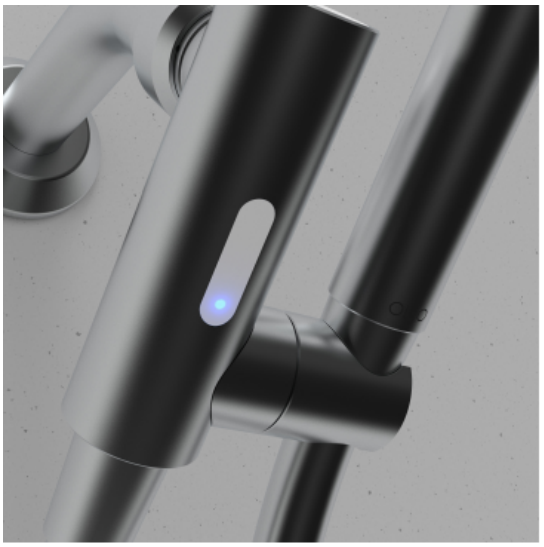
LOW POWER SENSING AND TRACKING

SODAQ



Smart Shower

Document: Technical document Smart shower

Version: Draft 0.3

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SODAQ

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Document management

This technical file of the Smart Shower is only applicable to V1.5

Version	Date	Author(s)	Description / amendments
Draft 0.1	2021-02-10	Jordi Zoon	The initial draft version of "technical file smart shower"
Draft 0.2	2021-03-18	Jordi Zoon	Added temperature range

Introduction to the Smart shower

The smart shower device is designed and developed by SODAQ engineering B.V. in cooperation with Kinetron B.V.. The device is an indoor, battery powered device that a) measures water temperature and flow of a shower, b) transmits all acquired data over Bluetooth, and c) uses the shower water flow to generate power for the device to operate on.

Intended and foreseeable use

The product is intended to give consumers insight into their own shower habits and water consumption. The measured data, water temperature, water consumption, and time, is transmitted over Bluetooth to the smart shower phone application. The device is intended for home use only and should not be used in professional settings, nor should it be used for billing purposes. The device may only be used in a temperature range going from 0℃ up to 45℃.

Product functioning

The main objective of the Smart Shower project is to measure waterflow, water temperature, duration of a shower and the timestamp of when the shower has been started. These variables can be requested by the end user via a smartphone during and after the shower. The Smart Shower broadcasts the UUID for one hour after the shower. Afterwards it goes into sleep keeping the RTC running for the timestamps when a new shower has started.
To use the Smart Shower a mobile application will need to be developed that can communicate with the device over Bluetooth. The microcontroller used in the Smart Shower is a Nrf52833 and does support BLE 5.2. For this project only the features of 5.0 are required.
The smart shower will send the data in EU metrics [Liters and degrees Celsius]. As the app needs to display the data in US metrics these conversions need to happen in the app.

Functional overview

For the functional overview, see the block diagram in figure 1.

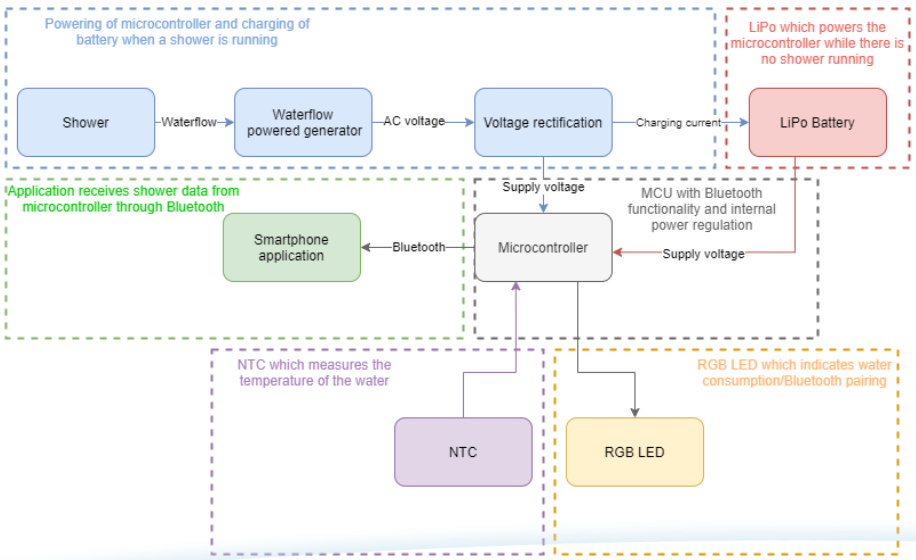


Figure 1: Functional block diagram

Main product components

The product uses the nRF52833 for communication functionality with the user's phone. The nRF52833 is also used as the main MCU. The entire device is powered by a rechargable 60 mAh LiPo battery. The battery is charged by a water turbine (that is also used to measure the water flow) that is also capable of powering the entire device in case the LiPo is passed it's life time

The product has two sensors

1. Temperature sensor, NXFT15WF104FA2B050 to measure the water temperature
2. Waterflow sensor, Custom design by Kinetron to measure the water flow, generate power to charge the battery or run the MCU.

Datasheets of all major components are attached as files in Annex B

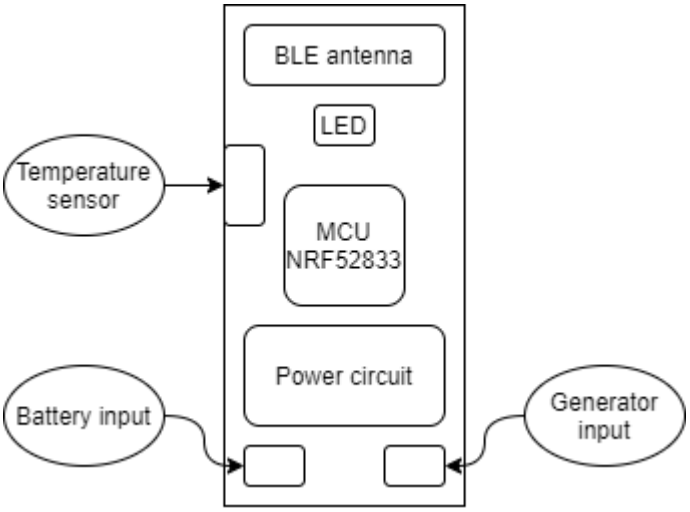
The PCB is mounted on the black tube (3rd from the right) and then placed into the clear plastic housing (right). This entire assembly in combination will then be potted to ensure no water can damage the electronics. The potted assembly then gets slid into the stainless steel enclosure where it will then be in the water flow path of the shower.

PCB layout and layers

The PCB of the product consists of four layers. Only the top layer has components on it, The main components are:

- nRF52833
- 2.4GHz antenna
- RGB LED
- Temperature sensor
- Battery connector
- Generator connector

A detailed overview of the layers and their components is provided by the gerber files and the bill of materials (BOM) provided in the attached files of Annex C.



Software and firmware versions of the product

The release firmware for the MCU (nRF52833), will be released with firmware version Vx.x with software commit x.x.x. and has been stored on gitlab (https://…).

Band and mode of communication protocols

Before mentioned communication protocols operate according to the mode and band with associated output power of the table below

Band and mode	Output power	Max transmission rate
Bluetooth 2.4GHz	+8 dBm	2 Mbps

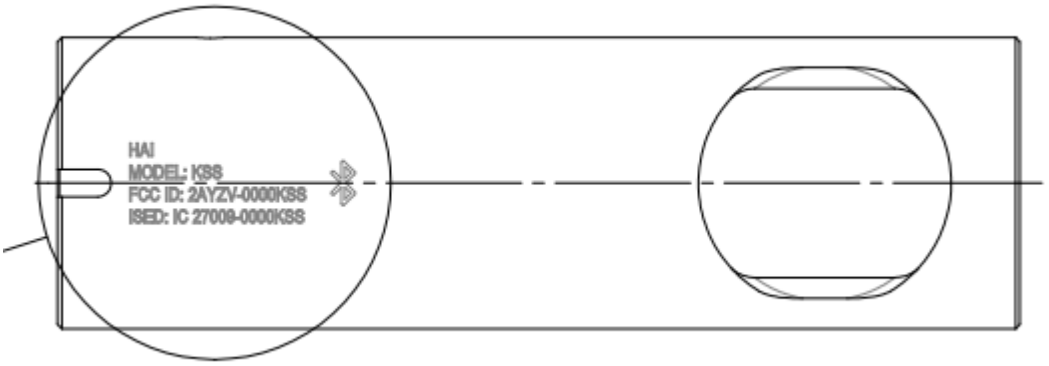
Product design considerations

During the course of designing and developing the product the following considerations are worthwhile to mention as it provides context to the final product design as defined in this technical document.

1. A Li-Po battery has been included to keep the RTC running.
2. The Li-Po is completely disconnected until the first use to increase its shelf life.

Information and marking on the product's casing

The product itself is engraved with the brand name, model number, FCC ID and ISED ID.



Product's essential requirements and applicable harmonized standards

The test report(s) is attached hereto as a file in Annex D, indicating that the product is compliant with the indicated harmonized standards in the table below.

Radio Equipment Directive 2014/53/EU

Essential requirement	Directive	Harmonized standard
Health and safety	RED 2014/53/EU article 3.1a	EN 61010-1:2010

FCC

Essential requirement	Standards
EMC aspects	FCC part 15B
Radio aspects	FCC part 15.247

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. (Example - use only shielded interface cables when connecting to computer or peripheral devices).

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

ISED

Essential requirement	Standards
EMC aspects	RSS GEN
Radio aspects	RSS 247

This device complies with Industry Canada (IC) license-exempt RSS standard(s).
Operation is subject to the following two conditions.

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Other requirements

Bluetooth SIG

Annex A - User information and installation instructions

**** Please refer to the folder with name: Annex A - User information and installation instructions *****

Annex B - Datasheets of product's main components

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Annex C - Gerber files and Bill of materials

**** Please refer to folder with name: Annex C - Gerber files and Bill of materials*****

Annex D - Test reports

**** Please refer to zip-file with name: Annex D - Test reports *****