AN13602

IFM L1 test tool for PN7462

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Application note
COMPANY PUBLIC

Document information

Information	Content
Keywords	Smart card, PN7462AU, ISO7816
Abstract	This document provides a detailed guide on how to configure the IFM L1 Test tool for PN7462 board by using ALPAR protocol. It includes a description of all supported commands.

1 Revision history

Revision history

Rev	Date	Description
1.0	20220503	First release

2 Introduction

The goal of this document is to describe the EMV IFM L1 Test tool based on NXP's PN7462, the functional elements that it is built upon and the interfaces between them. There is a special focus on the ALPAR protocol implemented between NXP's PN7462 and the host controller. It also includes a guide on how to set up the test tool and execute the EMV script for evaluation or testing purposes.

Additionally, it includes a section with results of the preliminary evaluation of the test tool against EMV IFM L1 v4.3c specifications and a reference ICS form filled out with product details.

3 IFM test tool overview

The IFM test tool contains the following components:

- PC with SCRTester tool connected through USB(UART) to PN7462 demo board.
- SCRTester tool implementing EMV Loopback application for EMV L1 contact testing.
- PN7462 SW implementing ALPAR protocol to communicate with SCRTester.

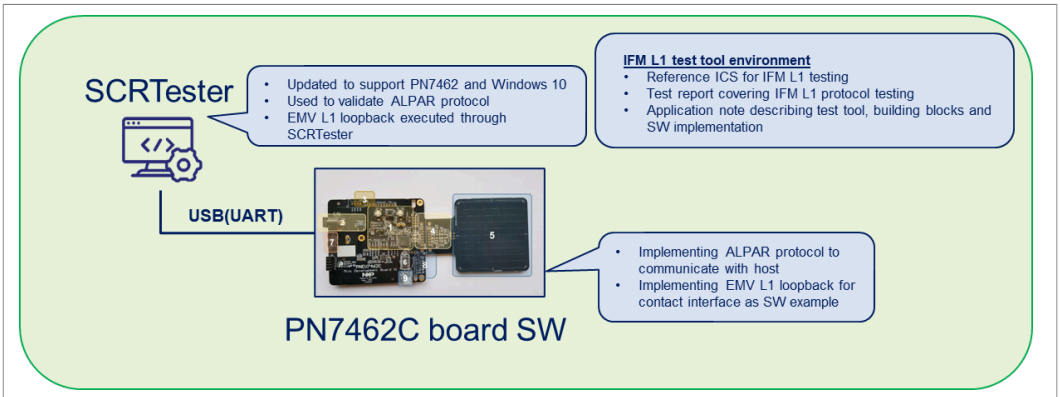


Figure 1. IFM test tool architecture

3.1 Components

Table 1. PN7462 IFM L1 Test tool components

Name	Description
PN7462C board HW	The board used is the PNEV7462C with the PN7462AU on board, that has contactless and contact reader capabilities. It includes a contact smart card connector on the bottom side.
PN7462C board SW	The software used is based on NXP's Contact Protocol Library, with the Protocol Abstraction Layer updated for the setup. On top of that, the ALPAR protocol is implemented as an interface to call the contact functions through UART commands.
SCRTester	The SCRTester tool is a PC software that enables the communication with all NXP smart card reader demo boards through serial communication. For the communication with the PNEV7462C board, it implements the ALPAR protocol and should be connected via USART interface through a RS-232-TTL adapter. It is compatible with Windows 10 OS. Download from nxp.com (SW141410): https://www.nxp.com/downloads/en/software/141410.zip

4 Software implementation

The PN7462 has been developed in order to be used either in ISO/IEC 7816-3 or E.M.V. 4.3 environment.

The NXP Ct Library implements the needed functions to enable the PN7462 as a smart card reader. It comprises the Protocol Abstraction Layer (PAL) and the Hardware Abstraction Layer (HAL).

To implement the ALPAR protocol, the project PN7462AU_ex_phExCTEMVCo based on the NXP Ct Library v4.11was taken, and then the ALPAR logic into the main loop was implemented.

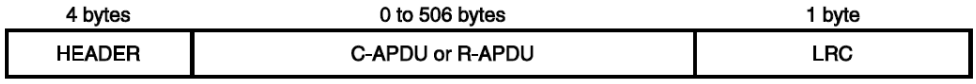
When the PN7462 wakes up, it enters an endless loop, where it waits for UART data. Once received data through UART, decodes the ALPAR command and checks for data integrity and structure. If the command is OK, then the corresponding ALPAR command is executed, which calls the corresponding commands from the PAL or HAL, and then sends back the response to the host via UART.

4.1 ALPAR protocol

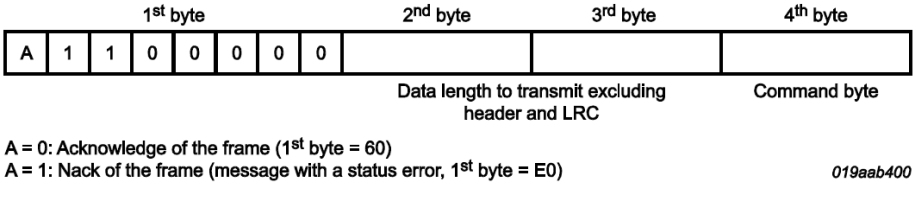
The communication between the host controller (SCRTester) and the PN7462 board obeys to a protocol named ALPAR. This protocol encapsulates the useful data of a message in an invariant frame structure and defines a dialog structure of messages exchanges.

Data is exchanged in blocks, each made up of binary characters built in bytes. The structure is the following:

- 4 header characters
- 0 to 506 data characters (C-APDU or R-APDU)
- 1 LRC character



The 4 header bytes include the following bytes:



The Longitudinal Redundancy Check (LRC) byte is such that the exclusive-oring of all bytes including LRC is null.

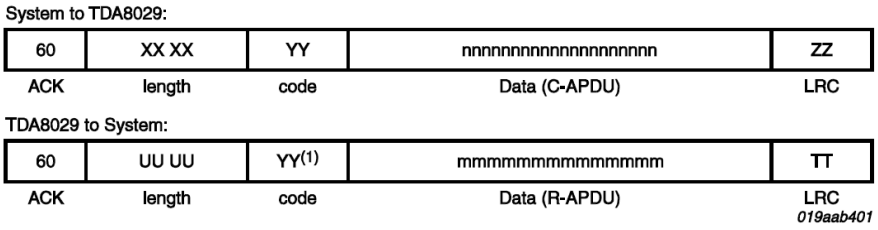
4.1.1 General dialog structure

The host controller is the master for the transmission; each command from the master is followed by an answer from the PN7462C board, including the same command byte as the input command.

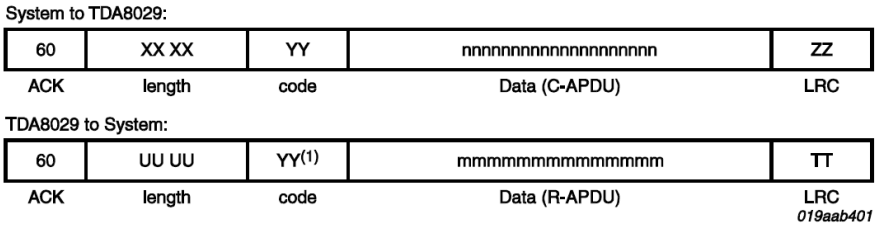
However, in some cases (card insertion or extraction, a time-out detection on RX line or an automatic emergency deactivation of the card) the PN7462C board can initiate an exchange.

4.1.1.1 Successful command

System to PN7462C board



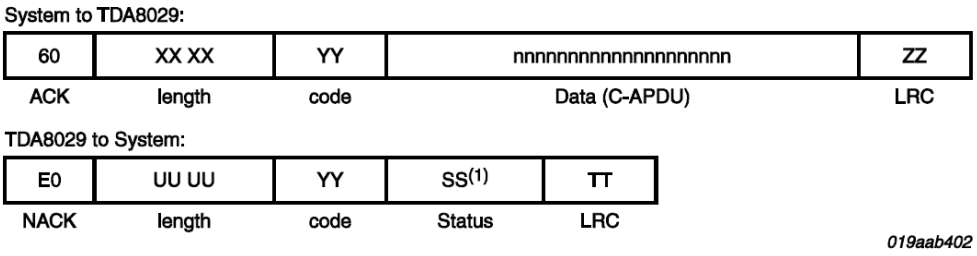
PN7462C board to system



1. *The same command byte YY is returned in the answer from TDA8029*

4.1.1.2 Unsuccessful command

System to PN7462C board



PN7462C board to system

System to TDA8029:

60	XX XX	YY	nnnnnnnnnnnnnnnnnnn	ZZ
ACK	length	code	Data (C-APDU)	LRC

TDA8029 to System:

E0	UU UU	YY	SS(1)	TT
NACK	length	code	Status	LRC

019aab402

(1) In this case, the status contains the error code information.

4.1.1.3 Answer with and acknowledge

System to PN7462C board

System to TDA8029 (example: power_off):

60	00 00	4D	2D
ACK	length	code	LRC

TDA8029 to System:

60	00 00	4D	2D
ACK	length	code	LRC

019aab403

PN7462C board to system

System to TDA8029 (example: power_off):

60	00 00	4D	2D
ACK	length	code	LRC

TDA8029 to System:

60	00 00	4D	2D
ACK	length	code	LRC

019aab403

(1) In the case where the answer is an acknowledge of the command, the board sends back a frame with the same content of the command.

4.2 Supported commands

4.2.1 General commands

The following command bytes are available (listed in numerical order):

Table 2. List of implemented ALPAR commands

Command	Code	Description
card_command (APDU)	00_H	Sends an APDU to the activated smart card
check_pres_card	09_H	Check the card presence
get_fw_version	$0A_H$	Reads the firmware version
set_card_baud_rate	$0B_H$	Changes the baud rate for host communication
set_serial_baud_rate	$0D_H$	Changes the baud rate for host communication
show_fidi	$0E_H$	Displays the current FiDi
negotiate (PPS)	10_H	Initiates a parameter change for T=0
set_clock_card	11_H	Selects the division for the smart card clock
start_EMV_loopback	$2F_H$	Launch the EMV loopback process. Blocking function that does not return
power_off	$4D_H$	Deactivates the current smart card
power_up_1.8V	68_H	Activates the card with VCC=1.8 V
power_up_3V	$6D_H$	Activates the card with VCC=3 V
power_up_5V	$6E_H$	Activates the card with VCC=5 V
set_nad	$A5_H$	Sets the NAD parameter for T=1 communication
idle_mode	$A9_H$	Sets the smart card in idle mode (activated with lower consumption)
get_reader_status	AA_H	Displays information about the current state of the reader

Additional outgoing commands:

Table 3. Implemented ALPAR outgoing commands

Command	Code	Param	Description
Card_extraction	$A0_H$	00_H	These commands are sent as soon as a card is inserted or extracted without any command coming from the system. These commands use the same operating code, but the extra parameter gives the additional information.
Card_insertion	$A0_H$	01_H	

4.2.2 Error list

The error list gives the status code identification and a brief description of the status error code.

Table 4. Implemented ALPAR error commands

Code	Description
20_H	Wrong APDU
21_H	Too short APDU
22_H	Card muted now (during T=1 exchange)
24_H	Bad NAD
25_H	Bad LRC
26_H	Resynchronized
27_H	Chain aborted
29_H	Overflow from card
30_H	Non-negotiable mode (TA2 present)
31_H	Protocol is neither T=0 nor T=1 (negotiate command)
33_H	PPS answer is different from PPS request
35_H	Bad parameter in command
39_H	PPS not accepted (no answer from card)
$3B_H$	Early answer of the card during the activation
40_H	Card deactivated
55_H	Unknown command
80_H	Card muted (after power-on)
81_H	Time out (waiting time exceeded)
83_H	4 parity errors in reception or in transmission
86_H	Bad FiDi
88_H	ATR duration greater than 19200 etus (E.M.V.)
$8D_H$	Parity error during ATR
$A0_H$	Procedure byte error
$C0_H$	Card absent
$C6_H$	ATR not supported
$E1_H$	Card clock frequency not accepted (after a set_clock_card command)
$E3_H$	Supply voltage drop-off
$E4_H$	Temperature alarm
$E9_H$	Framing error
$F0_H$	Serial LRC error

4.3 Commands description

4.3.1 Card_command (APDU)

This command is used to transmit card commands under APDU format from system to PN7462 whatever T=0 or T=1 protocol is used.

An answer to such command is also made in APDU format from PN7462 to the system. Example:

System to PN7462	60 00 07 00 00 A4 00 00 02 4F 00 8E
PN7462 to System	60 00 02 00 90 00 F2

4.3.2 Check_pres_card

This command is used to check the presence of a card.

System to PN7462	60 00 00 09 69
PN7462 to System	60 00 01 09 PRES 68

PRES byte indicates the presence of the card in the main slot (00 if there is no card, 01 if a card is present).

4.3.3 Get_fw_version

This command is used to identify the software version which is flashed in the PN7462 MCU.

For example, the current software can be coded in ASCI as “7462 100”

System to PN7462	60 00 00 0A 6A
PN7462 to System	60 00 08 0A 37 34 36 32 20 31 30 30 74

4.3.4 Set_card_baud_rate

This command is used mainly for cards which are not fully ISO 7816-3 compliant with specific and negotiable modes. As a matter of fact, some cards are in specific mode, but they do not give TA2 parameter in their answer to reset. So, the card has to be set to the right baud rate by means of this specific command which programs the baud rate.

Example:

System to PN7462	60 00 01 0B FD LRC
PN7462 to System	60 00 00 0B 6B

Where FD is the value of FiDi:

Table 5. Supported FiDi values

TA1	ETU	TA1	ETU	TA1	ETU	TA1	ETU	TA1	ETU	TA1	ETU
0x01	372	0x21	558	0x41	1116	0x61	1860	0xA1	768	0xC1	1536
0x02	186	0x22	279	0x42	558	0x62	930	0xA2	384	0xC2	768

Table 5. Supported FiDi values...*continued*

TA1	ETU	TA1	ETU	TA1	ETU	TA1	ETU	TA1	ETU	TA1	ETU
0x03	93	0x23	139.5	0x43	279	0x63	465	0xA3	192	0xC3	384
0x04	46.5	0x24	69.8	0x44	139.5	0x64	232.5	0xA4	96	0xC4	192
0x05	23.3	0x25	34.9	0x45	69.8	0x65	116.3	0xA5	48	0xC5	96
0x06	11.6	0x26	17.4	0x46	34.9	0x66	58.1	0xA6	24	0xC6	48
0x07	5.8	0x27	8.7	0x47	17.4	0x67	29.1	0xA7	12	0xC7	24
0x08	31	0x28	46.5	0x48	93	0x68	155	0xA8	64	0xC8	128
0x11	372	0x31	744	0x51	1488	0x91	512	0xB1	1024	0xD1	2048
0x12	186	0x32	372	0x52	744	0x92	256	0xB2	512	0xD2	1024
0x13	93	0x33	186	0x53	372	0x93	128	0xB3	256	0xD3	512
0x14	46.5	0x34	93	0x54	186	0x94	64	0xB4	128	0xD4	256
0x15	23.3	0x35	46.5	0x55	93	0x95	32	0xB5	64	0xD5	128
0x16	11.6	0x36	23.3	0x56	46.5	0x96	16	0xB6	32	0xD6	64
0x17	5.8	0x37	11.6	0x57	23.3	0x97	8	0xB7	16	0xD7	32
0x18	31	0x38	62	0x58	124	0x98	42.7	0xB8	85.3	0xD8	170.7

4.3.5 Set_serial_baud_rate

This command is used for changing the baud rate onto the serial link between the system and the PN7462. The default value is set to 115200 baud.

PAR byte indicates the selected baud rate according to Table 6.

System to PN7462	60 00 01 0D PAR LRC
PN7462 to System	60 00 00 0D 6D

Table 6. Baud rate parameter

Baud rate (Baud)	Parameter	Baud rate (Baud)	Parameter
9600	00_H	921600	07_H
19200	01_H	1288000	08_H
38400	02_H	2400000	09_H
57600	03_H	3500000	$0A_H$
115200	04_H	3750000	$0B_H$
230400	05_H	4000000	$0C_H$
460800	06_H	5000000	$0D_H$

After a baud rate change, the new value takes place for the next command sent by the system.

4.3.6 Show_fidi

This command displays the current FiDi of the card in use.

Example:

System to PN7462	60 00 00 0E 6E
PN7462 to System	60 00 01 0E FiDi LRC

Where FiDi gives the current FiDi.

4.3.7 Negotiate (PPS)

This command is used to make a PPS (Protocol and Parameter Selection) to the card. This could be triggered if the card ATR proposed a different Fi/Di or two different protocols. By using this command, a PPS will be made to the card with the Fi or Di and protocol type entered as a parameter (PP). It is up to the host to make the correct Fi/Di submission to the card.

Example:

System to PN7462	60 00 02 10 PP FD LRC
PN7462 to System	60 00 00 10 70

Where FD is the ratio Fi/Di given by TA1 parameter of the ATR and PP is the protocol to be used.

If the command is acknowledged, any subsequent exchanges between the card and PN7462 will be made by using new parameters.

4.3.8 Set_clock_card

This command is used for changing the card clock frequency. The default value is set to FXTAL/6 which is 4.52 MHz.

A parameter has to be transmitted in order to choose the card clock frequency:

System to PN7462	60 00 01 11 PAR LRC
PN7462 to System	60 00 00 11 71

Based on a crystal with a frequency equal to 27.12 MHz

Table 7. set_clock_card parameter

Frequency	Parameter
Fxtal = 27.12 MHz	00_H
Fxtal/2 = 13.56 MHz	01_H
Fxtal/3 = 9.04 MHz	02_H
Fxtal/4 = 6.78 MHz	03_H
Fxtal/5 = 5.42 MHz	04_H
Fxtal/6 = 4.52 MHz	05_H
Fxtal/8 = 3.39 MHz	06_H
Fxtal/16 = 1.69 MHz	07_H

After a card clock frequency change, all the waiting times are internally set to the new value.

Before applying the requested clock, the compatibility of the frequency with the current Fi used by the card is checked as described in ISO/IEC 7816-3. For example, if the card has answered in its ATR a Fi parameter of 372 or 558 (fmax ≤ 6 MHz), a change of the card clock frequency to Fxtal (27.12 Mz) or Fxtal/2 (13.56 MHz) will not be processed and an error status will be sent to the application.

4.3.9 Start_EMV_Loopback

This command launches the EMV Loopback mechanism. This is a loop which tries to activate the smart card (main slot) every 2 seconds. If the card activation is a success, then the EMV loopback starts and the full test is performed automatically.

At the end, the loop restarts, trying to activate the smart card again.

This command never returns and works by itself. It allows passing a full EMV protocol certification without any action from the user.

System to PN7462	60 00 00 2F 4F

4.3.10 Power_off

This command is used to deactivate whatever has been activated for 3 V or 5 V operation. A deactivation sequence is processed following the ISO 7816-3 normalization.

System to PN7462	60 00 00 4D 2D
PN7462 to system	60 00 00 4D 2D

4.3.11 Power_up commands

There are three different power-up commands (5 V, 3 V, 1.8 V). Two of them (power_up_3V and power_up_5V) have to be followed by a parameter:

- 00_H indicates that all the parameters of the ATR of the card compliant with ISO/IEC 7816-3 will be taken into account.
- 01_H indicates that only the ATR of cards whose parameters are inside the E.M.V. 4.3. specification scope will be taken into account; cards having an ATR which does not comply with E.M.V. 4.3 requirements will be rejected.

4.3.12 Power_up_1.8V

This command allows the user to activate the card at a VCC of 1.8 V. Every signal going to the card will be referenced to this VCC. See power_up_5V for the other characteristics.

4.3.13 Power_up_3V

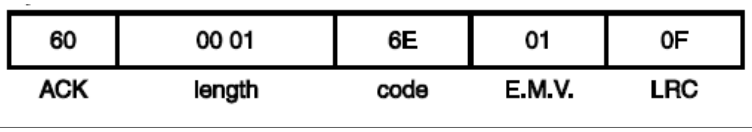
This command allows the user to activate the card at a VCC of 3 V. Every signal going to the card will be referenced to this VCC. See power_up_5V for other characteristics.

4.3.14 Power_up_5V

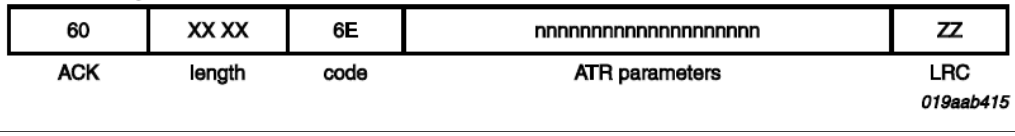
This command allows activating the card at a VCC of 5 V. All the signals going to the card will be referenced to this VCC.

An activation sequence is processed following the ISO/IEC 7816-3 normalization (VCC is rising, I/O is enabled, CLK is started, and RST is processed). If the card answers to this command, the answer will include all ATR parameters. These parameters are stored in the PN7462 memory and will be taken into account during the whole card session (until the card is deactivated or until a warm reset is processed). The structure of the answer is the following:

System to PN7462C board



PN7462C board to System



If the card does not answer to the reset, a status giving an error code is returned to the application.

The power_up_5V command can be used to generate a warm reset, if the card is already activated.

4.3.15 Card_take_off and card_insertion

These two commands are sent directly to the system processor as soon as a card extraction or insertion has occurred.

PN7462 to System	60 00 01 A0 10 C1	For a card extraction
	60 00 01 A0 11 C1	For a card insertion

4.3.16 Set_NAD

This command is used from the application layer in order to specify a SAD (source address) and a DAD) destination address) for a logical connection using T=1 protocol as defined in ISO/IEC 7816-3. The default value is 00 and will be kept until the send NAD command has been notified to the PN7462. Any NAD submission where SAD and DAD are identical (except 00) will be rejected. If bits b4 or b8 of the NAD required are set to 1 (VPP programming) the NAD will be rejected.

The NAD shall be initialized before any information exchange with the card using T=1 protocol, otherwise and error message will be generated.

Example:

System to PN7462	60 00 01 A5 NAD LRC

PN7462 to System	60 00 00 A5 C5

Where NAD is the new value of NAD immediately taken into account.

4.3.17 Idle_mode

This command is used to set the controller in idle mode. The card, if activated, has its clock (CLK) set to high or low level, depending on the parameter, but is still active.

To wake up the device, the command has to be sent again with the ClockStop parameter set to 00.

Example:

System to PN7462	60 00 02 A9 CS CL LRC
PN7462 to System	60 00 00 A9 C9

Where:

- CS: Clock Stop parameter. 00 to enable the clock, and 01 to stop the clock.
- CL: Clock Level when it stops. 00 to stop at low level and 01 to stop at high level.

4.3.18 Get_reader_status

This command is used to check the status of the reader.

System to PN7462	60 00 00 AA CA
PN7462 to System	60 00 01 AA PRES LRC

PRES byte indicates main slot card presence.

5 How to set up IFM L1 test tool

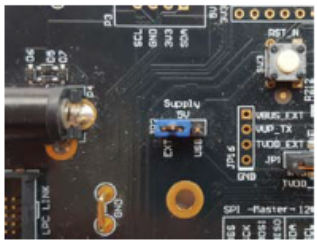
The IFM consists of 2 elements: the PNEV7462C board and the host PC, and they are connected through serial communication via RS232-TTL adapter.

In this section, we explain how to set up and program the PNEV7462C board, how to set the connection between the board and the PC, and how to send ALPAR commands to the board with the SCRTester.

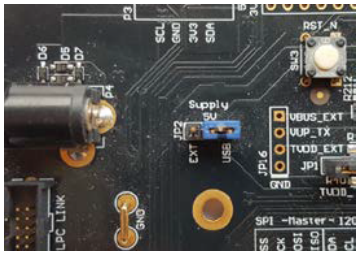
5.1 Set up the PNEV7462C board

For proper jumper setup and power-up of the PNEV7462C board, see the PN7462 family quick start guide (UM10883).

The PNEV7462C can be powered either from an external off-board power supply on the DC power connector P4 or from the USB port on connector X3. Jumper setting JP2 needs to be done to select the power source, see Figure 2.



(1) External power supply selected



(2) USB power supply selected

Figure 2. PNEV7462C board power source configuration

After setting the JP2 jumper, connect either the DC power connector on P4 or the USB connector on X3. When powering from external DC power supply, the board needs to be supplied with a voltage of 7.5 V.

5.2 Connect PC and PNEV7462C board

The communication between the PNEV7462C board and the host PC is done through serial communication. For that, we need to connect a PC serial port with the USART interface of the PNEV7462C. An FTDI 3V3 RS232-TTL adapter is used in this example.

The USART interface can be accessed at pins JP32. Connect the FTDI cable to the JP32 pins as detailed in Table 8 and shown in Figure 3. Also connect the USB end of the FTDI cable to a USB port of the PC.

Table 8. FTDI connections to PNEV7462C

FTDI cable pin	JP32 pins
GND (black)	Any GND pin
TXD (orange)	A (HSU_RX)
RXD (yellow)	B (HSU_TX)

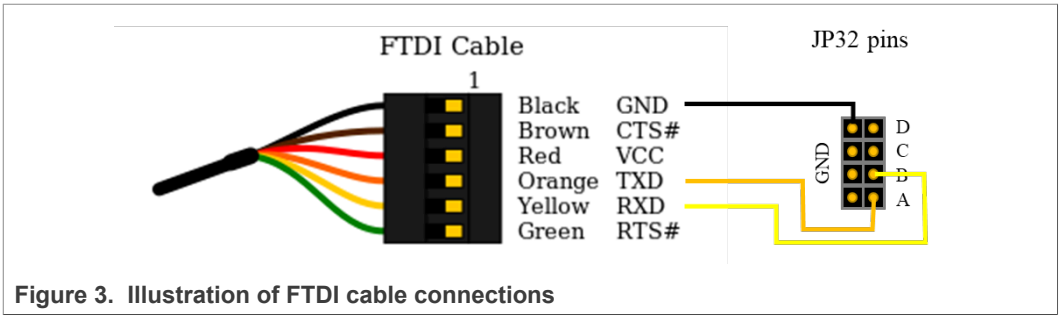


Figure 3. Illustration of FTDI cable connections

5.3 Program the PNEV7462C board

5.3.1 Download and install MCUXpresso IDE

The provided project with the ALPAR implementation was developed in MCUXpresso IDE and is provided as a MCUXpresso IDE project.

Go to MCUXpresso-IDE and follow the process to download the MCUXpresso IDE v11.4.0

Once downloaded, run the downloaded executable file, and follow the instructions to install the IDE. After the installation, create a directory where the workspace will be placed. Open MCUXpresso IDE and select the workspace directory (see Figure 4).

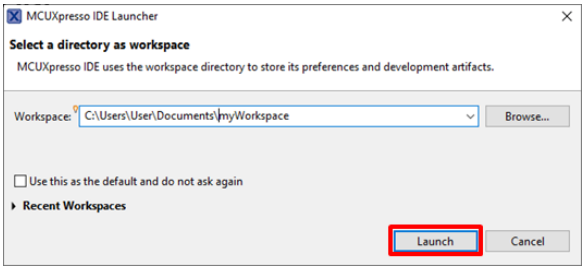


Figure 4. Workspace directory selection

5.3.2 Import SW project

Unpack the file containing the SW project. The zip file is called *mobileknowledge-alpar-implementation-on-pn7462-e3454159eb8a v1.0.zip*.

On the quickstart panel, click “Import project(s) from the file system…” and select the root directory of the unpacked zip file.

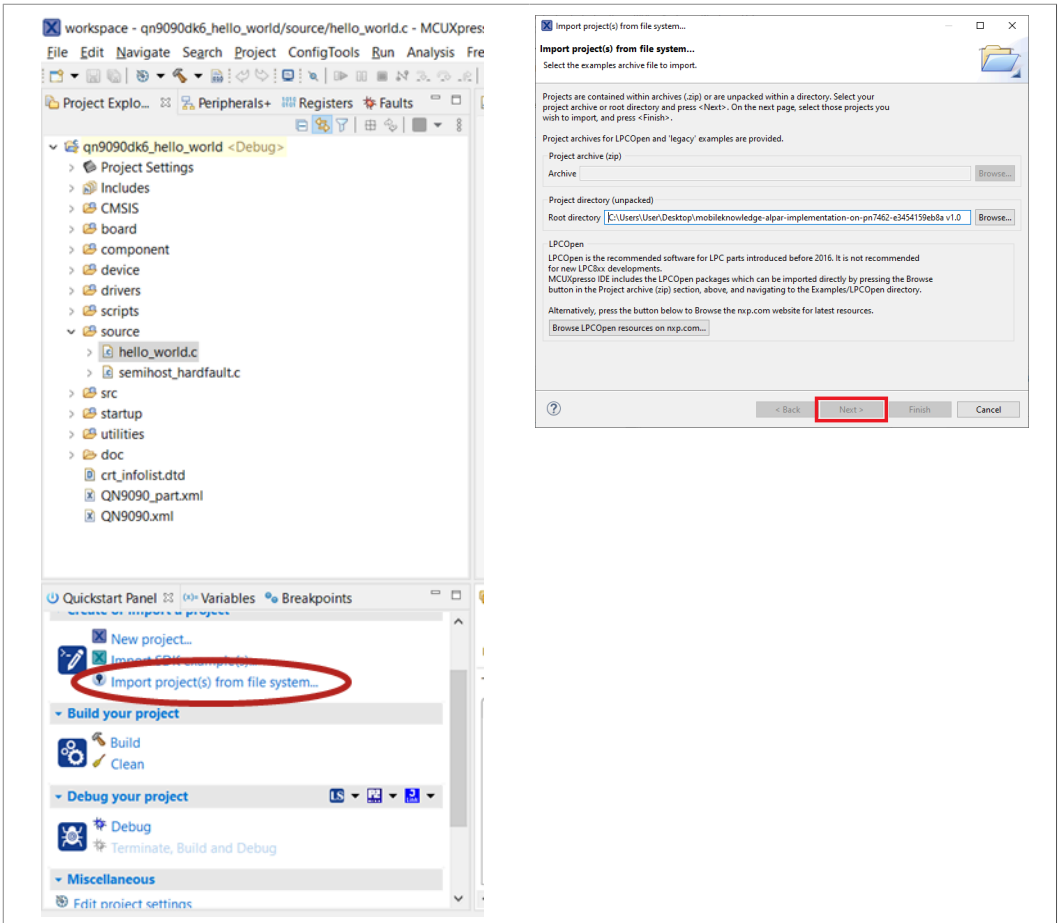


Figure 5. Project Import

After clicking "Next", check the box for the PN7462_ex_phExCTEMVCo project and uncheck the “Copy projects into workspace” checkbox. Finally click "finish".

Once the project is imported, select the build configuration for the project by clicking the Manage Configurations button and selecting the desired build configuration.

Then, right-click the project name on the left in the workspace navigation bar and click build project. This builds all the files and generates the corresponding files to program the board.

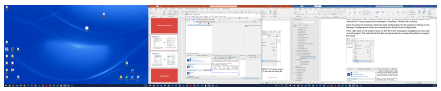


Figure 6. Configuration

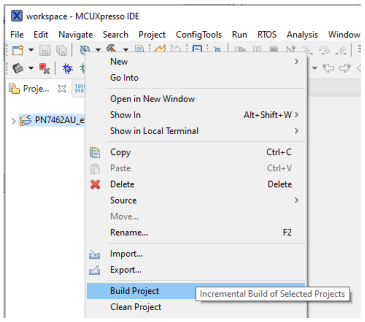


Figure 7. Project Build

Finally, after building the project, one can program the PNEV7462 board. To run and debug the project on the PNEV7462 board, first connect an LPCLink2 to the PC using a USB cable, and also connect it to the PNEV7462 using an SWD cable, connecting LPCLink2 connector J7 with PNEV7462C board SWD connector JP4. After that, in the Quickstart Panel, click LinkServer drop down list button and click “Debug using LinkServer probes”. Acknowledge the selection of the CMSIS-DAP probe. This begins a debug session for the project.

Once the Debug Session is set, click the Resume button (or F8) so the project runs.

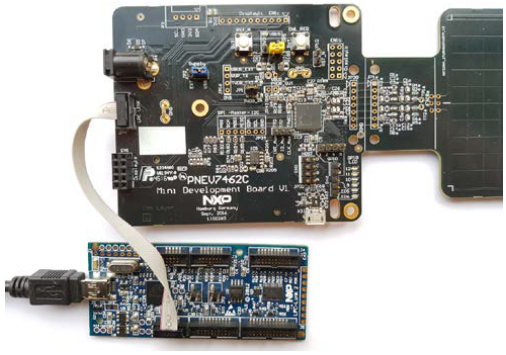


Figure 8. LPC-Link2 debug probe connected to the PNEV7462C

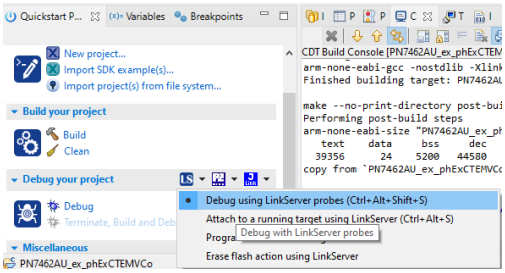


Figure 9. Project debug launch

5.4 SCRTester

SCRTester is a PC software allowing the user to communicate with an NXP smart card reader (PN7462 for instance) through an RS-232 serial link.

5.4.1 Run and install SCRTester

Run the SCRTester installer, and once installed run the SCRTester application.

5.4.2 Configure SRCTester

In the New button dropdown list, select Serial connection.

In the protocols section, select ALPAR protocol.

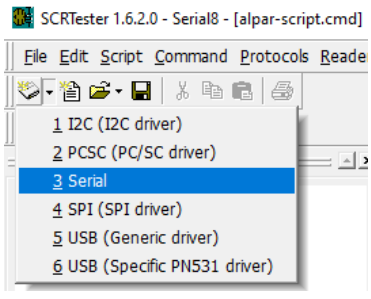


Figure 10. Setting for serial connection

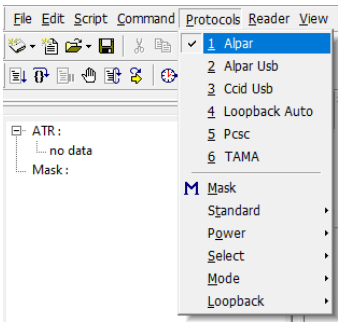


Figure 11. Selecting ALPAR protocol

In the Reader menu, configure the connection with parameters detailed in Table 9. After the configuration, in the same menu select the COM port corresponding to the COM port of the serial connection with the PNEV7462C board and click Connect.

Table 9. FTDI connections to PNEV7462C

Baud Rate (Bauds)	Parity Bit	Stop bit
115200	No parity	1 stop bit

If the PNEV7462C board is well programmed and well powered, and the FTDI cable is well connected, one can easily verify the setup by clicking the “Mask Number” button. It sends to the PNEV7462C a command requesting the FW version of the program, and the board answers with the FW version coded in ASCI.

To read more on SCRTester use and configuration, read SCRTester user manual.

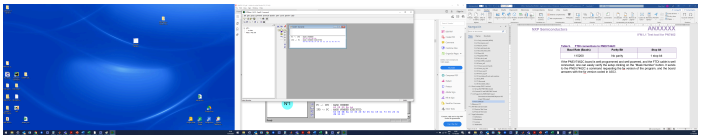


Figure 12. Mask Number button and FW version response

5.4.3 Run command script

To validate the implementation of the ALPAR protocol, a command script is provided with filename *alpar_script.cmd*.

Open the script and configure the SCRTester in command mode by going to the Script menu and clicking Commands. In this mode, the SCRTester completes the command with the header byte and the length bytes.

Double-click the first line and go through the script command by command by clicking the Step button. Follow the instructions written on the comments of the script and compare the responses with the expected ones detailed in the comments.

Figure 13. Step button

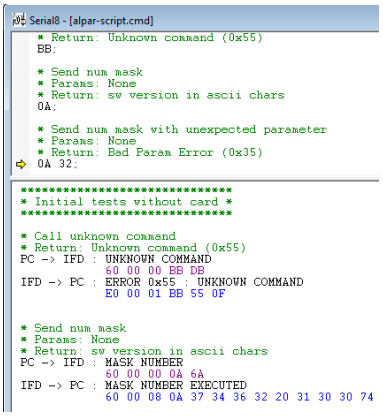


Figure 14. Example of script commands run

5.4.4 Run EMVCo loopback

PN7462C board SW includes a script that implements EMVCo IFM L1 Loopback according to version 4.3c of the specifications. The script execution can be triggered from

the SCRTester by sending the specific ALPAR command. For more information, refer to Section 4.3.9.

6 Reference ICS

Reference ICS can be found attached at the end of the current document. Please note that there are some fields that should be filled out before submitting.

Part of the ICS for EMV 4.3c relative to SW implementation can be found below.

Table 10. Implemented Protocol Types

Item number	Protocol Type	Reference	Status	Support (Y/N)
1	ATR	EMV 4.3c, §8	m	Y
2	Character protocol T=0	EMV 4.3c, §9.2.2	m	Y
3	Block protocol T=1	EMV 4.3c, §9.2.4	m	Y
4	Transport of APDUs by T=0	EMV 4.3c, §9.3.1	m	Y
5	Transport of APDUs by T=1	EMV 4.3c, §9.3.2	m	Y

Table 11. General Protocol Information

Item number	Parameter	Reference	Status	Support (Y/N)
1	Does the terminal reject an ICC returning TCK in a T=0 only ATR?	EMV 4.3c, §8.3.4		N
2	Does the terminal continue the card session as soon as all characters indicated in T0 and/or TDi have been received?	EMV 4.3c, §8.3.4		Y
3	Implicit negotiable mode (without PPS)	EMV 4.3c, §8.3.3.1	m	Y
4	Explicit negotiable mode (with PPS)	EMV 4.3c, §8.3.3.1	o	N

Table 12. Parameter Values for ATR

Item number	Parameter	Reference	Status	Support
1	When TA2 is returned with b5=0, is the IFM able to support TA1 values that are not in the range ‘11’ to ‘13’?	EMV 4.3c, §8.3.3.1	o	No
2	Is the IFM able to support TC2 values different from ‘0A’?	EMV 4.3c, §8.3.3.7	o	No

Table 13. Protocol T=1 – Implemented Features

Item number	Function	Reference	Status	Support
1	Node addressing with NAD≠”00”	EMV 4.3c, §9.2.4.1.1	o	Y
2	Behavior on BWT excess	EMV 4.3c, §9.2.5.1	m	Deactivate
3	Behavior on WTX excess	EMV 4.3c, §9.2.5.1	m	Deactivate
4	Behavior on CWT excess	EMV 4.3c, §9.2.5.1	m	Deactivate

Table 13. Protocol T=1 – Implemented Features*...continued*

Item number	Function	Reference	Status	Support
5	Behavior on I-block when LEN='FF'	EMV 4.3c, §9.2.5.1	m	Request for block retransmission

Table 14. Block Types

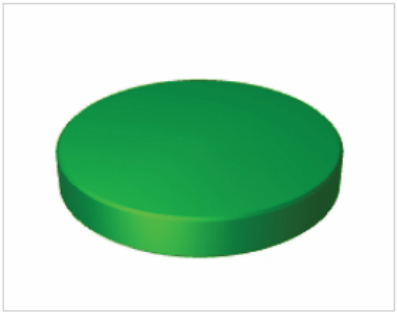
Item number	Block	Reference	Status	Support
1	S(RESYNCH request)	EMV 4.3c, §9.2.5.1 / 8 and NOTE	o	No
2	Behavior on BWT excess	EMV 4.3c, §9.2.5.1 / 9 and NOTE	o	No

Table 15. Parameter Values for T=1

Item number	Parameter	Reference	Status	Support
1	LEN of INF in the range ['0', …, '254']	EMV 4.3c, §9.2.4.1.1 reference specification	m	Yes

7 IFM test tool test results

7.1 Electrical test cases



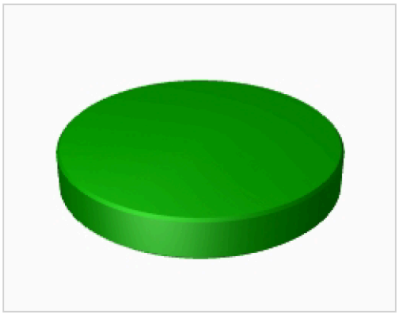
	Test Case Executions	102	
✓	Passed	102	100%
✗	Failed	0	0%
?	Inconclusive	0	0%
	Total Duration	00:15:25	

Figure 15. Electrical Test Cases Result Summary

All electrical test cases passed successfully. Result summary can be seen in the figure above.

Full report can be found under the name '*211027 - DETMOK018F Electrical tests summary report.pdf*'.

7.2 Protocol test cases



	Test Case Executions	665	
✓	Passed	665	100%
✗	Failed	0	0%
?	Inconclusive	0	0%
	Total Duration	00:56:00	

Figure 16. Protocol Test Cases Result Summary

All protocol test cases passed successfully. Result summary can be seen in the figure above.

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