



# Cloud-JAM board

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Data sheet

09/09/2017





## Summary

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### .1 REVISION HISTORY

Date	Author	Description
2016/10/21	C. Raineri	Draft version
2016/10/25	C. Raineri	Added images of the board instead of topographic views.
2016/12/27	C. Raineri	Added housing prescription.
2017/02/14	C. Raineri	Changed Cloud-JAM images

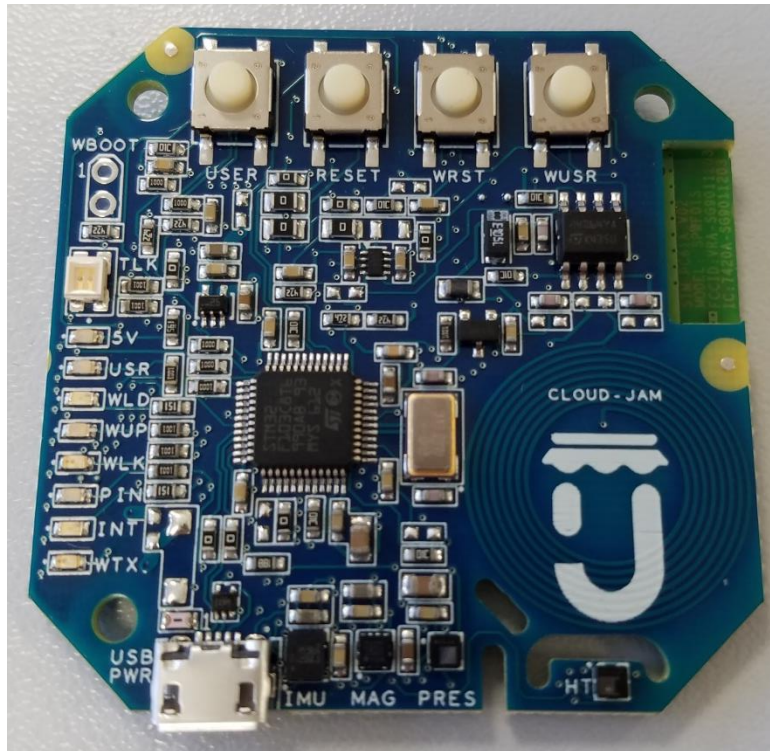


2017/03/31	C. Raineri	Added EU DoC.
2017/04/28	C. Raineri	Modified temperature range, .added transmitted power on Wi-Fi and operating environment. Modified DoC. Change revision to V2
2017/09/09	C. Raineri	Changed STMicroelectronics reference function pack Added configuration of Wi-Fi Access Point parameters via serial interface

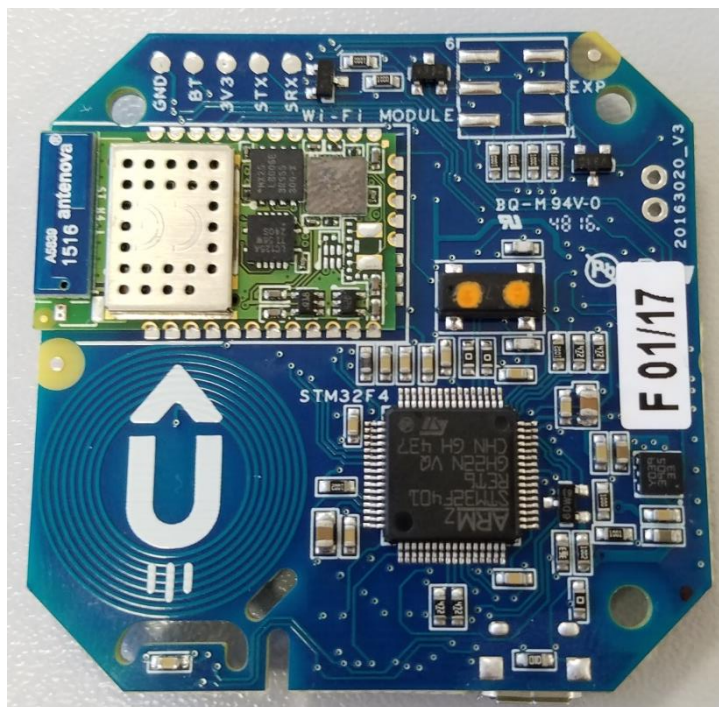


## .2 CLOUD-JAM BOARD IMAGES

TOP VIEW



BOTTOM VIEW





### .3 INTRODUCTION

This data sheet provides the description of the Cloud-JAM board, the first member of the JAM family boards. As RushUp product, Cloud-JAM is an accelerator product and can be used from makers, developers, high mix low volume products and from all who want to benefit from an off the shelf industrialized board. In particular Cloud-JAM is the accelerator product of the STM32 ODE system. For details about RushUp and STM32 ODE, please visit:

[www.rushup.tech](http://www.rushup.tech)

[http://www.st.com/content/st\\_com/en/products/ecosystems/stm32-open-development-environment.html](http://www.st.com/content/st_com/en/products/ecosystems/stm32-open-development-environment.html)

### .4 DESCRIPTION

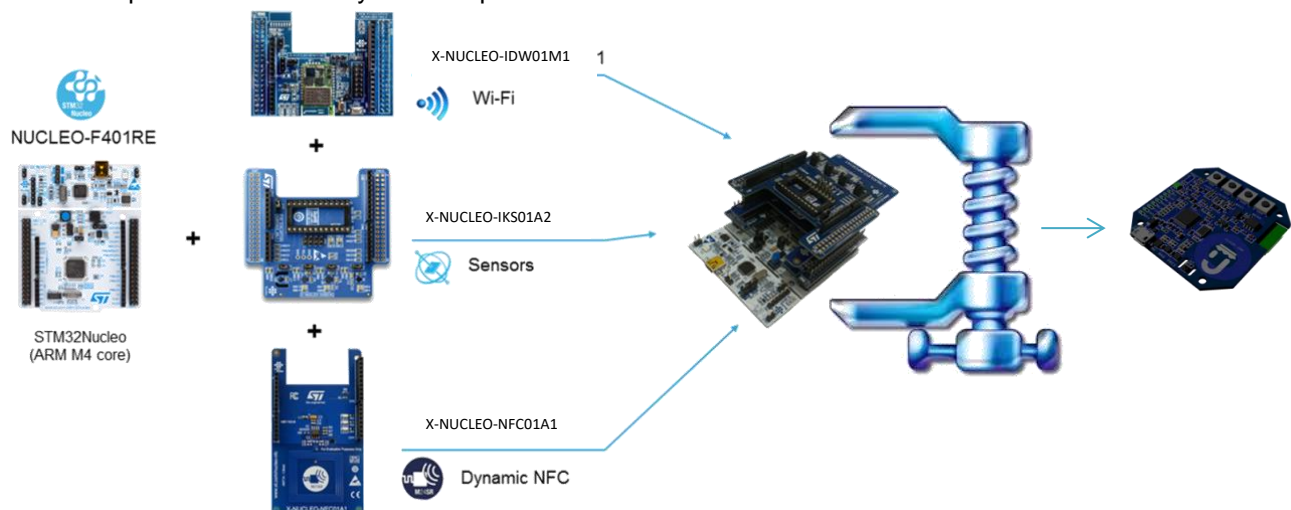
The Cloud-JAM board is the industrialized version of the FP-CLD-WATSON1 STM32 ODE functional pack. It can connect IoT node based on STM32 Nucleo to IBM Watson IoT, transmits sensor data and receive commands from Cloud application.

Motion & environmental sensors board connected to the cloud through Wi-Fi network using SSID, Password and web authentication stored in the dynamic NFC.

Inside Cloud-JAM you can find the next STM32-Nucleo elements:

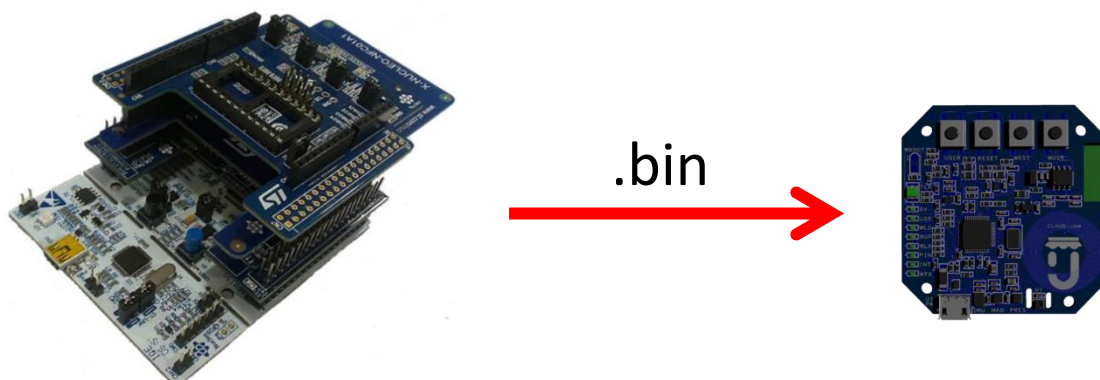
- NUCLEO-F401RE
- X-NUCLEO-IDW01M1
- X-NUCLEO-IKS01A2
- X-NUCLEO-NFC01A1

The connection and the components are the same as all the above boards connected together in a single functional pack as indicated by the next picture.



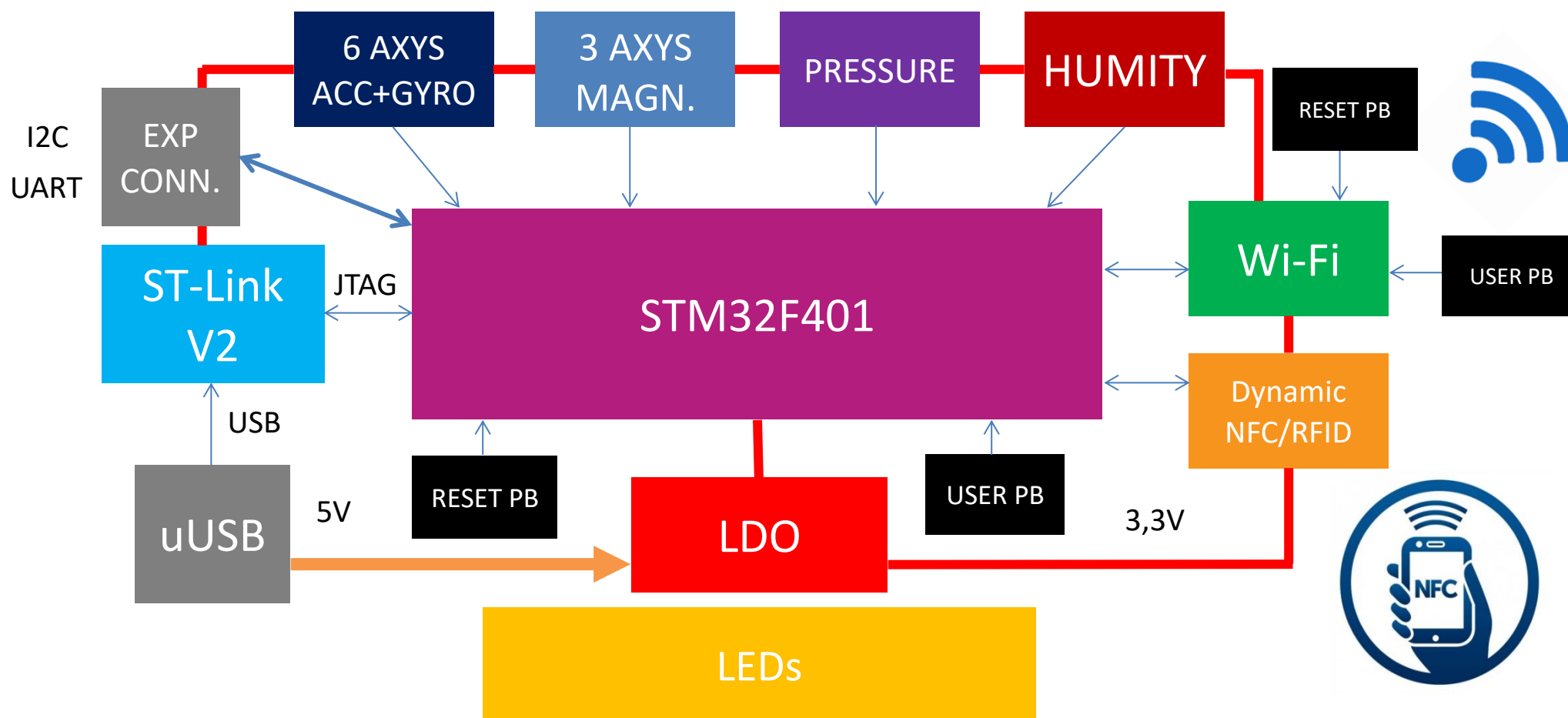
Cloud-JAM board embeds also the debugger so it can be used also for development and debug.

Since the board is exactly the same as the functional pack (from electrical connections point of view), one of the most important features is that the firmware is plug & play and compatible between the two development systems. User can develop and debug on Nucleo functional pack and then download the .bin file into the Cloud-JAM board.





## .5 BLOCK DIAGRAM





## .6 HARDWARE & COMPONENTS DETAIL

### .6.1 Embedded debugger

Cloud-JAM incorporates the ST-LINK V2 debugger and then is capable not only to download the firmware but also to debug it with the main development tools.

The ST-LINK/V2 is an in-circuit debugger and programmer for the STM8 and STM32 microcontroller families. The single wire interface module (SWIM) and JTAG/serial wire debugging (SWD) interfaces are used to communicate with any STM8 or STM32 microcontroller located on an application board.

STM32 applications use the USB full-speed interface to communicate with Atollic®, IAR™, Keil® or TASKING integrated development environments.

Direct firmware update feature supported (DFU) and Status LED which blinks during communication with the PC.

### .6.2 CPU

The STM32F401RE device is based on the high-performance ARM® Cortex® -M4 32-bit RISC core operating at a frequency of up to 84 MHz.

Its Cortex®-M4 core features a Floating point unit (FPU) single precision which supports all ARM single-precision dataprocessing instructions and data types. It also implements a full set of DSP instructions and a memory protection unit (MPU) which enhances application security.

The STM32F401RE incorporate high-speed embedded memories (512 Kbytes of Flash memory, 96 Kbytes of SRAM), and an extensive range of enhanced I/Os and peripherals connected to two APB buses, two AHB buses and a 32-bit multi-AHB bus matrix. The device offer one 12-bit ADC, a low-power RTC, six general-purpose 16-bit timers including one PWM timer for motor control, two general-purpose 32-bit timers. It also features standard and advanced communication interfaces.

- I2C
- SPI
- Full duplex I2Ss.
- USART
- SDIO interface
- USB 2.0 OTG full speed interface

Refer to for the peripherals available looking at the specific data sheet.

The STM32F401RE operate in the -40 to +105 °C temperature range from a 1.7 (PDR OFF) to 3.6 V power supply.

A comprehensive set of power-saving mode allows the design of low-power applications.

### .6.3 Sensors

#### .6.3.1 iNEMO inertial module LSM6DSL

The LSM6DSL is a system-in-package featuring a 3D digital accelerometer and a 3D digital gyroscope performing at 0.65 mA in high-performance mode and enabling always-on low-power features for an optimal motion experience for the consumer. .

The LSM6DSL supports main OS requirements, offering real, virtual and batch sensors with 4 kbyte for dynamic data batching.

ST's family of MEMS sensor modules leverages the robust and mature manufacturing processes already used for the production of micromachined accelerometers and gyroscopes.

The various sensing elements are manufactured using specialized micromachining processes, while the IC interfaces are developed using CMOS technology that allows the design of a dedicated circuit which is trimmed to better match the characteristics of the sensing element.

The LSM6DSL has a full-scale acceleration range of  $\pm 2/\pm 4/\pm 8/\pm 16$  g and an angular rate range of  $\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$  dps. High robustness to mechanical shock makes the LSM6DSL the preferred choice of system designers for the creation and manufacturing of reliable products.

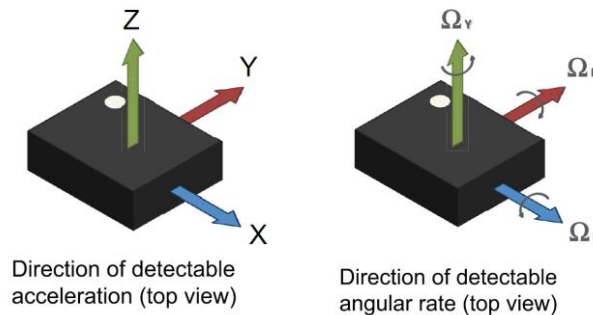
The LSM6DSL is available in a plastic land grid array (LGA) package

#### **Features**

- Power consumption: 0.4 mA in combo normal mode and 0.65 mA in combo high-performance mode
- "Always-on" experience with low power consumption for both accelerometer and gyroscope
- Smart FIFO up to 4 kbyte based on features set
- Compliant with Android K, L, and M



- Hard, soft ironing for external magnetic sensor corrections
- $\pm 2/\pm 4/\pm 8/\pm 16$  g full scale
- $\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$  dps full scale
- Analog supply voltage: 1.71 V to 3.6 V
- Independent IOs supply (1.62 V)
- Compact footprint, 2.5 mm x 3 mm x 0.83 mm
- SPI & I2C serial interface with main processor data synchronization feature
- Pedometer, step detector and step counter
- Significant motion and tilt function
- Standard interrupts: free-fall, wakeup, 6D/4D orientation, click and double-click
- Embedded temperature sensor
- ECOPACK®, RoHS and “Green” compliant



For any specific information and for the firmware commands and procedures, please refer to the data sheet of the components.

### .6.3.2 High-performance eCompass module LSM303AGR

The LSM303AGR is an ultra-low-power highperformance system-in-package featuring a 3D digital linear acceleration sensor and a 3D digital magnetic sensor.

The LSM303AGR has linear acceleration full scales of  $\pm 2g/\pm 4g/\pm 8g/\pm 16g$  and a magnetic field dynamic range of  $\pm 50$  gauss.

The LSM303AGR includes an I2C serial bus interface that supports standard, fast mode, fast mode plus, and high-speed (100 kHz, 400 kHz, 1 MHz, and 3.4 MHz) and an SPI serial standard interface.

The system can be configured to generate an interrupt signal for free-fall, motion detection and magnetic field detection.

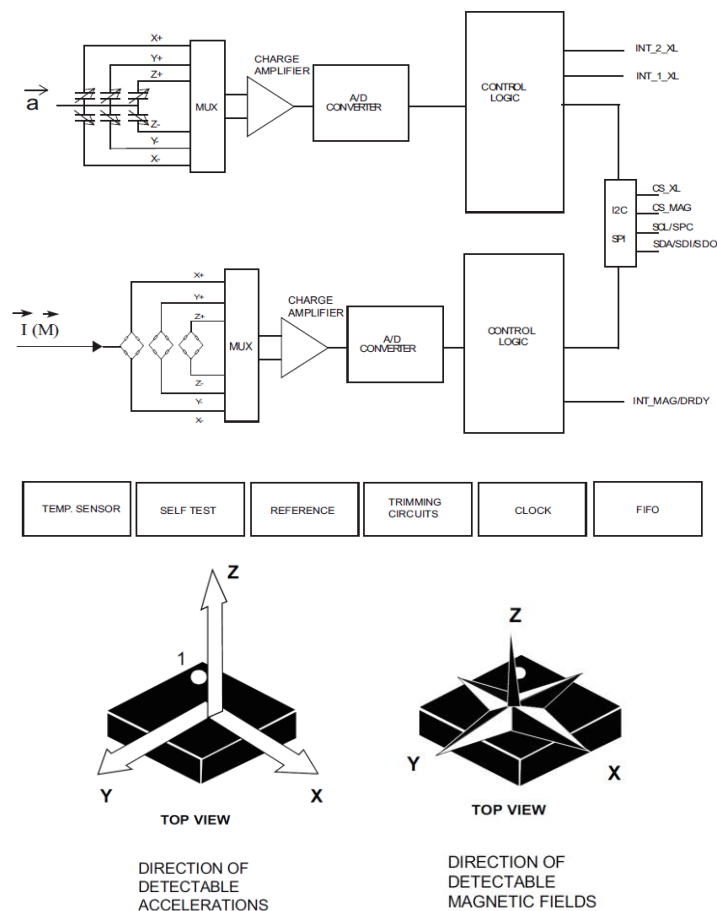
The magnetic and accelerometer blocks can be enabled or put into power-down mode separately. The LSM303AGR is available in a plastic land grid array package (LGA) and is guaranteed to operate over an extended temperature range from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

#### Features

- 3 magnetic field channels and 3 acceleration channels
- $\pm 50$  gauss magnetic dynamic range
- $\pm 2/\pm 4/\pm 8/\pm 16$  g selectable acceleration full scales
- 16-bit data output
- SPI / I2C serial interfaces
- Analog supply voltage 1.71 V to 3.6 V
- Selectable power mode/resolution for accelerometer and magnetometer
- Single measurement mode for magnetometer
- Programmable interrupt generators for freefall, motion detection and magnetic field detection
- Embedded self-test
- Embedded temperature sensor
- Embedded FIFO
- ECOPACK®, RoHS and “Green” compliant



## Block diagram



For any specific information and for the firmware commands and procedures, please refer to the data sheet of the components.

### 6.3.3 Humidity and temperature

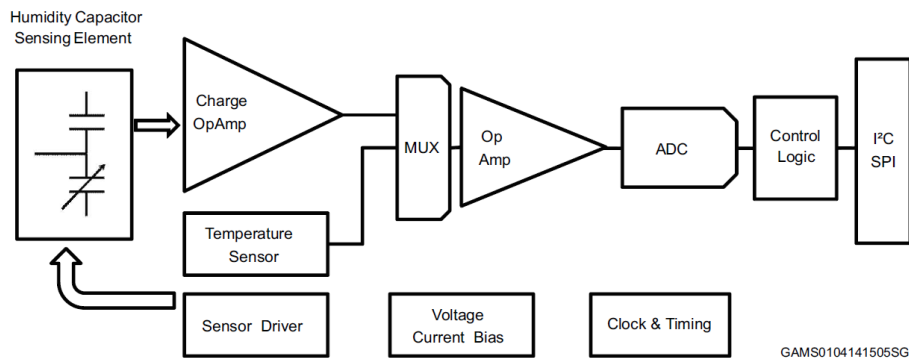
The HTS221 is an ultra-compact sensor for relative humidity and temperature. It includes a sensing element and a mixed signal ASIC to provide the measurement information through digital serial interfaces.

The sensing element consists of a polymer dielectric planar capacitor structure capable of detecting relative humidity variations and is manufactured using a dedicated ST process.

The HTS221 is available in a small top-holed cap land grid array (HLGA) package guaranteed to operate over a temperature range from -40 °C to +120 °C.

#### Features

- 0 to 100% relative humidity range
- Supply voltage: 1.7 to 3.6 V
- Low power consumption: 2  $\mu$ A @ 1 Hz ODR
- Selectable ODR from 1 Hz to 12.5 Hz
- High rH sensitivity: 0.004% rH/LSB
- Humidity accuracy:  $\pm 3.5\%$  rH, 20 to +80% rH
- Temperature accuracy:  $\pm 0.5$  °C, 15 to +40 °C
- Embedded 16-bit ADC
- 16-bit humidity and temperature output data
- SPI and I<sup>2</sup>C interfaces
- Factory calibrated
- Tiny 2 x 2 x 0.9 mm package
- ECOPACK® compliant

**Block diagram**

For any specific information and for the firmware commands and procedures, please refer to the data sheet of the components.

**.6.3.4 Barometer**

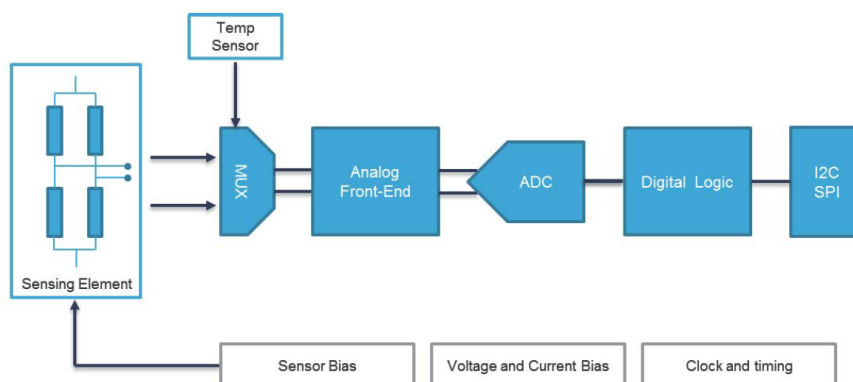
The LPS22HB is an ultra-compact piezo resistive absolute pressure sensor which functions as a digital output barometer. The device comprises a sensing element and an IC interface which communicates through I2C or SPI from the sensing element to the application.

The sensing element, which detects absolute pressure, consists of a suspended membrane manufactured using a dedicated process developed by ST.

The LPS22HB is available in a full-mold, holed LGA package (HLGA). It is guaranteed to operate over a temperature range extending from -40 °C to +85 °C. The package is holed to allow external pressure to reach the sensing element.

**Features**

- 260 to 1260 hPa absolute pressure range
- Current consumption down to 3  $\mu$ A
- High overpressure capability: 20x full-scale
- Embedded temperature compensation
- 24-bit pressure data output • 16-bit temperature data output
- ODR from 1 Hz to 75 Hz
- SPI and I2C interfaces
- Embedded FIFO
- Interrupt functions: Data Ready, FIFO flags, pressure thresholds
- Supply voltage: 1.7 to 3.6 V
- High shock survivability: 22,000 g
- Small and thin package • ECOPACK® lead-free compliant

**Block diagram**

For any specific information and for the firmware commands and procedures, please refer to the data sheet of the components.

**.6.4 NFC memory**

The M24SR64-Y device is a dynamic NFC/RFID tag that can be accessed either from the I2C or the RF interface. The RF and I2C host can read or write to the same memory, that is why only one host can com-



municate at a time with the M24SR64-Y. The management of the interface selection is controlled by the M24SR64-Y device itself. The RF interface is based on the ISO/IEC 14443 Type A standard. The M24SR64-Y is compatible with the NFC Forum Type 4 Tag specifications and supports all corresponding commands. The I2C interface uses a two-wire serial interface consisting of a bidirectional data line and a clock line. The devices carry a built-in 4-bit device type identifier code in accordance with the I2C bus definition. The device behaves as a slave in the I2C protocol.

#### **I2C mode**

M24SR64-Y is powered by VCC. The I2C interface is connected to the M24SR64-Y. The I2C host can communicate with the M24SR64-Y device. 1.1.2

#### **Tag mode**

The M24SR64-Y is supplied by the RF field and can communicate with an RF host (RFID reader or an NFC phone). The User memory can only be accessed by the RF commands.

#### **Dual interface mode**

Both interfaces, RF and I2C, are connected to the M24SR64-Y and both RF or I2C host can communicate with the M24SR64-Y device. The power supply and the access management are carried out by the M24SR64-Y itself. For further details, please refer to the token mechanism described inside the data sheet of the component.

- Contactless interface
- NFC Forum Type 4 Tag
- ISO/IEC 14443 Type A
- 106 Kbps data rate
- Internal tuning capacitance: 25 pF Memory
- 8-Kbyte (64-kbit) EEPROM
- Support of NDEF data structure
- Data retention: 200 years
- Write cycle endurance:
  - 1 million Write cycles at 25 °C
  - 600k Write cycles at 85 °C
  - 500k Write cycles at 105 °C
- Read up to 246 bytes in a single command
- Write up to 246 bytes in a single command
- 7 bytes unique identifier (UID)
- 128 bits passwords protection

For any specific information and for the firmware commands and procedures, please refer to the data sheet of the components.

### **.6.5 Wi-Fi module SPWF01SA**

The SPWF01SA intelligent Wi-Fi module represent a plug-and-play and standalone 802.11 b/g/n solution for easy integration of wireless Internet connectivity features into existing or new products.

Configured around a single-chip 802.11 transceiver with integrated PA and comprehensive power management subsystem, and an STM32 microcontroller with an extensive GPIO suite, the modules also incorporate timing clocks and voltage regulators.

The SPWF01SA.11 orderable parts integrate 1.5 MB of Flash and is available with an embedded micro 2.45 GHz highly-efficient ISM band antenna.

With low power consumption and ultra-compact (2.7 x 1.5 cm) footprint, the module is ideal for fixed and mobile wireless applications, as well as challenging battery-operated applications.

The SPWF01SA parts is released with an integrated full featured TCP/IP protocol stack with added web server and additional application service capabilities, such as REST API for accessing files on servers in the cloud and support for dynamic web pages with CGI/SSI functions to easily interact with the module and the host processor over the air.

For secure end-to-end communication with the cloud, an SSL/TLS stack is embedded in every module with no licensing charge. See application note AN4683 for details.

The SW package also includes an AT command layer interface for user-friendly access to the stack functionalities via the UART serial port. For details, see user manual UM1695.

It is always possible to upgrade the module firmware via UART and Over The Air (FOTA). Out of the 1 MB extended Flash available on the SPWF01Sx.1y module, 512 KB of the Flash is dedicated to FW upgrade and the other 512 KB is dedicated to host proprietary files, organized in a file system image, accessible through the integrated web server.. ST recommends that users regularly check for documentation and the current FW version available at [www.st.com/wifimodules](http://www.st.com/wifimodules).



This section provides some information regarding the SPWF01SA Serial-to-Wi-Fi b/g/n intelligent module (order code: SPWF01SA.11). More detailed information can be found at the [www.st.com](http://www.st.com) web site.

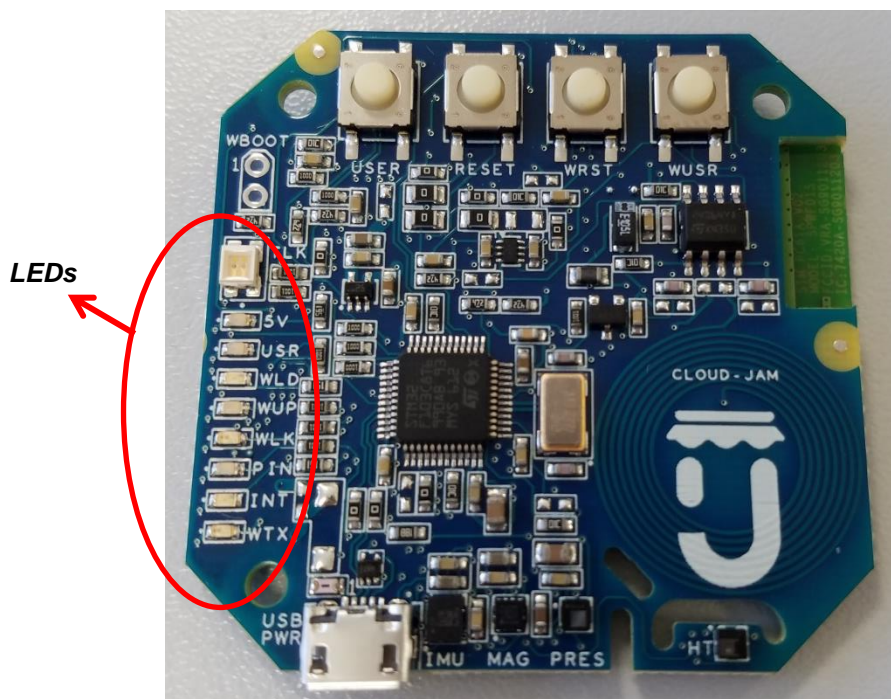
The main features of the SPWF01SA module are:

- 2.4 GHz IEEE 802.11 b/g/n transceiver
- STM32 ARM Cortex-M3, with 64 KB RAM and 512KB Flash memory
  - 1 MByte extended FLASH for FW update
  - Over the air (FOTA)
- Integrated TCP/IP protocol stack
  - 8 Simultaneous TCP or UDP clients and 1 Socket server
  - 1 TLS/SSL Socket client supporting up to TLS 1.2, including common encryption algorithms: AES (128,256), hash (MD5, SHA-1, SHA-256) and public key algorithms (RSA, ECC).
  - Web server supporting dynamic web pages
  - RESTful API to get & post web content
- WEP/WPA/WPA2 personal security
- System modes: station, IBSS, and miniAP
- miniAP easily provisioned (SSID, PWD)
- Industrial temperature range: -40 °C to 85 °C
- SPWF01SA is a fully FCC/IC/CE certified module.

#### .6.6 LEDs

Cloud-JAM integrates all the LEDs presents in the Nucleo functional pack, in particular they are:

- ST-LINK V2 bicolor LED: TLK LED
- Power supply present: 5V LED
- User free connected to MCU pin PA5: USR LED
- Wi-Fi blink connected to pin 5 of the module: WLD LED
- Wi-Fi power up connected to pin 14 of the module: WUP LED
- Wi-Fi link connected to pin 15 of the module: WLK LED
- iNEMO interrupt 2 connected to pin 9 of LSM6DSL: PIN LED
- iNEMO interrupt 1 connected to pin 4 of LSM6DSL: INT LED
- Wi-Fi TXD1 connected to pin 6 of the module: WTX LED

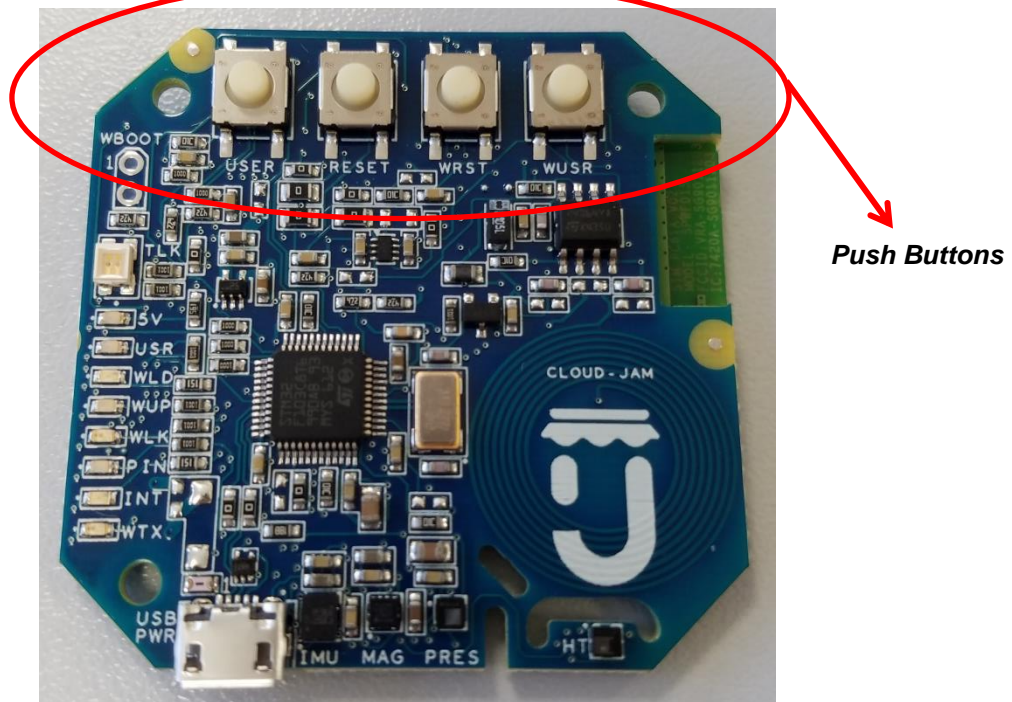


#### .6.7 Push buttons

Cloud-JAM integrates all the push buttons presents in the Nucleo functional pack, in particular they are:

- PB1 user push button connected to MCU pin PC13: USER
- PB2 reset push button connected to MCU pin NRST: RESET
- PB3 reset push button connected to Wi-Fi module pin nRESET: WRST

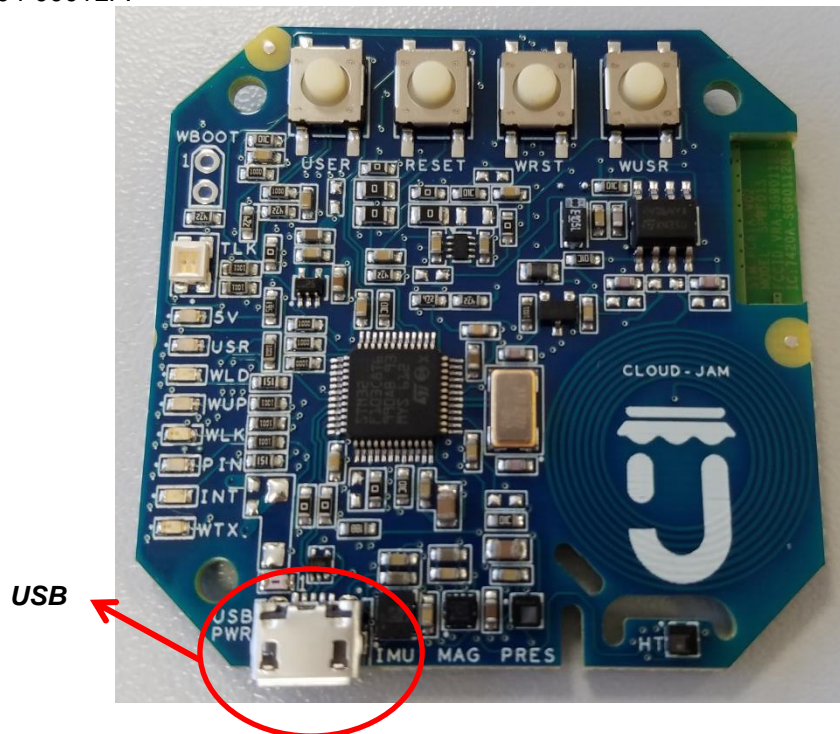
- PB4 user push button connected to Wi-Fi module pin 13: WUSR



#### .6.8 USB connector

The USB connector act as power supply input porta at 5V dc level and also as debugger and programmer as referred to chapter 5.1.

The connector is USB female 90° orientation micro B type and the part number mounted on the board is the FCI 10118194-0001LF.



#### .6.9 Expansions connector

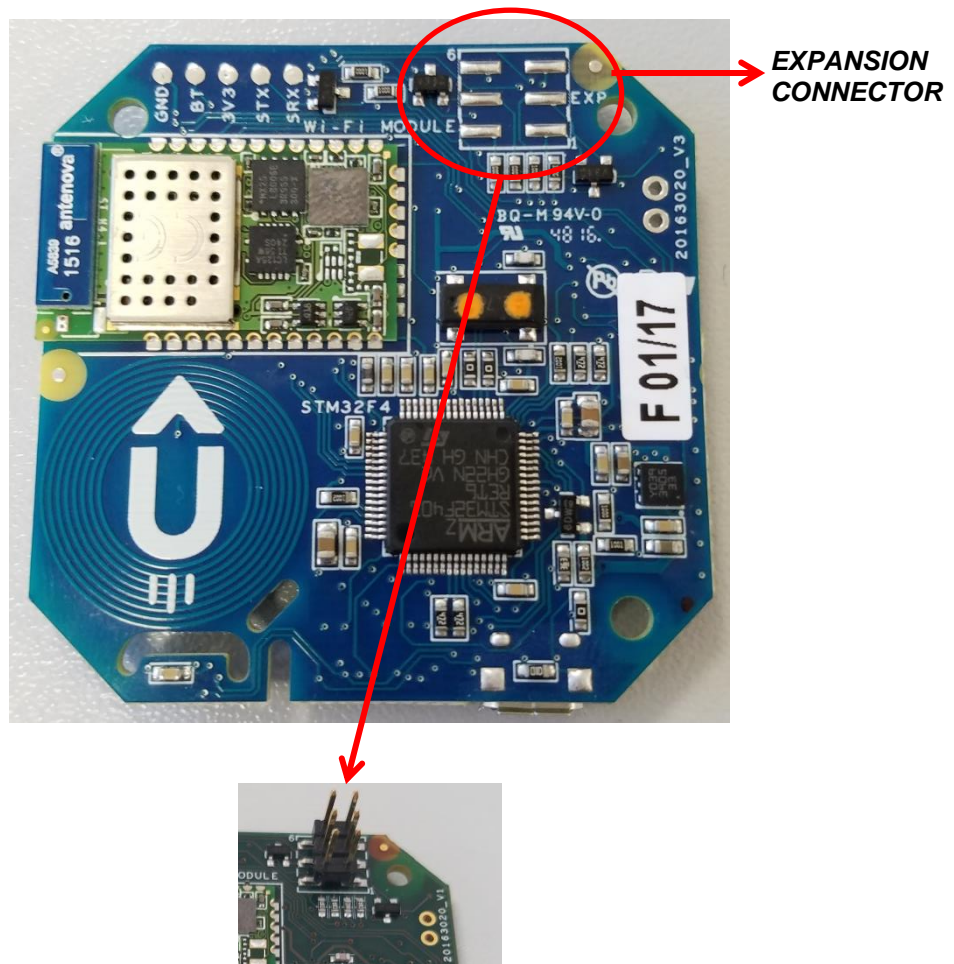
Even if Cloud-JAM is mainly intended as industrialized version of FP-CLD-WATSON1 Nucleo functional pack, there is also an expansion connector in which there are power supply, two serial communication port or four general purpose I/O.



Connector is vertical type 2.54mm pitch double row Amphenol part number 95278-101A06LF

Here in after the connection table.

PIN NUMBER	NAME	DESCRIPTION
1	I2C3_SCL/PA8	Clock line of the I2C3 of the MCU or PA8 pin as GPIO
2	USART6_RX/PC7	Receive line of the USART6 of the MCU or PC7 GPIO
3	I2C3_SDA/PC9	Data line of the I2C3 of the MCU or PC9 pin as GPIO
4	USART6_TX/PC6	Transmitter line of the USART6 of the MCU or PC6 GPIO
5	+3V3	3,3V power supply from Cloud-JAM. This is not intended as external power supply but only as voltage signal for polarization or logic circuits. Max current available for sourcing 25mA.
6	GND	GND reference voltage of the Cloud-JAM



## .7 DEVELOPMENT & DEBUG WITH CLOUD-JAM

### .7.1 System requirements

In case Cloud-JAM is used to develop and debug applications usign ST-LINK V2 embedded debugger, before starting the user should:

1. Install the preferred Integrated Development Environment (IDE).



2. ST-LINK/V2-1 driver will be installed automatically. In case of problem, the user can proceed with manual installation of the driver, from toolchains install directory (further details are available in Section 3).
3. Download the STM32 Nucleo firmware from the [www.st.com/stm32nucleo](http://www.st.com/stm32nucleo) webpage.
4. Establish the connection with the STM32 Nucleo board, by connecting the board to the USB port of the PC.

The above steps will be detailed in the coming sections

## .7.2 IDEs supporting STM32 core inside Cloud-JAM

STMicroelectronics STM32 32-bit ARM® Cortex® -M core-based microcontrollers are supported by a complete range of software tools. It encompasses traditional integrated development environment IDEs with C/C++ compilers and debuggers from major third-parties (free versions up to 64 Kbytes of code, depending on third-party), completed with innovative tools from STMicroelectronics.

Toolchains supporting all Nucleo boards are:

- EWARM v7.10.3 or later(a)
  - 30-day evaluation edition
  - 32-Kbyte Limited QuickStart edition (16-Kbyte limitation for Cortex M0)
- MDK-ARM v5.17 or later(a)(b)
  - MDK-Lite (32-Kbyte code size limitation)
- TrueSTUDIO Lite v5 or later(b)
  - No limitation
- SW4STM32 v1.5 and later(a)
  - No limitation

Information on the toolchain version supporting the STM32 device is available on toolchain release note at third-party web site.

## .7.3 ST-LINK/V2-1 installation

Exactly as per all the STM32 Nucleo boards, Cloud-JAM include an ST-LINK/V2-1 embedded debug tool interface. This interface needs a dedicated USB driver to be installed. This driver is available at the [www.st.com](http://www.st.com) website and supported within the following software toolchains:

- IAR Embedded Workbench for ARM (EWARM). The toolchain is installed by default in the C:\Program Files\IAR Systems\Embedded Workbench x.x directory on the PC local hard disk. After installing EWARM, install the ST-LINK/V2-1 driver by running the ST-Link\_V2\_USB.exe from [IAR\_INSTALL\_DIRECTORY]\Embedded Workbench x.x\arm\drivers\ST-Link \ST-Link\_V2\_USBdriver.exe.
- Keil Microcontroller Development Kit (MDK-ARM) toolchain. The toolchain is installed by default in the C:\Keil directory on the PC local hard disk; the installer creates a start menu µVision5 shortcut. When connecting the ST-LINK/V2-1 tool, the PC detects new hardware and requires to install the ST-LINK\_V2\_USB driver. The “Found New Hardware wizard” appears and guides the user through the steps needed to install the driver from the recommended location.
- Atollic TrueSTUDIO STM32. The toolchain is installed by default in the C:\Program Files\Atollic directory on the PC local hard disk. The ST-Link\_V2\_USB.exe file is automatically installed when installing the software toolchain.
- AC6 System Workbench for STM32 (SW4STM32). The toolchain is installed by default in the C:\Program Files\AC6 directory on the PC local hard disk. The ST-Link\_V2\_USB.exe file is automatically executed when installing the software toolchain.

Complementary information on the firmware package content and the STM32 Nucleo requirements is available on the Getting started with the STM32 Nucleo board firmware package UM1726 User manual at the [www.st.com](http://www.st.com) website.

Note: The embedded ST-LINK/V2-1 only supports SWD interface for STM32 core.

## .7.4 Firmware package

The STM32 Nucleo examples, applications and demonstration are provided in one single .zip file. The extraction of the .zip file generates one folder, STM32 Nucleo\_FW\_VX.Y.Z, which contains the following sub-folders:

- Template project is a pre-configured project with empty main function to be customized by the user. This is helpful to start creating an application based on the peripherals drivers.
- Example project includes toolchain projects for each peripheral example ready to be run.
- Applications includes set of applications ready to be run.
- Demonstration includes the demonstration firmware ready to be run



## **.7.5 Executing and debugging firmware using software toolchains**

The steps below can be applied to an already existing example, demonstration or template project available from STM32\_Nucleo\_FW\_VX.Y.Z firmware at the [www.st.com](http://www.st.com) website. First of all, the user must read the firmware/readme.txt file, which contains the firmware description and hardware/software requirements.

### **.7.5.1 EWARM toolchain**

The following procedure explains how to compile, link and execute an existing EWARM project.

1. Open IAR Embedded Workbench for ARM (EWARM).
2. In the File menu, select Open and click Workspace to display the Open Workspace dialog box. Browse to select either an example or demonstration or template workspace file and click Open to launch it in the Project window.
3. In the Project menu, select Rebuild All to compile the project.
4. If the project is successfully compiled, no errors and warning appears.

To change the project settings (Include and preprocessor defines), go through the following project options:

- For Include directories: **Project>Options...>C/C++ compiler>**
  - For pre-processor defines: **Project>Options...>C/C++ compiler>pre-processor>**
5. In IAR Embedded Workbench IDE, from the Project menu, select Download and Debug or, alternatively, click the Download and Debug button in the toolbar, to program the Flash memory and start debugging.
  6. The debugger in IAR Embedded Workbench can be used to debug source code at C and assembly levels, set breakpoints, monitor individual variables and watch events during the code execution. To run the application from the Debug menu, select Go. Alternatively, click the Go button in the toolbar to run the application.

### **.7.5.2 MDK-ARM toolchain**

1. Open Keil MDK-ARM Microcontroller Development Kit. Figure 11 shows the basic names of the "Keil µvision5" windows, to which this document refers.
2. In the Project menu, select Open Project... Browse to select either an example or a demonstration or a template project file and click Open to launch it in the Project window.
3. In the Project menu, select Rebuild All target files to compile the project.
4. If the project is successfully compiled, the following window is displayed

If user needs to change his project settings (Include and preprocessor defines), he must go through the project options:

- For Include directories: **Project>Options for Target > C/C++ > Include Paths**
  - For pre-processor defines: **Project>Options for Target > C/C++ > Preprocessor symbols > Define**
5. In MDK-ARM IDE, from the Debug menu, select Start/Stop Debug Session or, alternatively, click the Start/Stop Debug Session button in the toolbar, to program the Flash memory and start debugging.
  6. The debugger in the MDK-ARM can be used to debug source code at C and assembly levels, set breakpoints, monitor individual variables and watch events during the code execution. To run the application from the Debug menu, select Run. Alternatively, click the Run button in the toolbar to run the application.

### **.7.5.3 TrueSTUDIO toolchain**

1. Open Atollic TrueSTUDIO for ARM product. The program launches and prompts for the workspace location.
2. Browse to select a TrueSTUDIO workspace of either an example or a demonstration or a template workspace file and click **OK** to load it.



3. To load an existing project in the selected workspace, select **Import** from the **File** menu to display the **Import** dialog box.
4. In the Import window, open General, select Existing Projects into Workspace and click Next.
5. Click Select root directory and browse to the TrueSTUDIO workspace folder.
6. In the Projects panel, select the project and click Finish.
7. In the Project Explorer, select the project, open the Project menu, and click Build Project.
8. If the project is successfully compiled, the following messages will be displayed on the console window

If user needs to change the project settings (Include directories and preprocessor defines), he must go through Project>Properties and select C/C++ Build>Settings from the left panel:

- For Include directories: C Compiler>Directories>Include path
- For pre-processor defines: C Compiler>Symbols> Defined symbols

9. To debug and run the application, select the project in the Project Explorer and press F11 to start a debug session.

The debugger in the Atollic TrueSTUDIO can be used to debug source code at C and assembly levels, set breakpoints, monitor individual variables and watch events during the code execution. To run the application, from the **Run** menu, select **Resume**, or alternatively click the **Resume** button in the toolbar.

#### .7.5.4 SW4STM32 toolchain

1. Open the AC6 SW4STM32 for STM32. The program launches and prompts for the workspace location.
2. Browse to select a SW4STM32 workspace of either an example or a demonstration or a template workspace file and click OK to load it.
3. To load an existing project in the selected workspace, select Import from the File menu to display the Import dialog box.
4. In the Import window, open General, select Existing Projects into Workspace and click Next Figure 21. SW4STM32 workspace launcher dialog box
5. Click Select root directory, browse to the SW4STM32 workspace folder.
6. In the Projects panel, select the project and click Finish.
7. In the Project Explorer, select the project, open the Project menu, and click Build Project.
8. If the project is successfully compiled, the following messages display on the console window. To change the project settings (Include directories and preprocessor defines), simply go through Project>Properties, select C/C++ Build>Settings from the left panel:

- For Include directories follow the path: C Compiler>Directories>Include path
- For pre-processor defines follow the path: C Compiler>Symbols> Defined symbols

9. To debug and run the application, select the project in the Project Explorer and press F11 to start a debug session.

The debugger in the AC6 SW4STM32 can be used to debug source code at the C and assembly levels, to set breakpoints, to monitor individual variables and to watch events during the code execution. To run an application select Resume, from the Run menu, or alternatively click the Resume button in the toolbar.



## .8 GO TO PRODUCTION WITH CLOUD-JAM

In case the application has been developed with Nucleo functional pack it's possible to download directly the .bin file generated by the debug activity.

The best way to download the firmware using the ST-LINK V2 integrated on the Cloud-JAM is to use the ST-LINK UTILITY program.

It's possible to download it at this web address:

<http://www.st.com/en/embedded-software/stsw-link004.html>

### .8.1 ST-LINK UTILITY PC REQUIREMENTS

The STM32 ST-LINK utility PC configuration requires as a minimum:

- PC with USB port and Intel® Pentium® processor running a 32-bit version of one of the following Microsoft® operating systems:
  - Windows® XP
  - Windows® 7
  - Windows® 10
- 256 Mbytes of RAM • 30 Mbytes of hard disk space available

### .8.2 Installing the STM32 ST-LINK utility

Follow these steps and the on-screen instructions to install the STM32 ST-LINK utility:

1. Download the compressed STM32 ST-LINK utility software from the ST website.
2. Extract the contents of the .zip file into a temporary directory.
3. Double-click the extracted executable, setup.exe, to initiate the installation, and follow the on-screen prompts to install the STM32 ST-LINK utility in the development environment. The documentation for the utility is located in the subdirectory \Docs where the STM32 ST-LINK utility is installed.

Note:

*If an earlier version of STM32 ST-LINK utility software is already installed, follow the uninstalling instructions described here in after before installing the new version.*

### .8.3 Uninstalling the STM32 ST-LINK utility

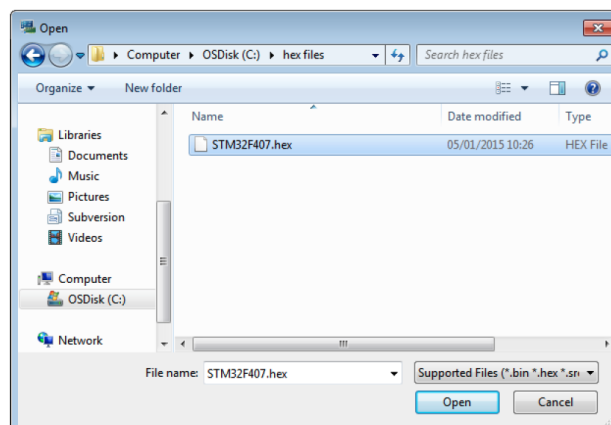
Follow these steps to uninstall the STM32 ST-LINK utility:

4. Select Start | Settings | Control Panel.
5. Double-click on Add or Remove Programs.
6. Select STM32 ST-LINK utility.
7. Click on the Remove button.

### .8.4 Cloud-JAM programming using ST-LINK UTILITY

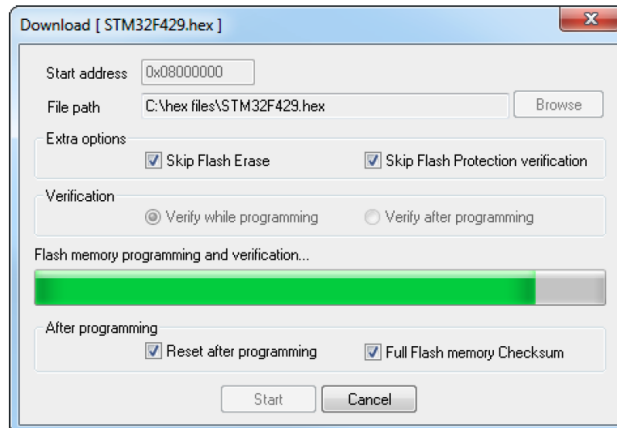
The STM32 ST-LINK utility can download binary .bin, Hex, or srec files into Flash or RAM. To do this, follow these steps:

1. Click on Target | Program... (or Target | Program & Verify... if the user wants to verify the written data) to open the Open file dialog box, as shown in Figure below. If a binary file is already opened, go to step 3.





2. Select a binary, Intel Hex or Motorola S-record file and click on the Open button.
3. Specify the address from which to start programming, as shown in Figure 18: it may be a Flash or a RAM address.



4. Select Skip Flash erase option to skip flash erase operation in case the device is already erased
5. Select Skip Flash Protection verification to skip flash memory protection verification in case the device is not protected.
6. Choose a verification method by selecting one of the two radio buttons:
  - 6.1 Verify while programming: fast on-chip verification method which compares the program buffer content (portion of file) with the Flash memory content.
  - 6.2 Verify after programming: slow but reliable verification method which reads all the programmed memory zone after the program operation ends and compares it with the file content.
7. At last, click on the Start button to start programming:
  - 7.1 If Target | Program & Verify... is selected in the first step, a check is done during the programming operation.
  - 7.2 If the Reset after programming box is checked, an MCU reset will be issued.
8. Choose a verification method by selecting one of the two radio buttons:
  - 8.1 Verify while programming: fast on-chip verification method which compares the program buffer content (portion of file) with the Flash memory content.
  - 8.2 Verify after programming: slow but reliable verification method which reads all the programmed memory zone after the program operation ends and compares it with the file content.
9. At last, click on the Start button to start programming:
  - 9.1 If Target | Program & Verify... is selected in the first step, a check is done during the programming operation.
  - 9.2 If the Reset after programming box is checked, an MCU reset will be issued.

**Note:1**

The STM32F2 and STM32F4 Series supports different programming modes depending on the MCU supply voltage. When using ST-LINK, the MCU supply voltage should be specified in the Target | Settings Menu to be able to program the device with the correct mode. When using ST-LINK/V2, the supply voltage is detected automatically. If the device is read-protected, the protection will be disabled. If some Flash memory pages are write-protected, the protection will be disabled during programming and then recovered.

**Note:2**

The user can program Hex/Srec files that contains multiple segments for different target memory locations (Internal flash memory, external flash memory, Option bytes...). When programming the Read Out Protection to level 2 (debug and boot in SRAM/system Memory features are DISABLED), a message box will be displayed for confirmation to avoid protecting the chip by accident.

**Note:3**

The extra options are dedicated for programming operation on unprotected and erased devices.

**Note:4**

For any other detail please refer to UM0892 user manual of the STM32 ST-LINK Utility software that can be found here:

[http://www.st.com/content/ccc/resource/technical/document/user\\_manual/e6/10/d8/80/d6/1d/4a/f2/CD00262073.pdf/files/CD00262073.pdf/jcr:content/translations/en.CD00262073.pdf](http://www.st.com/content/ccc/resource/technical/document/user_manual/e6/10/d8/80/d6/1d/4a/f2/CD00262073.pdf/files/CD00262073.pdf/jcr:content/translations/en.CD00262073.pdf)



## .9 TYPICAL APPLICATION

### .9.1 FP-CLD-WATSON1 software description

Application software and documentation can be found at the following web address:

[http://www.st.com/content/st\\_com/en/products/embedded-software/mcus-embedded-software/stm32-embedded-software/stm32-ode-function-pack-sw/fp-cld-watson1.html](http://www.st.com/content/st_com/en/products/embedded-software/mcus-embedded-software/stm32-embedded-software/stm32-ode-function-pack-sw/fp-cld-watson1.html)

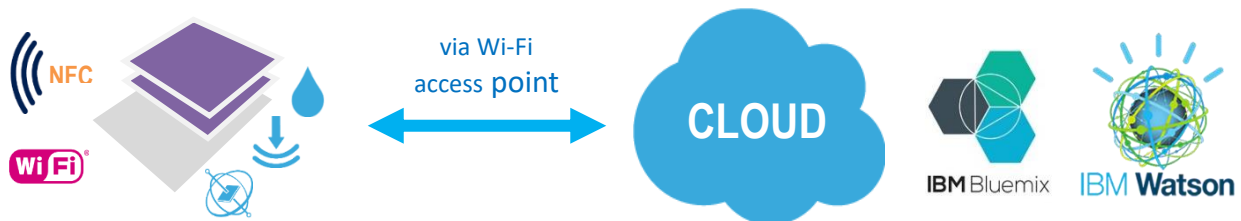
The software is based on the STM32CubeHAL hardware abstraction layer for the STM32 microcontroller. The package extends STM32Cube by providing a board support package (BSP) for the Wi-Fi, NFC and sensor expansion boards. The drivers abstract low-level details of the hardware and allow the middleware components and applications to access sensor data in a hardware-independent manner, to read/write information from/to NFC/RFID tag and to access and control the Serial-to-Wi-Fi module (SPWF01SA).

The package also includes middleware components implementing the MQ Telemetry Transport (MQTT) application level network protocol for communication with IBM Watson IoT. MQTT is a lightweight messaging protocol with a small code footprint, low power and low bandwidth usage, particularly suitable for sensor data telemetry and implementation in embedded systems.

A sample application to experiment connectivity with IBM Watson IoT platform is provided on top of the middleware stacks. Developers can use it to prototype end-to-end IoT applications, by registering the STM32 Nucleo microsystem in the IBM Bluemix Cloud service and begin transmitting real time sensor data in a straightforward manner. Thanks to NFC dynamic tag, users can automatically open a trial web page provided by IBM and visualize data generated by all the sensors on the STM32 Nucleo board.

#### **Features**

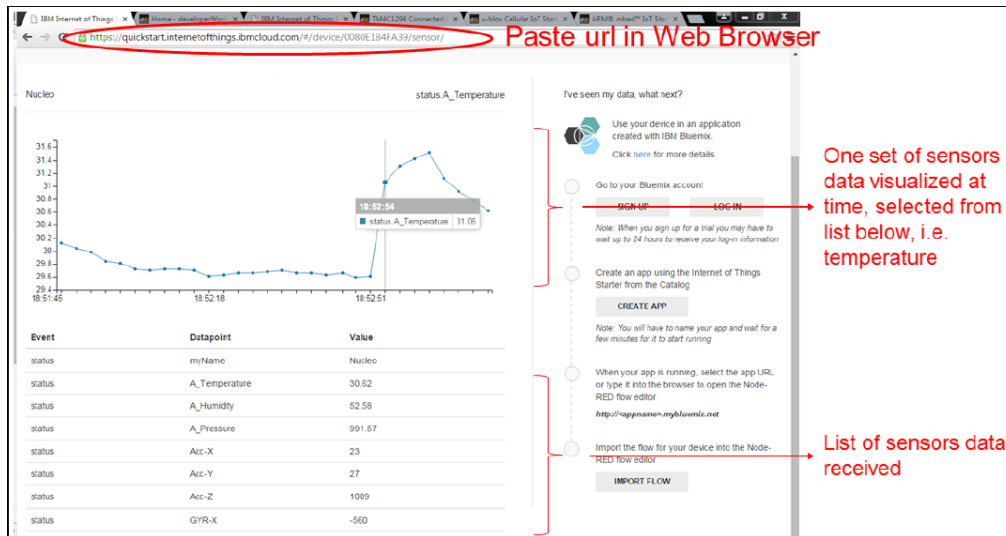
- Complete middleware to build applications based on Wi-Fi connectivity (SPW01SA) and connect Cloud-JAM board with IBM Watson IoT.
- Software interface to access the HTS221 temperature and humidity sensor, LPS22HB pressure sensor, and motion sensors LSM303AGR and LSM6DSL, and to write and read the M24SR64-Y RFID/NFC tag.
- Integrated MQTT protocol middleware.
- Sample implementation available coming from X-NUCLEO-IKS01A2, X-NUCLEO-IDW01M1, and X-NUCLEO-NFC01A1 boards plugged onto a NUCLEO-F401RE board.
- Easy access to Watson IoT platform in IBM Watson IoT for data collection, processing and visualization.
- Free, user-friendly license terms.



IoT node with motion and environmental sensor, NFC tag, connecting to the IBM BlueMix/Watson Cloud via Wi-Fi.

Thanks to NFC memory integrated, using an active host like a smartphone, when the mobile device is paired to the Cloud-JAM, from the board itself the web address, the serial number of the board and the keys to access the IBM Bluemix cloud are taken and by the smartphone it's possible to see the real time measures coming from the board inside the cloud page.

The quick start URL can be copied from the serial interface and pasted in a web browser to view the real time sensor data, as shown below



If an NFC-enabled mobile device is available, the quick start web page can be even more easily opened by drawing the device near to the NFC tag, as shown below.



In order to offer a visual indication of the connectivity status, the green USR on Cloud-JAM is turned ON once the board is connected to IBM Watson IoT; it blinks each time a sample of sensors data is transmitted.

Cloud-JAM sends the sensors data through Wi-Fi module using an external access point. To configure the Wi-Fi module integrated in the Cloud-JAM (SSID and PASSWORD of the access point), there are several modes:

- Manual configuration by the application code.
- Automatic configuration by an external APP.

In manual case the configuration is done using the selected development tool adding SSID and PASSWORD as code inside application program.

If the configuration is done using an APP, one solution can be as follow indicated.

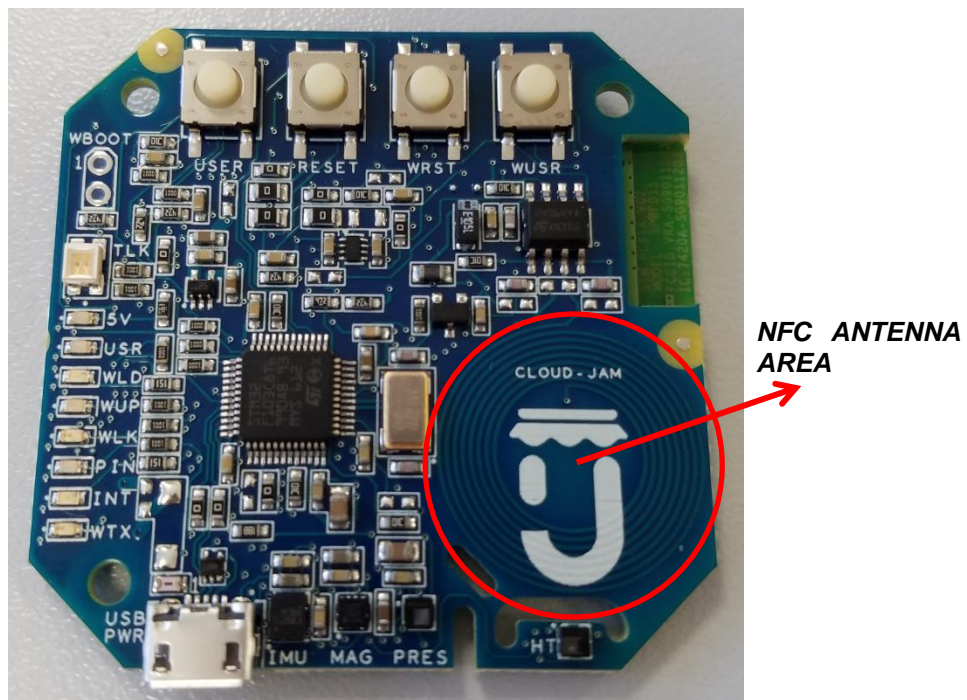
## 9.2 Access point configuration via NFC and APP

To configure access point parameters via NFC:

1. Download on your NFC enabled mobile phone the ST25 NFC mobile application: <https://play.google.com/store/apps/details?id=com.st.demo> (any other mobile application able to write NDEF parameters to NFC can also be used).
2. Launch the ST25 NFC mobile app and press the "Compose NDEF" button.



3. Select Wi-Fi and enter the SSID and password for the access point. Bring your mobile phone close to the NFC antenna on Cloud-JAM and press the “Write to tag” button.



4. Reset the Cloud-JAM board and hold down the RESET push button. The application will read SSID and PWD from NFC and use them to connect to the AP.

### .9.3 Access point configuration using serial terminal

1. Connect Cloud-JAM to a PC using USB cable.
2. Configure a serial terminal with the following parameters to view log messages
  - a. BAUDRATE: 460800
  - b. DATA: 8 bit
  - c. PARITY: none
  - d. STOP: 1 bit
  - e. FLOW CONTROL: none
  - f. NEWLINE RX: CR+LF
  - g. NEWLINE TX: CR
3. Press RESET button on Cloud-JAM and keep pressed USER button on Cloud-JAM to force read of access point parameters from serial interface.
4. Enter SSID and PASSWORD using serial interface.



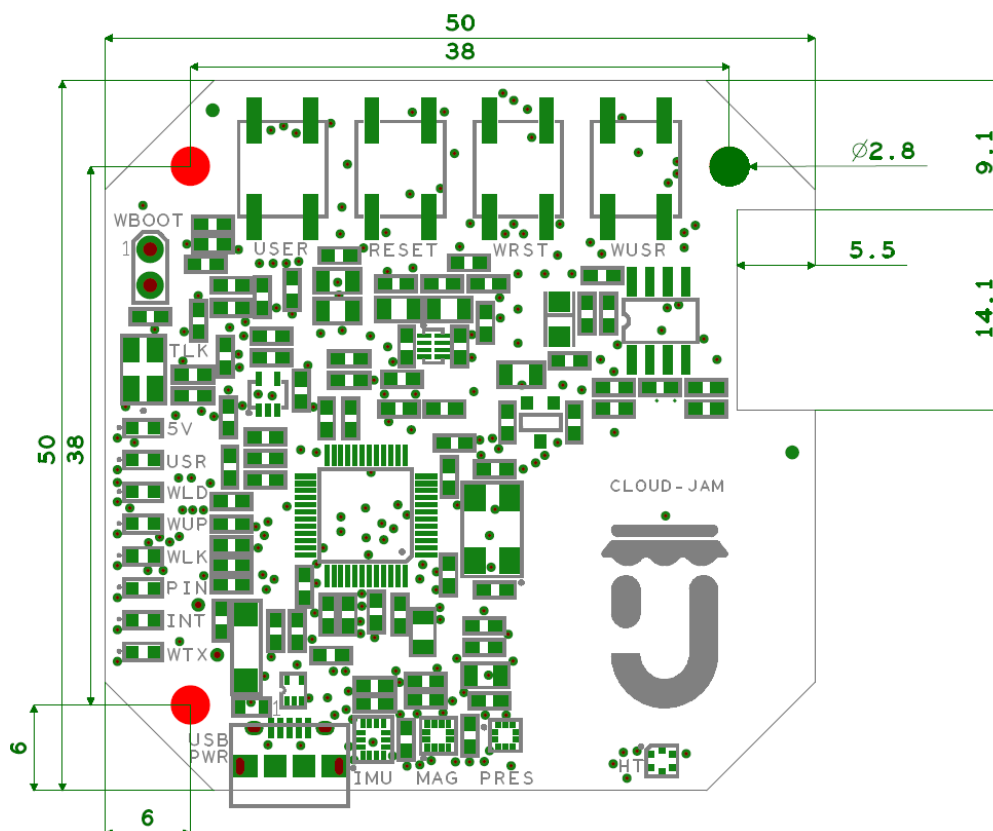
- Access point parameters are copied to FLASH memory; configuration is kept in memory after each RESET of the board.

## .10 SPECIFICATIONS

Parameter	Minimum	Typical	Maximum	Conditions
Power supply voltage	3,5V	5V	5,5V	USB port input connector
Input current	-	-	0.5A	Protected by resettable PTC
Operation temperature	-20°C	-	70°C	-
Storage temperature	-40°C		85°C	-

Wireless standard	Frequency band low	Frequency band high	Transmitted power
Wi-Fi	2402 MHz	2480 MHz	11 dBm
NFC	13.56MHz	13,56 MHz	Passive NFC

## .11 MECHANICAL SPECIFICATIONS



The measures are in mm and the view is TOP side.

## .12 HOUSING PRESCRIPTION

Cloud-JAM is PCBA (Printed Circuit Board Assembly) system and then is not a final product, it's necessary to close the board in a specific housing or mechanical box.



The housing, in addition to achieve the desired functionality, must be fireproof (in case of unexpected failure of the electronic board component that produce a little spark, a fire will be blocked).

## .13 PACKAGING

FRONT VIEW



REAR VIEW



Packaging contain Cloud-JAM board only and not the USB cable or other accessories.



## .14 UE Declaration of Conformity

### EU Declaration of Conformity (DoC)

We

Company name: F&E s.r.l.

Postal address: C. Battisti 136

Postcode: 24025

City: Gazzaniga (Bg)

Telephone number: +3903573180

E-Mail address: info@faesrl.com

declare that the DoC is issued under our sole responsibility and belongs to the following product:

Apparatus model/Product: Cloud-JAM

Type: STM320DE IoT electronics board

Batch: CJ

Serial number: From 000001 to 999999

Object of the declaration (identification of apparatus allowing traceability; it may include a colour image of sufficient clarity where necessary for the identification of the apparatus):

**RUSHUP**



**JAM**

The object of the declaration described above is in conformity with the relevant Union legislation:

Directive 2014/53/EU (RED)

RED Directive 2014/53/EU

RoHS Directive 2011/65/EU

The following standards and technical specifications have been applied:

Title, Date of standard/specification:

EN 62311:2008

EN 301 489-17 V2.2.1: 2012

EN 301 489-1 V1.9.2: 2011

EN 301 489-17 V3.1.1

EN 301 489-3 V1.6.1: 2013

EN 301 489-1 V2.2.0 (radiated immunity up to 6 GHz)

EN 300 328-3 V1.9.1: 2015

EN 300 328-3 V2.1.1: 2016

Notified body (where applicable):

4 digit notified body number:

Nemko S.p.A.

2051

Reference number of the certificate of notified body: 318102 dated 2017/04/28

Additional information:

Signed for and on behalf of:

Gazzaniga (Bg)

2017/04/28

Gianmarco Lanza, CEO,

Place of issue

Date of issue

Name, function, signature



## **.15 OPERATING ENVIRONMENT**

The operating environment excludes special environments (extreme temperatures, dust, humidity, vibrations, flammable gases, corrosive or explosive atmosphere, etc.).

## **.16 DISCLAIMERS**

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