UM1084
User manual

CR95HF development software

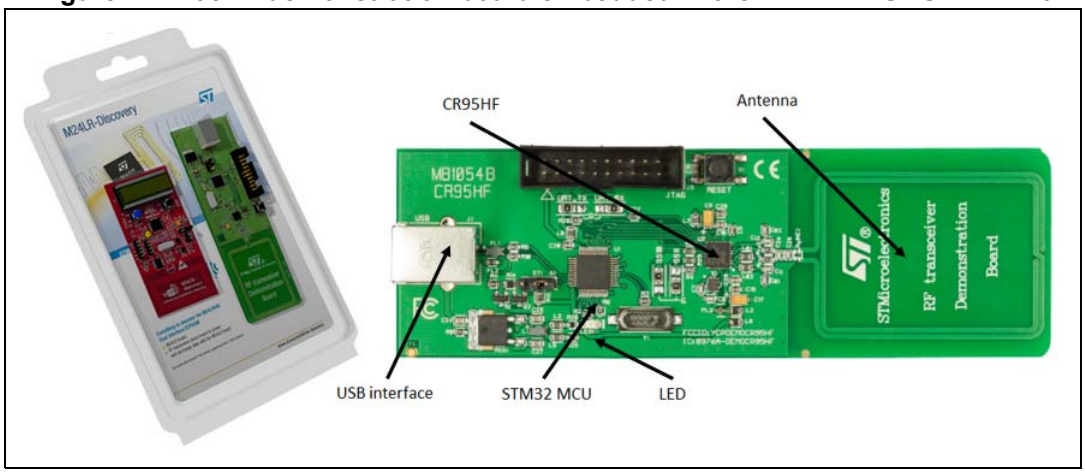
Introduction

The CR95HF development software (STSW-95HF001) is a PC software which allows to configure, evaluate, and communicate with CR95HF 13.56 MHz multi-protocol contactless transceiver.

The software must be used in conjunction with the CR95HF demonstration board (see *Figure 1*) which includes a ready-to-use board to interface with the host PC through a USB interface. This CR95HF demonstration board is included in the M24LR-DISCOVERY kit.

The CR95HF demonstration board is powered through the USB bus and no external power supply is required. It includes a CR95HF contactless transceiver, a 48 x 34 mm 13.56 MHz inductive etched antenna and the associated tuning components. The CR95HF communicates with the STM32F103CB 32-bit core MCU via the SPI bus.

Figure 1. CR95HF demonstration board embedded in the M24LR-DISCOVERY kit



Reference documents

- DEMO databrief
- CR95HF datasheet

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1 Installing the CR95HF development software (STSW-95HF001)

To install the CR95HF development software (STSW-95HF001):

1. Download the latest revision of the CR95HF development software from http://www.st.com.
2. Unzip the setup.zip file.
3. Execute the setup.exe file to install the CR95HF development software on your computer. Follow the instructions described in *Figure 2* to *Figure 10* to install the CR95HF development software under C:\Program files, and CR95HFDll.dll system file under C:\WINDOWS\system32.

When the installation process is complete, you can launch the CR95HF development software. Refer to *Section 2* for a detailed description of the software functions.

Figure 2. setup.exe welcome message

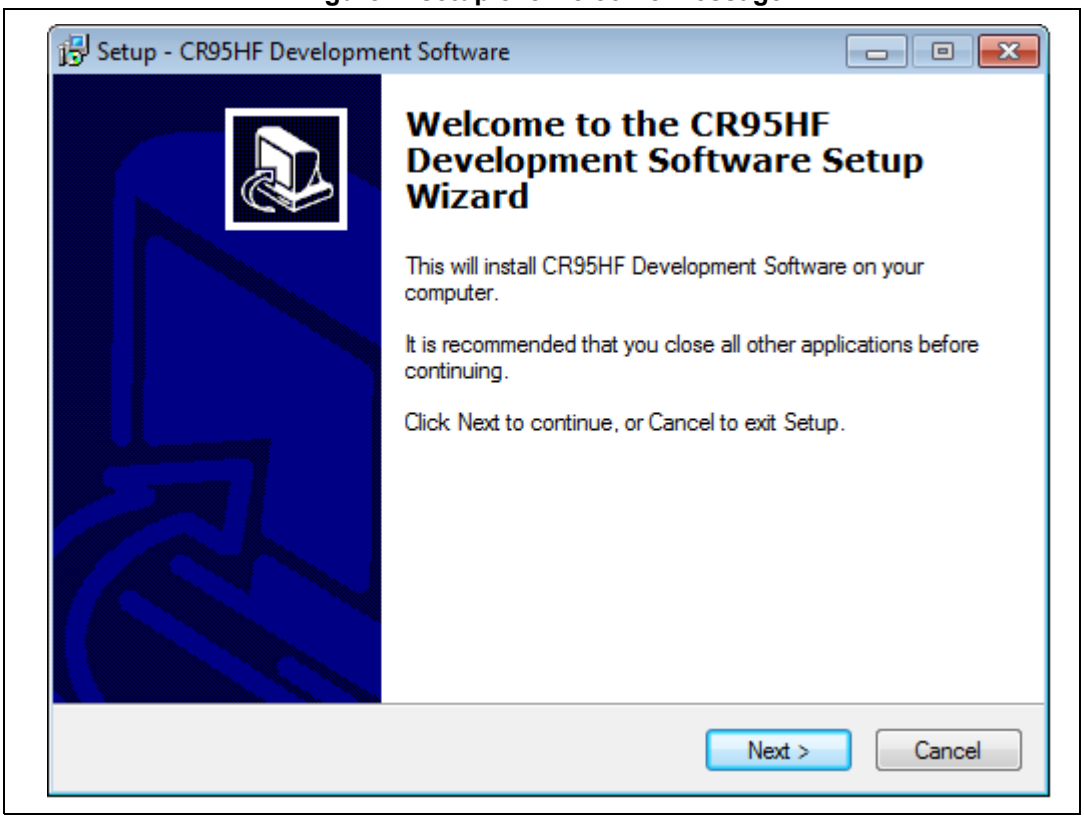


Figure 3. setup.exe license agreement

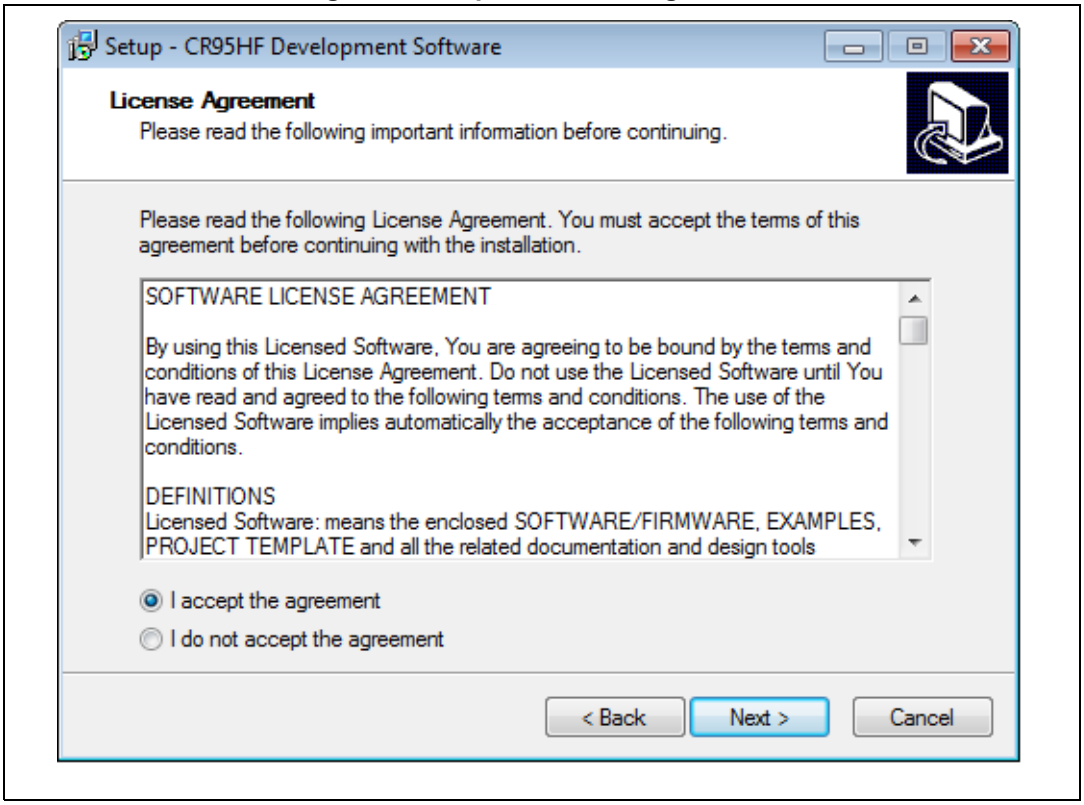


Figure 4. Select the destination folder

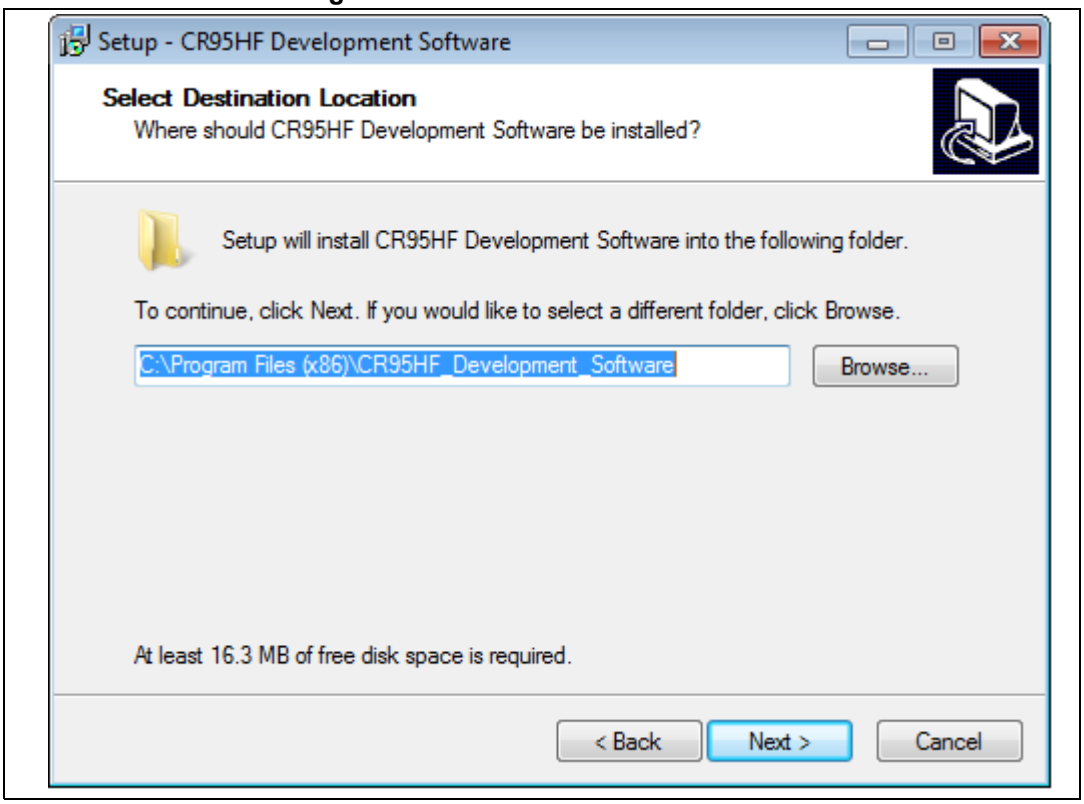


Figure 5. Insert the CR95HF development software from the start menu

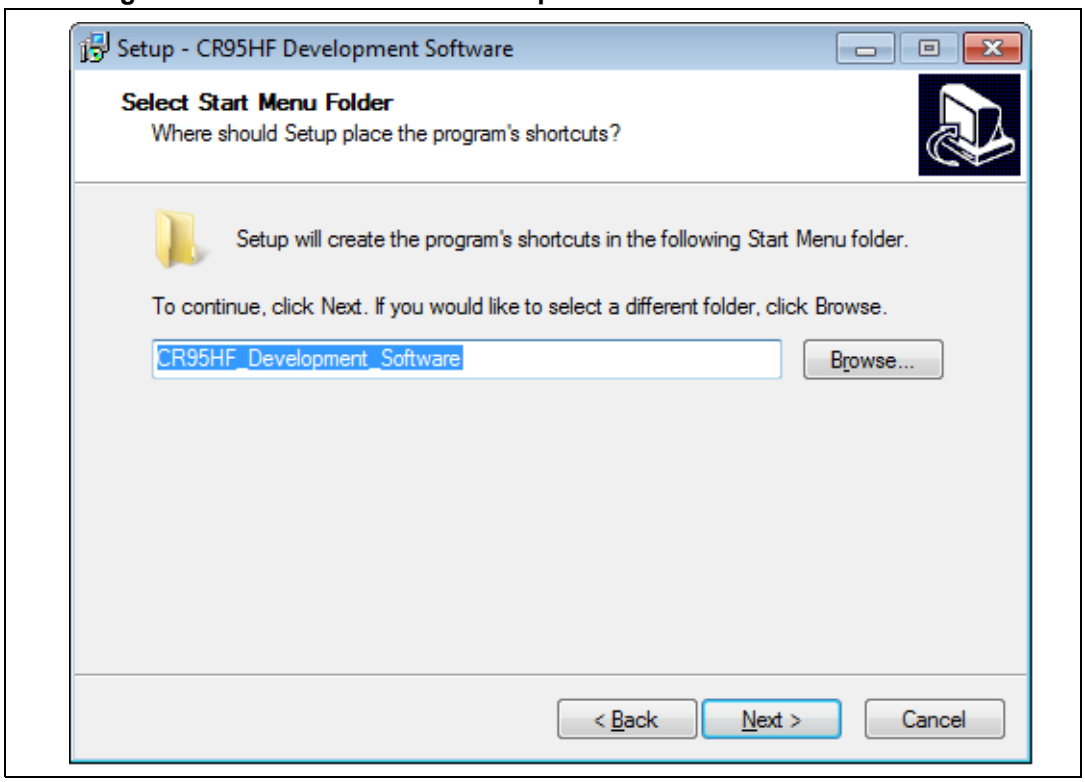


Figure 6. Create desktop or quick launch icons (optional)

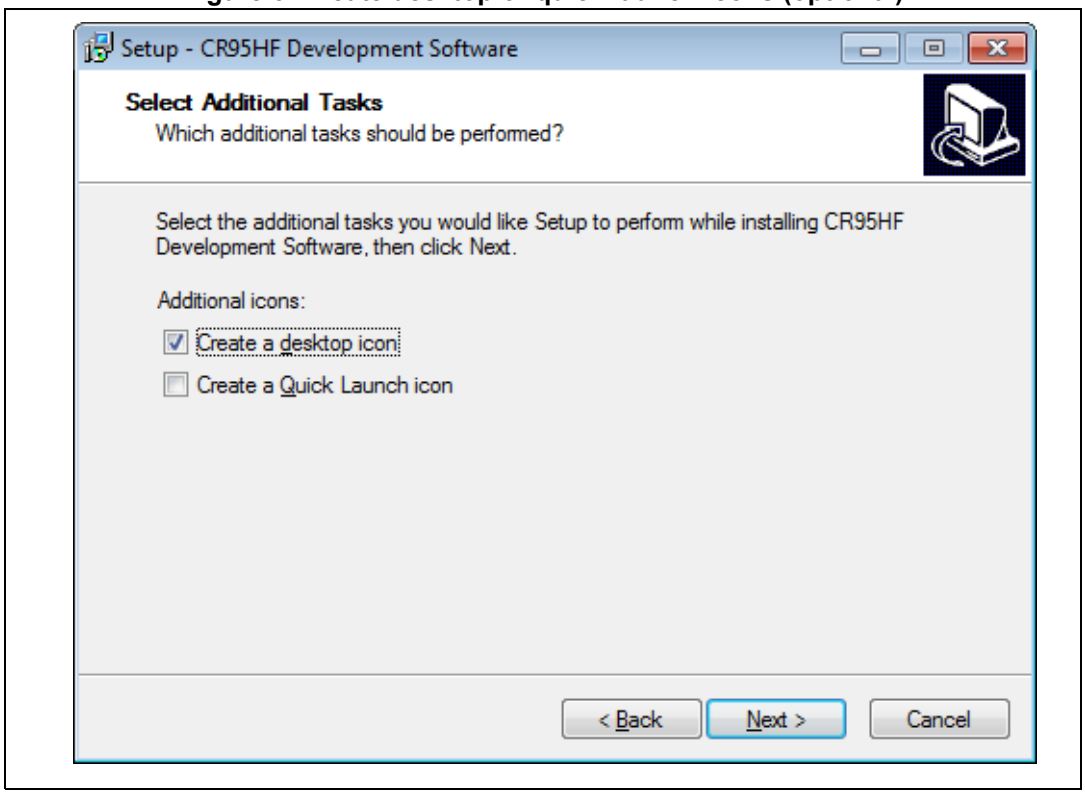


Figure 7. Install the CR95HF development software on your computer

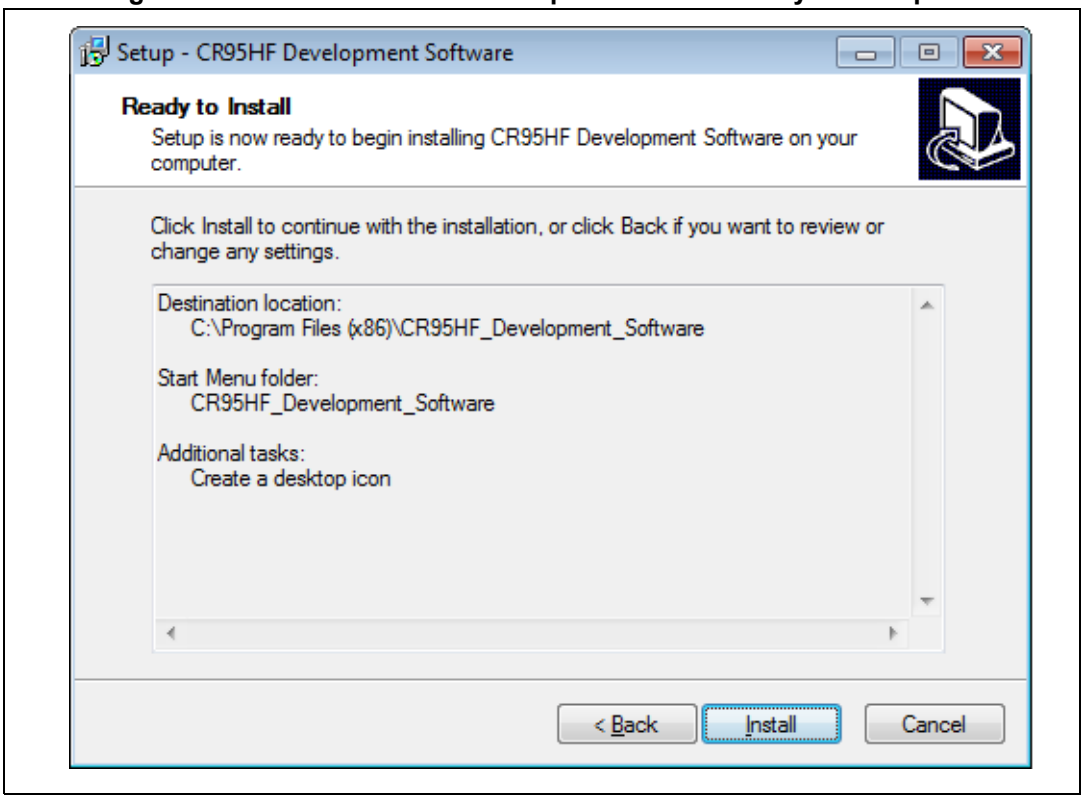


Figure 8. Install the CR95HFdll.dll

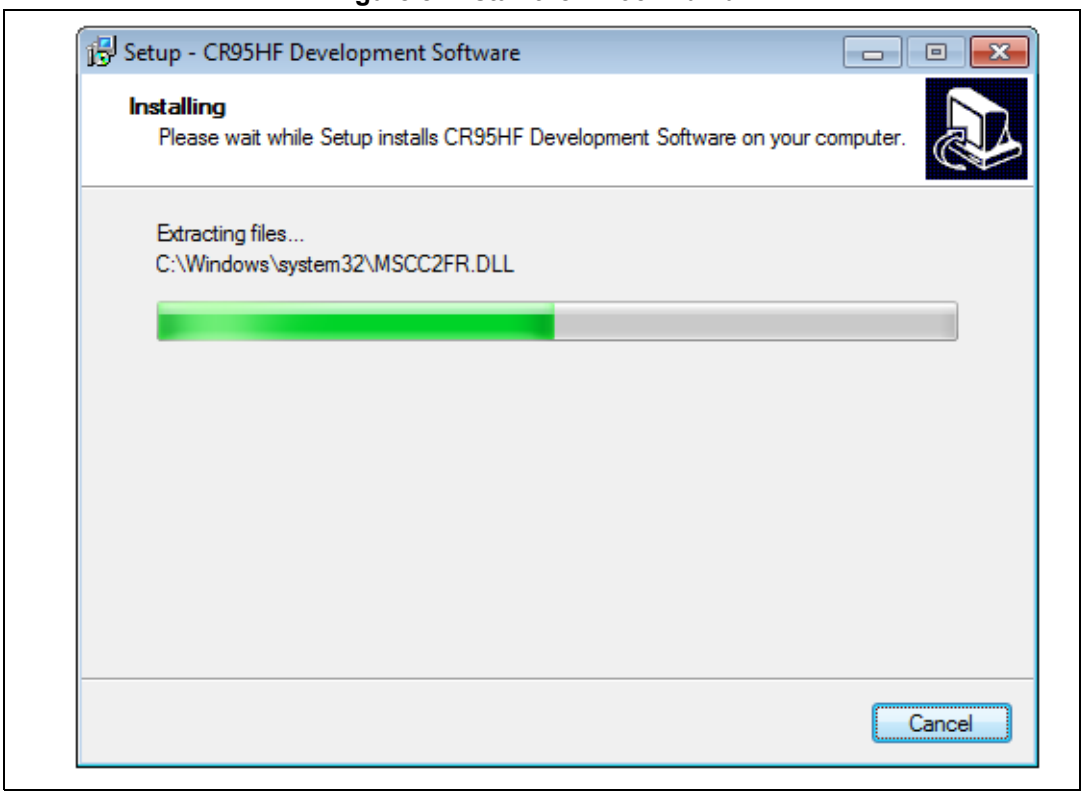


Figure 9. Read the CR95HF development software README

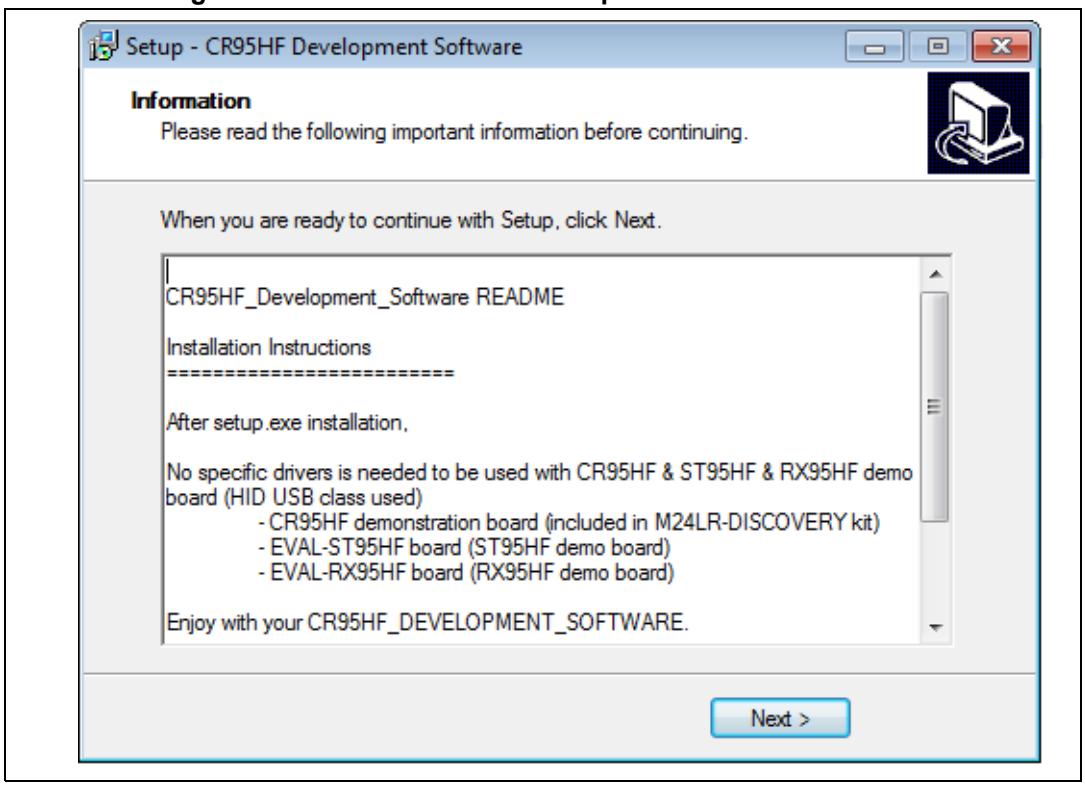
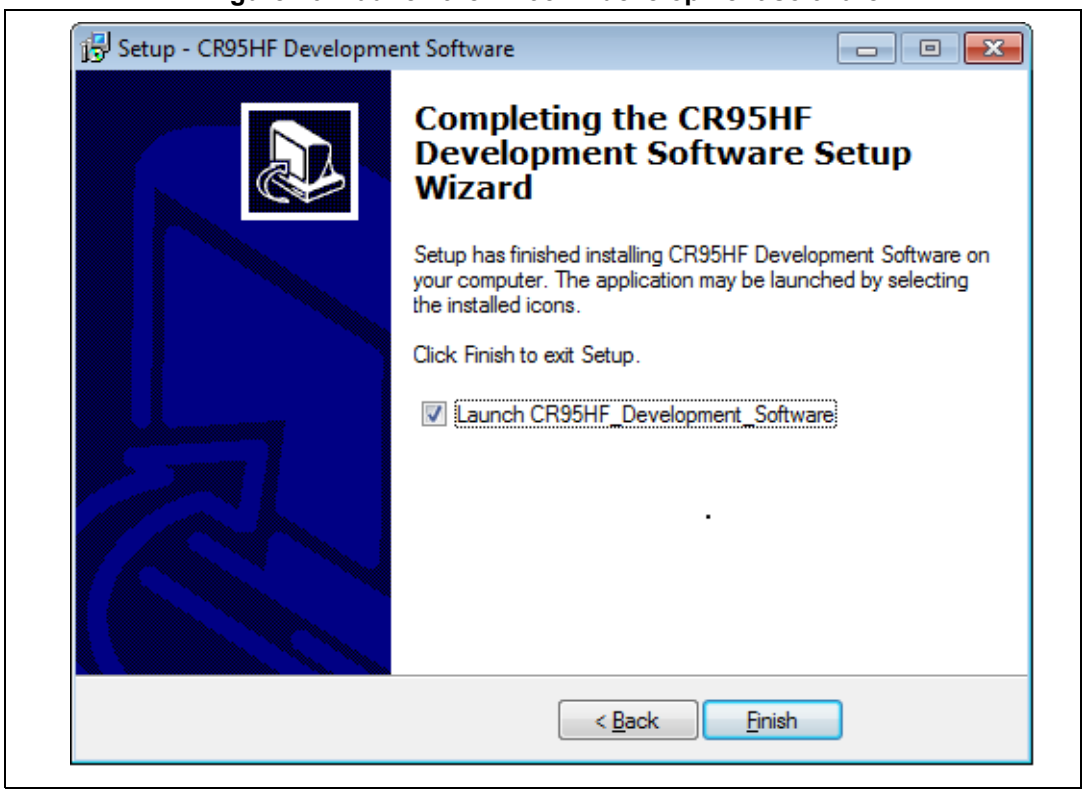


Figure 10. Launch the CR95HF development software



2 Using the CR95HF development software

2.1 Launching the CR95HF development software

Before launching the CR95HF development software, make sure that the CR95HF demonstration board embedded in the M24LR-DISCOVERY kit board is connected to the USB port of your computer.

The on-board LED blinks to indicate that the board works properly.

When the CR95HF development software is launched, a detection process begins (see *Figure 11* and *Figure 12*) to check:

- the revision of the DLL installed on your computer
- the revision of the STM32 MCU firmware installed on your CR95HF demonstration board
- the CR95HF identification number (IDN)

The objective of these checks is to verify that the DLL installed on your PC is up-to-date, and that your CR95HF demonstration board is ready to be used with the CR95HF development software.

If a problem occurs during the detection, the message shown in *Figure 13* is displayed.

Figure 11. Detection message 1/3

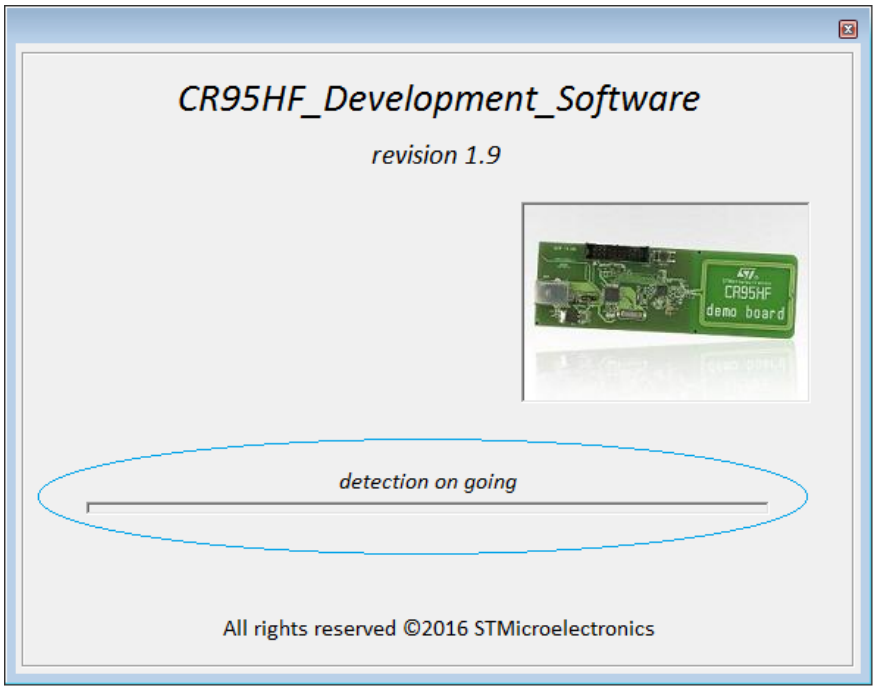


Figure 12. Detection message 2/3

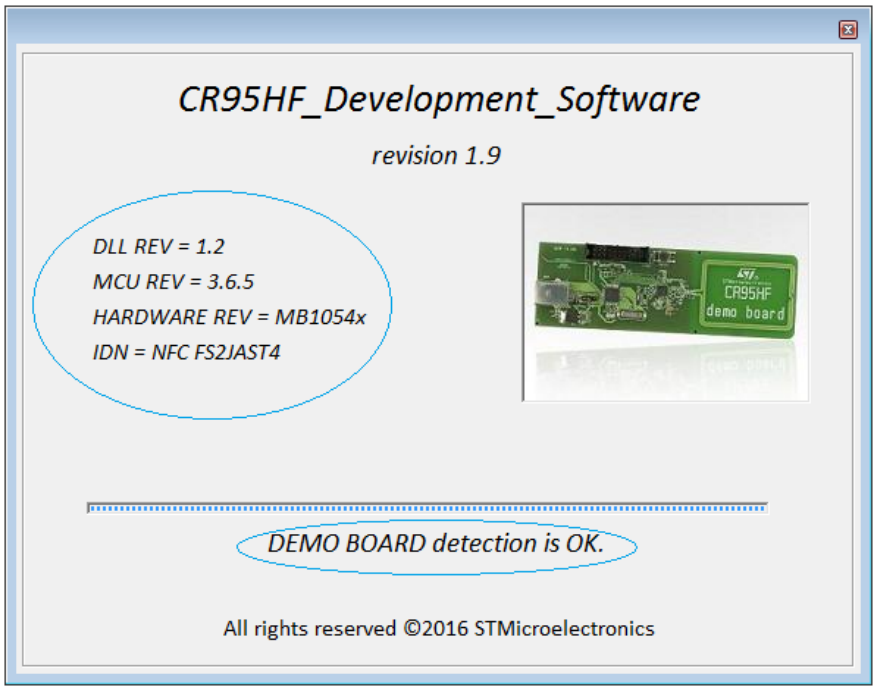
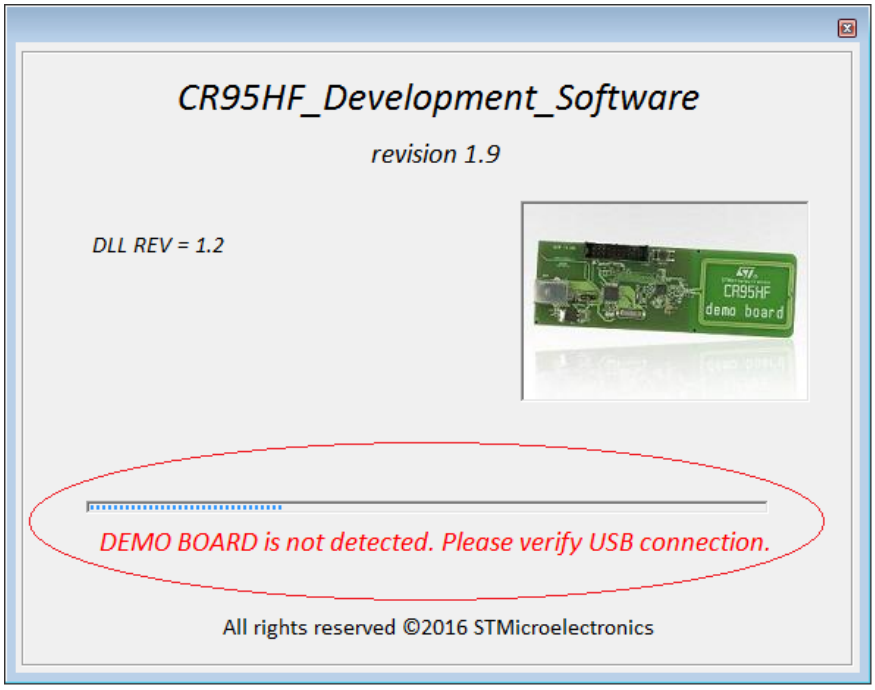


Figure 13. Detection message 3/3

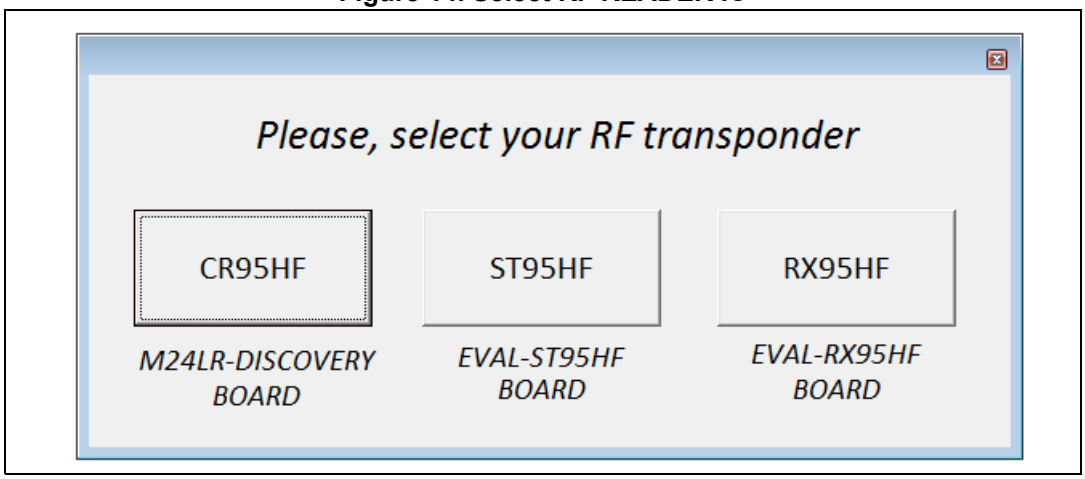


2.2 Main menu

If the software package has been installed correctly and the CR95HF demonstration board is connected to PC USB port, a pop up menu is displayed (see *Figure 14*).

The user need to select a RF READER IC between CR95HF, RX95HF or ST95HF.

Figure 14. Select RF READER IC



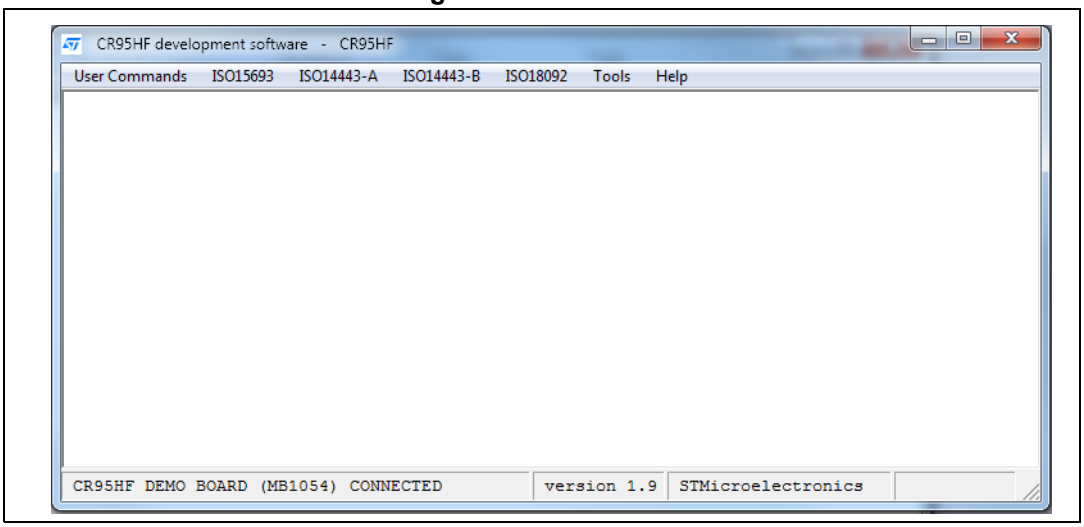
The main menu is displayed depending on the selected IC.

Note: The software release number is shown at the bottom of the menu window.

This menu allows the user to access several sub-menus:

- **User commands** (see *Section 2.3*)
- **ISO15693** mode (see *Section 2.4*)
- **ISO14443-A** mode (see *Section 2.5*)
- **ISO14443-B** mode (see *Section 2.6*)
- **ISO18092** mode (see *Section 2.7*)
- **Tools** menu (see *Section 2.8*)
- **Help** menu (see *Section 2.9*)

Figure 15. Main menu



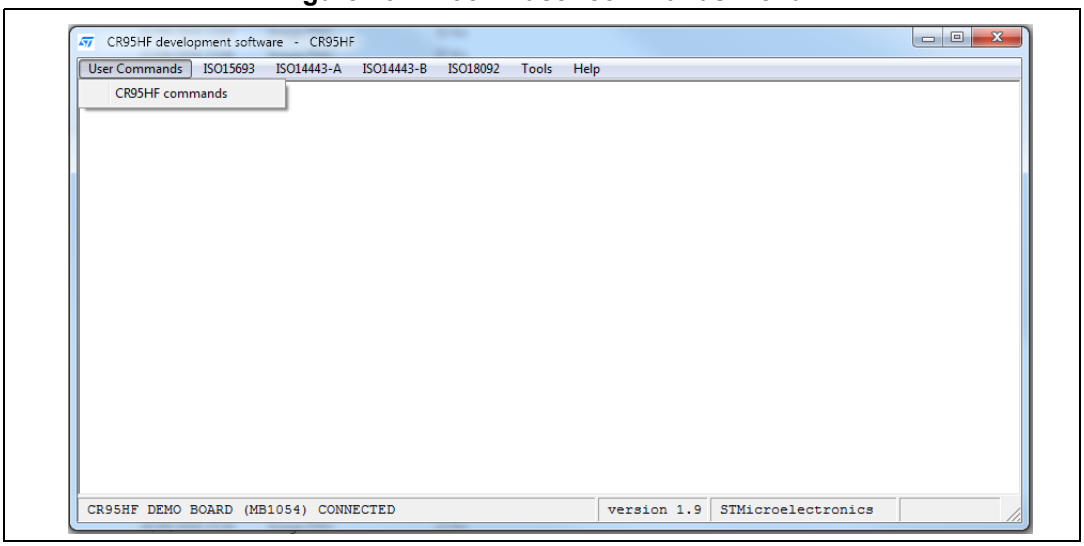
2.3 User commands

This firt menu allows to access to all the commands described on the datasheet of the CR95HF, ST95HF and RX95HF IC (depending on selected IC).

2.3.1 CR95HF commands menu

1. Select CR95HF commands: from the main User command menu to communicate with the CR95HF embedded on your board and use all the commands and parameters described in the CR95HF datasheet (see *Figure 16*).

Figure 16. CR95HF user commands menu



2. Select a command from the list (see *Figure 17*). The corresponding CR95HF command is sent to the CR95HF demonstration board. The selected parameters together with the

board answer are displayed in the log window located at the bottom of the CR95HF user interface window.

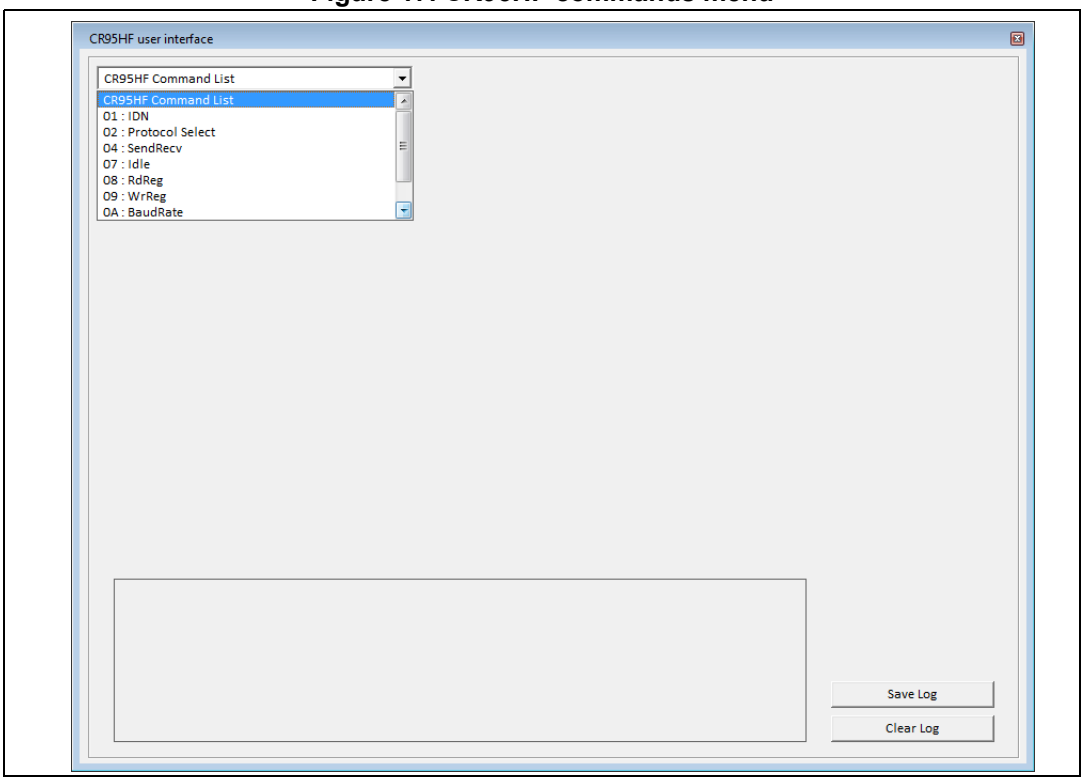
Two buttons are available from this menu:

- **Save Log** can be used to save the log content.
- **Clear Log** clears the log window.

The following commands can be sent through the CR95HF user interface:

- 01: IDN
- 02: Protocol Select
- 04: SendRecv
- 07: Idle
- 08: RdReg
- 09: WrReg
- 0A: baud rate
- 55: Echo

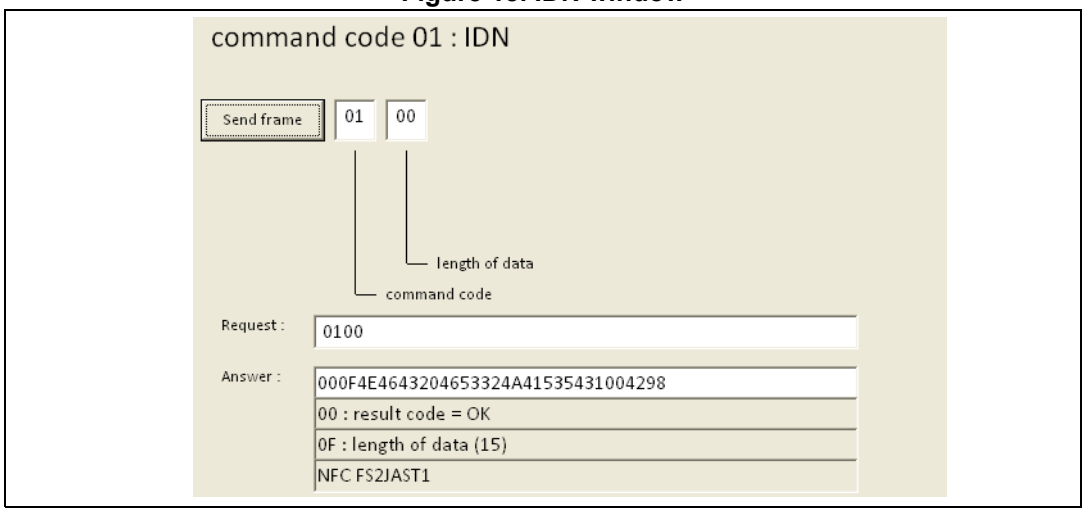
Figure 17. CR95HF commands menu



01: IDN

Click **01: IDN** to request short information about the CR95HF and its firmware version (see *Figure 18*).

Figure 18. IDN window



02: Protocol Select

Click **02: Protocol Select** to select the communication protocol to be used between the CR95HF and the tags, or to switch the RF field off (see *Figure 19*):

- Click **00: Field OFF** to send a Field OFF command that turns the RF field off (see *Figure 20*).
- Click **01: ISO15693** to select and configure the ISO15693 communication protocol (see *Figure 21*).
- Click **02: ISO14443-A** to select and configure the ISO-14443-A communication protocol (see *Figure 22*).
- Click **03: ISO14443-B** to select and configure the ISO-14443-B communication protocol (see *Figure 23*).
- Click on **04: ISO18092** to select and configure the ISO-18092 communication protocol (see *Figure 24*).

Figure 19. Protocol Select window

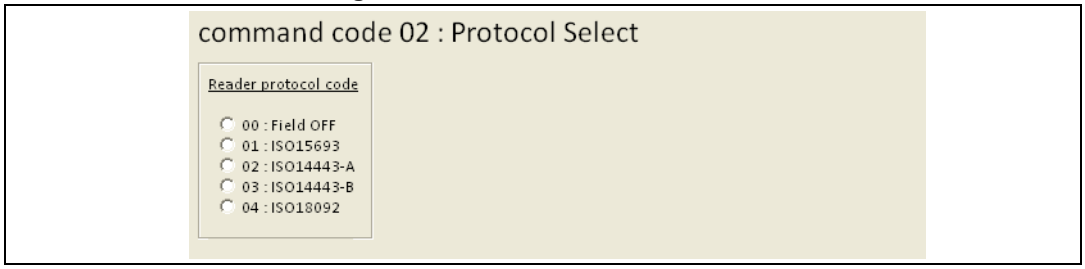


Figure 20. Field OFF window

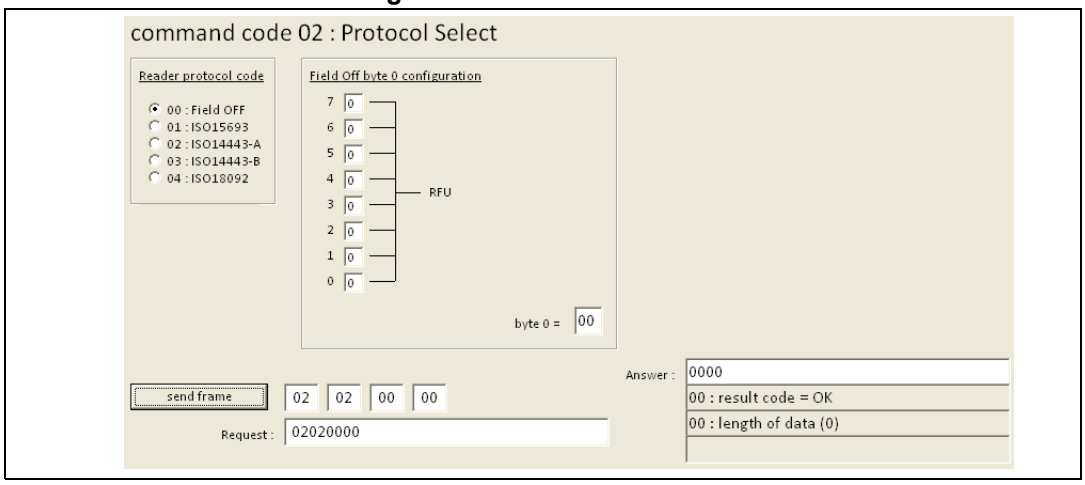


Figure 21. ISO15693 window

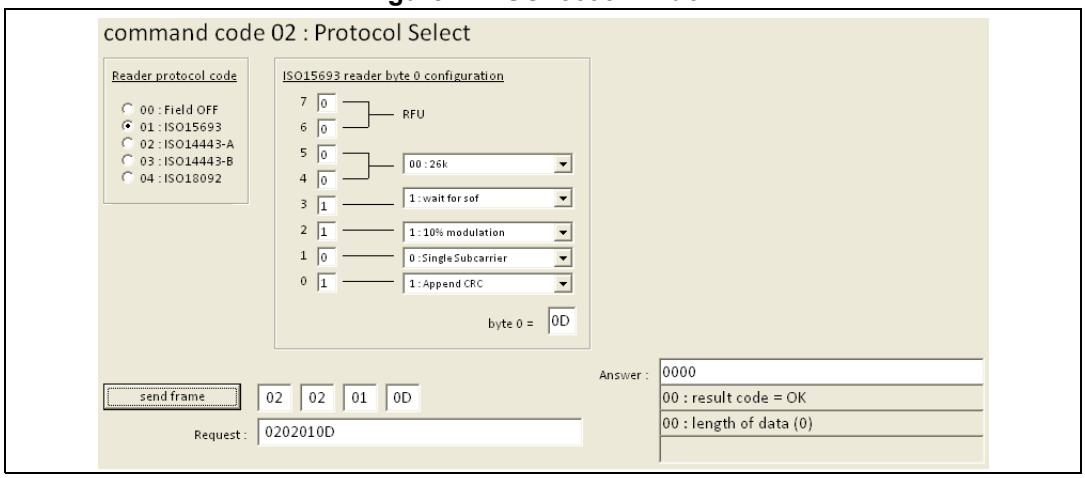


Figure 22. ISO14443-A window

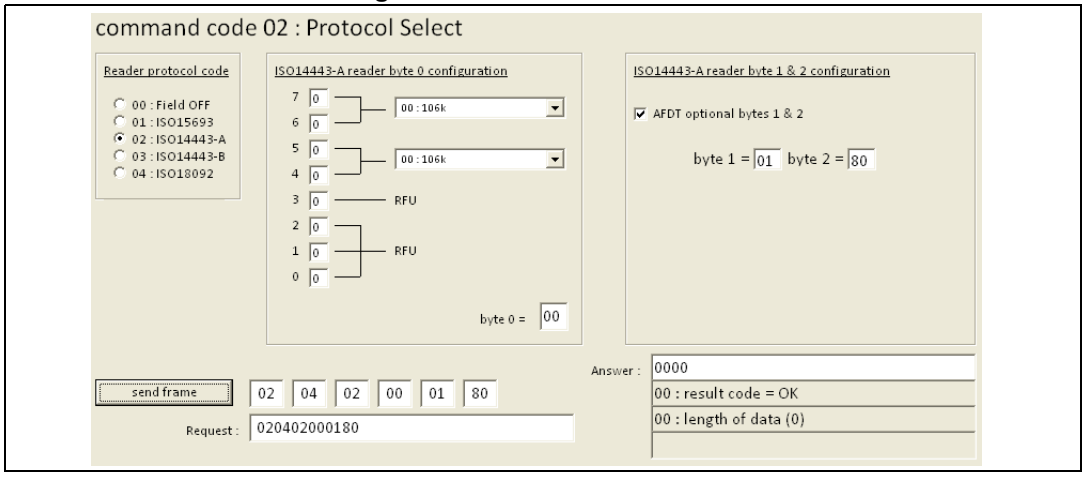


Figure 23. ISO14443-B window

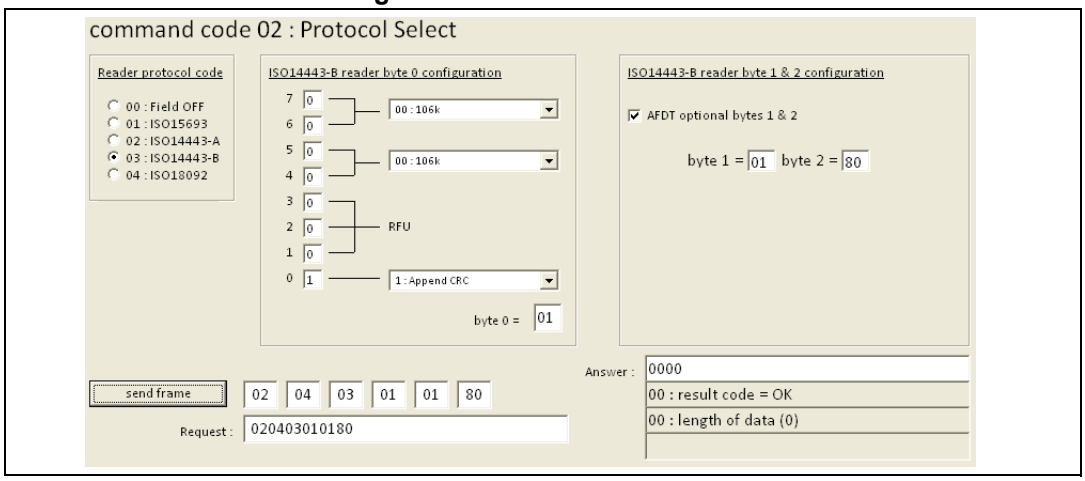
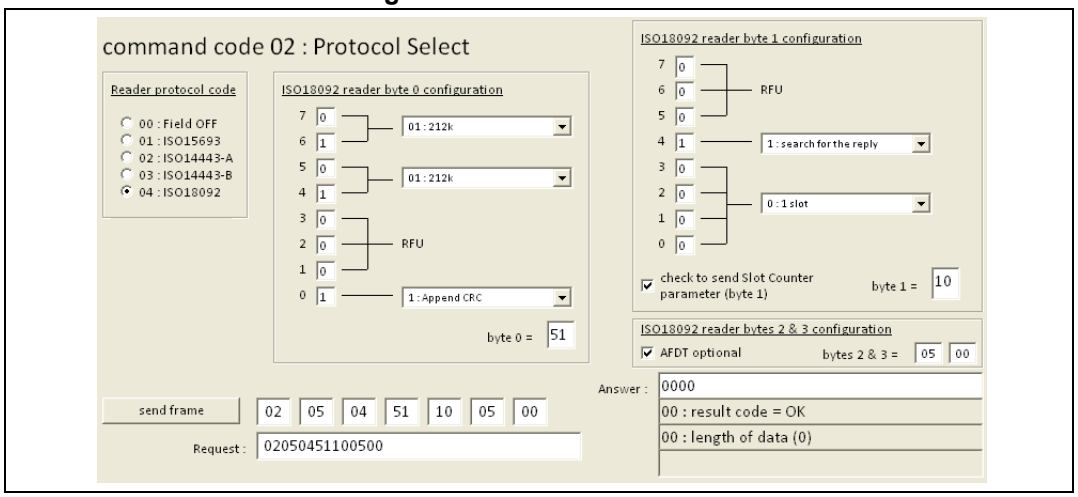


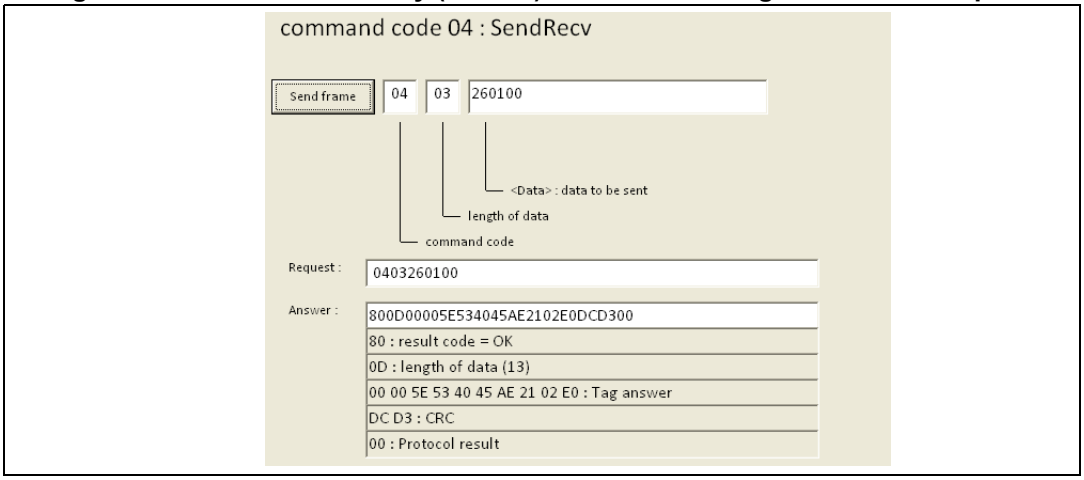
Figure 24. ISO18092 window



04: SendRecv

Click **04: SendRecv** to send data and receive the tag response using the previously selected protocol (see *Figure 25* for an example).

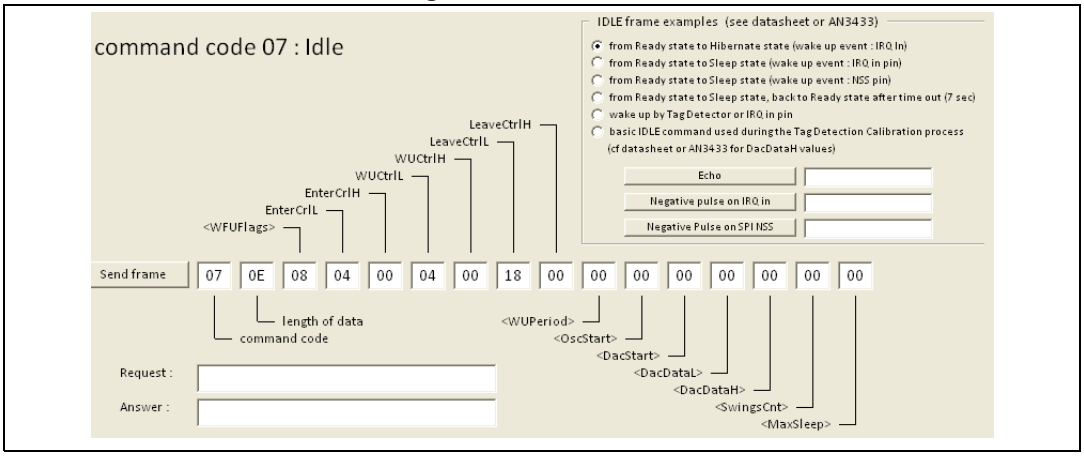
Figure 25. ISO15693 Inventory (260100) transmitted using a SendRecv request



07: Idle

Click **07: Idle** to switch the CR95HF to Tag Detection or Hibernate mode and specify the condition to exit this mode (see *Figure 26*).

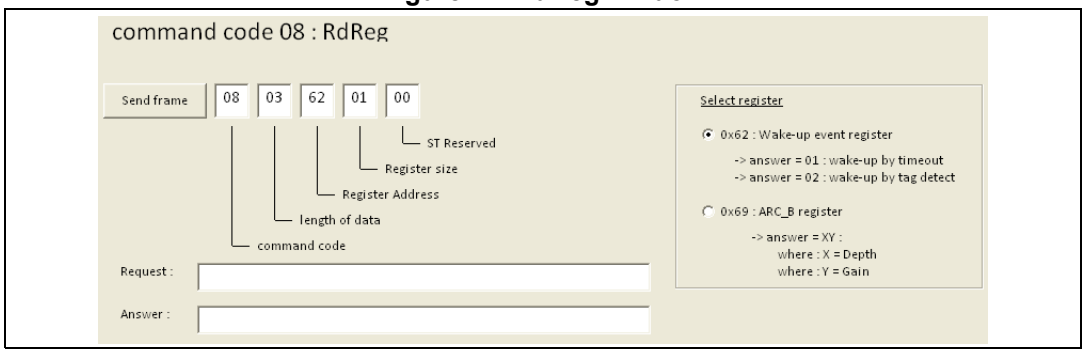
Figure 26. Idle window



08: RdReg

Click **08: RdReg** to read the Wakeup register (see *Figure 27*).

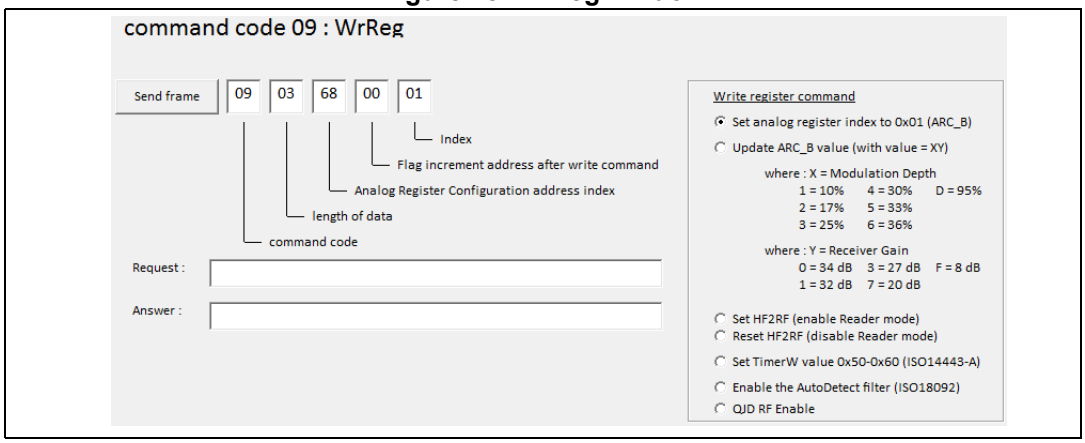
Figure 27. RdReg window



09: WrReg

Click 09: WrReg to set Analog refister and update ARC_B register (see Figure M)

Figure 28. WrReg window

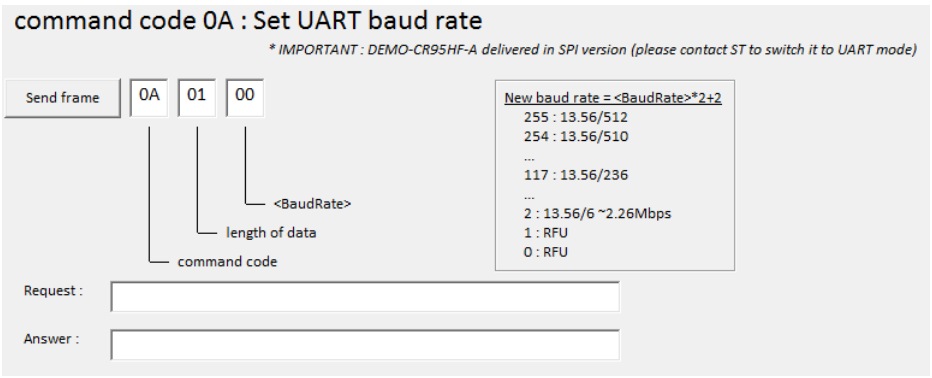


0A: baud rate

Click **0A: Set UART baud rate** to configure the UART data transfer (see *Figure 29*).

Note: The CR95HF demonstration board *is delivered in SPI version. Contact your nearest ST sales offices to switch it to UART mode.*

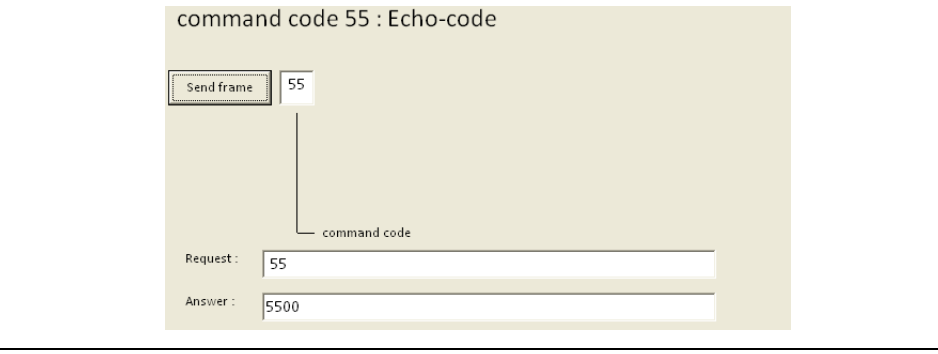
Figure 29. Set UART baud rate window



55: Echo

Click **55: Echo** to perform a serial interface echo (see *Figure 30*).

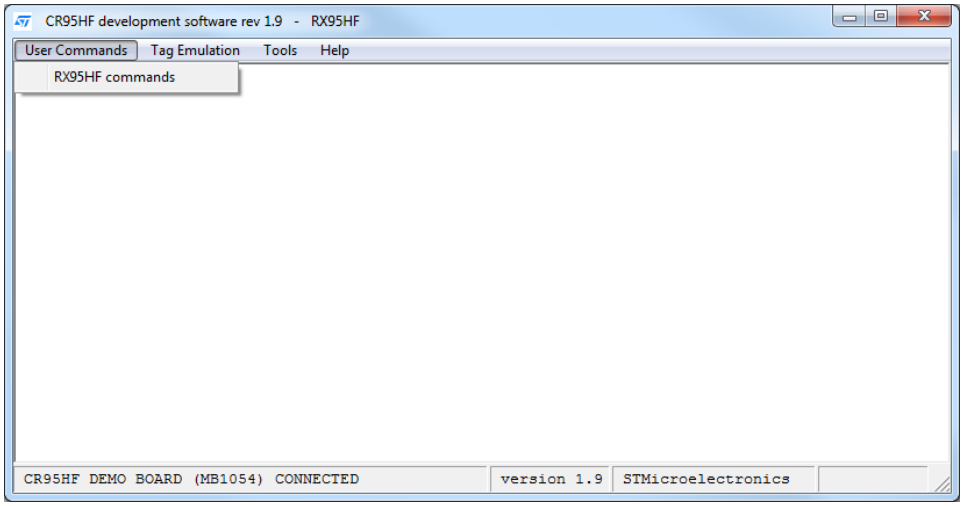
Figure 30. Echo window



2.3.2 RX95HF commands menu

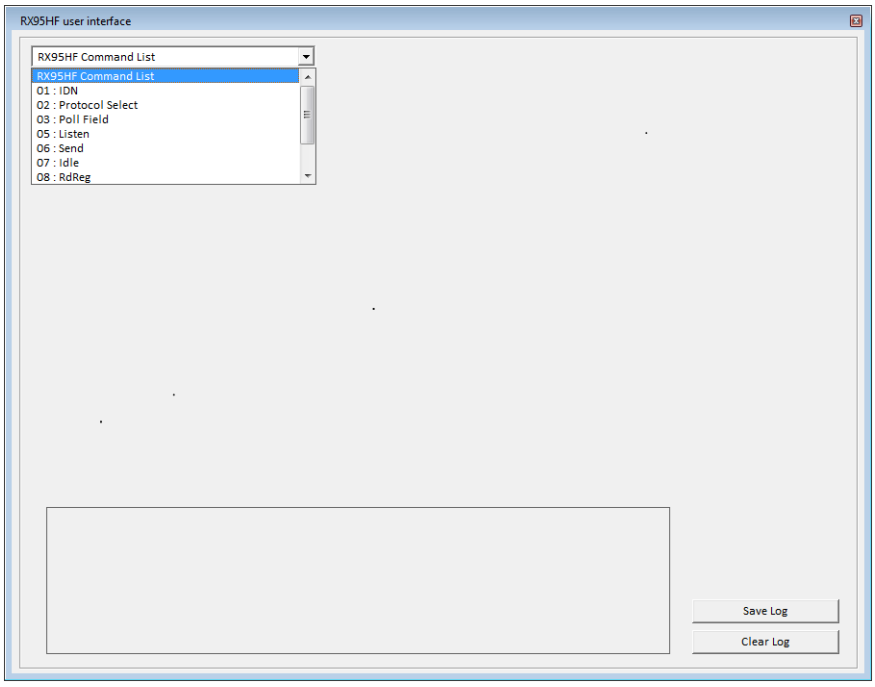
1. Select RX95HF commands: from the menu User Commands to communicate with the RX95HF embedded on your board and use all the commands and parameters described in the datasheet (see *Figure 31*).

Figure 31. User commands menu for RX95HF



2. Select a command from the list (see *Figure 32*). The corresponding RX95HF command is sent to the CR95HF demonstration board. The selected parameters together with the board answer are displayed in the log window located at the bottom of the RX95HF user interface window.

Figure 32. RX95HF commands menu



Two buttons are available from this menu:

- Save Log can be used to save the log content.
- Clear Log clears the log window.

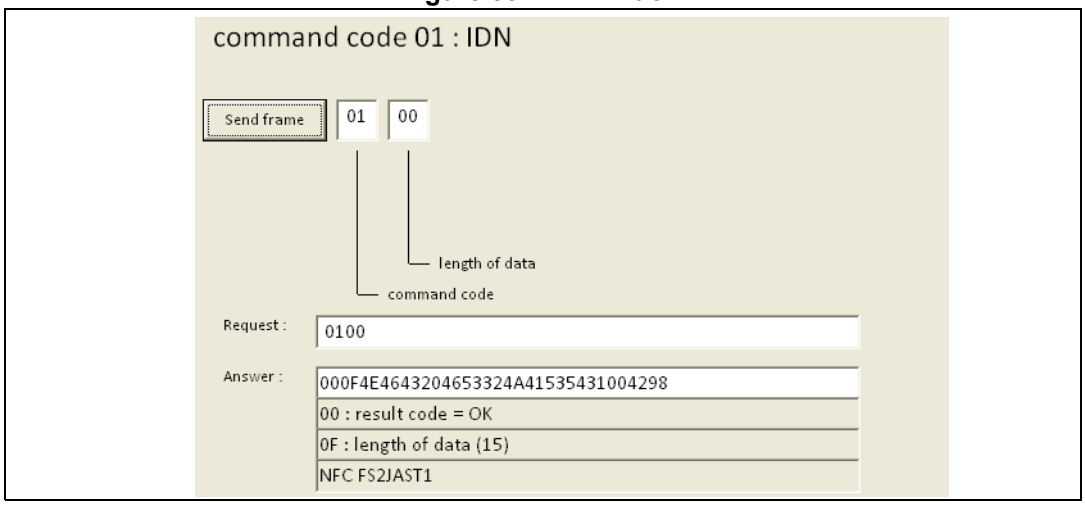
The following commands can be sent through the CR95HF user interface:

- 01: IDN
- 02: Protocol Select
- 03: Poll Field
- 05: Listen
- 06: Send
- 07: Idle
- 08: RdReg
- 09: WrReg
- 0D: AC filter
- 55: Echo

01: IDN

Click 01: IDN to request short information about the RX95HF and its firmware version (see *Figure 33*).

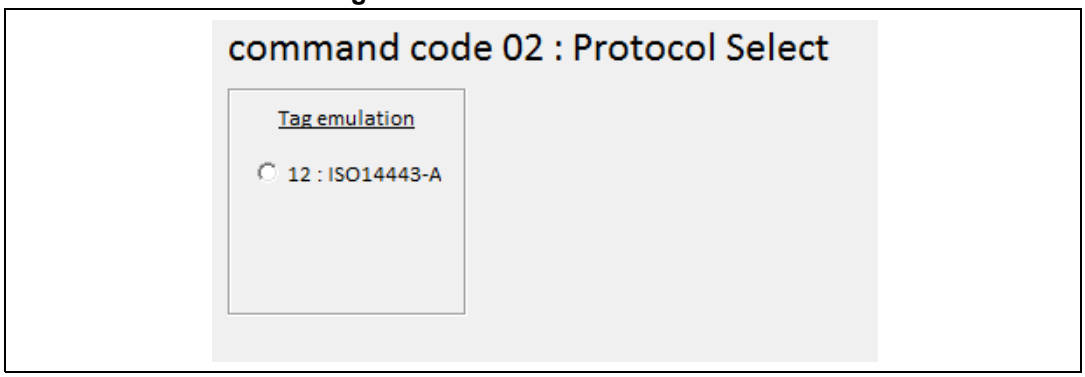
Figure 33. IDN window



02: PROTOCOL SELECT

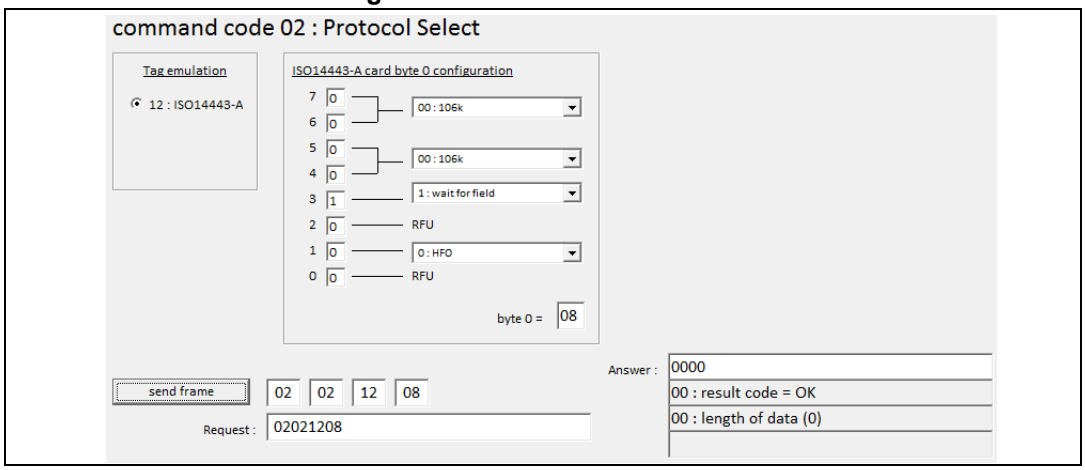
Click 02: Protocol Select to select the communication protocol to be used between the RX95HF and the transceiver (see *Figure 34*):

Figure 34. Protocol Select window



Click 12: ISO14443-A to select and configure the ISO-14443-A communication protocol for tag emulation (see *Figure 35*).

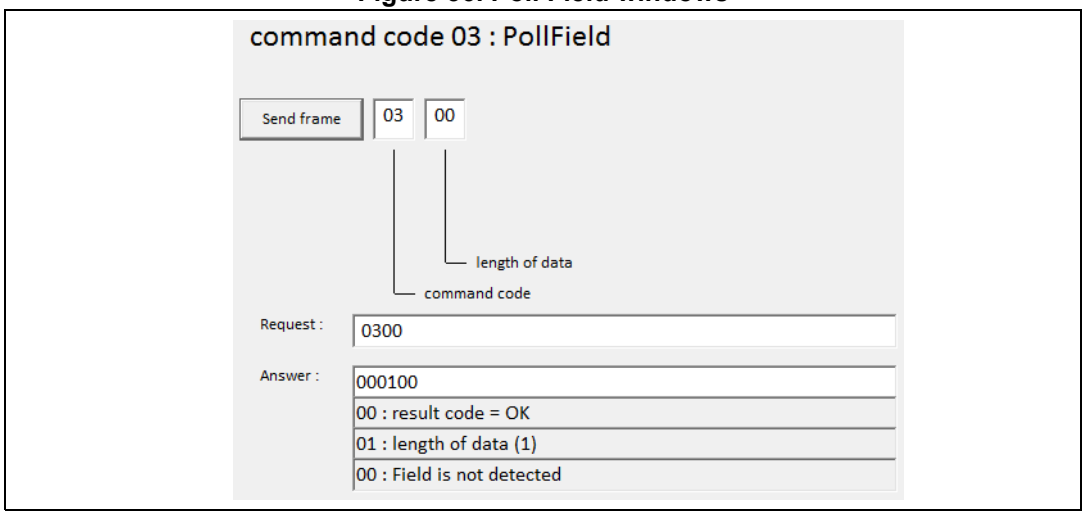
Figure 35. ISO14443-A windows



03: POLL FIELD

Click 03: Poll Field to be able to send Poll Field command. The result will inform the emulated tag of the presence of RF field. (see *Figure 36*):

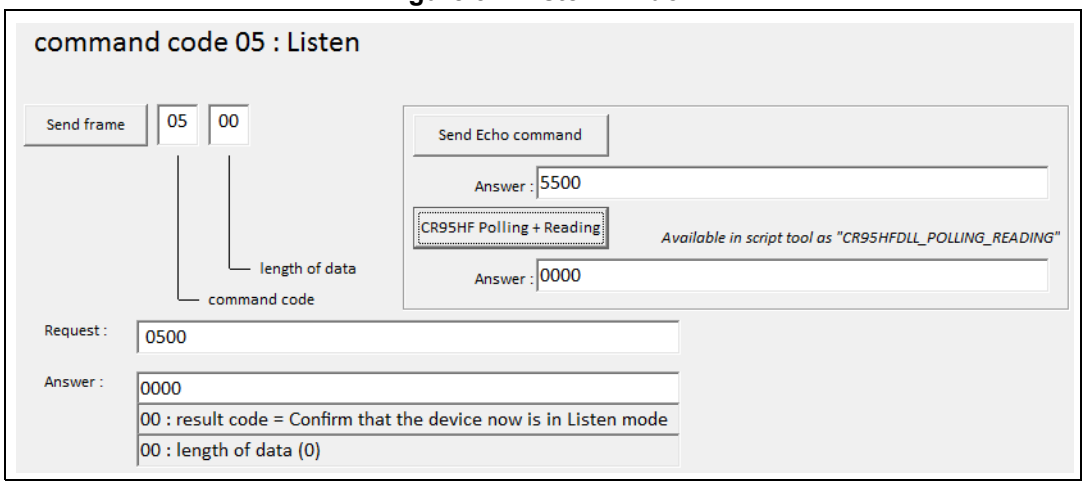
Figure 36. Poll Field windows



05: LISTEN

Click 05: Listen to be able to send Listen command. The result will inform if the emulated tag is in Listen mode (see *Figure 37*):

Figure 37. Listen window

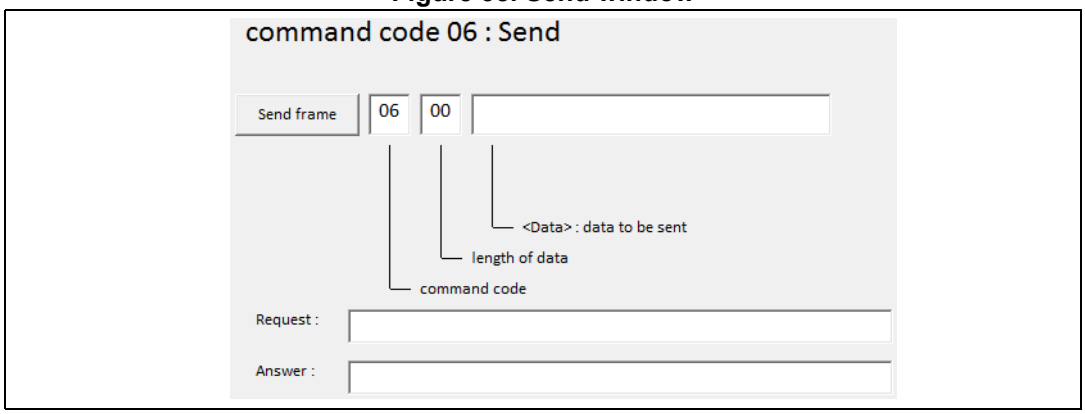


"Echo" command and "CR95HF Polling + Reading" command has been added to be able to play with Listen mode and control the state of the emulated tag.

06: SEND

Click 06: Send to be able to send Send command with some parameters. The parameters will be the answer of the emulated tag to the transceiver (see *Figure 38*):

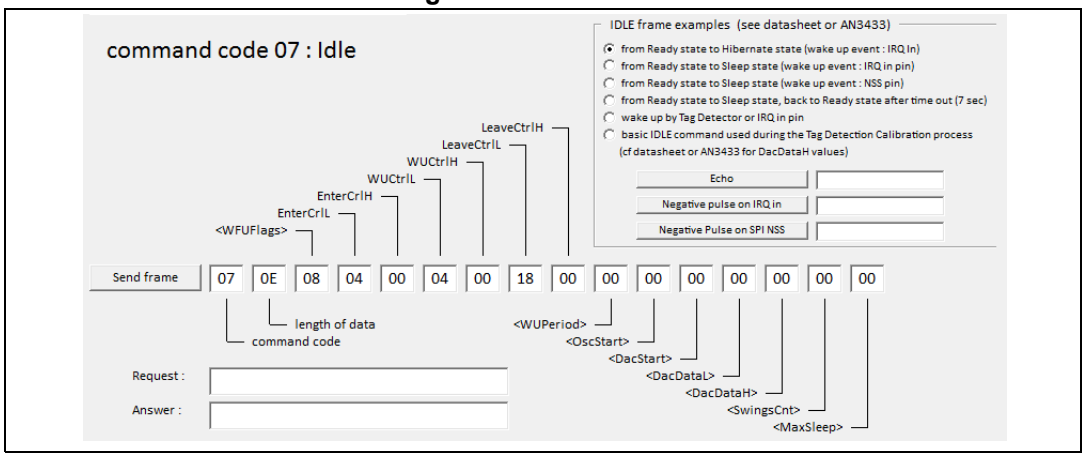
Figure 38. Send window



07: IDLE

Click 07: Idle to be able to send Idle command with some parameters (see *Figure 39*):

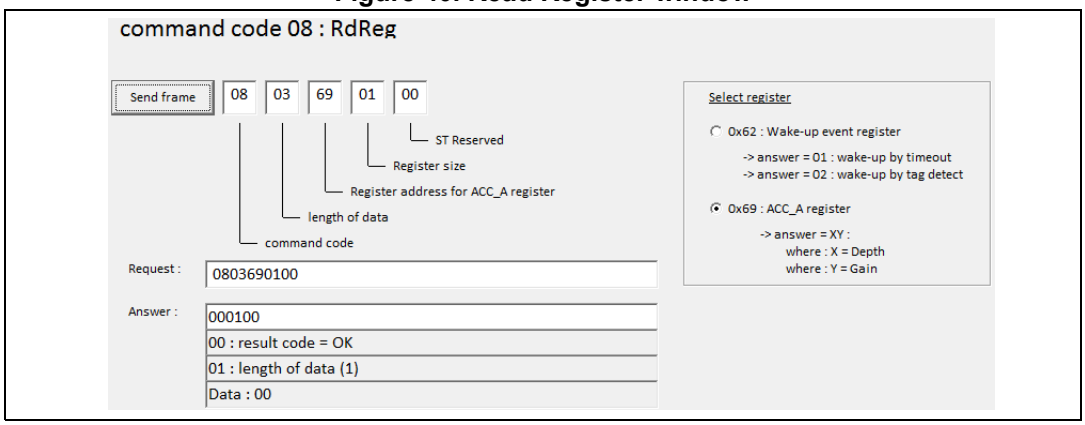
Figure 39. Idle window



08: RDREG

Click 08: RdReg to be able to Read ACC_A register or to send Wake-up event (see *Figure 40*):

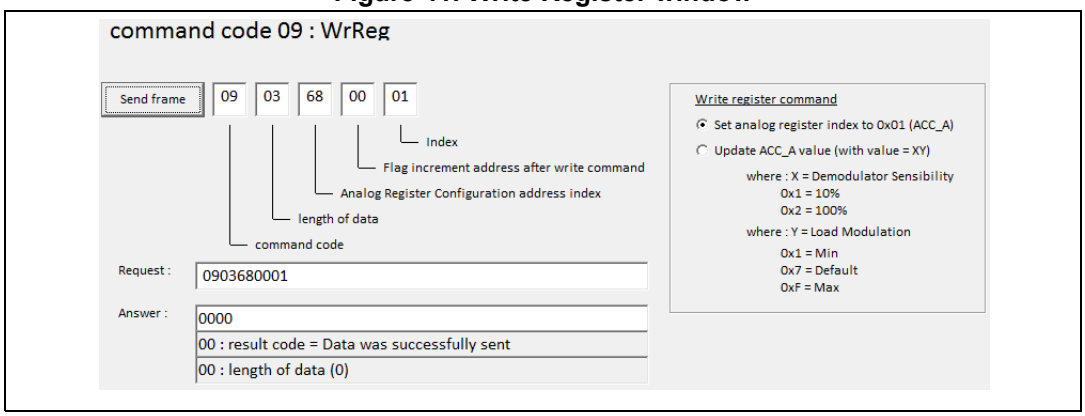
Figure 40. Read Register window



09: WRREG

Click 09: WrReg to be able to set Analog registers and update ACC_A register (see *Figure 41*):

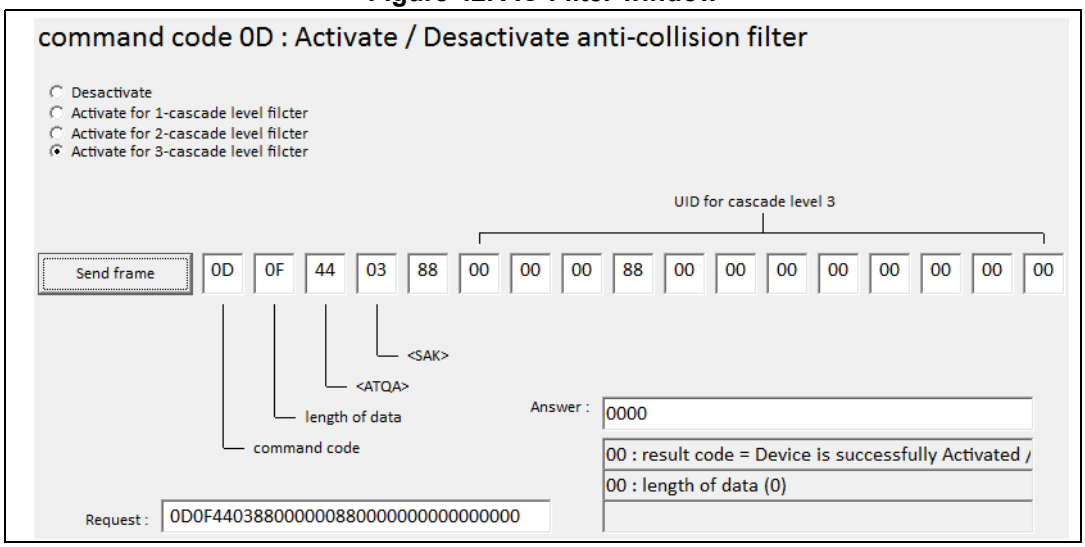
Figure 41. Write Register window



0D: AC-FILTER

Click 09: AC-Filter to be able to set ATQA, SAK and UID value for anticollision process (see *Figure 42*):

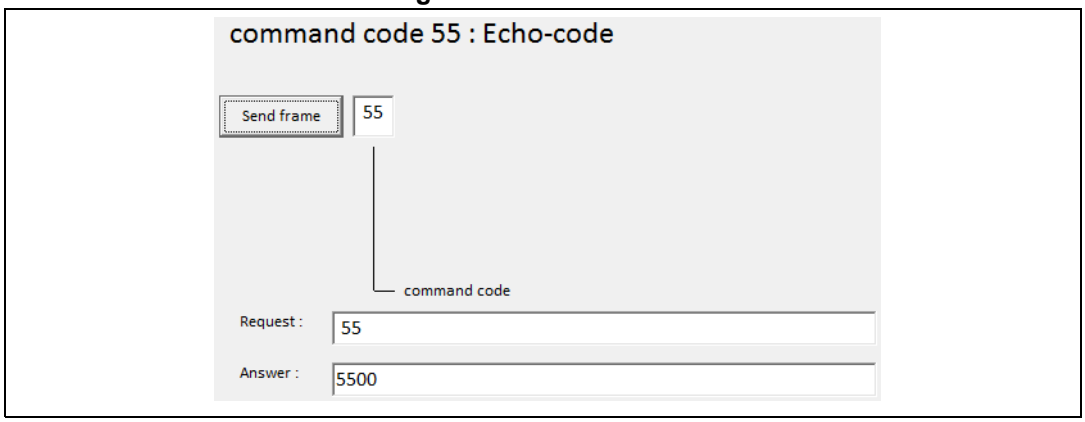
Figure 42. AC-Filter window



55: ECHO

Click 55: Echo to perform a serial interface echo (see *Figure 43*).

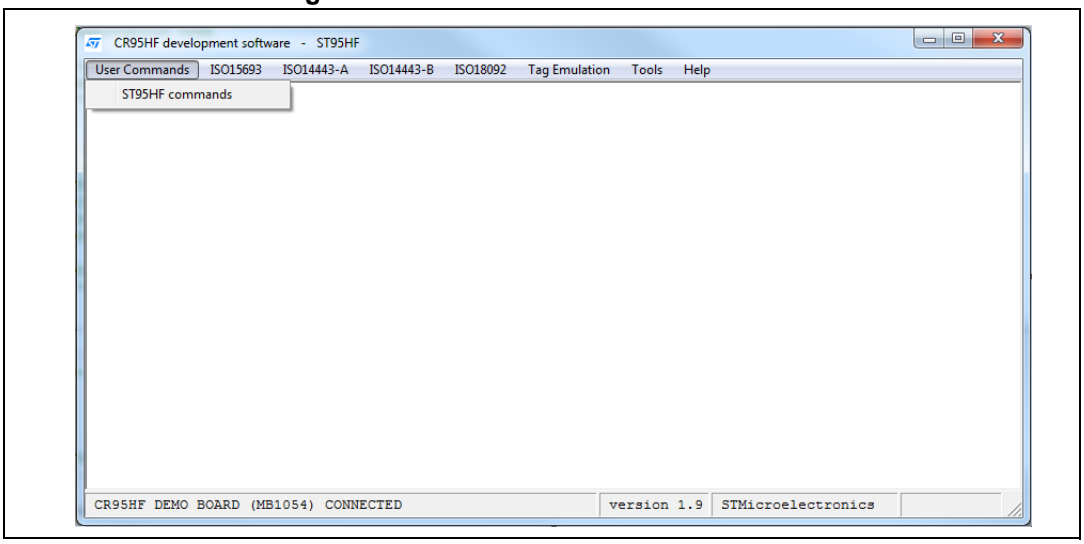
Figure 43. Echo window



2.3.3 ST95HF commands menu

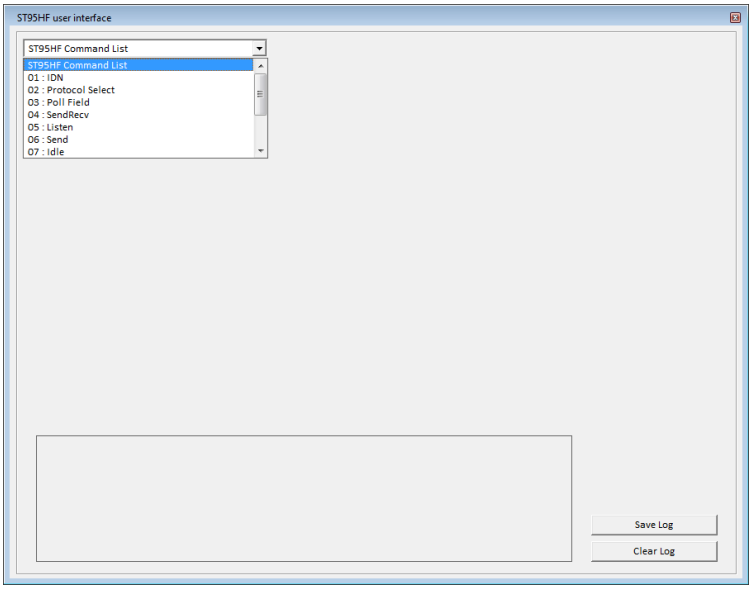
1. Select ST95HF commands from the menu User Commands to communicate with the ST95HF embedded on your board and use all the commands and parameters described in the datasheet (see *Figure 44*).

Figure 44. ST95HF user commands menu



2. Select a command from the list (see *Figure 45*). The corresponding RX95HF command is sent to the CR95HF demonstration board. The selected parameters together with the board answer are displayed in the log window located at the bottom of the RX95HF user interface window.

Figure 45. ST95HF commands menu



Two buttons are available from this menu:

- Save Log can be used to save the log content.
- Clear Log clears the log window.

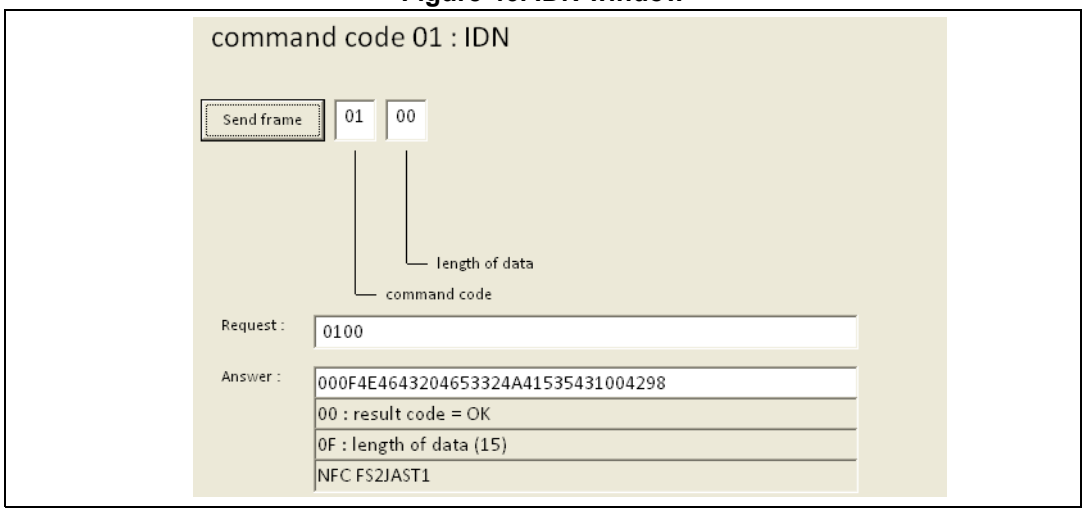
The following commands can be sent through the CR95HF user interface:

- 01: IDN
- 02: Protocol Select
- 03: Poll Field
- 04: SendRecv
- 05: Listen
- 06: Send
- 07: Idle
- 08: RdReg
- 09: WrReg
- 0A: BaudRate
- 0D: AC filter
- 55: Echo

01: IDN

Click **01: IDN** to request short information about the CR95HF and its firmware version (see *Figure 18*).

Figure 46. IDN window



02: Protocol Select

Click **02: Protocol Select** to select the communication protocol to be used between the CR95HF and the tags, or to switch the RF field off (see *Figure 19*):

- Click **00: Field OFF** to send a Field OFF command that turns the RF field off (see *Figure 20*).
- Click **01: ISO15693** to select and configure the ISO15693 communication protocol (see *Figure 21*).
- Click **02: ISO14443-A** to select and configure the ISO-14443-A communication protocol (see *Figure 22*).
- Click **03: ISO14443-B** to select and configure the ISO-14443-B communication protocol (see *Figure 23*).
- Click on **04: ISO18092** to select and configure the ISO-18092 communication protocol (see *Figure 24*).

Figure 47. Protocol Select window

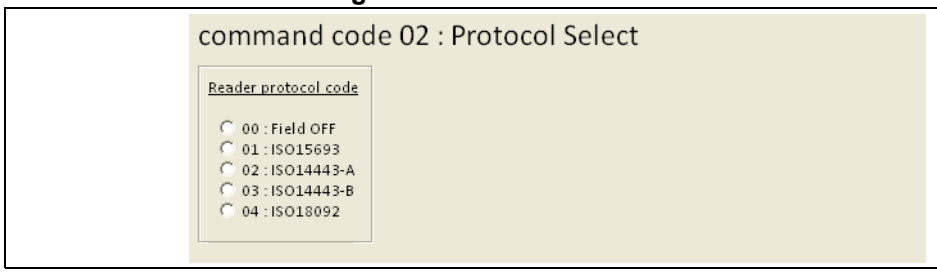


Figure 48. Field OFF window

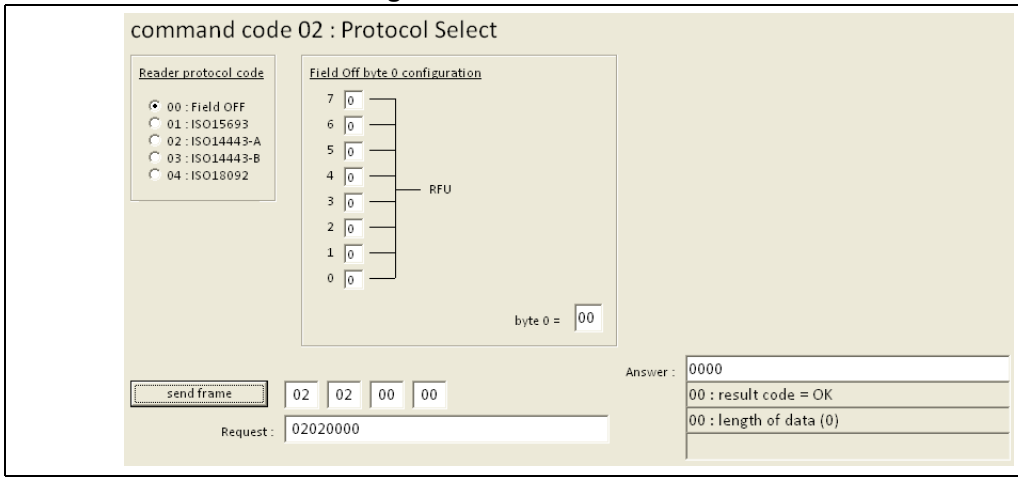


Figure 49. ISO15693 window

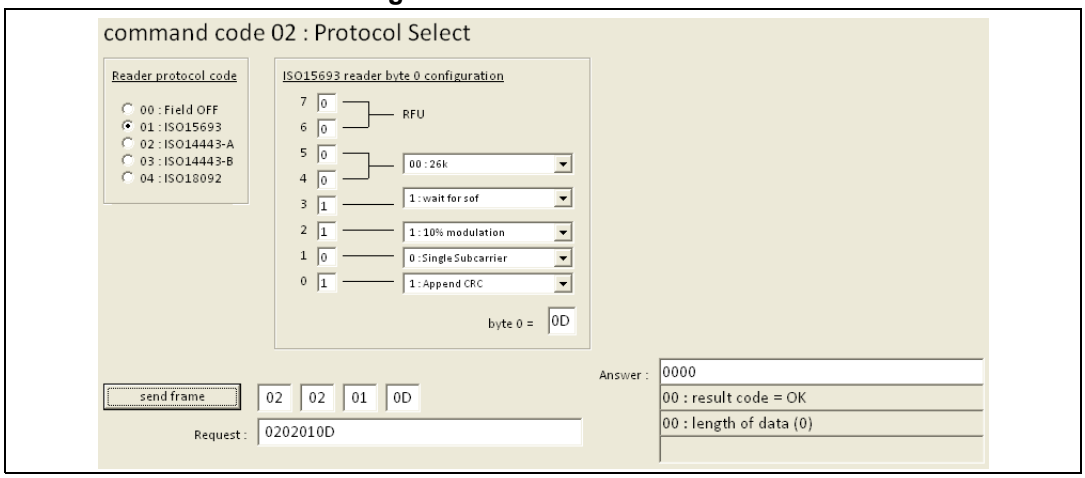


Figure 50. ISO14443-A window

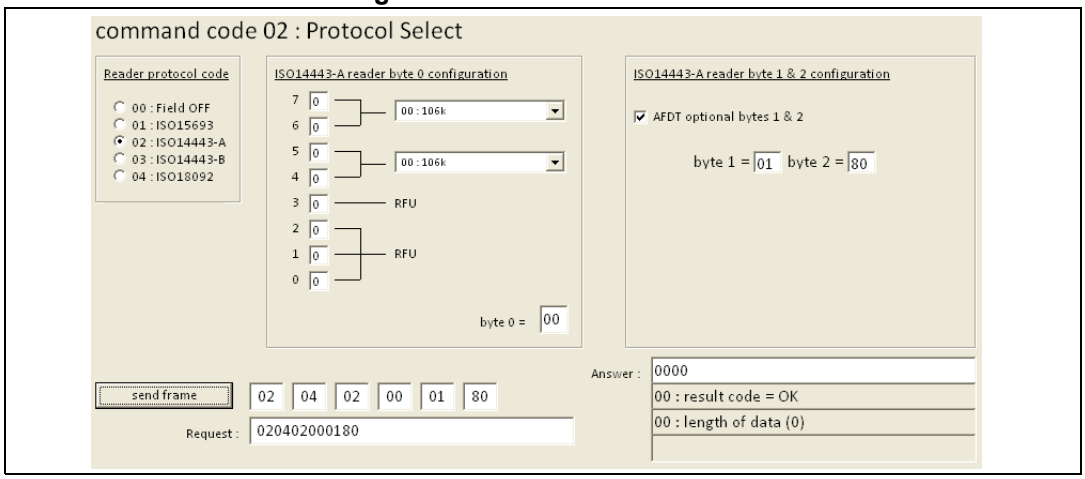


Figure 51. ISO14443-B window

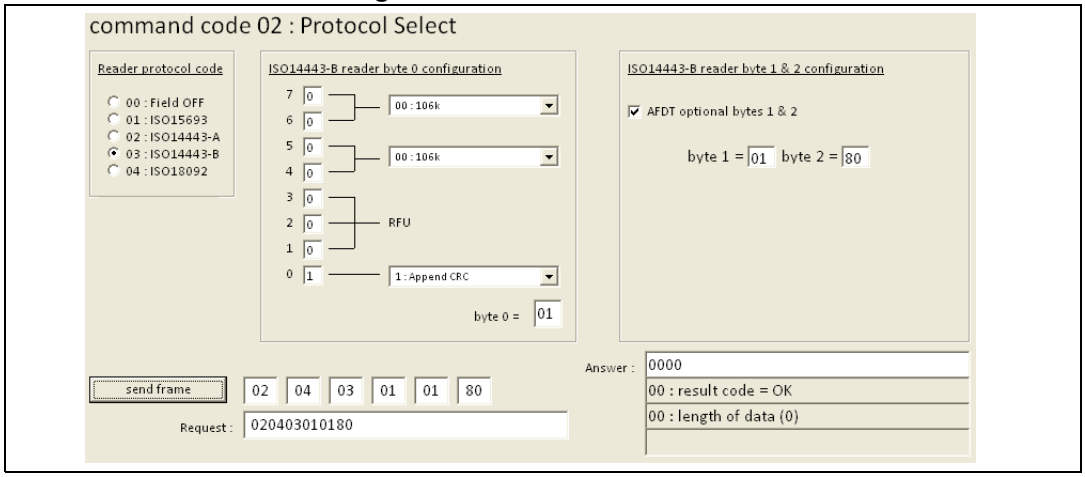
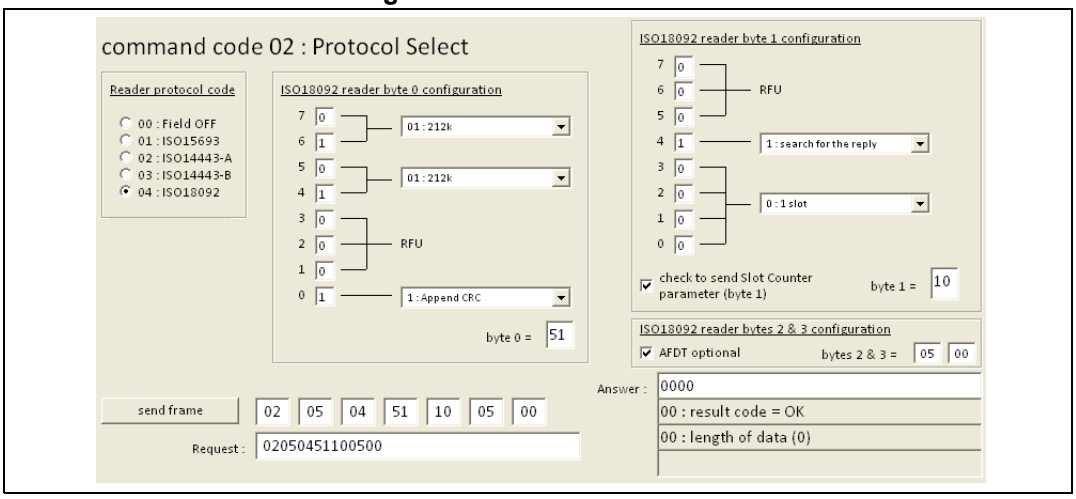


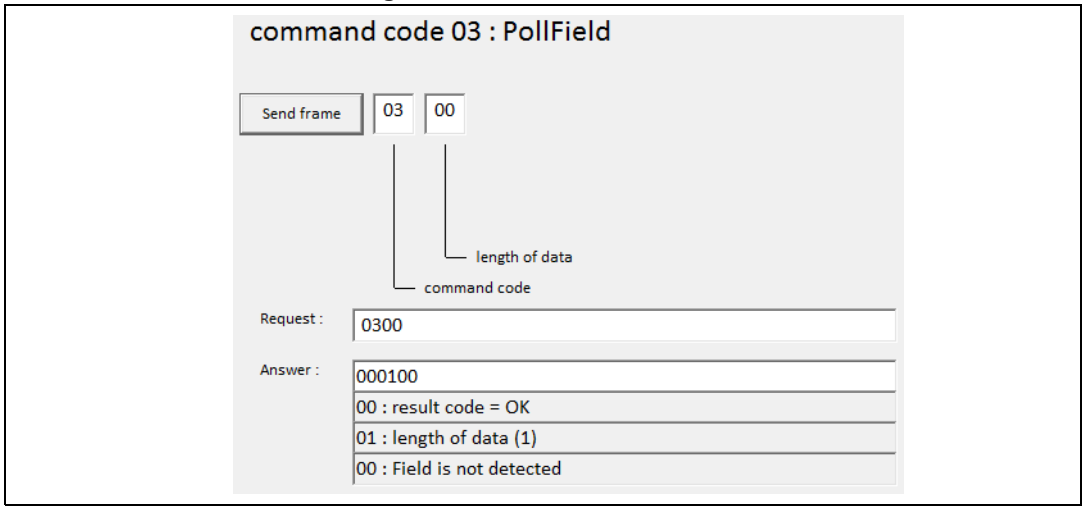
Figure 52. ISO18092 window



03: POLL FIELD

Click 03: Poll Field to be able to send Poll Field command. The result will inform the emulated tag of the presence of RF field. (see *Figure 36*):

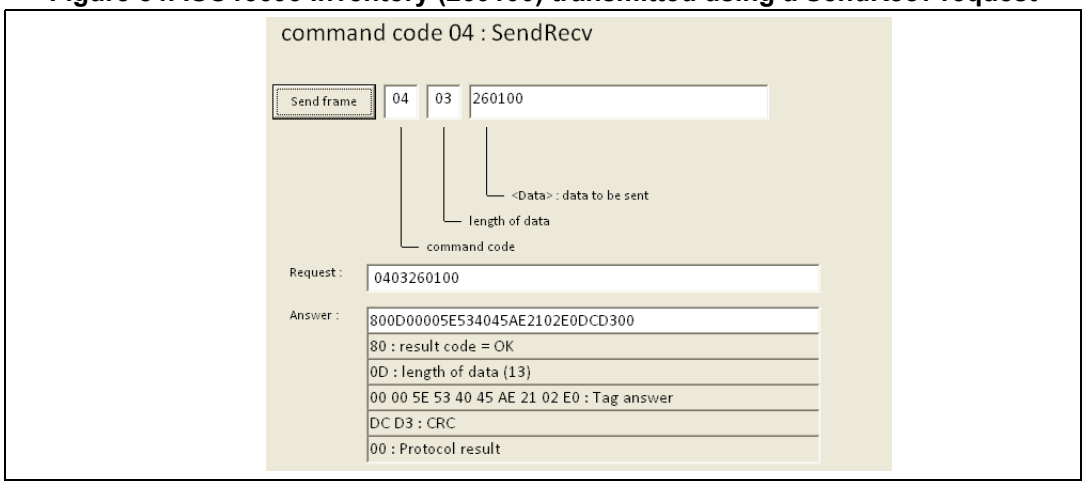
Figure 53. Poll Field windows



04: SendRecv

Click **04: SendRecv** to send data and receive the tag response using the previously selected protocol (see *Figure 25* for an example).

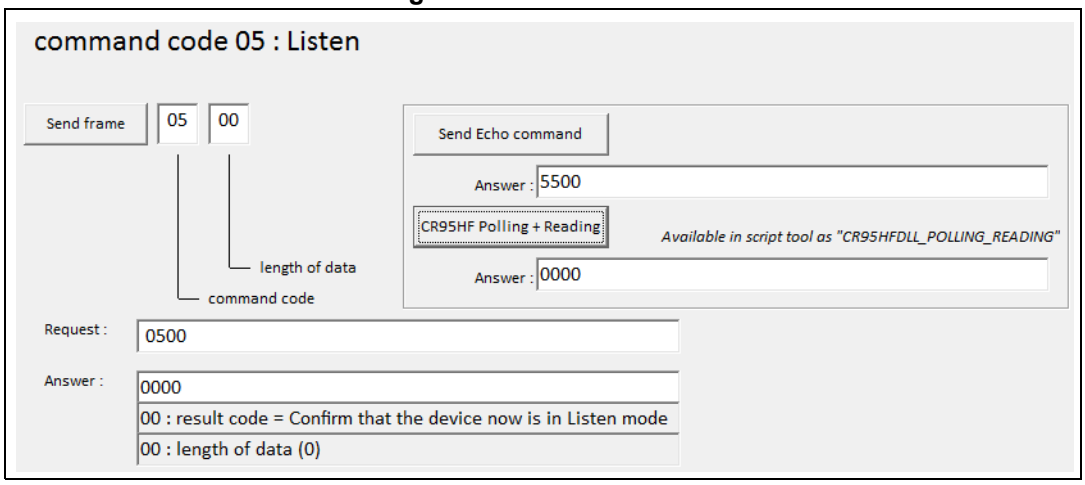
Figure 54. ISO15693 Inventory (260100) transmitted using a SendRecv request



05: LISTEN

Click 05: Listen to be able to send Listen command. The result will inform if the emulated tag is in Listen mode (see *Figure 37*):

Figure 55. Listen window

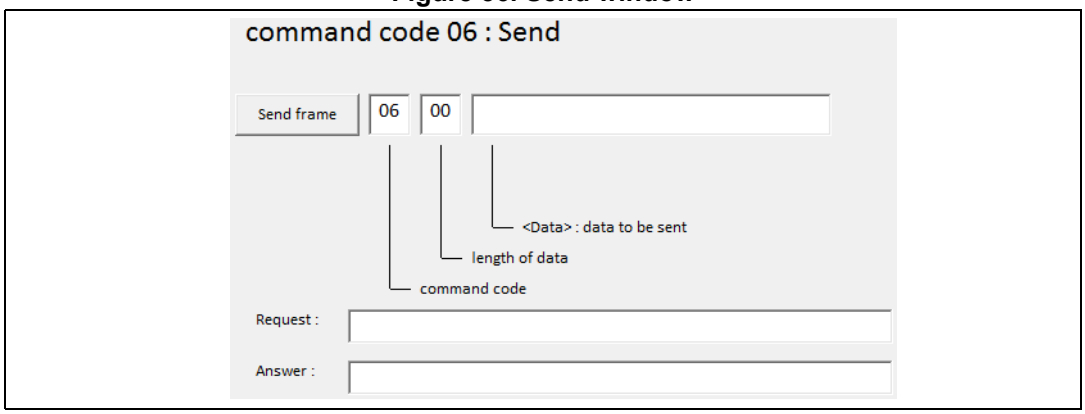


"Echo" command and "CR5HF Polling + Reading" command has been added to be able to play with Listen mode and control the state of the emulated tag.

06: SEND

Click 06: Send to be able to send Send command with some parameters. The parameters will be the answer of the emulated tag to the transceiver (see *Figure 38*):

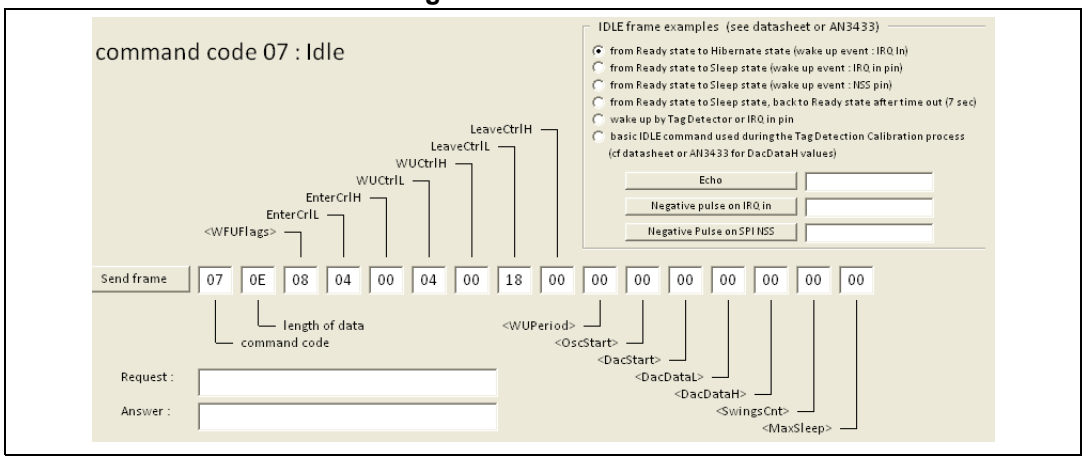
Figure 56. Send window



07: Idle

Click **07: Idle** to switch the CR95HF to Tag Detection or Hibernate mode and specify the condition to exit this mode (see *Figure 26*).

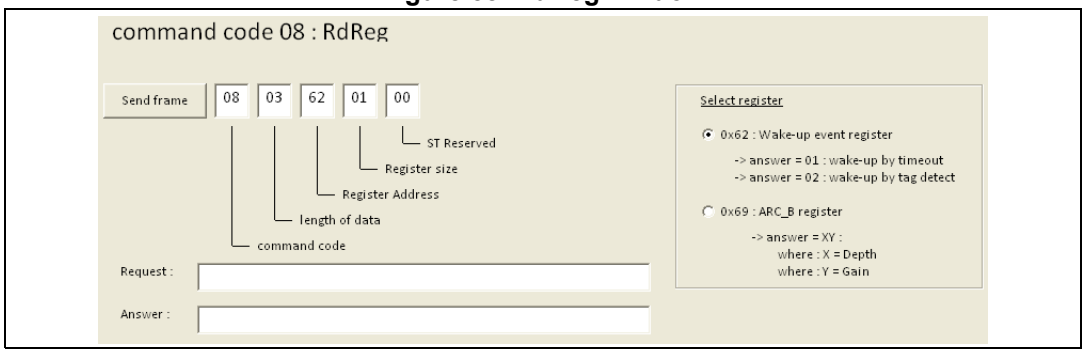
Figure 57. Idle window



08: RdReg

Click **08: RdReg** to read the Wakeup register (see *Figure 27*).

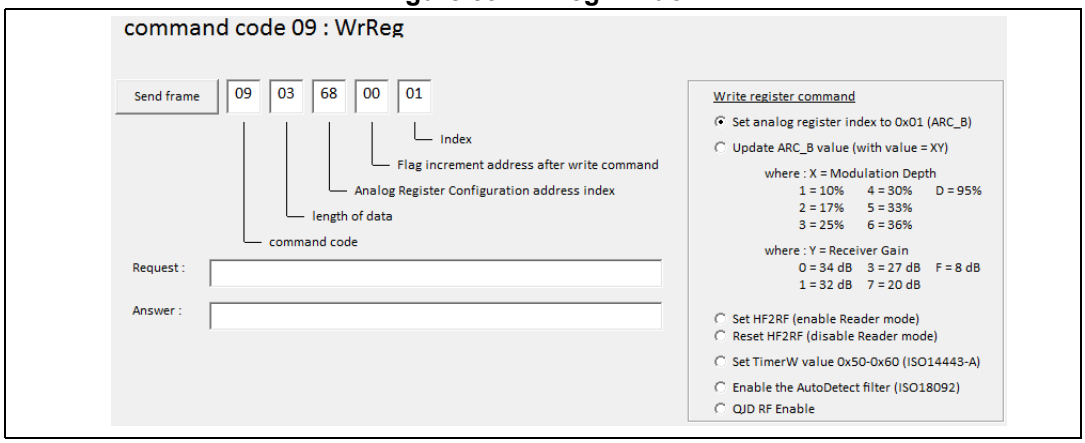
Figure 58. RdReg window



09: WrReg

Click 09: WrReg to set Analog refister and update ARC_B register (see Figure M)

Figure 59. WrReg window

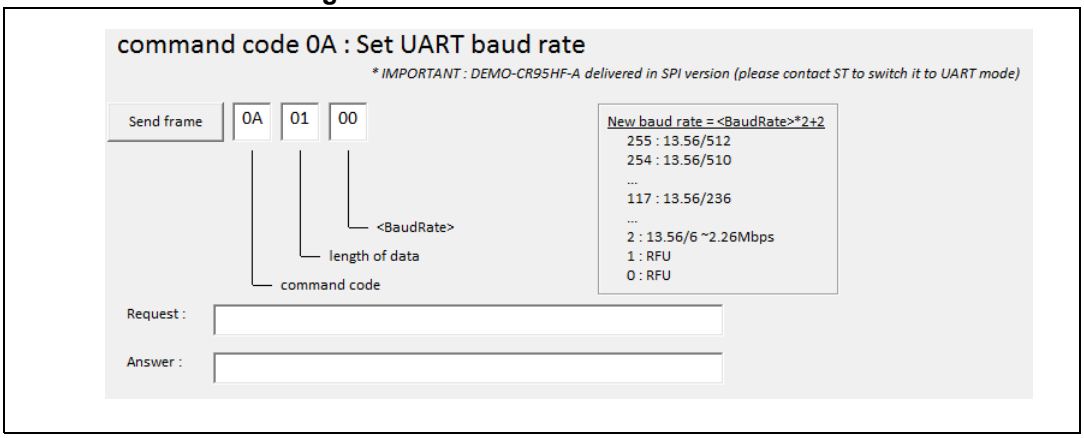


0A: baud rate

Click **0A: Set UART baud rate** to configure the UART data transfer (see *Figure 29*).

Note: The CR95HF demonstration board *is delivered in SPI version. Contact your nearest ST sales offices to switch it to UART mode.*

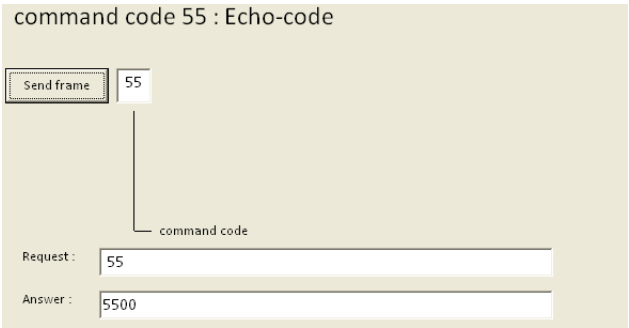
Figure 60. Set UART baud rate window



55: Echo

Click **55: Echo** to perform a serial interface echo (see *Figure 30*).

Figure 61. Echo window

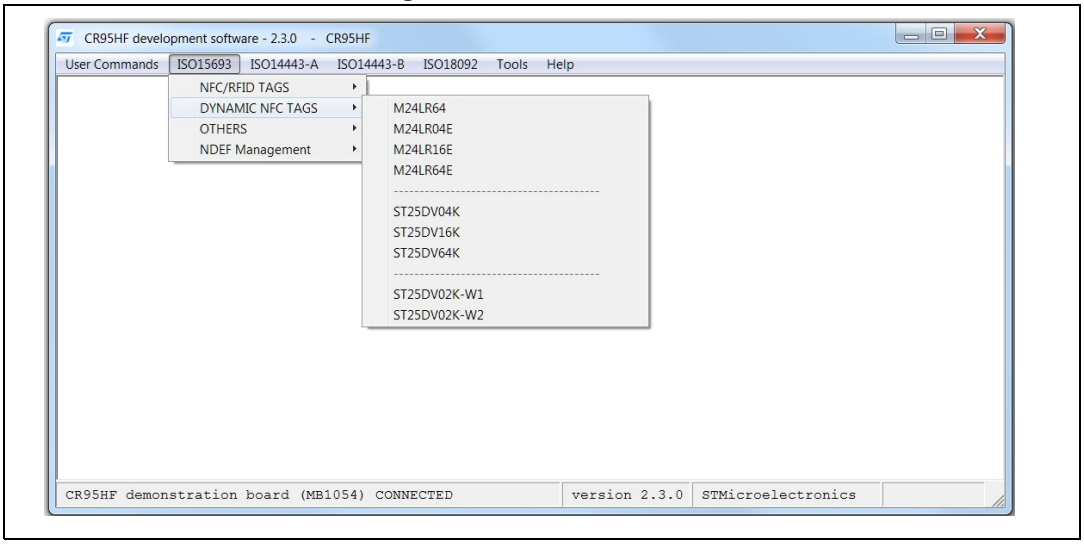


2.4 ISO15693 menu

1. Select **ISO15693** from the main menu to use the CR95HF demonstration board as an ISO15693 reader (see *Figure 62*).
   The menu allows to select:

- NFC/RFID TAGS
  - LRI1K
  - LRI2K
  - LRIS2K
  - LRIS64K
  - ST25TV512
  - ST25TV02K
  - ST25TV16K
  - ST25TV64K
- DYNAMIC NFC TAGS
  - M24LR64
  - M24LR04E
  - M24LR16E
  - M24LR64E
  - ST25DV04K
  - ST25DV16K
  - ST25DV64K
  - ST25DV02K-W1
  - ST25DV02K-W2
- OTHERS
  - PICOPASS
- NDEF Management
  - Vicinity Tags - NDEF message user interface
  - NFC Type 5 - NDEF message user interface

Figure 62. ISO15693 menu



2. EXAMPLE 1: M24LR64E USER INTERFACE
   Select a device from the list (see *Figure 63* for an example). The board is then

automatically configured as an ISO15693 reader, and the CR95HF can send/receive ISO15693 frames to/from the tags using the SendRecv command.

ISO15693 communications are configured as follows:

– 10% high data rate
– One subcarrier

The ISO15693 configuration is displayed in the log window.

The upper part of the menu shows buttons which allow to send ISO15693 requests to a tag through the CR95HF demonstration board antenna. The main available requests are:

– Inventory
– Select
– Stay Quiet
– Reset to ready
– Get system info
– Initiate
– Inventory initiated
– Fast initiate
– Fast Inventory initiated

Refer to the CR95HF datasheet for the full list of ISO15693 commands.

By default, the ISO15693 requests are sent in Non-selected/Non-addressed mode, and the requests are decoded by all the tags present in the RF field.

To switch to Addressed mode, follow the steps below:

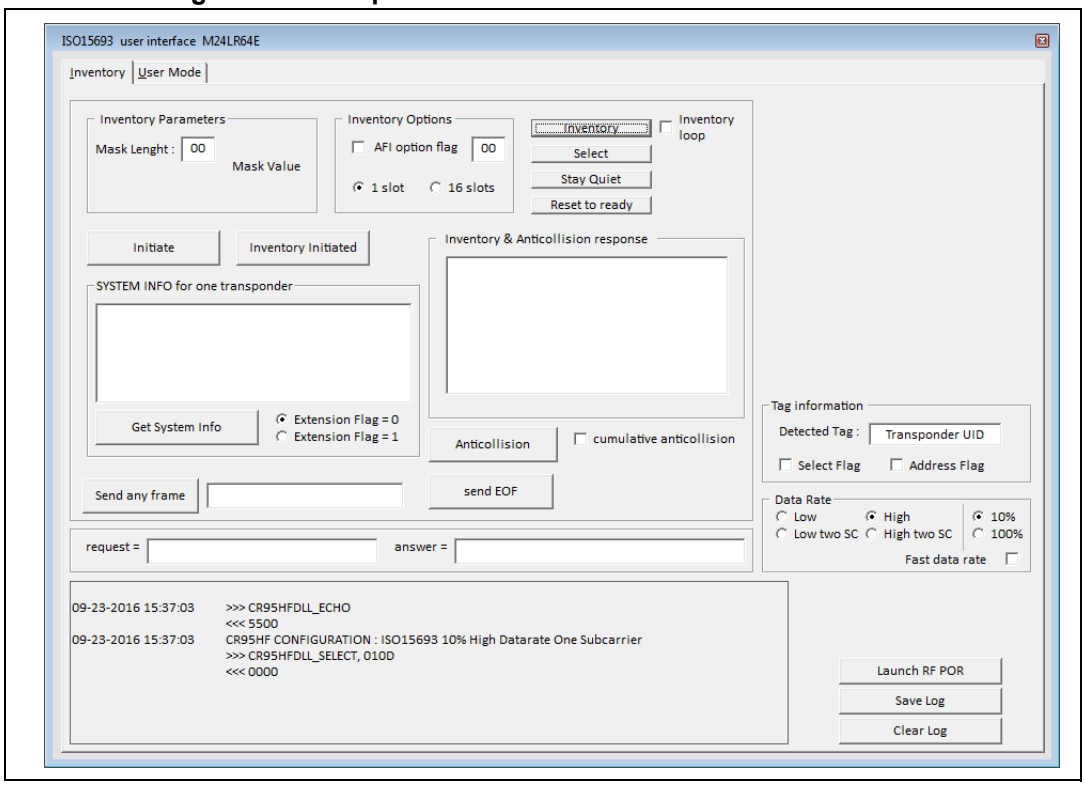
a) Send an Inventory request to retrieve the tag UID.
b) Click on the UID displayed in the **INVENTORY response** window to automatically copy the UID into the **Tag information** text box.
c) Check **Address Flag** to activate the Addressed mode for the coming requests.

The following sequence is required to switch to Selected mode:

a) Send a Select request in Addressed mode (steps *a* to *c* above).
b) Uncheck **Address Flag.**
c) Check **Select Flag**.

All the coming requests will be sent to the previously selected tag.

Figure 63. Example of ISO15693 user interface for M24LR64



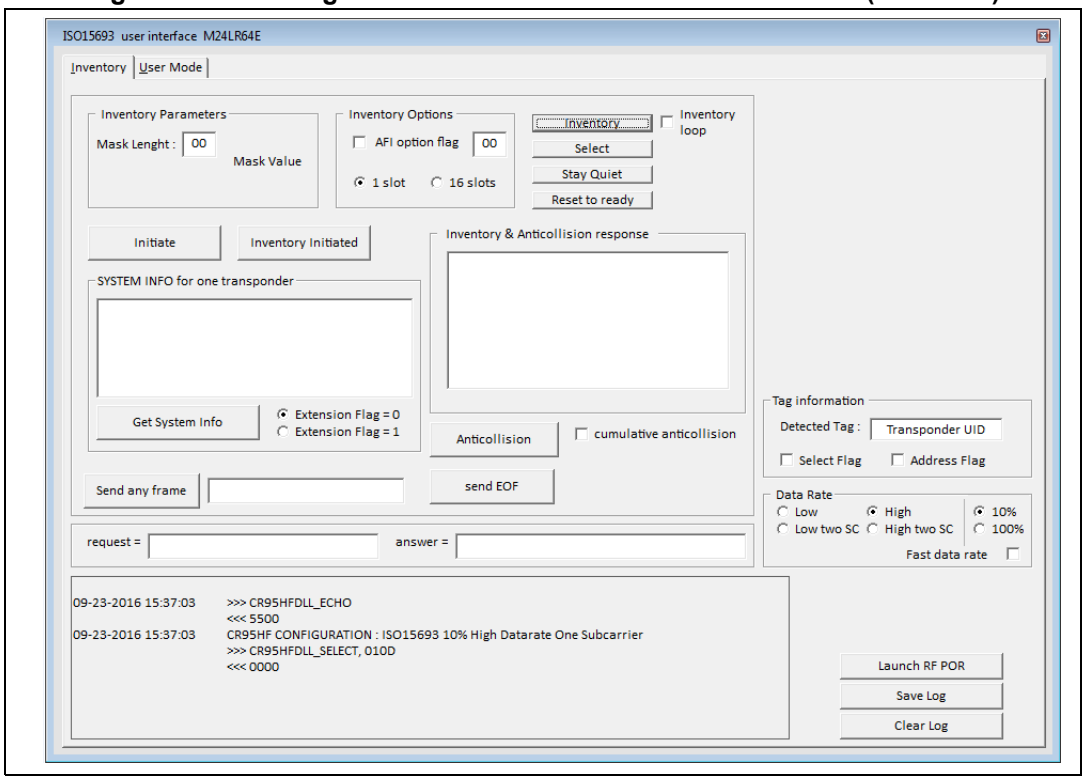
3. Click **User Mode** from the toolbar of the device ISO15693 user interface to display the ISO15693 requests that can be sent in User mode (see *Figure 64*). The main requests are:
   - Read single and multiple block(s)
   - Fast read single and multiple block(s)

     The CR95HF demonstration board is automatically configured in Fast mode, and put back in normal mode when the request is complete.

   Other requests are available (DSFID, AFI, ..). Refer to the device datasheet for the full list of ISO15693 requests available for a given product.

Note: The tag answer to a read request is displayed in the right part of the window.

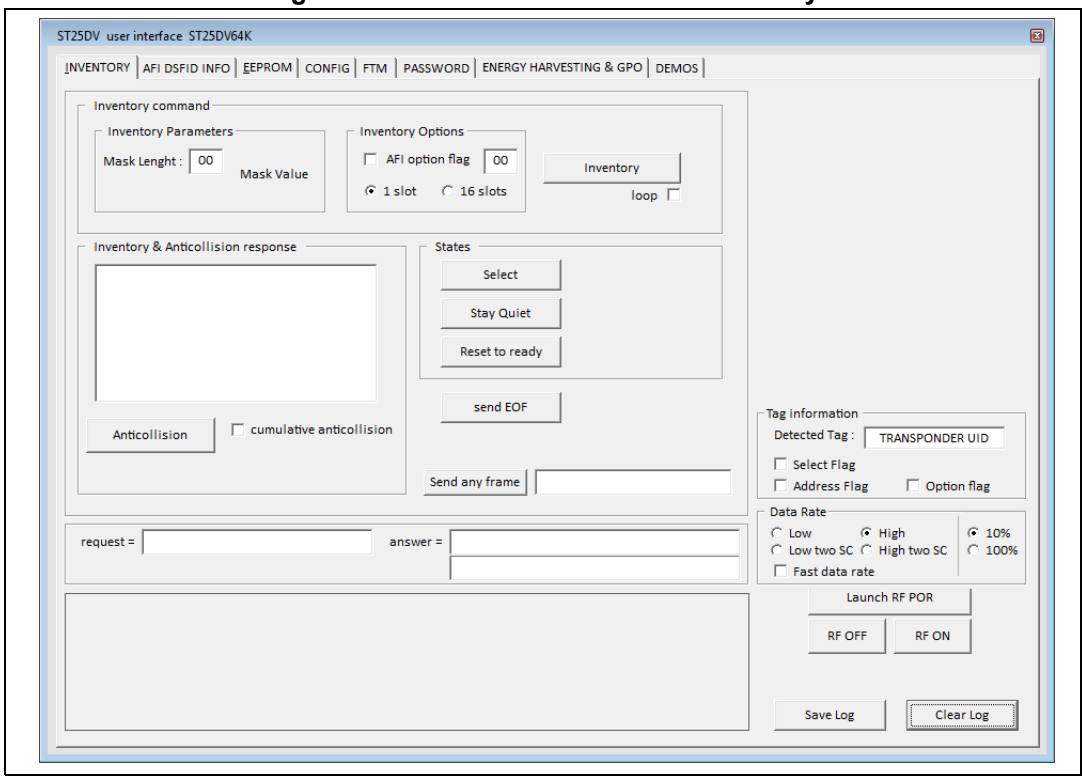
Figure 64. Selecting User Mode from ISO15693 user interface (M24LR64)



4. EXAMPLE 2 : ST25DV64K USER INTERFACE.
   A specific user interface has been build in order to be able to use ST25DV products. This user interface allows to manage all the features of the ST25DV :
   - INVENTORY
   - EEPROM
   - FTM (FAST TRANSFER MODE)
   - CONFIGURATION
   - PASSWORD
   - ENERGY HARVESTING
   - DEMOS

   a) INVENTORY & ANTICOLLISION COMMANDS
   This part of the user interface allows the user to send Inventory commands and manage ISO15693 states:
      - Inventory
      - Select
      - Stay Quiet
      - Reset to Ready
      - Anticollision button will allow to launch global antcollision process manage by the STM32 and display up to 5 UID's tags.

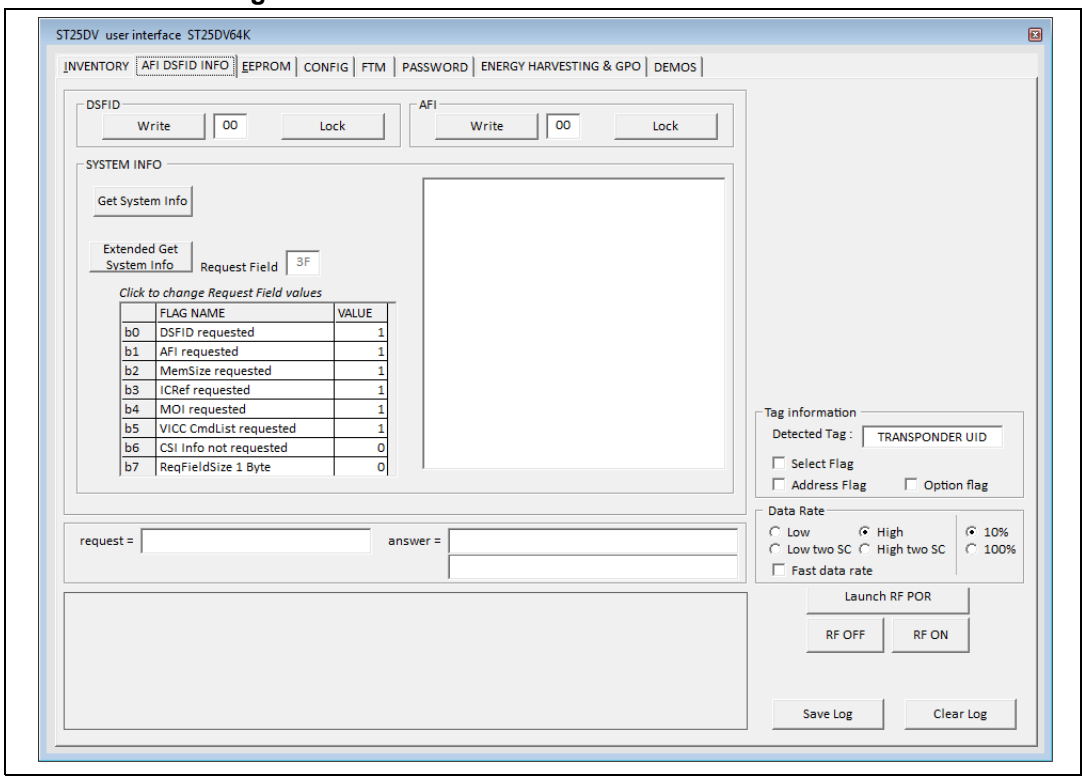
Figure 65. ST25DV user interface: Inventory



b) AFI, DSFID & SYSTEM INFO COMMANDS (see *Figure 66*):

– Write DSFID
– LOCK DSFID
– Write AFI
– LOCK AFI
– Get System Info
– Extended Get System Info

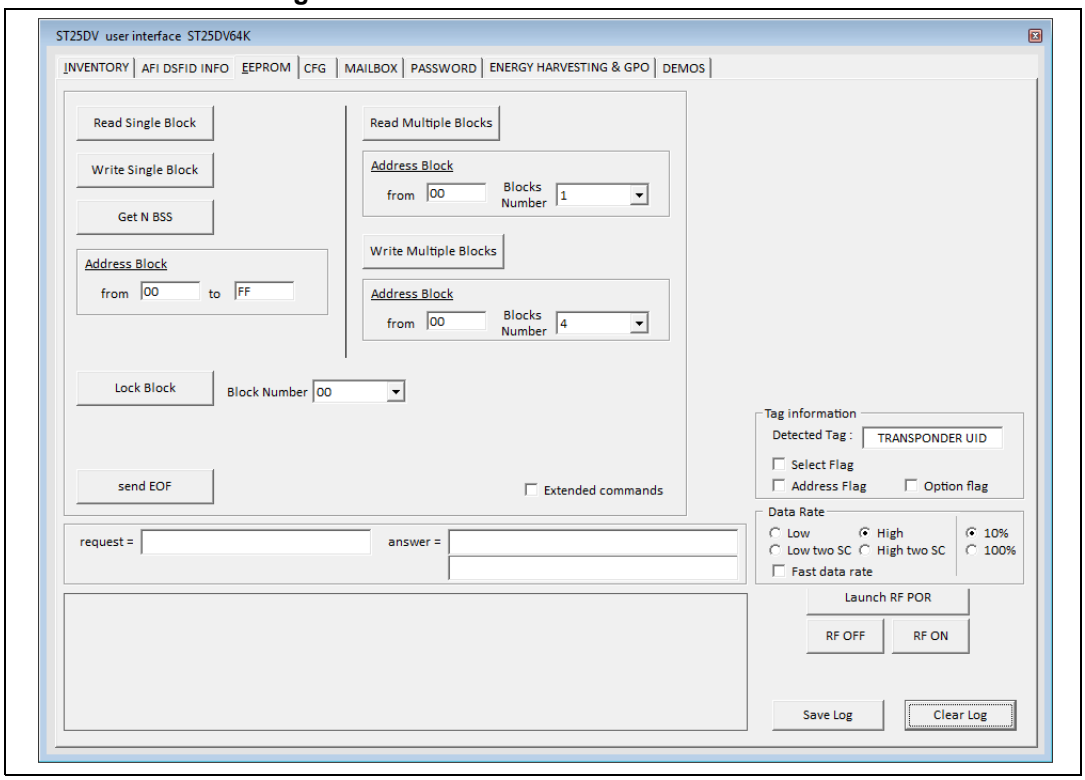
Figure 66. ST25DV user interface: AFI DSFID INFO



c) EEPROM commands (see *Figure 67*):

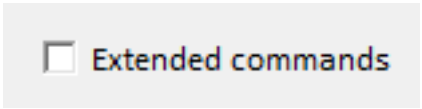
– Read Single Block
– Write Single Block
– Read Multiple Blocks
– Write Multiple Block
– Get N BSS
– Lock Block (block 0 or Block 1)

Figure 67. ST25DV user interface: EEPROM



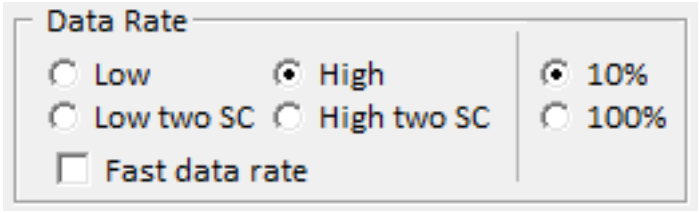
To be able to access to Extended commands, the user will need to click on "Extended commands" check box (see *Figure 68*).

Figure 68. ST25DV user interface: display Extended commands



To be able to access to Fast commands, the user will need to click on "Fast data rate" check box (see *Figure 69*).

Figure 69. ST25DV user interface: ISO15693 Data Rate management

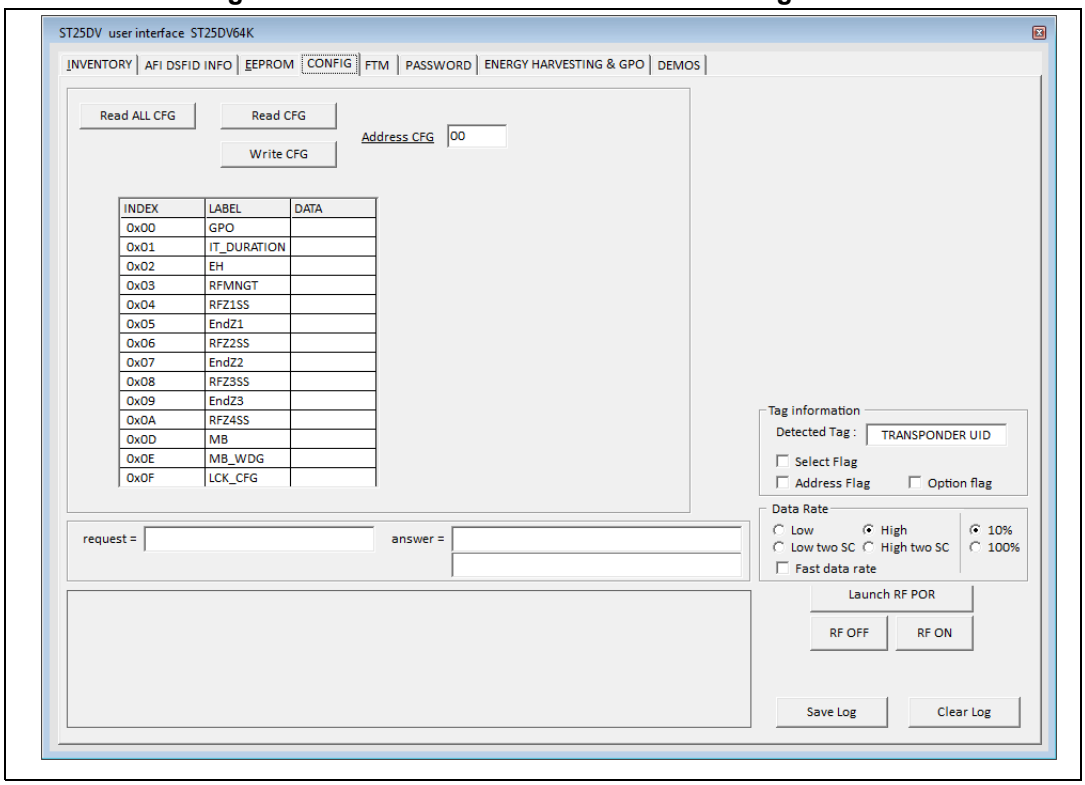


d) CONFIGURATION commands (see *Figure 7*):

– Read CONFIG bytes

– Write CONFIG bytes

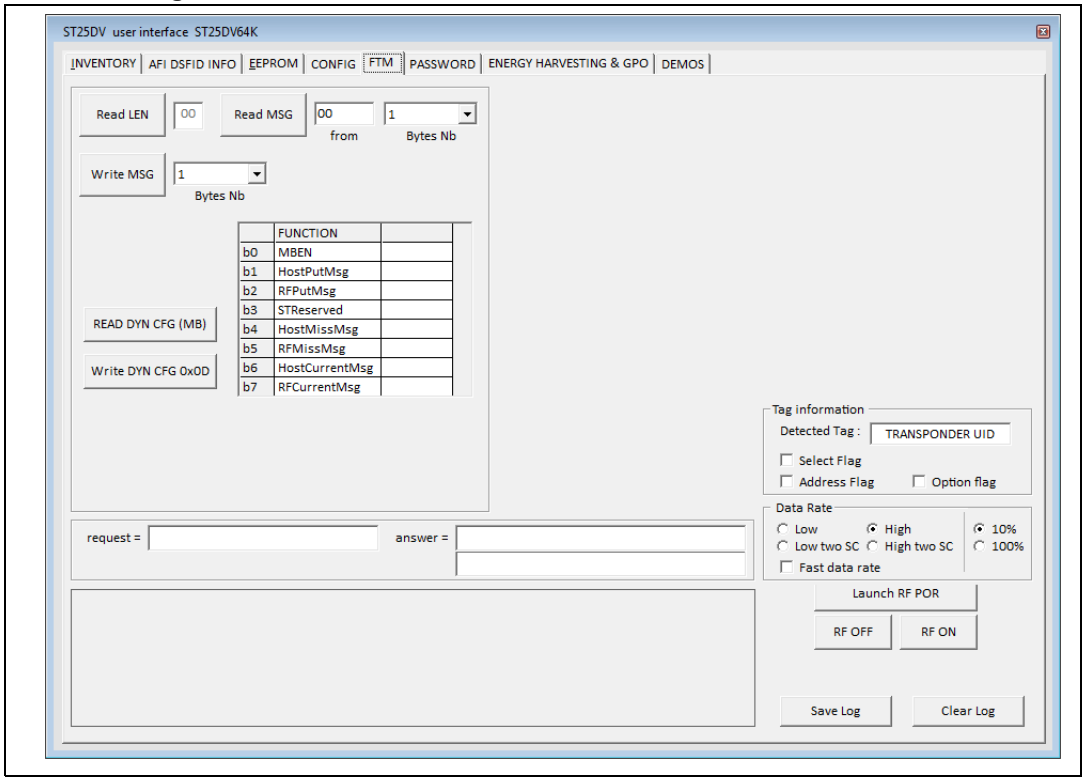
Figure 70. ST25DV user interface: static configuration



e) FTM commands (see *Figure 71*):

– Read Len
– Read Message
– Write Message
– Read DYNAMIC register
– Write DYNAMIC register

Figure 71. ST25DV user interface: Fast Transfer Mode interface

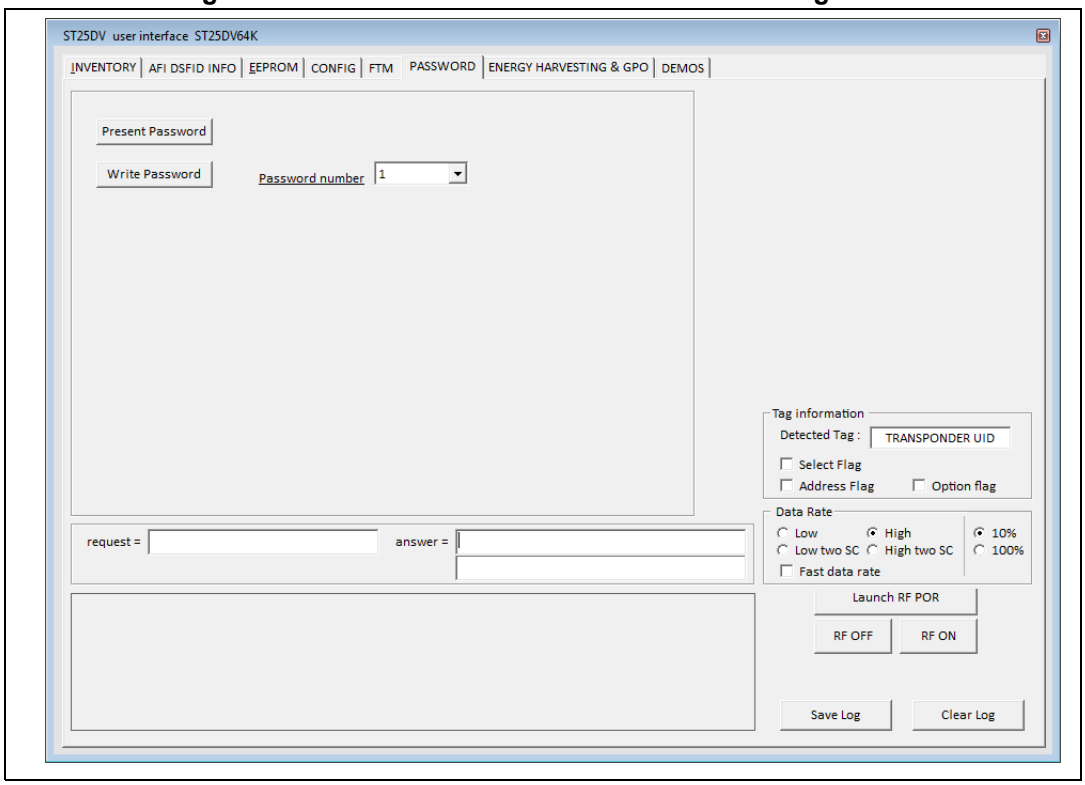


f) PASSWORD commands (see *Figure 72*):

– Present Password

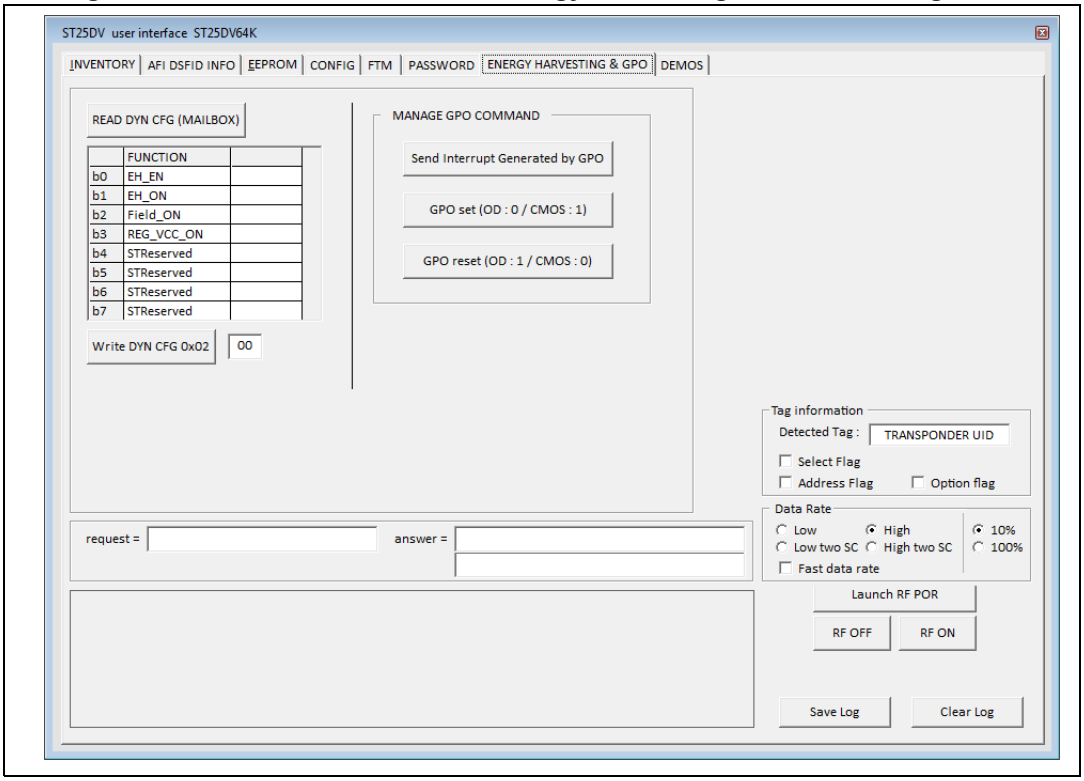
– Write Password

Figure 72. ST25DV user interface: Password management



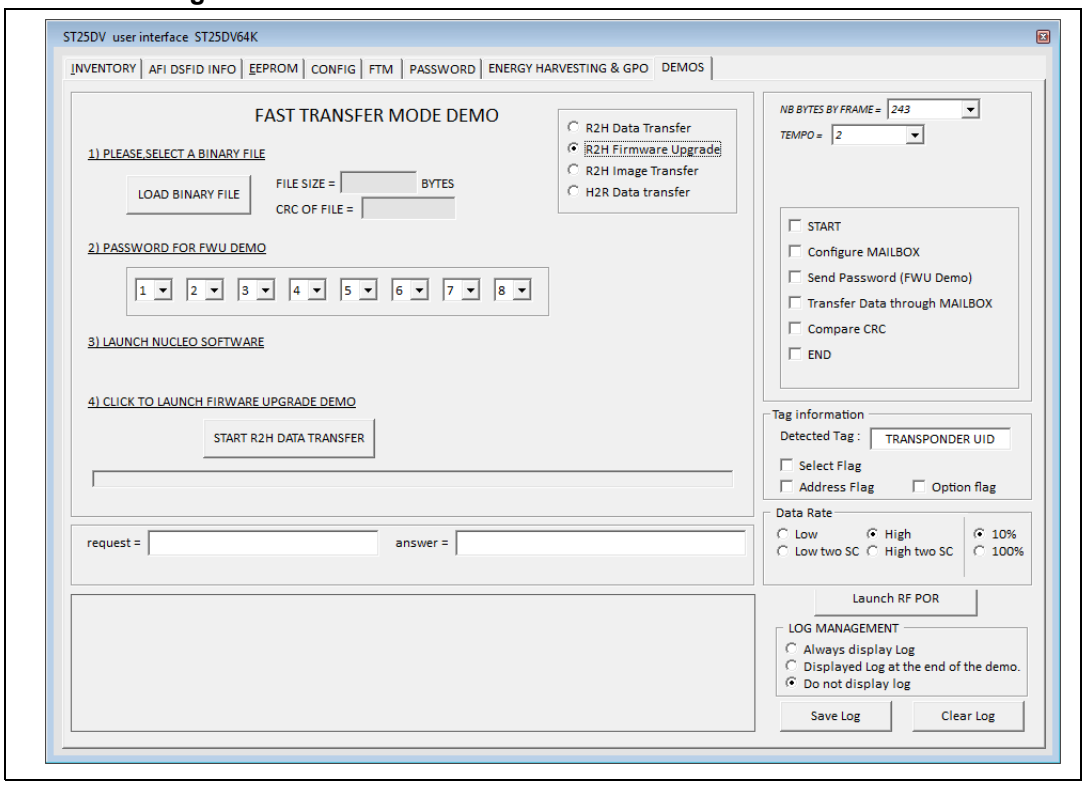
g) ENERGY HARVESTING & GPO commands
– Read DYNAMIC register
– WRITE DYNAMIC register
– Send Interrupt
– Set GPO
– Reset GPO

Figure 73. ST25DV user interface: Energy Harvesting and GPO management



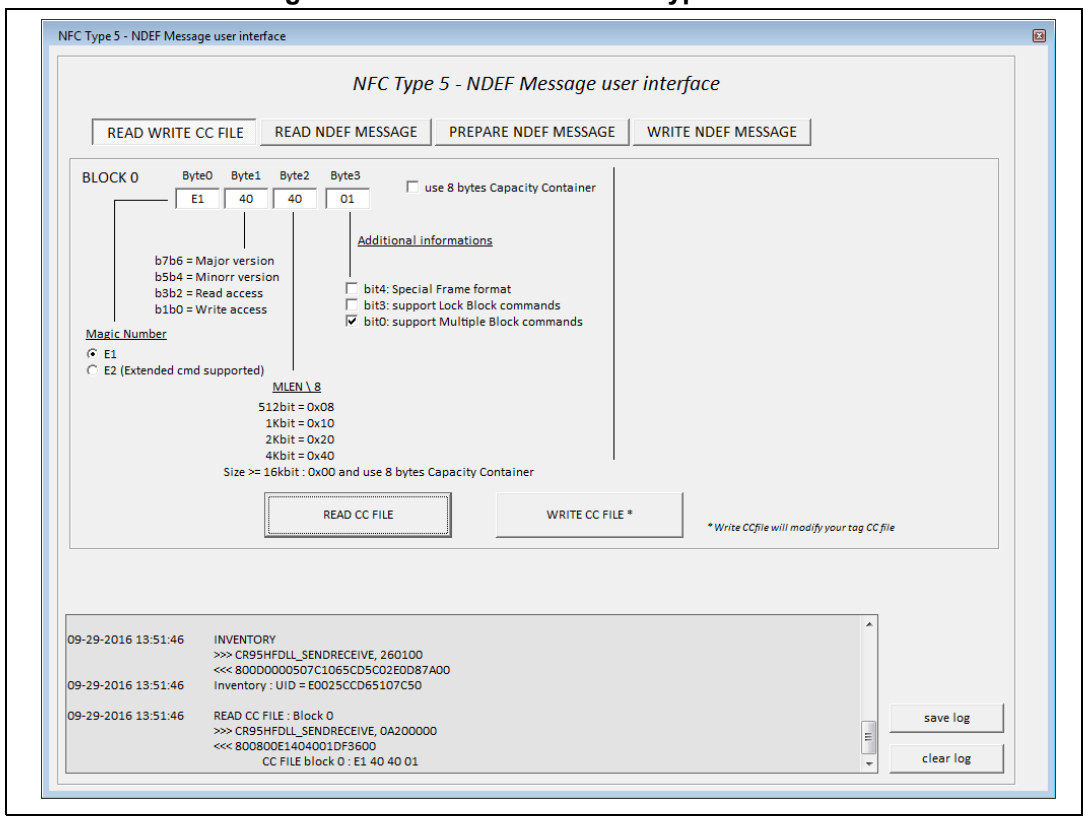
h) DEMOS (see *Figure 74*).
This demos can be played with ST25DV-DISCOVERY boards.
Refers to user manual UM2062 for more informations about this demos.

Figure 74. ST25DV user interface: Fast Transfer Mode demo



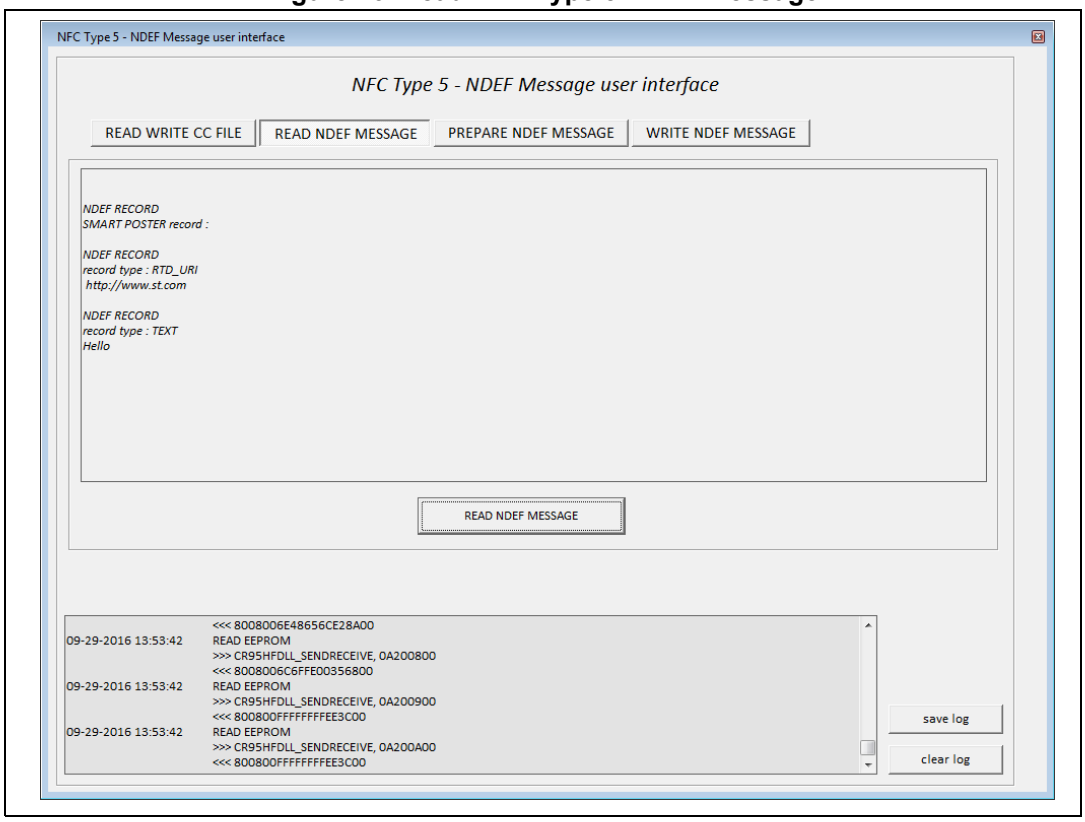
5. NFC type 5: NDEF Message User Interface.
   a) READ & WRITE CC file (see *Figure 75*)
   – Read CC File
   – Write CC File

Figure 75. Read and write NFC Type 5 CC file



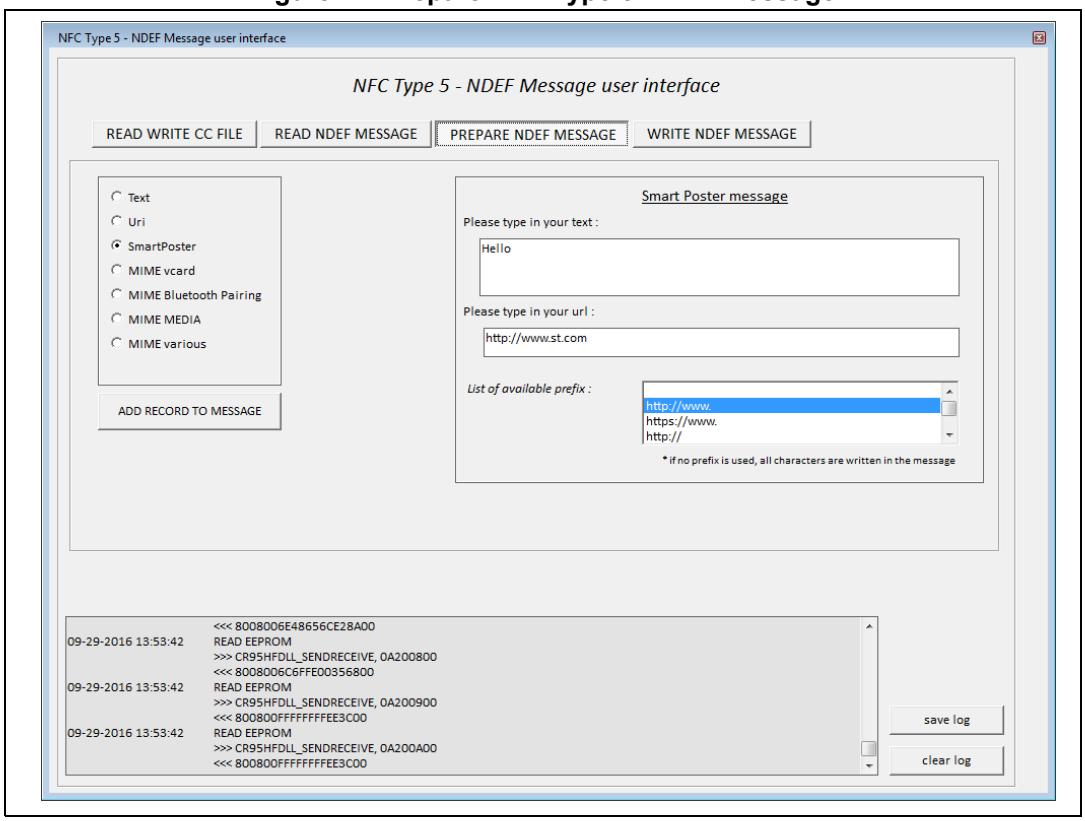
b) READ NDEF MESSAGE

Figure 76. Read NFC Type 5 NDEF message



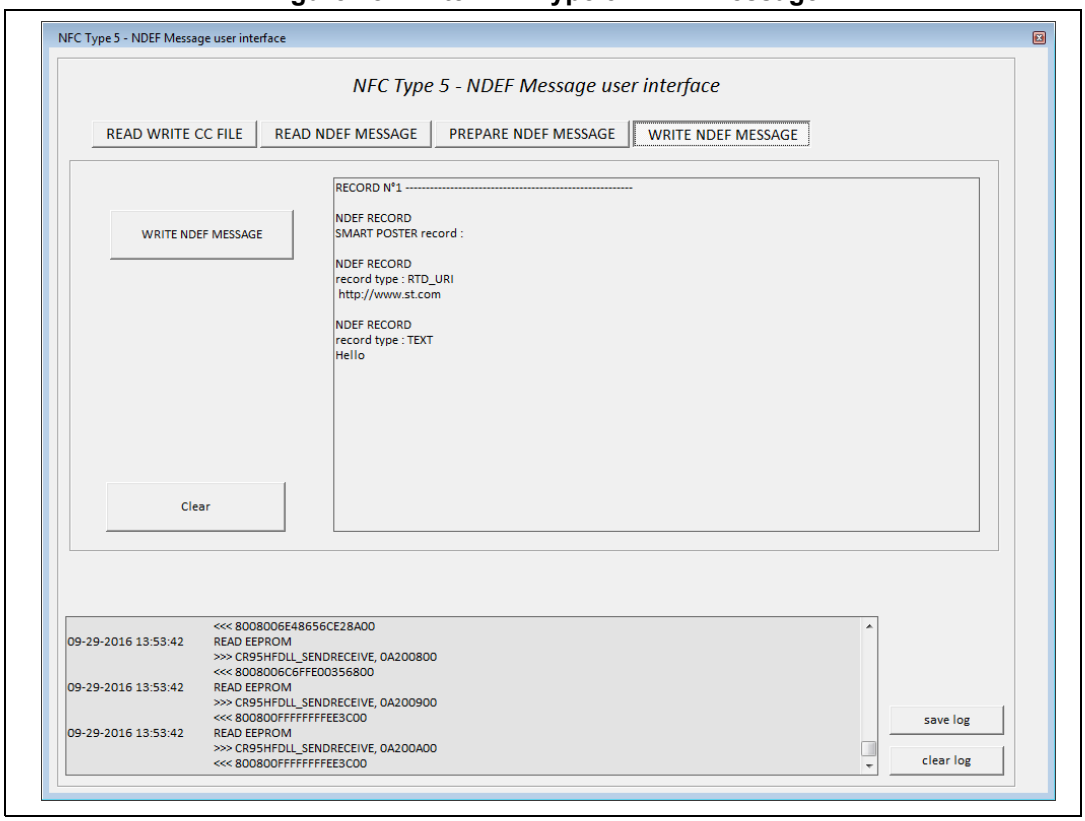
c) PREPARE NDEF MESSAGE
Use User interface to prepare your NDEF message by selecting one of the NDEF recrd format (Text, Uri, Smartposter, vcard, Bluetooth pairing).
Click on ADD RECORD TO MESSAGE button, will add the record in the NDEF message.

Figure 77. Prepare NFC Type 5 NDEF message



d) WRITE NDEF MESSAGE
The prepared NDEF MESSAGE with embedded NDEF records is displayed.
If you need to change anything on the NDEF MESSAGE, click on Clear and go back to PREPARE NDEF MESSAGE to create a new one.
Click on WRITE NDEF MESSAGE to write the NDEF message to the NFC Tag.

Figure 78. Write NFC Type 5 NDEF message



2.5 ISO14443-A menu

Select the ISO14443-A from the main menu to use the CR95HF demonstration board as an ISO14443-A reader. The menu allows to select:

- ISO14443-A Cards commands: (see *Section 2.5.1*).
  This menu allows the user to send any ISO14443-A requests
- TOPAZ (see *Section 2.5.2*).
  This menu allows the user to send any ISO14443-A requests to TOPAZ product
- M24SR02, M24SR04, M24SR16, M24SR64 (see *Section 2.5.3*).
  This menu allows the user to send any ISO14443-A requests or APDU request to M24SR product
- SRTAG2K-D, ST25TA16K, ST25TA64K (see *Section 2.5.3*).
  This menu allows the user to send any ISO14443-A requests or APDU request to SRTAG product.
- ST25TA512, ST25TA02K, ST25AT02K-D, ST25TA02K-P, ST25TA512B, ST25TA02KB, ST25AT02KB-D, ST25TA02KB-P (see *Section 2.5.3*).

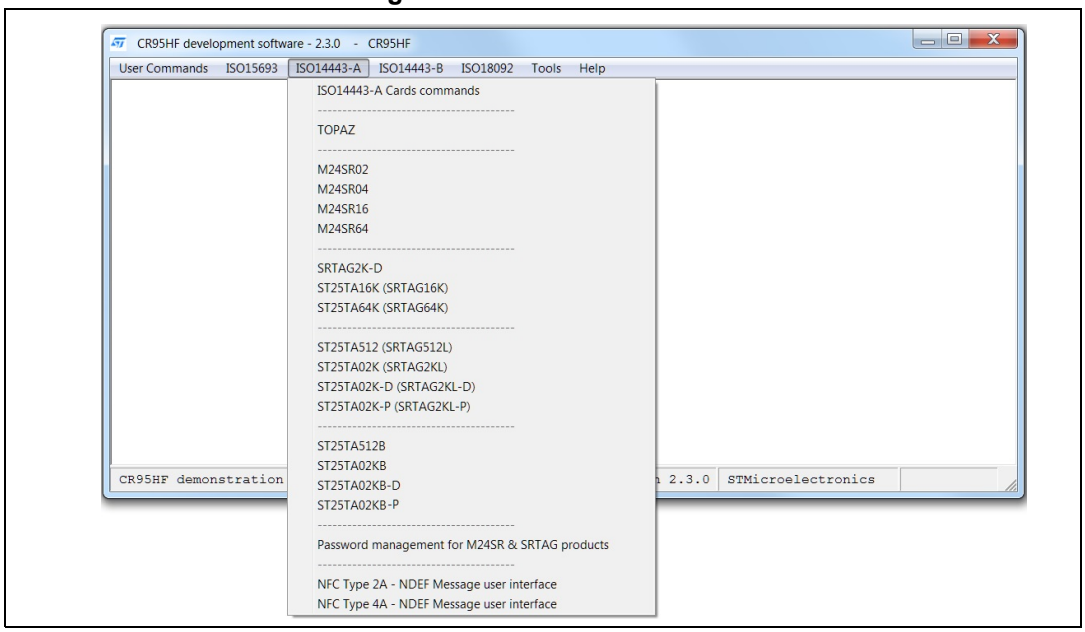
This menu allows the user to send any ISO14443-A requests or APDU request to ST25TA product.

– Password management for M24SR and ST25TA products (see *Section 2.5.4*).
This menu allows the user to manage password and access rights on M24SR and SRTAG products

– Type_2A NDEF Message user interface
This menu allows the user to read and write NDEF message to Tag Type 2A

– Type_4A NDEF Message user interface (see *Section 2.5.5*).
This menu allows the user to read and write NDEF message to Tag Type 4A

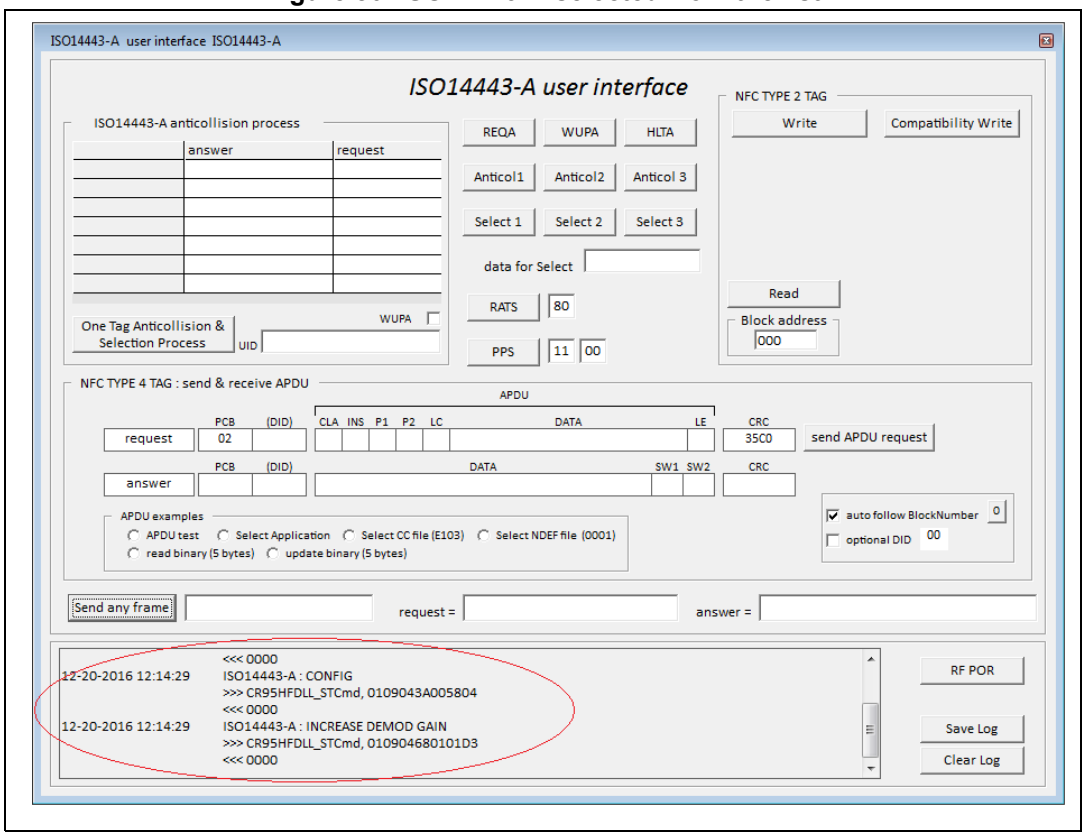
Figure 79. ISO14443-A menu



2.5.1 ISO14443-A Cards commands

Select ISO14443-A from the list (see *Figure 80* for an example). This automatically configures the board as an ISO14443-A reader and displays all the ISO14443-A requests.

Figure 80. ISO14443-A selected from the list



The ISO14443-A configuration is displayed in the log window as shown in *Figure 80*.

The upper part of the window contains buttons allowing to send ISO14443-A requests to tags through the CR95HF demonstration board.

Refer to the device datasheet for the full list of ISO14443-A requests available for a given product.

Anticollision process will try to communicate with your Tag and try to select it. This automatic process is only for 1 tag.

It sends successively:

- ReqA
- Anticol1
- Select1
- Anticol2
- Select2
- Anticol3
- Select3

The process will be stopped as soon as an error occurs or if the anticollision process is finished (4 bytes or 7 bytes or 10 bytes UID).

Other commands can be sent such as:

- RATS
- PPS
- READ
- WRITE

Send Receive APDU can be used to send APDU requests.

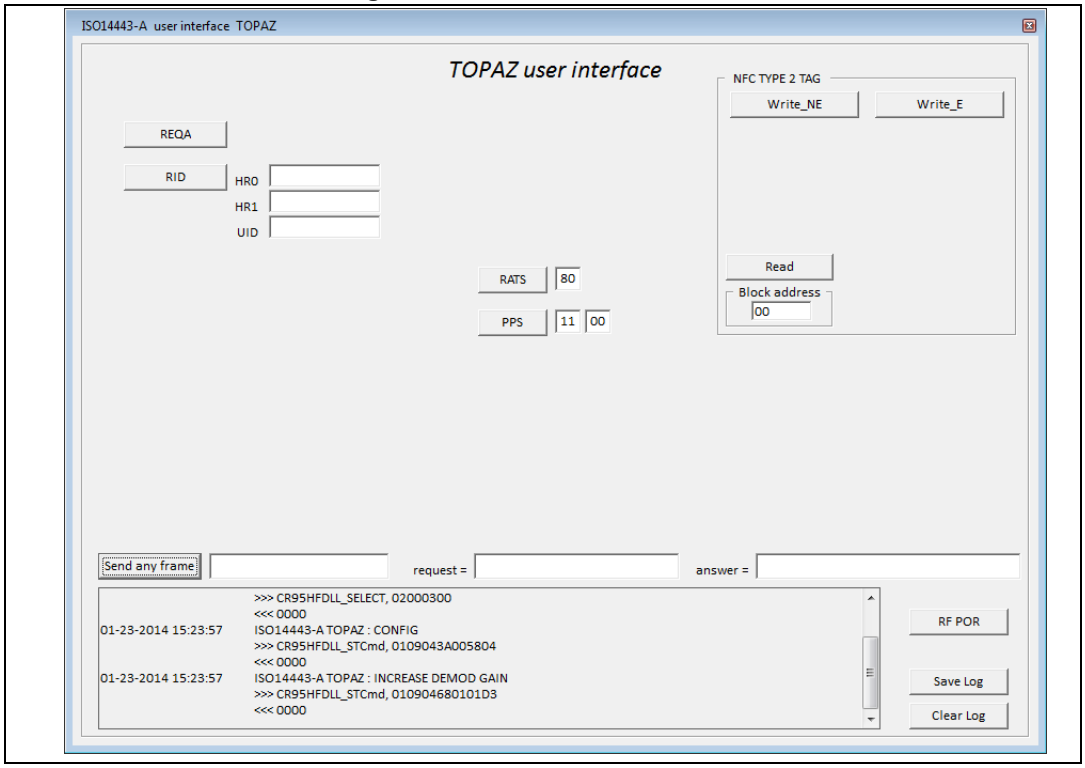
2.5.2 TOPAZ user interface

The TOPAZ configuration is displayed in the log window as shown in *Figure 81*

Some basic commands are available to be able to play with TOPAZ cards such as :

– REQA
– RID
– RATS
– PPS
– READ
– WRITE_NE
– WRITE_E

Figure 81. TOPAZ user interface



2.5.3 M24SR, SRTAG and ST25TA user interface

The selected product user interface has been separated into two different windows to improve the visibility of the tool.

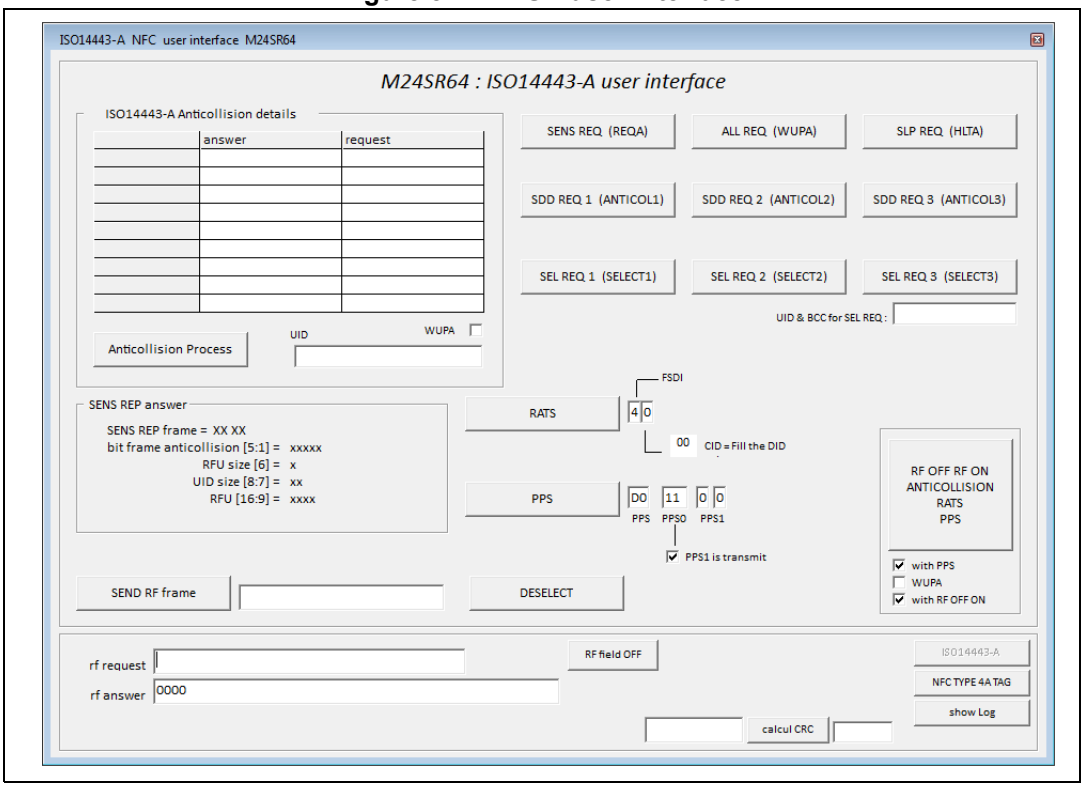
We have separated this two windows following the “life” of the selected product (see *Figure 82*):

- after a RF POR or a deselect command, the selected product is in the ISO14443-A world
- after RATS or PPS command, the selected product enter in the NFC world.

First, selected product among the liost of products (M24SR, SRTAG, ST25TA).

When selecting the device, the ISO14443-A window appears.

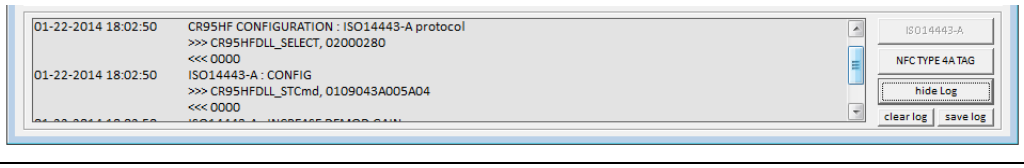
Figure 82. M24SR user interface



As soon as the windows appears, the ISO14443-A protocol selection is done in background.

Click on show log to display the log window and see the CR95HF protocol selection sequence (see *Figure 83*)

Figure 83. CR95HF protocol selection sequence



ISO1443-A screen

The first screen (see *Figure 82*) is displayed when the M24SR is selected in the option menu. Several buttons are displayed in this window. The buttons represent all the available commands in the ISO14443-A world:

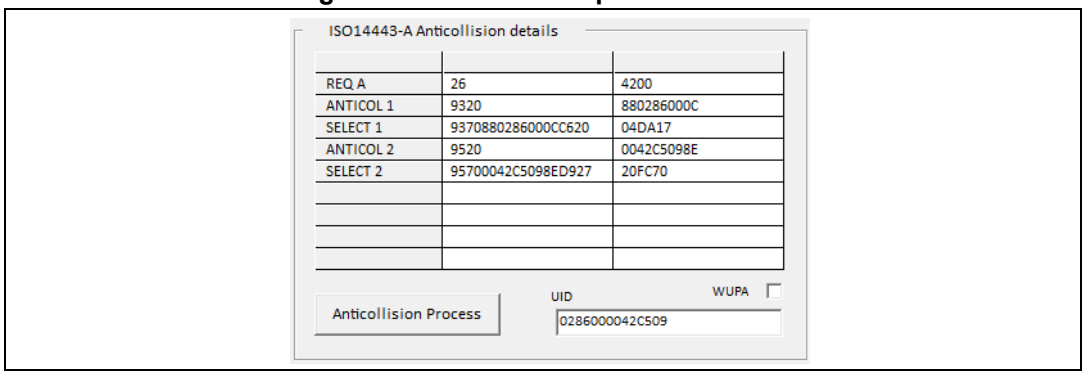
Some buttons are used to send single commands:

- **SENS REQ (REQA)**: send a REQA to the M24SR
- **ALL REQ (WUPA)**: send WPUA command to the M24SR
- **SLP REQ (HLTA)**: send HLTA command to the M24SR
- **SDD REQ 1 2 3 (ANTICOL 1 2 3)**: send Anticol command to the M24SR
- **SEL REQ 1 2 3 (SELECT 1 2 3):** send Select command to the M24SR
- **RATS**: send RATS command to the M24SR
- **PPS**: send PPS command to the M24SR
- **DESELECT**: send Deselect command to the M24SR

Two additional buttons allow to accelerate the communication with the M24SR:

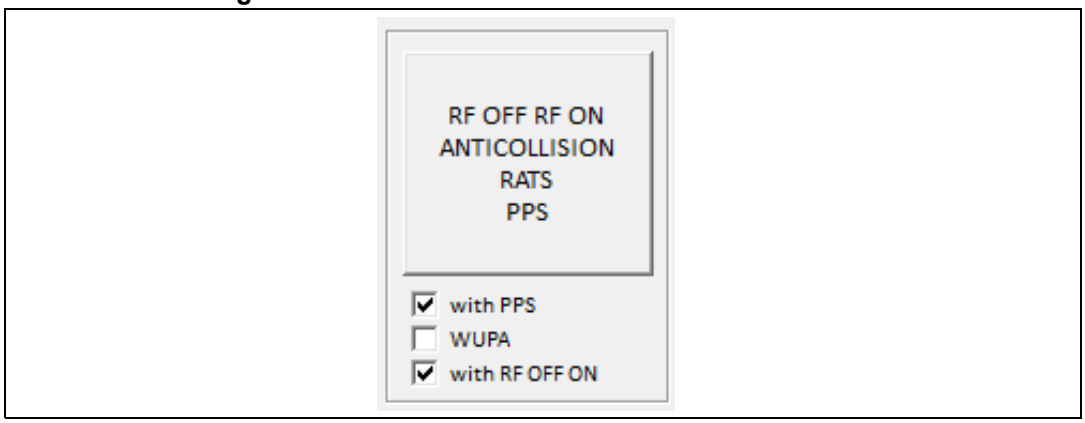
- **Anticollision Process** button
  can be used to detect a Tag and read the UID of this tag
  when clicking on this button, the anticollision sequence is sent (beginning by a REQA or WUPA) depending of the Option button.
  The REQA/WUPA answer is detailled in SENS REQ answer screen.
  The anticollision sequence is summarized in the array.
  The sequence is launched and stopped when an error occurred.
  At the end of the sequence, if no error is found, the UID of the selected M24S is displayed in UID field as show on *Figure 84*

Figure 84. Anticollision process results



- **RF OFF RF ON ANTICOLLISION RATS PPS** button
  can be used the whole anticollision process with RATS with PPS to reach NFC type 4A world.
  This button can be configured by enabling or disabling
  - RF OFF/ON
  - Replace REQA command by WUPA command
  - PPS request added to the sequence

Figure 85. RF OFF on anticollision RATS PPS button



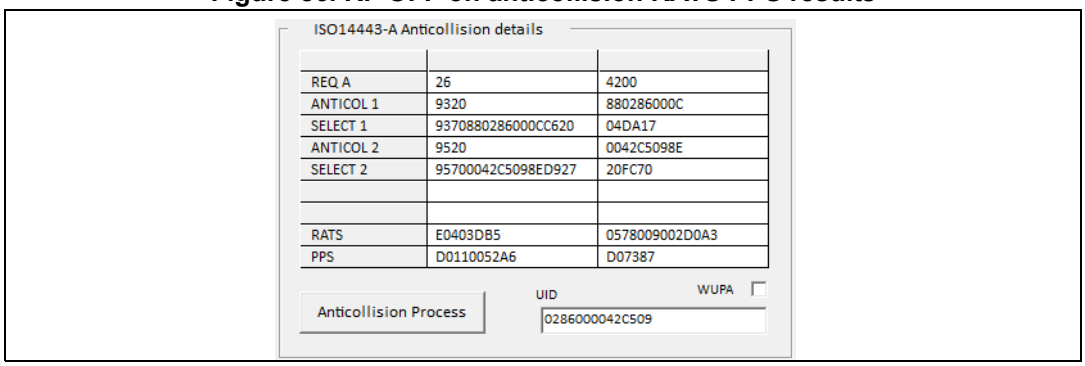
The sequence is launched and stopped when an error occurred.

At the end of the sequence, if no error is found,

- The UID of the selected M24SR is displayed in UID field.
- RATS answer
- PPS Answer (if option selected)
- The log windows is filled with RF request & RF answer

As shown on *Figure 86*

Figure 86. RF OFF on anticollision RATS PPS results

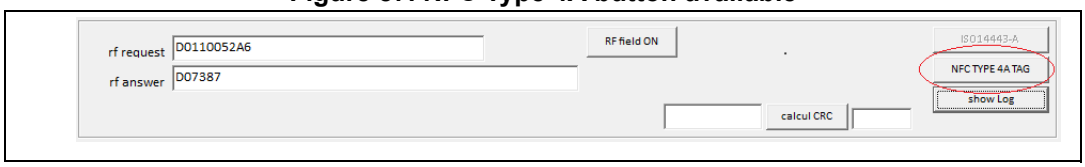


At the end of this action, if no error is occurred and M2SR answers are Ok, the window will automatically switch to the windows called **NFC Type 4A**.

How to access to ISO14443-A command and NFC Type 4A commands:

– When the ISO14443-A windows is displayed, the “NFC Type 4A” button is available to switch to NFC Type 4A window.
See *Figure 87*

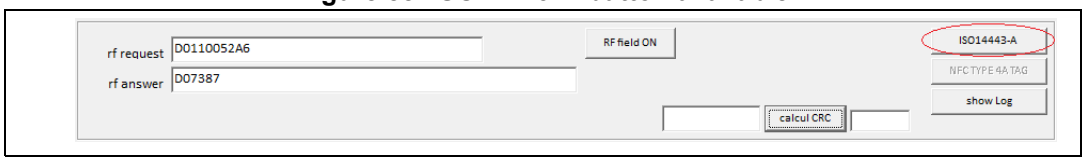
Figure 87. NFC Type 4A button available



– When the NFC Type 4A windows is displayed, the **ISO14443-A** button is available to switch to iso14443-A window.

See *Figure 88*

Figure 88. ISO14443-A button available



As already explained in the user manual, the “RF request” and “RF answer” fields contains the send command and the answer from M24SR.

Figure 89. RF request and RF answer

The **show log** button is available to be able to see the history of RF request and RF answer. See *Figure 90* and *Figure 91*.

Figure 90. “Show Log” button

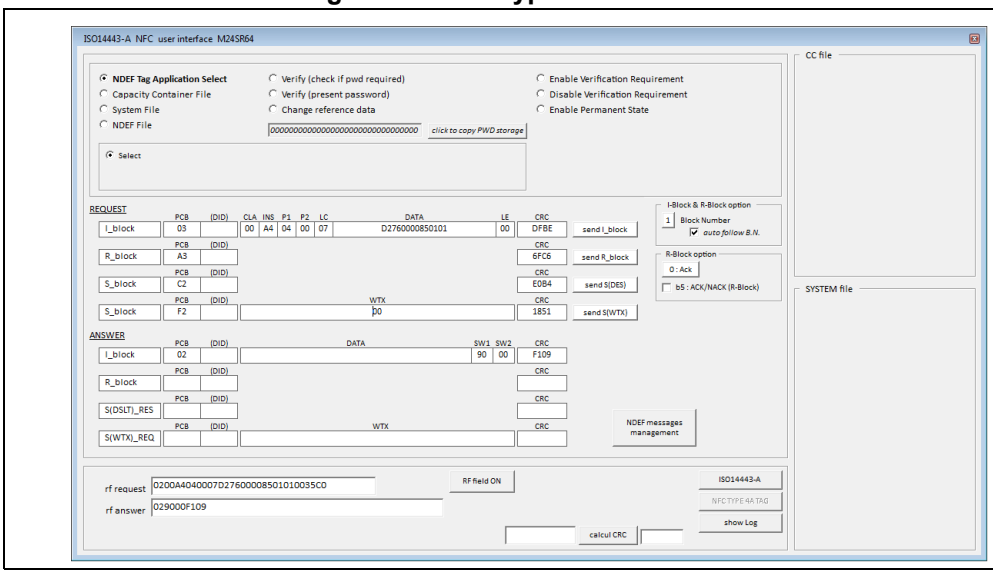
Figure 91. Log windows of RF request/answer

The formatted request (ex: CR95HFDLL_STCmd, 010904680101DF) can be used in script tool.

NFC Type 4A screen

This window will allows to send NFC APDU requests to be able to play with the M24SR tag in NFC world (see *Figure 92*). This window is automatically reached when the "RF OFF RF ON ANTICOLLISION RATS PPS" button is used and all the processes are done successfully or when the user click on "NFC Type A" button.

Figure 92. NFC Type 4A user interface

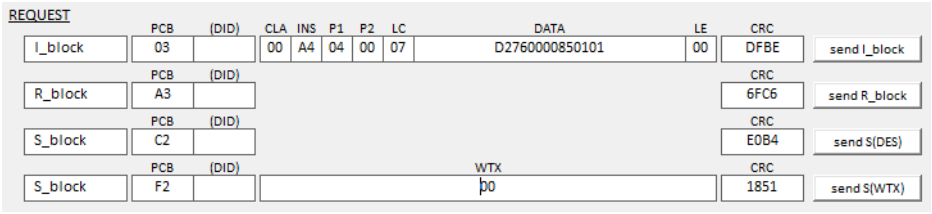


The middle part of the window is used to generate the RF frame to be sent to the M24SR: I_Block, R_Block, S(DES)_Block and S(WTX)_Block request.

All this field can be changed by clicking and modifying data

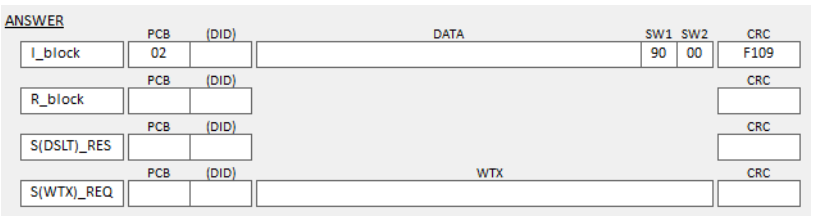
Four buttons are available to send I_Block, R_Block, S_Block requests.

Figure 93. I_Block, R_Block, S_Block requests



The answer of the M24SR is filled in I_Block, R_Block, S_Block answer fields depending on the request sent to the M24SR.

Figure 94. I_Block, R_Block, S_Block answer



The higher part of the window can be used to automatically fill the I_Block request.

The goal is to facilitate the communication with the M24SR (following NFC forum and M24SR datasheet).

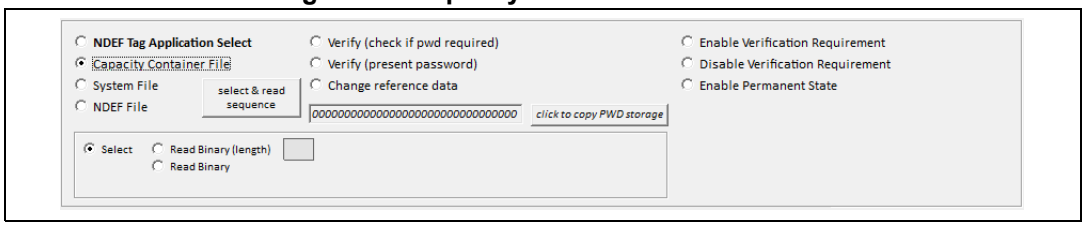
Several option buttons are available:

- **NDEF Tag Application select**
  When this option is selected, the I_Block frame is filled with adequate data.

Once the command option is selected, the data in I_Block rf frame are filled, you can press the button “send I_Block” to send RF frame.

- **Capacity Container file**
  Selecting Capacity Container File option will allow other option to appear
  clicking on one of this option will fill, the I_Block frame is filled with adequate data.

Figure 95. Capacity container file selected



– **Select command**:
fill data with CC file Select command

– **Read binary (length) command**
fill data with read binary command on CC file in order to read the length of the cc file

– **Read binary command**
fill data with read binary command on CC file

Once the command option is selected, the data in I_Block rf frame are filled, you can press the button “send I_Block” to send RF frame.

– **Select & read sequence** button will launch automatically all the procedure and will display it in a CC file result window

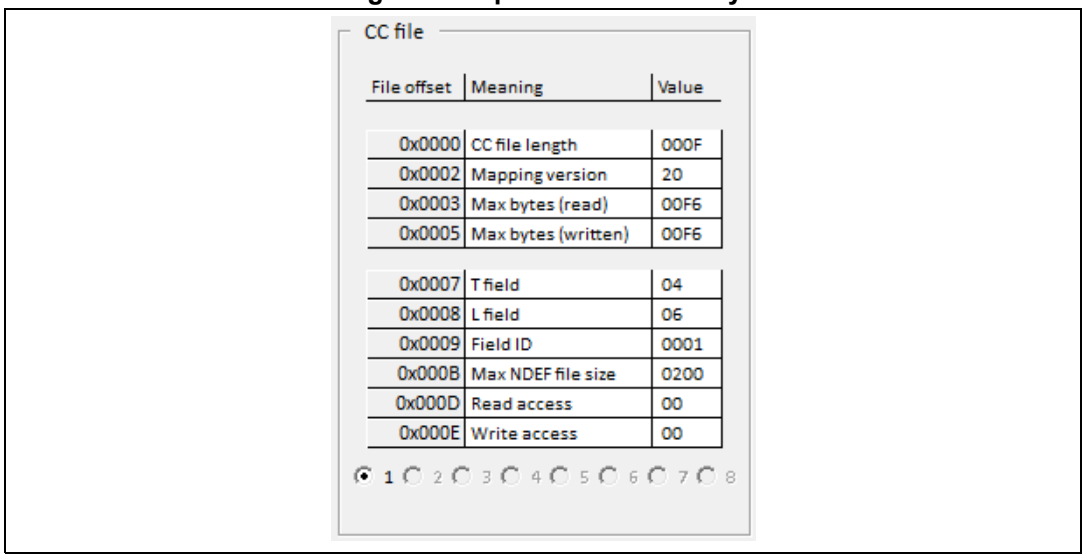
Select cc file

Read cc file length

Read cc file data

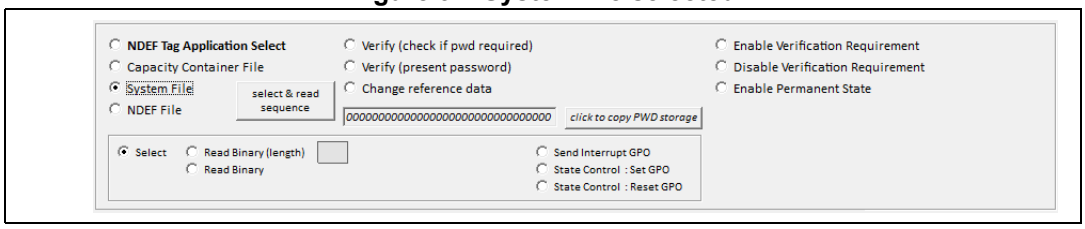
Display data in a specific CC file array (available only of no error detected)

Figure 96. Specific CC file array



- **System file**
  Selecting System File option will allow other option to appear.
  Clicking on one of this option will fill, the I_Block frame is filled with adequate data.

Figure 97. System file selected



  - **Select command**:
    fill data with System file Select command
  - **Read binary (length) command**:
    fill data with read binary command on System file in order to read the length of the system file
  - **Read binary command**:
    fill data with read binary command on System file
  - **Send Interupt GPO**
  - **State control: Set GPO**
  - **State control: Reset GPO**

Once the command option is selected, the data in I_Block rf frame are filled, you can press the button send I_Block to send RF frame.

  - **Select & read sequence** button will launch automatically all the procedure and will display it in System file result window

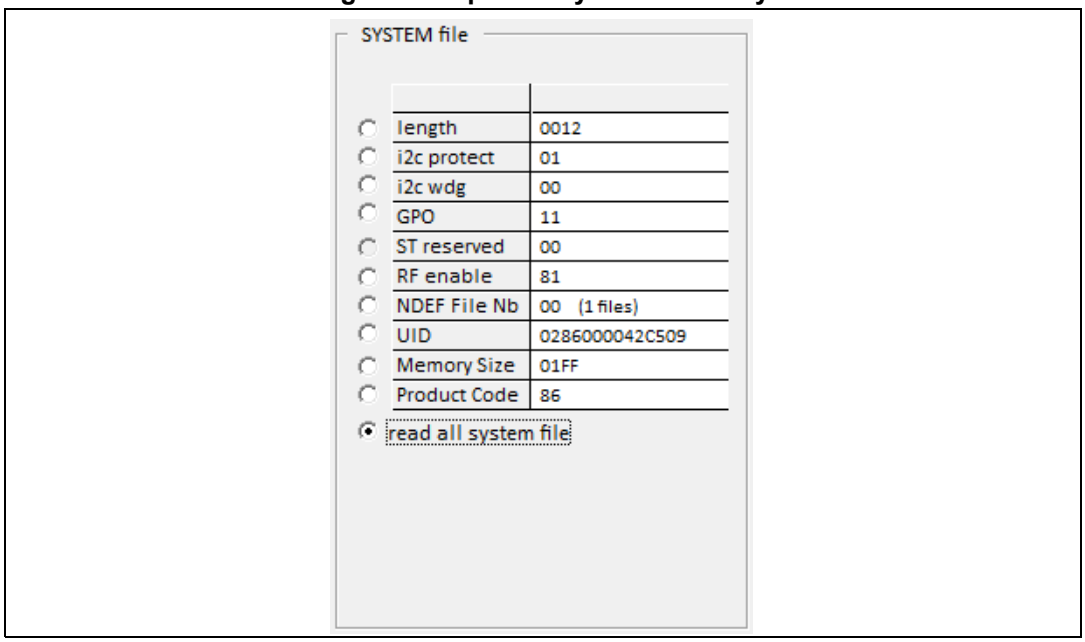
    Select system file

    Read sytem file length

    Read system file data

    Display data in a specific System file array (available only of no error detected)

Figure 98. Specific system file array

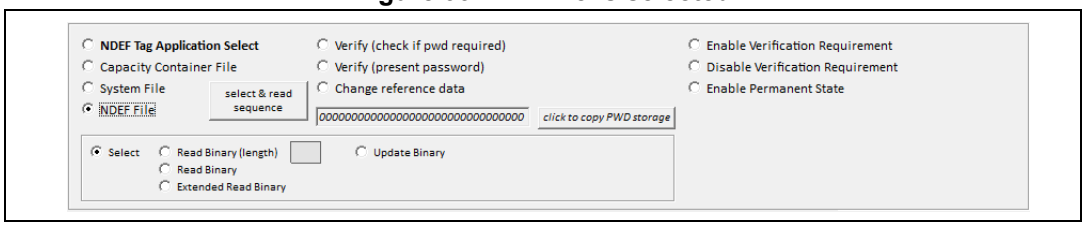


- **NDEF file**

Selecting NDEF File option will allow other option to appear.

Clicking on one of this option will fill, the I_Block frame is filled with adequate data.

Figure 99. NDF file is selected



– **Select command**:
fill data with NDEF file Select command

– **Read binary (length) command**:
fill data with read binary command on NDEF file in order to read the length of the cc file

– **Read binary command**
fill data with read binary command on NDEF file

– **Extended Read binary command**
fill data with extended read binary command on NDEF file

– **Update Binary command**
Fill data with update binary command on NDEF file

In case of M24SR request a WTX , this button will automatically manage it. The M24SR will reply with a Window Extension request (that will be displayed in S(WTX) answer array), then the tool will automatically send a S(WTX) request to the M24SR
All this request / answer communication will be displayed in Log window.

Once the command option is selected, the data in I_Block rf frame are filled, you can press the button “send I_Block” to send RF frame.

– **Select & read sequence** button will launch automatically all the procdure and will display it in NDEF file result window (NDEF file can be decoded)

Select NDEF file

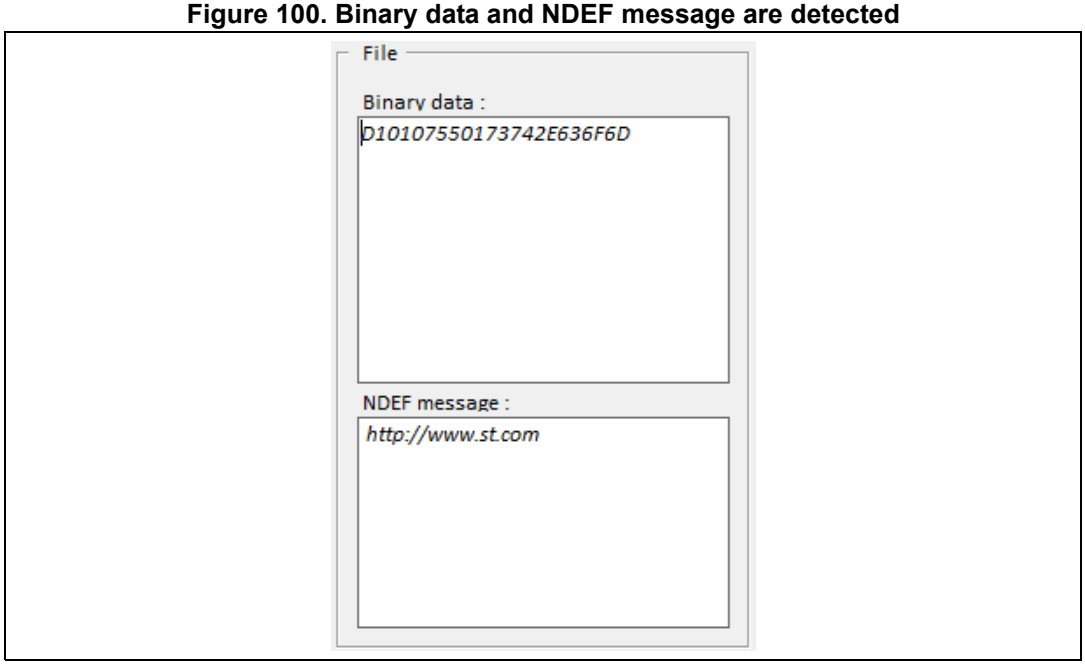
Read NDEFfile length

Read NDEF file data

Display binary data in a field (available only if no error detected)

Display decoded NDEF message if any is in a field (available only if no error detected)

Figure 100. Binary data and NDEF message are detected



- **Commands to manage Password and Access Rights**

Three command can be used to manage Passwords (Read password or Write password).

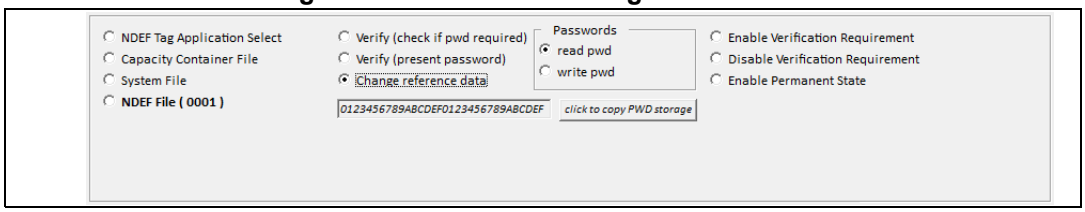
– **Verify (check if password is required)**
fill data with Verify command

– **Verify (present password)**
fill data with Verify command

– **Change reference data (change password value)**
fill data with Verify command

Note: Notes that a NDEF file has to be selected previously (see Datasheet)
The command sent will be applied to selected NDEF file

Figure 101. Password management button

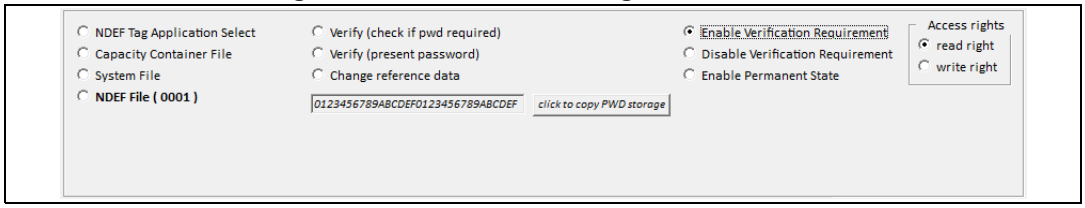


Three commands can be used to manage Access right and M24SR state (see *Figure 101*).

- **Enable Verification requirement**
  fill data with Verify command
- **Disable Verification requirement**
  fill data with Verify command
- **Enable Permanent State**
  fill data with Verify command

Note: Notes that a NDEF file has to be selected previously (see Datasheet)
The command sent will be applied to selected NDEF file

Figure 102. Password management buttons



NDEF Messages management button

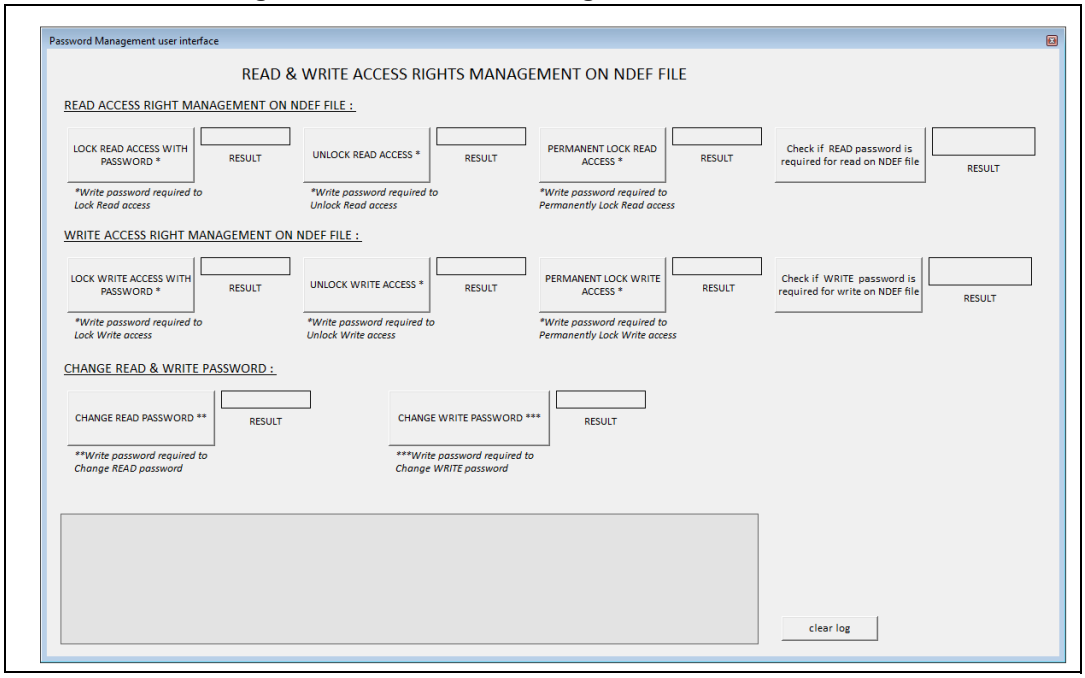
It allows directly access to Type_4A NDEF Message user interface (see *Section 2.5.5*)

Figure 103. NDEF message management button

2.5.4 Password management for M24SR and SRTAG products

This tool allows to manage Password and access rights.

Figure 104. Password management user interface



- READ access right commands are available:
  - LOCK UNLOCK
  - PERMANENT LOCK
  - CHECK
- WRITE ACCESS RIGHT commands are available:
  - LOCK
  - UNLOCK
  - PERMANENT LOCK
  - CHECK on WRITE
- CHANGE PASSWORD commands are available to change password:
  - READ password
  - WRITE password

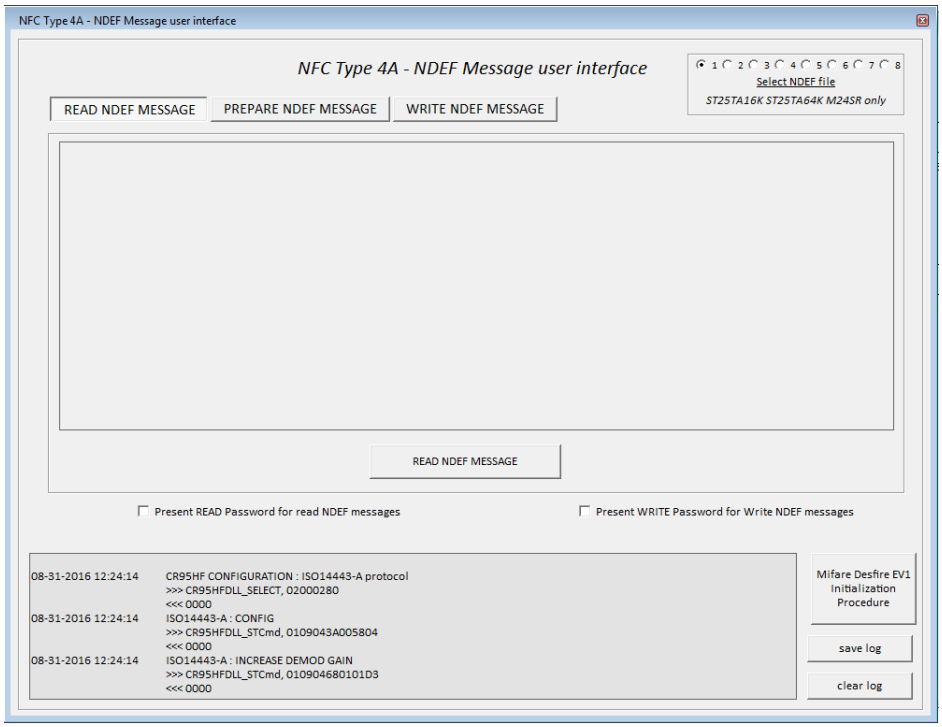
2.5.5 NFC Type 4A - NDEF Message user interface

This tool allows to read or write a NDEF file.

This user interface can manage Type 2A and type 4A, type 4B, type 3, type 5 and Vicinity cards. It can be accessed by selecting the item in the menu.

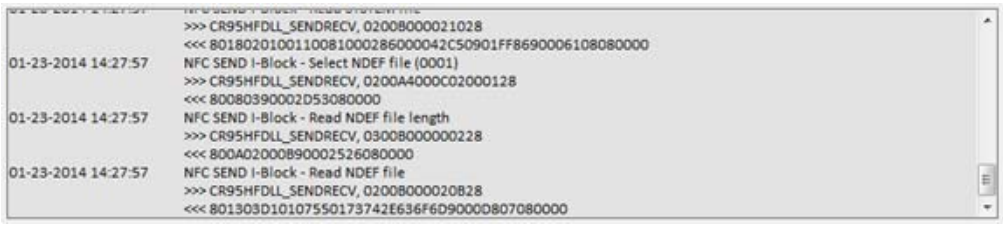
Once the NDEF message management menu is selected, the CR95HF is set following the selected RF protocol (Configuration) and the User interface appears.

Figure 105. NFC Type 4A - NDEF message user interface



When this tool is selected, the CR95HF is configured as a ISO14443-A reader. See the log window to know the configuration set up.

Figure 106. Log window of configuration setup



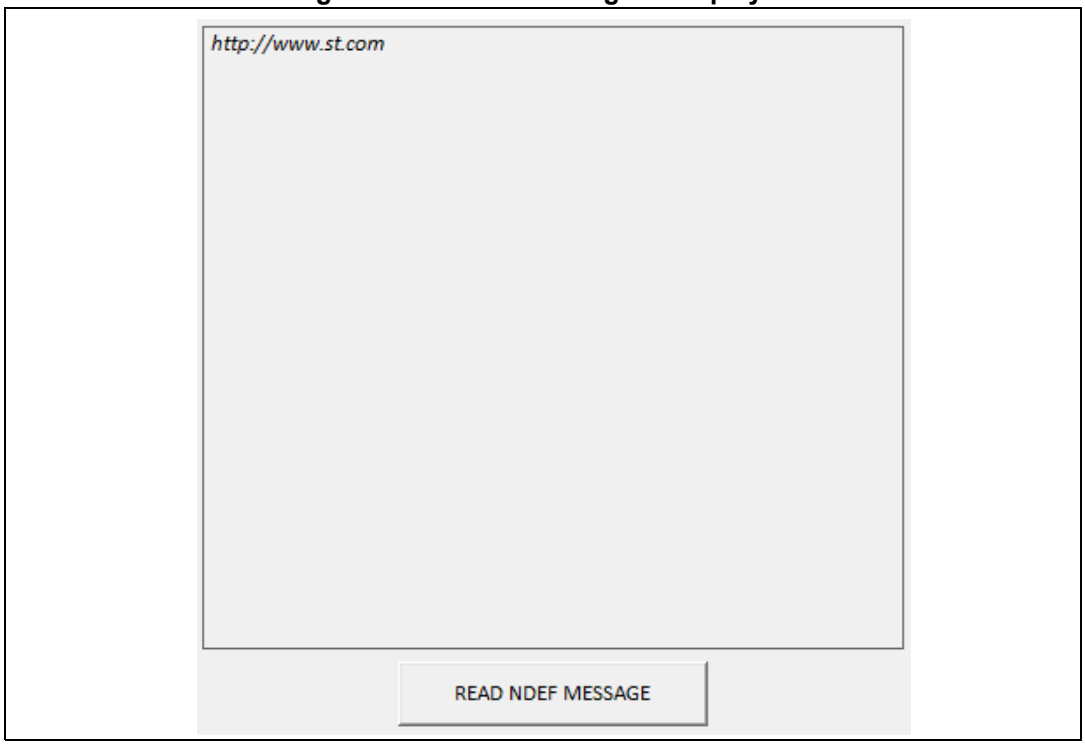
READ NDEF MESSAGE button

The READ NDEF message button is used to launch all the procedure to select the device and read the NDEF message. This whole process is described bellow.

READ NDEF MESSAGE process:

- The RF field is disabled in order to deselect the tag (RF Por).
- The RF fied is enabled.
- The Anticollision sequence is launched (ReqA, Anticol, select, RATS, PPS). The result is that the device is put in the NFC world.
- Select Application launched
- Read CC file process is launched (select, read length, read CC file)
  The goal is to identify NDEF file ID
- Read NDEF file process is launched (select, read length, read NDEF message)
- Decoding of NDEF message
- The available message is displayed on the screen (see *Figure 107*)

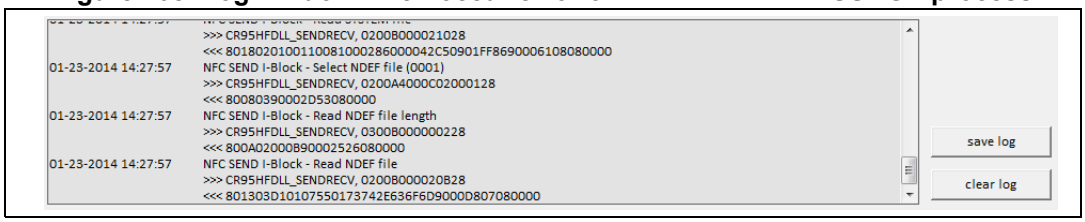
Figure 107. NDEF message is displayed



This process is automatically stopped if any error or “no answer” is detected.

The Log window at the bottom of the screen will help to understand the issue in case of error.

Figure 108. Log window when occur error on READ NDEF MESSAGE process



PREPARE NDEF MESSAGE

This item will allow to create a NDEF Message with a single NDEF record or several NDEF record.

Notes that the NDEF message will not be written to the Tag. To be able to write the NDEF message to the Tag, you will need to click on WRITE NDEF MESSAGE

Figure 109. Prepare TEXT NDEF record

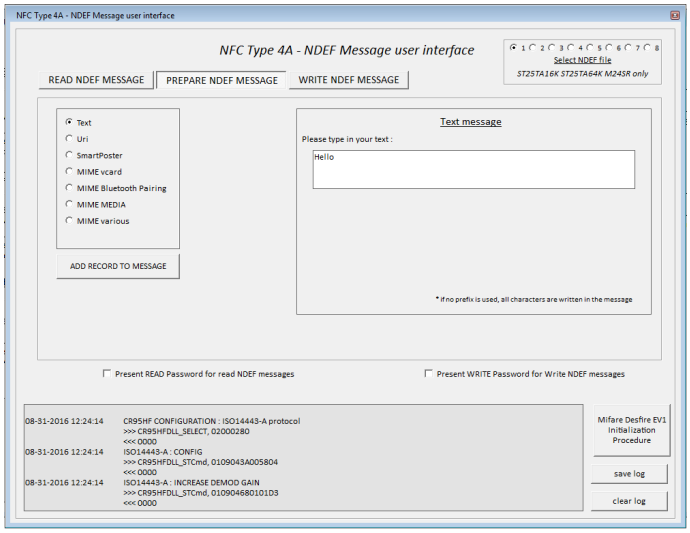


Figure 110. Prepare URI NDEF record

Figure 111. Prepare SMARTPOSTER NDEF record

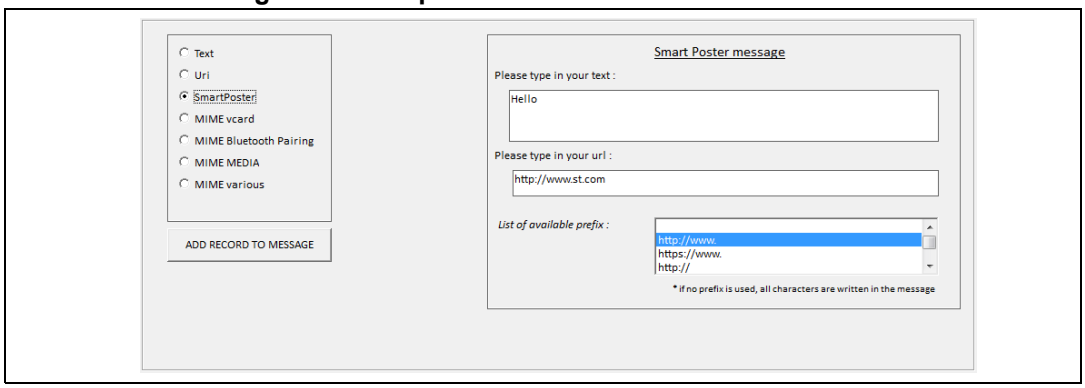


Figure 112. Prepare MIME VCARD NDEF record

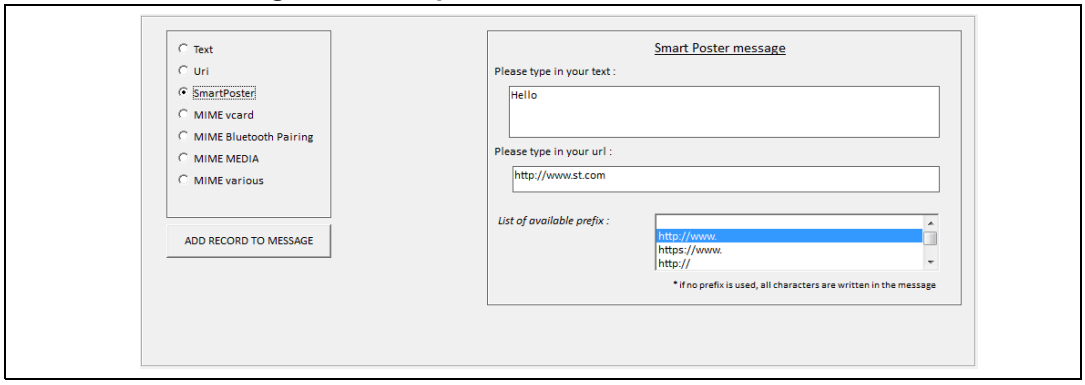


Figure 113. Prepare MIME BLUETOOTH PAIRING NDEF record

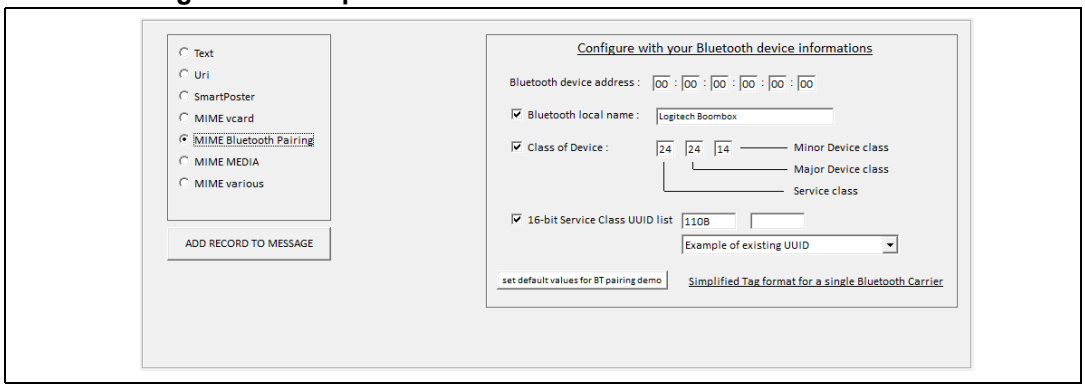


Figure 114. Prepare MIME MEDIA NDEF record

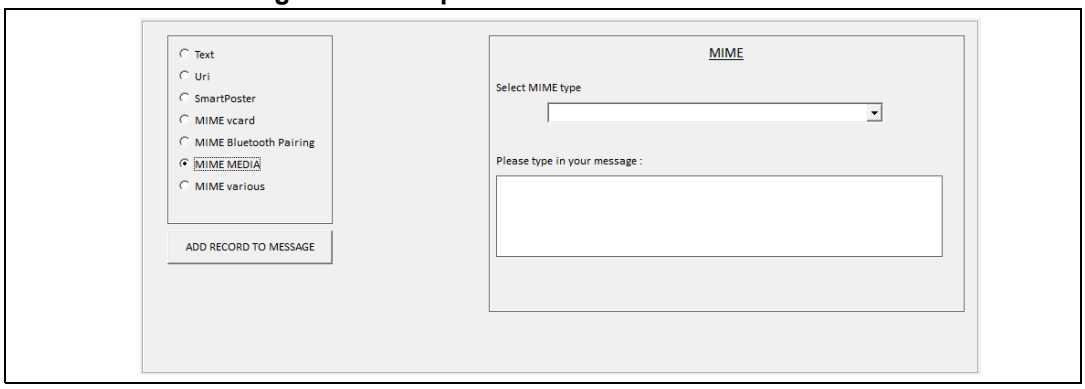
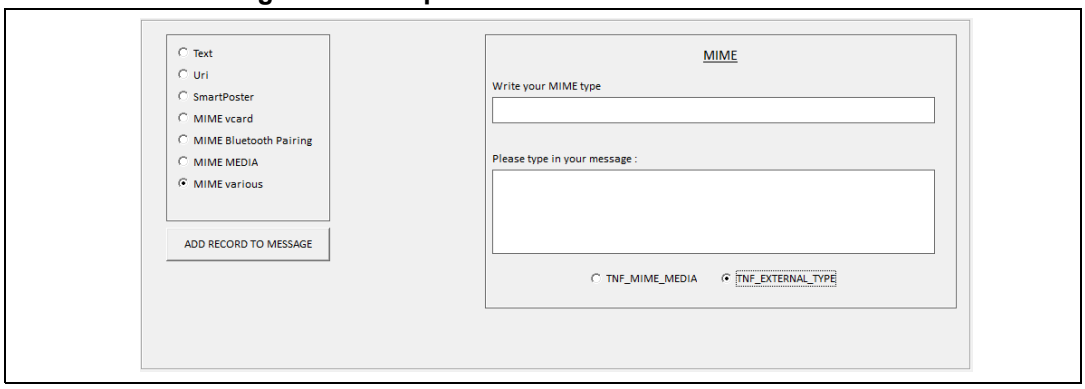


Figure 115. Prepare MIME VARIOUS NDEF record



WRITE NDEF MESSAGE

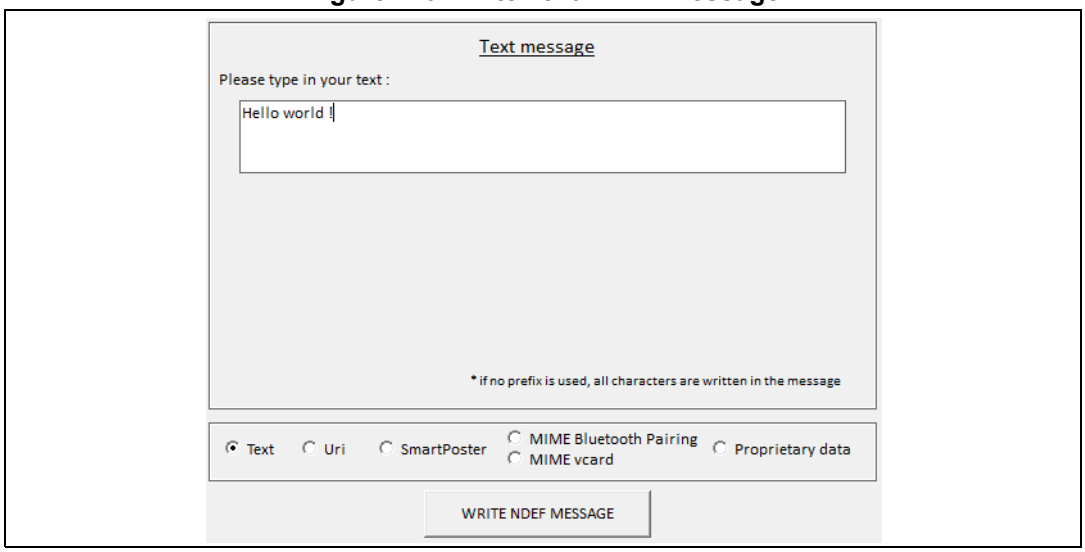
Once one or more NDEF records have been selected, The user are able to write the whole NDEF message in the tag selecting WRITE NDEF MESSAGE ITEM.

The user can now check NDEF message. Then click on WRITE NDEF MESSAGE to write it.

If the user want to change message, he can click on CLEAR then return on PREPARE NDEF MESSAGE to build a new one.
At the right of the window, the user will be able to prepare and write a NDEF message from a list of NDEF message types:

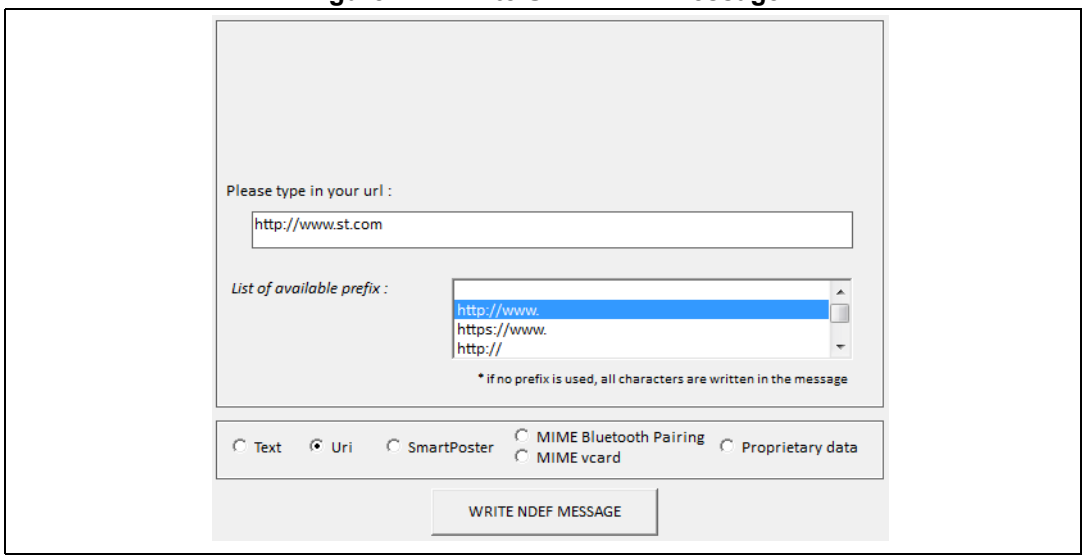
- **Text**

Figure 116. Write Text NDEF message



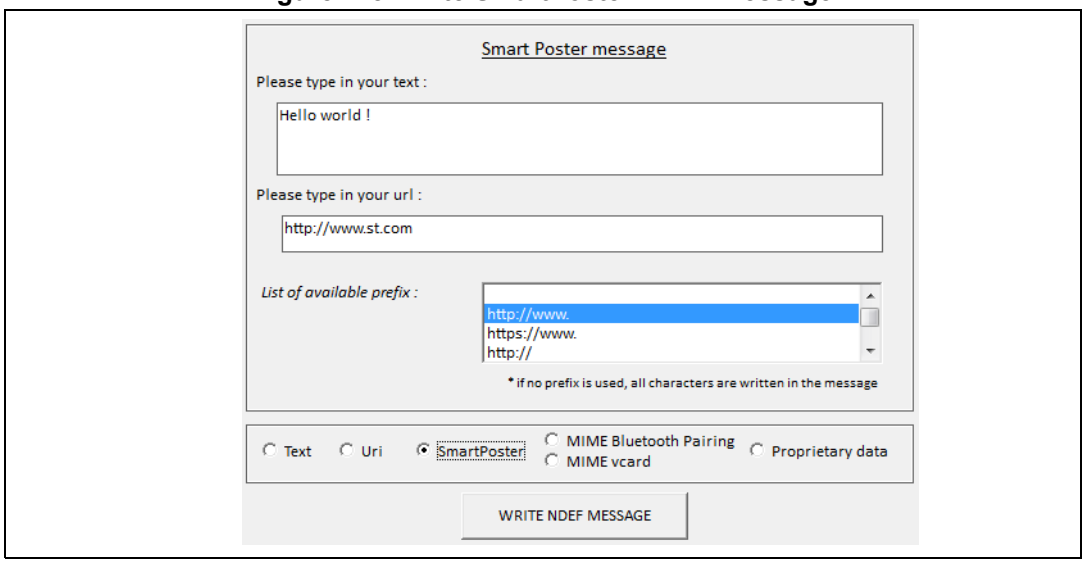
- **URL**

Figure 117. Write URL NDEF message



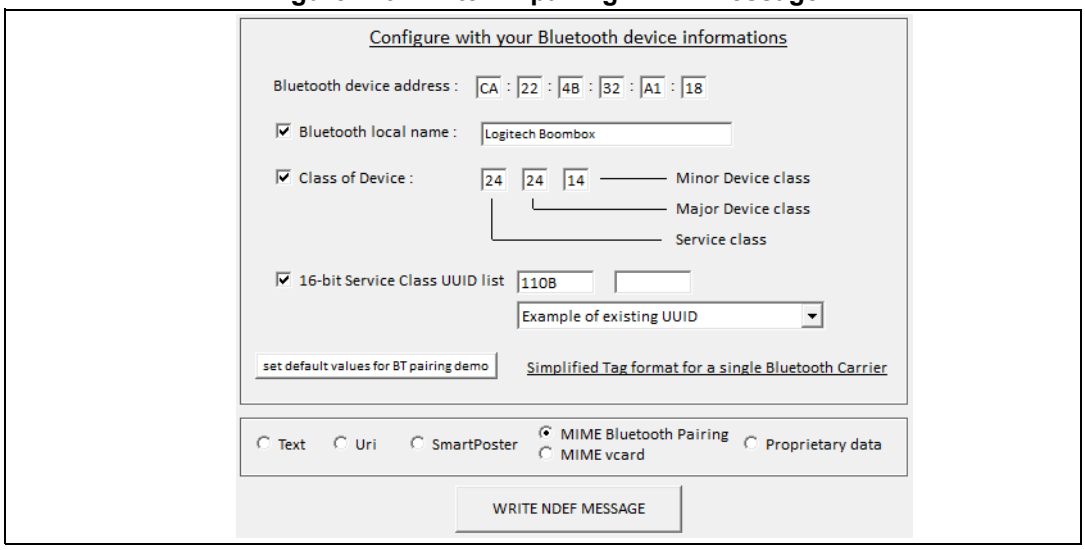
- **SmartPoster**

Figure 118. Write SmartPoster NDEF message



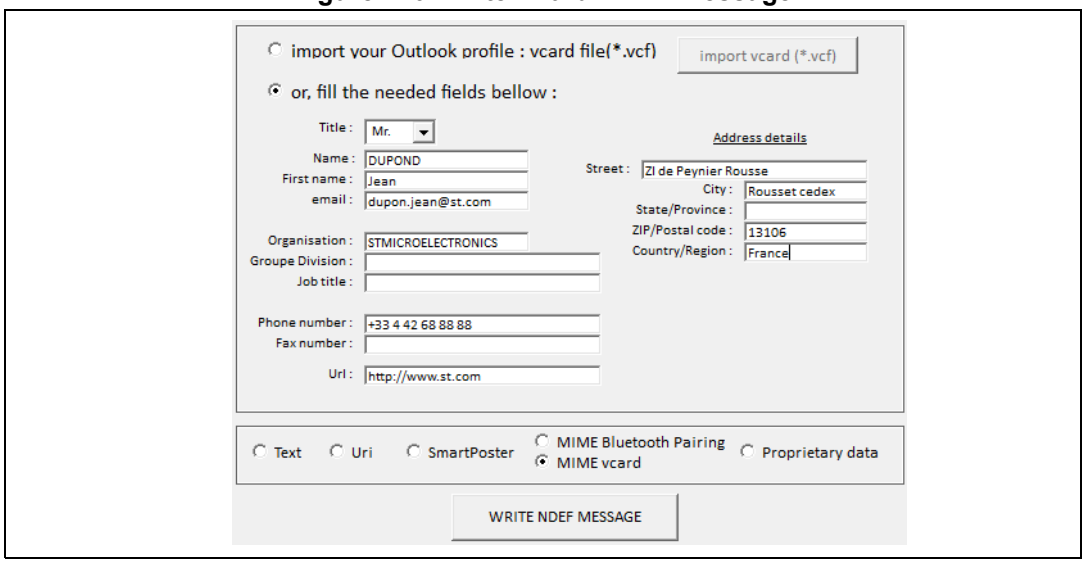
- **MIME Bluetooth pairing**

Figure 119. Write BT pairing NDEF message



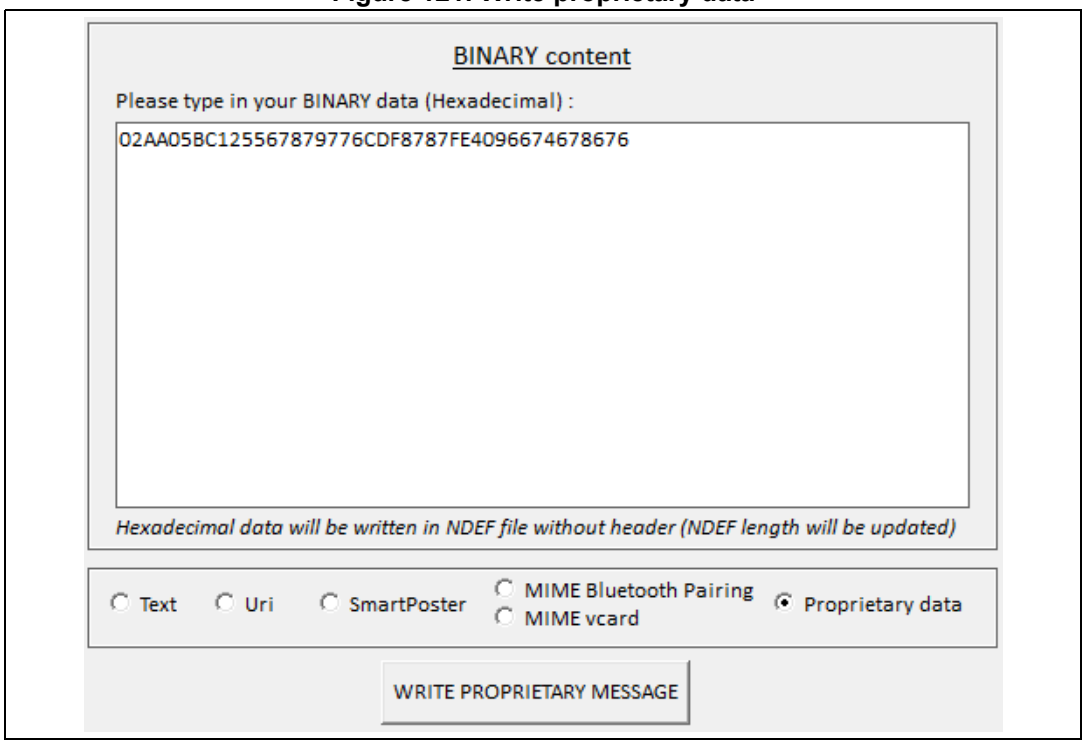
- **MIME vcard**

Figure 120. Write vCard NDEF message



- **Proprietary data** (that is not NDEF message but can be use to fill the memory with hexadecimal data)

Figure 121. Write proprietary data

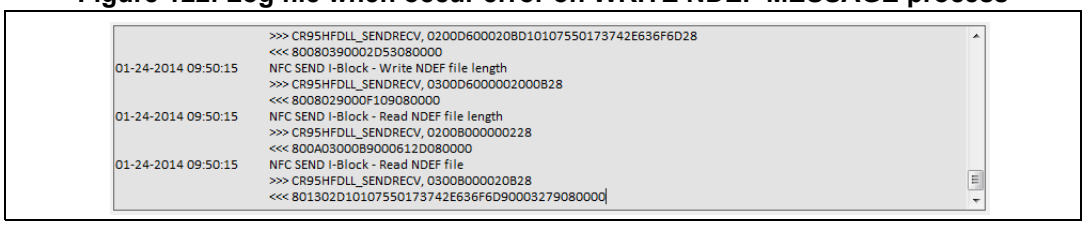


WRITE NDEF MESSAGE process:

- The RF field is disabled in order to deselect the tag (RF Por).
- The RF fied is enabled.
- The Anticollision sequence is launched (ReqA, Anticol, select, RATS, PPS). The result is that the device is put in the NFC world.
- Select Application launched
- Read CC file process is launched (select, read length, read CC file)
  The goal is to identify NDEF file ID
- Write the Encoded NDEF messageThis process is automatically stopped if any error or “no answer” is detected.

The Log window at the bottom of the screen will help to understand the issue In case of error.

Figure 122. Log file when occur error on WRITE NDEF MESSAGE process



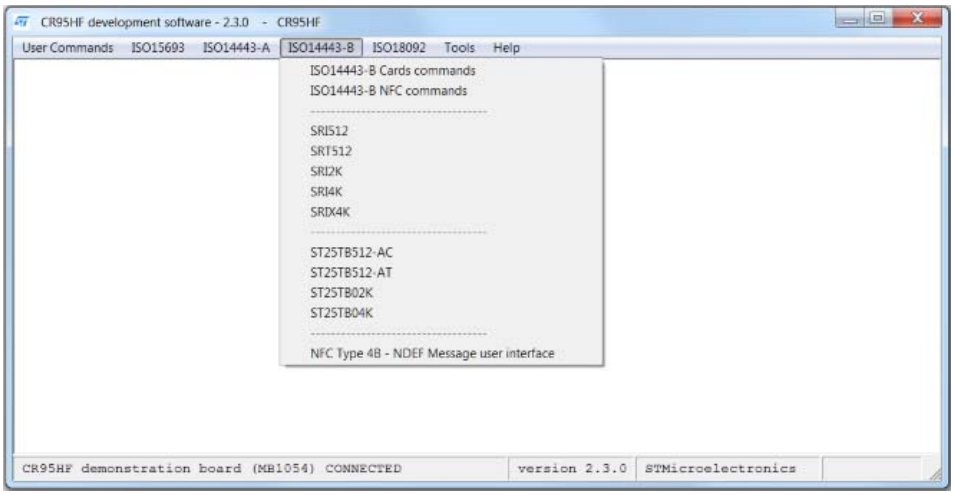
2.6 ISO14443-B menu

This section allows to communicate with ISO14443-B tags.

Select ISO14443-B from the main menu to use the CR95HF demonstration board as an ISO14443-B reader. You can then choose between:

- ISO14443-B cards
- SO14443-B with NFC features
- SRIxx and SRTxx devices
- ST25TBxxx devices

Figure 123. ISO14443-B menu



Select a device from the list (see *Figure 124* and *Figure 125* for an example). This automatically configures the board as an ISO14443-B reader and displays all the ISO14443-B requests.

ISO14443-B communications are configured as follows:

- 106 kbits/s data rate for both transmission and reception
- CRC appended

The ISO14443-B configuration is displayed in the log window.

The upper part of the window contains buttons allowing to send ISO14443-B requests

to tags through the CR95HF demonstration board antenna (refer to the device datasheet).

Select the ISO14443-B menu to launch one of the following user interface (see *Figure 125*):

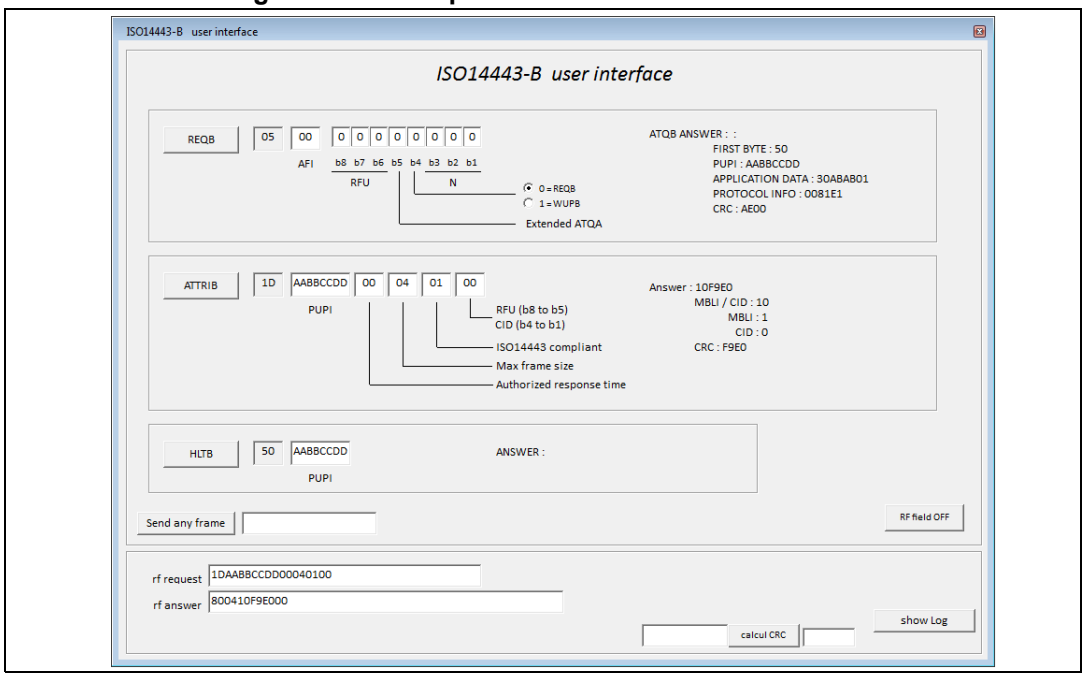
- ISO14443-B Cards commands: (see *Section 2.6.1*)
  This menu allows the user to send any ISO14443-B requests
- ISO14443-B NFC commands: (see *Section 2.6.2*)
  This menu allows the user to send any ISO14443-B requests
- SRI512, SRT512, SRI2K, SRI4K, SRIX4K, ST25Tb512-AC, ST25TB512-AT, ST25Tb02K, ST25TB04K (see *Section 2.6.4*)
  This menu allows the user to send any ISO14443-B requests to SRXxx and ST25TBxxx products
- Type_4B NDEF Message user interface (see *Section 2.6.3*)
  This menu allows the user to read and write NDEF message to Tag Type 4B

2.6.1 ISO14443-B Cards commands

This window allows to communicate to any ISO14443-B card.

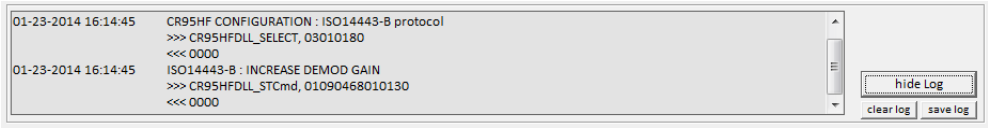
When selecting the ISO14443-B Card commands, the user interface is displayed, as shown in *Figure 125*

Figure 124. Example of ISO14443-B user interface



The protocol selection is launched immediately. The summary of the commands sent to the CR95HF are included in the log window. Click on “show log” to display it (see *Figure 126*)

Figure 125. Log file



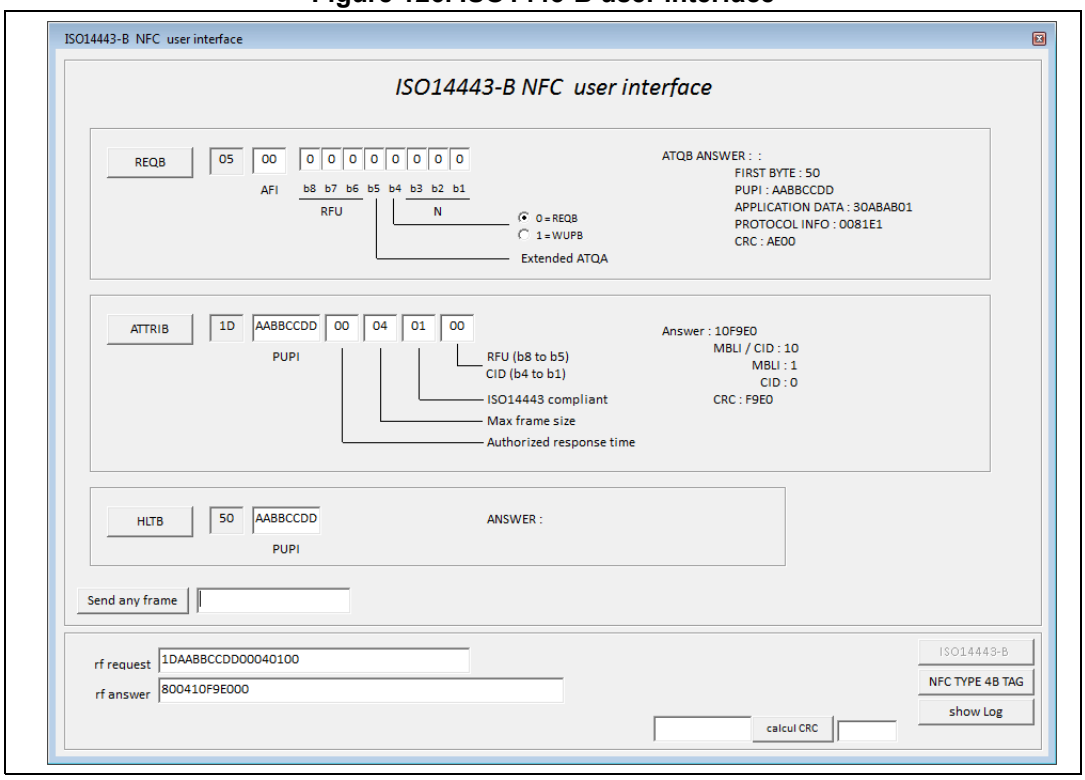
Some basic commands are available to be able to play with TOPAZ cards such as:

- REQB
- WPUB
- ATTRIB

Log window can be displayed by clicking on “Show log” button.

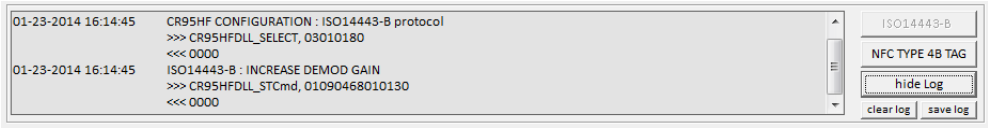
2.6.2 ISO14443-B NFC commands

Figure 126. ISO1443-B user interface



The protocol selection is launched immediately. The summary of the commands sent to the CR95HF are included in the log window. Click on “show log” to display it (see *Figure 126*)

Figure 127. Protocol select for ISO14443-B



This screens allow to send ISO14443-A commands:

- REQB
- WUPB
- ATTRIB

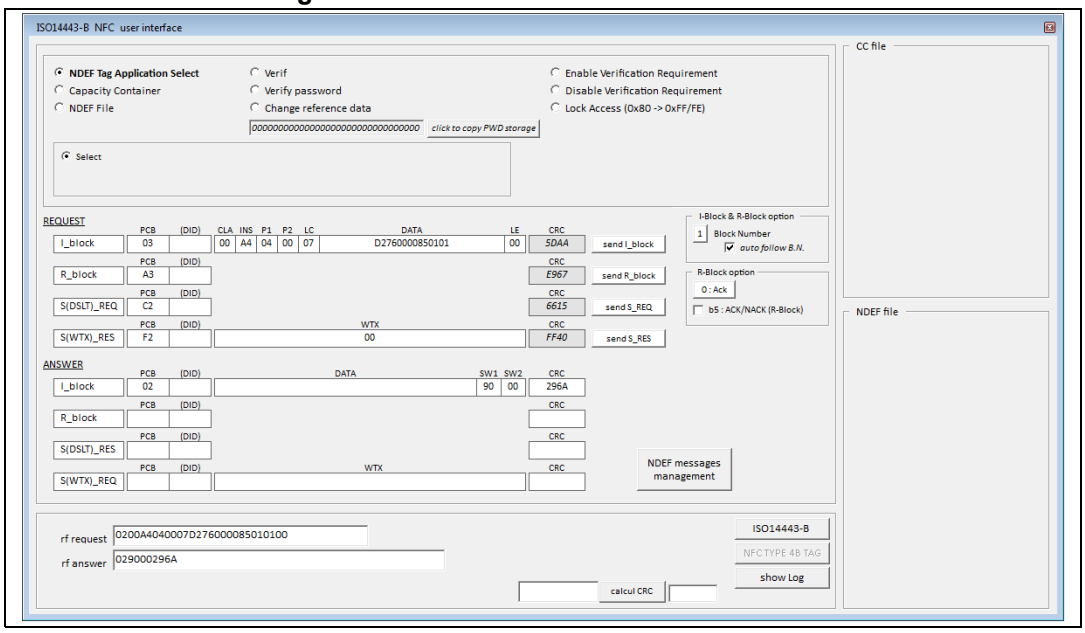
REQB & ATTRIB commands are mandatory to put the ISO14443-B NFC card into NFC world.

As soon as this commands have been sent successfully, you will be able to send NFC commands.

This commands are available on a second window. To show this window, please click on NFC TYPE 4B TAG button.

This window will allows to send NFC APDU in order to play with the NFC Type 4B tag.

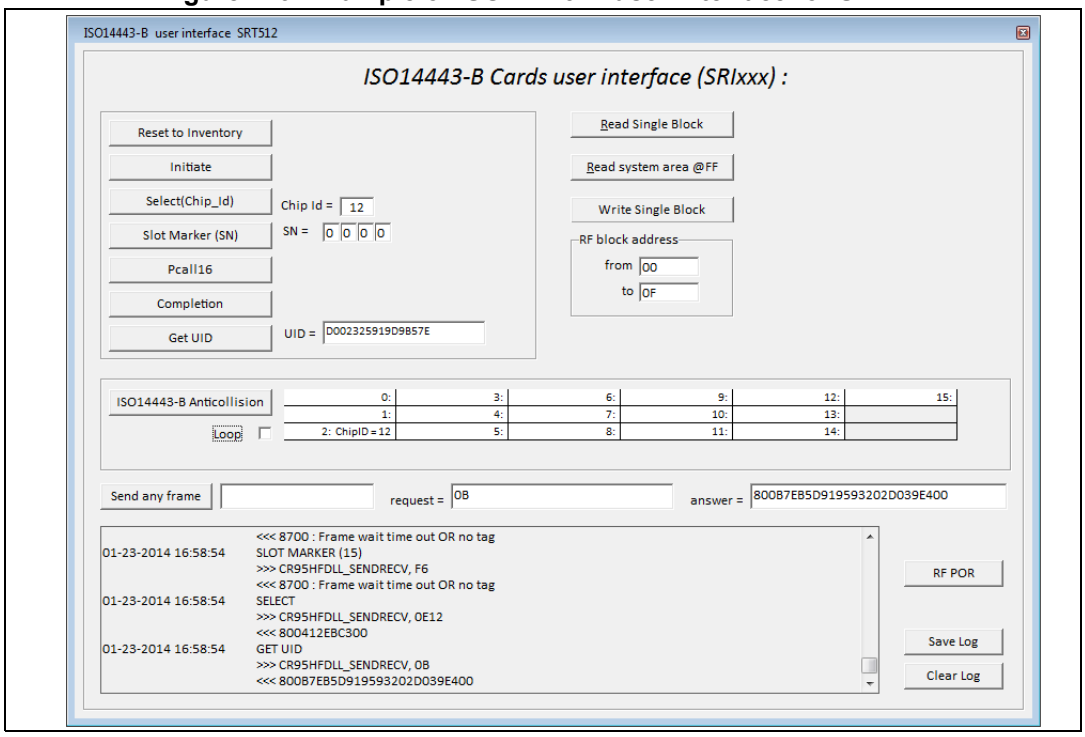
Figure 128. ISO14443-B NFC user interface



For more informations about the use of each button, please refers to *Section 2.5.3*.

2.6.3 SRIxx/SRTxx/ST25TBxxx products

Figure 129. Example of ISO14443-B user interface for SRIxxx



The ISO14443-B configuration is displayed in the log window as shown in figure.

The window allows to send all the command of the datasheet for this products :

- Reset to Inventory
- Initiate
- Select
- Slot Marker
- Pcall16
- Completion
- Get UID
- Read Single Block
- Read System area (address 0xFF)
- Write Single Block
- A single button allows to launch all ths Anticollision sequence.

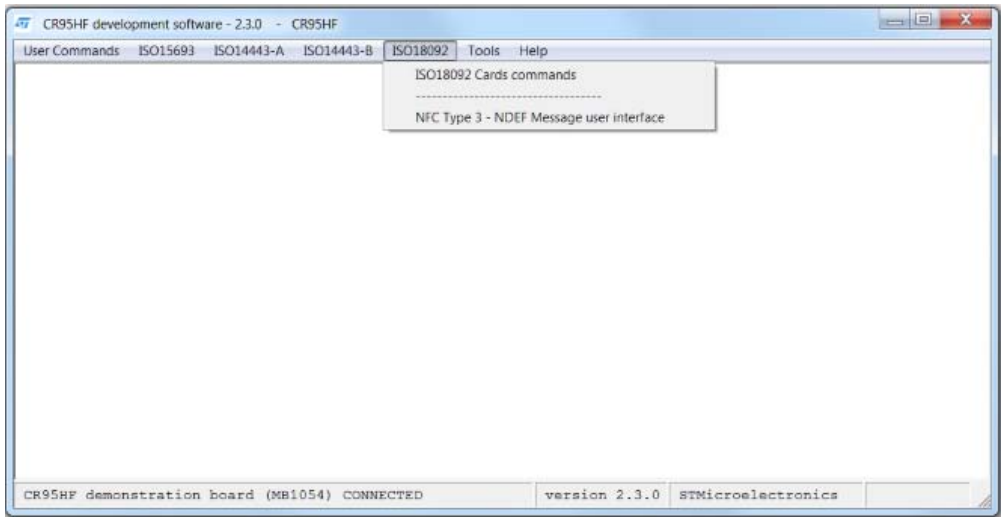
2.6.4 Type_4B NDEF Message user interface

The functionality of this tool is the same as the NFC TYPE 4A TAG that can be found in ISO14443-A (see to *Section 2.5.5* for more informations about how to use it).

2.7 ISO18092 menu

1. Select ISO18092 from the main menu to use the CR95HF demonstration board as an ISO18092 reader (see *Figure 130*).

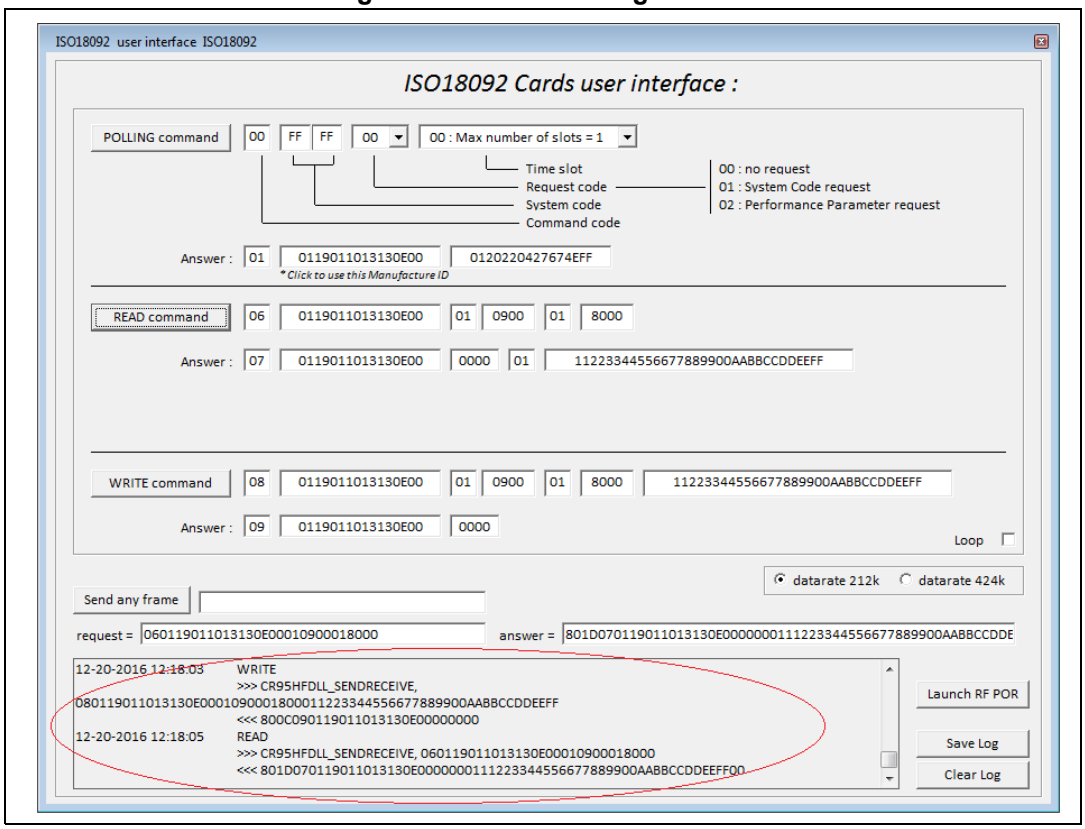
Figure 130. ISO18092 menu



2. Select ISO18092 Cards commands from the list. This automatically configures the board as an ISO8092 reader and displays all the ISO18092 requests.

The ISO18092 configuration is displayed in the log window as shown in *Figure 131*.

Figure 131. ISO18092 log window



Polling command can be done to communicate with an ISO18092 card. The response of the tag will be displayed in several fields.

ManufactureID is displayed in the second field. Click on this field to fill the Read & Write commands with this mandatory field.

Read command and Write command are also available.

2.8 Tools menu

Select the **Tools** menu to launch one of the following tools (see *Figure 132*):

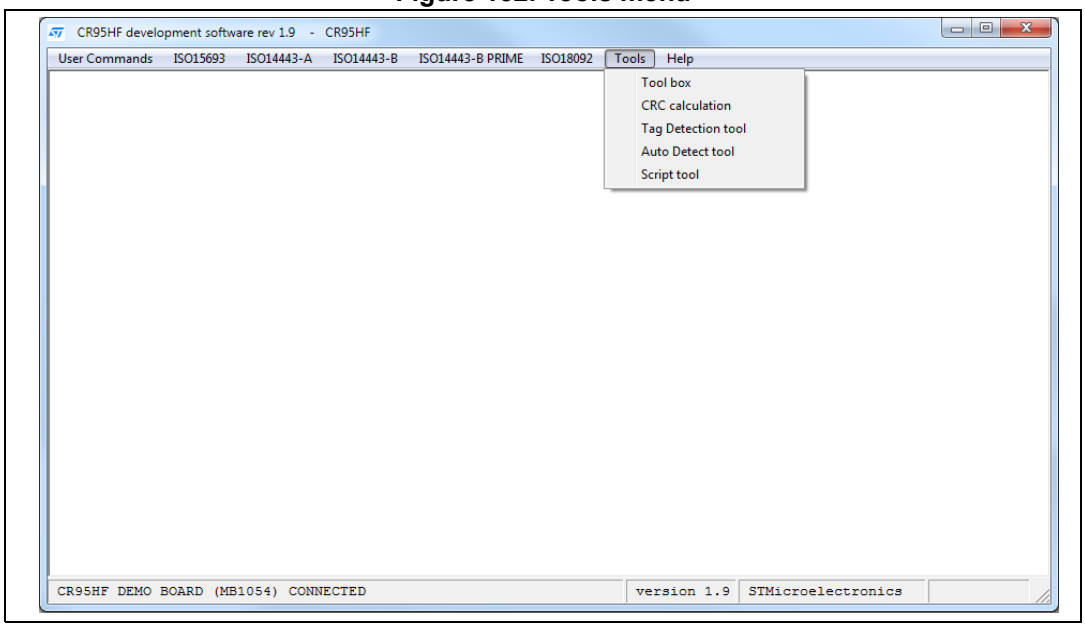
- **CR95HF demonstration board tool box** (see *Section 2.8.1: CR95HF demonstration board toolbox*)

  This menu allows the user to send requests to the CR95HF demonstration board.
- **Tag Detection tool (**see *Section 2.8.2: Tag Detection tool*)

  This menu can be used to launch a CR95HF demonstration board calibration and a CR95HF Tag Detection.
- **Auto Detect tool** (see *Section 2.8.3: Auto detection tool*)
  This menu allows to launch successive anticollision processes on several RFID technologies in order to detect tags
- **Script tool (**see *Section 2.8.4: Script tool*)

  This menu allows to transmit and execute a sequence of CR95HF requests.

Figure 132. Tools menu

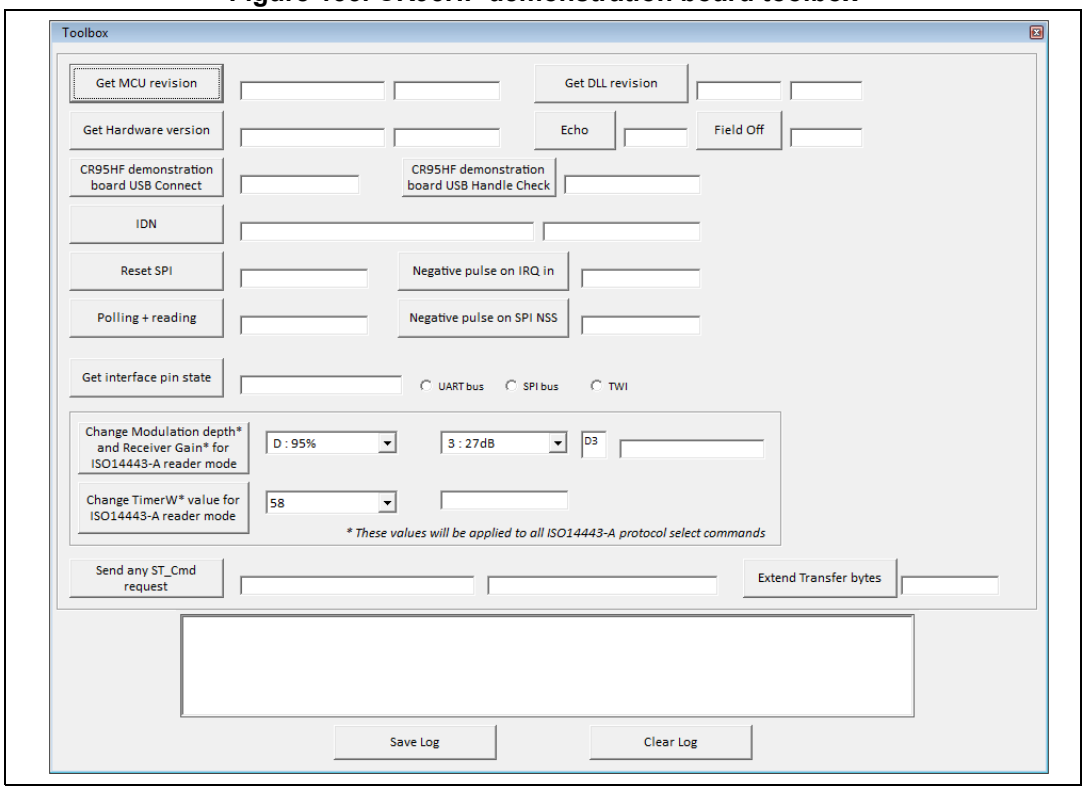


2.8.1 CR95HF demonstration board toolbox

The CR95HF demonstration board toolbox allows to send the following requests to the CR95HF demonstration board (see *Figure 133*):

- **Get MCU revision**: reads the revision of the STM32 microcontroller firmware.
- **Get DLL revision**: reads the revision of the DLL installed on your PC.
- **IDN**: sends an IDN command to the CR95HF and receives the answer.
- **Field Off**: turns the RF field off.
- **Echo**: sends an Echo command to the CR95HF and receives the answer.
- **Reset SPI**: resets SPI communications between the STM32 MCU and the CR95HF.
- **Negative pulse on IRQ in**: applies a negative pulse on the CR95HF IRQ input.
- **Negative Pulse on SPI NSS**: applies a negative pulse on CR95HF NSS pin.
- **Polling + reading**: puts the CR95HF in polling & reading mode.
- **Get interface pin state**: detects the bus configuration of the CR95HF demonstration board.
- **Change Modulation depth and Receiver Gain**: modifies the setting for ISO14443-A.
- **Change TimerW value**: modifies the setting for ISO14443-A.

Figure 133. CR95HF demonstration board toolbox



2.8.2 Tag Detection tool

Two commands are available (see *Figure 134*):

- **Calibration**

  Clicking the **Calibration** button performs a CR95HF demonstration board calibration to determine the DacDataL/DacDataH parameters that will be used in Tag Detection mode. The calibration sequence is the following:

  a) Send an Idle command to the CR95HF with DacDataL fixed to 0 and DacDataH set to its maximum value.

  b) Read the Wakeup register to check whether the CR95HF has entered Wakeup mode on a tag detection event. Otherwise, a new Idle command is sent with a lower DacDataH value. These steps are repeated until a tag is detected.

  The DacDataL/DacDataH parameters that will be used for tag detection are:

  $DacDataL_{Tag\ detection} = DacDataL_{Calibration} - 2$

  $DacDataH_{Tag\ detection} = DacDataH_{Calibration} + 2$, $DacDataH_{Calibration}$ being the value corresponding to the detection limit.

- **Tag Detection**

  The tag detection sequence is performed using the $DacDataL_{Tag\ detection}$/$DacDataH_{Tag\ detection}$:

  a) Send an Idle command to put the CR95HF in tag detection state.

  b) Wait till the CR95HF wakes up: read the Wakeup register to check if the CR95HF has been woken up by a tag detected in the RF field or by timeout.

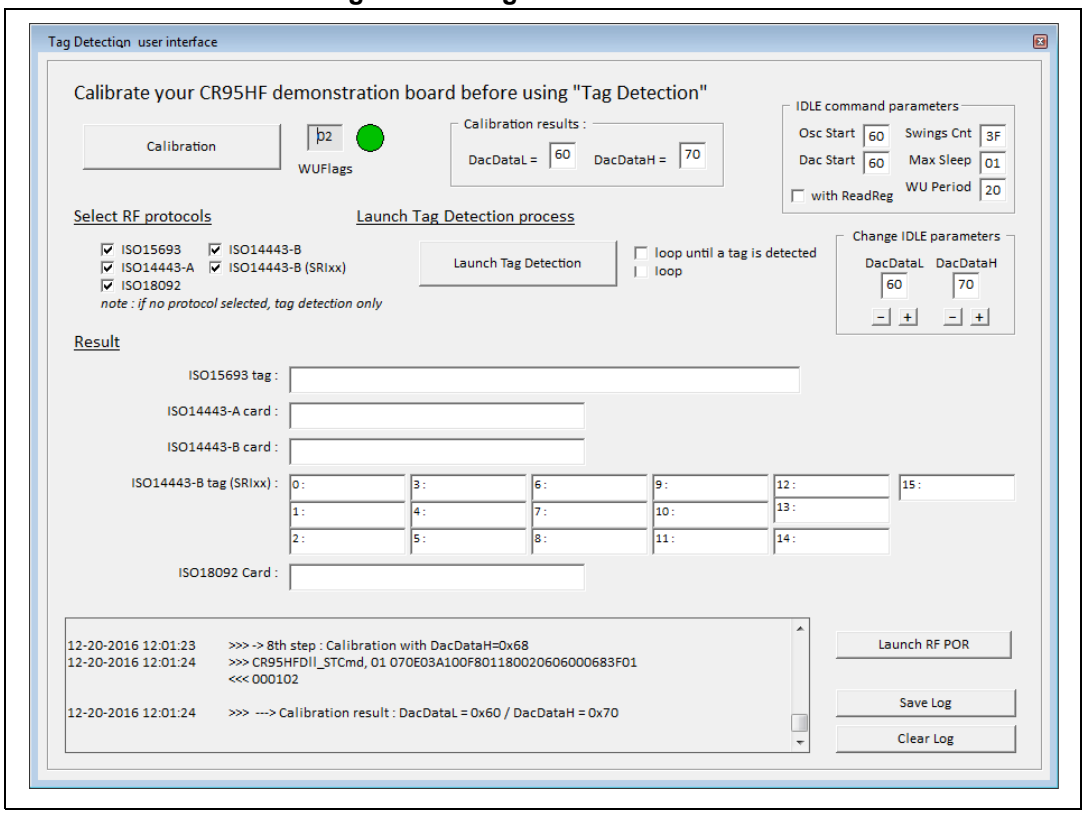
  If a tag is detected in the CR95HF demonstration board field, the CR95HF enters Wakeup mode, and an ISO15693/ISO14443-B anti-collision procedure starts to identify the tags present in the field.

  To perform one-shot tag detection, uncheck both **Loop** and **Loop until a tag is detected**, before pressing the **Tag Detection** button.

  If only **Loop** is checked, the tag detection runs continuously and stops when **Loop** is unchecked.

  If only **Loop until a tag is detected** is checked, the tag detection runs continuously and stops when a tag is detected and identified.

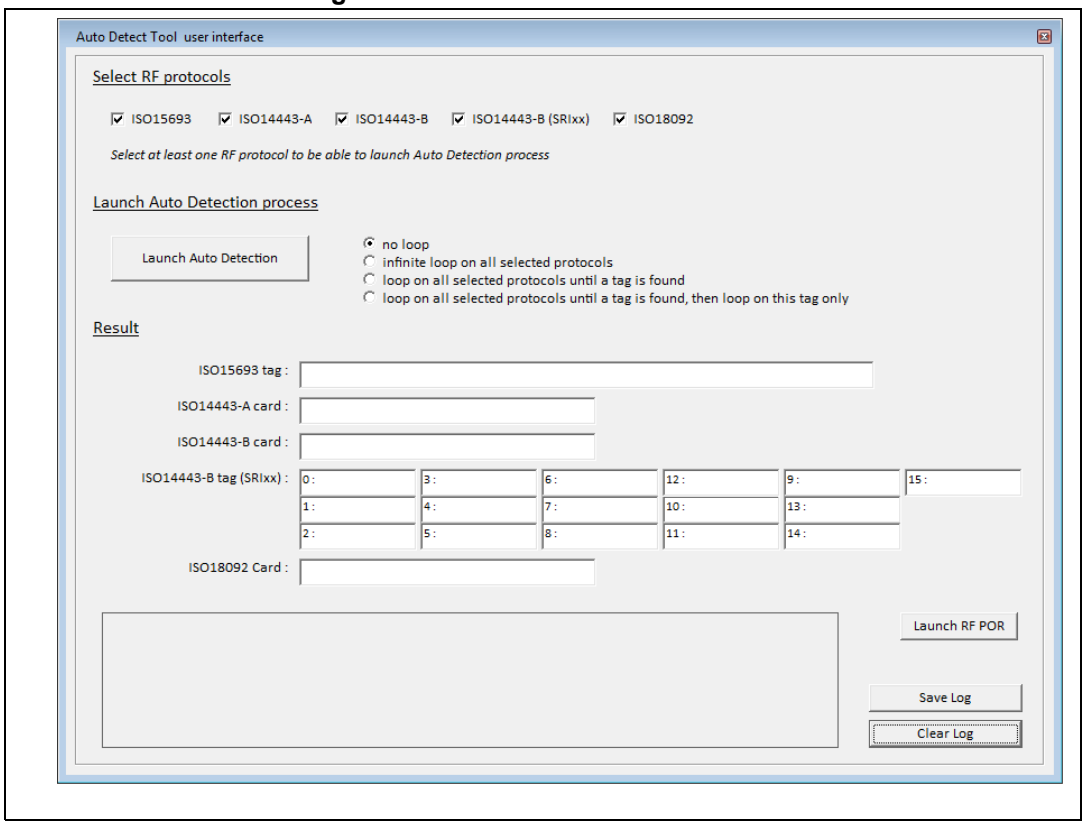
Figure 134. Tag detection interface



2.8.3 Auto detection tool

The Auto detection tool allows to play a tag hunt on several RFID technologies (see *Figure 135*).

Figure 135. Auto Detect tool interface



- **Select RF protocols**
  By selecting one or more RF protocol, you can define which kind of tag will be detected and on which protocol the tag hunt will be launched.
- **Launch Auto Detection process**
  The Launch Auto Detection button allows to launch a tag hunt on a selected process. This can be done once. The Loop option can be selected.
- **Result**
  In case of a Tag detection, the result field will be the field with the Tag identification.

2.8.4 Script tool

The **Script** tool allows playing a script containing a sequence of CR95HF commands (see *Figure 139*). The following functions are available:

- **Save Script** saves the script in a text file.
- **Load Script** loads a script file
- **Launch Script** runs the script. The script is executed until an error occurs. Read the log to identify the cause of the error and correct your script. This can be due to a syntax error. Refer to the Script Help to correct it.
- **Help**: display the list of commands that can be used to program the script.

Figure 136. Script help page 1/3

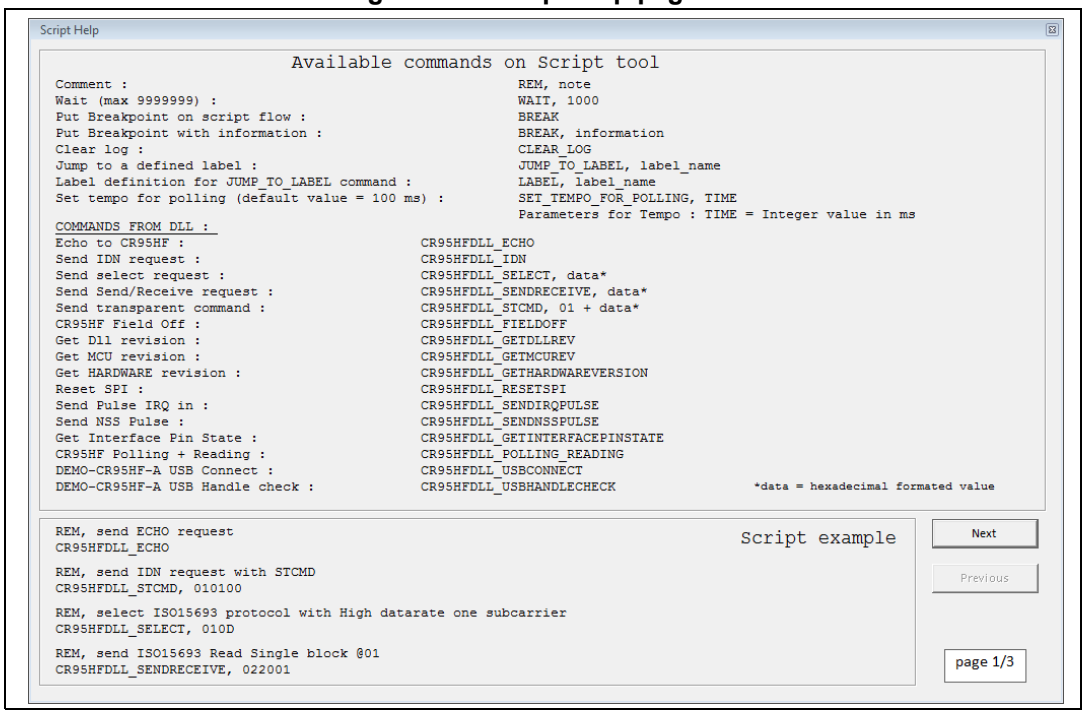


Figure 137. Script help page 2/3

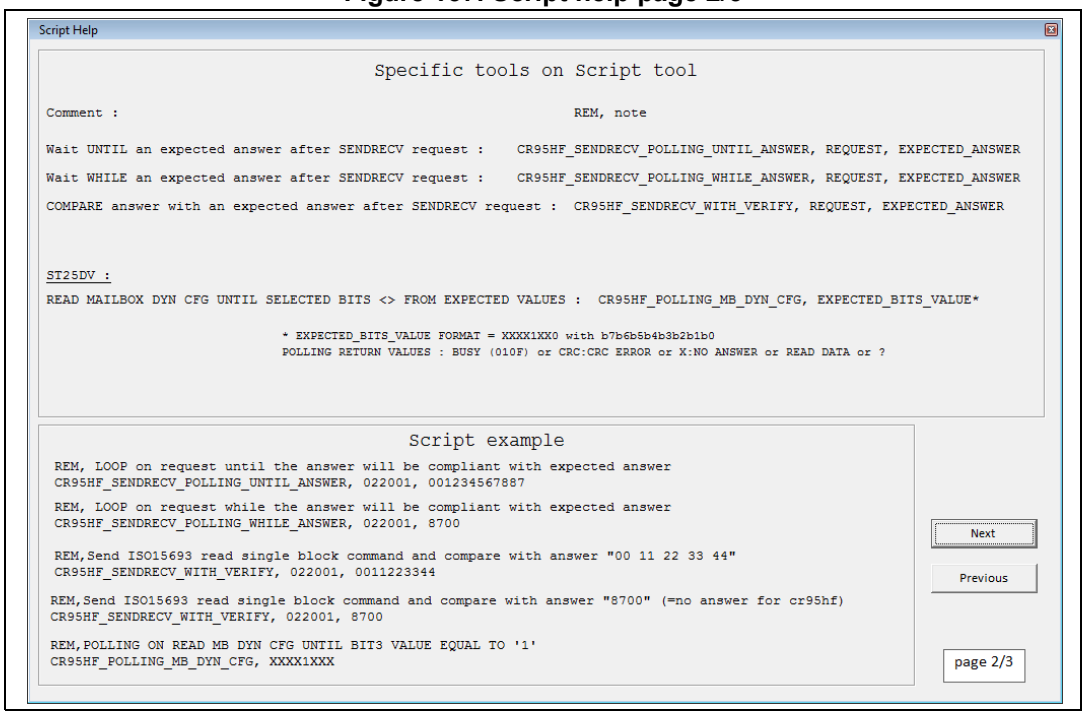
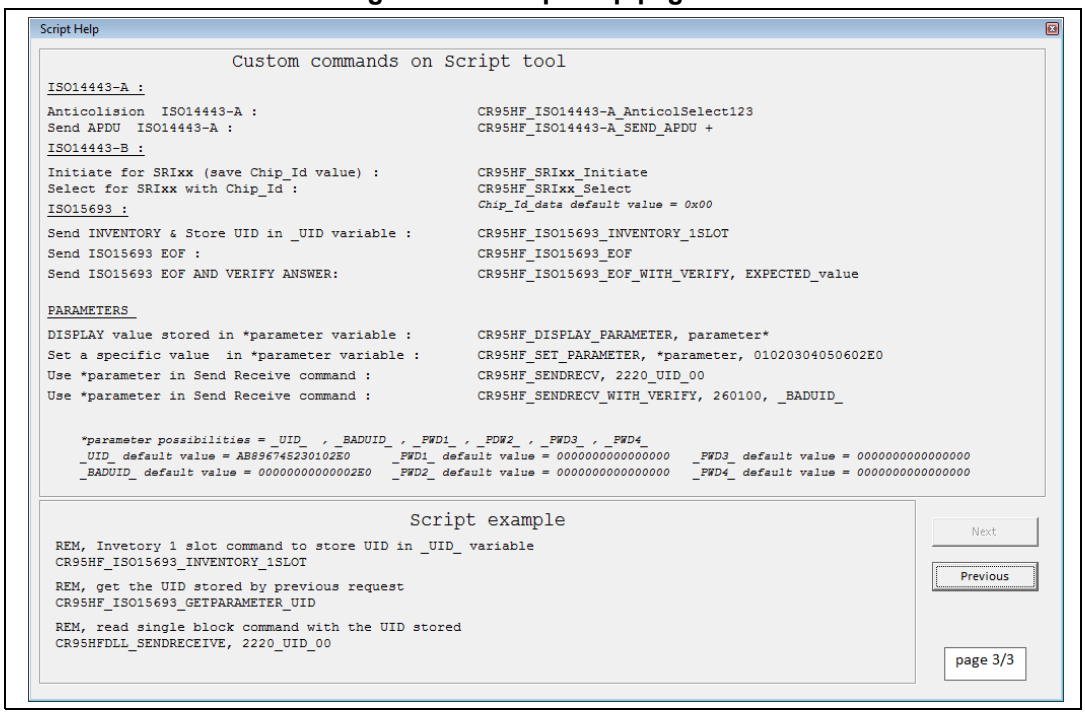
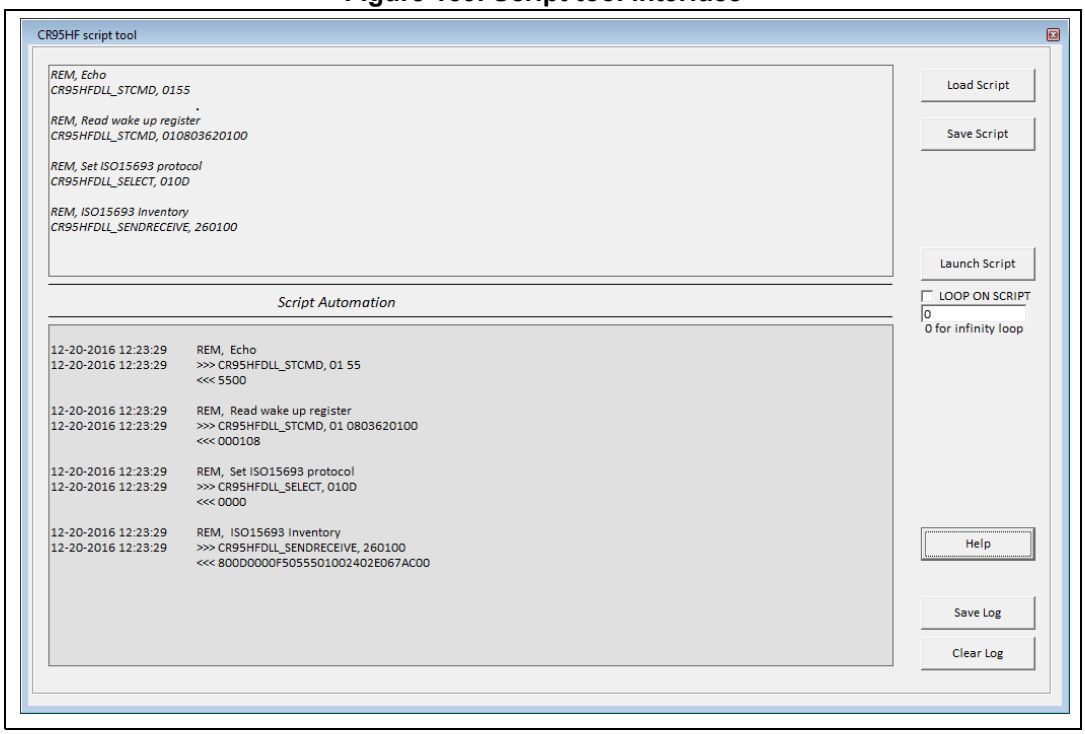


Figure 138. Script help page 3/3



The Script Help (see *Section 2.9: Help menu*) describes the syntax of all the commands that can be sent to the CR95HF demonstration board.

Figure 139. Script tool interface



2.9 Help menu

Select the **Help** menu to access the following functions (see *Figure 140*):

- **Change background color**

  This function changes the color of the main window. Once set, the background color is saved and recalled each time the software is used (see *Figure 141*).

- **Script Help**

  This function allows to get information on CR95HF function syntax (see *Figure 136*, *Figure 137* and *Figure 138*). It is particularly useful when developing a script (see *Section 2.8.4: Script tool*).

- **About ...**

  Click **About ...**to get information on the CR95HF development software (see *Figure 145*).

Figure 140. Help menu

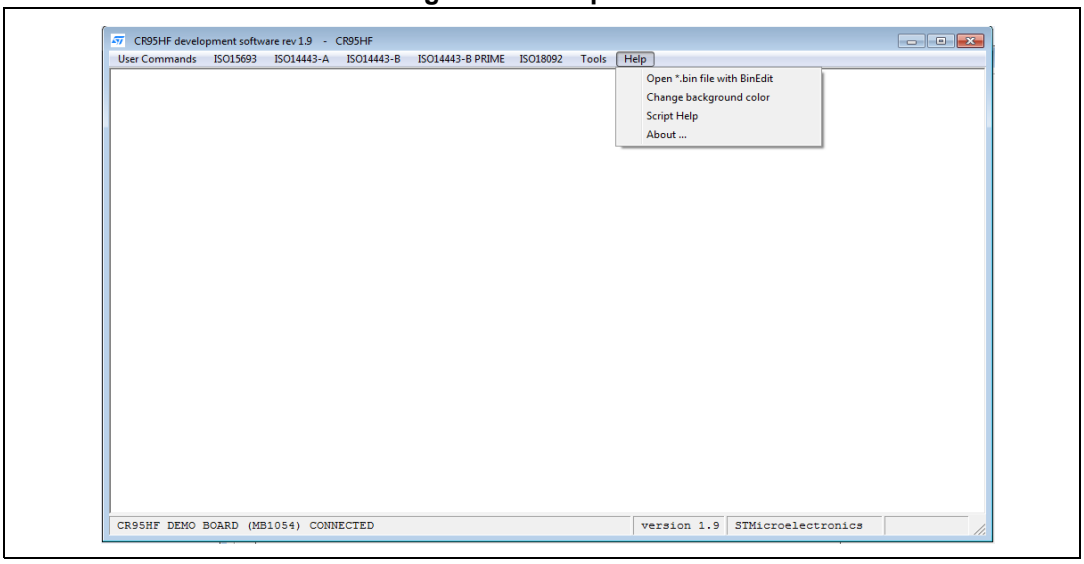


Figure 141. Change background color menu

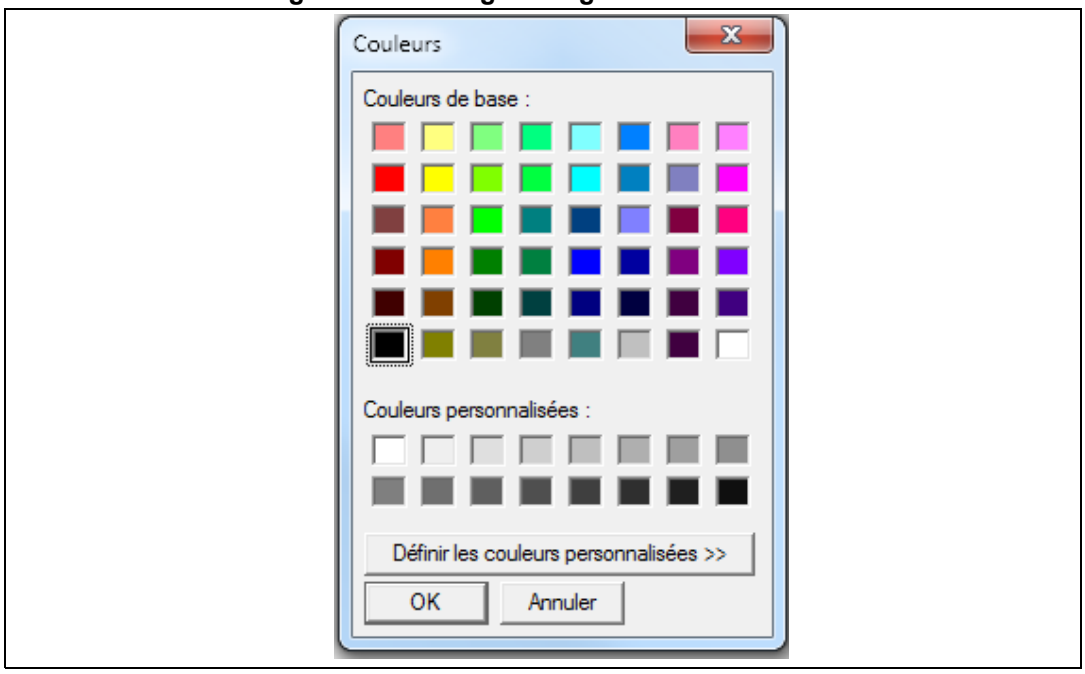


Figure 142. Script help 1

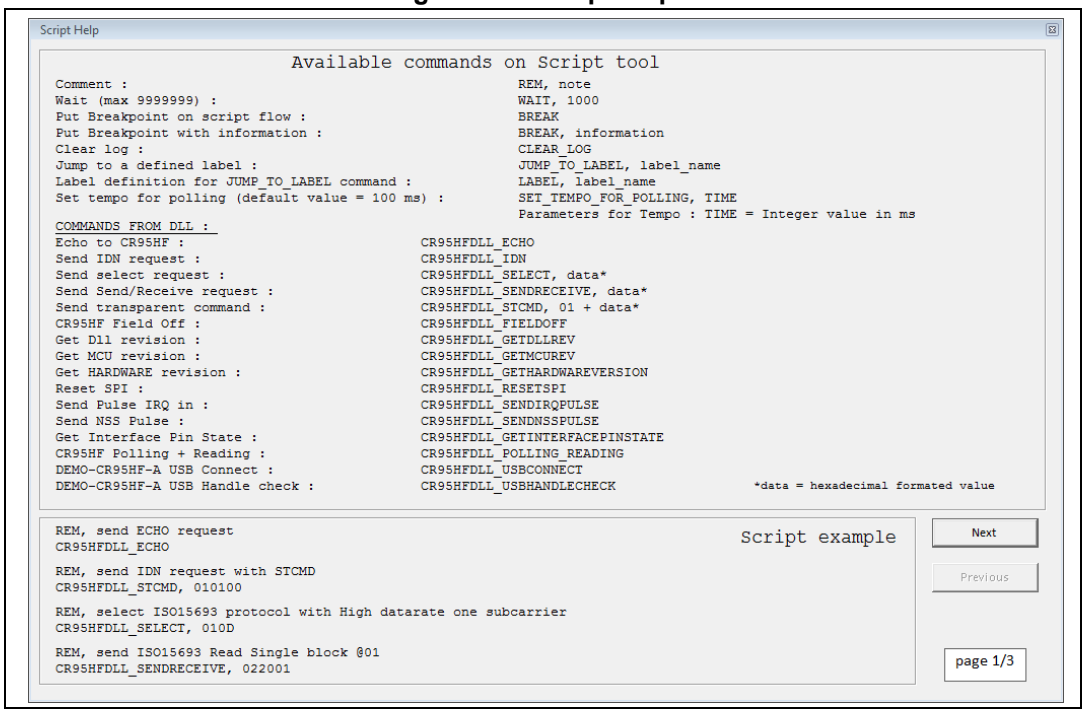


Figure 143. Script help 2

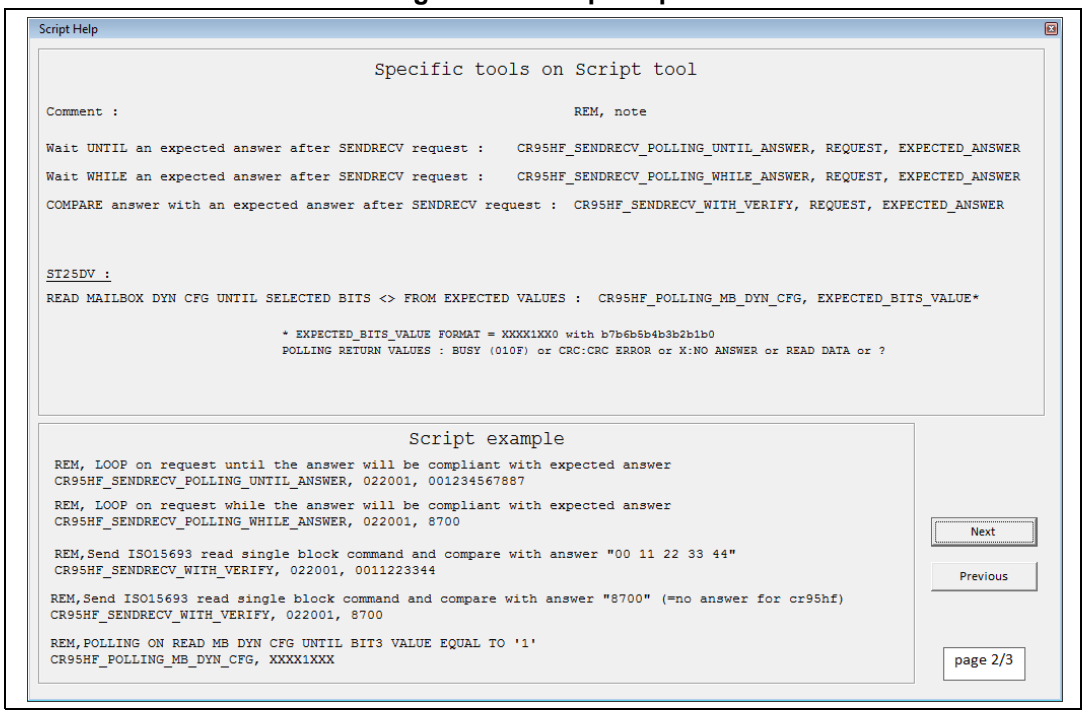


Figure 144. Script help 3

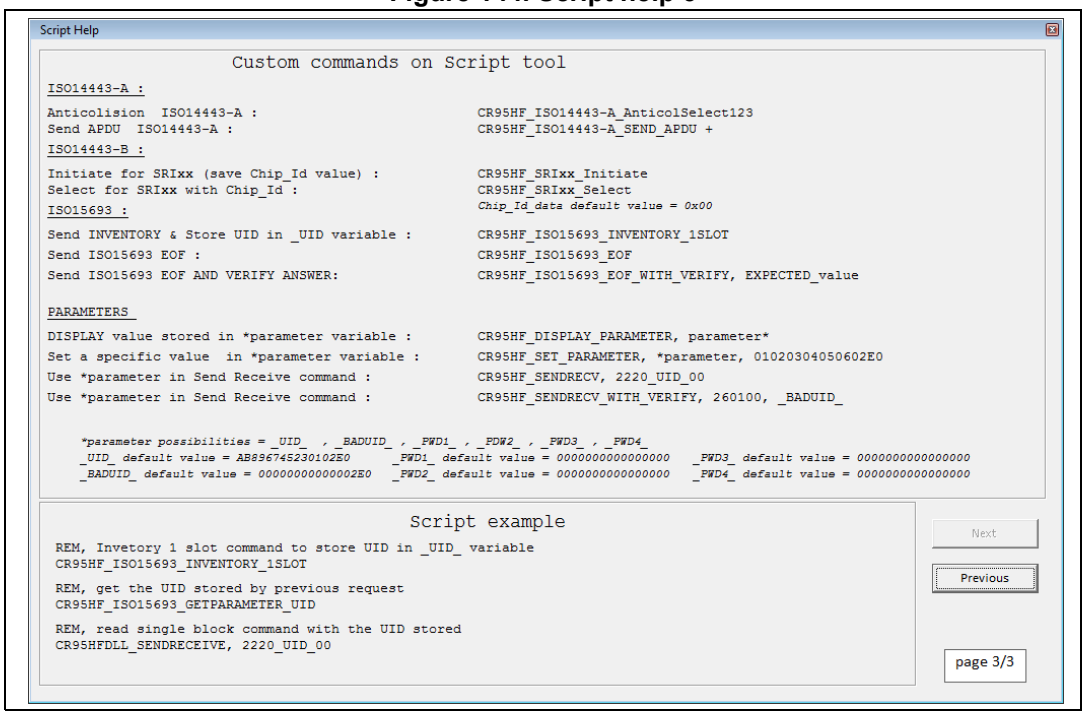
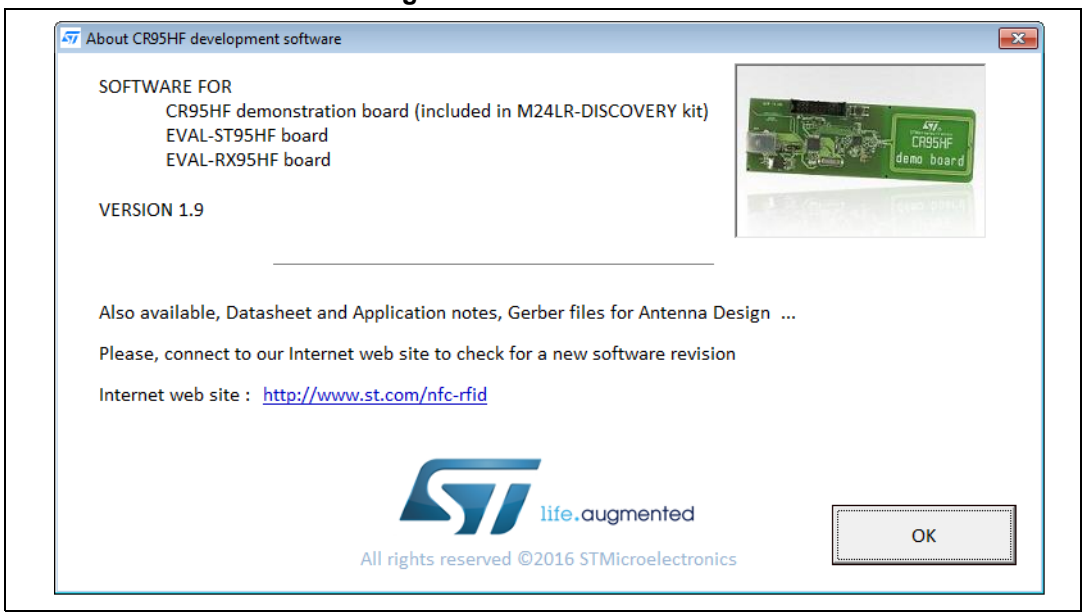


Figure 145. About window



2.10 Log window

The log is displayed at the bottom of each window. It contains all the requests sent to the CR95HF demonstration board through the USB interface. The log contains the following information:

- Date and hour when the command has been sent.
- Request and parameters sent to the CR95HF demonstration board: name of the command sent to the board through the DLL, followed by all parameters in hexadecimal format.
- Answer from the CR95HF.

The command and parameter formats are compatible with the Script tool (see *Section 2.7: ISO18092 menu*) and can be directly copied in a script file.

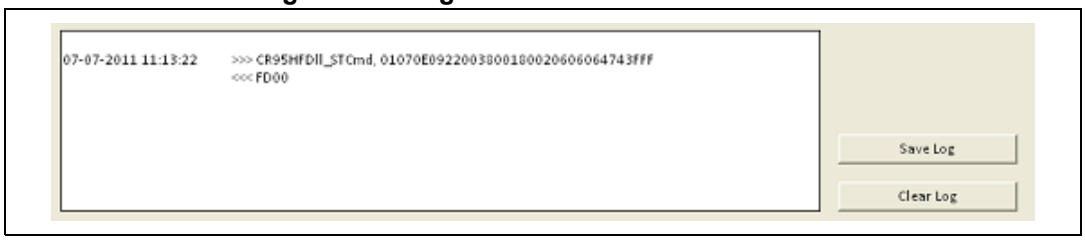
As an example, the log contains the information shown in *Figure 146* when an Idle command is sent to the board. In this example:

'CR95HFDll_STCmd 01 070E092200380018002060606 4743FFF' means that:

- The CR95HFDll_STCmd request has been sent to the CR95HF demonstration board.
- '01' is the header of CR95HFDll_STCmd command.
- '070E092200380018002060606 4743FFF' corresponds to an Idle command followed by its parameters.

'FD00' is the answer from the CR95HF demonstration board.

Figure 146. Log window for an Idle command



3 Revision history

Table 1. Document revision history

Date	Revision	Changes
12-Jul-2011	1	Initial release.
28-Oct-2011	2	Changed document title. Updated disclaimer on last page.
12-Sep-2013	3	Updated the title and the *Introduction* for RPN consistency. Added *Section 2.7: ISO18092 menu* and *Section 2.6: ISO14443-B menu*. Extended the list of *Section 2.8.1: CR95HF demonstration board toolbox*. Added *Section 2.8.3: Auto detection tool*. Updated several software figures (*Figure 15*, *Figure 19* to *Figure 24*, *Figure 26* to *Figure 62* ...) Added *Figure 124: Example of ISO14443-B user interface*.
25-Feb-2014	4	Updated *Section 2.3: User commands on page 15*, added *Figure 2.3.1: CR95HF commands menu* Added new *Section : 09: WrReg on page 21* with new *Figure 28*. Added new *Section 2.3.2: RX95HF commands menu on page 22* with new figure from *Figure 34* to *Figure 43*. Added new *Section 2.5* and *Section 2.6* with new figures from *Figure 79* to *Figure 129* Updated *Figure 15*, *Figure 62*, *Figure 130*, *Figure 132* and *Figure 140*

Table 1. Document revision history (continued)

Date	Revision	Changes
15-Dec-2016	5	Updated: – *Section 2.2: Main menu*, *Section 2.3.1: CR95HF commands menu*, *Section 2.3.2: RX95HF commands menu*, *Section 2.4: ISO15693 menu*, *Section 2.5: ISO14443-A menu*, *Section 2.5.3: M24SR, SRTAG and ST25TA user interface*, *Section 2.5.5: NFC Type 4A - NDEF Message user interface*, *Section 2.8.4: Script tool* – *Figure 14: Select RF READER IC*, *Figure 16: CR95HF user commands menu*, *Figure 17: CR95HF commands menu*, *Figure 62: ISO15693 menu*, *Figure 63: Example of ISO15693 user interface for M24LR64*, *Figure 64: Selecting User Mode from ISO15693 user interface (M24LR64)*, *Figure 105: NFC Type 4A - NDEF message user interface*, *Figure 130: ISO18092 menu*, *Figure 132: Tools menu*, *Figure 133: CR95HF demonstration board toolbox*, *Figure 140: Help menu*, *Figure 141: Change background color menu*, *Figure 145: About window* Added: – *Figure 15: Main menu*, *Figure 31: User commands menu for RX95HF*, *Figure 65: ST25DV user interface: Inventory*, *Figure 66: ST25DV user interface: AFI DSFID INFO*, *Figure 67: ST25DV user interface: EEPROM*, *Figure 68: ST25DV user interface: display Extended commands*, *Figure 69: ST25DV user interface: ISO15693 Data Rate management*, *Figure 70: ST25DV user interface: static configuration*, *Figure 71: ST25DV user interface: Fast Transfer Mode interface*, *Figure 72: ST25DV user interface: Password management*, *Figure 73: ST25DV user interface: Energy Harvesting and GPO management*, *Figure 74: ST25DV user interface: Fast Transfer Mode demo*, *Figure 75: Read and write NFC Type 5 CC fileFigure 76: Read NFC Type 5 NDEF messageFigure 77: Prepare NFC Type 5 NDEF messageFigure 78: Write NFC Type 5 NDEF message*, *Figure 79: ISO14443-A menu*, *Figure 109: Prepare TEXT NDEF record*, *Figure 110: Prepare URI NDEF record*, *Figure 111: Prepare SMARTPOSTER NDEF record*, *Figure 112: Prepare MIME VCARD NDEF record*, *Figure 113: Prepare MIME BLUETOOTH PAIRING NDEF record*, *Figure 114: Prepare MIME MEDIA NDEF record*, *Figure 115: Prepare MIME VARIOUS NDEF record*, *Figure 136: Script help page 1/3*, *Figure 137: Script help page 2/3*, *Figure 138: Script help page 3/3*, *Figure 142: Script help 1*, *Figure 143: Script help 2*, *Figure 144: Script help 3* – *Section 2.3.3: ST95HF commands menu*, *Section 2.5.4: Password management for M24SR and SRTAG products*, *PREPARE NDEF MESSAGE*
09-Aug-2018	6	Updated: – *Section 2.4: ISO15693 menu*, *Section 2.5: ISO14443-A menu*, *Section 2.6: ISO14443-B menu*, title of *Section 2.6.3: SRIxx/SRTxx/ST25TBxxx products*. – *Figure 62: ISO15693 menu*, *Figure 79: ISO14443-A menu*, *Figure 123: ISO14443-B menu*, *Figure 130: ISO18092 menu*

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