using IEC 61672-3:2013 test procedures.
- Linear dynamic range of 43-120 dB(A) or 40-120 dB(A) according to class 1 and class 2 tolerances respectively.
- Detachable free field electret condenser microphone. Extension mounts and cables are available.
- Configurable and continuous sound level measurements.
- Synchronization of multiple sound level meters.
- Solar powered
- LoRaWAN™ (Class B, EU868, US915, AS923).
- GPS location and time.
- Pole mount, wall mount or place it on a surface.
- Weatherproof (UV resistant, IP67).
- CE mark.
- Connect App (registration, settings, testing).
- Dashboard (device/project/user management, data collection).

Use cases

- Monitoring of noise pollution in nature reserves.
- Asset monitoring by anomaly detection.
- Smart cities.
- Traffic noise monitoring.
- Construction noise monitoring.
- Music venues.
- Festivals.
- Live event rental companies.
- Working environment monitoring.
- Noise complaint verification.
- Occupancy sensing.


Solar panel
Power switch
USB connector
IP68 vent
Microphone windscreen
Detachable microphone
Printed circuit board
LoRa antenna
Battery wire harness
Microphone clamps
Battery
Internal USB cable

High accuracy
The Ranos dB 1 and Ranos dB 2 measurement accuracy is according to IEC 61672-1:2014 class 1 and class 2 respectively, with a linear dynamic range of 43-120 dB(A) with class 1 tolerances and 40-120 dB(A) with class 2 tolerances. This means that all measurement specifications and/or features that are required by the standard are present. The performance has been validated by an accredited lab using IEC 61672-3:2013 testing procedures. A standard sound calibrator according to IEC 60942 can be used for periodical field calibration. The measurements and calculations run continuously (at a bit depth of 24 bit and a sample rate of 48 kHz), this is necessary for accurate time-averaged continuous sound level measurements and for minimum/maximum sound level measurements. There are no physical differences between the Ranos dB 1 and Ranos dB 2, the only difference is that the dB 1's microphone is factory calibrated and corrected individually using a 200 coefficient FIR filter.

Microphone
The Ranos dB microphones are developed, manufactured and tested in house for optimal performance as part of the product.
The microphones are based on an ECM (Electret Condenser Microphone) element. They are robust, relatively low cost, waterproof (IP67) and have a free field sound field property.
Additionally, the microphones are detachable for transport and for separate mounting. Optional mounting hardware and cables for separate mounting are available.

Wireless
The Ranos products use the LoRa / LoRaWAN radio communication platform and support the EU868, US915 and AS923 frequency plans.
It supports Class B networks, allowing the cloud server to send direct messages to the Ranos dB.
LoRa's low power consumption and long range enables use in remote locations. The available bandwidth is low, but more than enough for the majority of applications.
Additionally, there are several other advantages such as: No or low data subscription cost. No Sim-cards are needed. Several network options are available (public, commercial or set up your own).

GPS
The GPS provides an accurate source of time and location. The location can be included with the payload so it can tell you where it is. This is useful in cases where there are lots of Ranos', or where the Ranos' are constantly moving. No need to pin each Ranos on the map manually.
At every new GPS fix, the internal RTC (Real Time Clock) is re-synchronized to the GPS time. This is an important aspect as the timestamp(s) included with each payload needs to be accurate for the data to be useful in comparisons or in time dependent applications. The accurate internal time allows us to implement a time synchronization feature, which synchronizes the sampling and transmission times of multiple Ranos'.
The GPS only turns on for a short

moment at each (configurable) time interval passing, and the GPS is kept in standby for the rest of the time to reduce power consumption.

Measurements
Lots of measurements consisting of the standard IEC 61672-1:2014 time and frequency weightings are available. The following measurements are available via wireless LoRa communication: LAfast, LAslow, LCfast, LCslow, LAeq, LCeq, LAmax, Lamin, LCmax, LCmin. Detailed information can be found in the instruction manual. The time period over which the minimum, maximum and time-averaged continuous sound level measurements (LAeq, LCeq) are calculated is configurable. One, more or all measurements can be configured to be used simultaneously.

Power
The Ranos dB does not need an external power source, it can run off of the integrated battery and solar panel continuously. Please note that this is not true for all locations. The solar irradiation might not be sufficient the whole year around in the more northern and southern parts of the world. We provide the necessary calculations and information in our instruction manual. A generic type SLA (Sealed Lead Acid) battery is used for its wide charge and discharge operating temperature range. SLA is one of the very few technologies that can be charged in sub zero temperatures.

Weatherproof
All the Ranos dB's external parts are rated IP67 or better, they are UV resistant and can withstand an operating temperature range of at least -10 to +50 degrees Celsius. Rain is enough to clean off the solar panel in most cases. Manual cleaning might be needed in cases where it is very dusty, or where there is snow for longer periods of time. A special vent membrane that does not let through moisture, but does let through gasses is used to make sure the air volume inside of the housing can expand and contract due to varying weather conditions throughout the day.

Mounting
Three convenient mounting options are available: pole mount, wall mount, or it can be set on top of a surface. All-round, pole mounting is the best mounting solution. It interferes the least with the measurements acoustically. The necessary components for pole mounting are supplied with the Ranos dB as standard. Optionally the Ranos dB can be wall mounted, a wall mounting bracket is available. To reduce the acoustic influence of a wall or a large diameter pole, the microphone can be mounted at a distance from the object using an optional microphone extension arm and cables. Several arm and cable lengths are available. Lastly it is also possible to set the Ranos dB on top of a surface. Rubber stick-on feet are provided as standard to prevent damage to the bottom of the Ranos dB.

Software

We provide a complete software package for everything from device registration to data collection and visualization. All software is developed to be user friendly and intuitive. No coding or other software knowledge is necessary. The Connect App is available for Windows and Android and needs a wired USB connection with the Ranos. It is used for device registration, configuration, testing and calibration. Additionally, it can be used for true real time monitoring. Connect Dashboard is available for any OS with a modern web browser. It is used for device management, project management, user management, data collection, data visualization and more. Once a device has been registered using the Connect App and your account, the devices will automatically be made available to that account in the Connect Dashboard. Connect Dashboard is ready for use with TTN, Helium, KPN and more to come. For those who want to use their own software or dashboard, we provide payload information and a working (online) example payload parser.

Description of measurement quantities

Measurement quantity notations are composed of the following abbreviations:

L	Sound pressure level, F fast) or S (slow) time weighting
L*eq	Equivalent continuous sound level
Lmin**	Minimum sound level
Lmax**	Maximum sound level
L*peak	Peak sound level

A	A frequency weighted sound (pressure) level
C	C frequency weighted sound (pressure) level
Z	Z frequency weighted sound (pressure) level
F	Fast time weighting
S	Slow time weighting

The * is replaced by a frequency and/or time weighting

Power

Power source
The Ranos dB 1 and Ranos dB are powered from a 6VDC rechargeable sealed lead acid battery. At reference environmental conditions (most importantly around 20 degrees Celsius), the battery capacity is sufficient for two weeks of continuous operation from a fully charged state, without any additional solar charging. This is to be able to bridge multiple subsequent days of bad weather.

Power on/off
When the switch inside of the recess on the side of the Ranos dB is pressed in, the Ranos dB is powered on. Within a few seconds after pressing in the switch, the LED ring around the switch will turn on continuously once for a few seconds to indicate it has been powered on.

Charging
The battery is automatically charged when the solar panel of the Ranos dB is exposed to sunlight. The Ranos dB continues charging from solar energy while it is not powered on, it is protected from overcharging and short circuit.

Checking power status
When powered on and when no LoRa keys have been set, the LED ring around the power switch will blink on and off continuously with a rate of roughly 2 blinks per second. If a LoRa key has been set, the LED ring around the power switch will blink once at every LoRa up and down-link, when there are errors there will be a pattern of blinks depending on the type of error.

In a situation where a LoRa key has been set, where no errors are present, and where a long LoRa transmission interval has been set, the Ranos dB might not show any indications of power status in or around the Ranos dB for a long period of time. In this case it is advised to press out and in the power switch to confirm power status from the initial power on LED indication. Alternatively, when the measurement routine cannot be interrupted, the power status and battery voltage can be checked via USB using the DSS Connect App, refer to the Connect App section for checking power status using this method.

Installing or replacing the battery
A Yuasa NP12-6 sealed lead acid battery, or one of a different make and model, but with the same specifications is recommended:

- SLA type (sealed lead acid)
- 6VDC nominal voltage, 6,825VDC float charge voltage
- 12Ah nominal capacity or larger
- 6,35x 0,8 mm male quick disconnect tabs
- Atleast -10 to + 50 degrees Celsius operating temperature (charge and discharge).
- Battery size of 151 x 50 x 94 mm (quick disconnect tab height excluded), male quick disconnect tabs positioned on top of the battery along one of the long sides.

An empty, flat and horizontal working area of at least 50x50cm is advised for performing the following steps.

Lid and battery removal:
(in case of replacing the battery):

1. Remove the housing lid by removing the six screws on the side of the housing using a Philips 2 screwdiver.
2. Pull the battery out of the housing, make sure the battery wires are not caught on anything or pinched while doing so. Set the battery down right next to the Ranos dB once it is completely out of its compartment to prevent pulling force from being exerted on the battery wire harness.
3. Carefully slide the Faston connector off of the battery terminals by pulling and wiggling on the red insulation part of the connectors. Long nose pliers can be used if more gripping force is needed. Never pull on the wires, use careful control of force while pulling on the connector to prevent yourself from pulling on the wires when the connector comes off.

Battery and lid installation:

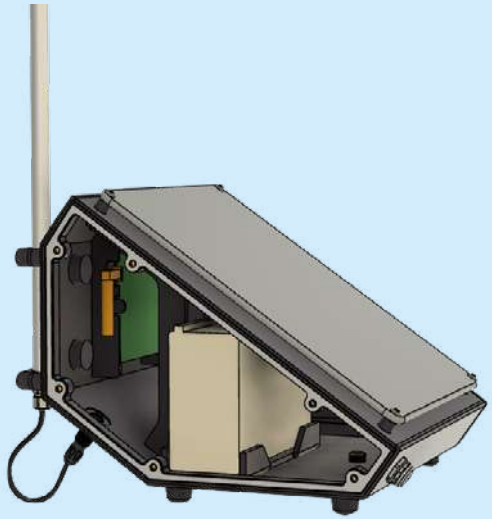
4. For use cases where the Ranos dB will be moved or transported with the battery installed, it is advised to fill the play between the battery and battery compartment walls. Stick the supplied foam pieces to the battery:
   - Bottom: 45x140x2mm.
   - Long side: 70x140x2mm.
   - Short side: 45x80x12mm.
5. Set the new battery down next to the Ranos dB, aligned with the battery compartment. When looking into the opening of the housing, the battery faston flat tabs should be to the left in order for them to clear the internal reinforcement bulkheads when sliding in the battery.
6. Inside of the Ranos dB there is one unconnected cable harness with female Faston connectors. Slide the Faston connector of the black wire onto the black or - terminal

of the battery, and slide the Faston terminal of the red wire onto the red or + terminal of the battery.

7. Slide the battery into the battery compartment, ensure the wires do not get caught on anything, pinched between anything and make sure no pulling force is exerted.

8. Position the cover over the opening in such a way that the screw holes are lined up, and make sure the cover closes all the way along the edges without gaps. The housing edge along the opening should fall into the grooves machined into the inside of the cover. It might be necessary to put some pressure on the lid before it snaps into place. Lay the sensor on its side before doing so.

9. Mount the lid with the six supplied M4x12 screws. The screws must be tightened with a force of 1Nm. Do not overtighten or use screws longer than 12mm to prevent damage to the housing.



Battery replacement interval
In critical applications it is recommended to preventively replace the battery once a year. This is due to the difficult to predict combination of environmental effects and a varying average solar irradiance per region and month. In less critical applications once every 2 years is sufficient. In an ideal situation, where it is constantly around 20 degrees Celsius and where the battery is always at 95%> charge, the battery would be able to last 3 to 5 years.

When the battery charge had been drained too far, the Ranos dB will automatically shut down when the battery voltage is too low, and once the battery has charged up enough it will also automatically start up again.

Battery health
To keep the battery health optimal, the following is advised:

- The Ranos dB should not be stored with a discharged battery, charge to at least 6,2VDC before putting the Ranos in storage.
- Check the battery voltage every month when storing for a longer period of time.
- In normal operation, make sure the battery is as full as possible, as much of the time as possible by optimizing placement.

Estimating if solar irradiation is sufficient

We advise to check the energy production for your region using an online tool and our energy specifications.

- Visit the following link: https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html
- Select the “OFF-GRID” tab.
- Select your location on the map.
- Fill in the following specifications: Solar radiation database: PVGIS-CMSAF

- Installed peak PV power [Wp]: 9,2
- Battery capacity [Wh]: 72
- Discharge cutoff limit [%]: 40%
- Consumption per day [Wh]: 4,08
- Slope [°]: 35
- Azimuth [°]: 0

- Click visualizer results and view the results.
- The solar panel should be pointed to the south, the effect of an offset angle relative to the south can be viewed by varying azimuth.
- The solar panel is mounted to the Ranos dB housing at an angle of 35 degrees.
- The light blue bars in the “PV output” graph show the average of the energy not captured because the battery became full.
- Under Simulation outputs “Percentage days with full battery [%]:” indicates how much of the time the battery was 100% full. The higher this percentage, the longer the battery will last.

Microphone
Two microphone models are available, the MMDB1 and MMDB2. The two models are exactly the same and both are selected for a free-field frequency response as close as possible to flat. The difference is in that the MMDB1 comes with a pre-configured frequency response correction for a frequency response within class 1 tolerance. The MMDB2 is within class 2 frequency response tolerance.

Installing the microphone

- Mount the microphone to the back of the Ranos dB using the two supplied clamp parts and four M4x16 screws. Before completely tightening the screws, slide up the microphone until the microphone cable gland meets the bottom side of the bottom microphone clamp. For effective clamping, the clamping parts should be roughly perpendicular to each other. The screws must be tightened with a force of 1Nm. Do not overtighten or use screws longer than 16mm to prevent damage to the housing.

- Connect the microphone cable to the microphone connector located below the microphone mount. Line up the white arrows and press until a click is heard. To disconnect the microphone, pull back on the microphone connector sleeve.

Windscreen
When making measurements in windy environments, wind noise will cause measurement errors. Such effects can be reduced by using the windscreen, WS1. WS1 is suitable for long term outdoor use. The effect of the windscreen on the microphone frequency response is negligible. The windscreen is simply slid over the microphone.

Dummy microphone
Dummy microphone DM1 can be connected in place of the microphone to enable injection of electrical signals for testing. Signal can be input to the dummy microphone via standard BNC. The input is AC coupled and the output of the dummy microphone loads the input of the Ranos dB with a 2k Ohm resistance. There is no load inductance or capacitance. The microphone is internally buffered, the buffer parasitic capacitance and inductance is smaller than that of the connection cables. No additional termination is needed. The dummy microphone effect on the frequency response of the microphone input is negligible.

Switch recess cover
A cover for the connector/switch recess is supplied as extra protection and for visual reasons. The cover can simply be pressed into the recess. Make sure to press the rubber cap of the USB connector into the connector before pressing the recess cover in.

Rubber feet
To prevent damage to the bottom of the sensor when standing on top of a surface, stick on rubber feet are supplied. Stick the rubber feet to the 4 bottom corners of the sensor.

Pole mount
The Ranos dB can be mounted to a pole with a diameter of 40 to 120mm.

Installing the pole mount

1. Mount the two brackets to the back of the Ranos dB using the supplied M8x16 screws and the M8 rings. A Philips 3 screwdriver is needed. The screws must be tightened with a force of 3Nm. Do not overtighten or use screws longer than 16mm to prevent damage to the housing.

2. Loosen the pole clamps until they open up and insert them through the brackets.

3. Wrap the clamps around the around the pole and back into the other ends of the pole clamps.

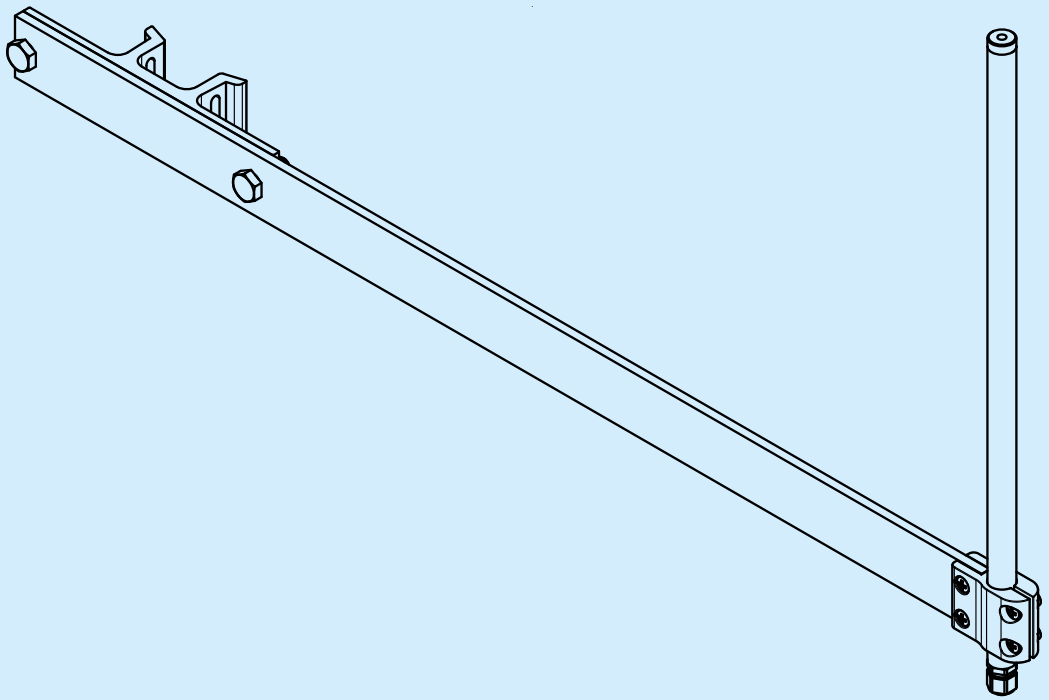
4. Tighten the pole clamps until the clamps stop sliding when lightly pushing/pulling the sensor housing sideways/up and down. The clamps can damage the paint of a pole when mounted directly to it. To prevent damage use a tough plastic or rubber mat between the pole and clamps.

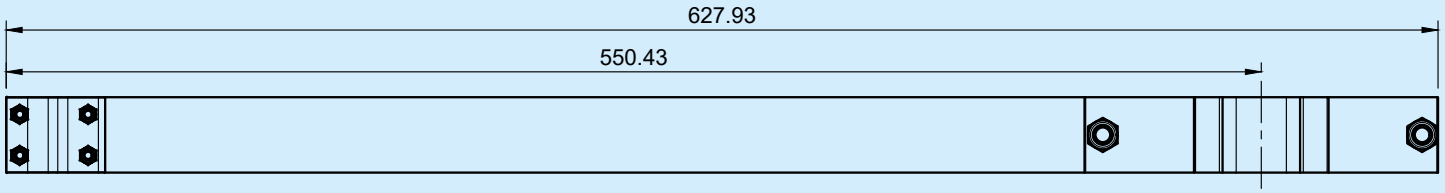
Microphone extension mount (optional)

The microphone extension mount (MEM1 and MEM2) allows the MMDB1 and MMDB2 microphones to be mounted extended from a pole. This can be done to reduce the effects of reflections and diffraction from the housing and/or a pole. A microphone extension cable is needed when using a microphone extension mount.

Two lengths of extension mounts are available:

- Microphone extension mount 0,6m (MEM1)
- Microphone extension mount 1m (MEM2)





Microphone extension mount installation:

1. Install the pole mounting bracket to the extension arm using the two supplied M8x20 screws, rings and nuts. Orientation does not matter, as the mount is symmetrical.

2. Install the microphone clamp to the extension arm using the two of the four M4x12 screws and nuts and a Philips 2 screwdriver.

3. Insert the screw and nut for the microphone clamping part and turn the screw a few times just to keep them in place.

4. Insert the microphone diaphragm side first through the bottom of the microphone clamp, in such a way that the microphone will point up. Slide the microphone trough until it stops against the cable gland of the microphone.

5. Tighten the microphone clamp screws until the microphone is secured firmly.

6. Loosen the pole clamp until it opens and insert it through the pole mount bracket.

7. Wrap the clamp around the around the pole and back into the other end of the pole clamp.

Microphone extension cables (optional)
A microphone extension cable can be used for specific use cases or for testing and calibration. The extension cable can be connected between the microphone output connector and the Ranos dB microphone input connector on the housing. The microphone extension cables can be used with the microphone extension mount.

The Ranos dB does not have to be powered down while installing the extension cable. However, high minimum and maximum values will be displayed at the moment of (dis) connection. An overload and/or under range flag might appear too.

Three lengths of extension cables are available:
- Microphone extension cable 1,5m (MEC015)
- Microphone extension cable 3m (MEC030)
- Microphone extension cable 5m (MEC050)

Wallmount (optional)
The wallmount (WM1) can be used to mount the Ranos dB to a wall. When using the wall mount, it is advised to mount the microphone separately, as described in the section “Mounting options and measurement accuracy”. If the Ranos dB is mounted to a wall with the microphone in standard configuration, mounted to the back of the Ranos dB, the overall measured SPL will increase and so called “comb filtering” effects will appear.

The wall mount consist of a part that is mounted to a wall, and another part that is mounted to the Ranos dB. The Ranos dB can be hung into the wall part and the two are locked together using a single M4 screw.

Installing the wall mount:

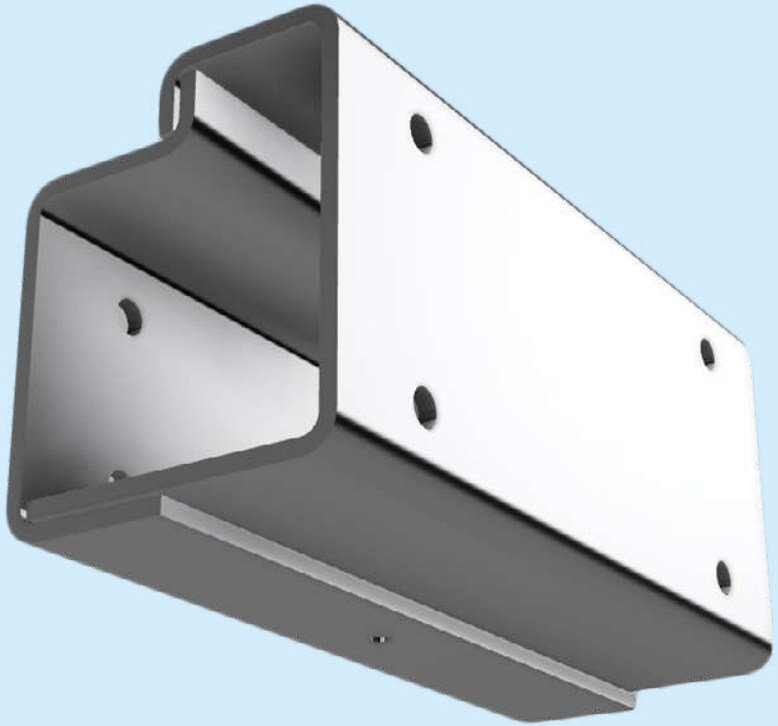
1. Mount the wall mount part (with 4 mounting holes) to the rear of the Ranos dB using the M8x16 screws and M8 rings that were supplied with the pole mounting kit, using a Philips 3 screwdriver. The bracket should be oriented in such a way that the tapped M4 screw hole is at the bottom.

2. Mount the other half of the wall mount to the wall or a surface using the screws from the screw kit, or supply your own.

3. Hang the Ranos dB into the wall mount such that the vertical parts hook into each other.

4. Align the through hole and tapped holes at the bottom of the wall mounting brackets.

5. Insert the M4x12 screw from the bottom through the wall side mounting bracket, into the tapped M4 thread of the Ranos dB side mounting bracket and tighten hand tight.



Mounting options and measurement accuracy

Three mounting options for the Ranos dB are available: pole mount, tabletop and wall mount. The pole mount and tabletop accessories are shipped with the Ranos dB as standard, the wall mount is optional. For performing measurements conforming to the specifications, care needs to be taken in the used mounting method and placement of the Ranos dB.

It would be most optimal if it was possible to have the microphone float on its own in free air. This is obviously practically impossible.
To minimize the effect of reflections and diffraction of nearby surfaces, the nearby surfaces should be as small as possible and should preferably be round(ed). The amplitude of the reflected or diffracted sound wave will also be decreased by mounting the microphone as far away from the nearby surfaces as possible.

Mounting the Ranos dB to a pole with a diameter of 80mm or less, and at a height of at least 3m is advised. It is even better if the microphone is mounted to the same pole, but separately from the Ranos dB and extended from the pole using the microphone extension mount and microphone extension cables. The object the microphone is mounted to should be free from mechanical vibrations, as mechanical vibrations might show in measurements at lower levels.

In general, the following rules of thumb should be used:

1. Mount the Ranos dB at least 2m away from large flat reflective surfaces, preferably more than 3 m. The more distance, the better.
2. In case of tabletop or wall mount use, the microphone will have to be mounted separately at a distance from objects and surfaces using the microphone extension mount and cables.

Example good mounting options:

- Ranos dB mounted to a free standing pole with a diameter of less than 80 mm, at a height of at least 2m from the ground. Microphone mounted in standard configuration, to the rear of the Ranos dB.

- Ranos dB mounted to a wall or standing on a surface. Microphone mounted separately to a nearby free standing pole with a diameter of less than 80 mm, at a distance of at least 2 m from the ground and walls, using a microphone extension mount and microphone extension cable.

Accuracy and IEC 61672

The short version
Measurement accuracy is according to IEC 61672-1:2014 class 1 or 2, validated by an accredited lab using IEC 61672-3:2013 test procedures.

The long version
First a short introduction to the IEC 61672 standard and its parts:

The first IEC standard for sound level meters was the IEC 123 from 1961, which was superseded by IEC 651 in 1979 and was later renamed IEC 60651. In 2002 the IEC 60651 was superseded by IEC 61672-1. The latest edition of the IEC 61672-1 originates from 2014, hence and its full name is hence: IEC 61672-1:2014.

IEC 61672-1
IEC 61672-1 is a standard for sound level meter specifications. Two performance categories, class 1 and class 2, are specified in this standard. In general, specifications for class 1 and class 2 sound level meters have the same design goals and differ mainly in the acceptance limits and the range of operational temperature. Acceptance limits for class 2 are greater than, or equal to, those for class 1.

IEC 61672-2
IEC 61672-2 provides details of the tests necessary to verify conformance to all mandatory specifications given in IEC 616720-1.

IEC 61672-3
IEC 61672-3 describes procedures for periodic testing of sound level meters that were designed to conform to the class 1 or class 2 specifications of the IEC 61672-1 standard. The aim of the standard is to ensure that periodic testing is performed in a consistent manner by all laboratories.

Current standards for sound level meters are based on older concepts and they are not regularly updated, while technology is constantly changing and improving. Using modern technologies, we have tried to conform to as many of the specifications from IEC 61672-1 as possible, with the goal to at least have class 1 or 2 measurement accuracy. Using these modern technologies, we have improved aspects that are important to our application, such as long range wireless communication, low maintenance, low production cost and low energy consumption.

Besides using modern technologies in our hardware, we use modern methods to collect, process and analyze measurement data. Instead of the traditional wired interface we have developed a wireless communication system. The data is directly transmitted to our database

where it is stored and made available to our dashboard and/or app for semi real-time or later analysis. It is even possible to run automation off of measurement data, and it is possible to change the settings remotely via the wireless connection.

It is easier to mention what we don't conform to, as this is less than the things we do conform to:

IEC 61672-1:

- The microphone is not according to IEC 60942.
- The correction data generated in house using our own procedures instead of IEC 62585
- There is no documented data about the effects of ESD on the operation of the SLM. Only CE tests were performed.

IEC 61672-2:

- Pattern testing according to I EC 61672-2 was not performed.

IEC 61672-3:

- All electrical and acoustical tests according to IEC 61672-3:2013 were performed by an accredited lab and were successful. However, we cannot officially pass the test according to IEC 61672-3 with the main reason being that our microphone is not to the IEC 60942 standard. To us, using a microphone to the IEC 60942 standard would be a big limiting factor as the proposed technology is expensive and not very robust. There are newer microphone technologies that can perform within specification.

Acoustic calibration using sound calibrator

A sound calibrator for ½'' microphones that complies with IEC 60942 and the applicable performance class must be chosen. The reference sound pressure level is 94dB and the sound level calibration check frequency is 1kHz.

Examples of suitable calibrators:
- Cirrus Research CR:514
- Cirrus Research CR:515

- Power on the Ranos dB and connect it to your Android device using the DSS Connect App from the Google Play store, or to your Windows OS PC (via Google Chrome browser: app.dutchsensorsystems.com). Use the supplied USB cables and adapters to make the connection.

- If the Ranos dB has already been registered to an account, use the corresponding credentials to log in. If the Ranos dB has not been registered to an account yet, register or log in and register the Ranos dB to your account.

- If the Ranos dB has been registered to an account for one time calibration only, it can be unregistered from the account using the Connect Dashboard dashboard.dutchsensorsystems.com Log in using the credentials of the account the Ranos dB is registered to. Navigate to “Devices” and click the trash can icon to the right of the Ranos dB you would like to unlink.

- Navigate to the second “ranos live” tab.
- Install a ½ inch adapter in/onto your sound calibrator if applicable.
- Slowly insert the microphone all the way into the coupler.
- Turn on the sound calibrator, set the frequency to 1kHz and the sound level to 94 dB. When the sound calibrator signal frequency is valid, the microphone is within specification, and when the signal has stabilized, the Ranos dB will detect the sound calibrator signal.
- Once the sound calibrator signal has been detected, a “Calibrator detected” popup will show up.

Click “Start automatic calibration”. Do not move the microphone or calibrator while the calibration is running, the calibration will be aborted when a signal fluctuation has been detected. The automatic calibration will determine the necessary adjustment so that the reading of the Ranos is equal to the sound pressure level inside of the coupler. At the end of the routine, the adjustment value will automatically be set and stored in the “Correction” field in the first settings tab of the Connect App.

- Turn off and carefully remove the sound calibrator.

Connect App: software installation and connection via USB

The Ranos dB is connected to the Dutch Sensor Systems Connect App via a wired USB connection. The Connect App is used to register, configure, test and calibrate the Ranos dB. While the Ranos dB is meant to be used remotely, the Connect App also enables a real time measurement display with extensive measurement options. A logging feature is included in case remote support from Dutch Sensor Systems is required.

After registering and configuring your device, it will become available in the Connect Dashboard for further assignment to projects, remote data collection and more.

Preparing your device for use
Smartphone with Google Android operating System:

1. Open the Google Play Store, search for “DSS Connect App” and install the application.
2. For some smartphones it might be necessary to enable the OTG function manually. To do so, go to settings > System and enable OTG.
3. Click “Register” to create an account and login, or click “Login” if you already have an account.
4. The USB connection screen will appear.

Personal computer with Microsoft Windows operating system:

- Download and install the Google Chrome web browser: www.google.com/chrome
- Using the Google Chrome web browser, navigate to app.dutchsensorsystems.com
- Click “Register” to create an account and login, or click “Login” if you already have an account.
- The USB connection screen will appear.

Connecting your device to the Ranos dB via USB

- Power on the Ranos dB.
- Connect the Ranos dB to your device using the supplied cable, and if applicable one of the supplied OTG adapters.
- For a smartphone with Google Android operating System, accept the connection.
- For a personal computer with Microsoft Windows operating system click “Connect and select the Ranos dB in a popup that will appear.
- The Ranos dB is now connected.
- Do not forget to press the rubber cap back into the USB connector after configuration to prevent moisture ingress in outdoor use.

Note: for some Personal computers with Microsoft Windows operating system it might be necessary to install FTDI drivers before the Ranos dB will be recognized in the the USB connection screen. This usually won’t be necessary. FTDI driver download web page: **Drivers - FTDI (ftdichip.com)**

Connect App: working principles

Connection and network
A smartphone or PC is connected to the Ranos dB using the Connect App and a USB connection. The network connection of the smartphone or PC is used to register the Ranos dB to an account, check for available settings and firmware updates.
Without a network connection the Connect App will not work.

Connect App and Connect Dashboard
Either the Connect App or the Connect Dashboard can be used to create an account, the credentials can be used for both. The app or webpage will guide the user through the registration process.

Smartphone with Google Android OS:
Google Play Store: “DSS Connect App”
PC with Microsoft Windows OS:
app.dutchsensorsystems.com

Registering a Ranos dB to an account
The first step is to log into an account or to register an account. The account that is logged in will be the account the Ranos dB is linked to. When a new or unregistered Ranos dB is connected to the Connect App, the app will ask to give it a name. Completing this step will link the Ranos dB to the logged in account. After registering the Ranos dB it becomes available in the Connect Dashboard under “Devices”, with the name that was given in the Connect App. The Ranos dB can be unregistered from the from the “Devices” page in the Connect Dashboard.

When trying to connect to a Ranos dB that has been registered to a different account from the account currently logged in, an “Unauthorized” message will be displayed. You will not be able to continue any further.

Ranos settings
Settings are stored locally, but are also synchronized with a database. This is done in order to ensure the settings are safe, even if a firmware update fails. When a Ranos dB has been unregistered from an account, the default settings will be synchronized from the database at the first following time the Connect App checks for settings.

One part of the settings that runs in the background is the FIR (Finite Impulse Response) microphone correction filtering. A FIR microphone correction filter can be uploaded by Dutch Sensor Systems. This filter is used to linearize the frequency response of a microphone. The Ranos dB 1 makes use of this filter, the dB 2 does not.

Firmware update
After connecting the Connect App to the Ranos dB, the Connect App will first check if there are any firmware updates available. If a firmware update is available and critical, a popup will show up. You cannot continue further any in the app before installing the firmware update. If an update is not critical it will become available for installation from the “ranos info” page. After a firmware update has finished, the latest stored settings will be restored.

Connect App: “Ranos settings” page

After connecting the Connect App to the Ranos dB, this is the first page to show up by default. The settings page is the most important page, as this is where you will configure the LoRa wireless communication settings and which measurement quantities will be sent.

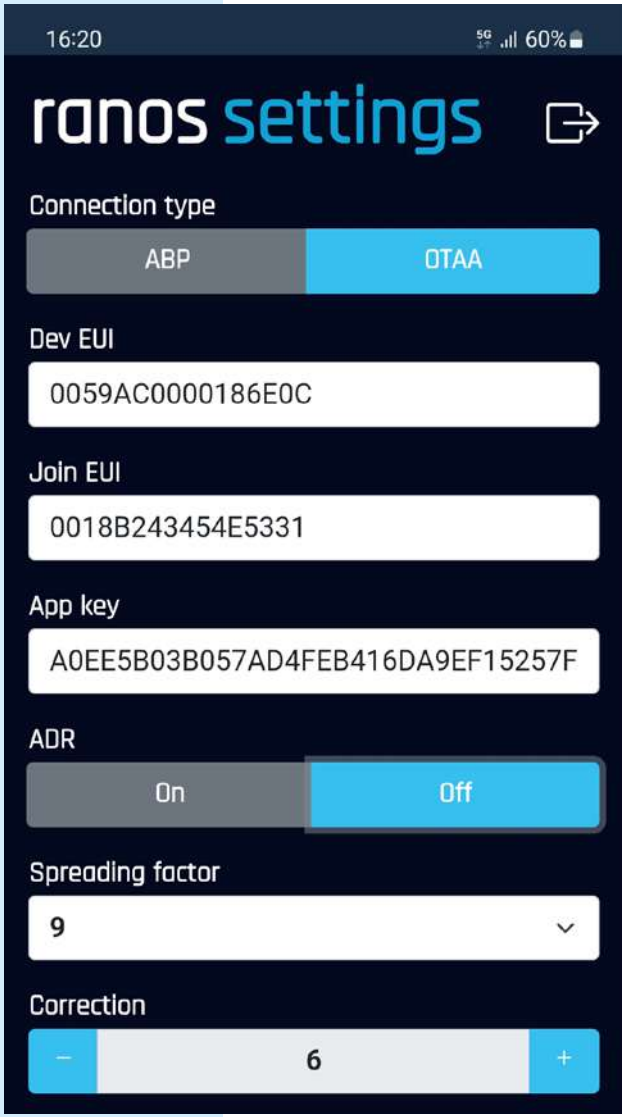
After changing the settings the save button must be clicked in order for the new settings to become active and stored.

Connection type
Set the network connection method to ABP (Activation By Personalization) or OTAA (Over-The-Air Activation).

Settings for OTAA
Device EUI:
End-device identifier
Join EUI:
Application identifier
App key:
Application key

ADR:
Adaptive data rate on or off. ADR will optimize power consumption by finding the lowest power transmission settings while ensuring that messag-es are still received at gateways. ADR off is advised for applications where the device is continuously moving.

Spreading factor:
LoRa is based on CSS (Chirp Spread Spectrum) technology. The spreading factor controls the chirp rate. A lower spreading factor will result in faster chirps, a higher transmission rate and a reduction of range. A higher spreading factor will result in a longer time-on-air and more power con-sumption.



Settings for ABP

Device address:

Device address

App session key:

Application session key, used for encryption and decryption of the payload.

Network session key:

Network session key, used for interaction between the Node and the Network Server.

ADR ON/ADR OFF:

Adaptive data rate on or off. ADR will optimize power consumption by finding the lowest power transmission settings while ensuring that messages are still received at gateways. ADR off is advised for applications where the device is continuously moving.

Spreading factor:

LoRa is based on CSS (chirp spread spectrum) technology. The spreading factor controls the chirp rate. A lower spreading factor will result in faster chirps, a higher transmission rate and a reduction of range.

A higher spreading factor will result in a longer time-on-air and more power consumption.

Please refer to lora-alliance.org for more information.

Frequency Sub-Band:

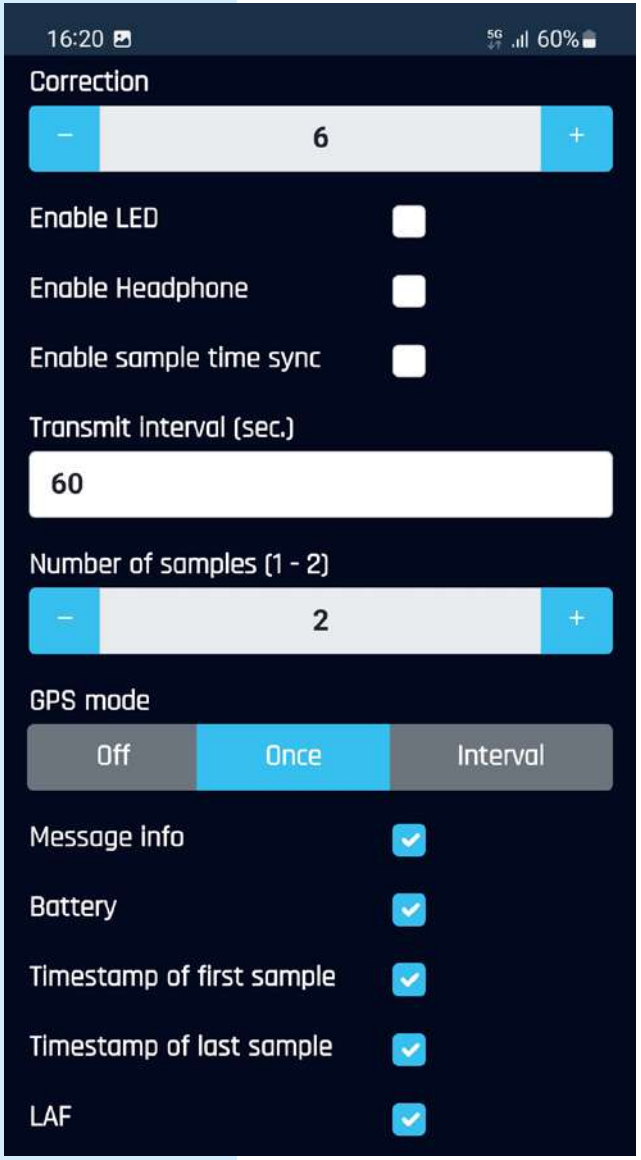
This option will only show for the 902-928 version of the Ranos dB. Used to set the correct sub-band for the local frequency plan and/or your gateway.

Correction:

Correction value applied to the overall input microphone signal. Used to adjust the displayed sound level when a sound calibrator has been applied to the microphone. When using the automatic calibration function, this field is set automatically.

Enable LED:

Enables the LED status indication inside of the externally accessible power switch and on the PCB.



Enable Headphone:
Enables the headphone output on the PCB. Used for test and calibration purposes. This connection is not accessible from outside of the housing. This setting will cause extra current draw (although minimal).

Enable sample synchronization:
Synchronize multiple Ranos dB' by enabling this function. The "Transmit interval" and "Number of samples" needs to be equal for the Ranos dB' that need to be synchronized.

The Ranos dB collects the selected amount of "Number of samples" in between two "Transmit interval". The samples are collected evenly spaced in time. After all samples have been collected, the samples will be transmitted right before starting a new sampling cycle.

Once a GPS time fix (Unix Epoch) has been obtained and the last sampling cycle has been transmitted, the Ranos dB will calculate the next coming start moment of the new sampling cycle relative to if the Unix Epoch time was the start time of the sampling cycles. The Ranos dB will wait until this moment and the sampling cycle is then restarted. This ensures that the sample moment for Ranos dB' with the same "Transmit interval" and "Number of samples" will be synchronous.

After the first synchronization moment, the internal RTC time will be re-synchronized from the GPS time every 12 hours. The actual resynchronization will take place right after the first LoRa transmission after 12 hours have passed.

Transmit interval:
This setting sets the interval in seconds between each LoRa transmission. Limited by local regulations.

Number of samples:
Sets the number of samples contained in each transmission. The sample interval, calculated from transmit interval divided by number of samples in the payload also sets the LAeq and LCeq averaging time.

GPS mode:
Sets the GPS location acquisition mode.
OFF:
If the timestamp is enabled the sensor will try to obtain the GPS time upon startup. The GPS will check for time every minute until a fix is found. If the timestamp is enabled, the GPS will be activated every 12 hours for 5 minutes to resynchronize internal time.

ONCE:
Upon startup the sensor will try to obtain a GPS location and time. The GPS will check for time and location every minute until a fix is found. If the timestamp is enabled, the GPS will be activated every 12 hours for 5 minutes to resynchronize internal time.

INTERVAL:
The GPS will try to obtain time and location at the set interval. The GPS will be turned on for 5 minutes each time.

Message info:
Includes information about the composition of the payload when enabled. Please refer to the payload description document on our website: iotsoundsensor.com/lora-payload-description

LAfast:
A frequency weighted, fast time weighted sound level. Momentary value taken at the sample time.

LAslow:
A frequency weighted, slow time weighted sound level. Momentary value taken at the sample time.

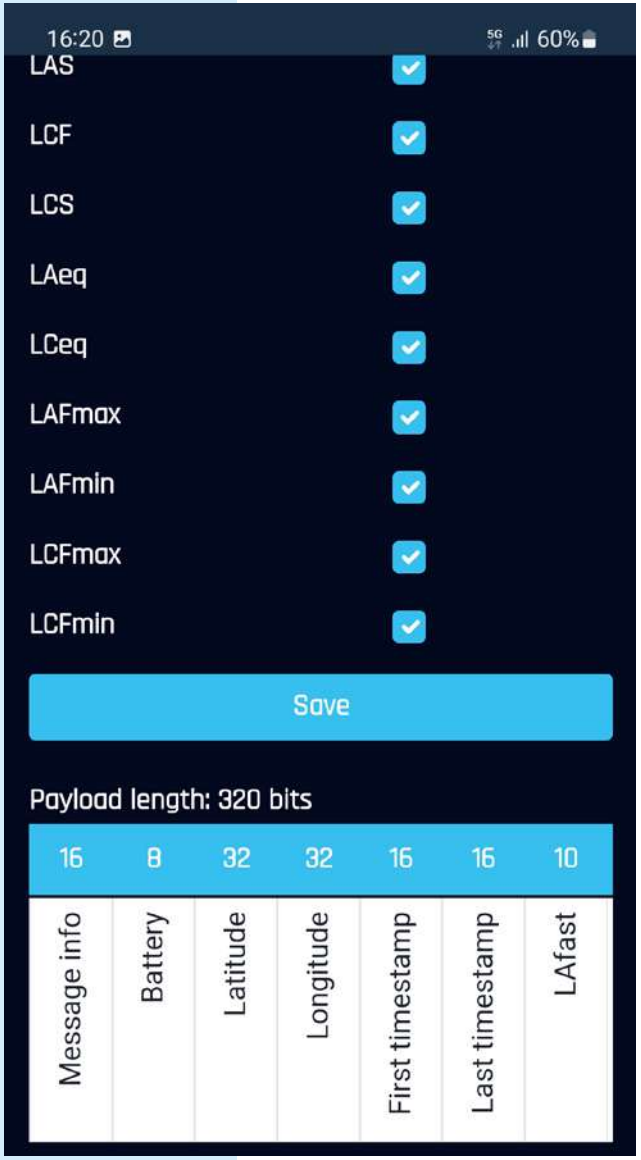
LCfast:
C frequency weighted, fast time weighted sound level. Momentary value taken at the sample time.

LCslow:
C frequency weighted, slow time weighted sound level. Momentary value taken at the sample time.

LAeq:
A frequency weighted, equivalent continuous sound level over the set sample interval (transmit interval divided by number of samples).

LCeq:
C frequency weighted, equivalent continuous sound level over the set sample interval (transmit interval divided by number of samples).

LAFmax:
Maximum A frequency weighted, fast time weighted sound level over the set sample interval (transmit interval divided by number of samples).



LAFmin:
Minimum A frequency weighted, fast time weighted sound level over the set sample interval (transmit interval divided by number of samples).

LCFmax:
Maximum C frequency weighted, fast time weighted sound level over the set sample interval (transmit interval divided by number of samples).

LCFmin:
Minimum C frequency weighted, fast time weighted sound level over the set sample interval (transmit interval divided by number of samples).

Battery:
Battery voltage measured directly on the battery input connector. Please note that the voltage of the battery fluctuates while it is being charged from solar power. The measured battery voltage is accurate at night, when the battery is not being charged. The battery charge state versus battery voltage curve is not linear, so the battery charge state cannot be calculated 100% accurately from just the battery voltage alone. A rough estimate can however be calculated from the battery voltage (when not being charged) using the following formula: 100-((6,5-measured voltage)/((6,5-5,25)/100))

Timestamp (of first sample):
Includes the capture time of the first sample in the payload.

Timestamp of last sample:
Available when the number of samples is higher than 1. Includes the capture time of the last sample in the payload. Samples in between the first and last time stamp are equally spaced in time. Enabling “Timestamp of first sample” and “Timestamp of last sample” allows accurate calculation of the time of the in between samples.

Payload length:
Shows the resulting payload length in bytes.

Connect App: “Ranos live” page

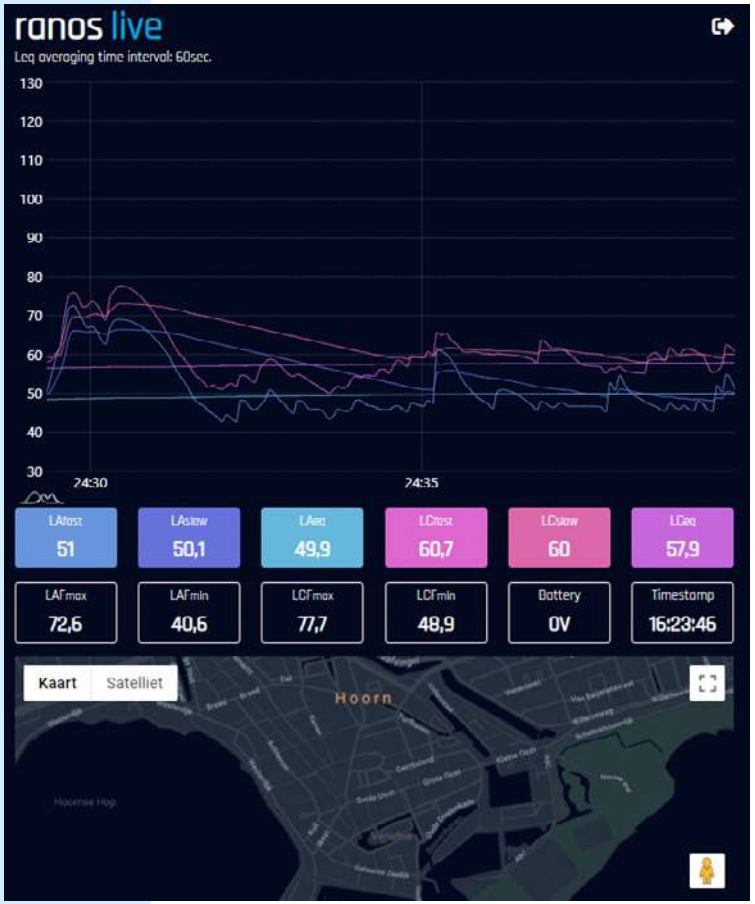
The second tab, “ranos live”, is where real time measurements are monitored. One Ranos dB that is connected via USB is supported at a time. This interface in mainly used for testing and calibration, but it is great as a temporary working display as well. When the “ranos live” tab is opened, the LoRa routine is disabled and the GPS checks a location every 5 minutes.

The top graph displays the selected measurements. Each line is color coded to correspond with its numeric measurement quantity box below the graph. The numeric measurement quantities have a resolution of 0,1 dB and the update rate is 100ms.The boxes below the graph can be clicked to exclude the measurement from the graph.

Boxes filled with background color are not graphed and are displayed numerically only. The measurements should be valid (within specifications) within 10 seconds after opening the “ranos live” page. The Ranos dB will continue back to normal operation for use via LoRa automatically within 30 seconds after exiting the “ranos live” page.

In case of an overload or under range condition, a flag with time and detected level of the most recent condition will be displayed below the measurements.

The map below the graph and numeric value boxes will show the location of the Ranos dB found by the GPS.



Available measurements

LAfast
A frequency weighted,
fast time weighted sound level.

LAslow
A frequency weighted,
slow time weighted sound level.

LAeq
A frequency weighted, equivalent continuous sound level over the set sample interval. The resulting set time interval is displayed above the graph. The measurement will be re-initiated when switching to another page and back.

LAFmin
Minimum A frequency weighted, fast time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LAFmax
Maximum A frequency weighted, fast time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LCfast
C frequency weighted,
fast time weighted sound level.

LCslow
C frequency weighted,
slow time weighted sound level.

LCeq
C frequency weighted, equivalent continuous sound level over the set sample interval. The resulting set time interval is displayed above the graph. The measurement will be re-initiated when switching to another page and back.

LCFmin
Minimum C frequency weighted, fast time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LCFmax
Maximum C frequency weighted, fast time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

Timestamp
Displays start time of the current running period over which the maximum and minimum values are calculated.

Battery
Battery voltage measured directly on the battery input connector.

Extra available measurements via calibration settings

LZfast
Z frequency weighted, fast time weighted sound level.

LZslow
Z frequency weighted, slow time weighted sound level.

LZeq
Z frequency weighted, equivalent continuous sound level over the set sample interval. The resulting set time interval is displayed above the graph. The measurement will be re-initiated when switching to another page and back.

LZFmin
Minimum Z frequency weighted, fast time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LZFmax
Maximum Z frequency weighted, fast time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LCpeak
C frequency weighted, peak time weighted sound level.

LCpeak_min
Minimum C frequency weighted, peak time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LCpeak_max
Maximum C frequency weighted, peak time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LZpeak
Z frequency weighted, peak time weighted sound level.

LZpeak_min
Minimum Z frequency weighted, peak time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LZpeak_max
Maximum Z frequency weighted, peak time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LAslow_min
Minimum A frequency weighted, slow time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LAslow_max
Maximum A frequency weighted, slow time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LAeq_min
Minimum A frequency weighted, equivalent continuous sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph. The measurement will be re-initiated when switching to another page and back.

LAeq_max
Maximum A frequency weighted, equivalent continuous sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph. The measurement will be re-initiated when switching to another page and back.

LCslow_min
Minimum C frequency weighted, slow time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LCslow_max
Maximum C frequency weighted, slow time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LCeq_min
Minimum C frequency weighted, equivalent continuous sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LCeq_max
Maximum C frequency weighted, equivalent continuous sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LZslow_min
Minimum Z frequency weighted, slow time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LZslow_max
Maximum Z frequency weighted, slow time weighted sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LZeq_min
Minimum Z frequency weighted, equivalent continuous sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

LZeq_max
Maximum Z frequency weighted, equivalent continuous sound level over the set sample interval. Automatically resets at every new sample interval. The last reset time is displayed in the “Timestamp” box below the graph.

Battery
The battery voltage that is displayed is measured directly on the battery input connector. The voltage of the battery fluctuates while it is being charged from solar power. The measured battery voltage is accurate when there is no light on the solar panel, when the battery is not being charged. The battery charge state versus battery voltage curve is not linear, so the battery charge state cannot be calculated 100% accurately from just the battery voltage alone. A rough estimate can however be calculated from the battery voltage (when not being charged) using the following formula: 100-((6,5-measured voltage)/((6,5-5,25)/100)).

A battery voltage of 5,5VDC at the start of a use period without charging via solar power is sufficient for at least 6 hours of working time. The Ranos dB performance does not degrade or change with battery voltage, but the Ranos dB will cut off system power at around 4,5VDC. Stated voltages are for a measured battery voltage when it is not being charged. The Ranos dB will conform to specifications with a power supply (battery) voltage ranging from 4,5 to7VDC.

Overload
An overload flag will be displayed before the Ranos is outside of its linear range. The flag will latch on and will display the time and level of the most recent overload condition. The level of the detected overload condition might not be accurate if it is far above the upper limit of the operating range. An overload flag can be cleared by pressing X in the right corner of the flag.

The MMDB1 and MMDB2 microphones are the limiting factor in the Ranos' upper limit of its level range. The microphones will start to deviate from linearity at a level higher than LZpeak 123 dB for any frequency between 20 Hz – 20 kHz. The overload detector consists of an LZpeak measurement at the Ranos input, a measured value of over LZpeak 123 dB should cause an overload flag for any frequency between 20 Hz – 20 kHz.

The overload function is not affected by excluding LZpeak from the "ranos live" page or from the "ranos settings" page.

Under range
An under range flag will be displayed when the measured sound pressure level is less than the acoustical lower boundary for the acoustical linear operating range of LCSlow when using the the MMDB1 or MMDB2 microphone. The set value is LCSlow 42dB.

The under range function is not affected by excluding LCSlow measurement from the "ranos live" page or from the "ranos settings" page. However, when the C weighting is bypassed for testing and/or calibration via the "ranos calibration" page, the C weighting for the under range detector will also be bypassed, making it more sensitive to low frequency noise.

Connect App: “Ranos info” page

The “ranos info” page is where miscellaneous info and utilities can be found.

Firmware version:
At the top you will find a bar that displays the current firmware version. If a new firmware is available, it will become available for install from here.

Logging
Below the firmware version and update bar you will find three buttons: “Start log”, “Clear log” and “Save log”.

- Start log: allows the user to see the Ranos dB software routines in case of testing or troubleshooting. After starting the low, the button text changes to “Stop log”. Click the button again to stop the log.
- Clear log: clears the displayed log data.
- Save log: saves the collected data that is displayed to the Dutch Sensor Systems database. This can be useful when support from Dutch Sensor Systems is required.

Connect App: “Ranos calibration” page

The “ranos calibration” page enables more types of measurements for the “ranos live” page by changing the internal DSP signal routing. Active settings will be displayed while working in the “ranos live” page. Any made settings in the calibration page will be cleared after disconnecting the Ranos or after 30 seconds of inactivity outside of the “ranos live” page. This ensures the altered DSP routing is always temporary and does not affect normal operation via LoRa.

Min/Max source A
Set the source data for the calculation of the A weighted minimum and maximum sound levels to Fast (LAfast), Slow (LAslow) or EQ (LAeq).

Min/Max source C
Set the source data for the calculation of the C weighted minimum and maximum sound levels to Fast (LAfast), Slow (LAslow) or EQ (LAeq).

Bypass A
Bypasses the A frequency weighting filter, effectively turning them into Z frequency weighted measurements.

Bypass C
Bypasses the C frequency weighting filter, effectively turning them into Z frequency weighted measurements. The under range detection processing will be affected by enabling.

Bypass FIR
Bypasses the FIR microphone correction filter.

LCfast to LCpeak
Changes the LCfast measurement into an LCpeak measurement.

Manual reset
Disables the minimum and maximum value hold automatic reset and enables a button in the “ranos live” page to manually reset the held values. Meant for use during testing of time weightings and electrical linearity. Manual reset does not clear overload or under range flags. The actual reset will take place within 2 seconds after operating the reset function.

Write
Writes the calibration settings to the DSP.

Clear
Clears the calibration settings from the DSP and puts the Ranos back into normal operating mode.

General	
Applicable standards	IEC 61672-1:2014
Performance class	Ranos dB 1: class 1 measurement accuracy with MMDB1 microphone Ranos dB: class 2 measurement accuracy with MMDB2 microphone
RF immunity group	group X
CE marking:	yes

Microphones, preamp and conversion			
Microphones	Microphone Performance class: Type: Sound field: IP rating: Frequency range: Freq. resp. calibration: Output impedance: Sensitivity: Reference SPL: Reference point: Reference direction: SPL before damage:	MMDB1 class 1 electret condenser freefield IP67 20 Hz – 20 kHz Yes 2,2k 12,6 mV/Pa (-38dB re 1V/Pa) 94 dB center of microphone diaphragm 0 degrees 140 dB	MMDB2 class 2 electret condenser freefield IP67 20 Hz – 20 kHz No 2,2k 12,6 mV/Pa (-38dB re 1V/Pa) 94 dB center of microphone diaphragm 0 degrees 140 dB
Microphone preamplifier	Integrated, not removable Gain nominally set for MMDB1 and MMDB1 microphones -6 to 6dB gain or attenuation in 0,1dB steps for calibration Input sensitivity: 48,08 mV/Pa or -26,36 dB re 1V/Pa Input impedance: 40k Ohm Input voltage range: 1Vrms (2,83Vp-p) Input bias voltage: 2,97V Input max. bias current: 3mA		

AD and DA conversion	Samplerate: 48 kHz Bitdepth: 24 bit Frequency response: +/-0,05dB 3Hz – 20kHz

Processing

Processing type	Digital (everything after signal conditioning, preamp, ADC)		
Processing rate Processing precision	48 kHz 56 bit		
Microphone correction filter	200 tap FIR filter, pre-set by Dutch Sensor Systems		
Measurement quantities		Available in Connect App (cable connection)	Available in Connect Dashboard (wireless connection)
	LAfast	✓	✓
	LAslow	✓	✓
	LAeq	✓	✓
	LAFmin	✓	✓
	LAFmax	✓	✓
	LCfast	✓	✓
	LCslow	✓	✓
	LCeq	✓	✓
	LCFmin	✓	✓
	LCFmax	✓	✓
	LZfast	✓	
	LZslow	✓	
	LZeq	✓	

	LZFmin	✓	
	LZFmax	✓	
	LCpeak	✓	
	LCpeak_min	✓	
	LCpeak_max	✓	
	LZpeak	✓	
	LZpeak_min	✓	
	LZpeak_max	✓	
	LAslow_min	✓	
	LAslow_max	✓	
	LAeq_min	✓	
	LAeq_max	✓	
	LCslow_min	✓	
	LCslow_max	✓	
	LCeq_min	✓	
	LCeq_max	✓	
	LZslow_min	✓	
	LZslow_max	✓	
	LZeq_min	✓	
	LZeq_max	✓	

LXeq averaging time	1-3600 sec. (applies to all running LXeq measurements)
Resolution of measurement quantities	0,1 dB

Measurement specifications

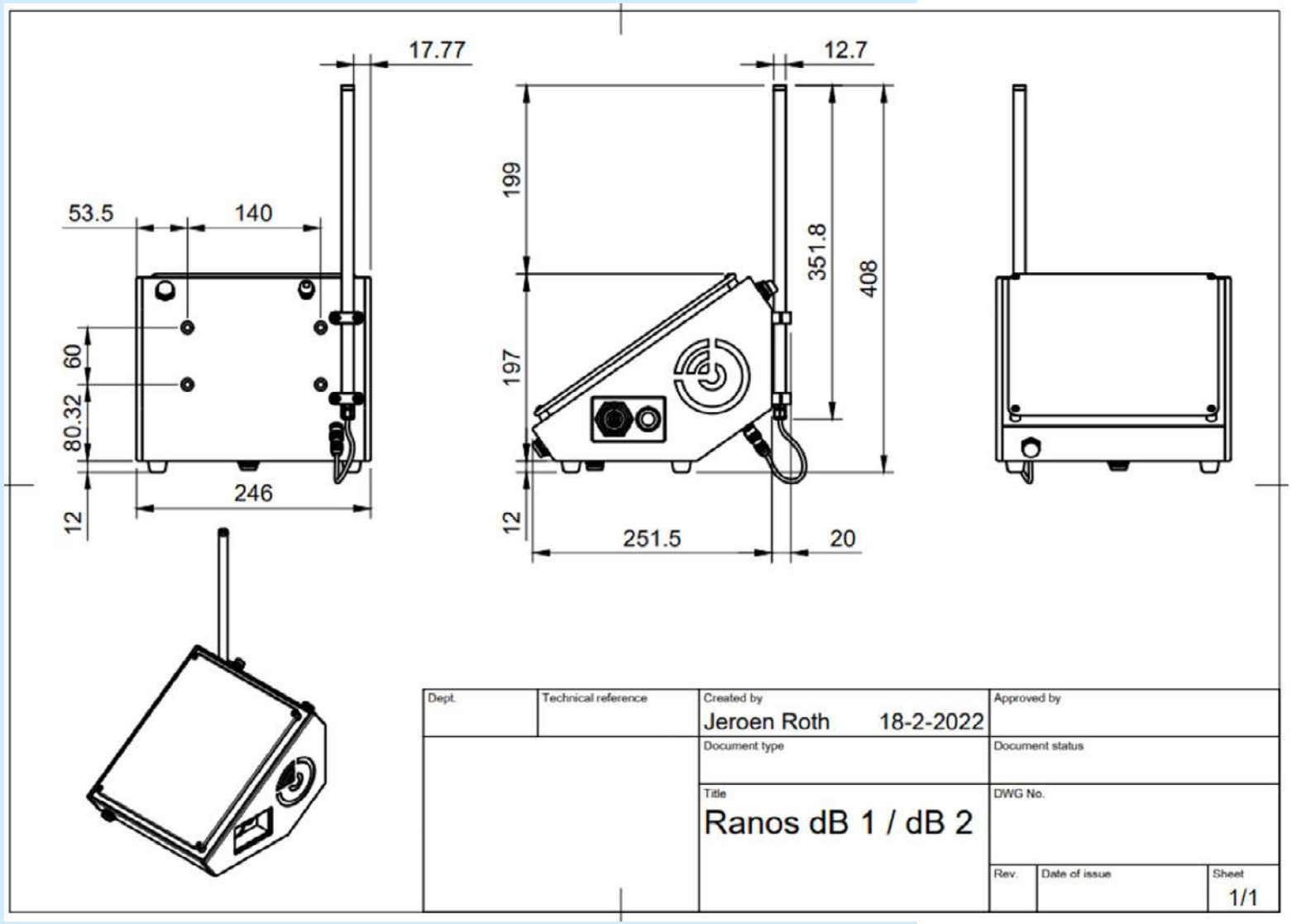
Level ranges	Single level range of 38-120 dB(A)						
Measurement range per frequency and frequency weighting (Electrical. To +/- 0,8 dB max. deviation) (LXF, LXS, LXeq, electrical)	Freq. 31,5 500 1000 4000 8000 12500	A low 38 41 40 40 40 41	A up 80,6 116,8 120 121 119 115,7	C low 37 38 38 37 40 40	C up 117 120 120 119,2 117 113,8	Z low 49 47 49 49 45 49	Z up 120 120 120 120 120 120
Measurement range at 1 kHz: (electrical, including LCpeak and LZpeak) Upper Lower	LA 120 40	LC 120 38	LZ 120 49	LCpeak 123 47	LZpeak 123 54		
Noise floor (electrical)	**Class 1** 31,8 dB(A) 30,1 dB(C) 56,5 dB(Z)	**Class 2** 30,3 dB(A) 30,2 dB(C) 58,8 dB(Z)					
Noise floor (acoustical)	**Class 1** 37,7 dB(A) 42,3 dB(C) 58,1 dB(Z)	**Class 2** 37,2 dB(A) 42,0 dB(C) 58,7 dB(Z)					

System	
Display	Connect App: one Android OS device or a Windows OS PC via physical USB connection. For configuration, testing, calibration and temporary display. Connect Dashboard: unlimited amount of display devices via web browser. For display, device management, project management and remote configuration.
Language	English
Externally accessible inputs and outputs	1 microphone input (3 pin female, Hirose) 1 USB-B female
Internal connections for special purposes	1 analog audio output (920 mVAC RMS max.) Various I/O's: UART, SPI, I2C, 3,3VDC logic, PWM
RF	LoRa: Class B, EU868, US915, AS923 GPS: multi constellation, GPS, Galileo, GLONASS, antenna integrated
Battery	1x 6VDC, 12Ah sealed lead acid battery, Yuasa NP12-6 is preferred
Battery voltage range	4,5 to 7VDC
Battery life	At least two weeks from a full battery, without additional solar charging
Battery life cycle	1 year minimum
External power	None, solar power only

Physical	
Weight	3,8 kg (including battery and microphone, excluding pole mount)
Size	Ranos dB: 271,5 x 246 x 408 mm (D x W x H, including rubber feet and microphone, H = 209 excluding microphone) Microphones MMDB1 and MMDB2: 333 x 12,7 mm (L x D)
IP rating	IP67
Mounting options	Polemount, wallmount, tabletop
Accessories	**Scope of delivery** Housing lid and screws Microphone Microphone clamps and screws Microphone windscreen Recess cover Pole mount, hose clamps and screws Rubber feet USB A male - USB B male cable 1m (USBAB1) USB C male - USB A female (USBCAOTG) USB Micro-B - USB A female (USBMBAOTG **Optional cables** Dummy microphone (DM1) Microphone extension cable 1,5m (MEC015) Microphone extension cable 3m (MEC030) Microphone extension cable 5m (MEC050) **Optional mounting accessories** Wallmount (WM1) Microphone extension mount (MEM1) Microphone extension mount (MEM2)

Reference environmental conditions Air temperature 23 °C | Static pressure 101,325 kPa | Relative humidity 50 %.	
Reference orientation	Upright
Size	Ranos dB: 271,5 x 246 x 408 mm (D x W x H, including rubber feet and microphone, H = 209 excluding microphone) Microphones MMDB1 and MMDB2: 333 x 12,7 mm (L x D)
Operating temperature	-10 to +50 degrees Celcius
Storage temperature	-20 to +60 degrees Celsius
Humidity	Up to 95% RH non- condensing
Electromagnetic performance	CE

Dimensions in mm

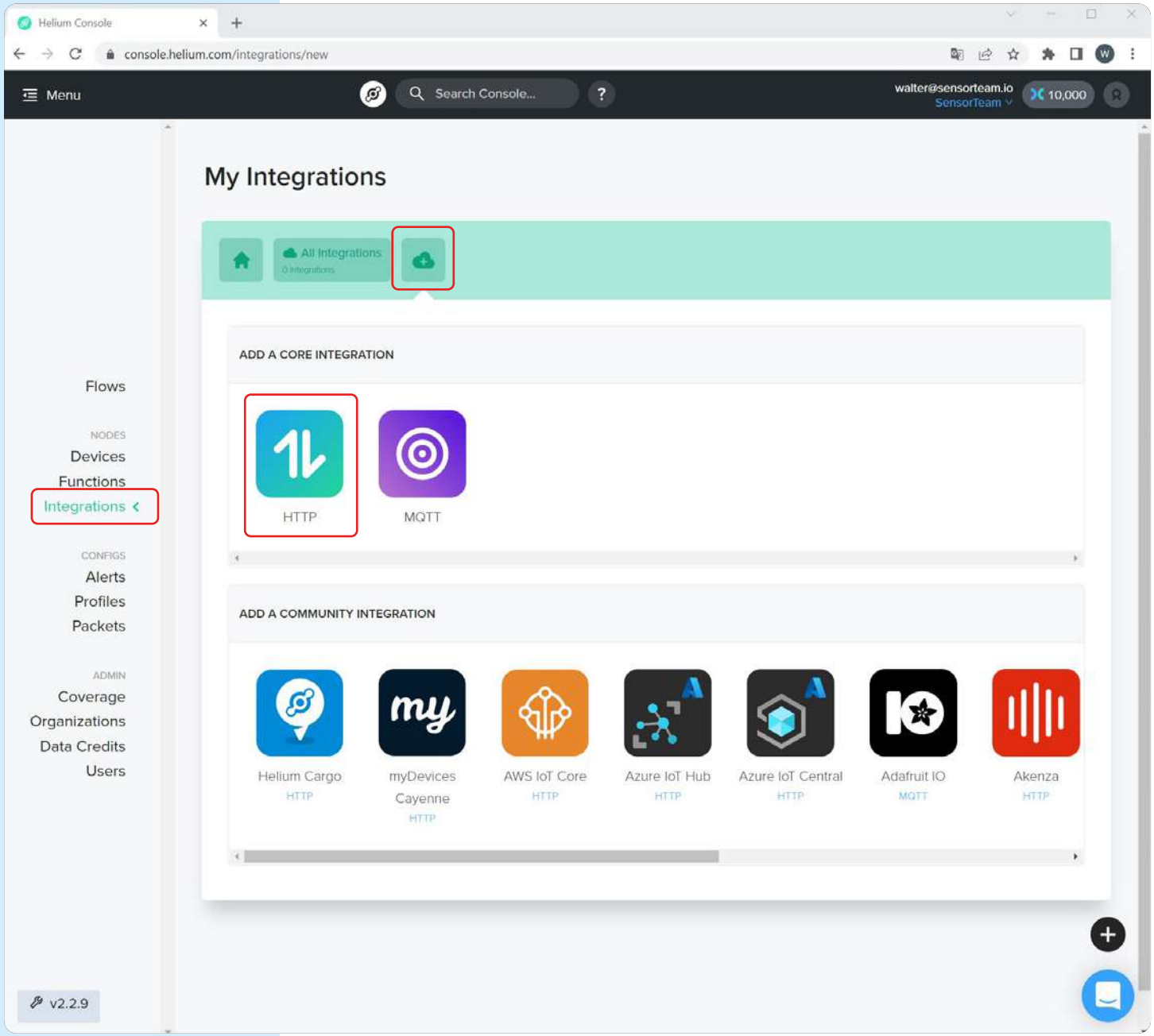


Appendix A

Ranos dB Helium integration manual

Create integration

1. Navigate to your Helium console.
2. Click “Integrations”,
3. Click “Add Integration” and choose “HTTP”.



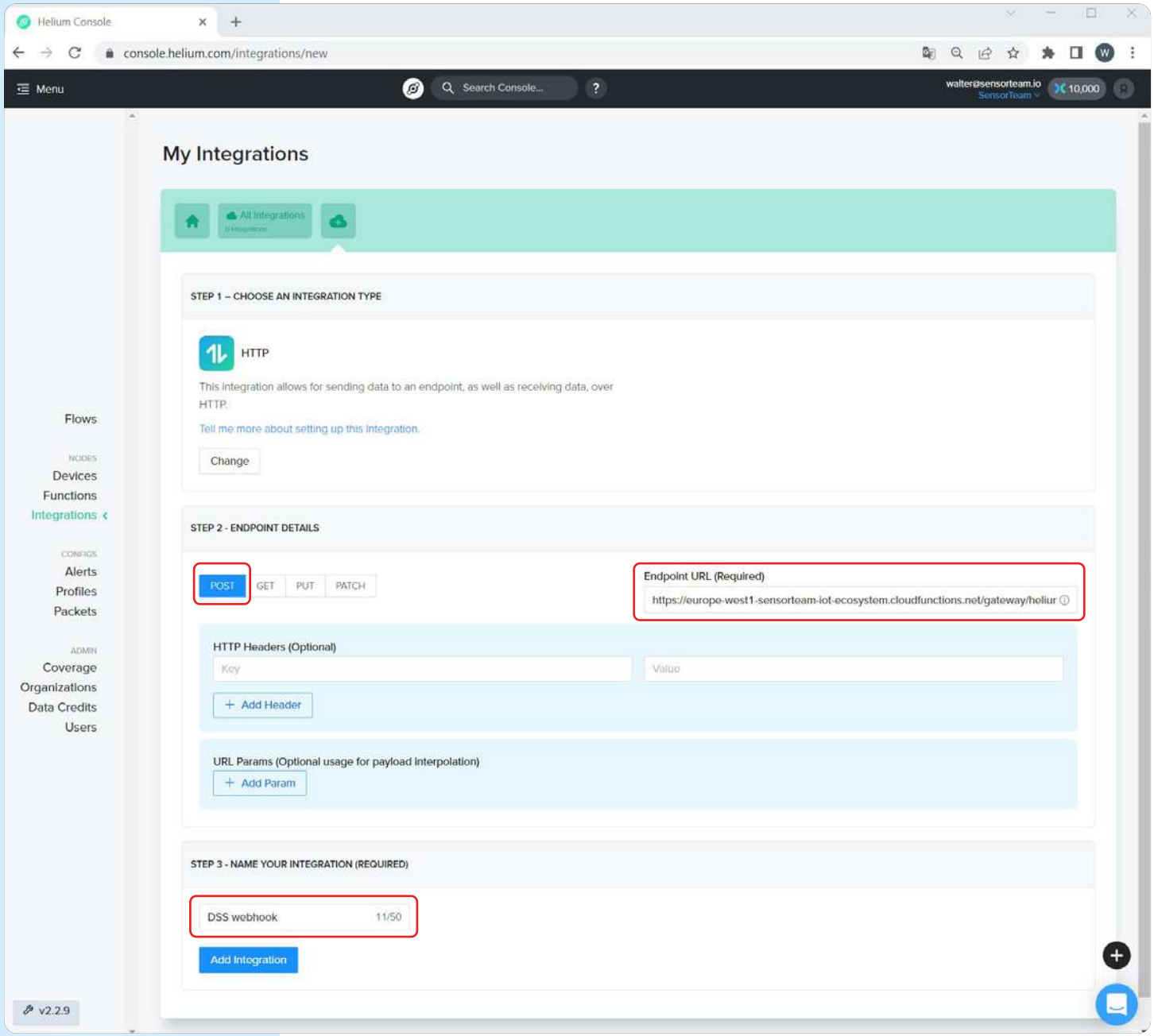
Enter the following information:

4. Choose POST.

5. Endpoint URL:
   https://europe-west1-sensorteam-iot-ecosystem.cloudfunctions.net/gateway/helium/lora/sound

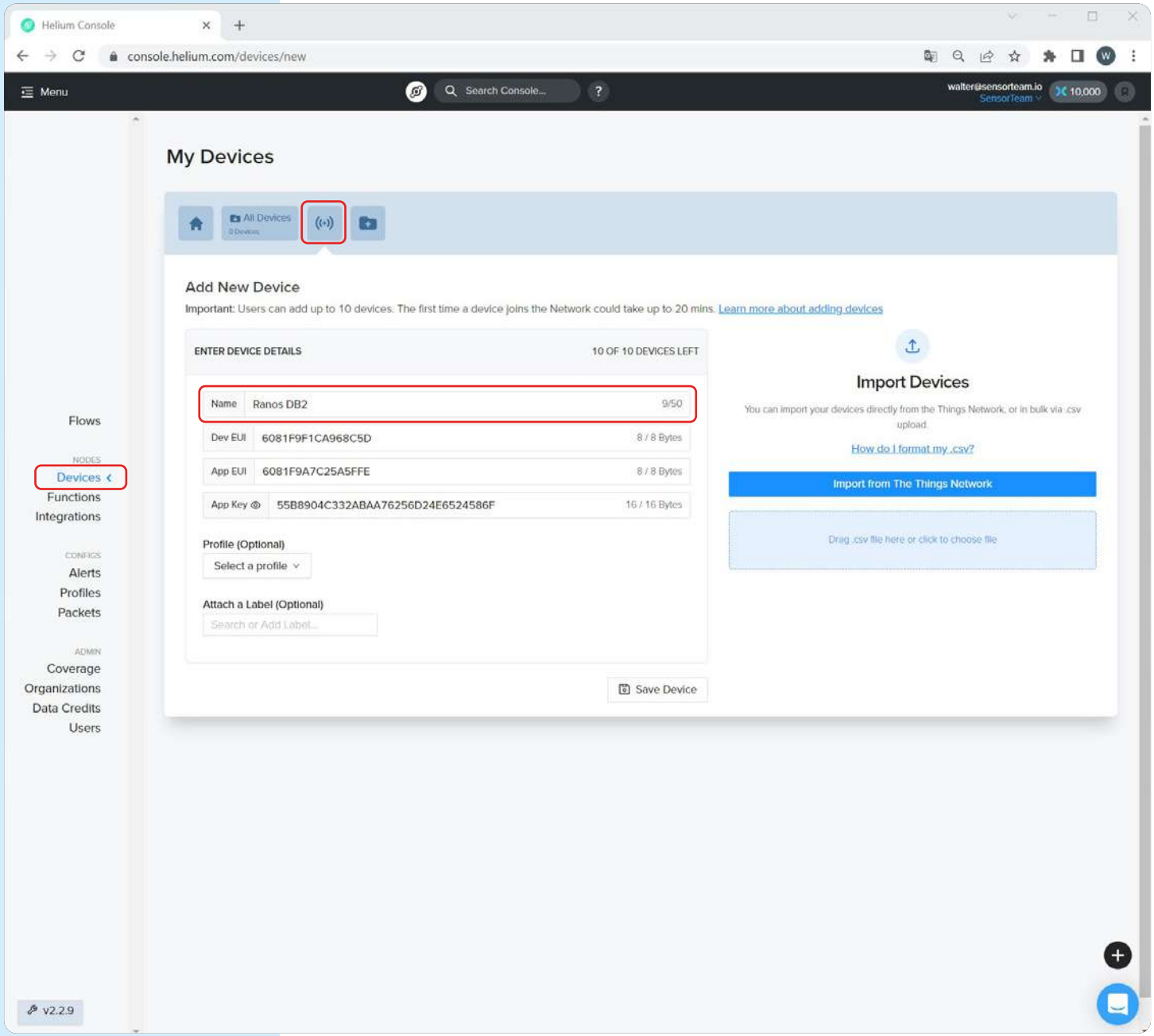
6. Name your integration.

7. Click “Add integration”.



Create device

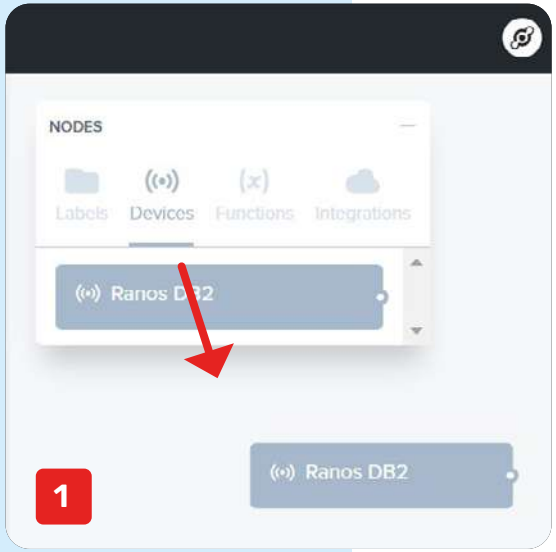
1. Navigate to “Devices” and click “Add new device”.
2. Choose a name and click “Save Device”.
3. The keys will be generated automatically.
4. Copy and paste the keys into the Ranos using our Connect App. (App EUI = Join EUI)



Create Flow

Navigate to “Flows” create a flow as follows:

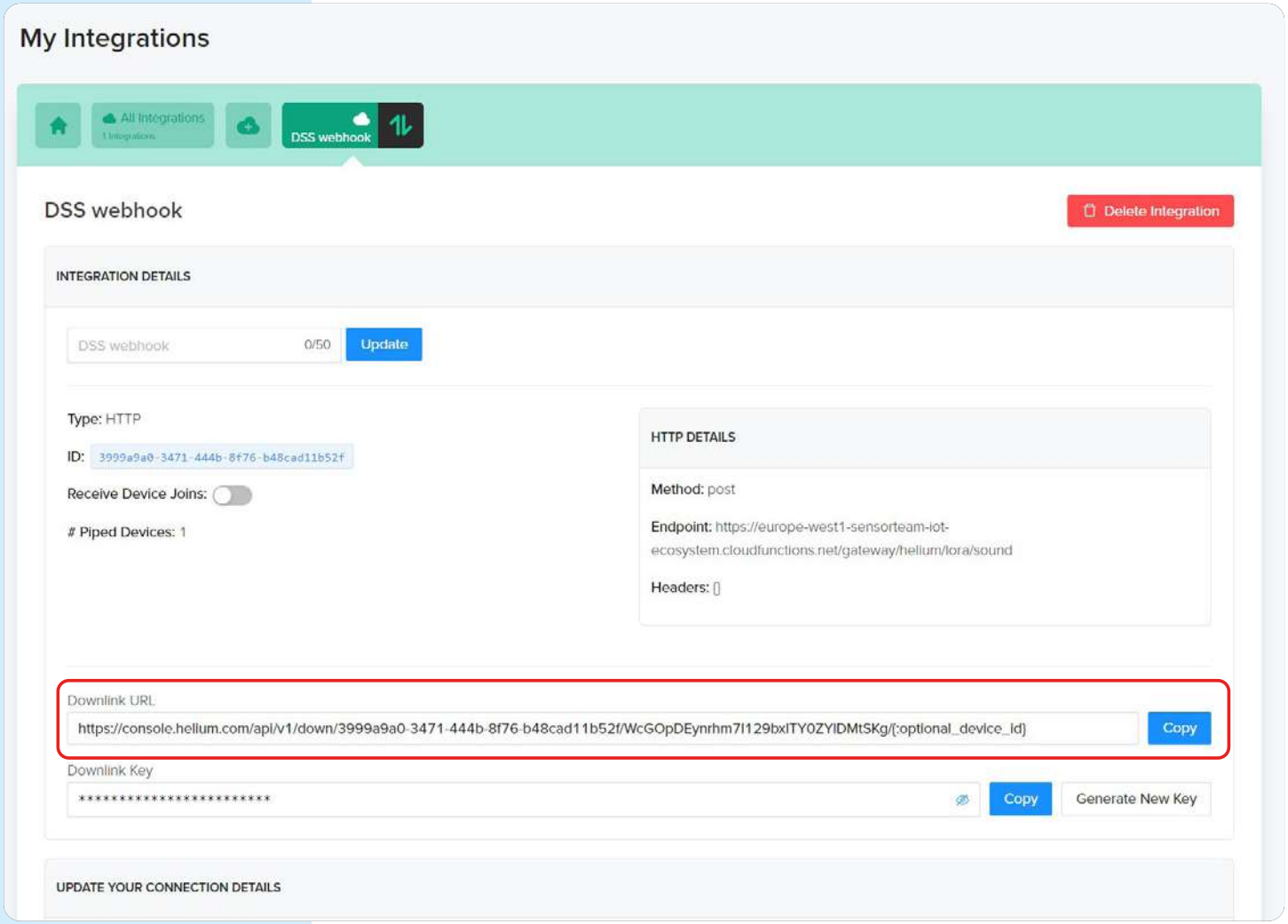
1. Click “Nodes”, “Devices” and drag the device into the worksheet.
2. Click “Integrations” and drag the integration into the worksheet.
3. Connect the device to the integration.



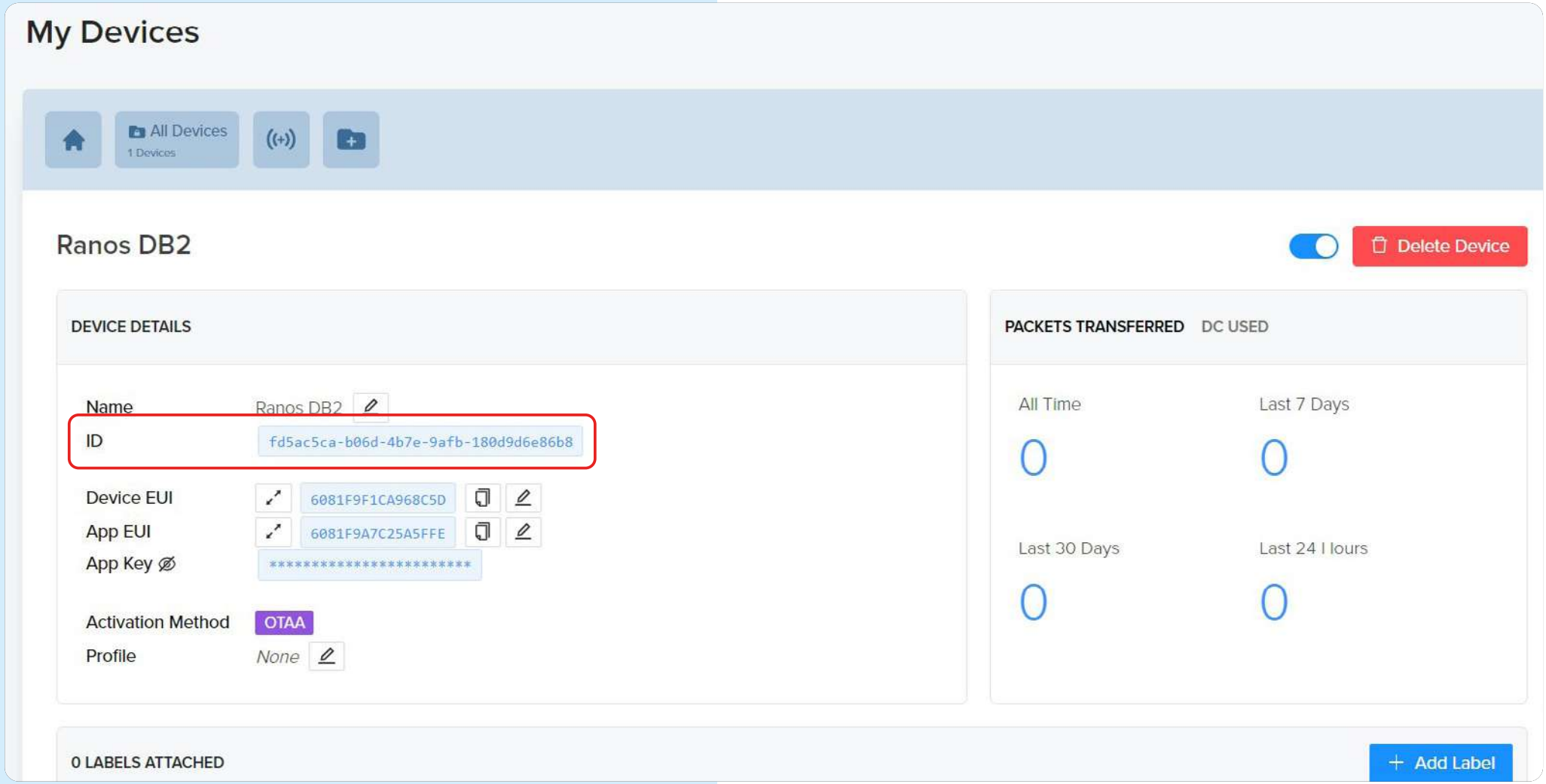
Downlink configuration

1. Navigate to “Integrations”, open your integration and copy and save the downlink URL. Remove the following text from the URL: “/{:optional_device_id}”

   Example: https://console.helium.com/api/v1/down/3999a9a0-3471-444b-8f76-b48cad11b52f/WcGOpDEyn-rhm7l129bxITY0ZYIDMtSKg



2. Navigate to “Devices”, open your device and copy and save the ID.



3. Open the Connect Dashboard, navigate to “Devices”, click the gear icon under actions and click “Edit” under details.

4. Enter the following information:

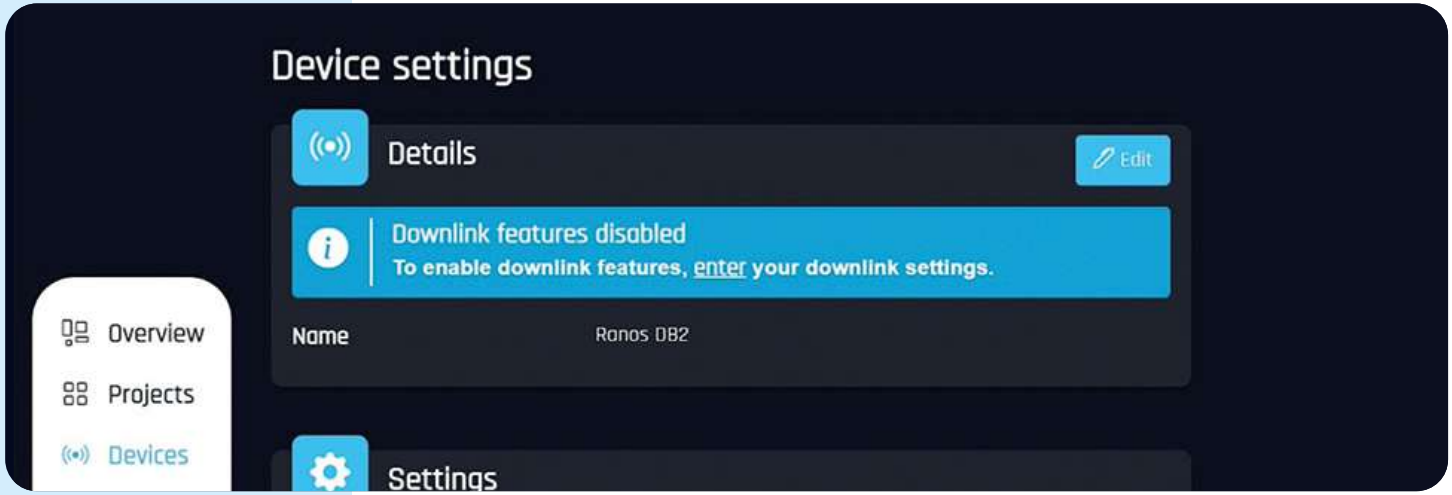
- Name: Name of the Ranos dB. Already filled in, edit or leave as is.

- Provider: Helium

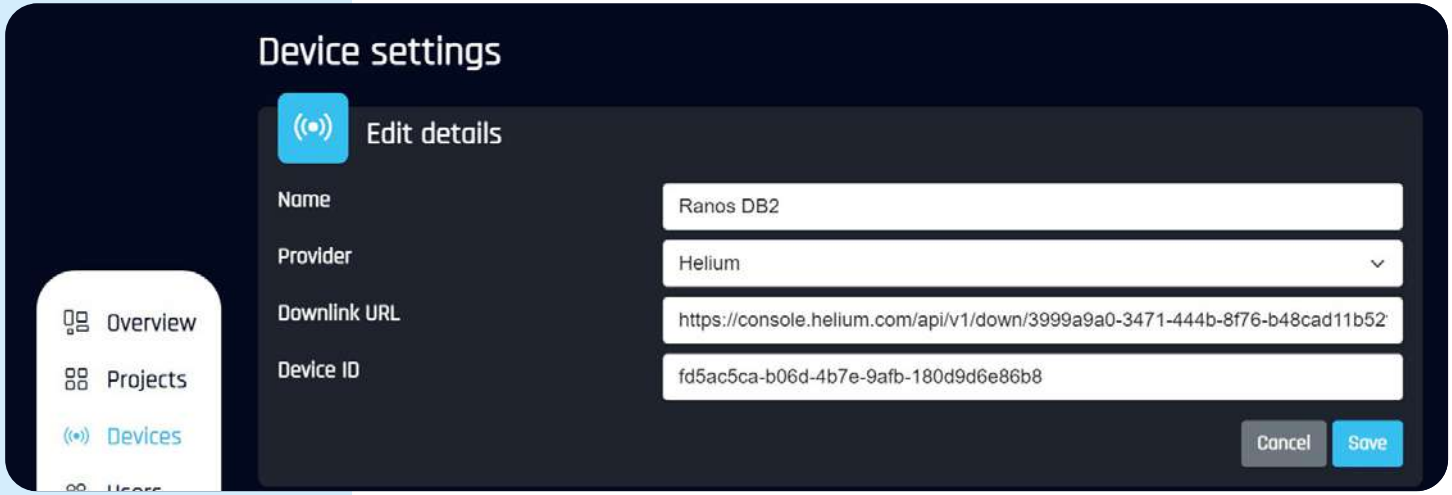
- Paste the Downlink URL that was copied from the Helium Integration.

- Paste the ID that was copied from the Helium Device.

3



4



Appendix B

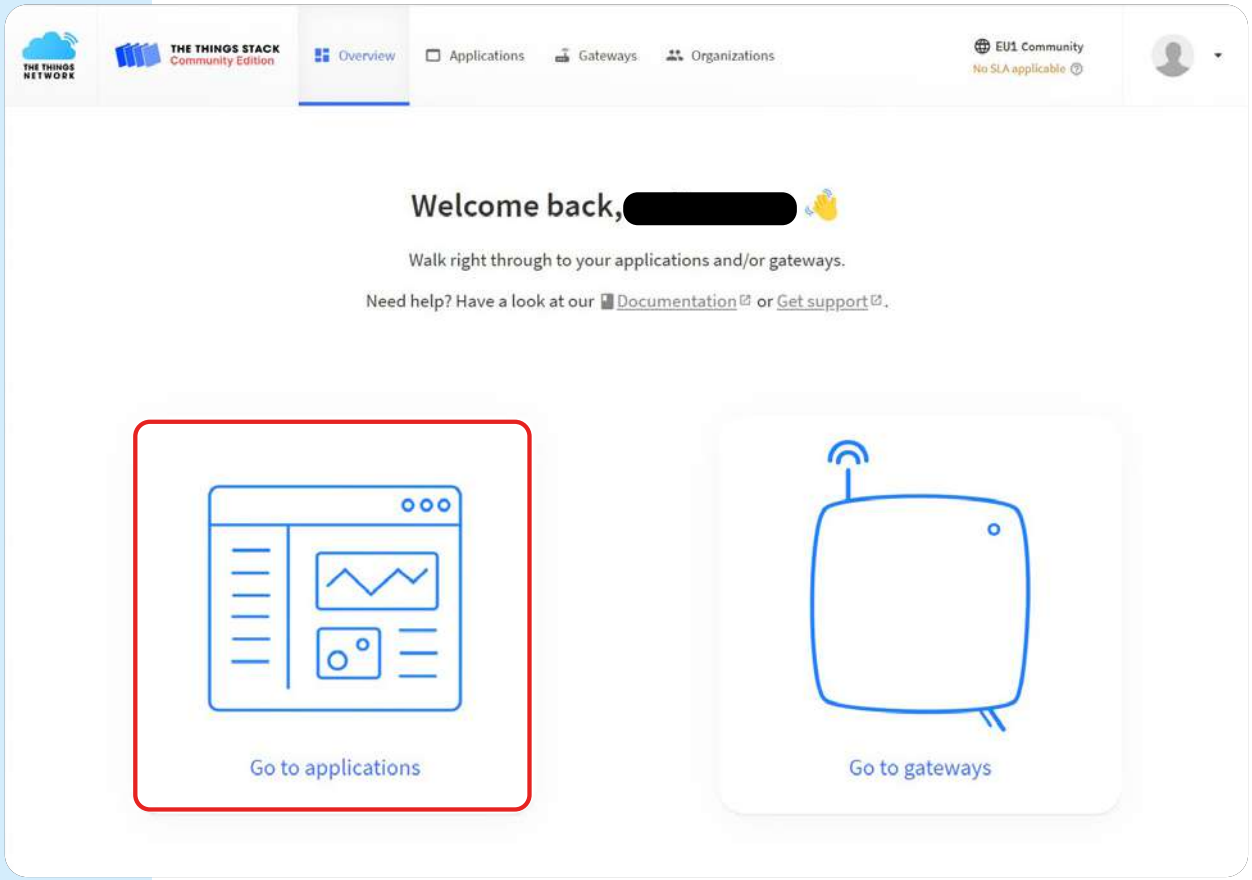
Ranos dB TTN integration manual

Create application

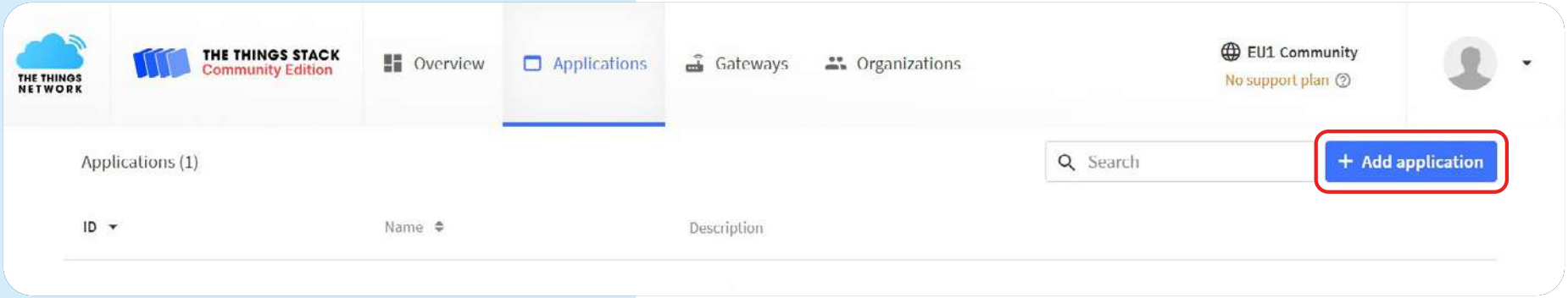
1. Navigate to your TTN console and click “Go to applications”.

2. Click “App application”.

1



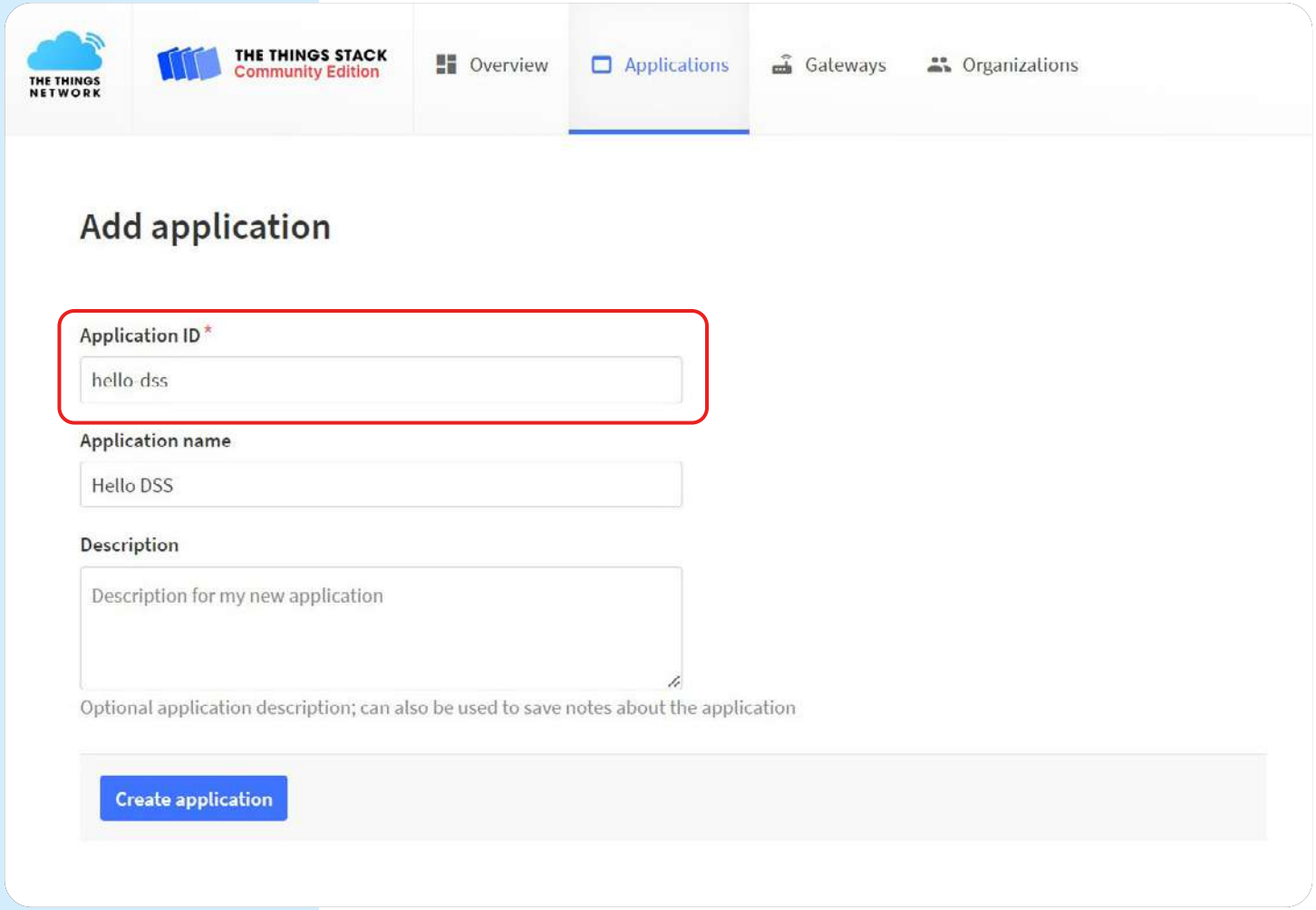
2



3. Fill in the Application ID, Application name and Description as desired.

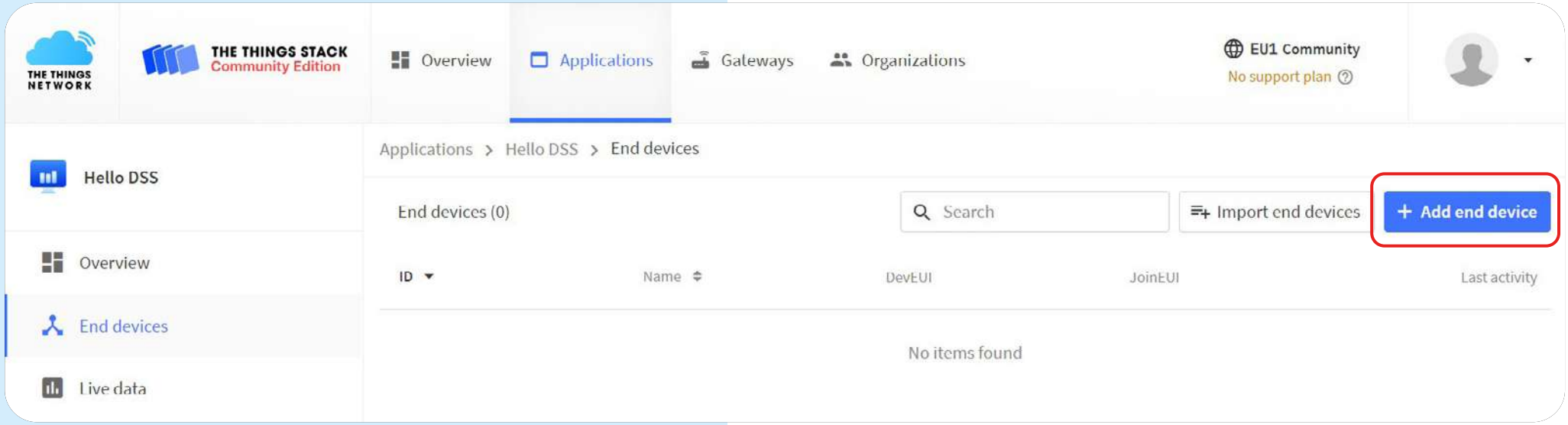
4. Copy and save the Application ID for later use during Connect Dashboard configuration.

5. Click “Create application”



Create end device

1. Open the application, navigate to “End devices” and click “Add end device”.



2. Click the tab “Manually”
   Enter the following information:

   - Frequency plan: choose the frequency plan according to your region and gateway type.

   - LoRaWan version: 1.0.1

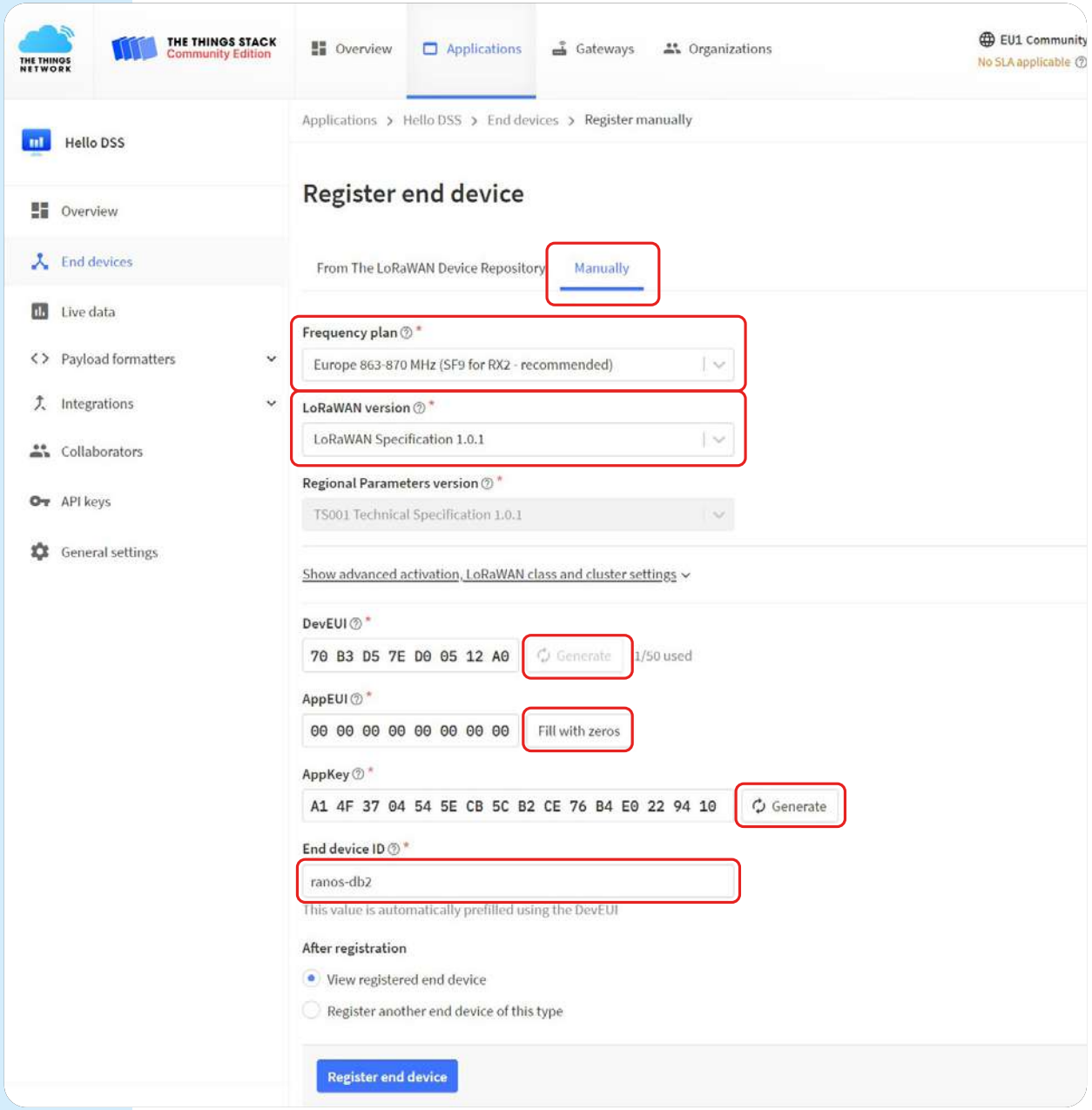
   - DevEUI: let TTN generate the DevEUI, click the “Generate” button next to the text field.

   - AppEUI: fill the AppEUI with zeros, click the “Fill with zeros” button next to the text field.

   - AppKey: let TTN generate the AppKey, click the “Generate” button next to the text field.

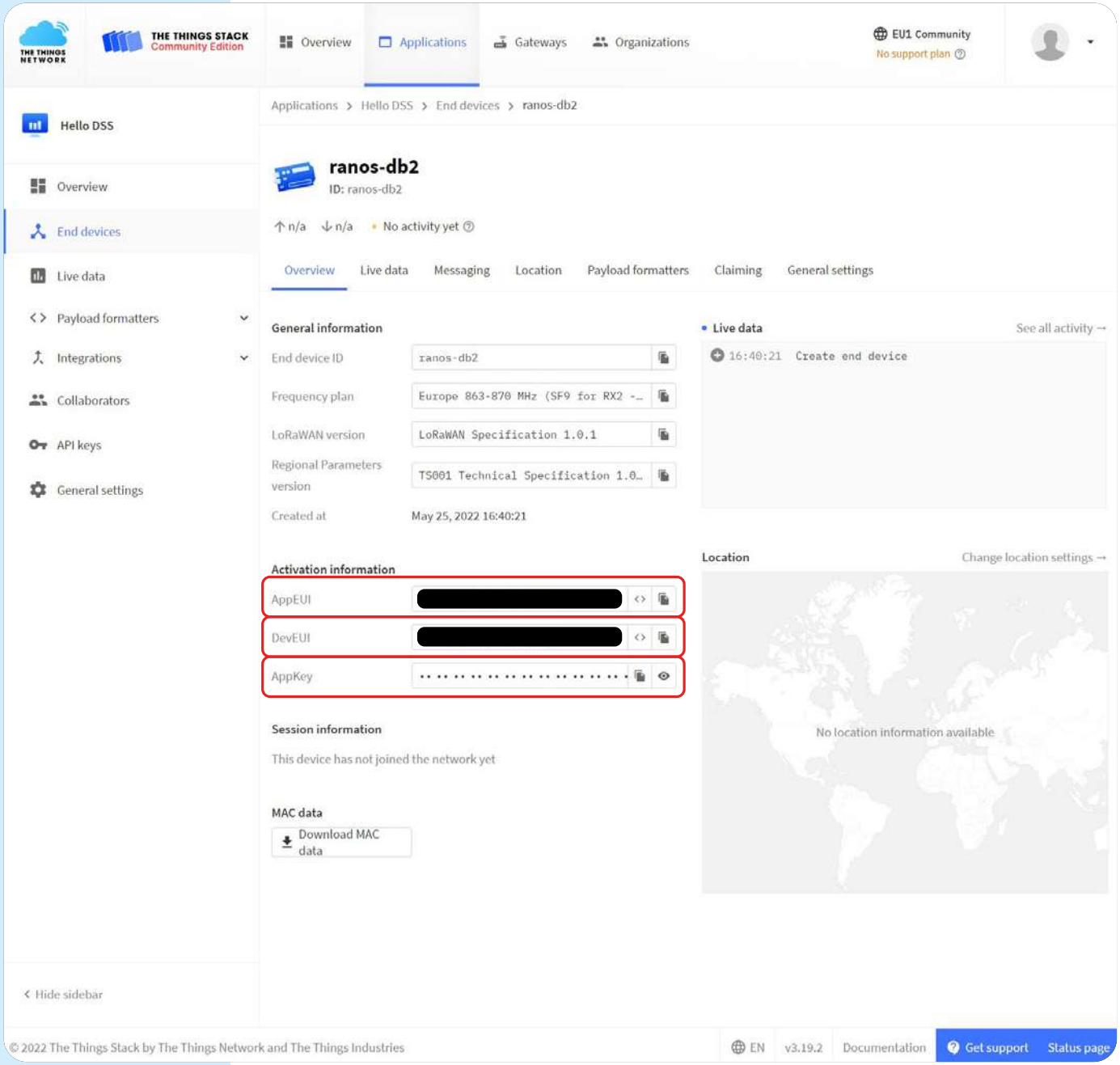
   - End device ID: <choose a name for your device>

3. Click “Register end device” to create the device.



4. Click the device and copy and paste the keys into the Ranos using our Connect App. Please note the different order in our Connect App:

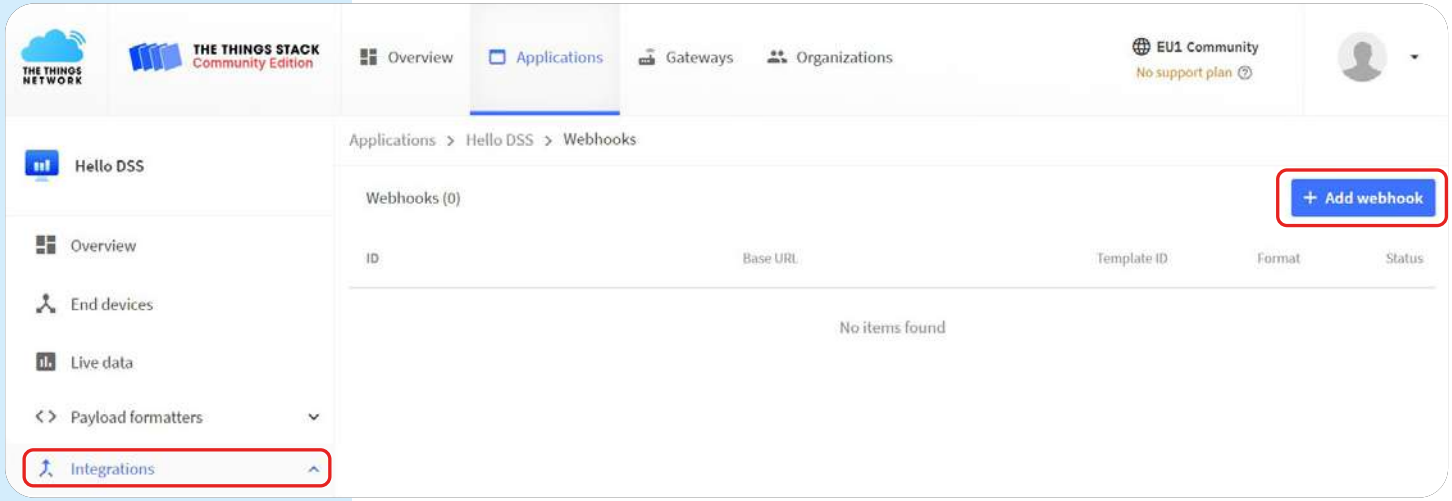
   1. DevEUI
   2. JoinEUI (former AppEUI)
   3. AppKey

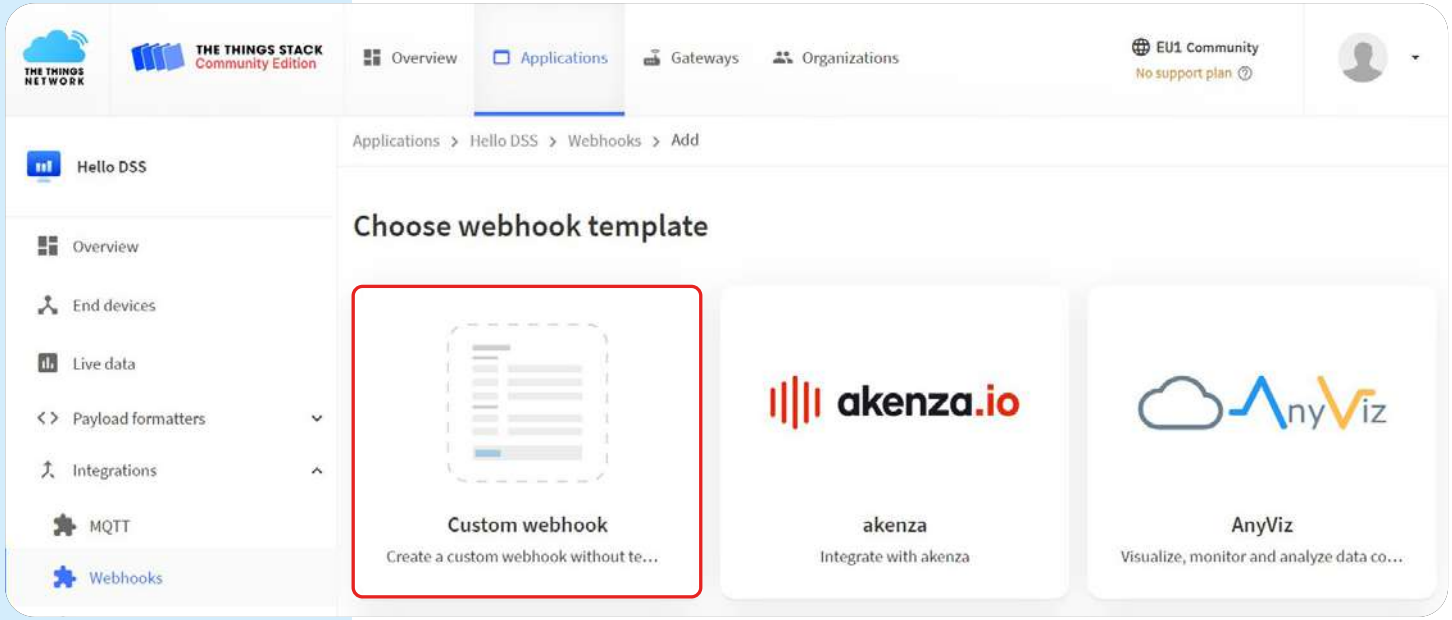


Add webhook

1. Navigate to integrations > webhook and click “Add webhook”.

2. Choose the “Custom webhook” template.





3. Enter the following information:

   - Webhook ID: <choose an ID>

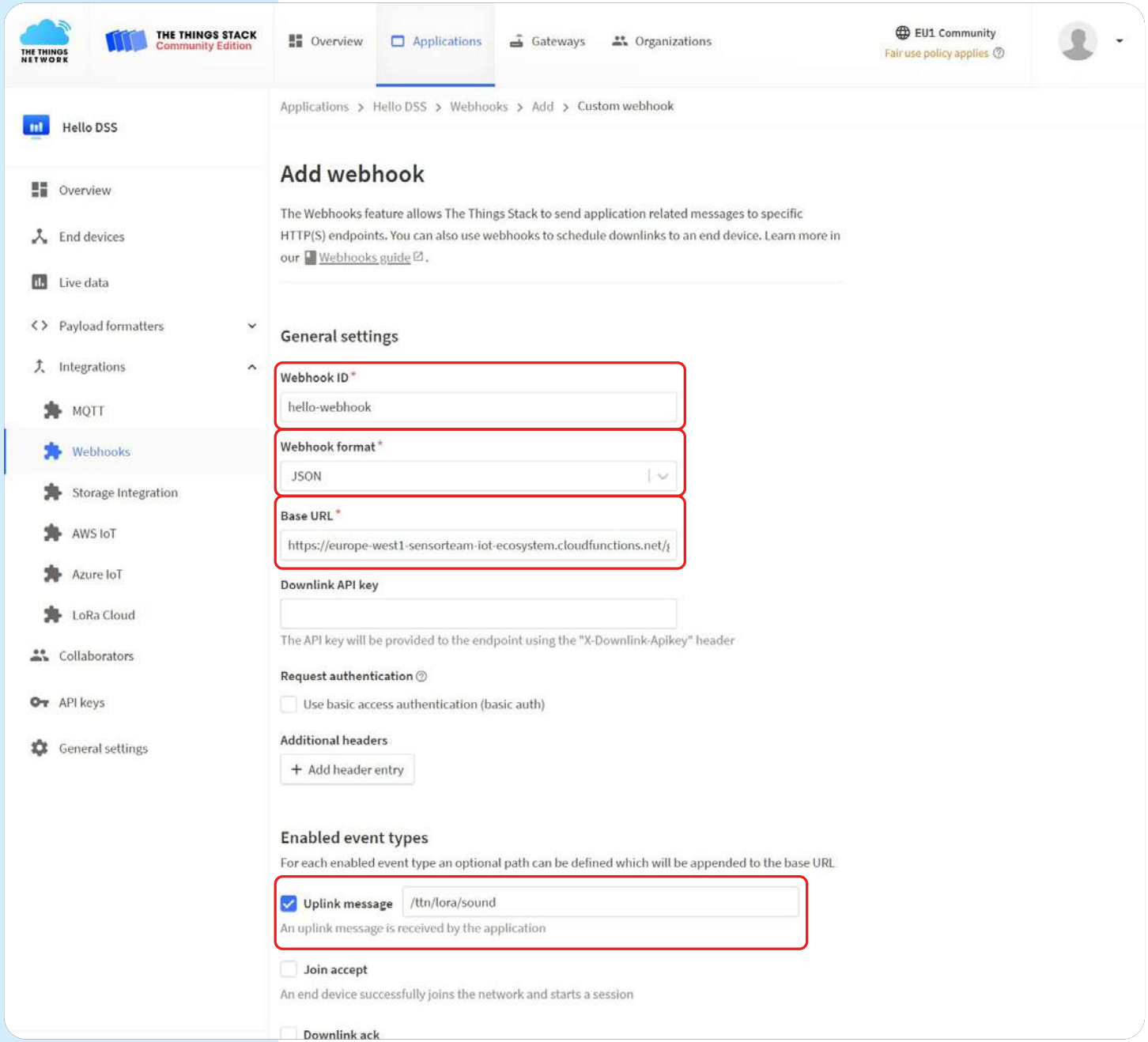
   - Copy and save the Webhook ID for later use during Connect Dashboard configuration.

   - Webhook Format: JSON

   - Base URL: https://europe-west1-sensorteam-iot-ecosystem.cloudfunctions.net/gateway

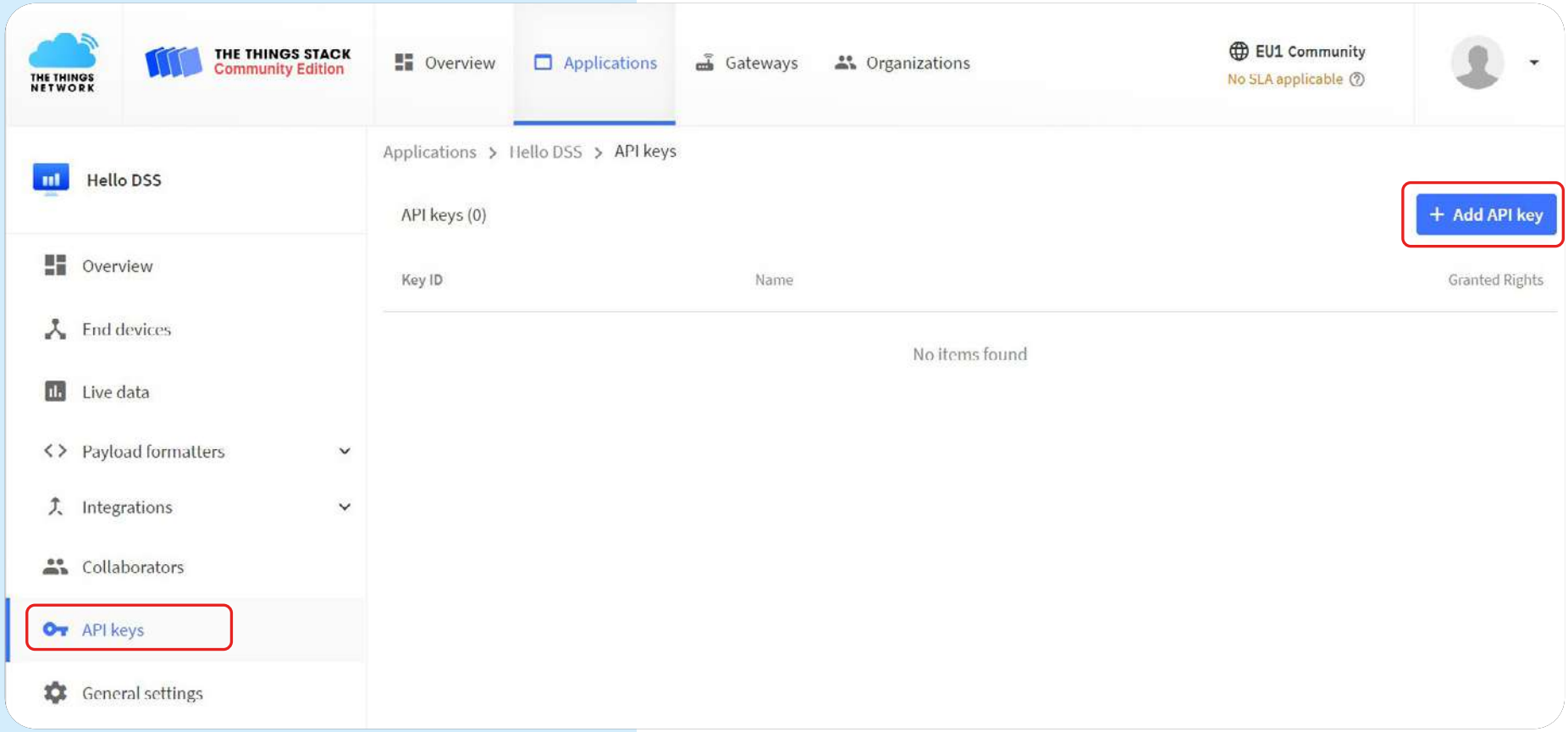
   - Enable Uplink message, URL: /ttn/lora/sound

4. Click “Add webhook” at the bottom of the page to save.



Create API key

1. Navigate to API keys and Click “Add API key”

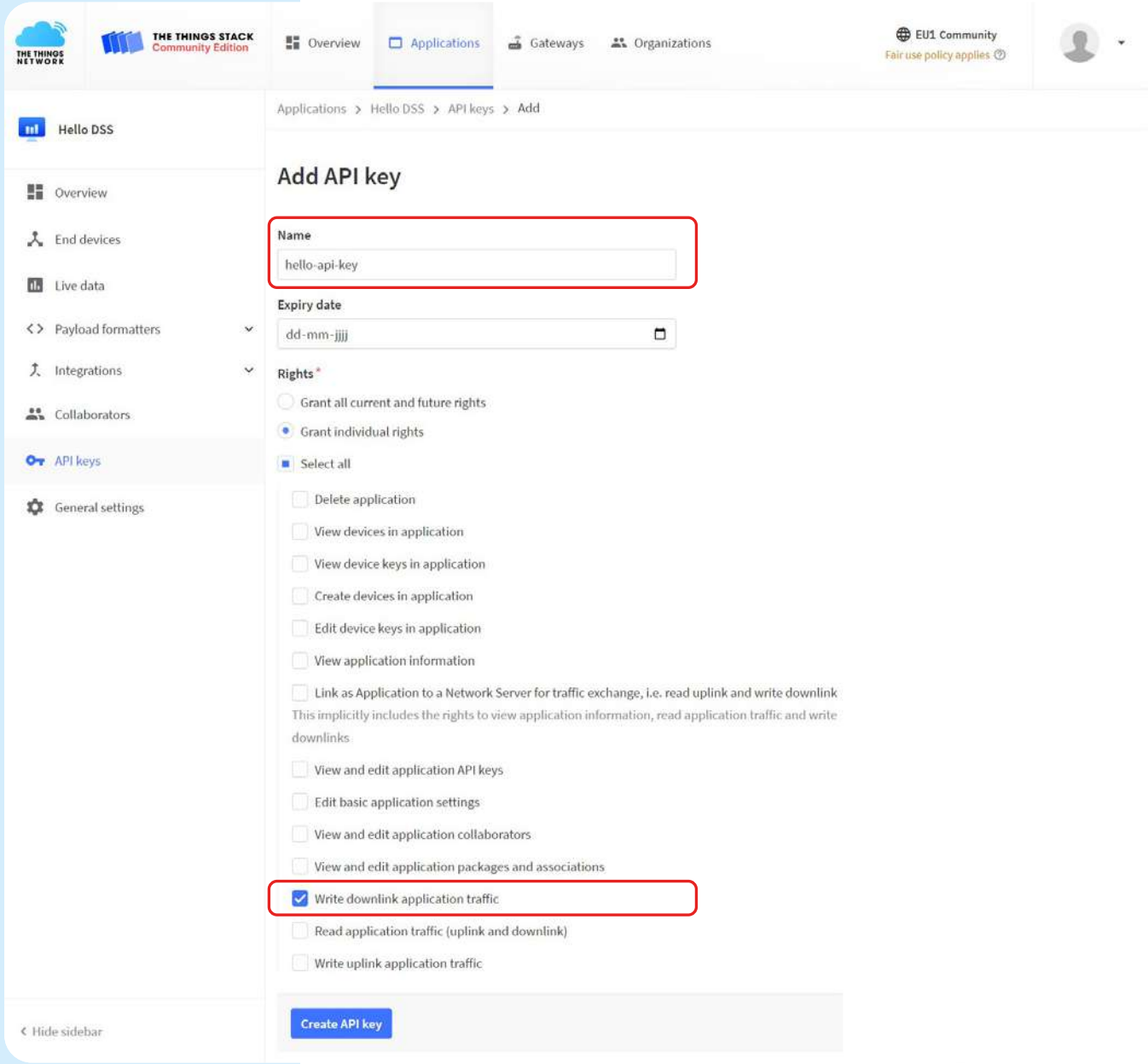


2. Enter the following information:

   - Name: <choose a name>

   - Rights: Select “Grant individual rights” and check “Write downlink application traffic”.

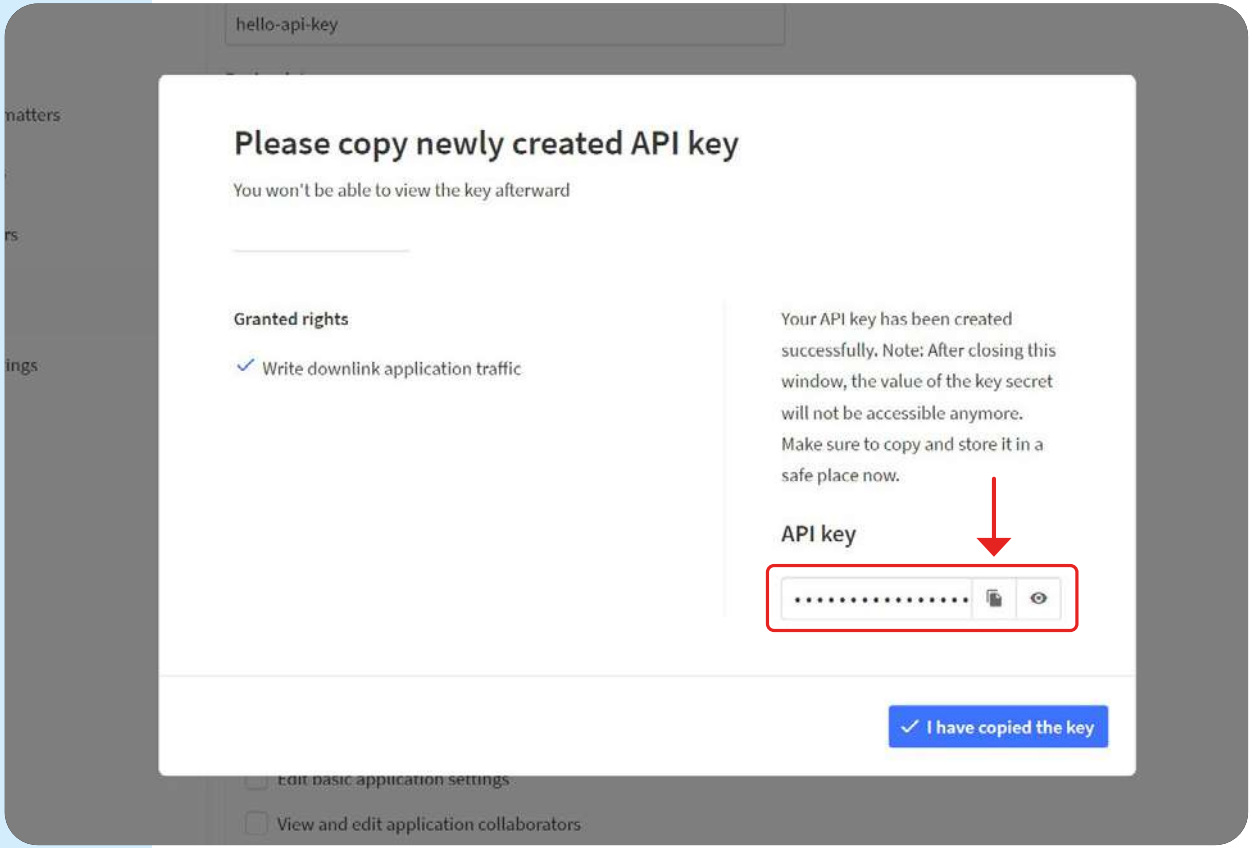
3. Click “Create API key” at the bottom of the page.



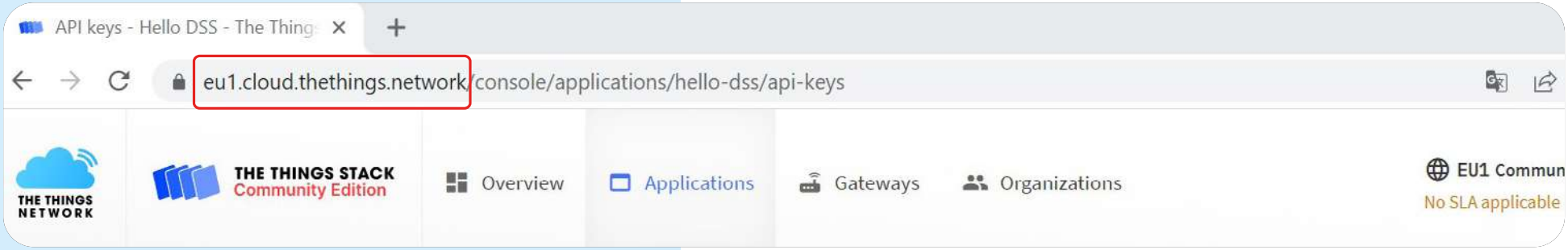
4. After clicking “Create API key” a popup will show. Copy and save the API key from the popup for later use during Connect Dashboard configuration.

   The popup and key will not show again anywhere else.

5. Copy and save the base URL of the TTN portal (Note: DO NOT USE A SLASH) for later use during Connect Dashboard configuration.



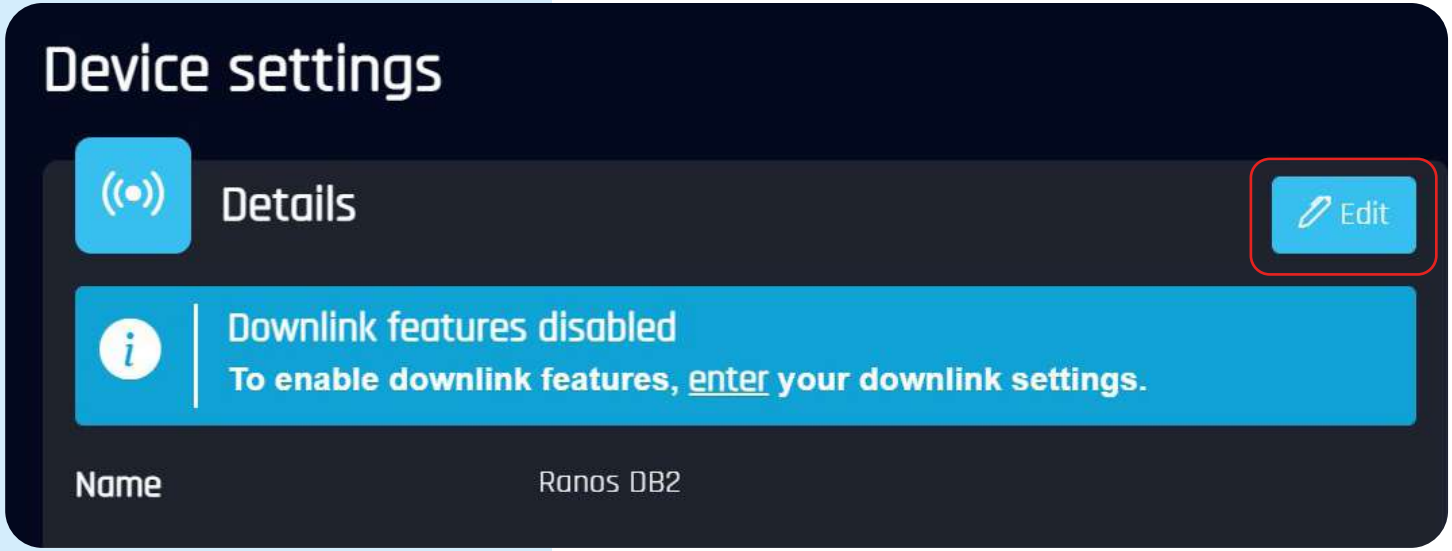
4



5

Connect Dashboard downlink configuration

1. Navigate to “Devices” and click the gear icon under actions and click “Edit” under details.



2. Enter the following information:

   - Name: Name of the Ranos dB.
     Already filled in, edit or leave as is.

   - Provider: TTN

   - Base URL: paste base URL
     of the TTN portal.

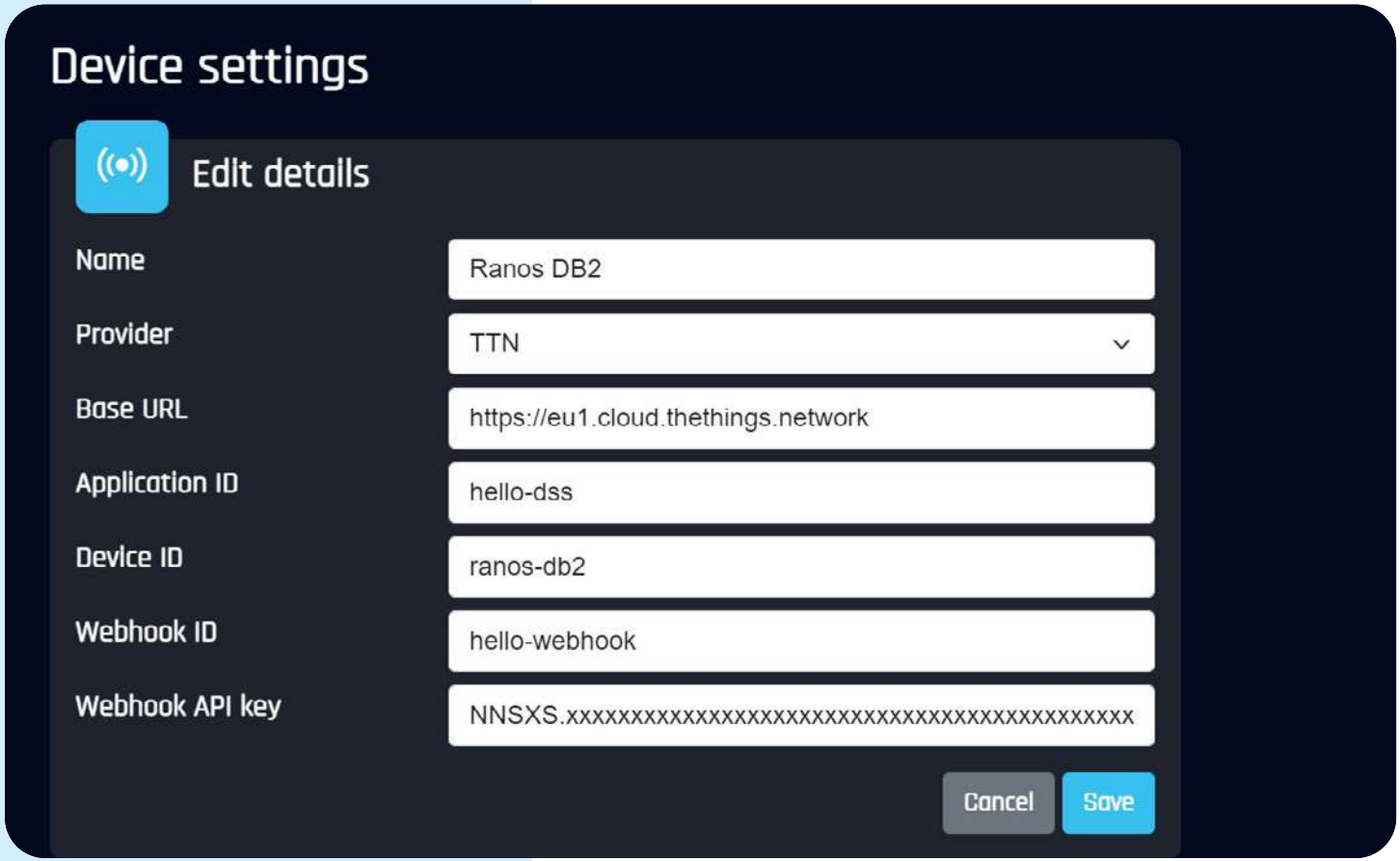
   - Application ID: paste
     the TTN Application ID

   - Device ID: Paste
     the TTN End device ID

   - Webhook ID: Paste the
     TTN Webhook ID

   - Webhook API key: paste
     the TTN API key

3. Click save.



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