LAQ4 LoRaWAN Air Quality Sensor Manual

Document Version: 1.0

Image Version: v1.0

Version	Description	Date
1.0	Release	2021-Mar-5

1. Introduction

1.1 What is LAQ4 LoRaWAN Air Quality Sensor

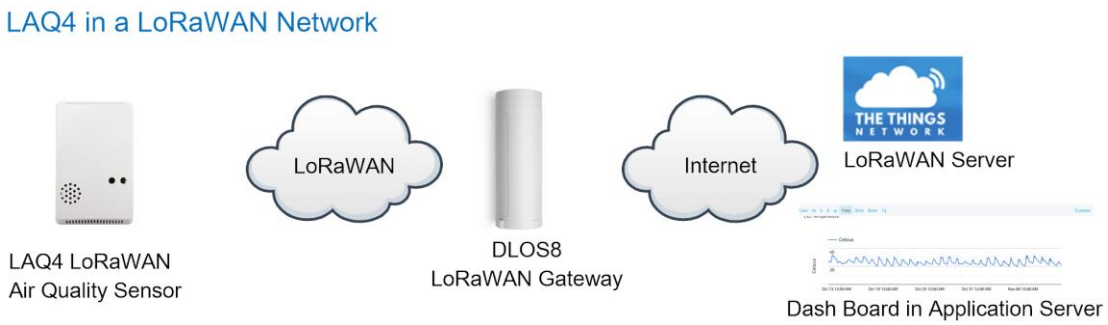
The Dragino LAQ4 is a **LoRaWAN Air Quality Sensor** for Internet of Things solution. It is designed to measure the **surrounding environment parameters include: TVOC(Total Volatile Organic Compound), eCO2(equivalent CO2), temperature and relative air humidity**, and then upload to IoT server via LoRaWAN wireless protocol.

IAQ (Indoor Air Quality) is very important factor for indoor activity and human life. **VOC**(Volatile Organic Compound) are emitted as gases from certain solids or liquids and they are the main source for poor indoor air quality. LAQ4 provides the trend for IAQ measurement and, like all other TVOC sensors, LAQ4 requires calibration for more accuracy measurement on TVOC and eCO2.

LAQ4 supports **temperature and humidity alarm** feature, user can get alarm for instant notice.

LAQ4 supports **Datalog feature**, User can retrieve the sensor data from LoRaWAN commands.

Each LAQ4 is pre-load with a set of unique keys for LoRaWAN registration, register these keys to local LoRaWAN server and it will auto connect after activation.



1.2 Specifications

Common DC Characteristics:

- Supply Voltage: built in 4000mAh Li-SOCI2 battery
- Operating Temperature: -40 ~ 85°C

TVOC Sensor:

- 0ppb to 29206 ppb. Values outside this range are clipped
- Temperature and Humidity Compensation

eCO2 Sensor:

- 400ppm to 32768 ppm. Values outside this range are clipped

Note: eCO2 (equivalent calculated carbon-dioxide) is different things vs the real CO2. It is calculated by TVOC value.

- Temperature and Humidity Compensation

Temperature Sensor:

- Range: -40 to + 80°C
- Accuracy: Typ ±0.3 @ 0-90 °C
- Resolution: 0.01°C
- Long Term Shift: Typ <0.02 °C/yr

Relative Humidity Sensor:

- Range: 0 ~ 99.9% RH
- Accuracy: ± 3%RH (0 ~ 100%RH)
- Resolution: 0.04% RH
- Long Term Shift: <0.25 %RH/yr

LoRa Spec:

- Frequency Range,
  - ✓ Band 1 (HF): 862 ~ 1020 Mhz
- 168 dB maximum link budget.
- High sensitivity: down to -148 dBm.
- Bullet-proof front end: IIP3 = -12.5 dBm.
- Excellent blocking immunity.
- 127 dB Dynamic Range RSSI.
- LoRaWAN 1.0.3 Specification

Power Consumption:

- Deep Sleep Mode / IDLE Mode: 9uA
- Sampling Mode: 11.8mA @ 2s for every 60 seconds.
- LoRaWAN Transmit Mode: 125mA.

Battery Life:

- 7 ~ 10 months.

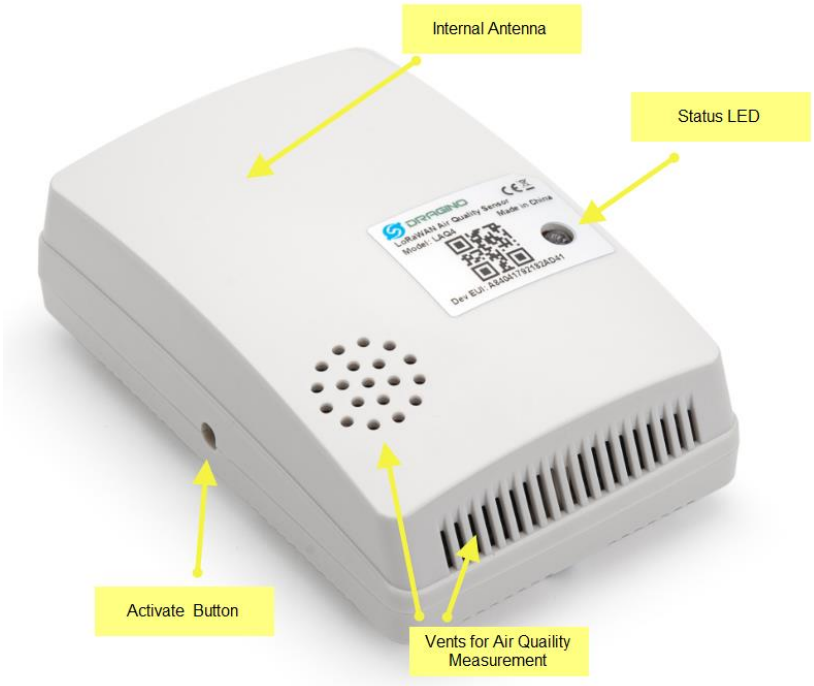
1.3 Features

- ✓ LoRaWAN v1.0.3 Class A
- ✓ Ultra-low power consumption
- ✓ Monitor TVOC/ eCO2/ Temperature and Relative Humidity
- ✓ Temperature & Humidity alarm
- ✓ Bands: CN470/EU433/KR920/US915 EU868/AS923/AU915/IN865
- ✓ AT Commands to change parameters
- ✓ Auto adjust timing. Remote retrieve data.
- ✓ Uplink on periodically or Interrupt
- ✓ Downlink to change configure

1.4 Applications

- ✓ Home and Building Automation
- ✓ Industrial Monitoring and Control

1.5 Device Structure



1.6 Hardware Change log

LAQ4 v1.0:

Release.

2. How to use LAQ4?

2.1 How to activate LAQ4?

The LAQ4 has two working modes:

- ✓ Deep Sleep Mode: LAQ4 doesn't have any LoRaWAN activate. This mode has ultra-low power consumption. It is used for storage and shipping to save battery life.
- ✓ Working Mode: In this mode, LAQ4 works as LoRaWAN Sensor to Join LoRaWAN network and send out the sensor data to IoT server. Between each sampling/tx/rx periodically, LAQ4 will be in IDLE mode, in IDLE mode, LAQ4 has the same power consumption as Deep Sleep mode.

The LAQ4 is set in deep sleep mode by default; The Activate Button is used to switch to different modes:

Behavior on ACT	Function	Action
Pressing ACT between 1s < time < 3s	Test uplink status	If LAQ4 is already Joined to LoRaWAN network, LAQ4 will send an uplink packet.
Pressing ACT and hold for more than 3s	Active LAQ4	Green led will fast blink 5 times, device will enter working mode and start to Join LoRaWAN network. green led will be solid turn on for 5 seconds after successfully joined in network.
Quickly press ACT 3 times in four seconds	Start Calibrate	BLUE LED will be solid on for 5 seconds. And LAQ4 will start to calibrate process. Please put the device in clear environment and wait for 30 minutes.
Quickly press ACT 5 times in five seconds	Deactivate Device	Red led will be solid on for 5 seconds. Means LAQ4 are in Deep Sleep Mode.

2.2 How it works?

The LAQ4 is working as LoRaWAN OTAA Class A end node. Each LAQ4 is shipped with a worldwide unique set of OTAA and ABP keys. User needs to input the OTAA or ABP keys in the LoRaWAN network server to register. And then activate LAQ4, it will join the LoRaWAN network and start to transmit air quality data. The default period for each uplink is 20 minutes.

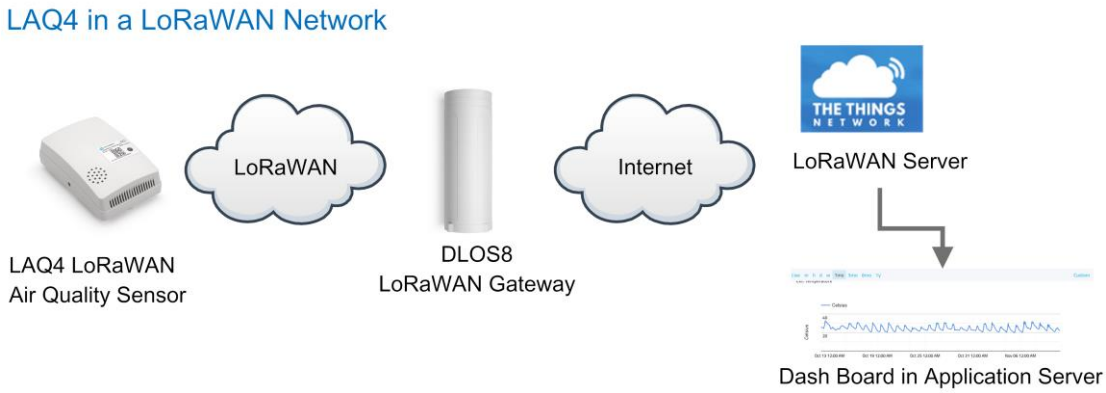
2.3 Quick guide to connect to LoRaWAN server (OTAA)

2.3.1 Network Structure

Below is a typical example LoRaWAN network structure for LAQ4. In this structure, we use:

- DLOS8 as LoRaWAN Gateway. It will get the packet from LAQ4 and pass to LoRaWAN Network server.
- TTN LoRaWAN Server V3 as LoRaWAN Network Server. TTN will handle the registration of LAQ4 and dispatch the value to Application Server.
- TagoIO as application server to handle the demonstration of LAQ4 in Chart.

*Note: User can use other parts to replace above gateways and servers.



Assume the DLOS8 is already set to connect to TTN V3. What the rest we need to is to register the LAQ4 to TTN:

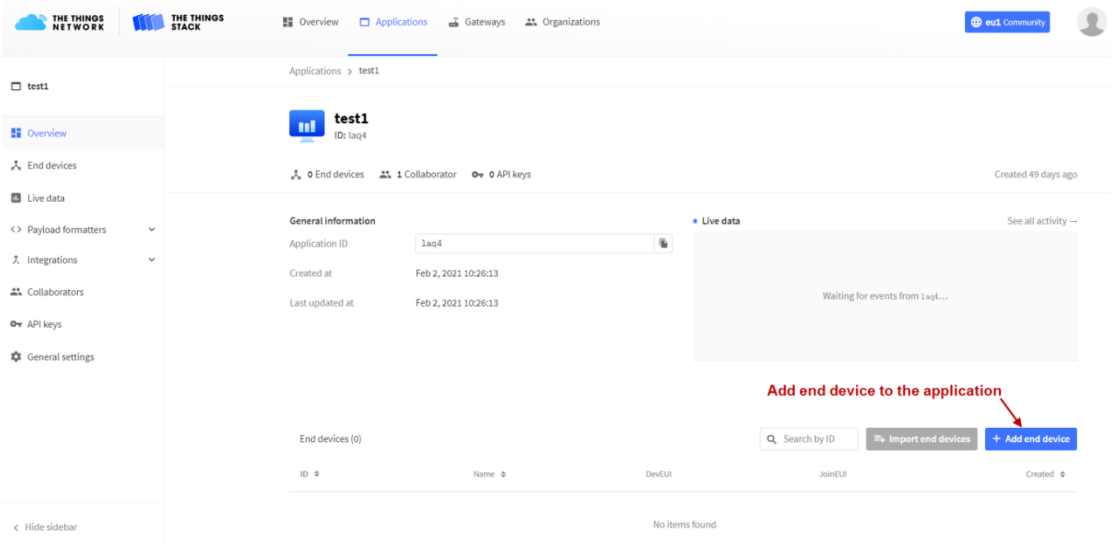
2.3.2 Connect LAQ4 to TTN v3

Step 1: Create a device in TTN v3 with the OTAA keys from LAQ4.

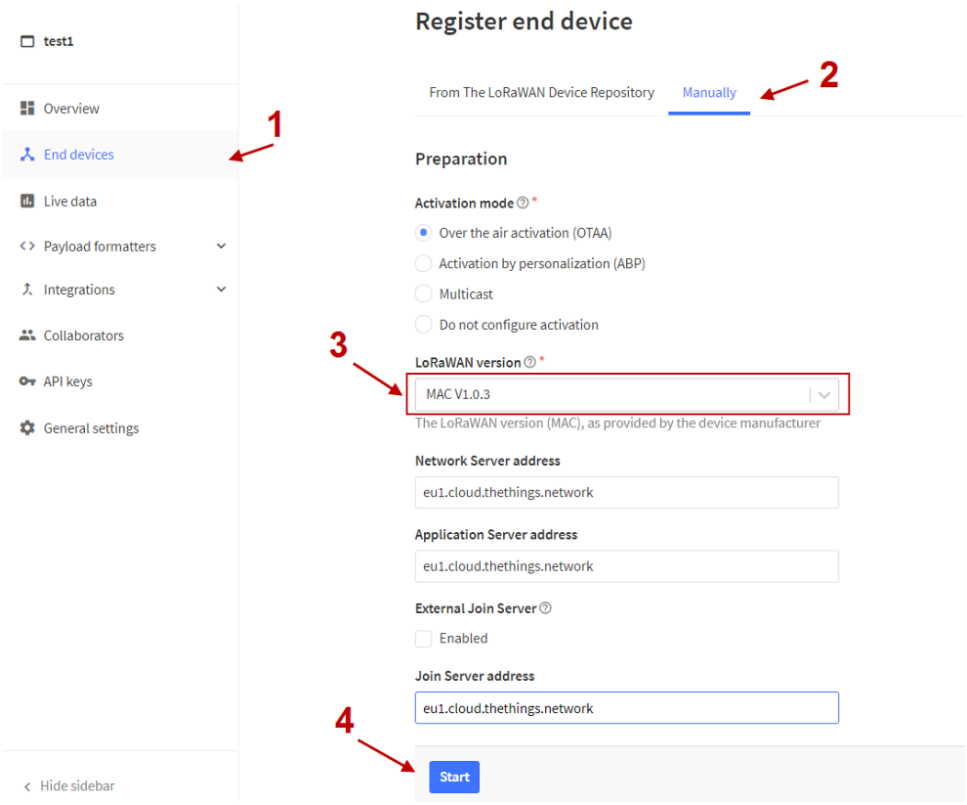
Each LAQ4 is shipped with a sticker with the default device EUI as below:

Input these keys in the LoRaWAN Server portal. Below is TTN v3 screen shot:

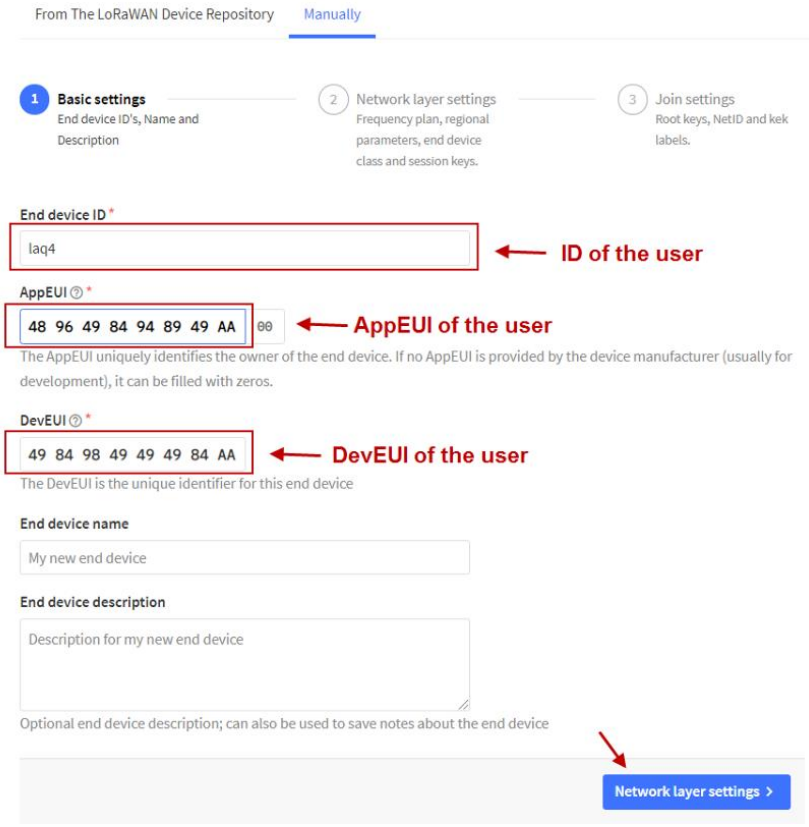
1/ Add End Device in the application



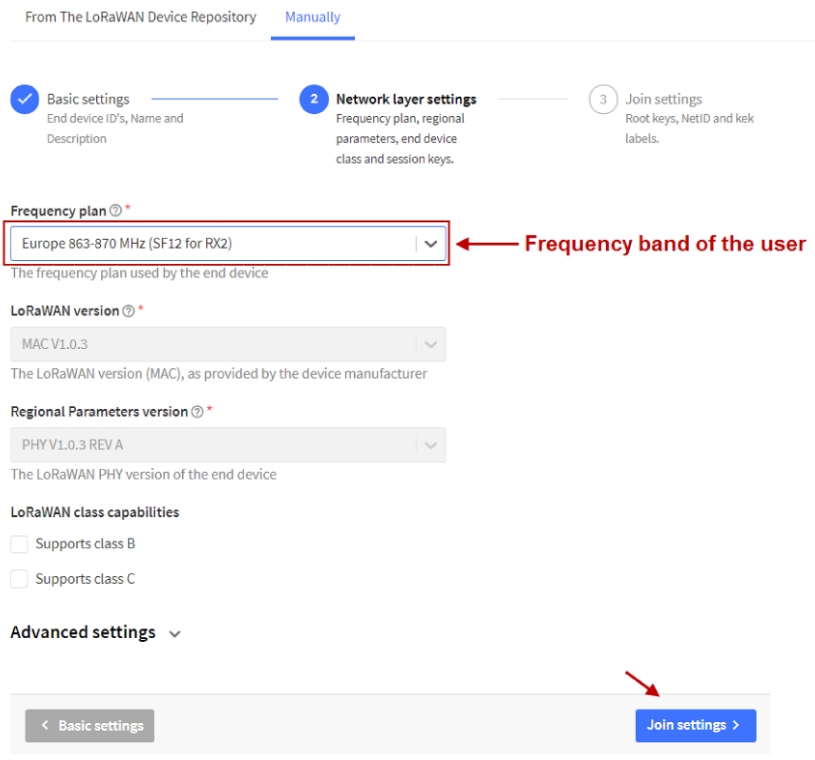
2/ Set Device Profile



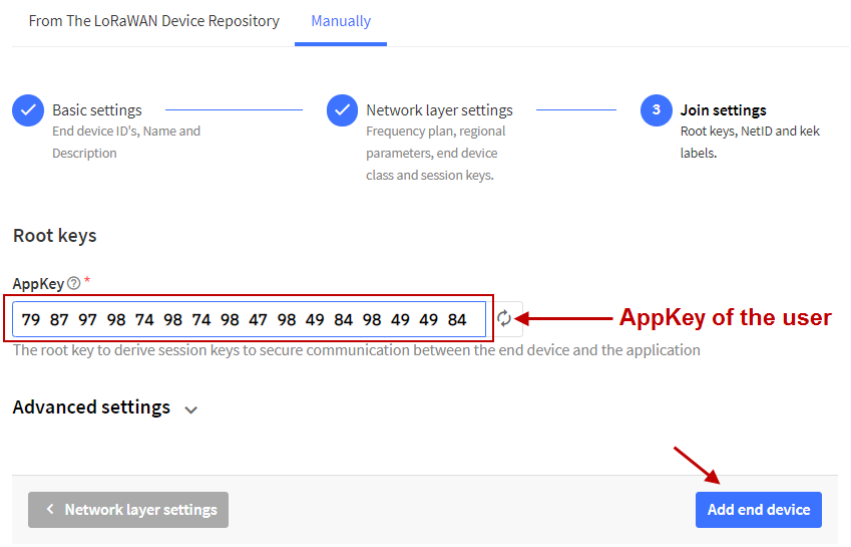
3/ Input APP EUI and Dev EUI in Basic Settings



4/ Choose the Frequency Band in Network Layer



5/ Add APP Key in Join Setting



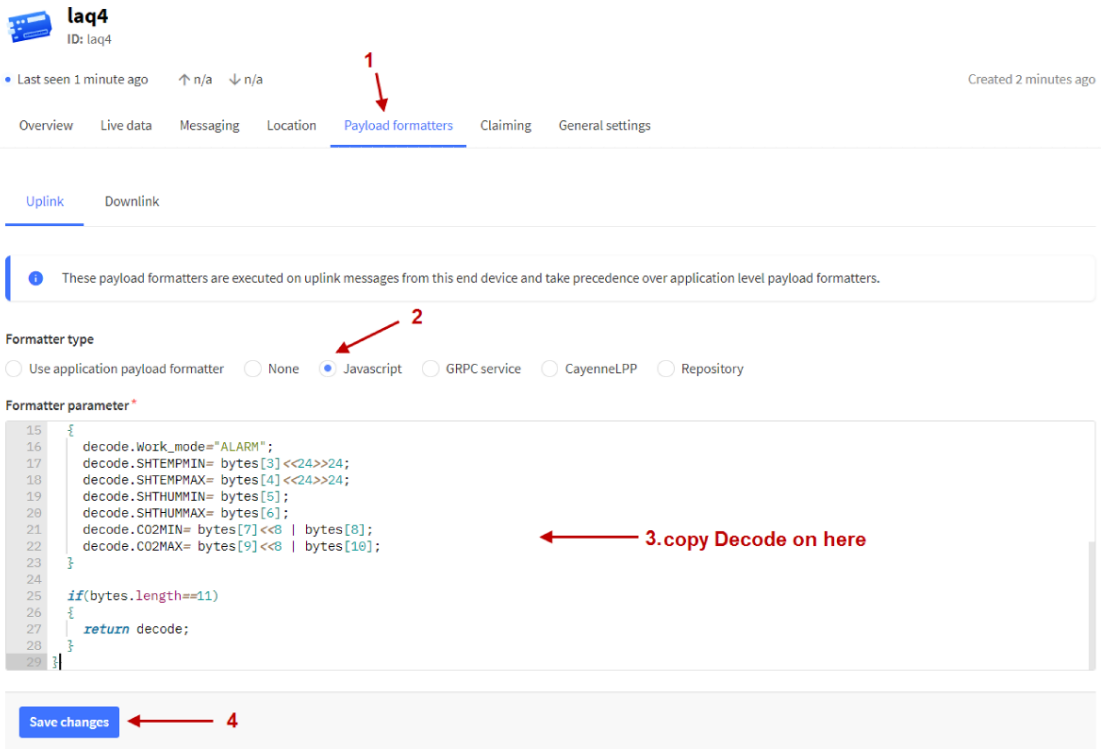
Step 2: Modify Payload Formatters

For Uplink:

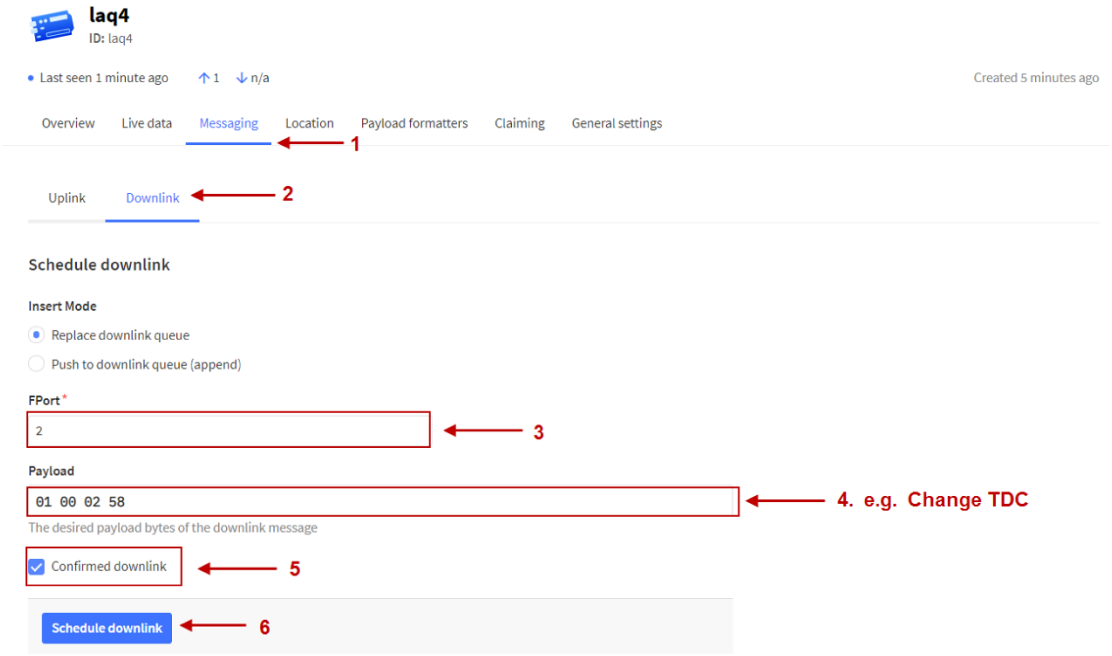
Choose Java Script and Paste the TTN Decoder from this link:

http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LAQ4/Decoder/

to below area.

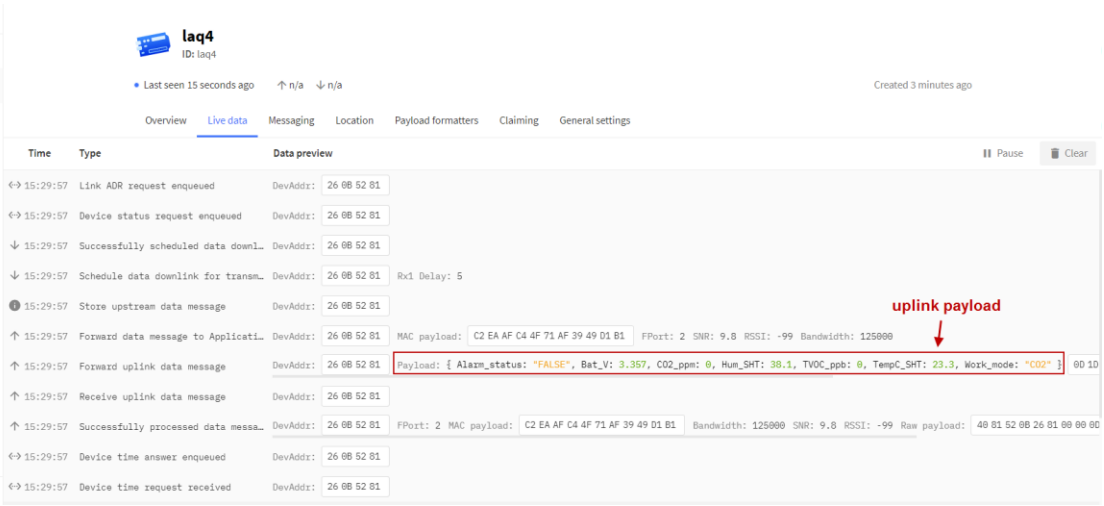


For Downlink:



Step 3: Press Activate Button to Activate LAQ4.

Step 4: LAQ4 will start to TTN network via the LoRaWAN coverage by DLOS8. After join successfully, LAQ4 will start to uplink Air Quality Value to LoRaWAN server. We can see below to show the successful of uplink photos.

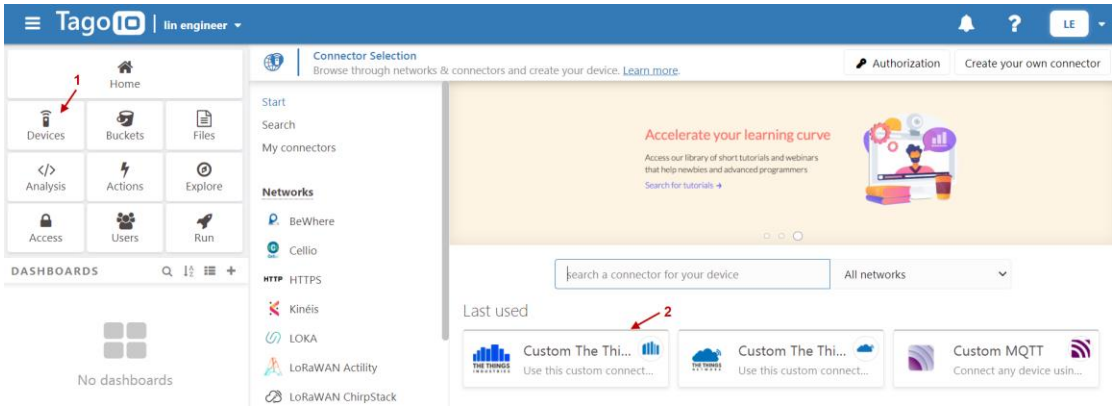


2.3.3 Pass Value from TTN v3 to Tago.IO

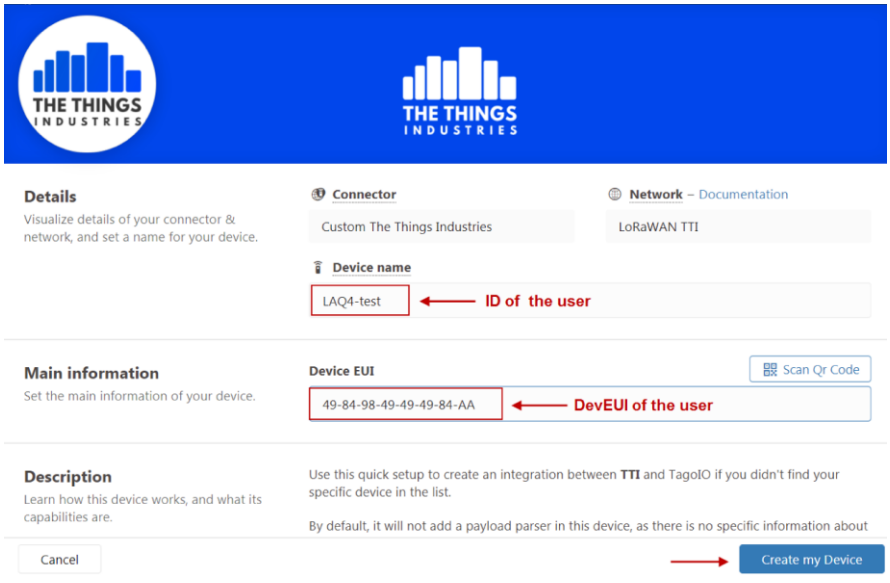
TTNv3 is a LoRaWAN server to handle the registration and device management for LAQ4. The sensor value shows in TTN v3 is not friendly for analyze. We need to connect TTN v3 to an Application Server to have a friendly view of the sensor value collected by LAQ4. Here we will use tago.io as example.

Step 1: Go to tago.io and register an account.

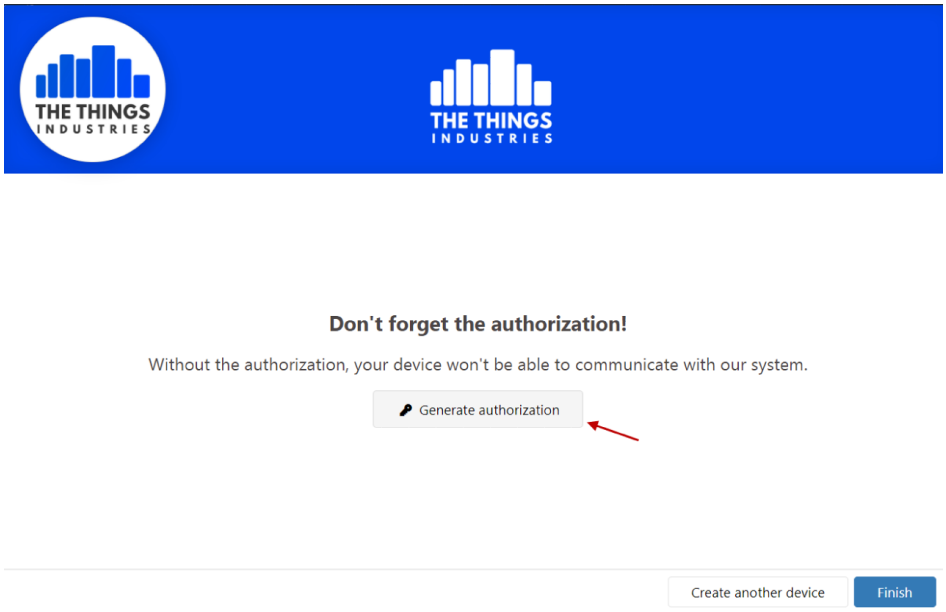
Step 2: Create devices, in the Connector Selection, choose Custom The Things Network.



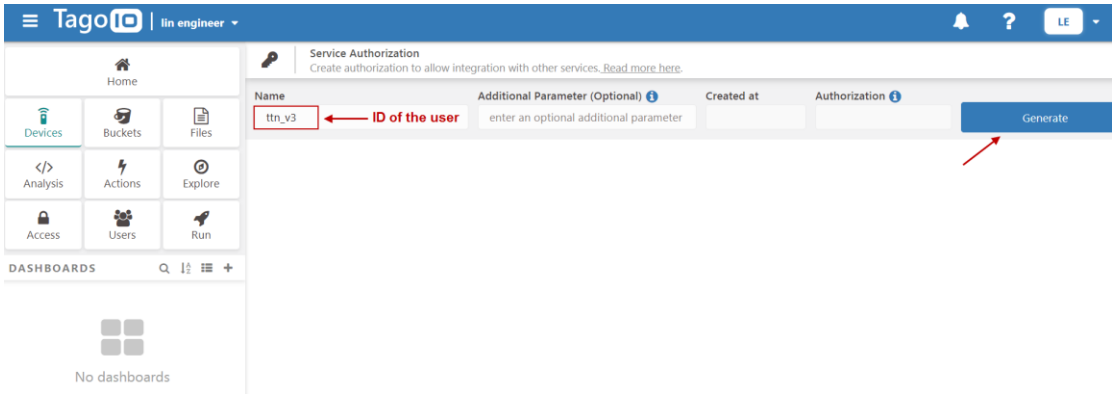
Step 3: Input the device name and Dev EUI of LAQ4, then click Create my Device.



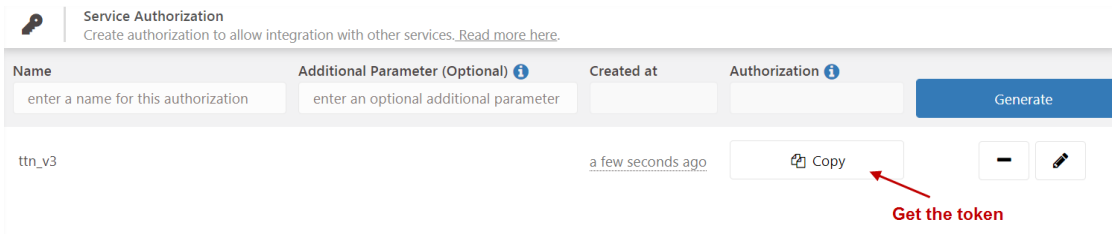
Step 4: Generate authorization.



Step 5: Put any Name here and generate the Authorization.

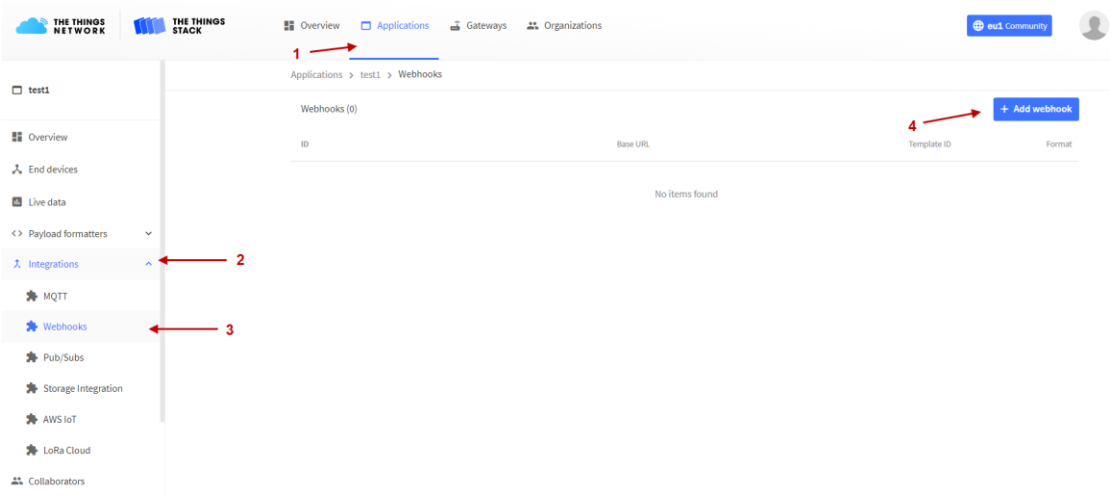


Step 6: Copy this Authorization, We need to put it to TTN v3.

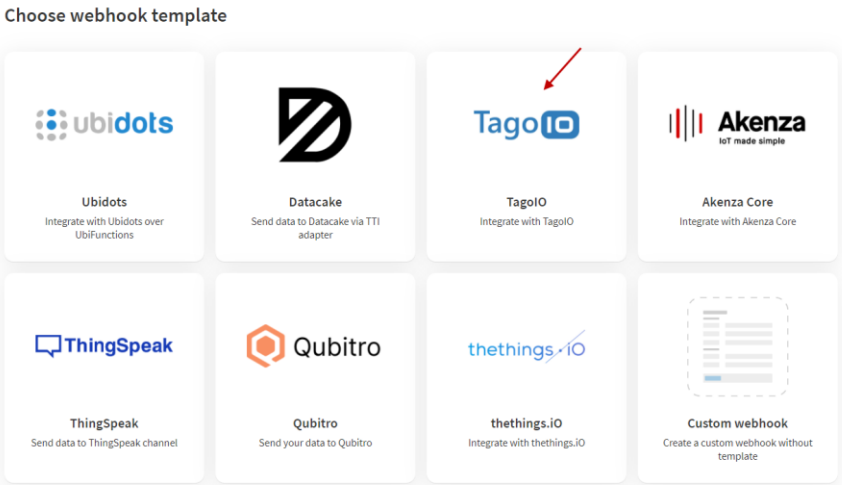


Step 7: Back to TTNv3 portal and select Application --> Integration --> Webhooks.

Click : Add Webhook.

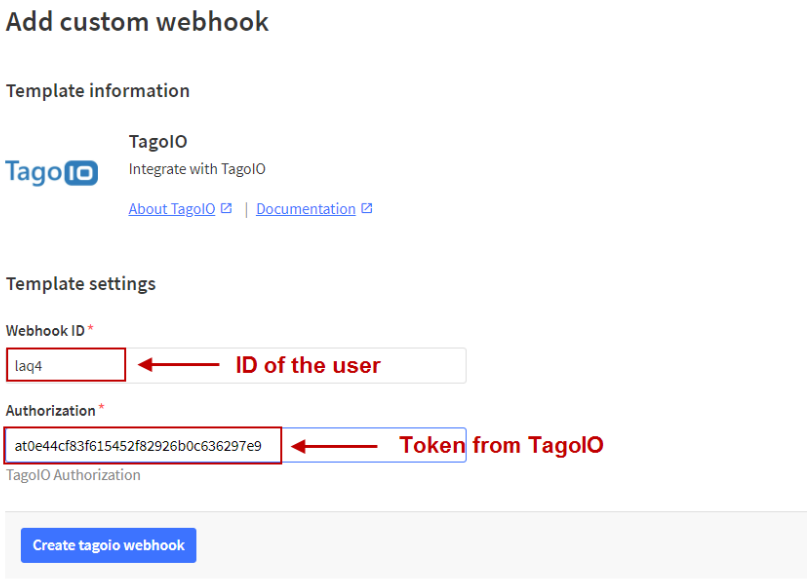


Step 8: Choose TagoIO as the Webhook.

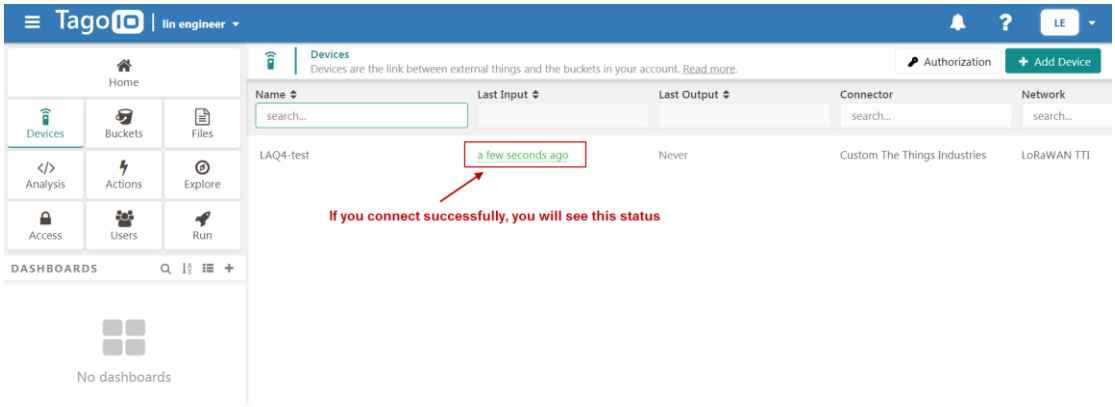


Step9: Put the Authorization Key from Tago in the Webhook.

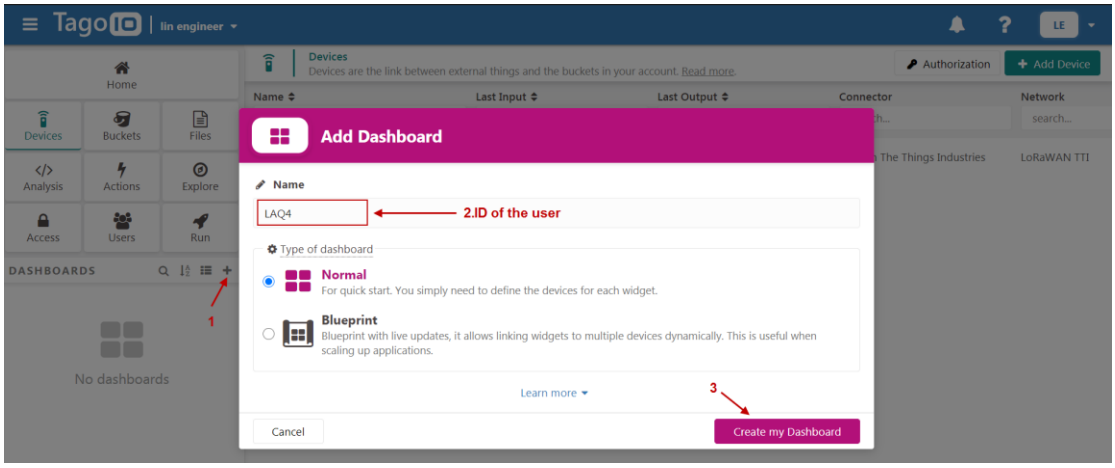
The Webhook ID can be any ID.



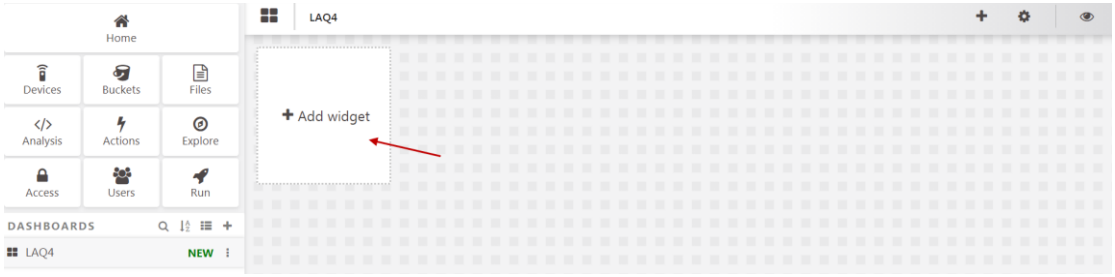
After we create the Webhook, we have create link between Tago and TTN v3 for the device. If the Device now send a payload , we can see in the tago for the update:

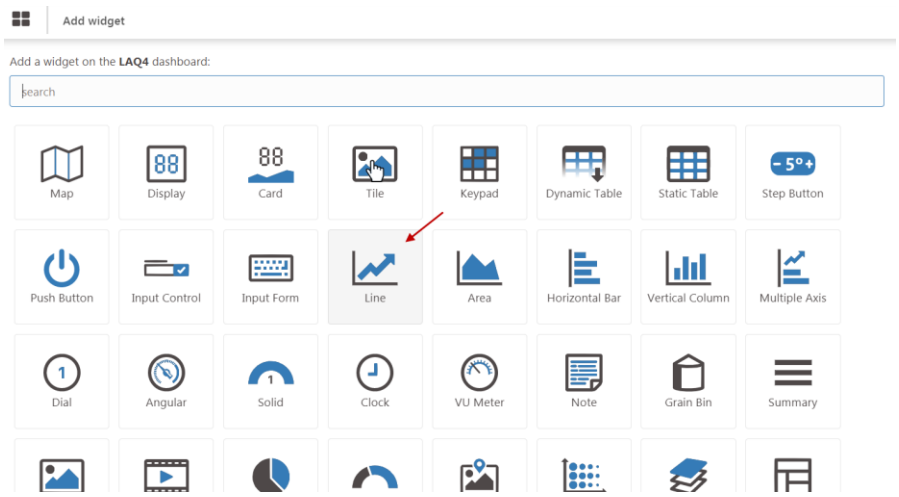


Step 10: Create a Dashboard in Tago to better show the reading of LAQ4.

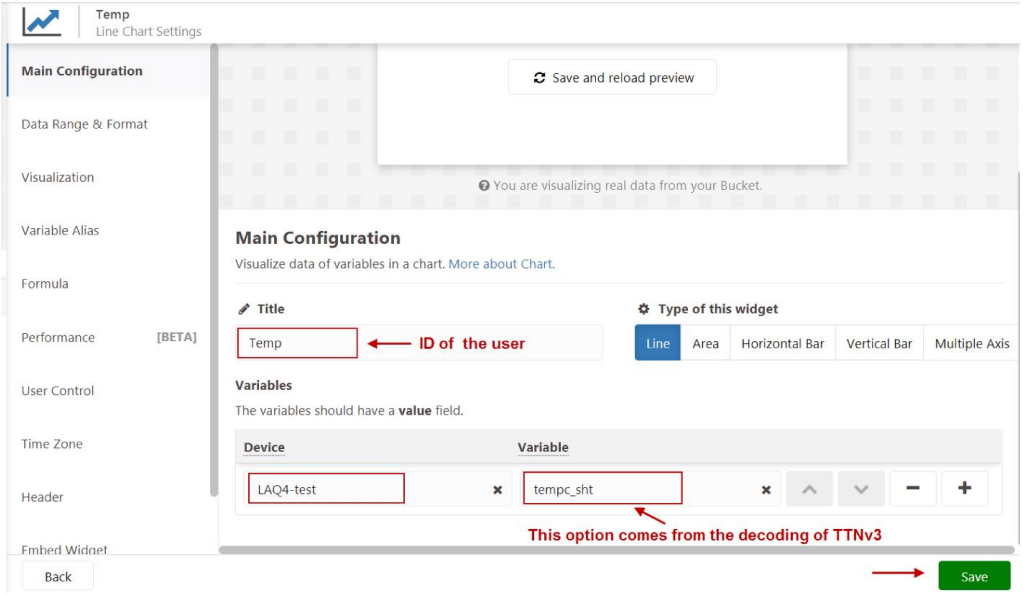


Step 11: Add Widget

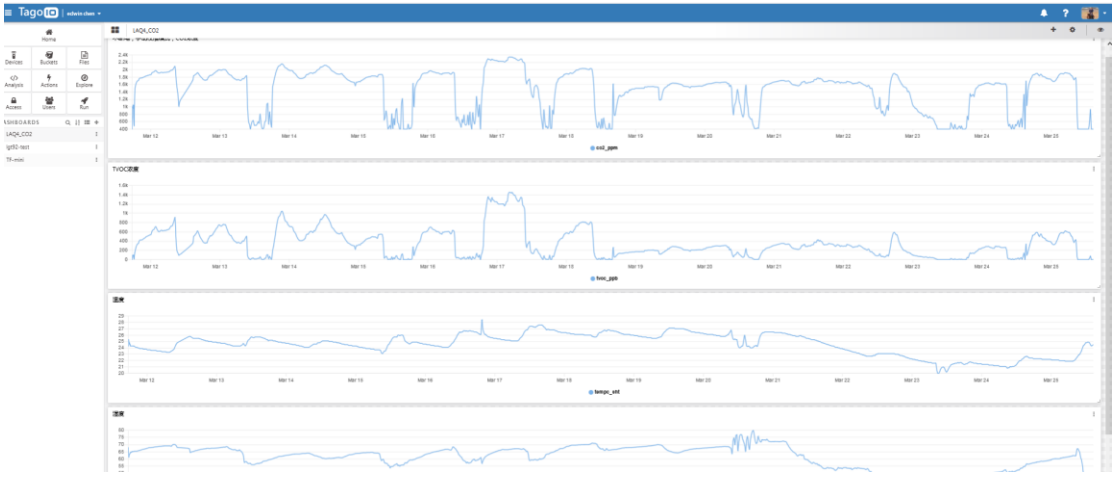




In the widget settings, choose the device to the device we just create. When the device has got a uplink payload from TTNv3. And in TTNv3, use has put the correct decoder, TTNv3 will also past the variable fields to Tago. In Tago, user can choose the Variable from drop list and save the chart settings.



Below shows a result after configure:



2.4 Uplink Data

2.4.1 Uplink Interval

By default, LAQ4 uplinks the sensor data every 20 minutes. User can change this interval by AT Command or LoRaWAN Downlink Command. See this link:

http://wiki.dragino.com/index.php?title=End_Device_AT_Commands_and_Downlink_Commands#Change_Uplink_Interval

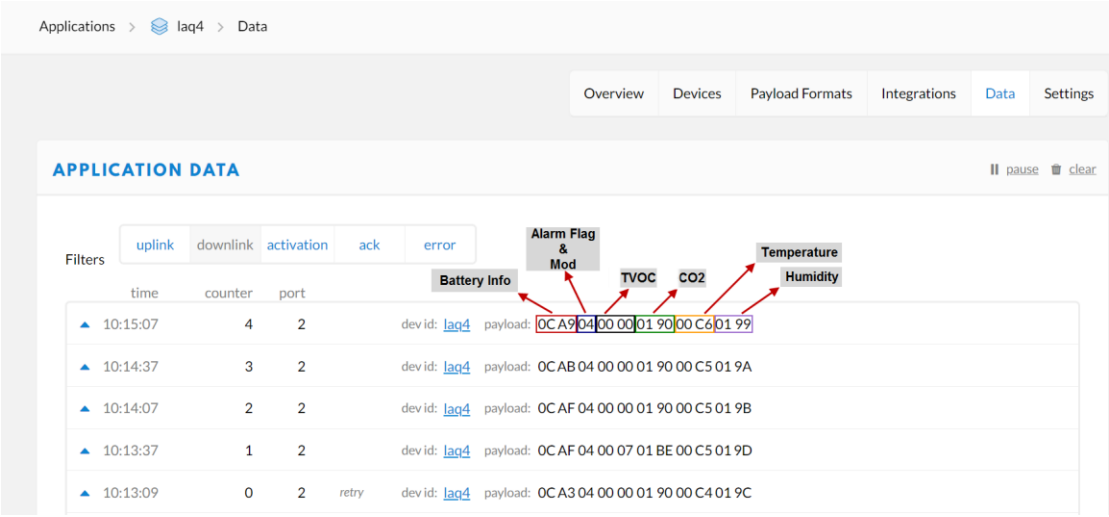
Note: Changing on uplink interval will affect the battery life.

2.4.2 Payload Analyze

LAQ4 has below raw payload for Normal Uplinks.

Size(bytes)	2	1	2	2	2	2
Value	Battery	Alarm Flag	TVOC	CO2	Temperature	Humidity

Below shows a Payload we see from TTN v2.



Battery:

Check the battery voltage.

Ex1: 0x0B45 = 2885mV

Ex2: 0x0B49 = 2889mV

TVOC:

Example:

Ex1: 0x0001 = 1ppb

Ex2: 0x0007 = 7ppb

Notice: If TVOC=0, means LAQ4 is in calibration process.

eCO2:

Example:

Ex1: 0x0190 = 400ppm

Ex2: 0x01be = 446ppm

Notice: If eCO2=0, means LAQ4 is in calibration process.

Temperature:

Example:

If payload is: 0105H: (0105 & FC00 == 0), temp = 0105H /10 = 26.1 degree

If payload is: FF3FH : (FF3F & FC00 == 1) , temp = (FF3FH - 65536)/10 = -19.3 degrees.

Humidity:

If payload:0x(0197)=412 Value: 412 / 10=41.2, So 41.2%

Alarm Flag & MOD:

Example:

If payload & 0x01 = 0x01 → This is an Alarm Message

If payload & 0x01 = 0x00 → This is a normal uplink message, no alarm

If payload >> 2 = 0x01 → means MOD=1, This is a sampling uplink message

If payload >> 2 = 0x31 → means MOD=31, this message is a reply message for polling by LoRaWAN Server, this message contains the alarm settings. see this link for detail.

2.5 Calibration

Like other VOC sensor, user need to calibrate LAQ4 to get better accuracy reading.

LAQ4 use baseline value to calculate the relative TVOC and eCO2. During calibration, LAQ4 will process Automatic Baseline Correction to get the best baseline and use it to calculate TVOC and eCO2 in the following reading.

Calibration in clear / fresh air is very important to get the best baseline. If the calibration is done in polluted air, the TVOC and eCO2 reading will be smaller than reading with a fresh/clear air baseline.

Due to sensor various physic parameter, the reading of TVOC and eCO2 will be different from different sensor. But the trend of the reading will match in the same environment.

For the first time use of LAQ4, please put it on the clear / fresh air and press the activation button three times to start calibration, the BLUE Led will be ON for 5 seconds to show it is already in calibration process. LAQ4 required approximate 30 minutes to get the best baseline.

There are two Calibration Mode for LAQ4

Auto Calibrate Mode: Devices will auto calibrate every day according to the best air quality in the last 24 hours. If the device is in polluted air for more than 24 hours, device will be calibrated with a polluted base line and cause large error. Suitable for office / home environment. User can't use it in close space such as cool chain, greenhouse, warehouse.

Manually Calibrate Mode: Default Mode, user need to calibrate use the activate button to calibrate the device manually. Suitable for close space such cool chain, greenhouse, warehouse.

Auto Calibrate Mode and Manually Calibrate Mode has the same power consumption.

LAQ4 has been set to Manually Calibrate Mode by default, in this mode, it is recommended that, every month, user manually put the LAQ4 in clear / fresh air location to calibrate to get the best reading. If user doesn't calibrate for long time, the reading will slowly increase, but the trend will be still the same.

2.6 TVOC and eCO2 effect on Human

Just for reference:

Carbon Dioxide (PPM)	Effect on Human
<500	Normal
500-1000	A little uncomfortable
1000-2500	Tired
2500-5000	Unhealthy

TVOC Concentration (PPB)	Effect on Human
<50	Normal
50-750	Anxious, uncomfortable
750-6000	depressive, headache
>6000	headache and other nerve problems

2.7 Datalog Feature

LAQ4 support Datalog feature, user can send downlink command to retrieve the sensor value store in the device. To use this feature, user need to set correct UTC time to LAQ4. When user want to retrieve sensor value, he can send a poll command from the IoT platform to ask sensor to send value in the required time slot.

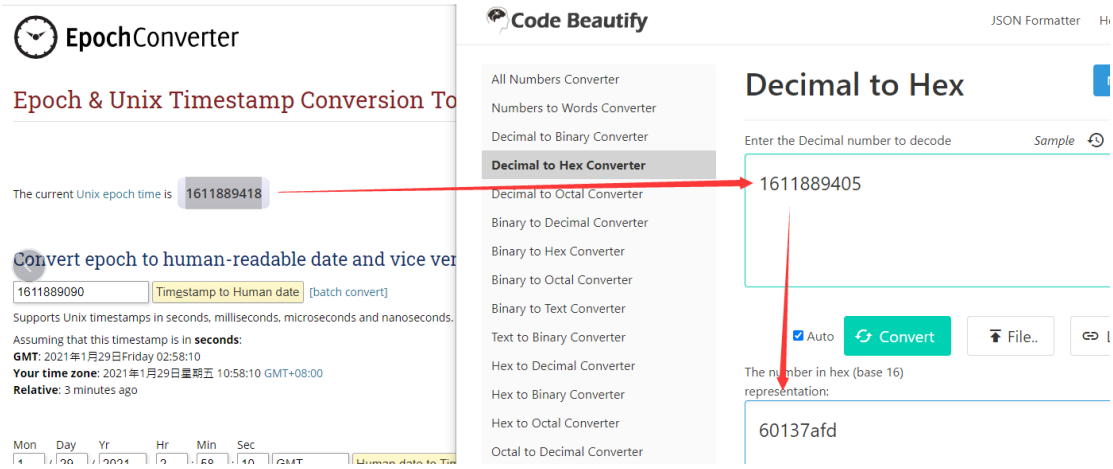
2.7.1 Unix TimeStamp

LAQ4 use Unix TimeStamp format base on

Size (bytes)	4	1
DeviceTimeAns Payload	32-bit unsigned integer : Seconds since epoch*	8bits unsigned integer: fractional-second in ½^8 second steps

Figure 10 : DeviceTimeAns payload format

User can get this time from link: https://www.epochconverter.com/ :
Below is the converter example



So, we can use AT+TIMESTAMP=1611889405 or downlink 3060137afd00 to set current time 2021 – Jan -- 29 Friday 03:03:25

2.7.2 Set Device Time

There are two ways to set device's time:

1. Through LoRaWAN MAC Command (Default settings)

User need to set SYNCMOD=1 to enable sync time via MAC command.

Once LAQ4 Joined LoRaWAN network, it will send the MAC command (DeviceTimeReq) and server will reply with (DeviceTimeAns) to send the current time to LAQ4. If LAQ4 fails to get the time from server, LAQ4 will use the internal time and wait for next time request (AT+SYNCTDC to set time request period, default is 10 days).

Note: LoRaWAN Server need to support LoRaWAN v1.0.3(MAC v1.0.3) or higher to support this MAC command feature, Chirpstack,TTN v3 and loriot support but TTN v2 doesn't support. If server doesn't support this command, it will through away uplink packet with this command, so user will lose the packet with time request for TTN v2 if SYNCMOD=1.

2. Manually Set Time

User need to set SYNCMOD=0 to manual time, otherwise the user set time will be overwrite by the time set by server.

2.7.3 Poll sensor value

User can poll sensor value base on timestamps from server. Below is the downlink command.

1byte	4bytes	4bytes	1byte
31	Timestamp start	Timestamp end	Uplink Interval

Timestamp start and Timestamp end use Unix TimeStamp format as mentioned above. Devices will reply with all data log during this time period, use the uplink interval.

For example, downlink command 31 5FC5F350 5FC6 0160 05
Is to check 2020/12/1 07:40:00 to 2020/12/1 08:40:00's data
Uplink Internal =5s， means LHT65 will send one packet every 5s. range 5~255s.

2.7.4 Datalog Uplink payload

The Datalog poll reply uplink will use below payload format.

Retrieval data payload

Size(bytes)	**2**	**1**	**2**	**2**	**4**
Value	CO2	Poll message flag & Ext	Temperature	Humidity	Unix Time Stamp

Poll message flag & Ext

Bit(bit)	7	[6:2]	1	0
Value	Poll message flag	Mod	Reserve	Alarm Bit

Poll Message Flag: 1: This message is a poll message reply.

Mod: Working Mode, reserve.

- Poll Message Flag is set to 1.
- Each data entry is 11 bytes, to save airtime and battery, devices will send max bytes according to the current DR and Frequency bands.

  For example, in US915 band, the max payload for different DR is:

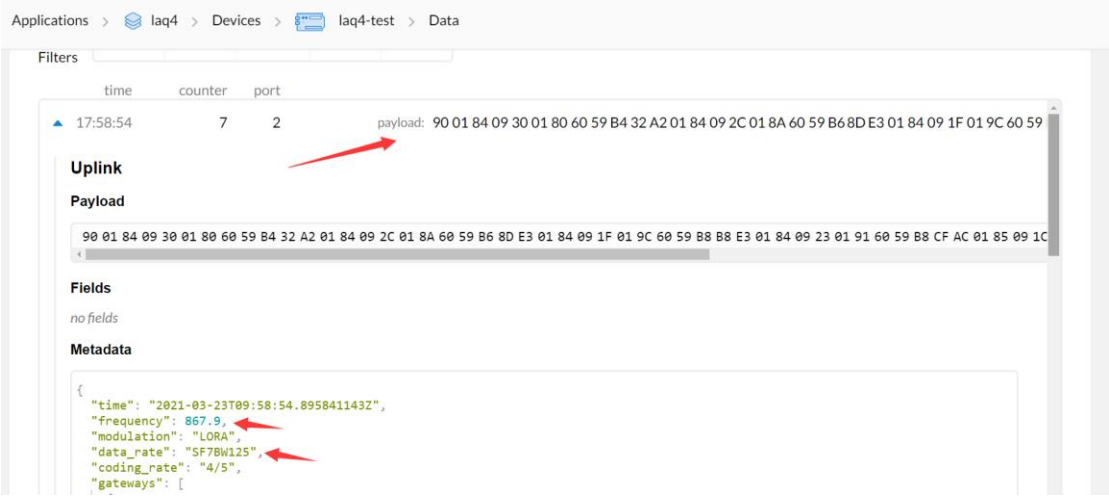
  a) DR0: max is 11 bytes so one entry of data
  b) DR1: max is 53 bytes so devices will upload 4 entries of data (total 44 bytes)
  c) DR2: total payload includes 11 entries of data
  d) DR3: total payload includes 22 entries of data.

  If devise doesn't have any data in the polling time. Device will uplink 11 bytes of 0

Example:

8019500 21/3/23 09:26:10 1 3370 sht_temp=23.52 sht_hum=38.4 tvoc=0 co2=400 alarm:false
8019510 21/3/23 09:36:13 1 3368 sht_temp=23.48 sht_hum=39.4 tvoc=2 co2=418 alarm:false
8019520 21/3/23 09:45:28 1 3370 sht_temp=23.35 sht_hum=41.2 tvoc=12 co2=483 alarm:false
8019530 21/3/23 09:45:51 1 3361 sht_temp=23.39 sht_hum=40.1 tvoc=12 co2=483 alarm:false
8019540 21/3/23 09:53:28 1 3359 sht_temp=23.32 sht_hum=39.5 tvoc=4 co2=428 alarm:true
8019550 21/3/23 09:53:41 1 3361 sht_temp=23.35 sht_hum=43.1 tvoc=4 co2=428 alarm:false
8019560 21/3/23 09:53:49 1 3364 sht_temp=23.35 sht_hum=45.4 tvoc=4 co2=428 alarm:false
8019570 21/3/23 09:53:59 1 3359 sht_temp=23.36 sht_hum=47.0 tvoc=0 co2=400 alarm:false

If user send below downlink command:
3160065F9760066DA705
Where : Start time: 6059B428 = time 21/3/23 09:26:00
Stop time 6059BAB8 = time 21/3/23 09:54:00



900184093001806059B432A20184092C018A6059B68DE30184091F019C6059B8B8E3018409230
1916059B8CFAC0185091C018B6059BA98AC0184091F01AF6059BAA5AC0184091F01C66059BAA
D900184092001D66059BAB7

Where the first 11 bytes is for the first entry:

900184093001806059B432

Co2=0x0190=400

poll message flag & mode & alarm flag =0x84,means reply data,mode=1,alarm=false

Temp=0x0930/100=22.00

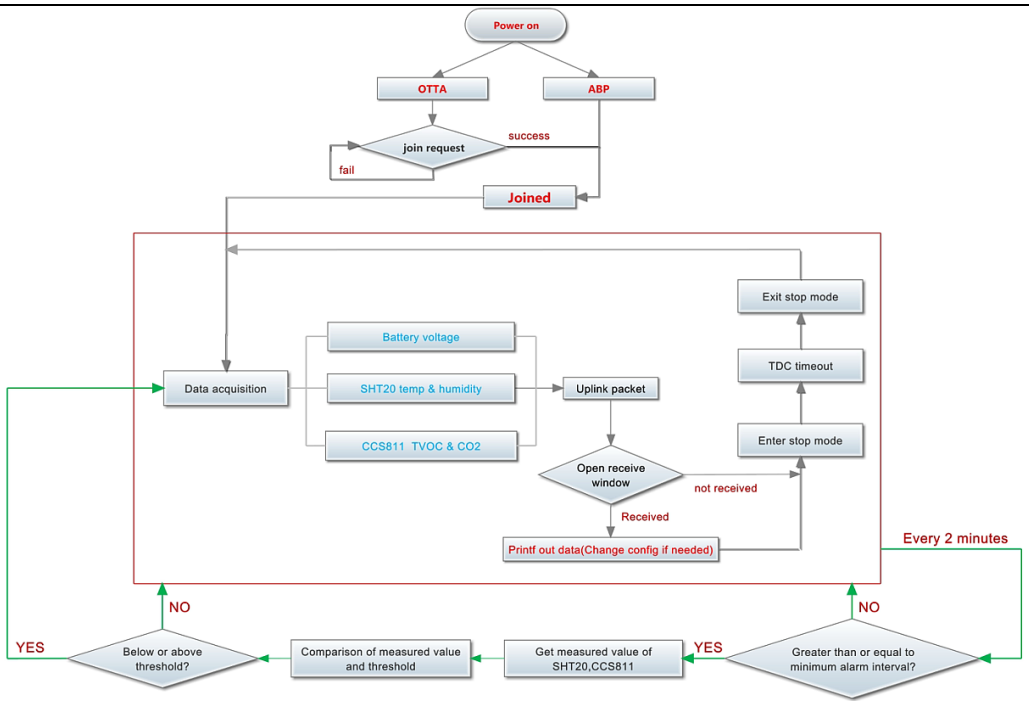
Hum=0x0180/10=32.6

Unix time is 0x6059B432=1616491560s=21/3/23 09:26:00

2.8 Alarm Feature

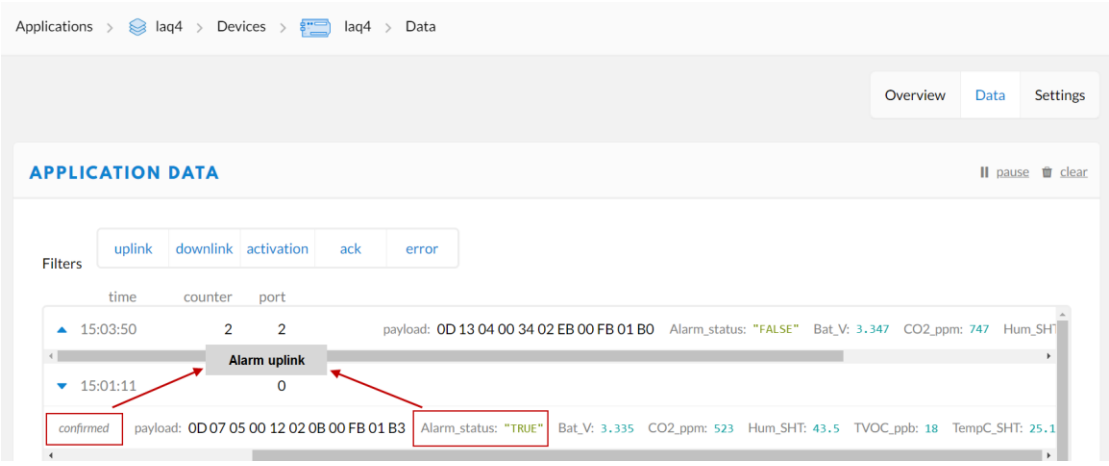
Note: The use for Alarm Feature will reduce the battery life.

LAQ4 work flow with Alarm feature.



User can use **AT+CO2, AT+ATEMP** and **AT+HUM** command to set the alarm low limit or high limit. Device will check CO2, temperature & Humidity every minute, if the temperature lower than low limit or greater than high limit. LAQ4 will send an **Alarm packet base on Confirmed Uplink Mode** to server.

Below is an example of the Alarm Packet (in TTN v2).



2.9 LED Status

The LAQ4 has a triple color LED which for easy showing different stage.

While user press side button, the LED will work as per LED status with ACT button.

In a normal working state:

- ✓ For each uplink, the LEDs will blink with:
  - BLUE LED will blink once in none calibration stage.
  - RED LED will blink once in calibration stage.
- ✓ For each success downlink, the PURPLE LED will blink once

2.10 Button Function

The side button is used to switch to different status, please see this link for detail. ACT button Function

3. Configure LAQ4 – By AT Command or LoRaWAN Downlink

LAQ4 supports configuration via LoRaWAN downlink command or AT Commands.

- Downlink command instructions for different platform:

http://wiki.dragino.com/index.php?title=Main_Page#Use_Note_for_Server

- AT Command Access Instructions: LINK

There are two parts of commands: General one and Special for this model.

3.1 General Configure Commands

These commands are to configure:

- ✓ General system settings like: uplink interval.
- ✓ LoRaWAN protocol & radio related command.

These commands can be found on the wiki:

http://wiki.dragino.com/index.php?title=End_Device_AT_Commands_and_Downlink_Commands

3.2 Sensor related commands

3.2.1 Set eCO2 Alarm Threshold

- AT Command:

AT+ CO2=min,max // Where min =0 or > 400, max =0 or < 64000

- ✧ When min=0, and max≠0, Alarm higher than max
- ✧ When min≠0, and max=0, Alarm lower than min
- ✧ When min≠0 and max≠0, Alarm higher than max or lower than min

Example:

AT+ CO2=0,3000 // Alarm when CO2 higher than 3000ppm.

- Downlink Payload:

0x(10 01 00 00 01 F4): // AT+ CO2=0,500

(note: 3rd byte and 4th byte = 0x0000 for low limit (not set), 5th byte and 6th byte = 0x01F4 for high limit: 500)

3.2.2 Set Temperature Alarm Threshold

- AT Command:

AT+SHTEMP=min,max // Where min =0 or > -40, max =0 or < 125

- ✧ When min=0, and max≠0, Alarm higher than max
- ✧ When min≠0, and max=0, Alarm lower than min
- ✧ When min≠0 and max≠0, Alarm higher than max or lower than min

Example:

AT+ATEMP=0,30 // Alarm when temperature higher than 30.

AT+ATEMP=-20,0 // Alarm when temperature lower then -20?

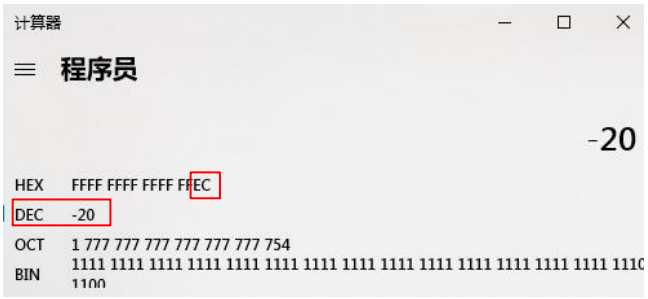
➢ Downlink Payload:

0x(10 02 00 1E): //Set AT+ATEMP=0,30

(note: 3rd byte= 0x00 for low limit(not set), 4th byte = 0x1E for high limit: 30)

0x(10 02 EC 00): //Set AT+ATEMP=-20,0

Note: the -20 Hex code is EC. See below windows calculator



3.2.3 Set Humidity Alarm Threshold

➢ AT Command:

AT+HUM=min,max // Where min =0 or > 0, max =0 or < 100

- ✧ When min=0, and max≠0, Alarm higher than max
- ✧ When min≠0, and max=0, Alarm lower than min
- ✧ When min≠0 and max≠0, Alarm higher than max or lower than min

Example:

AT+HUM=70,0 // Alarm when humidity lower than 70%.

➢ Downlink Payload:

0x(10 03 46 00): //Set AT+SHTHUM=70,0

(note: 3rd byte= 0x46 for low limit (70%), 4th byte = 0x00 for high limit (not set))

3.2.4 Set Alarm Interval

The shortest time of two Alarm packet. (unit: min)

➢ AT Command:

AT+ATDC=5 // The shortest interval of two Alarm packets is 5 minutes, Means if there is an alarm packet uplink, there won't be another one in the next 5 minutes.

➢ Downlink Payload:

0x(11 00 05) ---> Set AT+ATDC=0x 00 05 = 5 minutes

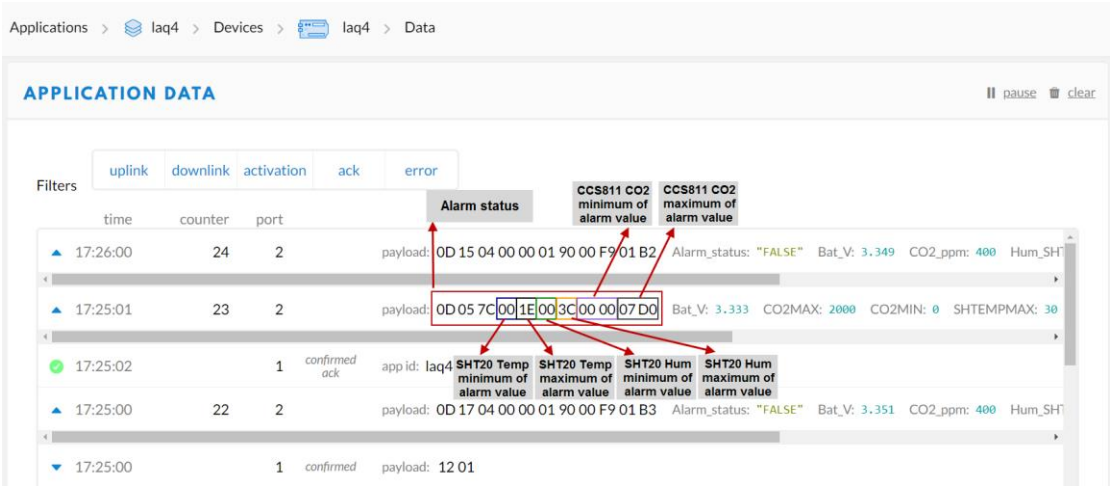
3.2.5 Poll the Alarm settings

Send a LoRaWAN downlink to ask device send Alarm settings.

- Downlink Payload:

0x12 01

Example:



Explain:

- Alarm & MOD bit is 0x7C, 0x7C >> 2 = 0x31: Means this message is the Alarm settings message.

3.2.6 Set Calibrate Mode

➢ AT Command:

AT+CALMOD=1 // Set to manually calibration mode.

AT+CALMOD=2 // Set to Automatically calibration mode.

➢ Downlink Payload:

0x(0B 01) ---> Set to manually calibration mode.

0x(0B 02) ---> Set to Automatically calibration mode.

3.2.7 Calibrate the sensor

Manually calibrate the air sensor. When use this command, please put the device in a fresh air environment.

➢ AT Command:

AT+CLRBSLI // Clear Baseline and re-calibrate the air sensor.

➢ Downlink Payload:

0x(13 01) ---> Same as AT+CLRBSLI

3.2.8 Set system time

Feature: Set system time, unix format. See here for formmat detail.

AT Command:

Command Example	Function
AT+TIMESTAMP=1611104352	OK Set System time to 2021-01-20 00:59:12

Downlink Command:

0x306007806000 // Set timestamp to 0x(6007806000),Same as AT+TIMESTAMP=1611104352

3.2.9 Set Time Sync Mode

Feature: Enable/Disable Sync system time via LoRaWAN MAC Command (DeviceTimeReq), LoRaWAN server must support v1.0.3 protocol to reply this command.

SYNCMOD is set to 1 by default. If user want to set a different time from LoRaWAN server, user need to set this to 0.

AT Command:

Command Example	Function
AT+SYNCMOD=1	Enable Sync system time via LoRaWAN MAC Command (DeviceTimeReq)

Downlink Command:

0x28 01 // Same As AT+SYNCMOD=1

0x28 00 // Same As AT+SYNCMOD=0

3.2.10 Set Time Sync Interval

Feature: Define System time sync interval. SYNCTDC default value: 10 days.

AT Command:

Command Example	Function
AT+SYNCTDC=0x0A	Set SYNCTDC to 10 (0x0A), so the sync time is 10 days.

Downlink Command:

0x29 0A // Same as AT+SYNCTDC=0x0A

3.2.11 Poll Sensor History Value

See Poll Data

4. Battery Info

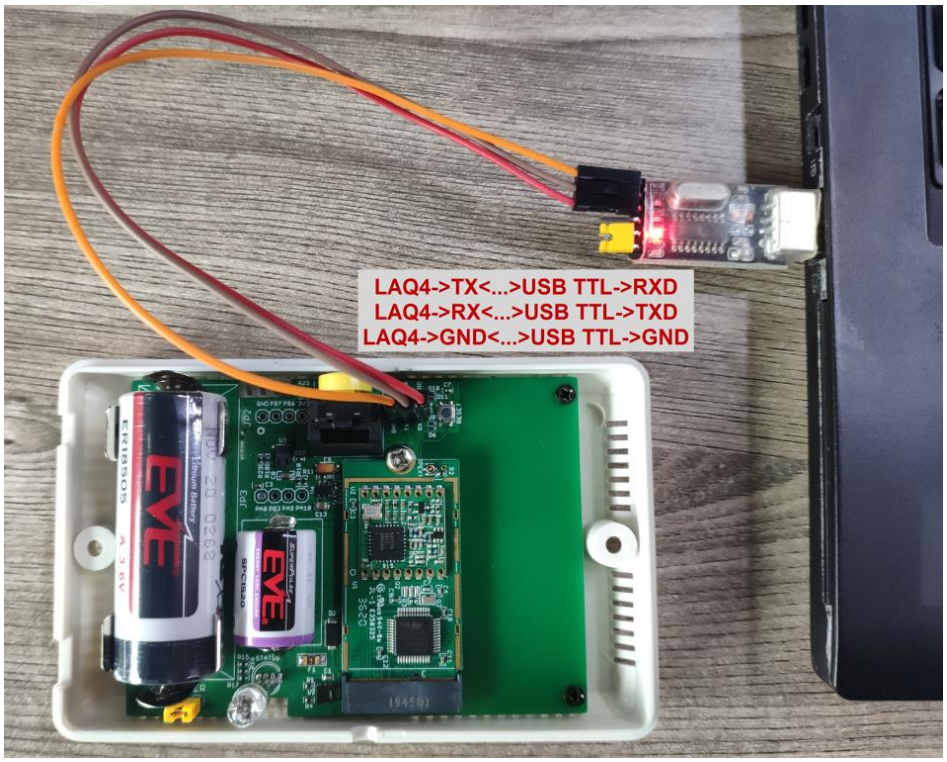
The LAQ4 use ER18505 battery (3.6v), if battery running out, user can buy ER18505 battery as replacement, it can be from different supplier, make sure the positive and negative position is correct when install.

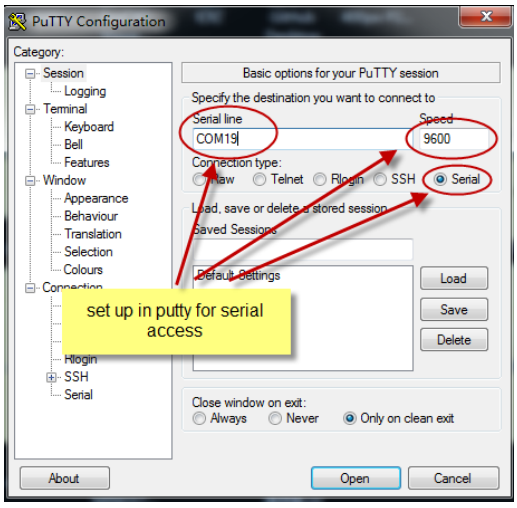
The battery life of LAQ4 is about 7~ 10 months, there are several parameters affect the battery power. Please see consumption report from here for the detail explain:
http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/Battery_Analyze/

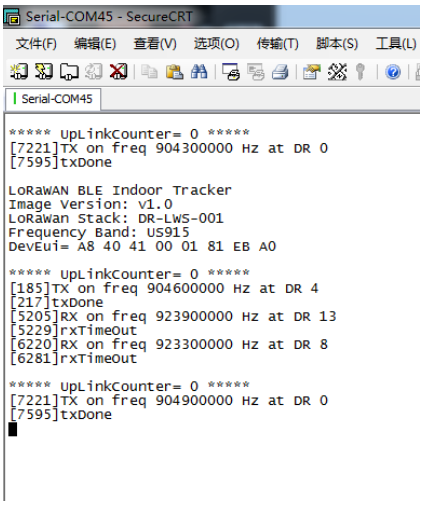
5. Use AT Command

5.1 Access AT Command

User can use a USB to TTL adapter to connect to LAQ4 to use AT command to configure the device. Example is as below:







6. FAQ

6.1 What is the frequency range of LAQ4?

Different LAQ4 version supports different frequency range, below is the table for the working frequency and recommend bands for each model:

Version	LoRa IC	Working Frequency	Best Tune Frequency	Recommend Bands
433	SX1278	Band2(LF): 410 ~525 Mhz	433Mhz	CN470/EU433
868	SX1276	Band1(HF):862~1020 Mhz	868Mhz	EU868/IN865/RU864
915	SX1276	Band1(HF):862 ~1020 Mhz	915Mhz	AS923/AU915/ KR920/US915

6.2 Difference between eCO2 and CO2?

eCO2 (equivalent calculated carbon-dioxide) is different things vs the real CO2. It is calculated by TVOC value. TVOC means Total Volatile Organic Compounds, which is compose by many gas besides CO2. So the eCO2 which calculated by TVOC can't representative the real CO2 level, because the percentage of CO2 in the total gas is uncertain. If user need to measure the real CO2 level, a real CO2 sensor is needed.

6.3 What is the Frequency Plan?

Please refer Dragino End Node Frequency Plan:
http://wiki.dragino.com/index.php?title=End_Device_Frequency_Band

6.4 How to update the firmware?

User can upgrade the firmware for 1) bug fix, 2) new feature release or 3) change frequency plan.
Please see this link for how to upgrade:
http://wiki.dragino.com/index.php?title=Firmware_Upgrade_Instruction_for_STM32_base_products#Hardware_Upgrade_Method_Support_List

Firmware location and changelog:
http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LAQ4/Firmware/

7. Order Info

Part Number: **LAQ4-XXX**

XXX: The default frequency band

- ✓ AS923: LoRaWAN AS923 band
- ✓ AU915: LoRaWAN AU915 band
- ✓ EU433: LoRaWAN EU433 band
- ✓ EU868: LoRaWAN EU868 band
- ✓ KR920: LoRaWAN KR920 band
- ✓ US915: LoRaWAN US915 band
- ✓ IN865: LoRaWAN IN865 band
- ✓ CN470: LoRaWAN CN470 band
- ✓ KZ865: LoRaWAN KZ865 band

8. Packing Info

Package Includes:

- ✓ LAQ4 LoRaWAN Temperature Sensor x 1

Dimension and weight:

- ✓ Device Size: 110 x 70 x 30 mm
- ✓ Device Weight: 130g
- ✓ Package Size:
- ✓ Package Weight: 145 x 80 x 50 mm

9. Support

- ➢ Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different time zones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.
- ➢ Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to

support@dragino.com