



## RFGate–BB5 Beacon

### Product Specification

#### About document

##### Scope

This document is applicable to BB5 Beacon, and mainly introduced product brief, electronic specifications, quickguidance, and function descriptions based on firmware BXP-DV1.1 series.

#### BB5 RFID Beacon

The BB5, also called RFID Beacon, is an IP66 rugged designed Bluetooth LE beacon ideal for enabling access control, attendance tracking and visitor analytic through RFID tag. This Beacon also features an optional Accelerometer sensor and independent panic button for emergency call and motion detection. Powered by a replaceable CR3032 coin cell battery, BB5 RFID Beacon has an outstanding lifetime of 3 years.



- Rugged IP66 Waterproof
- Temp range -20°C to +60 °C



- Replaceable CR3032 coin cell battery
- Up to 3 years lifetime



- Over-the-air updates (firmware)
- Versatile installation options
- Various configurable parameters



- Up to 150 meters
- Multiple advertising format
- Customized services provided



### For What

- Asset
- Machinery
- Material
- Equipment
- Vehicle



### For Whom

- Construction
- Healthcare
- Manufacturing
- Exhibition
- Warehousing

## 1. Product Brief

BB5 Beacon is mainly used for access control management, employee attendance and indoor positioning, etc. Thanks to its ultra -low power consumption, the beacon guaranties unsurpasse battery lifetime and on top of that its CR3032 battery can be replaced. Its high precision accelerometer sensor permits to detect most of movements or specific falls. As well, independent panic button can also be used for SOS emergency call.

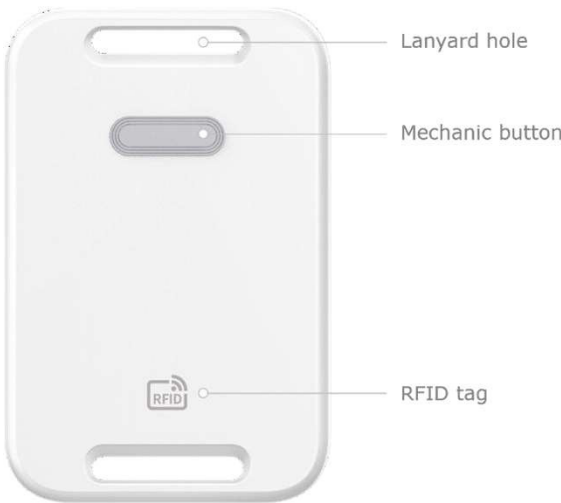
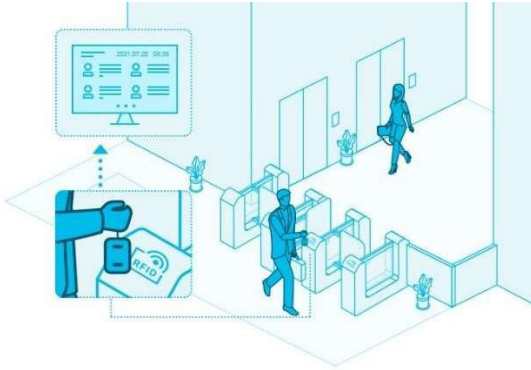


Figure 1: Top view of BB5 Beacon



Figure 2: Back view of BB5 Beacon

## 2.Application Scenarios

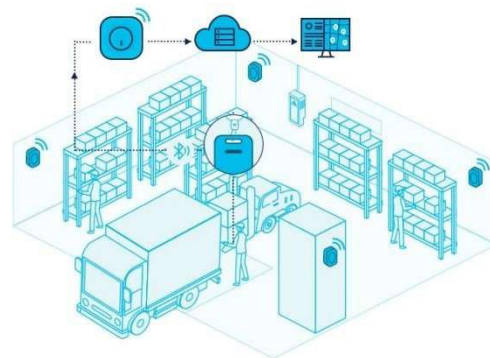


### Scenario1 : Access control

Integrated with RFID solution, BB5 Beacon can be used for access control and people flow management in various membership or visit or situations.

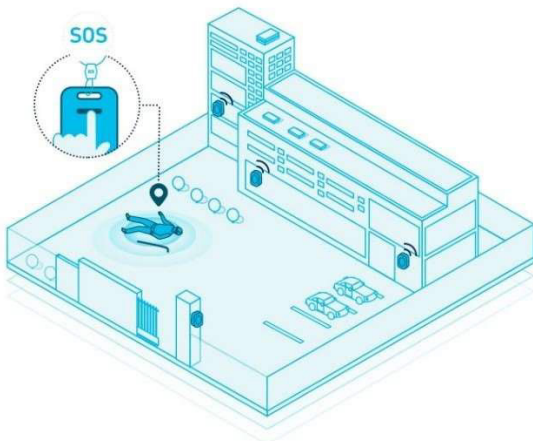
### Scenario2 : Personnel tracking

The BB5 RFID Beacon Tag is easy to wear in the form of a work card on a lanyard. You can provide BB5 to your employees, customers, or patients. Track their position or movement through Bluetooth signal. The wearer can use the buttons on the BB5 to notify you of emergency situations, task completion, or other predefined events in time.



### Scenario3 : Falling detection

BB5 has been designed with built-in 3-axis accelerometer sensor to detect movements, vibrations, and falls. For example, many elderly individuals may suffer accidental falls due to weakness or dizziness but cannot call for help immediately by themselves, BB5 can work it out as sending the acceleration data to cloud platform for further solutions.



## 3.Specification

### 1.General specifications

General specifications	
Main Chip	NordicnRF 5281 0
Bluetooth	Bluetooth 4.2(Hardware compatible with Bluetooth 5.1)
Dimension	65.4mmx 43.0mmx 5.7mm
Range	Up to 150 meters (in the open area and no obstacles)
Weight	17.8g (With battery)
Material	ABS +PC & TPU
Waterproof	IP66
Color	White
Installation	Hang Sticker, Neck Chain
Button	Mechanical button
LED	Single red LED

General specifications	
Sensor	3-axis accelerometer sensor (optional)
RFID	13.56Mhz MIFARE Classic EV1 RFID (customizable)
Operatin temperature	General -20°C / + 60°C -40°C / + 85°C can be customized
Storage temperature	-20°C / + 70°C (without battery) 10°C / + 25°C (with battery)
Humidity	0% ~ 95% (non-condensing)
Antenna Type	Ceramic antenna
Power supply	Replaceable 550mAh lithium coin CR3032 battery

Table 1: General specifications



## 2. Electronic specifications

### 1.Battery consumption

Here described battery consumption in various situations which refer to different use cases. You can refer to below table to create the use case and estimate battery lifetime.

3-axis Acc sensor sampling rate	SLOT1			Consumption (uA)	Life time*
	Advertising format	Tx power	Advertising interval		
10Hz	Device Info	0dBm	100ms	135.39	4.5 months
10Hz	Device Info	0dBm	500ms	34.93	17.5 months
10Hz	Device Info	0dBm	1000ms	23.29	26 months
10Hz	Device Info	4dBm	100ms	156.25	4 months
10Hz	Device Info	4dBm	500ms	40.54	15 months
10Hz	Device Info	4dBm	1000ms	25.11	24 months
10Hz	Device Info	-12dBm	100ms	119.15	5 months
10Hz	Device Info	-12dBm	500ms	32.09	19 months
10Hz	Device Info	-12dBm	1000ms	21	29 months
25Hz	Device Info	0dBm	1000ms	29.31	21 months
100Hz	Device Info	0dBm	1000ms	63.26	9.7 months

Table2: Battery consumption in various situations

\*Above battery lifetime are estimated under continuous single advertising slot with 0dBm Tx power.

## 2. Lifetime

Different lifetime in various typical scenarios.

### - Typical scenario1–Personnel tracking.

#### *Life time estimation: 3 years*

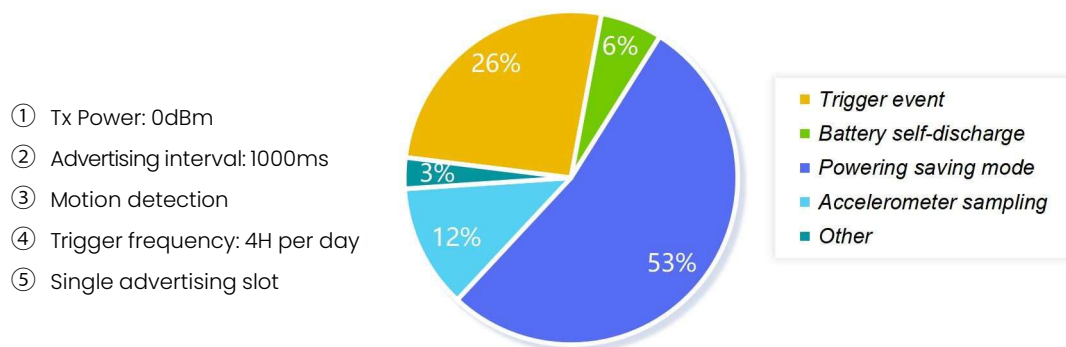


Figure3: Life time in personnel tracking scenario

### - Typical scenario 2–Access control

#### *Life time estimation: 2 years*

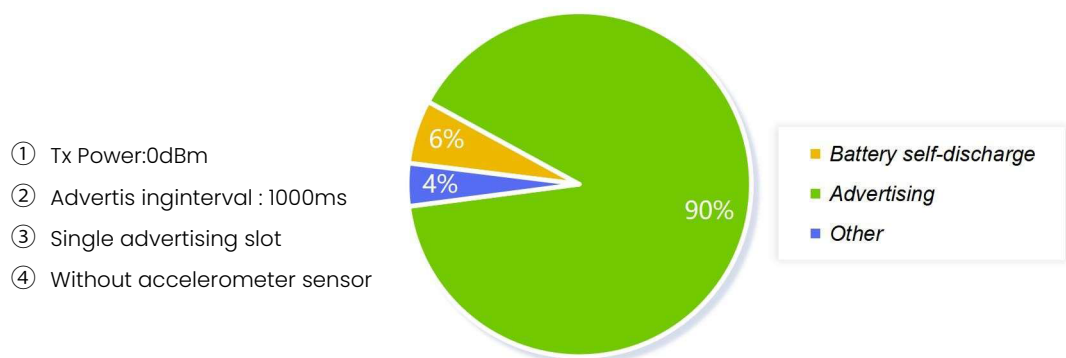


Figure4: Lifetime in access control scenario

Disclaimer: The contents of this battery estimation are for informational purposes only, and while effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability.

## 4. User guidance

### 1. How to wear/install BB5?

Multiple installation options of BB5 like hanging with lanyard or double-sided sticker can be selected by user.

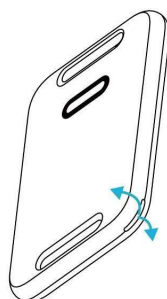


Option 2 : Hanging with lanyard



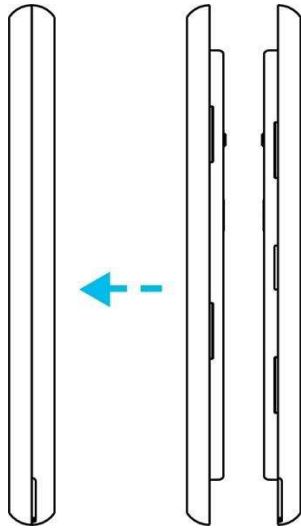
### 2. How to replace battery on BB5?

Operation flow:



Step 1: Disassemble back cover through buckle which located in rightbottom corner.

Step 2 : Take out battery from the groove.



Step 3 : Replace battery and assemble back cover. Please pay attention to the direction of back cover during assembling.

### 3. How to Power ON/OFF BB5?

There has a mechanical button on BB5, you can refer to below operation flow to power on/off device.

- Power ON: Long press mechanical button for more than 3 seconds, and LED will keep red blinking for 3 seconds.
- Power OFF: Long press mechanical button for more than 3 seconds, and LED will keep solid red for 3 seconds.

## 4. How to restore factory settings?

There are two ways to restore factory settings.

- Independent mechanical button (Hardwarereset): In power-off mode, long press inner mechanical button for 10s or more, then release button and single press button within 2s, device will proceed on factory reset.

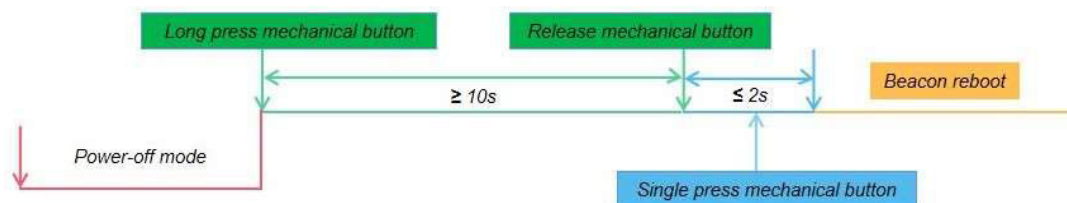


Figure5: BB5 Beacon Factory reset flow

- APP (Softwarereset\*): Remote factory reset through APP if BB5 connected with phone APP.

\*Software reset will not reset connection password.

## 5 How to connect to APP and issue configurations?

Please download "BeaconX Pro" APP from play store directly. For more configuration details, please refer to document-"Beacon XP series Beacon User Manual".

## 5.General function

### 1. Multiple advertising type

BB5 support multiple advertising type to comply with customers' requirements, such as primary Eddystone (UID/URL/TLM) and iBeacon protocol. What's more, BB5 also support the RFGate customized protocol to display Beacon information and sensor data in real time, thus extending more application scenarios.

## a)Eddystone-UID

Please refer to below standard Eddystone-UID format:

Byte offset	Field	Description
0	Service UUID	Value = 0xFE AA
2	Frame type	Value = 0x00
3	RSSI@0m	Calibrated Tx power at 0 m
4	Namespace ID	10 bytes Namespace ID
14	Instance ID	6 bytes Instance ID
20	RFU	2 bytes, reserved for future use, must be 0x00

## b)Eddystone-URL

Please refer to below Eddystone-URL format:

Byte offset	Field	Description
0	Service UUID	Value = 0xFEAA
2	Frame type	Value = 0x10
3	RSSI@0m	Calibrated Tx power at 0 m
4	URL scheme	Encoded Scheme Prefix
5+	Encoded URL	length 1-17

## c)Eddystone-TLM(unencrypted)

Please refer to below standard Eddystone-TLM (unencrypted) format:

Byte offset	Field	Description
0	Service UUID	Value = 0xFEAA
2	Frame type	Value = 0x20
3	Version	TLM version, value = 0x00 (unencrypted)
4	Battery voltage	2 bytes; 1mV/bit
6	Beacon temperature	2 bytes
8	ADV_CNT	4 bytes, Advertising PDU count
12	SEC_CNT	4 bytes, Time since power-on or reboot



## d) Apple iBeacon

Please refer to below standard APPLE iBeacon format:

Byte offset	Field	Description
0	Company ID	Value = 0x4C 00 (Apple, Inc.)
2	iBeacon type	Value = 0x02 (Proximity Beacon)
3	iBeacon length	Value = 0x15 (Fixed)
4	UUID	1 6 bytes
20	Major	2 bytes
22	Minor	2 bytes
24	RSSI@1m	1 byte, Calibrated Tx power at 1 m; Range: -100~0dBm

## e) 3-axisAcc sensor

RFGate customized advertising format for broadcasting 3-axis accelerometer sensor raw data, battery voltage etc. Please refer to below

Byte offset	Field	Description
0	Service UUID	Value = 0xFEAB
2	Frame type	Value = 0x60
3	Ranging data	1 byte, the Tx power in dBm emitted by the Beacon at custom distance (0m or 1m) Range: -100~0dBm
4	Advertising interval	1 byte, 100ms/bit; Range: 1-100
5	Sensor sampling rate	1 byte, 25Hz by default
6	Sensor full-scale	1 byte, ±2g by default
7	Trigger threshold	1 byte, the acceleration value to determine Beacon motion, 0.1g by default
8	Sensor data	6 bytes, the acceleration of X-axis, Y-axis, and Z-axis
14	Tx power	3 bytes (Tx power)
17	Battery voltage	2 bytes; 1mV/bit
19	RFU	1 byte, reserved for future use
20	MAC address	6 bytes

## f) Device info

RFGate customized advertising format for broadcasting device status info. Please refer to below table for details.

Byte offset	Field	Description
0	Service UUID	Value = 0xFEAB
2	Frame Type	Value = 0x40
3	Ranging data	1 byte, the Tx power in dBm emitted by the Beacon at custom distance (0m or 1m) Range: -100~0dBm

Byte offset	Field	Description
4	Advertising interval	1 byte, 100ms/bit; Range: 1~100
5	Battery voltage	2 bytes, 1mV/bit
7	Device property	Bit0-1, 00–need password; 11-no password is required.
		Bit2-7, reserved for future use
8	Device property	Bit0, 0–Unconnectable; 1–Connectable
		Bit1-7, reserved for future use
9	MAC Address	6 bytes
15	Software version	2 bytes
17	Tx power	1 byte

In this customized device info frame, there have corresponding response package which contains device name. (Need enable active scanning)

Byte offset	Field	Description
0	Device name	Maximum 22 bytes 20 characters and 2 bytes type & length

## 2.Multiple advertising slot

BB5 can support up to 6 advertising slots and each slot configurations are independent. It means that user can issue different configurations which include Txpower/Advinterval/Adv type and other parameters in each slot.

## 3.Motion detection

3-axis accelerometer sensor could be able to identify BB5 motion status, and then switch into pre-configured advertising status or data. As well, user can also set motion detection trigger to achieve power saving mode. For more, please refer to“ chapter 5.5.2 motion trigger “. Regarding to 3-axis accelerometer sensor directions, you can refer to below hardware design and sensor specifications.

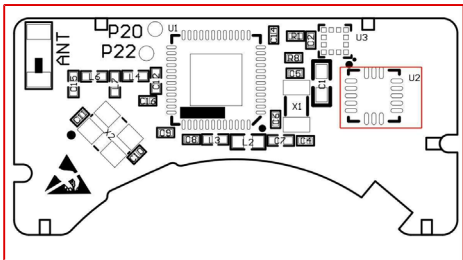


Figure6 : BB5 Beacon PCBA design

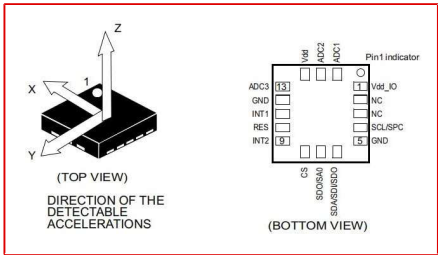


Figure7 : 3-axis accelerometer sensor specification

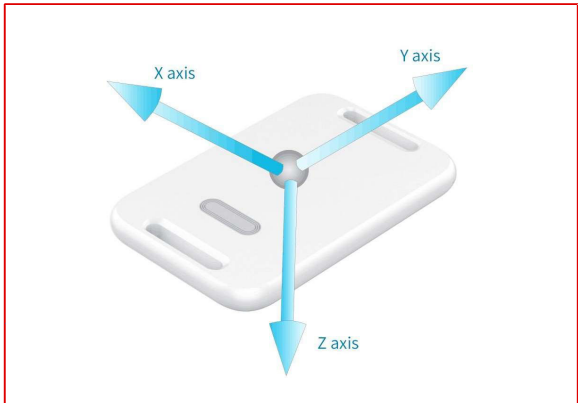


Figure8 : BB5 accelerometer sensing direction

For BB5 Beacon sensing direction with 3-axis accelerometer sensor, please refer to figure 8.

## 4.Sensor sampling

BB5 can broadcast or notify 3-axis accelerometer sensor data in real time, so you can achieve the sensor sampling data through advertisement or Connection Notify property. It could be used for personnel tracking and falling detection.

Use case: Assuming that elderly individuals suffer accidental falls due to weakness or dizziness but cannot call for help immediately by themselves. But if wearing with BB5 Beacon, it can broadcast real time 3-axis accelerometer sensor to cloud platform and recognize the fall behavior through algorithm, thus arranging the corresponding solutions.

## 5.Trigger mechanism

Trigge rmechanism is designed for some emergency statess witching immediately or some specific use cases such as motion detection. Currently BB5 Beaconcan support mechanical button trigger and motion trigger, please refer to below trigger table.

Trigger type	Trigger condition
Button trigger	Press button twice
	Press button three times
Motion trigger	Device moves

User can set the different trigger type, as well as trigger response. When the trigger condition takes effect, then it will have corresponding trigger response.

For instance, user set the trigger type -motion trigger, and set the trigger response -stop advertising for a while (30s). When device is in idle status, if user move device and then 3-axis accelerometer sensor data exceed to threshold value (motiondetected), then it will activate trigger response and device will stop advertising for 30s.

## 1. Button trigger

- Description

There have two kinds of trigger conditions regarding of button trigger, that is double click button and triple-click button.

- Triggerresponse

- a)Always advertising

After trigger type being occurred, then device will start broadcasting and keep always broadcasting until you change to other trigger response or cancel trigger type.

- b)Start advertising for a while

After trigger type being occurred, then device will start advertising for a while, and advertising time is configurable. It is set 30s by default.

- c)Stop advertising for a while

After trigger type being occurred, then device will stop advertising for a while, and advertising time is configurable. It is set 30s by default.

- Use cases

- a)SOS emergency & call services

- b)Regular task report / Workflow management

## 2. Motion trigger

- Description

When device changed from idle to motion status, 3-axis accelerometer sensor sampling data exceed to threshold value, it will be recognized as an effective motion and then activate trigger response.

- Trigger response

- a)Always advertising

After trigger type being occurred, device will start advertising and keep always advertising until you change to other trigger response or cancel trigger type.

b) Start advertising after a static period of specific time  
Device will start to broadcast after a static period of specific time, and it stops broadcasting again once a movement occurred. It is set 30s by default.

c) Stop advertising after a static period of specific time  
Device will stop broadcasting after a static period of specific time, and it starts to broadcast again once a movement occurred. It is set 30s by default.

– Use cases

- a) Power saving mode & Normal mode switch
- b) Asset status monitoring

## 3. Operating mode

Regarding of BB5 Beacon, there have several operating modes which reflect on different features and states. Please refer to below operating mode flow.

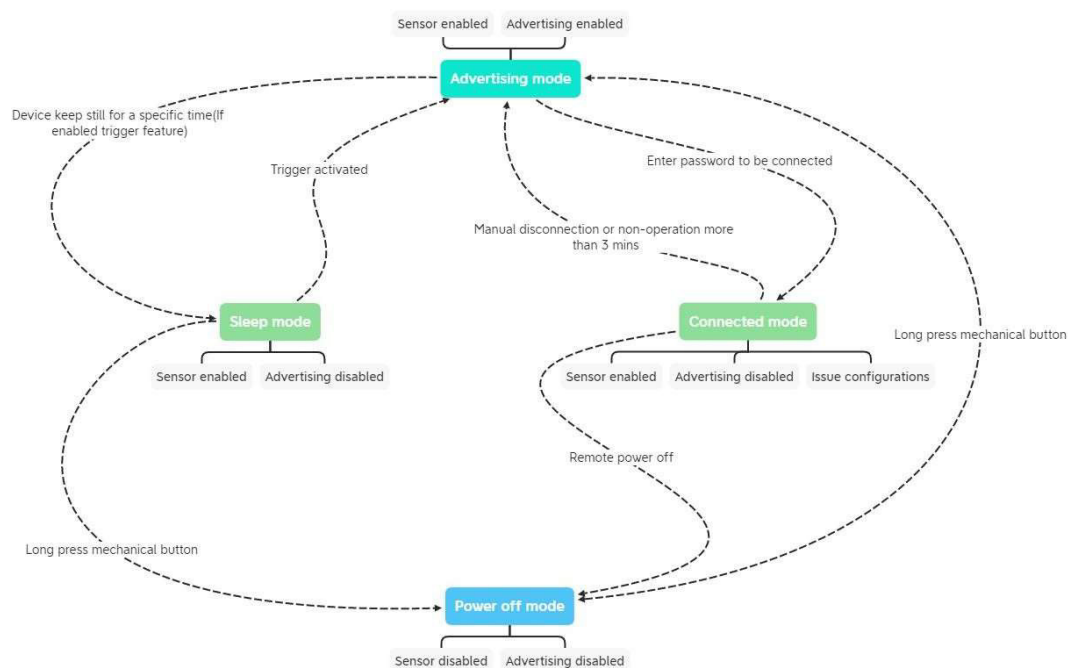


Figure9: BB5 Beacon Operating mode flow

### 1. Advertising mode

In advertising mode, BB5 Beacon is broadcasting, sensor is working and can be scanned by central device.

### 2. Power-off mode

MCU will enter low power mode to wait for power on event, beyond that, all services which include advertisement, sensor, RTC etc. will be disabled.

### 3. Connected mode

In this mode, central device (phone, gateway, or other master devices) is connected with BB5 Beacon and can configure parameters through GATT services.

When a connection is made to BB5, the part will stay in a connected state until the master breaks the connection or is out of range. On disconnect, BB5 return to the broadcasting state unless a reset was initiated during the connection.

In connected mode, BB5 Beacon will not broadcast but sensor will keep working still.

### 4. Sleep mode

In sleep mode, BB5 is not connected with central device and not broadcasting as well, but sensor is working to wait for motion trigger or button trigger. For instance, after device keep in idle status for a specific time (default 30s and parameters configurable), then device will stop broadcasting but keep sensor sampling working to maintain motion detection feature, that is also called power saving mode.

## 4. Beacon temperature monitoring

In BB5 Beacon, nRF52810 equipped with a built-in temperature sensor and temperature data will be broadcast through TLM frame. User can monitor the Beacon temperature and do forewarning measures.



## 1. Monitoring duration statistics

In TLM frame, there have SEC\_CNT and ADV\_CNT value that represents working time and advertisement quantities since Beacon power-up or reboot. User can do monitoring duration statistics through this value.

Use case-Products promotion

When customer pick up specific goods, motion detection in BB5 Beacon will be triggered. The merchant can calculate the trigger frequency by combining the motion trigger times and total monitoring duration, thus providing the customer preference analysis.

## 2. Low battery alert

When battery percentage is lower than 5%, LED blinks twice at 10s interval to remind user.

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\*Low battery alert threshold can be customized regarding of customer requirements.

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## 3. Remote power off

Device firmware can support remote power off feature. This function should be realized through APP.

## 4. Remote reboot

Device firmware can support remote reboot feature. This function should be realized through APP.

## 5. DFU update

Devices support DFU firmware update, and you can do DFU operations through official “nRF Connect” APP or RFGate” BeaconX Pro ” APP.

During firmware update period, LED will keep red blinking; After successful update, LED will keep red solid for 3s and then device reboot. For more detail

## 5. Remote parameters configuration

Device support various configurable parameters and you can issue below parameters through the APP directly.

- Advertising format and data
- Advertising slot
- Beacon name
- Tx power
- Advertising interval
- Connection password
- Trigger options
- Sensor parameters