PARTNER WEBINAR

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NORDICTECH WEBINARS

Integrating Bluetooth Direction Finding with u-blox

Today's speakers

Petter Myhre

Product Marketing Director

NORDIC SEMICONDUCTOR

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Product Manager, Product Strategy Short Range Radio

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Product Manager, Product Strategy Short Range Radio

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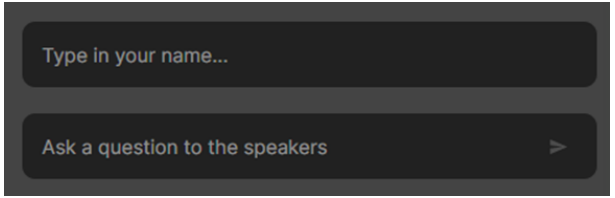
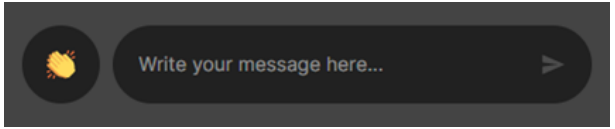
Practicalities

- Duration: ~ 45 min presentation, 15 min Q&A
- Questions are encouraged!
- Please type questions at the top of the right sidebar
  - All questions are anonymous
  - Try to keep them relevant to the topic
  - We will answer questions toward the end
- Please don't use the chat for questions
- If you have more questions:
  - Go to DevZone for Nordic related questions
  - Go to the u-blox support portal for u-blox related questions
- A recording of the webinar will be available together with the presentation at webinars.nordicsemi.com





{ DevZone

Integrating Bluetooth® Direction Finding with u-blox

December 12, 2022

u-blox, a Nordic Solution Partner

Outline

Bluetooth for high precision indoor positioning

- u-blox introduction
- Bluetooth direction finding
- Use cases
- u-blox offering
- Demonstrations
- How to get started
- Questions & Answers

u-blox introduction

u-blox at a glance

294.4m
Revenue in H1 2022
in CHF

3
Core markets


1997
Founded as a spin-off from
ETH Zurich

17.9 %
of revenue invested into
R&D

14500+
Customers
served world-wide

1200+
Employees
66% in R&D

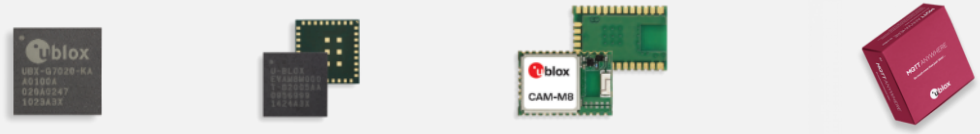
2007
IPO and listed
SIX:UBXN

12.5%
Growth (CAGR)
2007...2021

We provide a comprehensive “one-stop-shop” solution

Wireless and location made easy

u-blox solutions comprised of chipsets, modules and data services



Services

To enhance and complement location, connectivity, and security

Positioning

To locate the source of information

Cellular connectivity

To connect over a wide area

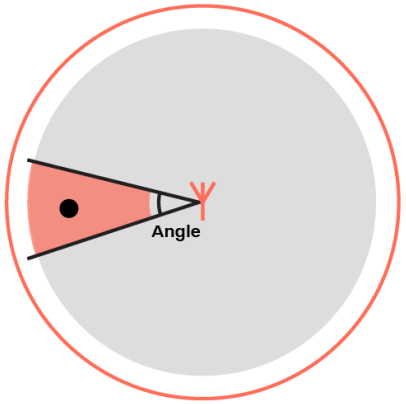
Short range connectivity

To connect over short distances


Bluetooth Direction Finding

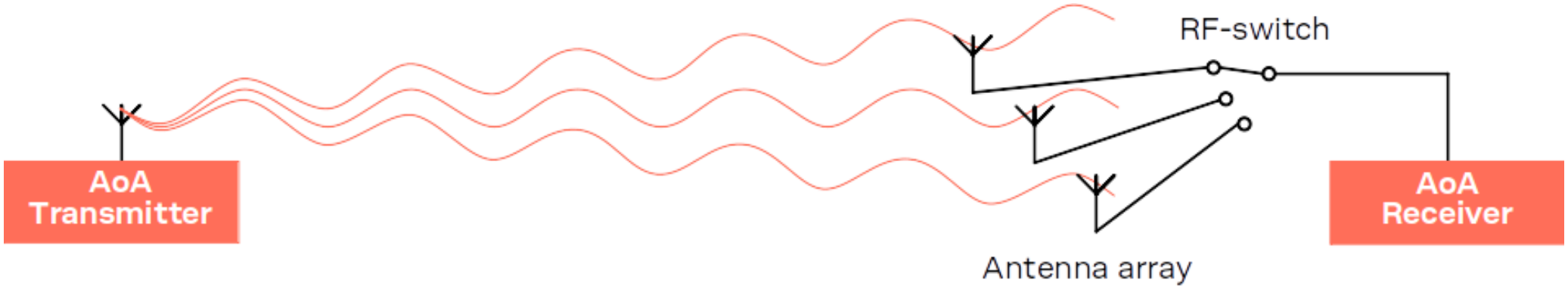
Bluetooth 5.1 Direction Finding

- Main feature with Bluetooth 5.1 is Direction Finding
- Two methods for determining the direction:
  - **Angle-of-Arrival (AoA)** calculates the angle of a received signal
  - **Angle-of-Departure (AoD)** calculates the angle of a transmitted signal
- Enables new use cases like high accuracy indoor positioning
- For details about Direction Finding technology, please watch Nordic's webinar from December 7, 2022



NORDICTECH WEBINARS

Angle of arrival architecture



- AoA transmitter (single antenna) sends continuous wave to the receiver
- AoA signal arrives at the switched antenna elements with different phase shifts depending on the angle
- AoA receiver samples IQ data of the continuous wave

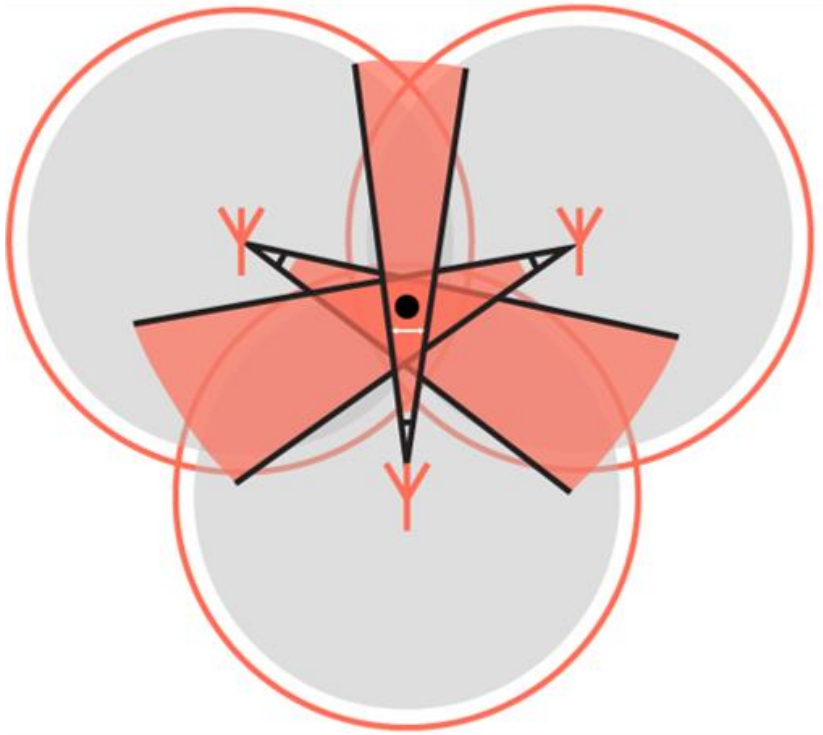
"I" - the "in-phase" signal
"Q" - the phase shifted signal

Bluetooth indoor positioning with AoA

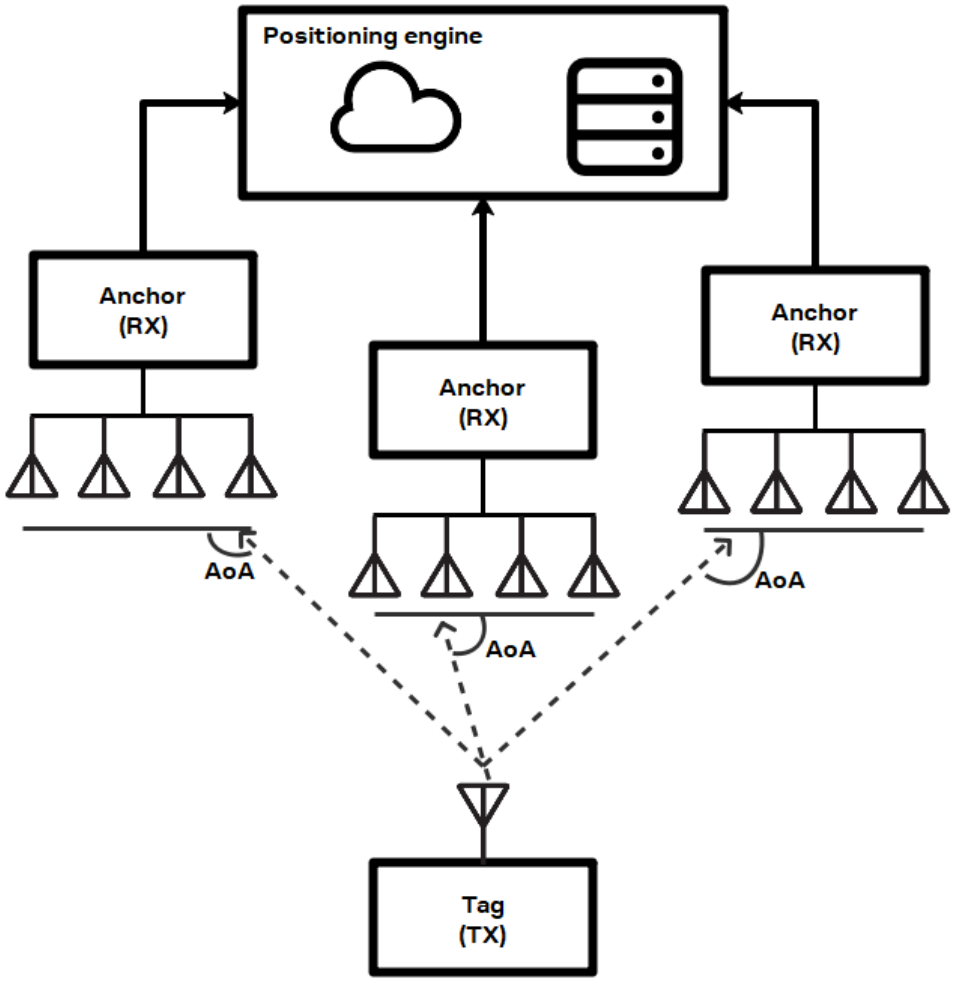
High accuracy positioning

- Having the direction to the transmitter from several reference points enables triangulation of its position

- Using Bluetooth AoA, sub 1 m positioning accuracy is possible



Positioning with Angle-of-Arrival, AoA



- Tag transmits advertisement messages
- Anchor points receive the messages and calculate the angle of the incoming signal
- Positioning engine combines angle data from many anchors and determines the position

- Readings from **one** anchor point
  → Angle
- Readings from **multiple** anchor points
  → Position

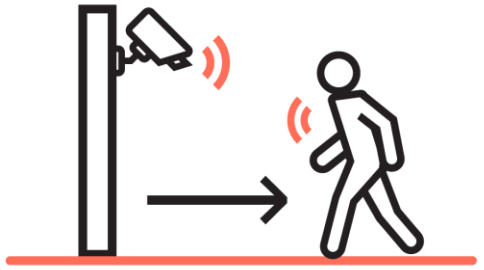
Use cases

Bluetooth AoA Use Cases

Direction Finding

Follow-me

- Device to follow a person / object based on angle to person / object



Access Control

- Detection of how object/person is moving in front of a gate or door

Collision detection

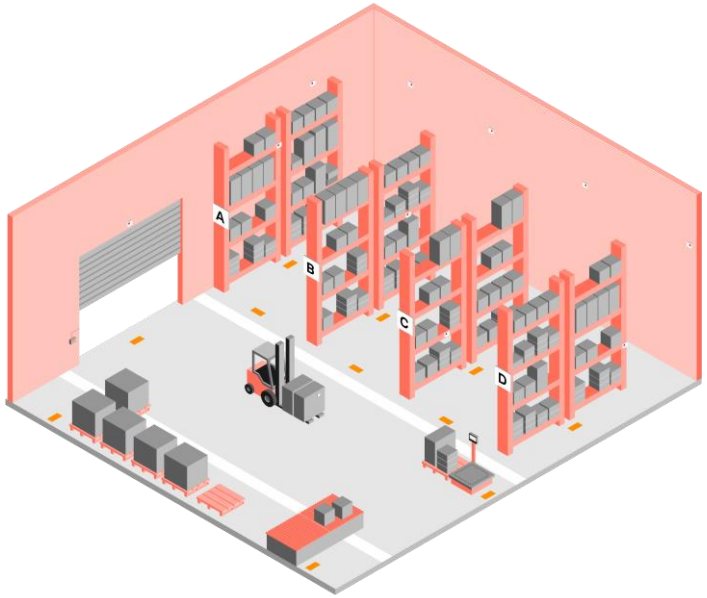
- Moving objects detecting angle and distance to each other in real-time

Bluetooth AoA Use Cases

Indoor positioning

Asset tracking

- Find & track an asset
- Accurate inventory
- Process optimization



People tracking

- Locate a person
- Safety worker / Emergency situations
- People flow
- Personalization

Asset tracking

Applicable in different market segments

- Hospital
  - Tracking of medical equipment, doctors and nurses
- Factory
  - Tracking of forklifts, goods, robots and tools
- Retail
  - Location based advertising
- Warehouse
  - Accurate inventory at all times

u-blox Bluetooth AoA products

NINA-B4

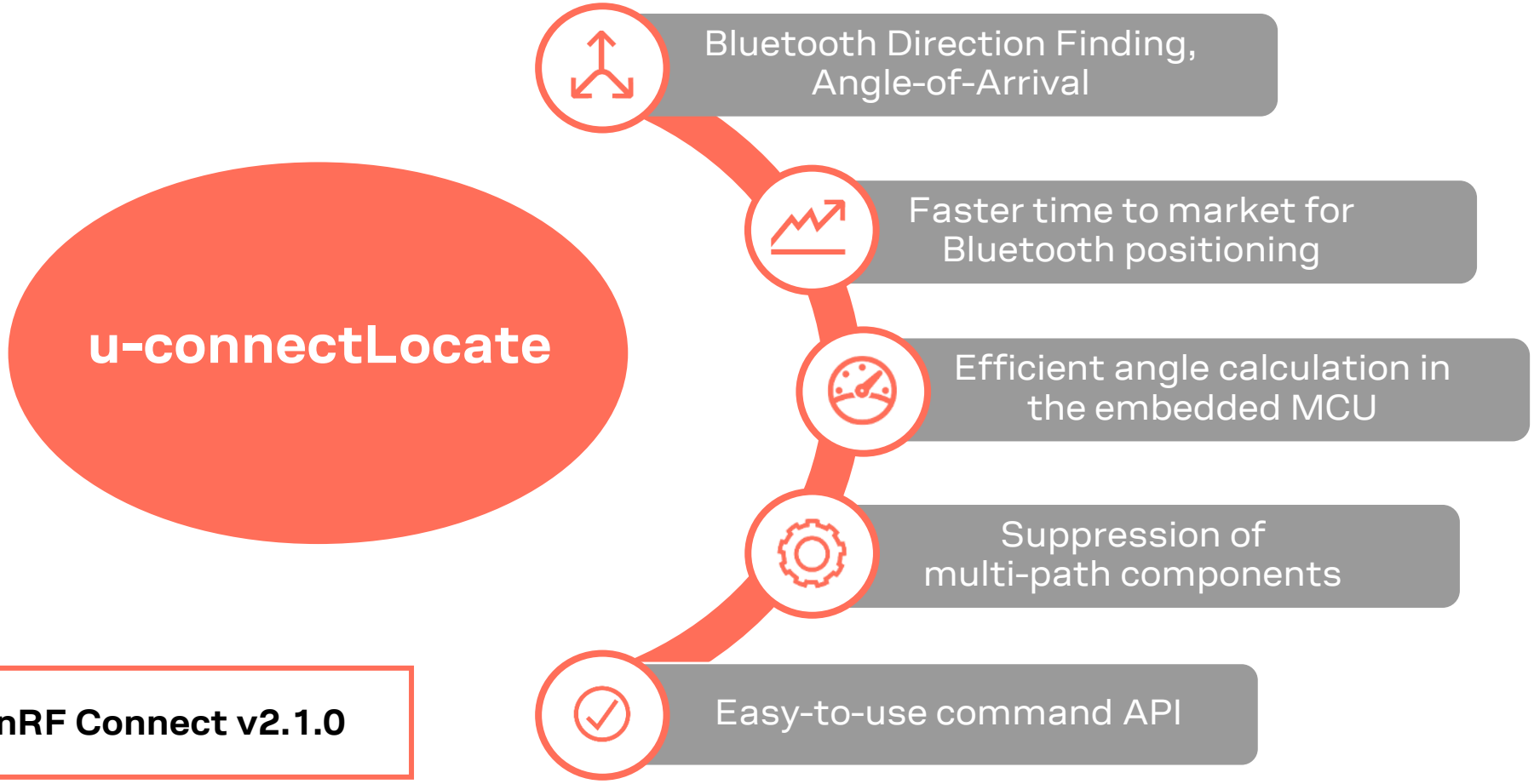
Designed for Bluetooth direction finding

- Bluetooth 5.1 module
- Based on Nordic Semiconductor nRF52833 SoC
- Internal or external antenna options
- Open CPU or u-connect software
- Global certification

- NINA-B411 variant
  - Optimized for Bluetooth direction finding
  - Antenna pin connecting to the antennas for best performance
  - Embedded angle calculation algorithm with u-connectLocate software

u-connectLocate: The essential piece

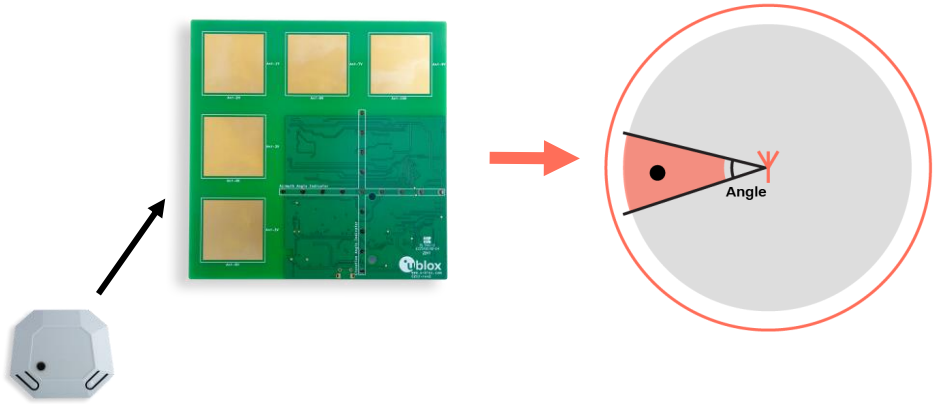
Embedded software for high precision positioning – by u-blox only

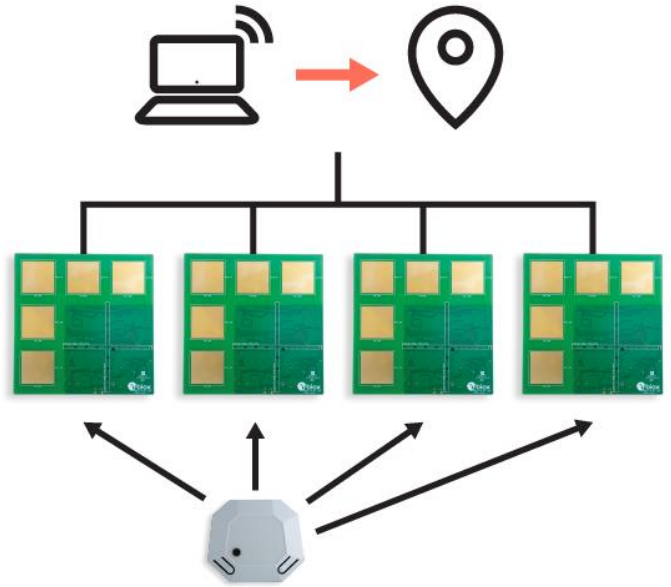


Built on nRF Connect v2.1.0

Two explorer kits available

Bluetooth Direction Finding and Indoor Positioning





XPLR-AOA-1 – Angle out-of-the box

- Evaluation of Bluetooth Direction Finding, AoA
- Antenna board and tag
- u-connectLocate Direction Finding software
- Tag software example

XPLR-AOA-2 – An indoor positioning system

- Evaluation of Bluetooth Indoor Positioning
- Four antenna boards and tags
- u-connectLocate Direction Finding software
- Tag example software
- High resolution positioning engine software
- Traxmate asset tracking platform trial license

What is Traxmate?

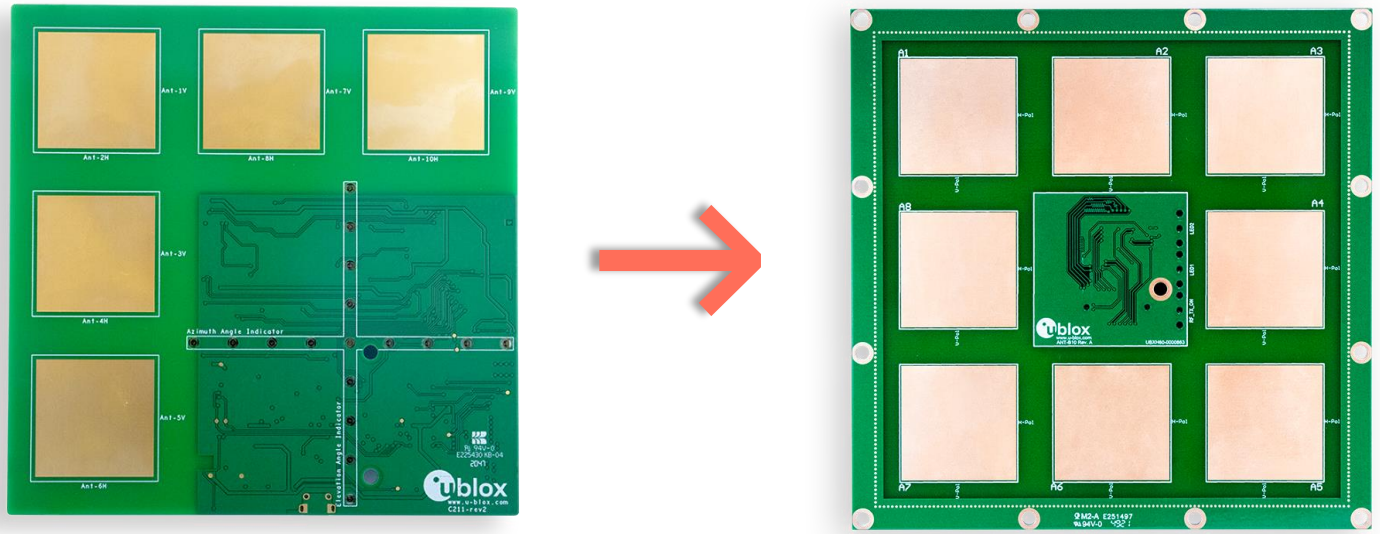
Traxmate is a complete enterprise asset tracking platform

It is a cloud-based tracking system that makes it easy to set up the tracking environment and to perform real-time tracking

In Traxmate you create buildings, upload floors plans and manage placements and settings for Wi-Fi and BLE anchor points.

From evaluation to commercial products

...and XPLR-AOA-1 to XPLR-AOA-3



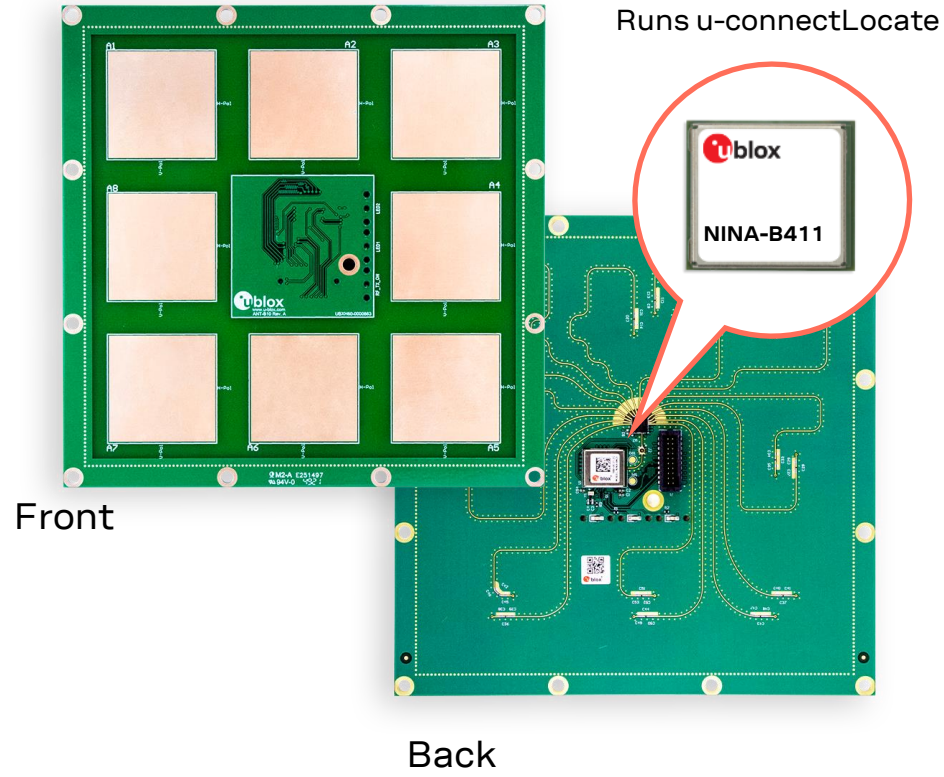
- More antenna elements for improved performance – same PCB footprint
- Single RF switch – Lower losses, better performance
- Optimized design for high volume production

The u-blox ANT-B10 antenna board

Bringing the u-blox indoor positioning expertise to the industrial market

The **ANT-B10** antenna board enables you to:

- **Build** and **implement** **indoor positioning systems**
- Reach **optimal performance** delivered by:
  - u-connectLocate algorithms
  - Eight antenna elements
  - Single RF switch for lower losses
- **Easily** transition from proof of concept to **mass production**
  - The logical next steps from the u-blox XPLR-AOA kits



The XPLR-AOA-3 kit

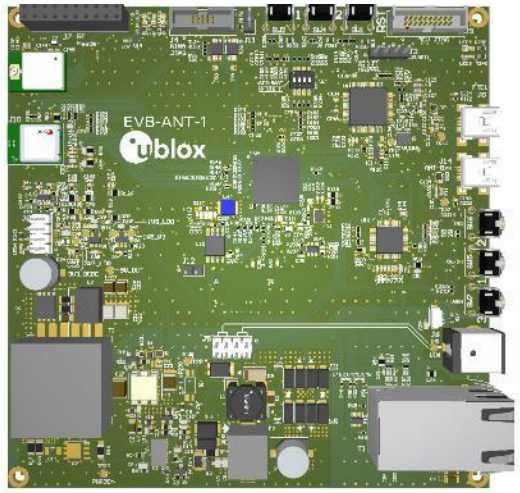
ANT-B10 + EVB-ANT-1 application board

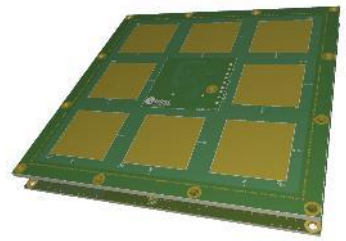
EVALUATE

- A support product, including the EVB-ANT-1 application board, for **evaluating** and **testing** of the ANT-B10 board as well as the u-blox direction-finding algorithm.

GO

- The ANT-B10 antenna and EVB-ANT-1 application boards together make up a simple reference design – Plug the two boards together and **get an anchor point within seconds.**





Kit includes Bluetooth 5.1 tag

EVB-ANT-1 application board

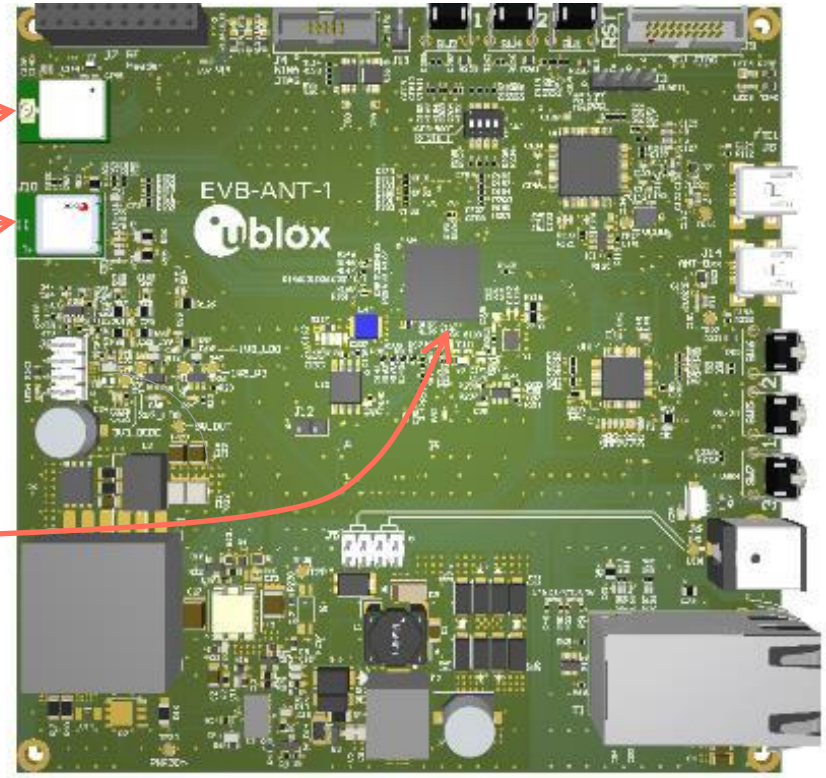
3-D view bottom

Pin header (reverse side):
SPI
UART
SW switches
Reset
3.3V
5.5V
GPIO's
USB

NINA-B411 Bluetooth module

u-blox Wi-Fi module

MCU (NXP RT1061)



Switches

USB connectors

DC jack

RJ-45 connector and Power-over-Ethernet

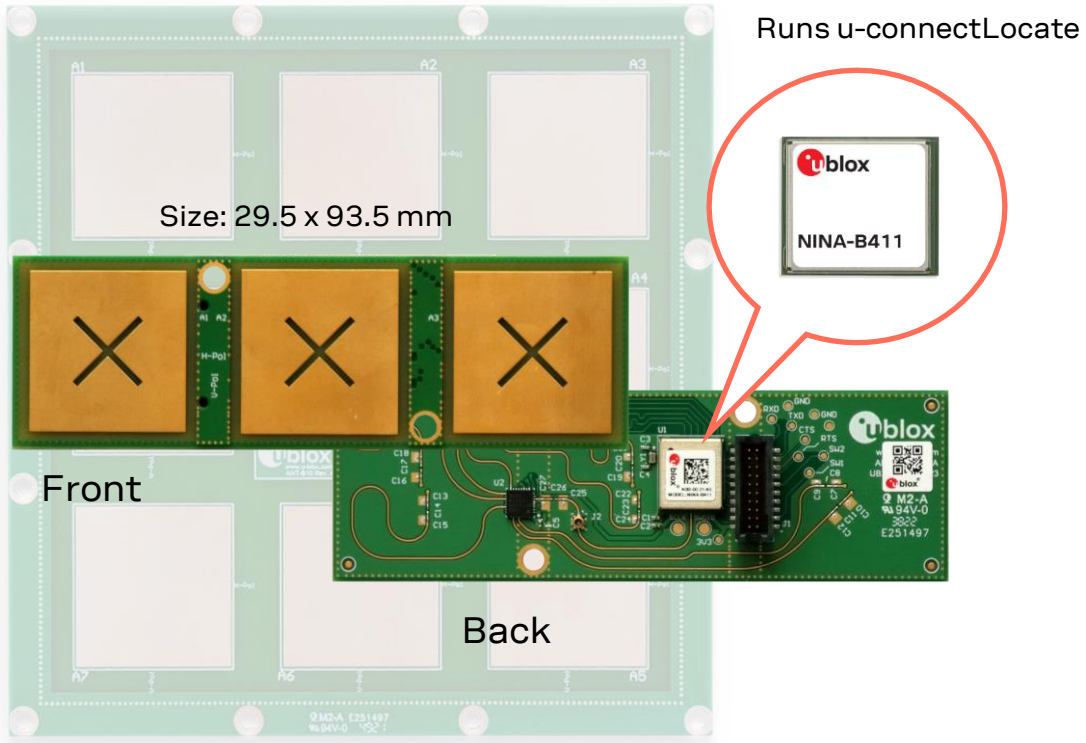
The u-blox ANT-B11 antenna board

2-D positioning with small PCB

ANT-B11 is a **compact** antenna board for **2-D indoor positioning**

- Based on its orientation, ANT-B11 calculates and outputs the final **Azimuth** or **Elevation** angle

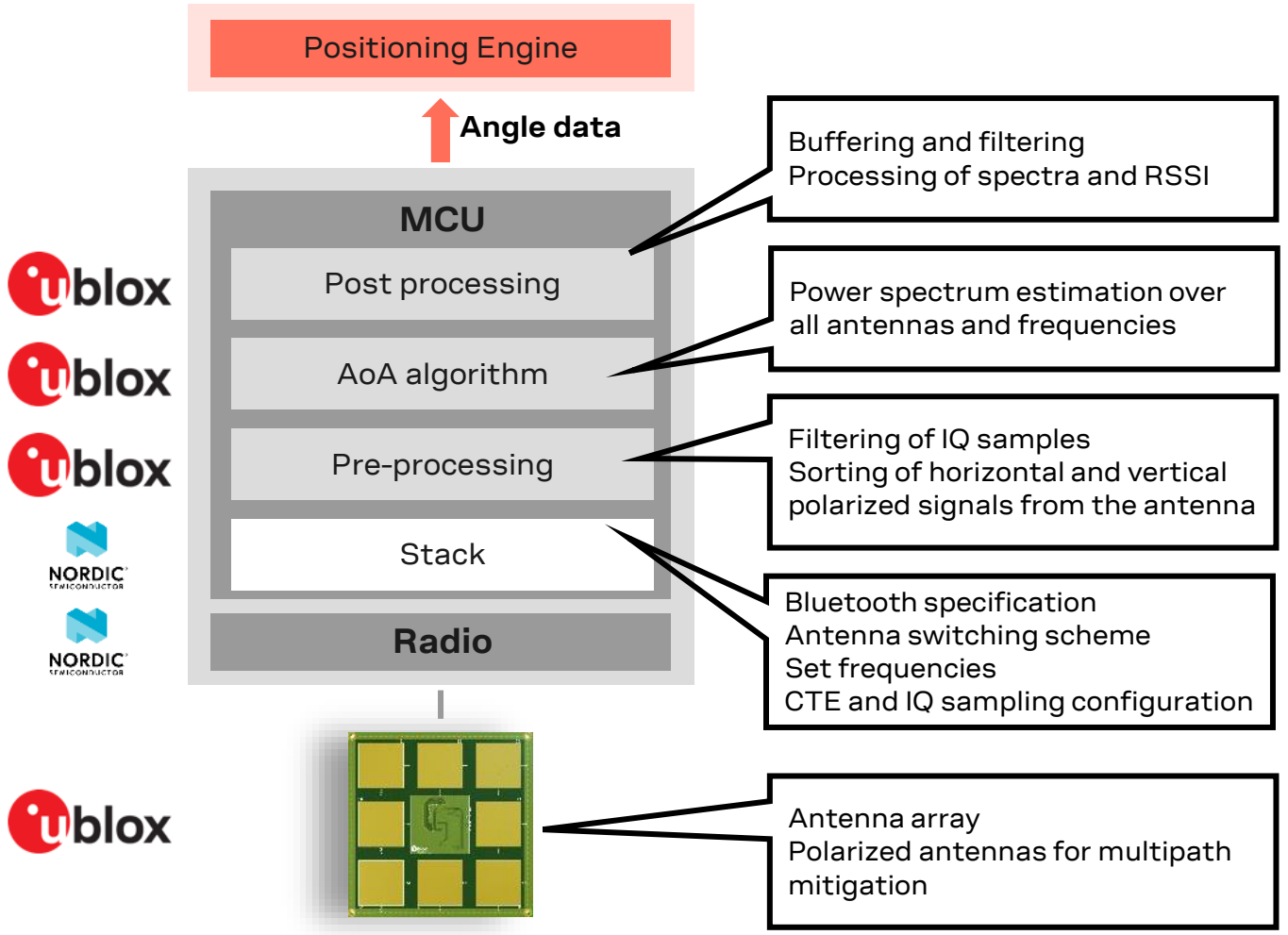
- **Small size – same technology**
  - Ideal for small enclosures and applications where 3-D positioning is not necessary
  - Runs u-connectLocate software
    - **all features supported**
  - Compatible with XPLR-AOA-3
    - **same off-the-shelf pin header**



Bluetooth Angle-of-Arrival

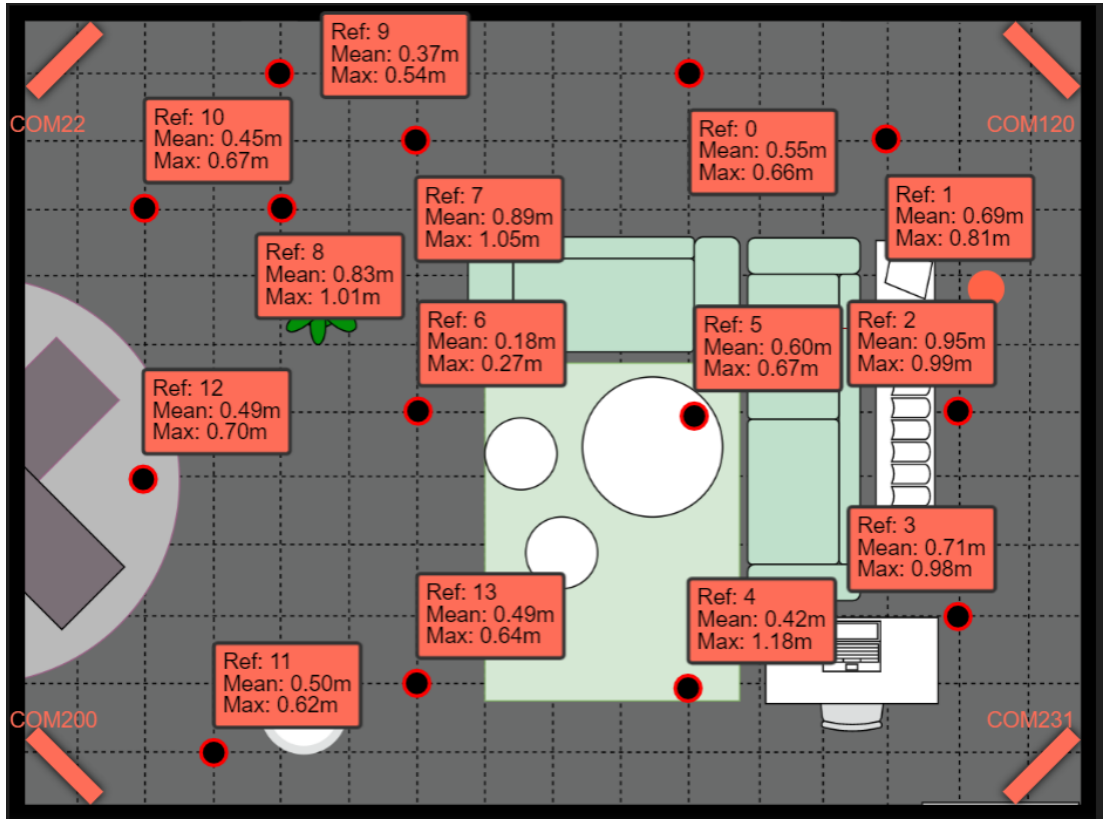
More than the Bluetooth LE stack

- The Bluetooth specification for AoA specifies the lower physical layer
- To generate angle data, processing and calculation on-top of the stack is required
- u-connectLocate software outputs the angle data
- Optimized algorithm for execution in Nordic nRF52833 SoC

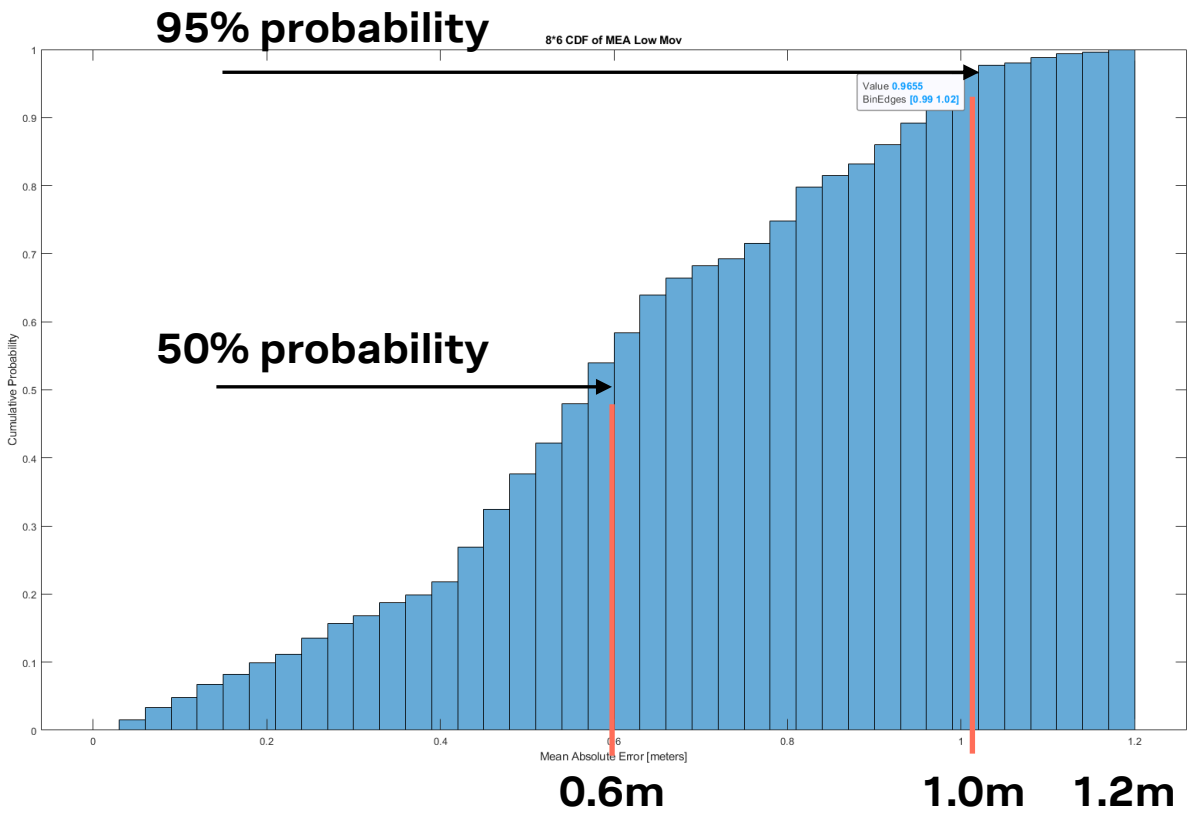


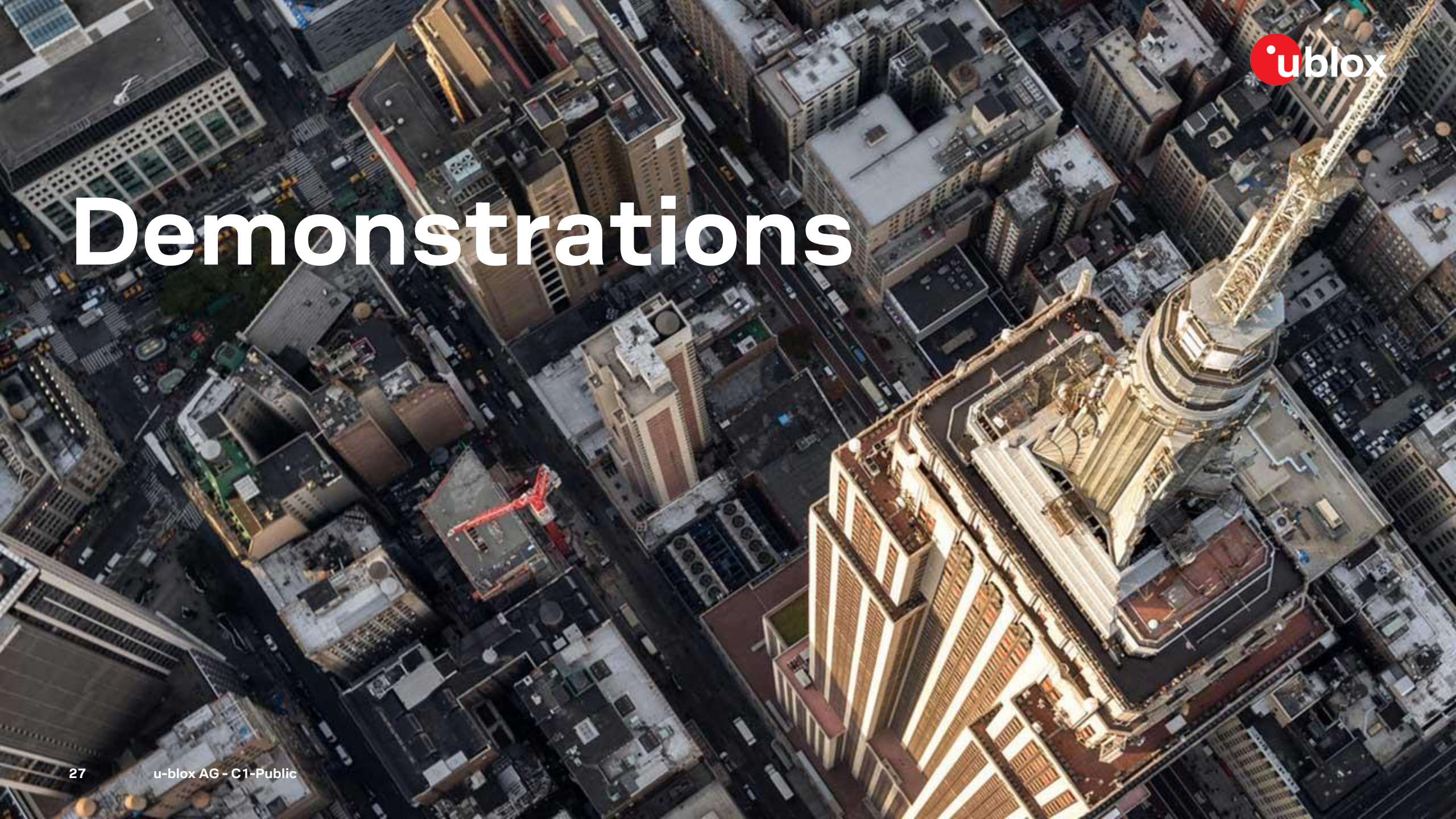
Measured accuracy

8×6 m room, 4 anchor points in the corners



Results

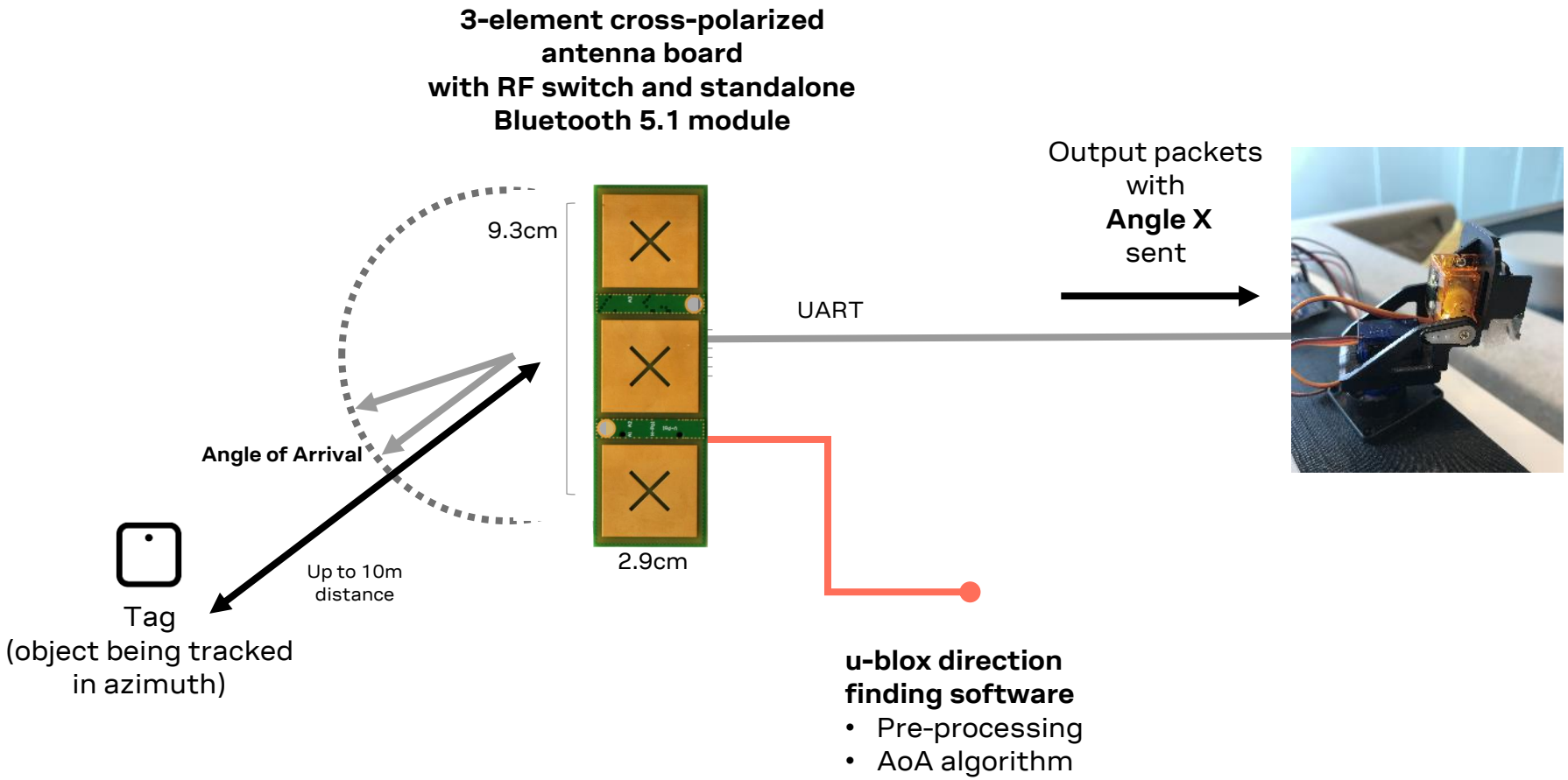




Demonstrations

Angle detection demo setup

Follow me

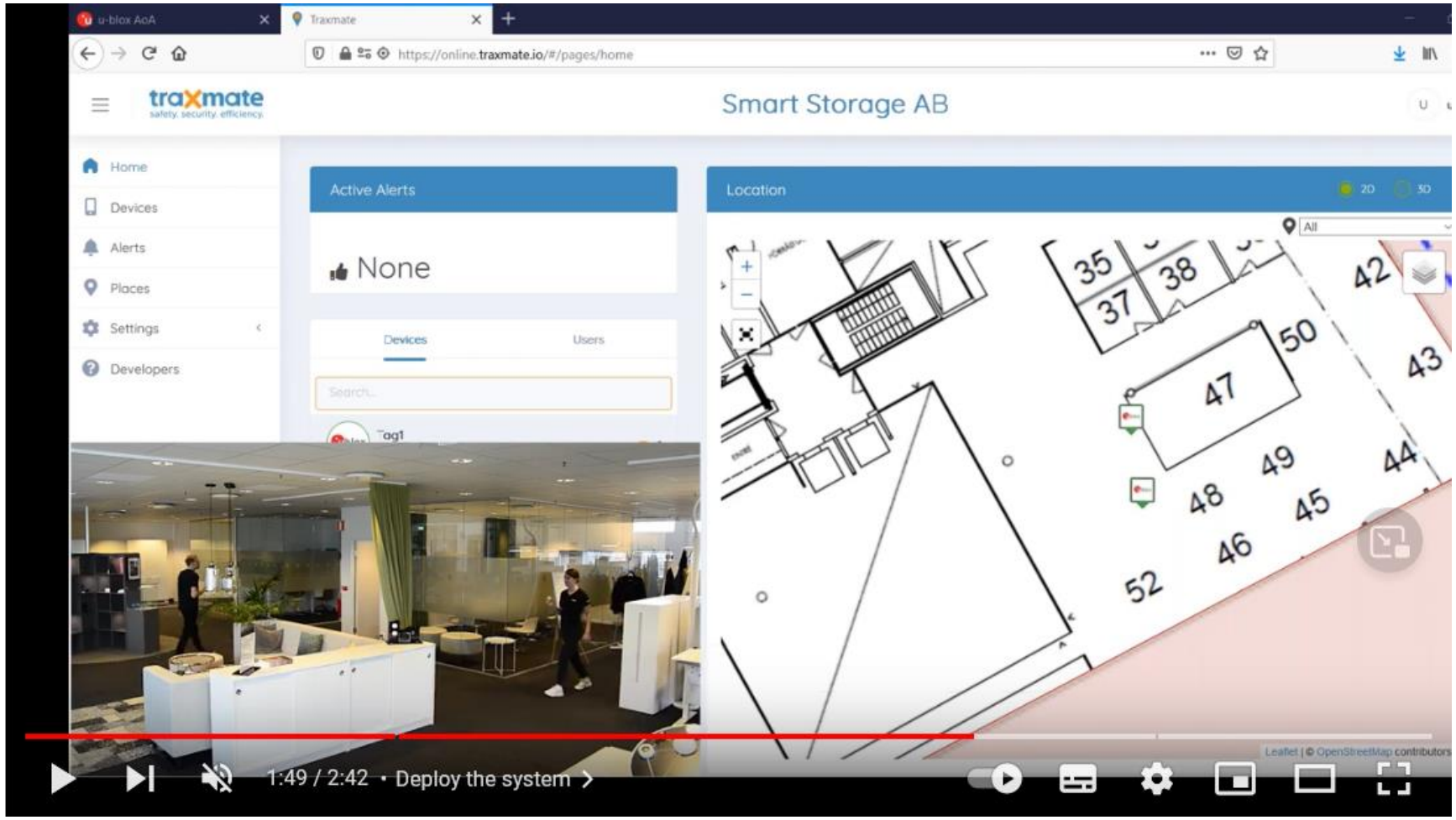


Follow me demo

Video

Bluetooth LE for indoor positioning

Video



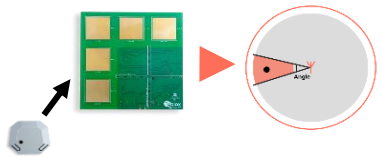
How to get started

Bluetooth for indoor positioning

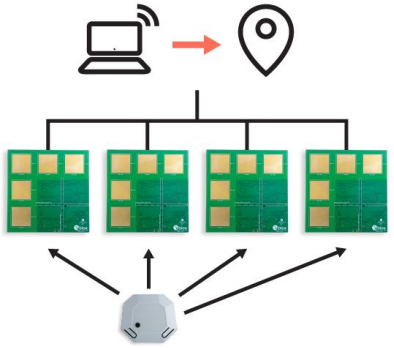
Explorer kits: Evaluate and investigate new applications

The XPLR-AOA kits will help you to:

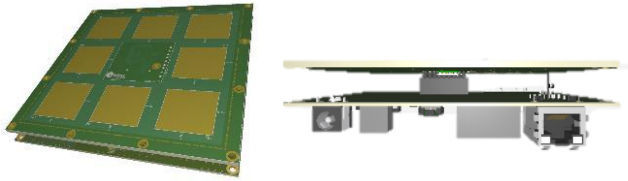
- **Get familiarized** with the technology
- Develop **proof-of-concept** implementations
- Discover **new use cases** and applications
- Bluetooth 5.1 compliant. Support nRF connect SDK version 2.1.0



XPLR-AOA-1 – Direction Finding



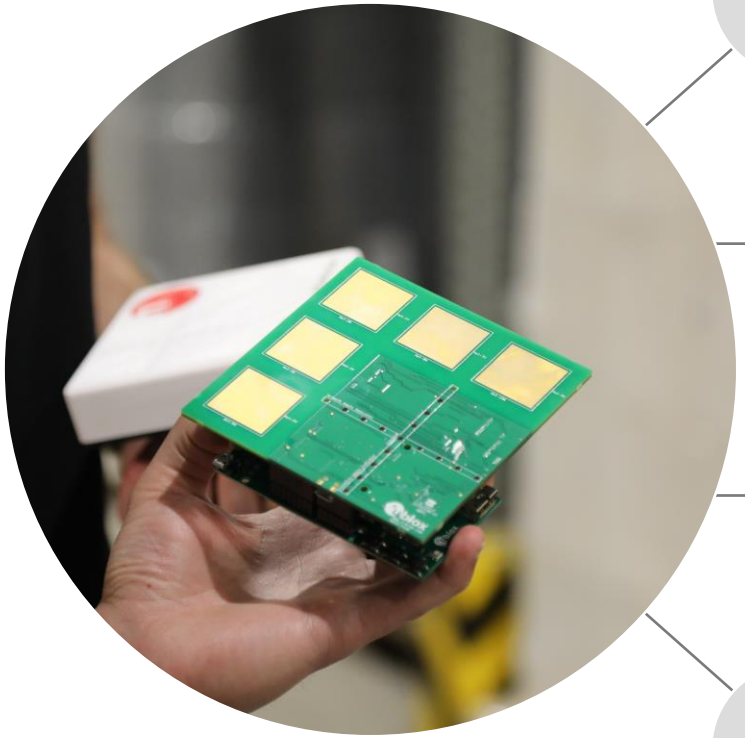
XPLR-AOA-2 – Indoor positioning



XPLR-AOA-3– Anchor point reference design

Order your own XPLR kit

From Digi-Key, Future Electronics, Mouser or RFPD



Digi-Key ELECTRONICS

FUTURE ELECTRONICS

MOUSER ELECTRONICS.

RichardsonRFPD
An Arrow Company

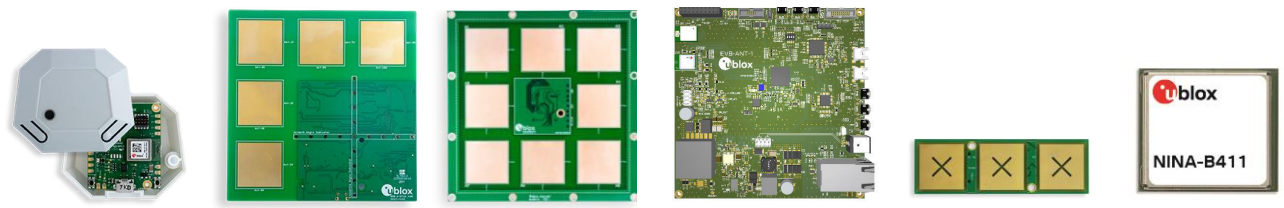
Useful links

- **All documentation and software available on www.u-blox.com**
  - Product summaries and data sheets
  - XPLR-AOA kits user guides
  - Demo setup user guide
  - White papers
  - AT commands manual
  - u-connectLocate software
  - Tag and XPLR-AOA-3 application board source code and schematics

Nordic Semiconductor Solution Partner

Bluetooth Direction Finding solutions

- u-blox is a Nordic Semiconductor Solution Partner for **Bluetooth Direction Finding** solutions including:
  - XPLR-AOA kits
  - ANT-B10/B11 antenna boards
  - EVB-ANT-1 Application Board
  - NINA-B41 (u-connectLocate)

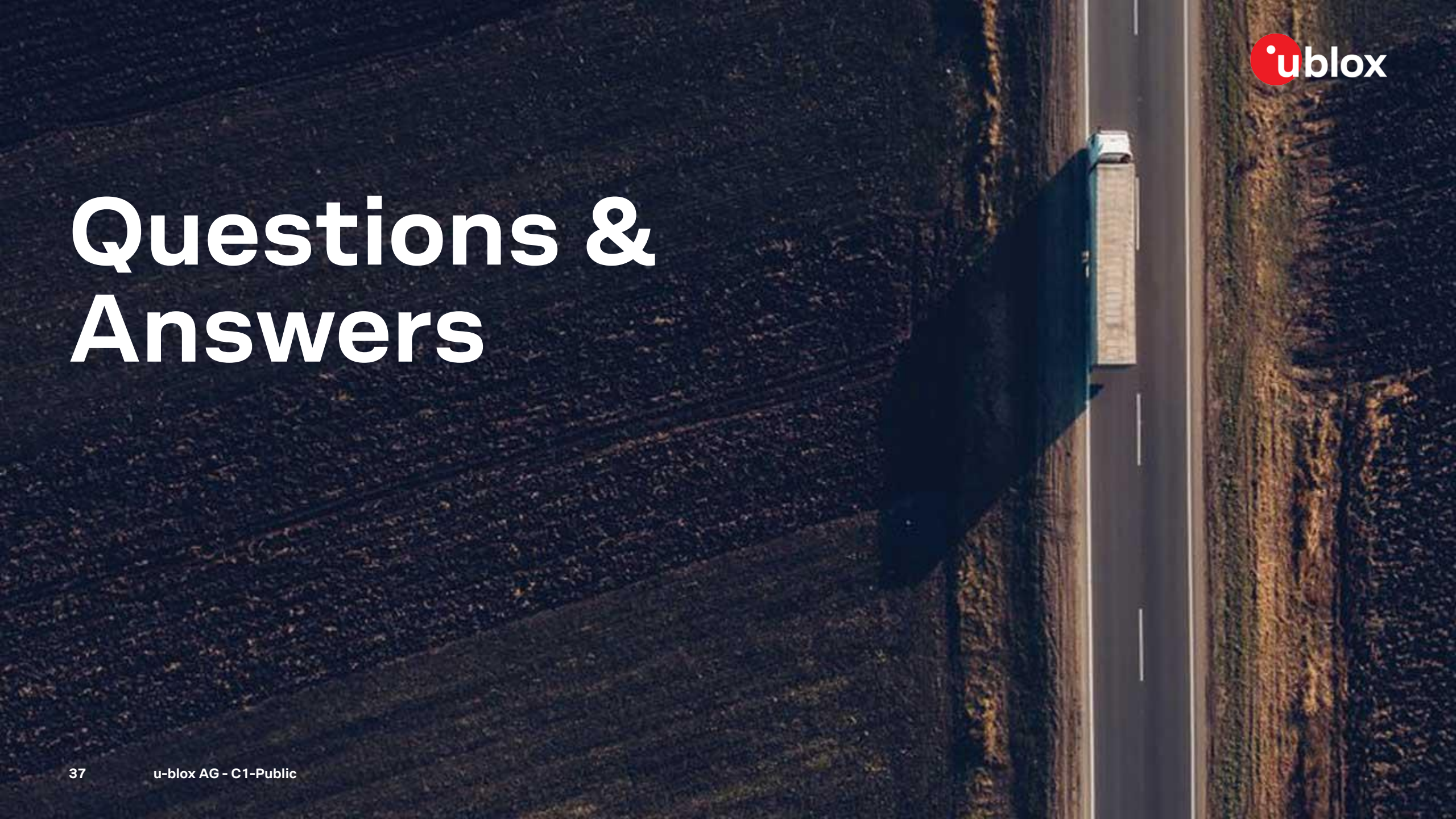


XPLR-AOA kits | ANT-B10 | EVB-ANT-1 | ANT-B11 | NINA-B41

Summary

Key learnings

- **Bluetooth 5.1** opens up a wide range of new use cases.
- We have demonstrated what the technology can deliver: **submeter accuracy.**
- Bluetooth direction-finding benefits are **low consumption**, **low cost** and **a huge ecosystem**.
- From **evaluation** to **direct integration** to your end-product, **u-blox** is your **natural partner for indoor positioning**.



Questions & Answers