



## **LoRaWAN™ SKY LIGHT PARKING SYSTEM**

***Wireless system for parking space occupancy  
monitoring  
with LoRaWAN™ technology  
and  
iBeacon integrated***

### ***Nabla Quadro Srl***

***Via G. Peroni 106  
00131 Roma, Italy  
Tel. +39 06 91511242  
[www.nablaquadro.it](http://www.nablaquadro.it)  
[infomail@nablaquadro.it](mailto:infomail@nablaquadro.it)***

***January 2018***

## Table of contents

Preface	3
Sky Light Parking Sensor - LoRaWAN™	4
Technical specifications	6

## Preface

**Sky Light Parking System** is a system for parking bay occupancy detection which is able to send data automatically to a central station for processing and storage. The communication is wireless and uses **LoRaWAN** technology.

In addition, an **iBeacon** is integrated inside to allow automatic recognition of the user who parks on the sensor (\*).

The purpose of this system is to **monitor parking spaces in real-time** so as to create file archives containing important information for parking managers.

Data can be available to users in real time (for instance via smart phones or variable message signs).

This kind of information, if appropriately processed, opens a possibility to provide different services, such as:

- Real time information about number and location of free parking spaces.
- Monitoring of no-go areas, in order to prevent and detect infringements.
- Monitoring of reserved areas (e.g. disabled, loading zones).
- Reduction of checking operations.
- Alert system for illegal occupancy of pay parking spaces.
- Pay by phone services.
- Booking parking spaces in advance.
- Elaboration of statistics about occupancy rate, turnover, mean standing time, parking distribution and revenues per day, week, month, year.
- Identification of the most suitable fees based on supply and demand in each parking area.

This system is based on a low-consumption wireless sensor and a patented detection technology. More precisely, detection is based on **three different technologies**:

- 1) Variation in incident light (patented principle)
- 2) Active infrared
- 3) Magnetic field sensor

The combination of three technologies guarantees a very high accuracy compared with conventional sensors based just on magnetic technology or ultrasounds.

(\*) through apps provided by third parties

## Sky Light Parking Sensor - LoRaWAN™

Sky Light Sensor is placed in the road surface, in the centre of a parking bay. The installation takes place in a short time (few minutes) using resins or quick cement and upon the removal of a street core of a 130 mm of diameter and 80 mm of depth. For the installation an ordinary pneumatic drill can be used.

Sensors are powered by a battery pack having high capacity and low self-discharge rate. The battery life is 10 years and more. After the placement the sensor is able to self-calibrate.



The casing creates a waterproof rigid volume which is able to protect the electronics from rainwater and mechanical stresses caused by vehicles. The features of these cases help a simple extraction of the sensors, making possible a rapid maintenance work.

The sensors send data to **LoRaWAN** gateways. They are typically provided by the network provider and are connected with LoRaWAN network servers.

At the same time, when the sensor is occupied, the **iBeacon** inside is switched on to send proximity data aimed to allow user identification.



**Key features:**

- **Real time vacancy detection** in both indoor and outdoor parking areas.
- **Triple detection technology** (variation in incident light, IR emitter, magnetic field) that guarantees an accuracy of 99% and more.
- **Self-calibration.**
- **Quick and easy installation:** wireless technology reduces installation time into the pavement.
- **Easy integration** with parking management systems, thanks to its open protocols.
- **Autonomous power supply:** sensor battery life is 10 years and more.
- **Easy maintenance:** the outer case helps to replace a sensor in less than 5 minutes.
- **Italian patent n° 0001379287** released on 30/08/10
- **iBeacon integrated:** to allow user identification (\*)

(\*) through apps provided by third parties

## Technical specifications

### Physical and mechanical characteristics

- Operating temperature: -30° +85°C
- International Protection level: IP68
- External size: Ø 110 mm, H 85 mm
- Installation hole: Ø 130 mm
- Case material: fibre reinforced nylon (PA66 - 30%FV)
- Weight: 1000 g
- Power supply: thionyl chloride battery (3,6 V - 20Ah)
- Battery life: more than 10 years (considering 30 parking events per day @SF12)
- Average consumption:
  - basic (no radio transmissions): 100 uA
  - considering 15 parking events per day as worst event @SF12: 130 uA
  - considering 30 parking events per day as worst event @SF12: 160 uA

### Data capture

- Detection technology: TRIPLE TECHNOLOGY
  - Incident ambient light (Italian patent n°0001379287)
  - Active infrared
  - Magnetic field
- Sampling rate: 1 Hz

### Data transmission LoRaWAN

- Data transfer protocol: LoRaWAN
- Working frequency: 868 MHz (ISM - unlicensed band)
- Transmitter power: +14dBm
- Receiver sensitivity: -132 dBm (LoRaWAN)
- Individual channel width: 125KHz (LoRaWAN)

### European Conformity LoRaWAN (CE)

- Directive 1999/5/CE (R&TTE)
- ETSI EN 301 489-1 (Electromagnetic compatibility and Radio spectrum Matters- EMC standard for radio equipment and services-Common technical requirements)
- ETSI EN 301 489-3 (Electromagnetic compatibility and Radio spectrum matters - Specific conditions for SRD operating from 9KHz to 40GHz)
- EN 300 220-1 (Short Range Devices. Radio equipment used from 25MHz to 1000MHz: technical characteristics and test method)
- CEI EN 55022 (radiated emissions)
- CEI EN 61000-4-2 (electrical discharge immunity)
- CEI EN 61000-4-3 (radiated electromagnetic field immunity)

**Radio specifications Bluetooth**

- Standard Bluetooth 4.1 (Bluetooth Low Energy)
- Frequency band 2.402 to 2.480 GHz (according Bluetooth 4.1 specifications, worldwide ISM band)
- Advertising channels CH37 (2.402 GHz), CH38 (2.426 GHz), CH39 (2.480 GHz) (according Bluetooth 4.1 specifications)
- Channel spacing 2 MHz (according Bluetooth 4.1 specifications)
- Tx power: + 4 dBm
- On-board chip antenna

**European Conformity Bluetooth Low Energy (CE)**

- EN 300 328 V 2.1.1 (2016-11) (a)
- ETSI EN 301 489-17 V3.1.1 (2017-02) (b)
- ETSI EN 301 489-1 V2.1.1 (2017-02) (c)
- EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013(d)
- EN 62479:2010