

# GET AHEAD WITH NXP'S PN5180 FRONTEND - DESIGN YOUR POS TERMINAL WITH EMVCO (L1) CERTIFICATION

## Session 1: EMVCo L1 Contactless certification process

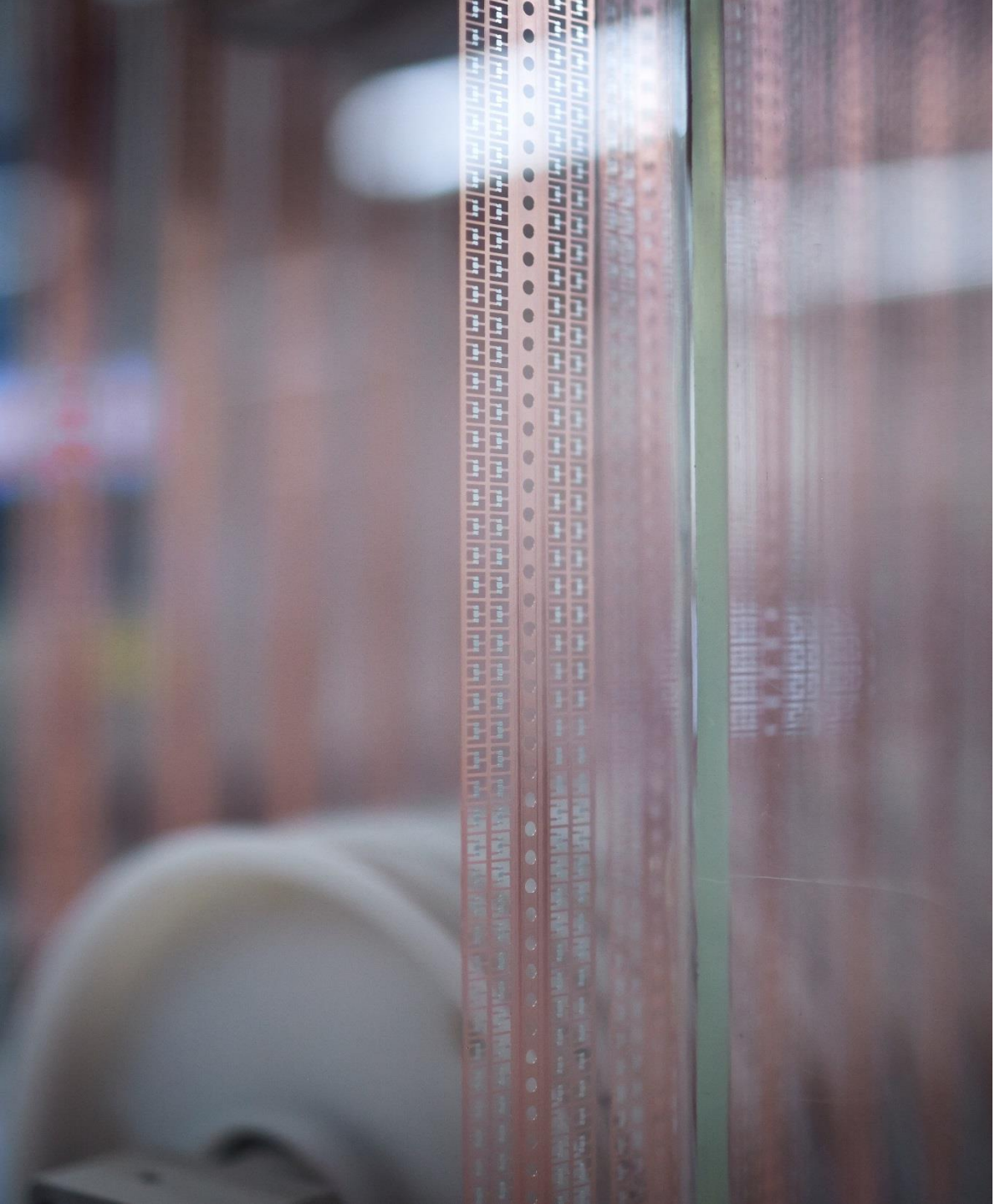
PABLO FUENTES  
JUNE 2018



PUBLIC



SECURE CONNECTIONS  
FOR A SMARTER WORLD



## Get ahead with NXP's PN5180 Frontend - Design your POS terminal with EMVCo (L1) certification

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Session I, 28<sup>th</sup> June

### **EMVCo L1 Contactless certification process**

<https://attendee.gotowebinar.com/rt/3034896575464625666>

Session II, 17<sup>th</sup> July

### **PN5180 for EMVCo L1 Contactless certification**

<https://attendee.gotowebinar.com/rt/5226533311901393666>





# Agenda - Session I

## EMVCo L1 Contactless certification process

- EMV® Introduction
- EMV® Contactless specifications
- EMV® Analog L1 Tests
- Analog L1 Terminal Type Approval
- NXP Product portfolio for POS
- More support



# EMV Introduction





# Key challenges in POS design



## Performance

Guarantee a good user experience



## Interoperability

Device should work seamlessly with all type of cards in the market



## Security

Ensure a secure transaction

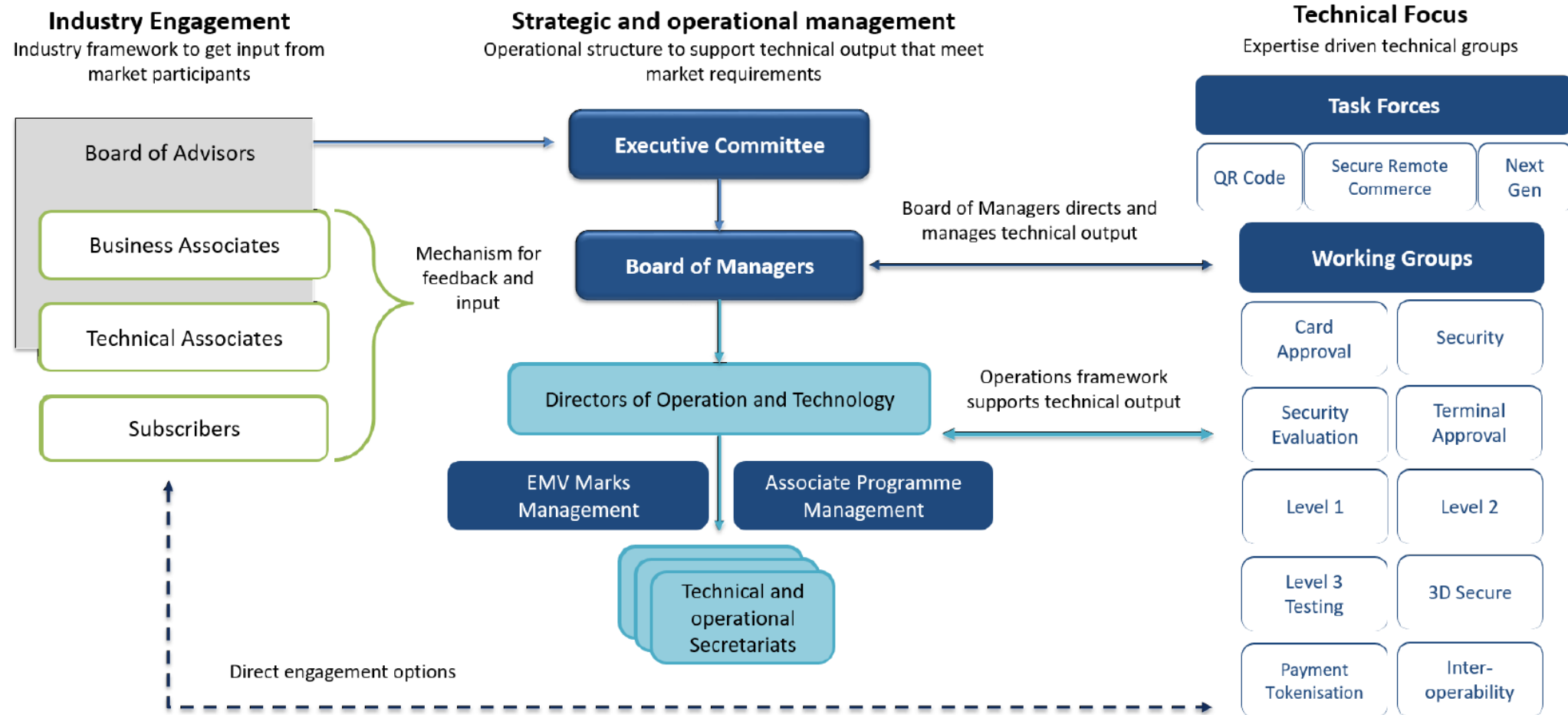


***EMV Specifications***  
*administered by EMVCo®*

Group of specifications for payment infrastructures based on smart cards. They were created to facilitate worldwide interoperability and acceptance of secure payment transactions.

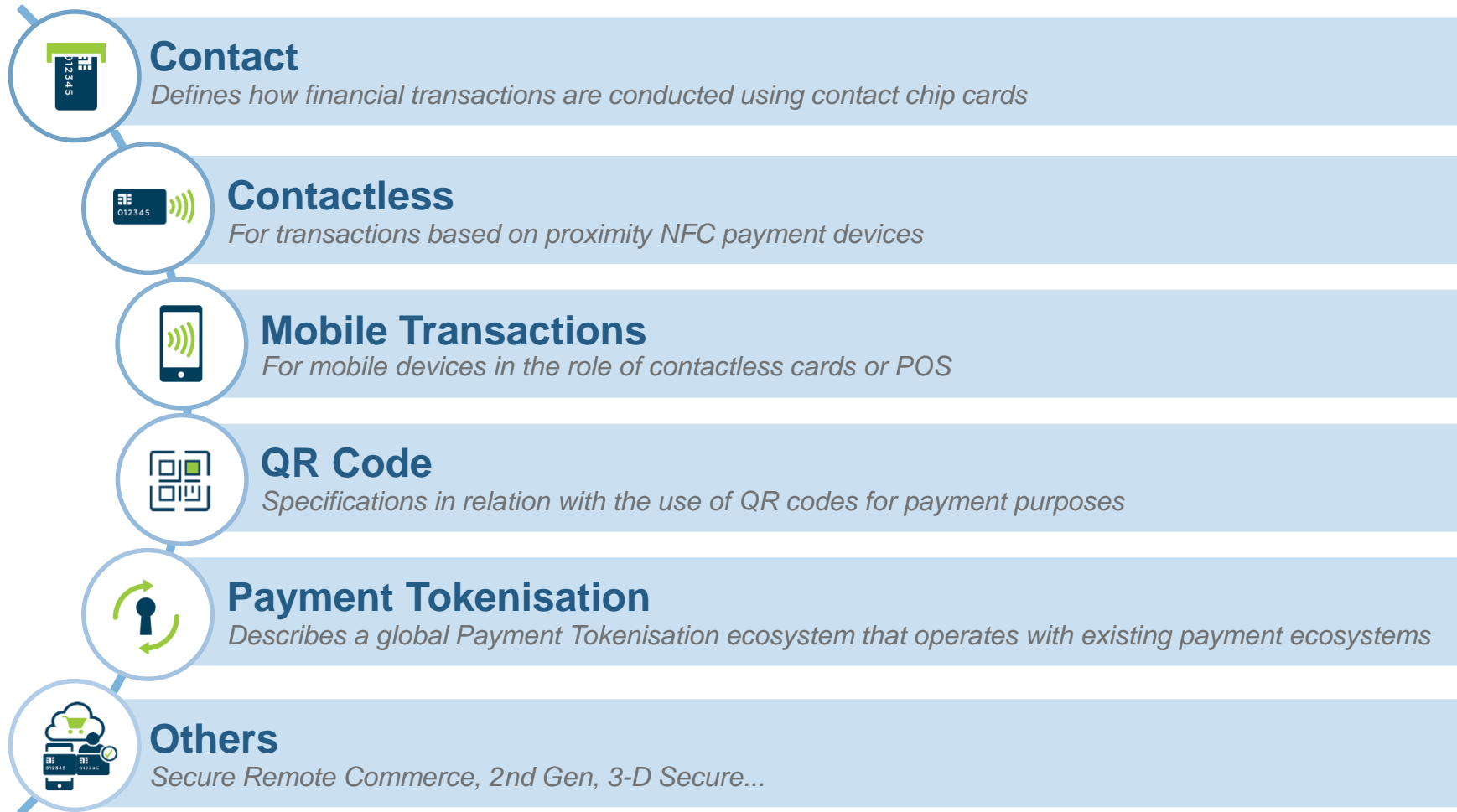


# About EMVCo



Source: [www.emvco.com](http://www.emvco.com)

# EMV technologies



Source: [www.emvco.com](http://www.emvco.com)

# EMV Contactless specifications v2.6





# Contactless specifications

## Structure

### Main documents:

#### Book A - Architecture and general requirements

Overview of the POS system architecture, instructions and parameters exchanged with the Entry Point, ...

#### Book B - Entry point specification

Entry Point: Software in the POS responsible of the transaction pre-processing, protocol activation and interaction with the kernels.

#### Book C - Kernel specifications (6 levels)

Kernel: software in the POS System that processes certain contactless transactions.

#### L1 Specifications for Payment Systems, EMV Contactless Interface Specs

Describes the minimum functionality required of PICCs and PCDs to ensure correct operation and interoperability.

### Other documents:

#### EMVCo Contactless Type Approval: PCD Test Bench and Test Case Requirements

Requirements for procedures and test equipment used for testing the analogue/digital interface of the PCDs.

#### PCD L1 Device Test Environment definition

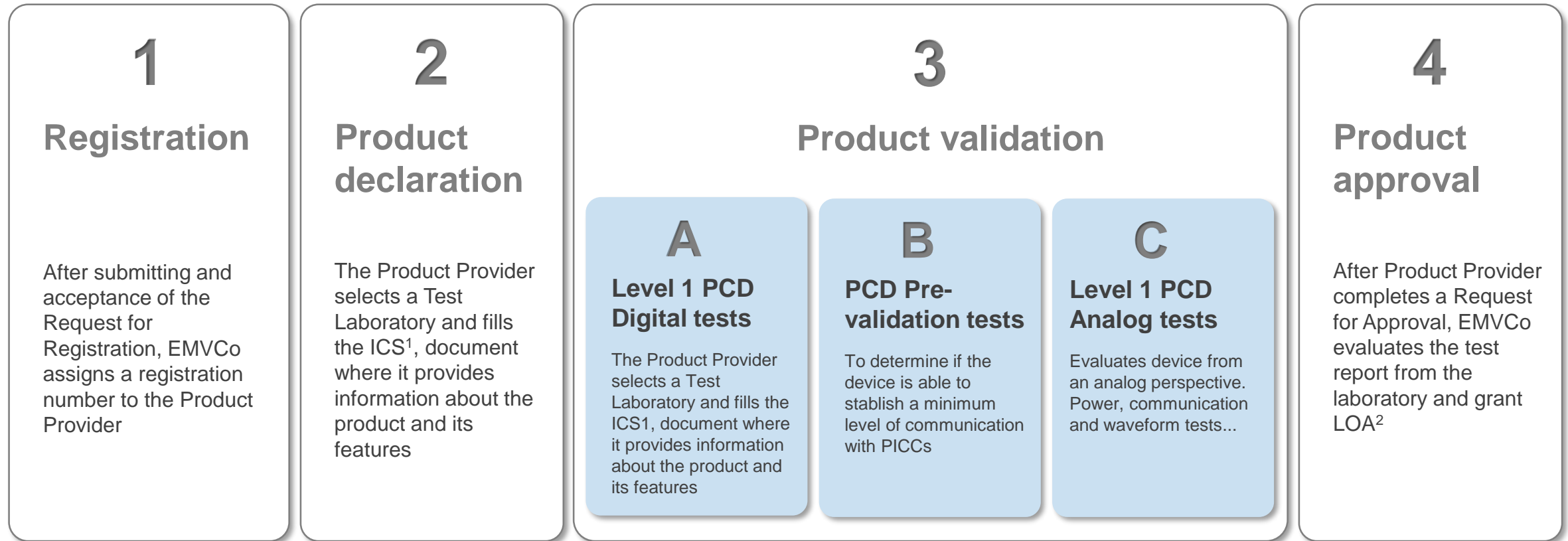
Requirements for the DTE, application that the vendor needs to develop for the Type Approval Tests.

#### Contactless symbol reproduction requirements

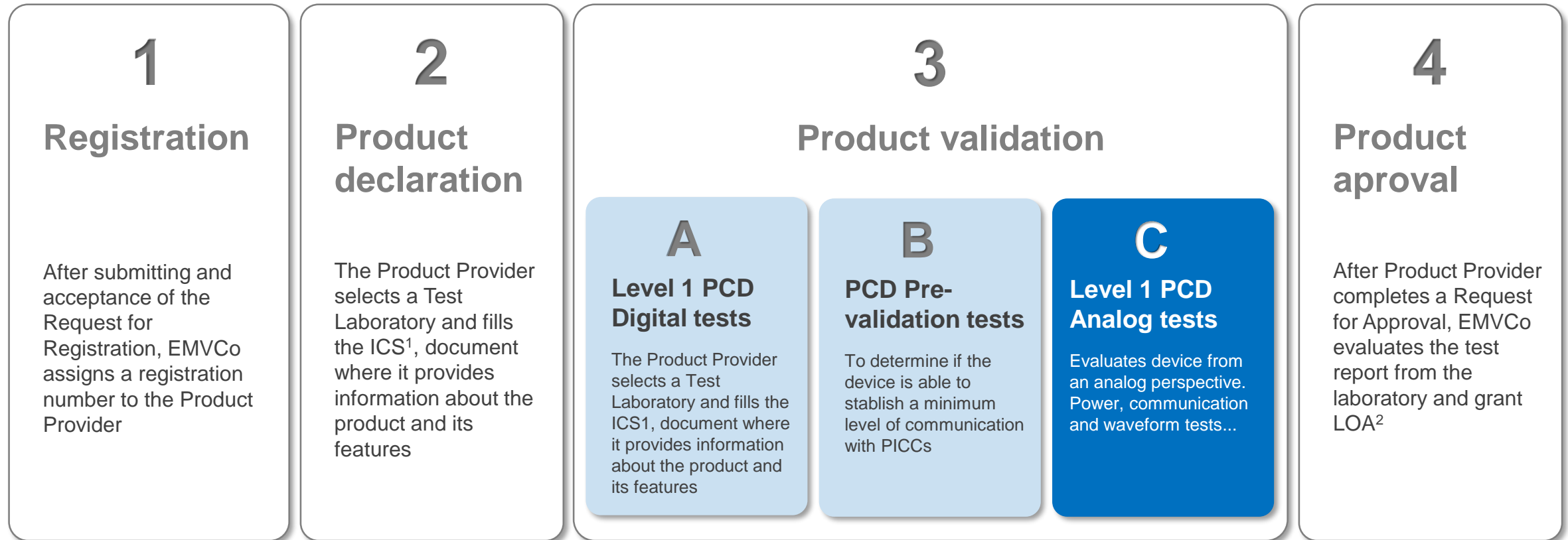


# PCD L1 Type Approval

# PCD Level 1 Approval Process



# PCD Level 1 Approval Process



<sup>1</sup>ICS - Implementation Conformance Statement

<sup>2</sup>LOA - Letter of Approval

# EMV Analog L1 Tests



# EMV Analog L1 Tests

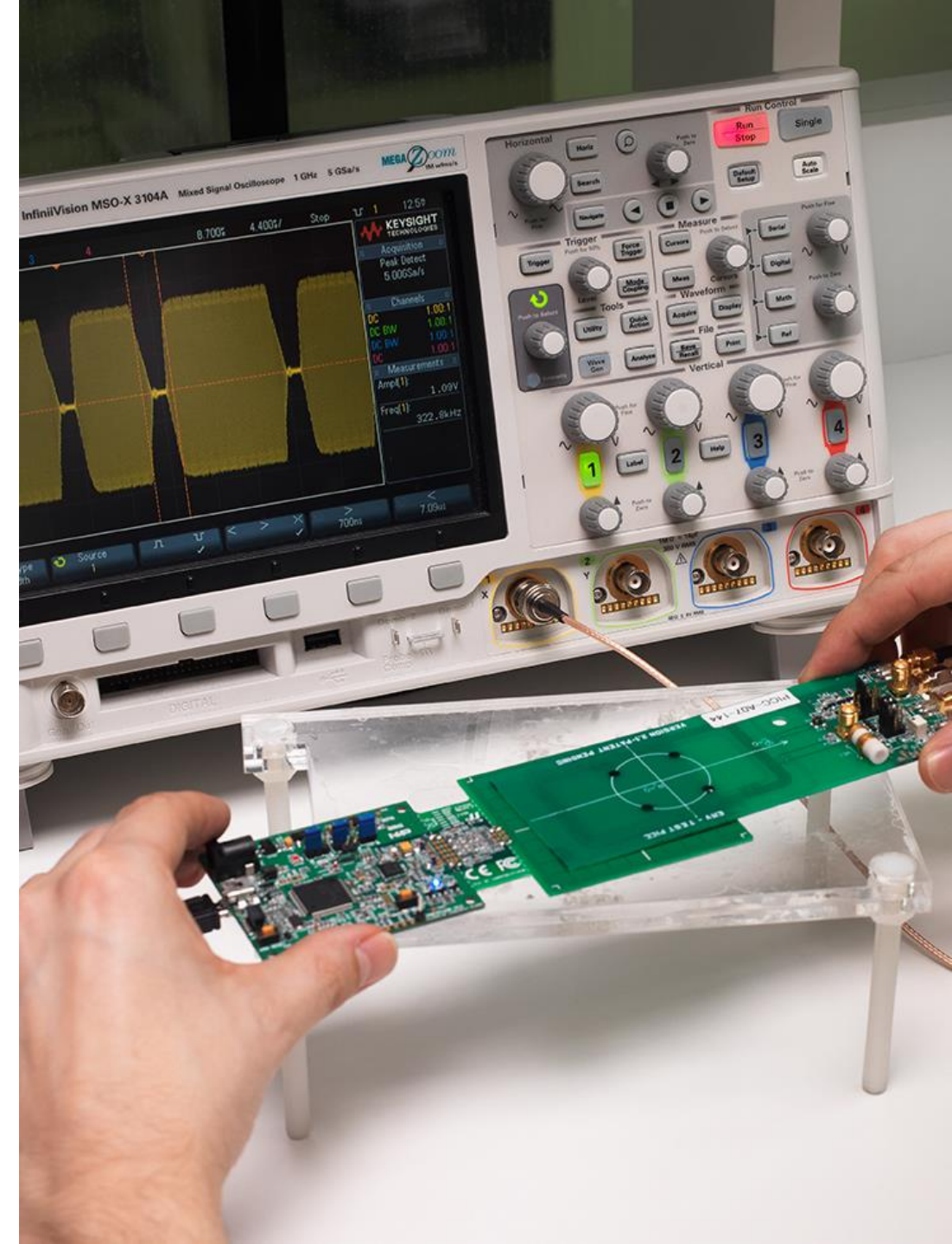
## Content

### Environment

- Device Test Environment
- Contactless Symbol
- Positioning conventions
- EMVCo Reference PICC

### Tests groups

- Power tests (Non-linear)
- Waveform tests (Linear)
- Responsiveness/Communication tests (Non-linear)
- Other tests





# EMV Analog L1 Tests

## Device Test Environment

### Definition

Software application that is used to control the device during the testing process for Type Approval

### Characteristics

- Developed by the Product Provider
- Submitted to the Tests Laboratory along with the samples
- Includes a subset of applications (modes of operation):
  - PCD Controls
  - Pre-validation test application
  - Loopback application
  - Transaction Send application

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  - Loopback application
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Mode of operation that implements a list of commands that the Laboratory tester can execute in a one-shot mode or in an endless mode.

Commands included:

- Carrier On/Off
- Polling
- RF Reset
- WUPA
- WUPB
- WUPA → RATS
- WUPB → ATTRIB

# EMV Analog L1 Tests

## Device Test Environment

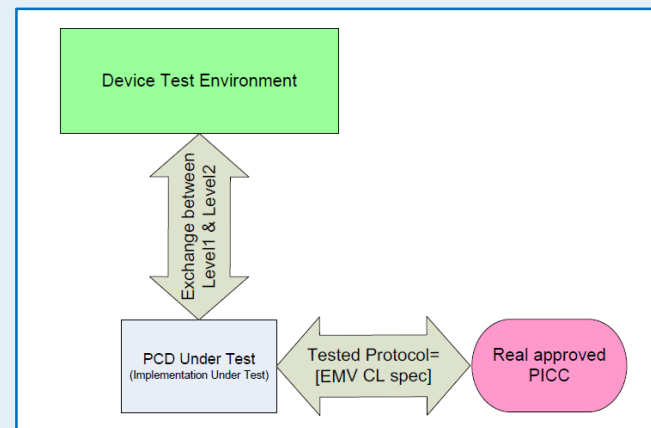
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  - Transaction Send application

Application to test the communication of the device with actual and EMV Contactless compliant PICCs.



# EMV Analog L1 Tests

## Device Test Environment

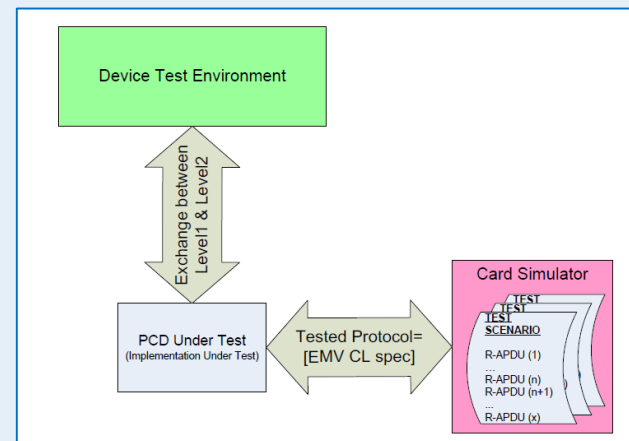
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  - Transaction Send application

Main application used for the Digital and Analogue tests. It is used to tests the communication with a Card simulator.



# EMV Analog L1 Tests

## Device Test Environment

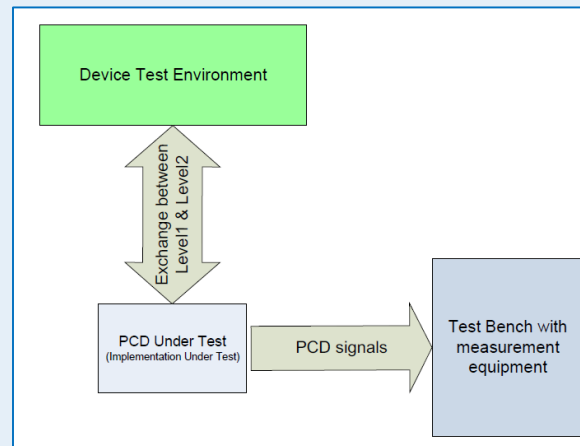
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  - PCD Controls
  - Pre-validation test application
  - Loopback application
  - **Transaction Send application** →

Application used in a part of the Analogue tests where the commands are evaluated without waiting for the PICC answer.



# EMV Analog L1 Tests

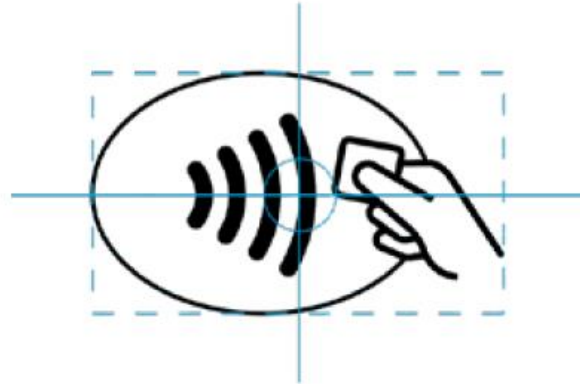
## Contactless Symbol

### Objective

- Identify the interface area where the user should tap his card to trigger transaction.
- The symbol is taken as the reference position for the tests required for Type Approval.
- Only EMVCo compliant terminals can display the Contactless symbol in the market.

### Requirements:

- The symbol has to be visible before and during the transaction process.
- It's not allowed to alter the drawing, arrangement or proportion of the elements of the symbol





# EMV Analog L1 Tests

## Positioning conventions

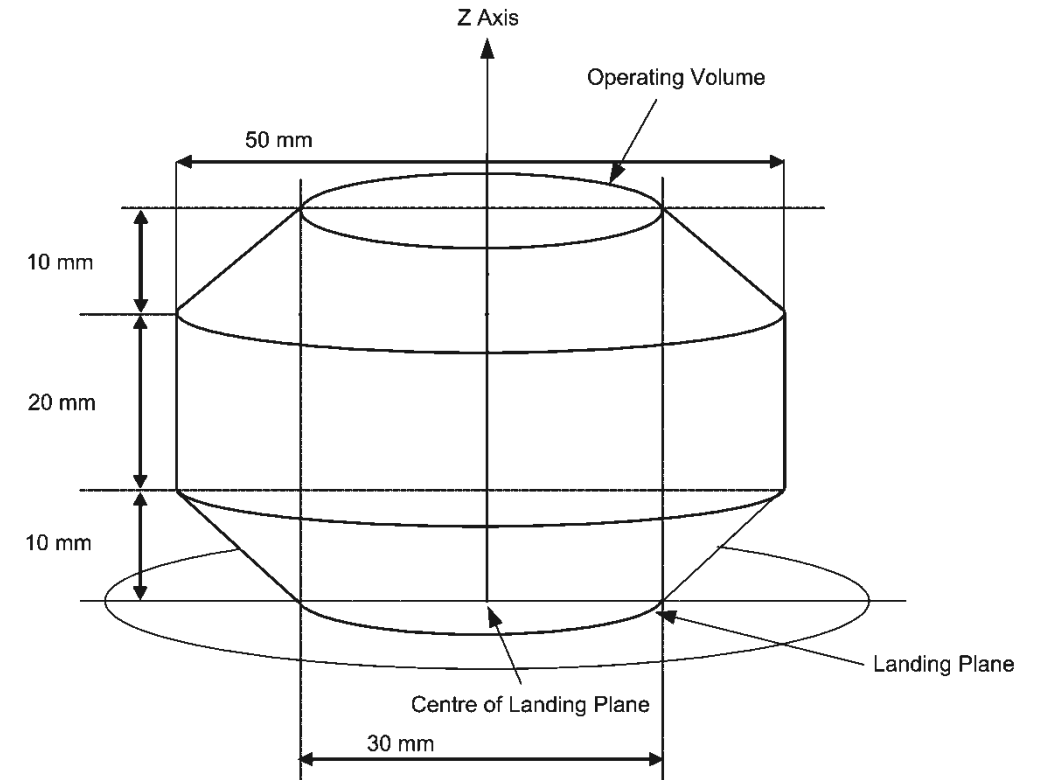
- EMV uses the Contactless Symbol as a reference to define an operating volume for the tests.
- Depending on the test case, it can be evaluated in one or multiple positions.
- Positions are expressed with 3 numbers that represents the height, radius and angle.

**(z, r,  $\varphi$ )**

z: height

r: radius

$\varphi$ : angle



# EMV Analog L1 Tests

## Positioning conventions

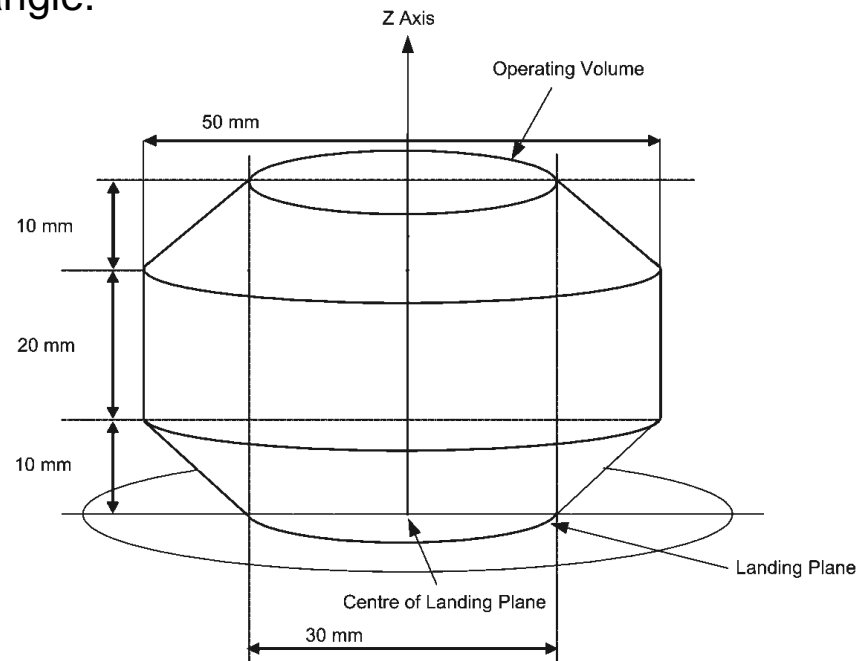
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**$(z, r, \varphi)$**

z: height

r: radius

$\varphi$ : angle



Value of Coordinate z	Value of z Identifiers for Label Points
0 mm	0
10 mm	1
20 mm	2
30 mm	3
40 mm	4

Value of Coordinate r	Value of r Identifiers for Label Points
0 mm	0
15 mm	1
25 mm	2

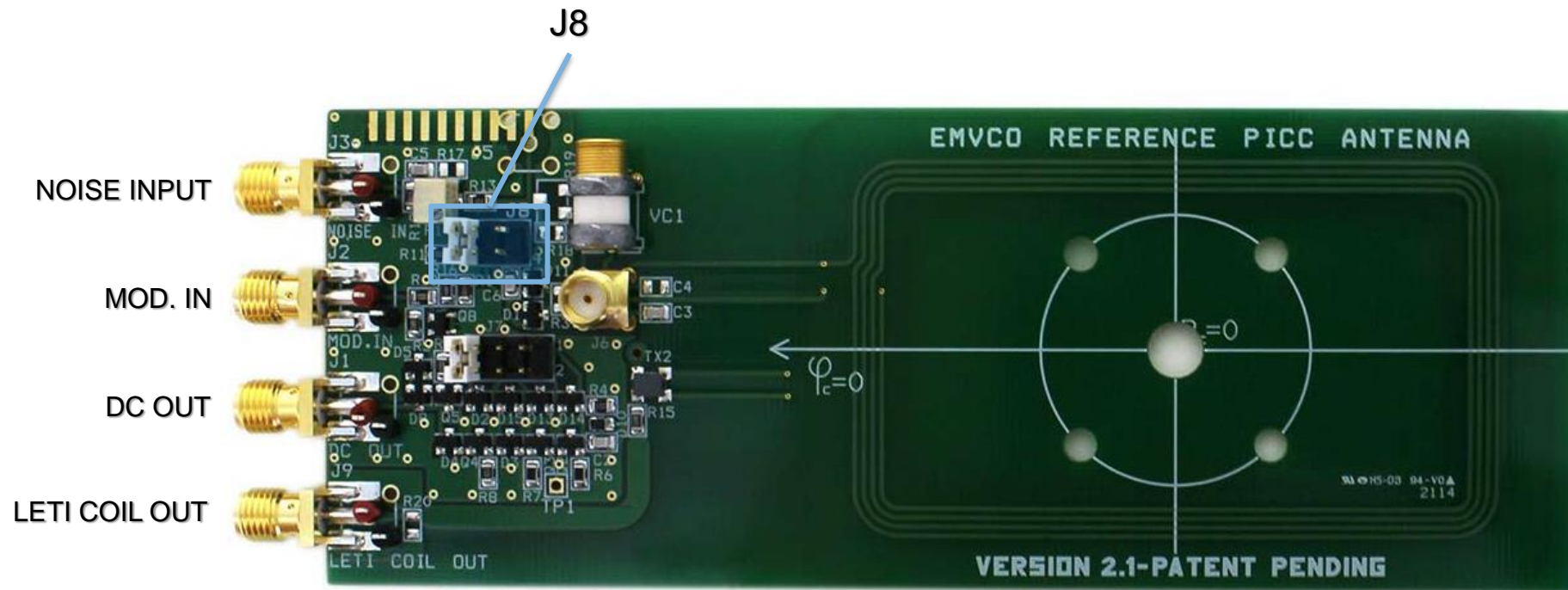
Value of Coordinate $\varphi$	Value of $\varphi$ Identifiers for Label Points
0	0
$\pi/2$	3
$\pi$	6
$3\pi/2$	9

# EMV Analog L1 Tests

## EMVCo Reference PICC

### Definition

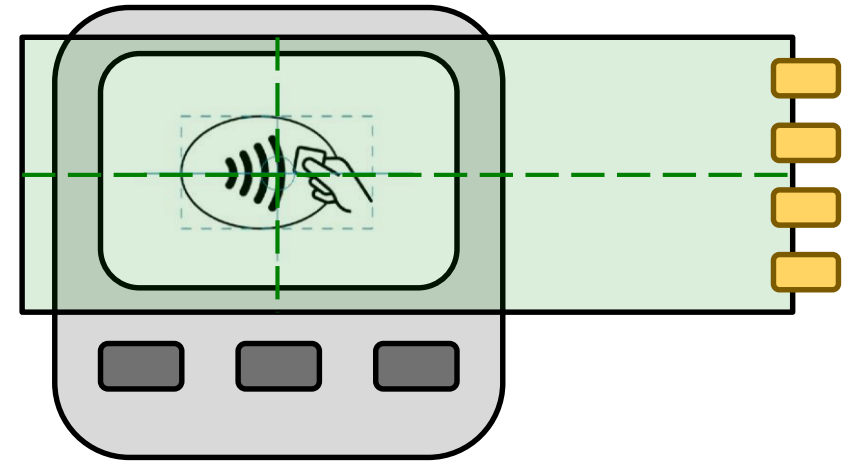
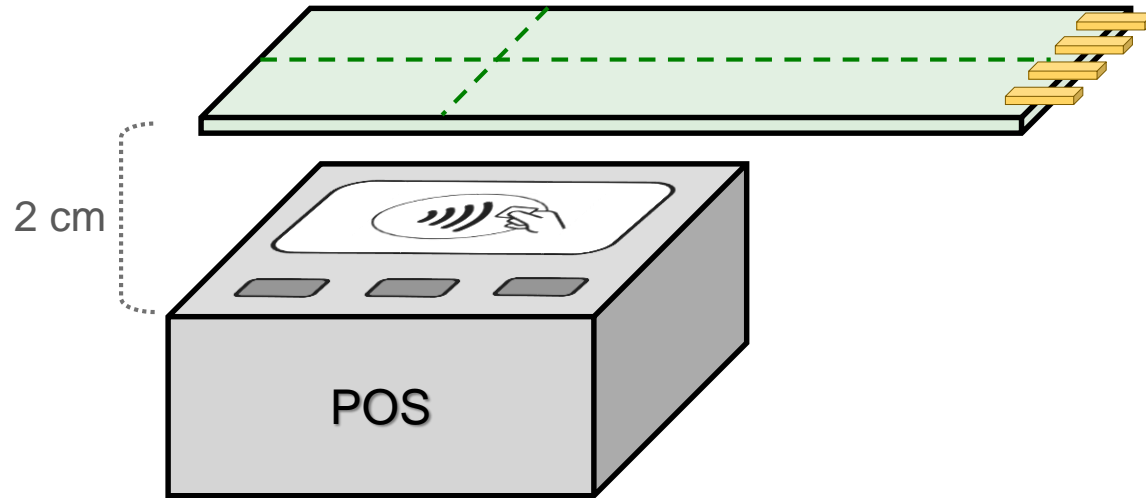
Reference antenna used to test contactless terminals. It allows us to measure the signal received from the POS and to simulate a PICC by injecting a modulated signal through one of its ports.



# EMV Analog L1 Tests

## Positioning examples

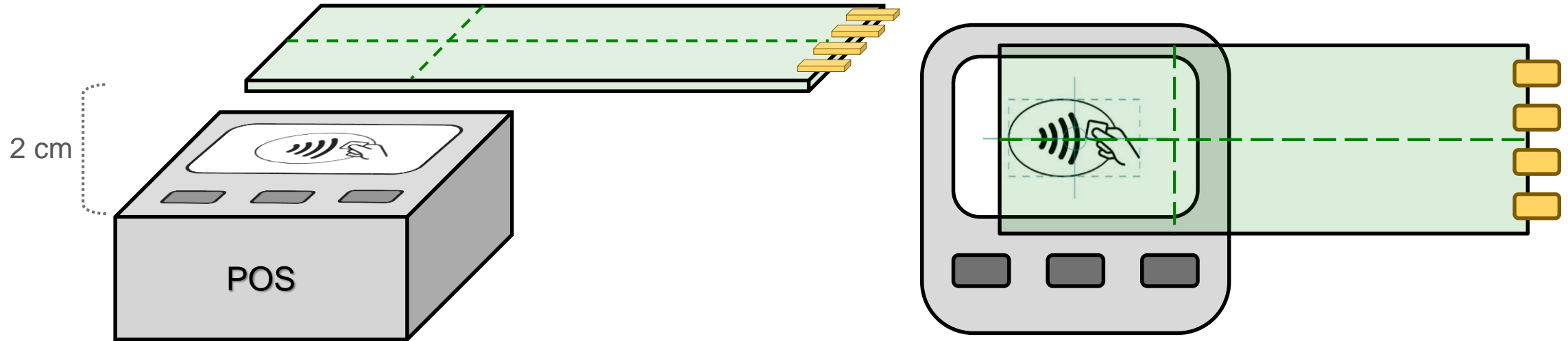
Reference PICC position (2, 0, 0)



# EMV Analog L1 Tests

## Positioning examples

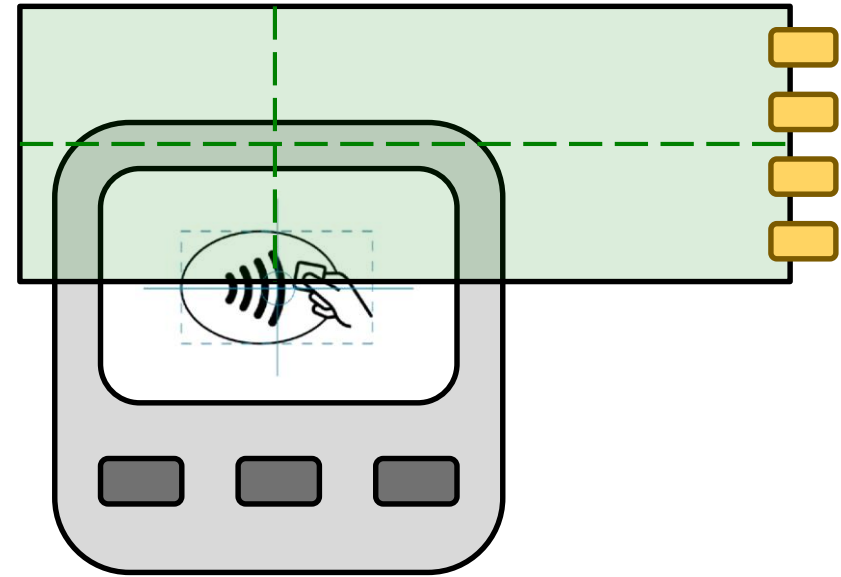
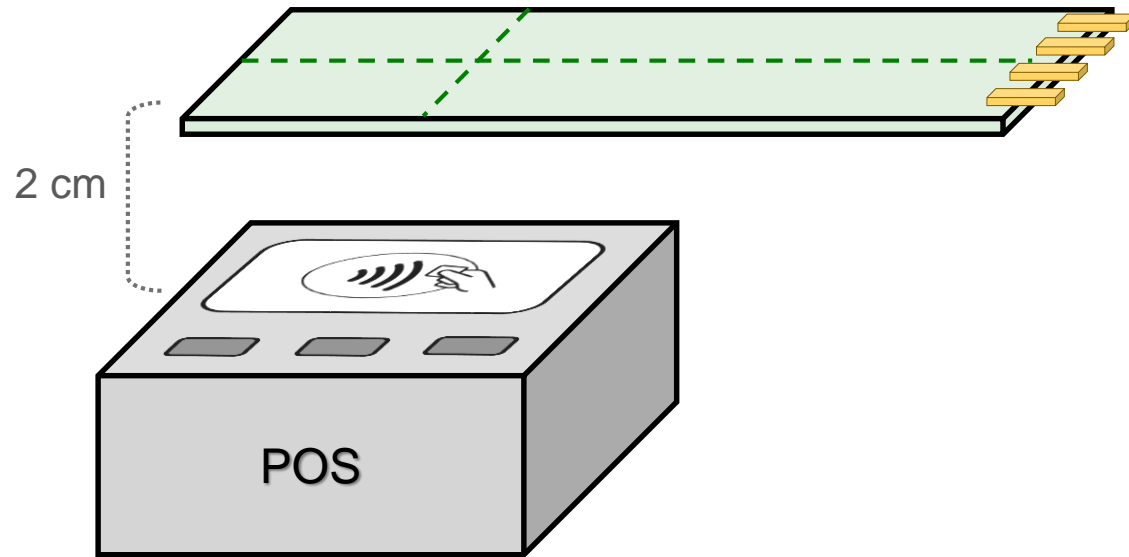
Reference PICC position (2, 2, 0)



# EMV Analog L1 Tests

## Positioning examples

Reference PICC position (2, 2, 3)

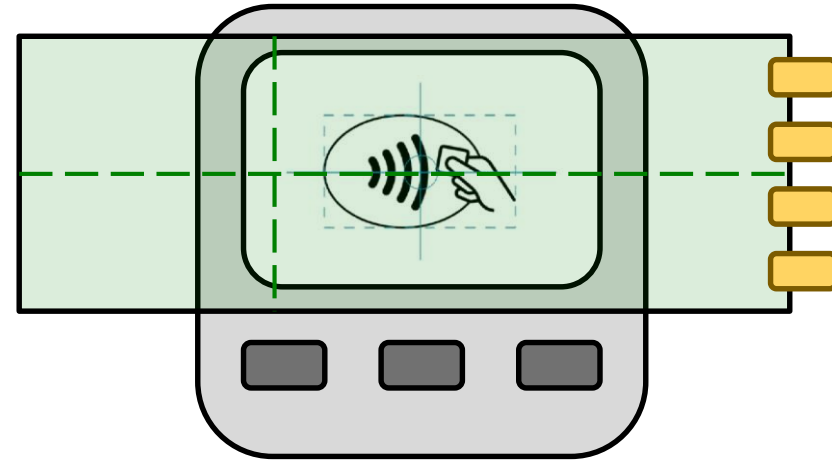
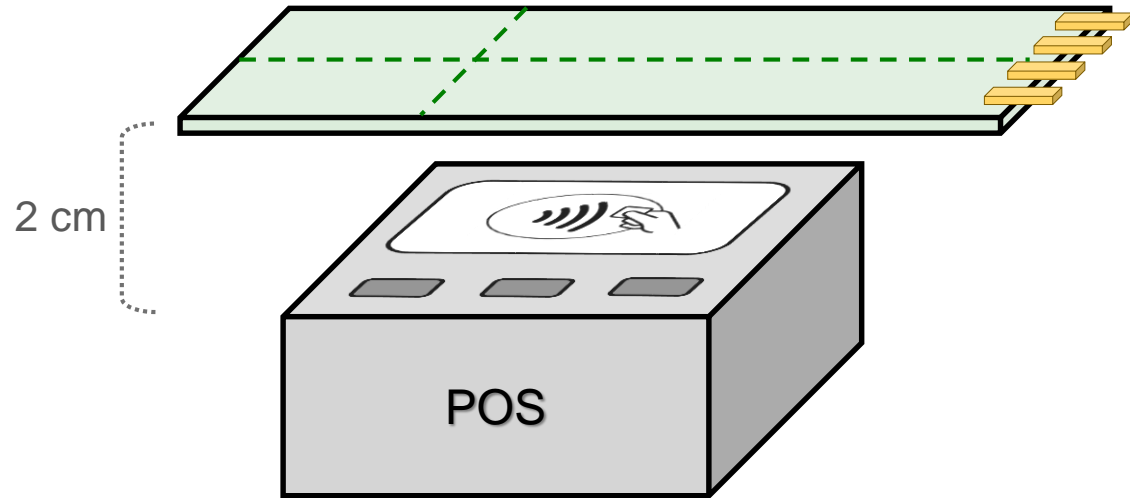




# EMV Analog L1 Tests

## Positioning examples

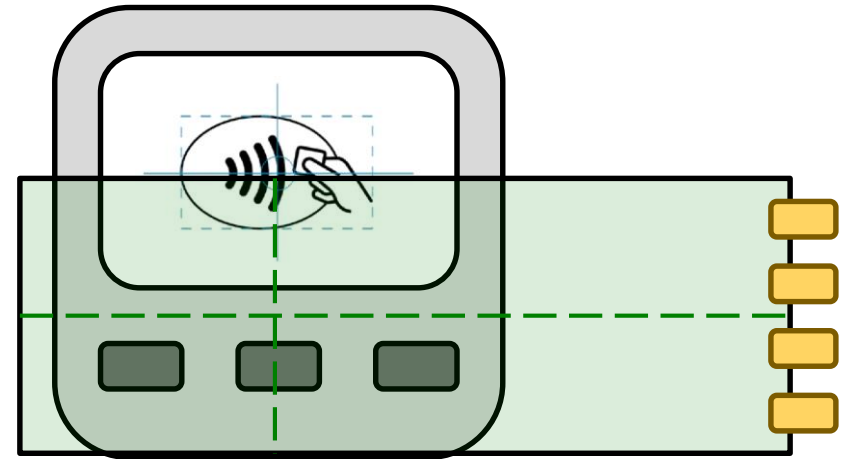
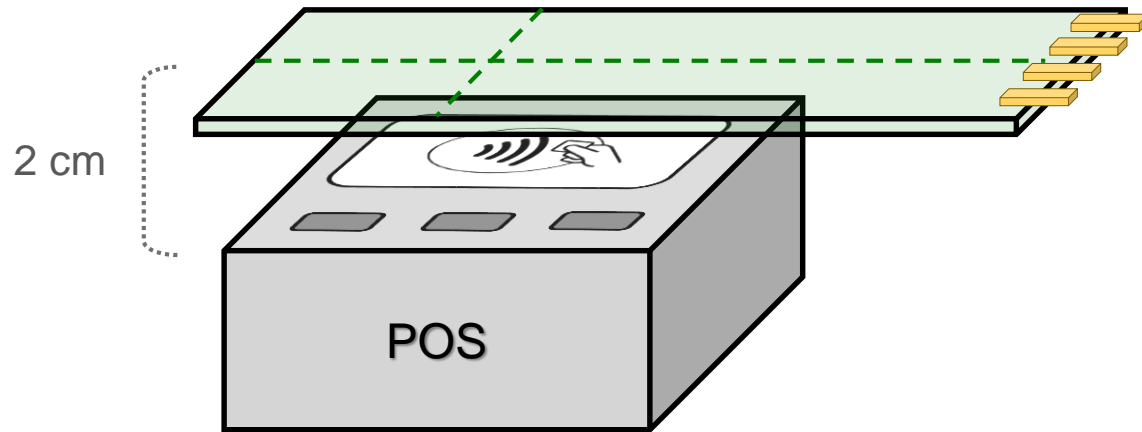
Reference PICC position (2, 2, 6)



# EMV Analog L1 Tests

## Positioning examples

Reference PICC position (2, 2, 9)



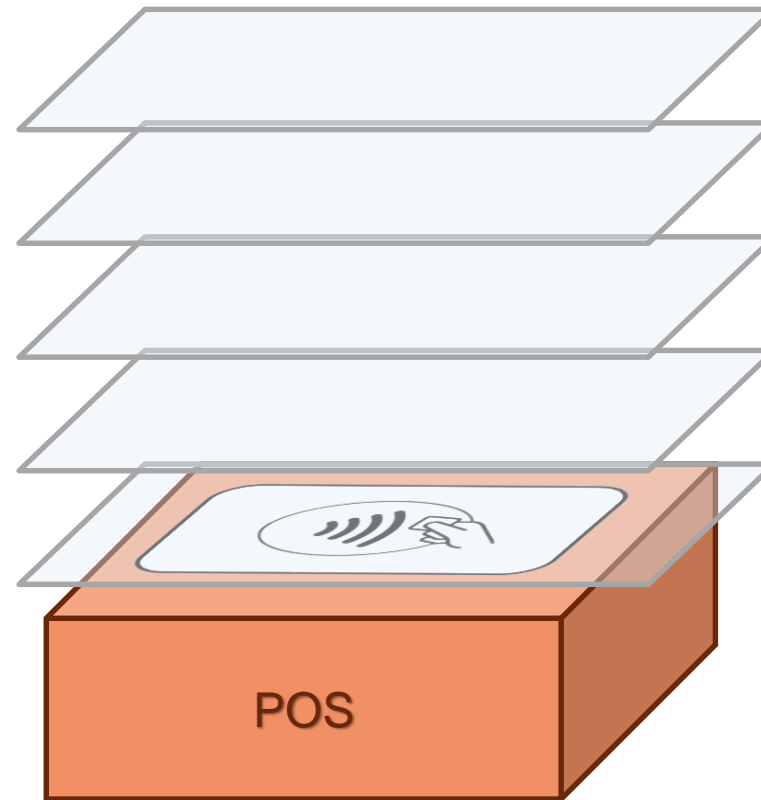
# EMV Analog L1 Tests

## *Power tests*



# EMV Analog L1 Tests

## Power tests



Z = 4

$$2,55 \text{ V} < V_{4XX} < 8,1 \text{ V}$$

Z = 3

$$2,775 \text{ V} < V_{3XX} < 8,1 \text{ V}$$

Z = 2

$$3 \text{ V} < V_{2XX} < 8,1 \text{ V}$$

Z = 1

$$3,05 \text{ V} < V_{1XX} < 8,1 \text{ V}$$

Z = 0

$$3,1 \text{ V} < V_{0XX} < 8,1 \text{ V}$$

# EMV Analog L1 Tests

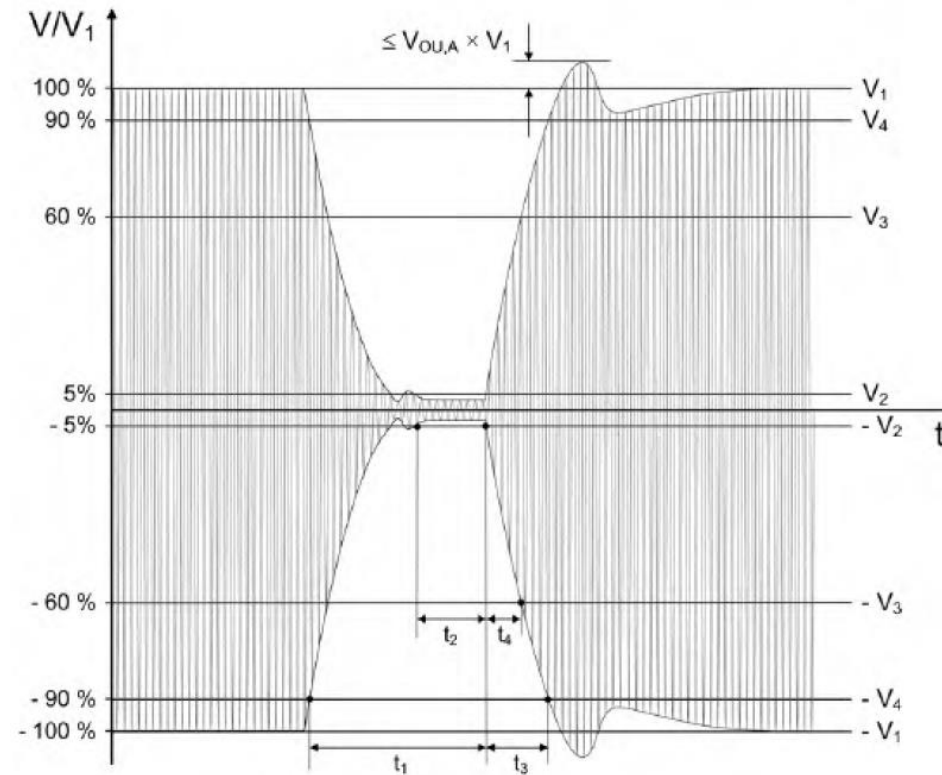
## *Waveform tests*

# EMV Analog L1 Tests

## Waveform tests

### Type A:

- TA121:  $t_1$
- TA122: Monotonic Decrease
- TA123: Ringing
- TA124:  $t_2$
- TA125:  $t_3$  and  $t_4$
- TA127: Monotonic Increase
- TA128: Overshoot



**EMVCo transactions are only performed at 106 kbps**

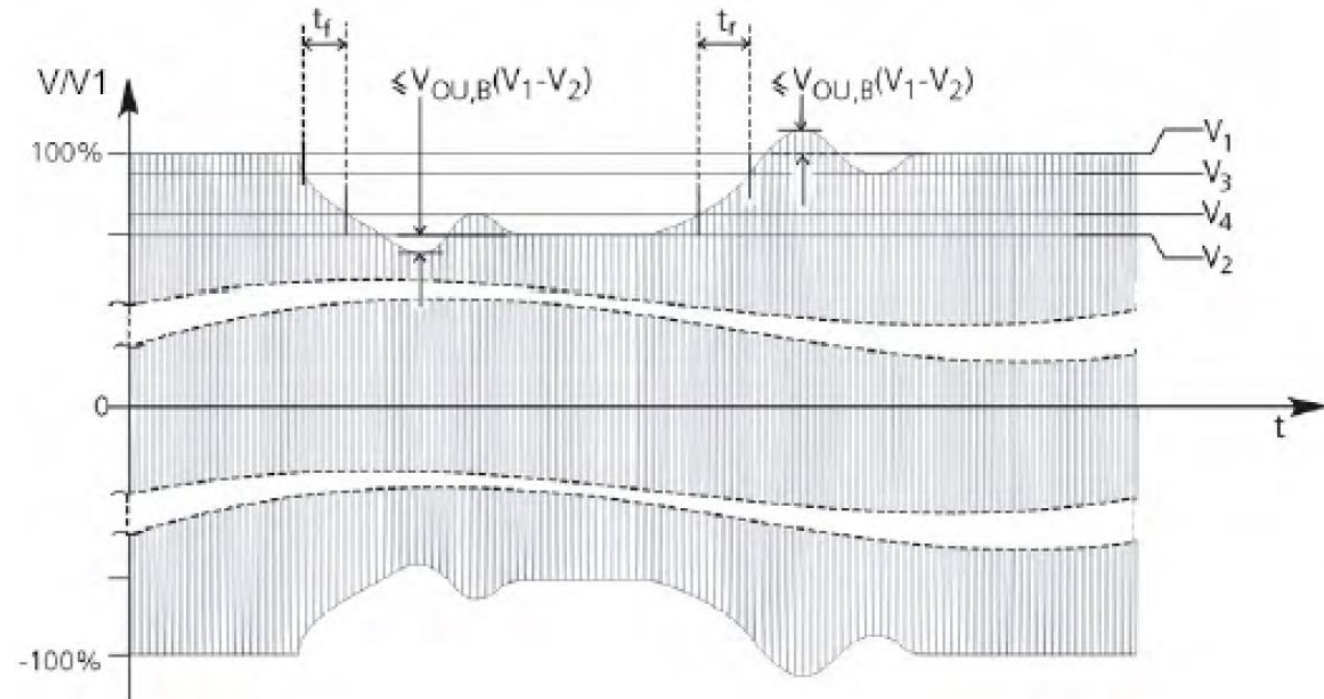


# EMV Analog L1 Tests

## Waveform tests

### Type B:

- TB121: Modulation Index
- TB122: Fall time
- TB123: Rise time
- TB124: Monotonic Increase
- TB125: Monotonic Decrease
- TB126: Overshoots
- TB127: Undershoots



**EMVCo transactions are only performed at 106 kbps**

# EMV Analog L1 Tests

## *Communication tests*



# EMV Analog L1 Tests

## Communication tests

### Purpose

Verify if the PCD communicates correctly depending on level and polarity of the PICC modulation

### Tests performed:

- Tx131 - Minimum positive modulation
- Tx133 - Maximum positive modulation
- Tx135 - Minimum negative modulation
- Tx137 - Maximum negative modulation

*Tx131 MinPos*



*Tx133 MaxPos*



# EMV Analog L1 Tests

## Other tests

### General

TAB112 – Carrier frequency  
TAB113 - Field resetting  
TAB114 - Power-Off  
TAB115 - Polling sequence

### Type A

TA139 - FDTA PICC  
TA141 - BitRate  
TA142 - BitCodingPCD  
TA143 - BitCodingPICC

### Type B

TB141 - BitRate  
TB142 - BitCodingPCD  
TB146 - BitCodingPICC  
TB147 - BitBoundaries  
TB145 - TFSOFF Max  
TB148 - TFSOFF Min

# EMV Contactless Specifications

## *New in v3.0*

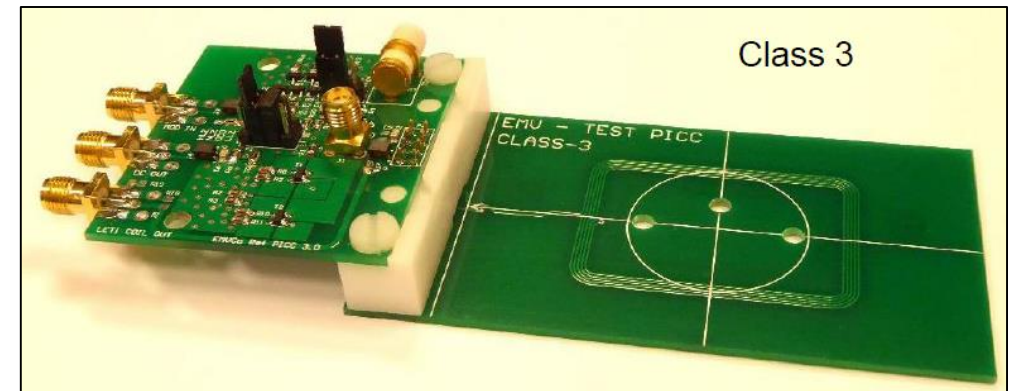
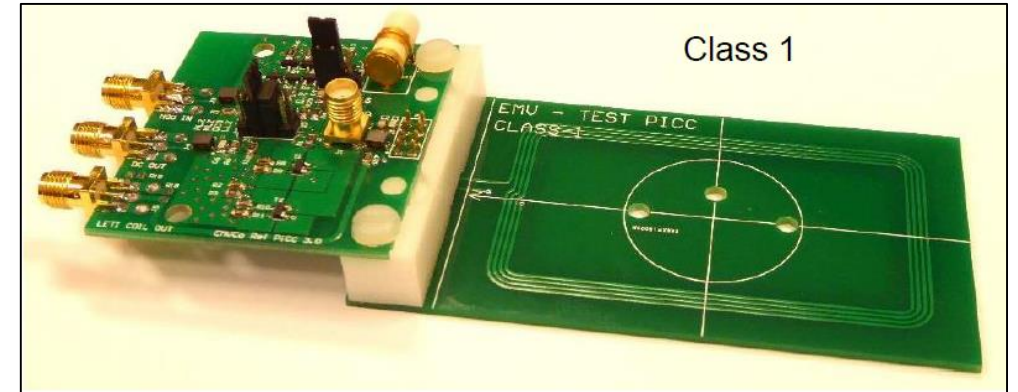


# EMV Analog L1 Tests

## EMV v3.0 Specifications

### What's new?

- There will be three EMV-TEST PICCs:
  - EMV-TEST PICC 1 (Class 1) Tuned to 16.1 MHz
  - EMV-TEST PICC 2 (Class 1) Tuned to 13.56 MHz
  - EMV-TEST PICC 3 (Class 3) Tuned to 13.56 MHz
- Different loads for PICCs → 2 different linear load instead of 1
- Waveshape test limits → Overshoot and undershoot are recalculated using NFC forum formulas.



# NXP Product portfolio for POS

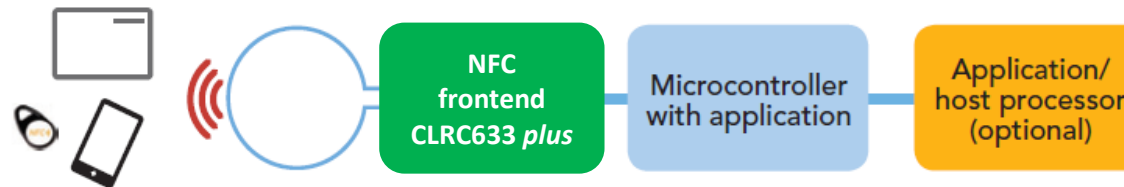


# CLRC663 *plus* - push your design further

Best performance at lowest power consumption



- Full RF standard compliance
- High performance and more flexible antenna design
- EMVCo 2.6 ready (analog & digital compliance)
- Longer battery life: Power-saving modes and extended LPCD options.
- Industrial / Automotive temperature range (-40 °C – 105° C)
- Multiple interfaces and support for high-security reader implementations
- Compact package (HVQFN32 with wettable flanks)

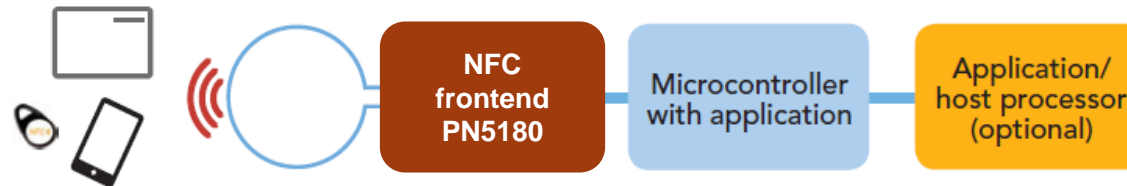




# PN5180 - The best full NFC frontend in the market



- Multi-protocol and high RF performance
- Full NFC Forum and EMVCo compliant frontend
- Flexible low power card detection
- Efficient, robust and reliable operation even in harsh conditions
- Maximum interoperability for next generation of NFC phones
- Onboard Dynamic Power Control (DPC) for optimized RF performance
- Fast SPI host interface with optimized commands for use with 32-bit host controllers
- Small, industry-standard packages with BGA form factor for PCI compliancy



# PN7462AU - The first all-in-one NFC solution

NFC and contact interfaces, MCU, and SW one chip



- Integrated Cortex-M0 microcontroller with customizable memory
- State of the art RF interface with EMVCo and NFC Forum compliance for easy certification
- DPC for optimized antenna performance
- Contact interface compliant with ISO/IEC 7816-2 to 4
- One configurable host interface: I2C, SPI, USB, HSUART
- Two master interfaces: I<sup>2</sup>C and SPI and 12 to 21 GPIOs
- Advanced power management
- HVQFN64 package (9x9 mm)



# More support





# NXP

## Relevant resources regarding POS

Certification	NXP support	End customer
<b>EMVCo L1 contact analog</b>	Application notes; demo board; Report from test house Customer schematic validation	Final device need to be tested at a certified lab
<b>EMVCo L1 contact digital</b>	Application note; source code; ICS example; internal test report Support on NXP stack integration Support on EMV test suite errors	Final device need to be tested at a certified lab
<b>EMVCo L2 contact</b>	Link to partners for stack ; Pre integration support if NXP L1 stack is used	Final device need to be tested at a certified lab

Certification	NXP support	End customer
<b>EMVCo L1 contactless analog</b>	Antenna design guide, loop back example; internal test report; demo board Antenna design support & RF support from CAS team	Final device need to be tested at a certified lab
<b>EMVCo L1 contactless digital</b>	Source code; application note ICS example; internal test report Support on NXP stack integration Support on EMV test suite errors	Final device need to be tested at a certified lab
<b>EMVCo L2 contactless</b>	Link to partners for stack ; Pre integration support if NXP L1 stack is used	Final device need to be tested at a certified lab





# MobileKnowledge

## Contact

We are your ideal **engineering consultant** for any specific support in connection with your **POS** developments.

If you want to:

- **Design an EMV POS or mPOS**
- **Select the best performing antenna**
- **Optimize the RF performance of your device**
- **Debug your device to make sure it is EMV L1 compliant**

Your trusted partner and expert design house for NFC technology

[contact@themobileknowledge.com](mailto:contact@themobileknowledge.com)  
[themobileknowledge.com](http://themobileknowledge.com)







## Get ahead with NXP's PN5180 Frontend - Design your POS terminal with EMVCo (L1) certification

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**Thank you for your kind attention!**

Please remember to fill out our **evaluation survey** (pop-up)

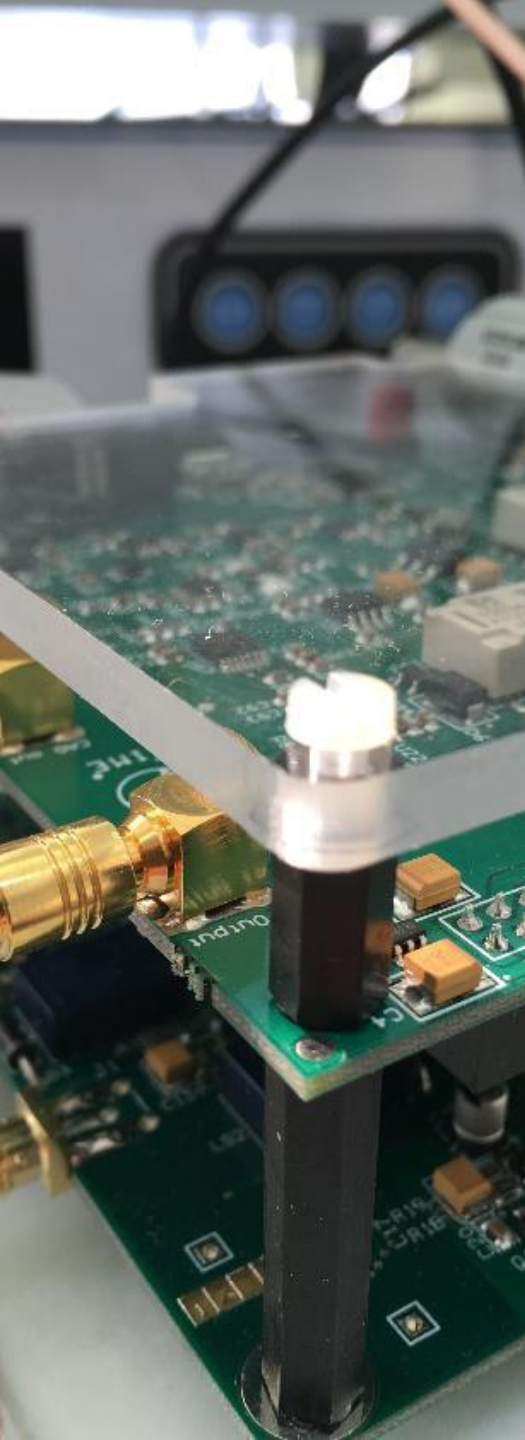
Check your email for **material download** and on-demand **video** addresses

Please check NXP and MobileKnowledge websites for **upcoming webinars** and **training sessions**

<http://www.nxp.com/support/classroom-training-events:CLASSROOM-TRAINING-EVENTS>

[www.themobileknowledge.com/content/knowledge-catalog-0](http://www.themobileknowledge.com/content/knowledge-catalog-0)





# MobileKnowledge

MobileKnowledge is a team of HW, SW and system engineers, experts in **smart, connected and secure** technologies for the IoT world. We are your ideal **engineering consultant** for any specific support in connection with your **IoT** and **NFC** developments. We design and develop secure HW systems, embedded FW, mobile phone and secure cloud applications.

Our services include:

- **Secure hardware design**
- **Embedded software development**
- **NFC antenna design and evaluation**
- **NFC Wearable**
- **EMV L1 pre-certification support**
- **Mobile and cloud application development**
- **Secure e2e system design**

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We help companies leverage  
the **secure IoT revolution**

