



USPACE-KYD-2F
Professional Distancing Tag
FCC ID : 2ARZVUK

Features

- Low-latency low-power distance monitoring tag based on DASH7-UWB hybrid technology.
- FCC Certified.
- DASH7 stack, operating in the FCC 915 MHz ISM band under FCC 15.247. GFSK 55.6 / 167.7 kbps modulation schemes. Conducted power at antenna port +11.56 dBm.
- UWB two-way-ranging, operating @ 6.4 GHz (802.15.4a, channel 5).

- BLE & NFC passive tag. Tap-to-connect protocol and secured BLE connectivity
- Alerting through light, vibration and sound
- automatic sleep mode through motion detection (< 50 μ A current consumption)
- up to 100 hours of operation (2 working weeks)
- Operating temperature: -40 °C to 85 °C

Applications

- respect of minimal distance between humans (COVID-19 sanitary restrictions)
- contamination chain traceback
- proximity of dangerous objects
- entering restricted / special area
- presence detection
- indoor real-time localization

Description

- The Uspace-KYD-2F is a FCC certified professional distance alerting tag, especially designed to prevent risky situations (FCC ID: 2ARZVUK)
- WizziLab product line at www.wizzilab.com/products



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1 Hardware specification

1.1 Recommended operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter	Min.	Typ.	Max.	Units
T _{STG}	Storage temperature range	-40	25	90	°C
V _{CHR}	Charging voltage (USB port)	-	5.0		V
I _{CHR}	Charing current (USB port)	-	-	500	mA

Table 2. Recommended operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
T _A	Operating ambient temperature range	-40	25	85	°C

1.2 Power consumption

Table 3. Power consumption

Symbol	Parameter	Min.	Typ.	Max.	Units
I _{DLP}	Current in deepsleep mode	-	-	5	μA
I _{LP}	Current in sleep mode	-	50	-	μA
I _{ON}	Current in monitoring mode (*)	-	10	-	mA
I _{BAT}	Battery capacity	-	1100	-	mAh
V _{BAT}	Battery voltage	-	-	3.7	V
T _{ON}	Battery lifetime in monitoring mode (*)	-	100	-	h
T _{AUTO}	Battery lifetime in monitoring mode with autosleep option (8h activity per day)	-	2	-	week

(*) the consumption in monitoring mode depends on the monitoring parameters. Here are provided typical values for the default (factory) configuration

1.3 FCC Certifications

FCC

If deployed in areas regulated by FCC, the USPACE is provided with FCC certificate

FCC ID: **2ARZVUK**.

2 Functionality

2.1 General Purpose – Distance Monitoring

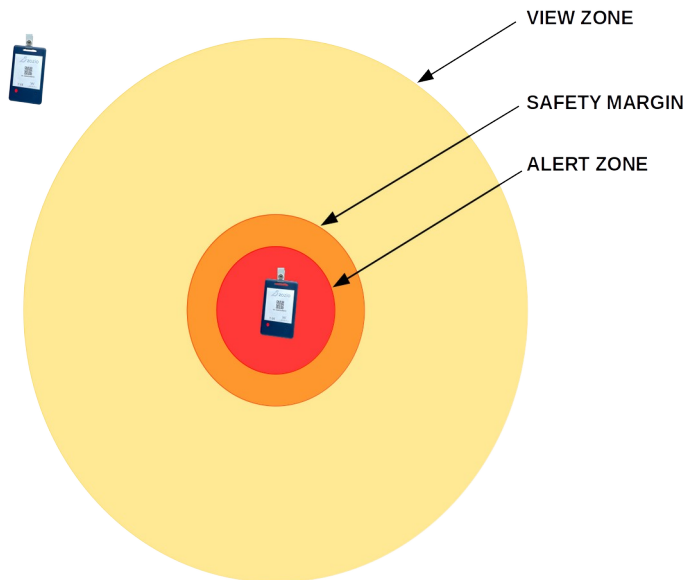
The Uspace-KYD is a professional distance alerting tag, especially designed to detect risky situations, such as human-to-human minimal distance transgression for Covid-19 sanitary protection, or dangerous objects proximity. In active (monitoring) mode, the tag scans for the presence of other tags using the DASH7 sub-GHz protocol (ISM 915 MHz) and makes distance measurements to each of the detected tags using UWB. The tag alerts in case of distance violation using the embedded human-machine-interfaces (HMI) - LED, buzzer, vibrator. When available, the tag can report its measurements to a DASH7 gateway, connected to the cloud, using the DASH7 protocol. In maintenance mode, the tag's BLE & NFC interfaces are enabled and the tag can be paired and accessed using tap-to-connect.

Persons typically wear the tag on the chest using a necklace. It can be attached to objects or walls to delimit risky areas.



2.2 Monitoring zones and events

Tags are out of the “view zone” if they are not mutually accessible over the DASH7 scan wireless link or when their relative distance, measured in terms of signal attenuation (link budget) exceeds a certain threshold (typically 80 dB). The view zone’s radius is thus typically roughly 10-20m.



When a tag is in the view zone of a distant tag, it first gets the distant tag custom “alert zone” and “safety margin”. The alert zone may differ from one object to another. For example the alert zone for Covid-19 distancing (object = human) is typically 2 meters. It can be set to 5 meters for a moving trolley, a freight elevator, a high voltage transformer or another industrial machine or tool. A safety margin (hysteresis) is provided in order to avoid toggling the alert / contact states. The safety margin is typically 20 cm, in accordance with the UWB measurement error.

When the tag enters the view zone of the distant tag, both generate a “Start Contact” event. The contact continues but alert is not triggered out of the alert zone (in particular it is not triggered in the safety margin zone).



When the tag enters the distant tag’s alert zone, both tags generate a “Start Alert” event and the alarm notification, composed of a LED blinking, buzzer and vibrator patterns, is played. The alert continues while the tag is in the alert zone or in the safety margin zone.



The alert stops when the tag exits the “alert + safety zone” and “End Alert” event is generated. The contact ends when the tag exits the “view zone” and an “End Contact” event is generated.



2.3 Contact Events Management

The tag has different contact events recording/reporting management modes :

- * **Stand-Alone** : Events are not recorded
- * **Stand-Alone with traceback** : Events are recording in internal flash and can be dumped through serial or BLE.
- * **Real-time monitoring** : Events are recorded in internal flash and reported over-the-air immediately to a Cloud service

All gathered contact information is anonymous. Indeed the contact/alert reports contain only information on the tags identifiers and event dates, and cannot be associated to places or persons, unless this is specifically (and manually) assigned by the system administrator.

2.4 Autosleep

The tag embeds a motion detector. When the device is motionless for a certain period, the tag stops monitoring and becomes inactive. Monitoring resumes when motion is detected. The autosleep can be disabled.

2.5 Default Configuration

By default (factory settings) tags are configured for human-to-human minimal distance monitoring for Covid-19 sanitary protection.

The view zone distance is set to 80 dB link budget on the scan wireless link

The alert zone is set to 2 meters

The safety margin is set to 20 cm

Autosleep is enabled, the motionless period is set to 10 minutes.

The tag functions in real-time monitoring mode - the contact events are recorded and reported over-the-air when a DASH7 connectivity is present (a DASH7 gateway is within wireless link range).

3 How to use

3.1 Just charge-and-play

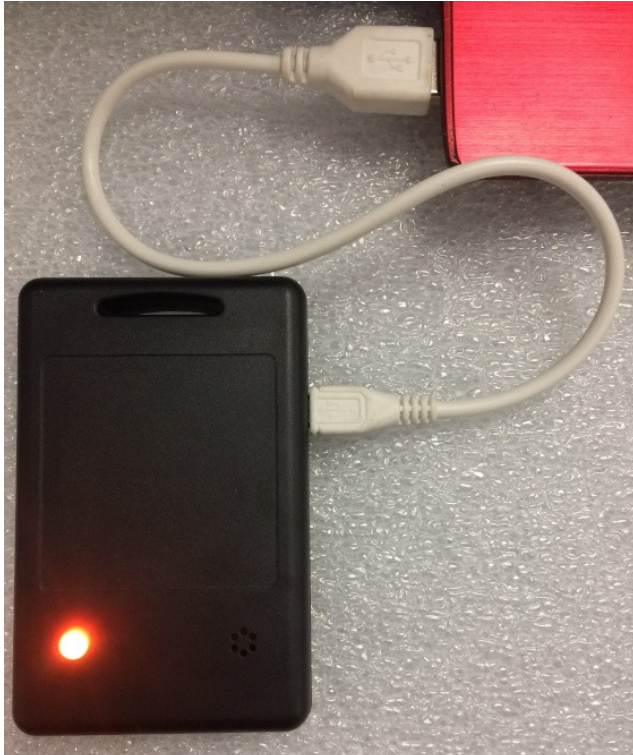
The tag is fully pre-configured and not requiring any initial setup through web or mobile application.

The tag is fully autonomous, its alerting functionality does not depend on the availability of any local or global network connection. In particular, even in real-time monitoring mode, the absence of DASH7 connectivity does not alter the alerting functionality. Reports history, when enabled, remains accessible in the tag's flash memory.

3.2 First enable

When produced and conditioned for shipping, the devices are set in ***deepsleep mode*** (aka shelf mode). They are completely inactive, do not scan nor measure distances, the BLE and NFC interfaces are disabled (no any intentional radio emissions).

In order to set the device to ***monitoring mode*** (aka tag mode), one should connect it to an electronic device's USB port or 5V DC power supply with USB connector using the provided USB adaptation cable. This will start charging the battery and set the device to charging mode (and exit shelf mode).



3.3 Charging

When the tag is connected to an electronic device's USB port or 5V DC power supply with USB connector, the tag enters **charging mode**, and the LED starts blinking in orange. The tag becomes inactive (no scanning). It remains accessible for configuration updates (see Advanced Configuration Section 4).



When the battery is fully charged, the LED will start blinking in green.



The device stays in charging mode while the charger is detected (even if the battery is fully charged).

When the charger is unplugged, the device switches back to **monitoring mode** and stops blinking.

3.4 Low Battery

When the battery is low, the LED makes a single orange blink on every battery measurement (default every minute). The device continues functioning in the current mode.

If critical low battery level is detected, the device degrades to ***deepsleep mode*** and can only be re-enabled by charging the battery above the critical low level.

If the battery level drops below the microcontroller's brown-out reset (BOR) level, the device shuts down. It can only be re-enabled by charging the battery above the critical low level.

Though the firmware provides maximum protection against power loss, in particular the power consumption drops to a few μA in deepsleep mode, it is highly recommended to avoid discharging the battery below the BOR level, as it may damage the battery.

Unplugging the battery is strictly prohibited, as it may corrupt the device FLASH memory or damage it beyond repair.

3.5 Sleep

When autosleep is enabled and the device is motionless for a certain period, the tag stops monitoring and switches to ***sleep mode***. It remains accessible for configuration updates. Monitoring resumes when motion is detected.

The device can be forced to sleep mode (aka maintenance mode) through the advanced configuration interfaces.

3.6 Monitoring

When the device is not in a low power mode (deepsleep, sleep) or charging mode, it is in monitoring mode. The tag scans and measures distances to other tag in its vicinity according to the description in 2.2. When an "Start Alert" event is detected, the tag starts blinking in RED, vibrates in pulses and plays a dual-tone buzzer.



Depending on the Contact Management option, described in 2.3, contact events and reported over-the-air to the cloud.

The alerting pattern stops when a End Alert event is detected or after a alerting timeout.

3.7 Tap-to-connect

A device, supporting the tap-to-connect protocol, can establish BLE connection with the tag. The procedure is initiated by an NFC access event that triggers the immediate exit from monitoring mode and disabling of all DASH7 (sub-GHz) and UWB interfaces. The tag start blinking in blue.



The tap-to connect is meant to be used as an alternative for configuration and report dumping.

4 Advanced Configuration

This section describes the Advanced Configuration Interface, accessible only to the system administrator over the dash7board Wizzilab's Cloud Service.

The configuration of USPACE can be done using 2 files:

- **APP_CONFIG** file allows to configure the behavior of the TAG itself
- **APP_SHARED_CONFIG** is exchanged with neighboring TAGs during the discovery process. It allows the other TAGs to know how to behave in presence of this TAG.

4.1 APP_CONFIG

The screenshot shows the 'APP CONFIG' interface with a 'Flush' button in the top right. The configuration is organized into several sections, each with a title, a value field, and 'Read' and 'Write' buttons.

- Mode:** A dropdown menu set to 'TAG'.
- Options:** A dropdown menu set to 'NONE'.
- Alarm mask:** A checkbox set to 'checked'.
- Keep Alive Period:** A text input field set to '86400'.
- Stable Assert Delay:** A text input field set to '600'.
- Motion Assert Threshold:** A dropdown menu set to '64mG'.
- Discovery period:** A text input field set to '1000'.
- LB threshold:** A text input field set to '90'.
- Contact time:** A text input field set to '0'.
- Expiration time:** A text input field set to '3000'.
- Save time:** A text input field set to '180'.
- Debug Trace Level:** A row of 16 checkboxes, with the first, fourth, and eighth checkboxes checked.

MODE:

- **SHELF** (aka **DEEPSLEEP**) Lowest Power Mode, can not be accessed remotely by DASH7
- **MAINTENANCE** (aka **SLEEP**) TAG is not active, can be accessed remotely by DASH7
- **TAG** (aka **MONITORING**) TAG is active

OPTIONS:

- **Active when Plugged:** When plugged a TAG is normally inactive. When checked, this option allows to keep the TAG active when plugged. For special usage like TAG signaling

the presence of Gateways, it is better to keep the TAG plugged all the time while remaining active.

- **Passive:** When checked this option prevents the TAG to actively discover the neighboring TAGs. It will still answer other TAGs discovery requests
- **AutoSleep:** When no motion is detected for “**Stable Assert Delay**” seconds, the TAG will go to sleep mode
- **Reporting Mode**
 - IMMEDIATE: Real time uplink
 - OPPORTUNISTIC: Upload in presence of an "Upload" TAG
 - LOG_ONLY: Logs saved in EEPROM, no reporting (readback not implemented)
 - NONE: No logs saved – Use for standalone mode

ALARM MASK: Masks applied in case of alarm

- No Buzzer: Disable Buzzer
- No Vibrator: Disable Vibrator
- No LED: Disable LED

Keep Alive Period: Maximum time between report in s

Stable Assert Delay: Time in s without motion to consider the TAG stable (and go to sleep when enabled)

Motion Assert Threshold: Accelerometer motion threshold

Discovery period: Interval in ms between discoveries. Do not go below 1000

LB threshold: Do NOT modify

Contact time: Minimal time in s of constant contact condition before triggering alarm. 0 to disable and have immediate alarm

Expiration time: Time in ms during which one measurement is considered valid. Do not modify

Save time: Time in seconds without interaction with the device before considering the contact terminated. Contact info is then stored in EEPROM when enabled

Debug Trace Level: Debug feature, Do not change

4.2 APP_SHARED_CONFIG

APP SHARED CONFIG

☐ Flush Enabled

Param 1 ⓘ

☒ Nat 2 ☐ Nat 11

Param 2 ⓘ

☐ Nat 0 ☐ ☒ ☐

PARAM1

Is distance: When checked, the metric used to “range” is a distance. When unchecked use Link Budget

Hysteresis: in dm for distances, dB for Link Budget. A Triggered alarm is released when distance greater the Distance+Hysteresis

Distance: in dm for distances, dB for link budget. Distance at which the alarm is triggered.

PARAM2

Alarm Pattern: Pattern to use on devices in alarm conditions with this device. A special alarm silent patten can be used for TAG indicating the presence of Gateways

Upload: Triggers “Upload to Gateway” on devices in alarm conditions with this device

Save: Contact information of this device must be saved in log on devices in alarm conditions with this device

Deactivate: Triggers “Go to Maintenance” on devices in alarm conditions with this device

5 Uplink Messages

This section describes the reporting formats, which are of interest only to the system administrator over the dash7board WizziLab's Cloud Service.

5.1 Status Report (FID 190)

The status message contains the main element of the configuration, the state and the battery voltage in mV.

Example:

```
{  
  "status_param_2"=>2, "status_param_2_fields"=>{"upload"=>0, "save"=>1,  
  "deactivate"=>0, "alarm_pattern"=>0},  
  "status_options"=>18, "status_options_fields"=>{"idx"=>2, "autosleep"=>1,  
  "passive"=>0}, "status_mode"=>1,  
  "status_state"=>5, "status_state_fields"=>{"stable"=>1, "plugged"=>0, "disco_off"=>1},  
  "status_vbat"=>4063  
}
```

5.2 Contact Report (FID 202)

The contact message always sends the current local timestamp in seconds

It is followed by up to 12 contact logs. Each contact log contains:

contact_uid: The UID of the contact

nb_contacts: The number of times the contact occurred (number of times the alarm was triggered)

timestamp_first_seen: The timestamp of the first alarm

seen_time: The duration between the first time the TAG is seen and the last time it has been seen

contact_time: The accumulated duration of the alarm situation

Example:

```
{  
  "report_ts"=>9607,  
  "contact_uid_0_"=>"001BC50C700220E7", "contact_since_0_"=>2107906,  
  "contact_since_0__fields"=>{"nb_contacts"=>2, "timestamp_first_seen"=>8234},  
  "seen_time_0_"=>612, "contact_time_0_"=>11,  
  "contact_uid_1_"=>"001BC50C70022169", "contact_since_1_"=>3695106,  
  "contact_since_1__fields"=>{"nb_contacts"=>2, "timestamp_first_seen"=>14434},  
  "seen_time_1_"=>133, "contact_time_1_"=>7,  
  "contact_uid_2_"=>"001BC50C70022231", "contact_since_2_"=>3730688,  
  "contact_since_2__fields"=>{"nb_contacts"=>0, "timestamp_first_seen"=>14573},  
  "seen_time_2_"=>170, "contact_time_2_"=>0  
}
```

6 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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

This device may not be employed for the operation onboard an aircraft, a ship or a satellite is

prohibited.

7 Revision history

Table 4. Document revision history

Date	Revision	Changes
2020-10-02	1.0	Document creation.
2020-11-24	1.1	FCC User Manual
2021-01-06	1.2	Integrates new pictures, HowTo section & feedback from certification house
2021-01-08	1.3	Integrate feedback from BACL from 2021-01-08