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NFC Reader Library for FRDM-K82F Board Installation guidelines

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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

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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

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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.

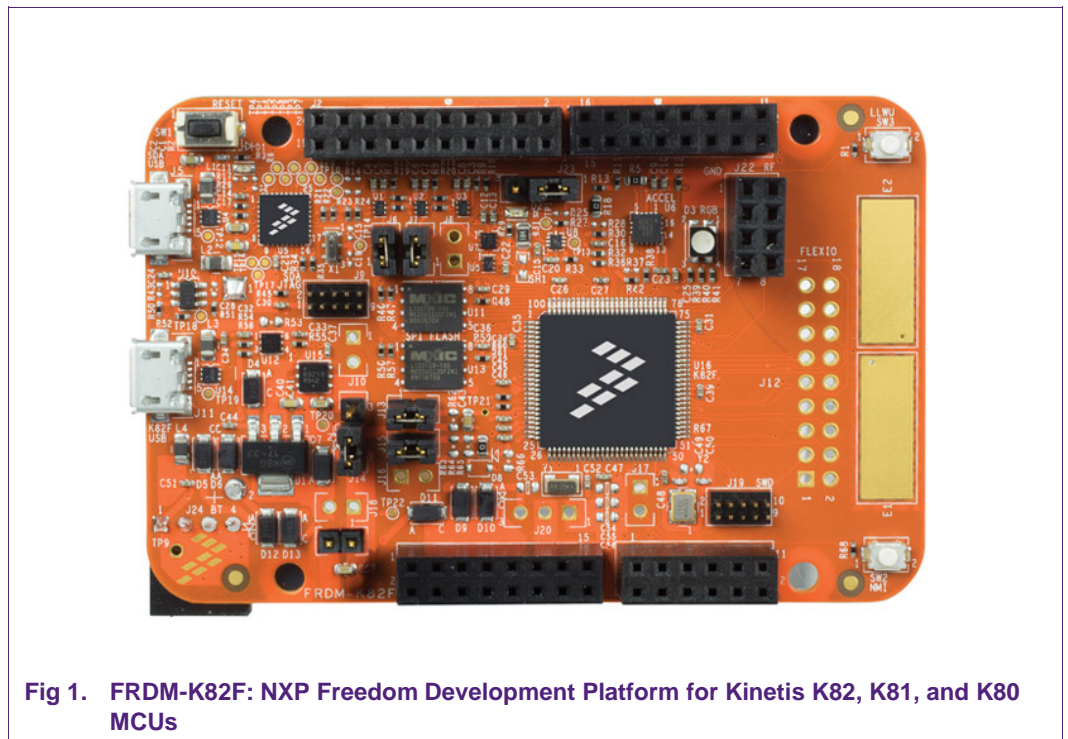


Fig 1. FRDM-K82F: NXP Freedom Development Platform for Kinetis K82, K81, and K80 MCUs

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.

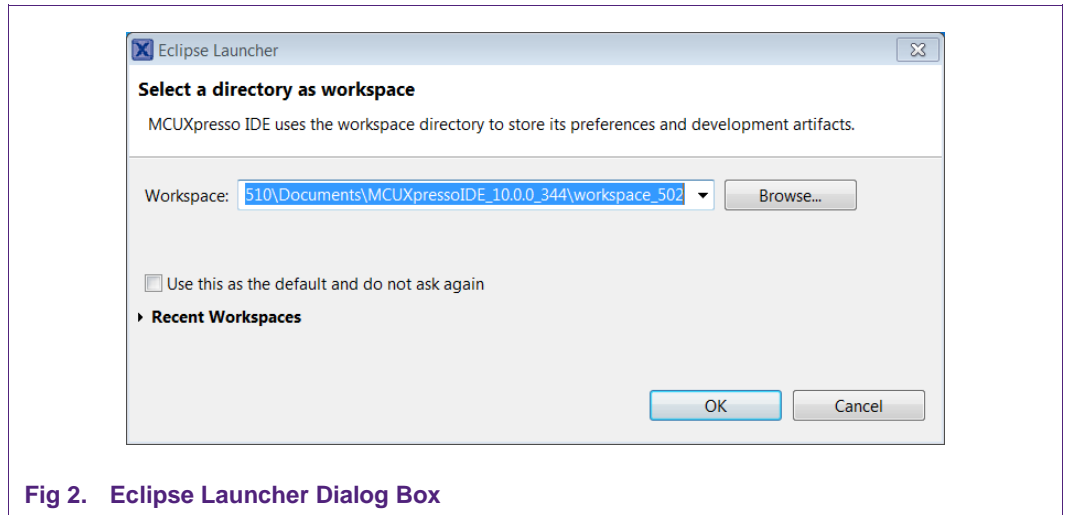


Fig 2. Eclipse Launcher Dialog Box

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.

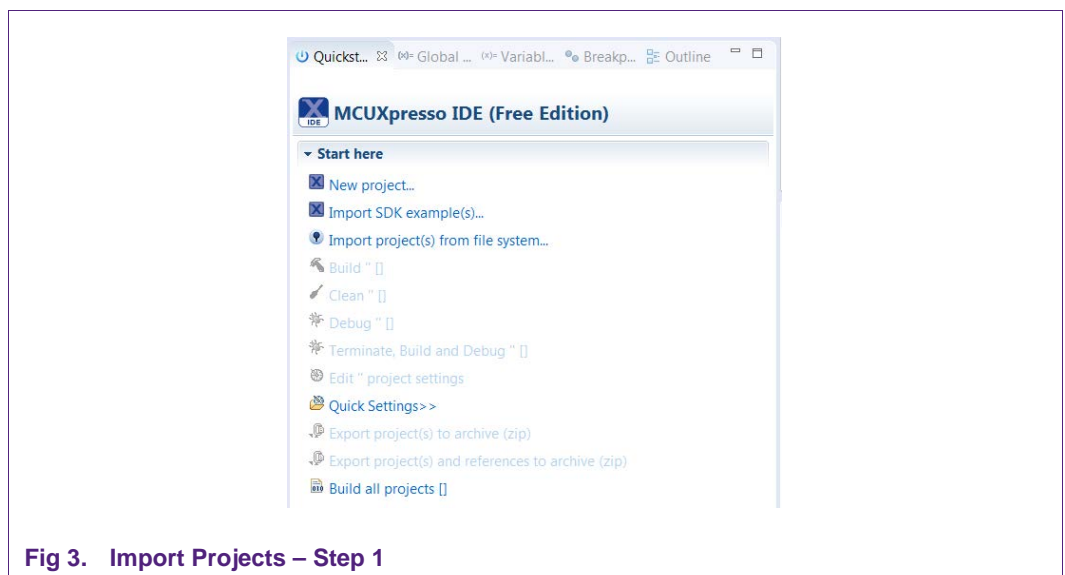


Fig 3. Import Projects – Step 1

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

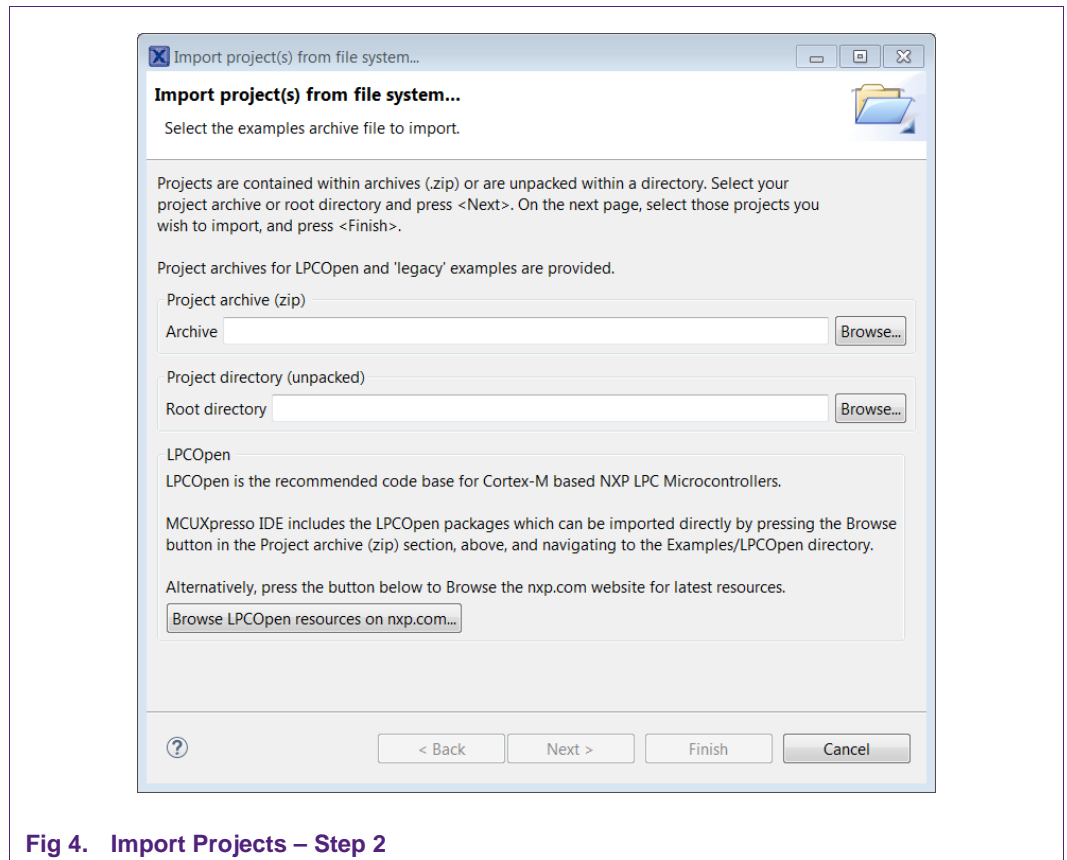


Fig 4. Import Projects – Step 2

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.

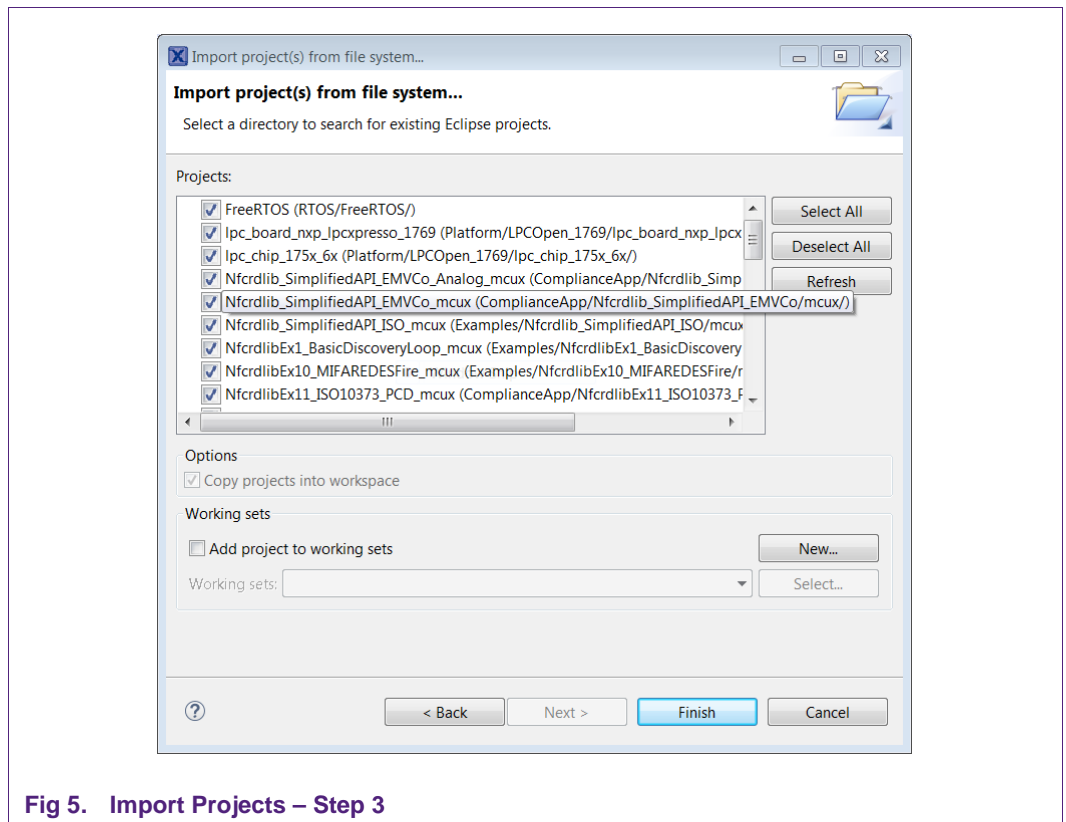


Fig 5. Import Projects – Step 3

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

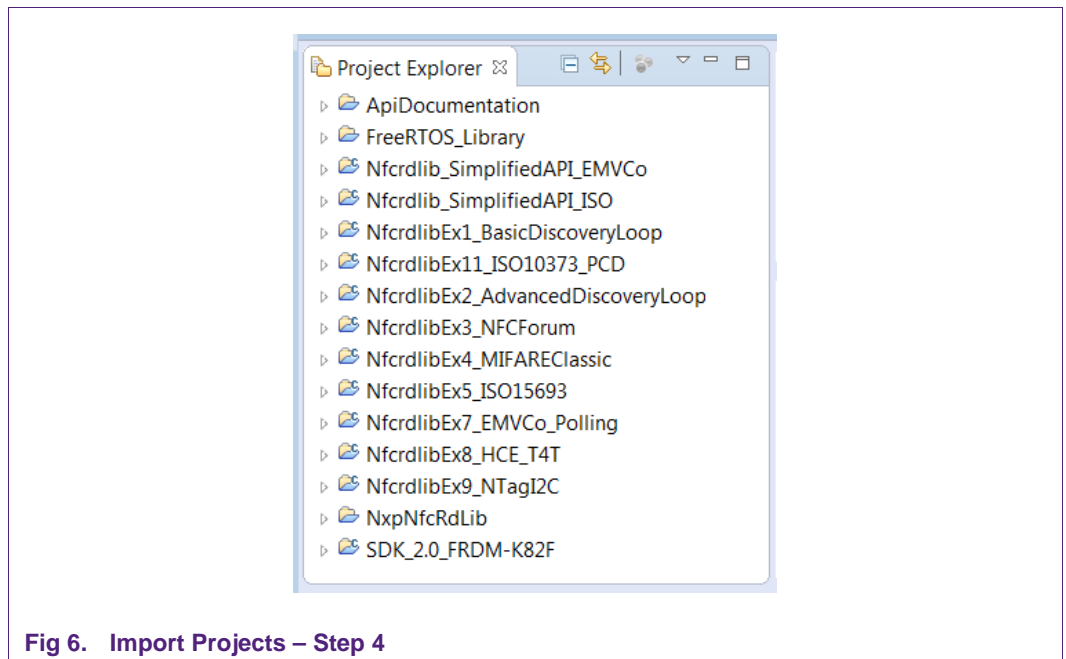


Fig 6. Import Projects – Step 4

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.

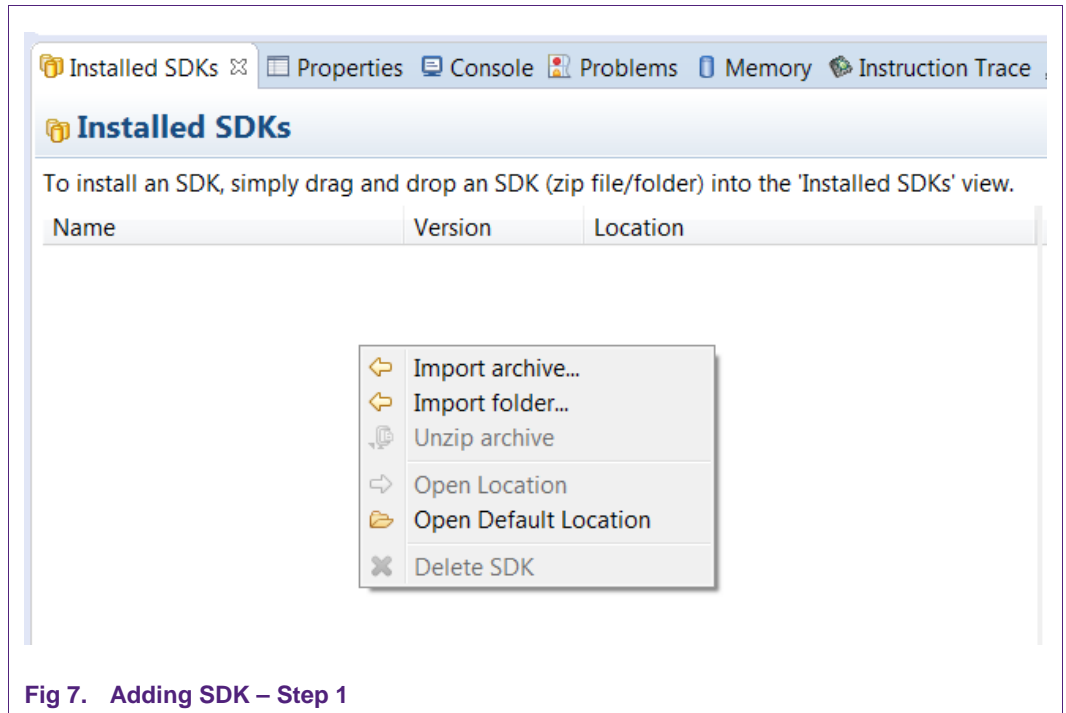


Fig 7. Adding SDK – Step 1

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

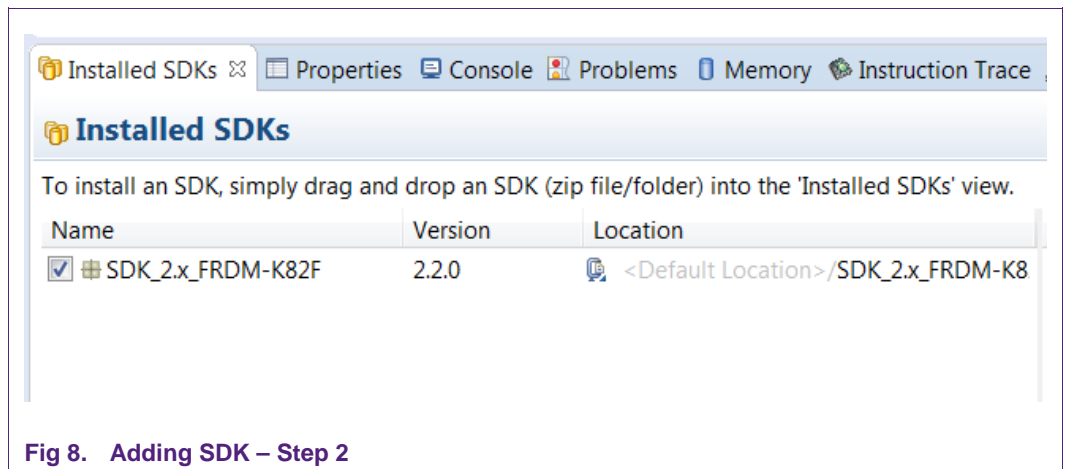


Fig 8. Adding SDK – Step 2

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).

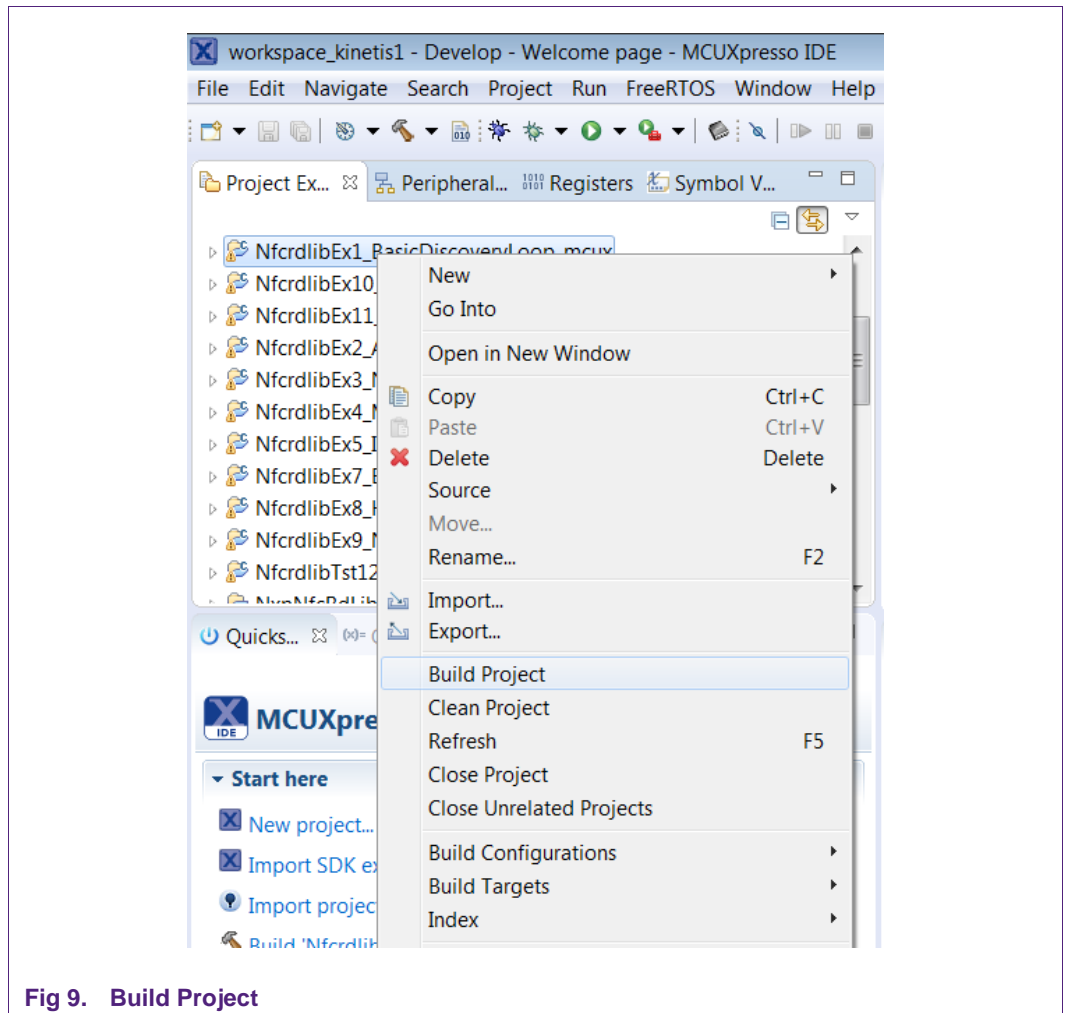


Fig 9. Build Project

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.

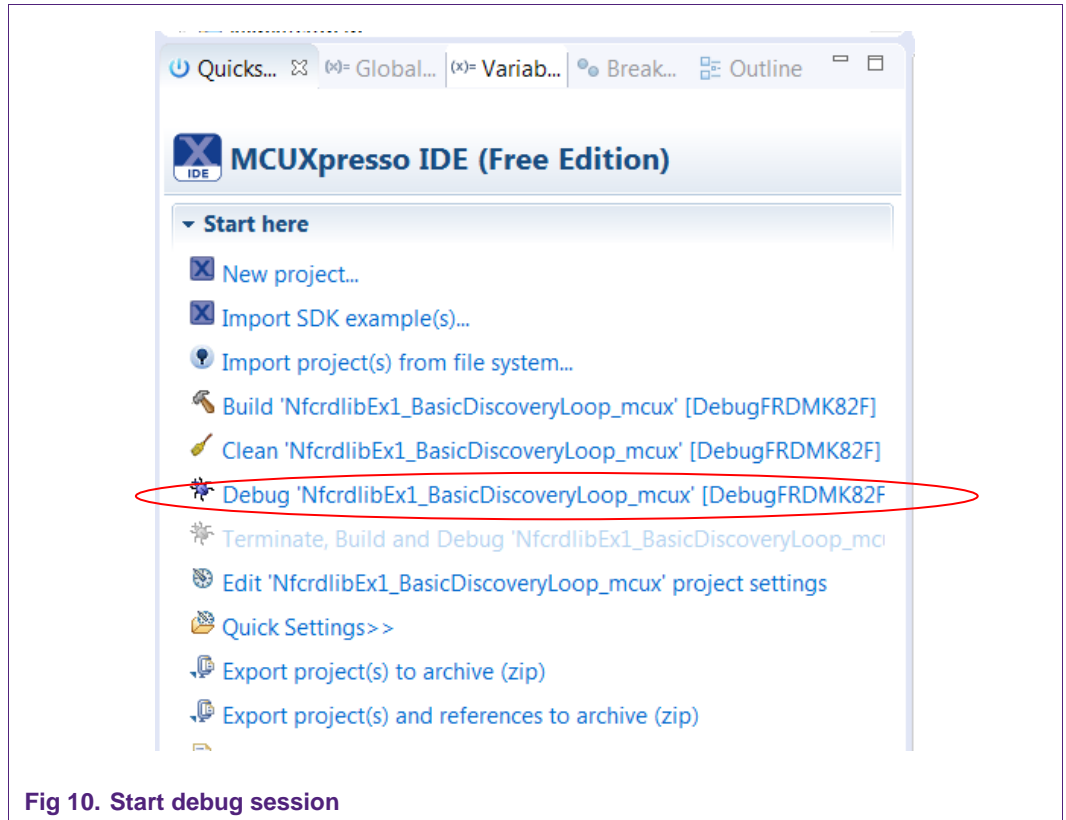
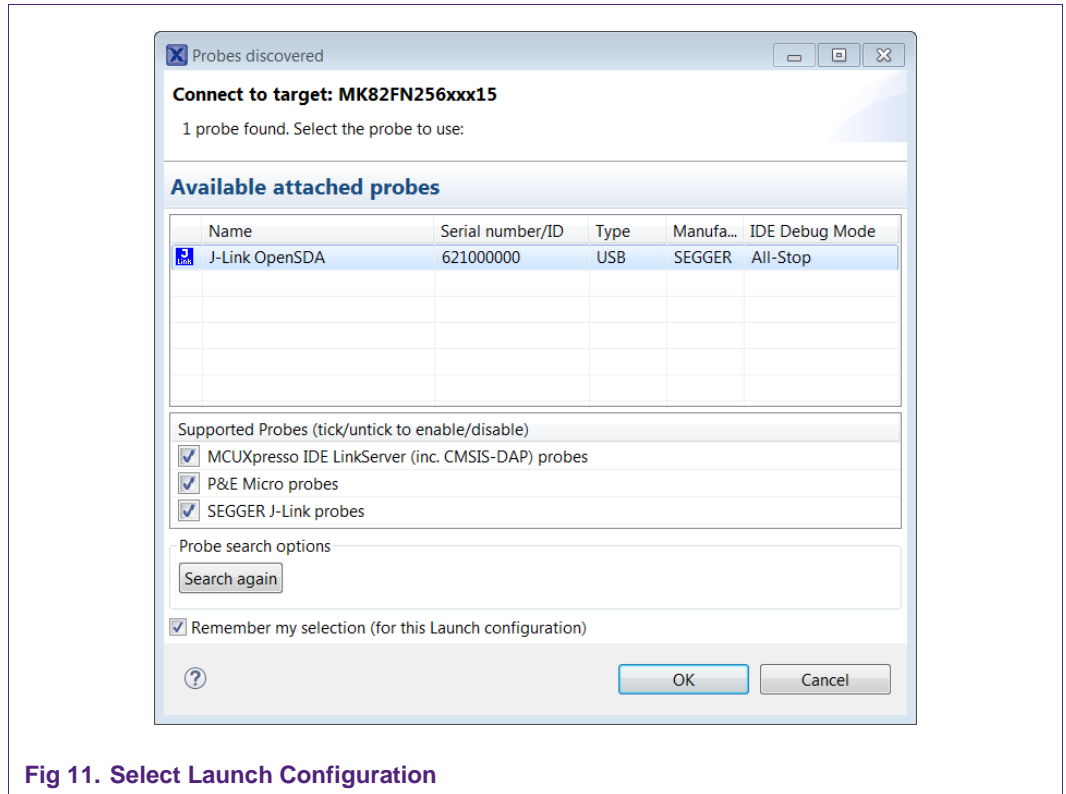
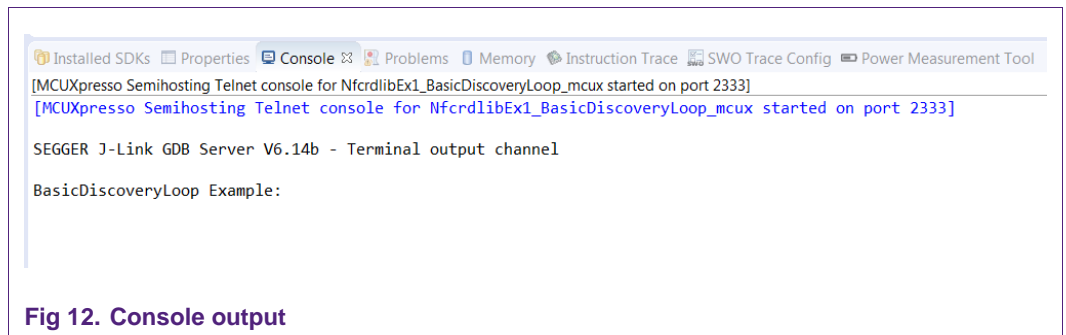


Fig 10. Start debug session

3. Probe discovered dialog appears.



4. Debug output in console view appears.



5. Connecting FRDM-K82F Board to NFC Frontend board

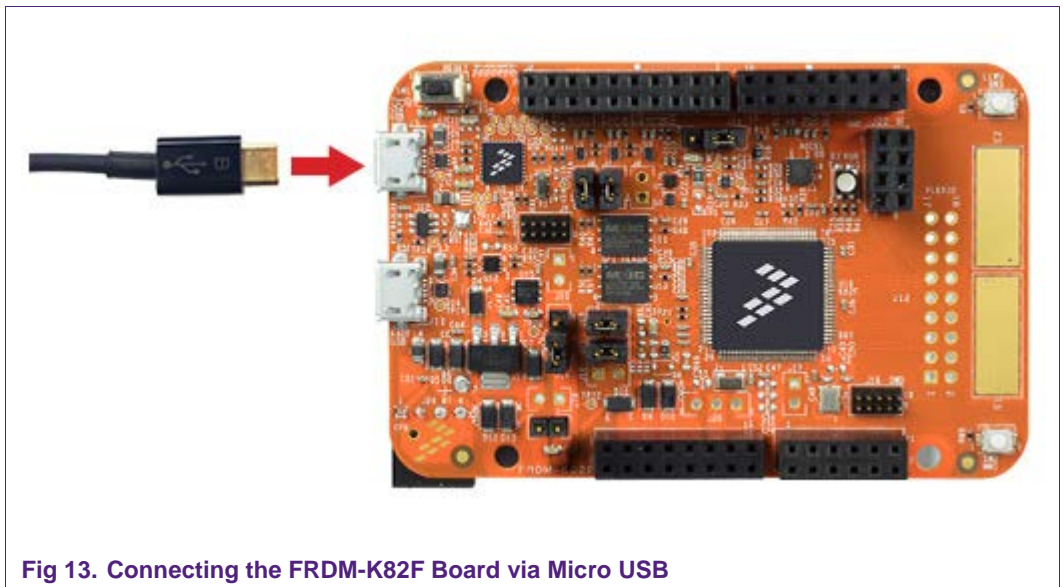
This chapter provides instructions how to connect FRDM-K82F development board to the host PC and to the NFC Frontend board: PNEV5180B, CLEV6630B to run NFC Reader Library.

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.



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).

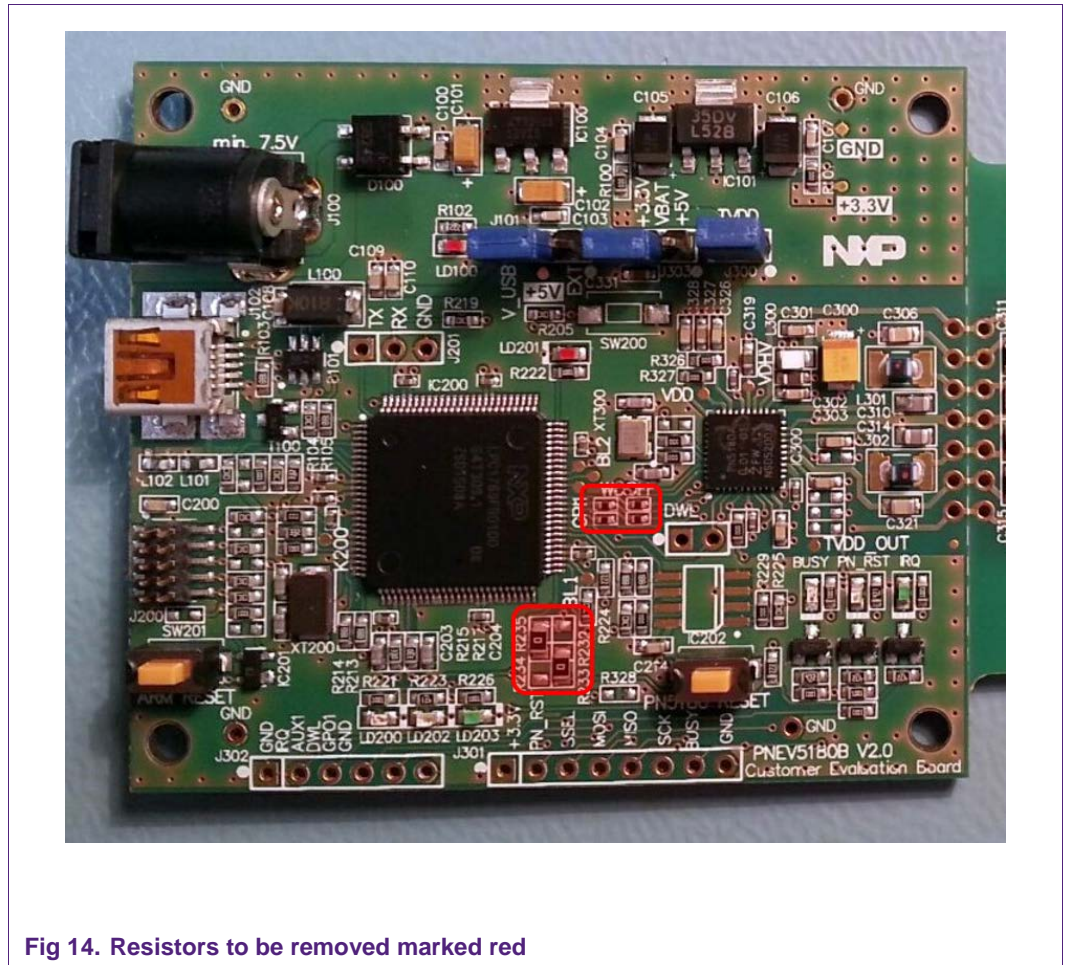


Fig 14. Resistors to be removed marked red

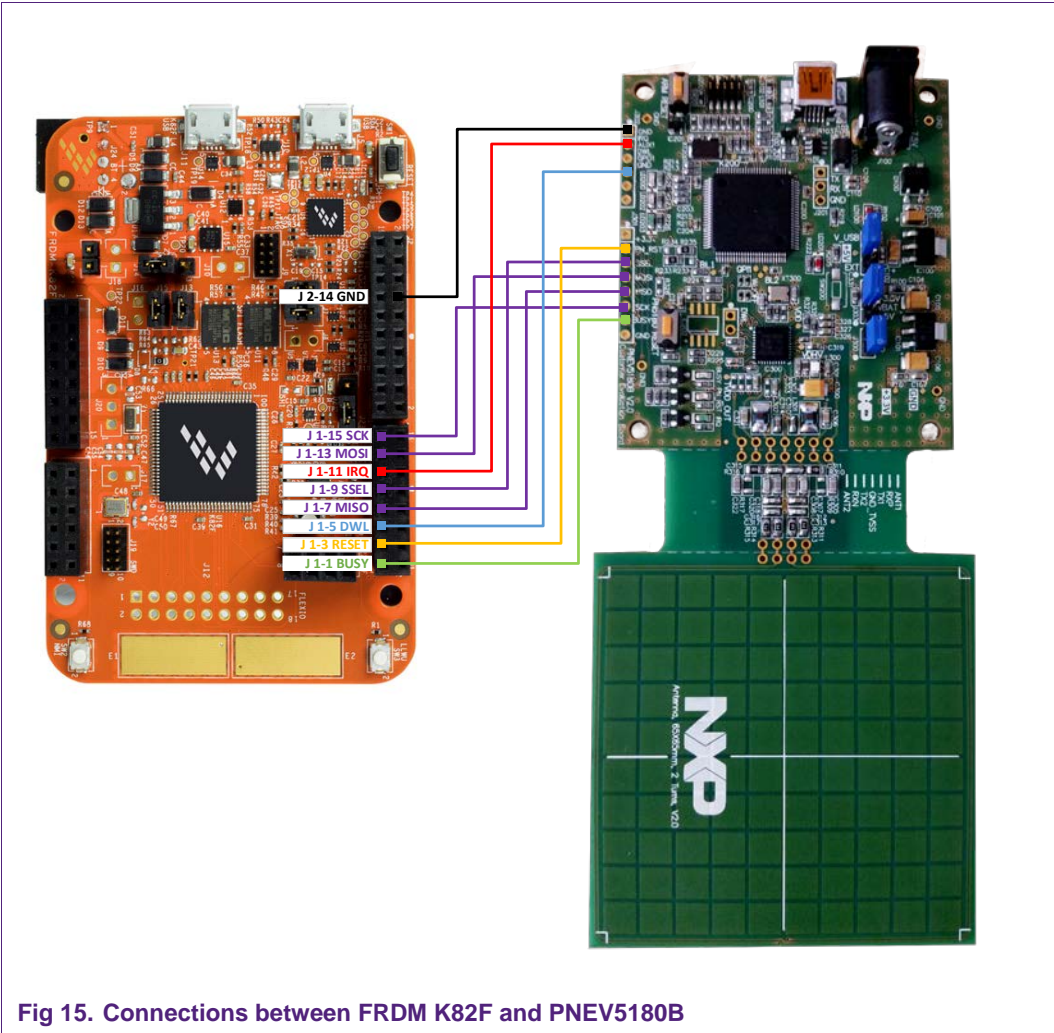
To check for the correct PNEV5180B board configuration please refer to the UM10954 - PN5180 SW Quick start guide.

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
IFSELO	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	-



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).

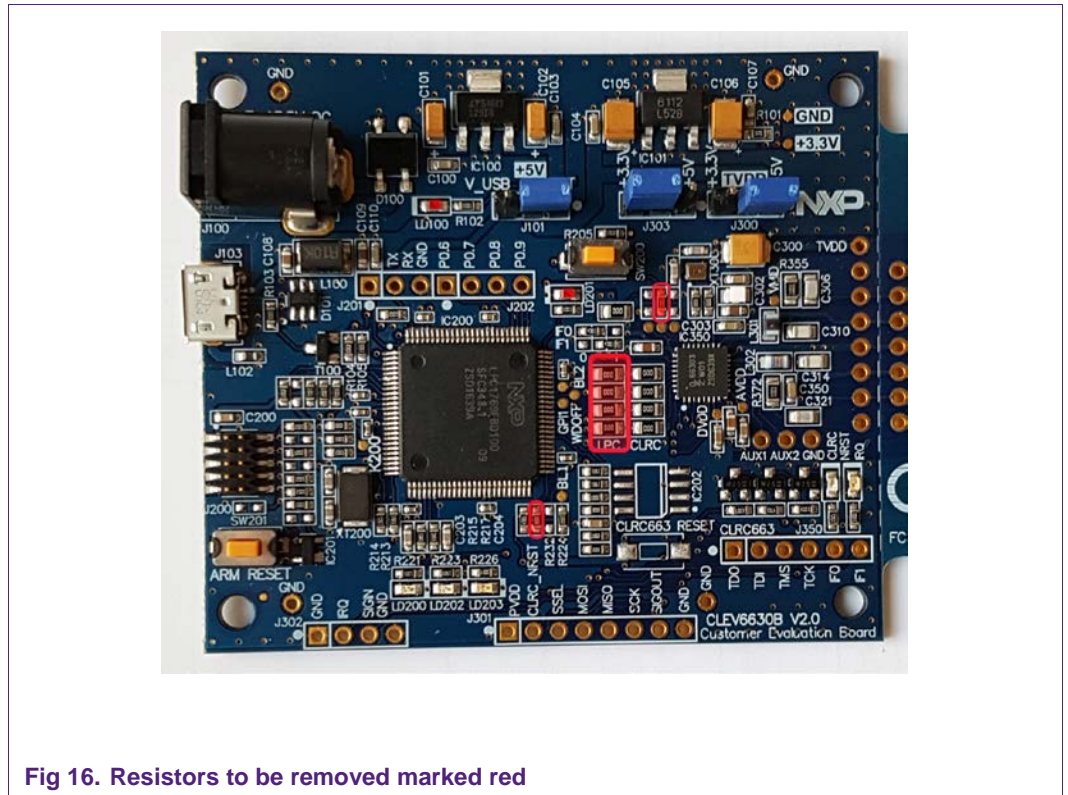


Fig 16. Resistors to be removed marked red

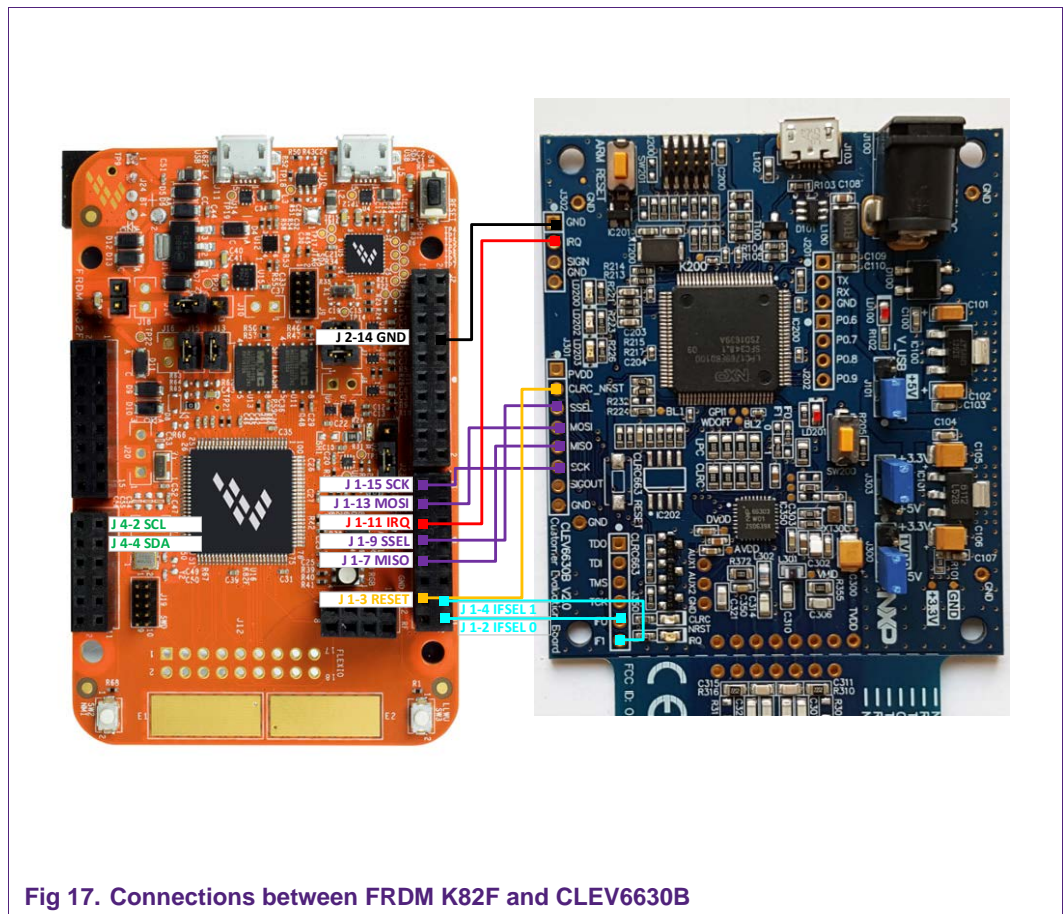
To enable RC663 NFC Frontend in the NFC Reader Library it is mandatory to define related preprocessor directive (project properties > settings > preprocessor) to PHDRIVER_FRDM_K82FRC663_BOARD.

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
IFSELO	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>

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