
ST25R200 Eval GUI for the STEVAL-25R200SA kit

Introduction

The PC software package (STSW-ST25R019) contains the ST25R200 Eval GUI and the ST25PC-NFC software (STSW-ST25PC001).

The ST25R200 Eval GUI allows the user to communicate with the ST25R200 evaluation board (STEVAL-25R200A). It provides an interface to change a wide range of settings. It also allows different features of the STEVAL-25R200SA kit to be executed and evaluated. This user manual provides a detailed description of the ST25R200 Eval GUI.

The ST25PC-NFC software (STSW-ST25PC001) allows access to all features of the ST25 NFC/RFID tags and ST25 dynamic NFC tags. It is not the object of this user manual.

The PC software must be used with the ST25R200 evaluation board, which contains all the necessary modules for a fully functional NFC reader.

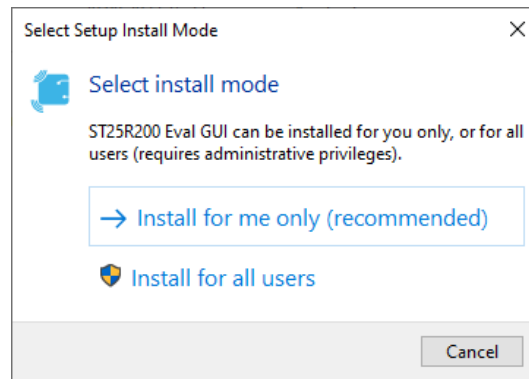
1 Preface

1.1 Downloading and installing the software

After downloading the software (available at st.com), double-click the executable file to begin the installation.

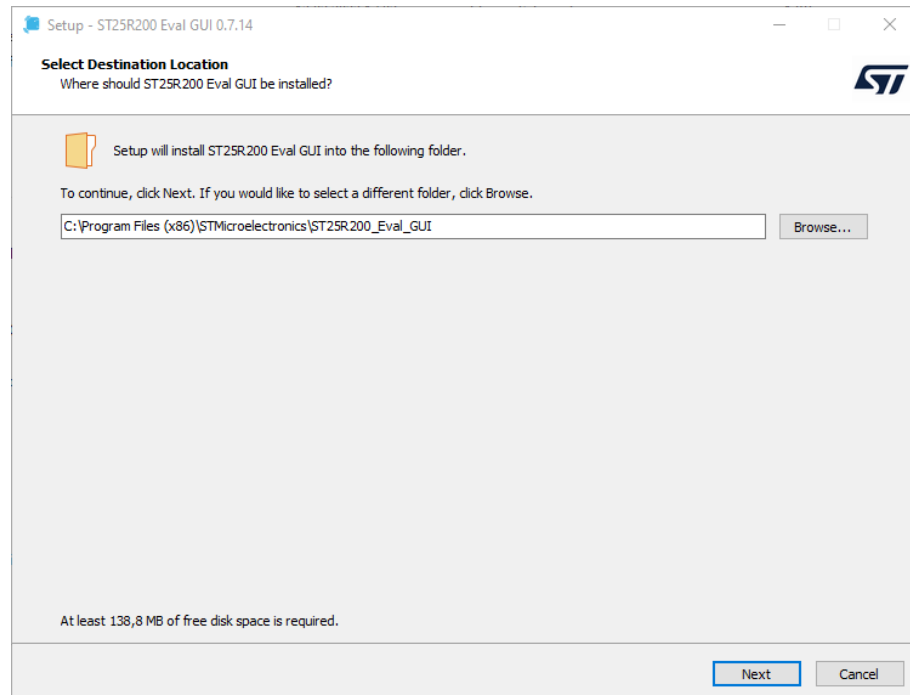
- Select whether to install the software for each user of the PC or only for the current user.

Figure 1. Selecting install mode



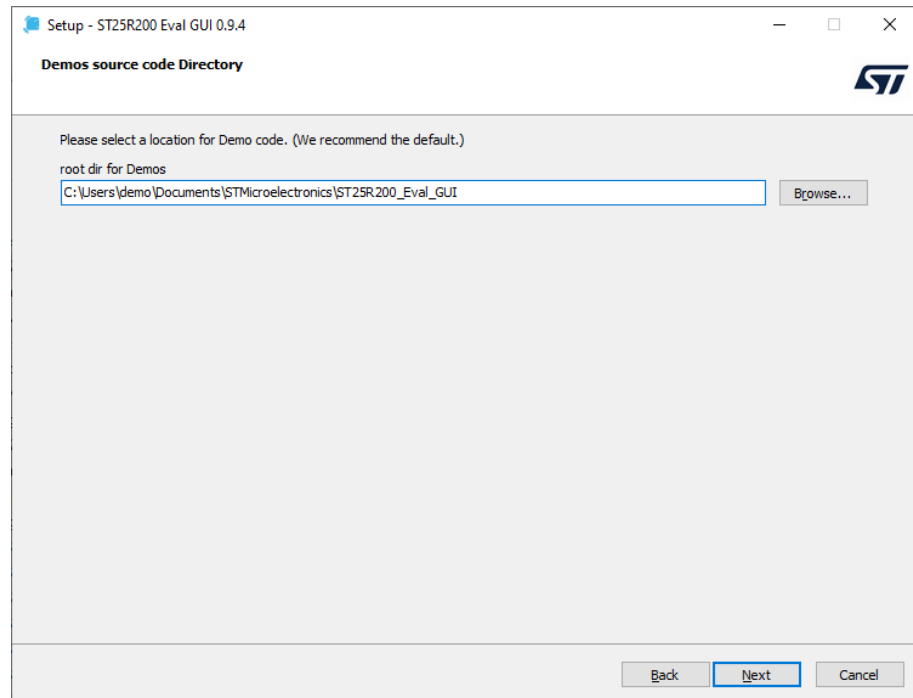
- Select the path to install the software.

Figure 2. Selecting the program destination



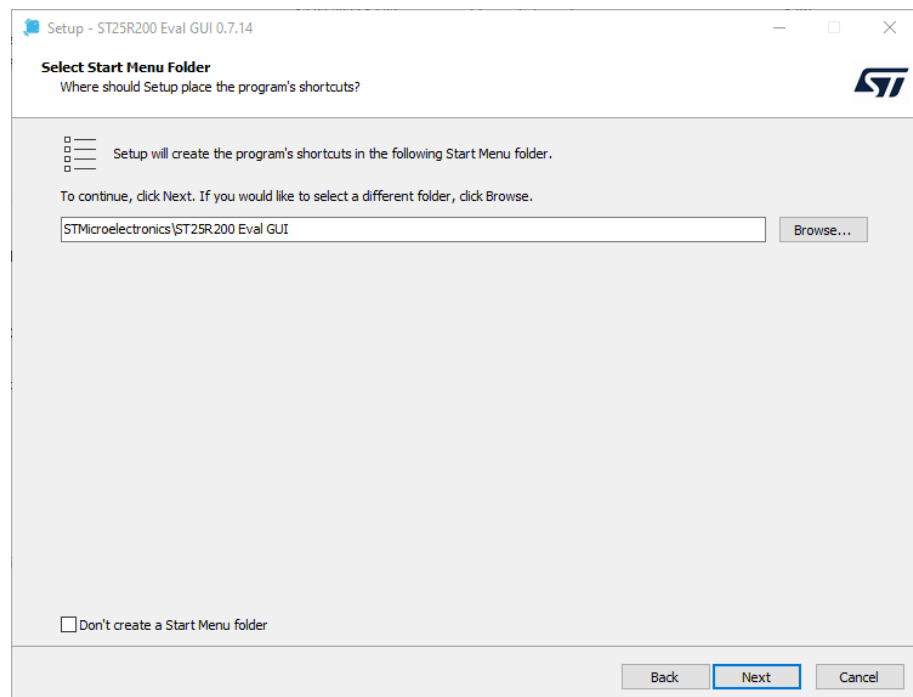
- Select the location for the demo file.

Figure 3. Selecting the demos source code directory



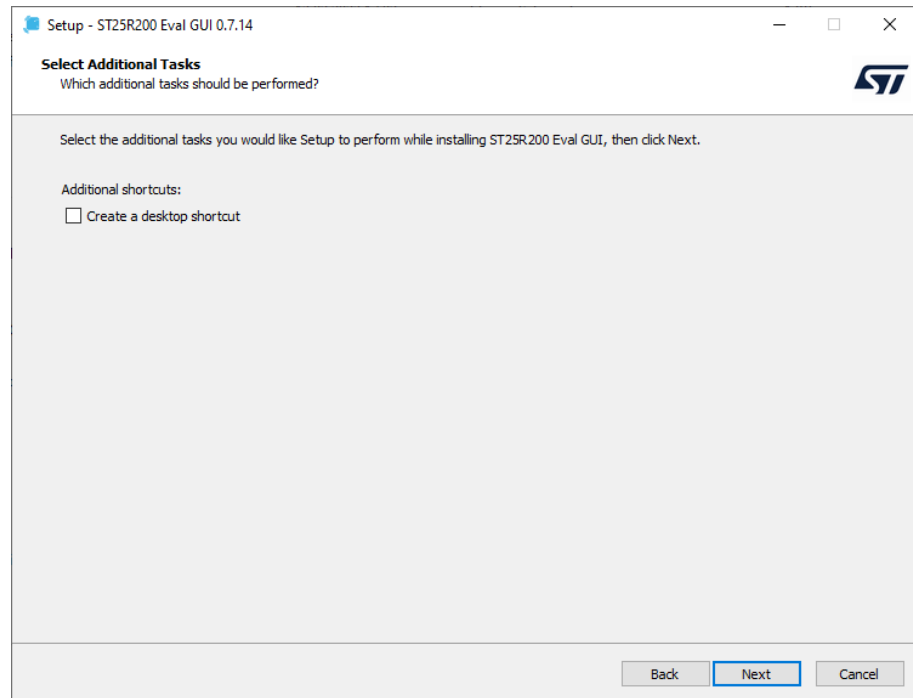
- It is possible to add the ST25R200 evaluation GUI to the start menu. This is recommended to allow the user to always find the software easily using the Windows® search function. If the user does not want to add the software to the start menu, they just need to tick the checkbox in the bottom left corner of the window.

Figure 4. Selecting a start menu folder



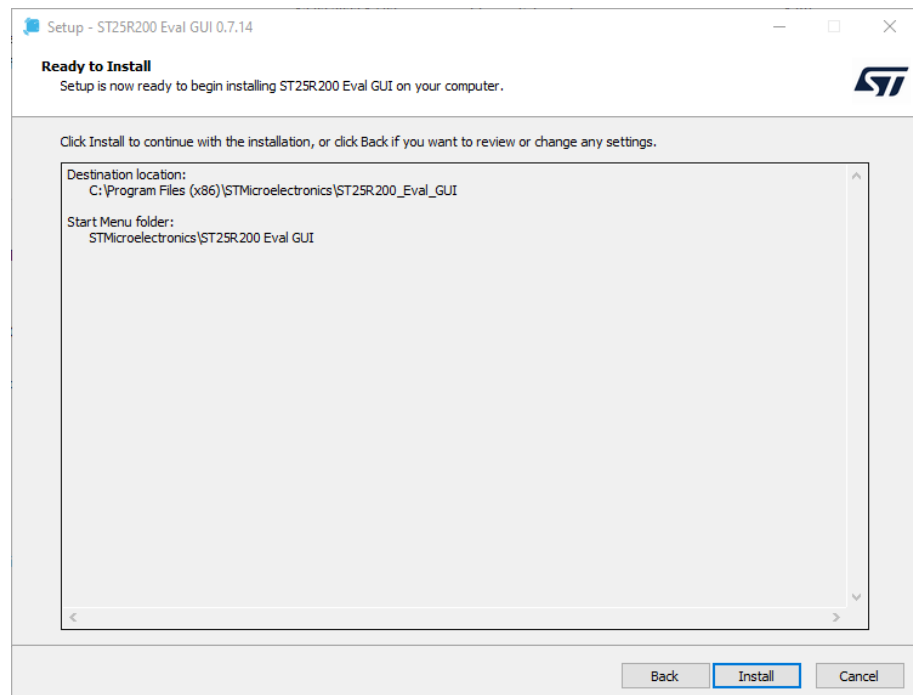
- To create a shortcut on the desktop, tick the checkbox shown below.

Figure 5. Creating a desktop shortcut



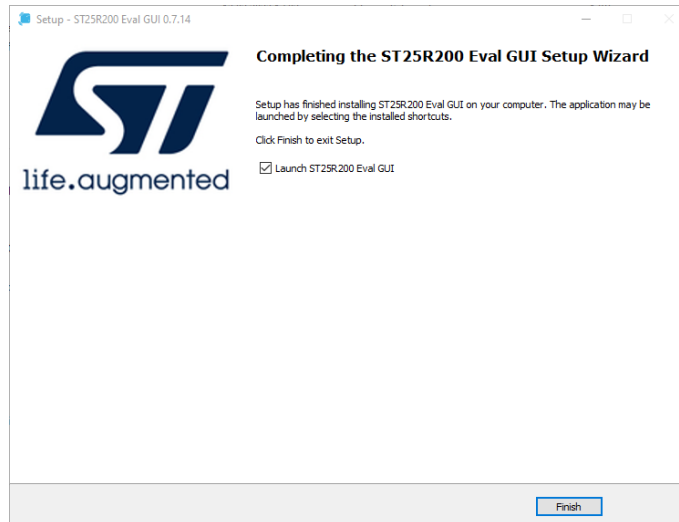
- The figure below shows a summary of the selected installation directories. Click install.

Figure 6. Ready to install



- Installing takes no more than a few minutes to complete. Launch the application by clicking the finish button.

Figure 7. Installation completed



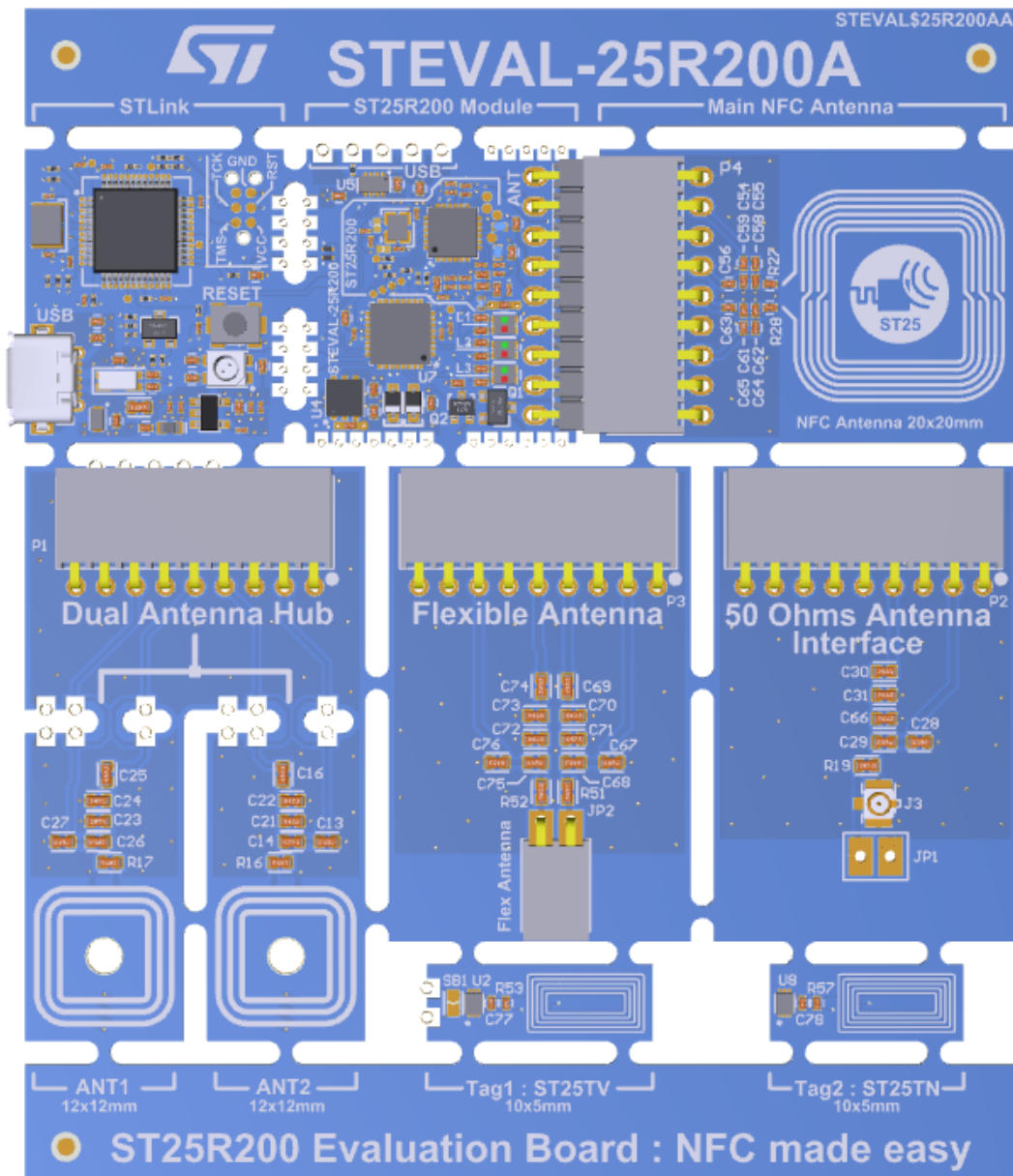
Note: This software is only available for PCs running on Microsoft® Windows®.

1.2 Hardware preparations

The ST25R200 evaluation board (STEVAL-25R200A) consists of an STLINK module, an ST25R200 core module, and various antenna modules.

The STLINK module allows easy programming and debugging of the firmware and acts as a communication interface for the ST25R200 core module. The ST25R200 core module consists of an STM32G0 MCU and an ST25R200 NFC reader.

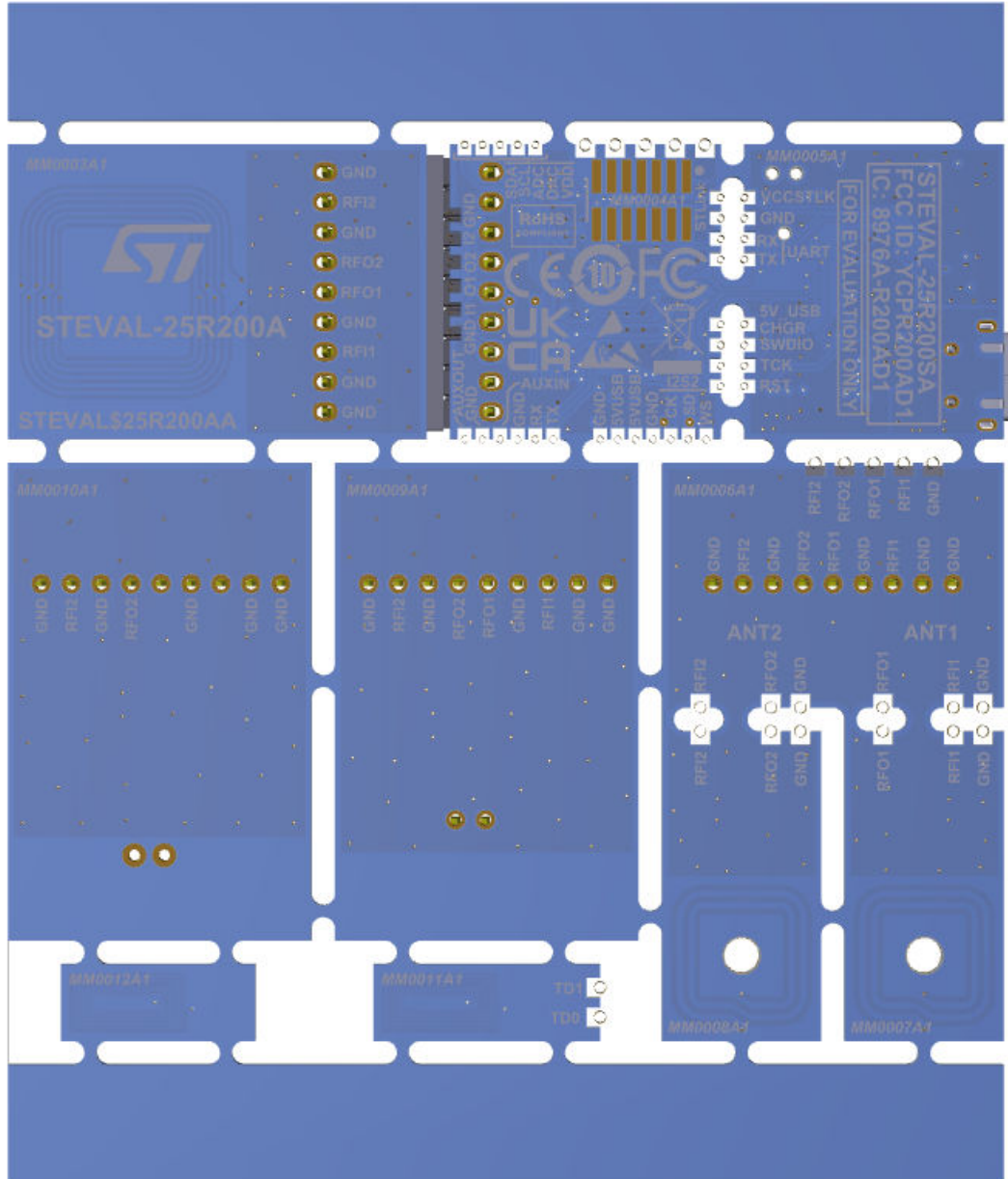
Figure 8. ST25R200 evaluation board - top view



All three modules are connected by default. The user can also use the other antenna modules. The STEVAL-25R200SA kit is described in a separate user manual (UM3199).

The AUXIN and AUXOUT pins are located at the bottom of the board. These are for general use and are displayed in reader + tag demo mode as described in Section 3.2: Reader+Tag Demo tab.

Figure 9. ST25R200 evaluation board - bottom view



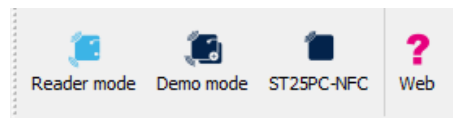
2 Reader mode

The application offers two different GUI modes:

- **Reader mode**
It allows the user to explore a wide range of functions in detail.
- **Demo mode**
A more compact mode that provides a simpler and more intuitive interface for demonstration purposes

This section provides an overview of all the functions available in reader mode.

Figure 10. GUI modes



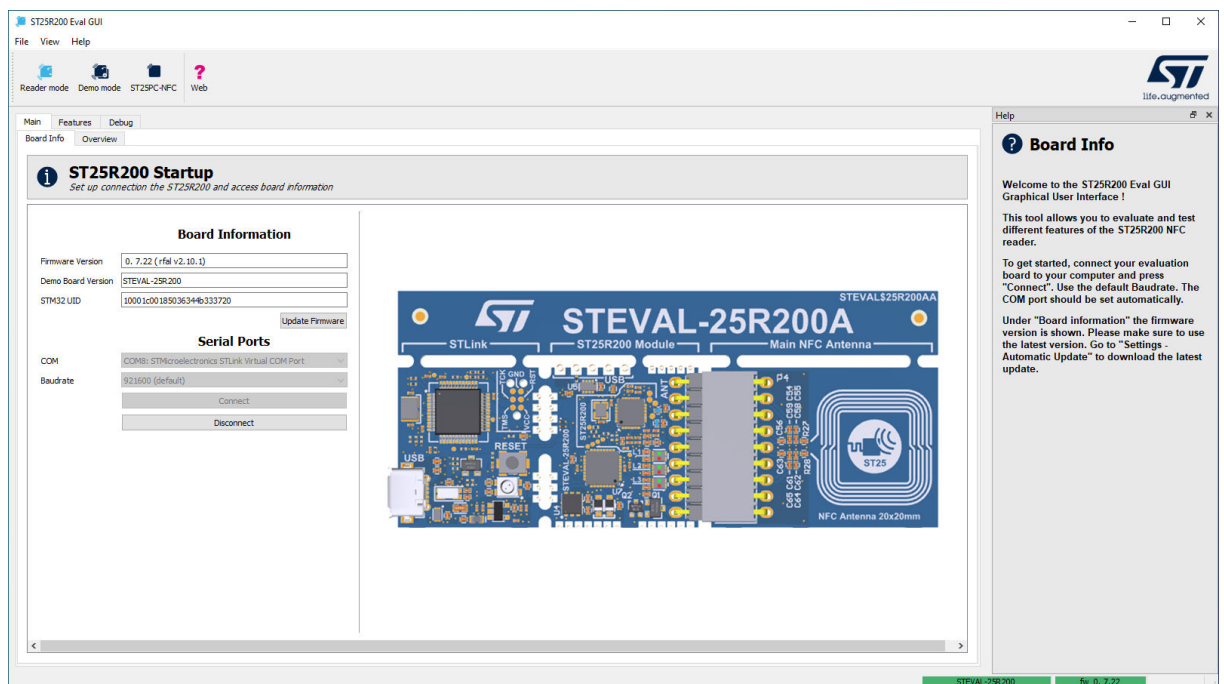
The brighter blue color indicates that reader mode is enabled. To change the mode, click on the appropriate icon. The third icon launches the ST25PC-NFC GUI application (see st.com for more information on it).

2.1 Main tab

The **Main** tab contains the **Board Info** tab and the **Overview** tab.

2.1.1 Board Info tab

Figure 11. Board Info tab



The **Board Info** tab allows the GUI to be connected to the ST25R200 evaluation board. To connect a board, ensure that the correct COM port and baud rate are selected.

When a board is connected, this tab displays basic information about the connected hardware.

- **Firmware version**
The firmware version currently running on the MCU.
- **Demo board version**
The type of demonstration board.
- **STM32 UID**
The unique ID of the STM32 on the ST25R200 core module.

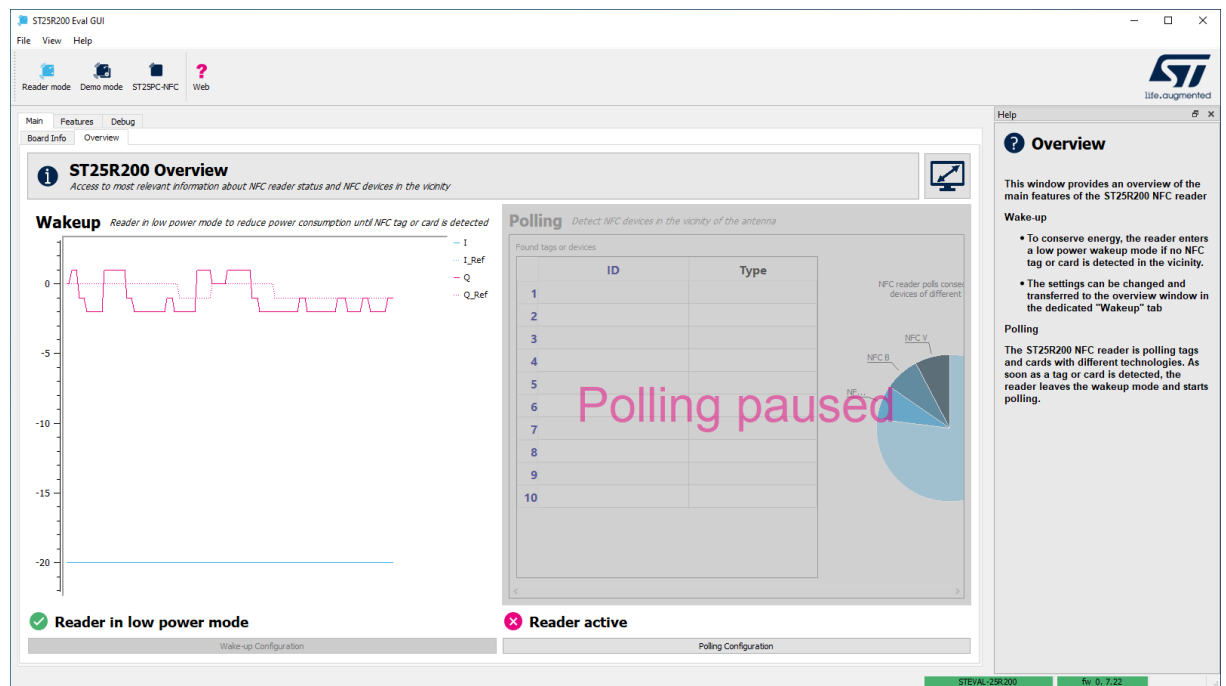
The **Update Firmware** button allows the user to update the firmware running on the STM32G0 on the core module. See [Section 4.2: Updating the firmware](#) for more information.

2.1.2 Overview tab

The **Overview** tab is a quick demonstration showing a typical NFC application combining wake-up mode and NFC polling. As soon as wake-up mode detects a variation, standard NFC polling is performed and the cards/ devices found are listed.

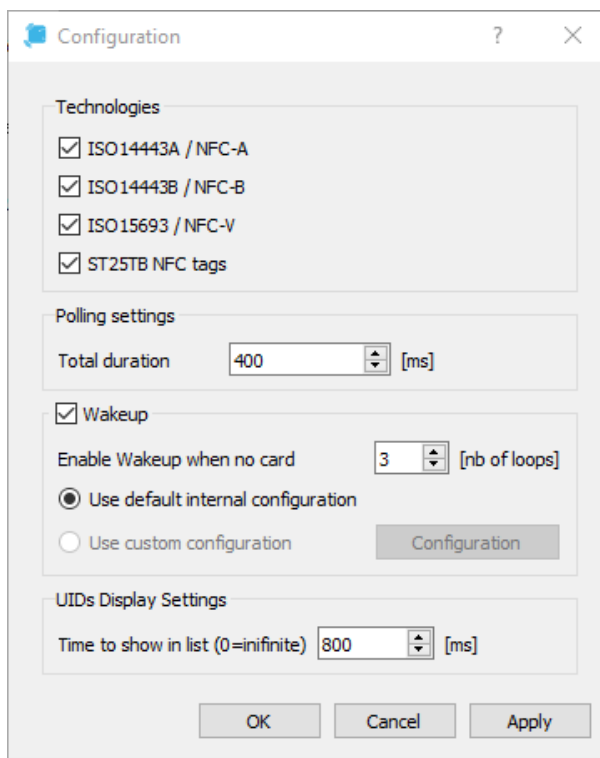
The demonstration remains in polling mode until no more cards/devices are detected.

Figure 12. ST25R200 overview



A small window with settings opens after clicking on the **Polling Configuration** button.

Figure 13. Polling configuration



These settings allow the user to enable/disable polling for different technologies. It is also possible to enable polling only and not to perform a wake-up.

To view the tab in full screen, click on the extended view icon.

Figure 14. Extended view



Click the same button again to exit full screen mode.

2.2 Features tab

This tab allows the user to discover the different features of the ST25R200 in the subtabs. Each subtab represents a feature and provides different settings for the corresponding functionality.

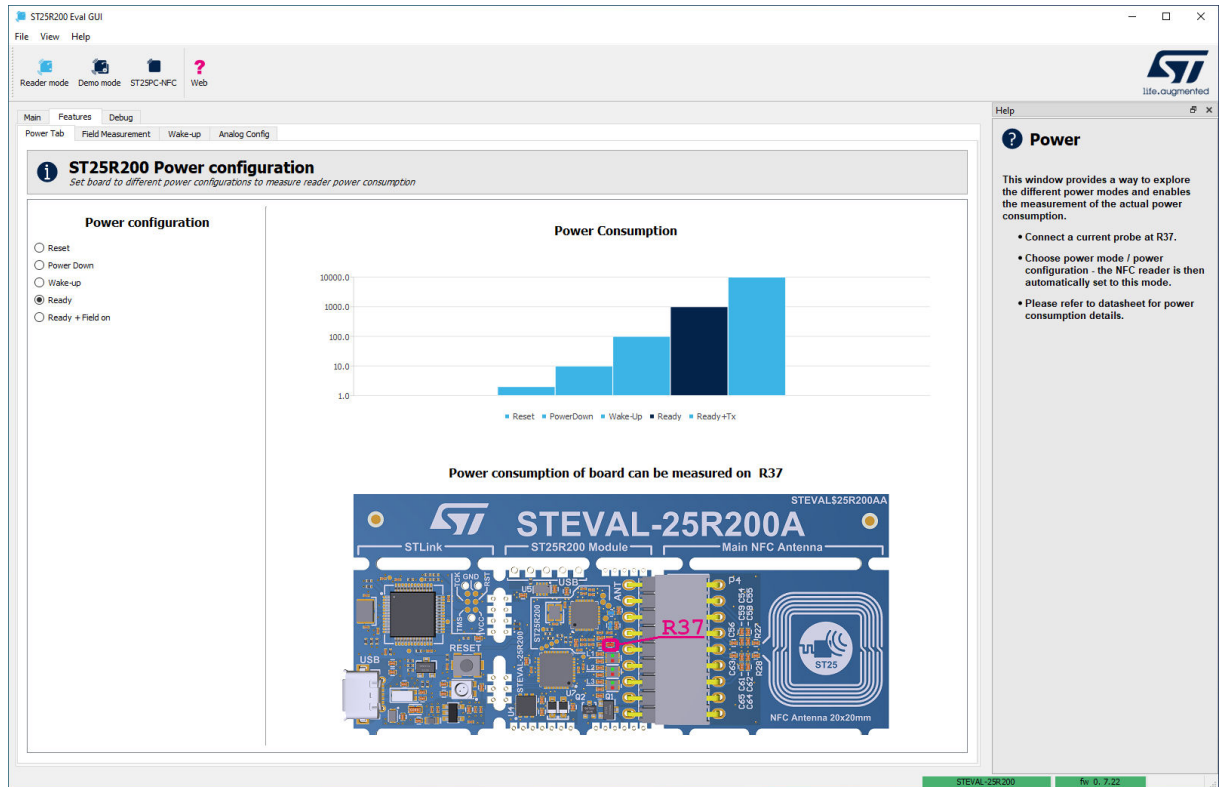
2.2.1 Power tab

The **Power** tab allows the user to set the ST25R200 to five different modes:

- Reset
- Power-down
- Wake-up
- Ready
- Ready + Field on

Each mode has a different power consumption (use the pins of R37 to measure the actual power consumption of the chip. For more details, refer to UM3199). The mode can be changed using the radio buttons on the left. The bar graph on the right side visualizes the different power consumption of the different modes. The currently selected mode is highlighted by a darker color in Figure 15.

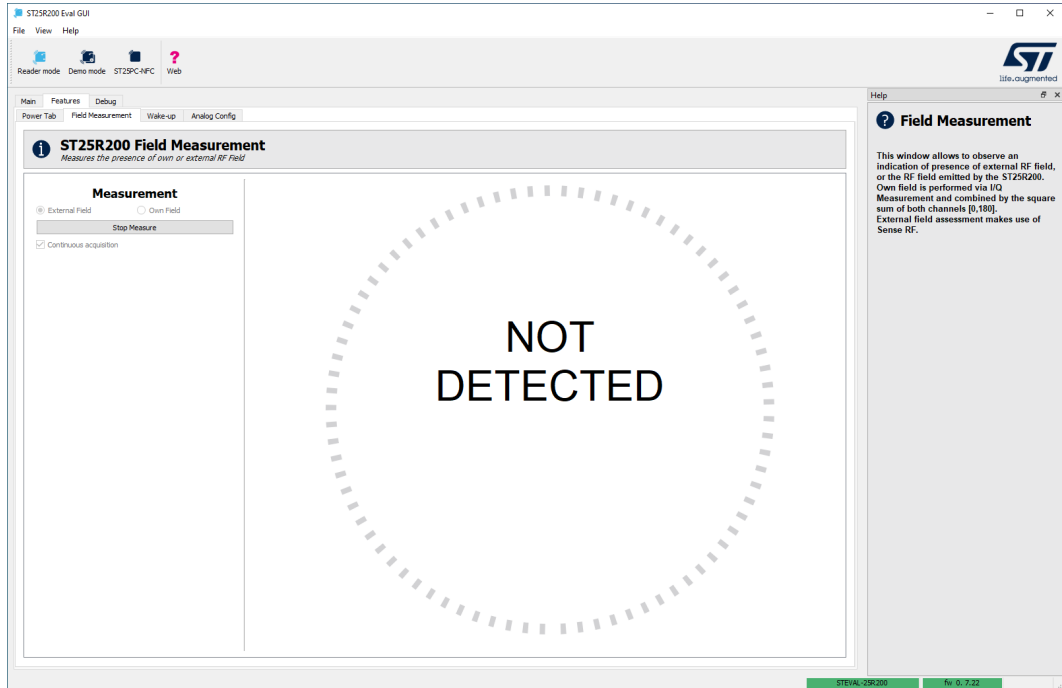
Figure 15. Power consumption



2.2.2 Field Measurement tab

This tab displays the intensity of the ST25R200's own field and the presence of an external field. It is possible to switch between these options using two radio buttons.

Figure 16. ST25R200 Field Measurement

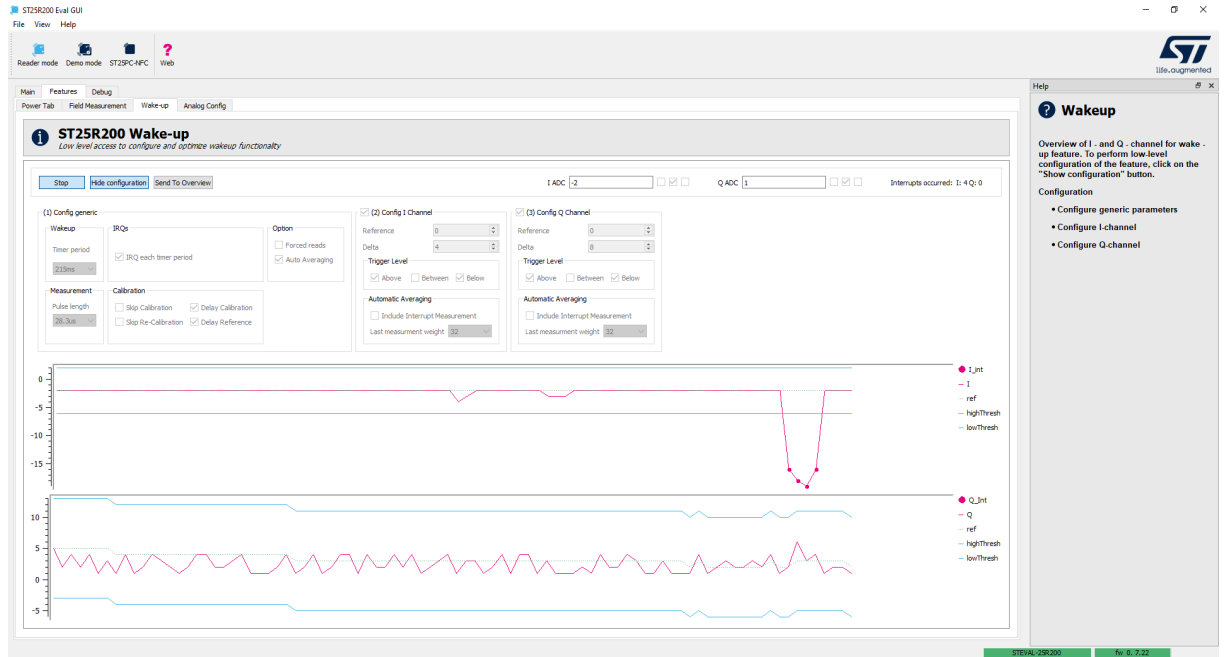


Click the **Measure** button to take a single measurement. If the continuous acquisition checkbox is selected, clicking the measure button starts repeated measurements. To stop the measurement, click on **Stop Measure**. The result of the measurement is visualized in the center of the tab with a numerical value and a circular element.

2.2.3 Wake-up tab

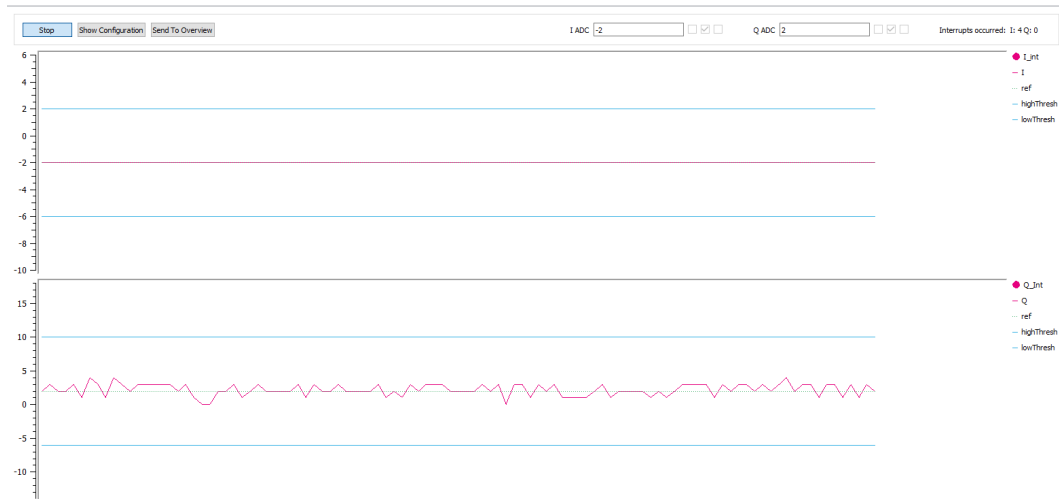
The wake-up mode uses very low power to detect if an object has entered the reader field. The field is switched on for a short time to measure whether an object has entered the field. The measurement provides the I and Q channel values. For more information, see the ST25R200 datasheet (DS13658) and application note (AN5993). Two graphs show the measured I and Q values. Click the **Start** button to start wake-up mode. The graphs in pink correspond to the measured values. The blue-colored graphs represent the upper and lower thresholds. The last measured I and Q ADC values are displayed above the two graphs.

Figure 17. Wake-up tab with the configuration shown



By default, a wake-up is triggered when the pink line (measurement) crosses one of the blue lines (threshold). When a wake-up interrupt is triggered, the pink line is marked with a circle.

Figure 18. Wake-up tab with the configuration hidden



Click on the **Show configuration** button to display the wake-up mode settings. These settings are mainly those found in the ST25R200 datasheet (DS13658). To change the settings, stop wake-up mode if it is currently enabled.

Figure 19. Wake-up configuration shown

Click the **Send To Overview** button to apply the selected settings to the wake-up functionality provided by the **Overview** tab (refer to [Section 2.1.2: Overview tab](#)).

2.2.4 Analog Config tab

This tab contains important configuration settings required to set chip-specific configurations for different technologies and bitrates at different operating times. The concept of analog configuration is part of the RFAL library and is used throughout the different ST25R devices. See the RFAL user manual (UM2890) for more details.

Figure 20. ST25R200 Analog Config tab

Function	Register	Mask	Value	RAW String
1	0001	0C	0C	R:0001 M:0C V:0C
2	Enables AM regulator	<input checked="" type="checkbox"/>		R:0000 M:08 V:08
3	Regulator AM enable	<input checked="" type="checkbox"/>		R:0004 M:01 V:01
4	TX Modulation1: am_mod	12%		R:0004 M:F0 V:40
5	d_yes	1 * Rfco		R:0003 M:0F V:00
6	en_subc_end	(BPSK only)/Fast subcarrier end de		R:000D M:10 V:10
7	Gain in WU mode/measurements (afe_gain_ld)	14 dB		R:0007 M:0F V:04
8	reg_s	Regulated voltages are defined by		R:0001 M:01 V:01
9	Regulator target voltage (rege)	VDD_A: 3.34 V VDD_DR: 3.34 V		R:0002 M:1F V:09

The **Analog Config** tab is divided into the **Mode**, **Functions**, **Actions**, and **Hashes** sections.

Mode

The **Mode** section provides a drop-down box containing several chip-specific supported technologies and events. A specific mode can be added to the mode list. This makes it easy to have individual settings for all transmit and receive modes. The **CHIP_INIT** mode sets global registers that must be used independently of other selected modes. For example, the pull-down of SPI lines can be enabled.

Functions

The **Functions** section contains register values associated with modes. A function consists of a name, the corresponding register, a mask, and the required value for the register. Frequently used functions can be selected from the drop-down box and added to the functions list. These functions are already defined and can be selected from a drop-down box.

For better readability, modes can be ordered using the up and down arrows in the mode section.

Attention: *Be careful when defining the same registers or functions for multiple entries in the mode list: for example, if a function is added to ISO 14443A and not restored in ISO 14443B mode, it is also applied to ISO 14443B.*

Actions

The **Actions** buttons complete the analog configuration concept. They read and write information to the board or to the PC.

The **Read from board** button reads the analog configuration from the connected board.

Note: *The values currently displayed on the GUI are overwritten.*

The **Write to board** button writes the current configuration from the **Analog Config** tab to the connected board.

Note: *If the **Analog Config** tab is left empty, the board remains with its stored values.*

The **Load from file** button is used to load a previously saved configuration file into the **Analog Config** tab. Use **Write to board** to write these newly loaded settings to the connected board.

The **Save to file** button saves the current configuration in the **Analog Config** tab to the file system. The **Generate custom code** button can be used to automatically generate a C header file for direct inclusion in a compiled firmware image. See the RFAL user manual (UM2890) for further details.

Hashes

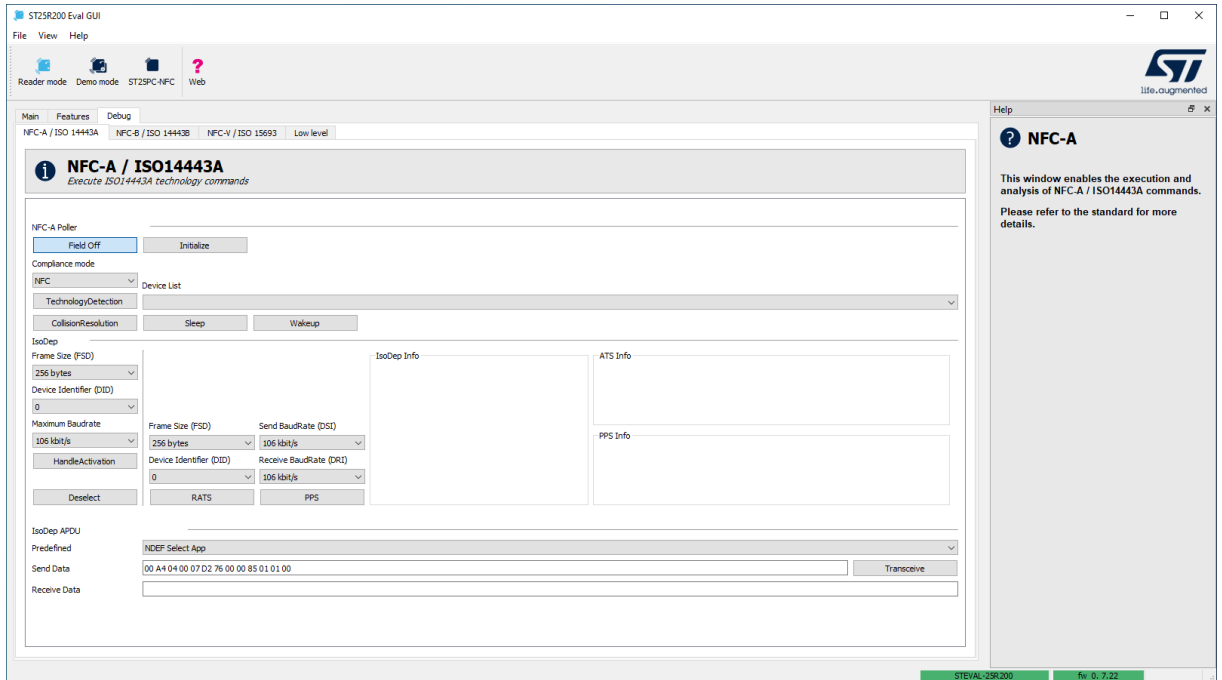
The **Hashed** section shows the analog configuration hashes currently loaded into the different areas. The **FW active (RAM)** field is the configuration currently in use. It can be different from the **FW stored (Flash)** field. The **FW stored (Flash)** field contains the hash value that is loaded when the chip is switched on. It is possible to load an analog configuration temporarily until the chip is switched off and on again. Click on **Write to board** without ticking the **Store to flash** checkbox to load a temporary configuration.

2.3 Debug tab

The **Debug** tab allows the user to access the ST25R200 at lower levels. Specifically, the user can explore the different technologies in detail using the **NFC-A / ISO 14443A**, **NFC-B / ISO 14443B**, and **NFC-V / ISO 15693** subtabs. The **Low level** subtab is not dedicated to a specific technology. It allows the user to control the assembled reader chip using chip specific commands as specified in the DS13658 datasheet.

2.3.1 NFC-A / ISO 14443A tab

Figure 21. NFC-A/ISO 14443A tab

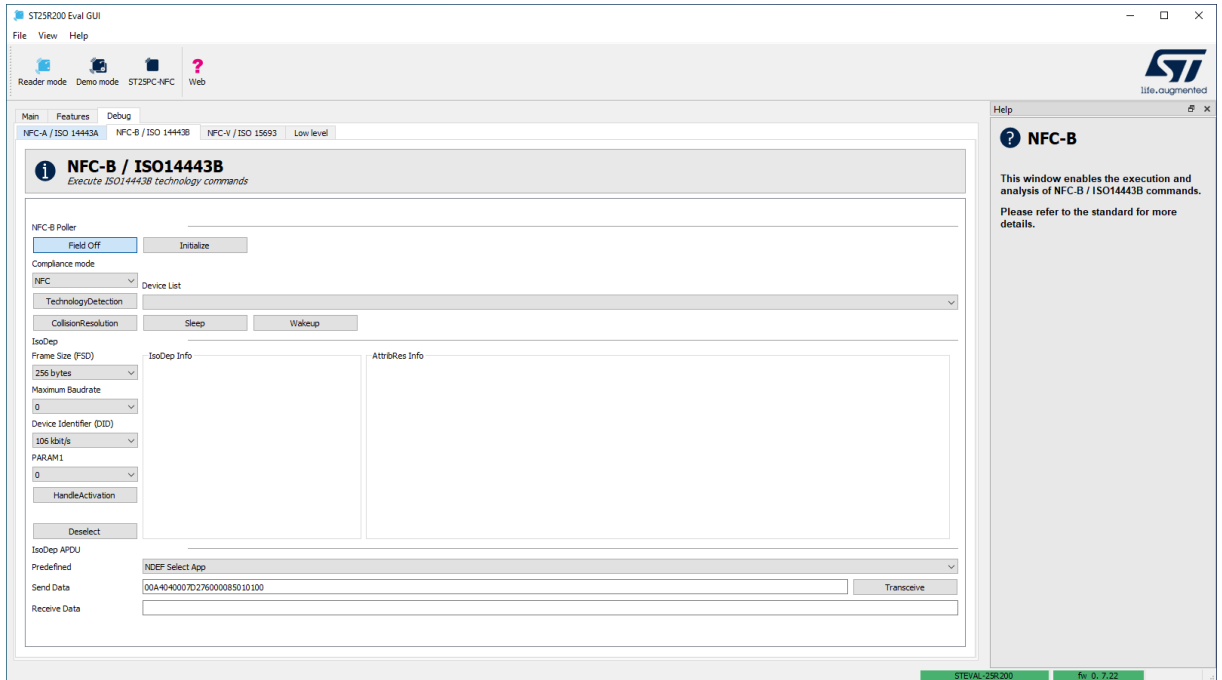


The **NFC-A / ISO 14443A** tab allows the execution/debugging of the different stages of NFC-A technology in accordance with the NFC Forum™/ISO 14443A standard. The GUI highlights the next button to click to assist the user. If the button is clicked and the operation is successful, the next suggested button is highlighted in blue. If a card is present, successful communication guides the user through the **TechnologyDetection** and **CollisionResolution** steps. The user then activates the card by clicking **HandleActivation**. After activation of the card, the user sends predefined or custom commands to the card using the **Transceive** button.

Note: **NFC Forum** and the **NFC Forum** logo are trademarks of the Near Field Communication Forum.

2.3.2 NFC-B / ISO 14443B tab

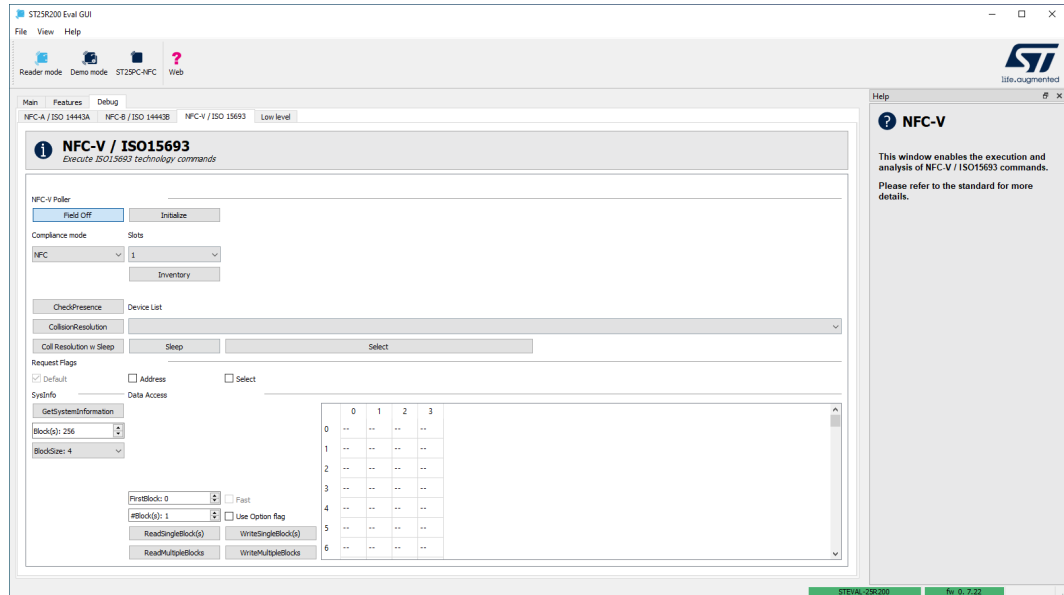
Figure 22. NFC-B / ISO 14443B tab



The **NFC-B / ISO 14443B** tab provides functionality to execute/debug the different stages of NFC-B communication according to the NFC Forum™/ISO 14443B standard. The GUI assists to the user by highlighting a suggestion of the next button to press. The highlighted buttons take the user through the **Initialize**, **TechnologyDetection**, **CollisionResolution**, and **HandleActivation** steps.

2.3.3 NFC-V / ISO 15693 tab

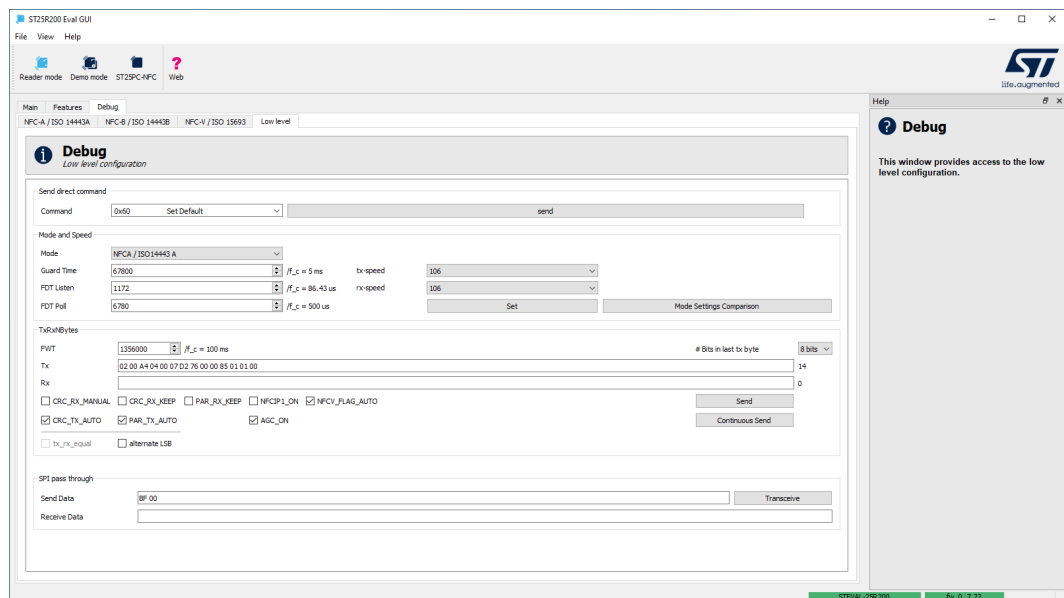
Figure 23. NFC-V / ISO 15693 tab



The **NFC-V / ISO 15693** tab provides functionality to execute/debug the different stages of NFC-V communication according to NFC Forum™ /ISO 15693. It provides help to the user by highlighting buttons to press. The highlighted buttons guide the user through the **Initialize**, **CheckPresence**, and **CollisionResolution** steps. After that, it is possible to execute **ReadSingleBlock(s)** to read one block of the card memory.

2.3.4 Low level tab

Figure 24. Low level tab

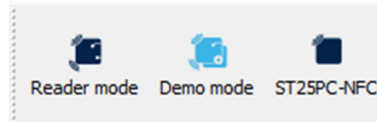


The **Low level** tab allows direct control of the ST25R200 reader mounted on the board. For details, see the ST25R200 datasheet (DS13658).

3 Demo mode

The demo mode displays certain features of the ST25R200 with a richer visual interface, including full screen support. To activate demo mode, click on the demo mode button in the toolbar.

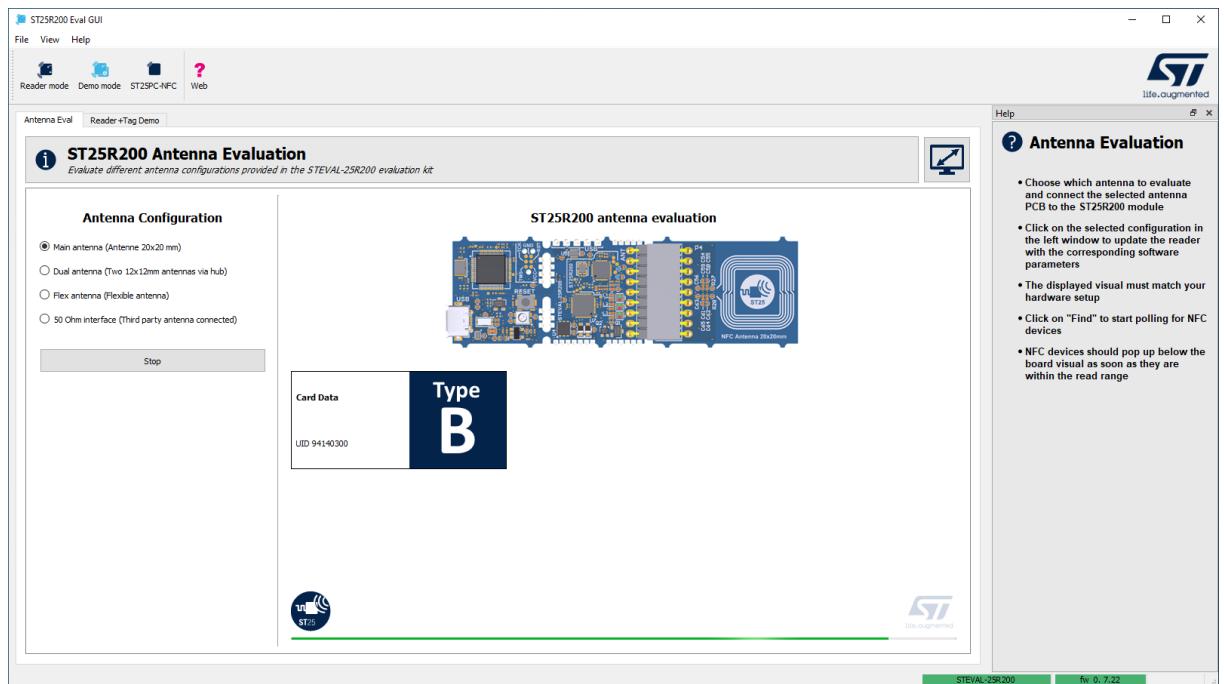
Figure 25. ST25R200 toolbar



3.1 Antenna Eval tab

In this tab, it is possible to select the current antenna configuration of the ST25R200 evaluation board and start the polling loop for this specific configuration. The radio button is used to toggle between the antenna configurations. A click on find activates the polling loop.

Figure 26. ST25R200 Antenna Eval tab



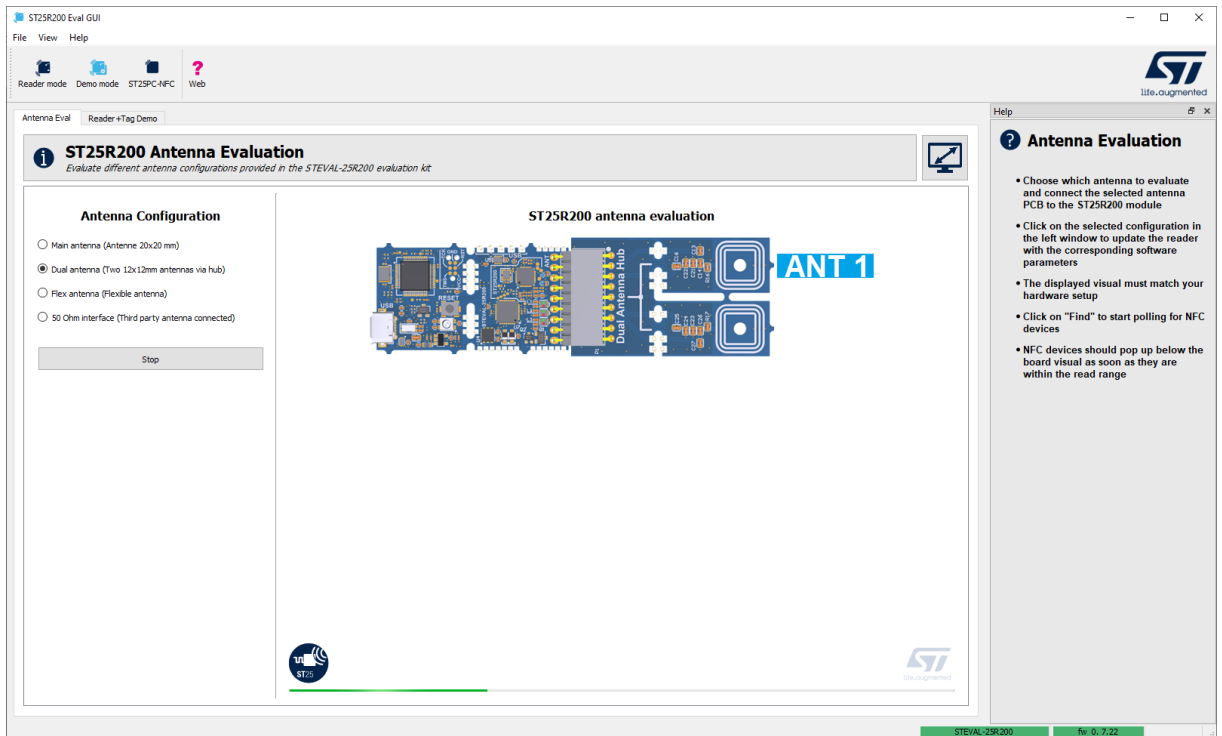
The image shows basic information about the tag found.

Figure 27. Tag information



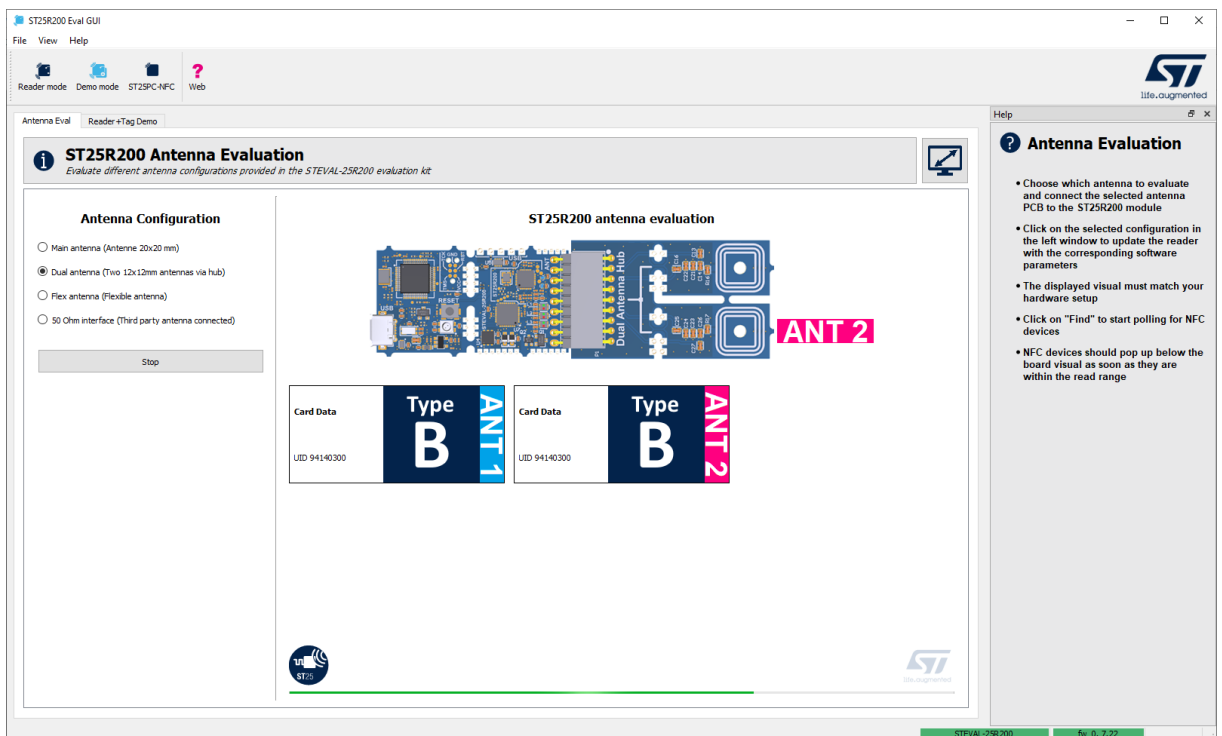
In dual antenna mode, the map information indicates which antenna it is detected on.

Figure 28. ST25R200 dual antenna mode



The above figure shows a PCB with two NFC coils, each of which polls independently. The following figure shows when an antenna detects a card.

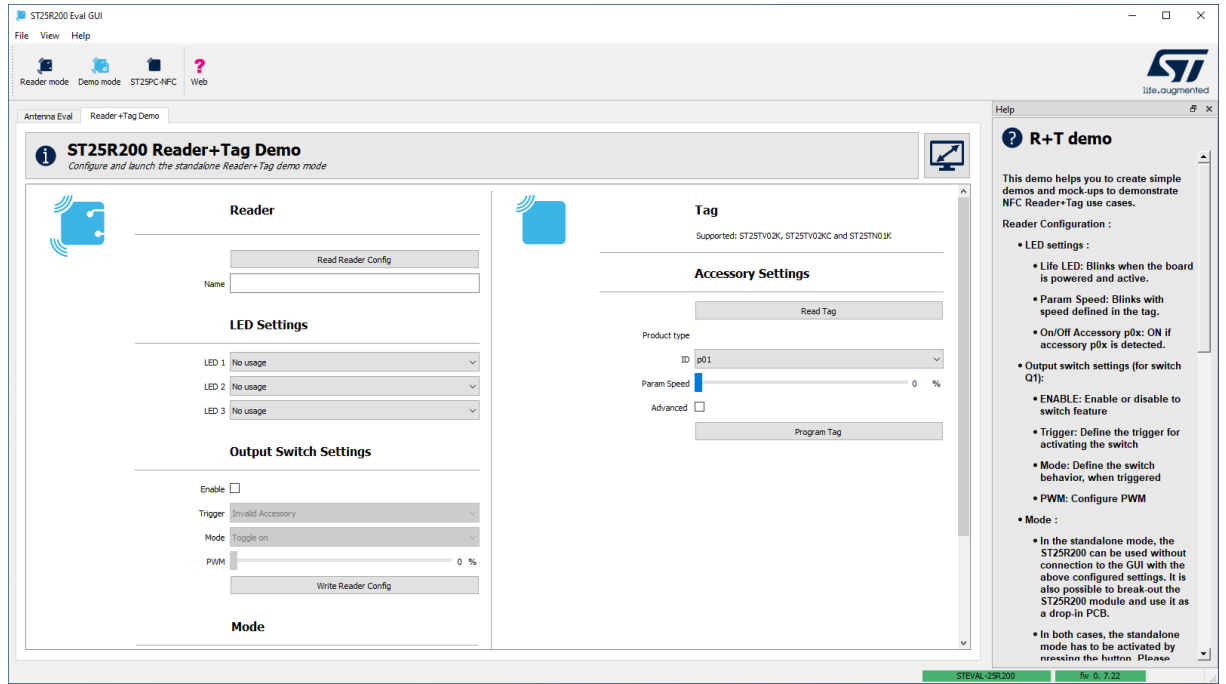
Figure 29. Antenna detection



3.2 Reader+Tag Demo tab

This tab allows rapid prototyping of NFC use cases. For example, the user can use a tag to turn on an electrical component.


Figure 30. Reader+Tag Demo tab



As illustrated above, the tab is divided into two sections, one for the reader, the other for the tag.

- The right section represents the tag**
 The user can place a tag on the reader, then read it or write to it using the **Read Tag** and **Program Tag** buttons. When writing a tag, it is possible to assign one of four IDs to the tag (ID: p01 to p04). The speed parameter is another property that can be set. The reader can read this speed setting, which allows an action to be performed at a slower or faster speed. The **No. of Usage** field represents the number of times the tag has been used in the demonstration.

Figure 31. Tag section



Tag

Supported: ST25TV02K, ST25TV02KC and ST25TN01K

Accessory Settings

Read Tag

Product type ST25TV02KC

ID p03

Param Speed 12 %

Advanced

No. of Usage 6

Usage time 0 sec


Signature Valid


Authenticated Yes

Clear authentication hash

URI <https://myst25.com/st25-eConnect/index.html?rt=>

Program Tag


ST25 NFC / RFID Tags


ST25PC-NFC

- The left section represents the reader**
 When a tag has been programmed with an ID (of p01 to p04 as explained above), the user can select an action from the drop-down menu to the right of the **LED1/2/3** fields as illustrated below.

Figure 32. Drop-down menu



For example, the user can select "On/Off Accessory: p0x" with x = 0 to 4, where p0x is the ID of the tag. After selecting an action, click the **Write Reader Config** button to flash the MCU. The demonstration is now set up. To start it, click the **Start Standalone Demo** button. If the user now places a tag with the correct ID on the reader, the corresponding LED lights up.

Note: The tag can be assigned to any ID using the controls on the right side of the tab as described above in *The right section represents the tag.*

Figure 33. Reader section



Reader

Read Reader Config

Name

LED Settings

LED 1

LED 2

LED 3

Output Switch Settings

Enable

Trigger

Mode

PWM

Write Reader Config

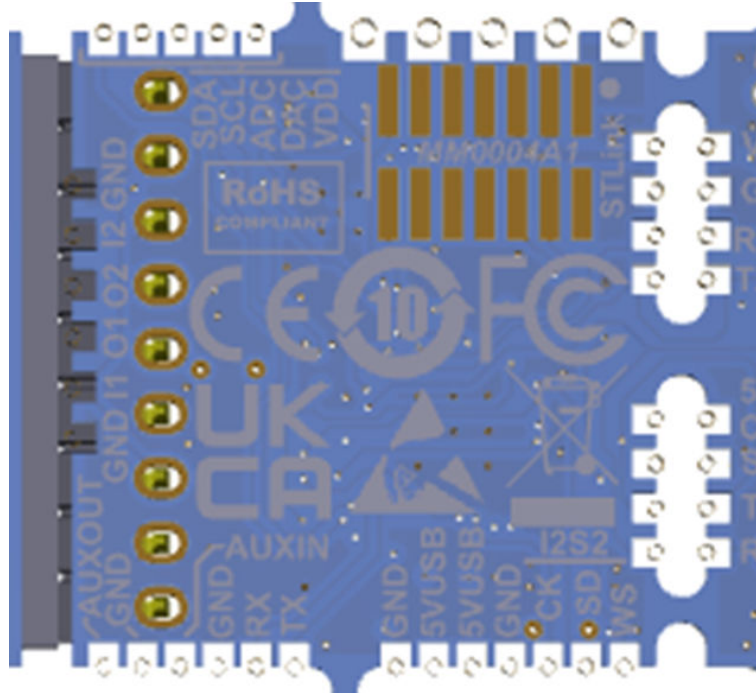
Mode

Start Standalone Demo

Output switch settings

If the user enables the output switch settings, they can assign the function to work with any tag ID using the drop-down menu of the **Trigger** field. The **Mode** field can be set to "toggle on/off" or to "PWM speed". This toggles the AUXOUT pin on the board. This is the pin in the bottom left corner in the figure below.

Figure 34. ST25R200 module (backside)

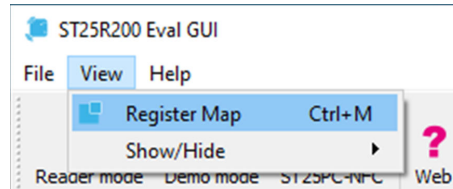


4 Other dialog boxes and panels

4.1 Register map

In the menu, click **View > Register Map** to open the register map.

Figure 35. Open the register map



The **Register Map** window, shown in the figure below, is a view that displays all registers and their values. It also allows changes to the register settings.

Figure 36. Register map

The screenshot shows the 'Register Map' window with a table of registers. The table has columns for register names, addresses, and 8 bits (7-0). The 'Value' column shows the hexadecimal value of the register. Some bits are highlighted in grey, indicating they are read-only.

	Addr.	7	6	5	4	3	2	1	0	Value
00h: Operation	0x00	0	0	0	0	1	0	1	0	0x0a
01h: General	0x01	0	0	0	0	1	1	0	0	0x0c
02h: Regulator	0x02	0	1	0	1	1	1	1	1	0x5f
03h: TX Driver	0x03	0	0	0	0	0	0	0	0	0x00
04h: TX Modulation 1	0x04	0	1	0	0	0	0	0	1	0x41
05h: TX Modulation 2	0x05	0	0	0	0	0	0	0	0	0x00
06h: RX Analog 1	0x06	0	1	0	1	0	0	1	1	0x53
07h: RX Analog 2	0x07	0	0	0	0	0	1	0	0	0x04
08h: RX Digital	0x08	1	1	0	0	1	1	0	0	0xcc
09h: Correlator 1	0x09	1	1	0	0	0	0	1	1	0xc3
0Ah: Correlator 2	0x0a	0	1	0	0	1	0	1	0	0x4a
0Bh: Correlator 3	0x0b	0	0	0	0	0	1	1	1	0x07
0Ch: Correlator 4	0x0c	1	0	1	0	1	0	1	0	0xaa
0Dh: Correlator 5	0x0d	0	0	0	1	0	0	1	0	0x12
0Eh: Correlator 6	0x0e	0	0	1	1	0	0	0	0	0x30
0Fh: Display 1	0x0f	0	1	1	1	1	0	1	1	0x7b
10h: Display 2	0x10	0	0	0	0	1	0	0	0	0x08
11h: Status	0x11	0	0	0	0	0	0	0	0	0x00
12h: Protocol	0x12	0	0	0	0	0	0	0	1	0x01
13h: Protocol TX 1	0x13	0	1	1	0	0	0	0	0	0x60
14h: Protocol TX 2	0x14	0	0	0	0	0	0	0	0	0x00
15h: Protocol TX 3	0x15	0	0	0	0	0	0	0	0	0x00
16h: Protocol RX 1	0x16	0	0	1	1	1	1	0	0	0x3c
17h: Protocol RX 2	0x17	0	0	1	1	1	0	1	0	0x3a
18h: Protocol RX 3	0x18	1	1	0	0	0	0	0	0	0xc0
19h: EMD 1	0x19	0	1	0	0	1	0	0	1	0x49
1Ah: EMD 2	0x1a	0	0	0	0	0	0	0	0	0x00
1Bh: MRT SQT Configuration	0x1b	0	0	1	0	0	0	0	1	0x21
1Ch: MRT	0x1c	0	0	0	0	1	1	1	0	0x0e
1Dh: SQT	0x1d	0	0	0	0	1	0	1	1	0x0b
1Eh: NRT GPT Configuration	0x1e	0	0	0	1	0	0	1	0	0x12
1Fh: NRT 1	0x1f	0	0	0	0	0	1	0	0	0x04
20h: NRT 2	0x20	0	1	1	0	1	0	1	0	0x65

When the **Register Map** window is open, it displays a list of register names with their addresses on the left side. On the right side, it shows the register values in hexadecimal. Between the register names and the register values, there are also 8 bits, which represent the current contents of the registers. Click on a bit to toggle the state from 1 to 0, or vice versa. This feature is disabled for some read-only registers. When it is the case, the register bits are greyed out.

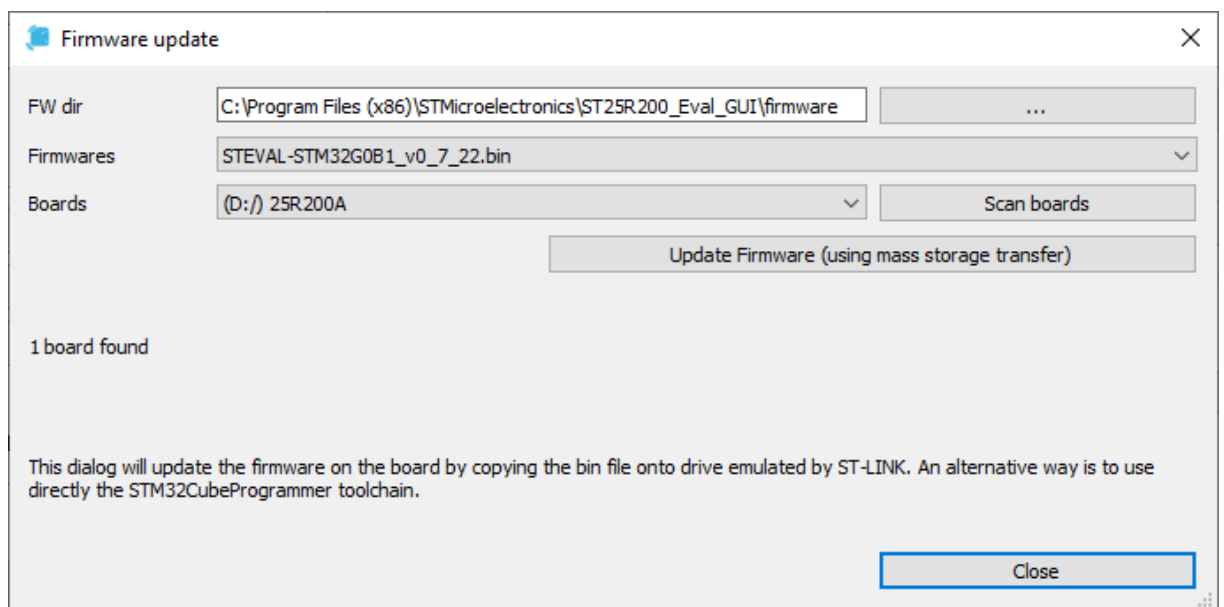
4.2 Updating the firmware

To update the firmware, do one of the following:

- Click the **Update Firmware** button in the **Board Info** tab.
- In the top menu, click **Help > Firmware Update**.
- Press CTRL + F.

The **Firmware update** dialog box illustrated below allows the flashing of firmware on the MCU of the ST25R200 evaluation board directly from the ST25R200 Eval GUI. The GUI comes with firmware for the evaluation board. The firmware combo box shows all the pieces of firmware located in the firmware folder specified by the firmware dir parameter. The latest version of the firmware can be found at st.com. Clicking the **Update Firmware (using mass storage transfer)** button flashes the firmware to the board. If multiple boards are connected, ensure that the correct board is selected in the **Boards** combo box.

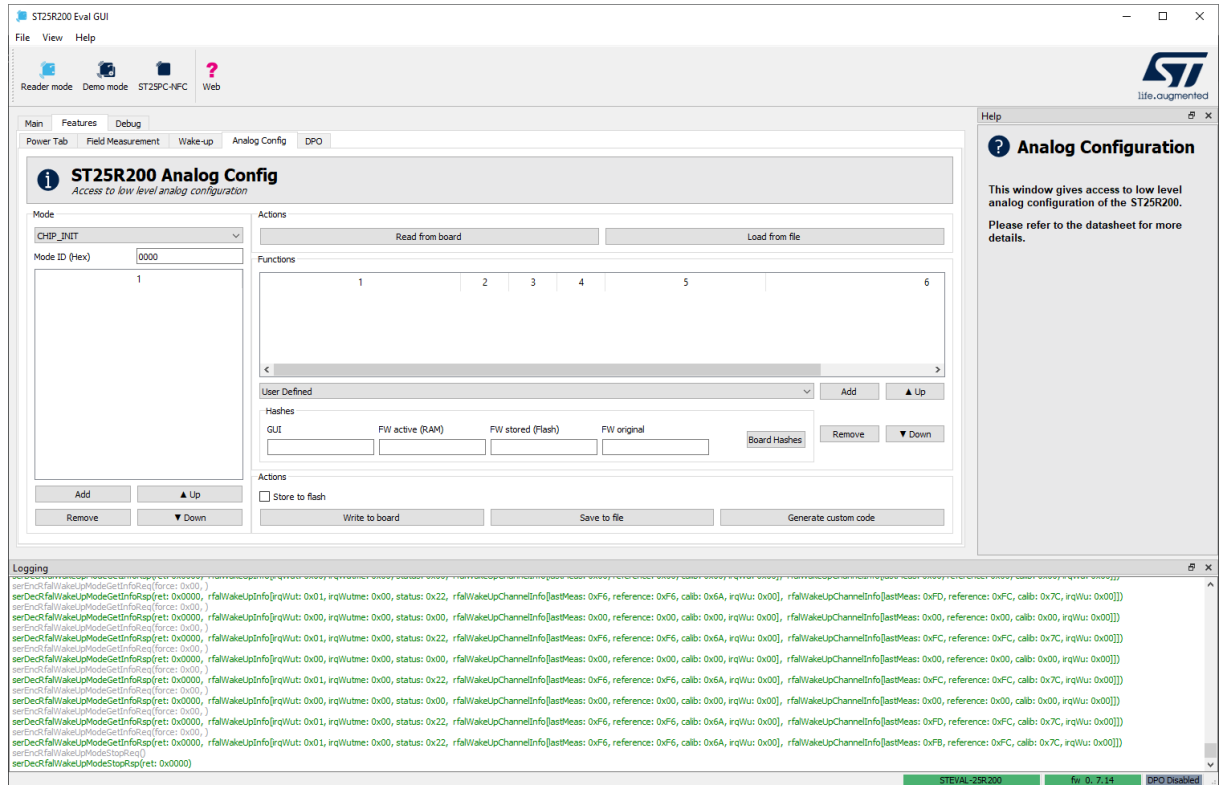
Figure 37. Firmware update



4.3 Logging

The **Logging** window is at the bottom of the GUI. It can be enabled/disabled in the **View** menu by selecting **Show/Hide > Logging**. It shows the entire communication between the GUI and the connected reader. Any request from the GUI is displayed in gray, while a positive response is displayed in green.

Figure 38. Logging

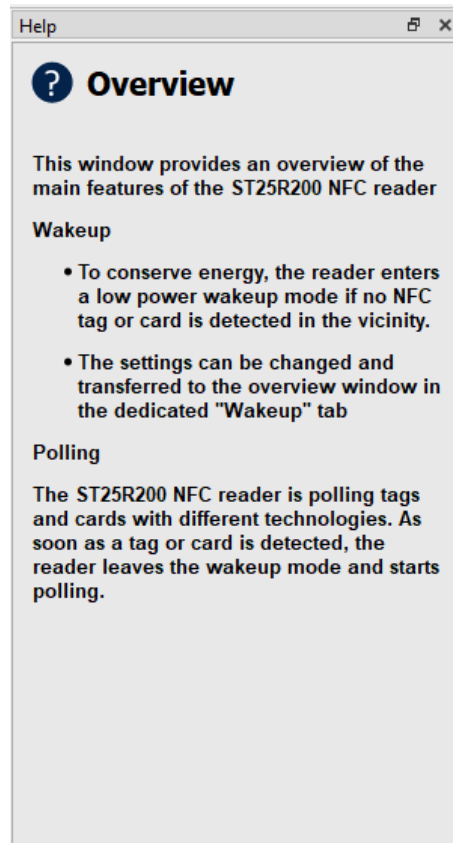


If the communication fails for any reason, this is indicated by a red font in the **Logging** window.

4.4 Help panel

To the right of each tab, there is a help panel that provides basic information about the current tab.

Figure 39. Overview



Revision history

Table 1. Document revision history

Date	Revision	Changes
11-Jul-2024	1	Initial release.

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