

UM0853 User manual

M24LR64-R tool kit user guide

1 Introduction

The purpose of this user manual is to teach how to use the M24LR64-R tool kit with the *M24LRxx_Application_Software*. It describes the *M24LRxx_Application_Software* interface and its menus, and shows how to send commands to M24LR64-R tags.

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Contents

1	Intro	duction		1
2	Tool	kit desc	criptions	7
	2.1	Develo	pment kit	7
	2.2	M24LR	864-R demonstration kit	9
	2.3	Starter	kit	10
3	How	to cont	rol the RF and I ² C channels from your screen	12
	3.1	Starting	g M24LRxx_Application_Software	12
		3.1.1	Choosing your tool kit	12
		3.1.2	Main menu	13
		3.1.3	Image Transfer Application menu	15
		3.1.4	Demo STM32-PRIMER2 menu	15
		3.1.5	Tools menu	16
		3.1.6	Help menu	16
	3.2	RF cha	nnel commands	16
		3.2.1	Inventory command	17
		3.2.2	Get System Info command	18
		3.2.3	Viewing RF requests and answers	18
		3.2.4	Selecting the RF mode	19
		3.2.5	Managing the M24LR64-R states	20
		3.2.6	Read command	20
		3.2.7	Write command	23
		3.2.8	Write AFI command	24
		3.2.9	Write DSFID command	25
		3.2.10	Lock AFI command	25
		3.2.11	Lock DSFID command	25
		3.2.12	RF password management	26
	3.3	I ² C cha	nnel	28
		3.3.1	I2C READ commands	29
		3.3.2	I2C WRITE commands	32
		3.3.3	I2C PASSWORD commands	36
4	Data	transfe	r management (picture demo)	38
2/49			Doc ID 16609 Rev 1	77

	4.1	Check communication
		4.1.1 Check communication by RF
		4.1.2 Check communication by I2C
	4.2	Writing a picture to your M24LR64-R 40
	4.3	Read/display the M24LR64-R's contents 42
5	Demo	application for use with DEMOKIT-M24LR-A
	5.1	Checking the RF communication 44
	5.2	Uploading a picture to your DEMOKIT-M24LR-A by RF 45
	5.3	Downloading a picture from your DEMOKIT-M24LR-A by RF 45
	5.4	Check communication status 46
	5.5	Using your STM32-PRIMER2 to read the contents of the reference antenna by I2C
6	Revis	ion history



List of figures

Figure 1.	RF reader (ISO 15693, RF 13.56 MHz)	7
Figure 2.	External antenna.	7
Figure 3.	Serial EEPROM USB reader	8
Figure 4.	I ² C bus cable	8
Figure 5.	ANT1-M24LR-A reference antenna	8
Figure 6.	ANT2-M24LR-A reference antenna	8
Figure 7.	M24LR64-R in SO8 package	
Figure 8.	RF reader	
Figure 9.	PRIM2-M24LR-A reference antenna	
Figure 10.	STM32-PRIMER2	
Figure 11.	I ² C & RF reader	
Figure 12.	ANT1-M24LR-A reference antenna	
Figure 13.	ANT2-M24LR-A reference antenna	
Figure 14.	M24LR64-R in SO8 package	
-	Application's opening page	
Figure 15.		
Figure 16.	Connection check by the software	
Figure 17.	Main menu window	
Figure 18.	show Reader application	
Figure 19.	show Image Transfer application	
Figure 20.	Demo STM32-PRIMER2 menu	
Figure 21.	Tools menu	
Figure 22.	Help menu	
Figure 23.	RF user interface 1	
Figure 24.	Inventory button	7
Figure 25.	Three tags detected 1	8
Figure 26.	Specific UID selected 1	8
Figure 27.	Get System Info button 1	8
Figure 28.	RF TAG REQUEST/ANSWER report 1	8
Figure 29.	RF request and RF answer 1	9
Figure 30.	Selecting the Non-addressed mode 1	
Figure 31.	Selecting the Addressed mode	
Figure 32.	Selecting the Select mode	
Figure 33.	Device state management interface	
Figure 34.	Initiating a read operation	
Figure 35.	Result of the read operation - Sector 00h	
Figure 36.	Result of the read operation - Sector 3Fh	
Figure 37.	Sector 0 block 0	
Figure 38.	Sector 0 blocks 1 to 5	
Figure 39.	Initiating a write operation	
Figure 40.	Fill with 55.	
0	Get Multiple Block Security Status button.	-
Figure 41.		
Figure 42.	Security status byte for sector 07	
Figure 43.	Security status bytes for sectors 07 and 08	
Figure 44.	Write AFI command	
Figure 45.	Write DSFID command	-
Figure 46.	Lock AFI command.	
Figure 47.	Warning before locking the AFI field.	
Figure 48.	Lock DSFID command	25



Figure 49.	Warning before locking the DSFID field	
Figure 50.	Warning displayed on the user interface	
Figure 51.	Present-sector Password command	
Figure 52.	Present-sector Password command successful	
Figure 53.	Present-sector Password command error	
Figure 54.	Write-sector Password command	
Figure 55.	Warning before changing the password	
Figure 56.	Write-sector Password command successful	
Figure 57.	Write-sector Password command error	
Figure 58.	Lock-sector Password command	
Figure 59.	Lock-sector Password command successful	
Figure 60.	Lock-sector Password command error	
Figure 61.	Button to switch between the RF and I2C interfaces	
Figure 62.	I2C User Interface window	
Figure 63.	Reading the memory array	
Figure 64.	Result of a Read operation to the memory array	
Figure 65.	Reading the sector security status	
Figure 66.	Result of the read sector security status operation.	
Figure 67.	Reading the I2C_Write_Lock bit area.	
Figure 68.	Result of the I2C_Write_Lock bit area read operation	
Figure 69.	Reading the system parameter sector	
Figure 70.	Result of the read system parameter sector operation	
Figure 71.	Writing to the memory array	
Figure 72.	Write cycle successful	
Figure 73.	Write cycle failed (no write cycle detected).	
Figure 74.	Result of the Write operation (003C)	
Figure 75.	Page Size field	
Figure 76.	Writing A1 to the memory array	
Figure 77.	Writing to the sector security status area	
Figure 78.	Result of the write to sector security status area operation	
Figure 79.	Writing to the I2C_Write_Lock bit area	
Figure 80.	Result of the write to I2C_Write_Lock bit area operation	
Figure 81.	Issuing an I2C Present Password command	
Figure 82.	Issuing an I2C Write Password command	
Figure 83.	Warning	
Figure 84.	Write Password cycle successful	
Figure 85.	Write Password cycle failed (no cycle detected).	
Figure 86.	Show Image Transfer Application window	
Figure 87.	Check communication tool	
Figure 88.	RF communication between the tag and the reader is OK	
Figure 89.	No RF communication between the tag and the reader	
Figure 90.	I2C communication between the tag and the reader is OK	
Figure 91.	Failed upload by I2C.	
Figure 92.	WRITE PICTURE TO M24LR64.	
Figure 93.	Picture to be uploaded	
Figure 94.	Selecting I2C to upload the picture	
Figure 95.	Uploading the picture by I2C	
Figure 96.	Selecting RF to upload the picture	
Figure 97.	Uploading the picture by RF	
Figure 98.	I2C upload process successful	
Figure 99.	I2C upload process failed	
⊢igure 100.	RF upload process successful	. 41



	RF upload process failed
	READ M24LR64 CONTENT interface
	Selecting I2C to download the picture
Figure 104.	Downloading the picture by I2C
Figure 105.	Selecting RF to download the picture
Figure 106.	Downloading the picture by RF
Figure 107.	Progress bar
Figure 108.	The ST logo is displayed
Figure 109.	Error message
Figure 110.	Demo STM32-PRIMER2 application window
Figure 111.	Check RF communication button
Figure 112.	RF communication ongoing between reader and reference antenna
Figure 113.	No RF communication between reader and reference antenna
Figure 114.	Upload frame
Figure 115.	Click to download Picture button
Figure 116.	HELLO WORLD picture downloaded
	ST logo downloaded
Figure 118.	Upload/download process going smoothly
	Upload/download process with errors



2 Tool kit descriptions

2.1 Development kit

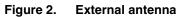
Ordering information: DEVKIT-M24LR-A

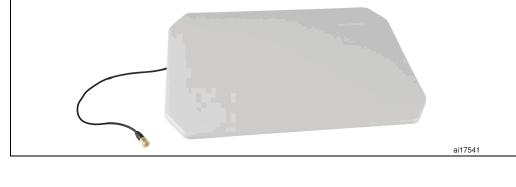
The development kit contains:

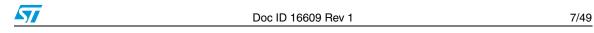
- a middle-range RF reader (ISO 15693, RF 13.56 MHz) interfaced via the USB bus and an external power supply to have a greater read range. *Figure 1* shows the RF reader.
- an external antenna, shown in *Figure 2*.
- a serial EEPROM USB reader, shown in *Figure 3*: it is an I²C bus reader (interfaced via the USB bus).
- an I²C bus cable to connect the serial EEPROM USB reader to the I²C 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)
- M24LR64-R samples in SO8 package (see Figure 7)

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









57









Figure 5. ANT1-M24LR-A reference antenna



Figure 6. ANT2-M24LR-A reference antenna

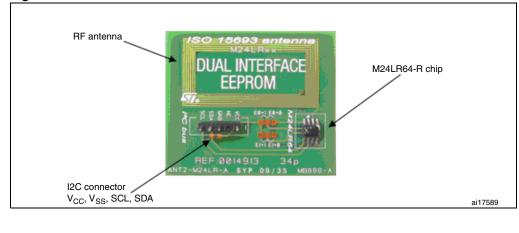




Figure 7. M24LR64-R in SO8 package



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's 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

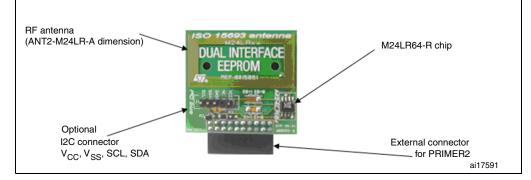




Figure 10. STM32-PRIMER2



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

2.3 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's 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



10/49



RF antenna M24LRXX DUAL INTERFACE EEPROM

Figure 12. ANT1-M24LR-A reference antenna



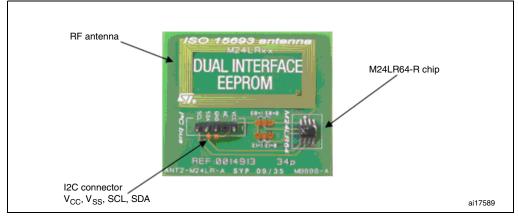


Figure 14. M24LR64-R in SO8 package



UM0853

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: "M24LR64-R 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 15*.

Dual Intel	rface EEPROM
DEMO KIT (USB based) Select your kit STARTER KIT DEMO KIT (USB based) DEMO KIT (RS232 based) DEVELOPMENT KIT	
	C check to add Serial EEPROM USB Reader
ОК	Cancel
	57.
STMICRO	ELECTRONICS

Figure 15. Application's opening 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

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.

Doc ID 16609 Rev 1



12/49

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 16*.

Dual interfac	e EEPROM
DEMO KIT (USB based)	C check to add Serial EEPROM USB Reader
OK	Cancel
STMICROELE All rights reserved @ 2009 5	CTRONICS

Figure 16. 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 17* appears.

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



Figure 17. Main menu window

57 M24LRxx Ap	plication Software					
Reader Application	Image Transfer Application	Demo STM32-PRIMER2	Tools He	elp		
Serial EEP	ROM USB Reader 1.0.	1 CONNECTED	version	n 1.0	STMicroelectronics	

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

Reader Application menu

Select **show Reader application** (*Figure 18*) to manage all the I²C and RF functions of the M24LR64-R.

Figure 18. show Reader application

Z	M24LRxx Ap	plication Software				
	Reader Application	Image Transfer Applicatio	n Demo STM32-PRIMER2	Tools Help		
	show Reader Ap	plication				
Γ						
	Contol FED	DOW HED Deeder 1 (1 CONNECTED		CTW: uses le stressiere	
	Serial EEP	ROM USB Reader 1.0	0.1 COMMECTED	version 1	0 STMicroelectronics	

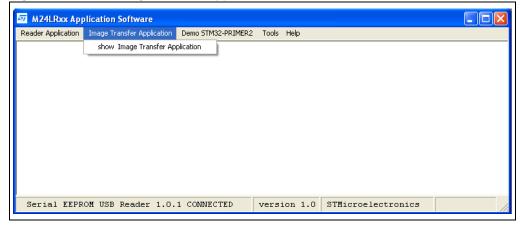


3.1.3 Image Transfer Application menu

Figure 19 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 19. show Image Transfer application



3.1.4 Demo STM32-PRIMER2 menu

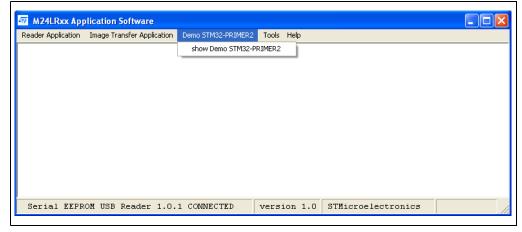
Figure 20 shows the Demo STM32-PRIMER2 menu.

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 20. Demo STM32-PRIMER2 menu





3.1.5 Tools menu

Figure 21 shows the Tools menu.

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

Figure 21. 1	lools menu				
🖅 M24LRxx App	lication Software				
Reader Application	Image Transfer Application	Demo STM32-PRIMER2	Tools Help		
			stop animation		
Serial EEPR	OM USB Reader 1.0.	1 CONNECTED	version 1.0	STMicroelectronics	

3.1.6 Help menu

Figure 22 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 22. Help menu

M24LRxx	Application	Software	ł						
Reader Applicati	on Image T	ransfer Appl	ication	Demo STM32-PRIMER2	Tools	Help			
						•	*.bin file with BinEdit e backgroung color 		
Serial EF	PROM USB	Reader	1.0.1	CONNECTED	versi	on 1.0	STMicroelectr	onics	

3.2 RF channel commands

Select **show Reader Application** in the main menu. The *RF user interface* opens. It is shown in *Figure 23*. With this interface you can send any command to the M24LR64-R tag present in the RF reader field.

16/49



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

Figure 23. RF user interface

DUAL INTERFACE EEPROM - M24	LR64				X			
Show I2C Commands	RF	RF User Interface						
Read	multiple read Read with block Security Status	<u>MEA</u> sector block	ORY seen by RF datas	555	Present password			
Get Multiple Block Security Status	from 0000 to 001F	0000 0001 0002	FF D8 FF E0 00 10 4A 46 49 46 00 01		Write password			
Write	19 34 07 65	0003 0004 0005 0006 0007	01 01 00 60 00 60 00 00 FF E1 00 72 45 78 69 66 00 00 49 49		Lock sector			
Inventory	Get System Info	0007 0008 0009 000A 000B	2 A 00 08 00 00 00 01 00 69 87 04 00 01 00 00 00		<u>Warning</u>			
UID DSFID E0022C1343910511 FF	System infos UID E0022C1343910511 DSFID FFh	000C 000D 000E	1% 00 00 00 00 00 00 00 01 00 86 92		There is no way to retreive RF or I2C password. If you			
	AFI FFh Memory size 07FFh Block size 03h	000F 00 0010 0011 0012	02 00 3D 00 00 00 2C 00 00 00 00 00 00 00 43 52	XX	change a Password, please don't forget it.			
✓ Non-addressed mode ○ A	IC reference 2Ch ddressed mode C Select mode	0013 0014 0015 0016	45 41 54 4F 52 3A 20 67 64 2D 6A 70 65 67 20 76		0226			
<u>S</u> ELECT STAY	QUIET RESET to READY	0017 0018 0019 0014	31 2E 30 20 28 75 73 69 6E 67 20 49 4& 47 20 4&		0103FFE0022C1343910511			
Write AFI	Lock AFI	001B 001C 001D	50 45 47 20 76 36 32 29 2C 20 64 65		INTERFACE			
Write DSFID	Lock DSFID	001E 001F	66 61 75 6C 74 20 71 75					

3.2.1 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 25*).

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 24. Inventory button



57

Figure 25. Three tags detected

Inventory
UID DSF
E0022C1304411011 FF E0022C1343910511 FF E0022C1392200607 FF

You can select a tag in the list of detected UIDs by clicking on the desired UID in the list as shown in *Figure 26*. The selected UID will then be used in all RF requests sent in Addressed mode.

Figure 26. Specific UID selected

Inventory	ор 🗖
UID	DSFID
E0022C1304411011	FF
E0022C1343910511	FF
E0022C1392200607	FF
1	

3.2.2 Get System Info command

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

Figure 27. Get System Info button

Get s	System Info
	System info
UID	E0022C1301310912
DSFID	AAh
AFI	AAh
Memory size	07FFh
Block size	03h
IC reference	2Ch

3.2.3 Viewing RF requests and answers

Figure 28. RF TAG REQUEST/ANSWER report

RF TAG REC	UEST report
RF TAG ANS	WER 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 29 shows an example of a reader's RF request and the corresponding answer from the tag.

Figure 29. RF request and RF answer

0A200000	
00FFD8FFE0A65B	

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

3.2.4 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 M24LR64-R datasheet.

The Non-addressed, Addressed or Select mode can be selected by clicking on the desired mode as shown in *Figure 30, Figure 31* or *Figure 32*.

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 M24LR64-R device (please refer to the M24LR64-R datasheet for details).

Figure 30. Selecting the Non-addressed mode

• Non-addressed mode C Addressed mode C Select 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 M24LR64-R datasheet for details).

After an Inventory command (see *Section 3.2.1: 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 31. Selecting the Addressed mode

O Non-addressed mode 💿 Addressed mode 🔿 Select 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 M24LR64-R device in the Select State (please refer to the M24LR64-R datasheet for details).

To select a tag, refer to the *SELECT* paragraph below, and to the M24LR64-R datasheet (Select paragraph).

Figure 32. Selecting the Select mode

🖸 Non-addressed mode 🛛 Addressed mode 🖉 Select mode

3.2.5 Managing the M24LR64-R states

The M24LR64-R can be in different states: Power-off, Ready, Quiet and Selected (refer to the M24LR64-R datasheet for details).

The interface shown in *Figure 33* is used to send three types of RF request to place the M24LR64-R in one out of three specific states: Selected, Quiet and Ready.

Figure 33. Device state management interface

SELECT STAY QUIET	RESET to READY
-------------------	----------------

SELECT

The **SELECT** button is used to send a Select RF request with the UID of a specific tag (*Section 3.2.1: Inventory command*) (refer to the M24LR64-R 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 M24LR64-R datasheet for details).

RESET TO READY

The **RESET TO READY** button is used to send a Reset to Ready RF request (refer to the M24LR64-R datasheet for details).

3.2.6 Read command

Figure 34. Initiating a read operation

20/49



By pressing the Read button, you launch RF requests to read the contents of the M24LR64-R 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 35* to *Figure 38*).

From **0000** to **07FF** reads all M24LR64-R EEPROM contents. *Figure 35* and *Figure 36* only show the results for sector 0 and sector 3F, respectively.

	MEN	NORY seen by RF	
sector	block	datas	555
	0000		
	0001	00 10 4A 46	
	0002	49 46 00 01	
	0003	01 01 00 60	
	0003	00 60 00 00	
	0004	FF E1 00 72	
	0005	45 78 69 66	
	0000	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	11 00 00 00	
	000D	00 00 00 00	
	OOOE	01 00 86 92	
	OOOF	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 2O 64 65	
	001E	66 61 75 6C	
	001F	74 20 71 75	

Figure 35. Result of the read operation - Sector 00h



igure oo. Thesait of the rea				-
		MEW	ORY seen by RF	
	sector	block	datas	555
		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	
	ЗF	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		
		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	
		071	II II II II	I

Figure 36. Result of the read operation - Sector 3Fh

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 37.

Figure 37.	Sector 0	block 0
------------	----------	---------

	MEWC)RY seen by RF	
sector	block	data	555
00	0000	FF D8 FF EO	XX

From 0001 to 0005 reads the blocks 1, 2, 3, 4, 5 in sector 0 as shown in Figure 38.

Figure 38. Sector 0 blocks 1 to 5

MEW	OR)	/ seen b	y RF	
block		data		555
0001	00	10 4A	46	
0002	49	46 00	01	
0003	01	01 00	60	XX
0004	00	60 00	00	
0005	FF	E1 00	72	
	block 0001 0002 0003 0004	block 0001 00 0002 49 0003 01 0004 00	block data 0001 00 10 4Å 0002 49 46 00 0003 01 01 00 0004 00 60 00	0001 00 10 4Å 46 0002 49 46 00 01 0003 01 01 00 60 0004 00 60 00 00

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 M24LR64-R at the specified addresses.
- The fourth column (**sss**) gives the sector security status.



Example: in *Figure 38* 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)

3.2.7 Write command

The **Write** button launches RF requests to write data to the M24LR64-R EEPROM from the block address specified in the **from** field to the block address entered in the **to** field.

In Figure 39, the Write command fills the blocks 0000h to 001Fh with "A1 34 09 67".

Figure 39. Initiating a write operation

	from 0000 to 001F
Write	A1 34 09 67
	Fill with

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 40. 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 41. Get Multiple Block Security Status button

Addresses are managed in the same way as for read operations. In *Figure 42* the security status byte is shown for the blocks with addresses ranging between 0x00E0 and 0x00FF (sector 07).



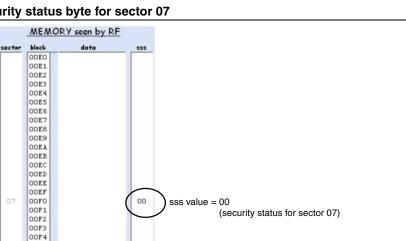
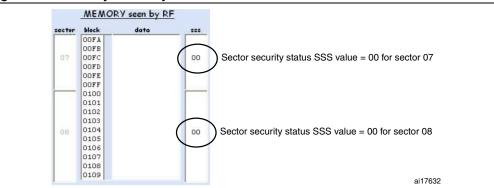


Figure 42. Security status byte for sector 07

00F5 00F7 00F8 00F9 00FA 00FB 00FC 00FD 00FE 00FF

Figure 43 shows the security status bytes for the blocks located at addresses 00FAh to 0109h (sector 07 & sector 08).

Figure 43. Security status bytes for sectors 07 and 08



3.2.8 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 44. Write AFI command

Write AFI	00	Data to be written to the AFI register
	\bigcirc	ai17636

24/49	Doc ID 16609 Rev 1	57

ai17631

UM0853

3.2.9 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 45. Write DSFID command



3.2.10 Lock AFI command

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

Figure 46. Lock AFI command



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

For this reason, a warning (shown in *Figure 47*) is displayed before locking the AFI. To abort the Lock AFI command, click on **Cancel**. To confirm the command, click on **OK**.

Figure 47. Warning before locking the AFI field

DUAL IN	TERFACE EEPROM: Lock AFI command
1	WARNING : there is no way to unlock the AFI field after a Lock AFI command
	OK Cancel

3.2.11 Lock DSFID command

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

|--|

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

This is the reason why a warning (shown in *Figure 49*) is displayed before locking the DSFID field. To abort the Lock DSFID command, click on **Cancel**. To confirm the command, click on **OK**.



DUAL INTERFACE EEPROM: Lock DSFID command WARNING : there is no way to unlock the DSFID field after Lock DSFID command OK

Figure 49. Warning before locking the DSFID field

3.2.12 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 50* shows the diplayed warning.

By default, the RF and I²C passwords are '00 00 00 00'.

Figure 50. Warning displayed on the user interface

Present password
Write password
Lock sector
Warning
There is no way to
retreive RF or I2C
password. If you
change a Password,
please don't forget it.

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.



i igule 51. Ti	esent-sector r assword com	Inditu
	Present password select password number 1 password data	select password number 1 2 3
	Go	

Figure 51. Present-sector Password command

The result of the Present-sector Password command appears in the RF answer field. *Figure 52* shows a successful command, and *Figure 53* shows an example where an error occurred.

Figure 52.	Present-sector Password command successful
------------	--

1

Figure 53. 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 54. Write-sector Password command

	Write password	
selec	ct password number 2	
pass	word data AEF54B56	
	Go	

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

Figure 55. Warning before changing the password

DUAL I	NTERFACE EEPROM: Password management 🔀
⚠	Warning : there is no way to retreive an I2C or RF Password Please, remember it !
	OK Cancel

57

Figure 56. Write-sector Password command successful

0 : Write Password OK

Write Password HS

Figure 57. 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 58. Lock-sector Password command

		Lock se	ctor	
sele	ct	sector number	21 💌	
sele	ct	password number	2 💌	
sele	ct	lock config		
		pwd presented	pwd not present	ed
\odot	00	Read Write	Read No Write	
0	01	Read Write	Read Write	
0	10	Read Write	No Read No W	rite
0	11	. Read No Write	No Read No W	rite
		G	io i	

Figure 59. Lock-sector Password command successful

	0078F0 : Lock Sector OK	
--	-------------------------	--

Figure 60. Lock-sector Password command error

|--|--|

3.3 I²C channel

You can use the I2C *User Interface window*, illustrated in *Figure 62*, to exchange data between a tag connected to the I2C reader and the M24LR64-R.

With the **Show RF interface** button (*Figure 61*) you can switch from the RF user interface to the I2C user interface.

Figure 61. Button to switch between the RF and I2C interfaces

|--|



DUAL INTERFACE EEPROM - M24LR64	
show RF interface	C User Interface
I2C READ • Memory from 0000 to 0007F • Sector Security Status (system) • I2C write Lock bits (system) • System Parameter Sector (system) Read I2C WRITE • Memory • Sector Security Status (system) • Construction • Sector Security Status (system) • Sector Security Status (system) • Sector Security Status (system) • Construction • Address • Address • Address • Address • Address • Address • Olio 000 • Present Password • Write Password • Write Password • Present Password • Write Password • WritePassword	MEMORY seen by I2C sector nemory data 0000 FF DB FF E0 0004 001 04 A 46 0001 00 10 04 A 46 001 04 A 46 001 00 60 0010 00 6 00 00 001 10 00 60 001 00 60 001 00 60 0014 FF E 59 66 001 00 60 00 001 00 60 0020 2.4 00 00 01 00 0026 69 87 04 00 0022 0.0 00 00 00 00 0030 1 A 00 00 00 0030 1 A 00 00 00 0030 1 A 00 00 00 0030 0 1 00 66 92 0030 0 1 00 66 92 0030 0 0 00 00 0034 00 00 00 00 0034 00 00 00 00 0034 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0044 00 00 00 00 0000 00 0044 00 00 00 00 0044 00 00 00 00 0000 00 0046 00 00 00 0046 00 00 00 0046 00 00 00 0046 00 00 00

Figure 62. I2C User Interface window

3.3.1 **I2C READ commands**

The Read button issues read commands to the M24LR64-R 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 3.2.6: Read command).

Figure 63 shows an example where the user choses to issue a Read Memory operation from address 0010h to address 003Fh.

	- j j			
12C READ	Memory			
			to	Address 003F
		I2C READ @ Memory	I2C READ • Memory Address	I2C READ © Memory Address

Figure 63. Reading the memory array

Ī	<u>12C RE<i>A</i>D</u>		\ddress D03F	
		Sector Security Stat		
		I2C write Lock bits ((system)	
		 System Parameter Se 	ctor (system)	
			<u>R</u> ead	

MEMORY seen by I2C						
sector	r memory	,	da	ta		
	0010	00	60	00	00	
	0014	FF	E1	00	72	
	0018	45	78	69	66	
	001C	00	00	49	49	
	0020	2 A	00	08	00	
	0024	00	00	01	00	
00	<0028	69	87	04		
	002C	01	00	00	00	
	0030	1 <i>A</i>	00	00	00	
	0034	00	00	00	00	
	0038	01	00	86	92	
	003C	02	00	ЗD	00	

Figure 64. Result of a Read operation to the memory array

Figure 64 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)

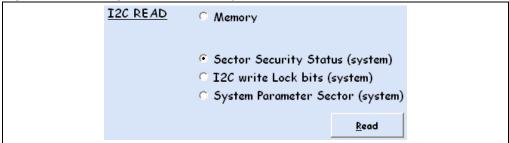
00 (00h Hex) is data for address 002Bh (sector 0)

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

Figure 65. Reading the sector security status





gure oo. Thesult of the read a	an of the feat sector security status t								
	MEMORY seen by I2C								
	system		555						
	0000		00	00 00	00 (
	0004		00	00 00	00 (
	0008		00	00 00	00 (
	000C		00	00 00	00 (
	0010		00	00 00	00 (
	0014		00	00 00	00 (
	0018		00	00 00	00 (
	001C		00	00 00	00 (
	0020		00	00 00	00 (
	0024		00	00 00	00 (
	0028		00	00 00	00 (
	002C		00	00 00	00 (
	0030		00	00 00	00 (
	0034		00	00 00	00 (
	0038		00	00 00	00 (
	003C		00	00 00	00 (

Figure 66. 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 67 shows how to launch an operation to read the I2C_Write_Lock bit area.

Figure 67. Reading the I2C_Write_Lock bit area

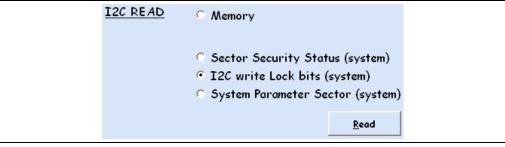


Figure 68. Result of the I2C_Write_Lock bit area read operation

MEMORY seen by I2C							
system	I2C write lock bits						
0800	00 00 00 00						
0804	00 00 00 00						
· · ·							

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



Figure 69. Reading the system parameter sector

		•		
120 R	EAD	Memory		
		C. C. alan C. and L. C. a	(
		Sector Security Stat	us (system)	
		C I2C write Lock bits ((system)	
		System Parameter Se	ctor (system)	
			<u>R</u> ead	
	I2C RI	I2C READ	© Sector Security Stat © I2C write Lock bits (Sector Security Status (system) I2C write Lock bits (system) System Parameter Sector (system)

Figure 70.	Result of the read s	ystem parameter	sector operation
------------	----------------------	-----------------	------------------

MEMORY seen by I2C									
,,									
system		sector	para	meters					
0900		FF FF	FF	FF					
0904		FF FF	FF	FF					
0908		FF FF	FF	FF					
090C		FF FF	FF	FF					
0910		FF FE	00	00					
0914		12 34	56	78					
0918		9A BC	02	EO					
091C		2C FF	07	03					

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

3.3.2 I2C WRITE commands

The **Write** button is used to issue write commands to the M24LR64-R connected to the I2C reader. The button is located in the I2C WRITE area of the I2C User Interface window (see *Figure 62*).

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 3.2.6: Read command*).

Figure 71 shows how to launch a write operation to the memory array.

Figure 71. Writing to the memory array

12C WRITE	Memory									
	🛇 Sector Security Status (system)									
	I2C write Lock bits (system)									
	🛇 System Parameter Sector (system)									
Address	Address									
from 0000	to 003F Page Size 4 💌									
Write Memory (mer	nory area)									
12 34 56 78	Fill with <u>W</u> rite									



In this example, a write operation is issued to write the data < 12 34 56 78 > to EEPROM memory addresses 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 72* and *Figure 73*).

Figure 72. Write cycle successful

|--|

Figure 73. Write cycle failed (no write cycle detected)

	Write Fail : NO WRITE Cycle
--	-----------------------------

Figure 74 shows the result of the write operation.

Figure 74. Result of the Write operation (003C)

MEMORY seen by I2C							
sector	memory			dat	as		
	0000		12	34 5	6 '	78	
	0004		12	34 5	6 '	78	
	0008		12	34 5	6 '	78	
	000C		12	34 5	6 '	78	
	0010		12	34 5	6 '	78	
	0014		12	34 5	6 '	78	
	0018		12	34 5	6 '	78	
	001C		12	34 5	6 '	78	
00	0020		12	34 5	6 '	78	
	0024		12	34 5	6 '	78	
	0028		12	34 5	6 '	78	
	002C		12	34 5	6 '	78	
	0030		12	34 5	6 '	78	
	0034		12	34 5	6 '	78	
	0038		12	34 5	6 '	78	
	003C		12	34 5	6 '	78	

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

Figure 75. Page Size field

Page Size	4
	1 2
	3 4

Figure 76 shows how to write "A1" to EEPROM memory address 0005.



Figure 76. V	Writing A1 to	the memory array
--------------	---------------	------------------

I2C WRITE	Memory					
	🔿 Sector Security Status (system)					
	I2C write Lock bits (system)					
	😳 System Parameter Sector (system)					
Address	Address					
from 0005	to 0005 Page Size 1 🔽					
⊂ ^W rite Memory (m	iemory area)					
A1	Fill with <u>W</u> rite					

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 3.2.6: Read command*).

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

Figure 77 shows how to write to the sector security status area.

Figure 77. Writing to the sector security status area

12C WRITE	Memory					
	Sector Security Status (system)					
	I2C write Lock bits (system)					
	🕤 System Parameter Sector (system)					
Address	Address					
from 0000	to 0003 Page Size 4 💌					
Write SSS (System	n area)					
AE F3 21 00	Fill with <u>W</u> rite					

Figure 78 shows the result of the operation.



igure 70. Thesair of the write	e to sector security status area operation		
	MEW	0	RY seen by I2C
	system		555
	0000		AE F3 21 00
	0004		00 00 00 00
	0008		00 00 00 00
	0000		00 00 00 00
	0010		00 00 00 00
	0014		00 00 00 00
	0018		00 00 00 00
	001C		00 00 00 00
	0020		00 00 00 00
	0024		00 00 00 00
	0028		00 00 00 00
	002C		00 00 00 00
	0030		00 00 00 00
	0034		00 00 00 00
	0038		00 00 00 00
	003C		00 00 00 00

Figure 78. 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 3.2.6: Read command*).

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

Figure 79 shows how to launch a write operation to the I2C_Write_Lock bit area.

Figure 79. Writing to the I2C_Write_Lock bit area



Figure 80 shows the result of the operation.

Figure 80. Result of the write to I2C_Write_Lock bit area operation

MEMO	ORY seen by I2C
system	I2C write lock bits
0800	12 00 00 00
0804	00 00 00 00



3.3.3 I2C PASSWORD commands

In the I2C PASSWORD area of the I2C User Interface window (see *Figure 62*), 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 81 shows how to launch an I2C Present Password command.

Figure 81. Issuing an I2C Present Password command

<u>12C</u>	<u>PA55</u>	WORD	• Present • Write Po		
_ Pr	esent Pa	ssword —			
AE	: 45 8	0 63	Fill with	<u>P</u> resent	
					<u> </u>

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 ito the **Write Password** field.

Figure 82 shows how to launch an I2C Write Password command.

Figure 82. Issuing an I2C Write Password command

I2C PASSWOR	C Present Password Write Password	
Write Password —		1
54 13 4B C8	Fill with Write	
]

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

A warning (see *Figure 83*) was added to prevent unwanted password changes.



.g		
	DUAL INTERFACE EEPROM: Password management	
	Warning : You are going to change the I2C password by sending a Write I2C Password command. There is no way to retreive an I2C or RF Password. Please, remember it !	
	ОК	

Figure 83. Warning

Note that in the I2C answer, you are notified of whether the write cycle succeeded or failed (see *Figure 84* and *Figure 85*).

Figure 84. Write Password cycle successful

Write Password Ok : prog time = 7.7 ms
--

Figure 85. Write Password cycle failed (no cycle detected)

Write Password Fail : NO WRITE Cycle	
--------------------------------------	--



4 Data transfer management (picture demo)

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

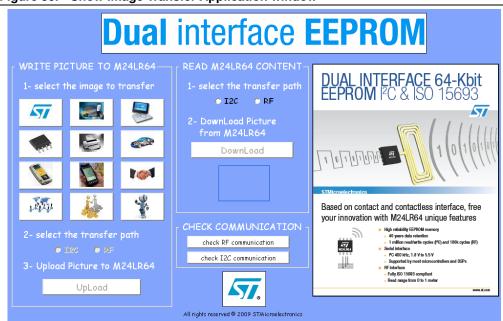


Figure 86. Show Image Transfer Application window

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 87. 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 88*.

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

Figure 88. 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 89. 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 90*.

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

Figure 90. 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 91. 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 92*), and choose the picture you would like to upload into the memory. Click on the picture to select it.



Figure 92. WRITE PICTURE TO M24LR64

In Figure 93, the ST logo was chosen as an example.

Figure 93. 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 94. Selecting I2C to upload the picture

2- select the transfer path
I2C O RF

You then have to click on the Upload by I2C button as shown in Figure 95.



Figure 95. Uploading the picture by I2C

 3- U	Jpload Picture to M24LR64
	Upload by I2C

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

Figure 96. Selecting RF to upload the picture

<u> </u>	•	-		
	2- select	the tr	ansfer path	
	•	120	• RF	

You then have to click on the **Upload by RF** button to launch the upload process (see *Figure 97*).

Figure 97. 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 98*) or failed (red circle like in *Figure 99*).

Figure 98. I2C upload process successful



Figure 99. 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 100*) or failed (red circle like in *Figure 101*).

Figure 100. RF upload process successful



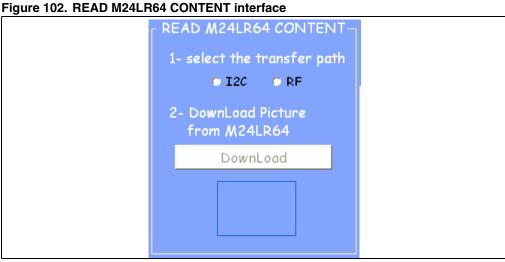


Figure 101. RF upload process failed



4.3 Read/display the M24LR64-R's contents

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.



You first have to select which of the I2C or RF interface you will use to download the picture

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

Figure 103. Selecting I2C to download the picture

from the memory of the M24LR64-R.

1- select the transfer path
• 120 • RF

You then have to click on the **Upload by I2C** button to launch the upload process (see *Figure 104*).

Figure 104. Downloading the picture by I2C



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



Figure 105. Selecting RF to download the picture

1- select the	transfer path
<u> </u>	• RF

You then have to click on the **Upload by RF** button to launch the upload process (see *Figure 106*).

Figure 106. Downloading the picture by RF



The application reads the contents of the EEPROM. A progress bar (shown in *Figure 107*) indicates that the process is running.

Figure 107. Progress bar



If the download process is successful, the picture is displayed on the screen like in *Figure 108*. Otherwise, an error message appears (see *Figure 109*).

Figure 108. The ST logo is displayed



Figure 109. 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).



UM0853

5 Demo application for use with DEMOKIT-M24LR-A

The demo application window, shown in *Figure 110*, is intended for use with the DEMOKIT-M24LR-A kit. All the pictures are in the bitmap format to be compliant with the STM32-PRIMER2 firmware and LCD screen driver.

DUAL INTERFACE EEPROM - DEMO M24LR64	
DUAL INTERFACE EEF	PROM
Click on one picture to transfer it by RF into your M24LR64	
Hello World Hello	Download picture
	Click on download to read from your M24LR64 by RF
STMicroelectronics	
	www.st.com

Figure 110. Demo STM32-PRIMER2 application window

5.1 Checking the RF communication

To check the RF communication between the reader and the reference antenna, press the **check RF communication** button (see *Figure 111*). 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 112*. If there is no RF communication between the reader and the reference antenna, the circle appears red like in *Figure 113*.

Figure 111. Check RF communication button Check communication RF Figure 112. RF communication ongoing between reader and reference antenna RF communication status Figure 113. No RF communication between reader and reference antenna RF communication status

44/49



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

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



Figure 114. 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 dowload Picture** button shown below to download a picture by RF. Once dowloaded, the picture appears next to the button as shown in *Figure 116* and *Figure 117*.

Figure 115. Click to download Picture button





Figure 116. HELLO WORLD picture downloaded



Figure 117. ST logo downloaded



5.4 Check communication status

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

The green circle (*Figure 118*) indicates that the RF upload/download process is going smoothly.

The red circle (*Figure 119*) indicates that errors are occurring during the RF upload/download process.

Figure 118. Upload/download process going smoothly

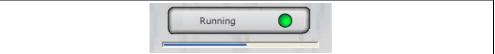
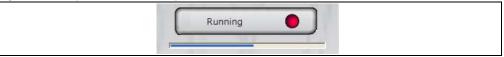


Figure 119. Upload/download process with errors



46/49



5.5 Using your STM32-PRIMER2 to read the contents of the reference antenna by I2C

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.

Enjoy your M24LR64-R kit!

UM0853



6 Revision history

Table 1. Document revision history

	Date	Revision	Changes
Γ	28-Jan-2010	1	Initial release.

48/50



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