

AN11268

Quick startup guide for POS Development Kit OM5597/RD2663

Rev. 1.0 — 2 September 2014
242410

Application note
COMPANY PUBLIC

Document information

Info	Content
Keywords	POS, Point of Sales, Development Kit, Reference Design, RC663, TDA8026
Abstract	This document is intended for new users to start working with the POS Development Kit. It shows the basic functionality and the implemented show cases.



Revision history

Rev	Date	Description
1.0	20140902	Initial version

Contact information

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

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

1. Introduction

1.1 Scope

The purpose of this document is to provide a guideline to aid in the first operation of the OM5597 RD2663 Point of Sales Development Kit (further referenced to as POS DK).

1.2 General Description

The POS DK can be used to demonstrate, evaluate and adapt the simple implementation of NXP's devices in Point of Sales terminals.

Both contactless and contact applications can easily be evaluated. This development kit is EMV level1 digital and analog certified and therefore an ideal starting point to develop specific POS terminals based on NXP components.

The design embeds all the required hardware and software for the following interfaces:

- EMVCo compliant contactless smart cards based on RC663,
- EMVCo compliant contact smart cards based on TDA8026,
- Up to four secure access modules (SAMs) via TDA8026.

The user interface is composed of a color LCD display and a pin pad.

The default hardware interface is RS-232, which is used for code uploading and debugging. However, a USB 2.0 full speed connector is also offered but not implemented in the default software.

1.3 Package Content

The OM5597/RD2663 POS Development Kit comes in a package containing the following items:

1. POS DK including firmware
2. USB cable
3. MIFARE DESFire EV1 card [8]
4. Personalized JCOP dual-interface payment card [10]

A SAM is not part of this kit and must be ordered separately.

2. Getting Started

2.1 Powering the POS DK

The POS DK requires a power supply between $U_{DCmin} = 4.7$ and $U_{DCmax} = 5.3$ V. This can be provided in two ways:

- Use the USB connector to connect e.g. to a PC (only power-supply, no data connection implemented)
- Use the 2.5mm jack with external power supply.

Do not supply the POS DK with a voltage higher than 5.3 V as it can potentially damage the POS DK. A supply voltage below 4.7 V might lead to improper functionality.

For details about the power-supply please refer to AN11270 "Hardware Design Guide for POS Development Kit".

The power consumption of the POS DK can reach up to 250-300 mA when generating the RF field.

Once powered on, the POS DK displays a welcome message as shown in Fig 1.

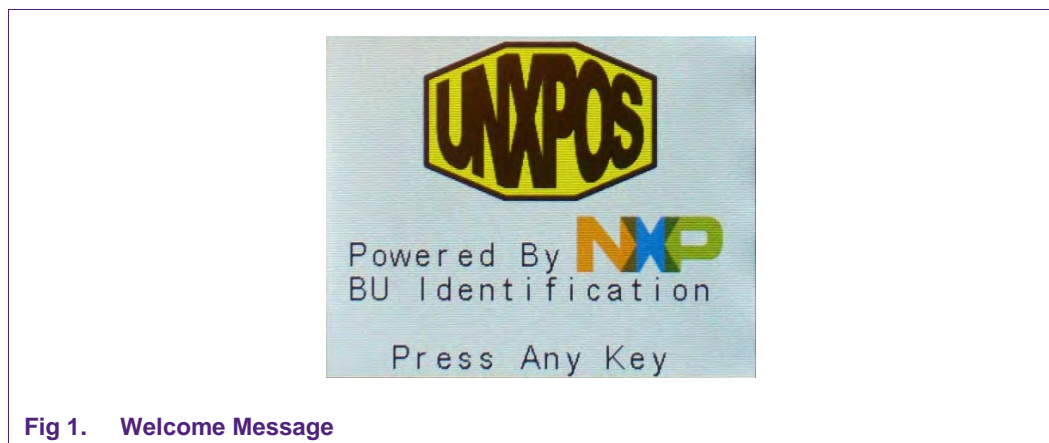


Fig 1. Welcome Message

As soon as a key is pressed the main menu will be displayed as shown in Fig 2.

The items at the menu and the consequent items in the sub-menus can be accessed by pressing the relevant key at the pin pad.

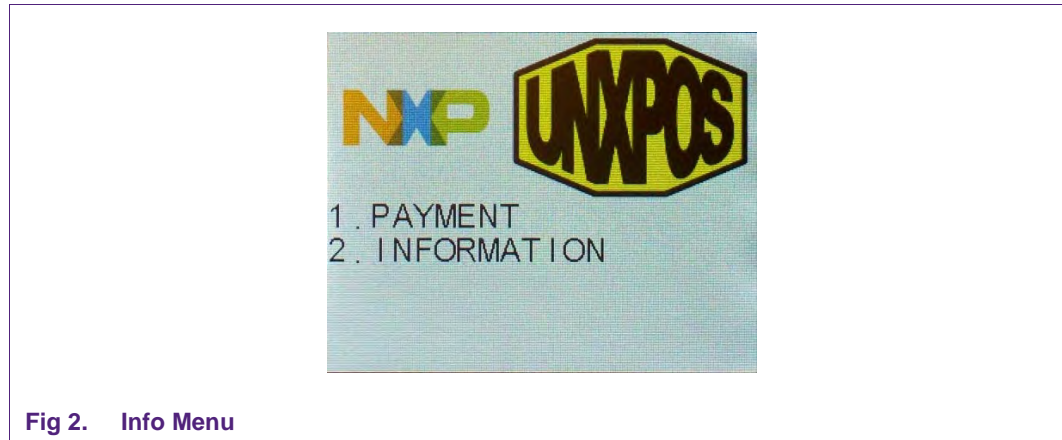


Fig 2. Info Menu

2.2 Showcases

The POS DK comes with a number of showcases which allow an easy demonstration of its capabilities and features:

1. Showcase "Payment"
2. Showcase "Closed Loop Payment"
3. Showcase "Payment System Environment"
4. Showcase "P2P Communication"

In order to leave a showcase during processing (e.g. during card polling), just press the button '#'. This will cancel the current step and go back to the main menu.

2.2.1 Payment

For demonstrating the Payment showcase you need the MIFARE DESFire Card, included in the POS package. Please note that this case does not show any secure communication.

First the card has to be initialized with the according payment application as well as an initial credit:

1. Power on the POS DK.
2. Press any key. The INFO menu appears.
3. Press key '2' to select the INFORMATION sub-menu as seen in Fig 3.

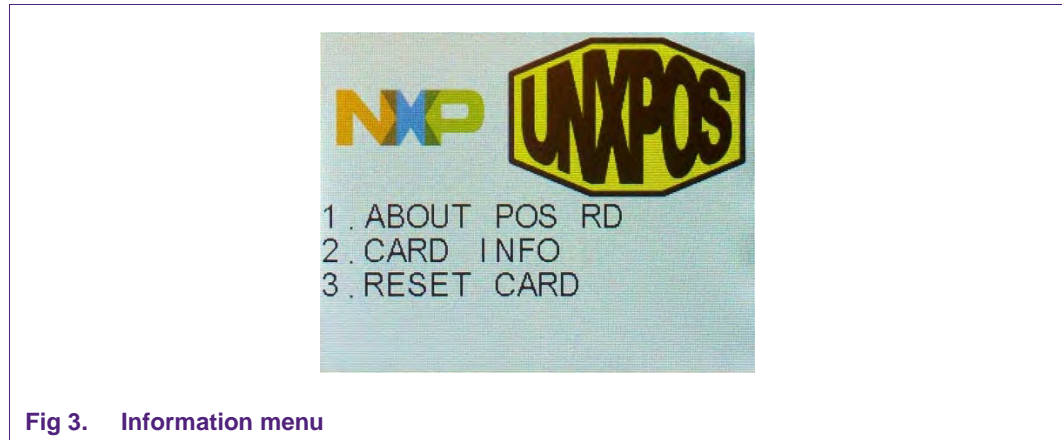


Fig 3. Information menu

4. Press key '3' to select the RESET CARD sub-menu. 'Present card' is displayed
5. Put the MIFARE DESFire card on the antenna of the reader in order to create a payment application on the card. By doing this an initial amount of 500.00 credits is also stored on the card which can be consumed during the payment showcase. After this procedure the message "RESET SUCCESS" is displayed as shown in Fig 4.

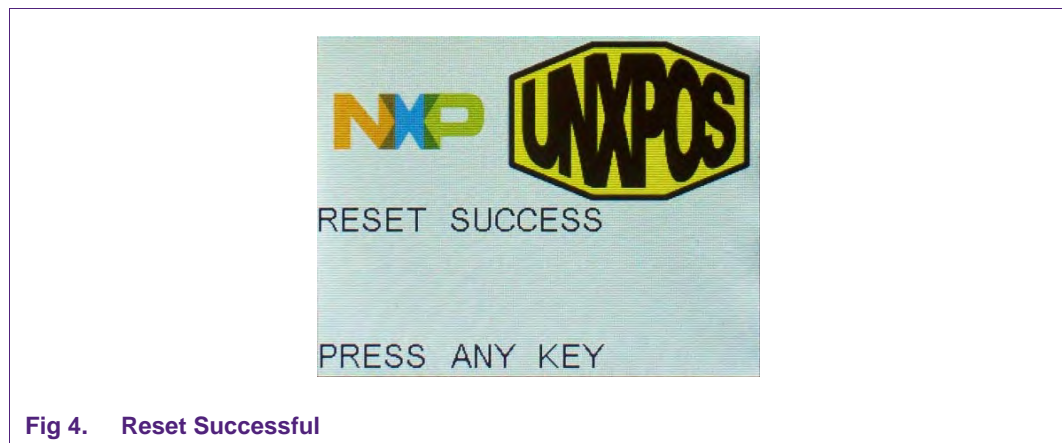


Fig 4. Reset Successful

This procedure can be repeated at any time to reset the amount of credits to 500.00. By pressing any key, the main menu will be shown again.

Now the actual payment showcase can be shown:

1. Press key '1' to start the payment application as shown in Fig 5.

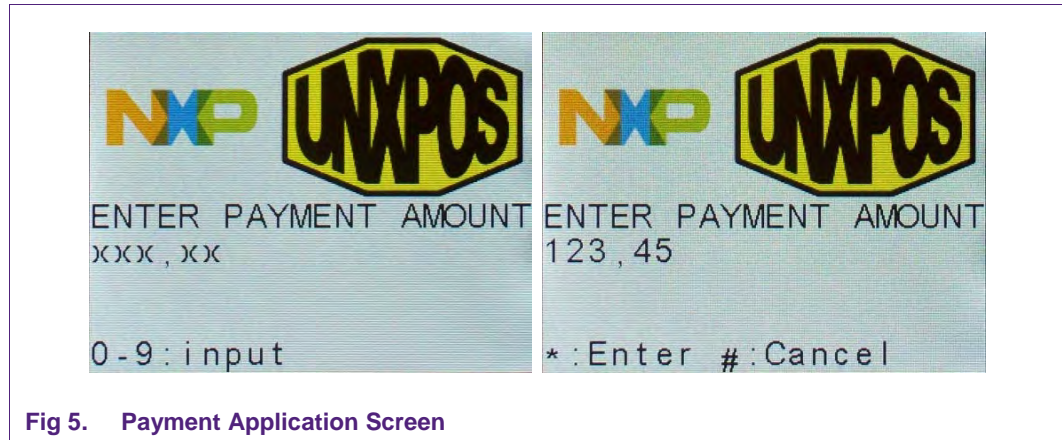


Fig 5. Payment Application Screen

2. Now enter the amount which shall be debited from the card and confirm with '*'.
3. Put the card on the antenna of the reader.
 - If "DEBIT SUCCESS" is displayed as shown in Fig 6, the previously inserted amount is debited from the credits on the card.
 - If "DEBIT ERROR" is displayed the entered value was higher than the amount of credits on the card.

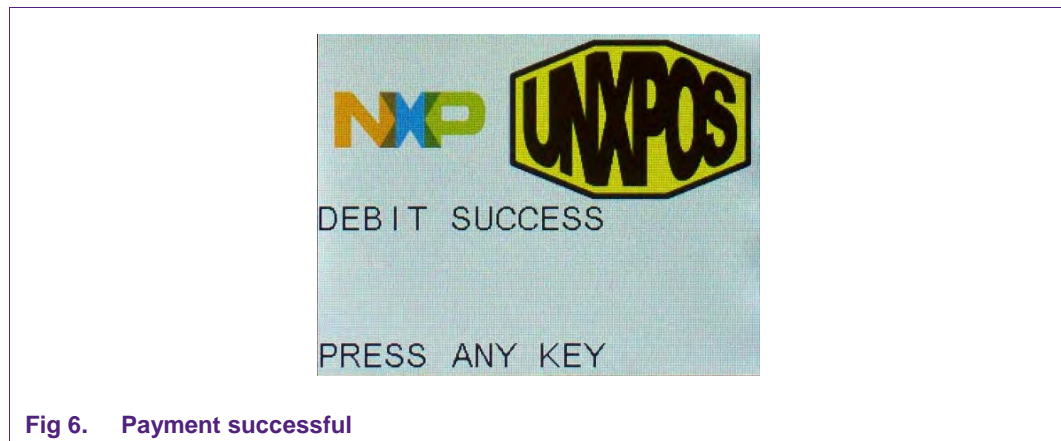


Fig 6. Payment successful

4. By pressing any key, the main menu will be shown again.
- The remaining amount stored on the card can be checked by following procedure:
1. Press key '2' to select the INFORMATION sub-menu.
 2. Press key '2' to select the CARD INFO sub-menu.
 3. Put the MIFARE DESFire Card on the antenna of the reader. As shown in Fig 7 'NXP DESFire NoAuth' and the remaining value is now displayed.

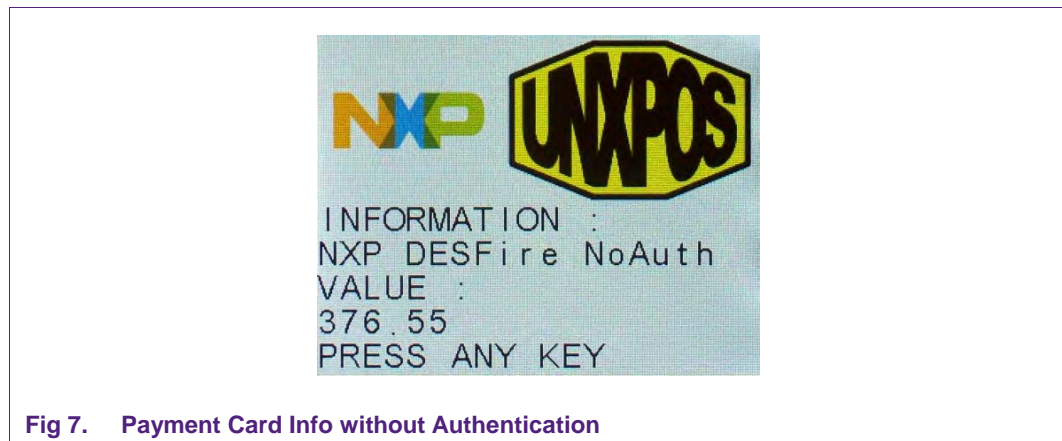


Fig 7. Payment Card Info without Authentication

2.2.2 Closed Loop Payment

For demonstrating the Closed Loop Payment showcase you need the MIFARE DESFire Card, included in the POS package, as well as a MIFARE SAM V2.6 [12] which is available separately.

This showcase has a similar workflow as described in section 2.2.1 but this time the communication is secured by the SAM.

Therefore plug in the SAM into one of the SAM Slots and power up or reset the reader. Then proceed as described in section 2.2.1.

During the reset of the card, an application with restricted access rights is stored on the card. When calling the CARD INFO sub-menu the text “NXP DESFire Auth” is displayed as shown in Fig 8.

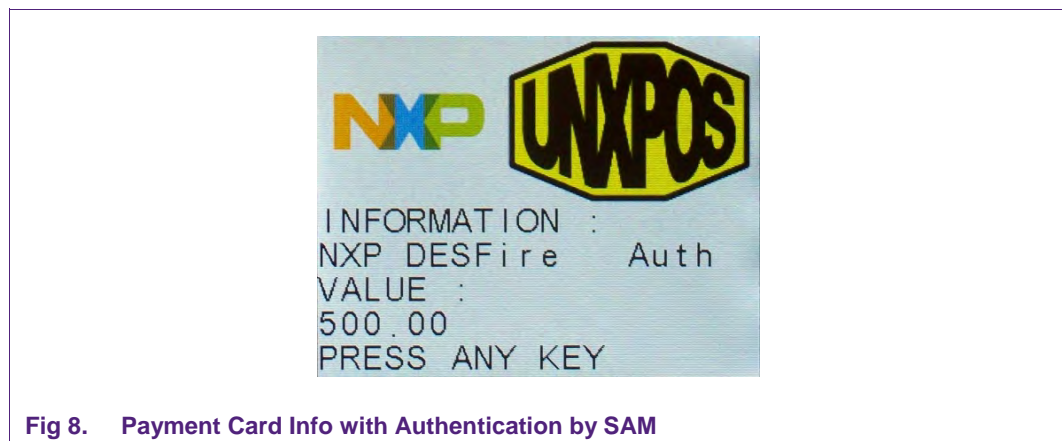


Fig 8. Payment Card Info with Authentication by SAM

2.2.3 Payment System Environment

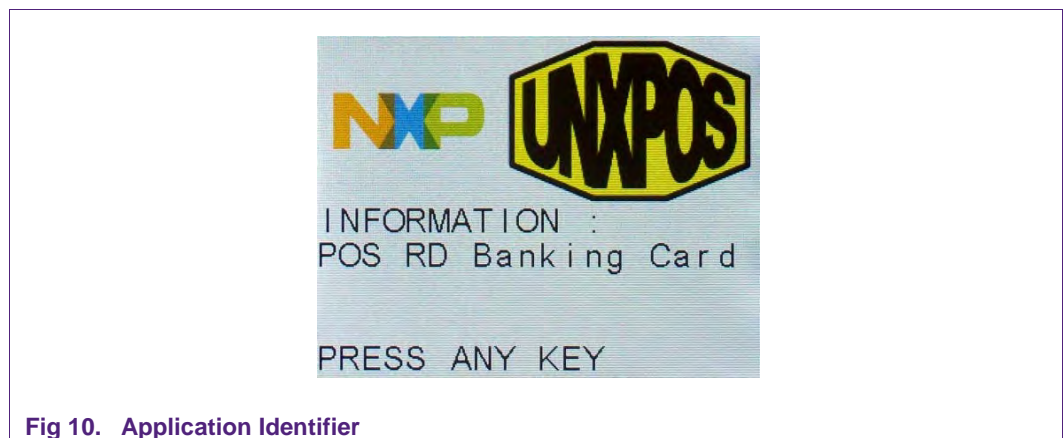
This showcase demonstrates how to read out basic information from one of the cards provided with this development kit (MIFARE DESFire EV1 and JCOP dual-interface)

1. Power on the POS DK
2. Press any key. The INFO menu appears
3. Press key '2' to select the INFORMATION sub-menu
4. Press key '2' to select the CARD INFO sub-menu. As shown in Fig 9 you are asked to present the card.



5. Put either one of the cards on the antenna of the contactless reader or put the JCOP card in contact reader. In the second case consider the correct orientation of the card: contact-interfaces to the front and upside
6. You can either present the card to the antenna of the reader or put it into the card slot. In the second case please keep in mind the slot in direction. (Chip connector first and up)

The display now shows the name of the detected application. In this case it is 'POS RD Banking Card' as seen in Fig 10.



2.2.4 P2P Communication

This showcase demonstrates how to perform peer-to-peer communication with an NFC enabled mobile phone. This can be used for couponing applications, for example.

1. In case a NFC mobile phone with Android 2.3 is used, it is required to start an application and share a tag application. Give also a name for this tag e.g. "My NFC tag".
2. Power on the POS DK.
3. Press any key. The INFO menu appears.
4. Press key '2' to select the INFORMATION sub-menu.
5. Press key '2' again to reach the CARD INFO Sub-menu.
6. The message 'Present card' is displayed. The POS DK now tries to detect a tag in the field.
7. Put the mobile phone over the antenna of the POS DK
8. A peer-to-peer communication is performed between the POS DK and the mobile phone.
9. Once the communication is performed, the POS DK displays the message: 'NFC mobile detected'. At the mobile phone, the message 'New tag collected', 'NXP POS Reference Design Payment Coupon ID' is displayed.

2.3 Using the POS DK as a Reference Design

2.3.1 Hardware Design

All schematics, Layouts (Gerber files) and the BOM of the POS DK hardware are provided in the source package as well.

For more information on the hardware please refer to the Hardware Design Guide AN11270 [1].

2.3.2 Software Design

The software stack, running on the POS DK including the previously described showcases is available in source and binary in the source package to allow an easy adoption to the individual design of the customer.

For more information on the software please refer to the Software Design Guide AN11269 [3].

3. Hidden Menu Functions

The RD2663 POS DK is compliant to EMV Level1 digital and analog. To facilitate the certification of your POS DK the necessary functionality for the certification process is already included. This section shows how to select these features from a hidden menu.

Within this hidden menu the POS software offers several types of testing functionality:

1. A EMV contactless loopback function,
2. A EMV contact loopback function
3. A NFC P2P loopback function
4. A NFC P2P data exchange function.
5. RF Settings (low level test function)

The first four test functions can be started and used from the POS DK without using COMCOM. However, there is debug information available when using ComCom.

The RF Settings functions require the use of ComCom.

3.1 Enabling Hidden Menu

To show the hidden menu, proceed as follows:

1. Power On the POS DK 2.
2. Start the console application 'ComCom' [9] on your PC.3. Select the COM port number to be used by pressing the according key (1 – 9). Steps 2-4 are only relevant if you also want to access the hidden remote menu.
3. Select the baud rate 115200 bauds by pressing the letter 'c'.
4. Press 'a' to open the COM port.
5. Press key '*' twice.

This will bring up the hidden menu as shown in Fig. 12 to either select one of the loopback options or access the hidden remote menu from ComCom.

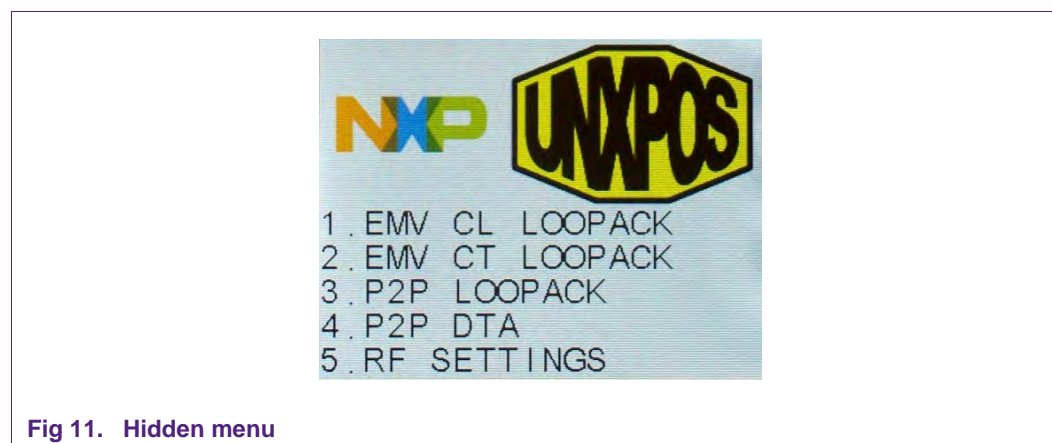


Fig 11. Hidden menu

3.1.1 EMV Loopback CL Function

Selecting this option will start a RF polling loop alternating between type A and type B. You can use this for EMV Contactless verification as well as simply testing the effects of analog circuitry changes.

3.1.2 EMV Loopback CT Function

Starts a polling loop on the contact interface slot.

3.1.3 NFC P2P Loopback Function

Starts a P2P loopback via LLCP. Every frame received from a peer device will be echoed by the POS

3.1.4 .NFC P2OP Data Exchange

First implementation step of the P2P loopback needed for NFC Forum certification test.

3.2 RF Settings

Selecting '5. RF SETTINGS' brings up the hidden remote menu in the ComCom application (Fig. 13). It allows to directly access certain low level RF functions for testing. From here simply choose a menu entry by pressing the corresponding key.

```

*****
***          ComCom Serial Port manager          ***
*** When COM 1 is open press CTRL+A to come back to ***
*** the menu                                     ***
*****
*** a - Open COM 1                               ***
*** z - Close COM 1                             ***
***                                             ***
*** e - Exit                                     ***
*****

EMU RF analog functions menu:
- 'a': Config Default RF Type A
- 'b': Config Default RF Type B
- 'c': Carrier on
- 'd': Carrier off
- 'e': Send 1 polling WUPA WUPB (RF Config reg may be reset), 'E': During 5s
- 'f': Send 1 RF reset pulses, 'F': During 5s
- 'g': Send 1 WakeupA, 'G': During 5s
- 'h': Send 1 WakeupB, 'H': During 5s
- 'i': Send 1 RATS, 'I': During 5s
- 'j': Send 1 Attrib, 'J': During 5s
- 'k': Test with Validation cards
- 'l': Display registers
- 'm': Write registers
- 'x': exit
    
```

Fig 12. ComCom console in 'EMV RF analog functions menu'

3.2.1 Config Default RF Type A

Loads the internally preconfigured register settings for the ISO 14443 Type A protocol.

3.2.2 Config Default RF Type B

Loads the internally preconfigured register settings for the ISO 14443 Type B protocol.

3.2.3 Carrier on

Enables continuous unmodulated carrier output for e.g. ISO 14443 or EMVCo standard power tests

3.2.4 Carrier off

Disables continuous unmodulated carrier output.

3.2.5 Polling WUPA WUPB

Starts a RF polling for both ISO 14443 Type A and Type B cards using the Wakeup commands. Previous register settings will be overridden.

3.2.6 RF Reset

Enables the unmodulated carrier and creates an off-pulse of approx. 8 μ s. The carrier will always be enabled regardless of the previous state and will stay on afterwards.

3.2.7 WakeupA

Sends a single ISO 14443 Type A Wakeup (WUPA) command. Note that the reader has to be explicitly configured to perform this action, using menu option 'a' to load the necessary settings.

3.2.8 WakeupB

Sends a single ISO 14443 Type B Wakeup (WUPB) command. Note that the reader has to be explicitly configured to perform this action, using menu option 'b' to load the necessary settings.

3.2.9 RATS

Directly sends a single Request Answer To Select command. Please note that you have to manually load the configuration settings for ISO14443 Type A before using this option.

3.2.10 ATTRIB

Directly sends a single ATTRIB command. As for the RATS command, you have to manually configure the reader for ISO 14443 Type B protocol. Again, use menu option 'b' to do so.

3.2.11 Test with Validation Cards

Starts a continuous polling sequence for use with the official EMVCo validation cards.

3.2.12 Display Registers

Displays a register dump from 0x00 to 0x57 in the format "register: value" separated by commas.

3.2.13 Write Registers

Allows you to change the value of a given register. This is useful when fine-tuning certain settings as for example the threshold.

4. References

- [1] **Application Note** - AN11270: Hardware Design Guide for POS Reference Design OM5597/RD2663, <http://www.nxp.com>
- [2] **Application Note** - AN11271: Toolchain Information for POS Reference Design OM5597/RD2663, <http://www.nxp.com>
- [3] **Application Note** - AN11269: Software Design Guide for POS Reference Design OM5597/RD2663, <http://www.nxp.com>
- [4] **Application Note** - AN11021: CLRC663, MFRC631, MFRC630, SLRC610 Software Design Guide for NXPRDLib, <http://www.nxp.com>
- [5] **Application Note** - AN111019: CLRC663, MFRC630, MFRC 631, SLRC610 Antenna Design Guide, <http://www.nxp.com>
- [6] **Application Note** - AN11020: Matching Calculations CLRC663, MFRC631, MFRC630, SLRC610, <http://www.nxp.com>
- [7] **Application Note** - AN11246: CLRC663, MFRC631, MFRC630, CLRC610 Directly Matched Antenna design Calculation Sheet – advanced user, <http://www.nxp.com>
- [8] **Web Page** - OM5597 Point of Sales Reference Design <http://www.nxp.com>
- [9] **Software package for OM5597**, including COMCOM console program and OM5597/RD2663 Firmware Source Code, <http://www.nxp.com>
- [10] **Hardware package for OM5597**, including Schematics and Layout information, <http://www.nxp.com>
- [11] **Product data sheet** - JCOP Card available at DocStore [14]
- [12] **Product data sheet** - SAM AV2.6 available at DocStore [14]
- [13] **Product data sheet** - MF3ICD81 MIFARE DESFire EV1 available at DocStore [14]
- [14] **NXP Doc Store**
www.nxp.com/redirect/docstore.nxp.com/flex/DocStoreApp.html#/

5. Legal information

5.1 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

5.2 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Evaluation products — This product is provided on an "as is" and "with all faults" basis for evaluation purposes only. NXP Semiconductors, its affiliates and their suppliers expressly disclaim all warranties, whether express, implied or statutory, including but not limited to the implied warranties of non-infringement, merchantability and fitness for a particular purpose. The entire risk as to the quality, or arising out of the use or performance, of this product remains with customer.

In no event shall NXP Semiconductors, its affiliates or their suppliers be liable to customer for any special, indirect, consequential, punitive or incidental damages (including without limitation damages for loss of business, business interruption, loss of use, loss of data or information, and the like) arising out of the use of or inability to use the product, whether or not based on tort (including negligence), strict liability, breach of contract, breach of warranty or any other theory, even if advised of the possibility of such damages.

Notwithstanding any damages that customer might incur for any reason whatsoever (including without limitation, all damages referenced above and all direct or general damages), the entire liability of NXP Semiconductors, its affiliates and their suppliers and customer's exclusive remedy for all of the foregoing shall be limited to actual damages incurred by customer based on reasonable reliance up to the greater of the amount actually paid by customer for the product or five dollars (US\$5.00). The foregoing limitations, exclusions and disclaimers shall apply to the maximum extent permitted by applicable law, even if any remedy fails of its essential purpose.

5.3 Licenses

Purchase of NXP ICs with NFC technology

Purchase of an NXP Semiconductors IC that complies with one of the Near Field Communication (NFC) standards ISO/IEC 18092 and ISO/IEC 21481 does not convey an implied license under any patent right infringed by implementation of any of those standards.

5.4 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.

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

6. List of figures

Fig 1.	Welcome Message	4
Fig 2.	Info Menu	5
Fig 3.	Information menu	6
Fig 4.	Reset Successful	6
Fig 5.	Payment Application Screen	7
Fig 6.	Payment successful	7
Fig 7.	Payment Card Info without Authentication	8
Fig 8.	Payment Card Info with Authentication by SAM	8
Fig 9.	Present card.....	9
Fig 10.	Application Identifier.....	9
Fig 11.	Hidden menu.....	11
Fig 12.	ComCom console in 'EMV RF analog functions menu'	12

7. Contents

1.	Introduction	3
1.1	Scope	3
1.2	General Description	3
1.3	Package Content.....	3
2.	Getting Started	4
2.1	Powering the POS DK.....	4
2.2	Showcases.....	5
2.2.1	Payment.....	5
2.2.2	Closed Loop Payment.....	8
2.2.3	Payment System Environment.....	9
2.2.4	P2P Communication	10
2.3	Using the POS DK as a Reference Design	10
2.3.1	Hardware Design	10
2.3.2	Software Design.....	10
3.	Hidden Menu Functions.....	11
3.1	Enabling Hidden Menu.....	11
3.1.1	EMV Loopback CL Function.....	12
3.1.2	EMV Loopback CT Function	12
3.1.3	NFC P2P Loopback Function.....	12
3.1.4	.NFC P2OP Data Exchange.....	12
3.2	RF Settings	12
3.2.1	Config Default RF Type A	12
3.2.2	Config Default RF Type B	12
3.2.3	Carrier on	13
3.2.4	Carrier off	13
3.2.5	Polling WUPA WUPB.....	13
3.2.6	RF Reset.....	13
3.2.7	WakeupA.....	13
3.2.8	WakeupB.....	13
3.2.9	RATS	13
3.2.10	ATTRIB	13
3.2.11	Test with Validation Cards.....	13
3.2.12	Display Registers	13
3.2.13	Write Registers.....	13
4.	References	14
5.	Legal information	15
5.1	Definitions	15
5.2	Disclaimers.....	15
5.3	Licenses.....	15
5.4	Trademarks.....	15
6.	List of figures.....	16
7.	Contents.....	17

Please be aware that important notices concerning this document and the product(s) described herein, have been included in the section 'Legal information'.

© NXP B.V. 2014.

All rights reserved.

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

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

Date of release: 2 September 2014
242410

Document identifier: AN11268