

RN00009

NFC Reader Library version 07.09.00

Rev. 2.3 — 6 September 2023

Release notes

Revision history

Revision history

Rev	Date	Description
v.2.3	20230906	Version 07.09.00 added in Section 3
v.2.2	20230404	Version 07.08.00 added in Section 3
v.2.1	20220621	Version 07.04.00 added in Section 3
v.2.0	20211109	Version 07.01.00 added in Section 3
v.1.9	20190110	Version 05.21.00 added in Section 3
v.1.8	20180924	Version 05.19.00 added in Section 3
v.1.7	20180910	Version 05.19.00 added in Section 3
v.1.6	20180530	Version 05.16.00 added in Section 3
v.1.5	20180121	Version 05.12.00 added in Section 3
v.1.4	20170906	Version 05.07.00 added in Section 3
v.1.3	20170518	Version 05.02.00 added in Section 3
v.1.2	20170214	Version 04.06.00 added in Section 3
v.1.1	20170111	Version 4.050.03.011702 added in Section 3
v.1.0	20161124	Initial version



1 Document purpose

This document contains the release information for the NXP NFC Reader Library for the reader frontend ICs namely PN5180, PN5190, CLRC663 and NFC controller PN7462AU. The Source code is supported for development boards such as

1. LPC1769/K82 Controller/Raspberry Pi + CLEV6630B v2.0,
2. LPC1769/Raspberry Pi + PNEV5180B Development Board,
3. PNEV7462C - Customer development board for PN7462 family
4. PNEV5190BP - Development board for PN5190

This document also lists known problems and restrictions.

2 Hardware requirements

- Sample cards
- USB cables, etc.

And one of the following:

- CLEV6630B - Customer development board v2.0
- PNEV5180B - Customer development board
- PNEV7462C - Customer development board for PN7462 family
- PNEV5190BP - Development board for PN5190
- Raspberry Pi model 3

3 Changelog

The following features and problems were addressed between the releases.

3.1 Version 7.09.00

- **Reader Library components**

- PN7462AU HAL is updated to provide Set Configuration PHHAL_HW_CONFIG_PN7462AU_LPCD_DURATION to configure AGC sample delay time in microseconds.
- PAL Sli15693, AL ICODE, and discovery loop components are updated to handle extra delta timeout (DELTATV, POLL) based on library mode (ISO/NFC).
- The PAL I14443-4 component is updated to handle FWT(TEMP) correctly as per the ISO/IEC 14443-4 specification.
- In-line with other platform E2PROM macros, PHHAL_HW_PN5180_SET_LISTEN_EEPROM_ADDR macro is updated to PHHAL_HW_PN5180_SET_LISTEN_E2PROM_ADDR and macro moved to phhalHw_Pn5180_Instr.h file.

- **Examples and compliance applications update**

- Example and Compliance applications are updated to avoid E2PROM write multiple times during application boot, if there is Autocoll configuration.

- **PN7462AU RF sources**

- PN7462AU RF sources are updated to provide Set Configuration PHHAL_RF_LPCD_DURATION to configure AGC sample delay time in microseconds.

- **Compliance tests execution with all applicable front ends and NFC controllers**

- NFC Forum Certification Release 13 Digital compliance testing is done as per Reader Device class and Card Emulation Device class.

- EMVCo 3.1 PCD Digital compliance testing is done.
- ISO10373-6 PCD and PICC Digital compliance testing is done.

3.2 Version 7.08.00

- **Reader Library components**
 - Required Crypto Sym configurations are enabled in NFCLib initialization for DNA products.
 - MfdfEVx issue with encrypted communication is fixed.
- **Examples and Compliance applications update**
 - NFC Forum DTA Compliance application included in release package, supports reader device class and card emulation device class testing as per NFC Forum Certification Release version 13.
 - Transport Keys are added based on 12NC part numbers for PN76xx NFC controllers for NfcrdlibEx7_MIFAREPlus and NfcrdlibEx10_MIFAREDESFire_EVx example applications.
- **FreeRTOS**
 - FreeRTOS kernel version in NxpNfcRdlib updated from v10.4.3 LTS Patch 2 to v10.5.0
- **PN7462AU Examples and RF sources**
 - PN7462AU USB Library updated to support Interface and End points configuration.
 - phExCcid and phExNFCCcid example applications are updated as per USB library updates.
- **Compliance tests execution with all applicable frontends and NFC controllers**
 - NFC Forum Certification Release 13 Digital compliance testing is done as per Reader Device class and Card Emulation Device class.
 - EMVCo 3.1 PCD Digital compliance testing is done.
 - ISO10373-6 PCD and PICC Digital compliance testing is done.

3.3 Version 7.07.00

- **Reader Library components**
 - Missing AL components initializations added in NFCLib AL initialization.
- **Examples and Compliance applications update**
 - All NxpNfcRdLib Examples, Compliance applications, and platform-specific examples are updated to use MCUXpresso style for Heap and Stack placement.
- **FreeRTOS**
 - FreeRTOS kernel version in NxpNfcRdlib updated from v10.4.3 to v10.4.3 LTS Patch 2.
- **HALs**
 - PN7462AU HAL updated to support RF Collision Avoidance feature.
 - PN7462AU HAL updated to support Proximity Check feature.
 - PN5190 and PN7642AU HALs updated to provide platform timer correction configuration to use with proximity check feature.
- **PN7462AU Examples and RF sources**
 - RF sources and Example applications are migrated from phRTOS to phOsal support.
 - CT HAL and PAL updated to comply with CT EMVCo v4.3d Specification.
- **Compliance tests execution with PN5190 B2 IC**
 - NFC Forum Certification Release 13 digital and analog compliance testing is done as per Reader Device class and Card Emulation Device class.
 - EMVCo 3.1 PCD digital and analog compliance testing is done.

3.4 Version 7.06.00

- **Reader Library PAL, DiscoveryLoop, and AL TOP components**
 - NxpNfcRdLib updated as per NFC Forum CR13 Card Emulation Device class.
 - Updated to NFC Forum Digital Protocol technical specification v2.3 from v1.1
 - Updated to NFC Forum Activity technical specification v2.2 from v1.1
 - ceT4T component updated as per NFC Forum Type 4 Tag technical specification v1.2 from v1.0, support added for NDEF file mapping version 3.0 and extended field coding.
 - NFCLib component updated to correct ISO Transmit API TxBuffer issue for raw data transmit for 14443-3 and 14443-4 exchanges.
 - DiscLoop EMVCo Polling loop updated to support Proprietary technologies polling.
- **PN7462AU Examples and RF sources**
 - phExCcid example application updated to support extended length APDU.
 - RF sources updated to handle low temperature sensor wake-up from Standby mode correctly.
 - RF sources updated to handle Power consumption reduction before entering Standby mode.
- **Compliance tests execution**
 - NFC Forum Certification Release 13 Digital Protocol compliance testing is done as per Reader Device class and Card Emulation Device class.

3.5 Version 7.05.00

- **HAL PN5190**
 - PN5190 HAL updated for PN5190 FW release v02.05
 - PN5190 new instruction APIs added to configure Multiple Digital test bus and Read EEPROM User area CRC.
 - PN5190 SetConfig and GetConfig for PHHAL_HW_CONFIG_TIMING_MODE, PHHAL_HW_CONFIG_TIMING_MS and PHHAL_HW_CONFIG_TIMING_US are added to calculate PICC command exchange timing.

3.6 Version 7.04.00

- **Reader Library PAL, DiscoveryLoop, and AL TOP components**
 - NxpNfcRdLib updated as per NFC Forum CR13 Reader Device class.
 - Updated to NFC Forum Digital Protocol technical specification v2.3 from v1.1
 - Updated to NFC Forum Activity technical specification v2.2 from v1.1
 - AL TOP T2T component updated as per NFC Forum Type 2 Tag technical specification v1.2 from v1.0
 - AL TOP T3T component updated as per NFC Forum Type 3 Tag technical specification v1.1 from v1.0
 - AL TOP T4T component updated as per NFC Forum Type 4 Tag technical specification v1.2 from v1.0, support added for NDEF file mapping version 3.0 and extended field coding.
 - AL TOP T5T component updated as per NFC Forum Type 5 Tag technical specification v1.2 from draft specification of T5T.
 - Implemented the Proprietary Technology Guard Time(PTGT) configuration as per NFC Forum Activity technical specification v2.2
- **Compliance tests execution**
 - NFC Forum Certification Release 13 Digital Protocol compliance testing is done as per Reader Device class.

3.7 Version 7.03.00

- **HAL PN5190**
 - Updated to support LINUX Configuration with Raspberry Pi.
- **DAL**
 - Updated to support PN5190 LINUX Configuration with Raspberry Pi.
 - Updated Raspberry Pi pin mapping with PN5180 to resolve issue with latest Raspberry Pi Image.

3.8 Version 7.02.00

- **HAL RC663**
 - Providing PHHAL_HW_RC663_CONFIG_ANTENNA_PARAMETERS setconfiguration support to enable/disable default customer reference board 65*65 Antenna specific configurations.

3.9 Version 7.01.00

- **HAL**
 - Providing PHHAL_HW_CONFIG_RFRESET_ON_TIMEOUT setconfiguration support in PN7462AU, PN7640 and PN5190 HALs.
 - CLRC663 Antenna parameters are updated for improved performance w.r.t ISO/IEC15693 protocol with 65x65 antenna.
 - CLRC663, PN5180 and PN7462AU HALs are updated to check for internal RF Field before Exchange and Transmit functionality in Passive Reader Mode.
 - PN7640 and PN7462AU HALs are updated to return received data in case of Integrity Error.
- **PAL MIFARE**
 - Handled proprietary error code NAK3.
- **Discovery Loop**
 - File name of phacDiscLoop_Sw_Int_VAS.x is changed to phacDiscLoop_Sw_Int_ECP.x
- **Reader Library HAL, PAL and AL components**
 - Updated NULL Param checks in different Reader Library components.
- **Compliance tests execution**
 - EMVCo 3.1 compliance testing is done as per EMV Contactless PCD Digital Specification v3.1(December 2020) and Test Cases Requirements v3.1a (September 2021) using new Micropross EMVCo Testsuite v1.5.0.
 - EMVCo 3.1 compliance testing is done as per EMV Contactless PCD Analog test cases requirements v3.1a using internal test tool

3.10 Version 7.00.00

- **HAL PN7640**
 - PN7640 HAL Component support added to work with PN7640 open NFC Controller.
- **Examples and Compliance applications update**
 - Examples and Compliance applications are updated to support and work with PN7640 IC.
- **FreeRTOS**
 - FreeRTOS kernel version in NxpNfcRdlib updated from v10.2.1 to v10.4.3 to support PN7640 IC.

3.11 Version 6.13.00

- **HAL PN5190**
 - PN5190 Register header file is updated with new registers (DPC_CONFIG reg., along with missed registers) supported by PN5190 FW v02.03

3.12 Version 6.12.00

- **HAL PN5190**
 - HAL is updated to provide new SetConfig to use required SWITCH_MODE_NORMAL command to perform Abort operation of a PN5190 Command.
 - New TLV Commands RETRIEVE_RF_FELICA_EMD_DATA and SWITCH_MODE_NORMAL Usecase 2.2, supported by PN5190 FW v02.02 and greater is been added to HAL PN5190 Instruction layer.
 - Abort handling is updated to not send SWITCH_MODE_NORMAL command between split response read.
 - CLIF_ANA_STATUS Register is updated in HAL Register Definition File.
 - In TypeA Reader Mode, before sending AntiCollision CMD CLIF_SIGPRO_RM_ENABLES register value is updated from Protocol EEPROM region in PN5190 HAL to meet both NFC forum and EMVCo Compliance requirements.
- **HAL RC663**
 - Updated to configure FDT A,POLL based on User System requirement in T1T Reader mode, based on macro in HAL header file.
- **PN7462AU**
 - Validated with new GNUC ARM GCC Compiler version 10.2.1, which is part of MCUXpresso IDE Version 11.4.0.
- **PAL**
 - Delta FWT in PAL 14443-4A, 14443-3B and 14443-4 is updated to PASS NFC Forum CR11 compliance with HAL RC663 with new Micropross NFC Forum Digital Testsuite v2.2.1.
 - Default FSCI value shall be configured to 10, when PH_NXPNFCRDLIB_CONFIG_HIGHER_FSDI macro is enabled by the application.
- **Compliance test execution**
 - NFC Forum CR11 compliance testing is done as per NFC Forum Device Test Application Specification v2.2.02 (2018-01-18) using Micropross NFC Forum Digital Testsuite v2.2.1.
 - EMVCo 3.0 compliance testing is done as per EMVCo Contactless PCD Digital Test Cases Requirements v3.1a (February 2021) using new Micropross EMVCo Testsuite v1.4.1.

3.13 Version 6.11.00

- **HAL PN5190**
 - After AntiCollision Command, RM_OOK_COL_LOW_SLOPE bits in CLIF_SIGPRO_RM_ENABLES register needs to be set to '00'b to pass EMVCo analog compliance.

3.14 Version 6.10.00

- **HAL PN5190**
 - Reader Mode TypeA Sensitivity settings is retained when EMD is Enabled before Layer4 Activation for EMVCo Analog Compliance.
 - When EMD is Enabled before Layer4 Activation in TypeA Reader mode, RM_RESYNC_RESET_ENABLE bit needs to be enabled in CLIF_SIGPRO_RM_ENABLES register.

3.15 Version 6.09.00

- **HAL PN5190**
 - Complete Reader and Card Mode Support is available and validated.
 - Active and Passive P2P Mode functionality is available and validated.
 - Instruction and Register definition is updated based on FW Changes.
 - EMVCo/ISO/NFC Forum and FeliCa EMD Handling is validated.
 - All LPCD and ULPCD Features available with PN5190 is available and validated.
 - Async Abort feature is validated.
- **PN7462AU**
 - Validated with new GNUC Arm GCC Compiler version 9.2.1, which is part of MCUXpresso IDE Version 11.2.0.
- **PAL 14443-4mc**
 - Added new API `phpall14443p4mC_Sw_DeInit` for de-initialization.
- **AL**
 - Support for NTAG 22X product is available in MIFARE Ultralight Application Layer component (NDA).
 - Updated with AL MIFARE DESFire EVx component from NXP Reader Library.
 - Updated with AL MIFARE Plus EVx component from NXP Reader Library.
 - All ICODE Application layer commands are available in Public Release of NXP NFC Reader Library.
- **Discovery Loop**
 - Discovery Loop when configured in EMVCo Mode, return status with Multiple TypeB cards in proximity is aligned with Discovery Loop return status.
- **Examples/Compliance Apps**
 - PN7462AU `phExCcid` example is updated to support only CT Interface or both CLIF and CT Interface.
 - PN5190 support is added in all the example and compliance applications.
 - Reader-specific initialization code is now separated and added in separate files for all examples and compliance applications.
 - Updated `NfcrdlibEx1_DiscoveryLoop` example by merging functionalities of Legacy `NfcrdlibEx1_BasicDiscoveryLoop`, `NfcrdlibEx2_AdvancedDiscoveryLoop` and `NfcrdlibEx7_EMVCo_Polling` examples and is been replaced with new examples.
 - MIFARE DESFire example is updated to support MIFARE DESFire EV2/3 Cards.
 - `NfcrdlibEx7_MIFAREPlus` example is added to demonstrate a sample use case with MIFARE Plus EV1/2 Cards.
 - `NfcrdlibEx6_LPCD` example is added to demonstrate LPCD Timing and Threshold configurations with different reader ICs supported by NFC Reader Library.
 - Default build configuration for all Example and Compliance Applications is updated to K82F MCU Debug build with PN5190 Reader IC.
 - `NfcrdlibEx8_HCE_T4T` example is updated with NDEF Message URI that shall automatically open page in default browser of Mobile.
 - `NfcrdlibEx5_ISO15693` example is updated to demonstrate higher baud rate support of PN5190 with NTag5 Boost and Switch.
 - Compliance applications renamed with more meaningful names.
 - `Nfcrdlib_SimplifiedAPI_EMVCo_Analog` renamed as `Nfcrdlib_EMVCo_AnalogComplApp`
 - `Nfcrdlib_SimplifiedAPI_EMVCo_Interop` renamed as `Nfcrdlib_EMVCo_InteropComplApp`
 - `Nfcrdlib_SimplifiedAPI_EMVCo` renamed as `Nfcrdlib_EMVCo_LoopBackComplApp`
 - `NfcrdlibEx11_ISO10373_PCD` renamed as `Nfcrdlib_ISO10373_6_PCD_ComplApp`
- **Compliance test execution**
 - NFC Forum CR11 compliance testing is done as per NFC Forum Device Test Application Specification v2.2.02 (2018-01-18).

- EMVCo 3.0 compliance testing is done as per EMVCo Contactless PCD Digital Test Cases Requirements v3.0a (August 2018).
- ISO/IEC 14443-3 and ISO/IEC 14443-4 compliance testing is done as per ISO/IEC 10373-6 Second Edition (2011-01-15) test specification.
- ISO/IEC 18092 compliance testing is done as per ISO/IEC 23917 First Edition(2005-11-01) test specification.

3.16 Version 5.21.00

• HAL CLRC663

- Update the Apply Protocol Setting for TypeB to meet NFC Forum CR11 compliance by setting TxWait to 699 uS.

• HAL PN7462

- Updated Autocoll functionality to move to correct Type- A state during P2P mode in case of wrong commands received during Layer-4 activation.

• MIFARE DESFire Light AL module

- New MIFARE DESFire Light AL component is now part of NFC Reader Library delivery and works and with this release. LRP Crypto mode is not supported yet.

• LLCP component

- Updated LLCP code as per NFC Forum LLCP Specification v1.2.

• Discovery Loop

- Minor bug fix during Activation of Type F, Type V and ISO18000p3m3 tag to check against configured maximum CONF_DEVICE_LIMIT by the user.
- Consistency in returning collision error in EMVCo mode during collision in WupA.
- Updated set-configuration code to use macros for comparison and clean-up of code.

• Compiancy

- NFC Reader Library is now compliant to CR11 NFC Forum Certification (Internal Certification) for below Reader ICs.
 - PN5180 and PN7462 family (excluding PN7412) are compliant to Universal Device.
 - RC663 is compliant to Reader Device.

3.17 Version 5.19.00

• HAL CLRC663

- Enabled handling of higher frame size when EMD is enabled, to allow receiving frames bigger than 256 bytes in EMVCo mode.

• HAL PN5180

- Corrected the return value of number of valid bits in case of bitwise anti-collision logic.

• PAL ISO 14443-3B

- Accuracy of FWT calculation has been increased, using floating point arithmetic, to be compliant with EMVCo v3.0 retransmission delay.
- Updated parsing of received FSCI value to include checks for higher FSCI value as per EMVCo v3.0 requirements.

• PAL ISO 14443-4A

- PPS command can now be sent in EMVCo mode.
- Accuracy of FWT calculation has been increased, using floating point arithmetic, to be compliant with EMVCo v3.0 retransmission delay.

- Updated parsing of received FSCI value to include checks for higher FSCI value as per EMVCo v3.0 requirements.
- **PAL FeliCa**
 - Corrected the FWT calculation as per NFC Forum Digital Specification to include TR1 value.
- **Discovery Loop**
 - Enabled EMD handling, in case of NFC Forum mode to be compliant with NFC Forum Digital Specification v1.1.
 - If response to REQA has collision during anti-collision phase of Type A technology, the CT byte will not be validated with ATQA information.
 - Updated the parameter checks of FSDI/FSCI values to include higher frame size support as per EMVCo v3.0 requirements.
 - Collision resolution logic of Type F technology has been updated not to consider the HAL return code when sending REQC, if NFC DEP has been detected.

3.18 Version 5.16.00

- Reverted usage of GPIO2 to GPIO7 in HIF example of PN7462 family like it was in v5.14 release.

3.19 Version 5.15.00

- **HAL CLRC663**
 - T1T Optimization: HAL CLRC663 is optimized to reduce the T1T transaction time by reducing the byte to byte delay time during Tx operation.
 - All CLRC663 (plus) family members are now supported by NFC Reader Library.
 - Asynchronous baud rate at ISO14443 operating mode was not working with CLRC663 family.
 - New API in command layer has been added to send continuous bit sequence provided by the user. This API enables the user to send PRBS sequence to support MIC (Ministry of Internal Affairs and Communications) certification. The sequence provided complies as per the PRBS rules.
- **HAL CLRC663 and PN5180**
 - HAL CLRC663 and HAL PN5180 have been updated to return correct status code when T1T received frame is having either parity or transmission error.
- **PAL ISO14443-3A**
 - ActivateCard API is updated to perform retry of Select in case of Time-out in EMVCo mode.
- **PAL ISO14443-4A**
 - RATS API is updated to parse the De-select response frame correctly.
- **PAL ISO14443-4mC**
 - FSC check is being done in PAL 14443-4mC Activate API to validate the user provided input against FSCT4T, MIN as per NFC Forum Digital Specification.
- **TOP T2T**
 - Issue in perform CheckNdef and ReadNdef after performing ReadNdef of more than 1024 bytes using T2T card (NTag I2C) resolved.

3.20 Version 5.12.00

- **MISRA**
 - Fixed a majority of MISRA warnings.
- **CLRC663 HAL**
 - HAL CLRC663 is optimized to reduce EMVCo Polling time by not performing the settings that are already performed previously.

- During calibration cycle of LPCD of CLRC663, when a lot of metal is close to the antenna (antenna is de-tuned), it is observed that Q Result value that is being read is 0x00h from LPCD Calibration cycle. For LPCD to work even in this scenario, CLRC663 HAL is changed to allow configuration of Q and I value of 0x00h and 0x3Fh from LPCD Calibration cycle.
- **Application Layer ICODE API Signature Change**
 - `phallCode_Destroy()` API signature is updated to provide password (XORed) for ICODE products that require this feature.
- **Discovery Loop Type A activation update**
 - Discovery Loop is updated to resolve multiple Type A activations using `phacDiscLoop_ActivateCard()` API. This update is done as per the NFC Forum Activity Specification version 1.1 which performs HALT of all the tags except the one that is targeted to be activated.
- **Application Layer CET4T**
 - In previous versions of NFC Reader Library, the user had to make sure to initialize the NDEF file size equal or greater than maximum NDEF message that is expected to be written/updated plus 2 (i.e. NDEF File Size = Maximum NDEF Message along with length + 2). CE T4T is updated the check for correct size of NDEF File that is available for updating the data when Update Binary is done.
- **DAL LPC1769 update**
 - DAL of LPC1769 is updated to configure supported SPI Baud rates by `LPCOpen (LPC1769)`. Previously SPI speed of LPC1769 defined in board header files was 5 MHz which is changed to 4 MHz as supported by the `LPCOpen`.
- **Generic HAL update**
 - Configuration macro to configure High Tx baud rate (53 Kbps) for ISO15693 based tags is defined in generic HAL and the same can be configured by HAL PN5180 and PN7462AU.

3.21 Version 5.07.00

- **PN5180 HAL optimizations**
 - **HAL exchange optimization**

HAL PN5180 was optimized to reduce EMVCo Transaction time by reducing number of BAL exchanges with PN5180 frontend, which are not required for EMVCo Transaction.
 - **Inventory Read and Inventory Page Read Error**

When multiple ICODE SLI-X (ISO15693) tags are placed in the field, PN5180 fails to detect the collision in case Inventory Read and Inventory Page Read commands are sent.
 - **Poll Guard Time optimization**

Poll guard time optimization was done in NFC Reader Library mainly to meet EMVCo Poll guard time requirement on different platforms (Host Microcontroller + NFC frontends) with constant guard time values. Instead of using CLIF timer, DAL timer is used to wait for Poll guard time to expire before sending Poll command.
- **Discovery Loop**

EMVCo polling loop is optimized by reordering generic code that needs to be executed only the first time, instead of executing on every run. Furthermore, the FDT (Frame Delay Time) of HLTA is now taken into account while configuring GTB before sending WupB command.
- **PAL 15693**

PAL 15693 FDT configuration did not take into account the ASK configuration of HAL. PAL 15693 is now updated to configure FDT based on the ASK configuration of HAL as per ISO15693 Specification.

3.22 Version 5.02.00

- **NFC Reader Library portability improvements:**
 - **OSAL update:**

Operating System Abstraction Layer (OSAL) was part of NFC Reader Library and had dependency on NFC Reader Library headers and the implementation of adaptation layer of FreeRTOS, NullOs and Linux was dependent on phPlatform layer, which made the usage of OSAL not possible without NXP NFC Reader Library.

Change:

OSAL can now be used as an independent library and is not coupled with NFC Reader Library, which enables the use of OSAL in systems which may or may not use NFC Reader Library. If any other system (ex: mPOS, Secure Card Reader) where NFC Reader Library is optional and is using OSAL for OS abstraction, then there is no overhead in the integration of NFC Reader Library within the system.

After OSAL changes, if the customer needs to port NFC Reader Library on any other RTOS or different different controller then NFC Reader Library does not need to be changed any more but only changes are required in OSAL which is outside NFC Reader Library which makes porting easier than before without the need of changing NFC Reader Library code base.

– DAL (Driver Abstraction Layer):

DAL is introduced instead of old phPlatform and phbalReg which was part of NFC Reader Library. phPlatform was used to abstract initialization of NFC Reader Library by configuring pins connected between Host Microcontroller and Front End (FE) along with performing reset of FE, Timer abstraction, ISR Handler implementation and initializing BAL and HAL components.

With this approach, when NFC Reader Library is integrated into System which uses different microcontroller or if the pins connected to FE are multiplexed with another peripheral then phPlatform did not give enough flexibility to the user to bring up NFC Reader Library. Also, phPlatform had to be modified in different places and there was no clean approach to bring up NxpNfcRdLib with another system.

Change:

DAL provides APIs to abstract Microcontroller GPIO functionalities like configuring a pin to input/output/ interrupt, reading and writing to pins. DAL also provides generic BAL abstraction layer required for NFC Reader Library.

If NFC Reader Library needs to be ported on any other Host Microcontroller or Microcontroller SDK, then NFC Reader Library need not be changed but changes are only required to be done in DAL.

• PN5180 Digital Delay:

PN5180 FW version 3.6 and older did not support Digital Delay calculation in FW, instead this was applied in NFC Reader Library PN5180 HAL. PN5180 FW 3.8 enabled the support of applying Digital delay in FW but to use this feature, digital delay calculation done in NFC Reader Library PN5180 HAL needs to be disabled. In NFC Reader Library version 4.050.03 of NFC Reader Library that a build macro will be provided to either enable/disable Digital delay calculation in NFC Reader Library PN5180 HAL and customer need to make sure that he builds NFC Reader Library based on the FW of PN5180 used. This leads to overhead in GUI to provide different NxpNfcRdLib binaries for different FW version of PN5180.

Change:

NFC Reader Library PN5180 HAL will read the FW version of PN5180 during HAL initialization and uses this FW version information to either apply digital delay inside HAL of NFC Reader Library or PN5180 FW.

On PN5180 firmware version 3.6 and below the digital delay is applied by host software (NFC Reader Library), on firmware version 3.8 and newer the digital delay is applied by PN5180 firmware.

• PN5180 in Test Bus Mode:

To support NFC Reader Library execution of PN5180 HAL in NFC Cockpit use-case, when Test bus is enabled, handling of NSS and Busy pin needs be done correctly as stated in PN5180 Datasheet, i.e. NSS needs to be asserted and should wait until busy pin to go high before sending command over SPI.

Change:

NFC Reader Library PN5180 HAL is updated to configure the NSS pin during HAL Initialization and DAL will not configure or control NSS during BAL exchange. During PN5180 HAL initialization, EEPROM is read, to know if Test bus is enabled/disabled, this information is then used during every BAL exchange to control NSS and BUSY pin functionality. As DAL is not either configuring/controlling NSS pin, even CLRC663 HAL is updated to configure NSS pin during HAL CLRC663 Initialization and control NSS pin during every SPI BAL exchange.

- **ISO 18000p3m3 on PN7462AU:**

Software work around for PN7462AU HW limitation in ISO18000p3m3 (to detect presence of multiple ISO18000p3m3 tags in vicinity) during technology detection, errors such as minframe \ collision \ protocol \ integrity in case of timeout during begin round \ next slot are being treated as collision error to indicate presence of tags. Also, the HAL resolution logic has been modified to make sure that tags that were not resolved due to unavailability of HAL Rx buffer, a wait time is introduced before sending next slot to make sure that these tags once again participate in collision resolution process.

- **AL ICODE Command Support:**

Previous AL components like AL ISO15693, AL ICODE SLI, AL ICODE DNA commands are now being provided as a single component as AL ICODE. This integrated layer provides command support to interact with ICODE SLIX, SLIX-2, SLIX-L, SLIX-S and ICODE DNA tags based on ISO 15693.

- **ICODE DNA support:**

PAL ISO15693 is updated to provide new “phpalSli15693_FastInventoryReadExtended” API to support Inventory Read Extended API and the current “phpalSli15693_InventoryReadExtended” API signature is being updated to support CID feature of ICODE DNA tag.

- **Type 5 Tag support:**

Bug related to ISO15693 in PN5180 HAL and TOP-T5T fixed.

- **MCUXpresso Support:**

All the examples are updated to support MCUXpresso IDE and the support for LPCXpresso and KDS is discontinued.

- **Polling guard time setting:**

Fixed: phhalHw_Exchange hangs in case PHHAL_HW_CONFIG_POLL_GUARD_TIME_US set to 0.

3.23 Version 4.06.00

- Versioning scheme of NFC Reader Library changed.

All following changes in this release are related to CLRC663 and CLRC663 *plus*.

- CLRC663 (*plus*) - low power card detection (LPCD) improvements
 - Additional options are provided to configure different I/Q thresholds when LPCD Filter is enabled to choose either between stable detection with power saving (Option1) or higher detection range (Option2).
- Antenna-related configuration for CLRC663 (*plus*) is moved into separate header file
- ISO18000-3 mode 3 (ICODE-ILT) tag detection improved (CLRC663 (*plus*) only).

3.24 Version 4.050.03.011702

- ICODE DNA Command Support
- MIFARE DESFire EV2 Command Support
- MIFARE Plus EV1 Command Support
- EMVCo 2.6 Updates
- CLRC663OB/V1A LPCD Algorithm
- CLRC663OB/V1A 65*65 Antenna RF Settings in EEPROM Support
- NDEF Operations on MIFARE Classic Tag
- Removed PN512 support. For PN512 support, refer to versions before version 4.050.03.001651
- Removed support for LPC11U68.
- Pin connections for Kinetis FRDM-K82F and Raspberry Pi have been updated. Please refer to the Start-up Guides respectively. [AN11908](#), [AN11802](#)

3.24.1 Problems addressed

The following problems were addressed between version 4.040.05.011646 and this version:

- NFC Forum Example (Example3) does not support Type 5 Tag (ICODE SLI with NDEF data)
- EMVCo Poll Guard Times GTA/GTB for PN5180 needs to be adjusted depending on platform
- ISO18000p3m3 Multiple Select not possible
- Issue on NDEF Formatting of a new/empty MIFARE DESFire EV1 IC-based card

3.25 Version 4.040.05.011646

- Support for FRDM-K82F Platform
- Support for Linux on Raspberry Pi Model 3 Platform
- Simplified API for EMVCo and ISO Profile
- Configuration for variable preamble reception related to FeliCa
- Improvements on platform porting layer
- Various bugs in OSAL layer fixed

3.26 Version 4.030.00.001627

- Added support for PN7462AU and derivatives
- Simplification of Tag operations component
- Support for Inventory Read Extended Mode for ICODE SLIX-2 Cards
- Inventory Read API for Addressed & Selected Mode
- ISO18000p3m3 HAL Inventory

- ISO18000p3m3 Discovery Loop was not able to resolve all the tags in a selected tag population
- ISO15693 Discovery Loop was not able to resolve all the tags
- RC663 HAL Specific Issues
- RF ISR Abstraction changes
- Build Macro and Component Dependencies Management
- Operating System Abstraction Layer
- PhPlatform component is created in the Reader Library
- Examples Optimization
- Migration to LPC OpenStackV2.x
- NxpRdLib portability improvements

3.27 Version 4.010.03.001609

- Added EMVCo 2.5 support for PN512
- Added MIFARE DESFire EV1 support (distributed via Secure Files on NXP.com only)

3.28 Version 4.010.02.001606

- Added EMVCo 2.5 support for CLRC663 and PN5180 reader ICs. Use Ex6 for certification

3.29 Version 4.010.00.001602

- PN5180 support added
- LPC11U68 support added
- Added switch to switch between active high and active low Interrupt signal on CLRC663
- Small bug fixes

3.30 Version 3.092.04.001533

- ICODE SLI/ILT support added (ISE/IEC 15693 and ISO/IEC 18000-3 Mode 3)
- Type 4 Tag card emulation functionality added (PN512 only)
- Reworked and extended example projects
- Reworked LLCP and SNEP layers
- Improved Discovery Loop
- FreeRTOS support added
- LPC1227 support dropped due to discontinuation of LPCXpresso LPC1227
- API reference of NFC Reader Library improved
- EMVCo 2.3.1a support (CLRC663 only)
- NTAG-I2C application layer added
- New directory structure of the LPCXpresso projects
- RF Collision Avoidance support (PN512 only)
- ISO EMD Handling as per ISO/IEC 14443-3:2011/Amd.1:2011 (PN512 only)
- FeliCa protocol implementation for Multi-slot response
- OSAL: abstractions improved for commonly used OS features like timers, semaphores, events and mutexes
- Many fixes and improvements

4 Memory footprint

Below memory footprint is obtained when NFC Reader Library is compiled for K82 with PN5190 in -O2 optimization level. This data is for reference only.

Table 1. Footprint table

Component	GNU-ARM-CC	
	Sum of code [Byte]	Sum of RAM in [Byte]
phacDiscLoop	11,168	-
phalFelica	840	-
phal18000p3m3	3,908	-
phalCode	9,400	-
phalMfc	1,156	-
phalMfdf	19,288	-
phalMfdfEVx	54,404	-
phalMfdfLight	25,480	-
phalMfNtag42XDna	22,104	-
phalMfp	8,588	-
phalMfpEVx	18,204	-
phalMful	3,252	-
phalT1T	1,327	-
phalTop	26,220	42
phalVca	7,476	-
phceT4T	4,231	-
phCidManager	120	-
phCryptoRng	1,388	-
phCryptoSym	10,206	-
phhalhw	32	-
phhalHwPn5190	20,212	4
phKeyStore	1,815	-
phInLlcp	8,374	343
phNfcLib	13,124	6,951
phnpSnep	2,184	6
phpalEpcUid	2,196	-
phpalFelica	1,768	-
phpal14443p3a	2,148	-
phpal14443p3b	2,792	-
phpal14443p4	3,674	-
phpal14443p4a	1,544	-

Table 1. Footprint table...continued

Component	GNU-ARM-CC	
	Sum of code [Byte]	Sum of RAM in [Byte]
phpall14443p4mc	4,376	-
phpall18000p3m3	2,492	-
phpall18092mPI	7,580	-
phpall18092mT	5,400	-
phpalMifare	1,336	-
phpalSli15693	4,724	-
phTMIUtils	496	-
phTools	2,535	334
DAL (K82 + Pn5190)	1,078	5
OSAL (FreeRTOS Abstraction)	1,504	-
Grand total	320,144	7,685

5 Supported tag and card products

The NFC Reader Library stack implements all ISO protocols that are relevant for NFC.

Such as

- ISO 14443-3/4 A/B
- ISO 18000-3 mode 1 (ISO 15693) and 3
- ISO 18092
- JIS X 6319-41

On top of these standard protocols, the NFC Reader Library also implements product-specific commands, that are used to extend the feature set of NXP's tag products. These commands are implemented in the so-called Application Layer of the NFC Reader Library. To help getting started easier, the NFC Reader Library provides examples for selected card and tag products. All supported tag products are implemented with the complete command set that is specified in the respective data sheet.

The table below lists down all tags and cards that are supported by NFC Reader Library.

Product	Supported in NFC Reader Library	Application Layer component	Example in NFC Reader Library
Connected tags			
NTAG 5 family	Yes	ICODE	
NTAG I ² C (<i>plus</i>)	Yes		Yes
NTAG Tags and Labels			
NTAG 42x DNA family	Yes		
NTAG 21x (TagTamper) family	Yes		
NTAG 22x DNA (Status Detect) family	Yes		
ICODE Tags and Labels			
ICODE DNA	Yes		
ICODE SLI family	Yes		
ICODE SLIX family	Yes		
ICODE SLIX 2	Yes		
ICODE ILT family	Yes		
MIFARE contactless cards			
MIFARE DESFire family	Yes		Yes
MIFARE Plus family	Yes		Yes
MIFARE Ultralight family	Yes		
MIFARE Classic EV 1	Yes		Yes
Non NXP			
FeliCa	Yes		
Jewel / Topaz	Yes		

6 Installation instructions

For detailed installation instructions, please refer to Readme.txt in each example project and corresponding application notes / user manuals.

7 Known problems and restrictions

7.1 Hardware setup constraints

Before using this SW Package with corresponding HW, refer to the Application Notes / User Manual of the corresponding IC/Board.

- AN11211: Quick Start Up Guide CLEV663B Blue board
- AN11744: PN5180 Evaluation board quick start guide
- UM10883: PN7462 Quick Start Guide - Customer Board
Important: See Section on "Adding PN7462AU Plugin" in that document.
- Linux support is only validated on Raspberry Pi 3 Model B, however it is expected to work on the other Raspberry Pi models as well.

7.2 Software limitations

1. None

7.3 Guidelines

- The OPE MODE Configuration can be EMVCo, ISO, or NFC. This configuration is present in the Discovery Loops, PALs, and HALs. An application may choose to configure discovery loop that in turn configures PALs and HALs. Otherwise, an application has to individually configure for each relevant PAL and HAL.
- When the Discovery is configured following NFC Activity v1.0 and CON_BAIL_OUT_A=1, some type A cards (e.g. MIFARE Ultralight, MIFARE Classic, MIFARE DESFire, ...) may interpret other type requests (ALLB_REQ/SENSB_REQ, SENSF_REQ, ...) as an error. This may lead to reset of the PICC state (to IDLE state) preventing further card activation following collision resolution process (card will not answer to ANTICOLL command).

8 API reference

APIs are described in a zip file kept in docs/14_user_doc. Unzip the file and open index.html in the root folder of the unzipped location.

9 Abbreviations

Table 2. Abbreviations

Acronym	Description
EMV	Europay Master Visa standard
NFC	Near Field Communication
LLCP	Logic Link Control Protocol
SNEP	Simple NDEF Exchange Protocol
HCE	Host Card Emulation
HAL	Hardware abstraction layer
PAL	Protocol abstraction layer
AL	Application layer
AC	Activity layer
LN	Link abstraction layer
NP	Network protocol layer
BAL	Bus abstraction layer
P2P	Peer to Peer
TOP	Tag Operations

10 References

- [1] Data sheet MF1S503X MIFARE Classic 1K - Mainstream contactless smart card IC for fast and easy solution development, available on https://www.nxp.com/docs/en/data-sheet/MF1S50YYX_V1.pdf
- [2] Data sheet - MIFARE Ultralight; MF0ICU1, MIFARE Ultralight contactless single-ticket IC, available on <https://www.nxp.com/docs/en/data-sheet/MF0ICU1.pdf>
- [3] Data sheet – MIFARE Ultralight EV1 contactless ticket IC, available on http://www.nxp.com/documents/data_sheet/MF0ULX1.pdf
- [4] Data sheet – MIFARE MF0ICU2 MIFARE Ultralight C, available on http://www.nxp.com/documents/short_data_sheet/MF0ICU2_SDS.pdf
- [5] Data sheet - MIFARE DESFire; MF3ICDX21_41_81, MIFARE DESFire EV1 contactless multi-application IC, available on http://www.nxp.com/documents/short_data_sheet/MF3ICDX21_41_81_SDS.pdf
- [6] Data sheet - JIS Standard JIS X 6319 Specification of implementation for integrated circuit(s) cards - Part 4: High Speed proximity cards
- [7] Data sheet – Innovision Topaz, http://downloads.acs.com.hk/drivers/en/TDS_TOPAZ.pdf
- [8] Data sheet - CLRC663; High performance multiprotocol NFC frontend CLRC663 and CLRC663 *plus*, available on <http://www.nxp.com/docs/en/data-sheet/CLRC663.pdf>
- [9] ISO/IEC Standard - ISO/IEC 14443 Identification cards - Contactless integrated circuit cards - Proximity cards
- [10] ISO/IEC Standard - ISO/IEC 18092 Information technology - Telecommunications and information exchange between systems - Near Field Communication- Interface and Protocol (NFCIP-1)
- [11] Technical Specification Logical Link Control Protocol, NFCForum-TS-LLCP_1.1, available on <https://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/>
- [12] Technical Specification – Simple NDEF Exchange Protocol, NFCForum-TS-SNEP_1.0, available on <https://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/>
- [13] Technical Specification – Type 1 Tag Operation, NFCForum-TS-Type-1-Tag_1.1, available on <https://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/>
- [14] Technical Specification – Type 2 Tag Operation, NFCForum-TS-Type-2-Tag_1.1, available on <https://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/>
- [15] Technical Specification – Type 3 Tag Operation, NFCForum-TS-Type-3-Tag_1.1, available on <https://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/>
- [16] Technical Specification – Type 4 Tag Operation, NFCForum-TS-Type-4-Tag_2.0, available on <https://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/>
- [17] Technical Specification – NFC Data Exchange Format, NFCForum-TS-NDEF_1.0, available on <https://nfc-forum.org/our-work/specifications-and-application-documents/specifications/specification-releases/>
- [18] Application note - AN11022 - CLRC663 evaluation board quick start guide, available on <https://www.nxp.com/docs/en/application-note/AN11022.pdf>
- [19] Secure Files on NXP.com, <https://www.nxp.com/mynxp/secure-files>
- [20] MCUXpresso IDE, <https://www.nxp.com/support/:MCUXpresso-IDE>

[21] LPCXpresso target boards, <https://www.nxp.com/support/LPCXPRESSO-BOARDS>

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Tables

Tab. 1. Footprint table 15 Tab. 2. Abbreviations 19

Contents

1	Document purpose	2
2	Hardware requirements	2
3	Changelog	2
3.1	Version 7.09.00	2
3.2	Version 7.08.00	3
3.3	Version 7.07.00	3
3.4	Version 7.06.00	4
3.5	Version 7.05.00	4
3.6	Version 7.04.00	4
3.7	Version 7.03.00	5
3.8	Version 7.02.00	5
3.9	Version 7.01.00	5
3.10	Version 7.00.00	5
3.11	Version 6.13.00	6
3.12	Version 6.12.00	6
3.13	Version 6.11.00	6
3.14	Version 6.10.00	6
3.15	Version 6.09.00	7
3.16	Version 5.21.00	8
3.17	Version 5.19.00	8
3.18	Version 5.16.00	9
3.19	Version 5.15.00	9
3.20	Version 5.12.00	9
3.21	Version 5.07.00	10
3.22	Version 5.02.00	10
3.23	Version 4.06.00	13
3.24	Version 4.050.03.011702	13
3.24.1	Problems addressed	13
3.25	Version 4.040.05.011646	13
3.26	Version 4.030.00.001627	13
3.27	Version 4.010.03.001609	14
3.28	Version 4.010.02.001606	14
3.29	Version 4.010.00.001602	14
3.30	Version 3.092.04.001533	14
4	Memory footprint	15
5	Supported tag and card products	17
6	Installation instructions	18
7	Known problems and restrictions	18
7.1	Hardware setup constraints	18
7.2	Software limitations	18
7.3	Guidelines	18
8	API reference	18
9	Abbreviations	19
10	References	20
11	Legal information	22

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