Lansitec LoRaWAN Bluetooth Gateway

Datasheet

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contact@lansitec.com

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1. General Introduction

The BLE Gateway is designed based on BLE and LoRaWAN technology. The BLE gateway receives and restructures nearby Bluetooth devices' (beacons and sensors) data and forwards it to the LoRaWAN gateway. The parameter settings, such as the heartbeat report interval, LoRaWAN work mode, the device filter, and the device report rule, are adjustable through LoRaWAN downlink commands.

This document applies to the following products:

Table 1: Product List

Name	Product Description
Indoor BLE Gateway	BLE 5.0, 120 x 120 x 31 mm, 5V
Compact BLE Gateway	BLE 5.0, 97 x 62 x 7 mm, 600 mAh, 5V
Solar BLE Gateway	BLE 5.0, built-in antenna, solar, 160 x 160 x 55 mm, 5300 mAh
Macro BLE Gateway	BLE 5.0, build-in antenna, 160 x 160 x 55 mm, 38000 mAh

2. Abbreviation

- **ABP**: Activation by Personalization
- **ADR**: Adaptive Data Rate
- **AS:** Application Server
- **NS**: Network Server
- **BLE**: Bluetooth Low Energy
- **CRC**: Cyclic Redundancy Check
- **LoRa**: Long-Range Modulation Technique
- **LoRaWAN**: LoRaWAN Wide Area Network
- **OTAA**: Over the Air Activation
- **PRI**: Position Report Interval
- **RFU**: Reserved for Future Usage
- **RSSI**: Received Signal Strength Indicator

3. Product Specifications

LoRaWAN

Protocol	Version 1.0.2B
Activation Mode	OTAA or ABP
LoRaWAN Frequency	US915, AU915, EU868, EU433, AS923, RU864, KR920, IN865, CN470
LoRa TX power	0 to 20dBm
LoRa Sensitivity	-139dBm @SF12, BW 125kHz, 434MHz/470MHz -137dBm @SF12, BW 125kHz, 868MHz/915MHz
LoRa Communication Distance	>1.5km in the urban area
Encryption	AES128

Bluetooth

Protocol	Bluetooth 5.0
TX Power	4, 0, -4, -8, -12, -16, -20dBm
Sensitivity	-96dBm
Receiving Range	100m

System and Mechanical

Parameter	Indoor BLE Gateway	Compact BLE Gateway	Solar BLE Gateway	Macro BLE Gateway
Picture				
Operating Current	6mA @ Bluetooth receiving Max. 140mA @ 20dBm			
Operating Temperature	-40°C to + 70°C	-10°C to + 60°C	-40°C to + 70°C	-40°C to + 70°C
Charging Temperature	N/A	0°C to + 40°C	-20°C to + 60°C	N/A
Storage Temperature	-50°C to + 85°C	-40°C to + 85°C	-50°C to + 85°C	-50°C to + 85°C
Operating Humidity	5% - 95%			
Battery	N/A	Li-ion 600mAh rechargeable	Li-ion 5300mAh, Lithium rechargeable	Lithium thionyl chloride non-chargeable battery, 2 x 19,000mAh
Power	DC 5V/1A	DC 5V/1A	Solar-powered	Do NOT charge this product and battery.
Dimension	120 x 120 x 31 mm	97 x 62 x 7 mm	160 x 160 x 55 mm	160 x 160 x 55 mm

4. Application Information

4.1 Function

4.1.1 LoRaWAN Function

The gateway supports both OTAA and ABP modes. The indoor gateway works in class C mode, while the solar, macro, and compact gateway work in class A mode. DevEUI, AppEUI, and AppKey, or DevAddr, NwkSKey, and AppSKey, are stored in the gateway and are necessary for joining a network. DevEUI or DevAddr is labeled at the back of the device. Lansitec helps to configure these parameters before shipping if required.

After powering on and joining the LoRaWAN network, the gateway sends a registration message to the Application Server (AS), including the gateway's current parameters settings. It periodically reports the heartbeat messages to AS. The heartbeat report interval can be configured as an integral multiple of 30 seconds, with the default Heartbeat interval being 1 hour. The heartbeat message also contains status information of the gateway, which AS can use to monitor the gateway.

The BLE gateway receives BLE devices and forwards the corresponding information to the LoRaWAN gateway. If it receives a device multiple times in one Bluetooth receiving duration, it only reports the latest one.

Please refer to:
990-00169 "B-Mobile Personnel & Asset Tracking Solution" to find out how to design and develop your tracking system.

4.1.2 Bluetooth Function

Filter Block: In a BLE device advertising packet, some data are fixed and can be used to filter all received packets. These data are filter blocks. One filter block can be one byte or bytes in a row. The BLE packet can be filtered with one or 3 filter blocks at the most.

Data Block: A data block can be one byte or more bytes in a row in a BLE packet that the gateway reports to the LoRaWAN gateway. There can be 1 or several data blocks. A maximum of 10 are supported.

A Bluetooth gateway can receive multiple BLE devices (200 at the most) during a receiving period and compare all packets received with the filter blocks. If any packet matches the filter block criteria, it is considered to fulfill the filter conditions. The gateway will send the content to the LoRaWAN gateway according to the start and end addresses specified by the data block. Refer to Chapter ***4.4.3 Device Report Rule,*** and Chapter ***4.5.5 Filtering Command,*** for details.

Specify the start and end address of the BLE device advertising packet in the rule configuration to configure the filter block and data block.

It supports reporting a maximum of 3 types of different device filters and caches a maximum of 200 devices (all 3 device types combined).

Mac Block: Each device possesses a unique 6-byte MAC address for identification. This MAC address is independent of the device's advertising packet. The MAC block is used to report either a single byte or the entire 6-byte MAC address, with the address ranges from 00 to 05 bytes.

Device Type: There are different types of BLE devices, such as beacons, sensors, and display devices. Each device can be filtered with different filter blocks and report different data blocks. The gateway supports a maximum of 3 device types.

4.1.3 LoRa Network Connectivity

The gateway needs to acknowledge the first of every two heartbeat messages. It counts the number of lost confirmed heartbeat messages to determine the LoRa network connectivity. It considers itself disconnected from the network if it loses 5 confirmed and 5 unconfirmed heartbeat messages. Then, it stops sending the position report anymore and tries to rejoin the network. It attempts to join every 30 minutes, and this network reconnection interval is configurable. The position report resumes sending once the network is reconnected.

4.2 Application Scenarios

The gateway follows the general rules below:

- When a registration request is received from the gateway,
  1) If AS only wants the gateway to work with default parameters, AS ignores the registration message and waits for the periodic report.
  2) Or AS records the first-time configuration and acknowledges the request. If AS contains some history configuration of the gateway and a mismatch occurs, AS should send the new configuration to the gateway. After that, the gateway updates and starts working with the new parameters.

After registration, the user can change the configuration of the gateway.

If the gateway resets after registration or when receiving a periodic heartbeat message, AS needs to check if any configuration mismatch occurs. AS should send the new configuration to the gateway in the next downlink window if necessary.

4.3 On/Off and LED Status

4.3.1 Indoor BLE Gateway

1) Turn on: Plug in the charger, and the red LED flashes four times while the green LED is on. Then the green LED is off, and the red LED is on.
2) Turn off: Unplug the charger.
3) Joining the network: The green LED is on.
4) LoRaWAN communication: The green LED flashes once with every LoRaWAN communication.

4.3.2 Compact BLE Gateway

1) Turn on: Press the button for four seconds, and the red LED flashes four times while the green LED is on.
2) Turn off: Press the button for four seconds, and only the red LED flashes four times and then turns off.
3) Joining the network: The green LED is on.
4) After joining the network, press the button once:
   a) Green LED is on: Successfully joined.
   b) Red LED is on: Joining failed, or the gateway is OFF.
5) In the ON state, press the button three times, the green LED flashes three times, and the gateway rejoins the network.
6) Charge: Red LED flashes every second.
7) Charge done: Solid red LED.

4.3.3 Macro Bluetooth Gateway & Solar BLE Gateway

1) Turn on: Press the power button on the sidebar (labeled with the Power On/Off label). The device is powered on, the red LED flashes three times, and the startup music plays.
2) Turn off: No sign. The device is powered off directly.
3) Joining the network: No sign. Please check the packets in the network server.

4.4 Uplink Message

Table 2: Uplink Message Table

Message Type	Name	Description
0x1	Registration	Once the LoRaWAN network is successfully connected or a specific downlink message A20000 (refer to ***4.5.3 Command Request***) is received, the gateway will send this message once.
0x2	Heartbeat	The gateway periodically sends this message to confirm the status of the LoRaWAN network connection.
0x3	Device Report Rule	This message shows the current device report rule. It includes filter block, filtered content, and data block to report. If there are multiple report rules, the gateway will display them according to different device types.
0x8	Device Type 1 Message	The gateway sends this message by filtering the devices according to the device report rule. Refer to ***4.4.4 Device Type 1 Message***.
0x9	Device Type 2 Message	The gateway sends this message by filtering the devices according to the device report rule. Refer to ***4.4.5 Device Type 2 Message***.
0xA	Device Type 3 Message	The gateway sends this message by filtering the devices according to the device report rule. Refer to ***4.4.6 Device Type 3 Message***.
0xE	Multi-Device Types Message	If the gateway receives more than one type of device, it reports the message based on the message body described in ***4.4.7 Multi-Device Type Message***.
0xF	Acknowledgment	The gateway processes result in any downlink message that needs to be acknowledged.

4.4.1 Registration

Bytes	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**
Item	Type	LoRaWAN Frequency Band	POWER	CFG	PRI	HB	Bluetooth receiving duration	Network reconnection interval

Type Field (the most significant byte)

Bit	Name	Value	Description
Bits 7-4	Type	0x1	Message type. AS uses it to identify different uplink messages. Bit7 is the significant bit.
Bit 3	ADR	**0**: OFF **1**: ON	LoRaWAN ADR (Adaptive Data Rate) enables status. The default value is OFF. When ADR is enabled, the maximum payload length is as listed in ***Table 4: LoRaWAN Data Rate and Payload Length Limitation Map (bytes)***
Bits 2-0	Mode	000-111 (0-7 in decimal)	The current working LoRaWAN frequency sub-band plan.

LoRaWAN Band Field

Bit	Name	Value	Description
Bits 7-0	LoRaWAN frequency band	**0x00**: KR920 **0x01**: AU915 **0x04**: CN470 **0x08**: AS923 **0x10**: EU433 **0x20**: EU868 **0x40**: US915	LoRaWAN frequency band plan. Lansitec reserves this field and will be configured before shipping. Currently, it only supports one mode. Default value: South Korea: KR920, European: EU868, China: CN470, American: US915, Southeast Asian: AS923.

Power Field

Bit	Name	Value	Description
Bits 7-3	Power	00000-10100 (0-20 in decimal)	LoRa TX power (dBm). The default value depends on the gateway LoRaWAN frequency work mode, and it's the largest allowed. For example, if the mode is EU868, the default value should be 16 dBm. Refer to **Table 3: LoRa Transmitting Power (dBm)** for detailed setting information.
Bit 2	RFU	0	Reserved for future usage.
Bit 1	Continuously BLE receiving	**0**: Disable **1**: Enable	0 (0 in binary): Continuous Bluetooth receiving function is disabled. 1 (1 in binary): Continuous Bluetooth receiving function is enabled.
Bit 0	RFU	0	Reserved for future usage.

Table 3: LoRa Transmitting Power (dBm)

EU868	US915	AU915	CN470	AS923	KR920	IN865
16	20	20	20	16	14	20
14	18	18	18	14	12	18
12	16	16	16	12	10	16
10	14	14	14	10	8	14
8	12	12	12	8	6	12
6	10	10	10	6	4	10
4	8	8	8	4	2	-
2	6	6	6	2	-	-

CFG Field

Bit	Name	Value	Description
Bits 7-4	DR	0x0-0x5 (0-5 in decimal)	LoRaWAN Uplink Data Rate (DR0-DR5). The default value is DR3 ***Note**: For the available DR value in each LoRaWAN frequency band, please refer to **Table 4: LoRaWAN Data Rate and Payload Length Limitation Map (bytes)**.*
Bits 3-0	RFU	0x0	Reserved for future usage.

Table 4: LoRaWAN Data Rate and Payload Length Limitation Map (bytes)

DR	EU868	US915	EU433	AU915	CN470	AS923	KR920	IN865
0	51	11	51	51	51	51	65	51
1	51	53	51	51	51	51	151	51
2	51	126	51	51	51	51	242	51
3	115	242	115	115	115	115	242	115
4	242	242	242	242	242	242	242	242
5	242	-	242	242	242	242	242	242

PRI Field

Bit	Name	Value	Description
Bits 15-0	Position report interval	0x0000-0xFFFF (0-65535 in decimal)	Position report interval, unit: 5s, big endian. 0 means OFF. The default value is 0x003C (5 minutes).

HB Field

Bit	Name	Value	Description
Bits 7-0	Heartbeat interval	0x01-0xFF (1-255 in decimal)	Heartbeat message report interval, unit: 30s. The heartbeat message can't be disabled. The default value is 0x78 (1 hour).

Bluetooth receiving duration Field

Bit	Name	Value	Description
Bits 7-0	Bluetooth receiving duration	0x01-0xFF (1-255 in decimal)	Bluetooth receiving duration must be shorter than the position report interval. Unit: 1s. The default value is 0x0B (11 seconds).

Network reconnection Interval Field

Bit	Name	Value	Description
Bits 7-0	Network reconnection interval	0x00-0xFF (0-255 in decimal)	The network reconnection time interval after the device is disconnected from the network. Unit: 5min. The default value is 0x06 (30 minutes). ***Note**: When this field is configured to 0, the gateway will reconnect to the network based on the reconnect interval. This reconnection interval will double each time the connection fails, such as 5, 10, 20, 40, 80, 160, 320, 640 minutes, and then remain at 640 minutes.*

Example: 16 20 A0 30 003C 78 0B 06

- **16**: "1" is the message type of registration message, and "6" indicates that the current working LoRaWAN frequency is EU868.
- **20**: The LoRaWAN frequency is EU868.
- **A0**: The binary expression is 1010 0000, where bits 3-7 represent the Tx power as 10100 (20 in decimal), indicating a Tx Power of 20dBm. Bit 1 is a continuous Bluetooth receiving field. It is configured as 0, which means the continuous Bluetooth receiving function is disabled. Bits 2&0 are reserved for future usage.

- **30**: The binary expression is 0011 0000, where bits 4-7 represent the DR value as 0011 (3 in decimal), indicating a DR value of 3. Bits 0-3 are reserved for future usage.
- **003C**: The position report interval is configured as 003C in hexadecimal, which equals 60 in decimal. Therefore, the position report interval is calculated as 60 x 5s = 300s = 5 minutes.
- **78**: The heartbeat report interval is configured as 78 in hexadecimal, which equals 120 in decimal. Therefore, the heartbeat report interval is calculated as 120 x 30s = 3600s = 1 hour.
- **0B**: The Bluetooth receiving duration is configured as 0B in hexadecimal, which equals 11 in decimal. Therefore, the Bluetooth receiving duration is 11s.
- **06**: The network reconnection interval is configured as 06 in hexadecimal, which equals 6 in decimal. Therefore, the network reconnection interval is calculated as 6 x 5min = 30 minutes.

4.4.2 Heartbeat

Bytes	**1**	**1**	**1**	**2**	**2**	**1**
Item	TYPE	VOL	RSSI	SNR	VER	CHGSTAT

Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-4	Type	0x2	Message type, AS uses it to identify different uplink messages. Bit7 is the most significant bit.
Bits 3-0	RFU	0x1	Reserved for future usage.

VOL Field

Bit	**Name**	**Value**	**Description**
Bits 7-0	VOL	Macro Gateway 0x00-0x96 (0-150 in decimal)	Battery voltage, unit: 0.01 V, The formula is VOL x 0.01 + 1.5. If the value is CB (203 in decimal), the voltage is 203 x 0.01 + 1.5 = 3.53v. ***Note**: If the battery's voltage is lower than 3.2v, it is suggested to change the battery ASAP.*
		Solar & Compact Gateway 0x00-0x64 (0-100 in decimal)	Battery level in percentage. It indicates how much is left. (Unit: %)
		Indoor Gateway 0x00-0x64 (0-100 in decimal)	Battery level in percentage. There is no battery in this gateway. It is always 100%.

RSSI Field

Bit	**Name**	**Value**	**Description**
Bits 7-0	RSSI	0x00-0xA0 (0-160 in decimal)	LoRa Received Signal Strength Indication was detected and calculated by the LoRaWAN gateway. (unit: -1dBm)

SNR Field

Bit	**Name**	**Value**	**Description**
Bits 15-0	SNR	-3000-3000	LoRa Signal Noise Ratio, unit: 0.01dB

			The signal noise ratio received from the LoRaWAN gateway. ***Note**: If the SNRINC field is 0, the Application Server should ignore this field.*

VER Field

Bit	Name	Value	Description
Bits 15-0	Version	16-bit hex	Firmware version

CHGSTAT Field

Bit	Name	Value	Description
Bits 7-0	CHGSTAT	Compact & Solar Gateway **0x00**: Not charging **0x50**: Charging **0x60**: Charging completed	Status of charging
		Macro Gateway	This field remains **0x00** and can't be changed.
		Indoor Gateway	This field remains **0x00** and can't be changed.

Example: 21 CB 3E 033E 006C 00

- **21**: This represents the message type of heartbeat message.
- **CB**: The battery voltage, represented as CB in hexadecimal, equals 203 in decimal. To calculate the battery voltage in volts, use the formula: 203 x 0.01 + 1.5 = 3.53V.
  ***Note**: Only the macro gateway displays the battery voltage in the Vol field. The solar, compact, and indoor gateway display the battery level in this field. The battery level indicates how much power is remaining. The maximum value for this field is 64, which is equivalent to 100%, indicating that the battery power is at its fullest capacity.*
- **3E**: The LoRa RSSI, represented as 3E in hexadecimal equals 62 in decimal. Therefore, the LoRa RSSI value is -62dBm.
- **033E**: The signal noise ratio, represented as 033E in hexadecimal equals 830 in decimal. Therefore, the signal-noise ratio is calculated as 830 x 0.01 = 8.3dB.
- **006C**: Firmware version, represented as 006C in hexadecimal equals 108 in decimal. Therefore, the firmware version is V1.08.
- **00**: This represents the status of charging. Only the compact gateway and solar gateway have this charge state. 00 means that the device is not charging at this time, 50 means that the device is currently charging, and 60 means that the device has completed charging. The macro gateway and indoor gateway remain 00 in this field.

4.4.3 Device Report Rule

This message shows the current device report rule. It includes filter block, filtered content, and data block to report. If there are multiple report rules, the gateway will display them according to different device types.

Bytes	**1**	**1**	**1**	**3-33**				**3-33**
Item	Message type	Device type quantity	Payload block	1	1	1	0-30	...
				Rule type	Start address	End address	Filter value	...

In device type 1, the gateway filters an iBeacon device with UUID (F2-A5-2D-43-E0-AB-48-9C-B6-4C-4A-83-00-14-67-20) as default. It filters devices (or called beacons) by fixed bytes (UUID) and reports their major and minor values.

Message Type Field

Bit	Name	Value	Description
Bits 7-4	Message type	0x3	Message type, AS uses it to identify different uplink messages. Bit7 is the most significant bit.
Bits 3-0	RFU	0x0	Reserved for future usage

Device Type Quantity Field

Bit	Name	Value	Description
Bits 7-0	Device type quantity	0x00-0x03 (0-3 in decimal)	The gateway supports reporting a maximum of 3 types of devices. The gateway does not report any Bluetooth payload if this number is 0 and only reports heartbeat messages.

Payload Block Field

Bit	Name	Value	Description
Bits 7-4	Device type ID	0x1-0x3 (1-3 in decimal)	The device type ID is used to differentiate the filters used by different devices. Up to 3 types of devices are supported.
Bits 3-0	Filter and data block quantity	0x1-0xD (1-13 in decimal)	The total number of filters and data blocks

Rule Type Field

Bit	Name	Value	Description
Bits 7-0	Rule type	***0x01***: Filter block **0x02**: Data block **0x03**: Mac block	Indicate the type of the following data. **0x01**: Indicate the following data is the start address, end address, and data to be filtered for this payload filter block. **0x02**: Indicate the following data is the data block's start and end addresses to be sent. **0x03**: Indicate the following data is the mac block's start and end addresses to be sent. And report the content within this range at the beginning of the data block in the device's uplink message.

Each device possesses a unique 6-byte MAC address. However, not every Bluetooth device's advertising packet includes this MAC address. Therefore, the start and end addresses of the MAC address mentioned below do not correspond to the start and end of the Bluetooth advertising packet.

Start Address Field

Bit	Name	Value	Description
Bits 7-0	Start address	0x00-0x1E (0-30 in decimal)	Start address of the payload filter block, data block, or Mac block.

			***Note**: the Mac address consists of only 6 bytes, thus the start address ranges from 0x00 to 0x05.*

End Address Field

Bit	Name	Value	Description
Bits 7-0	End address	0x00-0x1E (0-30 in decimal)	End address of the payload filter block or data block. End address >= start address, and end address - start address < 20 ***Note**: the Mac address consists of only 6 bytes, thus the end address ranges from 0x00 to 0x05.*

Filter Value Field

Byte	Name	Value	Description
Bytes 30-0	Value	String	When the rule type is **0x01** (Filter block), this field is the content that needs to be filtered. When the rule type is **0x02** (Data block), there is no need to fill in any value for this field. The data range to be reported has already been specified by the previous start and end addresses. Therefore, the gateway will directly report the content within this range. When the rule type is **0x03** (Mac block), there is no need to fill in any value for this field. The data range to be reported has already been specified by the previous start and end addresses. Therefore, the gateway will directly report the content within this range.

Example 1: If there is a device (or beacon in other words) with the iBeacon payload 0x0201061AFF4C000215F2A52D43E0AB489CB64C4A8300146720AABBCCCCB3 around the gateway and the gateway has only one device type using the yellow font part to filter the beacon and report the content in the green font, then you will see the following device report rule message: 30 01 17 01 0001 0201 01 0404 FF 01 0918 F2A52D43E0AB489CB64C4A8300146720 02 0203 02 0508 02 191A 02 1D1D.

- **30:** Represents the message type of the device report rule message.
- **01:** The device type quantity field. The gateway currently only has one device report rule.
- **17:** The payload block field. 1 is the device type ID, which means this is the device type 1 rule (this type will use 8 as the message type to report the beacon message). The number 7 indicates that this rule contains a total of 7 blocks (3 filter blocks and 4 data blocks).
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0001:** The start address of the first filter block is the 00 byte of the beacon payload, and it ends at the 01 byte of the beacon payload.
- **0201:** The content that needs to be filtered is 0201.
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0404:** The start address of the second filter block is the 04 byte of the beacon payload, and it ends at the 04 byte of the beacon payload.
- **FF:** The content that needs to be filtered is FF.
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0918:** The start address of the third filter block is 09 byte of the beacon payload, and its end address is 18 in hexadecimal equals 24 in decimal, indicating the 24 byte of the beacon payload.

- **F2A52D43E0AB489CB64C4A8300146720:** The content that needs to be filtered is F2A52D43E0AB489CB64C4A8300146720.
- **02:** The rule type field, where 02 means the following block is a data block.
- **0203:** The start address of the first data block is the 02 byte of the beacon payload, and it ends at the 03 byte of the beacon payload, which means the gateway will send **061A**.
- **02:** The rule type field, where 02 means the following block is a data block.
- **0508:** The start address of the second data block is the 05 byte of the beacon payload, and it ends at the 08 byte of the beacon payload, which means the gateway will send **4C000215**.
- **02:** The rule type field, where 02 means the following block is a data block.
- **191A:** The start address of the third data block is 19 in hexadecimal equals 25 in decimal, indicating the 25 byte of the beacon payload. Its end address is 1A in hexadecimal, which equals 26 in decimal, indicating the 26 byte of the beacon payload, which means the gateway will send **AABB**.
- **02:** The rule type field, where 02 means the following block is a data block.
- **1D1D:** The start address of the fourth data block is 1D in hexadecimal equals 29 in decimal, indicating the 29 byte of the beacon payload, and it ends at the 29(1D in hexadecimal) byte of the beacon payload, which means the gateway will send **B3**.

Example 2: If there are some devices with the payload 0x0c093c23414d2d31303030313e around the gateway, and the gateway has only one device type using the yellow font part to filter the devices and report the content in the green font, then you will see the following device report rule message: 30 02 23 01 0003 0c093c23 01 0c0c 3e 02 040B.

- **30:** Represents the message type of the device report rule message.
- **02:** The device type quantity field. The gateway currently has two device report rules, and this message is one of them.
- **23:** The payload block field. 2 is the device type ID, which means this is the device type 2 rule (this type will use 9 as the message type to report the device message). The number 3 indicates that this rule contains a total of 3 blocks (2 filter blocks and 1 data block).
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0003:** The start address of the first filter block is the 00 byte of the device payload, and it ends at the 03 byte of the device payload.
- **0c093c23:** The content that needs to be filtered is 0c093c23.
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0c0c:** The start address of the second filter block is 0c in hexadecimal, equals 12 in decimal, indicating the 12 byte of the device payload, and it ends at the 12(0c in hexadecimal) byte of the device payload.
- **3e:** The content that needs to be filtered is 3e.
- **02:** The rule type field, where 02 means the following block is a data block.
- **040B:** The start address of the data block is 04 byte of the device payload, and its end address is 0B in hexadecimal equals 11 in decimal, indicating the 11 byte of the device payload. This means the gateway will send **414d2d3130303031**.

Example 3: If there is a device with the MAC address 648216982653 and a advertising packet 0x0c093c23414d2d31303030313e around the gateway, and the gateway has only one device type using the yellow font part to filter the devices and report the last three bytes of the MAC address and the content in the green font, then you will see the following device report rule message: 30 02 22 01 0c0c 3e 02 040B 03 0305.

- **30:** Represents the message type of the device report rule message.
- **02:** The device type quantity field. The gateway currently has two device report rules, and this message is one of them.
- **22:** The payload block field. 2 is the device type ID, which means this is the device type 2 rule (this type will use 9 as the message type to report the device message). The number 2 indicates that this rule contains a total of 2 blocks (1 filter block and 1 data block).
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0c0c:** The start address of the filter block is 0c in hexadecimal, equals 12 in decimal, indicating the 12 byte of the device payload, and it ends at the 12 (0c in hexadecimal) byte of the device payload.
- **3e:** The content that needs to be filtered is 3e.
- **02:** The rule type field, where 02 means the following block is a data block.
- **040B:** The start address of the first data block is 04 byte of the device payload, and its end address is 0B in hexadecimal equals 11 in decimal, indicating the 11 byte of the device payload. This means the gateway will send **414d2d3130303031**.
- **03:** The rule type field, where 03 means the following block is a Mac block.
- **0305:** The start address of the device's Mac address is the 3rd byte, and the end address is the 5th byte, indicating the 3 byte of the device's Mac address, which means the gateway will send **982653**.

4.4.4 Device Type 1 Message

The gateway reports the message according to the message body below if only the device type 1 device is received.

Bytes	**1**	**1-31**	**1**	**1-31**	**1**	**……**
Item	Type	Data	RSSI	Data	RSSI	……

Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-4	Message type	0x8	Message type: AS uses it to identify different uplink messages. Bit7 is the most significant bit.
Bits 3-0	Number	0x1-0xF (1-15 in decimal)	The number of devices to be reported.

For indoor or compact gateways, Bluetooth keeps receiving information all the time and sends the device information list at the end of the PRI period. It only sends 15 Bluetooth devices at a time. If it receives more, it stores them in the buffer and sends them through the following messages every 20s. If more devices are received in the next period, it adds them to the end of the buffer and sends the older ones first. If some devices are received again before sending them, it updates their information and sends them later. Moreover, they will not be placed at the tail of the message.

Data Field

Byte	**Name**	**Value**	**Description**
Bytes 31-1	Data	String	Mac address and the data block to be reported

RSSI Field

Bit	**Name**	**Value**	**Description**
Bits 7-0	RSSI	0x01-0xFF	The received signal strength indication of the device is

			utilized by the server to calculate the distance. Since the reported RSSI value is a signed number, the actual device RSSI value needs to be subtracted by 256 (unit: -1dBm) ***NOTE**: This field is represented by a negative 8-bit number for compatibility with the legacy version.*

Example 1: 83 061A4C000215AABB B3 061A4C000215AABC B4 061A4C000215AABD B5

- **83:** The number 8 represents the message type of the type 1 device, and 3 is the number of type 1 devices to be reported.
- **061A4C000215AABB:** The data that needs to be reported.
- **B3:** The RSSI field. B3 in hexadecimal equals 179 in decimal, and the RSSI formula is 179 - 256 = -77dBm, so the device RSSI value is -77dBm.
- **061A4C000215AABC:** The data that needs to be reported.
- **B4:** The RSSI field. B4 in hexadecimal equal to 180 in decimal, and the RSSI formula is 180 - 256 = -76dBm, so the device RSSI value is -76dBm.
- **061A4C000215AABD:** The data that the type 1 device needs to report.
- **B5:** The RSSI field. B5 in hexadecimal equals 181 in decimal, and the RSSI formula is 181 - 256 = -75dBm, so the device RSSI value is -75dBm.

Example 2: 82 648216982653 4C0215AABC B4 648216982654 061A15AABD B5

- **82:** The number 8 represents the message type of the type 1 device, and 2 is the number of type 1 devices to be reported.
- **648216982653**: The 6-byte Mac address of the device.
- **4C0215AABC:** The data that needs to be reported.
- **B4:** The RSSI field. B4 in hexadecimal equal to 180 in decimal, and the RSSI formula is 180 - 256 = -76dBm, so the device RSSI value is -76dBm.
- **648216982654**: The 6-byte Mac address of the device.
- **061A15AABD:** The data that the type 1 device needs to report.
- **B5:** The RSSI field. B5 in hexadecimal equals 181 in decimal, and the RSSI formula is 181 - 256 = -75dBm, so the device RSSI value is -75dBm.

4.4.5 Device Type 2 Message

The gateway reports the message according to the message body below if only the type 2 device is received.

Bytes	**1**	**1-31**	**1**	**1-31**	**1**	**……**
Item	Type	Data	RSSI	Data	RSSI	……

Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-4	Message type	0x9	Message type, AS uses it to identify different uplink messages. Bit7 is the most significant bit.
Bits 3-0	Number	0x1-0xF (1-15 in decimal)	The number of devices to be reported.

Data Field

Byte	Name	Value	Description
Bytes 31-1	Data	String	Mac address and the data block to be reported.

RSSI Field

Bit	Name	Value	Description
Bits 7-0	RSSI	0x01-0xFF	The received signal strength indication of the device is utilized by the server to calculate the distance. Since the reported RSSI value is a signed number, the real device RSSI value needs to be subtracted by 256 (unit: -1dBm) ***NOTE**: For compatibility with the legacy version, this field is represented by a negative 8-bit number.*

Example 1: 92 414d2d3130303031 b3 414d2d3130303032 b4

- **92:** The number 9 represents the message type of the type 2 device, and 2 is the number of type 2 devices to be reported.
- **414d2d3130303031:** The data that needs to be reported.
- **b3:** The RSSI field. b3 in hexadecimal equal to 179 in decimal, and the RSSI formula is 179 - 256 = -77dBm, so the device RSSI value is -77dBm.
- **414d2d3130303032:** The data that needs to be reported.
- **b4:** The RSSI field. b4 in hexadecimal equal to 180 in decimal, and the RSSI formula is 180 - 256 = -76dBm, so the device RSSI value is -76dBm.

Example 2: 92 982653 414d2d3130303031 b3 982654 414d2d3130303032 b4

- **92:** The number 9 represents the message type of the type 2 device, and 2 is the number of type 2 devices to be reported.
- **982653**: The last 3 bytes of the Mac address of the device.
- **414d2d3130303031:** The data that needs to be reported.
- **b3:** The RSSI field. b3 in hexadecimal equal to 179 in decimal, and the RSSI formula is 179 - 256 = -77dBm, so the device RSSI value is -77dBm.
- **982654**: The last 3 bytes of the Mac address of the device.
- **414d2d3130303032:** The data that needs to be reported.
- **b4:** The RSSI field. b4 in hexadecimal equal to 180 in decimal, and the RSSI formula is 180 - 256 = -76dBm, so the device RSSI value is -76dBm.

4.4.6 Device Type 3 Message

The gateway reports the message according to the message body below if only the type 3 device is received.

Bytes	1	1-31	1	1-31	1	……
Item	Type	Data	RSSI	Data	RSSI	……

Type Field

Bit	Name	Value	Description
Bits 7-4	Message type	0xA	Message type: AS uses it to identify different uplink messages. Bit7 is the most significant bit.

Bits 3-0	Number	0x1-0xF (1-15 in decimal)	The number of devices to be reported.

Data Field

Byte	Name	Value	Description
Bytes 31-1	Data	String	Mac address and the data block to be reported.

RSSI Field

Bit	Name	Value	Description
Bits 7-0	RSSI	0x01-0xFF	The received signal strength indication of the device is utilized by the server to calculate the distance. Since the reported RSSI value is a signed number, the real device RSSI value needs to be subtracted by 256 (unit: -1dBm) ***NOTE**: This field is represented by a negative 8-bit number for compatibility with the legacy version.*

Example 1: A2 0010030A C2 0010030B C4

- **A2:** The number A represents the message type of the type 3 device, and 2 is the number of type 3 devices to be reported.
- **0010030A:** The data that needs to be reported.
- **C2:** The RSSI field. C2 in hexadecimal equal to 194 in decimal, and the RSSI formula is 194 - 256 = -62dBm, so the device RSSI value is -62dBm.
- **0010030B:** The data that needs to be reported.
- **C4:** The RSSI field. C4 in hexadecimal equal to 196 in decimal, and the RSSI formula is 196 - 256 = -60dBm, so the device RSSI value is -60dBm.

Example 2: A1 648216 0010030A C2

- **A1:** The number A represents the message type of the type 3 device, and 1 is the number of type 3 devices to be reported.
- **648216**: The first 3 bytes of the Mac address of the device.
- **0010030A:** The data that needs to be reported.
- **C2:** The RSSI field. C2 in hexadecimal equal to 194 in decimal, and the RSSI formula is 194 - 256 = -62dBm, so the device RSSI value is -62dBm.

4.4.7 Multi-Device Type Message

The gateway reports the message according to the message body below if more than one type of device is received. The devices are sent according to the FIFO rule.

Bytes	**1**	**1**	**1-31**	**1**	**1**	**1-31**	**1**	**.....**
Item	Type	Device Type ID	Data	RSSI	Device Type ID	Data	RSSI	.....

Type Field

Bit	Name	Value	Description
Bits 7-4	Type	0xE	Message type: AS uses it to identify different uplink

			messages. Bit7 is the most significant bit.
Bits 3-0	Number	0x1-0xF (1-15 in decimal)	The number of devices to be reported.

Device type Field

Bit	Name	Value	Description
Bits 7-0	Device type ID	0x01-0x03 (1-3 in decimal)	The device type ID is used to differentiate the filter blocks used by different devices. Up to 3 types of devices are supported.

Data Field

Byte	Name	Value	Description
Bytes 31-1	Data	String	Data block to be reported.

RSSI Field

Bit	Name	Value	Description
Bits 7-0	RSSI	0x01-0xFF	Received signal strength indication of the device. The server utilizes it to calculate the distance. Since the reported RSSI value is a signed number, the real device RSSI value needs to be subtracted by 256 (unit: -1dBm) ***NOTE**: This field is represented by a negative 8-bit number for compatibility with the legacy version.*

Example: E3 01 061A4C000215AABB B3 03 414d2d3130303031 B1 02 0010030B C5

- **E3:** E represents the message that multi-type devices should be reported, and 3 means 3 types of devices.
- **01:** The device type field, 01 indicates the following message is a type 1 device message.
- **061A4C000215AABB:** The data in the type 1 device must be reported.
- **B3:** The RSSI field. B3 in hexadecimal equals 179 in decimal, and the RSSI formula is 179 - 256 = -77dBm, so the device RSSI value is -77dBm.
- **03:** The device type field, 03 indicates the following message is a type 3 device message.
- **414d2d3130303031**: The data in the type 3 device needs to be reported.
- **B1:** The RSSI field. B3 in hexadecimal equals 177 in decimal, and the RSSI formula is 177 - 256 = -79dBm, so the device RSSI value is -79dBm.
- **02**: The device type field, 02 indicates the following message is a type 2 device message.
- **0010030B:** The data in the type 3 device needs to be reported.
- **C5:** The RSSI field. C5 in hexadecimal equals 197 in decimal, and the RSSI formula is 197 - 256 = -59dBm, so the device RSSI is -59dBm.

4.4.8 Acknowledgment

Bytes	**1**	**1**
Item	Type	MSGID

Type Field

Bit	Name	Value	Description
Bits 4-7	Type	0xF	Message type: AS uses it to identify different uplink messages.
Bits 0-3	Result	**0x0**: Success **0x1**: Failure	Processes result in any downlink message that needs to be acknowledged.

MSGID Field

Bit	Name	Value	Description
Bits 0-7	MSGID	0x00-0xFF (0-255 in decimal)	The MSGID field of the corresponding downlink message.

Example: F0 00

- **F0**: In the acknowledgment message, the F represents the message type, and 0 indicates that the downlink process was successful.
- **00**: This represents the message ID, which corresponds to the MSGID field of the downlink message.

4.5 Downlink Message

Table 5: Downlink Message Table

Message Type	Name	Description
0x8	LoRaWAN configuration	AS uses this message to configure LoRaWAN parameters.
0x9	Gateway configuration	AS uses this message to configure the gateway parameters.
0xA	Command request	AS uses this message to request the gateway to execute instructions.
0xA	Bluetooth Receiving Configuration	AS uses this message to request the gateway to change the Bluetooth receiving configuration.
0xA	Filtering Command	AS uses this message to request the gateway to modify the device rule.
0xA	Network Reconnection Interval Command	AS uses this message to request the gateway to modify the reconnection interval.

4.5.1 LoRaWAN Configuration

Bytes	**1**	**1**	**1**
Item	Type	DR	MODE

Type Field

Bit	Name	Value	Description
Bits 4-7	Type	0x8	Message type: The gateway uses it to identify different downlink messages.
Bit 3	ADR	**0**: OFF **1**: ON	ADR (Adaptive Data Rate) status.
Bits 0-2	RFU	000	Reserved for future usage

DR Field

Bit	Name	Value	Description
Bits 4-7	DR	0x0-0x5 (0-5 in decimal)	LoRaWAN Uplink Data rate (DR0-DR5). The data rate is limited from DR3 to DR5. ***Note**: For the available DR value in each LoRaWAN frequency band, please refer to **Table 4: LoRaWAN Data Rate and Payload Length Limitation Map (bytes)**.*
Bits 0-3	RFU	0x0	Reserved for future usage

Mode Field

Bit	Name	Value	Description
Bits 7-5	Mode	000	LoRaWAN sub-band. These bits are reserved and can't be changed.
Bits 4-0	Power	00000-10100 (0-20 in decimal)	LoRa TX power (dBm) The default value depends on the tracker work mode. It is always the highest one of the allowed TX powers. ***Note**: For the available TX Power value in each LoRaWAN*

			frequency band plan, please refer to ***Table 3: LoRa Transmitting Power (dBm)****.*

Example: 80 40 14

- **80**: In the LoRaWAN configuration message, 8 represents the message type. And 0 is 0000 in binary, where bit 3 is 0, which means the ADR function is turned off (Enabling ADR is not recommended), and bits 0-2 are reserved for future usage.
- **40**: This represents the DR field, where bits 4-7 are 0100 in binary, which equals 4 in hexadecimal. This indicates that the DR value is 4, and bits 0-4 are reserved for future usage.
- 14: 14 in hexadecimal equals 0001 0100 in binary. In this binary representation, bits 5-7 are reserved for future usage, and bits 0-4 represent the Tx power as 10100 (20 in decimal), indicating a Tx Power of 20dBm.

4.5.2 Gateway Configuration

Bytes	**1**	**2**	**1**
Item	Type	PRI	HB

Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-4	Type	0x9	Message type: The gateway uses it to identify different downlink messages.
Bits 3-0	RFU	0x0	Reserved for future usage.

PRI Field

Bit	**Name**	**Value**	**Description**
Bits 15-0	Position report interval	0x0000-0xFFFF (0-65535 in decimal)	Position report interval, unit 5s, big endian 0 means OFF. Default: 0x003C (5 minutes)

HB Field

Bit	**Name**	**Value**	**Description**
Bits 7-0	Heartbeat interval	0x01-0xFF (1-255 in decimal)	Heartbeat message report interval, unit 30s. **This value must be larger than 0**. Default: 0x78 (1 hour)

Example: 90 000C 3C

- **90**: This represents the message type of the downlink gateway configuration message.
- **000C**: This represents the position report interval configuration. If you want to change the position report interval from 5 minutes to 1 minute, please use the formula: 1 minute = 12 x 5s, and 12 in decimal equals 000C in hexadecimal. Therefore, this position report interval should be configured as 000C.
- **3C**: This represents the heartbeat report interval configuration. If you want to change the heartbeat report interval from 1 hour to 30 minutes, please use the formula: 30 minutes = 60 x 30s, and 60 in decimal equals 3C in hexadecimal. Therefore, this heartbeat report interval should be configured as 3C.

4.5.3 Command Request

Bytes	1	1	1
Item	Type	MSGID	Value

Type Field

Bit	Name	Value	Description
Bits 7-4	Type	0xA	Message type: The gateway uses it to identify different downlink messages.
Bits 3-0	Command	**0x2:** Register request **0x3**: Device reboot **0x4**: Stop Bluetooth receiving **0x5**: Start Bluetooth receiving **0x8**: Device report rule	**0x2**: Request the gateway to send the registration message. **0x3**: Reboot the gateway. **0x4**: Stop continuously Bluetooth receiving. It is the opposite of 0x5. Once 0x4 is activated, the Bluetooth receiving will be enabled before sending position messages according to the originally configured Bluetooth receiving duration (default duration is 3s). Refer to ***Figure 1: PRI Field and Receiving Duration***. **0x5**: Start continuous Bluetooth receiving. This command applies to all Bluetooth gateways. **0x8:** The gateway reports each type of device's rule (filter block and data block) in one message, as described in section ***4.4.3 Device Report Rule***. If 3 types of device rules are configured, the gateway will send 3 device rules at an interval of 5 seconds.

Note 1: The gateway sends the following default settings when 0xA80000 is received. The interval is 5s.

0x30-01-12-01-0918-F2A52D43E0AB489CB64C4A8300146720-02-191C

MSGID Field

Bit	Name	Value	Description
Bits 7-0	Message ID	0x00-0xFF (0-255 in decimal)	The gateway does not check the message ID, so this field is not mandatory. It can be any number from 0x00 to 0xff.

Value Field

Bit	Name	Value	Description
Bits 7-0	Value	0x00	Reserved for future usage.

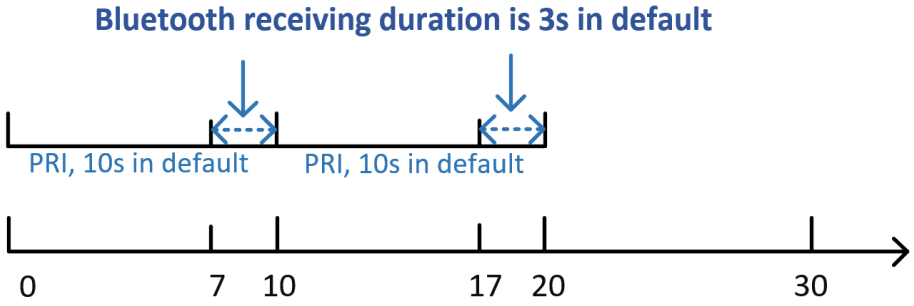


Figure 1: PRI Field and Receiving Duration

Example 1: A3 00 00

- **A3**: In the downlink command request message, A represents the message type, and 3 is the command to restart the device.
- **00**: This represents the message ID, which can be any other number.
- **00**: The value field is reserved for future usage.

Example 2: A8 00 00

- **A8**: In the downlink command request message, A represents the message type, and 8 is the command to request the gateway report the current device rule.
- **00**: It represents the message ID, which can be any other number.
- **00**: The value field is reserved for future usage.

4.5.4 Bluetooth Receiving Configuration

Bytes	**1**	**1**	**1**
Item	Type	MSGID	Value

Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-4	Type	0xA	Message type; The gateway uses it to identify different downlink messages.
Bits 3-0	Command	**0x6**: Change Bluetooth receiving start time **0x7**: Change Bluetooth receiving duration	**0x6**: Advance or delay the receiving start time. A positive value delays the start time, while a negative value advances it. This command applies to all Bluetooth gateways. ***Figure 2: Delay the Receiving Start Time*** shows an example of delaying the receiving start time for 3 seconds. The command should be 0xA60003. **0x7**: Change the receiving duration for the solar and macro BLE gateways. The Bluetooth receiving duration must be shorter than the position report interval. ***Figure 3: Bluetooth Receiving Duration: 5s*** is an example of changing it to 5 seconds. The command should be 0xA70205. Default settings:

			The Bluetooth receiving duration is 11s, and the position report interval is 5min.

MSGID Field

Bit	Name	Value	Description
Bits 7-0	Message ID	0x00-0xFF (0-255 in decimal)	The gateway does not check the message ID, so this field is not mandatory. It can be any number from 0x00 to 0xff.

Value Field

Bit	Name	Value	Description
Bits 7-0	Value	-127-127	If the command is 6, this field is used to set the value for advancing or delaying time. If the value is positive, the receiving starting time will be delayed. Otherwise, it will advance. If the command is 7, this field sets the value for the new receive time.

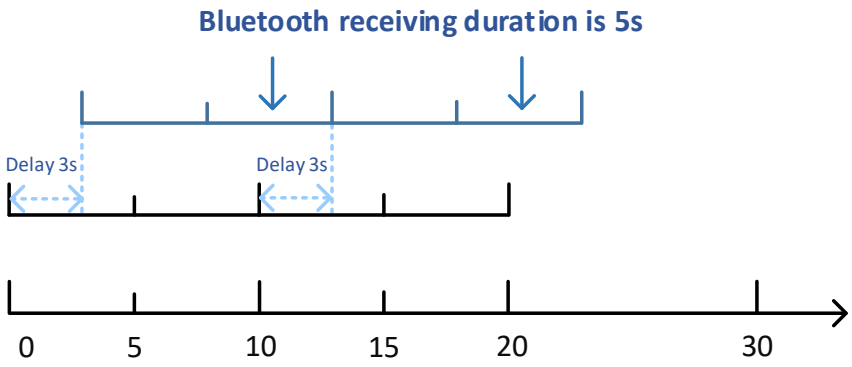


Figure 2: Delay the Receiving Start Time

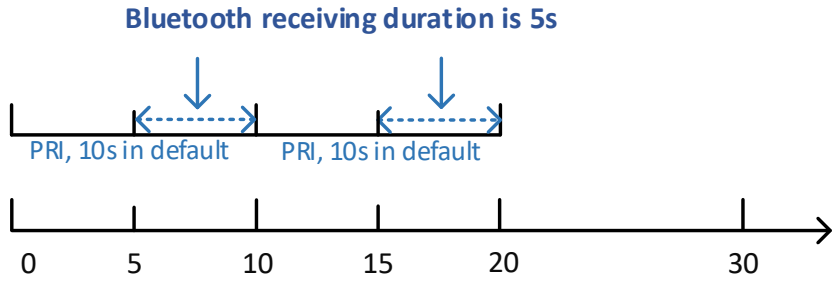


Figure 3: Bluetooth Receiving Duration: 5s

Example 1: A6 00 FD

- **A6**: In the downlink Bluetooth receiving configuration message, A represents the message type, and 6 indicates a change in the Bluetooth receiving start time.
- **00**: This represents the message ID, which can be any other number.
- **FD**: The value field, hexadecimal FD, equals 253 in decimal. Use formula: 253 - 256 = -3. It is a negative number. The negative value advances the start time, so this command advances the start time of Bluetooth reception by 3 seconds.

Example 2: A7 00 05

- **A3**: In the downlink Bluetooth receiving configuration message, A represents the message type, and 6 indicates a change in the Bluetooth receiving duration.
- **00**: This represents the message ID, which can be any other number.
- **05**: The value field, hexadecimal 05, equals 5 in decimals. Therefore, this command changes the Bluetooth receiving duration to 5 seconds.

4.5.5 Filtering Command

Bytes	**1**	**1**	**4-N**
Item	Type	MSGID	Value

Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-4	Type	0xA	Message type: The gateway uses it to identify different downlink messages.
Bits 3-0	Command	**0x9**: Set device rule	**0x9:** Set the device rule type

MSGID Field

Bit	**Name**	**Value**	**Description**
Bits 7-0	Message ID	0x00-0xFF (0-255 in decimal)	The gateway does not check the message ID, so this field is not mandatory. It can be any number from 0x00 to 0xff.

Value Field

The gateway can only send one command to set one type of device at a time.

Bytes	**1**	**3-33**				**3-33**
Item	Payload Block Type	1	1	1	0-30	……
		Rule Type	Start Address	End Address	Filter Value	……

Payload Block Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-4	The ID of different device types	0x1-0x3 (1-3 in decimal)	The device type ID is used to differentiate the filters used by different devices. Up to 3 types of device filters are supported.
Bits 3-0	Filter and data block quantity	0x0-0xD (0-13 in decimal)	The total number of filters and data blocks. If the same device type ID is used, the later command will overwrite the existing one. When this field is 0, the gateway will delete the corresponding rule for this type of device filter.

Rule Type Field

Bit	**Name**	**Value**	**Description**
Bits 7-0	Rule type	**0x01**: Filter block	Indicate the type of the following data. **0x01**: This is a required field. Indicate the following data: the start address, end address, and data to be

			filtered for this filter block.
		0x02: Data block	**0x02**: This is a required field. Indicate the following data is the data block's start address and end address to be sent.
		0x03: Mac block	**0x03**: This is an optional field. Indicate the following data is the Mac block's start address and end address to be sent.

Each device possesses a unique 6-byte MAC address. However, not every Bluetooth device's advertising packet includes this MAC address. Therefore, the start and end addresses of the MAC address mentioned below do not correspond to the start and end of the Bluetooth advertising packet.

Start Address Field

Bit	Name	Value	Description
Bits 7-0	Start address	0x00-0x1E (0-30 in decimal)	Start address for filtering block or data block. ***Note**: the Mac address consists of only 6 bytes, thus the start address ranges from 0x00 to 0x05.*

End Address Field

Bit	Name	Value	Description
Bits 7-0	End address	0x00-0x1E (0-30 in decimal)	End address for filter block or data block. End address >= Start Address and End address - Start Address < 20 ***Note**: the Mac address consists of only 6 bytes, thus the end address ranges from 0x00 to 0x05.*

Filter Value Field

Byte	Name	Value	Description
Bytes 30-0	Value	String	When the rule type is **0x01** (Filter Block), this field is the content that needs to be filtered. When the rule type is **0x02** (Data Block), there is no need to fill in any value for this field. The reporting range has already been specified by the previous start address and end address. Therefore, the gateway will directly report the content within this range. When the rule type is **0x03** (Mac block), there is no need to fill in any value for this field. The data range to be reported has already been specified by the previous start and end addresses. Therefore, the gateway will directly report the content within this range.

Example 1: If there are some beacons with the iBeacon payload.

The payload is 0x0201061AFF4C000215F2A52D43E0AB489CB64C4A8300146720AABBCCCCB3, and we want the gateway to use the yellow font part to filter the beacons and report the content in the green font, then we can send a downlink filtering command: A9 00 17 01 0001 0201 01 0404 FF 01 0918 F2A52D43E0AB489CB64C4A8300146720 02 0203 02 0508 02 191A 02 1D1D.

- **A9:** In the downlink filtering command, A represents the message type, and 9 indicates this command will set a new device report rule.

- **00:** The message ID can be any number from 0x00 to 0xff.
- **17:** The payload block field. 1 is the device type ID, which means this is the device type 1 rule (this type will use 8 as the message type to report the beacon message). The number 7 indicates that this rule contains a total of 7 blocks (3 filter blocks and 4 data blocks).
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0001:** The start address of the first filter block is the 00 byte of the beacon payload, ending at the 01 byte of the beacon payload.
- **0201:** The content that needs to be filtered is 0201.
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0404:** The start address of the second filter block is the 04 byte of the beacon payload, ending at 04 byte.
- **FF:** The content that needs to be filtered is FF.
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0918:** The start address of the third filter block is 09 byte of the beacon payload, and its end address is 18 in hexadecimal equals 24 in decimal, indicating the 24 byte of the beacon payload.
- **F2A52D43E0AB489CB64C4A8300146720:** The content that needs to be filtered is F2A52D43E0AB489CB64C4A8300146720.
- **02:** The rule type field, where 02 means the following block is a data block.
- **0203:** The start address of the first data block is the 02 byte of the beacon payload, and it ends at the 03 byte, Which means the gateway will report **061A**.
- **02:** The rule type field, where 02 means the following block is a data block.
- **0508:** The start address of the second data block is the 05 byte of the beacon payload, and it ends at the 08 byte of the beacon payload, which means the gateway will report **4C000215**.
- **02:** The rule type field, where 02 means the following block is a data block.
- **191A:** The start address of the third data block is 19 in hexadecimal, equals 25 in decimal, indicating the 25 byte of the beacon payload, and its end address is 1A in hexadecimal, equals 26 in decimal, indicating the 26 byte of the beacon payload which means the gateway will report **AABB**.
- **02:** The rule type field, where 02 means the following block is a data block.
- **1D1D:** The start address of the fourth data block is 1D in hexadecimal, which equals 29 in decimal, indicating the 29 byte of the beacon payload, and it ends at the 29(1D in hexadecimal) byte of the beacon payload, which means the gateway will report **B3**.

Example 2: If there is a device with the payload 0x0c093c23414d2d31303030313e around the gateway, and we want the gateway to use the yellow font part to filter the device and report the content in the green font, then you will see the following device report rule message: A9 00 23 01 0003 0C093C23 01 0C0C 3E 02 040B.

- **A9:** In the downlink filtering command, A represents the message type, and 9 indicates this command will set a new device report rule.
- **00:** The message ID can be any number from 0x00 to 0xff.
- **23:** The payload block field. 2 is the device type ID, which means this is the device type 2 rule (this type will use 9 as the message type to report the device message). The number 3 indicates that this rule contains 3 blocks (2 filter blocks and 1 data block).
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0003:** The start address of the first filter block is the 00 byte of the device payload, and it ends at the 03 byte of the device payload.

- **0c093c23:** The content that needs to be filtered is 0c093c23.
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0c0c:** The start address of the second filter block is 0c in hexadecimal equals 12 in decimal, indicating the 12 byte of the device payload, and it ends at the 12(0c in hexadecimal) byte of the device payload.
- **3e:** The content that needs to be filtered is 3e.
- **02:** The rule type field, where 02 means the following block is a data block.
- **040B:** The start address of the data block is 04 byte of the device payload, and its end address is 0B in hexadecimal equals 11 in decimal, indicating the 11 byte of the device payload, which means the gateway will send **414d2d3130303031**.

Example 3: If there is a BLE device with the Mac address 648216982653 and an advertising packet 0x0c093c23414d2d31303030313e around the gateway, and we want the gateway to use the yellow font part to filter the device and report the content in the green font, and add the last three bytes of the Mac address to the uplink message, then you will see the following device report rule message: A9 00 22 01 0C0C 3E 02 040B 03 0305.

- **A9:** In the downlink filtering command, A represents the message type, and 9 indicates this command will set a new device report rule.
- **00:** The message ID can be any number from 0x00 to 0xff.
- **22:** The payload block field. 2 is the device type ID, which means this is the device type 2 rule (this type will use 9 as the message type to report the device message). The number 2 indicates that this rule contains 2 blocks (1 filter block and 1 data block).
- **01:** The rule type field, where 01 means the following block is a filter block.
- **0c0c:** The start address of the filter block is 0c in hexadecimal equals 12 in decimal, indicating the 12 byte of the device payload, and it ends at the 12(0c in hexadecimal) byte of the device payload.
- **3e:** The content that needs to be filtered is 3e.
- **02:** The rule type field, where 02 means the following block is a data block.
- **040B:** The start address of the data block is 04 byte of the device payload, and its end address is 0B in hexadecimal equals 11 in decimal, indicating the 11 byte of the device payload, which means the gateway will send **414d2d3130303031**.
- **03:** The rule type field, where 03 means the following block is a Mac block.
- **0305:** The start address of the device's Mac address is the 3rd byte, and the end address is the 5th byte, indicating the 3 byte of the device's Mac address, which means the gateway will send 982653.

Example 4: To delete the device report rule, for example, the type 3 device. You can send the downlink command: A9 00 30.

- **A9:** In the downlink filtering command, A represents the message type, and 9 indicates this command will set a new device report rule.
- **00:** The message ID. It can be any number from 0x00 to 0xff.
- **30:** The payload block field. 3 is the device type ID and the device type 3 rule. However, since the following number is 0, the gateway will delete the corresponding rule for this type of device filter.

4.5.6 Network Reconnection Interval Command

Bytes	**1**	**1**	**1**
Item	Type	MSGID	Value

Type Field

Bit	Name	Value	Description
Bits 7-4	Type	0xA	Message type; The gateway uses it to identify different downlink messages.
Bits 3-0	Command	**0xA**: Reconnection interval	**0xA**: The network reconnection time interval after the device is disconnected from the network. Unit: 5min.

MSGID Field

Bit	Name	Value	Description
Bits 7-0	Message ID	0x00-0xFF (0-255 in decimal)	The gateway does not check the message ID, so this field is not mandatory. It can be any number from 0x00 to 0xff.

Value Field

Bit	Name	Value	Description
Bits 7-0	Value	0x00-0xFF (0-255 in decimal)	The default value is 0x06 (30 minutes). ***Note**: When this field is configured to 0, the gateway will reconnect to the network based on the reconnect interval. This reconnection interval will double each time the connection fails, such as 5, 10, 20, 40, 80, 160, 320, 640 minutes, and then remain at 640 minutes.*

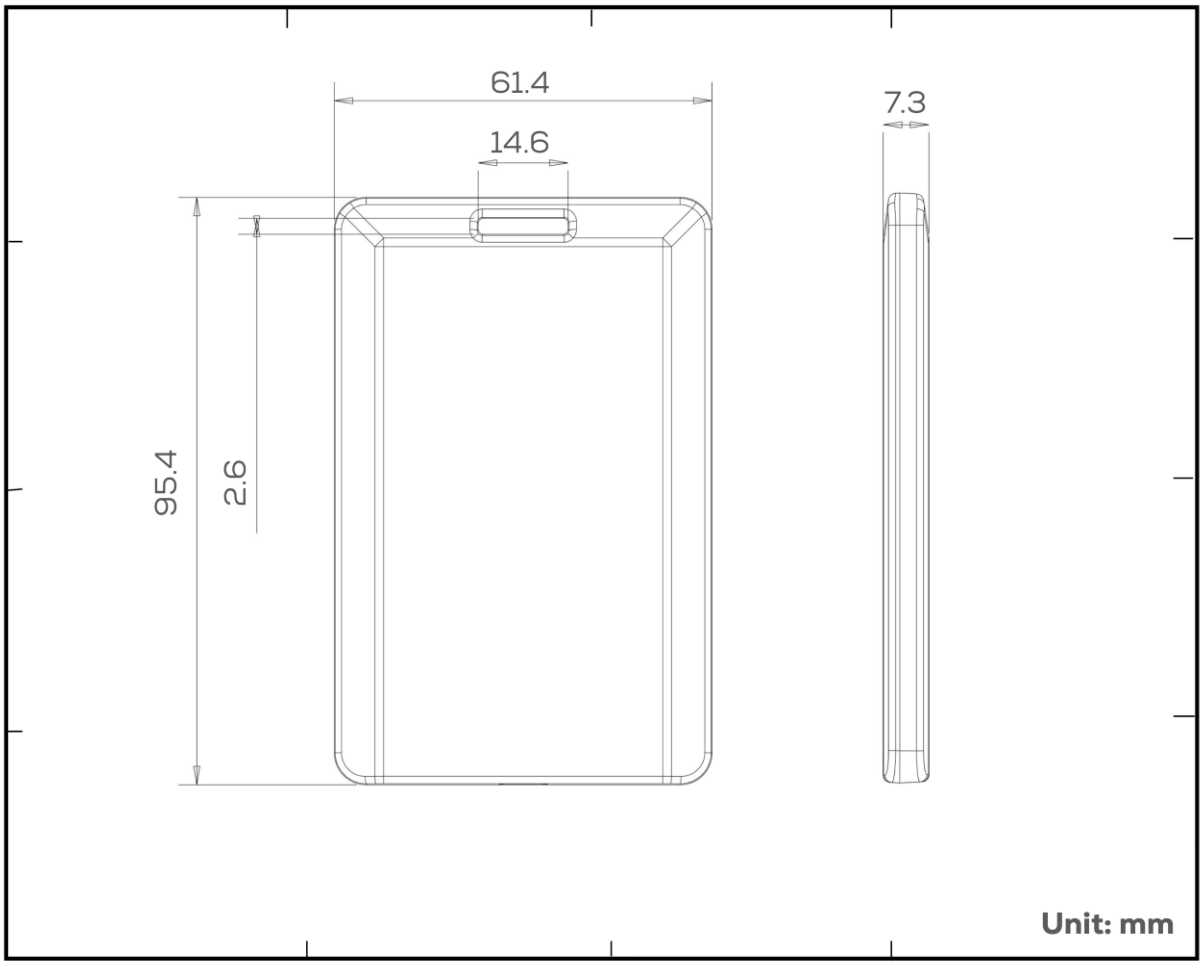
Example: AA 00 01

- **AA**: In the downlink command request message, A represents the message type, and A is the command to change the reconnection interval.
- **00**: This represents the message ID, which can be any other number.
- **01**: This represents the network reconnection interval configuration. If you want to change the reconnection interval from 30 minutes to 5 minutes, please use the formula: 5 minutes = 1 x 5min. Therefore, this network reconnection interval should be configured as 01.

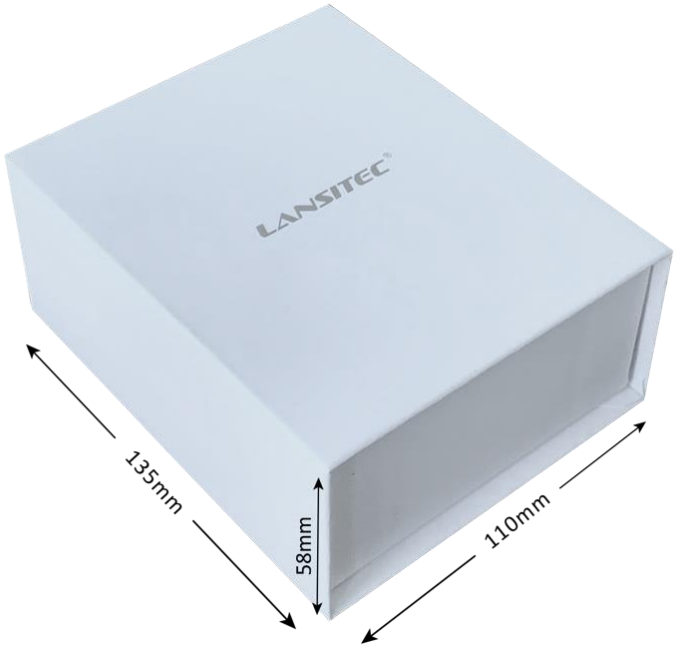
5. Packaging

5.1 Compact BLE Gateway

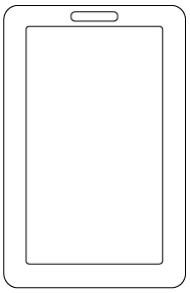
Below is the packaging for Compact BLE Gateway, BLE 5.0, 95.4x61.4x7.3 mm:



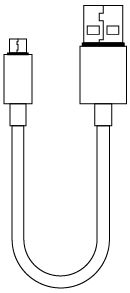
When shipped as samples:



Packing list:



Compact BLE Gateway x 1

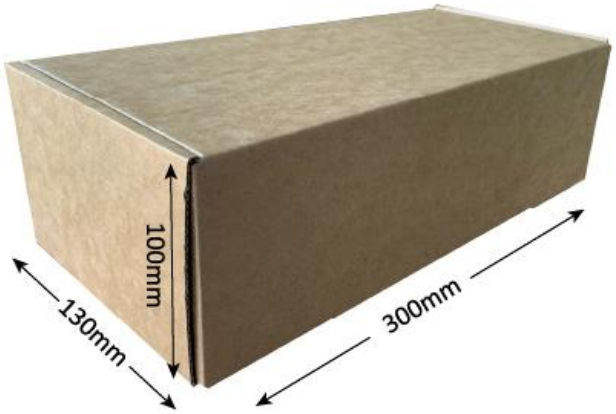


Micro USB Charging Cable (1.0m) x 1

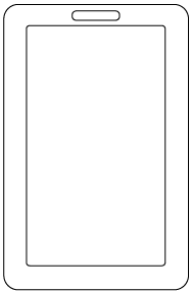
Lanyard x 1

PVC Sticker x 1

When shipped in batches:

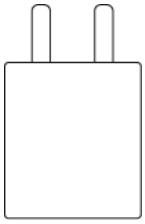


Packing list:

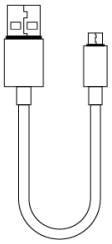


Compact BLE Gateway x 10

Accessories for each gateway (shipped in another package):



USB Charger



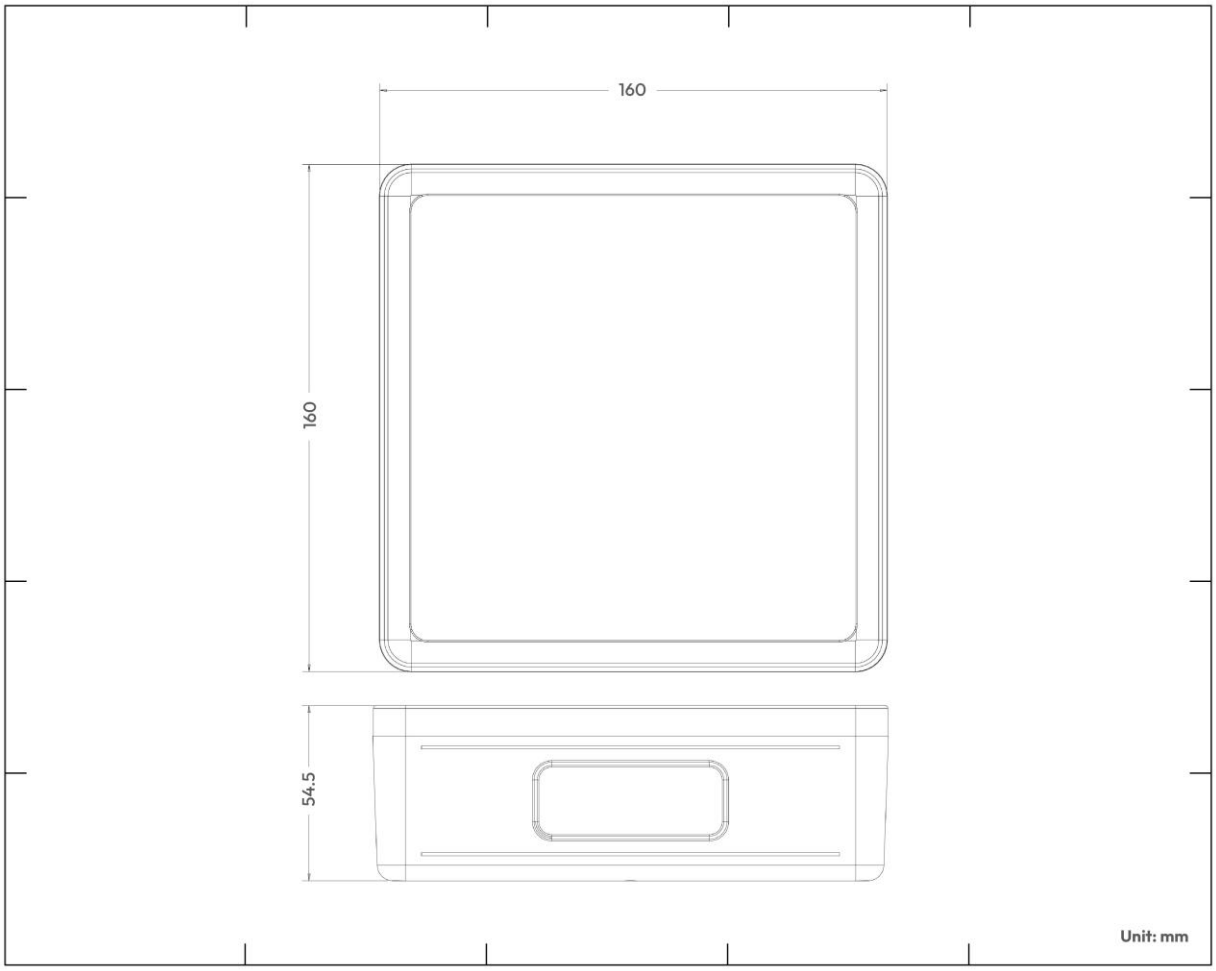
Micro USB Charging Cable

Lanyard

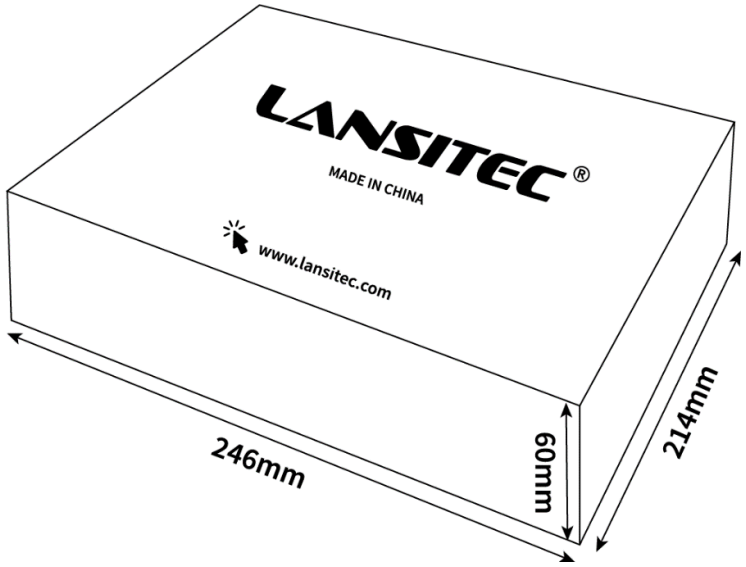
Sticker

5.2 Macro&Solar BLE Gateway

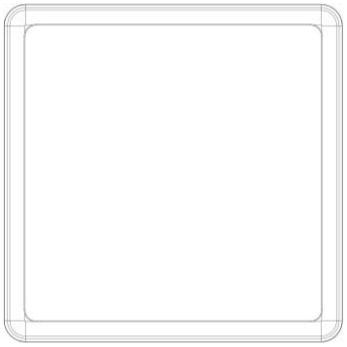
Below is the packaging for Macro&Solar BLE Gateway, Bluetooth5.0, 160x160x55mm:



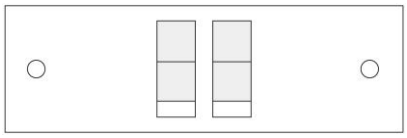
When shipped as samples:



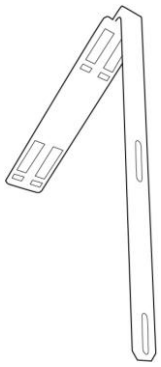
Packing list:



Macro or Solar BLE Gateway x 1



Installation Brackets (1) x 2



Installation Brackets (2) x 1

6. Ordering Information

Table 6: Indoor BLE Gateway Part Number

Description	Part Number
BLE Gateway, BLE5.0, 120x120x31mm, CN470, 5V	100-18369
BLE Gateway, BLE5.0, 120x120x31mm, IN865, 5V	100-18365
BLE Gateway, BLE5.0, 120x120x31mm, AU915, 5V	100-18465
BLE Gateway, BLE5.0, 120x120x31mm, AS923, 5V	100-18466
BLE Gateway, BLE5.0, 120x120x31mm, US915, 5V	100-18467
BLE Gateway, BLE5.0, 120x120x31mm, EU868, 5V	100-18468
BLE Gateway, BLE5.0, 120x120x31mm, IN865, 5V	100-18469
BLE Gateway, BLE5.0, 120x120x31mm, KR920, 5V	100-18378

Table 7: Compact BLE Gateway Part Number

Description	Part Number
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, CN470, 5V	100-18471
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, AS923, 5V	100-18475
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, US915, 5V	100-18473
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, RU864, 5V	100-18476
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, EU868, 5V	100-18477
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, AU915, 5V	100-18478
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, IN865, 5V	100-18479
BLE Gateway, BLE 5.0, 95.4x61.4x7.3mm, KR920, 5V	100-18474

Table 8: Solar BLE Gateway Part Number

Description	Part Number
BLE Gateway, built-in antenna, BLE 5.0, solar, 150x90x60mm, EU868, 5300mAh	100-02046
BLE Gateway, built-in antenna, BLE 5.0, solar, 150x90x60mm, AS923, 5300mAh	100-02048
BLE Gateway, built-in antenna, BLE 5.0, solar, 150x90x60mm, US915, 5300mAh	100-02049
BLE Gateway, built-in antenna, BLE 5.0, solar, 150x90x60mm, AU915, 5300mAh	100-02050
BLE Gateway, built-in antenna, BLE 5.0, solar, 150x90x60mm, RU864, 5300mAh	100-02051
BLE Gateway, built-in antenna, BLE 5.0, solar, 150x90x60mm, KR920, 5300mAh	100-02052
BLE Gateway, built-in antenna, BLE 5.0, solar, 150x90x60mm, IN865, 5300mAh	100-02053

Table 9: Macro BLE Gateway Part Number

Description	Part Number
BLE Gateway, built-in antenna, BLE 5.0, 150x90x60mm, EU868, 38000mAh	100-02392
BLE Gateway, built-in antenna, BLE 5.0, 150x90x60mm, AS923, 38000mAh	100-02365
BLE Gateway, built-in antenna, BLE 5.0, 150x90x60mm, US915, 38000mAh	100-02366
BLE Gateway, built-in antenna, BLE 5.0, 150x90x60mm, AU915, 38000mAh	100-02367
BLE Gateway, built-in antenna, BLE 5.0, 150x90x60mm, RU864, 38000mAh	100-02368
BLE Gateway, built-in antenna, BLE 5.0, 150x90x60mm, KR920, 38000mAh	100-02369
BLE Gateway, built-in antenna, BLE 5.0, 150x90x60mm, IN865, 38000mAh	100-02370

7. Appendix

You can find the payload decoder in the DownloadCenter:
https://www.lansitec.com/download/DownloadCentre.html.

To access the decoder, please contact Lansitec staff and get the credential.

End of document