

nRF52840 Quick Start Guide

Introduction

The Qorvo® QM33120WDK1 is a development kit to evaluate the capabilities of the low power and low cost QM33120W and QM33110W UWB transceivers.

It includes two different shields (AoA and non-AoA) plugged over two Nordic nRF52840 DK evaluation boards.

Warning: nRF52840 DK are shipped preprogrammed with firmware version 0.1.1. Flash must be erased and firmware MUST be upgraded to v1.0.0.

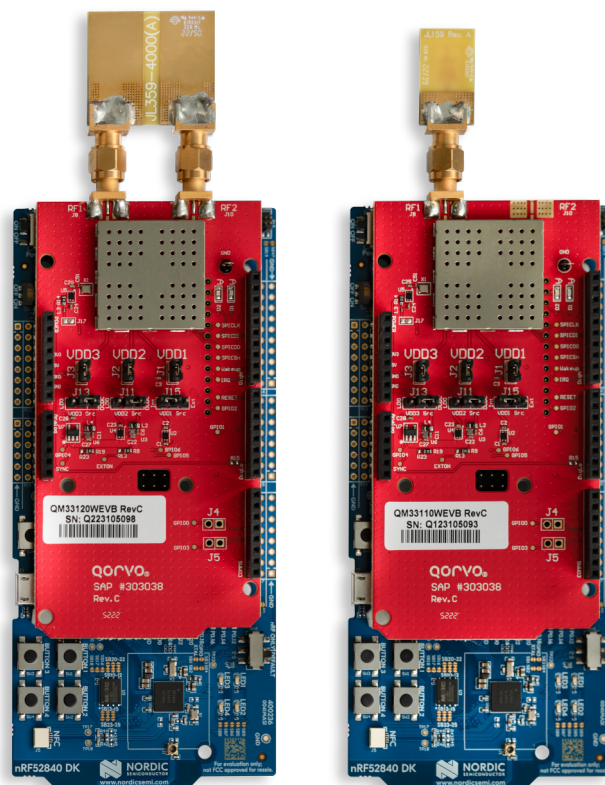


Fig. 1.1: QM33120WDK1 boards

QM331x0WEVB boards

QM331x0WEVB boards, nRF52840 DK boards and the antennas are shipped connected.

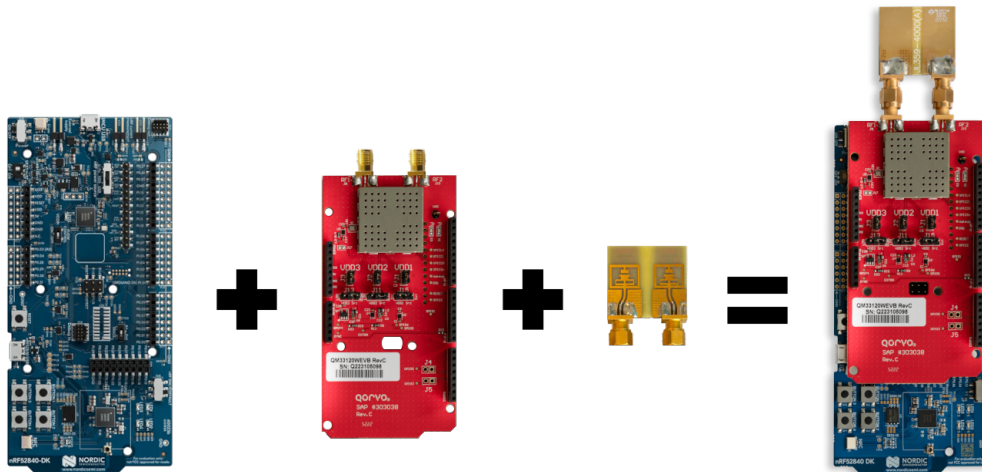


Fig. 1.2: QM331x0WEVB boards

Nordic nRF52840 DK Boards

The nRF52840 DK has two switches that define the power supply for the board. When the kit is received, all switches are in the working position.

The nRF52840 DK is equipped with two micro-USB ports:

- **J2:** used for flashing/debugging via J-Link OB.
- **J3:** used for UART/USB communications with MCU.

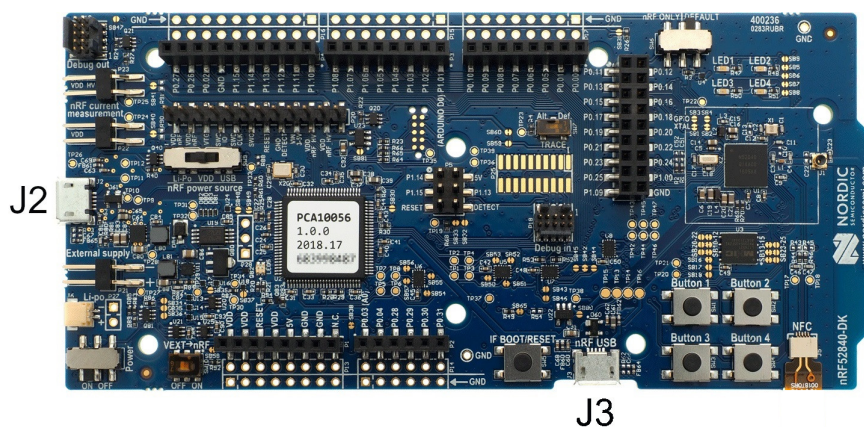


Fig. 1.3: nRF52840 DK micro-USB connectors

Please refer to QM33120WDK1 User Guide document for further information.

Required Tools

Hardware Tools

Development kit board is equipped with Segger J-Link OB (on-board programmer), no additional hardware tool is needed to flash the device.

Software Tools

To flash the development kit, you can use the [Segger J-Flash Lite](#)¹, which is a component of the **J-Link Software and Documentation Pack**. Follow the instructions below to download and install J-Flash Lite:

1. Go to the [Segger downloads page](#)².
2. Choose the latest version of the J-Link Software and Documentation Pack which is compatible with your operating system.
3. Download and execute the installer, then follow the installation procedures.
4. Once the software is installed, you can proceed with flashing your development kit.

Flashing the development kit

Warning: nRF52840 DK boards are shipped preprogrammed with firmware version 0.1.1. Flash must be erased and firmware MUST be upgraded to v1.0.0.

1. To flash the board, connect a micro-USB cable to the **J2** socket (see the [nRF52840 DK micro-USB connectors](#)).
2. Locate the JFlashLite tool in your installation directory (e.g. C:\Program_Files\SEGGER\FlashLite.exe in Windows or /usr/bin/JFlashLite in Ubuntu) and launch the application.

Note: When you connect the development kit for the first time, you may be prompted to update firmware of the on-board programmer. Please approve the update by clicking **OK** and wait for the update to complete.

3. Upon starting JFlashLite, the Device and Interface selection dialog will appear. Select **NRF52840_xxAA** device by clicking on “...” button. On the right side of dialog window, select **SWD** Interface with clock speed of **4000 kHz**. Click **OK** to proceed.



Fig. 1.4: Select CPU settings.

4. Next, select the firmware file you wish to flash onto the board. Click the “...” button to browse for the firmware (e.g. DW3_QM33_SDK/Binaries/nRF52840 DK-DW3_QM33_SDK_UCI-FreeRTOS.hex). After selecting the file, click **Program Device** to start the flashing process.

¹ https://wiki.segger.com/J-Flash_Lite

² <https://www.segger.com/downloads/jlink/>

Note: To evaluate the board with the Qorvo One TWR GUI application please ensure that you flashed the **UCI** hex file.

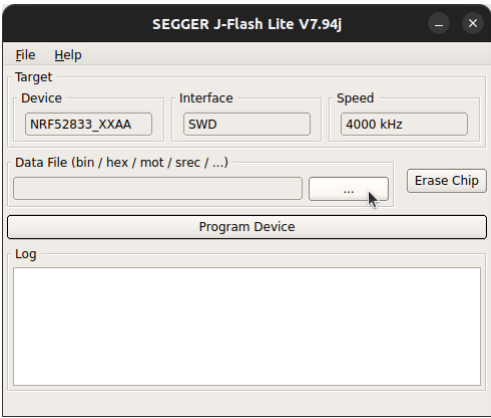


Fig. 1.5: Select .hex file to flash.

5. Once the progress bar is completed, the device has been successfully flashed. Perform a power cycle by disconnecting and reconnecting the power supply to reset the board. Your device should be now ready to use.

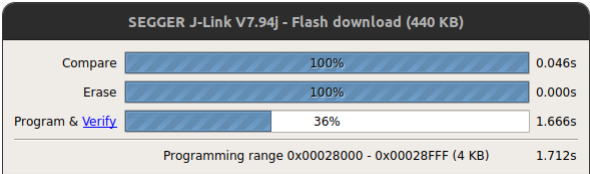


Fig. 1.6: Programming progress window.

QM33120WDK1 Setup

Connect both nRF52840 DK boards to a PC as below using the included micro-USB cables.

Note: Make sure that the antennas face each other during the evaluation.

Warning: When performing the ranging evaluation, make sure to connect micro-USB **only to J3** socket (see the [nRF52840 DK micro-USB connectors](#)).



Fig. 1.7: QM33120WDK1 evaluation set-up

Ranging and AoA Evaluation

Install **Qorvo One TWR GUI** evaluation software included in the package and start the application. Please check *Qorvo Software License* and click **Next** if you agree to the terms and conditions.

Warning:

- If you got the error:
`dlopen(): error loading libfuse.so.2`
Install libfuse2 using the following commands:
`sudo apt update`
`sudo apt install libfuse2`
- On Ubuntu 20.04, you may also need to install qt5-default:
`sudo apt update`
`sudo apt install qt5-default`
- On Ubuntu 22.04 & Ubuntu 24.04, you may also need to install qtbase5-dev:
`sudo apt update`
`sudo apt install qtbase5-dev`

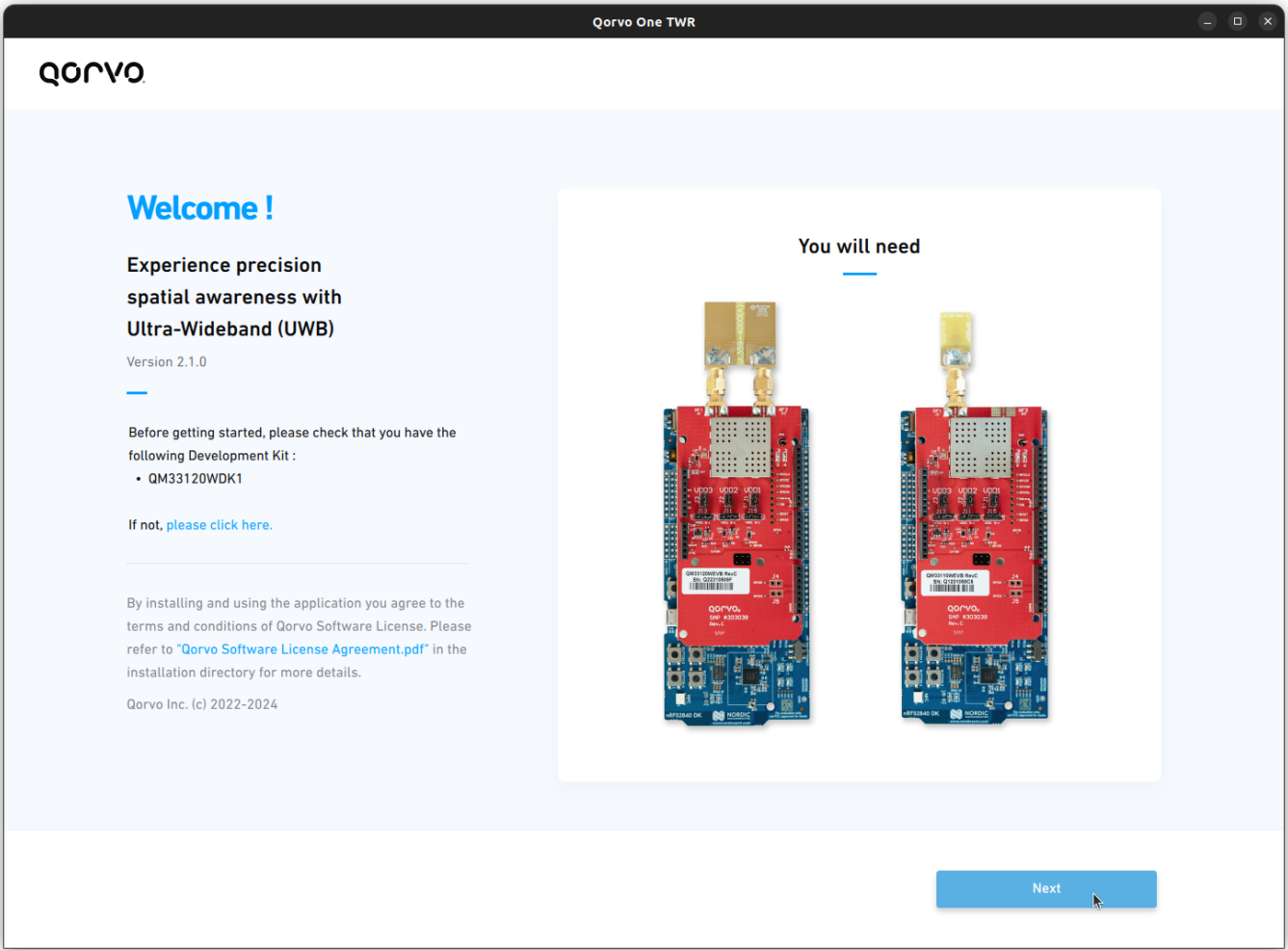


Fig. 1.8: Welcome screen

The boards will be detected and displayed on the main screen.

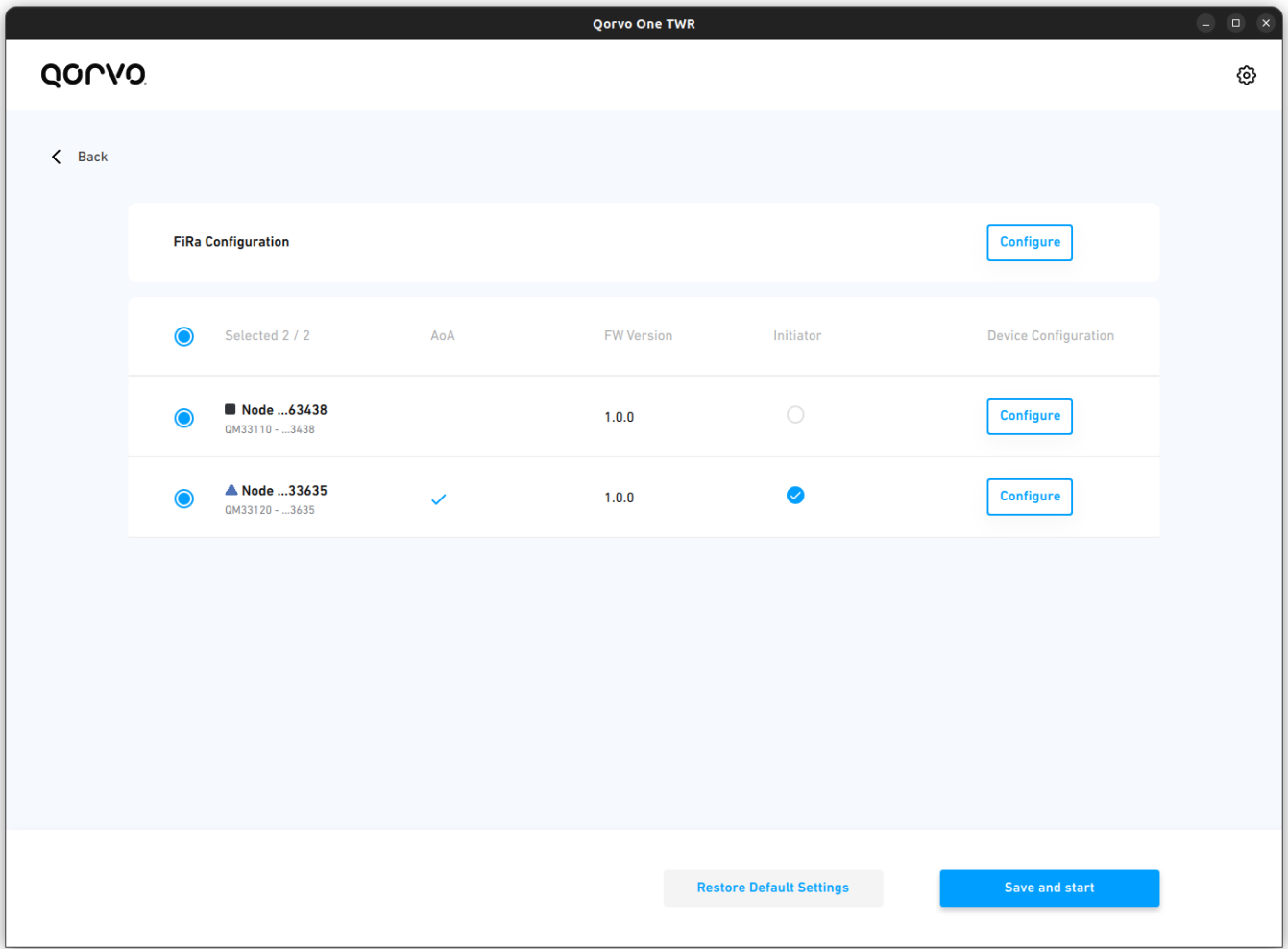


Fig. 1.9: Boards detection

FiRa Configuration

For AoA evaluation, ensure that an AoA-capable board is configured as initiator by clicking radio button in the **Initiator** column.

Use **FiRa Configuration** button to setup the ranging parameters. A new window will appear, allowing you to modify various FiRa settings, such as **UWB Channel** or **Ranging duration**.

FiRa Configuration

Initiator and Responder

Session ID

0x0000002A

Measurement scheme ⓘ

DS-TWR-deferred

Peer mode

One-to-Many

Pulse Repetition Freq. (PRF)

BPRF

UWB Channel

9

SFD ⓘ

2

Frame preamble code

9

Ranging duration (ms)

200

Slot duration (ms)

2

Num. of slots in ranging rounds ⓘ

25

Ranging Frame (RFRAME)

SP3

vendor ID

0x0708

Static STS config

0x060504030201

Vupper64

0x0605040302010708

Ranging round hopping

☐

Report angle

☒

Reset all Configuration

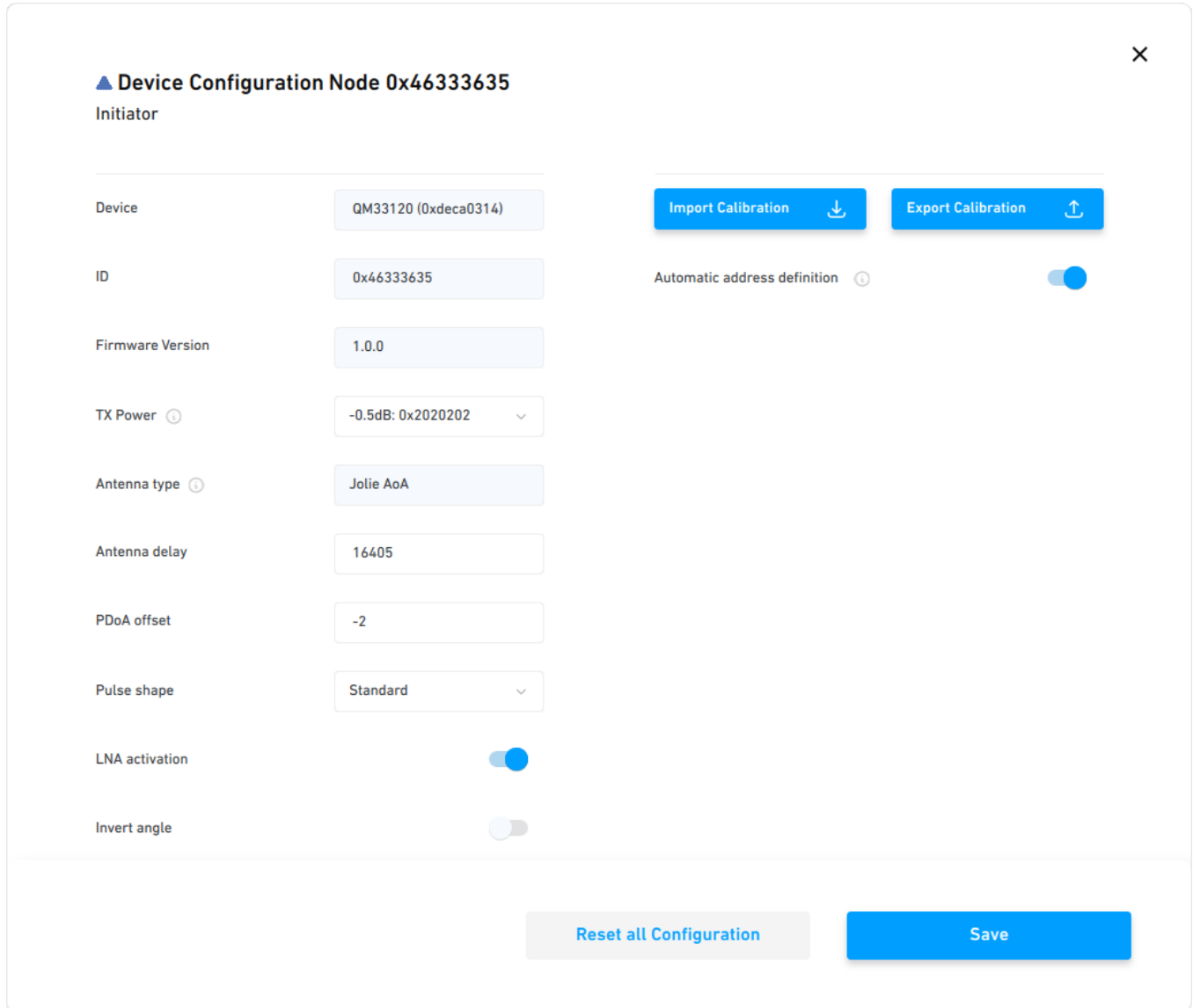
Save

Fig. 1.10: FiRa configuration

Apply desired setting and click **Save** button. You can also use **Reset all Configuration** to restore the default values.








Device configuration

To setup the device parameters of each board, click the **Configure** button located in the **Device Configuration** column. A new window will appear, allowing you to modify various device settings, such as **TX Power** or **Antenna delay**.



▲ Device Configuration Node 0x46333635 ✕

Initiator

Device	QM33120 (0xdeca0314)	Import Calibration 	Export Calibration 
ID	0x46333635	Automatic address definition  <input checked="" type="checkbox"/>	
Firmware Version	1.0.0		
TX Power 	-0.5dB: 0x2020202 		
Antenna type 	Jolie AoA		
Antenna delay	16405		
PDoA offset	-2		
Pulse shape	Standard 		
LNA activation	<input checked="" type="checkbox"/>		
Invert angle	<input type="checkbox"/>		

Reset all Configuration
Save

Fig. 1.11: Device configuration

To ensure optimal ranging performance, the board's UWB chip requires calibration.

To understand calibration settings, refer to the **Calibration and Configuration** section in **DW3000 QM33 SDK Developer Manual**. However, to quickly evaluate the system you can use preset settings provided in the SDK.

Note:

- Configuration and calibration settings are non-volatile, they are retained after power cycle or firmware update.
- If you perform a Non-Volatile Memory (NVM) erase, such as a chip erase, it is crucial to reapply calibration and configuration to the device.

Warning: It is mandatory to perform the configuration procedure of the UWB chip when the development kit is used for the first time or when the SDK is upgraded to a higher version since the compatibility of the calibration data from one firmware version to another is not guaranteed.

To load the calibration, click the **Import Calibration** button.

In the new dialog, select appropriate calibration file corresponding to the antenna in use (please see **Antenna type** field):

- for **AoA board (two antennas)**, please choose following file:
DW3_QM33_SDK_1.0.0/Tools/uwb-qorvo-tools/scripts/device/load_cal/calib_files/
QM33120WDK1/jolie_aoa.json,
- for **non-AoA board (single antenna)**, please choose following file:
DW3_QM33_SDK_1.0.0/Tools/uwb-qorvo-tools/scripts/device/load_cal/calib_files/
QM33120WDK1/jolie_omni_non_aoa.json.

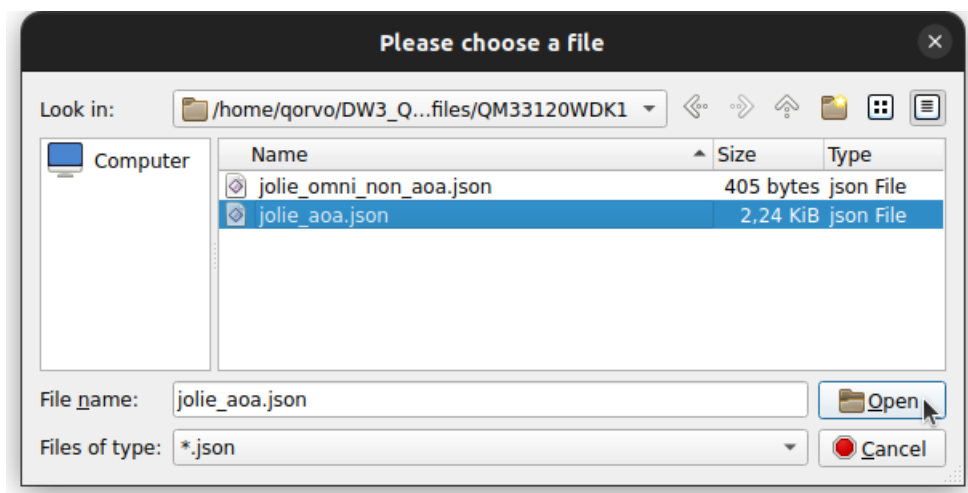


Fig. 1.12: Device calibration file

Press **Save** button in **Device configuration** window to apply configuration and calibration. When calibration has changed, saving may take up to 10 seconds.

TWR Ranging

Press **Save** and **start** to start the ranging experience.

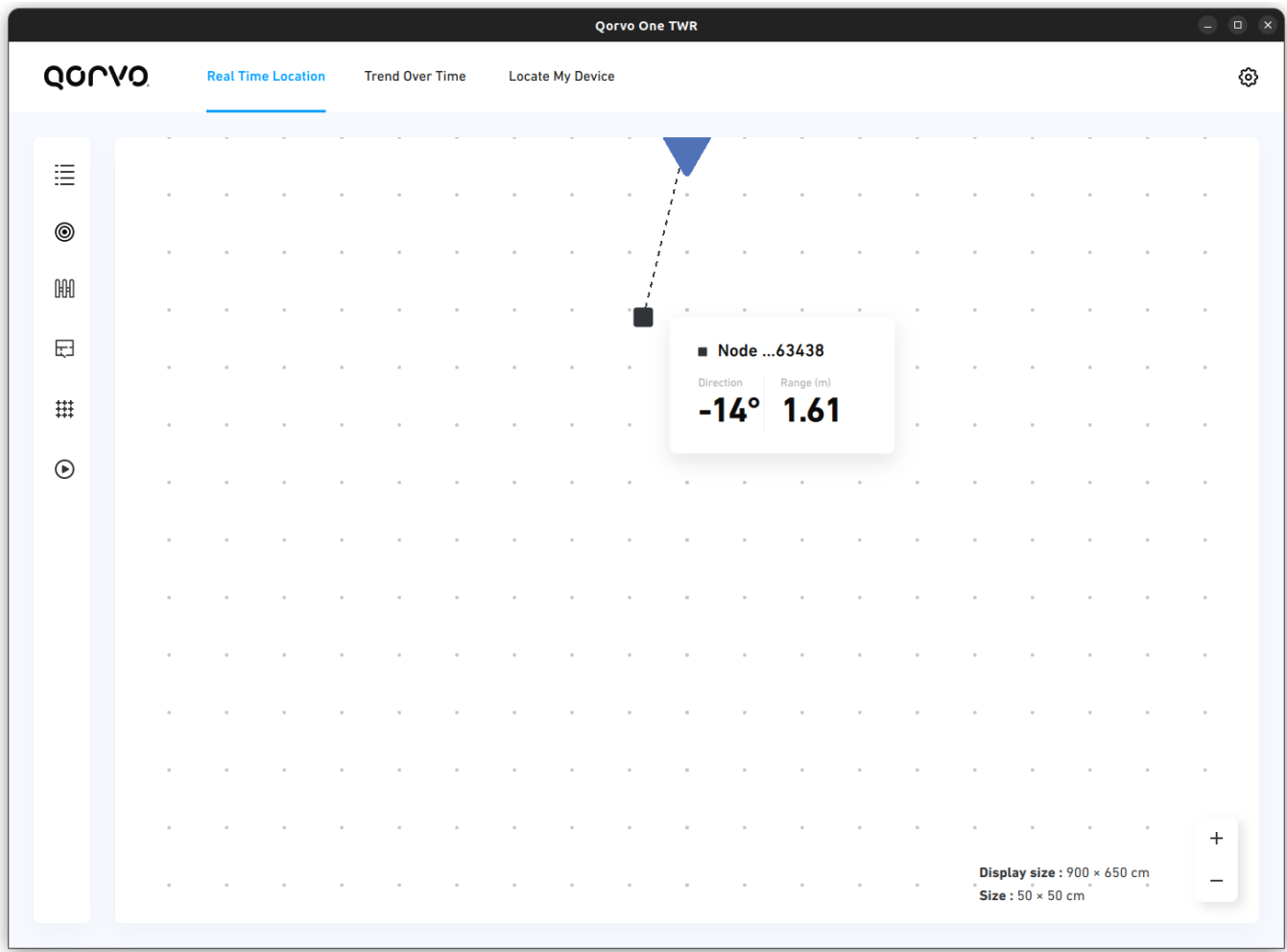


Fig. 1.13: Real Time Location

Auto Calibration

The Qorvo One TWR GUI software provides an auto calibration feature that simplifies the calibration process on the development boards. This feature automatically adjusts the antenna delay and the PDoA offset in the NVM of the MCU.

Note: As antenna delay and PDoA offset values are stored in a specific section of the NVM, they are retained after power cycle or firmware update.

It is highly recommended to perform auto calibration as it improves distance and AoA performances.

Click on the **Auto Calibration** button located in the left bar.



Fig. 1.14: Auto calibration icon

A new tab will appear, listing the different devices.

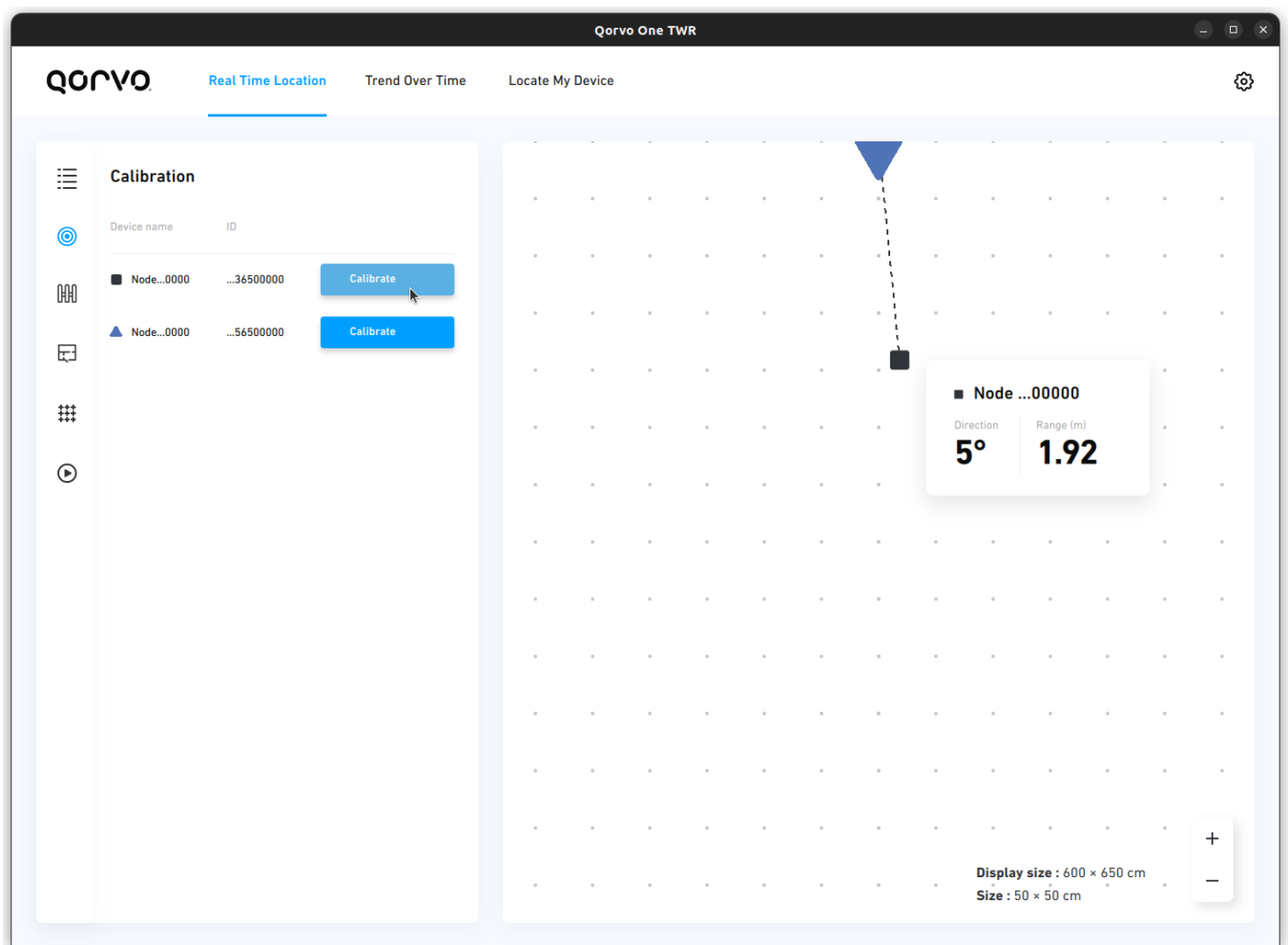


Fig. 1.15: Auto Calibration tab

Click on the **Calibrate** button of the device to calibrate. A new window will appear, explaining the auto calibration process.

Note: It is important to follow the instructions displayed in the window as precisely as possible to ensure improved performance.

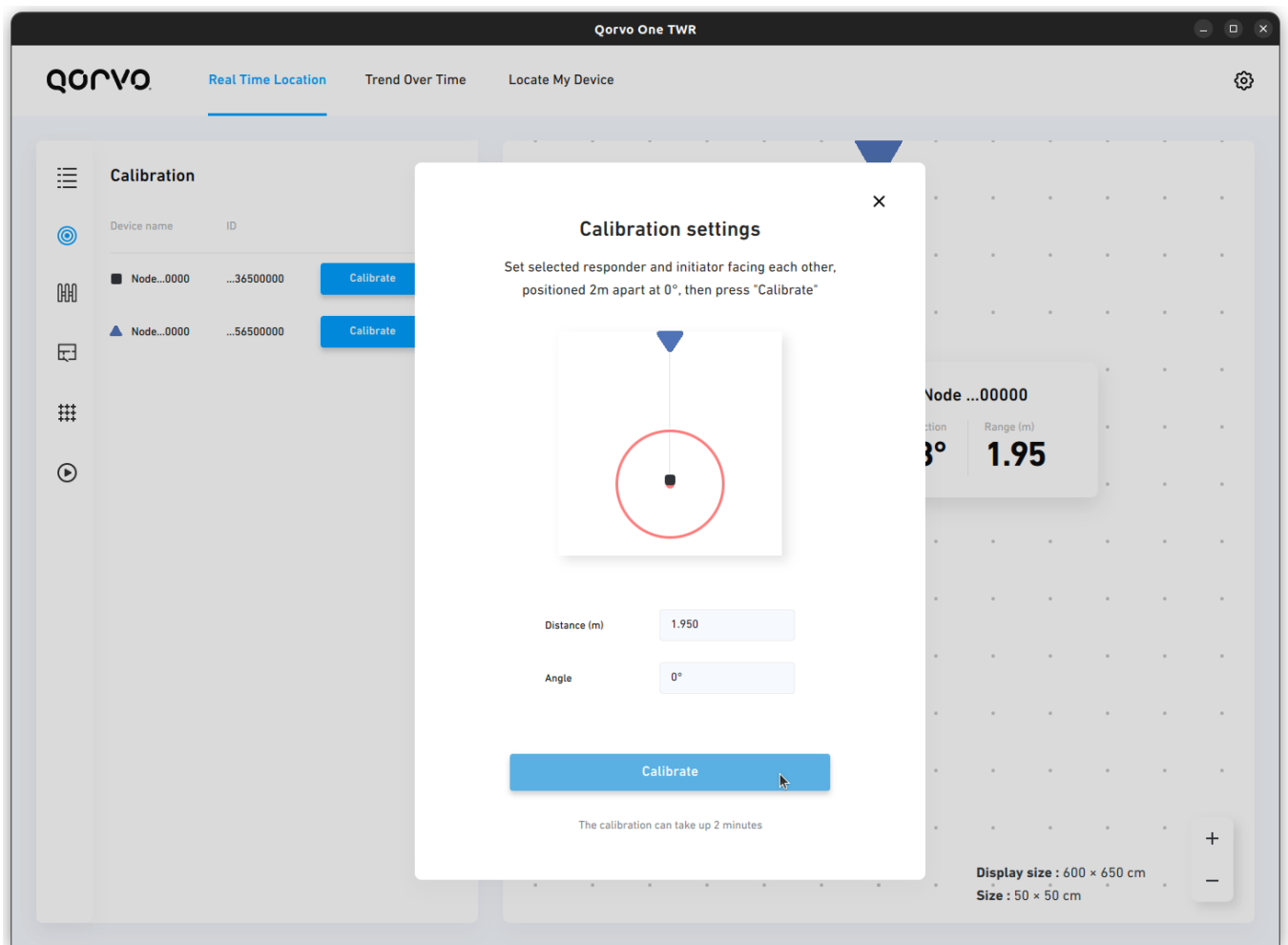


Fig. 1.16: Auto Calibration window

Click on the **Calibrate** button to start the auto calibration. Once the auto calibration process is complete, the software will display a message indicating the success of the calibration.

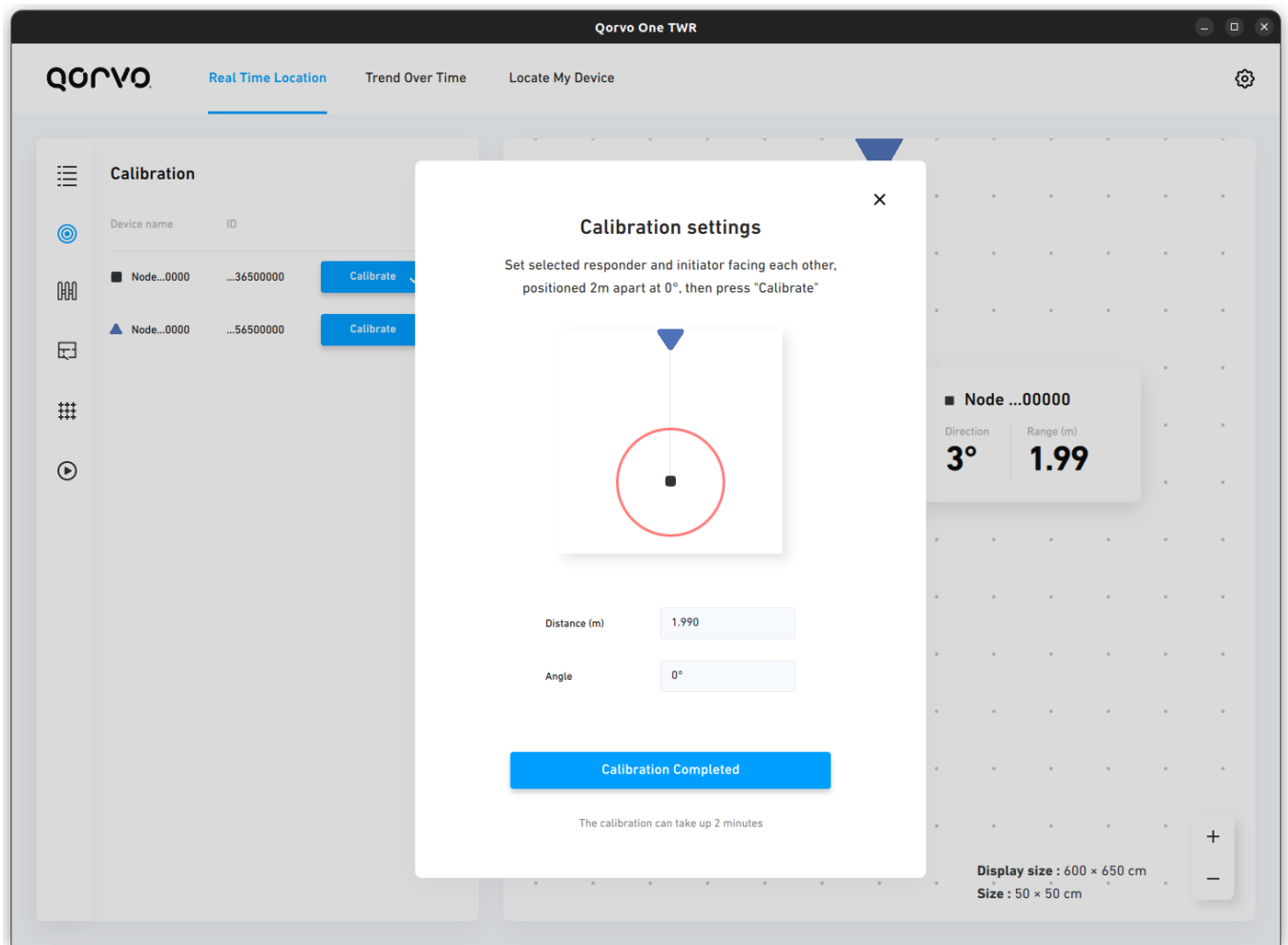


Fig. 1.17: Auto Calibration completed

The device will be marked as calibrated in the Auto Calibration tab.

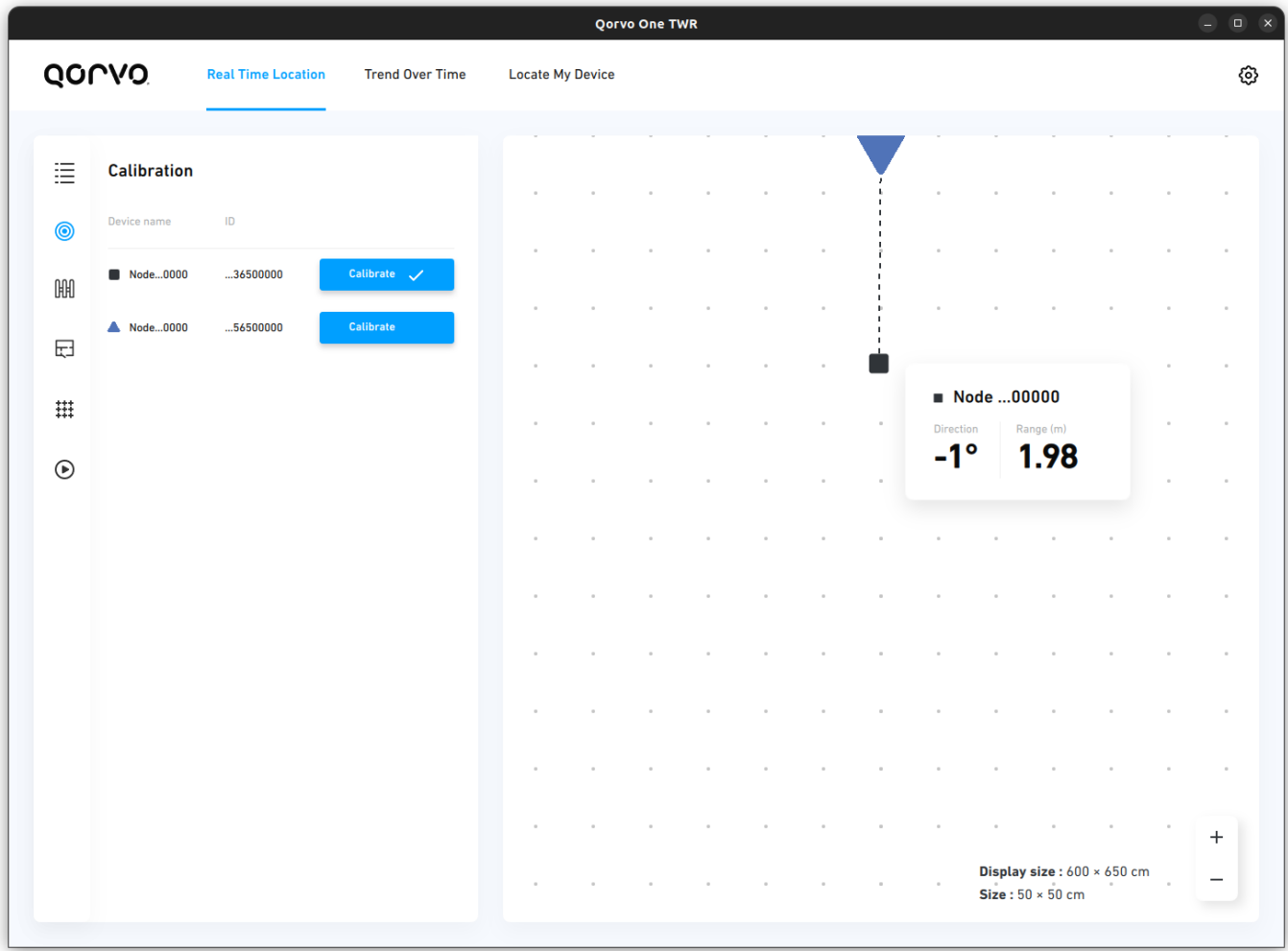


Fig. 1.18: Auto Calibration tab with device calibrated

After completing the auto calibration, you can proceed with the TWR ranging or AoA evaluation as described in the previous section.

Revision History

Version	Date	Comment
DW3_QM33_SDK_1.0.0	2024-08-22	<ul style="list-style-type: none">• Added USB connectors description in <i>Nordic nRF52840 DK Boards</i> section.• Added <i>Required Tools</i> section.• Added <i>Flashing the development kit</i> section.• Updated <i>Ranging and AoA Evaluation</i> section:<ul style="list-style-type: none">– Content divided into subsections: <i>FiRa Configuration</i>, <i>Device Configuration</i> and <i>TWR Ranging</i>.– Added information about calibration and configuration.– Updated GUI images to the latest version.• Updated target board images and their descriptions.• Added Auto Calibration chapter.
DW3_QM33_SDK_0.1.1	2022-11-03	Initial release