AN11842

PN7150 BeagleBone Black SBC Kit Quick Start Guide

Rev. 1.2 — 25 July 2018
373112

Application note
COMPANY PUBLIC

Document information

Info	Content
Keywords	OM5578, PN7150, BeagleBone, NFC, P2P, Card Emulation, Linux, Android
Abstract	This document gives a description on how to get started with the OM5578 PN7150 NFC Controller SBC Kit on BeagleBone Black platform.

Revision history

Rev	Date	Description
1.2	20180725	Updated weblinks
1.1	20170222	Updated demo images weblinks
1.0	20150518	First official release version

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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 BeagleBone Black platform. 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/PN7150BBB demo kit

OM5578/PN7150BBB kit is a high performance fully NFC compliant expansion board for BeagleBone Black (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/BBB kit overview

The demo kit is fully described in UM10935 document [4].

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 [2]).

1.3 Android driver support

PN7150 NFC Controller is supported from the official Android Open Source Project (refer to [5] for more details) with the addition of dedicated patches (refer to AN11690 [3]).

2. Quick Startup on BeagleBone

2.1 Required items

- BeagleBone Black [1]
- MicroSD card of at least 4 Gb (8 Gb for Android demo image)
- 5V adapter to power the BeagleBone (**Note: Micro USB cable doesn't provide the 5V required by the antenna supply of the OM5578/PN7150S board. Without it no RF field can be generated by the OM5578**).
- USB Keyboard
- USB Mouse
- USB Hub to connect both Mouse and Keyboard to the BeagleBone
- HDMI cable to connect to a Monitor / TV
- Computer (running Windows, Linux or Mac OS X) for MicroSD card installation
- BeagleBone demo image file (see [6])

2.2 Hardware setup

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

Fig 2. OM5578/PN7150S BeagleBone configuration

Then stacked together the boards with the BeagleBone.

Fig 3. OM5578/PN7150S and BeagleBone Black stacked together

2.3 Software setup

Prepare a MicroSD card, with the downloaded BeagleBone demo image (see [6]), following the installation guidelines. First extract the ".img" file from the archive, then flash it on the microSD card according to below guidelines.

2.3.1 On Windows

Insert the MicroSD card into your computer (note the device drive letter), and using Win32 Disk Imager, write the image into it:

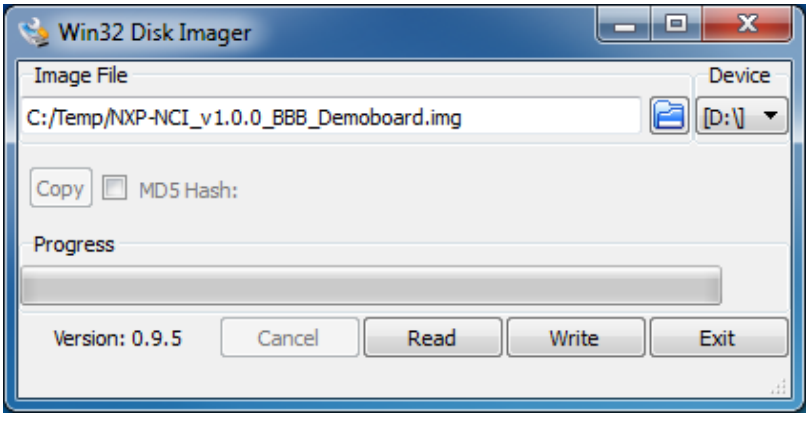

Fig 4. Win32 Disk Imager

2.3.2 On Linux

Insert the MicroSD card into your computer and determine the device node assigned to it (ignore the device number; e.g. /dev/sdb, not sdb1):

```
$ sudo dmesg | tail -20
```

```
$ sudo dmesg | tail -20
[95300.848154] usb 2-1: new high-speed USB device number 33 using ehci-pci
[95300.983859] usb 2-1: New USB device found, idVendor=14cd, idProduct=6d00
[95300.983872] usb 2-1: New USB device strings: Mfr=1, Product=3, SerialNumber=2
[95300.983880] usb 2-1: Product: USB 2.0  SD/MMC READER
[95300.983888] usb 2-1: Manufacturer: SDMMC M121
[95300.983895] usb 2-1: SerialNumber: 800340070270
[95300.984593] usb-storage 2-1:1.0: USB Mass Storage device detected
[95300.984882] scsi18 : usb-storage 2-1:1.0
[95301.985555] scsi 18:0:0:0: Direct-Access  USB 2.0  SD/MMC Reader  PQ: 0 ANSI: 0 CCS
[95301.986856] sd 18:0:0:0: Attached scsi generic sg2 type 0
[95301.988277] sd 18:0:0:0: [sdb] Attached SCSI removable disk
```

Fig 5. Identifying device number under Linux

Then, unmount the device node using following command:

```
sudo umount /dev/devicenode
```

Finally flash the image to the device node using following command:

```
sudo dd if=path_to_image_file.img of=/dev/devicenode bs=1M
```

2.3.3 On MAC OS X

Using PiFiller (see https://learn.adafruit.com/beaglebone-black-installing-operating-systems/mac-os-x), select the image file then insert the MicroSD card into your computer to flash it.

2.4 Linux NFC demo application

2.4.1 Application details

The demo application is 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 [2]).

2.4.2 Starting Linux NFC demo

Insert the MicroSD card in the BeagleBone. Connect HDMI Display, mouse and keyboard via the USB Hub. Finally supply the BeagleBone using 5V adapter.

The BeagleBone boots and displays the bone-debian GUI:

Fig 6. bone-debian GUI

Open a terminal and 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
```

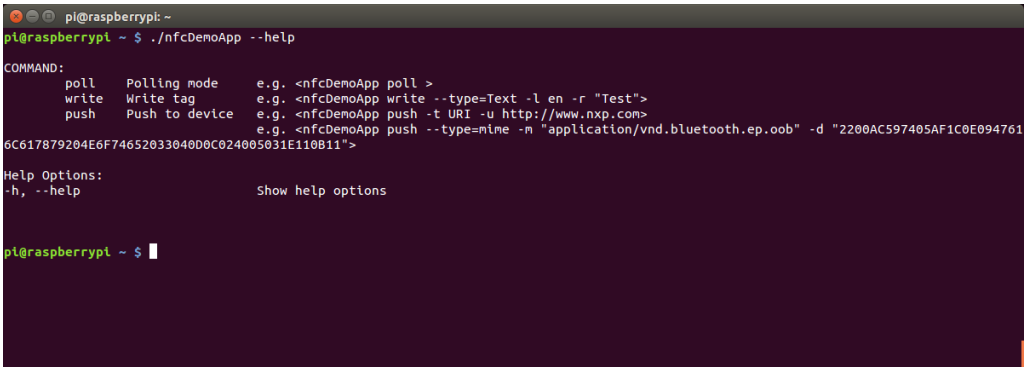

Fig 7. Linux demo application commands

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
- **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
```

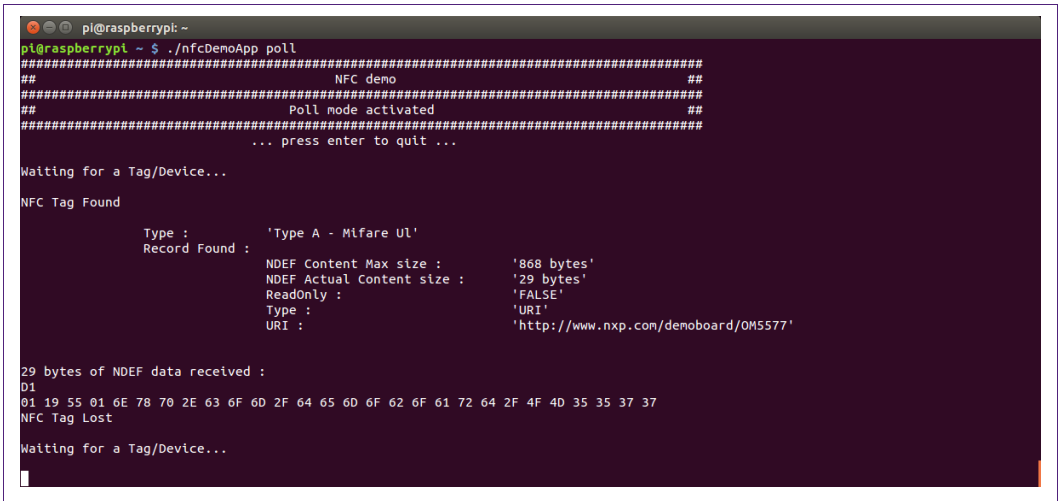

Fig 8. Linux demo application polling mode

2.4.2.2 Tag writing mode

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

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

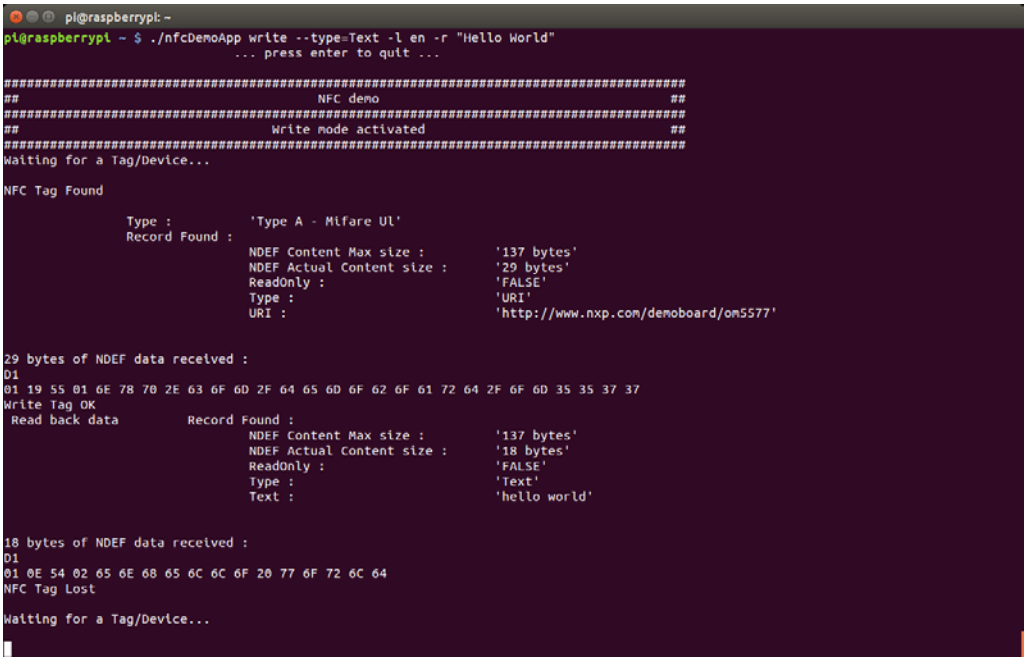

Fig 9. Linux demo application tag writing mode

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

```
$ ./nfcDemoApp write –-help
```

2.4.3 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>
```

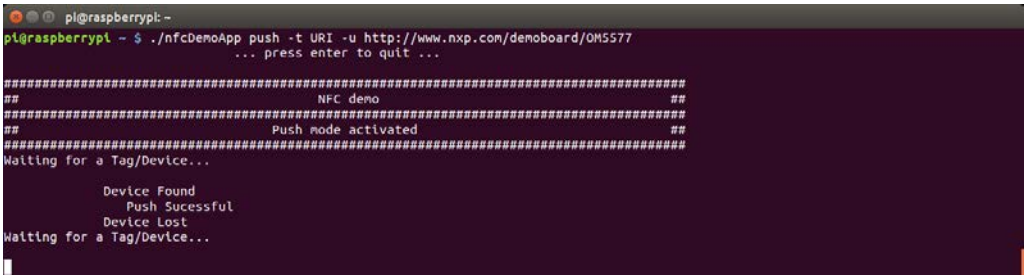

Fig 10. Linux demo application device push mode

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

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

2.5 Android NFC demo

Insert the MicroSD card in the BeagleBone. Connect HDMI Display, mouse and keyboard via the USB Hub. Finally supply the BeagleBone using 5V 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).

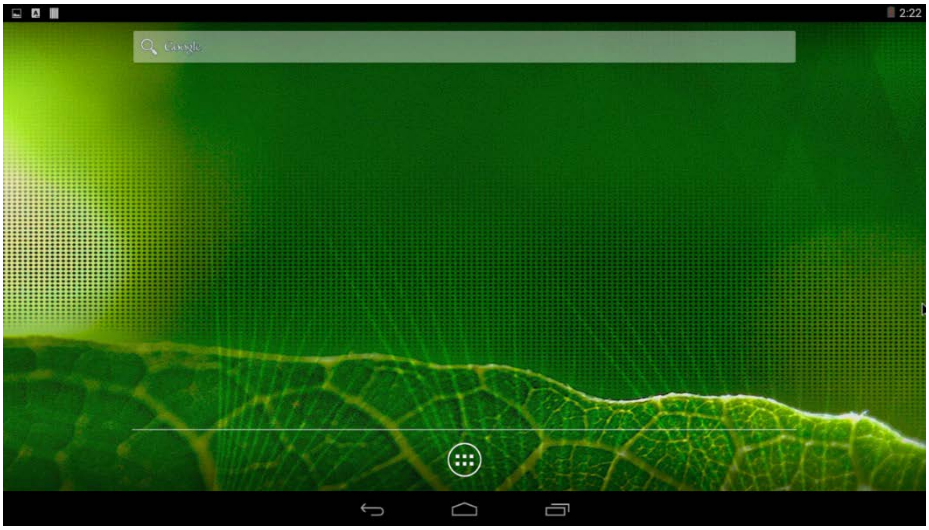

Fig 11. Android home screen

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

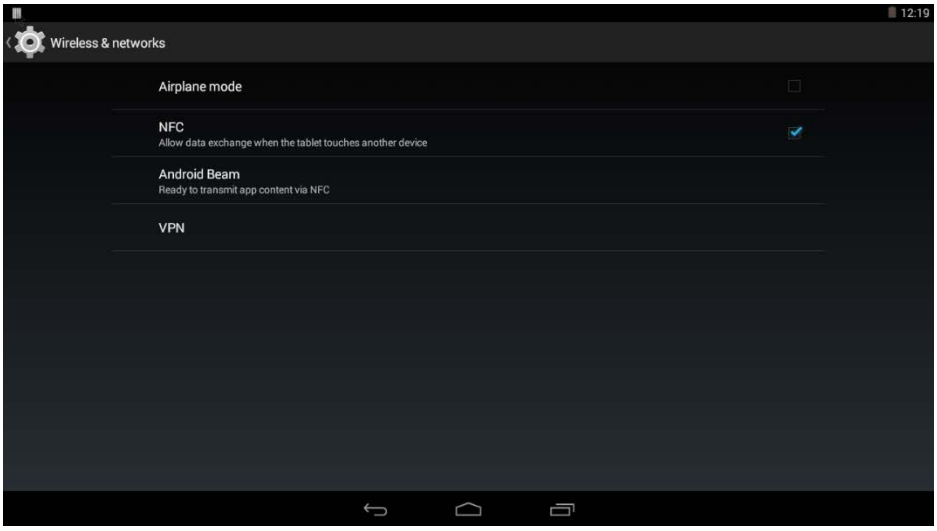

Fig 12. Android “Setting/Wireless&Network” menu

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

Fig 13. Android applications

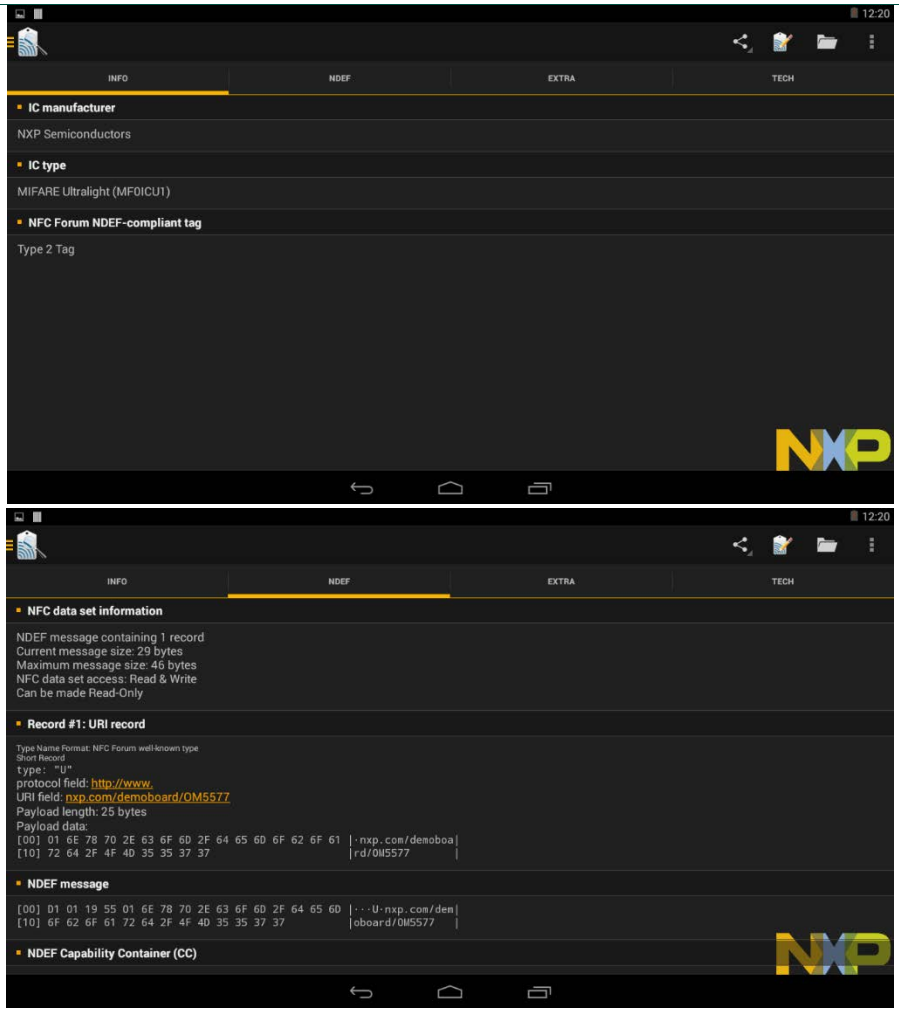

Fig 14. Android TagInfo application

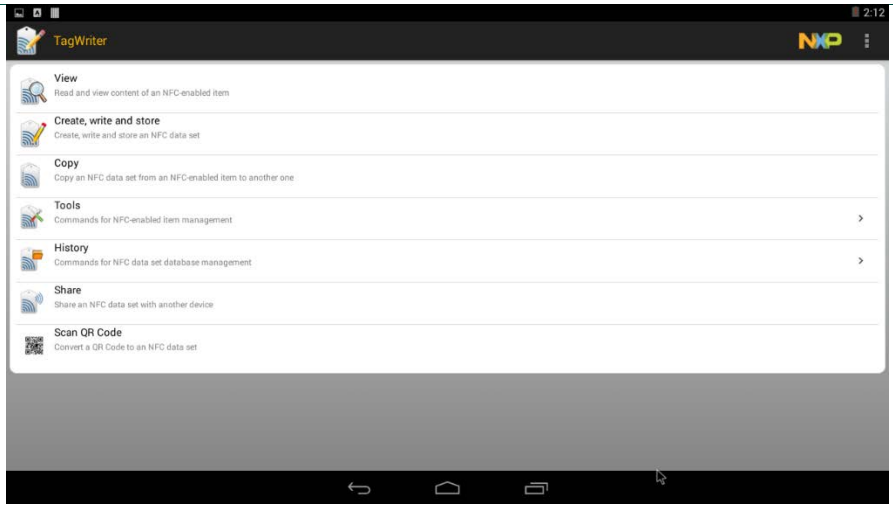

Fig 15. Android TagWriter application

3. References

[1] BeagleBone is a low-power open-source hardware single-board credit-card-sized Linux computer that connects to the Internet and runs software such as Android and Ubuntu. With plenty of I/O and processing power for real-time analysis provided by a 720MHz ARM® processor based SoC (System on Chip), BeagleBone can be complemented with cape plug-in boards to augment functionality.

For more information about it please visit
http://beagleboard.org/bone

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

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

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

[5] 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/

[6] BeagleBone Linux demo image:
https://www.nxp.com/lgfiles/updates/NFC/OM5578-PN7150S_BBB_Linux_demo_v1.2.zip

BeagleBone Android KitKat demo image:
https://www.nxp.com/lgfiles/updates/NFC/OM5578-PN7150S_BBB_AndroidKitKat_demo_v1.0.zip

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6. Contents

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Date of release: 25 July 2018
373112
Document identifier: AN11842