BROWAN

Object Locator

Reference Manual

Model Name: TBOL100

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1. Description

The Object Locator utilizes LoRaWAN connectivity to communicate the location of the device. The intended use is to attach the sensor to a object like a backpack or purse to be able to remotely know its location.

The sensor is composed of a GNSS receive, a push button, an LED indicator, and a USB-C connector. The device contains a LiPo battery that can be recharged through the USB-C connector.

2. Specifications

2.1 Mechanical
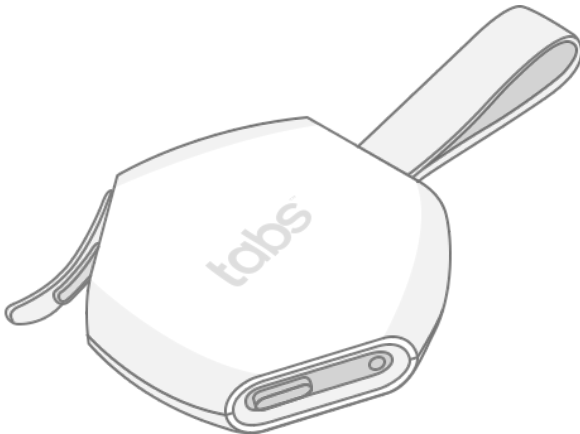
2.1.1 Sensor

Length x Width x Height	50mm x 13mm x 50mm
Weight	28g
Sensor	• GNSS • 3D MEMs accelerometer • Push Button

2.2 Environmental

Temperature	0°C to +50°C
IP Rating	IP 64 equivalent

2.3 Radio

Frequency	• 863–870MHz for EU • 902–928MHz for North America
Tx Power	+19dBm conducted
Rx Sensitivity	-140dBm conducted
Antenna Gain	-5dBi Peak, -8dBi Avg

2.4 Certifications and Conformity

FCC ID: 2AMUGTBOL100

IC: 22980-TBOL100

CE

ROHS REACH

2.5 Power

Source	4.2V LiPo 540mAh battery
Maximum Voltage	4.2V
Minimum Voltage	3.6V
Current	TBD

2.6 User Interface

LEDs	One green LED

2.7 Additional Features

PCB Temperature	NTC 100k ohm
Battery Monitoring	Resistor divider

3. Operation

3.1 Transport Mode

The sensor is hibernating without functionality to prevent radio transmissions and to minimize battery usage. To enter flight mode from default mode, the user shall press and hold any button for at least 10 seconds. Upon release of the button, flight mode is activated and the green LED shall flash rapidly for a duration of 3 seconds as an indication to the user.

To exit flight mode, the user shall press and hold any button for at least 10 seconds. Upon release of the button, flight mode is deactivated and default mode entered. As an indication to the user, the green LED shall light up for a duration of 3 seconds.

3.2 Default Mode

This mode is active when the device is in normal operating mode.

Whenever device motion is detected after a period of rest, the green LED shall flash 3 times within 500ms.

After a button is pressed, the green LED shall turn on for at most 50ms, after which an uplink transmission is scheduled. After the uplink transmission is complete – but before any down-link windows are opened – the green LED shall turn on for 500ms.

When a command to actuate the vibrator is received, all LEDs shall flash rapidly for the duration of the buzz. A buzz shall last 5 seconds with the buzzer activated for one (1) second followed by a one (1) second idle period, resulting in 3 vibrations and 2 idle periods.

3.3 Charging Indication

These indications do not constitute an operating mode by themselves, but may be active whenever there are no other ongoing indications as defined by the flight and default operating modes.When the device is connected to a powered charger, and the battery is charging, the green LED shall be on continuously. If the battery is fully charged while a powered charger is connected, the green LED shall fade-in and out from 0% to 50% brightness at a rate of 12 cycles per minute.

4. Messages

LoRaWAN Packets for this device use port 136.

4.1 Status

4.1.1 Triggers

Packet Triggers:
1.The sensor will update status every 120 minute if the sensor is in stationary mode.
2.The sensor will update status every 30 seconds if the sensor is in moving mode.
3.Press button to trigger event.
*Note: The sensor will uplink immediately if it changes status from stationary mode to moving mode.

4.1.2 Payload

Port	136
Payload length	11 bytes

Byte	1	2	3	4	5	6	7	8	9	10	11
Field	Status	Battery	Temp	Lat				Long			

Status	Sensors status	
	Bit[0]	1 - button trigger event, 0 - no button trigger event
	Bit[1]	1 - moving mode, 0 - stationary mode (TBD)
	Bit[2]	RFU
	Bit [3]	1 - no GNSS fix, 0 - GNSS fixed
	Bit [4]	1 - GNSS error, 0 - GNSS OK
	Bit[7:5]	RFU
Battery	**Battery level**	
	Bits [3:0]	unsigned value v, range 1 – 14; battery voltage in V = (25 + v) ÷ 10.
	Bits [7:4]	RFU

Temp	Temperature as measured by on-board NTC	
	Bits [6:0]	unsigned value τ, range 0 – 127; temperature in °C = τ - 32.
	Bit [7]	RFU
Lat	Latitude as last reported by GNSS receiver	
	Bits [27:0]	signed value φ, range -90,000,000 – 90,000,000; WGS84 latitude in ° = φ ÷ 1,000,000. *Note: little-endian format.
	Bits [31:28]	RFU
Long	Longitude and position accuracy estimate as last reported by GNSS receiver	
	Bits [28:0]	signed value λ, range -179,999,999 – 180,000,000; WGS84 longitude in ° = λ ÷ 1,000,000.
	Bits [31:29]	unsigned value α, range 0-7; position accuracy estimate in m = $2^{\alpha+2}$ (max). The value 7 represents an accuracy estimate of worse than 256m.
	Note: If there is no GNSS fix (see sensor status), the Lat. and Lon. fields contain the last values reported by the GNSS receiver. If there has never been a GNSS fix acquired, the values may both be 0. *Note2: little-endian format.	

5. Label format information

5.1 Back label
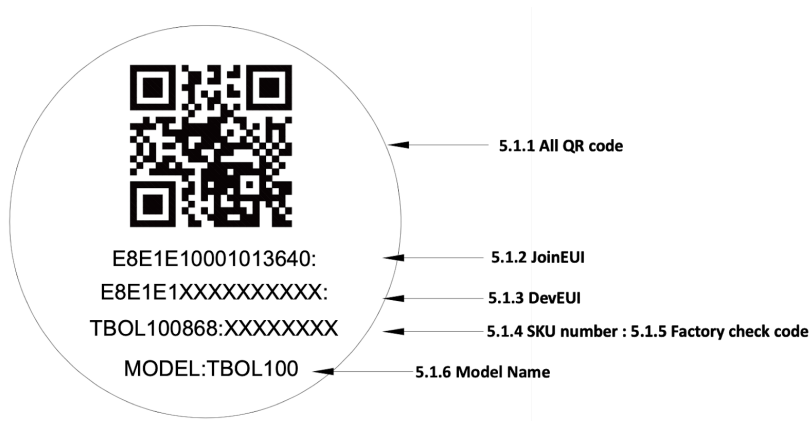
21BWOL100868XXXXXX92E8E1E1XXXXXXXXXX

Definition of Back Label:

GS1 DataMatrix

- The GS1 Application Identifier (21) indicates that the GS1 Application Identifier data field contains a serial number.
- The GS1 Application Identifier (92) assigned to the company's internal information is DevEUI.

5.2 QR code label

5.2.1 All QR code

URN:LWDP:E8E1E10001013640:E8E1E1XXXXXXXXXX:TBOL100868:XXXXXXXX

The total maximum resulting character sentence is 72 alphanumeric characters long.

5.2.2 JoinEUI

800MHz: E8E1E10001013640 (EU/IN/RU)

Uses a hexadecimal representation resulting in 16 characters.

5.2.3 DevEUI

E8E1E1XXXXXXXXXX

Uses a hexadecimal representation resulting in 16 characters.

5.1.4 SKU number

Non-reserved characters(except ":" and space) with a maximum length of 20 characters.

5.1.5 Factory check code

XXXXXXXX

Checksum of the factory production line.

5.1.6 Model Name

MODEL:TBOL100.

Fixed code, not including in QR code.

6. Important Product & Safety Instructions

For the most current and more detailed information about Tabs features and settings as well as safety instructions, please download the user manual for the products online at www.browan.com before the use of any Tabs products or services.

Certain sensors contain magnets. **Keep away from ALL Children!** Do not put in nose or mouth. Swallowed magnets can stick to intestines causing serious injury or death. Seek immediate medical attention if magnets are swallowed.

These products are not toys and contain small parts that can be dangerous to children under 3 years old. Do not allow children or pets to play with products.

Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled.

Observe the following precautions to avoid a sensor explosion or fire:
- Do not drop, disassemble, open, crush, bend, deform, puncture, shred, microwave, incinerate or paint the sensors, Hub or other hardware.
- Do not insert foreign objects into any opening on the sensors or Hub, such as the USB port.
- Do not use the hardware if it has been damaged—for example, if cracked, punctured or harmed by water. Disassembling or puncturing the battery (whether integrated or removable) can cause an explosion or fire.
- Do not dry the sensors or battery with an external heat source such as a microwave oven or hairdryer.

7. Warnings

- Do not place naked flame sources, such as lighted candles, on or near the equipment.
- The battery shall not be exposed to excessive heat such as sunshine, fire or the like.
- Do not dismantle, open or shred battery pack or cells.
- Do not expose batteries to heat or fire. Avoid storage in direct sunlight.
- Do not short-circuit the battery. Do not store batteries in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.
- Do not remove a battery from its original packaging until required for use.
- Do not subject batteries to mechanical shock.
- In the event of a battery leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.
- Do not use any charger other than that specifically provided for use with the equipment.
- Observe the plus (+) and minus (-) marks on the battery and equipment and ensure correct use.
- Do not use any which is not designed for use with the product.
- Do not mix cells of different manufacture, capacity, size or type within a device.
- Keep batteries out of the reach of children.
- Seek medical advice immediately if a battery has been swallowed.
- Always purchase the correct battery for the equipment.
- Keep batteries clean and dry.
- Wipe the battery terminals with a clean dry cloth if they become dirty.

8. Notices

- Avoid exposing your sensors or batteries to very cold or very hot temperatures. Low or high temperature conditions may temporarily shorten the battery life or cause the sensors to temporarily stop working.
- Take care in setting up the Hub Gateway and other hardware. Follow all installation instructions in the User Guide. Failure to do so may result in injury.
- Do not install hardware equipment while standing in water or with wet hands. Failure to do so can result in electric shock or death. Use caution when setting up all electronic equipment.
- When charging the sensors, do not handle the sensors with wet hands. Failure to observe this precaution could result in electric shock.

- PROP 65 WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm
- Cleaning Tabs Products: Use a clean dry cloth or wipe to clean Tabs products. Do not use detergent or abrasive materials to clean the Tabs products, as this may damage the sensors.

9. Cautions

CAUTION: Disposal of a battery (or battery pack) into a fire or a hot oven, or mechanically crushing or cutting of a battery (or battery pack) can result in an **EXPLOSION!**

Leaving a battery (or battery pack) in an extremely high temperature surrounding environment that can result in an **EXPLOSION** or leakage of flammable liquid or gas.

A battery (or battery pack) subjected to extremely low air pressure may also result in an **EXPLOSION** or leakage of flammable liquid or gas.

Discard used batteries according to the manufacturer's instructions.

CAUTION: The unit is provided with a battery-powered circuit.

There is a danger of **EXPLOSION** if the battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Risk of **EXPLOSION** if Battery is replaced by an Incorrect Type. Dispose of Used Batteries According to the Instructions.

10. Regulatory

CE FC	Hereby, Browan Communications Inc. declares that the radio equipment for Tabs products is in compliance with Directive 2014/53/EU. This device complies with Part 15 of the FCC Rules and RSS Standards of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
(crossed-out wheelie bin symbol)	This symbol means that according to local laws and regulations your product should be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. Some collection points accept products for free. The separate collection and recycling of your product at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment.

10.1 Federal Communication Commission Interference Statement

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

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

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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

 IMPORTANT NOTE:

 Radiation Exposure Statement:

The product complies with the US portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

10.2 Industry Canada statement:

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions :

(1) This device may not cause interference
(2) This device must accept any interference, including interference that may cause undesired operation of the device

Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes au (x) RSS (s) exemptés de licence d'Innovation, Sciences et Développement économique Canada. L'opération est soumise aux deux conditions suivantes :

(1) Cet appareil ne doit pas causer d'interférences
(2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil

The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

This equipment should be installed and operated with minimum distance 0cm between the radiator & your body.

Déclaration d'exposition aux radiations :

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

Cet équipement doit être installé et utilisé avec un minimum de 0 cm de distance entre le radiateur et votre corps.