

Ultra low power DASH7 Sub-GHz / UWB Localization Tag



Description

- Combined DASH7-FSK/LoRa/UWB & LoRaWAN battery powered localization tag with years-long lifetime.
- Fully integrated off-the-shelf options and motion detection sensor.
- Functions over long-range LoRaWAN, mid-range DASH7-FSK/LoRa or short range D7A-UWB networks.
- Identification & configuration over NFC
- Beaconsing & configuration over BTLE
- FOTA over DASH7.
- Operating temperature: -40 °C to 85 °C

Sub-GHz modem

- Murata CMWX1ZZABZ hardware
- FCC & CE / RED certification
- Operates in the 868-915 MHz ISM band
- 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 GFSK 9.6 / 55.6 / 167.7 kbps or LoRa™ SF8 to SF12.
- Output power up to +14 dBm (with the embedded chip antenna).

UWB modem

- Based on the DWM1001 hardware
- Operates in the 6.4 GHz band
- Embedded PCB antenna.
- Embedded low power motion detection sensor.
- Bi-directional DASH7-UWB v1.2 Industrial IoT connectivity
- Supports two-way and time-difference of arrival (TDOA) ranging with up to 10 cm accuracy with optimized low power figures. Can be event-driven by the sub-GHz radio.
- ECC / FCC compliant 802.15.4a UWB physical layer @ 110 and 850 kbps on channel 5 (6.4 GHz)
- NFC & BTLE connectivity.

Applications

- Combined indoor / outdoor assets localization
- Security systems
- Industrial monitor and control
- Internet of things (IoT)

- WizziLab product line at www.wizzilab.com/products

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1 Hardware specification

1.1 Recommended operating conditions

Table 1. Recommended operating conditions

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

1.2 Absolute maximum ratings⁽¹⁾

Table 2. Absolute maximum ratings

Symbol	Parameter	Min.	Typ.	Max.	Units
T _{STG}	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.

1.3 Sensors and Actuators

Accelerometer

On board ultra low power 3 axis accelerometer.

Temperature

On board temperature sensor.

Battery

On board battery measure circuit.

Buttons

On board hardware reset and general purpose button.

LED

On board RGB LED with integrated controller.

1.4 Battery

Table 3. Lifetime on 3.0V LiMnO₂ with 2300mAh capacity

Symbol	Parameter	Min.	Typ. ⁽¹⁾	Max.	Units
T _{LIFE}	Motion sensor ON D7A downlink with 1s latency UWB localization	-	3	-	years

(1) 60 s per day cumulative transmission time (40 LoRaWAN uplink messages with SF12 LoRa modulation or 1500 D7A uplink messages with GFSK modulation at 55 kbps). 10 localization (10 x 4 two-way ranging) per day.

2 Casing and Battery

2.1 Off-the-shelf Option

The WOLT is proposed off-the-shelf in a transparent 78 x 39 x 14 mm blue casing respecting the IP65 specification of IEC 529 (Dust and Hose-proof) and powered with a flat LiMnO₂ battery with 2300 mAh capacity.



2.2 Custom Options

The WOLT can be fitted into custom transparent or non transparent casing and supports input voltages from 2.4V to 5V (DC-DC option) allowing to adapt the battery capacity to the use case. For more information, please contact us at : contact@wizzilab.com

3 Sub-GHz modem

3.1 Certifications

ECC/RED

If deployed in Europe, the WOLT is provided with ECC/RED certified DASH7/LoRaWAN (TTN) network profiles.

FCC

If deployed in North America, the WOLT is provided with FCC certified DASH7/LoRaWAN (TTN) network profiles.

3.2 Data rates

The DASH7 modem has several data rates and modulation scheme available to better fit any kind of application.

Table 4. DASH7 sub-GHz data rates

Modulation scheme	Parameter	Rate	Data Rate	Units
GFSK	ECC and FCC	High	166700	bps
	ECC and FCC	Normal	55600	bps
	ECC and FCC	Low	9600	bps
LoRa	ECC and FCC	SF8	3125	bps
	ECC and FCC	SF10	980	bps
	ECC only	SF11	440	bps
	ECC only	SF12	250	bps

3.3 Transmitting power

Table 5. DASH7 sub-GHz transmission power

Condition	Max TX power	Units
ECC/RED regulations	+14	dBm
FCC regulations	+14	dBm
Non regulated	+14	dBm

3.4 Receiver sensitivity

Table 6. DASH7 sub-GHz reception sensitivity

Modulation scheme	Rate	Typical Sensitivity	Units
GFSK	High	-105.0	dBm
	Normal	-110.0	dBm
	Low	-117.5	dBm
LoRa	SF8	-125.5	dBm
	SF10	-131.0	dBm
	SF11	-133.5	dBm
	SF12	-135.5	dBm

3.5 Ranging

Table 7. Ranging error

Symbol	Parameter	Min.	Typ.	Max.	Units
$E_{\text{DIST-D7A}}$	Power attenuation (link budget) ranging error (1)	-	30	-	m
$E_{\text{DIST-LWAN}}$	Power attenuation (link budget) ranging error (1) with TDOA enhancement	-	1000	-	m

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

4 UWB modem

4.1 Certifications

Certification-ready firmware based on DWM1001 hardware.

4.2 Data rates

The DASH7 modem has several data rates and modulation scheme available to better fit any kind of application.

Table 8. DASH7-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

4.3 Transmitting power

Table 9. DASH7-UWB transmission power

Condition	Max TX power	Units
ECC/RED regulations	+16	dBm
FCC regulations	+16	dBm
Non regulated	+31	dBm

4.4 Ranging

Table 10. DASH7-UWB ranging error

Symbol	Parameter	Min.	Typ.	Max.	Units
$E_{\text{DIST-TWR}}$	Two-way ranging error (1)	-	30	-	cm
$E_{\text{DIST-TDOA}}$	Time difference of arrival ranging error (2)	-	30	-	cm

(1) two-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

5 NFC & BTLE connectivity

TBD

6 Application

6.1 Indoor / Outdoor Tracker

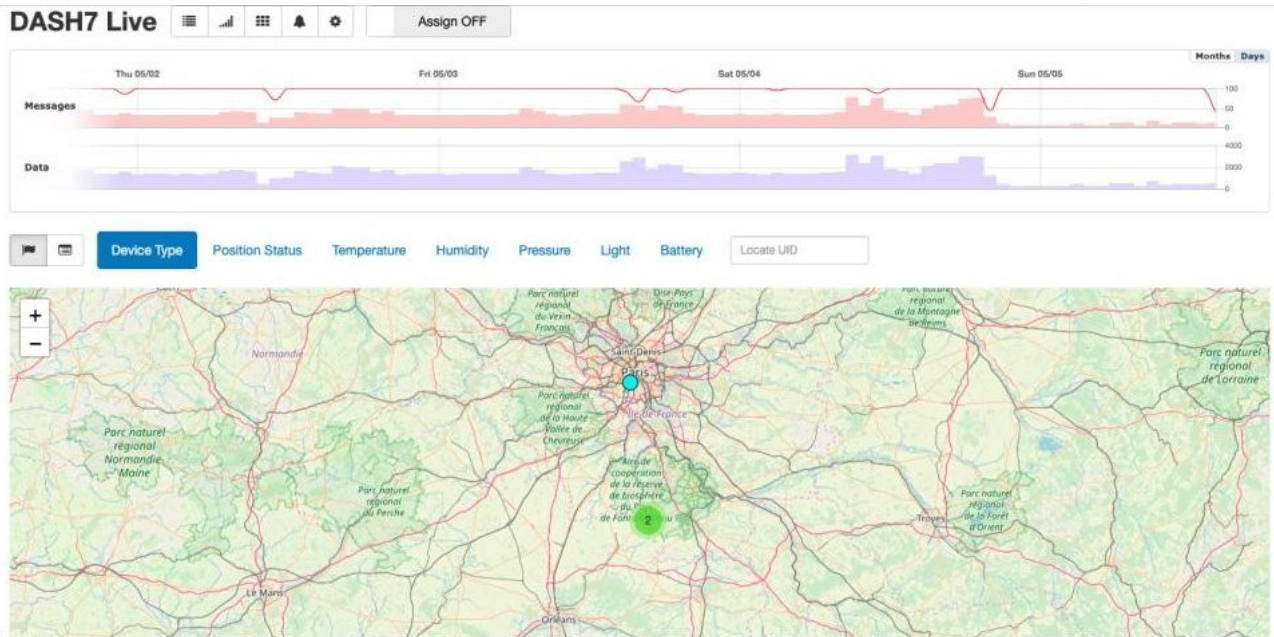
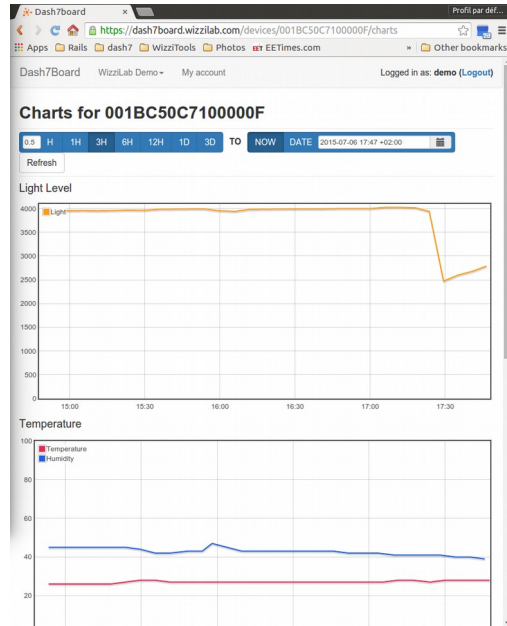
The WOLT can be used for efficient combined indoor-outdoor tracking due to the combination of long / mid / short range connectivity. It is also useful for identification due to its NFC & BTLE connectivity. The UWB ranging provides high localization accuracy up to 10 cm.



6.2 Ready to deploy

The WOLT 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 WOLT-D7A -UWB seamlessly connects to the WizziLab's DASH7 Industrial IoT platform.

For details visit our website : www.wizzilab.com/products



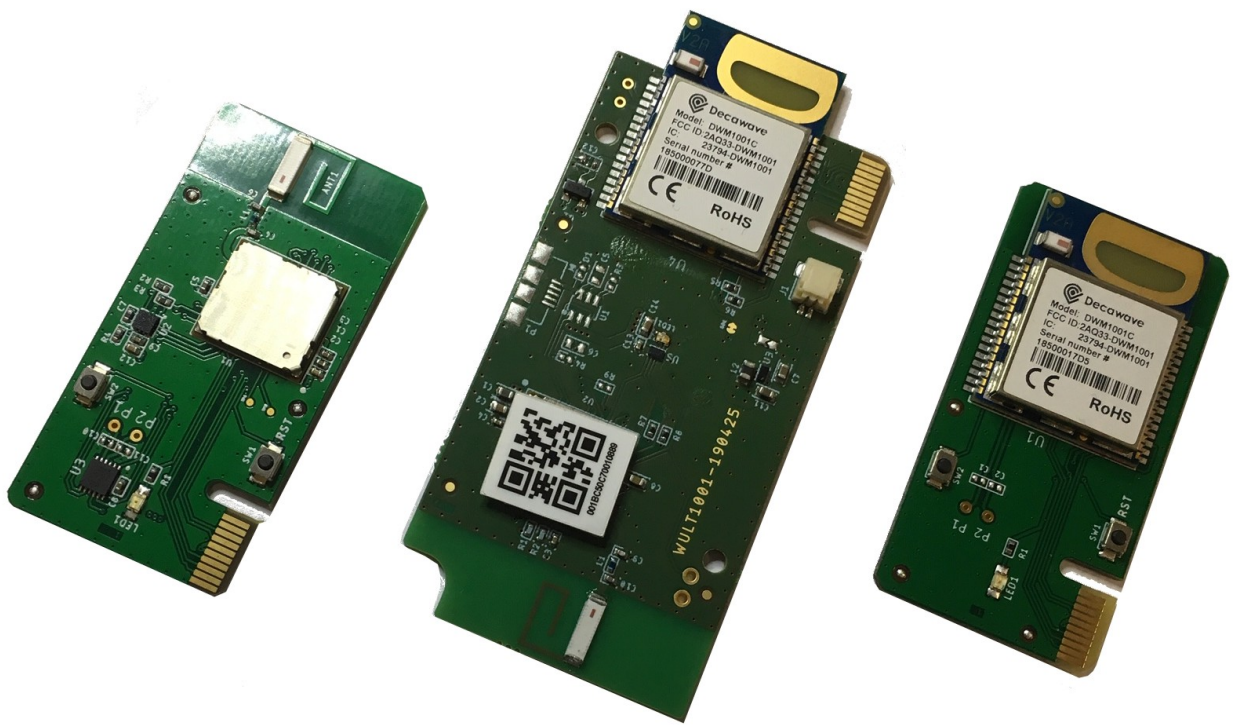
DASH7 Access Point (gateway) and Network Management Platform (<https://dash7board.wizzilab.com>)

6.3 Firmware

The WOLT is provided with highly configurable firmware, allowing to select 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 and BTLE beaconing are available as well.

7 The WOLT Family

The WOLT trackers family also includes an ultra wide band tracker, WOLT-UWB and a dual mode UWB/FSK/LORA tracker.



WOLT-D7A, Combined WOLT-D7A-UWB and WOLT-UWB tags

For details visit our website : www.wizzilab.com/products

8 Ordering information

Contact us at : contact@wizzilab.com

Or visit our website: <http://www.wizzilab.com/products>

9 Revision history

Table 11. Document revision history

Date	Revision	Changes
2019-09-12	1.0	Document creation.