

AN11908

NFC Reader Library for FRDM-K82F Board Installation guidelines

Rev. 1.3 — 18 April 2018
407213

Application note
COMPANY PUBLIC

Document information

Info	Content
Keywords	NFC, Reader Library, MCUXpresso, PN5180, CLRC663, CLEV6630B, Kinetis K82, FRDM-K82F
Abstract	This document describes how to use NXP's NFC Reader Library with a NXP Freedom K82F board using MCUXpresso.



Revision history

Rev	Date	Description
1.3	20180418	Editorial updates
1.2	20170511	MCUXpresso added
1.1	20170105	Example list updated, ICODE support defined, CLEV6630B description updated
1.0	20161110	First release

Contact information

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

1. Introduction

The NFC Reader Library is a feature complete software support library for NXP's NFC Frontend ICs. It is designed to give developers a faster and simpler way to deliver NFC-enabled products. This multi-layer library, written in C, makes it easy to create NFC based applications. See [1] for more details.

The purpose of the present document is to give instructions on how to install the NFC Reader Library with a NXP Freedom K82F board [2], using MCUXpresso [3], together with NXP's NFC Frontends. In this document PNEV5180B and CLEV6630B demo boards will be used.

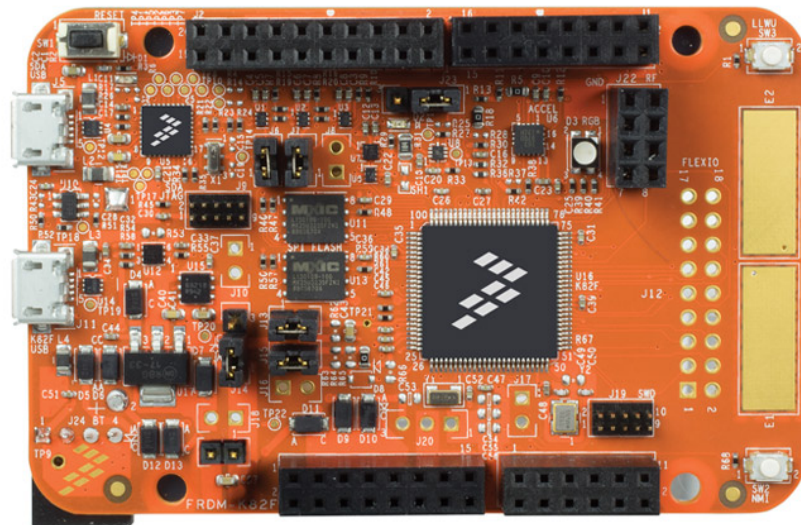


Fig 1. FRDM-K82F: NXP Freedom Development Platform for Kinetis K82, K81, and K80 MCUs

2. FRDM-K82F Development Platform

The NXP Freedom development platform is a set of software and hardware tools for evaluation and development. It is ideal for rapid prototyping of microcontroller-based applications. The Freescale Freedom K82 hardware, FRDM-K82F, is a simple yet sophisticated design featuring a Kinetis K series microcontroller built on the ARM® Cortex®-M4 core which features a floating-point unit (FPU).

FRDM-K82F can be used to evaluate the K80, K81, and K82 Kinetis K series devices. The FRDM-K82F board features the MK82FN256VLL15 MCU, which boasts a maximum operation frequency of 150 MHz, 256 KB of flash, a 256 KB RAM, a full-speed USB controller with available crystal-less operation, and analog and digital peripherals. The FRDM-K82F hardware is form-factor compatible with the Arduino™ R3 pin layout, providing a broad range of expansion board options. The onboard interface includes a six-axis digital accelerometer and magnetometer, an RGB LED, FlexIO header, and sufficient footprint to add an optional Bluetooth module (for use over UART) and RF module (for use over SPI).

Details how to prepare the board and install proper debug driver are described on FRDM-K82F product page [2].

Note:

NXP Reader Library package for MCUXpresso is preconfigured to be used with SEGGER J-Link debugger tool.

3. MCUXpresso IDE

The MCUXpresso IDE enables powerful application development for NXP MCUs based on ARM® Cortex®-M cores, including LPC and Kinetis microcontrollers. The MCUXpresso IDE offers advanced editing, compiling and debugging features with the addition of MCU-specific debugging views, code trace and profiling, multicore debugging, and more. Feature-rich IDE optimized for ease-of-use, based on industry standard Eclipse and GCC providing a powerful application development environment, Supports Freedom, Tower, MCUXpresso and your custom development boards with debug probes from NXP, P&E, and SEGGER. Available in full-featured free (code size unlimited) and affordable professional editions (including MCUXpresso IDE email support and advanced trace features).

Details about the MCUXpresso installation and usage are described on the MCUXpresso product page [3].

4. Importing NFC Reader Library to the MCUXpresso

The NFC Reader library, version for MCUXpresso, is delivered in archive file and contains implementation of the NFC Reader Library, FreeRTOS, SDK_2.0_FRDM-K82F platform and SW examples which demonstrates how to use NFC.

In this document the term „MIFARE Classic card“ refers to a MIFARE Classic IC-based contactless card, the term “MIFARE DESFire card” refers to a MIFARE DESFire IC-based contactless card.

Table 1. Example projects

Example projects delivered with the NFC Reader Library

Example	Description
NfcrdlilbEx1_Basic DiscoveryLoop	Explains how to poll for different technologies (Tag, P2P, HCE), detect and report them. Default configuration parameters are used.
NfcrdlilbEx2_AdvancedDi scoveryLoop	Explains how to poll for different technologies (Tag, P2P, HCE), detect and report them. All configuration parameters are used and explained.
NfcrdlilbEx3_ NFCForum	Explains how to configure the NFC Reader Library for different P2P modes such as Active Mode, Target Mode, Initiator Mode and SNEP Client/Server.
NfcrdlilbEx4_MIFARE Classic	Explains the usage of MIFARE Classic card communication commands.
NfcrdlilbEx5_ ISO15693	Explains the usage of this technology and provides an overview about the most common commands.
NfcrdlilbEx7_ EMVCo_Polling	Explains polling for EMVCo payment cards.
NfcrdlilbEx8_ HCE_T4T	Explains how to emulate a NFC Forum Type 4 Tag supporting read and write operations.
NfcrdlilbEx9_ NTagI2C	Explains NTag-I2C specific commands.
NfcrdlilbEx10_ MIFAREDESFire	Explains the usage of MIFARE DESFire cards. (This example is delivered with the NFC Reader Library version available via NXP DocStore)
NfcrdlilbEx11_ISO10373_ PCD	Example is used to perform ISO 10373-6 PCD compliance validation.
Nfcrdlilb_SimplifiedAPI EMVCo	EMVCo loopback application with simplified API, which can be used for EMVCo level 1 digital certification.
Nfcrdlilb_SimplifiedAPI EMVCo_Analog	Example is used to perform EMVCo2.6(L1) Analog compliance validation.
Nfcrdlilb_SimplifiedAPI ISO	Explains how to use simplified API with different types of cards.

Following guidelines, describing how to prepare the SW environment to run prepared SW examples on FRDM-K82F board.

4.1 Import projects to the MCUXpresso

This chapter explains how to use the MCUXpresso to create workspace and work with delivered projects.

To launch the MCUXpresso for creating, building and debugging projects follow guidelines below:

1. Start MCUXpresso IDE.
The “Eclipse Launcher” dialog box appears and prompts you to select a workspace to use. It is recommended to use an empty folder as a new workspace.

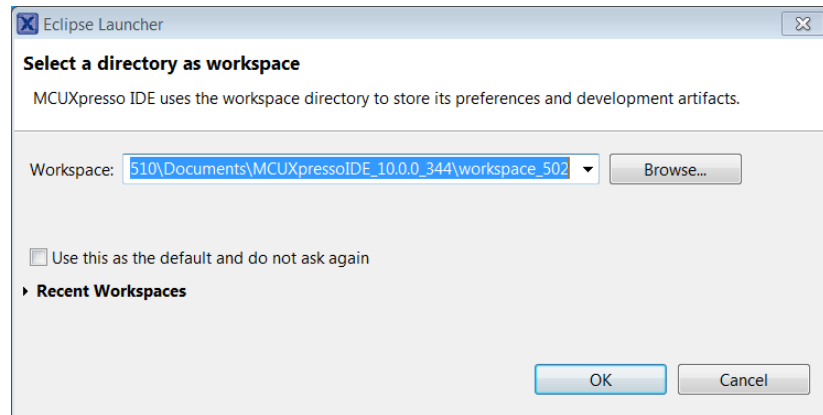


Fig 2. Eclipse Launcher Dialog Box

The IDE starts and displays the Welcome page.

2. Import NFC Reader Library and examples projects.
Right click in the “Quickstart Panel” window and select “Import project(s) ...” option.

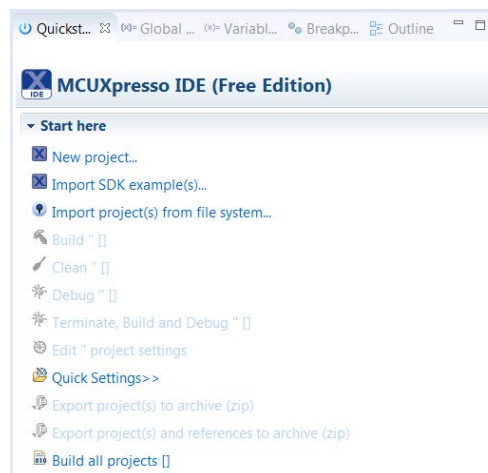


Fig 3. Import Projects – Step 1

3. Import wizard appears to select import source.
Click “Browse” next to “Archive” and browse dialog appears

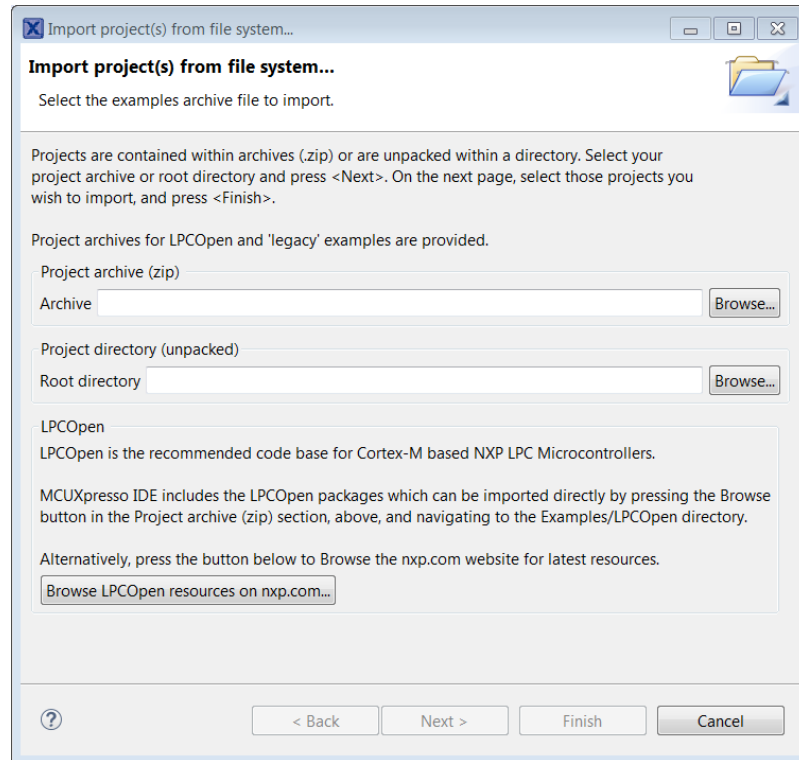


Fig 4. Import Projects – Step 2

4. In this step archive file containing the NFC Reader Library and examples projects needs to be specified. Search for a file name
NxpNfcRdLib_KinetisK82_v05.02.00.zip in NxpNfcRdLib installation folder.
5. Finally click on “Finish” button to complete the import wizard.

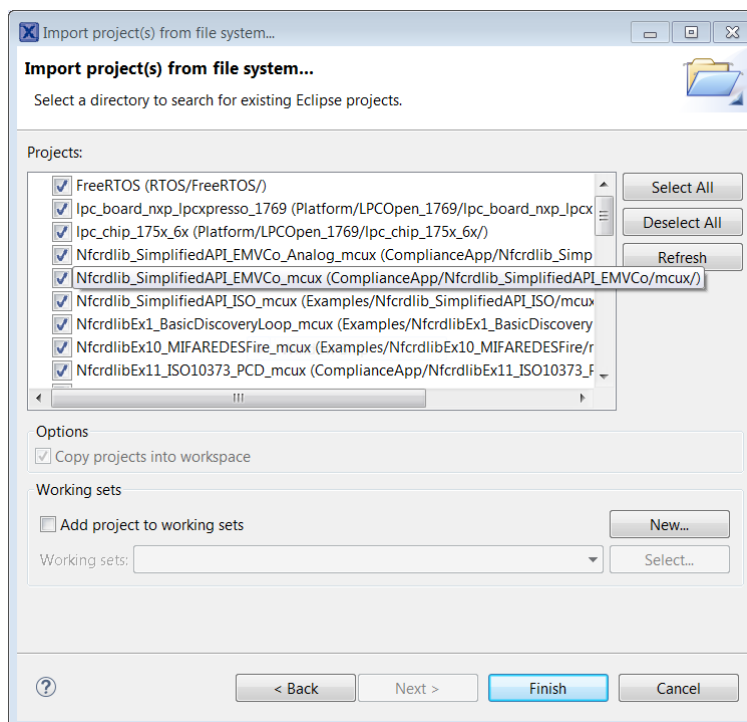


Fig 5. Import Projects – Step 3

6. All projects are listed in the “Project Explorer” window.

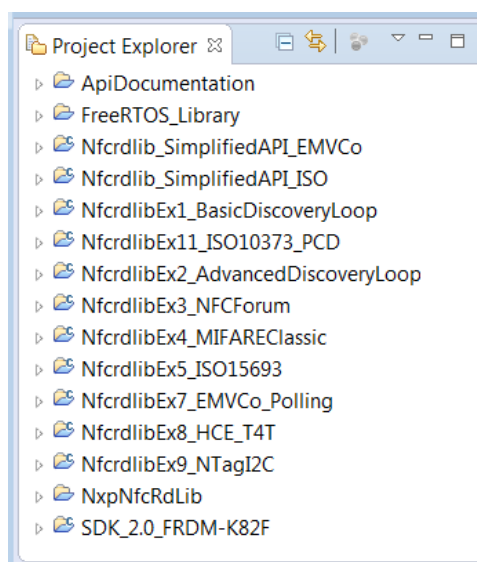


Fig 6. Import Projects – Step 4

4.2 Install SDK

To build, run and debug projects it is mandatory to install board SDK. The FRDM-K82F SDK is shipped with the NFC Reader Library and examples package.

- 1. Left click at Installed SDKs view. Pop-up menu appears.

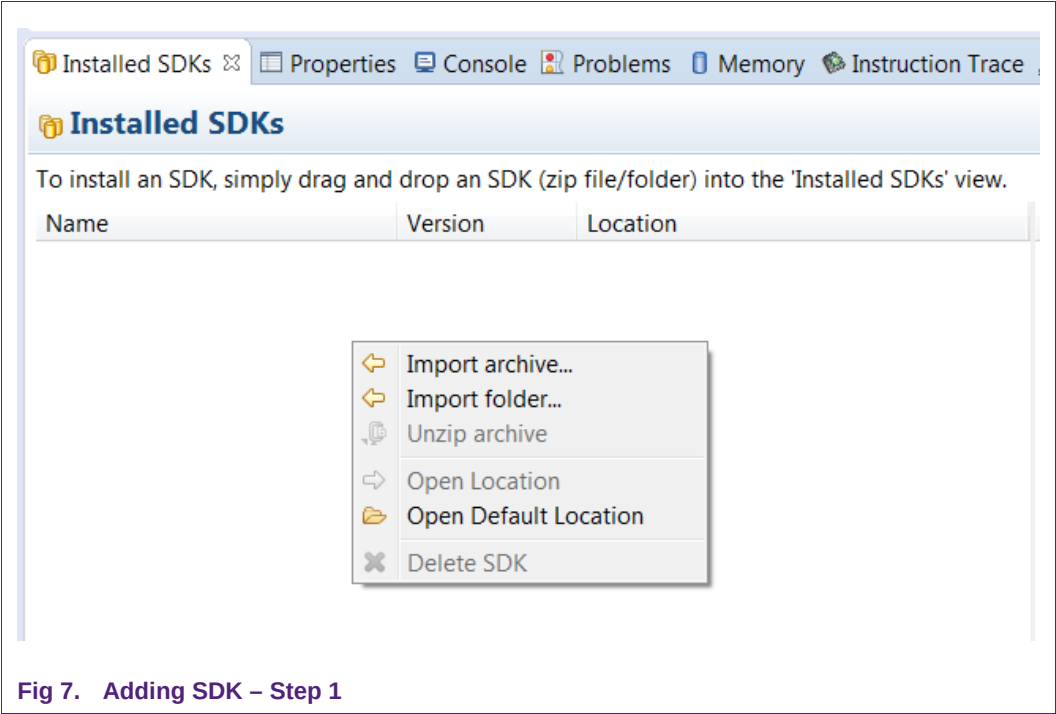


Fig 7. Adding SDK – Step 1

- 2. Right click “Import archive” and browse to the NXP NFC Reader Library and examples projects archive file. Import process starts automatically.

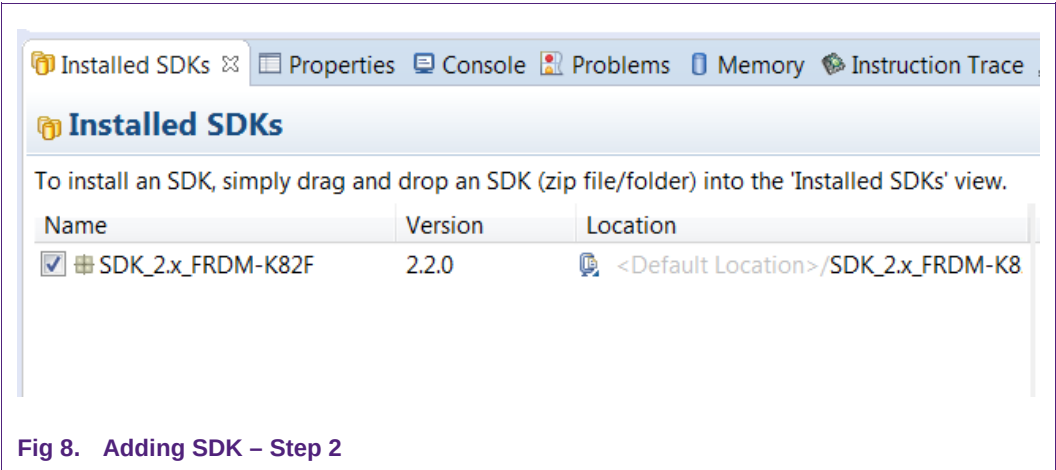


Fig 8. Adding SDK – Step 2

4.3 Build, Debug and Run Projects

The provided NFC Reader Library project and example projects are pre-configured to be used with FRDM-K82F target board.

4.3.1 Building Projects

To build only selected projects, and all dependency projects, right-click on the project and select “Build Project” option. Default build configuration is debug (DebugFRDMK82F).

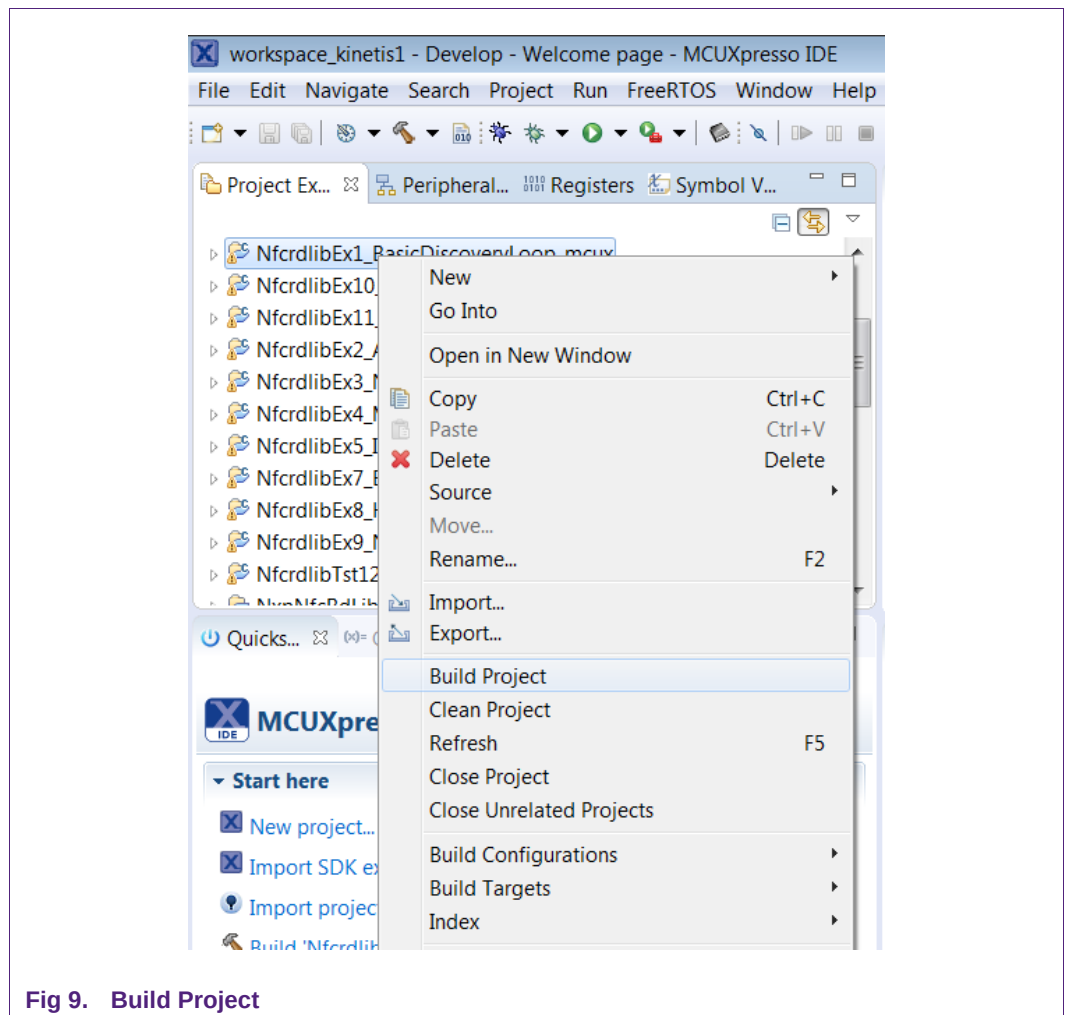


Fig 9. Build Project

Alternatively, select Project > Build All to build all projects at once.

4.3.2 Debugging Projects

To debug a project, perform following steps.

1. Launch the IDE and select a project in ‘Project explorer’.

2. Click Debug menu item in Quickstart panel.

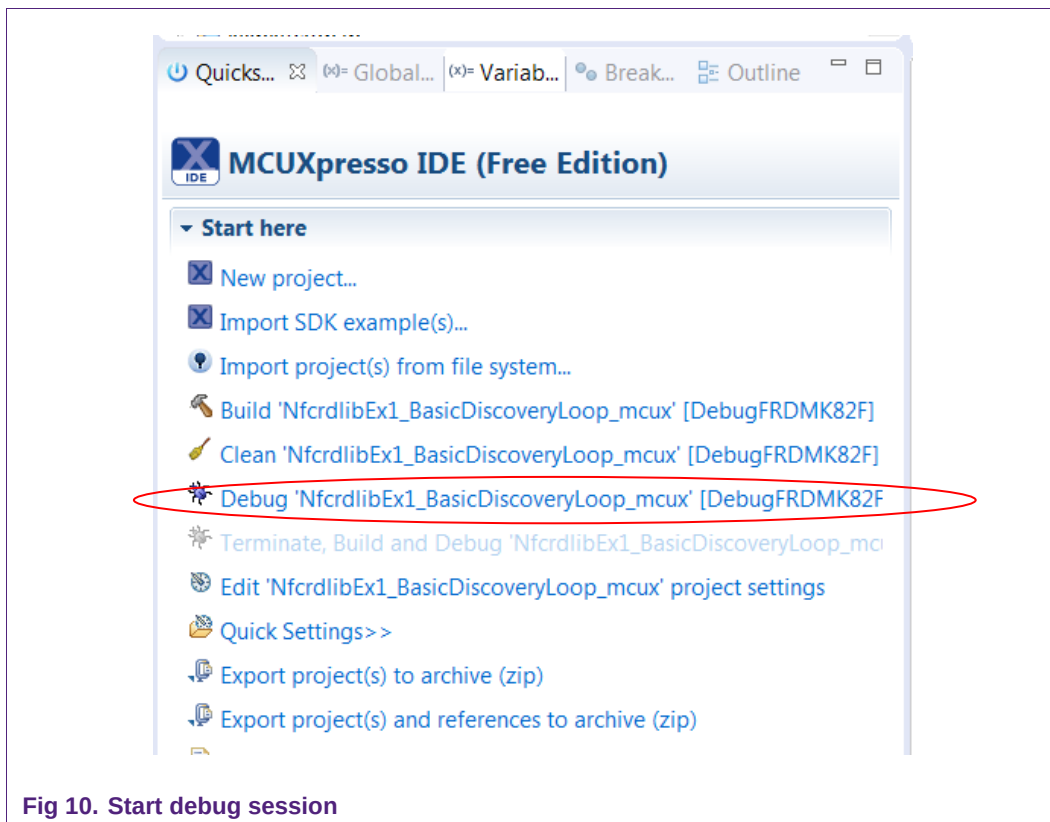


Fig 10. Start debug session

3. Probe discovered dialog appears.

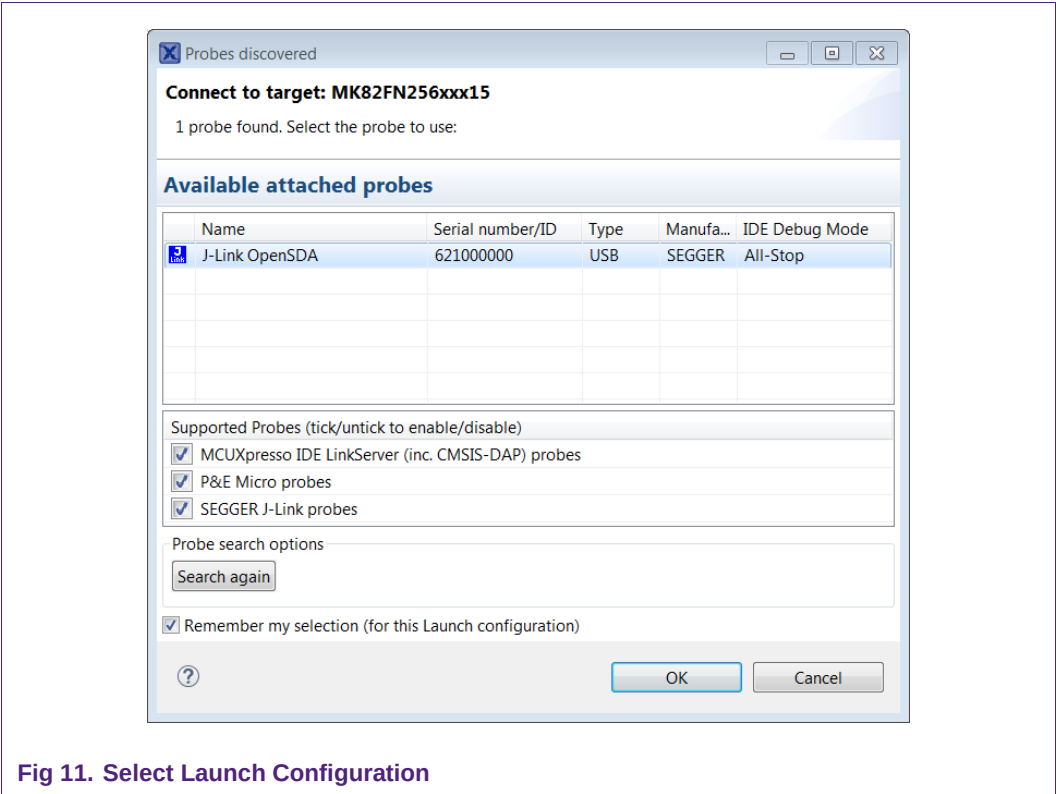


Fig 11. Select Launch Configuration

4. Debug output in console view appears.

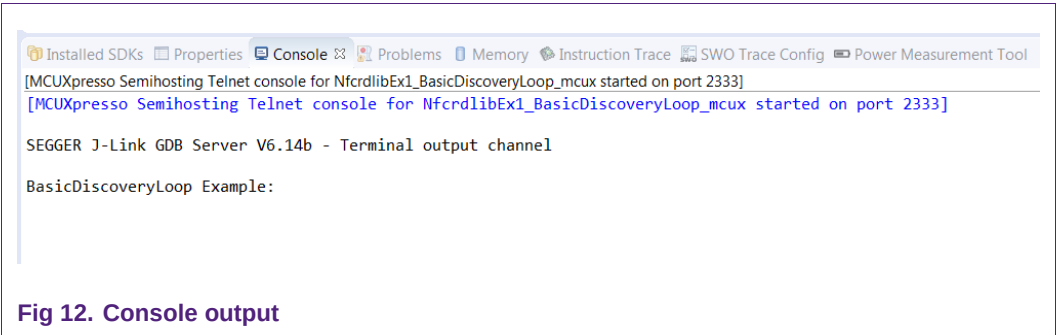


Fig 12. Console output

5. Connecting FRDM-K82F Board to NFC Frontend board

This chapter provides instructions how to connect FRDM-K82F development board to the host PC and to the NFC Frontend board: PNEV5180B, CLEV6630B to run NFC Reader Library.

5.1 Connecting the FRDM-K82F to the PC Host

To flash binaries and debug project it is required to connect host PC and FRDM-K82F board via debug interface.

The debug interface on the MK82FN512VDC12 MCU is a serial wire debug (SWD) port with trace output capability. There are two debug interfaces on the FRDM-K82F: an onboard OpenSDAv2 circuit (J5) and a K82F direct SWD connection via a 10-pin header (J19). To use an external debugger, such as J-Link on J19, you may need to disconnect the OpenSDAv2 SWD circuit from the K82F by removing jumpers J6 and J7.

Connect FRDM-K82F board and host PC via micro USB cable as shown below.

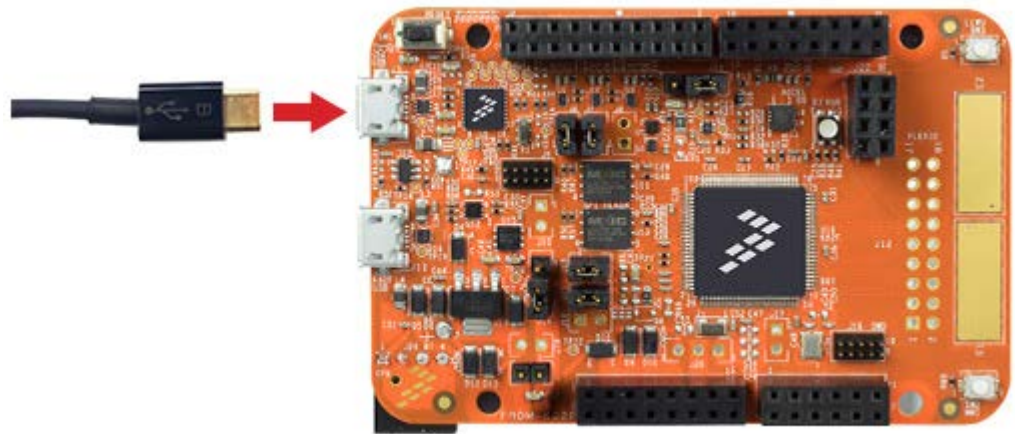


Fig 13. Connecting the FRDM-K82F Board via Micro USB

Note:

NXP Reader Library package for KDS supports SEGGER J-Link debugger tool, therefore it is required to flash on appropriate debugger binary. Detailed guidelines how to prepare the board with the right debugger are available on FRDM-K82F product web page.

5.2 Connecting the FRDM-K82F to the PNEV5180B

To assure direct access from the FRDM-K82F development board to the PN5180 frontend IC on the PNEV5180B board, the following change has to be performed:

In total six resistors in two groups need to be removed to obtain proper decoupling of the LPC1769 MCU from the PNEV5180 board (Fig 14).

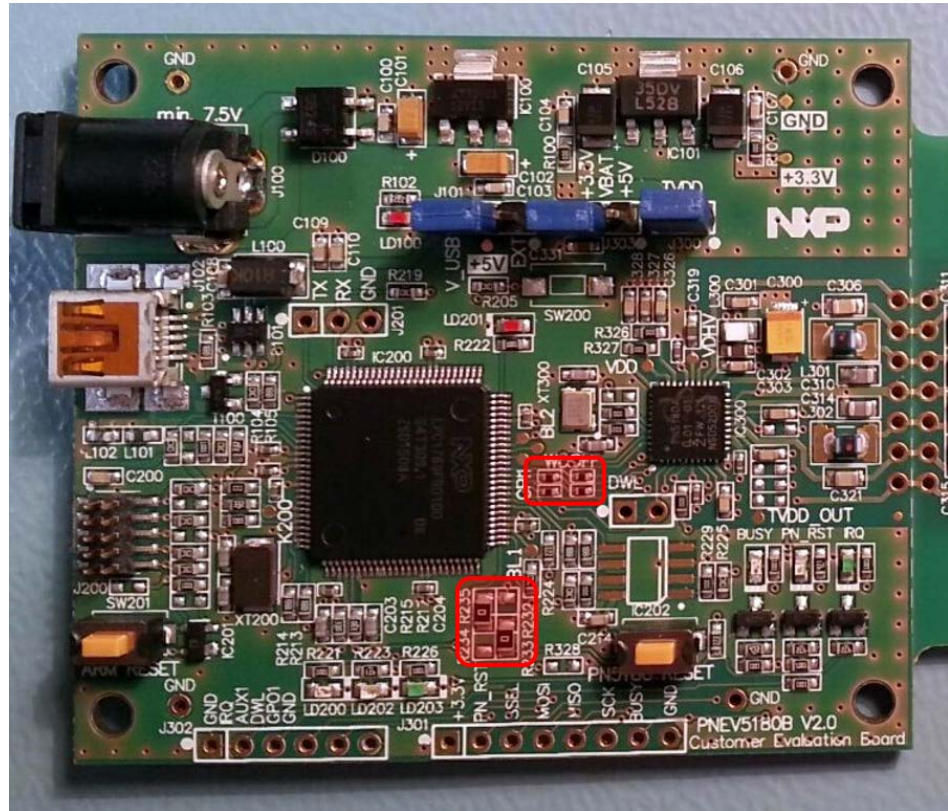


Fig 14. Resistors to be removed marked red

To check for the correct PNEV5180B board configuration please refer to the UM10954 - PN5180 SW Quick start guide.

To configure PN5180 NFC Frontend in the NFC Reader Library it is mandatory to define related preprocessor directive (project properties->settings->preprocessor) to PHDRIVER_FRDM_K82FPN5180_BOARD.

Connect both boards as described below.

Table 2. Pin Connection Table for PNEV5180B

PIN Function	FRDM-K82F	PNEV5180B
MOSI	J1-13 (PORTA-16)	MOSI
MISO	J1-7 (PORTA-17)	MISO
SCK	J1-15 (PORTA-15)	SCK
SSEL	J1-9 (PORTA-14)	SSEL
BUSY	J1-1 (PORTA-5)	BUSY
RESET	J1-3 (PORTA-13)	PN_RESET
IRQ	J1-11 (PORTC-7)	IRQ
IFSEL0	J1-2 (PORTB-16)	-
IFSEL1	J1-4 (PORTB-17)	-
SDA	J4-4 (PORTC-10)	-
SCL	J4-2 (PORTC-11)	-
DWL	J1-5 (PORTA-12)	DWL
AD0	J2-1 (PORTB-20)	-
AD1	J2-3 (PORTB-21)	-
AD2	J2-5 (PORTB-22)	-
GND	J3-12; J3-14; J2-14	GND
+3.3V	J3-4; J3-8	-
+5V	J3-16	-

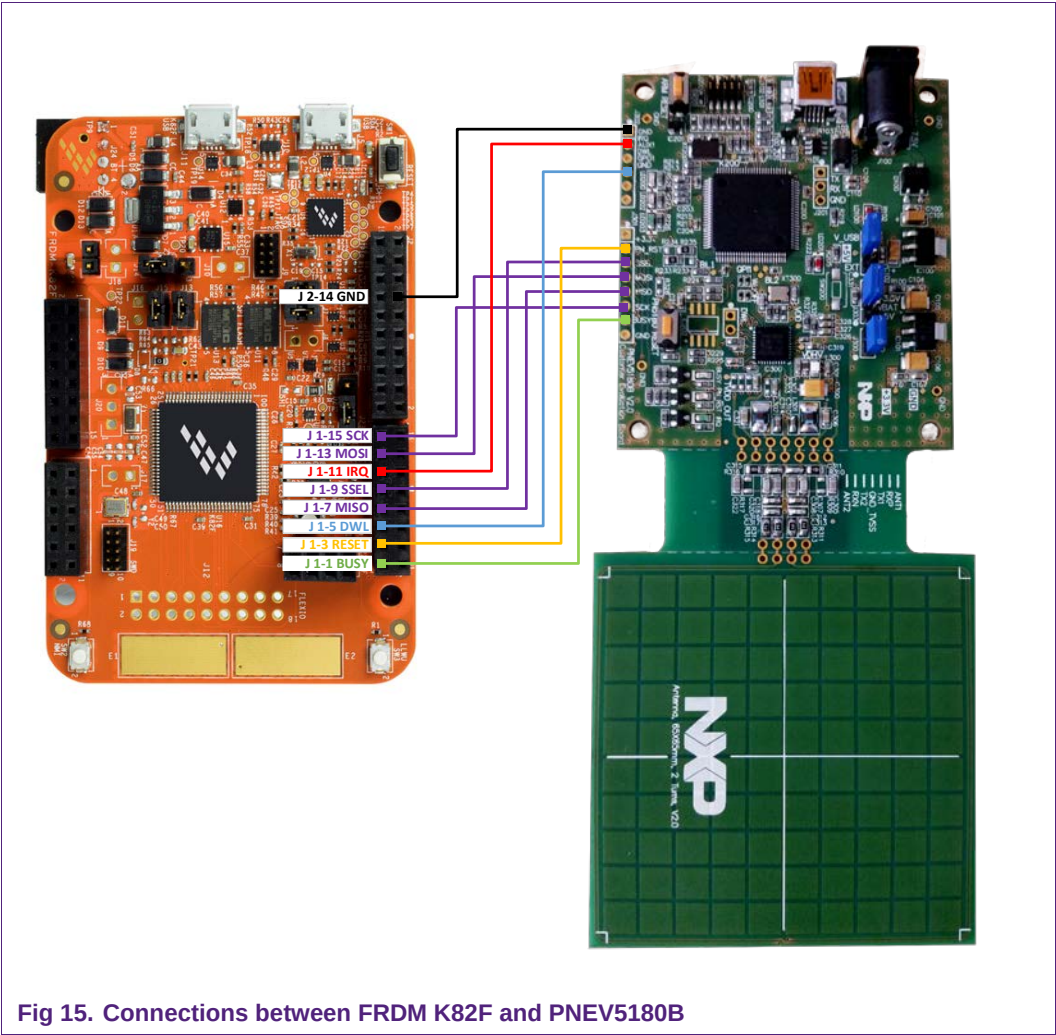


Fig 15. Connections between FRDM K82F and PNEV5180B

5.3 Connecting the FRDM-K82F to the CLEV6630B

To assure direct access from the FRDM-K82F development board to the CL66303 frontend IC on the CLEV6630B board, the following changes are needed:

In total six resistors marked by red squares need to be removed to obtain proper decoupling of the LPC1769 MCU from the CLEV6630B board (Fig 16).

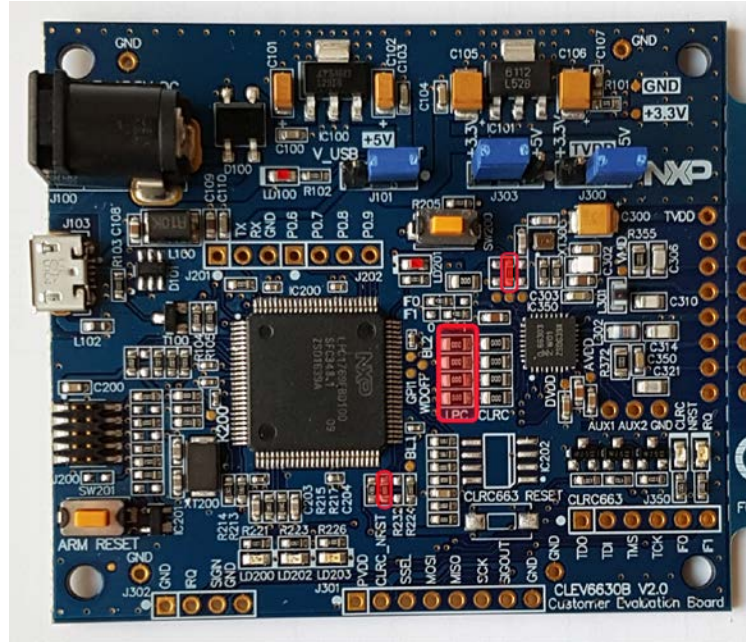


Fig 16. Resistors to be removed marked red

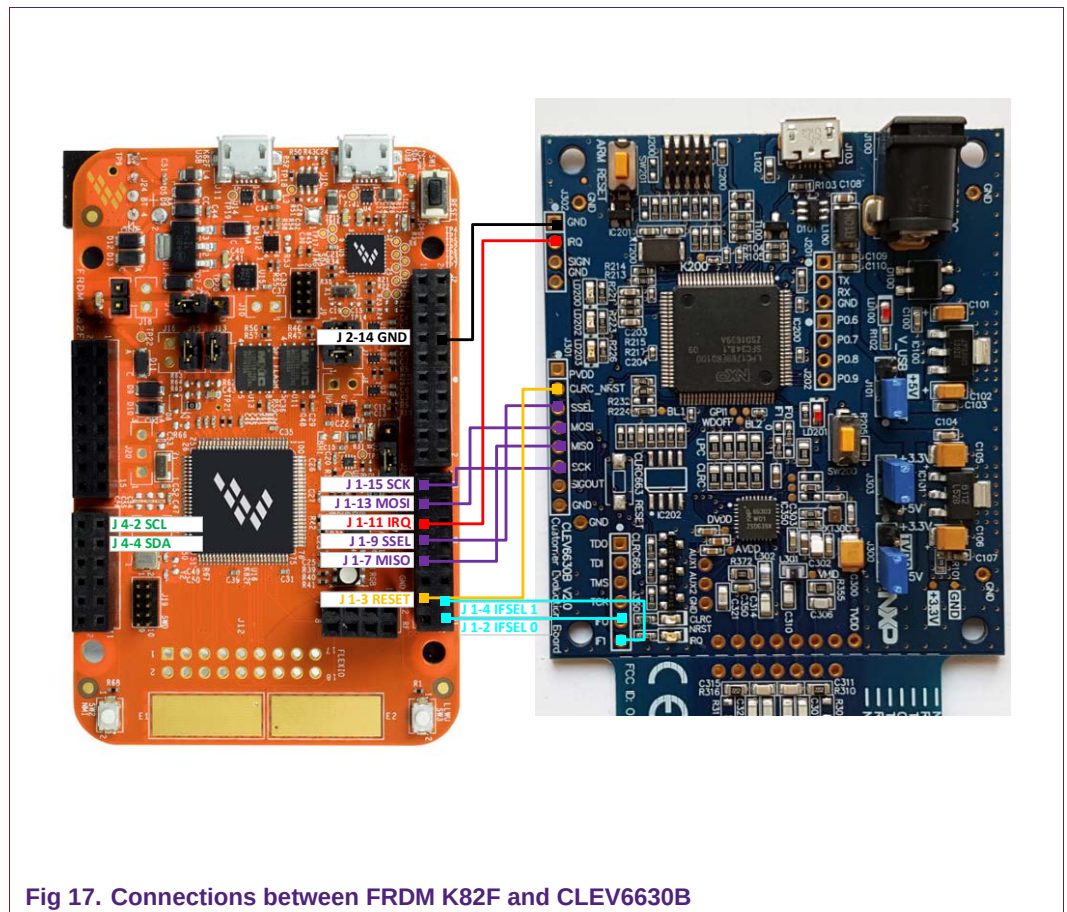
To enable RC663 NFC Frontend in the NFC Reader Library it is mandatory to define related preprocessor directive (project properties > settings > preprocessor) to PHDRIVER_FRDM_K82FRC663_BOARD.

Connect both boards as described below.

Table 3. Pin Connection Table for CLEV6630B

PIN Function	FRDM-K82F	CLEV6630B
MOSI	J1-13 (PORTA-16)	MOSI
MISO	J1-7 (PORTA-17)	MISO
SCK	J1-15 (PORTA-15)	SCK
SSEL	J1-9 (PORTA-14)	SSEL
BUSY	J1-1 (PORTA-5)	-

PIN Function	FRDM-K82F	CLEV6630B
RESET	J1-3 (PORTA-13)	CLRC_NRST
IRQ	J1-11 (PORTC-7)	IRQ
IFSEL0	J1-2 (PORTB-16)	IF0
IFSEL1	J1-4 (PORTB-17)	IF1
GND	J3-12; J3-14; J2-14	GND
+3.3V	J3-4; J3-8	-
+5v	J3-16	-



6. References

- [1] The NFC Reader Library gives Software support for NFC Frontend solutions.

For more information about it please visit <http://www.nxp.com/products/:NFC-READER-LIBRARY>.

- [2] FRDM-K82F: NXP Freedom Development Platform for Kinetis K82, K81, and K80 MCUs.

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/freescale-freedom-development-platform-for-kinetis-k82-k81-and-k80-mcus:FRDM-K82F>

- [3] MCUXpresso Integrated Development Environment (IDE).

For more information about it please visit <http://www.nxp.com/products/software-and-tools/run-time-software/mcuxpresso-software-and-tools/mcuxpresso-integrated-development-environment-ide:MCUXpresso-IDE>

7. Legal information

7.1 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.

7.2 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. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

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 and its suppliers accept 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.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

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.

7.3 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. Purchase of NXP Semiconductors IC does not include a license to any NXP patent (or other IP right) covering combinations of those products with other products, whether hardware or software.

7.4 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 Classic — is a trademark of NXP B.V.

DESFire — is a trademark of NXP B.V.

Kinetis — is a trademark of NXP B.V.

8. List of figures

Fig 1.	FRDM-K82F: NXP Freedom Development Platform for Kinetis K82, K81, and K80 MCUs..	3
Fig 2.	Eclipse Launcher Dialog Box	6
Fig 3.	Import Projects – Step 1	6
Fig 4.	Import Projects – Step 2	7
Fig 5.	Import Projects – Step 3	8
Fig 6.	Import Projects – Step 4	8
Fig 7.	Adding SDK – Step 1	9
Fig 8.	Adding SDK – Step 2	9
Fig 9.	Build Project.....	10
Fig 10.	Start debug session	11
Fig 11.	Select Launch Configuration	12
Fig 12.	Console output.....	12
Fig 13.	Connecting the FRDM-K82F Board via Micro USB	13
Fig 14.	Resistors to be removed marked red	14
Fig 15.	Connections between FRDM K82F and PNEV5180B.....	16
Fig 16.	Resistors to be removed marked red	17
Fig 17.	Connections between FRDM K82F and CLEV6630B	18

9. List of tables

Table 1. Example projects5

Table 2. Pin Connection Table for PNEV5180B15

Table 3. Pin Connection Table for CLEV6630B.....17

10. Contents

1.	Introduction	3
2.	FRDM-K82F Development Platform	4
3.	MCUXpresso IDE	4
4.	Importing NFC Reader Library to the MCUXpresso	5
4.1	Import projects to the MCUXpresso	6
4.2	Install SDK	9
4.3	Build, Debug and Run Projects	10
4.3.1	Building Projects	10
4.3.2	Debugging Projects	10
5.	Connecting FRDM-K82F Board to NFC Frontend board	13
5.1	Connecting the FRDM-K82F to the PC Host	13
5.2	Connecting the FRDM-K82F to the PNEV5180B	14
5.3	Connecting the FRDM-K82F to the CLEV6630B	17
6.	References	19
7.	Legal information	20
7.1	Definitions	20
7.2	Disclaimers	20
7.3	Licenses	20
7.4	Trademarks	20
8.	List of figures	21
9.	List of tables	22
10.	Contents	23

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