# Getting started with the NFC card reader expansion board based on ST25R210 for STM32 and STM8 Nucleos

## Introduction

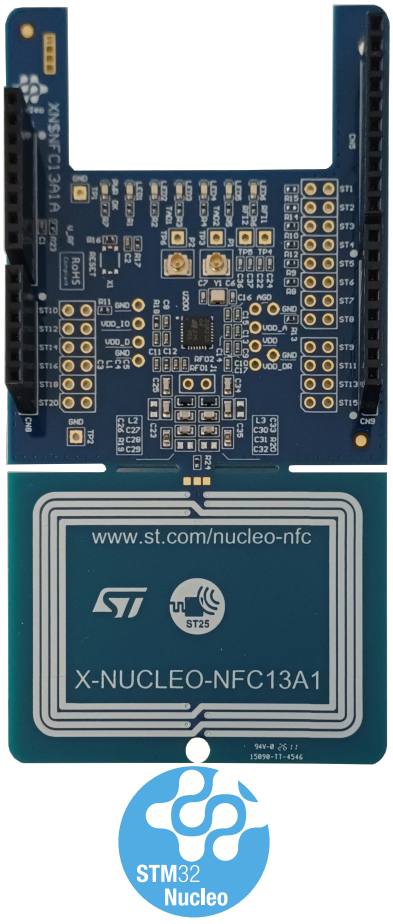
The X-NUCLEO-NFC13A1 NFC card reader expansion board is based on the ST25R210 device.

The expansion board is configured to support all five NFC Forum tag types in reader mode.

The ST25R210 manages frame coding and decoding in reader mode for standard applications. It supports ISO/IEC 14443 type A and B, ISO/IEC 15693 (single subcarrier only) and ISO/IEC 18092 communication protocols as well as the detection, reading and writing of NFC forum type 1, 2, 3, 4, and 5 tags.

Integrated HF reader/NFC initiator/NFC target IC with an antenna etched on the PCB and the related tuning circuit.

**Figure 1. X-NUCLEO-NFC13A1 expansion board**

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# 1 Getting started

## 1.1 Overview

The X-NUCLEO-NFC13A1 expansion board features:

- On-board NFC card reader and host card emulation IC: ST25R210
- NFC Forum NFC-A, NFC-B, NFC-F and NFC-V poller
- NFC Forum NFC-A, NFC-F listener
- Operation band 13.56 MHz
- Max generated magnetic field: -7.45 dBµA/m @ 10m, 44.05 dBµV/m @ 10m
- 13.56 MHz inductive antenna, 47 mm x 34 mm, four turns, etched on PCB and associated tuning circuit
- Compatible with a verity of STM32 Nucleo boards for easy and quick development
- Six general-purpose LEDs
- Equipped with Arduino UNO R3 connector
- Free comprehensive development firmware library compatible with STM32Cube and samples for ST25R210
- FCC certified
- RoHS and WEEE compliant

## 1.2 Board connection

Connect the X-NUCLEO-NFC13A1 to an STM32 Nucleo-64 development board via Arduino UNO R3 connectors.

The PC USB port has to be capable of delivering at least 300 mA at 5 V supply.

A green LED indicates whether the 5 V supply is present, while the six status LEDs are controlled via MCU.

Provision for unpopulated jumpers enable alternative connections of all lines (except the SPI) to the STM32 MCU.

To demonstrate the wake-up feature, two capacitive electrodes are placed on the PCB and the automatic antenna tuning variable capacitors are also implemented.

The board is connected to a power supply. It should be used on a clean and non-flammable surface.

## 1.3 Hardware requirements

The X-NUCLEO-NFC13A1 expansion board is designed to be used with any STM32 Nucleo board, although complete testing has been performed using the NUCLEO-L476RG hosting the STM32L476RG microcontroller.

The STM32 Nucleo firmware and the related documentation are available at http://www.st.com/stm32nucleo.

## 1.4 System requirements

To use STM32 Nucleo boards with the X-NUCLEO-NFC13A1 expansion board the following software and hardware are required:

- an STM32 Nucleo-64 development board
- a Windows® PC to install the firmware package
- a USB type A to Mini-B USB cable to connect the STM32 Nucleo board to the PC
- the unit must be supplied by a safety extra low voltage with falling characteristics (<5 V, <15 W), according to EN60950-1. This power supply has to be classified as ES1 (Electrical Source1), PS1 according to EN62368-1

To install the board firmware package (order code: X-CUBE-NFC13) the PC must have:

- 128 MB of RAM
- 40 MB of free hard disk space

The X-CUBE-NFC13 firmware and the related documentation are available at www.st.com.

# 2 Board setup

To set up the board:

**Step 1.** Connect the X-NUCLEO-NFC13A1 expansion board to the STM32 Nucleo board from the top through the Arduino® UNO R3 connectors

**Step 2.** Power the STM32 Nucleo board using a Mini USB B cable

**Step 3.** Program the firmware on the STM32 Nucleo board using the provided example

**Step 4.** Reset the MCU using the reset button available on the STM32 Nucleo board.
The evaluation kit is ready to be used.

# 3 Hardware

The X-NUCLEO-NFC13A1 expansion board allows the user to test the functionality of the ST25R210, which supports the reader/writer and the card emulation modes.

The ST25R210 IC module and the STM32 Nucleo board are connected through CN5, CN6, CN8 and CN9 connectors (see the tables below).

**Table 1. Interconnections between the X-NUCLEO-NFC13A1 expansion board and the NUCLEO-L476RG board (left side)**

| Signal | Connector | Pin number | NUCLEO-L476RG | X-NUCLEO-NFC13A1 |
|---|---|---|---|---|
| NC | CN6 Power | 1 | - | - |
| IOREF | | 2 | - | (NC) |
| RESET | | 3 | - | - |
| 3V3 | | 4 | - | 3V3 (VDD_IO) |
| 5V | | 5 | - | 5V (VDD) |
| GND | | 6 | - | GND |
| GND | | 7 | - | GND |
| VIN | | 8 | - | - |
| A0 | CN8 Power | 1 | PA0 | IRQ_MCU |
| A1 | | 2 | PA1 | MCU_LED1 |
| A2 | | 3 | PA4 | MCU_LED2 |
| A3 | | 4 | PB0 | MCU_LED3 |
| A4 | | 5 | PC1 | MCU_LED4 |
| A5 | | 6 | PC0 | MCU_LED5 |

**Table 2. Interconnections between the X-NUCLEO-NFC13A1 expansion board and the NUCLEO-L476RG board (right side)**

| Signal | Connector | Pin number | NUCLEO-L476RG | X-NUCLEO-NFC13A1 |
|---|---|---|---|---|
| D15 | CN5 Digital | 10 | PB8 | SCL_MCU |
| D14 | | 9 | PB9 | SDA_MCU |
| AVDD | | 8 | AVDD | NC |
| GND | | 7 | GND | GND |
| D13 | | 6 | PA5 | SCLK_MCU |
| D12 | | 5 | PA6 | MISO_MCU |
| D11 | | 4 | PA7 | MOSI_MCU |
| D10 | | 3 | PB6 | /SS_MCU |
| D9 | | 2 | PC7 | IRQ_MCU (alt.) |
| D8 | | 1 | PA9 | /SS_MCU (alt.) |
| D7 | CN9 Digital | 8 | PA8 | MCU_LED6 |
| D6 | | 7 | PB10 | MCU_LED6 (alt.) |
| D5 | | 6 | PB4 | /SS_MCU (alt.) |
| D4 | | 5 | PB5 | MCU_LED2 (alt.) |
| D3 | | 4 | PB3 | SCLK_MCU (alt.) |
| D2 | | 3 | PA10 | MCU_LED3 (alt.) |

| Signal | Connector | Pin number | NUCLEO-L476RG | X-NUCLEO-NFC13A1 |
|---|---|---|---|---|
| D1 | CN9 Digital | 2 | PA2 | NC |
| D0 | | 1 | PA3 | NC |

## 3.1 Host interface and GPIO connection

The X-NUCLEO-NFC13A1 expansion board contains the ST25R210-ANET chip and is powered by the STM32 Nucleo board.

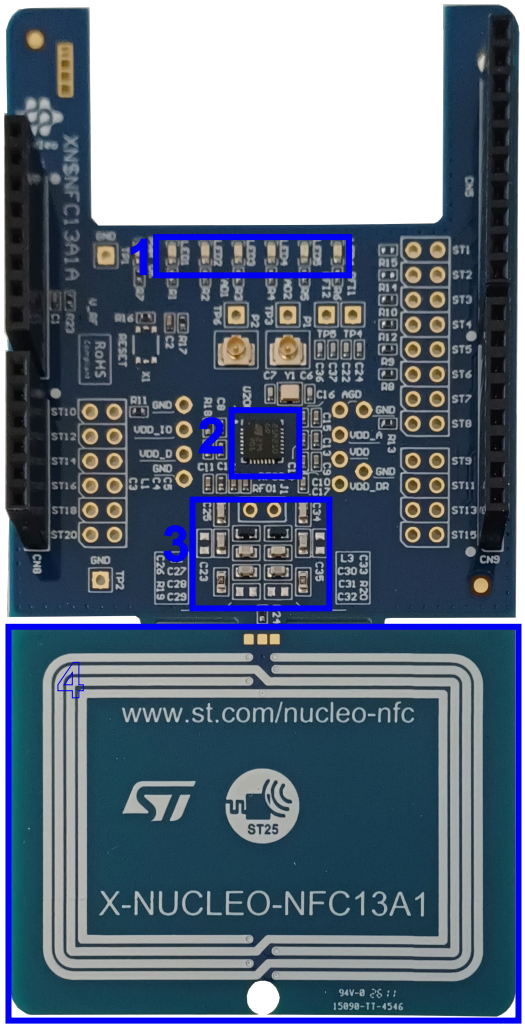
The ST25R210 is driven by the microcontroller via SPI interface.

The six LEDs indicate the detected RFID technology (for example, ISO14443 Type A for LED4).

## 3.2 X-NUCLEO-NFC13A1 expansion board component placement

**Figure 2. X-NUCLEO-NFC13A1 component placement**

1. General purpose LEDs
2. ST25R210
3. Matching circuit
4. 47x34 mm four-turn antenna



## 3.3 ST25R210 device

The ST25R210 is a high performance NFC universal device supporting NFC initiator, NFC target, NFC reader, and NFC card emulation modes.

The ST25R210 includes an advanced analog front end (AFE) and a highly integrated data framing system for:

- ISO 18092 passive and active initiator, ISO18092 passive and active target
- NFC-A/B (ISO 14443A/B) reader including higher bit rates
- NFC-F (Felica™) reader
- NFC-V (ISO 15693) reader up to 53 kbps
- NFC-A and NFC-F card emulation

Special stream and transparent modes of the AFE and framing system can be used to implement other custom protocols such as MIFARE® classic in reader or card emulation mode.

# 4 Regulatory compliance information

### Notice for US Federal Communication Commission (FCC)

Part 15.19

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment.

Part 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### FCC ID

FCC ID: YCPNFC13A1

### Notice for Innovation, Science and Economic Development Canada (ISED)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This class B device complies with Canadian Interference-Causing Equipment Standard ICES-003: CAN ICES-003(B) / NMB-003(B)

Conformité à Innovation, Sciences et Développement Économique Canada (ISDE)

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Cet appareil numerique de classe B est conforme à la Norme sur le Matériel Brouilleur NMB-003 du Canada: CAN ICES-003(B) / NMB-003(B).

### Notice for the European Union

The X-NUCLEO-NFC13A1 is in conformity with the essential requirements of the Directive 2014/53/EU (RED) and of the Directive 2011/65/EU (RoHS II), including subsequent revisions and additions, as well as amended by the Delegated Directive 2015/863/EU (RoHS III). Applied harmonized standards are listed in the EU Declaration of Conformity.

### Notice for the United Kingdom

The X-NUCLEO-NFC13A1 is in conformity with the relevant provisions of the following EU legislation recognized by the United Kingdom:

• Radio Equipment Regulations 2017 (S.I. 2017/1206) implementing Directive 2014/53/EU (RED)

• The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (RoHS) (S.I. 2012/3032) implementing Directive 2011/65/EU (RoHS II), including subsequent revisions and additions, as well as amended by the Delegated Directive 2015/863/EU (RoHS III).

Applied harmonized standards are listed in the UK Declaration of Conformity.

### IC certified

IC certified, with IC: 8976A-NFC13A1; PMN: X-NUCLEO-NFC13A1 ; HVIN: X-NUCLEO-NFC13A1.

# 5 Ordering information

Table 3. **Order Code**

| Order Code | Description | PCB version |
|---|---|---|
| X-NUCLEO-NFC13A1 | Expansion board based on ST25R210 for STM32-NUCLEO | XN$NFC13A1A |

# Revision history

Table 4. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 13-May-2026 | 1 | Initial release. |
| 27-May-2026 | 2 | Updated Section 1.1: Overview. |

# Contents

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