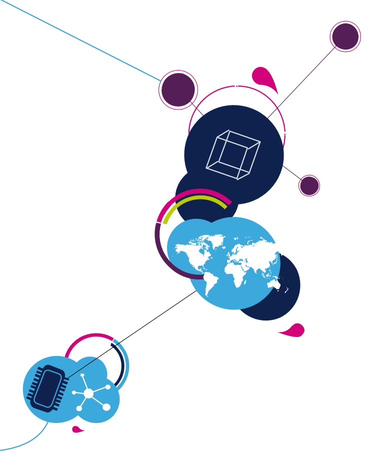

Simplifying Integration of Sensors Data, Using the NFC Enabled Multi-Sensors Node, STEVAL-SMARTAG1

John Tran

life.augmented

Technology Tour 2019

Schaumburg, IL | April 25

What’s NFC?

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Radio Frequency IDentification

RFID is a short range contactless communication technology

Employs an active reader/writer and a passive tag/transponder

- The reader powers the tag and initiates the communication

Frequency Bands

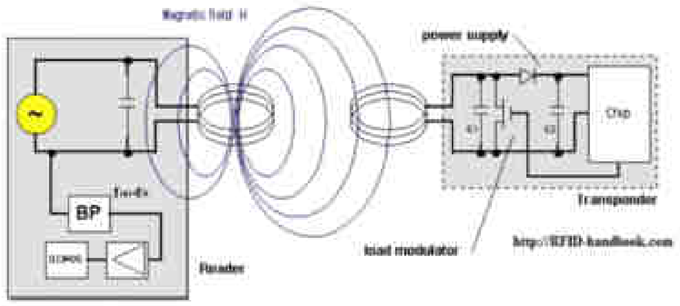
- •LF (120-150 KHz)
- •HF (13.56 MHz)
- •UHF (433 to 960 MHz)

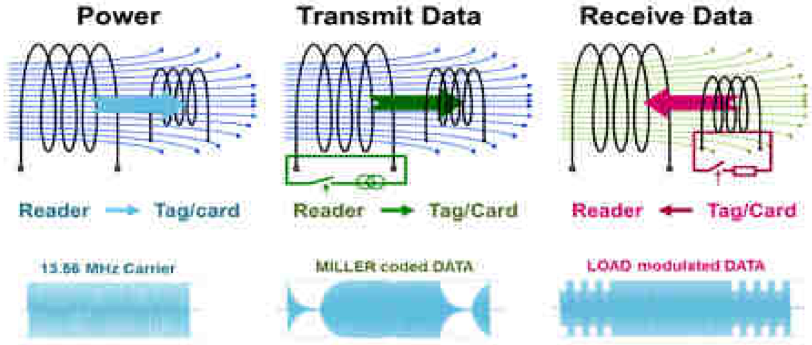
Operating ranges

- •Proximity (few cm)
- •Vicinity (up to 1m)
- •Long Range (up to 10m)

Applications

- •Transit, payment, inventory tracking, building and car access, etc.





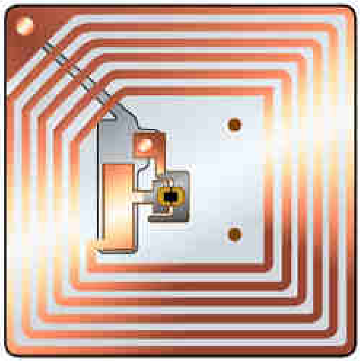
ISO14443 signaling

RFID Technologies at a Glance

RFID	LF	HF	UHF
Coupling mode	Inductive	Inductive	Electro-magnetic backscatter
Operating frequency	125kHz – 134kHz	13.56MHz	860MHz – 960MHz
Antenna	Coil	Coil	Dipole
Max operating distance	up to 1m	Vicinity: up to 1m Proximity: up to 10cm	~10m
Regulation	Worldwide harmonized	Worldwide harmonized	Different regulations per country
Standards	ISO14223 ISO18000-2	ISO14443 A/B ISO15693 ISO18092 ISO18000-3 **NFC Forum**	ISO18000-6 B/C EPC Class 1 Gen 2 **RAIN RFID**
Environmental influences	Small influence on operating distance Works in metal and industrial environment	Small influence on operating distance Works in metal and industrial environment	Influence on operating distance by reflection and absorption (metal and liquids)
Applications	Animal tagging	Product identification Public transport / Libraries Access control / Payment	Pallets and container ID Retail / Logistics Authentication
ST solutions		X	X

Comparison of RFID vs. Barcode

- Works in harsh and contaminated environments
- Options to implement data security / encryption
- Protocol supports “anti-collision” which allows reading/writing of an individual tag when multiple tags are in the reader field
- Unlike barcodes, line of sight is not necessary
- Offers data storage with options to interface to local processing (i.e. MCUs, FPGAs, etc.)



NFC Technology at a Glance

An interactive technology enabling engagement with IoT devices

- Near Field Communication, a short range wireless technology
  - Operating at 13.56MHz
  - Based on the RFID HF standard (ISO14443 & ISO15693)

- Interactive and zero power, enabling convenient connection to the Internet of Things

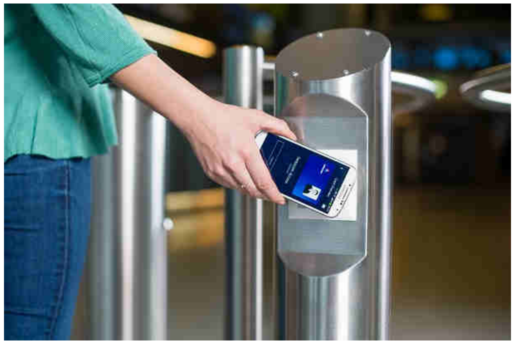
➔ NFC-enabled mobile phone can engage with items by a simple tap

- NFC is maintained by the NFC Forum
  - Ensures Interoperability between devices
  - Standardized use cases (web link, Bluetooth handover,…)

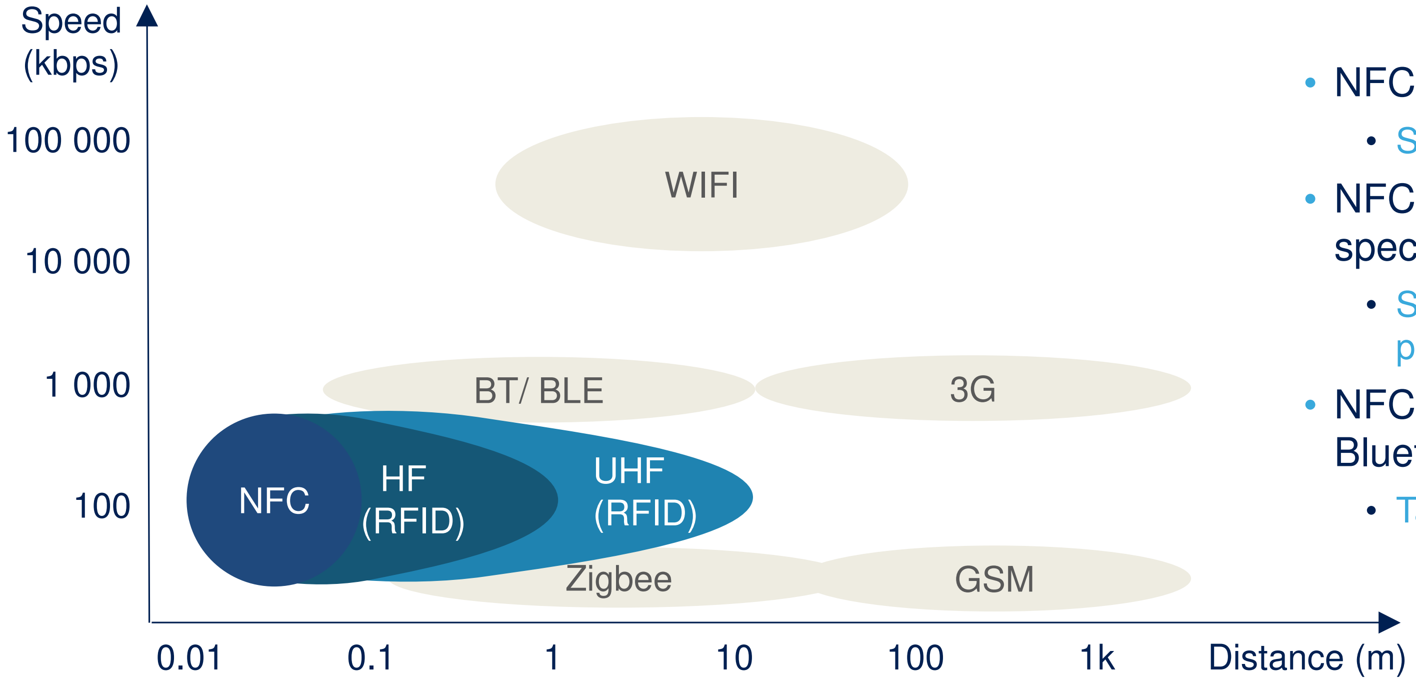
- Fast growing deployment in Mobile phone
  - Since 2010 virtually all Android phones support NFC
  - Apple has use NFC ApplePay since 2014, and in 2017 Apple added support of NFC reader mode in iOS11 onward

NFC in Depth

- Requires an action such as bringing your card/phone near the reader in order to use
- Maximum data transfer rate is 424 kbps
  - Proprietary modes can go up to 6.8Mbps
- NFC operating modes
  - Read/Write (reader-to-passive tag/card)
  - **Card Emulation (e.g. Apple Pay, Android Pay)**
  - **Peer-to-Peer (e.g. reader-to-reader)**
- Applications include access control, payments, electronic passports, transportation ticketing, device pairing, data file exchange (e.g. Android Beam)
- Various combinations of memory and security
- Standards and specifications
  - ISO14443A, ISO14443B, Sony FeliCa, ISO15693



NFC in the Wireless Spectrum



- NFC is a flavor of RFID
  - Subset of RFID HF standard: 13.56MHz
- NFC is complementary in the wireless spectrum
  - Short distance, Low data-rate & Zero power for applications
- NFC is complementary to Wi-Fi and Bluetooth technologies
  - Tap & Pair: convenient pairing use case

History of NFC

- 1983 RFID Patented
- 2003 NFC approved as an ISO/IEC standard
- 2004: Philips, Sony and Nokia create the NFC Forum
- 2006: First specifications for NFC tags are released
- 2006 Nokia releases the Nokia 6131 NFC compatible phone
- 2007: Commercial roll-outs in US, Europe, and China
- 2008: NFC Forum membership increases to +150 members
- 2010: Samsung releases the first Android-based NFC phone, the Nexus S
- 2011: Google Wallet introduced
- 2012: NFC in Windows 8
- 2013: Apple Pay introduced. Rolled out to mass market in 2014.
- 2017: Apple Core NFC introduced in iOS11

NFC Forum Tag Types

	Type 1	Type 2	Type 3	Type 4	Type 5
Products	BROADCOM “Topaz”	NXP NTAG MIFARE	SONY “FELICA”	ST25T(A&B) DESFire	ST25TV iCode
Specification	ISO 14443-A	ISO 14443-A	JIS X 6319-4	ISO 14443-A/B	ISO15693
Data Rate	106 kbit/s	106 kbit/s	212/424 kbit/s	106-424 kbit/s	26kbit/s
Protocol	Specific command Set	Specific command Set	FeliCa protocol	ISO 14443-4 ISO 7816-4	ISO/IEC 21481
Cost	Low	Low	Moderate	Moderate	Low
Use cases	Tags with small and fixed memory for single applications		Flexible tags with larger memory offering multi-application capabilities.		Long range tags with multiple applications
Memory type	Memory cards		CPU cards/Memory Cards0		Memory Cards

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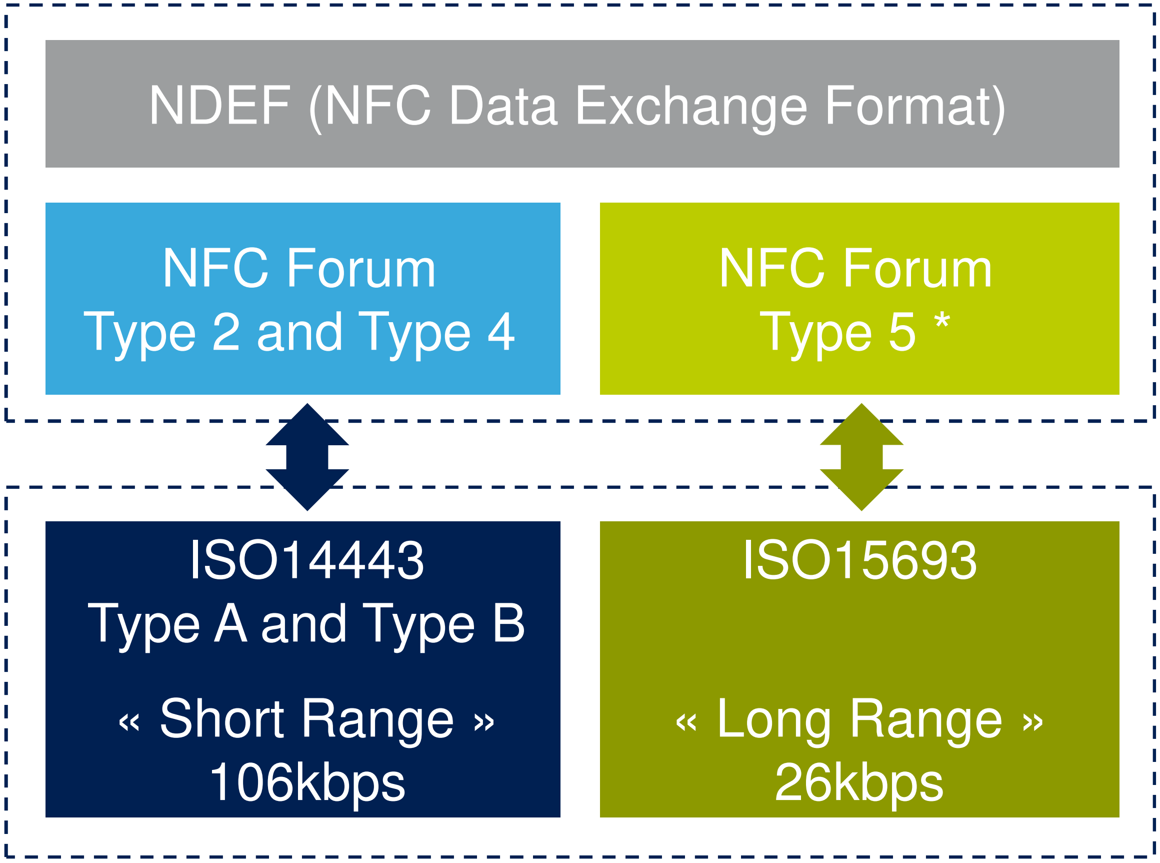
NFC Standards

NFC specification
→ **Upper layer SW**

RFID HF ISO standards
→ **HW / SW protocol**



NDEF (NFC Data Exchange Format)

NFC Forum
Type 2 and Type 4

NFC Forum
Type 5 *

ISO14443
Type A and Type B

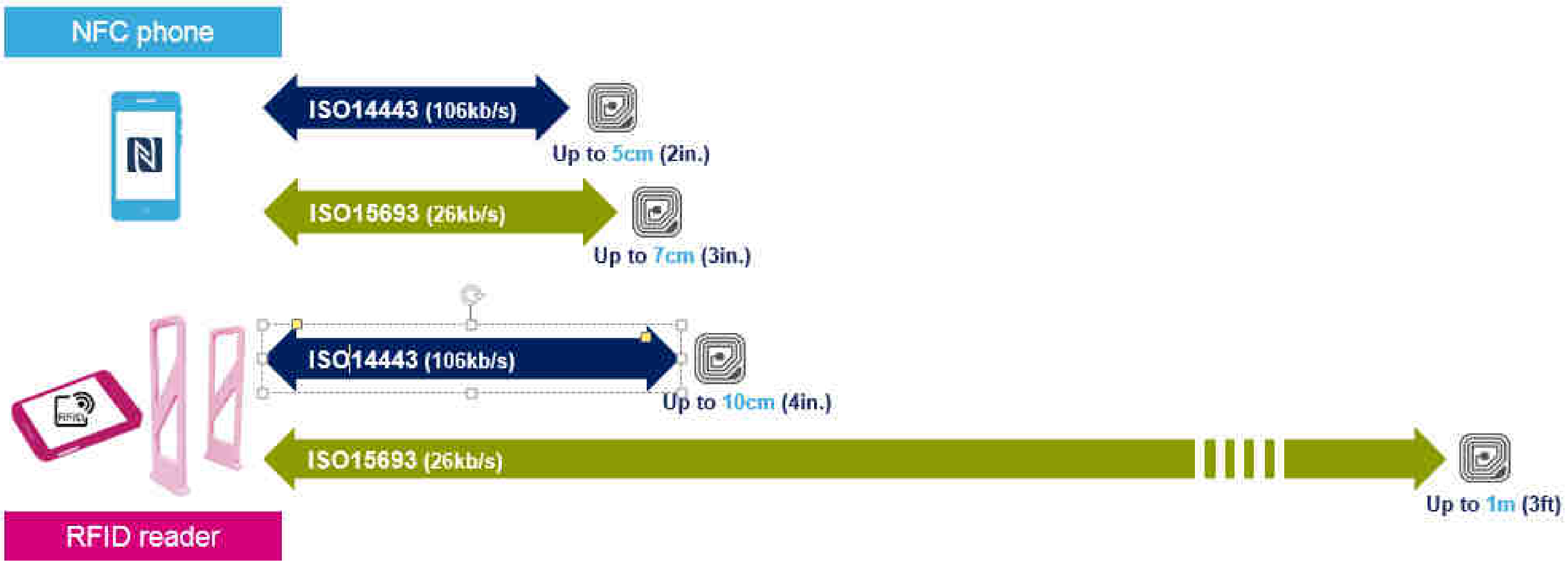
« Short Range »
106kbps

ISO15693

« Long Range »
26kbps

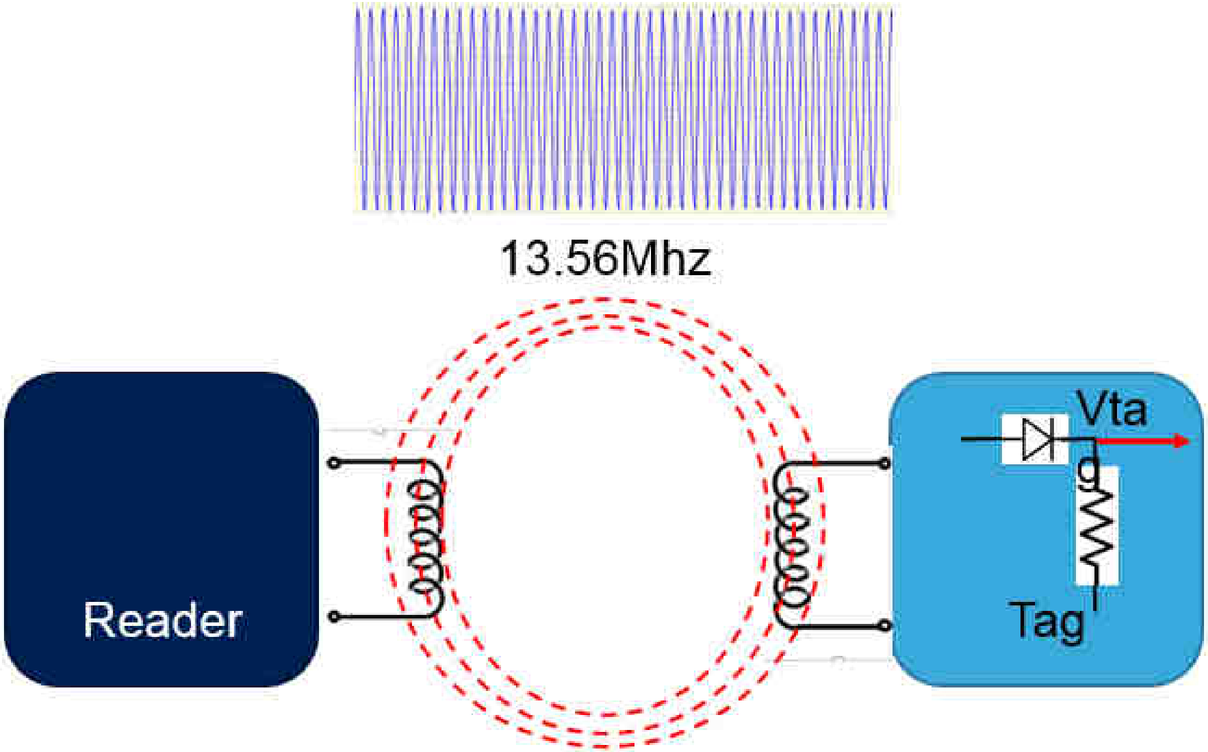
(*) ISO15693 integrated in NFC Forum specifications in October 2015 as NFC Forum type 5 (aka type V)

Typical NFC / RFID range



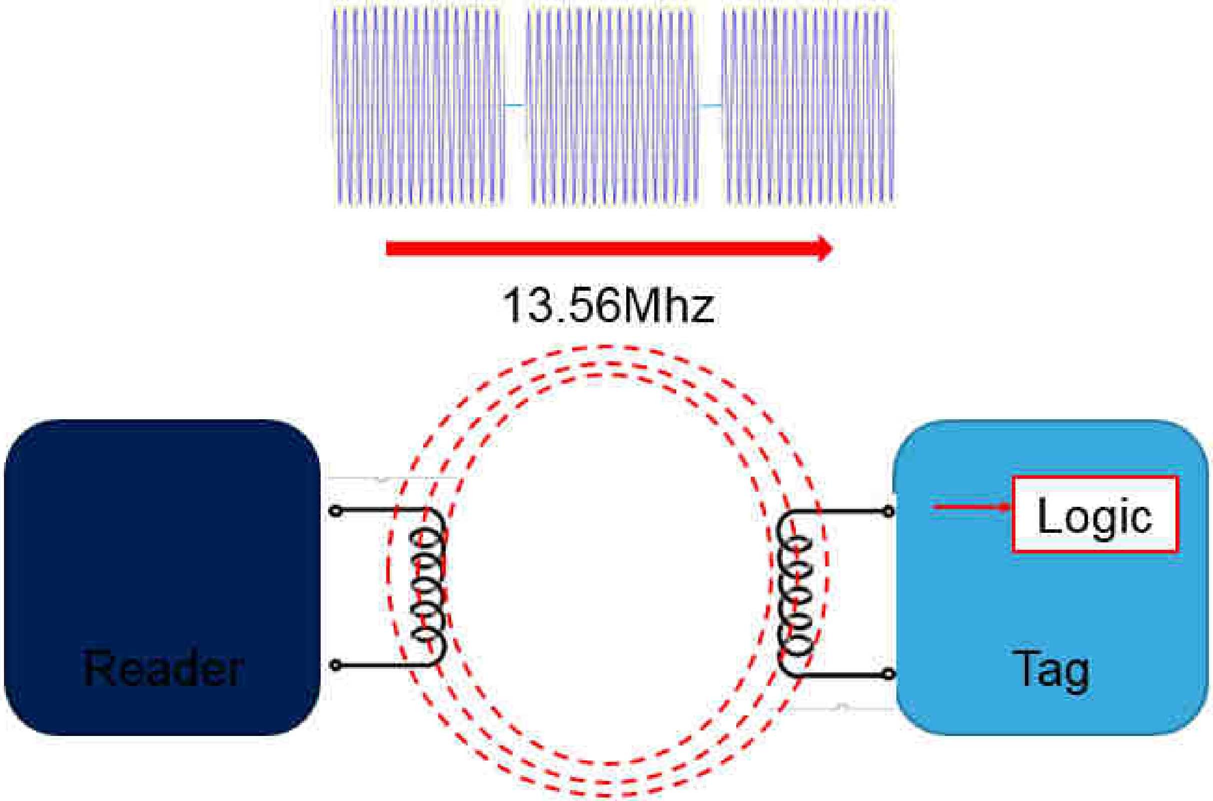
- ISO14443 is called « **short range** » standard while with higher RF speed
- ISO15693 is called « **long range** » standard

HF Communication – The Basis



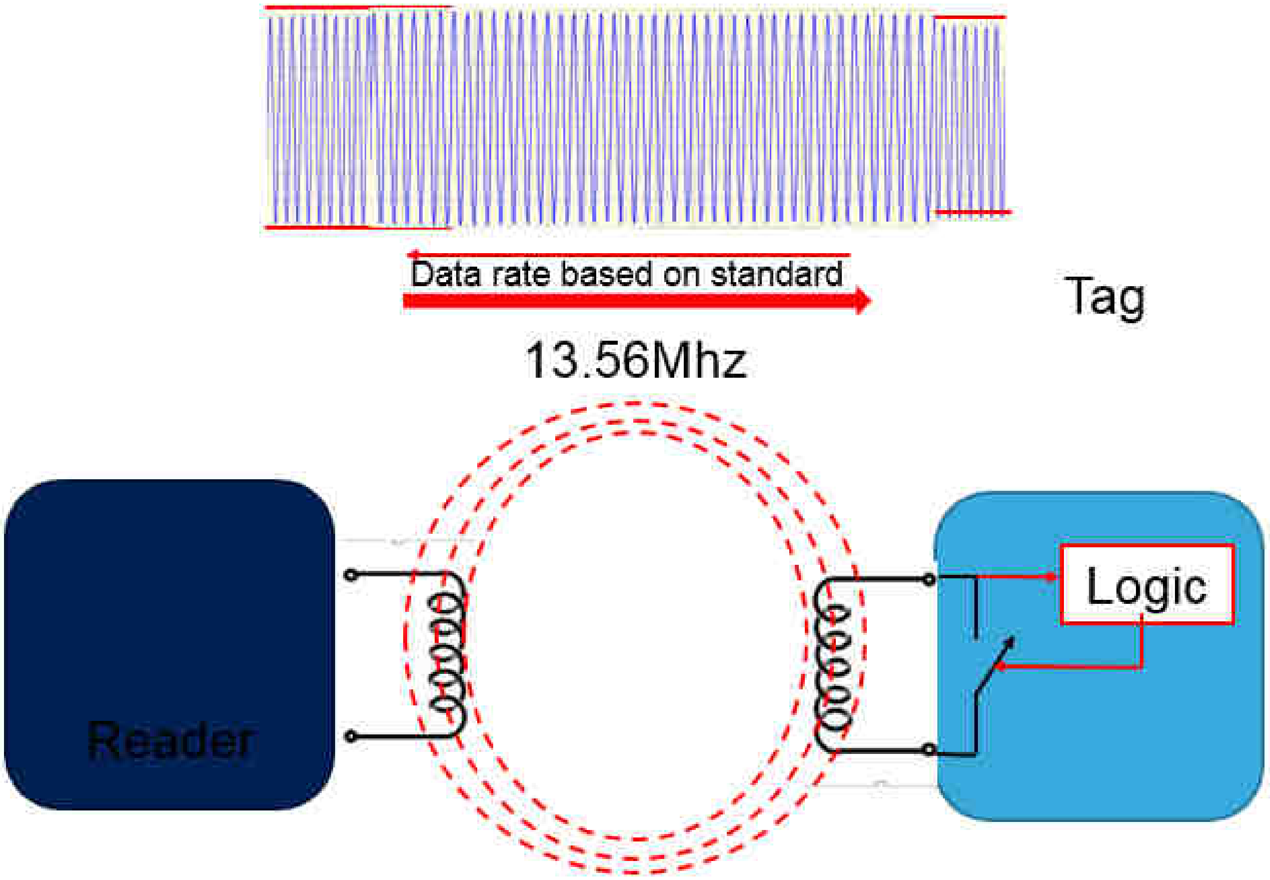
HF Communication

Reader to Tag



HF Communication

Tag to reader



HF Communication

Communication	ISO14443A	ISO14443B	ISO15693	Felica
Reader to Tag	100% ASK Miller modified coding	10% ASK NRZ Coding	10% or 100% ASK Manchester Coding	8 – 30% ASK Manchester Coding
Tag to Reader	Subcarrier fc/16 OOK Manchester	Subcarrier fc/16 BPSK NRZ-L	Single or Double Subcarrier fc/32 or fc/28 Manchester	>12% ASK load modulation Manchester Coding

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ST NFC Sensor TAG

ST **NFC Sensor TAG**

NFCSensorTAG is **a NFC enabled sensor node** that can sense temperature, humidity, pressure, vibration, motion and **transmit the data when triggered by an NFC reader**. It is a **reference platform** that can be scaled down/up based on requirement of final applications and use cases.

An **alternative way of connectivity** for applications that:

- Are extremely **low POWER** (also full passive) and **low COST**;
- Require small real estate (**reduced BOM)** and **fast implementation**;
- Do **NOT** require **Real-Time Remote** monitoring (Near Field Communication)

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Leveraging ST Technology

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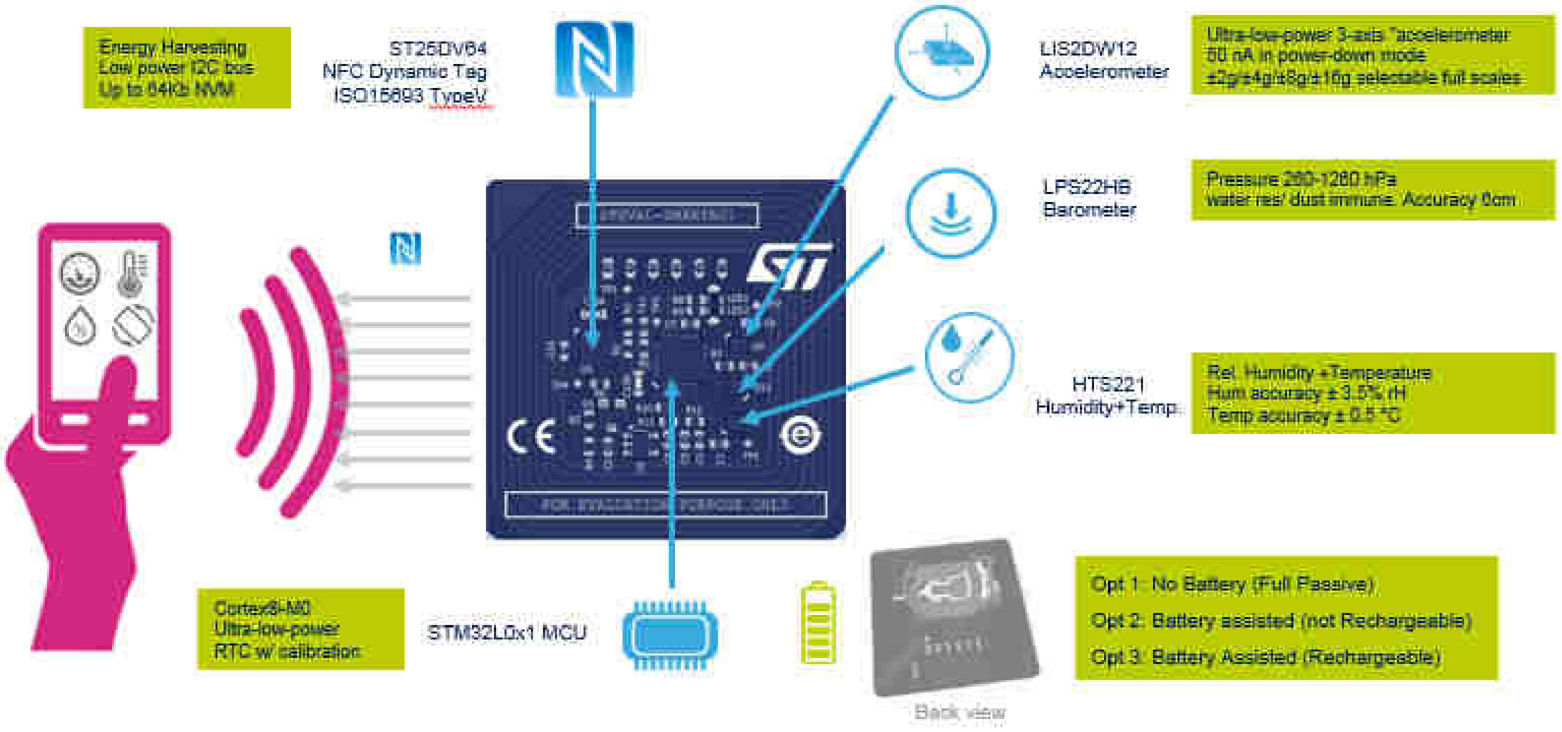
What’s on the Board



Energy Harvesting
Low power I2C bus
Up to 64Kb NVM

ST25DV64
NFC Dynamic Tag
ISO15693 TypeV

LIS2DW12
Accelerometer

Ultra-low-power 3-axis "accelerometer
50 nA in power-down mode
±2g/±4g/±8g/±16g selectable full scales

LPS22HB
Barometer

Pressure 260-1260 hPa
water res/ dust immune. Accuracy 0cm

HTS221
Humidity+Temp.

Rel. Humidity +Temperature
Hum accuracy ± 3.5% rH
Temp accuracy ± 0.5 °C

Cortex®-M0
Ultra-low-power
RTC w/ calibration

STM32L0x1 MCU

Back view

Opt 1: No Battery (Full Passive)

Opt 2: Battery assisted (not Rechargeable)

Opt 3: Battery Assisted (Rechargeable)

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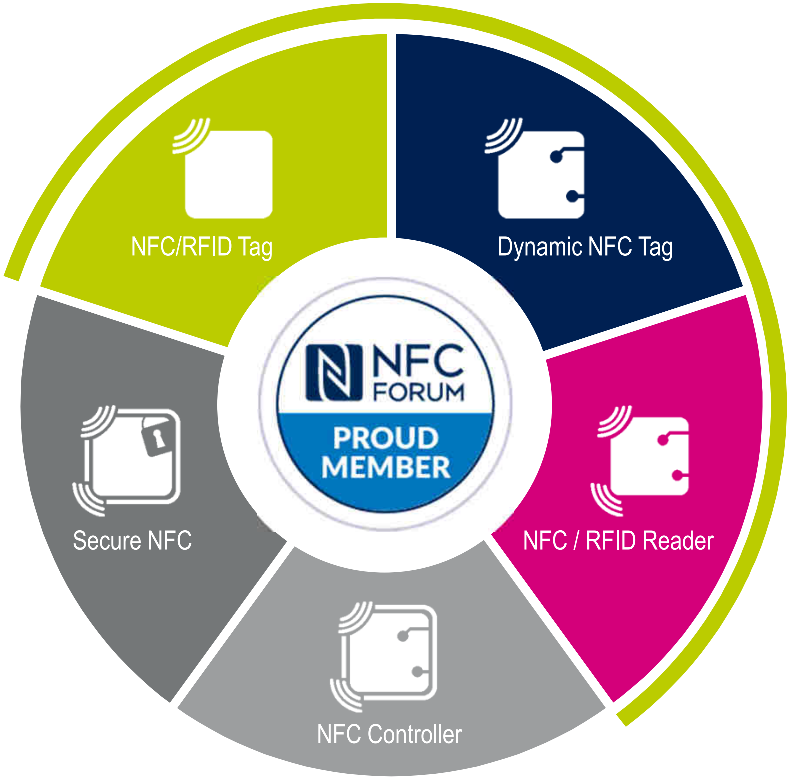
ST25 NFC Value Proposition

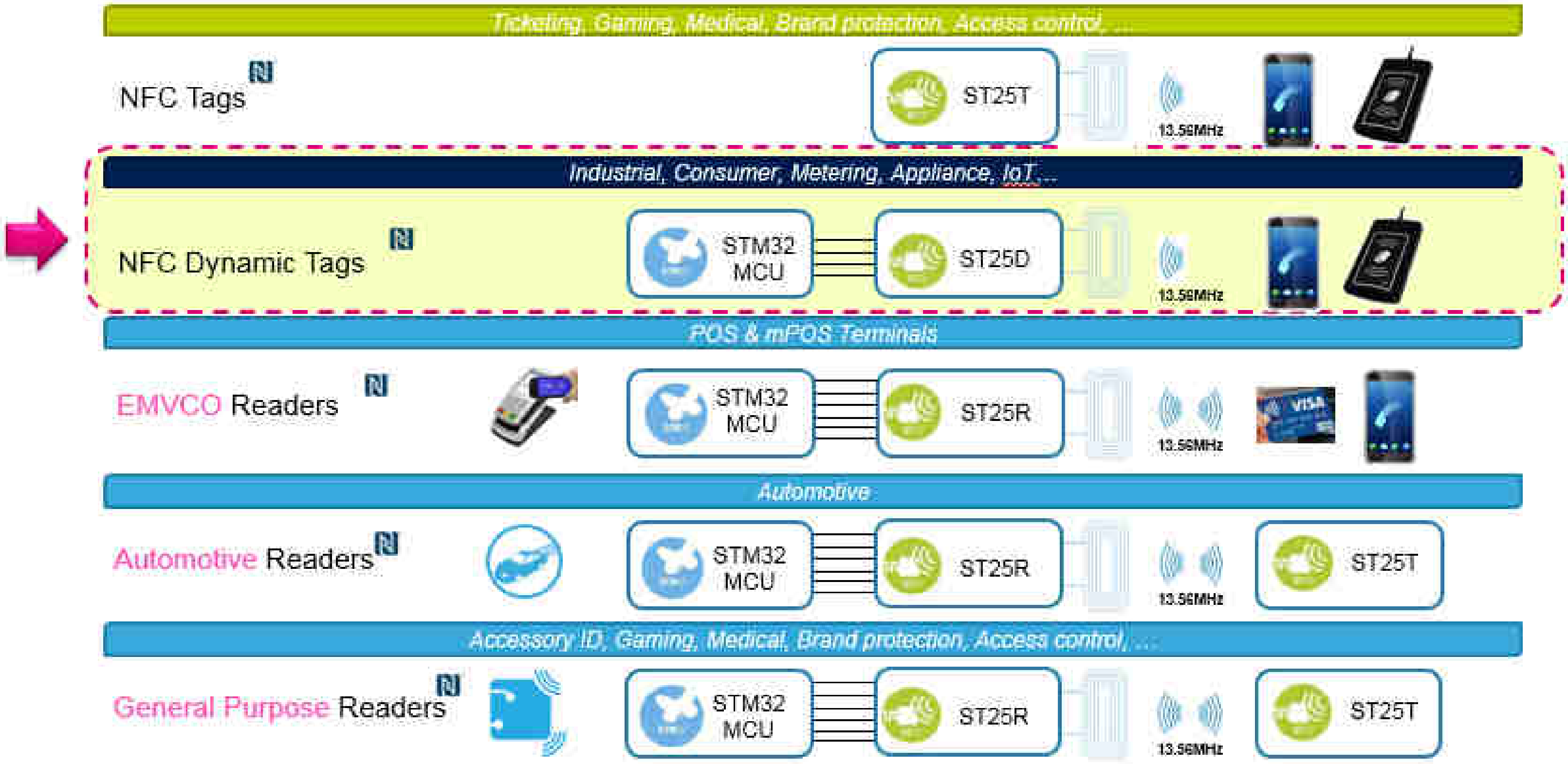


NFC / RFID Tags and Readers

Simply More Connected

Covering all NFC application needs and leveraging a rich ecosystem

ST25 Product Lines



Ticketing, Gaming, Medical, Brand protection, Access control, ...

NFC Tags

ST25T

13.56MHz

Industrial, Consumer, Metering, Appliance, IoT ...

NFC Dynamic Tags

STM32 MCU

ST25D

13.56MHz

POS & mPOS Terminals

EMVCO Readers

STM32 MCU

ST25R

13.56MHz

Automotive

Automotive Readers

STM32 MCU

ST25R

13.56MHz

ST25T

Accessory ID, Gaming, Medical, Brand protection, Access control, ...

General Purpose Readers

STM32 MCU

ST25R

13.56MHz

ST25T

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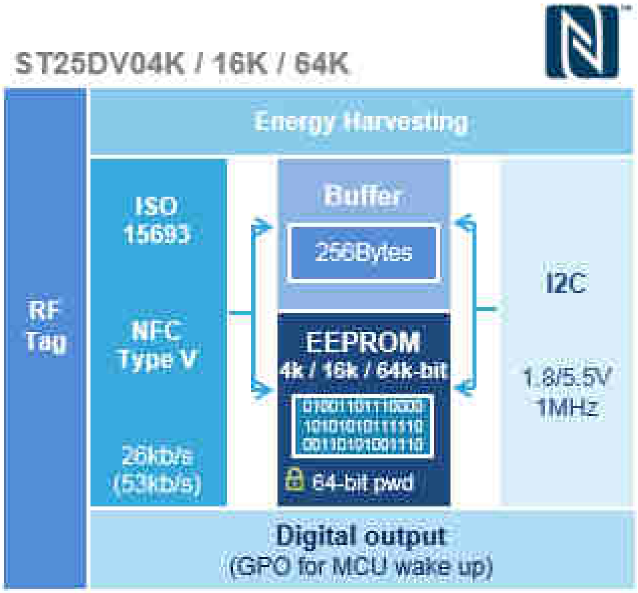
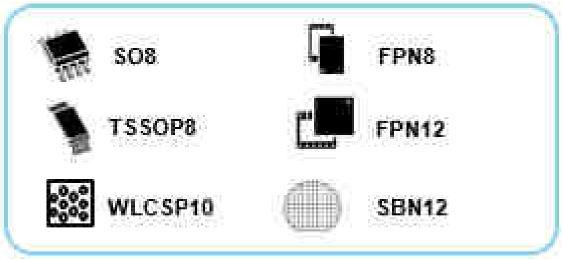
ST25 Product Portfolio

Tags			Dynamic tags			HF Readers			UHF Readers
ST25TA	ST25TB	ST25TV	M24SR	M24LR	ST25DV	CR95HF ST95HF	ST25R3910	ST25R3911B - ST25R3915	ST25RU3993
ISO14443-A 106kb/s NFC type 4	ISO14443-B 106kb/s	ISO15693 up to 53kb/s NFC type 5	ISO14443-A 106kb/s NFC type 4	ISO15693 up to 53kb/s	ISO15693 up to 53kb/s NFC type 5	ISO14443-A/B ISO15693	ISO14443-A/B ISO15693 FeliCa	ISO14443-A/B FeliCa ISO15693 ISO18092	ISO18000 6c & b Gen2 Protocol
EEPROM 512b-64Kbit 200-year 1Mcycles	EEPROM 512b-4Kbit 40-year 1Mcycles	EEPROM 512b-64Kbit 60-year 100kcycles	EEPROM 2Kbit to 64Kbit 200-year 1Mcycles	EEPROM 4Kbit to 64Kbit 40-year 1Mcycles	256Bytes buffer EEPROM 4Kbit to 64Kbit 40-year 1Mcycles	Reader / Writer Card Emulation	Reader / Writer Limited P2P	Reader / Writer P2P EMVco & PBOC AECQ100	Reader / Writer -90dBm sensitivity Internal VCO
TruST25 128bit password 20bit counter UID Field Detect	32bit counters Lock OTP bits UID	TruST25 64bit password 16-bit counter UID Tamper detect	128bit password RF disable Field Detect	32bit password E-harvesting Field Detect	Fast transfer mode 64bit password E-harvesting Field Detect	-	AAT	VHBR AAT Multi Antenna Dynamic output power	Dense Reader Mode Linear RSSI Automatic PSRR Auto ACK
			I2C 1MHz 2.7V - 5.5V	I2C 400kHz 1.8V - 5.5V	I2C 1MHz 1.8V - 5.5V	SPI & UART 2Mbit/s 2.7V - 5.5V 230mW	SPI 6Mbit/s 2.4V - 3.6V 700mW max	SPI 6Mbit/s 2.4V - 5.5V 1 - 1.4W max	SPI 5Mbit/s 1.65V – 5.5V 0/20dBm Output

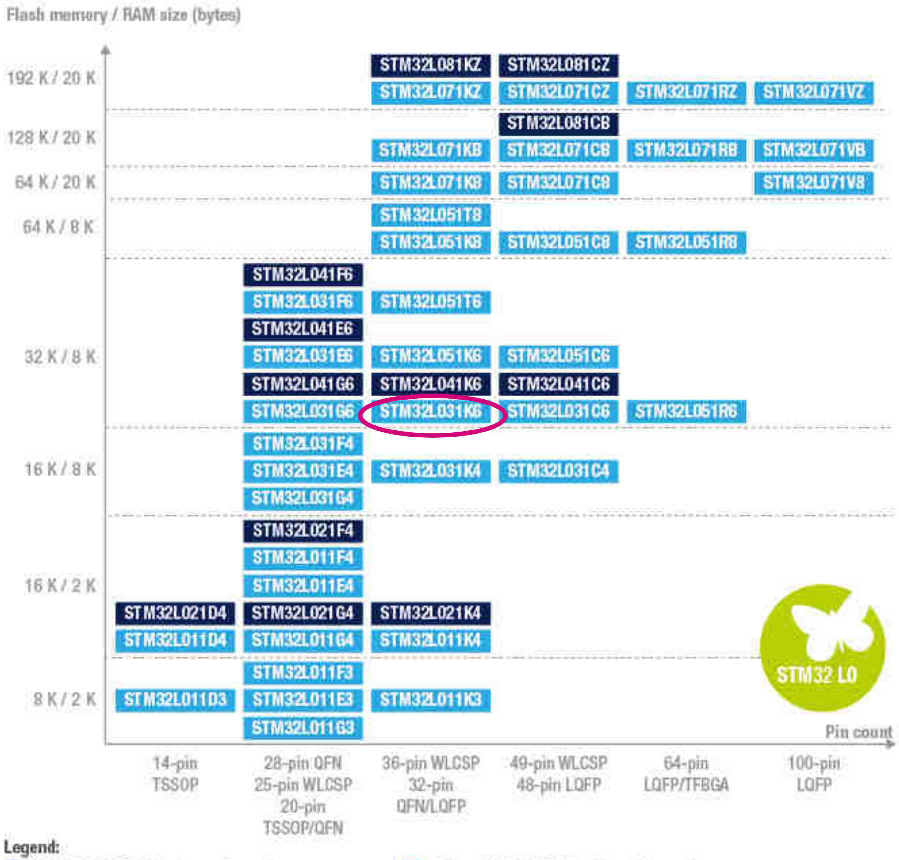
Focus on ST25DV Type5 Dynamic Tag

	ST25DV series
Contactless Interface	ISO15693 / NFC Forum Type 5
RF speed	up to 53kbps (26kbps std)
Single supply voltage	1.8V to 5.5V
Serial Interface	I2C @1MHz
Extra Features	GPO: 7 interrupts modes (OD or CMOS) Energy Harvesting Low Power Mode (<1uA stby)
Memory format & size	EEPROM data - 4 / 16 / 64-kbit
Data retention	40-year at +55°C
Fast Transfer Mode	256 Bytes memory buffer
Erase/Write cycles	1M cycles
Data protection	Password 64-bit
Temperature range	-40°C to +85°C
Package	SO8/TSSOP8/FPN8-12/WLCSP/SBN12





STM32L0 ULP MCU Series



Flash memory / RAM size (bytes)

	14-pin TSSOP	28-pin QFN 25-pin WLCSP 20-pin TSSOP/QFN	36-pin WLCSP 32-pin QFN/LQFP	49-pin WLCSP 48-pin LQFP	64-pin LQFP/TFBGA	100-pin LQFP
192 K / 20 K			STM32L081KZ STM32L071KZ	STM32L081CZ STM32L071CZ	STM32L071RZ	STM32L071VZ
128 K / 20 K			STM32L071KB	STM32L081CB STM32L071CB	STM32L071RB	STM32L071VB
64 K / 20 K			STM32L071K8	STM32L071C8		STM32L071V8
64 K / 8 K			STM32L051T8 STM32L051K8	STM32L051C8	STM32L051R8	
32 K / 8 K		STM32L041F6 STM32L031F6 STM32L041E6 STM32L031E6 STM32L041G6 STM32L031G6	STM32L051T6 STM32L051K6 STM32L041K6 STM32L031K6	STM32L051C6 STM32L041C6 STM32L031C6	STM32L051R6	
16 K / 8 K		STM32L031F4 STM32L031E4 STM32L031G4	STM32L031K4	STM32L031C4		
16 K / 2 K	STM32L021D4 STM32L011D4	STM32L021F4 STM32L011F4 STM32L011E4 STM32L021G4 STM32L011G4	STM32L021K4 STM32L011K4			
8 K / 2 K	STM32L011D3	STM32L011F3 STM32L011E3 STM32L011G3	STM32L011K3			

Pin count

Legend:

■ With 128-bit AES Hardware Encryption

🟦 Without 128-bit AES Hardware Encryption

STM32L031 ULP MCU

All the ingredients for your application

32bits CPU

8KB SRAM

1KB EEPROM

Control

Connectivity

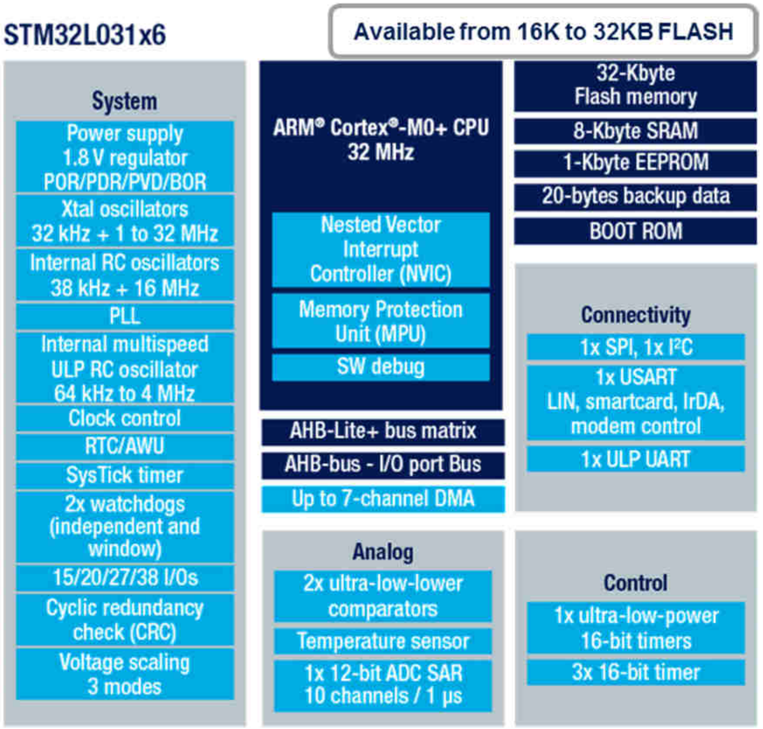
Analog

Battery friendly

250nA standby

Goes everywhere

Down to 2 x 2,5 mm package



STM32L031x6

Available from 16K to 32KB FLASH

System

- Power supply 1.8 V regulator POR/PDR/PVD/BOR
- Xtal oscillators 32 kHz + 1 to 32 MHz
- Internal RC oscillators 38 kHz + 16 MHz
- PLL
- Internal multispeed ULP RC oscillator 64 kHz to 4 MHz
- Clock control
- RTC/AWU
- SysTick timer
- 2x watchdogs (independent and window)
- 15/20/27/38 I/Os
- Cyclic redundancy check (CRC)
- Voltage scaling 3 modes

ARM® Cortex®-M0+ CPU 32 MHz

- Nested Vector Interrupt Controller (NVIC)
- Memory Protection Unit (MPU)
- SW debug

AHB-Lite+ bus matrix

AHB-bus - I/O port Bus

Up to 7-channel DMA

- 32-Kbyte Flash memory
- 8-Kbyte SRAM
- 1-Kbyte EEPROM
- 20-bytes backup data
- BOOT ROM

Connectivity

- 1x SPI, 1x I^{2}C
- 1x USART LIN, smartcard, IrDA, modem control
- 1x ULP UART

Analog

- 2x ultra-low-lower comparators
- Temperature sensor
- 1x 12-bit ADC SAR 10 channels / 1 µs

Control

- 1x ultra-low-power 16-bit timers
- 3x 16-bit timer

Smart Things

ST Leading Sensors

ULTRA LOW POWER **ACCELEROMETER & GYROSCOPE**

LIS2DW12 / LSM6DSL

Low power & noise for UI, IoT, wearable

http://www.st.com/content/st_com/en/products/mems-and-sensors/accelerometers/lis2dw12.html

http://www.st.com/en/mems-and-sensors/lsm6dsl.html

ACCELEROMETER & MAGNETOMETER **COMPASS**

LIS2MDL / LSM303AH

Accuracy, with pedometer (LSM303AH)

http://www.st.com/content/st_com/en/products/mems-and-sensors/e-compasses/lis2mdl.html

http://www.st.com/content/st_com/en/products/mems-and-sensors/e-compasses/lsm303ah.html

HIGH ACCURACY **PRESSURE SENSOR**

LPS22HB / LPS33HW

Compact, low power, water resistant

http://www.st.com/content/st_com/en/products/mems-and-sensors/pressure-sensors/lps22hb.html

http://www.st.com/content/st_com/en/products/mems-and-sensors/pressure-sensors/lps33hw.html

COMBO **HUMIDITY & TEMPERATURE**

HTS221

High accuracy Humidity and Temp

http://www.st.com/en/mems-and-sensors/hts221.html

ANALOG & DIGITAL **MICROPHONES**

MP23AB01DH / MP34DT05-A

Better sound quality

http://www.st.com/en/audio-ics/mp23ab01dh.html

http://www.st.com/en/audio-ics/mp34dt05-a.html

ST Advantage:

- Flexibility Power Consumption vs. Noise
- Ecosystem (SW, libraries, ref design, Nucleo boards …)

ST Advantage:

- Power Consumption
- Thermal Stability
- Precision

ST Advantage:

- LPS22HB: Stability over time
- LPS33HW: resistant to harsh environment (automotive gel, metal lid, ceramic substrate)

ST Advantage:

- Low power consumption 2uA @ 1Hz
- -40C to +120C operation
- SPI/I2C host interface

ST Advantage:

- High performance
135dB AOP
65dB SNR

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ST Motion Sensors

LIS2DW12

3-axis Accelerometer

Package

2x2x0.7 mm

Applications examples

- Wearables
- Gesture/Position detect
- IoT
- Vibration/Motion monitor
- Anti-theft

Accelerometer

- ±2/±4/±8/±16 g selectable Full Scales
- Noise/accuracy level flex

12 to 14bit res

- Low current consumption

380nA LP Mode and 40nA Standby

Advantages

- High Accuracy for precise motion tracking
- Low Power Consumption for long battery life
- Embedding Digital Features, including Freefall, Wakeup, Orientation, Tap
- Easy integration, Software & Tools available

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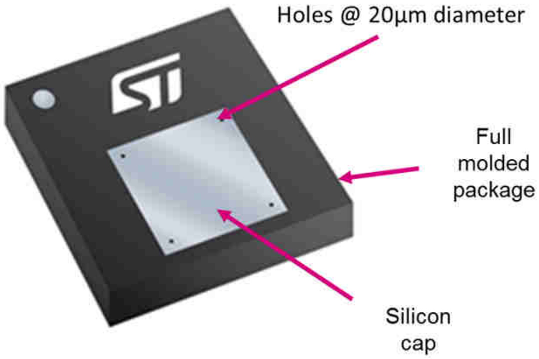
Pressure/Altimeter Sensor

LPS22HB

Pressure Barometer/Altimeter Sensor



Applications examples

- Weather Stations
- Indoor and Outdoor Navigation

Pressure

- Range 260-1260 hPa
- Relative accuracy of pressure measurement:

  < 10 µbar

  6cm resolution

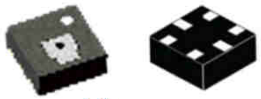
Advantages

- World's Smallest pressure sensor in production
- Full-mold Package with silicon cap and four micro holes guaranteeing sensor moisture and dust resistance
- Very low Power consumption 3µA
- Embedded Temperature compensation

Humidity & Temperature Sensor

HTS221

Relative Humidity and Temperature combo



HLGA-6L
(2.0 x 2.0 x 0.9mm)

Applications examples

- Environmental stations/monitoring
- HVA Conditioning
- Medical equipment
- Home appliances
- White goods

Humidity

- Range: 0%RH : 100%RH
- Accuracy: ±3.5%RH

Temperature

- Range: -40°C : +125°C
- Accuracy: ± 0.5°C, from 15°C to +40°C

Advantages

- High Accuracy
- Low power consumption 2 µA
- Extended operative supply voltage

Benefits

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ST NFC Sensor TAG Benefits

- **Low Cost** compared to other Wireless Technologies. Reduced BOM (doesn’t require RF matching circuitry), Lower cost RF IC, simplified Layout (low cost PCB), low cost certification.
- **Low Power**: Ultra Low Power Connectivity, Computing and Sensing Technologies allow long battery life and battery less operations.
- **Easy to implement**: easy certifications (Passive RF)
- **Flexible**: scalable to the right configuration for many applications
- Enhanced **added values features** can be implemented though NFC TAG (ID, Error Logs, Security, FW upgrade…)

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Addressing multiple Needs & Markets

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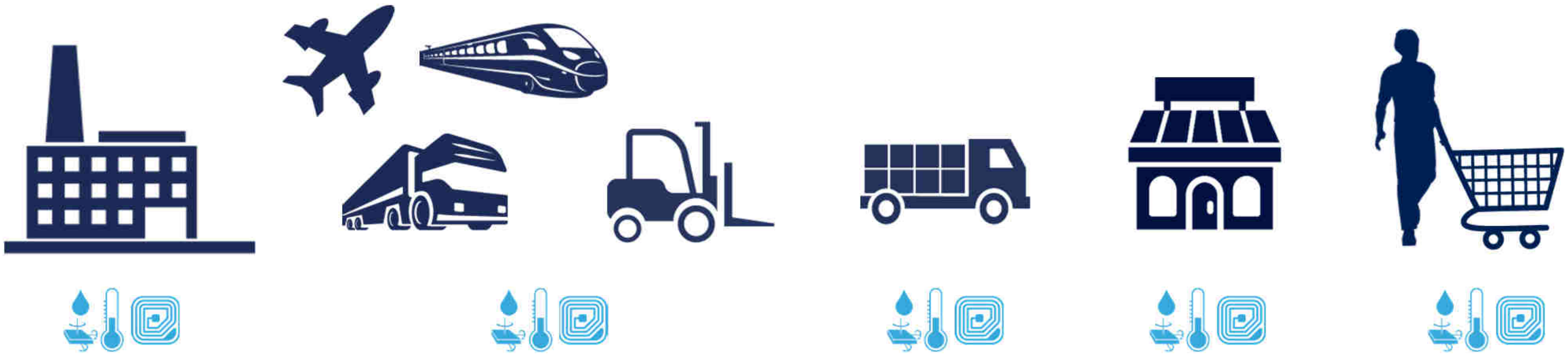
Asset Tracking

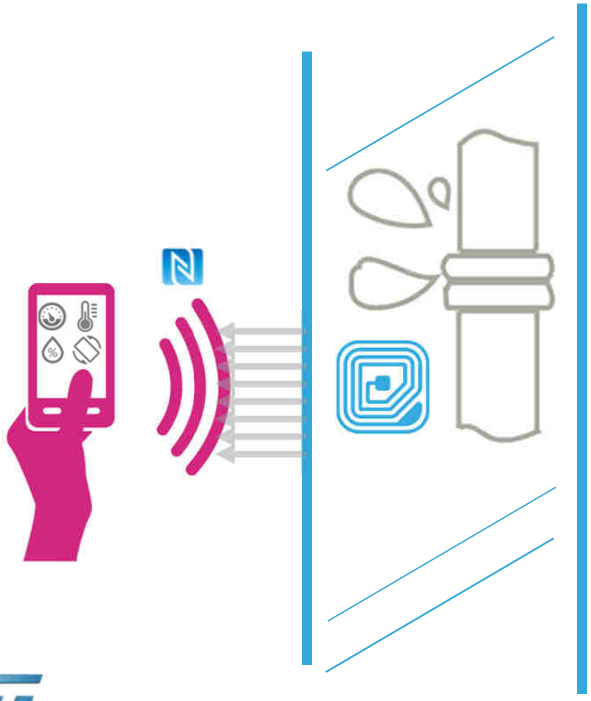
Monitoring goods from Manufacturing to the end User

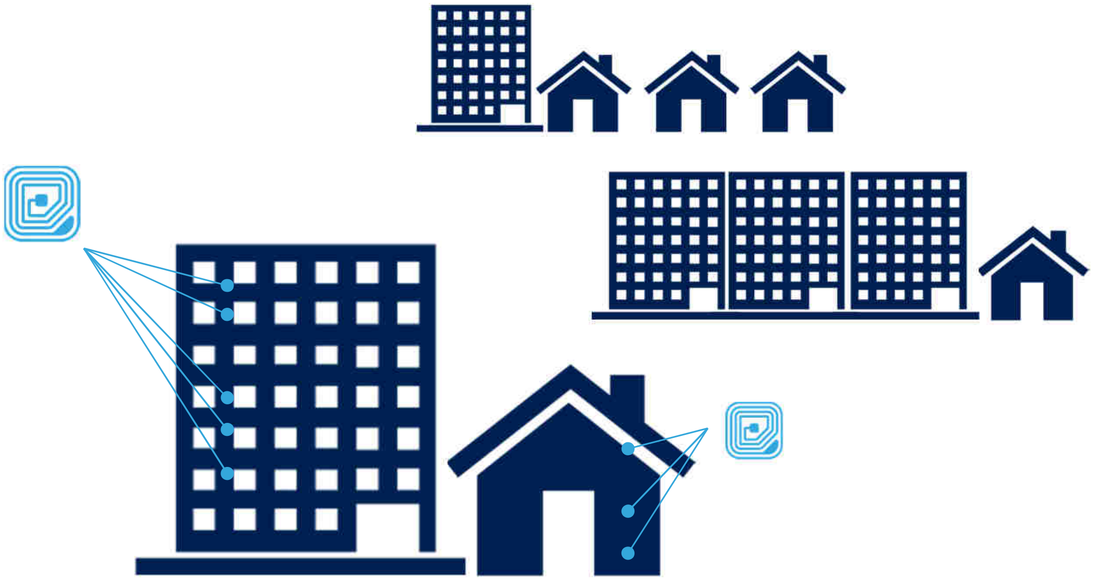


NFC → Secure (Near Field). Interoperability with Smartphone and/or dedicated Reader → Cloud
Temperature, Humidity & Pressure → Monitoring for Goods sensitive to environmental changes
Motion Sensors to detect **Vibrations**, Shocks, Freefall etc…which can damage/alter the goods
Low Power → Passive RF Tag (also battery less operation) / Long lasting battery life
Low Cost → Reduced BOM / Low cost connectivity.
Scalable → easy to add or remove sensors based on use case.

Smart Buildings/Cities

- Environmental and Motion Data Monitoring (Smart Badge / Weather Stations…)
- Building/Constructions Structure Monitoring (Vibration alert, Pipe Leaks…)





Smart Packaging

- Connect the “Unconnected”
- Temperature, Humidity, Vibration
- Level of Content and Use information
- Good ID / info / Commerce / Experience

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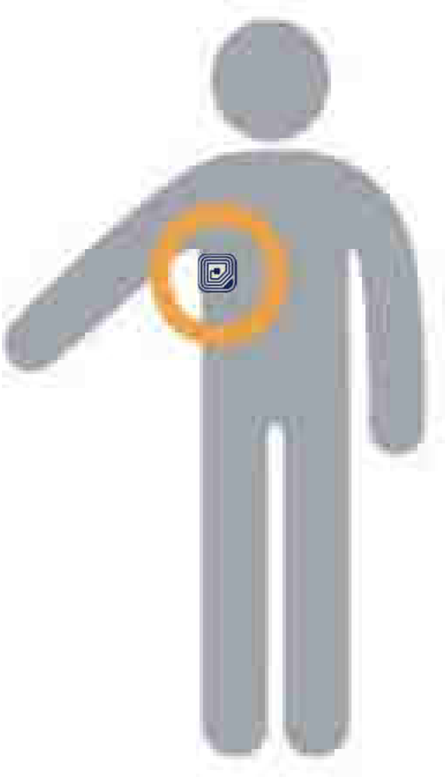
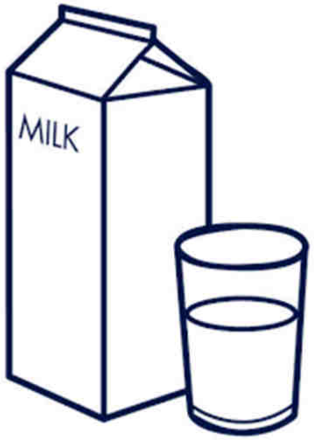
Healthcare

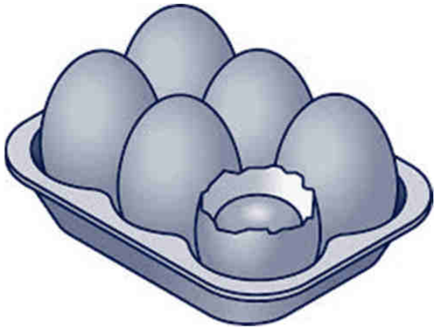
- Temperature Patches (also disposable)
- Patient activity tracker (also disposable)

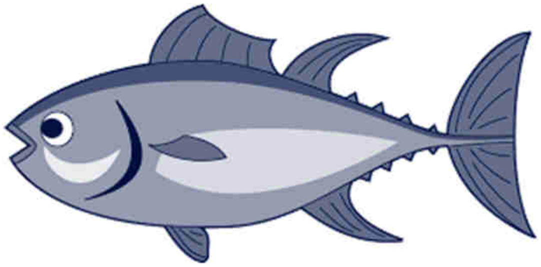


Perishable Goods

- Condition of goods monitoring
- Shelf/Storage Life Calculation
- Exp. date alert
- Product ID/info/History

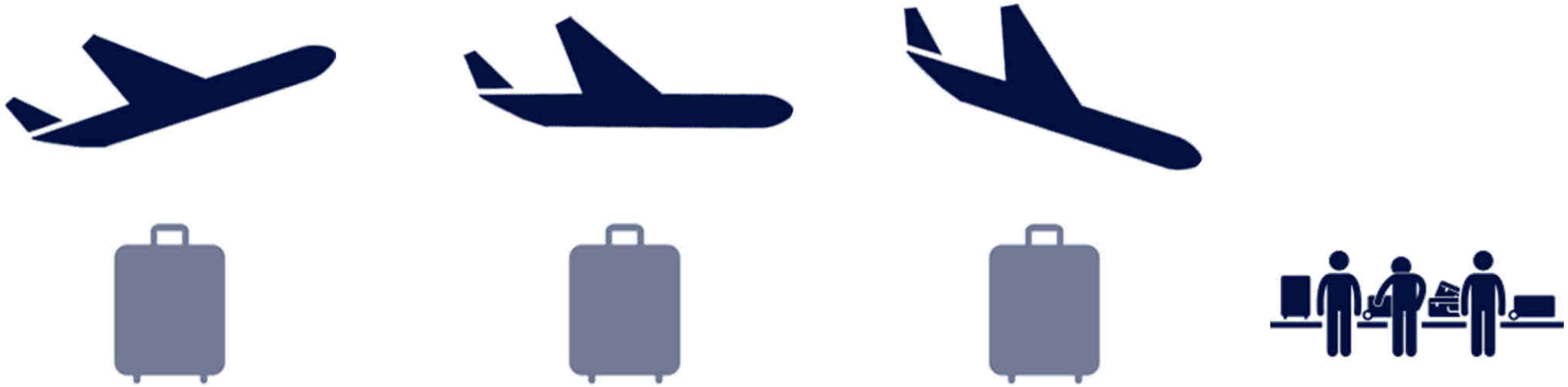




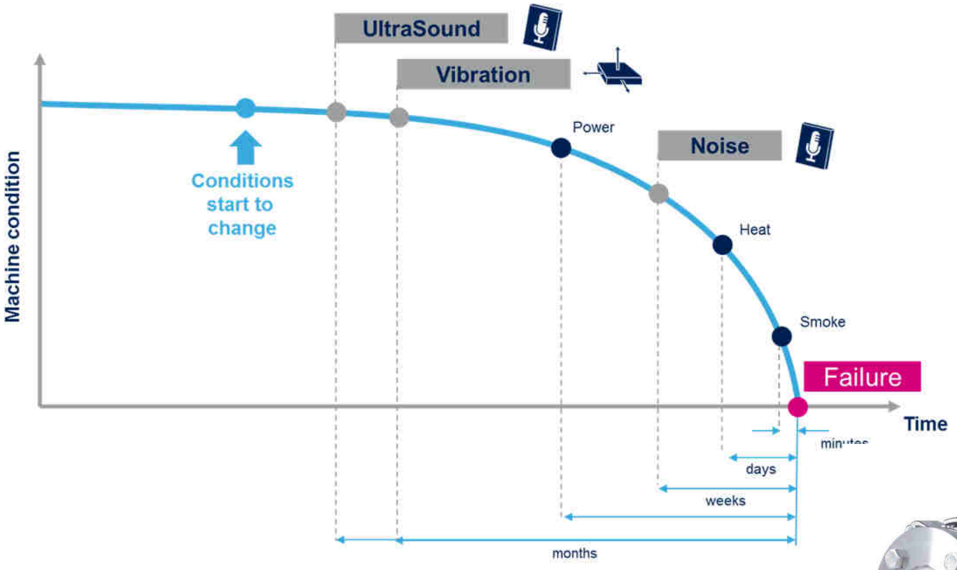


Smart Baggage

- Baggage Check-in/out
- Baggage ID and Geo-Location
- In-flight condition monitoring



Predictive Maintenance



Audio

Microphones to capture noise and for ultrasound emissions

Motion
MEMS Sensors

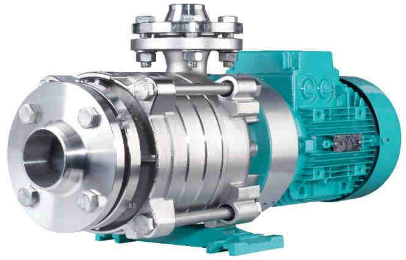
Environmental
Humidity and Pressure

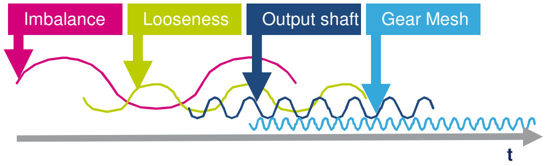
Temp Sensors

Microphone
For Audio and Ultrasound

Vibration Measurements

Condition monitoring enables to implement a predictive maintenance strategy by taking regular **vibration measurements** from sensors and comparing them to a baseline to detect health degradation





Defects/wears have different signature

Use Case Example - Summary

Supply Chain & QC

- from manufacturing to end user.

Smart building/home/city:

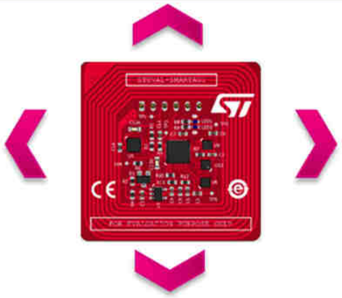
- Environmental and Motion Data
- Building/Constructions Structure

Agriculture & Planting

Humidity, Temperature, light…

Retail/ Fitness

Smart Clothing / Patches: Activity, Temperature, Sweat, mktg…



Healthcare:

Medical patches & loggers: Patient temperature & activity monitoring

Animal tracking

Activity, Temperature, big data monitoring production, health…

Perishable Goods:

Exp. date alert, Shelf/Storage Life Calculation/Condition of goods

Smart Packaging:

Temperature, Vibration Use, ID, . .

And much more…

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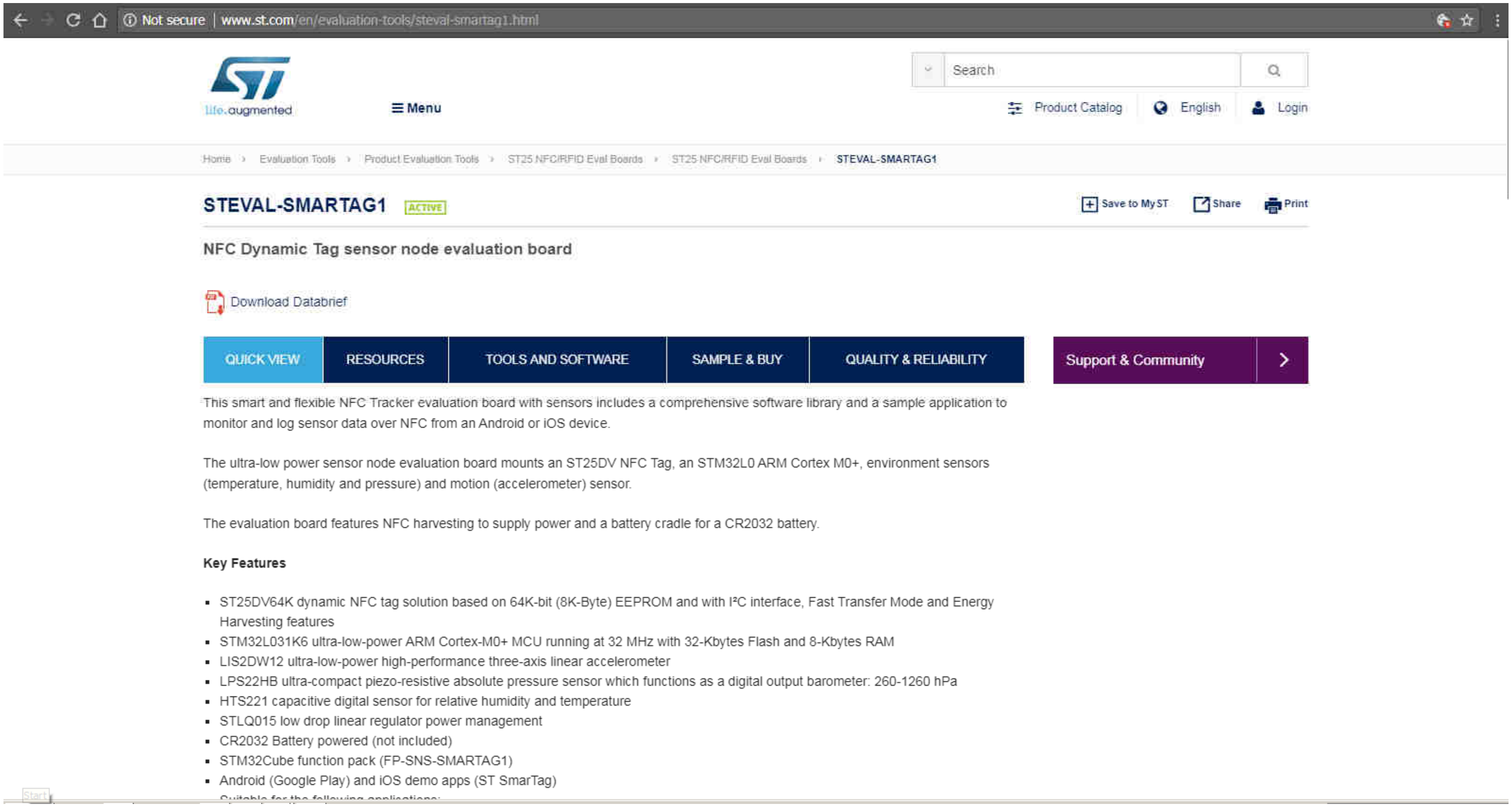
Not secure | www.st.com/en/evaluation-tools/steval-smartag1.html
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QUALITY & RELIABILITY
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STEVAL-SMARTAG1 ACTIVE

NFC Dynamic Tag sensor node evaluation board

This smart and flexible NFC Tracker evaluation board with sensors includes a comprehensive software library and a sample application to monitor and log sensor data over NFC from an Android or iOS device.

The ultra-low power sensor node evaluation board mounts an ST25DV NFC Tag, an STM32L0 ARM Cortex M0+, environment sensors (temperature, humidity and pressure) and motion (accelerometer) sensor.

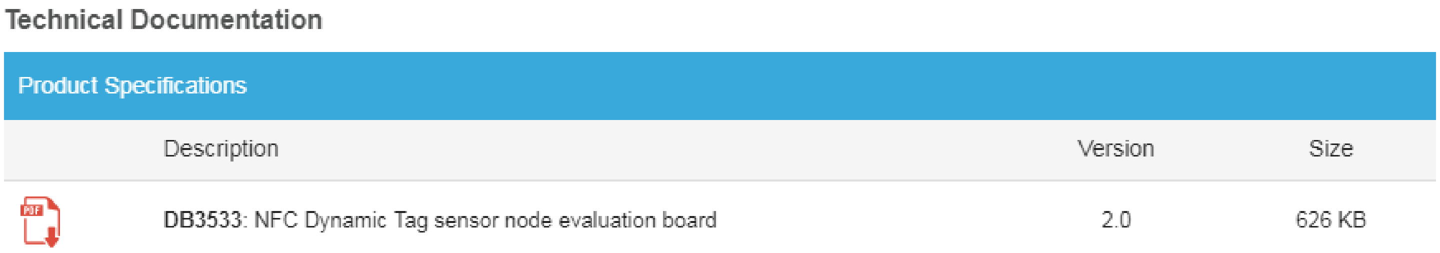
The evaluation board features NFC harvesting to supply power and a battery cradle for a CR2032 battery.

Key Features

- ST25DV64K dynamic NFC tag solution based on 64K-bit (8K-Byte) EEPROM and with I²C interface, Fast Transfer Mode and Energy Harvesting features
- STM32L031K6 ultra-low-power ARM Cortex-M0+ MCU running at 32 MHz with 32-Kbytes Flash and 8-Kbytes RAM
- LIS2DW12 ultra-low-power high-performance three-axis linear accelerometer
- LPS22HB ultra-compact piezo-resistive absolute pressure sensor which functions as a digital output barometer: 260-1260 hPa
- HTS221 capacitive digital sensor for relative humidity and temperature
- STLQ015 low drop linear regulator power management
- CR2032 Battery powered (not included)
- STM32Cube function pack (FP-SNS-SMARTAG1)
- Android (Google Play) and iOS demo apps (ST SmarTag)
- Suitable for the following applications:

Technical Documentation

Databrief



Technical Documentation

Product Specifications

	Description	Version	Size
PDF	DB3533: NFC Dynamic Tag sensor node evaluation board	2.0	626 KB

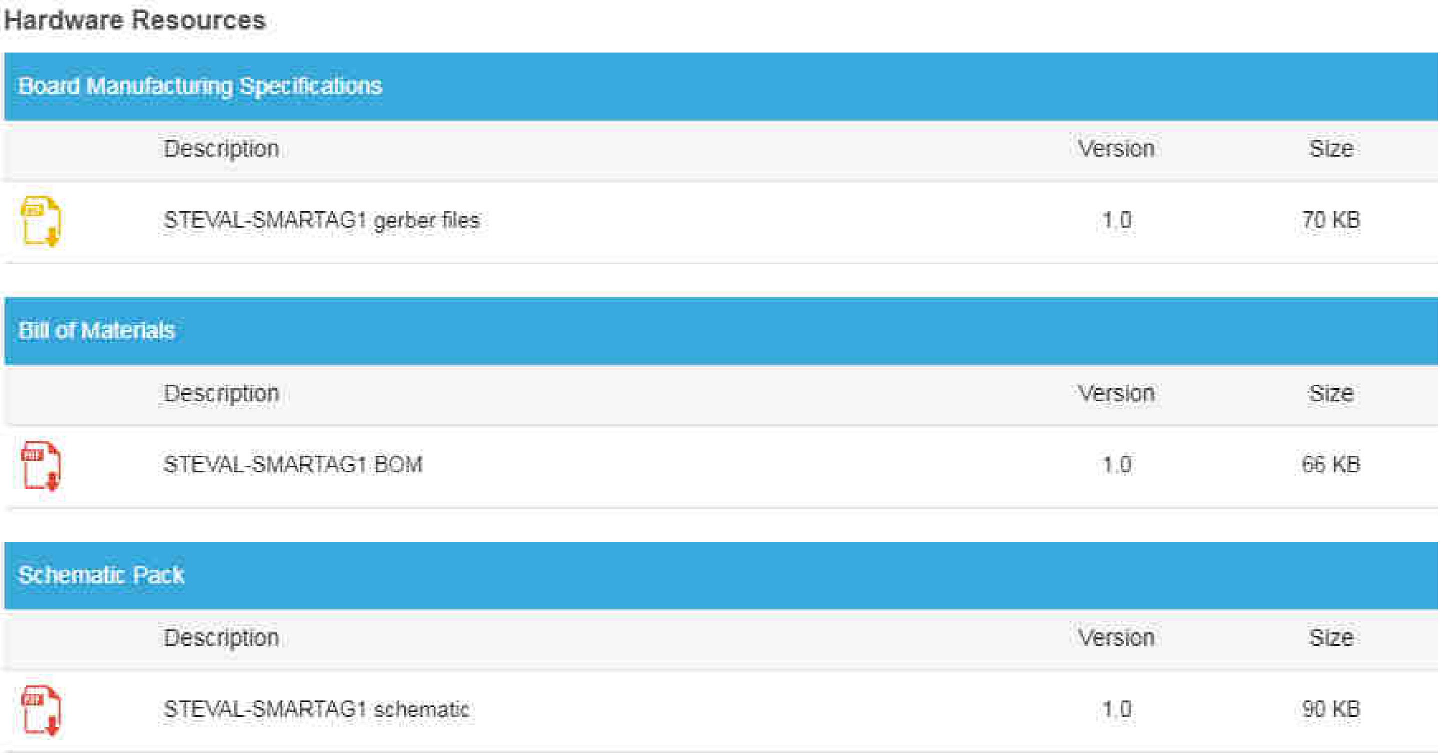
www.st.com/nfcsensortag

Hardware Resources

Gerbers

BOM

SCHEMATIC



Hardware Resources

Board Manufacturing Specifications

	Description	Version	Size
	STEVAL-SMARTAG1 gerber files	1.0	70 KB

Bill of Materials

	Description	Version	Size
	STEVAL-SMARTAG1 BOM	1.0	66 KB

Schematic Pack

	Description	Version	Size
	STEVAL-SMARTAG1 schematic	1.0	90 KB

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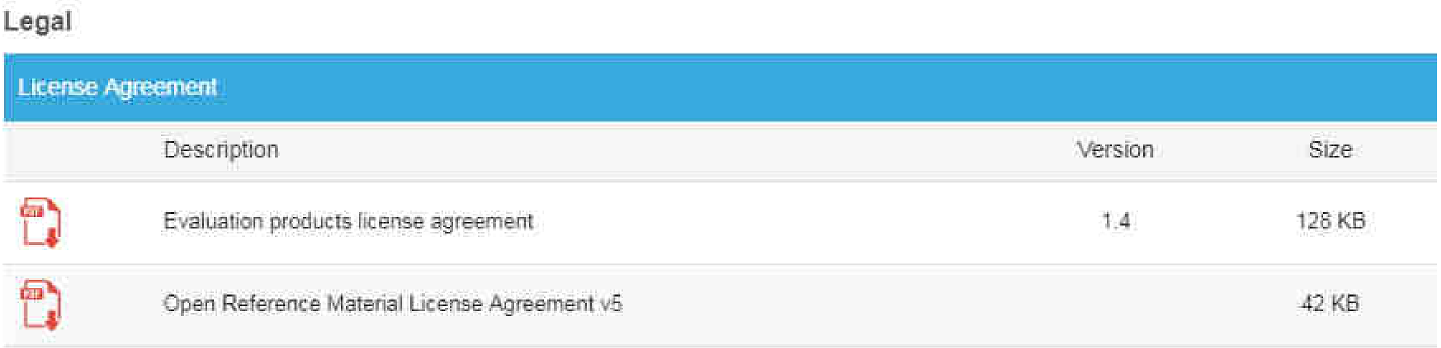
Miscellaneous

License agreements and certifications



Legal

License Agreement

	Description	Version	Size
	Evaluation products license agreement	1.4	128 KB
	Open Reference Material License Agreement v5		42 KB

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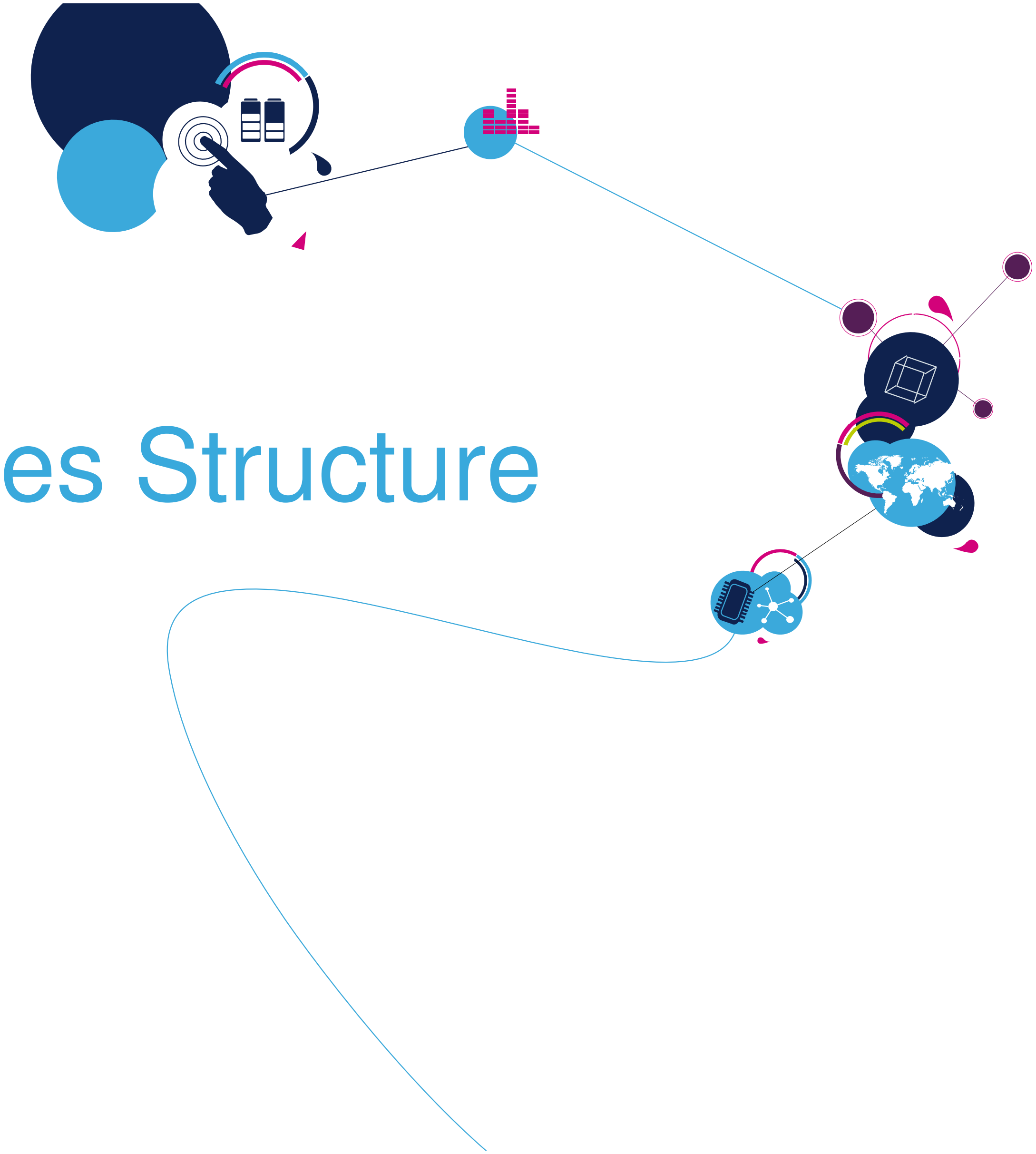
Firmware Packages Structure



ST Ecosystem: STM32 ODE

HARDWARE

SOFTWARE

16

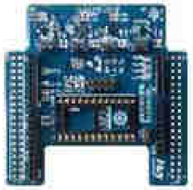
NUCLEO

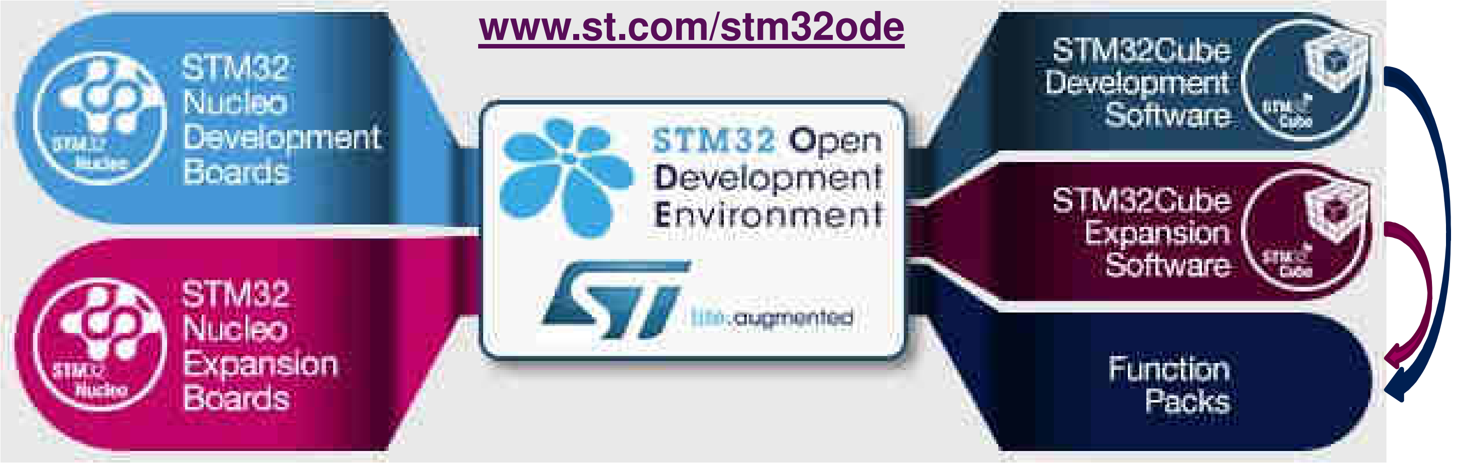
L0 to L4

F0 to F7

33

X-NUCLEO





www.st.com/stm32ode

STM32 Nucleo Development Boards
STM32 Nucleo Expansion Boards
STM32 Open Development Environment
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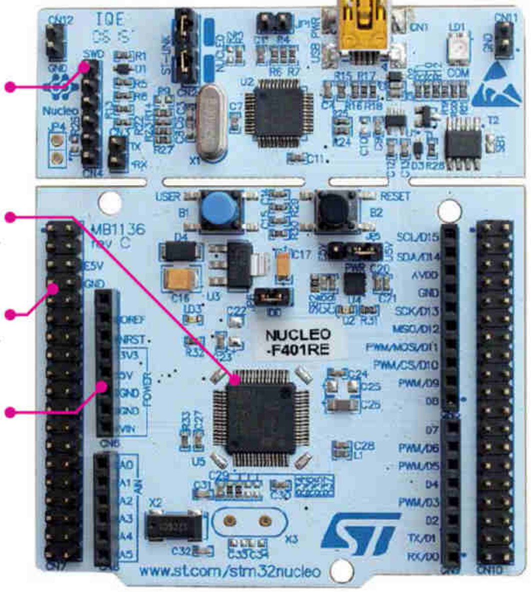
STM32Cube Development Software
STM32Cube Expansion Software
Function Packs

Nucleo / X-Nucleo



Board power supply through USB or external source

Integrated debugging and programming ST-LINK probe

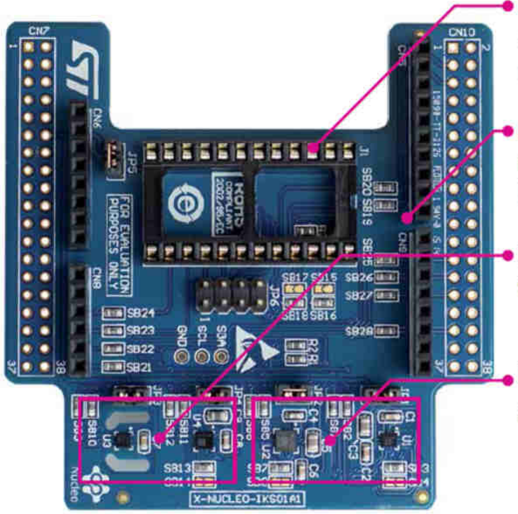
STM32 microcontroller

ST morpho extension header

Arduino™ extension headers

STM32 Nucleo

Development board



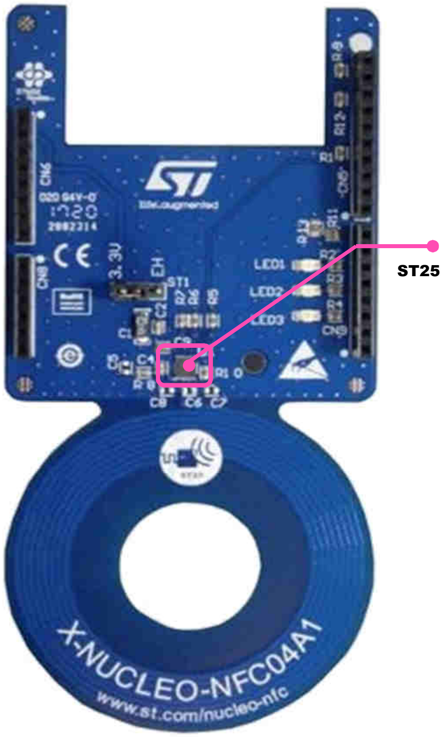
DIL24 support for new devices

Arduino extension headers

Environmental sensors

Motion sensors

Expansion board (X-NUCLEO)



ST25DV

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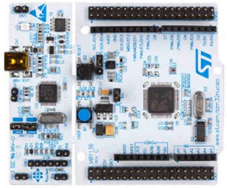
Nucleo / X-Nucleo & NFCSensorTAG

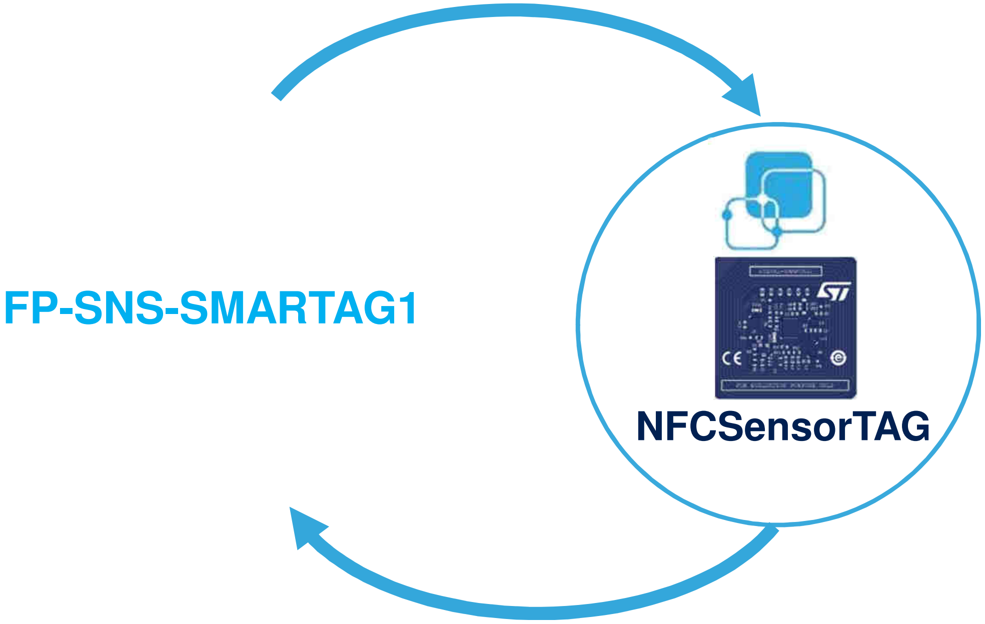
- Modular development system
- Rich set of **firmware packages**

- Form-factor development system
- Same set of firmware packages & **more**

X-NUCLEO-NFC04A1

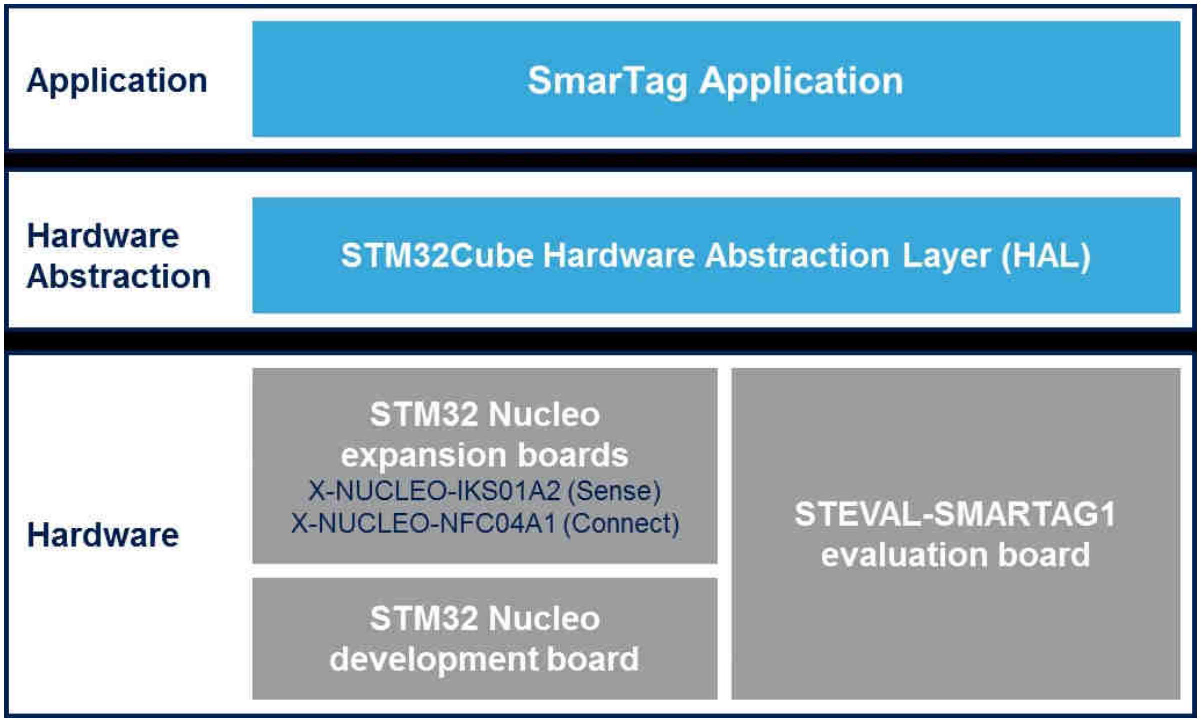
X-NUCLEO-IKS01A2


NUCLEO-L053RE


FP-SNS-SMARTAG1

NFCSensorTAG

Hardware / Software Block Diagram



Application

SmarTag Application

Hardware Abstraction

STM32Cube Hardware Abstraction Layer (HAL)

Hardware

STM32 Nucleo expansion boards
X-NUCLEO-IKS01A2 (Sense)
X-NUCLEO-NFC04A1 (Connect)

STM32 Nucleo development board

STEVAL-SMARTAG1 evaluation board

Application
(e.g. ST25PC)

HAL and BSP

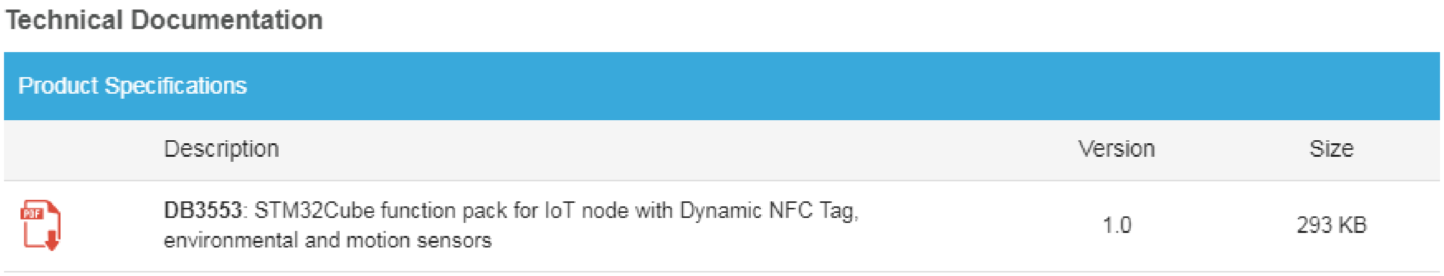
Boards

Function Packages

STM32ODE software package

Open Development Environment – src code

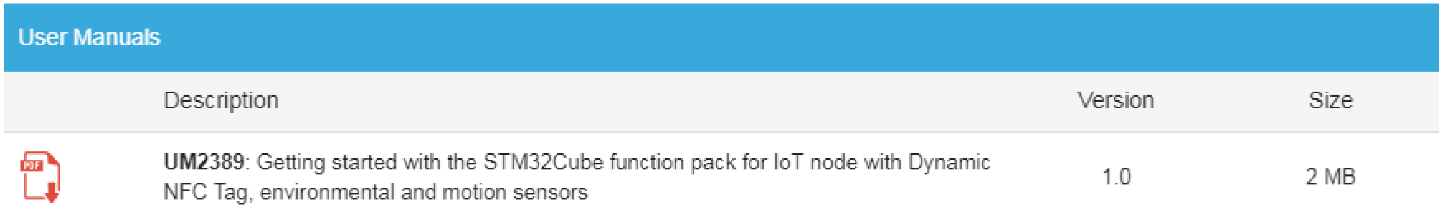
- **FP-SNS-SMARTAG1** Version 1.1.1



Technical Documentation

Product Specifications			
	Description	Version	Size
PDF	**DB3553**: STM32Cube function pack for IoT node with Dynamic NFC Tag, environmental and motion sensors	1.0	293 KB

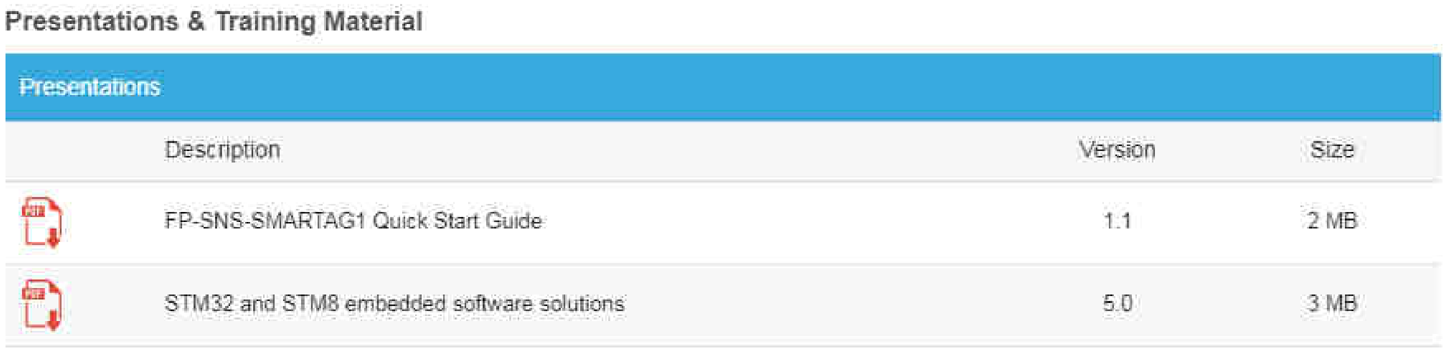
Function Pack User Manual



User Manuals

	Description	Version	Size
PDF	**UM2389**: Getting started with the STM32Cube function pack for IoT node with Dynamic NFC Tag, environmental and motion sensors	1.0	2 MB

Function Pack Presentations

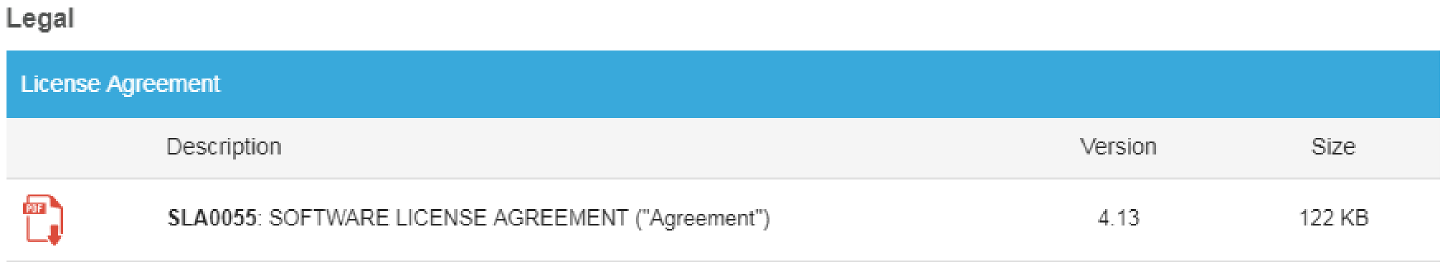


Presentations & Training Material

Presentations

	Description	Version	Size
PDF	FP-SNS-SMARTAG1 Quick Start Guide	1.1	2 MB
PDF	STM32 and STM8 embedded software solutions	5.0	3 MB

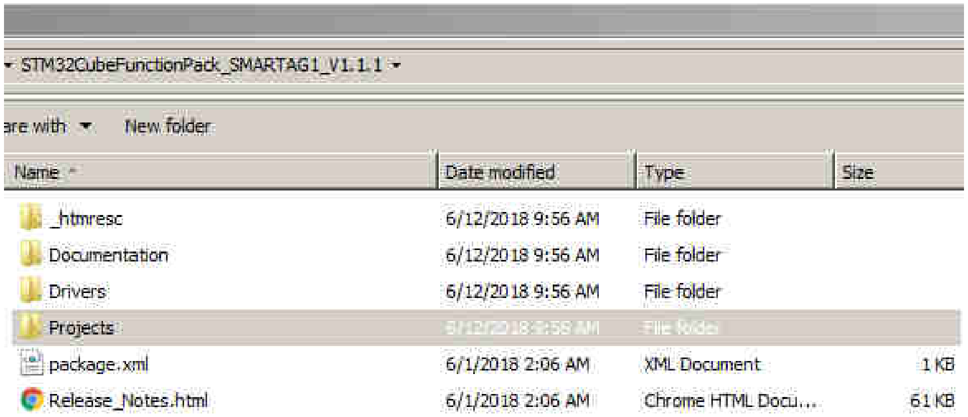
Miscellaneous



Legal

License Agreement			
	Description	Version	Size
	SLA0055: SOFTWARE LICENSE AGREEMENT ("Agreement")	4.13	122 KB

Function Pack and Nucleo Boards Stack



▾ STM32CubeFunctionPack_SMARTAG1_V1.1.1 ▾

are with ▾ New folder

Name	Date modified	Type	Size
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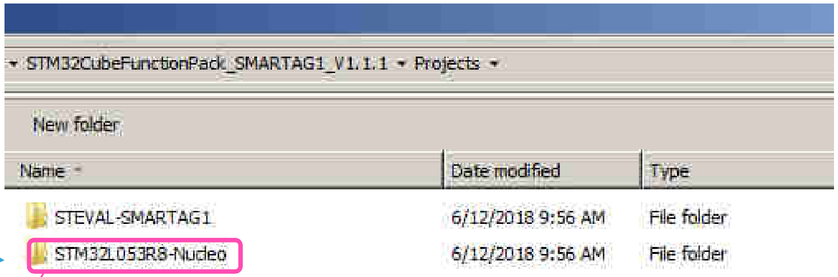
Documentation	6/12/2018 9:56 AM	File folder	
Drivers	6/12/2018 9:56 AM	File folder	
Projects	6/12/2018 9:56 AM	File folder	
package.xml	6/1/2018 2:06 AM	XML Document	1 KB
Release_Notes.html	6/1/2018 2:06 AM	Chrome HTML Docu...	61 KB



▾ STM32CubeFunctionPack_SMARTAG1_V1.1.1 ▾ Projects ▾

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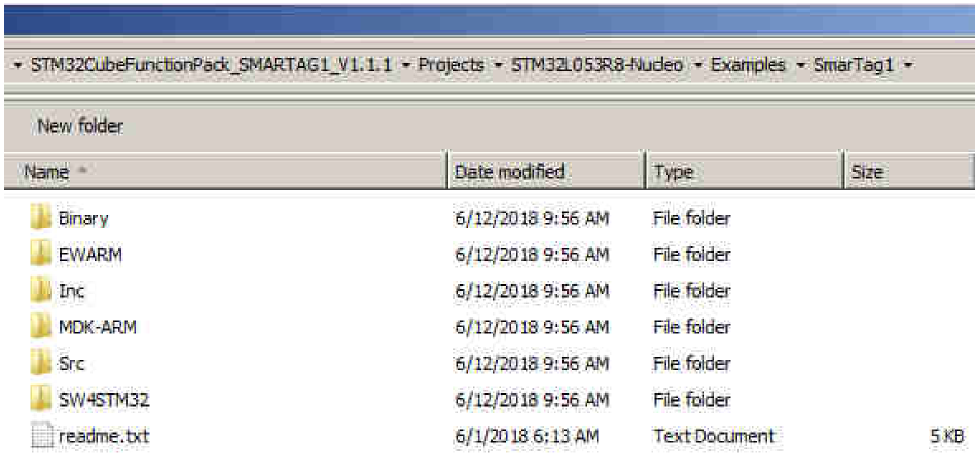
STM32L053R8-Nucleo	6/12/2018 9:56 AM	File folder



▾ STM32CubeFunctionPack_SMARTAG1_V1.1.1 ▾ Projects ▾ STM32L053R8-Nucleo ▾ Examples ▾ SmarTag1 ▾

New folder

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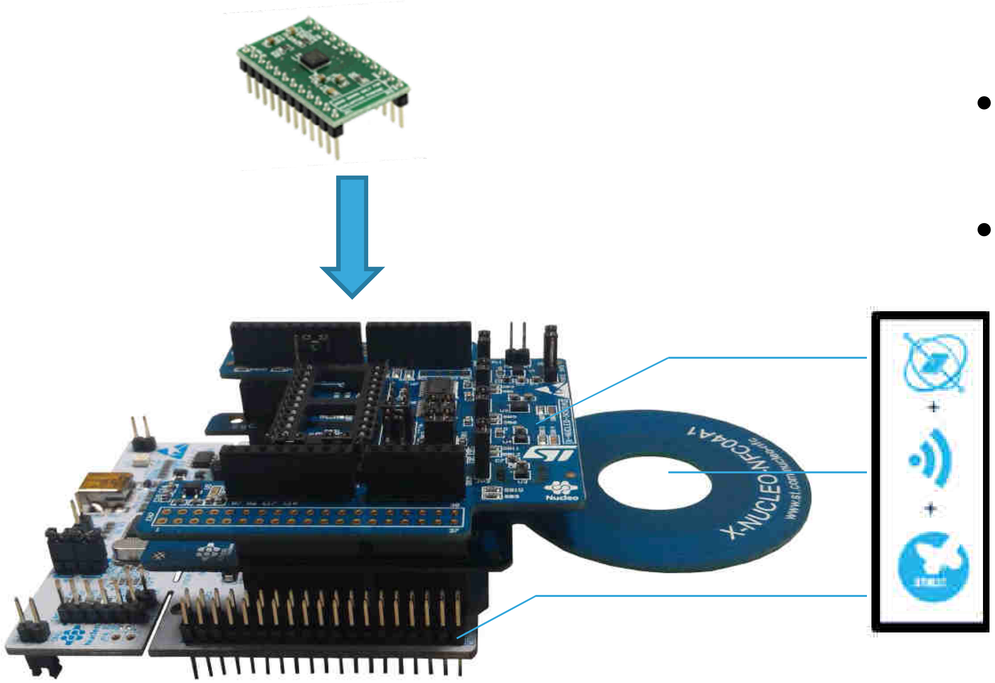
Inc	6/12/2018 9:56 AM	File folder	
MDK-ARM	6/12/2018 9:56 AM	File folder	
Src	6/12/2018 9:56 AM	File folder	
SW4STM32	6/12/2018 9:56 AM	File folder	
readme.txt	6/1/2018 6:13 AM	Text Document	5 KB

IAR project files

Keil project files

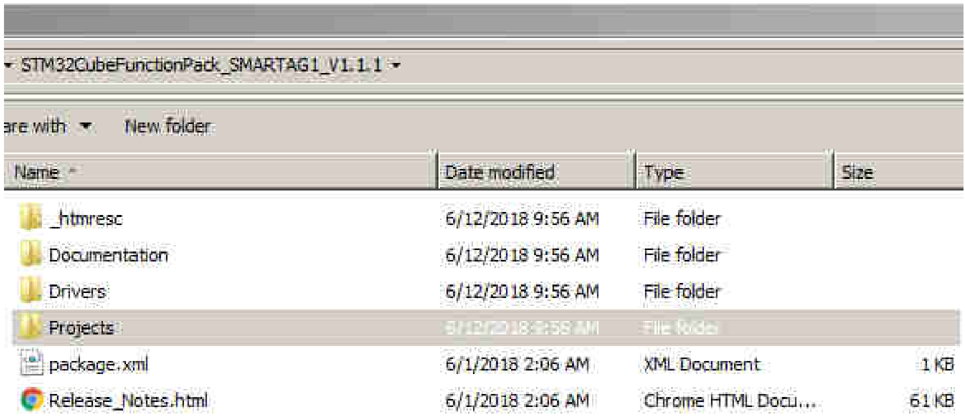
SystemWorkbench

Benefits of using Nucleo Stack



- Flexibility and Scalability with STM32 Variants (L0,L1,L4,F4,F3 and more)
- Note: Functional pack example only include L053
- DIL24 socket on IKS01A2 for additional MEMs adapter and other sensors

Function Pack and STEVAL-SMARTAG1



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Projects	6/12/2018 9:56 AM	File folder	
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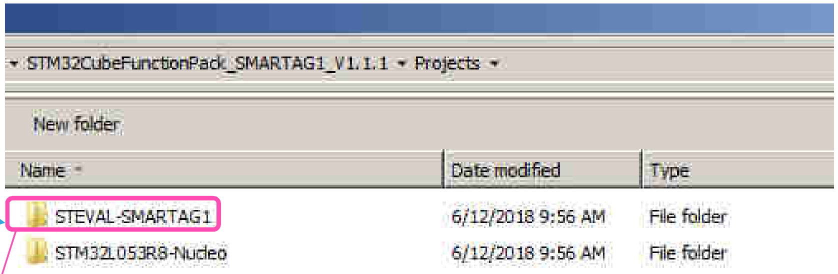
Release_Notes.html	6/1/2018 2:06 AM	Chrome HTML Docu...	61 KB



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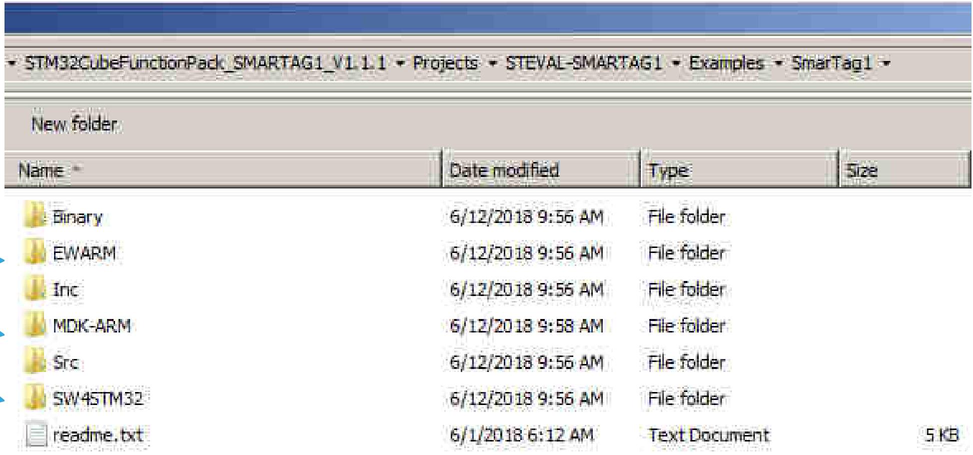
STM32CubeFunctionPack_SMARTAG1_V1.1.1 ▸ Projects ▸ STEVAL-SMARTAG1 ▸ Examples ▸ SmarTag1
New folder

Name	Date modified	Type	Size
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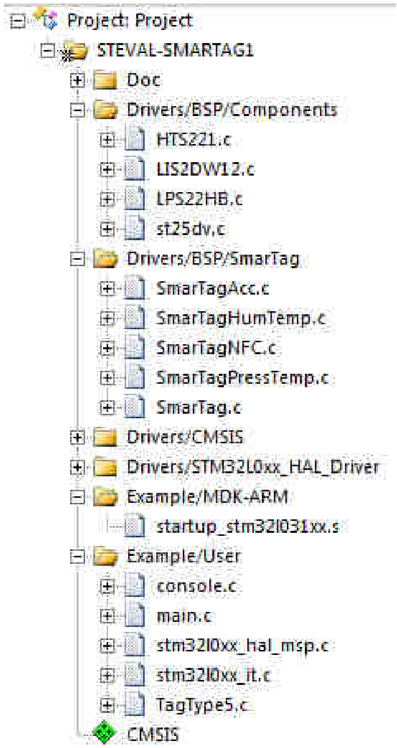
MDK-ARM	6/12/2018 9:58 AM	File folder	
Src	6/12/2018 9:56 AM	File folder	
SW4STM32	6/12/2018 9:56 AM	File folder	
readme.txt	6/1/2018 6:12 AM	Text Document	5 KB

IAR project files

Keil project files

SystemWorkbench

Folder Structure (KEIL)



```
Project: Project
  STEVAL-SMARTAG1
    Doc
    Drivers/BSP/Components
      HTS221.c
      LIS2DW12.c
      LPS22HB.c
      st25dv.c
    Drivers/BSP/SmarTag
      SmarTagAcc.c
      SmarTagHumTemp.c
      SmarTagNFC.c
      SmarTagPressTemp.c
      SmarTag.c
    Drivers/CMSIS
    Drivers/STM32L0xx_HAL_Driver
    Example/MDK-ARM
      startup_stm32l031xx.s
    Example/User
      console.c
      main.c
      stm32l0xx_hal_msp.c
      stm32l0xx_it.c
      TagType5.c
    CMSIS
```

BSP = Board Support Package

- Components (typ. MEMS sensors)
- Boards (SensorTile, Nucleo, Nucleo-expansion)

CMSIS = Cortex Microcontroller Software Interface Standard

- DSP library collection (fixed / float)

HAL = Hardware Abstraction Layer

- STM32 specific hardware drivers

Main.c is in Example\...\Src\

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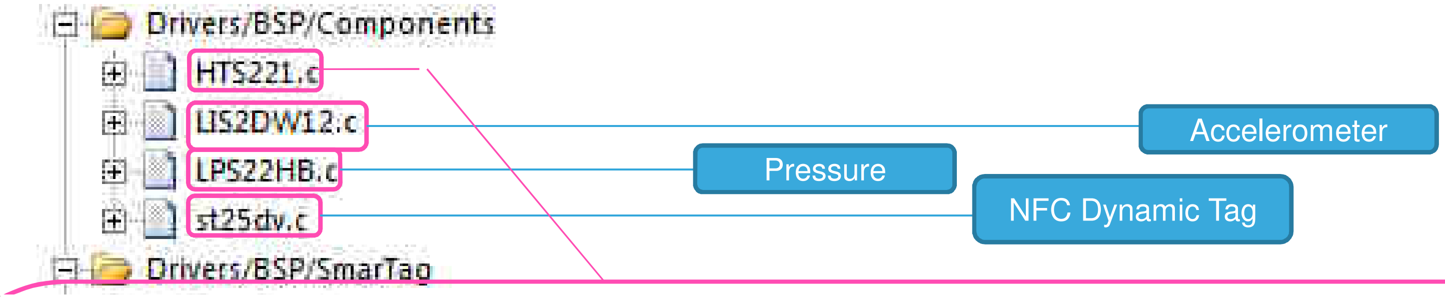
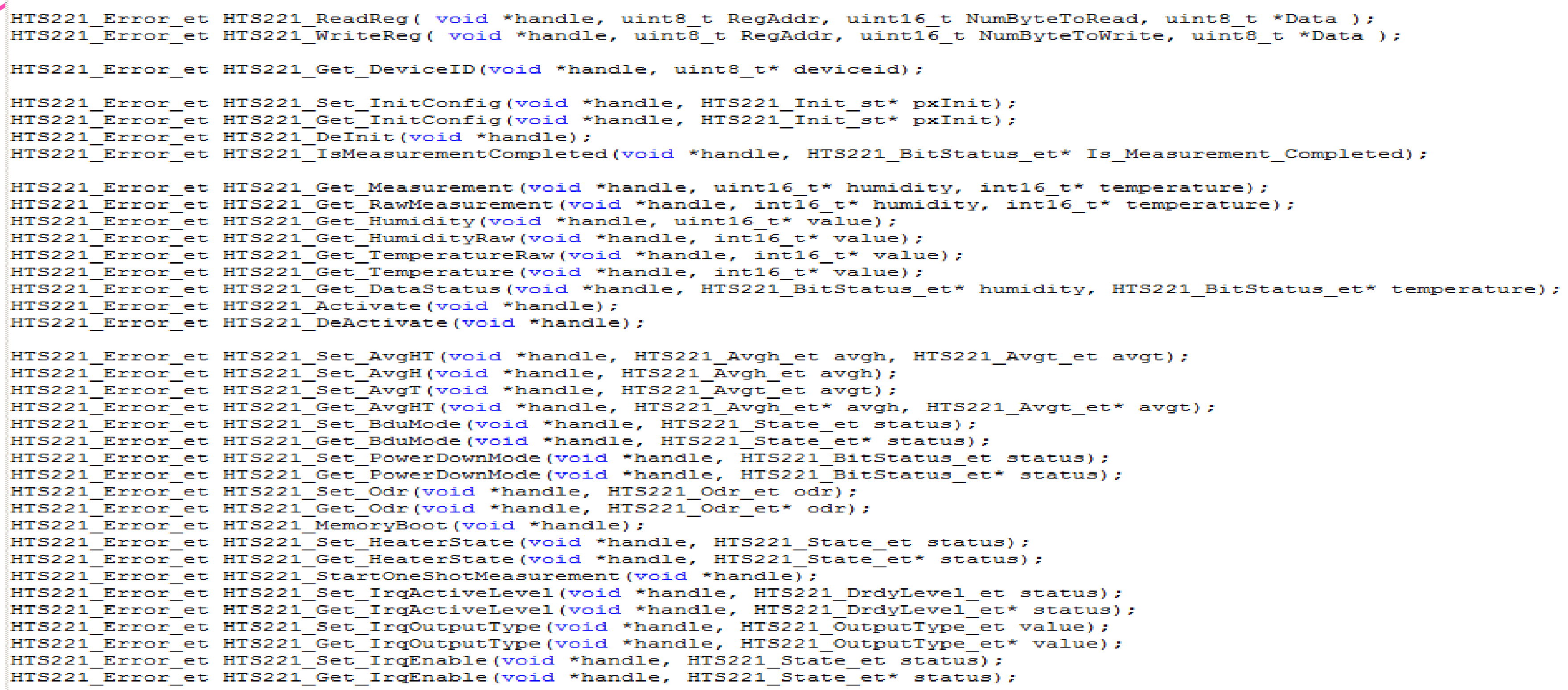




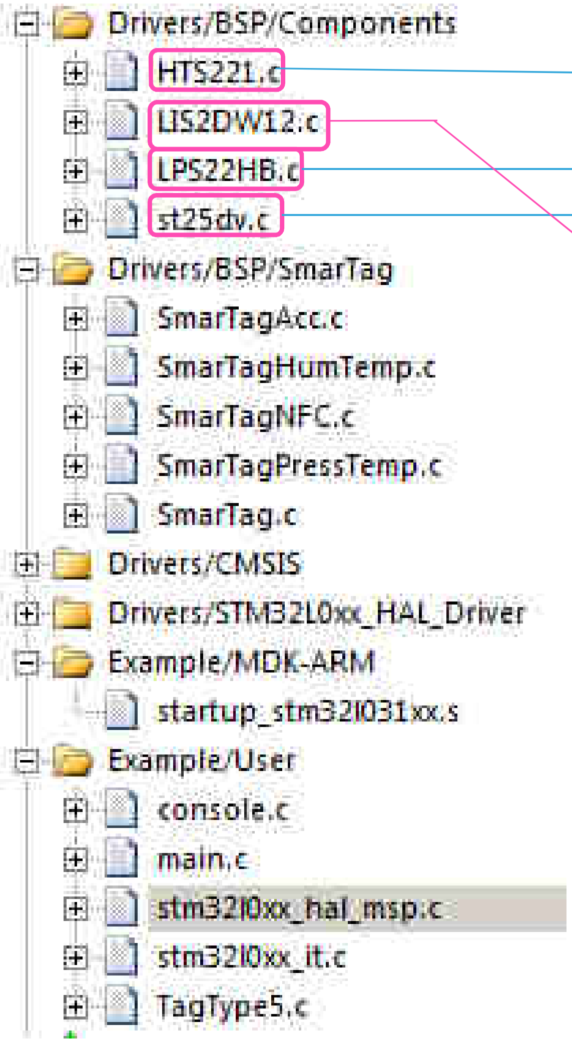
```
HTS221_Error_et HTS221_ReadReg( void *handle, uint8_t RegAddr, uint16_t NumByteToRead, uint8_t *Data );
HTS221_Error_et HTS221_WriteReg( void *handle, uint8_t RegAddr, uint16_t NumByteToWrite, uint8_t *Data );

HTS221_Error_et HTS221_Get_DeviceID(void *handle, uint8_t* deviceid);

HTS221_Error_et HTS221_Set_InitConfig(void *handle, HTS221_Init_st* pxInit);
HTS221_Error_et HTS221_Get_InitConfig(void *handle, HTS221_Init_st* pxInit);
HTS221_Error_et HTS221_DeInit(void *handle);
HTS221_Error_et HTS221_IsMeasurementCompleted(void *handle, HTS221_BitStatus_et* Is_Measurement_Completed);

HTS221_Error_et HTS221_Get_Measurement(void *handle, uint16_t* humidity, int16_t* temperature);
HTS221_Error_et HTS221_Get_RawMeasurement(void *handle, int16_t* humidity, int16_t* temperature);
HTS221_Error_et HTS221_Get_Humidity(void *handle, uint16_t* value);
HTS221_Error_et HTS221_Get_HumidityRaw(void *handle, int16_t* value);
HTS221_Error_et HTS221_Get_TemperatureRaw(void *handle, int16_t* value);
HTS221_Error_et HTS221_Get_Temperature(void *handle, int16_t* value);
HTS221_Error_et HTS221_Get_DataStatus(void *handle, HTS221_BitStatus_et* humidity, HTS221_BitStatus_et* temperature);
HTS221_Error_et HTS221_Activate(void *handle);
HTS221_Error_et HTS221_DeActivate(void *handle);

HTS221_Error_et HTS221_Set_AvgHT(void *handle, HTS221_Avgh_et avgh, HTS221_Avgt_et avgt);
HTS221_Error_et HTS221_Set_AvgH(void *handle, HTS221_Avgh_et avgh);
HTS221_Error_et HTS221_Set_AvgT(void *handle, HTS221_Avgt_et avgt);
HTS221_Error_et HTS221_Get_AvgHT(void *handle, HTS221_Avgh_et* avgh, HTS221_Avgt_et* avgt);
HTS221_Error_et HTS221_Set_BduMode(void *handle, HTS221_State_et status);
HTS221_Error_et HTS221_Get_BduMode(void *handle, HTS221_State_et* status);
HTS221_Error_et HTS221_Set_PowerDownMode(void *handle, HTS221_BitStatus_et status);
HTS221_Error_et HTS221_Get_PowerDownMode(void *handle, HTS221_BitStatus_et* status);
HTS221_Error_et HTS221_Set_Odr(void *handle, HTS221_Odr_et odr);
HTS221_Error_et HTS221_Get_Odr(void *handle, HTS221_Odr_et* odr);
HTS221_Error_et HTS221_MemoryBoot(void *handle);
HTS221_Error_et HTS221_Set_HeaterState(void *handle, HTS221_State_et status);
HTS221_Error_et HTS221_Get_HeaterState(void *handle, HTS221_State_et* status);
HTS221_Error_et HTS221_StartOneShotMeasurement(void *handle);
HTS221_Error_et HTS221_Set_IrqActiveLevel(void *handle, HTS221_DrdyLevel_et status);
HTS221_Error_et HTS221_Get_IrqActiveLevel(void *handle, HTS221_DrdyLevel_et* status);
HTS221_Error_et HTS221_Set_IrqOutputType(void *handle, HTS221_OutputType_et value);
HTS221_Error_et HTS221_Get_IrqOutputType(void *handle, HTS221_OutputType_et* value);
HTS221_Error_et HTS221_Set_IrqEnable(void *handle, HTS221_State_et status);
HTS221_Error_et HTS221_Get_IrqEnable(void *handle, HTS221_State_et* status);
```

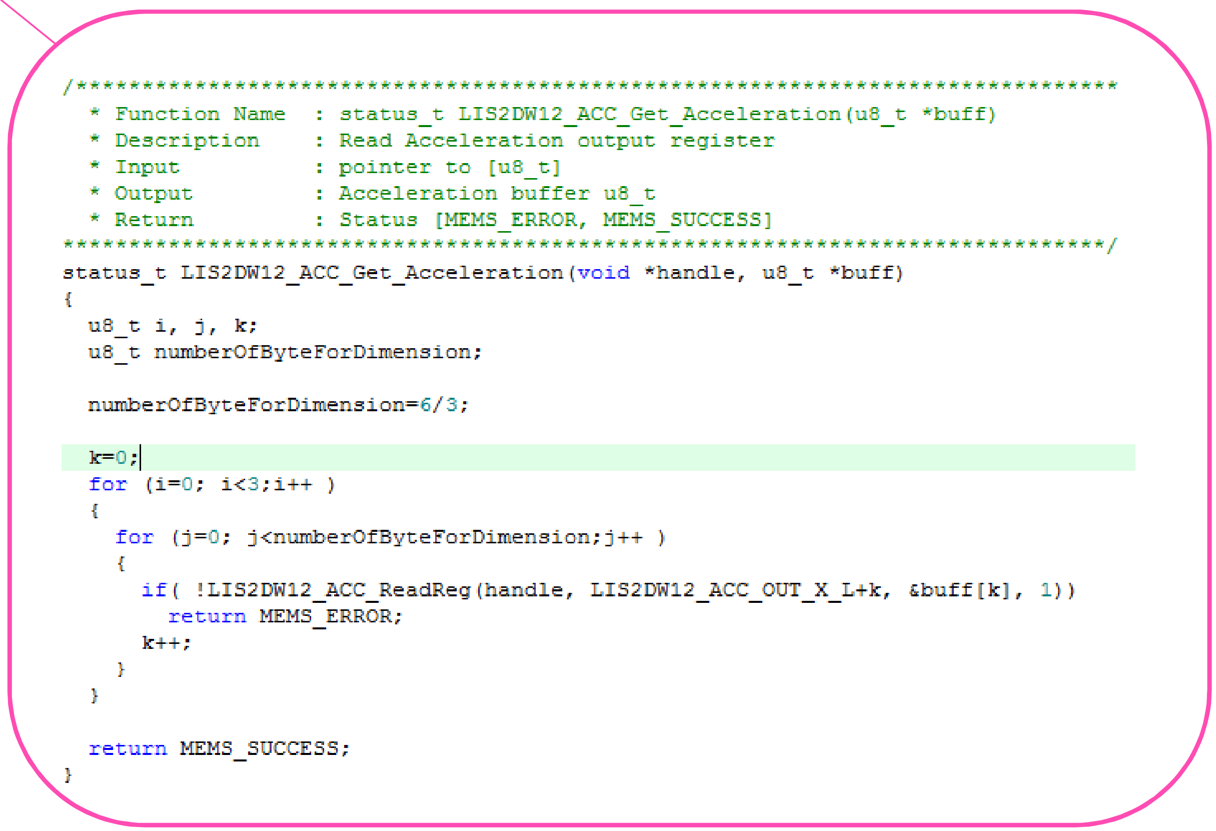


```
Drivers/BSP/Components
    HTS221.c
    LIS2DW12.c
    LPS22HB.c
    st25dv.c
Drivers/BSP/SmarTag
    SmarTagAcc.c
    SmarTagHumTemp.c
    SmarTagNFC.c
    SmarTagPressTemp.c
    SmarTag.c
Drivers/CMSIS
Drivers/STM32L0xx_HAL_Driver
Example/MDK-ARM
    startup_stm32l031xx.s
Example/User
    console.c
    main.c
    stm32l0xx_hal_msp.c
    stm32l0xx_it.c
    TagType5.c
```

Humidity + Temperature

Pressure

NFC Dynamic Tag

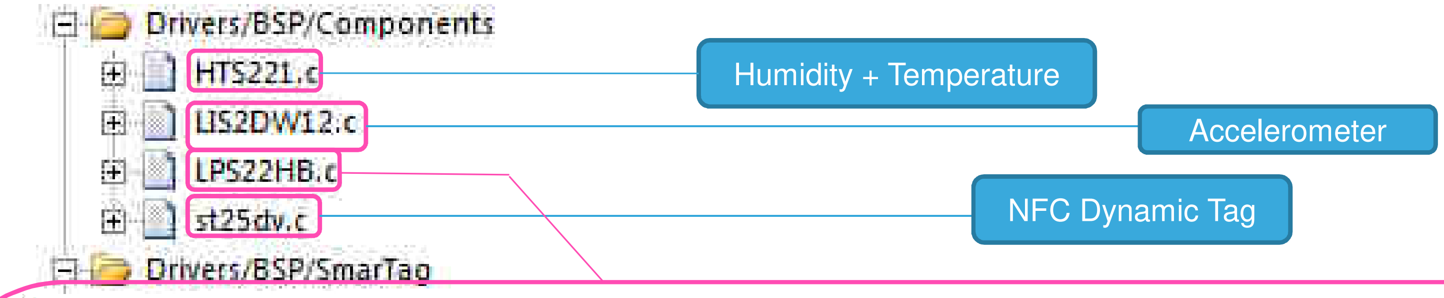


```
/*******************************************************************************
  * Function Name  : status_t LIS2DW12_ACC_Get_Acceleration(u8_t *buff)
  * Description    : Read Acceleration output register
  * Input          : pointer to [u8_t]
  * Output         : Acceleration buffer u8_t
  * Return         : Status [MEMS_ERROR, MEMS_SUCCESS]
*******************************************************************************/
status_t LIS2DW12_ACC_Get_Acceleration(void *handle, u8_t *buff)
{
  u8_t i, j, k;
  u8_t numberOfByteForDimension;

  numberOfByteForDimension=6/3;

  k=0;
  for (i=0; i<3;i++ )
  {
    for (j=0; j<numberOfByteForDimension;j++ )
    {
      if( !LIS2DW12_ACC_ReadReg(handle, LIS2DW12_ACC_OUT_X_L+k, &buff[k], 1))
        return MEMS_ERROR;
      k++;
    }
  }

  return MEMS_SUCCESS;
}
```


Drivers/BSP/Components

HTS221.c

LIS2DW12.c

LPS22HB.c

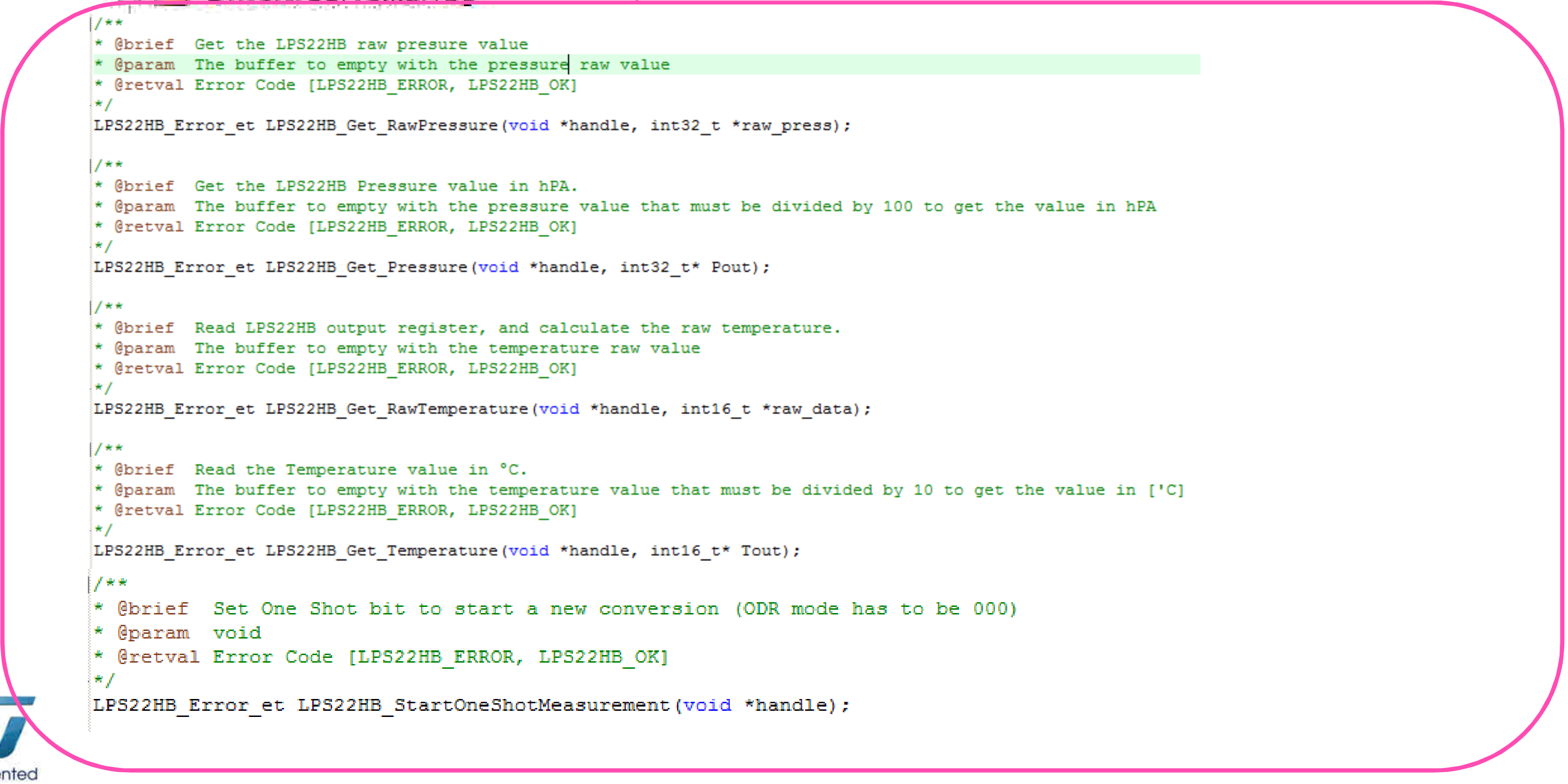
st25dv.c

Drivers/BSP/SmarTag

Humidity + Temperature

Accelerometer

NFC Dynamic Tag

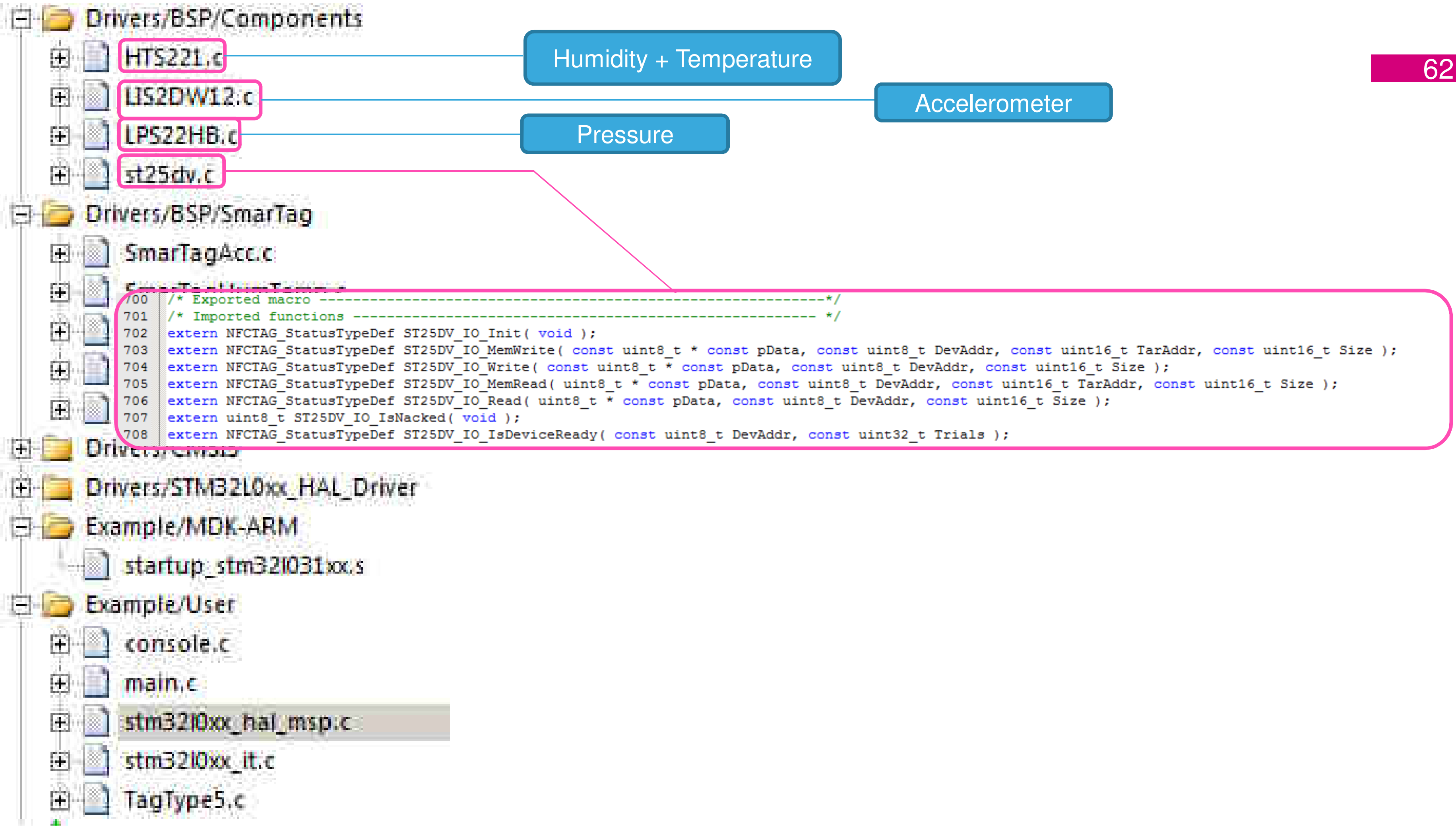

```
/**
* @brief  Get the LPS22HB raw presure value
* @param  The buffer to empty with the pressure raw value
* @retval Error Code [LPS22HB_ERROR, LPS22HB_OK]
*/
LPS22HB_Error_et LPS22HB_Get_RawPressure(void *handle, int32_t *raw_press);

/**
* @brief  Get the LPS22HB Pressure value in hPA.
* @param  The buffer to empty with the pressure value that must be divided by 100 to get the value in hPA
* @retval Error Code [LPS22HB_ERROR, LPS22HB_OK]
*/
LPS22HB_Error_et LPS22HB_Get_Pressure(void *handle, int32_t* Pout);

/**
* @brief  Read LPS22HB output register, and calculate the raw temperature.
* @param  The buffer to empty with the temperature raw value
* @retval Error Code [LPS22HB_ERROR, LPS22HB_OK]
*/
LPS22HB_Error_et LPS22HB_Get_RawTemperature(void *handle, int16_t *raw_data);

/**
* @brief  Read the Temperature value in °C.
* @param  The buffer to empty with the temperature value that must be divided by 10 to get the value in ['C]
* @retval Error Code [LPS22HB_ERROR, LPS22HB_OK]
*/
LPS22HB_Error_et LPS22HB_Get_Temperature(void *handle, int16_t* Tout);

/**
* @brief  Set One Shot bit to start a new conversion (ODR mode has to be 000)
* @param  void
* @retval Error Code [LPS22HB_ERROR, LPS22HB_OK]
*/
LPS22HB_Error_et LPS22HB_StartOneShotMeasurement(void *handle);
```



Drivers/BSP/Components

- HTS221.c
- LIS2DW12.c
- LPS22HB.c
- st25dv.c

Drivers/BSP/SmarTag

- SmarTagAcc.c

Drivers/CMSIS

Drivers/STM32L0xx_HAL_Driver

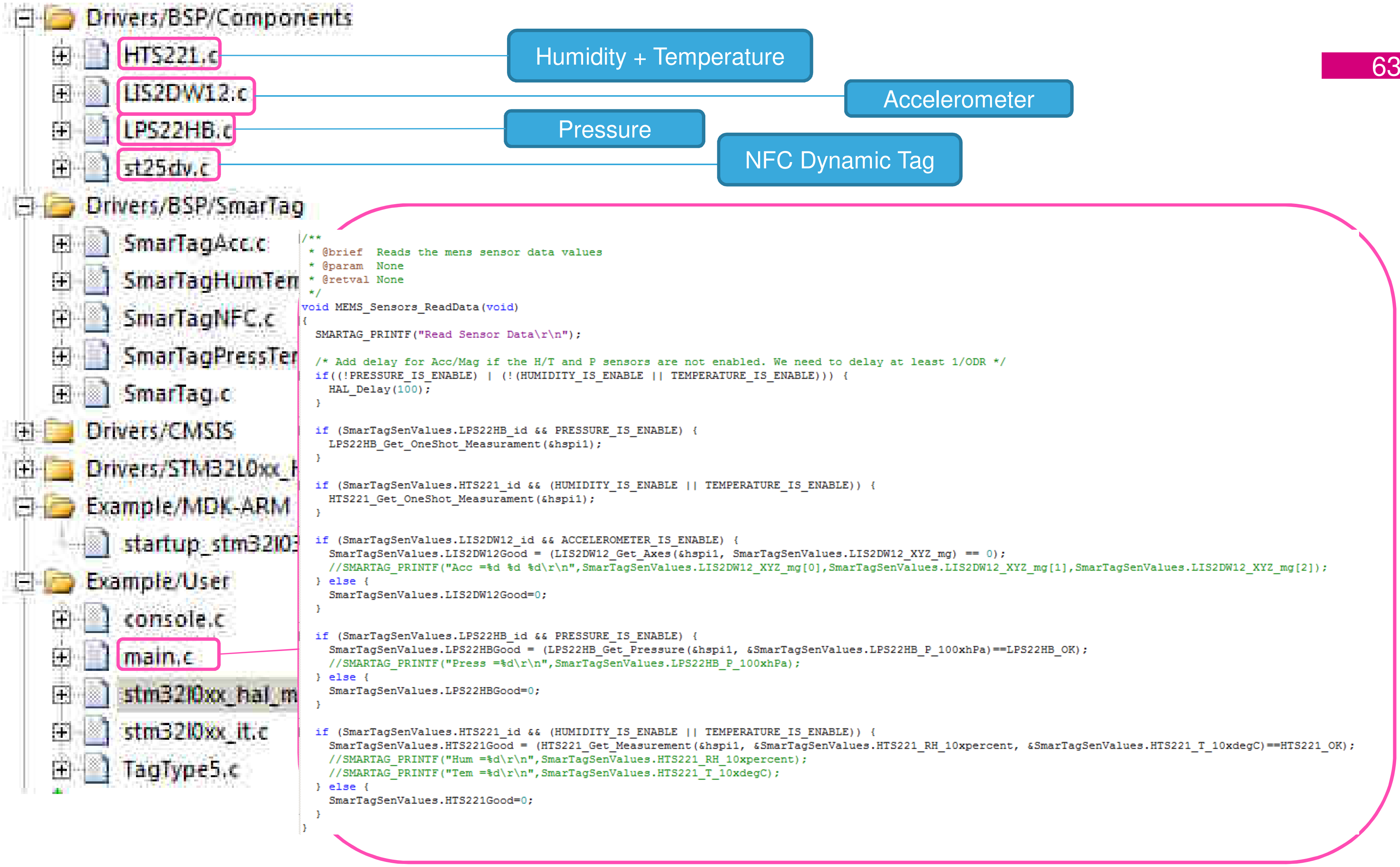
Example/MDK-ARM

- startup_stm32l031xx.s

Example/User

- console.c
- main.c
- stm32l0xx_hal_msp.c
- stm32l0xx_it.c
- TagType5.c

```c
/* Exported macro ------------------------------------------------------------*/
/* Imported functions ------------------------------------------------------- */
extern NFCTAG_StatusTypeDef ST25DV_IO_Init( void );
extern NFCTAG_StatusTypeDef ST25DV_IO_MemWrite( const uint8_t * const pData, const uint8_t DevAddr, const uint16_t TarAddr, const uint16_t Size );
extern NFCTAG_StatusTypeDef ST25DV_IO_Write( const uint8_t * const pData, const uint8_t DevAddr, const uint16_t Size );
extern NFCTAG_StatusTypeDef ST25DV_IO_MemRead( uint8_t * const pData, const uint8_t DevAddr, const uint16_t TarAddr, const uint16_t Size );
extern NFCTAG_StatusTypeDef ST25DV_IO_Read( uint8_t * const pData, const uint8_t DevAddr, const uint16_t Size );
extern uint8_t ST25DV_IO_IsNacked( void );
extern NFCTAG_StatusTypeDef ST25DV_IO_IsDeviceReady( const uint8_t DevAddr, const uint32_t Trials );
```



```
/**
  * @brief  Reads the mens sensor data values
  * @param  None
  * @retval None
  */
void MEMS_Sensors_ReadData(void)
{
  SMARTAG_PRINTF("Read Sensor Data\r\n");

  /* Add delay for Acc/Mag if the H/T and P sensors are not enabled. We need to delay at least 1/ODR */
  if((!PRESSURE_IS_ENABLE) | (!(HUMIDITY_IS_ENABLE || TEMPERATURE_IS_ENABLE))) {
    HAL_Delay(100);
  }

  if (SmarTagSenValues.LPS22HB_id && PRESSURE_IS_ENABLE) {
    LPS22HB_Get_OneShot_Measurament(&hspi1);
  }

  if (SmarTagSenValues.HTS221_id && (HUMIDITY_IS_ENABLE || TEMPERATURE_IS_ENABLE)) {
    HTS221_Get_OneShot_Measurament(&hspi1);
  }

  if (SmarTagSenValues.LIS2DW12_id && ACCELEROMETER_IS_ENABLE) {
    SmarTagSenValues.LIS2DW12Good = (LIS2DW12_Get_Axes(&hspi1, SmarTagSenValues.LIS2DW12_XYZ_mg) == 0);
    //SMARTAG_PRINTF("Acc =%d %d %d\r\n",SmarTagSenValues.LIS2DW12_XYZ_mg[0],SmarTagSenValues.LIS2DW12_XYZ_mg[1],SmarTagSenValues.LIS2DW12_XYZ_mg[2]);
  } else {
    SmarTagSenValues.LIS2DW12Good=0;
  }

  if (SmarTagSenValues.LPS22HB_id && PRESSURE_IS_ENABLE) {
    SmarTagSenValues.LPS22HBGood = (LPS22HB_Get_Pressure(&hspi1, &SmarTagSenValues.LPS22HB_P_100xhPa)==LPS22HB_OK);
    //SMARTAG_PRINTF("Press =%d\r\n",SmarTagSenValues.LPS22HB_P_100xhPa);
  } else {
    SmarTagSenValues.LPS22HBGood=0;
  }

  if (SmarTagSenValues.HTS221_id && (HUMIDITY_IS_ENABLE || TEMPERATURE_IS_ENABLE)) {
    SmarTagSenValues.HTS221Good = (HTS221_Get_Measurement(&hspi1, &SmarTagSenValues.HTS221_RH_10xpercent, &SmarTagSenValues.HTS221_T_10xdegC)==HTS221_OK);
    //SMARTAG_PRINTF("Hum =%d\r\n",SmarTagSenValues.HTS221_RH_10xpercent);
    //SMARTAG_PRINTF("Tem =%d\r\n",SmarTagSenValues.HTS221_T_10xdegC);
  } else {
    SmarTagSenValues.HTS221Good=0;
  }
}
```

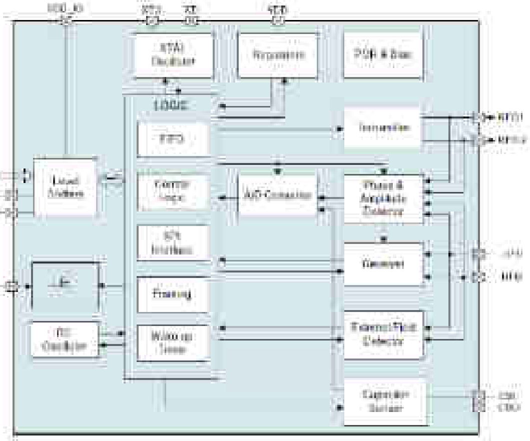
NFC Reader Discovery Board

life.augmented

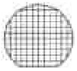
ST25R3911B NFC / RFID Reader

1.4W High Power reader solution

ST25R3911B



QFN32

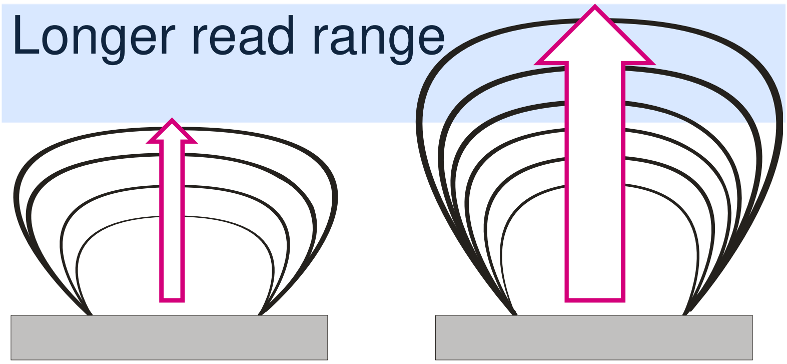

Wafer

- Use cases
  - Ideal for Payment Applications
  - Access Control, Gaming, eGovernment
- Key features
  - NFC forum compatible (no passive target)
  - **1.4W** output power at 5V
  - Passes **EMVco** & **PBOC** certification without external power amplifier
  - Automatic Antenna Tuning
  - **VHBR** support up to 6.8Mb/s
  - -40°C to **125°C** temperature range
- Key benefits
  - Low power operation & standby
  - Works in challenging environment
  - Enhanced fast transfer rate for Passport
  - Easy-to-use evaluation / development kits
  - Reference designs, application notes

Output power & sensitivity

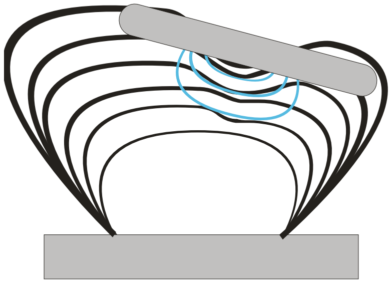
- Higher output power
  - The ST25R3911B includes low impedance drivers capable of generating >1 W of output power
  - EMVco certification easily possible without external boosters
  - “Slave” devices like interface tags are able to harvest far more energy for batteryless devices
  - The ST25R3911B is able to operate in metal encapsulation like doorlocks

- Higher sensitivity
  - The ST25R3911B has a 10x higher sensitivity than any competitor.



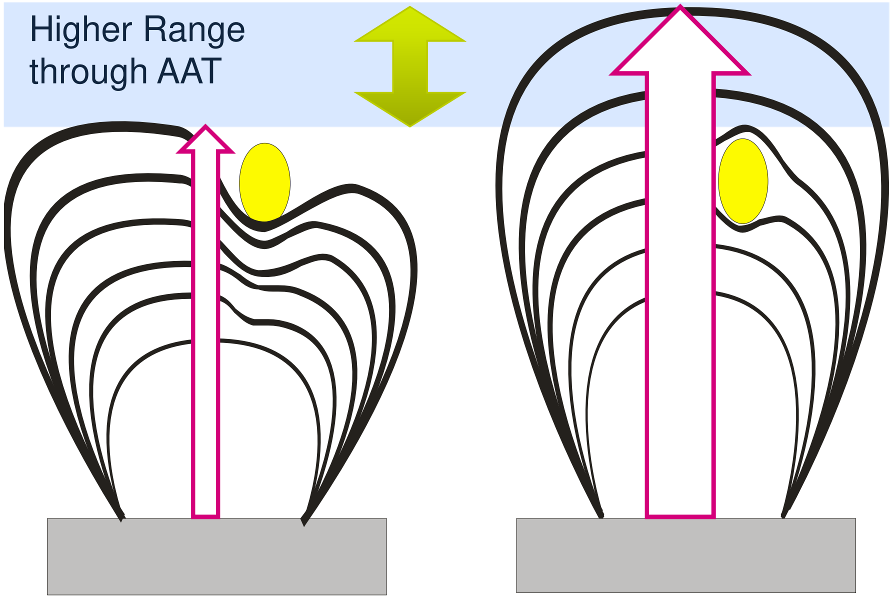
Longer read range

10x more sensitivity



Automatic Antenna Tuning

- Range & Field strength
  - AAT increases the range of an HF reader in bad environmental conditions and sustains maximum output power to the field with best efficiency
- Compensates for environment
  - Automatic antenna tuning analyses the phase shift of the antenna and retunes automatically
- Reduces production cost
  - The antenna can be tuned with an automatic procedure during production to fine adjust the design to different housings.

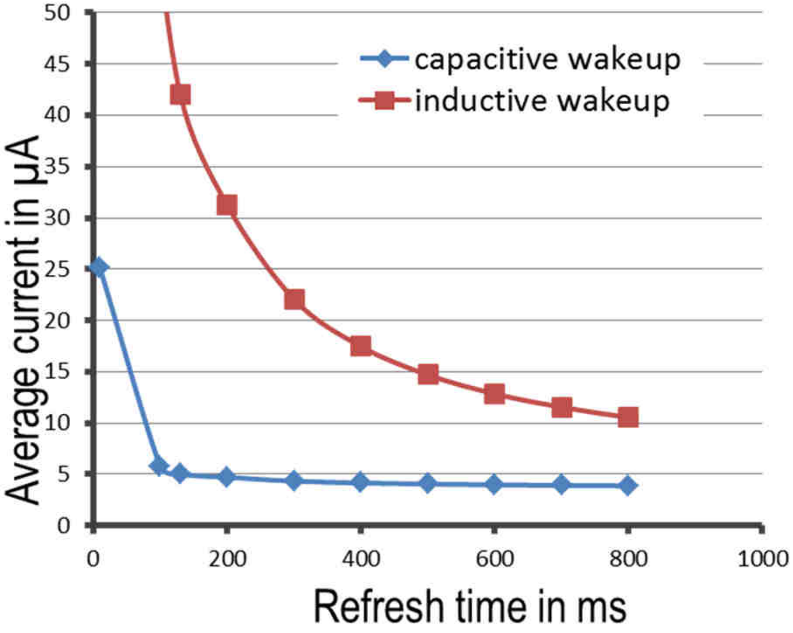


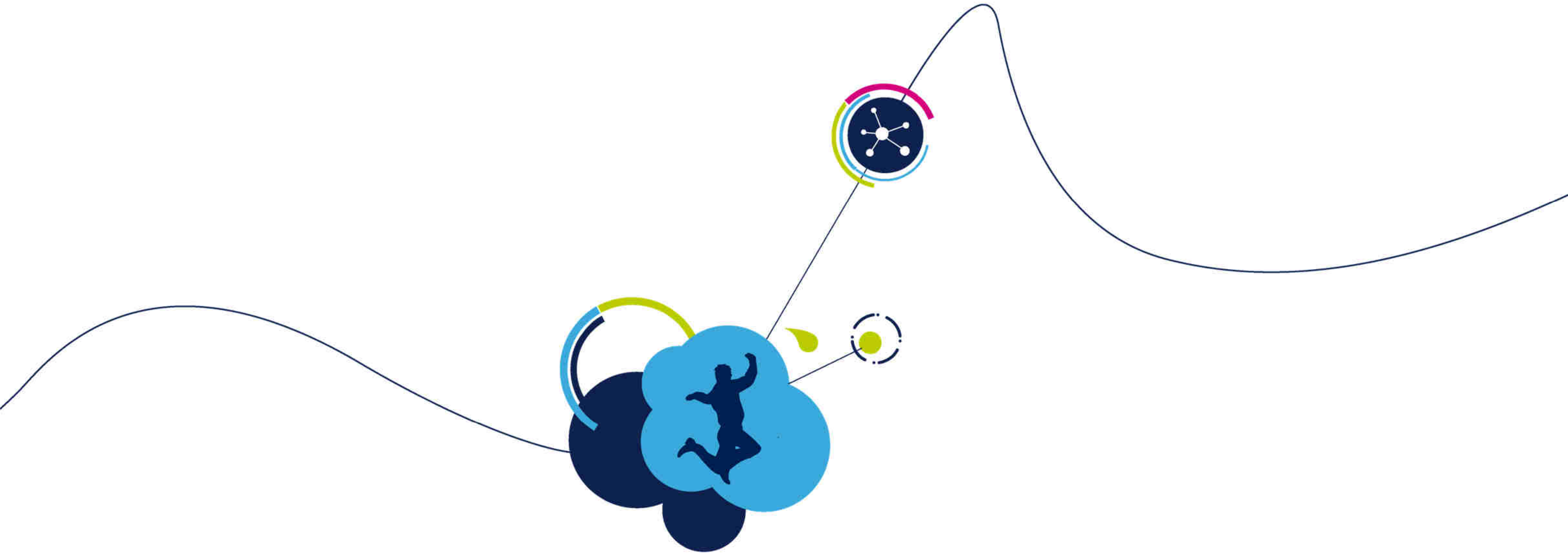
Multiple Tag placement

Multiple tags in the field can be compensated to transfer a maximum of power for each.

Low Power Wake-up

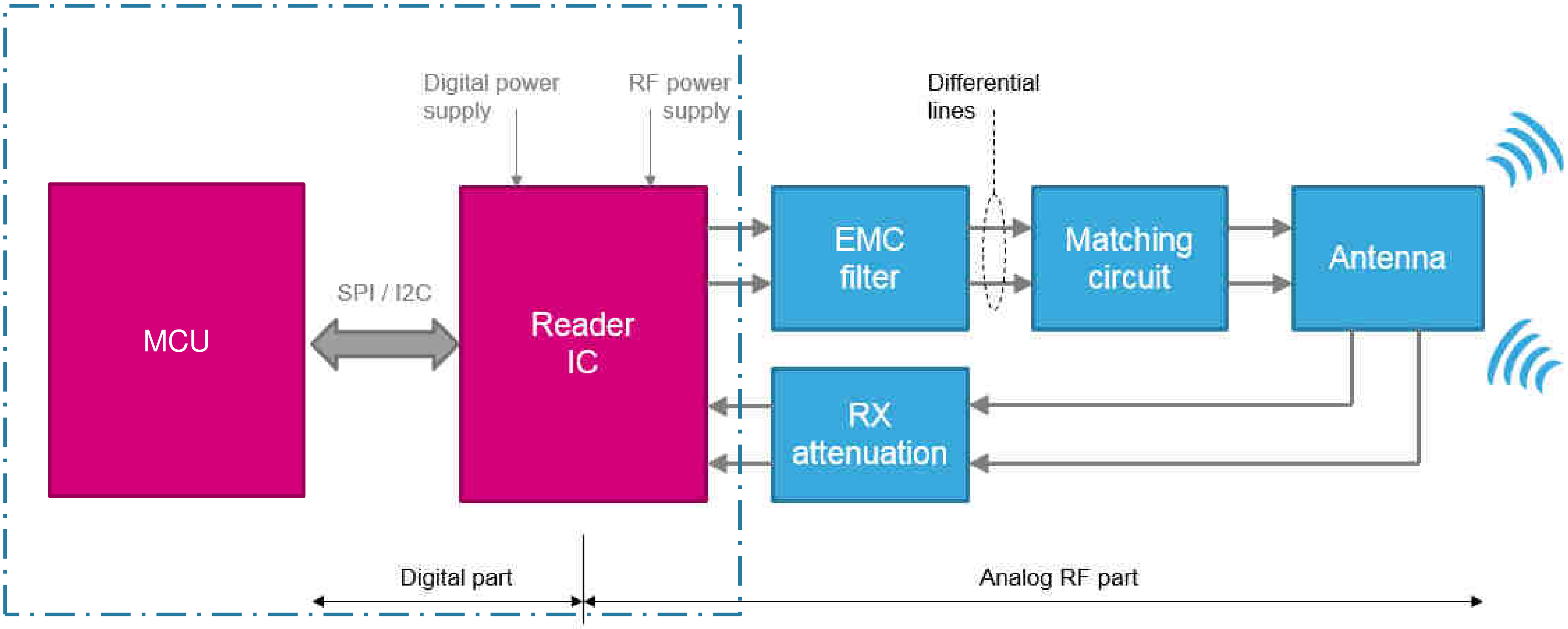
- Internal wakeup circuitry
  - The ST25R3911B includes a fully programmable wake-up scheme. All relevant parameters like cycle time & sensitivity can be programmed.
  - No MCU required to run the wake-up
  - Capacitive & Inductive wakeup can be combined for sophisticated wake-up scripts
- Capactive wake-up
  - ST25R3911B can detect capacitive changes. E.g. the approach of a hand
- Inductive wake-up
  - The inductive wakeup is dedicated to detect approaching cards only



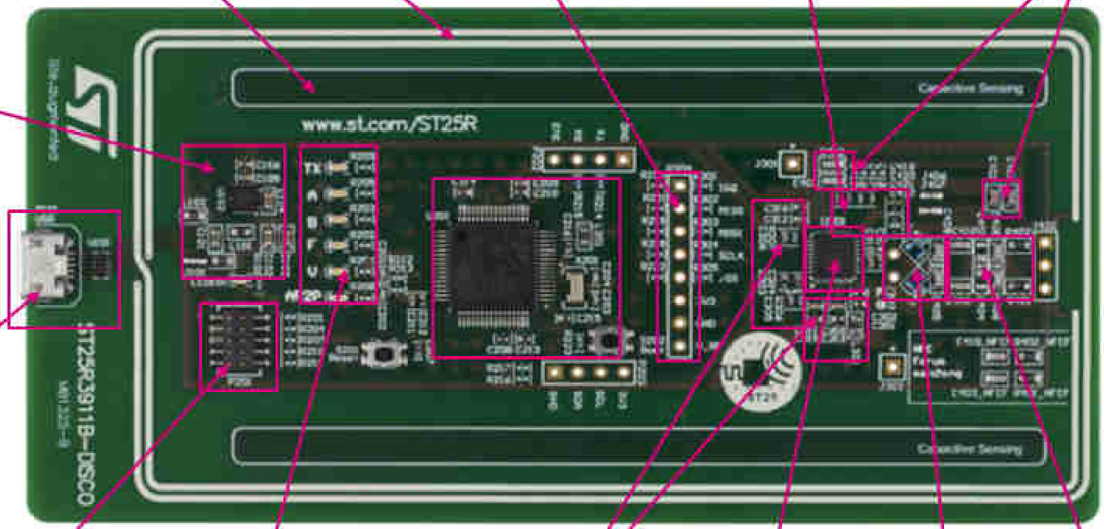


Discovery System Block Diagram

Discovery System Block Diagram



Discovery Board



Capacitive wake-up sensor (ST25R3911 feature)

NFC antenna

SPI interface

Capacitors for AAT (ST25R3911B feature)

RX attenuation

LDO

USB connection to PC

ST LINK programming connector

Status LEDs

- TX – transmitting
- A – NFC A
- B – NFC B
- F – NFC F
- V – NFC V
- AP2P

Power supply caps

Reader IC (ST25R3911B)

EMC filter

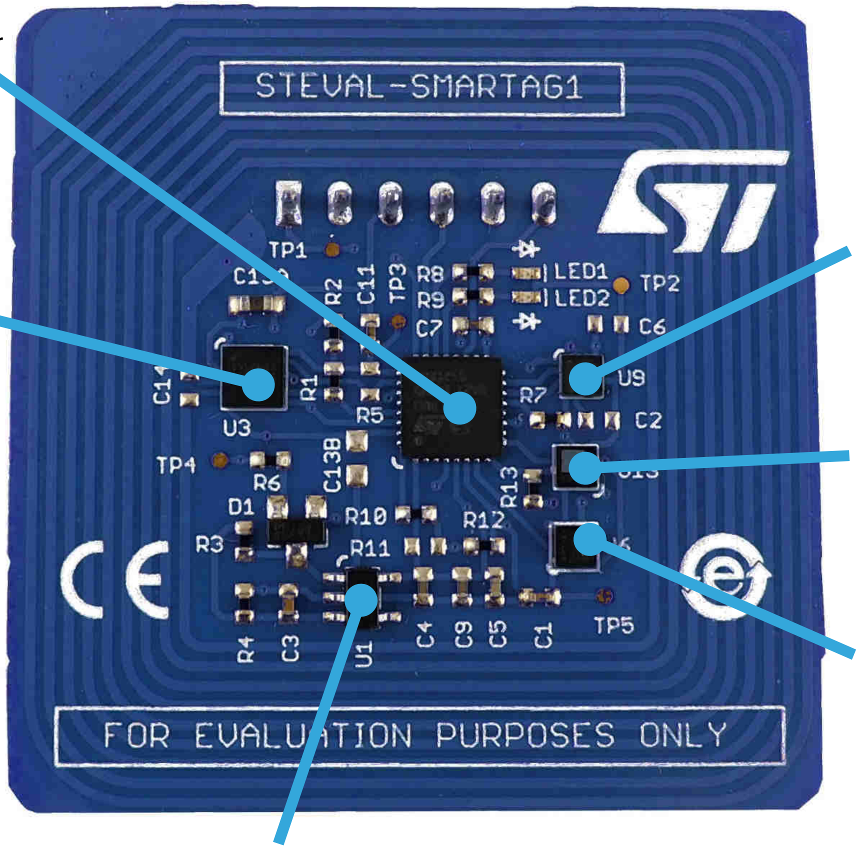
Matching circuit

Sensor Tag Hardware Features

Take a good look at the sensor tag

STM32L031K6U6
ARM Cortex-M0+ 32bit Microcontroller

ST25DV64K-JFR6D3
64Kbit dynamic NFC/RFID tag

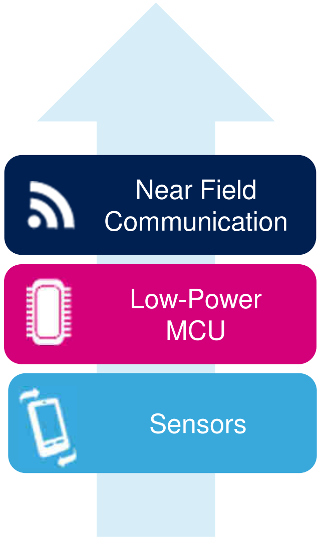


LIS2DW12
Ultra-low power 3-axis digital Accelerometer

LPS22HB
Low-power digital sensor for ambient Pressure

HTS221
Capacitive digital sensor for Relative Humidity and Temperature

STLQ015M18R
Low dropout linear regulator

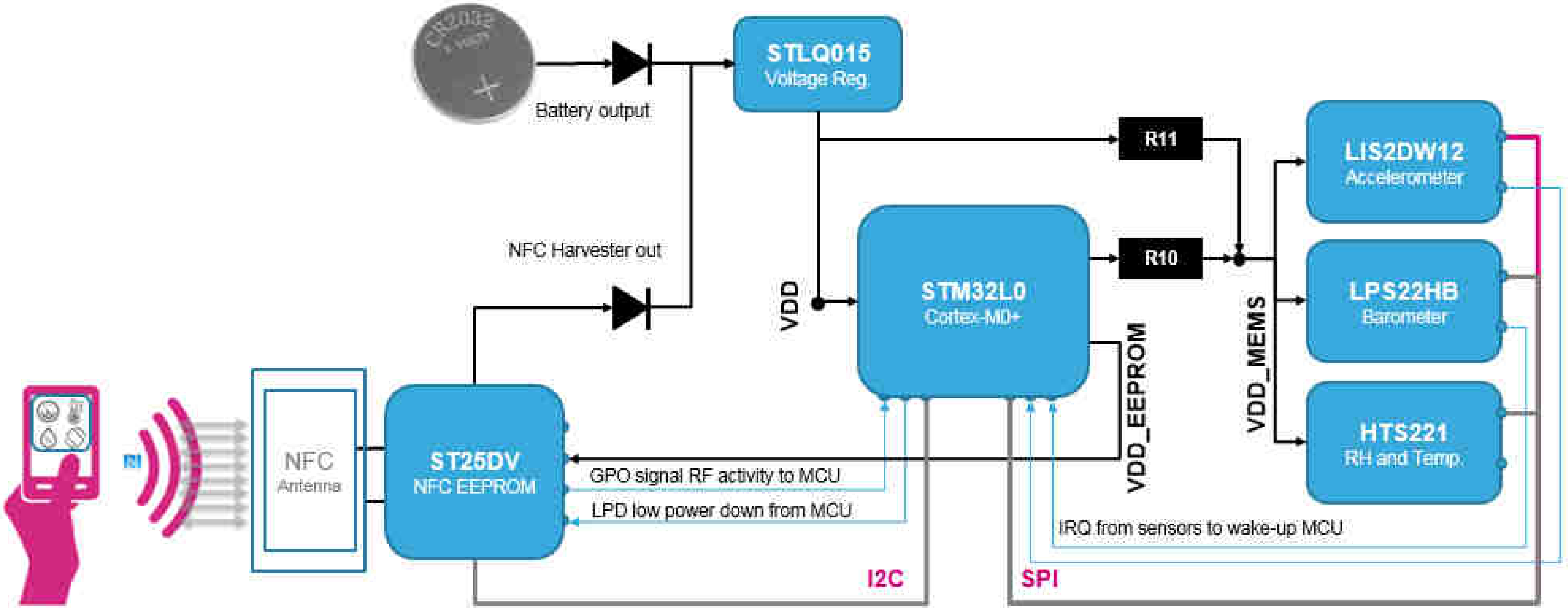


Near Field Communication

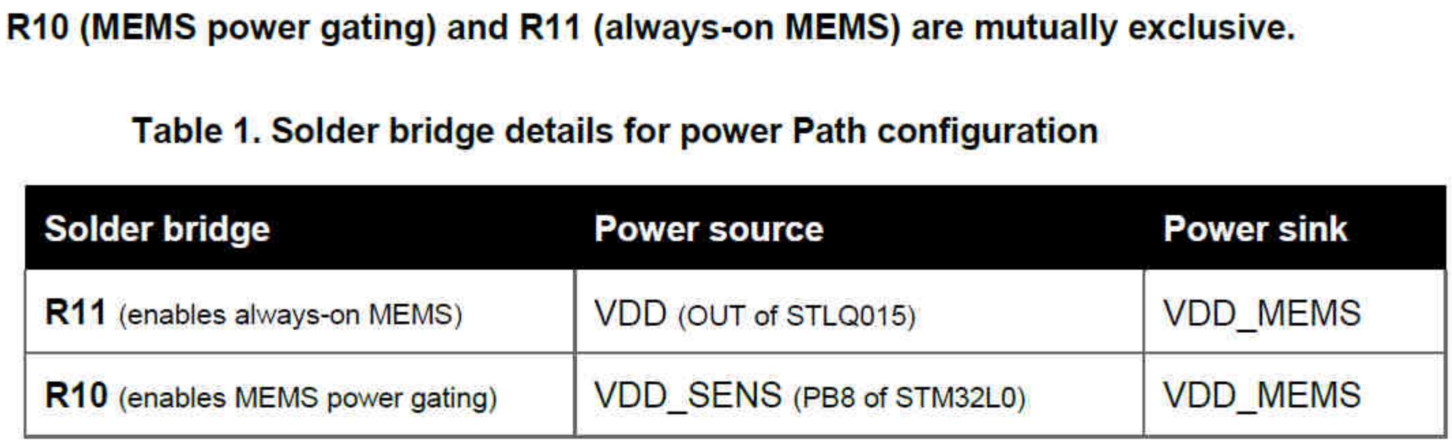
Low-Power MCU

Sensors

SmartTag Block Diagram



Power configuration



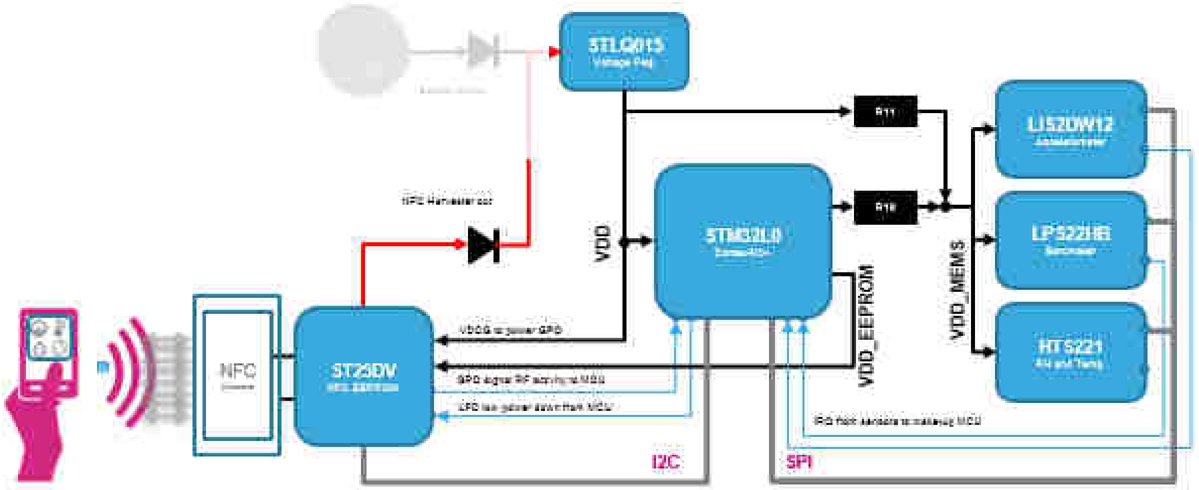
R10 (MEMS power gating) and R11 (always-on MEMS) are mutually exclusive.

Table 1. Solder bridge details for power Path configuration

Solder bridge	Power source	Power sink
R11 (enables always-on MEMS)	VDD (OUT of STLQ015)	VDD_MEMS
R10 (enables MEMS power gating)	VDD_SENS (PB8 of STM32L0)	VDD_MEMS

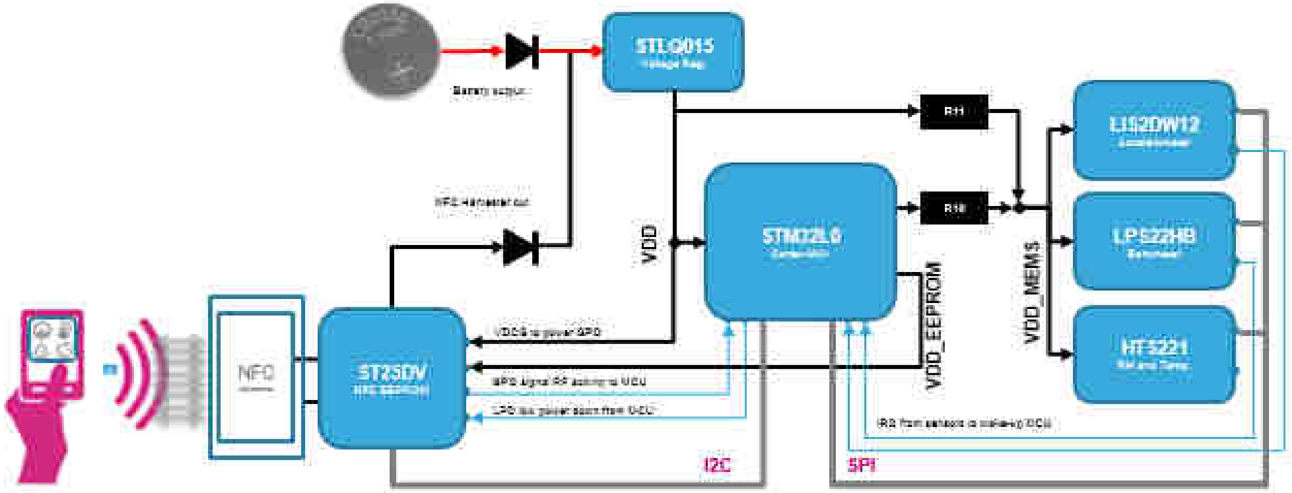
Battery-less Mode

- No battery needed.
- The entire sensor tag is powered by NFC Reader RF field.
- One can perform ONE-SHOT mode



Battery Mode

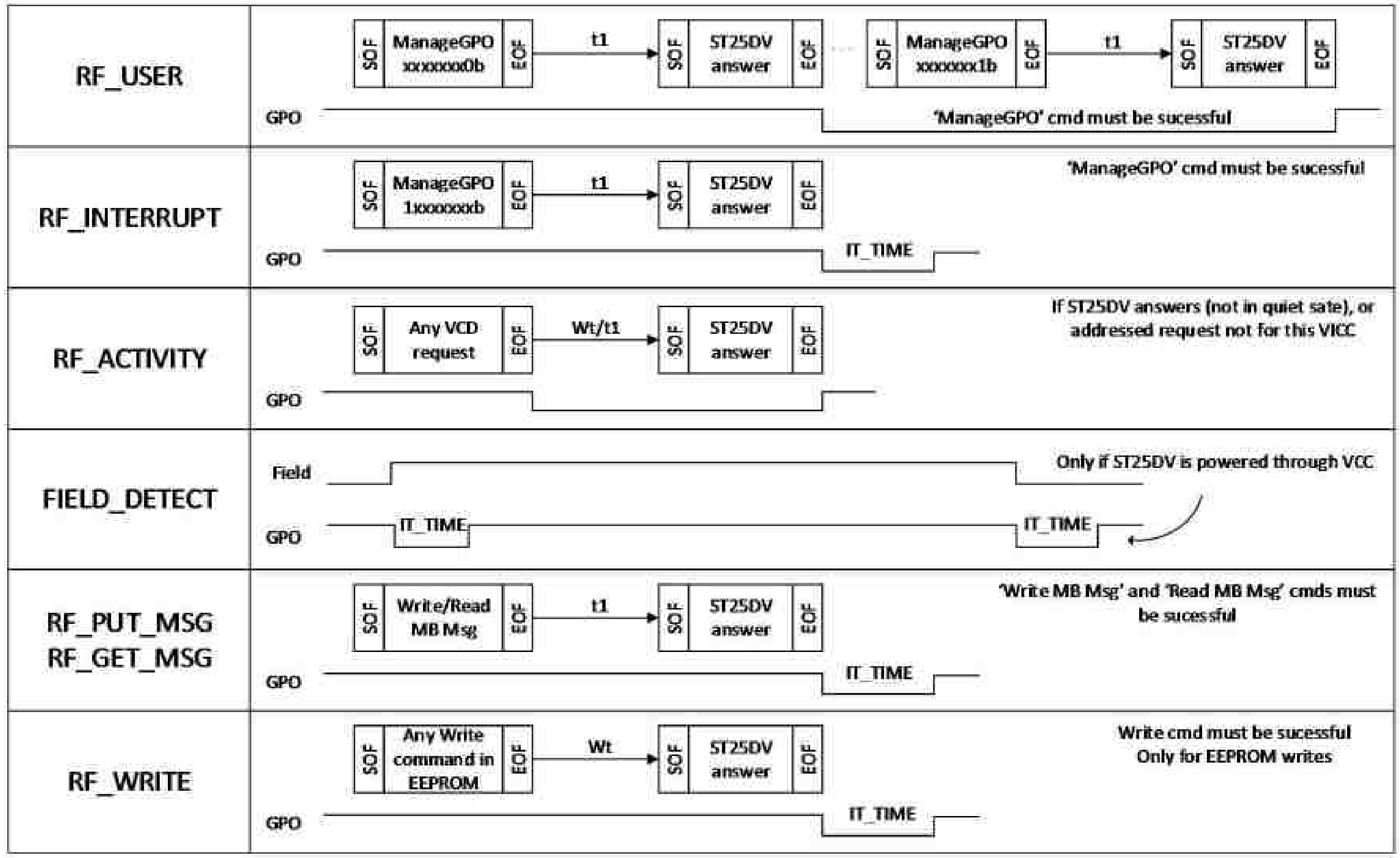
- Synchronous sampling and logging at interval that is controlled by the MCU Real Time Clock
- Asynchronous sampling and logging when an event detection login embedded in MEMs sensors
- Only accelerometer and ambient pressure sensor can wake-up the microcontroller.



Arbitration and Timing(I2C and RF)

- MCU communicates with ST25DV via I2C
- NFC Reader communicates with ST25DV via RF
- Communication is First Come First Serve
- When RF transaction is in progress, I2C commands are Nack (no acknowledgement)
- When I2C communication is in progress, any RF request receives no-response code of 0xFh

Using ST25DV GPO for arbitration



'ManageGPO' cmd must be sucessful

'ManageGPO' cmd must be sucessful

If ST25DV answers (not in quiet sate), or addressed request not for this VICC

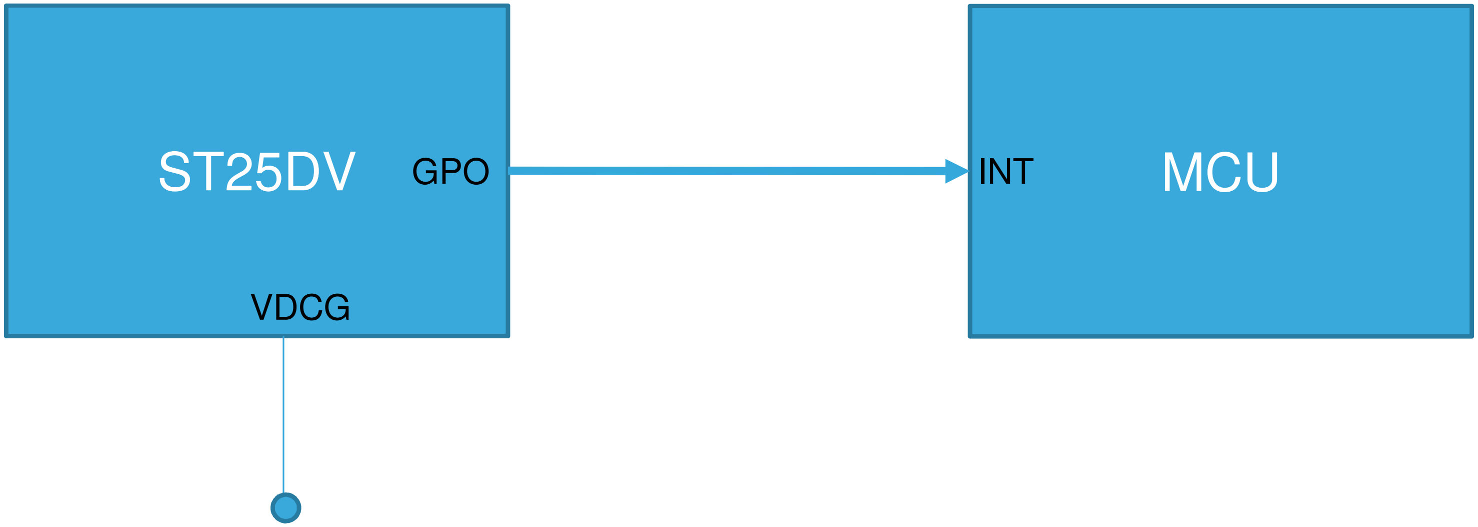
Only if ST25DV is powered through VCC

'Write MB Msg' and 'Read MB Msg' cmds must be sucessful

Write cmd must be sucessful
Only for EEPROM writes

ST25DV GPO Power Block

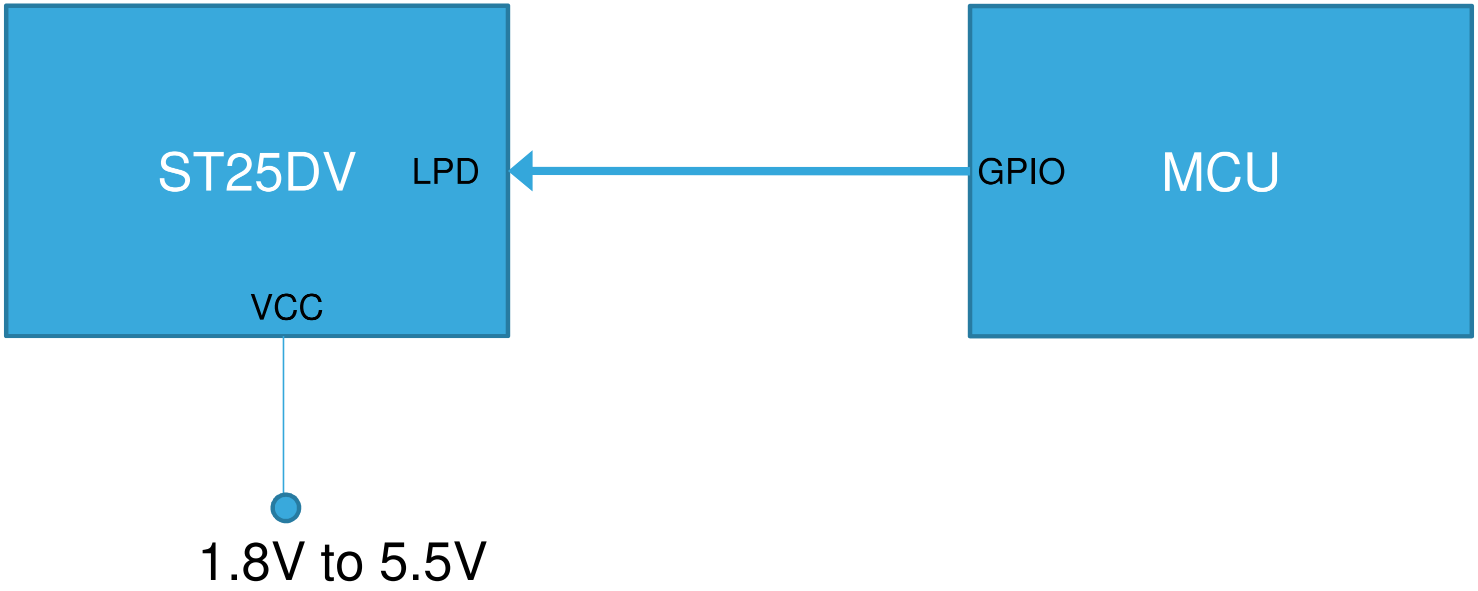
In this configuration, a RF field detection will wakeup the MCU.



Vcc (100nA leakage)

ST25DV LPD

In this configuration, MCU puts the ST25DV in low-power mode consuming less than 1uA by driving the LPD pin HIGH.

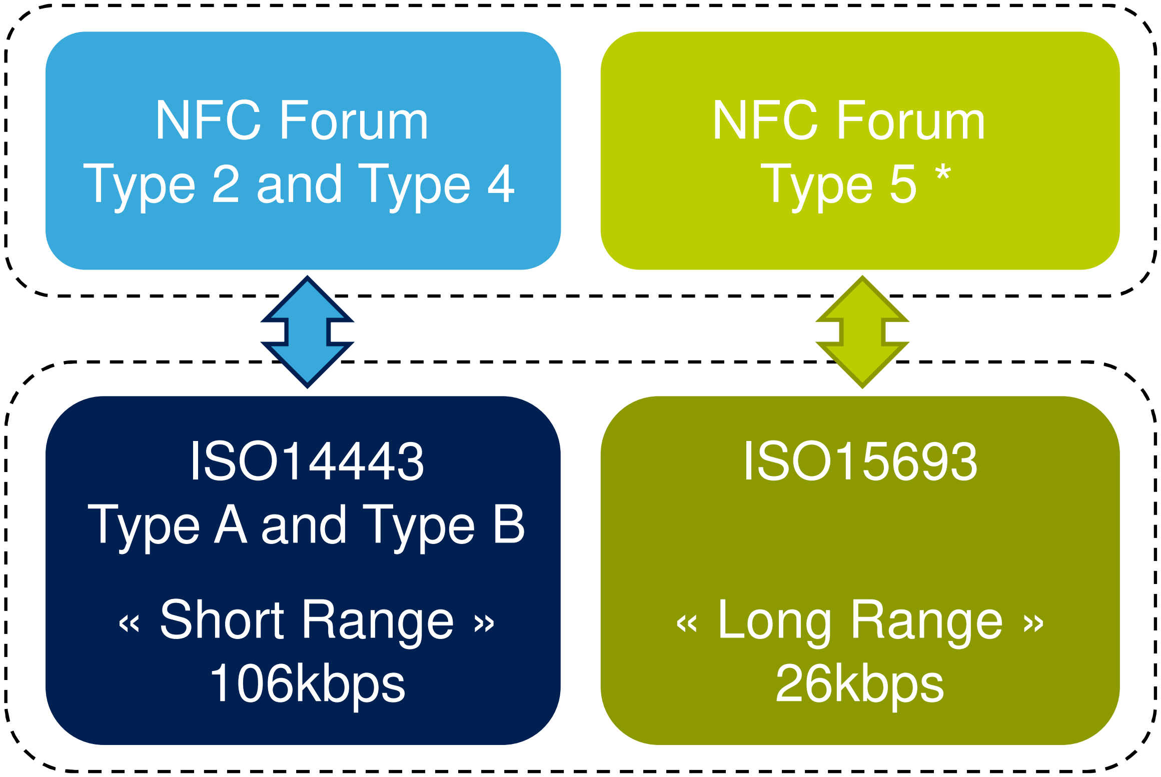


How is data being stored?

NFC and RFID

NFC specification
→ Upper layer SW

ISO standards
→HW/SW protocol
→13.56 MHz



NFC Forum
Type 2 and Type 4

NFC Forum
Type 5 *

ISO14443
Type A and Type B

« Short Range »
106kbps

ISO15693

« Long Range »
26kbps

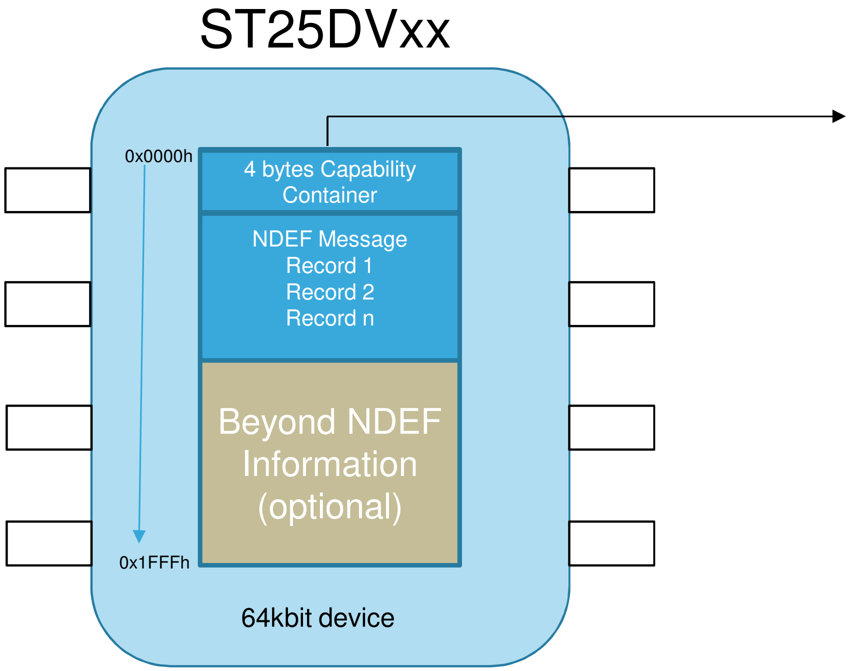
(*) ISO15693 integrated in NFC Forum specifications in October 2015 as NFC Forum type 5 (aka type V)

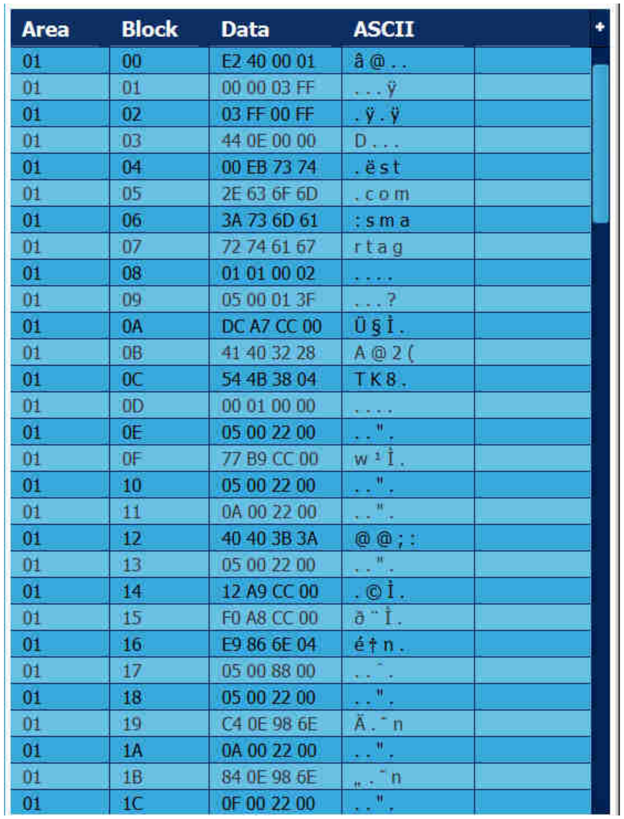
What is a NDEF record?

- Contain the User data.
- The NFC forum defines the format of the NDEF record.
- Different kinds of NDEF records :
  - URL
  - Text
  - SMS
  - Wi-Fi pairing
  - Bluetooth pairing
  - Smart poster….

→ for detailed Info for NDEF record structure, please refer to the Technical Specifications of the NFC Forum!

Sensor data stored as NDEF message





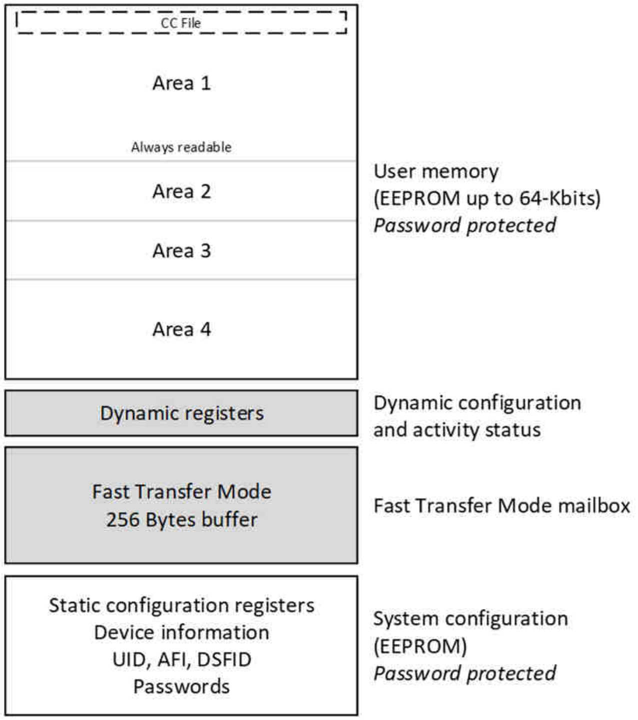
Area	Block	Data	ASCII
01	00	E2 40 00 01	â @ . .
01	01	00 00 03 FF	. . . ÿ
01	02	03 FF 00 FF	. ÿ . ÿ
01	03	44 0E 00 00	D . . .
01	04	00 EB 73 74	. ë s t
01	05	2E 63 6F 6D	. c o m
01	06	3A 73 6D 61	: s m a
01	07	72 74 61 67	r t a g
01	08	01 01 00 02	. . . .
01	09	05 00 01 3F	. . . ?
01	0A	DC A7 CC 00	Ü § Ì .
01	0B	41 40 32 28	A @ 2 (
01	0C	54 4B 38 04	T K 8 .
01	0D	00 01 00 00	. . . .
01	0E	05 00 22 00	. . " .
01	0F	77 B9 CC 00	w ¹ Ì .
01	10	05 00 22 00	. . " .
01	11	0A 00 22 00	. . " .
01	12	40 40 3B 3A	@ @ ; :
01	13	05 00 22 00	. . " .
01	14	12 A9 CC 00	. © Ì .
01	15	F0 A8 CC 00	ð ¨ Ì .
01	16	E9 86 6E 04	é † n .
01	17	05 00 88 00	. . ˆ .
01	18	05 00 22 00	. . " .
01	19	C4 0E 98 6E	Ä . ˜ n
01	1A	0A 00 22 00	. . " .
01	1B	84 0E 98 6E	„ . ˜ n
01	1C	0F 00 22 00	. . " .

- NDEF NFC Data Exchange Format

ST25DV Memory

- Memory organization
  - User memory
    - 4Kbits/16Kbits/64Kbits EEPROM
    - 4 configurable areas
    - Areas protectable by passwords
  - System configuration
    - EEPROM
    - Static registers, define behavior at boot
    - Device identifiers and passwords
    - Protected by password
  - Dynamic configuration
    - Dynamic registers
    - Status and temporary configuration
  - Fast transfer mode buffer
    - Message exchange between I2C and RF
    - 256 Bytes mailbox buffer

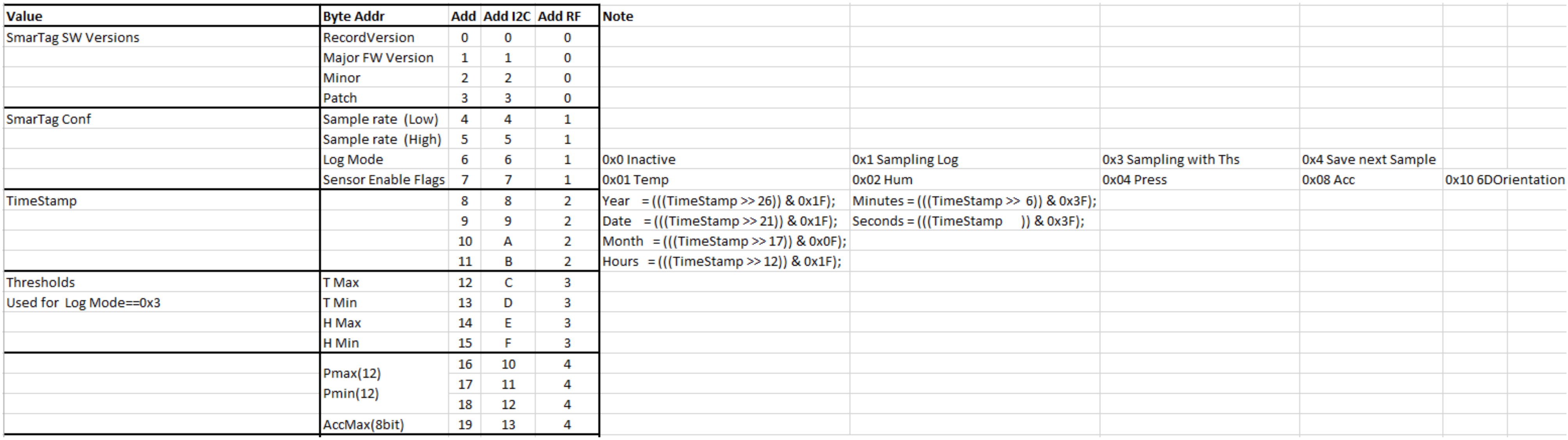
ST25DV memory organization



Sensor data structure

- Each event requires 8 bytes
  - ❑ 4 bytes are time stamp
  - ❑ 4 bytes are sensor data
- When orientation is also logged, 12 bytes are required vs. 8 bytes
- When memory is full, last sample pointer will be at the beginning of data

Tag configuration data and addresses

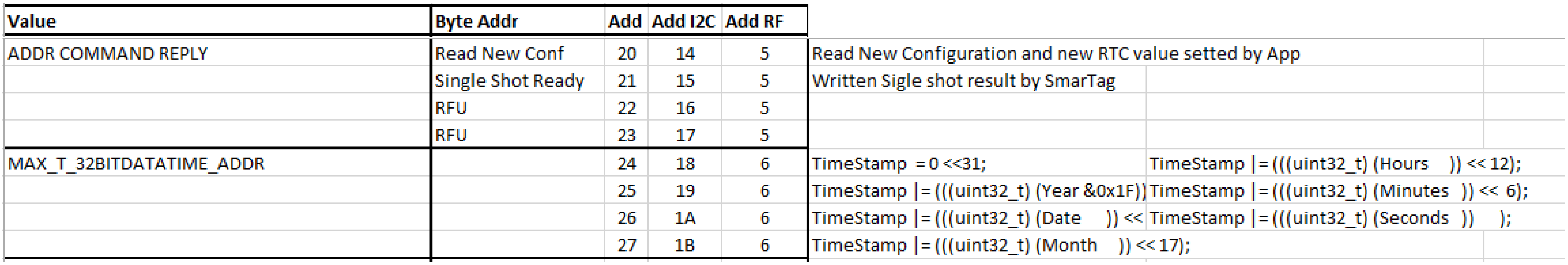


Value	Byte Addr	Add	Add I2C	Add RF	Note				
SmarTag SW Versions	RecordVersion	0	0	0					
	Major FW Version	1	1	0					
	Minor	2	2	0					
	Patch	3	3	0					
SmarTag Conf	Sample rate (Low)	4	4	1					
	Sample rate (High)	5	5	1					
	Log Mode	6	6	1	0x0 Inactive	0x1 Sampling Log	0x3 Sampling with Ths	0x4 Save next Sample	
	Sensor Enable Flags	7	7	1	0x01 Temp	0x02 Hum	0x04 Press	0x08 Acc	0x10 6DOrientation
TimeStamp		8	8	2	Year = (((TimeStamp >> 26)) & 0x1F);	Minutes = (((TimeStamp >> 6)) & 0x3F);			
		9	9	2	Date = (((TimeStamp >> 21)) & 0x1F);	Seconds = (((TimeStamp)) & 0x3F);			
		10	A	2	Month = (((TimeStamp >> 17)) & 0x0F);				
		11	B	2	Hours = (((TimeStamp >> 12)) & 0x1F);				
Thresholds	T Max	12	C	3					
Used for Log Mode==0x3	T Min	13	D	3					
	H Max	14	E	3					
	H Min	15	F	3					

	Pmax(12)
	Pmin(12)
		16	10	4					

		17	11	4					
		18	12	4					
	AccMax(8bit)	19	13	4					

Tag configuration data and addresses



Value	Byte Addr	Add	Add I2C	Add RF		
ADDR COMMAND REPLY	Read New Conf	20	14	5	Read New Configuration and new RTC value setted by App	
	Single Shot Ready	21	15	5	Written Sigle shot result by SmarTag	
	RFU	22	16	5		
	RFU	23	17	5		
MAX_T_32BITDATATIME_ADDR		24	18	6	TimeStamp =0 <<31;	TimeStamp |= (((uint32_t) (Hours)) << 12);
		25	19	6	TimeStamp |= (((uint32_t) (Year &0x1F))	TimeStamp |= (((uint32_t) (Minutes)) << 6);
		26	1A	6	TimeStamp |= (((uint32_t) (Date)) <<	TimeStamp |= (((uint32_t) (Seconds)));
		27	1B	6	TimeStamp |= (((uint32_t) (Month)) << 17);	

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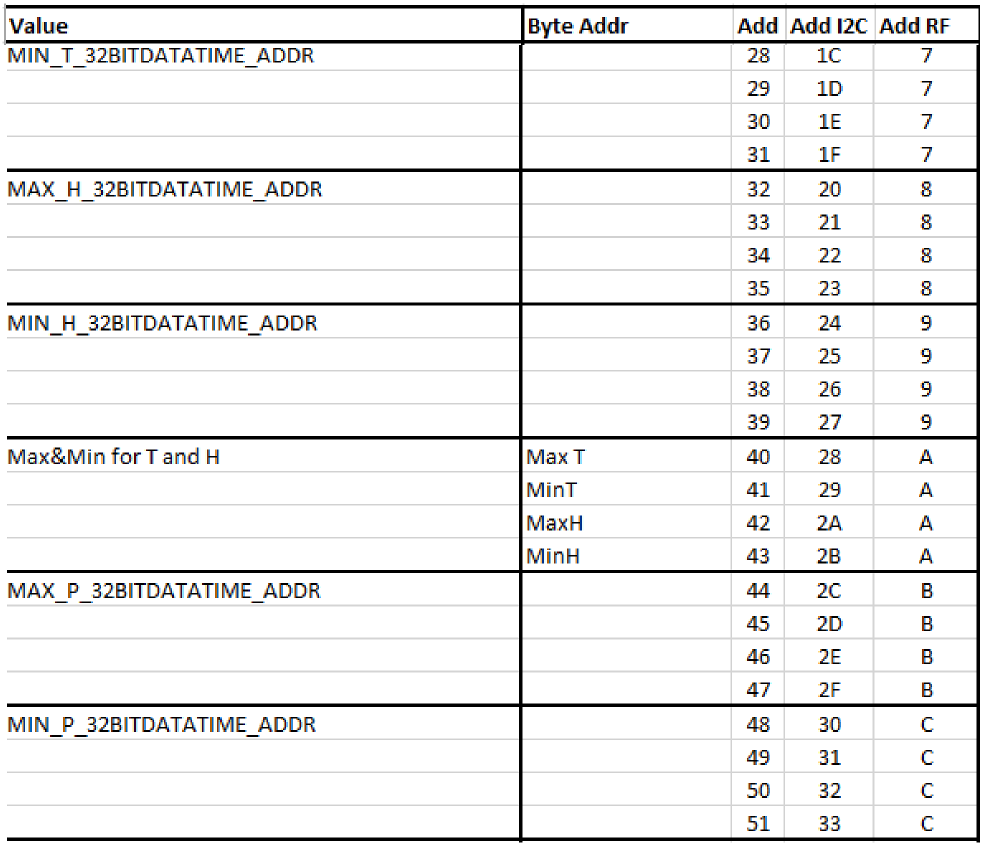
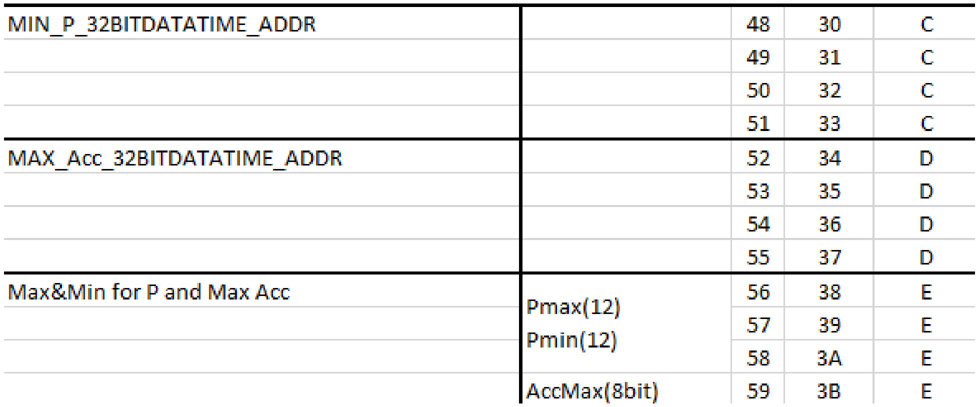
Tag configuration data and addresses

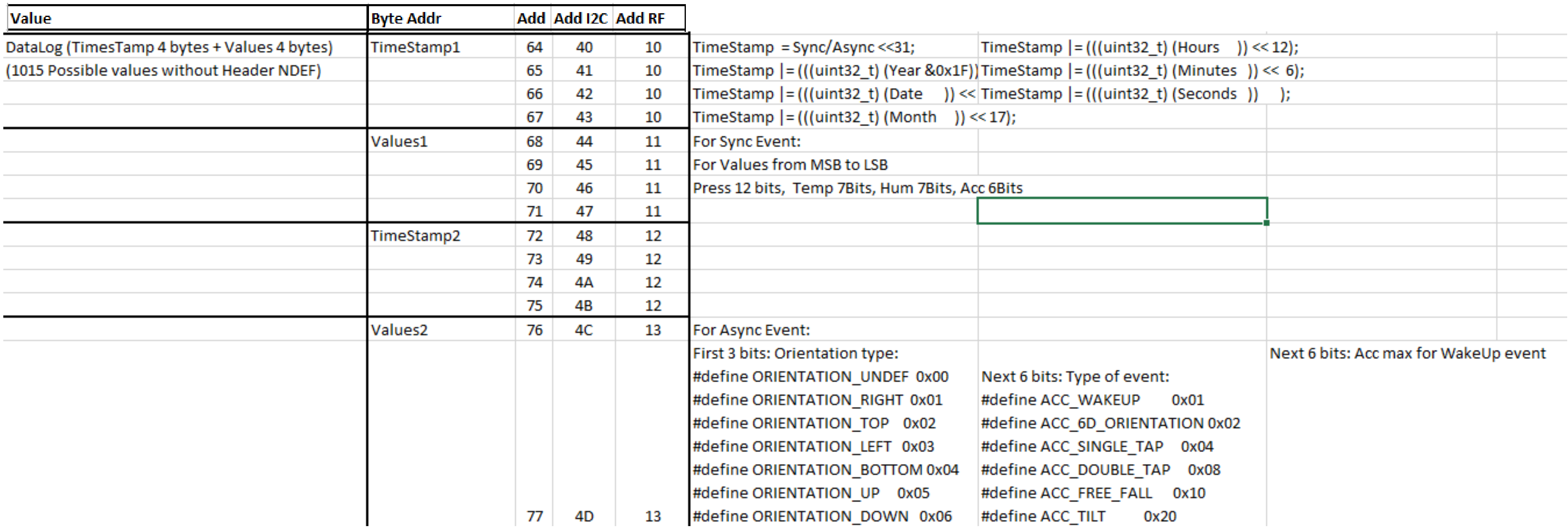


Value	Byte Addr	Add	Add I2C	Add RF
MIN_T_32BITDATATIME_ADDR		28	1C	7
		29	1D	7
		30	1E	7
		31	1F	7
MAX_H_32BITDATATIME_ADDR		32	20	8
		33	21	8
		34	22	8
		35	23	8
MIN_H_32BITDATATIME_ADDR		36	24	9
		37	25	9
		38	26	9
		39	27	9
Max&Min for T and H	Max T	40	28	A
	MinT	41	29	A
	MaxH	42	2A	A
	MinH	43	2B	A
MAX_P_32BITDATATIME_ADDR		44	2C	B
		45	2D	B
		46	2E	B
		47	2F	B
MIN_P_32BITDATATIME_ADDR		48	30	C
		49	31	C
		50	32	C
		51	33	C



MIN_P_32BITDATATIME_ADDR		48	30	C
		49	31	C
		50	32	C
		51	33	C
MAX_Acc_32BITDATATIME_ADDR		52	34	D
		53	35	D
		54	36	D
		55	37	D
Max&Min for P and Max Acc	Pmax(12)	56	38	E
	Pmin(12)	57	39	E
		58	3A	E
	AccMax(8bit)	59	3B	E

Tag configuration data and addresses



Value	Byte Addr	Add	Add I2C	Add RF			
DataLog (TimesTamp 4 bytes + Values 4 bytes)	TimeStamp1	64	40	10	TimeStamp = Sync/Async <<31;	TimeStamp |= (((uint32_t) (Hours)) << 12);	
(1015 Possible values without Header NDEF)		65	41	10	TimeStamp |= (((uint32_t) (Year &0x1F))	TimeStamp |= (((uint32_t) (Minutes)) << 6);	
		66	42	10	TimeStamp |= (((uint32_t) (Date)) <<	TimeStamp |= (((uint32_t) (Seconds)));	
		67	43	10	TimeStamp |= (((uint32_t) (Month)) << 17);		
	Values1	68	44	11	For Sync Event:		
		69	45	11	For Values from MSB to LSB		
		70	46	11	Press 12 bits, Temp 7Bits, Hum 7Bits, Acc 6Bits		
		71	47	11			
	TimeStamp2	72	48	12			
		73	49	12			
		74	4A	12			
		75	4B	12			
	Values2	76	4C	13	For Async Event:		
					First 3 bits: Orientation type:		Next 6 bits: Acc max for WakeUp event
					#define ORIENTATION_UNDEF 0x00	Next 6 bits: Type of event:	
					#define ORIENTATION_RIGHT 0x01	#define ACC_WAKEUP 0x01	
					#define ORIENTATION_TOP 0x02	#define ACC_6D_ORIENTATION 0x02	
					#define ORIENTATION_LEFT 0x03	#define ACC_SINGLE_TAP 0x04	
					#define ORIENTATION_BOTTOM 0x04	#define ACC_DOUBLE_TAP 0x08	
					#define ORIENTATION_UP 0x05	#define ACC_FREE_FALL 0x10	
		77	4D	13	#define ORIENTATION_DOWN 0x06	#define ACC_TILT 0x20	

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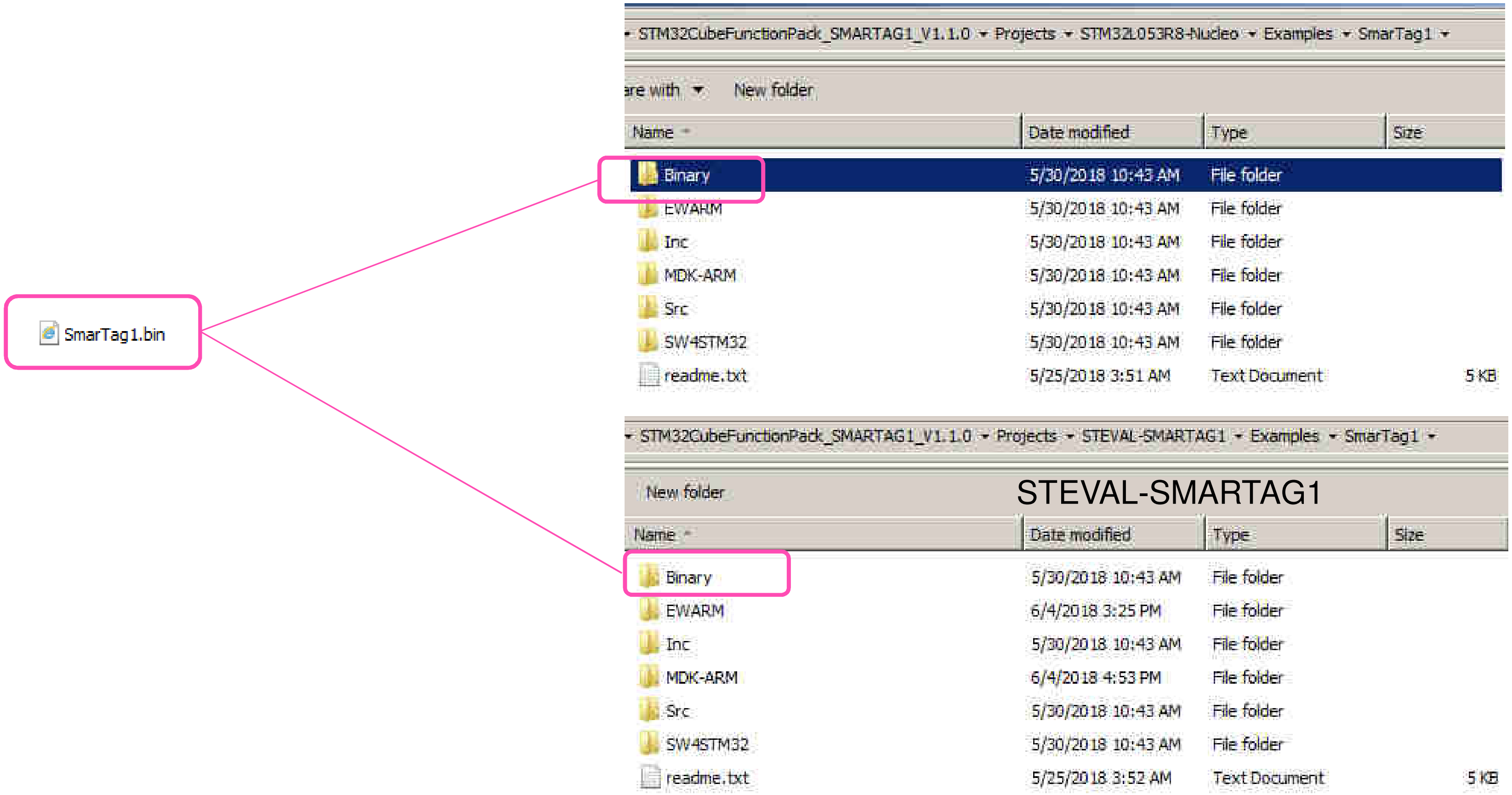
Downloading Firmware

Downloading Binary



STM32CubeFunctionPack_SMARTAG1_V1.1.0 ▸ Projects ▸ STM32L053R8-Nucleo ▸ Examples ▸ SmarTag1 ▸

are with ▾ New folder

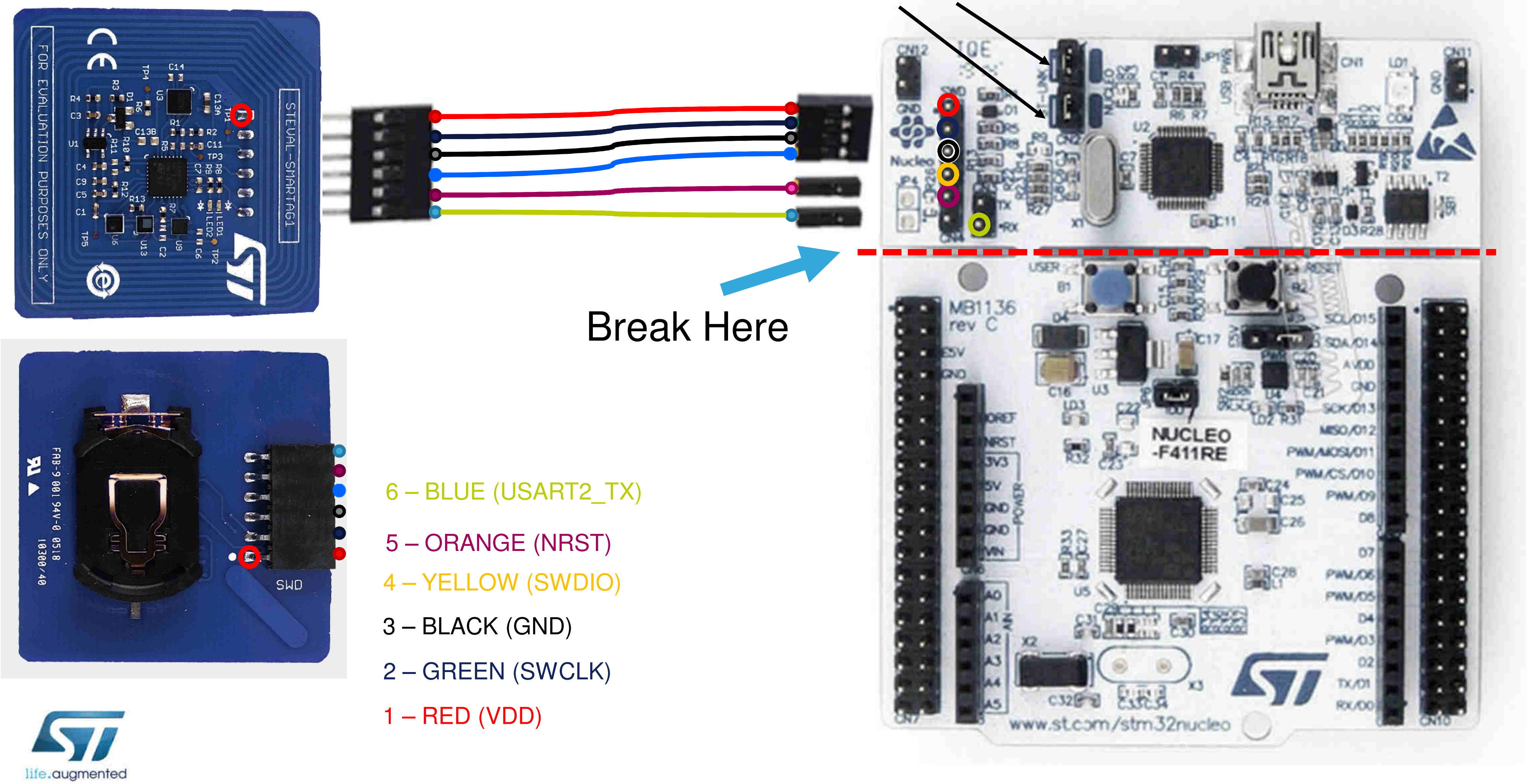
Name	Date modified	Type	Size
Binary	5/30/2018 10:43 AM	File folder	
EWARM	5/30/2018 10:43 AM	File folder	
Inc	5/30/2018 10:43 AM	File folder	
MDK-ARM	5/30/2018 10:43 AM	File folder	
Src	5/30/2018 10:43 AM	File folder	
SW4STM32	5/30/2018 10:43 AM	File folder	
readme.txt	5/25/2018 3:51 AM	Text Document	5 KB

STM32CubeFunctionPack_SMARTAG1_V1.1.0 ▸ Projects ▸ STEVAL-SMARTAG1 ▸ Examples ▸ SmarTag1 ▸

New folder

STEVAL-SMARTAG1

Name	Date modified	Type	Size
Binary	5/30/2018 10:43 AM	File folder	
EWARM	6/4/2018 3:25 PM	File folder	
Inc	5/30/2018 10:43 AM	File folder	
MDK-ARM	6/4/2018 4:53 PM	File folder	
Src	5/30/2018 10:43 AM	File folder	
SW4STM32	5/30/2018 10:43 AM	File folder	
readme.txt	5/25/2018 3:52 AM	Text Document	5 KB



Remove both jumpers on CN2

Break Here

6 – BLUE (USART2_TX)

5 – ORANGE (NRST)

4 – YELLOW (SWDIO)

3 – BLACK (GND)

2 – GREEN (SWCLK)

1 – RED (VDD)

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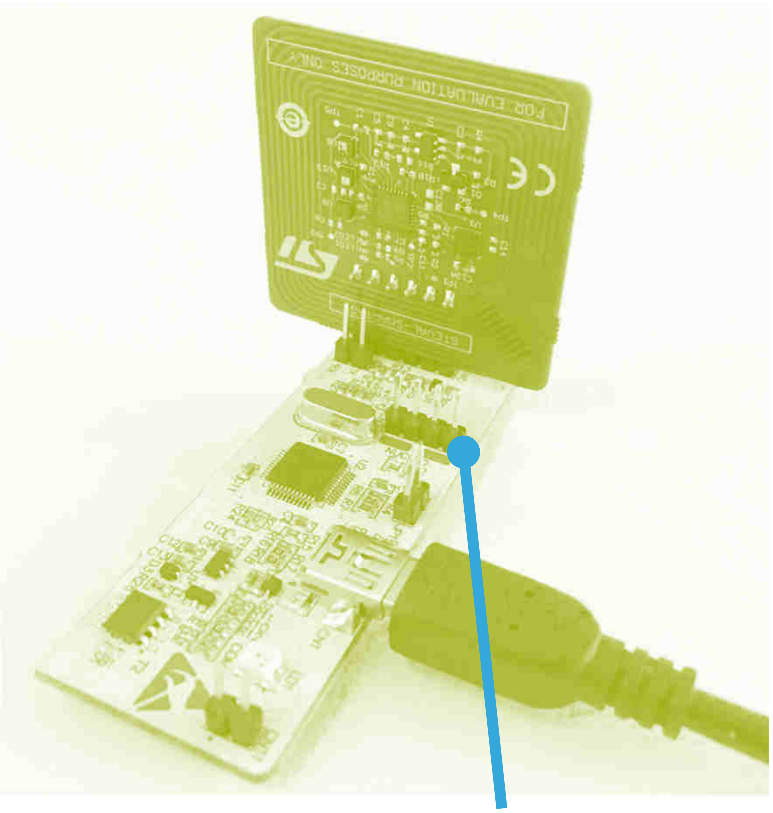
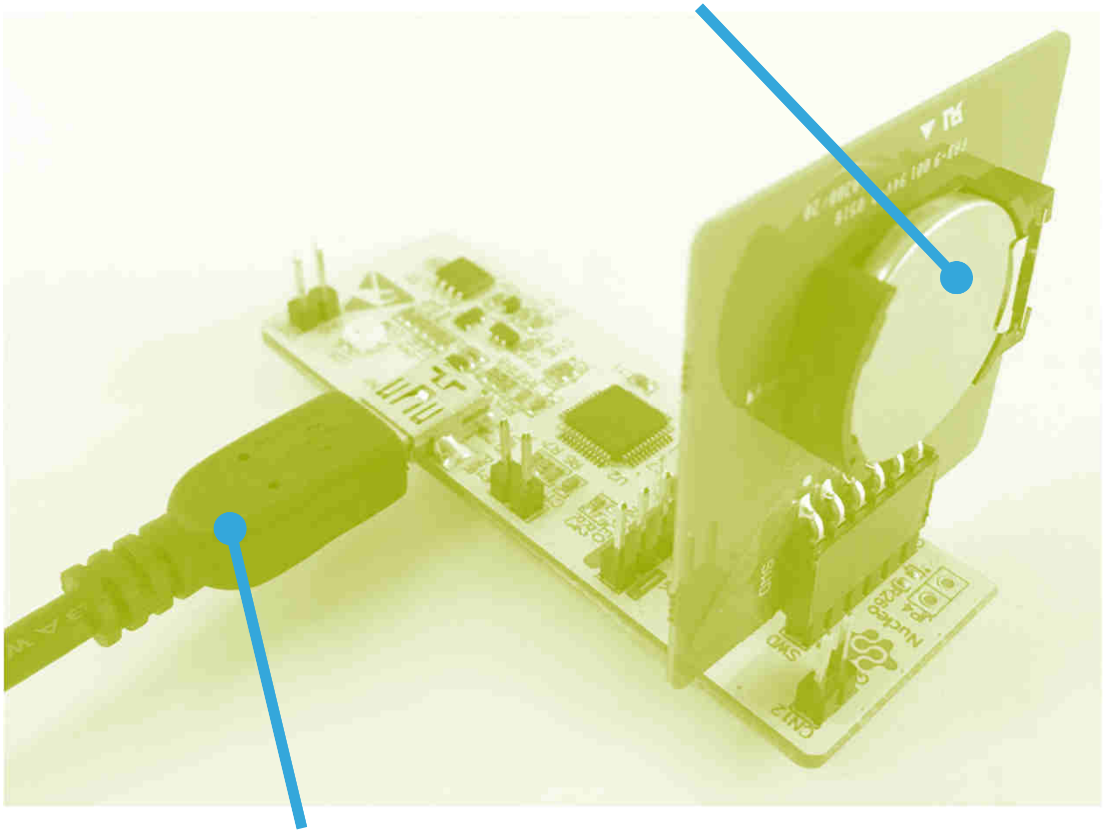
CR2032 battery

NFCSensorTAG must be powered
to be able to flash and debug



CN2

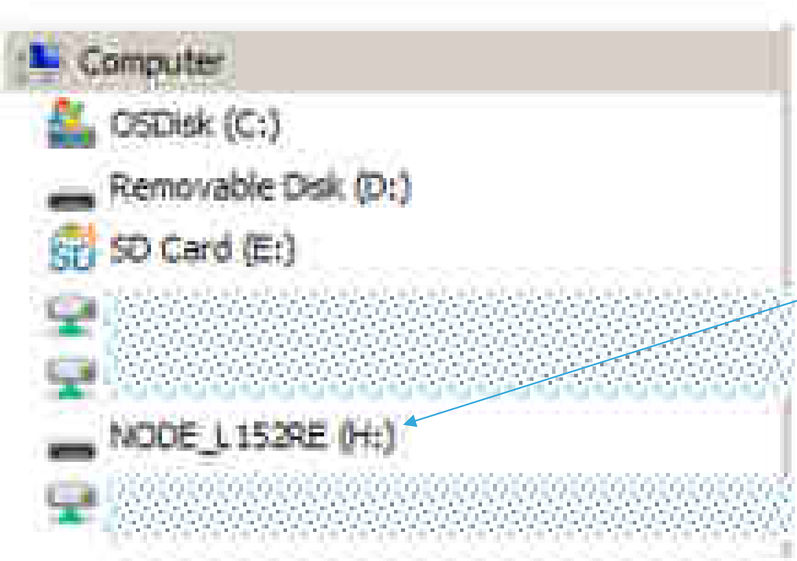
Remove jumpers to be able
to flash and debug



USB

Connect to PC to be able to
flash and debug

Binary Drag and Drop



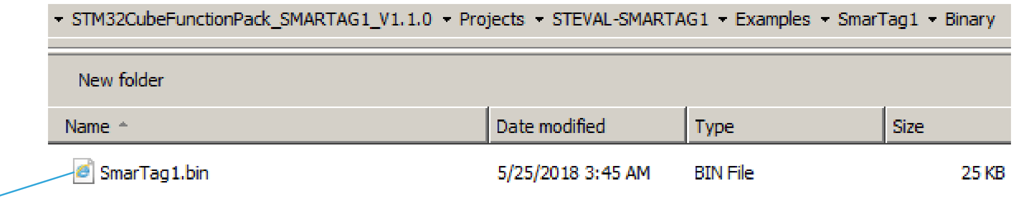
Computer

OSDisk (C:)

Removable Disk (D:)

SD Card (E:)

NODE_L152RE (H:)

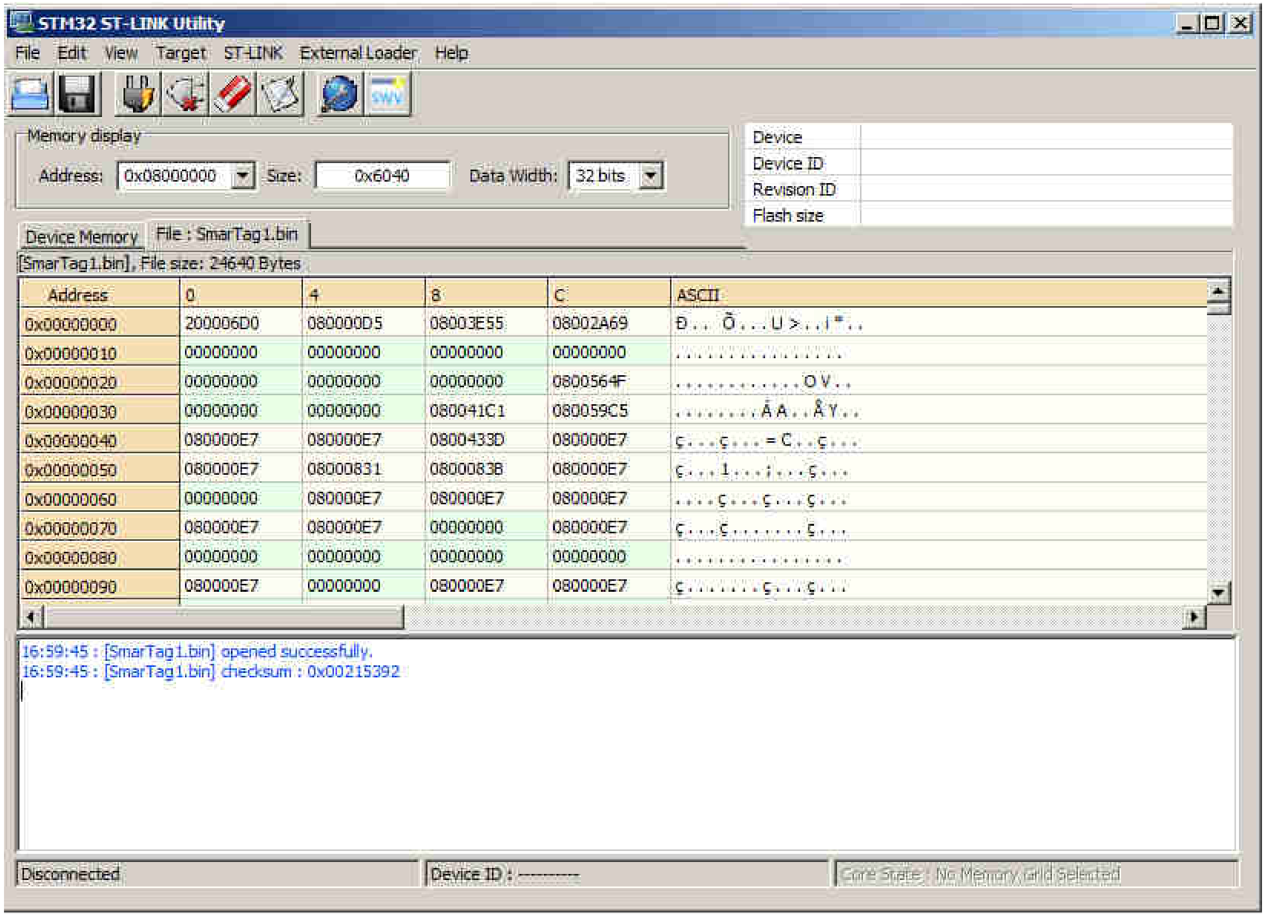


STM32CubeFunctionPack_SMARTAG1_V1.1.0 ▸ Projects ▸ STEVAL-SMARTAG1 ▸ Examples ▸ SmarTag1 ▸ Binary

Name	Date modified	Type	Size
SmarTag1.bin	5/25/2018 3:45 AM	BIN File	25 KB

Note: The name of the drive node does not matter. You can use the STLINK part from any STM32 Nucleo board

Using STM32 ST-LINK Utility



Address: 0x08000000 Size: 0x6040 Data Width: 32 bits

[SmarTag1.bin], File size: 24640 Bytes

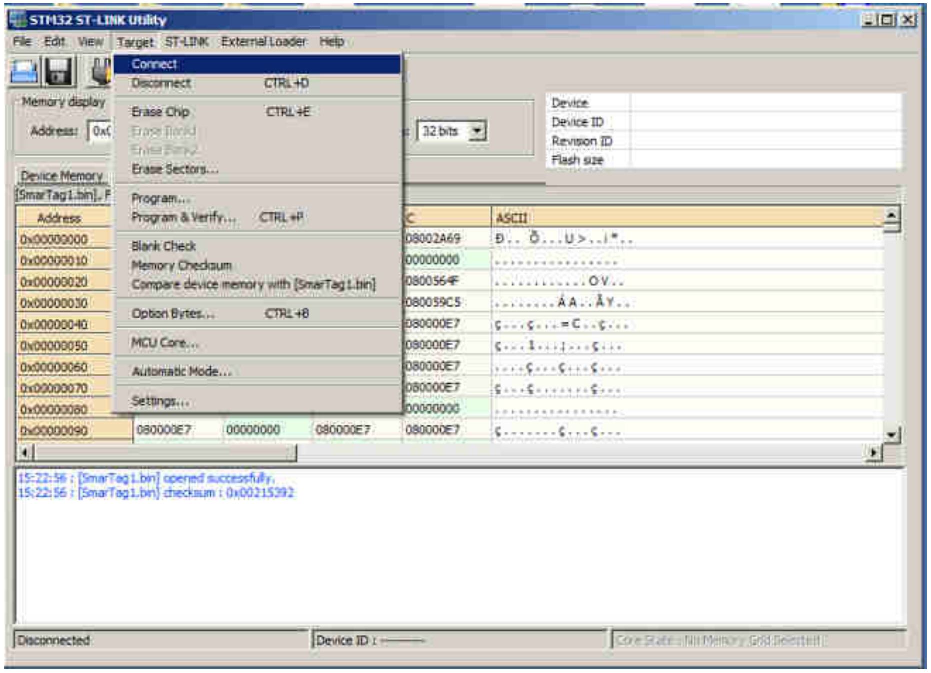
Address	0	4	8	C	ASCII
0x00000000	200006D0	080000D5	08003E55	08002A69	Ð . . Õ . . . U > . . i * . .
0x00000010	00000000	00000000	00000000	00000000	. . . .
0x00000020	00000000	00000000	00000000	0800564F	. . . . O V . .
0x00000030	00000000	00000000	080041C1	080059C5	. . . . Á A . . Å Y . .
0x00000040	080000E7	080000E7	0800433D	080000E7	ç . . . ç . . . = C . . ç . . .
0x00000050	080000E7	08000831	0800083B	080000E7	ç . . . 1 . . . ; . . . ç . . .
0x00000060	00000000	080000E7	080000E7	080000E7	. . . . ç . . . ç . . . ç . . .
0x00000070	080000E7	080000E7	00000000	080000E7	ç . . . ç . . . . ç . . .
0x00000080	00000000	00000000	00000000	00000000	. . . .
0x00000090	080000E7	00000000	080000E7	080000E7	ç . . . . ç . . . ç . . .

```
16:59:45 : [SmarTag1.bin] opened successfully.
16:59:45 : [SmarTag1.bin] checksum : 0x00215392
```

Disconnected | Device ID : ---------- | Core State : No Memory Grid Selected

https://www.st.com/en/development-tools/stsw-link004.html

Connecting to ST-LINK



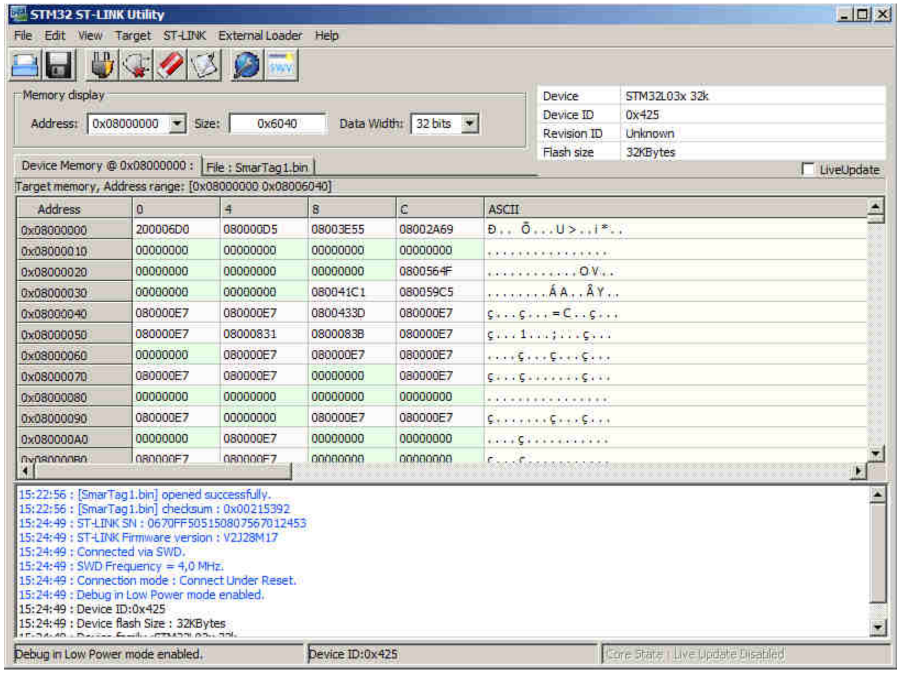
Data Width: 32 bits

Device	
Device ID	
Revision ID	
Flash size	

Address				C	ASCII
0x00000000				08002A69	Đ . . Õ . . . U > . . i * . .
0x00000010				00000000	. . . .
0x00000020				0800564F	. . . . O V . .
0x00000030				080059C5	. . . . Á A . . Å Y . .
0x00000040				080000E7	ç . . . ç . . . = C . . ç . . .
0x00000050				080000E7	ç . . . 1 . . . ; . . . ç . . .
0x00000060				080000E7	. . . . ç . . . ç . . . ç . . .
0x00000070				080000E7	ç . . . ç . . . . ç . . .
0x00000080				00000000	. . . .
0x00000090	080000E7	00000000	080000E7	080000E7	ç . . . . ç . . . ç . . .

```
15:22:56 : [SmarTag1.bin] opened successfully.
15:22:56 : [SmarTag1.bin] checksum : 0x00215392
```

Disconnected | Device ID : ——— | Core State : No Memory Grid Selected



Address: 0x08000000 Size: 0x6040 Data Width: 32 bits

Device	STM32L03x 32k
Device ID	0x425
Revision ID	Unknown
Flash size	32KBytes

Device Memory @ 0x08000000 : | File : SmarTag1.bin

Target memory, Address range: [0x08000000 0x08006040]

Address	0	4	8	C	ASCII
0x08000000	200006D0	080000D5	08003E55	08002A69	Đ . . Õ . . . U > . . i * . .
0x08000010	00000000	00000000	00000000	00000000	. . . .
0x08000020	00000000	00000000	00000000	0800564F	. . . . O V . .
0x08000030	00000000	00000000	080041C1	080059C5	. . . . Á A . . Å Y . .
0x08000040	080000E7	080000E7	0800433D	080000E7	ç . . . ç . . . = C . . ç . . .
0x08000050	080000E7	08000831	0800083B	080000E7	ç . . . 1 . . . ; . . . ç . . .
0x08000060	00000000	080000E7	080000E7	080000E7	. . . . ç . . . ç . . . ç . . .
0x08000070	080000E7	080000E7	00000000	080000E7	ç . . . ç . . . . ç . . .
0x08000080	00000000	00000000	00000000	00000000	. . . .
0x08000090	080000E7	00000000	080000E7	080000E7	ç . . . . ç . . . ç . . .
0x080000A0	00000000	080000E7	00000000	00000000	. . . . ç . . . .
0x080000B0	080000E7	080000E7	00000000	00000000	ç . . . ç . . . .

```
15:22:56 : [SmarTag1.bin] opened successfully.
15:22:56 : [SmarTag1.bin] checksum : 0x00215392
15:24:49 : ST-LINK SN : 0670FF505150807567012453
15:24:49 : ST-LINK Firmware version : V2J28M17
15:24:49 : Connected via SWD.
15:24:49 : SWD Frequency = 4,0 MHz.
15:24:49 : Connection mode : Connect Under Reset.
15:24:49 : Debug in Low Power mode enabled.
15:24:49 : Device ID:0x425
15:24:49 : Device flash Size : 32KBytes
```

Debug in Low Power mode enabled. | Device ID:0x425 | Core State : Live Update Disabled

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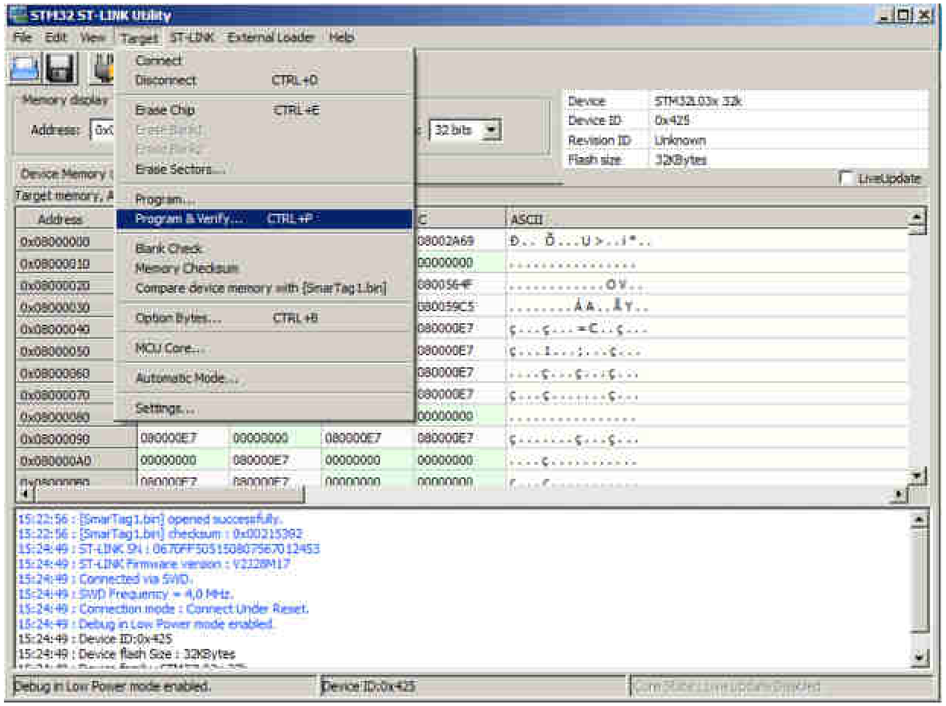
Start Programming

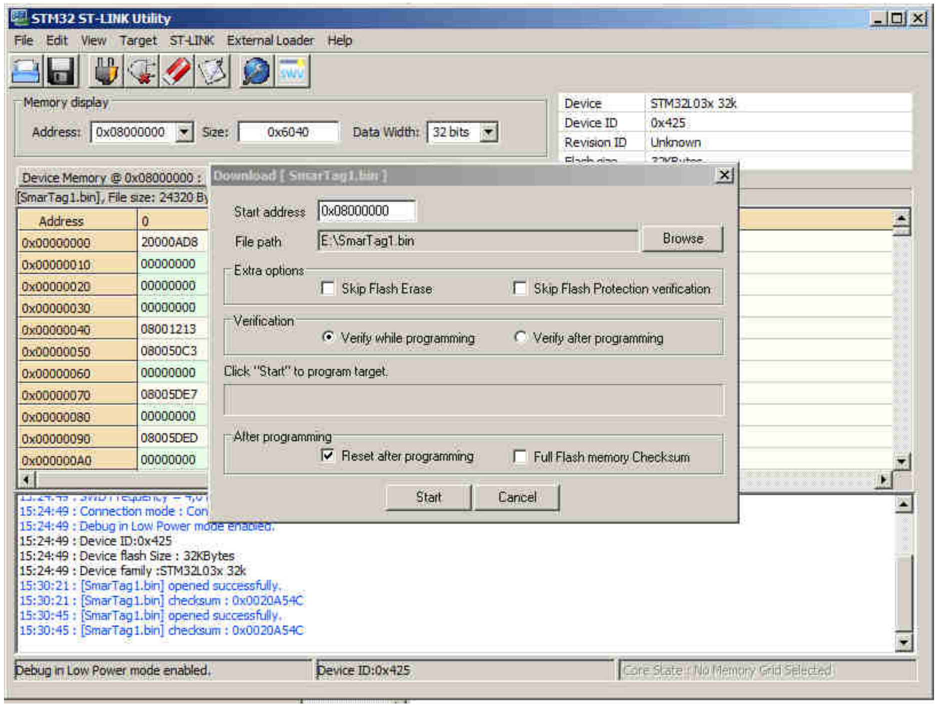


Device	STM32L03x 32k
Device ID	0x425
Revision ID	Unknown
Flash size	32KBytes

Address				C	ASCII
0x08000000				08002A69	Ð.. Õ...U>..i*..
0x08000010				00000000	....
0x08000020				0800564F	............OV..
0x08000030				080059C5	........ÅA..ÅY..
0x08000040				080000E7	ç...ç...=C..ç...
0x08000050				080000E7	ç...I...;...ç...
0x08000060				080000E7	....ç...ç...ç...
0x08000070				080000E7	ç...ç.......ç...
0x08000080				00000000	....
0x08000090	080000E7	00000000	080000E7	080000E7	ç.......ç...ç...
0x080000A0	00000000	080000E7	00000000	00000000	....ç...........
0x080000B0	080000E7	080000E7	00000000	00000000	ç...ç...........

```
15:22:56 : [SmarTag1.bin] opened successfully.
15:22:56 : [SmarTag1.bin] checksum : 0x00215392
15:24:49 : ST-LINK SN : 0670FF505150807567012453
15:24:49 : ST-LINK Firmware version : V2J28M17
15:24:49 : Connected via SWD.
15:24:49 : SWD Frequency = 4,0 MHz.
15:24:49 : Connection mode : Connect Under Reset.
15:24:49 : Debug in Low Power mode enabled.
15:24:49 : Device ID:0x425
15:24:49 : Device flash Size : 32KBytes
```

Debug in Low Power mode enabled. | Device ID:0x425 | Core State : Live Update Disabled


STM32 ST-LINK Utility
File Edit View Target ST-LINK External Loader Help
SWV
Download [SmarTag1.bin]
Browse
Start
Cancel

Memory display: Address: 0x08000000 Size: 0x6040 Data Width: 32 bits

Device	STM32L03x 32k
Device ID	0x425
Revision ID	Unknown
Flash size	32KBytes

Device Memory @ 0x08000000 :

[SmarTag1.bin], File size: 24320 By

Address	0
0x00000000	20000AD8
0x00000010	00000000
0x00000020	00000000
0x00000030	00000000
0x00000040	08001213
0x00000050	080050C3
0x00000060	00000000
0x00000070	08005DE7
0x00000080	00000000
0x00000090	08005DED
0x000000A0	00000000

Start address: 0x08000000

File path: E:\SmarTag1.bin

Extra options: □ Skip Flash Erase □ Skip Flash Protection verification

Verification: ● Verify while programming ○ Verify after programming

Click "Start" to program target.

After programming: ☑ Reset after programming □ Full Flash memory Checksum

```
15:24:49 : SWD Frequency = 4,0
15:24:49 : Connection mode : Con
15:24:49 : Debug in Low Power mode enabled.
15:24:49 : Device ID:0x425
15:24:49 : Device flash Size : 32KBytes
15:24:49 : Device family :STM32L03x 32k
15:30:21 : [SmarTag1.bin] opened successfully.
15:30:21 : [SmarTag1.bin] checksum : 0x0020A54C
15:30:45 : [SmarTag1.bin] opened successfully.
15:30:45 : [SmarTag1.bin] checksum : 0x0020A54C
```

Debug in Low Power mode enabled. | Device ID:0x425 | Core State : No Memory Grid Selected

Let’s get to the Hands-On Section

LAB Preparation

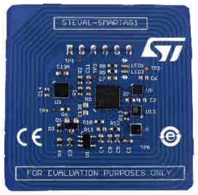
- For the workshop ST will provide

ST USB Key
with presentation of the workshop

Micro USB Cable

ST25R3911B Discovery Kit

CR2032 Battery

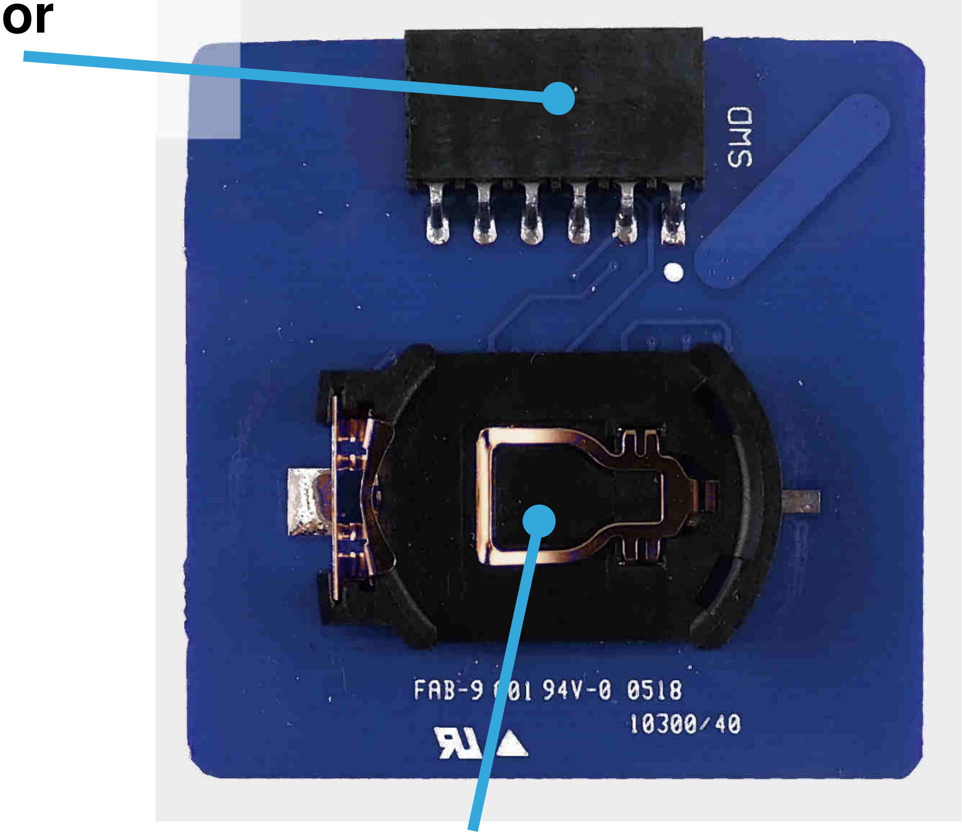


NFC Sensor Tag Evaluation Board

Installation of ST25PC Software

- Locate the executable en.ST25PC-NFC.exe in the flash drive.
- Click and install it. In some computers, the installation might need internet access to download certain Microsoft Visual C++ Redistributable (x86)
- Say “yes” to driver install.

Install the battery

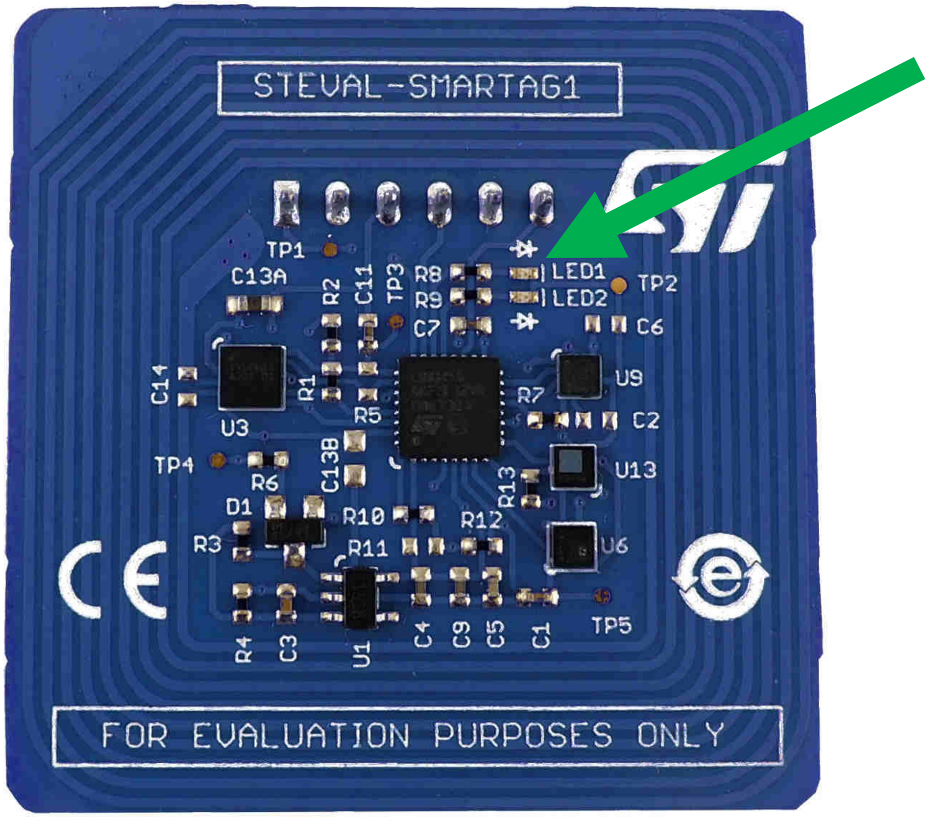


SWD connector
To ST-Link/V2

Battery holder
CR2032

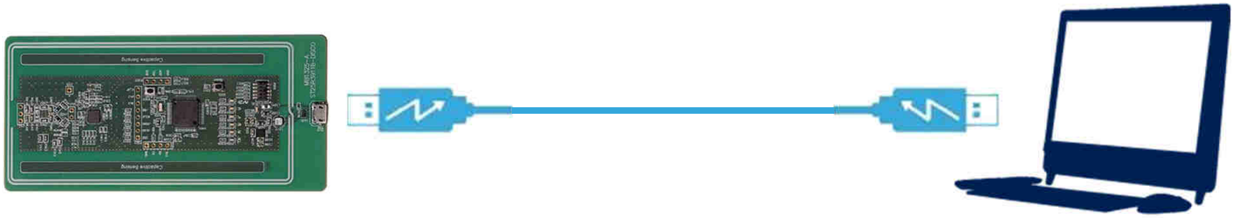
<u>Important Note:</u>
Load your coin cell battery with + facing out.

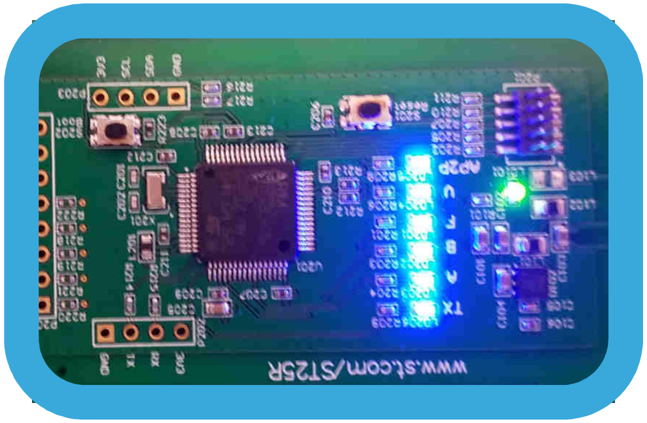
Check if battery and tag are good!



After 8 seconds, LED1 should blink every 5 seconds

Connect your reader

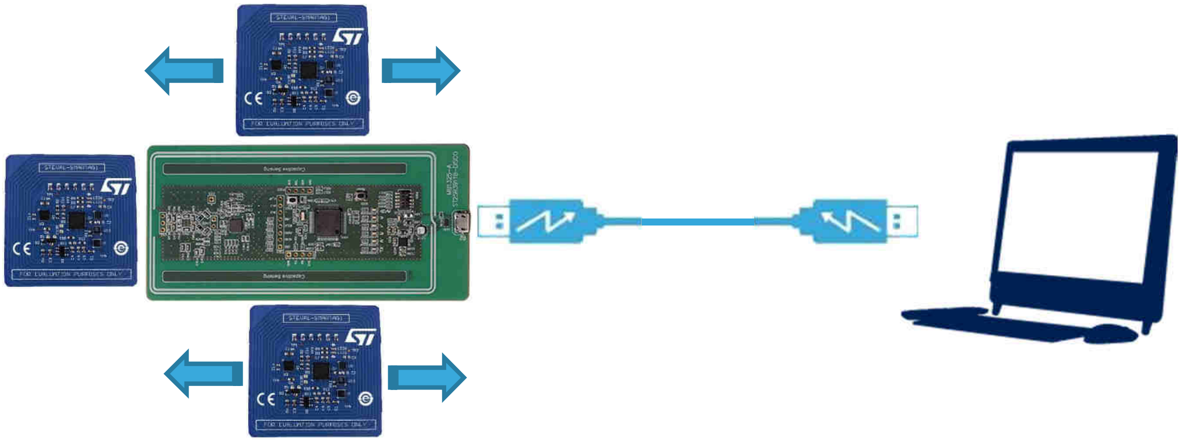




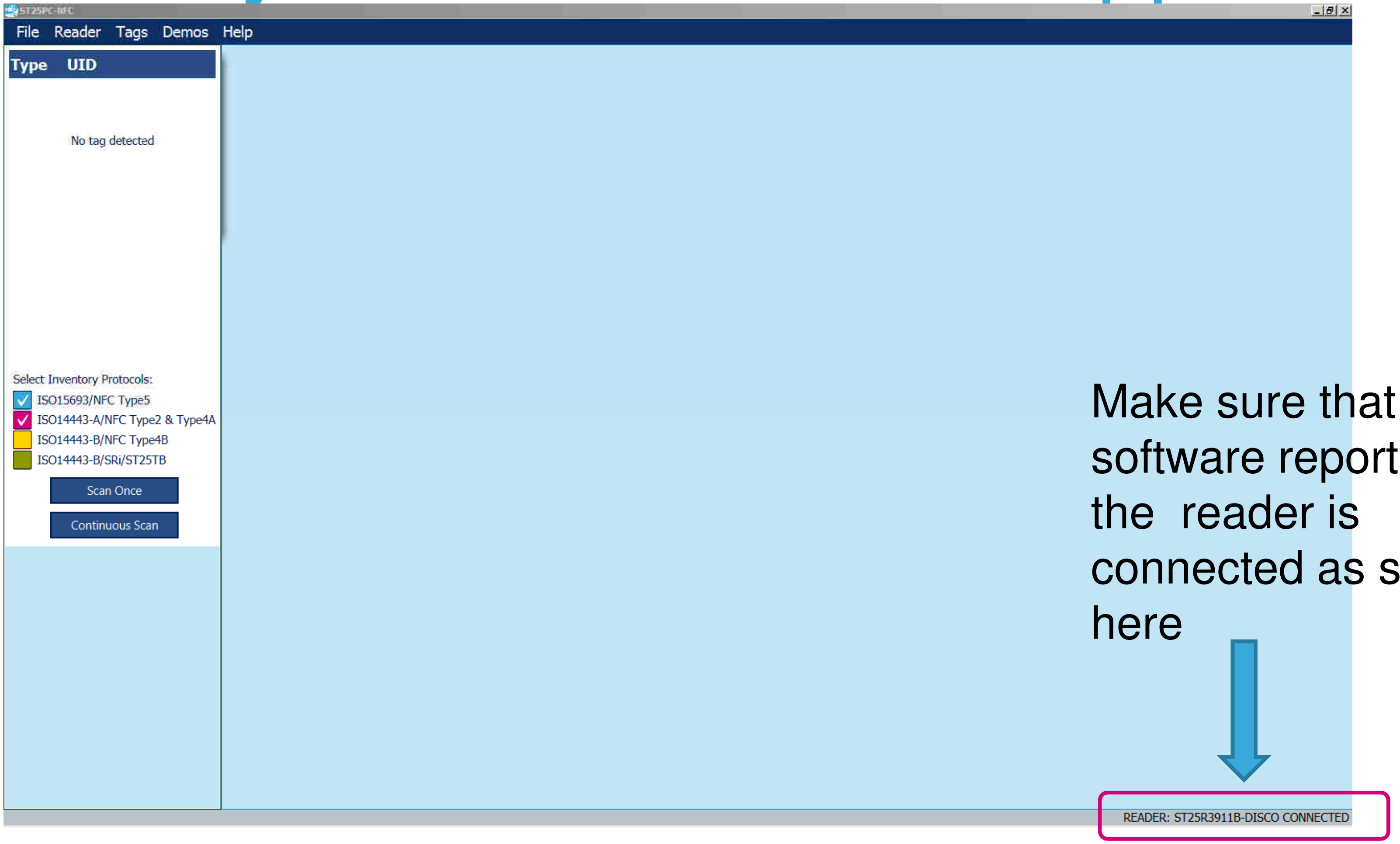
Tag Placement while reading

Important Note:
You can place the tag on top or under the ST25R3911B ONLY if there is insulation between them.

Or you will risk shorting out the components!



Now run your ST25PC-NFC Application



No tag detected

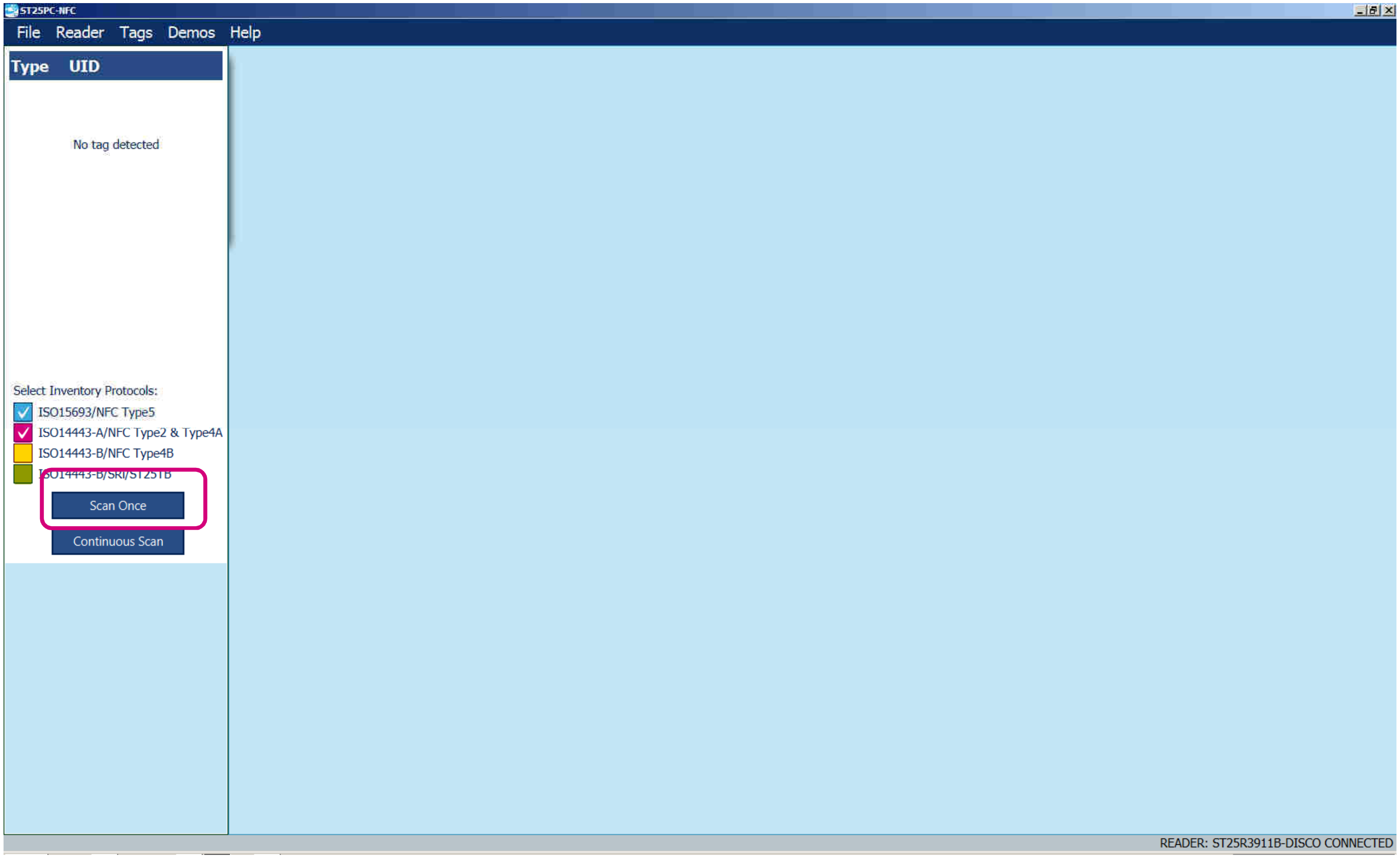
Select Inventory Protocols:

- ☑ ISO15693/NFC Type5
- ☑ ISO14443-A/NFC Type2 & Type4A
- □ ISO14443-B/NFC Type4B
- □ ISO14443-B/SRi/ST25TB

READER: ST25R3911B-DISCO CONNECTED

Make sure that the software reports that the reader is connected as seen here

First, scan for the tag



No tag detected

Select Inventory Protocols:

- ☑ ISO15693/NFC Type5
- ☑ ISO14443-A/NFC Type2 & Type4A
- □ ISO14443-B/NFC Type4B
- □ ISO14443-B/SRI/ST25TB

READER: ST25R3911B-DISCO CONNECTED

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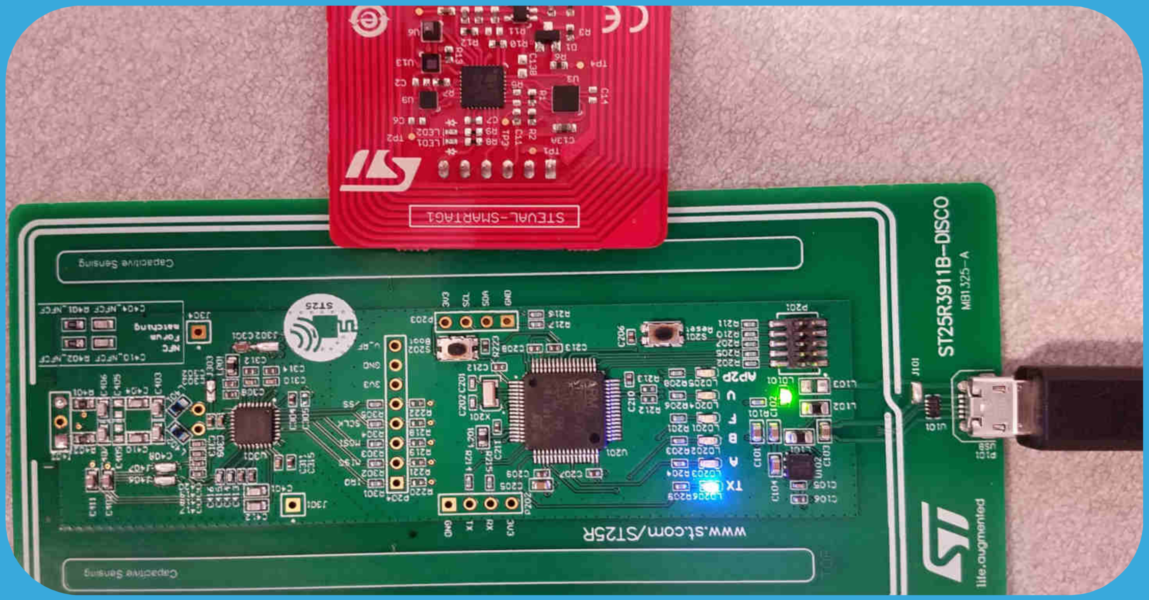
Correct LED patterns on the ST25R3911B



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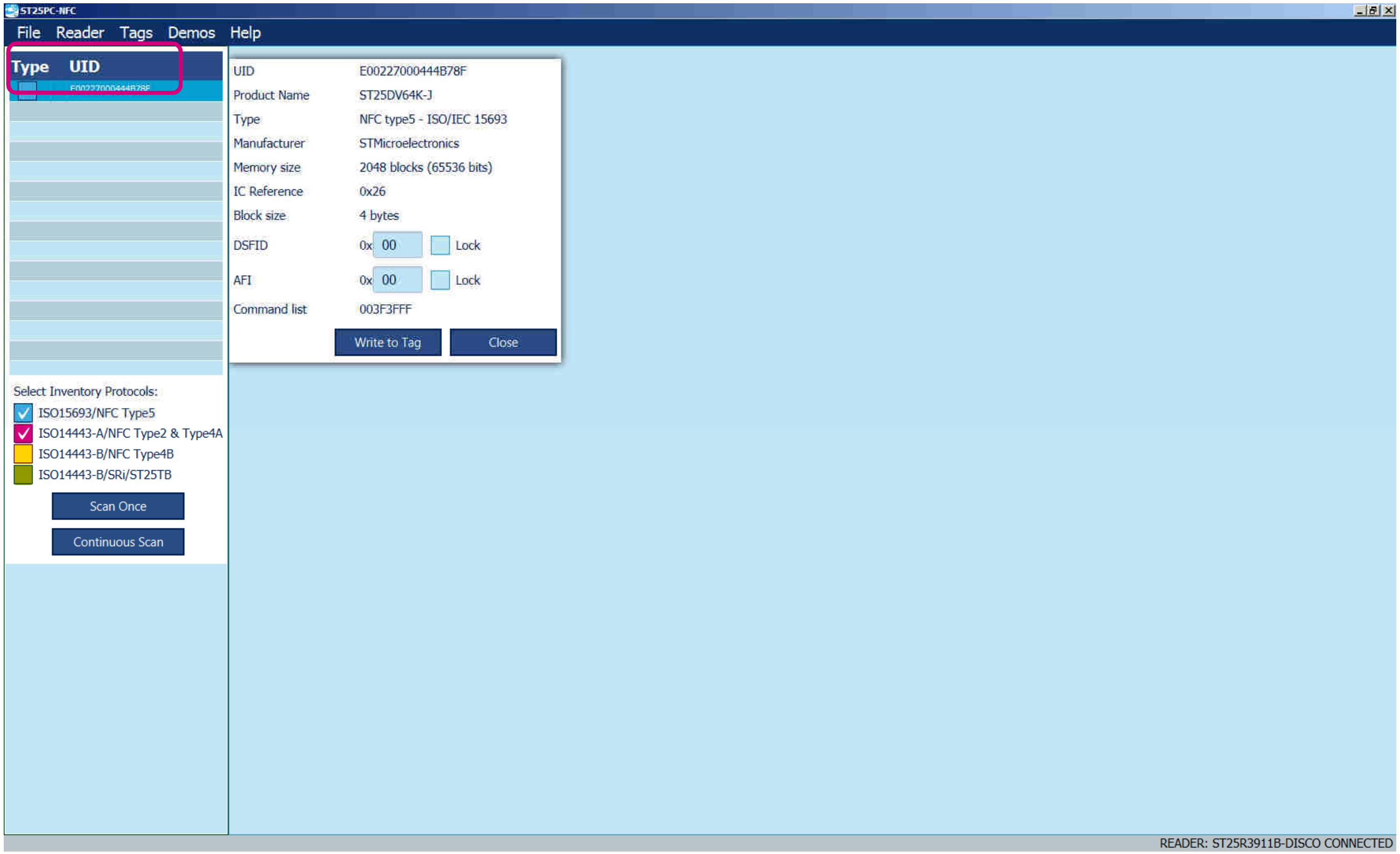
View tag UID, memory size and more



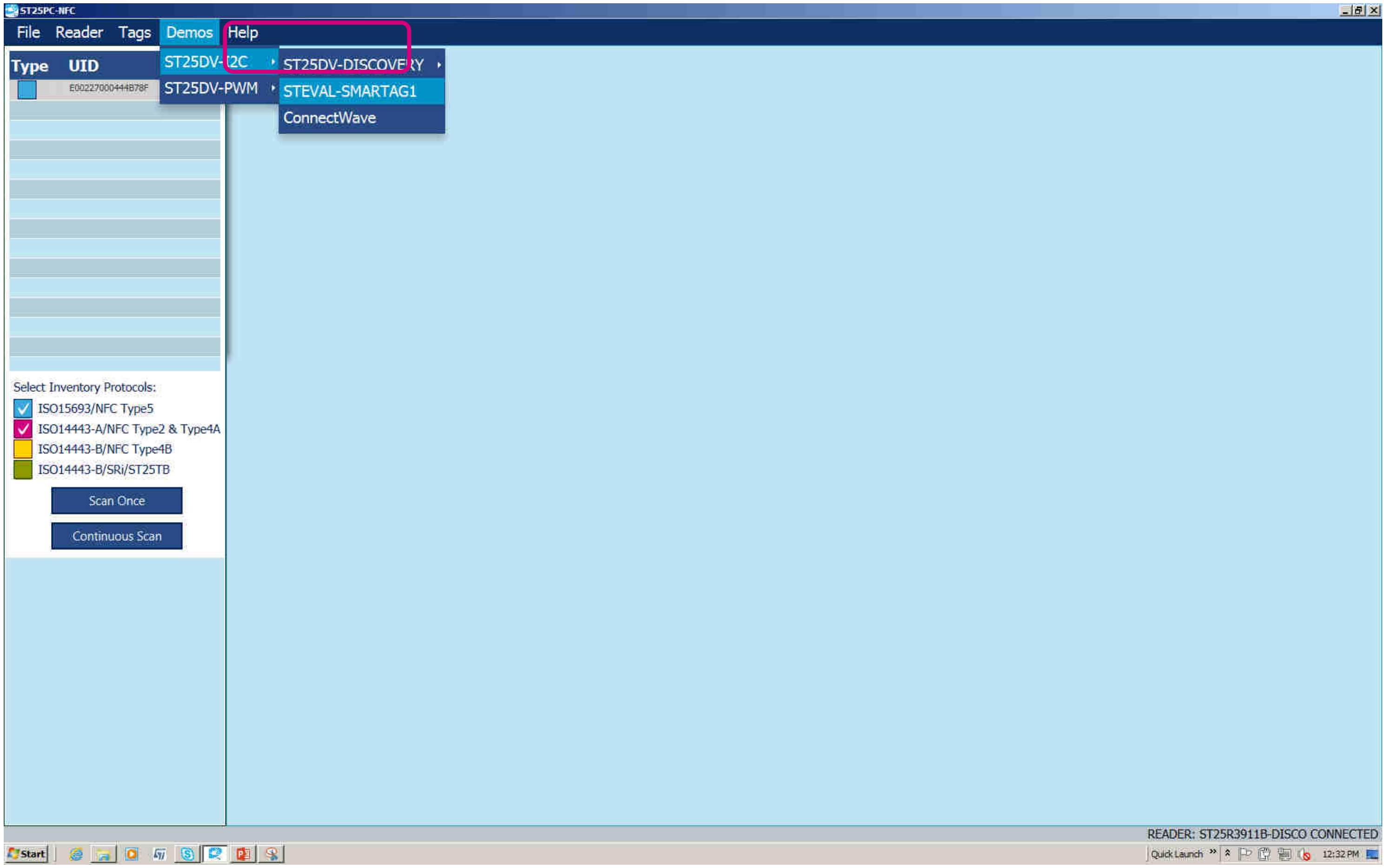
UID	E00227000444B78F
Product Name	ST25DV64K-J
Type	NFC type5 - ISO/IEC 15693
Manufacturer	STMicroelectronics
Memory size	2048 blocks (65536 bits)
IC Reference	0x26
Block size	4 bytes
DSFID	0x 00 □ Lock
AFI	0x 00 □ Lock
Command list	003F3FFF

Select Inventory Protocols:

- ☑ ISO15693/NFC Type5
- ☑ ISO14443-A/NFC Type2 & Type4A
- □ ISO14443-B/NFC Type4B
- □ ISO14443-B/SRi/ST25TB

READER: ST25R3911B-DISCO CONNECTED

Running the sensor tag demo

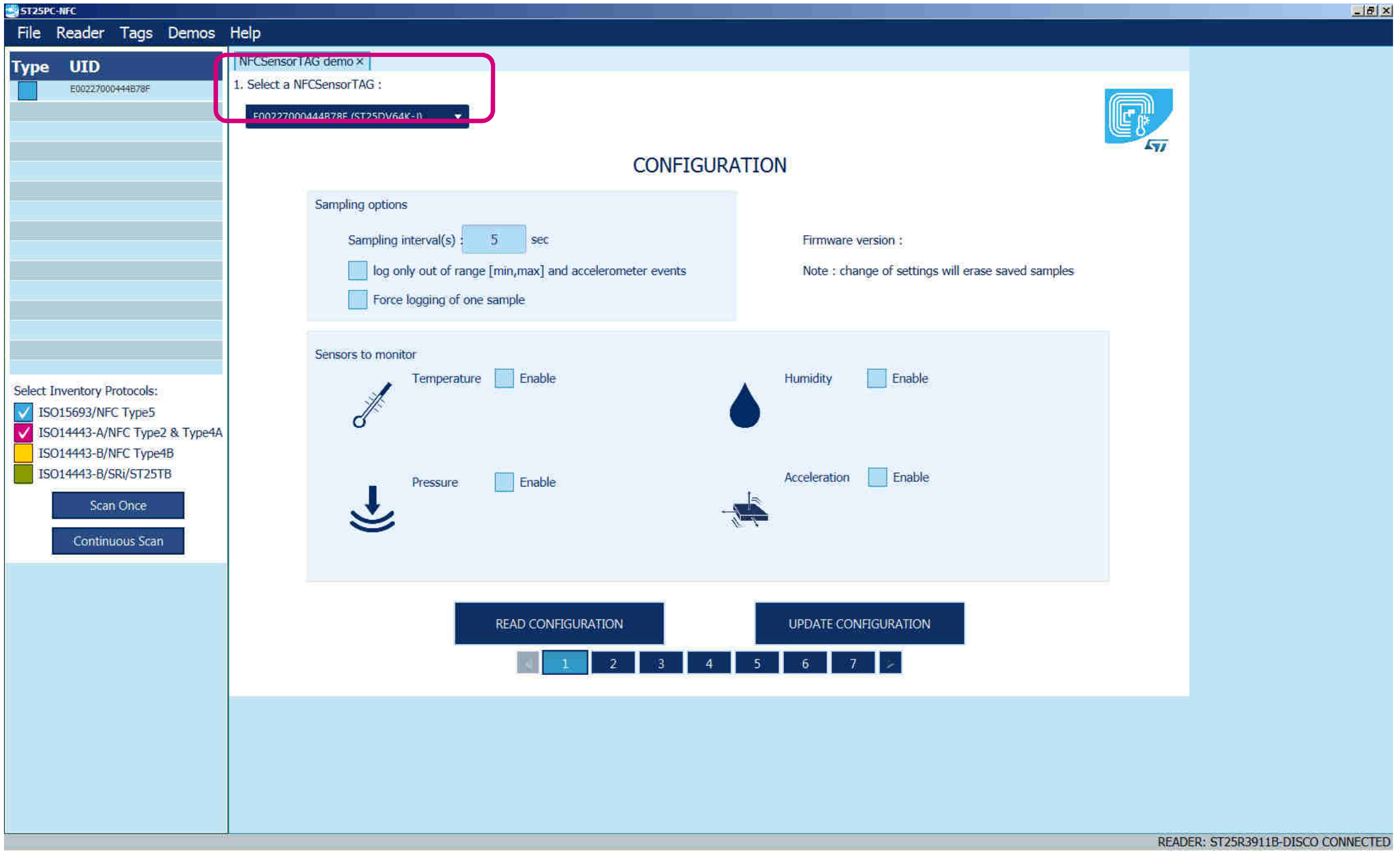


Select Inventory Protocols:

- ☑ ISO15693/NFC Type5
- ☑ ISO14443-A/NFC Type2 & Type4A
- □ ISO14443-B/NFC Type4B
- □ ISO14443-B/SRi/ST25TB

READER: ST25R3911B-DISCO CONNECTED

Sensor default configuration



Type	UID
🟦	E00227000444B78F

Select Inventory Protocols:

- ☑ ISO15693/NFC Type5
- ☑ ISO14443-A/NFC Type2 & Type4A
- □ ISO14443-B/NFC Type4B
- □ ISO14443-B/SRi/ST25TB

1. Select a NFCSensorTAG :

E00227000444B78F (ST25DV64K-I)

CONFIGURATION

Sampling options

Sampling interval(s) : 5 sec

□ log only out of range [min,max] and accelerometer events

□ Force logging of one sample

Firmware version :

Note : change of settings will erase saved samples

Sensors to monitor

Temperature □ Enable

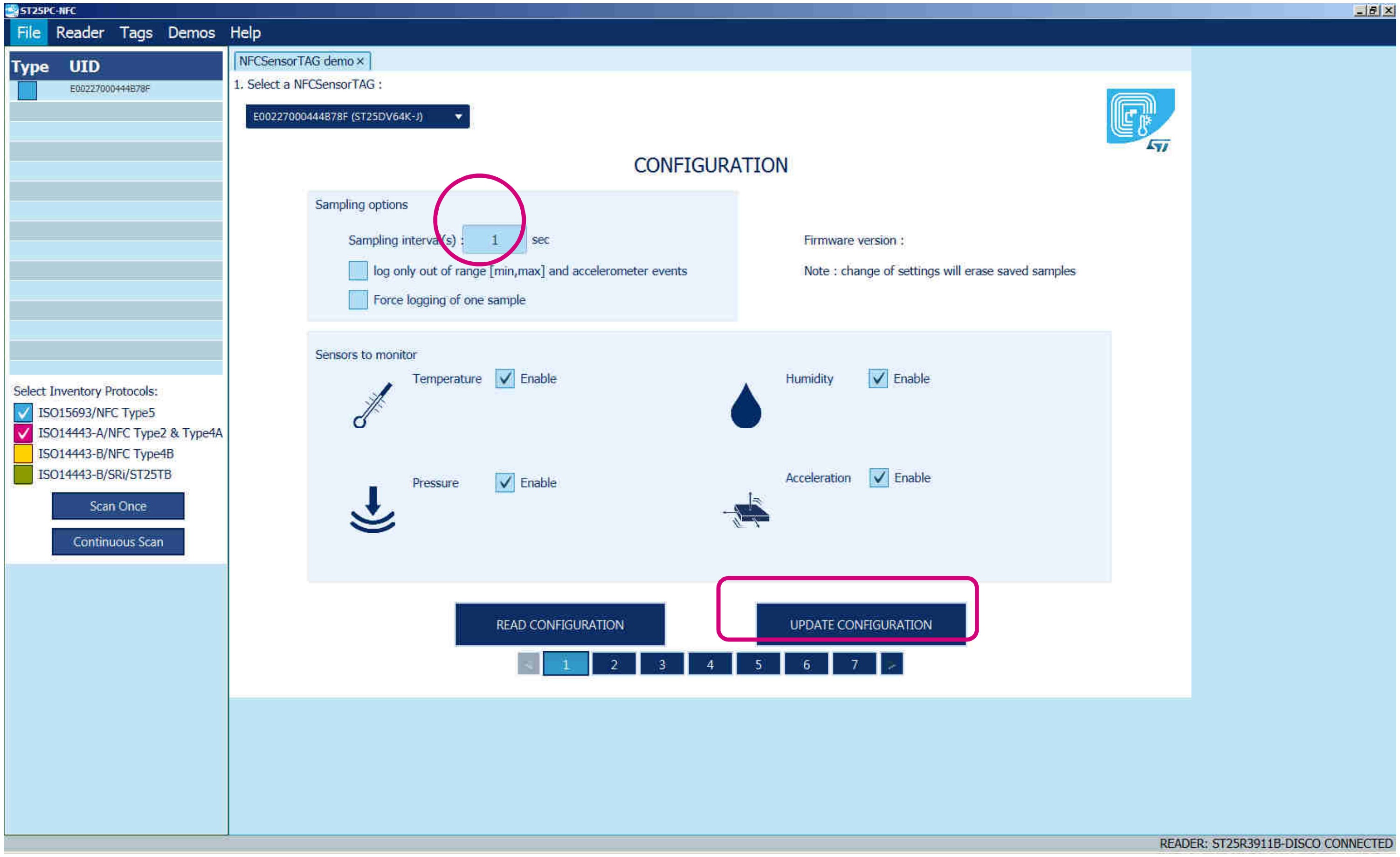
Humidity □ Enable

Pressure □ Enable

Acceleration □ Enable

READER: ST25R3911B-DISCO CONNECTED

Setting new configuration



E00227000444B78F

Select Inventory Protocols:

☑ ISO15693/NFC Type5
☑ ISO14443-A/NFC Type2 & Type4A
□ ISO14443-B/NFC Type4B
□ ISO14443-B/SRi/ST25TB

1. Select a NFCSensorTAG :

E00227000444B78F (ST25DV64K-J)

CONFIGURATION

Sampling options

Sampling interval(s) : 1 sec

□ log only out of range [min,max] and accelerometer events

□ Force logging of one sample

Firmware version :

Note : change of settings will erase saved samples

Sensors to monitor

Temperature ☑ Enable

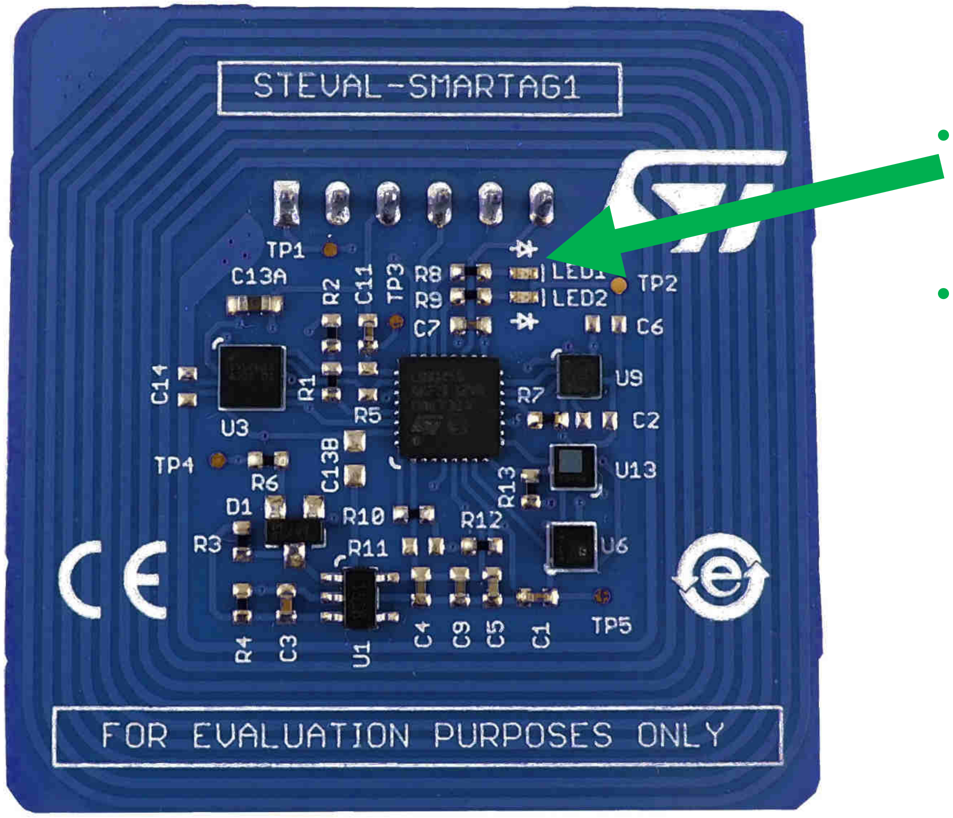
Humidity ☑ Enable

Pressure ☑ Enable

Acceleration ☑ Enable

READER: ST25R3911B-DISCO CONNECTED

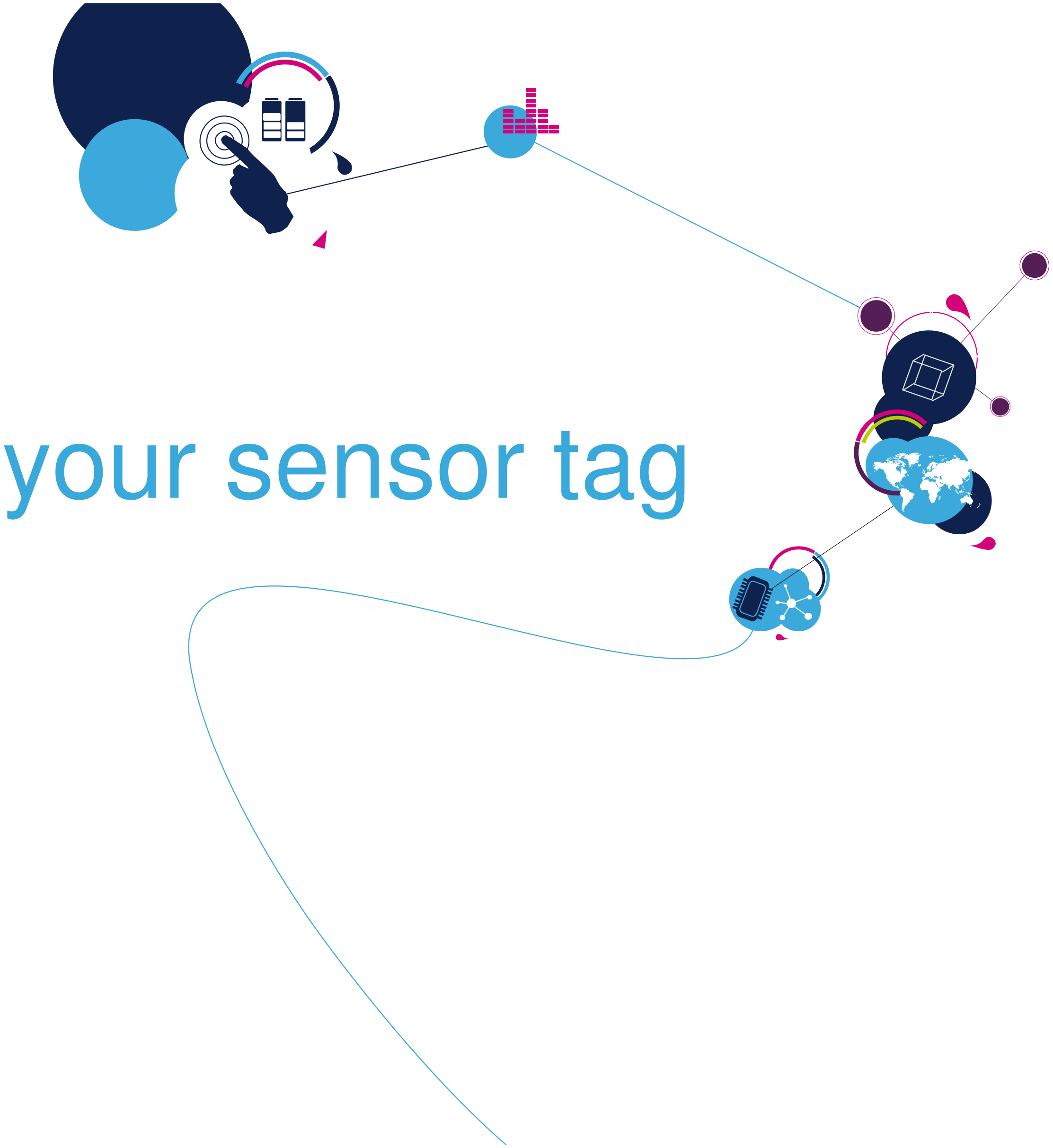
Check if your successful!



- Remove the tag from the reader RF field

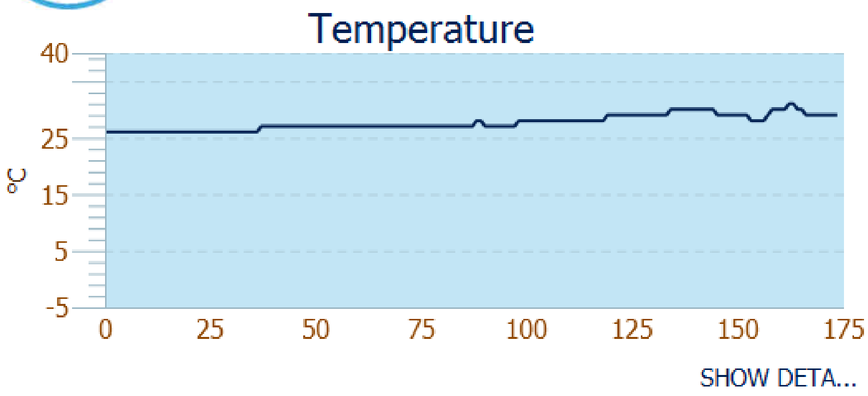
- LED1 now should blink every 1 seconds

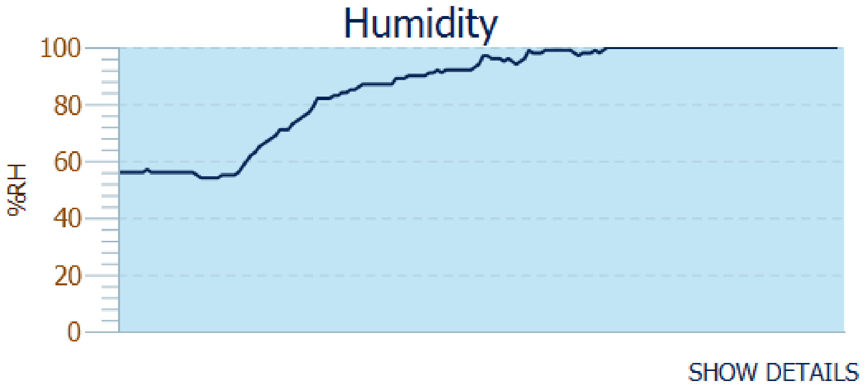
Time to exercise your sensor tag

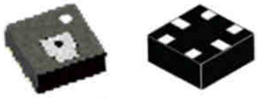


HTS221

Relative Humidity and Temperature combo







HLGA-6L
(2.0 x 2.0 x 0.9mm)

Humidity

- Range: 0%RH : 100%RH
- Accuracy: ±3.5%RH

Temperature

- Range: -40°C : +125°C
- Accuracy: ± 0.5°C, from 15°C to +40°C

Advantages

- High Accuracy
- Low power consumption 2 µA
- Extended operative supply voltage

Changing the humidity and temperature

- Blowing on the sensor will increase the humidity at point of measurement.

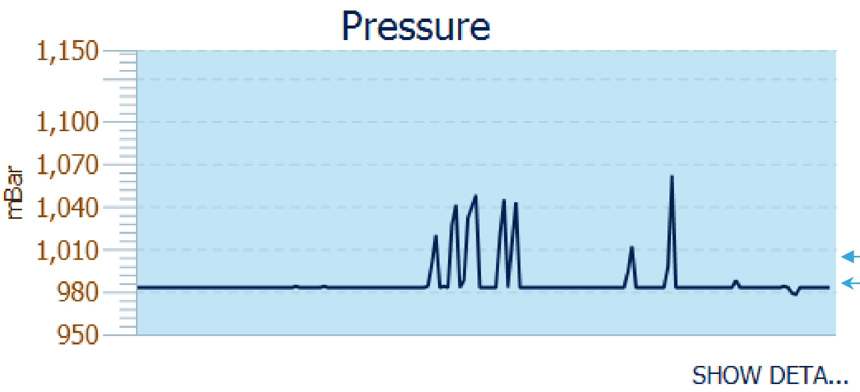
- Put the sensor tag into the bag and inflating with your breath will put it in a high humidity environment.

- Please don’t put water on the tag because it will short out the circuit.

- Warm your hand up against a cup of coffee and keep the tag in your hand to log higher temperature

LPS22HB

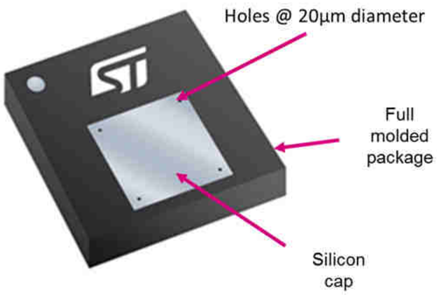
Pressure Barometer/Altimeter Sensor



1009.9 mbar

ST Austin, TX
Elevation 886 feet

Sensor Expo 2018 San Jose
Elevation 95 feet



Pressure

- Range 260-1260 hPa
- Relative accuracy of pressure measurement:

  < 10 µbar

  6cm resolution

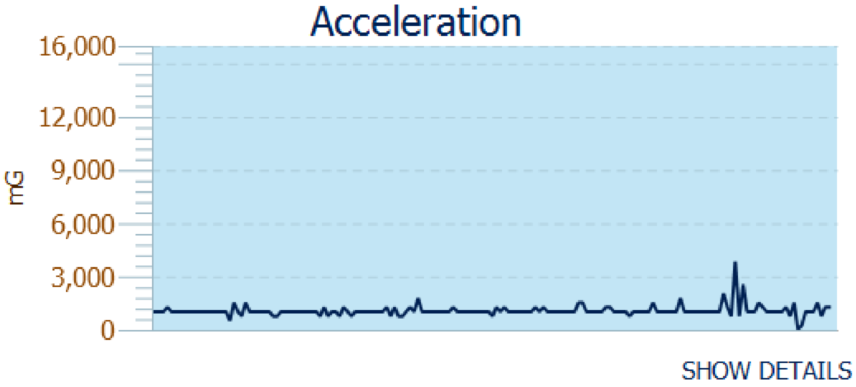
Changing the pressure

- Change pressure by inflating the Ziploc bag

- Close the Ziploc bag and lightly press on the “air bag”. Try not to rupture the bag. Each time you do this you will increase the pressure.

LIS2DW12

3-axis Accelerometer



Package

2x2x0.7 mm

Accelerometer

- ±2/±4/±8/±16 g selectable Full Scales
- Noise/accuracy level from 12 to 14bit resolution
- Low current consumption

380nA LP Mode and 40nA Standby

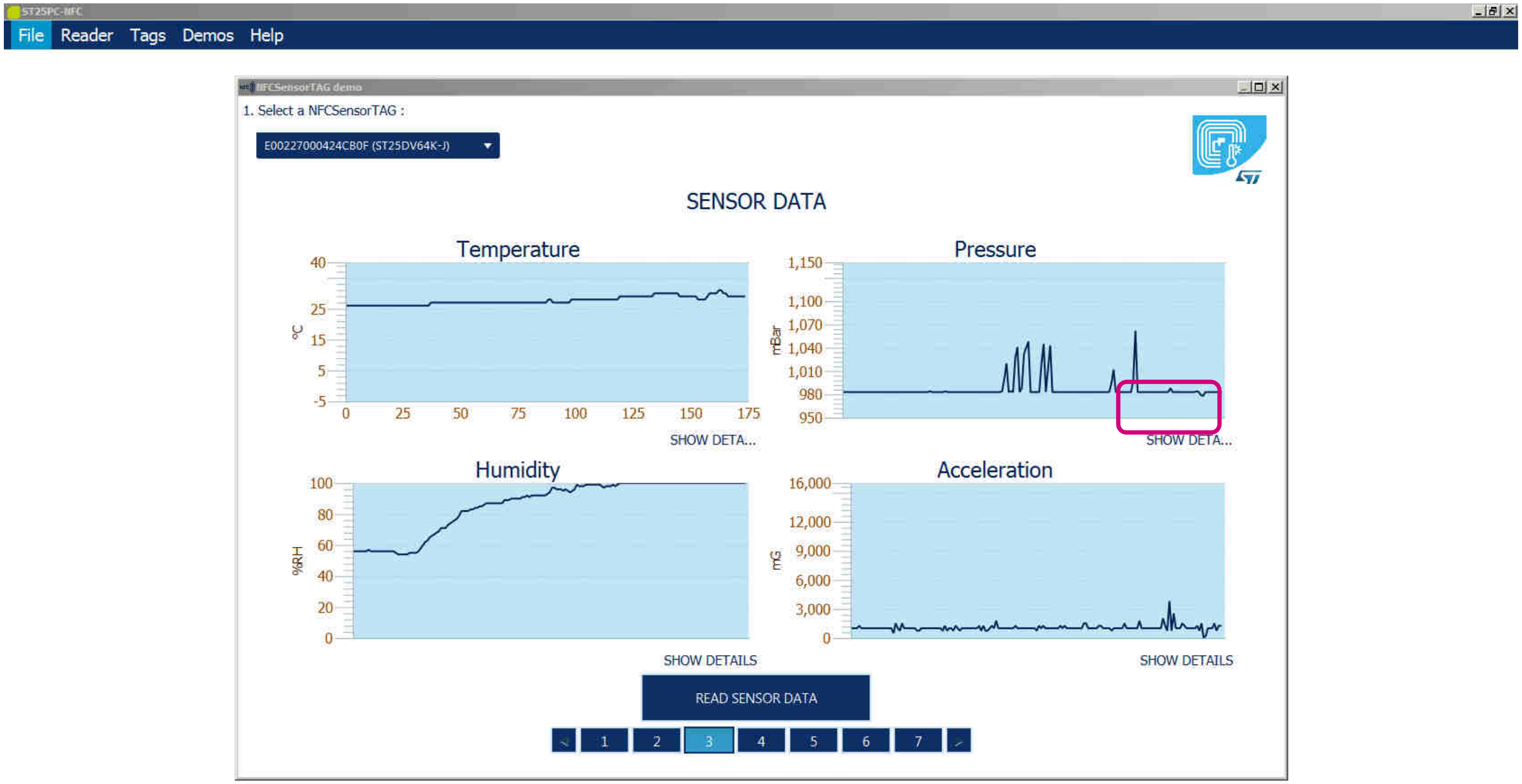
Shock and Impact

- Register the following action and make note of it.
- Drop onto a carpeted floor
- A tap of your finger against the body of the tag
- Please don’t throw the sensor tag against a hard surface as components might come loose.

Let’s view your data!

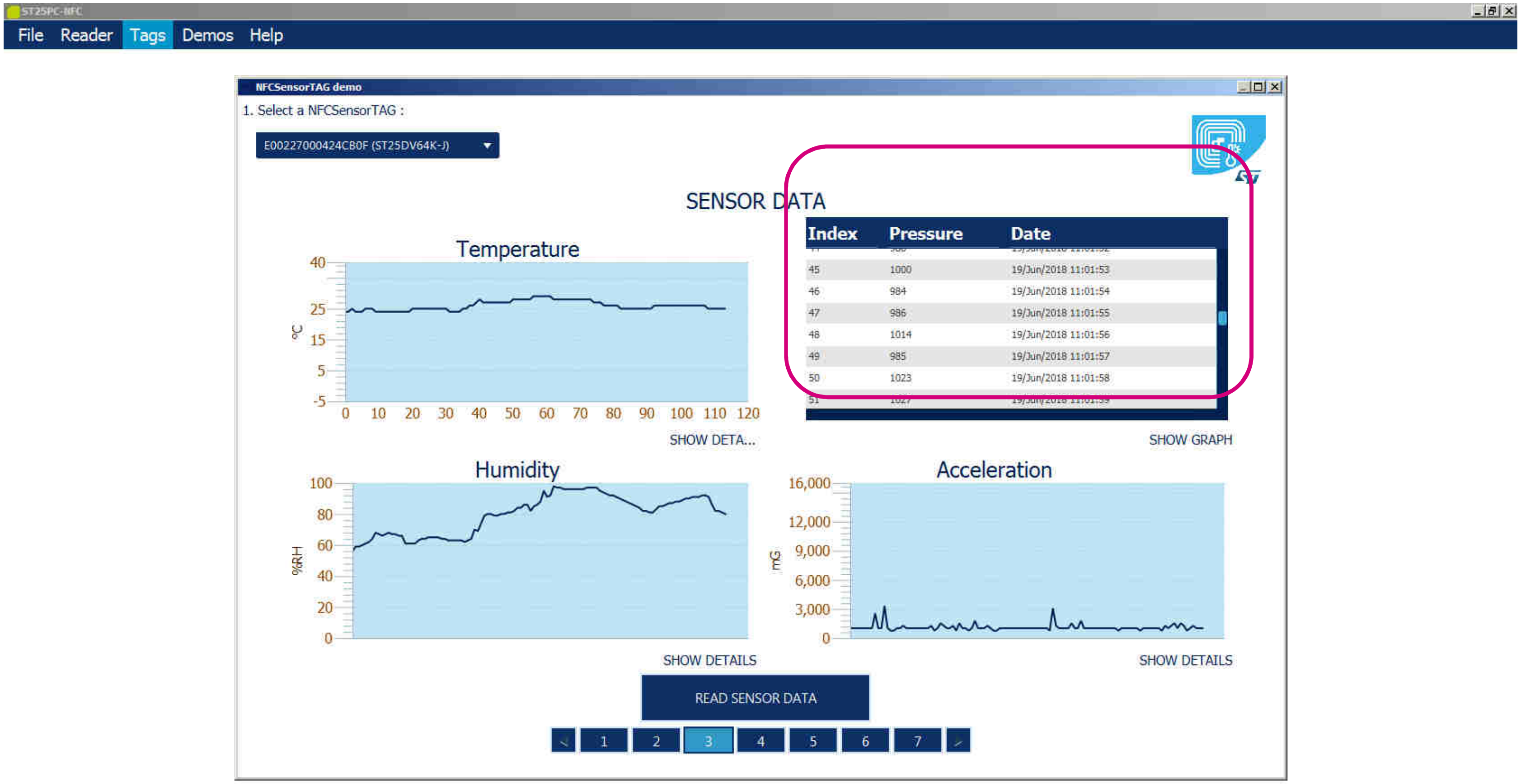
life.augmented

Show details



READER: ST25R3911B-DISCO CONNECTED

Show Details Panel

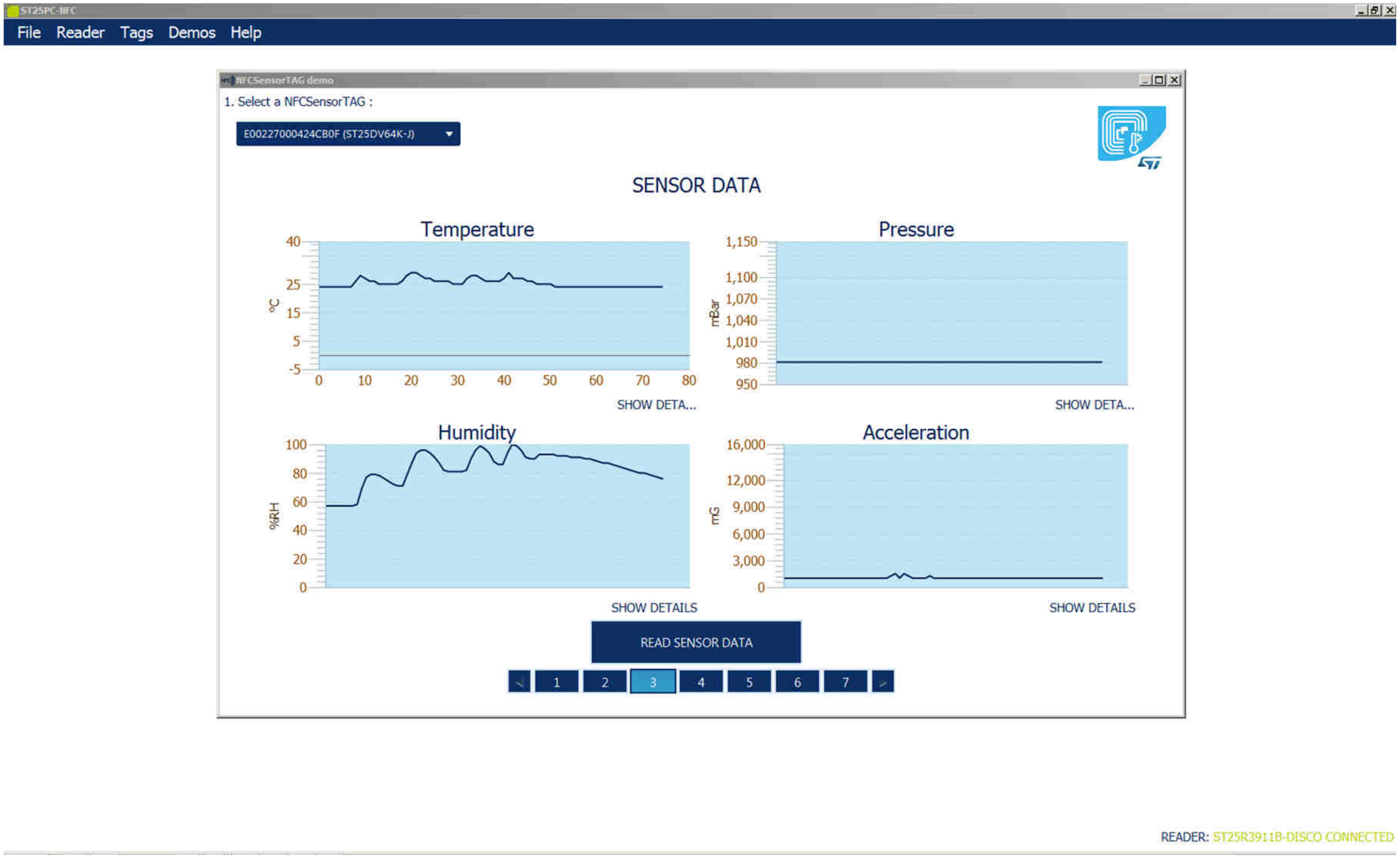


1. Select a NFCSensorTAG :

E00227000424CB0F (ST25DV64K-J)

Index	Pressure	Date
45	1000	19/Jun/2018 11:01:53
46	984	19/Jun/2018 11:01:54
47	986	19/Jun/2018 11:01:55
48	1014	19/Jun/2018 11:01:56
49	985	19/Jun/2018 11:01:57
50	1023	19/Jun/2018 11:01:58
51	1027	19/Jun/2018 11:01:59

My sample data

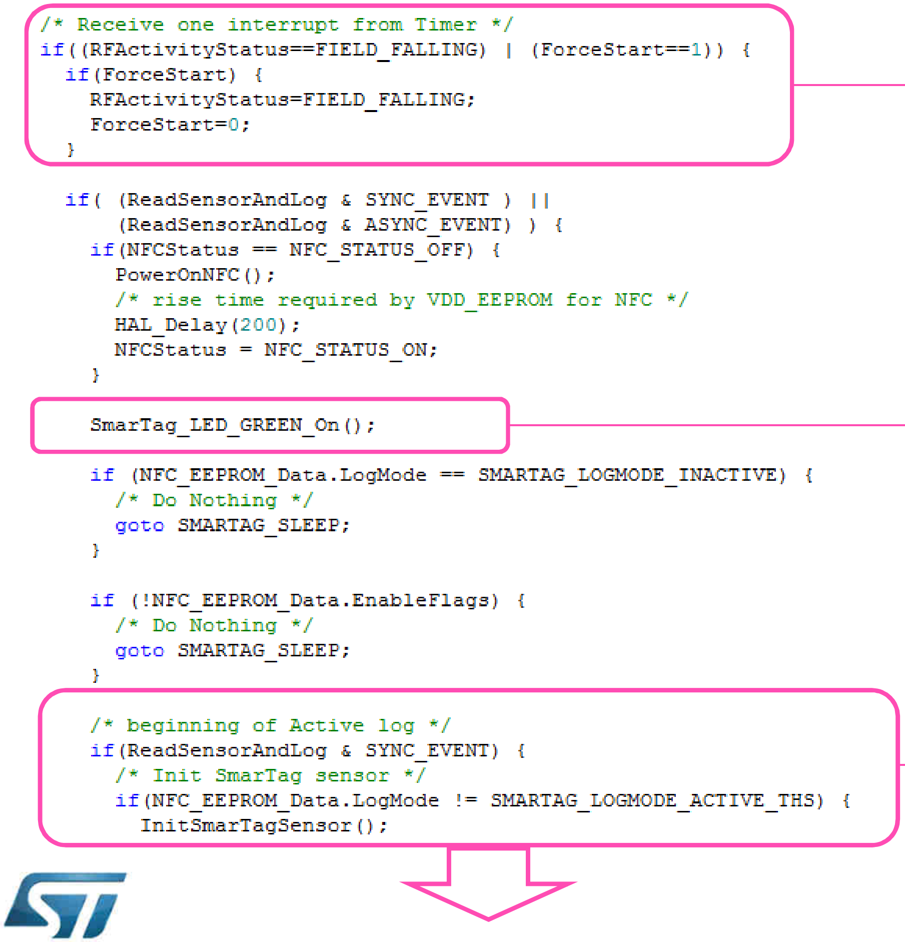


1. Select a NFCSensorTAG :

E00227000424CB0F (ST25DV64K-J)

READER: ST25R3911B-DISCO CONNECTED

Process of data logging on the tag in Battery Assisted Mode



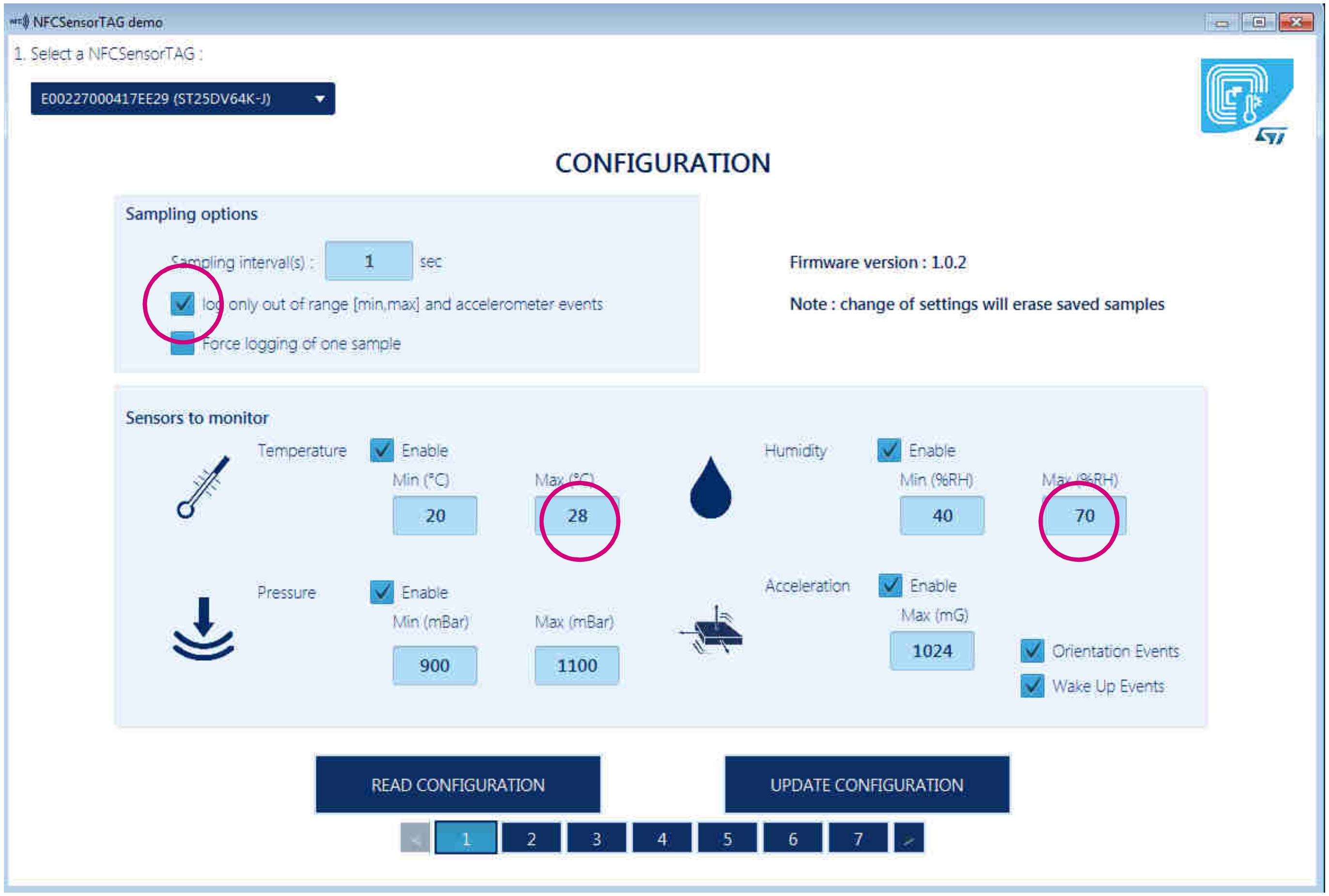
```
/* Receive one interrupt from Timer */
if((RFActivityStatus==FIELD_FALLING) | (ForceStart==1)) {
  if(ForceStart) {
    RFActivityStatus=FIELD_FALLING;
    ForceStart=0;
  }

  if( (ReadSensorAndLog & SYNC_EVENT ) ||
      (ReadSensorAndLog & ASYNC_EVENT) ) {
    if(NFCStatus == NFC_STATUS_OFF) {
      PowerOnNFC();
      /* rise time required by VDD_EEPROM for NFC */
      HAL_Delay(200);
      NFCStatus = NFC_STATUS_ON;
    }

    SmarTag_LED_GREEN_On();

    if (NFC_EEPROM_Data.LogMode == SMARTAG_LOGMODE_INACTIVE) {
      /* Do Nothing */
      goto SMARTAG_SLEEP;
    }

    if (!NFC_EEPROM_Data.EnableFlags) {
      /* Do Nothing */
      goto SMARTAG_SLEEP;
    }

    /* beginning of Active log */
    if(ReadSensorAndLog & SYNC_EVENT) {
      /* Init SmarTag sensor */
      if(NFC_EEPROM_Data.LogMode != SMARTAG_LOGMODE_ACTIVE_THS) {
        InitSmarTagSensor();
```

If RF field is detected, don’t data log. Read in Progress

Turn on LED1

Begin the logging process and subsequently writing to the memory

Setting min-max in Temp and Humidity



NFCSensorTAG demo

1. Select a NFCSensorTAG :

E00227000417EE29 (ST25DV64K-J)

CONFIGURATION

Sampling options

Sampling interval(s) : 1 sec

☑ log only out of range [min,max] and accelerometer events

□ Force logging of one sample

Firmware version : 1.0.2

Note : change of settings will erase saved samples

Sensors to monitor

Temperature ☑ Enable

Min (°C) 20

Max (°C) 28

Humidity ☑ Enable

Min (%RH) 40

Max (%RH) 70

Pressure ☑ Enable

Min (mBar) 900

Max (mBar) 1100

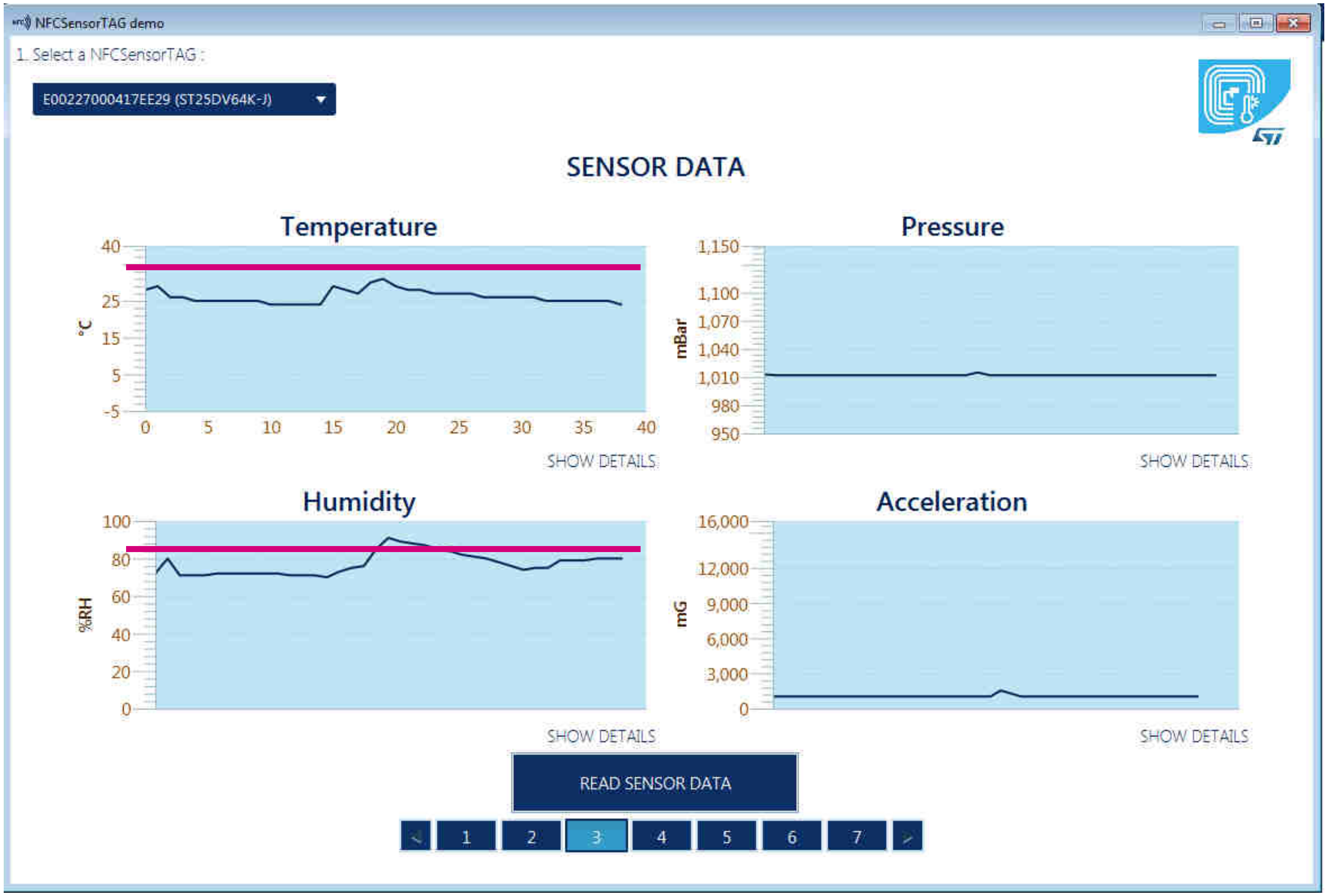
Acceleration ☑ Enable

Max (mG) 1024

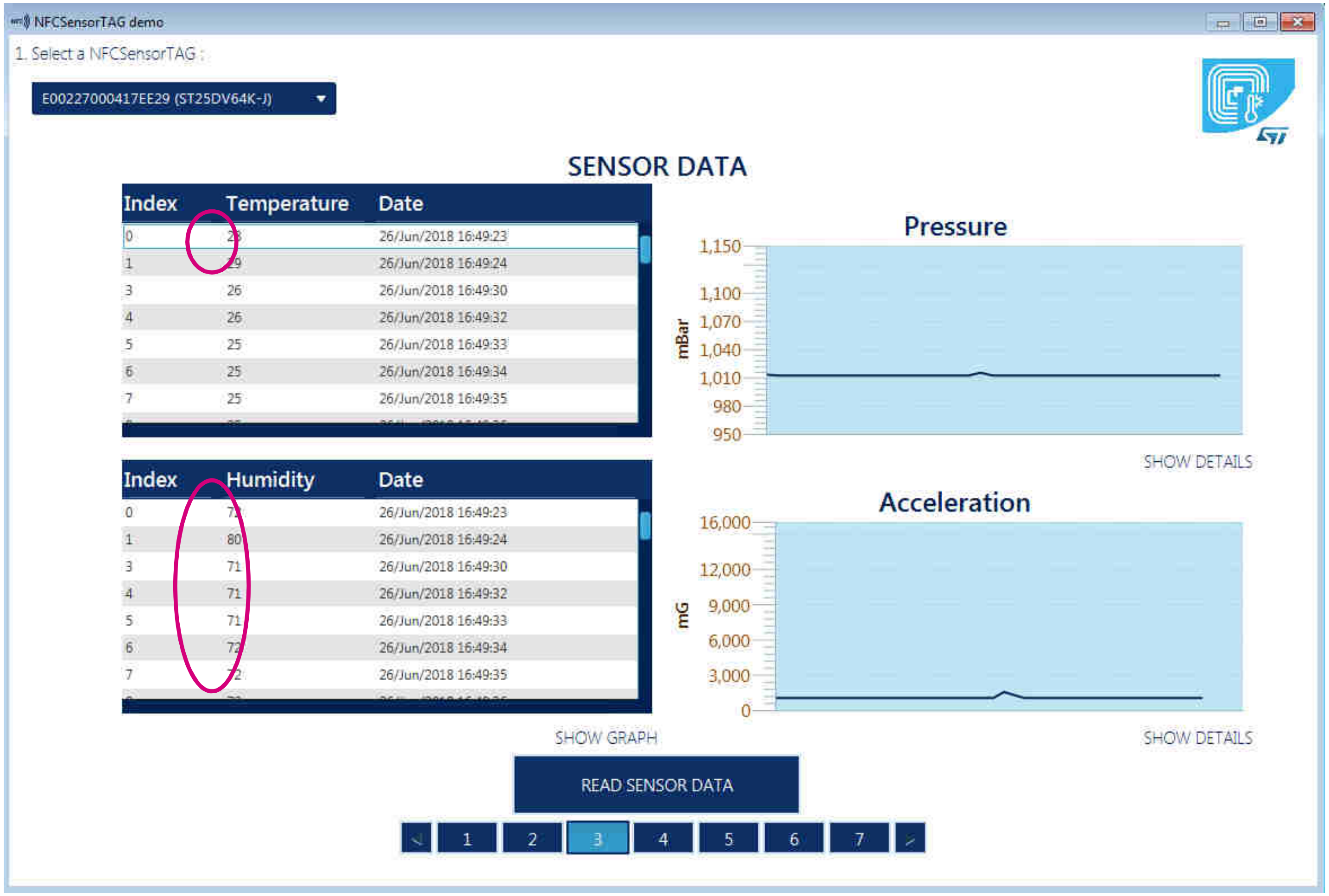
☑ Orientation Events

☑ Wake Up Events

Data Log only when min-max values



Data Log only when min-max values



NFCSensorTAG demo

1. Select a NFCSensorTAG :

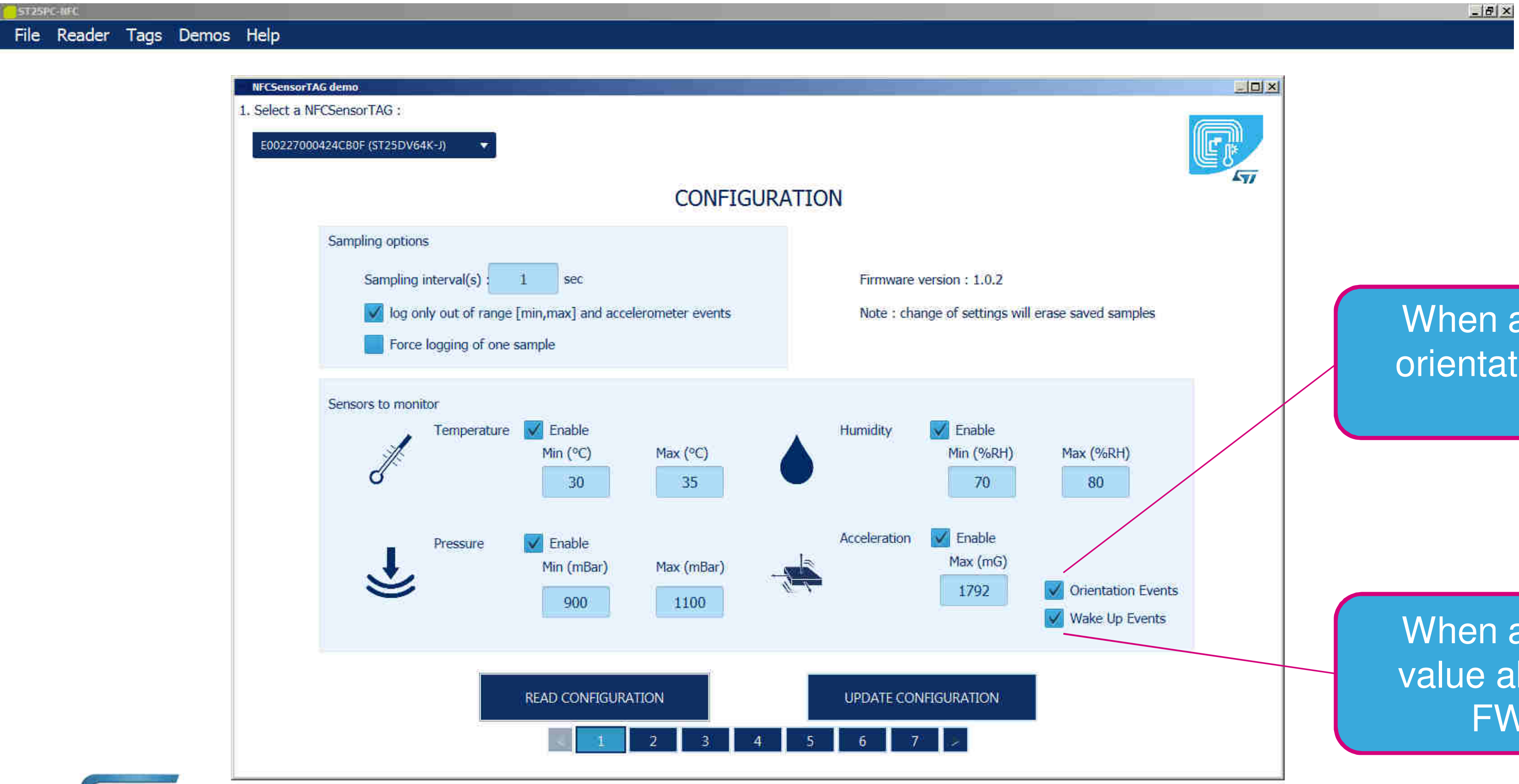
E00227000417EE29 (ST25DV64K-J)

SENSOR DATA

Index	Temperature	Date
0	23	26/Jun/2018 16:49:23
1	29	26/Jun/2018 16:49:24
3	26	26/Jun/2018 16:49:30
4	26	26/Jun/2018 16:49:32
5	25	26/Jun/2018 16:49:33
6	25	26/Jun/2018 16:49:34
7	25	26/Jun/2018 16:49:35

Index	Humidity	Date
0	72	26/Jun/2018 16:49:23
1	80	26/Jun/2018 16:49:24
3	71	26/Jun/2018 16:49:30
4	71	26/Jun/2018 16:49:32
5	71	26/Jun/2018 16:49:33
6	72	26/Jun/2018 16:49:34
7	72	26/Jun/2018 16:49:35

Event Driven Logging



1. Select a NFCSensorTAG :

E00227000424CB0F (ST25DV64K-J)

CONFIGURATION

Sampling options

Sampling interval(s) : 1 sec

☑ log only out of range [min,max] and accelerometer events

□ Force logging of one sample

Firmware version : 1.0.2

Note : change of settings will erase saved samples

Sensors to monitor

Temperature ☑ Enable Min (°C) 30 Max (°C) 35

Humidity ☑ Enable Min (%RH) 70 Max (%RH) 80

Pressure ☑ Enable Min (mBar) 900 Max (mBar) 1100

Acceleration ☑ Enable Max (mG) 1792

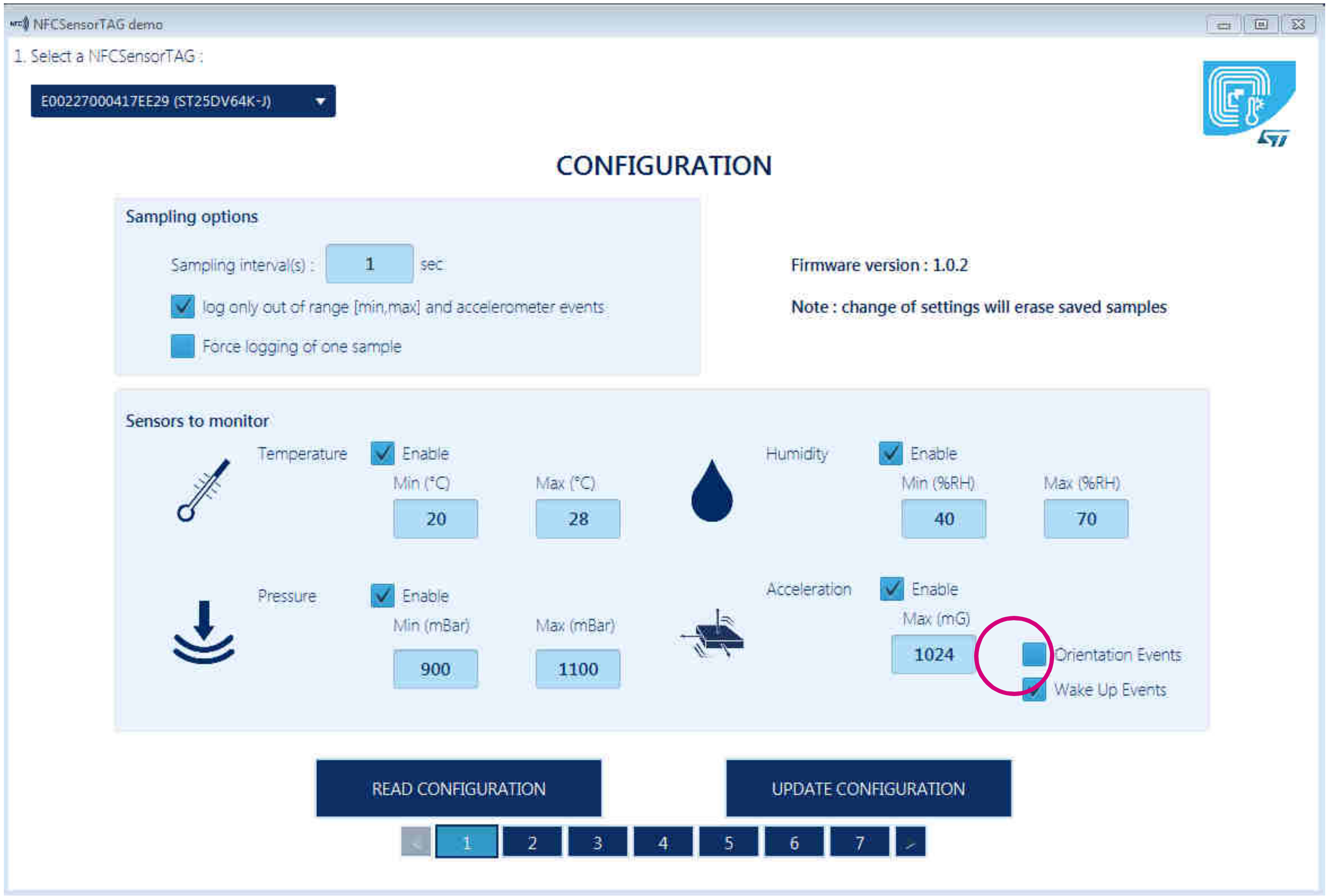
☑ Orientation Events

☑ Wake Up Events

When accelerometer detects orientation change, it logs the data.

When accelerometer detects value above 4G (value set by FW), it logs the data

Setting threshold event for single sensor



1. Select a NFCSensorTAG :

E00227000417EE29 (ST25DV64K-J)

CONFIGURATION

Sampling options

Sampling interval(s) : 1 sec

☑ log only out of range [min,max] and accelerometer events

□ Force logging of one sample

Firmware version : 1.0.2

Note : change of settings will erase saved samples

Sensors to monitor

Temperature ☑ Enable Min (°C) 20 Max (°C) 28

Humidity ☑ Enable Min (%RH) 40 Max (%RH) 70

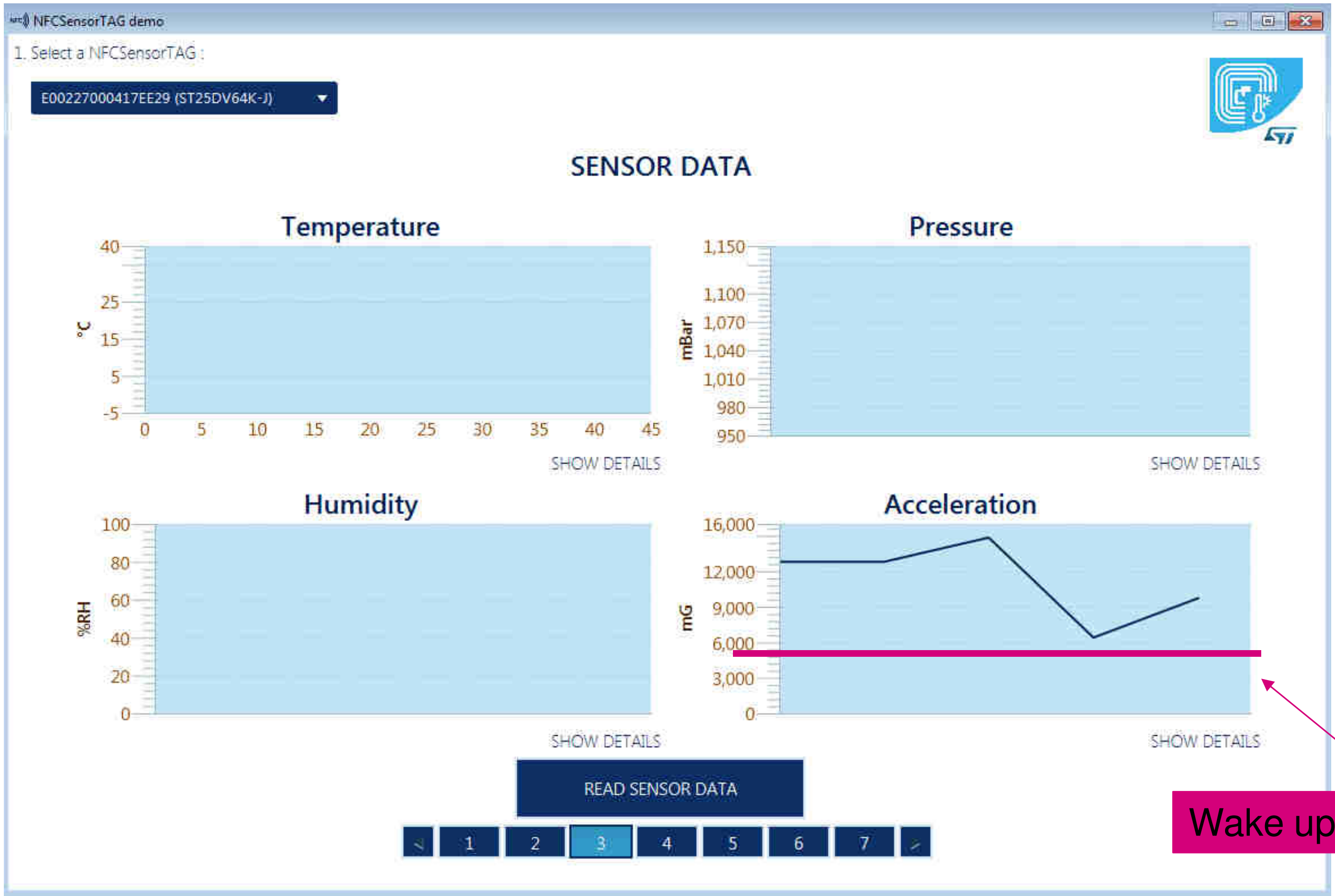
Pressure ☑ Enable Min (mBar) 900 Max (mBar) 1100

Acceleration ☑ Enable Max (mG) 1024

□ Orientation Events

☑ Wake Up Events

Setting threshold event for single sensor



NFCSensorTAG demo

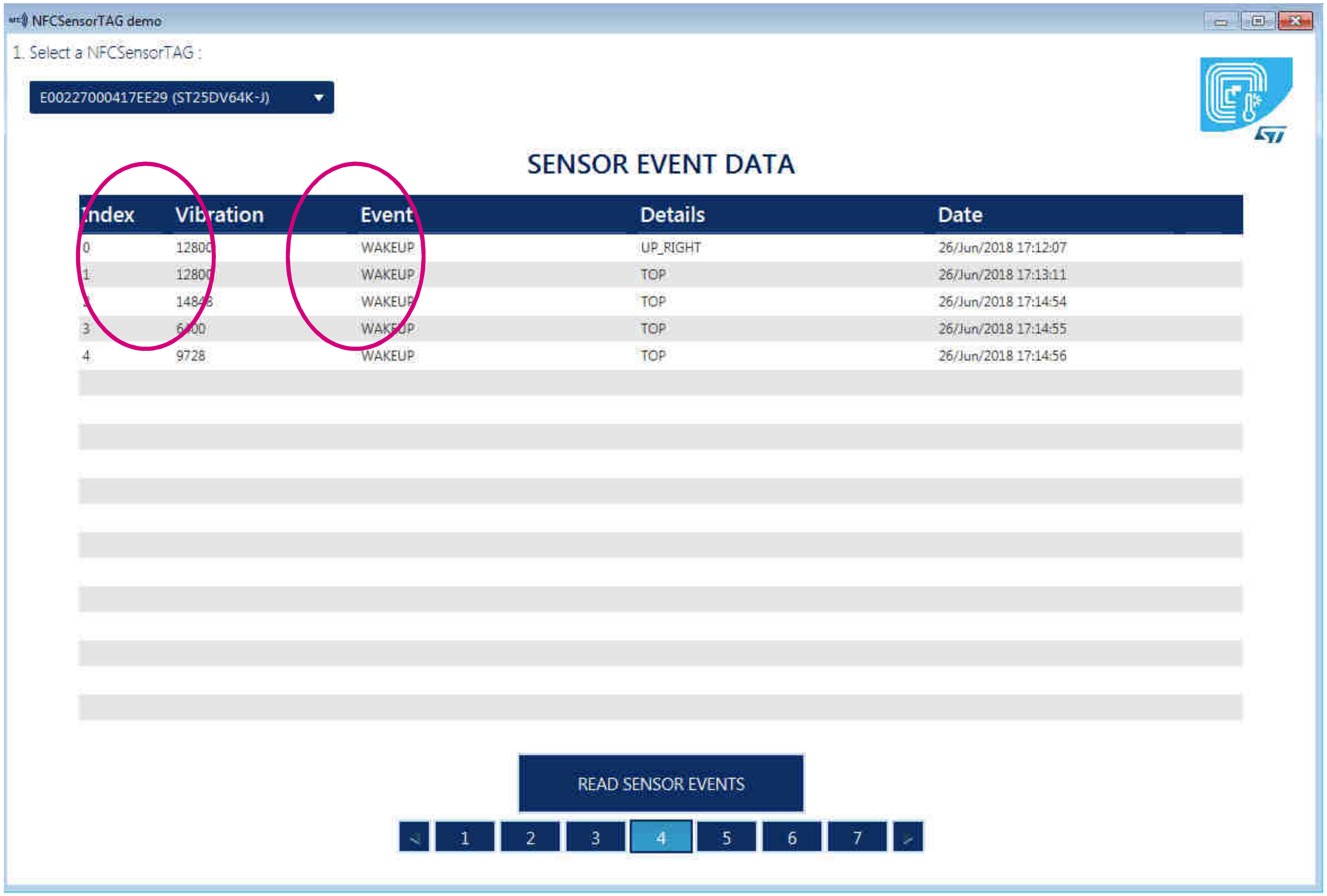
1. Select a NFCSensorTAG :

E00227000417EE29 (ST25DV64K-J)

SENSOR DATA

Wake up detection (>4G)

Setting threshold event for single sensor



NFCSensorTAG demo

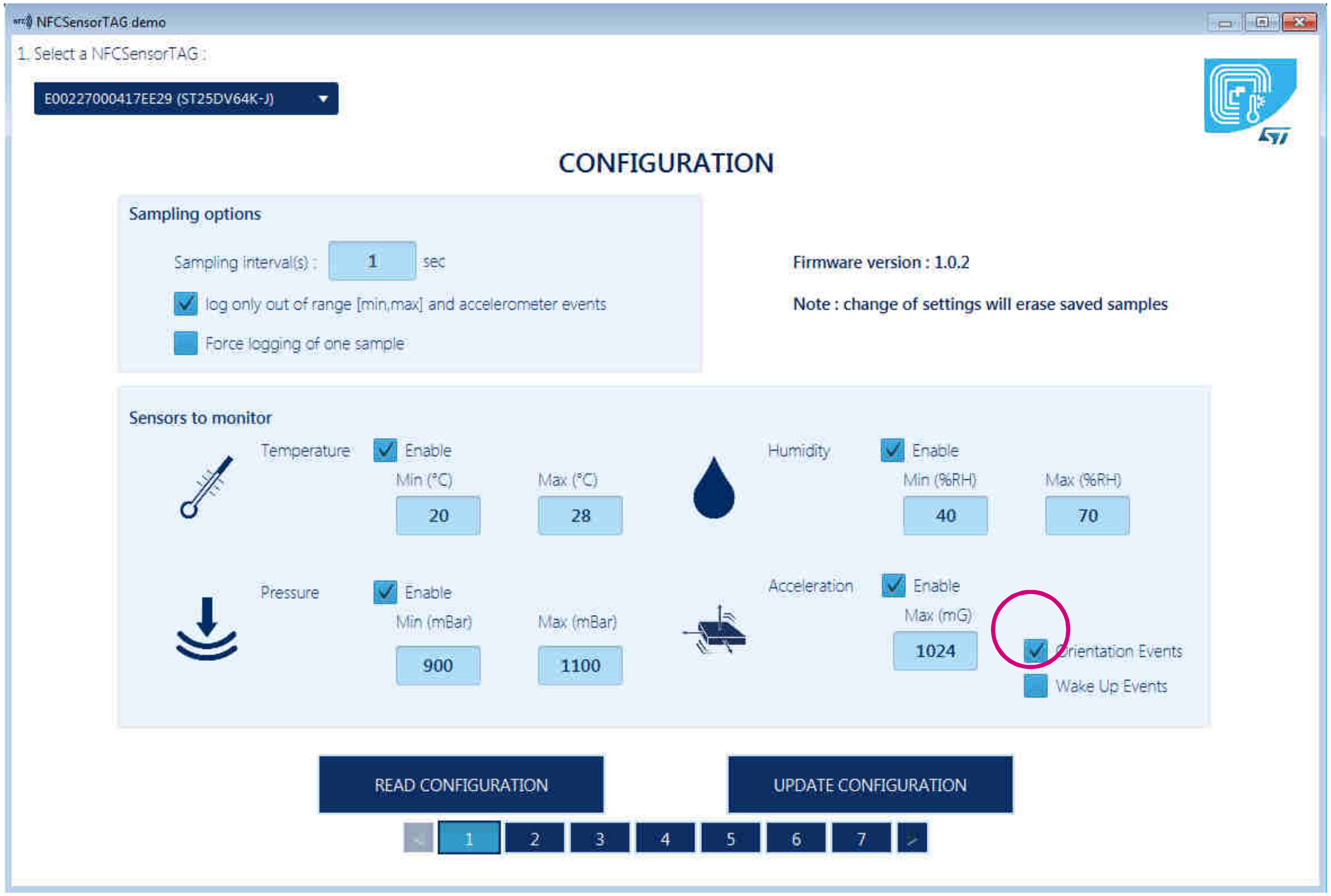
1. Select a NFCSensorTAG :

E00227000417EE29 (ST25DV64K-J)

SENSOR EVENT DATA

Index	Vibration	Event	Details	Date
0	12800	WAKEUP	UP_RIGHT	26/Jun/2018 17:12:07
1	12800	WAKEUP	TOP	26/Jun/2018 17:13:11
2	14848	WAKEUP	TOP	26/Jun/2018 17:14:54
3	6400	WAKEUP	TOP	26/Jun/2018 17:14:55
4	9728	WAKEUP	TOP	26/Jun/2018 17:14:56

Setting threshold event for single sensor



NFCSensorTAG demo

1. Select a NFCSensorTAG :

E00227000417EE29 (ST25DV64K-J)

CONFIGURATION

Sampling options

Sampling interval(s) : 1 sec

☑ log only out of range [min,max] and accelerometer events

□ Force logging of one sample

Firmware version : 1.0.2

Note : change of settings will erase saved samples

Sensors to monitor

Temperature ☑ Enable Min (°C) 20 Max (°C) 28

Humidity ☑ Enable Min (%RH) 40 Max (%RH) 70

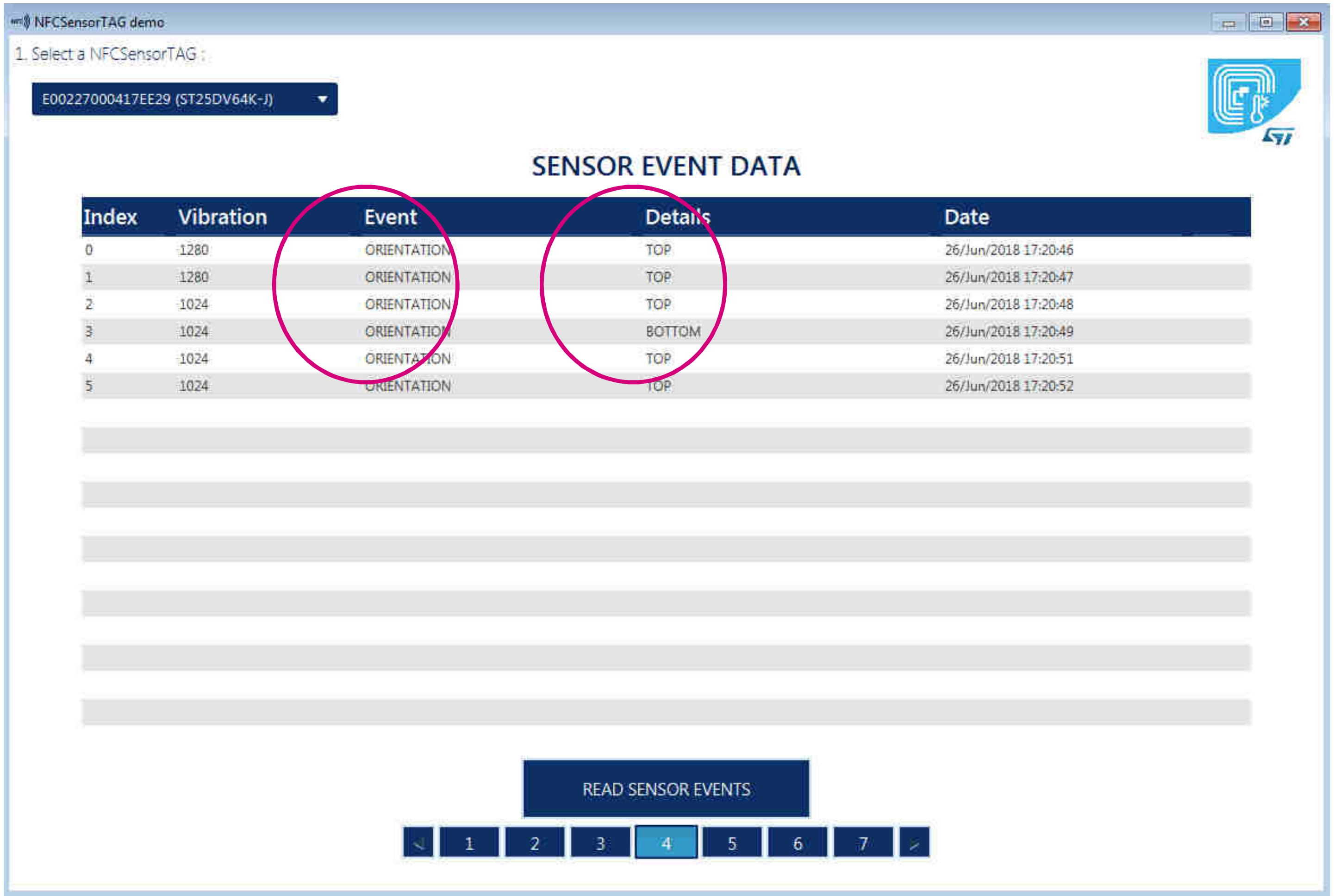
Pressure ☑ Enable Min (mBar) 900 Max (mBar) 1100

Acceleration ☑ Enable Max (mG) 1024

☑ Orientation Events

□ Wake Up Events

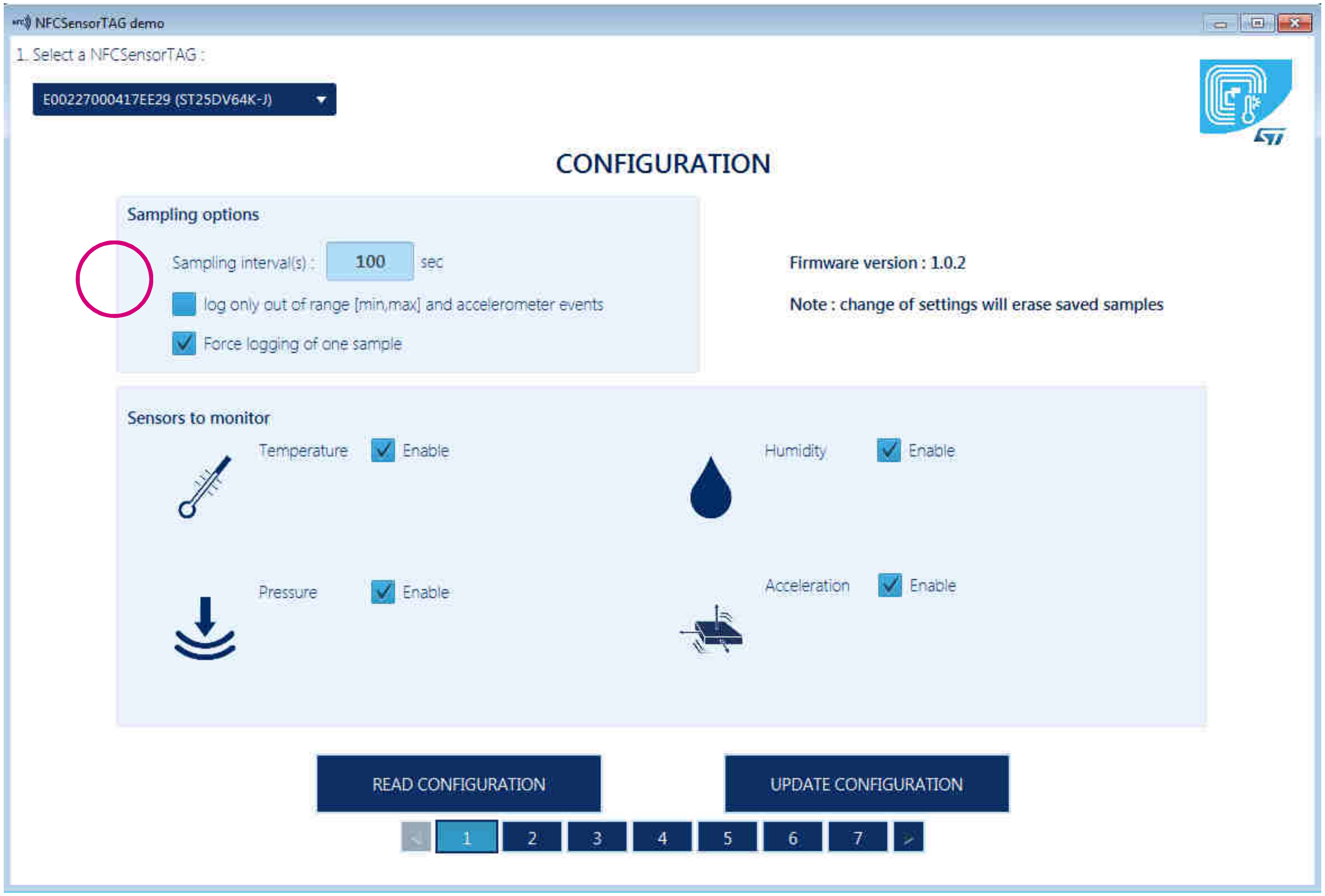
Setting threshold event for single sensor



SENSOR EVENT DATA

Index	Vibration	Event	Details	Date
0	1280	ORIENTATION	TOP	26/Jun/2018 17:20:46
1	1280	ORIENTATION	TOP	26/Jun/2018 17:20:47
2	1024	ORIENTATION	TOP	26/Jun/2018 17:20:48
3	1024	ORIENTATION	BOTTOM	26/Jun/2018 17:20:49
4	1024	ORIENTATION	TOP	26/Jun/2018 17:20:51
5	1024	ORIENTATION	TOP	26/Jun/2018 17:20:52

Setting threshold event for single sensor



NFCSensorTAG demo

1. Select a NFCSensorTAG :

E00227000417EE29 (ST25DV64K-J)

CONFIGURATION

Sampling options

Sampling interval(s) : 100 sec

□ log only out of range [min,max] and accelerometer events

☑ Force logging of one sample

Firmware version : 1.0.2

Note : change of settings will erase saved samples

Sensors to monitor

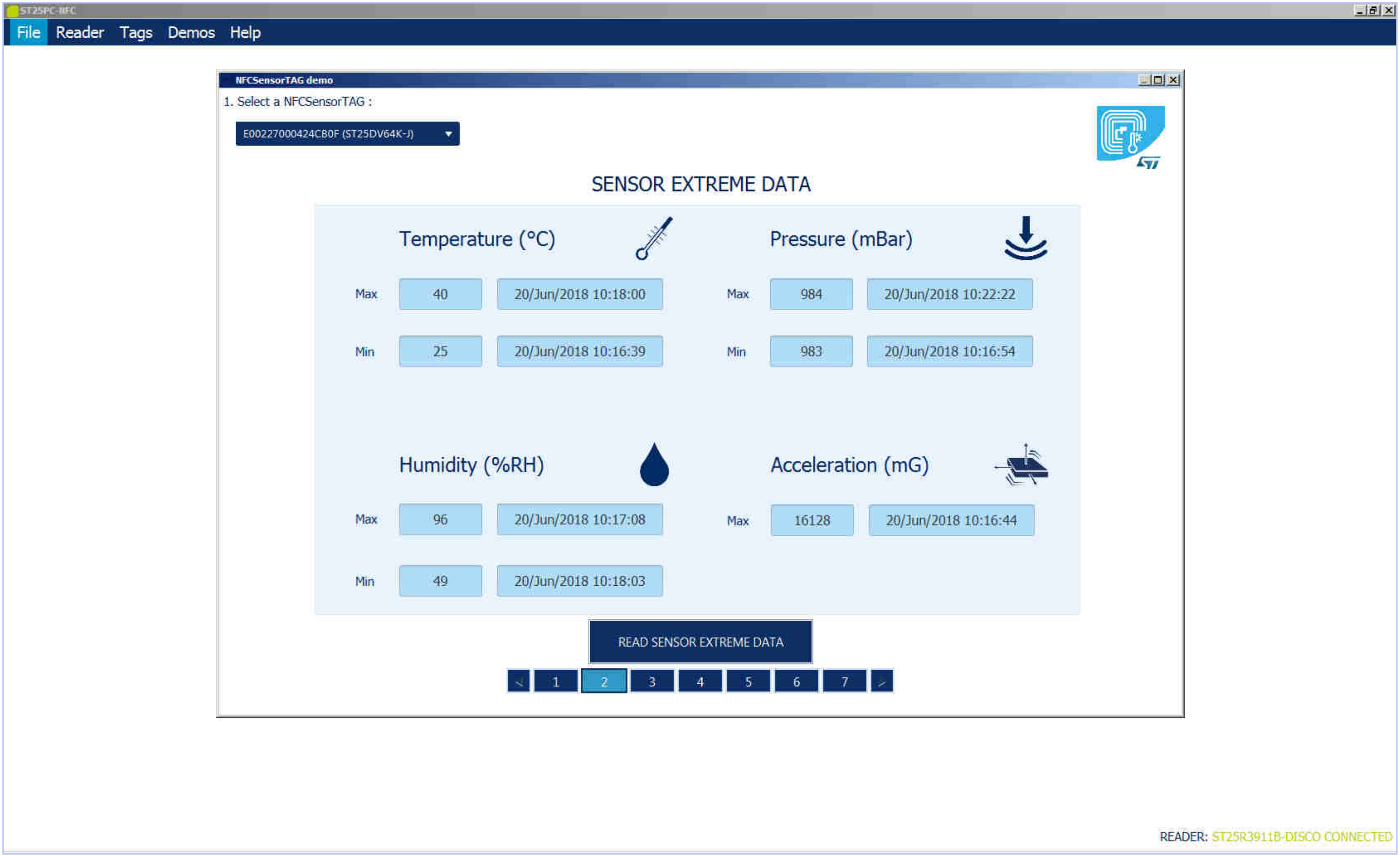
Temperature ☑ Enable

Humidity ☑ Enable

Pressure ☑ Enable

Acceleration ☑ Enable

Viewing sensor extreme data



1. Select a NFCSensorTAG :

E00227000424CB0F (ST25DV64K-J)

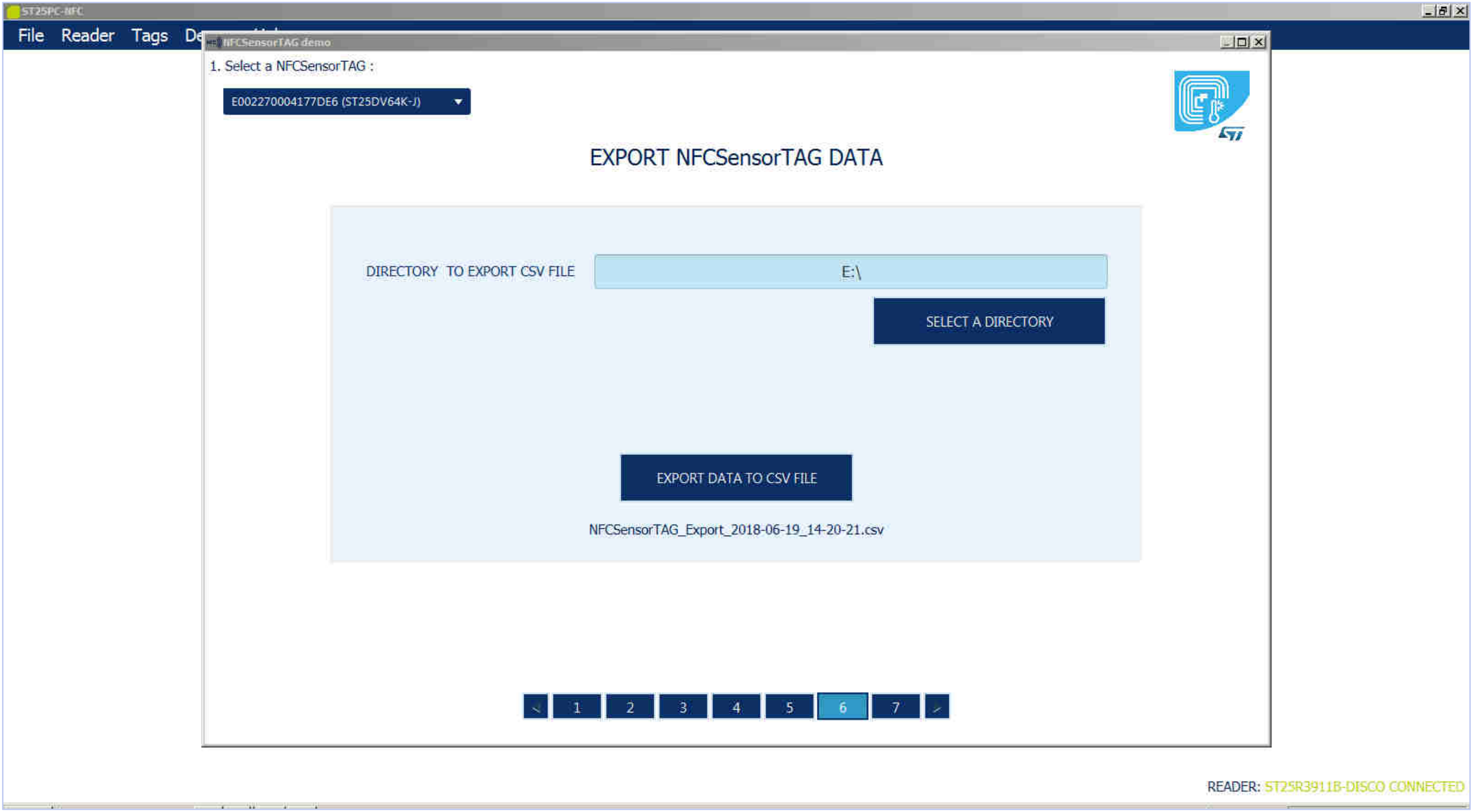
SENSOR EXTREME DATA

	Temperature (°C)		Pressure (mBar)	
Max	40	20/Jun/2018 10:18:00	984	20/Jun/2018 10:22:22
Min	25	20/Jun/2018 10:16:39	983	20/Jun/2018 10:16:54

	Humidity (%RH)		Acceleration (mG)	
Max	96	20/Jun/2018 10:17:08	16128	20/Jun/2018 10:16:44
Min	49	20/Jun/2018 10:18:03		

READER: ST25R3911B-DISCO CONNECTED

Exporting Sensor Data



1. Select a NFCSensorTAG :

E002270004177DE6 (ST25DV64K-J)

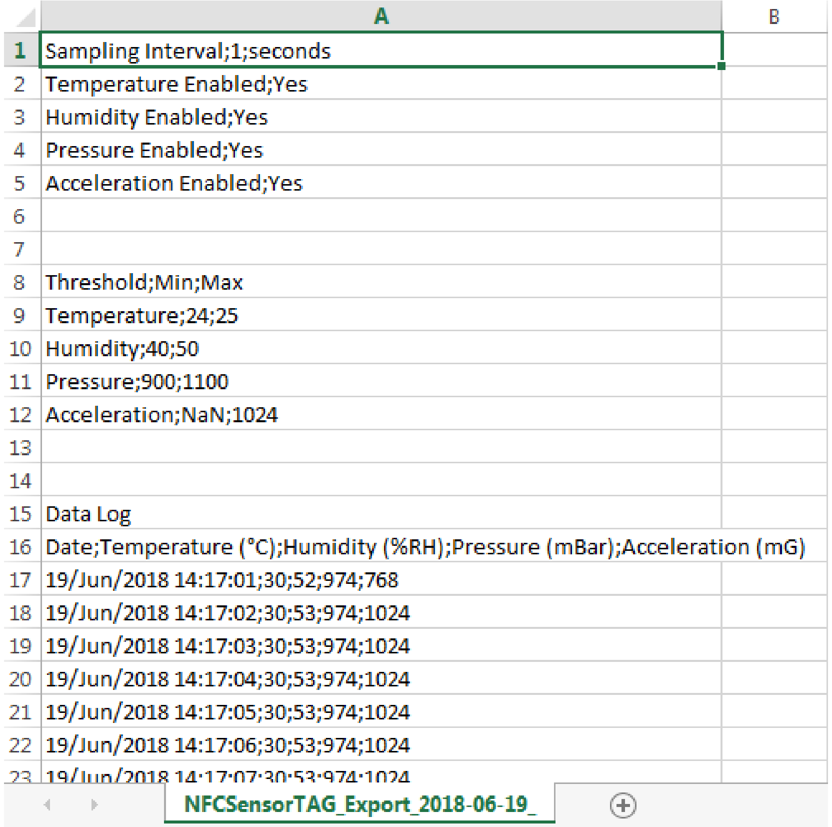
EXPORT NFCSensorTAG DATA

DIRECTORY TO EXPORT CSV FILE: E:\

NFCSensorTAG_Export_2018-06-19_14-20-21.csv

READER: ST25R3911B-DISCO CONNECTED

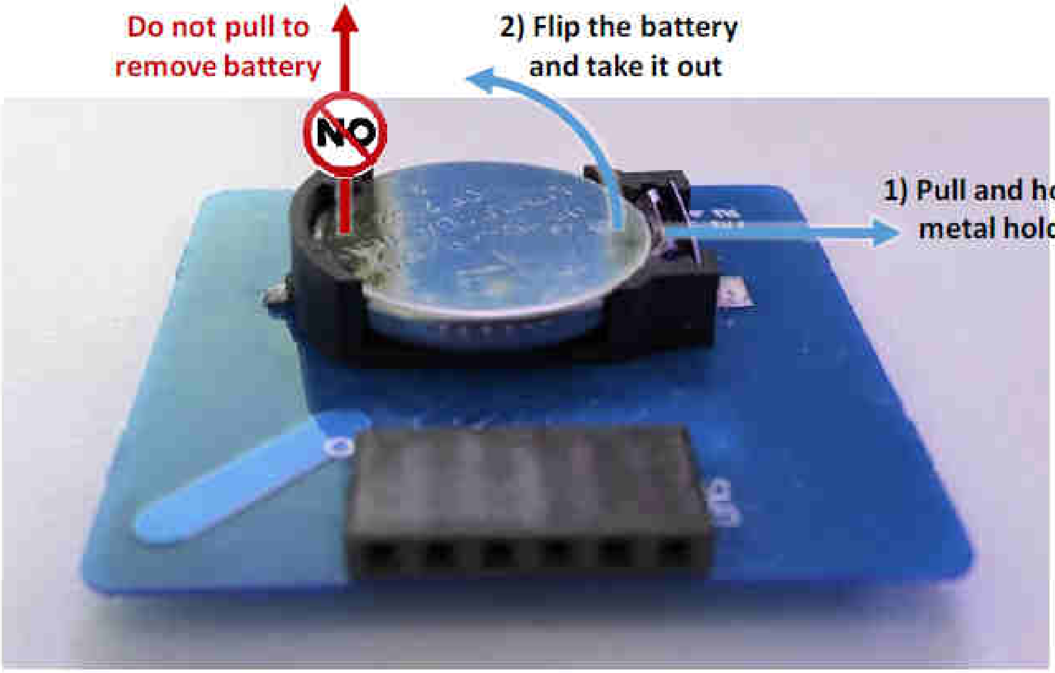
Using exported data



	A	B
1	Sampling Interval;1;seconds	
2	Temperature Enabled;Yes	
3	Humidity Enabled;Yes	
4	Pressure Enabled;Yes	
5	Acceleration Enabled;Yes	
6		
7		
8	Threshold;Min;Max	
9	Temperature;24;25	
10	Humidity;40;50	
11	Pressure;900;1100	
12	Acceleration;NaN;1024	
13		
14		
15	Data Log	
16	Date;Temperature (°C);Humidity (%RH);Pressure (mBar);Acceleration (mG)	
17	19/Jun/2018 14:17:01;30;52;974;768	
18	19/Jun/2018 14:17:02;30;53;974;1024	
19	19/Jun/2018 14:17:03;30;53;974;1024	
20	19/Jun/2018 14:17:04;30;53;974;1024	
21	19/Jun/2018 14:17:05;30;53;974;1024	
22	19/Jun/2018 14:17:06;30;53;974;1024	
23	19/Jun/2018 14:17:07;30;53;974;1024	

Battery-less operation

Correct way to remove coin cell battery



Do not pull to remove battery

NO

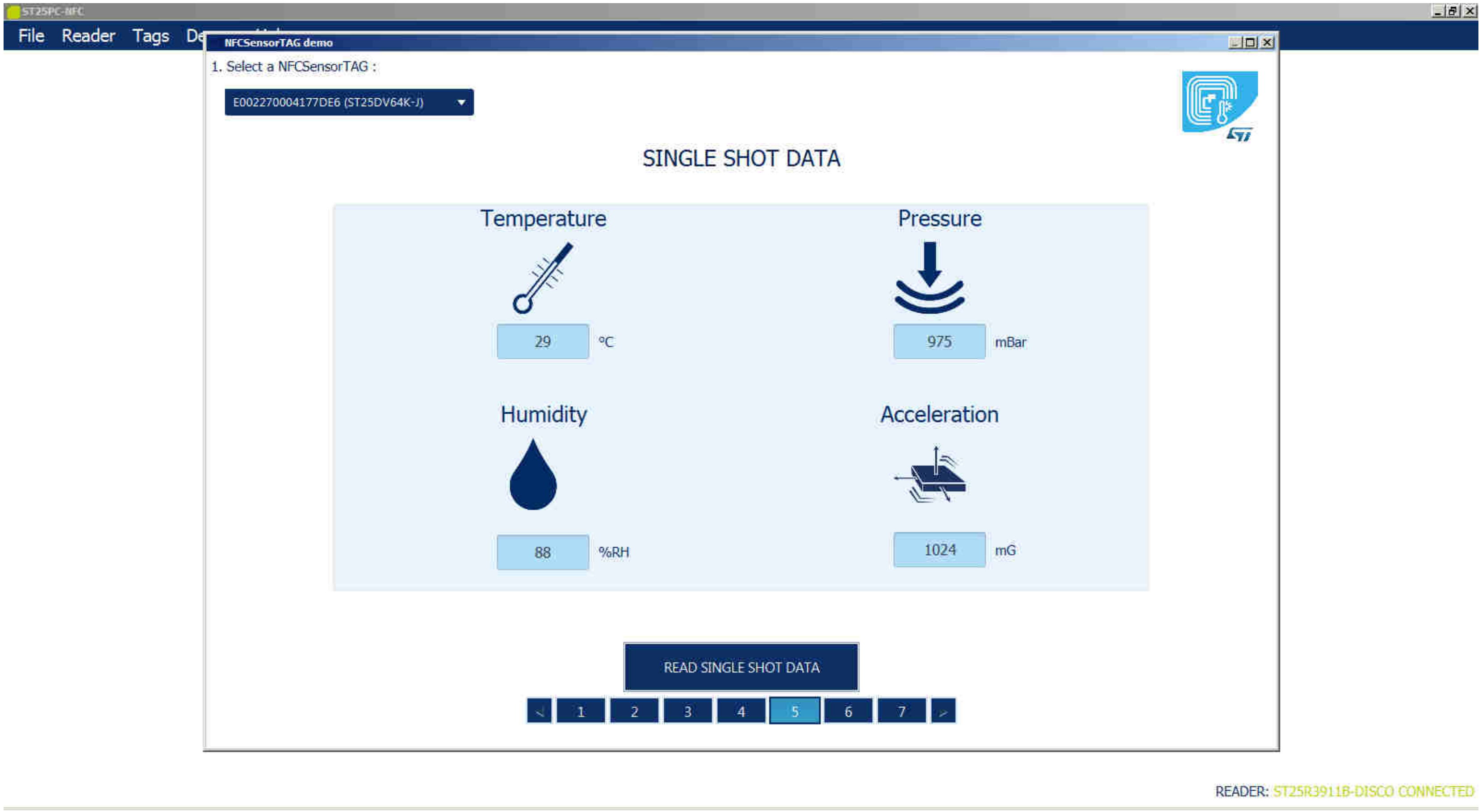
2) Flip the battery and take it out

1) Pull and hold the metal holder

Exercise

- Remove the battery from your sensor tag
- Set for single shot mode from the PC Application Tab #5
- Put the tag in the plastic bag and put it right on top of the reader
- If the placement is good, you will be able to read sensor data.

Single Shot Reading



1. Select a NFCSensorTAG :

E002270004177DE6 (ST25DV64K-J)

SINGLE SHOT DATA

Temperature: 29 °C

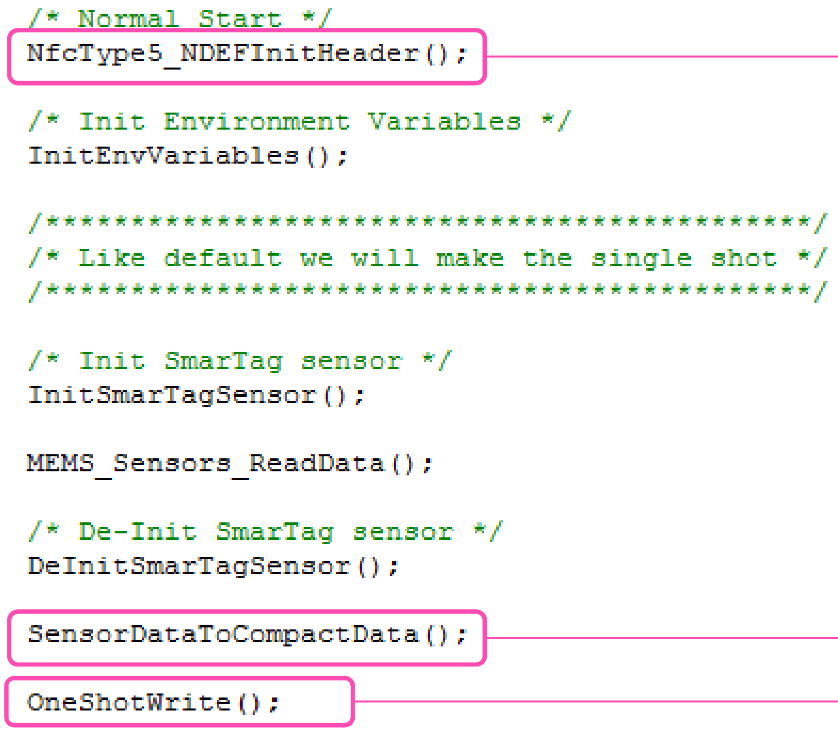
Pressure: 975 mBar

Humidity: 88 %RH

Acceleration: 1024 mG

READER: ST25R3911B-DISCO CONNECTED

Storing 1-shot data on the tag



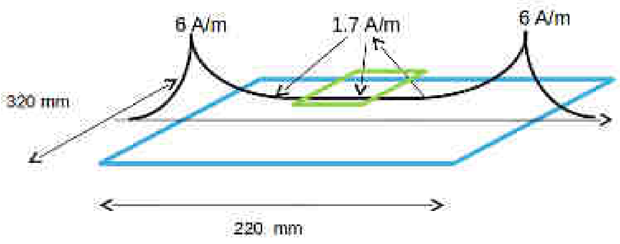
```
/* Normal Start */
NfcType5_NDEFInitHeader();

/* Init Environment Variables */
InitEnvVariables();

/*********************************************/
/* Like default we will make the single shot */
/*********************************************/

/* Init SmarTag sensor */
InitSmarTagSensor();

MEMS_Sensors_ReadData();

/* De-Init SmarTag sensor */
DeInitSmarTagSensor();

SensorDataToCompactData();

OneShotWrite();
```

We initialized the ST25DV with an NDEF message header

We compact the sensor data

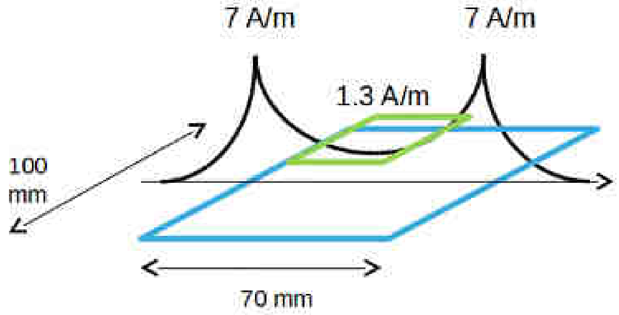
We store the data in the tag

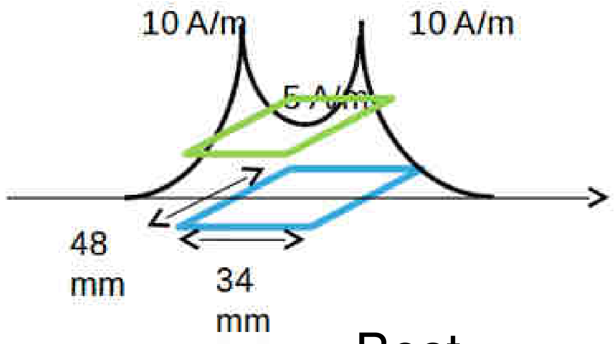
Tag Placement for Optimal EH



Good

Better





Best

Optimized Architecture for Battery-less Application

- Don’t need large EEPROM memory
- Use ST25DV 256bytes buffer (mail box)
- No issue with EEPROM endurance

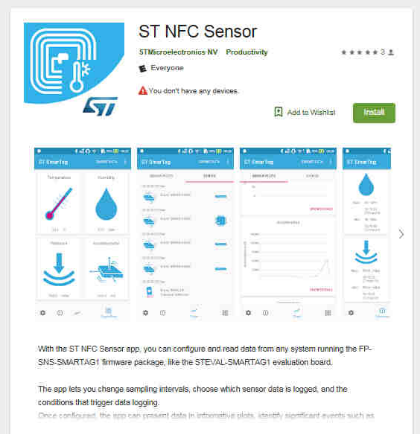
life.augmented

Smartphone APK

GET IT ON Google Play

iOS

Download on the App Store



ST NFC Sensor

STMicroelectronics NV Productivity

Everyone

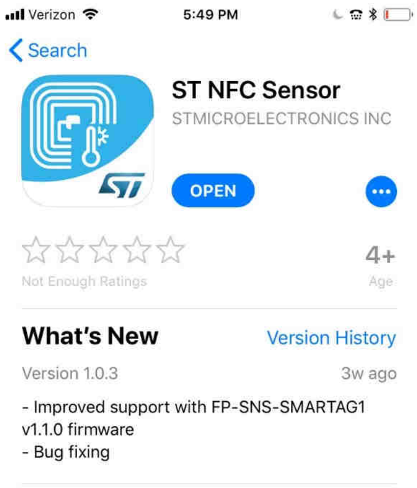
You don't have any devices.

Add to Wishlist | Install

With the ST NFC Sensor app, you can configure and read data from any system running the FP-SNS-SMARTAG1 firmware package, like the STEVAL-SMARTAG1 evaluation board.

The app lets you change sampling intervals, choose which sensor data is logged, and the conditions that trigger data logging.

Once configured, the app can present data in informative plots, identify significant events such as



Verizon 5:49 PM

Search

ST NFC Sensor

STMICROELECTRONICS INC

OPEN

Not Enough Ratings

4+ Age

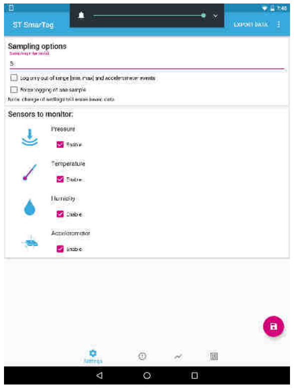
What's New | Version History

Version 1.0.3 | 3w ago

- Improved support with FP-SNS-SMARTAG1 v1.1.0 firmware
- Bug fixing

life.augmented

Android App


ST SmarTag

Sampling options

5

□ Log only out of range [min, max] and accelerometer events

□ Force logging of one sample

Note: change of settings will erase saved data

Sensors to monitor:

Pressure

☑ Enable

Temperature

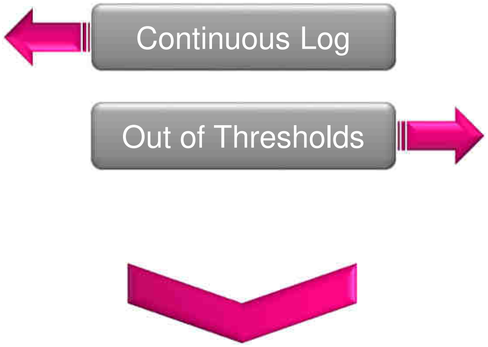
☑ Enable

Humidity

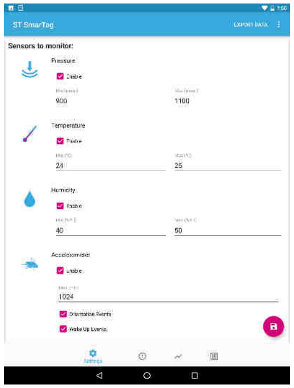
☑ Enable

Accelerometer

☑ Enable


Continuous Log

Out of Thresholds


ST SmarTag

Sensors to monitor:

Pressure

☑ Enable

900 1100

Temperature

☑ Enable

24 25

Humidity

☑ Enable

40 50

Accelerometer

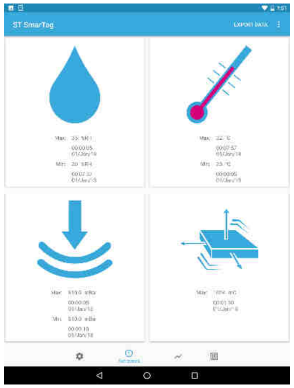
☑ Enable

1024

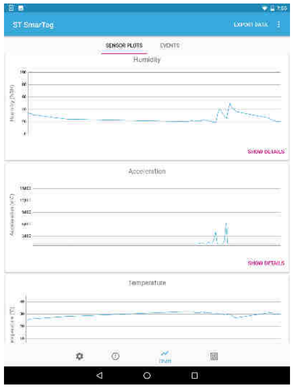
☑ Orientation Events

☑ Wake Up Events

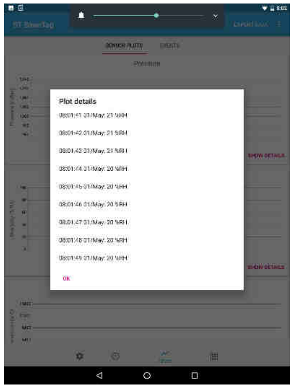
Min Max Rec



Data Plot



Plot Details


Plot details

08:01:41 31/May: 21 %RH

08:01:42 31/May: 21 %RH

08:01:43 31/May: 21 %RH

08:01:44 31/May: 20 %RH

08:01:45 31/May: 20 %RH

08:01:46 31/May: 20 %RH

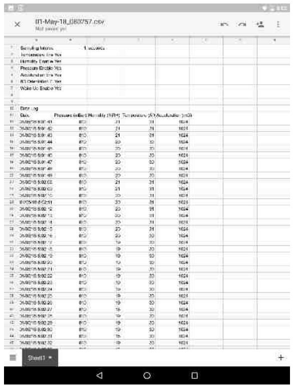
08:01:47 31/May: 20 %RH

08:01:48 31/May: 20 %RH

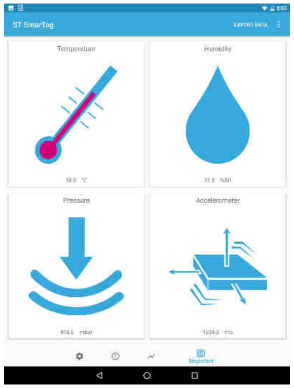
08:01:49 31/May: 20 %RH

OK

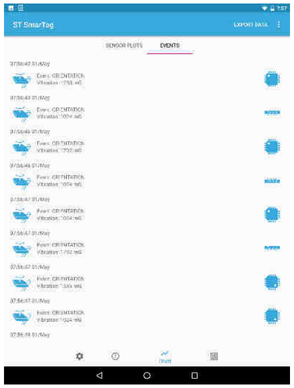
Data Export



One Shot EH



Event Logging



life.augmented

iOS support of NFC tag reader mode

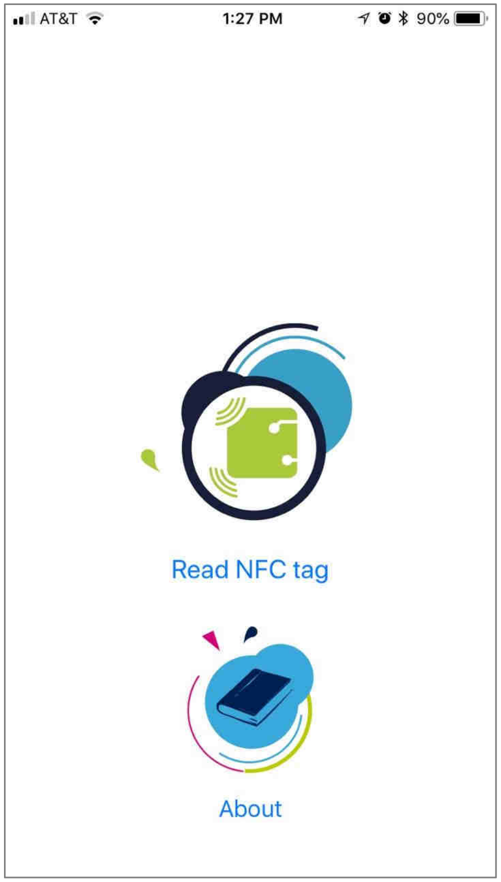
- A new core NFC function of Apple iOS11 adds support for NFC tag reading to iPhone7 and iPhone7 Plus as well as the new iPhone8 and 8 Plus and iPhoneX

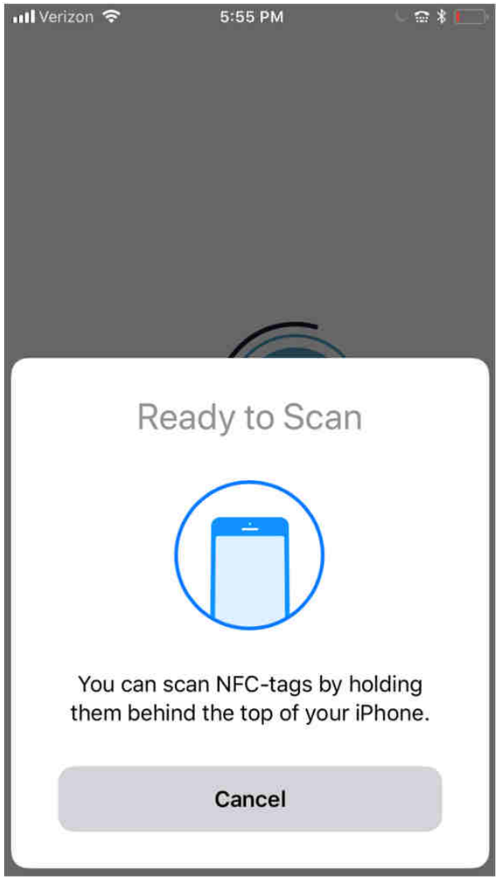
- iOS11 use cases
  - Read tags of **types 1 through 5** with NDEF (*)
  - Need iOS application (not «native» as Android)

- Download the NFC Sensor Tag App on iTunes

(*) NDEF: NFC Data Exchange Format

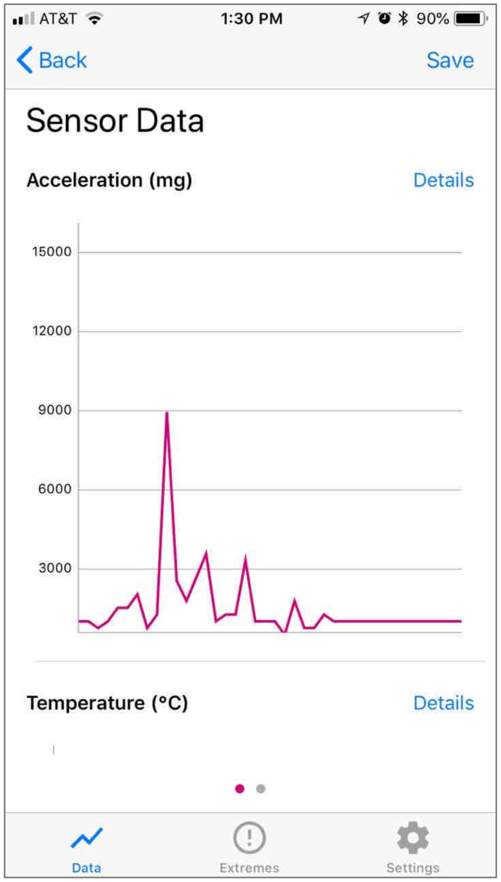
iPhone App





Ready to Scan

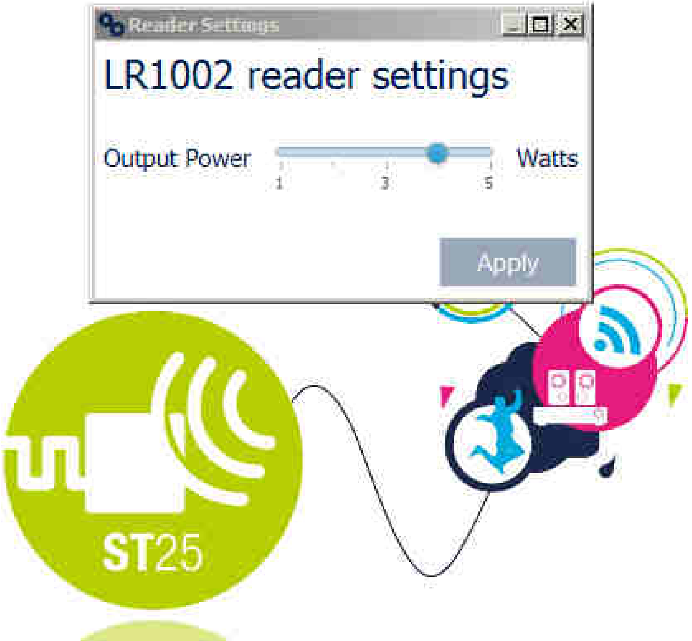
You can scan NFC-tags by holding them behind the top of your iPhone.



Iphone Capability

- iOS 11 is currently does not allow writing NDEF message. Only reading
- Cannot change default configuration of the sensor tag (e.g. logging time interval and thresholds)

Using more powerful NFC readers

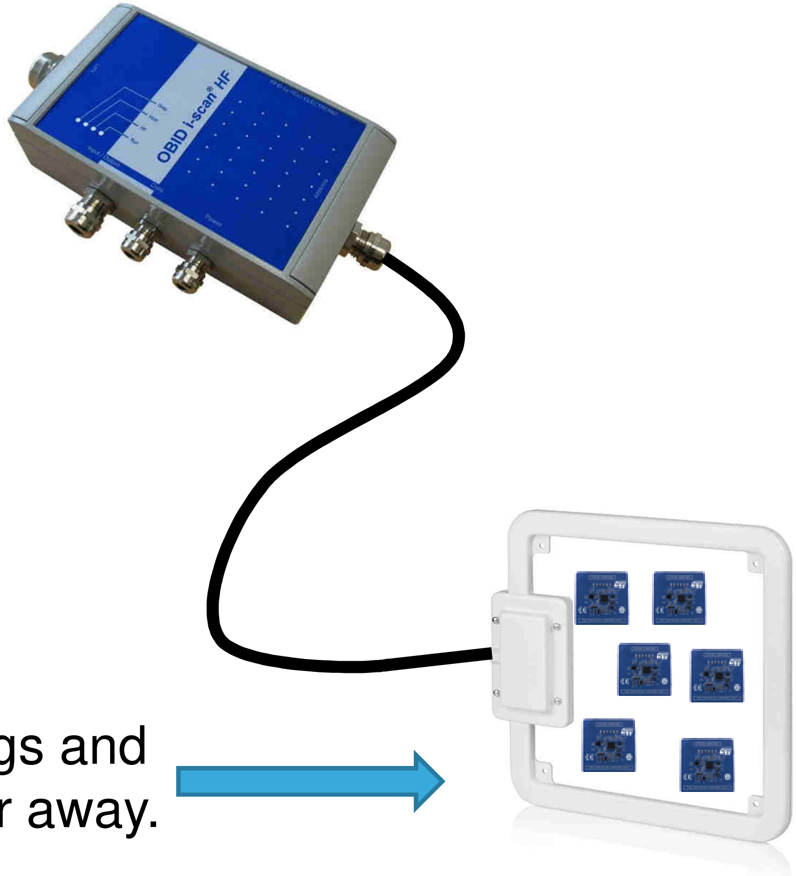


Reader Settings

LR1002 reader settings

Output Power 1 3 5 Watts

Apply



Read multiple tags and read them further away.

ST NFC Sensor to Cloud

What do you need

- Android 6.0.1 or greater Tablet/Phone
- ST NFC Sensor V1.1.0
- **STEVAL-SMARTAG1**
- CR2032 Battery
- **UM2427**: How to use the ST NFC Sensor TAG evaluation board
- NFC_Cloud_Demo1.zip

UM2427

User manual

How to use the ST NFC Sensor TAG evaluation board

Introduction

The STEVAL-SMARTAG1 NFC sensor tag platform is an NFC-enabled sensor node with inertial and environmental digital MEMS sensors, an STM32 microcontroller and a dynamic NFC tag for communication with NFC readers such as tablets and smartphones.

You can use the NFC-enabled sensor node as the basis for your own designs and as a platform to test and develop NFC-enabled applications with the STM32 Open Development Environment (STM32 ODE).

The ST NFC Sensor TAG platform is also an evaluation tool to help you assess the performance of the sensors and the capabilibes of the NFC dynamic tag embedded on the STEVAL-SMARTAG1 evaluation board.

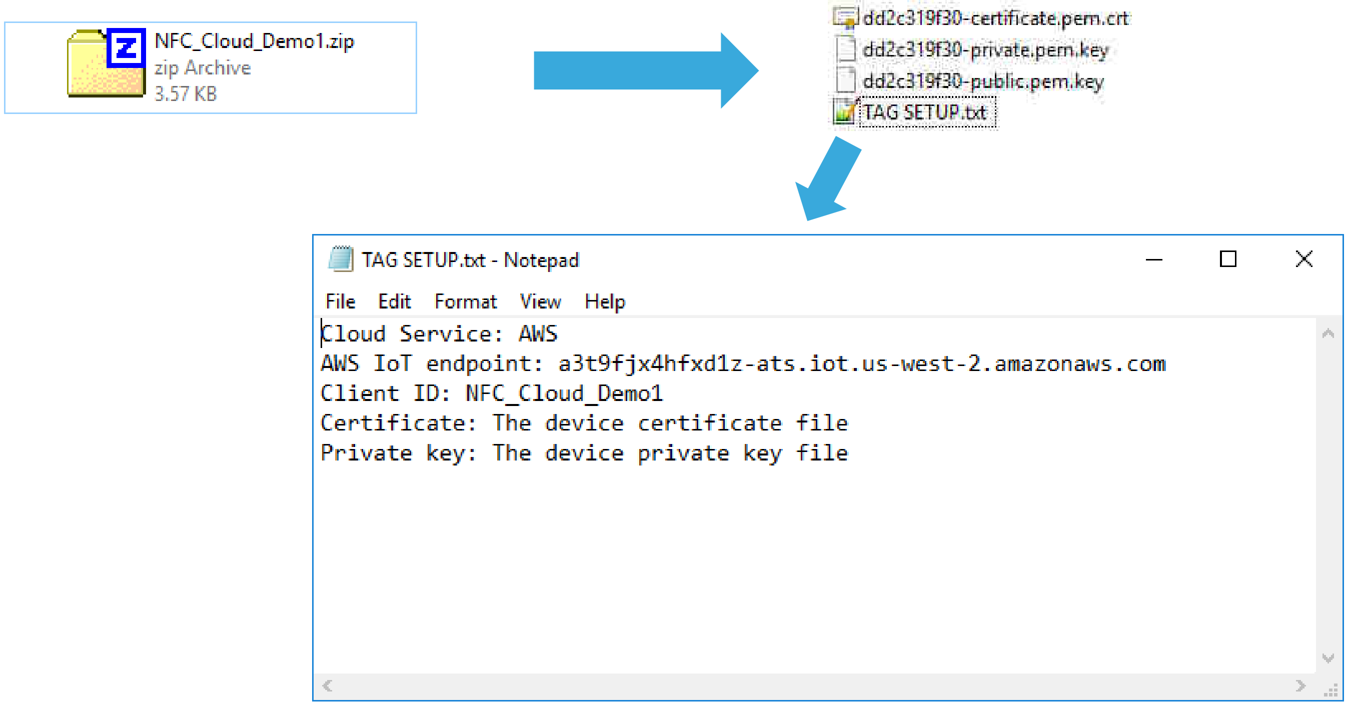
The board has a small and thin form factor, which makes it particularly useful for deployment in field research and data collection activities that help refine application-specific algorithms.

Figure 1. STEVAL-SMARTAG1 NFC sensor tag

UM2427 - Rev 1 - June 2018
For further information contact your local STMicroelectronics sales office.

www.st.com

NFC_Cloud_Demo1.zip

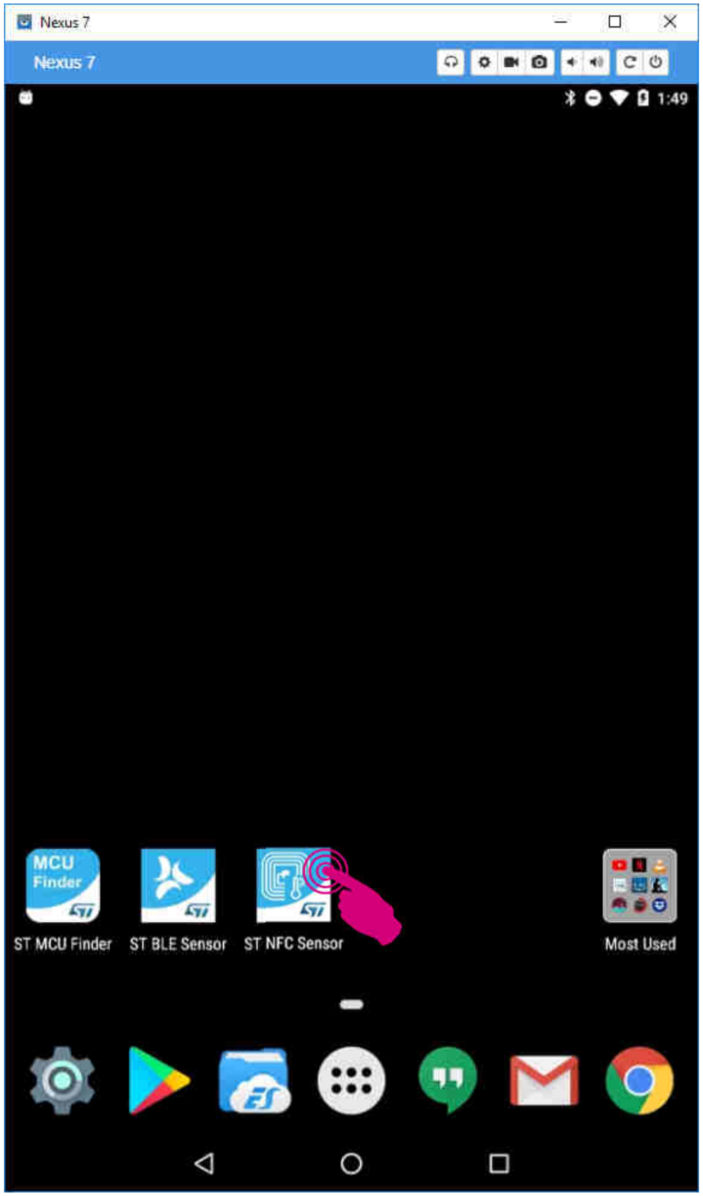


NFC_Cloud_Demo1.zip
zip Archive
3.57 KB

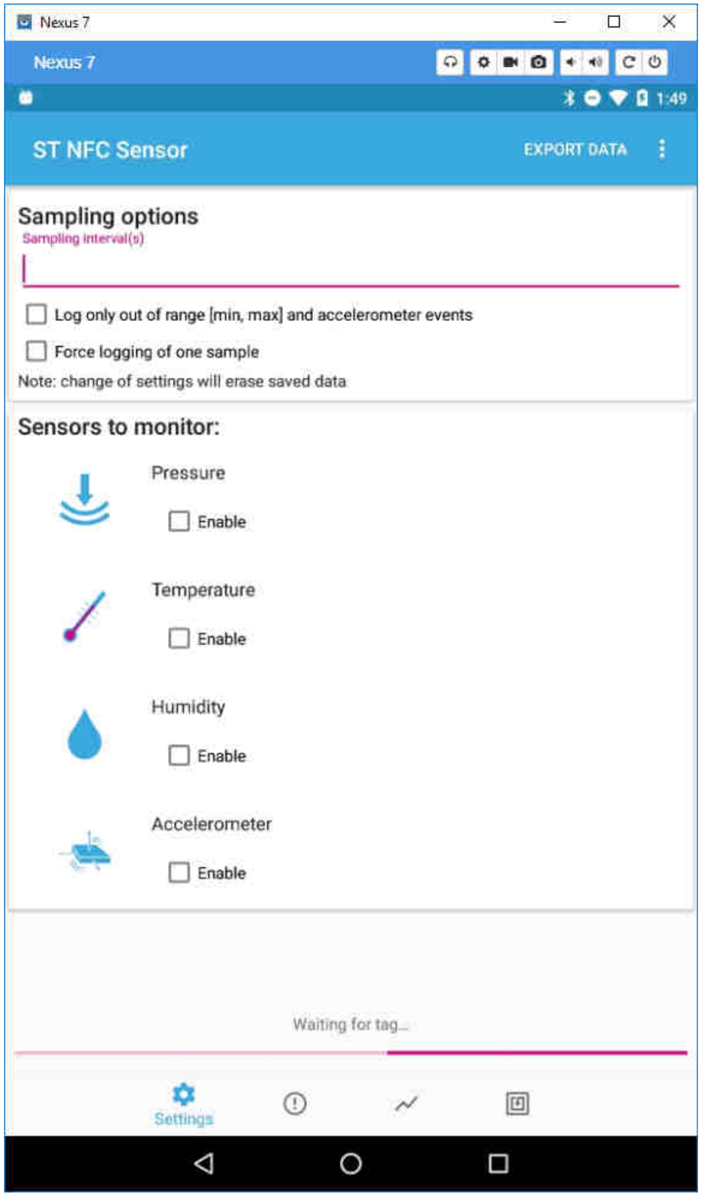
dd2c319f30-certificate.pem.crt
dd2c319f30-private.pem.key
dd2c319f30-public.pem.key
TAG SETUP.txt

```
Cloud Service: AWS
AWS IoT endpoint: a3t9fjx4hfxd1z-ats.iot.us-west-2.amazonaws.com
Client ID: NFC_Cloud_Demo1
Certificate: The device certificate file
Private key: The device private key file
```

Copy the extracted folder in a known location on the Android Tablet (you’ll need this later)



- Open ST NFC Sensor



Sampling options

Sampling interval(s)

□ Log only out of range [min, max] and accelerometer events

□ Force logging of one sample

Note: change of settings will erase saved data

Sensors to monitor:

Pressure
□ Enable

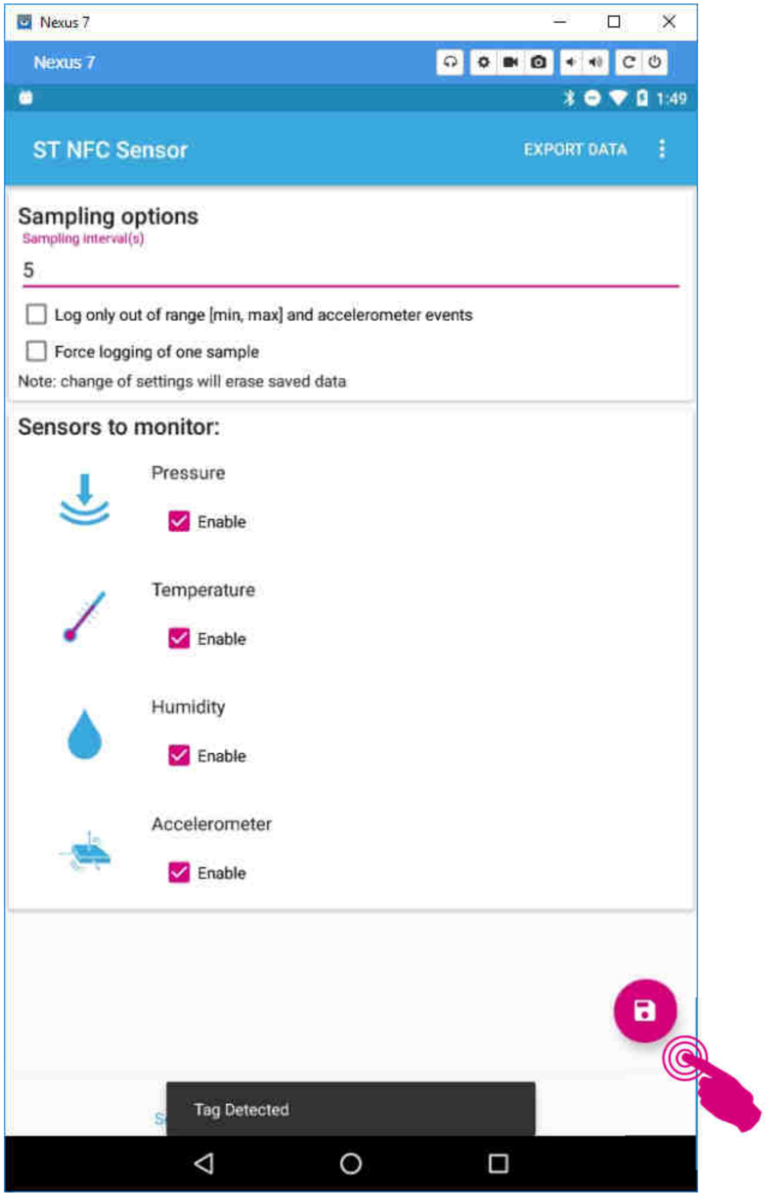
Temperature
□ Enable

Humidity
□ Enable

Accelerometer
□ Enable

Waiting for tag...

- While on Settings TAB, tap the ST NFC Sensor



ST NFC Sensor

Sampling options

Sampling interval(s)

5

□ Log only out of range [min, max] and accelerometer events

□ Force logging of one sample

Note: change of settings will erase saved data

Sensors to monitor:

Pressure ☑ Enable

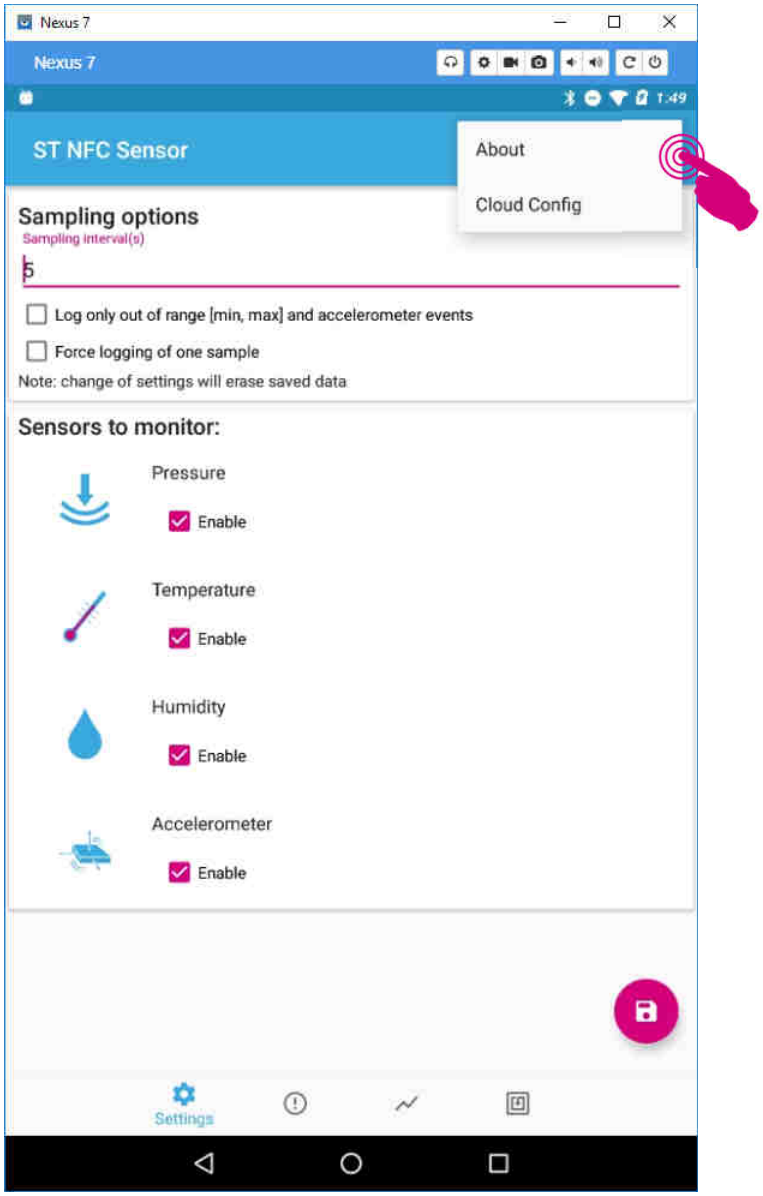
Temperature ☑ Enable

Humidity ☑ Enable

Accelerometer ☑ Enable

Tag Detected

- Previous configuration will be loaded
- You can change to:
  - Sampling option 5s
  - All sensor enabled
- Write tapping on Disc pink icon with ST NFC Sensor in range



Sampling options

Sampling interval(s)

5

□ Log only out of range [min, max] and accelerometer events

□ Force logging of one sample

Note: change of settings will erase saved data

Sensors to monitor:

Pressure

☑ Enable

Temperature

☑ Enable

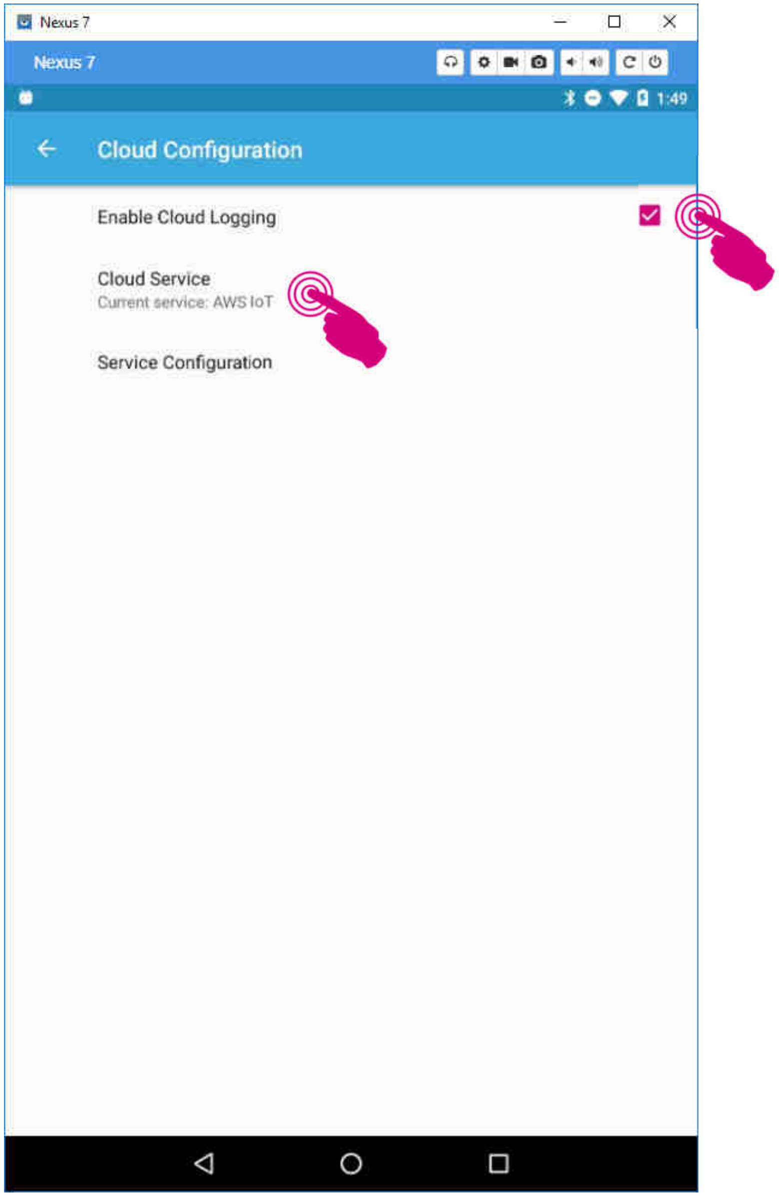
Humidity

☑ Enable

Accelerometer

☑ Enable

- Tap on the 3 dots on top right corner
- Tap on **Cloud Config**



Nexus 7

Nexus 7

1:49

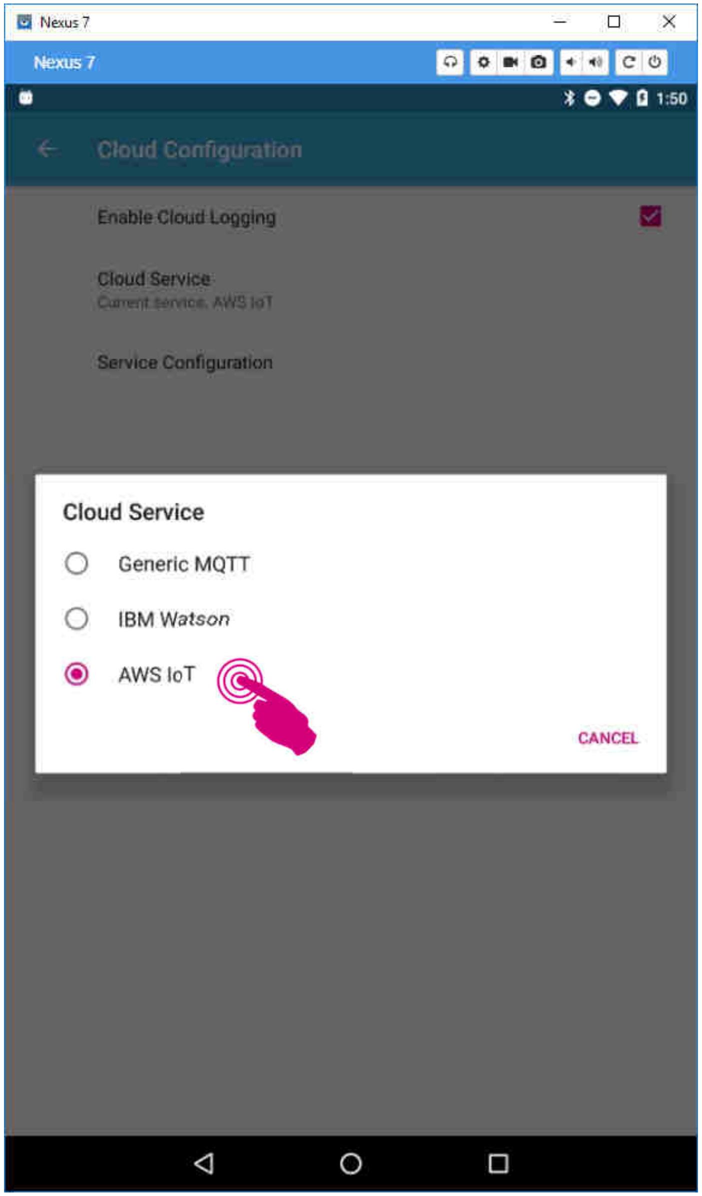
Cloud Configuration

Enable Cloud Logging ☑

Cloud Service
Current service: AWS IoT

Service Configuration

- Tap on **Enable Cloud Logging**
- Tap on **Cloud Service**



Cloud Configuration

Enable Cloud Logging ☑

Cloud Service
Current service: AWS IoT

Service Configuration

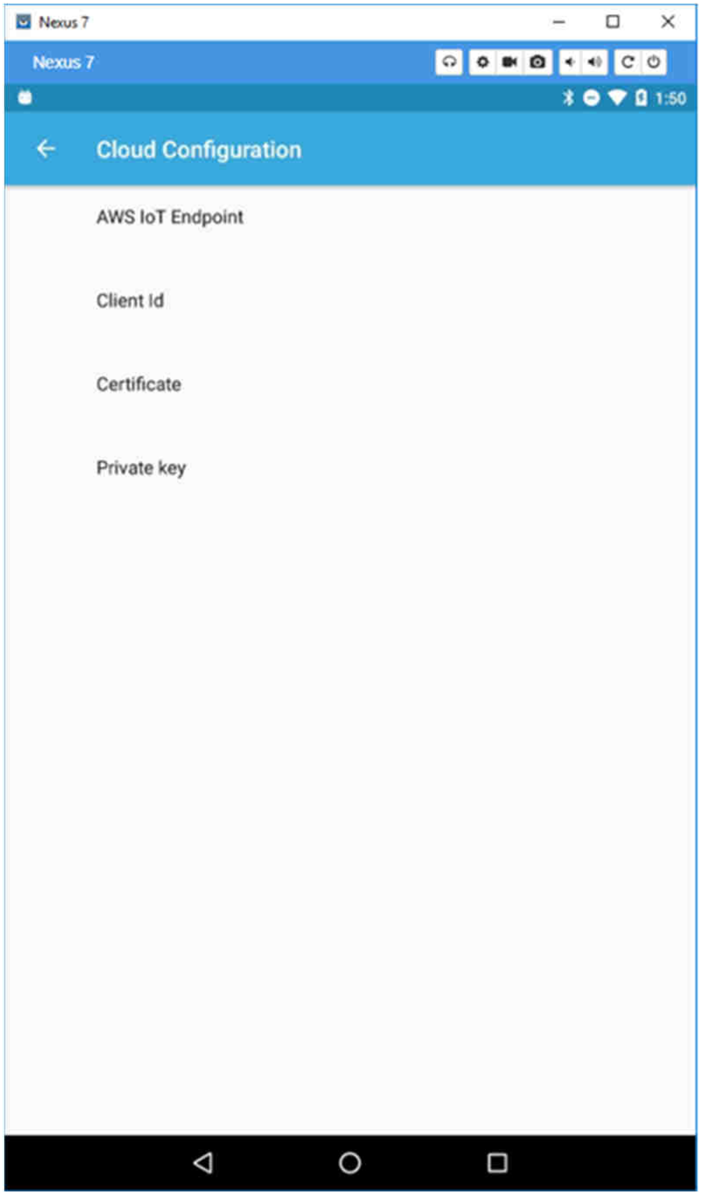
Cloud Service

○ Generic MQTT

○ IBM Watson

● AWS IoT

- Tap on **AWS IOT**



Cloud Configuration

AWS IoT Endpoint

Client Id

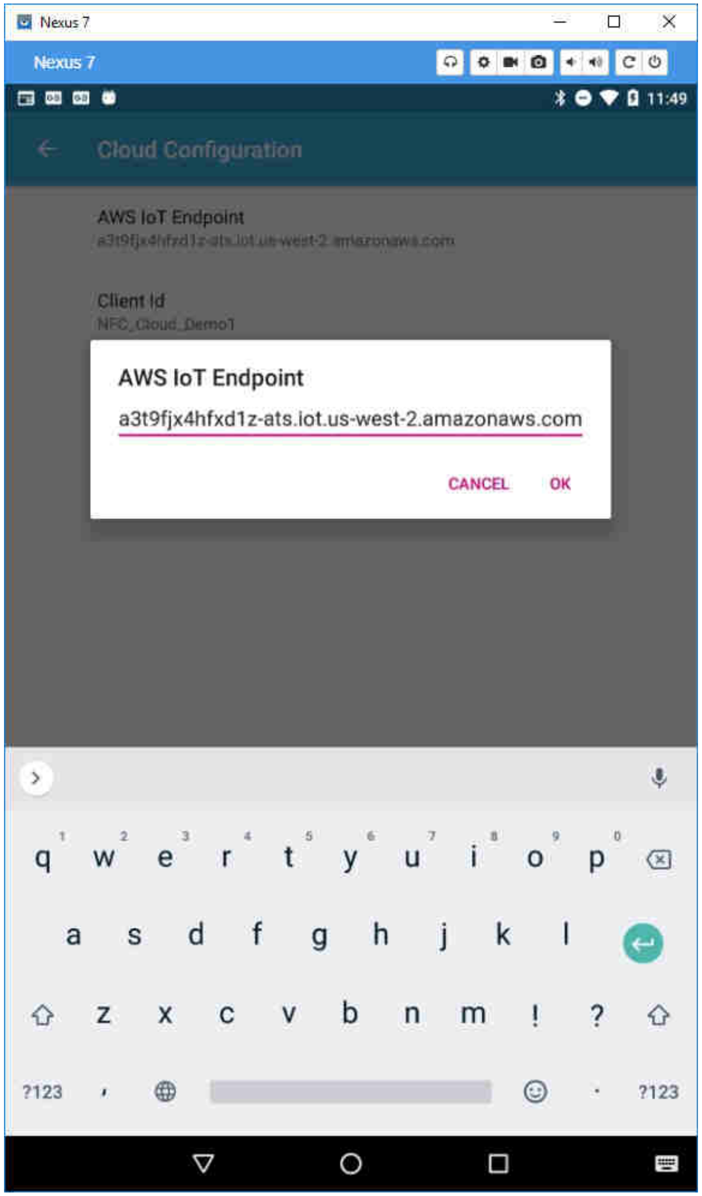
Certificate

Private key

- On the Cloud configuration tool we'll now need to insert
  - **AWS IoT Endpoint**
  - **Cliend ID**
  - **Certificate**
  - **Private Key**

- Recommendation is to have a txt file with AWS IoT Endpoint and client ID to paste in the field (TAG SETUP.txt)

- Certificate and Private Key in separate files (downloaded from AWS).



Nexus 7

Cloud Configuration

AWS IoT Endpoint
a3t9fjx4hfxd1z-ats.iot.us-west-2.amazonaws.com

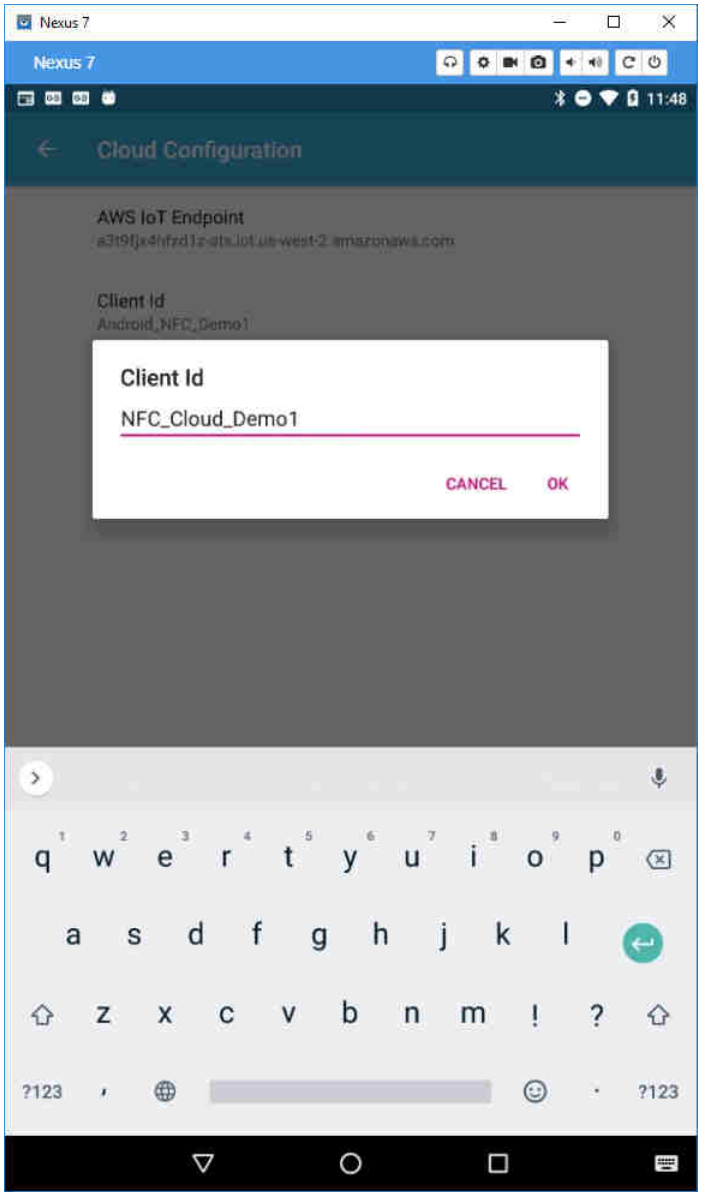
Client Id
NFC_Cloud_Demo1

AWS IoT Endpoint

a3t9fjx4hfxd1z-ats.iot.us-west-2.amazonaws.com

- Cut and paste AWS IoT Endpoint

```
a3t9fjx4hfxd1z-ats.iot.us-west-2.amazonaws.com
```



Cloud Configuration

AWS IoT Endpoint
a3t9fjx4hfzd1z-ats.iot.us-west-2.amazonaws.com

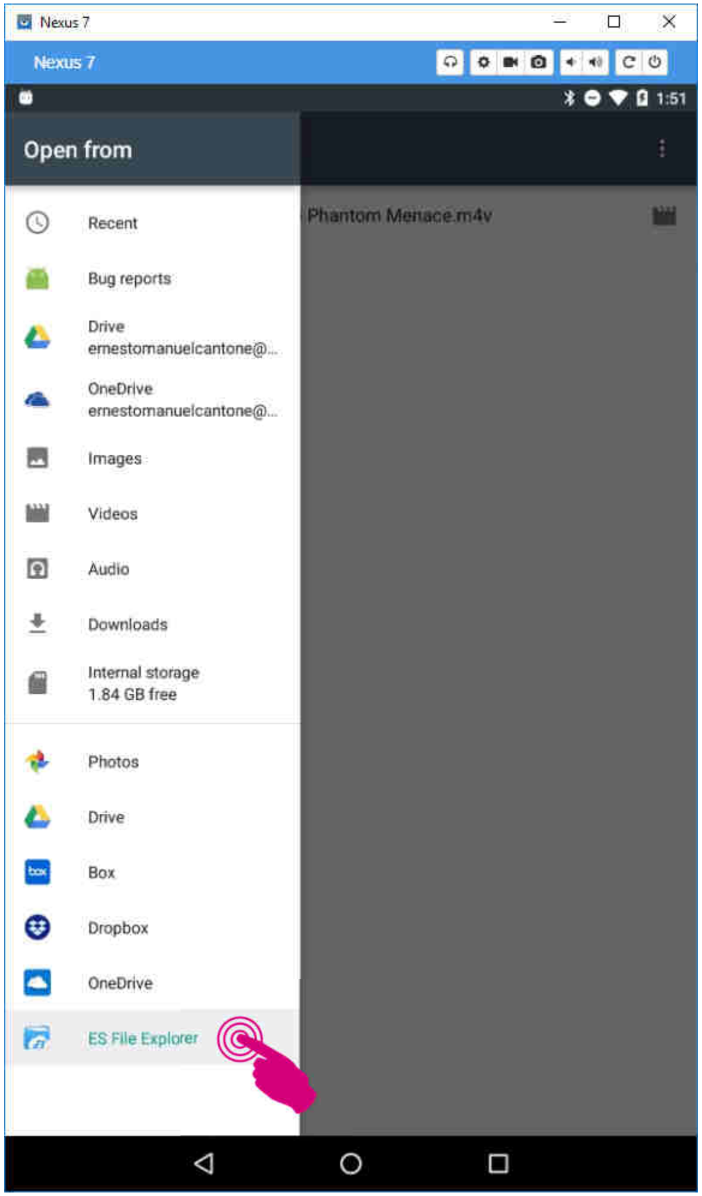
Client Id
Android_NFC_Demo1

Client Id

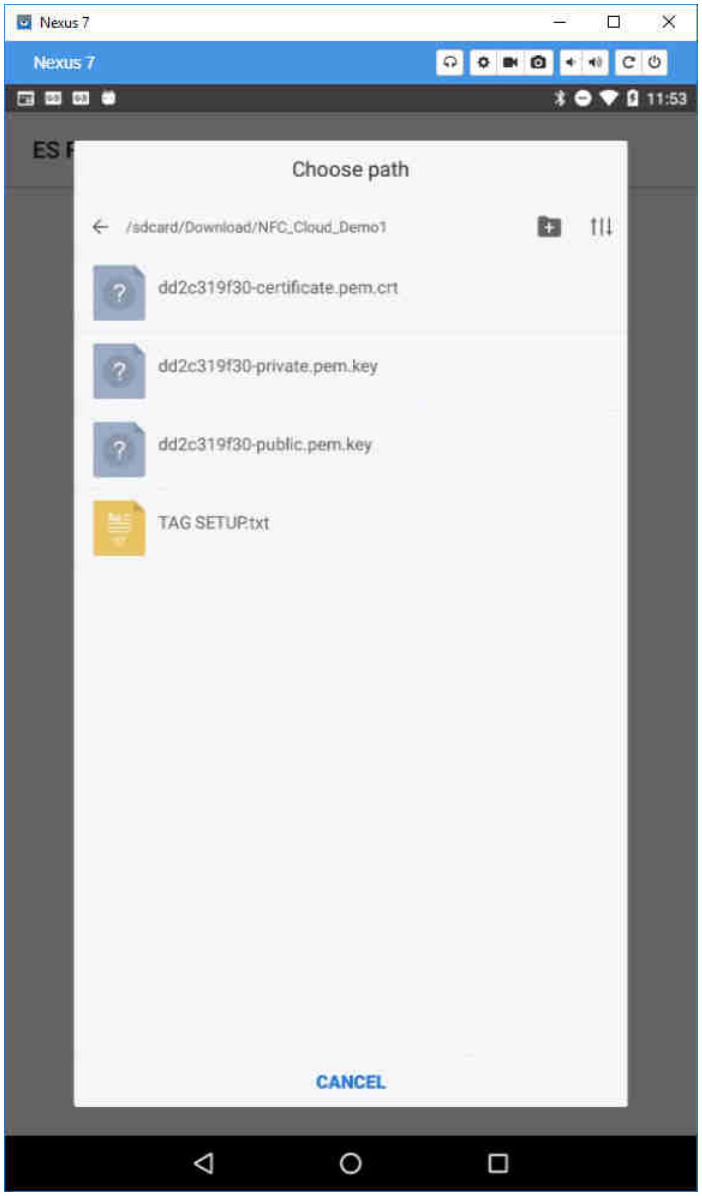
NFC_Cloud_Demo1

- Cut and paste Client Id

```
Android_NFC_Demo1
```



- Browse your tablet with a File Explorer app (ES file Explorer in this example) to locate the correct certificate/key
  - NOTE: a cloud location can also be used (Box, Dropbox, Google Drive, OneDrive, …)



Choose path

/sdcard/Download/NFC_Cloud_Demo1

dd2c319f30-certificate.pem.crt

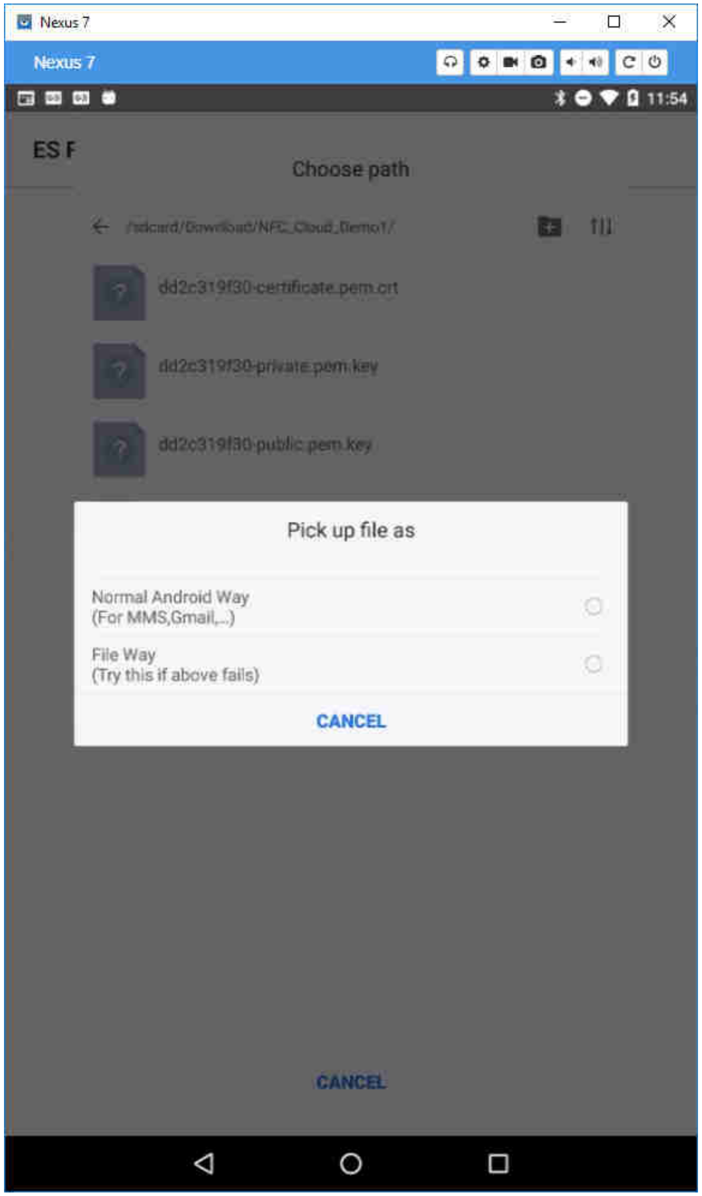
dd2c319f30-private.pem.key

dd2c319f30-public.pem.key

TAG SETUP.txt

- In this example we stored the files in the folder `..\Download/NFC_Cloud_Demo1`

- In this location we have the following files:
    - `dd2c319f30-certificate.pem.crt`
    - `dd2c319f30-private.pem.key`
    - `dd2c319f30-public.pem.key`



Choose path

/sdcard/Download/NFC_Cloud_Demo1/

dd2c319f30-certificate.pem.crt

dd2c319f30-private.pem.key

dd2c319f30-public.pem.key

Pick up file as

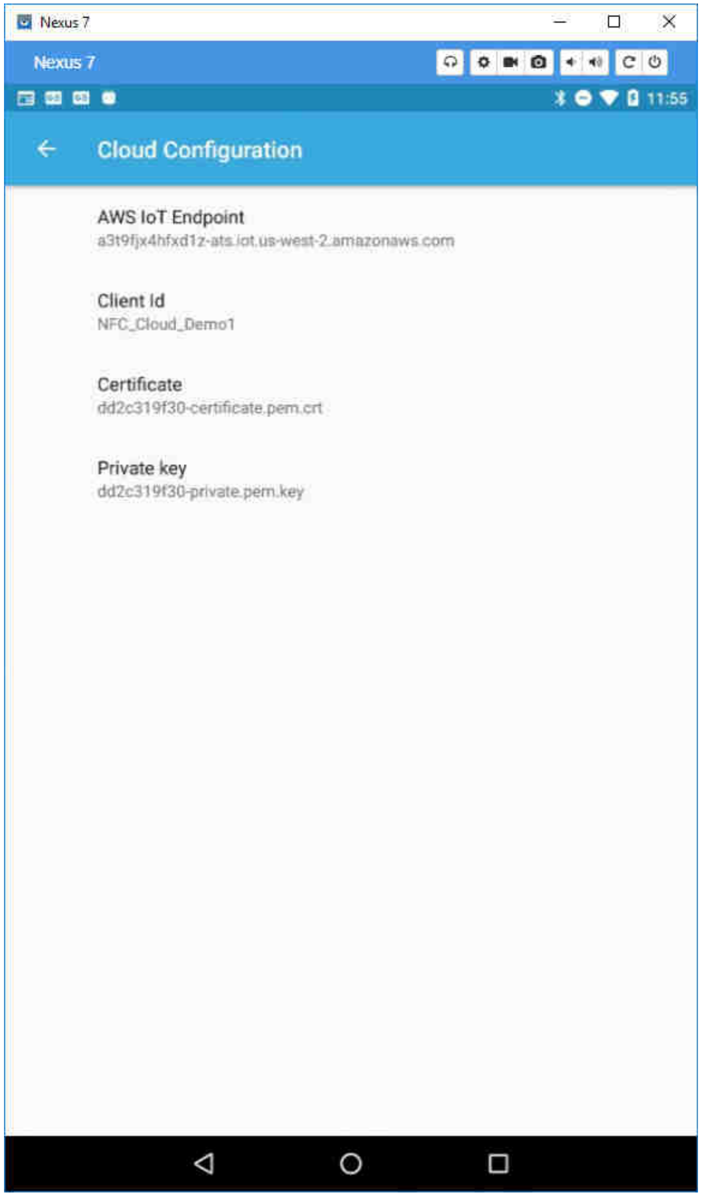
Normal Android Way
(For MMS,Gmail,...) ○

File Way
(Try this if above fails) ○

CANCEL

CANCEL

- Link the Certificate and Private Key with the provided methods
  - In the example “File Way” was used



Cloud Configuration

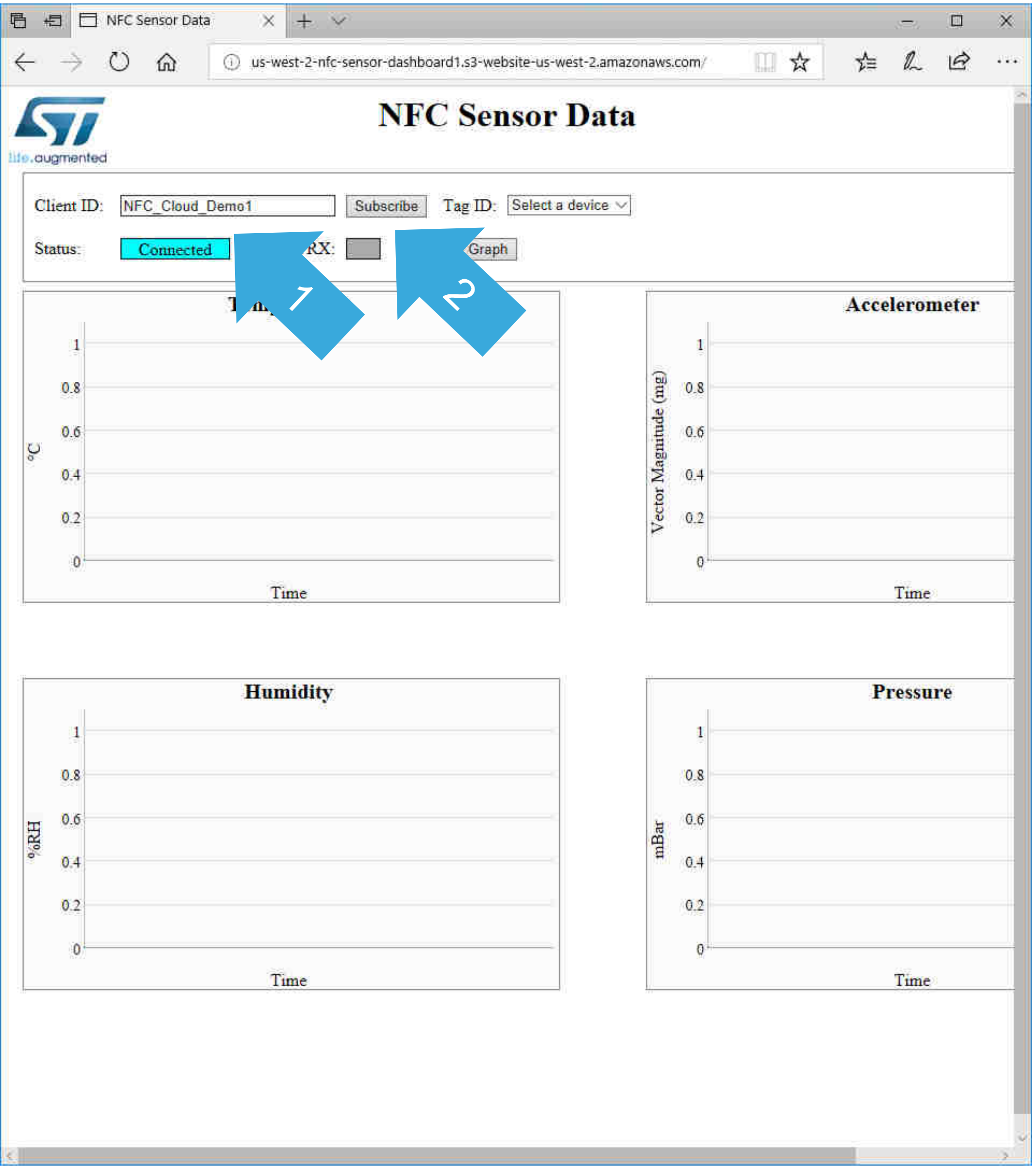
AWS IoT Endpoint
a3t9fjx4hfxd1z-ats.iot.us-west-2.amazonaws.com

Client Id
NFC_Cloud_Demo1

Certificate
dd2c319f30-certificate.pem.crt

Private key
dd2c319f30-private.pem.key

- Once every field is filled you can go back and they will be stored in the app for next access



Client ID: NFC_Cloud_Demo1

Tag ID: Select a device

Status: Connected

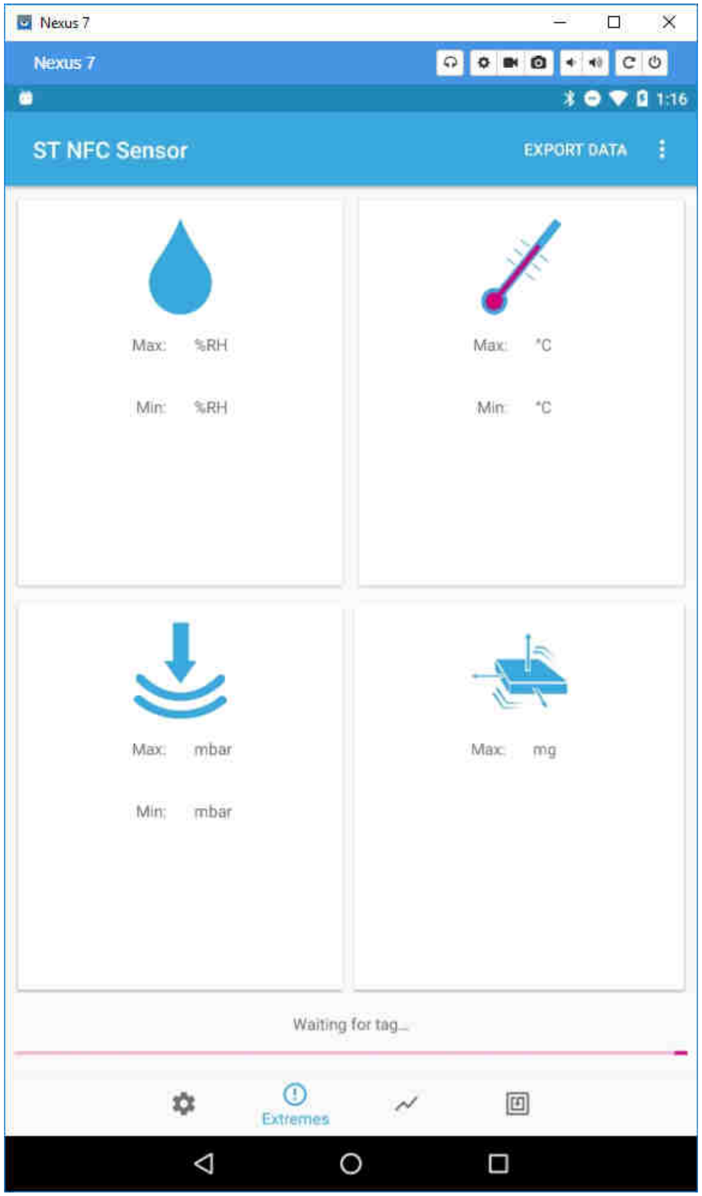
- On a browser of your choice (Chrome is visualized) go to

http://us-west-2-nfc-sensor-dashboard1.s3-website-us-west-2.amazonaws.com/

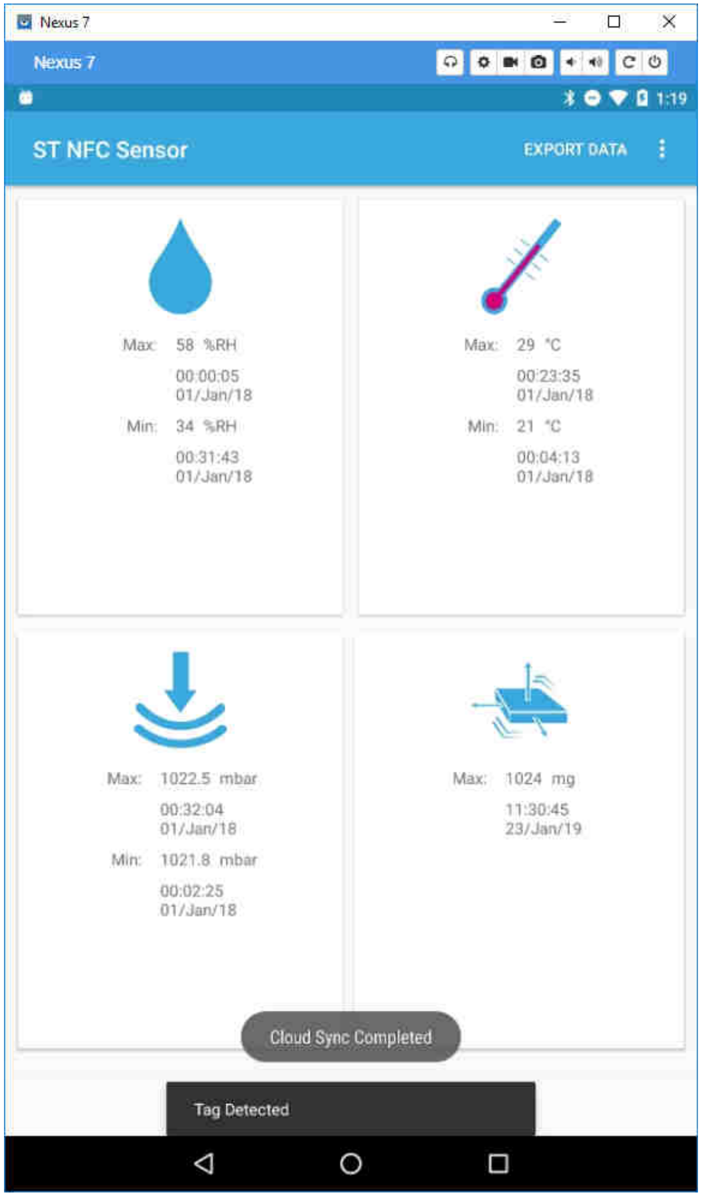
- On the Client ID field insert

```
NFC_Cloud_Demo1
```

- Click Subscribe



- Select **Extremes** Tab



ST NFC Sensor

Max: 58 %RH
00:00:05
01/Jan/18
Min: 34 %RH
00:31:43
01/Jan/18

Max: 29 °C
00:23:35
01/Jan/18
Min: 21 °C
00:04:13
01/Jan/18

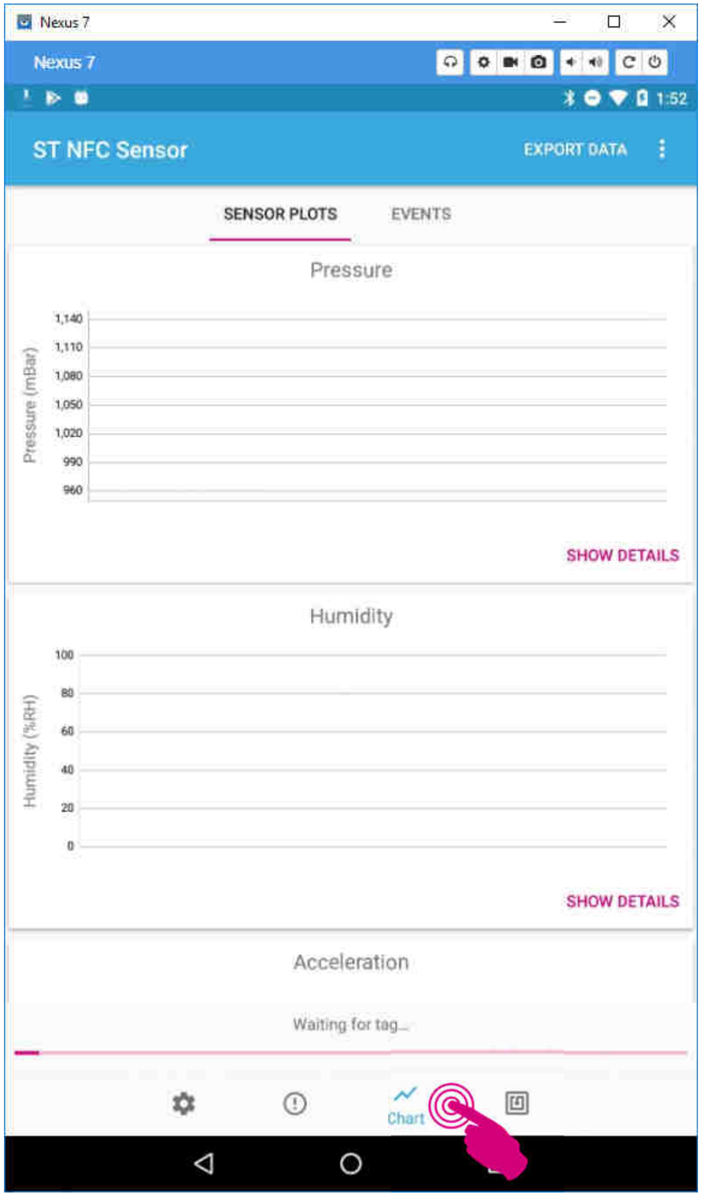
Max: 1022.5 mbar
00:32:04
01/Jan/18
Min: 1021.8 mbar
00:02:25
01/Jan/18

Max: 1024 mg
11:30:45
23/Jan/19

Cloud Sync Completed

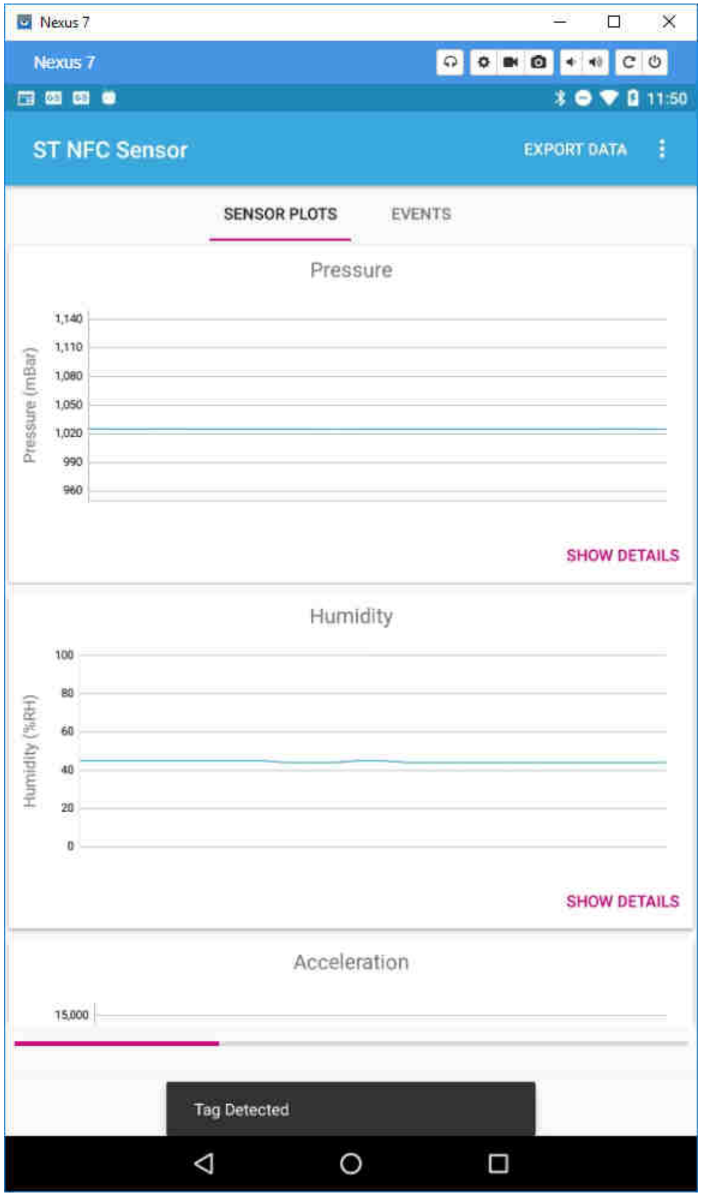
Tag Detected

- Tap Tag to set Extremes



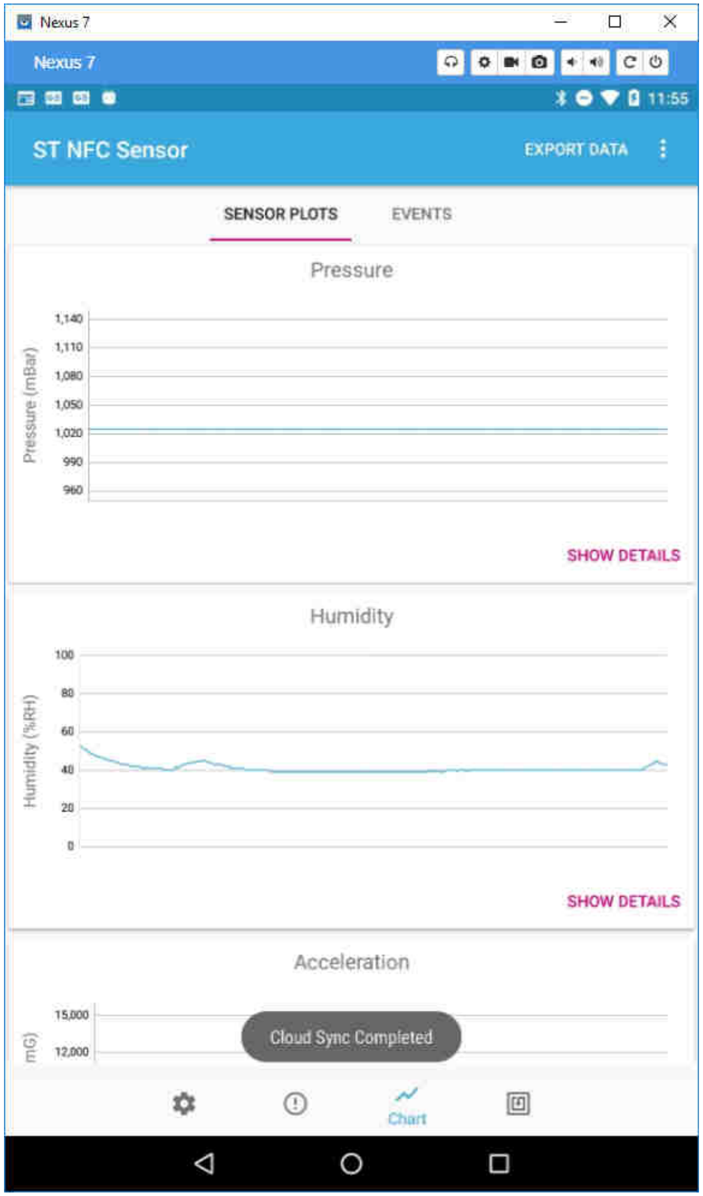
Waiting for tag...

- Select **Chart** Tab



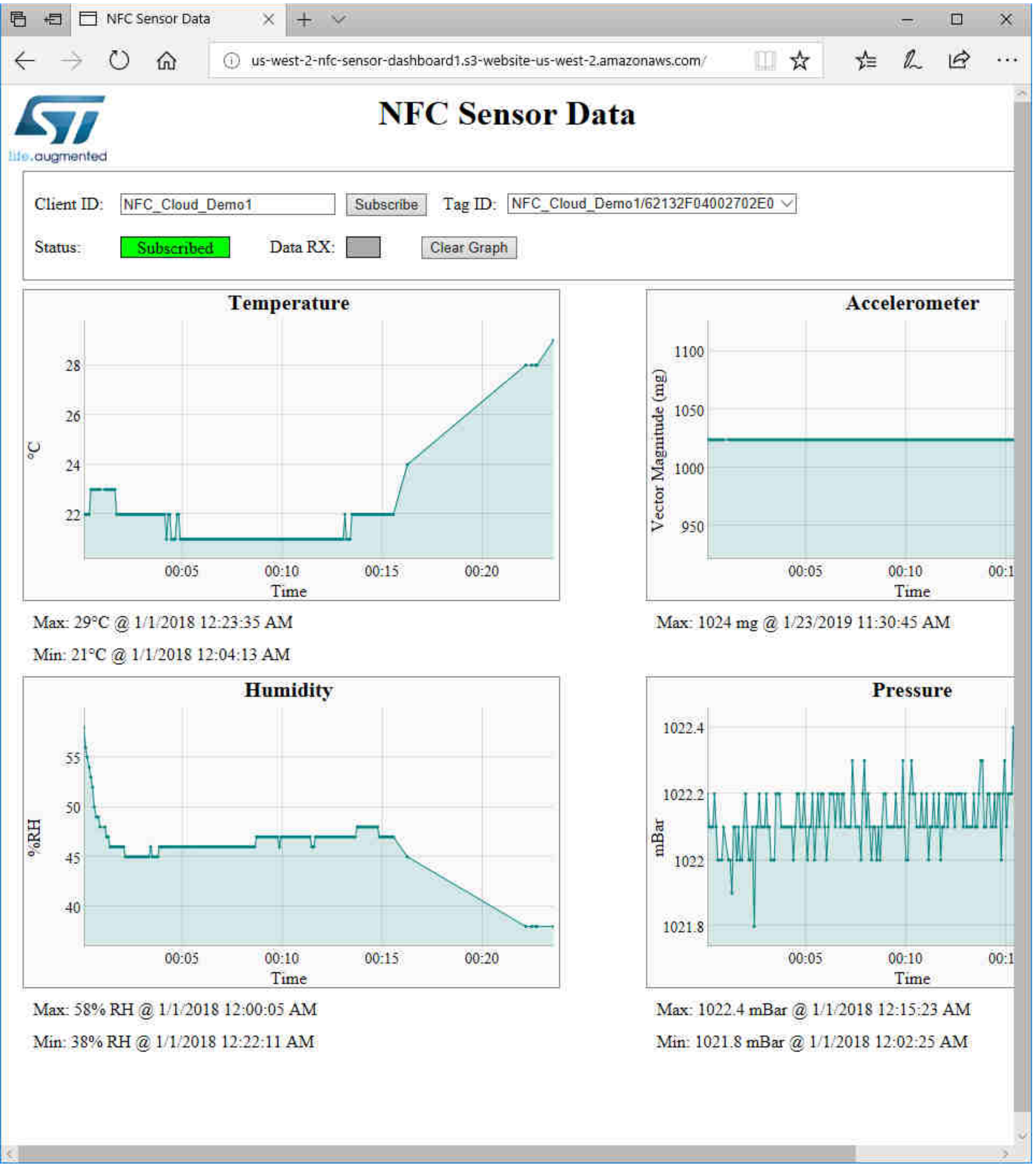
Tag Detected

- Tap the NFC Sensor



Cloud Sync Completed

- Data will be automatically sync'd with the Cloud



NFC Sensor Data

Client ID: NFC_Cloud_Demo1 Subscribe Tag ID: NFC_Cloud_Demo1/62132F04002702E0

Status: Subscribed Data RX: Clear Graph

Max: 29°C @ 1/1/2018 12:23:35 AM

Min: 21°C @ 1/1/2018 12:04:13 AM

Max: 1024 mg @ 1/23/2019 11:30:45 AM

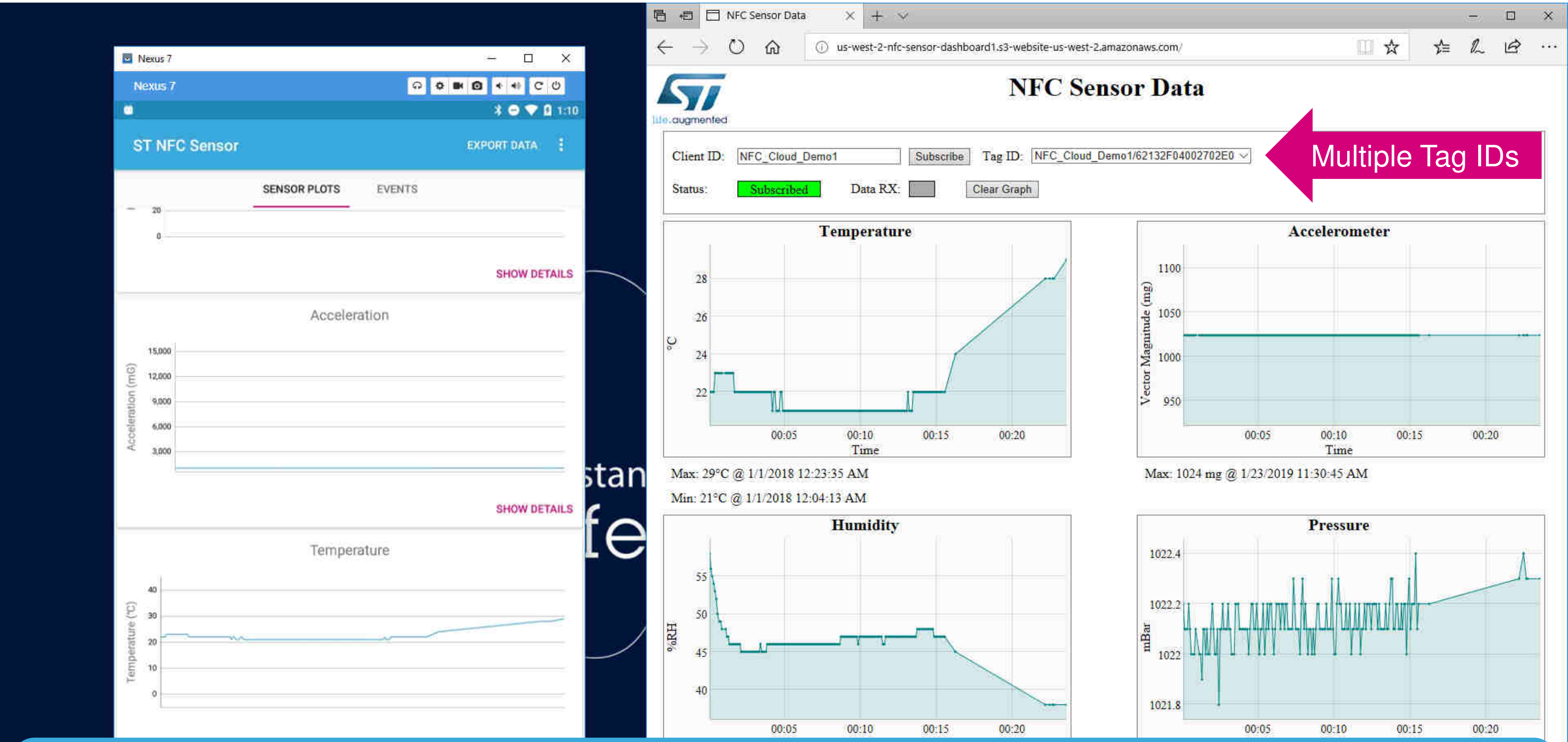
Max: 58% RH @ 1/1/2018 12:00:05 AM

Min: 38% RH @ 1/1/2018 12:22:11 AM

Max: 1022.4 mBar @ 1/1/2018 12:15:23 AM

Min: 1021.8 mBar @ 1/1/2018 12:02:25 AM

- When a NFC Sensor is now read from a tablet data will be displayed



NFC Sensor Data

Client ID: NFC_Cloud_Demo1

Tag ID: NFC_Cloud_Demo1/62132F04002702E0

Status: Subscribed

Data RX:

Max: 29°C @ 1/1/2018 12:23:35 AM

Min: 21°C @ 1/1/2018 12:04:13 AM

Max: 1024 mg @ 1/23/2019 11:30:45 AM

Multiple Tag IDs

At every tap from the NFC Sensor data will now be visualized both on the tablet and on the cloud dashboard.
EXAMPLE: Multiple users in different moments and with different handheld devices can now tap the same NFC Sensor and post on the same Cloud dashboard to rebuild a shipment history