

Smart Tracker Datasheet

V1.5

Release: 2023/06/14

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1 General Introduction

Tracker is an intelligent hardware based on LoRaWAN transmission. It has built-in motion, Bluetooth, GNSS and other sensors, combined with the external Bluetooth beacon, which can be used not only as a tracking device for indoor and outdoor personnel positioning, but also as a Bluetooth gateway for asset location management. It can provide users with location services with accuracy from 1 meter to 4 meters. Compared with other schemes, the scheme combining tracker and beacon has the advantages of low cost, convenient deployment, long standby time and so on, and is suitable for the scene with high positioning accuracy.

The tracker described in this document can be a badge worn by people, or a gateway scanning BLE beacon, or a T-Box used for car tracking. Badge and T-Box have nearly the same function except some peripherals. BLE gateway is a device with a specific function, detecting BLE beacons. The badge and T-Box can also work as a BLE gateway by special parameters setting.

Tracker	G-Sensor	BLE	GNSS	LED	Button	Buzzer	Vibrator	Solar panel
Badge	Yes	Yes	Optional	Yes	Yes	Yes	Yes	No
T-Box	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Gateway_S	No	Yes	No	No	No	Yes	No	Yes
Gateway	No	Yes	No	No	No	Yes	No	No

Function Highlights:

- LoRaWAN 1.0.3 compliant
- Maximum 6-month standby time
- Build-in G-sensor for motion detection
- Online upgrade by BLE, batch upgrading
- Online configure by BLE or Lora
- High capacity battery

Tracker	Battery Capacity	Battery Type	Rechargeable
Badge	800mAh	lithium polymer	Yes
T-Box	4000mAh	lithium polymer	Yes
BLE Gateway_S	4000mAh	lithium polymer	Yes
BLE Gateway	19000mAh	lithionyl chloride	No

- Multi battery optimization setting

2 Product Specifications

Table 1: Product Specifications

Positioning Mode	BLE/GNSS
Protocol	LoRaWAN
Frequency	CN470/US915/AU915/AS923/EU868
Sensitivity	-130dBm@SF9, -123dBm@SF8, -115dBm@SF7
Operating Current	20uA@sleep mode
	Max 102mA@20dBm
Standby Time	6 months
Operating Temperature	-20~+45°C
Charging Temperature	-10~+40°C
Storage Temperature	-40~+85°C
Communication Distance	>1.5km in urban area

3 Application Information

3.1 Function

The tracker works in OTAA mode and Class A mode by default, but it can also be set as ABP mode by BLE configure. In both modes, DevEUI, AppEUI and AppKey, or DevAddr, NwkSkey and AppSkey, frequency can be changed.

The tracker supports both BLE and GNSS location. To support BLE location, the BLE beacons need to be deployed around the tracker, the tracker gets its position by detecting the BLE signal.

If no beacon signal is scanned, the tracker will turn on GNSS module to get satellite signal, vice versa, if beacon signal is scanned, GNSS main power will be turned off with backup power on.

The badge can work as an Quuppa AOA tag, if it detects an AOA locator exists by BLE broadcast, it will send AOA packet every 500ms to the locator. The broadcast UUID of the locator must be A3FDED9A-87E2-4C2E-9E2F-5B7A2AC2AF05, else the AOA function will not be enabled. If the tracker is out of the range of AOA, it will stop AOA function.

The tracker can also work as a beacon, if it detects special beacon, it will scan BLE interleaved with broadcast. This feature is designed for a special case when the tracker is in an environment with poor Lora signal, such as shield room, the beacon mode can be turned on and the signal can be sent out with the help of Bluetooth gateway, which must be deployed in a place with good signal, such as the gate of the building.

The badge can be used to detect the safe distance of the bearer. When the distance exceeds a certain distance, an alarm is triggered and the contact information is reported.

According to LoRaWAN specification, in Class A mode downlink response time is decided by uplink duty cycle. To avoid relying the position message for downlink configure, tracker uses heartbeat message to control the downlink response time. The default heartbeat period is 5 minutes. Heartbeat message also contains status information of the tracker. It can be used by customer server to monitor the tracker.

3.2 Operation

3.2.1 Power On/Off

The badge can be turned on by pressing the power button. To power on the badge, need to press the button till the green LED on and red LED blinks and buzzer beep. The badge can't be turned off by pressing the button for security reason.

For gateway and T-Box, there's no button outside the housing, it's necessary to unplug the housing and connect the power cable if there's no USB interface. But If the gateway and T-Box have USB interface, when power cable is plugged, it will start up.

Since firmware 1.B, for both badge and T-Box/Gateway, plug in the USB cable can start up the device.

3.2.2 Reboot

For badge, under startup state, long press the button above three seconds, the LED light will blink three times, and the buzzer will beep, then the device restart.

For gateway and T-Box, there're four methods to restart:

1. Unplug the power cable and plug again to reboot.
2. Plug the power cable by USB interface.
3. Send reboot command from customer server remotely.
4. Turn on a beacon with specific UUID which is assigned by RUICTEC and configured in the device before delivery. Users can also modify it through Bluetooth.

3.2.3 SOS

Press the button three times in three seconds can trigger a SOS alarm. If the alarm is generated successfully, the buzzer beep for one time and the red LED blinks. The server needs to send an acknowledgement message after receiving the alarm, then the red LED turn off and green LED blinks, it tells the caller that the alarm has been received. After that, the platform administrator needs to dismiss SOS by downlink command; otherwise, the green LED keeps flashing. The caller can also restart the device to deactivate the alarm.

3.2.4 Status Check

Short press the button to check whether the tracker is working, if the green LED blinks, it indicates the tracker is working and the left power of battery is above 70%. If both green LED and red LED blink, the power is above 40%. If only red LED blinks, the power is below 40%, need to be charged ASAP.

3.2.5 Charging

When the power is low, it should be charged in time. The charging interface is Micro USB with 5V input. When the power is not fully charged, the red LED flashes, and the green LED keeps on when the power is fully charged.

3.3 Uplink Messages

Message Type	CAS ACK Need	LNS ACK Need	Port	Badge	Gateway	T-Box
Heartbeat	No	Yes	10	Yes	Yes	Yes
GNSS coordinate	No	Yes	11	Yes	No	Yes
BLE coordinate	No	Configurable	12	Yes	Yes	Yes
Alarm	Only SOS	Only SOS not needed	13	Yes	Only power off	No SOS
Acknowledge	No	Yes	14	Yes	Yes	Yes
Locator Beacon UUID	No	Yes	15	Yes	No	Yes
Asset Beacon UUID	No	Yes	16	Yes	Yes	Yes
Pass-through Beacon Filter	No	Yes	17	Yes	Yes	Yes
History Beacon Config List	No	Yes	18	Yes	Yes	Yes
History Beacon Info List	No	Yes	19	Yes	Yes	Yes
History GNSS Info List	No	Yes	20	Yes	No	Yes
Pass-through Message	No	No	21-25	Yes	Yes	Yes

LNS ACK Need means LoRaWAN Network Server need to confirm the uplink message, else the device will retry for one time.

CAS ACK Need means Customer Application Server need to confirm the uplink message, else the device will retry till confirmed.

Port is the frame port of LoRa message, used for message recognition before the payload is parsed.

3.3.1 Heartbeat

Heartbeat is a message periodically sent to report device parameters and operating status regardless of device movement status. When the device is stationary, the application server can send downlink parameters or commands when receiving heartbeat messages.

Bytes	1	1	1	1	1	1	1	1	1	1	2	4	1	2	1
Item	VER	RSSI	SNR	STATUS	VOL	COM	BLE	OPTION	WARN	PERIOD	SLEEP	TIME	THRES	STEP	TEMP

ACK from LNS needed, else will resend for one time.

VER:

Bit	Name	Value	Description
7~6	HW	0~3	Hardware type. 0: Badge 1: BLE Gateway 2: T-Box 3: Reserved
5~4	Major	0~3	Major version of software, 0 for test
3~0	Minor	0~15	Minor version of software

RSSI:

Bit	Name	Value	Description
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7~0	RSSI	-128~127	<p>The downlink Received Signal Strength Indication, sent by the LoRa gateway, detected and calculated by the device.</p> <p>Unit: dBm</p> <p>The real value is (RSSI - 20).</p> <p>For example, if the reported RSSI is -110, the final value should be -130dBm.</p>
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SNR:

Bit	Name	Value	Description
7~0	SNR	-128~127	The downlink Signal Noise Ratio.

STATUS:

Bit	Name	Value	Description
7~5	GNSS	0x0: off 0x1: Positioning 0x2: Positioning success 0x3: no signal 0x4: Indoor 0x5: Stationary	<p>Status of GNSS module.</p> <p>0: GNSS function is disabled because of continuous positioning failure or located in BLE environment.</p> <p>1: GNSS module is searching the signal.</p> <p>2: GNSS module succeed to acquire the coordinates.</p> <p>3: Fail to acquire the coordinates.</p> <p>4: GNSS is off because detect the device is indoor.</p> <p>5: GNSS is off because detect the device is stationary for at least two minutes.</p> <p>The GNSS module will try to acquire the coordinates in 60 seconds, if fail it will stop searching.</p> <p>Only apply for badge and T-Box.</p>
4~3	BATTERY	0x0: power cable disconnected 0x1: power cable connected, charging 0x2: power cable connected, charge completed	<p>Status of battery charging.</p> <p>Only apply for badge.</p>
2	VIBSTATE	0: Stationary 1: Nonstationary	<p>Motion status.</p> <p>Indicates whether the device moved during the heartbeat period.</p> <p>Only apply for badge and T-Box.</p>
1	Work Mode	0: Tracker 1: Gateway	<p>0 indicates the device works as a tracker.</p> <p>1 indicates the device works as a BLE gateway.</p> <p>Only apply for badge.</p>
0	RFU	0	Reserved for future use.

Voltage:

Bit	Name	Value	Description
7~0	VOL	0~255	Real battery voltage = VOL/100 + 2(V)

			Only apply for badge and T-Box.
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Communication parameters:

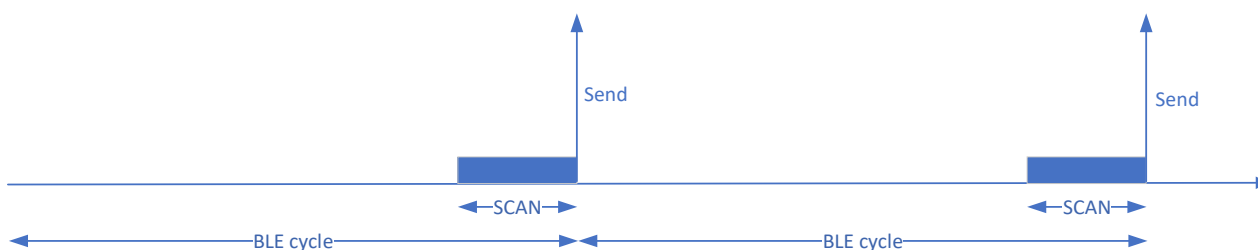
Bit	Name	Value	Description
7~6	TXPOW	0x0~0x3	Configured transmit power. For EU868 and AS923: 0x0: 16dBm 0x1: 14dBm 0x2: 12dBm 0x3: 10dBm For US915 and AU915: 0x0: 20dBm 0x1: 18dBm 0x2: 16dBm 0x3: 14dBm For CN470: 0x0: 17dBm 0x1: 15dBm 0x2: 13dBm 0x3: 11dBm Default value is 0.
5~3	DR	0x0~0x3	Supported Data Rate. US915: 0x0: DR3 0x1: DR2 0x2: DR1 AS923, AU915, EU868, CN470: 0x0: DR5 0x1: DR4 0x2: DR3 Default value is DR3 for US915, DR5 for others. Badge and T-Box are mobile device, so ADR feature is disabled, the customer need to configure proper DR according to the maximum distance between device and gateway.
2~0	SCHEME	0x0~0x07	Working scheme 0x0: US915 0x1: EU868 0x2: AU915 0x3: CN470 0x4: AS923 0x5: KR920 0x6: IN865 0x7: RU864 Currently supported schemes are US915, EU868,

			AU915, CN470 and AS923.
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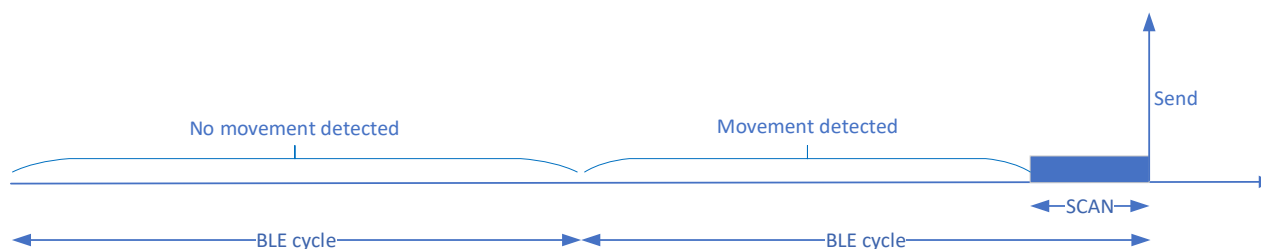
BLE:

Bit	Name	Value	Description
7	AUREPORT	0: Disable 1: Enable	Indicates whether the tracker start BLE scan and report coordinates even it's stationary, it is mainly used during test. The default value is 0, in this case the tracker only turns on Bluetooth scanning and GNSS when it detects movement. It can be enabled to make a badge works as a BLE gateway. If the device is BLE gateway, this field will be ignored.
6~3	BLE	0: BLE disabled 1: 5sec 2: 10sec 3: 20sec 4: 30sec 5: 1min 6: 2min 7: 5min 8: 10min 9: 15min 10: 20min 11: 30min 12: 1h 13: 2h 14: 6h 15: 12h	BLE scan cycle. The default value is 10 seconds. The badge and T-Box only trigger BLE scan if it's moving in case AUREPORT is disabled. The BLE gateway always starts Bluetooth scanning every cycle. For BLE gateway or badge works as a BLE gateway without external power supply, a long BLE scan period can be set to save power.
2~0	SCAN	0: 1s 1: 2s 2: 3s 3: 6s 4: 9s 5: 12s 6: 15s 7: Always	Duration of Bluetooth scanning in one cycle. This value is determined by the Bluetooth beacon transmission cycle, if the beacon broadcast every 500ms, 1s is proper. In some cases, to save the power of beacon, may extend the interval of beacon to 1 second, then SCAN need to be changed to 2 seconds to ensure beacon can always be scanned. The default value is 1s. This value should be set less than BLE value mentioned above, if it's larger than BLE, it will be changed to BLE-1 by the device.

The following figure shows the relationship between BLE and SCAN parameters if AUREPORT is enabled.



The following figure shows the relationship between BLE and SCAN parameters if AUREPORT is disabled.

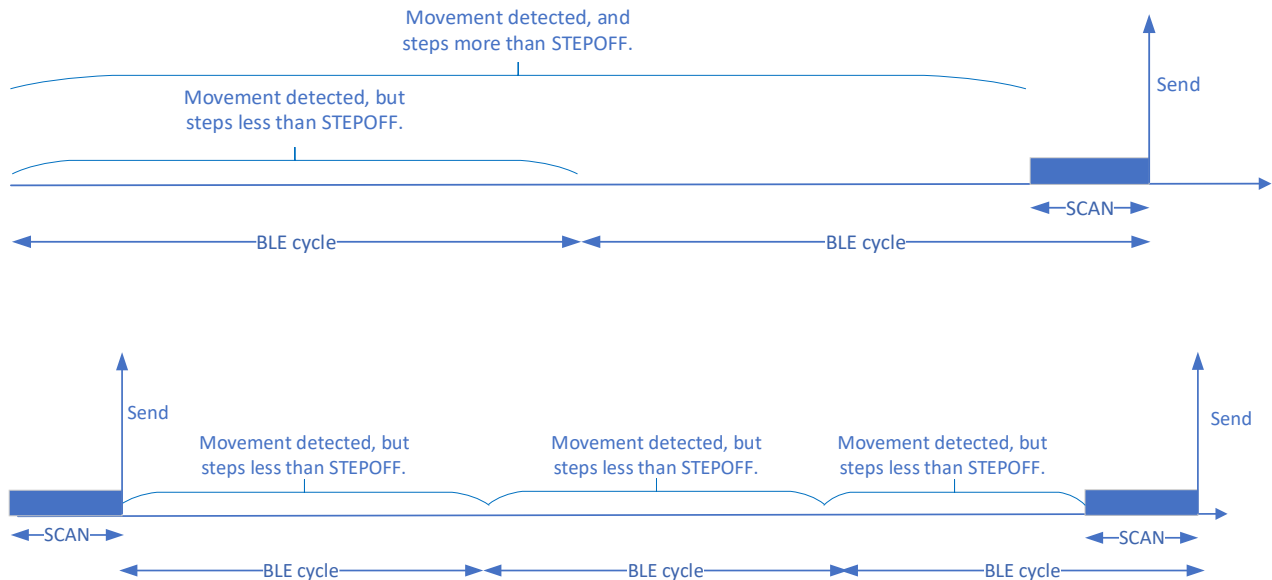


BLE Options:

Bit	Name	Value	Description
7~6	SCALE	0~3	<p>This bit indicates what kinds of beacon will be scanned.</p> <p>If the badge works as a tracker or the device is a T-Box:</p> <ul style="list-style-type: none"> 0: Scan only locator and alarm beacon 1: Scan locator, asset and alarm beacon 2: Scan only proximity badge 3: Scan all kinds of beacon and badge <p>Alarm beacons are deployed in special areas to trigger device alarms. If the system is mainly for people tracking, SCALE can be set as 0. If only for keeping people's social distancing safe, 2 can be set. If the badge works as a BLE gateway or the hardware type is BLE gateway:</p> <ul style="list-style-type: none"> 0: Scan only asset beacon 1: Scan only proximity badge 2: Scan all kinds of beacon and badge
5~3	STEPSOFF	0~7	<p>When the Bluetooth scan period arrives, if the number of steps is less than this value, Bluetooth scan will not be started.</p> <p>Unit: 2 steps.</p> <p>If BLEOFF is 0, STEPSOFF doesn't work.</p> <p>For example: If STEPSOFF is 4, the threshold will be 8 steps. When BLE scan periods arrives, the device found the number of incremental steps is less than 8, BLE scan will not start.</p> <p>Only apply for badge.</p>
2~0	BLEOFF	0~7	<p>If the beacons scanned are the same as last time, they are not reported, till BLEOFF periods later.</p> <p>If the movement steps is less than STEPSOFF, it will not start BLE scan, till BLEOFF periods later.</p> <p>The default value is 3.</p> <p>Example 1: If BLEOFF is 3, every BLE scan cycle the device find the incremental steps is less than the threshold, after 3 periods, even still less than the threshold, the device still start BLE scan and report.</p> <p>Example 2: If BLEOFF is 3, every BLE scan cycle the device find the incremental steps is more than the threshold, it will start BLE scan and report, but in the following three periods the detected BLE are always</p>

			the same with the first ones, then the device will not report the BLE data, after 3 periods, even still the same with before, the device will report.
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The following figures show the relationship between STEPOFF and BLE scan when BLEOFF equals to 2.



WARN:

This field only apply for badge.

A badge can detects and reports adjacent badges, and triggers a buzzer or vibrator alarm based on the defined contact distance.

Bit	Name	Value	Description
7~6	RFU		
5	BUZZER	0x0: buzzer disable 0x1: buzzer enable	Disable or enable buzzer. Only works when proximity is enabled.
4	VIBRATOR	0x0: vibrator disable 0x1: vibrator enable	Disable or enable vibrator. Only works when proximity is enabled.
3~1	Distance	0: 2m 1: 4m 2: 6m 3: 8m 4: 10m 5: 15m 6: >15m	When two badges are close to this distance, the buzzer will beep or the vibrator will vibrate.
0	Proximity	0: disabled 1: enabled	Whether to enable proximity detection function. If it's enabled, it will broadcast BLE signal periodically, at the same time it will also detect other badge's BLE signal. Default value is 0. When proximity is enabled, for real-time, BLE can be set to 5 and SCAN to 1. To improve accuracy, BLE can be set to 10 and SCAN to 2. To do both, you

			<p>can set BLE to 5 and SCAN to 2, but in this case power consumption will increase.</p> <p>In AOA environment, this function will be always disabled.</p>
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PERIOD:

Bit	Name	Value	Description
7~4	GNSS	0: GPS disabled 1: 5s 2: 10s 3: 15s 4: 30s 5: 60s 6: 150s 7: 5min 8: 15min 9: 30min 10: 1h 11: 1.5h 12: 3h 13: 6h	<p>GNSS startup cycle.</p> <p>The default value is 15s.</p> <p>For a badge, if GNSS is disabled, AUREPORT is set as 1, and STEPSOFF is set as 0, the badge will work as a gateway, after that the parameter work mode in heartbeat message will be set as 1.</p> <p>The customer server can set these parameters before deploying the tracker as a gateway.</p> <p>Only apply for badge and T-Box.</p>
3~0	HB	0: 1min 1: 5min 2: 10min 3: 20min 4: 30min 5: 1h 6: 2h 7: 6h 8: 12h 9: 24h	<p>Heartbeat transmission period.</p> <p>The default value is 10 minutes.</p>

SLEEP:

In some scenarios, the device does not need to work 24 hours a day. To save power, you can set the device to sleep when it is not working. During the sleep, the device does not send data or the data sending frequency is reduced.

Bit	Name	Value	Description
15~13	RFU	0	Reserved for Future Use.
12~10	Degree	0~7	<p>Between Start and End time, the period will be Degree * BLE or HB, 0 means no message reported.</p> <p>To save power, during special time the badge can stop working or slow down the message frequency. It's controlled by Degree, Start and End.</p> <p>Default value is 0.</p>
9~5	Start	0~23	From this hour, the device will enter sleep mode.

			Local time. Default value is 0.
4~0	End	0~23	From this hour, the device will wake up from sleep mode. If Start equals to End, the device will not enter sleep mode. local time. Default value is 0.

TIME:

Bit	Name	Value	Description
31~0	Time		Seconds since 1970/01/01 00:00:00 The device needs to know the exact time if sleep mode is enabled. The device cannot obtain the time based on the GNSS because the GNSS function may not be enabled. In this case, the device periodically reports the device time. If the server detects a large time error, the server send a command to adjust the device time. Suggest to adjust the time when the time error exceeds 10 seconds. If Start equals to End, TIME will not be reported.

THRES:

Bit	Name	Value	Description
7~4	RFU	0	Reserved for future use.
3	BLEACK	0: Disable 1: Enable	Indicates whether BLE message need acknowledged by LNS. By default, Bluetooth messages do not need to be acknowledged. Therefore, there is a probability of lost messages. In some applications, Bluetooth messages may be too important to be lost, so you can set this parameter to obtain the server's confirmation.
2~0	BLE Scan Range	0: No limit 1:-90dbm 2:-87dbm 3:-84dbm 4:-81dbm 5:-78dbm 6:-75dbm 7:-72dbm	If the RSSI of detected beacon is less than this value, it will be ignored. When the beacon is positioned at the edge of the building, it can be scanned by the tracker outside the building, and the tracker can be mistaken for being inside. This parameter enables the device to ignore weak Bluetooth signals, reducing miscalculation.

STEP:

Bit	Name	Value	Description
15~0	STEP	0~ 65535	The badge can count the number of movement steps taken by the carrier. The tracker always report the total number of steps since startup. The number of steps will be cleared when the device restarts, and the server should be able to count the steps correctly. Only apply for badge.

TEMP:

Bit	Name	Value	Description
7~0	TEMP	0~255	Indicates the current ambient temperature. 50 needs to be subtracted from the reported value to get the actual temperature. For example, if the reported value is 40, the actual temperature is -10 degrees.

3.3.2 GNSS coordinate

Bytes	4	4	1
Item	LONGITUDE	LATITUDE	TIME

LONGITUDE:

Bit	Name	Value	Description
31	ORIENTATION	0~1	0: East longitude 1: West longitude
30~0	LONGITUDE	0~1,800,000,000	Longitude, formula is: $(LONGITUDE / 10^7) + (LONGITUDE \% 10^7) / (100000.0 * 60)$.

LATITUDE:

Bit	Name	Value	Description
31	ORIENTATION	0~1	0: North latitude 1: South latitude
30~0	LATITUDE	0~900,000,000	Latitude, formula is: $(LATITUDE / 10^7) + (LATITUDE \% 10^7) / (100000.0 * 60)$.

TIME:

Bit	Name	Value	Description
7~0	TIME	0~60	The time it takes to locate a GNSS location. If the badge fail to acquire coordinate in 60 seconds, it will stop acquiring coordinate and try again in next cycle. Unit: Second

3.3.3 BLE Coordinates

This message is used to report the locator beacon, asset beacon, or adjacent badge detected by the device. For locator beacons, only three of the strongest signals are reported.

Bytes	1	1	1		2	2	1	1	2	1	..	2
Item	TYPES	MINUM	M2NUM	...	MAJOR1	MINOR11	RSSI11	BAT	MINOR12	RSSI12	..	MAJOR2

In most beacon deployment schemes, Bluetooth beacons have the same Major, and it would be wasteful to send both Major and Minor for each beacon, so multiple beacons can send only one Major.

TYPES:

Bit	Name	Value	Description
7~5	RFU	0	Reserved for future use.
4	Close Contact	0~1	Indicates whether the badge is too close to others.
3~0	TYPES	1~15	The Major types of scanned beacons in this message. It indicates how many different Majors reported in one message.

M1NUM:

Bit	Name	Value	Description
7~6	RFU	0	Reserved for future use.
5~0	LENGTH	1~63	The number of beacons with the same Major as Major1. In the same way, M2NUM means the number of Major as Major2.

MAJOR1:

Bit	Name	Value	Description
15~0	MAJOR1	0~65535	Major of BLE beacon.

MINOR11:

Bit	Name	Value	Description
15~0	MINOR11	0~65535	Minor of BLE beacon which Major is MAJOR1.

MINOR11 and MINOR12 are the beacons which have the same MAJOR as MAJOR1.

RSSI11:

Bit	Name	Value	Description
7	BATIND	0~1	Indicates whether battery information is added after RSSI field. 0: No battery info When BEACON is 3, BATIND has a special function. If BEACON is 3 and BATIND is 1, it indicates the scanned beacons are used for lost people and pets, this information is helpful for searching lost people/pets purpose. The BLE UUID for people/pets must be: 806429D8CD7240DB80362A8D6917DA5E
6~5	BEACON	0~3	0: Beacon used for positioning. 1: Beacon used for asset management. 2: Beacon deployed in hazardous area for security. 3: Badge used for proximity detection.
4~0	RSSI11	0~31	Received Signal Strength Indication of BLE, the server utilize it to calculate the distance. The real value is $(RSSI11 + 59) * (-1)$ dbm. If the RSSI calculated by the badge is smaller than -90dbm, it will always report 31.

			If the RSSI calculated by the badge is larger than -59dbm, it will always report 0.
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If alarm beacon is scanned, the buzzer will beep for three times.

BAT:

Bit	Name	Value	Description
7	RFU	0	Reserved For Future Use.
6~0	BAT	0~100	The remaining power, unit: Percent. If the battery detection is not supported by the beacon, it will be set as 0. For the beacons produced by RCT, RSSI@1m field of iBeacon message is used for battery indication. It's only supported by RCT produced beacon.

Here is an example how the scanned beacons are organized in this message. Suppose there're three kinds of beacons, steps is 50.

Major: 0x0101 Minor: 0x1101 RSSI:-60dbm BAT: 90% Type: Asset
 Major: 0x0101 Minor: 0x1102 RSSI:-65dbm BAT: Unknown Type: Locator
 Major: 0x0101 Minor: 0x1103 RSSI:-70dbm BAT: 80% Type: Alarm
 Major: 0x0201 Minor: 0x2101 RSSI:-59dbm BAT: 80% Type: Proximity
 Major: 0x0201 Minor: 0x2102 RSSI:-60dbm BAT: 90% Type: Proximity
 Major: 0x0101 Minor: 0x3101 RSSI:-75dbm BAT: 90% Type: Locator
 Major: 0x0101 Minor: 0x3102 RSSI:-80dbm BAT: 80% Type: Asset
 Major: 0x0301 Minor: 0x3101 RSSI:-65dbm BAT: Unknown Type: Asset
 Major: 0x0301 Minor: 0x4102 RSSI:-60dbm BAT: 90% Type: Proximity
 Major: 0x0401 Minor: 0x5101 RSSI:-60dbm BAT: 90% Type: Alarm
 Major: 0x0401 Minor: 0x5102 RSSI:-65dbm BAT: 80% Type: Locator
 Major: 0x0401 Minor: 0x5103 RSSI:-75dbm BAT: 90% Type: Asset

The message should be: 0x000032 04 05020203 0101 11018A15A 110206 1103CB50 3101905A 3102B550 0201 2101D050 2102D15A 0301 310126 4102D15A 0401 5101C15A 51028650 5103B05A

In one message at most 50 beacons can be reported, if the device is badge, proximity has the highest priority, then alarm, position and asset. If the device is gateway, proximity has the highest priority, then asset.

The beacons are distinguished by the following UUID.

Type	UUID	Extendable
Proximity	531811F50CAE4341BEBAF6B16B651D6C	NO
Alarm	545EF5EE26B747D2AE0CAD65659E1BAC	Fixed, B5DDA367F36945FB95B4453EDAABDC90
Locator	EFE49FA5F2BF48FF89F1AFCD8A7B5E81	YES, at most 5, configurable
Asset	DBE091B9EE34421BB3EDD274C045D9A3	YES, at most 5, configurable

Among the four kinds of beacons, UUID of proximity detection badge and alarm beacon are unique and can't be changed. For locator and asset, the UUID in the table can't be changed, but more UUID of such kinds beacon can be configured to support 3rd party vendor's products.

Notes: for alarm, locator and asset beacon, if it's the extent 3rd party beacon, the device will not try to report battery SOC info, if it supports battery SOC report, it should set the same UUID listed in the table and set SOC information

in field RSSI@1m of iBeacon message.

For alarm beacon, if it's 3rd party beacon and not support SOC report, the UUID must be set as B5DDA367F36945FB95B4453EDAABDC90, else the tracker may take RSSI@1m as SOC .

For special deployment purpose, the badge can convert to be a beacon, it's triggered by iBeacon with special UUID 9015141A-32B1-4DA7-96F6-D85BA68811CB. When this kind of beacon scanned, the badge will broadcast every one second, the broadcast UUID is DBE091B9EE34421BB3EDD274C045D9A3, the same as the asset beacon. If the device type is gateway, it should ignore this special beacon.

3.3.4 Alarm

Bytes	1	1
Item	MSGID	ALARM

ACK from LNS needed, else will resend for one time.

ALARM:

Bit	Name	Value	Description
7~5	RFU	0	Reserved for future use.
4	ACK	0-1	0: ACK from the customer server not needed. 1: ACK from the customer server needed, else will resend till ACK received.
3~0	ALARM	0: SOS 1: SOS dismissed 2:Power off 3:BLE disabled 4:LoRa disabled 5:GPS disabled 6:Enter hazardous area	Alarm type. 0: SOS is triggered by pressing the button 3 times in 3 seconds. For SOS, ACK from customer server is needed, else will report every 10 seconds. 1 SOS is dismissed by pressing the button for 5 seconds to reset the badge. 2 Badge is powered off. Badge can't be powered off by the button. Power off is triggered by remote command or BLE command. 3 Bluetooth broadcasting disabled because special beacon scanned. 4 Lora disabled because special beacon scanned. BLE scan interval is changed to be 1min, and try to recover Lora function in case no special beacon scanned in three continuous periods. 5 GPS function disabled because of continuous weak GPS signal. 6 Beacon deployed in hazardous area is scanned. If stay in the area, the alarm will report every 10 seconds, buzzer beeps for 3 times at the beginning.

			NOTES: 3 and 4 are not supported currently. BLE gateway only support alarm 2. T-Box support alarm 2,5,6.
--	--	--	---

MSGID:

Bit	Name	Value	Description
7~0	MSGID	0~255	Tracker generated sequence number of this uplink message that need MSGID, CS should respond ACK with this number, and otherwise tracker will resend the message.

3.3.5 Acknowledge

Bytes	1	1
Item	MSGID	RESULT

Confirmation of a downlink message indicates that the downlink message has been received.

MSGID:

Bit	Name	Value	Description
7~0	MSGID	0~255	The MSGID field of corresponding downlink message.

RESULT:

Bit	Name	Value	Description
7~4	RFU	0	Reserved for Future Use.
3~0	RESULT		0: Downlink message received and handle correctly. 1: Parameter not supported to set. 2: Parameter out of range.

3.3.6 Locator beacon UUID

Locator beacon can be scanned by both badge and T-Box. For tracker it only report at most three locator beacons of strongest signal.

By default, the tracker can parse standard beacon in iBeacon format and the UUID must be EFE49FA5F2BF48FF89F1AFCD8A7B5E81. If the customers have other kinds of standard iBeacon, but the UUID is different, the customer can configure this UUID in the tracker. The maximum supported UUID number is five, this message is used to report the configured UUID list.

This message must be requested by the server, else the tracker will not report.

Port: 15

Bytes	1	1	16	
Item	NUMBER	INDEX	UUID	...

NUMBER field

Bit	Name	Value	Description
7~3	RFU	0	Reserved for Future Use.
2~0	NUMBER	0~5	The number of configured UUID. Currently the maximum supported UUID is five.

INDEX field

Bit	Name	Value	Description
7~3	RFU	0	Reserved for Future Use.
2~0	INDEX	0~4	The index of the UUID in the list.

UUID field

Bit	Name	Value	Description
127~0	UUID		UUID.

3.3.7 Asset beacon UUID

This kind of beacon is used for asset management, it can be scanned by all the tracker. But for badge and T-Box, it's optional. By default, the supported UUID is DBE091B9EE34421BB3EDD274C045D9A3. This message is used to report the configured 3rd part beacons' UUID.

This message must be requested by the server, else the tracker will not report.

Port: 16

Bytes	1	1	16	
Item	LENGTH	INDEX	UUID	...

Similar to locator beacon UUID list, asset beacon also supports maximum 5 UUID.

3.3.8 Pass-through asset beacon filter

Sometimes some beacons are used, but the format is not standard iBeacon protocol, which can not be parsed by the tracker directly, then the tracker can pass-through the data according to the configuration. The filter, start and end points of the message need to be configured in the tracker. The tracker recognize the message according to the filter in the payload, filter is bytes of fixed data which is unique compared to other beacons. This message is used to report the configuration of the tracker.

This message must be requested by the server, else the badge will not report.

Port: 17

Bytes	1	1	1	1	1	1	FILTERLEN	
Item	LENGTH	PORT	START	END	FILTERSTART	FILTERLEN	FILTER	...

LENGTH field

Bit	Name	Value	Description
7~3	RFU	0	Reserved for Future Use.
2~0	LENGTH	0~5	The number of configured filter. Currently the maximum supported filter is five.

PORT field

Bit	Name	Value	Description
7~0	PORT	21~25	The port of the filter in the list. The data of this filter will be reported from this port.

START field

Bit	Name	Value	Description
7~0	START	0~255	The tracker will receive a completed message of the beacon, but it has no knowledge to parse it, then it will truncate the contents from START byte to END byte.

END field

Bit	Name	Value	Description
7~0	END	0~255	

FILTERSTART field

Bit	Name	Value	Description
7~0	FILTERSTART	0~255	From which byte the filter starts.

FILTERLEN field

Bit	Name	Value	Description
7~0	FILTERLEN	4~15	Length of the filter.

FILTER field

Bit	Name	Value	Description
FILTERLEN	FILTER		The filter used to read the message.

3.3.9 History Beacon Config List

By default the beacon coordinates are reported without confirmation, but sometimes some beacons are too important to leave out, in this case the badge will send these coordinates with confirmation needed, if no acknowledge received, the badge will put them in the buffer and resend later. This message report which beacons will be resent in case of sending failure.

Port: 18

Bytes	1	1	2	2	1	2	2		
Item	NUMBER	INDEX	MAJOR	MINOR	INDEX	MAJOR	MINOR	...	

NUMBER field

Bit	Name	Value	Description
7~5	RFU	0	Reserved for Future Use.
4~0	NUMBER	0~20	The number of configured beacon. Currently the maximum supported number is 20.

INDEX field

Bit	Name	Value	Description
7~5	RFU	0	Reserved for Future Use.
4~0	INDEX	0~19	The index of the beacon in the list.

MAJOR field

Bit	Name	Value	Description
15~0	Major	0x0001~0xFFFF	If Minor is 0, all the beacons with this Major will be resend.

MINOR field

Bit	Name	Value	Description
15~0	Minor	0x0000~0xFFFF	

3.3.10 History Beacon Info List

When the tracker detects several beacons in one scan period, it only store the first beacon configured in config list, and will ignore other beacons. Every time when the badge receive ACK from LNS, it will try to resend the beacons in the buffer list.

Port: 19

Bytes	1	2	2	1	2	2	2	2	
Item	NUMBER	MAJOR	MINOR	RSSI	FRMOFF	TIMEOFF	MAJOR	MINOR	...

NUMBER field

Bit	Name	Value	Description
7~4	RFU	0	Reserved for Future Use.
3~0	NUMBER	1~10	The number of configured beacon. Currently the maximum supported number is 10.

MAJOR field

Bit	Name	Value	Description
15~0	Major	0x0001~0xFFFF	

MINOR field

Bit	Name	Value	Description
15~0	Minor	0x0001~0xFFFF	

RSSI field

Bit	Name	Value	Description
7~5	RFU	0	
4~0	RSSI	0~31	Received Signal Strength Indication of BLE, the server utilize it to calculate the distance. The real value is $(RSSI_{11} + 59) * (-1)$ dbm. If the RSSI calculated by the badge is smaller than -90dbm, it will always report 31. If the RSSI calculated by the badge is larger than -59dbm, it will always report 0.

FRMOFF field

Bit	Name	Value	Description
15~0	FRMOFF	0~65535	The delta between the lost frame and the frame of current message.

TIMEOFF field

Bit	Name	Value	Description
15~0	TIMEOFF	0~65535	The delta with the frame of current message. Unit: Second

3.3.11 History GNSS Info List

Port: 20

Bytes	1	4	4	2	2	
Item	NUMBER	LONGITUDE	LATITUDE	FRMOFF	TIMEOFF	...

NUMBER field

Bit	Name	Value	Description
7~4	RFU	0	Reserved for Future Use.
3~0	NUMBER	1~8	The number of GNSS position. Currently the maximum supported number is 8.

FRMOFF field

Bit	Name	Value	Description
15~0	FRMOFF	0~65535	The delta between the lost frame and the frame of current message.

TIMEOFF field

Bit	Name	Value	Description
15~0	TIMEOFF	0~65535	The delta with the frame of current message. Unit: Second

3.3.12 Pass-through Message

Port: 21, 22, 23, 24, 25 for asset beacon.

Bytes	1	LENGTH * sizeof(single message)
Item	LENGTH	DATA

LENGTH field

Bit	Name	Value	Description
7~0	LENGTH	1~5	The size of the pass-through data.

Data field

Bit	Name	Value	Description
LENGTH	DATA		The pass-through data, it's of asset beacon or locator beacon, the format is defined out of the scope of this datasheet, and the customer has the full knowledge to parse the data.

3.4 Downlink Messages

All downlink messages need to be confirmed by the device.

Message Type	Frame Port
Parameter Setting	10
BLE SCAN Start Time	11
Command	12
Acknowledge	13
Locator beacon UUID	14
Asset beacon UUID	15
Pass-through asset beacon filter	16
History BLE Config	17

3.4.1 Parameter Setting

Port: 10

Bytes	1	1	1	1	
Item	MSGID	TYPE	VALUE	TYPE	...

TYPE is from 1 to 17.

Example: For CN470, to set TXPOWER as 15, Data rate as DR4, the message could be: 0x0001010201

All the supported TYPEs are listed as below:

TX Power

Type: 1

Bit	Name	Value	Description
7~0	TXPOW	0x0~0x3	Configure transmit power. For EU868 and AS923: 0x0: 16dBm 0x1: 14dBm 0x2: 12dBm 0x3: 10dBm For US915 and AU915: 0x0: 20dBm 0x1: 18dBm 0x2: 16dBm 0x3: 14dBm For CN470: 0x0: 17dBm 0x1: 15dBm 0x2: 13dBm 0x3: 11dBm Other values will be ignored, and respond out of range.

Data Rate

Type: 2

Bit	Name	Value	Description
7~0	DR	0x0~0x2	Data Rate. US915: 0x0: DR3 0x1: DR2 0x2: DR1 AS923, AU915, EU868, CN470: 0x0: DR5 0x1: DR4 0x2: DR3 For US915 DR1 should only be set when there are only a few

			beacons.
--	--	--	----------

AUREPORT

Type: 3

Bit0	AUREPORT	0: Disable 1: Enable	Indicates whether the badge report coordinates if it's static. It is mainly used for test.
------	----------	-------------------------	--

BLE

Type: 4

7~0	BLE	0: Disable BLE 1: 5sec 2: 10sec 3: 20sec 4: 30sec 5: 1min 6: 2min 7: 5min 8: 10min 9: 15min 10: 20min 11: 30min 12: 1h 13: 2h 14: 6h 15: 12h	Change the period of BLE scanning. Other values will be ignored and respond out of range.
-----	-----	---	--

SCAN

Type: 5

7~0	SCAN	0: 1s 1: 2s 2: 3s 3: 6s 4: 9s 5: 12s 6: 15s 7: Always	The continuous BLE scan time during one period. Other values will be ignored and respond out of range. If the device is gateway and powered by an external power, then SCAN can be set as 7.
-----	------	--	--

SCALE

Type: 6

1~0	SCALE	0~3	This bit indicates what kinds of beacon will be scanned.
-----	-------	-----	--

STEPSOFF

Type: 7

7~0	STEPSOFF	0~7	When BLE scan period has reached, but the movement steps are less than this value, it will not start BLE scan, unit: 5 steps. If BLEOFF is 0, STEPSOFF will not take effect.
-----	----------	-----	--

BLEOFF

Type: 8

7~0	BLEOFF	0~7	If the scanned beacons are the same with the last time, it will stop reporting the BLE data, till BLEOFF periods later. If the movement steps are less than STEPSOFF, it will not start BLE scan, till BLEOFF periods later. The default value is 3.
-----	--------	-----	--

BUZZER

Type: 9

7~0	BUZZER	0x0: buzzer disable 0x1: buzzer enable	Disable or enable buzzer.
-----	--------	---	---------------------------

VIBRATOR

Type: 10

Bit0	VIBRATOR	0x0: vibrator disable 0x1: vibrator enable	Disable or enable vibrator.
------	----------	---	-----------------------------

DISTANCE

Type: 11

7~0	Distance	0: 2m 1: 4m 2: 6m 3: 8m 4: 10m 5: 15m 6: >15m	When two badges are close to this distance, the buzzer will beep or the vibrator will vibrate. For other values out of this list will be rejected.
-----	----------	---	---

PROXIMITY

Type: 12

Bit0	Proximity	0: disable 1: enable	Whether to enable proximity detection function, if it's enabled, it will broadcast BLE signal periodically, at the same time it will also detect other badge's BLE signal. Default value is 0.
------	-----------	-------------------------	---

GNSS

Type: 13

7~0	GPS	0: Disable GPS 1: 5s 2: 10s 3: 15s 4: 30s 5: 60s 6: 150s 7: 5min 8: 15min 9: 30min 10: 1h 11: 1.5h 12: 3h 13: 6h	The period of GPS coordinates report.
-----	-----	---	---------------------------------------

HB

Type: 14

7~0	HB	0: 1min 1: 5min 2: 10min 3: 20min 4: 30min 5: 1h 6: 2h 7: 6h 8: 12h 9: 24h	The period of Heartbeat message.
-----	----	---	----------------------------------

DATETIME

Deprecated, the time synchronization is currently triggered by command 9.

Type: 15

31~0			Timestamp.
------	--	--	------------

Device time is reported from heartbeat message, if the application server find the time gap between Network Server and the device is more than 5 seconds, the server can update device's time by setting the current time. When device receive this message, it will trigger time synchronization with Network Server by MAC command.

SLEEP

Type: 16

23~16	Degree	0~7	
15~8	Start	0~23	
7~0	End	0~23	

When a device boot up, it shouldn't enter sleep mode at once even the Start and End are configured, the parameters only take effect 10 minutes later after boot up. This strategy gives the server the chance to recover the device from sleep mode to active mode by rebooting the device and sending new configuration.

THRES

Type: 17

Bit	Name	Value	Description
7~3	RFU	0	Reserved for future use.

2~0	BLE Scan Range	0: No limit 1:-90dbm 2:-87dbm 3:-84dbm 4:-81dbm 5:-78dbm 6:-75dbm 7:-72dbm	If the RSSI of detected beacon is less than this value, it will be ignored.
-----	----------------	---	---

BLE ACK

Type: 18

Bit	Name	Value	Description
7~1	RFU	0	Reserved for future use.
0	BLE ACK	0: Disable 1: Enable	Whether BLE message need acknowledged by network server.

3.4.2 BLE SCAN Start Time

This command is used to trigger the device start BLE scan in advance. It's mainly used for BLE gateway, In order to improve the positioning accuracy, multiple gateways should scan the same beacon at the same time, and then calculate using three-point positioning. This command is used to adjust the start time of BLE gateway scanning.

Port: 11

Bytes	1	2
Item	MSGID	TIME

TIME field

Bit	Name	Value	Description
15~0	TIME	0~65535	Indicates how many seconds the device should send data in advance.

3.4.3 Command

Port: 12

Bytes	1	1
Item	MSGID	CMD

The tracker will send ACK to the Application server with the same MSGID. The Application server should maintain a timer to resend, the timer interval should be set according to the period of the uplink messages. The downlink www.rctiot.com

message is able to be sent to the badge after several uplink messages received, if no ACK received from badge after that, the downlink message may be lost.

CMD field

Bit	Name	Value	Description
7~4	RFU	0	Message type, helmet can use it to identify different downlink messages.
3~0	CMD	0x0: Position request 0x1: Reset 0x2: Turn off 0x3: Search 0x4: Dismiss Search 0x5: Locator beacon list 0x6: Asset beacon list 0x7: Pass-through beacon list 0x8: History BLE Config list 0x9: Time synchronization	Requested command. 0x0: Request the tracker to send the position even the device is static. 0x1: Reset the device. 0x2: Turn off the device. 0x3: Trigger buzzer beep. 0x4: Stop buzzer beep. 0x5: Acquire the supported locator beacon UUID which are in iBeacon format. 0x6: Acquire the supported asset beacon UUID list which are in iBeacon format. 0x7: Acquire the configuration of pass-through beacon. 0x8: Acquire the configuration of BLE list which need to be confirmed. 0x9: Trigger the device to synchronize time with NS.

MSGID field

Bit	Name	Value	Description
7~0	MSGID	0~255	Server generated sequence number of downlink messages that need MSGID. Badge will respond ACK with this number, otherwise CS should resend the message.

3.4.4 Acknowledge

Port: 13

Bytes	1
Item	MSGID

MSGID field

Bit	Name	Value	Description
7~0	MSGID	0~255	The message id of corresponding uplink message, e.g. alarm report

3.4.5 Locator beacon UUID

Used to configure locator beacon UUID list. To reset the configuration, UUID can be set as 0xfffff....

Port: 14

Bytes	1	1	1	16	
Item	MSGID	LENGTH	INDEX	UUID	...

MSGID field

Bit	Name	Value	Description
7~0	MSGID	0~255	The message id of corresponding uplink message

LENGTH field

Bit	Name	Value	Description
7~3	RFU	0	Reserved for Future Use.
2~0	LENGTH	1~5	The number of configured UUID. Currently the maximum supported UUID is five.

INDEX field

Bit	Name	Value	Description
7~3	RFU	0	Reserved for Future Use.
2~0	INDEX	0~4	The index of the UUID in the list to be set.

UUID field

Bit	Name	Value	Description
127~0	UUID		UUID.

3.4.6 Asset beacon UUID

Used to configure asset beacon UUID list.

Port: 15

Bytes	1	1	1	16	
Item	MSGID	NUMBER	INDEX	UUID	...

MSGID field

Bit	Name	Value	Description
7~0	MSGID	0~255	The message id of corresponding uplink message

NUMBER field

Bit	Name	Value	Description
-----	------	-------	-------------

7~3	RFU	0	Reserved for Future Use.
2~0	NUMBER	1~5	The number of configured UUID. Currently the maximum supported UUID is five.

3.4.7 Pass-through asset beacon filter

Used to set the configuration of the tracker. To set the filter, End must be larger than Start. To reset the filter, Start and End can be set as 0.

Port: 16

Bytes	1	1	1	1	1	1	FILTERLEN
Item	MSGID	PORT	START	END	FILTERSTART	FILTERLEN	FILTER

MSGID field

Bit	Name	Value	Description
7~0	MSGID	0~255	The message id of corresponding uplink message

PORT field

Bit	Name	Value	Description
7~0	PORT	21~25	The port of the filter in the list. The data of this filter will be reported from this port.

START field

Bit	Name	Value	Description
7~0	START	0~255	The tracker will receive a completed message of the beacon, but it has no knowledge to parse it, then it will truncate the contents from START byte to END byte.

END field

Bit	Name	Value	Description
7~0	END	0~255	

FILTERSTART field

Bit	Name	Value	Description
7~0	FILTERSTART	0~255	From which byte the filter starts.

FILTERLEN field

Bit	Name	Value	Description
7~0	FILTERLEN	4~15	Length of the filter.

FILTER field

Bit	Name	Value	Description
FILTERLEN	FILTER		The filter used to read the message.

3.4.8 History BLE Config

It tells the tracker which beacons should be sent with confirmation needed. If failed, these beacons should be stored and resent later. The tracker will consider these configurations even [BLEACK](#) is disabled.

Port: 17

Bytes	1	1	1	2	2	1	2	2	
Item	MSGID	NUMBER	INDEX	MAJOR	MINOR	INDEX	MAJOR	MINOR	...

NUMBER field

Bit	Name	Value	Description
7~5	RFU	0	Reserved for Future Use.
4~0	NUMBER	1~20	The number of configured beacon. Currently the maximum supported number is 20.

INDEX field

Bit	Name	Value	Description
7~5	RFU	0	Reserved for Future Use.
4~0	INDEX	0~19	The index of the beacon in the list to be set.

MAJOR field

Bit	Name	Value	Description
15~0	Major	0x0000~0xFFFF	If Minor is 0, all the beacons with this Major will be resend.

MINOR field

Bit	Name	Value	Description
15~0	Minor	0x0000~0xFFFF	If both major and minor are 0, the configuration of the index will be cleared.

To simplify development, we have developed a Javascript for users to parse the data. The script can be used in Network Server for data encode and decode. Please refer to document “smart tracker data parse” for more information.

4. BLE Configuration

The working parameters of the device can be configured online through Lora network or by establishing BLE connection through APP. In addition, the device ID, Key, frequency, and working mode can only be changed through APP.

After the configuration is complete, disconnect the BLE connection and the device restarts automatically. Lora does not work during BLE connection.

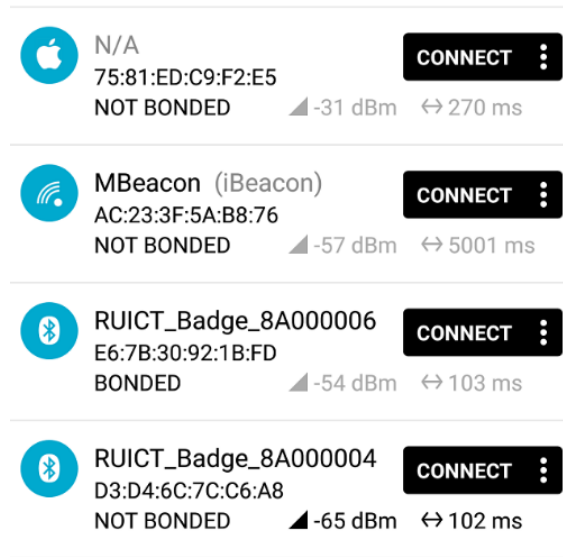
4.1 Android System

4.1.1 Install tool

In Android, nrfConnect need to be installed, download address:
<https://github.com/NordicSemiconductor/Android-nRF-Connect/releases>

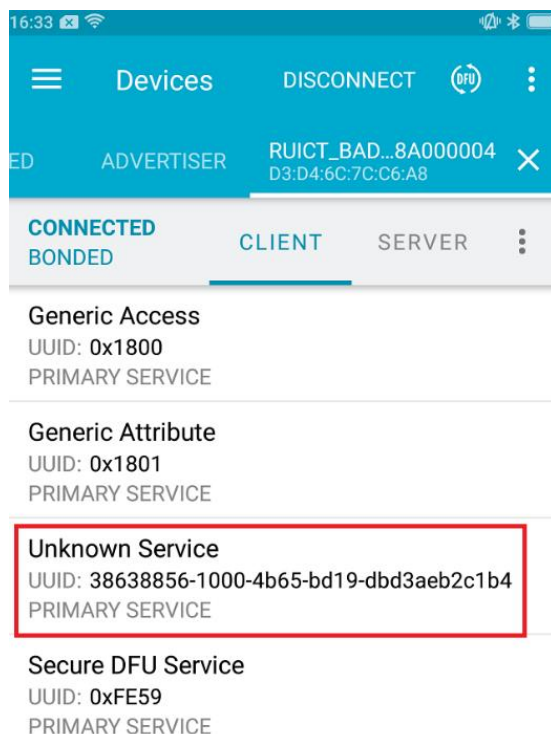
4.1.2 Connect Device

Turn on the phone's Bluetooth function and nrfConnect APP, then click the "Scan" button in the upper right corner. Long press the button to restart the badge. The badge can be connected to the APP for the first 30 seconds after the restart. After the timeout, need to restart the badge again.

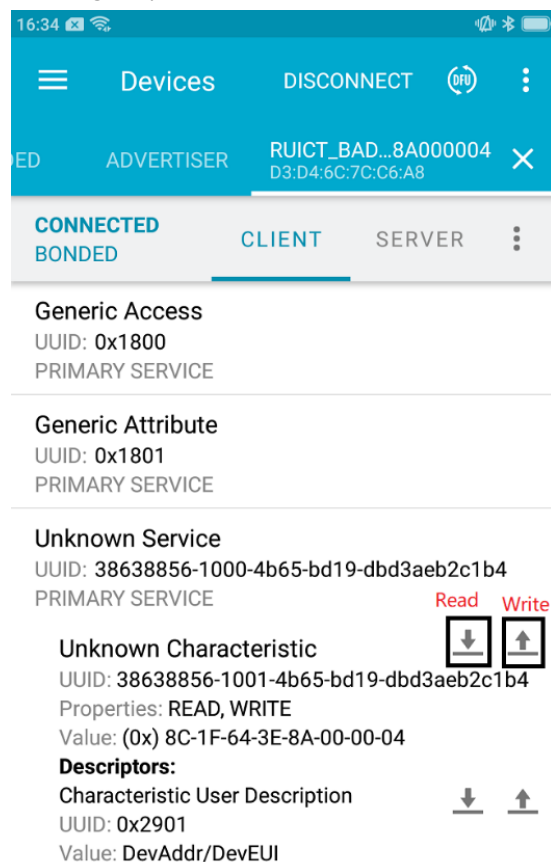


Find the badge you want to configure, name format is RUICT_Badge_device number. A password is required to establish a connection. The default password is 524354.

4.1.3 Parameters Configure



Select "Unknown Service" to enter configure panel.



The following configuration items are supported :

UUID	Items	Description
38638856-1001-4b65-bd19-dbd3aeb2c1b4	DevAddr/DevEUI	Read/Write
38638856-1002-4b65-bd19-dbd3aeb2c1b4	AppSkey/AppKey	Write
38638856-1003-4b65-bd19-dbd3aeb2c1b4	NwkSkey/AppEui	Write
38638856-1004-4b65-bd19-dbd3aeb2c1b4	Work Mode	Read/Write
38638856-1005-4b65-bd19-dbd3aeb2c1b4	Work Parameters	Read/Write
38638856-1006-4b65-bd19-dbd3aeb2c1b4	Connect Password	Write
38638856-1007-4b65-bd19-dbd3aeb2c1b4	3 rd Party Locator Beacon UUID	Read/Write
38638856-1008-4b65-bd19-dbd3aeb2c1b4	3 rd Party Asset Beacon UUID	Read/Write
38638856-1009-4b65-bd19-dbd3aeb2c1b4	Reset Beacon UUID	Read/Write

No matter whether the device is in OTAA mode or ABP mode, fill in DevEUI. If the device is in ABP mode, the last 4 bytes are intercepted as DevAddr.

For security reasons, all keys are unreadable, and the Key in the device is encrypted. To set the Key in the network server, please contact us to obtain the unencrypted value.

Work Mode

The operating mode contains 4 bytes of data, which is used to set the standard and operating frequency of the device.

The format is AABCCDD

AA: 00 indicates ABP mode, and 01 indicates OTAA mode

BB: Device scheme, 00: US915, 01: EU868, 02: AU915, 03: CN470, 04: AS923

CC: the starting frequency point.

The initial channel number of CN470 is 0, corresponding to 470.3M, and each frequency point occupies 0.2M frequency interval.

AS923 starts with a channel number of 0 and corresponds to a frequency point of 920.2M. Each frequency point occupies a frequency interval of 0.2M.

EU868 starts with a channel number of 0 and corresponds to a frequency point of 863.1M. Each frequency point occupies a frequency interval of 0.2M.

US915 starts with a channel number of 0 and corresponds to a frequency point of 902.3M. Each frequency point occupies a frequency interval of 0.2M.

AU915 starts with a channel number of 0 and corresponds to a frequency point of 915.2M. Each frequency point occupies a frequency interval of 0.2M.

DD: indicates the termination frequency.

For example, to set the 8 frequency points starting from 479.9m and OTAA mode, set it to 01033037. For AS923 the default mode is 01040110. For EU868 the default mode is 01010C1B. For US915 the default mode is 0100080F, i.e. band2. For AU915 the default mode is 0102080F.

BLE connect password

You can use this option to change the default BLE connection password. After changing the password, you need to remember the new password; otherwise, the Bluetooth connection cannot be established.

3rd Party Locator Beacon UUID

You can configure only one third-party Locator beacon over Bluetooth. To configure more UUID, you need to configure it remotely by Lora.

3rd Party Asset Beacon UUID

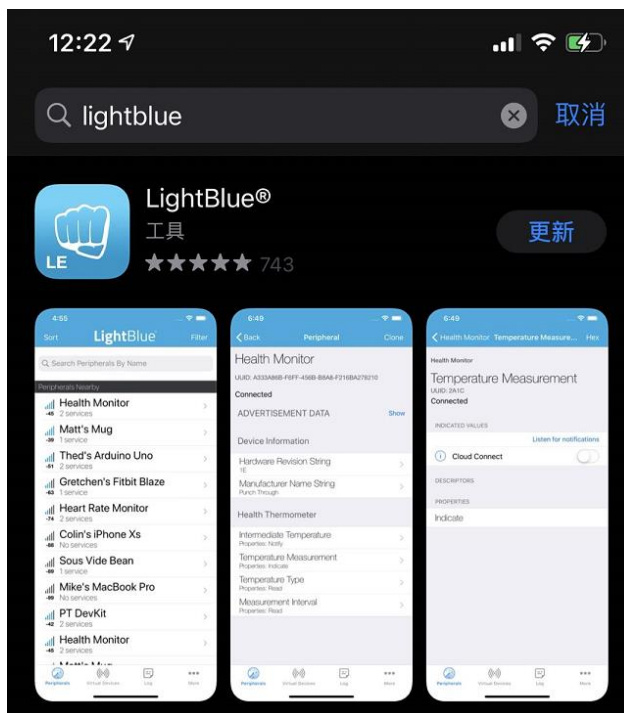
You can configure only one third-party Asset beacon over Bluetooth. To configure more UUID, you need to configure it remotely by Lora.

Reset Beacon UUID

For the BLE gateway and T-box, it is difficult to upgrade the software because there is no external switch to restart. The gateway and T-box will automatically restart after scanning the beacon defined here. Do not disclose the UUID to others. Otherwise, the system may be damaged.

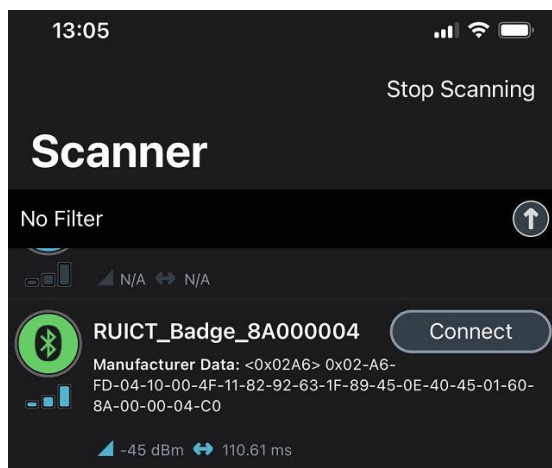
4.2 Apple System

Lightblue will make it even easier on iPhones.



4.2.1 Connect Device

Long press the button to restart the badge. The badge can be connected to the APP for the first 30 seconds after the restart. After the timeout, the badge should be restarted again.



4.2.2 Parameters Configure

Find the device you want to configure and click "Connect" to connect the device. The APP will pop up a dialog box to prompt you to enter the password. The default password is "524354". After the connection is successful, enter the configuration interface, as shown in the figure below. The specific method is the same as the above nrfConnect method, which will not be described here.



5. OTA

The device can be upgraded by establishing a Bluetooth connection with nrfConnect. The nrfConnect interface on Android and iPhone is slightly different.

5.1 Android System

5.1.1 Install tool

Download address:

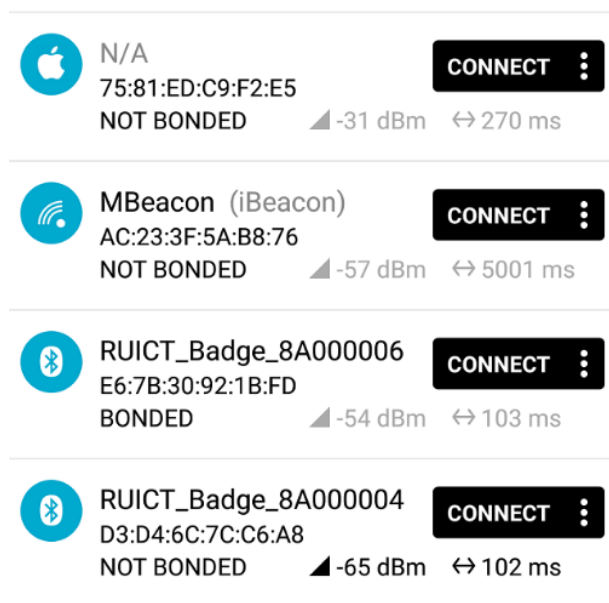
<https://github.com/NordicSemiconductor/Android-nRF-Connect/releases>

5.1.2 Upload firmware

Upload the upgrade package to any directory on the mobile phone.

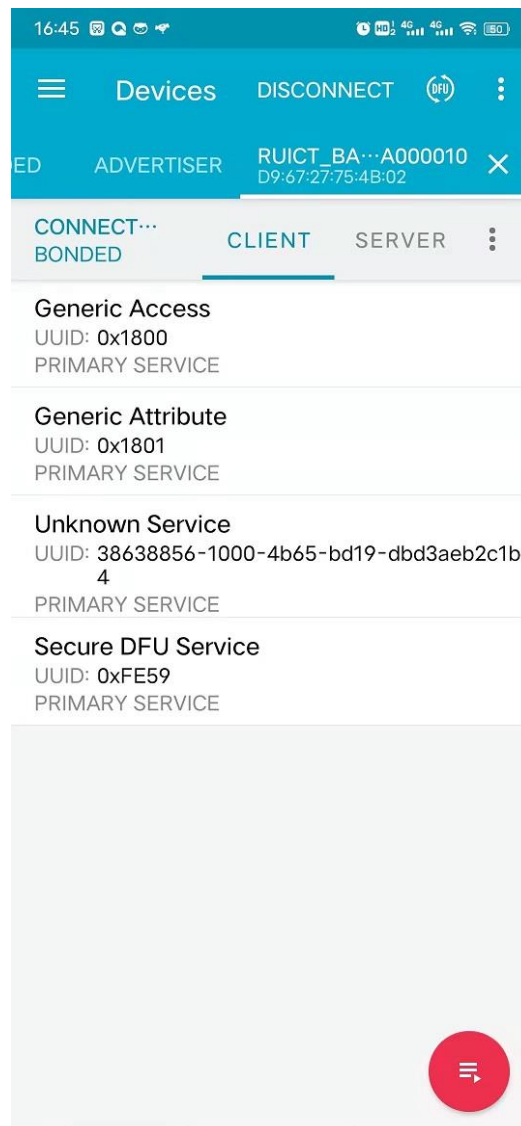
5.1.3 Connect Device

Turn on the bluetooth function and APP of your phone and click the "Scan" button in the upper right corner. Long press the button to restart the badge. The badge can be connected to the APP for the first 30 seconds after the restart. After the timeout, you need to restart the badge again.

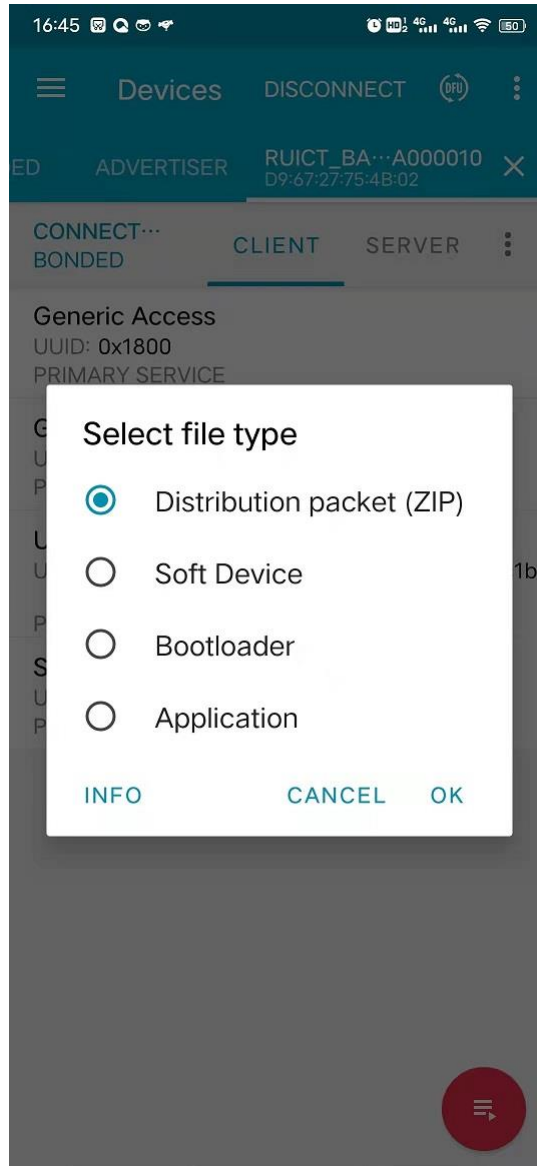


Find the device you want to configure and click "Connect" to connect the device. The APP will pop up a dialog box to prompt you to enter the password. The default password is "524354".

5.1.4 Upgrade



Click "DFU" in the upper right corner and select the ZIP file type.



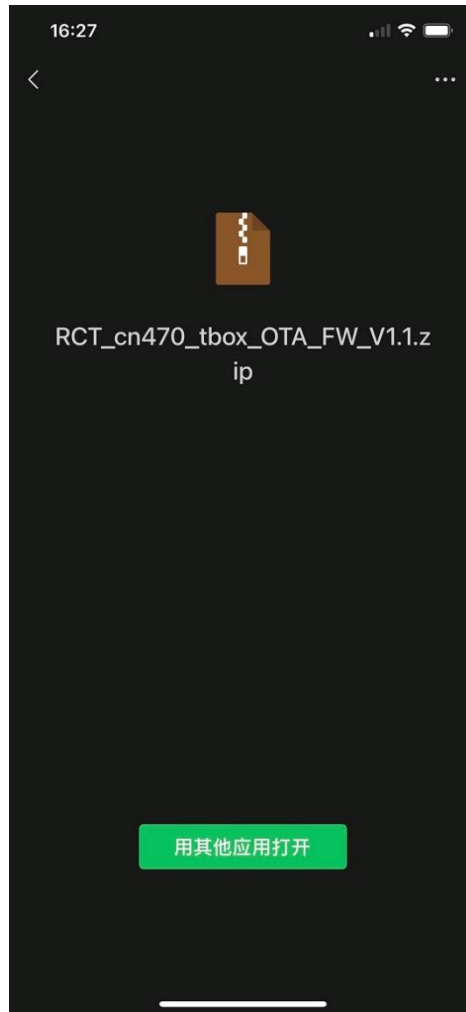
Locate the directory for saving the upgrade package and select the upgrade file.

5.2 Apple System

Apple phones also need to use nrfConnect to upgrade.

5.2.1 Upload Firmware

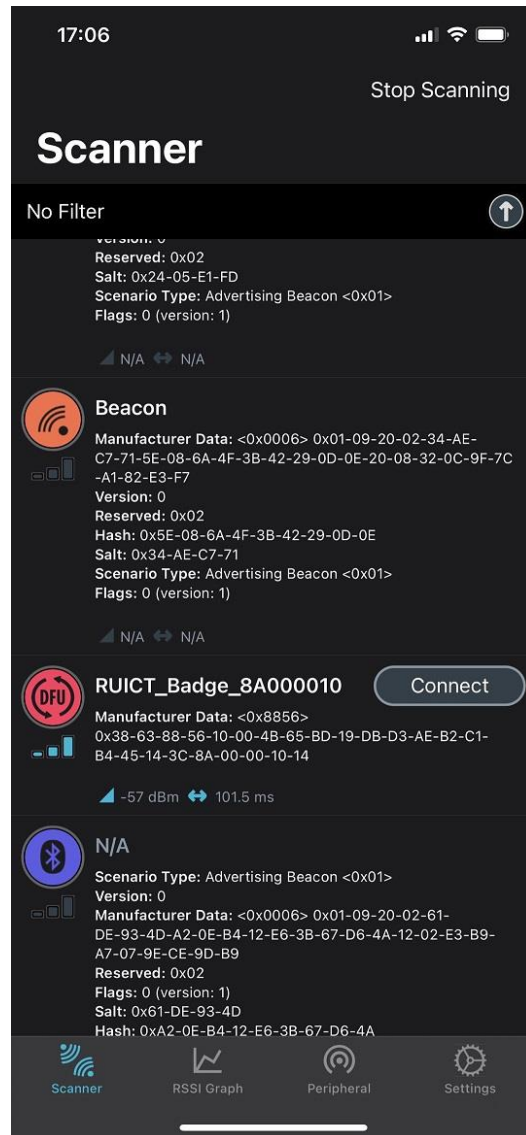
First send the upgrade package to wechat and open the upgrade package on wechat. You can also select other similar APP to import the firmware.



Select nrfConnect in the application that pops up, and the upgrade package is saved in nrfConnect.

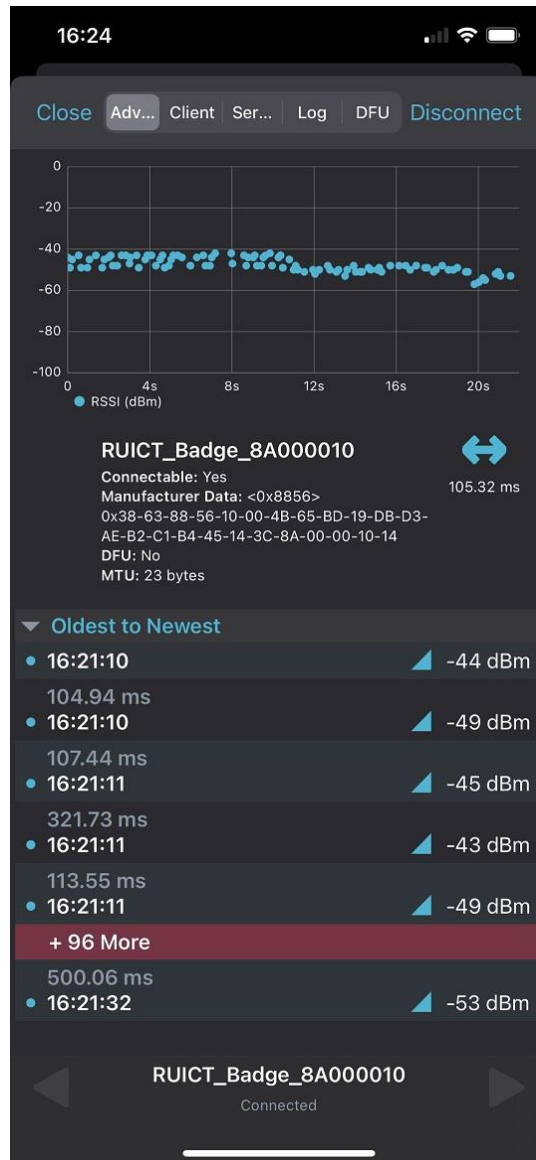
5.2.2 Connect Device

Long press the button to restart the badge. The badge can be connected to the APP for the first 30 seconds after the restart. After the timeout, the badge should be restarted again.



Click "Connect" to establish bluetooth connection.

5.2.3 Upgrade



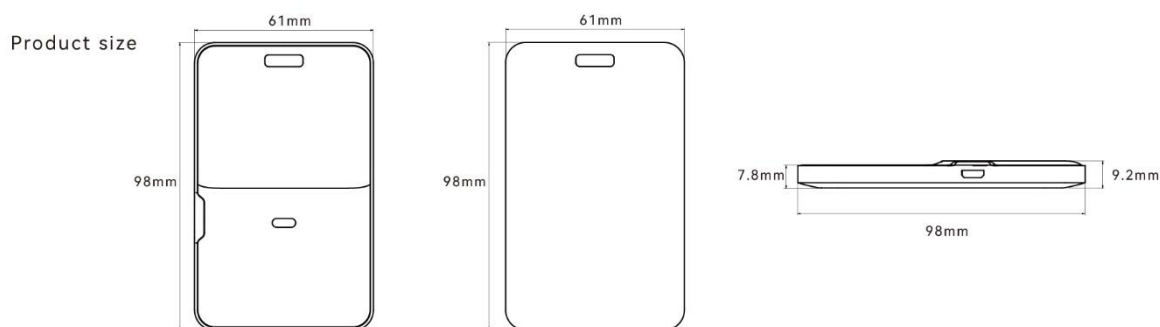
Click "DFU" in the upper right corner and select the corresponding upgrade package.

5.3 Batch upgrade

We provide hardware tool and PC based software to perform automatic batch upgrade. If you purchase more than 100 devices, please contact us(support@ruichuangte.com) for free software and hardware.

6. Mechanical structure

6.1 Badge



Parameter	Value
Model	BC02
Band	EU868/AS923/US915
Transmit power	20dBm
Protocol	LoraWAN1.0.3
Join	OTAA, ABP
Positioning mode	BLE RSSI, AOA, GNSS

BLE band	2.4GHz
BLE sensitivity	-92dBm, threshold can be set
BLE protocol	BLE5.0, support iBeacon and any other BLE protocols
GNSS	GPS, Beidou
Charging mode	Micro USB, 5V/250mA
Battery	800mAh lithium battery
Static standby	20uA
Dormancy	8uA, sleep period can be configured
BLE scans every 10 seconds	1.8mA, ble scanning cycle can be configured
BLE scans every 20 seconds	0.9mA
GNSS positioning once every 30 seconds	13.5mA, GNSS cycle can be configured
GNSS positioning once a minute	6.4mA
Endurance time	440 hours (10s interval for continuous reporting of BLE) 60 hours (30s interval for continuous reporting of GNSS)
Reporting interval	Configurable, minimum 5S reporting interval, sleep at night
Communication distance	Lora: 1km downtown, Bluetooth: 50m
Motion detection	Support, built-in motion sensor, intelligent sleep can be set
SOS	Support
Online upgrade	Bluetooth, batch upgrade
Other functions	Secure social distance monitoring, Bluetooth white list, Bluetooth AOA
Working temperature	-20°C ~ 60°C
Degree of protection	IP66
Product size	98mm x 60mm x 7.7~9.1mm (L x W x H)
Weight	50g
Shell material	ABS
Installation mode	Hanging rope

6.2 Gateway



Parameter	Value
Model	GO02
Band	EU868/AS923/US915
Transmit power	Maximum 17dBm, configurable
Protocol	LoraWAN1.0.3
Join	OTAA, ABP
Positioning mode	BLE RSSI
BLE band	2.4GHz
BLE sensitivity	-92dBm, threshold can be set
BLE protocol	BLE5.0, it supports iBeacon protocol and any other BLE protocols
Battery	4000mah rechargeable lithium battery
Solar panel	5.5V, 1.2W
Static standby	12uA
Dormancy	6uA
Reporting interval	Configurable, minimum 5S reporting interval, sleep at night
Communication distance	Lora: 1km downtown, Bluetooth: 50m
Online upgrade	Bluetooth, batch upgrade
Working temperature	-20°C ~ 60°C
Degree of protection	IP67
Product size	148mm x 94mm x 60mm (L x W x H)
Weight	309g
Shell material	ABS
Installation mode	Screw

6.3 T-Box

T-Box has the same size with BLE gateway, but with solar panel equipped.



Parameter	Value
Model	TD02
Band	EU868/AS923/US915
Transmit power	Maximum 17dBm, configurable
Protocol	LoraWAN1.0.3
Join	OTAA, ABP
Positioning mode	BLE RSSI, AOA, AGNSS
BLE band	2.4GHz
BLE sensitivity	-92dBm, threshold can be set
BLE protocol	BLE5.0, it supports iBeacon protocol and any other BLE protocols
Battery	3200mah rechargeable lithium battery
Charging mode	Solar, USB
Solar panel	5.5V,1.2W
Static standby	12uA
Dormancy	6uA
Reporting interval	Configurable, minimum 5S reporting interval, sleep at night
Communication distance	Lora: 1km downtown, Bluetooth: 50m
Motion detection	Support, built-in motion sensor, intelligent sleep can be set
Online upgrade	Bluetooth, batch upgrade
Working temperature	-20°C ~ 60°C
Degree of protection	IP67
Product size	119mm x 94mm x 60mm (L x W x H)
Weight	309g
Shell material	ABS
Installation mode	3M glue

7. Abbreviation

ABP: Activation By Personalization

ADR: Adaptive Data Rate

AGNSS: Assisted GNSS

BLE: Bluetooth Low Energy

CAS: Customer Application Server

CRC: Cyclic Redundancy Check

DR: Data Rate

GNSS: Global Navigation Satellite System

GPRS: General Packet Radio Service

LNS: LoRaWAN Network Server

LoRa: Long Range modulation technique

LoRaWAN: Long Range Network protocol

MAC: Medium Access Control

OTAA: Over-The-Air Activation

RSSI: Received Signal Strength Indicator

SOC: State Of Charge

The End