B-UWB-MEK1 quick start guide

Introduction

This document explains how to get started quickly with the B-UWB-MEK1 module evaluation kit. B-UWB-MEK1 includes Evaluation boards equipped with the STM32-based B-UWB-MOD1 UWB module designed to test advanced positioning and tracking technology in real conditions, or to be embedded directly into a ready-to-use indoor location system. The Evaluation boards can be used both as fixed or mobile devices for complete system evaluation.

The quick start guide covers such aspects as hardware content, system introduction, software tools, 1D and 3D measurements, device addition, system update, and support.

Figure 1. B-UWB-MEK1 module evaluation kit

Picture is not contractual.

1 Unpack hardware

Check the content

- B-UWB-MEK1 boards(1), equipped with the B-UWB-MOD1 modules mounted on PERSPEX® panels
- Omnidirectional antennas
- USB Type-C® to USB Type-A cables

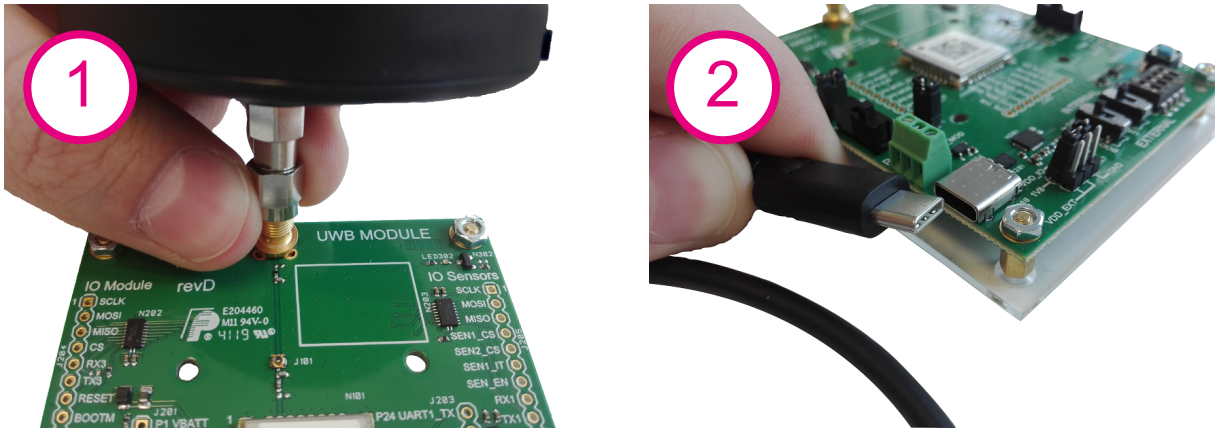
1. *B-UWB-MEK1 is available in packs of two boards. The number of packs needed depends on the use case.*

Figure 2. B-UWB-MEK1 board, antenna and cable

Assemble the boards

1. Screw the antenna carefully (maximum torque from 0.3 to 0.6 N.m)
2. Plug the USB cable

Figure 3. B-UWB-MEK1 antenna and cable connection



2 Come to know the system

2.1 Delivery pack

The software development kit (SDK) included in the delivery pack contains documentation and the related software toolchain, to make the development process based on B-UWB-MEK1 and B-UWB-MOD1 easier.

Make sure to decompress the SDK folder received as a compressed archive into a path without any whitespace.

Note: This quick start guide and its appendices are based on system version 3.x. For update or advanced system features, refer to the comprehensive user documentation presented in Reference documentation.

2.2 Configurations

B-UWB-MEK1 is designed to test ultra-wideband (UWB) positioning and tracking independently, or to be used within an existing location system based on this technology.

This quick start guide provides an easy access to the main functionalities by presenting three basic modes for a setup composed of up to 6 boards:

- Filtered 1D measurement
- Raw 1D measurement
- 3D single self-positioning

Appendix Add devices explains the configuration steps to use more devices.

2.3 Board overview

B-UWB-MEK1 boards are built around the ultra-compact surface mounted B-UWB-MOD1 UWB module, which is the kernel of various adjustable device-centric and server-centric location configurations.

B-UWB-MOD1 features the STM32L476JE 32-bit microcontroller based on the Arm® 32-bit Cortex®-M4 CPU with FPU.

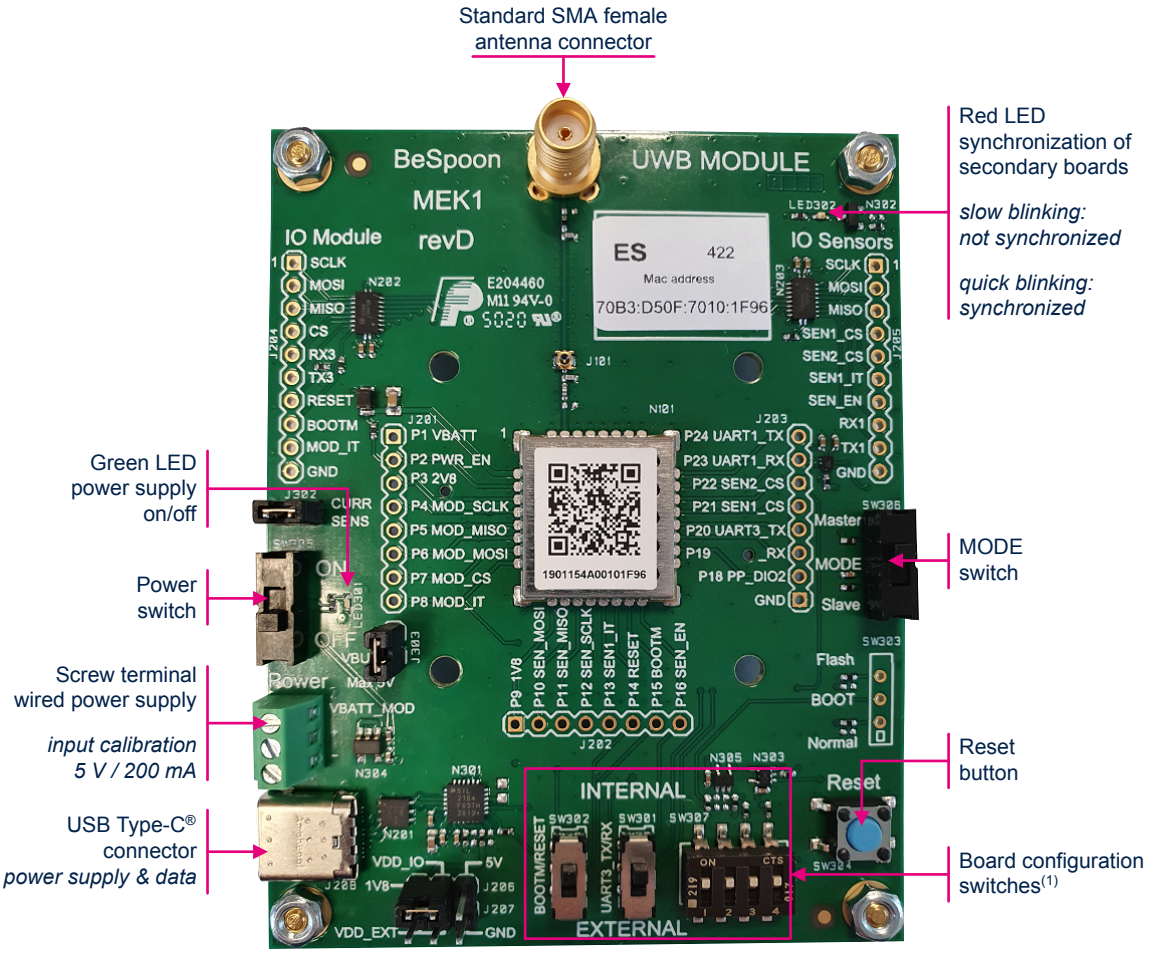
All B-UWB-MEK1 boards have the same pre-settings and functionalities, to be alternatively in master or secondary mode, as a fixed or mobile device for measurement and positioning. The green LED indicates the board synchronization status, the red LED shows the power supply.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

Each board has two switches and one button to control roles and functions as shown in Figure 4:

- ON / OFF - alternate the power switch
- Master / Secondary - alternate the MODE switch
- Reset - press the Reset button

Figure 4. B-UWB-MEK1 board front view

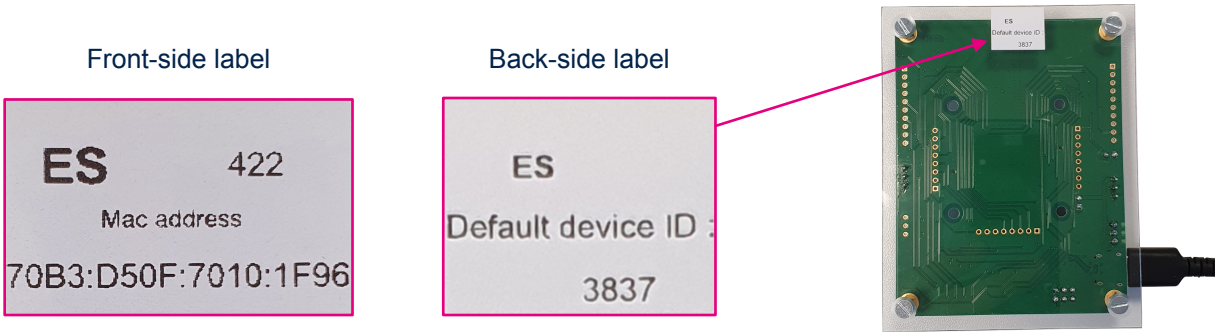


1. *For advanced development.*
Keep in INTERNAL upper position unless specified otherwise.

Zoom on device information labels

The labels on the front and back sides of the board provide the board specific identifiers.

Figure 5. B-UWB-MEK1 labels on the front side and back side



2.4 Software tools

2.4.1 Driver

Windows® systems require a Silicon Labs' CP210x driver to connect. For Ubuntu®, refer directly to MOD1/MEK1 programming tool.

Windows 10®

The system installs the driver itself within a few seconds when the board is plugged onto the USB port.

If the automatic installation does not happen, Windows® drivers are also provided in the delivery package in `\mod1_SDK_3.x.x-rxxxxx\tools\exe\CP210x_Universal_Windows_Driver.zip`.

Older Windows® versions

CP210x drivers for older Windows® versions are available on Silicon Labs' website at www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers.

2.4.2 MOD1/MEK1 programming tool

This application enables users to set their boards for different configurations by providing access to the module memory.

Windows®

Path: `\mod1_SDK_3.x.x-rxxxxx\tools\exe\bspmoduletoolsgui_3.x.x_amd64.exe`

Installation: double-click on the file to open the application directly.

Ubuntu®

Path: `\mod1_SDK_3.x.x-rxxxxx\tools\deb\bspmoduletoolsgui_3.x.x_amd64.deb`

Installation:

1. Open *Terminal*
2. Access the `deb` directory in the SDK by using Linux® command `cd` (*change directory*) and entering the corresponding path.
   In the example below, the user is navigating from the home directory and the SDK directory is stored on the *Desktop*:
   `cd Desktop/mod1_SDK_3.x.x_REVISION/tools/deb`
3. Enter the following command:
   `./install_bspmoduletools_all.sh`
4. Enter the password
   The installation script starts to run. The installation script ends with `Bespoon DKMS package correctly installed !`

2.4.3 Trace tool

Various terminal applications can be used as UART trace tools to read distances. On Windows®, use for instance Tera Term, an application provided by the Open Source Development Network at osdn.net/projects/ttssh2/.
Ubuntu® systems already include the Minicom serial communication application.

Follow the steps below to configure the trace tool:

Step 1. Select the board used as the master in the upcoming procedures.

Step 2. Set its MODE switch accordingly.

Step 3. Connect the board to the computer via the USB.

Step 4. Turn on the board with the power switch and open the trace tool.

Step 5. Select [**Serial**] and the port of the corresponding USB connection.

Step 6. In [**Setup**]>[**Serial port**], enter the following settings:
- Baud rate `921600 bauds`
- Data `8 bits`
- Parity `none`
- Stop bit `1`
- Flow control `none`

Step 7. Go to [**Setup**]>[**Save setup**].

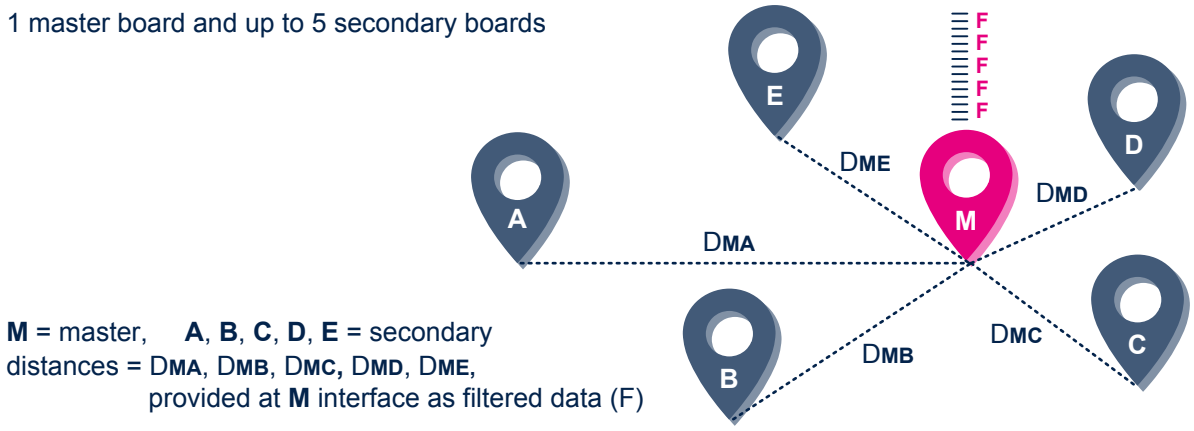
Step 8. Save the setup (`*.ini` file) in the suggested program directory.

Step 9. Press the Reset button to reset the board.
The terminal displays: `MEK MASTER ANCHOR [ID] STARTED`

3 Filtered 1D measurement

The filtered 1D measurement mode improves the accuracy of 1D measurements by post-processing the collected data with a filter. It is the default mode on B-UWB-MEK1 boards.

Figure 6. Filtered 1D measurement



Step 1. Check that the trace tool is closed.

Step 2. On the master board, check that the MODE switch is in position Master.

Step 3. Connect the master board to the computer.

- If no other B-UWB-MEK1 location mode was used before, skip steps 4 to 8 and jump to step 9 directly since filtered 1D measurement is the default setting.
- Otherwise, proceed with step 4.

Step 4. Open the MOD1/MEK1 programming tool and use the power switch to turn on the board.

Step 5. In the menu on the right, select the serial port of the master board.
The programming tool displays a progress bar and device information.

Step 6. In [**Localization**]>[**TYPE**], select [**1D_FILT**].

Step 7. Click on [**Apply Localization Parameters**].

Step 8. Wait until the progress bar displays OK.

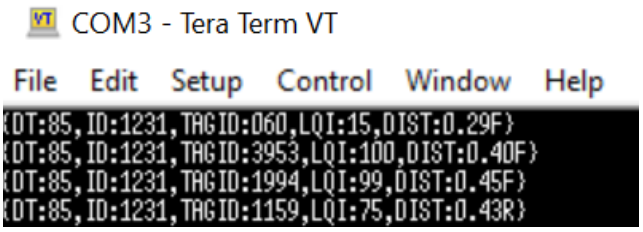
Step 9. On the secondary boards, set the MODE switch in the position opposite to Master

Step 10. Supply the secondary boards with 5 V power and use their power switches to turn them on.

Step 11. In the trace tool, open a new connection.

Step 12. Reset the master board.
The terminal displays filtered 1D measurement logs:

Figure 7. Filtered 1D measurement trace

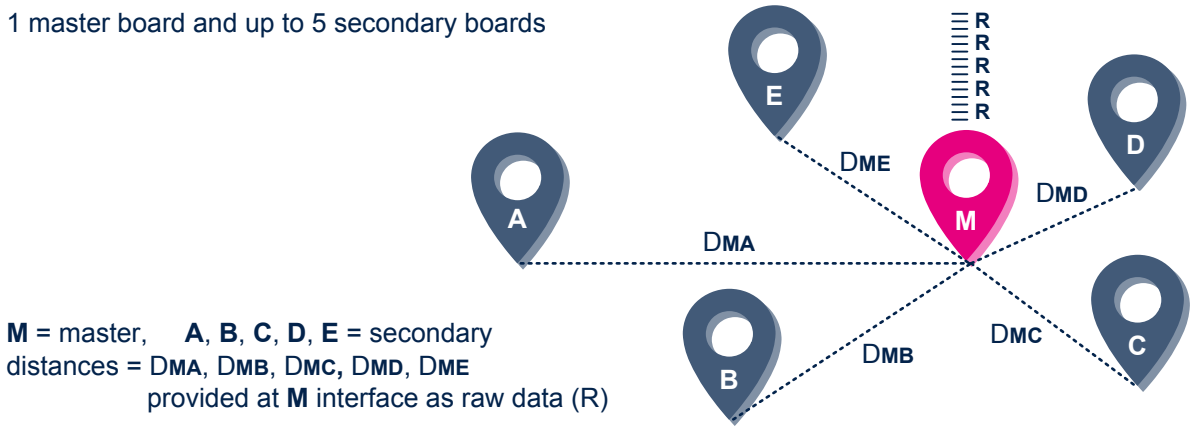


- `DT` (delta): time between measures in milliseconds (until decimal point)
- `ID`: device ID of the master board
- `TAGID`: device ID of the secondary board (each board on a separate line)
- `LQI` (link quality indicator): signal strength in percent
- `DIST` (distance): measurement between master and secondary in meters
- `F` at line end: indicates a filtered value

4 Raw 1D measurement

The raw 1D measurement mode provides 1D measurement data without any post-processing.

Figure 8. Raw 1D measurement



Step 1. Check that the trace tool is closed.

Step 2. On the master board, check that the MODE switch is in position Master.

Step 3. Connect the master board to the computer.

Step 4. Open the MOD1/MEK1 programming tool and use the power switch to turn on the board.

Step 5. In the menu on the right, select the serial port of the master board.
The programming tool displays a progress bar and device information.

Step 6. In [**Localization**]>[**TYPE**], select [**1D_RAW**].

Step 7. Click on [**Apply Localization Parameters**].

Step 8. Wait until the progress bar displays OK.

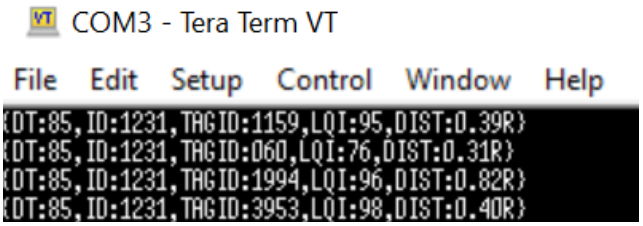
Step 9. On the secondary boards, set the MODE switch in the position opposite to Master

Step 10. Supply the secondary boards with 5 V power and use their power switches to turn them on.

Step 11. In the trace tool, open a new connection.

Step 12. Reset the master board.
The terminal displays raw 1D measurement logs:

Figure 9. Filtered 1D measurement trace



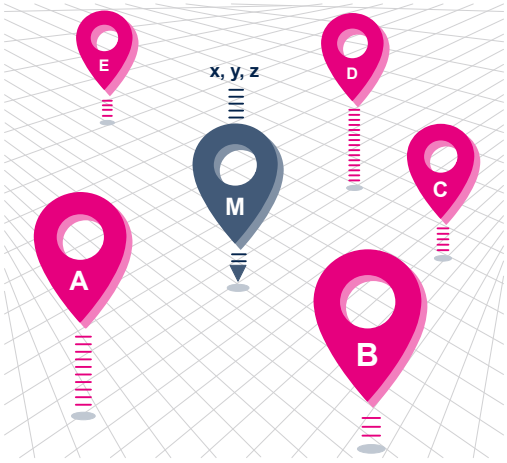
- `DT` (delta): time between measures in milliseconds (until decimal point)
- `ID`: device ID of the master board
- `TAGID`: device ID of the secondary board (each board on a separate line)
- `LQI` (link quality indicator): signal strength in percent
- `DIST` (distance): measurement between master and secondary in meters
- `R` at line end: indicates a raw value

5 3D single self-positioning

3D single self-positioning is ideal to track one single, fast-moving mobile device very precisely, at very high speed.

Figure 10. 3D single self-positioning

1 mobile master board and 3 to 5 fixed secondary boards (5 recommended)



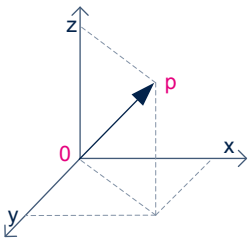
M = master, **A**, **B**, **C**, **D**, **E** = secondary
position (x, y z) of **M** computed and provided at **M** interface

Step 1. Deploy the setup (secondary boards):

Step 1a. Position the boards

Step 1b. Define a fixed reference point to measure the 3D coordinates of the fixed secondary board antennas according to the coordinate system.

Figure 11. 3D coordinate system



0 = defined reference point
p = secondary board position (antenna center)

Coordinates can be negative.

Step 1c. Measure the coordinates of each fixed secondary board according to this fixed reference.

Step 2. Prepare the master board:

Step 2a. Check that the trace tool is closed.

Step 2b. Check that the MODE switch is in position Master and use the power switch to turn on the board.

Step 2c. Connect the master board to the computer

Step 3. Configure the master board in the MOD1/MEK1 programming tool:

Step 3a. In the menu at the top of the right area, select the serial port of the master board.
The programming tool displays a progress bar and device information.

Step 3b. In [**Localization**]>[**TYPE**], select [**3D_SELF**].

Step 3c. In [**Localization**]>[**INFRA**], click on [**+**] to add the secondary boards to the configuration:

- *DeviceID*: enter the device IDs of the secondary boards
- *x, y, z*: enter the coordinates of the secondary boards in meters, using a point as decimal separator

Step 3d. Click on [**Apply Localization Parameters**].

Step 3e. Wait until the progress bar displays OK.

Step 4. Start 3D single self-positioning:

Step 4a. Check that the MODE switch is in the position opposite to Master on each secondary board.

Step 4b. Supply the secondary boards with 5 V power and use their power switches to turn them on.

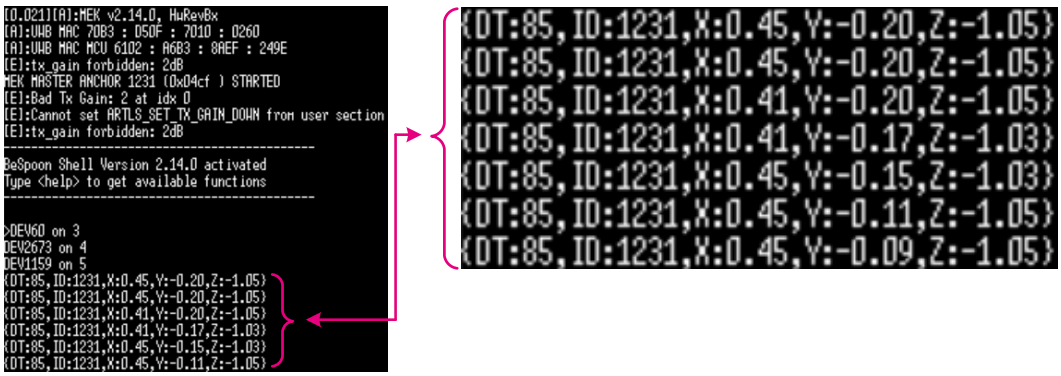
Step 4c. In the trace tool, open a new connection.

Step 4d. Reset the master board.

The terminal displays the following traces:

– `MEK MASTER ANCHOR [ID] STARTED`
– `DEV[Device ID]` for each board of the configuration
– 3D single self-positioning logs

Figure 12. Filtered 3D single self-positioning trace



– `DT` (delta): time between measures in milliseconds (until decimal point)
– `ID`: device ID of the master board being located
– `X, Y, Z`: 3D coordinates of the master board in meters

6 Go ahead or ask for support

This quick start guide deals with the most frequent B-UWB-MEK1 use cases requiring no customization. To get access to more functions, look for the adapted documentation in Reference documentation.

For support or information about standardized as well as customized solutions, refer to the UWB and product pages on *www.st.com*, or to the nearest STMicroelectronics office.

Appendix A Reference documentation

Table 1 presents a summary of the documents available for B-UWB-MEK1. Refer to the STMicroelectronics website at *www.st.com* for the latest updates.

Table 1. B-UWB-MEK1 related documents

Document	User profile	Source
B-UWB-MEK1 data brief	Basic	*www.st.com*
B-UWB-MOD1 data brief	Basic	
B-UWB-MEK1 quick start guide (this document)	Basic	
3D mode visualization in the location client	Advanced	SDK
Antenna offset adaptation	Advanced	
Filter adjustment for the location algorithm	Expert	
GPS-like mode within an existing RTLS	Advanced	
SFI modification	Expert	
Single self-positioning with tags	Advanced	
Information about the UWB system topologies	Expert	
SDK advanced documentation	Expert	

Appendix B Add devices

B.1 Prerequisites and configurations

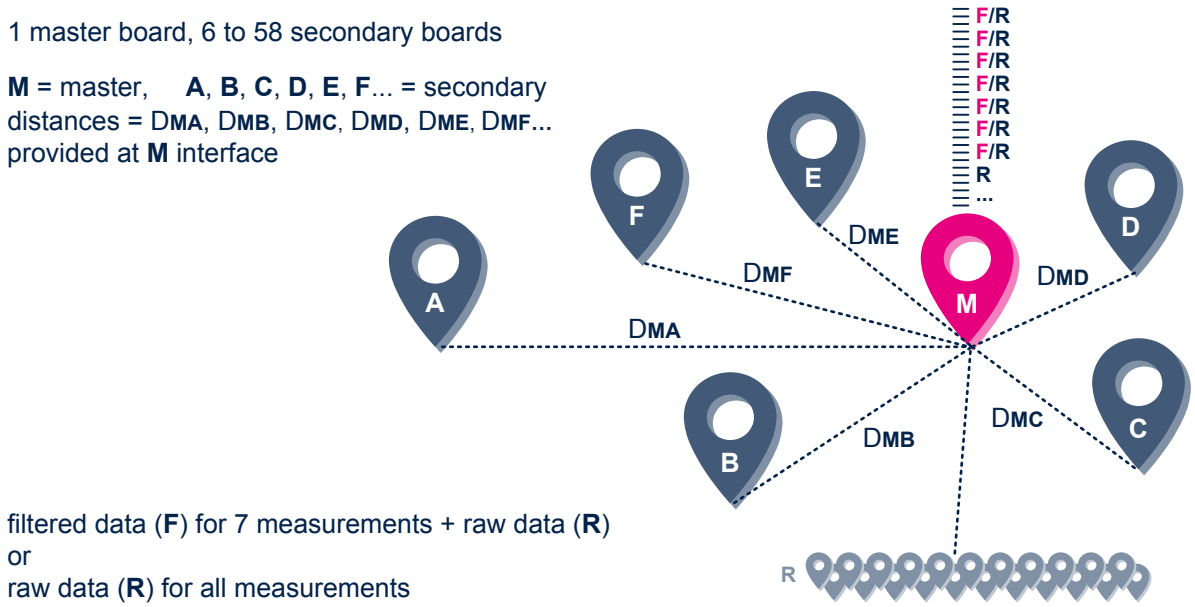
This appendix applies to measurement and positioning constellations with more than six devices in the following modes:

- Filtered and raw 1D measurement (refer to B.2)
- 3D single self-positioning (refer to B.3)

B.2 Filtered and raw 1D measurement with additional boards

This section details multiple 1D measurements with filtering limited to seven devices or without any post-processing. Refer to Section 3 and Section 4 for the description of the plain filtered 1D measurement and raw 1D measurement respectively.

Figure 13. Multiple filtered and raw 1D measurement



Step 1. Check that the trace tool is closed.

Step 2. On one board selected as the master board, put the MODE switch in position Master.

Step 3. On all other boards, put the MODE switch in the position opposite to Master.

Step 4. Adjust the rate parameters of each board, one after another:

- **Step 4a.** Connect the board to the computer.
- **Step 4b.** Open the MOD1/MEK1 programming tool and use the power switch to turn on the board.
- **Step 4c.** In the menu on the right, select the serial port of the board.
  The programming tool displays a progress bar and device information.
- **Step 4d.** In [**Settings**]>[**PROTOCOL RATE**], click on [**Wizard**].
- **Step 4e.** Select the base rate
- **Step 4f.** In the upcoming message box, select [**NO**].
- **Step 4g.** Enter the number of secondary boards used in the installation and validate.
- **Step 4h.** Click on [**Apply Settings**].
- **Step 4i.** Wait until the progress bar displays OK.

Step 5. Set the location system parameters:

- **Step 5a.** Check that the master board is connected to the computer and turned on.
- **Step 5b.** In the MOD1/MEK1 programming tool, in the menu at the top of the right area, select the serial port of the master board.
  The programming tool displays a progress bar and device information.
- **Step 5c.** In [**Localization**]>[**TYPE**], select [**1D_FILT**] or [**1D_RAW**].
- **Step 5d.** Click on [**Apply Localization Parameters**].
- **Step 5e.** Wait until the progress bar displays OK.

Step 6. Supply the secondary boards with 5 V power and use their power switches to turn them on.

Step 7. In the trace tool, open a new connection.

Step 8. Reset the master board.

The terminal displays 1D measurement logs:

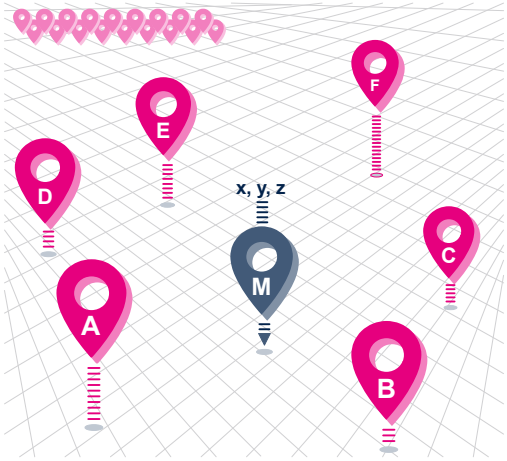
- `DT` (delta): time between measures in milliseconds (until decimal point)
- `ID`: device ID of the master board
- `TAGID`: device ID of the secondary board (each board on a separate line)
- `LQI` (link quality indicator): signal strength in percent
- `DIST` (distance): measurement between master and secondary in meters
- `F` at line end: indicates a filtered value
- `R` at line end: indicates a raw value

B.3 3D single self-positioning with an augmented constellation

3D single self-positioning is ideal to track one single, fast-moving mobile device very precisely, at very high speed. Adding secondary boards to the 3D self positioning constellation of fixed devices increases robustness and enables the coverage of larger areas. Refer to Section 5 for the description of the plain 3D single self-positioning.

Figure 14. 3D single self-positioning with additional fixed devices

1 mobile master board
6 to 52 fixed secondary boards



M = master, **A**, **B**, **C**, **D**, **E**, **F...** = secondary
position of **M** computed and provided at **M** interface

Step 1. Check that the trace tool is closed.

Step 2. On one board selected as the master board, put the MODE switch in position Master.

Step 3. On all other boards, put the MODE switch in the position opposite to Master.

Step 4. Adjust the rate parameters of each board, one after another:

- **Step 4a.** Connect the board to the computer.
- **Step 4b.** Open the MOD1/MEK1 programming tool and use the power switch to turn on the board.
- **Step 4c.** In the menu on the right, select the serial port of the board.
  The programming tool displays a progress bar and device information.
- **Step 4d.** In [**Settings**]>[**PROTOCOL RATE**], click on [**Wizard**].
- **Step 4e.** Select the base rate
- **Step 4f.** In the upcoming message box, select [**YES**].
- **Step 4g.** Enter the number of secondary boards used in the installation and validate.
- **Step 4h.** Click on [**Apply Settings**].
- **Step 4i.** Wait until the progress bar displays OK.

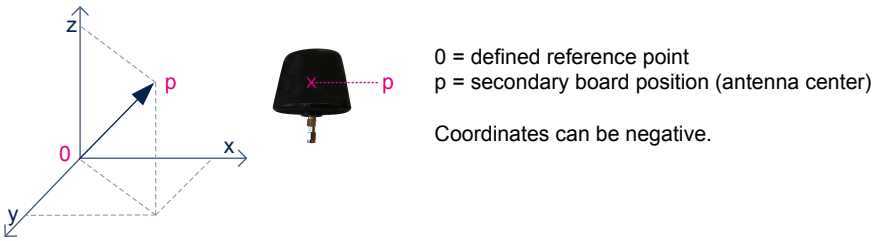
Step 5. Set the constellation of fixed secondary boards:

Step 5a. Position the secondary boards:

- Ensure intervals of at least 1.5 m between the devices
- Avoid alignments
- Avoid coplanarity

Step 5b. Define a fixed reference point to measure the 3D coordinates of the fixed secondary board antennas according to the coordinate system.

Figure 15. 3D coordinate system



Step 5c. Measure the coordinates of each fixed secondary board according to this fixed reference.

Step 6. Set the location system parameters:

Step 6a. Check that the master board is connected to the computer and turned on.

Step 6b. In the MOD1/MEK1 programming tool, in the menu at the top of the right area, select the serial port of the master board.

The programming tool displays a progress bar and device information.

Step 6c. In [**Localization**]>[**TYPE**], select [**3D_SELF**].

Step 6d. In [**Localization**]>[**INFRA**], click on [**+**] to add the secondary boards to the configuration:

- *DeviceID*: enter the device IDs of the secondary boards
- *x, y, z*: enter the coordinates of the secondary boards in meters, using a point as decimal separator

Step 6e. Click on [**Apply Localization Parameters**].

Step 6f. Wait until the progress bar displays OK.

Step 7. Supply the secondary boards with 5 V power and use their power switches to turn them on.

Step 8. In the trace tool, open a new connection.

Step 9. Reset the master board.

The terminal displays the following traces:

- `MEK MASTER ANCHOR [ID] STARTED`
- `DEV[Device ID]` for each board of the configuration
- 3D single self-positioning logs:
  - `DT` (delta): time between measures in milliseconds (until decimal point)
  - `ID`: device ID of the master board being located
  - `X, Y, Z`: 3D coordinates of the master board in meters

Appendix C Update the system

C.1 Update the system with default settings

This section is about:

- Upgrading firmware
- Resetting module and location infrastructure parameters

Follow this procedure to upgrade the system without integrating any particular module setting or location infrastructure parameters. To update firmware with customized settings, refer to C.2.

Repeat the procedure with every board used in the infrastructure.

Step 1. Connect the board to the computer via the USB.

Step 2. Open the MOD1/MEK1 programming tool and use the power switch to turn on the board.

Step 3. Check that the firmware version displayed on the right side is the latest one (Version 3.x) and proceed. If this is not the case, ask for support from the nearest STMicroelectronics office.

Step 4. In the menu on the right, select the serial port of the board.

Step 5. Wait until the progress bar on the right displays OK.

Step 6. In the *Program* tab, check that the following options are properly set:

- [**FLASH Firmware**]: *3.x. MEK1 Firmware*
- [**FLASH Settings**]: *MEK1 Default Settings*
- [**FLASH Localization**]: *Default Localization Parameters*

Step 7. Click on the [**Flash**] field at the bottom of the *Program* tab.

Step 8. Wait until the progress bar on the right displays OK.

The B-UWB-MEK1 boards and infrastructure are now up to date.

C.2 Update the system with customized settings

This section is about:

- Upgrading firmware
- Integrating customized module, customized location infrastructure parameters, or both

Follow this procedure to update firmware by considering specific conditions, either customized by STMicroelectronics before delivery or tuned on site.

Repeat the procedure with every board used in the infrastructure.

Step 1. Connect the board to the computer via the USB.

Step 2. Open the MOD1/MEK1 programming tool and use the power switch to turn on the board.

Step 3. Check that the firmware version displayed on the right side is the latest one (Version 3.x) and proceed. If this is not the case, ask for support from the nearest STMicroelectronics office.

Step 4. In the menu on the right, select the serial port of the board.

Step 5. Wait until the progress bar on the right displays OK.

Step 6. Export the customized module settings, the location infrastructure settings, or both:

- For module settings, in the *Settings* tab, click on [**Export settings**] and save the exported file.
- For location infrastructure setting, in the *Localization* tab, click on [**Export parameters**] and save the exported file.
- For module and location infrastructure settings, export and save both files

Step 7. In the *Program* tab:

Step 7a. Select [**FLASH Firmware**] and *3.x. MEK1 Firmware*

Step 7b. Import the needed customized settings:

- For module settings, select [**FLASH Settings**] and *Custom Settings File*
- For location infrastructure setting, select [**FLASH Localization**] and *Custom Localization File*
- For module and location infrastructure settings, select both files

Step 7c. For each import, click on the file icon to browse and find the previously saved file

Step 8. Click on the [**Flash**] field at the bottom of the *Program* tab.

Step 9. Wait until the progress bar on the right displays OK.

The B-UWB-MEK1 boards and infrastructure are now up to date with customized settings.

Revision history

Table 2. **Document revision history**

Date	Revision	Changes
17-Mar-2021	1	Initial release.

Contents

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