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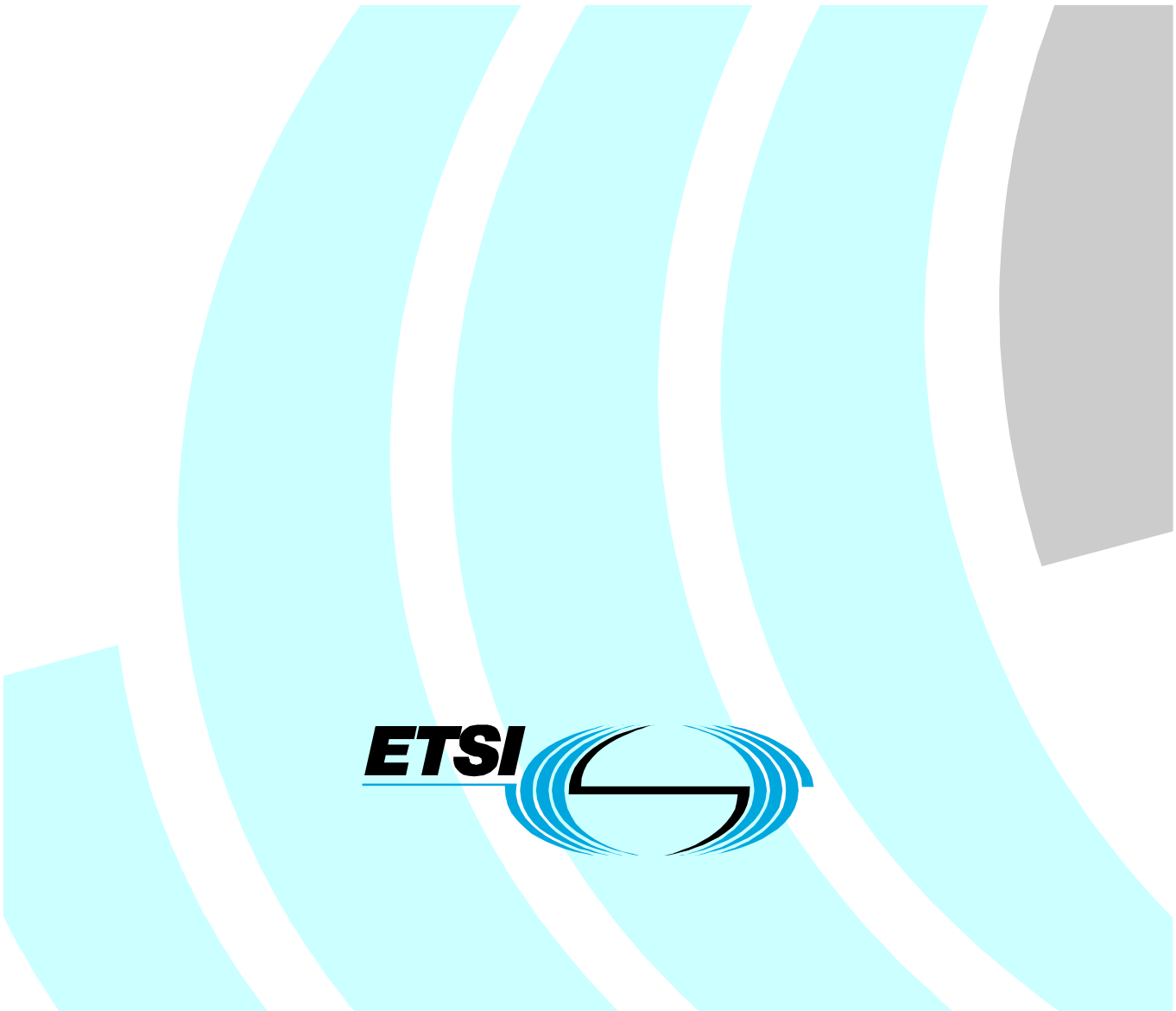
Technical Specification

Smart cards;
UICC-Terminal interface;
Physical, electrical and logical test specification
(Release 5)



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Introduction

The present document defines the interface tests for the Terminal/UICC interface.

The aim of the present document is to ensure interoperability between an UICC and a Terminal independently of the respective manufacturer, card issuer or operator.

Application specific tests for applications residing on an UICC are specified in TS 131 121 [4].

1 Scope

The present document specifies the interface test for the Terminal/UICC.

The present document specifies the tests of:

- physical characteristics of the UICC;
- the electrical interface between the UICC and the Terminal;
- the initial communication establishment and the transport protocols;
- the application independent procedures.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to an TC SCP document, a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI TS 102 221: "Smart cards; UICC-Terminal interface; Physical and logical characteristics (Release 5)".

[2] ISO/IEC 7816-3 (1997): "Information technology - Identification cards - Integrated circuit(s) cards with contacts - Part 3: Electronic signals and transmission protocols".

[3] ETSI TS 121 111: "Universal Mobile Telecommunications System (UMTS); USIM and IC card requirements (3GPP TS 21.111 Release 5)".

[4] ETSI TS 131 121: "Universal Mobile Telecommunications System (UMTS); UICC-terminal interface; Universal Subscriber Identity Module (USIM) application test specification (3GPP TS 31.121)".

3 Definitions, symbols, abbreviations and coding conventions

3.1 Definitions

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

3 V technology Smart Card: Smart Card operating at 3 V ± 10 % and 5 V ± 10 %

1,8 V technology Smart Card: Smart Card operating at 1,8 V ± 10 % and 3 V ± 10 %

3 V technology Terminal: Terminal operating the Smart Card - Terminal interface at 3 V ± 10 % and 5 V ± 10 %

1,8 V technology Terminal: Terminal operating the Smart Card - Terminal interface at 1,8 V ± 10 % and 3 V ± 10 %

access conditions: set of security attributes associated with a file

data object: information coded as TLV objects, i.e. consisting of a Tag, a Length and a Value part

Dedicated File (DF): file containing access conditions and, optionally, Elementary Files (EFs) or other Dedicated Files (DFs)

directory: general term for MF, DF and ADF

Elementary File (EF): file containing access conditions and data and no other files

file: directory or an organized set of bytes or records in the UICC

file identifier: 2 bytes which address a file in the UICC

Master File (MF): unique mandatory file containing access conditions and optionally DFs and/or EFs

plug-in UICC: second format of UICC

3.2 Symbols

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

f	frequency
Fi	Clock rate conversion factor
I	Current
Icc	Current at VCC
Lc	Length of Command data sent by the application layer in a case 3 or 4 Command
Le	Maximum length of data Expected by the application layer in response to a case 2 or 4 Command
Luicc	Exact Length of data available in the UICC to be returned in response to the case 2 or 4 Command received by the UICC
t_F	fall time
t_R	rise time
Vcc	Voltage at VCC

3.3 Abbreviations

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

ACK	ACKnowledge
ADF	Application Dedicated File
AID	Application IDentifier
ATR	Answer To Reset
BGT	Block Guard Time
BWI	Block Waiting Integer
BWT	Block Waiting Time
CLK	CLocK
CWI	Character Waiting Integer
CWT	Character Waiting Time
DF	Dedicated File
EDC	Error Detection Code byte
EF	Elementary File
etu	elementary time unit
GSM	Global System for Mobile communications
I/O	Input/Output
I-Block	Information-Block
ID	IDentifier
IEC	International Electrotechnical Commission
IFSC	Information Field Size for the UICC
IFSD	Information Field Size for the Terminal

INS	INStruction
ISO	International Organization for Standardization
LEN	LENgth
LSB	Least Significant Bit
MF	Master File
MSB	Most Significant Bit
NAD	Node ADdress byte
PCB	Protocol Control Byte
PIN	Personal Identification Number
PPS	Protocol and Parameter Selection
R-Block	Receive-ready Block
RFU	Reserved for Future Use
RST	Reset
S-Block	Supervisory-Block
SFI	Short (elementary) File Identifier
TLV	Tag Length Value
UE	User Equipment
USIM	Universal Subscriber Identity Module
VCC	Power supply input
WI	Waiting time Integer
WTX	Waiting Time eXtension
WWT	Work Waiting Time

3.4 Coding conventions

For the purposes of the present document, the following coding conventions apply.

All lengths are presented in bytes, unless otherwise stated. Each byte is represented by bits b8 to b1, where b8 is the Most Significant Bit (MSB) and b1 is the Least Significant Bit (LSB). In each representation, the leftmost bit is the MSB.

In the UICC, all bytes specified as RFU shall be set to '00' and all bits specifies as RFU shall be set to 0. If the GSM and/or USIM application exists on a UICC or is built on a generic telecommunications card, then other values may apply for the non- GSM or non-USIM applications. The values will be defined in the appropriate specifications for such cards and applications. These bytes and bits shall not be interpreted by a Terminal in a GSM or 3G session.

The coding of all data objects in the present document is according to TS 102 221 [1]. All data objects are BER-TLV except if otherwise defined.

4 Physical characteristic tests

The following tests apply to Terminals using either ID-1 or Plug-in UICC.

4.1 Contact pressure

4.1.1 Definition and applicability

The contact pressure shall be large enough to ensure reliable and continuous contact (e.g. to overcome oxidization and to prevent interruption caused by vibration).

4.1.2 Conformance requirement

Under no circumstances shall the contact force exceed 0,5 N per contact.

4.1.2.1 Reference

TS 102 221 [1], clause 4.4.4.

4.1.3 Test purpose

To verify that the contact pressure of each contacting element is not greater than 0,5 N when each of the following types of card is used:

1) Unembossed.

2) Embossed on the contact side.

NOTE: Only type 1) applies to the plug-in UICC.

4.1.4 Method of test

4.1.4.1 Initial conditions

The Terminal manufacturers shall provide, if possible, a separate card reader (mechanical components) to allow measurements.

4.1.4.2 Procedure

The pressure of each contacting element is measured.

4.1.5 Acceptance criteria

The contact force shall not exceed 0,5 N per contact.

4.2 Curvature of the contacting elements

4.2.1 Definition and applicability

The contact pressure shall be large enough to ensure reliable and continuous contact (e.g. to overcome oxidization and to prevent interruption caused by vibration).

4.2.2 Conformance requirement

The radius of any curvature of the contacting elements shall be greater than or equal to 0,8 mm over the contact area.

4.2.2.1 Reference

TS 102 221 [1], clause 4.4.4.

4.2.3 Test purpose

To verify that the radius of curvature of the contacting elements is greater than or equal to 0,8 mm over the contact area.

4.2.4 Method of test

4.2.4.1 Initial conditions

The Terminal manufacturers shall provide, if possible, a separate card reader (mechanical components) to allow measurements.

4.2.4.2 Procedure

The radius of curvature of the contacting elements is measured on both axes.

4.2.5 Acceptance criteria

The radius of any curvature of the contacting elements shall be greater than or equal to 0,8 mm over the contact area.

5 Electrical characteristic tests

The following tests apply to Terminals using either ID-1 or Plug-in UICC.

5.1 Test of the power transition phases

5.1.1 Phase preceding Terminal power on

5.1.1.1 Definition and applicability

When the mobile equipment is switched off, the contacts of the UICC-Terminal interface remain in an inactive state in order to prevent any damage to the UICC.

5.1.1.2 Conformance requirement

The residual voltage across the contacts of the UICC-Terminal interface (C1, C2, C3, C7) shall not exceed ±0,4 V referenced to GND.

5.1.1.3 Reference

TS 102 221 [1], clause 4.4.3.

5.1.1.4 Test purpose

To verify that the residual voltage across the contacts of the UICC-Terminal interface (C1, C2, C3, C7) is not greater than ±0,4 V referenced to GND.

5.1.1.5 Method of test

5.1.1.5.1 Initial condition

The Terminal shall be connected to an UICC simulator.

The contact C1 (VCC) of the UICC-Terminal interface shall be loaded with an impedance of 10 kΩ.

The other contacts (C2, C3, C7) shall be loaded with an impedance of 50 kΩ.

5.1.1.5.2 Procedure

The residual voltage on each contact shall be measured.

5.1.1.6 Acceptance criteria

The residual voltage on each contact shall not exceed ±0,4 V referenced to GND.

5.1.2 Phase during UICC power on

5.1.2.1 Definition and applicability

When the user equipment is switched on or when the UICC-Terminal interface is being activated after supply voltage switching, the contacts shall be activated in a defined sequence in order to prevent any damage to the UICC.

A 1,8 V technology Terminal may switch from 1,8 V to 3 V and a 3 V technology Terminal may switch from 3 V to 5 V after it has analysed the ATR and identified the UICC voltage class by deactivating the UICC and activating it at the new supply voltage.

This test applies to:

a) 3 V technology Terminals supporting class A and class B operating conditions. This subcase does not apply to terminals which are in compliance with TS 121 111 [3].

b) 1,8 V technology Terminals supporting class B and class C operating conditions.

5.1.2.2 Conformance requirement

a-1) When the UE is soft powered on, the contacts of the UICC-Terminal interface shall be activated to 3 V mode in the following order:

1 - VCC at state H and stable;

2 - CLK stable;

3 - RST at state L for at least 400 clock cycles after the clock signal is applied to CLK;

4 - I/O at state Z within 200 clock cycles after the clock signal is applied to CLK.

a-2) When the UICC - Terminal interface is being activated after the 3 V/5 V switching the contacts shall be activated to 5 V mode in the order given in a-1).

b-1) When the UE is soft powered on, the contacts of the UICC-Terminal interface shall be activated to 1,8 V mode in the following order:

1 - VCC at state H and stable;

2 - CLK stable;

3 - RST at state L for at least 400 clock cycles after the clock signal is applied to CLK;

4 - I/O at state Z within 200 clock cycles after the clock signal is applied to CLK.

b-2) When the UICC - Terminal interface is being activated after the 1,8 V/3 V switching the contacts shall be activated to 3 V mode in the order given in b-1).

5.1.2.3 Reference

a-1), a-2), b-1), b-2) TS 102 221 [1], clause 4.4.2.

5.1.2.4 Test purpose

To verify that the contacts of the UICC-Terminal interface are activated in the correct order, as described in the conformance requirement.

5.1.2.5 Method of test

5.1.2.5.1 Initial condition

The Terminal shall be connected to an UICC-Terminal simulator.

5.1.2.5.2 Procedure

To test the requirements a-1) and b-1), the UE shall be soft powered on.

To test the requirement a-2) and b-2) the Terminal shall be caused to switch the voltage on the UICC-Terminal interface.

The verification of each activation procedure shall be started with the first contact leaving the inactive state. The UICC-Terminal interface shall be monitored until it is fully activated.

5.1.2.6 Acceptance criteria

The contacts of the UICC-Terminal interface shall be activated in the correct order, as described in the conformance requirement.

5.1.3 Phase during Terminal power off

5.1.3.1 Definition and applicability

When the user equipment is soft powered off or when the UICC-Terminal interface is being deactivated for 1,8 V/3 V or 3 V/5 V switching, the contacts shall be deactivated in a defined sequence in order to prevent any damage to the UICC.

NOTE: If during UE operation the UICC is physically removed it is impractical to ensure correct sequencing of deactivation and the possible damage to the UICC cannot be safeguarded by a type approval test. Furthermore, in this situation the integrity of the UICC data is not guaranteed.

This test applies to:

a) 3 V technology Terminals supporting class A and class B operating conditions. This subcase does not apply to terminals which are in compliance with TS 121 111 [3].

b) 1,8 V technology Terminals supporting class B and class C operating conditions.

5.1.3.2 Conformance requirement

a-1) Depending on the state of the clock at the time of deactivation, the contacts of the UICC-Terminal shall be deactivated in one of two ways.

If the clock is running, the contacts of the UICC-Terminal interface shall be deactivated in the following order:

1 - RST at low level;

2 - Clock stopped at low level;

3 - I/O at status A;

4 - VCC inactive.

If the clock is stopped and is not restarted, the Terminal is allowed to deactivate all the contacts in any order, provided that all signals reach low level before Vcc leaves high level.

a-2) When the UICC - Terminal interface is deactivated for 3 V/5 V switching, the contacts shall be deactivated as given in a-1).

b-1) Depending on the state of the clock at the time of deactivation, the contacts of the UICC-Terminal shall be deactivated in one of two ways.

If the clock is running, the contacts of the UICC-Terminal interface shall be deactivated in the following order:

1 - RST at low level;

2 - Clock stopped at low level;

3 - I/O at status A;

4 - VCC inactive.

If the clock is stopped and is not restarted, the Terminal is allowed to deactivate all the contacts in any order, provided that all signals reach low level before Vcc leaves high level.

b-2) When the UICC-Terminal interface is deactivated for 1,8 V/3 V switching, the contacts shall be deactivated as given in b-1).

5.1.3.3 Reference

a-1), a-2), b-1), b-2) TS 102 221 [1], clause 4.4.2.

5.1.3.4 Test purpose

To verify that, depending on the state of the clock (running or stopped), the contacts of the UICC-Terminal interface become deactivated in the correct order, as given in the conformance requirement.

5.1.3.5 Method of test

5.1.3.5.1 Initial condition

The Terminal shall be connected to an UICC simulator.

The UICC characteristics of the directories (see TS 102 221 [1], clause 11.1.1.4.6.1) shall indicate that clock stop is allowed.

5.1.3.5.2 Procedure

To test the requirements a-1) and b-1), the UE shall be soft powered off.

To test the requirement a-2) and b-2), the Terminal shall be caused to switch the voltage on the UICC-Terminal interface.

The UICC-Terminal interface shall be monitored until it is fully deactivated.

5.1.3.6 Acceptance criteria

The contacts of the UICC-Terminal interface shall be deactivated in the correct order, as given in the conformance requirements.

5.1.4 Warm reset timing

5.1.4.1 Definition and applicability

The warm reset is performed according to clause 5.3.3 of ISO/IEC 7816-3 [2] and the UICC shall enter either the negotiable or the specific mode.

5.1.4.2 Conformance requirement

1) VCC at state H and stable.

2) CLK stable.

3) RST at state H.

4) RST at state L for 400 clock cycles.

5) RST at state H for at least 400 clock cycles.

6) RST at state H for 40 000 clock cycles before deactivation if no answer is received.

5.1.4.2.1 Reference

TS 102 221 [1], clause 6.6.

ISO/IEC 7816-3 [2], clause 5.3.3.

5.1.4.3 Test purpose

To verify that the contacts of the UICC-Terminal interface are activated in the correct order, as described in the conformance requirement.

5.1.4.4 Method of test

5.1.4.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator.

5.1.4.4.2 Procedure

a) The Terminal shall be made to initiate a warm reset (TBD).

b) The UICC simulator shall send a valid ATR:

b-1) 400 clock cycles after RST is set to state H.

b-2) 39 990 clock cycles after RST is set to state H. The contacts of the UICC-Terminal interface shall be monitored during the warm reset sequence.

5.1.4.5 Acceptance criteria

The Terminal shall perform a warm reset as described in the conformance requirement.

In steps b-1) and b-2) the Terminal shall read the answer to the warm reset and work with the UICC.

5.1.5 UICC type recognition and voltage switching

5.1.5.1 Reaction of 3 V technology Terminals on type recognition of 3 V technology UICCs

5.1.5.1.1 Definition and applicability

When a 3 V technology Terminal detects a 3 V technology UICC during the ATR analysis the Terminal may either switch to 5 V operation or stay in 3 V operation.

This test applies to 3 V technology Terminals supporting class A and class B operating conditions. This test does not apply to terminals which are in compliance with TS 121 111 [3].

5.1.5.1.2 Conformance requirement

1) A 3 V technology Terminal shall initially activate the UICC with 3 V (i.e. the first activation of a card session).

2) The Terminal shall analyse the ATR and identify the voltage class supported by the UICC.

3) If a 3 V technology Terminal identifies a 3 V technology UICC the Terminal may switch to 5 V operation. Switching from 3 V to 5 V shall only be performed by deactivating the UICC and activating it with 5 V supply voltage immediately after the analysis of the ATR without issuing any commands.

5.1.5.1.3 Reference

TS 102 221 [1], clause 6.2.

5.1.5.1.4 Test purpose

1) To verify that a 3 V technology Terminal initially activates the UICC with 3 V.

2) To verify that a 3 V technology Terminal correctly identifies the voltage class.

3) To verify that a 3 V technology Terminal deactivates the UICC-Terminal interface immediately after the analysis of the ATR without issuing any command and activates it with 5 V supply voltage or proceeds with the 3 V operation during the whole card session without switching to 5 V supply voltage.

5.1.5.1.5 Method of test

5.1.5.1.5.1 Initial condition

The Terminal shall be connected to an UICC simulator simulating a 3 V technology UICC with nominal test conditions (see clause 5.2.1). All elementary files shall be coded as default.

The Terminal shall be powered on.

5.1.5.1.5.2 Procedure

The UICC simulator shall send an ATR indicating a 3 V technology UICC.

The UICC-Terminal interface shall be monitored for at least 1 minute until the UE is switched off.

5.1.5.1.6 Acceptance criteria

1) The initial activation of the UICC-Terminal interface shall be performed with 3 V supply voltage.

2) The Terminal shall react in one of the following ways:

   a) The Terminal deactivates the UICC-Terminal interface immediately after the receipt of the ATR from the UICC and activates it with 5 V supply voltage.

   b) The Terminal proceeds with the card session without switching to another supply voltage.

5.1.5.2 Reaction of 3 V technology Terminals on type recognition of 1,8 V technology UICCs

5.1.5.2.1 Definition and applicability

When a 3 V technology Terminal detects a 1,8 V technology UICC during the ATR analysis the Terminal shall stay in 3 V operation.

This test applies to 3 V technology Terminals supporting class A and class B operating conditions. This test does not apply to terminals which are in compliance with TS 121 111 [3].

5.1.5.2.2 Conformance requirement

1) A 3 V technology Terminal shall initially activate the UICC with 3 V (i.e. the first activation of a card session).

2) The Terminal shall analyse the ATR and identify the voltage class supported by the UICC.

3) If a 3 V technology Terminal identifies a 1,8 V technology UICC during the ATR analysis the Terminal shall stay in 3 V operation.

5.1.5.2.3 Reference

TS 102 221 [1], clause 6.2.

5.1.5.2.4 Test purpose

1) To verify that a 3 V technology Terminal initially activates the UICC with 3 V.

2) To verify that a 3 V technology Terminal correctly identifies the voltage class.

3) To verify that a 3 V technology Terminal stays in 3 V operation during the whole card session.

5.1.5.2.5 Method of test

5.1.5.2.5.1 Initial condition

The Terminal shall be connected to an UICC simulator simulating a 1,8 V technology UICC with nominal test conditions (see clause 5.2.1). All elementary files shall be coded as default.

The Terminal shall be powered on.

5.1.5.2.5.2 Procedure

The UICC simulator shall send an ATR indicating a 1,8 V technology UICC.

The UICC-Terminal interface shall be monitored for at least 1 minute until the UE is switched off.

5.1.5.2.6 Acceptance criteria

1) The initial activation of the UICC-Terminal interface shall be performed with 3 V supply voltage.

2) The Terminal shall react in the following way:

   - The Terminal proceeds with the card session without switching to another supply voltage.

5.1.5.3 Reaction of 1,8 V technology Terminals on type recognition of 1,8 V technology UICCs

5.1.5.3.1 Definition and applicability

When a 1,8 V technology Terminal detects a 1,8 V technology UICC during the ATR analysis the Terminal may either switch to 3 V operation or stay in 1,8 V operation.

This test applies to 1,8 V technology Terminals supporting class B and class C operating conditions.

5.1.5.3.2 Conformance requirement

1) A 1,8 V technology Terminal shall initially activate the UICC with 1,8 V (i.e. the first activation of a card session).

2) The Terminal shall analyse the ATR and identify the voltage class supported by the UICC.

3) If a 1,8 V technology Terminal identifies a 1,8 V technology UICC the Terminal may switch to 3 V operation. Switching from 1,8 V to 3 V shall only be performed by deactivating the UICC and activating it with 3 V supply voltage immediately after the analysis of the ATR without issuing any commands.

5.1.5.3.3 Reference

TS 102 221 [1], clause 6.2.

5.1.5.3.4 Test purpose

1) To verify that a 1,8 V technology Terminal initially activates the UICC with 1,8 V.

2) To verify that a 1,8 V technology Terminal correctly identifies the voltage class.

3) To verify that a 1,8 V technology Terminal deactivates the UICC-Terminal interface immediately after the analysis of the ATR without issuing any command and activates it with 3 V supply voltage or proceeds with the 1,8 V operation during the whole card session without switching to 3 V supply voltage.

5.1.5.3.5 Method of test

5.1.5.3.5.1 Initial condition

The Terminal shall be connected to an UICC simulator simulating a 1,8 V technology UICC with nominal test conditions (see clause 5.2.1). All elementary files are coded as default.

The Terminal shall be powered on.

5.1.5.3.5.2 Procedure

The UICC simulator shall send the ATR indicating a 3 V technology UICC.

The UICC-Terminal interface shall be monitored for at least 1 minute until the UE is switched off.

5.1.5.3.6 Acceptance criteria

1) The initial activation of the UICC-Terminal interface shall be performed with 1,8 V supply voltage.

2) The Terminal shall react in one of the following ways:

   a) The Terminal deactivates the UICC-Terminal interface immediately after the analysis of the ATR from the UICC and activates it with 3 V supply voltage.

   b) The Terminal proceeds with the card session without switching to another supply voltage.

5.1.5.4 Reaction of 1,8 V technology Terminals on type recognition of 3 V technology UICCs

5.1.5.4.1 Definition and applicability

When a 1,8 V technology Terminal detects a 3 V technology UICC during the ATR analysis the Terminal shall switch to 3 V operation.

This test applies to 1,8 V technology Terminals supporting class B and class C operating conditions.

5.1.5.4.2 Conformance requirement

1) A 1,8 V technology Terminal shall initially activate the UICC with 1,8 V (i.e. the first activation of a card session).

2) The Terminal shall analyse the ATR and identify the voltage class supported by the UICC.

3) If a 1,8 V technology Terminal identifies a 3 V technology UICC the Terminal shall switch to 3 V operation. Switching from 1,8 V to 3 V shall only be performed by deactivating the UICC and activating it with 3 V supply voltage immediately after the analysis of the ATR without issuing any commands.

5.1.5.4.3 Reference

TS 102 221 [1], clause 6.2.

5.1.5.4.4 Test purpose

1) To verify that a 1,8 V technology Terminal initially activates the UICC with 1,8 V.

2) To verify that a 1,8 V technology Terminal correctly identifies the voltage class.

3) To verify that a 1,8 V technology Terminal deactivates the UICC-Terminal interface immediately after the recognition of a 3 V technology UICC (in order to switch the supply voltage).

4) To verify that a 1,8 V technology Terminal activates the UICC with 3 V.

5.1.5.4.5 Method of test

5.1.5.4.5.1 Initial condition

The Terminal shall be connected to an UICC simulator simulating a 3 V technology UICC with nominal test conditions (see clause 5.2.1). All elementary files are coded as default.

The Terminal shall be powered on.

5.1.5.4.5.2 Procedure

The UICC simulator shall send the ATR indicating a 3 V technology UICC.

The UICC-Terminal interface shall be monitored for at least 1 minute until the UE is switched off.

5.1.5.4.6 Acceptance criteria

1) The initial activation of the UICC-Terminal interface shall be performed with 1,8 V supply voltage.

2) The Terminal shall react in the following way:

   - The Terminal deactivates the UICC-Terminal interface immediately after the analysis of the ATR from the UICC and activates it with 3 V supply voltage. The Terminal proceeds with the card session.

5.1.5.5 Void

5.1.5.6 Reaction of a Terminals receiving no ATR

5.1.5.6.1 Definition and applicability

A Terminal shall initially activate the UICC with the lowest voltage class available. If no ATR is received, the UICC-Terminal interface shall be deactivated and activated with the next higher class.

NOTE: A 1,8 V technology Terminal shall initially activate the UICC with 1,8 V. If no ATR is received, the UICC-Terminal interface shall be deactivated and activated with 3 V.

5.1.5.6.2 Conformance requirement

If a Terminal does not receive an ATR, the Terminal shall deactivate the UICC-Terminal interface and repeat the activation with the next higher voltage class.

5.1.5.6.3 Reference

TS 102 221 [1], see clause 6.2.

5.1.5.6.4 Test purpose

To verify that a Terminal deactivates the UICC-Terminal interface and repeats the activation with the next higher voltage class in case that the Terminal cannot receive an ATR.

5.1.5.6.5 Method of test

5.1.5.6.5.1 Initial condition

The Terminal shall be connected to an UICC simulator. All elementary files shall be coded as default. The Terminal shall be powered on.

5.1.5.6.5.2 Procedure

The UICC simulator shall send no ATR.

5.1.5.6.6 Acceptance criteria

If no ATR is received by the Terminal, the Terminal shall wait at least 40 000 clock cycles before deactivating the UICC-Terminal interface. The Terminal shall then repeat the activation procedure with the next higher voltage class.

5.2 Electrical tests on each Terminal contact

5.2.1 Nominal test conditions

Tables 5.1 to 5.3 give the electrical conditions that must be applied by the UICC simulator to all contacts during a test if not stated otherwise.

Table 5.1: Nominal test conditions on 5V UICC - Terminal interface

Contacts	Low level	High level	Max. capacitive load
C1 (VCC)	---	I = 10 mA	
C2 (RST)	I = -200 µA	I = +20 µA	30 pF
C3 (CLK)	I = -200 µA	I = +20 µA	30 pF
C5 (GND)	---	---	
C7 (I/O) Terminal input Terminal output	 I = +1 mA I = -1 mA	 I = +20 µA I = +20 µA	30 pF

Table 5.2: Nominal test conditions on 3 V UICC-Terminal interface

Contacts	Low level	High level	Max. capacitive load
C1 (VCC)	---	I = 7.5 mA	
C2 (RST)	I = -200 µA	I = +20 µA	30 pF
C3 (CLK)	I = -20 µA	I = +20 µA	30 pF
C5 (GND)	---	---	
C7 (I/O) Terminal input Terminal output	 I = +1 mA I = -1 mA	 I = +20 µA I = +20 µA	30 pF

Table 5.3: Nominal test conditions on 1,8 V UICC-Terminal interface

Contacts	Low level	High level	Max. capacitive load
C1 (VCC)	---	I = 5 mA	
C2 (RST)	I = -200 µA	I = +20 µA	30 pF
C3 (CLK)	I = -20 µA	I = +20 µA	30 pF
C5 (GND)	---	---	
C7 (I/O) Terminal input Terminal output	 I = +1 mA I = -1 mA	 I = +20 µA I = +20 µA	30 pF

NOTE 1: Measurements of contacts voltage levels can be done at any time since the beginning of activation of the UICC and the end of deactivation of the UICC (ISO/IEC 7816-3 [2], clause 5.1).

NOTE 2: The reference point of all measurements is the contact C5 (Ground).

NOTE 3: Currents flowing into the UICC are considered positive.

5.2.2 Electrical tests on contact C1

C1 = Card power supply (VCC).

5.2.2.1 Test 1

5.2.2.1.1 Definition and applicability

When the user equipment is activated, the supply voltage on the UICC -Terminal interface shall remain in the specified range in order to ensure correct operation and to prevent any damage to the UICC.

This test applies to:

a) 3 V technology Terminals supporting class A and class B operating conditions. This subcase does not apply to terminals which are in compliance with TS 121 111 [3].

b) 1,8 V technology Terminals.

5.2.2.1.2 Conformance requirement

a-1) The voltage on contact C1 of the UICC-Terminal interface shall be 5 V ± 10 % for Icc up to 10 mA when the Terminal is in 5 V operation mode.

a-2) The voltage on contact C1 of the UICC-Terminal interface shall be 3 V ± 10 % for Icc up to 10 mA when the Terminal is in 3 V operation mode.

b-1) The voltage on contact C1 of the UICC-Terminal interface shall be 3 V ± 10 % for Icc up to 10 mA when the Terminal is in 3 V operation mode.

b-2) The voltage on contact C1 of the UICC-Terminal interface shall be 1,8 V ± 10 % for Icc up to 10 mA when the Terminal is in 1,8 V operation mode.

5.2.2.1.3 Reference

a-1) TS 102 221 [1], clause 5.1.

a-2), b-1) TS 102 221 [1], clause 5.2.

b-2) TS 102 221 [1], clause 5.3.

5.2.2.1.4 Test purpose

To verify that the Terminal keeps the voltage on contact C1 of the UICC-Terminal interface within the ranges specified in the conformance requirements.

5.2.2.1.5 Method of test

5.2.2.1.5.1 Initial condition

The Terminal shall be connected to an UICC simulator.

The UE shall be activated.

The remaining contacts of the UICC-Terminal interface shall be in nominal test conditions (see clause 5.2.1).

5.2.2.1.5.2 Test Procedure

The voltage of contact C1 (VCC) of the UICC-Terminal interface shall be measured.

5.2.2.1.6 Acceptance criteria

The voltage on contact C1 of the UICC-Terminal interface shall be within the ranges specified in the conformance requirements.

5.2.2.2 Test 2

5.2.2.2.1 Definition and applicability

When the user equipment is activated, the supply voltage on the UICC-Terminal interface shall be able to counteract spikes in the current consumption of the UICC up to the limits given in the conformance requirement, ensuring that the supply voltage stays in the specified range.

This test applies to:

a) 3 V technology Terminals supporting class A and class B operating conditions. This subcase does not apply to terminals which are in compliance with TS 121 111 [3].

b) 1,8 V technology Terminals supporting class B and class C operating conditions.

5.2.2.2.2 Conformance requirement

a-1) The voltage on contact C1 of the UICC-Terminal interface shall be 5 V ± 10 % for spikes in the current consumption with a maximum charge of 40 n. As with no more than 400 ns duration and an amplitude of at most 200 mA when the Terminal is in 5 V operation mode.

a-2) The voltage on contact C1 of the UICC-Terminal interface shall be 3 V ± 10 % for spikes in the current consumption with a maximum charge of 12 n. As with no more than 400 ns duration and an amplitude of at most 60 mA when the Terminal is in 3 V operation mode.

b-1) The voltage on contact C1 of the UICC-Terminal interface shall be 3 V ± 10 % for spikes in the current consumption with a maximum charge of 12 n. As with no more than 400 ns duration and an amplitude of at most 60 mA when the Terminal is in 3 V operation mode.

b-2) The voltage on contact C1 of the UICC-Terminal interface shall be 1,8 V ± 10 % for spikes in the current consumption with a maximum charge of 12 n. As with no more than 400 ns duration and an amplitude of at most 60 mA when the Terminal is in 1,8 V operation mode.

5.2.2.2.3 Reference

a-1) TS 102 221 [1], clause 5.1.

a-2), b-1) TS 102 221 [1], clause 5.2.

b-2) TS 102 221 [1], clause 5.3.

5.2.2.2.4 Test purpose

To verify that the Terminal keeps the voltage on contact C1 of the UICC-Terminal interface within the specified range for the conditions given in the UICC-Terminal conformance requirement.

5.2.2.2.5 Method of test

5.2.2.2.5.1 Initial condition

The Terminal shall be connected to an UICC simulator.

The UE shall be activated.

The remaining contacts of the interface shall held in nominal test condition (see clause 5.2.1).

5.2.2.2.5.2 Procedure

In order to test the requirements a-1), the voltage on contact C1 of the UICC-Terminal interface shall be monitored and the following current spikes shall be applied:

1) continuous spikes:
   - current amplitude 20 mA;
   - current offset 0 mA;
   - duration 100 ns;
   - pause 100 ns.
2) continuous spikes:
   - current 20 mA;
   - current offset 0 mA;
   - duration 400 ns;
   - pause 400 ns.
3) continuous spikes:
   - current amplitude 15 mA;
   - current offset 5 mA;
   - (i.e. maximum amplitude = 5 mA + 15 mA = 20 mA);
   - duration 150 ns;
   - pause 300 ns.
4) random spikes:
   - current amplitude 200 mA;
   - current offset 0 mA;
   - duration 200 ns;
   - pause between 0,1 ms and 500 ms, randomly varied.
5) random spikes:
   - current amplitude 100 mA;
   - current offset 0 mA;

- duration 400 ns;
- pause between 0,1 ms and 500 ms, randomly varied.

6) random spikes:

- current amplitude 195 mA;
- current offset 5mA;
- (i.e. maximum amplitude = 5 mA + 195 mA = 200 mA);
- Duration 200 ns;
- Pause between 0,1 ms and 500 ms, randomly varied.

In order to test the requirements a-2), b-1) and b-2), the voltage on contact C1 of the UICC-Terminal interface shall be monitored and the following current spikes shall be applied:

1) continuous spikes:

- current amplitude 12 mA;
- current offset 0 mA;
- duration 100 ns;
- pause 100 ns.

2) continuous spikes:

- current 12 mA;
- current offset 0 mA;
- duration 400 ns;
- pause 400 ns.

3) continuous spikes:

- current amplitude 9 mA;
- current offset 3 mA;
- (i.e. maximum amplitude = 3 mA + 9 mA = 12 mA);
- duration 150 ns;
- pause 300 ns.

4) random spikes:

- current amplitude 60 mA;
- current offset 0 mA;
- duration 200 ns;
- pause between 0,1 ms and 500 ms, randomly varied.

5) random spikes:

- current amplitude 30 mA;
- current offset 0 mA;
- duration 400 ns;

- pause between 0,1 ms and 500 ms, randomly varied.

6) random spikes:

- current amplitude 57 mA;
- current offset 3 mA;
- (i.e. maximum amplitude = 3 mA + 57 mA = 60 mA);
- duration 200 ns;
- pause between 0,1 ms and 500 ms, randomly varied.

NOTE: The specified spike durations shall be measured at 50 % of the spike amplitude.

5.2.2.2.6 Acceptance criteria

The voltage on contact C1 of the UICC-Terminal interface shall be within the ranges specified in the conformance requirements.

5.2.2.3 Electrical tests on contact C2

C2 = Reset (RST).

5.2.2.3.1 Definition and applicability

When the user equipment is activated, the voltage on contact C2 of the UICC-Terminal interface shall remain in the specified range in order to ensure correct operation and to prevent any damage to the UICC.

This test applies to:

a) 3 V technology Terminals supporting class A and class B operating conditions. This subcase does not apply to terminals which are in compliance with TS 121 111 [3].

b) 1,8 V technology Terminals supporting class B and class C operating conditions.

5.2.2.3.2 Conformance requirement

a-1) The voltage on contact C2 (RST) of the UICC-Terminal interface shall be between -0,3 V and +0,6 V for a current of -200 µA in low state and between Vcc -0,7 V and Vcc + 0,3 V for a current of +20 µA in high state when the Terminal is in 5 V operation mode.

a-2) The voltage on contact C2 (RST) of the UICC-Terminal interface shall be between -0,3 V and 0,2 × Vcc for a current of -200 µA in low state and between 0,8 × Vcc and Vcc + 0,3 V for a current of +20 µA in high state when the Terminal is in 3 V operation mode.

b-1) The voltage on contact C2 (RST) of the UICC-Terminal interface shall be between -0,3 V and 0,2 × Vcc for a current of -200 µA in low state and between 0,8 × Vcc and Vcc + 0,3 V for a current of +20 µA in high state when the Terminal is in 3 V operation mode.

b-2) The voltage on contact C2 (RST) of the UICC-Terminal interface shall be between -0,3 V and 0,2 × Vcc for a current of -200 µA in low state and between 0,8 × Vcc and Vcc + 0,3 V for a current of +20 µA in high state when the Terminal is in 1,8 V operation mode.

5.2.2.3.3 Reference

a-1) TS 102 221 [1], clause 5.1.

a-2), b-1) TS 102 221 [1], clause 5.2.

b-2) TS 102 221 [1], clause 5.3.

5.2.2.3.4 Test purpose

To verify that the Terminal keeps the voltage on contact C2 (RST) of the UICC-Terminal interface within the specified range, as given in the conformance requirement.

5.2.2.3.5 Method of test

5.2.2.3.5.1 Initial condition

The Terminal shall be connected to an UICC simulator.

The UE shall be activated.

The remaining contacts of the UICC-Terminal interface shall be held in nominal test conditions (see clause 5.2.1).

5.2.2.3.5.2 Procedure

The voltage on contact C2 (RST) of the UICC-Terminal interface shall be measured.

5.2.2.3.6 Acceptance criteria

The voltage on contact C2 (RST) of the UICC-Terminal interface shall be within the range specified in the conformance requirement.

5.2.3 Void

5.2.4 Electrical tests on contact C3

C3 = Clock (CLK).

5.2.4.1 Definition and applicability

When the user equipment is activated, the voltage, the rise/fall time of the signal, the clock cycle ratio and the frequency on contact C3 of the UICC - Terminal interface shall remain in the specified range in order to ensure correct operation and to prevent any damage to the UICC.

This test applies to:

a) 3 V technology Terminals supporting class A and class B operating conditions. This subcase does not apply to terminals which are in compliance with TS 121 111 [3].

b) 1,8 V technology Terminals supporting class B and class C operating conditions.

5.2.4.2 Conformance requirement

a-1) The voltage on contact C3 (CLK) of the UICC - Terminal interface shall be between -0,3 V and +0,5 V for a current of -200 μA in low state and between 0,7 × Vcc and Vcc + 0,3 V for a current of +20 μA in high state when the Terminal is in 5 V operation mode.

a-2) The rise and the fall time of the clock signal shall not exceed 9 % of the clock period with a maximum of 0,5 μs when the Terminal is in 5 V operation mode.

a-3) The cycle ratio of the clock signal shall be between 40 % and 60 % of the period, in steady state when the Terminal is in 5 V operation mode.

a-4) The frequency of the clock signal shall be between 1 MHz and 5 MHz when the Terminal is in 5 V operation mode.

a-5) The voltage on contact C3 (CLK) of the UICC - Terminal interface shall be between -0,3 V and 0,2 × Vcc for a current of -20 μA in low state and between 0,7 × Vcc and Vcc + 0,3 V for a current of +20 μA in high state when the Terminal is in 3 V operation mode.

a-6) The rise and the fall time of the clock signal shall not exceed 50 ns when the Terminal is in 3 V operation mode.

a-7) The cycle ratio of the clock signal shall be between 40 % and 60 % of the period, in steady state when the Terminal is in 3 V operation mode.

a-8) The frequency of the clock signal shall be between 1 MHz and 5 MHz when the Terminal is in 3 V operation mode.

b-1) The voltage on contact C3 (CLK) of the UICC - Terminal interface shall be between -0,3 V and 0,2 × Vcc for a current of -20 μA in low state and between 0,7 × Vcc and Vcc + 0,3 V for a current of +20 μA in high state when the Terminal is in 3 V operation mode.

b-2) The rise and the fall time of the clock signal shall not exceed 50 ns when the Terminal is in 3 V operation mode.

b-3) The cycle ratio of the clock signal shall be between 40 % and 60 % of the period, in steady state when the Terminal is in 3 V operation mode.

b-4) The frequency of the clock signal shall be between 1 MHz and 5 MHz when the Terminal is in 3 V operation mode.

b-5) The voltage on contact C3 (CLK) of the UICC-Terminal interface shall be between -0,3 V and 0,2 × Vcc for a current of -20 μA in low state and between 0,7 × Vcc and Vcc + 0,3 V for a current of +20 μA in high state when the Terminal is in 1,8 V operation mode.

b-6) The rise and the fall time of the clock signal shall not exceed 50 ns when the Terminal is in 1,8 V operation mode.

b-7) The cycle ratio of the clock signal shall be between 40 % and 60 % of the period, in steady state when the Terminal is in 1,8 V operation mode.

b-8) The frequency of the clock signal shall be between 1 MHz and 5 MHz when the Terminal is in 1,8 V operation mode.

5.2.4.3 Reference

a-1 – a-4) TS 102 221 [1], clause 5.1.

a-5 – a-8), b-1 – b-4) TS 102 221 [1], clause 5.2.

b-5 - b-8) TS 102 221 [1], clause 5.3.

5.2.4.4 Test purpose

To verify that the Terminal keeps the voltage, the rise and fall time, the cycle ratio and the frequency on contact C3 (CLK) of the UICC - Terminal interface within the ranges specified in the conformance requirements.

5.2.4.5 Method of test

5.2.4.5.1 Initial condition

The Terminal shall be connected to an UICC simulator.

The UE shall be activated.

The remaining contacts of the UICC-Terminal interface shall be held in nominal test conditions (see clause 5.2.1).

5.2.4.5.2 Procedure

The voltage, the rise/fall time, the clock cycle ratio and the frequency on contact C3 (CLK) of the UICC-Terminal interface shall be measured.

5.2.4.6 Acceptance criteria

The voltage, the rise and fall time, the cycle ratio and the frequency on contact C3 (CLK) of the UICC-Terminal interface shall be within the ranges specified in the conformance requirements.

5.2.5 Electrical tests on contact C7

C7 = Input - output (I/O).

5.2.5.1 Definition and applicability

When the user equipment is activated, the Terminal shall keep the voltage, the current and the rise/fall time of the signal on contact C7 of the UICC-Terminal interface within the specified range in order to ensure correct operation and to prevent any damage to the UICC.

This test applies to:

a) 3 V technology Terminals supporting class A and class B operating conditions. This subcase does not apply to terminals which are in compliance with TS 121 111 [3].

b) 1,8 V technology Terminals supporting class B and class C operating conditions.

5.2.5.2 Conformance requirement

a-1) Terminal receiving state A (low state):

- With an imposed voltage of 0 V the current flowing out of the Terminal shall not exceed 1 mA when the Terminal is in 5 V operation mode.

a-2) Terminal transmitting state A (low state):

- The voltage shall be between -0,3 V and 0,15 × Vcc when a current of 1 mA flowing into the Terminal is applied when the Terminal is in 5 V operation mode.

a-3) Terminal transmitting or receiving state Z (high state):

- The voltage shall be between +3,8 V (V_{OH})/0,7 × Vcc (V_{IH}) respectively and Vcc + 0,3 V when a current of 20 μA flowing out of the Terminal is applied when the Terminal is in 5 V operation mode.

a-4) The rise time and the fall time of the I/O signal shall not exceed 1 μs when the Terminal is in 5V operation mode.

a-5) Terminal receiving state A (low state):

- With an imposed voltage of 0 V the current flowing out of the Terminal shall not exceed 1 mA when the Terminal is in 3 V operation mode.

a-6) Terminal transmitting state A (low state):

- The voltage shall be between -0,3 V and 0,2 × Vcc when a current of 1 mA flowing into the Terminal is applied when the Terminal is in 3 V operation mode.

a-7) Terminal transmitting or receiving state Z (high state):

- The voltage shall be between 0,7 × Vcc and Vcc + 0,3 V when a current of 20 μA flowing out of the Terminal is applied when the Terminal is in 3 V operation mode.

a-8) The rise time and the fall time of the I/O signal shall not exceed 1 μs when the Terminal is in 3 V operation mode.

b-1) Terminal receiving state A (low state):

- With an imposed voltage of 0 V the current flowing out of the Terminal shall not exceed 1 mA when the Terminal is in 3 V operation mode.

b-2) Terminal transmitting state A (low state):

- The voltage shall be between -0,3 V and 0,2 × Vcc when a current of 1 mA flowing into the Terminal is applied when the Terminal is in 3 V operation mode.

b-3) Terminal transmitting or receiving state Z (high state):

- The voltage shall be between 0,7 × Vcc and Vcc + 0,3 V when a current of 20 μA flowing out of the Terminal is applied when the Terminal is in 3 V operation mode.

b-4) The rise time and the fall time of the I/O signal shall not exceed 1 μs when the Terminal is in 3 V operation mode.

b-5) Terminal receiving state A (low state):

- With an imposed voltage of 0 V the current flowing out of the Terminal shall not exceed 1 mA when the Terminal is in 1,8 V operation mode.

b-6) Terminal transmitting state A (low state):

- The voltage shall be between -0,3 V and 0,2 × Vcc when a current of 1 mA flowing into the Terminal is applied when the Terminal is in 1,8 V operation mode.

b-7) Terminal transmitting or receiving state Z (high state):

- The voltage shall be between 0,7 × Vcc and Vcc + 0,3 V when a current of 20 μA flowing out of the Terminal is applied when the Terminal is in 1,8 V operation mode.

b-8) The rise time and the fall time of the I/O signal shall not exceed 1 μs when the Terminal is in 1,8 V operation mode.

5.2.5.3 Reference

a-1 – a-4) TS 102 221 [1], clause 5.1.

a-5 – a-8), b-1 – b-4) TS 102 221 [1], clause 5.2.

b-4 – b-8) TS 102 221 [1], clause 5.3.

5.2.5.4 Test purpose

To verify that the Terminal keeps the voltage, the current and the rise and fall times of the signal on contact C7 (I/O) of the UICC-Terminal interface within the ranges specified in the conformance requirements.

5.2.5.5 Method of test

5.2.5.5.1 Initial condition

The Terminal shall be connected to an UICC simulator.

The UE shall be activated.

The remaining contacts of the UICC-Terminal interface shall be held in nominal test conditions (see clause 5.2.1).

5.2.5.5.2 Procedure

The voltage, the current and the rise/fall time on contact C7 (I/O) of the UICC-Terminal interface shall be measured.

5.2.5.6 Acceptance criteria

The voltage, the current and the rise and fall times of the signal on contact C7 (I/O) of the UICC-Terminal interface shall be within the ranges specified in the conformance requirements.

6 Initial communication tests

The following tests apply to Terminals using either ID-1 or Plug-in UICC.

6.1 ATR

6.1.1 ATR characters

6.1.1.1 Definition and applicability

The ATR is the first string of bytes sent from the UICC to the Terminal after a reset has been performed.

The historical bytes indicate to the external world how to use the card.

Both protocols T=0 and T=1 are mandatory for the Terminal. The protocol starts after either the answer to reset or a successful PPS exchange.

6.1.1.2 Conformance requirement

1) The Terminal shall adopt the data encoding convention and initial etu time defined in the initial character TS of the ATR.

2) The Terminal shall be able to receive interface characters for transmission protocols other than T=0 and T=1, historical bytes and a check byte, even if only T=0 and T=1 are used by the Terminal.

6.1.1.2.1 Reference

TS 102 221 [1], clauses 6.3 and 7.

6.1.1.3 Test purpose

1) To verify that the Terminal adopts the data encoding convention and initial etu time defined in the initial character TS of the ATR.

2) To verify that the Terminal accepts interface characters for transmission protocols (T=0 and T=1), historical bytes and a check byte.

6.1.1.4 Method of test

6.1.1.4.1 Initial conditions

The Terminal shall be connected to the UICC (or UICC simulator).

6.1.1.4.2 Procedure

a) The Terminal shall be powered on.

b) The UICC (or UICC simulator) shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)

Character	Value	Description
TA3	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'C2'	Check byte

c) The Terminal shall be made to send further commands to the UICC (or UICC simulator) (e.g. by entering the PIN).

d) The Terminal is switched off and on.

e) The UICC (or UICC simulator) shall send an ATR as follows:

Character	Value	Description
TS	'3F'	Indicates inverse convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)
TA3	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'C2'	Check byte

f) The Terminal shall be made to send further commands to the UICC (or UICC simulator) (e.g. by entering the PIN).

g) The Terminal is switched off and on.

h) The UICC (or UICC simulator) shall send an ATR as follows:

Character	Value	Description
TS	'3F'	Indicates inverse convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	Only TD2 is present Protocol T=0 supported by UICC
TD2	'B1'	TA3, TB3 and TD3 are present Protocol T=1 supported by UICC
TA3	'FE'	IFSC is 254 bytes long
TB3	'00'	Block Waiting Integer=0 Character Waiting Integer=0

Character	Value	Description
TD3	'1F'	Only TA4 is present Global interface bytes following (T=15)
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'8D'	Check byte

i) The Terminal shall be made to send further commands to the UICC (or UICC simulator) (e.g. by entering the PIN).

j) The Terminal is switched off and on.

k) The UICC (or UICC simulator) shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'91'	TA2 and TD2 are present Protocol T=1 supported by UICC
TA2	'81'	Protocol T=1 used in specific mode Parameters indicated by the interface bytes, and card is not able to change mode
TD2	'B1'	TA3, TB3 and TD3 are present Protocol T=1 supported by UICC
TA3	'FE'	IFSC is 254 bytes long
TB3	'00'	Block Waiting Integer=0 Character Waiting Integer=0
TD3	'0F'	Global interface bytes following (T=15)
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EF_{DIR} present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'0D'	Check byte

l) The Terminal shall be made to send further commands to the UICC (or UICC simulator) (e.g. by entering the PIN).

m) The Terminal is switched off and on.

n) The UICC (or UICC simulator) shall send an ATR as follows:

Character	Value	Description
TS	'3F'	Indicates inverse convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'91'	TA2 and TD2 are present Protocol T=1 supported by UICC
TA2	'81'	Protocol T=1 used in specific mode Parameters indicated by the interface bytes, and card is not able to change mode
TD2	'B1'	TA3, TB3 and TD3 are present Protocol T=1 supported by UICC
TA3	'FE'	IFSC is 254 bytes long
TB3	'00'	Block Waiting Integer=0 Character Waiting Integer=0
TD3	'0F'	Global interface bytes following (T=15)
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EF_{DIR} present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'0D'	Check byte

o) The Terminal shall be made to send further commands to the UICC (or UICC simulator) (e.g. by entering the PIN).

6.1.1.5 Acceptance criteria

In step c), the Terminal shall start a T=0 session in direct convention and work with the UICC (or UICC simulator).

In steps f) and i), the Terminal shall start a T=0 session in inverse convention and work with the UICC (or UICC simulator).

In step l), the Terminal shall start a T=1 session in direct convention and work with the UICC (or UICC simulator).

In step o), the Terminal shall start a T=1 session in inverse convention and work with the UICC (or UICC simulator).

6.2 Clock stop mode with 1,8 V technology UICC

6.2.1 Definition and applicability

The Terminal shall be able to receive interface characters, historical bytes and a check byte, even if only T=0 and T=1 are used by the Terminal.

T=15 global interface parameters shall be returned by the UICC.

The UICC shall support the clock stop procedure. The clock stop mode is indicated in TA_i (i > 2) in T=15 in the ATR.

6.2.2 Conformance requirement

If the UICC supports any other operating conditions even together with class A, clock stop mode shall be supported and the indication shall be set accordingly. The terminal shall follow this indication independently of operating conditions indicated by the card.

In case the UICC does not support any supply voltage indication, the UICC shall be treated as a 5 V only card by the Terminal.

The Terminal shall wait at least 1 860 clock cycles after having received the last character, including the guard time (2 etu), of the response before it switches off the clock. It shall wait at least 744 clock cycles before it sends the first command after having started the clock.

6.2.2.1 Reference

TS 102 221 [1], clauses 6.7, 6.10 and 11.1.1.4.6.1.

ISO/IEC 7816-3 [2], clauses 5.3.4 and 6.5.5.

6.2.3 Test purpose

1) To verify that the clock is only switched off as indicated in the ATR first global interface byte and file characteristics (byte 1 of the directory characteristics).

2) To verify that the timing of the clock switching is as specified.

6.2.4 Method of test

6.2.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator. PIN shall be enabled.

6.2.4.2 Procedure

a) The Terminal shall be powered on and the UICC simulator shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)
TA3	'C6'	Clock stop supported (no preferred state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'42'	Check byte

and be used with bits set as follows:

b8	b7	b6	b5	B4	b3	b2	b1	Meaning
0	1	1	0	0	0	0	1	Voltage classes BC and clock stop mode supported. No preferred level.

b) When the Terminal is in mode PIN check, 10 s shall elapse before the PIN shall be entered.

c) The Terminal shall be powered off and on. The UICC simulator shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI = 1 (F = 372) Baud rate adjustment factor DI = 1 (D = 1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)
TA3	'86'	Clock stop supported (high electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'02'	Check byte

and be used with bits set as follows:

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
0	1	1	0	0	1	0	1	Voltage classes BC and clock stop mode supported. High level preferred

d) When the Terminal is in mode PIN check, 10 s shall elapse before the PIN shall be entered.

e) The Terminal shall be powered off and on. The UICC simulator shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)
TA3	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported

Character	Value	Description
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'C2'	Check byte

and be used with bits set as follows:

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
0	1	1	0	1	0	0	1	Voltage classes BC and clock stop mode supported. Low level preferred

f) When the Terminal is in mode PIN check, 10 s shall elapse before the PIN shall be entered.

6.2.5 Acceptance criteria

1) During step b), the Terminal shall switch off the clock at either high or low level.

2) During step d), the Terminal shall switch off the clock at high level.

3) During step f), the Terminal shall switch off the clock at low level.

4) During steps b), d) and f), the Terminal shall not switch off the clock until at least 1 860 clock cycles after having received the last character of the response including the minimum guard time (2 etu).

5) During steps b), d) and f), the Terminal shall wait at least 744 clock cycles before it sends the first command after having restarted the clock.

NOTE: The Terminal shall operate at either 1,8 V or 3 V and use the supply voltage procedure if it does not support the first value.

6.3 Clock stop mode with 3 V technology UICC

6.3.1 Definition and applicability

The Terminal shall be able to receive interface characters, historical bytes and a check byte, even if only T=0 and T=1 are used by the Terminal.

T=15 global interface parameters shall be returned by the UICC.

The UICC shall support the clock stop procedure. The clock stop mode is indicated in TA_i (i > 2) in T=15 in the ATR.

6.3.2 Conformance requirement

If the UICC supports any other operating conditions even together with class A, clock stop mode shall be supported and the indication shall be set accordingly. The terminal shall follow this indication independently of operating conditions indicated by the card.

In case the UICC does not support any supply voltage indication, the UICC shall be treated as a 5 V only card by the Terminal.

The Terminal shall wait at least 1 860 clock cycles after having received the last character, including the guard time (2 etu), of the response before it switches off the clock. It shall wait at least 744 clock cycles before it sends the first command after having started the clock.

6.3.2.1 Reference

TS 102 221 [1], clauses 6.7, 6.10 and 11.1.1.4.6.1.

ISO/IEC 7816-3 [2], clauses 5.3.4 and 6.5.5.

6.3.3 Test purpose

1) To verify that the clock is only switched off as indicated in the ATR first global interface byte and file characteristics (byte 1 of the directory characteristics).

2) To verify that the timing of the clock switching is as specified.

6.3.4 Method of test

6.3.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator. PIN shall be enabled.

6.3.4.2 Procedure

a) The Terminal shall be powered on and the UICC simulator shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)
TA3	'C3'	Clock stop supported (no preferred state) 3 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'47'	Check byte

and be used with bits set as follows:

b8	b7	b6	b5	B4	b3	b2	b1	Meaning
0	0	1	1	0	0	0	1	Voltage classes AB and clock stop mode supported. No preferred level

b) When the Terminal is in mode PIN check, 10 s shall elapse before the PIN shall be entered.

c) The Terminal shall be powered off and on. The UICC simulator shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372)

Character	Value	Description
		Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)
TA3	'83'	Clock stop supported (high electrical state) 3 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'07'	Check byte

and be used with bits set as follows:

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
0	0	1	1	0	1	0	1	Voltage classes AB and clock stop mode supported. High level preferred

d) When the Terminal is in mode PIN check, 10 s shall elapse before the PIN shall be entered.

e) The Terminal shall be powered off and on. The UICC simulator shall send an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'80'	TD2 only is present Protocol T=0 supported by UICC
TD2	'1F'	TA3 only is present Global interface bytes following (T=15)
TA3	'43'	Clock stop supported (low electrical state) 3 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'C7'	Check byte

and be used with bits set as follows:

b8	b7	b6	b5	b4	b3	b2	b1	Meaning
0	0	1	1	1	0	0	1	Voltage classes AB and clock stop mode supported. Low level preferred

f) When the Terminal is in mode PIN check, 10 s shall elapse before the PIN shall be entered.

6.3.5 Acceptance criteria

1) During step b), the Terminal shall switch off the clock at either high or low level.

2) During step d), the Terminal shall switch off the clock at high level.

3) During step f), the Terminal shall switch off the clock at low level.

4) During steps b), d) and f), the Terminal shall operate at 3 V and not switch off the clock until at least 1 860 clock cycles after having received the last character of the response including the minimum guard time (2 etu).

5) During steps b), d) and f), the Terminal shall wait at least 744 clock cycles before it sends the first command after having restarted the clock.

6.4 Void

6.5 Speed enhancement

6.5.1 Definition and applicability

The Terminal shall at least support speed enhancement using (F,D) = (512,8) and (512,16) in addition to (372,1), the default.

6.5.2 Conformance requirement

For the Terminal, it is mandatory to support F = 512 and D = 8 as well as F = 512 and D = 16 (in addition to the default values F = 372 and D = 1).

6.5.3 Test purpose

To verify that the Terminal supports the transmission parameters F = 512 and D = 8 as well as F = 512 and D = 16.

6.5.4 Method of test

6.5.4.1 Initial conditions

The Terminal is connected to the UICC simulator.

6.5.4.2 Procedure

a) The Terminal is powered on.

b) The UICC simulator sends an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, TD1 are present 7 bytes of historical bytes
TA1	'94'	F=512, D=8
TD1	'80'	TD2 only is present T=0
TD2	'1F'	TA3 only is present Global interface bytes following
TA3	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC, supporting class B and class C
T1	'80'	
T2	'31'	Card data services

Character	Value	Description
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'47'	Check byte

c) After receipt of the PPS Request, the UICC simulator answers with the PPS Response "FF 10 94 7B" using a work waiting time of 9 600 etu (initial waiting time).

d) The UICC simulator transmits with enhanced speed (F = 512, D = 8).

e) The Terminal is switched off and on. The UICC simulator sends an ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, TD1 are present 7 bytes of historical bytes
TA1	'95'	F=512, D=16
TD1	'80'	TD2 only is present T=0
TD2	'1F'	TA3 only is present Global interface bytes following
TA3	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC, supporting class B and class C
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
TCK	'DA'	Check byte

f) After receipt of the PPS Request, the UICC simulator answers with the PPS Response "FF 10 95 7B" using a work waiting time of 9 600 etu (initial waiting time).

g) The UICC simulator transmits with enhanced speed (F = 512, D = 16).

6.5.5 Acceptance criteria

After step b) the Terminal shall send to the UICC simulator the PPS Request "FF 10 94 7B".

After step c) the Terminal shall work with the UICC simulator.

After step e) the Terminal shall send to the UICC simulator the PPS Request "FF 10 95 7B".

After step f) the Terminal shall work with the UICC simulator.

7 Transmission protocol tests

The following tests apply to Terminals using either ID-1 or Plug-in UICC.

7.1 Character transmission

7.1.1 Bit/character duration during the transmission from the Terminal to the UICC

7.1.1.1 Definition and applicability

A character consists of 10 consecutive bits:

- 1 start bit in state L;
- 8 bits, which comprise the data byte;
- 1 even parity checking bit.

7.1.1.2 Conformance requirement

The bit/character duration and the delay between two consecutive characters (between start leading edges) sent by the Terminal shall be in the range specified.

7.1.1.2.1 Reference

TS 102 221 [1], clause 7.2.1.

7.1.1.3 Test purpose

To verify the timing during the transmission from the Terminal to the UICC.

7.1.1.4 Method of test

7.1.1.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.1.1.4.2 Procedure

A number of characters are transmitted from the Terminal to the UICC simulator. The UICC simulator shall measure the bit/character duration and the delay between two consecutive characters for all characters transmitted by the Terminal.

7.1.1.5 Acceptance criteria

The timing shall be in the specified range.

7.1.2 Bit/character duration during the transmission from the UICC to the Terminal

7.1.2.1 Definition and applicability

A character consists of 10 consecutive bits:

- 1 start bit in state L;
- 8 bits, which comprise the data byte;
- 1 even parity checking bit.

7.1.2.2 Conformance requirement

The bit/character duration and the delay between two consecutive characters (between start leading edges) sent by the Terminal shall be in the range specified.

7.1.2.2.1 Reference

TS 102 221 [1], clause 7.2.1.

7.1.2.3 Test purpose

To verify the timing during the transmission from the UICC to the Terminal.

7.1.2.4 Method of test

7.1.2.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.1.2.4.2 Procedure

The UICC simulator shall send responses with the maximum and minimum bit/character duration specified in TS 102 221 [1].

7.1.2.5 Acceptance criteria

The Terminal shall accept the response and act accordingly.

7.2 T=0 protocol

7.2.1 Timing

7.2.1.1 Definition and applicability

The minimum interval between the leading edge of the start bits of two consecutive characters shall be at least 12 etu. The Work Waiting Time (WWT) is the maximum interval between the start leading edge of any character sent by the UICC and the start leading edge of the previous character sent by either by the UICC or the terminal.

The value of the WWT shall not exceed $960 \times WI \times Fi/f$. WI is an integer received in the specific interface byte TC2. The clock rate conversion factor, Fi, may be indicated in TA1.

7.2.1.2 Conformance requirement

1) If TA1 is absent the Terminal shall use the default value Fi = 372.

2) If no TC2 is available the Terminal shall use the default value of WI (10).

3) The Terminal shall accept characters sent by the UICC with the Work Waiting Time within the specified range.

7.2.1.2.1 Reference

TS 102 221 [1], clause 7.2.2.1.

7.2.1.3 Test purpose

1) To verify the correct evaluation of the characters TA1 and TC2 indicated in the ATR.

2) To verify that the Terminal accepts the minimum and maximum Work Waiting Time during the transmission from the UICC to the Terminal.

3) To verify that the Terminal deactivates the UICC if WWT is exceeded.

7.2.1.4 Method of test

7.2.1.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.2.1.4.2 Procedure

a) Upon reception of a reset the UICC simulator shall transmit the ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct or inverse convention
T0	'87'	TD1 only is present 7 bytes of historical bytes
TD1	'80'	TD2 only is present
TD2	'1F'	TA3 only is present Global interface bytes following
TA3	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'C3'	Check byte

b) Upon reception of a reset the UICC simulator shall transmit the ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct or inverse convention
T0	'97'	TA1 and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'C0'	TC2 and TD2 are present
TC2	'01'	WI=1 meaning WWT=960x(Fi/f)x1

Character	Value	Description
TD2	'1F'	TA3 only is present Global interface bytes following
TA3	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'83'	Check byte

c-1) The UICC simulator shall transmit with a WWT of 12 etu.

c-2) The UICC simulator shall transmit with the specified WWT (960 × (Fi/f) × WI).

c-3) The UICC simulator shall not transmit i.e. WWT exceeded.

7.2.1.5 Acceptance criteria

In step a), the Terminal shall work with the UICC simulator using the default values of TA1 and TC2.

In steps c-1) and c-2) the Terminal shall work with the UICC simulator.

In step c-3) the Terminal shall initiate a deactivation of the UICC within 960 etu following the excess of WWT.

7.2.2 Command processing, ACK, NACK, NULL procedure bytes

7.2.2.1 Definition and applicability

Procedure bytes are used to keep up the communication between the terminal and the UICC. They shall not be transmitted to the Application Layer.

The status bytes SW1 SW2 form an end sequence indicating the status of the UICC at the end of a command.

7.2.2.2 Conformance requirement

The Terminal shall correctly use the different modes of data transmission.

7.2.2.2.1 Reference

TS 102 221 [1], clause 7.2.2.3.

ISO/IEC 7816-3 [2], clause 8.3.

7.2.2.3 Test purpose

To verify that the Terminal correctly uses the different modes of data transmission.

7.2.2.4 Method of test

7.2.2.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

T=0 ATR shall have been received and eventual PPS procedure successfully completed.

7.2.2.4.2 Procedure

a) The Terminal shall be made to initiate a VERIFY PIN command with 8 bytes of data.

b) The UICC simulator shall answer the first 5 bytes with ACK=INS complemented.

c) The UICC simulator shall answer the next data byte with NULL (NULL="60").

d) The UICC simulator shall then send ACK=INS. This byte is sent when the elapsed time since step b) is greater than the Work Waiting Time.

e) The UICC simulator shall answer the transmission of the rest of the data with NULL.

f) The UICC simulator shall then send SW1 and SW2, indicating correct execution of the command ("90" and "00" for SW1 and SW2 respectively). These bytes are sent when the elapsed time since step d) is greater than the Work Waiting Time.

7.2.2.5 Acceptance criteria

The command shall be executed correctly.

7.2.3 Case 2 command, use of procedure bytes '61xx' and '6Cxx'

7.2.3.1 Definition and applicability

Procedure bytes '61XX' and '6CXX' are returned by the UICC to control exchanges between the Transport Layer of the Terminal and the UICC, and should never be returned to the Application Layer of the Terminal. Command processing in the UICC is not complete if it has returned procedure bytes '61XX' or '6CXX'.

7.2.3.2 Conformance requirement

The UICC returns procedure bytes '61xx 'and '6Cxx' to the Transport Layer of the Terminal to indicate to it the manner in which it should retrieve the data requested by the command currently being processed. These procedure bytes are only used when processing case 2 and 4 commands using T=0.

7.2.3.2.1 Reference

TS 102 221 [1], clause 7.3.1.1.5.

ISO/IEC 7816-3 [2], clause 8.3.

7.2.3.3 Test purpose

To verify that the Terminal correctly handles the procedure bytes '61XX' and '6CXX' when processing a case 2 command.

7.2.3.4 Method of test

7.2.3.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

T=0 ATR shall have been received and eventual PPS procedure successfully completed.

7.2.3.4.2 Procedure

a) The Terminal shall be made to initiate a case 2 command with Le > Luicc (ex: READ RECORD command).

b) The UICC simulator shall send '6CLuicc' procedure bytes.

c) Following receipt of the command, the UICC simulator shall send '61xx' procedure bytes.

d) Following receipt of the command, the UICC simulator shall send corresponding data + '61yy' procedure bytes.

e) Following receipt of the command, the UICC simulator shall then send the rest of the data and SW1 and SW2, indicating correct execution of the command ("90" and "00" for SW1 and SW2 respectively).

7.2.3.5 Acceptance criteria

After step b) the Terminal shall send the previous command with Le = 'Luicc'.

After step c) the Terminal shall send a GET RESPONSE command with Le = 'xx'.

After step f) the Terminal shall send a GET RESPONSE command with Le = 'yy'.

7.2.4 Case 4 command, use of procedure bytes '61xx'

7.2.4.1 Definition and applicability

Procedure bytes '61XX' and '6CXX' are returned by the UICC to control exchanges between the Transport Layer of the Terminal and the UICC, and should never be returned to the Application Layer of the Terminal. Command processing in the UICC is not complete if it has returned procedure bytes '61XX' or '6CXX'.

7.2.4.2 Conformance requirement

The UICC returns procedure bytes '61xx' and '6Cxx' to the Transport Layer of the Terminal to indicate to it the manner in which it should retrieve the data requested by the command currently being processed. These procedure bytes are only used when processing case 2 and 4 commands using T=0.

7.2.4.2.1 Reference

TS 102 221 [1], clause 7.3.1.1.5.

ISO/IEC 7816-3 [2], clause 8.3.

7.2.4.3 Test purpose

To verify that the Terminal correctly handles the procedure bytes '61XX' when processing a case 4 command.

7.2.4.4 Method of test

7.2.4.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

T=0 ATR shall have been received and eventual PPS procedure successfully completed.

7.2.4.4.2 Procedure

a) The Terminal shall be made to initiate a case 4 command with Le > Luicc (ex: SELECT command).

b) The UICC simulator shall answer the command header with INS and send '61xx' procedure bytes following reception of data.

c) Following receipt of the command, the UICC simulator shall send corresponding data + '61yy' procedure bytes.

d) Following receipt of the command, the UICC simulator shall then send the rest of the data and SW1 and SW2, indicating correct execution of the command ("90" and "00" for SW1 and SW2 respectively).

7.2.4.5 Acceptance criteria

After step b) the Terminal shall send a GET RESPONSE command with Le = 'xx'.

After step c) the Terminal shall send a GET RESPONSE command with Le = 'yy'.

7.2.5 Command processing, warning and error status bytes

7.2.5.1 Definition and applicability

The status bytes SW1 SW2 form an end sequence indicating the status of the UICC at the end of a command.

7.2.5.2 Conformance requirement

In the case of an error, the UICC may return status indicating error or warning conditions instead of the '61xx' or '6Cxx' response.

7.2.5.2.1 Reference

TS 102 221 [1], clauses 7.2.2.3 and 10.2.1.

7.2.5.3 Test purpose

To verify that the Terminal correctly handles status bytes different than '9000'.

7.2.5.4 Method of test

7.2.5.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

T=0 ATR shall have been received and eventual PPS procedure successfully completed.

7.2.5.4.2 Procedure

a) Warning:

a-1) The Terminal shall be made to initiate a case 4 command (ex: SELECT command).

a-2) The UICC simulator shall send warning status bytes ('62xx' '63xx' or '9xxx').

a-3) Following receipt of the command, the UICC simulator shall then send the rest of the data and SW1 and SW2, indicating correct execution of the command ("90" and "00" for SW1 and SW2 respectively).

b) Error:

b-1) The Terminal shall be made to initiate a case 4 command (ex: SELECT command).

b-2) The UICC simulator shall send error status bytes ('6xxx' except '6Cxx', '61xx', '62xx' and '63xx').

7.2.5.5 Acceptance criteria

After step a-2) the Terminal shall send a GET RESPONSE command with Le = '00'.

After step b-2) the Terminal shall discontinue processing of the command.

7.2.6 Error correction

7.2.6.1 Definition and applicability

If the UICC as receiver detects a parity error within 11 etu ± 0,2 etu starting from the leading edge of the start bit, in a character just received, it shall set I/O to state L to indicate the error to the Terminal.

7.2.6.2 Conformance requirement

The error detection and correction procedure is mandatory for T=0 protocol except for the Terminal during the ATR-procedure.

7.2.6.2.1 Reference

TS 102 221 [1], clause 7.2.2.4.

7.2.6.3 Test purpose

To verify the error handling during the transmission from the Terminal to the UICC.

7.2.6.4 Method of test

7.2.6.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.2.6.4.2 Procedure

The UICC simulator shall transmit an error signal in response to a received character by setting the I/O line to state L for a maximum of 2 etu and a minimum of 1 etu, 10,5 etu ± 0,2 etu after the leading edge of the start bit of the received character.

7.2.6.5 Acceptance criteria

The Terminal shall repeat the disputed character after a minimum delay of 2 etu.

7.2.7 Error detection

7.2.7.1 Definition and applicability

If the Terminal as receiver detects a parity error within 11 ± 0,2 etu starting from the leading edge of the start bit, in a character just received, it shall set I/O to state L to indicate the error to the UICC.

7.2.7.2 Conformance requirement

The error detection and correction procedure is mandatory for T=0 protocol except for the Terminal during the ATR-procedure.

7.2.7.2.1 Reference

TS 102 221 [1], clause 7.2.2.4.

7.2.7.3 Test purpose

To verify the error handling during the transmission from the UICC to the Terminal.

7.2.7.4 Method of test

7.2.7.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.2.7.4.2 Procedure

The UICC simulator shall send a response with a parity error and check that the terminals correctly handles it.

7.2.7.5 Acceptance criteria

The Terminal shall detect the parity error by setting the I/O line to state L for a maximum of 2 etu and a minimum of 1 etu, 10,5 etu ± 0,2 etu after the leading edge of the start bit of the erroneous character and correctly evaluate the character when repeated by the UICC simulator.

7.3 T=1 protocol

7.3.1 Character Waiting Time

7.3.1.1 Definition and applicability

CWT is defined as the maximum delay between the leading edges of two consecutive characters in the block.

7.3.1.2 Conformance requirement

CWI is used to calculate CWT and shall be in the range from 0 to 5. The value is set in bits b4 to b1 in TB3. The value of CWT may be calculated from the following equation: CWT = $(11 + 2^{CWI})$ etu.

7.3.1.2.1 Reference

TS 102 221 [1], clause 7.2.3.1.

ISO/IEC 7816-3 [2], clause 9.5.3.

7.3.1.3 Test purpose

To verify that the Terminal respects the CWT indicated by the UICC.

7.3.1.4 Method of test

7.3.1.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.3.1.4.2 Procedure

a) Upon reception of a reset the UICC simulator shall transmit the ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'81'	Only TD2 is present Protocol T=1 supported by UICC

Character	Value	Description
TD2	'A1'	TB3 and TD3 are present Protocol T=1 supported by UICC
TB3	'05'	Block Waiting Integer=0 Character Waiting Integer=5 indicating CWT=43 etu
TD3	'1F'	Only TA4 is present Global interface bytes following (T=15)
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'67'	Check byte

b) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring reception of an I-Block.

b-1) The UICC simulator shall send the I-Block (data + '9000' indicating correct execution of the command) using CWT=11 etu.

b-2) The UICC simulator shall send the I-Block (data + '9000' indicating correct execution of the command) using CWT=43 etu.

7.3.1.5 Acceptance criteria

In step b.1) and b.2) the Terminal shall acknowledge the error free I-Block.

7.3.2 Block Timing

7.3.2.1 Definition and applicability

BWT is defined as the maximum delay between the leading edge of the last character of the block received by the card and the leading edge of the first character of the next block sent by the card.

BGT is defined as the minimum delay between the leading edge of two consecutive characters sent in opposite directions. The value of BGT shall be 22 etu.

7.3.2.2 Conformance requirement

BWI is used to calculate BWT and shall be in the range from 0 to 4. The value is set in bits b5 to b8 in TB3. The value of BWT may be calculated from the following equation: $BWT = 11 + (2^{BWI} \times 960 \times 372/f)$ etu.

The delay between the last character of a block received by the UICC and the first character of the next block sent from the UICC shall be in the interval: BGT < delay < BWT.

7.3.2.2.1 Reference

TS 102 221 [1], clause 7.2.3.

ISO/IEC 7816-3 [2], clause 9.5.3.

7.3.2.3 Test purpose

To verify that the Terminal respects the BGT and BWT indicated by the UICC in the ATR and detects time-out.

7.3.2.4 Method of test

7.3.2.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.3.2.4.2 Procedure

a) Upon reception of a reset the UICC simulator shall transmit the ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'81'	Only TD2 is present Protocol T=1 supported by UICC
TD2	'A1'	TB3 and TD3 are present Protocol T=1 supported by UICC
TB3	'31'	Block Waiting Integer=3 indicating BWT = 11 + (8 × 960 × 372 / f) etu Character Waiting Integer=1 indicating CWT=13 etu
TD3	'1F'	Only TA4 is present Global interface bytes following
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'53'	Check byte

b) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring reception of chained I-Blocks.

c) The UICC simulator shall measure the delay between the last character of each block sent by the UICC and the first character of each following block sent by the Terminal.

d) BWT:

d-1) The UICC simulator shall send the I-Blocks using BGT = 22 etu.

d-2) The UICC simulator shall send each I-Block using BWT = 11 + (2^{BWI} × 960 × 372/f) etu.

BWT excess:

d-3) The UICC simulator shall not send an I-Block.

7.3.2.5 Acceptance criteria

In step c) the Terminal shall use a BGT of at least 22 etus.

In steps d-1) and d-2) the Terminal shall acknowledge reception of the I-Blocks without error.

In step d-3) the Terminal shall detect a time-out and send an R-Block requesting retransmission of the last block.

7.3.3 Block Waiting Time extension

7.3.3.1 Definition and applicability

WTX is a parameter used to ask for more time to process a command.

Supervisory blocks, S-block, are used to send control information.

S-blocks are always used in pairs. A S(request) is always followed by a S(response) block.

- S(WTX request), a request for an extension of the waiting time;
- S(WTX response), an acknowledge of the extension of the waiting time.

7.3.3.2 Conformance requirement

The UICC might need more than BWT to process the previously received block, a S(WTX request) is sent by the UICC. The terminal shall acknowledge with a S(WTX response).

When an S(… request) has been sent and either a BWT time-out occurs (with the terminal) or the received response is not a S(… response), the S(… request) shall be resent.

7.3.3.2.1 Reference

TS 102 221 [1], clause 7.2.3.1.

ISO/IEC 7816-3 [2], clauses 9.5.3 and 9.7.3, scenarios 2, 14 and 15.

7.3.3.3 Test purpose

1) To verify that the Terminal respects the WTX procedure and applies the extended BWT.

2) To verify that the Terminal handles the different types of errors in S(... request).

7.3.3.4 Method of test

7.3.3.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.3.3.4.2 Procedure

a) Upon reception of a reset the UICC simulator shall transmit the ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'81'	Only TD2 is present Protocol T=1 supported by UICC
TD2	'A1'	TB3 and TD3 are present Protocol T=1 supported by UICC
TB3	'21'	Block Waiting Integer=2 indicating BWT = 11 + (4 × 960 × 372/f) etu Character Waiting Integer=1 indicating CWT=13 etu
TD3	'1F'	Only TA4 is present Global interface bytes following
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC

Character	Value	Description
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'21'	Data Coding Byte
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'43'	Check byte

b) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring exchange of I-Blocks.

c-1) Error free S(WTX request):

c-1-1) Following receipt of the I-block, the UICC simulator shall send a S(WTX request) without error (BWT multiplied by 2).

c-1-2) The UICC simulator shall use the extended BWT when receiving the S(WTX response), then complete the command (data + '9000' indicating correct execution of the command).

c-2) Error in S(WTX request):

c-2-1) Following receipt of the I-block, the UICC simulator shall send a S(WTX request) and generate the following errors:

- Parity error.
- NAD ≠ '00'.
- S(WTX response) instead of S(WTX request).
- Other S(.... response) instead of S(WTX request).
- LEN error.

c-2-2) Following reception of the block sent by the Terminal (correct or with error assumed) the UICC simulator shall retransmit the S(WTX request) without error.

c-2-3) The UICC simulator shall use the extended BWT when receiving the S(WTX response), then complete the command (data + '9000' indicating correct execution of the command).

7.3.3.5 Acceptance criteria

After steps c-1-1) and c-2-2) the Terminal shall send a S(WTX response).

After step c-2-1) the Terminal shall send an R-Block requesting retransmission of the last block.

7.3.4 Chaining - Respect of IFSC by Terminal

7.3.4.1 Definition and applicability

Chaining allows the terminal or the UICC to transfer information, which is longer than IFSC or IFSD. If information longer than IFSC or IFSD is transferred, the information should be divided into pieces, each has a length ≤ IFSC or IFSD. Each piece should be sent in an I-block using the chaining function.

The IFSC defines the maximum length of the information field of blocks that can be received by the UICC.

7.3.4.2 Conformance requirement

The default value of the IFSC is 32 bytes. Another value may be indicated in TA3 of the ATR.

When the terminal is the sender, all I-blocks of a chain shall have LEN = IFSC bytes except for the last, which could have a value in the range of 0 to IFSC.

When a receiver receives a more-data I-block, a R(N(R)) shall be sent. N(R) = N(S) of the expected I-block. At least one chained block should follow.

7.3.4.2.1 Reference

TS 102 221 [1], clauses 7.2.3.1.1 and 7.2.3.5.

ISO/IEC 7816-3 [2], clause 9.7.3, scenarios 5 and 6.

7.3.4.3 Test purpose

To verify that the Terminal respects the Information Field Size of the UICC in chaining mode.

7.3.4.4 Method of test

7.3.4.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

7.3.4.4.2 Procedure

a) No TA3.

a-1) Upon reception of a reset the UICC simulator shall transmit the ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'81'	Only TD2 is present Protocol T=1 supported by UICC
TD2	'A1'	TB3 and TD3 are present Protocol T=1 supported by UICC
TB3	'00'	Block Waiting Integer=0 Character Waiting Integer=0
TD3	'1F'	Only TA4 is present Global interface bytes following
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'20'	
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'63'	Check byte

a-2) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of chained I-Blocks.

a-3) Following receipt of the command, the UICC simulator shall evaluate the length and acknowledge reception of the received I-Blocks without error.

b) TA3='FE'

b-1) Upon reception of a reset the UICC simulator shall transmit the ATR as follows:

Character	Value	Description
TS	'3B'	Indicates direct convention
T0	'97'	TA1, and TD1 are present 7 bytes of historical bytes
TA1	'11'	Clock rate conversion factor FI=1 (F=372) Baud rate adjustment factor DI=1 (D=1)
TD1	'81'	Only TD2 is present Protocol T=1 supported by UICC
TD2	'B1'	TA3, TB3 and TD3 are present Protocol T=1 supported by UICC
TA3	'FE'	IFSC is 254 bytes long
TB3	'00'	Block Waiting Integer=0 Character Waiting Integer=0
TD3	'1F'	Only TA4 is present Global interface bytes following
TA4	'46'	Clock stop supported (low electrical state) 1,8 V technology UICC
T1	'80'	
T2	'31'	Card data services
T3	'C0'	SELECT by AID supported EFDIR present
T4	'73'	Card capabilities
T5	'BE'	SFI supported
T6	'20'	
T7	'00'	No extended Lc and Le No Logical channels supported
TCK	'8D'	Check byte

b-2) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of chained I-Blocks.

b-3) Following receipt of the command, the UICC simulator shall evaluate the length and acknowledge reception of the received I-Blocks without error.

7.3.4.5 Acceptance criteria

In step a-2) the Terminal shall send the chained I-Blocks, except the last one, using the default value of IFSC, i.e. 32 bytes long information field.

In step b-2) the Terminal shall send the chained I-Blocks, except the last one, using the specified value of IFSC, i.e. 254 bytes long information field.

7.3.5 Chaining - IFSD management

7.3.5.1 Definition and applicability

Chaining allows the Terminal or the UICC to transfer information, which is longer than IFSC or IFSD. If information longer than IFSC or IFSD is transferred, the information should be divided into pieces, each has a length ≤ IFSC or IFSD. Each piece should be sent in an I-block using the chaining function.

When a receiver receives a more-data I-block, a R(N(R)) shall be sent. N(R) = N(S) of the expected I-block. At least one chained block should follow.

The IFSD defines the maximum length of the information field of blocks that the terminal can receive.

The default value of the IFSD is 32 bytes and may be adjusted during the card session. The maximum value of the IFSD is 254 bytes.

7.3.5.2 Conformance requirement

When the UICC is the sender, all I-blocks of a chain shall have LEN ≤ IFSD bytes per block.

7.3.5.2.1 Reference

TS 102 221 [1], clause 7.2.3.

7.3.5.3 Test purpose

To verify that the Terminal correctly handles the Information Field Size in chaining mode.

7.3.5.4 Method of test

7.3.5.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.5.4.2 Procedure

a) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring reception of chained I-Blocks.

b) The UICC simulator shall send an I-Block with LEN > IFSD.

c) Following correct receipt of the next block the UICC simulator shall send the rest of I-Blocks (data + '9000' indicating correct execution of the command).

7.3.5.5 Acceptance criteria

In step b), the Terminal shall detect the incorrect LEN and send an R-Block requesting retransmission of the last block.

In step c) the Terminal shall acknowledge reception of the I-Blocks without error by sending R-Blocks with N(R)=sequence number of expected I-Block.

7.3.6 I-Block error correction

7.3.6.1 Definition and applicability

Information blocks are used to transfer command and response APDUs.

The I-blocks are denoted as follows: I(N(S), M) where:

- N(S) is the send-sequence number of the block;
- M is the more-data bit used in the chaining function.

7.3.6.2 Conformance requirement

When an I-block has been sent and a BWT time-out occurs or an invalid block has been received (with the terminal), an R-block is sent, which requests with its N(R) for the expected I-block with N(S)=N(R).

7.3.6.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenario 8.

7.3.6.3 Test purpose

To verify that the Terminal sends an I-Block again when notified incorrect reception by the UICC (R-Block meaning error).

7.3.6.4 Method of test

7.3.6.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.6.4.2 Procedure

a) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of chained I-Blocks.

b) The UICC simulator shall assume each transmitted I-Block, including the last non-chained one, is invalid by sending an R-Block requesting retransmission.

7.3.6.5 Acceptance criteria

In step b), the Terminal shall resend each disputed I-Block.

7.3.7 I-Block error detection

7.3.7.1 Definition and applicability

Information blocks are used to transfer command and response APDUs.

The I-blocks are denoted as follows: I(N(S), M) where:

- N(S) is the send-sequence number of the block;
- M is the more-data bit used in the chaining function.

7.3.7.2 Conformance requirement

When an I-block has been sent and a BWT time-out occurs or an invalid block has been received (with the terminal), an R-block is sent, which requests with its N(R) for the expected I-block with N(S)=N(R).

7.3.7.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenario 9.

7.3.7.3 Test purpose

To verify that the Terminal correctly handles the different types of invalid I-Blocks.

7.3.7.4 Method of test

7.3.7.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.7.4.2 Procedure

a) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring reception of I-Blocks.

b) The UICC simulator shall send I-Blocks and generate the following errors:

- Parity error.
- NAD ≠ '00'.
- PCB with wrong sequence number.
- PCB of an R-Block.
- PCB of an S-Block.
- LEN error (= 'FF').
- EDC error.

c) Following correct reception of the block sent by the Terminal, the UICC simulator shall retransmit the I-Block without error and complete the command (data + '9000' indicating correct execution of the command).

NOTE: Test can be achieved either by generating the errors in one session using chained blocks or through separate tests generating one error.

7.3.7.5 Acceptance criteria

In step b), the Terminal shall detect the invalid block and send an R-Block requesting retransmission of the last block (N(R)=sequence number of last I-Block).

In step c) the Terminal shall acknowledge reception of the I-Block without error.

7.3.8 R-Block error handling in non-chaining mode

7.3.8.1 Definition and applicability

Receive-ready blocks, R-blocks, are used to transfer acknowledgements.

The R-blocks are denoted as follows: R(N(R)), where:

- N(R) is the number of the expected I-block.

7.3.8.2 Conformance requirement

When an R-block was sent and an invalid block is received or BWT time-out, the R-block will be resent.

7.3.8.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenario 10.

7.3.8.3 Test purpose

To verify that the Terminal handles the different types of invalid R-Blocks and correctly recovers while sending non chained data.

7.3.8.4 Method of test

7.3.8.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.8.4.2 Procedure

a) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of a non chained I-Block.

b) The UICC simulator shall assume the received block is invalid by sending an R-Block and generate the following errors:

- Parity error.
- NAD ≠ '00'.
- PCB with wrong sequence number.
- PCB with b6=1.
- PCB of an S-Block.
- LEN error.
- EDC error.

c) Following correct reception of the block sent by the Terminal, the UICC simulator shall retransmit the R-Block without error.

7.3.8.5 Acceptance criteria

In step b) the Terminal shall detect the invalid block and send an R-Block requesting retransmission of the last block (N(R)=sequence number of invalid R-Block).

After step c), the Terminal shall resend the first I-Block.

7.3.9 R-Block error handling in chaining mode

7.3.9.1 Definition and applicability

Receive-ready blocks, R-blocks, are used to transfer acknowledgements.

The R-blocks are denoted as follows: R(N(R)), where:

- N(R) is the number of the expected I-block.

7.3.9.2 Conformance requirement

When an R-block was sent and an invalid block is received or BWT time-out, the R-block will be resent.

7.3.9.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenario 21.

7.3.9.3 Test purpose

To verify that the Terminal handles the different types of invalid R-Blocks and correctly recovers while sending chained data.

7.3.9.4 Method of test

7.3.9.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.9.4.2 Procedure

a) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of chained I-Blocks.

b) The UICC simulator shall send an invalid R-Block and generate the following errors:

- Parity error.
- NAD ≠ '00'.
- PCB with b6=1.
- PCB of an S-Block.
- LEN error.
- EDC error.

c) Following correct reception of the block sent by the Terminal, the UICC simulator shall retransmit the R-Block without error.

7.3.9.5 Acceptance criteria

In step b) the Terminal shall detect the invalid block and send an R-Block requesting retransmission of the last block (N(R)=sequence number of invalid R-Block).

After step c), the Terminal shall send the rest of chained data (I-Block).

7.3.10 Successive errors in both directions

7.3.10.1 Definition and applicability

Receive-ready blocks, R-blocks, are used to transfer acknowledgements.

The R-blocks are denoted as follows: R(N(R)), where:

- N(R) is the number of the expected I-block.

7.3.10.2 Conformance requirement

When an R-block was sent and an invalid block is received or BWT time-out, the R-block will be resent.

7.3.10.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenarios 12 and 13.

7.3.10.3 Test purpose

To verify that the Terminal properly recovers after receiving and being notified errors successively.

7.3.10.4 Method of test

7.3.10.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.10.4.2 Procedure

a) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring reception of I-Blocks.

b) The UICC simulator shall send an invalid I-Block.

c) Following correct reception of the block sent by the Terminal, the UICC simulator shall assume the received block is invalid by sending an R-Block, also invalid.

d) Following correct reception of the block sent by the Terminal:

d-1) No error:

d-1-1) The UICC simulator shall retransmit the I-Block without error and complete the command (data + '9000' indicating correct execution of the command).

d-2) Error assumed:

d-2-1) The UICC simulator shall assume the received block is invalid by sending an R-Block requesting retransmission (N(R)= correct sequence number of step c)).

d-2-2) Following correct reception of the block sent by the Terminal, the UICC simulator shall complete the command (data + '9000' indicating correct execution of the command).

7.3.10.5 Acceptance criteria

After step b) and c), the Terminal shall detect the invalid block and send an R-Block requesting retransmission of the last block (N(R)=sequence number of invalid I-Block).

After step d-2-1), the Terminal shall resend the previous R-Block with N(R)=sequence number of invalid I-Block.

After step d-1) and d-2-2), the Terminal shall acknowledge the error free I-Block(s).

7.3.11 Chaining - Abortion

7.3.11.1 Definition and applicability

Supervisory blocks, S-block, are used to send control information.

S-blocks are always used in pairs. A S(request) is always followed by a S(response) block.

- S(ABORT request), a request to abort the chain function;
- S(ABORT response), an acknowledge of the abortion of the chain function.

7.3.11.2 Conformance requirement

When an S(… request) has been sent and either a BWT time-out occurs (with the terminal) or the received response is not a S(… response), the S(… request) shall be resent. But if an S(… response) has been sent and either an invalid block is received or a BWT time-out occurs (with the terminal), an R-block shall be sent.

7.3.11.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenarios 26 and 27.

7.3.11.3 Test purpose

To verify that the Terminal correctly handles the abortion procedure in chaining mode.

7.3.11.4 Method of test

7.3.11.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.11.4.2 Procedure

a) Terminal sends chained data:

   a-1) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of chained I-Blocks.

   a-2) The UICC simulator shall acknowledge receipt of the first chained I-Block by sending an R-Block without error.

   a-3) Following receipt of the second I-Block, the UICC simulator shall send an S(ABORT request).

   a-4) The UICC simulator shall acknowledge receipt of the response and give back the Terminal the right to send (R-Block without error) and complete the next command.

b) UICC sends chained data:

   b-1) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring reception of chained I-Blocks.

   b-2) The UICC simulator shall transmit the first chained I-Block without error.

   b-3) Following correct reception of the block sent by the Terminal, the UICC simulator shall send an S(ABORT request).

   b-4) The UICC simulator shall acknowledge receipt of the response without error.

   b-5) The UICC simulator shall restart and complete the command (data + '9000' indicating correct execution of the command).

7.3.11.5 Acceptance criteria

After steps a-3) and b-3), the Terminal shall send an S(ABORT response).

In step b-5) the Terminal shall acknowledge reception of the I-Blocks without error by sending R-Blocks with N(R)=sequence number of expected I-Block.

7.3.12 Block repetition and resynchronization

7.3.12.1 Definition and applicability

Resynchronization of the protocol may be attempted at three consecutive levels. If one level is unsuccessful, then the next level is tried.

- For the terminal, the three levels are:
  - Retransmission of blocks.
  - Use of S(RESYNCH request).
  - Card reset or deactivation.

Supervisory blocks, S-block, are used to send control information.

S-blocks are always used in pairs. A S(request) is always followed by a S(response) block.

- S(RESYNCH request), a request of a resynchronization;
- S(RESYNCH response), an acknowledge of the resynchronization.

7.3.12.2 Conformance requirement

When an S(… request) has been sent and either a BWT time-out occurs (with the terminal) or the received response is not a S(… response), the S(… request) shall be resent. But if an S(… response) has been sent and either an invalid block is received or a BWT time-out occurs (with the terminal), an R-block shall be sent.

If the terminal fails to receive an error-free block during a card-session, a maximum of two further attempts is allowed before a S(RESYNCH request) is sent.

7.3.12.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenarios 29, 30, 31, 32 and 34.

7.3.12.3 Test purpose

1) To verify that the Terminal resynchronizes the UICC if block repetition is unsuccessful.

2) To verify that the Terminal correctly handles an invalid response to an S(... request).

7.3.12.4 Method of test

7.3.12.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.12.4.2 Procedure

a) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of an I-Block.

b) Following receipt of the first I-Block, the UICC simulator shall send an erroneous block or be unresponsive.

c) Following correct reception of the block sent by the Terminal, the UICC simulator shall send two more erroneous blocks or remain unresponsive two more times.

d-1) No error:

d-1-1) Following correct reception of the block (S(RESYNCH request)) sent by the Terminal, the UICC simulator shall send a S(RESYNCH response), then complete the next command without error.

d-2) Error assumed:

d-2-1) Following correct reception of the block (S(RESYNCH request)) sent by the Terminal, the UICC simulator shall send a S(RESYNCH response) and generate the following errors:

- Parity error.
- NAD ≠ '00'.
- LEN error (≠ '01').
- S(RESYNCH request) instead of S(RESYNCH response).
- Other S(... response).
- EDC error.

d-2-2) Following correct reception of the block (S(RESYNCH request)) sent by the Terminal, the UICC simulator shall send a S(RESYNCH response), then complete the next command without error.

7.3.12.5 Acceptance criteria

After step b), the Terminal shall send an R-Block requesting retransmission.

In step c), the Terminal shall send the same R-Block as in b) two more times, then initiate an S(RESYNCH request).

After step d-2-1), the Terminal shall resend an S(RESYNCH request).

7.3.13 UICC is unresponsive

7.3.13.1 Definition and applicability

Resynchronization of the protocol may be attempted at three consecutive levels. If one level is unsuccessful, then the next level is tried.

- For the terminal, the three levels are:
  - Retransmission of blocks.
  - Use of S(RESYNCH request).
  - Card reset or deactivation.

7.3.13.2 Conformance requirement

After an ATR due to a Warm reset or successful PPS procedure, the communication between the terminal and the UICC can be initiated. But if the terminal fails to receive an error-free block, in the beginning of the protocol, a maximum of two more successive attempts to receive the block is allowed before resetting or a deactivation of the card takes place.

If the terminal fails to receive an error-free block during a card-session, a maximum of two further attempts is allowed before a S(RESYNCH request) is sent.

7.3.13.2.1 Reference

TS 102 221 [1], clause 7.2.3.4.

ISO/IEC 7816-3 [2], clause 9.7.3, scenarios 33 and 35.

7.3.13.3 Test purpose

To verify that the Terminal correctly resets or deactivates the UICC at the start of the protocol and during the protocol if resynchronization is unsuccessful.

7.3.13.4 Method of test

7.3.13.4.1 Initial conditions

The Terminal shall be connected to the UICC simulator, and powered on.

ATR shall have been received and eventual PPS procedure successfully completed.

7.3.13.4.2 Procedure

a) At the start of the protocol:

a-1) Following receipt of the first block, the UICC simulator shall be unresponsive.

a-2) Following correct reception of the block sent by the Terminal, the UICC simulator shall remain unresponsive two more times.

b) During the protocol:

b-1) Following receipt of the first block by the UICC simulator, the Terminal shall be made to initiate a command requiring sending of an I-Block.

b-2) Following receipt of the first I-Block, the UICC simulator shall be unresponsive.

b-3) Following correct reception of the block sent by the Terminal, the UICC simulator shall remain unresponsive two more times.

b-4) Following correct reception of the block (S(RESYNCH request)) sent by the Terminal, the UICC simulator shall remain unresponsive three more times.

7.3.13.5 Acceptance criteria

After step a-1), the Terminal shall:

- send an R-Block if the first block it sent was an I-Block.
- repeat the S-Block if the first block it sent was an S-Block.

In step a-2), the Terminal shall send the same block as in a-1) two more times, then reset or deactivate the UICC.

After step b-2), the Terminal shall send an R-Block with N(R)=sequence number of previous I-Block.

In step b-3), the Terminal shall send the same R-Block as in b-2) two more times, then initiate an S(RESYNCH request).

In step b-4), the Terminal shall resend S(RESYNCH request) two more times, then reset or deactivate the UICC.

Annex A (normative): UICC simulator functional requirement

A.1 General

The UICC simulator shall implement the functions of an UICC as described in TS 102 221 [1].

A.2 Contacts C1, C3, C7

A.2.1 Default measurement/setting uncertainties

Unless stated otherwise below, the following uncertainties apply:

Voltage measurement uncertainty: < ±50 mV

Time measurement uncertainty: < ±100 ns

A.2.2 Contact C1

Continuous Spikes:

Voltage measurement uncertainty: < ±100 mV

Current Load Amplitude: 0 mA to 20 mA

Adjustable Step Size: 1 mA

Uncertainty: < ±1 mA

Additional Current Offset: 0 mA to 5 mA

Adjustable Step Size: 1 mA

Uncertainty: < ±1 mA

Pulse Width: 100 ns to 500 ns

Adjustable Step Size: 50 ns

Uncertainty: < ±25 ns

Rise and Fall Time: ≤ 50 ns

Pause Width: 100 ns to 500 ns

Adjustable Step Size: 50 ns

Uncertainty: < ±25 ns

Random Spikes:

Voltage measurement uncertainty: < ±100 mV

Current Load Amplitude: 50 mA to 200 mA

Adjustable Step Size: 1 mA

Uncertainty: < ±1 mA

Additional Current Offset: 0 mA to 5 mA

Adjustable Step Size: 1 mA

Uncertainty: < ±0,1 mA

Pulse Width: 100 ns to 500 ns

Adjustable Step Size: 50 ns

Uncertainty: < ±25 ns

Rise and Fall Time: ≤ 50 ns

Pause Width: 0,1 ms to 500 ms, randomly varied

Adjustable Step Size: 0,1 ms

Uncertainty: < ±0,1 ms

A.2.3 Contact C7

The Elementary Time Unit (etu) used in the clauses below refer to the nominal bit duration on the I/O line, as defined in ISO/IEC 7816-3 [2].

Voltage setting uncertainty: < ±25 mV

Rise and fall Time setting uncertainty: < ±100 ns

Jitter measurement uncertainty: < ±5 × 10E-3 etu

Jitter setting uncertainty: < ±5 × 10E-3 etu

A.2.4 Contact C3

Frequency measurement uncertainty: < ±0,5 %

Voltage Measurement uncertainty: < ±50 mV

Rise and fall time measurement uncertainty: < ±5 ns

Duty cycle:

Measurement range: 35 % to 65 %

Measurement uncertainty: < ±2,5 %

A.3 Definition of timing

It shall be possible to define all timings relative to the clock. The UICC simulator shall be able to calculate and to use the absolute values automatically, even if the Terminal changes the frequency during the communication.

Annex B (informative): Change history

The table below indicates all change requests that have been incorporated into the present document since it was created by EP SCP.

Change history								
Date	**Meeting**	**Doc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**Old**	**New**
2001-06	SCP-06	SCP-010156				TSG-T #11 agreed to transfer the contents of the test specification, 3GPP TS 31.120 to EP SCP. V1.0.0 is submitted to EP SCP for approval. It contains only editorial changes compared to 3GPP TS 31.120 V3.0.0		1.0.0
2001-06	SCP-06	SCP-010194				Undoing a change regarding the coding conventions in clause 3.4	1.0.0	1.0.1
2001-06	SCP-06	-				EP SCP agreed that V1.0.1 was ready to be put under change control. As a result, V3.0.0 was created.	1.0.1	3.0.0
2001-07	SCP-06	SCP-010193	001		B	Alignment with Rel-4 version of core specification (UICC current consumption values for 3 V and 1.8V)	3.0.0	4.0.0
		SCP-010200	002		F	Correction of ATR examples regarding DCB and T4		
2002-03	SCP-09	SCP-020052	003		F	Correction of Errors in UICC type recognition	4.0.0	4.1.0
2003-01	SCP-12	SCP-030013	005		F	Correction of test on processing of ACK, NACK, NULL procedure bytes and correction of CHV	4.1.0	4.2.0
		SCP-030062	006		D	Remove UICC as an abbreviation to align with 3GPP TR 21.905		
2003-09	SCP-14	SCP-030288	007		F	Upgrade to Rel-5 version of the specification	4.2.0	5.0.0
2004-05	SCP-17	SCP-040284	010		A	Removal of test 6.4 and modification of the numbering order of electrical tests in clause 5.2	5.0.0	5.1.0
2004-09	SCP#18	SCP-040376	015		A	Removal of transmit for WWT exceeded in test 7.2.1 Timing	5.1.0	5.2.0
2004-11	SCP#19	SCP-040489	020		A	Non-specific Referencing	5.2.0	5.3.0
		SCP-040492	023		A	Modification of test 7.3.2 Block Timing		
2005-06	SCP#21	SCP-050129	026		F	Correction of test case 7.3.9	5.3.0	5.4.0
		SCP-050131	029		F	Correction of test case 7.3.11		
		SCP-050186	032		F	Correction of references to ISO/IEC 7816		
2005-09	SCP#22	SCP-050297	035		A	Change of internal references	5.4.0	5.5.0
2006-03	SCP#25	SCP-060160	038		A	Removal of test case 5.1.5.5	5.5.0	5.6.0

History

Document history		
V5.0.0	September 2003	Publication
V5.1.0	June 2004	Publication
V5.2.0	September 2004	Publication
V5.3.0	December 2004	Publication
V5.4.0	July 2005	Publication
V5.5.0	October 2005	Publication
V5.6.0	May 2006	Publication