UM0853
User manual

M24LRxx application software user guide

1 Introduction

The purpose of this user manual is to teach how to use the M24LRxx tool kit with the *M24LRxx_Application_Software*. It describes the *M24LRxx_Application_Software* interface and its menus, and shows how to send commands to M24LRxx tags.

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2 Tool kit descriptions

2.1 M24LRxx development kit

Ordering information: **DEVKIT-M24LR-A**

The development kit contains:

- A middle-range RF reader (ISO 15693, RF 13.56 MHz) interfaced via the USB bus and an external power supply to have a greater read range. *Figure 1* shows the RF reader.
- An external antenna, shown in *Figure 2*.
- A serial EEPROM USB reader, shown in *Figure 3*: it is an I²C bus reader (interfaced via the USB bus).
- An I^2C bus cable to connect the serial EEPROM USB reader to the I^2C bus of the reference antenna. *Figure 4* shows the cable to use.
- M24LR64-R reference antennas:
  - ANT1-M24LR-A shown in *Figure 5*:
    RF antenna size: 75 mm × 45 mm (2.9 in × 1.77 in)
  - ANT2-M24LR-A shown in *Figure 6*:
    RF antenna size: 20 mm × 40 mm (0.79 in × 1.57 in)
- M24LRxx samples in SO8 package (see *Figure 7*)

Figure 1. RF reader (ISO 15693, RF 13.56 MHz)

Figure 2. External antenna

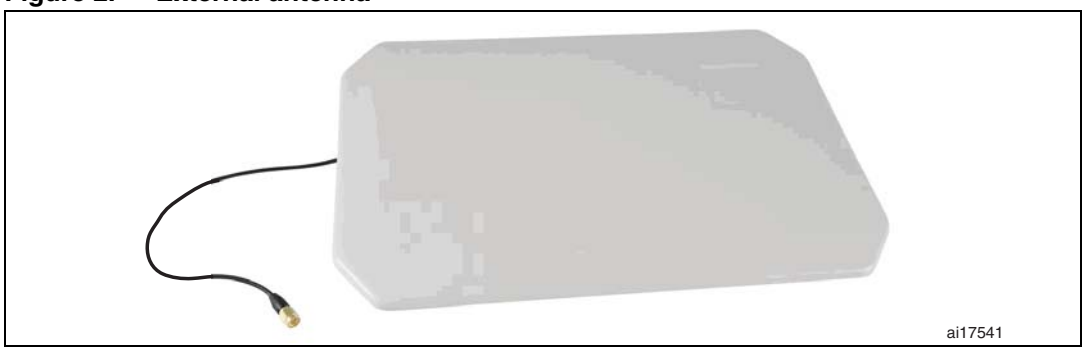


Figure 3. Serial EEPROM USB reader

Figure 4. I²C bus cable

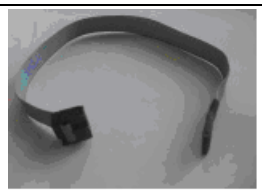


Figure 5. ANT1-M24LR-A reference antenna

Figure 6. ANT2-M24LR-A reference antenna

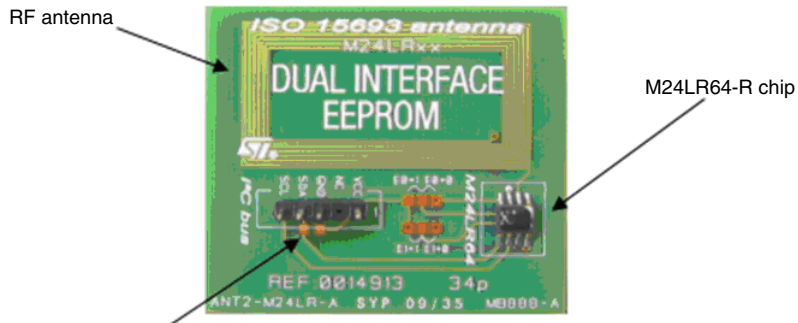
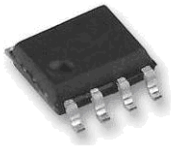


Figure 7. M24LR64-R in SO8 package



2.2 M24LR64-R demonstration kit

Ordering information: **DEMOKIT-M24LR-A**

The demonstration kit contains:

- A middle-range RF reader (ISO 15693, RF 13.56 MHz) interfaced via the USB bus, shown in *Figure 8*
- An M24LR64-R reference antenna: PRIM2-M24LR-A shown in *Figure 9*
  RF antenna size: 20 mm × 40 mm (0.79 in x 1.57 in)
- Optional: STM32-PRIMER2 (to be ordered separately) shown in *Figure 10*

Figure 8. RF reader

Figure 9. PRIM2-M24LR-A reference antenna

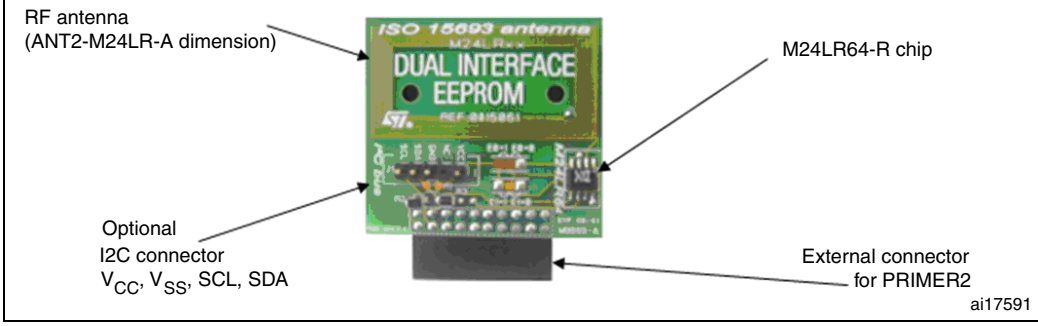


Figure 10. STM32-PRIMER2

1. Not included in the kit, to be ordered separately.

2.3 M24LRxx starter kit

Ordering information: STARTKIT-M24LR-A

The starter kit contains:

- A short-range RF reader (ISO 15693, RF 13.56 MHz), interfaced via the USB bus (including the external I²C bus cable + connector) illustrated in *Figure 11*
- M24LR64-R reference antennas:
  - ANT1-M24LR-A shown in *Figure 12*: RF antenna size: 75 mm × 45 mm (2.9 in × 1.77 in)
  - ANT2-M24LR-A shown in *Figure 13*: RF antenna size: 20 mm × 40 mm (0.79 in × 1.57 in)
- M24LR64-R samples in SO8 package (see *Figure 7*)

Figure 11. I²C & RF reader

Figure 12. ANT1-M24LR-A reference antenna

Figure 13. ANT2-M24LR-A reference antenna

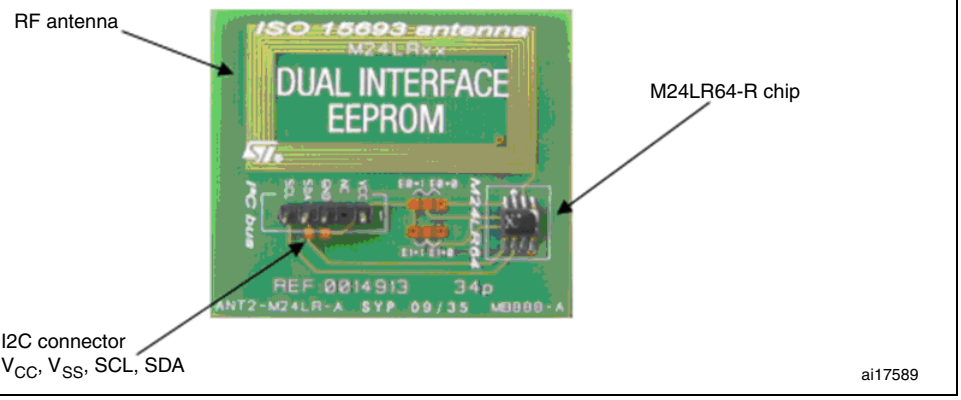
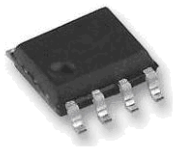


Figure 14. M24LR64-R in SO8 package



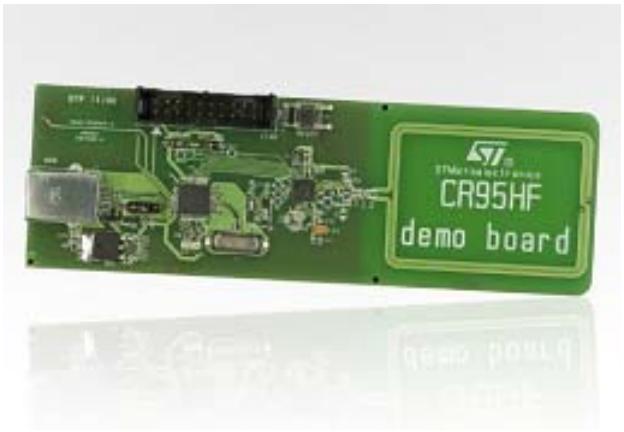
2.4 M24LRxx demonstration kit

Ordering information: DEMO-CR95HF-A.

The DEMO-CR95HF-A is a demonstration kit used to evaluate the performances of ST CR95HF 13.56 MHz multiprotocol contactless transceiver.

It is powered through the USB bus and no external power supply is required. It includes a CR95HF contactless transceiver, a 47 x 34 mm 13.56 MHz inductive etched antenna and its associated tuning components.

Figure 15. DEMO-CR95HF-A demonstration kit



3 How to control the RF and I²C channels from your screen

3.1 Starting *M24LRxx_Application_Software*

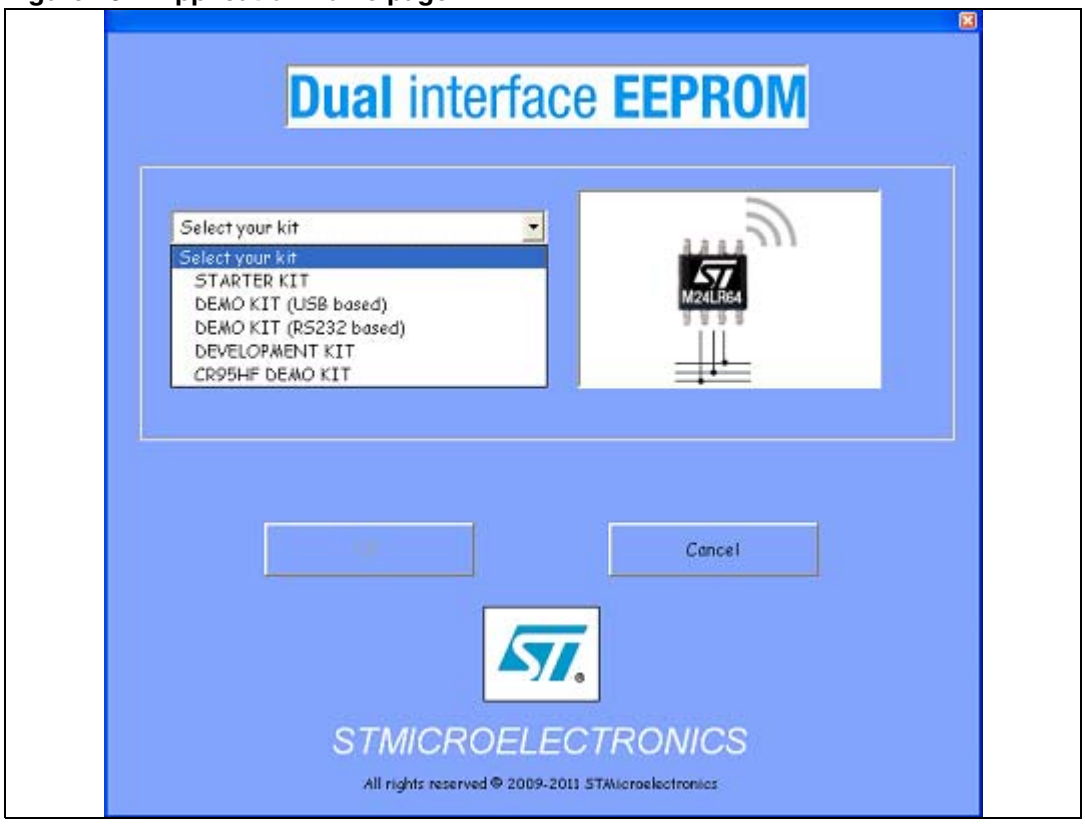
Before starting, you must have:

- previously installed all the drivers. For how to install the required drivers, please refer to UM0863: “M24LRxx tool driver install guide”
- connected the reader’s USB cable

3.1.1 Choosing your tool kit

On the PC desktop, double click on the *M24LRxx_Application_Software* icon. On launching the software, you will be prompted to select the kit you wish to use as shown in *Figure 16*.

Figure 16. Application home page



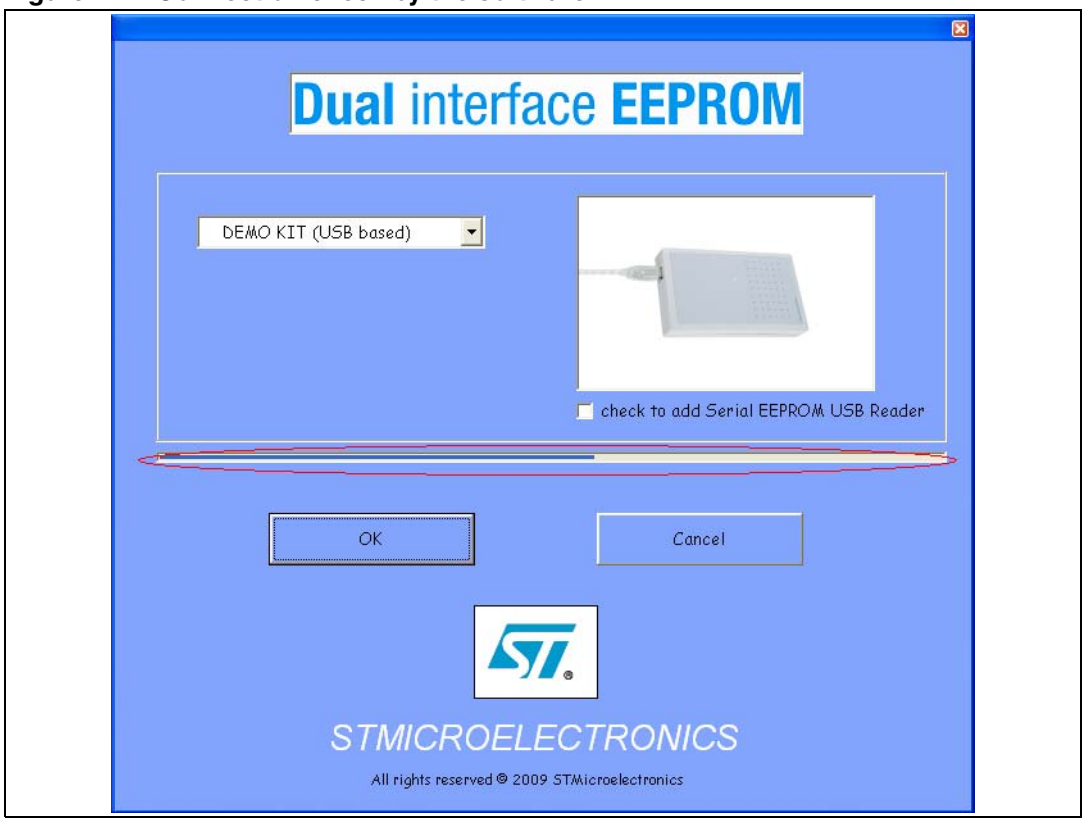
Select your kit from the list below and press the OK button:

- STARTER KIT
- DEMO KIT (USB based)
- DEMO KIT (based on the RS232 port - old version)
- DEVELOPMENT KIT
- DEMO-CR95HF-A

If you select DEMO KIT (USB based), you can also play with the SERIAL EEPROM USB reader by checking the box to add the Serial EEPROM USB reader.

Once the kit has been selected, the software checks that the selected readers are well connected. A progress bar appears during the check as shown in *Figure 17*.

Figure 17. Connection check by the software



If a problem occurs, a window appears to indicate what the problem is:

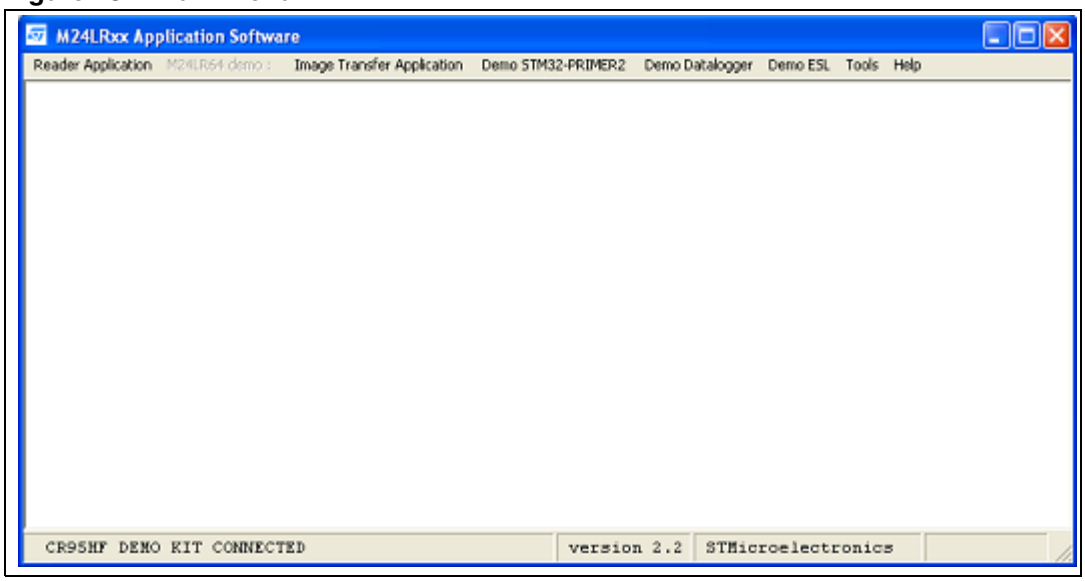
- If the development kit is used, the problem could be:
  - medium-range RF reader not plugged in the USB port
  - medium-range RF reader driver not installed
  - I²C bus reader not plugged in the USB port
  - I²C bus reader driver not installed
- If the demo kit is used, the problem could be:
  - medium-range RF reader not plugged in the USB port
  - medium-range RF reader driver not installed
- If the starter kit is used, the problem could be:
  - Short-range RF reader not plugged in the USB port
  - Short-range RF reader driver not installed

3.1.2 Main menu

If all the drivers have been installed correctly, and the selected readers have been plugged, the window shown in *Figure 18* appears.

The connection status of the readers as well as the version of the software are displayed at the bottom of the window.

Figure 18. Main menu

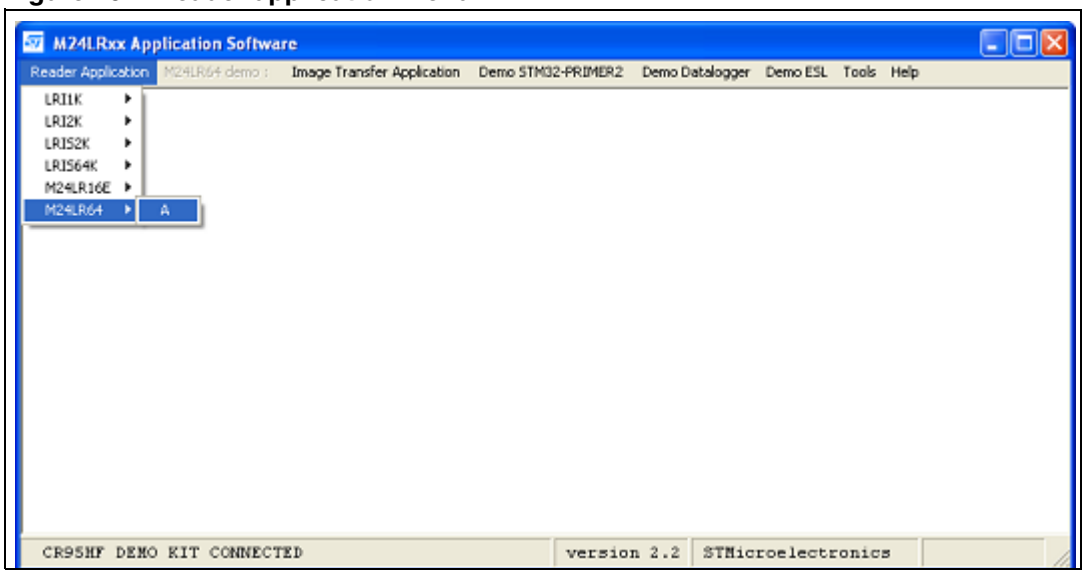


You can use the menu at the top of the window to select several applications:

Reader Application menu

Click **Reader Application** and select a product from the list (see *Figure 19*) to manage all the I²C and RF commands of LRxxx (RFID) and M24LRXX (Dual Interface EEPROM) products.

Figure 19. Reader application menu

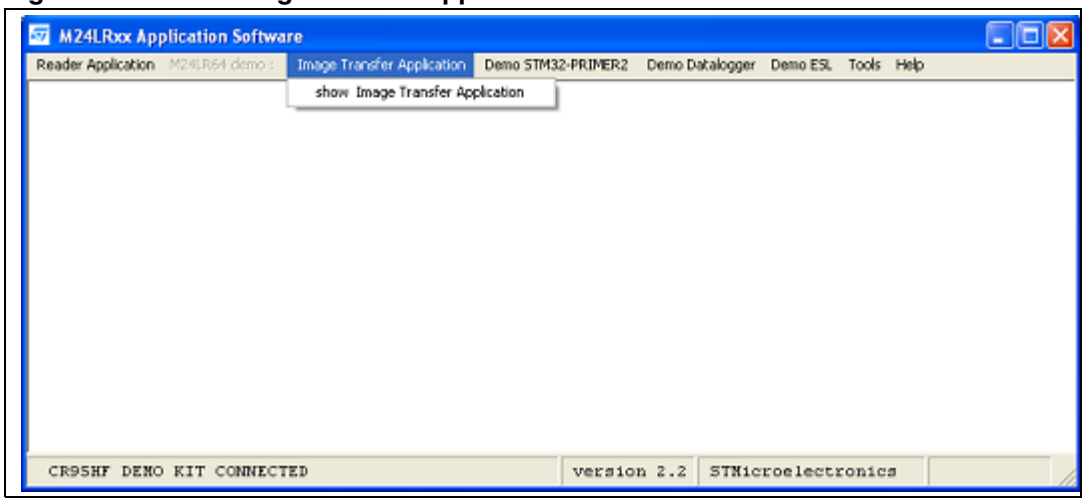


3.1.3 Image Transfer Application menu

Figure 20 shows the Image Transfer Application menu.

Select **show Image Transfer application** to upload or download a picture to or from the M24LR64-R by RF or I²C.

Figure 20. show Image Transfer application



3.1.4 Demo STM32-PRIMER2 menu

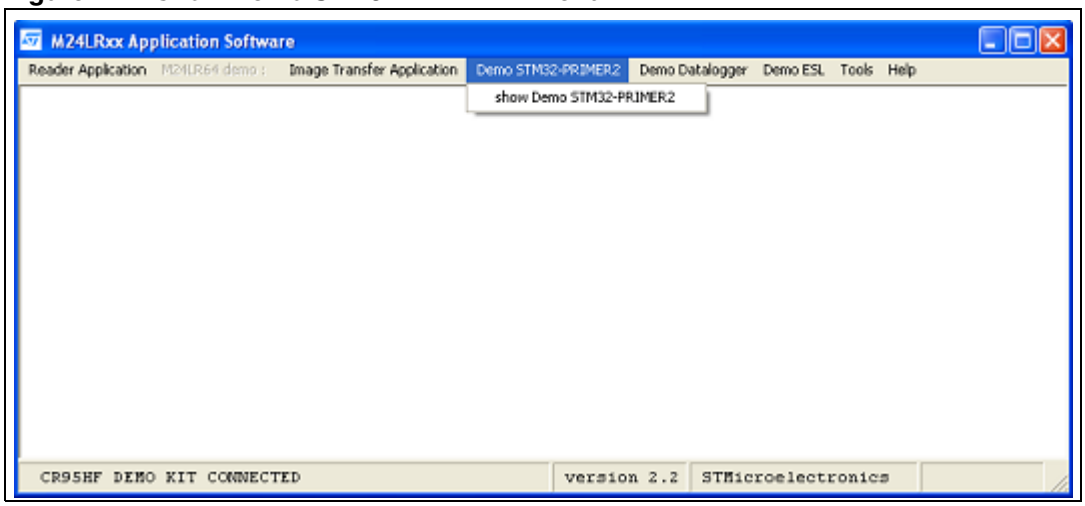
Figure 21 shows the **Demo STM32-PRIMER2 menu**.

Select **show Demo STM32-PRIMER2** to upload or download a picture to or from the M24LR64-R by RF.

Pictures are formatted to be usable by the “Dual EE” firmware of your STM32-PRIMER2 demo.

Refer to UM0850 for details on how to use Dual EE.

Figure 21. show Demo STM32-PRIMER2 menu

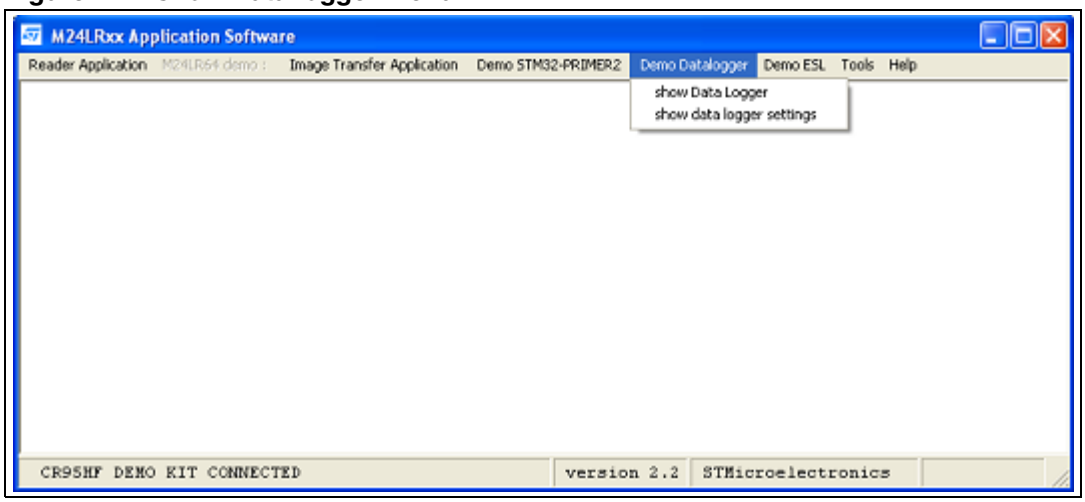


3.1.5 Demo datalogger menu

Figure 22 shows the **Data Logger menu**.

Select **show Data Logger** to launch the data logger demonstration. This application performs temperature acquisition and displays a graphical representation of the data. Refer to *Section 6: Datalogger demonstration* for a description of this demonstration application.

Figure 22. show Data logger menu



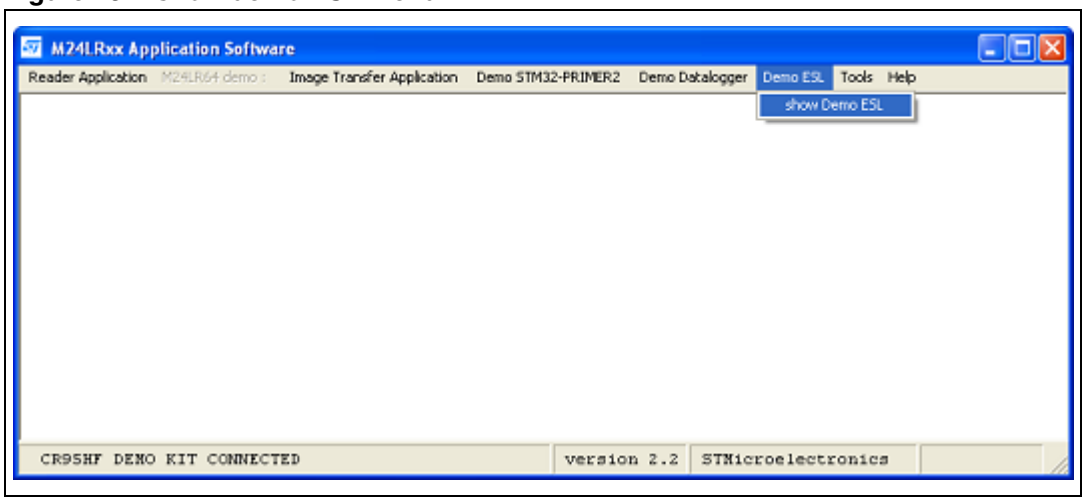
3.1.6 Demo ESL menu

Figure 23 shows the ESL Demo menu.

Select **Show ESL demo** to configure your M24LRxx as an ESL (electronic shelf label) and display the ESL data of your device.

Refer to *Section 7: ESL demonstration* for a detailed description of this demonstration application.

Figure 23. show demo ESL menu

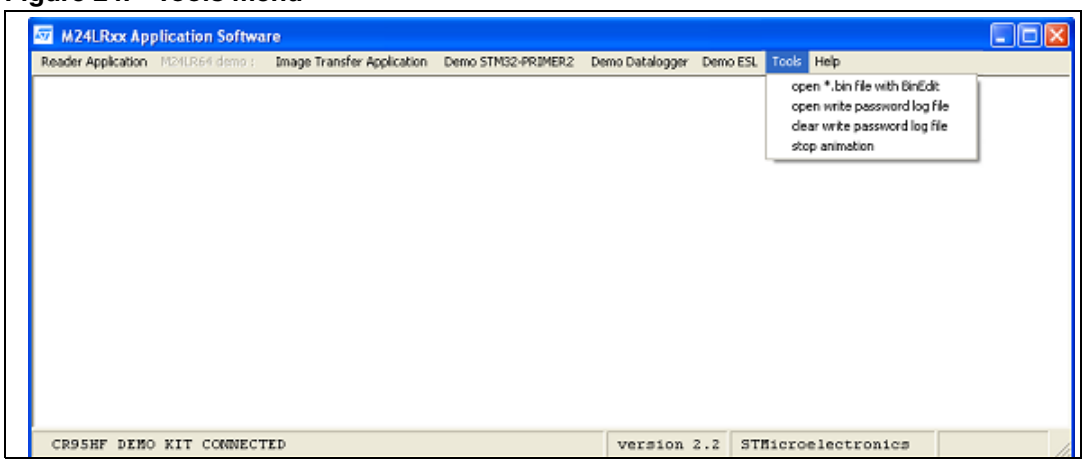


3.1.7 Tools menu

Figure 24 shows the Tools menu.

Select **stop animation** to stop the animation in the reader application interface.

Figure 24. Tools menu

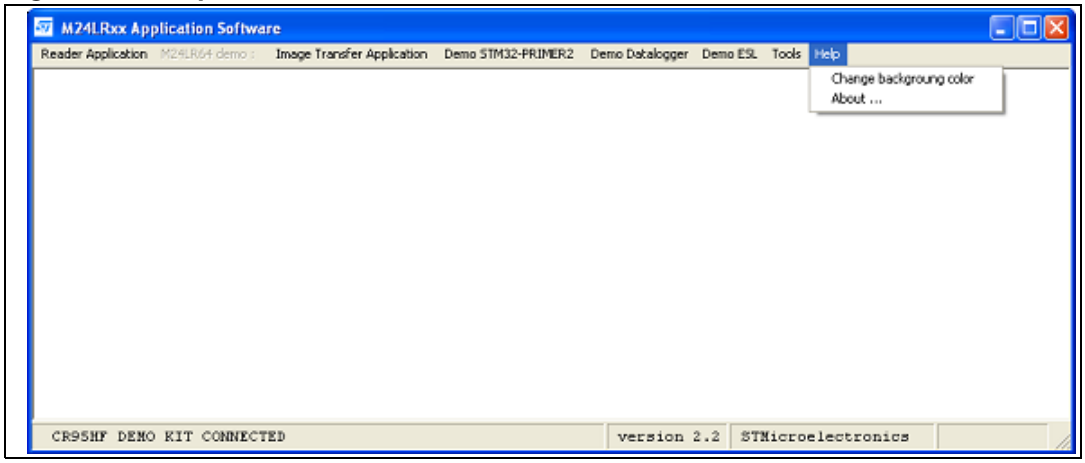


3.1.8 Help menu

Figure 25 shows the Help menu:

- **Open *.bin file with BinEdit** gives you access to a freeware for reading binary files (*.bin format).
- **Change background color** allows you to change the color of the main window.
- **About** provides information about the software.

Figure 25. Help menu



3.2 Reader application

Select **Reader Application** in the main menu and choose a product from the list:

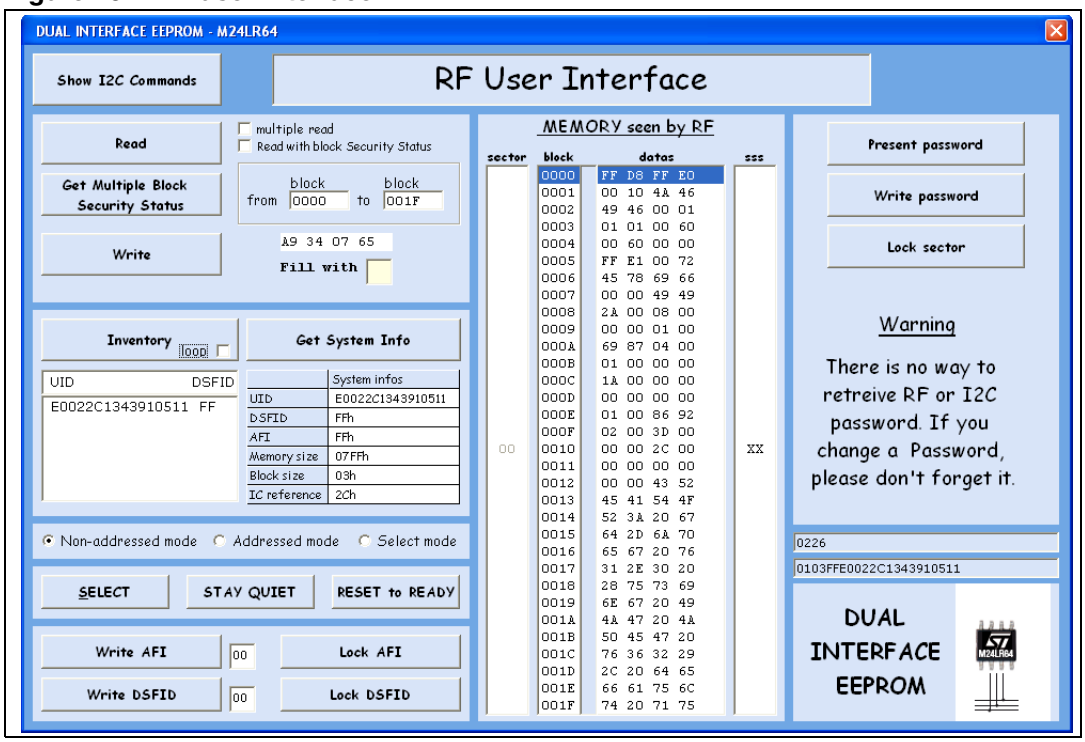
- LRIxx for ISO15693 RFID products
- M24LRxx for Dual Interface EEPROM products.

The following section describes the **Reader Application** menu for an M24LR64-R device.

3.2.1 RF commands

The *RF user interface* opens (see *Figure 26*). Using this interface you can send any command to the LRIxxx or M24LRxx tag present in the RF reader field. Refer to the datasheet for a detailed description of the RF commands.

Figure 26. RF user interface



The **Show I2C Commands** button is used to switch from the RF user interface to the I²C user interface.

3.2.2 Inventory command

The **Inventory** button launches an Inventory command and thus detects the tags present in the RF field. The command is associated with an anticollision algorithm to detect each tag individually (see *Figure 27* and *Figure 28*).

The **Loop** option is used to loop on inventory commands. It is selected (or deselected) by checking (or unchecking) the box next to **Loop**.

Figure 27. Inventory button

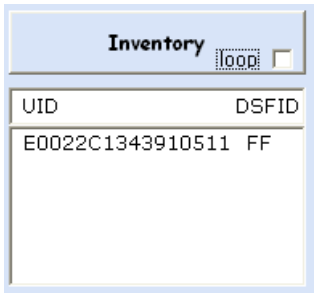
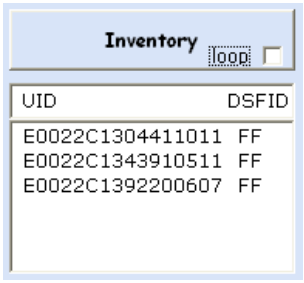
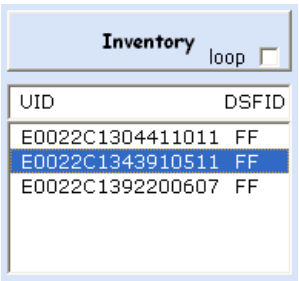


Figure 28. Three tags detected



You can select a tag in the list of detected UIDs by clicking on the desired UID in the list as shown in *Figure 29*. The selected UID will then be used in all RF requests sent in Addressed mode.

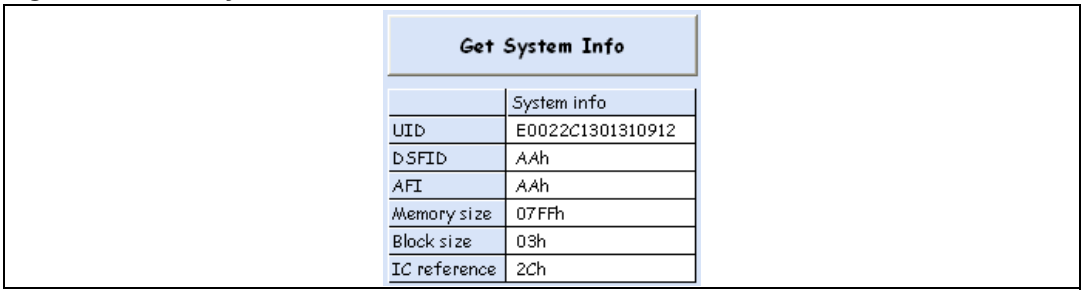
Figure 29. Specific UID selected



3.2.3 Get System Info command

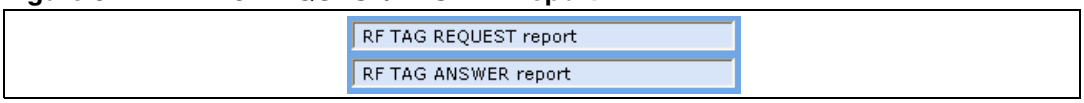
The **Get System Info** button launches a Get System Info command, thus filling the **System info** fields.

Figure 30. Get System Info button



3.2.4 Viewing RF requests and answers

Figure 31. RF TAG REQUEST/ANSWER report

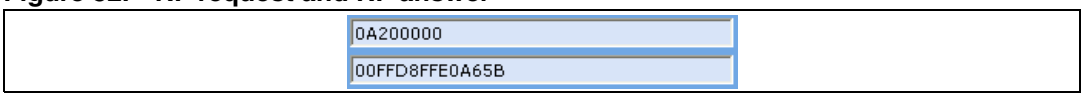


The **RF TAG REQUEST report** button shows the RF request sent by the RF reader to the tag.

The **RF TAG ANSWER report** button shows the RF answer from the tag, detected by the RF reader.

Figure 32 shows an example of a reader's RF request and the corresponding answer from the tag.

Figure 32. RF request and RF answer



The RF read request is at address 0000. The RF answer is the read data: FF D8 FF E0.

3.2.5 Selecting the RF mode

The RF ISO 15693 protocol allows the user to communicate in RF in three different modes: the Non-addressed mode, the Addressed mode and the Select mode. For further details, please refer to the M24LRxx datasheet.

The Non-addressed, Addressed or Select mode can be selected by clicking on the desired mode as shown in *Figure 33*, *Figure 34* or *Figure 35*.

Non-addressed mode

Selecting the Non-addressed mode clears the bits 5 and 6 in the Request_flags of the RF request (bit 5 = 0, bit 6 = 0).

The request is executed by any M24LRxx device (please refer to the M24LRxx datasheet for details).

Figure 33. Selecting the Non-addressed mode

Addressed mode

Selecting the Addressed mode clears bit 5 and sets bit 6 in the Request_flags of the RF request (bit 5 = 0, bit 6 = 1).

The request is addressed. The UID field is present (please refer to the M24LRxx datasheet for details).

After an Inventory command (see *Section 3.2.2: Inventory command*), you will be able to click on an UID to select a specific tag. The desired UID will be sent with the request if the Addressed mode is chosen.

If no specific UID tag is selected, the device sends “00 00 00 00 00 00 00 00” instead of the UID value.

Figure 34. Selecting the Addressed mode

Select mode

Selecting the Select mode sets bit 5 and clears bit 6 in the Request_flags of the RF request (bit 5 = 1 and bit 6 = 0).

The request is executed only by the M24LRxx device in the Select State (please refer to the M24LRxx datasheet for details).

To select a tag, refer to the *SELECT* paragraph below, and to the M24LRxx datasheet (Select paragraph).

Figure 35. Selecting the Select mode

3.2.6 Managing M24LRxx states

The M24LRxx can be in different states: Power-off, Ready, Quiet and Selected (refer to the M24LRxx datasheet for details).

The interface shown in *Figure 36* is used to send three types of RF request to place the M24LRxx in one out of three specific states: Selected, Quiet and Ready.

Figure 36. Device state management interface

SELECT

The **SELECT** button is used to send a Select RF request with the UID of a specific tag (*Section 3.2.2: Inventory command*) (refer to the M24LRxx datasheet for details).

If no tag was selected after the Inventory request, the device sends “00 00 00 00 00 00 00 00” instead of the UID value.

STAY QUIET

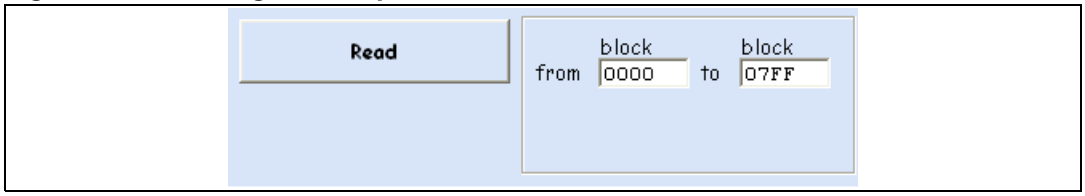
The **STAY QUIET** button is used to send a Stay Quiet RF request (refer to the M24LRxx datasheet for details).

RESET TO READY

The **RESET TO READY** button is used to send a Reset to Ready RF request (refer to the M24LRxx datasheet for details).

3.2.7 Read command

Figure 37. Initiating a read operation

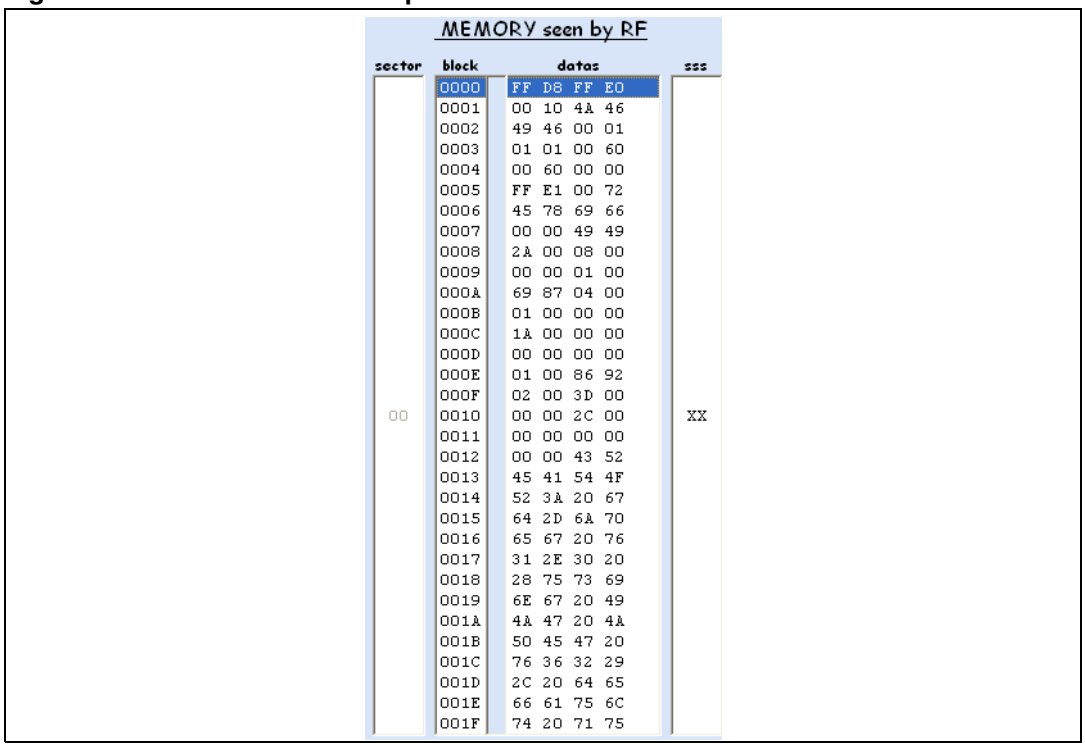


By pressing the Read button, you launch RF requests to read the contents of the M24LRxx EEPROM from the block address specified in the **from** field to the block address specified in the **to** field.

The result of the read operation is displayed in the **MEMORY seen by RF** area (see *Figure 38* to *Figure 41*).

From **0000** to **07FF** reads all M24LRxx EEPROM contents. *Figure 38* and *Figure 39* only show the results for sector 0 and sector 3F, respectively.

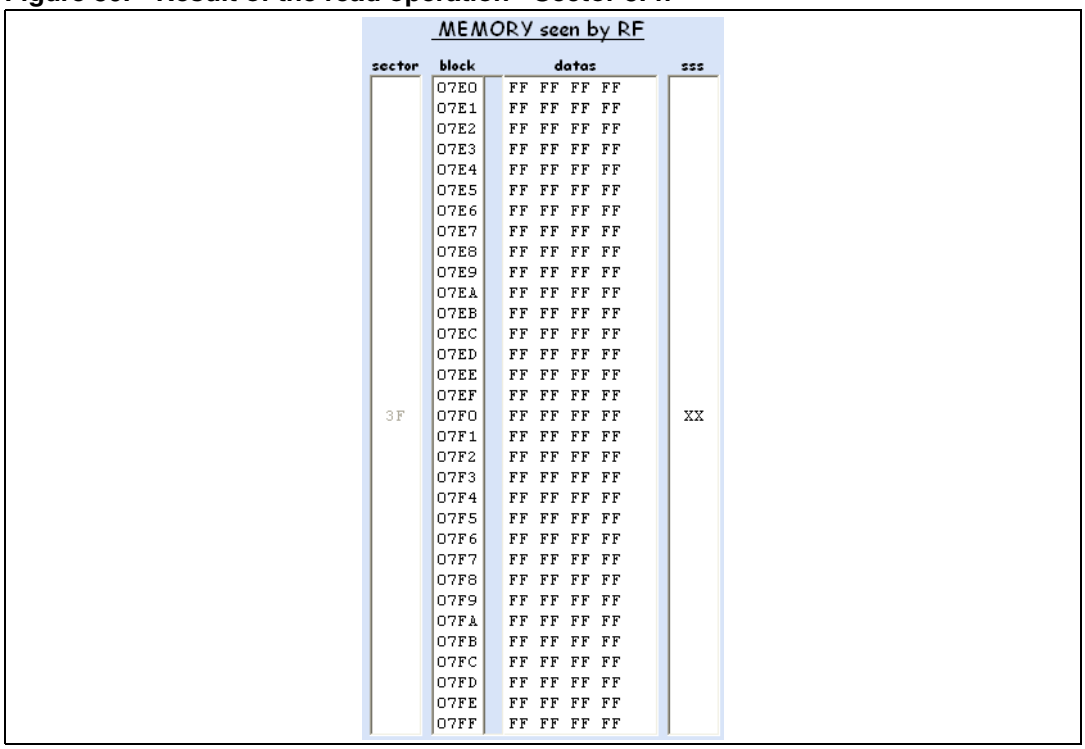
Figure 38. Result of the read operation - Sector 00h



MEMORY seen by RF

sector	block	datas	sss
	0000	FF D8 FF E0	
	0001	00 10 4A 46	
	0002	49 46 00 01	
	0003	01 01 00 60	
	0004	00 60 00 00	
	0005	FF E1 00 72	
	0006	45 78 69 66	
	0007	00 00 49 49	
	0008	2A 00 08 00	
	0009	00 00 01 00	
	000A	69 87 04 00	
	000B	01 00 00 00	
	000C	1A 00 00 00	
	000D	00 00 00 00	
	000E	01 00 86 92	
	000F	02 00 3D 00	
00	0010	00 00 2C 00	XX
	0011	00 00 00 00	
	0012	00 00 43 52	
	0013	45 41 54 4F	
	0014	52 3A 20 67	
	0015	64 2D 6A 70	
	0016	65 67 20 76	
	0017	31 2E 30 20	
	0018	28 75 73 69	
	0019	6E 67 20 49	
	001A	4A 47 20 4A	
	001B	50 45 47 20	
	001C	76 36 32 29	
	001D	2C 20 64 65	
	001E	66 61 75 6C	
	001F	74 20 71 75	

Figure 39. Result of the read operation - Sector 3Fh



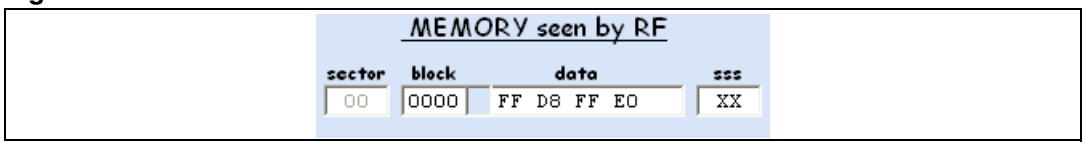
MEMORY seen by RF

sector	block	datas	sss
	07E0	FF FF FF FF	
	07E1	FF FF FF FF	
	07E2	FF FF FF FF	
	07E3	FF FF FF FF	
	07E4	FF FF FF FF	
	07E5	FF FF FF FF	
	07E6	FF FF FF FF	
	07E7	FF FF FF FF	
	07E8	FF FF FF FF	
	07E9	FF FF FF FF	
	07EA	FF FF FF FF	
	07EB	FF FF FF FF	
	07EC	FF FF FF FF	
	07ED	FF FF FF FF	
	07EE	FF FF FF FF	
	07EF	FF FF FF FF	
3F	07F0	FF FF FF FF	XX
	07F1	FF FF FF FF	
	07F2	FF FF FF FF	
	07F3	FF FF FF FF	
	07F4	FF FF FF FF	
	07F5	FF FF FF FF	
	07F6	FF FF FF FF	
	07F7	FF FF FF FF	
	07F8	FF FF FF FF	
	07F9	FF FF FF FF	
	07FA	FF FF FF FF	
	07FB	FF FF FF FF	
	07FC	FF FF FF FF	
	07FD	FF FF FF FF	
	07FE	FF FF FF FF	
	07FF	FF FF FF FF	

Use the arrows on the keyboard to change the sector or block to be read.

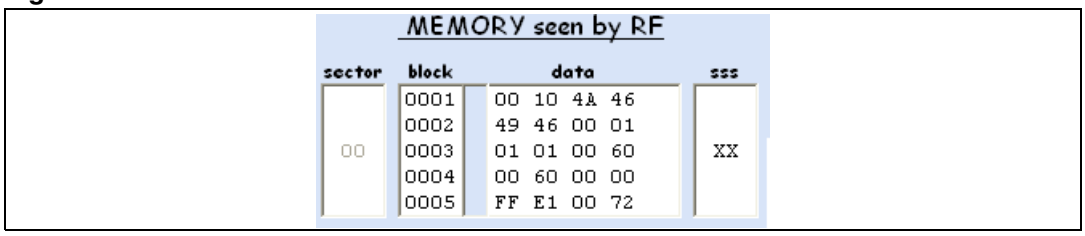
From **0000** to **0000** reads block 0 in sector 0 as shown in *Figure 40*.

Figure 40. Sector 0 block 0



From **0001** to **0005** reads the blocks 1, 2, 3, 4, 5 in sector 0 as shown in *Figure 41*.

Figure 41. Sector 0 blocks 1 to 5



How to read the memory area with the RF Interface:

- The first column (**sector**) indicates the sector read.
- The second column (**block**) indicates the address of the block read.
- The third column (**data**) shows the contents of the M24LRxx at the specified addresses.
- The fourth column (**sss**) gives the sector security status.

Example: in *Figure 41* above, the data **49 46 00 01** means:

49 (49h Hex) is the first piece of data read in block number 0002 (sector 0)

46 (46h Hex) is the second piece of data read in block number 0002 (sector 0)

00 (00h Hex) is the third piece of data read in block number 0002 (sector 0)

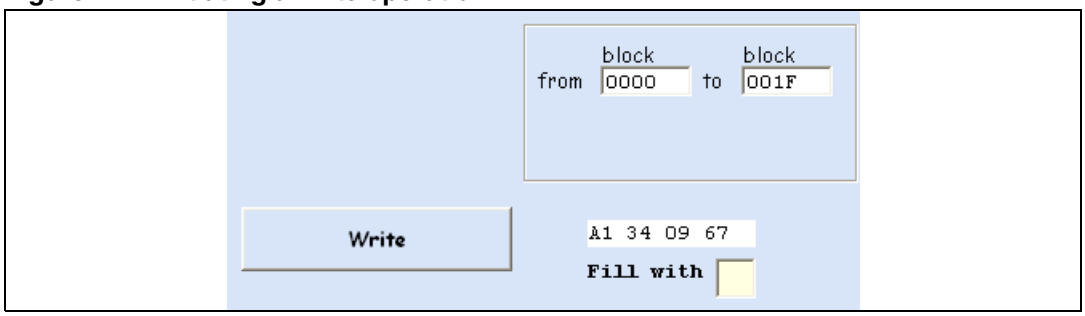
01 (01h Hex) is the fourth piece of data read in block number 0002 (sector 0)

3.2.8 Write command

The **Write** button launches RF requests to write data to the M24LRxx EEPROM from the block address specified in the **from** field to the block address entered in the **to** field.

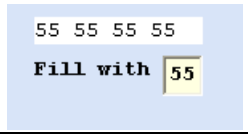
In *Figure 42*, the Write command fills the blocks 0000h to 001Fh with “A1 34 09 67”.

Figure 42. Initiating a write operation



You can choose to write the same byte four times by changing the value in the **Fill with** field. In the example below, the byte 55 is to be written four times.

Figure 43. Fill with 55



Get Multiple Block Security Status command

The **Get Multiple Block Security Status** button launches RF requests to read the security statuses of the blocks that correspond to the address range specified in the **from** and **to** fields.

Figure 44. Get Multiple Block Security Status button

Addresses are managed in the same way as for read operations. In *Figure 45* the security status byte is shown for the blocks with addresses ranging between 0x00E0 and 0x00FF (sector 07).

Figure 45. Security status byte for sector 07

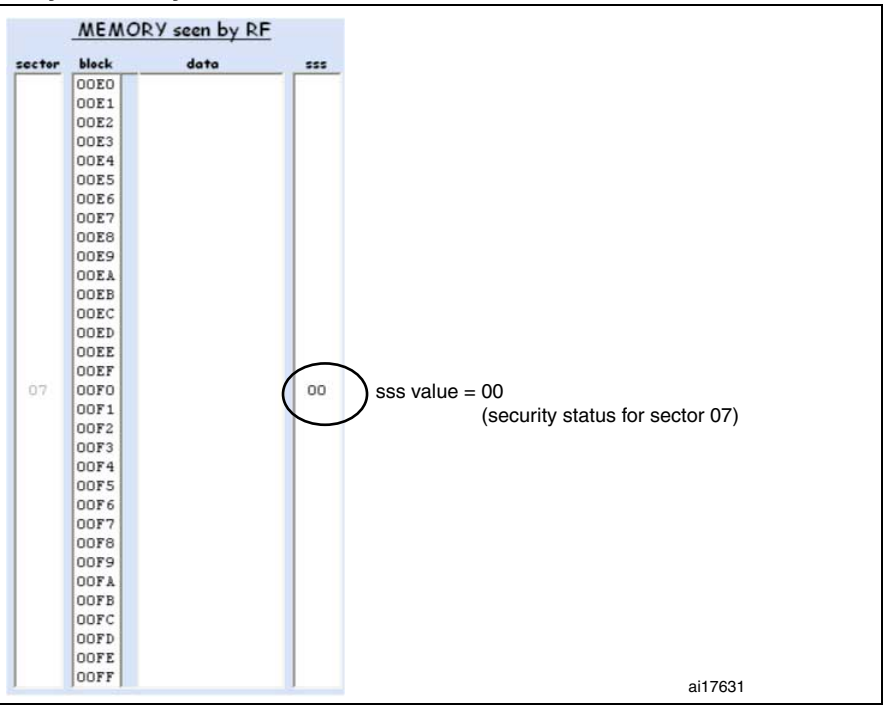
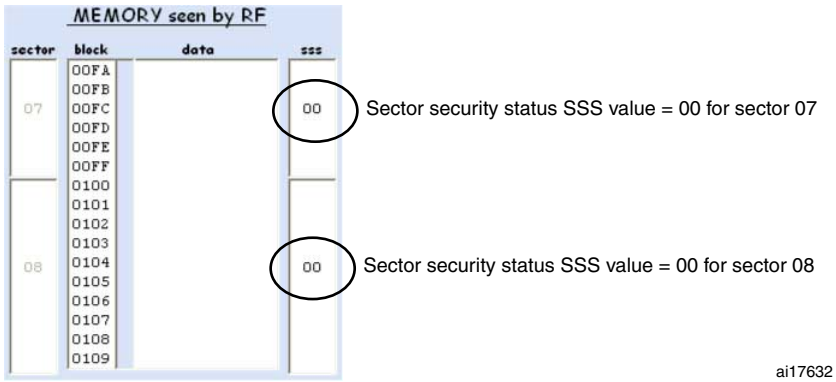


Figure 46 shows the security status bytes for the blocks located at addresses 00FAh to 0109h (sector 07 & sector 08).

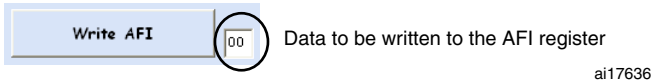
Figure 46. Security status bytes for sectors 07 and 08



3.2.9 Write AFI command

The **Write AFI** button launches a Write AFI command. The data in the dedicated field next to the **Write AFI** button are written to the AFI register.

Figure 47. Write AFI command



3.2.10 Write DSFID command

The **Write DSFID** button launches a Write DSFID command. The data in the dedicated field next to the **Write DSFID** button are written to the DSFID register.

Figure 48. Write DSFID command

3.2.11 Lock AFI command

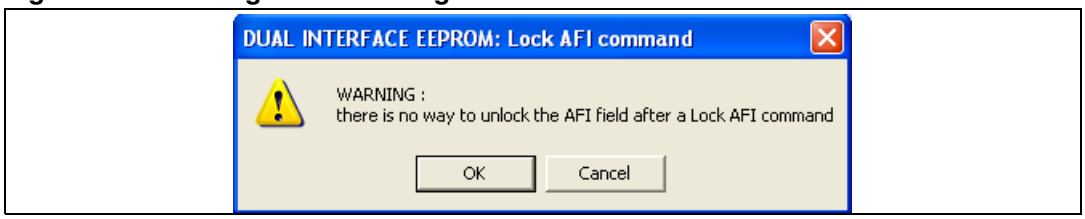
The **Lock AFI** button launches a Lock AFI command. The execution of this command locks the AFI field *permanently*.

Figure 49. Lock AFI command

Caution: Once the AFI field has been locked, it cannot be unlocked.

For this reason, a warning (shown in *Figure 50*) is displayed before locking the AFI. To abort the Lock AFI command, click on **Cancel**. To confirm the command, click on **OK**.

Figure 50. Warning before locking the AFI field



3.2.12 Lock DSFID command

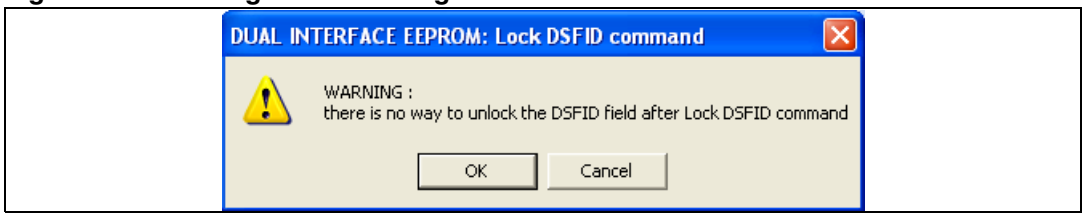
The **Lock DSFID** button launches a Lock DSFID command. When executed, this command locks the DSFID field permanently.

Figure 51. Lock DSFID command

Caution: Once the DSFID field has been locked, it cannot be unlocked.

This is the reason why a warning (shown in *Figure 52*) is displayed before locking the DSFID field. To abort the Lock DSFID command, click on **Cancel**. To confirm the command, click on **OK**.

Figure 52. Warning before locking the DSFID field



3.2.13 RF password management

The user interface displays a warning concerning password changes: you should be very careful when you change a password because there is no way of retrieving forgotten RF passwords. You have to remember the new passwords you enter. The sectors locked by a password can only be unlocked if you can provide the correct password. *Figure 53* shows the displayed warning.

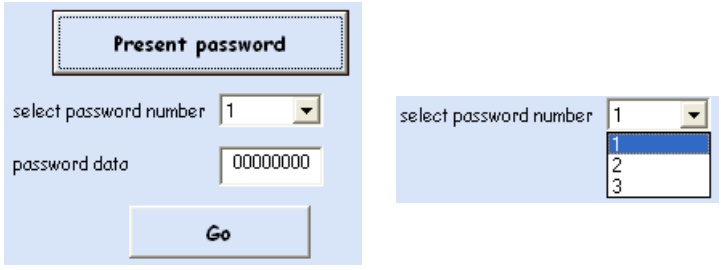
By default, the RF and I²C passwords are ‘00 00 00 00’.

Figure 53. Warning displayed on the user interface

Present-sector Password command

The **Present password** button issues a Present-sector Password command with the data filled in the **password data** field and the selected password number.

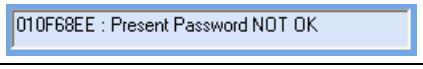
Figure 54. Present-sector Password command



The result of the Present-sector Password command appears in the RF answer field. *Figure 55* shows a successful command, and *Figure 56* shows an example where an error occurred.

Figure 55. Present-sector Password command successful

Figure 56. Present-sector Password command error



Write-sector Password command

The **Write Password** button issues a Write-sector Password command with the data filled in the **password data** field and the selected password number.

Figure 57. Write-sector Password command

When you press the **Write password** button, a warning pops up to prevent any unwanted password change. To abort the Write-sector Password command, click on **Cancel**. To confirm the command, click on **OK**.

Figure 58. Warning before changing the password

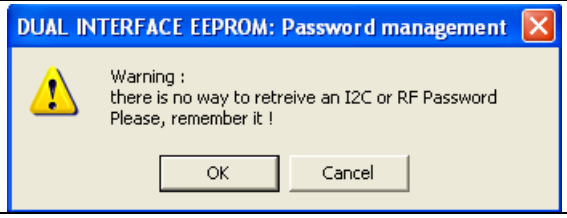
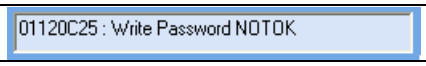


Figure 59. Write-sector Password command successful

Write Password HS

Figure 60. Write-sector Password command error



Lock-sector Password command

The **Lock sector** button issues a Lock-sector Password command with the data configured in the **select sector number**, **select password number** and **select lock config** fields.

Figure 61. Lock-sector Password command

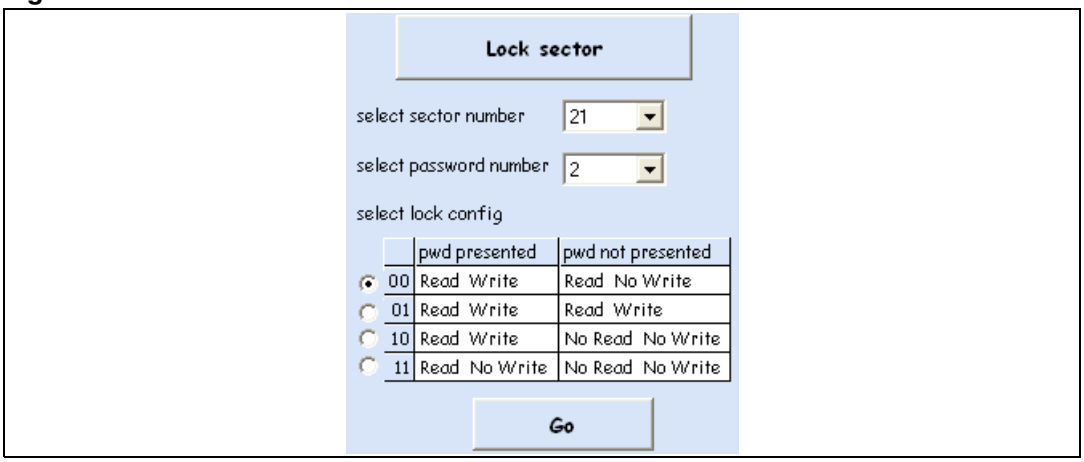


Figure 62. Lock-sector Password command successful

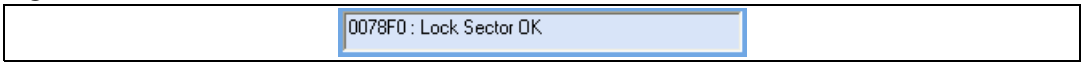
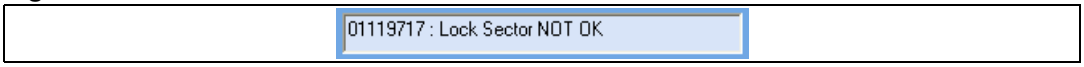


Figure 63. Lock-sector Password command error



3.2.14 Additional feature: energy harvesting commands

M24LRXXE devices, such as the M24LR16E-R, have the Energy Harvesting capability.

Clicking the **Display Energy Harvesting commands** button (see *Figure 64*) opens a new window which allows to manage Energy Harvesting (see *Figure 65*). Several RF commands are available:

- Click the **Read config byte** button to send a ReadCfg command to the M24LRXXE and display the value of the config byte.
- Click the **Write E.H. config** button to send a WriteEHCfg command to the M24LRXXE in order to change EH configuration (EH_MODE and EH config bits).
- Click the **Write D.O. config** button to send a WriteDOCfg command to the M24LRXXE and change Digital Output config.
- Click the **Check E.H. enable** button to send a CheckEHEn command to the M24LRXXE and display the value of this Control Register.
- Click the **Reset/Set EH** buttons to send a SetRstEHEn command to the M24LRXXE and deactivate/activate energy harvesting (when possible)

Refer to the datasheets for full details on energy harvesting commands.

Figure 64. Energy harvesting commands button

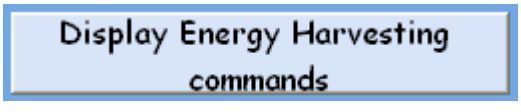
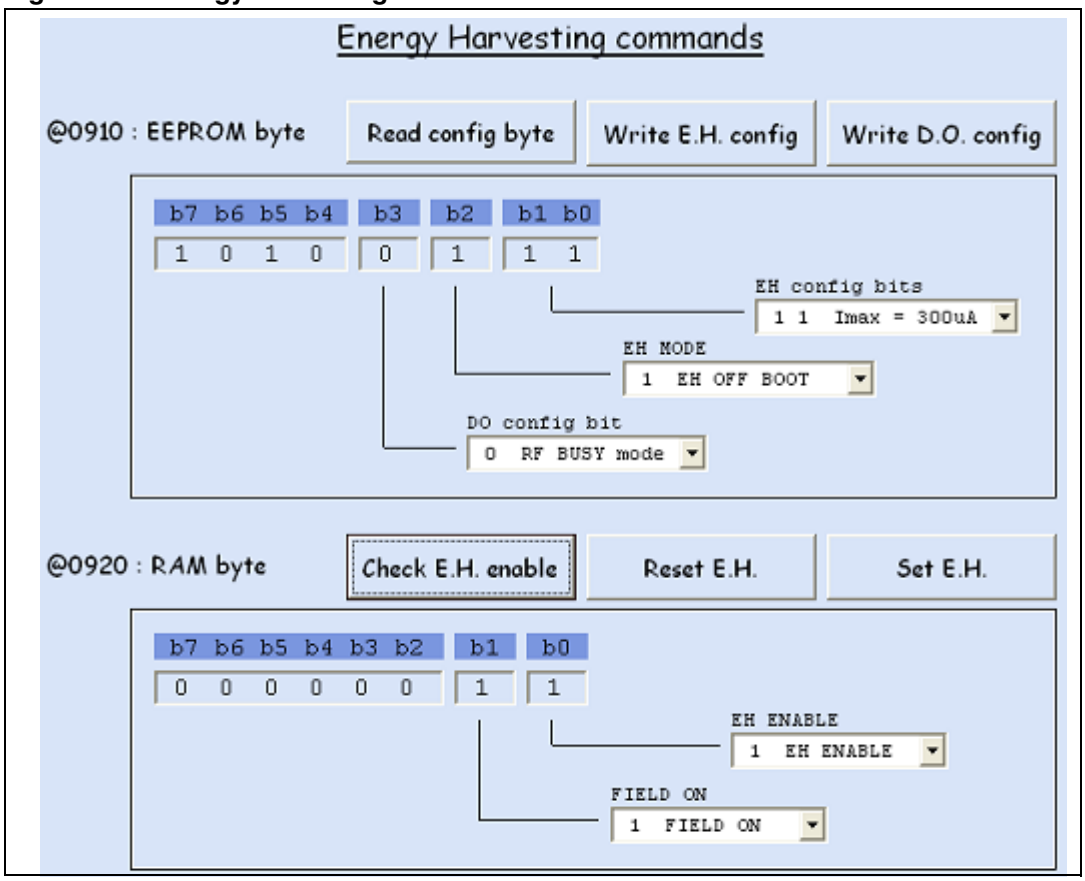


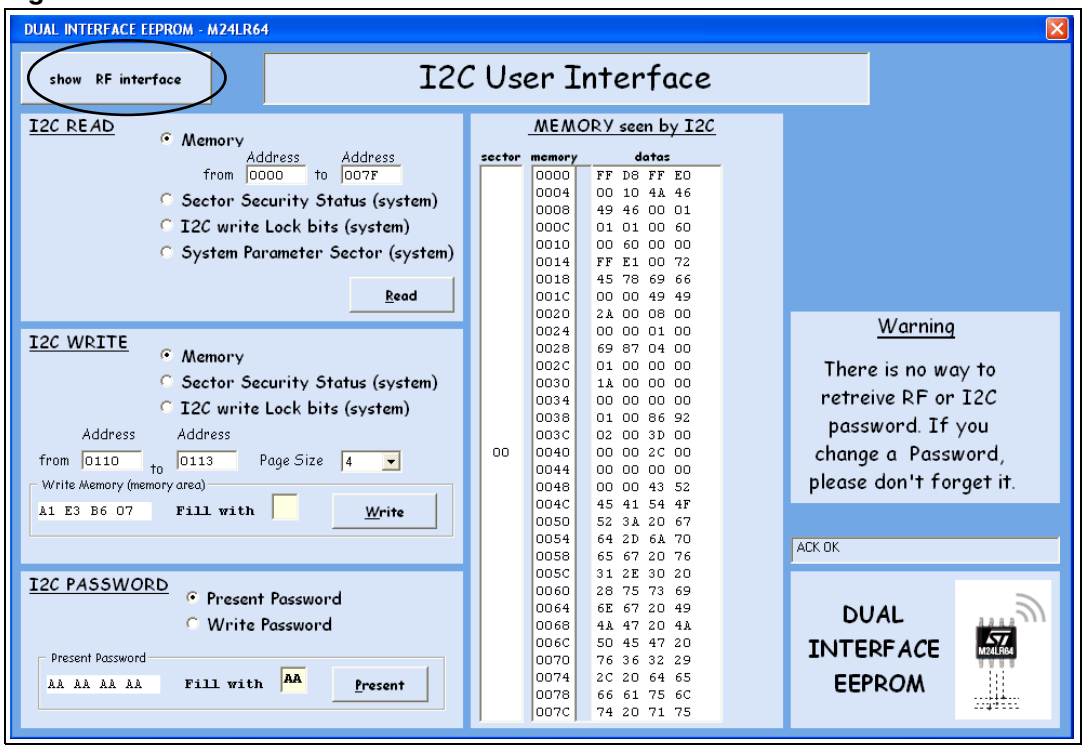
Figure 65. Energy harvesting command menu



3.3 I²C commands

You can use the I2C *User Interface window*, illustrated in *Figure 66*, to exchange data between a tag connected to the I2C reader and the M24LRxx.

Figure 66. I2C User Interface window



With the **Show RF interface** button (*Figure 67*) you can switch from the RF user interface to the I²C user interface.

Figure 67. Button to switch between the RF and I2C interfaces

3.3.1 I²C READ commands

The **Read** button issues read commands to the M24LRxx connected to the I2C reader. To do so, select the I2C READ area, and then press on the **Read** button.

Read command to the memory array

To read the memory array, select **Memory** from the list and specify the address range to be read. Then click on the **Read** button. Addresses are managed in the same way as for RF commands (see *Section 3.2.7: Read command*).

Figure 68 shows an example where the user decides to issue a Read Memory operation from address 0010h to address 003Fh.

Figure 68. Reading the memory array

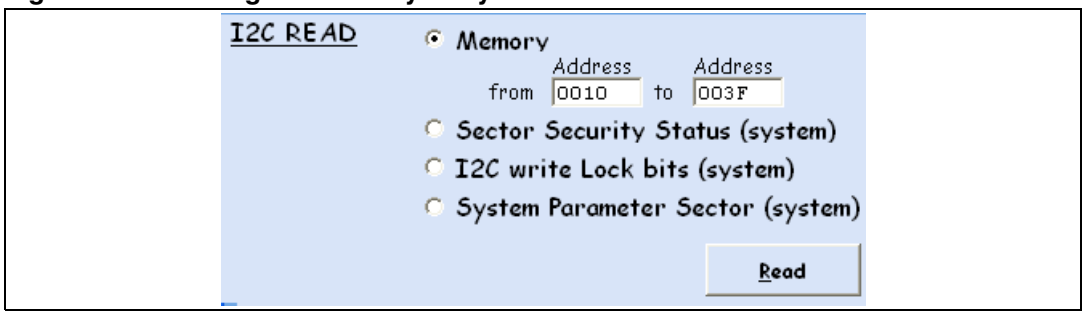


Figure 69. Result of a Read operation to the memory array

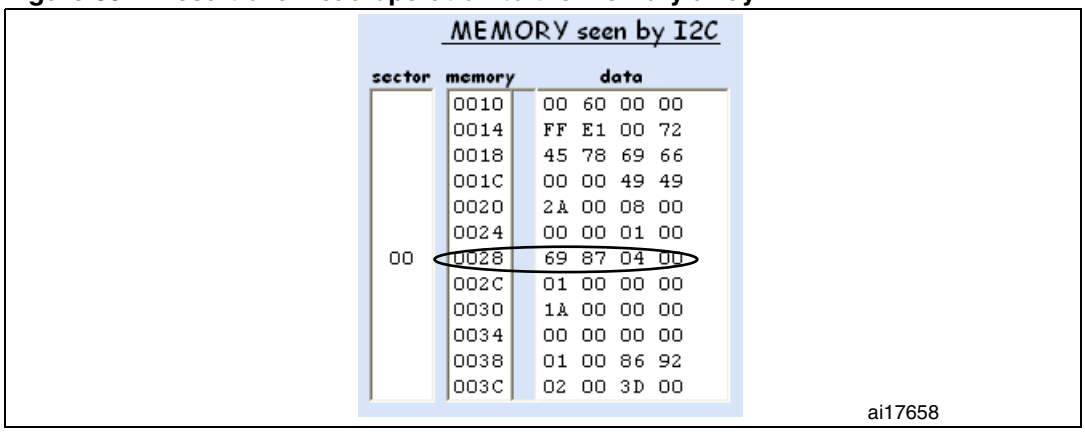


Figure 69 illustrates the result of the Read operation to the memory array. The first column shows which sector is read. The second column indicates the address of the first byte in the page. Then the third column gives the data.

Let us take the example corresponding to the data < 69 87 04 00 >

69 (69h Hex) is data for address 0028h (sector 0)

87 (87h Hex) is data for address 0029h (sector 0)

04 (04h Hex) is data for address 002Ah (sector 0)

00 (00h Hex) is data for address 002Bh (sector 0)

Reading the sector security status

To read all the sector security status bytes (RF block security), select **Sector Security Status (system)** then press the **Read** button.

Figure 70 shows how to launch an operation to read the sector security status.

Figure 70. Reading the sector security status

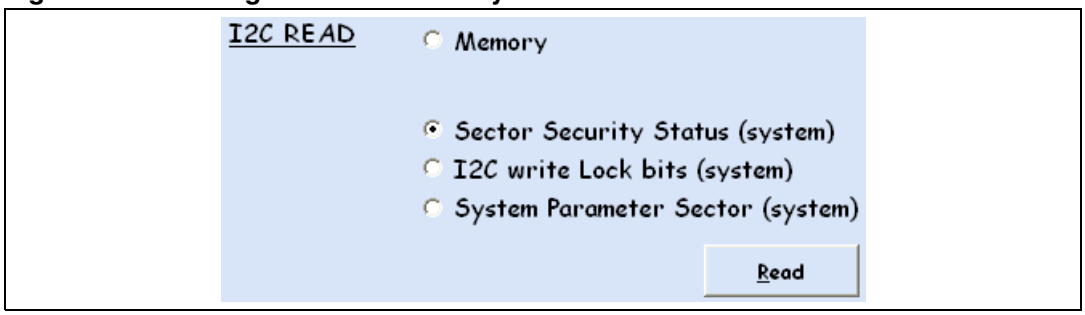
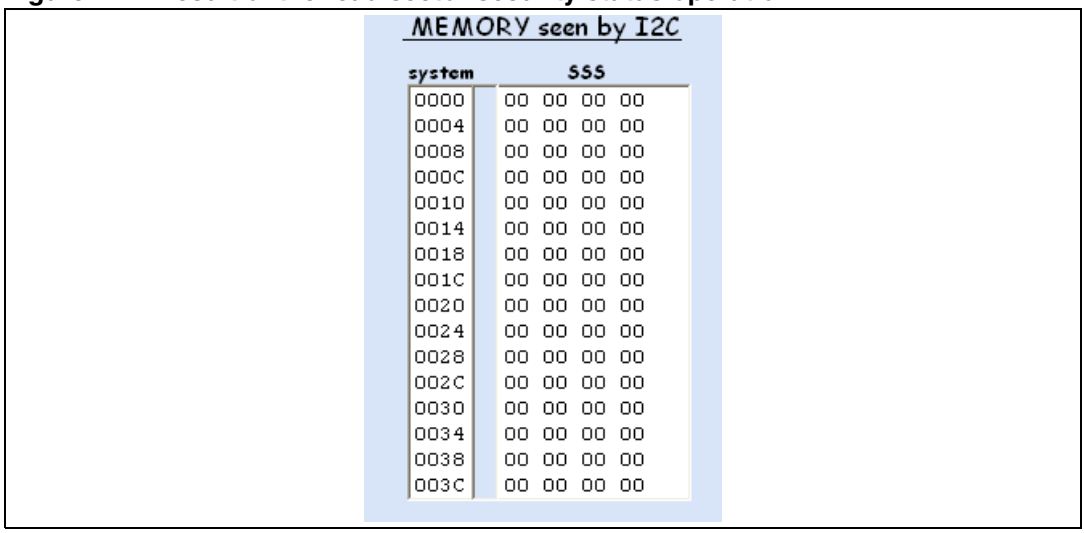


Figure 71. Result of the read sector security status operation



Reading the I2C_Write_Lock bit area

To read the 2C_Write_Lock bit area (I2C sector security), select **I2C write lock bits (system)** and press the **Read** button.

Figure 72 shows how to launch an operation to read the I2C_Write_Lock bit area.

Figure 72. Reading the I2C_Write_Lock bit area

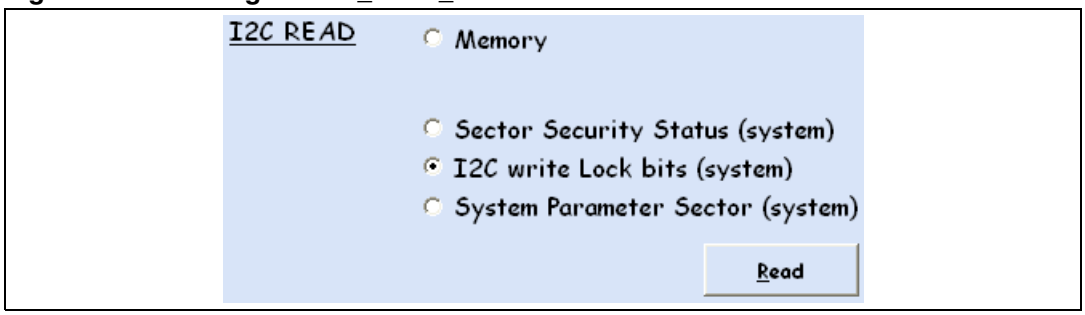
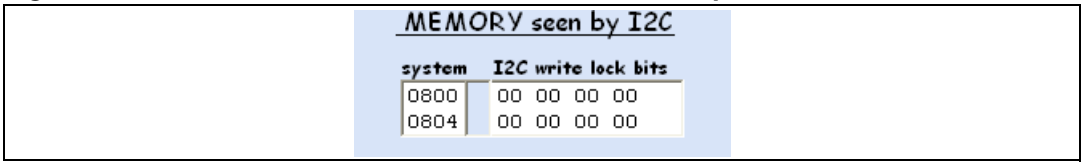


Figure 73. Result of the I2C_Write_Lock bit area read operation



Reading the system parameter sector

To read the data in the system parameter sector, select **System Parameter Sector (system)** and press the **Read** button.

Figure 74 shows how to launch an operation to read the system parameter sector.

Figure 74. Reading the system parameter sector

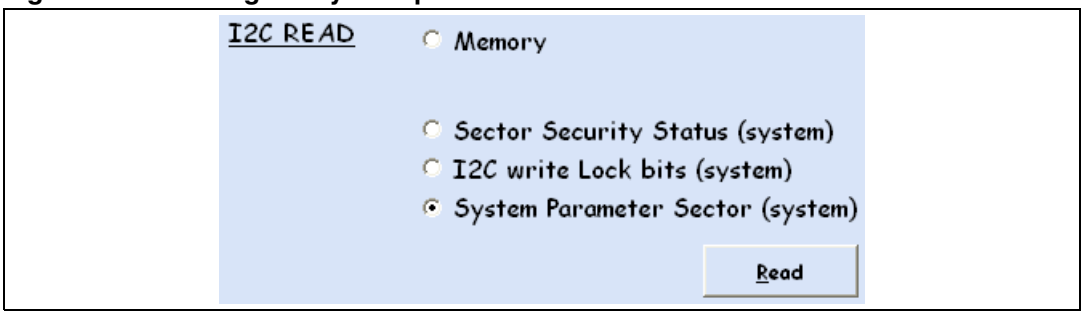
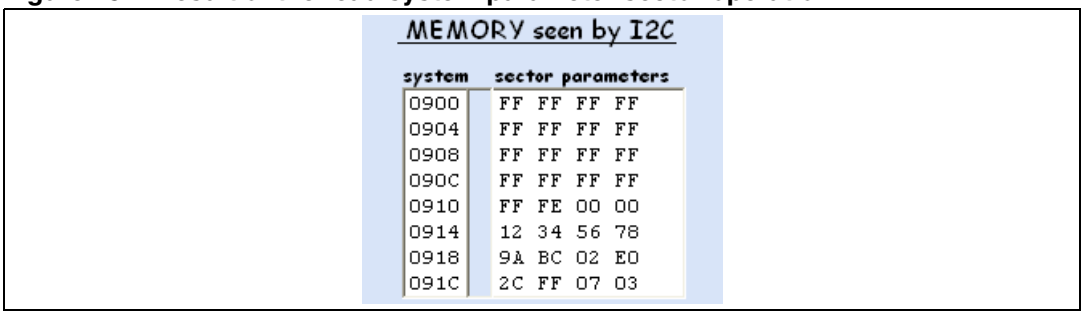


Figure 75. Result of the read system parameter sector operation



Please, refers to the M24LR64-R datasheet for the system parameters.

3.3.2 I2C WRITE commands

The **Write** button is used to issue write commands to the M24LRxx connected to the I2C reader. The button is located in the I2C WRITE area of the I2C User Interface window (see *Figure 66*).

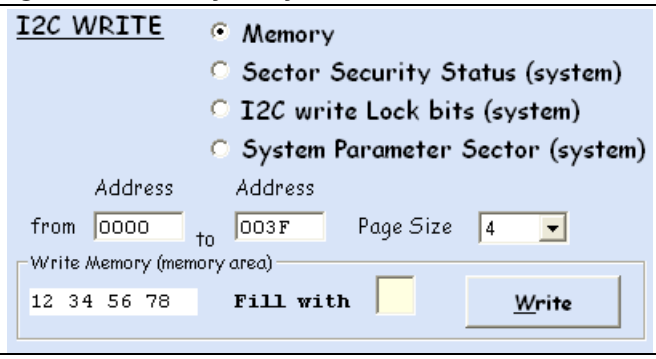
To issue a command, select the I2C WRITE area and press the **Read** button.

Write command to the memory array

To write to the memory array, select **Memory** and choose the address range to be written. Then press the **Write** button. Addresses are managed is the same way as for RF commands (see *Section 3.2.7: Read command*).

Figure 76 shows how to launch a write operation to the memory array.

Figure 76. Writing to the memory array



In this example, a write operation is issued to write the data < 12 34 56 78 > to EEPROM memory addressees 0000 to 003F by I2C communication.

Note that in the I2C answer, you are notified of whether the write cycle succeeded or failed (see *Figure 77* and *Figure 78*).

Figure 77. Write cycle successful

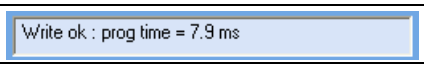


Figure 78. Write cycle failed (no write cycle detected)

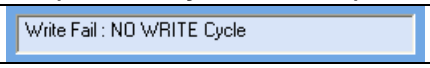
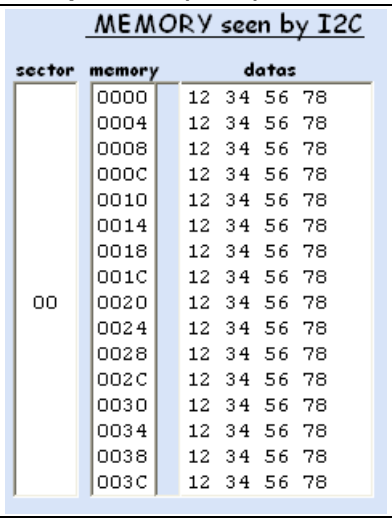


Figure 79 shows the result of the write operation.

Figure 79. Result of the Write operation (003C)



You can write 1, 2, 3 or 4 bytes by playing with the **Page Size** field.

Figure 80. Page Size field

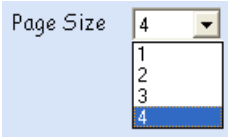
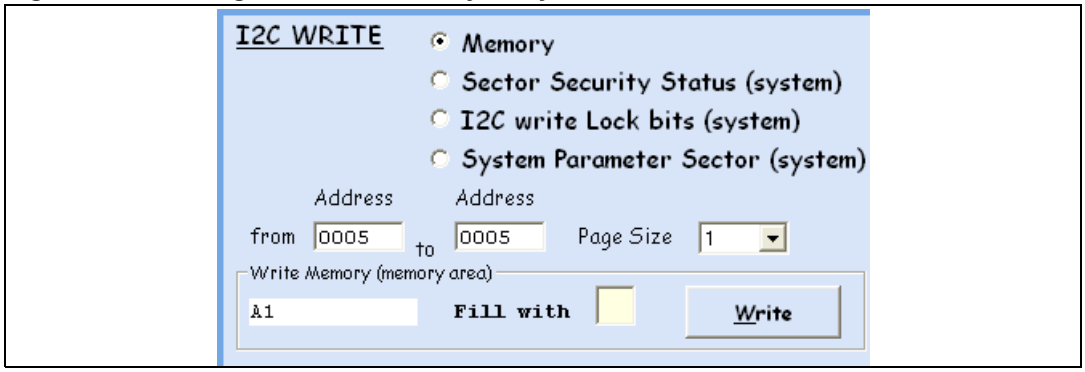


Figure 81 shows how to write “A1” to EEPROM memory address 0005.

Figure 81. Writing A1 to the memory array



Writing to the sector security status area

To write to the sector security status area, select **Sector Security Status (system)** and type the address range to be written, then press the **Write** button. Addresses are managed is the same way as for RF commands (see *Section 3.2.7: Read command*).

Please note that the I2C password has to be presented successfully prior to writing to the Sector Security Status area.

Figure 82 shows how to write to the sector security status area.

Figure 82. Writing to the sector security status area

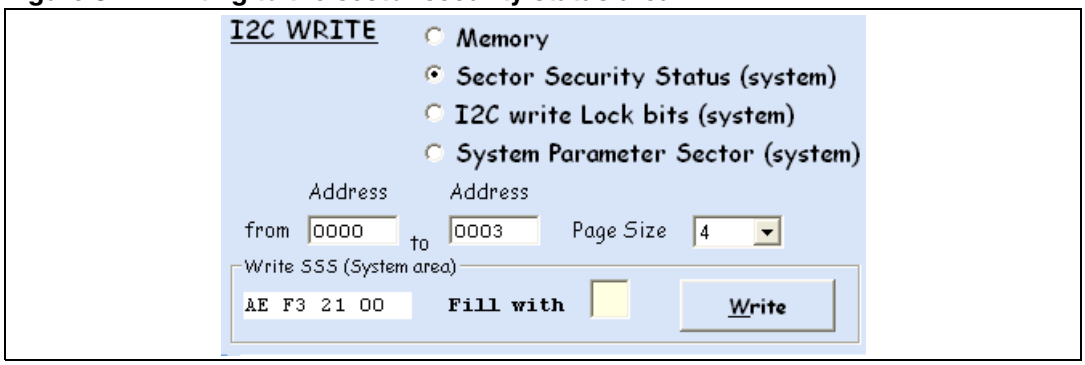
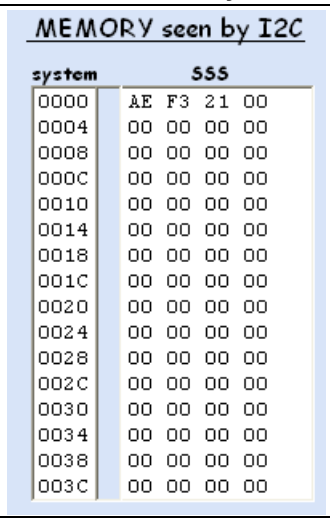


Figure 83 shows the result of the operation.

Figure 83. Result of the write to sector security status area operation



Writing to the I2C_Write_Lock bit area

To write to the I2C_Write_Lock bit area, select **I2C write lock bits (system)** and fill the address range to be written, then press the **Write** button. Addresses are managed is the same way as for RF commands (see *Section 3.2.7: Read command*).

Please note that the I2C password has to be presented successfully prior to writing to the I2C_Write_Lock bit area

Figure 84 shows how to launch a write operation to the I2C_Write_Lock bit area.

Figure 84. Writing to the I2C_Write_Lock bit area

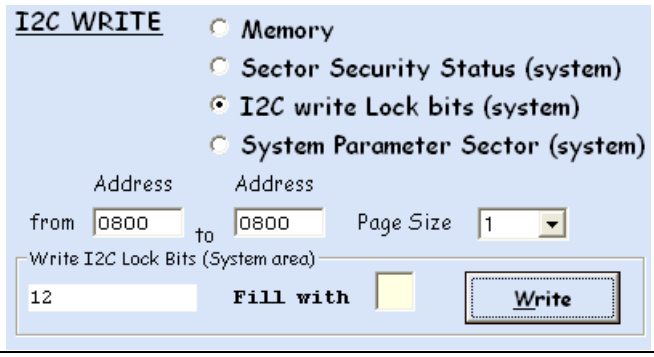
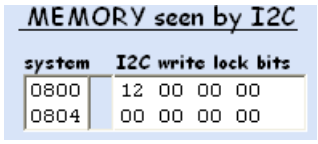


Figure 85 shows the result of the operation.

Figure 85. Result of the write to I2C_Write_Lock bit area operation



3.3.3 I2C PASSWORD commands

In the I2C PASSWORD area of the I2C User Interface window (see *Figure 66*), select **Present Password** to be able to send an I2C Present Password command. The button at the bottom right-hand side of the I2C PASSWORD area will indicate **Present**.

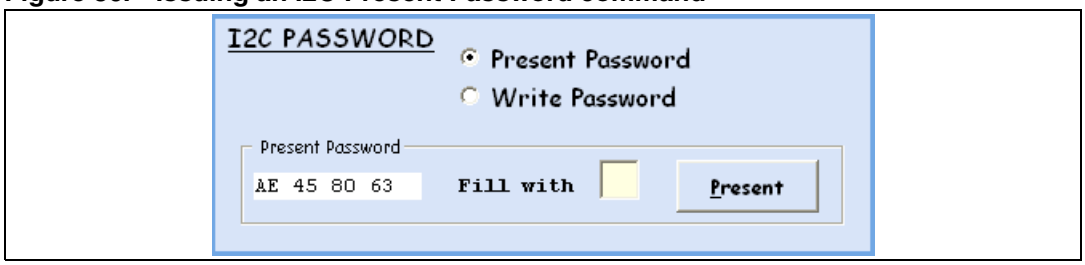
In the same area, select **Write Password** to be able to send an I2C Write Password command. The button at the bottom right-hand side of the I2C PASSWORD area will indicate **Write**.

I2C Present Password command

To issue an I2C Present Password command, select **Present Password** and type the I2C password into the **Present Password** field.

Figure 86 shows how to launch an I2C Present Password command.

Figure 86. Issuing an I2C Present Password command



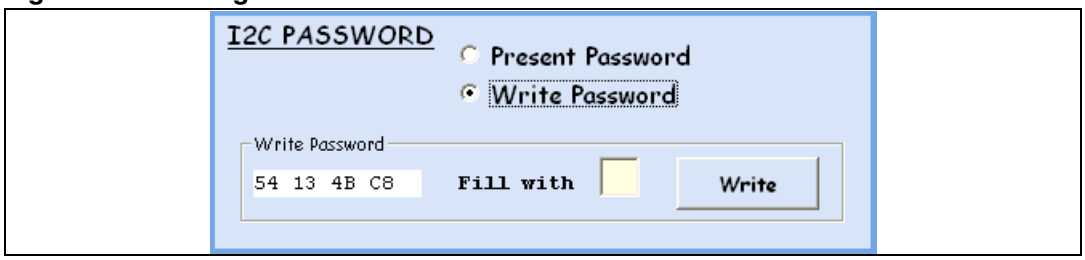
In this example, an I2C Present Password command is sent with the I2C password <AE 45 80 63 >.

I2C Write Password command

To issue an I2C Write Password command, select **Write Password** and type the I2C password into the **Write Password** field.

Figure 87 shows how to launch an I2C Write Password command.

Figure 87. Issuing an I2C Write Password command



In this example, an I2C Write Password command is sent with the I2C password <54 13 4B C8 >.

A warning (see *Figure 88*) was added to prevent unwanted password changes.

Figure 88. Warning

Note that in the I2C answer, you are notified of whether the write cycle succeeded or failed (see *Figure 89* and *Figure 90*).

Figure 89. Write Password cycle successful

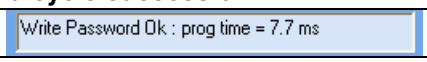
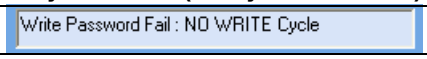


Figure 90. Write Password cycle failed (no cycle detected)

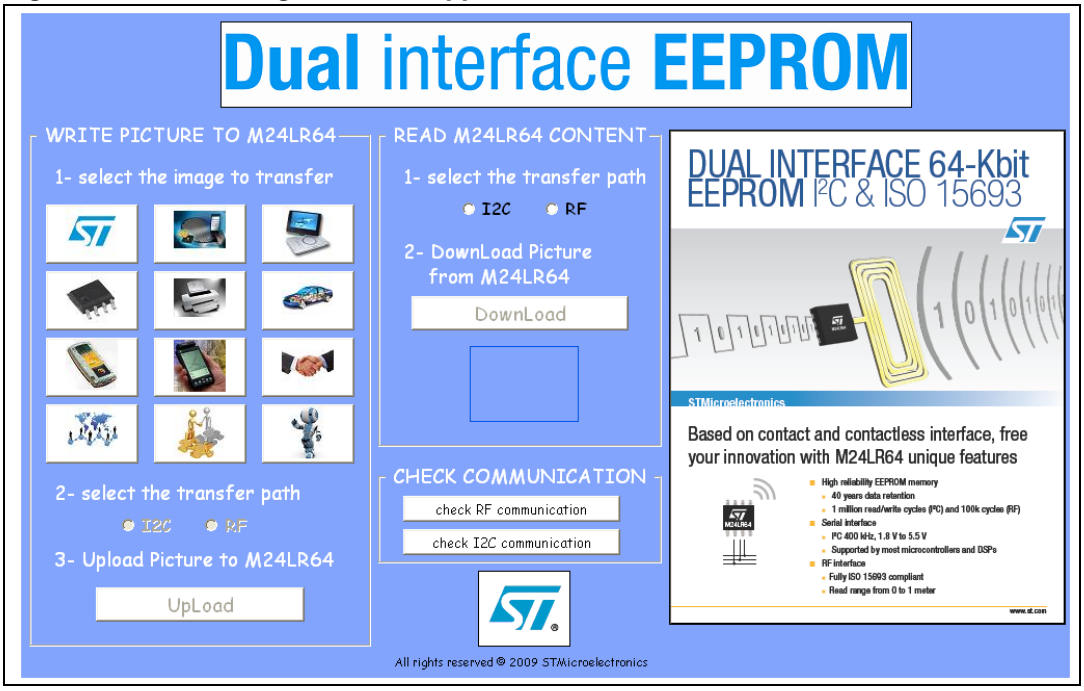


4 Data transfer management (picture demo)

Select **show Image Transfer Application** from the main menu of the *M24LRxx_Application_Software* application.

Note: M24LR64-R reference antennas are required to play this demonstration.

Figure 91. show Image Transfer Application menu



The show Demo application allows you to play with the M24LR64-R device with both interfaces: I2C and RF.

With this demo you can load a picture by RF or I2C (.jpeg file of 2 Kbytes) into the M24LR64-R device. You can also download and display the contents of the memory by I2C or RF. If JPG-like contents were previously loaded into the EEPROM, you will be able to visualize them.

4.1 Check communication

This tool help you test the I2C or RF communications between the M24LR64-R device and the reader.

Figure 92. Check communication tool

If you want to use the RF interface to check communications, click on the **check RF communication** button. If you want to use the I2C bus, click on the **check I2C communication** button.

4.1.1 Check communication by RF

After clicking on **check RF communication**, the button changes to **running** as shown in *Figure 93*.

If the circle next to the **running** button is green, the communication by RF between the M24LR64-R and the reader is OK.

Figure 93. RF communication between the tag and the reader is OK

If the circle next to the **running** button is red, the communication by RF between the M24LR64-R and the reader is NOT OK

Figure 94. No RF communication between the tag and the reader

4.1.2 Check communication by I2C

After clicking on **check I2C communication**, the button changes to **running** as shown in *Figure 95*.

If the circle next to the **running** button is green, the communication by I2C between the M24LR64-R and the reader is OK.

Figure 95. I2C communication between the tag and the reader is OK

If the circle next to the **running** button is red, the upload by I2C failed.

Figure 96. Failed upload by I2C

4.2 Writing a picture to your M24LR64-R

In the show Demo application window, go to the WRITE PICTURE TO M24LR64 area (see *Figure 97*), and choose the picture you would like to upload into the memory. Click on the picture to select it.

Figure 97. WRITE PICTURE TO M24LR64

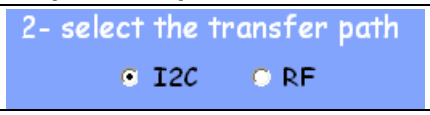
In *Figure 98*, the ST logo was chosen as an example.

Figure 98. Picture to be uploaded

After selecting the picture, you need to choose which of the I2C or RF interface you will use to upload it to the memory of the M24LR64-R device.

To upload it by I2C, click on **I2C** as shown below.

Figure 99. Selecting I2C to upload the picture

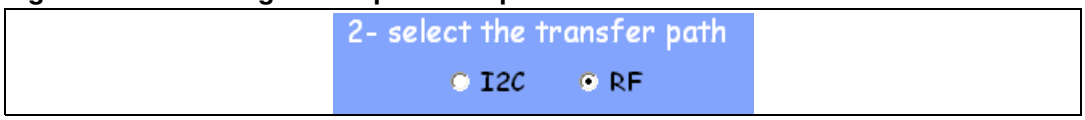


You then have to click on the **Upload by I2C** button as shown in *Figure 100*.

Figure 100. Uploading the picture by I2C

To upload the picture by RF, click on **RF** as shown below.

Figure 101. Selecting RF to upload the picture



You then have to click on the **Upload by RF** button to launch the upload process (see *Figure 102*).

Figure 102. Uploading the picture by RF

You can use the CHECK COMMUNICATION area to verify whether the data are written successfully or not.

If the I2C bus was used, click on **check I2C communication**. The color of the circle will tell you if the upload process was successful (green circle like in *Figure 103*) or failed (red circle like in *Figure 104*).

Figure 103. I2C upload process successful

Figure 104. I2C upload process failed

If the RF interface was used, click on **check RF communication**. The color of the circle will tell you if the upload process was successful (green circle like in *Figure 105*) or failed (red circle like in *Figure 106*).

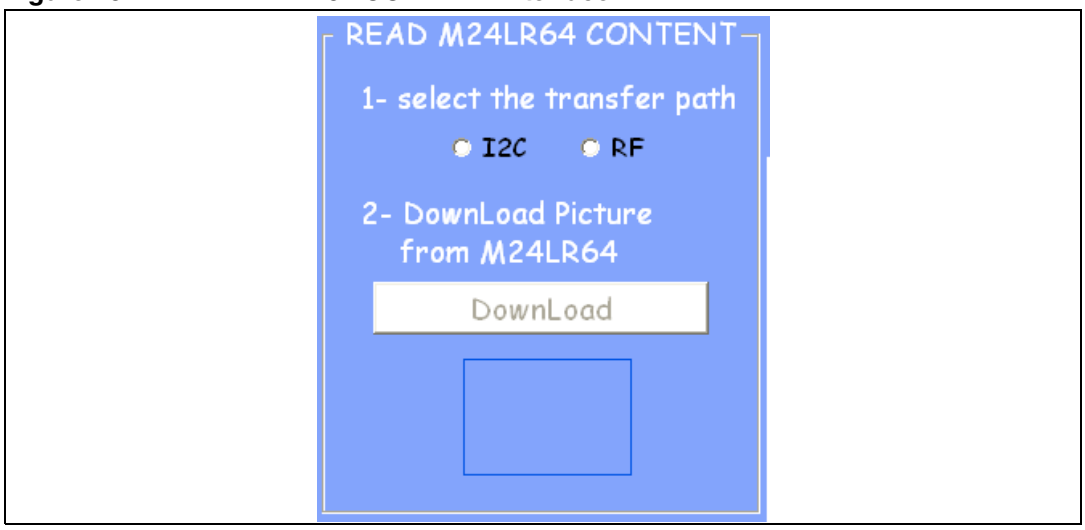
Figure 105. RF upload process successful

Figure 106. RF upload process failed

4.3 Read/display the M24LR64-R memory content

In the show Demo application window, the READ M24LR64 CONTENT area allows you to display the contents of the memory on your computer screen if the picture was uploaded.

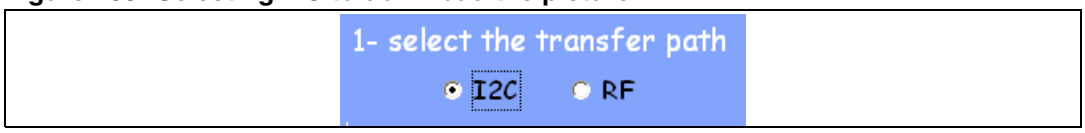
Figure 107. READ M24LR64 CONTENT interface



You first have to select which of the I2C or RF interface you will use to download the picture from the memory of the M24LR64-R.

To download it by I2C, click on **I2C** as shown below.

Figure 108. Selecting I2C to download the picture

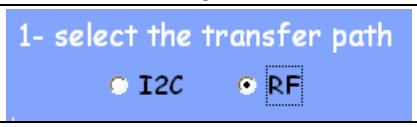


You then have to click on the **Upload by I2C** button to launch the upload process (see *Figure 109*).

Figure 109. Downloading the picture by I2C

To download the picture by RF, click on **RF** as shown below.

Figure 110. Selecting RF to download the picture

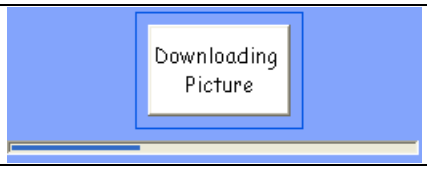


You then have to click on the **Upload by RF** button to launch the upload process (see *Figure 111*).

Figure 111. Downloading the picture by RF

The application reads the contents of the EEPROM. A progress bar (shown in *Figure 112*) indicates that the process is running.

Figure 112. Progress bar



If the download process is successful, the picture is displayed on the screen like in *Figure 113*. Otherwise, an error message appears (see *Figure 114*).

Figure 113. The ST logo is displayed

Figure 114. Error message

You can use the CHECK COMMUNICATION area to verify whether the data were read successfully or not.

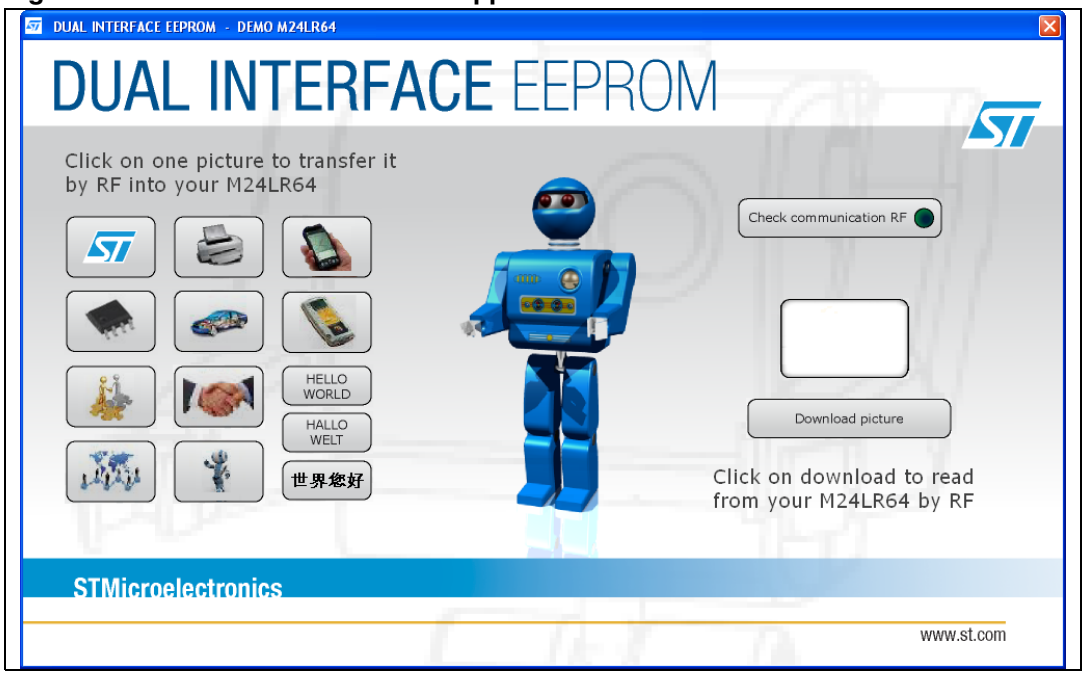
If you used the I2C bus to download the picture, click on **check I2C communication**. The color of the circle will tell you if the upload process was successful (green circle) or failed (red circle).
If you used the RF interface to download the picture, click on **check RF communication**. The color of the circle will tell you if the upload process was successful (green circle) or failed (red circle).

5 DEMOKIT-M24LR-A demonstration

The demonstration application menu, shown in *Figure 115*, is intended for use with the DEMOKIT-M24LR-A kit. All the pictures are in bitmap format to be compliant with the STM32-PRIMER2 firmware and LCD screen driver.

Note: M24LR64-R reference antennas are required to play this demonstration.

Figure 115. Demo STM32-PRIMER2 application menu



5.1 Checking RF communications

To check the RF communication between the reader and the reference antenna, press the **check RF communication** button (see *Figure 116*). The button changes to **running**. If the RF communication between the reader and the reference antenna is good, the circle is green like in *Figure 117*. If there is no RF communication between the reader and the reference antenna, the circle appears red like in *Figure 118*.

Figure 116. Check RF communication button

Figure 117. RF communication ongoing between reader and reference antenna

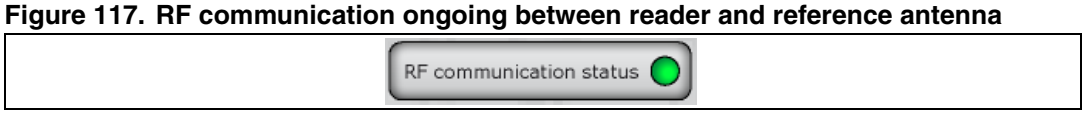


Figure 118. No RF communication between reader and reference antenna

5.2 Uploading a picture to your DEMOKIT-M24LR-A by RF

Use the frame shown below to upload a picture by RF.

Figure 119. Upload frame

Click on a picture to upload the picture in bmp format to the M24LR64-R by RF.

You can use the three additional icons on the right-hand side (HELLO WORLD, HALLO WELT...) to decrease the upload time (3 seconds versus 20 seconds).

5.3 Downloading a picture from your DEMOKIT-M24LR-A by RF

Press the **click to download Picture** button shown below to download a picture by RF. Once downloaded, the picture appears next to the button as shown in *Figure 121* and *Figure 122*.

Figure 120. Click to download Picture button

Figure 121. HELLO WORLD picture downloaded

Figure 122. ST logo downloaded

5.4 Check communications status

You can use the CHECK COMMUNICATION area to verify whether the data were written or read successfully or not.

The green circle (*Figure 123*) indicates that the RF upload/download process is going smoothly.

The red circle (*Figure 124*) indicates that errors are occurring during the RF upload/download process.

Figure 123. Upload/download process going smoothly

Figure 124. Upload/download process with errors

5.5 Using your STM32-PRIMER2 to read the contents of the reference antenna through I^2C

If the picture was uploaded by RF as described above, you will be able to display it on the LCD screen of your STM32-PRIMER2.

Please refer to the UM0850 user guide to configure your STM32-PRIMER2 and use the embedded software.

6 Datalogger demonstration

The datalogger demonstration must be used in conjunction with the DATALOG-M24LR-A datalogger reference board. Refer to UM0925 "*Using the M24LR64-R datalogger reference design*" and AN3209 "*Developing your M24LR64-R datalogger application for temperature acquisition*" for a detailed description of the datalogger reference board and application.

To run the datalogger demonstration:

1. Select **Show Datalogger** to display the User Interface for Datalogger demo (see *Figure 125*).
2. Select **Show Datalogger Setting** to display the Datalogger setting menu (see *Figure 126*).

Figure 125. Datalogger demonstration home page

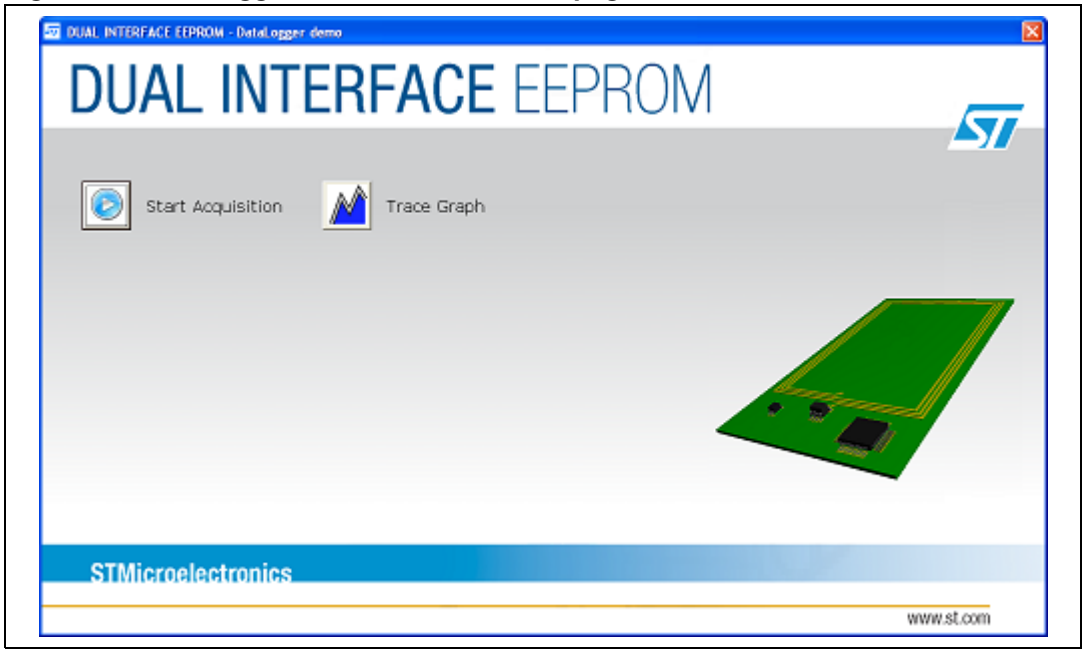
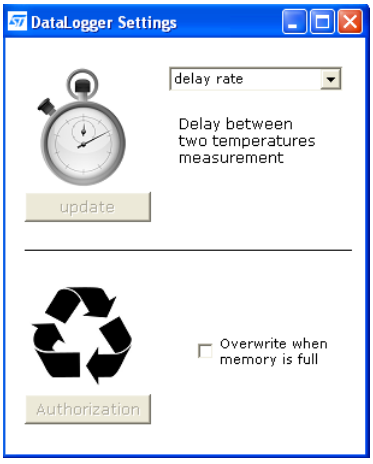


Figure 126. Datalogger setting menu



7 ESL demonstration

The ESL demonstration allows to use the M24LRxx devices as electronic shelf labels (ESLs).

To run the ESL demonstration:

1. Select **show demo ESL** from the main menu to launch the ESL application (see *Figure 127*).
2. Several parameters can be set to configure your ESL device (see *Figure 128*):
   - Logo

     Check the French (PROMO) or English logo (DISCOUNT) to indicate that a special price is proposed. Check the blank logo if no special price is applied.
   - Price trend arrow

     Check the up or down arrow to indicate if the price has been increased or decreased, or the blank arrow if no indication is required.
   - Enter the product price
   - Enter text in ASCII format in Line 1 and Line 2 to display the name and a brief description of the product.

1. To write the data in your ESL-like M24LRxx:
   a) Emerge the M24LRxx in your reader RF field.
   b) Click the **Transfer data to your ESL** button.
2. To read and modify the data contained in your ESL-like M24LRxx:
   a) Emerge the M24LRxx in your reader RF field.
   b) Click the **Read ESL configuration** button. A window is then displayed at the right of the ESL demo - configuration tool area (see *Figure 128*). It shows the type of discount, the product description, as well as the price and the price trend.

Figure 127. show Demo ESL menu

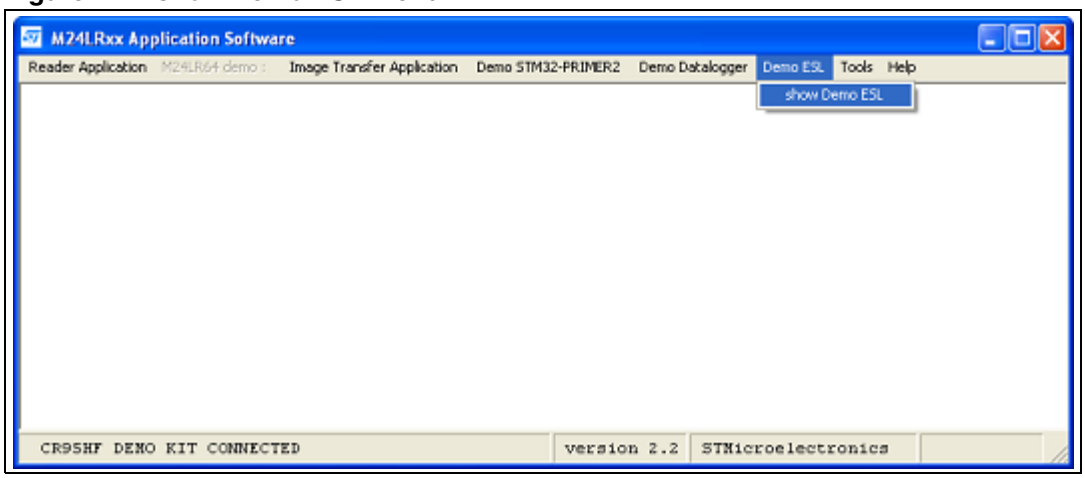
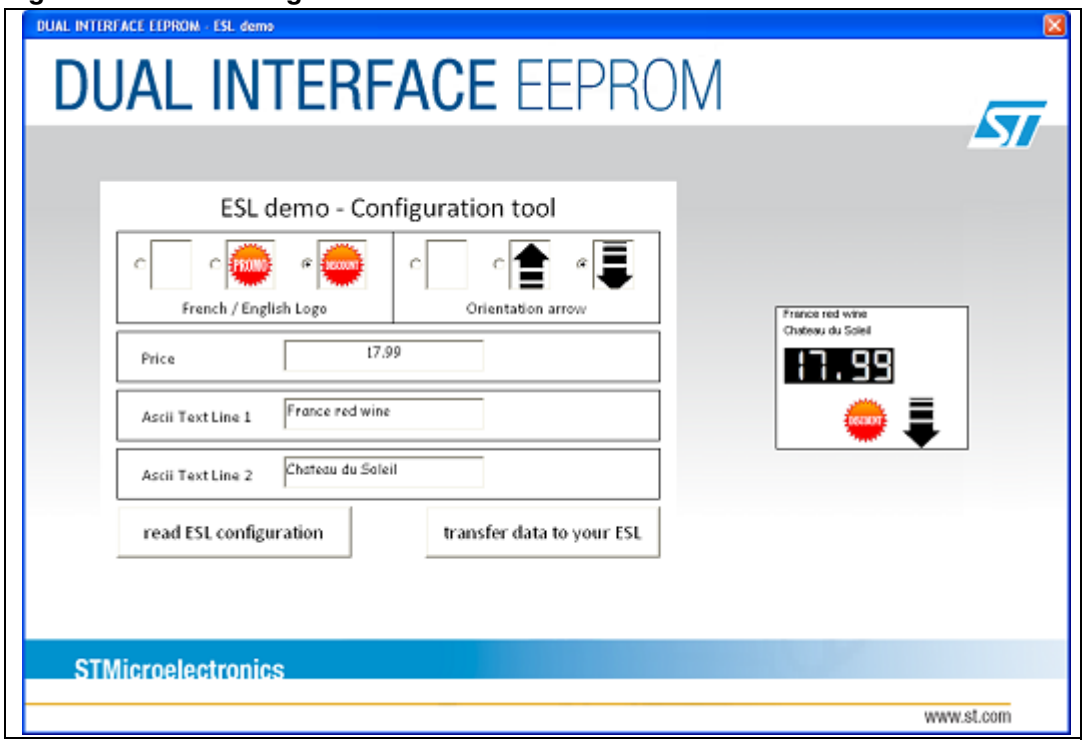


Figure 128. ESL setting menu



8 Revision history

Table 1. Document revision history

Date	Revision	Changes
28-Jan-2010	1	Initial release.
10-Oct-2011	2	Extended document scope to tlhe whole M24LR64xx family. Added *Section 2.4: M24LRxx demonstration kit*. Updated *Figure 16: Application home page*, *Figure 18: Main menu*. Updated *Section : Reader Application menu*. Updated *Figure 20: show Image Transfer application*, *Figure 21: show Demo STM32-PRIMER2 menu*. Added *Section 3.1.5: Demo datalogger menu* and *Section 3.1.6: Demo ESL menu*. Updated *Figure 24: Tools menu* and *Figure 25: Help menu*. Updated *Section 3.2: Reader application*. Added *Section 3.2.14: Additional feature: energy harvesting commands*. Added *Section 6: Datalogger demonstration* and *Section 7: ESL demonstration*. Updated disclaimer on last page.
28-Oct-2011	3	Changed document title.

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