tabs

Object Locator

Reference Manual

TBOL100-915
TBOL100-868

Table of Contents

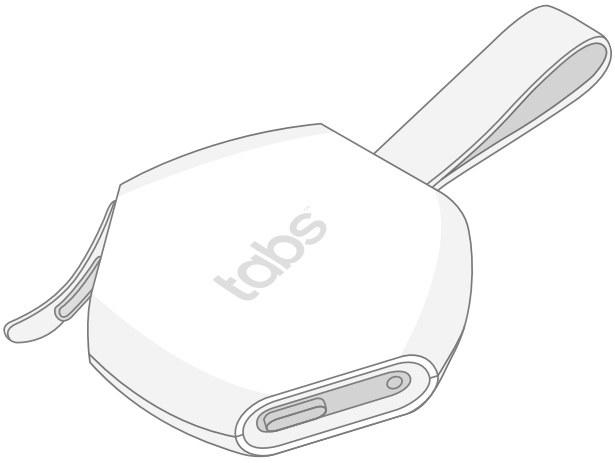
1. Description

The Tabs 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 20mm x 50mm
Weight	28 grams
Sensor	GNSS, 3D MEMs accelerometer, Push Button

2.2 Environmental

Temperature	-20°C to +50°C
IP Rating	IP 64 equivalent

2.3 Radio

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

2.4 Certifications and Conformity

FCC
IC
CE
ROHS REACH

2.5 Power

Source	4.2V LiPo 540mAh battery
Maximum Voltage	4.2V
Minimum Voltage	3.6V
Current	170mA max / 5uA minimum

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 Shipping Mode

When object locators leave the factory, they are put into shipping mode, where the sensor is hibernating without functionality to prevent radio activity and minimize battery usage. Devices are delivered in this mode.

The LED shall be off at all times when in shipping mode and button presses will be ignored.

When the device is connected to a USB charger, the device shall exit shipping mode and enter default mode. There is no method for customers to put the device back into shipping mode.

3.2 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.

3.3 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, or once if a low battery condition is detected. This indication shall repeat once per minute while the device remains in motion.

After a button is pressed, the green LED shall turn on for at most 50ms, after which an up-link transmission is scheduled. After the up-link 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.

3.4 Charging and Low Battery 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. As specified, no LED indications are active in shipping mode. 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 Common Fields

Status[7:0]

{Fault3, Fault2, LED1, LED0, Fault1, Fault0, BTN1, BTN0}

- Nominally Fault0 indicates no network time available
- Nominally Fault1 indicates loss of primary sensor function
- Nominally Fault2 indicates loss of secondary sensor function
- Nominally Fault3 indicates loss of network connectivity

Battery[7:0]

LoRaWAN Decode

- 0 => Device is charging or line powered
- 1 to 254 => device level, 1 = minimum and 254 = fully charged
    - Futher encode
        - [7:4] = predicted battery life percentage, 15 = New, 0 = Replace
        - [3:0] = BatteryVoltage — 2.5V, in 0.1V steps, So 3.1V = 6
- 255 => Device could not measure battery — possible Fault

Temperature[6:0]

Unsigned Integer (0 to 127) Temperature = value - 32, measurement range -32 to 95°C

For Object Locator devices Fault 3 indicates ‘1’ for no GNSS fix, and ‘0’ for GNSS fix is OK.

Note: If there is no GNSS fix, 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.

4.1.2 Triggers

Packet Triggers: 60 minute inactivity, movement, button press, position update every 15 seconds while moving and GNSS has a 2D fix, update every 2 minutes while moving and GNSS does not have a 2D fix.

4.1.3 Payload

Port	136
Payload Length	11 bytes

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

Status	**Sensor status**	
	Bit [3]	1 – no GNSS fix, 0 – GNSS fix OK
	Bits [7:4]	See common status format above
Battery	**Battery level**	
	Bits [3:0]	unsigned value ν, range 1 – 14; battery voltage in V = (25 + ν) ÷ 10.
	Bits [7:4]	unsigned value κ, range 0 – 15; remaining battery capacity in % = 100 × (κ ÷ 15).
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.
	Bit [31:28]	RFU
Lon	**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.

5. Command

RESERVED.