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Quick Startup Guide for RD710

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Application note COMPANY PUBLIC

Document information

Info	Content
Keywords	RD710, Quick startup guide, SAM AV1, SAM AV2, RC523.
Abstract	This document is intended for new users to start working with the Design- In Kit. It shows the basic functionality with MIFAREdiscover.



Revision history

Rev	Date	Description
2.4	20121008	Examples add and MIFARE discover explanation updated
2.3	20120807	Updated firmware info
2.2	20120710	FCC disclaimer, driver installer, Pegoda2Go, firmware info added, demo mode changed, outdated types removed, ISO replaced with ISO/IEC
2.1	20111206	Added in 5.1 the Activation of a MIFARE Classic Card.
2.0	20110803	Extended usecases for MIFAREdiscover
1.1	20110712	Update due to release of new usecases of MIFAREdiscover
1.0	20110411	Initial version
	20110105	Draft version

Contact information

For more information, please visit: <u>http://www.nxp.com</u>

For sales office addresses, please send an email to: salesaddresses@nxp.com

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1. Introduction

The purpose of this document is to provide a set of guidelines to aid in the first operation of the RD710 reader. The MIFAREdiscover (ver.3.x.x) will be used as a user interface to communicate to the readers and cards, respectively.

The USB drivers are included in the CD package and on NXP web (see [44])

1.1 Firmware Info

This package comes with a new firmware (version 2.2.7) for the RD710 reader. In this version the NXP Basic Function Library (BFL) is replaced by the NXP Reader Library (NXPRdLib). The functionality of the PC/SC mode has not been changed. The PC Software using the Reader in this mode (e.g. MIFAREDiscover) will not face any functional differences.

1.1.1 Additional functionality and benefits of Firmware v2.2.7 in standalone mode

- Support of ISO/IEC 14443 Type B Tags
- Improved multi Tag handling
- Improved code structure and modular library design for easier development
- Improved LPCXpresso Support

For further information about the actual implementation please refer to [38].

1.1.2 Firmware version installed on the Reader

If you have received the reader together with this document version on CD it already contains the latest firmware. You can check this with the program Pegoda2Go which is as well in the CD package. If you have already installed the driver you can start Pegoda2Go as described in section 2.5 and check the current flashed version. Otherwise you have to install the drivers first.

1.1.3 Update Recommendation:

For new projects and implementations the usage of the latest firmware and source code is recommended. This is as well the case for projects using the reader in PC/SC mode only.

As the NXPRdLib has a different software design compared to the BFL, porting of existing projects based on the former firmware will require major rework and is not recommended unless one needs to take advantage of the additional functionality and benefits.

If you want to flash to the latest version proceed as described in section 8. Therefore the latest binary file is located on the CD and on NXP web [42].

(Reader documentation\Cortex M3 \firmware_v2_2\pegoda_fw_v2_2.bin).

2. Installation

2.1 Required items

To use the MIFAREdiscover, the following items are required:

- MIFARE cards as MIFARE DESFire EV1, MIFARE Classic, MIFARE Ultralight
- Pegoda Reader (RD710 or RD710 as part of EV710) (see [37]- [41])
- MIFAREdiscover
 - o Public version available on NXP web (see [45])
 - Full version (see [47])

2.2 Installing USB driver for the Reader

An installer for the USB drive is present on the CD (Driver\ Windows Driver Installer.exe).

- 1) Run this installer and follow the displayed instructions.
- 2) Connect the Pegoda RD710 with your computer.
- 3) Wait until Windows has installed the driver.

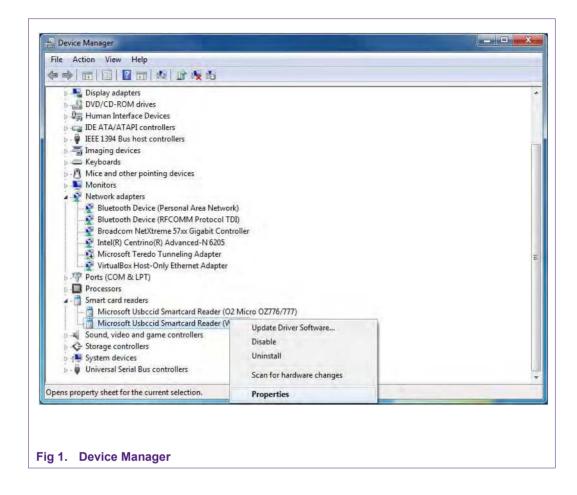
If Windows installs the drives correctly you can skip section 2.3 and continue with section 2.4.

2.3 Installing USB driver for the Reader manually

The demonstrated installation is shown on Windows 7, but it is the same in Windows XP and Vista.

- 4) If you don't have a CD that was delivered with your Pegoda, open your web browser, go to see [44] and download and extract the zip file.
- 5) Connect the Pegoda RD710 with your computer.
- 6) Wait until Windows 7 installs a standard driver.
- Open the Windows Device Manager and navigate to the installed Reader (see figure 1 below)

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- 8) Click Smartcard Reader with the right mouse button and choose "Properties".
- 9) Choose the tab driver and click "Update Driver".

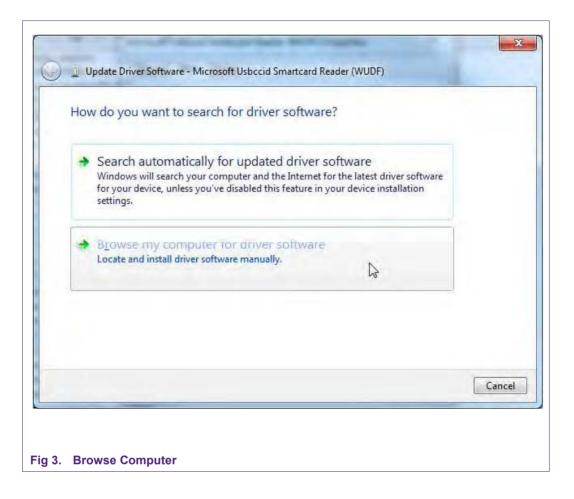
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General	Driver	Details	
3	Micros	oft Usboo	id Smartcard Reader (WUDF)
	Driver	Provider:	Microsoft
	Driver	Date:	21.06.2006
	Driver	Version:	6.1.7601.17514
	Digital	Signer:	Microsoft Windows
Dri	ver Deta	ls	To view details about the driver files.
Ugd	ate Drive	r	To update the driver software for this device.
Roll	Back Dri	ver	If the device fails after updating the driver, roll back to the previously installed driver.
	<u>D</u> isable		Disables the selected device.
	<u>J</u> ninstall		To uninstall the driver (Advanced).
			OK Cance

10) Windows will ask you how to search for the driver. Choose "Browse my computer for driver software".

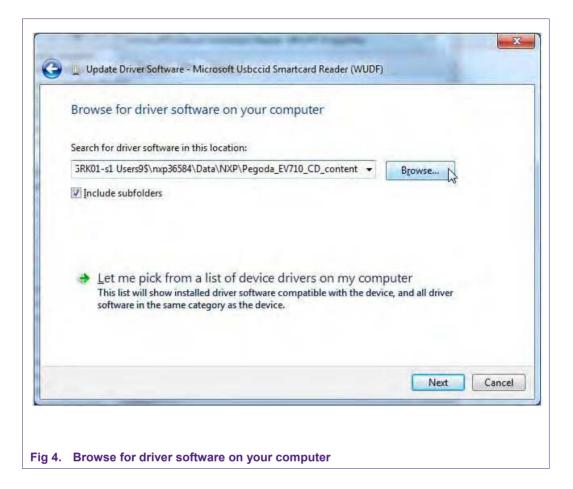
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11) Choose "Browse", navigate to the root directory of the CD or the previous extracted content and click "Next".

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12) Wait until Windows has finished the installation.

0	Update Driver Software - Microsoft Usbccid Smartcard Reader (WUDF)	x
	Installing driver software	
Fig 5.	Installing driver software	

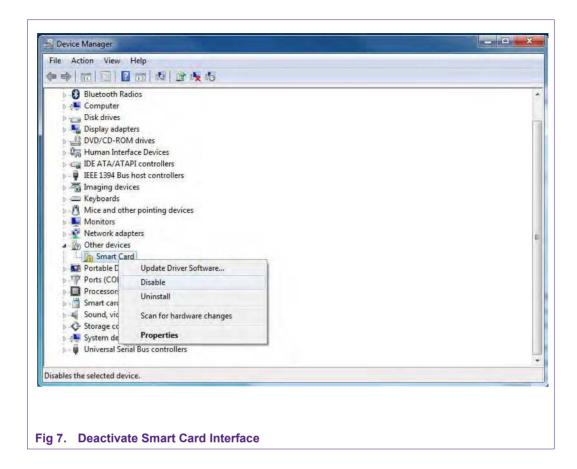


13) The installation is done.

2.4 Deactivate Smart Card Interface

For some customers it may be useful to deactivate the Smart Card Interface. This is especially important for users of Windows 7. If you see that Windows repeatedly tries to install a new Smart Card Interface you need to do the following steps.

- 1. Go to the Control Panel of your computer (Start Control Panel)
- 2. Click "System" "Device Manager" and then "Other devices"
- 3. Click "Smart Card" with your right mouse button and then disable.

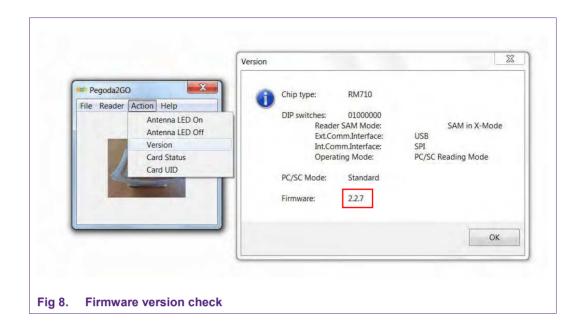


2.5 Pegoda2Go

Pegoda2Go is a small program to check the basic functions of the RD710. It can be started directly for the CD (\Software and Tools\Pegoda2GO.exe)

If the driver is installed correctly and the Pegoda is connected the device should be present in the 'Reader' menu. May hitting the 'Refresh' item is required.

Once the reader is selected the Action menu allows to switch the Antenna LEDs and to get information about the Pegoda configuration and the used firmware version as shown in figure Fig 8. If a card is present in the reader field the basic information of this card can be shown as well.



2.6 Installing MIFAREdiscover

There are two different versions of MIFAREdiscover; for once the full version can be retrieved from the doc store and the public version, which can be downloaded from the NXP Homepage.

The public MIFAREdiscover supports the functions for MIFARE Classic (see[8]) MIFARE Ultralight (see[11]), General ISO/IEC 14443-A (see[7]) protocol handling.

The full MIFAREdiscover supports the functions for MIFARE SAM AV2 (see [23]-[34]) support (X and conventional), MIFARE Plus (see [4]) MIFARE DESFire EV1 (see [3]), MIFARE Classic, MIFARE Ultralight, MIFARE Ultralight C (see [5]) and General ISO/IEC14443-A protocol handling.

2.6.1 System Requirements

- Microsoft Windows XP SP2 or higher
- Minimum screen resolution 1024x768 pixels
- Microsoft .NET Framework 3.5 Service Pack 1 or higher [will be installed along with this installer]
- Pegoda
- MIFARE SAM AV2 for X-mode

2.6.2 Installation process

Install Microsoft .NET Framework 3.5 SP1 (or higher if available)

The Installer "SetupMIFAREdiscover" tries to install the Microsoft .NET Framework 3.5 Service Pack 1 by using a Net-Installer. If you have limited or no network connection to download and install the Microsoft .NET Framework the setup process is terminated and you have to install the Microsoft .NET Framework manually.

- .NET Framework can be found online (see [48])
- Install the "SetupMIFAREdiscover" package:

Install the package and follow the instructions. The whole installation process requires administration rights. After you have successfully installed the program "MIFAREdiscover" and all of its required components you can start "MIFAREdiscover" via the link

"Start -> All Programs -> NXP Semiconductors -> MIFAREdiscover -> MIFAREdiscover".

Read "ReleaseNotes.txt" file that you received with the MIFAREdiscover package.

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3. Demo mode and DIP switch configuration of the Pegoda

		DIP	SWITC	HNUM	BER				
\$	7	5	5	4	3	2	1	READER	MQDE
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	RD662	IN PCSC MODE
QFF	ØFF	ØFF	OFF	OFF	QFF	ØFF	OFF	RD710	NO SAM
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	RD710	N S-MODE
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	R0710	IN X-MODE
ON	ON	OFF	OFF	OFF	OFF	OFF	OFF		FLASH MODE
									0/ <i>9</i> 00083

3.1 DIP switch configurations for various Reader modes

You can find a photo with description on NXP web (see [40]) (table and figure 1)

3.2 Demo mode

To get into demo mode, configure the DIP switch as follows

8	7	6	5	4	3	2	1
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF

and connect the USB cable. Only power is provided by the USB cable, the reader itself works autonomously without interaction of the PC.

The demo mode is used to showcase some basic functionality of the reader. In this mode, ISO/IEC 14443-3A and ISO/IEC 14443-3B activation loop is performed and an acoustic signal is generated based on the detected card and *SAK-byte*, respectively.

The following table depicts the default sound coding for different MIFARE cards:

Table 1. Card type according to SAK and number of beep

Card Type	beep	blink
MIFARE 1K (0x08)	1	2
MIFARE Classic 4K (0x18)	2	2
MIFARE Ultralight (0x00)	3	2
MIFARE DESFire	4	2
MIFARE Plus	5	2
ISO/IEC 14443 Type B	1	1

If you still using the older firmware (v1.x) this demo mode behaves slightly different. There is no ISO/IEC 14443-3B activation loop and the reader reacts as described in the following table.

Table 2.	Card type according to SAK a	and number of beep for old firmware version
Card Type	•	Beep and blink
MIFARE 1	K (0x08)	1
MIFARE C	lassic 4K (0x18)	2
MIFARE U	Itralight (0x00)	3
MIFARE D	ESFire	4
MIFARE P	lus	5

This can be used to determine which firmware is currently running on the reader.

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4. Public Version

All in this section explained steps are applicable to the full version as well.

4.1 Starting MIFAREdiscover

Connect the RD710 Reader with the PC by using the USB cable. Choose the desired DIP switch configuration on the mainboard of the reader (see chapter 3.1) as this tool does not support SAM. The DIP switches should all be set to "OFF".

Start MIFAREdiscover from the Start menu.

New Profile	Contactless Reader Selection	×
Get available Reader's	RD71x: NXP Pegoda N CL 0 0	
	Key file	
Browse		
	Timing Mode 🕫 FDT C OT	
ocessir		Ok
		Cancel
	Rea	derList: RD71x: NXP Pegoda N CL (

Press "Get available Reader's" for the drop down field "contact- and contactless reader selection". The available readers will be listed depending on the DIP switch configuration and the chosen reader.

Press "Ok" to open the mainframe of the MIFAREdiscover program for the specific reader configuration.

The following main window will appear. The History frame shows you that the reader has been opened successfully. The configured reader mode can be depicted from the history list as well.

4.2 Mainframe general overview

The public MIFAREdiscover supports the functions for MIFARE Classic (see [9]), MIFARE Ultralight (see [11]), General ISO/IEC 14443-A (see [7]) protocol handling.

Therefore, the user interface is divided into functional blocks which are shown in different tabs in Fig 11 (1).

They open the so called 'Command selection' window (2) which allows to select a command window in (3).

At the bottom (4) Fig 11 shows the history field where all the operations are displayed. For a more detailed view on the sent data and received data a switch to the log window is possible. Both fields can be cleared, or can be stored in a text file.

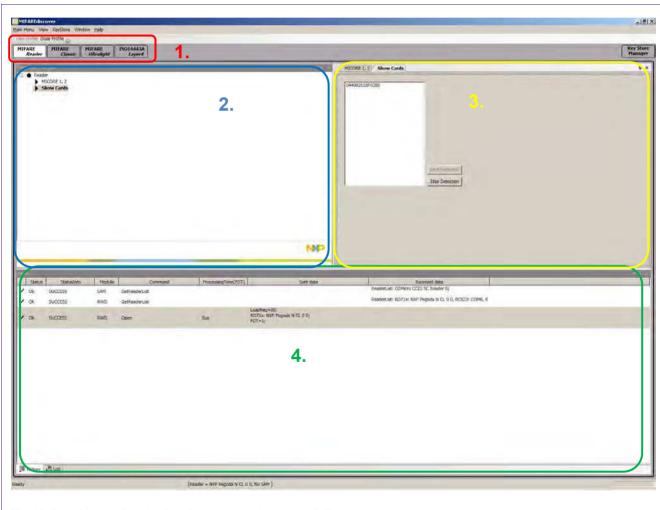


Fig 11. Interface to Reader has been opened successfully

Note: The sequence of commands as described in ISO/IEC 14443 or in the relevant datasheet must be kept to be able to activate and operate a card. The MIFAREdiscover does not cross check the logical command flow.

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4.2.1 MIFARE Reader

Field On RegisterData 00 00 00 00 01 00 00 02 00 00 03 00 00 04 04 00 05 00 00 ReadReg 09 26 00 WateReg	Reset		Field Off			
Register Data 00 00 01 00 02 00 03 00 04 04 05 00 06 00 07 21 08 00 09 26		E	Field On	j		
00 00 01 00 02 00 03 00 04 04 05 00 06 00 07 21 08 00 09 26	RegisterData	1	_			
01 00 Image: Constraint of the second s	Register	Data				
02 00 03 00 04 04 05 00 06 00 07 21 08 00 09 26	00	00		-		
02 00 03 00 04 04 05 00 06 00 07 21 08 00 09 26						
04 04 05 00 06 00 07 21 08 00 09 26		-				
05 00 06 00 07 21 08 00 09 26		-		-		
06 00 07 21 08 00 09 26	3	-				
07 21 08 00 ReadReg 09 26 ReadReg						
08 00 ReadReg 09 26		100.00	14			
09 26	- Carlos and Carlos an					
				_	ReadReg	
OA 00 + WriteReg	09					
	0A	00		*	WriteReg	

With this tab you can control the basic functions on the reader.

The "MICORE 1, 2' command window allows you to reset the reader and to turn the electromagnetic (card reading) field off or on.

The commands 'ReadReg' and 'WriteReg' allow reading or writing the register to control the reader. For further information on the register settings and functions please refer to the individual Reader ICs data sheet.

-	MICORE 1.2 Show Cards	
		Steel Contractions
		Stop Landonin (
Fig 13. Show Cards command wi	ndow	

The 'Show Cards' command window in Fig 13 allows you to detect all the cards which are present in the reader field. With 'Start Detection' the reader starts to poll for cards (ISO 14443 Type A and B) and you get the UID of the cards presented to the Pegoda as well as the card type. With 'Stop Detection' the polling is stopped again.

4.2.2 MIFARE Classic

The command window "ISO14443A Layer 3" is shown in Fig 14.

- 1. This part of the panel allows you to activate a number of cards and perform the anti-collision protocol according to [7]. The most convenient method is to push the 'Activate Idle' button. After that, in the table a UID appears in section 2 and its State is 'Active'.
- 2. This section allows you to manage multiple cards in the reader field. Select a specific card you want to communicate with. Therefore this card has to be in 'Active' State. To to switch to another card in the reader field choose the current 'Active' card and with 'Halt' you can change the State from 'Active' to 'Halt' state (and work with another card in the meantime). Pick a 'Halt' UID and the button 'Act.Wakeup' changes the State back to 'Active' and you can work with the card again. 'Clear List' deletes all data in the table

With the control elements it the blue section you can send individual commands and data to the card in an ISO 14443 Layer3 massage frame. Thereby the input format is hex coded. The checkboxes there indicate if you want to append a CRC code to the command and if you expect that the card to append a CRC to the response. The answer of the card is then displayed in the log windows. For a list of available command please refer to cards datasheet.

	Cascade	and the second s			-	
Request	93	•	Anticollision	Select	Activate Idle	1.
Wakeup	95	•	Anticollision	Select	RF Reset	
	97	*	Anticollision	Select		J
Halt)
State	ATQA	UID			SAK	2.
Unknown						2.
Unknown	-			63		
Unknown		2				
_				_		
RX CRC					Incomplete Byte	3.
TX CRC				# Bits	1 *	
00						
					Exchange	

Fig 15 shows the 'Data Processing' window. With this window you can process the data stored on the MIFARE Classic card:

- 1. 'Personalization UID Usage' allows you to configure the type of UID the card should use. For the available types please refer to [8][8].
- 2. To gain access to the different storage sectors of the card you first need to authenticate with a Key. Therefore you can choose a 'BlockNo' and the 'Ref Key' (prepared in the KeyStore 5.3.2.3) and use the button 'MFC Auth Key A' or 'MFC Auth Key B'.
- 3. With 'Read' you can read a block from the card and with 'Write' you can write the block on the card then is selected in the data grid. Use 'Increment' to increase and 'Decrement' to decrease the contents of a block. The results are stored in an internal data-register. The 'Restore' button move the contents of a block into an internal data-register. Use 'Transfer' to write contents of the temporary internal data-register to a value block.

ype)0	Personalize UID Usage				
uthentiation lockNo D1 MFC Auth I MFC Auth I	Key A	2.			3.
ata Access IIFARE Data	3				<u>J.</u>
Block	Data [Hex]	Data [ASCii]	Value [Dec]	DstBlock	Description
09	000000000000000000000000000000000000000	00000000000000000	???	09	Data 🔦
0A.	000000000000000000000000000000000000000	0000000000000000	222	0A	Data 🗔
OB	000000000000FF078069FFFFFFFFFFFFF	00000ÿïÿÿÿÿÿÿ	???	OB	Trailer
OC.	000000000000000000000000000000000000000	00000000000000000	???	0C	Data
0D	000000000000000000000000000000000000000	000000000000000	222	0D	Data
OE	000000000000000000000000000000000000000	00000000000000000	???	OE	Data
OF	000000000000000000000000000000000000000	0000000000000000	???	OF	Trailer
10	000000000000000000000000000000000000000	0000000000000000	???	10	Data
11	000000000000000000000000000000000000000	00000000000000000	222	11	Data *
4		III			•
Read		Value [Dec] 1 🔹	Increment	Decrement	Restore
Write				Edit AC	Transfer

4.2.3 MIFARE Ultralight

The Ultralight tab provides the 'ISO14443A Layer 3' command window as well. For the provide functionality please see section 4.2.2.

The 'Ultralight' command window allows:

- 1. To read and write data on a chosen page of the card.
- 2. To write Lock Bytes (refer to [21]).

Page No	00 -	Lock Bytes	2.	1.	
Data	00000000	✓ Write	Compatibility Write		
Read					

4.2.4 MIFARE ISO14443A Layer 4

This tab provides all the functionality to work with ISO14443A Layer 4 [7] and the command window is shown in Fig 17.

- 1. This part can be use to activate a card to Layer 4 and control the date exchange rate.
- 2. The textbox shows the State of the cards. Control which card is the active one.
- 3. Use the blue marked part to send commands to the card in a ISO14443A Layer4 message frame format.

For more information on the provided commands of this window please refer to [7].

Current L3	activate	d UID								
CID		Reader	Buf Sz.						1.	
00	*	256		•	GetATS					
DRI (PCD to	PICC)	DSI (PI	CC to PC	D)						
106k		106k		•	PPS	Act.Idle	+GetRATS	ActivateCard		
						Act.Wup	+GetRATS	Deselect	J	
State	CID	DRI	DSI	ATS			UID		`	
Unknown	00	106k	106k	1				-	2.	
Unknown	01	106k	106k							
Unknown	02	106k	106k							
4	4	4		4	W.		*	F F		
RX CRC	_			_				incomplete Byte		
TX CRC							# Bits	1 -	3.	
00A404000	7d27600	008501	0100					•		
								Exchange		
						_	_			
						m				

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4.2.5 Key Store Manager

The Key Store Manager window as shown in Fig 18 allows you to define a number of Keys to be used for the authentication of e.g. memory sectors.

Each key block can have a nickname and a certain type. It is divided in 3 keys, A B and C with individual Versions.

From more information on keys and how to be used with cards please refer to the individual card IC datasheets.

						10000	Store nager
Key S	tore						⇒×
Key No	Name	Кеу Туре	Entry PartA	Version A	Entry PartB	Version B	E
0	name	MIFARE	FFFFFFFFFF	00	0000000000	01	0(-
1	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0
2	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
3	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
4	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
5	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
6	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
7	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0
8	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
9	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	01
10	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	01
11	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
12	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
13	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
14	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
15	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(
16	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0(+

Fig 18. Key Store Manager

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5. Example of some use case for the public version

5.1 Accessing the MIFARE Classic

Open the 'MIFARE Classic' Tab and select 'ISO 14443A Layer 3'. On the right side you can see a number of buttons for the activation of the card. The most convenient method is to push the 'Activate Idle' button. Then a UID appears in the table and the state changes to 'Active'.

Designed	CascadeTag(s)	Anticollision	Select	Activate Idle	
Request			Select	Activate Idle	
Wakeup	95 .	Anticollision	Select	RF Reset	
	97 .	Anticollision	Select		
Hait					
State	ATQA UID	10.00		SAK	
Active				08	
Unknown					
Unknown Unknown	10				
RX CRC				Incomplete Byte	
TX CRC			# Bits	1 -	
00				-	
				Exchange	

Now open the Key Store Manager and select the following settings for the first Key: Key Type: MIFARE, Entry PartA: FFFFFFFFFF, Version: 0 as shown in Fig 20.

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≜ain Menu View KeyStore Window <u>H</u> elp new Profile close Profile RF Reset Field Off Field On ActivateIdle				R				
MIFARE Reader Classic Ultralight Layer4	-		-					ley Store Manager
Command Selection 🔹 🕈 🌵	× 15014	443A Lay	yer 3 Data Processing Key	tore				= >
MIFARE Classic ISO14443A Layer 3	Key No	Name	Кеу Туре	Entry PartA	Version A	Entry PartB	Version B	Ent
Data Processing	0	name	MIFARE	FFFFFFFFFFF	00	000000000000000000000000000000000000000	01	0000 +
 Compared to the second sec second second sec	1	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000)1	0000
	2	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000
	3	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000
	4	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000
g 20. Key Store Manager								

Leave the Key Store Manager and select "Data Processing".

Personalizatio	n					
Туре						
00	Personalize UID Usage					
Authentiation						
BlockNo	Ref Key					
00	• Key No: 0, A		45			
22						
MFC Auth K	ey A					
MFC Auth K	ev B					
Concernancescore	<u>becom</u>					
Data Access						
MIFARE Data						
and the second sec						
Block	Data [Hex]	Data [ASCii]	Value [Dec]	DstBlock	Description	
Block	Data [Hex] E4987FB3B0980200648E645949605105	Data [ASCii] a ^{se} BodYI Q	Value [Dec]	DstBlock	Description Data	
	and an extension of the second s	21.7*ALA	and the second second		and the second se	• []
00	E4987FB3B0980200648E645949605105	a ^a *DodYI'Q	777	00	Data	•
00	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434	a ³⁻ BodYl ¹ Q 7tøêjêýjá5èaT44	777 777	00	Data Data	
00 01 02	E4987FB3B0980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 00000000000000000000000000000000	a ^a lad y''Q 7tøêjêýjâ5èäT44 0000000000000000	777 777 777 777	00 01 02	Data Data Data	
00 01 02 03	E4987FB3B0980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 00000000000000000000000000000000	a ²⁺ DodY1 [*] Q 7tøĉjêý(85è8T44 0000000000000000 000000000000000000	777 777 777 777 777	00 01 02 03	Data Data Data Trailer	
00 01 02 03 04	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	ā*60011°Q 7tøêjêýjá5è8T44 000000000000000 000000000000000000000000000000000000	777 777 777 777 777 777	00 01 02 03 04	Data Data Data Trailer Data	
00 01 02 03 04 05	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	ā*60011°Q 7tøêjêýjá5è8T44 00000000000000 00000000000000 00000000000000 000000000000000 000000000000000000000000000000000000	277 777 777 777 777 777 777 777	00 01 02 03 04 05	Data Data Data Trailer Data Data	
00 01 02 03 04 05 06	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	a ²⁺ 0adY1 [*] Q 7tøêjêýjá5èäT44 000000000000000 000000000000000 0000000000000000 000000000000000000000000000000000000	277 777 777 777 777 777 777 777 777	00 01 02 03 04 05 06	Data Data Data Trailer Data Data Data	
00 01 02 03 04 05 06 07	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	a ³⁺ 0adY1 [*] Q 7tøêjêýjá5èäT44 000000000000000 000000000000000 000000000000000 000000000000000 000000000000000 0000000000000000 000000000000000000000000000000000000	227. 777 777 777 777 777 777 777 777 777	00 01 02 03 04 05 06 07	Data Data Data Trailer Data Data Data Trailer	
00 01 02 03 04 05 06 07 08	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	a*9dam?Q 7toéjéyjáséat44 000000000000000000000000000000000000	227. 777 777 777 777 777 777 777 777 777	00 01 02 03 04 05 06 07	Data Data Data Trailer Data Data Data Trailer	
00 01 02 03 04 05 06 07 08 * Read	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	à*GadYI'Q 7tøéjéjáSéäT44 000000000000000 000000000000000 00000000000000 00000000000000 0000000000000 0000000000000 000000000000 000000000000 000000000000 000000000000 000000000000 0000000000000 0000000000000 10 10 10	??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ???	00 01 02 03 04 05 06 07 08 08	Data Data Data Trailer Data Data Data Trailer Data Restore	
00 01 02 03 04 05 06 07	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	a ³⁺ 0adY1 [*] Q 7tøêjêýjá5èäT44 000000000000000 000000000000000 000000000000000 000000000000000 000000000000000 0000000000000000 000000000000000000000000000000000000	227. 777 777 777 777 777 777 777 777 777	00 01 02 03 04 05 06 07	Data Data Data Trailer Data Data Data Trailer	
00 01 02 03 04 05 06 07 08	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	à*GadYI'Q 7tøéjéjáSéäT44 000000000000000 000000000000000 00000000000000 00000000000000 0000000000000 0000000000000 000000000000 000000000000 000000000000 000000000000 000000000000 0000000000000 0000000000000 10 10 10	??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ???	00 01 02 03 04 05 06 07 08	Data Data Data Trailer Data Data Data Trailer Data	
00 01 02 03 04 05 06 07 08 * Read	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	à*GadYI'Q 7tøéjéjáSéäT44 000000000000000 000000000000000 00000000000000 00000000000000 0000000000000 0000000000000 000000000000 000000000000 000000000000 000000000000 000000000000 0000000000000 0000000000000 10 10 10	??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ???	00 01 02 03 04 05 06 07 08 08	Data Data Data Trailer Data Data Data Trailer Data Restore	
00 01 02 03 04 05 06 07 08	E4987FB380980200648E645949605105 378674F8EA7DEAFDA6E235E8E4543434 000000000000000000000000000000000000	à*GadYI'Q 7tøéjéjáSéäT44 000000000000000 000000000000000 00000000000000 00000000000000 0000000000000 0000000000000 000000000000 000000000000 000000000000 000000000000 000000000000 0000000000000 0000000000000 10 10 10	??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ??? ???	00 01 02 03 04 05 06 07 08	Data Data Data Trailer Data Data Data Trailer Data	

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Select BlockNo 00, Ref Key 0, A and click "MFC Auth Key A" Now you should be able to read Sector 0 (Blocks 0-3). Select BlockNo 04, Ref Key 0, A and click "MFC Auth Key A" Now you should be able to read and write in Sector 1 (Blocks 4-7). The same is for all the other blocks and sectors.

5.2 Accessing the MIFARE Ultralight

Open the 'MIFARE Ultralight' Tab and select 'ISO 14443A Layer 3'. On the right side you can see a number of buttons for the activation of the card. The most convenient method is to push the 'Activate Idle' button. Then a UID appears in the table and the state changes to 'Active'.

Then select the "Ultralight" command window.

Data Access Page No	02 -	Lock Bytes		
Data	0000000	Write	Compatibility Write	
Read	D8480000E11006000315D1011155046F			

Select a 'Page No' and click 'Read' to read the data in the second text box. You also can write 4 Bytes into the first text box and click 'Write' to transfer it to the card.

If you check the 'Compatibility Write' box you can write 16Byte at once (compatible to MIFARE Classic). The data is then distributed to 4 pages starting with the on selected at Page No.

NOTE: Start writing at Block 3. The first three blocks (0 - 2) are reserved for the UID, some internal data and the lock bits of the memory.

Keep in mind that you can only write when the lock bits (Block 2, Byte 2 and 3) are all set to 0b (read and write permission).

AN10992

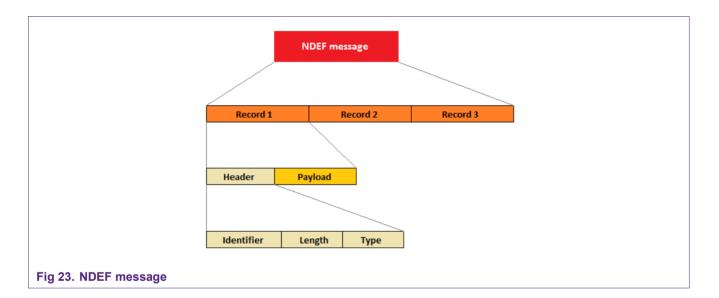
Quick Startup Guide for RD710

5.3 Writing NFC Tag

MIFARE discover can be used to format MIFARE Card products to act a NFC Tags (refer to [17]) and store NDEF messages on them. The following examples show how to store an url in this format on the card to make it accessible from NFC devices. Therefore the NDEF Massage format is explained briefly.

5.3.1 The NDEF message

A NDEF message is composed of one or more NDEF records as shown in figure Fig 23. Each Record has a Header and a Payload. The header is made of the Identifier, Length and Type.



The NDEF message use for the following examples should contain the url <u>http://www.nxp.com</u>. Therefore the coded message has to look as followed:

03 | 0C | D1<mark>| 01 08 55 01 6E 78 70 2E 63 6F 6D | FE</mark>

The message starts with the Message TLV (Type Length Value) '03 0C D1'.

- 03 NDEF Record (this byte defines the type of record)
- 0C tells, how many bytes in the payload are
- D1 Type of the record (first record? last record? short record? etc.)
- 01 Type length (specifies the length of the Type field)
- 08 Payload length, bytes that are used for the payload (01 6E 78 70 2E 63 6F 6D)
- 55 Type field ('55' = 'U' and means URI)
- 01 URI Identifier ('http://www.')

6E 78 70 2E 63 6F 6D - Payload, the rest of the string in hex-code (nxp.com)

FE – Terminator TLV ('Message is finished')

For details about the TLV refer to [22]. And if you want to read more information about creating a NDEF Message, please refer to [19].

5.3.2 MIFARE Classic as NFC Tag

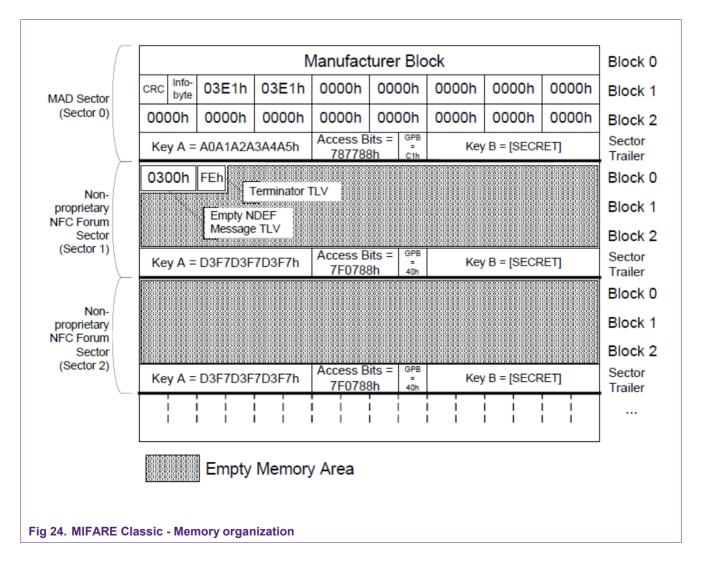
This part now shows how you can use the MIFARE Classic as NFC Tag [16] and put a NDEF message on a blank Card. We use the previously explained message url NDEF massage and store it on the Card.

5.3.2.1 Default factory settings MIFARE Classic

First there is some informative data about a MIFARE Classic Card [8][8].

- 16 Sectors (0 15)
- Standard Key A = FFFFFFFFFFF and standard Key B = FFFFFFFFFFFF
- Access bits are set to 'FF0780' and the GPB is '69'
- You can read and write only with Key A
- You cannot write in Block 0 of Sector 0

Every Sector contains 4 Blocks (0 - 3). Block 3 is always the Sector Trailer which contains Key A, the Access Bits, GPB and Key B of the Sector. Block 0, 1 and 2 are for storing data.



The only exception is Sector 0. Block 0 is read-only and contains the UID. The first two bytes of Block 1 are for the CRC byte (cyclic redundancy check) and the Info byte. There are 30 bytes remaining in Block 1 and 2. These are splitted in groups of two. Every byte-pair represents one Sector, starting at 1 and ending with 15.

Further Information can be found there: [16]

5.3.2.2 Activate the Card

Use the MIFARE Classic Tab and push the 'Activate Idle' button to communicate with the current card.

rese Partie Coop Partie II PF Partie Frei Off Frei Chr. Connactor Milf Alle Reseter Milf Alle Clenix Milf Alle Lithelight Layers	and the second second		Key Stor Manage
Window Help eset Field Off Field Or ActivateIdle MIFARE Ultralight ISO14443A Layer4	• 9 X Societada larges () Can Processing Provide larges () Can Processing Provide larges Societada Provide larges Societada Provide larges Societada Provide larges Societada Provide larges Provide larges Societada Provide larges Provide larges Societada Provide larges Provide	0 CDIAGCOGODOCODO 0 CEDEDOCUDOCODOCODO 0 CEDEDOCUNA 00 CEDEDOCUNA 01 CEDEDOCUNA 02 CEDEDOCUNA 03 CEDEDOCUNA 04 CEDEDOCUNA 05 CEDEDOCUNA 06 CEDEDOCUNA	Vex. Det Diffect Securition 177 10 Dea Dea 177 10 Dea Dea
History Status Statushto Woolue Command ProcessingTine(FDT) Ch SUCCESS Datest AdvanteeDe 455us	Sent suis Received asia (00-9487915401200) (546-10) Mare-02		• 3
調 History 副 log Ready Pegoda N CLO D. No SAM 1 Fim	nware Version = Peopda 2: v0116.06		
🧏 🏹 Hotta://www.inp.com. 🐖 😰 🕅 Offici Communicator 😿 Polici - Municelli Olu. 🗃 MED		EN	S @ ? ♀ ∃ ♥ € □ 6 1135

Application note

5.3.2.3 Key Store Manager

For accessing the different blocks of the card you have prepare a certain set of keys.

Open the key store and put in the keys as shown in Fig 26.

- The red Key is standard Key A ('Key No: 0, A').
- The blue Key is standard Key B ('Key No: 0, B').

All keys (=standard key) are always set to FFFFFFFFFFFFFFF, as explained in [8].

- The green Key is the public MAD Key A ('Key No: 1, A'). •
- The yellow Key is the public Sector Key A ('Key No: 2, A').

The public keys are defined in [16].

Key N	o Name	Кеу Туре	Entry PartA	Version A	Entry PartB	Version B	Entry
0	name	MIFARE	FFFFFFFFFF	00	FFFFFFFFFFF	01	00000
1	name	MIFARE	A0A1A2A3A4A5	00	A0A1A2A3A4A5	01	0000C
2	name	MIFARE	D3F7D3F7D3F7	00	D3F7D3F7D3F7	01	0000C
3	name	MIFARE	0000000000	00	00000000000	01	0000C
4	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	00000
5	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000C
6	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000C
7	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	00000
8	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	00000
9	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000C
10	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000C
11	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000C
12	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	00000
13	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	00000

Fig 26. Set MAD Keys

Application note

5.3.2.4 Formatting the MIFARE Classic to NFC Tag

The make the Information accessible by an NFC device as certain data structure has to be set in place.

The first step is to set the Keys of the MAD Keys, therefore:

- 1. To Authenticate for Block 00-03 select BlockNo 00 and standard Key A (Key No: 0, A) and push 'MFC Auth Key A'
- 2. Write 'A0A1A2A3A4A5787788C1FFFFFFFFFFFFFFFFF' to Block 03 and push 'Write'

Note: The **orange** and **green** highlighted parts are Key A and Key B. The **lavender** highlighted parts are the Access bits. In this case they stand for read-only with Key A and read and write access with Key B. The **yellow** highlighted part is the GPB (General Purpose Bit). More information on the coding of these bits can be found in [20].

0	Key No: 0, A				
MFC Auth M	(ey A) 1.				
MFC Auth H					
WIFC AUCH ((ey o				
ta Access					
IFARE Data			and the second second second	(Junioration and	
Block	Data [Hex]	Data [ASCii]	Value [Dec]	DstBlock	Description
00	04BEF95A812280984200E10000000000	34ùZ"80á0000	777	00	Data 🛃
01	000000000000000000000000000000000000000	000000000000000000	777	01	Data
02	000000000000000000000000000000000000000	0000000000000000000	???	02	Data
03	A0A1A2A3A4A5787788C1FFFFFFFFFFFF	;€£¤¥xwÁÿyyyy	222	03	Trailer
04	000000000000000000000000000000000000000	000000000000000000000000000000000000000	777	04	Data
05	000000000000000000000000000000000000000	000000000000000000	???	05	Data
06	000000000000000000000000000000000000000	0000000000000000000	777	06	Data
07	000000000007F078840000000000000	00000@00000	???	07	Trailer
nº	000000000000000000000000000000000000000	laanaanaanaanaanaanaanaanaanaanaanaanaan	222	Ino	I Data
				7.4 W	76
Read		Value [Dec] 1	Increment	Decrement	Restore
Write	2.			Edit AC	Transfer

Application note COMPANY PUBLIC Now the information where to find the NDEF massage in the card storage has to be written into the MAD:

- 1. To authenticate for block 00 to 03 select BlockNo 00 and Key B and push 'MFC Auth Key B'

'03E1' is the NFC AID [22]. C001 contains the CRC and Info – Byte according to [20]. Now you can use Sector 1 of the MIFARE Classic Card to write your NDEF message.

llockNo 00	Ref Key						
MFC Auth	Key A						
MFC Auth							
ata Access							
/IFARE Data							
Block	Data [Hex]	Data [ASCii]		Value [Dec]	DstBlock	Description	-
00	04BEF95A812280984200E10000000000	%úZ"80á00000		777 ???	00	Data	-
01	000003E10000000000000000000000000000000				01	Data	
02	000000000000000000000000000000000000000			777	02	Data	
03	A0A1A2A3A4A5787788C1FFFFFFFFFFFF	;¢£¤¥xwÁÿÿÿÿÿÿ		77?	03	Trailer	į,
04	000000000000000000000000000000000000000	000000000000000000000000000000000000000	1	??? 04		Data	Į.
05	000000000000000000000000000000000000000	000000000000000000000000000000000000000]	??? 05		Data	
06	000000000000000000000000000000000000000	000000000000000000000000000000000000000	1	777	06	Data	Ê
07	000000000007F078840000000000000	00000@000000		772	07	Trailer	í
00	100000000000000000000000000000000000000		1	1999	100	Inata	
Read	2.	Value [Dec] 1	▼ Inc	rement	Decrement	Restore	£.
Write	3.				Edit AC	Transfe	r

Application note

Next the Sector Keys and Access rights for this sector have to be set:

- 3. To authenticate for block 04 to 07 select Block 04 and standard Key A (Key No: 0, A) and push 'MFC Auth Key A'
- 4. Write 'D3F7D3F7D3F77F078840FFFFFFFFFFFFFFFF' to Block 07 and push 'Write'

In this case the Access bits 7F0788 stand for read and write access with Key A and B.

MFC Auth								
ta Access								
IFARE Dat								
Block	Data [Hex]	Data [ASC			Value [Dec]	DstBlock	Description	
03	A0A1A2A3A4A5787788C1FFFFFFFFFFFF	;¢£¤¥xwÁj			777	03	Trailer	
04	000000000000000000000000000000000000000		00000000000000 ??			04	Data	
05	000000000000000000000000000000000000000				272	05	Data	-8
06	000000000000000000000000000000000000000				???	06	Data	-0
07	D3F7D3F7D3F77F078840FFFFFFFFFFF	0+0+0+@	Ó÷Ó÷Ó÷@ÿÿÿÿÿ		2??	07	Trailer	
08	000000000000000000000000000000000000000	0000000	000000000000000		777	08	Data	
09	000000000000000000000000000000000000000	0000000	00000000		777	09	Data	
0A	000000000000000000000000000000000000000	0000000	000000000000000000000000000000000000000		777	0A	Data	
	000000000000000000000000000000000000000					0.0	Trailor	
Read	2.	Value [Dec]	1 •	Incr	ement	Decrement	Resto	re
Write	3.				14	Edit AC	Transf	er

Application note

5.3.2.5 Write NDEF Message

Last step is to write the actual NDEF message to the card.

- 1. Authenticate with BlockNo 04 with Key A (Key No: 2, A) and push 'MFC Auth Key A'
- 2. Write '030CD1010855016E78702E636F6DFE00' (see 5.3.1) to Block 04 and

4 MFC Auth F	ey A 1.					
MFC Auth k	ley B					
ita Access IFARE Data						
Block	Data [Hex]	Data [ASCii]	Value [Dec]	DstBlock	Description	
03	A0A1A2A3A4A5787788C1FFFFFFFFF	;¢£¤¥xwÁÿÿÿÿÿÿ	272	03	Trailer	
04	030CD1010855016E78702E636F6DFE00		277	04	Data	
05	000000000000000000000000000000000000000	00000000000000000	777	05	Data	зš
06	000000000000000000000000000000000000000	000000000000000	???	06	Data	
07	D3F7D3F7D3F77F078840FFFFFFFFFFFFF	Ó÷Ó÷Ó÷@ÿÿÿÿÿÿ	777	07	Trailer	
08	000000000000000000000000000000000000000	000000000000000	77?	08	Data	
09	000000000000000000000000000000000000000	000000000000000000000000000000000000000	272	09	Data	
0A	000000000000000000000000000000000000000	000000000000000000	333	0A	Data	-
. e. [m		160 C	•	
Read		Value [Dec] 1 •	ncrement	Decrement	Restor	e
Write	2.			Edit AC	Transfe	er
	NDEF message					

The procedure is now finished and you can use e.g. a NFC enabled Mobile to test the configured NFC Tag.

5.3.3 MIFARE Ultralight as NFC Tag

This is a short explanation how to use the MIFARE Ultralight as an NFC Tag Type 2 [21] store an NDEF message on the card. The used masseag contains the URL: http://www.nxp.com.

5.3.3.1 Default factory settings MIFARE Ultralight

The first three pages (00 - 02) are used for the UID, some internal data and the lock bits of the memory. They are read-only. Therefore you start writing at Page 03. Page 03 is only 'one time programmable'.

	Byte Number	0	1	2	3	Page
Static Lock bytes	UID / Internal	UID0	UID1	UID2	Internal0	0
OTP area - Capability	Serial Number	UID3	UID4	UID5	UID6	1
Container (CC)	Internal / Lock	Internal1	Internal2	Lock0	Lock1	2
1 st Data Area Byte at	OTP-CC	OTP0-CC0	OTP1-CC1	OTP2-CC2	OTP3-CC3	3
Page 4 Byte 0	Data	Data0	Data1	Data2	Data3	4
	Data	Data4	Data5	Data6	Data7	5
	Data	Data8	Data9	Data10	Data11	6
	Data					7
Read/Write Data Area	Data					8
	Data	-	-		1	9
	Data	-		- 72	1	10
	Data	4		22	14 A	11
	Data		-2			12
	Data		·	22	J. H.	13
	Data			Ξ.	4	14
	Data			4	4	15

Fig 31. Memory of a Ultralight card

Every page is made of 4 bytes.

On page 02 Byte 2 and 3 need to be set to '00 00', else you cannot write or read. For details refer to [21].

5.3.3.2 Activate TAG

To activate the Card use the MIFARE Ultralight Tab and push the 'Activate Idle' button as shown in Fig 25.

5.3.3.3 Write NDEF Message

First step is to set the so called CC (Capability Container) located at page 03.

Please NOTE that once you set a bit to logic 1 in this area, it cannot be changed back to 0 anymore (xor operation).

Select the 'Ultralight' command window as shown in figure Fig 32.

- 1. Pick 'Page No' 03 and press the 'Read' button.
- 2. Write 'E1100600' into the Data textbox and push 'Write'.

Data Access Page No 03 Data E1100600	Cock Bytes Write Compatibility Write
Read 0000000FFFFFFF00000000000000000000000	2.
Fig 32. Set the CC	

Now the NDEF message can be written to the tag. Therefore:

- 1. Pick 'Page No' 04
- 2. tackle the 'Compatibility Write' box
- 3. Write '030CD1010855016E78702E636F6DFE00' (the HEX coded NDEF message) and click 'Write'

The procedure is now finished and you can use e.g. a NFC enabled Mobile to test the configured NFC Tag.

6. Full Version

6.1 Starting MIFAREdiscover

Connect RD710 Reader to the PC with USB cable. Choose the desired DIP switch configuration on the mainboard of the reader (see figure 9). This can be

- Reader in X-Mode for RD710 with MIFARE SAM inserted in the slot
- Reader in No SAM-Mode
- Reader in S-Mode

In the following descriptions we need to have the DIP switch of the Pegoda set to X-Mode.

Start MIFAREdiscover from the Start menu.

You will be asked to select your reader connected to MIFARE AV2 SAM as shown in Fig.15.

😌 New Profile	
	Contactless Reader Selection
Get available Reader's	Not Used
	Contact Reader Selection (for SAM)
Get available Receirs	NXP Pegoda X 0 0
	Key file
Browse	
	Timing Mode 💿 FDT 🔿 OT
Fig 33. Select reader conne	cted to SAM

Select the reader. Any time the profile can be closed or opened by using close and open profile respectively.

After selection of the reader the key file can be browsed if it is necessary. In the key file, the secret keys can be stored, which may be needed to authenticate MIFARE SAM AV2 with the host or to be changed later. Press OK button to validate the profile. If the MIFARE SAM AV2 is connected properly, the status field of the history window shows "SUCCESS".

Application note

6.2 User Interface Overview

There are 5 areas in the main window, as shown in Fig 16.

- 1. Menu Bar and Buttons: for reader connection, display settings and help
- 2. Command Selection Window: list of commands
- 3. Configuration Window: for detailed configurations of commands
- 4. History Window: Showing the command execution histories
- 5. Status Bar: Showing the current command execution status

IFARE MIFARE SAM MIFARE Plus MIFA	Classic Ultralight	MIFARE DESFine EV1 KeyEntryManagement // MFRC52X Control //	ISO14443A-3 LoadInitVector KUC	FntryMananement
 MIFARE SAM AV1/AV2 ⇒ SAM Configuration ⇒ SAM Key Management KUCENT/Management bumpKeys Loadini/Vector AuthenticateHost ISOAuthentication KILauthentication KILSIAuthentication PKI-Signatures Offline Crypto ⇒ Crard Activation MIFARE DESFre, MIFARE Ultralight ➡ MIFARE DESFre, MIFARE Ultralight 	22 Key A 0x00000000000000000000000000000000000		Programming bit mask I Update Key A I Update Key B	Settings Disable Generate MAC Disable Change Key Disable Verity MAC Disable Change Key Disable Encryption Disable Encryption diversion er of KUC F Keep Init Vector (DESFire) t F Allow Crypto with Secret Key
	GetKeyEntry ChangeKeyEntry DisableKeyEntry Offline Cryptogram		KeyGass Host C OfflineCha C PICC C OfflineCha SAM UID SAM UID C C C C OfflineCha AVI1 Plain Key Update	
NP	ÖffChangeKey OffDisableKey			
Status StatusInfo Module	Command	ProcessingTime(FDT)	Sent data	Received data
	ReaderList			ReaderList: Broadcom Corp Contacted SmartCard 0, NXP Pt
Ok SUCCESS RWD Get	ReaderList m	NXP Pegoda X (LoadReg=0x80; FDT=0x1;		
History Log	_			
		[Reader = NXP Pegoda X 0 0, SAM X Interface]		

7. Examples of some use cases for the full version

In every use case (defined below) we need to have the DIP switch of the Pegoda reader set to **X-Mode**.

<u>Overview</u>

7.1. Checking the connected MIFARE SAM AV2

Here you will get some hardware and software related information about the installed SAM.

7.2. Switch the MIFARE SAM from AV1 to AV2 Mode

AV2 mode is recommended because of security reasons.

7.3. Authenticate host

This step is needed when operating with the SAM.

7.4. Operating the MIFARE DESFire EV1

7.4.1.Using MIFARE SAM AV2 for communication with MIFARE DESFire EV1

This example shows how to perform a basic authentication between SAM and MIFARE DESFire EV1.

7.4.2. Create Application and format MIFARE DESFire

7.4.3. Authenticate Application

7.5. Operating the MIFARE Plus S

- **7.5.1.Switch MIFARE Plus from Security Level 0 in Security Level 1** Security level 0 is the initial delivery configuration of the PICC. We have to pre-personalize the card to get into security level 1.
- 7.5.2.Switch MIFARE Plus from Security Level 1 in Security Level 3 Because security level 1 is the compatibility mode to the MIFARE Classic card, we want to use the enhanced security of security level 3.

7.5.3.Read/Write Actions of MIFARE Plus in Security Level 3 A short introduction of how to access blocks with read and write operation in security level 3.

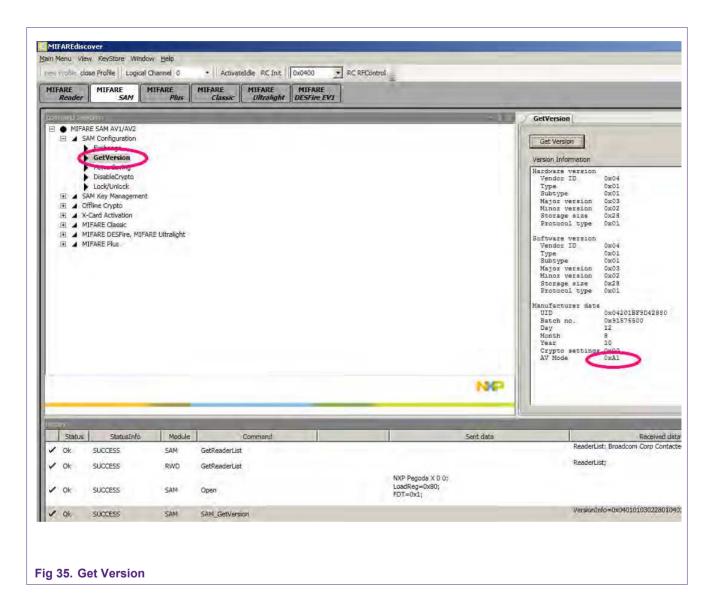
Application note

COMPANY PUBLIC

7.1 Checking the connected MIFARE SAM AV2

Ensure that the Pegoda reader is set to "X-Mode".

Let's check the connected MIFARE SAM AV2. It can be done using the GetVersion command.



The last byte of the "GetVersion" response will be "0xA1" for MIFARE SAM AV1 and will be "0xA2" for MIFARE SAM AV2.

7.2 Switch the MIFARE SAM from AV1 to AV2 Mode

The default MIFARE SAM is delivered from NXP semiconductor in MIFARE SAM AV1 mode. DIP switches should be set to "X-Mode" (see figure 9). For switching to AV2 mode follow the steps.

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7.2.1 Authenticate host

Select the "AuthenticateHost" command at the command window. Set the reference key as shown in the following figure. The reference key here used is "Key No: 0, A" for the default setting, where you need to authenticate host using SAM Master key entry and version "00" to change the key.

Reader SAM Plus Classic Ultralight	CetVersion AuthenticateHost
MIFARE SAM AV1/AV2 SAM Configuration Exchange GatVersion PowerSaving DisableCrysto Lod/Uhlock SAM Key Management Lod/Uhlock SAM Key Management DumpKeys TosainIvector KufchtyManagement DumpKeys TosainIvector Kufchtateliset Killauthentication PKI-KeyManagement Killauthentication MIFARE DesSin MIFARE DesSin MIFARE DesSin	AuthMode Diversify key Gareate session key Calendary Land, TWO encyption road Gareate session key Calendary Land, TWO encyption-roads Gareate session key Calendary Land, TWO encypted)
	NP

Application note

COMPANY PUBLIC

7.2.2 Change SAM Master key to AES

SAM master key entry has to be changed to AES type to be able to switch the SAM mode.

Select the "KeyEntryManagement" Command from the command window and set the key "00" and key type "AES 128" (AES 192 is also ok). Set other field as shown in the following figure. We take the new key values and version all 00s, if you want, you can make your own keys as you like.

MIFARE Reader	MIFARE SAM	MIFARE Plus	MIFARE	MIFARE Ultralight	MIFARE DESFire EV1					
ommand Selectic			≁û X	Key Store	AuthenticateHost ¹	KeyEntryManagem	ent	-	Programming bit mask	Settings
Ge Po	change etVersion owerSaving sableCrypto		<	KeyNo 0x00	Key Type		• Versi) pn	Update Key A Update Key B Update Key C	Disabl
Lo SAM I	ck/Unlock (ev Managem)			-	000000000000000000000000000000000000000		- 0x00	•	☑ Update DF KeyNo & AID	Disabl
KeyEntryManagement				000000000000000000000000000000000000000		 ■ 0x00 ■ 0x00 		Update CEK number and version Update reference number of KUC	🔲 Keep I	
DumpKeys LoadInitVector AuthenticateHost ISOAuthentication KillAuthentication PKI-KeyManagement PKI-Signatures		KeyNo. CEK Key VCEK RefNo. KUC 0x00 • 0x00 0xFF • DF KeyNo, DF AID 0x000000 • •					 ☑ Update configuration set ☑ Send version separately 	Allow C Allow E Allow E AV1: Hi AV1: Er		
MIFAF	d Activation RE Classic RE DESFire, MIF	FARE Ultralight		Porterior	eyEntry KeyEntry				KeyClass Host OfflineChange PICC OfflineCrypto	Extended s
					KeyEntry				SAM UID 0x042118F9D42880	
1			NP	0x00	ngeKey					
-					ohleKeli				m.	
listory Status	StatusInfo	Module		Command				Sent d		Rece
	UCCESS	SAM	SAM_Change			KeyNo Changi KeyEnt KeySet	eKeyEntry_Pro ry: DF_AID=0 =KeySet: allo Set=KeyExtSe	tion: sentPl Mas: keyVe x000000, DF wCryptoWit		
↓ History	Log									
ady	and an interest of the			-	IReader = NXP	Pegoda X 0 0, SAM 2	X Interface]	-		

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If the SAM master key is already AES key type the steps 7.2.1 and 7.2.2 are not required.

Now change the key entry in the key file to have the same key as we have in the MIFARE SAM. Open the key file from menu. Change the key type and key values as we downloaded in previous command.

IIFARE Reader	MIFARE	MIFARE	MIFARE Classic	MIFARE Ultralight	MIFARE DESFIRE EVI					
مى مەربىيە			,		n		Getver	sion A	uthenticateHost KeyEntr	Management Key Store
	E SAM AV1/AV2						Key No	Name	Key Tree	Entry PartA
	M Configuration Exchange						0		AES 128	000000000000000000000000000000000000000
	GetVersion						1		TDEA - DESFire	000000000000000000000000000000000000000
	PowerSaving						2	name	TDEA - DESFire	000000000000000000000000000000000000000
	DisableCrypto						3	name	TDEA - DESFire	000000000000000000000000000000000000000
	Lock/Unlock						4	name	TDEA - DESFire	000000000000000000000000000000000000000
	M Key Manager						5	name	TDEA - DESFire	000000000000000000000000000000000000000
	KeyEntryMan						6	name	TDEA - DESFire	000000000000000000000000000000000000000
	DumpKeys	concert.					7	name	TDEA - DESFire	000000000000000000000000000000000000000
	LoadInitVector						8	name	TDEA - DESFire	000000000000000000000000000000000000000

7.2.3 Lock/Unlock Command

Now the MIFARE SAM AV2 is ready to accept the Activation of AV2 mode command.

Select the "Lock/Unlock" Command from the command window. Set the mode to "Activate AV2 mode" and refer to the key "key no: 0, A" of the key file as shown in the following figure, figure 21.

Key Store AuthenticateHost KeyEntryManagement LockUnlock
Mode
C Unlock Reference Key
C Lack w/o specifying unlock key Key No: 0, A
C Lock with specifying unlock key
Activate AV2 mode
Unlock Key No. Unlock Key Version
0x00 • 0x00
MaxChainBlocks
0x000000
LockUnlock

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Now the MIFARE SAM is switched to AV2 mode.

Application note COMPANY PUBLIC

7.3 Authenticate Host

Ensure that the Pegoda reader is set to "X-Mode".

Select the "AuthenticateHost" command at the command window and open the Key Store Manager.

ARE MIFARE MIFARE MIFARE MIFARE MIFARE MIFARE MIFARE MIFARE DESTIN		Key-Star- Hanager
mend Selection • 0	Authentikaterilosi KnyEntryNanogement (MPECS2X Control (150144934-5) Londints/ettar (10XEntryNanogement	* >
Image: Set Configuration Image: Set King Kingspendel Image: Kingspendel Image: Set Kin	Autritods Diversify ites Consultations for CMAC datulation Consultations for CMAC datulation Consultations for Consultations for Consultatio	

Change the settings:

KeyNo: 0, Key Type: AES 128, Part A: 000000000000000000, VersionA: 00

MIFARE Reader	MIFARE SAM	MIFARE Plus	MIFARE Classic	MIFAR Ultra		MIFARE DESFire EV1					
Iommand Sele	ction		• # ×	Key S	tore						1
	E SAM AV1/AV2 M Configuration			Key No	Name	Key Type	Entry PartA	Version A	Entry PartB	Version B	Entry PartC
1. 2	Exchange			0	name	AES 128	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000000000000000000
	GetVersion			1	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	000000000000000000000000000000000000000
• •	PowerSaving			2	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	000000000000000
. t	DisableCrypto			3	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	000000000000000000
	Lock/Unlock M Key Manageme	ot		4	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	00000000000000000
	KeyEntryManage			5	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	000000000000000
•	KUCEntryManage			6	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	000000000000000000000000000000000000000
•	DumpKeys			7	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	00000000000000000
1	LoadInitVector AuthenticateHo			8	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	000000000000000000000000000000000000000
1	ISOAuthenticatio			9	name	TDEA - DESFire	000000000000000000000000000000000000000	00	000000000000000000000000000000000000000	01	0000000000000000

Leave the Key Store manager and select "AuthenticateHost" again. Be sure to tick "Generate session key" at the AuthMode section and "Plain" at HostMode. Click "AuthHost".

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MIFARE Reader SAM MIFARE MIFARE Plus Classic				MIFARE DESFire EV1			
- MIFARE SAM AV1/AV2		- Ŭ	Key St	ore Authent	icateHost Ke	YEntryManagement	ckUnlock
 MIFARE SAM AV1/AV2 SAM Configuration Exchange GetVersion PowerSaving DisableCrypto Lock/Unlock SAM Key Managerr KeyEntryMana KUCEntryMana MCEntryMana MCEntryMana MUCEntryMana MUCEntryMana MUCEntryMana MUCEntryMana MUCEntryMana MUCEntryMana Milauthenticate ISOAuthenticate FISOAuthenticate FISOAuthenticate Killauthenticate FISOAuthenticate Killauthenticate MIFARE Classic MIFARE Classic MIFARE Plus 	gement gement Host Ion on ament		Refere Key h	inersify using Th so DrAC divers nce Key o: 0, A fication Input	Restan 0000000000000		Y

7.4 Operating the MIFARE DESFire EV1

The MIFARE DESFire EV1 answers every command with a status code. These codes can be found in MIFAREdiscover command selection at the Received data column. For example, if you enter an invalid command you will get "AppDataOut=0x1C".

A list with useful status and error codes is provided:

Table 3.	Useful status and error	r codes
Hex Code		Status
0x00		OPERATION_OK
0x0C		NO_CHANGES
0x0E		OUT_OF_EEPROM_ERROR
0x1C		ILLEGAL_COMMAND_CODE
0x1E		INTEGRITY_ERROR
0x40		NO_SUCH_KEY
0x7E		LENGTH_ERROR
0x9D		PERMISSION_DENIED
0x9E		PARAMETER_ERROR
0xA0		APPLICATION_NOT_FOUND
0xA1		APPL_INTEGRITY_ERROR
0xAE		AUTHENTICATION_ERROR
0xAF		ADDITIONAL_FRAME
0xBE		BOUNDARY_ERROR

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Hex Code	Status
0xC1	PICC_INTEGRITY_ERROR
0xCD	PICC_DISABLED_ERROR
0xCE	COUNT_ERROR
0xDE	DUPLICATE_ERROR
0xEE	EEPROM_ERROR
0xF0	FILE_NOT_FOUND
0xF1	FILE_INTEGRITY_ERROR

7.4.1 Using MIFARE SAM AV2 for communication with MIFARE DESFire EV1

At first, the DESFire Key has to be downloaded to the MIFARE SAM if it is not already there. According to the steps done here, downloading a key to the MIFARE SAM requires host authentication as shown in § 7.3.

7.4.1.1 Uploading MIFARE DESFire EV1 AES key to SAM

Let's change the key entry number 1 to PICC DESFire EV1 AES key. To make it simple

The other options are checked as shown in the following figure, figure 25.

MIFARE Reader SAM MIFARE Plus	MIFARE Classic	MIFARE Ultralight DESFire E	
Command Salection MIFARE SAM AVI/AV2 SAM Configuration SAM Configuration		* 4 ×	Authenticatekiost KeyEntryHanagement MERCS2X Control ISO14443A-3 LoadInit/Vector KUCEntryHanagement KeyKo Key Version Version Vupdate Key Key Disable Generate MAC Disable Generate MAC Disable Generate MAC Disable Generate MAC Disable Senerate MAC KeyKo Coduct 0x000 0x000 0x000 Windots continuation set Vindots continuation set Vindots continuation set Vindots continuation set Allow Dump Seston/PHTFAR Allow Dump Sestenerate MAC Allow Dump Sestenerate MAC
g 43. Downloading N	IIFARE	DESFire EV1	I AES key to SAM

Do not forget to tick the "keep Init Vector" option for DESFire EV1 AES and standard TDEA keys.

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7.4.1.2 Accessing MIFARE DESFire EV1

The steps are as follows:

- 1. RC Init to initialize the l^2C communication (shown in fig. 26).
- 2. RC RFControl to turn on the RF field (shown in fig. 26).

mmand Selection 🔹 🛡 🗙	Key Store AuthenticateHost KeyEntryManagement MFRC52X Control	
MIFARE SAM AV1/AV2 SAM Configuration Exchange GetVersion PowerSaving DisableCrypto Lock/Unlock SAM Key Management KeyEntryManagement KUCEntryManagement DumpKeys	Load Register Dx81	
LoadInitVector AuthenticateHost ISOAUthentication KillAuthentication PKG-KeyMaagement PKG-Signatures Offline Crypto	0x01 0x00 0x02 0x00 0x03 0x00 0x04 0x00 0x05 0x00 0x06 0x00 0x07 0x00	Load Register
MERVALUATION SCAMAL2A 3 ISO14443A-4	Ux03 Ux00 RC ReadReg 0x09 0x00 + RC WriteReg	0x81 RC LoadValues

- 3. ActivateIdle to activate the MIFARE DESFire EV1 card to ISO/IEC14443 part 3 (shown in fig. 27).
- 4. RATS and PPS command to prepare the MIFARE DESFire EV1 card to ISO/IEC 14443-4 layer (shown in fig. 28).

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MIFARE Reader	MIFARE SAM	MIFARE Plus	MIFARE Classic	100 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	IIFARE ESFire EV1				
Command Sele	ection		• 4 ×	Key Store Auti	henticateHost	KeyEntry	/Manageme	ent N	AFRC52X
	E SAM AV1/AV2								
	M Configuration Exchange			CmdCode		-			
	GetVersion			0x26	REQA Wai	keup			
•	PowerSaving			SelCode					
	DisableCrypto			0x93	Anticoll. Se	elect			
	Lock/Unlock M Key Manageme	t	_						
	KeyEntryManage			Filters					
•	KUCEntryManag				Number of C	Cards			
	DumpKeys				0x01	+			
1	LoadInitVector AuthenticateHos				Time [ms]				
	ISOAuthenticatio	15.2		Time Filter	0x00000000) +			
	KillAuthenticatio				Mask 1		Mask 2		Value 1
•	PKI-KeyManage	ment		ATQA Filter	Contraction of the second	-	0x00	-	0x00
1.0.0.000	PKI-Signatures			E AIQA HIGH			1000000		UNUU
	fline Crypto Card Activation			SAK Filter	Mask 1	10	Value 1		
16 17 12 50	MFRC52X Control	ol		D SAK CITES	0x00	+	0x00		
	ISO14443A-3			P		-			
111 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ISO14443A-4			ActivateIdle	a HaitA				
1. The Colors	FARE Classic			UID	•				
	FARE DESFire, MII FARE Plus	-ARE Ultralight		0x000000000	00000		ActivateW	akeup	
					Bits				
				Incomplete	Byte OxOO	1			
				0x0000000000	000000000000000000000000000000000000000	0000000	000000000000000000000000000000000000000	000000	1000000
			NP	Exchange					

Application note COMPANY PUBLIC

MIFAREdiscover Main Menu View KeyStore Window Help ActivateIdle RC Init 0x0400 new Profile close Profile Logical Channel 0 RC REControl MIFARE MIFARE MIFARE MIFARE MIFARE MIFARE SAM DESFire EV1 Reader Pins Classic Ultralight - 0 X Command Selection Key Store AuthenticateHost KeyEntryManagement MFRC52X Control ISO14443A-3 ISO14443A-4 MIFARE SAM AV1/AV2 SAM Configuration PresenceCheck Exchange GetVersion CID DSI DRI PowerSaving 0x00 . 106 * 106 -RATS + PPS DisableCrypto Lock/Unlock FWI FSCI SAM Key Management Dx00 0x00 . . Init KeyEntryManagement **KUCEntryManagement** CID DRI DSI ATS DumpKeys 0x00 0x00 0x00 0x067577810280 LoadInitVector AuthenticateHost 0x01 **ISOAuthentication** 0x02 KillAuthentication Clear List PKI-KeyManagement FreeCid **PKI-Signatures** Fig 46. RATS + PPS

Sometimes, when opening RD710 with MIFARE SAM AV2 for the first time, RegA and ActivateIdle commands fail. As a workaround, please execute the following steps.

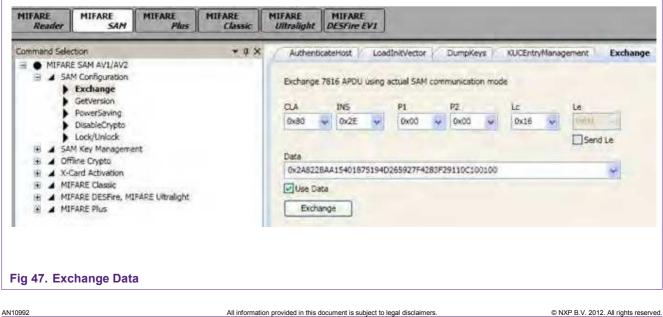
Select "SAM Configuration" and "Exchange" at the Command Selection window and insert the following data:

CLA = 0x80, INS = 0x2E, P1 = 0x00, P2 = 0x00, Lc = 0x16

Tick "Use Data"

Data: 2A822BAA15401875194D265927F4283F29110C100100

And press "Exchange".



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7.4.2 Create Application and format MIFARE DESFire

- 1. See § 7.3 and do the AuthenticateHost command
- 2. Open the "KeyEntryManagement" and change the Master Key to KeyNo: 03 if it is still "default". The Key Type has to be TDEA DESFire.

All Keys and Versions are 0, KeyClass is PICC. Be sure to tick everything at Programming bit mask (see figure below).

MIFARE Reader SAM MIFARE MIFARE Plus Classic	MIFARE Ultralight DESFire EV1	
Command Selection	AuthenticateHost MFRC52X Control ISO14443A-3 ISO14443A-4 KeyNo Key Type Version 0x00000000000000000000000000000000000	X-DESFire Data Processing SelectApplication KeyEntryManageme Programming bit mask Settings V lodate Key A Disable Generate MAC V lodate Key B Disable Verify MAC V lodate Key C Disable Encryption V lodate CEK number and version Disable Decryption V lodate reference number of KUC Keep Init Vector (DESFill V spdate configuration set Allow Dump Session/M V v21: Higher CmdSecle AV1: Enable HostAuth,
MIFARE Classic MIFARE DESFIRe, MIFARE Ultralight ChangeKeyPICC SelectApplication AuthenticatePICC Data Processing XUltralight XDESFire Data Processing MIFARE Plus	GetKeyEntry ChangeKeyEntry DisableKeyEntry	KeyClass Extended settings Host OfflineChange PICC OfflineCrypto SAM UID Diversified Use Only \$\text{NUD}\$ \$\text{AU11BF9D42880}\$ AV1: Plain Key Update \$\text{Image}\$

- 3. Click "ChangeKeyEntry"
- 2. To get access to DESFire, do the steps described in § 7.4.1.2.
- 3. Then select "X-DESFire Data Processing" at the Command Selection and insert the following data:
 - **DESFire KeyNo:0**

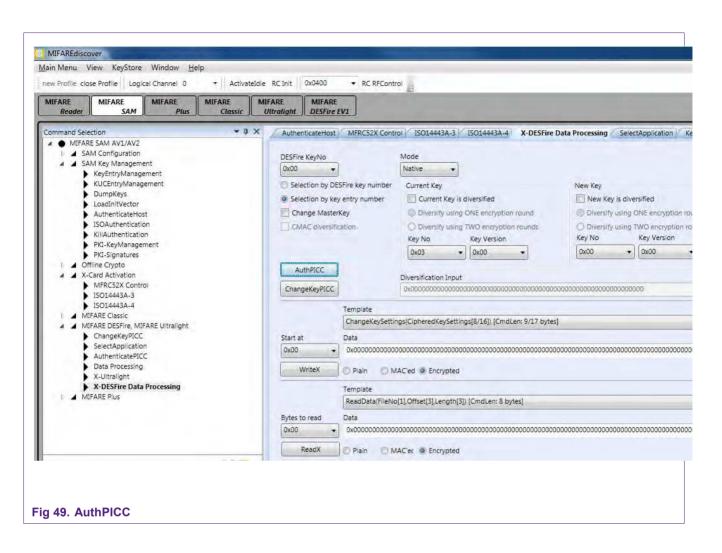
"Selection by key entry number"

Mode: Native

Current Key KeyNo: 0x03, KeyVersion 0x00

4. Click "AuthPICC".

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- 5. Go to "ISO14443A-4".
- 6. To see applications on the card, insert "0x6A" and click "Exchange".

To create a new application, insert "0xCaaaaaaa0f8e" and click "Exchange" (The repeated "a" describe the AID (Application ID))

To format the card, insert "0xfc" and click "Exchange".

7.4.3 Authenticate Application

- 1. Do the ApplicationHost command, as described in § 7.3.
- 2. Open the "KeyEntryManagement" and change the Master Key to "KeyNo: 01" if it is still "default". The Key Type has to be AES 128.

All Keys and Versions are 0, KeyClass is PICC. Be sure to tick everything at Programming bit mask and "Keep Init Vector (DESFire)".

- 3. Click "ChangeKeyEntry"
- 4. To get access to DESFire, do the steps described in § 7.4.2.
- 5. Select Application with "5aaaaaaa" and click "Exchange".

MIFARE MIFARE MIFARE MIFARE Class	MIFARE MIFARE Ultralight DESFire EV1	
	AuthenticateHost MFRC52X Control ISO14443A-3	ISO14443A-4 X-DESFire Data Pr
 MIFARE SAM AV1/AV2 SAM Configuration SAM Key Management KeyEntryManagement 	PresenceCheck	
KUCEntryManagement	CID DSI DRI 0x00 + 106 + 106 +	
 DumpKeys LoadInitVector 		RATS + PPS
AuthenticateHost	FWI FSCI 0x00 • 0x00 •	
 ISOAuthentication KillAuthentication 		Init
KillAuthentication PKI-KeyManagement	CID DRI DSI ATS	
PKI-Signatures	0x00 0x00 0x00 0x067577810280	
Gffline Crypto X-Card Activation	0x01	
MFRC52X Control	0x02	
▶ ISO14443A-3		
ISO14443A-4		FreeCid
 MIFARE DESFire, MIFARE Ultralight 		Deselect
ChangeKeyPICC	0x5aaaaaa	
SelectApplication AuthenticatePICC		
Data Processing	Exchange	
X-Ultralight		
X-DESFire Data Processing		

- 6. Select "X-DESFire Data Processing" at the Command Selection
- 7. Insert the following data:

DESFire KeyNo: 1

"Selection by key entry number"

Mode: Native

Current Key: Key No.: 01, Key Version: 0

All information provided in this document is subject to legal disclaimers.

8. Click "AuthPICC".

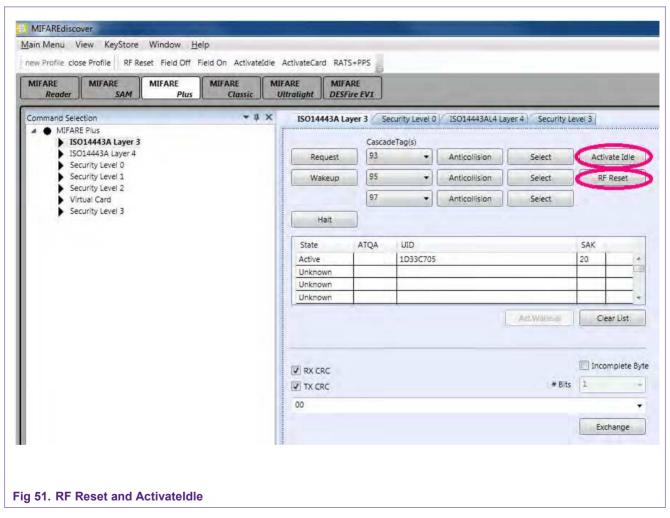
Now you are registered with your first Application.

7.5 Operating the MIFARE Plus S

To get to MIFARE Plus, you have to set the DIP switches to X-mode (see figure 9) and switch the MIFARE SAM into AV2 mode.

7.5.1 Switch MIFARE Plus from Security Level 0 in Security Level 1

Select "MIFARE Plus" (below the Menu bar) and then "ISO14443A Layer 3" at the command selection. Click "RF Reset" first and "Activate Idle" afterwards.



Go to "ISO14443A Layer 4" and click "ActivateCard".

Reader	MIFARE	MIFARE Plus	MIFARE Classic	MIFARE Ultral		MIFARE DESFire E	vı						
mand Sele			- ą	×	ISO14443/	A Layer 3	Secu	irity Leve	el O I	ISO14443AL4	Layer 4	Security Le	vel 3 Security
	014443A Layer 3	4											
	014443A Layer 4 curity Level 0	1			Current L3	activate	d UID						
	curity Level 1			10	CID		Reader	Buf Sz.		-	-		
	curity Level 2				00	7	256			GetATS			
	tual Card curity Level 3				DRI (PCD t 106k	o PICC)	DSI (PIC	C to PC	•	PPS	Article	+GetRATS	ActivateCard
				1	TOOK	-	TOOK		1	PPS	Actione	HUERAIS	ActivateCaro
											Act.Wus	+GetRATS	Deselect
					State	CID	DRI	DSI	ATS			UID	
					ActiveL4	00	106k	106k	0C75	5778002C1052F	2F0035C7	1D33C70	5
					Unknown	-	00	106k	1				
				-	Unknown	02	00	106k	-	m			-
					RX CRC								Incomplete
					TX CRC							# Bits	1
				0	CD0103301	12640000)						
													F Farmer
													Exchange

Application note COMPANY PUBLIC Select "Security Level 0" at the Command selection and insert the data as the next figure shows:

Block [Hex]	Data [Hex]	Data [ASCii]	Description
9000	000000000000000000000000000000000000000	00000000000000	
9001	000000000000000000000000000000000000000	000000000000000	
9003	000000000000000000000000000000000000000	000000000000000000000000000000000000000	
Commit Perso			

Press Ctrl on your keyboard to select all 3 entries. Then click "Write Perso" and afterwards "Commit Perso".

Then, press the following buttons (Menu bar) in this sequence: "RF Reset", "ActivateIdle", "ActivateCard".

Now, your card is in Security Level 1.

Application note

COMPANY PUBLIC

7.5.2 Switch MIFARE Plus from Security Level 1 in Security Level 3

After switching MIFARE Plus into Security Level 1, it is now possible to switch to Security Level 3.

Select "Security Level 1" at the Command selection and change the settings as shown in the following figure. Click "FirstAuth" after you are done.

Reader SAM Plus	MIFARE MIFAI Classic Ultr	RE MIFARE DESFire EV1			
Command Selection	• 0 × / ISO14443A	Layer 3 Security Level 0 Security Level 1			
ISO14443A Layer 3 ISO14443A Layer 4 Security Level 0 Security Level 1 Security Level 2 Virtual Card Security Level 3	MFC Auth	Ref Key No 02 Ref Key Ref Key Key No: 0, A Cation 000000000000000000000000000000000000	HW - KeyStore SW - KeyStore	PcdCaps 000000000000 Use PcdCaps	
	Data Access				
	MIFARE Dat	Biological and an and a second s		100.02.3	
	MIFARE Dat	Data [Hex]	Data [ASCii]	Value [Dec]	1
	MIFARE Dat Block	- Data [Hex] 000000000000000000000000000000000000	0000000000000000	21/2	0
	MIFARE Dat	Data [Hex]	Presented in the second s		-

Now your card is in Security Level 3.

You can check if the MIFARE Plus is in security level 3 by performing an "ActivateIdle" command. At the section "Received Data" in the command history you will see the SAK of the card afterwards. For example, if you have a 4KB MIFARE Plus card you will get 0x20 if it is in Security Level 3. See the Application note AN10833 for details. (http://www.nxp.com/documents/application_note/AN10833.pdf)

7.5.3 Read/Write Actions of MIFARE Plus in Security Level 3

Select "Security Level 3" at the Command selection.

Because the standard key for the blocks are the same as we inserted at the keystore at position 02, version 02, we can now use these to authenticate at different storage locations.

Change the settings:

Block/KeyNo: 4000

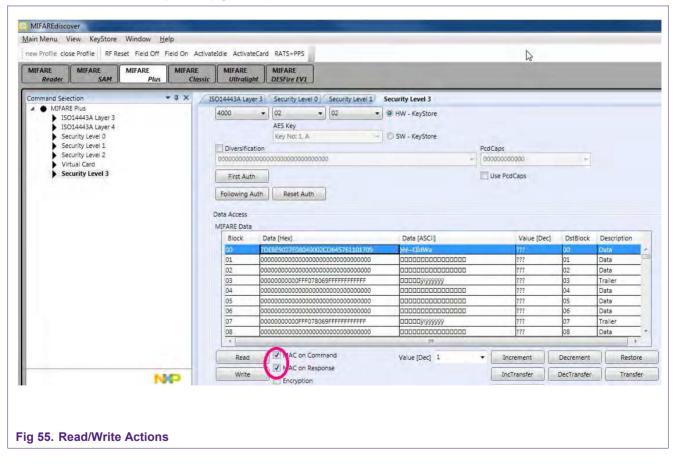
Ref Key No: 02

Ref Key Version: 02

"HW - KeyStore"

And click "FirstAuth"

If you click "Read" you can now read the individual blocks and if you click "Write" you can write beforehand edited blocks. Be sure to tick "MAC on Command" and "MAC on Response" (figure 37).



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7.6 Using MIFAREdiscover without MIFARE SAM AV2

Ensure that the Pegoda is set to "Normal Mode".

All described accesses to MIFARE cards are also possible without the MIFARE SAM AV2. If you use a MIFARE SAM AV2 all keys that are needed to get access to MIFARE cards get stored on the SAM.

If no MIFARE SAM AV2 is used the keys have to be inserted at the Key Store Manager of MIFAREdiscover. At positions where a key is needed you have to insert "SW – KeyStore" and the suitable storage location instead of "HWKeyStore".

Application note

COMPANY PUBLIC

8. Firmware download

In order to download firmware to the reader, the DIP switches have to be configured to "flash mode" as described in section 3. After a reset of the Pegoda reader it does response as mass storage device. The user can upgrade the Pegoda firmware by copying it (drag and drop) to the Pegoda mass storage device.

Important note: The file name of the binary file must be renamed to pegoda2x.bin, where x can be any character or letter or none; otherwise the Pegoda will refuse to copy the file and Windows will response with an I/O error (see 36).

Еггог Сор	ying File or Folder
8	Cannot copy Timware_Pegode: The request could not be performed because of an I/O device error.
	OK I
	D15eeb84
g 56. I/O	Error when filename is not correct

After successfully copying the file, the Pegoda will start blinking and beeping; windows will response with the following message (see 37). Don't be irritated that this is a windows error dialog as well.

8	Cannot copy peopda2x: Cannot find the specified file. Make sure you specify the correct path and file name.
	DtSanhB42

Now, the firmware has been updated; reset the device and choose the desired reader mode with the DIP switches.

9. Error Codes

In MIFAREdiscover, user will observe following error and component codes in the History window under Status Info. The definitions of the error codes will help user to understand the cause of error.

Error codes & definitions

SUCCESSReturned in case of no errorSUCCESS_CHAININGRc chaining is not complete, further action neededSUCCESS_INCOMPLETE_BYAn incomplete byte was receivedINTEGRITY_ERRORNoreply received, e.g. PICC removalCOLLISION_ERRORA collision occurredBUFFER_OVERFLOWA tempt to write beyond buffer sizeFRAMING_ERRORInvalid frame formatPROTOCOL_ERRORReceived response violates protocolAUTH_ERRORA tendet or or occurred in RAM/ROM or FlashREAD_WRITE_ERRORA Read or Write error occurred in RAM/ROM or FlashREAD_WRITE_ERRORA Read or Write error occurred in RAM/ROM or FlashRTERRARA Read or Write error occurred in RAM/ROM or FlashREAD_WRITE_ERRORA renor occurred in RC communicationINTERFACE_ERRORA nerror occurred in RC communicationLINGTH_ERRORA internal error occurredINTERNAL_ERRORInvalid data parameters supplied (layer id check faide)INVALID_DATA_PARAMSInvalid parameters supplied (layer and check faide)INVALID_PARAMETERAn eading/Writing a parameter would produce and overflowUNSUPPORTED_PARAMETERParameter not supportedUNSUPPORTED_COMMANDCommand not supportedUSE_CONDITIONCondition of use not satisfiedKEYA key error occurred	Error Codes	Definition
SUCCESS_INCOMPLETE_BYTEAn incomplete byte was receivedIO_TIMEOUTNo reply received, e.g. PICC removalINTEGRITY_ERRORWrong CRC or parity detectedCOLLISION_ERRORA collision occurredBUFFER_OVERFLOWAttempt to write beyond buffer sizeFRAMING_ERRORInvalid frame formatPROTOCOL_ERRORReceived response violates protocolAUTH_ERRORA tutentication errorREAD_WRITE_ERRORThe RC sensors signal overheatingRF_ERRORError on RF-InterfaceINTERFACE_ERRORAn error occurred in RC communicationLENGTH_ERRORA length error occurredINTERNAL_ERRORInvalid data parameters supplied (layer id check failed)INVALID_DATA_PARAMS failedInvalid parameter suppliedINVALID_PARAMETERParameter not supportedUNSUPPORTED_PARAMETERParameter not supportedUNSUPPORTED_COMMANDCommand not supportedUSE_CONDITIONCondition of use not satisfied	SUCCESS	Returned in case of no error
IO_TIMEOUTNo reply received, e.g. PICC removalINTEGRITY_ERRORWrong CRC or parity detectedCOLLISION_ERRORA collision occurredBUFFER_OVERFLOWAttempt to write beyond buffer sizeFRAMING_ERRORInvalid frame formatPROTOCOL_ERRORReceived response violates protocolAUTH_ERRORAuthentication errorREAD_WRITE_ERRORThe RC sensors signal overheatingRF_ERRORError on RF-InterfaceINTERFACE_ERRORAn error occurred in RAM/ROM or FlashINTERFACE_ERRORAn error occurred in RC communicationLENGTH_ERRORA length error occurredINTERNAL_ERRORInvalid data parameters supplied (layer id check failed)INVALID_DATA_PARAMS failed)Invalid parameter suppliedINVALID_PARAMETERParameter not supportedUNSUPPORTED_PARAMETERParameter not supportedUNSUPPORTED_COMMANDCommand not supportedUSE_CONDITIONCondition of use not satisfied	SUCCESS_CHAINING	Rx chaining is not complete, further action needed
INTEGRITY_ERRORWrong CRC or parity detectedCOLLISION_ERRORA collision occurredBUFFER_OVERFLOWAttempt to write beyond buffer sizeFRAMING_ERRORInvalid frame formatPROTOCOL_ERRORReceived response violates protocolAUTH_ERRORAuthentication errorREAD_WRITE_ERRORA Read or Write error occurred in RAM/ROM or FlashTEMPERATURE_ERRORThe RC sensors signal overheatingRF_ERRORError on RF-InterfaceINTERFACE_ERRORA length error occurred in RC communicationLENGTH_ERRORA length error occurredINTERNAL_ERRORAn internal error occurredINVALID_DATA_PARAMSInvalid data parameters supplied (layer id check failed)INVALID_PARAMETERNeading/Writing a parameter would produce an overflowUNSUPPORTED_PARAMETERParameter not supportedUNSUPPORTED_COMMANDCommand not supportedUNSUPPORTED_COMMANDCondition of use not satisfied	SUCCESS_INCOMPLETE_BYTE	An incomplete byte was received
COLLISION_ERRORA collision occurredBUFFER_OVERFLOWAttempt to write beyond buffer sizeFRAMING_ERRORInvalid frame formatPROTOCOL_ERRORReceived response violates protocolAUTH_ERRORAuthentication errorREAD_WRITE_ERRORA Read or Write error occurred in RAM/ROM or FlashTEMPERATURE_ERRORThe RC sensors signal overheatingRF_ERRORError on RF-InterfaceINTERFACE_ERRORA length error occurredINTERNAL_ERRORA length error occurredINVALID_DATA_PARAMS failed)Invalid data parameters supplied (layer id check failed)INVALID_PARAMETERParameter not supportedUNSUPPORTED_PARAMETERParameter not supportedUNSUPPORTED_COMMANDCommand not supportedUSE_CONDITIONCondition of use not satisfied	IO_TIMEOUT	No reply received, e.g. PICC removal
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USE_CONDITION Condition of use not satisfied	UNSUPPORTED_PARAMETER	Parameter not supported
_	UNSUPPORTED_COMMAND	Command not supported
KEY A key error occurred	USE_CONDITION	Condition of use not satisfied
	KEY	A key error occurred

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Component codes & Identifiers

Component Code	Identifiers
GENERIC	Generic Component Code
BAL	BAL Component Code
HAL	HAL Component Code
PAL_ISO14443P3A	ISO14443-3A PAL-Component Code
PAL_ISO14443P3B	ISO14443-3B PAL-Component Code
PAL_ISO14443P4A	ISO14443-4A PAL-Component Code
PAL_ISO14443P4	ISO14443-4 PAL-Component Code
PAL_MIFARE	MIFARE(R) PAL-Component Code
PAL_FELICA	Open FeliCa PAL-Component Code
PAL_EPCUID	ICode EPC/UID PAL-Component Code
PAL_SLI15693	ICode SLI/ISO15693 PAL-Component Code
PAL_I18000P3M3	ISO18000-3 Mode3 PAL-Component Code
PAL_I18092MPI Code	ISO18092 passive initiator mode PAL-Component
AL_MFC	MIFARE(R) Classic AL-Component Code
AL_MFUL	MIFARE(R) Ultralight AL-Component Code
AL_MFP	MIFARE(R) Plus AL-Component Code
AL_VCA	Virtual Card Architecture AL-Component Code
AL_FELICA	Open FeliCa AL-Component Code
AL_I15693	ISO15693 AL-Component Code
AL_SLI	ICode SLI AL-Component Code
AL_I18000P3M3	ISO18000-3 Mode3 AL-Component Code
AL_MFDF	MIFARE DESFIRE EV1 AL Component Code
AL_P40CMDPRIV	P40 command libraryAL-Component Code
AL_P40CMDPUB	P40 command libraryAL-Component Code
DL_AMP	Amplifier DL-Component Code
DL_THSTRM	Thermostream DL-Component Code
DL_OSCI	Oscilloscope DL-Component Code
DL_RDFPGA	Reader FPGA Box DL-Component Code
DL_MSTAMPOSC	Master Amplifier Oscilloscope DL-Component Code
DL_STEPPERStepper	DL-Component Code
CIDMANAGER	Cid Manager Component Code
CRYPTOSYM	CryptoSym Component Code
KEYSTORE	KeyStore Component Code

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TOOLSTools Component CodeCRYPTORNGCryptoRng Component CodeLOGLog Component Code

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10. References

	Datasheet – MFR523; Contactless reader IC, BU-ID Doc. No. 1152** ¹⁾ , available on NXP Web: http://www.nxp.com/documents/data_sheet/MFRC523.pdf
[2]	Datashoot – MEE\/710, Perioda E\/710, available on NXP.Web

- [2] **Datasheet –** MFEV710, Pegoda EV710, available on NXP Web: http://www.nxp.com/documents/short_data_sheet/MFEV710_SDS.pdf
- [3] **Datasheet –** MIFARE DESFire; MF3ICDx21_41_81, MIFARE DESFire EV1 contactless multi-application IC, BU-ID Doc. No. 1340**, available on NXP docu control
- [4] Datasheet MIFARE Plus; MF1PLUSx0y1, Mainstream contactless smart card IC for fast and easy solution development, BU-ID Doc. No. 163734, available at NXP docu control http://www.nxp.com/documents/short data sheet/MF1PLUSX0Y1 SDS.pdf
- [5] **Datasheet –** MIFARE Ultralight C; MF0ICU2, BU-ID Doc. No. 1714**, available on NXP Web: http://www.nxp.com/documents/short_data_sheet/MF0ICU2_SDS.pdf
- [6] Datasheet ICODE ILT , smart label IC; will be available on NXP Web
- [7] **ISO/IEC Standard** ISO/IEC14443 Identification cards Contactless integrated circuit cards Proximity cards
- [8] **Datasheet** MF1ICS50 MIFARE Classic 1K, available on NXP web, Doc.-Id.: 0010** http://www.nxp.com/documents/data_sheet/MF1S50YYX.pdf
- [9] **Datasheet** MF1ICS70 MIFARE Classic 4K, available on NXP web, Doc.-Id.: 0435** http://www.nxp.com/documents/data_sheet/MF1S70YYX.pdf
- [10] **Datasheet** MF0ICU2 MIFARE Ultralight C, available on NXP web, Doc.-Id.: 1714** http://www.nxp.com/documents/short_data_sheet/MF0ICU2_SDS.pdf
- [11] **Datasheet** MF0ICU1 MIFARE Ultralight, available on NXP web, Doc.-Id.: 0286** http://www.nxp.com/documents/data_sheet/MF0ICU1.pdf
- [12] **Datasheet** MF1PLUSx0y1 MIFARE Plus X, available on NXP web, Doc.-Id.: 1635** http://www.nxp.com/documents/data_sheet/MF1PLUSX0Y1_SDS.pdf
- [13] **Datasheet** MF1SPLUSx0y1 MIFARE Plus S, available on NXP web, Doc.-Id.: 1870** http://www.nxp.com/documents/data_sheet/MF1SPLUSX0Y1_SDS.pdf
- [14] Datasheet MF3ICD21, MF3ICD41, MF3ICD81 MIFARE DESFire EV1, available on NXP web, Doc.-Id.: 1456** http://www.nxp.com/documents/short data sheet/MF3ICDX21 41 81 SDS.pdf
- [15] Datasheet P5DF072EV2/T0PD4090 MIFARE SAM AV1, available on NXP web, Doc.-ld.: 1897** http://www.nxp.com/documents/short_data_sheet/P5DF072EV2_T0PD4090_SDS. pdf
- [16] Datasheet AN1305; MIFARE Classic as NFC Type MIFARE Classic Tag, available on NXP Web: http://www.nxp.com/documents/application_note/AN1305.pdf
- [17] **White Paper** R_10014; NFC Tags ,available on NXP Web: http://www.nxp.com/documents/other/R_10014.pdf
- [18] **Documentation** NFC Data Exchange Format (NDEF),available on NFC Forum Web : http://www.nxp.com/redirect/nfc-forum.org/specs

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- [19] **Documentation** URI Record Type Definition , available on NFC Forum Web : http://www.nxp.com/redirect/nfc-forum.org/specs
- [20] **Application Note** AN10787; MIFARE Application Directory (MAD), available on NXP Web : http://www.nxp.com/documents/application_note/AN10787.pdf
- [21] **Application Note** AN1303; MIFARE Ultralight as Type 2 Tag, available on NXP Web: http://www.nxp.com/documents/application_note/1303.pdf
- [22] **Application Note** AN1304; NFC Type MIFARE Classic Tag Operation, available on NXP Web: http://www.nxp.com/documents/application_note/AN1304.pdf

MIFARE SAM AV2:

- [23] **Datasheet** P5DF081 System Guidance, Delivery and Operation Manual http://www.nxp.com/documents/short_data_sheet/P5DF081_SDS.pdf
- [24] **Software** MIFARE SAM AV2/ P5DF081 PES Reader Library
- [25] Application note MIFARE SAM AV2 Quick Start up Guide
- [26] Application note MIFARE SAM AV2 Interface and Architecture
- [27] Application note MIFARE SAM AV2 Key Management and Personalization
- [28] Application note AN10980 MIFARE SAM AV2 Host Communication
- [29] Application note AN10979 MIFARE SAM AV2 For MIFARE Plus
- [30] Application note AN1826 MIFARE SAM AV2 For MIFARE DESFire EV1
- [31] Application note AN1827 MIFARE SAM AV2 For MIFARE Ultralight C
- [32] Application note AN10978MIFARE SAM AV2 For MIFARE Classic
- [33] Application note AN10977 MIFARE SAM AV2 -X interface
- [34] **Application note** 1830 MIFARE SAM AV2 General Purpose Cryptography
- [35] Software MIFARE discover PC demo software for MIFARE SAM AV2
- [36] Objective Datasheet User Manual MIFAREdiscover

Pegoda EV710:

Available on NXP web: http://www.nxp.com/demoboard/MFEV710.html#documentation

- [37] Application note AN10990 Example Projects for NXP RD710 Readers
- [38] Application note AN10993 Pegoda Software Design Guide
- [39] Application note AN10992 Quick Startup Guide for RD710
- [40] Application note AN10991 RM710 Hardware Design Guide
- [41] Application note AN11002 Pegoda Toolchain Information
- [42] Software Pegoda RD710 Firmware Binary, Ready to Flash
- [43] **Software** Pegoda RD710 Firmware Source Code and Schematics
- [44] **Software** Pegoda RD710 Driver for 32 and 64 bit
- [45] **Software** MIFAREdiscover Public version,
- [46] **Software** NXPRdLib Public version,

Available on DocStore

[47] Software – MIFAREdiscover Full version, doc ID.: 1717**

Third Party:

[48] **Software** - .NET Framework, available online: http://www.nxp.com/redirect/microsoft.com/Dot_NET_Framework

¹⁾... BU-ID document version number

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11. Electromagnetic Compatibility

Contactless reader RD 710 fulfil the following requirements of electromagnetic compatibility:

FCC, Part 15 and CE.

11.1 FCC Compliance Statement

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution!

The Federal Communications Commission warns the users that changes or modifications to the unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The accessories associated with this equipment are as follows: . Shielded communication cable

These accessories are required to be used in order to ensure compliance with FCC rules.

11.2 COMPLIANCE INFORMATION according to 47CFR 2.1077

NXP declares that the products

RD 710, FCC ID: OWRMFRD710

are in conformity with Part 15 of the FCC Rules.

Operation of this product is subject to the following conditions:

- (1) this device may not cause harmful interference
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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12. Legal information

12.1 Definitions

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12.1 Licenses

Purchase of NXP ICs with ISO/IEC 14443 type B functionality



This NXP Semiconductors IC is ISO/IEC 14443 Type B software enabled and is licensed under Innovatron's Contactless Card patents license for ISO/IEC 14443 B.

The license includes the right to use the IC in systems and/or end-user equipment.

RATP/Innovatron Technology

12.2 Trademarks

Notice: All referenced brands, product names, service names and trademarks are property of their respective owners.

MIFARE — is a trademark of NXP B.V.

DESFire — is a trademark of NXP B.V.

MIFARE Ultralight - is a trademark of NXP B.V.

MIFARE Plus — is a trademark of NXP B.V.

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