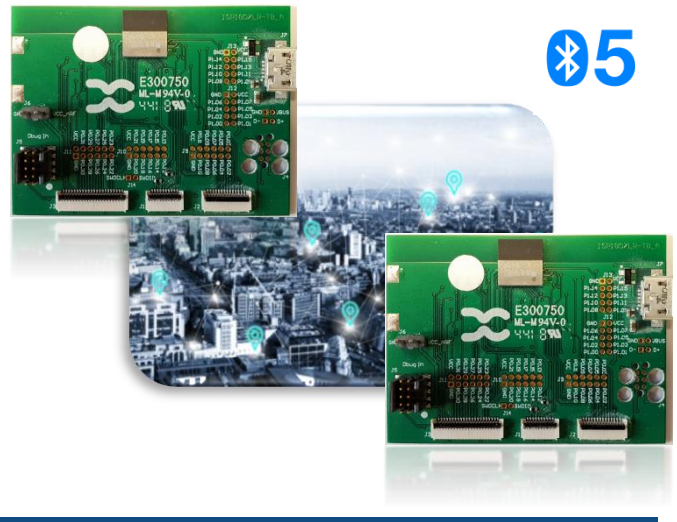


# ISP1807-LR

Application note AN181201



## Long Range Demo with ISP1807-LR module



### Scope

This application note described a demo that can be used to easily test the Bluetooth 5 long range feature with the ISP1807-LR module. The demo was inspired by the demo available on the following link related to the nRF52840-DK: <https://github.com/NordicPlayground/nRF52-ble-long-range-demo>

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## 1. Requirements

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The demo requires the following hardware:

- 2 x ISP1807-LR Test Board
- 2 x ISP130603E Interface Board  
(with battery, if it is not connected to PC during the testing)
- 2 x nRF6310-DK Nordic Board for button and LED configurations  
(with battery, if it is not connected to PC during the testing)
- A PC running either Windows, Linux, or Mac OS-X with [nrfjprog](http://infocenter.nordicsemi.com/index.jsp?topic=%2Fcom.nordic.infocenter.tools%2Fdita%2Ftools%2Fnrf5x_command_line_tools%2Fnrf5x_installation.html&cp=5_1_1) installed:  
[http://infocenter.nordicsemi.com/index.jsp?topic=%2Fcom.nordic.infocenter.tools%2Fdita%2Ftools%2Fnrf5x\\_command\\_line\\_tools%2Fnrf5x\\_installation.html&cp=5\\_1\\_1](http://infocenter.nordicsemi.com/index.jsp?topic=%2Fcom.nordic.infocenter.tools%2Fdita%2Ftools%2Fnrf5x_command_line_tools%2Fnrf5x_installation.html&cp=5_1_1)
- The latest version of the [J-Link Software and Documentation](https://www.segger.com/downloads/jlink) pack:  
<https://www.segger.com/downloads/jlink>
- Micro USB cables

In option, for logging and debugging:

- Serial Port Viewer  
(for example Tera Term or Realterm)
- JLink RTTViewer  
(available on the Segger directory)
- [Segger Embedded Studio](https://www.segger.com/products/development-tools/embedded-studio/) integrated development environment:  
<https://www.segger.com/products/development-tools/embedded-studio/>
- Nordic Software development kit [nRF5\\_SDK\\_v15.0.0](http://developer.nordicsemi.com/nRF5_SDK/nRF5_SDK_v15.x.x/):  
[http://developer.nordicsemi.com/nRF5\\_SDK/nRF5\\_SDK\\_v15.x.x/](http://developer.nordicsemi.com/nRF5_SDK/nRF5_SDK_v15.x.x/)

## 2. How to test long range

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1. Program the two ISP1807-LR - Test Board: one peripheral mode and one central mode.

a) Peripheral:

Program `peripheral_long_range_demo_pca10056_s140.hex` found in the following folder:  
`..\nrf52840-long-range-demo-kit\peripheral_long_range_demo_kit\hex`

b) Central:

Program `central_long_range_demo_pca10056_s140.hex` found in the following folder: `..\nrf52840-long-range-demo-kit\central_long_range_demo_kit\hex`

2. Use the buttons on the two nRF6310-DKs to select mode.

3. Ready to test ! Prepare yourself for a long walk !

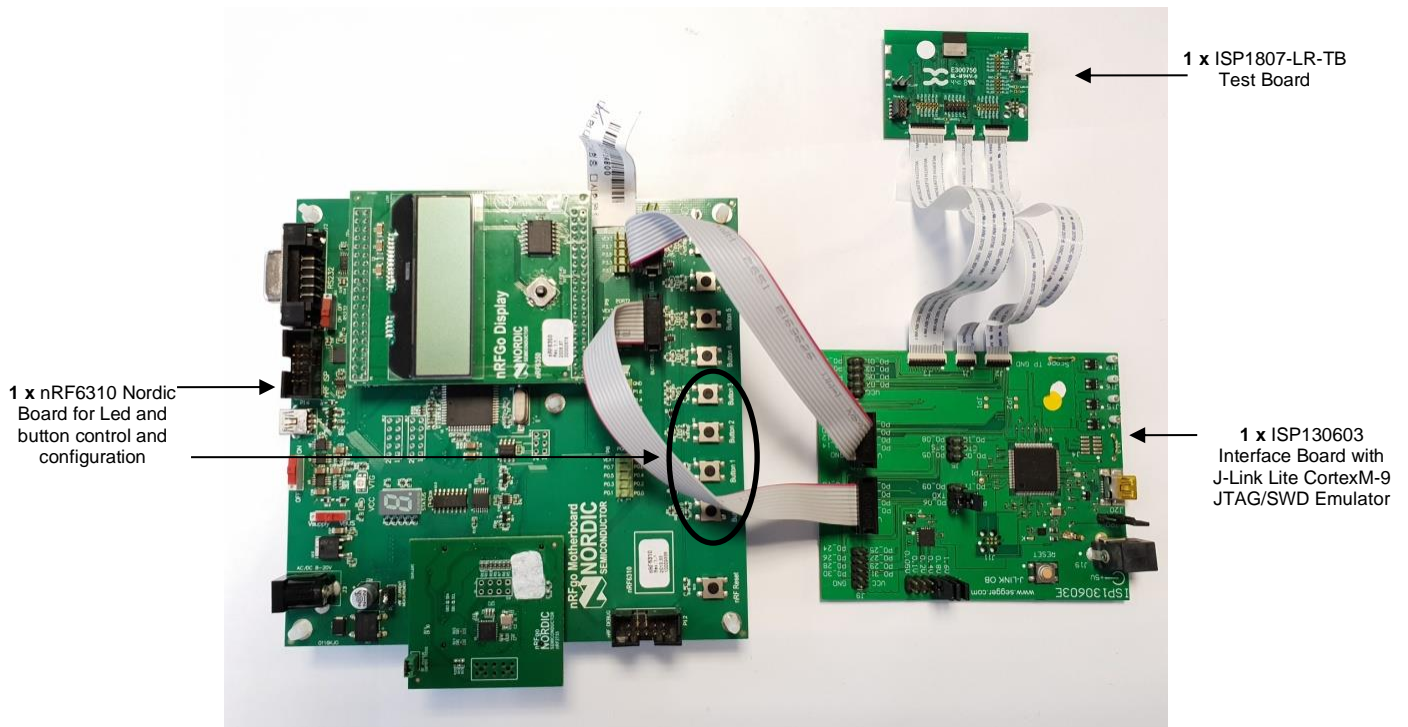


Figure 1: Demo Board

## Compile, debug, log

- Compile and debug:  
The demo is using the Software Dev Kit SDK 15.0.0.  
The nrf52840-long-range-demo-kit folder should be placed in the following folder:  
..\nRF5\_SDK\_15.0.0\_a53641a\examples\ble\_central\_and\_peripheral\  
  
• Log: To see the logged information, use either a Serial Port Viewer (UART log) or RTT viewer.

Note 1: The central filters devices based on device name, both when initiating a connection and when reporting RSSI of the advertiser. The default device name is "Long range demo".

Note 2: For non-connectable advertising on coded phy, the central does not filter on device name because the device name is not included in the advertising packet.

### 3. Buttons and LED configurations

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Buttons and LEDs are available on the nRF6310 Nordic Board

#### 3.1. Peripheral

LEDs	Description
LED 1	«on»: coded phy (125Kbps) «slow blinking»: 1Mbps
LED 2	«on»: 0 dBm «slow blinking»: 8 dBm
LED 3	«fast blinking»: non-connectable advertising
LED 4	«fast blinking»: connectable advertising «on»: connected state

Buttons	Description
Button 1	Switch between coded phy and 1Mbps
Button 2	Switch between 0 dbm and 8 dBm
Button 3	Switch between non-connectable and connectable advertising
Button 4	Not in use

#### 3.2. Central

LEDs	Description
LED 1	«on»: coded phy (125Kbps) «slow blinking»: 1Mbps
LED 2	«on»: 0 dBm «slow blinking»: 8 dBm
LED 3	«on»: scanning, trying to connect «slow blinking»: scanning
LED 4	«on»: connected state

Buttons	Description
Button 1	Switch between coded phy and 1Mbps
Button 2	Switch between 0 dbm and 8 dBm
Button 3	Switch between «scanning» and «scanning, trying to connect»
Button 4	Not in use

### 3.3. Default parameters

#### Peripheral

- Coded phy
- 8 dBm
- Connectable advertising

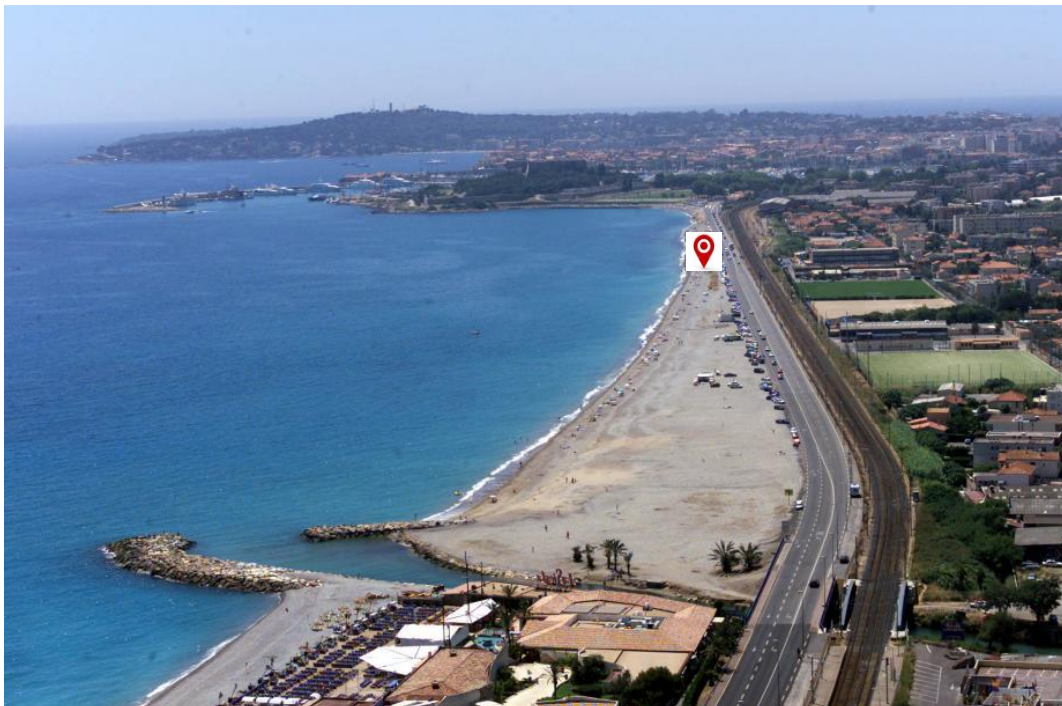
#### Central

- Coded phy
- 8 dBm
- Scanning only
- If connected to PC: log RSSI over UART/RTT

## 4. Test condition and results

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The demonstration took place on a beach located on the south east coast of France named “*Marina Baie des Anges*”. We have chosen this location to have a long distance (around 2.5 km) similar to open field with limited parasitic elements that could disturbing the signal.



*Figure 2: Test location*



The ISP1807-LR Test board (Central and Peripheral) is placed at 1 meter distance from the ground. Please see the test set up on the pictures below:

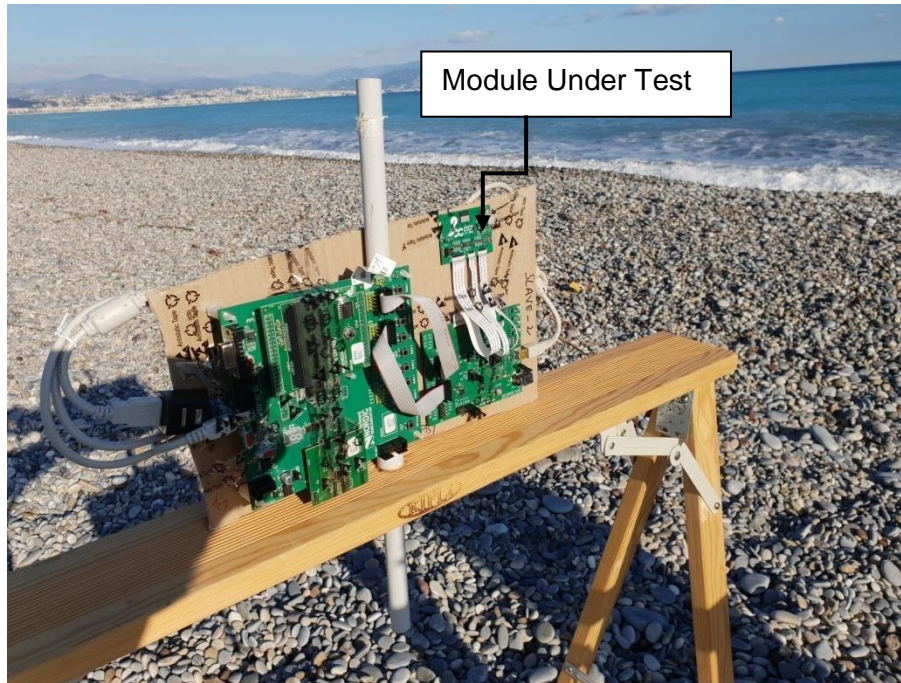


Figure 3: Test Set Up

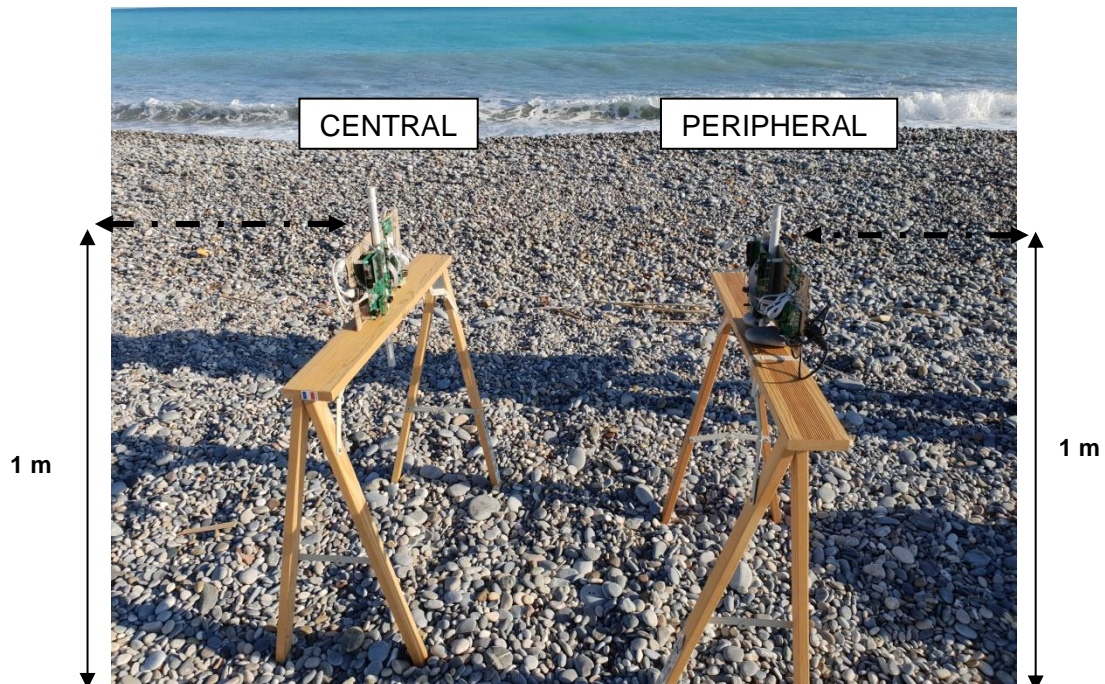


Figure 4: Test Set Up



The range measurement was determined with google map and GPS position and the data was collected once the connection between Central and Peripheral was lost or when the data transfer was very slow. A terminal JLink RTT Viewer was connected to the Central to see the data frames and the communication state between the 2 devices.

Please see below the map with the range measurement depending the different configurations mode.

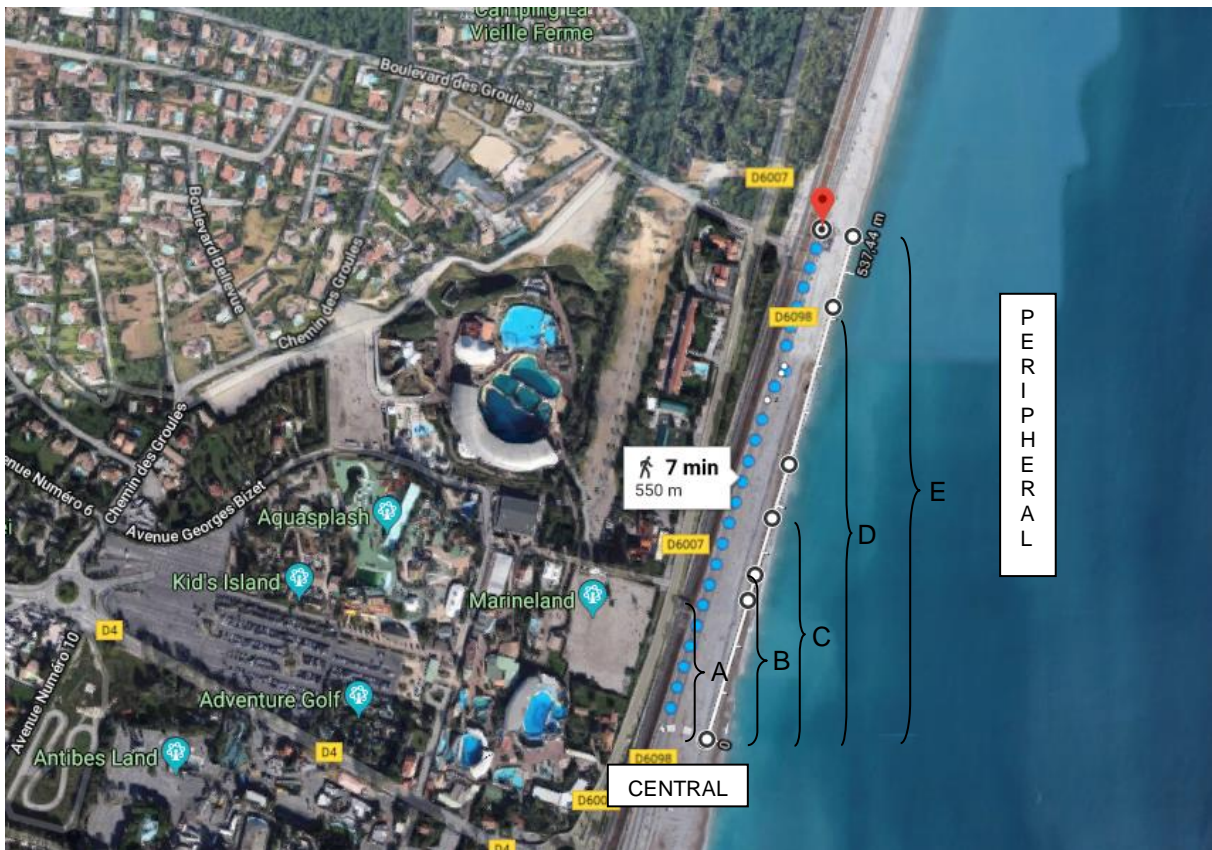


Figure 5: Results showing the range obtained between Central and Peripheral depending on the different configurations A, B, C, D and E

Range measurement between Central and Peripheral:

Config	Central	Peripheral	Range (m)
A	ISP1807-LR (0 dBm / 1 Mbits)	ISP1807-LR (0 dBm / 1 Mbits)	~150
B	ISP1807-LR (0 dBm / 125 Kbits)	ISP1807-LR (0 dBm / 125 Kbits)	~175
C	ISP1807-LR (8 dBm / 1 Mbits)	ISP1807-LR (8 dBm / 1 Mbits)	~230
D	ISP1807-LR (8 dBm / 125 Kbits)	ISP1807-LR (8 dBm / 125 Kbits)	~465
E*	nRF52840-DK (8 dBm / 125 Kbits)	ISP1807-LR (8 dBm / 125 Kbits)	~535

Note: Reference Nordic Board nRF52840-DK was configured as Central and ISP1807-LR was configured as Peripheral.

## 5. About this project

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This application is one of several applications that has been built by the support team at Nordic Semiconductor, as a demo of some particular feature or use case. It has not necessarily been thoroughly tested, so there might be unknown issues. It is hence provided as-is, without any warranty.

However, in the hope that it still may be useful also for others than the ones it was initially wrote for, we've chosen to distribute it from the GitHub.

The application is built to be used with the official nRF5 SDK, that can be downloaded from <https://www.nordicsemi.no>

Please post any questions about this project on <https://devzone.nordicsemi.com>.