



PLACEPOD<sup>®</sup> VEHICLE COUNTING SENSOR  
USER MANUAL

## PlacePod® Vehicle Counting Sensor

---



PlacePod Vehicle Counting sensor (PlacePod VC) is an in-ground sensor that communicates with a LoRa gateway to provide real-time vehicle counts. PlacePod VC provides accurate count data for passing vehicles in driveways and designated entrances/exits, up to 7 years of battery life, and is stable over temperature fluctuations, even in harsh environments. **(Note: surface-mount PlacePod VC sensors are for short-term product evaluation purposes only.)**

### Key Features & Benefits

- Includes the industry's most accurate magnetic sensing system for vehicle detection with the combination of PNI's high-performance magnetic sensor and vehicle counting algorithms.
- Includes a built-in LoRa radio that communicates to a gateway with complete LPWAN compatibility.
- Sensors and algorithms are finely tuned for ultra-low power consumption, providing continuous vehicle detection without missing a vehicle count.
- Capability for wireless configuration and software updates using Bluetooth Low Energy (BLE) via PNI's mobile iOS and Android applications.
- PNI's Parking Management Application provides cloud-based algorithms for processing the vehicle count data
- PlacePod VC specifications are located in Appendix II.

### Applications

- Smart Parking Management & Reporting
- Parking Guidance Systems
- Event Parking Management
- Smart City
- Commercial and Mixed-use Real Estate
- Public & Private Parking Lot Management

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>4</b>
<b>2</b>	<b>SYSTEM FUNCTIONAL ELEMENTS .....</b>	<b>5</b>
2.1	SYSTEM OVERVIEW .....	5
2.2	PLACEPOD PHYSICAL SENSOR .....	6
2.3	GATEWAY .....	7
2.4	NETWORK SERVICE .....	7
2.5	PNI PARKING MANAGEMENT APPLICATION .....	8
<b>3</b>	<b>PLACEPOD COUNTING SOLUTION SETUP AND INSTALLATION .....</b>	<b>9</b>
3.1	SETUP AND INSTALLATION OVERVIEW .....	9
3.2	SET-UP OVERVIEW .....	9
3.3	ACTIVATE PLACEPOD .....	10
3.4	INSTALLATION SITE SURVEY .....	11
3.5	INSTALL THE PLACEPOD .....	12
3.6	CALIBRATE THE PLACEPOD .....	13
3.7	PNI CLOUD SERVICE .....	13
<b>4</b>	<b>APPENDICES .....</b>	<b>27</b>
4.1	APPENDIX I: GLOSSARY .....	27
4.2	APPENDIX II: PLACEPOD SPECIFICATIONS .....	29

## 1 INTRODUCTION

This guide is designed to support the PlacePod VC device. For questions relating to other elements of the LoRa Network, please contact the provider. For information about PNI's PlacePod Vehicle Detection Sensor, please visit: [PlacePod Smart Parking](#).

The PlacePod User Manual is divided into three sections:

- **System Functional Elements**

PNI's PlacePod VC sensor is one component of a vehicle counting system. The System Functional Elements section describes the system components and preliminary decisions that must be made to enable a smooth implementation.

- **Setup and Installation**

The Setup and Installation section provides setup and installation instructions for the PlacePod VC sensor and references additional materials that will assist with this process.

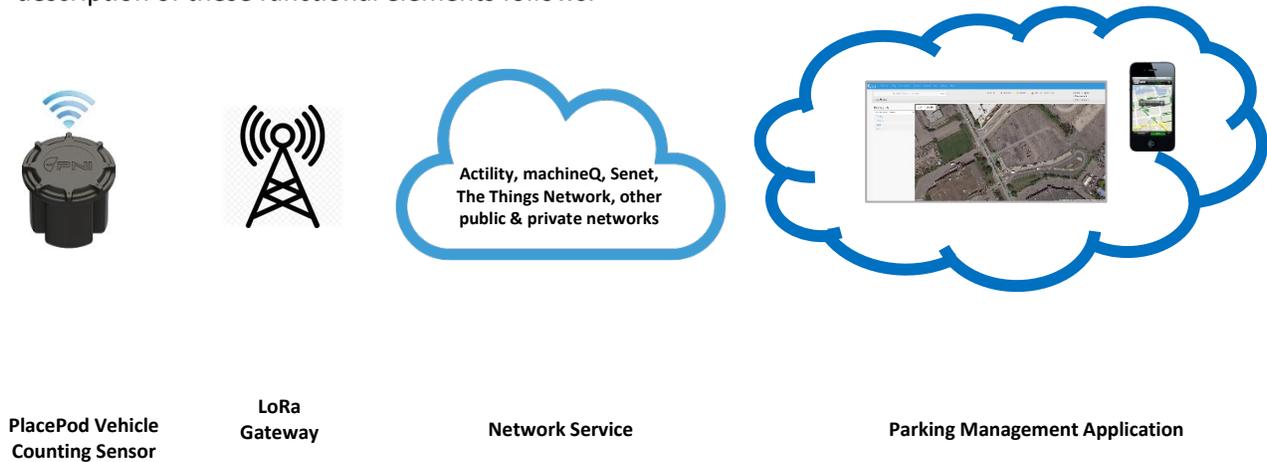
- **Appendices: Additional Information**

The Appendices provide additional information such as a glossary and detailed specifications.

## 2 SYSTEM FUNCTIONAL ELEMENTS

### 2.1 SYSTEM OVERVIEW

The diagram below shows the primary elements of the PlacePod system architecture. A brief description of these functional elements follows.



**Figure 2-1: PNI Vehicle Counting Solution - Functional Elements**

- PlacePod VC Sensor** – The PlacePod VC sensor is a LPWAN-compatible vehicle counting device. It is built with PNI’s high-performance magnetic sensor and vehicle detection algorithms that accurately detect the passing of a vehicle in a driveway or designated entrance/exit lane. Each sensor has a unique ID for easy provisioning, tracking and management.
- Gateways** – Each PlacePod VC device communicates to the gateways set up to receive these signals. The gateways collect the signals from the PlacePod VC devices and send the information on to the Network Service. The number of gateways required depends upon the size and environment of the areas covered by the vehicle counting system.
- Network Service** – The Network Service collects the signals from the gateways and communicates this data to the PNI Parking Management Application. The choice of provider for the Network Service is a key integration decision determined by the scope of the project.
- PNI Parking Management Application** – A cloud-based service for interfacing with algorithms for processing the vehicle count data, configuring the parking area size and managing and resetting the current vehicle count. An API allows users to integrate vehicle count data into their custom or 3<sup>rd</sup> party applications, digital signage, and parking guidance systems.

## 2.2 PLACEPOD VC PHYSICAL SENSOR

The physical sensor detects vehicle presence using the combination of PNI’s high-performance magnetic sensor and vehicle detection algorithms that accurately detect and count each vehicle passing over a sensor.

Two decision factors determine which PlacePod VC product is optimal for a particular customer installation:

### 1) In-Ground or Surface Mount:

**The surface mount models are used for short term product evaluation only.** The in-ground model is the default since placing the PlacePod VC sensor just below the parking surface provides the most durable, permanent installation and the battery life of the surface mount is designed for short term pilot studies.



Figure 2-2: PlacePod Vehicle Counting sensor models

### 2) LoRa Communications Bandwidth:

The PlacePod VC sensor communicates with the gateway over the following LoRa bandwidths – 915 MHz and 868 MHz. The applicable bandwidth is determined by regional communications regulations. For example, in the United States 915 MHz is used, while in Europe 868 MHz is the default. Additional regional frequencies will be supported.

### Product Ordering Information

Part Number	Model	Region	LoRa Frequency
VSC-NA915LR-SET	In-ground	North America	915 MHz
VSC-EU868LR-SET	In-ground	Europe	868 MHz

## 2.3 GATEWAY

PlacePod VC supports gateways that use the LoRaWAN™ specification for wireless communication. Note that this manual describes the functional components in a linear manner – PlacePod VC to Gateway to Network Service to Parking Application. However, the network service is generally chosen before the gateway since many network providers offer bundled services that allow for smoother implementation. Once a network service has been selected, talk to the network provider regarding the bundled services they may offer.

The two decisions related to gateway deployment are: 1) choosing the desired gateway features, and 2) determining the number of gateways required based on coverage area and number of PlacePods deployed on the network.

PNI strongly recommends that the customer conduct a pre-installation site survey in order to determine the number of gateways required for reliable network performance. The number of gateways needed depends on the signal strength (RSSI) and the noise level (SNR) of PlacePods in each driveway or entry/exit. Factors affecting the number of gateways required include location of gateways, density of gateways, nearby buildings and obstructions, antenna size, and choice of manufacturer. The same lane may have RSSI variation of 10 to 15dB when a car is present or when the space is vacant. PNI recommends testing for a -90dBm RSSI without a car in the lane as the baseline for gateway setup. For small projects, a minimum of two gateways are recommended as redundancy protection. Generally, more gateways translate to better coverage. Deploying too few gateways will affect the network reliability due to weak signal strength at the gateways and a lack of redundancy.

Gateways can be ordered from many LoRa gateway manufacturers, such as Multitech, Cisco, Tektelic, Kerlink, The Things Network, and others.

## 2.4 NETWORK SERVICE

The Network Service uses remote servers to collect PlacePod VC sensor data relayed from the gateways. This data is stored on the network service provider's servers and accessed by the customer through the Parking Application. PlacePod VC works with either public or private LoRa networks (such as Actility, PNI, machineQ, The Things Network, and Senet). PlacePod VC is also successfully integrated into other LoRa networks in the US, Canada and Europe.

PNI has developed a network service and Parking Management Application that is ideal for testing and proof of concept purposes and monitoring and managing all parking resources

PNI partners with service companies that provide integrated gateway and network cloud solutions. Utilizing the bundled services from these companies allows for the smoothest implementation.

Some customers prefer to create and run their own custom parking management solutions. A systems integrator can help implement a customized solution using less common components.

## 2.5 PARKING MANAGEMENT APPLICATION

PNI provides a cloud-based service for interfacing with algorithms for processing the vehicle count data, configuring the parking area size and managing and resetting the current vehicle count. An API allows users to integrate the vehicle count data into their custom or 3rd party applications, digital signage, and parking guidance systems.

PNI's Parking Management Application is ideal for testing and proof of concept or large-scale system implementations. Please contact your system integrator or the third-party Parking Application vendor directly for information regarding these options.

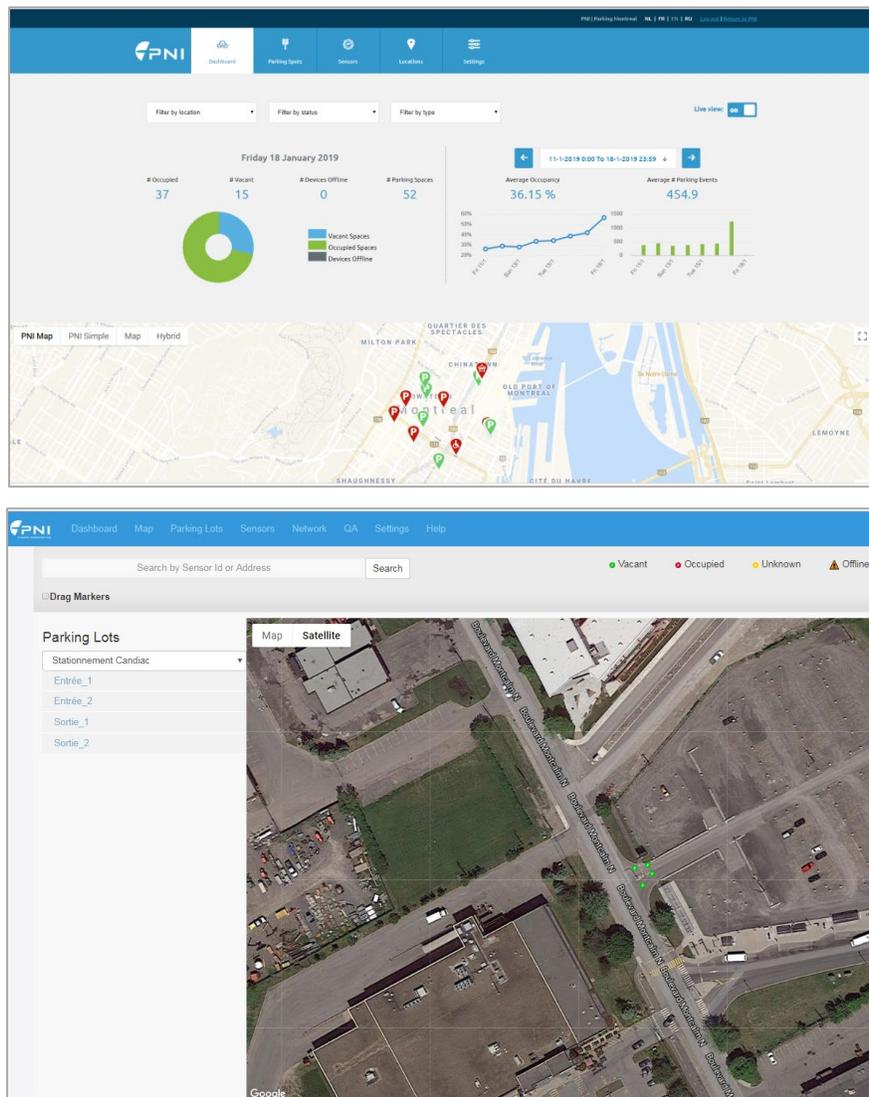


Figure 2-5: Dashboard screenshots from PNI's Parking Management Application

### 3 PLACEPOD VEHICLE COUNTING SOLUTION SETUP AND INSTALLATION

#### 3.1 SETUP AND INSTALLATION OVERVIEW

This section will outline the steps needed to ensure the PlacePod VC is successfully installed and functional.

This assumes that the customer has already chosen a LoRa network service provider and installed gateways.

#### 3.2 SET-UP OVERVIEW

Following are the recommended steps to set up the PlacePod VC solution with a gateway and PNI's Network Service:

##### **Pre-Installation Steps:**

1. Choose a LoRa network service provider
2. Acquire gateways and install in pre-determined location decided from pre-installation LoRa RF site survey. A pre-installation survey can be an important step in determining the number of gateways required for a reliable network. A PlacePod VC sensor can be used as a survey tool in a site survey as follows:
  - a. Determine all locations PlacePod VCs are expected to be installed.
  - b. Determine possible gateway locations taking into consideration the following:
    - i. Distance from gateway to each PlacePod VC
    - ii. Line of sight from gateway to each PlacePod VC
    - iii. Power connection for gateway
    - iv. Internet connection for gateway
  - c. Install a test gateway in one of the possible gateway locations.
  - d. Bring a PlacePod VC to each of the possible PlacePod VC installation locations and place it on the ground in the center of the driveway or entrance/exit lanes you wish to monitor.
  - e. Turn the PlacePod VC on and use the Network Logger\* to monitor the RSSI levels as the PlacePod VC sends messages.  
\* Network Logger will vary based on network service provider. Contact your network service provider for information.
  - f. If signal is not within expected range (PNI recommends -90dBm), then gateway location must be improved. This may be accomplished by bringing the gateway closer to the PlacePod or repositioning the gateway so that it has direct line of sight to the PlacePod.

**Note:** For help installing gateways, please contact your gateway manufacturer.

3. Ensure PlacePods have been provisioned onto the LoRa network.

Note: Provisioning is the process of adding each PlacePod VC sensor into the software monitoring the system. If you are using PNI's network service and parking management application, each sensor is recorded into PNI's application. Some third-party applications provision directly into the network service. If you are using a third-party network service and parking application, contact the vendor regarding how to provision the PlacePod VC sensors onto their network.

PlacePod VC Installation Steps:

1. Activate the PlacePod VC
2. Installation Site Survey
3. Install the PlacePod VC
4. Calibrate the PlacePod VC for the vacant driveway or entrance/exit lanes

### 3.3 ACTIVATE PLACEPOD

PNI's PlacePod VC sensor ships in a special mode where the RF radio is inactive during product shipment. Using the PlacePod Sensor Utility iOS or Android application will activate the PlacePod so that it will join and communicate with the RF network. In order for PlacePod VC to join the network it is important that the RF network is available at the time of activation.

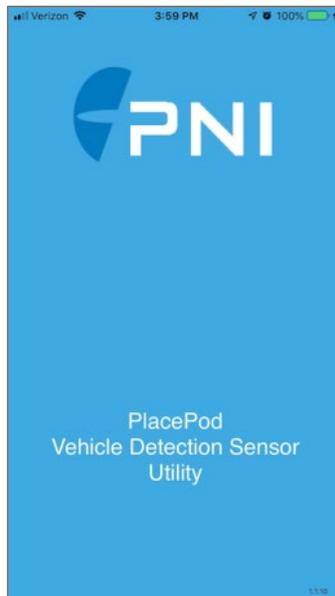
This iOS application enables communication with PNI's PlacePod VC sensor using Bluetooth Low Energy (BLE).

The application is compatible with iOS platforms 9.0+ and has been tested on the following devices:

- iPhone 6 Plus (A1522) iOS 12.0
- iPad mini (Wi-Fi Only/1st Gen) (A1432) iOS 9.3.5
- iPhone 6s (A1688) iOS 12.0

There are two main groups of core functionality in this application. These include:

- BLE application for direct communication with a PlacePod VC
- Label scanning application



**Figure 3-1: Utility Application Main Screen**

To download the PlacePod Sensor Utility application, visit the iOS App Store at:

<https://itunes.apple.com/us/app/placepod-sensor-utility/id1383901393>

Detailed instructions for using the PlacePod Sensor Utility iOS application are included in the PlacePod Utility Application User Manual. To download the user manual, visit:

<https://www.pnicorp.com/download/placepod-utility-application-ios-user-manual/>

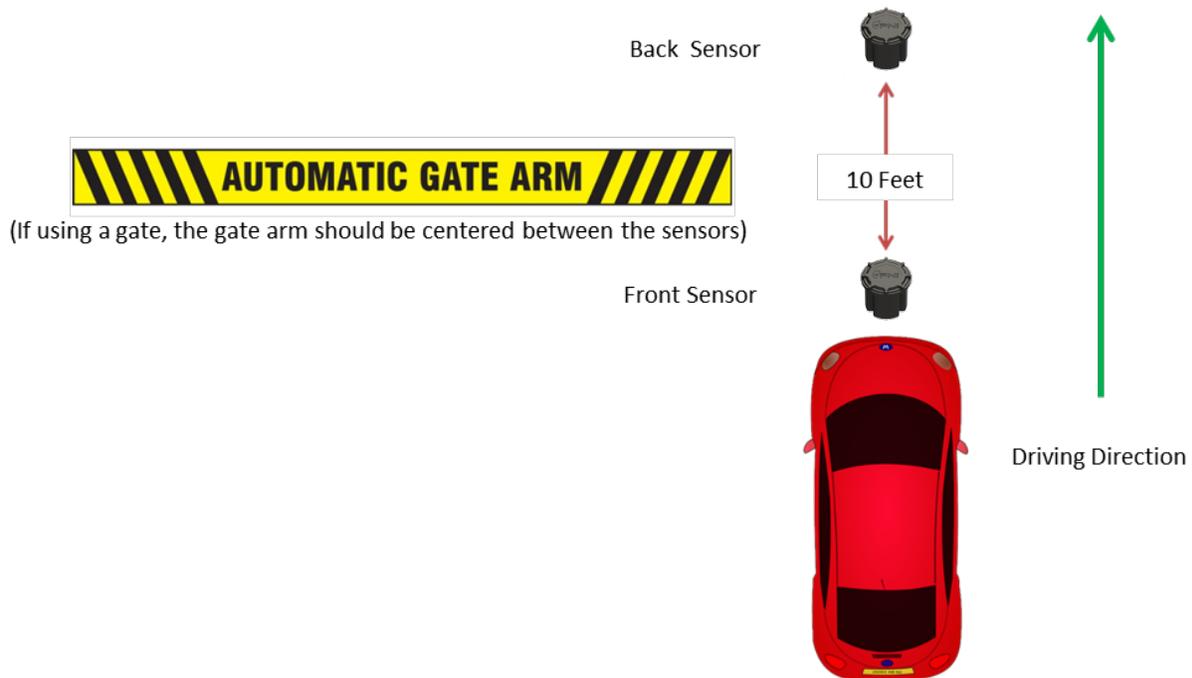
To use the PlacePod Sensor Utility – Android application to activate PlacePod VC, please contact:

[PNI Customer Support](#).

### 3.4 INSTALLATION SITE SURVEY

Once the PlacePod VC has been activated it is important to ensure that the sensors are able to communicate with the LoRa network by performing an installation survey. The installation survey is performed in a similar manner to the pre-installation survey described in Section 3.2.2. However, in this case the actual PlacePods and gateways being deployed are tested during installation (but before final installation so adjustments can be made if required). If the pre-installation site survey was performed, the installation site survey should confirm the signal strengths from the PlacePods to the gateways are sufficient for the system to function properly. If a pre-installation site survey was not completed, then gateways may need to be moved to a better location and/or added. PNI recommends testing for a -90dBm RSSI without a car over the sensor as the baseline for gateway setup.

The positioning of the PlacePod VC sensor must be carefully chosen so the vehicles approach from one direction and the sensor will be between the wheels when a vehicle passes over it. If there is an automatic gate arm, then the sensors should be positioned on either side of it.



### 3.5 INSTALL THE PLACEPOD

PlacePod VC should be installed in-ground (the surface-mounted model is for pilot/temporary testing only). Please refer to the Installation Guide for details on each type of installation. PlacePod VC sensors are installed in pairs, a front and back sensor for each lane being monitored. Each PlacePod has a unique ID which can be found on the bottom of the sensor. PNI recommends that you record each sensor ID and match it to the entrance/exit lane and make note of the sensor location (front or back) before installing it into the driveway. The cloud based counting algorithm needs to determine if the sensor is in the front or back position. PNI's PlacePod Application allows this information to be input as part of the provisioning process. Third-party Parking Applications will also generally allow this, although in some systems this information is configured directly into the Network Service.

Download the PlacePod Installation Guide at:

<https://www.pnicorp.com/download/placepod-installation-guide/>

### 3.6 CALIBRATE THE PLACEPOD

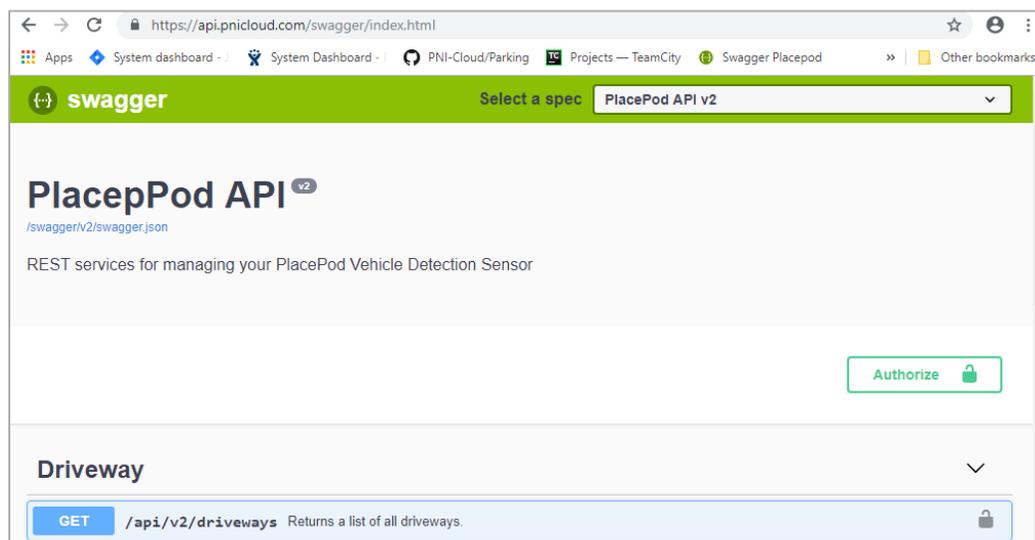
The PlacePod must be calibrated before it is able to properly detect a vehicle counting event. Once the PlacePod is installed in the driveway, ensure that the space is free of any non-permanent ferrous objects such as toolboxes, installation tools, and other equipment. Consult the [PlacePod Sensor Utility iOS application User Manual](#) for detailed instructions about calibrating the PlacePod.

### 3.7 PNI PARKING MANAGEMENT APPLICATION

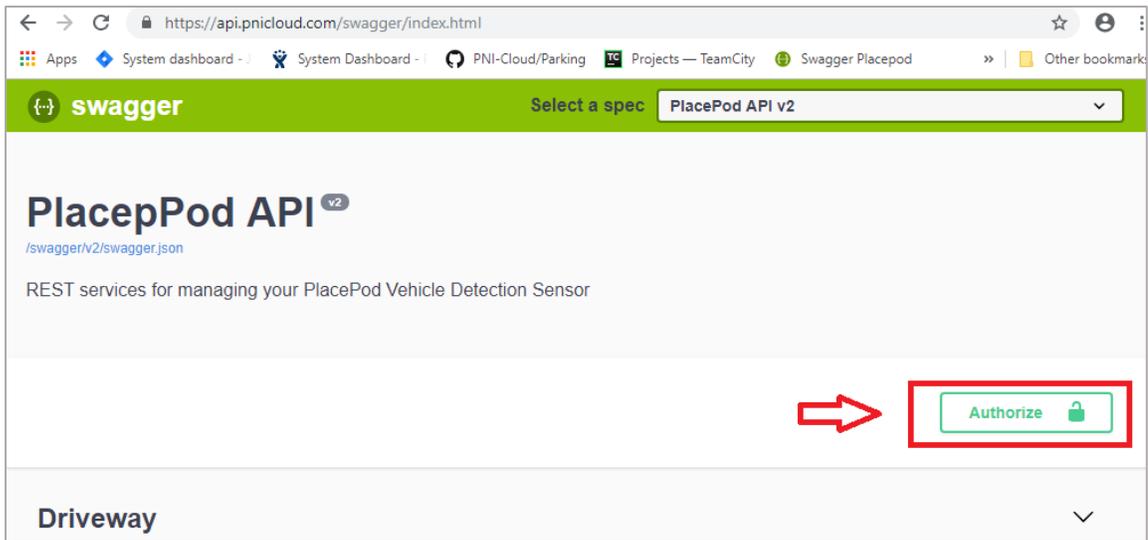
Your Customer API Key will be included in a spreadsheet with your product shipment, this key is used to secure your data when communicating with the cloud service.

#### 3.7.1 Initial Setup

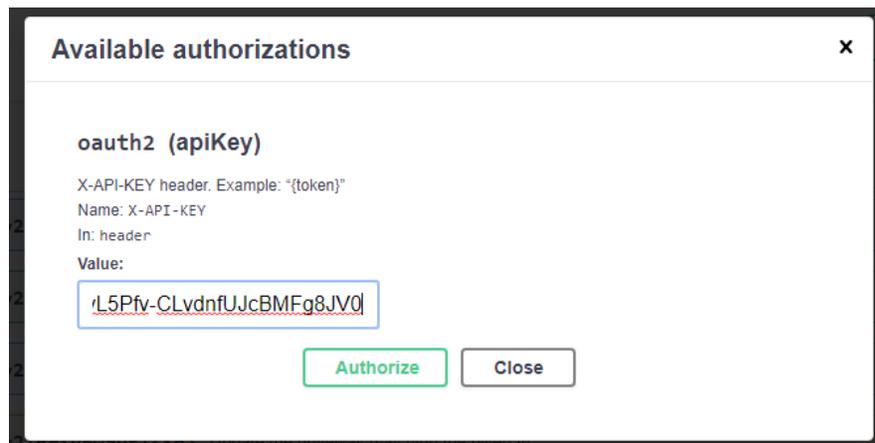
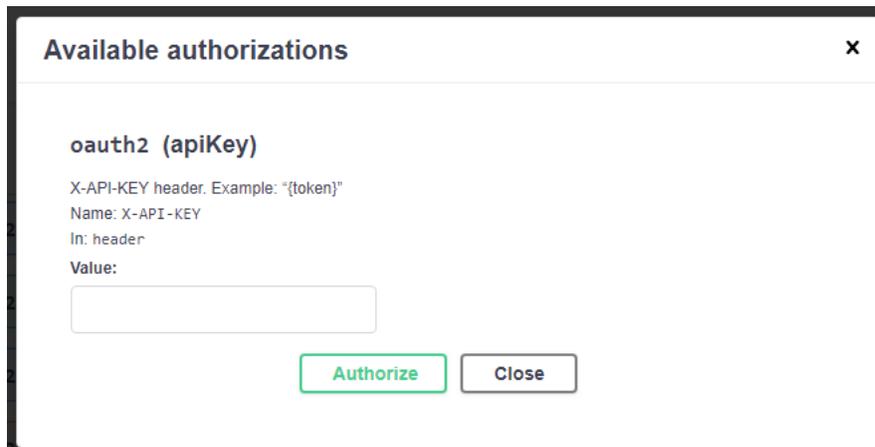
1. Look at the two received PlacePods. Record both of their serial numbers. For this example, we will use “0000111122223333” and “4444555566667777”.
2. Once API key is received, go to URL: <https://api.pnicloud.com>

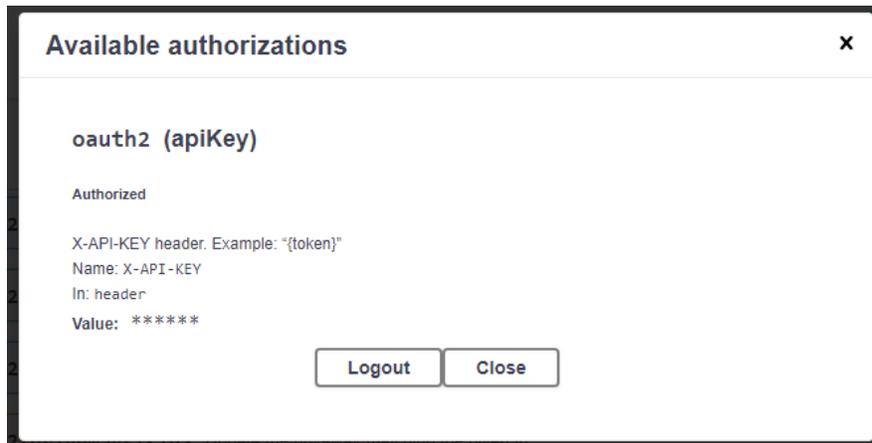


3. Make sure the selected spec is “PlacePod API V2” (it should be by default).
4. Click “Authorize”

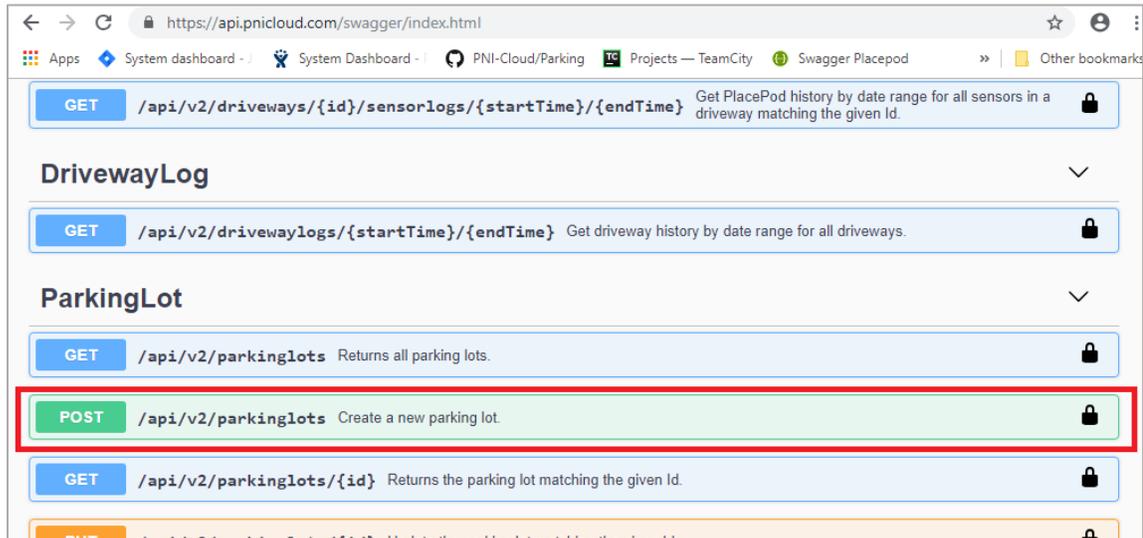


5. Paste the API key in the “Value” field and click “Authorize”

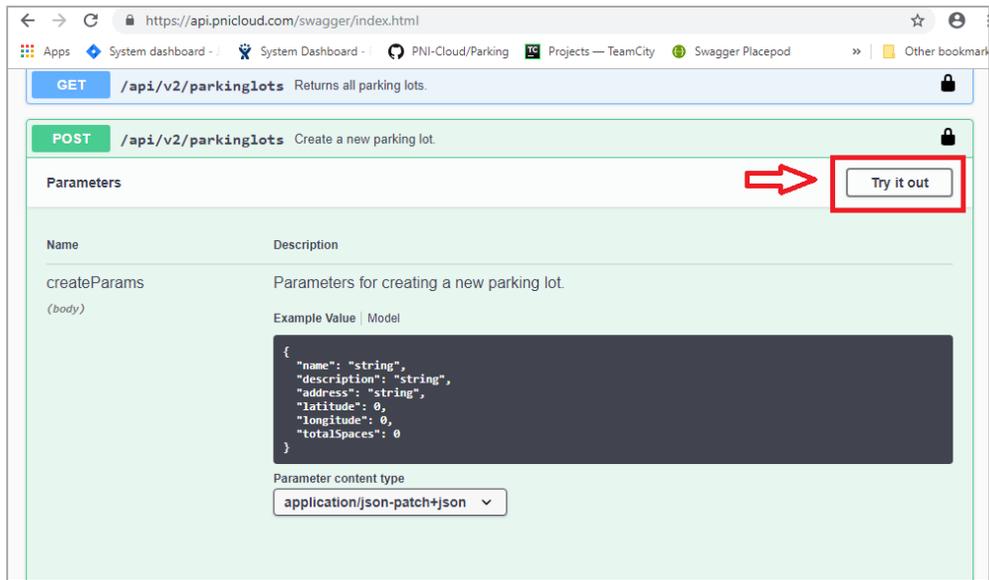




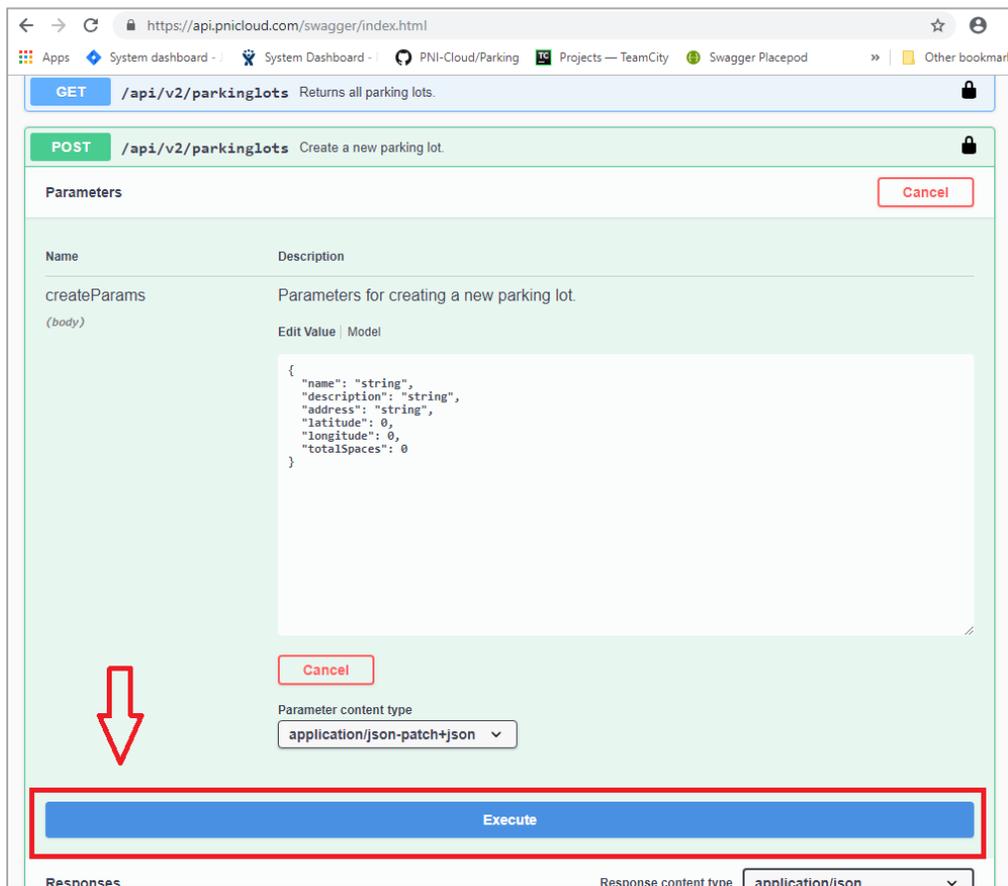
- Close the Authorization window, scroll down to the “ParkingLot” section and click on “POST” /api/v2/parkinglots



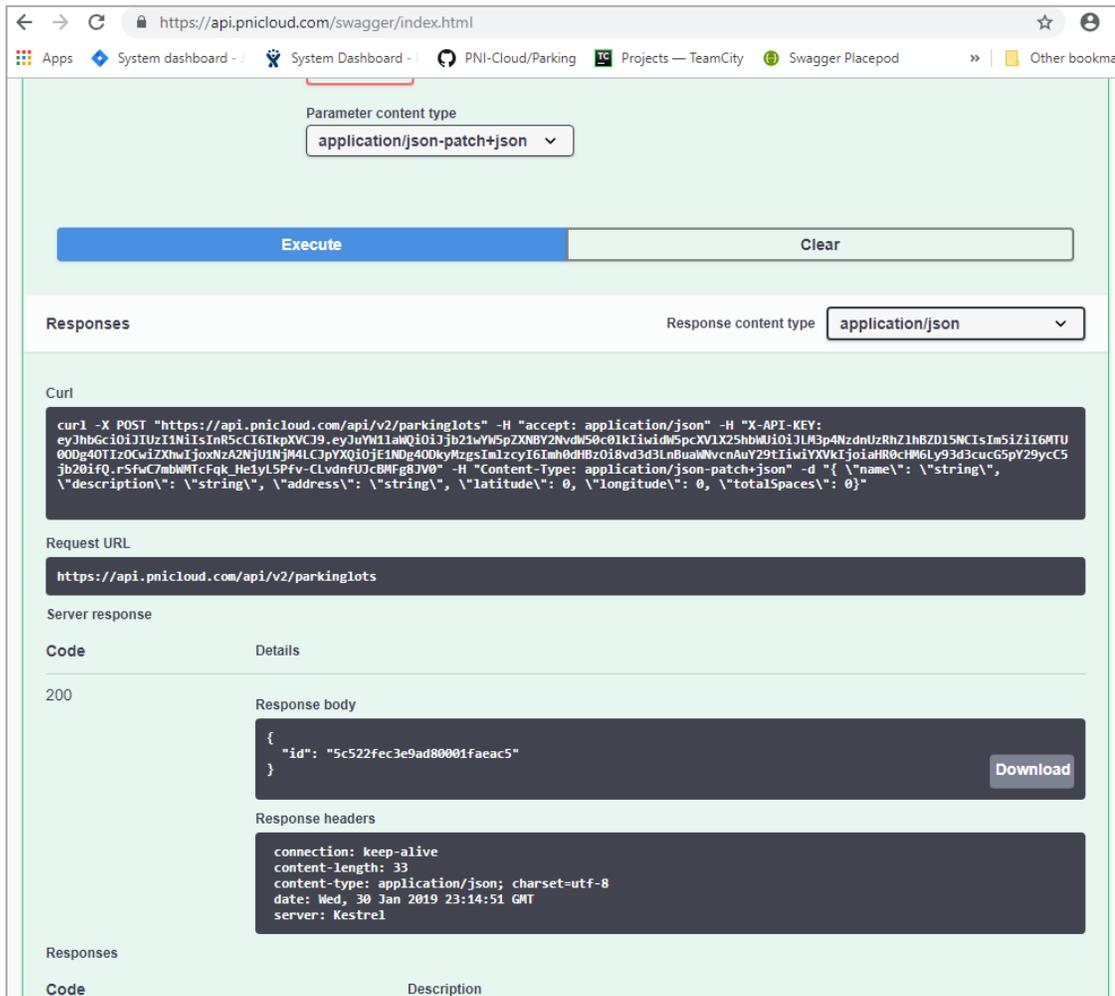
- The section will expand. Click on “Try it out”



8. If you know the total number of spaces that are in the parking lot, then change “totalSpaces” to that value. Otherwise do not change anything.
9. You can optionally change the fields like “name” or “address”. Once the fields look ok, click “Execute.”



10. You should see a response like this:



The screenshot shows the Swagger UI interface for the API endpoint `https://api.pnicloud.com/api/v2/parkinglots`. The parameter content type is set to `application/json-patch+json`. The response content type is `application/json`. The response body is a JSON object:

```
{
  "id": "5c522fec3e9ad80001faeac5"
}
```

The response headers are:

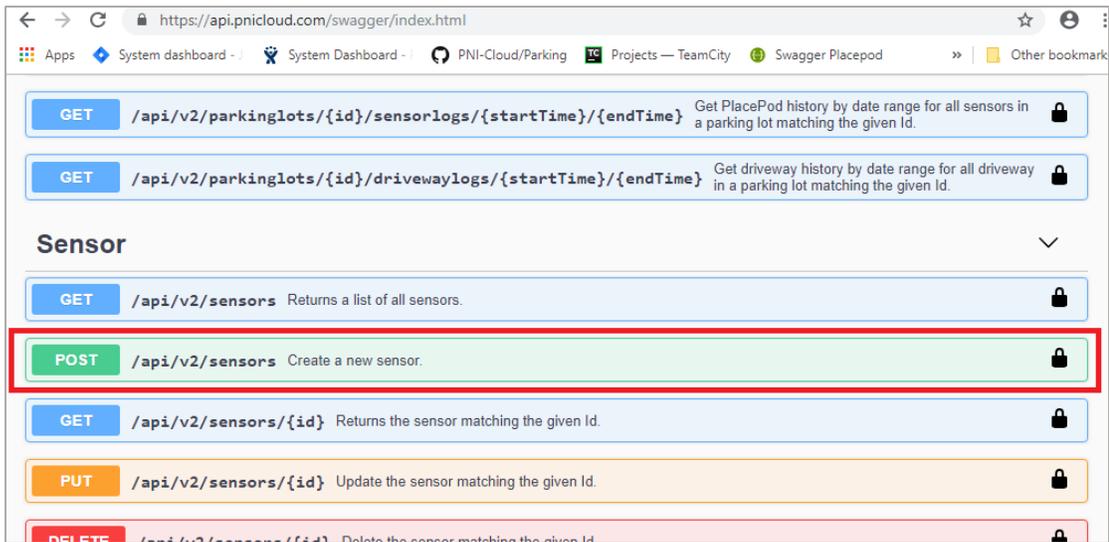
```
connection: keep-alive
content-length: 33
content-type: application/json; charset=utf-8
date: Wed, 30 Jan 2019 23:14:51 GMT
server: Kestrel
```

11. Record the ID in the response body.

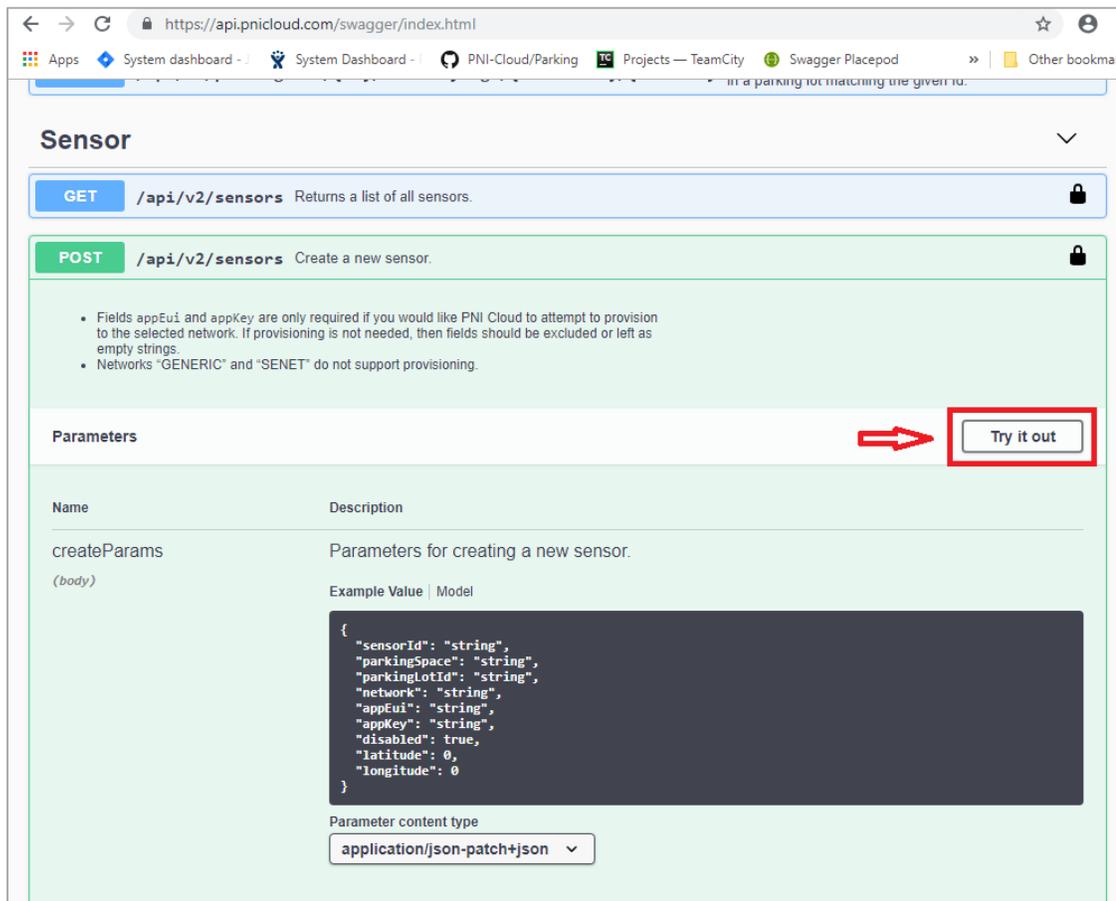


The screenshot shows a close-up of the response body JSON object. The `"id"` field is highlighted with a red box, showing the value `"5c522fec3e9ad80001faeac5"`.

12. Scroll down to the "Sensor" section and click on "POST" /api/v2/sensors



13. The section will expand. Click on "Try it out"



14. You will initially see a body like this:

POST /api/v2/sensors Create a new sensor.

- Fields `appEui` and `appKey` are only required if you would like PNI Cloud to attempt to provision to the selected network. If provisioning is not needed, then fields should be excluded or left as empty strings.
- Networks "GENERIC" and "SENET" do not support provisioning.

**Parameters**
Cancel

Name	Description
createParams <small>(body)</small>	Parameters for creating a new sensor. Edit Value   Model <div style="border: 2px solid #f44336; padding: 5px; margin-top: 10px; display: inline-block;"> <pre> {   "sensorId": "string",   "parkingSpace": "string",   "parkingLotId": "string",   "network": "string",   "appEui": "string",   "appKey": "string",   "disabled": true,   "latitude": 0,   "longitude": 0 } </pre> </div> <span style="color: #f44336; font-size: 2em; margin-left: 10px;">←</span>

15. Remove fields "appEui" and "appKey" and change "network" to "PNI".

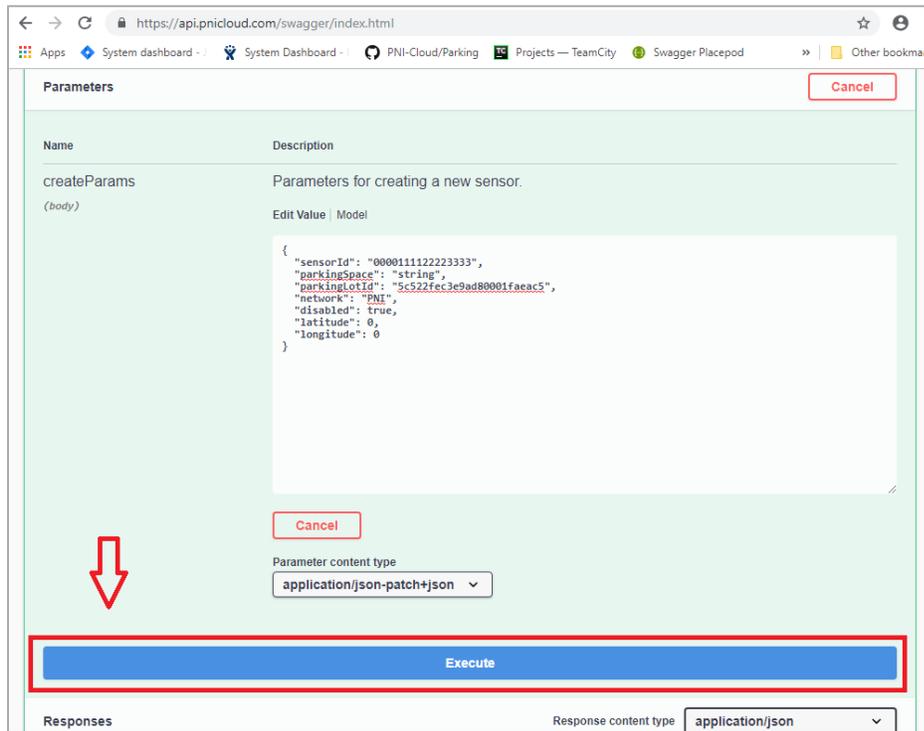
16. For field "parkingId", enter the ID recorded from earlier.

17. For "sensorId", enter the sensor's ID that is included with it.

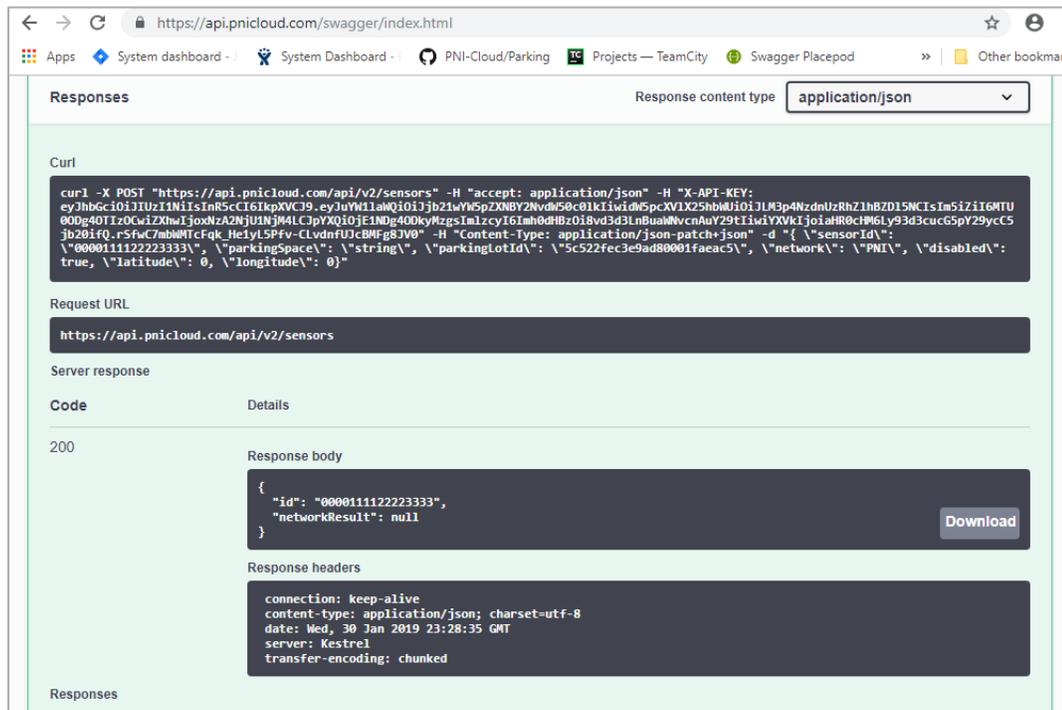
18. The body should now look something like this:

Name	Description
createParams <small>(body)</small>	Parameters for creating a new sensor. Edit Value   Model <div style="border: 2px solid #f44336; padding: 5px; margin-top: 10px; display: inline-block;"> <pre> {   "sensorId": "0000111122223333",   "parkingSpace": "string",   "parkingLotId": "5c522fec3e9ad80001faeac5",   "network": "PNI",   "disabled": true,   "latitude": 0,   "longitude": 0 } </pre> </div> <span style="color: #f44336; font-size: 2em; margin-left: 10px;">←</span>

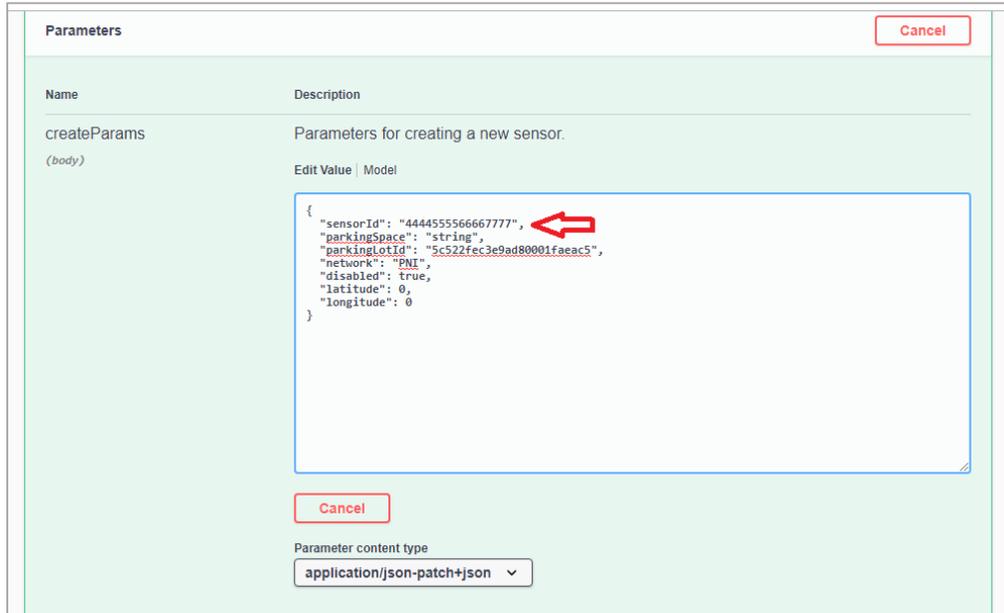
19. Now click “Execute”



20. You should see a response like this:



21. Go back up to the body, and enter the other PlacePod VC's serial number



Parameters

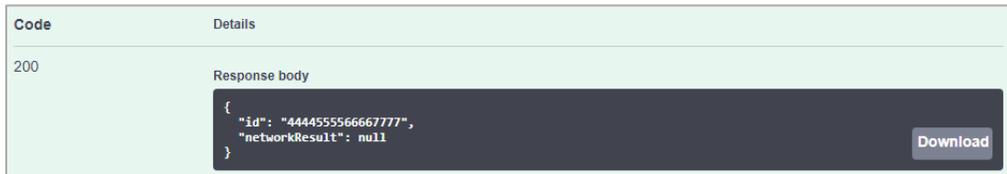
Name: createParams  
Description: Parameters for creating a new sensor.  
(body)

Edit Value | Model

```
{
  "sensorId": "4444555566667777",
  "parkingSpace": "string",
  "parkingLotId": "5c522fec3e9ad80001faeac5",
  "network": "PNI",
  "disabled": true,
  "latitude": 0,
  "longitude": 0
}
```

Parameter content type: application/json-patch+json

22. Repeat steps 18 and 19. You should see a result like this:

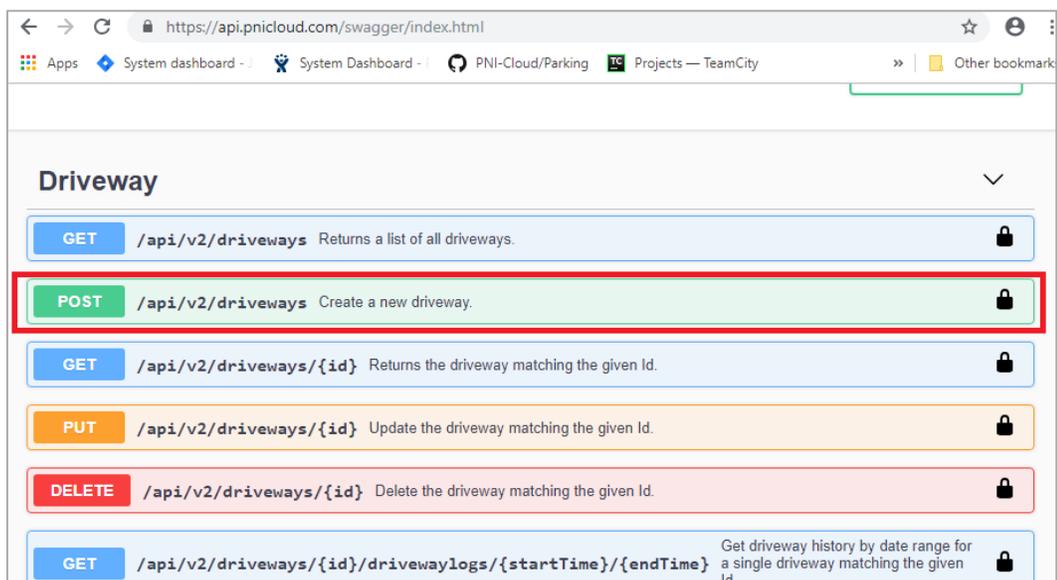


Code: 200  
Details: Response body

```
{
  "id": "4444555566667777",
  "networkResult": null
}
```

Download

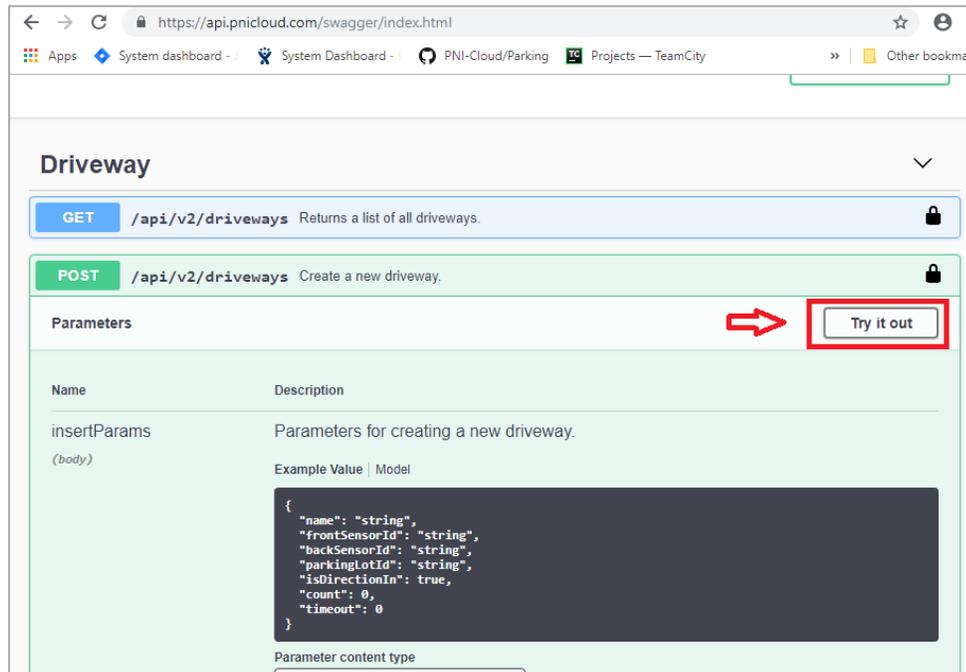
23. Scroll up to the “Driveways” section and click on “POST” /api/v2/driveways



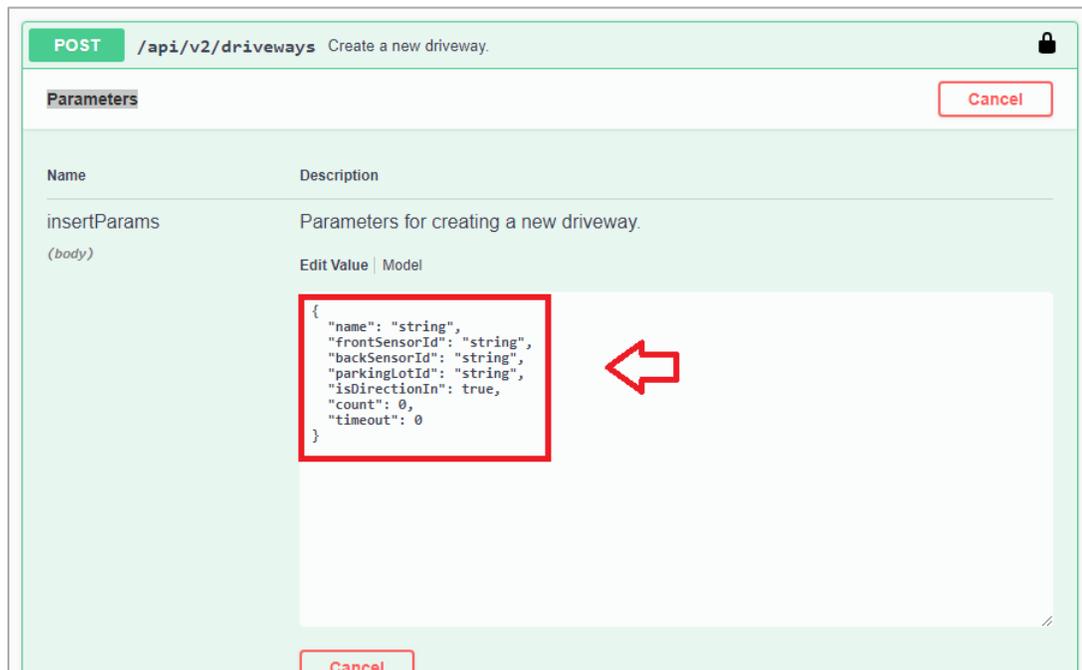
Driveway

- GET /api/v2/driveways Returns a list of all driveways.
- POST /api/v2/driveways Create a new driveway.**
- GET /api/v2/driveways/{id} Returns the driveway matching the given Id.
- PUT /api/v2/driveways/{id} Update the driveway matching the given Id.
- DELETE /api/v2/driveways/{id} Delete the driveway matching the given Id.
- GET /api/v2/driveways/{id}/drivewaylogs/{startTime}/{endTime} Get driveway history by date range for a single driveway matching the given Id.

24. The section will expand. Click on “Try it out”



25. You will initially see a body like this:



26. Change “parkingLotId” to the Id that was recorded earlier.

27. Change “frontSensorId” to match the serial number of one of the PlacePods and “backSensorId” to match the other serial number.

28. If the driveway is leading into the parking lot, then leave "isDirectionIn" as true. If the driveway is leaving the parking lot, then set "isDirectionIn" to false.
29. The body should now look something like this

Name	Description
insertParams <i>(body)</i>	Parameters for creating a new driveway. Edit Value   Model

```

{
  "name": "string",
  "frontSensorId": "0000111122223333",
  "backSensorId": "4444555566667777",
  "parkingLotId": "5c522fec3e9ad80001faeac5",
  "isDirectionIn": true,
  "count": 0,
  "timeout": 0
}

```



30. Now click "Execute"

Name	Description
insertParams <i>(body)</i>	Parameters for creating a new driveway. Edit Value   Model

```

{
  "name": "string",
  "frontSensorId": "0000111122223333",
  "backSensorId": "4444555566667777",
  "parkingLotId": "5c522fec3e9ad80001faeac5",
  "isDirectionIn": true,
  "count": 0,
  "timeout": 0
}

```

Parameter content type



31. You should see a response like this:

Server response	
Code	Details
200	Response body <pre> {   "id": "5c532a043e9ad80001faeaca" } </pre> <input type="button" value="Download"/>

32. If another driveway is needed, repeat steps 11 – 29. Make sure to use the other PlacePod VC’s serial numbers.

### 3.7.2 Sending data

Once you have decoded an event packet (Cayenne type 0x00 “digital input” and channel 0x21) you should have an integer value between 0 and 128 inclusive.

Make a request to POST “api/v2/sensors/{id}/vehiclecount”

Replace {id} with the ID of the sensor that produced the event.

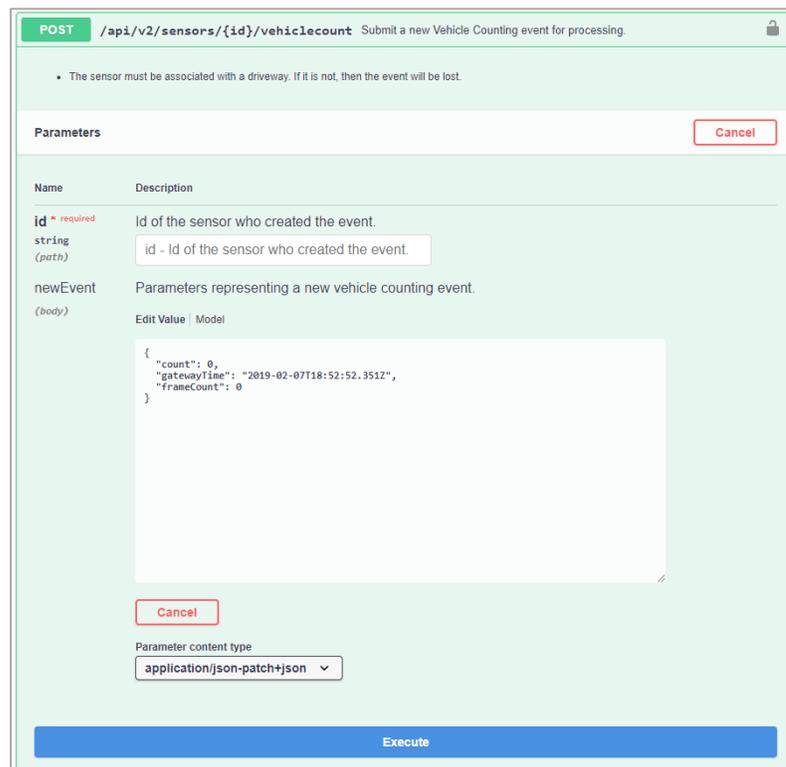
Example body:

```
{
  "count": 12
}
```

Example request:

```
curl -X POST "https://api.pnicloud.com/api/v2/sensors/0000000000000011/vehiclecount" -H "accept: application/json" -H "X-API-KEY: eyJ...O2qQ" -H "Content-Type: application/json-patch+json" -d '{"count": 12}'
```

You can test this on the API swagger page.



POST /api/v2/sensors/{id}/vehiclecount Submit a new Vehicle Counting event for processing.

- The sensor must be associated with a driveway. If it is not, then the event will be lost.

**Parameters** Cancel

Name	Description
<b>id</b> * required string (path)	Id of the sensor who created the event. id - Id of the sensor who created the event.
<b>newEvent</b> (body)	Parameters representing a new vehicle counting event. Edit Value   Model

```
{
  "count": 0,
  "gatewayTime": "2019-02-07T18:52:52.351Z",
  "frameCount": 0
}
```

Cancel

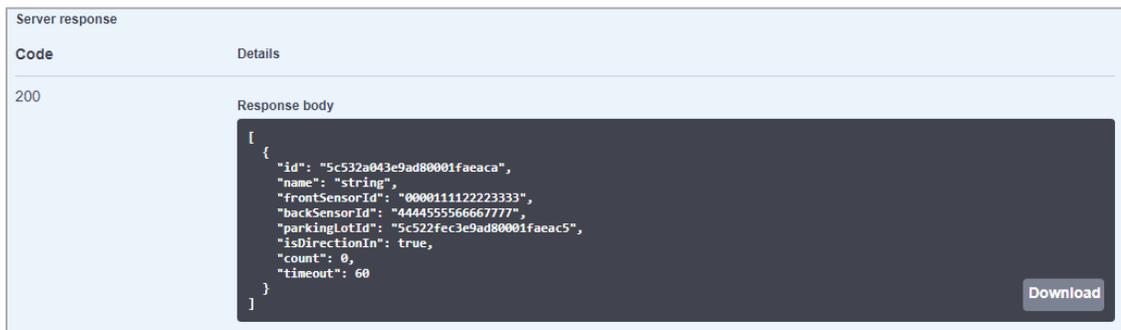
Parameter content type  
application/json-patch+json

Execute

Or if you're using our PlacePod VC evaluation kit and have the sensors provisioned on PNI's Cloud, then the necessary data will automatically be forwarded for processing. No additional setup is required.

### 3.7.3 Receiving Data

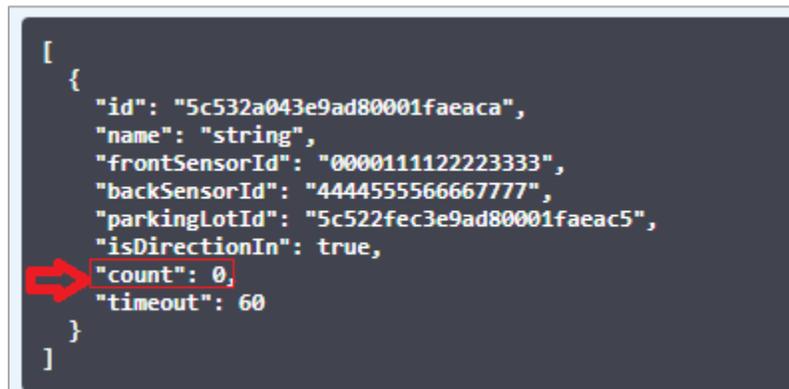
1. Repeat steps 2 - 5 from [Initial setup](#)
2. Close the Authorization window.
3. To get the currently computed count for all driveways, go to the "Driveway" section and click on "GET" /api/v2/driveways.
4. Click "Try it out" then execute", you should get results like this:



```

Server response
Code      Details
200
Response body
[
  {
    "id": "5c532a043e9ad80001faeaca",
    "name": "string",
    "frontSensorId": "000011122223333",
    "backSensorId": "4444555566667777",
    "parkingLotId": "5c522fec3e9ad80001faeac5",
    "isDirectionIn": true,
    "count": 0,
    "timeout": 60
  }
]
Download
  
```

5. The "count" field indicates the current estimated vehicle count for that specific driveway.



```

[
  {
    "id": "5c532a043e9ad80001faeaca",
    "name": "string",
    "frontSensorId": "000011122223333",
    "backSensorId": "4444555566667777",
    "parkingLotId": "5c522fec3e9ad80001faeac5",
    "isDirectionIn": true,
    "count": 0,
    "timeout": 60
  }
]
  
```

6. To get an estimated running total of the number of cars in the parking lot (assuming you have at least 1 in driveway and 1 out driveway and have set the total number of spaces in the parking lot), then go to the "Parking Lot" section and click on "GET" /api/v2/parkinglots
7. Click "try it out" then "execute" and you should get a result like this:

```
[
  {
    "id": "2EzbjQw6j5f4HQzBw",
    "name": "* Default Lot",
    "description": "",
    "address": "",
    "latitude": 38.4209,
    "longitude": -122.755255,
    "totalSpaces": null,
    "count": null
  },
  {
    "id": "5c522fec3e9ad80001faeac5",
    "name": "string",
    "description": "string",
    "address": "string",
    "latitude": 0,
    "longitude": 0,
    "totalSpaces": 0,
    "count": 0
  }
]
```



8. The “totalSpaces” field will be the same value as the one you set in step 8 of [Initial setup](#)
9. The “count” field will represent the estimated number of vacant parking spaces left in the parking lot. This is calculated using the counts from all the specific parking lot’s driveways.

## 4 APPENDICES

### 4.1 APPENDIX I: GLOSSARY

**Bluetooth Low Energy (BLE):** A wireless technology designed to connect an individual person's devices.

**Ferrous:** A material containing Iron. Materials containing iron in the vicinity of a PlacePod can interfere with the calibration of the device.

**Gateway:** LPWAN equipment that receives wireless signals from remote devices (such as parking sensors) using LoRa bandwidth, and then relays these signals to a network service using a different communications protocol.

**LoRaWAN™:** A protocol, defined by the LoRa Alliance, specifying how devices (such as parking sensors) communicate with LPWAN gateways.

**LoRa:** A low-power consumption, long-range technology for wireless data communication, utilizing unlicensed sub-1GHz bandwidths. The bandwidth utilized varies by region (915 MHz in North America, 868 MHz in Europe). PlacePod communicates with gateways using LoRa bandwidths.

**LPWAN:** A Low Power Wide Area Network, utilizing wireless communications to allow battery powered devices (such as vehicle counting sensors) to communicate.

**Network:** Two or more devices that communicate with each other. The internet is a very large network including every device connected to the internet, but a router connecting a computer and a printer is also a network.

**Provisioning:** The process of identifying a device and incorporating it into a network so that it can be utilized together with the software managing the network.

**RSSI:** Received Signal Strength Indicator (RSSI) is a measure of the power level at a receiving device from a sending device. This power is often measured in dBm, and the higher the power, the stronger the signal.

**SNR:** Signal to Noise Ratio (SNR) is the ratio of the power of a particular signal to the background noise associated with that signal.

## 4.2 APPENDIX II: PLACEPOD SPECIFICATIONS

**Table 4-1: Performance Specifications\***

Parameter	Values
Communication	<ul style="list-style-type: none"> <li>LoRa 915 MHz or 868 MHz Module</li> <li>LoRaWAN compliant</li> <li>Uses Sub-GHz ISM bands in North America and Europe</li> </ul>
LoRaWAN Device Type	Class A
Output	Vehicle count
Battery Life/Type	<ul style="list-style-type: none"> <li>Up to 7 years depending on configuration and distance from gateway</li> <li>Lithium-Thionyl Chloride</li> </ul>
Dimensions In-Ground	4.3 in (10.92 cm) diameter -minimum hole 4.5 in (11.43 cm) 3.75 in (9.525 cm) height -minimum hole 4.5 in (11.43 cm)
Dimensions Surface-Mount (Evaluation-Kit)	9.0 in (22.86 cm) diameter 1.25 in (3.15 cm) height
Installation Position	Two sensors 10 ft (3 m) apart in center of driveway entrance or exit lane
Operating Temperature	-30°C to +70°C / -22°F to +158°F
Storage Temperature	-40°C to +85°C / -40°F to +185°F
Activation Type	OTAA (over the air activation)
Certifications	FCC (915MHz), CE (868MHz)

**Footnote:**

\* Specifications are subject to change.

**Table 4-2 PlacePod Vehicle Counting Sensor Default Settings**

Parameter	Default
Frequency Sub Band (US915, AU915)	2
Spreading Factor	US915, EU868 = 7
Frame Port	3
Keep-Alive Interval	1 Hour
Over-The-Air Activation Keys	Programmable
Payload Format	CayenneLPP [1]
Confirmed Messages	None
BLE Advertise	Once every second while deactivated and once every 3 seconds once activated

For Customer Support, please contact PNI Sensor at: <https://www.pnicorp.com/support/>



Copyright ©2018 Protonex LLC dba PNI Sensor. All Rights Reserved.

Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under copyright laws.

PNI Sensor  
2331 Circadian Way  
Santa Rosa, CA 95407, USA  
Tel: (707) 566-2260

**DO NOT OPEN THE PLACEPOD SENSOR. THE PLACEPOD SENSOR IS SHIPPED READY TO ACTIVATE AND INSTALL. THE SENSOR SHOULD NOT BE OPENED FOR ANY REASON. OPENING THE SENSOR VOIDS THE PRODUCT WARRANTY.**

**Warranty and Limitation of Liability – PlacePod Vehicle Counting Sensor (“Product”).** PNI Sensor ("PNI") manufactures its Products from parts and components that are new or equivalent to new in performance. PNI warrants that each Product to be delivered hereunder, if properly used, will, for one year (365 days) following the date of shipment be free from defects in material and workmanship and will operate in accordance with PNI’s published specifications and documentation for the Product in effect at time of order. Any Product that is non-functional and unresponsive to firmware and software updates will be considered failed hardware units and will be replaced at no charge. This warranty includes one year (365 days) of debugging maintenance for customers that use the PNI Parking Management Software to manage PNI’s Product.

This warranty does not cover wear and tear due to normal use, or damage to the Product as the result of improper installation, misuse, neglect of care, alteration, vandalism, theft, accident, or unauthorized repair.

**THE ABOVE WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, WHETHER EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY WARRANTY OTHERWISE ARISING OUT OF ANY PROPOSAL, SPECIFICATION, OR SAMPLE. PNI NEITHER ASSUMES NOR AUTHORIZES ANY PERSON TO ASSUME FOR IT ANY OTHER LIABILITY.**

If any Product furnished hereunder fails to conform to the above warranty, Customer’s sole and exclusive remedy and PNI’s sole and exclusive liability will be, at PNI’s option, to repair, replace, or credit Customer’s account with an amount equal to the price paid for any such Product which fails during the applicable warranty period provided that (i) Customer promptly notifies PNI in writing that such Product is defective and furnishes an explanation of the deficiency; (ii) such Product is returned to PNI’s service facility at Customer’s risk and expense; and (iii) PNI is satisfied that claimed deficiencies exist and were not caused by improper installation, misuse, neglect of care, alteration, vandalism, theft, accident, or unauthorized repair. If a Product is defective, transportation charges for the return of the Product to Customer within the United States and Canada will be paid by PNI. For all other locations, the warranty excludes all costs of shipping, customs clearance, and other related charges. PNI will have a reasonable time to make repairs or to replace the Product or to credit Customer’s account. PNI warrants any such repaired or replacement Product to be free from defects in material and workmanship on the same terms as the Product originally purchased.

Except for the breach of warranty remedies set forth herein PNI shall have no liability for any indirect or speculative damages (including, but not limited to, consequential, incidental, punitive and special damages) relating to the use of or inability to use this Product, whether arising out of contract, negligence, tort, or under any warranty theory, or for infringement of any other party’s intellectual property rights, irrespective of whether PNI had advance notice of the possibility of any such damages, including, but not limited to, loss of use, revenue or profit. In no event shall PNI’s total liability for all claims regarding a Product exceed the price paid for the Product. PNI neither assumes nor authorizes any person to assume for it any other liabilities.