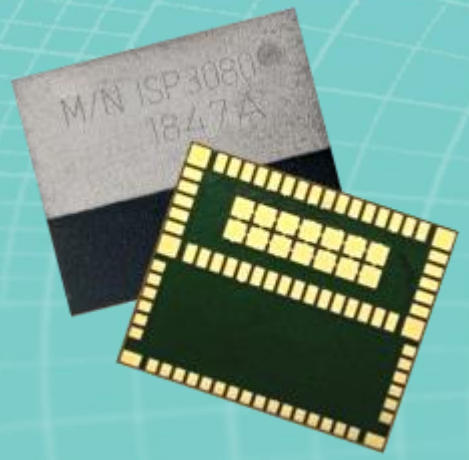
INSIGHT SIP



Ultra Wide Band Radio – Technology, Uses and Current “State of Play”

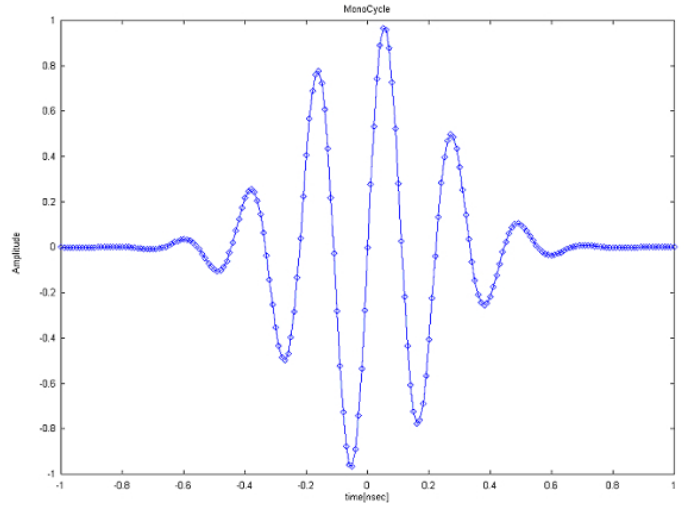
1.Ultra-Wide Band Technology

What is UWB ?

- A method of transmission, not a standard
- Not new – first used by Marconi in 1901!
- Transmits over a large bandwidth, allowing sharing with other users
    - More precise terms FCC/ITU-R Defn:

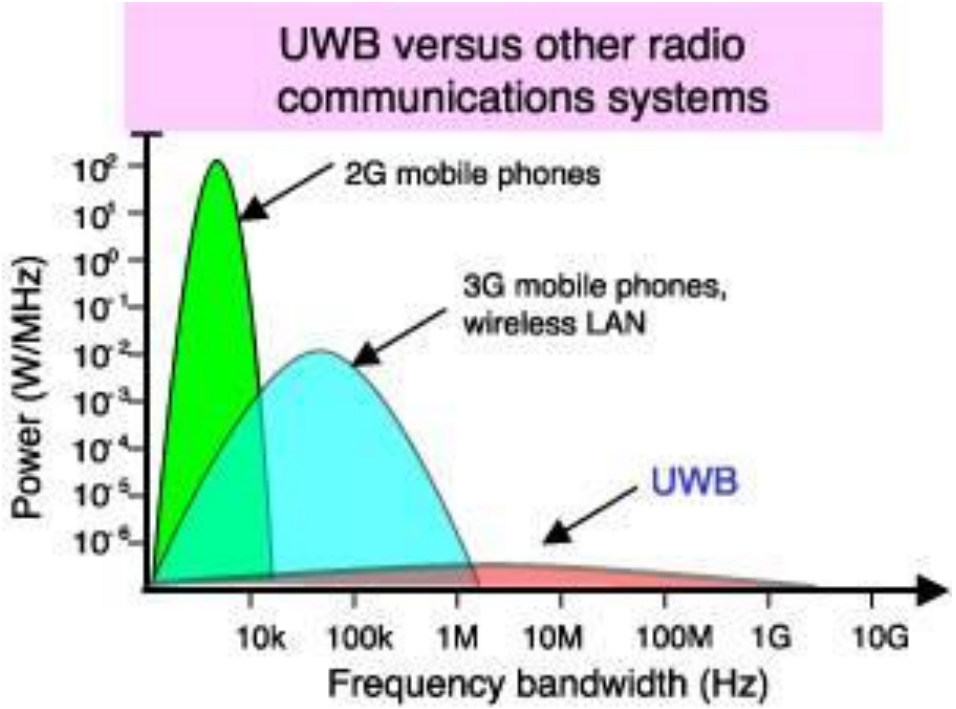
"transmission for which emitted signal bandwidth exceeds the lesser of 500 MHz or 20% of fractional bandwidth"

- Two main types - Pulsed and traditional carrier based methods



What is UWB ?

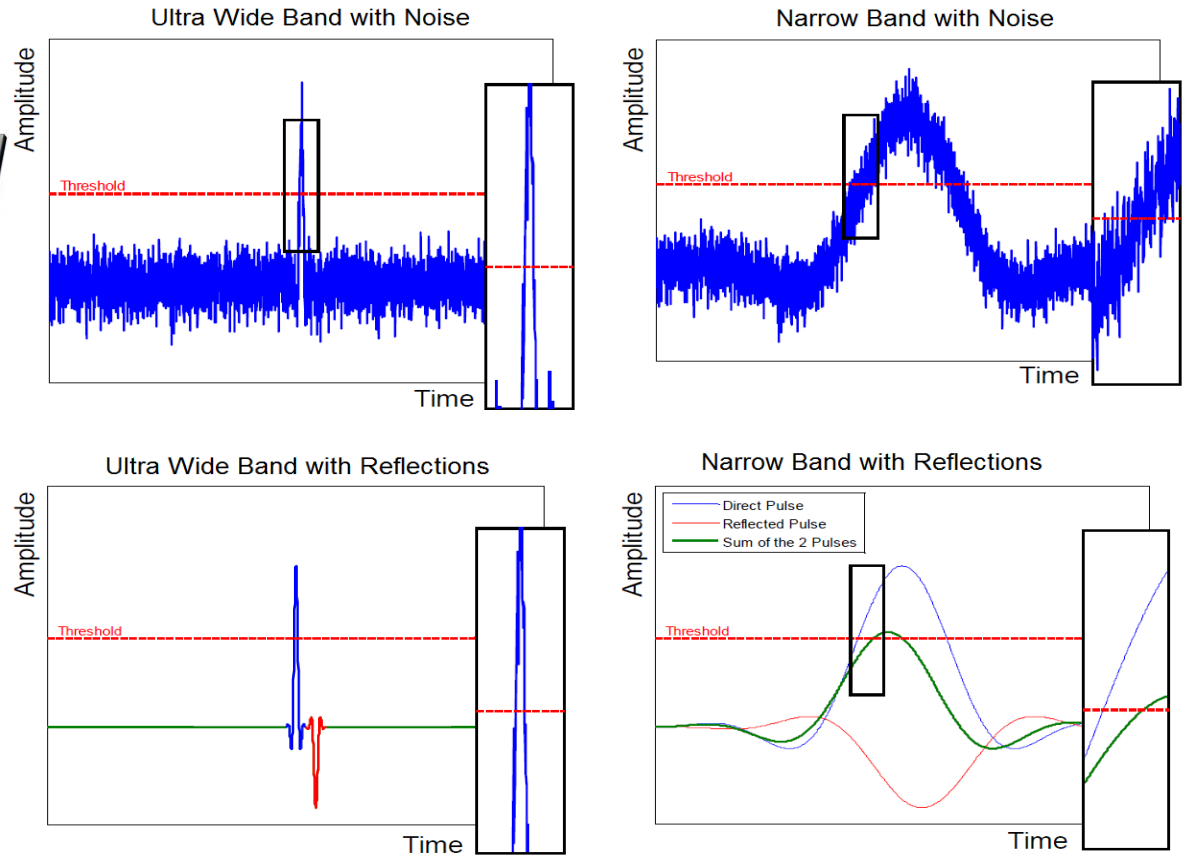
- Low Power transmission over wide bandwidth
- Allows co-existence with other transmission protocols
- Can be used for either
  1. High data rate transmission
  2. Very short, sharp-edged pulses (*remember your Fourier Transforms!)*
- Current interest is largely in second category



Technical Characteristics for timed pulse

- High temporal resolution above noise
- Clear separation of reflected signals
- Insensitivity to amplitude variations

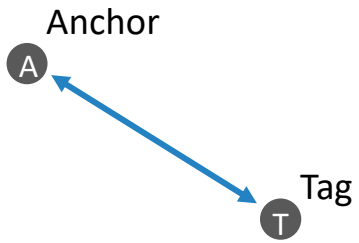
=> Precise environmentally insensitive timing pulse

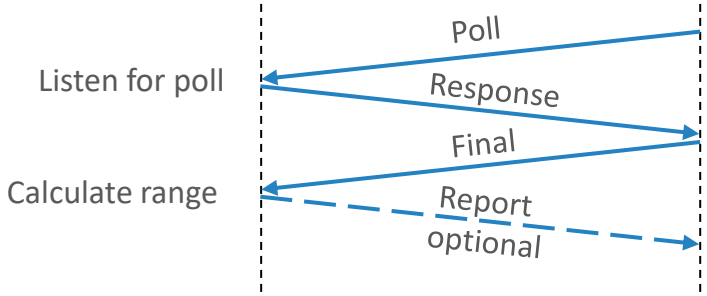


2. Positioning with UWB

Positioning methods with UWB

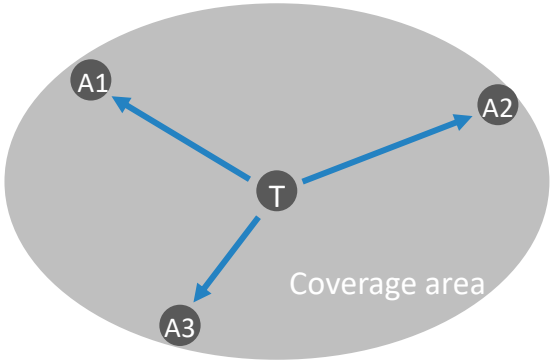
- 2-Way Ranging

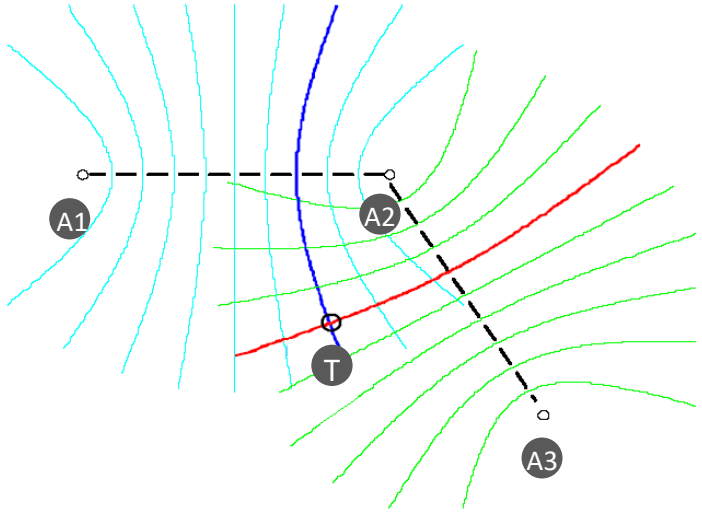




- Simple measurement of time of flight

- Time Difference of Arrival (TDOA)

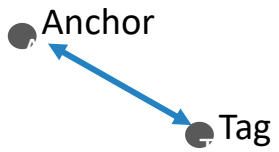




- Location determined by a multi-lateration algorithm
- Need to have Anchors precisely synchronized/ calibrated

2-way ranging vs. TDoA

2-Way Ranging



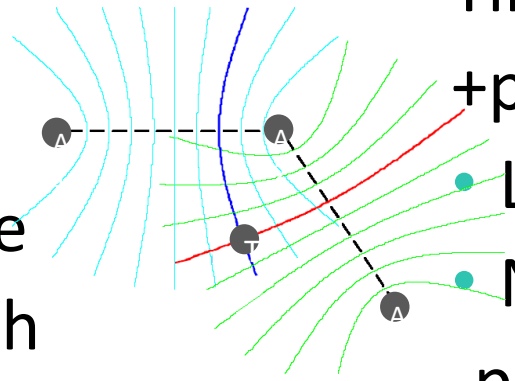
+points

- Simple, easy to set configure
- Can triangulate via TWR with many anchors

-points

- c. 10x exchanges, collision risk
- Much higher power consumption
- Need to identify all Anchors

Time Difference of Arrival (TDOA)



+points

- Low power Tag via simple “blink”
- No need to pre-identify Anchors

-points

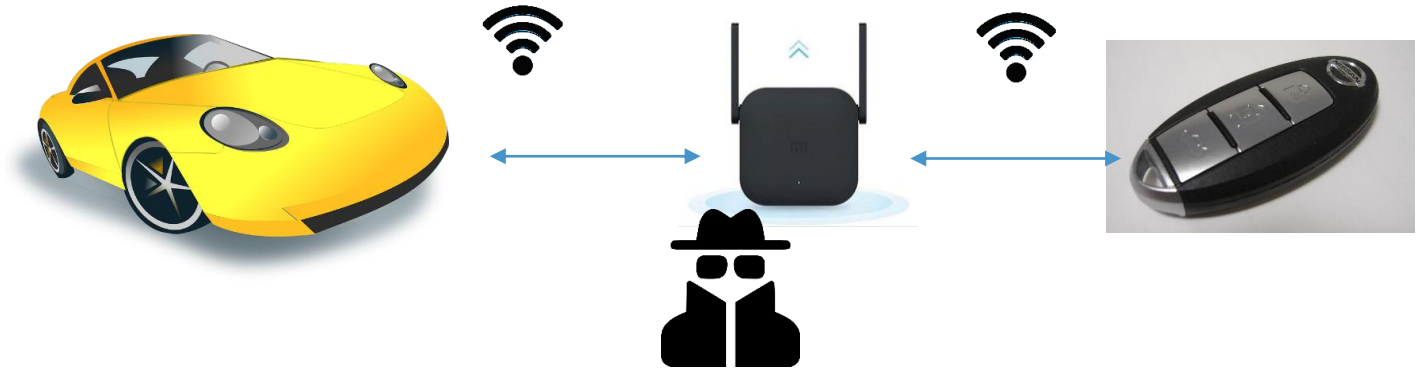
- Complex system required to re-assemble/process received signals
- Anchor calibration to picosecond accuracy required, continuous process required

Standardization in UWB

- Until recently a barrier to market adoption
- 802.15.4 defined certain PHY level characteristics, but fragmented implantation – no interoperability
- Till 2018, only Proprietary Solutions
- 802.15.4z (2018) defined common PHY and MAC for interoperable ranging
- FiRa Consortium defines Profiles sitting on these layers
- Car Connectivity Consortium details further digital key specifications

UWB Secure Entry

Traditional Keyless entry via RSSI

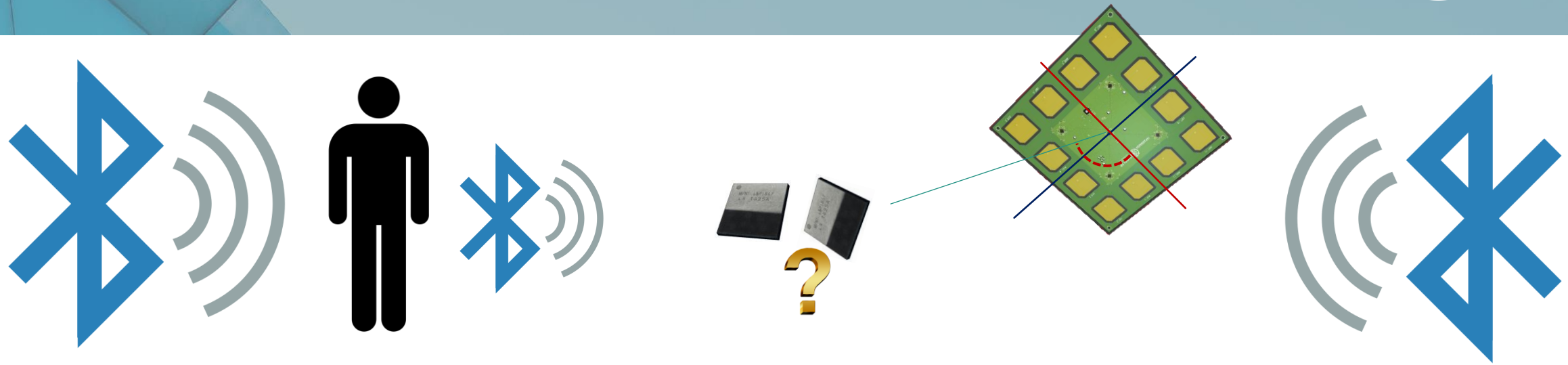


- RSSI based solution vulnerable to “relay attack”
- Signal boost simulates proximity
- Bypasses crypto exchange

2-Way Ranging

- ToF solution much more secure
- Adding distance adds time – Detected !

Bluetooth Beacon/AoA – UWB Comparison



- Bluetooth Beacon/RSSI solution sensitive to
  - Obstructions and reflections
  - Calibration of transmitters
  - Orientation of receiver
- AoA highly sensitive to reflections (Phase-based solution)
- Both have accuracy degrade rapidly with distance

3.Ultra-Wide Band - Use Cases and Practical Issues

UWB on the phone

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Smartphones [edit]

Brand	Device name	Platform	Release date	Availability	UWB Controller
Apple	iPhone 11	iOS	September 2019	all models	Apple U1
	iPhone 12		October 2020	all models	Apple U1
	iPhone 13		September 2021	all models	Apple U1
	iPhone 14		September/October 2022	all models	Apple U1
Google	Pixel 6	Android	October 2021	Pro model only[3]	Qorvo DW3720[4]
	Pixel 7		October 2022	Pro model only[5]	
Samsung	Galaxy Note20		August 2020	Ultra model only[6]	NXP SR100T
	Galaxy S21		January 2021	Plus (+) and Ultra models only[7]	NXP SR100T
	Galaxy S22		February 2022	Plus (+) and Ultra models only[8]	
	Galaxy S23		February 2023	Plus (+) and Ultra models only	
	Galaxy Z Fold2		September 2020		NXP SR100T
	Galaxy Z Fold3		August 2021		NXP SR100T
	Galaxy Z Fold4		August 2022		
Xiaomi	MIX4		September 2021		NXP SR100T

Smartwatches [edit]

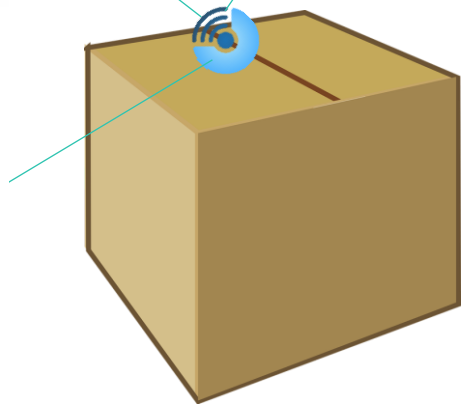
Brand	Device name	Platform	Release date	Availability	UWB Controller
Apple	Watch Series 6	watchOS	September 2020		Apple U1
	Watch Series 7		October 2021		
	Watch Series 8		September 2022		
	Watch Ultra		September 2022		

- UWB appearing in top end phones
- Used in Apple “Air Tag”
- Phone as “Digital Key”
- Phone as “tracking tag”
- Possibilities for accessories
- Will become standard feature???

ISP

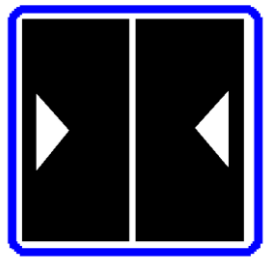
UWB Applications

- Digital Key / Secure Entry
- Asset Tracking
- People Tracking
- Keep out Geofencing – dangerous zones
- Keep in Geofencing – “Don’t steal my stuff!!”
- “Find me” Tag
- Digital ticketing

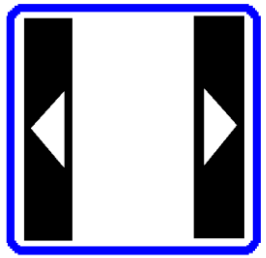


Combining UWB and BLE for long life Coin cell powered Tags

UWB power hungry with radio on (c. 50mA)



- Detect approximate distance via BLE Advertising
- When apparently close, switch on UWB, start two way ranging



- Open door when secure distance measurement

Combining UWB and BLE for long life Coin cell powered Tags

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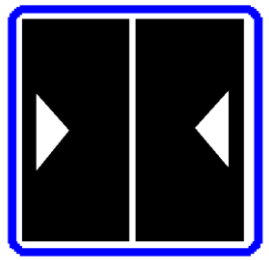

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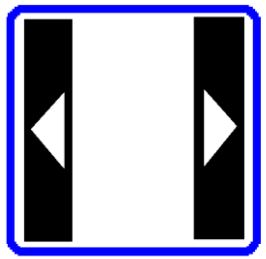
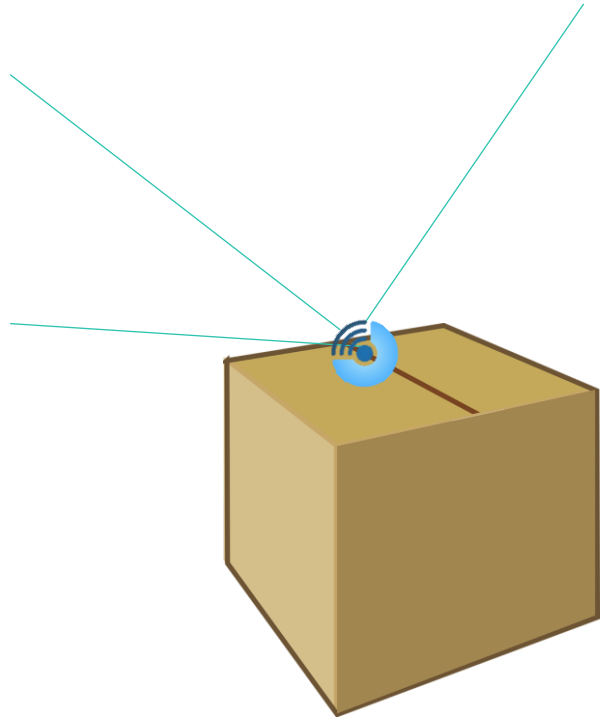


- Open door when secure distance measurement allows

UWB/BLE Warehouse example

- Default state – UWB off, BLE advertising at slow rate
- Find package, connect via BLE, send activate UWB Blink command
- Detect location
- Switch off UWB
- Return to default state



ISP3080 UWB / BLE DUAL RADIO WITH INTEGRATED ANTENNA

With integrated BLE and dual Band (5 and 9) UWB antennas offering global coverage with a single device

Based on Qorvo DW3000 and Nordic nRF52833

PART NUMBER	ISP3080-UX
Main protocol	UWB
BT Features	Bluetooth LE 5.1
Other protocol	BT Mesh – Thread – Zigbee
UWB Tx Power	- 41,3 dBm / MHz
BT Tx Power	+ 8 dBm
UWB Chip	QM33110
BLE Chip	nRF52833
Processor	Cortex M4F
Flash	512 kB
RAM	128 kB
GPIOs (ADCs)	23 (4)
Interfaces	(High Speed) SPI, TWI, UART, PWM, PDM
NFC tag	Yes
Temperature	85°C
Dimensions	10 mm x 12 mm x 1 mm

- UWB positioning “Tag” with no external components
- Real Time Location Systems
- Wireless Geofencing
- Security access control
- Indoor positioning
- FiRa Compatible – works with suitable Mobile Phones

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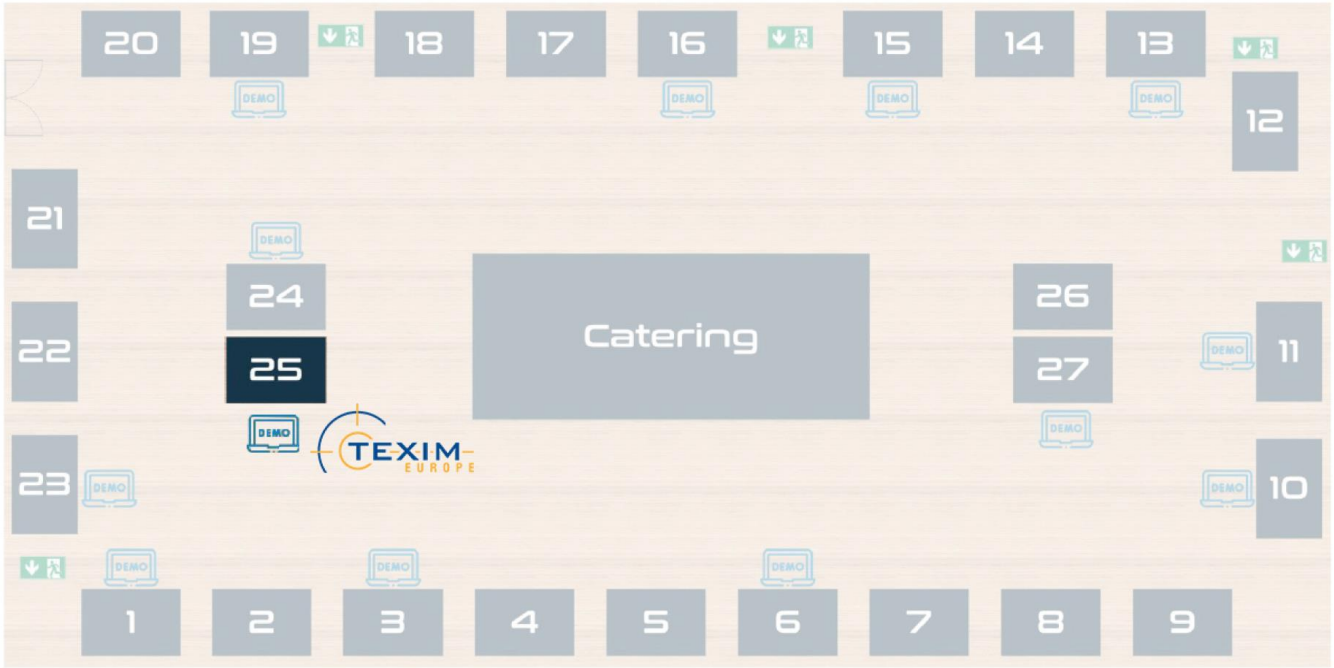
Texim Europe table top location



THANK YOU

sales@insightsip.com

FOR MORE INFORMATION