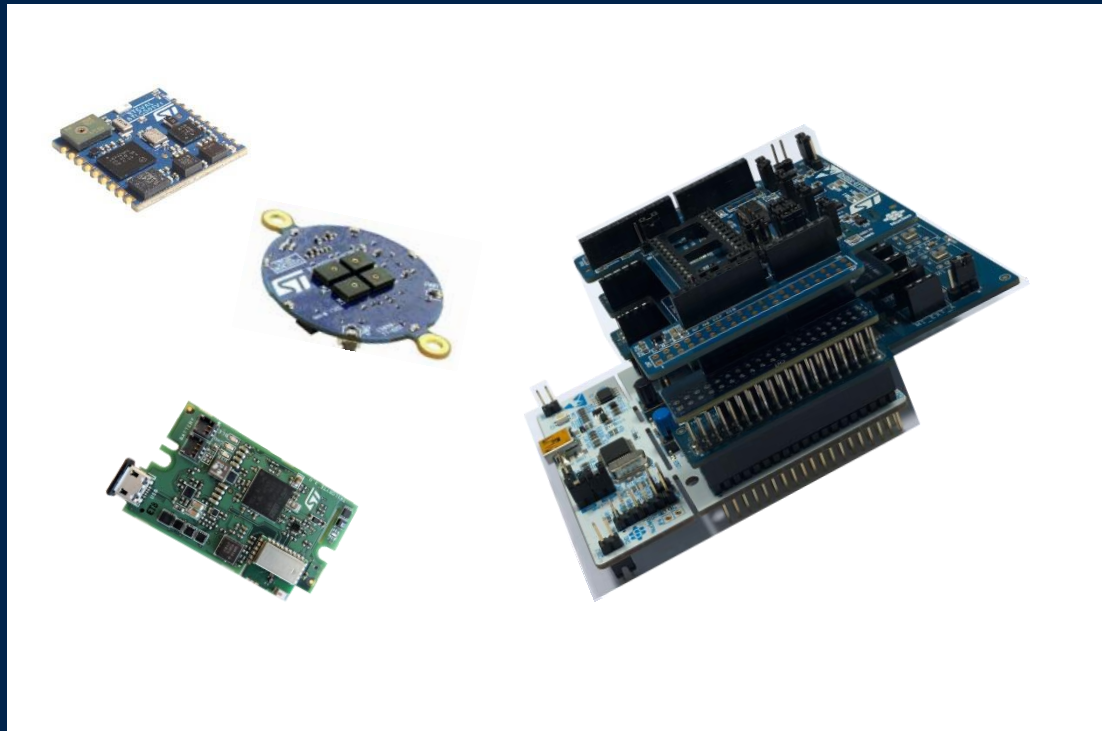




life.augmented



Quick Start Guide

STM32Cube function pack for ultra-low power IoT node with BLE connectivity, digital microphone, environmental and motion sensors (FP-SNS-ALLMEMS2)

Version 2.1.0 (May 15, 2020)

Agenda

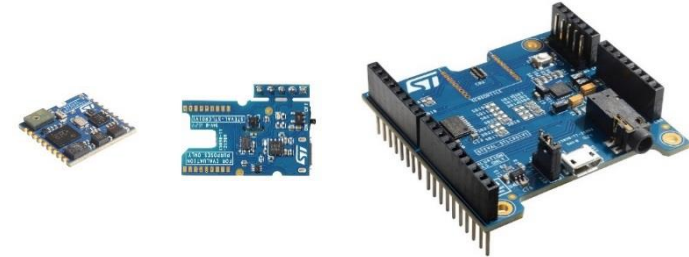
- 1 Hardware and Software overview
- 2 Setup & Demo Examples
- 3 Documents & Related Resources
- 4 STM32 Open Development Environment: Overview

1- Hardware and Software overview

Hardware Overview

Sample implementations are available for:

1. STM32 Nucleo with expansion boards
 - NUCLEO-F446RE (or NUCLEO-L476RG) + X-NUCLEO-CCA02M2 + X-NUCLEO-BNRG2A1 + X-NUCLEO-IKS01A2
2. STEVAL-STLKT01V1 evaluation boards
 - STEVAL-STLCS01V1 + STEVAL-STLCR01V1 + STEVAL-STLCX01V1
3. STEVAL-BCNKT01V1 evaluation boards
 - STEVAL-BCNCS01V1 + STEVAL-BCNCR01V1 + STEVAL-BCNST01V1
4. STEVAL-MKSBOX1V1 evaluation boards



Motion MEMS and environmental sensors expansion board

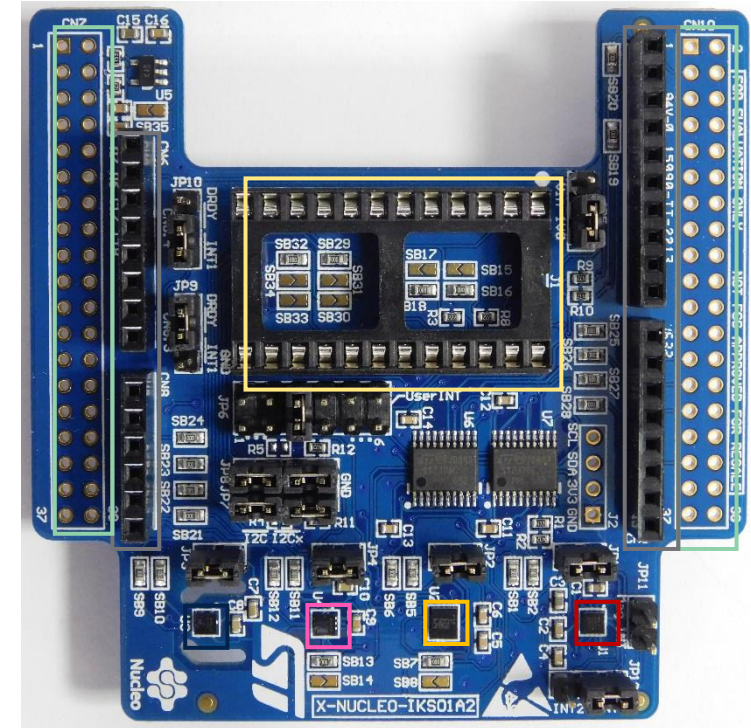
STM32 Nucleo with Expansion boards - Hardware Overview (1/8)

X-NUCLEO-IKS01A2 Hardware Description

- The X-NUCLEO-IKS01A2 is a motion MEMS and environmental sensor evaluation board system.
- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST's latest sensors.

Key Product on board

- LSM6DSL MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g) + 3D gyroscope ($\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$ dps)
- LSM303AGR MEMS 3D magnetometer (± 50 gauss) + MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g)
- LPS22HB MEMS pressure sensor, 260-1260 hPa absolute digital output barometer
- HTS221 Capacitive digital relative humidity and temperature
- DIL 24-pin Socket available for additional MEMS adapters and other sensors (UV index)



- | | | |
|--|---|--|
|  HTS221 |  LSM6DSL |  ST morpho connector** |
|  LPS22HB |  LSM303AGR |  Arduino UNO R3 connector |
|  DIL 24-pin | ** Connector for the STM32 Nucleo Board | |

Latest info available at www.st.com
X-NUCLEO-IKS01A2

Motion MEMS and environmental sensors expansion board

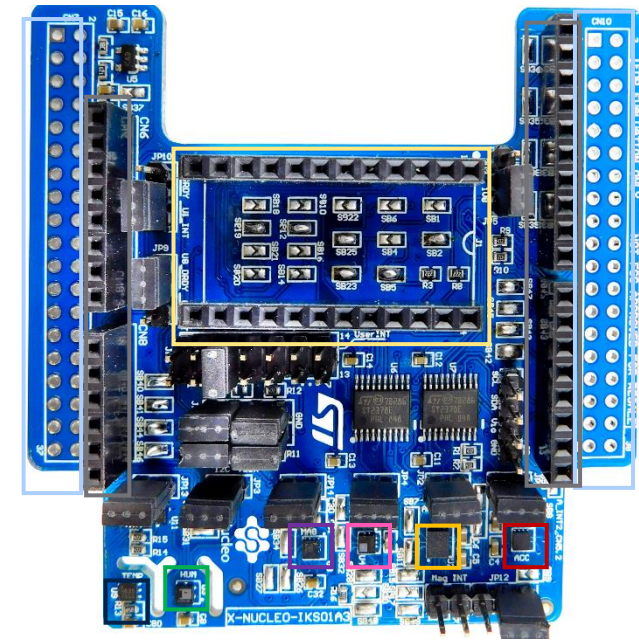
STM32 Nucleo with Expansion boards - Hardware Overview (2/8)


X-NUCLEO-IKS01A3 Hardware Description

- The X-NUCLEO-IKS01A3 is a motion MEMS and environmental sensor evaluation board system.
- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST's latest sensors.

Key Product on board

- LSM6DSO MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g) + 3D gyroscope ($\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000$ dps)
- LIS2DW12 MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g)
- LIS2MDL MEMS 3D magnetometer (± 50 gauss)
- LPS22HH MEMS pressure sensor, 260-1260 hPa absolute digital output barometer
- HTS221: Capacitive digital relative humidity and temperature
- STTS751 Digital Temperature sensor
- DIL 24-pin Socket available for additional MEMS adapters and other sensors (UV index)



 HTS221	 LSM6DSO	 ST morpho connector**
 LPS22HH	 LIS2DW12	 Arduino UNO R3 connector
 LIS2MDL	 STTS751	 DIL 24-pin

** Connector for the STM32 Nucleo Board

Bluetooth Low Energy Expansion Board

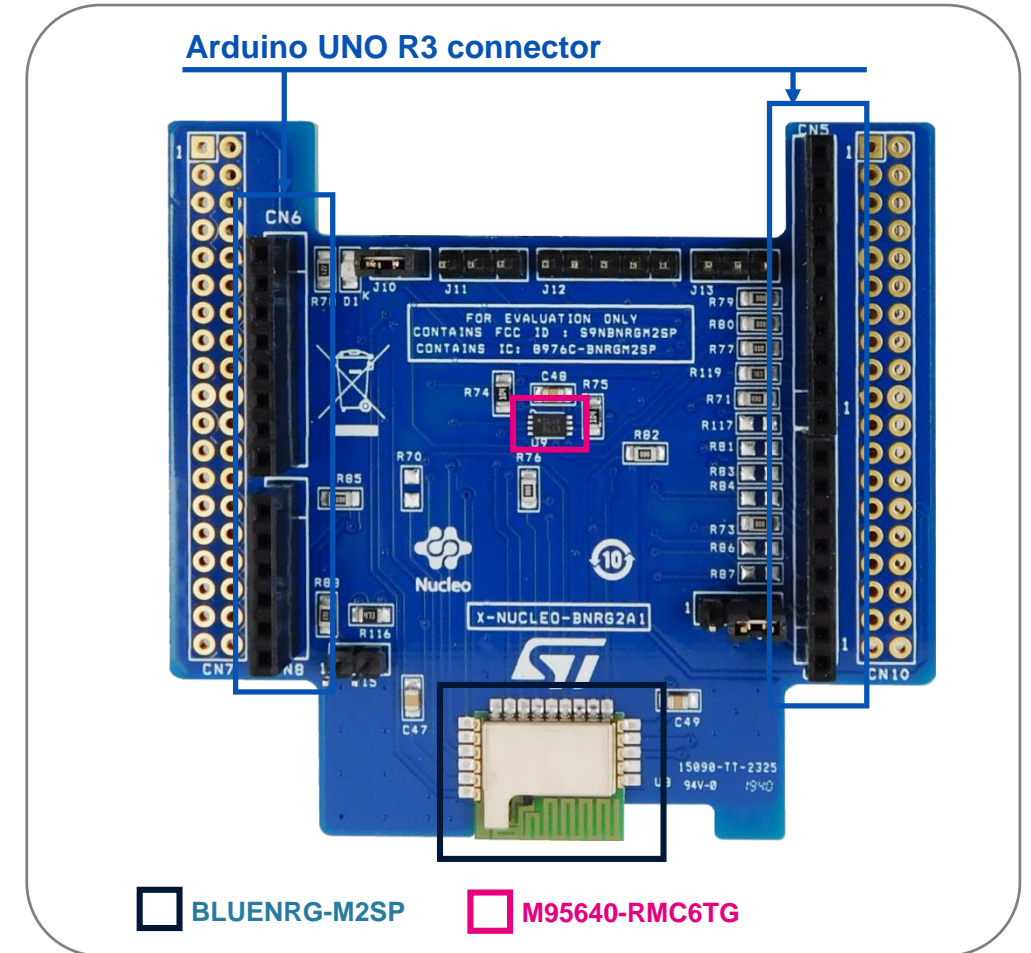
STM32 Nucleo with Expansion boards - Hardware Overview (3/8)

X-NUCLEO-BNRG2A1 Hardware Description

- The X-NUCLEO-BNRG2A1 is a Bluetooth Low Energy (BLE) evaluation and development board system, designed around ST's BLUENRG-M2SP Bluetooth Low Energy module based on BlueNRG-2.
- The BlueNRG-2 processor hosted in the BLUENRG-M2SP module communicates with the STM32 microcontroller, hosted on the Nucleo development board, through an SPI link available on the Arduino UNO R3 connector.

Key Product on board

- BLUENRG-M2SP Bluetooth Low Energy, FCC and IC certified (FCC ID: S9NBNRGM2SP, IC: B976C-BNRGM2SP), module based on Bluetooth® Low Energy wireless network processor BlueNRG-2, BLE v5.0 compliant.
- BLUENRG-M2SP integrates a BALF-NRG-02D3 balun and a PCB antenna. It embeds 32 MHz crystal oscillator for the BlueNRG-2.
- M95640-RMC6TG 64-Kbit serial SPI bus EEPROM with high-speed clock interface



Latest info available at www.st.com
X-NUCLEO-BNRG2A1

MEMS Microphones expansion board (X-NUCLEO-CCA02M2)

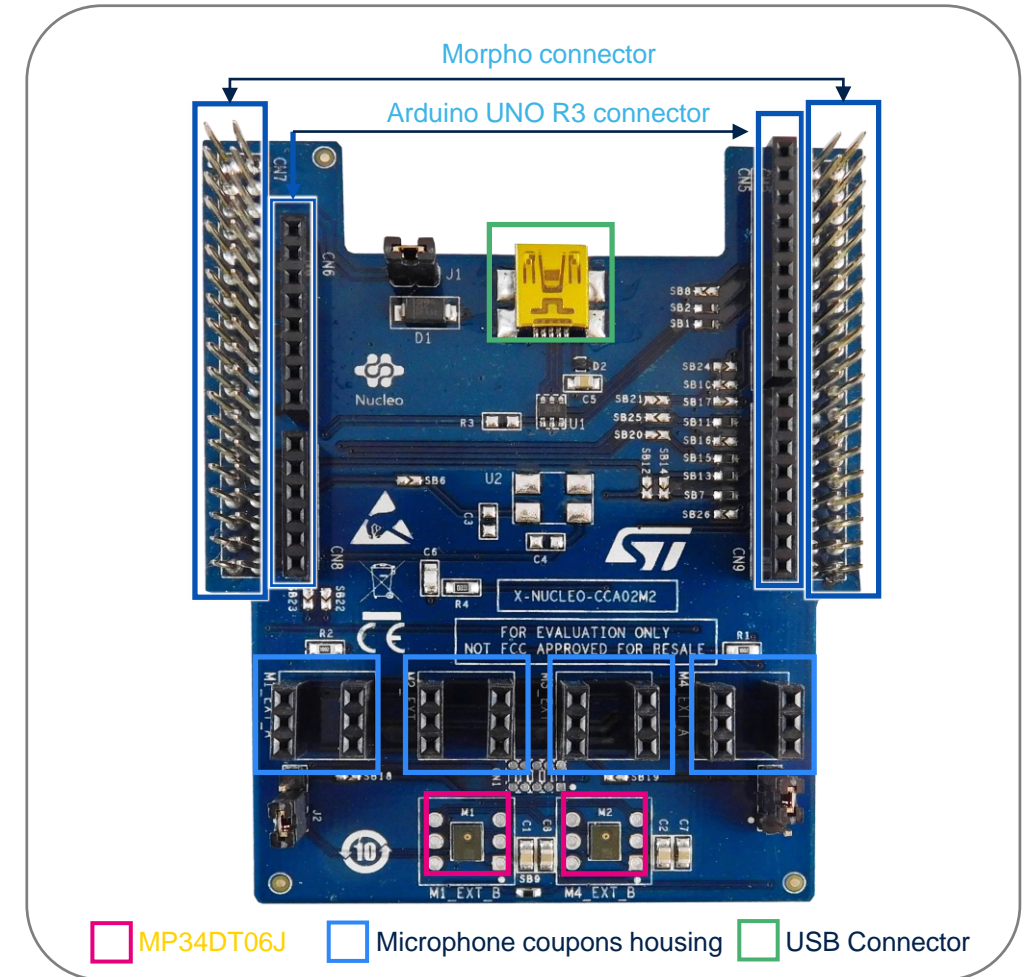
STM32 Nucleo with Expansion boards - Hardware Overview (4/8)

X-NUCLEO-CCA02M2 Hardware Description

- The X-NUCLEO-CCA02M2 is an expansion board that has been designed around MP34DT06J digital MEMS microphone. It is compatible with the ST morpho connector layout and with digital microphone coupon boards such as STEVAL-MIC001V1, STEVAL-MIC002V1 and STEVAL-MIC003V1.
- The X-NUCLEO-CCA02M2 embeds two MP34DT06J microphones and allows synchronized acquisition and streaming of up to 4 microphones through I²S, SPI, DFSDM or SAI peripherals.

Key Product on board

- MP34DT06J ultra-compact, low-power, omnidirectional, digital MEMS microphone built with a capacitive sensing element and an IC interface.



Latest info available at www.st.com
X-NUCLEO-CCA02M2

Important Hardware Additional Information

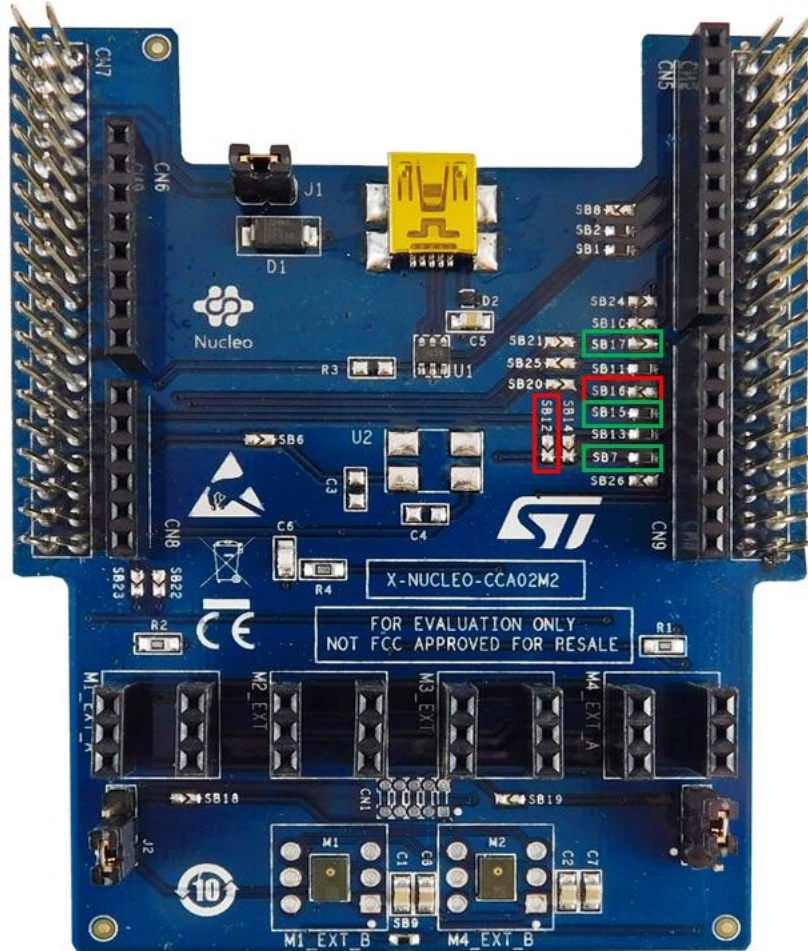
STM32 Nucleo with Expansion boards - Hardware Overview (5/8)

1. For F4xx STM32 Nucleo motherboard, there is an hardware conflict between the X-NUCLEO-IKS01A2 expansion board and the X-NUCLEO-CCA02M2 expansion board through the Arduino UNO R3 extension connector. The hardware conflict is onto 5,6 and 7 pin of the CN9 arduino
 - a) For X-NUCLEO-IKS01A2:
 - In the pin 5 (SB27) and 6 (SB26) there are the interrupts INT1 and INT2 for LSM6DSL component (used for the feature hardware)
 - In the pin 7 (SB25) there is the interrupt for LPS22HB component
 - b) For X-NUCLEO-CCA02M2:
 - In the pin 5 (SB7) there is the clock for the Microphones
 - In the pin 6 (SB15) there is the clock x2 for the Microphones
 - In the pin 7 (SB17) there is the connection for the microphone PDM34 (solder bridge open as default)
2. For F4xx STM32 Nucleo motherboard, there is an hardware conflict between the X-NUCLEO-IKS01A3 expansion board and the X-NUCLEO-CCA02M2 expansion board through the Arduino UNO R3 extension connector. The hardware conflict is onto 5,6 and 7 pin of the CN9 arduino
 - a) For X-NUCLEO-IKS01A3:
 - In the pin 5 (SB43) and 6 (SB45) there are the interrupts INT1 and INT2 for LSM6DSL component (used for the feature hardware)
 - In the pin 7 (SB47) there is the interrupt for LPS22HB component
 - b) For X-NUCLEO-CCA02M2:
 - In the pin 5 (SB7) there is the clock for the Microphones
 - In the pin 6 (SB15) there is the clock x2 for the Microphones
 - In the pin 7 (SB17) there is the connection for the microphone PDM34 (solder bridge open as default)

For this reason the hardware features are not available for F4xx STM32 Nucleo motherboard (The related gpio pins is not configured).

Important Hardware Additional Information

STM32 Nucleo with Expansion boards - Hardware Overview (6/8)



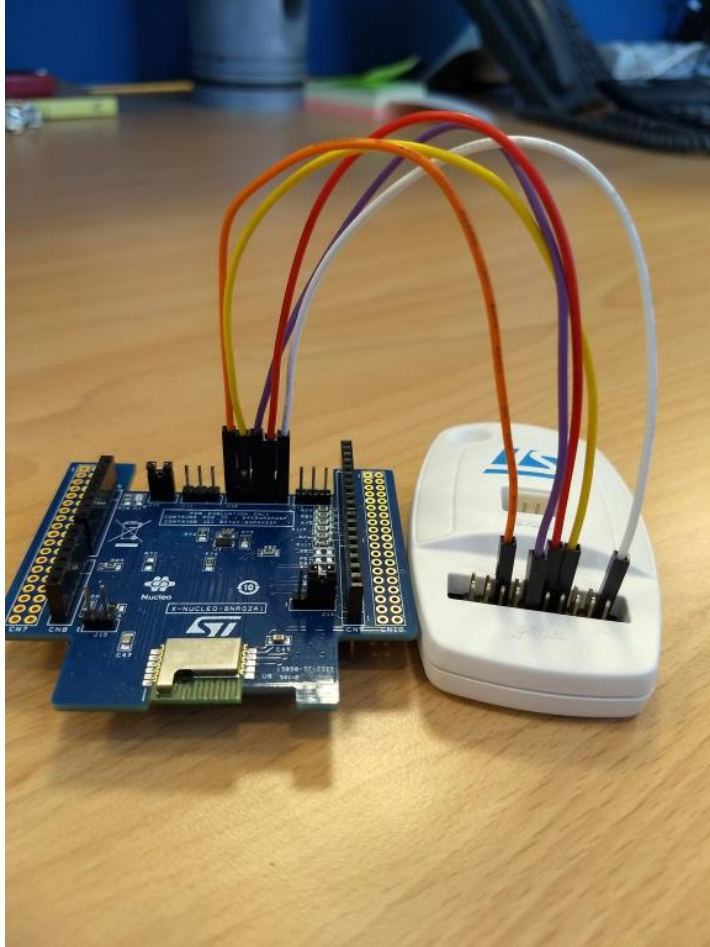
Modifications of the X-NUCLEO-CCA02M2 board

3. With L4 STM32 Nucleo motherboard:

- a) before to connect the board X-NUCLEO-CCA02M2 with the STM32 L4 Nucleo motherboard through the Morpho connector layout onto X-NUCLEO-CCA02M2 board:
 - close the solder bridges SB12, SB16 (red highlight) and open the solder bridges SB7, SB15 and SB17 (green highlight - To enable the signal clock from L4 Nucleo motherboard)
 - if additional microphones are plugged in the board, close the solder bridge SB17.
- b) before to connect the X-NUCLEO-IKS01A2 expansion board with the X-NUCLEO-CCA02M2 expansion board:
 - remove the solder bridge SB25 if additional microphones are plugged onto X-NUCLEO-CCA02M2 board
- c) before to connect the X-NUCLEO-IKS01A3 expansion board with the X-NUCLEO-CCA02M2 expansion board:
 - remove the solder bridge SB47 if additional microphones are plugged onto X-NUCLEO-CCA02M2 board

Important Hardware Additional Information

STM32 Nucleo with Expansion boards - Hardware Overview (7/8)



BlueNRG-2 library does not work with the stock firmware that is loaded in the BLE module of X-NUCLEO-BNRG2A1 expansion board.

For this reason:

- first of all, it is needed to solder on X-NUCLEO-BNRG2A1, if it is not soldered, a 0 Ohm resistor at R117.
- Then you can use a standard ST-Link V2-1 with 5 jumper wires female-female together with STSW-BNRGFLASHER software tool (currently available only for Windows PC) in order to update the firmware of the BLE module of X-NUCLEO-BNRG2A1.

You need to connect the J12 pins of the X-NUCLEO-BNRG2A1 to the pins of the ST-Link V2-1 as shown in the picture and follow the steps show in the next slide.

In particular we have the following connections:

	J12	ST-Link V2-1
Pin	1	1
Pin	2	9
Pin	3	12
Pin	4	7
Pin	5	15

BlueCoin Starter kit (STEVAL-BCNKT01V1)

Hardware Overview

BlueCoin Starter kit Hardware Description

- STEVAL-BCNKT01V1 is the starter kit for the BlueCoin board (STEVAL-BCNCS01V1), a highly integrated development and prototyping platform for augmented acoustic and motion sensing, aiming to improve system design cycle and accelerate delivery of results
- Two host boards are also provided as part of the kit:
 - The CoinStation provides audio output, battery management and two Time-of-flight ranging sensors.
 - The Cradle is a small host board featuring USB and SD card interfaces, it is useful for on-the-field testing and data acquisition campaigns.

Key Product on board

- BlueCoin module (STEVAL-BCNCS01V1) with STM32F446, LSM6DSM, LSM303AGR, LPS22HB, 4x MP34DT06J, BlueNRG-MS, BALF-NRG-01D3, STBC03JR
- CoinStation (STEVAL-BCNST01V1) board
- BlueCoin Cradle (STEVAL-BCNCR01V1)
- 130 mAh Li-Po battery
- Plastic box for housing the BlueCoin cradle and the battery
- SWD programming cable



Latest info available at www.st.com
STEVAL-BCNKT01V1

SensorTile development kit (STEVAL-STLKT01V1)

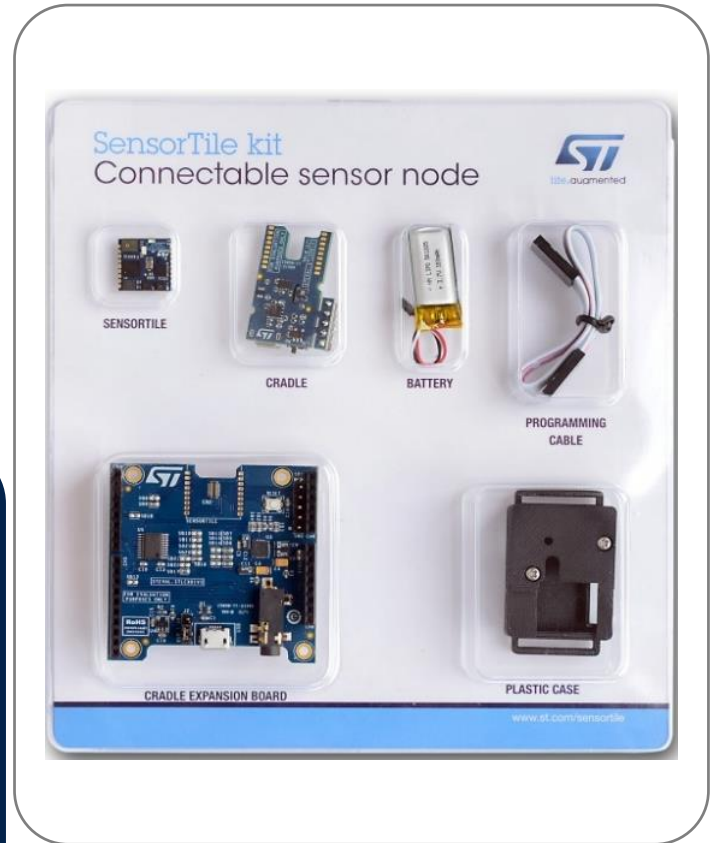
Hardware Overview

SensorTile development kit Hardware Description

- STEVAL-STLKT01V1 is the development kit for the SensorTile board (STLCS01V1), a highly Integrated Development Platform with a broad range of functionalities aiming to improve system design cycle and accelerate delivery of results
- Two host boards are also provided as part of the kit, both featuring SWD programming interface
 - Cradle expansion has a plugin connection for SensorTile Core System and an Arduino interface
 - The Cradle is a small host featuring battery charger and SD card interface that supports on-the-field testing and data acquisition campaigns

Key Product on board

- SensorTile module (STEVAL-STLCS01V1) with STM32L476JG, LSM6DSM, LSM303AGR, LPS22HB, MP34DT05-A, BlueNRG-MS, BALF-NRG-02D3 and LD39115J18R
- SensorTile expansion Cradle board equipped with audio DAC, USB port, STM32 Nucleo, Arduino UNO R3 and SWD connector
- SensorTile Cradle with battery charger, humidity and temperature sensor, SD memory card slot, USB port and breakaway SWD connector
- 100 mAh Li-Ion battery
- Plastic box
- SWD programming cable



Latest info available at www.st.com/STEVAL-STLKT01V1

SensorTile.box wireless multi sensor development kit (STEVAL-MKSBOX1V1)

Hardware Overview

SensorTile.box wireless multi sensor development kit Hardware Description

- The STEVAL-MKSBOX1V1 (SensorTile.box) is a ready-to-use box kit with wireless IoT and wearable sensor platform to help you use and develop apps based on remote motion and environmental sensor data, regardless of your level of expertise.
- The SensorTile.box board fits into a small plastic shroud with a long-life rechargeable battery, and the ST BLE Sensor app on your smartphone connects via Bluetooth to the board and allows you to immediately begin using the wide range of default IoT and wearable sensor applications.
- SensorTile.box includes a firmware programming and debugging interface that allows professional developers to engage in more complex firmware code development using the STM32 Open Development Environment (STM32 ODE), which includes a sensing AI function pack with neural network libraries

Key Product on board

- Ultra-low-power STM32L4 Series MCUs based on ARM® Cortex® -M4 MCU 120 MHz with 2048 kbytes Flash (STM32L4R9ZI)
- Accurate temperature : STTS22H
- Low power precise 6x IMU: LSM6DSOX
- Stand-alone XLs: LIS3DHH, LIS2DW12
- Magnetometer: LIS2MDL
- Altimeter / pressure sensor : LPS22HH
- Wide-band microphone: MP23ABS1
- Humidity sensor: HTS221



Latest info available at www.st.com
STEVAL-MKSBOX1V1

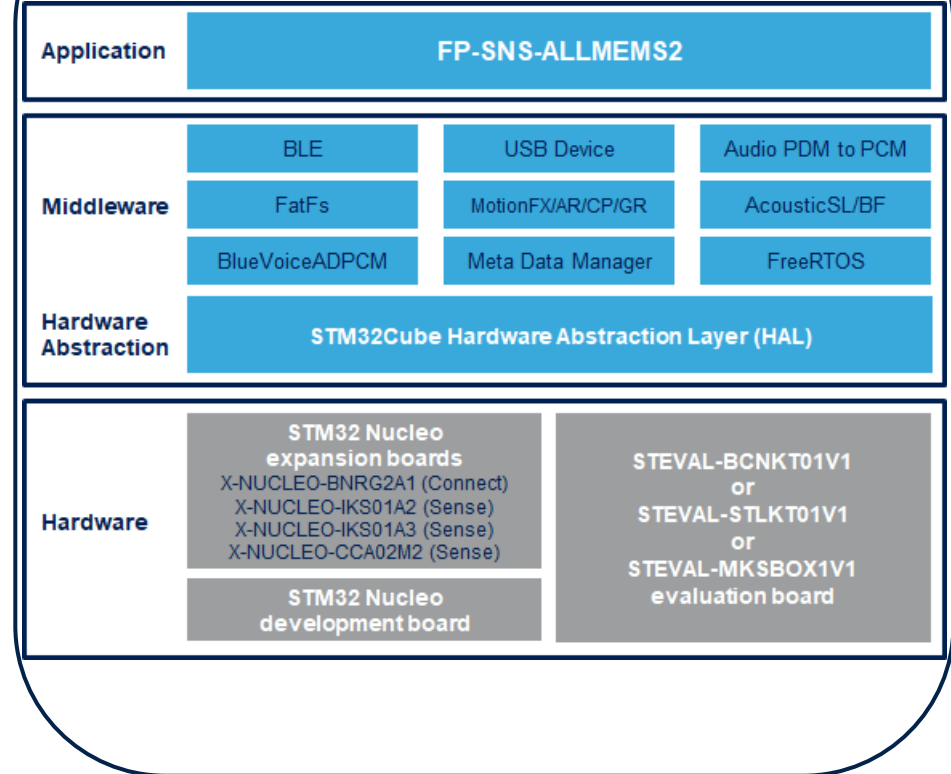
Software Description

- FP-SNS-ALLMEMS2 is an STM32Cube function pack which lets you connect your IoT node to a smartphone via BLE and use a suitable Android™ or iOS™ application, like the STBLESensor app, to view real-time environmental and motion sensor data, digital microphone and battery levels. It provides features similar to the FP-SNS-ALLMEMS1 function pack, but with a different implementation for ultra-low power consumption.
- The package also enables advanced functions such as voice communication over BLE, sound source localization and acoustic beam forming using inputs from multiple microphones, as well as sensor data fusion and accelerometer-based real-time activity recognition, audio data logging and MEMS sensor data logging on SD card.
- This package, together with the suggested combination of STM32 and ST devices, can be used to develop specific wearable applications or smart things applications in general, where ultra-low power consumption is a key requirement.

Key features

- Complete firmware to develop an IoT node with BLE connectivity, digital microphone, environmental and motion sensors.
- Middlewares libraries for sensor data fusion and accelerometer-based real-time activity recognition, acoustic source localization and beam forming, audio processing and streaming over BLE communication profile, SD Card data logging FreeRTOS operate system.
- Compatible with STBLESensor application for Android/iOS, to perform sensors data reading, audio and motion algorithms features demo, and firmware update (FOTA).
- Easy portability across different MCU families, thanks to STM32Cube.
- Free, user-friendly license terms.

Overall Software Architecture



Latest info available at www.st.com
FP-SNS-ALLMEMS2

2- Setup & Demo Examples

Setup & Demo Examples

Software and Other prerequisites

- **STSW-LINK004**
 - STM32 ST-LINK Utility (STSW-LINK004) is a full-featured software interface for programming STM32 microcontrollers
- **FP-SNS-ALLMEMS2**
 - Copy the .zip file content into a folder on your PC. The package will contain source code example (Keil, IAR, STM32CubeIDE) based only on **NUCLEO-F446RE** or **NUCLEO-L476RG** or **STEVAL-BCNKT01V1** or **STEVAL-STLKT01V1** or **STEVAL-MKSBOX1V1**
- **ST BLE Sensor** Application for Android/iOS to download from Google Store / iTunes

2.1- Setup Overview: STM32 Nucleo with Expansion boards

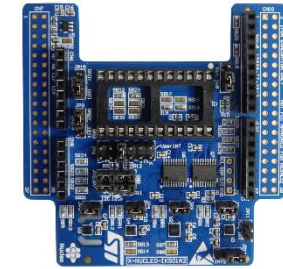
Setup Overview

HW prerequisites with STM32 Nucleo Expansion boards

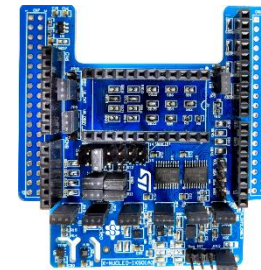
- 1x Bluetooth Low Energy Expansion Board (**X-NUCLEO-BNRG2A1**)
- 1x Motion MEMS and Environmental Sensor Expansion Board (**X-NUCLEO-IKS01A2** or **X-NUCLEO-IKS01A3**)
- 1x Digital MEMS Microphone Expansion Board (**X-NUCLEO-CCA02M2**)
- 1x STM32 Nucleo Development Board (**NUCLEO-F446RE** or **NUCLEO-L476RG**)
- 1x Android™ or iOS™ device
- 1x PC with Windows 7 and above
- 1x USB type A to Mini-B USB cable



NUCLEO-F446RE
NUCLEO-L476RG



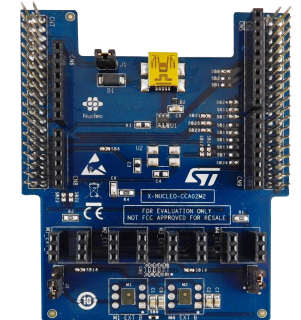
X-NUCLEO-IKS01A2



X-NUCLEO-IKS01A3



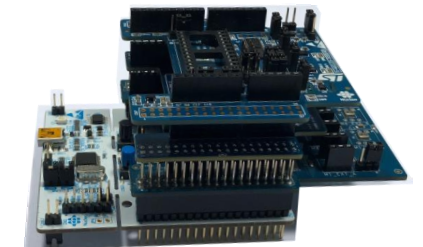
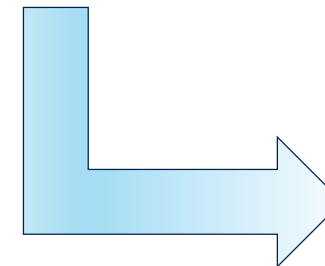
X-NUCLEO-BNRG2A1



X-NUCLEO-CCA02M2



Mini USB



It is necessary to connect the boards in the order shown in this picture

Setup Overview

HW prerequisites and setup with BlueCoin (1/2)

- 1x BlueCoin Kit (**STEVAL-BCNKT01V1**):
 - **BlueCoin Core System: BCNCS01V1**
 - **BlueCoin Coin Station: BCNST01V1**
 - **BlueCoin Cradle: BCNCR01V1**
 - **Battery**
 - **Programming cable**
- 1x Android™ or iOS™ device
- 1x PC with Windows 7 and above
- 1x STM32-Nucleo or ST-Link programmer
- 1x USB type A to Mini-B USB cable for the ST-Link
- 1x USB type A to Micro-B USB cable for BlueCoin Cradles and Coin Station



Mini USB



Micro USB

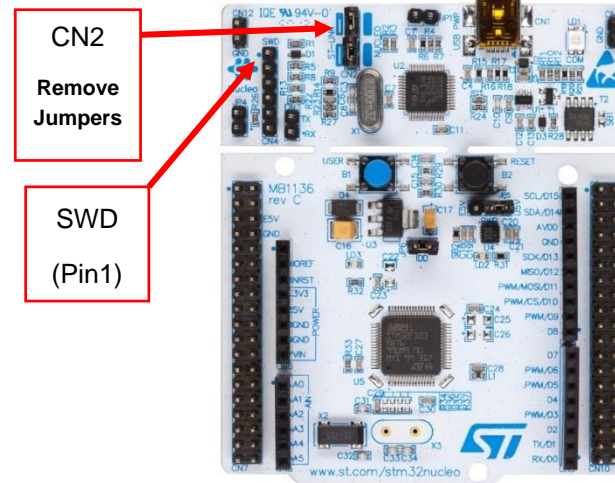


Setup Overview

HW prerequisites and setup with BlueCoin (2/2)

- In order to program the board you need to connect an external ST-Link to the SWD connector on the cradles, a 5pin flat cable is provided within the BlueCoin Kit package
- The easiest way is to get an STM32-Nucleo board which includes an ST-Link V2.1 programmer
- Be sure that CN2 Jumpers are OFF and connect your STM32 Nucleo board to the ClueCoin Coin Station through the provided cable paying attention to the polarity of the connectors. Pin 1 can be identified by a little circle on the PCB silkscreen (STM32 Nucleo board and BlueCoin Coin Station)

SWD connections with 5-pin flat cable



Setup Overview

HW prerequisites and setup with SensorTile (1/2)

- 1x SensorTile Kit (**STEVAL-STLKT01V1**):
 - **SensorTile Core System: STLCS01V1**
 - **SensorTile Cradle eXpansion: STLCX01V1**
 - **SensorTile Cradle: STLCR01V1**
 - **Battery**
 - **Programming cable**
- 1x Android™ or iOS™ device
- 1x PC with Windows 7 and above
- 1x STM32-Nucleo or ST-Link programmer
- 1x USB type A to Mini-B USB cable for the ST-Link
- 1x USB type A to Micro-B USB cable for SensorTile Cradles



Mini USB



Micro USB

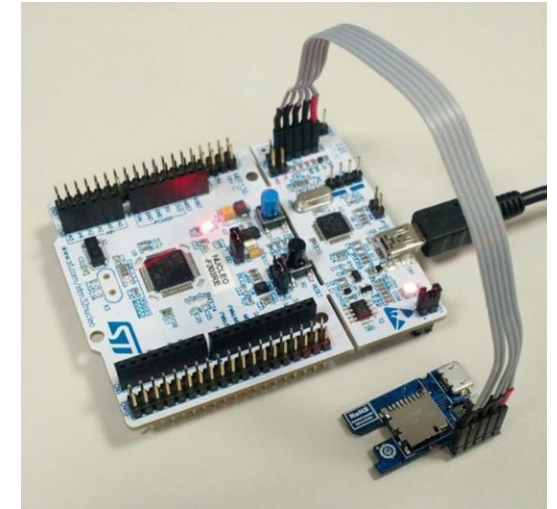


Setup Overview

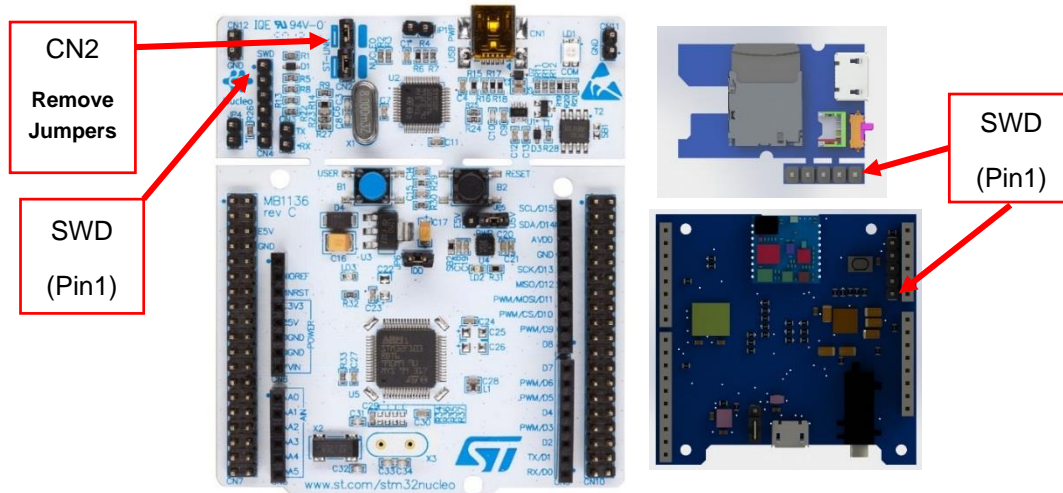
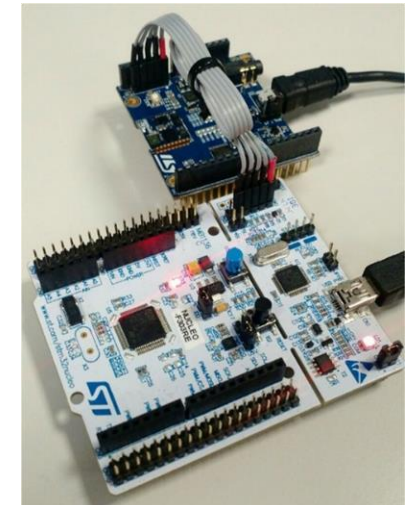
HW prerequisites and setup with SensorTile (2/2)

- In order to program the board you need to connect an external ST-Link to the SWD connector on the cradles, a 5pin flat cable is provided within the SensorTile Kit package
- The easiest way is to get an STM32-Nucleo board which includes an ST-Link V2.1 programmer
- Be sure that CN2 Jumpers are OFF and connect your STM32 Nucleo board to the SensorTile Cradle through the provided cable paying attention to the polarity of the connectors. Pin 1 can be identified by a little circle on the PCB silkscreen (STM32 Nucleo board and SensorTile Cradle Expansion) or by the square shape of the soldering pad of the connector (SensorTile Cradle).

Cradle SWD connection



Cradle eXpansion SWD connection



Setup Overview

HW prerequisites with STM32 Nucleo Expansion boards

- 1x STEVAL-MKSBOX1V1 evaluation board
- Laptop/PC with Windows 7, 8 or 10
- 1 x microUSB cable
- 1x USB type A to Mini-B USB cable
- ST-Link/V2 in-circuit debugger/programmer for STM8 and STM32



Micro USB



ST-Link/V2



Mini USB



STEVAL-MKSBOX1V1

Setup Overview

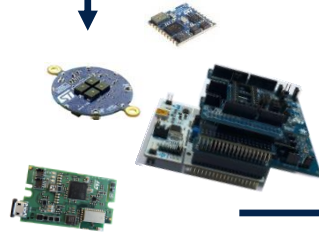
Start coding in just a few minutes (1/3)



1 www.st.com/stm32code

2

Select Function Pack:
FP-SNS-ALLMEMS2



3

Download & unpack

FP-SNS-ALLMEMS2 package structure

Name	
_htmresc	
Documentation	← Docs
Drivers	← BSP, HAL and drivers
Middlewares	← BlueNRG-MS, BlueNRG2, Audio, Motion, FatFs, FreeRTOS
Projects	← Application example
Utilities	← Boot loader binary
package.xml	
Release_Notes.html	

4

↓
.\Projects\STM32F446RE-BlueCoin\Applications\ALLMEMS2
.\Projects\STM32F446RE-Nucleo\Applications\ALLMEMS2
.\Projects\STM32L4R9ZI-SensorTile.box\Applications\ALLMEMS2
.\Projects\STM32L476RG-Nucleo\Applications\ALLMEMS2
.\Projects\STM32L476RG-SensorTile\Applications\ALLMEMS2

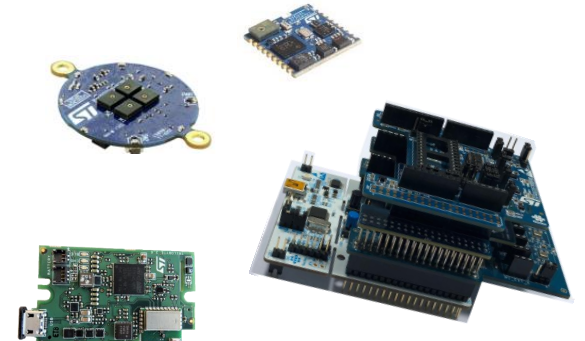
Android™/iOS™ smartphone and
ST BLE Sensor application
(V4.2.1 or higher)

6

Use the pre-compiled binaries for registering your device, or alternative
re-compile the code adding your device certificate



5









Setup Overview

Start coding in just a few minutes (2/3)

1. How to install the pre-compiled binary:

- For each applications, there is inside the package one folder called “Binary”

Projects > STM32F446RE-Nucleo > Applications > ALLMEMS2 > Binary		
Name	Date modified	Type
 STM32F446RE-Nucleo_IKS01A2_ALLMEMS2_BL_v2.1.0.bin	5/13/2020 3:00 PM	BIN File
 STM32F446RE-Nucleo_IKS01A2_ALLMEMS2_v2.1.0.bin		
 STM32F446RE-Nucleo_IKS01A3_ALLMEMS2_BL_v2.1.0.bin		
 STM32F446RE-Nucleo_IKS01A3_ALLMEMS2_v2.1.0.bin		

Projects > STM32F446RE-BlueCoin > Applications > ALLMEMS2 > Binary		
Name	Date modified	Type
 STM32F446RE-BlueCoin_ALLMEMS2_BL_v2.1.0.bin	5/13/2020 10:25 AM	BIN File
 STM32F446RE-BlueCoin_ALLMEMS2_v2.1.0.bin	5/13/2020 10:21 AM	BIN File

- It contains:
 - pre-compiled FP-SNS-ALLMEMS2 FW that could be flashed to a supported STM32 Nucleo Board using the ST-Link at the right position (0x08004000)
 - [Important Note](#): this pre-compiled binary is compatible with the FOTA update procedure
 - pre-compiled FP-SNS-ALLMEMS2 + BootLoader FW that could be directly flashed to a supported STM32 Nucleo Board using the ST-Link or by doing “Drag & Drop” (the latter only for STM32 Nucleo boards)
 - [Important Note](#): this pre-compiled binary is not compatible with the FOTA update procedure

Setup Overview

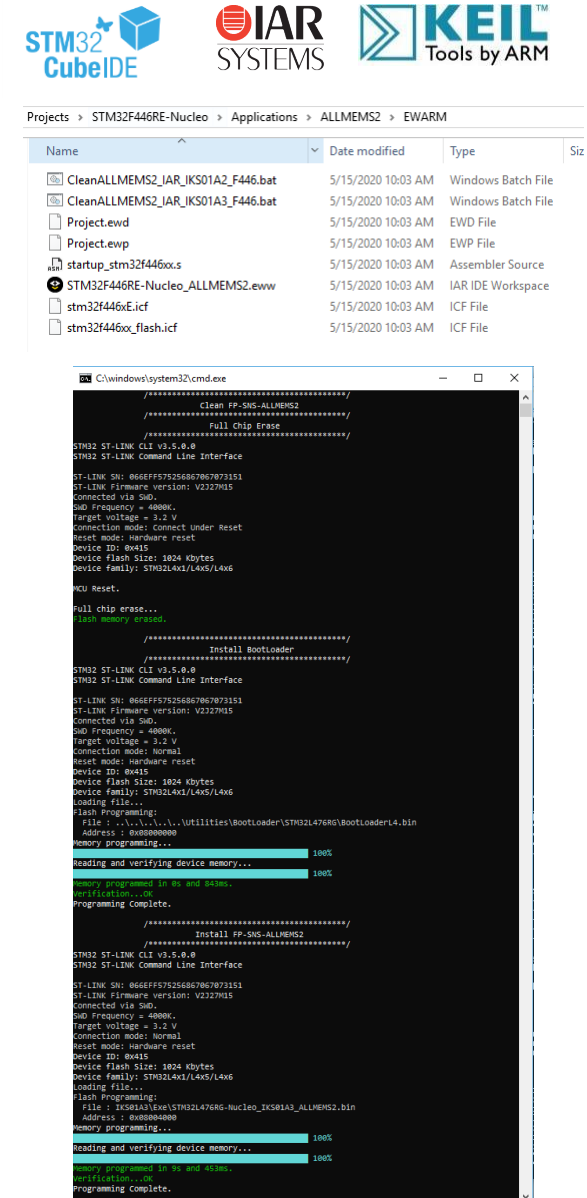
Start coding in just a few minutes (3/3)

2. How Install the code after compiling the project:

- Compile the project with your preferred IDE
- On Windows: for each IDE and for each platform there is one batch script:
 - IAR toolchain Embedded Workbench V8.32.3:
 - CleanALLMEMS2_IAR_ IKS01Ax_F446.bat and CleanALLMEMS2_IAR_ IKS01Ax_L476.bat
 - CleanALLMEMS2_IAR_ST.bat (yy → ST or BC or ST.box)
 - µVision toolchain - MDK-ARM Professional Version: 5.29.0:
 - CleanALLMEMS2_STM32CubeIDE_IKS01Ax_F446.bat and CleanALLMEMS2_STM32CubeIDE_IKS01Ax_L476.bat
 - CleanALLMEMS2_STM32CubeIDE_yy.bat (yy → ST or BC or ST.box)
 - STM32CubeIDE Version 1.3.1:
 - CleanALLMEMS2_MDK_ARM_IKS01Ax_F446.bat and CleanALLMEMS2_MDK_ARM_IKS01Ax_L476.bat
 - CleanALLMEMS2_MDK-ARM_yy.bat (yy → ST or BC or ST.box)
- For Linux/iOS: only for STM32CubeIDE and for each platform there is one OpenOCD:
 - For Nucleo F446/L476:
 - CleanALLMEMS2_STM32CubeIDE_IKS01A2_F446.sh or CleanALLMEMS2_STM32CubeIDE_IKS01A3_F446.sh
 - CleanALLMEMS2_STM32CubeIDE_IKS01A2_L476.sh or CleanALLMEMS2_STM32CubeIDE_IKS01A3_L476.sh
 - For STEVAL-STLKT01V1/ STEVAL-MKSBOX1V1 /STEVAL-BCNKT01V1 :
 - CleanALLMEMS2_STM32CubeIDE_yy.sh (yy → ST or BC or ST.box)

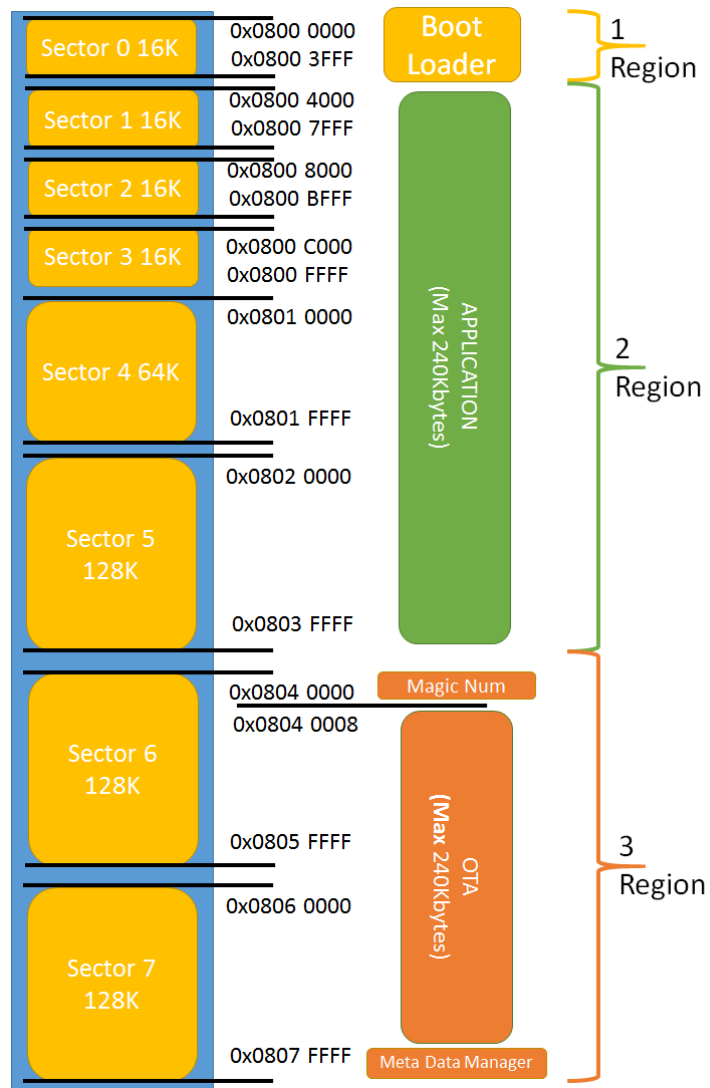
It's necessary to edit this file for setting the right installation and Library path

- These scripts perform the following steps:
 - Full Flash Erase
 - Flash the right BootLoader at the right position (0x08000000)
 - Flash the PREDMNT1 firmware at the right position (0x08004000)
 - This is the firmware that was compiled with the IDE
 - This firmware is compatible with the FOTA update procedure
 - Save a complete Binary FW that includes both ALLMEMS2 and the BootLoader
 - This binary can be directly flashed to a supported STM32 board using the ST-Link or by doing “Drag & Drop”
 - Important Note: this additional pre-compiled binary is not compatible with the FOTA update procedure



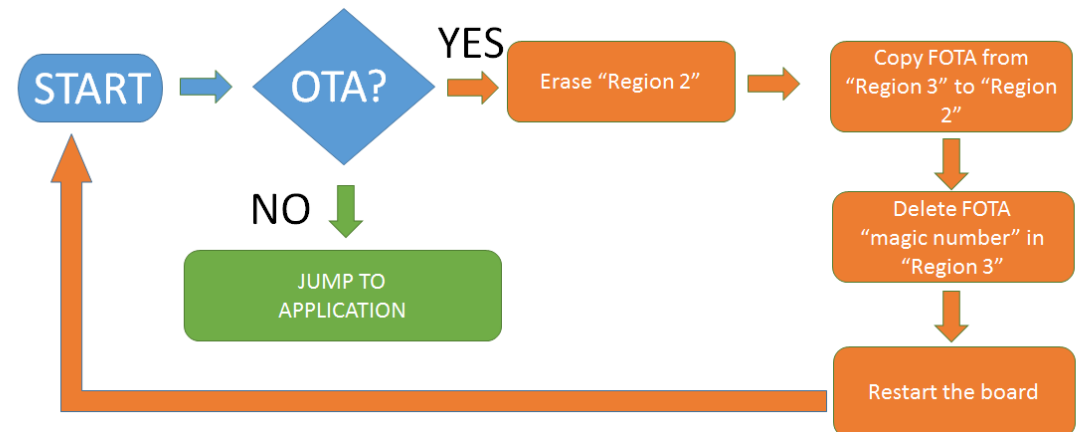
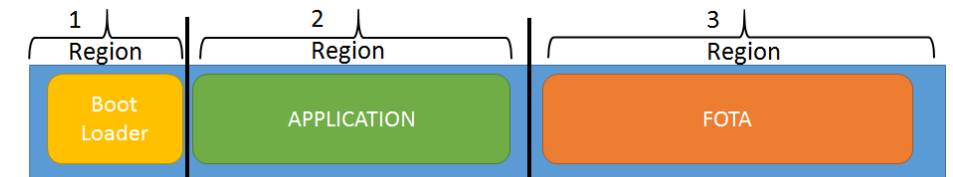
Setup Overview

Flash Management and Boot Process



Flash Structure for STM32F446RE

FLASH Organization



Setup Overview

Bluetooth low energy and sensors software

FP-SNS-ALLMEMS2 for NUCLEO-F446RE / NUCLEO-L476RG - Serial line monitor (e.g.Tera Term)

- Pressing the **RESET** User button on STM32 Nucleo board. You could see the initialization phase

```
COM27 - Tera Term VT
File Edit Setup Control Window Help
UART Initialized
STMicroelectronics FP-SNS-ALLMEMS2:
Version 2.1.0
STM32L476RG-Nucleo board
MCU clock set at 80 MHz

Code compiled for X-NUCLEO-IKS01A3 board
OK Accelero Sensor
OK Gyroscope Sensor
OK Magneto Sensor
OK Temperature and Humidity (Sensor1)
OK Temperature and Pressure (Sensor2)

Meta Data Manager read from Flash
Meta Data Manager version=1.1.1
Generic Meta Data found:
  MAG_CALIBRATION Size=120 [bytes]
  NODE_NAME Size=8 [bytes]

<HAL 1.11.1_0>
Compiled May 13 2020 16:09:48 (KEIL)
Send Every 30mS 3 Short precision Quaternions
Send Every 500mS Temperature/Humidity/Pressure
Send Every 50mS Acc/Gyro/Magneto
Send Every 50mS dB noise

Debug Connection Enabled
SERVER: BLE Stack Initialized
HWver= 1.2
FWver= 2.1.a
BoardName= AM2U210
BoardMAC = c1:35:f8:a8:ca:28

HW & SW Service W2ST added successfully
Console Service W2ST added successfully
Config Service W2ST added successfully

Testing BootLoaderCompliance:
Version 2.0.0
BL Version OK
MagicNum OK
MaxSize =70000
OTAStartAdd OK
OTADoneAdd OK
BootLoader Compliant with FOTA procedure

Initialized ST MotionAR v3.0.2
Initialized ST MotionCP v2.1.0
Initialized ST MotionFX v2.4.0
Magneto Calibration Not present
Initialized ST MotionGR v2.1.0
Initialized ST Acoustic SL v2.2.0 (17452 bytes allocated)

>>>>>CONNECTED 4a:be:e6:ae:b1:1e
UUID Rescan Forced
--->Calib=ON

Enabled Humidity Sensor (One Shot)
Enabled Temperature Sensor1 (One Shot)
Enabled Pressure Sensor (One Shot)
Enabled Temperature Sensor2 (One Shot)
```

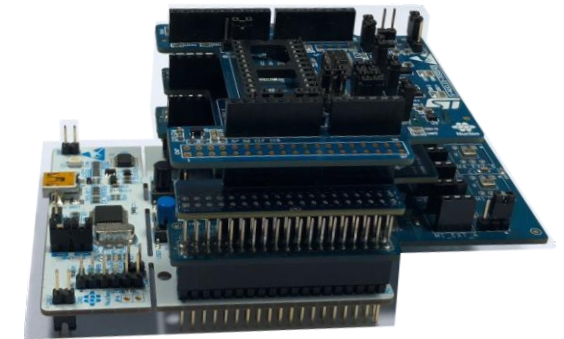
- When the boards are connected to an Android or iOS device, you can see what is transmitted via BLE

Tera Term: Serial port setup

Port:	COM20	OK
Baud rate:	115200	Cancel
Data:	8 bit	
Parity:	none	Help
Stop:	1 bit	
Flow control:	none	

Transmit delay
0 msec/char 0 msec/line

Configure the serial line monitor (speed, LF)

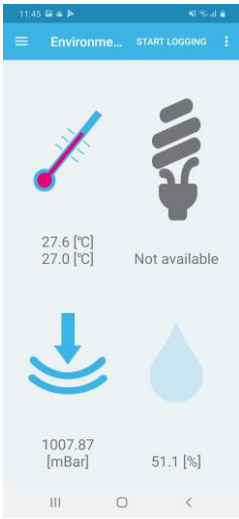


2.4- Demo Examples

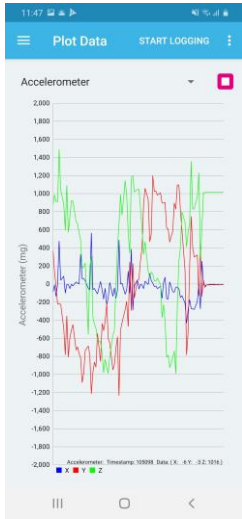
ST BLE Sensor Application Overview

Demo Examples

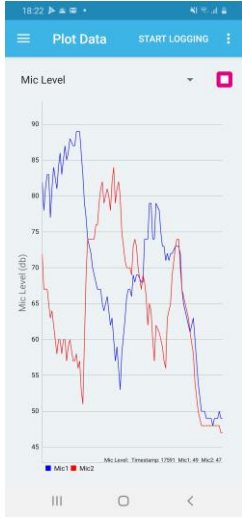
ST BLE Sensor Application for Android/iOS (1/5)



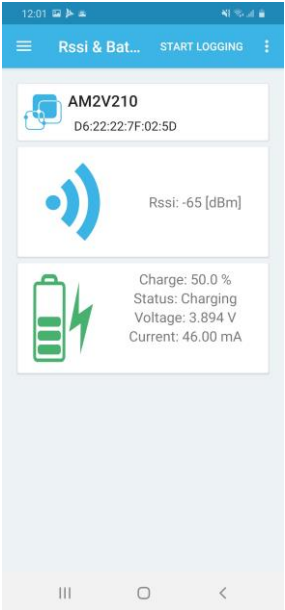
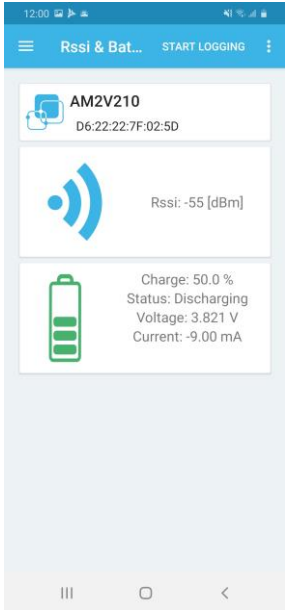
Environmental page



Accelerometer plot

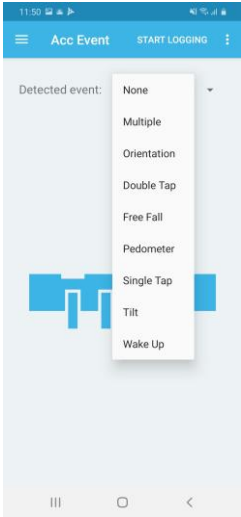


Microphones level plot

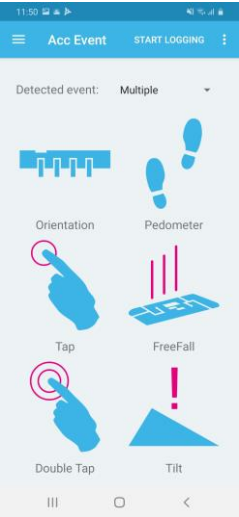


RSS & Battery Page

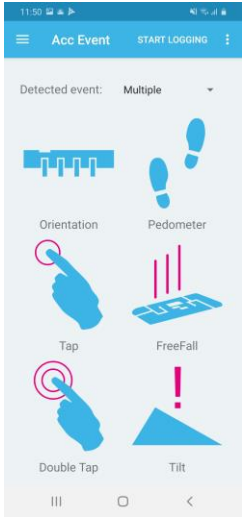
DSO/DSOX/DSM/DSL Acc Event



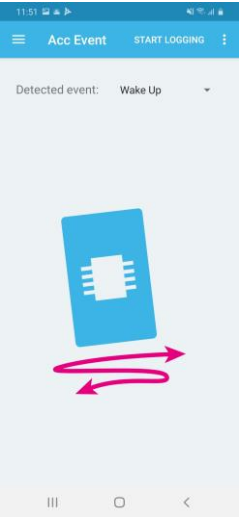
Menu Events



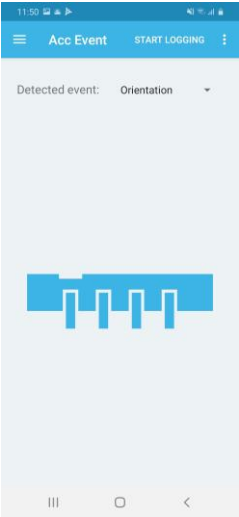
Multiple events page



Pedometer



Wake Up



Orientation

KNOWN LIMITATION

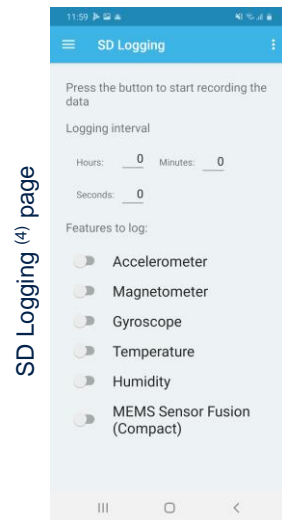
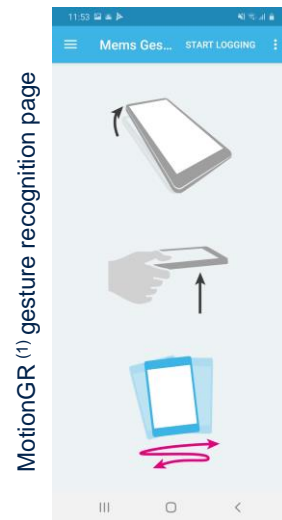
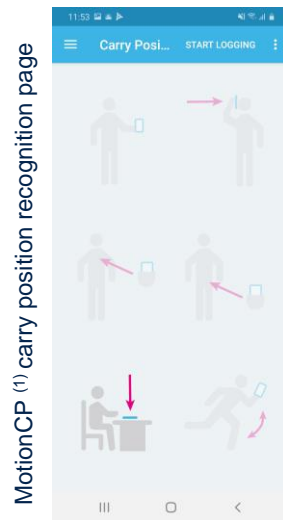
For NUCLEO-F446RE board, there is an hardware conflict between the boards:

- X-NUCLEO-IKS01A2 and the X-NUCLEO-CCA02M2.
- X-NUCLEO-IKS01A3 and the X-NUCLEO-CCA02M2.

The hardware features of the LSM6DSL/ LSM6DSO are disabled.

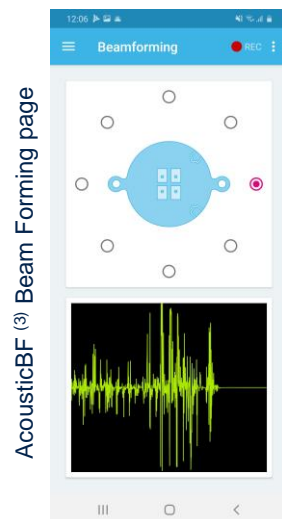
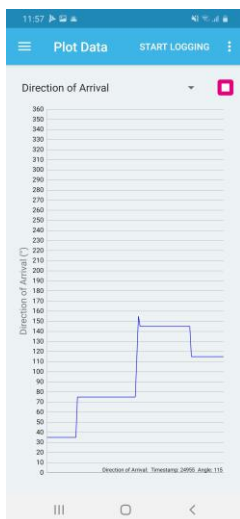
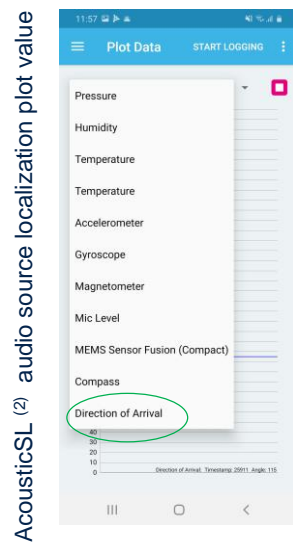
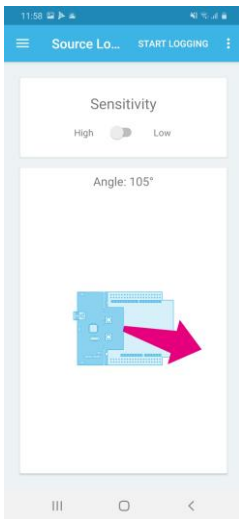
Demo Examples

ST BLE Sensor Application for Android/iOS (2/5)

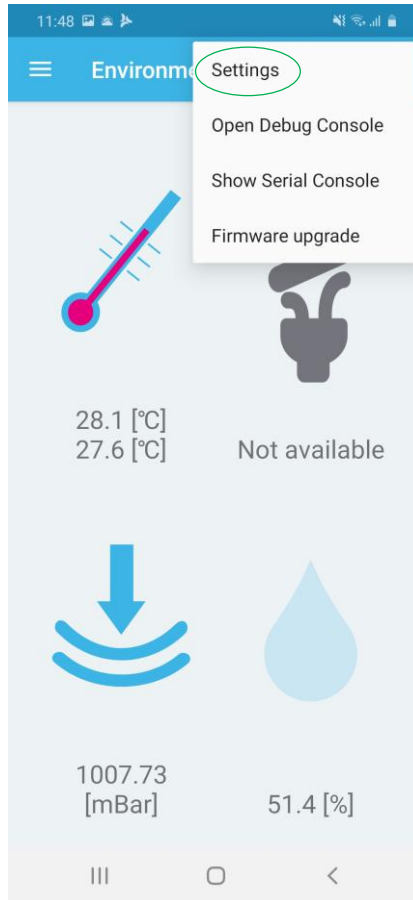


NOTE

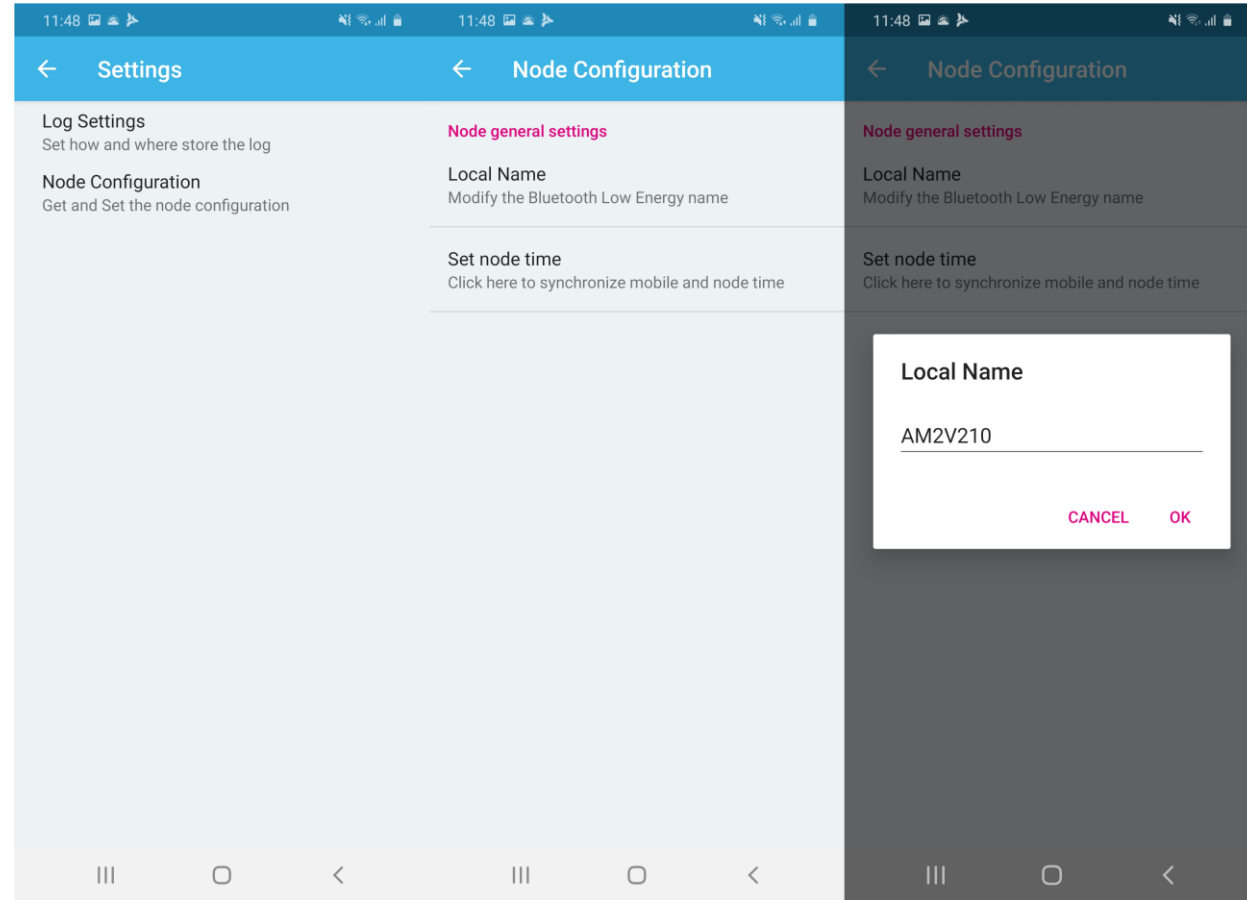
When the data logging starts, the other ST BLE Sensor app functions are disabled and the data logging goes on even if the app is closed. The RTC alarm is used to log the selected data with the logging interval chose.



- (1) Feature not available on NUCLEO-F446RE and STEVAL-BCNKT01V1
- (2) Feature not available on STEVAL-STLKT01V1 and STEVAL-MKSBOX1V1
- (3) Feature available on STEVAL-BCNKT01V1
- (4) Feature available on STEVAL-STLKT01V1 and STEVAL-MKSBOX1V1



Menu option



Settings menu option

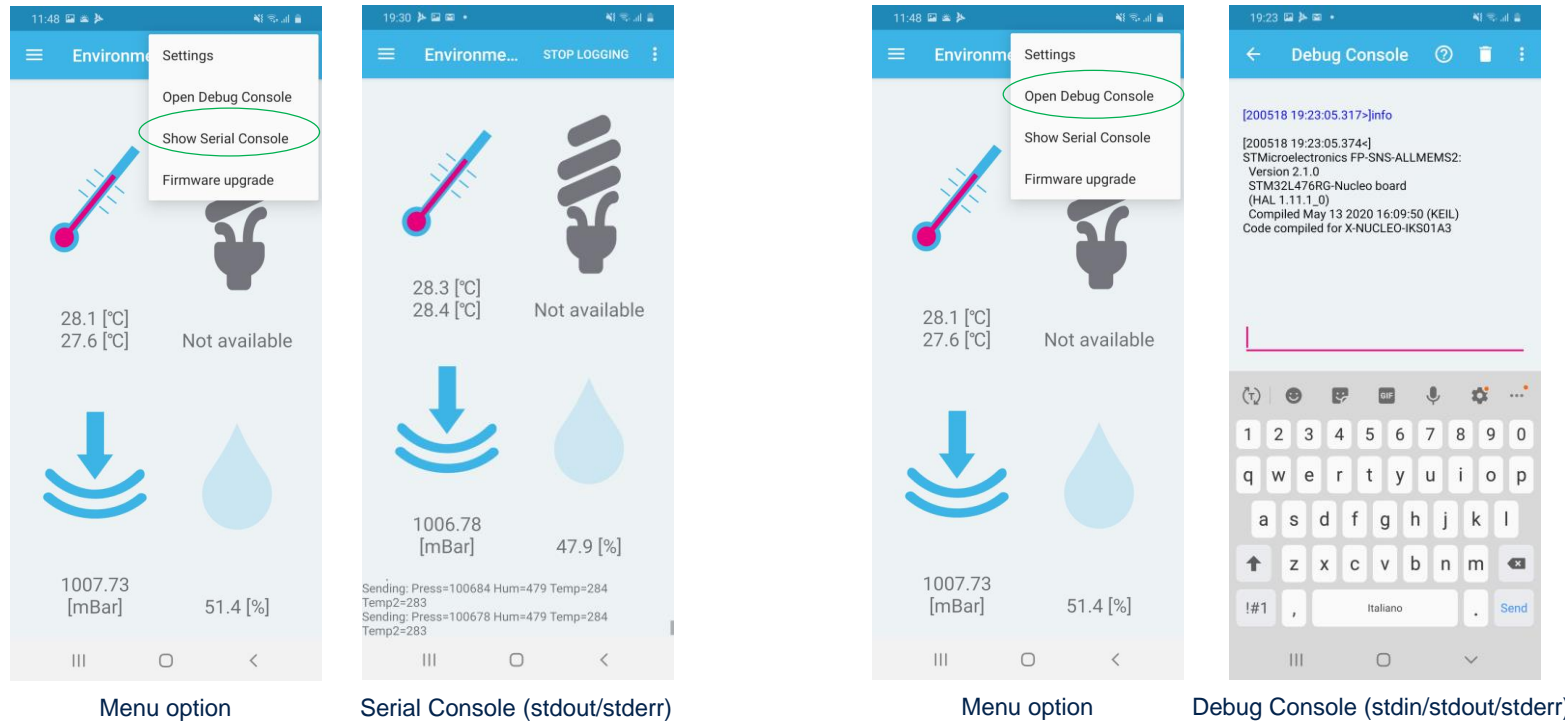
Node configuration menu option

Local Name

If Settings is chosen, it is possible to change the node name using the node configuration

Demo Examples

ST BLE Sensor Application for Android/iOS (4/5)



For STEVAL-STLKT01V1 (SensorTile) and STEVAL-MKSBOX1V1 (SensorTile.box) SD data logging is available for Environmental, Magnetometer, Gyroscope, Accelerometer and Audio data.

Below, the debug console commands to start the data logging:

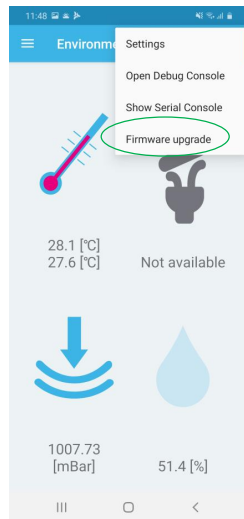
- start/stop: to start/stop the data logging for environmental, Accelerometer, Magnetometer and Gyro data.
- AudioStart/AudioStop : to start/stop the data logging for Audio data.

It is not possible starting the data logging for MEMS and audio data together.

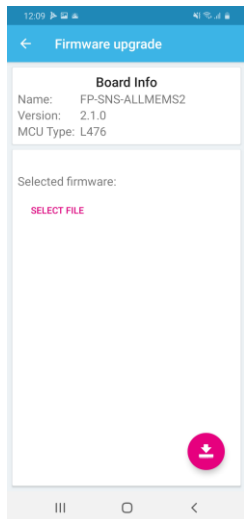
When the data logging is started (audio or MEMS), the others functionality of the ST BLE Sensor app is disabled and the data logging go on even if the app is closed (It is necessary to restart the app if the data logging must be stopped).

Demo Examples

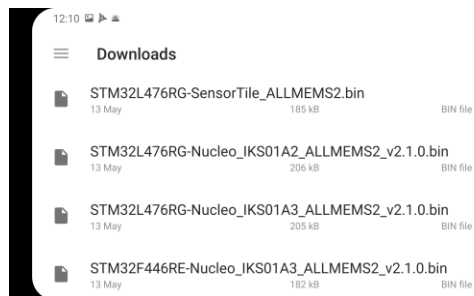
ST BLE Sensor Application for Android/iOS (5/5)



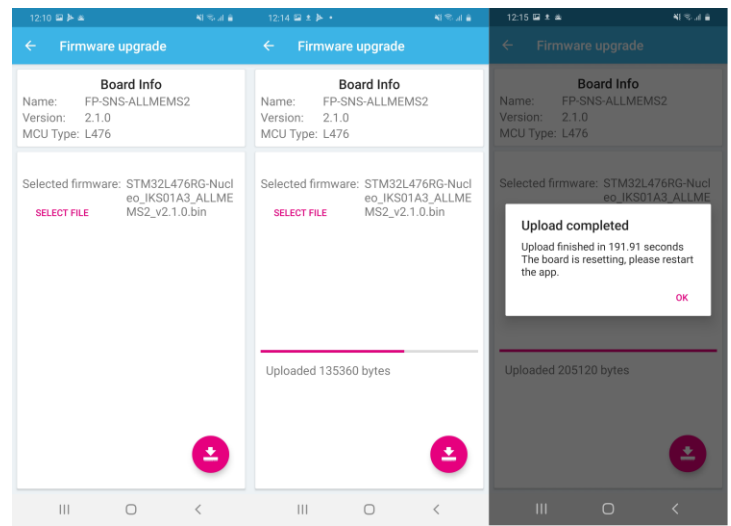
Menu option



Firmware upgrade page



Firmware update file selection



Application page during FOTA and on completion



Terminal window information during FOTA

3- Documents & Related Resources

Documents & Related Resources (1/2)

All documents are available in the DESIGN tab of the related products webpage

FP-SNS-ALLMEMS2

- **DB3673:** STM32Cube function pack for ultra-low power IoT node with BLE connectivity, digital microphone, environmental and motion sensors – [data brief](#)
- **UM2439:** Getting started with the STM32Cube function pack for ultra-low power IoT node with BLE connectivity, digital microphone, environmental and motion sensors – [user manual](#)
- [Software setup file](#)

X-NUCLEO-CCA02M2

- [Gerber files, BOM, Schematics](#)
- **DB4016:** Digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo – [data brief](#)
- **UM2631:** Getting started with the digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo – [user manual](#)

X-NUCLEO-BNRG2A1

- [Gerber files, BOM, Schematic](#)
- **DB4086:** Bluetooth Low Energy expansion board based on the BLUENRG-M2SP module for STM32 Nucleo – [data brief](#)
- **UM2667:** Getting started with the X-NUCLEO-BNRG2A1 BLE expansion board based on BLUENRG-M2SP module for STM32 Nucleo – [user manual](#)

X-NUCLEO-IKS01A2

- [Gerber files, BOM, Schematic](#)
- **DB3009:** Motion MEMS and environmental sensor expansion board for STM32 Nucleo – [data brief](#)
- **UM2121:** Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo – [user manual](#)

Documents & Related Resources (2/2)

All documents are available in the DESIGN tab of the related products webpage

X-NUCLEO-IKS01A3

- [Gerber files, BOM, Schematic](#)
- **DS3851**: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – [data brief](#)
- **UM2559**: Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo – [user manual](#)

STEVAL-BCNKT01V1

- [Gerber files, BOM, Schematic](#)
- **DB3258**: BlueCoin Starter kit – [data brief](#)
- **UM2240**: Getting started with the STEVAL-BCNKT01V1 BlueCoin starter kit: augmented acoustics, motion sensing development and prototyping platform – [user manual](#)

STEVAL-STLKT01V1

- [Gerber files, BOM, Schematic](#)
- **DB2956**: SensorTile development kit – [data brief](#)
- **UM2101**: Getting started with the STEVAL-STLKT01V1 SensorTile integrated development platform – [user manual](#)

STEVAL-MKSBOX1V1

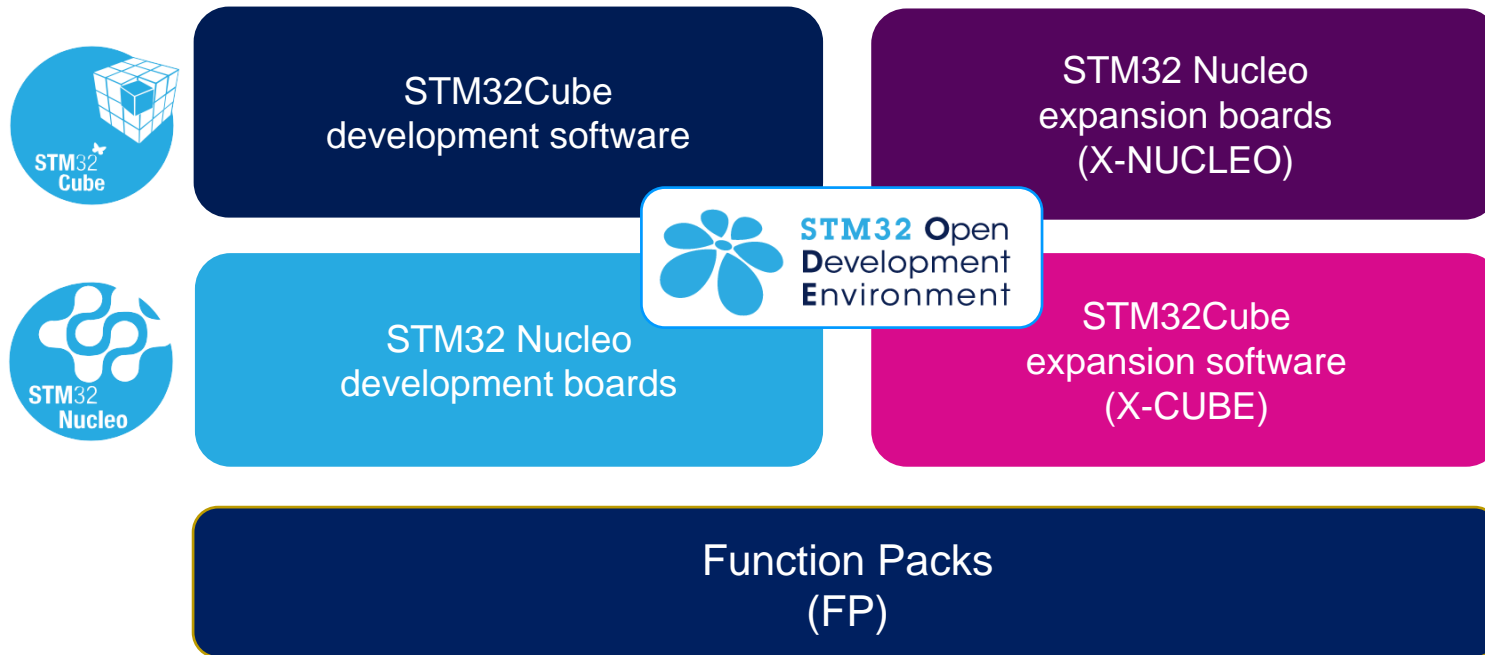
- [Gerber files, BOM, Schematic](#)
- **DB3903**: SensorTile.box wireless multi sensor development kit with user friendly app for IoT and wearable sensor applications – [data brief](#)
- **UM2580**: How to use the wireless multi sensor development kit with customizable app for IoT and wearable sensor applications – [user manual](#)

4- STM32 Open Development Environment: Overview

STM32 Open Development Environment

Fast, affordable Prototyping and Development

- The STM32 Open Development Environment (STM32 ODE) is an open, flexible, easy, and affordable way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs



For further information, please visit www.st.com/stm32ode

Thank you

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