Manuals+ — User Manuals Simplified.

WIZZILAB WOLT-UWB-S Ultra Low Power D7A or LoRaWAN or UWB Interactive Location Tag User Manual
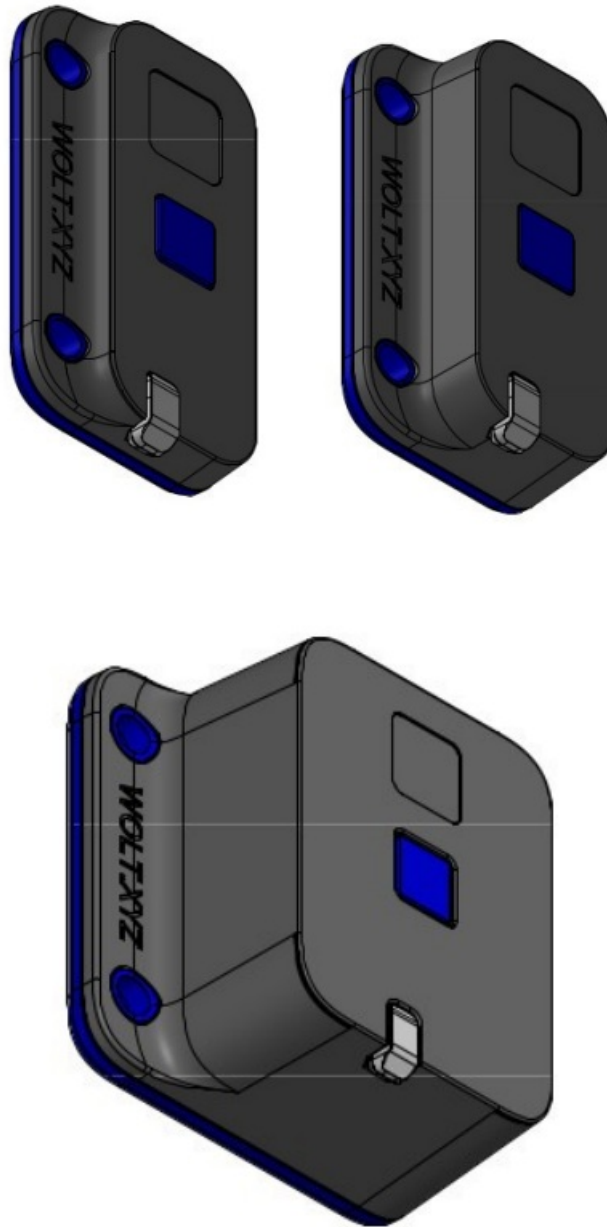
Contents

WIZZILAB

WIZZILAB WOLT-UWB-S Ultra Low Power D7A or LoRaWAN or UWB Interactive Location Tag

Description

- Combined UWB/D7A-FSK/D7A-LoRa & LoRaWAN battery-powered interactive location tag with a years-long lifetime.
- Communication over long-range LoRaWAN, mid-range D7A-FSK / D7A-LoRa, and short-range UWB.
- RBG LED and button human interface.
- Firmware Update Over the Air (FOTA) over D7A.
- Low-latency low-power UWB two-way ranging for RTLS systems with up to 10 cm accuracy
- Motion sensor: 3-axis accelerometer
- NFC Passive Tag. Identification & configuration of NFC
- Beaconing & configuration over BTLE
- Tap-to-connect protocol
- **Operating temperature:** -40 ℃ to 85 ℃
- Current consumption optimized for low power
- **sleep mode**: <10μA
- IP65 casing

- FCC, CE / RED certification

Applications

- Indoor assets location with sub-meter precision
- Security systems
- Industrial monitor and control
- Internet of things (IoT)
- WizziLab product line at **www.wizzilab.com/products**

Sub-GHz modem

- Murata CMWX1ZZABZ hardware with WizziLab proprietary firmware
- FCC, CE / RED and UKCA certification
- Operates in the 868-915 MHz ISM bands
- Embedded chip antenna.
- Bi-directional DASH7-FSK/LoRa v1.2 Industrial IoT connectivity with 1s latency (**www.dash7-alliance.org**)
- Bi-directional LoRaWAN connectivity (uplink driven).
- IoT modulation schemes FSK (1.8bpsk/55kbps) or LoRa(125kHz/SF6 to 10)
- Output power up to +13.2 dBm (FSK)+13.1dBm(Lora)

UWB/BLE/NFC Modem

- Qorvo DWM1001 hardware with WizziLab proprietary firmware
- FCC, CE / RED certification
- Low-latency low-power two-way ranging for RTLS systems with up to 10 cm accuracy.
- 110 / 850 kbps data rate IEEE 802.15.4-2011.
- UWB compliant, on channels 3/5.
- Embedded PCB UWB antenna.
- DASH7 over UWB communication @ 110 / 850 kbps on channels 3/5.
- BLE & NFC-A listening device. Tap-to-connect protocol and secured BLE connectivity
- Motion sensor: 3-axis accelerometer
- Bluetooth® connectivity & chip antenna
- Tap-to-connect

Variants

WOLT-UWB-S

- The WOLT-UWB-S is proposed in a 91 x 52 x 5 mm casing respecting the IP65 specification of IEC 529 (Dust and Hose-proof) and powered with a flat LiMnO2 battery with 2300 mAh capacity @3.0V.

Drawing title block: WOLT.XYZ — TAG S — No. DE PLAN 220311-WOLT-TAG_S — A3 — REVISION A
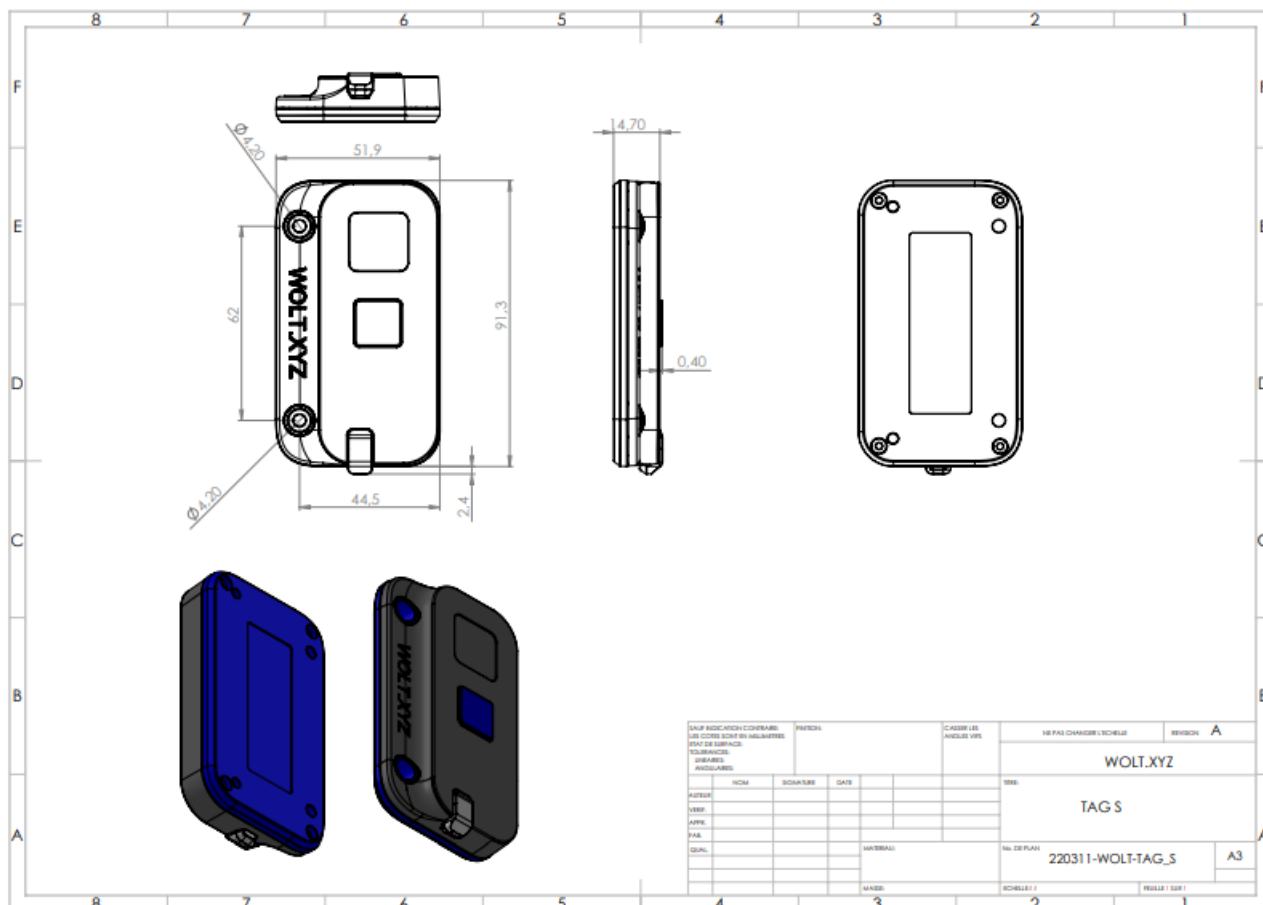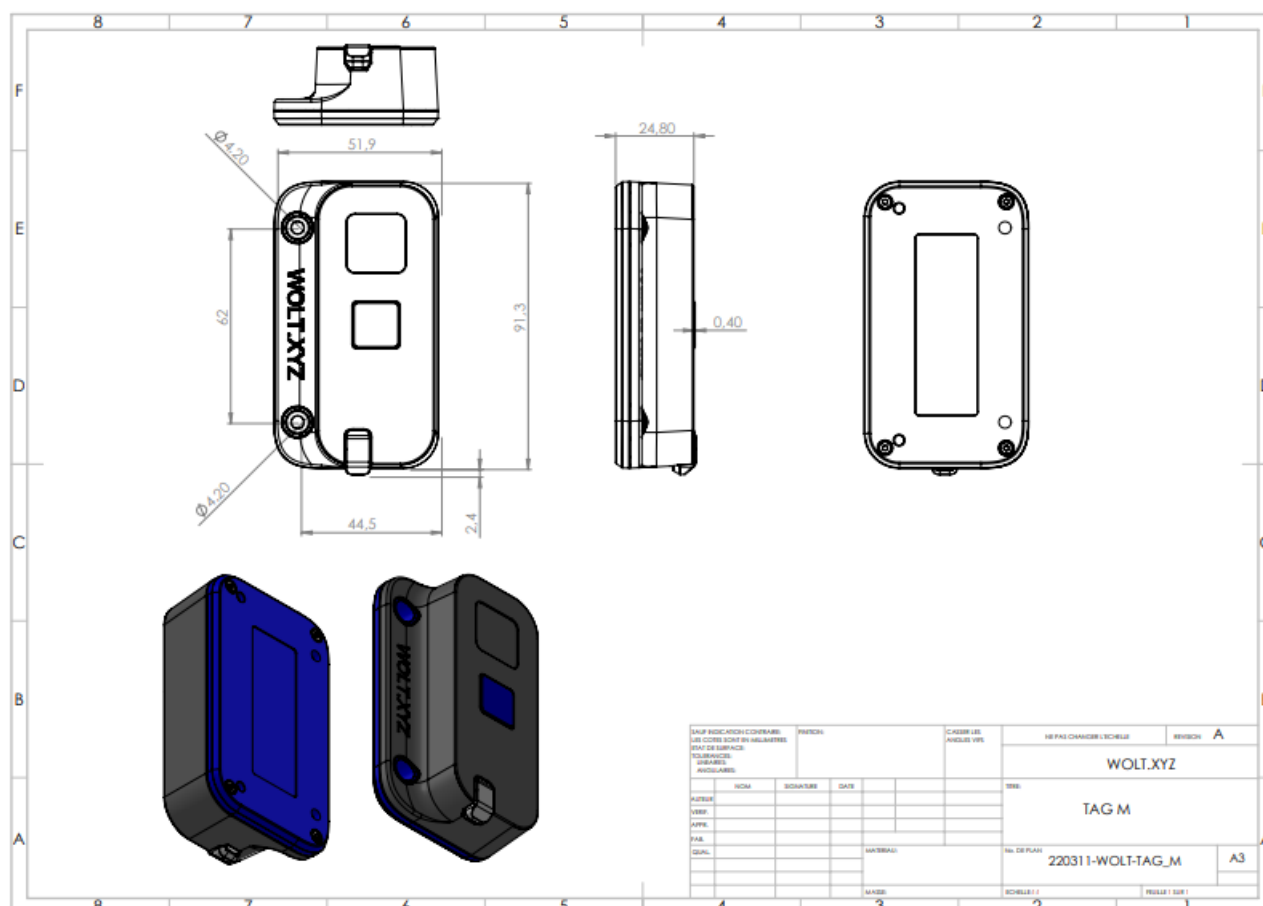
WOLT-UWB-M

- The WOLT-UWB-M is proposed in a 91 x 52 x 25 mm casing respecting the IP65 specification of IEC 529 (Dust and Hose-proof) and powered with a LiSOCl2 battery with a 5400 mAh capacity @3.6V

Drawing title block: WOLT.XYZ — TAG M — No. DE PLAN 220311-WOLT-TAG_M — A3 — REVISION A

WOLT-UWB-XL

- The WOLT-UWB-XL (aka Anchor) is proposed in a 94 x 90 x 46 mm casing respecting the IP65 specification of IEC 529 (Dust and Hose-proof) and powered with a LiSOCl2 battery with 38000 mAh capacity @3.6V
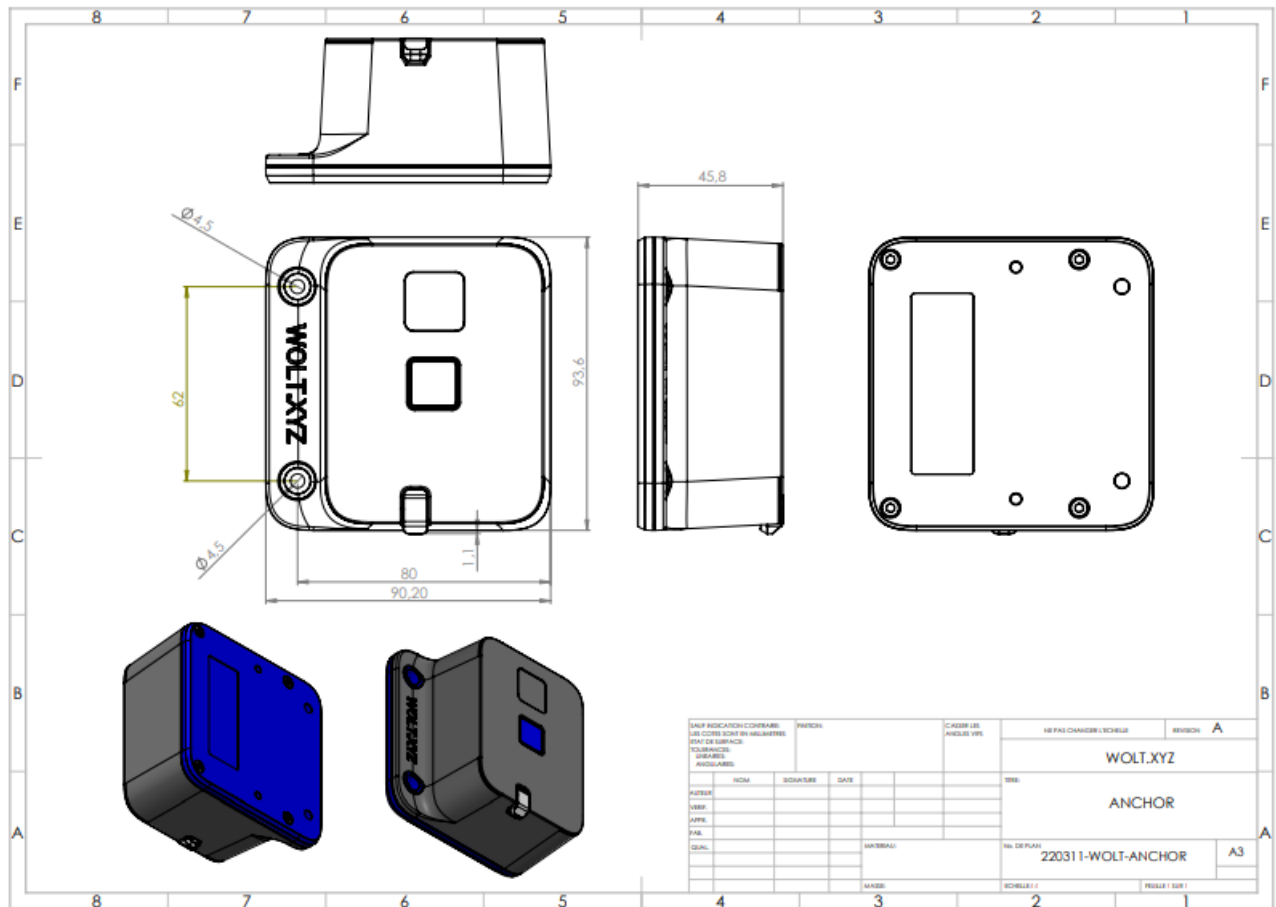
Functional Description

Sub-GHz Modem

- The devices features a combined DASH7-FSK/LoRa & LoRaWAN modem functioning @868 MHz in the RED/EU regulated areas and @915MHz in the FCC regulated areas. It both allows communication over long-range LoRaWAN and mid-range DASH7-FSK/LoRa, and over-the-air configuration and code update using the D7A protocol.

UM-1 combo UWB/BLE/NFC

- The UM-1 Module is a full-function RTLS / wireless modem subsystem in a compact factor, composed of Qorvo DWM1001 hardware, and WizziLab proprietary firmware. The UM-1 module enables customers to quickly get a RTLS system up-and-running, also provides additional over-theair communication capabilities through the UWB, BLE and NFC interfaces. The UWB part of the system is designed to operate on 4.493 GHz (IEEE 802.15.4- 2011, Channel 3) and 6.490 GHz (IEEE 802.15.4- 2011, Channel 5) Nominal Centre Frequencies with a 500 MHz Bandwidth and data rates of 110 kbps and 850 kbps. It also features a BLE modem and a passive NFC-A listening device.
- The UM-1 module comes loaded with embedded firmware which provides two-way ranging (TWR) and BLE (tap-to-connect, beaconing and sniffing in Eddystone and IBeacon format) functions. The firmware is available

as a nonmodifiable library, which provides a function API. This allows to execution the host firmware directly on the MCU of the UM-1.

UWB transceiver

- The UM-1 module has a DW1000 UWB transceiver mounted on the PCB. The DW1000 uses a 38.4
- MHz reference crystal. The crystal has been trimmed in production to reduce the initial frequency error to approximately 3 ppm, using the DW1000 IC's internal on-chip crystal trimming circuit.
- Always-On (AON) memory can be used to retain DW1000 configuration data during the lowest power operational states when the on-chip voltage regulators are disabled. This data is uploaded and downloaded automatically. The use of DW1000 AON memory is configurable.
- The on-chip voltage and temperature monitors allow the host to read the voltage on the VDDAON pin and the internal die temperature information from the DW1000.
- See the DW1000 Datasheet [2] for more detailed information on device functionality, electrical
- specifications and typical performance.

Bluetooth® Microprocessor Nordic nRF52832

- The nRF52832 is an ultra-low power 2.4 GHz wireless system on chip (SoC) integrating the nRF52 Series 2.4 GHz transceiver and an ARM Cortex-M4 CPU with 512kB flash memory and 64kB RAM.
- See the nRF52832 datasheet [1] for more detailed information on device functionality, electrical specifications and typical performance.

NFC Passive Tag

- Allows identification & configuration over NFC

Three Axis Motion Detector

- The LIS2DH12 is an ultra-low-power high-performance three-axis linear accelerometer with digital I2C/SPI serial interface standard output. The LIS2DH12 has user-selectable full scales of ±2g/±4g/±8g/±16g and is capable of measuring accelerations with output data rates from 1 Hz to 5.3 kHz. The self-test capability allows the user to check the functionality of the sensor in the final application. The device may be configured to generate interrupt signals by detecting two independent inertial wake-up/free-fall events as well as by the position of the device itself.
- The LIS2DH12 is guaranteed to operate over an extended temperature range from -40 °C to +85 °C.
- See the LIS2DH12TR Datasheet [4] for more detailed information on device functionality, electrical specifications and typical performance.

Temperature

- On board temperature sensor.

Battery Measure

- On board battery measure circuit.

LED

- On board RGB LED with integrated controller.

Button

- On board button for human-machine interraction.

Power Management

- On board power management circuit with DC-DC converters down to 2.8V to optimize power consumption.

Battery

- The WOLT-UWB comes in three different versions, S/M/XL, mounted with batteries with increasing capacity.

Hardware specification

Recommended operating conditions

Table 1. Recommended operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
TA	Operating ambient temperature range	-40	–	85	°C

Absolute maximum ratings(1)
Table 2. Absolute maximum ratings

Symbol	Parameter	Min.	Typ.	Max.	Units
TSTG	Storage temperature range	-40	–	85	°C

1. Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device.

- These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied.
- Exposure to absolute–maximum–rated conditions for extended periods may affect device reliability.

Battery Capacity

The WOLT-UWB comes in three different versions, S/M/XL, with increasing battery capacity.

Table 3. Battery Capacity

Variant	Voltage	Capacity
WOLT-UWB-S	3.0V	2.3 Ah
WOLT-UWB-M	3.6V	5.4 Ah
WOLT-UWB-XL	3.6V	38 Ah

Lifetime

- The power consumption is shared between a permanent routine (regular sub-GHz radio channel carrier sense, regular sensors measurements, regular keep-alive) and an event-driven routine (location).
- The lifetime will vary depending on the actual usage.

Table 4. Lifetime (years)

Symbol	Operation Mode	Min.	Typ.	Max.	Units
TLIFE, S	**Static tag**	–	3(1)	–	years
TLIFE, M	**Static tag with pick-to-light**	–	3(2)	–	years
TLIFE, XL	**Dynamic tag**	–	3(3)	–	years
TLIFE, XL,A	**Anchor**	–	5(4)	–	years

1. one location every 5 minutes.
2. one location every 90s, one pick-to-light per hour
3. one location every 5s, with duty 33 %
4. one two-way ranging every 5 s.

Table 5. Lifetime (locations)

Symbol	Operation Mode	Min.	Typ.	Max.	Units
LIFE,S	**Static tag**	–	0.1	–	Mlocs(1)
LIFE,M	**Static tag with pick-to-light**	–	1	–	Mlocs
LLIFE,XL	**Dynamic tag**	–	10	–	Mlocs
LLIFE,XL,A	**Anchor**	–	10	–	MTWR(2)

1. locations x 1 million. One location is composed of 1 D7A discovery (wake-up), typically 4 UWB distance two-way rangings, and 1 report to the location server over the D7A LAN.
2. UWB two-way rangings x 1 million.

Wireless Specification

Sub-GHz radio

The DASH7 modem has several data rates and modulation schemes available to better fit any kind of application.
Table 6. DASH7 sub-GHz transmission power

Condition	Max TX power	Units
ECC/RED regulations	+14	dBm
FCC regulations	+13.1(Lora) +13.2(FSK)	dBm

Table 7. Ranging error

Symbol	Parameter	Min.	Typ.	Max.	Units
EDIST-D7A	Location error (1) based on power attenuation (link budget)	–	10	–	m
EDIT-LWAN	Location error (1) based on power	–	1000	–	m
	attenuation (link budget)				

1. Highly depends on anchor/gateway density, line-of-sight conditions, and operator.

UWB radio

Table 8 . UWB transceiver operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
BUWB	RX/TX frequency range	4493		6490	MHz
PDSP	Output power spectral density			-41.3	dBm/MHz
PTX	Output Channel Power		-17		dBm/500MHz
PV	Output power variation with temperature	-1		+1	dB
PRX	Receiver power			0	dBm

Table 9 . UWB data rates

Modulation scheme	Parameter	802,154a channel	Data Rate	Units
UWB	ECC and FCC	#5 (6.4 GHz)	110000	bps
	ECC and FCC	#5 (6.4 GHz)	850000	bps

Table 10. UWB transmission power

Condition	Max TX power	Units
FCC/ECC/RED regulations, PRF16	0	dBm
FCC/ECC/RED regulations, PRF64	0	dBm

Table 11. UWB ranging error

Symbol	Parameter	Min.	Typ.	Max.	Units
EDIST-TWR	Two-way ranging error (1)	–	30	–	cm
EDIST-TDOA	Time difference of arrival ranging error (2)	–	30	–	cm

1. wo-way ranging by time of flight estimation without preliminary clock synchronization between the tag and the anchor, according to Decawave's application note APS013. (2) Depends on inter-anchors' synchronization accuracy

BLE radio

Table 12. BLE transceiver operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
BBLE	RX/TX frequency range	2402		2480	MHz
PTX	Output Channel Power			2.41	dBm

Antennas Performance

- Refer to the detailed description in the DWM1001 Datasheet [5].

Certifications ECC/RED

- If deployed in Europe, the WOLT-UWB is provided with ECC/RED certified network profiles for all active radios.

FCC

- If deployed in countries regulated by FCC, the WOLT-UWB is provided with FCC certified network profiles for all active radios.

Application

Assets location Tracker

- The WOLT-UWB can be used for efficient medium-to-high precision tracking due to the combination of long / mid / short range connectivity. It is also useful for identification due to its
- NFC & BTLE connectivity. The UWB ranging provides high location accuracy up to 30 cm.
- Depending on battery capacity, the application is configured in one of the following operation modes :
- Static tag – performs location on transition from motion to stable.
- Static tag with pick-to-light – performs location on transition from motion to stable. Turn on LED pattern up to 12 times a day.
- Dynamic tag – performs location continuously during motion.
- Anchor – location reference
- Refer to the lifetime limitations in the Hardware Section.

Ready to deploy

- The WOLT-UWB is suited for proof of concept, pilot and volume applications. By default, it is provisioned with LoRaWAN credentials for TTN (www.thethingsnetwork.org). For DASH7 communication, WizziLab provides infrastructure for easy D7A network deployment. The WOLTUWB seamlessly connects to the WizziLab's DASH7 Industrial IoT platform.
- For details visit our website: **www.wizzilab.com/products**
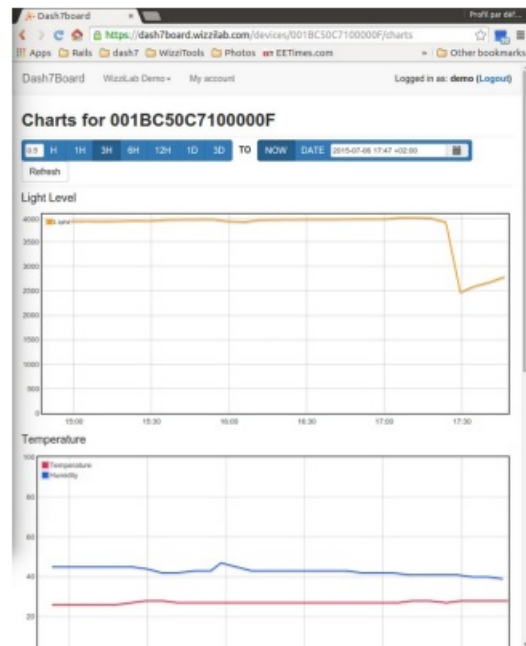
- DASH7 Access Point (gateway) and Network Management Platform (**https://dash7board.wizzilab.com**)

Firmware

The WOLT-UWB is provided with configurable firmware, allowing to select of beacon rates, beacon conditions (motion detection, …), and beacon networks (LoRaWAN and/or D7A). Downlink access over D7A and LoRaWAN is available for static/dynamic configuration, FOTA and actuation (LED blinking). Identification over NFC is available as well.
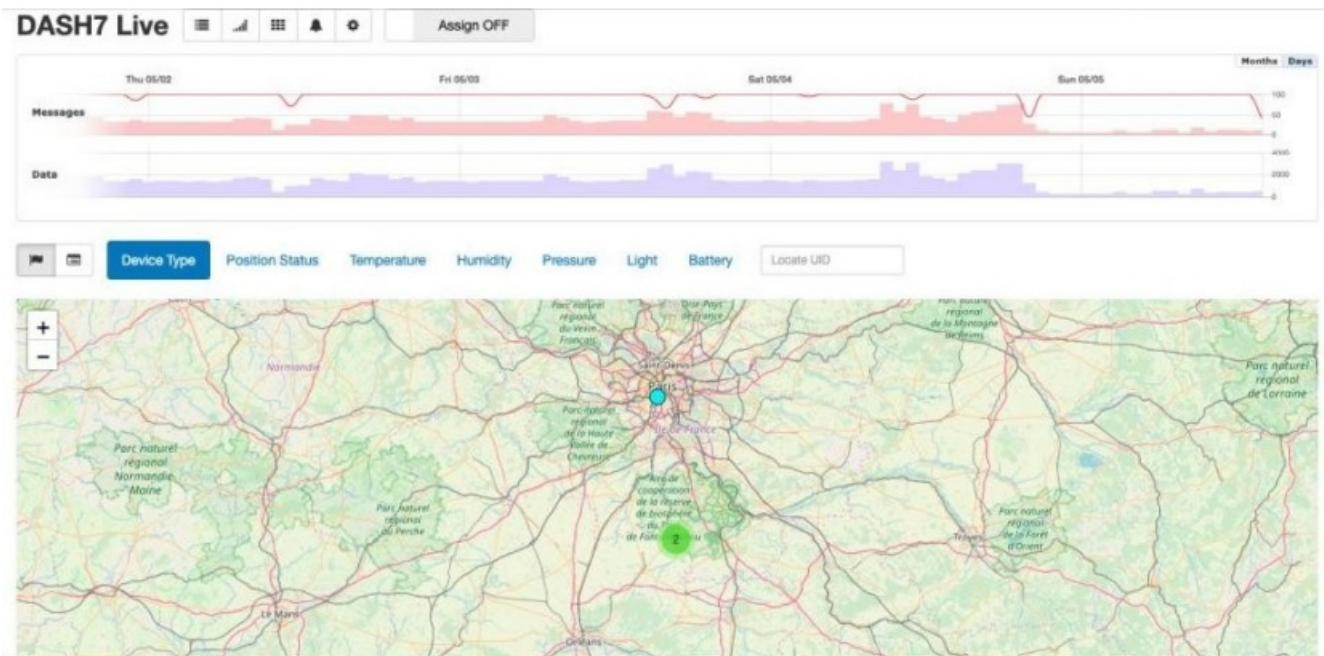
DASH7 Logistics Management Platform (**https://dash7board.wizzilab.com**)

Installation

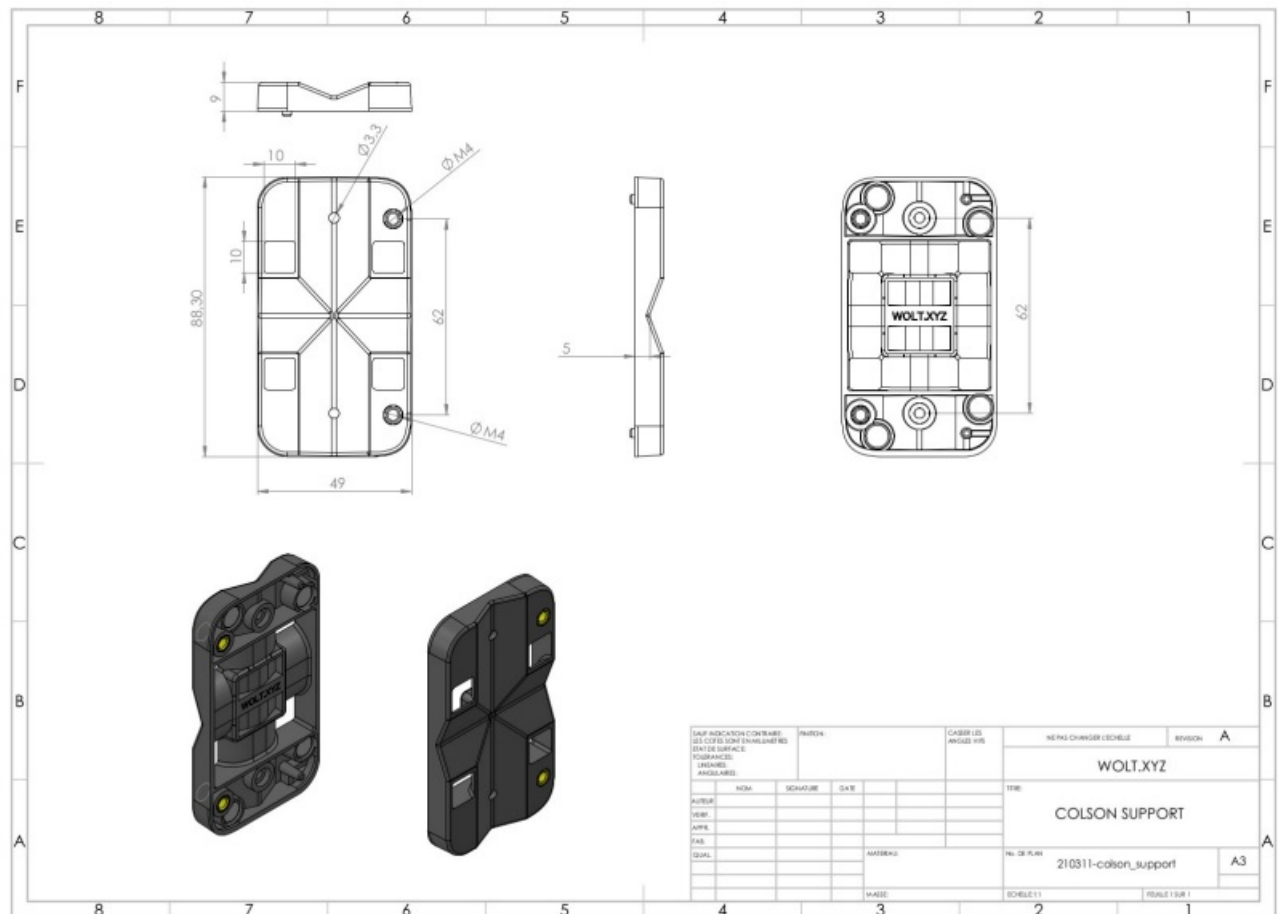**Mounting**

Direct Mounting

- Device can be fixed directly to a mount by screwing through the available M4 holes.

Magnets

- The bottom side of any casing can be optionally equipped with magnets, allowing to stick to metallic plates.

Colson Support

- A Colson accessory can be affixed to the device, compatible with all casing versions.

Go-Pro Support

- A Go-Pro accessory can be affixed to the device, compatible with all casing versions.

Activation

- By default, devices are produced and shipped in shelf mode. They need to be activated on the dashboard.

Configuration   Flush Enabled   Read All

MODE ⓘ
ACTIVE   Read   Write

LED Duration ⓘ
Nat 30   Read   Write

Sleep Duration ⓘ
Nat 0   Read   Write

Wakeup threshold ⓘ
Nat 4   Read   Write

Beacon Status

Beacon Configuration   Flush Enabled   Read All

Period stable ⓘ
Nat 1800   Read   Write

Period motion ⓘ
Nat 120   Read   Write

Beacon ITF enable ⓘ
☑ ☑ ☑ ☑   Read   Write

Beacon force ⓘ
☐ ☐ ☐ ☐ ☐   Read   Write

Scan Enable ⓘ
BOTH   Read   Write

Scan cells ⓘ
Nat 3   Read   Write

ITF 0 ⓘ
ITF A   Read   Write

ITF 1 ⓘ
ITF B   Read   Write

ITF 2 ⓘ
ITF C   Read   Write

ITF 3 ⓘ
ITF D   Read   Write

ITF 4 ⓘ
ITF E   Read   Write

For details, follow the instruction at: **https://wizzilab.com/wiki/#!hardware/wolt-uwb.md**

The WOLT Family

The WOLT trackers family also includes the WOLT-D7A dual mode FSK/LORA tracker with precision up to 3m. For details visit our website: **www.wizzilab.com/products**

FCC

Caution

- Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the 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,
2. this device must accept any interference received, including interference that may cause undesired operation.

This equipment may only be operated indoors. Operation outdoors violates 47 U.S.C. 301 and could subject the operator to serious legal penalties.

IMPORTANT NOTE:

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

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

FCC Radiation Exposure Statement:

- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Ordering information

- Contact us at: **contact@wizzilab.com**
- Or visit our website: **http://www.wizzilab.com/products**

Revision history

Table 15. Document revision history

Date	Revision	Changes
2022-05-13	0.1	Document creation based on WOLT-D7A and UM-1 datasheets
2022-06-21	0.2	Feedback from the certification process
2022-06-28	0.3	Feedback from the certification process
2022-11-01	0.4	Specific FCC additions
2022-12-28	0.5	Fix typos
2023-01-13	0.6	Fix FCC power level

References

1. nRF52832 Product Specification v1.3 **www.nordicsemi.com**
2. Decawave DW1000 Datasheet **www.decawave.com**
3. Decawave DW1000 User Manual **www.decawave.com**
4. STMicroelectronics LIS2DH12TR **www.st.com**
5. Decawave DWM1001 Datasheet **www.decawave.com**
6. ALP specification v1.2 **www.dash7-alliance.org**

7. D7A specification v1.2 **www.dash7-alliance.org**

Documents / Resources

	WIZZILAB WOLT-UWB-S Ultra Low Power D7A or LoRaWAN or UWB Interactive Location Tag [pdf] User Manual WTU-1-XL, WTU1XL, 2ARZVWTU-1-XL, 2ARZVWTU1XL, WOLT-UWB-S, WOLT-UWB-M, WOLT-UWB-XL, WOLT-UWB-S Ultra Low Power D7A or LoRaWAN or UWB Interactive Location Tag, Ultra Low Power D7A or LoRaWAN or UWB Interactive Location Tag