GENERAL SPECIFICATIONS

ICT SigFox indoor temperature sensor

Document revision history

DATE	REVISION	OBJECT	Author
17/06/2016	0	Creation	RLV
20/10/2016	1	Additional details on autonomy in §5.2	RLV
07/09/2017	2	Precision regarding temperature conditions for the battery's theoretical service life	MC

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1. OBJECT OF THE DOCUMENT

Describe the operation and technical characteristics of the product "SigFox indoor temperature sensor" (temperature and SigFox radio technology).

2. APPLICABLE DOCUMENTS - REFERENCE DOCUMENTS

Detailed software specifications - SigFox sensors data exchanges: 50-09_SigFox_SPDL_Sensor_Rev4.pdf

3. DEFINITIONS - TERMINOLOGY

SigFox: the SigFox technology provides low bandwidth, long range, secured UNB (Ultra Narrow Band) radio communication with very low energy consumption. The star network covers an end-to-end transmission, from the equipment to the information system.

Differential coding: (also called **delta compression)**) is a lossless data compression technique that consists in transforming data through the series of differences between successive data. This method based on the simplified Huffman coding is only interesting if the data to be compressed are subject to little change.

4. BACKGROUND AND OBJECTIVES OF THE STUDY

The SigFox indoor temperature sensor has been developed based on new electronics that incorporate the SigFox technology.

Important: the sensor must be placed under coverage of the SigFox public network.

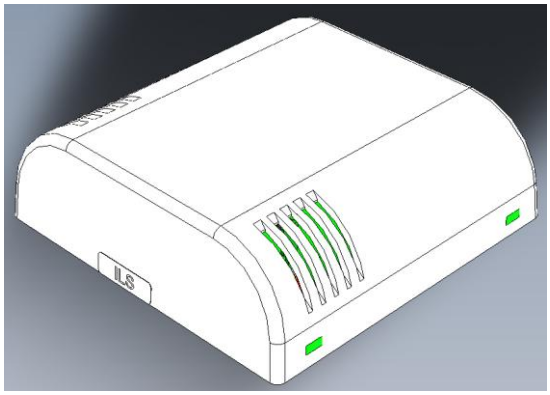
Physical measurements serve as an indication; they cannot be associated with a billing process for example.

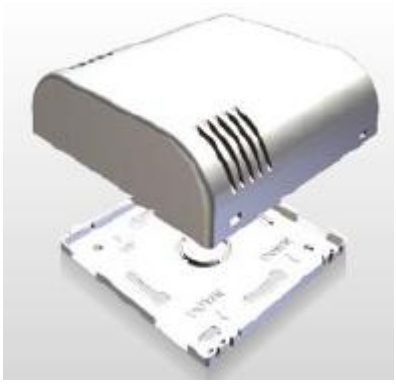
Important: the costs associated with network access (subscription and volume) are borne by the customer.

5. GENERAL STRUCTURE OF THE PRODUCT

5.1 Mechanical presentation and installation recommendations

The SigFox indoor temperature sensor board is housed in a white, "Ambiance" type ABS enclosure compliant with flammability standard UL94-V0 HB (non-flammable), which consists of a base plate and a cover that clips onto it.

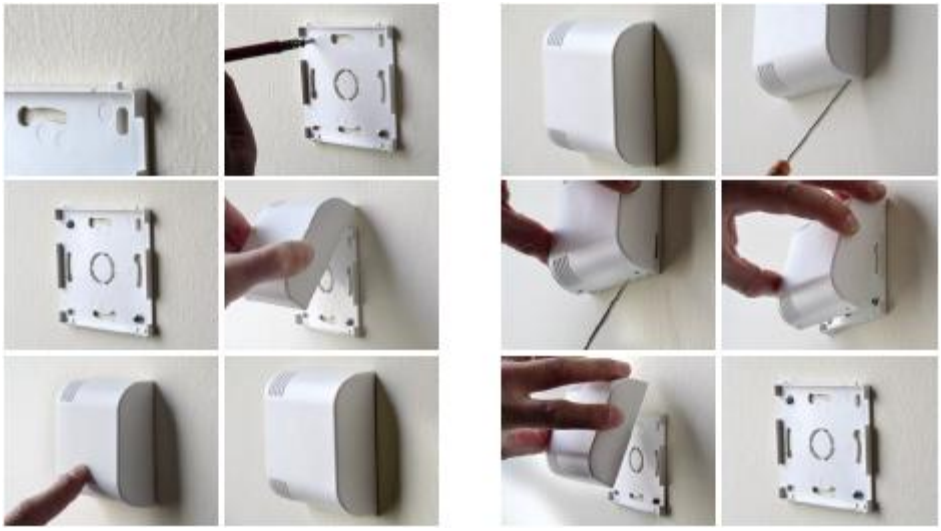




The enclosure dimensions are: 80 x 80 x 25 mm

The sensor is designed to be wall-mounted (using screws or double-sided tape) inside the housing in an area representative of the measured quantities, with the vents oriented vertically in order to facilitate air circulation.

Assembly and disassembly are carried out as follows:



The sensor must be placed on the vertical inner wall (screws + bushings supplied), away from windows, direct sunlight, cold inlets or air vents and not above a radiator or any hot spot so as not to be subjected to excessively fast changes in temperature that may be detrimental to the quality of the measurements.

It must be placed at least 1 metre away from any metal surface that can constitute a ground plane that significantly attenuates the radio signal.

Note: Check the radio coverage inside the building prior to the installation since SigFox penetration is quickly limited indoors.

The sensor incorporates a SigFox radio transceiver associated with an antenna.

5.2 Power supply

The SigFox indoor temperature sensor board is powered by an embedded lithium battery. The electronics are designed in such a way as to obtain a very low standby current.
The battery's theoretical service life is approximately 9 years based on one measurement every hour and one radio transmission every 24 hours for temperature measurements when the data sent are not compressed.
In the case where the data are compressed, the battery's theoretical service life is approximately 12 years provided that the data do not fluctuate too much (less effective data compression).
For any other configuration with a lower measurement or transmission period, the service life will be reduced.
The battery is replaced at the factory.
This theoretical lifetime of the battery is valid for the operating temperature range of +10 °C to +25 °C.

5.3 Information frame and power supply self-test

Sensor information frames are sent during the period of radio transmission of these information frames set in the product configuration. These information frames can be deactivated by specifying "0" for the corresponding parameter in the configuration. The two pieces of information sent in these frames are: the battery voltage measurement and the number of radio transmissions.

Indeed, the board measures the supply voltage of its battery and sends the measurement during the period of radio transmission of sensor information frames set in the product configuration. The sensor is capable of detecting a low battery information. If the voltage drops below a minimum threshold, an alarm is sent to the network after the data has been transmitted.

The number of radio transmissions corresponds to the number of radio transmissions that the sensor has made since leaving the factory.

5.4 Configuration and software settings for the SigFox indoor temperature sensor

The sensor is supplied with factory settings, defined at the time of the order, and for a minimum volume of 100 sensors:

- Minimum interval between two measurements: 1 to 48 hours, in 1 hour increments,
- Interval between two radio transmissions of measurement frames: 2 to 48 hours, in 1 hour increments,
- Interval between two radio transmissions of sensor information frames (measured battery voltage and number of radio transmissions): 0 to 30 days, in 1 day increments ("0": deactivation of sensor information frame transmission)
- Alarm thresholds:
  - Minimum battery level for threshold overrun alarm (from 1 to 36 1/10V, i.e. from 0.1 V to 3.6 V)
  - Minimum and maximum temperature for threshold overrun alarm (0 to 400 1/10°C, i.e. 0°C to +40°C)
- Alarm thresholds deactivation: "0" → Alarm thresholds activated and "1" → Alarm thresholds deactivated (this deactivation only concerns the measurements of physical quantities (temperature))
- Data compression type: "0" Data compression deactivated and "1" → nke "Delta compression" type activated

Later versions will allow these configuration settings to be updated locally using a micro SD card (connector present on the board) on which a configuration file that specifies the new values of these settings will be loaded.

In later versions, the embedded software will also be updated locally using a micro SD card.

The settings of the sensor configuration file are specified in the document "50-09_SigFox_SPDL_Sensor_Rev4.pdf".

5.5 Temperature measurement

The board is fitted with a sensor that measures the temperature.
At regular intervals, the sensor wakes up to perform a measurement. The latter is then stored in the memory, after which the sensor is placed in standby mode.
These measurements are sent at regular intervals to the SigFox network via radio link.
The microcontroller manages its consumption optimally according to its measurement period.

The temperature sensor fitted is compatible with measurement ranges from 0°C to +40°C (0.1°C resolution and +/- 0.5°C accuracy).

5.6 Microcontroller

A Flash memory inside the microcontroller supports:

- the software: the sensor is supplied with the current version of the software.
- the configuration settings for the operating profile.

A RAM memory inside the microcontroller allows the measurements to be saved until the next radio transmission. Once the transmission is complete, the memory is erased.

5.7 NFC tag

An NFC tag attached to the sensors (inside the enclosure) includes a product type, as well as a unique internal identification code in order to simplify any intervention by the installer, who will retrieve this information by "tagging" the product.

6. FUNCTIONS OF THE PRODUCT IN INSTALLATION AND USE

6.1 Operation and communication

A magnetic sensor activated by a magnet and an embedded confirmation buzzer allow the sensor to be taken out of storage mode and to initiate communication with the network (start "alarm").
Similarly, the system can be stopped by reactivating the magnetic sensor using a magnet. When the sensor is stopped, it also transmits a stop "alarm".

The sensor sends the measurements made during each radio transmission period.
"Low battery" or "Measurement out of range" alerts are also respectively sent during the period of radio transmission of information and data that follows their detection, if this function is activated.

6.2 Data transfer period and reference date

The data transfer rate (measurements or alarms, if any) of the SigFox indoor temperature sensor is one of the parameters of its configuration.
Transmission dates are calculated from a first transmission date and by adding the transfer period.
The data structure (format of each measurement) of this sensor is specified in the document "50-09_SigFox_SPDL_Sensor_Rev4.pdf".

6.3 Measurement data

Temperature measurements are stored in 1/10th of the corresponding physical unit, i.e. 1/10°C.
To optimise the number of data frames, with a view to minimising consumption and thereby increasing the product's autonomy, the data will then be compressed using the differential coding method (delta compression).

6.4 Alarm data

Important: between two measurements, the sensor goes into standby mode. No alarm shall be detected (e.g. temperature measurement below or above one of the two thresholds set). It is not until the next measurement that a possible alarm will be detected if the threshold overrun is confirmed, and it will be sent immediately.

The different types of alarms are:

- Product activation/deactivation alarms
- Power supply alarms (low battery)
- Physical quantity alarms (temperature)
- Tearing alarm (enclosure opening)

If a preconfigured threshold for battery voltage is exceeded, the alarm is sent during the next period of radio transmission of information.

A configuration setting allows the alarms relating to the measured physical quantities (temperature) to be deactivated.

7. MANUFACTURABILITY

In order to limit production costs, the electronic boards will have to follow a conventional manufacturing process involving a mix of SMD and through-hole components wave soldered onto FR4 epoxy printed circuit board with metallised holes.
In compliance with EMC standards and despite the additional cost generated, a 4-layer CAD with the most significant ground plane possible shall be favoured. The finish of printed circuit boards shall comply with the latest Lead Free / RoHS specifications.

7.1 Testability

An in situ test (or one similar in performance) is carried out at 100% once the components are inserted.
A functional check is performed by a test software embedded in each SigFox indoor temperature sensor and specific tooling.
Mounting pads for test probes shall be arranged on the traces of strategic signals. A PC software shall be used for programming the microcontroller and shall use a plug-in connector.

7.2 Identification-Traceability

Products are identified individually. Each board is programmed with a unique internal identification code.
Each sensor bears a unique internal identification code visible on the product identification label.

This label allows traceability and indicates:
- the NKE product group code (50-09-037-xxx)
- a unique NKE code for determining the manufacturing order (MO) number and the product number in the MO
- the serial number

7.3 Packaging

Each board is delivered mounted in an enclosure.
When shipped, the SigFox indoor temperature sensors are grouped in batches, in a cardboard box capable of withstanding transport constraints.

8. MAINTAINABILITY

There is no provision for preventive maintenance operations.
The product must be returned to the factory to carry out after-sales service or to replace the battery.

9. DESIGN CONSTRAINTS

9.1 Operating temperature

Temperature probe: Range from 0°C to +40°C

9.2 Storage temperature

The board requires a storage range from +10°C to +30°C (optimum range to preserve the battery).

9.3 Power supplies

Power is provided by a lithium battery.

9.4 Autonomy

See paragraph above.

9.5 Mechanical stress - shocks - vibrations

N.B. : the enclosure is mounted on a vertical wall using screws and bushings (supplied).

10. NORMATIVE REQUIREMENTS

10.1 Electromagnetic compatibility

For CE marking purposes, products comply with the general EMC regulations for electronics. NKE takes care of the testing necessary to ensure the compatibility of its products.
The selected radio component complies with standards EN 300-220 / EN 301-489.

10.2 Electrical Safety

N/A

10.3 Standards and regulations specific to the business segment

NF EN-60335-1
Products are designed and manufactured in accordance with Directive 2002/96/EC on Waste Electrical and Electronic Equipment and Directive 2002/95/EC on the Restriction of Hazardous Substances (RoHS).

11. MARKETING SPECIFICATIONS

11.1 Product service life

7 years minimum

11.2 Projected quantities

The product must be designated for up to 500 units produced per year.

11.3 Pricing structure

The applicable pricing conditions are those set out in the applicable commercial offerings.

11.4 Guarantee

Products are guaranteed 24 months from the date of delivery by NKE, subject to implementation in accordance with the rules set out in the technical specifications.

11.5 Maintenance

N/A. Except for battery replacement, which requires the product to be returned to the factory.

11.6 Product documentation requirements

Customer's responsibility.