AN11841

PN7150 Arduino SBC Kit Quick Start Guide

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Keywords	OM5578, PN7150, Arduino, Kinetis, UDOO, LPC, NFC, P2P, Card Emulation, Linux, Android, NullOS, RTOS
Abstract	This document gives a description on how to get started with the OM5578 PN7150 NFC Controller SBC Kit on boards featuring Arduino compatible header.

Revision history

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1.3	20170222	Updated demo images weblinks
1.2	20160819	Added Android Marshmallow demo
1.1	20160620	Added Android NFC demo on UDOO Neo
1.0	20160518	First official release

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1. Introduction

This document gives a description on how to get started with the OM5578 PN7150 NFC-Controller SBC Kit on platform featuring Arduino compatible header. This document provides a step by step guide to the installation procedure of the hardware and the software. Finally, it shows PN7150 NFC Controller functionalities through demonstration application.

1.1 OM5578/PN7150ARD demo kit

OM5578/PN7150ARD kit is a high performance fully NFC compliant expansion board compatible with Arduino Compatible Interface platforms (refer to [1] for more details). It meets compliance with Reader mode, P2P mode and Card emulation mode standards. The board features an integrated high performance RF antenna to insure high interoperability level with NFC devices.

The demo kit is comprised of a PN7150 NFC Controller Board, a dedicated interface board, and a NFC Sample Card.

Fig 1. OM5578/ARD kit overview

The demo kit is fully described in UM10935 document [8].

1.2 Linux driver support

PN7150 NFC Controller is supported under GNU/Linux system using the NXP Linux libnfc-nci software stack delivered through public GitHub repository https://github.com/NXPNFCLinux/linux_libnfc-nci (for more details, refer to AN11697 [5]).

In chapter 2.4 it is described how to run an image with the already integrated driver on your kit.

1.3 Android driver support

PN7150 NFC Controller is supported from the official Android Open Source Project (refer to [7] for more details) with the addition of dedicated patches (refer to AN11690 [6]).

In chapter 2.5 it is described how to run an image with the already integrated driver on your kit.

1.4 RTOS and Null OS support

Since implementing NFC Forum NCI standardized API, the PN7150 NFC Controller can be easily integrated into system based on RTOS or even without OS.

Code example are given in the scope of LPCXpresso and Kinetis Design Studio projects and can easily be ported to any other system.

2. Quick Startup on UDOO Neo

2.1 Required items

• UDOO Neo [2]

• Compatible MicroSD card of at least 4 Gb memory size (8 Gb for Android demo image)

• Computer (running Windows, Linux or Mac OS X) for SD/MicroSD card installation and remote access to UDOO Neo

• Micro USB cable to connect UDOO Neo to the computer

• UDOO Neo demo image file (see [9])

• Other than for Linux NFC demo (see 2.4), where UDOO Neo is run as a headless IoT device, one need for the Android NFC demo (see 2.5) in addition the following items:

- USB Mouse
- Micro HDMI cable to connect to Monitor / TV
- UDOO 12V power supply (**Note: the 5V generated by UDOO Neo board from the Micro USB is not stable on the Android image. Without the 12V power supply the RF discovery may suddenly stop**)

2.2 Hardware preparation

First of all assemble the PN7150 NFC Controller Board with the Arduino Interface Board.

Fig 2. OM5578/PN7150ARD demo kit assembly

Then stacked together the boards with the UDOO Neo.

Fig 3. OM5578/PN7150ARD and UDOO Neo stacked together

Note: The UDOO Neo feature a “two rows” connectors, the demo kit must be plugged in the inner ones as show in below picture:

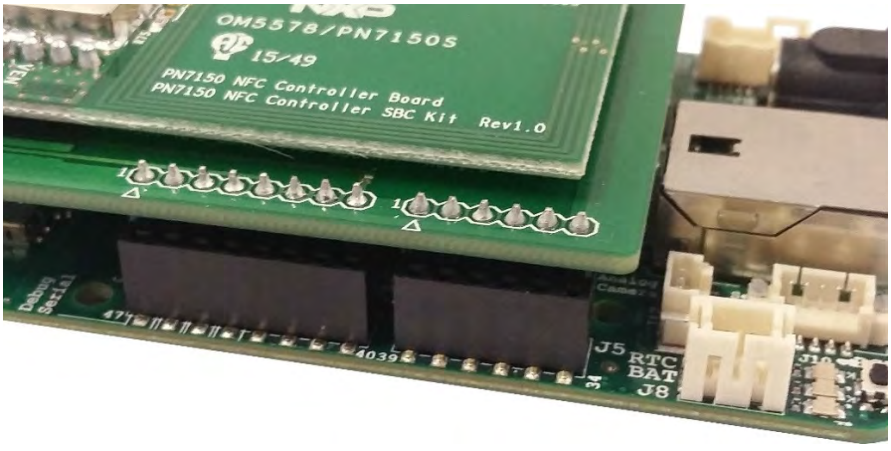

Fig 4. OM5578/PN7150ARD and UDOO Neo stacked together - zoom

2.3 Software preparation

The MicroSD needs to store an image specific for the OM5578 Linux or Android NFC demo. This demo image can be downloaded from [9] and loaded to the MicroSD card, following the installation guidelines provided here: http://www.udoo.org/docs-neo/Getting_Started/Create_a_bootable_MicroSD_card_for_UDOO_Neo.html

2.4 Linux NFC demo application

2.4.1 Application details

The demo application uses a part of the Linux libnfc-nci stack available on public GitHub repository https://github.com/NXPNFCLinux/linux_libnfc-nci. The related source code can then be found there (more details in document AN11697 [5]).

2.4.2 Starting the application

Start the UDOO Neo board as “USB Headless IoT Device”, by just inserting the Micro-SD card in the related slot and connect the micro-USB cable to your PC. Be sure to have installed the right driver specific for the USB connection, refer to http://www.udoo.org/docs-neo/Basic_Setup/Usb_Direct_Connection.html.

Open a remote session through “Web Control Panel” by browsing to “192.168.7.2” in a web browser, it should display the UDOO Neo platform dashboard:

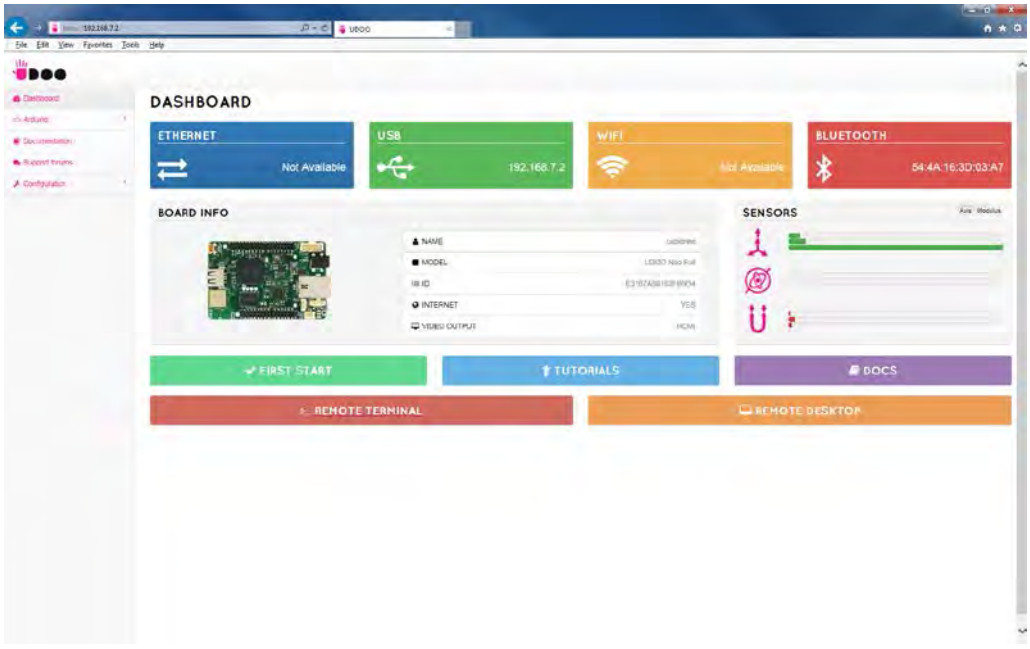

Fig 5. UDOO dashboard

Then open a terminal session by clicking on “>_ REMOTE TERMINAL” button.

Note: there is other way to open a remote terminal allowing to run the demo application. Refer to http://www.udoo.org/docs-neo/Getting_Started/Use_as_a_Computer.html and http://www.udoo.org/docs-neo/Getting_Started/Use_as_a_headless_IoT_Device.html for more details.

Log in the terminal using the default credentials:

- Login: udooer
- Password: udooer

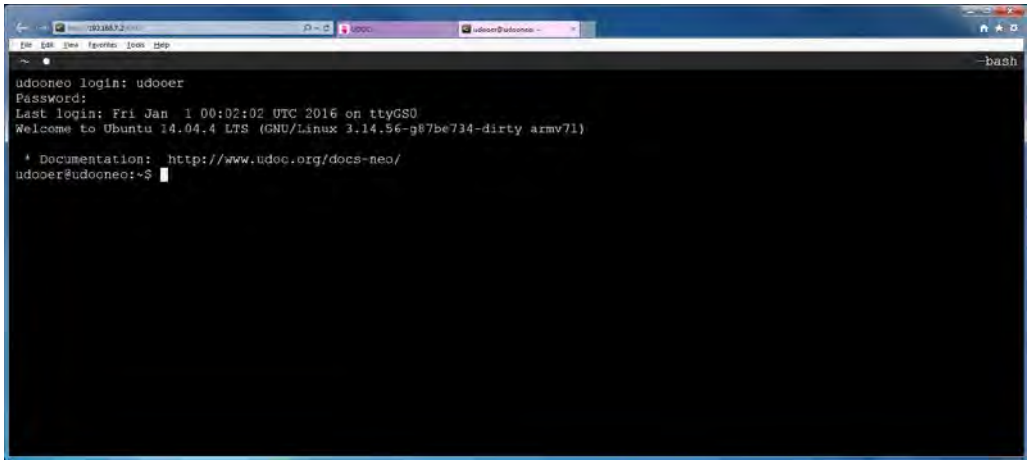

Fig 6. UDOO Remote Terminal

Then browse to the Linux libnfc-nci stack directory (refer to chapter 1.2 for more details about the Linux NFC software stack).

```
$ cd ~/linux_libnfc-nci
```

The application requires parameters to run:

```
$ ./nfcDemoApp <OPTIONS>
```

You can get the parameters details by launching the application help menu:

```
$  ./nfcDemoApp –-help
```

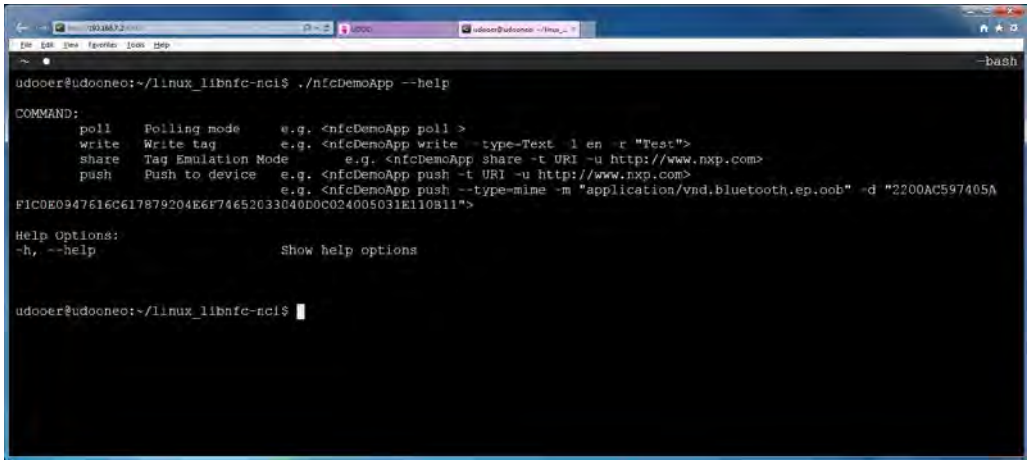

Fig 7. Linux demo application parameters

The demo application offers 3 modes of operation:

- **Polling**: continuously waiting for a remote NFC device (tag or peer device) and displays related information
- **Tag writing**: allows writing NDEF content to a NFC tag
- **Tag emulation**: allows sharing NDEF content to a NFC reader device
- **Device push**: allows pushing NDEF content to a remote NFC peer device

2.4.2.1 Polling mode

When in this mode, the application will display information of any discovered NFC tags or remote NFC device. It is reached starting the application with “poll” parameter:

```
$ ./nfcDemoApp poll
```

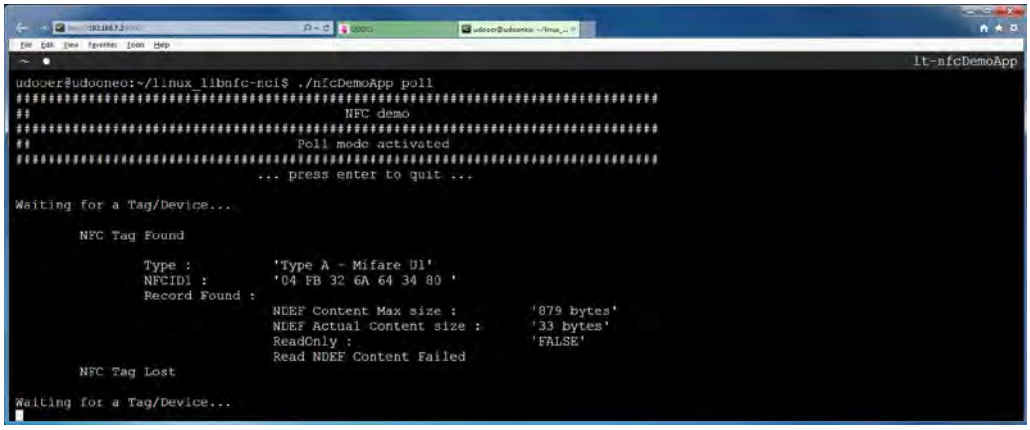

Fig 8. Linux demo application polling mode

2.4.2.2 Device push mode

This mode allows pushing data to a remote NFC device (e.g. an NFC phone). It is reached using “push” parameter:

```
$ ./nfcDemoApp push <OPTIONS>
```

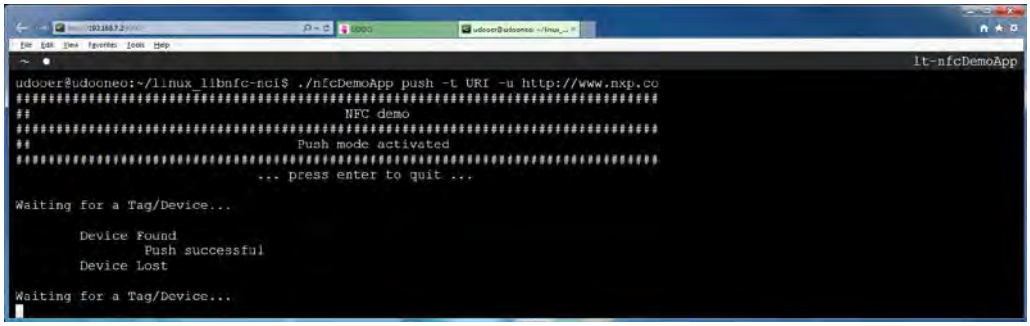

Fig 9. Linux demo application device push mode

You can get more information about the message format using “-h” or “--help” parameter:

```
$ ./nfcDemoApp push --help
```

2.4.2.3 Tag emulation mode

This mode allows emulating an NFC tag (NFC Forum T4T) to share data to a remote NFC reader (e.g. an NFC phone). It is reached using “share” parameter:

```
$ ./nfcDemoApp share <OPTIONS>
```

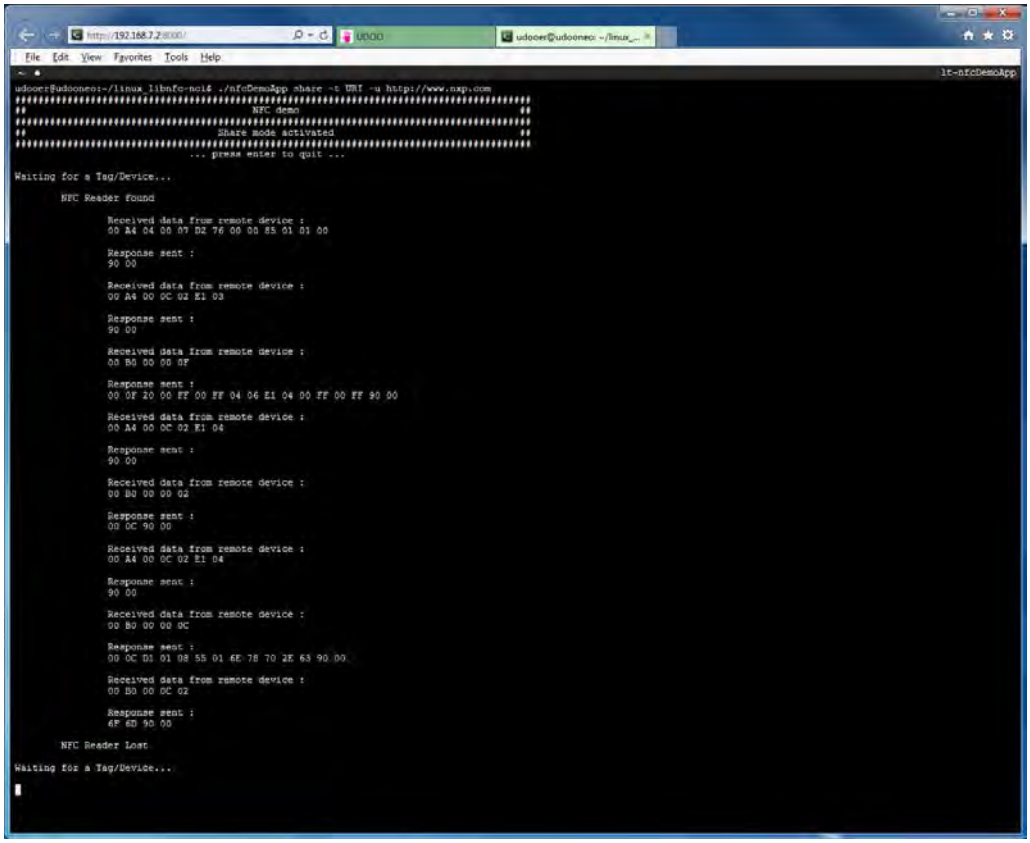

Fig 10. Linux demo application Tag emulation mode

You can get more information about the message format using “-h” or “--help” parameter:

```
$ ./nfcDemoApp share --help
```

2.4.2.4 Tag writing mode

This mode allows writing data to an NFC tag. It is reached using “write” parameter:

```
$ ./nfcDemoApp write <OPTIONS>
```

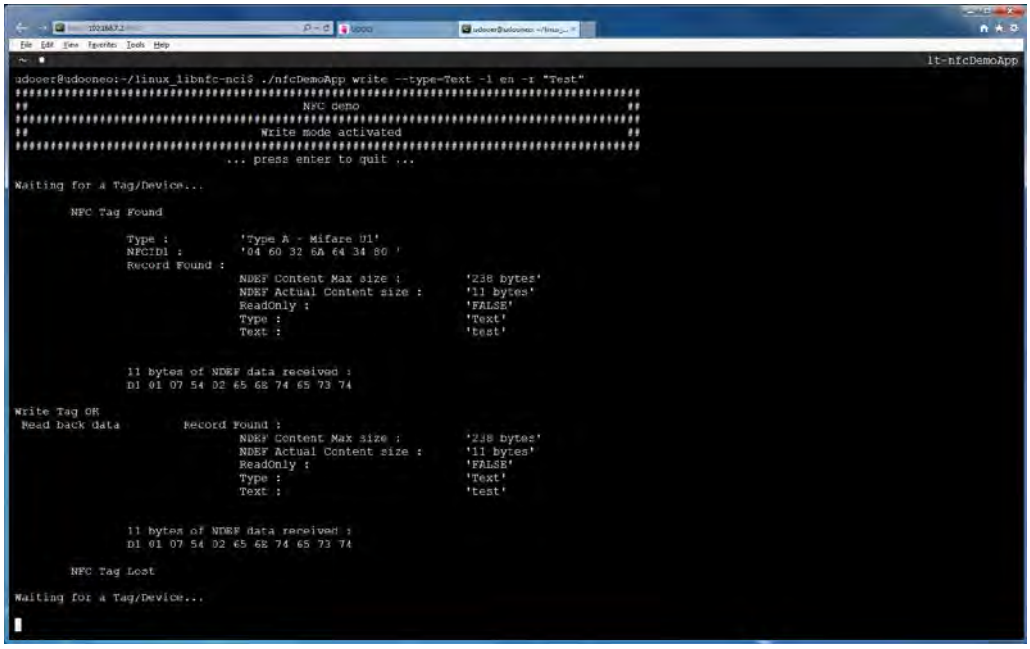

Fig 11. Linux demo application tag writing mode

You can get more information about the message format using “-h” or “--help” parameter:

```
$ ./nfcDemoApp write –-help
```

2.5 Android NFC demo

Insert the MicroSD card with the written image (see 2.3) in the UDOO Neo. Connect HDMI Display and USB mouse. Finally supply the board using 12V adapter.

After a few seconds Android boots up, NFC is then running, ready to read tags or interact with remote NFC device (e.g. NFC phone).

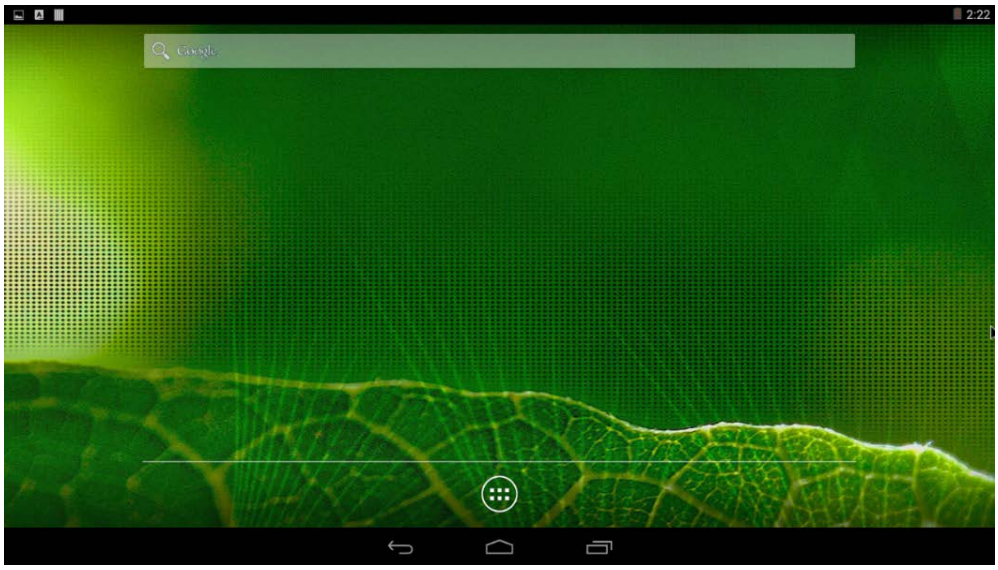

Fig 12. Android home screen

You can enable/disable the NFC function via “Settings/Wireless & Network/More…”

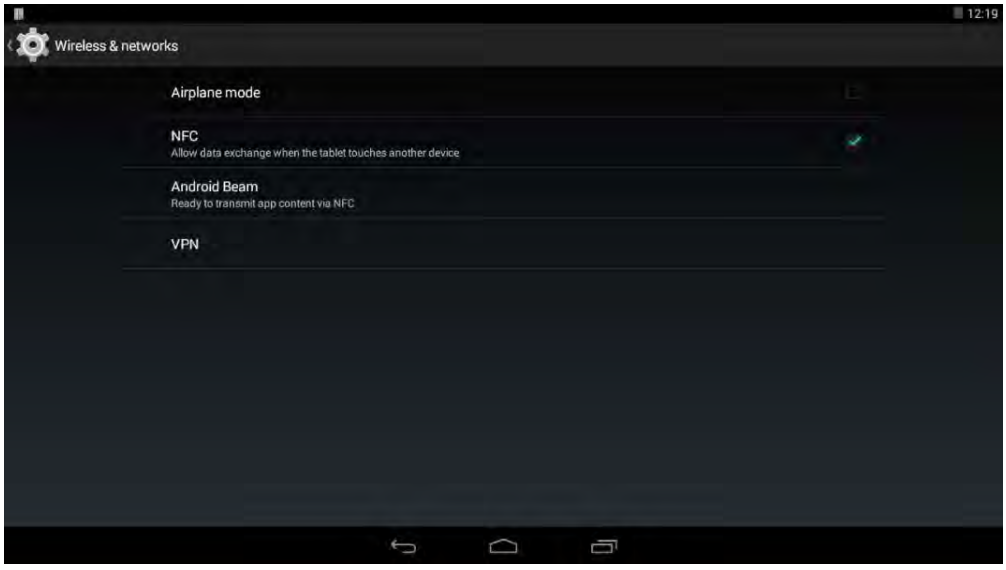

Fig 13. Android “Setting/Wireless&Network” menu

Using already installed NXP TagInfo and NXP TagWriter applications you can get information from discovered tag and write content.

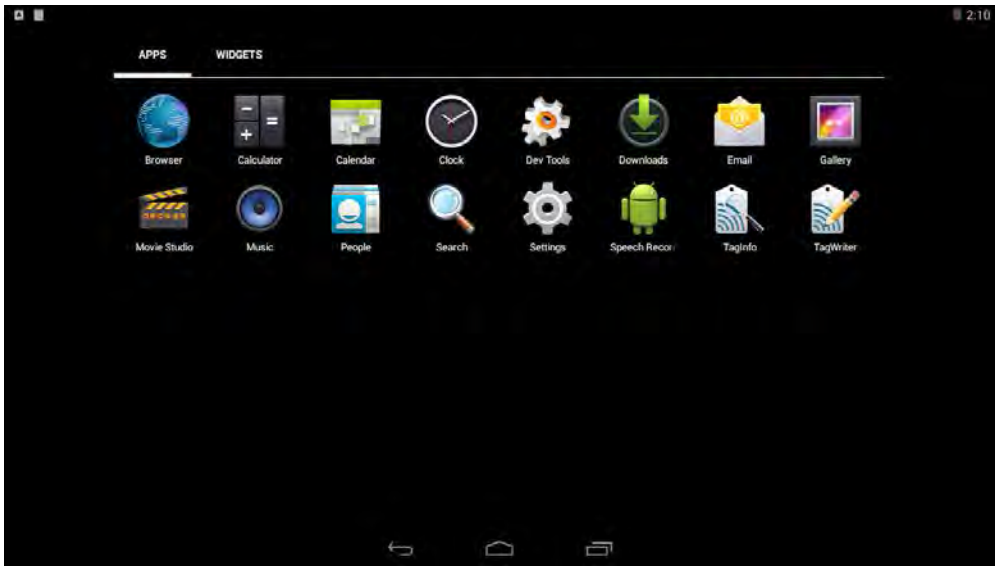

Fig 14. Android applications

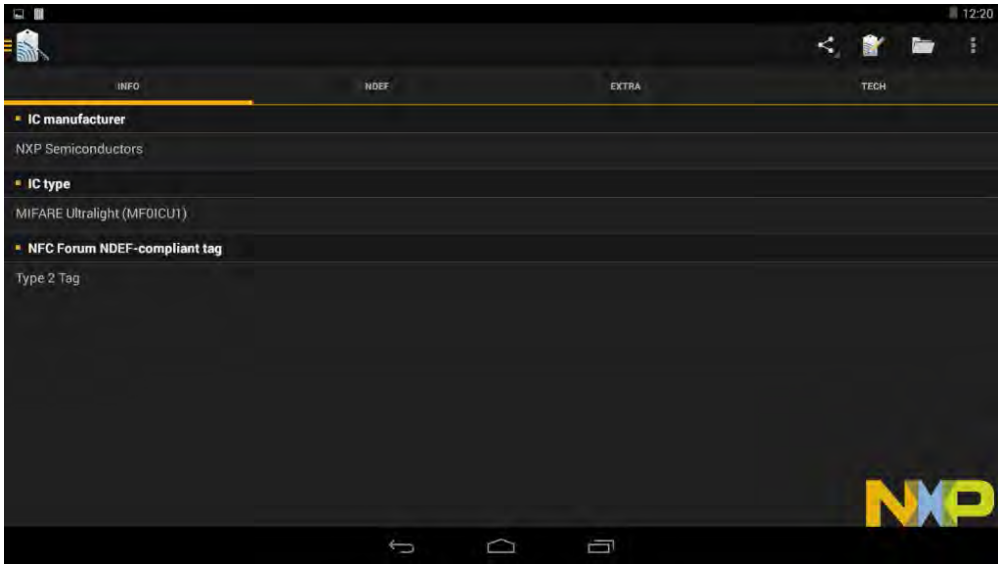

Fig 15. Android TagInfo application

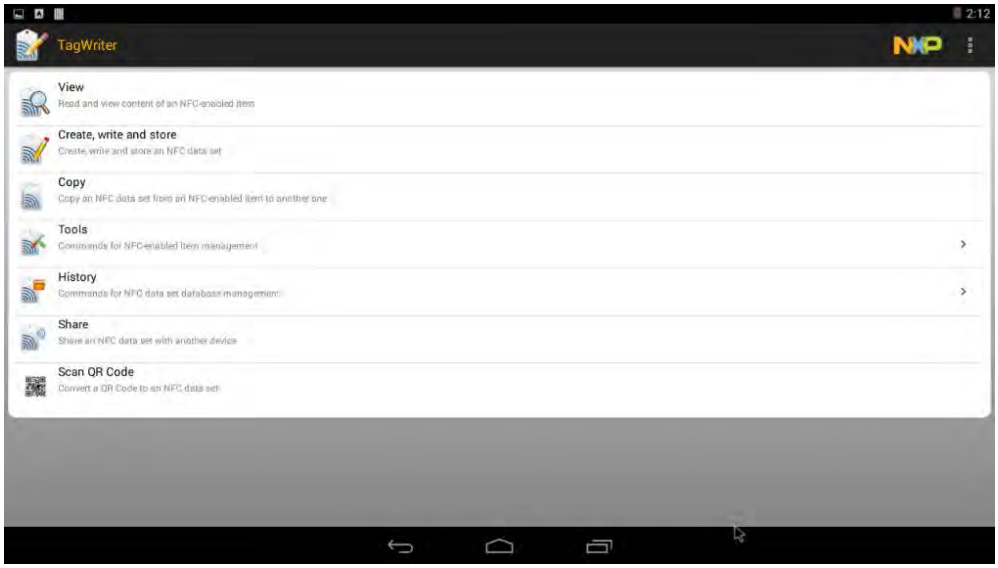

Fig 16. Android TagWriter application

3. Quick Startup on Kinetis

3.1 Required items

- FRDM-K64F board [3]
- Computer (running Windows, Linux or Mac OS X) with KDS installed [11]
- Micro USB cable to connect FRDM-K64F to the computer
- NXPNCI Kinetis Design Studio example software package (see AN11845 [10])

3.2 Hardware setup

First of all assemble the PN7150 NFC Controller Board with the Arduino Interface Board as shown if Fig 2.

Then stacked together the boards with the FRDM-K64F.

Fig 17. OM5578/PN7150ARD and FRDM-K64F stacked together

3.3 Software setup

Follow procedure described in AN11845 [10].

4. Quick Startup on LPCXpresso

4.1 Required items

- OM13071 [14] or OM13074 [15]
- Computer (running Windows, Linux or Mac OS X) with LPCXpresso installed [13]
- Micro USB cable to connect FRDM-K64F to the computer
- NXPNCI LPCXpresso example software package (see AN11658 [12])

4.2 Hardware setup

First of all assemble the PN7150 NFC Controller Board with the Arduino Interface Board as shown if Fig 2.

Then stacked together the boards with the LPCXpresso board.

Fig 18. OM5578/PN7150ARD and OM13071 stacked together

4.3 Software setup

Follow procedure described in AN11658 [12].

5. References

[1] The Arduino Uno is a microcontroller board with 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

For more information about it please visit https://www.arduino.cc/en/Main/ArduinoBoardUno

[2] UDOO NEO is an all-in-one open hardware low-cost computer equipped with NXP's i.MX 6SoloX applications processor for Android and Linux.

For more information about it please visit http://www.udoo.org/udoo-neo/

[3] The Freedom-K64F is an ultra-low-cost development platform for Kinetis K64, K63, and K24 MCUs.

For more information about it please visit http://www.nxp.com/products/software-and-tools/hardware-development-tools/freedom-development-boards/freedom-development-platform-for-kinetis-k64-k63-and-k24-mcus:FRDM-K64F

[4] LPCXpresso is a low-cost development platform available from NXP, supporting NXP's ARM-based microcontrollers. The platform is comprised of a simplified Eclipse-based IDE and low-cost target boards which include an attached JTAG debugger. LPCXpresso is an end-to-end solution enabling embedded engineers to develop their applications from initial evaluation to final production.

For more information about it please visit http://www.nxp.com/products/software-and-tools/hardware-development-tools/lpcxpresso-boards:LPCXPRESSO-BOARDS

[5] AN11697 PN71x0 Linux Software Stack Integration Guidelines: http://www.nxp.com/documents/application_note/AN11697.pdf

[6] AN11690 NXPNCI Android Porting Guidelines: http://www.nxp.com/documents/application_note/AN11690.pdf

[7] Android is an open-source software stack for a wide range of mobile devices and a corresponding open-source project led by Google.

For more information about it please visit https://source.android.com/

[8] UM10935 PN7150 NFC Controller SBC Kit User Manual:
http://www.nxp.com/documents/user_manual/UM10935.pdf

[9] UDOO Neo Linux demo image:
https://nxp1.sharepoint.com/teams/12_33/NFCshare/OM5578/_layouts/15/guestaccess.aspx?docid=0799a0701ac9f4d90afdb89910f30bec1&authkey=AewCRyw3L6mG_cyK0EKQPmc

UDOO Neo Android Lollipop demo image:
https://nxp1.sharepoint.com/teams/12_33/NFCshare/OM5578/_layouts/15/guestaccess.aspx?docid=0fe05ee8f5770497d975e332bdca8007e&authkey=AZUMHy30mdbmYoGeQdLAyQc

UDOO Neo Android Marshmallow demo image:
https://nxp1.sharepoint.com/teams/12_33/NFCshare/OM5578/_layouts/15/guestaccess.aspx?docid=091d2aacc986b4f1397146786a2ef8661&authkey=Adpw4jwDEtbHiUMNnetzw7E

[10] AN11845 NXPNCI Kinetis Design Studio example:
http://www.nxp.com/documents/application_note/AN11845.pdf

[11] Kinetis Design Studio IDE (KDS) is a complimentary integrated development environment for Kinetis MCUs that enables robust editing, compiling and debugging of your designs.

For more information about it please visit http://www.nxp.com/products/software-and-tools/run-time-software/kinetis-software-and-tools/ides-for-kinetis-mcus/kinetis-design-studio-integrated-development-environment-ide:KDS_IDE

[12] AN11658 NXPNCI LPCXpresso Design Studio example:
http://www.nxp.com/documents/application_note/AN11658.pdf

[13] LPCXpresso IDE gives developers a low-cost way to create high-quality applications for LPC microcontrollers (MCUs). Based on the Eclipse platform, it has many enhancements to simplify application development and debugging.

For more information about it please visit http://www.nxp.com/products/software-and-tools/hardware-development-tools/lpcxpresso-boards/lpcxpresso-ide:LPCXPRESSO

[14] OM13071: LPCXpresso824-MAX Board for LPC82x family MCUs:
http://www.nxp.com/demoboard/OM13071.html

[15] OM13074: LPCXpresso board for LPC11U37H:
http://www.nxp.com/demoboard/OM13074.html

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