UM10957

PN7462AU Door Access User Manual

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User manual
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Document information

Info	Content
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Abstract	This document serves as a User Manual for Door Access Demo Application

Revision history

Rev	Date	Description
1.1	20160913	Figures updated
1.0	20160308	First release

Contact information

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

1. Introduction

This document describes “Door Access application” and shows how PN7462AU Customer Demo board can be used in the door access management.

Two types of Door Access examples are available and explained here:

- Export controlled version,
- Non Export Controlled version

1.1 Door Access Application – Non Export Controlled version

In this version of the application a MIFARE Classic card is used for the authentication and for data exchange the contactless interface is used.

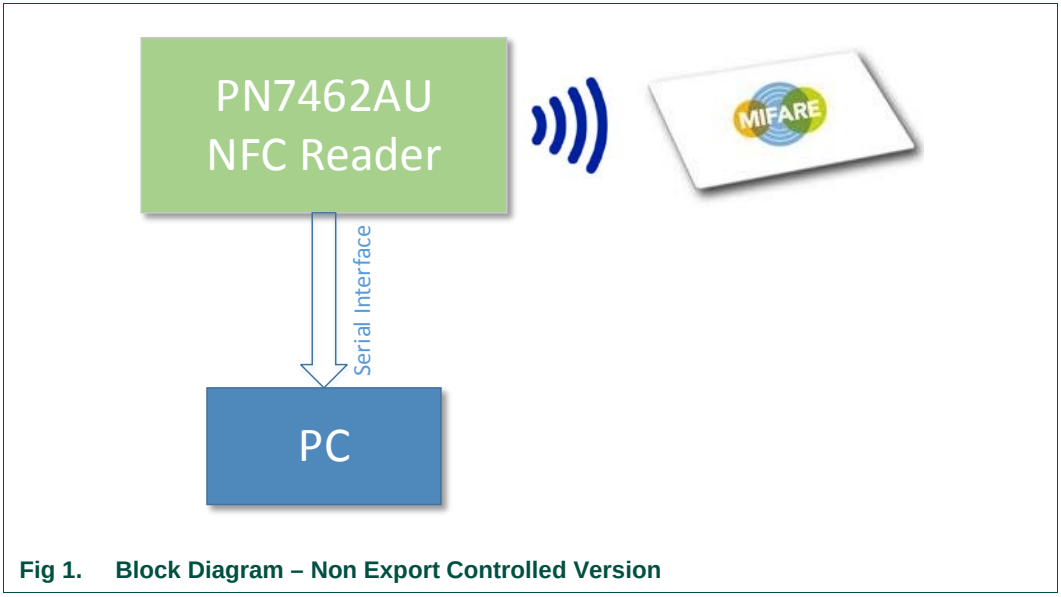

Fig 1. Block Diagram – Non Export Controlled Version

The application is running a NFC polling loop and goes to standby mode after each polling loop in case no CL card is detected by the RF field of the reader. The polling loop is implemented for Type A, B, F, ISO15693 and ISO 1800-P3M3. The application prints out the detected type of the card and UID if available. In case the NFC device is detected, the application sends a NDEF message containing the NXP webpage address.

After each polling loop the application goes to standby mode and remains for 500 ms. A timer is used as a wakeup source from standby. This process continues until a card is detected by the RF field of the reader. If a card is detected, the card type with its UID is sent via HSU and will be printed on the PC console.

In case a MIFARE Classic card is detected, application tries to authenticate the card using the default MIFARE key. If the authentication is successful a block of data is read from the card. The type of the card, UID and data are sent via HSU and printed on the PC console.

LEDs (Table 1) are used to indicate status or activity flow, like card detection, authentication pass/ fail, reading data pass/ fail. The application is using four LEDs on the demo board (green, yellow, red and blue).

Table 1. LEDs status specification

	LED	
CL card detected	Yellow	
card authenticated	Yellow + green	+
Card authentication failed	Yellow + red	+
Transaction successful completed	Yellow + green blinking	+ blinking 3x
Transaction failed	Yellow + red blinking	+ blinking 3x
Polling	all 4 LEDs blink circular	

The reader can detect Type A/B, Felica, ISO15693 and ISO18000-3M3 cards.

P2P functionality is integrated in the Non Export controlled version. When a NFC enabled phone is detected from the RF field as an active or passive target the LLCP SNEP will be activated and NDEF message will be sent to the mobile device.

If LPCD (Low Power Card Detection) is enabled, the reader checks during the wakeup time the presence of a card and enters the card detected mode when a card is present & repeats the cycle. If no card is present it goes back to standby mode. LPCD is enabled by default.

1.2 Door Access Application – Export Controlled version

This version of the application is using a MIFARE DESFire EV1 card for the authentication, data exchange is done over contactless interface and software key store or SAM (Secure Access Module) key store is used for storing the authentication key. By default the software key store is enabled. The user can use the SAM key store by enabling a Macro as explained in the section 3.5. SAM is a key storage element and it should be inserted in the CT main.

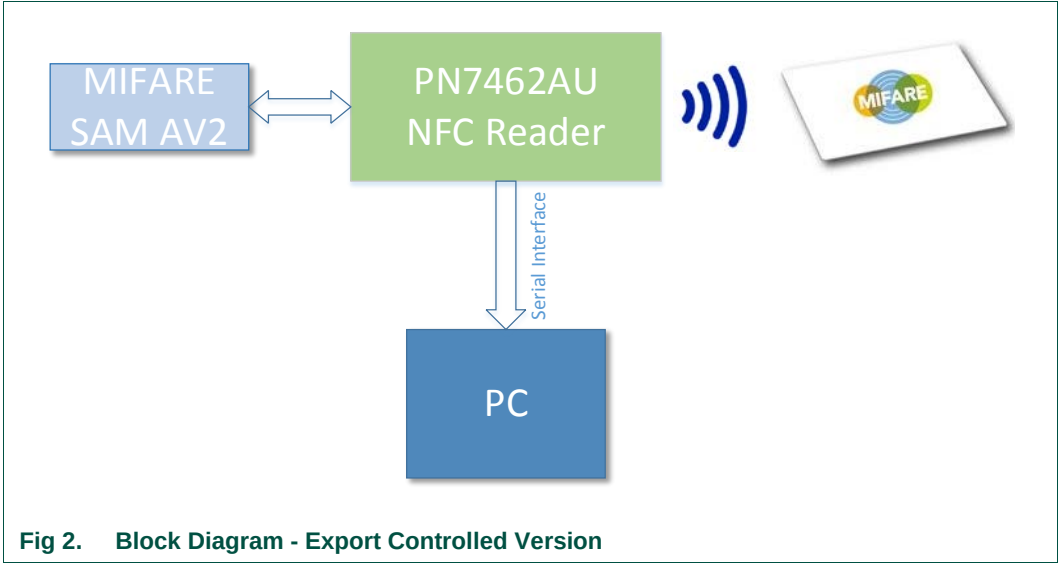

Fig 2. Block Diagram - Export Controlled Version

On power up, NFC Reader starts polling for (PICC) cards (Type A, B or F, ISO15693, ISO18000-3M3) and if no card is present, the reader goes to standby mode. Timer is used as a wakeup source from standby - timer periodically every 500 ms. This process continues until a card is detected by the RF field of the reader. If a card is detected, the card type with its UID is sent via HSU & this is printed on the PC console

If a MIFARE DESFire EV1 card is detected, the reader tries to select a pre written custom application on the card. It tries to authenticate the card using the key stored in SAM. If SAM is not present, then software keys can be used for authentication. If authentication is successful a block of data will be read from the card. Type of the vcard, UID along with the data read is sent via HSU & this is printed on the PC console.

LEDs (Table 2) are used to indicate status or activity flow, like card detection, authentication pass/ fail, reading data pass/ fail. Application is using four LEDs on the demo board (green, yellow, red and blue).

Table 2. LEDs status specification

	LED	
CL card detected	Yellow	
card authenticated	Yellow + green	+
Card authentication failed	Yellow + red	+
card authenticated, using SAM	Yellow + blue + green	+ +
Card authentication failed, using SAM	Yellow + blue + red	+ +
Transaction successful completed	Yellow + green blinking	+ blinking 3x
Transaction failed	Yellow + red blinking	+ blinking 3x
Polling	all 4 LEDs blink circular	

Reader is capable to detect Type A/B, Felica, ISO15693, and ISO18000-3M3 cards.

If LPCD (Low Power Card Detection) is enabled, the reader checks during the wakeup time the presence of a card and enters the card detected mode when a card is present & repeats the cycle. If no card is present it goes back to standby mode. LPCD is enabled by default.

1.3 Development environment

To prepare the project and build the source code the components listed in the Table 3 are required.

Table 3. Development environment

Item	Version	Purpose
PN7462AU Customer Board	2.1	Engineering development board.
LPC-Link2	1.0	Stand-alone debug adapter
LPCXpresso IDE	8.0.0.526	Development IDE
LPCXpresso PN7462AU Plugin	com.nxp.pn7xxxx.update-8.0.0-SNAPSHOT-150	Add PN7462AU reader to the LPCXpresso
USBToSerial Convertor		

Note
Installation procedure of the *"LPCXpresso IDE" and "LPCXpresso PN7462AU Plugin"* is described in the *"UM10883 - PN7462AU Quick Start Guide - Customer Board"* document. Latest LPCXPresso plugin is required.

1.4 Project download link

The source code of the Door Access application is part of a delivered "PN7462AU customer support package" and the project can be found in ".\PN7462AU Software" folder.

Note:
Export controlled version is available only by NXP Docstore. Docstore tool is online tool for sharing documents and data. Access to NXP Docstore is available only to customers with valid NDA.

1.5 Driver Installation for USB to serial converter

Windows 7 driver is required for USB to serial converter and it is part of the delivered "PN7462AU customer support package" and the driver can be found in "Drivers" folder.
www.nxp.com/external/prolific

2. Door Access Use Case – Non Export Controlled Version

This section describes in detail the setup procedure and execution environment required for Non-Export Controlled version of “Door Access Use Case application”.

This version of the application is using MIFARE Classic card for the authentication and data exchange is done over contactless interface.

2.1 Hardware Setup

For preparing the project and building the source code components listed in the Table 4 are required.

Table 4. Development environment

Item	Version	Purpose
PN7462AU Customer Board	2.1	Engineering development board.
LPC-Link2	1.0	Stand-alone debug adapter
USBToSerial converter		USB To Serial
Power adapter		Optional

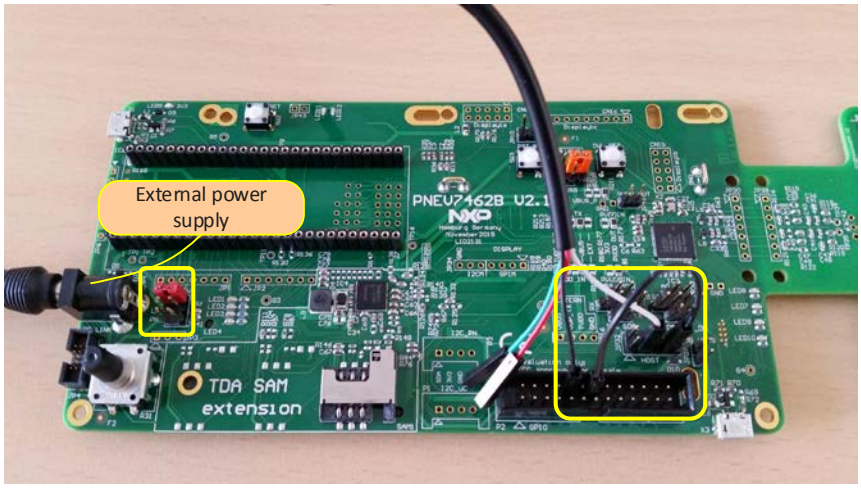

Fig 3. PN7462AU Customer Board – Hardware Setup (with power adapter)

Connection Details:

1) **DC Power Supply of 7.5 V**

   Board is powered using the 7.5 V power adapter.

2) **Power supply selection jumper**

   Jumper should be placed to connect JP41.1 -> JP41.2

   This is to choose the external power supply to the board.

3) **Connect Rx of 'USB - Serial converter' to ATX_B**

Take a USB to Serial converter (USB to TTL to UART RS232 COM Cable Module Converter) as shown in the Fig 4.

One side of this cable has USB connector and other side has 4 wires.

- Vcc (Red wire)
- Tx (Green wire)
- Rx (White wire)
- Ground (Black wire)

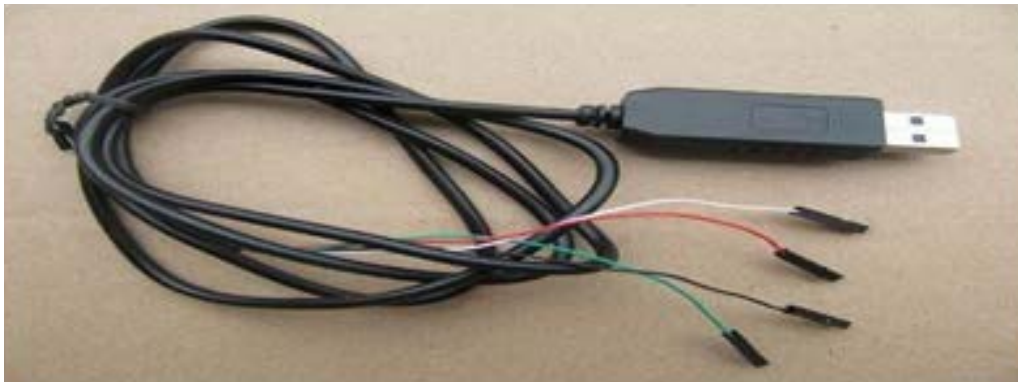

Fig 4. USB to serial converter

Connect the RX line to the ATX_B (jp32.3) pin of the Customer Board.

4) **Common Ground connection**

Connect ground wire (Black wire) of the 'USB to Serial converter' to one of the common ground pins on the customer board as shown Fig 3.

5) **CTS to ground connection**

Connect ATX_D (JP32.7) pin of the Customer board to one of the common ground pins using a wire. This grounds the CTS line and this connection is necessary to print on the PC console using USB to serial converter.

2.1.1 Hardware setup without any external supply

To eliminate the use of external power supply, we can power the board using Vcc line (+5 V) of USB to serial converter. For this, Vcc line (Red wire) of USB to serial converter should be connected to JP41.2 of the board. (Remember to remove any external power supply selection jumper already placed on JP41).

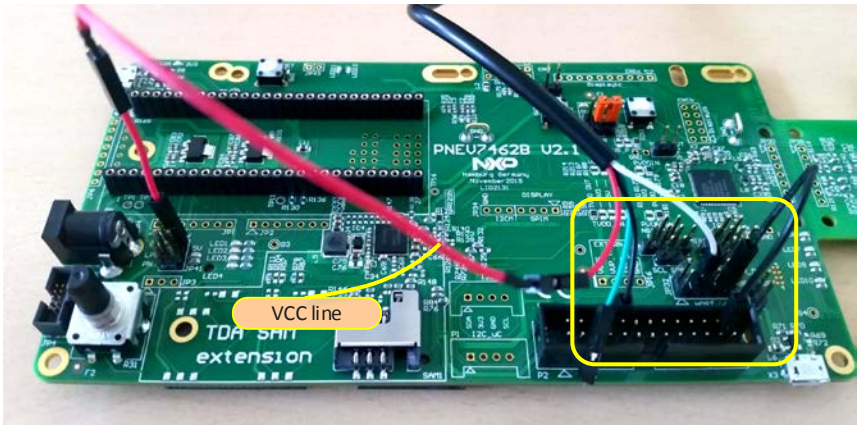

Fig 5. USB powered setup (setup without any external power supply)

2.1.2 LPC-Link2 Debug Adapter Connection

To flash the binary or to debug the code LPC-Link2 debug adapter should be used. It can be connected to JTag connector (JP4) of the customer board as shown in the figure below.

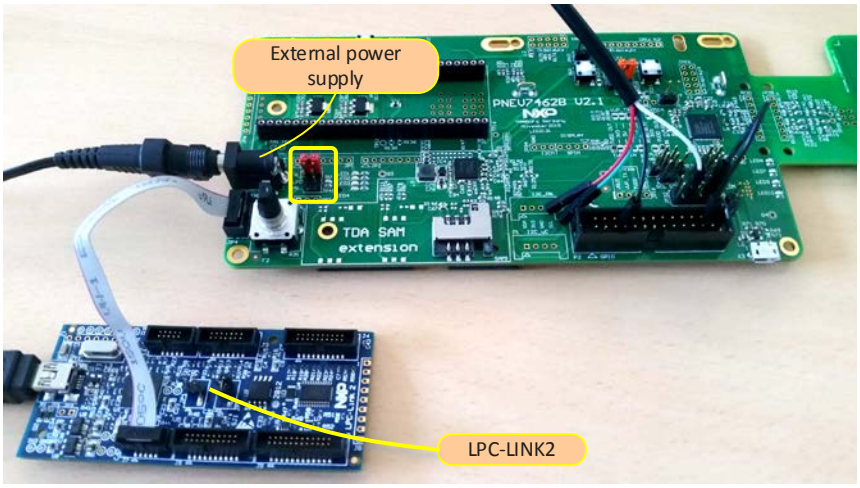

Fig 6. LPC Link2 connection for debugging and flashing

2.2 Importing project

After installation of the “PN7462AU FW & SW Examples Full Version” please follow steps described below.

The sequence of preparing the project is:

- Open the LPCXpresso IDE and select an empty workspace
- Select the option “Import project(s)” in Quick Panel

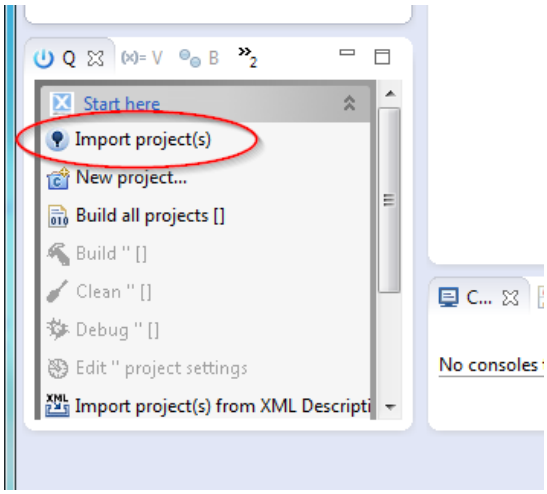

Fig 7. Importing project to LPCXpresso IDE

The dialog for project import opens.

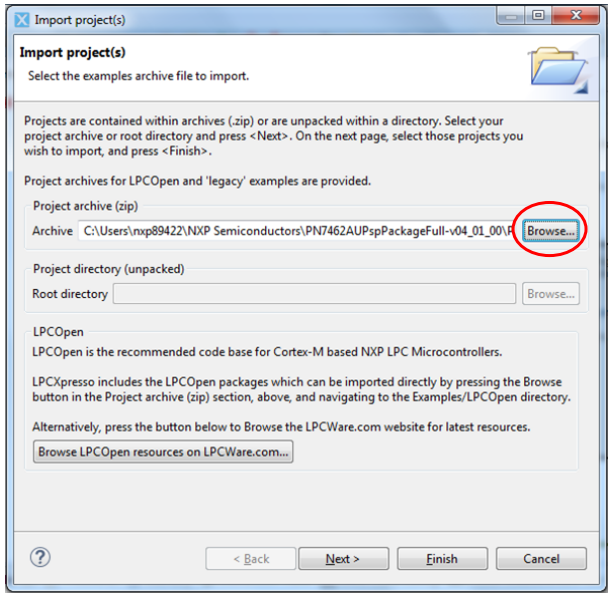

Fig 8. Importing project to LPCXpresso IDE

Browse to the project zip file *“.\PN7462AU Software\PN7462AU-FW_v04.01.00.zip”* and click *“Next”.*

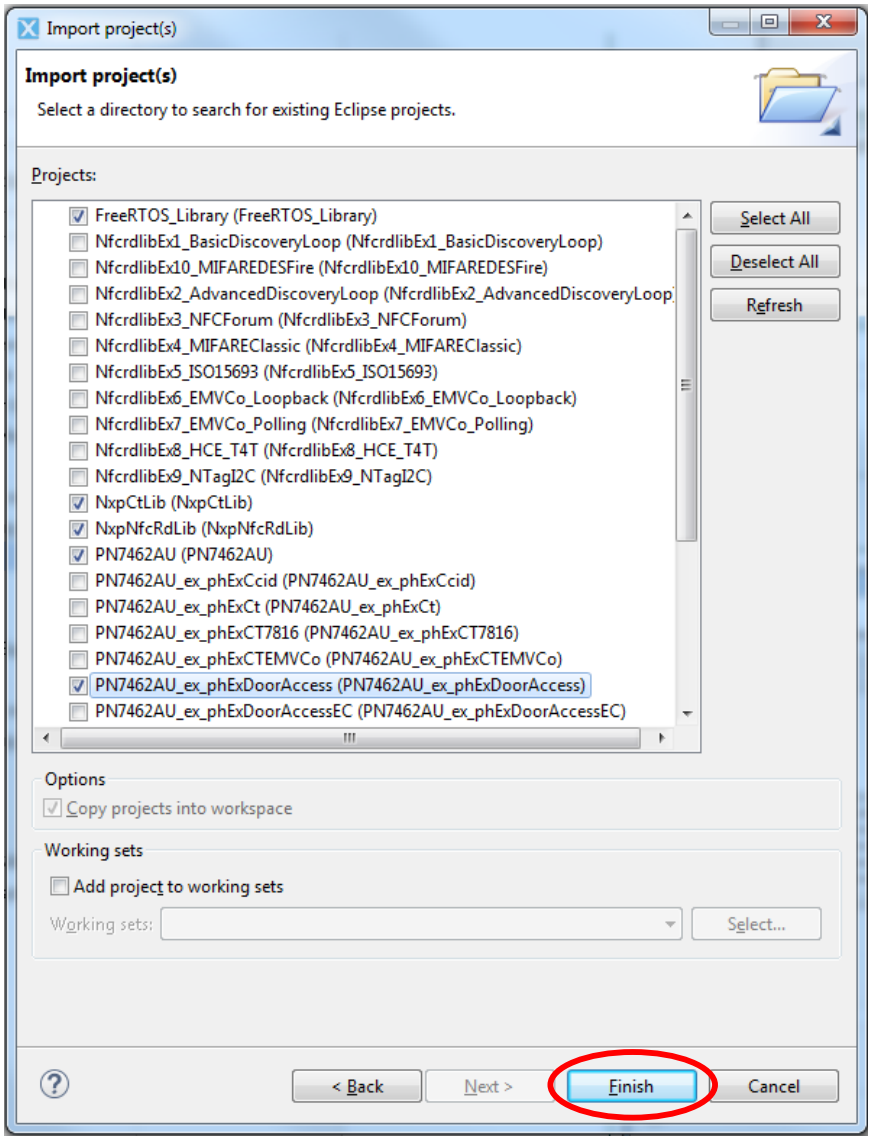

Fig 9. Select project

In the projects window all available projects in the package will be listed. To import only DoorAccess examples, it is mandatory to select next projects in the list:

- FreeRTOS_Library
- NxpCtLib
- NxpNfcRdLib
- PN7462AU
- PN7462AU_ex_phExDoorAccess

All projects in the list can be also selected and imported to the workspace.

Select appropriate projects and click Finish. Selected applications are going to be imported to the workspace.

2.3 Building project

Building projects in a workspace is a simple case of using the “Quickstart Panel” - ‘Build all projects’. Alternatively a single project can be selected in the “Project Explorer View” and built separately. Note that building a single project may also trigger a build of any associated library projects.

To build the project select appropriate project and press “Build” as shown in the figure below.

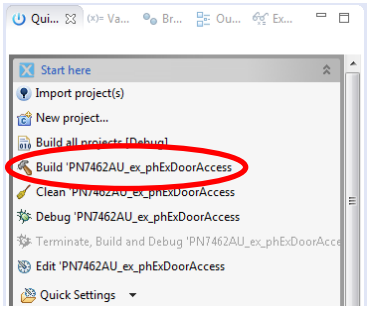

Fig 10. Build project

As a part of the build output, the binary for Flash file is created. This binary file can be used to update PN7462AU Flash via USB mass storage interface or by using Flash tool or debug in LPCXpresso IDE.

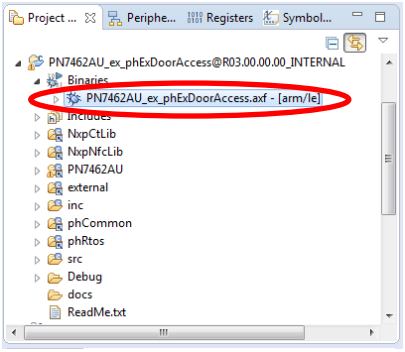

Fig 11. Build output - flash binary file

Note:
Due to legal issues, NXP cannot provide source code for the FreeRTOS and the

FreeRTOS source code should be integrated by users. Detailed description on how to integrate source code of the FreeRTOS to the project it is described in the “AN11784 PN7462AU How to integrate RTOS” document.

After successful integration of the FreeRTOS source code, project build should be compiled without errors as shown on the picture below.

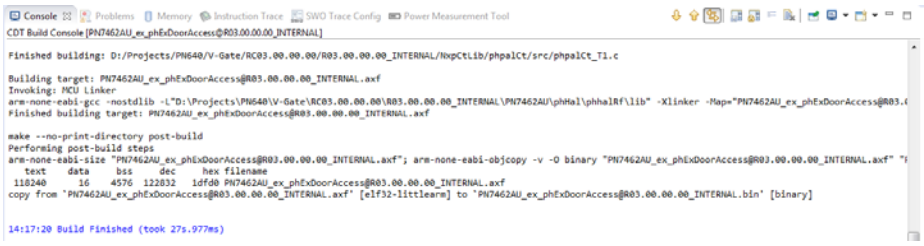

Fig 12. Successful build

2.4 Activity flow

The activity flow of Non Exported version project is as shown below

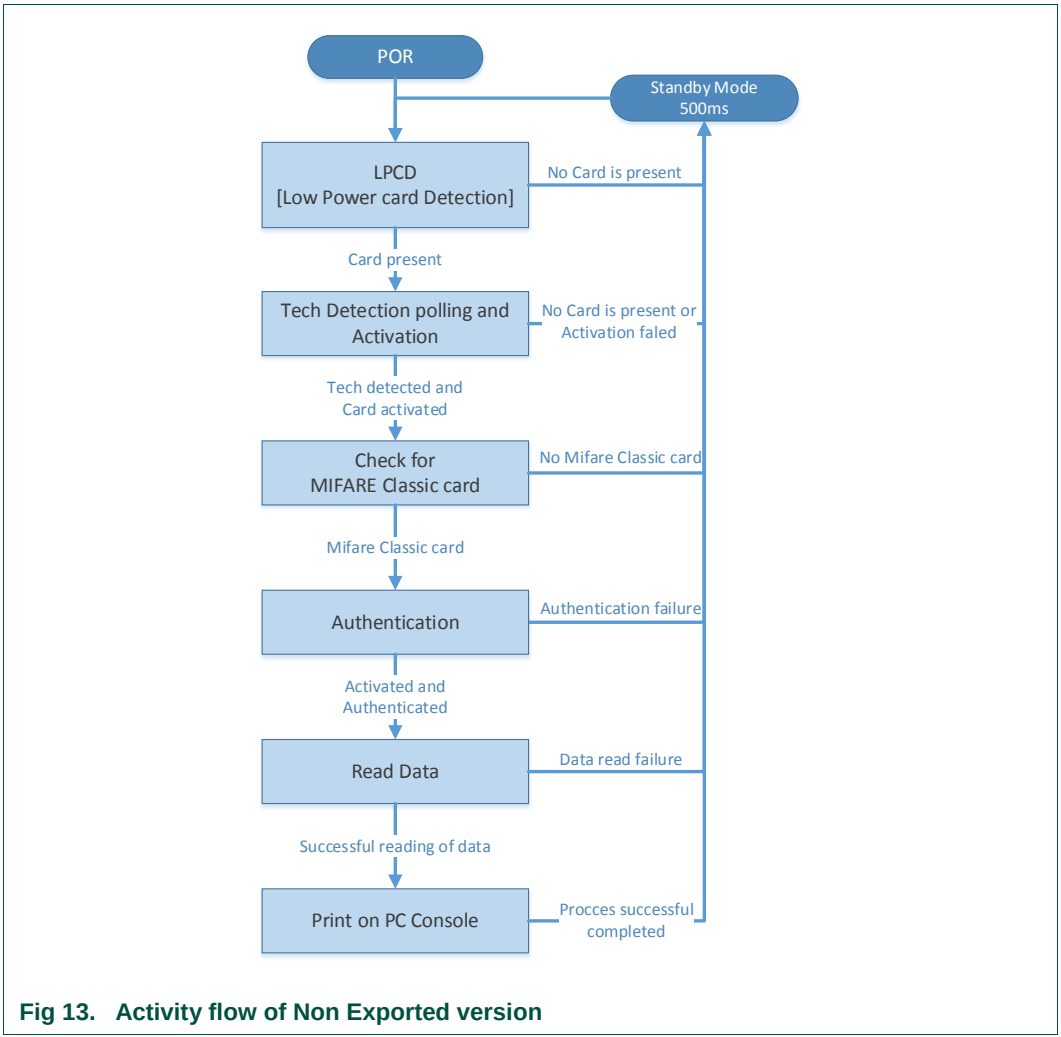

Fig 13. Activity flow of Non Exported version

3. Door Access Use Case – Export Controlled Version

This section describes in detail the setup procedure and execution environment required for Export Controlled version of Door Access Use Case application.

This version of the application is using MIFARE DESFire EV1 card for the authentication, data exchange is done over contactless interface and software key store or SAM (Secure Access Module) key store is used for key storing.

3.1 Hardware Setup

For preparing the project and building the source code components listed in the Table 5 are required.

Table 5. Development environment

Item	Version	Purpose
PN7462AU Customer Board	2.1	Engineering development board.
LPC-Link2	1.0	Stand-alone debug adapter

Item	Version	Purpose
USBToSerial converter		USB To Serial
Power adapter		Optional
SAM card		MIFARE SAM AV2 in AV1 mode

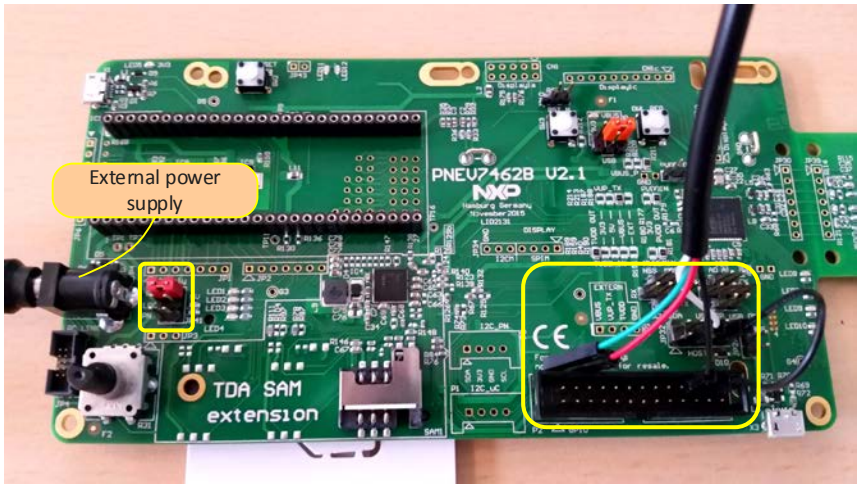

Fig 14. Door Access Export controlled version hardware setup (with power adapter)

Connection Details:

1) **DC Power Supply of 7.5 V**

   Board is powered using the 7.5 V power adapter.

2) **Power supply selection jumper**

   Jumper should be placed to connect JP41.1 -> JP41.2

   This is to choose the external power supply to the board.

3) **SAM in main CT slot**

   MIFARE SAM AV2 in AV1 mode must be insert in CT main slot.

4) **Connect Rx of 'USB - Serial converter' to ATX_B**

   Take a USB to Serial converter (USB to TTL to UART RS232 COM Cable Module Converter) as shown in the figure.

   One side of this cable has USB connector and other side has 4 wires.

   - Vcc (Red wire)
   - Tx (Green wire)
   - Rx (White wire)
   - Ground (Black wire)

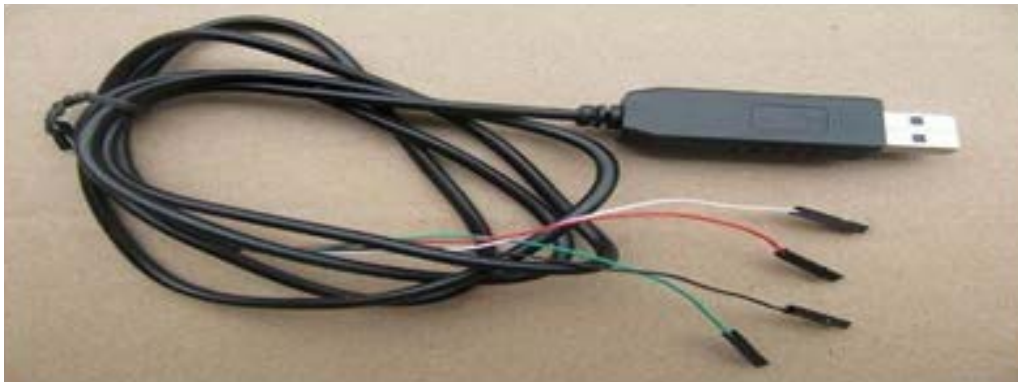

Fig 15. USB to serial converter

Connect the RX line to the ATX_B (jp32.3) pin of the Customer Board.

5) **Common Ground connection**

   Connect ground wire (Black wire) of the 'USB to Serial converter' to one of the common ground pins in the customer board as shown Fig 14.

6) **CTS to ground connection**

   Connect ATX_D (JP32.7) pin of the Customer board to one of the common ground pins using a wire. This grounds the CTS line and this connection is necessary to print on the PC console using USB to serial converter.

3.1.1 Hardware setup without external supply

To eliminate the use of external power supply, we can power the board using Vcc line (+5 V) of USB to serial converter. For this, Vcc line (Red wire) of USB to serial converter should be connected to JP41.2 of the board. (Remember to remove any external power supply selection jumper already placed on JP41).

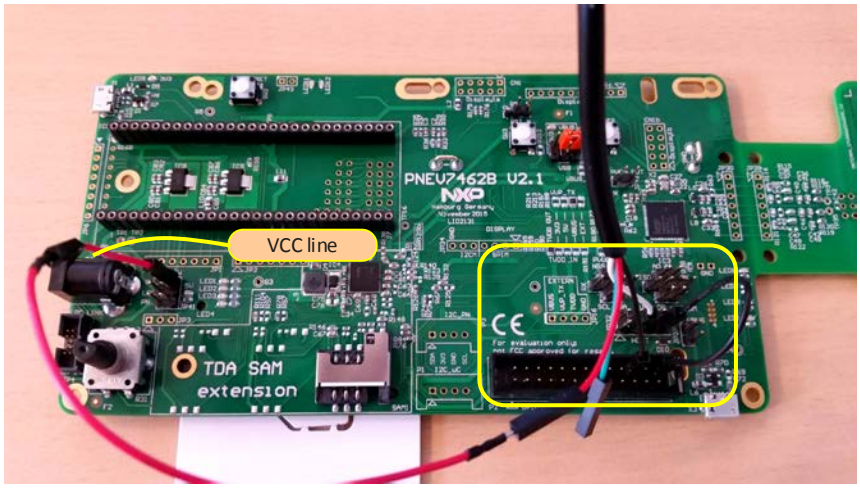

Fig 16. Hardware setup without external supply

3.1.2 LPC-Link2 Debug Adapter Connection

To flash the binary or to debug the code LPC-Link2 debug adapter should be used. It can be connected to JTag connector (JP4) of the customer board as shown in the figure below.

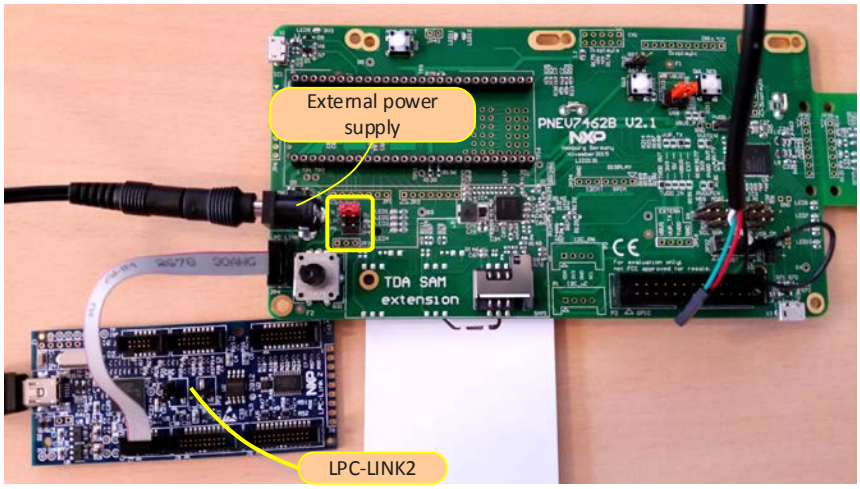

Fig 17. LPC Link2 connection for debugging and flashing

3.2 Importing project

After installation of the “PN7462AU FW & SW Examples Full Version” please follow steps described below.

The sequence of preparing the project is:

- Open the LPCXpresso IDE and select an empty workspace
- Select the option “Import project(s)” in Quick Panel

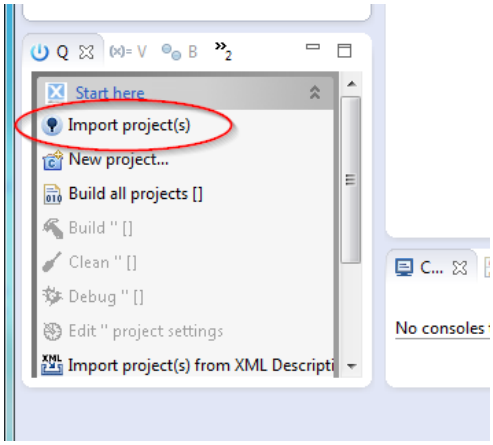

Fig 18. Importing project to LPCXpresso IDE

The dialog for project import opens.

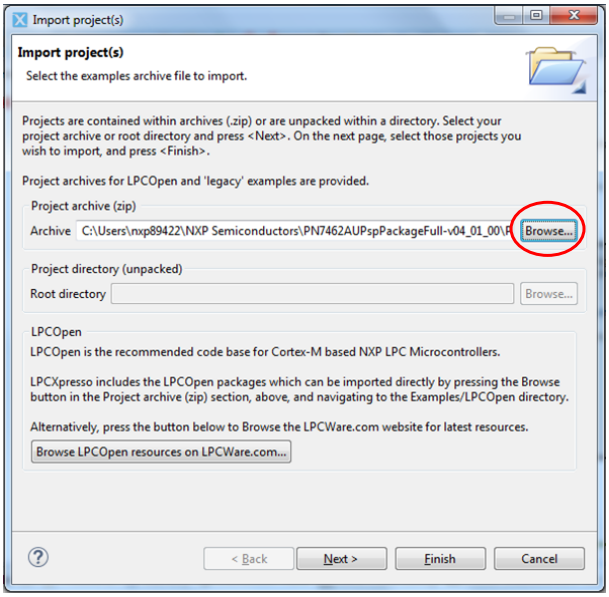

Fig 19. Importing project to LPCXpresso IDE

Browse to the project zip file *".\PN7462AU Software\PN7462AU-FW_v04.01.00-Full.zip"* and click *"Next"*.

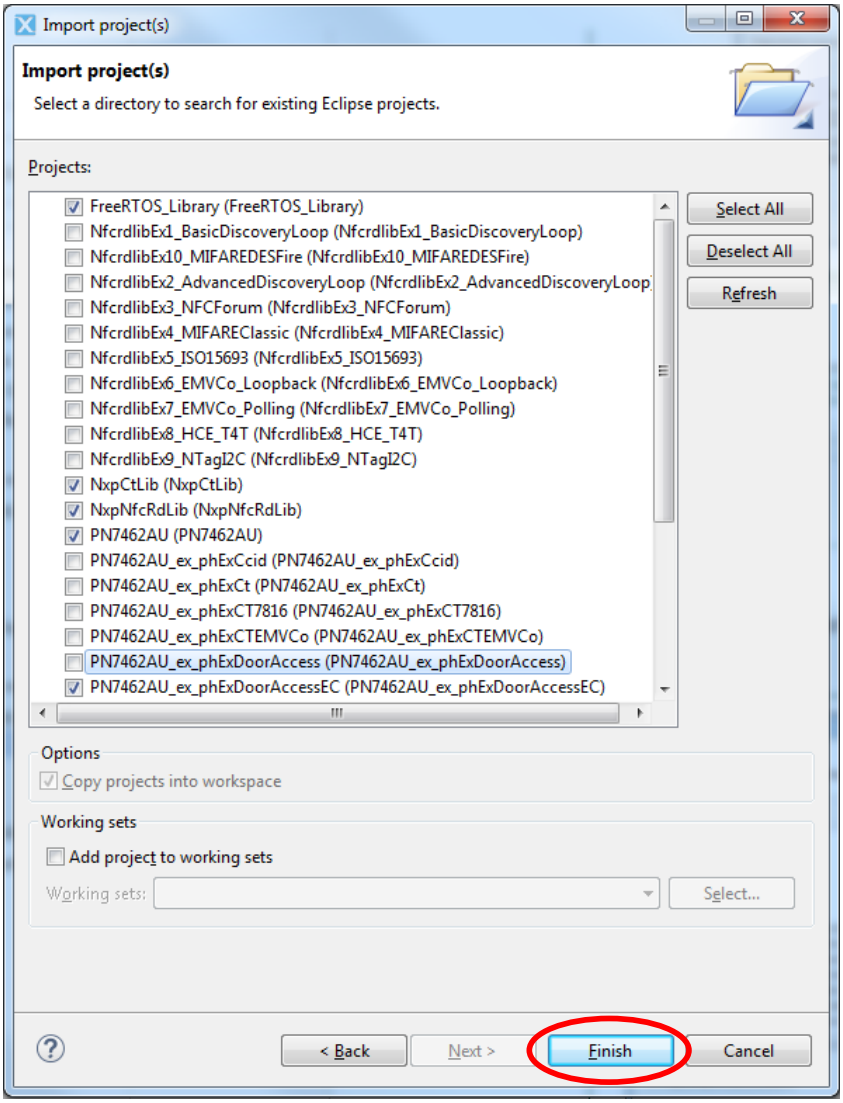

Fig 20. Select project

In the projects window all available projects in the package will be listed. To import only Door Access Export Controlled example, it is mandatory to select next projects in the list:

- FreeRTOS_Library
- NxpCtLib
- NxpNfcRdLib
- PN7462AU

- PN7462AU_ex_phExDoorAccessEC

All projects in the list can be also selected and imported to the workspace.

Select appropriate projects and click Finish. Selected applications are going to be imported to the workspace.

3.3 Building project

Building projects in a workspace is a simple case of using the “Quickstart Panel” - ‘Build all projects’. Alternatively a single project can be selected in the “Project Explorer View” and built separately. Note that building a single project may also trigger a build of any associated library projects.

To build the project select appropriate project and press “Build” as shown in the figure below.

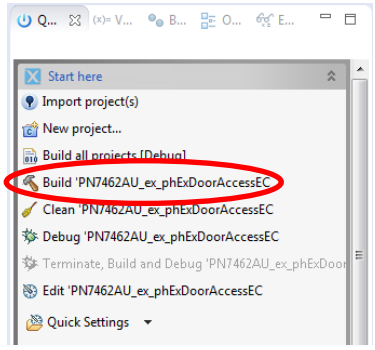

Fig 21. Build project

As a part of the build output, the binary for Flash file is created. This binary file can be used to update PN7462AU Flash via USB mass storage interface or by using Flash tool or debug in LPCXpresso IDE.

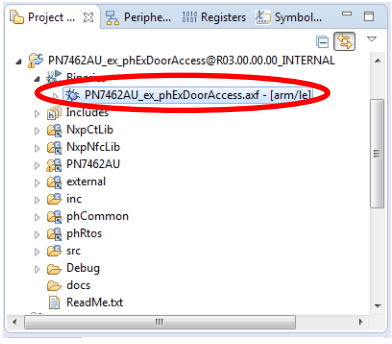

Fig 22. Build output - flash binary file

Note:

Due to legal issues, NXP cannot provide source code for the FreeRTOS and the FreeRTOS source code should be integrated by users. Detailed description on how to integrate source code of the FreeRTOS to the project it is described in the “AN11784 PN7462AU How to integrate RTOS” document.

After successful integration of the FreeRTOS source code, project build should be compiled without errors as shown on the picture below.

3.4 Activity flow

Activity flow of Export controlled version without SAM and with software keys is shown as below

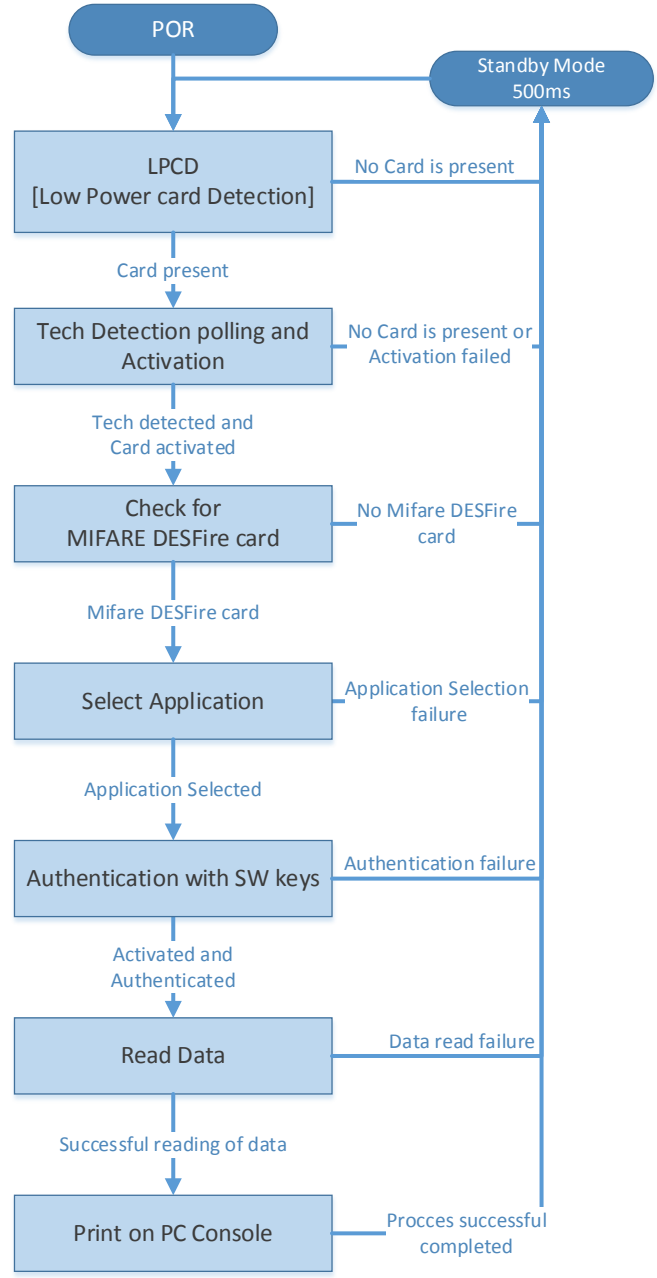

Fig 23. Authentication with SW Keys

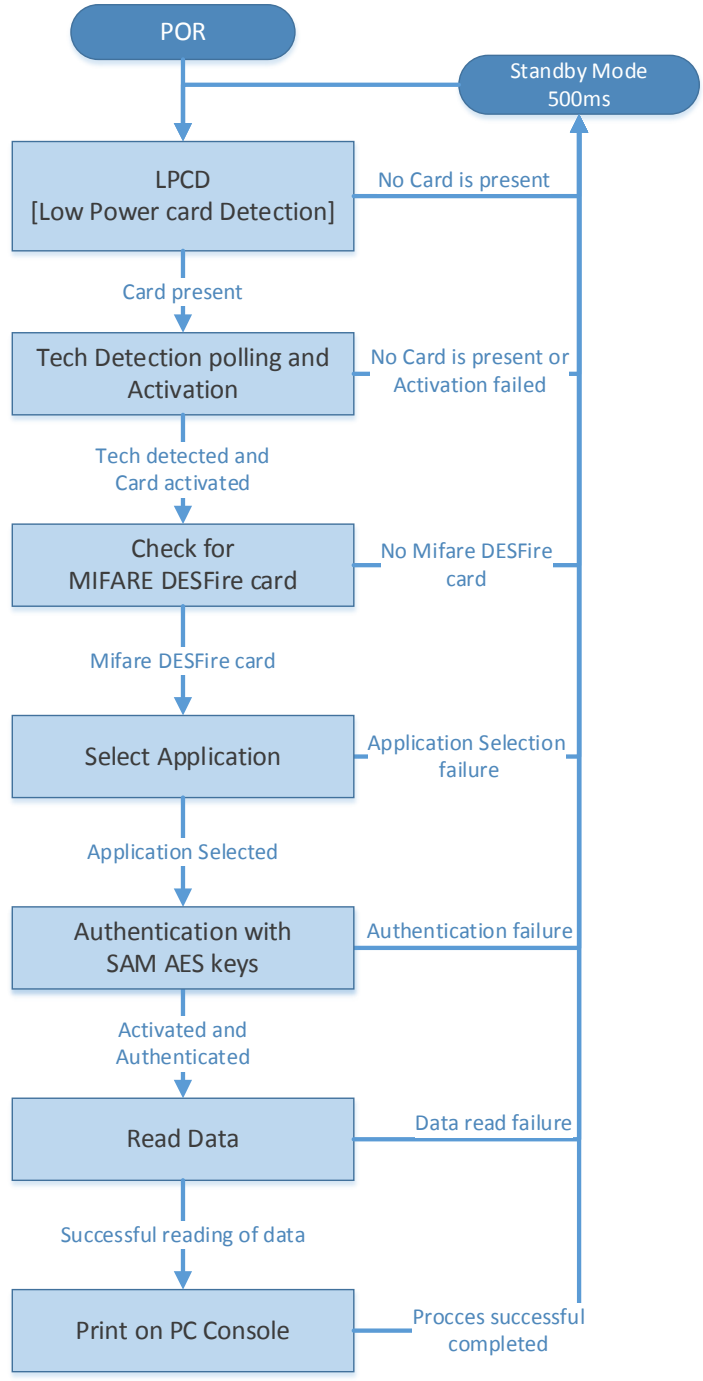

Fig 24. Authentication with SAM DES Keys

3.5 Enabling the use of SAM in Export Controlled version

In export controlled version, by default use of SAM is disabled and software keys are enabled. To enable SAM support, a macro "*PHFL_ENABLE_SAM_KEY_STORE*" should be added in the projects settings as shown below.

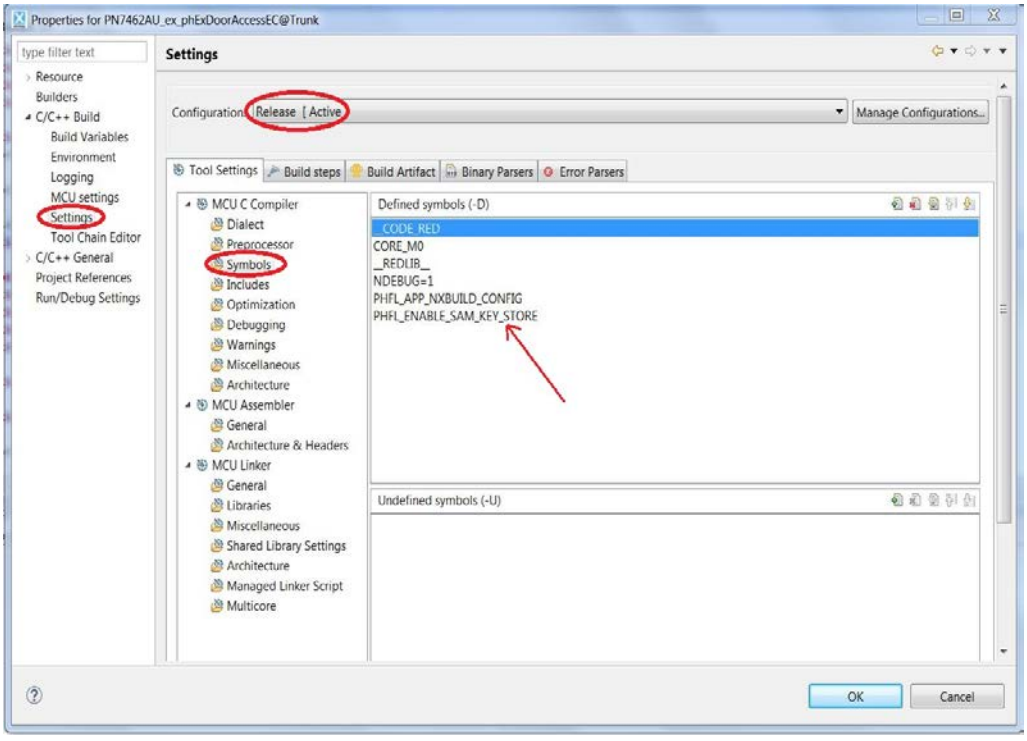

Fig 25. Enabling the use of SAM

4. Application Messages displayed in the PC console

Door Access application can send application messages through the HSU interface to the PC. Please check chapter 2.1 to see how to connect.

Type of the Card, UID and Data read will be displayed on the PC Console. This can be viewed by opening the corresponding COM port using any Serial COM tools like SSCOM.

Below figure shows the display of the prints for different cards on SSCOM tool in the case of Door Access Export Control. Here the COM port for USB to Serial connector is COM6.

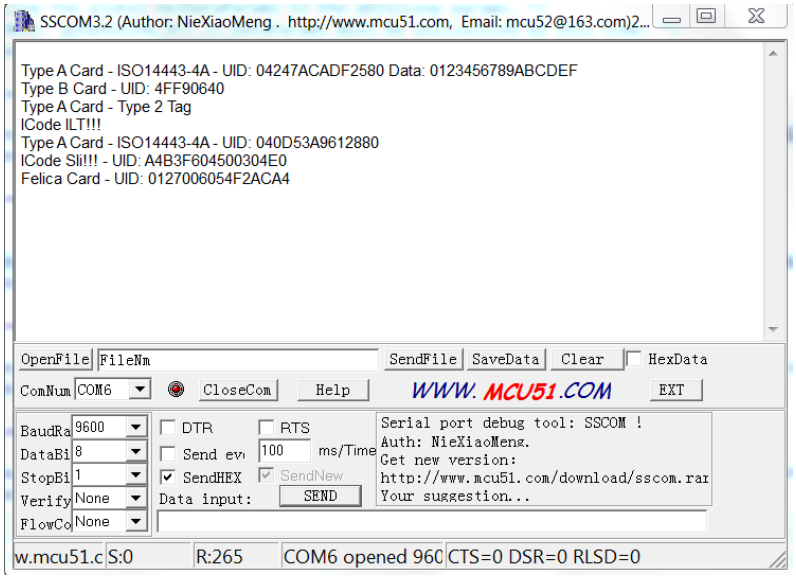

Fig 26. Application printouts using SSCOM tool

5. Enabling standby mode

By default standby mode is not enabled. It can be enabled by defining a symbol (MACRO) in the project properties:

PHFL_ENABLE_STANDBY

Standby time is set to 500 ms and LPCD also enabled.

Below figure shows how to enable Standby mode.

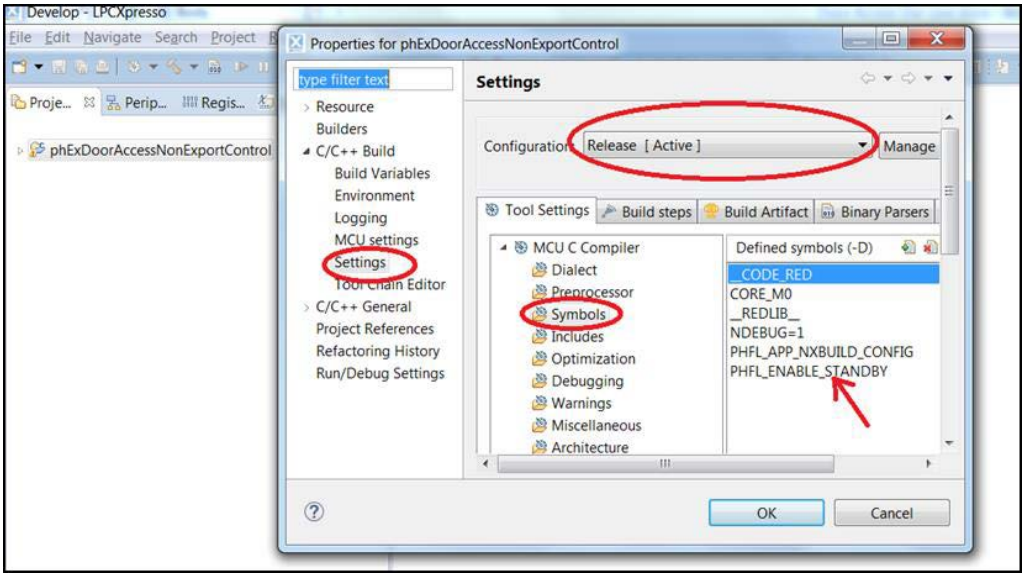

Fig 27. Project Properties – Enable Standby Mode

6. References

[1] LPCXpresso webpage
http://www.nxp.com/products/software-and-tools/software-development-tools/software-tools/lpc-microcontroller-utilities/lpcxpresso-ide-v8.2.2:LPCXPRESSO

[2] Windows drivers for USBToSerial Convertor
www.nxp.com/external/prolific

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