



MOKO SMART



User Guide

MOKO BeaconX Pro APP

Version 1.0



iBeacon



Eddystone

Revision History

Version	Data	Notes	Contributor(s)
V1.0	Dec 25 2021	Initial version	Daniel

About this User Guide

This User Guide was designed to help users to know and set up **MOKO Beacon** through **MOKO BeaconX Pro APP***, users will be initial to know the process of Beacon advertisement, connection, configuration, DFU update and etc. This guide will not cover the sales administration and the ordering process. Some technical guides will be needed if further explanation is required.

- Applicable version description:

Android APP Version: BeaconX Pro V2.0.0 or above

IOS APP Version: BeaconX Pro V2.0.0 or above

Firmware Version: BXP-D_V1.0.0 or above, BXP-C_V1.0.0 or above.

- Each figure (diagram, screenshot, or other image) and table are provided with a number and description:

Figure 1: QR Code for downloading Android/iOS BeaconX Pro APP

Table 1: Supported advertisement frame in different device type

The numbers and descriptions of the figure and table can be found in the “List of Figures” and “List of Tables”.

Table of Contents

Revision History.....	1
About this User Guide.....	1
1. Overview	7
2. MOKO BeaconX Pro APP user guidance	8
2.1 Permission guarantee	8
2.2 Select your Beacon series.....	9
2.3 Discover your Beacon device.....	9
2.3.1 Scanning your Beacon device.....	9
2.3.2 Filtering your Beacon device	10
2.4 Connect with your Beacon device	10
2.5 Getting your Beacon to broadcast.....	11
2.5.1 Setting your advertisement SLOT	11
2.6 Setting up your Beacon's trigger function	16
2.6.1 Setting up Button trigger	16
2.6.2 Setting up Motion trigger	16
2.6.3 Setting up Temperature & Humidity trigger	17
2.6.4 Setting up Ambient light trigger	18
2.7 Access to sensor parameters	19
2.7.1 Configure 3-axis accelerometer sensor.....	20
2.7.2 Configure Temperature & Humidity sensor.....	20
2.7.3 Configure Ambient Light sensor.....	23
2.8 Quick switch for basic features	24
2.8.1 Switch your Beacon to unconnectable	25
2.8.2 Disable your Beacon's button function	25
2.8.3 Disable password verification	25
2.8.4 Enable trigger LED indicator	26
2.9 Remote turn off your Beacon.....	26
2.10 Remote reset your Beacon.....	26
2.11 Modify your Beacon's connection password	26
2.12 Upgrade your Beacon's firmware	27
2.12.1 Android – MOKO APP DFU instructions.....	27
2.12.2 iOS – MOKO APP DFU instructions	27

2.12.3	DFU failure considerations	28
2.13	Check your about device information	28
2.14	Obtain log file from Android APP.....	29
3.	Content parsing of Beacon advertisement	30
3.1	Google Eddystone – UID	30
3.2	Google Eddystone – URL	31
3.3	Google Eddystone – TLM (Unencrypted)	32
3.4	Customized advertisement frame – “iBeacon”	33
3.5	Customized advertisement frame – “Device info”	35
3.6	Customized advertisement frame – “3-axis Acc”	36
3.7	Customized advertisement frame – “T&H”	37
4.	Common instructions of “nRF connect” APP.....	39
4.1	How to unlock device (password verification)?	39
4.2	How to modify device name?	40
4.3	How to upgrade firmware through “nRF connect” APP?	40
4.3.1	Android – “nRF connect” APP DFU instructions	40
4.3.2	iOS – “nRF connect” APP DFU instructions	40
5.	FAQ.....	42
Appendix	44
A.1	Frame type of MOKO defined advertisement	44
A.2	Sampling rate comparison table of 3-axis accelerometer sensor	44
A.3	Full-scale comparison table of 3-axis accelerometer sensor	44
Contact	45

List of Figures

Figure 1: QR Code for downloading Android/iOS BeaconX Pro APP	8
Figure 2: Permission guarantee flow of BeaconX pro APP.....	8
Figure 3: Select your Beacon series	9
Figure 4: Default scanning preview of Beacon device.....	9
Figure 5: Configurations of scanning filter settings	10
Figure 6: Configurations of advertisement SLOT interface.....	11
Figure 7: TLM advertisement configuration interface.....	12
Figure 8: UID advertisement configuration interface.....	13
Figure 9: URL advertisement configuration interface	13
Figure 10: iBeacon advertisement configuration interface.....	14
Figure 11: Device info advertisement configuration interface	14
Figure 12: 3-axis Acc advertisement configuration interface.....	15
Figure 13: T&H advertisement configuration interface	15
Figure 14: Configurations of button trigger interface.....	16
Figure 15: Configurations of motion trigger interface	17
Figure 16: Configurations of Temperature trigger – Temperature above	17
Figure 17: Configurations of Temperature trigger – Temperature below	18
Figure 18: Configurations of Humidity trigger – Humidity above	18
Figure 19: Configurations of Humidity trigger – Humidity below	18
Figure 20: Configurations of Ambient light trigger	19
Figure 21: Workflow of Start advertising after ambient light continuously detected for XX s.....	19
Figure 22: Workflow of Stop advertising after ambient light continuously detected for XX s	19
Figure 23: Configurations of 3-axis accelerometer sensor.....	20
Figure 24: Set sampling interval of T&H sensor	21
Figure 25: Set temperature storage trigger mechanism.....	21
Figure 26: Set humidity storage trigger mechanism	21
Figure 27: Set T&H storage trigger mechanism	22
Figure 28: Set interval time storage mechanism of T&H sensor	22
Figure 29: Synchronize Beacon time to smart phone time.....	22
Figure 30: Export and erase T&H sensor data.....	23
Figure 31: Monitoring interface of ambient light status.....	23

Figure 32: Sync and export ambient light detection record	24
Figure 33: Configurations of Quick switch interface	24
Figure 34: Switch your Beacon to unconnectable	25
Figure 35: Disable button power off function	25
Figure 36: Disable button reset function.....	25
Figure 37: Disable password verification	25
Figure 38: Enable trigger LED indicator.....	26
Figure 39: Firmware upgrade workflow of MOKO standard application (Android).....	27
Figure 40: Load upgrade package to nRF connect APP via iTunes	28
Figure 41: Device information display interface.....	29
Figure 42: Obtain log file from Android APP	29
Figure 43: Example content of UID advertisement	30
Figure 44: Example content of URL advertisement	31
Figure 45: Example content of TLM advertisement	32
Figure 46: Example content of Customized-iBeacon advertisement	33
Figure 47: Example content of Customized-Device info advertisement	35
Figure 48: Example content of Customized-3-axis ACC advertisement	36
Figure 49: Example content of Customized-T&H advertisement.....	38
Figure 50: Workflow of unlocking device in android nRF Connect APP.....	39
Figure 51: Firmware upgrade workflow of Android nRF Connect APP.....	40
Figure 52: Firmware upgrade workflow of iOS nRF Connect APP	41

List of Tables

Table 1:	Supported advertisement frame in different device type	12
Table 2:	Content structure of UID advertisement.....	31
Table 3:	Content structure of UID advertisement.....	32
Table 4:	Content structure of TLM advertisement.....	33
Table 5:	Content structure of Customized-iBeacon advertising packet	34
Table 6:	Content structure of Customized-iBeacon response packet.....	34
Table 7:	Content structure of Customized-Device info advertising packet	36
Table 8:	Content structure of Customized-Device info response packet.....	36
Table 9:	Content structure of Customized-3-axis ACC advertisement	37
Table 10:	Content structure of Customized-T&H advertisement.....	38
Table 11:	Different factors in different full-scale of 3-axis accelerometer sensor.....	42
Table 12:	Frame type of MOKO defined advertisement.....	44
Table 13:	Sampling rate comparison table of 3-axis accelerometer sensor.....	44
Table 14:	Full-scale comparison table of 3-axis accelerometer sensor	44

1. Overview

This User Guide is mainly applicable for MOKO standard BeaconX Pro APP and MOKO Beacon with BeaconX Pro serial firmware, and mainly contained below parts:

- [*MOKO BeaconX Pro APP user guidance*](#)
- [*Content parsing of Beacon advertisement*](#)
- [*Common instructions of “nRF connect” APP*](#)
- [*FAQ*](#)

For more hardware technical info or user guidance, please ask our sales team for document – “**Product Specification**”.

For more firmware protocol info or user guidance, please ask our sales team for document – “**Firmware protocol**”.

2. MOKO BeaconX Pro APP user guidance

This user guidance for MOKO BeaconX Pro app is based on Android/iOS APP version 2.0.0 or above, and the content of this user guidance are subject to change without prior notice for further improvement.

For latest APP, please scan below QR code or search “**BeaconX Pro**” and download from Google play store or Apple store.



Figure 1: QR Code for downloading Android/iOS BeaconX Pro APP

2.1 Permission guarantee

For MOKO BeaconX Pro APP, it will require for Location, Bluetooth, and Storage permissions from phones. Scanning for Bluetooth LE devices requires Location permission starting from Android 6.0 Marshmallow due to Beacons, like iBeacon or those with support for Eddystone™, may be used to determine the location of the phone and user. APP can work normally only when these permissions granted.

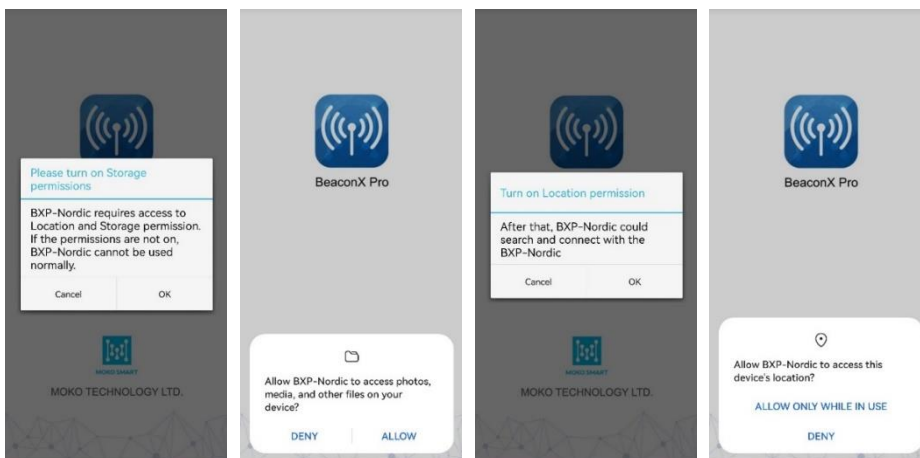


Figure 2: Permission guarantee flow of BeaconX pro APP



Notice – This is always complying with Google or Apple private policy, and we commit that data will not be applied for other use.

2.2 Select your Beacon series

For MOKO BeaconX Pro APP, we have assigned different sub-series APP according to different product type, which mainly reflect on chipset type. Currently we have adopted two kinds of chipset for our Beacon product – Nordic series and Telink series, and accordingly two sub-series APP as well.

So after you got the Beacon from MOKO and installed MOKO BeaconX Pro APP, then you need to select correct APP sub-series version before you do further configurations, demonstration as below:

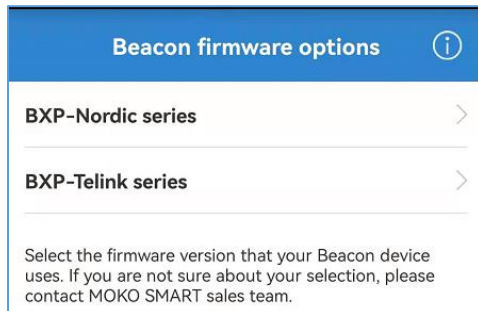


Figure 3: Select your Beacon series



Notice – If the sub-series APP you selected is not matched with your Beacon, it will give prompt when you try to connect device and indicate that the firmware version you selected is incorrect.

2.3 Discover your Beacon device

The smartphone with MOKO BeaconX Pro APP (Android or iOS) installed can be as a **Bluetooth Center** to scan and discover the advertisement packets (ADV packets) of Bluetooth Low Energy (BLE) Beacons, and it will provide multiple strategies to filter the Bluetooth packets and that can help you capture the required Bluetooth LE peripherals directly and quickly.

2.3.1 Scanning your Beacon device

After APP permission granted and then it will come to BLE Beacon **SCANNING PREVIEW** interface. The **SCANNER** will keep scanning continuously and lists all surrounding advertising Bluetooth LE peripherals which integrated with MOKO firmware, unless stop scanning manually by pressing scanning button.

In this **SCANNER** interface, you will see device advertisement preview to recognize your Beacon device. All Beacon devices with MOKO standard firmware are default set with **Device info** advertisement frame type, and below picture shows the default scanning preview of Beacon device. For more scanning previews of other advertisement type, please refer to [chapter 2.4 - Getting your Beacon to broadcast](#).

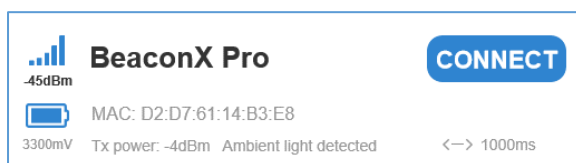
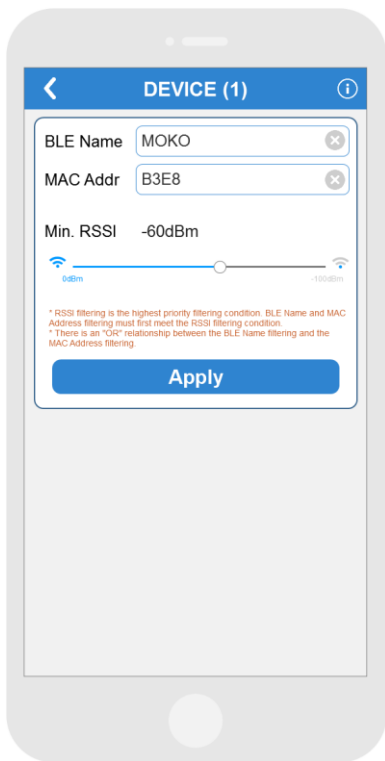


Figure 4: Default scanning preview of Beacon device

2.3.2 Filtering your Beacon device

To find your Beacon device directly, we have developed multiple strategies to filter mass Beacon device, users may narrow your device list by BLE name, MAC address and RSSI value through “**Edit Filter**” option.



BLE Name	<p>Allow to input 1-20 characters.</p> <p>Example: Only Beacon devices whose BLE name contain “MOKO” will be list in SCANNER interface.</p> <p>NOTE: Space effective, and case-insensitive as well.</p>
Mac Addr	<p>Allow to input 1-6 bytes (HEX).</p> <p>Example: Only Beacon devices whose Mac address contain “B3:E8” will be list in SCANNER interface.</p> <p>NOTE: There is no need to input colon between MAC address in search filter column, and case-insensitive as well.</p>
Min.RSSI	<p>Only the ADV packets with RSSI not less than the Min.RSSI value will be list in SCANNER interface , and configuration range is -100dBm to 0dBm.</p> <p>Example: When setting the Min.RSSI value to -70, the ADV packets with RSSI of -70dBm or greater than -70dBm will be list in SCANNER interface.</p>

Figure 5: Configurations of scanning filter settings

NOTE:

- ① RSSI is the highest priority filtering condition. It means that filtered device must meet the RSSI filtering condition.
- ② There is an “OR” relationship between BLE Name and Mac Addr. It means that filtered device just need meet one of the filtering conditions.

2.4 Connect with your Beacon device

For BLE device, if the status is connectable, then it will shows “CONNECT” button in the **SCANNING PREVIEW** interface, and vice versa. You can follow below steps to connect with your Beacon device:

Step 1: Press “**CONNECT**” button and device LED will blink 4 times rapidly.

Step 2: Input connection password and then press “**OK**” button, device LED will blink 4 times rapidly again.



Notice – Default password in MOKO standard firmware is “Moko4321”.

2.5 Getting your Beacon to broadcast

Once device connected, the main screen of the MOKO APP displays. This screen contains three parts which include **SLOT interface**, **SETTING interface** and **DEVICE interface**.

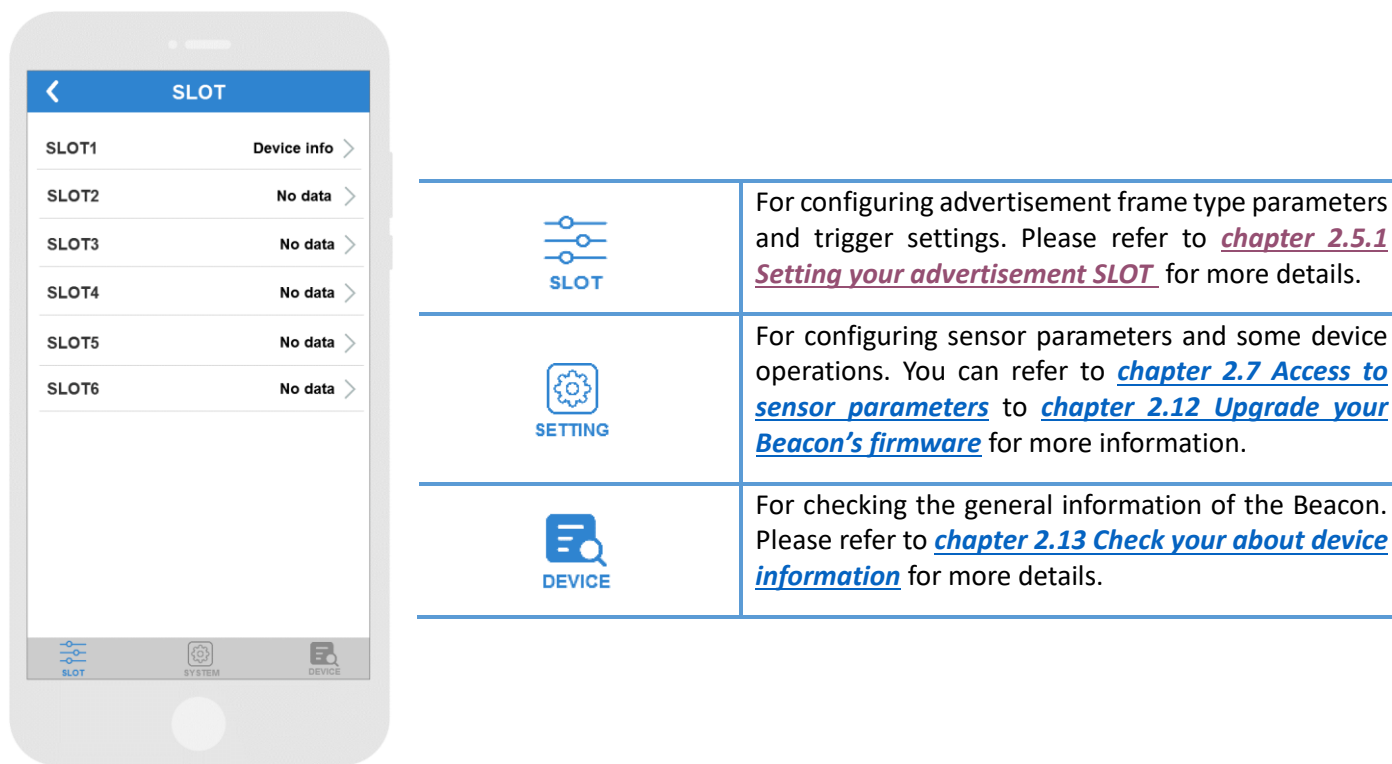


Figure 6: Configurations of advertisement SLOT interface

2.5.1 Setting your advertisement SLOT

There have six advertisement slots can be configured separately in SLOT interface, and different device type will show different advertisement frame. Here described the different sensor device types and corresponding supported advertisement frame.

You can configure a certain frame type on different SLOT, each SLOT can be same frame type or different frame type. As well, “3-axis Acc” and “T&H” frame type are displayed in association with the device type. For example, if a device equipped with 3-axis accelerometer sensor, then “3-axis Acc” frame type will be available but “T&H” will not be available in the SLOTS.

For more, you can refer to below detailed advertisement frame.

Device type	Advertisement frame	
No sensor	Eddystone™ – TLM	iBeacon
	Eddystone™ – UID	Device info
	Eddystone™ – URL	No data
3-axis accelerometer sensor	Eddystone™ – TLM	Device info
	Eddystone™ – UID	3-axis Acc
	Eddystone™ – URL	iBeacon
		No data
Temperature and humidity sensor	Eddystone™ – TLM	Device info
	Eddystone™ – UID	T&H
	Eddystone™ – URL	iBeacon

Device type	Advertisement frame	
	No data	
3-axis accelerometer sensor and Temperature & Humidity sensor	Eddystone™ – TLM	Device info
	Eddystone™ – UID	3-axis Acc
	Eddystone™ – URL	T&H
	iBeacon	No data

Table 1: Supported advertisement frame in different device type



Notice – It is not recommended to configure 6 slots as **No data**, that means the device will not broadcast any advertisement unless user reset the Beacon.

2.5.1.1 Configure TLM advertisement

This TLM advertisement is exactly complying with *Eddystone™- TLM*, and mainly to shows below information and none advertisement configurations.

Below described picture instantiations of TLM configuration interface and TLM scanning preview interface.

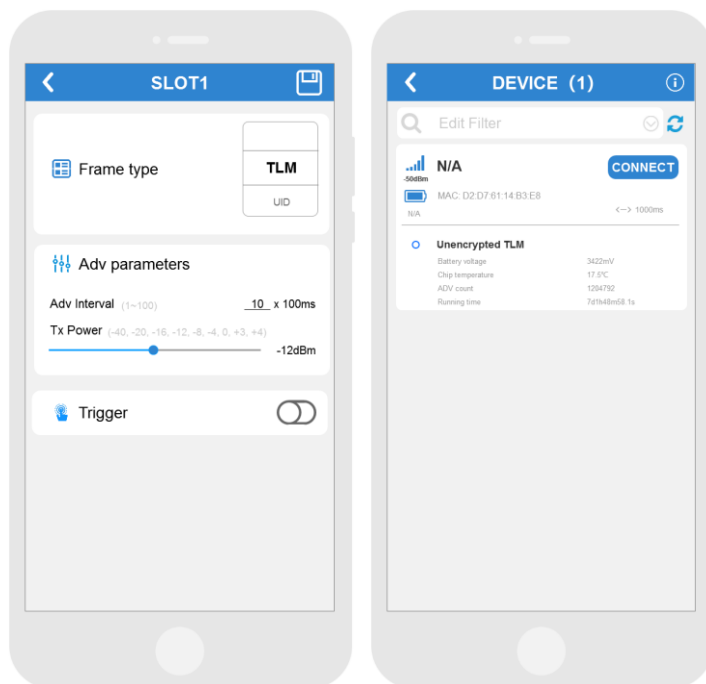


Figure 7: TLM advertisement configuration interface

2.5.1.2 Configure UID advertisement

This UID advertisement is exactly complying with *Eddystone-UID*, and its Beacon ID is 16 bytes long, consisting of a 10-byte namespace component and 6-byte instance component. The namespace is intended to ensure ID uniqueness across multiple Eddystone implementers and may be used to filter on-device scanning for beacons.

Below described picture instantiations of UID configuration interface and UID scanning preview interface.

Adv interval – The time between advertising packets and configuration range is 100ms~10000ms. *(similarly hereinafter)*

Tx Power – Output power in number of dBm. *(similarly hereinafter)*

Battery voltage - Current battery voltage in millivolts.

Chip temperature - Temperature in degrees Celsius sensed by the beacon.

ADV count - Running count of advertisement frames of all types emitted by the beacon

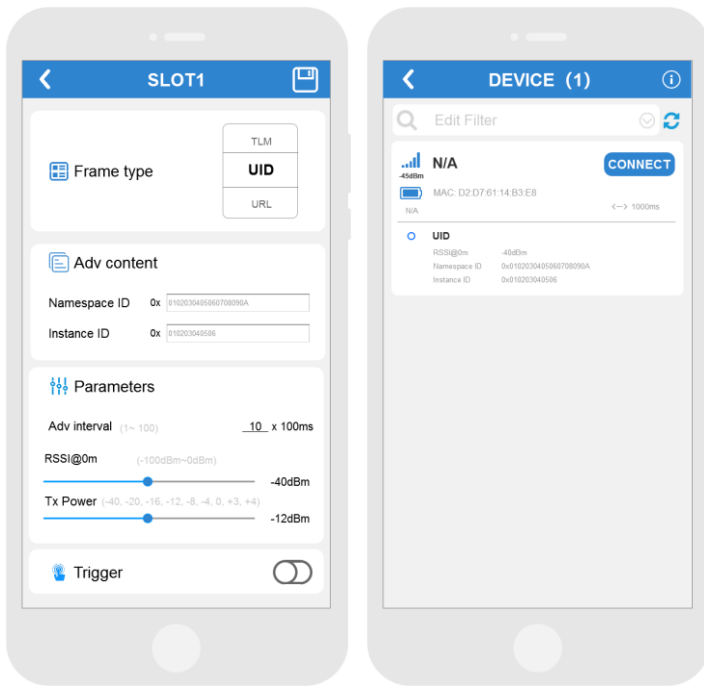


Figure 8: UID advertisement configuration interface

2.5.1.3 Configure URL advertisement

This URL advertisement is exactly complying with *Eddystone™-URL*, and you can set URL link in URL frame type. The *Eddystone™-URL* frame broadcasts a URL using a compressed encoding format in order to fit more within the limited advertisement packet. Once decoded, the URL can be used by any client with access t

Below described picture instantiations of URL configuration interface and URL scanning interface.

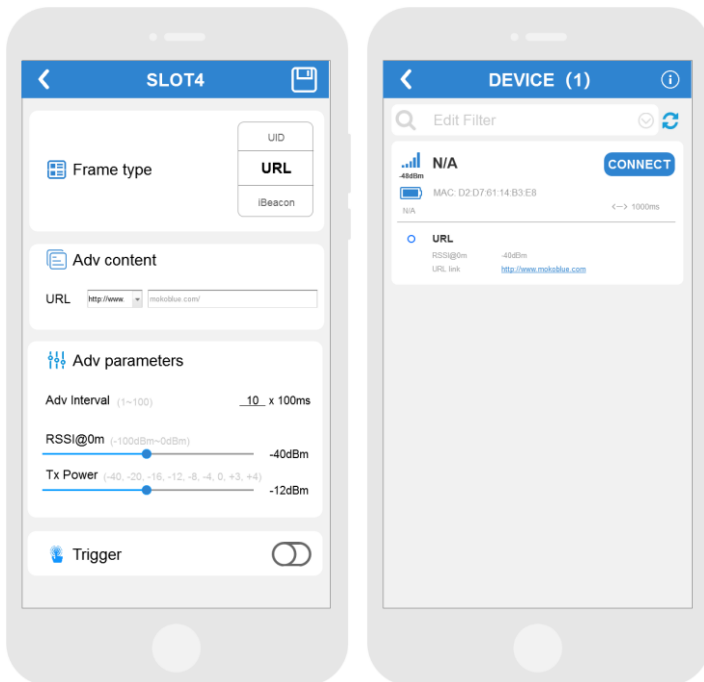


Figure 9: URL advertisement configuration interface

Namespace ID – 10 bytes, unique self-assigned beacon ID namespace.

Instance ID – 6 bytes, unique self-assigned via any method suitable for your application.

RSSI@0m – Tx power in dBm emitted by the Beacon at 0 meter. Configuration range is -100dBm~0dBm.

URL link – 1~17 characters of the US-ASCII coded character set.

RSSI@0m – Tx power in dBm emitted by the Beacon at 0 meter. Configuration range is -100dBm~0dBm.

2.5.1.4 Configure *iBeacon* advertisement

This iBeacon advertisement is exactly complying with *APPLE-iBeacon* advertisement format, but apart from this, MOKO have added response advertisement additionally in order to show more information in iOS APP due to iOS system restrictions.

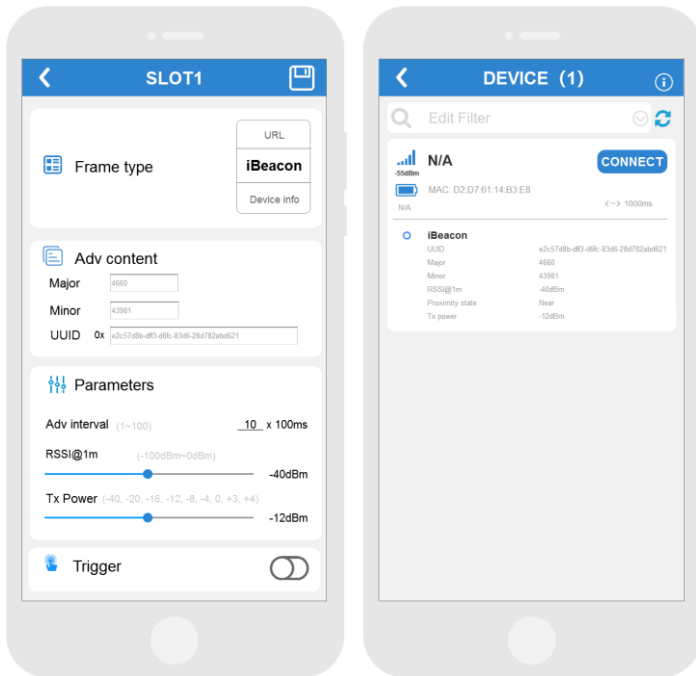


Figure 10: iBeacon advertisement configuration interface

2.5.1.5 Configure *Device info* advertisement

This “Device info” customized advertisement is mainly designed to broadcast some basic device information as well as device name, below described picture instantiations of “Device info” configuration interface and scanning preview interface.

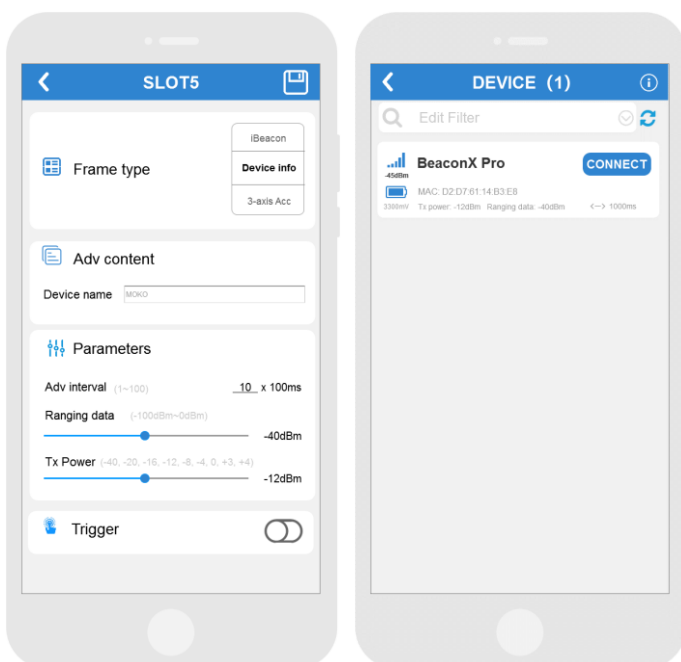


Figure 11: Device info advertisement configuration interface

Major – 2 bytes. Further specifies a specific iBeacon and use case. For instance, this value could be defined as a sub-region within a larger region defined by the UUID. (Configuration range 0~65535)

Minor – 2 bytes. Allows further subdivision of region or use case, specified by the developer. (Configuration range 0~65535)

UUID – 16 bytes. Application developers should define a UUID specific to their app and deployment use case. (No need to input dash between the UUID)

RSSI@1m – Tx power in dBm emitted by the Beacon at 1 meter. Configuration range is -100dBm~0dBm.

Device name – Used to assign a user-friendly name to the Beacon with no more than 20 characters of the US-ASCII coded character set.

Ranging data – Value that’s put into the advertising data that declares to receiving devices what the power should be at a specific distance from the Beacon. Configuration range is -100dBm~0dBm. (similarly hereinafter)

2.5.1.6 Configure 3-axis Acc advertisement

This “3-axis Acc” customized advertisement is mainly designed to broadcast 3-axis sampling data information as well as relevant parameters, and below described picture instantiations of “3-axis Acc” configuration interface and scanning preview interface. For more configurations of 3-axis accelerometer sensor, please refer to [chapter 2.7.1 – Configure 3-axis accelerometer sensor](#).

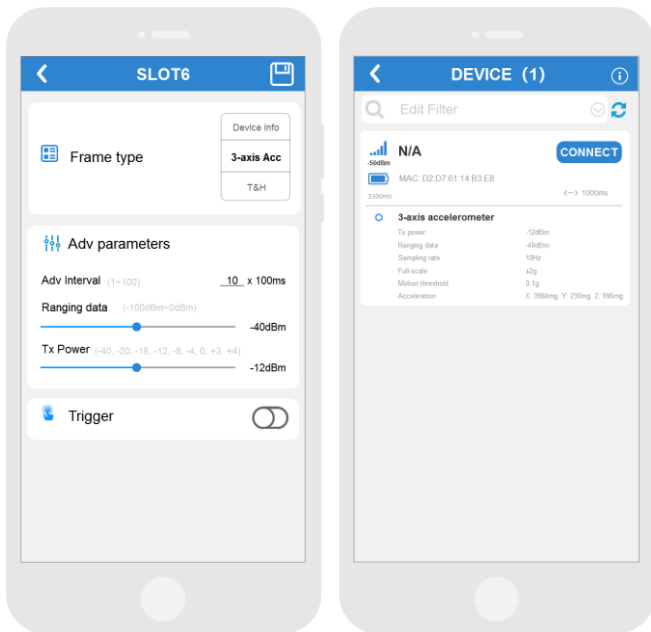


Figure 12: 3-axis Acc advertisement configuration interface

2.5.1.7 Configure T&H advertisement

This “T&H” customized advertisement is mainly designed to broadcast sampling data information from temperature and humidity sensor as well as relevant sensor parameters, and below described picture instantiations of “T&H” configuration interface and scanning interface. For more configurations of temperature & humidity sensor, please refer to [chapter 2.7.2 – Configure Temperature & Humidity sensor](#).

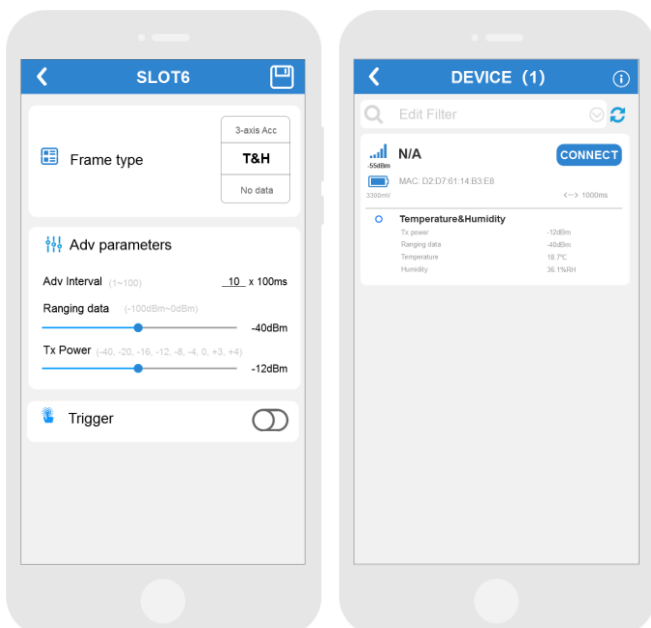


Figure 13: T&H advertisement configuration interface

2.6 Setting up your Beacon's trigger function

Trigger function is designed for some emergency states switching or some specific defined use cases, which include [Button trigger](#), [Motion trigger](#), [Temperature & humidity trigger](#) and [Ambient light trigger](#). You can identify the different custom defined event through different advertising status before and after triggered.

For instance, you can set Motion trigger as motion detection alarm feature, and set Ambient light trigger as anti-dismantle alarm feature, and etc. You can set different trigger type in different advertisement SLOT at the same time with no conflicts.

2.6.1 Setting up Button trigger

A typical application scenario for the *Button trigger* function is task completion statistics. When workers complete tasks and then double/triple tap the button to trigger specific advertisement, then cloud platform will receive it and do task statistics automatically.

For you, there have two kinds of trigger mechanism in button trigger, that is “**Press button twice**” or “**Press button three times**”. In each mechanism, there have three kinds of trigger response can be set.

Figure 14: Configurations of button trigger interface

➤ Start and keep advertising

The Beacon will start and keep advertising after *press the button twice* or *press the button three times*.

➤ Start advertising for XX s

The Beacon will start advertising for XX s after press the button twice, and then stop advertising. It is 30s default set in the firmware if enabled. (Configuration range is 1~65535)

➤ Stop advertising for XX s

The Beacon will stop advertising for XX s after press the button twice, and then start advertising. It is 30s default set in the firmware if enabled. (Configuration range is 1~65535)

2.6.2 Setting up Motion trigger

Motion trigger is widely applied for motion monitoring or asset theft prevention. For instance, when Beacon detect effective movements, it will trigger specific advertisement, then cloud platform will receive it and inform relevant person that asset is moving and the possibility of theft.

In this case, you can choose “**Device move**” trigger type and set corresponding trigger response.

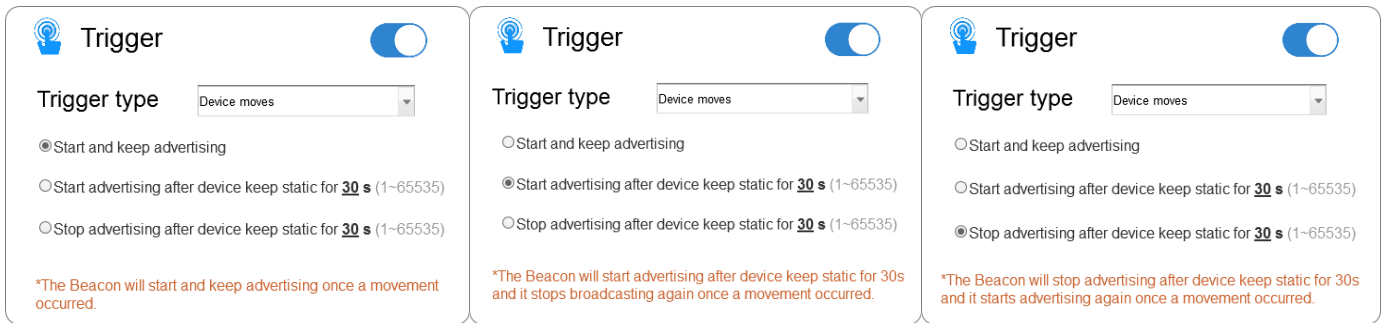


Figure 15: Configurations of motion trigger interface

➤ Start and keep advertising

The Beacon will start and keep advertising after device moves.

➤ Start advertising after device keep static for XX s

The Beacon will start advertising after device keep static for XX s, and then stop advertising if device moves. It is 30s default set in the firmware if enabled. (Configuration range is 1~65535)

➤ Stop advertising after device keep static for XX s

The Beacon will stop advertising after device keep static for XX s, and then start advertising if device moves. It is 30s default set in the firmware if enabled. (Configuration range is 1~65535)

2.6.3 Setting up Temperature & Humidity trigger

A typical use case for *temperature & humidity trigger* is the temperature and humidity monitoring alarm in the cold chain factory.

For instance, you can pre-set the alarm threshold and when sampling temperature or humidity exceeds this threshold, then alarm will be triggered and change to defined advertisement status, cloud platform will receive the defined advertisement and inform relevant person of alarm event, thus realizing the real-time monitoring.

So based on these realistic application scenarios, we have designed four kinds of trigger mechanism in Temperature & Humidity trigger, that is “**Temperature above**”, “**Temperature below**”, “**Humidity above**”, “**Humidity below**”, in order to apply for most use cases.

➤ Temperature above



Temperature threshold – Alarm that triggers when the sensor temperature is *higher than* this value, and configuration range is -20°C~60°C.

Start advertising – The Beacon will start advertising when the temperature is *higher than* the value you have set. Otherwise it will stop advertising.

Stop advertising – The Beacon will stop advertising when the temperature is *higher than* the value you have set.

Figure 16: Configurations of Temperature trigger – Temperature above

➤ Temperature below

The screenshot shows the 'Trigger' settings for 'Temperature below'. A toggle switch is turned on. The 'Trigger type' is set to 'Temperature below'. The 'Temperature threshold' is set to 30 °C. Below the slider, there are two radio buttons: 'Start advertising' (selected) and 'Stop advertising'. A note at the bottom states: '*The Beacon will start advertising when the temperature is below 30°C.'

Temperature threshold – Alarm that triggers when the sensor temperature is *lower than* this value, and configuration range is -20°C~60°C.

Start advertising – The Beacon will start advertising when the temperature is *lower than* the value you have set. Otherwise it will stop advertising.

Stop advertising – The Beacon will stop advertising when the temperature is *lower than* the value you have set.

Figure 17: Configurations of Temperature trigger – Temperature below

➤ Humidity above

The screenshot shows the 'Trigger' settings for 'Humidity above'. A toggle switch is turned on. The 'Trigger type' is set to 'Humidity above'. The 'Humidity threshold' is set to 50%. Below the slider, there are two radio buttons: 'Start advertising' (selected) and 'Stop advertising'. A note at the bottom states: '*The Beacon will start advertising when the humidity is above 50%.'

Humidity threshold – Alarm that triggers when the sensor humidity is *higher than* this value, and configuration range is 0%~95%.

Start advertising – The Beacon will start advertising when the humidity is *higher than* the value you have set. Otherwise it will stop advertising.

Stop advertising – The Beacon will stop advertising when the humidity is *higher than* the value you have set.

Figure 18: Configurations of Humidity trigger – Humidity above

➤ Humidity below

The screenshot shows the 'Trigger' settings for 'Humidity below'. A toggle switch is turned on. The 'Trigger type' is set to 'Humidity below'. The 'Humidity threshold' is set to 50%. Below the slider, there are two radio buttons: 'Start advertising' (selected) and 'Stop advertising'. A note at the bottom states: '*The Beacon will start advertising when the humidity is below 50%.'

Humidity threshold – Alarm that triggers when the sensor humidity is *lower than* this value, and configuration range is 0%~95%.

Start advertising – The Beacon will start advertising when the humidity is *lower than* the value you have set. Otherwise it will stop advertising.

Stop advertising – The Beacon will stop advertising when the humidity is *lower than* the value you have set.

Figure 19: Configurations of Humidity trigger – Humidity below

2.6.4 Setting up Ambient light trigger

Ambient light trigger can be applied in many industries as anti-dismantle alarm or unboxing monitoring features. Just stick Beacon (with ambient light sensor) in the container, when it was opened, ambient light status will be changed and then alarm will be triggered accordingly.

Based on this, you can choose “**Ambient light detected**” trigger option to set relevant configurations.

Trigger

☒ Start and keep advertising

Trigger type
Ambient light detected

☒ Start and keep advertising

☐ Start advertising after ambient light continuously detected for 30 s (1~65535)

☐ Stop advertising after ambient light continuously detected for 30 s (1~65535)

*The Beacon will start and keep advertising after ambient light detected.

Trigger

☐ Start and keep advertising

Trigger type
Ambient light detected

☐ Start and keep advertising

☒ Start advertising after ambient light continuously detected for 30 s (1~65535)

☐ Stop advertising after ambient light continuously detected for 30 s (1~65535)

*The Beacon will start advertising after device detected ambient light continuously for 30s.

Trigger

☐ Start and keep advertising

Trigger type
Ambient light detected

☐ Start and keep advertising

☐ Start advertising after ambient light continuously detected for 30 s (1~65535)

☒ Stop advertising after ambient light continuously detected for 30 s (1~65535)

*The Beacon will stop advertising after device detected ambient light continuously for 30s.

Figure 20: Configurations of Ambient light trigger

➤ Start and keep advertising

The Beacon will start and keep advertising once device detected ambient light.

➤ Start advertising after ambient light continuously detected for XX s

The Beacon will start advertising after device detected ambient light continuously for XX s. This time is specified by user and default set is 30s. During this period, if ambient light is not detected, then this trigger mechanism will not be activated. You can refer to below trigger workflow.

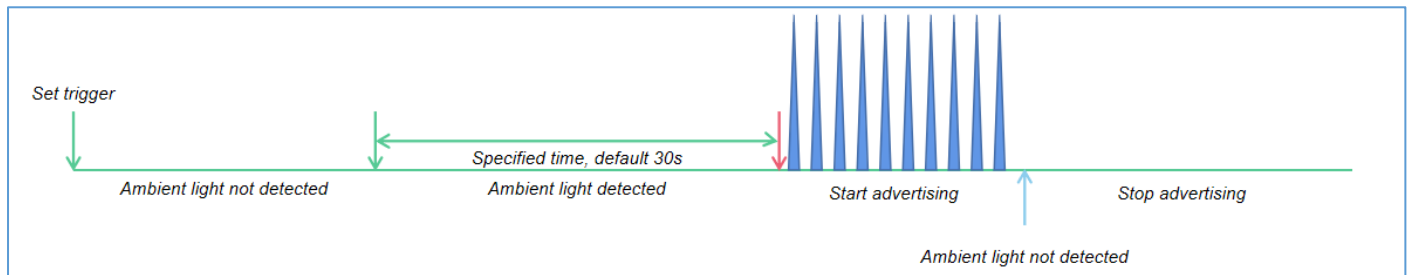


Figure 21: Workflow of Start advertising after ambient light continuously detected for XX s

➤ Stop advertising after ambient light continuously detected for XX s

The Beacon will start advertising after device detected ambient light continuously for XX s. This time is specified by user and default set is 30s. During this period, if ambient light is not detected, then this trigger mechanism will not be activated. You can refer to below trigger workflow.

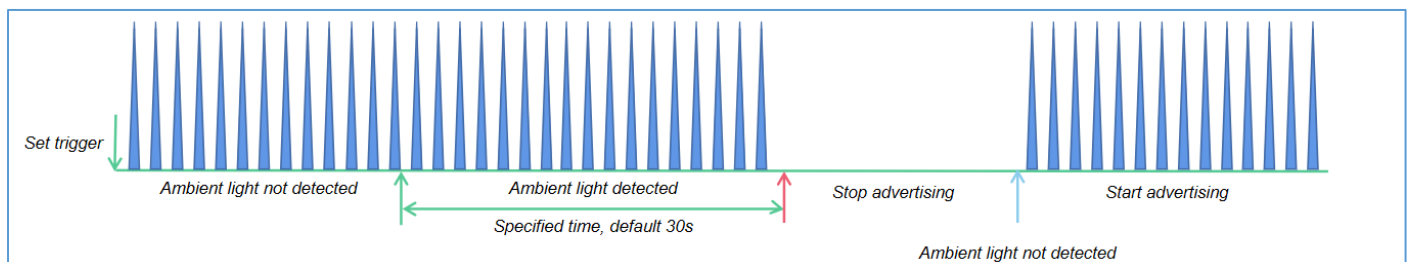


Figure 22: Workflow of Stop advertising after ambient light continuously detected for XX s

2.7 Access to sensor parameters

Regarding of current MOKO Beacon, there have several kinds of sensor are available for users to do configurations, that is **3-axis accelerometer sensor**, **Temperature & Humidity sensor** and **Ambient light sensor**. Configurable sensor will be list in **SETTING >> Sensor configurations** interface in association with your Beacon device type. For instance, If device equipped with 3-axis accelerometer sensor or temperature & humidity sensor, then it will show “3-axis accelerometer” and “Temperature & Humidity” options, and vice versa.

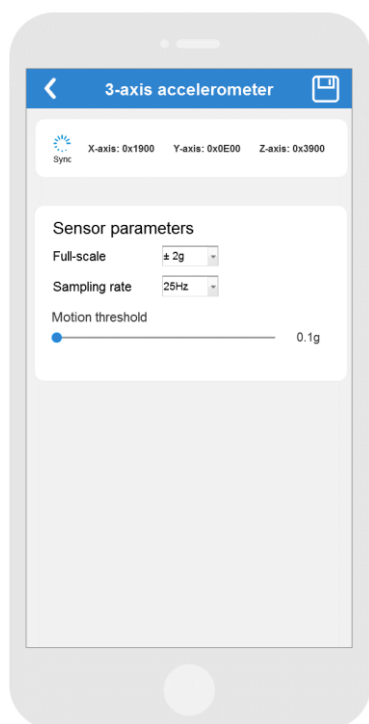
Apart from this, you can also set up your Beacon's sensor trigger function along with appropriate sensor configurations.

2.7.1 Configure 3-axis accelerometer sensor

For 3-axis accelerometer sensor, there have two main feature parts available for user to set, that is **3-axis Acc Sensor parameters** and **Motion trigger**.

For 3-axis Acc Sensor parameters, please refer to below descriptions.

For Motion trigger, please refer to [chapter 2.6.2 – Setting up Motion trigger](#).




 Sync	Real-time synchronization of raw data acquisition from 3-axis accelerometer sensor.
Full-scale	The dynamically selectable detection range value of sensor. Configuration list: $\pm 2g/\pm 4g/\pm 8g/\pm 16g$.
Sampling rate	The number of samples per second taken from sensor. Configuration list: 1Hz/10Hz/25Hz/50Hz/100Hz
Motion threshold	Sets the acceleration threshold on the sensor to detect motion event. Once the 3-axis acceleration vector sum exceeds this <i>Motion threshold</i> you have set, it means that device moved. The lower the number, the lower amount acceleration acted on the device is required to detect movements. NOTE: This threshold range is associated with Full-scale and maximum configurable threshold is consistent with the selected Full-scale, and minimum configurable range is 0.1g.

Figure 23: Configurations of 3-axis accelerometer sensor

2.7.2 Configure Temperature & Humidity sensor

For Temperature & Humidity sensor, there have two main parts available for user to set, that is **T&H Sensor parameters** and **Temperature & Humidity trigger**.

For T&H Sensor parameters, please refer to below descriptions.

For Temperature & Humidity trigger, please refer to [chapter 2.6.3 – Setting up Temperature & Humidity trigger](#).

In T&H Sensor parameters, not only you can obtain the real-time sensor data, but you can also set up the specific trigger mechanism to store the sensor data as you want. All these functions are integrated in these four items, which are [“Real-time data”](#), [“Data storage mechanism”](#), [“Sync Beacon time”](#) and [“Export T&H Data”](#).

2.7.2.1 How to set sampling interval of T&H sensor?

You can set the sampling interval of T&H sensor and monitor the T&H sensor real-time sampling data through APP in **SETTING >> Sensor configurations >> Temperature & Humidity** section, and the real-time data will refresh at the frequency which set by you in sampling interval.

Or you can monitor the T&H sensor data by receiving Beacon's T&H advertisement, for more information you can refer to [chapter 3.7 - Customized advertisement frame – "T&H"](#).

Temperature 26.1 °C

Humidity 64.8 %RH

Sampling interval 1 sec (1~65535)

Sampling interval	The time in seconds when the sensor takes a temperature and humidity measurement.
--------------------------	-----------------------------------------------------------------------------------

Figure 24: Set sampling interval of T&H sensor

NOTE:

- ① If T&H sensor sampling interval you set is larger than T&H advertising interval, Beacon will keep normal advertising by following the advertising interval but with the same T&H sensor data, until next sampling data refreshed.
- ② If T&H sensor sampling interval you set is less than T&H advertising interval, Beacon will keep normal advertising by following the advertising interval but with the last T&H sampling data, until next advertising cycle.

2.7.2.2 How to store T&H sensor sampling data in Beacon?

You can set your desired **Data storage mechanism** to store the data of temperature and humidity sensor. When the preset conditions are reached, a set of temperature and humidity data will be stored in Beacon. Below described four kinds of Data storage mechanism.

NOTE: When set 0 in Temperature or Humidity rangeability, all sampling T&H data will be stored in Beacon.

Storage trigger

Temperature 0.0 °C

Humidity

*The device stores all sampled T&H data.

Temperature	Sets the temperature rangeability threshold on the sensor. When temperature changes more than this specified value, the T&H sampling data will be stored in Beacon.
--------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 25: Set temperature storage trigger mechanism

Storage trigger

Temperature

Humidity 0.0 %RH

T&H

*The device stores all sampled T&H data.

Humidity	Sets the humidity rangeability threshold on the sensor. When humidity changes more than this specified value, the T&H sampling data will be stored in Beacon.
-----------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 26: Set humidity storage trigger mechanism

Figure 27: Set T&H storage trigger mechanism

T&H	Sets the temperature & humidity rangeability threshold on the sensor at the same time. Only when both temperature and humidity changes more than this specified value, the T&H sampling data will be stored in Beacon.
----------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Figure 28: Set interval time storage mechanism of T&H sensor

Time	The interval time in minutes to store the T&H sampling data. For instance, if you have set it as 1 min, then device will store a T&H sampling data every 1 minute.
-------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------

2.7.2.3 How to sync your Beacon time?

You can click “**Sync**” button in **SETTING >> Sensor configurations >> Temperature & Humidity** section to sync Beacon to smart phone time, and then system updated time will be displayed.

Figure 29: Synchronize Beacon time to smart phone time

2.7.2.4 How to export and erase T&H sensor Data?

You can click “**Export T&H data**” option in **SETTING >> Sensor configurations >> Temperature & Humidity** section to export and erase T&H sensor data.

NOTE: The maximum storage data record can up to 4000 pieces.

Time	Temperature(°C)	Humidity(%RH)
23/12/2021 09:31:31	18.0	76.0
23/12/2021 09:31:22	19.0	81.0
23/12/2021 09:31:11	19.0	86.0
23/12/2021 09:30:28	19.0	91.0
23/12/2021 09:30:08	20.0	91.0
23/12/2021 09:29:55	21.0	89.0
23/12/2021 09:29:47	22.0	84.0
23/12/2021 09:29:44	23.0	78.0
23/12/2021 09:29:42	23.0	71.0
23/12/2021 09:29:41	23.0	66.0
23/12/2021 09:29:40	23.0	59.0
23/12/2021 09:29:39	23.0	51.0
23/12/2021 09:29:38	21.0	45.0
23/12/2021 09:07:55	18.0	49.0
23/12/2021 09:07:39	18.0	54.0
23/12/2021 09:07:33	18.0	60.0

Figure 30: Export and erase T&H sensor data

Sync	To synchronize the stored historical <i>T&H</i> data, and at the same time to monitor the <i>T&H</i> sensor data in real time.
Display	A graph that visualizes changes in temperature and humidity data.
Erase all	To erase all stored historical <i>T&H</i> data.
Export	To export all stored historical <i>T&H</i> data through email or other methods.

2.7.3 Configure Ambient Light sensor

For Ambient Light sensor, there have two main parts available for user to set, that is **Ambient Light sensor configuration** and **Ambient light trigger**.

2.7.3.1 How to monitor ambient light status?

You can monitor the *ambient light* status through APP in **SETTING >> Sensor configurations >> Light sensor** section, and the real-time ambient light status will be refreshed once there have ambient light changes.

Or you can monitor the *ambient light* status by receiving Beacon's *Device info* advertisement, for more information you can refer to [chapter 3.5 - Customized advertisement frame – "Device info"](#).

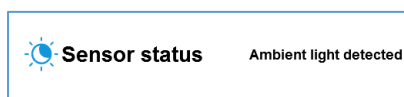


Figure 31: Monitoring interface of ambient light status

NOTE:

- ① **Ambient light detected:** Indicates that the current ambient light intensity perceived by sensor exceeds the sensor threshold.
- ② **Ambient light not detected:** Indicates that the current ambient light intensity perceived by sensor does not exceed the sensor threshold.

2.7.3.2 How to export and erase ambient light detection record?

Ambient light detection can be applied in many industries as anti-dismantle alarm or unboxing monitoring features. In this case, it will be very essential to export ambient light detection record and know the asset open/close status.

Once light sensor detected status changes, then Beacon will store the timestamp and corresponding status in order to help user to review the ambient light detection record. You can click “**Export**” and “**Erase all**” button through APP in **SETTING >> Sensor configurations >> Temperature & Humidity** section to export and erase ambient light detection record.

NOTE: The maximum storage data record can up to 500 pieces.




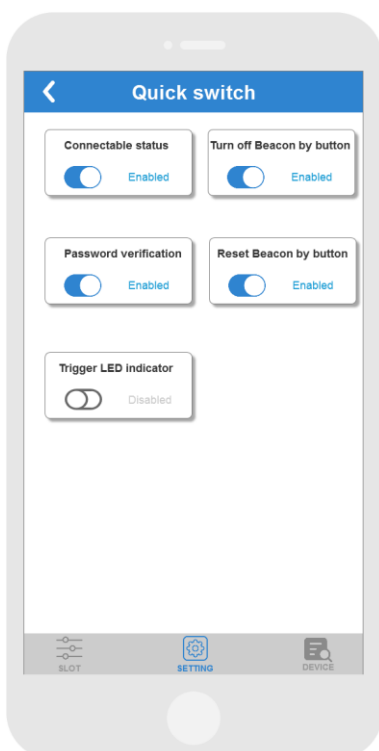
 Sync  Erase all  Export	
Time 17/08/2021 09:45:01 17/08/2021 09:45:02 17/08/2021 09:45:03 17/08/2021 09:45:04 17/08/2021 08:45:05 17/08/2021 19:45:06 17/08/2021 09:45:07	Sensor status Ambient light detected Ambient light not detected Ambient light detected Ambient light not detected Ambient light detected Ambient light not detected Ambient light detected
Sync	To synchronize the stored historical ambient light detection record, and at the same time to monitor the ambient light status in real time.
Erase all	To erase all stored historical ambient light detection record.
Export	To export all stored historical ambient light detection record through email or other methods.

Figure 32: Sync and export ambient light detection record

2.8 Quick switch for basic features

In current firmware, there have some basic functions such as “Turn off Beacon by button”, “Reset Beacon by button” and etc. As well, we have designed switch for these basic functions, you can disable/enable these features through the switch, thus adapting to different use cases.

You can turn on/off these function switch in **SETTING >> Quick switch** section, and below shows the *Quick switch* interface as well as relevant feature descriptions.



Switch type	FW Version < V2.0.0	FW Version ≥ V2.0.0
Connectable status	Support	Support
Turn off Beacon by button	Support	Support
Password verification	Support	Support
Reset Beacon by button	Not support	Support
Trigger LED indicator	Not support	Support

Figure 33: Configurations of Quick switch interface

2.8.1 Switch your Beacon to unconnectable

In some cases, you will need to disable the Beacon connectable property, to let it working as the location tag. So you can disable the connectable status in **SETTING >> Quick switch >> Connectable status**. After disabled, device will not be connected by master BLE device any more unless you hardware reset the Beacon.

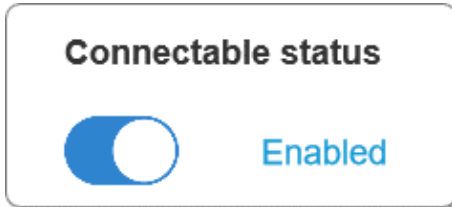


Figure 34: Switch your Beacon to unconnectable

2.8.2 Disable your Beacon's button function

Basically the independent button in the Beacon was designed to realize power off or reset functions, but in some specific cases, there will need to disable the button functions in order to avoid intended shut down or reset operations. So logically there also have the switch to enable/disable these functions.

You can go to **SETTING >> Quick switch >> Turn off Beacon by button** and **SETTING >> Quick switch >> Reset Beacon by button** to disable these two button control functions.

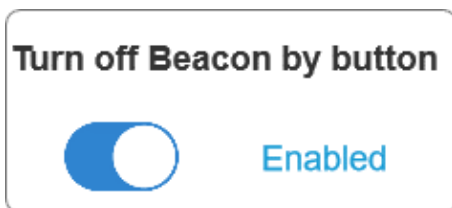


Figure 35: Disable button power off function

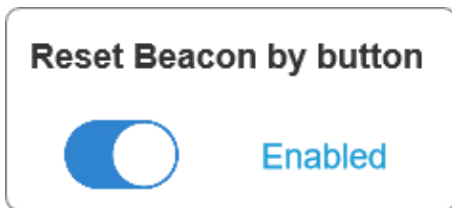


Figure 36: Disable button reset function

2.8.3 Disable password verification

You can go to **SETTING >> Quick switch >> Password verification** to disable password verification, after password verification disabled, there will no need to input password when you connect with Beacon. Under this circumstance, you will not be able to change password or reset Beacon due to security process restrictions.

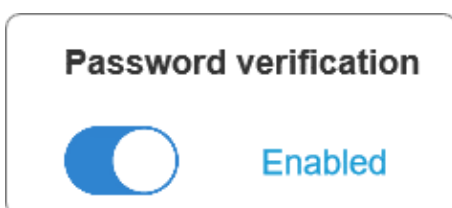


Figure 37: Disable password verification

2.8.4 Enable trigger LED indicator

In terms of trigger function, there also developed LED indicator mechanism for the trigger function, to remind user whether alarm be triggered or not. That is, when alarm be triggered, LED will blink 1 time for reminder, it is applicable for all trigger functions, which include button trigger, motion trigger, T&H trigger and ambient light trigger.

This function is OFF by default, and you can enable it through **SETTING >> Quick switch >> Trigger LED indicator**.

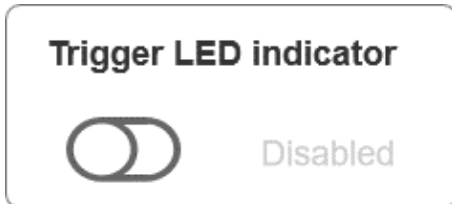


Figure 38: Enable trigger LED indicator

2.9 Remote turn off your Beacon

In some cases that mechanical button function should be disabled or without mechanical button, to avoid intentional shut down situations, then we will need remote shut down function for backup.

You can remote turn off your Beacon by just tapping **SETTING >> Turn off Beacon** option, then it will give prompt to you to confirm the shut down operations.



Notice – Please make sure that device have mechanical button, or other ways to turn on the Beacon before you do remote shut down operations.

2.10 Remote reset your Beacon

In some cases that mechanical button function should be disabled or without mechanical button, to avoid intentional reset situations, then we will need remote reset function for backup.

You can remote reset your Beacon by just tapping **SETTING >> Reset Beacon** option, then it will give prompt to you to confirm the reset operations.

2.11 Modify your Beacon's connection password

In MOKO firmware, password verification is ON by default and set "Moko4321" as default connection password. You can modify your Beacon's connection password by just tapping **SETTING >> modify password** option, and then input the password as you want.

Device connection will be interrupted after password modified, and it will be restore to firmware default password (Moko4321) if Beacon is reset.

NOTE:

- ① Connection password should not exceed 16 characters in length.

2.12 Upgrade your Beacon's firmware

The Beacon can realize OTA firmware update through DFU operations. Regarding of different import method of android APP and iOS app, here we will describe the detailed steps separately.

2.12.1 Android – MOKO APP DFU instructions

Step 1: Copy the upgrade package to a folder in the root directory of the smartphone.

Step 2: **Connect** with device and go to “**SETTING**” interface, press “**DFU**” option and then file manager route of smartphone will be prompted.

Step 3: Choose the required upgrade firmware package and the upgrade process will start automatically. Wait for the upgrade to complete, APP will disconnect with Beacon after upgrade completed successfully.

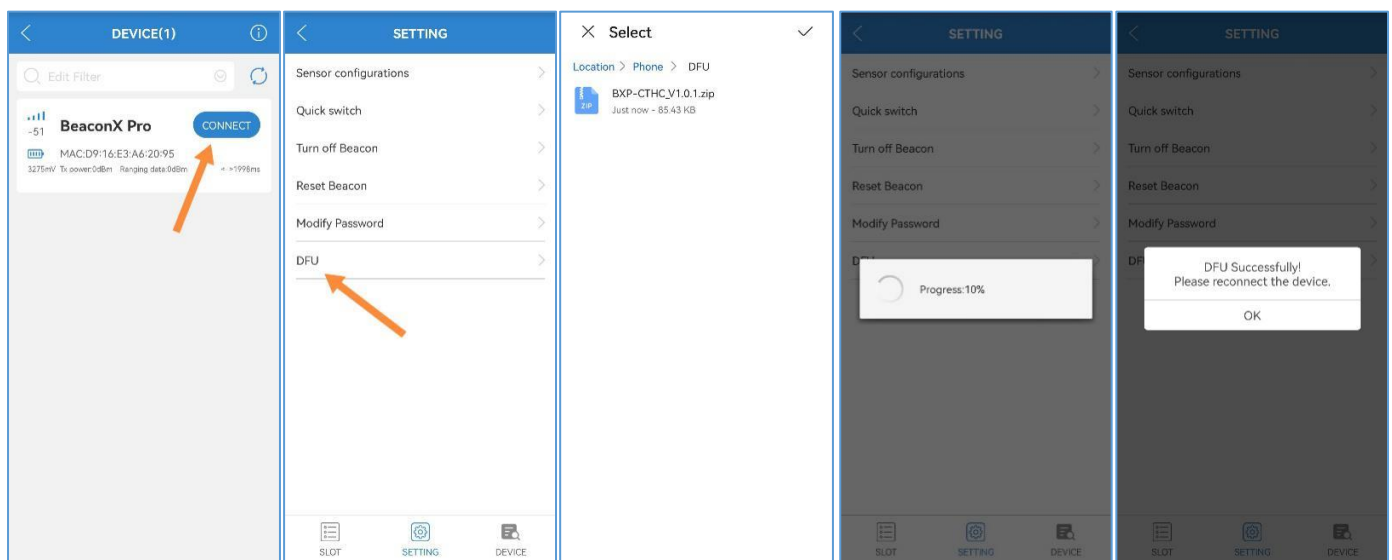


Figure 39: Firmware upgrade workflow of MOKO standard application (Android)

2.12.2 iOS – MOKO APP DFU instructions

Step 1: Install iTunes in PC and then import firmware upgrade package into APPLE phones, you can refer to below picture demonstrations – **Figure 35: Load upgrade package to nRF connect APP via iTunes.**

Step 2: Connect with device and go to “**SETTING**” interface, press “**DFU**” option and then firmware upgrade package will be shown automatically in DFU path.

Step 3: Choose the required upgrade firmware package and then start DFU process. Wait for the upgrade to complete, APP will disconnect with Beacon after upgrade completed successfully.

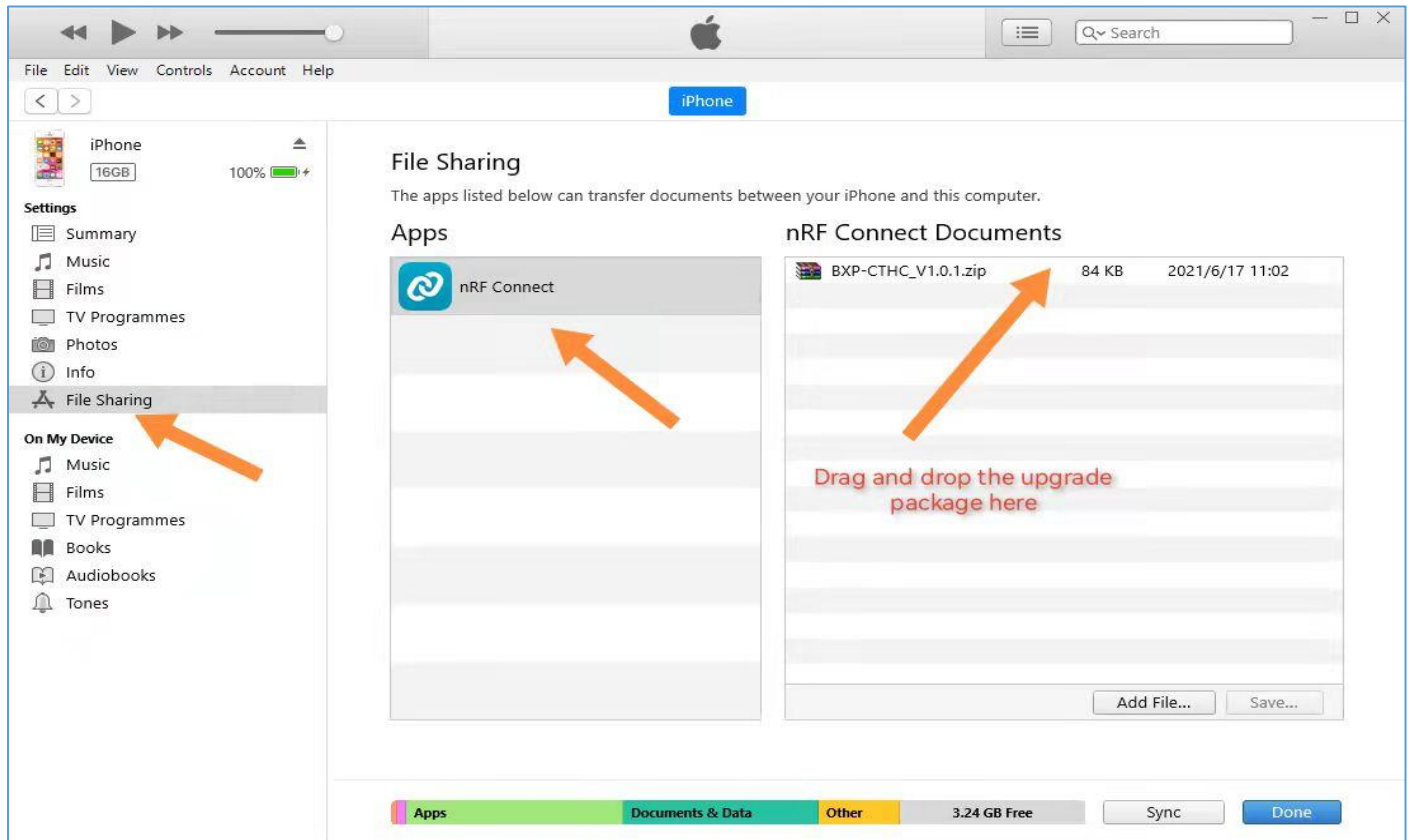


Figure 40: Load upgrade package to nRF connect APP via iTunes

2.12.3 DFU failure considerations

If the DFU fails, it can be mostly considered from below aspects:

- Check whether the firmware upgrade package is correct.
- Check if the APP is the latest version in APP store.
- Try to change the DFU file path and try again.
- Try to change the phone and try again.

If NONE of above operations are effective, please contact with MOKO sales team.

2.13 Check your about device information

In some cases, you will need to know the firmware version of Beacon, or product model and etc. You can go to **Device** interface to check and confirm these essential information.

In customization firmware, these information can also be edit as customer required.

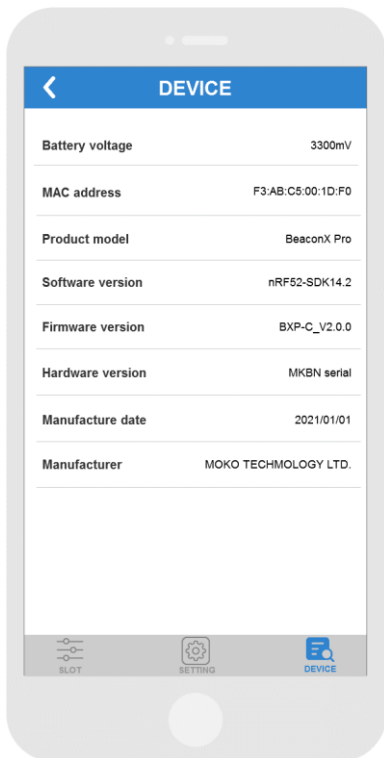


Figure 41: Device information display interface

2.14 Obtain log file from Android APP

Sometimes when testing with our APP, there may occurred some issues that cannot be reproduced in MOKO side, then we will need you to help obtain the log file from android APP and then provide for us to further analysis.

Currently only Android APP support log record, and the **LOG** option is in “**Beacon firmware options**” interface, you can export the log file and then send to us by following below steps if rare issue happened:

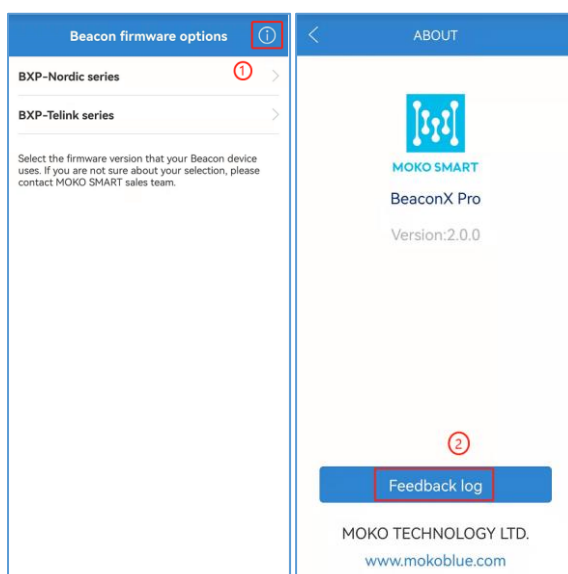


Figure 42: Obtain log file from Android APP

3. Content parsing of Beacon advertisement

In terms of MOKO standard firmware, there contained several kinds of advertisement frame type which include standard format and customized format, that is:

- Google Eddystone™ - UID
- Google Eddystone™ - URL
- Google Eddystone™ - TLM (Unencrypted)
- Customized advertisement frame - “iBeacon”
- Customized advertisement frame - “Device info”
- Customized advertisement frame - “3-axis Acc”
- Customized advertisement frame - “T&H”
- No data

3.1 Google Eddystone – UID

In terms of UID advertisement frame type, this is exactly complied with Google Eddystone regulations, and you can refer to below link for more information:

<https://github.com/google/eddystone/tree/master/eddystone-uid>

Below picture showed the example content of **UID** advertisement:

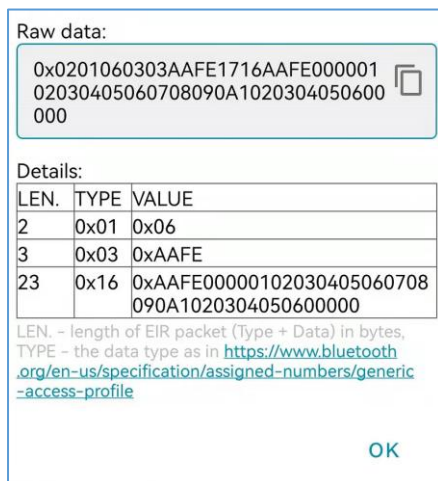


Figure 43: Example content of UID advertisement

Below table described the detailed content structure of **UID** advertisement:

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Flags content
01	Data type	0x01	AD type: Flags
02	Advertising type	0x06	BR/EDR not supported / LE general discoverable mode
03	Data length	0x03	AD length of Complete List content
04	Data type	0x03	AD type: Complete List of 16-bit Service Class UUIDs

Byte offset	Field	Example Value	Description
05-06	Service UUID	0xAA FE	Google Eddystone UUIDs
07	Data length	0x17	AD length of Service Data content
08	Data Type	0x16	AD type: Service Data
09-10	Service UUID	0xAA FE	Google Eddystone UUIDs
11	Frame type	0x00	Google Eddystone frame type, 0x00: UID
12	RSSI@0m	0x00	Calibrated Tx power at 0 m, defined by user
13-22	Namespace ID	0x01 02 03 04 05 06 07 08 09 0A	10-bytes Namespace ID, defined by user
23-28	Instance ID	0x10 20 30 40 50 60	6-bytes Instance ID, defined by user
29-30	RFU	0x00 00	2-bytes reserved for future use, must be 0x00 00

Table 2: Content structure of UID advertisement

3.2 Google Eddystone – URL

In terms of URL advertisement frame type, this is exactly complied with Google Eddystone regulations, and you can refer to below link for more information: <https://github.com/google/eddystone/tree/master/eddystone-url>

Below picture showed the example content of **URL** advertisement:

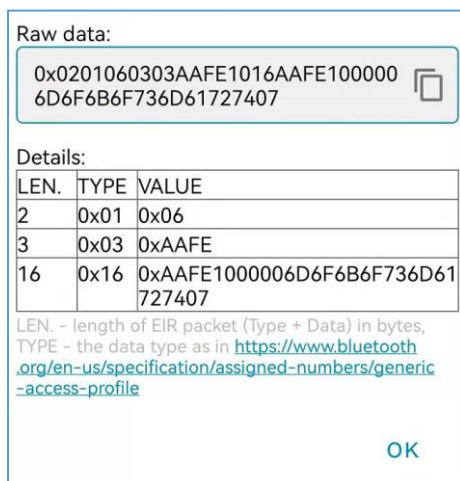


Figure 44: Example content of URL advertisement

Below table described the detailed content structure of **URL** advertisement:

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Flags content
01	Data type	0x01	Ad type: Flags
02	Advertising type	0x06	BR/EDR not supported / LE general discoverable mode
03	Data length	0x03	AD length of Complete List content
04	Data type	0x03	AD type: Complete List of 16-bit Service Class UUIDs
05-06	Service UUID	0xAA FE	Google Eddystone UUIDs
07	Data length	0x10	AD length. This data length is variable and determined by the input URL string, length range will be 4-23 bytes
08	Data Type	0x16	Ad type: Service Data
09-10	Service UUID	0xAA FE	Google Eddystone UUIDs
11	Frame type	0x10	Google Eddystone frame type, 0x10: URL

Byte offset	Field	Example Value	Description
12	RSSI@0m	0x00	Calibrated Tx power at 0 m, defined by user
13	URL Scheme Prefix	0x00	Encoded Scheme prefix, 0x00 – 0x03 0x00: http://www. 0x01: https://www. 0x02: http:// 0x03: https://
14-22	Encoded URL	0x6D 6F 6B 6F 73 6D 61 72 74 07	Input example URL (characteristics). Content parse: <i>mokosmart.com</i> For more details, please visit Google Eddystone - <i>eddytone/README.md at master · google/eddytone (github.com)</i>

Table 3: Content structure of UID advertisement

3.3 Google Eddystone – TLM (Unencrypted)

In terms of TLM advertisement frame type, this is exactly complied with Google Eddystone regulations, and you can refer to below link for more information: <https://github.com/google/eddytone/blob/master/eddytone-tlm/tlm-plain.md>

Below picture showed the example content of **TLM** advertisement:

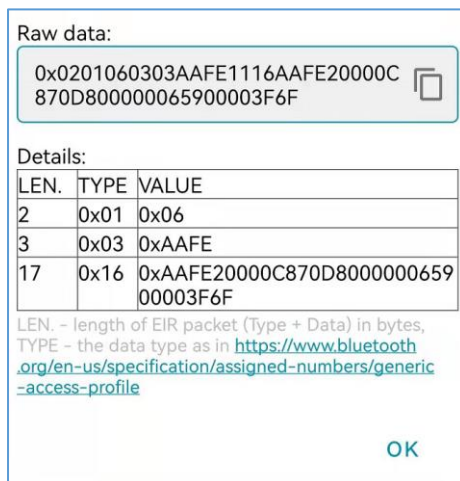


Figure 45: Example content of TLM advertisement

Below table described the detailed content structure of **TLM** advertisement:

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Flags content
01	Data type	0x01	AD type: Flags
02	Advertising type	0x06	BR/EDR not supported / LE general discoverable mode
03	Data length	0x03	AD length of Complete List content
04	Data type	0x03	AD type: Complete List of 16-bit Service Class UUIDs
05-06	Service UUID	0xAA FE	Google Eddystone UUIDs
07	Data length	0x11	AD length of Service Data content
08	Data Type	0x16	AD type: Service Data
09-10	Service UUID	0xAA FE	Google Eddystone UUIDs
11	Frame type	0x20	Google Eddystone frame type, 0x20: TLM
12	RSSI@0m	0x00	Calibrated Tx power at 0 m, defined by user

Byte offset	Field	Example Value	Description
13-14	Battery voltage	0x0C 87	Battery voltage is the current battery charge in millivolts, expressed as 1 mV per bit. Content parse: 3207mV
15-16	Beacon temperature	0x0D 80	Beacon temperature is the temperature in degrees Celsius sensed by the beacon and expressed in a signed 8.8 fixed-point notation. 2 bytes, Content Parse: 0D>>>13, 80>>128. In 8.8 notation, it should be $13+128/256=13.5^{\circ}\text{C}$.
17-20	ADV_CNT	0x00 00 0E 08	ADV_CNT is the running count of advertisement frames of all types emitted by the beacon since power-up or reboot, useful for monitoring performance metrics that scale per broadcast frame. If this value is reset (e.g. on reboot), the current time field must also be reset. 4 bytes, Content parse: 3592
21-24	SEC_CNT	0x00 00 8C 45	SEC_CNT is a 0.1 second resolution counter that represents time since beacon power-up or reboot. If this value is reset (e.g. on a reboot), the ADV count field must also be reset. 4 bytes, Content parse: 0x00 00 8C 45>>>35909, that is 3590.9s which equal to HH:MM:SS.000 format - 00:59:50.900(s).

Table 4: Content structure of TLM advertisement

3.4 Customized advertisement frame – “iBeacon”

This *Customized iBeacon* advertisement frame is combined with two parts, one is standard APPLE iBeacon format which comply with APPLE iBeacon regulations, another one is customized scan response packet.

What the purpose of adding extra scan response packet is just displaying more information in iOS APP, as APP cannot get the detail information from APPLE iBeacon advertisement due to iOS system restrictions. For APPLE iBeacon regulations, you can refer to below link for further information: <https://developer.apple.com/ibeacon/Getting-Started-with-iBeacon.pdf>.

Below picture showed the example content of *Customized-iBeacon* advertisement:

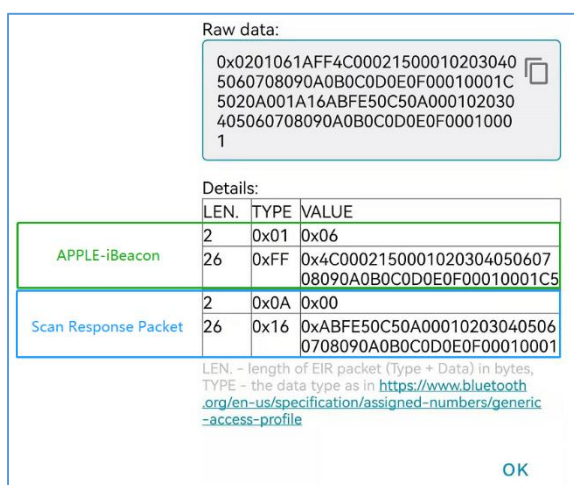


Figure 46: Example content of Customized-iBeacon advertisement

Here we will divide **Customized-iBeacon** advertisement into *APPLE-iBeacon advertising packet* and *Scan Response Packet* for separate content parse:

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Flags content
01	Data type	0x01	AD type: Flags
02	Advertising type	0x06	BR/EDR not supported / LE general discoverable mode
03	Data length	0x1A	AD length of Manufacture Specific Data content
04	Data type	0xFF	AD type: Manufacture Specific Data
05-06	Service UUID	0x4C 00	Apple Inc. <0x004C> (Little-endian)
07	Data type	0x02	Apple defined data type, 0x02: Beacon
08	Data length	0x15	AD length of Apple defined Beacon type content
09-24	iBeacon UUID	0x00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F	16 bytes, iBeacon UUID. Application developers should define a UUID specific to their app and deployment use case.
25-26	Major	0x00 01	2-bytes, iBeacon Major. Further specifies a specific iBeacon and use case. For example, this could define a sub-region within a larger region defined by the UUID. Configuration range: 1~65535
27-28	Minor	0x 00 01	2-bytes, iBeacon Minor. Allows further subdivision of region or use case, specified by the application developer. Configuration range: 1~65535
29	RSSI@1m	0xC5	1byte, Calibrated Tx power at 1 m; Configuration range: -100~0dBm

Table 5: Content structure of Customized-iBeacon advertising packet

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Tx Power Level content
01	Data type	0x0A	AD type: Tx Power Level
02	Advertising type	0x00	1 byte signed integer, Tx Power, unit: dBm. Content parse: 0dBm
03	Data length	0x1A	AD length of Service Data content
04	Data type	0x16	AD type: Service Data
05-06	Service UUID	0xAB FE	MOKO-Defined UUIDs
07	Frame type	0x50	MOKO-Defined advertisement frame type; 0x50: iBeacon frame. For more MOKO-Defined advertisement frame type regulations, please refer to appendix - Frame type of MOKO defined advertisement .
08	RSSI@1m	0xC5	1byte, Calibrated Tx power at 1 m; (Same as the RSSI@1m in iBeacon advertisement)
09	Adv interval	0x0A	Slot advertisement interval, unit: 100ms/digit. Content parse: 1000ms
09-24	iBeacon UUID	0x00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F	16-bytes, iBeacon UUID. (Same as the UUID in iBeacon advertisement)
25-26	Major	0x00 01	2-bytes, iBeacon Major. (Same as the Major in iBeacon advertisement)
27-28	Minor	0x 00 01	2-bytes, iBeacon Minor. (Same as the Minor in iBeacon advertisement)

Table 6: Content structure of Customized-iBeacon response packet

3.5 Customized advertisement frame – “Device info”

This “Device info” advertisement frame is customized by MOKO and mainly designed to transfer device name, battery voltage and etc. It is also combined with two parts, one is advertising packet and another one is Scan Response Packet.

Below picture showed the example content of **Customized-Device info** advertisement:

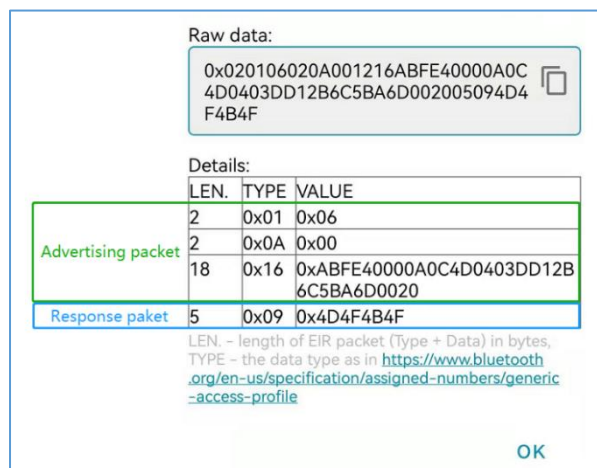


Figure 47: Example content of Customized-Device info advertisement

Here we will divide **Customized-Device info** advertisement into *advertising packet* and *Scan Response Packet* for separate content parse:

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Flags content
01	Data type	0x01	AD type: Flags
02	Advertising type	0x06	BR/EDR not supported / LE general discoverable mode
03	Data length	0x02	AD length of Tx Power Level content
04	Data type	0x0A	AD type: Tx Power Level
05	Advertising type	0x00	1 byte signed integer, Tx Power, unit: dBm. Content parse: 0dBm
06	Data length	0x12	AD length of Service Data content
07	Data type	0x16	AD type: Service Data
08-09	Service UUID	0xAB FE	MOKO-Defined UUIDs
10	Frame type	0x40	MOKO-Defined advertisement frame type; 0x40: Device info frame. For more MOKO-Defined advertisement frame type regulations, please refer to appendix-MOKO defined advertisement frame type .
11	Ranging data	0x00	Value that's put into the advertising data that declares to receiving devices what the power should be at a specific distance. Configuration range: -100~0dBm
12	Adv interval	0x0A	Slot advertisement interval, unit: 100ms
13-14	Battery voltage	0x0C 4D	Battery voltage is the current battery charge in millivolts, expressed as 1 mV per bit. Example Content parse: 3149mV
15	Device property indicator	0x04	1 byte to indicate device property info in Beacon. Bit 0-1: Password verification status (00-Enabled; 10-Disabled) Bit 2: Ambient light sensor status (0-Not equipped; 1-Equipped)

Byte offset	Field	Example Value	Description
			Bit 3-7: RFU Example content parse: 04(HEX)>>>0000 0100(BIN)>>>Ambient light sensor equipped & Password verification enabled
16	Switch status indicator	0x03	1 byte to indicate feature switch status in Beacon. Bit 0: Connectable status (0-Unconnectable; 1-Connectable) Bit 1: Ambient light status (0-Ambient light not detected; 1-Ambient light detected) Bit 2-7: RFU Example content parse: 03(HEX)>>>0000 0011(BIN)>>>Ambient light detected & Connectable
17-22	MAC address	0xDD 12 B6 C5 BA 6D	Beacon MAC address
23	Firmware type	0x00	1-byte to indicate firmware type. 0x00: BXP-C; 0x01: BXP-D; 0x02: BXP-TLA
24	Firmware version	0x20	1-byte to indicate firmware version; Bit 0-3: secondary version; Bit 4-7: Main version Example content parse: 0x20(HEX)>>>0010 0000(BIN)>>>2.0(Firmware version)

Table 7: Content structure of Customized-Device info advertising packet

Byte offset	Field	Example Value	Description
00	Data length	0x05	AD length
01	Data type	0x09	AD type: Complete local name
02-05	Advertising type	0x4D 4F 4B 4F	1-20 bytes device name, comply with US-ASCII standard. Example content parse: MOKO

Table 8: Content structure of Customized-Device info response packet

3.6 Customized advertisement frame – “3-axis Acc”

This “3-axis Acc” advertisement frame is customized by MOKO and mainly designed to transfer 3-axis accelerometer sensor configuration parameters, sensor data, battery voltage and etc.

Below picture showed the example content of **Customized- 3-axis ACC** advertisement:



Figure 48: Example content of Customized-3-axis ACC advertisement

Below table described the detailed content structure of **Customized- 3-axis ACC** advertisement:

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Flags content
01	Data type	0x01	AD type: Flags
02	Advertising type	0x06	BR/EDR not supported / LE general discoverable mode
03	Data length	0x02	AD length of Tx Power Level content
04	Data type	0x0A	AD type: Tx Power Level
05	Tx power	0x00	1 byte signed integer, Tx Power, unit: dBm. Content parse: 0dBm
06	Data length	0x18	AD length of Service Data content
07	Data Type	0x16	AD type: Service Data
08-09	Service UUID	0xAB FE	MOKO-Defined UUIDs
10	Frame type	0x60	MOKO-Defined advertisement frame type; 0x60: 3-axis ACC frame. For more MOKO-Defined advertisement frame type regulations, please refer to appendix-MOKO defined advertisement frame type .
11	Ranging data	0x00	Value that's put into the advertising data that declares to receiving devices what the power should be at a specific distance. Configuration range: -100~0dBm
12	Adv interval	0x0A	Slot advertisement interval, unit: 100ms
13	Sampling rate	0x01	Sampling rate of 3-axis accelerometer sensor, 10Hz by default. For more, please refer to appendix – Sampling rate comparison table
14	Full-scale	0x00	Full-scale of 3-axis accelerometer sensor, $\pm 2g$ by default. For more, please refer to appendix – Full-scale comparison table
15	Motion threshold	0x01	Motion threshold to judge movements, unit: 0.1g/digit. Example content parse: 0.1g
16-17	X-axis Raw data	0xFE C0	2-bytes, X-axis raw data. For calculating algorithm, please refer to FAQ - How to calculate raw data of 3-axis accelerometer sensor?
18-19	Y-axis Raw data	0xFE C0	2-bytes, Y-axis raw data
20-21	Z-axis Raw data	0xC3 C0	2-bytes, Z-axis raw data
22-23	Battery voltage	0x0C 45	Battery voltage is the current battery charge in millivolts, expressed as 1 mV per bit. Content parse: 3141mV
24	RFU	0x00	Reserved for future use, 0x00 by default
25-30	MAC address	0xDD 12 B6 C5 BA 6D	Beacon MAC address

Table 9: Content structure of Customized-3-axis ACC advertisement

3.7 Customized advertisement frame – “T&H”

This “**T&H**” advertisement frame is customized by MOKO and mainly designed to transfer Temperature & Humidity sensor configuration parameters, sensor data, battery voltage and etc.

Below picture showed the example content of **Customized-Device info** advertisement:

Raw data:

0x020106020A001316ABFE70000A00
 C801370C2B03D916E3A62095

Details:

LEN.	TYPE	VALUE
2	0x01	0x06
2	0x0A	0x00
19	0x16	0xABFE70000A00C801370C2B03 D916E3A62095

LEN. - length of EIR packet (Type + Data) in bytes,
 TYPE - the data type as in <https://www.bluetooth.org/en-us/specification/assigned-numbers/generic-access-profile>

OK

Figure 49: Example content of Customized-T&H advertisement

Below table described the detailed content structure of **Customized-T&H** advertisement:

Byte offset	Field	Example Value	Description
00	Data length	0x02	AD length of Flags content
01	Data type	0x01	AD type: Flags
02	Advertising type	0x06	BR/EDR not supported / LE general discoverable mode
03	Data length	0x02	AD length of Tx Power Level content
04	Data type	0x0A	AD type: Tx Power Level
05	Tx power	0x00	1 byte signed integer, Tx Power, unit: dBm. Content parse: 0dBm
06	Data length	0x13	AD length of Service Data content
07	Data Type	0x16	AD type: Service Data
08-09	Service UUID	0xAB FE	MOKO-Defined UUIDs
10	Frame type	0x70	MOKO-Defined advertisement frame type; 0x60: T&H frame. For more MOKO-Defined advertisement frame type regulations, please refer to appendix-MOKO defined advertisement frame type .
11	Ranging data	0x00	Value that's put into the advertising data that declares to receiving devices what the power should be at a specific distance. Configuration range: -100~0dBm
12	Adv interval	0x0A	Slot advertisement interval, unit: 100ms
13-14	Sampling temperature	0x00 C8	Sampling temperature in 2 bytes (Signed integer), unit: 0.1°C/digit. Example content parse: 0x00 C8(HEX)>>>200(DEC)>>>20.0°C
15-16	Sampling humidity	0x01 37	Sampling humidity in 2 bytes (Unsigned integer), unit: 0.1%/digit. Example content parse: 0x01 37(HEX)>>>311(DEC)>>>31.1%(Humidity)
17-18	Battery voltage	0x0C 2B	Battery voltage is the current battery charge in millivolts, expressed as 1 mV per bit. 2 bytes, Content parse: 3141mV
19	Device type	0x03	Reserved for future use, 0x00 by default
20-25	MAC address	0xD9 16 E3 A6 20 95	Beacon MAC address

Table 10: Content structure of Customized-T&H advertisement

4. Common instructions of “nRF connect” APP

In case of some customers who using the “nRF connect” APP to compatible with different vendors’ Beacon, here we have listed some common instructions of **android “nRF connect” APP** as a template.

4.1 How to unlock device (password verification)?

Due to most operations based on device unlocked status, so here described the steps to unlock device based on **Android nRF Connect** APP in order to continue other operations further.

For **iOS nRF Connect APP**, you can also follow this similar steps with same **SERVICES** and **CHARACTERISTICS**. This chapter will not give example of password verification for **iOS nRF Connect APP** again.

Step 1: Connect device - ①.

Step 2: Click “**Eddystone configuration Service**”- **UUID: a3c87500-8ed3-4bdf-8a39-a01bebede295** and read **unlock** characteristic - **UUID: a3c87507-8ed3-4bdf-8a39-a01bebede295** - ② first.

Step 3: Write **unlock** property - ③ and there will have a prompt. In this step , you need to convert password (ASCII) into HEX first and then input in the option box. If password is less than 16 bytes, then you will need to add “FFFF” (case insensitive) behind to full-fill 16 bytes accordingly.

For instance: If you are using default connection password in the firmware – “Moko4321” (ASCII), the corresponding HEX is “4d6f6b6f34333231”. Due to this password is less than 16 bytes, so you will need to add “FFFFFFFFFFFFFF” behind and then input option box.

Step 4: Read **lock state** characteristic – **UUID: a3c87506-8ed3-4bdf-8a39-a01bebede295** - ④ and it will shows “0x01” (unlocked).

NOTE: If you disabled password verification in the Beacon, it will be no need to do “unlock device” operations.

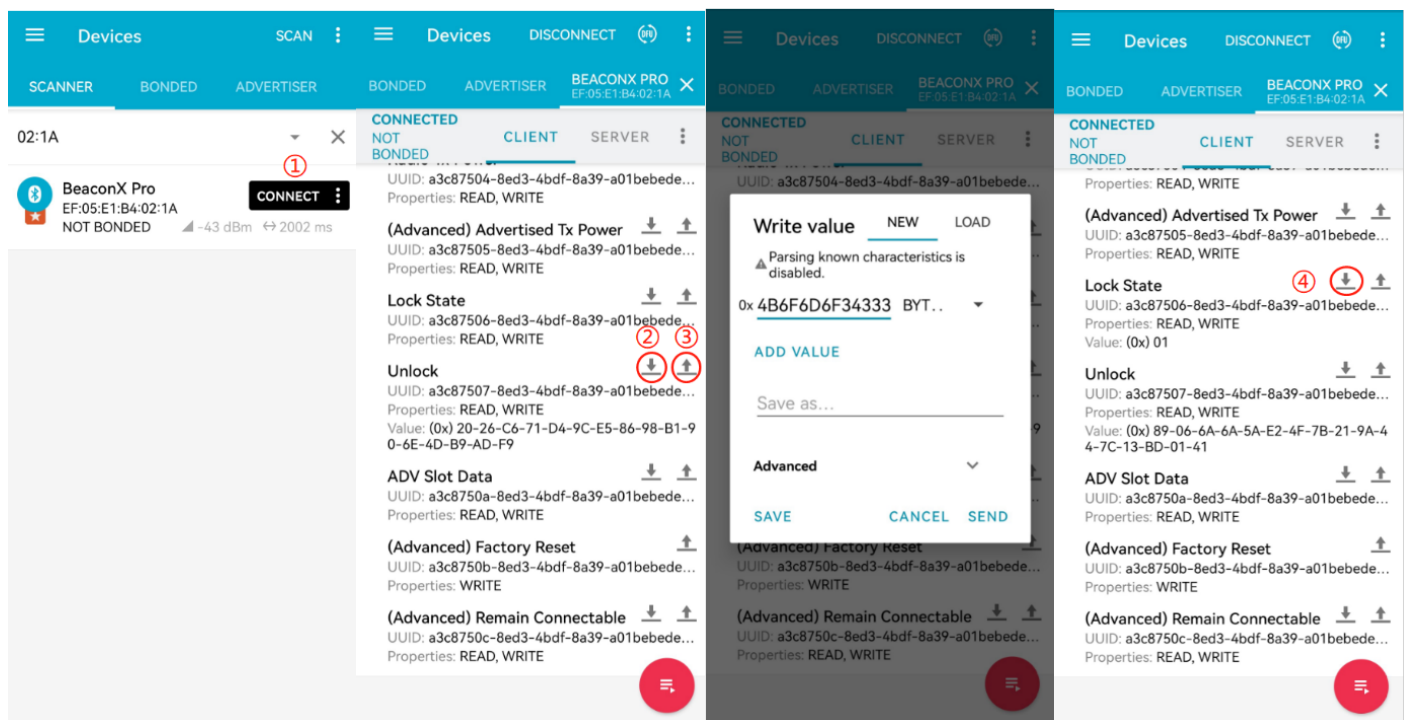


Figure 50: Workflow of unlocking device in android nRF Connect APP

4.2 How to modify device name?

Step 1: *Connect* device.

Step 2: *Unlock* device. Please refer to [chapter 4.1 – How to unlock device.](#)

Step 3: Modify device name

- ① Assume that you will need to modify device name into “Moko4321”, then convert into HEX – “4d6f6b6f34333231”
- ② Find “**ADV Slot Data**” characters in “**Eddystone configuration Service**”, then input “404d6f6b6f34333231” and press OK. Device name will be shown as “Moko4321”.

4.3 How to upgrade firmware through “nRF connect” APP?

4.3.1 Android – “nRF connect” APP DFU instructions

Step 1: Copy the upgrade package to a folder in the root directory of the smartphone.

Step 2: Turn on the Bluetooth of the smartphone and use the **nRF Connect** APP to scan the Beacon with the default name of **BeaconX Pro**. (You can use the filtering function of the APP to filter the Beacon name)

Step 3: *Connect* device.

Step 4: *Unlock* device. Please refer to [chapter 4.1 – How to unlock device.](#)

Step 5: Click the **DFU** button on the top of the screen and select the **Distribution packet (ZIP)** from the file type list, and then select the upgrade package from the smartphone folder.

Step 6: The upgrade process will start automatically and wait for the upgrade to complete, APP will disconnect with Beacon after upgrade completed successfully.

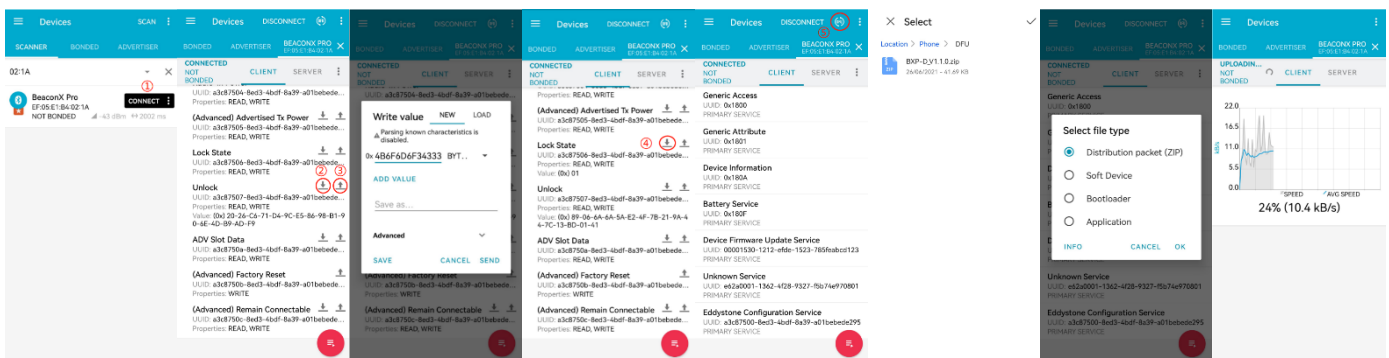


Figure 51: Firmware upgrade workflow of Android nRF Connect APP

4.3.2 iOS – “nRF connect” APP DFU instructions

Step 1: Use the desktop application **iTunes** to load the upgrade package to the **nRF Connect** App. You need connect your iPhone to your computer using the USB cable. Click your device in iTunes and then click **File Sharing** in the left sidebar of iTunes. You can find the **nRF Connect** on the Apps list and then drag and drop the upgrade package from a folder or window onto the **Documents** list to copy it to the **nRF Connect** App on your smartphone. Please refer to [Figure 35: Load upgrade package to nRF connect APP via iTunes.](#)

Step 2: Turn on the Bluetooth of the smartphone and use the **nRF Connect** APP to scan the Beacon with the default name of **BeaconX Pro**. (You can use the filtering function of the APP to filter the Beacon name)

Step 3: **Connect** device and then **Unlock** device. Please refer to [chapter 4.1 – How to unlock device.](#)

Step 4: Click the **DFU** button on the top of the screen and select the upgrade package.

Step 5: Click the **Start** button on the bottom of the screen and the upgrade process will start automatically. Wait for the upgrade to complete, APP will disconnect with Beacon after upgrade completed successfully.

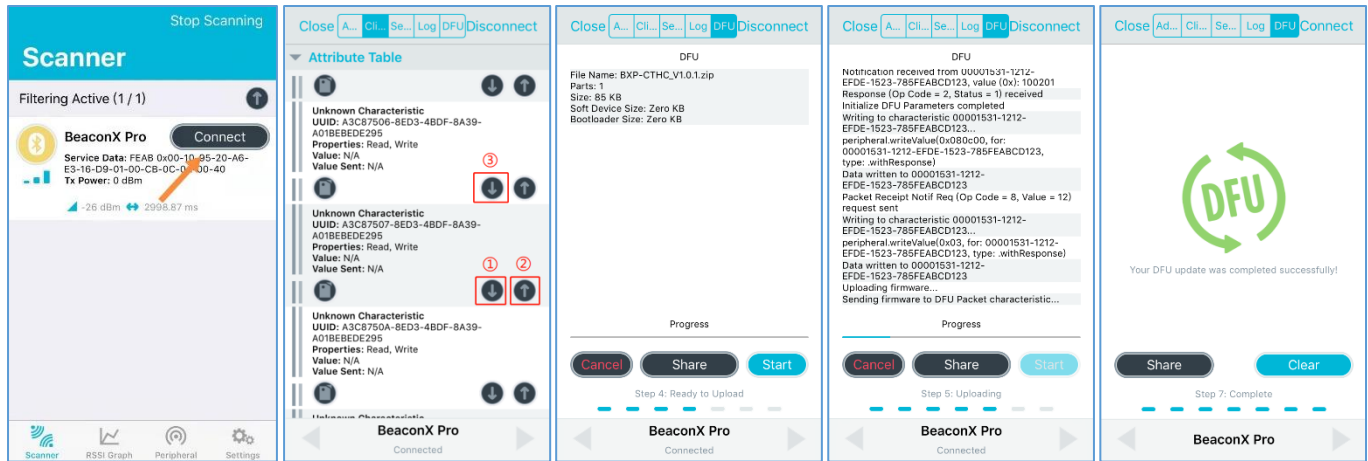


Figure 52: Firmware upgrade workflow of iOS nRF Connect APP

5. FAQ

General Questions

- How to calculate raw data of 3-axis accelerometer sensor?

In current firmware and accelerometer sensor, we have adopted 12bit output for sensor raw data. Due to the XYZ raw data are signed integer type, so the calculation steps as below.

If the original raw data is less than 0x80 00, then execute "**Result=(RAW>>4)*S**".

If the original raw data is greater than or equal to 0x8000, then execute "**Result=((RAW>>4)-0x1000)*S**".

And below shows the different factors in different full-scale of 3-axis accelerometer sensor:

Sampling mode	Full scale	S
High -resolution mode (12-bit raw data output)	±2g	1 mg/digit
	±4g	2 mg/digit
	±8g	4 mg/digit
	±12g	12 mg/digit

Table 11: Different factors in different full-scale of 3-axis accelerometer sensor

Case analysis –

Case 1: Original data less than 0x8000. (Positive value)

Precondition – High resolution mode, ±2g full-scale

For example – X_RAW=0x0080; Y_RAW=0x00C0; Z_RAW=0x3E80

Calculation steps –

$X_result = (0x0080 \gg 4) * 1 \text{ mg/digit} = (0x0008) * 1 \text{ mg/digit} = 8 * 1 = 8\text{mg};$

$Y_result = (0x00C0 \gg 4) * 1 \text{ mg/digit} = (0x000C) * 1 \text{ mg/digit} = 12 * 1 = 12\text{mg};$

$Z_result = (0x3E80 \gg 4) * 1 \text{ mg/digit} = (0x03E8) * 1 \text{ mg/digit} = 1000 * 1 = 1000\text{mg};$

Case 2: Original raw data more than 0x8000. (Negative value)

For example –X_RAW =0xFE40; Y_RAW =0xFE00; Z_RAW =0xC0C0

Calculation steps –

$X_result = ((0xFE40 \gg 4) - 0x1000) * 1 \text{ mg/digit} = (0x0FE4 - 0x1000) * 1 \text{ mg/digit} = -28 * 1 = -28\text{mg};$

$Y_result = ((0xFE00 \gg 4) - 0x1000) * 1 \text{ mg/digit} = (0x0FE0 - 0x1000) * 1 \text{ mg/digit} = -32 * 1 = -32\text{mg};$

$Z_result = ((0xC0C0 \gg 4) - 0x1000) * 1 \text{ mg/digit} = (0x0C0C - 0x1000) * 1 \text{ mg/digit} = -1012 * 1 = -1012\text{mg};$

- What is RSSI?

The RSSI (Received Signal Strength Indication) is a measurement of the power present in a received radio signal. It is usually displayed in dBm (Decibel-milliwatts). Low power devices, like Bluetooth Low Energy devices, are using very weak power to transfer data, therefore the usual values of RSSI are between -100dBm (Very weak signal) to around -20 dBm (strong signal).

- *Why the RSSI values are different on two Android devices.*

By definition the RSSI value is a measurement of the power present in received radio signal. The signal strength depends on the antennas, device orientation, location, distance from the phone to target device, humidity etc.

- *What's the difference between Advertising data and Scan Response data?*

In Bluetooth 4+ device, if not connected, continuously advertises with the Advertising data. When a scanner receives it, it may send the Scan request packet to obtain more advertising information. Then, the advertising device sends the Scan response data. Both packets may have up to 31 bytes.

APP Questions

- Why the device name shows N/A?

Device name is contained in scan response packet in “*Device info*” advertisement frame type, if “*Device info*” slot is not set, then APP will not achieve the device name and will shows N/A accordingly.

Appendix

A.1 Frame type of MOKO defined advertisement

Service UUID	Frame type	HEX value
0xAB FE	Device info	0x40
	iBeacon	0x50
	3-axis Acc	0x60
	T&H	0x70

Table 12: Frame type of MOKO defined advertisement

A.2 Sampling rate comparison table of 3-axis accelerometer sensor

Sensor model	Sampling rate	HEX value
LIS3DH/LIS2DH	1Hz	0x00
	10Hz	0x01
	25Hz	0x02
	50Hz	0x03
	100Hz	0x04

Table 13: Sampling rate comparison table of 3-axis accelerometer sensor

A.3 Full-scale comparison table of 3-axis accelerometer sensor

Sensor model	Full-scale	HEX value
LIS3DH/LIS2DH	±2g	0x00
	±4g	0x01
	±8g	0x02
	±16g	0x03

Table 14: Full-scale comparison table of 3-axis accelerometer sensor

© Copyright 2021 MOKO TECHNOLOGY. All Rights Reserved. Any information furnished by MOKO TECHNOLOGY LTD. is believed to be accurate and reliable. All specifications are subject to change without notice. Responsibility for the use and application of MOKO TECHNOLOGY LTD. materials or products rests with the end user since MOKO TECHNOLOGY LTD. cannot be aware of all potential uses. MOKO TECHNOLOGY LTD. makes no warranties as to non-infringement nor as to the fitness, merchantability, or sustainability of any MOKO TECHNOLOGY LTD. materials or products for any specific or general uses. MOKO TECHNOLOGY LTD. or any of its affiliates shall not be liable for incidental or consequential damages of any kind. All MOKO TECHNOLOGY LTD. products are sold pursuant to the MOKO TECHNOLOGY LTD. Terms and Conditions of Sale in effect from time to time, a copy of which will be furnished upon request. Other marks may be the property of third parties. Nothing herein provides a license under any MOKO TECHNOLOGY LTD. or any third-party intellectual property right.

Contact

MOKO TECHNOLOGY LTD. An original manufacturer for IoT smart devices

Address: 4F, Building 2, Guanghui Technology Park, MinQing Rd, Longhua, Shenzhen, Guangdong, China

E-mail: Support_BLE@mokotechnology.com

Website: www.mokosmart.com

www.mokoblue.com