

Casambi Whitepaper

Setting Casambi modules to act as iBeacon senders



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CASAMBI

Introduction

Casambi's technology provides lighting designers and manufacturers with the ability to wirelessly link devices together enabling the creation of customizable smart lighting networks that are configured and controlled using the Casambi App. The solution is based on Bluetooth Low Energy (BLE), a wireless technology built to communicate data within a short range.

BLE is also the standard used by iBeacon, Apple's technology that enables location awareness possibilities for apps. A device with iBeacon technology is used to establish a region around an object, and when an app enters the range, a relevant action or notification is triggered.

Imagine you are in the beverage section at a supermarket, and you have installed the supermarket's app on your phone - it might display a price discount on a special wine or an advertisement for a new flavor of a drink. Or you are on a tourist bus and during your journey, information about points of interest along the route appears in your app.

Beacon transmitters can be placed anywhere, but it is quite logical to place them inside luminaires – given that lighting is customarily installed in ceilings or places that allow maximum reach to cover the whole area people move around in. With no additional investment, iBeacon technology is provided in all Casambi's products, therefore any Casambi node can work as an iBeacon sender.

This guide outlines how iBeacon technology works and how businesses can use it as a tool to add a new dimension to customer experience. Proximity technology combined with Casambi's products employed as beacons will change the way smartphones are being used by consumers.

What is iBeacon?

A beacon is a super small wireless device used to broadcast Bluetooth radio signals to nearby tablets and smartphones. Within the detectable range of the beacon, the signal emitted can be picked up by a mobile app to trigger an action based on the user's location.

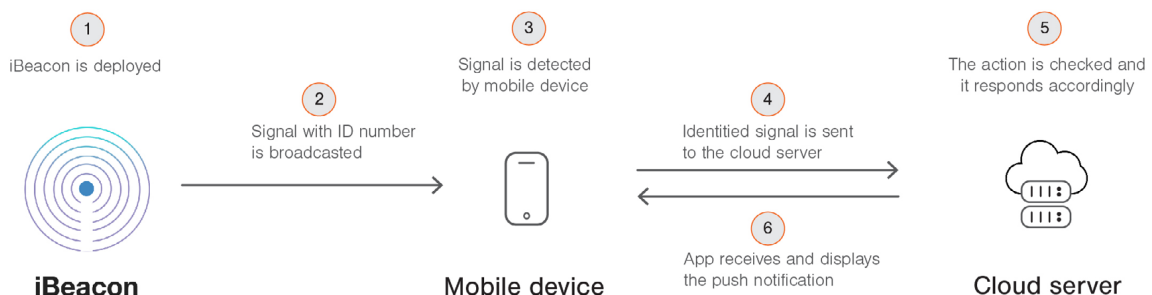
iBeacon is a trademarked term used by Apple to describe its own implementation of beacon technology based on Bluetooth Low Energy. The term iBeacon then became synonymous with the general term BLE beacon.

Beacons are compatible with iOS and Android devices that support BLE functionality.

How iBeacon works

iBeacon technology plays a key role in location-based services and proximity marketing allowing communication with customers at the right place, at the right time and with personalized messages sent directly to their smartphones. Let's understand the complete working of the iBeacon transmitter to send push notifications:

1. The iBeacon transmitter is deployed. This device is fixed in one place (anywhere) for maximum reach. Installing beacons on ceilings works well.
2. BLE signals are transmitted by iBeacon within its range. The broadcasted signal has a serial ID number that will be explained in the next section.
3. The signals are detected by a mobile device that is capable of receiving BLE signals from iBeacons.
4. The mobile device sends the ID number attached to the signal to the cloud server.
5. The action assigned to that ID number is checked by the server and it responds accordingly.
6. The app receives the information and displays the assigned notification which could be about a discount, a product launch, or simply a greeting.



To use this service properly, it is important to consider the following notes:

- The mobile should support Bluetooth Low Energy. Almost all mobile devices today have this by default.
- Bluetooth should be turned on to detect beacons.
- The mobile must contain compatible versions of operating systems.
- Smartphones don't trigger actions themselves based on proximity to beacons. A specific app installed on these devices is necessary to detect beacons.
- Location services and permissions should be granted in the app.

Identifying iBeacons

An iBeacon is identified by a strict data format composed of three codes: The Universally Unique Identifier (UUID), major and minor values. This information is hierarchical in nature with the major and minor fields allowing for subdivision of the identity established by the UUID.

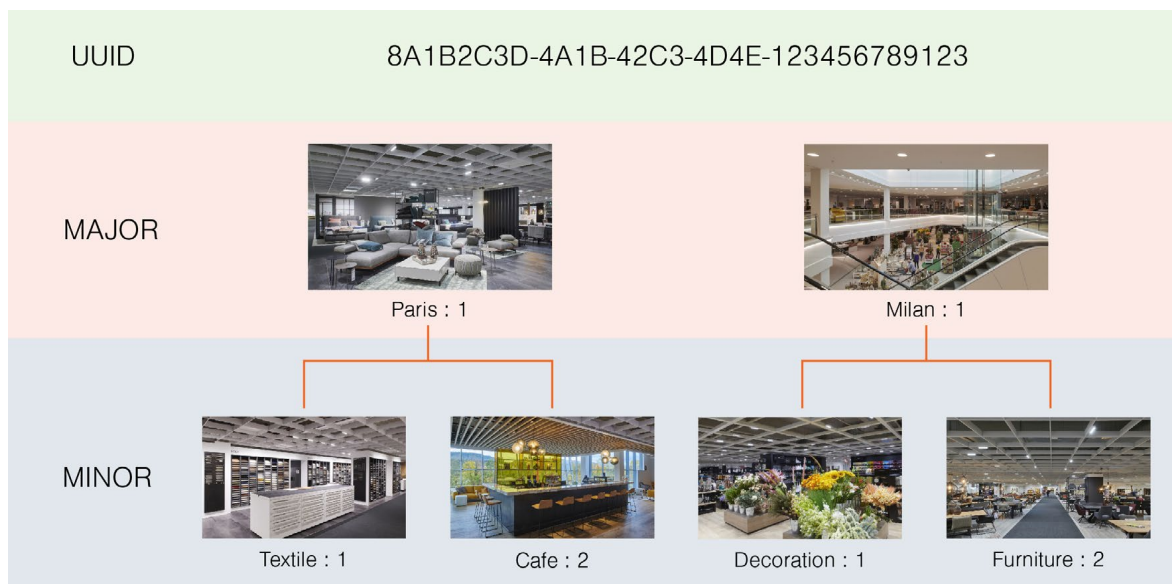
Field	Size	Description
UUID	16 bytes	Application developers should define a UUID specific to their app and deployment use case.
Major	2 bytes	Further specifies a specific iBeacon and use case. For example, this could define a sub-region within a larger region defined by the UUID.
Minor	2 bytes	Allows further subdivision of region or use case, specified by the application developer.

From "Getting Started with iBeacon" guide. <https://developer.apple.com/ibeacon/Getting-Started-with-iBeacon.pdf>

Following the format, the assignment of these three codes is totally up to the implementer. Here's an example for better understanding: Let's suppose that a furniture brand company is deploying iBeacons in its stores across different cities (Milan and Paris). All the iBeacons have the same Proximity UUID. For a particular branch, all of the iBeacons have the same Major. And in each department (furniture, decoration, textile, garden, cafe, and so on) within that particular branch, all the iBeacons have a unique Minor.

UUID is composed of 32 hexadecimal digits, divided into five groups, where hyphens separate them. These five groups contain respectively 8, 4, 4, 4, and 12 characters that can be letters from A to F or numbers from 0-9.

For Major and Minor, the digits are unsigned integer values between 0 and 65535.

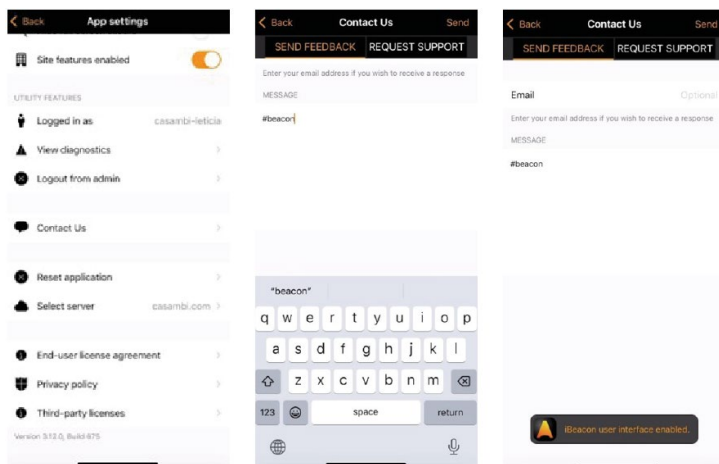


Casambi modules acting as iBeacon senders

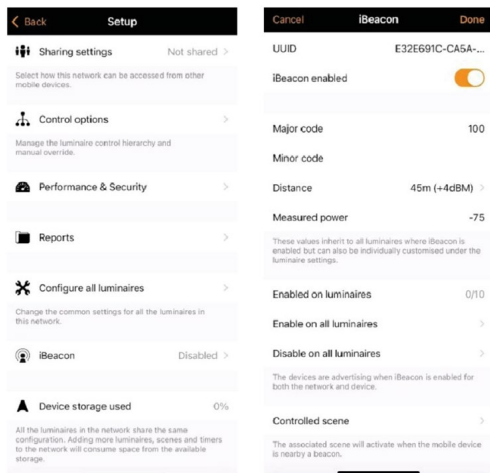
Casambi technology enables customers to use Casambi modules as iBeacon transmitters. It is possible to enable and configure iBeacon for a single Casambi module or for the entire network.

The iBeacon feature is not readily accessible within the app by default. To utilize it, you must enable the iBeacon interface by following these steps:

1. Go to **“More”**
2. Select **“App Settings”**
3. Scroll down and select **“Contact us”**
4. Select **“Send Feedback”**
5. Write **“#beacon”** in the message field and tap **“Send”**
6. A message will appear confirming that the **“iBeacon user interface enabled”**

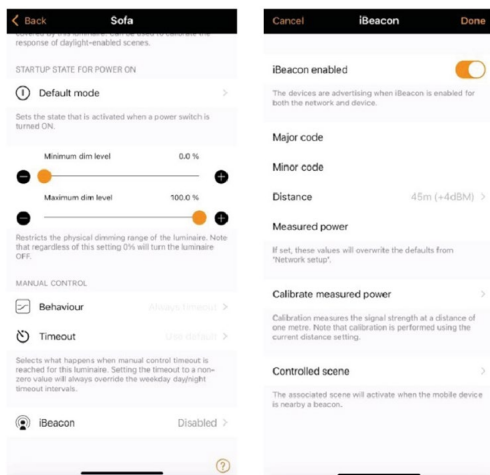


After enabling the iBeacon interface, you can proceed to enable and configure iBeacon for the network. To do this, navigate to **“More”**, then **“Network Setup”**, and select **“iBeacon”**.



At the top of the iBeacon screen, you will find the Casambi modules UUID, which is represented as E32E691C-CA5A-4145-A322-F00A08216417 and the option to enable iBeacon. On the same screen, you can also configure the “**Major code**” and “**Minor code**” as well as the distance. “**Distance**” defines the maximum range within which the iBeacon signals can be received by a mobile device.

If you want to configure iBeacon for an individual Casambi module, go to the “**Luminaires**” tab and double tap the desired unit. Scroll down and tap on “iBeacon”. The iBeacon settings view may appear slightly different, but you can still enable iBeacon for the unit and set the “**Major code**”, “**Minor code**” and “**Distance**”.



The measured power can be calibrated for iOS devices. iOS devices use this value to determine if the iBeacon device is close, near or far.

You can find step-by-step instructions to set Casambi modules to act as iBeacons on our Support website: [How to enable iBeacon sending for Casambi modules?](#)

It is important to note that a Casambi module acting as a beacon does not transmit any content, only signals. Using the iBeacon functions as desired will require a third-party app.

iBeacon core location

Monitoring

Monitoring a region allows an application to determine when a device enters or leaves a region defined by an iBeacon.

iOS limits the number of regions an app can be monitoring simultaneously to 20. By using a single UUID in multiple locations, a device can easily monitor many physical locations simultaneously.

Being notified when a user has entered a specific region, the app should configure the beacon using UUID + major + minor values.

Ranging

While monitoring detects movement in and out of range of the beacons, ranging provides the approximate proximity to a device.

The estimated proximity can be categorized into four proximity states: Immediate, Near, Far and Unknown.

BLE's maximum range varies, and it depends on the location of the iBeacon, obstructions in the environment (such as a wall, metal object, mirror, etc), and where the user's device is being stored (pocket, bag, or in-hand).

Proximity State	Description
Immediate	This represents a high level of confidence that the device is physically very close to the beacon. Very likely being held directly up to the beacon.
Near	With a clear line of sight from the device to the beacon, this would indicate a proximity of approximately 1-3 meters. As described in the section on accuracy, if there are obstructions between the device and the beacon which cause attenuation of the signal, this Near state may not be reported even though the device is in this range.
Far	This state indicates that a beacon device can be detected but the confidence in the accuracy is too low to determine either Near or Immediate. An important consideration is that the Far state does not necessarily imply "not physically near" the beacon. When Far is indicated, rely on the accuracy property to determine the potential proximity to the beacon.
Unknown	The proximity of the beacon cannot be determined. This may indicate that ranging has just begun, or that there are insufficient measurements to determine the state.

From "Getting Started with iBeacon" guide. <https://developer.apple.com/ibeacon/Getting-Started-with-iBeacon.pdf>

Accuracy

When a mobile device detects a beacon's signal, it uses the strength of the signal to determine both its proximity to the beacon and the accuracy of its estimation of proximity. The stronger the signal, the more confident the device can be about the proximity to the beacon.

In order to increase the system's accuracy for commercial use, a well-planned installation is necessary, considering uniformity and minimizing the space between the iBeacon nodes.

Disproving myths about iBeacon

Although iBeacon has gained worldwide visibility and acceptance since its launch, there are many myths around it. Let's look at the most common misconceptions and clarify them.

iBeacon works with iOS only.

iBeacon is based on Bluetooth Low Energy technology. This means that beacons can be recognized by any device with Bluetooth 4.0 that includes support for BLE in the Operating System (iOS 7.0 or later and Android 4.3 or later).

iBeacon tracks users.

The technology can't gather information or control users' mobile devices. iBeacon only broadcasts signals that are received by mobile apps to trigger certain actions. But only if the user has installed the app and Bluetooth is turned on.

iBeacon sends information.

Again, iBeacon only sends signals that allow the mobile application to send out notifications. All information comes to the smartphone from the server, not via iBeacon. Therefore, iBeacons don't transmit any content.

iBeacon determines the exact location.

iBeacon can't be used for triangulation or to establish the exact location of an object or person. By using a BLE signal, iBeacon has the ability to define the proximity of the user and find out if the user enters or exits a delimited region.

iBeacon can be used indoors only.

iBeacon offers more indoor location accuracy than GPS. However, it doesn't mean that it can be used only inside buildings. The iBeacon network can be successfully applied both inside and outside buildings.

A mobile phone battery runs out very quickly because of iBeacon.

For receiving radio signals, mobile devices use BLE technology, so the system does not affect battery consumption.

Applications

Beacons are permeating many aspects of our daily routines, making our lives more convenient and efficient than ever before. We can find them in many places from malls to museums and novel use cases are emerging all the time.

Here are some application examples:

Applications	Potential Uses
Stores	<ul style="list-style-type: none"> • Deliver in-store offers • Deliver e-catalogues to target shoppers
Restaurants	<ul style="list-style-type: none"> • Attract new customers with coupons • Notify what's special on the menu today • Reward customers for spending time at a restaurant • Enable mobile payments
Shopping Malls	<ul style="list-style-type: none"> • Guide visitors with floor plans • Offer time-limited promotions to encourage visitors to explore different areas across a site • Offer gaming experiences such as digital treasure hunts to entertain children
Airports	<ul style="list-style-type: none"> • Wayfinding • Real-time flight information updates (flight delays, gate changes, updates on baggage collection and so on) • Provide destination information and tourism guides • Send duty-free promotions
Stadium	<ul style="list-style-type: none"> • Show the way (to seats, restrooms, food stands, etc) • Offer seat upgrades in real time when empty places in a more expensive section are available • Give information about crowded locations • Send coupons for snacks and sporting goods • Guided tours of the stadium when there is no game • Give access to training sessions

Museums

- Self-guided tours
- Provide more details about an artwork the visitor is looking at
- Provide access to interactive media such as additional videos or games related to an artwork
- Inform about other facilities such as cafeteria, library or shop
- Provide information about future exhibitions or upcoming events
- Send museum shop promotions

Warehouses

- Give information on asset location
- Get information to carry out the analytics of vehicle movement

Healthcare

- Provide patients with detailed information on doctors' working hours
- Provide support for making appointments
- Provide directions to doctors' or patients' rooms

Workplaces

- Control surrounding luminaires
- Guide people to the booked station or the nearest conference room
- Locate colleagues on office premises
- Automatically call an elevator with the floor pre-selected when walking toward the elevator

Case studies

Casambi technology is tried and tested, and fast becoming the de facto standard in Europe. To date, over 4 million Casambi Ready devices have been sold worldwide. Casambi has been specified in over 150,000 projects, spanning every application from small high-end residential to 10,000+ node industrial spaces.

iBeacon technology is available in all Casambi's products, therefore any Casambi node can work as an iBeacon sender without additional investment. If you already have a Casambi control system or plan to implement one, you don't have to worry about buying and installing beacons, you just need to enable iBeacon technology in the Casambi App and integrate it with a third-party app.

Many customers took advantage of this and incorporated iBeacon technology into their projects in the most diverse applications. Here are a few examples:

The Terrace

Located in Berlin, Germany, the Terrace is equipped with a fully automated building control system that is in tune with the occupant from the moment they enter the premises. All 7,800 m², including retail space, car park and offices, contain a vast network of Casambi Ready sensors and smart luminaires that enable full automation of lights, temperature and access control.



Using iBeacons, real-time location tracking and indoor navigation provide employees and operators with the possibility to easily view and adjust the heating and lighting scene options within their immediate vicinity. Presence detection and daylight sensors optimize energy use within the building by ensuring that lights and heating are only on when required. The app provides user-friendly booking options for intelligent desk-sharing and underground parking allocation.

The building's app – which was developed by a third-party company – has integrated Casambi via the Casambi Cloud API. Through IP gateways, the sensors communicate via the Casambi Cloud API and send brightness and motion data to the building management system's cloud server. The iBeacons communicate with the building's own app, which in turn, controls the functions (lights, radiators, room occupancy, access control, sun blinds, etc.). Even the elevator is automatically called with the floor pre-selected as soon as a user – with the app on their cell phone – walks towards the elevator in the underground parking garage.

The on-site administrator has a dashboard with an overview of all the stored functions such as room occupancy, heat map, parking space management and desk occupancy. He also uses the dashboard to assign access and lighting control rights to employees or visitors. This ensures that no employee can make changes for which they are not authorized.

Finding iCows

LED lighting with smart control for localization and pre-programmed scenes has brought benefits for both people and animals at Bäck's Farm outside Säfte, in Sweden.

Here, Casambi was chosen for the new lighting because it is quick and easy to install with minimal disruption and zero control cabling. Pre-programmed lighting scenes for cleaning, milking and resting periods have resulted in efficiency gains and a reduction in energy consumption.

Beyond illumination, the smart lighting system also serves as a great canopy for other IoT devices that help transfer data throughout the space. iBeacon technology has been deployed to track cows via a smartphone app. Additionally, Casambi's lighting control solution connects with the collar-mounted chips to increase the brightness of luminaires within the vicinity of a searched-for cow.

You can explore some of our projects here: <https://casambi.com/projects/>



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