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Technical Specification

Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-4; Part 2: Test Suite Structure and Test Purposes (TSS&TP)

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Contents

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Foreword

This Technical Specification (TS) has been produced by the ETSI Project Pay Terminal and Systems (PTS). The present document was handed over to the CEN Secretariat in order to become an EN through the CEN approval process.
ETSI has produced a set of TSs which are not a copy of any CEN published EN. The TSs are complete and consistent documents with references among themselves. It has been made clear in these TSs that they are contributions to the CEN work for publication as EN (after re-editing the references). Once published by CEN as EN, ETSI will withdraw its TS.

The present document is part 2 of a multi-part document covering Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-4, as identified below:

Part 1: "Implementation Conformance Statement (ICS) proforma specification";

Part 2: "Test Suite Structure and Test Purposes (TSS&TP)";

Part 3: "Abstract Test Suite (ATS) and Implementation eXtra Information for Testing (IXIT)".

Overview of ETSI deliverables on EN 726 family

TS 101 200-1	"EN 726-1: Identification card systems; Telecommunications IC cards and terminals; Part 1: System overview".
TS 101 200-2	"EN 726-2: Identification card systems; Telecommunications IC cards and terminals; Part 2: Security framework".
TS 101 200-3	"EN 726-3: Identification card systems; Telecommunications IC cards and terminals; Part 3: Application independent card requirements".
TS 101 200-4	"EN 726-4: Identification card systems; Telecommunications IC cards and terminals; Part 4: Application independent card related terminal requirements".
TS 101 200-5	"EN 726-5: Identification card systems; Telecommunications IC cards and terminals; Part 5: Payment methods".
TS 101 200-6	"EN 726-6: Identification card systems; Telecommunications IC cards and terminals; Part 6: Telecommunications features".
TS 101 200-7	"EN 726-7: Identification card systems; Telecommunications IC cards and terminals; Part 7: Security module".

Overview of ETSI deliverables on EN 726 conformance testing family

TS 101 203-1	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-3; Part 1: Implementation Conformance Statement (ICS) proforma specification".
TS 101 203-2	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-3, Part 2: Test Suite Structure and Test Purposes (TSS&TP)".
TS 101 203-3	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-3; Part 3: Abstract Test Suite (ATS) and Implementation eXtra Information for Testing (IXIT) proforma specification".
TS 101 204-1	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-4; Part 1: Implementation Conformance Statement (ICS) proforma specification".
TS 101 204-2	**"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-4, Part 2: Test Suite Structure and Test Purposes (TSS&TP)".**
TS 101 204-3	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-4; Part 3: Abstract Test Suite (ATS) and Implementation eXtra Information for Testing (IXIT) proforma specification".
TS 101 207-1	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-7; Part 1: Implementation Conformance Statement (ICS) proforma specification".
TS 101 207-2	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-7, Part 2: Test Suite Structure and Test Purposes (TSS&TP)".
TS 101 207-3	"Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-7; Part 3: Abstract Test Suite (ATS) and Implementation eXtra Information for Testing (IXIT) proforma specification".

1 Scope

The present document provides Test Suite Structure and Test Purposes (TSS&TP). It applies to the application independent card related terminal requirements defined in TS 101 200-4 [7]. The TSS&TP is in compliance with the relevant requirements and according to the relevant guidance given in ISO/IEC 9646-7 [11] and ETS 300 406 [9].

The set of tests described herein is intended to proof the compliance of a terminal with the standard TS 101 200-4 [7]. However the number of tests and the depth of testing is not sufficient for a product qualification test, especially as the standard TS 101 200-4 [7] does not define any application.

For a product qualification at least the following tests should be added:

- Application tests

  Each application implemented in the terminal shall be tested against the specifications for these applications.

- User Card (UC) and Security Module (SM) interface test

  The interface between the user card and the security module shall be tested to verify the correct coding of all the used commands. The reaction of the terminal to every error code possible shall also be tested and be as specified for the application.

- Performance test

  To test whether the terminal complies with all the environmental conditions required and reacts within the specified time.

2 Normative references

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] EN 27816-1 (1989): "Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics (ISO 7816-1; 1987, edition 1)".

[2] EN 27816-2 (1989): "Identification cards - Integrated circuit(s) cards with contacts - Part 2: Dimensions and locations of the contacts (ISO 7816-2; 1988, edition 1)".

[3] EN 27816-3 (1992): "Identification cards - Integrated circuit(s) cards with contacts - Part 3: Electronic signals and transmission protocols (ISO/IEC 7816-3; 1989, edition 1)".

[4] EN 27816-3 (1992), Amendment 1 (1993): "Identification cards - Integrated circuit(s) cards with contacts - Part 3: Electronic signals and transmission protocols. Amendment 1: Protocol type T=1, asynchronous half duplex block transmission protocol (ISO/IEC 7816-3; 1989, Amendment. 1:1992)".

[5] EN 27816-3 (1992), Amendment 2 (1995): "Identification cards - Integrated circuit(s) cards with contacts - Part 3: Electronic signals and transmission protocols. Amendment 2: Revision of protocol type selection (ISO/IEC 7816-3; 1989, Amendment 2:1994)".

[6] TS 101 200-3 version 1.2.1: "EN 726-3: Identification card systems; Telecommunications IC cards and terminals; Part 3: Application independent card requirements".

[7] TS 101 200-4 version 1.2.1: "EN 726-4: Identification card systems; Telecommunications IC cards and terminals; Part 4: Application independent card related terminal requirements".

[8] TS 101 204-1: "Identification card systems; Telecommunications IC cards and terminals; Test methods and conformance testing for EN 726-4; Part 1: Implementation Conformance Statement (ICS) proforma specification".

[9] ETS 300 406 (April 1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardisation methodology".

[10] ISO/IEC 9646-1 (1994): "Information technology - Open systems interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[11] ISO/IEC 9646-7 (1995): "Information technology - Open systems interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

[12] ISO/IEC 646 (1991): "Information technology - ISO 7-bit coded character set for information interchange".

[13] ITU Recommendation T.50 (1988): "International alphabet nº 5".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions apply:

- terms defined in EN 27816 Parts 1 to 3 [1], [2], [3], [4], [5];
- terms defined in TS 101 200-3 [6];
- terms defined in ISO/IEC 9646-1 [10] and in ISO/IEC 9646-7 [11].

In particular, the following terms defined in ISO/IEC 9646-1 [10] apply:

Implementation Conformance Statement (ICS): A statement made by the supplier of an implementation or system claimed to conform to a given specification, stating which capabilities have been implemented. The ICS can take several forms: protocol ICS, profile ICS, profile specific ICS, information object ICS, etc.

ICS proforma: A document, as a questionnaire, which when completed for an implementation or system becomes an ICS.

3.2 Symbol

For the purposes of the present document, the following symbol applies:

{} Optional data, for example "CLA, INS, P1, P2, P3 {, data}" indicates that data may or may not follow the CLA, INS, P1, P2, P3 bytes.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AC	Access Condition(s)
ATC	Abstract Test Case
ATR	Answer To Reset
ATS	Abstract Test Suite
BCD	Binary Code Decimal
CAD	Card Accepting Device (this includes only the mechanics)
CHV	Card Holder Verification
CLA	CLAss
CLK	Clock
CM	CHV Module
CS	Cyclic Structure
DF	Dedicated Files
EF	Elementary Files
GND	Ground
GR	GRaphical form (TTCN)
I/O	Input/Output
IC	Integrated Circuit
ICS	Implementation Conformance Statement
ID	IDentifier
IFD	InterFace Device, used as short form for a terminal including CAD
INS	INStruction
IUT	Implementation Under Test
IV	Invalid behaviour test
IXIT	Implementation eXtra Information for Testing
LFS	Linear Fixed Structure
LI	Logical Interface
LM	Logical Model
LVS	Linear Variable Structure
MAC	Message Authentication Code
MF	Master File
MP	Machine Processable form (TTCN)
PC	Physical Characteristics
PDU	Protocol Data Unit
RC	Return Code
RST	Reset
SCS	System Conformance Statement
SE	SEcurity facilities
SP	Electronic Signals and transmission Protocols
SUT	System Under Test
TC	Test Case
TP	Test Purposes
TR	TRansparent
TSS	Test Suite Structure
TTCN	Tree and Tabular Combined Notation
UI	User Interface
VA	Valid behaviour test
VCC	supply Voltage
VPP	programming Voltage

4 Test environment

This clause specifies several requirements, which shall be met, and a number of rules, which shall be adhered to before testing can proceed.

4.1 Test equipment

This subclause gives a minimum specification for each of the items of test equipment referenced in the tests.

4.1.1 Card probes

This item of equipment shall have the format of an ID-1 card. It shall allow access to all electrical signals available in the terminal. Three probes shall be available, one with typical dimensions, one with minimal dimensions and one with the maximum dimensions for height and thickness. A simulator shall be attached to reply to every command as expected from the terminal. The format of the probes is as follows:

	Width	Height	Thickness
Typical	85,60 mm	53,98 mm	0,76 mm
Minimal	85,60 mm	53,92 mm	0,58 mm
Maximal	85,60 mm	54,18 mm	0,94 mm

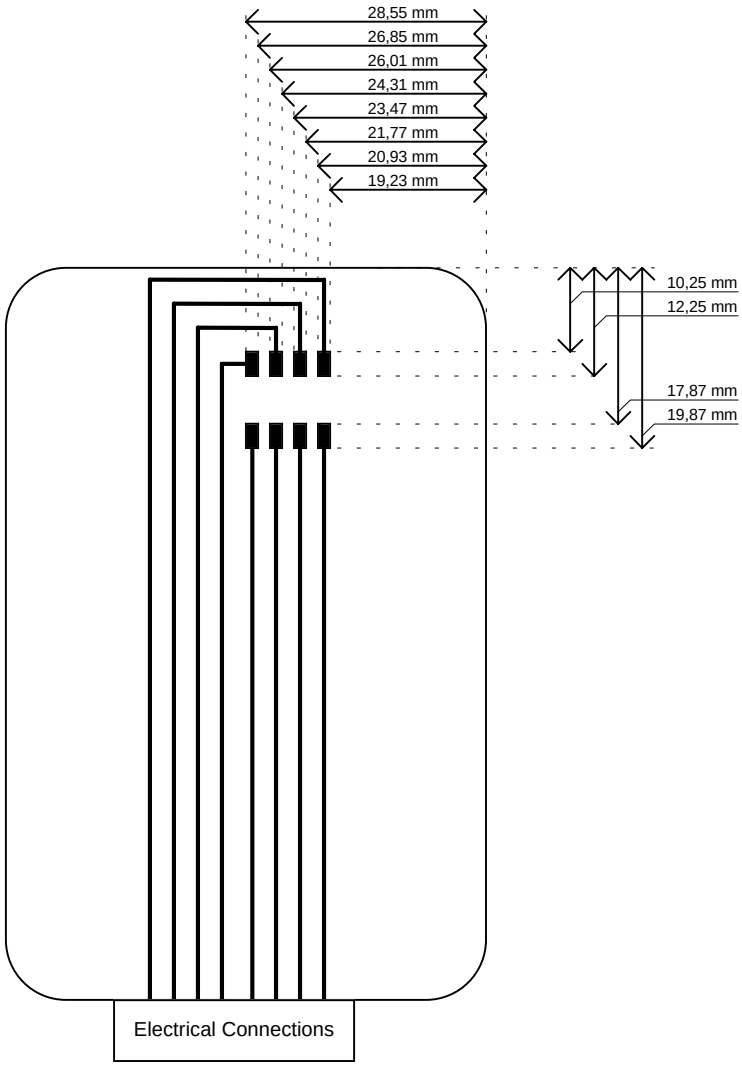


Figure 1:Location and dimensions of the IC card contacts

4.1.2 Embossed card

This item of equipment shall have the format of an ID-1 card (with the maximum dimensions for height and thickness) and an embossed area, which is raised by 0,51 mm.

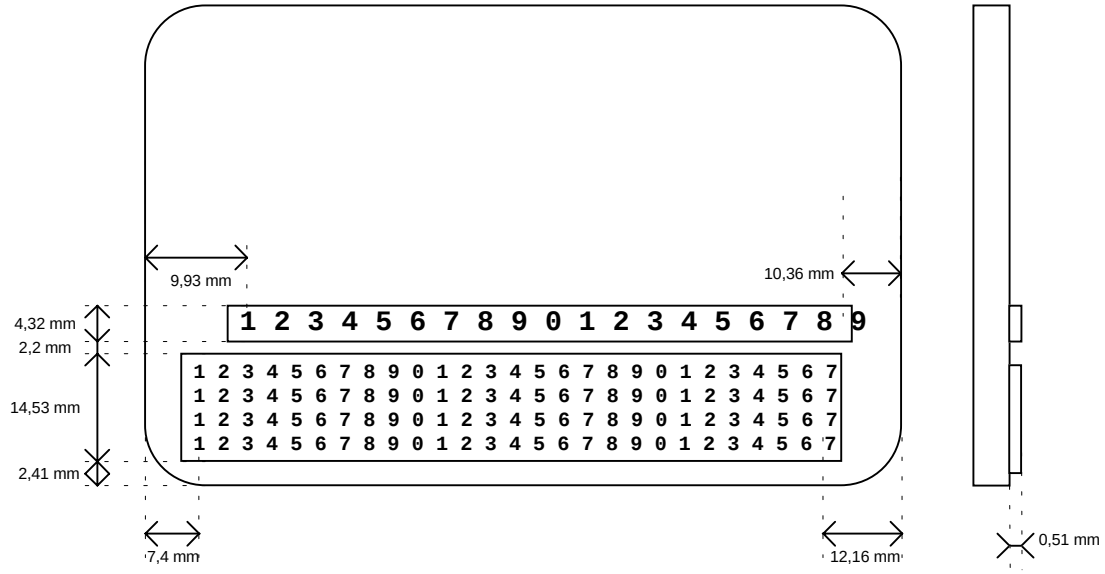


Figure 2: Dimensions of the IC card

4.1.3 IC card with magnetic stripe

This item of equipment shall have the format of an ID-1 card (with the typical dimensions) with chip and any allowed magnetic stripe on the opposite side of the contacts.

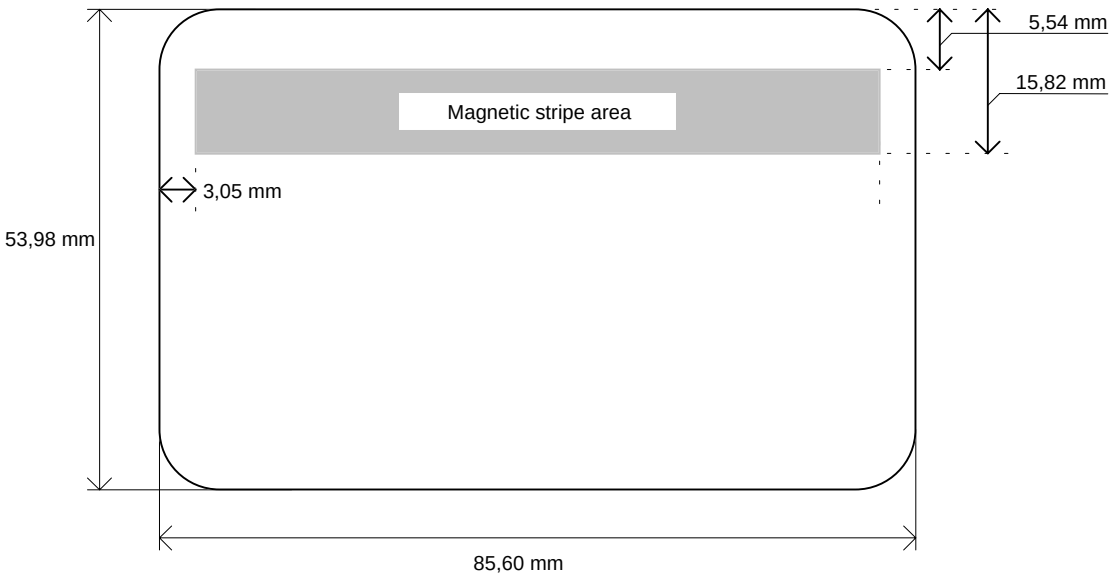


Figure 3: Dimensions of the IC card

4.2 Default data formatting

All numeric data enclosed in single quotes ("99") in the present document is hexadecimal data.

Where "X" is used in place of a hexadecimal digit, X ranges from "0" to "F". For example, the data "6X" ranges from "60" to "6F" inclusive.

Where data is expressed as a group of bytes, it shall be in the following format: "XX XX XX... XX", indicating first byte, second byte, third byte etc. in that order.

4.3 Test procedure

The following statement is applicable to the Test procedure clause for all test purposes contained within the present document:

- The test can either be performed in a closed or opened terminal whatever is necessary.

5 Test suite structure

- Physical requirements
  - IC card interface
    - Mechanical interface
    - Contacting

- Electronic signals and transmission protocols
  - Activation/Deactivation of contacts
  - Transmission types
  - Supply voltage VCC
  - Programming voltage
  - Duty cycle
  - Guard time

- Logical interface
  - Terminal <-> user card
  - Terminal <-> security module

- User interface
  - Language
  - Messages
  - Error display
  - Card change
  - CHV module
  - Application selection
  - Audio messages

6 Test purposes

6.1 Introduction

For each test requirement a Test Purpose (TP) is defined.

6.1.1 TP naming convention

TPs are numbered, starting at 01, within each group. Groups are organized according to the TSS. Additional references are added to identify the actual Test Suite. See table 1.

Table 1: TP Identifier naming convention scheme

Identifier:	**<group>_<subgroup>_<type>_<nnn>**		
<group>	=	major group	PC : Physical Characteristics SP : Electronic Signals and transmission Protocols SE : SEcurity facilities LI : Logical Interface UI : User Interface
<subgroup>	=	function or file	two characters to indicate the function, e.g. CM for CHV Module XX if function independent.
<type>	=	type	one character field representing the type of test VA: Valid behaviour test IV: Invalid behaviour test
<nnn>	=	sequential number:	(01-99)

6.1.2 Source of TP definition

The TPs were developed based on TS 101 200-4 [7] and TS 101 204-1 [8].

6.1.3 TP structure

Each TP has been written in a manner, which is consistent with all other TPs. The intention of this is to make the TPs more readable and checkable. A particular structure has been used and this is illustrated in table 2. This table should be read in conjunction with any TP. Use that TP as an example to fully understand the table.

Table 2: Structure of a single TP

TP Part	Text	Example
Header	<Identifier> *tab* <subclause reference in base EN> *tab* {*ICS/IXIT limitation* c<table no>_<item no>{.<subitem no>}{, }}	see table 1 subclause 0.0.0 c9_3.1, c9_3.2
Stimulus	Ensure that the terminal for <function> *or* <signal>	 CHV - Entry VCC
Reaction	<action> <conditions>	results in, contains, ... after selecting, using parameter, if supported ...
NOTE: Text in italics will not appear in TPs and text between <> is filled in for each TP and may differ from one TP to the next.		

6.1.4 Test strategy

As the base standard contained no explicit requirements for testing, the TPs were generated as a result of an analysis of the base standard and ICS.

6.1.5 Valid behaviour test

This type of test is used whenever it should be proved, that an implementation complies with the standard. The reaction on invalid stimuli or states is not the objective of this type of test.

6.1.6 Invalid behaviour test

Herewith invalid commands, parameters or states are tested to see, whether the implementation shows robustness against invalid stimuli and that the returned Status Words comply with the standard.

6.2 Terminal

6.2.1 Physical requirements

6.2.1.1 IC card interface

6.2.1.1.1 Mechanical interface

PC_MI_VA_01 subclause 4.1 c2_1

Purpose
Ensure that the mechanical interface between the IC card and the interface device is in accordance with EN 27816-1 [1] and EN 27816-2 [2].

Preconditions
- The CAD shall be disconnected from the terminal.

Test

All three card probes shall be inserted to the CAD and the connectivity between each card contact and the corresponding card reader contact shall be checked.

Result

All three cards shall be insertable and each of the contacts of the card shall be connected to the corresponding one of the CAD.

PC_MI_VA_02 subclause 4.1 c2_2.1

Purpose
Ensure that the interface device accepts cards with embossing on the same side as the contacts.

Preconditions
- None.

Test

Insert an IC card with embossing, with the embossing areas being raised by 0,51 mm and an irregular string being embossed in that area.

Result

The CAD shall accept this card without using excessive force (> 10 N) during insertion or withdrawal.

PC_MI_VA_03 subclause 4.1 c2_3.1

Purpose
Ensure that the interface device accepts cards with magnetic tracks on the opposite side as the contacts.

Preconditions
- None.

Test

Use an IC card with a magnetic stripe on the opposite side as the contacts for a standard application.

Result

The application shall work normally.

6.2.1.1.2 Contacting

PC_CO_VA_01 subclause 4.2 c3_1

Purpose
Ensure that the IFD does not short circuit the card, when inserted or pulled out.

Preconditions
- None.

Test

Insert the card and monitor the VCC and all output pins (normally only I/O).

Remove the card and monitor the VCC and all output pins (normally only I/O).

Result

The output pins shall not be held low as long as VCC is applied.

PC_CO_VA_02 subclause 4.2 c3_4, c3_5

Purpose
Ensure that the IFD is not damaged during card insertions or withdrawals.

Preconditions
- 50 IC cards available for insertion test.

Test

Do 100 000 insertion and withdrawing pairs (2 000 per card).

Result

The IFD shall continue to work properly after that test.

PC_CO_VA_03 subclause 4.2 c3_10

Purpose
Ensure that short circuits do not prevent normal operation of the terminal, when removed.

Preconditions
- Full metal card available.

Test

Insert metal card and start operation of the IFD, if necessary (e.g. lift the handset).

Remove metal card.

Result

The metal card should be rejected. The IFD shall resume normal service after the card has been removed.

PC_CO_VA_04 subclause 4.2 c3_10

Purpose
Ensure that the card is not physically damaged by the contacts of the IFD.

Preconditions
- A card without scratches is available.

Test

Perform 5 000 insertion/withdrawing pairs with that card.

Result

After this test the card shall work properly in the IFD and the surface of the card shall still be readable outside the sliding area of the contacts..

PC_CO_VA_05 subclause 4.2 c3_12, c3_13

Purpose
Ensure that the contact force is between x N and 0,5 N per contact.

Preconditions
- CAD is not connected to the IFD.
- The contacts of the CAD are accessible from the back side.

Test

Insert the card probe with minimal dimensions and probe the contact force for each contact.

Insert the card probe with maximal dimensions and probe the contact force for each contact.

Result

Each probing shall show a contact force between x N and 0,5 N.

PC_CO_VA_06 subclause 4.2 c3_12, c3_13

Purpose
Ensure that the shape of contacts and the way of contacting works even on polluted cards properly.

Preconditions
- A polluted (to be defined) IC card is available.

Test

The card is used for any standard application in that terminal.

Result

The session shall complete as with new (clean) IC cards.

6.2.2 Electronic signals and transmission protocols

6.2.2.1 Activation/Deactivation of contacts

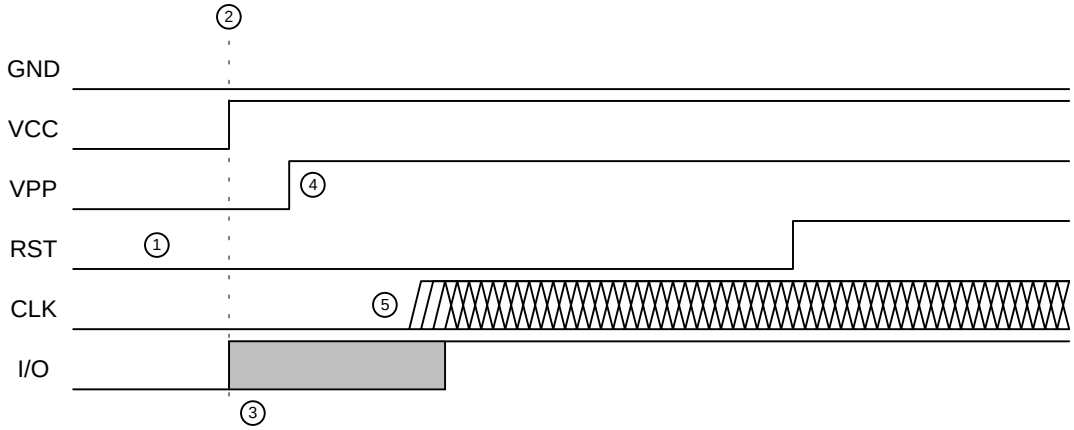
SP_AD_VA_01 subclause 4.2 c3_9

Purpose
Ensure that the contacts are activated according to EN 27816-3 [3].

Preconditions
- An oscilloscope is connected to all card contacts.

Test
Insert the card probe into the IFD.

Result
The activation of the contacts shall be as follows:



① RST is in state L
② VCC is powered
③ I/O is put into reception mode
④ VPP is raised to idle state
⑤ stable clock is provided

Figure 4: Activation of the IC card contacts

SP_AD_VA_02 subclause 4.2 c3_9

Purpose
Ensure that the contacts are deactivated according to EN 27816-3 [3].

Preconditions

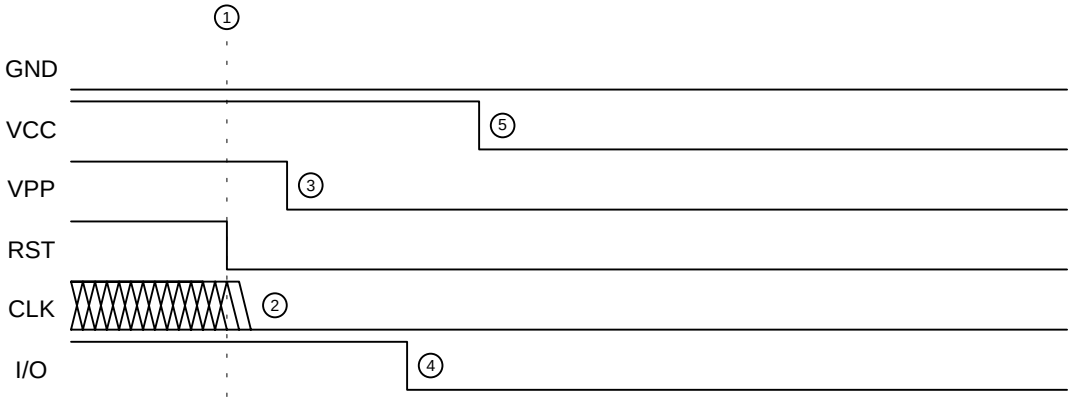
- An oscilloscope is connected to all card contacts.

Test

Remove the card probe from the IFD.

Result

The deactivation of the contacts shall be as follows:



1. RST is in state L
2. State L on CLK
3. VPP inactive
4. State L on I/O
5. VCC inactive

Figure 5: Activation of the IC card contacts

SP_AD_VA_03 clause 5 c7_1

Purpose

Ensure that the characteristics for the I/O pin in input mode are respected. (V_{IH}, V_{IL}, t_r, t_f).

Preconditions

- Card inserted and powered.
- An oscilloscope is connected to GND and I/O.

Test

Issue any command from the terminal.

Result

The voltage level for each high state shall be between 2 V and VCC + 0,3 V, the voltage level for each low state shall be between -0,3 V and 0,8 V. The rise and fall times, between 10 % and 90 % of the signal level are less than 1 µs.

SP_AD_VA_04 clause 5 c7_1

Purpose

Ensure that the characteristics for the I/O pin in output mode are respected. (V_{OH}, V_{OL}, t_r, t_f)

Preconditions

- Card Inserted and powered.
- An oscilloscope is connected to GND and I/O.
- The current can be measured on I/O from terminal to IC card.

Test

Receive any answer from the card.

Result

The voltage level for each high state shall be between 2,4 V and VCC with a current flow of no more than 100 µA (from card to terminal). The voltage level for each low state shall be between 0 V and 0,4 V with a current flow of no more than 1 mA (from terminal to card). The rise and fall times, between 10 % and 90 % of the signal level are less than 1 µs.

SP_AD_VA_05 clause 5 c7_1

Purpose

Ensure that the characteristics for the RST pin are respected. (V_{IH}, V_{IL})

Preconditions

- Card Inserted and powered up.
- An oscilloscope is connected to GND and RST.

Test

Issue a reset to the User Card (e.g. starting a new phone call).

Result

The voltage level for high state shall be between 2 V and VCC + 0,3 V, the voltage level for low state shall be between -0,3 V and 0,8 V.

6.2.2.2 Transmission types

SP_TT_VA_01 subclause 5.1 c8_1.3

Purpose
Ensure that the IFD supports the different types of reset behaviour for the cards using asynchronous transmission.

Preconditions
- A mute card is available.
- An oscilloscope is attached to all card signals.

Test
Insert the card into the IFD.

Result
The reset shall follow the following diagram, but the I/O will not return an answer:

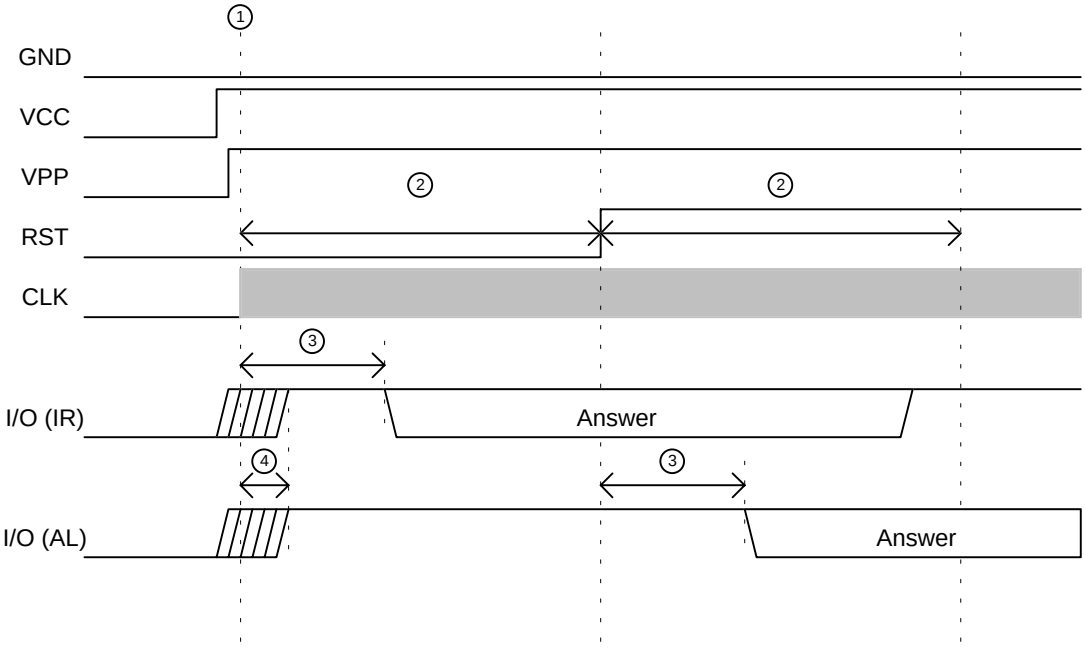


Figure 6: Diagram

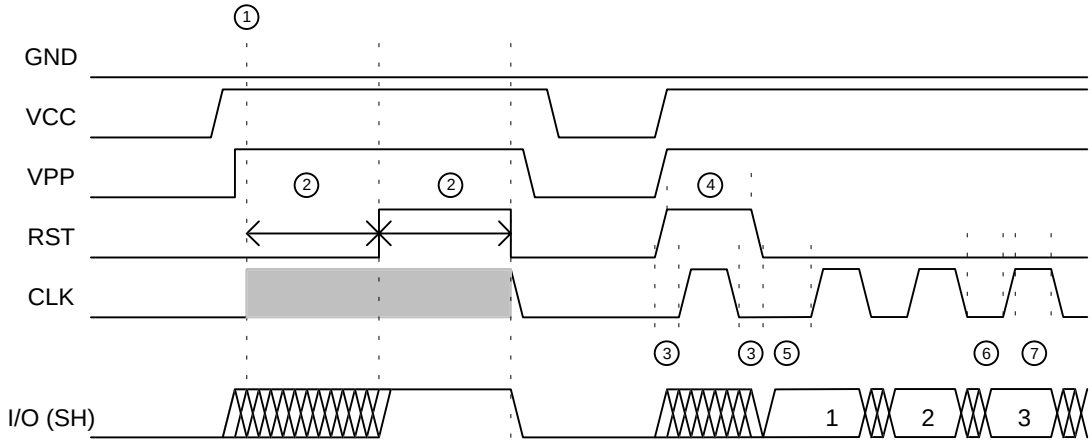
SP_TT_VA_02 subclause 5.1 c8_2.2

Purpose
Ensure that the conditions for an asynchronous IC card are applied first.

Preconditions
- A mute card is available.
- An oscilloscope is attached to all card signals.

Test
Insert the card into the IFD.

Result
The reset shall follow the following diagram, but the I/O will not return an Answer :



① stable clock provided
② 40 000 clock cycles
③ 5 us
④ > 50 us
⑤ 10 us < x < 100 us
⑥ 10 us < x < 100 us
⑦ 10 us < x < 50 us

Figure 7: Diagram

6.2.2.3 Supply voltage VCC

SP_SV_VA_01 subclause 5.2 c9_1

Purpose
Ensure that VCC is 5 V ± 5 %.

Preconditions
- A mute card is available.
- An oscilloscope is attached to VCC.

Test
Insert the card into the IFD.

Result
The oscilloscope shall show VCC to be between 4,75 V and 5,25 V.

SP_SV_VA_02 subclause 5.2 c9_2

Purpose
Ensure that VCC is 5 V ± 10 %.

Preconditions
- A mute card is available.
- An oscilloscope is attached to VCC.

Test
Insert the card into the IFD.

Result
The oscilloscope shall show VCC to be between 4,5 V and 5,5 V.

SP_SV_VA_03 subclause 5.3 10_1.1

Purpose
Ensure that the VCC pin supplies at least 20 mA to the IC card.

Preconditions
- A mute card is available.
- An oscilloscope is attached to VCC.
- The current consumption is increased to 20 mA using a resistor between VCC and GND.

Test
Insert the card into the IFD.

Result
The oscilloscope shall show VCC to be between 4,75 V and 5,25 V.

SP_SV_VA_04 subclause 5.3 c10_2.1

Purpose
Ensure that the VCC pin supplies at least 10 mA to the IC card.

Preconditions
- A mute card is available.
- An oscilloscope is attached to VCC.
- The current consumption is increased to 10 mA using a resistor between VCC and GND.

Test
Insert the card into the IFD.

Result
The oscilloscope shall show VCC to be between 4,5 V and 5,5 V.

SP_SV_VA_05 subclause 5.3 c10_3

Purpose
Ensure that the power supply is able to counteract spikes of 40 nAs and 200 mA, that is one spike of 200 ns every second.

Preconditions
- A card probe is inserted and powered up.
- A device is attached, that applies additional loads (max. 200 mA, including card consumption) every second for 200 ns.
- An oscilloscope is attached to VCC.

Test
Check the VCC line with a resolution of 40 ns and 100 mV per division, trigger with the application of the additional load.

Result
At no time during that spike or after it, shall VCC be outside the given limits (5 V ± 5/10 %).

SP_SV_VA_06 subclause 5.3 c10_3

Purpose
Ensure that the power supply is able to counteract spikes of 40 nAs and 400 ns duration, that is one spike of 100 mA every second.

Preconditions
- A card probe is inserted and powered up.
- A device is attached, that applies additional loads (max. 100 mA, including card consumption) every second for 400 ns.
- An oscilloscope is attached to VCC.

Test
Check the VCC line with a resolution of 80 ns and 100 mV per division, trigger with the application of the additional load.

Result
At no time during that spike or after it, shall VCC be outside the given limits (5 V ± 5/10 %).

6.2.2.4 Programming voltage

SP_PV_VA_01 subclause 5.3 c11_1

Purpose
Ensure that the VPP is the same voltage as VCC for European telecommunication cards.

Preconditions
- A card probe is inserted and powered up.
- An oscilloscope is attached to VCC and VPP.

Test
Check the voltages on VCC and VPP.

Result
VCC and VPP shall have the same value.

6.2.2.5 Duty cycle

SP_DC_VA_01 subclause 5.5 c12_1

Purpose
Ensure that the clock cycle meets the characteristics of EN 27816-3 [3] (V_{IH}, V_{IL}, t_r, t_f) with a duty cycle between 45 % and 55 %.

Preconditions
- A card probe is inserted and powered up.
- An oscilloscope is attached to CLK.
- The load on the CLK signal is ± 200 µA, ± 20 µA, ± 10 µA at 30 pF.

Test
Check format of CLK signal for all three loads.

Result
CLK shall be between 2,4 V and VCC + 0,3 V for 200 µA load for a high level signal.

CLK shall be between 0,7 × VCC and VCC + 0,3 V for 20 µA load for a high level signal.

CLK shall be between VCC – 0,7 V and VCC + 0,3 V for 10 µA load for a high level signal.

For low level and 200 µA load CLK shall be between -0,3 V and 0,5 V. The rise and fall time for every load shall not exceed 0,5 µs or 9 % of the period, whichever is lower. The duty cycle of CLK shall be between 45 % and 55 %.

SP_DC_VA_02 subclause 5.5 c12_2

Purpose
Ensure that the clock cycle meets the characteristics of EN 27816-3 [3] (V_{IH}, V_{IL}, t_r, t_f) with a duty cycle between 40 % and 60 %.

Preconditions
- A card probe is inserted and powered up.
- An oscilloscope is attached to CLK.
- The load on the CLK signal is ±200 µA, ±20 µA, ±10 µA at 30 pF.

Test
Check format of CLK signal for all three loads.

Result
CLK shall be between 2,4 V and VCC + 0,3 V for 200 µA load for a high level signal.

CLK shall be between 0,7 × VCC and VCC + 0,3 V for 20 µA load for a high level signal.

CLK shall be between VCC-0,7 V and VCC + 0,3 V for 10 µA load for a high level signal.

For low level and 200 µA load CLK shall be between -0,3 V and 0,5 V. The rise and fall time for every load shall not exceed 0,5 µs or 9 % of the period, whichever is lower. The duty cycle of CLK shall be between 40 % and 60 %.

6.2.2.6 Guard time

SP_GT_VA_01 subclause 5.6 c13_1

Purpose
Ensure that the guard time is according to the values given in EN 27816-3 [3] and EN 27816-3 (1992), Amendment 1[4].

Preconditions
- An oscilloscope is attached to the I/O line.
- The command with the shortest response time is known (e.g. error condition).

Test
Send the command and measure the time between the characters in the response and the answering time.

Result
Compare the measured values with those given in the ATR at TC_1 (guard time N) and 22 etu (block guard time).

SP_GT_VA_02 subclause 5.6 c13_2

Purpose
Ensure that the guard time is according to the values given in TS 101 200-3 [6].

Preconditions
- An oscilloscope is attached to the I/O line.
- The command with the shortest response time is known (e.g. error condition).

Test
Send the command and measure the time between the characters in the response and the answering time.

Result
Compare the measured values with those negotiated at PTS.

6.2.3 Logical interface

6.2.3.1 Terminal <-> user card

TS 101 200-4 [7] defines no application and has no strict requirements on the availability of commands/functions for the user card in the terminal, therefore no tests are given in the present document. However, testing of an application will require the use of a card simulator to provoke all kind of error recovery on application layer and to check the coding of all issued commands.

6.2.3.2 Terminal <-> security module

For the configuration where a SM as an IC card is installed to the terminal TS 101 200-4 [7] defines no application and no strict requirements on the availability of commands / functions for the security module in the terminal. For this reason no tests are given in the present document. However testing of an application will require the use of a card simulator to provoke all kind of error recovery on application layer and to check the coding of all issued commands.

6.2.4 User interface

6.2.4.1 Language

UI_LA_VA_01 subclause 10.1 c18_1

Purpose
Ensure that at least 2 languages are supported.

Preconditions
- None.

Test
Switch to the second language and check all the messages, see subclause 6.2.4.2.

Result
All the messages shall also be present in a second language.

UI_LA_VA_02 subclause 10.1 c18_2

Purpose
Ensure that one of the languages is English.

Preconditions
- None.

Test
Switch to other languages until one is English or the first language is displayed.

Result
The English language display shall be found.

UI_LA_VA_03 subclause 10.3.5 c26_1.1

Purpose
Ensure that the terminal chooses the language with the highest preference from the card, which is available in the terminal.

Preconditions
- A list of available languages for the terminal, with their priorities is available.
- IC cards with different language preferences existing in the terminal.
- IC cards with language preferences, where only the second or third preference is supported.

Test
Insert the IC cards and check the displayed language.

Result
The displayed language shall always be the language with the highest preference supported in the terminal.

UI_LA_VA_04 subclause 10.3.5 c26_1.2

Purpose
Ensure that the terminal chooses the language with the highest preference, if it can not comply with the preferences of the card.

Preconditions
- A list of available languages for the terminal, with their priorities is available.
- IC card with language preferences not existing in the terminal.

Test
Insert the IC cards and check the displayed language.

Result
The displayed language shall be the language with the highest preference in the terminal.

UI_LA_VA_05 subclause 10.3.5 c26_2

Purpose
Ensure that the user can change the languages at the beginning of a card session.

Preconditions
- Any supported IC card is available.

Test
Insert the IC card to start the card session and try to select other languages.

Result
It shall be possible to select other languages.

6.2.4.2 Messages

UI_MS_VA_01 subclause 10.2 c19_1

Purpose
Ensure that the message "Insert your card" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_02 subclause 10.2 c19_2

Purpose
Ensure that the message "Remove your card" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_03 subclause 10.2 c19_3

Purpose
Ensure that the message "Card refused" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_04 subclause 10.2 c19_4

Purpose
Ensure that the message "Re-Insert your card" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_05 subclause 10.2 c19_5, c5_1

Purpose
Ensure that the message "Enter your Card Holder Verification number" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_06 subclause 10.2 c19_6, c5_1

Purpose
Ensure that the message "Wrong Card Holder Verification number" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_07 subclause 10.2 c19_7, c5_1

Purpose
Ensure that the message "Enter your old Card Holder Verification number" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_08 subclause 10.2 c19_8, c5_1

Purpose
Ensure that the message "Re-enter Card Holder Verification number" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_09 subclause 10.2 c19_9

Purpose
Ensure that the message "Service locked" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_10 subclause 10.2 c19_10

Purpose
Ensure that the message "Service not available" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_11 subclause 10.2 c19_11

Purpose
Ensure that the message "Terminal out of service" is supported.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_MS_VA_12 subclause 10.2 c20_1

Purpose
Ensure that the user is able to suppress the display of user related data.

Preconditions
- The procedure needed to reveal user related data (phone number, purse value etc.) is known.
- The necessary cards are available.
- The procedure to suppress the display of user related data is known.

Test
Use the terminal in a way that it will reveal user related data. Try to suppress the display of this data.

Result
It shall be possible to suppress the display of the user related data.

6.2.4.3 Error display

UI_ED_VA_01 subclause 9 c17_1

Purpose
Ensure that the error recovery procedure at the transport level is according to EN 27816-3 [3] and EN 27816-3 (1992), Amendment 1[4].

Preconditions
- A card simulator able to insert communication errors on transport level is available.

Test
Insert all kind of errors (wrong length, wrong header for T = 1, wrong checksum, parity errors T = 1, T = 0) on transport level. These errors shall be inserted during various stages of communication (at the start of the communication, during command reception, while sending the response and in chaining mode).

Result
The terminal shall react as required by the standard.

UI_ED_VA_02 clause 9 c17_2.1

Purpose
Ensure that the unrecoverable error "Card malfunction, contact application provider" is displayed to the user.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_ED_VA_03 clause 9 c17_2.1.1

Purpose
Ensure that the unrecoverable error "Card blocked, contact application provider" is displayed to the user.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

UI_ED_VA_04 clause 9 c17_2.1.2

Purpose
Ensure that the unrecoverable error "Wrong Card Holder Verification (CHV)" is displayed to the user.

Preconditions
- The procedure needed to display that message is known.
- The necessary cards are available.

Test
Perform that procedure.

Result
Check the display, the terminal shall show an equivalent to the above message.

6.2.4.4 Card change

UI_CC_VA_01 subclause 4.3 c4_1

Purpose
Ensure that the method of inserting the card is with the short side first, where the contacts are located.

Preconditions
- A supported IC card is available.

Test
Insert the IC card with the short side first, where the contacts are located.

Result
The terminal shall operate normally.

UI_CC_VA_02 subclause 4.3 c4_3.1

Purpose
Ensure that there is a clear and unambiguous indication given, how to insert the card.

Preconditions
- An IC card is available.

Test
Ask 10 people not experienced with this terminal, how they would insert the card.

Result
At least 9 people shall give the right answer.

UI_CC_VA_03 subclause 4.3 c4_4

Purpose
Ensure that the card is always accessible to the user.

Preconditions
- A supported IC card is available.

Test
Start card sessions and try to remove the card by pulling it or any other defined mechanism in various stages or conditions (e.g. before the call, during the call, after hanging up, during write process and during power failure).

Result
It shall always be possible to get the card.

UI_CC_VA_04 subclause 4.3 c4_5

Purpose
Ensure that removal of the card at any time does not leave the applications in the terminal in an invalid or unknown logical state.

Preconditions
- A supported IC card is available.

Test
Start card sessions and try to remove the card in various stages (e.g. before the call, during the call, after hanging up and during write process). After removal of the card try to start a new card session.

Result
The terminal shall operate normally on the newly inserted card.

UI_CC_VA_05 subclause 10.3.1 c21_1

Purpose
Ensure that the terminal erases all IC card related data, except for relevant transaction data, when the IC card is removed.

Preconditions
- Detailed documentation is available.

Test
Check the documentation to see which data are stored.

Result
The check shall show that no IC card related data are stored, besides relevant transaction data.

UI_CC_VA_06 subclause 10.3.2 c22_1

Purpose
Ensure that the user can abort the current operation, the card is rejected and the terminal returns to idle state.

Preconditions
- The possibilities to abort the current operation are known (removal of the card, pressing special buttons, hang-up, short hang-up, etc.).
- A supported IC card is available.

Test
Start card sessions and try to abort the session in various stages (e.g. before the call, during the call, after hanging up, during pin check and during write process).

Result
The terminal shall reject the card and the terminal shall return to idle state.

6.2.4.5 Card Holder Verification (CHV) module

UI_CM_VA_01 subclause 4.5 c5_1, c5_2

Purpose
Ensure that the CHV module allows to enter the CHV number and/or biometric information to proof the identity.

Preconditions
- An IC card requiring a CHV number is available.

Test
Insert that IC card and wait for the request to enter the CHV number or the biometric information.

Result
After entering the requested data the terminal shall operate normally.

UI_CM_VA_02 subclause 4.5 c24_5.1

Purpose
Ensure that the CHV data is coded in accordance with ITU Recommendation T.50 [13] or ISO/IEC 646 [12].

Preconditions
- A card probe with a simulator connected to it is available.

Test
Insert the probe and request the CHV entry from the simulator.

Enter the CHV and check the transmitted format on the simulator.

Result
The format of the transmitted CHV shall comply with ITU Recommendation T.50 [13] or ISO/IEC 646 [12].

UI_CM_VA_03 subclause 4.5, 10.3.3 c5_1.3, c24_5.1

Purpose
Ensure that CHV entry can not be observed easily.

Preconditions
- A terminal is mounted as required.
- An IC card requiring a CHV number is available.

Test
Position people, standing and sitting, within the vicinity (a radius of 1 m) of the keypad.
Enter CHV number normally, both standing and sitting, without special protection.

Result
None of the people shall be able to tell the entered number, not even two digits.

UI_CM_VA_04 subclause 4.5 c5_1.3

Purpose
Ensure that the plain text CHV does not leave the terminal except when it is presented to the card.

Preconditions
- An appropriate observation device (protocol analyser, oscilloscope, simulator, management system) is attached to each interface of the terminal.
- An IC card requiring a CHV number is available.

Test
Start recording on all devices and enter the CHV number.

Result
No device shall show information, which can disclose the CHV besides the one being attached to the card interface.

UI_CM_VA_05 subclause 10.3.3 c23_2

Purpose
Ensure that the number of characters entered is visualized.

Preconditions
- An IC card requiring a CHV number is available.

Test
Insert the card and enter the CHV number when requested and check the display.

Result
The display shall show an indication (e.g. "*" for each entered digit).

UI_CM_VA_06 subclause 10.3.3 c23_3

Purpose
Ensure that the CHV entered is not disclosed by displaying it.

Preconditions
- An IC card requiring a CHV number is available.

Test
Insert the card and enter the CHV number when requested and check the display.

Result
The display shall not show the entered digits, nor any other indication that can reveal the CHV number.

UI_CM_VA_07 subclause 10.3.3 c23_4

Purpose
Ensure that the CHV entered is not disclosed by an audible feedback.

Preconditions
- An IC card requiring a CHV number is available.

Test
Insert the card and enter the CHV number when requested and check the audio messages.

Result
The available audio messages (sound, voice, keyboards clicks) shall not reveal the CHV numbers.

UI_CM_VA_08 subclause 10.3.3 c23_5

Purpose
Ensure that an end-of-CHV character can be entered.

Preconditions
- An IC card requiring a CHV number shorter than 8 digits is available.

Test
Insert the card and enter the CHV number followed by an end-of-CHV character (e.g. "#").

Result
It shall be possible to stop the CHV entry using the end-of-CHV character.

UI_CM_VA_09 subclause 10.3.3 c24_1, c24_2, c24_3

Purpose
Ensure that the CHV is presented to the IC card as 8 byte string, left aligned and padded with binary 1.

Preconditions
- A card probe with a simulator connected to it is available.
- A CHV shorter than 8 digits will be requested.

Test
Insert the probe and request the CHV entry from the simulator.

Enter the CHV and check the transmitted format on the simulator.

Result
The transmitted CHV shall be left aligned and padded with binary 1.

UI_CM_VA_10 subclause 10.3.3 c24_4.1

Purpose
Ensure that the CHV is enciphered when padded with binary 1.

Preconditions
- A card probe with a simulator connected to it is available.
- A CHV shorter than 8 digits will be requested.
- The CHV is requested to be enciphered.

Test

Insert the probe and request the CHV entry from the simulator.

Enter the CHV and check the transmitted format on the simulator.

Result

After deciphering the transmitted CHV shall be left aligned and padded with binary 1.

UI_CM_VA_11 subclause 10.3.3 c24_7

Purpose
Ensure that the CHV is BCD coded for applications requiring a longer CHV.

Preconditions
- A card probe with a simulator connected to it is available.
- A CHV longer than 8 digits will be requested.

Test

Insert the probe and request the CHV entry from the simulator.

Enter the CHV and check the transmitted format on the simulator.

Result

The transmitted CHV shall be BCD coded, left aligned and padded with binary 1.

UI_CM_VA_12 subclause 10.3.4 c25_1.1, c25_1.2, c25_1.3, c25_1.4

Purpose
Ensure that the CHV-change in the card is only activated, if the old CHV and two matching new CHVs have been entered.

Preconditions
- A card probe with a simulator connected to it is available.

Test
Insert the probe and initiate a CHV change.

Enter the CHVs as requested.

Result
The CHV change command shall be activated after the second entry of the new CHV.

UI_CM_VA_13 subclause 10.3.4 c25_1

Purpose
Ensure that an abortion of the CHV is notified, for example when entering a wrong second new CHV.

Preconditions
- An IC card requiring a CHV entry is available.

Test
Initiate the CHV entry, but disturb it by entering a wrong second new CHV.

Result
A notification shall be given and the CHV shall remain the same.

6.2.4.6 Application selection

UI_AS_VA_01 subclause 10.3.6 c27_1.1

Purpose
Ensure that an application is automatically selected in a mono-application terminal.

Preconditions
- A supported IC card is available.

Test
Insert the IC card.

Result
The supported application shall start.

UI_AS_VA_02 subclause 10.3.6 c27_2.1, c27_3

Purpose
Ensure that only the applications present and valid in both, the card and the terminal, are displayed as verbal description.

Preconditions
- A description of all supported applications in the terminal is available.
- Different IC cards with different set of applications is available.
- Different IC cards, with from the terminal supported applications where some of them are invalidated, are available.

Test
Insert the IC cards and compare the list of displayed applications and the list of available applications, in both the terminal and the IC card.

Result
Both lists, displayed and the combination of supported applications of card and terminal, shall match.

UI_AS_VA_03 subclause 10.3.6 c27_2.2, c27_3

Purpose
Ensure that all applications present in both, the card and the terminal, are displayed as verbal description.

Preconditions
- A description of all supported applications in the terminal is available.
- Different IC cards with different set of applications are available.
- Different IC cards, with by the terminal supported applications where some of them are invalidated, are available.

Test
Insert the IC cards and compare the list of displayed applications and the list of available applications, in both the terminal and the IC card.

Result
Both lists, displayed and the combination of supported applications of card or terminal, shall match.

UI_AS_VA_04 subclause 10.3.6 c27_4

Purpose
Ensure that the card expiry date is checked against the real time clock in the terminal.

Preconditions
- Supported IC cards with different expiry dates are available (long term expired, shortly expired, year > 2000 and valid).

Test
Insert all of the IC cards and check the reaction of the terminal.

Result
All expired IC cards shall be rejected.

6.2.4.7 Audio messages

UI_AM_VA_01 subclause 10.4 c28_1

Purpose
Ensure that audio messages are used for user guidance.

Preconditions
- Cards with all supported applications are available.

Test
Go through all allowed scenarios with these cards (debiting, loading, CHV change, etc.) and listen for the audio messages (voice, sound, key clicks, etc.).

Result
The user shall be able to use the available sounds for guidance (not confusion).

UI_AM_VA_02 subclause 10.4 c28_1.1

Purpose
Ensure that the user gets an audio message to remind him to remove his card.

Preconditions
- A supported IC card is available.

Test
Insert the IC card, start a card session and abort it, but leave the card in the terminal. Listen for the available audio messages.

Result
After a while the terminal shall remind the user to remove his card.

Annex A (informative): Bibliography

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