UM1084
User manual

CR95HF development software

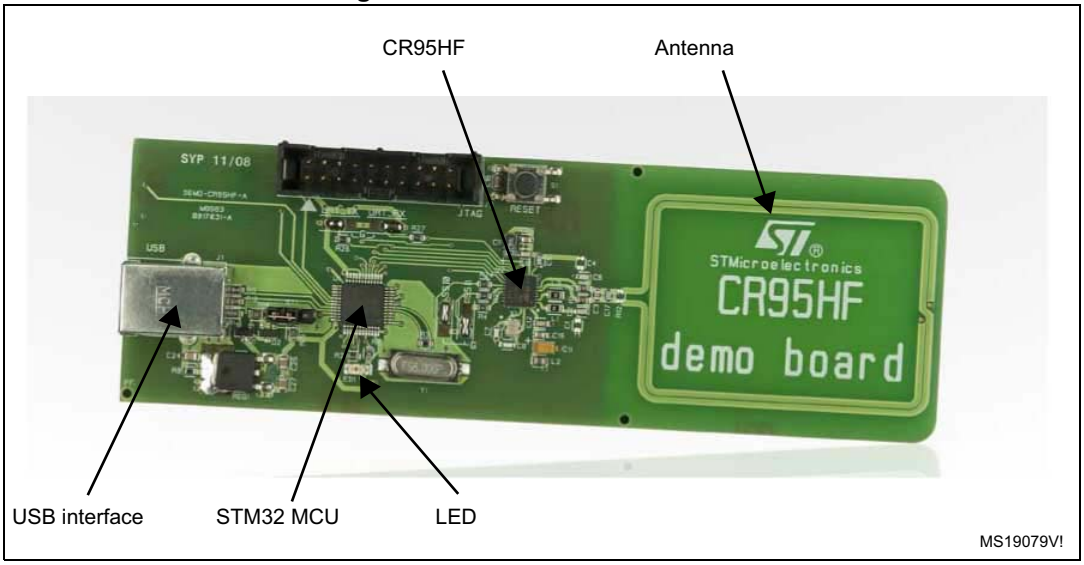
Introduction

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

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

The DEMO-CR95HF-A 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. DEMO-CR95HF-A board



Reference documents

- DEMO-CR95HF-A databrief
- CR95HF datasheet

Contents

List of figures

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

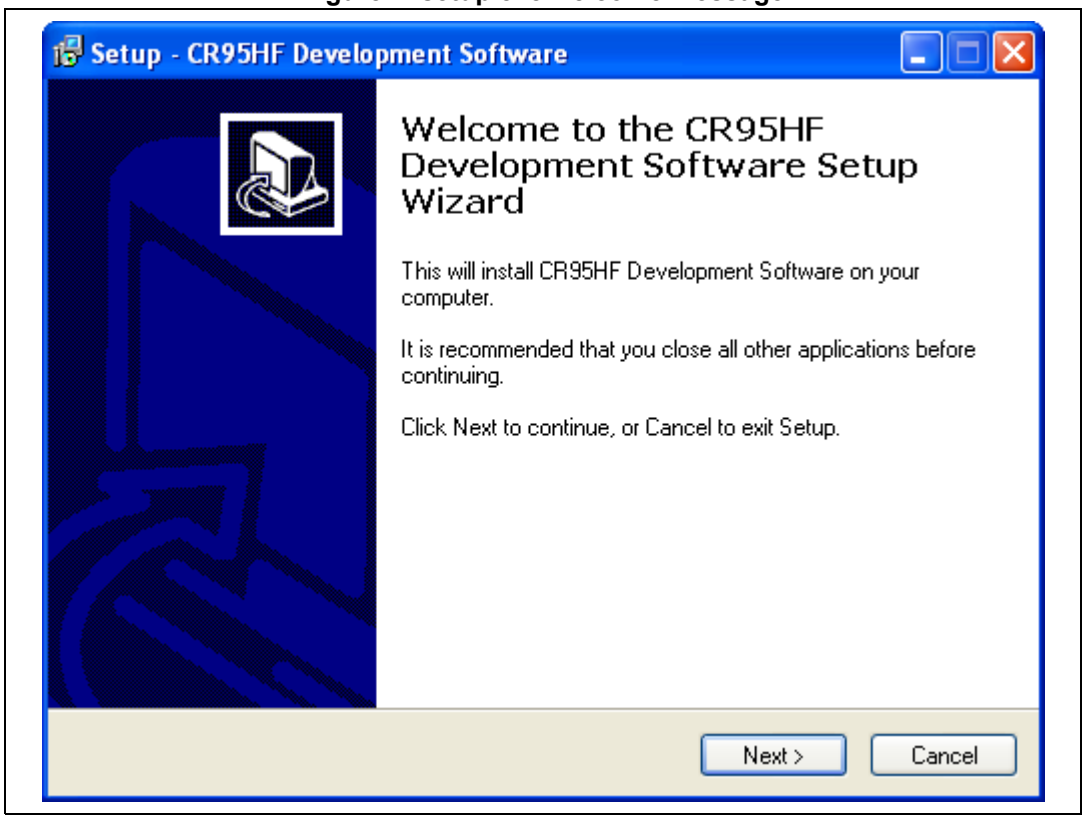


Figure 3. setup.exe licence agreement

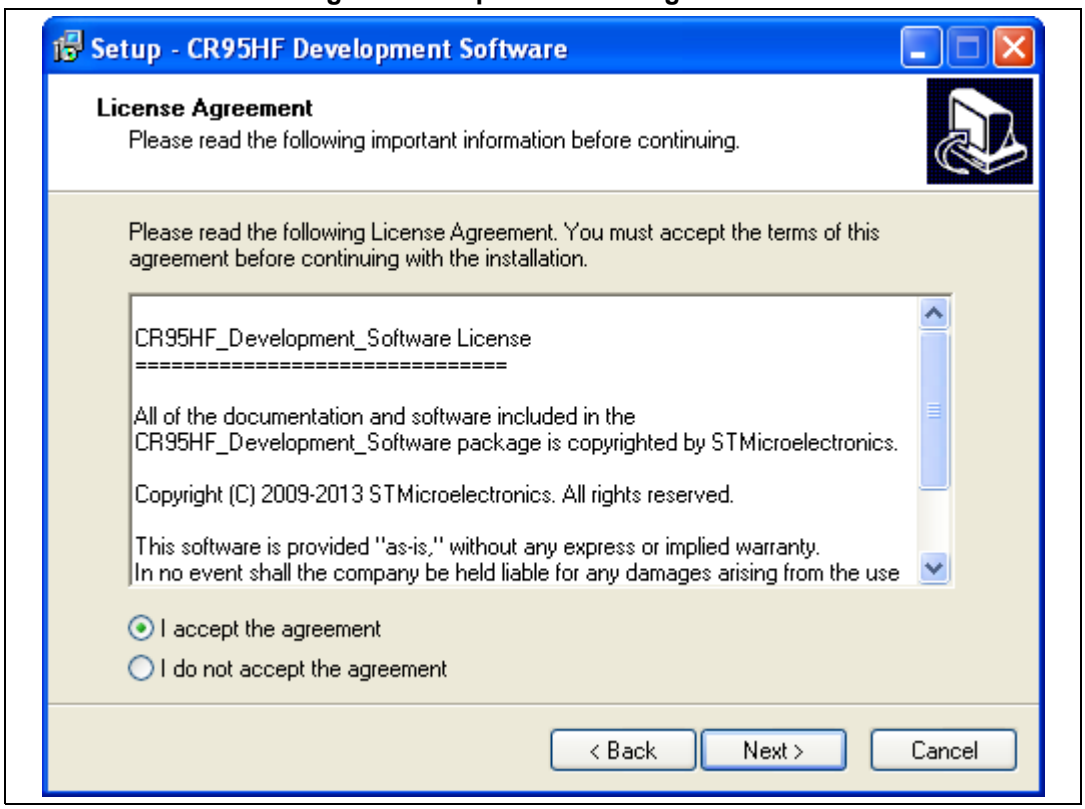


Figure 4. Select the destination folder

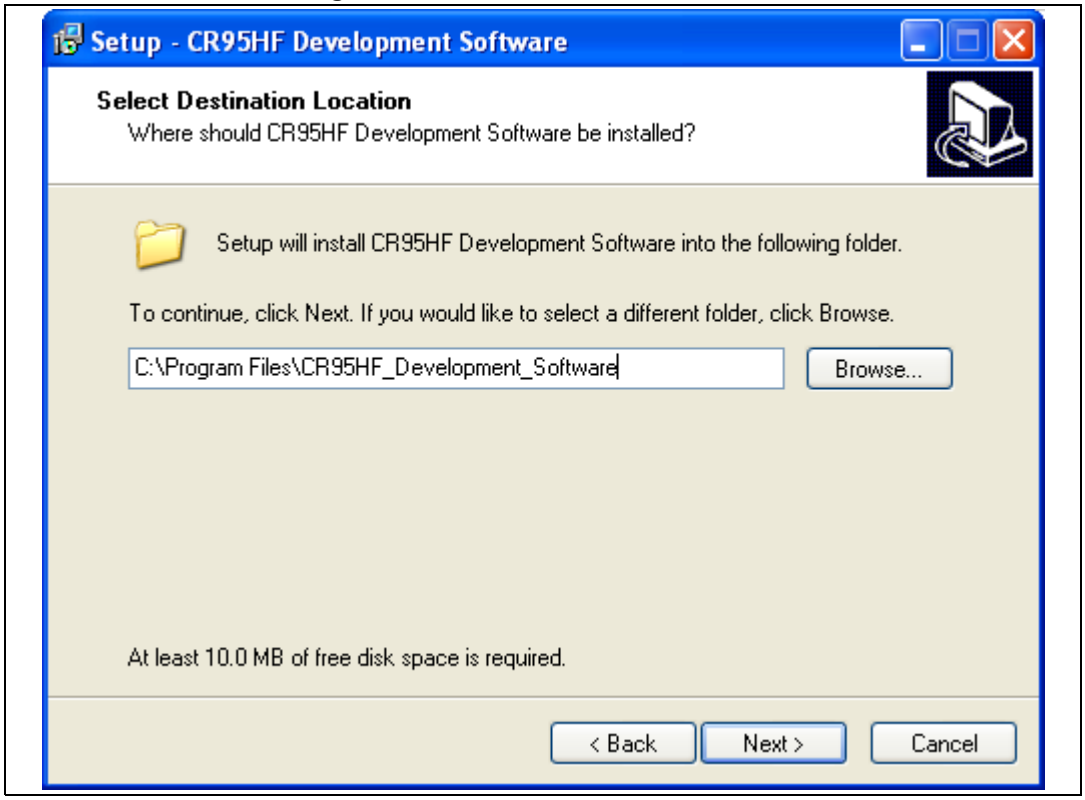


Figure 5. Insert the CR95HF development software from the start menu

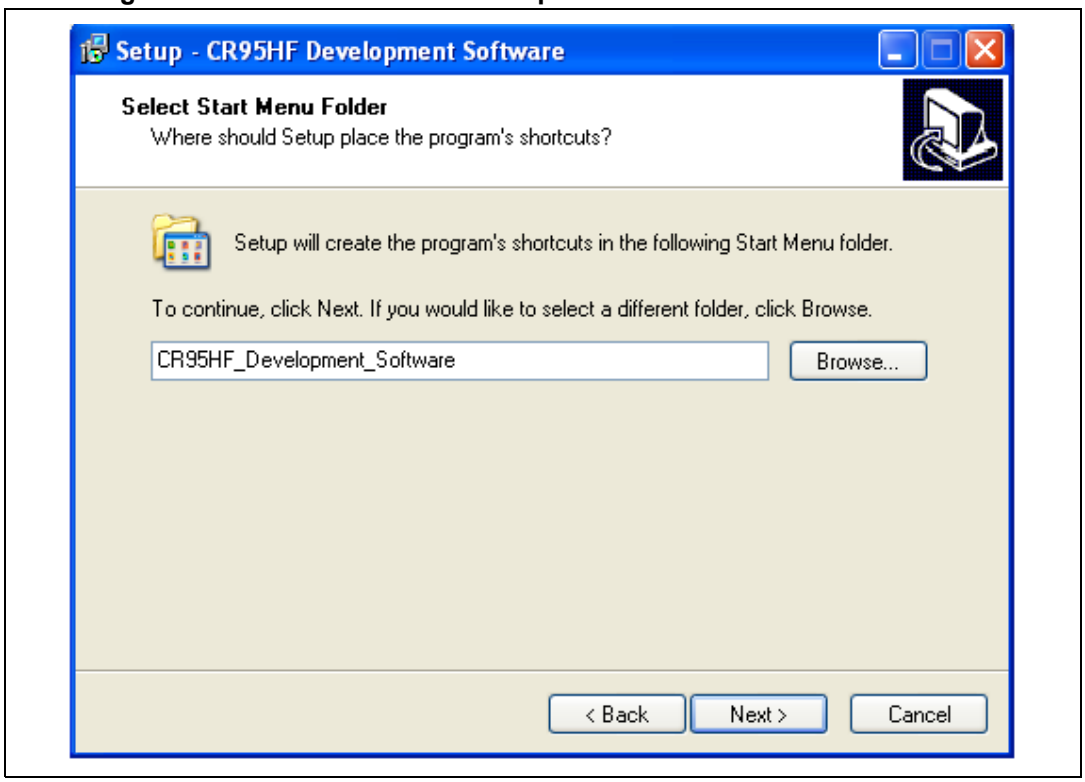


Figure 6. Create desktop or quick launch icons (optional)

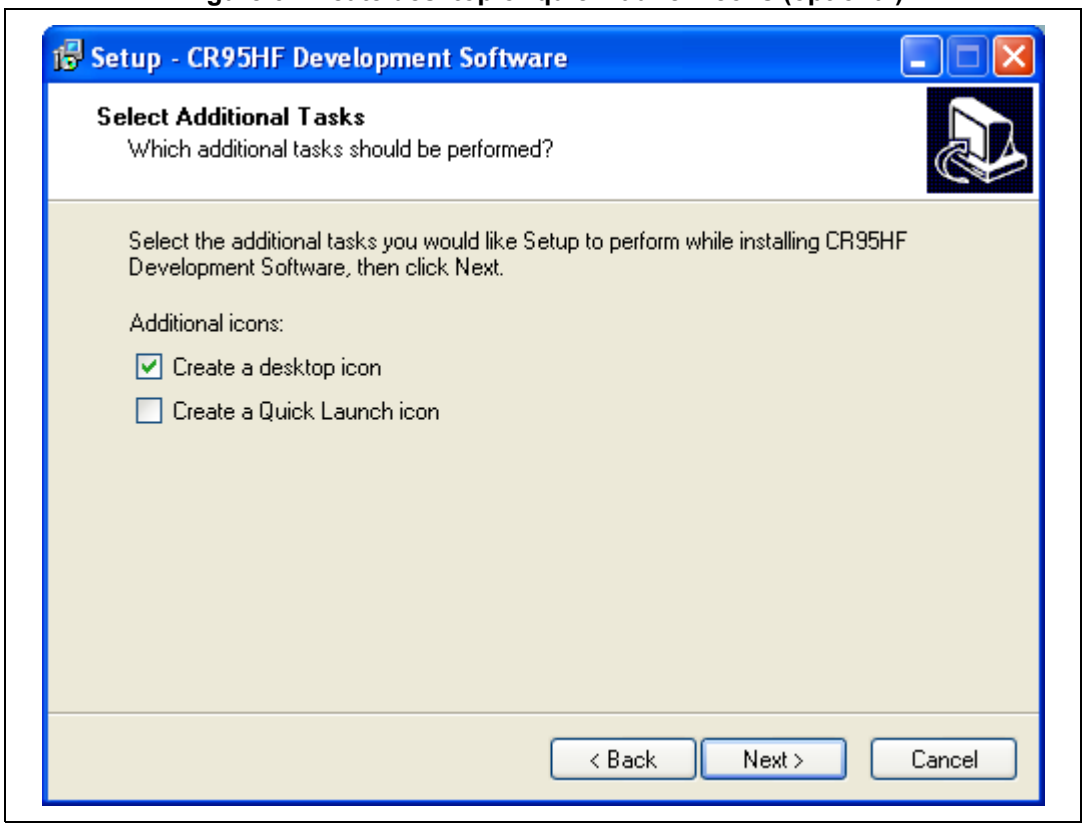


Figure 7. Install the CR95HF development software on your computer

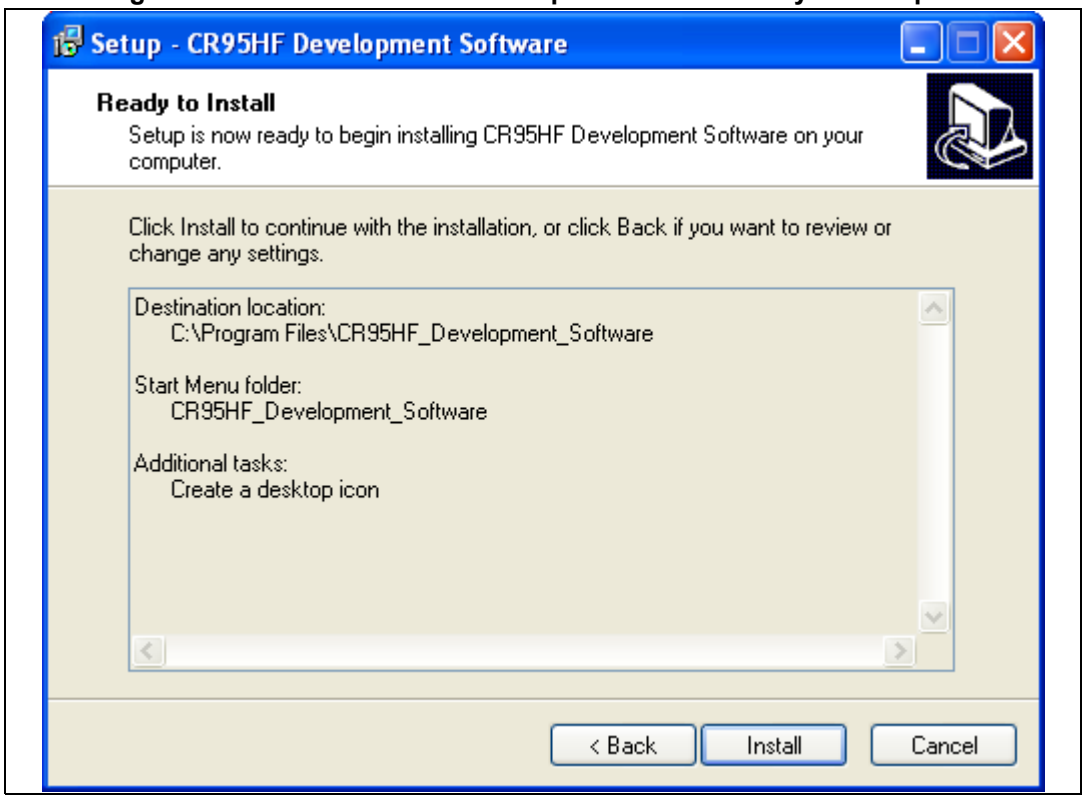


Figure 8. Install the CR95HFdll.dll

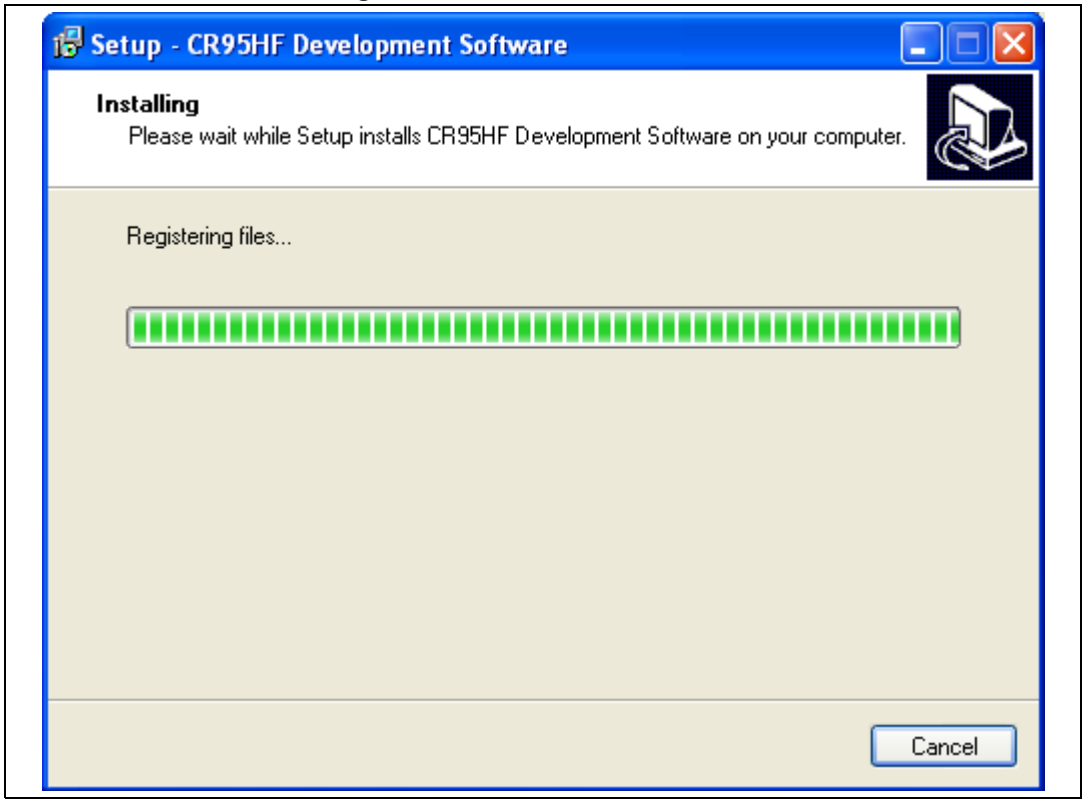


Figure 9. Read the CR95HF development software README

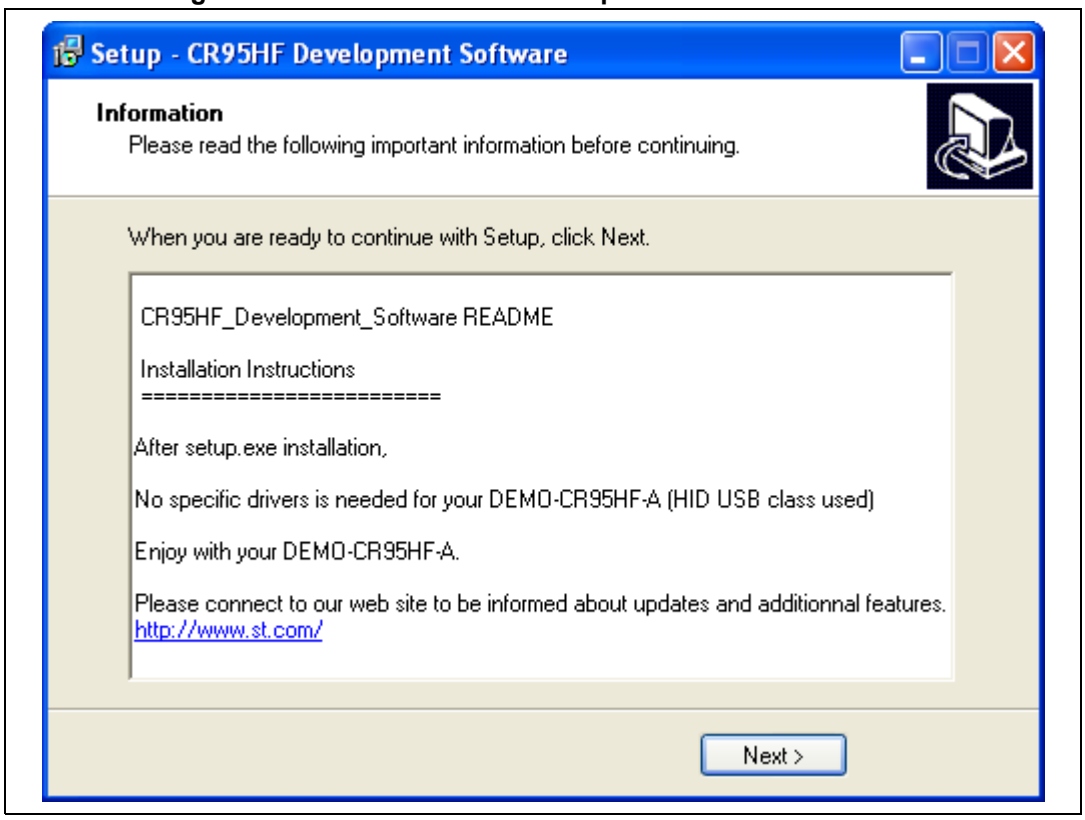


Figure 10. Launch the CR95HF development software

2 Using the CR95HF development software

2.1 Launching the CR95HF development software

Before launching the CR95HF development software, make sure that the DEMO-CR95HF-A 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 DEMO-CR95HF-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 DEMO-CR95HF-A 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 DEMO-CR95HF-A 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. DEMO-CR95HF-A detection message 1/3

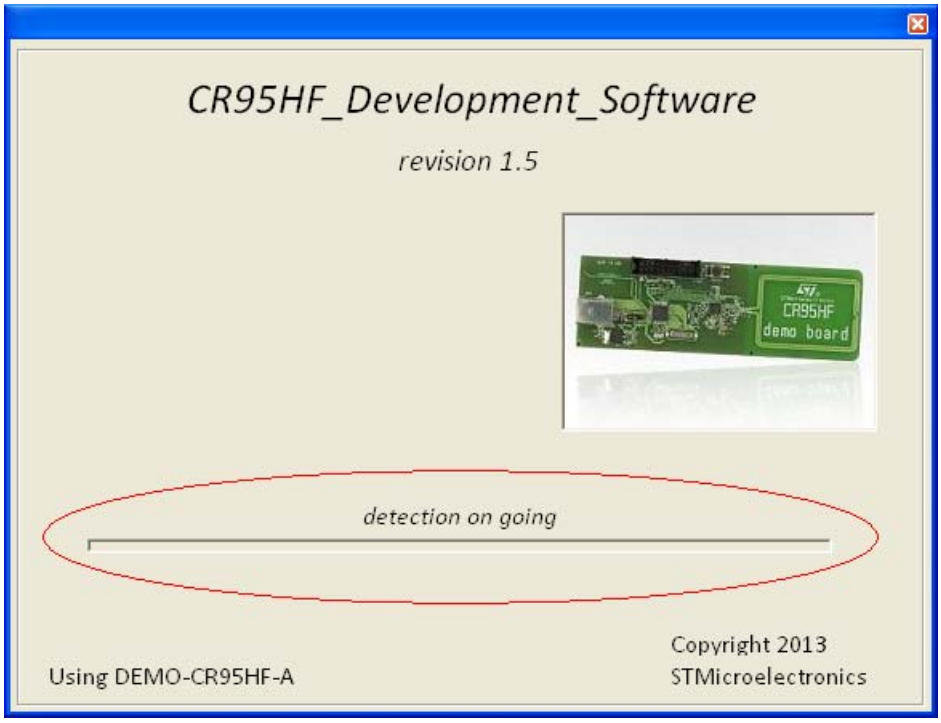


Figure 12. DEMO-CR95HF-A detection message 2/3

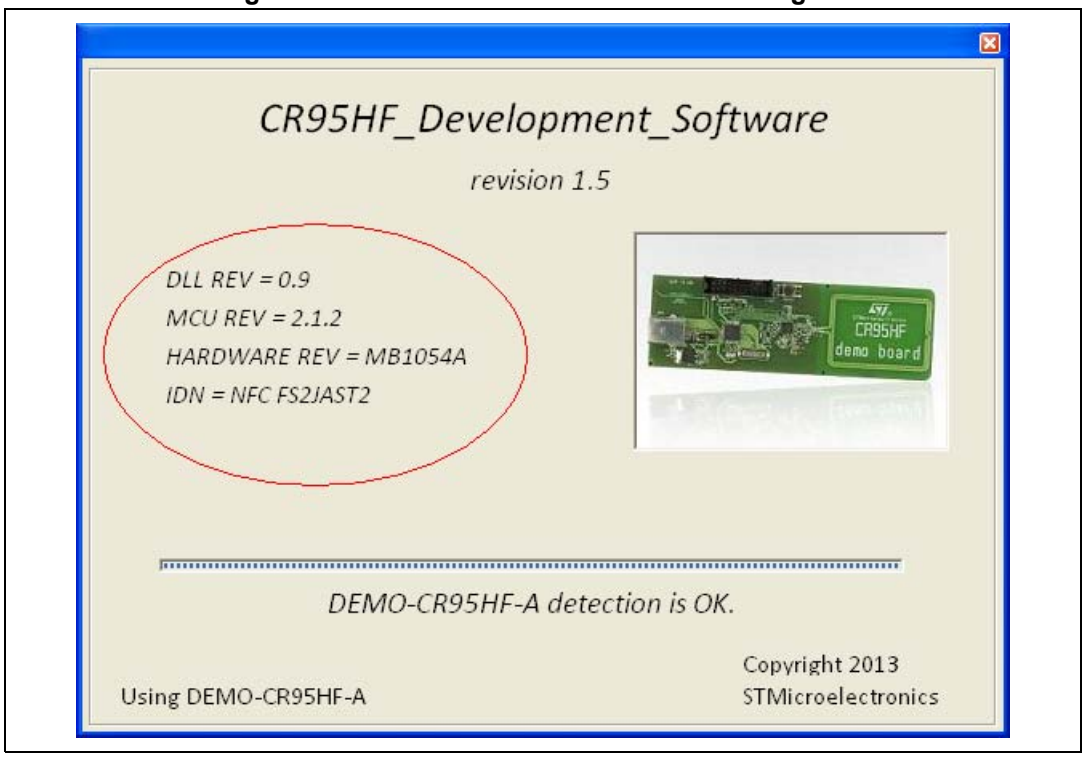


Figure 13. DEMO-CR95HF-A detection message 3/3

2.2 Main menu

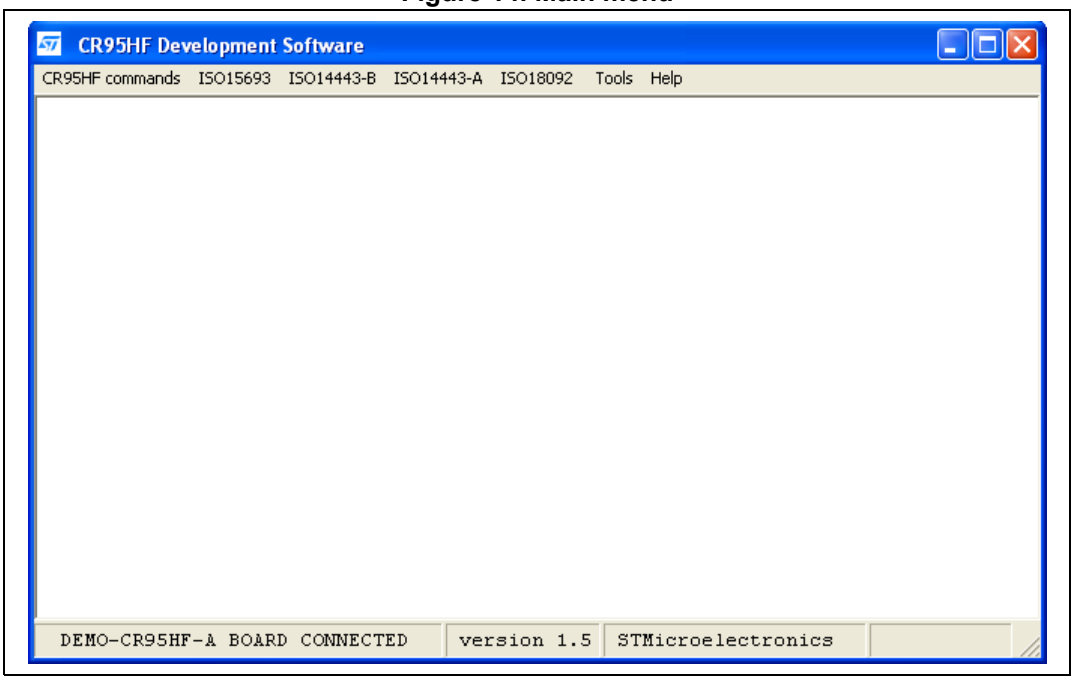
If the DLL has been installed correctly and the DEMO-CR95HF-A is connected to your PC USB port, the main menu is displayed to indicate that the software is running (see *Figure 14*).

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

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

- **CR95HF commands** (see *Section 2.3*)
- **ISO15693** mode (see *Section 2.4*)
- **ISO14443-B** mode (see *Section 2.5*)
- **ISO14443-A** mode (see *Section 2.6*)
- **ISO18092** mode (see *Section 2.7*)
- **Tools** menu (see *Section 2.8*)
- **Help** menu (see *Section 2.9*)

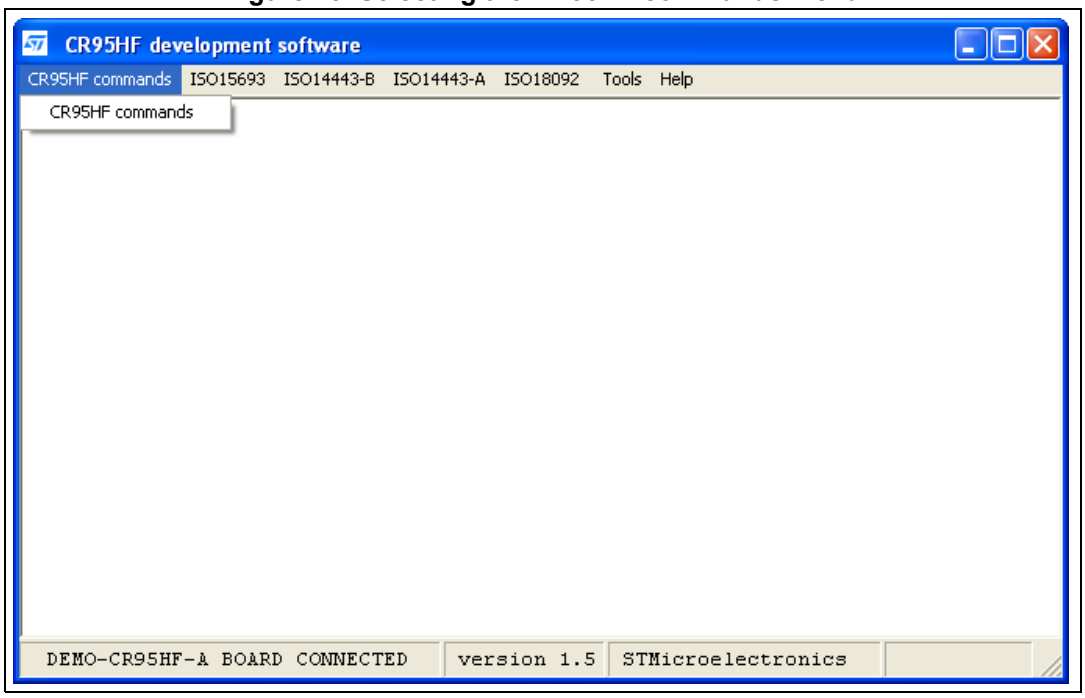
Figure 14. Main menu



2.3 CR95HF commands menu

1. Select **CR95HF commands** from the main menu to communicate with the CR95HF embedded on your board and use all the commands and parameters described in the CR95HF datasheet (see *Figure 15*).

Figure 15. Selecting the CR95HF commands menu



2. Select a command from the list (see *Figure 16*). The corresponding CR95HF command is sent to the DEMO-CR95HF-A. The selected parameters together with the board answer are displayed in the log window located at the bottom of the CR95HF user interface window.

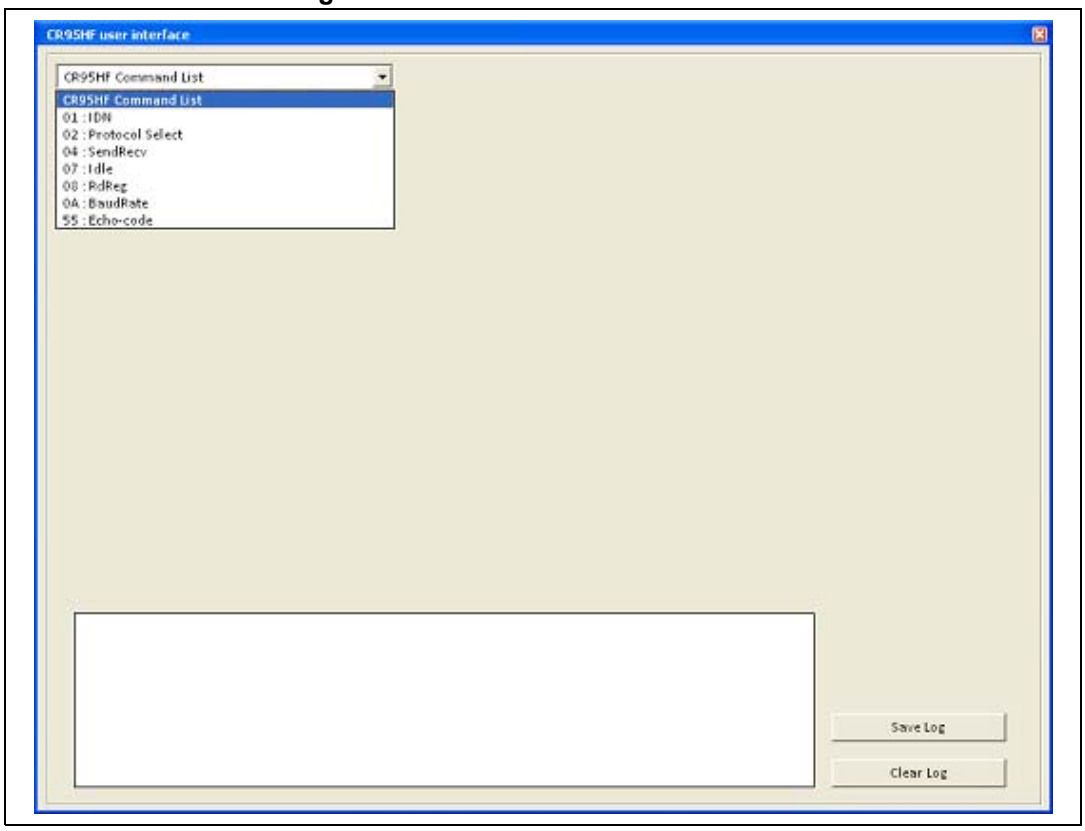
   Two buttons are available from this menu:

   – **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
   – 0A: Set UART baud rate
   – 55: Echo

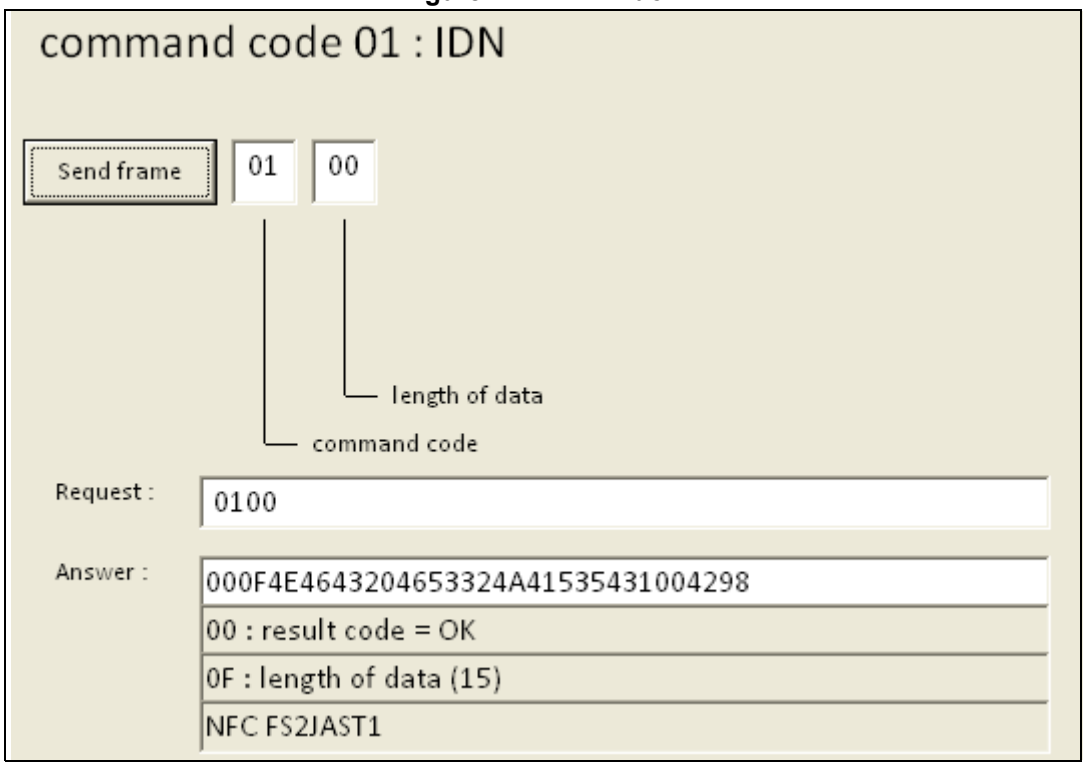
Figure 16. CR95HF user interface menu



2.3.1 01: IDN

Click **01: IDN** to request short information about the CR95HF and its firmware version (see *Figure 17*).

Figure 17. IDN window



2.3.2 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 18*):

- Click **01: ISO15693** to select and configure the ISO15693 communication protocol (see *Figure 20*).
- Click **02: ISO14443-A** to select and configure the ISO-14443-A communication protocol (see *Figure 21*).
- Click **03: ISO14443-B** to select and configure the ISO-14443-B communication protocol (see *Figure 22*).
- Click on **04: ISO18092** to select and configure the ISO-18092 communication protocol (see *Figure 23*).
- Click **00: Field OFF** to send a Field OFF command that turns the RF field off (see *Figure 19*).

Figure 18. Protocol Select window

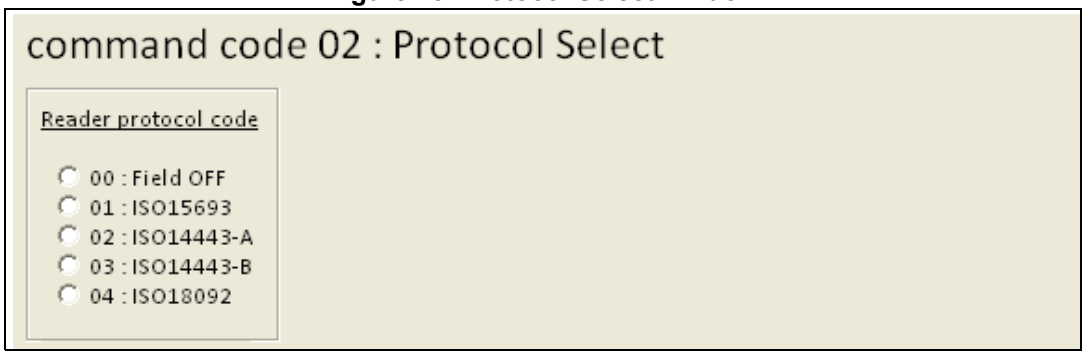


Figure 19. Field OFF window

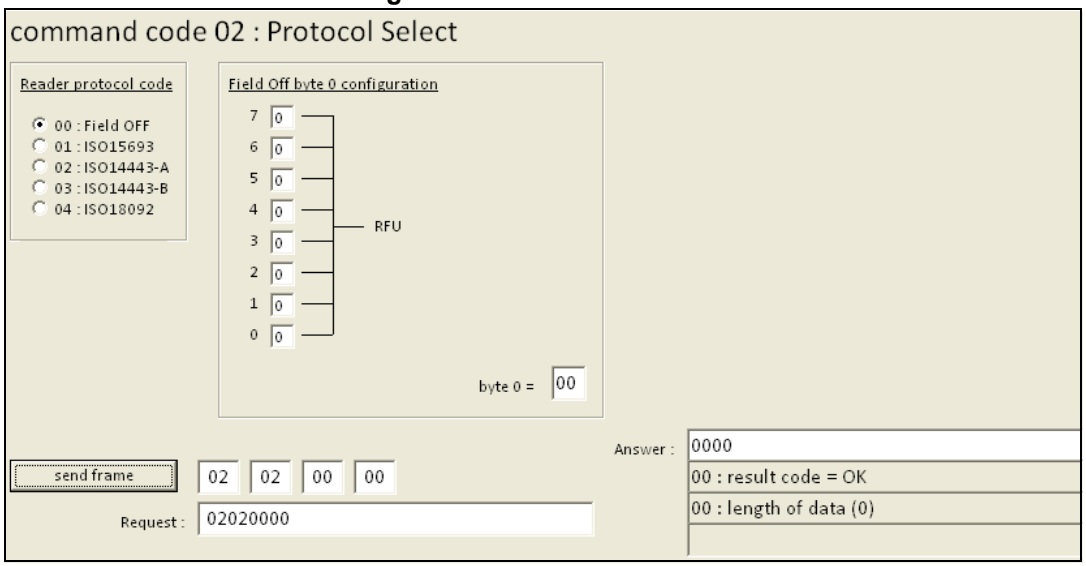


Figure 20. ISO15693 window

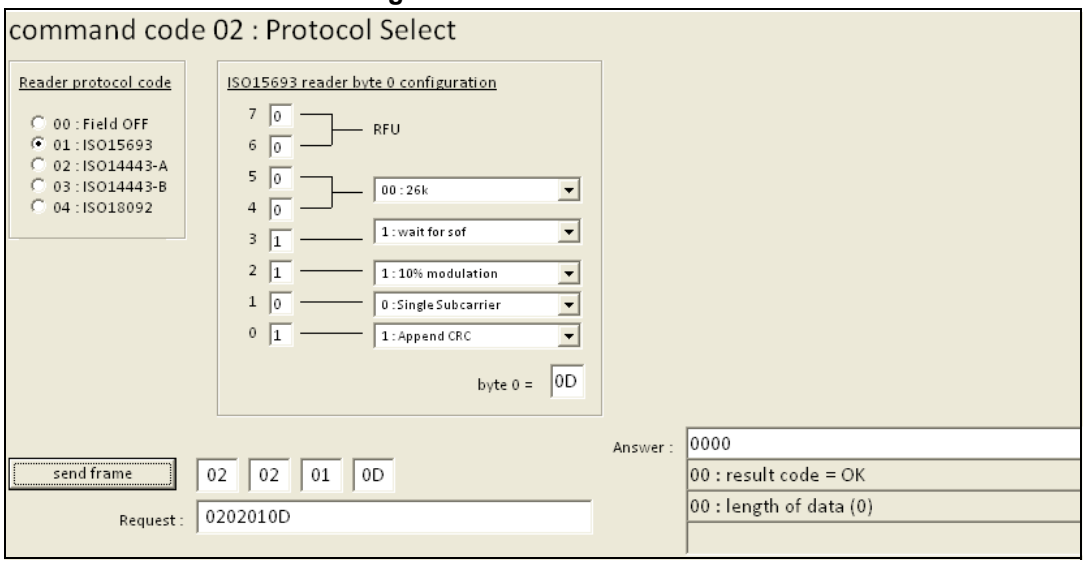


Figure 21. ISO14443-A window

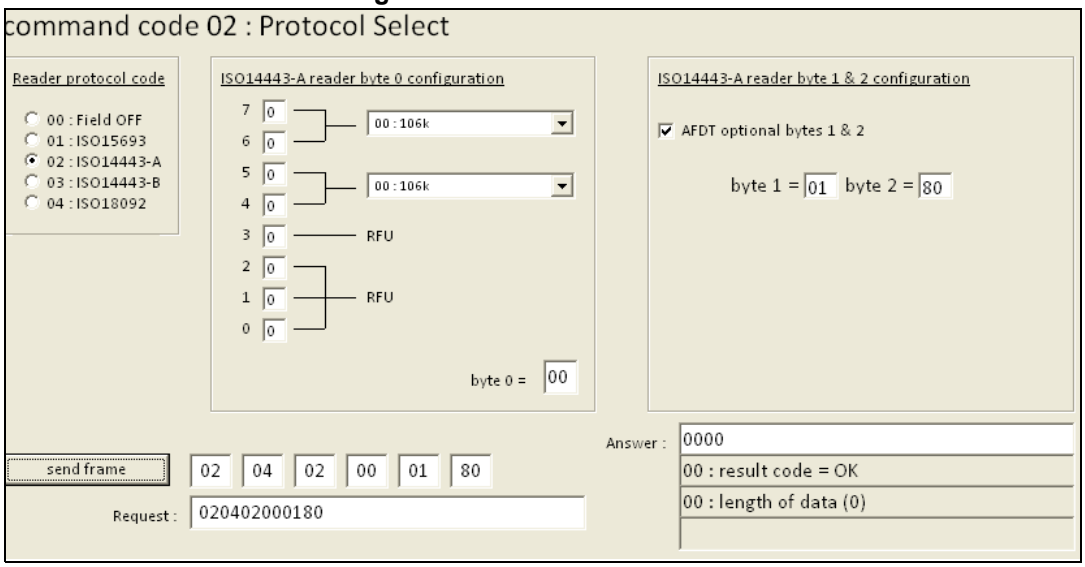


Figure 22. ISO14443-B window

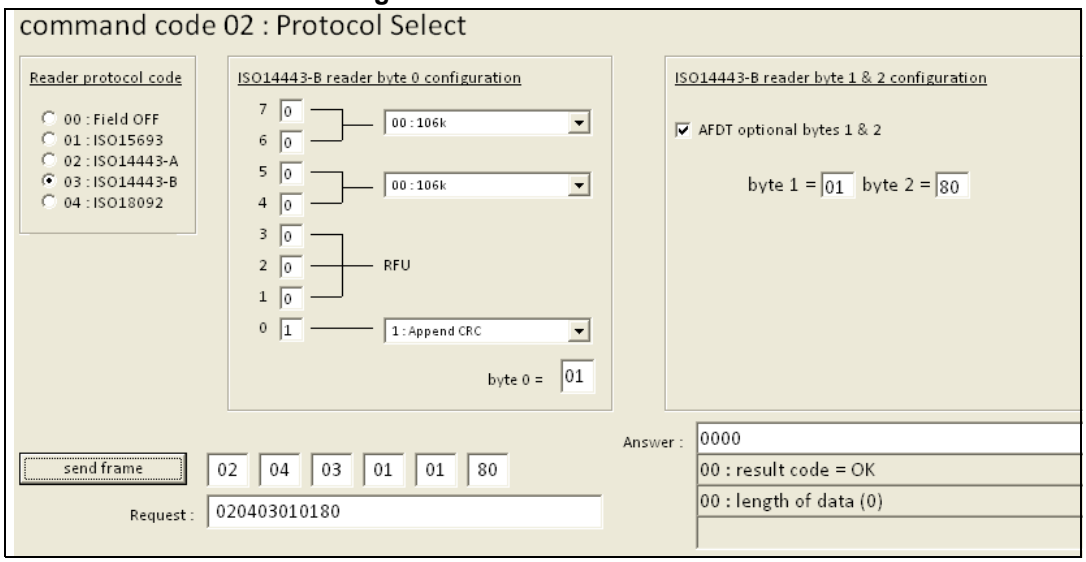
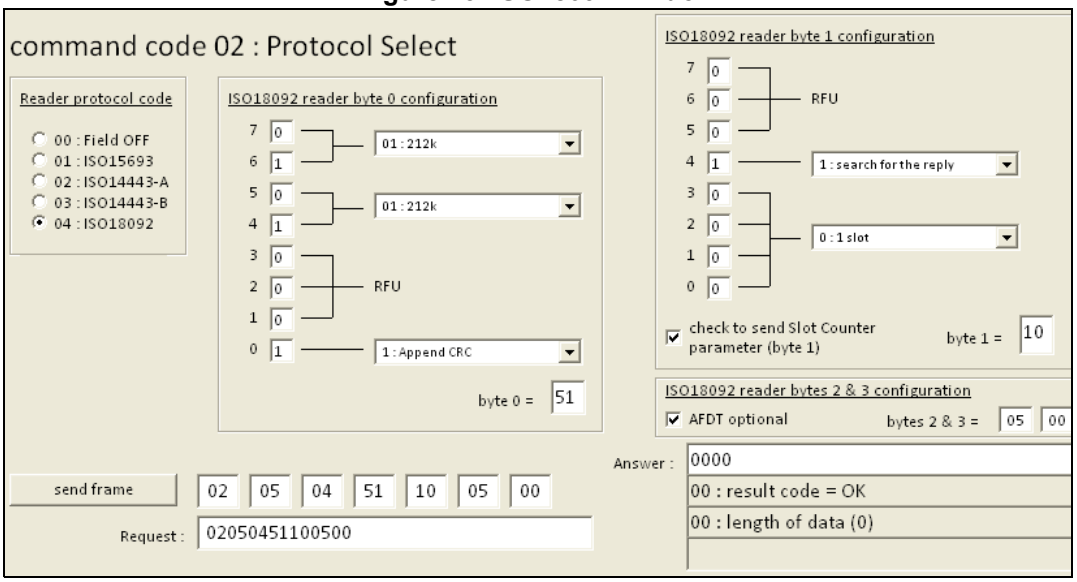


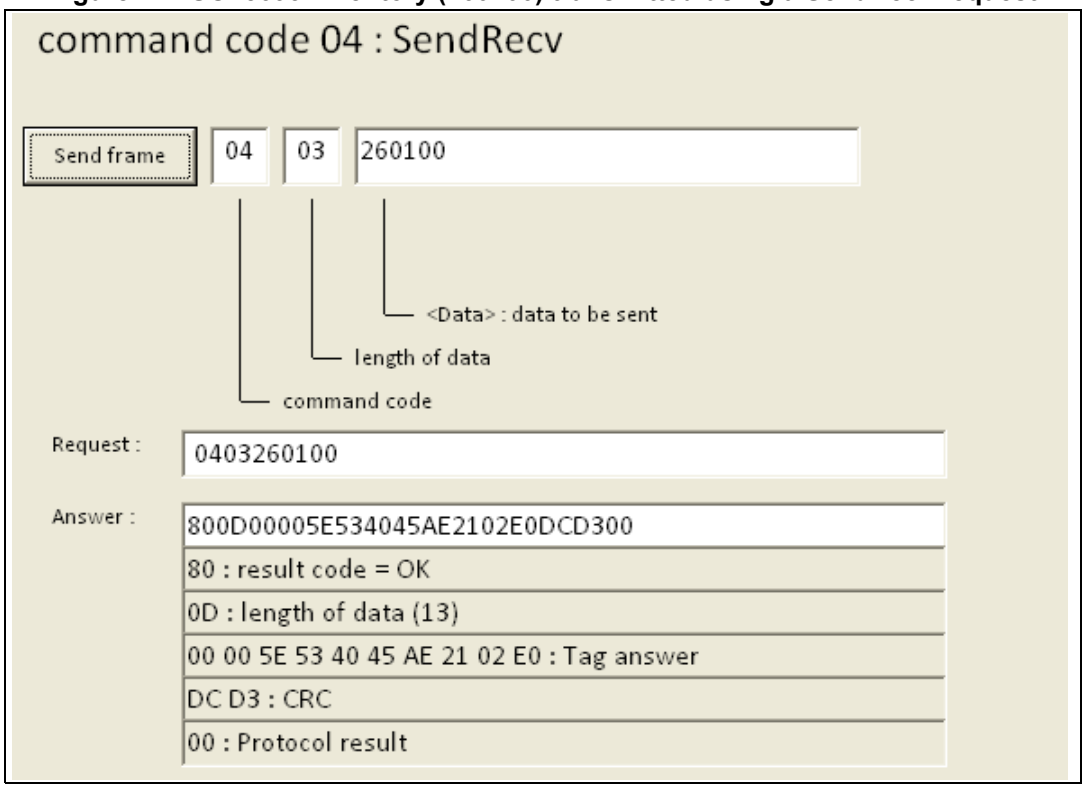
Figure 23. ISO18092 window



2.3.3 04: SendRecv

Click **04: SendRecv** to send data and receive the tag response using the previously selected protocol (see *Figure 24* for an example).

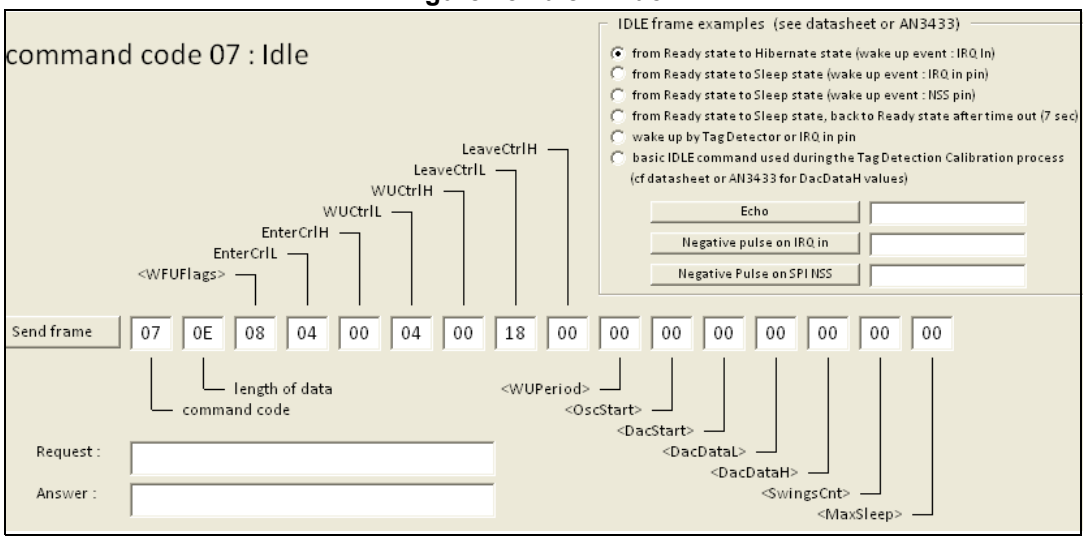
Figure 24. ISO15693 Inventory (260100) transmitted using a SendRecv request



2.3.4 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 25*).

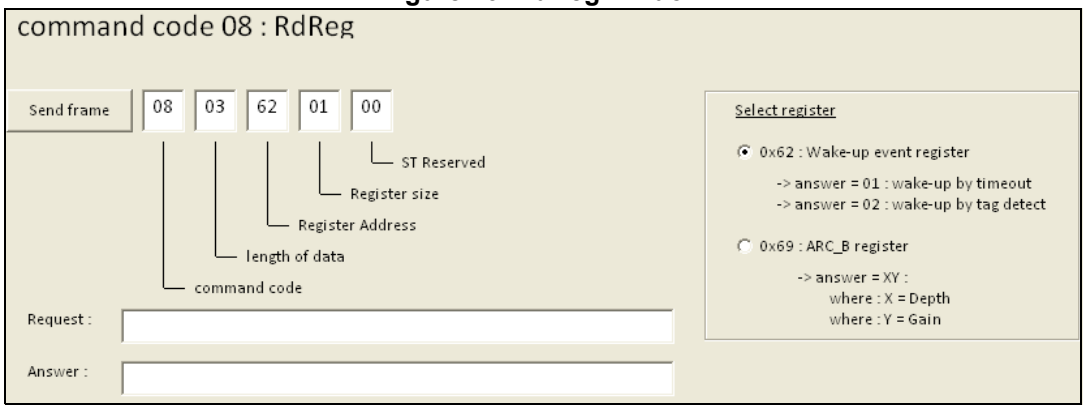
Figure 25. Idle window



2.3.5 08: RdReg

Click **08: RdReg** to read the Wakeup register (see *Figure 26*).

Figure 26. RdReg window

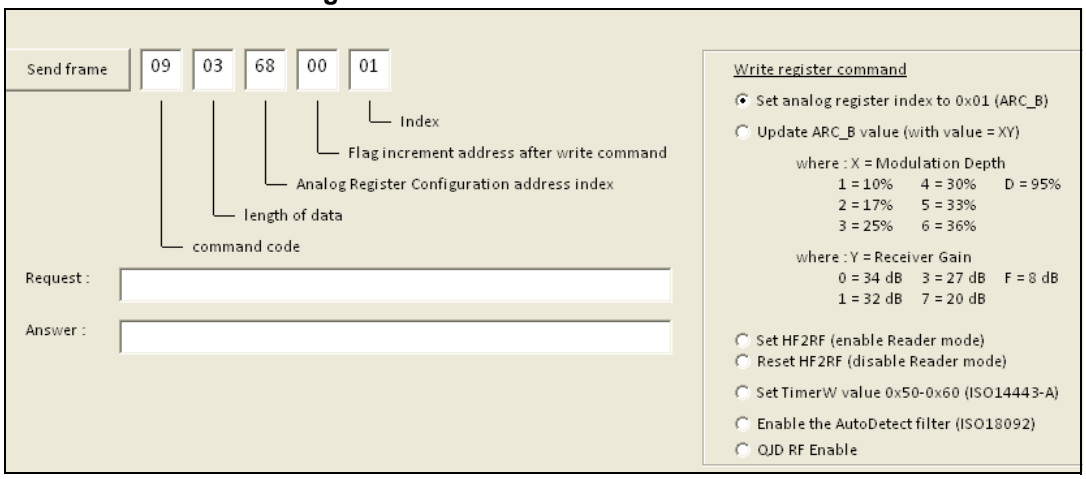


2.3.6 0A: Set UART baud rate

Click **0A: Set UART baud rate** to configure the UART data transfer (see *Figure 27*).

Note: The DEMO-CR95HF-A is delivered in SPI version. Contact your nearest ST sales offices to switch it to UART mode.

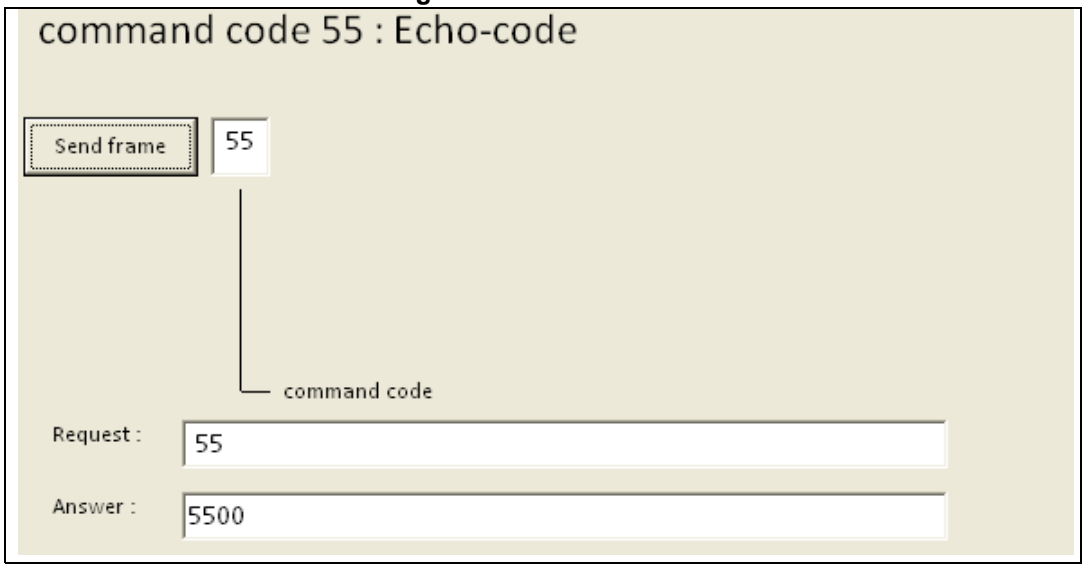
Figure 27. Set UART baud rate window



2.3.7 55: Echo

Click **05: Echo** to perform a serial interface echo (see *Figure 28*).

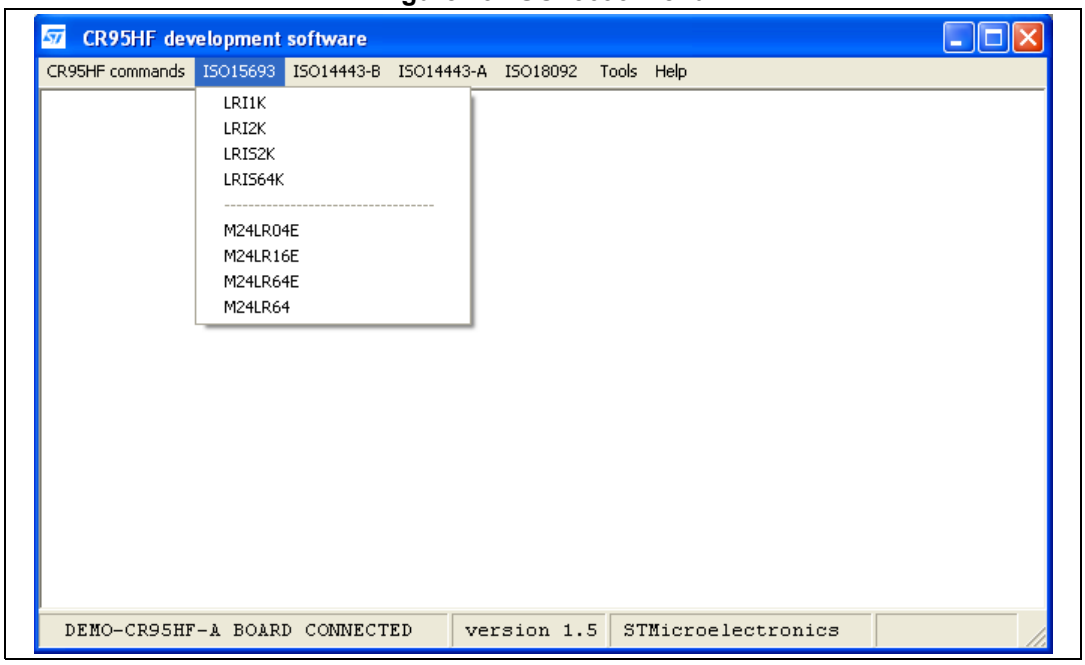
Figure 28. Echo window



2.4 ISO15693 menu

1. Select **ISO15693** from the main menu to use the DEMO-CR95HF-A as an ISO15693 reader. You can then choose between long range contactless memories and Dual Interface devices (see *Figure 29*).

Figure 29. ISO15693 menu



2. Select a device from the list (see *Figure 30* 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 DEMO-CR95HF-A 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:

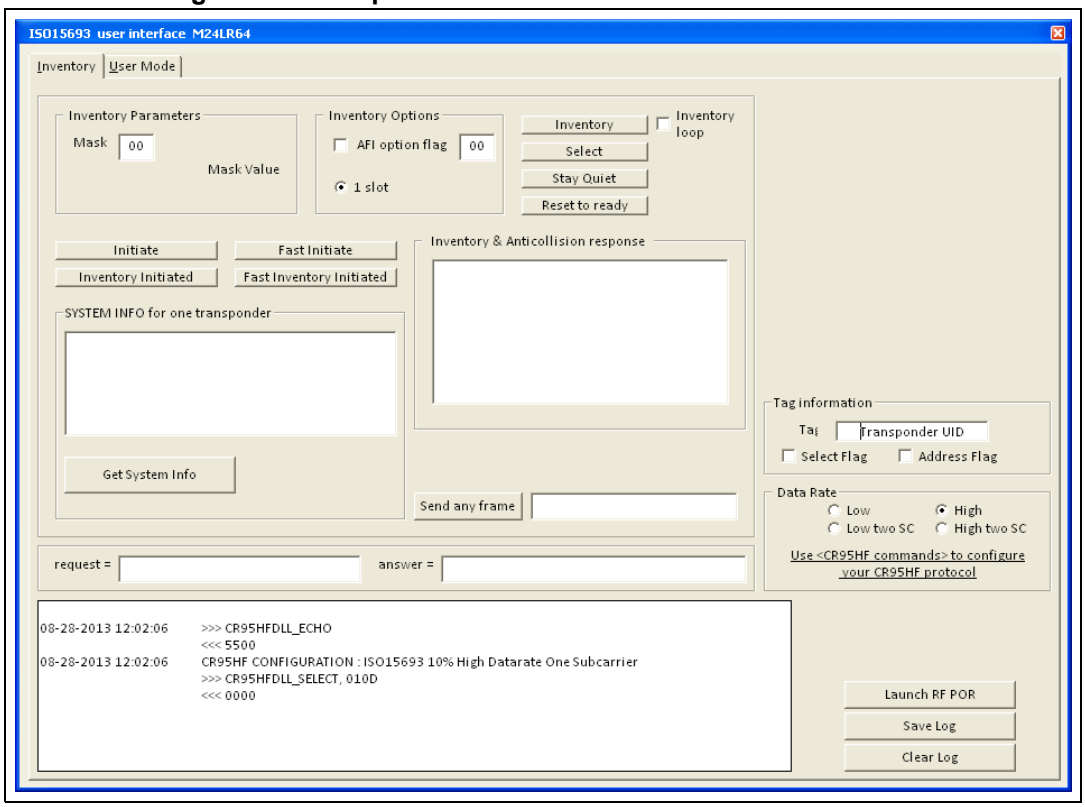
   a) Send an Inventory request to retrieve the tag UID.
   b) Click on the UID displayed in the **INVENTORY response** window to automatically copy the UID into the **Tag information** text box.
   c) Check **Address Flag** to activate the Addressed mode for the coming requests.

   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 30. Example of ISO15693 user interface for M24LR64



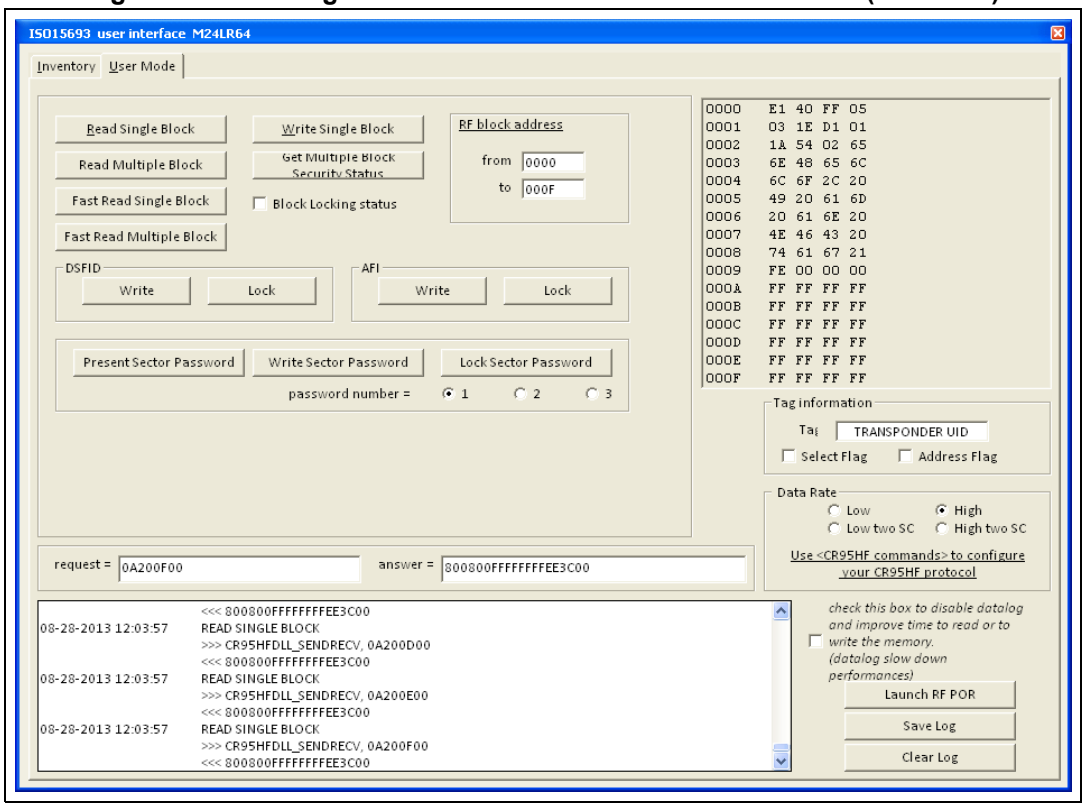
3. Click **User Mode** from the toolbar of the device ISO15693 user interface to display the ISO15693 requests that can be sent in User mode (see *Figure 31*). The main requests are:
   - Read single and multiple block(s)
   - Fast read single and multiple block(s)

     The DEMO-CR95HF-A 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.

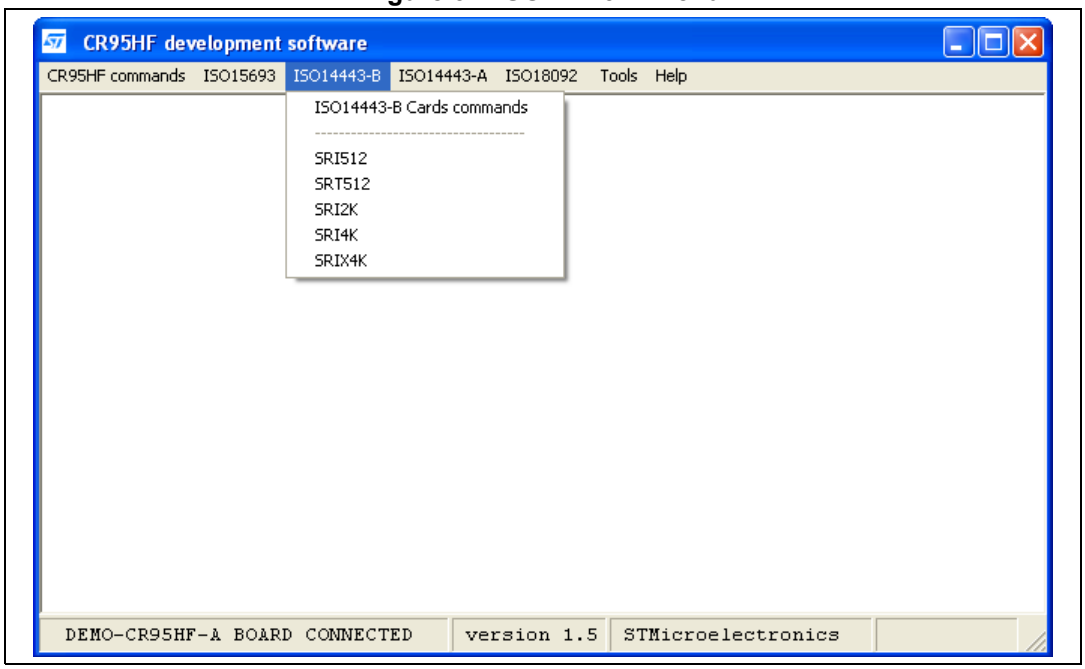
Figure 31. Selecting User Mode from ISO15693 user interface (M24LR64)



2.5 ISO14443-B menu

1. Select **ISO14443-B** from the main menu to use the DEMO-CR95HF-A as an ISO14443-B reader. You can then choose between short range contactless memories and Dual Interface devices (see *Figure 32*).

Figure 32. ISO14443-B menu



2. Select a device from the list (see *Figure 33* and *Figure 34* 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 DEMO-CR95HF-A antenna.

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

Figure 33. Example of ISO14443-B user interface

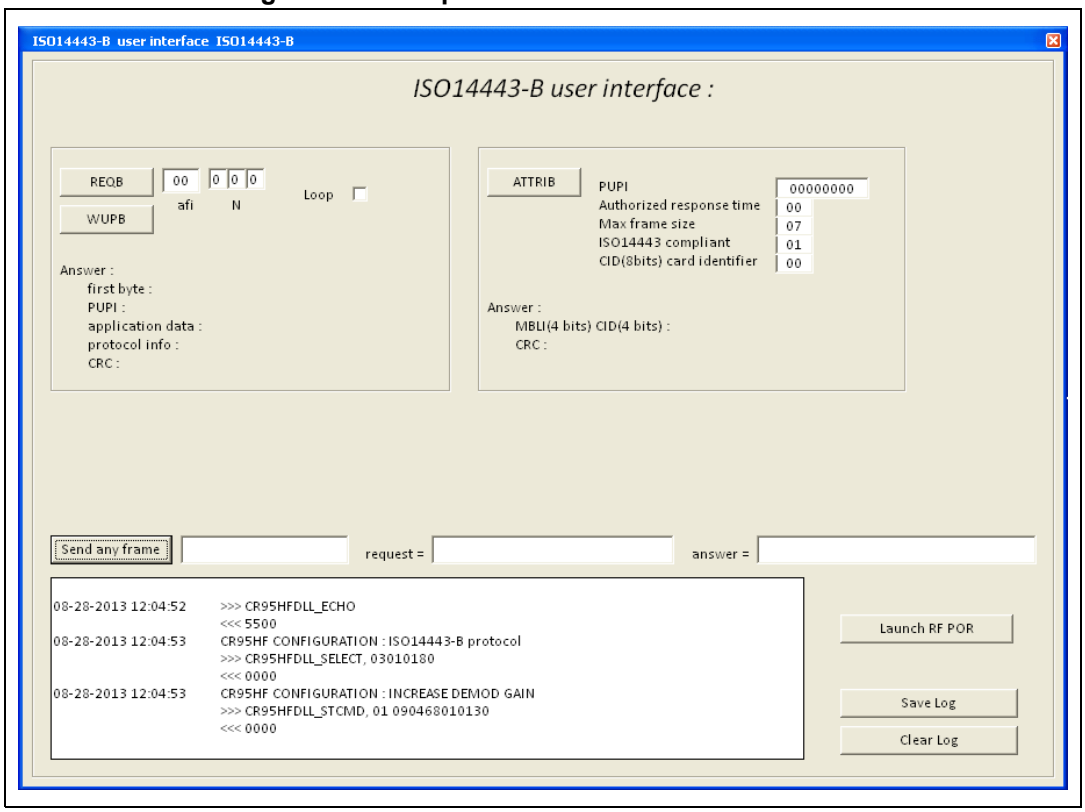
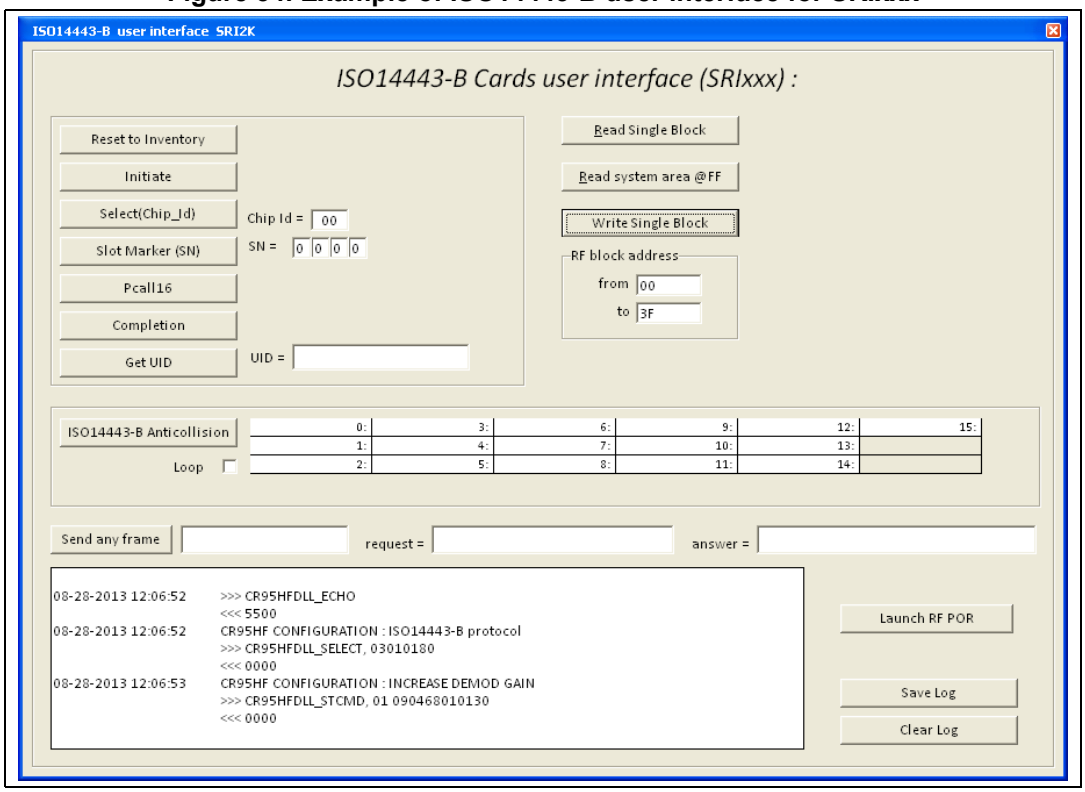


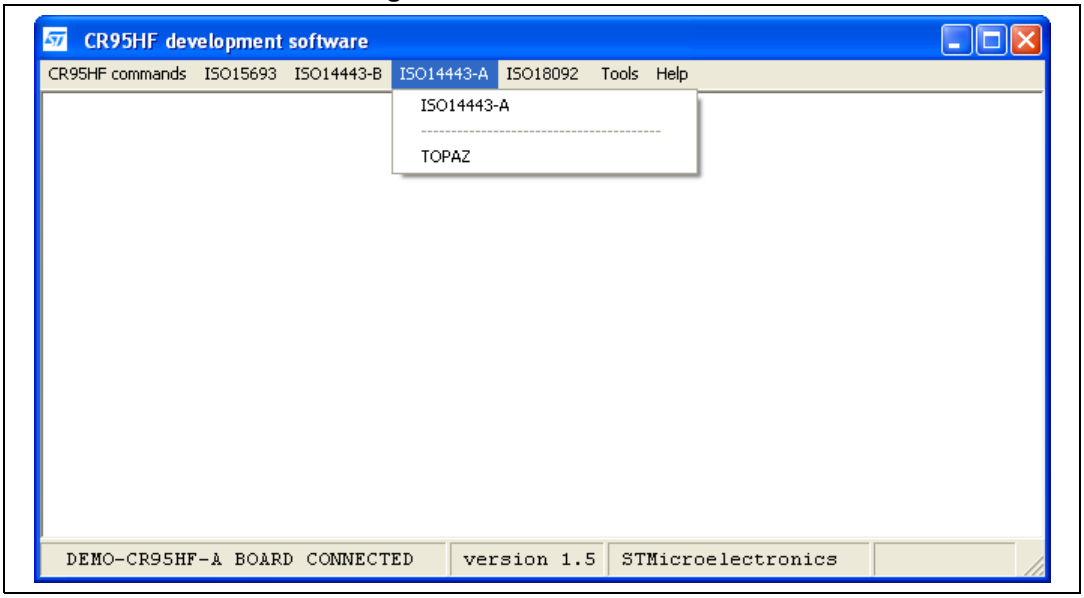
Figure 34. Example of ISO14443-B user interface for SRIxxx



2.6 ISO14443-A menu

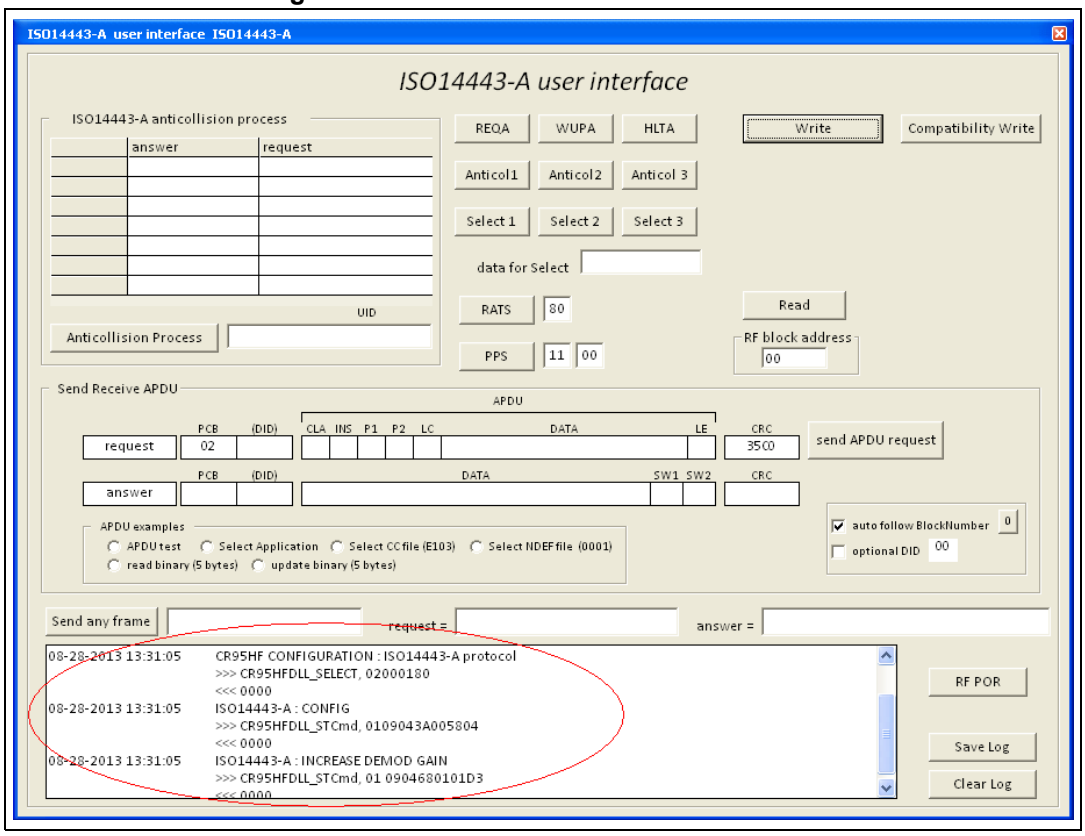
1. Select ISO14443-A from the main menu to use the DEMO-CR95HF-A as an ISO14443-A reader. You can then choose between standard ISO14443-A and TOPAZ devices (see *Figure 35*).

Figure 35. ISO14443-A menu



2. Select ISO14443-A from the list (see *Figure 36* for an example). This automatically configures the board as an ISO14443-A reader and displays all the ISO14443-A requests.

Figure 36. ISO14443-A selected from the list



The ISO14443-A configuration is displayed in the log window as shown in *Figure 36*.

The upper part of the window contains buttons allowing to send ISO14443-A requests to tags through the DEMO-CR95HF-A 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:

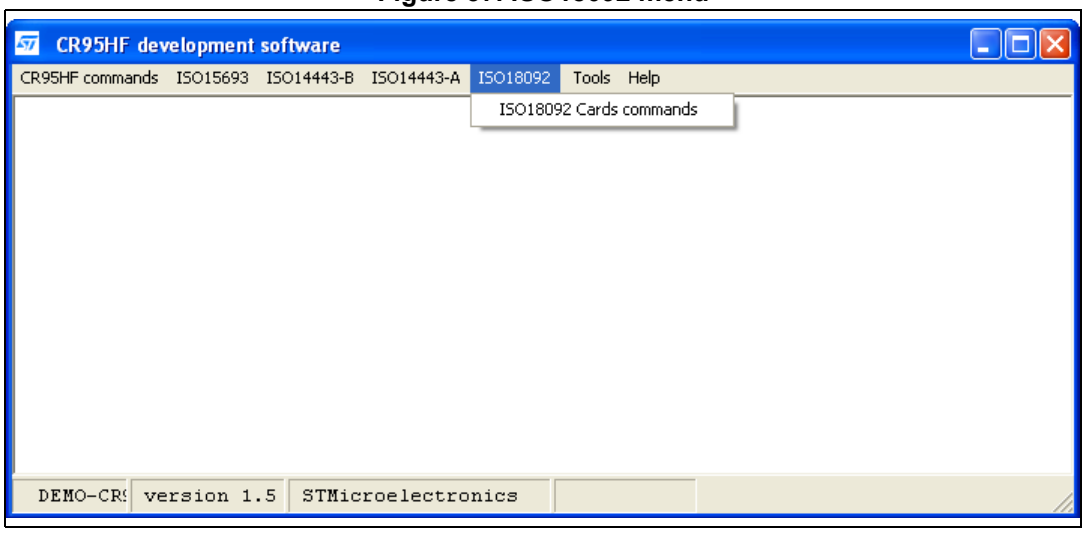
- RATS
- PPS
- READ
- WRITE

Send Receive APDU can be used to send APDU requests.

2.7 ISO18092 menu

1. Select ISO18092 from the main menu to use the DEMO-CR95HF-A as an ISO18092 reader (see *Figure 37*).

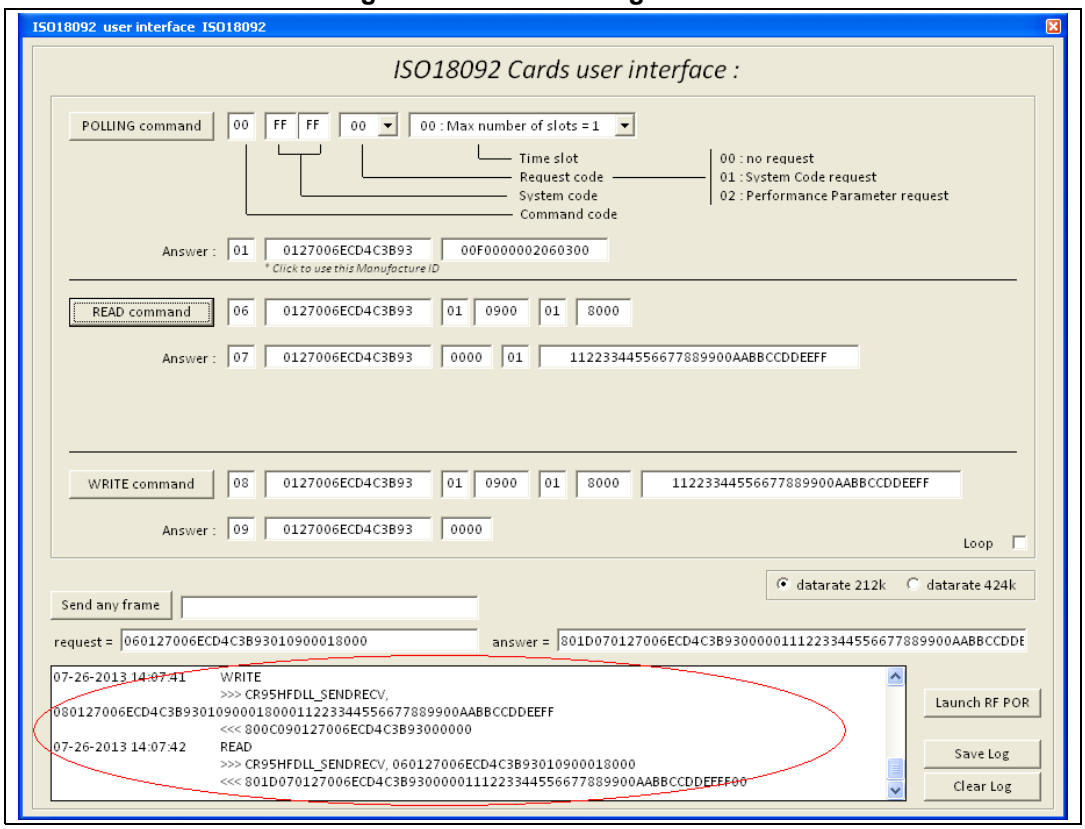
Figure 37. ISO18092 menu



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 38*.

Figure 38. 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.

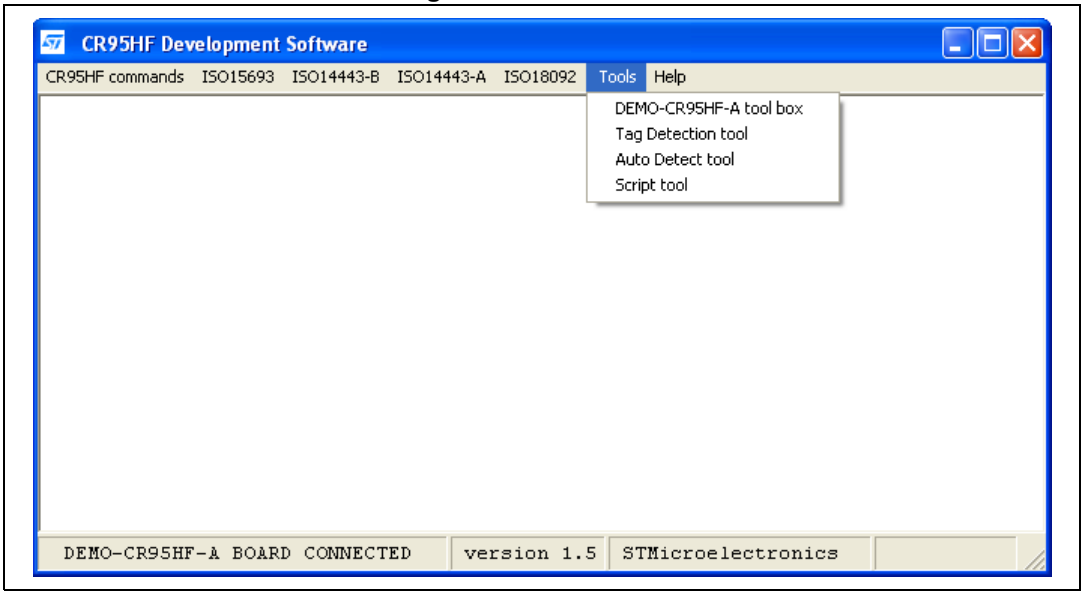
Read command and Write command are also available.

2.8 Tools menu

Select the **Tools** menu to launch one of the following tools (see *Figure 39*):

- **DEMO-CR95HF-A tool box** (see *Section 2.8.1: DEMO-CR95HF-A toolbox*)
  This menu allows the user to send requests to the DEMO-CR95HF-A board.
- **Tag Detection tool (**see *Section 2.8.2: Tag Detection tool*)
  This menu can be used to launch a DEMO-CR95HF-A 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 39. Tools menu

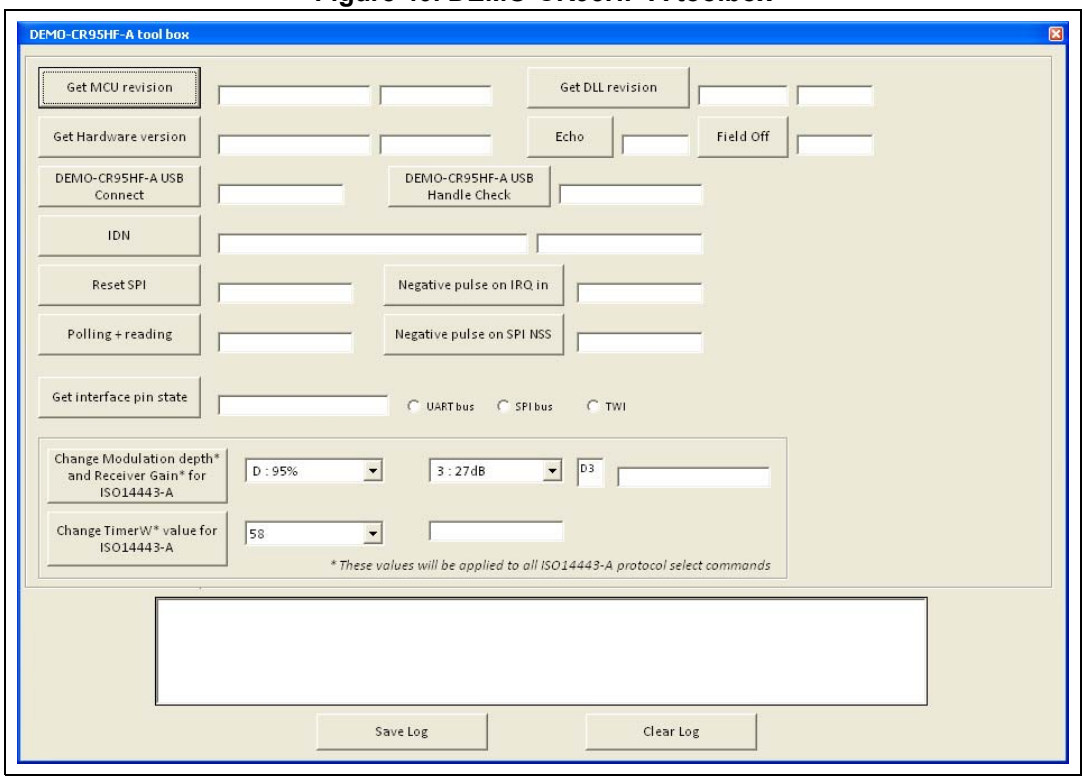


2.8.1 DEMO-CR95HF-A toolbox

The DEMO-CR95HF-A toolbox allows to send the following requests to the DEMO-CR95HF-A board (see *Figure 40*):

- **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 DEMO-CR95HF-A board.
- **Change Modulation depth and Receiver Gain**: modifies the setting for ISO14443-A.
- **Change TimerW value**: modifies the setting for ISO14443-A.

Figure 40. DEMO-CR95HF-A toolbox



2.8.2 Tag Detection tool

Two commands are available (see *Figure 41*):

- **Calibration**

  Clicking the **Calibration** button performs a DEMO-CR95HF-A 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.

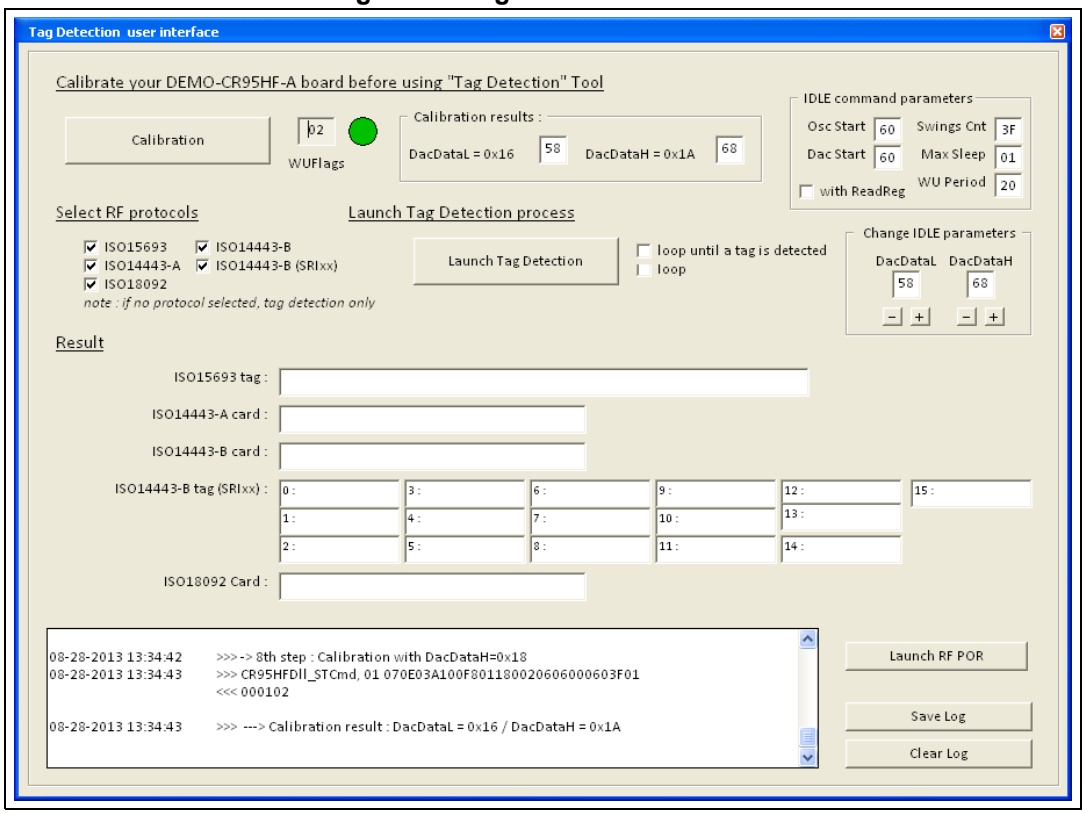
  If a tag is detected in the DEMO-CR95HF-A field, the CR95HF enters Wakeup mode, and an ISO15693/ISO14443-B anti-collision procedure starts to identify the tags present in the field.

  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.

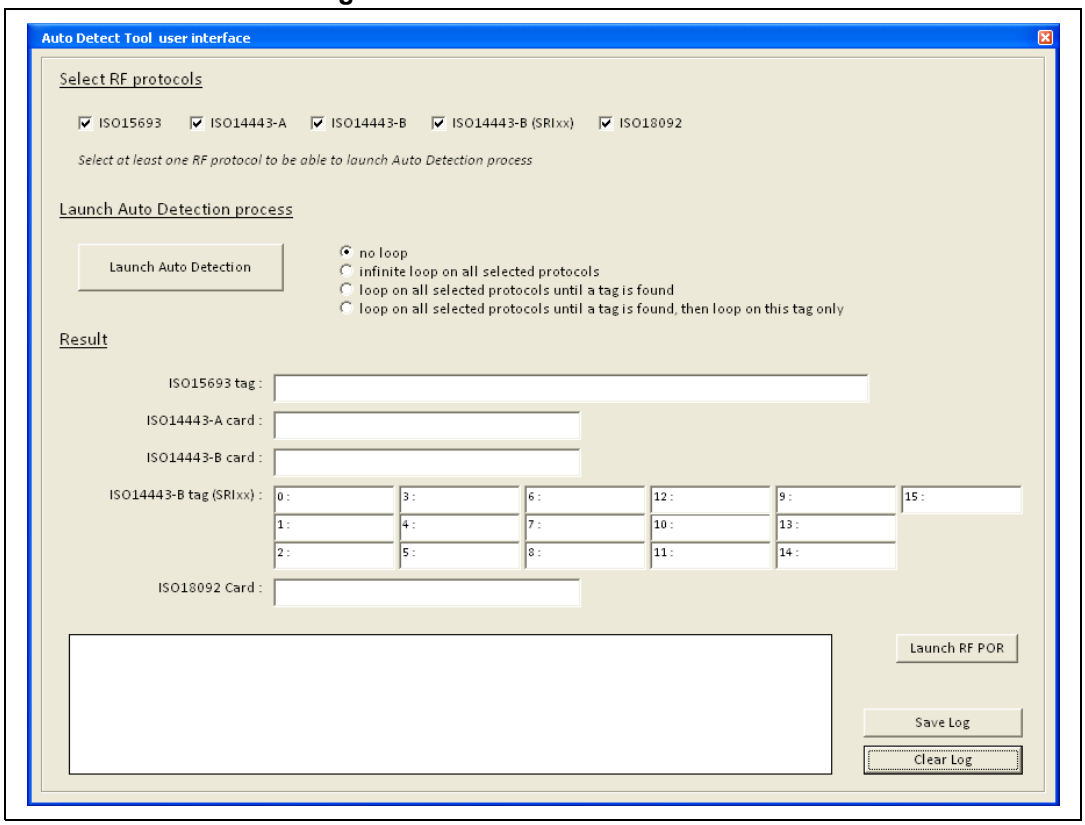
Figure 41. Tag detection interface



2.8.3 Auto detection tool

The Auto detection tool allows to play a tag hunt on several RFID technologies (see *Figure 42*).

Figure 42. 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.

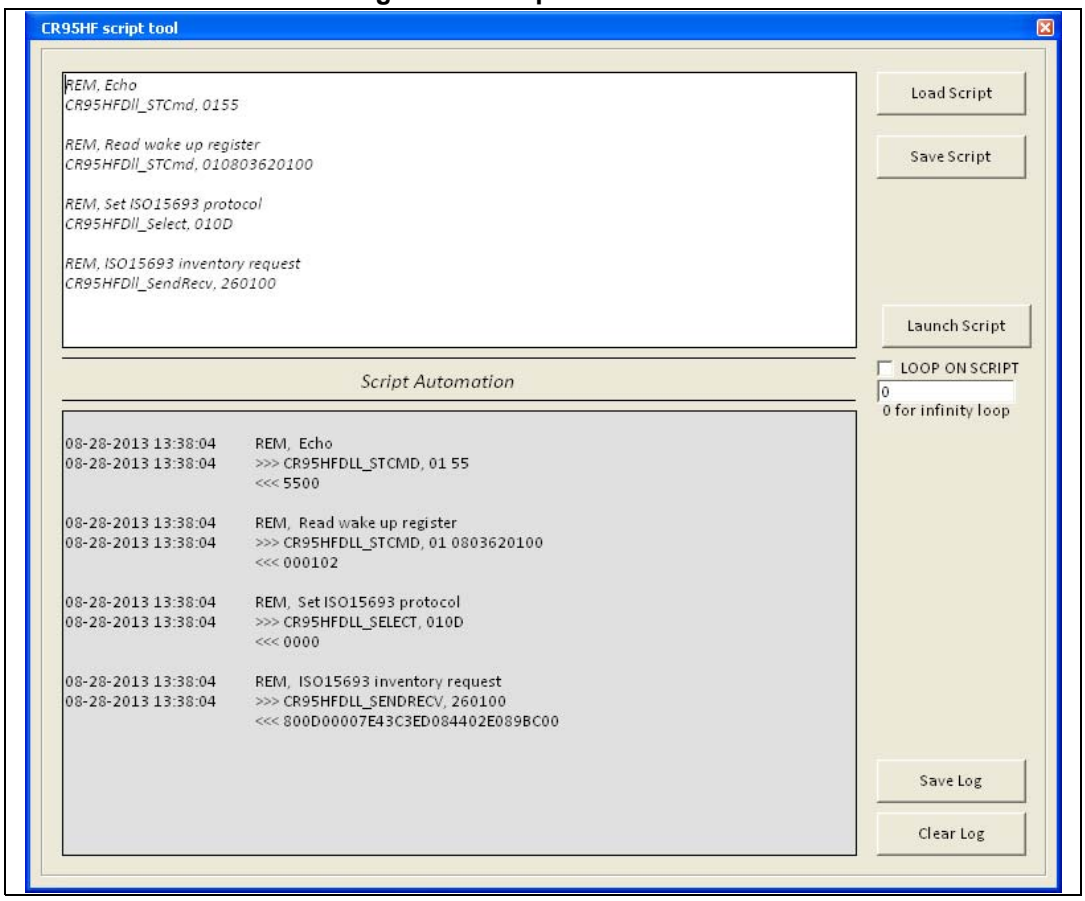
2.8.4 Script tool

The **Script** tool allows playing a script containing a sequence of CR95HF commands (see *Figure 43*). 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.

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

Figure 43. Script tool interface



2.9 Help menu

Select the **Help** menu to access the following functions (see *Figure 44*):

- **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 45*).

- **Script Help**

  This function allows to get information on CR95HF function syntax (see *Figure 46*). 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 47*).

Figure 44. Help menu

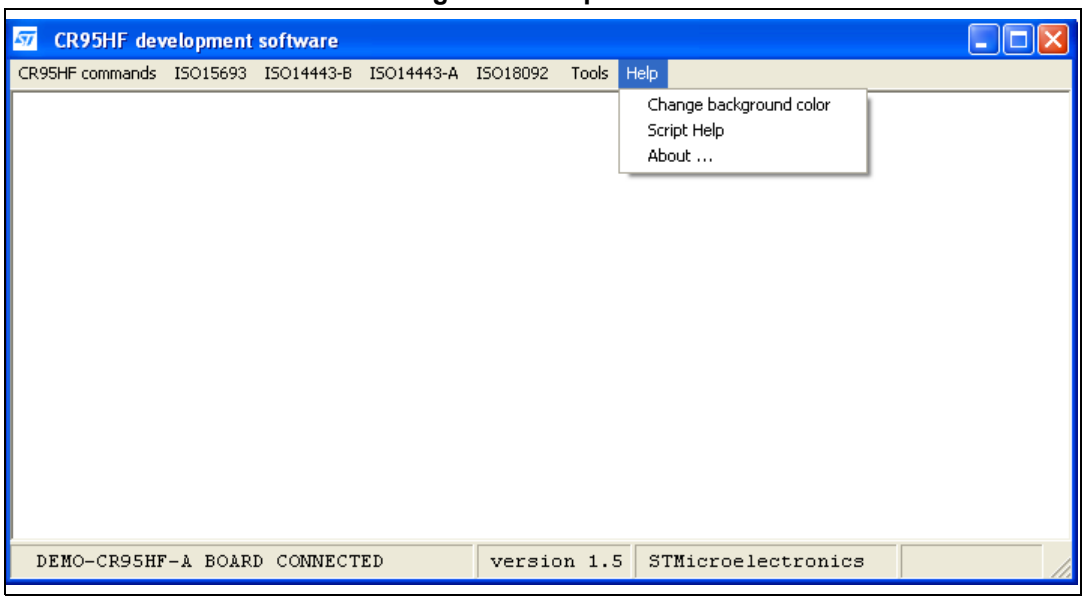


Figure 45. Change background color menu

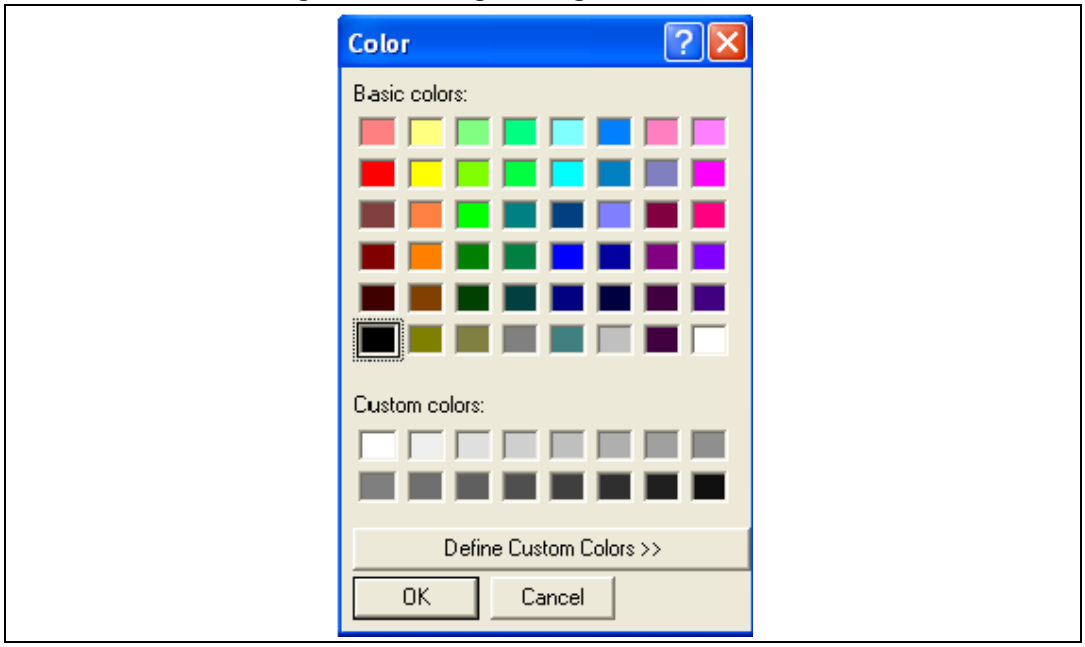


Figure 46. Script help

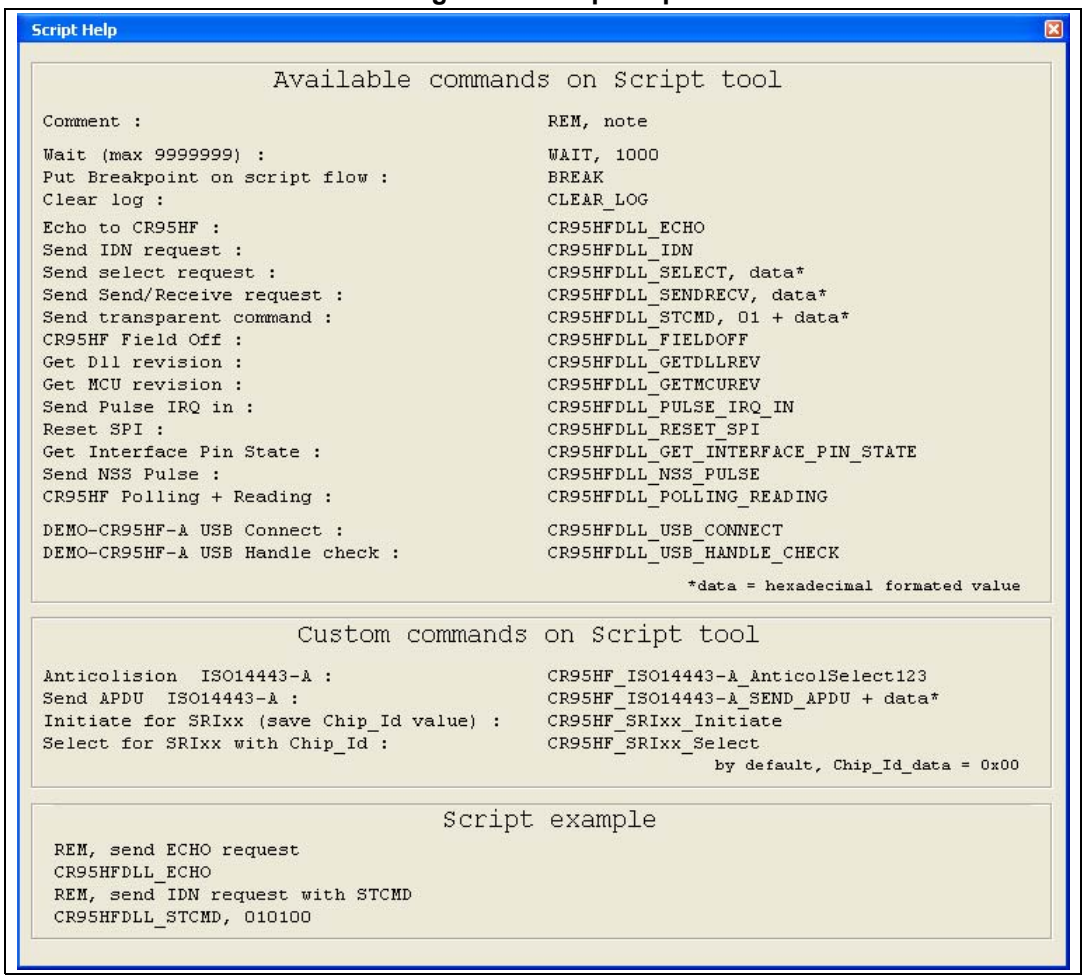
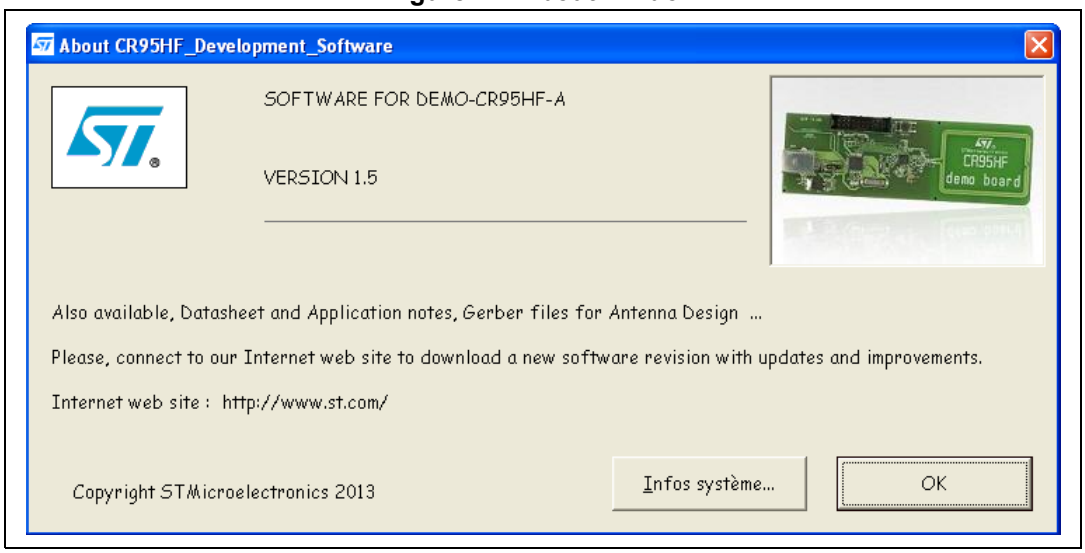


Figure 47. About window



2.10 Log window

The log is displayed at the bottom of each window. It contains all the requests sent to the DEMO-CR95HF-A 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 DEMO-CR95HF-A: 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 2.6: ISO14443-A menu*) and can be directly copied in a script file.

As an example, the log contains the information shown in *Figure 48* when an Idle command is sent to the board. In this example:

'CR95HFDll_STCmd 01 070E092200380018002060606 4743FFF' means that:

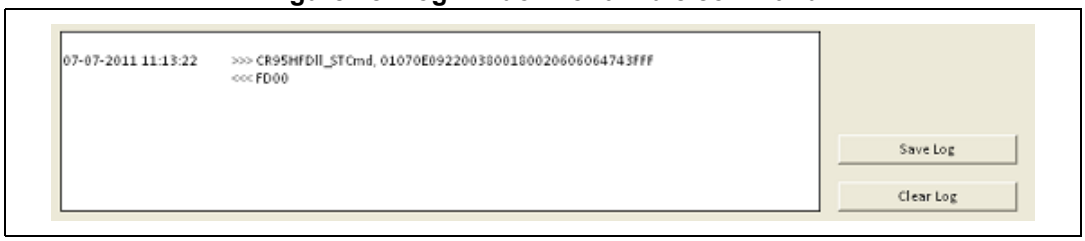
– The CR95HFDll_STCmd request has been sent to the DEMO-CR95HF-A.

– '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 DEMO-CR95HF-A board.

Figure 48. 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 2.6: ISO14443-A menu* and *Section 2.7: ISO18092 menu*. Extended the list of *Section 2.8.1: DEMO-CR95HF-A toolbox*. Added *Section 2.8.3: Auto detection tool*. Updated several software figures (*Figure 14*, *Figure 18* to *Figure 23*, *Figure 25* to *Figure 29* ...) Added *Figure 33: Example of ISO14443-B user interface*.

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