UM2517
User manual

ST25R3916-DISCO and STEVAL-25R3916B reference graphical user interface

Introduction

The ST25R3916-DISCO GUI (STSW-ST25R010) software allows the user to configure, evaluate, and communicate with the ST25R3916-DISCO and STEVAL-253916B kits using a PC.

The software must be used with the ST25R3916-DISCO or the STEVAL-253916B kits, which include a ready-to-use board to interface with the host PC through USB. This software allows the user to evaluate the features of ST25R3916 and ST253916B, high performance NFC universal device and EMVCo readers, communicating with the 32-bit core STM32L476 MCU via the SPI bus.

The boards are powered through the USB port, and no external power supply is required. They include an ST25R3916 or an ST25R3916B device, an etched antenna, and the associated tuning components.

This software package includes the ST25PC-NFC software, which allows access to all features of ST25 NFC / RFID Tags and ST25 Dynamic NFC Tags.

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1 Demonstration kits

This section describes the USB driver installation, and the GUI (graphical user interface) software for communication between the PC and the kits.

1.1 Board installation

To install a board, connect it to a PC with a USB cable leading from micro USB on MB1396 to a USB port capable to deliver more than 250 mA of current. Usually, this kind of port is on a powered USB hub, or directly on a PC.

1.2 Installing the ST25R3916-DISCO software (STSW-ST25R010)

To install the ST25R3916-DISCO development software (STSW-ST25R010)

- Download the latest version of the ST25R3916-DISCO development software from *www.st.com*
- Execute the installer and follow the GUI install procedure

When the installation process is complete, the ST25R3916-DISCO development software can be used.

Note: The boards operate using USB HID (human interface device class). There are no special drivers. Windows® uses stock mouse and keyboard driver.

1.3 Firmware update

The demonstration kit contains a firmware, and it is advisable to update it before using the STSW-ST25R010. There are two methods available, detailed in the next subsections.

1.3.1 Method 1: DFU of STM32L4

The ST25R3916-DISCO demonstration kit contains a DFU driver, to install before going through a firmware update. Typically, the driver is installed in background. If this fails, open the GUI, select “Firmware update” and follow the procedure detailed below.

1. Select in the menu “Help” the entry “Firmware update”. A file chooser opens, select a firmware .hex file matching the board. If the DFU driver is already installed, the firmware update takes a few seconds, otherwise go to point *2*.

2. If the DFU driver is not installed, open the “Device Manager” window (no need to wait for the GUI feedback):
   a) Select under “Other devices” the “STM32 BOOTLOADER”
   b) Click on the right button of the mouse and select “Update driver software” (*Figure 1*)
   c) Select “Browse my Computer for driver software”
   d) Enter “C:\Program Files (x86)\STMicroelectronics\ST25R3916_Discovery_GUI \Driver” and install it
   e) Under “Universal Serial Bus controllers” appears “STM device in DFU Mode” (*Figure 2*)
   f) In the meantime, the ST25R3916-DISCO GUI is in timeout, and the USB field in the status bar is red
   g) To do the update, restart from point *1*

Caution: The loading of a wrong firmware makes the board unusable. In this case, as no Boot button is available, use method 2 (see *Section 1.3.2*).

Figure 1. Device manager window

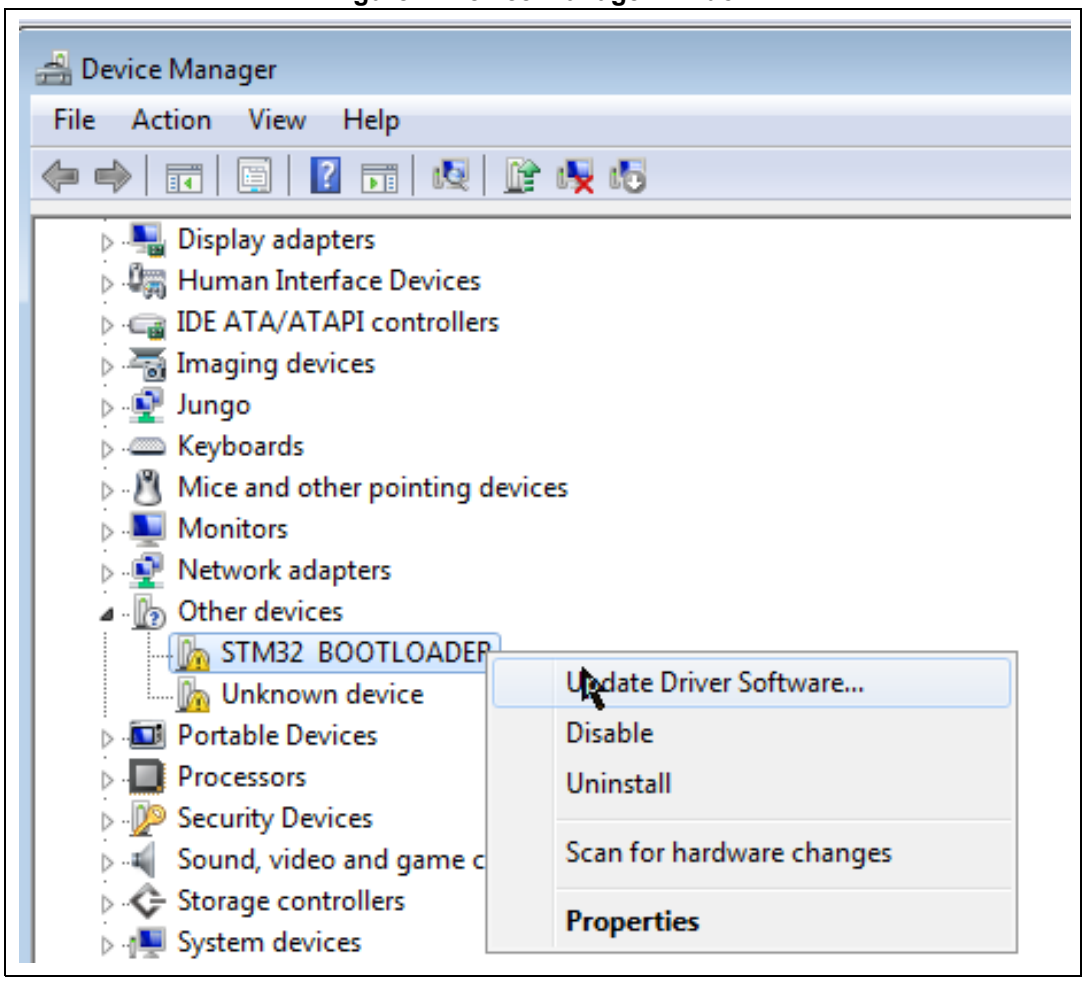
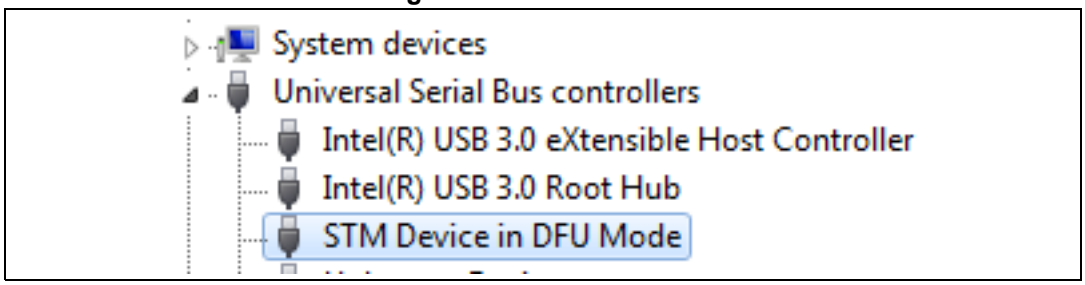


Figure 2. Device detected



1.3.2 Method 2: ST-Link

Use the ST-Link integrated on MB1396. Connect the mini USB to your PC and simply drag and drop the firmware binary to the new appearing drive.

1.4 ST25R3916 Discovery GUI tab

If the software package is installed correctly, the demonstration is put into USB mode (User button while starting), the ST25R3916-DISCO board is connected via micro USB to PC USB port, and the main menu is displayed (see *Figure 3*).

The toolbar also contains the ST25PC-NFC icon, which enables the ST25 tags editing. To open it, click on the ST25PC-NFC icon, while a board is connected. The Disco GUI automatically disconnects from the board, and opens the ST25PC-NFC to take control of the board. To go back to the Disco reader functionality, just close the ST25PC-NFC or click on the icon again. The ST25PC-NFC is closed automatically in this latter case.

See *Section 4* for details.

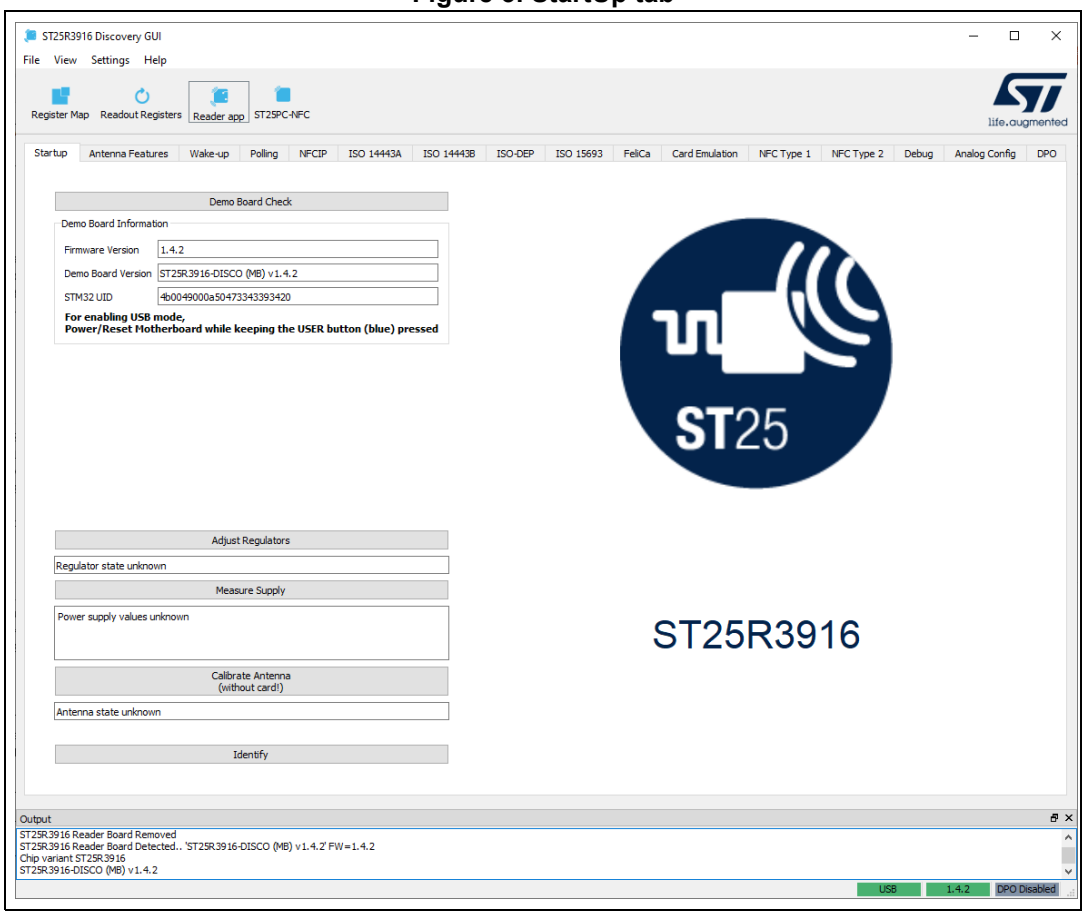
Note: The firmware version number is shown in the status bar of the main window.

This tab allows the user to access several submenus:

- StartUp tab (*Section 1.4.1*)
- Antenna features tab (*Section 1.4.2*)
- Wakeup tab (*Section 1.4.3*)
- DPO (*Section 1.4.4*)
- Polling tab (*Section 1.4.5*)
- NFCIP tab (*Section 1.4.6*)
- ISO 14443A tab (*Section 1.4.7*)
- ISO 14443B tab (*Section 1.4.8*)
- ISO-DEP tab (*Section 1.4.9*)
- ISO 15693 tab (*Section 1.4.10*)
- FeliCa™ tab (see *Section 1.4.11*)
- Card Emulation tab (*Section 1.4.12*)
- NFC Type 1 tab (*Section 1.4.13*)
- NFC Type 2 tab (*Section 1.4.14*)
- Debug tab (*Section 1.4.15*)
- Analog Config tab (*Section 1.4.16*)

1.4.1 StartUp tab

Figure 3. StartUp tab



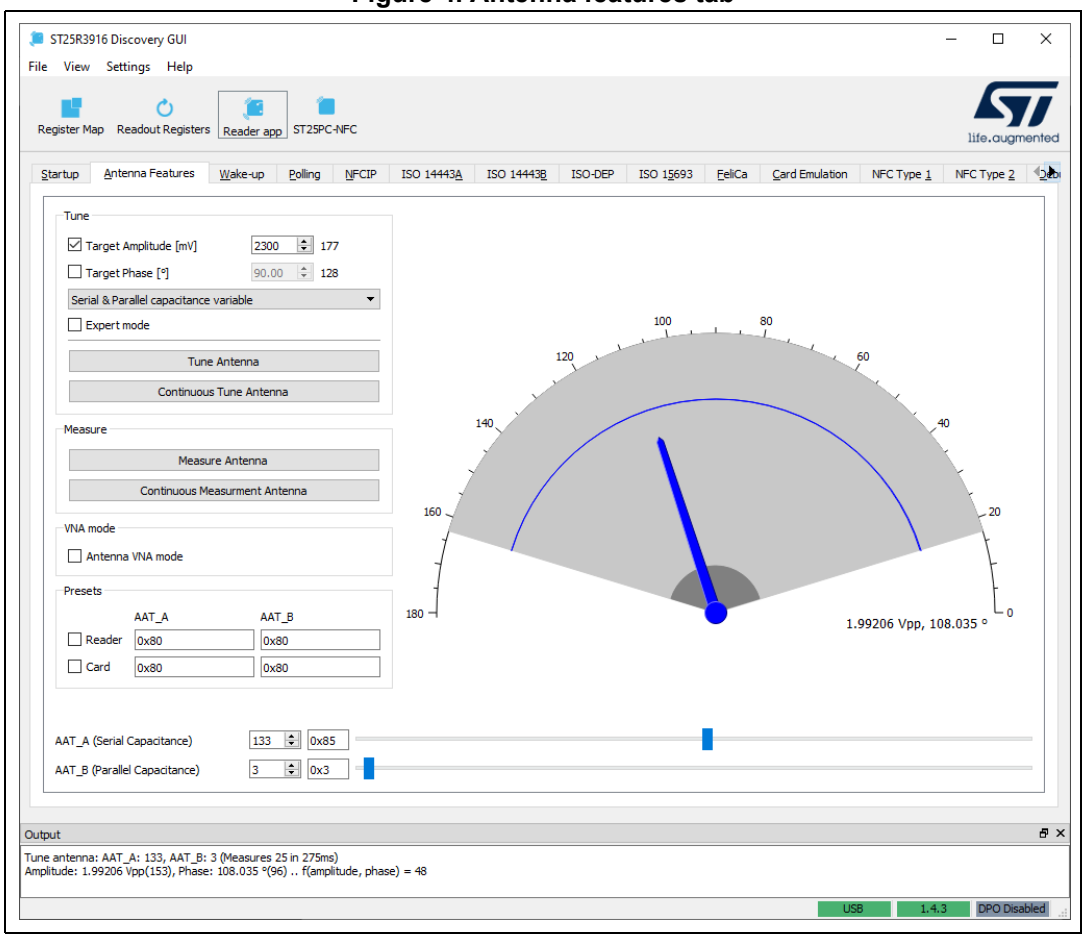
The status tab on the bottom right corner shows the connection status. If the HW is successfully connected via USB the status turns to green, and displays the firmware version.

- Click on “Demo Board Check” button. This action checks the USB connection to the demonstration board, and reads the board information required for the GUI operation. The configuration of the ST25R3916/ST25R3916B is based on this information.
- Click on “Adjust Regulators” button to set automatically the regulators. This command improves the system power supply rejection ratio.
- Click on “Calibrate Antenna” button. This command automatically adjusts the resonance frequency of the antenna LC tank.
- Antenna trimming OK is displayed next to the button.

When the Start-up procedure is done, the user can proceed using the other tabs.

1.4.2 Antenna features tab

Figure 4. Antenna features tab



- The needle shows the amplitude as measured on RFI, and the phase difference between RFI and RFO.
- The antenna can be tuned for a target amplitude or a target phase, or for a combination of these parameters.
- Click on “Measure Antenna” button to measure these three values.

Amplitude and phase difference can be continuously monitored using the “Continuous Measurement” button. Moreover, when this option is activated and a piece of metal is approached to the antenna, a detuning effect can be observed.

The “Auto Adjust Antenna” button allows the user to tune the antenna. This action can be done continuously by pressing the “Continuous Adjust Antenna” button.

It is possible to manually adjust the DAC driving varicaps, it is advised to use the “Continuous Measurement” to see its effect.

Note: The menu can be easily used for matching network evaluation of ST25R3916/ST25R3916B based readers.

1.4.3 Wakeup tab

The devices offer different wake-up modes. Each one generates an interrupt to the microcontroller in sleep mode:

1. Inductive (amplitude)
2. Inductive (phase)
3. Capacitive (not available on ST25R3916B)

Note: This demonstrator is for evaluation purposes. There are continuous updates ongoing, which may result in extra current consumption. The “read at interrupt only” switch avoids interaction and minimizes the current.

Inductive wake-up

The inductive wake-up scans periodically the input signal amplitude and the phase difference between output and input signals. If one of these antenna tuning parameters changes, an interrupt is generated.

To achieve the offset level click on “Measure” and “Measurement to Offset” buttons to set the initial status (“Offset”).

Figure 5. Wakeup window - Inductive (amplitude) wake-up enabled

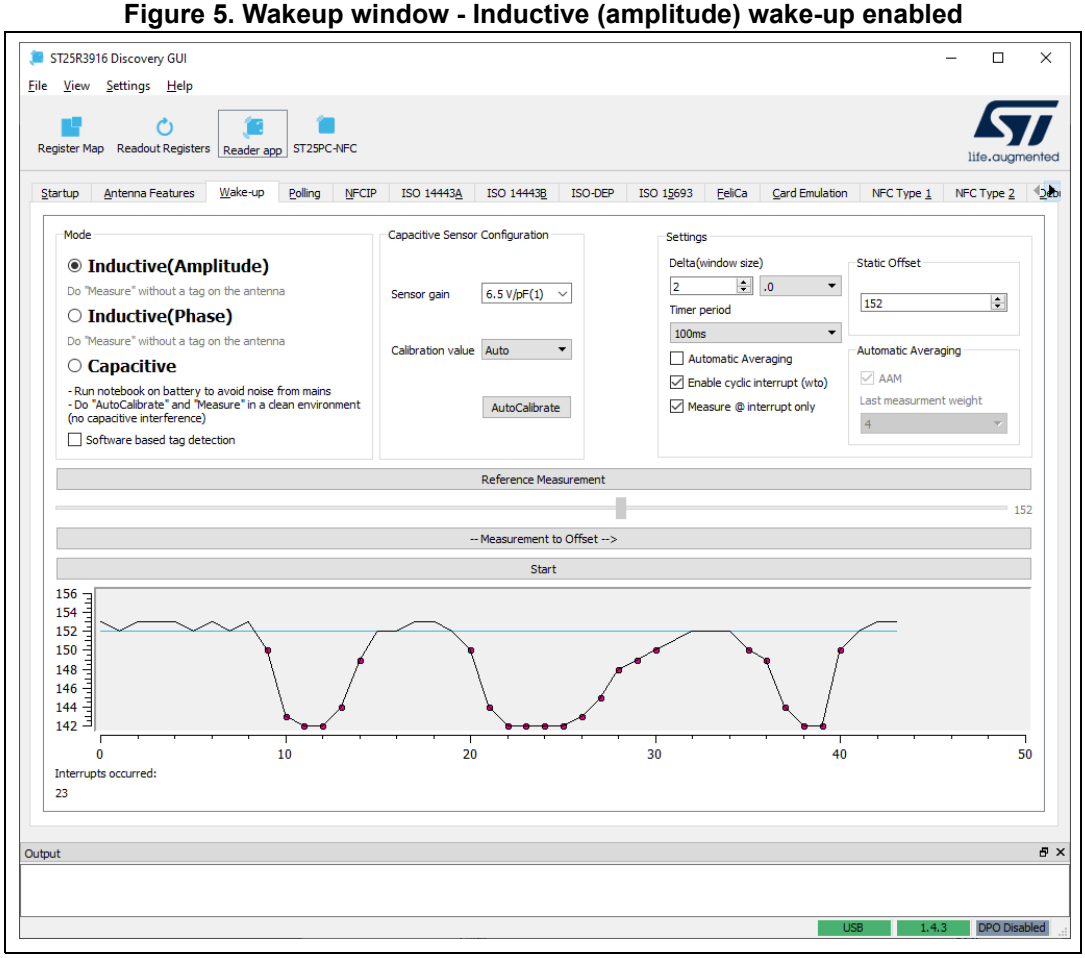
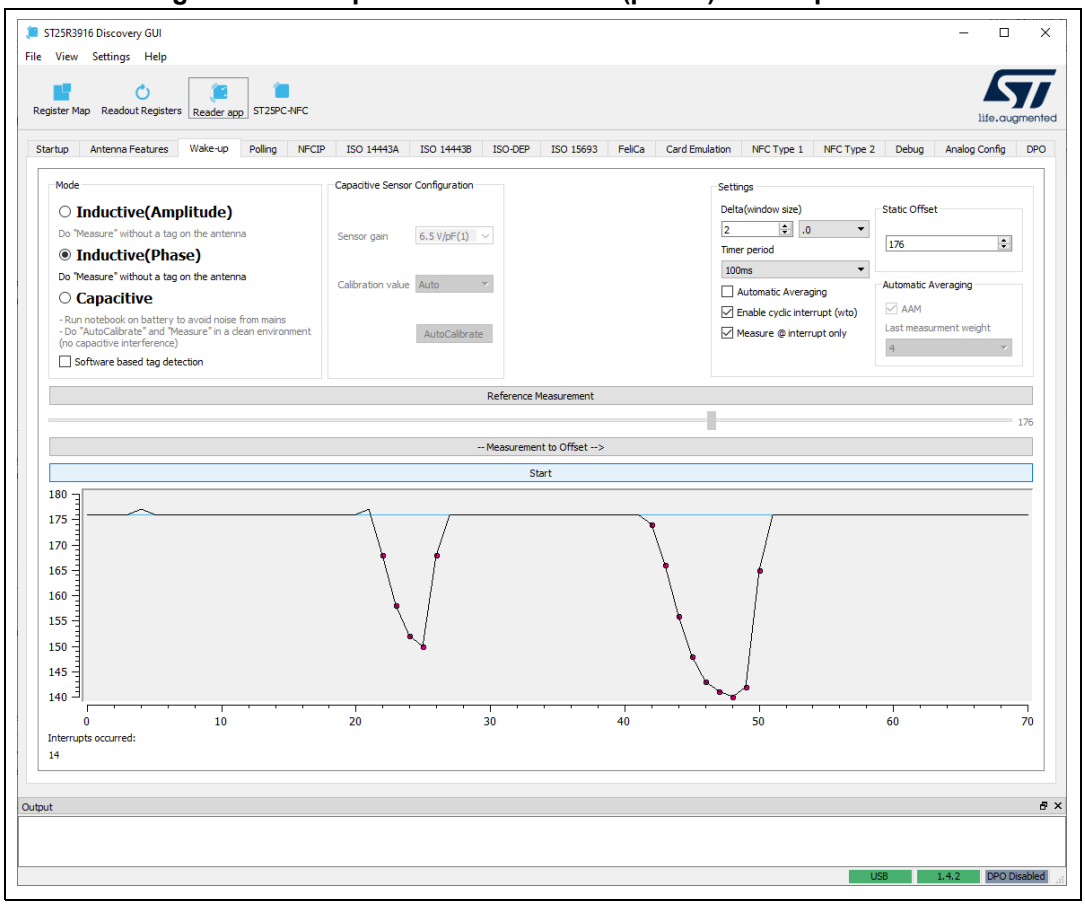


Figure 6. Wakeup window - Inductive (phase) wake-up enabled



Note: Different wake-up ranges can be achieved with the phase or amplitude method, depending upon the antenna matching network.

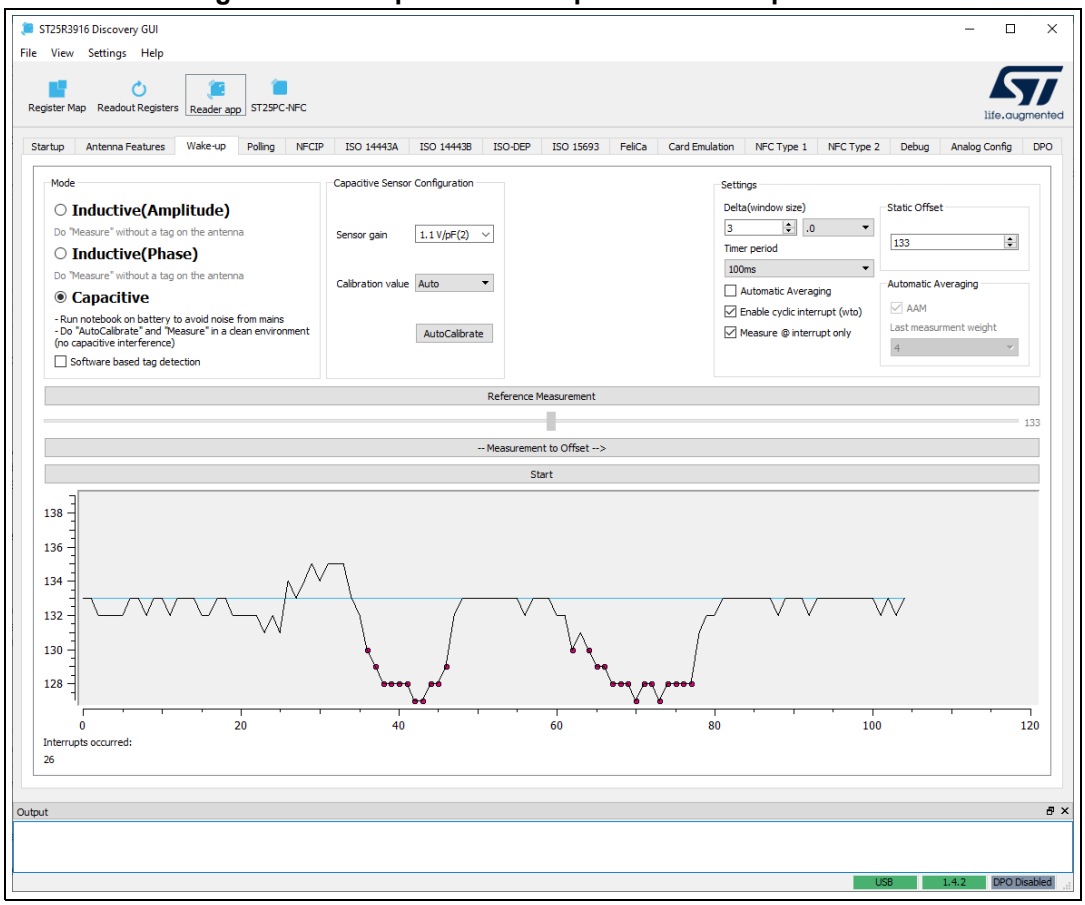
Capacitive wake-up

This method (not available on ST25R3916B) allows the user to measure the capacitance across two electrodes.

- Click on “AutoCalibrate” button to do the calibration and to remove the parasitic capacitances influence. The “AutoCalibrate” button works only if the calibration value is set to “Auto”. Alternatively, it is possible to set manually the calibration value.
- Click on “Measure” and “Measurement to Offset” button to set the initial status (“Offset”).
- Click on “Start” button to initiate the autonomous wake-up mode.

The measured values are shown in *Figure 7*, where each interrupt is indicated by a red dot.

Figure 7. Wakeup window - Capacitive wake-up enabled



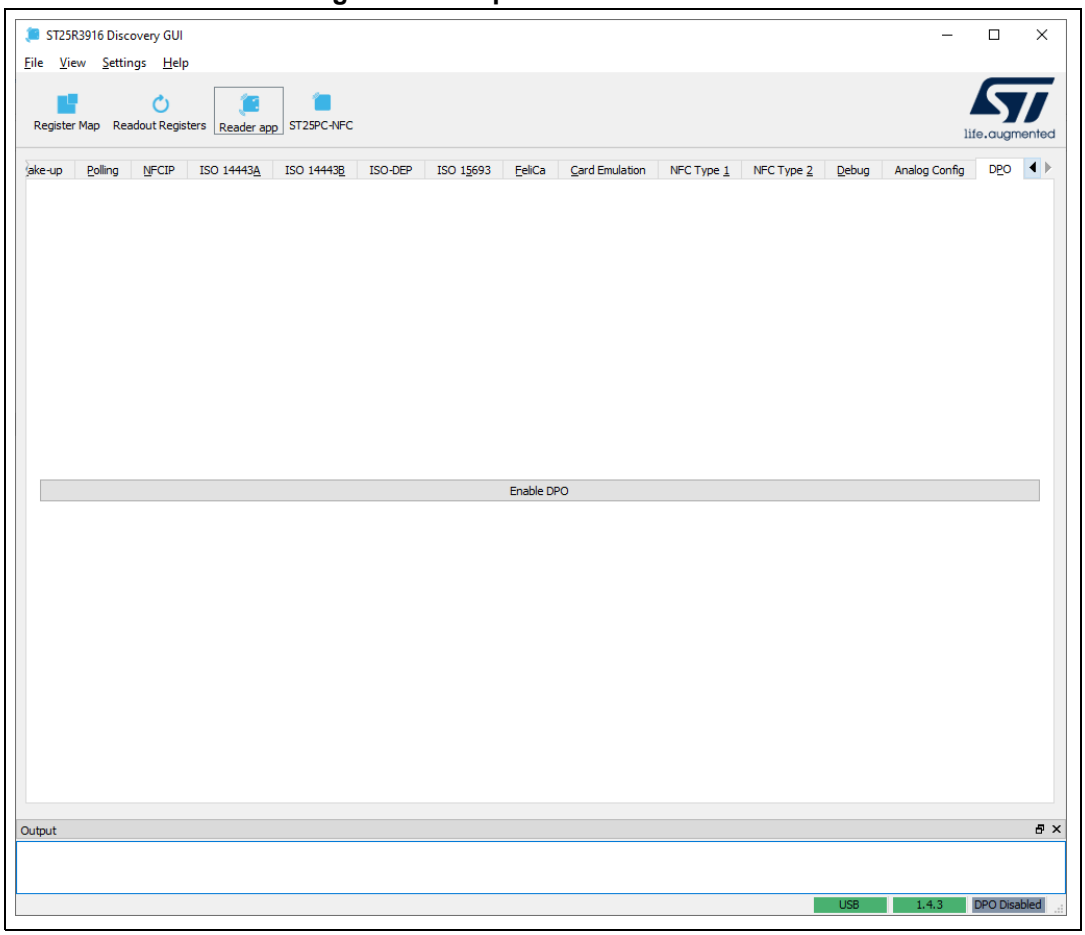
Additional parameters are:

- **Delta (window size)** defines the window in which no interrupt is generated. If the actual measured value is within the window range, no interrupt is generated.
- **Timer period** defines how often the measurement procedure is executed.
- **Automatic averaging** selects an automatic or static offset value. In case of an auto averaging, the offset is dynamically adjusted to the environment conditions. If this option is active, the offset changes dynamically with a weighted factor that can be selected. The weight option defines how fast the offset value is adapted to the new environment conditions.

1.4.4 DPO

DPO stands for dynamic power output. It is a software-based feature for the dynamic control of the transmitter driver resistance and the generated RF field, depending upon the presence of a PICC. A dynamic RF power adjustment can be useful in challenging environments where strong antenna detuning causes an abrupt increase in driver current and a violation of the maximum allowed field strength in the applicable standard. The dynamic adjustment of output power uses either the amplitude or the phase measurement capabilities of the ST25R3916 and ST25R3916B devices.

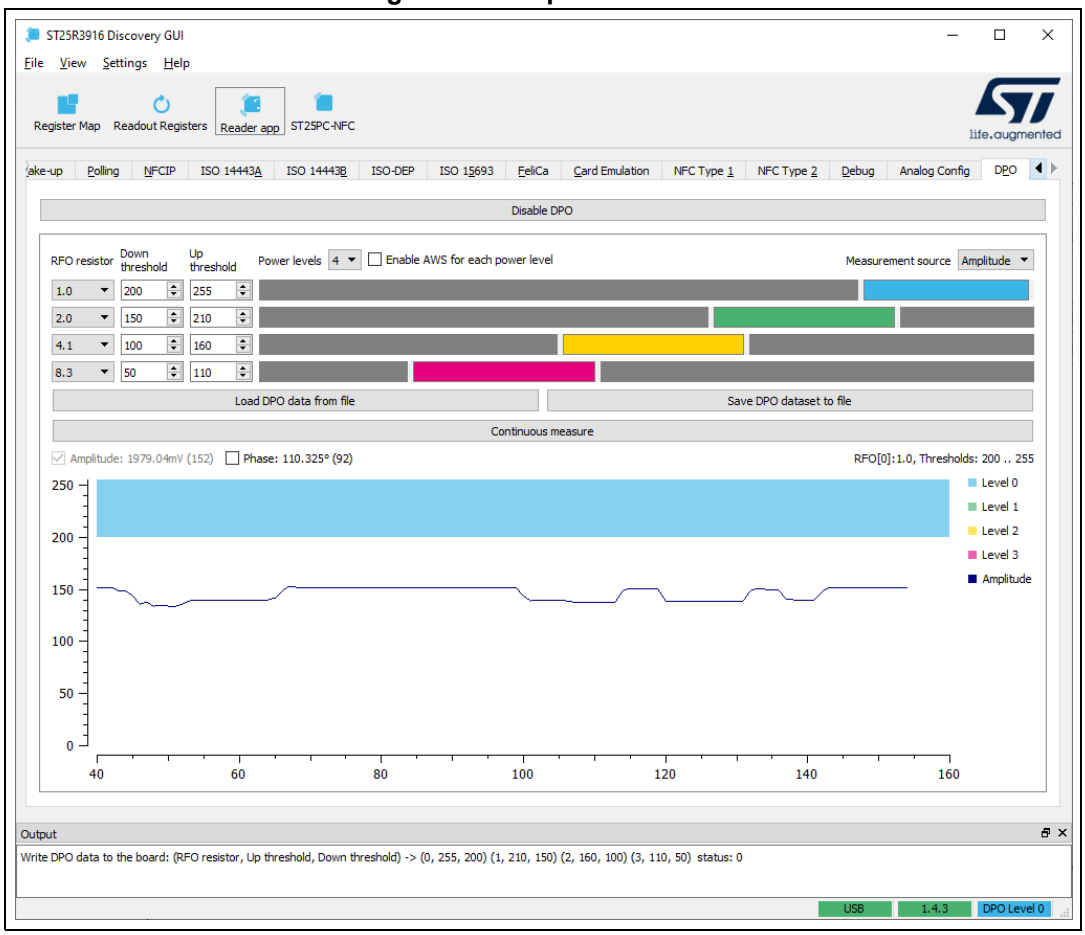
Figure 8. DPO panel in disabled state



The DPO function is enabled by clicking on the “Enable DPO” button. The panel adds additional user fields and shows threshold levels in a graphical view.

The following section describes the DPO functionality with two power levels.

Figure 9. DPO panel enabled



DPO measurement methods

The two drop-down fields at the top of the DPO screen allow the user to configure the number of power levels and the source of measurement to be used to adjust the RF power.

One of the two measurement methods (amplitude or phase) can be chosen.

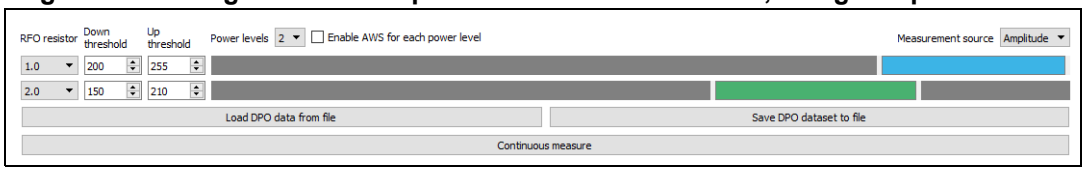
The **amplitude measurement** method uses the received signal level at the RFI as the basis for the switchover thresholds for power reduction. It is mandatory to first balance the receiver signal levels to be within the limits, by adjusting the capacitive voltage divider.

The **phase measurement** method uses the phase difference information between RFO and RFI signals when a card or other load is moved into the field. These phase angles are taken as the basis for the switchover thresholds.

Setting the DPO

- Select one of the three measurement methods detailed in *Section 1.4.3* for the dynamic power output adjustment. This example focuses on the amplitude based measurement, with two power levels.

Figure 10. Setting DPO with amplitude based measurement, using two power levels

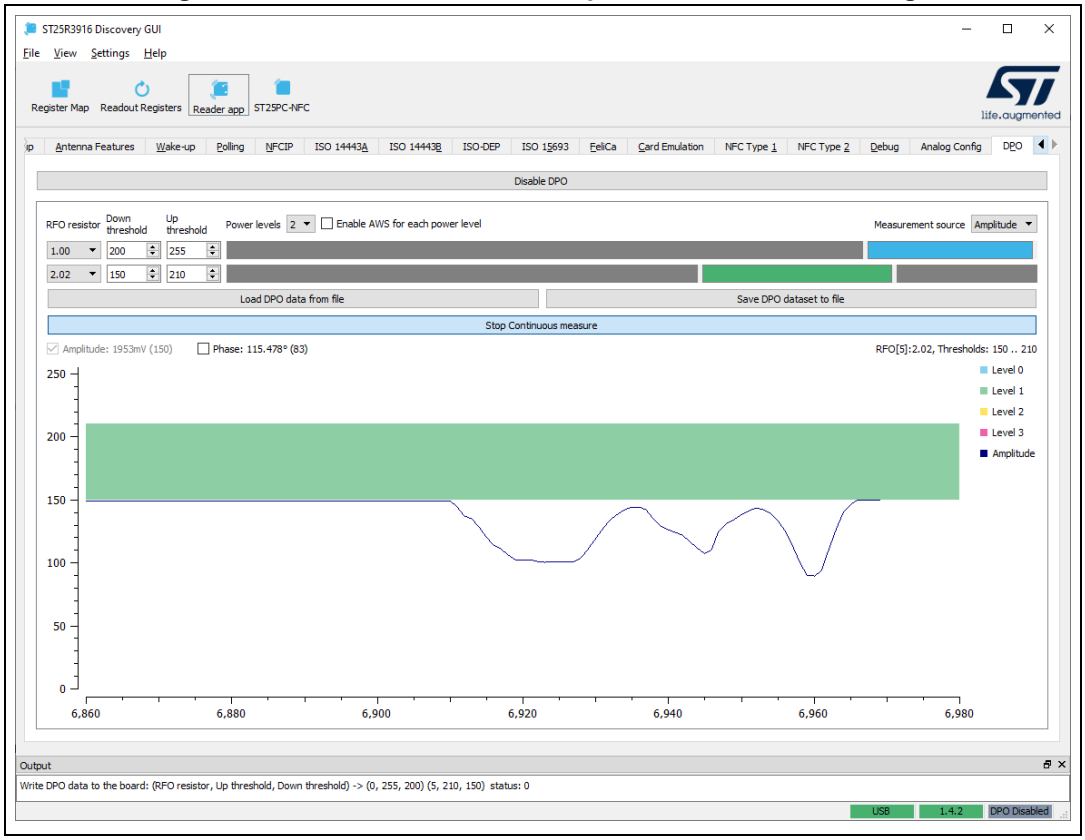


To use the DPO and to find the correct threshold levels, press the “Continuous measure” button. The device emits a continuous carrier using the selected RFO resistance, and displays the measurement result and DPO status in the GUI.

When moving a PICC into the field close to the reader antenna plane, the amplitude level changes in the graphical representation. This is denoted by a voltage level value at the top of the graph, as well as by a line continuously drawn into the graph, with its decimal representation. We can also see blue and green horizontal bars, spanning a threshold range in the graph, and simultaneously responsible for setting the RFO resistance linked to it.

At a certain position of the reader plane, the DPO switches from the blue to the green bar. This means that the driver resistance has successfully switched from 1.0 to 2.0 Ω in this case. When the PICC is removed, the DPO resides in the green threshold area, and never goes back to the blue bar. This situation is shown in *Figure 11*.

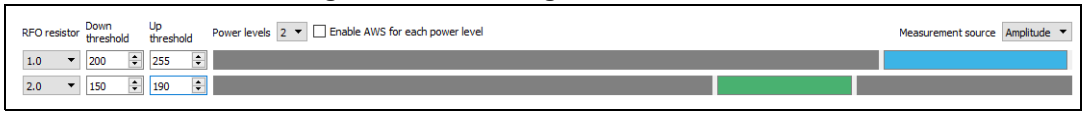
Figure 11. Enabled DPO with not optimized threshold settings



The device is stuck in the green region because the actual amplitude value (2.46 V = 189d) is lower than the up threshold of 210. The up threshold for the green bar must be decreased below 189 by changing the value in the up threshold field, or directly moving the edge of the green bar with the mouse.

Figure 12 shows an example of how the threshold levels can be set to switch between two resistance values.

Figure 12. Switching resistance values

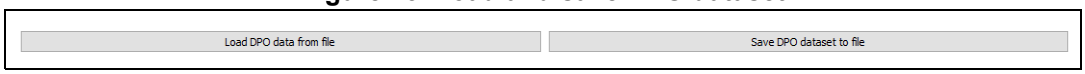


In most cases, the user must reduce the generated field in close proximity of the reader. This means that sliders or threshold levels must be moved down into the region of interest.

Saving a DPO setting

Once a satisfying DPO setting has been found, the DPO configuration can be saved and restored to a file with the corresponding buttons.

Figure 13. Load and save DPO dataset



AWS

AWS (active wave shaping) is a feature of both ST253916 and ST25R3916B. It lets the user control the shaping of the rising and falling edges of the modulated signal. Ticking the “Active Waveshaping” check-box makes more GUI features available, giving additional possibilities to influence the wave-shaping feature per power level and per technology. The DPO tab lets the user control the static AWS configuration in a more flexible way:

- Adjust transients for the waveshapes with slow to fast preset values (ST25R3916B only)
- Fine-tune RF undershoot and overshoot patterns per power level and mode
- More granular adjustments of driver resistance
- Selection of modulation index used for each DPO level

The active waveshaping in ST25R3916B is accomplished primarily by using the corresponding AWS registers, incorporated in the GUI with so called preset values from the drop-down box. These preset values represent transients in the waveshape reaching from slow to fast signal transitions. Individual adjustments can be done in the analog configuration, they are reflected as “Custom preset” in the DPO drop-down window. Additionally, over- and undershoot patterns (available on both ST25R3916 and ST25R3916B) can be applied on top of the AWS settings, resulting in an additional reduction of over and undershoots in special cases.

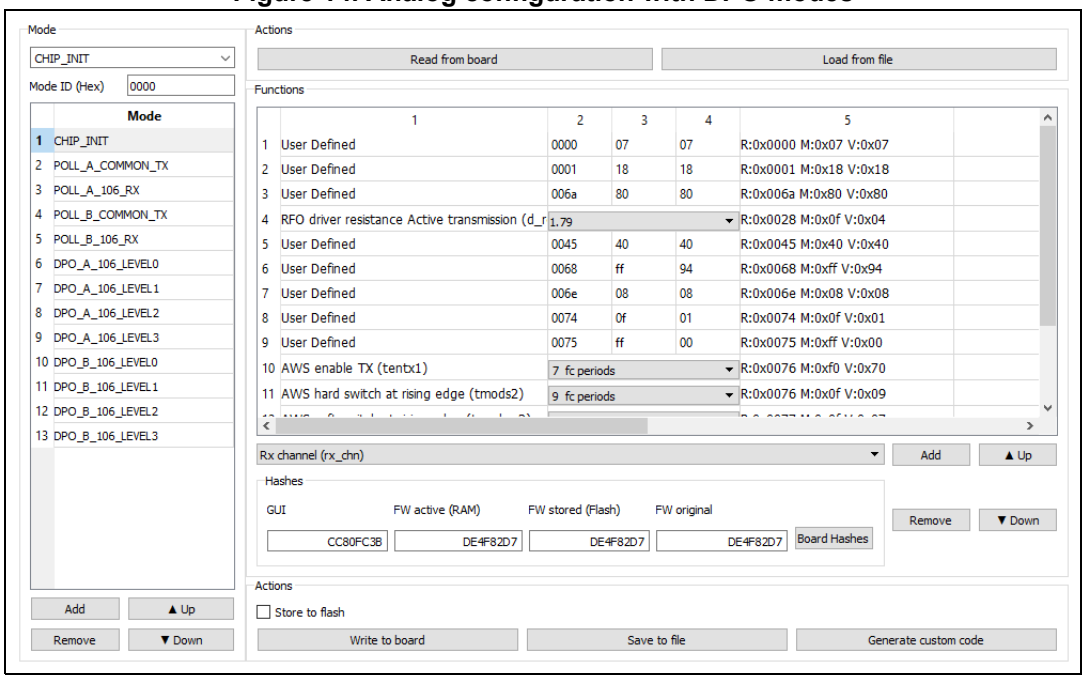
These parameters are stored and transferred to the analog configuration settings, and are automatically parsed while switching to the DPO tab.

As a result, the user finds the following new modes controlling AWS:

- DPO_A_106_Level0
- DPO_A_106_Level1
- DPO_A_106_Level2
- DPO_A_106_Level3
- DPO_B_106_Level0
- DPO_B_106_Level1
- DPO_B_106_Level2
- DPO_B_106_Level3

They contain functions with register settings for mode A and B, with distinct parameters, up to four power levels.

Figure 14. Analog configuration with DPO modes



When using an analog configuration containing AWS settings, the GUI detects them when switching to the DPO tab. This automatically sets the “Active Waveshaping” check box, and enables advanced GUI widgets, showing NFC A and B wave shapes, providing an easy way to fine-tune AWS parameters, as shown in *Figure 15*.

Figure 15. DPO tab

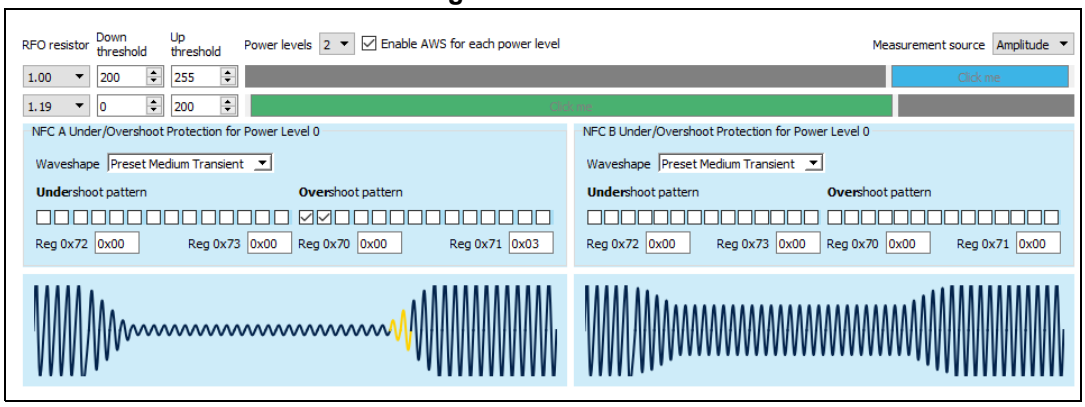


Figure 16. DPO log window

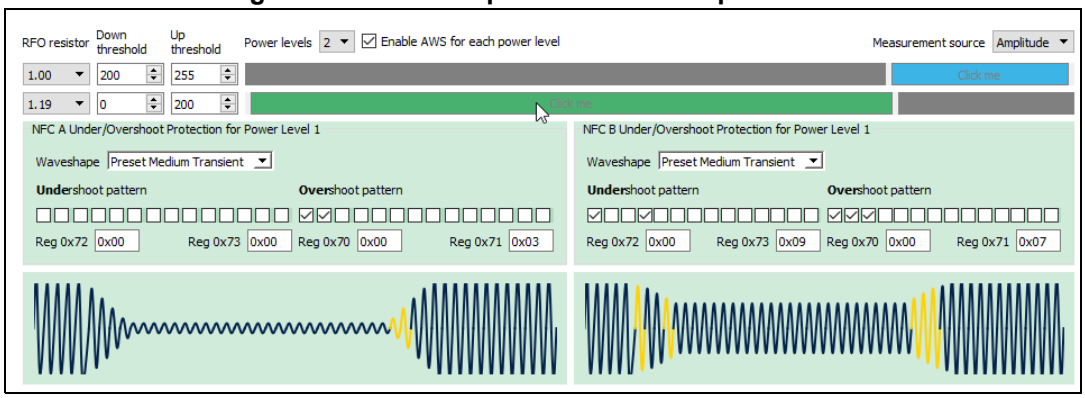
```
Analog Config loaded from file Analog Config loaded from file C:/Program Files
(x86)/STMicroe lectronics/ST25R3916_EMV_L1_DTE_GUI/analog_config/T25R3916_EMVCo30_v1.1_DPO.xml

Read DPO table from board: (RFO resistor, Up threshold,Down threshold) -> (0x1, 0xff, 0xc8)(0x1, 0xb1,
0x0)(0x2, 0xa0, 0x64) (0x3, 0x6e, 0x32) status: 0

Import DPO registers from Analog Config tab: Successfully imported: DPO_A_106_LEVEL0, DPO_A_106_LEVEL1,
DPO_A_106_LEVEL2, DPO_A_106_LEVEL3, DPO_B_106_LEVEL0, DPO_B_106_LEVEL1, DPO_B_106_ LEVEL2,
DPO_B_106_LEVEL3
```

The user can access a given set of power level parameters by clicking on the matching power level bar. The set of registers and the wave shape background color are updated accordingly.

Figure 17. Choose a power level set of parameters



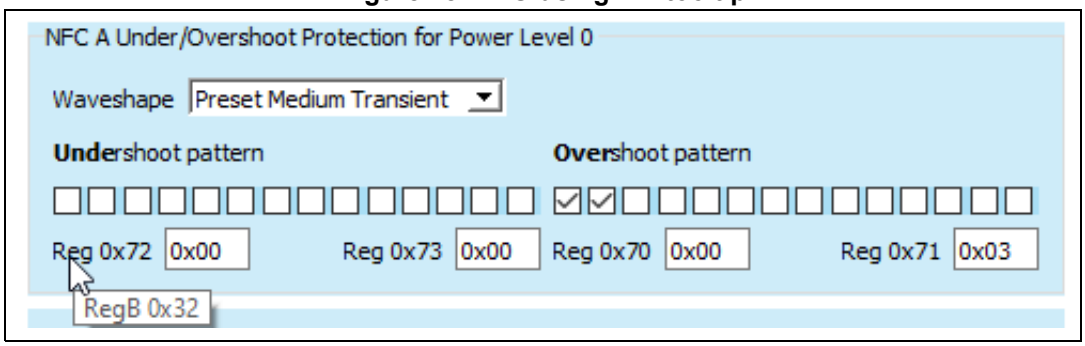
The user can either set manually a register value (for example, registers 0x70, 0x71, 0x72, 0x73 for both NFC A and B), or click on the tick boxes. The selected bits update the wave shape by highlighting the matching pulses in yellow. The corresponding register value is updated too. This provides a visual and easy way to fine-tune which undershoot and overshoot pulse to control.

Once the WUPA or WUPB loop button is pressed, the current AWS parameters are saved to the board, and WUPA (or WUPB) commands are continuously sent. This feature allows quickly fine-tuning and directly seeing the effect with a scope, without going through the different tabs provided by the tool.

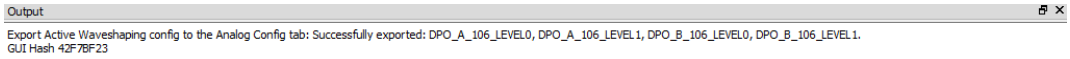
In order to apply new parameters, the loop command must be stopped first, and started again to apply the parameters to the board.

Some tool tips are available as reminder, see *Figure 18*.

Figure 18. DPO using AM tooltip



The AWS settings are shared with the analog configuration tab. They are updated when switching back to the analog configuration tab. The log window shows:



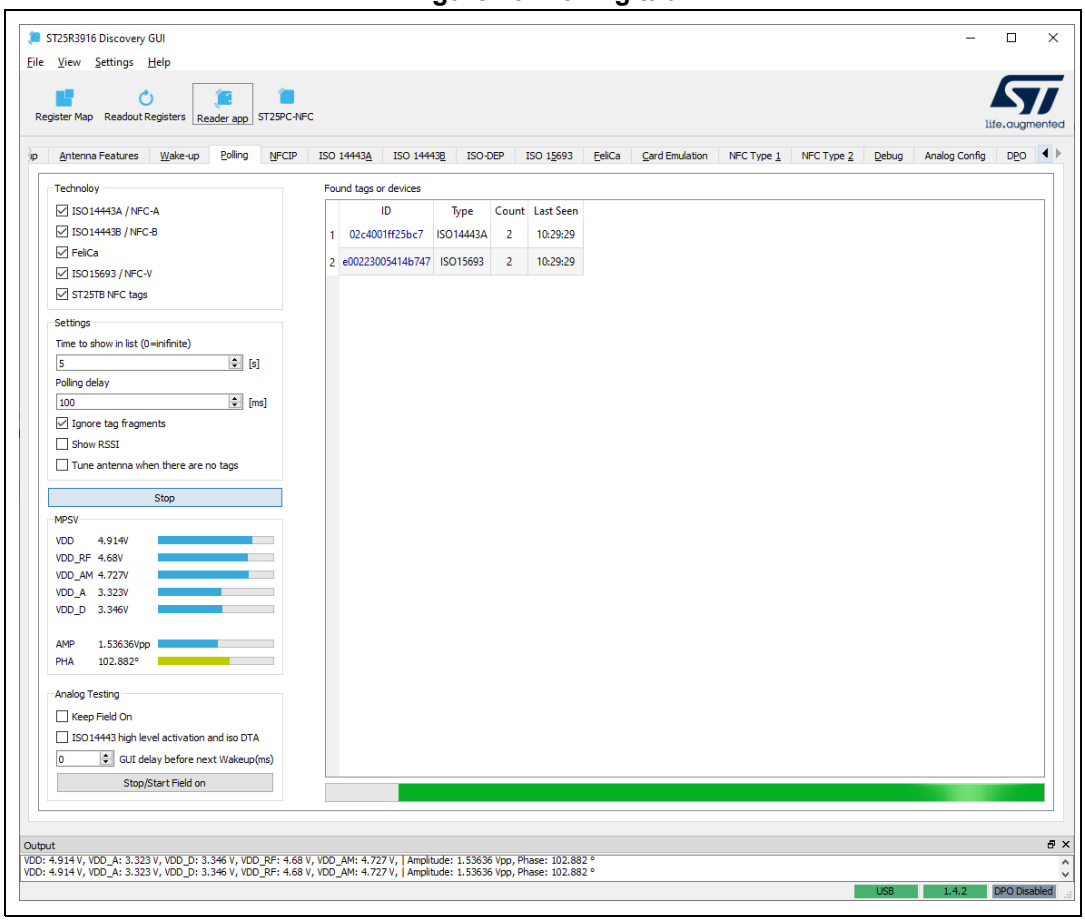

```
Export DPO registers to Analog Config tab: Successfully exported:
DPO_A_106_LEVEL0,
DPO_A_106_LEVEL1, DPO_A_106_LEVEL2, DPO_A_106_LEVEL3, DPO_B_106_LEVEL0,
DPO_B_106_LEVEL1,
DPO_B_106_LEVEL2, DPO_B_106_LEVEL3.
```

This allows the user to review them and uses the actions documented in *Section 1.4.16* (for example, save to a file or generate custom code).

1.4.5 Polling tab

Figure 19 shows the anticollision and multiprotocol features of the kits.

Figure 19. Polling tab



In addition to the protocols shown, the following protocols are supported:

- Kovio barcode 128/256 bit (ISO 14443A checkbox)
- iCLASS (ISO 15693 checkbox)

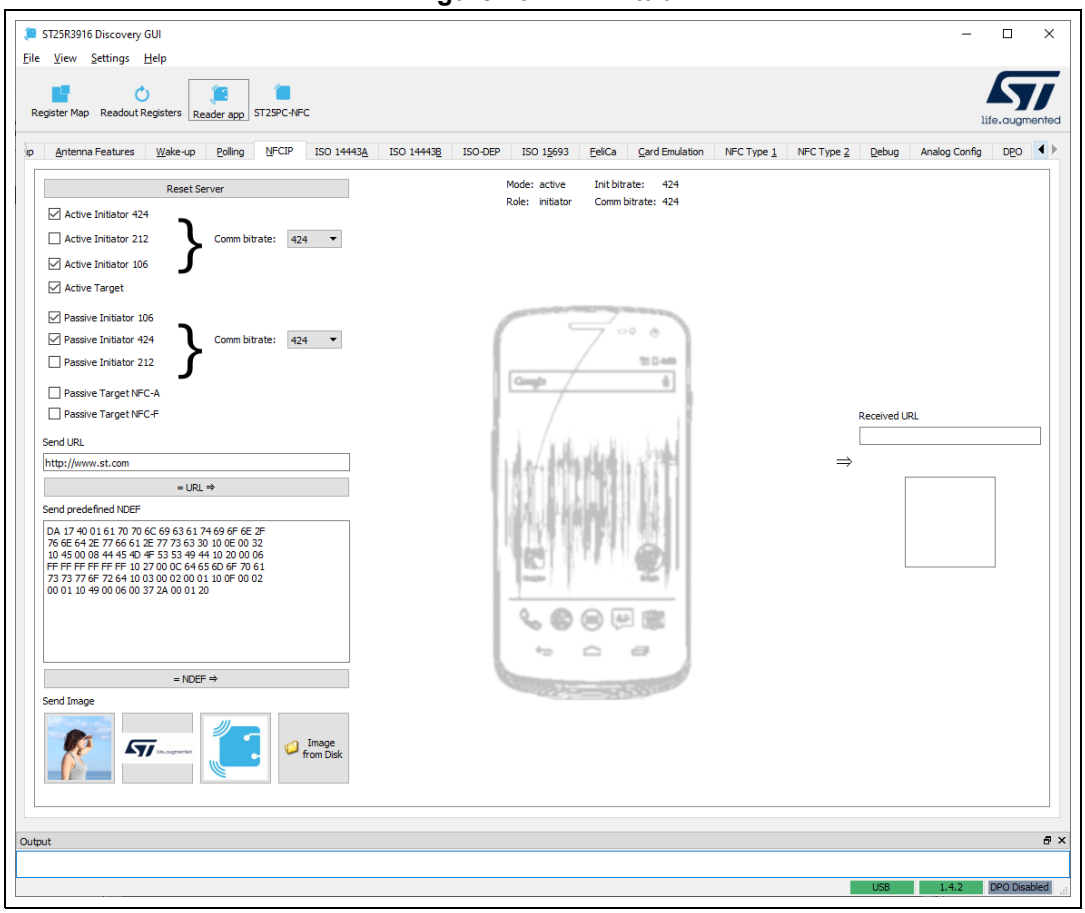
By default all standards are active.

- Click on the “Find” button. The reader starts to scan for tags that are in the proximity of the reader.
- The polling process stops if clicked on “Stop” button during the polling process.
- The screen log shows the UIDs or PUPIs, the type and how often the tag is detected.
- The time stamp shows the time of the last detection.

1.4.6 NFCIP tab

Figure 20 shows the NFCIP tab, which displays the peer-to-peer functionality.

Figure 20. NFCIP tab



Note: This feature requires an NFC enabled device supporting peer to peer protocol.

The devices are initially configured to cycle through the initiator and target mode. The default setting for the bit-rate is 424 kbps.

The communication starts automatically when the tab is selected.

Once the link is established, the initial gray phone picture on the GUI is replaced by a colored one.

When the connection is established, it is possible to transfer a URL to the phone:

- Write the URL and click on "= URL ⇨" button to start the transfer
- The phone browser opens the requested URL

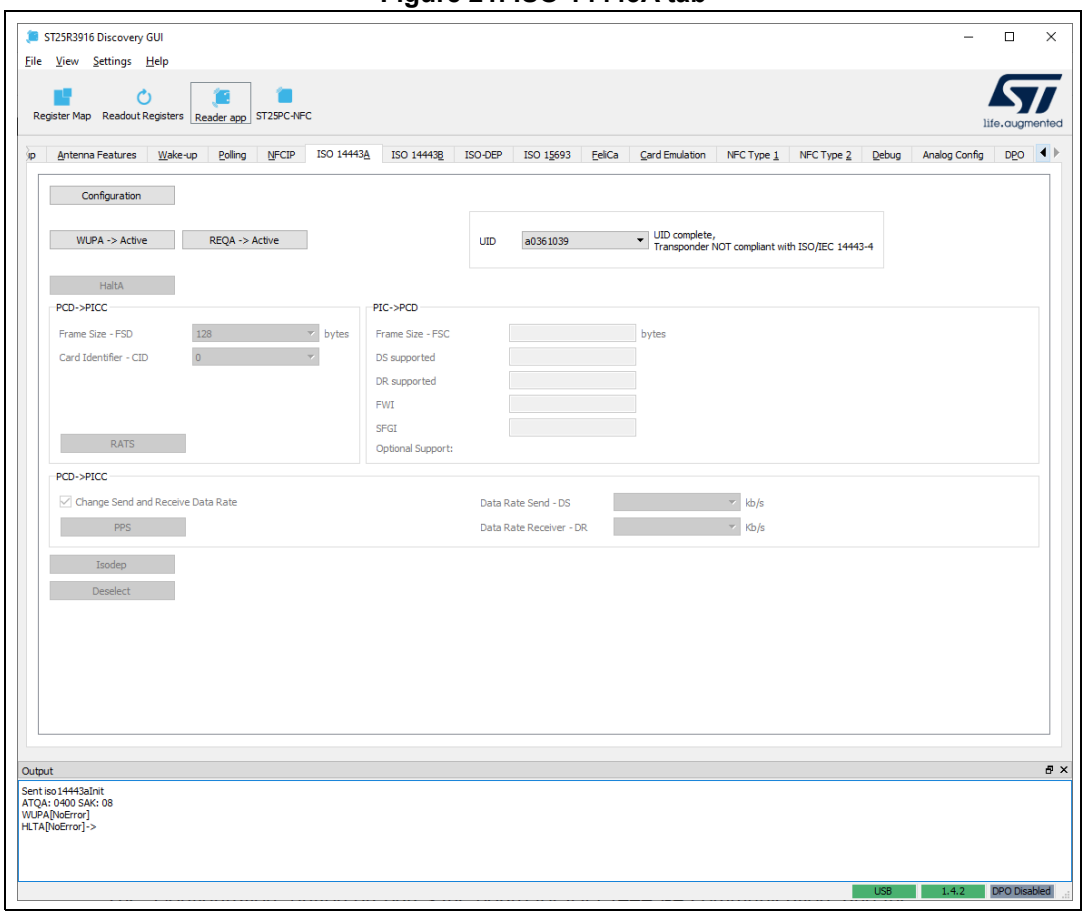
It is possible to transfer pictures to the phone (the GUI provides three samples as example).

The "Image from Disk" button provides an individual option to select a file.

  – Click on one picture to start the transfer. The transfer takes several seconds, because the picture contains a large amount of data. For this reason wait until the picture is transferred.
  – The phone displays the received picture with the comment "new Tag received".

1.4.7 ISO 14443A tab

Figure 21. ISO 14443A tab

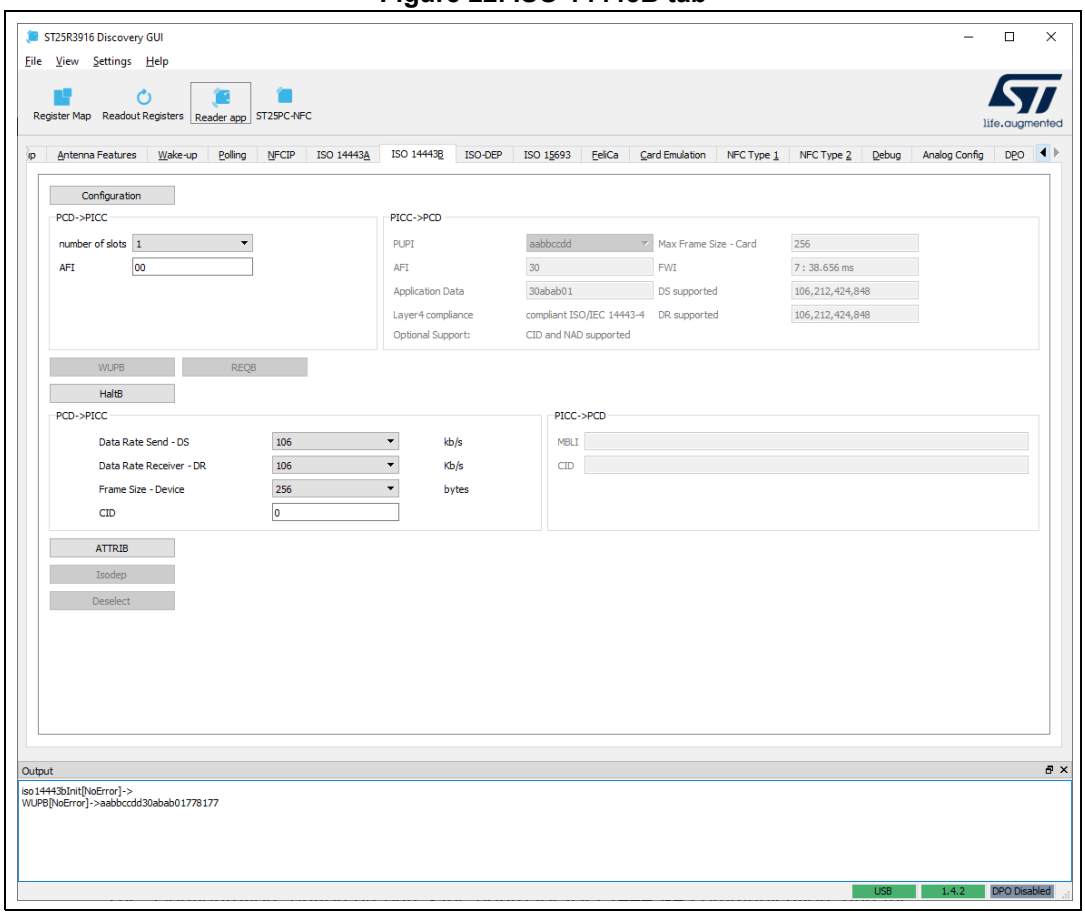


The “Configuration” button prepares the board for ISO 14443-A communication, and the following sequence activates the cards:

- “REQA → Active” or “WUPA → Active” starts the anticollision procedure
- Tag UID is displayed
- If the card/tag supports ISO 14443-4 additional commands like RATS or PPS can be carried out
- Click on RATS or PPS
- Send arbitrary frames using “Debug” tab (see *Section 1.4.15*)

1.4.8 ISO 14443B tab

Figure 22. ISO 14443B tab



The “Configuration” button prepares the board for ISO 14443-B communication, and the following sequence activates the card:

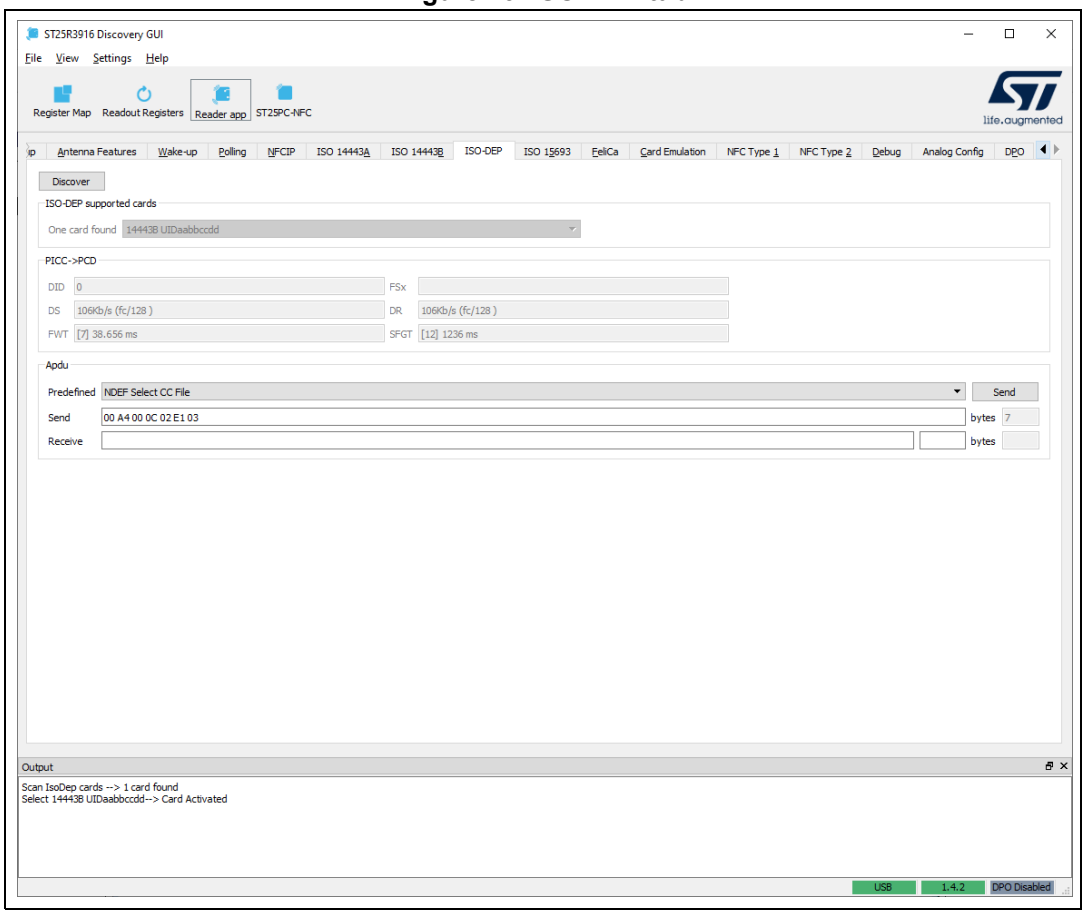
- Click on “REQB” or “WUPB” button to poll once. The PUPI of a found tag is displayed.
- If the card/tag supports ISO 14443-4, additional commands like “ATTRIB” can be carried out.
- Send arbitrary frames using “Debug” tab (see *Section 1.4.15*).

1.4.9 ISO-DEP tab

The ISO-DEP tab is on a layer higher than ISO14443A and ISO14443B tabs. It automatically performs all activation steps after pressing Discover, and lets the user send APDUs according ISO7816-4 to contactless smartcards.

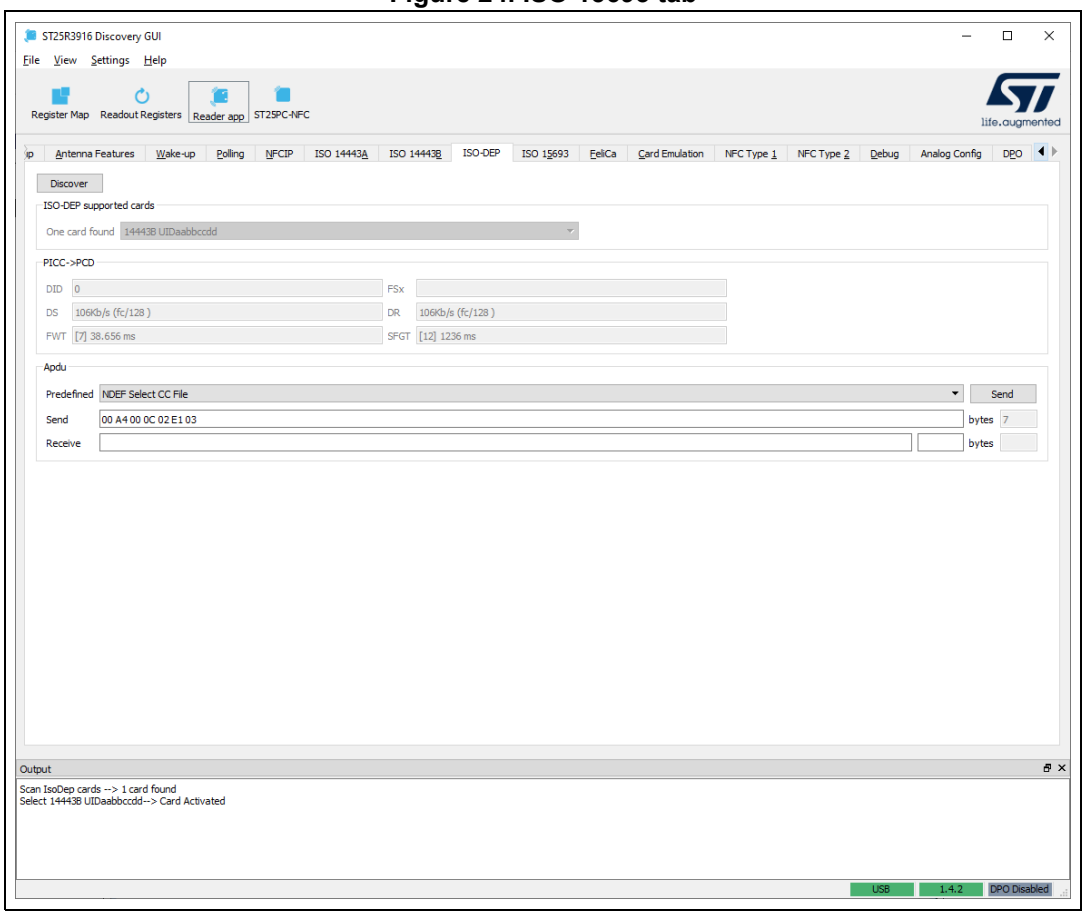
Some frequently used APDUs can be pre-selected in the combobox.

Figure 23. ISO-DEP tab



1.4.10 ISO 15693 tab

Figure 24. ISO 15693 tab



The “Configuration” button prepares the board for ISO 15693 communication, and the following sequence activates multiple cards:

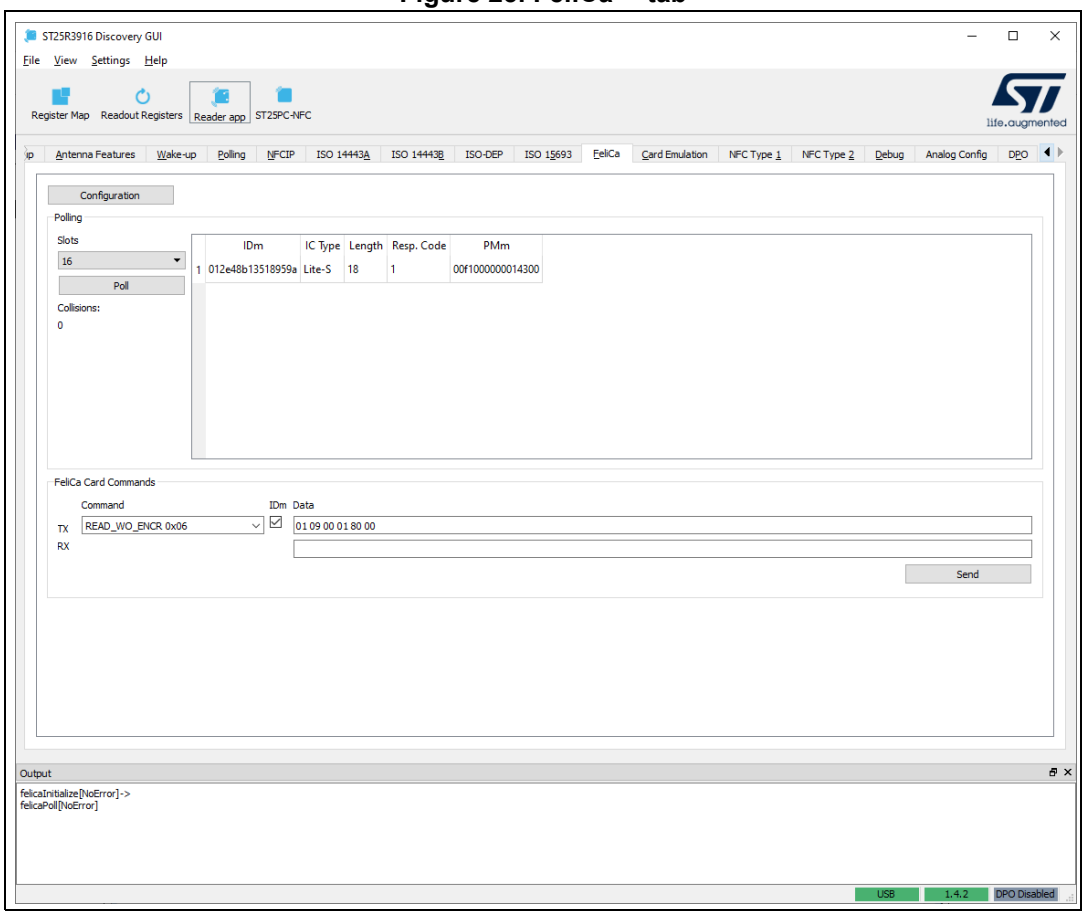
- Click on “Configuration” button.
- Set the ISO 15693 parameter to receive data rate, and the number of slots, which are used in the anticollision loop in the firmware.
- Click on “Inventory” button to scan for vicinity integrated circuit cards.
- Select one of the found UIDs using the drop-down box. The “Get System Information button” can now be pressed to retrieve more information about the selected card.

The “Get System Information” requests the supported features to the card. The command “Read blocks” reads out and displays the memory blocks of the card.

Note: Not all vicinity cards support “Get System Information” command.

1.4.11 FeliCa™ tab

Figure 25. FeliCa™ tab



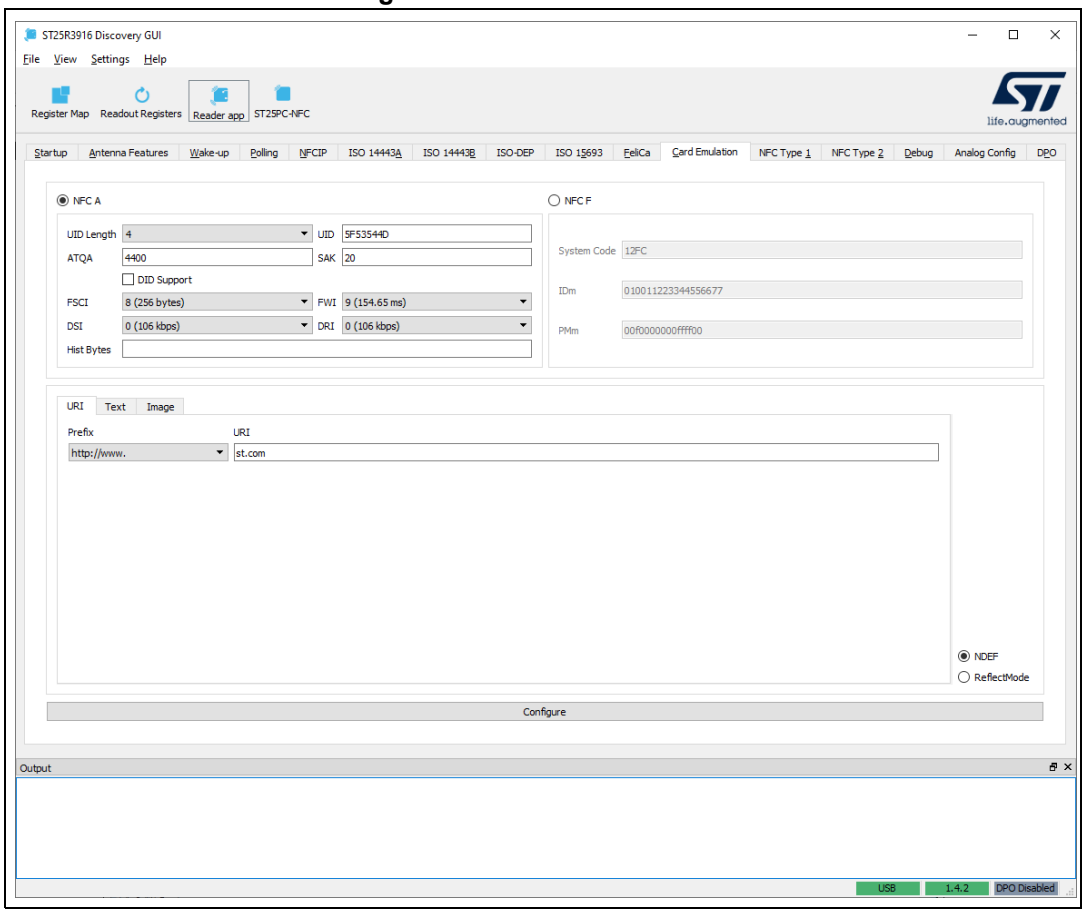
The “Configuration” button prepares the board for FeliCa communication, and the following sequence activates a card:

- Set the number of slots used in the anticollision.
- Click on “Poll” button to poll once for FeliCa cards.
- Arbitrary FeliCa commands can be executed using the “FeliCa Card Commands”. The IDm is inserted on request.

1.4.12 Card Emulation tag

This tab allows the user to configure the ST25R3916 and ST25R3916B in card emulation. It either emulates a T4T (in case of NFC A), or a T3T (in case of NFC F). Different contents can be configured.

Figure 26. Card Emulation tab

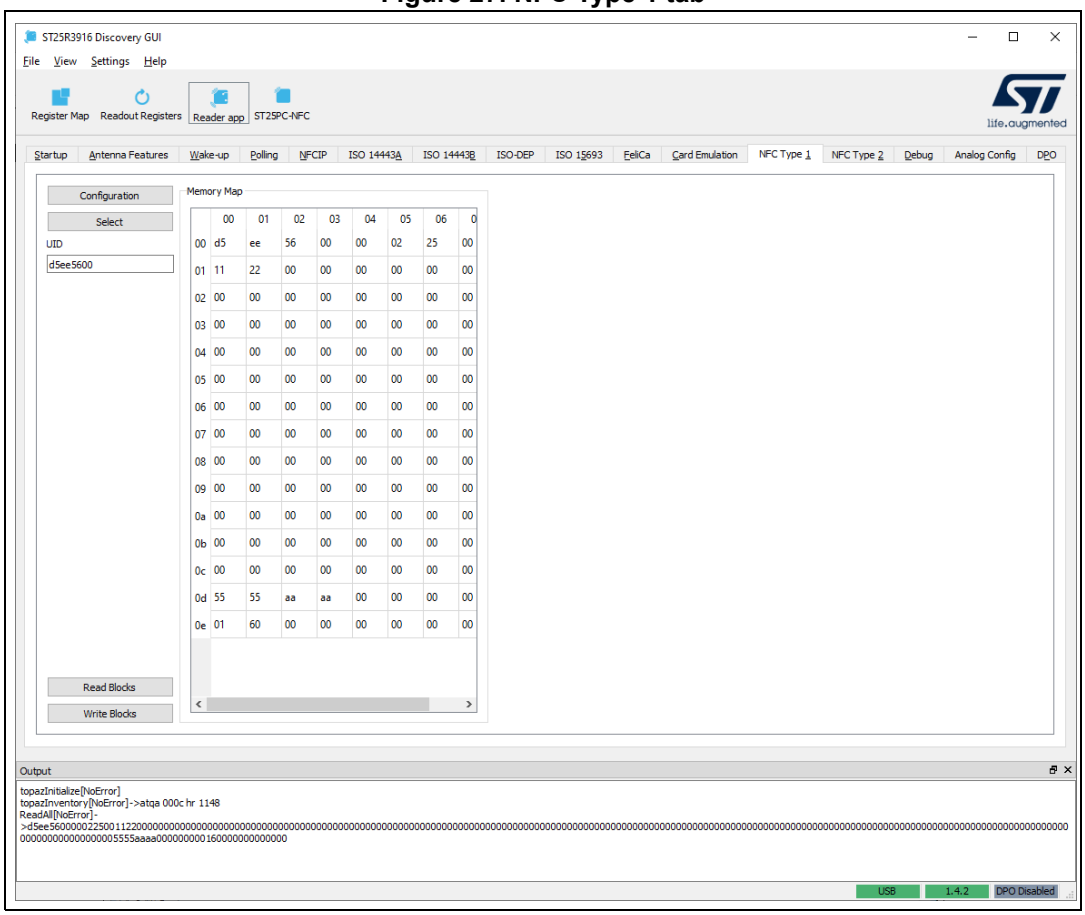


Note that some changes to the default values can make this emulation not inter-operable with a phone anymore.

The card emulation is performed inside GUI, and depends upon the PC reactivity and speed.

1.4.13 NFC Type 1 tab

Figure 27. NFC Type 1 tab

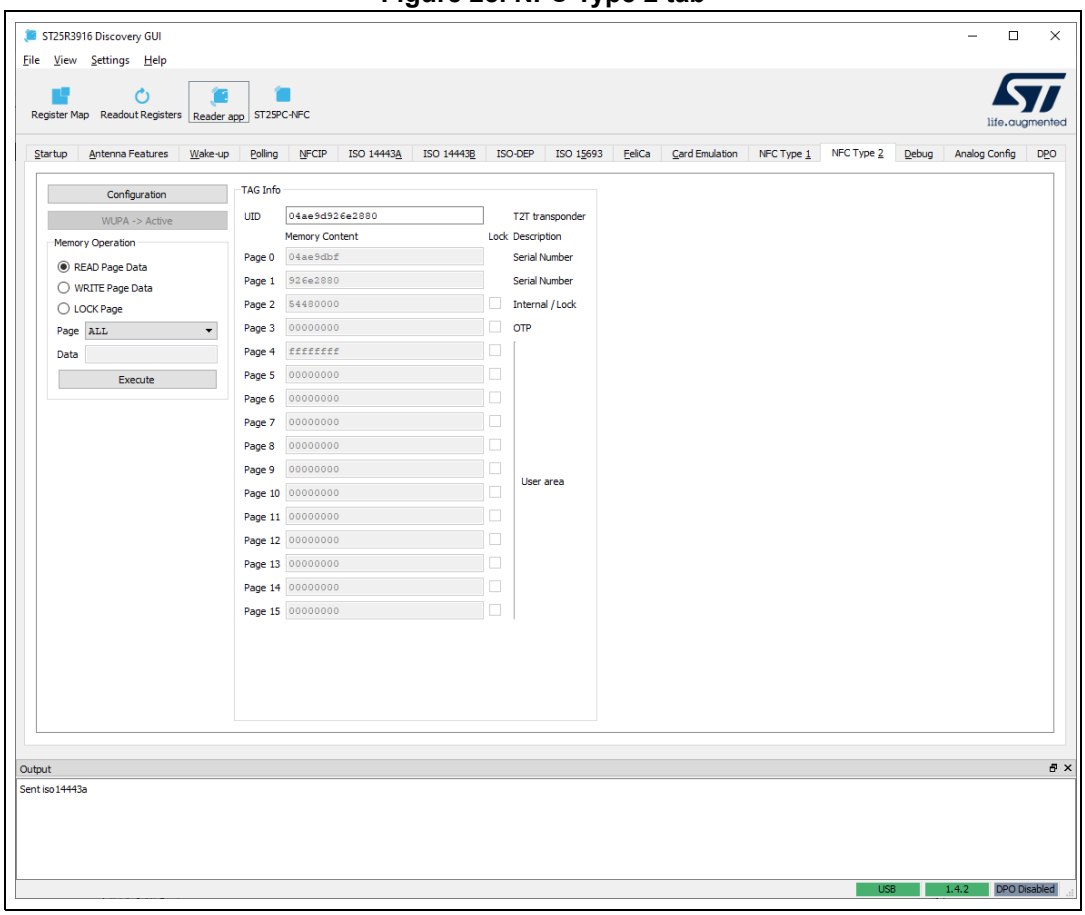


The “Configuration” button prepares the board for NFC Type 1 communication, and the following sequence activates a card:

- Click on “Select” button to send a WUPA
- The UID of the Type 1 Tag is shown
- The commands Read and Write are available, and it is possible to read and write the card memory blocks

1.4.14 NFC Type 2 tab

Figure 28. NFC Type 2 tab



The “Configuration” button prepares the board for ISO 14443A communication and enables the field.

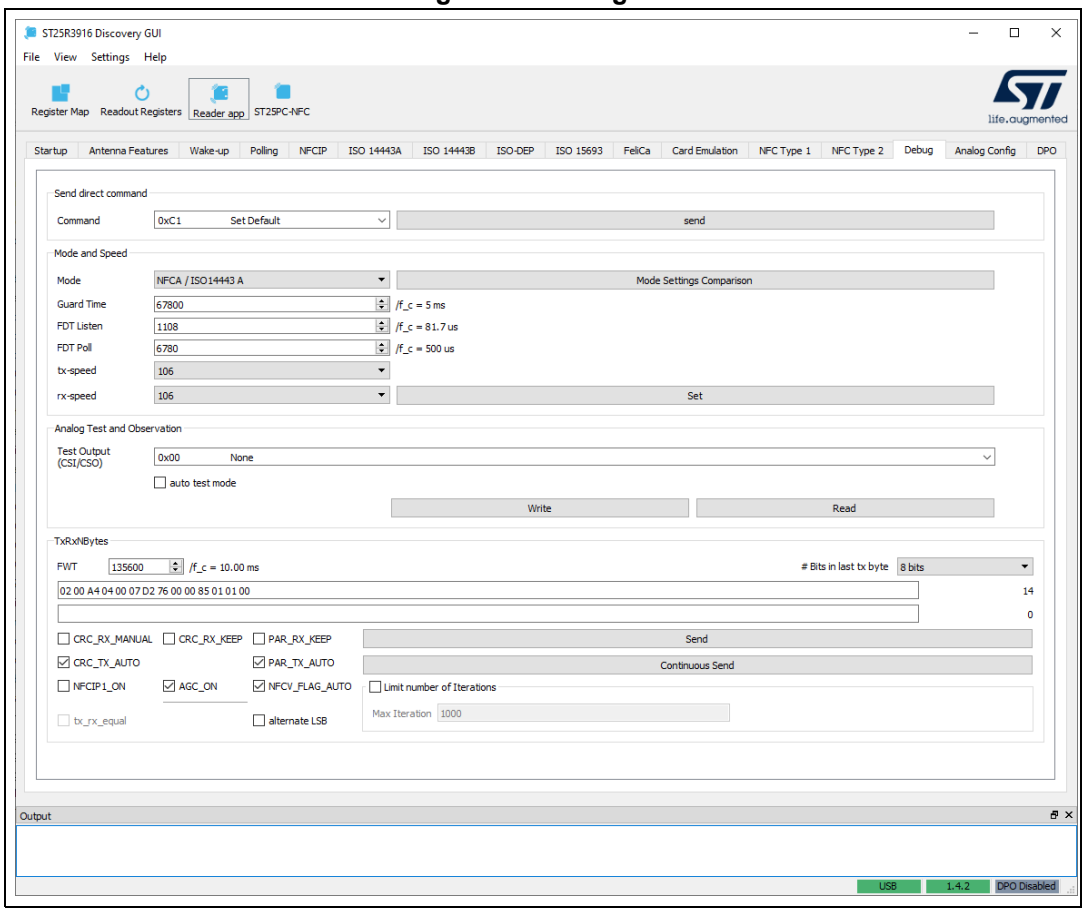
- Read data from page sequence:
  - Click on “Configuration” button
  - Click on “WUPA → Active” to find a card
  - Activate the “READ Data from Page” flag
  - Click on “Execute” to read the memory card content
- Write data from page sequence:
  - Click on “Configuration” button
  - Click on “WUPA → Active” to find a card
  - Activate the “WRITE Data from Page” flag
  - Click on “Execute” to write the memory card content
- Lock page:
  - Click on “Configuration” button
  - Click on “WUPA → Active” to find a card
  - Activate the “LOCK Page” flag
  - Click on “Execute” to lock the memory card page content

1.4.15 Debug tab

The debug tab is split into three boxes (see *Figure 29*)

- “Send Direct Command”, to send direct commands.
- “Mode and Speed” allows the user to configure the ST25R3916 and ST25R3916 to various protocols and bit rates, and gives the option to influence various protocol-dependent timings
- “TxRxNBytes”, to send arbitrary hex-encoded byte strings, with the previously selected protocol

Figure 29. Debug tab



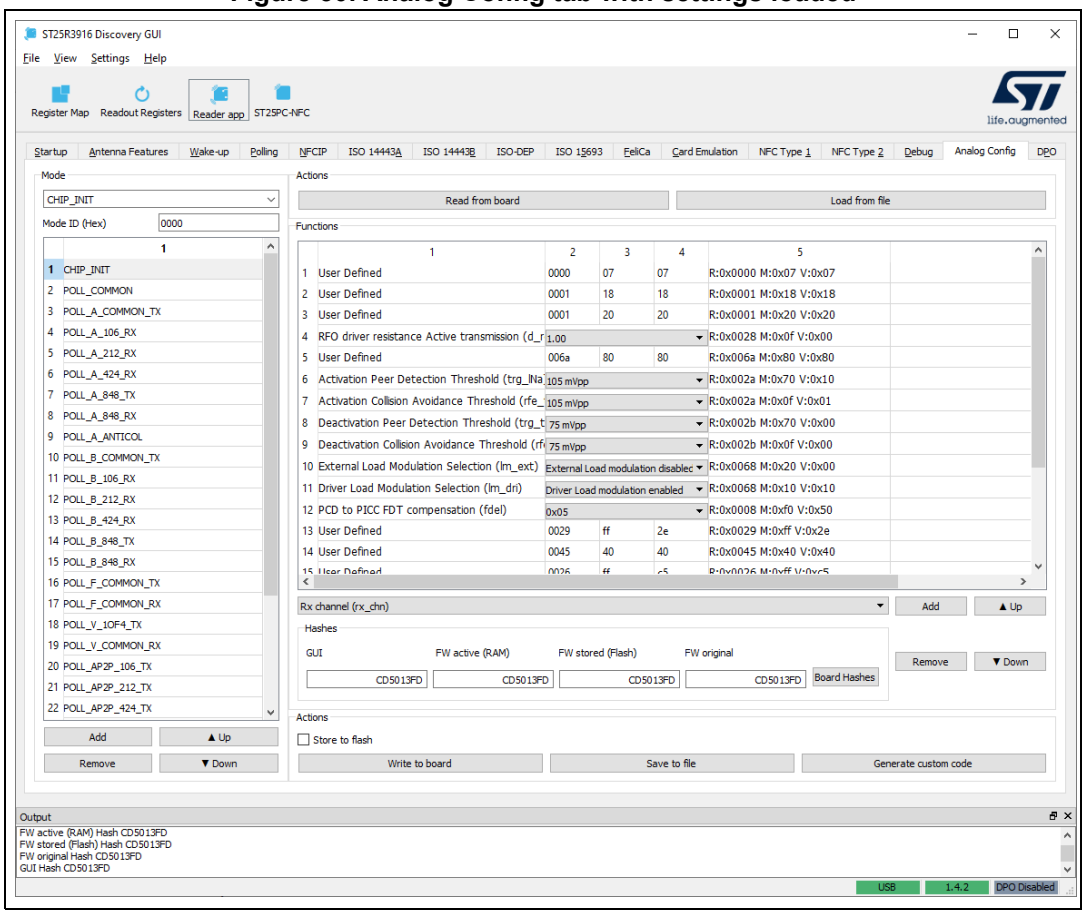
Note: The usage of this tab is for experienced users only.

1.4.16 Analog Config tab

This tab holds important configuration settings, required for setting chip specific registers for different technologies and bitrates. The concept of the analog configuration is part of the RFAL software structure and is used throughout different chip and board variants.

- Depending upon the communication standard (such as EMVCo or ISO 14443) a configuration file has to be loaded through the “Load from file” button. This configuration file is located under the GUI program subfolder analog_config after the installation.
- Before the Loopback Application can be started, the configuration file needs to be written to the board with the “Write to board” button.

Figure 30. Analog Config tab with settings loaded



The analog configuration page is divided into *Mode*, *Functions*, and *Actions*.

Mode

Mode provides a drop-down box holding all chip specific supported technologies. A specific mode can be added to the “Mode List”, which then enables Functions to be linked to selected modes. This easily accomplishes individual settings for all transmit and receive modes.

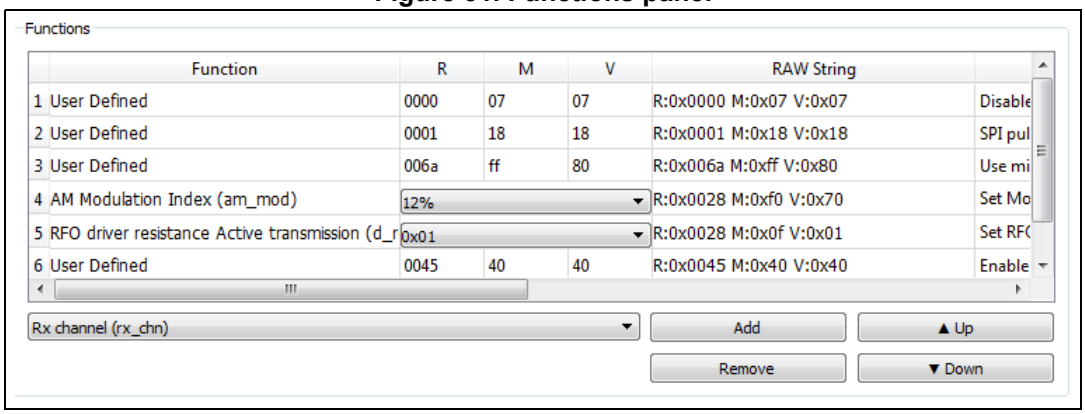
The “CHIP_INIT” mode is used to set global registers that have to be used independently of other selected modes. As an example, the enable of pull-downs of SPI lines can be performed.

Functions

The functions window holds register values linked to modes. A function is composed of a name, the corresponding register, a mask, and the required value for the register. Frequently used functions can be selected through the drop-down box and added to the function list. These functions are already defined with the correct name with predefined values selectable through a drop-down box.

For a better readability, modes can be ordered with the arrow up and down button in *Mode*. As an example, in *Figure 31*, in row 6 the function “AGC Enable Selection (agc_en) has been added with the drop-down box. Instead of displaying register, mask and value information the user has direct control over its allowed value range through a drop-down box. In this case, the AGC can be either enabled or disabled. The column “RAW String” translates the drop-down value into the actual register, mask, and value combination.

Figure 31. Functions panel



Take care to define the same registers or functions for multiple entries in the “Mode” list: if, as an example, a function is added to ISO 14443A and not restored in ISO 14443B mode, it is also applied to ISO 14443B.

Actions

The five action buttons complete the analog configuration concept by reading and writing information to the board or the PC.

The “Read from board” button reads the register configuration from the connected board. Note that values currently displayed in the analog configuration are overwritten.

The “Write to board” button writes the current register configuration from the analog configuration tab to the connected board. Note that if the analog configuration tab is left empty, no registers are written to the board (the board remains with its stored values).

The “Load from file” button loads a previously saved configuration file to the analog configuration tab. Use “Write to board” to write this newly loaded settings to the connected board.

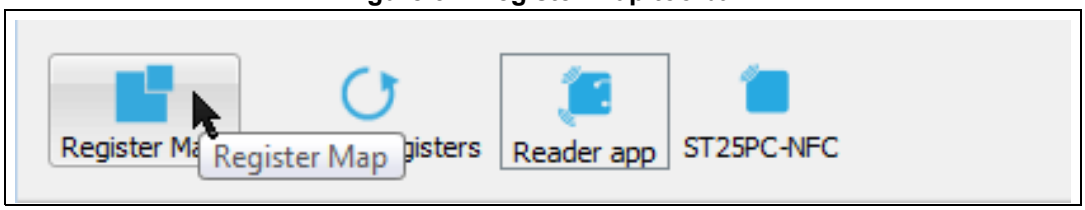
The “Save to file” button saves the current configuration in the analog configuration tab to the filesystem.

The button “Generate code template” can be used to automatically generate a C header file for direct inclusion into a compiled firmware image.

2 Register map

Pressing the “Register Map” button in the toolbar opens a dialog to interact with the ST25R3916 and ST25R3916B registers (*Figure 32*).

Figure 32. Register map toolbar



The GUI includes a register map window (*Figure 33*) showing the ST25R3916 registers.

This window can be opened by clicking the “Register Map” button in the toolbar, selecting the “View → Register Map” menu entry or pressing “Ctrl-M”.

Typically, the display of the registers uses hexadecimal notation, but it can be changed to decimal. Hovering over the icon “bits” opens up a tool tip showing details of the bit/bit fields.

Clicking bits toggles them, and entering a value without “0x” into the Value column results in the change of complete registers.

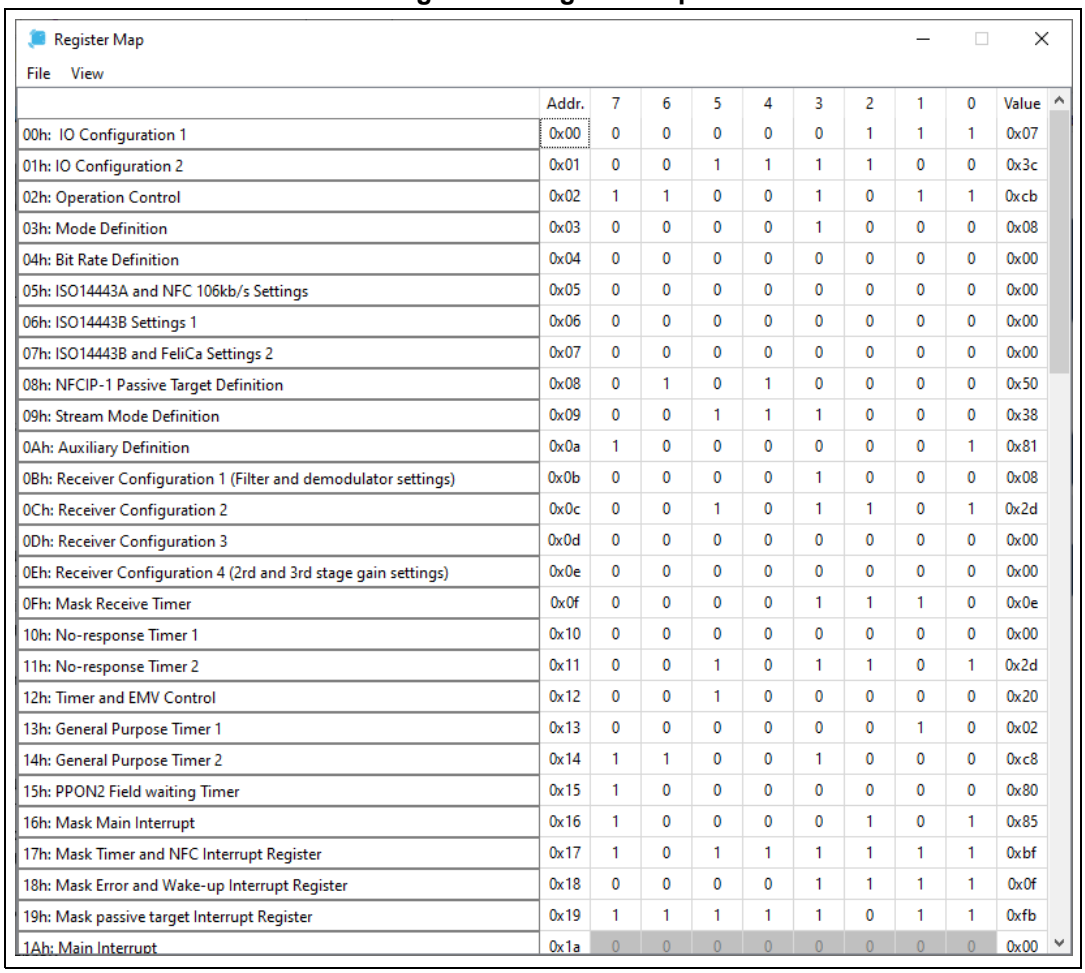
The update of the register map can be manually triggered (“File → Readout Registers”), or done automatically (“Settings → Automatic Update”).

By using the “Readout Registers” button all registers are read. This can be done at any time.

Registers may be overwritten, depending upon the current analog configuration setting and firmware operation.

The “Register Map” dialog allows the user to read all registers and write the registers with write access.

Figure 33. Register map



Register Map

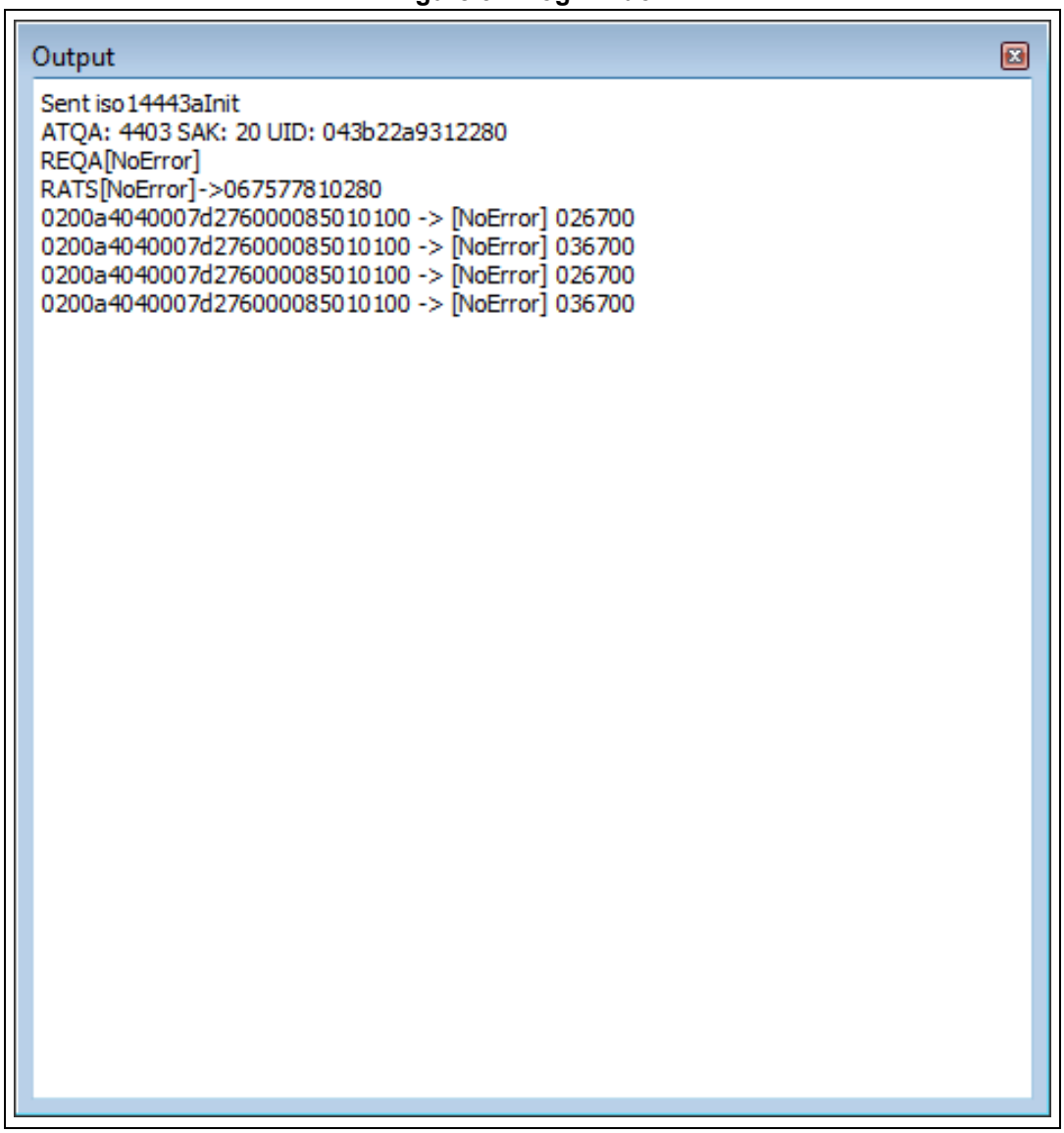
File View

	Addr.	7	6	5	4	3	2	1	0	Value
00h: IO Configuration 1	0x00	0	0	0	0	0	1	1	1	0x07
01h: IO Configuration 2	0x01	0	0	1	1	1	1	0	0	0x3c
02h: Operation Control	0x02	1	1	0	0	1	0	1	1	0xcb
03h: Mode Definition	0x03	0	0	0	0	1	0	0	0	0x08
04h: Bit Rate Definition	0x04	0	0	0	0	0	0	0	0	0x00
05h: ISO14443A and NFC 106kb/s Settings	0x05	0	0	0	0	0	0	0	0	0x00
06h: ISO14443B Settings 1	0x06	0	0	0	0	0	0	0	0	0x00
07h: ISO14443B and FeliCa Settings 2	0x07	0	0	0	0	0	0	0	0	0x00
08h: NFCIP-1 Passive Target Definition	0x08	0	1	0	1	0	0	0	0	0x50
09h: Stream Mode Definition	0x09	0	0	1	1	1	0	0	0	0x38
0Ah: Auxiliary Definition	0x0a	1	0	0	0	0	0	0	1	0x81
0Bh: Receiver Configuration 1 (Filter and demodulator settings)	0x0b	0	0	0	0	1	0	0	0	0x08
0Ch: Receiver Configuration 2	0x0c	0	0	1	0	1	1	0	1	0x2d
0Dh: Receiver Configuration 3	0x0d	0	0	0	0	0	0	0	0	0x00
0Eh: Receiver Configuration 4 (2rd and 3rd stage gain settings)	0x0e	0	0	0	0	0	0	0	0	0x00
0Fh: Mask Receive Timer	0x0f	0	0	0	0	1	1	1	0	0x0e
10h: No-response Timer 1	0x10	0	0	0	0	0	0	0	0	0x00
11h: No-response Timer 2	0x11	0	0	1	0	1	1	0	1	0x2d
12h: Timer and EMV Control	0x12	0	0	1	0	0	0	0	0	0x20
13h: General Purpose Timer 1	0x13	0	0	0	0	0	0	1	0	0x02
14h: General Purpose Timer 2	0x14	1	1	0	0	1	0	0	0	0xc8
15h: PPON2 Field waiting Timer	0x15	1	0	0	0	0	0	0	0	0x80
16h: Mask Main Interrupt	0x16	1	0	0	0	0	1	0	1	0x85
17h: Mask Timer and NFC Interrupt Register	0x17	1	0	1	1	1	1	1	1	0xbf
18h: Mask Error and Wake-up Interrupt Register	0x18	0	0	0	0	1	1	1	1	0x0f
19h: Mask passive target Interrupt Register	0x19	1	1	1	1	1	0	1	1	0xfb
1Ah: Main Interrupt	0x1a	0	0	0	0	0	0	0	0	0x00

3 Logging

The output can be observed using the log output panel, which can also be dragged out, to become its own window.

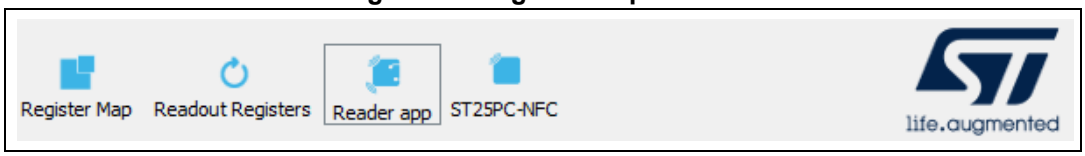
Figure 34. Log window



4 Using the ST25PC NFC application

Using the buttons in the toolbar this application can also directly open the ST25PC-NFC software (also available as STSW-ST25PC001). When the ST25PC-NFC is opened the Discovery GUI gets disconnected/inactive. By pressing the “Reader app” or closing the ST25PC-NFC the user can go back to Discovery operation.

Figure 35. Register map toolbar



More information on this GUI can be found in UM2444 “Software toolbox for NFC tags”, available on *www.st.com*.

5 Revision history

Table 1. Document revision history

Date	Revision	Changes
20-Dec-2018	1	Initial release.
08-Feb-2019	2	Changed document classification, from ST restricted to Public. Updated *Section 1.4.2: Antenna features tab*, *Section 1.4.3: Wakeup tab* and *Section 1.4.4: DPO*. Updated *Figure 3: StartUp tab*, *Figure 4: Antenna features tab*, *Figure 8: DPO panel in disabled state*, *Figure 9: DPO panel enabled* and *Figure 11: Enabled DPO with not optimized threshold settings*.
17-Mar-2023	3	Document scope extended to STEVAL-253916B kit. Updated document title, *Introduction*, *Section 1: Demonstration kits*, *Section 1.1: Board installation*, *Section 1.2: Installing the ST25R3916-DISCO software (STSW-ST25R010)*, *Section 1.3: Firmware update*, *Section 1.4: ST25R3916 Discovery GUI tab*, *Section 1.4.1: StartUp tab*, *Inductive wake-up*, and *Mode*. Updated figures *3* to *13*, *19* to *22*, *24* to *30*, *33*, and *35*. Added *AWS* and *Section 1.4.9: ISO-DEP tab*. Minor text edits across the whole document.