Table of Contents

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

1 Introduction

This is a quick starting guide on how to interface a LoRaWAN TBSL1 with LORIOT infrastructure, which is Tekbox's recommended LoRaWAN services provider (https://loriot.io/).

1.1 Sensors configuration

The following configuration is deployed (can be used as a reference for other set up):

- 1 SDI-12 soil moisture and temperature probe with 7 cells (Probe 0)
  - SDI-12 addresses from '1' to '7'
  - SDI-12 command: M1!
- 1 SDI-12 wind vane sensor (TBSWV1; Probe 1)
  - SDI-12 address: '8'
  - SDI-12 commands: M!, M1!
- 1 SDI-12 wind speed sensor (TBSWS1; Probe 2)
  - SDI-12 address: '9'
  - SDI-12 command: M!
- 1 SDI-12 air temperature sensor (TBSHT02; Probe 3)
  - SDI-12 address: 'b'
  - SDI-12 command: M1!
- 2 analog sensors inputs
- 1 pulse sensor input

1.2 LoRaWAN settings

For this example LoRaWAN AS923 plan will be used with 8 frequencies ranging from 923MHz to 924.4MHz with an increment of 200kHz

It is therefore assumed from this point that:

- Antenna fitted for 915MHz is used
- Gateway operating on 915MHz band is used (e.g. RisingHF RHF2S008 which provides easy integration with LORIOT LoRaWAN server).
- Gateway is correctly configured and attached to LORIOT LoRaWAN server operating on above plan and frequencies
- TBSL1 must be configured accordingly to match LORIOT LoRaWAN server configuration. In this example this means:
  - Class A
  - ADR off
  - ABP
  - AS923 plan as described above
  - EUI and ciphering keys as provided by LoRaWAN server

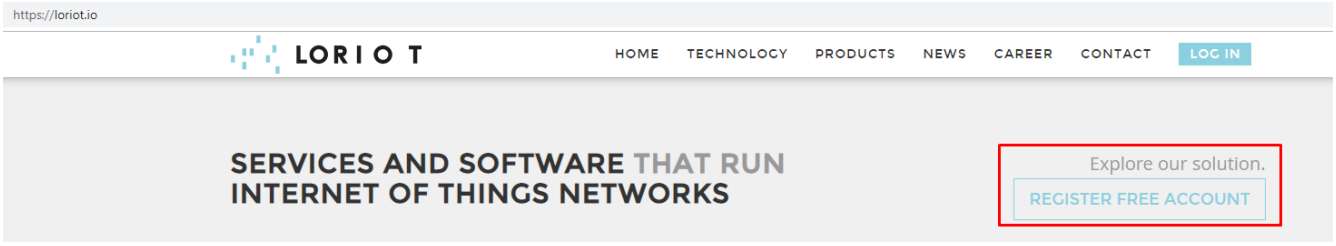
50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

2 Prerequisites

2.1 LORIOT LoRaWAN server

User must register an account on LORIOT: https://loriot.io/

Register for a free account and then possibly upgrade for additional features:

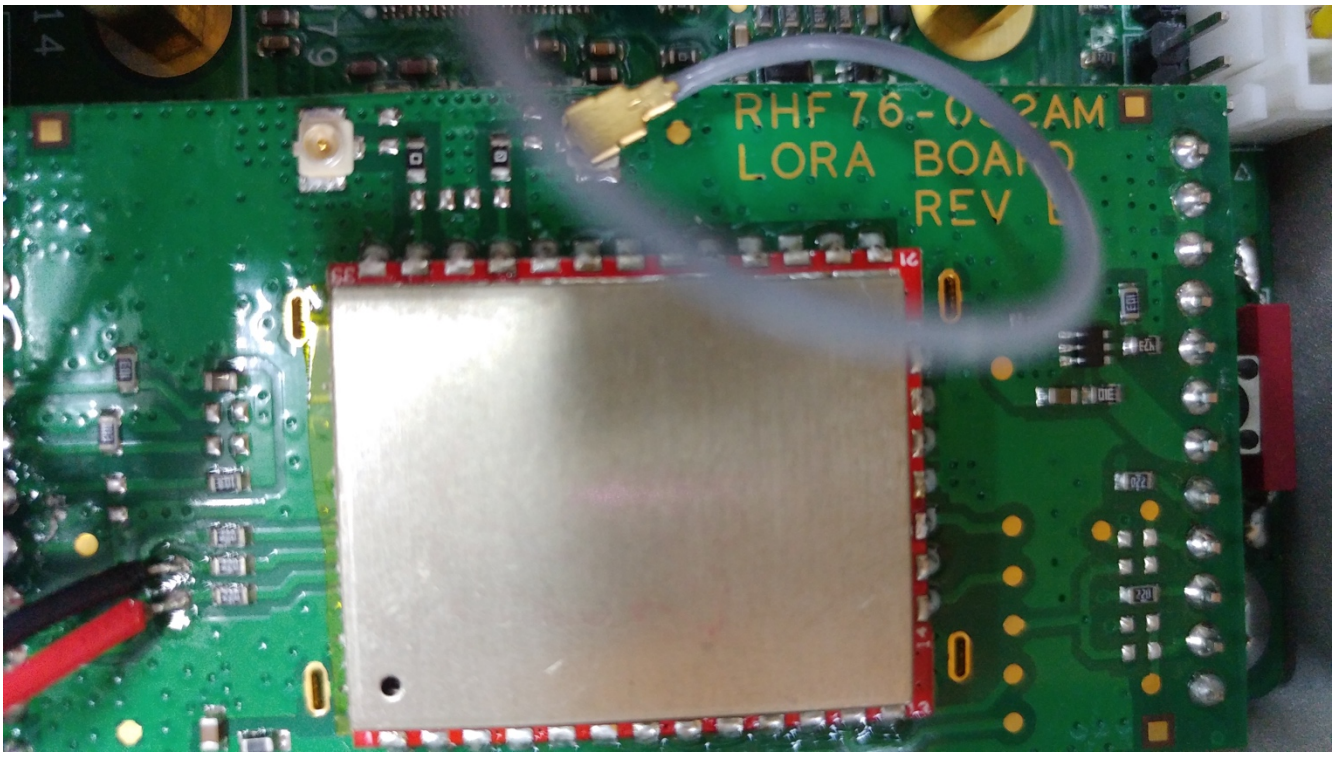


Refer to LoRaWAN configuration for further instructions how to use LORIOT LoRaWAN server with TBSL1.

2.2 Antenna

Connect antenna internally and externally, ensure the right connector is used on LoRaWAN modem board depending on the frequency used.

Antenna connected externally



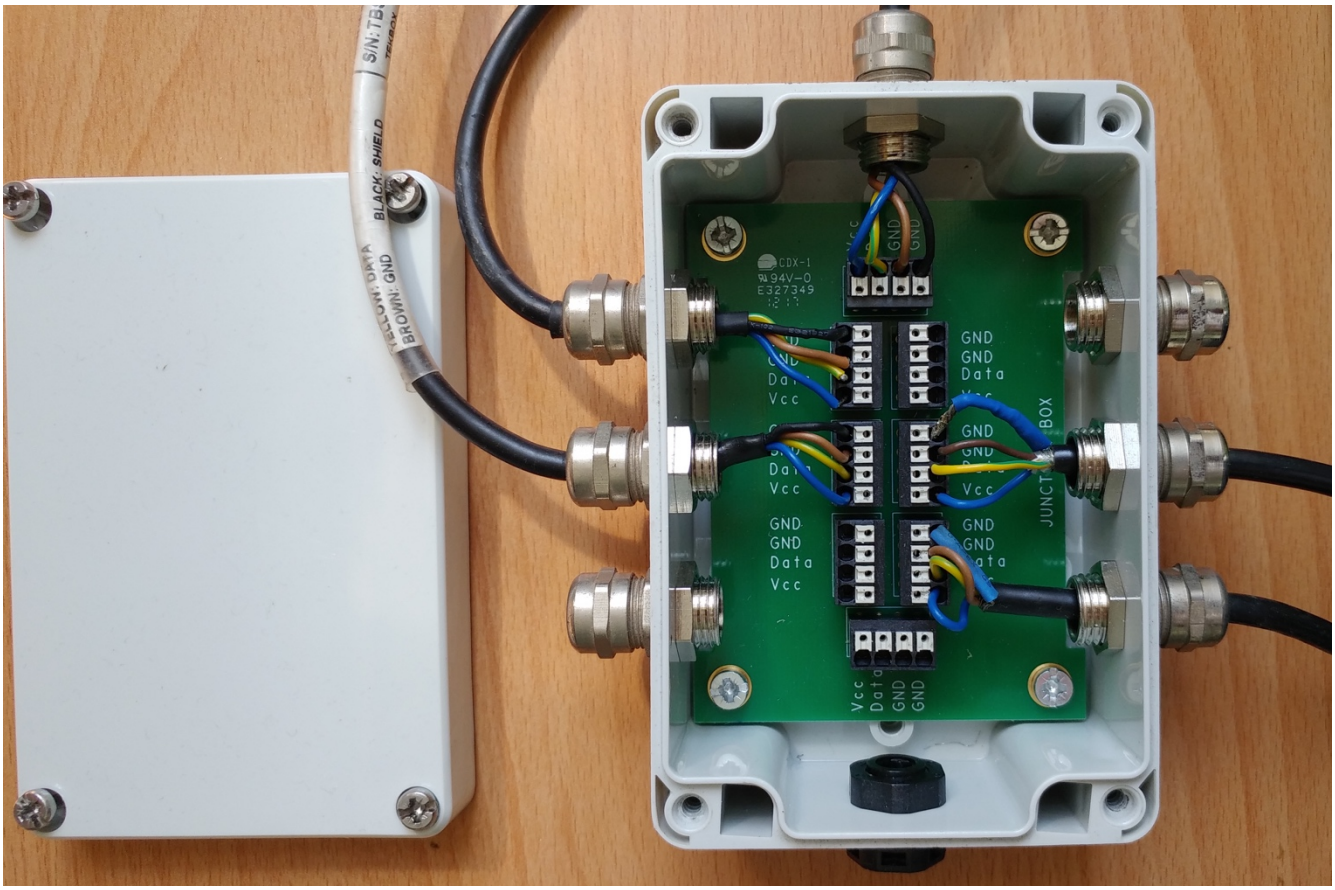
Antenna connected to LoRa modem high band connector

2.3 Sensors

Connect the sensors cable(s): one or both TBSL1 sensors connectors can be used depending on user's set up.

Sensors connectors

To deploy multiple SDI-12 sensors, Tekbox SDI-12 junction boxes can be used:



SDI-12 Junction box: upper connector plugged to TBSL1, others to SDI-12 sensors

CAUTION: both TBSL1 sensors connectors share the same electrical signals therefore

- **SDI-12 sensors can be freely connected to either connectors or both and also by using a junction box if required.**
- **TBSL1 supports only ONE pulse input: a pulse sensor can then be plugged to either connector, having one pulse input connected and the other left unused.**
- **TBSL1 supports 2 analog channels: each channel has an input on each connector. Therefore when a channel is connected to an analog sensor, the second one must be left unused.**

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

2.4 Battery

Connect a suitable battery inside the unit: 3.7V Li-Ion cell with at least 1500mAh capacity (refer to TBSL1 user manual), 10k NTC and protection circuit.

Li-Ion battery plugged

2.5 Solar panel

Refer to TBSL1 user manual for information related to solar panel required features.

Solar panel 5 pins connector must be modified as follows to allow for the unit to be supplied:

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

Then connect the solar panel on the TBSL1 5 pins connector.

TBSL1 is then fully fitted and starts operating as soon as the solar panel is connected.
Taking out the solar panel will switch off the platform.

2.6 TBSL1 configuration

The very first time TBSL1 is used, it starts up in console mode and is then ready to be configured.

Ensure that the PC used for configuration has ST virtual COM port driver installed (refer to www.st.com to download the driver).

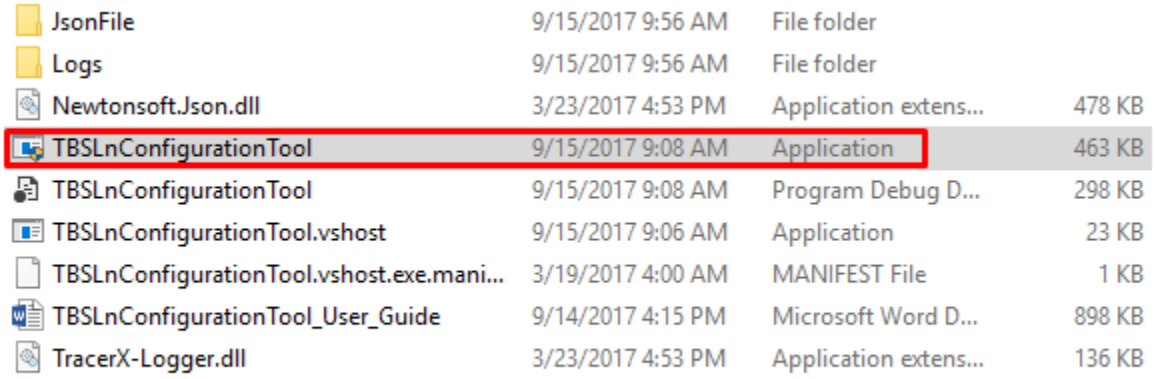
A USB cable and TBSL1 configuration tool installed on the PC are required to proceed with the platform set up.

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

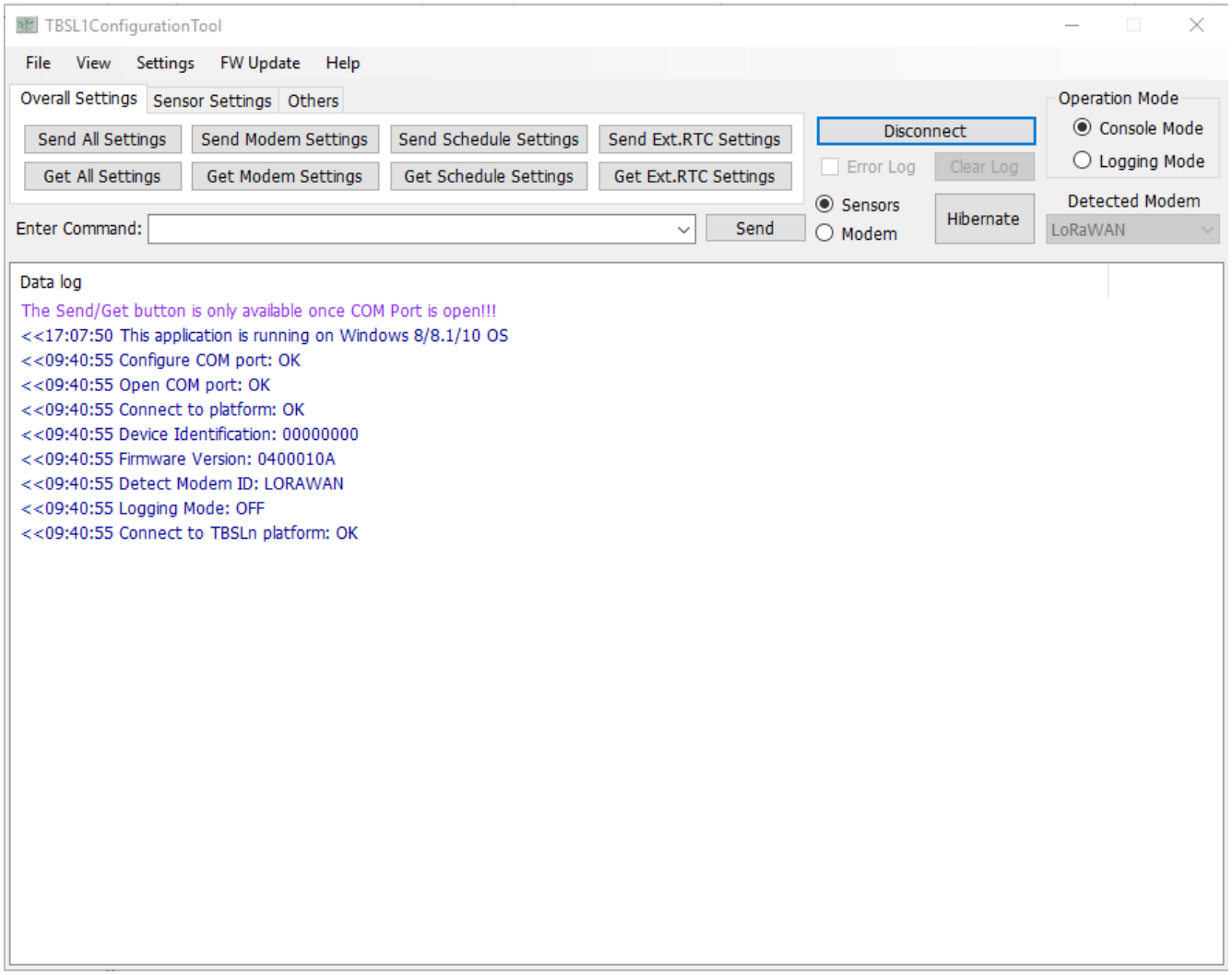
The final set up should look like this:

Then proceed with following steps:

- Open the PC application in Administrator mode

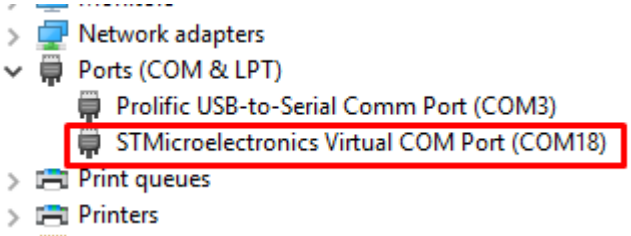


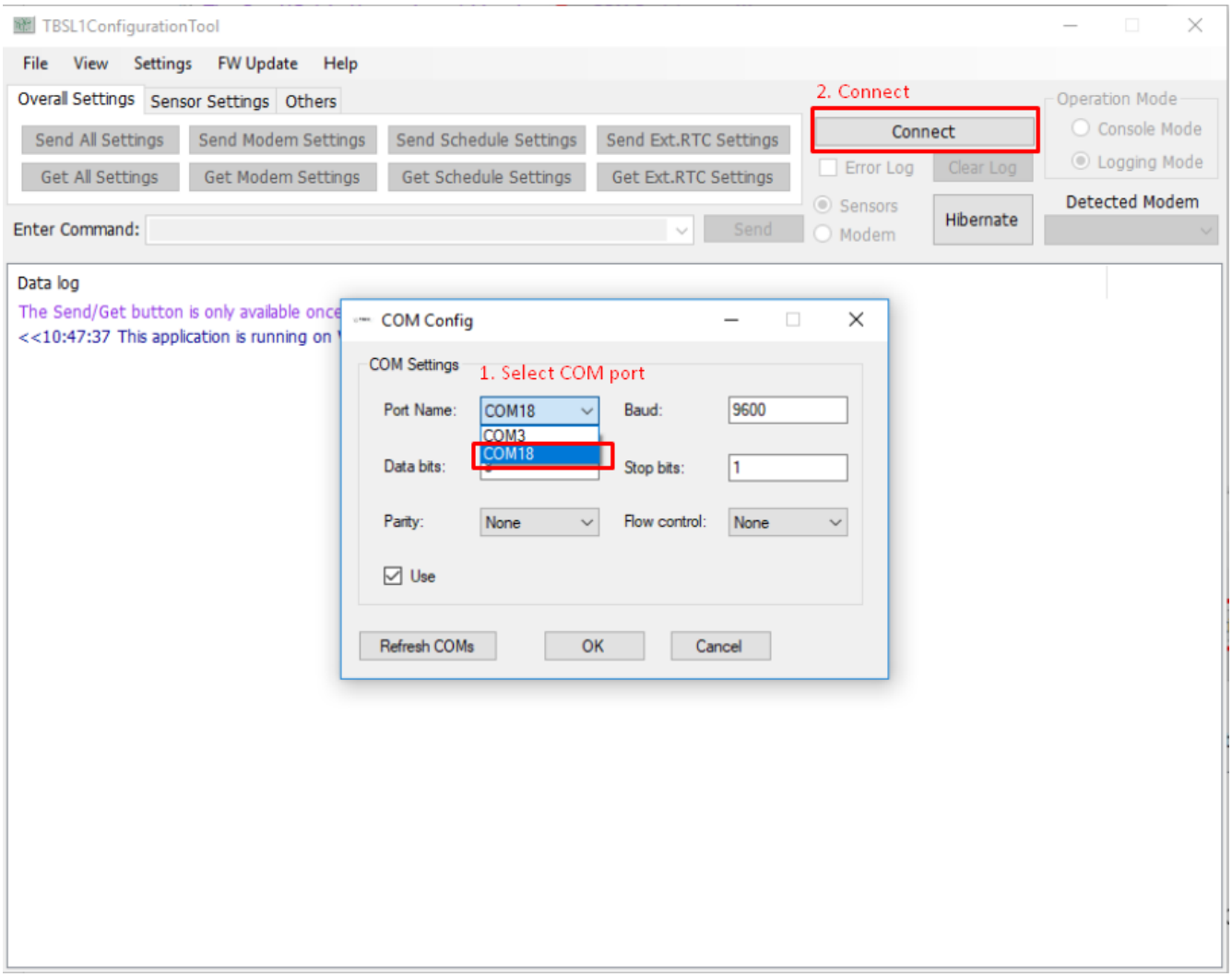
- Connect the USB cable between the PC and the TBSL1 USB connector.
- Wait about 10s until a USB serial COM port is enumerated on Windows Device Manager.
- The PC application will then:
    - Either autoconnect to the virtual serial COM port



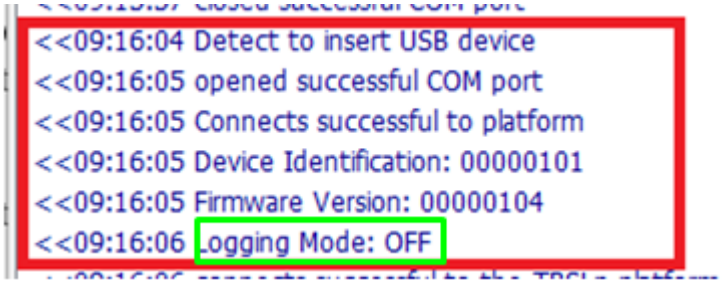
- Or will require manual connection by configuring the COM port from “Settings>COM port Configuration” PC application menu and clicking then on “Connection” button.

  First check that the virtual COM port is mounted by Windows, then select it in the tool:





- TBSL1 is then switched to console mode (indicated by the comment “Logging Mode: OFF” and is therefore ready to be configured.



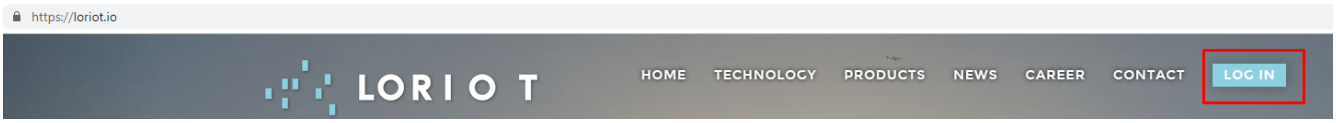
3 Configure TBSL1

3.1 LoRaWAN configuration

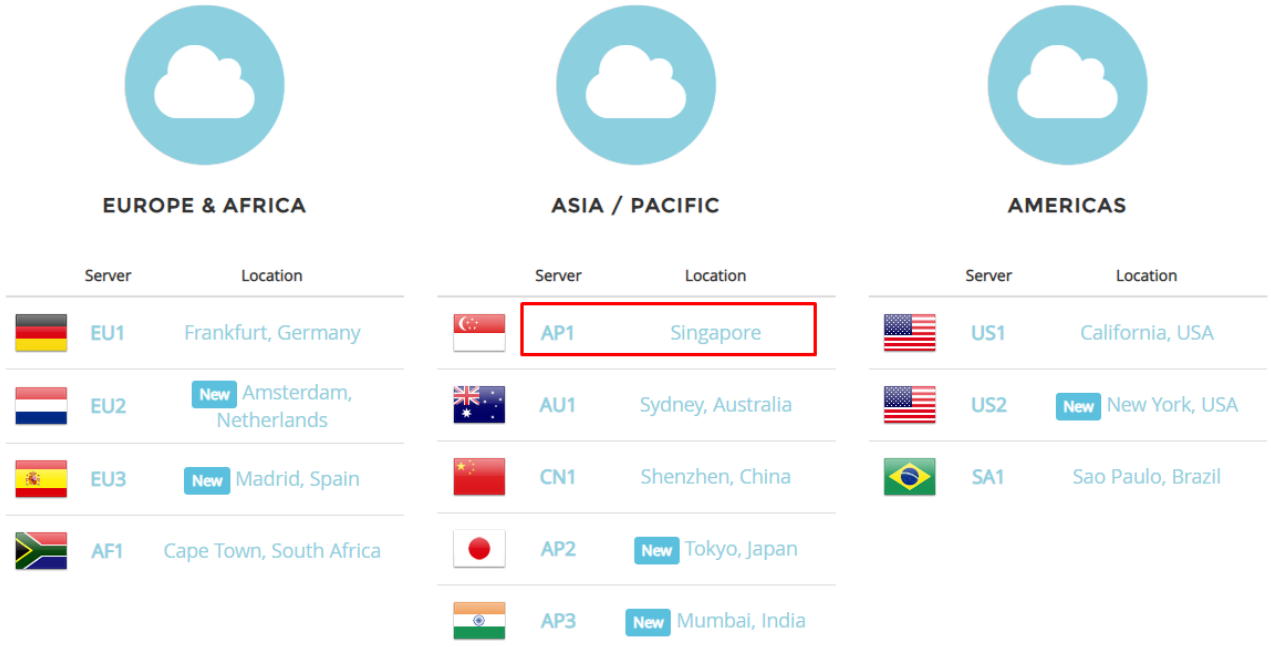
In this example and as described in the introduction, following LoRaWAN configuration is used:

- Class A
- ABP
- AS923
- ADR off
- No ACK

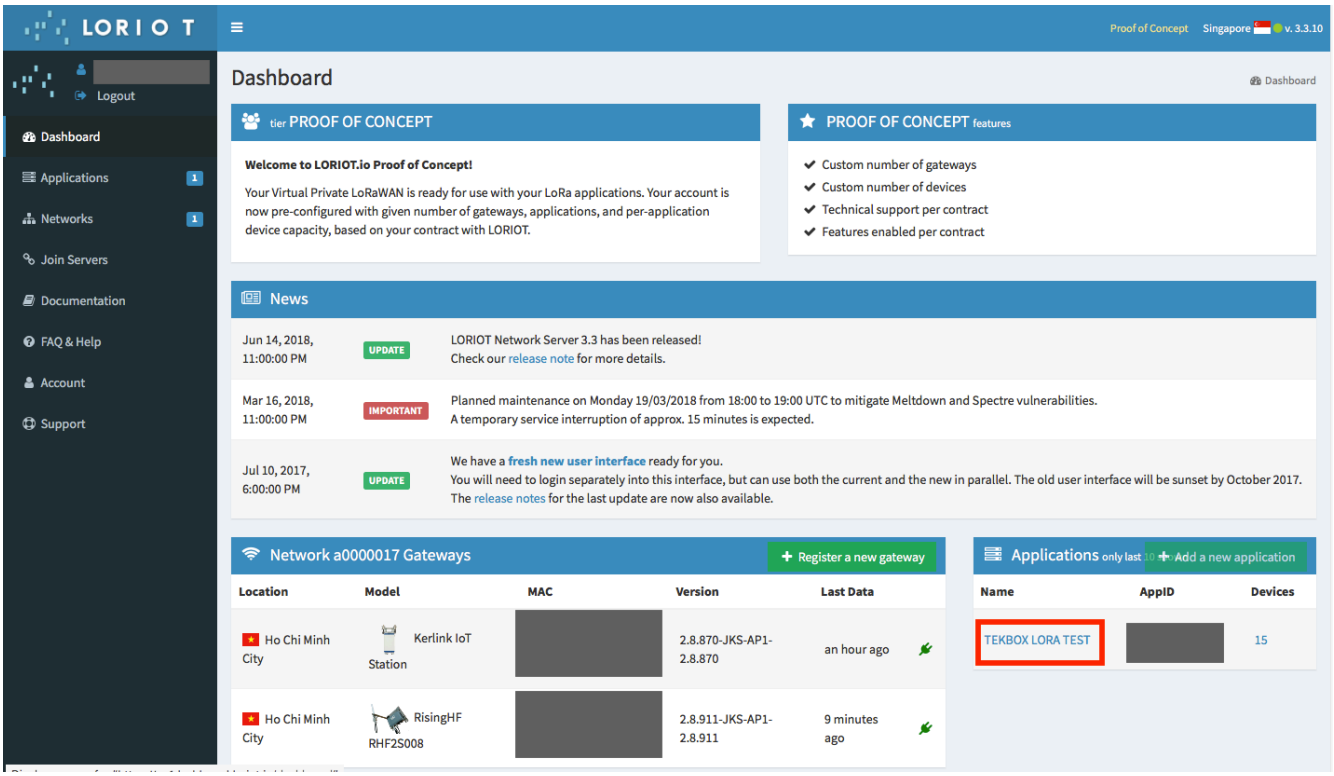
Login to your LORIOT account:



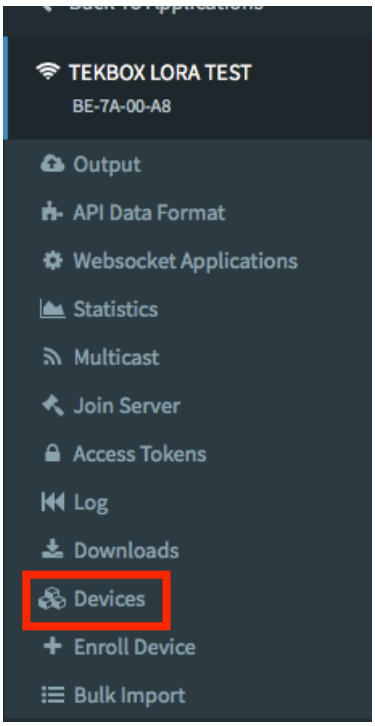
Pick the desired LoRaWAN server based on your geographical location (this is an important step to reduce network latencies) and enter your credentials:



Choose your LoRaWAN application to access your nodes:

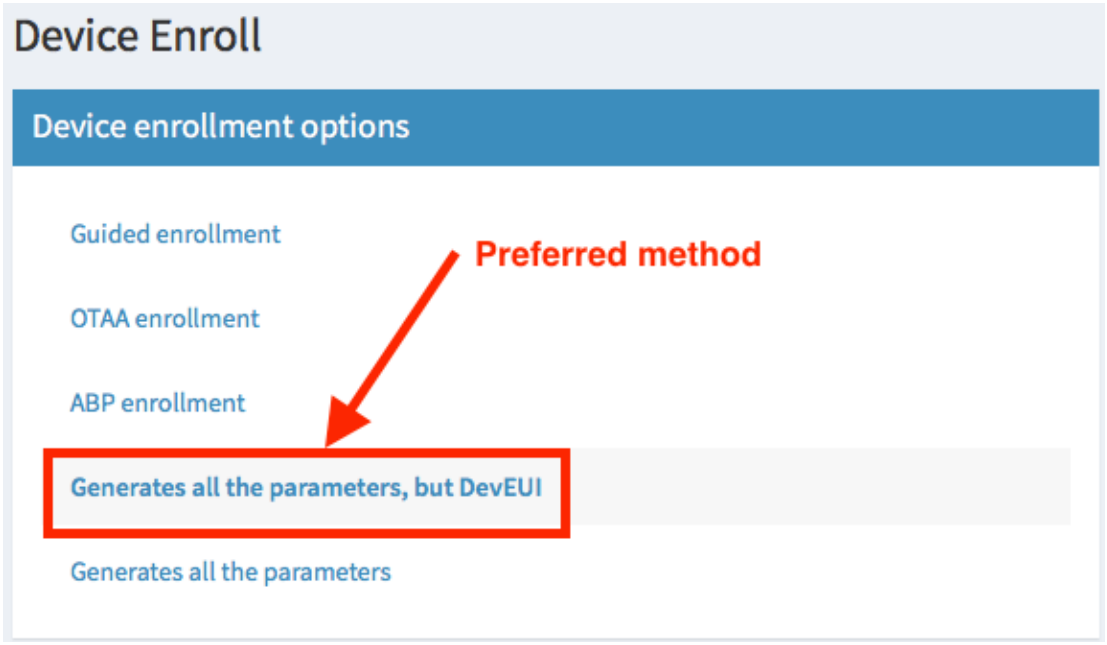


Access your devices (through ‘Device’ or ‘Manage devices’):

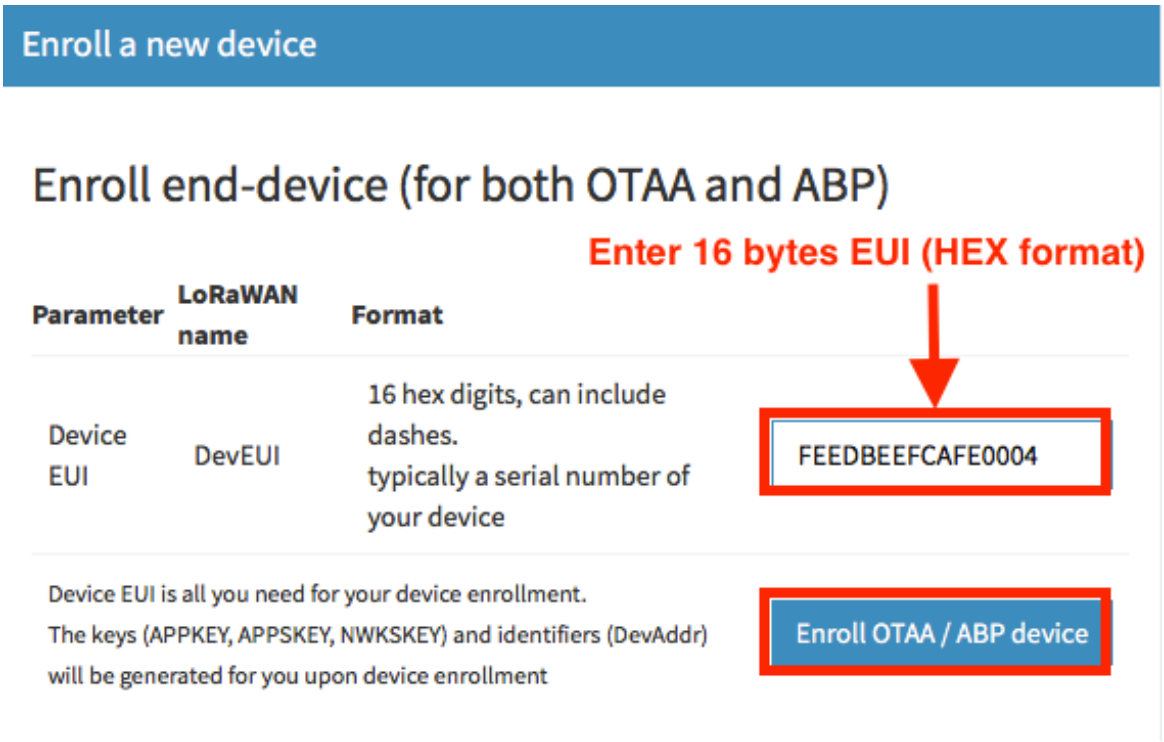


Create a new node (preferred method: user should enroll a new device using his own EUI):

then

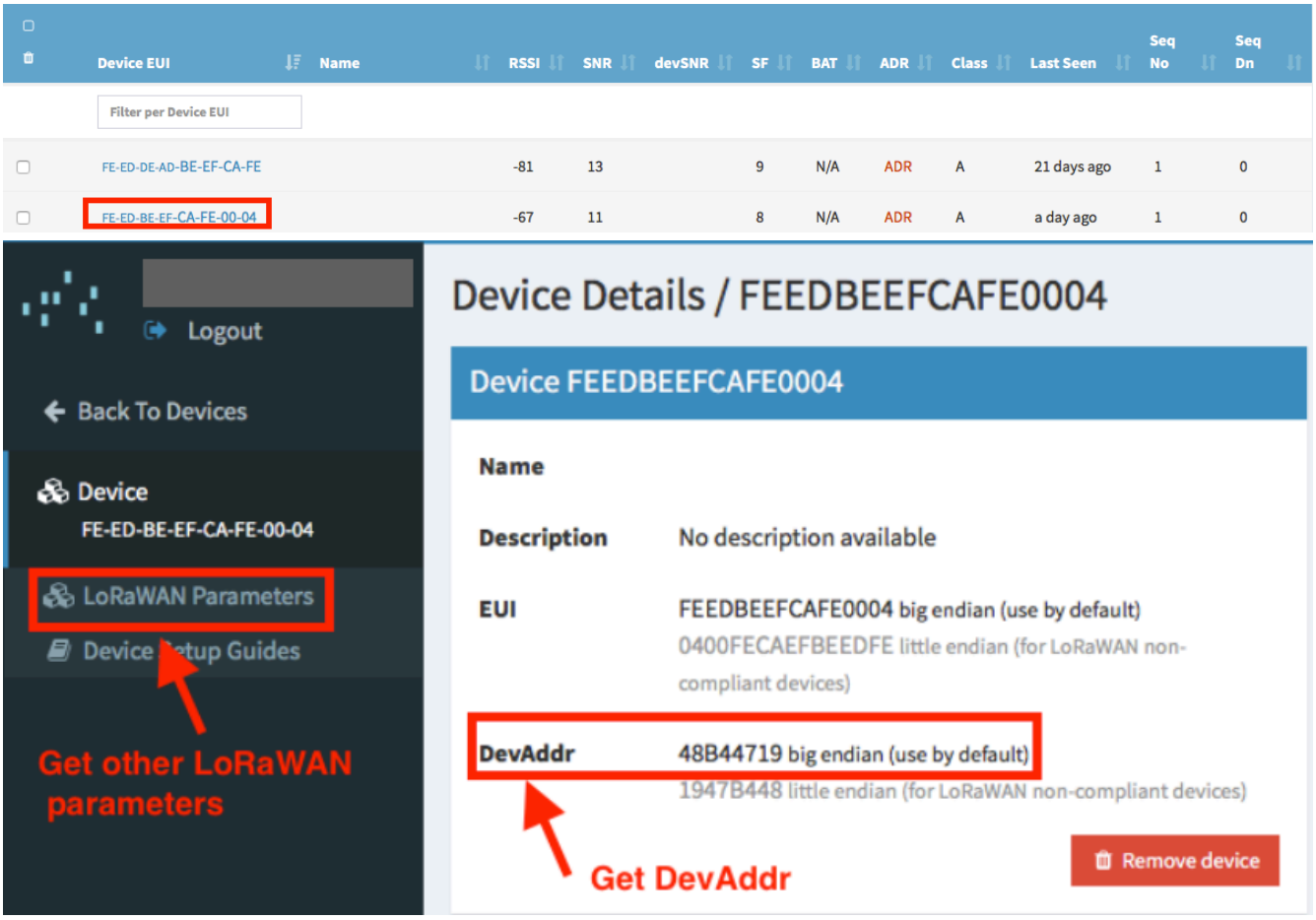


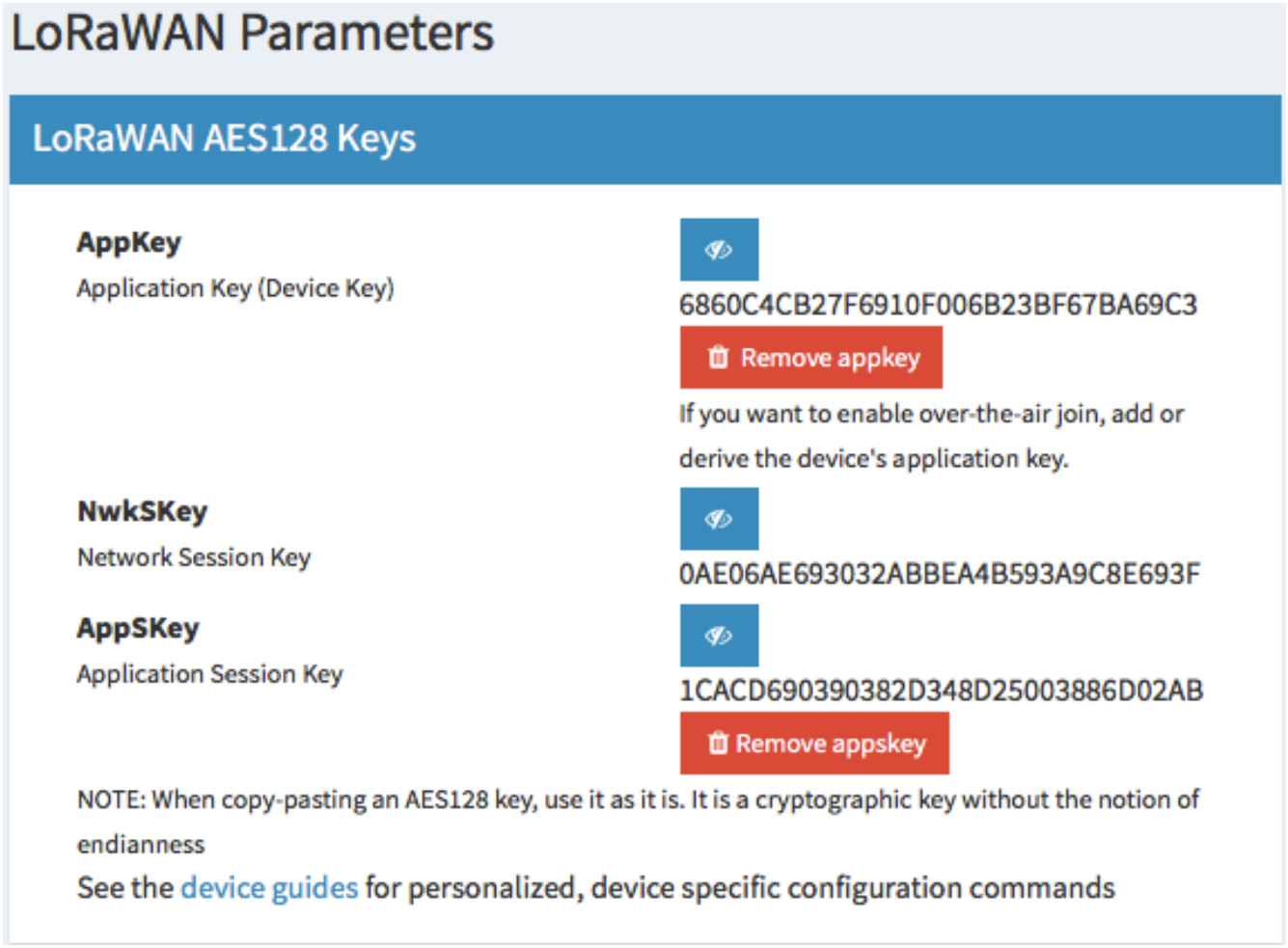
Enter EUI:



50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

Access the node's IDs and ciphering keys:



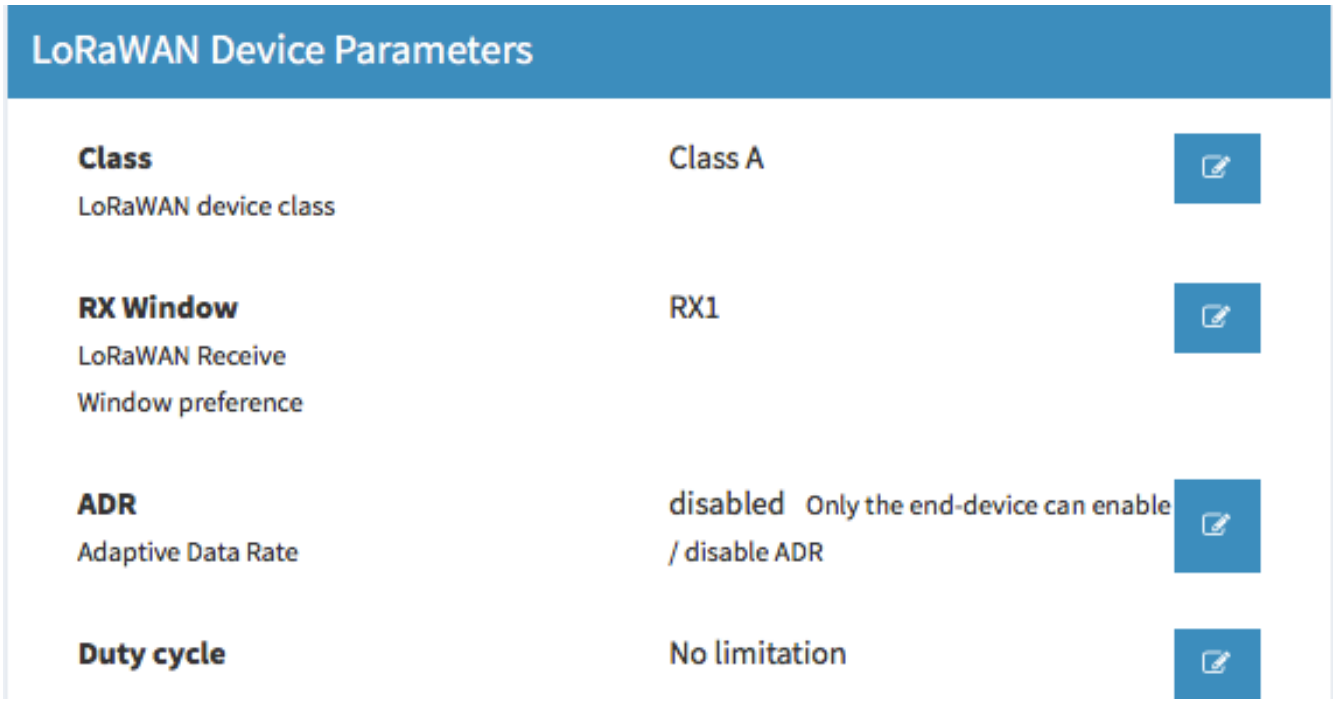


In our example, ABP configuration is used therefore the user needs to configure TBSL1 LoRaWAN modem with DevEUI, DevAddr, NwkSkey and AppSkey.

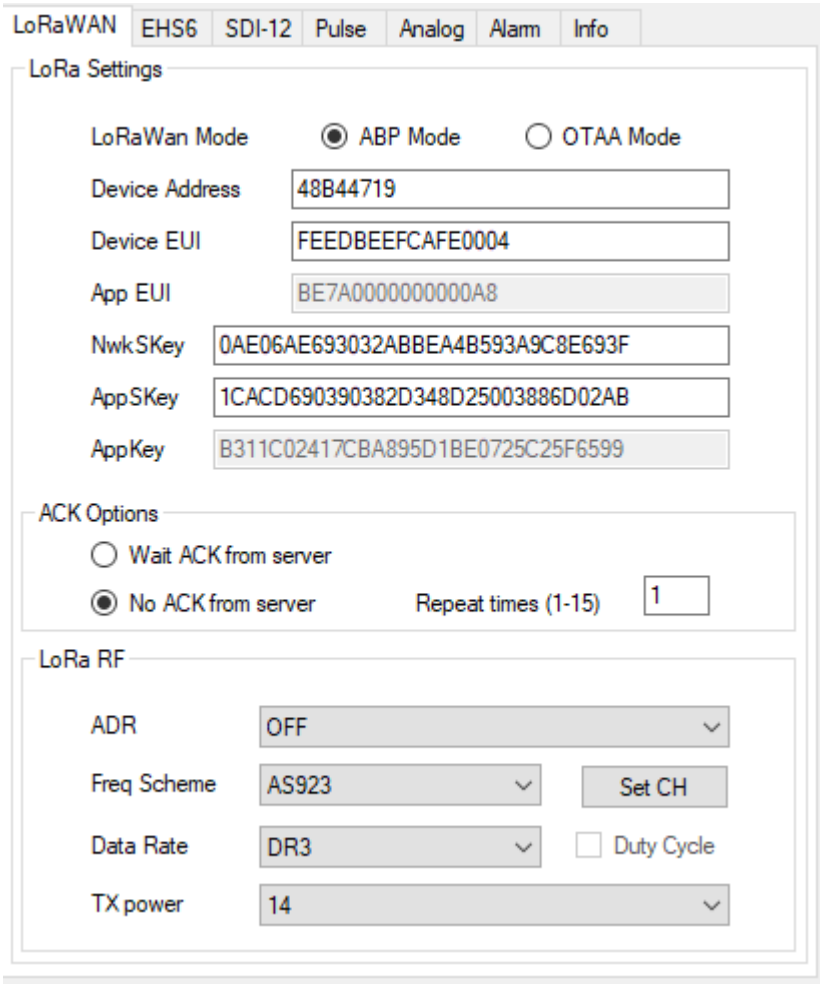
Would the user wants to activate his node by OTAA, then DevEUI, AppEUI and AppKey should be used instead.

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

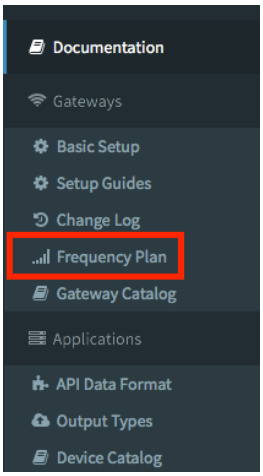
Check that other LoRaWAN parameters are correct (Class, duty cycle, etc…):

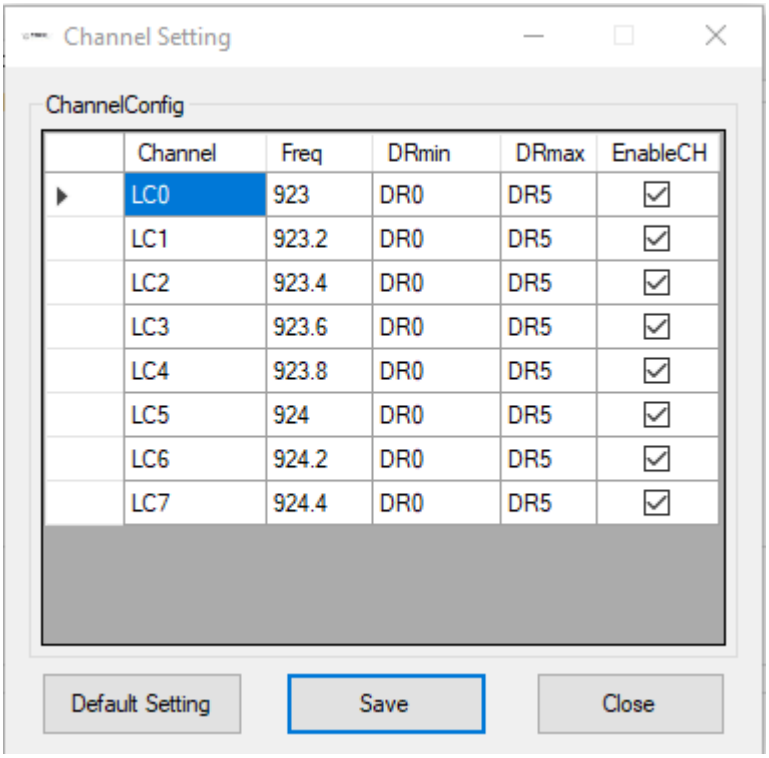


Those LoRaWAN settings needs then to be input in the TBSL1 configuration tool:



Ensure that right frequencies are defined by clicking on “Set CH” and cross-check with LORIOT AS923 plan accessible from the dashboard:



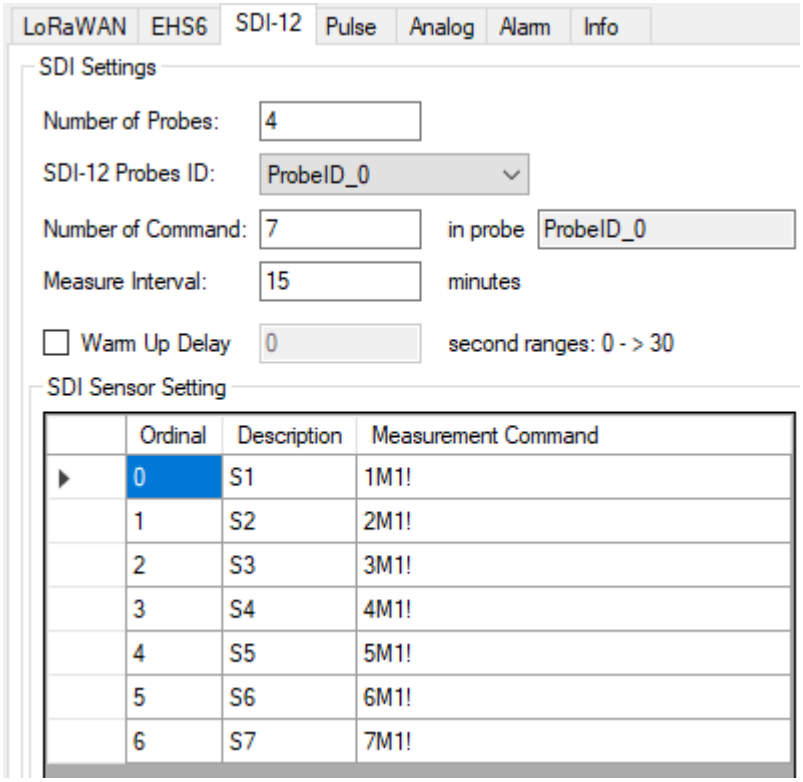


3.2 SDI-12 sensors configuration

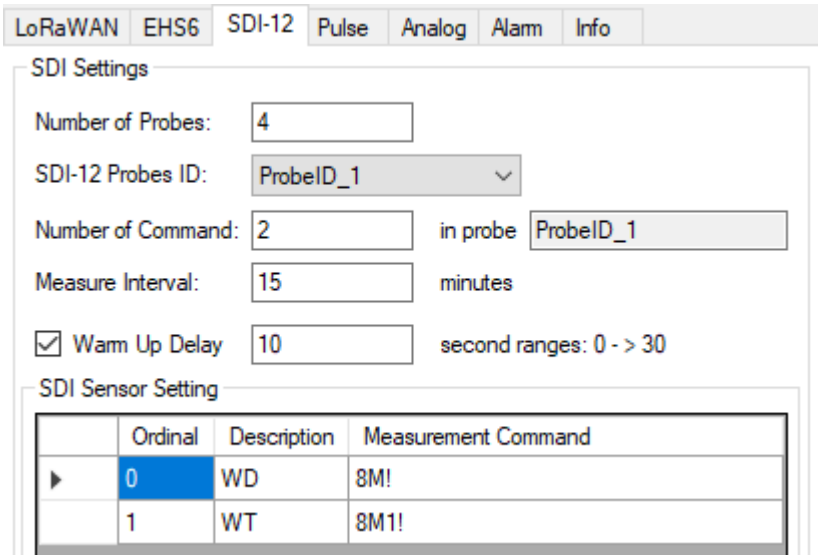
4 SDI-12 probes are defined in this example with the configuration described in the introduction. Measurement intervals are set to 15 minutes for each probe.

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

Probe 0:

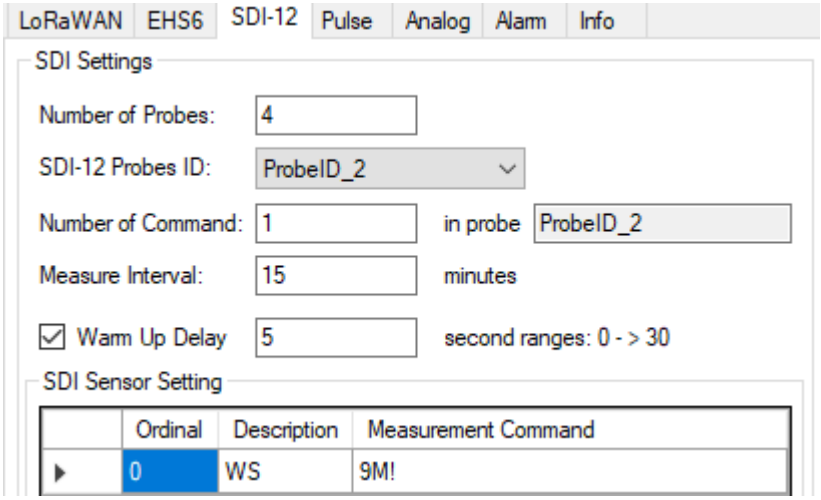


Probe 1:

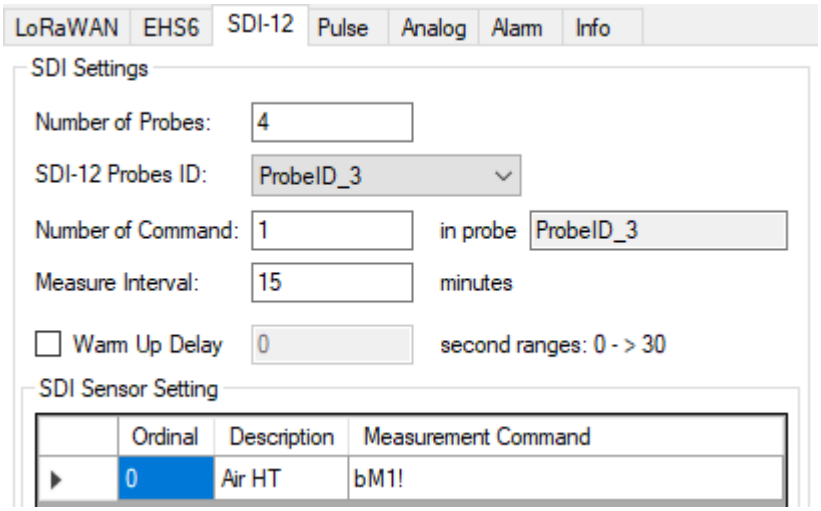


50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

Probe 2:



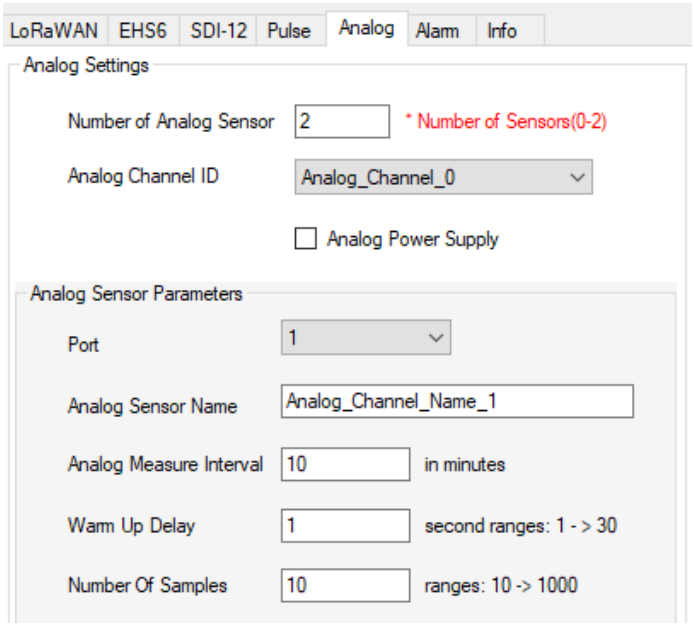
Probe 3:



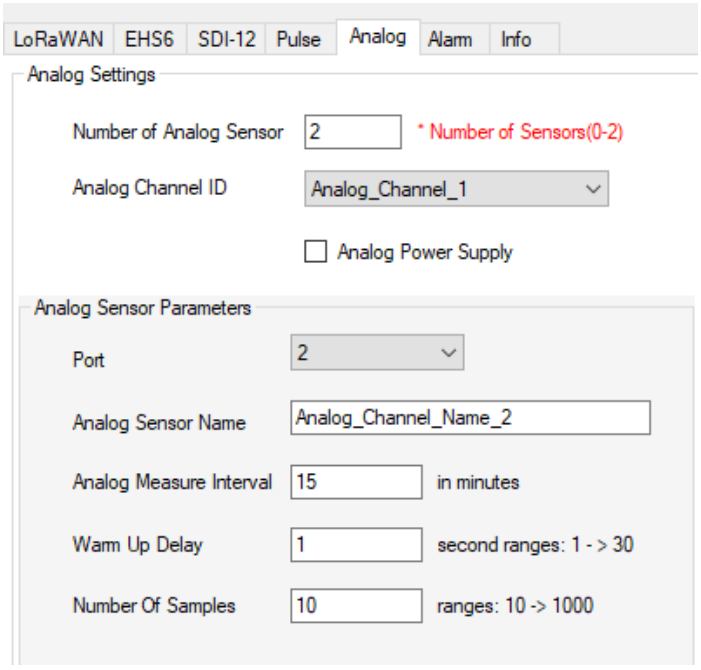
3.3 Analog sensors configuration

2 analog channels are configured with 10 and 15 minutes measurement intervals:

Channel 0:



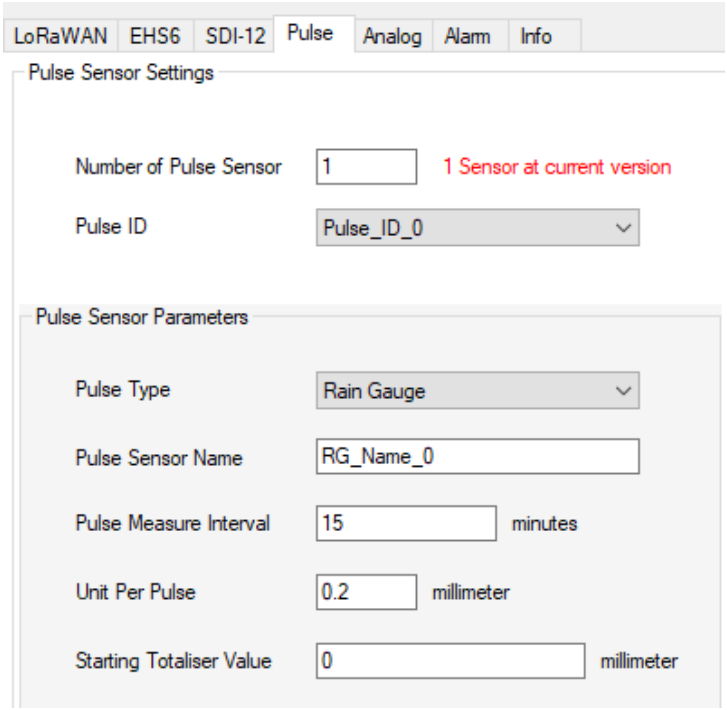
Channel 1:



50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

3.4 Pulse sensor

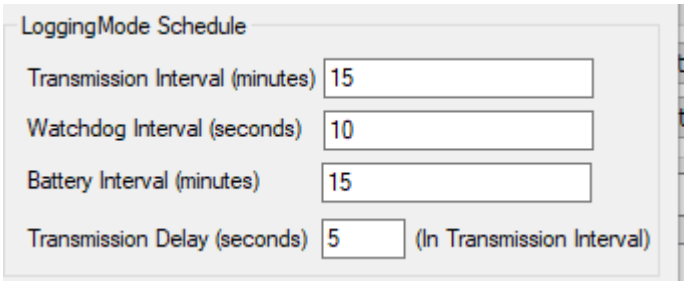
1 pulse sensor for rain gauge application:



3.5 Reporting intervals

Following intervals need then to be configured:

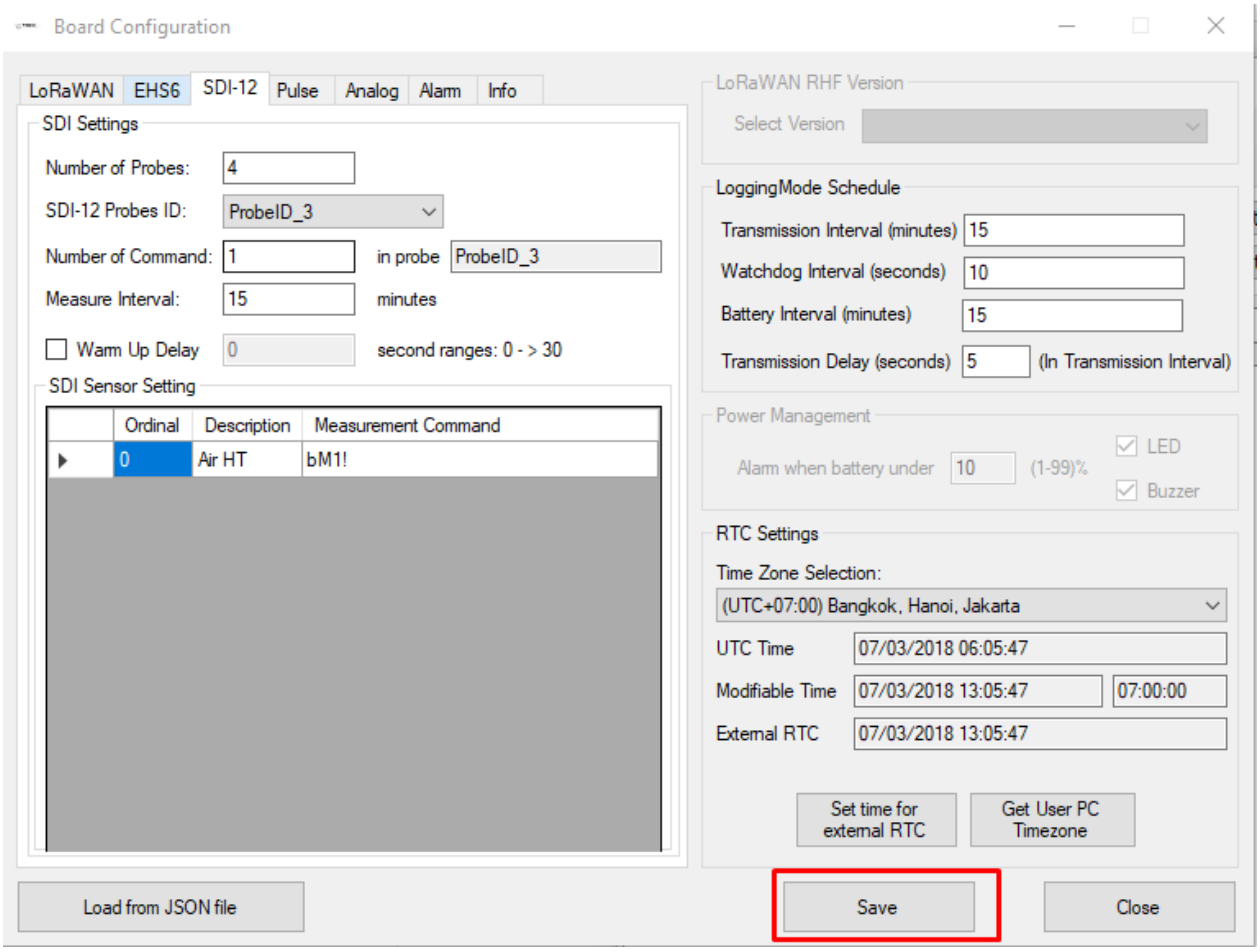
- Transmission
- Battery level reporting
- Transmission delay



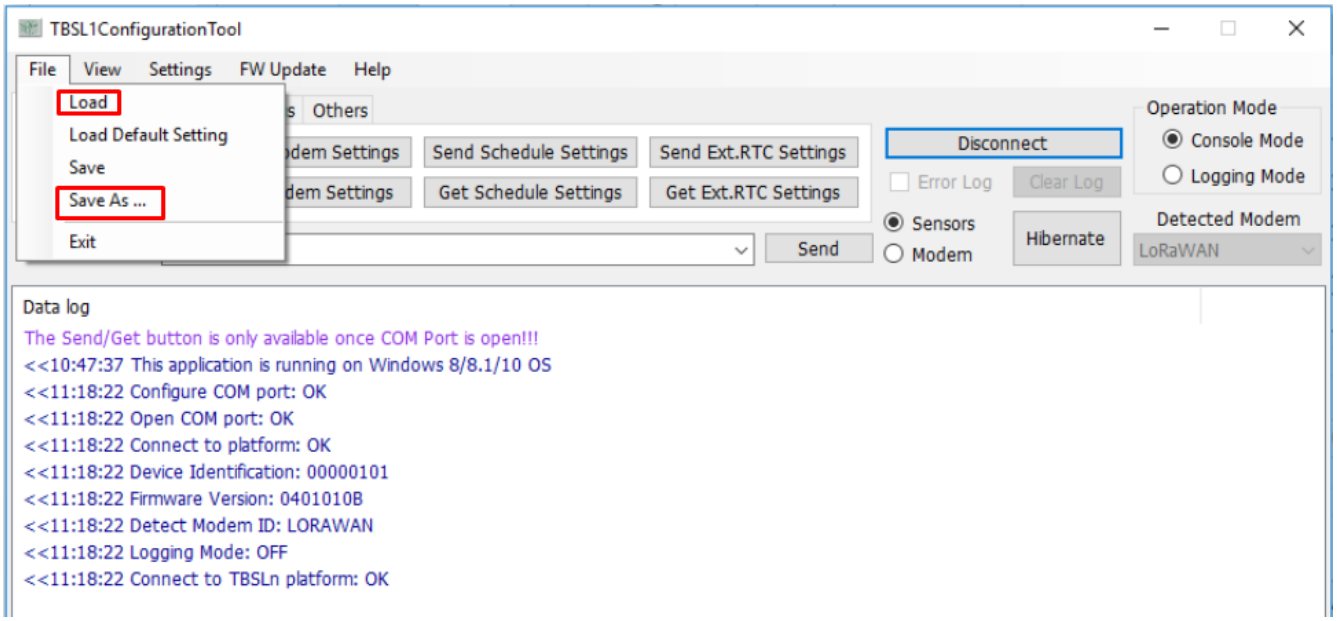
50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

3.6 Save configuration

From whatever tab, click on the 'Save' button to save the configuration:

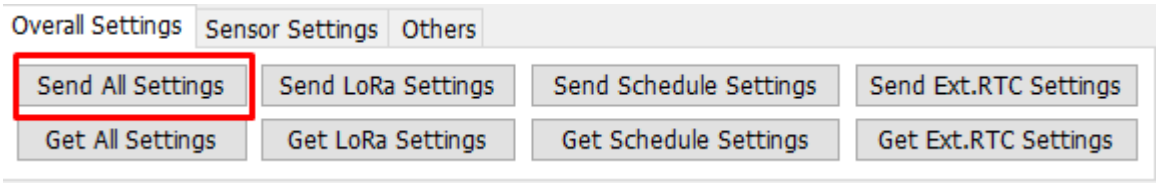


Current configuration can be saved into a JSON file and reloaded later through the 'File' menu:

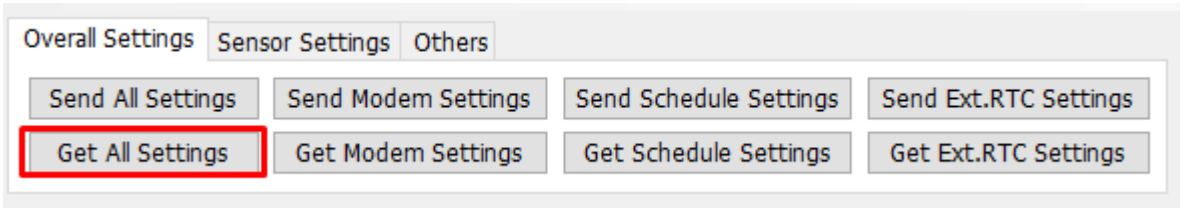


4 Platform activation

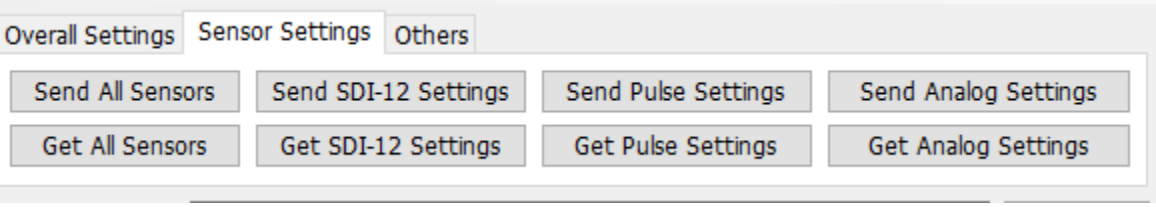
If platform default configuration has been modified, it is required to click on "Send All Settings" button (OR sub-category settings button depending on what has been changed): this will update the internal TBSL1 configuration.



Configuration can be checked likewise through the 'Get All Settings' button or any sub-category get settings button.

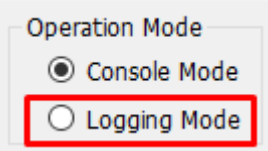


50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net



Set and get parameters for specific sensors categories

To turn the platform to operating mode, it just requires to click on "Logging Mode" button and wait for the confirmation.



From this point, the PC application can be closed or left open, and the USB cable is no longer required. TBSL1 starts logging measurements and transmitting them based on various programmed intervals.

Any further change to TBSL1 configuration requires to switch back to console mode by clicking to "Console Mode" button (note: the switch will only happen when the platform is not in sleep mode or at power up).

Alternatively if the unit has to be stored on shelves or left unattended for a while until it is deployed on the field, the following steps should be followed in order to save the battery:

- Click on 'Send All Settings'
- Click on 'Hibernate' ➔ this makes TBSL1 enter into hibernation mode
- Then 2 options to restart the platform in active mode (logging):
    - If TBSL1 is left hibernating, then swipe a magnet over the reed switch and it will automatically restart in logging mode
    - Unplug the solar panel and the platform will be shutdown. When plugging back the solar panel, TBSL1 will automatically restart in logging mode.

5 Data format

Several reporting messages are transmitted by TBSL1:

- Common data message
    - Ex: ***C00004AC10400010f0fR -53***
    - Fields:
        - **C:** common data message
        - **00004AC1:** device ID to be read as "00004AC1"

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

- **0400010f:** FW version to be read as "04.00.01.0F"
- **0:** Reserved for future use, systematically set to zero.
- **f:** total number of connected sensors, to be read as "15"
- **-53:** RSSI, to be read as "-53"

- Battery report message
  - Ex: ***PB16:10:27:02:45:00*** **4.100**
  - Fields:
    - **P:** parameters report message
    - **B:** battery
    - **16:10:27:02:45:00** time stamp, 2016 October 27th 02:45:00AM (HH:MM:SS)
    - **<space>**
    - **4.100:** battery voltage in V.

- Pulses report message
  - Ex: ***PP16:10:27:02:45:000*** **12004**
  - Fields:
    - **P:** parameters report message
    - **P:** pulse sensor
    - **16:10:27:02:45:00** time stamp, 2016 October 27th 02:45:00AM (HH:MM:SS)
    - **0:** pulse sensor ID
    - **<space>**
    - **12004:** pulse count
- Analog report message
  - Ex: ***PA16:10:29:14:30:001*** **0.235532 3.454323 5.454323**
  - Fields:
    - **P:** parameters report message
    - **A:** analog sensor
    - **16:10:29:14:30:00** time stamp, 2016 October 29th 14:30:00 (ie 2:30:00 PM, HH:MM:SS)
    - **<space>**
    - **0.235532:** minimum measured analog value
    - **<space>**
    - **3.454323:** average of analog measured values
    - **<space>**
    - **5.454323:** maximum measured value

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net

- SDI-12 report message
  - Ex: ***PS16:10:29:02:30:000204 -12.20003 +2.322432 -4.433332 -9.110423***
  - Fields:
    - **P:** parameters report message
    - **S:** SDI-12 sensor
    - **16:10:29:02:30:00** time stamp, 2016 October 29th 02:30:00AM (HH:MM:SS)
    - **0:** SDI-12 sensor ID
    - **2:** SDI-12 sub-sensor ID
    - **04:** 4 measurements returned by the sensor
    - **<space>**
    - ***-12.20003 +2.322432 -4.433332 -9.110423:*** 4 measurements values returned by SDI-12 sensor and separated by a <space> delimiter.

Refer to TBSL1-N datasheet for further description of each message format.

6 History

Version	Date	Author	Changes
V1.0	15/09/2017	Philippe Hervieu	Creation
V1.1	03/07/2018	Philippe Hervieu	Update vs FW/GUI 04.00.01.0B
V1.2	20/11/2018	Philippe Hervieu	Instructions to use TBSL1 with LorIoT LoRaWAN server

50/11 Truong Son, F2 | Q. Tan Binh | Ho Chi Minh City | Tel +84 (83)5471340 | E-mail office@tekbox.net| www.tekbox.net