



LW003-B

Product Specification

Version 3.1

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1 Product Introduction

LW003-B is a Bluetooth-LoRaWAN gateway integrating LoRa and Bluetooth wireless Communication. LW003-B can scan Bluetooth Beacon data and send data to LoRaWAN-Based gateway, and then upload to server, so as to realize personnel tracking, indoor positioning, asset monitoring and environmental monitoring.

2 Application Scenarios

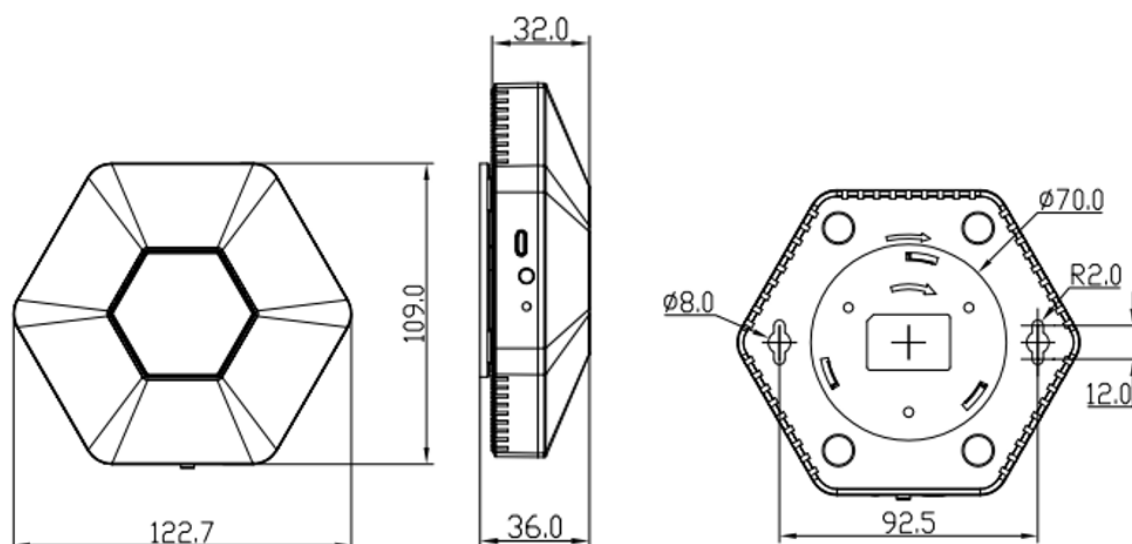
- Positioning & Location tracking
- Asset& Equipment tracking
- Personal tracking
- Environmental temperature and humidity monitoring

3 Product Specifications

3.1 Appearance



3.2 Mechanical Size



Unit: mm

3.2 LED Indicators

Items	Indicator	Operation	Remark
Turn ON	Solid blue and keep 3S	Press and hold the power button for 5 seconds till the LED indicate blue and release. The LED will indicate blue for 3 seconds to show the LW003-B is turned on.	
Turn OFF	Red LED Blink 3S	Press and hold the power button for 5 seconds till the red indicator flashes quickly and release. The indicator will flash red for 3 seconds to show the LW003-B is turned off.	
Join LoRa Network	Solid green and keep 3S	If the device had never Joined any network, after turning on, the device automatically sends join request	It will send join request automatic after power on the device or save "LoRa Setting" parameter in APP
Bluetooth connection established successfully	Green LED Blink 1S	Connect to the device via APP successfully	
Bluetooth connection disconnected	Red LED Blink 1S	APP disconnect to the device	If the device is in alarm status, the indicator may be not visible
Firmware Upgrade	Green LED Blink during the upgrade	Firmware upgrade via OTA in DFU mode	
	Solid Blue and keep 3S after		

	upgrade successfully		
	Solid Red and keep 3S after upgrade failed		
Charging	Blue LED blink	Plug in Micro USB charger	It can be set to off via MKLoRa app
Full Charged	Solid blue	Plug in Micro USB charger	It can be set to off via MKLoRa app
Low Battery Reminder	Red LED blink once every 30s	Battery level lower than 10%	It can be set to off via MKLoRa app
Factory Reset	Red/Green/Blue LED Blink one time by order	Reset the device, and restore all parameters.	
In Bluetooth broadcasting	Green LED keep blink	It can be set to off via MKLoRa app	It can be set to off via MKLoRa app

3.3 General Specifications

Categories	Parameter	Value
LoRa Wireless Specification	LoRa Protocol	LoRaWAN V1.0.3
	Lora Frequency	EU868/AU915/US915/AS923/IN865/KR920/EU433/CN470/CN779
	Tx Power	Max 21dBm
	Sensitivity	-137dBm@SF12 300bps
	LoRa Communication Distance	Up to 4 km (in urban open space)
BLE Wireless Specification	Bluetooth® (BLE)	5.0
	TX Power	Max 8 dBm
	BLE Scan Distance	150m scan distance (In urban open space) (BLE 4.2 or BLE 5.0 1M PHY) 300m scan distance (In urban open space) (BLE 5.0 Coded PHY)
Physical Parameter	Dimension	122.7mm×109mm×36mm (±2mm)
	Net Weight	165 g±2g
	Shell Material	ABS
Power supply Specification	Power Supply	Micro USB or Battery
	Changer Time	5 hours@5V/2A
	Battery characteristics	4200mA rechargeable battery
Power	Operating Current	< 180mA

Consumption	Sleep Current	< 15uA
Application Parameter	Operating Temperature	-20 ~ + 60℃
	IP Rating	No waterproof
	Certification	FCC, CE

4 User Guidance

4.1 How to make device working quickly

Step1: Check the device information

User can get device information according to the label on the boxes, as following picture:



Step2: Confirm the LoRaWAN network (Such as TTN, Senet, LoRIOT, Chirpstack) server to be used.

Step3: Register LoRaWAN gateway on LoRaWAN network server. If the gateway model is MKGW2-LW which is from moko, pls refer to [MOKO LoRaWAN Gateway MKGW2-LW Configuration Guide](#).

Step4: Register the device on LoRaWAN network server (OTAA mode).

The region/subject and DEVEUI can be get on Step1.

The default AppEUI is 70 B3 D5 7E D0 02 6B 87, the default AppKey is 2B 7E 15 16 28 AE D2 A6 AB F7 15 88 09 CF 4F 3C.

Note: When you use the US915 or AU915 band, the default FSB of the device is FSB2 (CH:8~15).

Step5: Join in LoRaWAN network server.

Please reboot the device, then device will send join request to LoRaWAN server automatically, then you can check the uplink payload on LoRaWAN server.

Step6: Uplink payload parse.

Option 1: You can refer to [chapter 6 Uplink Payload](#), here is the description of the payload parsing rules and samples parsing.

Option 2: MOKOSMART can provide payload decoder code based on some common LoRaWAN network servers.

4.2 How to connect to APP and configure parameters

Please download “MKLoRa” APP from app store directly. For more configuration details, please refer to [LW003-B APP Guide](#).

5 General Function

5.1 Introduction to Device Application

5.1.1 Indoor Positioning

- Firstly, the LW003-B should be installed in the corresponding position according to the preset position to ensure that the scanning range of LW003-B can cover the space to be positioned.
- The beacon information required by customers can be filtered according to [Scanning Filtering Rules](#) (Pls refer to [chapter 5.3 Bluetooth Scanning Filtering Rules](#)).
- Because the installation location of the LW003-B is known, the user can continuously analyze the [Beacon Payload](#) (Pls refer to [6.5 Beacon Payload](#)) data on the server side to monitor the location and movement of the personnel.

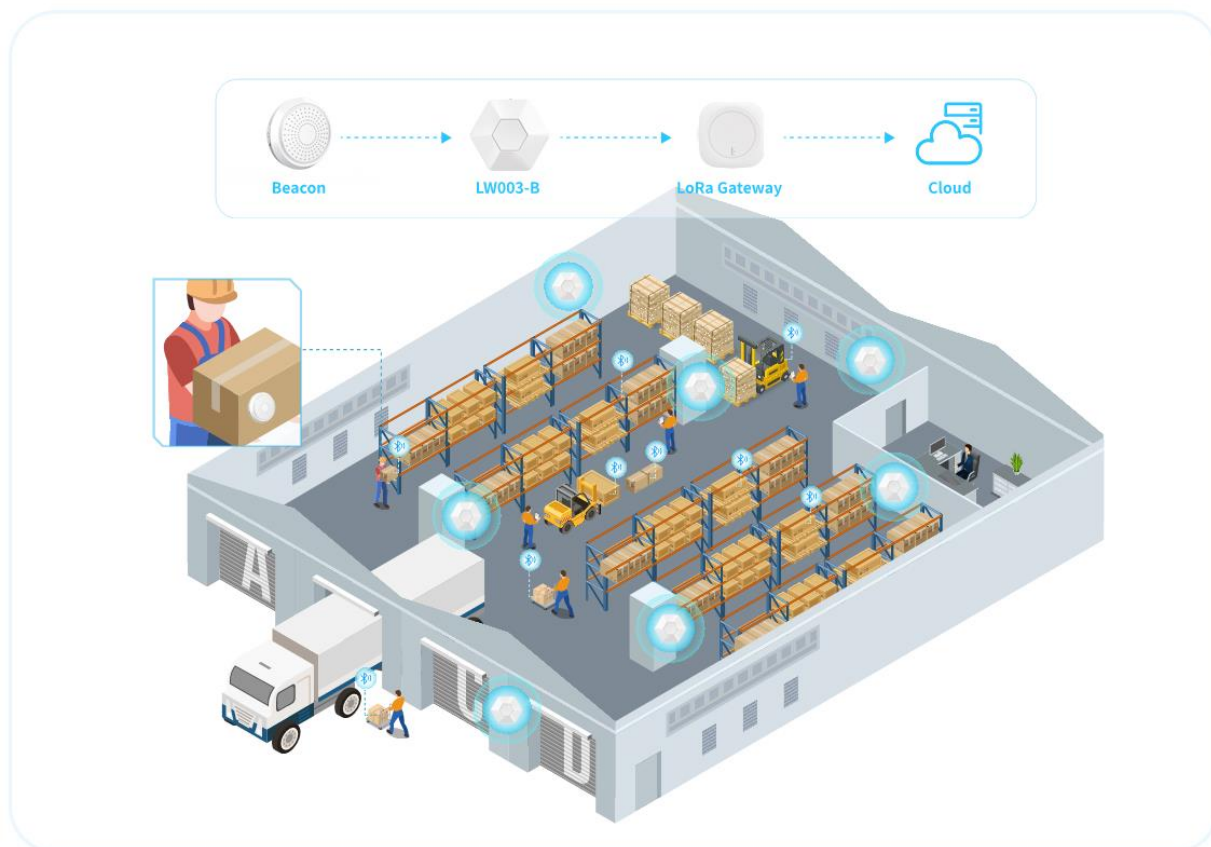


5.1.2 Asset Monitoring

LW003-B also can be used in factory to monitor critical assets.

For example:

- user can attach Bluetooth beacons to important devices that need to be monitored and install LW003-B around the important devices in factory.
- LW003-B will continuously scan the Bluetooth beacon broadcast information and report to the server.
- In this case, the background server should be able to continuously receive the information from the Bluetooth beacon bound on the device transmitted from the corresponding LW003-B. If no information is received in a certain period of time or the data is not transmitted from the corresponding LW003-B, the server can trigger an alarm to indicate that the device has been moved.



5.1.3 Environment Monitoring

LW003-B has built-in temperature and humidity sensors and regularly reports data to the server. The user can analyze and statistics the temperature and humidity of the server, so as to realize the function of environmental monitoring, which is mainly suitable for office, factory, hospital, school and other occasions.



5.2 Multiple Scan & Report Strategies

5.2.1 Overview

LW003-B supports four different Multiple Scan & Report Strategies:

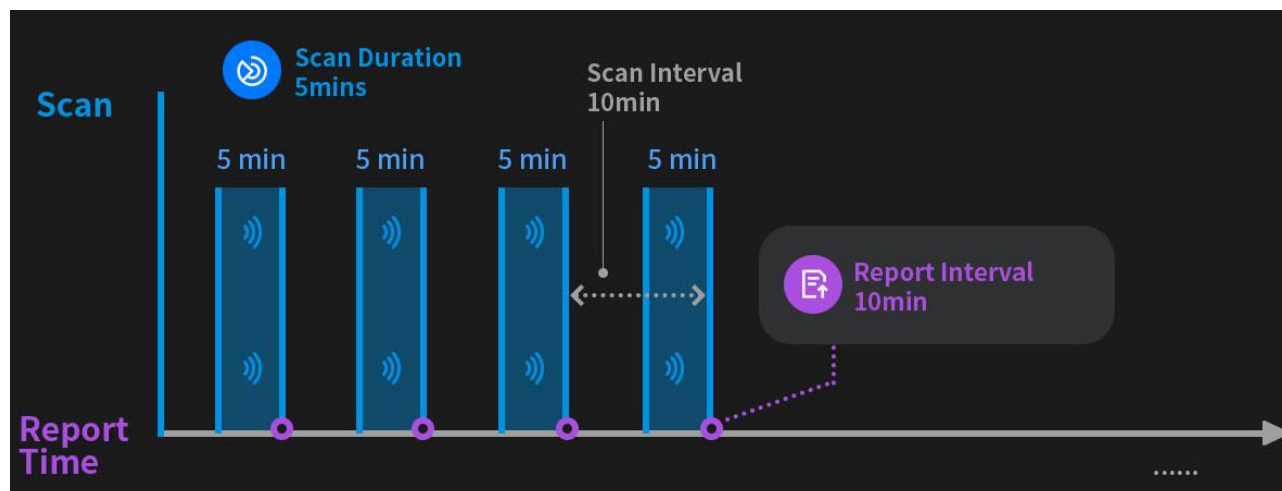
- Periodic Scan & Immediately Report
- Timing Scan & Immediately Report
- Scan Always On & Periodic Report
- Periodic Scan & Periodic Report
- Scan Always On & Timing Report
- Timing Scan & Timing Report
- Periodic Scan & Timing Report

LW003-B can only select one strategy at the same time, and the user can use MKLoRa app or LoRa downlink command to switch the strategy.

5.2.2 Periodic Scan & Immediately Report

The device will periodically turn on the Bluetooth scanning function, perform Bluetooth scanning and cache the eligible Bluetooth data, and then report the Bluetooth data that meets the filtering criteria scanned this time and turn off the Bluetooth scanning function after the scanning is completed.

Users can set different Bluetooth scan interval and the Bluetooth scan duration at each Bluetooth scan interval according to the actual application.



Example: Periodic acquisition of ambient temperature and humidity.

1. Set the strategy to periodic scan & immediately report.
2. Set the Bluetooth scan interval to 10mins; Set the Bluetooth scan duration interval to 5mins.
3. Place the T&H beacon (MOKO H4 series or others) close to LW003-B.

Based on the above settings, the LW003-B will report the T&H beacon information every 10mins.

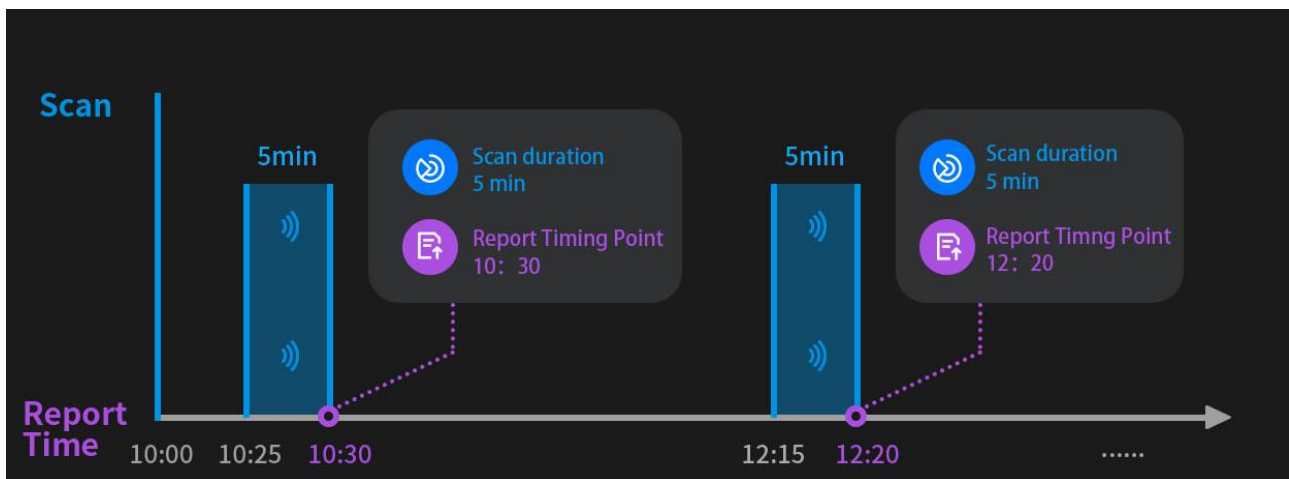
And, LW003-B will start scan at 5mins before reporting. The 5mins is the Bluetooth scan duration.

5.2.3 Timing Scan & Immediately Report

When we select Timing Scan & Immediately report strategy, the scanning function will be always on.

User can set the reporting time point, and the device will report the scanned Bluetooth data within this period at the corresponding reporting time point.

At same time, the Bluetooth duration of each scan also can be set. But it must be less than the interval between any two reporting time points.



Example: Reporting of the stock state on special time points

1. Set the strategy to timing scan & immediately report
2. Set the Bluetooth scan time point to 10:30 am and 12:20 pm.
3. Set the Bluetooth scan duration to 5mins.
4. Install the asset beacon (MOKO H2 series or others) on goods.

Based on the above settings:

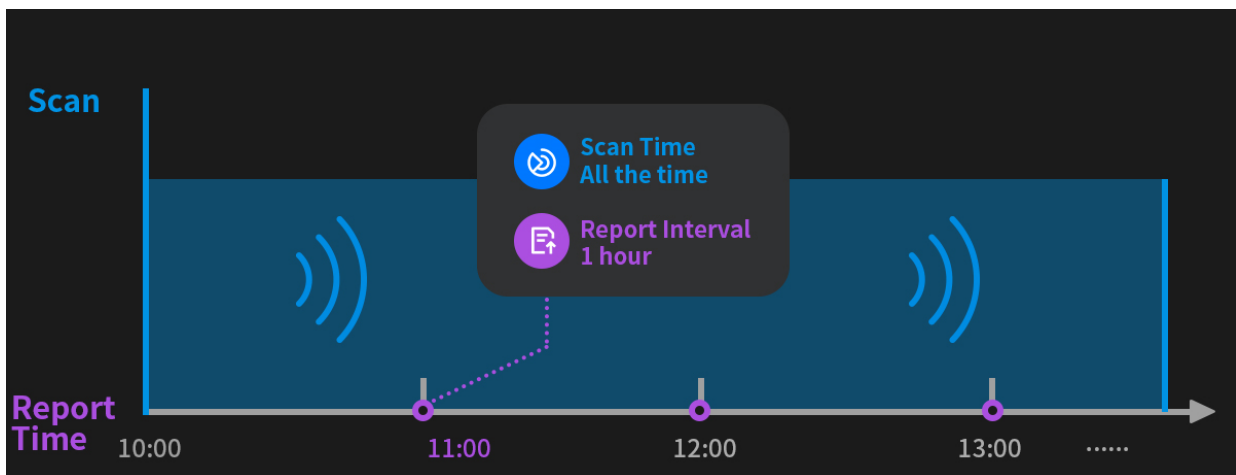
1st, LW003-B will start scan on 10:25 am, and report the H2 beacon information on 10:30am.

2nd, LW003-B will start scan on 12:15 pm, and report the H2 beacon information on 12:20pm.

5.2.4 Scan Always On & Periodic Report

Under this strategy, the Bluetooth scanning function is always on, and the user can set the reporting time point, and the device will report the scanned Bluetooth data within this period at the corresponding reporting time point.

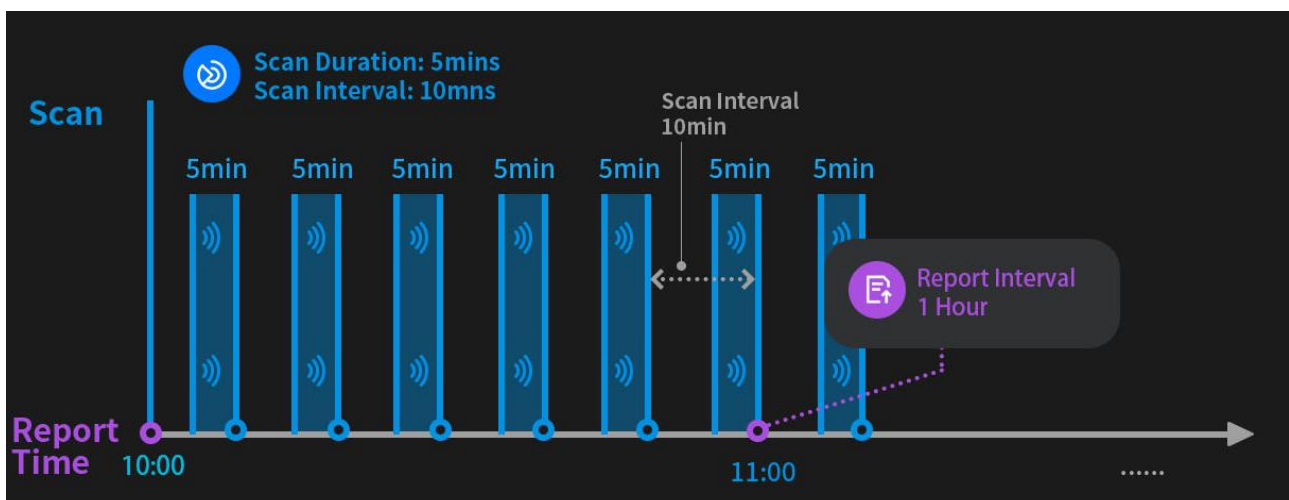
This is the strategy used by LW003-B old firmware (V2 version).



5.2.5 Periodic Scan & Periodic Report

The device will periodically turn on the Bluetooth scan function, perform Bluetooth scanning and cache the eligible Bluetooth data.

At the same time, the device will periodically report the beacon payload data, the content of the Bluetooth data scanned within the Bluetooth reporting cycle.



Example: Regular batch reporting of tools state

1. Set the strategy to periodic scan & periodic report
2. Set the Bluetooth scan interval to 10mins and set the Bluetooth scan duration to 5mins.
3. Set the Bluetooth report interval to 1 hour.
4. Install the asset beacon (MOKO H2 series or others) on tools.

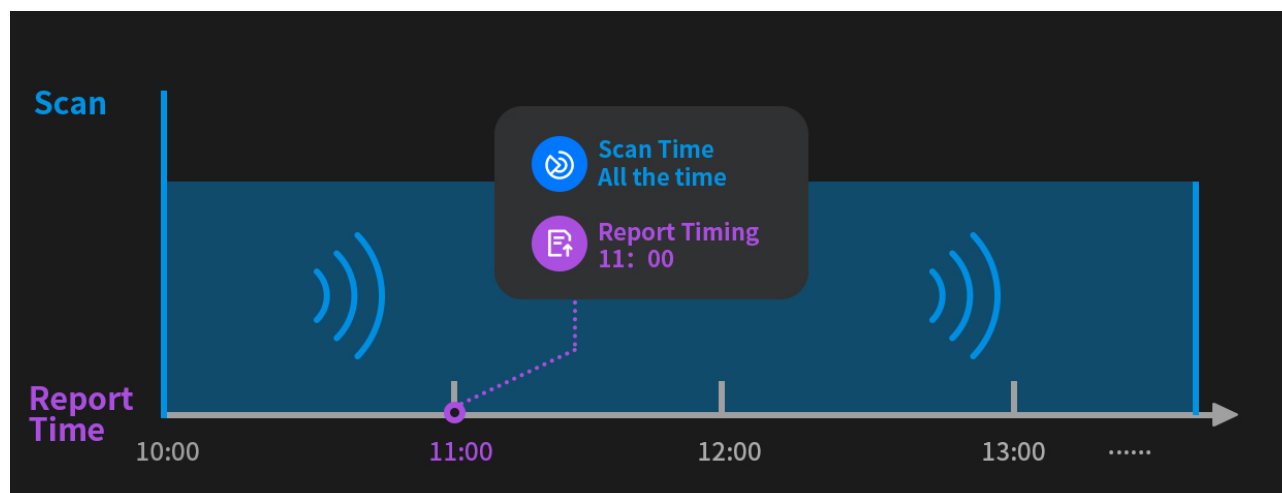
Based on the above settings, the LW003-B will scan the surrounding beacon information every 10mins.

And the LW003-B will report the data every 60 mins, the data will include data from multiple scan cycles. (If the end time of a scan cycle falls within the reporting interval, it will be reported at this

reporting point)

5.2.6 Scan Always On & Timing Report

Under this strategy, the scanning function is always on, and the user can set the reporting time point, and the device will report the scanned Bluetooth data within this period at the corresponding reporting time point.



Example: Reporting of the stock state on special time points

1. Set the strategy to timing scan & immediately report
2. Set the Bluetooth scan time point to 10:00 am, 11:00 am, 12:00 am and 13:00 pm.
3. Install the asset beacon (MOKO H2 series or others) on goods.

Based on the above settings:

1st LW003-B will always turn on Bluetooth scanning

2nd LW003-B will report the H2 beacon information scanned between 10:00 am and 11:00 am on 11:00 am.

3rd LW003-B will report the H2 beacon information scanned between 11:00 am and 12:00 am on 12:00am.

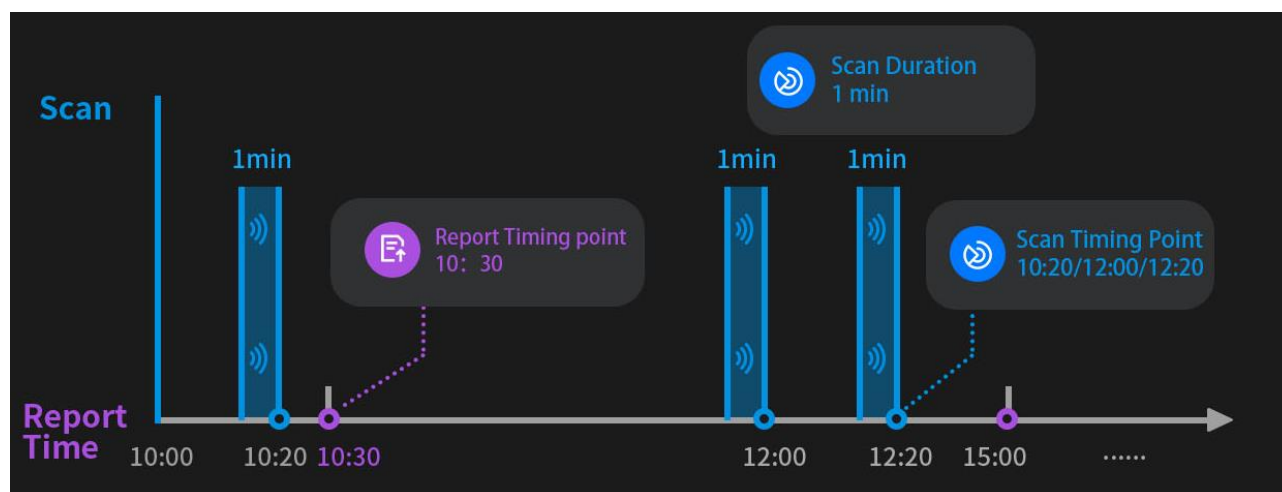
4th LW003-B will report the H2 beacon information scanned between 12:00 am and 13:00 pm on 13:00 pm.

5.2.7 Timing Scan & Timing Report

The device will regularly turn on the Bluetooth scanning function at the corresponding scan time point and perform Bluetooth scanning, and turn off after the scanning is finished.

At the same time, the device will regularly report the beacon payload data at the corresponding reporting time point, the content is the scanned Bluetooth data between the two reporting time points.

There can be multiple Bluetooth scan time points between each two reporting time points.



Example: Batch reporting of the stock state on special time points

1. Set the strategy to timing scan & time report
2. Set the Bluetooth scan time point to 10:20am, 12:00 am and 12:20 am.
3. Set the report timing to 10:30 am and 15:00 pm.
4. Set the Bluetooth scan duration to 1min.
5. Install the asset beacon (MOKO H2 series or others) on goods.

Based on the above settings:

1st, LW003-B will start scan at 10:19 am, 11:59 am and 12:19 pm. And get the H2 beacon information and goods stock state.

2nd, LW003-B will report on 10:30 am. The report data will include the goods stock state of 10:20 am.

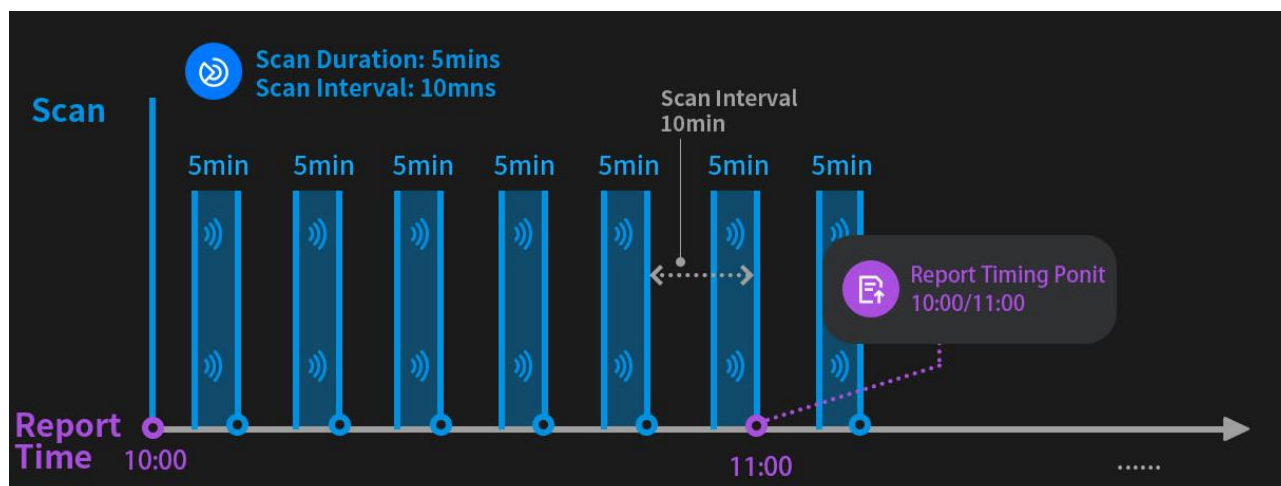
3rd, LW003-B will report on 15:00 pm. The report data will include the goods stock state of 12:00 am and 12:20 pm.

5.2.8 Periodic Scan & Timing Report

The device will periodically turn on the Bluetooth scan function, perform Bluetooth scanning and cache the eligible Bluetooth data.

At the same time, the device will regularly report beacon payload data, the content of the scanned

Bluetooth data between the two reporting time points.



Example: Batch reporting of the stock state on special time points

1. Set the strategy to periodic scan & timing report
2. Set the Bluetooth scan duration to 5mins and set the Bluetooth scan interval to 10mins.
3. Set the report timing to 10:00 am and 11:00 am.
4. Install the asset beacon (MOKO H2 series or others) on goods.

Based on the above settings:

1st, LW003-B will scan the surrounding beacon information every 10mins.

2nd, LW003-B will report on 11:00 am. The report data will include the goods stock state between 10:00 am and 11:00 am.

5.3 Bluetooth Scanning Filtering Rules

LW003-B supports multiple data filtering methods to help you easily obtain target beacon data:

- Filter by RSSI, MAC address, advertising name and advertising raw data (Include all MOKO beacon types)
- Filter out duplicate data: Only one piece of Bluetooth data is reported for beacons with the same MAC address in one Bluetooth fix period.

Detailed setup instructions can be found in [LW003-B APP guide](#).

5.3.1 Filter Repeating Data

Because each beacon device may be scanned and saved more than one time in one scan cycle, we have opened up Filter Repeating Data. With this function, for the same data, we only reported it once in the same reporting cycle and the data reported was the most recent scanned.

There are four types of Filter Repeating Data:

No: Don't do anything.

MAC: Beacon data with the same MAC will only be reported once in the same cycle

MAC + Data Type: Beacon data with the same MAC and the same beacon data type will only be reported once in the same cycle. Common data types are IBEACONS, Eddystone and AltBeacon.

MAC + Raw Data: Beacon data with the same MAC address and raw data will only be reported once in the same cycle.

Some beacons have multiple slots and each slot can broadcast different types of data and different content. Through the Filter Repeating Data, users can better get the data they want.

5.4 Bluetooth Broadcast Capabilities

The device can make a Bluetooth broadcast and can be connected in the following three cases.

1. Within the first N minutes after the device is turned back on.
2. Double click power button when the device is on, the device will turn on Bluetooth broadcast for N minutes.
3. LoRaWAN server sends LoRa command to turn on Bluetooth broadcast for N minutes.

Note: N is the broadcast timeout time, the unit is s, can be configured by the user. If the device is successfully connected and then disconnected, the broadcast timeout will be refreshed, and the user can choose to establish Bluetooth connection with the device again within this time.

When Bluetooth scanning on the way to open the Bluetooth broadcast, the user can choose whether to report the Bluetooth broadcast event payload to remind the Bluetooth scan was interrupted.

5.5 LoRaWAN Capabilities

The data of LW003 will be transmitted via LORA and LW003 is based on the standard LoRaWAN protocol V1.0.3. LW003 is compatible with most gateways and servers (TTN, SENET, LORA IOT, etc.) in the market

Link Check MAC Commands: LW003 supports LinkCheck function. Users can use this function to realize regular network monitoring function and confirm the network status of the device.

Device Time MAC Commands: LW003 supports the DeviceTime feature, which enables Users can periodically synchronize the time of the device to avoid time offset. The *Time Sync Interval* of the MKLoRa APP is the Device Time MAC Command interval.

5.5.1 Uplink message type selection

LW003-B will upload many different types of payloads. In some specific scenarios, customers can choose to set the corresponding type of payloads as confirmed message type when they require a high success rate of data upload.

Note: Confirmed message type will increase the communication burden of the gateway and may cause network congestion, so please use it with caution.

5.5.2 Multicast Group

LW003-B will support Multicast Group function, convenient for customers to set up and manage devices in bulk.

5.6 Heartbeat Mechanism

The device will report the heartbeat Payload regularly to ensure the link status of the network.

The heartbeat interval won't be refreshed if there are other payloads uplink in the heartbeat interval.

5.7 Local Data Sync

LW003-B Built-in 4M FLASH memory chip, can support 20,000 pieces(Based on Bluetooth 4.2)of data local storage at most. All data uploaded by the device is stored in the device.

Users can read data of the past 1 day, 7 days, 1 month, 3 months, 6 months, 1 year or custom days via Bluetooth or downlink command.

When the LoRaWAN network has problems or data loss is severe, users can quickly get the historical reporting data from the device.

Note: When the data is synchronized and exported successfully, pls remember to delete the device local data in case there is too much data in the next synchronization.

5.8 Temperature and Humidity Monitoring

LW003-B has built-in temperature and humidity sensor SHT30, which can be used to monitor environmental temperature and humidity through continuous analysis of uplink data.

5.9 Continuity Transfer Function

When the device encounters network disconnection or power failure, LW003-B can continue to transfer the data that hadn't been uploaded before when it is connected to the network or powered up again.

5.10 Default Power Status

In the application scenario of LW003-B, power supply may be suddenly cut off. Because the LW003-B's built-in battery has limited capacity, in this case, the device will quickly run out of power and shut down.

When power is restored later, if the device will not automatically be turn on, the user must manually turn on the LW003, this will result in increased human costs and there will be a risk of losing some uplink payload.

Based on the above situation, LW003-B adds the function to set the state of the device when the device is powered back on. There are three options: "Switch off", "Switch on" and "Revert to last mode".

- If set to "switch on", it means that the LW003-B will be on when the device is powered back on.
- If set to "switch off", it means that the LW003-B will be off when the device is powered back on.

If set to "Revert to last mode", it means that the LW003-B will be in the same state as it was before the power was cut off.

5.11 Time Synchronization

There are four methods to sync time through the MKLoRa APP, DeviceTime function, RTC or Downlink Command.

- MKLoRa APP: When the APP connect with the device success the phone system time will be sync to the device.
- Device Time MAC Commands: LW003 supports the DeviceTime feature, which enables users can periodically synchronize the time of the device to avoid time offset.
- RTC: The LW003 has a built-in RTC circuit. When LW003 is completely shut down, the RTC will continue to keep the time updated in ten days, then if the device is powered on in these ten days, the RTC will immediately synchronize the time to LW003.
- Downlink Command: User can use the downlink command to sync time, it is better to send the RTC time to device when the device send heartbeat (device information packet) as the device only open the receive window in CLASS A when there is uplink transmission or CLASS C.

5.12 Battery Performance

The LW003-B can support both battery and DC power. The device is equipped with a 4200 mAh rechargeable battery.

When LW003-B's battery level is low, its power indicator will flash every 30s and it will report *Low Power Payload* to the server as a prompt.

In additional, LW003-B supports sending *Shutdown Payload* as a notification alert when the device is turned off. Users can choose to turn off this feature.

5.13 Bluetooth Configuration Tool

The device can use MKLoRa app developed by Moko for quick OTA upgrades and parameter configuration.

About the detail of MKLoRa, pls refer to [LW003-B APP Guide](#).

6 Uplink Payload

6.1 Device Information Payload

When the device is successfully connected to the LoRaWAN network, the device will immediately send a Device Information Payload to server, and periodically report Device Information Payload thereafter.

Device information payloads will be sent in Port 1.

Byte Index	Type	Description
Byte 0 (Bit 7)	Battery charging status	0 means no charging; 1 means in charging.
Byte 0 (Bit 6~Bit0)	Battery level	Convert to decimal, unit is %.
Bytes 1-2	Battery Voltage	The voltage value of battery, the byte order is Big-Endian. The actual voltage need divide 1000 after the hexadecimal data convert to decimal. Example: 3C 0E convert to decimal is 3644, the actual voltage is 3.644V. If the device is powered by USB, the voltage will always above 3.4V
Byte 3	Firmware Version	Firstly, convert to 8-bit binary number. Example: 0x86 is 1000 0110 in binary number, 10 equals to 2, 00 equals to 0, 0110 equals to 6, so the firmware version is V 2.0.6
Byte 4	Hardware Version	Firstly, convert to 8-bit binary number. Example: 0x23 is 0010 0011 in binary number, 0010 equals to 2, 0011 equals to 3, so the hardware version is V 2.3
Byte 5-6	Temperature	Converts directly to decimal numbers, then divide 100. The unit is degree centigrade.
Byte 7-8	Humidity	Converts directly to decimal numbers, then divide 100. The unit is %.
Byte 9	Time zone	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.

6.2 Shut Down Payload

Shut Down payloads will be sent in Port 2.

Byte Index	Type	Description
Byte 0 (Bit 7)	Battery charging status	0 means no charging; 1 means in charging.
Byte 0 (Bit 6~Bit0)	Battery level	Convert to decimal, unit is %.
Bytes 1-2	Battery Voltage	The voltage value of battery, the byte order is Big-Endian. The actual voltage need divide 1000 after the hexadecimal data convert to decimal. Example: 3C 0E convert to decimal is 3644, the actual voltage is 3.644V. If the device is powered by USB, the voltage will always above 3.4V
Byte 4~7	Timestamp	Standard UTC time
Byte 8	Time zone	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.
Byte 9	Shut Down Type	The reason of power off. 00 means Bluetooth command or App; 01 means LoRaWAN Command; 02 means power button; 03 means battery run out.

6.3 Heartbeat Payload

Heartbeat Payload will be sent in Port 3.

Byte Index	Type	Description
Byte 0 (Bit 7)	Battery charging status	0 means no charging; 1 means in charging.
Byte 0 (Bit 6~Bit0)	Battery level	Convert to decimal, unit is %.
Bytes 1-2	Battery Voltage	The voltage value of battery, the byte order is Big-Endian. The actual voltage need divide 1000 after the hexadecimal data convert to decimal. Example: 3C 0E convert to decimal is 3644, the actual voltage is 3.644V. If the device is powered by USB, the voltage will always above 3.4V
Byte 3	Firmware Version	Firstly, convert to 8-bit binary number. Example: 0x86 is 1000 0110 in binary number, 10 equals to 2, 00 equals to 0, 0110 equals to 6, so the firmware version is V 2.0.6
Byte 4	Hardware Version	Firstly, convert to 8-bit binary number. Example: 0x23 is 0010 0011 in binary number, 0010 equals to 2, 0011 equals to 3, so the

		hardware version is V 2.3
Byte 5-6	Temperature	Converts directly to decimal numbers, then divide 100.The unit is degree centigrade.
Byte 7-8	Humidity	Converts directly to decimal numbers, then divide 100.The unit is %.
Byte 9	Time zone	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.
Byte 10	Message type	00 means normal heartbeat report; 01means the device come into low power state; 02 means other type.

6.4 Bluetooth Broadcast Event Payload

Heartbeat Payload will be sent in Port 4.

Byte Index	Type	Description
Byte 0 (Bit 7)	Battery charging status	0 means no charging; 1 means in charging.
Byte 0 (Bit 6~Bit0)	Battery level	Convert to decimal, unit is %.
Bytes 1-4	Scan start time of the scan cycle interrupted by the broadcast	Standard UTC time
Byte 5	Time zone of Byte 1-4	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.
Bytes 6-9	The point at which the Bluetooth broadcast interrupts the scan	Standard UTC time
Byte 10	Time zone of Byte 6-9	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.

6.5 Beacon Payload

Beacon Payload will be sent in Port 5.

Byte Index	Type	Description
Byte 0	Packet sequence	Packet serial number of the current reporting cycle
Byte 1-5	Reporting time of the payload	Standard UTC time and timezone
Byte 6	The total number of beacons in this payload	
Byte 7	The length of 1 st beacon	
Byte 8	The type of 1 st beacon	Convert to decimal:

		0 means iBeacon; 1 means Eddystone-UID; 2 means Eddystone-URL; 3 means Eddystone-TLM; 4 means BXP-iBeacon; 5 means BXP-DeviceInfo; 6 means BXP-ACC; 7 means BXP-T&H; 8 means BXP-Button; 9 means BXP-Tag; 10 means Unknow
Byte XX-XX	The report data of this beacon	It can be check on SCANNER-Payload Content Selection in MKLoRa app.
Byte XX-XX	The length of next beacon	
	The type of next beacon	
	The report data of next beacon	
		
		
		

User can select **the report content** via MKLoRa. Before parsing the data, please check which data is selected to be reported, the corresponding position of the data not selected to be reported will be replaced by the latter data.

6.5.1 The report content of each type

The report data of iBeacon type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11~26	UUID	In HEX format.
Byte 27~28	Major	Convert to decimal.
Byte 29~30	Minor	Convert to decimal.
Byte 31	Measured RSSI@1M	Convert to decimal, minus 256, the unit is dBm
Byte 32~XX	Raw data	

The report data of Eddystone-UID type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	RSSI@0M	Convert to decimal, minus 256, the unit is dBm
Byte 12~21	Namespace	In HEX format.
Byte 22~27	Instance	In HEX format.
Byte 28~XX	Raw data	

The report data of Eddystone-URL type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	RSSI@0M	Convert to decimal, minus 256, the unit is dBm
Byte 12	The length of URL	Convert to decimal. For example, 0x20 means the length of URL is 32Bytes.
Byte 13	URL Scheme Prefix	0x00 means http://www. 0x01 means https://www. 0x02 means http:// 0x03 means https://
Byte 14~XX	Encoded URL	Input example URL (characteristics). For more detail, please visit https://github.com/google/eddystone/blob/master/eddystone-url/README.md
Byte (XX+1) ~ (XX+N)	Raw data	

The report data of Eddystone-TLM type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	TLM Version	0x00 means Unencrypted TLM; 0x01 means Encrypted TLM;
Byte 12~13	Battery Voltage	Convert to decimal, the unit is mV.
Byte 14~15	Temperature	For example, the beacon temperature is 0x0D 80: Convert the 1 st byte to decimal, so 0D>>13. Convert the 2 nd byte to decimal, so 80>>128. In 8.8 notation, the temperature should be 13+(128/256) = 13.5, the unit is °C
Byte 16~19	ADV_CNT	Convert to decimal.
Byte 20~23	SET_CNT	Convert to decimal.
Byte 24~XX	Raw data	

The report data of BXP-iBeacon type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11~26	UUID	In HEX format.
Byte 27~28	Major	Convert to decimal.
Byte 29~30	Minor	Convert to decimal.
Byte 31	Measured RSSI@1M	Convert to decimal, minus 256, the unit is dBm

Byte 32	TX Power	It is a signed integer number, unit is dBm.
Byte 33	ADV Interval	Convert to decimal, the unit is 100ms.
Byte 34~XX	Raw data	

The report data of BXP-Device Info type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	TX Power	It is a signed integer number, unit is dBm.
Byte 12	Ranging Data	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
Byte 13	ADV Interval	Convert to decimal, the unit is 100ms.
Byte 14~15	Battery Voltage	Convert to decimal, the unit is mV.
Byte 16	Device Property	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) Bit 3-7: RFU Example content parse: 00(HEX)>>>0000 0000(BIN)>>>Ambient light sensor not equipped & Password verification enabled
Byte 17	Switch Status	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: 01(HEX)>>>0000 0001(BIN)>>>Ambient light not detected & Connectable
Byte 18~19	Firmware Version	Firmware version. Main version: 0x11 >>> V1.1.x; Sub version: 0x00 >>>Vx.x.0; 0x11 00 >>> V1.1.0; 0x11 0A >>> V1.1.10
Byte 20	The length of Device Name	Convert to decimal. For example, 0x08 means the length of Device Name is 8 Bytes.
Byte 21~XX	Device Name	Convert to ASCII.
Byte (XX+1) ~ (XX+N)	Raw Data	

The report data of BXP-ACC type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone

Byte 11	TX Power	It is a signed integer number, unit is dBm.
Byte 12	Ranging Data	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
Byte 13	ADV Interval	Convert to decimal, the unit is 100ms.
Byte 14~15	Battery Voltage	Convert to decimal, the unit is mV.
Byte 16	Sample Rate	Sampling rate of 3-axis accelerometer sensor, 10Hz by default. 0x00: 1Hz; 0x01: 10Hz; 0x02: 25Hz; 0x03: 50Hz; 0x04: 100Hz
Byte 17	Full Scale	Full-scale of 3-axis accelerometer sensor, $\pm 2g$ by default. 0x00: $\pm 2g$; 0x01: $\pm 4g$; 0x02: $\pm 8g$; 0x03: $\pm 16g$
Byte 18	Motion Threshold	Motion threshold to judge movements, unit: 0.1g/digit. Example content parse: 0.1g
Byte 19~20	X-axis Data	2 Bytes, calculated acceleration value in X-axis. You will just need to convert this HEX value to DEC. (Signed integer)
Byte 21~22	Y-axis Data	2 Bytes, calculated acceleration value in Y-axis. You will just need to convert this HEX value to DEC. (Signed integer)
Byte 23~24	X-axis Data	2 Bytes, calculated acceleration value in Z-axis. You will just need to convert this HEX value to DEC. (Signed integer)
Byte25~XX	Raw Data	

The report data of BXP-T&H type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	TX Power	It is a signed integer number, unit is dBm.
Byte 12	Ranging Data	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
Byte 13	ADV Interval	Convert to decimal, the unit is 100ms.
Byte 14~15	Battery Voltage	Convert to decimal, the unit is mV.
Byte 16~17	Temperature	Sampling temperature in 2 bytes (Signed integer), unit: 0.1°C/digit. Example content parse: 0x00 C8(HEX)>>>200(DEC)>>>20.0°C
Byte 18~19	Humidity	Sampling humidity in 2 bytes (Unsigned integer), unit: 0.1%/digit. Example content parse: 0x01 37(HEX)>>>311(DEC)>>>31.1%(Humidity)
Byte20~XX	Raw Data	

The report data of BXP-Button type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm

Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	Frame Type	MOKO-Defined advertisement frame type; 0x20: "Single press mode" advertisement 0x21: "Double press mode" advertisement 0x22: "Long press mode" advertisement 0x23: "Abnormal inactivity mode" advertisement 0x24 – 0x3F: RFU
Byte 12	Status Flags	Bit 0: Password verification status. 0: Password verification disabled; 1: Password verification enabled; Bit 1: Trigger status of alarm mode. 0: Alarm not be triggered. 1: Alarm be triggered; Bit 2 - Bit 7: Reserved for future use.
Byte 13~14	Trigger Count	Trigger record count of different alarm mode, it will be broadcast separately in different frame type. For this example, it means that the trigger record of single press alarm mode is 0.
Byte 15	The length of Device ID	Convert to decimal. For example, 0x02 means the length of Device ID is 2 Bytes.
Byte 16 - XX	Device ID	"Device ID" was designed to adapt some special rules of serial ID or combination of Major/Minor and etc. It was defined as a global variable and should be full-filled with 1-6 hexadecimal value. Default value: 0x00 00 01
Byte (XX+1)	Firmware Type	"Firmware type" was designed to distinguish the different firmware with different chipset or major function updates in button series. Default: 0x00
Byte (XX+2)	The length of Device Name	Convert to decimal. For example, 0x08 means the length of Device Name is 8 Bytes.
Byte (XX+2+N)	Device Name	Convert to ASCII.
Byte (XX+3+N)	Full scale	Full-scale of 3-axis accelerometer sensor. Default: $\pm 2g$ 0x00: $\pm 2g$; 0x01: $\pm 4g$; 0x02: $\pm 8g$; 0x03: $\pm 16g$
Byte (XX+4+N) ~ (XX+5+N)	Motion Threshold	Motion threshold to judge movements. Default: 16mg For more, please refer to "Chapter 2.5 – Access to 3-axis accelerometer sensor".
Byte (XX+6+N) ~ (XX+7+N)	X-axis Data	2 Bytes, calculated acceleration value in Z-axis. You will just need to convert this HEX value to DEC. (Signed integer)
Byte (XX+8+N) ~ (XX+9+N)	Y-axis Data	2 Bytes, calculated acceleration value in Y-axis. You will just need to convert this HEX value to DEC. (Signed integer)
Byte (XX+10+N) ~ (XX+11+N)	X-axis Data	2 Bytes, calculated acceleration value in Z-axis. You will just need to convert this HEX value to DEC. (Signed integer)

Byte (XX+12+N) ~ (XX+13+N)	Temperature	Beacon temperature is the temperature in degrees Celsius sensed by the beacon and expressed in a signed 8.8 fixed-point notation. Content Parse: 0D>>>13, 80>>>128. In 8.8 notation, it should be $13+128/256=13.5^{\circ}\text{C}$.
Byte (XX+14+N)	Ranging Data	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; Default: 0x00
Byte (XX+15+N) ~ (XX+16+N)	Battery Voltage	Battery voltage is the current battery charge in millivolts, expressed as 1 mV per bit. Example content parse: 0x0B C4 >>> 3012mv
Byte (XX+17+N)	TX Power	It is a signed integer number, unit is dBm.
Byte (XX+17+N) ~XXXX	Raw Data	

The report data of BXP-Tag type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	Sensor Status	1 byte to indicate the sensor status. Bit0: Hall sensor status. 1: Magnet away/absent; 0: Magnet approach/present. Bit1: Accelerometer sensor status. 1: In move; 0: In static. Bit2: Accelerometer sensor equipped status. 1: Equipped; 0: Not equipped. Bit3-Bit7: RFU.
Byte 12~13	Hall Trigger Event Count	Trigger event count of hall sensor. 2 bytes from 0-65535. When magnet present and then away, it counts 1. And it will count +1 only when magnet present and away again.
Byte 14~15	Motion Trigger Event Count	Trigger event count of hall sensor. 2 bytes from 0-65535. When motion trigger function be enabled and device moves, it counts 1. And it will count +1 only when next cycle triggered.
Byte 16~17	X-axis Data	2 Bytes, calculated acceleration value in Z-axis. You will just need to convert this HEX value to DEC. (Signed integer)
Byte 18~19	Y-axis Data	2 Bytes, calculated acceleration value in Y-axis. You will just need to convert this HEX value to DEC. (Signed integer)
Byte 20~21	X-axis Data	2 Bytes, calculated acceleration value in Z-axis. You will just need to convert this HEX value to DEC. (Signed integer)

Byte 22~23	Battery Voltage	Battery voltage is the current battery charge in millivolts, expressed as 1 mV per bit. Example Content parse: 3141mV
Byte 24	The length of Tag ID	Convert to decimal. For example, 0x02 means the length of Tag ID is 2 Bytes.
Byte 25~XX	Tag ID	Convert to ASCII.
Byte (XX+1)	The length of Device Name	Convert to decimal. For example, 0x08 means the length of Device Name is 8 Bytes.
Byte (XX+2) ~ (XX+N)	Device Name	Convert to ASCII.
Byte (XX+N+1) ~ XXX	Raw Data	

The report data of other type:

Byte Index	Type	Description
Byte 0 ~5	MAC	In HEX format.
Byte 6	RSSI	Convert to decimal, minus 256, the unit is dBm
Byte 7~10	Timestamp	Standard UTC time and time zone
Byte 11	The number of reported data blocks	Convert to decimal.
Byte 12: bit 6~7	The instruction code of data block 1	0b 00 means normal; 0b 01 means that the currently reported Bluetooth beacon data didn't contain this data type which was select by user via MKLoRa app; 0b 02 means that data block 1 start position or data block 1 end position was set incorrectly via MKLoRa app.
Byte 12: bit 0~5	The length of data block 1	Convert to decimal, the unit is bytes. If the instruction code of data block 1 is 1 or 2, the length of data block 1 will be 1 byte, only report data type of data block 1.
Byte 13	The data type of data block 1	
Byte 14~XX	The content of data block 1	Raw data
Byte (XX+1): bit 6~7	The instruction code of data block 2	0b 00 means normal; 0b 01 means that the currently reported Bluetooth beacon data didn't contain this data type which was select by user via MKLoRa app; 0b 02 means that data block 2 start position or data block 1 end position was set incorrectly via MKLoRa app.
Byte (XX+1): bit 0~5	The length of data block 2	Convert to decimal, the unit is bytes. If the instruction code of data block 2 is 1 or 2, the length of data block 2 will be 1 byte, only report data type of data block 2.
Byte (XX+2)	The data type of	

	data block 2	
Byte (XX+3) ~XXX	The content of data block 2	Raw data
.....		
Byte XXXX~XXXX	Raw Data	

7 Maintenance instruction

- Do not use or store the device in dusty or dirty areas.
- Do not use or store the device in extremely hot temperatures. High temperatures may damage the device or battery.
- Do not use or store the device in extremely cold temperatures .when the device warms to its normal temperature, moisture can form inside the device and damage the device or battery.
- Do not drop ,knock, or shake the device. Rough handing would break it.
- Do not use strong chemicals or washing to clean the device.
- Do not paint the device ,paint would cause improper operation
- Do not disassemble the device casually or use the tools for maintenance without permission

Handle your device, battery and accessories with care. The suggestions above help you keep your device operational.

FCC warning statements:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The device has been evaluated to meet general RF exposure requirement This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

FCC STATEMENT

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

8 Revision History

Version	Description	Editor	Date
1.0	Initial version	Iris	2020-07-08
1.1	Adjust document structure	Iris	2020-09-11
2.1	Overall Revision. Suitable for firmware version V2.0.7	Allen	2021-04-16
3.1	Overall Revision. Suitable for firmware version V3.0.3	Allen	2022-12-18

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