



LEAPS Social Distancing Monitor Quick Start Guide

Version 0.2

This document is subject to change without notice

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(3) LEAPS Software consists of the following components, which includes:

(a) The LEAPS SDM Networking Stack (“LEAPS SDM”) available as a binary code. The LEAPS Software runs on the DWM1001C module supplied by Qorvo Inc. UWBU (former Decawave Ltd.). It provides high precision range and indication with other modules using Ultra-wideband.

(4) The following third party components are used by LEAPS Software and are incorporated in the Firmware or included in the Software Bundle as the case may be:

(a) The LEAPS Software incorporates Zephyr RTOS 2.2.0 with Bluetooth Software Stack that is included in the Firmware. The Zephyr RTOS is a community project that is provided under the terms of an open source licence. For more details, kindly visit the link below:

<https://github.com/zephyrproject-rtos/zephyr/blob/master/LICENSE;>

(b) The LEAPS Software uses an open source CRC-32 function from FreeBSD which is included in the Software Bundle. This CRC-32 function is provided under the terms of the BSD licence. For more details, kindly visit the link below:

<https://github.com/freebsd/freebsd/blob/386ddae58459341ec567604707805814a2128a57/COPYRIGHT;>

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Feature list

Limits that apply for the demo binary code

RUNTIME IS LIMITED TO 2 HOURS. RESET MUST BE DONE TO MAKE IT WORK AGAIN.

Features in demo version 0.2

- Distance monitor and indication between stand-alone mobile devices. Infrastructure-less system.
- Distance precision 30 cm or better.
- Complete privacy by default.
- Update rate is set to 2 Hz by default.
- Uses Ultra-wideband and Bluetooth wireless technology to balance the best precision and low power consumption (based on DWM1001 module).
- Indication using BLUE LED on DWM1001-DEV board. The maximum distance threshold when the LED starts blinking is set to 2.5 m. The minimum distance threshold is set to 1m when the indication will be constantly ON.
- Battery lifetime which operates for 24 hours uses a 500 mAh LiPo at 2 Hz update rate on a DWM1001C module (depending on device density). Please note the DWM1001-DEV carrier board is not optimized for power consumption, and the battery lifetime might be shorter.
- Configurable parameters include update rate, network ID and accelerometer sensitivity.
- API: on-module UART Shell.
- Multiple networks is possible. This allows the separation of the Tags into different groups. Tags will measure only with other Tags from its network.
- Known issues and limits in this version.
 - Current testing has been done using 30 Tags due to limited amount of hardware and time. More in-depth testing will be done soon in the next version.
 - The same update rates must be applied to all nodes to function properly.

Features in the next version

- Expected in June 2020.
- Bug fixes and testing with a larger deployment.
- Improvements in the networking protocol.
- Accelerometer will be used to reduce the update rate or to disable the measurements when in motion.
- Additional configurable parameters: distance thresholds and accelerometer sensitivity.
- On-module data logger and measurement statistics.
- Bridge and gateway functionality (optional)

- Statistical data offload to the gateway (automatically offloaded as the node passes by).
- Real-time measurement data offload to the gateway.

Hardware

The demo is intended to be used on modules of MDEK1001 Development Kit supplied by Qorvo Inc. UWBU (former Decawave).

List of hardware

- At least 2 DWM1001-DEV modules (or a device with DWM1001C embedded).
- 1 micro-USB B data cable to be used for programming (must be a data cable).
- Battery or other proper power source for the modules can be used.

Please note that there are some limitations when using the MDEK1001 for the demo

- The Red LED on DWM1001-DEV when powered via USB is from the charger. The Red LED of the charger blinks because the power from the DCDC on the carrier board dips on transmission/reception. On a well designed carrier board this problem does not occur. Another option is to power the DWM1001-DEV using a battery. Please see the MDEK1001 manual for more information.
- Due to this reason the Blue LED is used for indication to make it more visible when powered from the USB.
- The DWM1001-DEV is not optimized for power consumption. It will not provide the battery lifetime as it is on a well-designed carrier board and as the LEAPS SDM is capable of achieving.

An example of a hardware setup



Software

Software download

Please download the software package from <https://www.leapslabs.com/download-sdm>.

Software package content

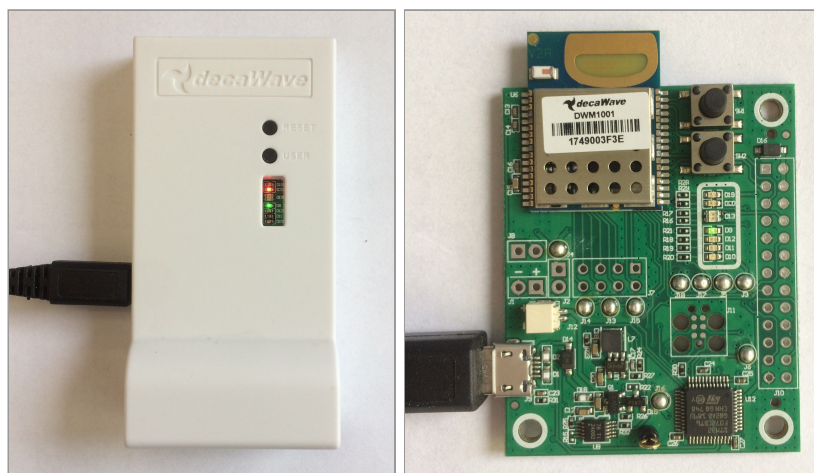
README

<code>leaps-sdm-demo-dwm1001c-v0.2.hex</code>	Firmware image with all binaries in .hex formats
<code>reflash-leaps-sdm-dwm1001c.bat</code>	Script for reflashing all-in-one binary using OpenOCD on Windows
<code>reflash-leaps-sdm-dwm1001c.sh</code>	Script for reflashing all-in-one binary using OpenOCD on Linux
<code>openocd-swd-dwm1001c.cfg</code> (tested on OpenOCD version 0.10.0)	OpenOCD configuration script for DWM1001C

Programming the binary

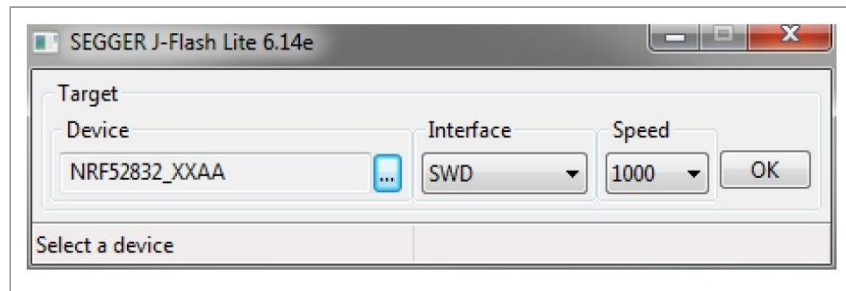
The necessary steps to flash the factory image on the DWM1001-DEV board are described below. The DWM1001-DEV contains an on-board J-Link programmer. The J-Flash Light software tool can be used to flash the image. An alternative is to use the open source tool OpenOCD which is available on various platforms.

- Download and install Segger J-Flash Lite (J-Link software suite) <https://www.segger.com/downloads/jlink/#J-LinkSoftwareAndDocumentationPack>
- Connect the module with a micro USB data cable as shown below.

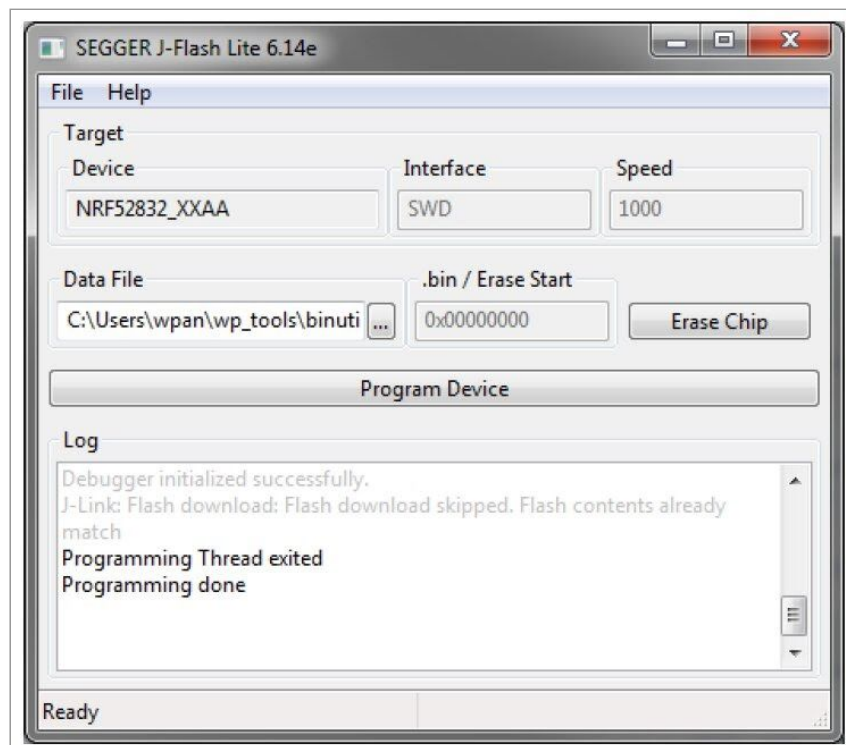


- Open J-Flash Lite.

- Choose nrf52832_XXAA as Device and SWD as interface. Use default speed 1000 and click “**OK**”.



- Click “**Erase Chip**” to do a full chip erase.



- In Data File, click “...” and browse to the hex file provided in the LEAPS SDM Software package (/leaps-sdm-demo-dwm1001c-v0.2/leaps-sdm-demo-dwm1001c-v0.2.hex) to flash. Then click “**Program Device**”.
- The LEDs on the boards should be active once the flash update completed.

Evaluation

Each device will act as a stand-alone Tag. The Tags uses Bluetooth and Ultra-wideband for an effective communication with other devices that can provide high precision distance measurements in a high density network and still provide the best battery lifetime.

In this demo the LEDs are used for evaluating the functionality of the system.

When operating the Green LED will blink shortly. The Green LED can be seen on the following figure.



When it is within a defined distance threshold with another Tag the Blue LED will start blinking. When it passes the minimum distance threshold the Blue LED will stay ON until the Tag leaves the threshold.



Optional configuration

The device can be optionally configured via an on-module Shell. This is unnecessary for most of the evaluation and it is recommended only for advanced users. Please follow the documentation of MDEK1001 to connect to the Shell.

Use '?' or 'help' commands to list the available commands with their usage information.

Next step

Thank you for testing LEAPS SDM Demo! Please send us your suggestions for further improvement to serve you better. We would really appreciate your feedback!

Interested?

LEAPS provides the following products and services

- Solutions
 - IoT modules: PCB Modules with LEAPS firmware
 - OEM end-user hardware
 - Tags - a wearable device with Buzzer and a haptic motor integrated.
 - Bridges, Gateways - industry ready devices.
- Evaluation kits
- Technology licensing
- Design services, customization services, technical support

Please contact sales@leapslabs.com if you are interested in our services.

Please note that LEAPS focuses on providing the technology to be used in product and service integration. It is worthy to note that we do not provide end-products. In a situation where you need an end-product we will be happy to introduce you to our partner companies.

References

- [MDEK1001 Development Kit](#)
- [DWM1001C module](#)
- DWM1001 Firmware User Guide v1.3 [DWM1001-Firmware-User-Guide.pdf]
- [Zephyr Project](#)

Document History

Revision	Date	Description	Revised By
0.2	05-May-2020	SDM Demo v0.2	LEAPS
0.1	30-Apr-2020	SDM Demo v0.1	LEAPS

About LEAPS

LEAPS is a company based in Prague, the Czech Republic. It focuses on building and marketing Real-Time Location and Real-Time Telemetry systems based on Ultra-wideband. Founded in 2016, the company is known for designing and developing Qorvo's (former Decawave) DWM1001 modules and PANS.

LEAPS is an advanced modular system under development and will be marketed under the LEAPS brand. PANS can be considered the Lite version of LEAPS (Freemium model).