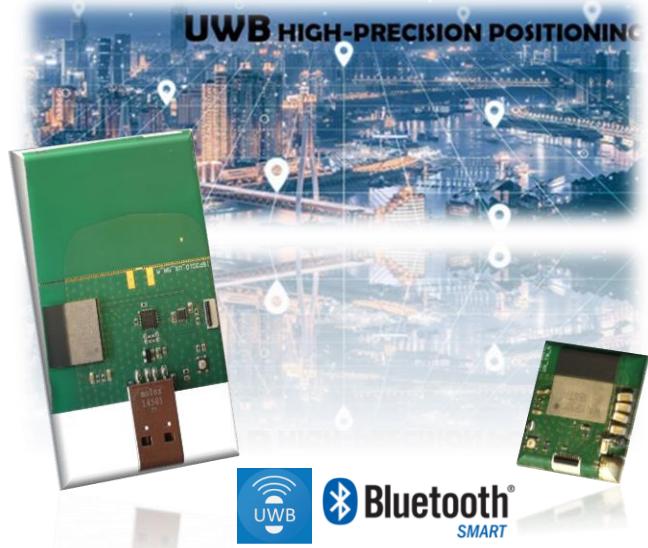


Range Demo with ISP3010 module

Application Note AN190302



Scope

This application note describes a precise positioning demo with the ISP3010 module that can be used to easily test the UWB technology. The demo is based on the Two Way Ranging (TWR) method who determine the Time of Flight of the UWB RF signal and then calculates the distance between the nodes by multiplying the time by the speed of light. This TWR process is realized between one Tag and one Anchor.

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1. Distance Measurement Scheme

In order to measure the distance between the Tag and the Anchor, three messages need to be exchanged:

- The Tag initializes TWR by sending Poll message to known address of Anchor in time referred to T_{SP} (Time of Sending Poll).
- The Anchor records time of Poll reception (T_{RP}) and replies with the Response message at time T_{SR} .
- The Tag upon reception of Response message records time T_{RR} and composes Final message, where its identification ID, T_{SP} , T_{RR} , T_{SF} information are included.

Based on time reception of Final message T_{RF} and information provided in the Final message the Anchor can determine the Time of Flight of UWB signal. Optionally, the resulted distance can be send to devices (Smartphone or tablet) through Bluetooth Low Energy (BLE) communication. The experiment shows that optimal distance between Tag and Anchor for TWR process is in range of around 50 meters.

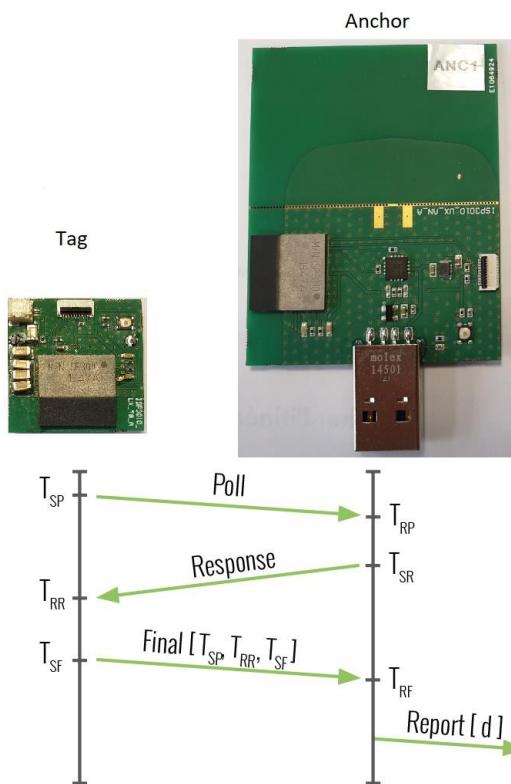


Figure 1: Two Way Ranging Scheme

2. Requirements

The demo requires the following hardware:

- 1 x ISP3010 TAG (with Battery CR2032 or LiPo battery) with Insight SIP firmware
- 1 x ISP3010 Anchor (with external power supply) with Insight SIP firmware
- An Android device with the “ISP3010 UWB demo” or “ISP1510 UWB demo” installed. Both applications are compatible with ISP3010 module.

3. How to test the range

1. Program the ISP3010 Anchor with Insight SIP firmware.
2. Program the ISP3010 Tag with Insight SIP firmware.
3. Download and install the Smartphone application “ISP3010 UWB demo” (or ISP1510 UWB demo) available on the Play Store.
4. Launch the app and connect the anchor and tag and start measurement distance. You get in real time the distance measured between the Tag and the Anchor.

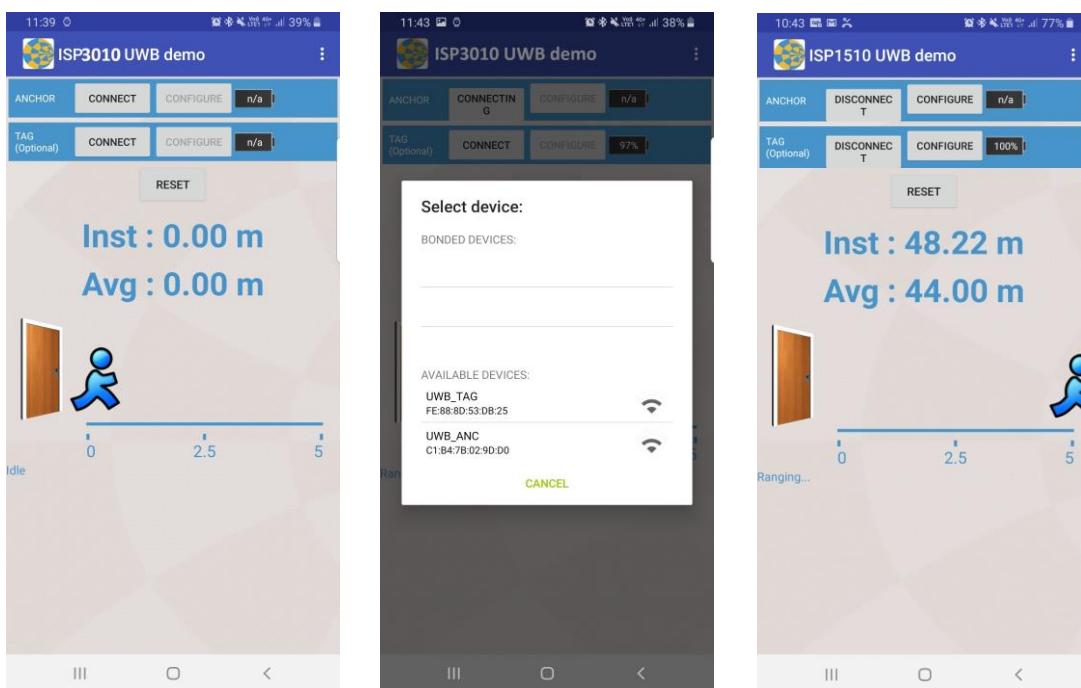


Figure 2: ISP3010 UWB Demo – Smartphone Application

Default parameters

Tag and Anchor Settings

- Delay between range measurement: 500 ms

UWB Signal Settings

- Pulse Repetition Frequency: 16 MHz
- Data Rate: 6.81 Mbits/s
- Preamble Length: 128
- Preamble Code: 3
- Channel 5: 6489.6 MHz (BW: 499.2 MHz)

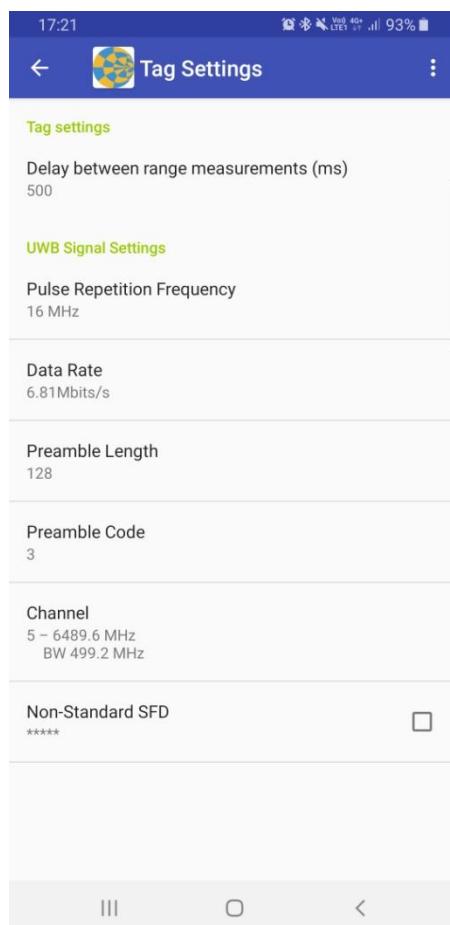


Figure 3: Tag and Anchor Settings



4. Test condition and results

The demonstration took place near the Insight SIP office. We have chosen this location to have a distance of about 100 m with limited parasitic elements, only with absorbing element like trees that could disturb the line of sight between the Tag and the Anchor.

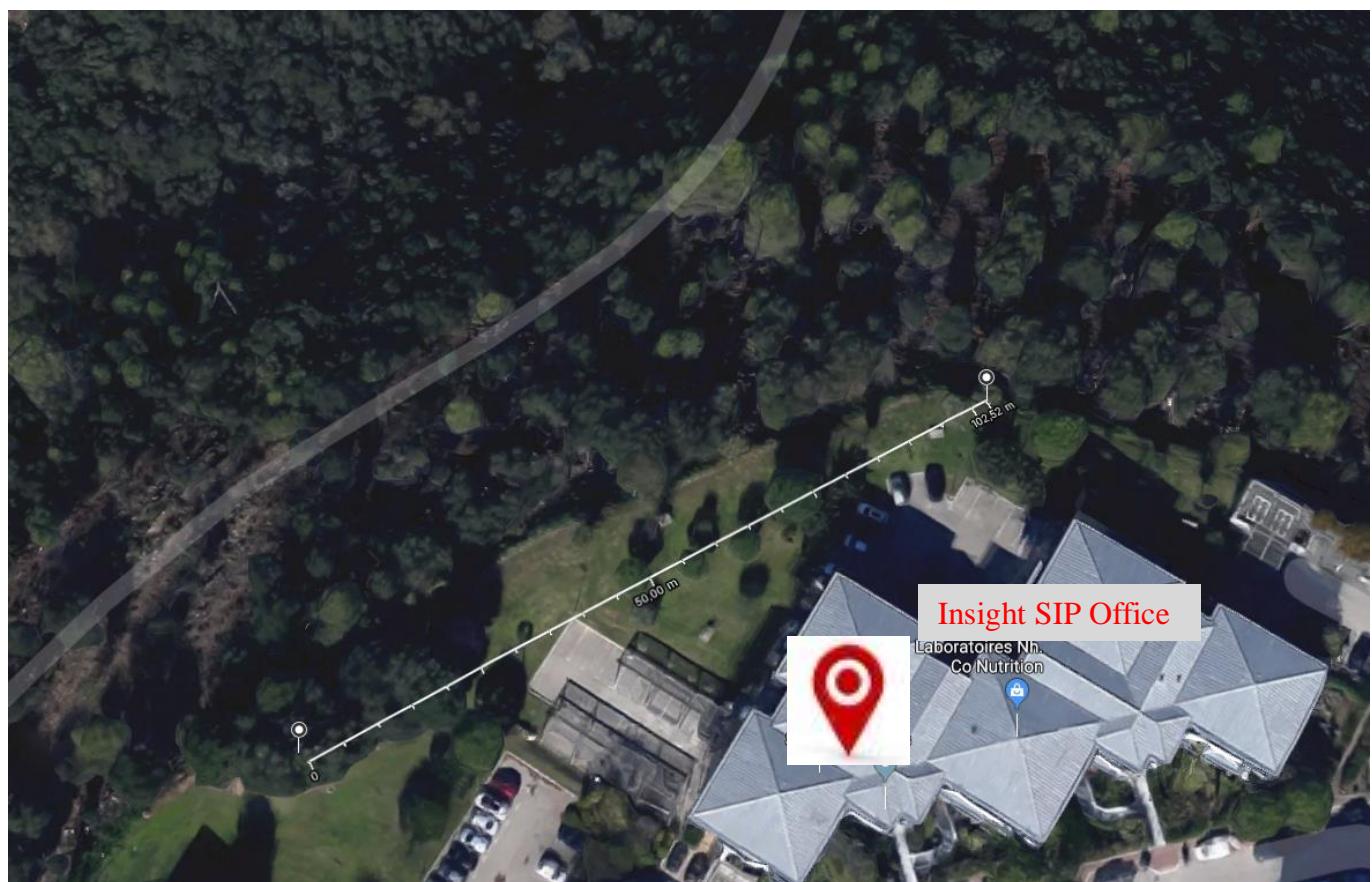


Figure 4: Test Location

The ISP3010 Anchor and ISP3010 Tag are placed at 1 meter distance from the ground. Please see the test set up on the pictures below:

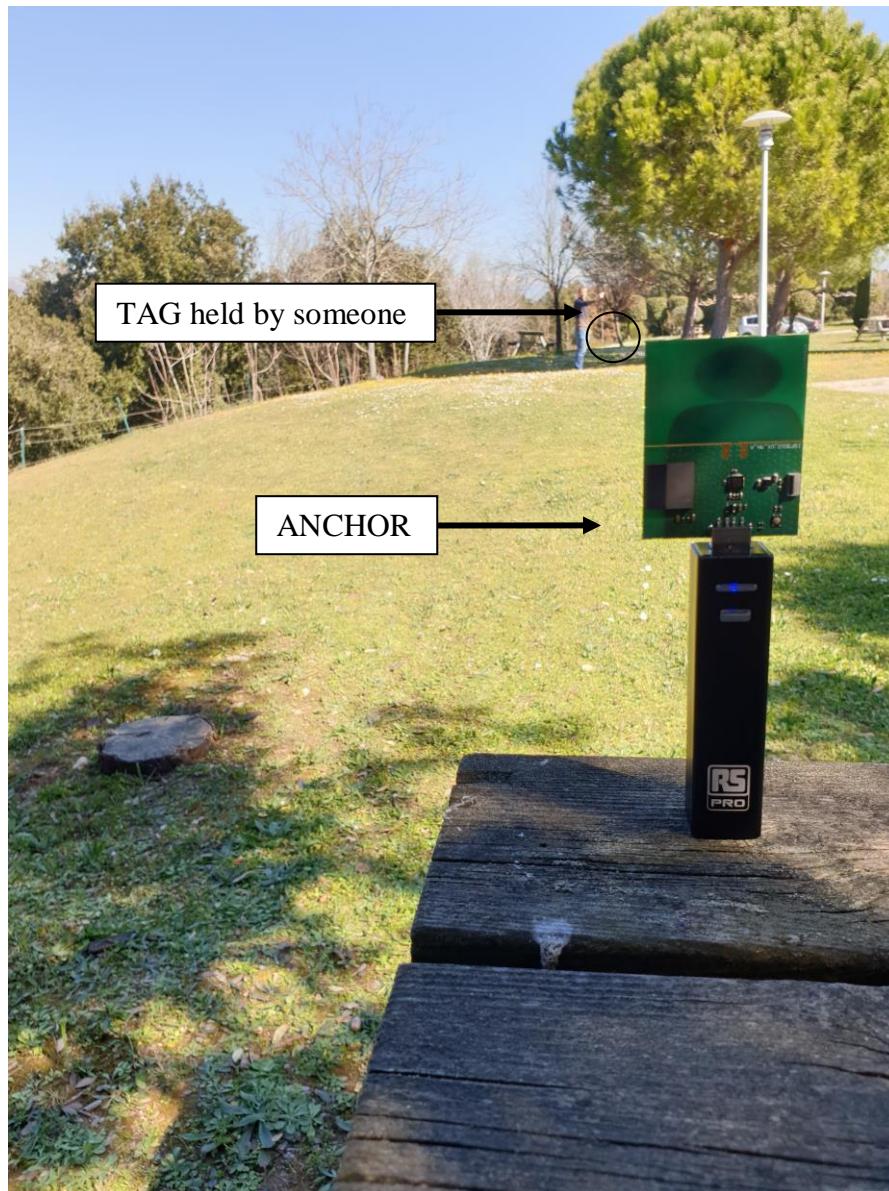


Figure 5: Test environment



The range measurement was sent to the Smartphone through Bluetooth Low Energy (BLE) communication by the Anchor. The range measured between Anchor and Tag is around 40 and 50 meters. The results are shown below:



Figure 6: ANCHOR ISP3010 with external antenna VS TAG ISP3010 with LIPO battery

5. About this project

This application has been built by the support team at Insight SIP, as a demo of some particular feature or use case.

The application is built to be used with the official nRF5 SDK, that can be downloaded from <https://www.nordicsemi.com/DocLib>

Please post any questions about this project on <https://www.insightsip.com/contact>.