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PRE-DRAFT AMENDMENT

Identification cards — Test methods — Part 6: Proximity cards

AMENDMENT 1: Additional PICC test methods

Cartes d'identification — Méthodes d'essai — Partie 6 : Cartes de proximité

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Amendment 1 to International Standard ISO/IEC 10373-6:2002 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, Identification cards and related devices.

— *Part 6: Proximity cards*

— *Part [n]:*

— *Part [n+1]:*

Annex G (Informative)

Additional protocol test methods

TBD/A For Type A experts to fill in.

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G.1 Terms and definitions (additional to defined in 3.2)

G.1.1 General definitions

CRC Cyclic Redundancy Check

CRC_A Cyclic Redundancy Check, as defined for PICC type A in ISO/IEC 14443-3

CRC_B	Cyclic Redundancy Check, as defined for PICC type B in ISO/IEC 14443-3
DUT	Device under test; within the scope of this document DUT represents the PICC or the PCD under the test
Mute	No response within a specified timeout
Test Scenario	A defined typical protocol and application specific communication to be used with the test methods defined in this document.

G.1.2 Type A related definitions

SELECT(l) , $l \in \{1,2,3\}$	select cascade level l command
SAK(cascade)	the SELECT(l) answer with the cascade bit (bit 3) set to 1 and the compliance bit (bit 6) set to 1
SAK(complete)	the SELECT(l) answer with the cascade bit (bit 3) set to 0 and the compliance bit (bit 6) set to 1
NVB:	NVB byte as described in ISO/IEC 14443-3
BCC:	the one byte block checksum as described in ISO/IEC 14443-3
UIDn , $n \in \{0..9\}$	User ID byte Nr. n
UIDn[a] , $n \in \{0..9\}$, $a \in \{1..8\}$	Bit at position a of UID byte n
UIDn[a..b] , $n \in \{0..9\}$; $a, b \in \{1..8\}$	Bits between position a and b of UID byte n
~UIDn , $n \in \{0..9\}$	inverted bits of User ID byte Nr. n
~UIDn[a] , $n \in \{0..9\}$, $a \in \{1..8\}$	inverted bit at position a of UID byte n
~UIDn[a..b] , $n \in \{0..9\}$; $a, b \in \{1..8\}$	inverted bits between position a and b of UID byte n
UIDTXI , $l \in \{1,2,3\}$	transmitted UID 32-bit data at cascade level l (see ISO/IEC 14443-3 2001: 6.4.4.)

Cascade level	single UID PICC	double UID PICC	triple UID PICC
UIDTX1	UID0 UID1 UID2 UID3	'88' UID0 UID1 UID2	'88' UID0 UID1 UID2
UIDTX2	---	UID3 UID4 UID5 UID6	'88' UID3 UID4 UID5
UIDTX3	---	---	UID6 UID7 UID8 UID9

UIDTXI[a] , $l \in \{1..3\}$, $a \in \{1..32\}$	Bit at position a of UID byte n
UIDTXI[a..b] , $l \in \{1..3\}$; $a, b \in \{1..32\}$	Bits between position a and b of UIDTXI
~ UIDTXI , $l \in \{1..3\}$	inverted bits of UIDTXI
~ UIDTXI[a] , $l \in \{1..3\}$, $a \in \{1..32\}$	inverted bit at position a of UIDTXI

$\sim \text{UIDTXI}[a..b]$, $l \in \{1..3\}$; $a, b \in \{1..32\}$ inverted bits between position a and b of UIDTXI

StateSet The set consisting of the different PICC states: {IDLE, READY, ACTIVE, ISO14443, HALT, READY*, ACTIVE*}

TransitionSet The set consisting of the possible state transitions: { REQA, WUPA, AC/split, nAC/split, AC/full, nAC/full, SELECT, nSELECT, HLTA, Error/ISO , Error/CRC, Error/short}. The Error/XXX transitions shall test the state transition behaviour for three selected error conditions:

- i. Error/ISO: sending an ISO command while not in ISO14443 state
- ii. Error/CRC: sending a command with a wrong CRC
- iii. Error/short sending a wrong short frame (7 bit)

TIS \in **StateSet** the Test Initial State

TTS \in (**StateSet** x **TransitionSet**) \rightarrow **StateSet** be the function which assigns to every state (**TIS**) and every state transitions (**T**) the expected target state the PICC should be after this state transition

G.2 Test apparatus and test circuits

This clause defines the test apparatus and test circuits for verifying the operation of a according to ISO/IEC 14443-3 2001. The test apparatus includes:

- Calibration coil (see 6.1)
- Test PCD assembly (see 6.2)
- Reference PICCs (see 6.3)
- Digital sampling oscilloscope (see 6.4)

G.2.1 Apparatus for testing the PICC (PICC-test apparatus)

This International Standard does not define any A/D convert test circuit. Care has to be taken to confirm that the results are not affected by performance of the test circuits.

G.2.1.1 Emulating the I/O protocol

The PICC-test-apparatus shall be able to emulate the protocol type A, type B and PCD applications, which are required to run the typical application specific communications corresponding to the PICC applications. The PICC-test-apparatus shall be able to break the transmitted packets into chained blocks with the required length.

G.2.1.2 Generating the I/O character timing in reception mode

The PICC-test-apparatus shall be able to generate the I/O bit stream according to ISO/IEC 14443-3:2001. All timing parameters like start bit length, guardtime, etc. shall be configurable.

G.2.1.3 Measuring and monitoring the RF I/O protocol

The PICC-test-apparatus shall be able to measure and monitor the timing of the logical low and high states of the RF Input/Receive line relative to the CLK frequency. The PICC-test-apparatus shall be able to monitor the PICC subcarrier.

G.2.1.4 Protocol Analysis

The PICC-test-apparatus shall be able to analyze the I/O-bit stream in accordance with protocol type A and type B as specified in ISO/IEC 14443-3,4 and extract the logical data flow for further protocol analysis.

G.2.1.5 Test scenario

Testing of the DUT, as defined in this document, requires a Test Scenario to be executed. This Test Scenario is a 'typical protocol and application specific communication', dependent on the protocol and application specific functionality foreseen for the normal use of and implemented in the DUT.

The Test Scenario shall be defined by the entity carrying out these tests and shall be documented with the test-results. The Test Scenario shall encompass a representative subset or preferably, if practical, the full functionality of the DUT expected to be utilized during normal use.

NOTE The testing entity may require information about the implemented protocol and functionality. For the purpose of an example, the following assumptions have been made for DUT type B:

- The DUT supports CID. PUPI of the PICC is '12 23 34 45'.
- The default CID value used in the test is CID=4.
- Instruction 'B0' (READ BINARY) is used as the default instruction for test scenarios.

G.2.2 Relationship of test methods versus base standard requirement

Table G.1 — Test methods for logical operation of the PICC type A protocol (TBD/A)

Clause	Test method from ISO/IEC 10373-6		Corresponding requirement	
	Name	Base standard	Clause(s)	
G.3.1	Polling	ISO/IEC 14443-3:2001	5	
G.3.2	Frame format and I/O transmission timing for type A protocol	ISO/IEC 14443-3:2001	6.1.5	
G.3.3	Behaviour of the PICC type A in the IDLE state	ISO/IEC 14443-3:2001	6.2.2	
G.3.4	Behaviour of the PICC type A in the READY state	ISO/IEC 14443-3:2001	6.2.3	
G.3.5	Behaviour of the PICC type A in the ACTIVE state	ISO/IEC 14443-3:2001	6.2.4	
G.3.6	Behaviour of the PICC Type A in the HALT state	ISO/IEC 14443-3:2001	6.2.5	
G.3.7	Behaviour of the PICC type A in the READY* state	ISO/IEC 14443-3:2001	6.2.6	
G.3.8	Behaviour of the PICC type A in the ACTIVE* state	ISO/IEC 14443-3:2001	6.2.7	
G.3.9	Handling of RATS by the PICC type A	ISO/IEC 14443-4:2001	5.6.1	
G.3.10	Handling of PPS request by the PICC type A	ISO/IEC 14443-4:2001	5.6.2	
G.3.11	Additional tests	TBD/A	TBD/A	

Table G.2 — Test methods for logical operation of the PICC type B protocol

Clause	Test method from ISO/IEC 10373-6		Corresponding requirement	
	Name	Base standard	Clause(s)	
G.4.1	Polling	ISO/IEC 14443-3:2001	7.1	
G.4.2	I/O transmission timing for type B protocol	ISO/IEC 14443-3:2001	7.1	
G.4.3	I/O reception timing for type B protocol	ISO/IEC 14443-3:2001	7.1	
G.4.4	Behaviour of the PICC type B in the IDLE state	ISO/IEC 14443-3:2001	7.4.4	
G.4.5	Behaviour of the PICC type B in the ACTIVE state	ISO/IEC 14443-3:2001	7.4.7	
G.4.6	Behaviour of the PICC type B in the HALT state	ISO/IEC 14443-3:2001	7.4.8	
G.4.7	PICC-reaction to protocol errors in the HALT state	ISO/IEC 14443-3:2001	7.4.8	
G.4.8	PICC reaction to the ATQB command frame with wrong parameters.	ISO/IEC 14443-3:2001	7.7	
G.4.9	Slot-MARKER Command	ISO/IEC 14443-3:2001	7.8	
G.4.10	HLTB Command	ISO/IEC 14443-3:2001	7.12	
G.4.11	ATTRIB command	ISO/IEC 14443-3:2001	7.10	
G.4.12	Different values of PCD maximum frame size	ISO/IEC 14443-3:2001	7.10.4	
G.4.13	PICC bit rate	ISO/IEC 14443-3:2001	7.10.4	

Table G.3 — Test methods for logical operation of PICC of type A/B

Clause	Test method from ISO/IEC 10373-6	Corresponding requirement	
	Name	Base standard	Clause(s)
G.5.1	Block sequencing by the PICC	ISO/IEC 14443-4:2001	7.5.3
G.5.2	Retransmission	ISO/IEC 14443-4:2001	7.5.4.3
G.5.3	Reactions of the PICC to transmission errors	ISO/IEC 14443-4:2001	7.5.5
G.5.4	Reactions of the PICC to protocol errors	ISO/IEC 14443-4:2001	7.5.5
G.5.5	Reactions of the PICC to the deactivation sequence	ISO/IEC 14443-4:2001	8
G.5.6	Deactivation frame waiting time	ISO/IEC 14443-4:2001	8.1
G.5.7	Recovery of a transmission error during deactivation sequence	ISO/IEC 14443-4:2001	8.2
G.5.8	Error free operations	ISO/IEC 14443-4:2001	Informative Annex B
G.5.9	Error handling by the PICC	ISO/IEC 14443-4:2001	Informative Annex B

G.3 Test method for logical operation of the PICC of Type A

G.3.1 Polling

The purpose of this test is to determine the behaviour of the PICC type A in an unmodulated operating field according to ISO/IEC 14443-3 2001: 5. The PICC shall be able to accept a REQA within 5 ms of unmodulated operating field.

G.3.1.1 Apparatus

See clause 2.

G.3.1.2 Procedure

Place the PICC into the field.

- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Do delay of 5 ms and send a valid REQA Command frame ((0100110)b).
- c) Record the presence and the content of the PICC response.

G.3.1.3 Test report

Report the signal recording. Fill the "Table G.4 — Type A specific timing table" on page 80 with measured values from c).

G.3.2 Frame format and I/O transmission timing for type A protocol

The purpose of this test is to determine the frame format and timing used by the PICC during communication initialisation and anticollision (see ISO/IEC 14443-3:2001 6.1).

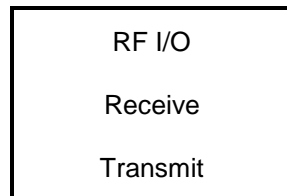
G.3.2.1 Apparatus

See clause 2.

G.3.2.2 Procedure

Place the PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Send a valid REQA Command frame ((0100110)b).
- b) Record the presence and the content of the PICC response.
- c) Analyse the timing after a PCD data transmission until the PICC start of communication (see ISO/IEC 14443-3:2001 6.1.2).

G.3.2.3 Test report

Report the signal recording and the ATQA. Fill the "Table G.4 — Type A specific timing table" on page 80 with measured values.

G.3.3 Behaviour of the PICC type A in the IDLE state

The purpose of this test is to determine the behaviour of the PICC type A in the IDLE state according to ISO/IEC 14443-3 2001: 6.2.2.

G.3.3.1 Apparatus

See clause 2.

G.3.3.2 Procedure

Place the PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.

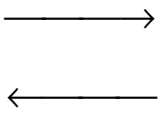
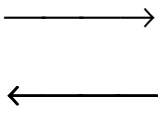
For every state transition T in the table perform the following steps as described in the Informative Annex A1:

- a) Put the PICC into IDLE state.
- b) Apply the state transition T.
- c) Check the answer from the card.

d) Check the target state of the card.

Scenario A 1 — Behaviour of the PICC type A in the IDLE state

Transition (T)	PICC-test-apparatus	PICC	Target State
REQA	(0100110)b	→ ← ATQA	READY
WUPA	(1010010)b	→ ← ATQA	READY
AC (split byte)	('93' '25' UIDTX1[1..5])	→ ← Mute	IDLE
nAC (split byte)	('93' '25' UIDTX1[1..4] ~UIDTX1[5])	→ ← Mute	IDLE
AC (full byte)	('93' '40' UIDTX1[1..16])	→ ← Mute	IDLE
nAC (full byte)	('93' '40' UIDTX1[1.. 15] ~UIDTX1[16])	→ ← Mute	IDLE
SELECT	('93' '70' UIDTX1 CRC_A)	→ ← Mute	IDLE
NSELECT	('93' '70' ~UIDTX1 CRC_A)	→ ← Mute	IDLE
HALTA	('50' '00' CRC_A)	→ ← Mute	IDLE
ERROR (short frame)	(0100111)b	→ ← Mute	IDLE

Transition (T)	PICC-test-apparatus	PICC	Target State
ERROR (wrong CRC)	('50' '00' ~CRC_A)		IDLE
ERROR (ISO/IEC 14443-4 block)	(e.g. '11' '00' CRC_A) (*)		IDLE

(*) ISO/IEC 14443-4 command will not be completely specified due to possible clashes with proprietary protocols

G.3.3.3 Expected result

The PICC answer is expected according to the scenario A1.

G.3.3.4 Test report

Record the presence and the content of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " with test result according the following:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	Fail

G.3.4 Behaviour of the PICC type A in the READY state

The purpose of this test is to determine the behaviour of the PICC type A in the READY state according to ISO/IEC 14443-3 2001: 6.2.3.

G.3.4.1 Apparatus

See clause 2.

G.3.4.2 Procedure

For every state transition T in the table perform the following steps as described in the Informative Annex A1:

- Put the PICC into READY state.
- Apply the state transition T.
- Check the answer from the card.
- Check the target state of the card.

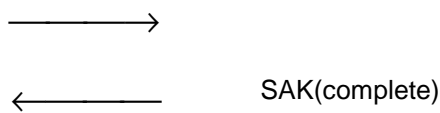
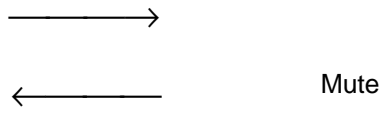
Scenario A 2 — Behaviour of the PICC type A in the READY state

Transition	PICC-test-apparatus	PICC	Target State
REQA	(0100110)b	————→ ←————	Mute IDLE
WUPA	(1010010)b	————→ ←————	Mute IDLE
AC (split byte)	('93' '25' UIDTX1[1..5])	————→ ←————	UIDTX1[6..32] BCC READY
nAC (split byte)	('93' '25' UIDTX1[1..4] ~UIDTX1[5])	————→ ←————	Mute IDLE
AC (full byte)	('93' '40' UIDTX1[1..16])	————→ ←————	UIDTX1[17..32] BCC READY
nAC (full byte)	('93' '40' UIDTX1[1..15] ~UIDTX1[16])	————→ ←————	Mute IDLE
HALTA	('50' '00' CRC_A)	————→ ←————	Mute IDLE
ERROR (short frame)	(0100111)b	————→ ←————	Mute IDLE
ERROR (wrong CRC)	('93' '70' UIDTX1 ~CRC_A)	————→ ←————	Mute IDLE
ERROR (ISO/IEC 14443-4block)	(e.g. '11' '00' CRC_A) (*)	————→ ←————	Mute IDLE

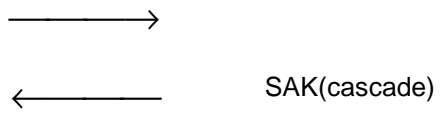
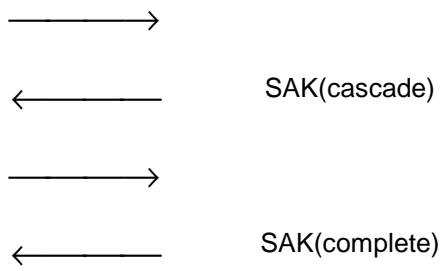
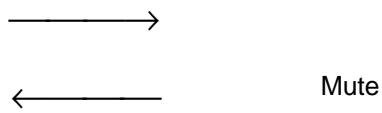
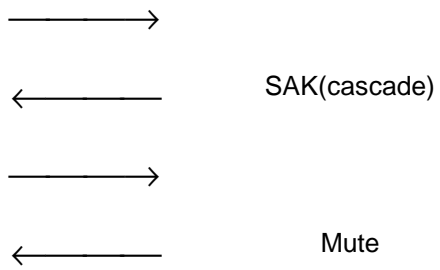
(*) ISO/IEC 14443-4 commands will not be completely specified due to possible clashes with proprietary protocols

Depending on the PICC UID cascade level perform also tests according to scenario A3 or A4 or A5

Scenario A 3 — Behaviour of the PICC type A in the READY state (single UID)

Transition	PICC-test-apparatus	PICC	Target State
SELECT	('93' '70' UIDTX1 CRC_A)		ACTIVE
NSELECT	('93' '70' ~UIDTX1 CRC_A)		IDLE

Scenario A 4 — Behaviour of the PICC type A in the READY State (double UID)

Transition	PICC-test-apparatus	PICC	Target State
SELECT level 1	('93' '70' UIDTX1 CRC_A)		READY
SELECT level 2	('93' '70' UIDTX1 CRC_A) ('95' '70' UIDTX2 CRC_A)		<i>don't check</i> ACTIVE
nSELECT level 1	('93' '70' ~UIDTX1 CRC_A)		IDLE
nSELECT level 2	('93' '70' UIDTX1 CRC_A) ('95' '70' ~UIDTX2 CRC_A)		<i>don't check</i> IDLE

Scenario A 5 — Behaviour of the PICC type A in the READY State (triple UID)

Transition	PICC-test-apparatus		PICC	Target State
SELECT level 1	('93' '70' UIDTX1 CRC_A)	—————→	←————	READY
			SAK(cascade)	
SELECT level 2	('93' '70' UIDTX1 CRC_A)	—————→	←————	<i>don't check</i>
	('95' '70' UIDTX2 CRC_A)	—————→	←————	READY
			SAK(cascade)	
SELECT level 3	('93' '70' UIDTX1 CRC_A)	—————→	←————	<i>don't check</i>
	('95' '70' UIDTX1 CRC_A)	—————→	←————	<i>don't check</i>
	('97' '70' UIDTX2 CRC_A)	—————→	←————	ACTIVE
			SAK(complete)	
nSELECT level 1	('93' '70' ~UIDTX1 CRC_A)	—————→	←————	IDLE
			Mute	
nSELECT level 2	('93' '70' UIDTX1 CRC_A)	—————→	←————	<i>don't check</i>
	('95' '70' ~UIDTX2 CRC_A)	—————→	←————	IDLE
			Mute	

Transition	PICC-test-apparatus	PICC	Target State
nSELECT level 3	('93' '70' UIDTX1 CRC_A)	—————→	<i>don't check</i>
		←————	
	('95' '70' UIDTX2 CRC_A)	—————→	<i>don't check</i>
		←————	
	('97' '70' ~UIDTX3 CRC_A)	—————→	IDLE
		←————	

G.3.4.3 Expected result

The PICC answer is expected according to the Scenario A 2 and depending on PICC UID cascade level either Scenario A 3 or Scenario A 4 or Scenario A 5.

G.3.4.4 Test report

Record the presence, the content of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the PICC responded as expected in	Pass
Any other case	Fail

G.3.5 Behaviour of the PICC type A in the ACTIVE state

The purpose of this test is to determine the behaviour of the PICC type A in the ACTIVE state according to ISO/IEC 14443-3 2001: 6.2.4.

G.3.5.1 Apparatus

See clause 2.

G.3.5.2 Procedure

For every state transition T in the table perform the following steps as described in the Informative Annex A1:

- a) Put the PICC into ACTIVE state.
- b) Apply the state transition T.
- c) Check the answer from the card.
- d) Check the target state of the card.

Scenario A 6 — Behaviour of the PICC type A in the ACTIVE state

Transition	PICC-test-apparatus	PICC	Target State
REQA	(0100110)b	—————→ ←————	Mute IDLE
WUPA	(1010010)b	—————→ ←————	Mute IDLE
AC (split byte)	('93' '25' UIDTX1[1..5])	—————→ ←————	Mute IDLE
nAC (split byte)	('93' '25' UIDTX1[1..4] ~UIDTX1[5])	—————→ ←————	Mute IDLE
AC (full byte)	('93' '25' UIDTX1[1..16])	—————→ ←————	Mute IDLE
nAC (full byte)	('93' '40' UIDTX1[1..15] ~UIDTX1[16])	—————→ ←————	Mute IDLE
HALTA	('50' '00' CRC_A)	—————→ ←————	Mute HALT
SELECT	('93' '70' UIDTX1 CRC_A)	—————→ ←————	Mute IDLE

Transition	PICC-test-apparatus	PICC	Target State
nSELECT	('93' '70' UIDTX1 CRC_A) → ←	Mute	IDLE
RATS	('E0' '00' CRC_A) → ←	ATS	ISO/IEC 14443-4
ERROR (short frame)	(0100111)b → ←	Mute	IDLE
ERROR (wrong CRC)	('93' '70' UIDTX1 CRC_A) → ←	Mute	IDLE
ERROR (ISO/IEC 14443-4block)	(e.g. '11' '00' CRC_A) (*) → ←	Mute	IDLE

(*) ISO/IEC 14443-4 commands will not be completely specified due to possible clashes with proprietary protocols

G.3.5.3 Expected result

The PICC answer is expected according to the Scenario A 6.

G.3.5.4 Test report

Record the presence, the content of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	Fail

G.3.6 Behaviour of the PICC Type A in the HALT state

The purpose of this test is to determine the behaviour of the PICC Type A in the HALT state according to ISO/IEC 14443-3 2001: 6.2.5.

G.3.6.1 Apparatus

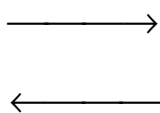
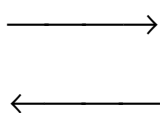
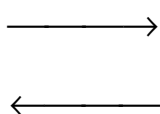
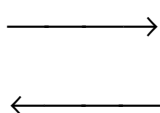
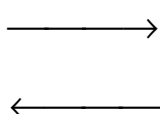
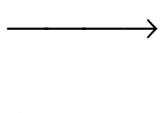
See clause 2.

G.3.6.2 Procedure

For every state transition T in the table perform the following steps as described in the Informative Annex A1:

- a) Put the PICC into HALT state.
- b) Apply the state transition T.
- c) Check the answer from the card.
- d) Check the target state of the card.

Scenario A 7 — Behaviour of the PICC type A in the HALT state

Transition	PICC-test-apparatus	PICC	Target State
REQA	(0100110)b		HALT
WUPA	(1010010)b		READY*
AC (split byte)	('93' '25' UIDTX1[1..5])		HALT
nAC (split byte)	('93' '25' UIDTX1[1..4] ~UIDTX1[5])		HALT
AC (full byte)	('93' '40' UIDTX1[1..16])		HALT
nAC (full byte)	('93' '40' UIDTX1[1..15] ~UIDTX1[16])		HALT

Transition	PICC-test-apparatus	PICC	Target State
HALTA	('50' '00' CRC_A)	→ ←	Mute HALT
SELECT	('93' '70' UIDTX1 CRC_A)	→ ←	Mute HALT
nSELECT	('93' '70' ~UIDTX1 CRC_A)	→ ←	Mute HALT
RATS	('E0' '00' CRC_A)	→ ←	Mute HALT
ERROR (short frame)	(0100111)b	→ ←	Mute HALT
ERROR (wrong CRC)	('93' '70' UIDTX1 CRC_A)	→ ←	Mute HALT
ERROR (ISO/IEC 14443-4 block)	(e.g. '11' '00' CRC_A) (*)	→ ←	Mute HALT

(*) ISO/IEC 14443-4 commands will not be completely specified due to possible clashes with proprietary protocols

G.3.6.3 Expected result

The PICC answer is expected according to the Scenario A 7.

G.3.6.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
In any other case	Fail

G.3.7 Behaviour of the PICC type A in the READY* state

The purpose of this test is to determine the behaviour of the PICC type A in the READY* state according to ISO/IEC 14443-3 2001: 6.2.6.

G.3.7.1 Apparatus

See clause 2.

G.3.7.2 Procedure

For every state transition T in the table perform the following steps as described in the Informative Annex A1:

- a) Put the PICC into READY* state.
- b) Apply the state transition T.
- c) Check the answer from the card.
- d) Check the target state of the card.



Scenario A 8 — Behaviour of the PICC type A in the READY* State (general)

Transition	PICC-test-apparatus	PICC	Target State
REQA	(0100110)b	—————→ ←————	Mute HALT
WUPA	(1010010)b	—————→ ←————	Mute HALT
AC (split byte)	('93' '25' UIDTX1[1..5])	—————→ ←————	UIDTX1[6..32] BCC READY*
nAC (split byte)	('93' '25' UIDTX1[1..4] ~UIDTX1[5])	—————→ ←————	Mute HALT
AC (full byte)	('93' '25' UIDTX1[1..16])	—————→ ←————	UIDTX1[17..32] BCC READY*
nAC (full byte)	('93' '40' UIDTX1[1..15] ~UIDTX1[16])	—————→ ←————	Mute HALT
HALTA	('50' '00' CRC_A)	—————→ ←————	Mute HALT
ERROR (short frame)	(0100111)b	—————→ ←————	Mute HALT
ERROR (wrong CRC)	('93' '70' UIDTX1 CRC_A)	—————→ ←————	Mute HALT
ERROR (ISO/IEC 14443-4 block)	(e.g. '11' '00' CRC_A)	—————→ ←————	Mute HALT

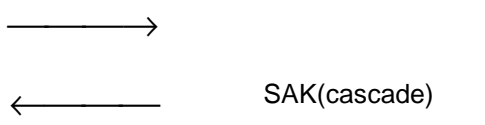
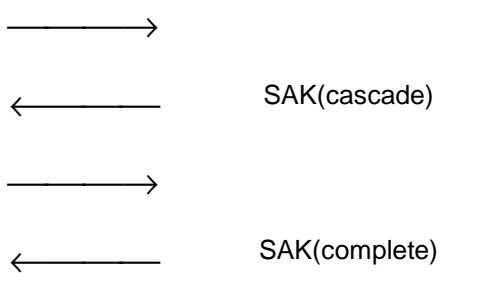

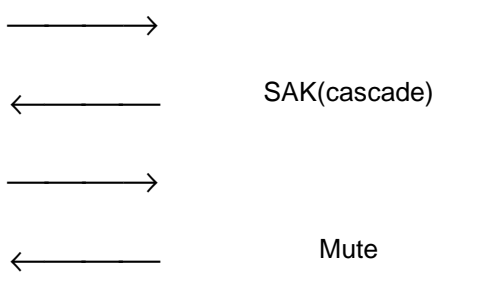
(*) ISO/IEC 14443-4 commands will not be completely specified due to possible clashes with proprietary protocols

Depending on the PICC UID cascade level perform also tests according to scenario A9 or A10 or A11.

Scenario A 9 — Behaviour of the PICC type A in the READY* State (single UID)

Transition	PICC-test-apparatus	PICC	Target State
SELECT	('93' '70' UIDTX1 CRC_A)		ACTIVE*
NSELECT	('93' '70' ~UIDTX1 CRC_A)		HALT

Scenario A 10 — Behaviour of the PICC type A in the READY* State (double UID)

Transition	PICC-test-apparatus	PICC	Target State
SELECT level 1	('93' '70' UIDTX1 CRC_A)		READY*
SELECT level 2	('93' '70' UIDTX1 CRC_A) ('95' '70' UIDTX2 CRC_A)		<i>don't check</i> ACTIVE*
nSELECT level 1	('93' '70' ~UIDTX1 CRC_A)		HALT
nSELECT level 2	('93' '70' UIDTX1 CRC_A) ('95' '70' ~UIDTX2 CRC_A)		<i>don't check</i> HALT

Scenario A 11 — Behaviour of the PICC type A in the READY* State (triple UID)

Transition	PICC-test-apparatus	PICC	Target State
SELECT level 1	(‘93’ ‘70’ UIDTX1 CRC_A)	————→ ←————	READY*
SELECT level 2	(‘93’ ‘70’ UIDTX1 CRC_A) (‘95’ ‘70’ UIDTX2 CRC_A)	————→ ←———— ————→ ←————	<i>don’t check</i> READY*
SELECT level 3	(‘93’ ‘70’ UIDTX1 CRC_A) (‘95’ ‘70’ UIDTX1 CRC_A) (‘97’ ‘70’ UIDTX2 CRC_A)	————→ ←———— ————→ ←———— ————→ ←————	<i>don’t check</i> <i>don’t check</i> ACTIVE*
nSELECT level 1	(‘93’ ‘70’ ~UIDTX1 CRC_A)	————→ ←————	HALT
nSELECT level 2	(‘93’ ‘70’ UIDTX1 CRC_A) (‘95’ ‘70’ ~UIDTX2 CRC_A)	————→ ←———— ————→ ←————	<i>don’t check</i> HALT

Transition	PICC-test-apparatus	PICC	Target State
nSELECT level 3	('93' '70' UIDTX1 CRC_A)	—————→	<i>don't check</i>
		←————	
	('95' '70' UIDTX2 CRC_A)	—————→	<i>don't check</i>
		←————	
	('97' '70' ~UIDTX3 CRC_A)	—————→	HALT
		←————	

G.3.7.3 Expected result

The PICC answer is expected according to the Scenario A 8 and depending on PICC UID cascade level either Scenario A 9 or Scenario A 10 or Scenario A 11.

G.3.7.4 Test report

Record the presence, the content of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	Fail

G.3.8 Behaviour of the PICC type A in the ACTIVE* state

The purpose of this test is to determine the behaviour of the PICC type A in the ACTIVE* state according to ISO/IEC 14443-3 2001: 6.2.7.

G.3.8.1 Apparatus

See clause 2.

G.3.8.2 Procedure

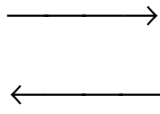
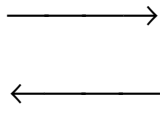
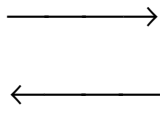
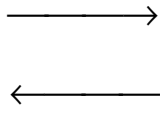
For every state transition T in the table perform the following steps as described in the Informative Annex A1:

- a) Put the PICC into ACTIVE* state.
- b) Apply the state transition T.
- c) Check the answer from the card.

d) Check the target state of the card.

Scenario A 12 — Behaviour of the PICC type A in the ACTIVE* state

Transition	PICC-test-apparatus	PICC	Target State
REQA	(0100110)b	————→ ←————	Mute HALT
WUPA	(1010010)b	————→ ←————	Mute HALT
AC (split byte)	('93' '25' UIDTX1[1..5])	————→ ←————	Mute HALT
nAC (split byte)	('93' '25' UIDTX1[1..4] ~UIDTX1[5])	————→ ←————	Mute HALT
AC (full byte)	('93' '40' UIDTX1[1..16])	————→ ←————	Mute HALT
nAC (full byte)	('93' '40' UIDTX1[1..15] ~UIDTX1[16])	————→ ←————	Mute HALT
HALTA	('50' '00' CRC_A)	————→ ←————	Mute HALT
SELECT	('93' '70' UIDTX1 CRC_A)	————→ ←————	Mute HALT
nSELECT	('93' '70' UIDTX1 CRC_A)	————→ ←————	Mute HALT

Transition	PICC-test-apparatus	PICC	Target State
RATS	(‘E0’ ‘00’ CRC_A)		ISO/IEC 14443-4
ERROR (short frame)	(0100111)b		HALT
ERROR (wrong CRC)	(‘93’ ‘70’ UIDTX1 CRC_A)		HALT
ERROR (ISO/IEC 14443-4 block)	(e.g. ‘11’ ‘00’ CRC_A) (*)		HALT

(*) ISO/IEC 14443-4 commands will not be completely specified due to possible clashes with proprietary protocols

G.3.8.3 Expected result

The PICC answer is expected according to the Scenario A 12.

G.3.8.4 Test report

Record the presence, the content of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	Fail

G.3.9 Handling of RATS by the PICC type A

The purpose of this test is to determine the handling of RATS and ATS by the PICC type A according to ISO/IEC 14443-4 2001: 5.6.1.

G.3.9.1 Apparatus



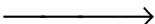


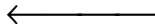
See clause 2.

G.3.9.2 Procedure

For every test in the table perform the following actions as described in the Informative Annex A1:

- a) Put the PICC into ACTIVE state.
- b) Send the test command.
- c) Check the answer of the PICC.

Scenario A 13 — Handling of RATS

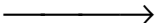

Test	PICC-test-apparatus	PICC
RATS_badCRC	('E0' '0F' ~CRC_A) 	
		Mute
RATS_RATS	('E0' '00' CRC_A) 	
		ATS
	('E0' '00' CRC_A) 	
		Mute

For the next test loop through the following CID and FSDI values:

$$0 \leq \text{CID} \leq 14$$

$$0 \leq \text{FSDI} \leq 8$$

Let param[1..4] = CID, param[5..8] = FSDI

Test	PICC-test-apparatus	PICC
RATS(CID,FSDI)	('E0' param CRC_A) 	
		ATS

G.3.9.3 Expected result

The PICC answer is expected according to the Scenario A 13.

G.3.9.4 Test report

Record the presence, the content of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	Fail

G.3.10 Handling of PPS request by the PICC type A

The purpose of this test is to determine the handling of the PPS request by the PICC type A according to ISO/IEC 14443-4 2001: 5.6.2.2.

G.3.10.1 Apparatus

See clause 2.

G.3.10.2 Procedure

For every Test in the table perform the following steps as described in the Informative Annex A1:

- a) Put the PICC into ISO/IEC 14443-4 state.
- b) Apply the Test commands.
- c) Check the answer from the card.

Scenario A 14 — Handling of PPS (general)

Test	PICC-test-apparatus	PICC
PPS(0,0)	('D0' '11' '00' CRC_A) \longrightarrow \longleftarrow	('D0' CRC_A)
PPS_PPS	('D0' '00' CRC_A) \longrightarrow \longleftarrow ('D0' '00' CRC_A) \longrightarrow \longleftarrow	(D0 CRC_A) Mute
PPS_badCRC	('D0' '00' ~CRC_A) \longrightarrow \longleftarrow	Mute
PPS_RFU	('D0' '10' '00' CRC_A) \longrightarrow \longleftarrow	Mute

For the following test loop through the values $1 \leq P \leq 7$

Let param[1] = (1)b, param[2..4] = P, param[5..8] = (0000)b

Test	PICC-test-apparatus	PICC
PPS_RFU	('D0' param '00' CRC_A) \longrightarrow \longleftarrow	Mute

For the following test loop through the values $1 \leq P \leq 7$

Let param[1..5] = (10001)b, param[6..8] = P

Test	PICC-test-apparatus	PICC
PPS_RFU	('D0' param '00' CRC_A) \longrightarrow \longleftarrow	Mute

For the following test loop through the values $1 \leq P \leq 15$

Let param[1..4] = (0000)b, param[5..8] = P

Test	PICC-test-apparatus	PICC
PPS_RFU	('D0' '11' param CRC_A) 	Mute

PICCs supporting further DSI and/or DRI values perform tests described in scenario A16.

For the following test loop through all supported combinations of DSI and DRI.

let param[1..2] = DRI, param[3..4] = DSI, param[5..8] = (0000)b

Scenario A 15 — Handling of PPS (PICCS supporting DSI > 0 and/or DRI > 0)

Test	PICC-test-apparatus	PICC
PPS(DRI,DSI)	('D0' '11' param CRC_A) 	('D0' CRC_A)

G.3.10.3 Expected result

The PICC answer is expected according to the Scenario A 14. For those PICCs, which support DSI > 0 and/or DRI > 0, the PICC answer is expected according to the Scenario A 15.

G.3.10.4 Test report

Record the presence, the content of the PICC responses.

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	Fail

G.3.11 Additional tests

G.3.11.1 Handling of Bitwise Anticollision

G.3.11.1.1 Apparatus

See clause 2.

G.3.11.1.2 Procedure

The purpose of this test is to simulate a full anticollision loop. The test is passed if this function returns TRUE. If it returns FALSE, the test has been failed. This test runs through all cascade levels and simulates a collision at every bit position of the UID.

G.3.11.1.3 Definitions:

See G.1 for general terminology.

- PICC_levels** number of PICC UID cascade levels.
- PICC_answer** PICC response of the last send command
- SEL(I)** SEL(1) = 93; SEL(2) = 95; SEL(3) = 97

Scenario A 16 — Handling of Bitwise Anticollision

```

BOOL AnticollisionTest
1) for c1 = 1 to PICC_levels do
2)     Put PICC into READY state
3)     if c1 = 1 then
4)         Send '93' UIDTX1 CRC_A
5)     if PICC_answer is incorrect then
6)         return FALSE
7)     if c1 = 2 then
8)         Send '95' UIDTX2 CRC_A
9)     if PICC_answer is incorrect then
10)         return FALSE
11)     for pos = 1 to 31 do
12)         NVB[1..4] = (pos + 16) mod 8
13)         NVB[5..8] = (pos + 16) div 8
14)         Send (SEL(level) NVB UIDTX(c1)[1..pos])
15)     if PICC_answer != UIDTX(c1)[pos+1..32] BCC)
16)         return FALSE
17)         Send WUPA
18)         Send (SEL(c1) NVB UIDTX(c1)[1..pos-1] ~UIDTX(c1)[pos])
19)         if PICC_answer != Mute
20)             return FALSE
21) end
22) Send (SEL(c1) '70' UIDTX(c1)[1..31] ~UID(c1)[32] CRC_A)
23)     if PICC_answer != Mute
24)         return FALSE
25) Send (SEL(c1) NVB UIDTX(c1) CRC_A)
26)     if level == PICC_level then
27)         if PICC_answer != SAK(complete)
28)             return FALSE
29)     else
30)         if PICC_answer != SAK(cascade)
31)             return FALSE
32) end
33) return TRUE

```

G.3.11.1.4 Test report

Fill the appropriate row in "Table G.6 — Reported Results for type A specific test methods " according to the test results as follows:

Explanation	Test result
If the Anticollision procedure returns	Pass

TRUE	
If the Anticollision procedure returns FALSE	Fail

G.4 Test method for logical operation of the PICC of Type B

G.4.1 Polling

The purpose of this test is to determine the behaviour of the PICC type B in an unmodulated operating field according to ISO/IEC 14443-3 2001: 5. The PICC shall be able to accept a REQB within 5 ms of unmodulated operating field.

G.4.1.1 Apparatus

See clause 2.

G.4.1.2 Procedure

Place the reference PICC into the field.

- a) Send a valid REQA Command frame ('(0100110)b').
- b) Do delay of 5 ms and send a valid REQB Command frame ('05 00 00 71 FF').
- c) Record the presence and the content of the PICC response.

G.4.1.3 Test report

Report the signal recording. Fill the "Table G.5 — Type B specific timing table" on page 81 with measured values from c).

G.4.2 I/O transmission timing for type B protocol

The purpose of this test is to determine the timing of the data transmitted by the PICC during the Anticollision sequence (see ISO/IEC 14443-3:2001 7.1).

G.4.2.1 Apparatus

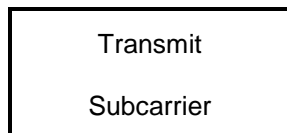
See clause 2.

G.4.2.2 Procedure

Place the reference PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.

RF I/O
Receive



- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Record the presence and the content of the PICC response.
- c) Analyse the timing after a PCD data transmission until the PICC start of communication (see ISO/IEC 14443-3:2001 7.1.6).
- d) Analyse the bit boundaries timing within a character sent by the PICC (see ISO/IEC 14443-3:2001 7.1.1).
- e) Analyse the extra guard time (EGT) between 2 consecutive characters sent by the PICC (see ISO/IEC 14443-3:2001 7.1.2).
- f) Analyse the timing of SOF sent by the PICC (see ISO/IEC 14443-3:2001 7.1.4).
- g) Analyse the timing of EOF sent by the PICC (see ISO/IEC 14443-3:2001 7.1.5).

G.4.2.3 Test report

Report the signal recording and the ATQB. Fill the "Table G.5 — Type B specific timing table" on page 81 with measured values from c) up to g).

G.4.3 I/O reception timing for type B protocol

The purpose of this test is to determine the reception timing of the PICC during the Anticollision sequence (see ISO/IEC 14443-3:2001 7.1, see ISO/IEC 14443-2:2001 9.2.5).

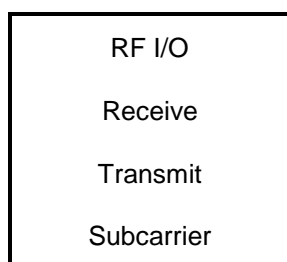
G.4.3.1 Apparatus

See clause 2.

G.4.3.2 Procedure

Place the reference PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2:2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Record the presence, the content and the timing of the PICC response.

- c) Record the guard time TR0 in which the PICC shall not generate a subcarrier (see ISO/IEC 14443-2-2001 9.2.5).
- d) Record the synchronisation time TR1, in which the PICC shall generate a subcarrier with no phase transition(see ISO/IEC 14443-2-2001 9.2.5).

G.4.3.3 Test report

Report the signal recording. Fill the "Table G.5 — Type B specific timing table" on page 81 with measured values from c) and d).

G.4.4 Behaviour of the PICC type B in the IDLE state

The purpose of this test is to determine the behaviour of the PICC type B in the IDLE state according to ISO/IEC 14443-3 2001: 7.4.4. The PICC shall recognise REQB and WUPB messages.

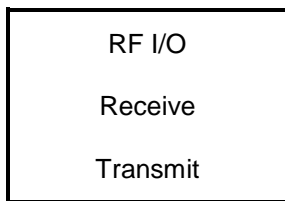
G.4.4.1 Apparatus

See clause 2.

G.4.4.2 Procedure

Place the reference PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



G.4.4.2.1 Procedure 1

- a) Place the reference PICC into the field.
- b) Send a valid REQB command.

Scenario B 1— Behaviour of the PICC type B in the IDLE state

PICC-test-apparatus	PICC
REQB command (‘05 00 00 71 FF’)	→
	←
	ATQB

G.4.4.2.1.1 Expected result

The PICC answer is expected according to the Scenario B 1.

G.4.4.2.1.2 Test report

Record the presence, the content and the timing of the PICC responses.

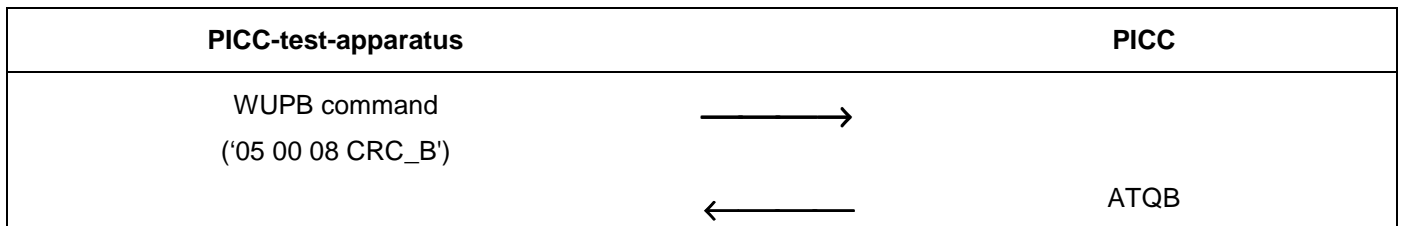
Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" according to the test results as follows:

Explanation	Test result
If ATQB is received	Pass
If no PICC response is received	Fail

G.4.4.2.2 Procedure 2

- a) Place the reference PICC into the field.
- b) Send a valid WUPB Command frame.

Scenario B 2— Behaviour of the PICC type B in the IDLE state



G.4.4.2.2.1 Expected result

The PICC answer is expected according to the Scenario B 2.

G.4.4.2.2.2 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" according to the test results as follows:

Explanation	Test result
If ATQB is received	Pass
If no PICC response is received	Fail

G.4.4.2.3 Procedure 3

- a) Place the reference PICC into the field.
- b) Send a valid SLOT_MARKER command.
- c) Send a valid ATTRIB Command frame.

- d) Send a valid HLTB Command frame.
- e) Send a valid DESELECT S-block Command frame.

Scenario B 3— Behaviour of the PICC type B in the IDLE state

PICC-test-apparatus		PICC
SLOT_MARKER commands (‘15 54 B7’, ‘25 D7 86’, etc.)	→	
	←	Mute
ATTRIBCommand (‘1D 12 23 34 45 00 06 01 04 74 61’)	→	
	←	Mute
HLTB Command (‘50 12 23 34 45 F6 68’)	→	
	←	Mute
DESELECT S-block (‘CA CID CRC_B’ or ‘C2 CRC_B’) *	→	
	←	Mute

* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.4.4.3 Expected result

No PICC answer is expected to any command.

G.4.4.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" according to the test results as follows:

Explanation	Test result
If no PICC response is received	Pass
If any PICC response is received	Fail

G.4.5 Behaviour of the PICC type B in the ACTIVE state

The purpose of this test is to determine the behaviour of the PICC type B in the ACTIVE state according to ISO/IEC 14443-3 2001: 7.4.7. This test tries to cause the card to answer to commands.

G.4.5.1 Apparatus

See clause 2.

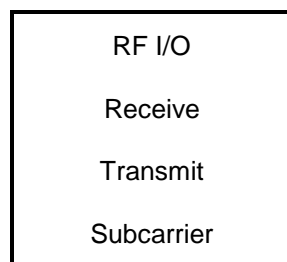
G.4.5.2 Procedure

Place the reference PICC into the field.

Enter the PICC to the ACTIVE state by following actions:

- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is '12 23 34 45' and the PICC supports CID.
- c) Send a valid ATTRIB Command frame ('1D 12 23 34 45 00 06 01 04 74 61'). The PICC has entered an ACTIVE state.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Send a valid ATTRIB Command frame ('1D 12 23 34 45 00 06 01 04 74 61').
- c) Send a valid ATTRIB Command frame with a wrong CRC ('1D 12 23 34 45 00 06 01 04 00 00').
- d) Send a valid SLOT_MARKER Command frame ('15 54 B7').
- e) Send a valid WUPB Command frame ('05 00 08 CRC_B').
- f) Send a valid WUPB Command frame with a wrong CRC ('05 00 08 00 00').

Scenario B 4 — Behaviour of the PICC type B in the ACTIVE state

PICC-test-apparatus		PICC
REQB command (‘05 00 00 71 FF’)	→	
	←	Mute
ATTRIB Command (‘1D 12 23 34 45 00 06 01 04 74 61’)	→	
	←	Mute
ATTRIB Command with wrong CRC (‘1D 12 23 34 45 00 06 01 04 00 00’)	→	
	←	Mute
SLOT_MARKER commands (‘15 54 B7’, ‘25 D7 86’, etc.)	→	
	←	Mute
WUPB Command (‘05 00 08 CRC_B’).	→	
	←	Mute
WUPB Command with wrong CRC (‘05 00 08 00 00’).	→	
	←	Mute
WUPB Command with wrong CID (‘05 00 08 00 00’).	→	
	←	Mute

G.4.5.3 Expected result

No PICC answer is expected for all commands frames. The PICC shall not emit subcarrier following any frame with invalid CRC_B or with wrong CID.

G.4.5.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If no PICC response is received	Pass
If any PICC response is received	Fail

G.4.6 Behaviour of the PICC type B in the HALT state

The purpose of this test is to determine the behaviour of the PICC type B in the HALT state according to ISO/IEC 14443-3 2001: 7.4.8.

G.4.6.1 Apparatus

See clause 2.

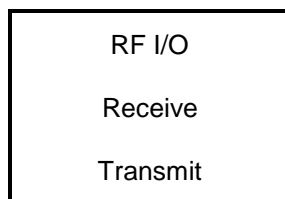
G.4.6.2 Procedure

Place the reference PICC into the field.

Enter the PICC to the HALT state by following action:

- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is '12 23 34 45' and the PICC supports CID.
- c) Send a valid ATTRIB Command frame ('1D 12 23 34 45 00 06 01 04 74 61'). The PICC has entered an ACTIVE state.
- d) Send a valid DESELECT S-block Command frame ('CA 04 CRC_B'). The PICC enters the HALT state.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Send a valid SLOT_MARKER Command frame ('15 54 B7').
- c) Send a valid ATTRIB Command frame ('1D 12 23 34 45 00 06 01 04 74 61').
- d) Send a valid HALT Command frame ('50 12 23 34 45 CRC_B').
- e) Send a valid DESELECT S-block Command frame ('CA 04 CRC_B').
- f) Send a valid WUPB Command frame ('05 00 08 CRC_B').

Scenario B 5 — Behaviour of the PICC type B in the HALT state

PICC-test-apparatus		PICC
REQB command (‘05 00 00 71 FF’)	—————→	
	←————	Mute
SLOT_MARKER commands (‘15 54 B7’, ‘25 D7 86’, etc.)	—————→	
	←————	Mute
ATTRIB Command (‘1D 12 23 34 45 00 06 01 04 74 61’)	—————→	
	←————	Mute
HLTB Command (‘50 12 23 34 45 F6 68’)	—————→	
	←————	Mute
DESELECT S-block (‘CA 04 CRC_B’)	—————→	
	←————	Mute
WUPB Command (‘05 00 08 CRC_B’)	—————→	
	←————	ATQB

G.4.6.3 Expected result

The PICC shall respond only to a WUPB Command. No PICC answer is expected for all other commands frames.

G.4.6.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If no PICC response is received to all commands frames exclude WUPB command frame	Pass
In any other case	Fail

G.4.7 PICC-reaction to protocol errors in the HALT state

The purpose of this test is to determine the behaviour of the PICC type B in the HALT state according to ISO/IEC 14443-3 2001: 7.4.8.

G.4.7.1 Apparatus

See clause 2.

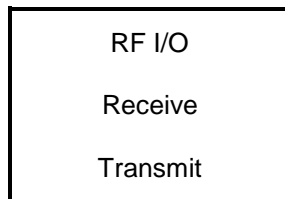
G.4.7.2 Procedure

Place the reference PICC into the field.

Enter the PICC to the HALT state by following action:

- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is '12 23 34 45' and the PICC supports CID.
- c) Send a valid ATTRIB Command frame ('1D 12 23 34 45 00 06 01 04 74 61'). The PICC has entered an ACTIVE state.
- d) Send a valid DESELECT S-block Command frame ('CA 04 CRC_B'). The PICC enters the HALT state.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Send a valid WUPB Command frame with wrong CRC_B value ('05 00 08 00 00').
- b) Send a valid WUPB command frame with RFU AFI value ('05 99 01 CRC_B')
- c) Send a valid WUPB command frame with RFU slots number ('05 00 0F CRC_B').
- d) Send a valid WUPB command frame with wrong PARAM parameter ('05 00 F0 CRC_B').

Scenario B 6 — The PICC reaction to protocol errors in the HALT state

PICC-test-apparatus		PICC
WUPB Command with wrong CRC_B value (‘05 00 08 00 00’)	—————→ ←————	Mute
WUPB Command with RFU AFI value (‘05 99 01 CRC_B’)	—————→ ←————	Mute
WUPB Command with RFU slots number (‘05 00 0F CRC_B’)	—————→ ←————	Mute
WUPB Command with wrong PARAM parameter (‘05 00 F0 CRC_B’)	—————→ ←————	Mute

G.4.7.3 Expected result

No card answer is expected for WUPB command frames with wrong parameters.

G.4.7.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If no PICC response is received	Pass
If any PICC response is received	Fail

G.4.8 PICC reaction to the ATQB command frame with wrong parameters.

The purpose of this test is to determine the reaction of the PICC to the ATQB command frame with wrong parameters according to ISO/IEC 14443-3 2001: 7.4.2.

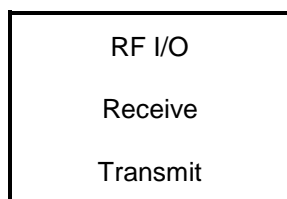
G.4.8.1 Apparatus

See clause 2.

G.4.8.2 Procedure

Place the reference PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Send a valid REQB command frame with RFU AFI value ('05 99 00 CRC_B').
- b) Send a valid REQB command frame with RFU slots number ('05 00 07 CRC_B').
- c) Send a valid REQB command frame with wrong PARAM parameter ('05 00 F0 CRC_B').
- d) Send a valid REQB command frame with wrong CRC value (05 00 00 00 00').

Scenario B 7 — The PICC reaction to the ATQB command frame with wrong parameters.

PICC-test-apparatus		PICC
REQB command with RFU AFI value ('05 99 00 CRC_B')	→	
	←	Mute
REQB command with RFU slots number ('05 00 07 CRC_B')	→	
	←	Mute
REQB command with wrong PARAM parameter ('05 00 F0 CRC_B').	→	
	←	Mute
REQB command with wrong CRC value (05 00 00 00 00')	→	
	←	Mute

G.4.8.3 Expected result

No card answer is expected for frames with wrong parameters.

G.4.8.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If no PICC response is received	Pass
If any PICC response is received	Fail

G.4.9 Slot-MARKER Command

The purpose of this test is to determine the reaction of the PICC to the Slot-MARKER command frame according to ISO/IEC 14443-3 2001:7.8.

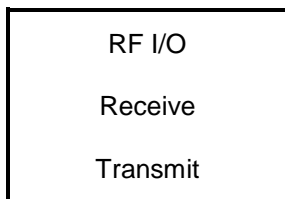
G.4.9.1 Apparatus

See clause 2.

G.4.9.2 Procedure

Place the reference PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



G.4.9.2.1 Procedure 1

Place the reference PICC into the field.

- e) Send a valid REQB command frame with the number of slots $n = 2$ (for example '05 00 02 CRC_B').
- f) If the PICC sends ATQB, the test ends at this point and shall be done again.
- g) If the PICC does not start sending an ATQB within $456/f_s$, then send a faulty Slot-Marker command frame with wrong APn parameter, for example: 16 CRC_B

This test may be repeated with REQB command with incremental numbers of slots.

G.4.9.2.1.1 Expected result

No card answer is expected for slot-MARKER command frames with wrong parameters.

G.4.9.2.1.2 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If no PICC response is received	Pass
If any PICC response is received	Fail

G.4.9.2.2 Procedure 2

Place the reference PICC into the field.

- a) Send a valid REQB command frame with the number of slots $n = 2$ (for example '05 00 02 CRC_B').
- b) If the PICC sends ATQB, the test ends at this point and shall be done again.
- c) If the PICC does not start sending an ATQB within $456/f_s$, then send a correct Slot-Marker command frame, for example: 15 CRC_B

This test may be repeated with REQB command with incremental numbers of slots.

G.4.9.2.2.1 Expected result

PICC shall answer with ATQB response for valid slot-MARKER command frames.

G.4.9.2.2.2 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If ATQB response is received	Pass
Any other case	Fail

G.4.10 HLTB Command

The purpose of this test is to determine the reaction of the PICC to the HLTB command frame according to ISO/IEC 14443-3 2001: 7.12.

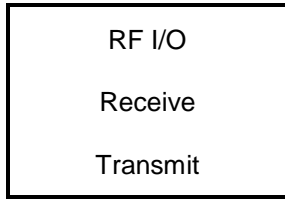
G.4.10.1 Apparatus

See clause 2.

G.4.10.2 Procedure

Place the reference PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Activate the PICC. Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is '12 23 34 45' and the PICC supports CID.
- b) Send a valid HLTB command frame with an erroneous PUPI ('50 00 00 00 00 CRC_B').
- c) Send a valid HLTB command frame with an erroneous CRC ('50 12 23 34 45 00 00').
- d) Send a valid HLTB command ('50 12 23 34 45 CRC_B').

Scenario B 8 — Reaction of the PICC to the HLTB command frame

PICC-test-apparatus		PICC
HLTB command frame with an erroneous PUPI ('50 00 00 00 00 CRC_B')	→ ←	Mute
HLTB command frame with an erroneous CRC ('50 12 23 34 45 00 00')	→ ←	Mute
HLTB command frame ('50 12 23 34 45 CRC_B')	→ ←	Answer to HLTB Command ('00 CRC_B')

G.4.10.3 Expected result

The PICC answer is expected according to the Scenario B 8.

No card answer is expected for HLTB command frames with wrong parameters.

G.4.10.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	Fail

G.4.11 ATTRIB command

The purpose of this test is to determine the reaction of the PICC to the ATTRIB command frame with wrong parameters according to ISO/IEC 14443-3 2001: 7.10.

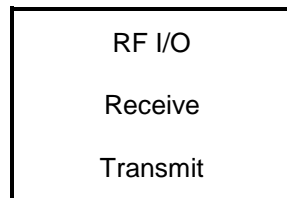
G.4.11.1 Apparatus

See clause 2.

G.4.11.2 Procedure

Place the reference PICC into the field.

During the following procedure the following test points shall be continuously monitored and verified correct to ISO/IEC 14443-2-2001. All signal transitions (level and timing) as well as the logical content of the communication shall be recorded.



- a) Activate the PICC. Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is '12 23 34 45' and the PICC supports CID.
- b) Send a valid ATTRIB Command frame with wrong PUPI ('1D 00 00 00 00 06 01 04 CRC_B').
- c) Send a valid ATTRIB Command frame with wrong PARAM1 (for example, PARAM1 = 0x03: '1D 12 23 34 45 03 06 01 04 CRC_B').
- d) Send a valid ATTRIB Command frame with wrong PARAM1 (for example, PARAM1 = 0xF0: '1D 12 23 34 45 F0 06 01 04 CRC_B').
- e) Send a valid ATTRIB Command frame with wrong PARAM2 (for example, PARAM2 = 0x0F: '1D 12 23 34 45 00 0F 01 04 CRC_B').
- f) Send a valid ATTRIB Command frame with wrong PARAM3 (for example, PARAM3 = 0xF0: '1D 12 23 34 45 00 06 F0 04 CRC_B').
- g) Send a valid ATTRIB Command frame with wrong CID (for example, PARAM4 = 0x0F: '1D 12 23 34 45 00 06 01 0F CRC_B').
- h) Send a valid ATTRIB Command frame with wrong CRC ('1D 12 23 34 45 00 06 01 04 00 00').

Scenario B 9 — The PICC reaction of the to the ATTRIB command frame with wrong parameters

PICC-test-apparatus		PICC
ATTRIB command frame with wrong PUPI (‘1D 00 00 00 00 00 06 01 04 CRC_B’).	—————→ ←————	Mute
ATTRIB command frame with wrong PARAM1 (for example, PARAM1 = 0x03) (‘1D 12 23 34 45 03 06 01 04 CRC_B’).	—————→ ←————	Mute
ATTRIB command frame with wrong PARAM1 (for example, PARAM1 = 0xF0): (‘1D 12 23 34 45 F0 06 01 04 CRC_B’)	—————→ ←————	Mute
ATTRIB command frame with wrong PARAM2 (for example, PARAM2 = 0x0F): (‘1D 12 23 34 45 00 0F 01 04 CRC_B’)	—————→ ←————	Mute
ATTRIB command frame with wrong PARAM3 (for example, PARAM3 = 0xF0) (‘1D 12 23 34 45 00 06 F0 04 CRC_B’)	—————→ ←————	Mute
ATTRIB command frame with wrong CID (for example, PARAM4 = 0x0F) (‘1D 12 23 34 45 00 06 01 0F CRC_B’)	—————→ ←————	Mute
ATTRIB command frame with wrong CRC (‘1D 12 23 34 45 00 06 01 04 00 00’)	—————→ ←————	Mute

G.4.11.3 Expected result

No PICC answer is expected for all commands frames.

G.4.11.4 Test report

Record the presence, the content and the timing of the PICC responses.

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If no PICC response is received	Pass
If any PICC response is received	Fail

G.4.12 Different values of PCD maximum frame size

The purpose of this test is to analyse the behaviour of the PICC type B for different values of PCD maximum frame sizes (see ISO/IEC 14443-3:2001: 7.10.4).

G.4.12.1 Apparatus

See clause 2.

G.4.12.2 Procedure

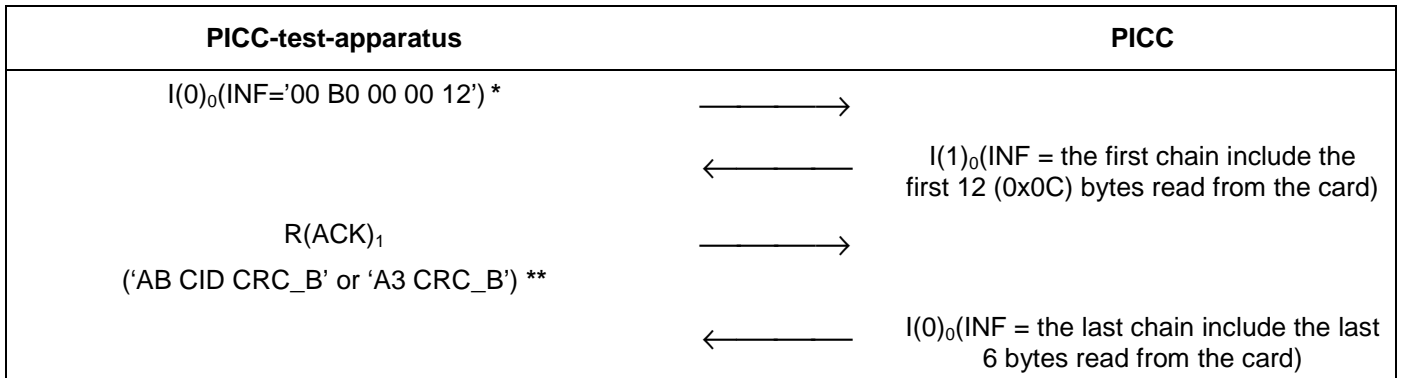
Place the reference PICC into the field.

Activate the PICC by the following sequence:

- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is '12 23 34 45' and the PICC supports CID.
- c) Send a valid ATTRIB Command frame. Specify in Param2 that PCD Maximum Frame size is 16 bytes (b4 to b1 of Param2 equal 0): '1D 12 23 34 45 00 00 01 04 CRC_B'.
- d) Send block I(0)₀ to the PICC, with the INF field containing a command for which chaining is required by the PICC. For example, this command should read sequentially at least 16 bytes from the card.
- e) Record the presence, the content and the timing of the PICC response.
- f) PICC shell answer with I-Block, indicating chaining: I(1)₀.
- g) Send the R-block R(ACK)₁ to the PICC.
- h) Wait for the answer of the PICC.

This test may be repeated with different values of PCD Maximum Frame size.

Scenario B 10 — PCD Maximum Frame Size



*NOTE The numbers are just an example.

* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.4.12.3 Test report

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.4.13 PICC bit rate selection mechanism

The purpose of this test is to analyse the PICC bit rate selection mechanism. This test is suitable only for the PICC, which supports high bit rates (212kbit/s or more).

G.4.13.1 Apparatus

See clause 2.

For the purpose of this test the PICC-test-apparatus must be configurable to change the bit rate during the test procedure. Tester should be able to measure the bit rate used by the PICC on each stage of this test procedure.

G.4.13.2 Procedure

Place the reference PICC into the field.

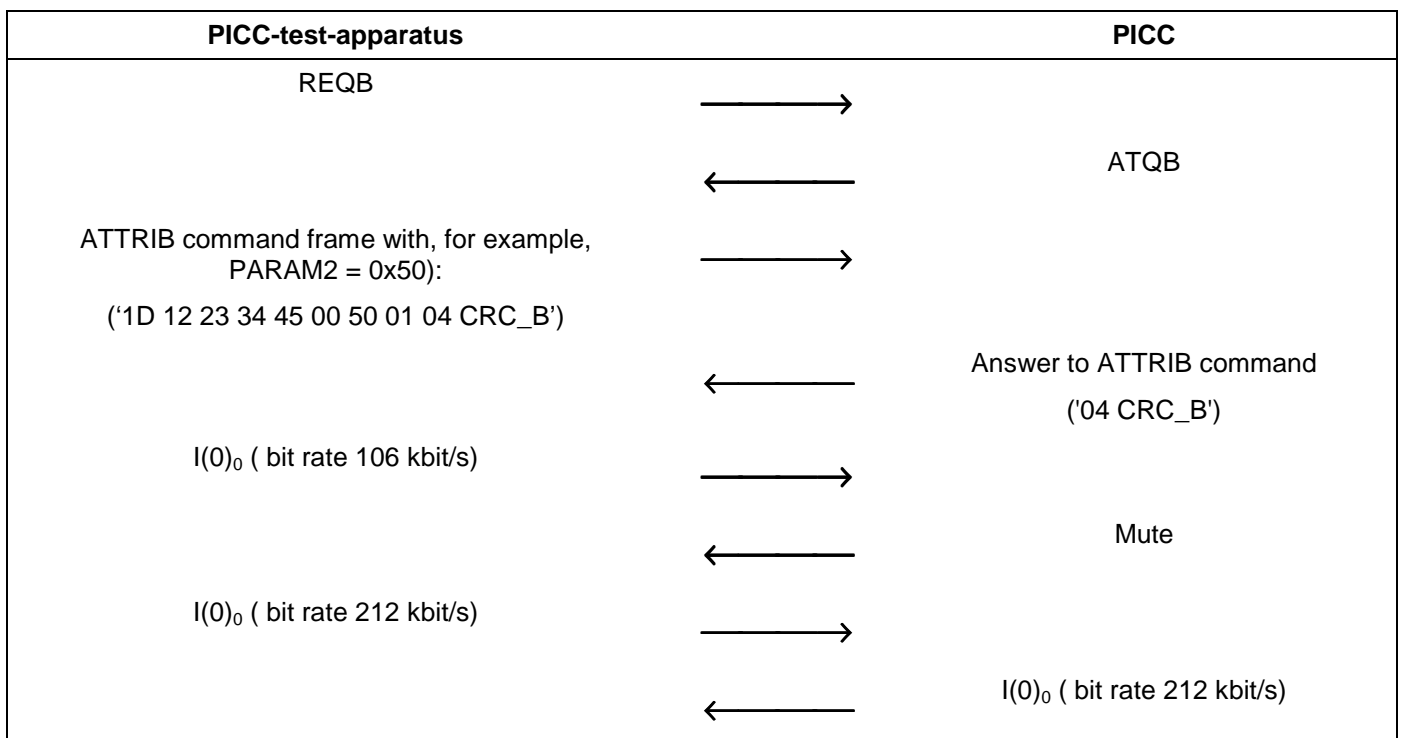
Activate the PICC by the following sequence:

- a) Send a valid REQB Command frame ('05 00 00 71 FF').
- b) PICC shall send ATQB. Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is '12 23 34 45' and the PICC supports CID. For the purpose of this test assume, that the PICC returned Bit_Rate_capability byte equal 0x91 (see ISO/IEC 14443-3:2001: 7.9.4.6), which means that bit rate supported by the tested PICC is 212 kbit/s and the PICC uses the same bit rate in both directions.

- c) Send a valid ATTRIB Command frame with Param2 byte equal to 0x50: '1D 12 23 34 45 00 50 01 04 CRC_B'. Value 0x50 means:
- PCD Maximum Frame size is 16 bytes (b4 to b1 of Param2 equal 0).
 - Bit rate selected is 212 kbit/s in both directions (b8 to b5 of Param2 equal 5).
- d) Wait for the PICC's response. The PICC shall send Answer to ATTRIB command.
- e) Send I-block I(0)₀ to the PICC using baud rate 106 kbit/s.
- f) PICC shall stay mute.
- g) Send I-block I(0)₀ to the PICC using baud rate 212 kbit/s.
- h) Wait for the PICC's answer. The PICC shall answer with I(0)₀ using baud rate 212 kbit/s

If the PICC supports bit rates 424 kbit/s and 847 kbit/s, this test may be repeated using the appropriate values of bit rate selection in ATTRIB command (for example, PARAM2=0xA0 for 424 kbit/s and PARAM2=0xF0 for 847 kbit/s)

Scenario B 11 — The PICC bit rate selection mechanism



G.4.13.3 Test report

Fill the appropriate row in "Table G.7 — Reported Results for type B specific test methods" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5 Test methods for logical operation of the PICC of Type A/B

G.5.1 Block sequencing by the PICC

The purpose of this test is to determine the reaction of the PICC to a transmission error (see ISO/IEC 14443-4:2001, 7.1, 7.5.5).

Erroneous block: block, which suffered a transmission error, i.e. frame error or an error in the epilogue.

G.5.1.1 Apparatus

See clause 2.

G.5.1.2 Procedure

Place the reference PICC into the field.

G.5.1.2.1 Procedure 1

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send an erroneous block to the PICC.
- c) If the PICC sends any response, then stop test at this point.
- d) If the PICC does not start sending a block within Frame Waiting Time then send the correct block.
- e) Record the response of the PICC.

Test Scenario 1— Block sequencing by the PICC, Procedure 1

PICC-test-apparatus		PICC
I(0) ₀ (INF='00 B0 00 00 02', CRC= wrong) *	→	Mute
	←	
I(0) ₀ (INF='00 B0 00 00 02')	→	I(0) ₀ (INF='31 32 90 00')
	←	

* NOTE The default command READBINARY (see ISO/IEC 7816-4) is used with this test. (Other ISO/IEC 7816-4 command can be used if required for a specific PICC that does not support the READBINARY command). Test report

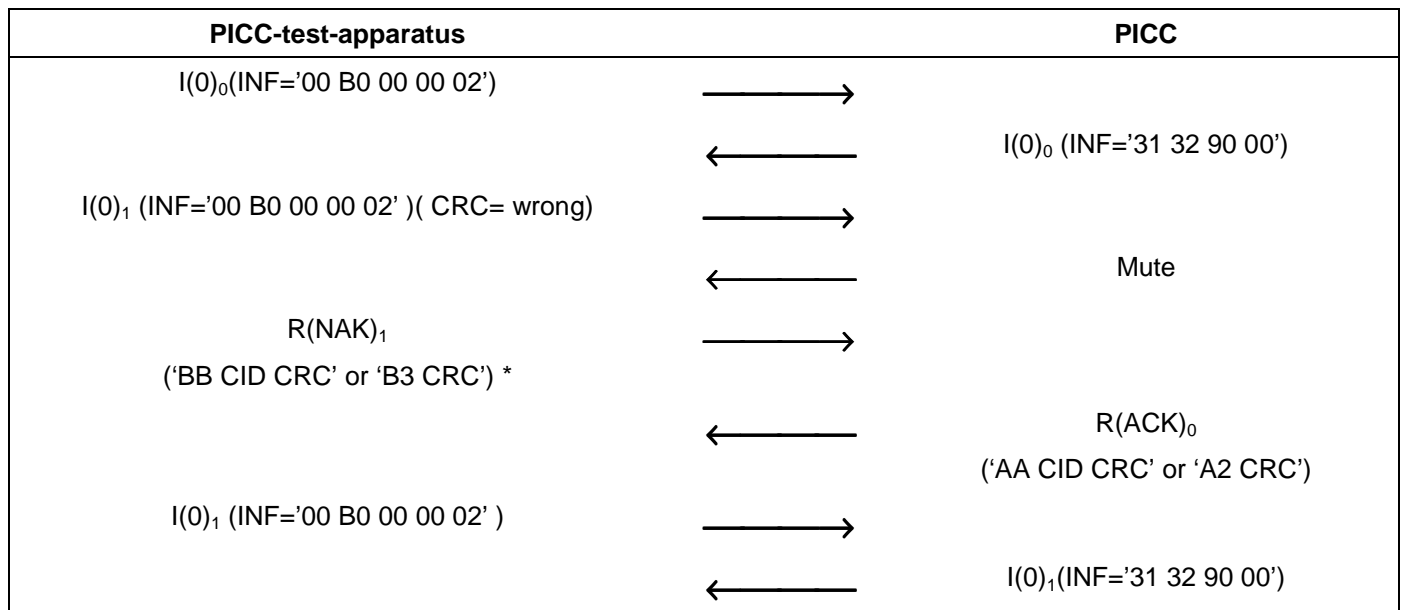
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.1.2.2 Procedure 2 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 7)

- Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- Send block $I(0)_0$ to the PICC, with the INF field containing a command supported by the PICC.
- Wait for the answer of the PICC, and send an erroneous block to the PICC.
- If the PICC does not start sending a block within Frame Waiting Time then send $R(NAK)_1$.
- Record the response of the PICC. The PICC shall answer with $R(ACK)_0$.

Test Scenario 2 — Block sequencing by the PICC, Procedure 2 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 7)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.1.2.2.1 Test report

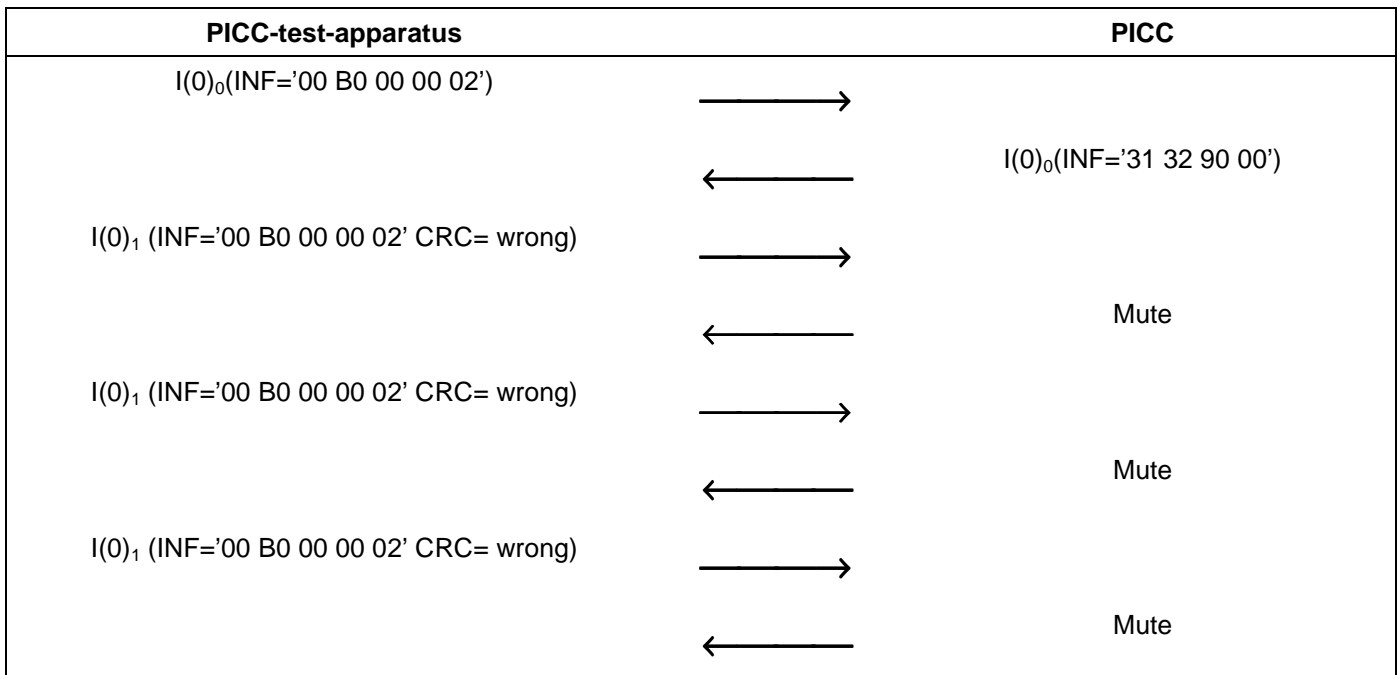
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.1.2.3 Procedure 3

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC.
- c) Wait for the answer of the PICC, and send an erroneous block to the PICC.
- d) If the PICC does not start sending a block within Frame Waiting Time then send an erroneous block to the PICC again up to 3 times.
- e) Record the response of the PICC.

Test Scenario 3 — Block sequencing by the PICC, Procedure 3



G.5.1.2.3.1 Test report

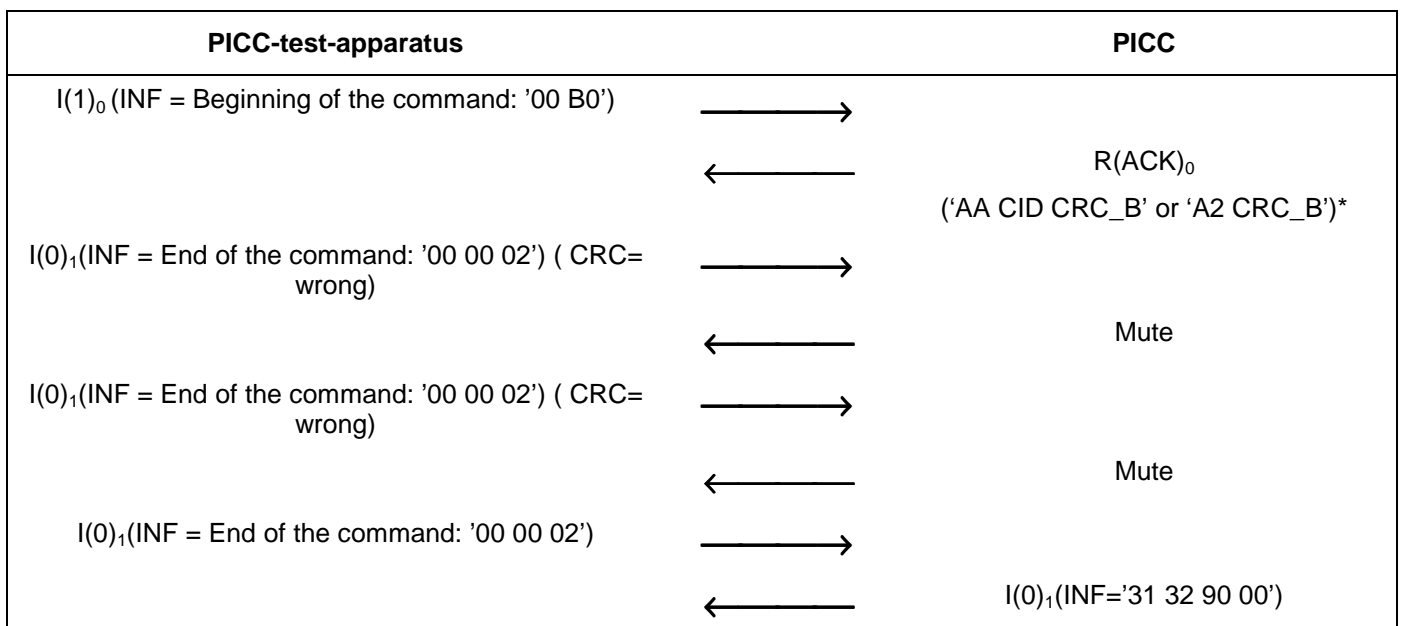
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.1.2.4 Procedure 4 (with chaining)

- Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- Send block $I(1)_0$ to the PICC, with the INF field containing the beginning of a command supported by the PICC.
- Wait for the answer of the PICC, and send an erroneous block to the PICC.
- If the PICC does not start sending a block within Frame Waiting Time, then send the an erroneous block again.
- If the PICC does not start sending a block within Frame Waiting Time, then send block $I(0)_1$ to the PICC, with the INF field containing the end of the command supported by the PICC.

Test Scenario 4 — Block sequencing by the PICC, Procedure 4 (with chaining)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.1.2.4.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.2 Retransmission

The purpose of this test is to check the retransmission by the PICC (see ISO/IEC 14443-4:2001, 7.5.4.3).

G.5.2.1 Apparatus

See clause 2.

G.5.2.2 Procedure

Place the reference PICC into the field.

G.5.2.2.1 Procedure 1 (see ISO/IEC 14443-4:2001, 7.5.4.2 rule 11)

- Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- Send block $I(0)_0$ to the PICC, with the INF field containing a command supported by the PICC.
- Wait for the answer of the PICC. The PICC shall answer with $I(0)_0$.
- Send R-block $R(NAK)_0$ to the PICC. Get response from the PICC.
- The PICC shall repeat the I-Block $I(0)_0$.

Test Scenario 5 — Retransmission by the PICC, Procedure 1 (ISO/IEC 14443-4:2001, 7.5.4.2 rule 11)

PICC-test-apparatus		PICC
$I(0)_0$ (INF='00 B0 00 00 02')	→	
	←	$I(0)_0$ (INF='31 32 90 00')
$R(NAK)_0$ (‘BA CID CRC_B’ or ‘B2 CRC’)*	→	
	←	$I(0)_0$ (INF='31 32 90 00')

* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.2.2.1.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.2.2.2 Procedure 2 (ISO/IEC 14443-4:2001, 7.5.4.2 rule 11)

- Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- Send block $I(0)_0$ to the PICC, with the INF field containing a command supported by the PICC.
- Wait for the answer of the PICC. The PICC shall answer with $I(0)_0$.
- Send an erroneous block to the PICC.
- If the PICC does not start sending a block within Frame Waiting Time then send the correct R-block $R(NAK)_0$ to the PICC..
- Record the response of the PICC. The PICC shall answer with $I(0)_0$.
- Send R-block $R(NAK)_0$ to the PICC. Get response from the PICC.
- The PICC shall repeat the I-Block $I(0)_0$.

Test Scenario 6 —Retransmission by the PICC, Procedure 2 (ISO/IEC 14443-4:2001, 7.5.4.2 rule 11)

PICC-test-apparatus		PICC
$I(0)_0$ (INF='00 B0 00 00 02')	→	
	←	$I(0)_0$ (INF='31 32 90 00')
$I(0)_1$ (INF='00 B0 00 00 04', CRC= wrong)	→	
	←	Mute
$R(NAK)_0$ (‘BA CID CRC’ or ‘B2 CRC’)*	→	
	←	$I(0)_0$ (INF='31 32 90 00')
$R(NAK)_0$ (‘BA CID CRC’ or ‘B2 CRC’)*	→	
	←	$I(0)_0$ (INF='31 32 90 00')

* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.2.2.2.1 Test report

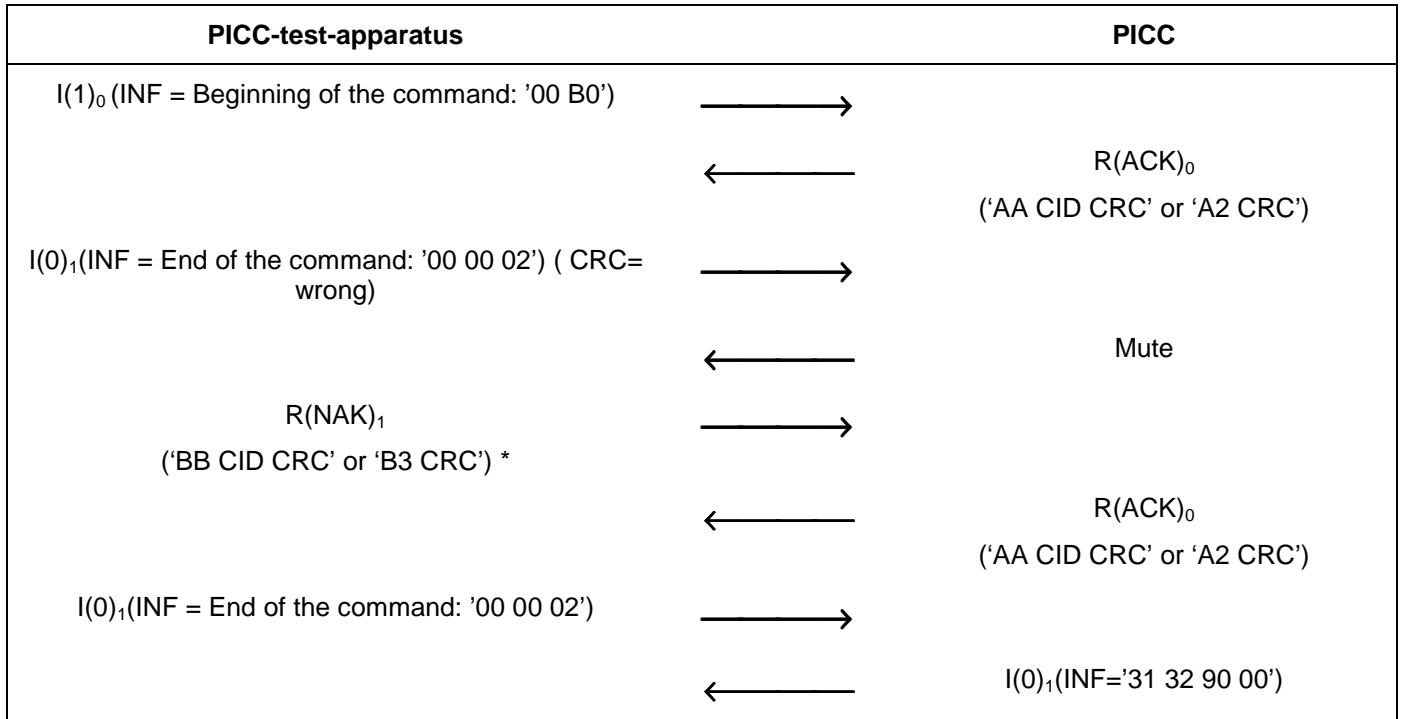
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.2.2.3 Procedure 3 (with chaining)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(1)₀ to the PICC, with the INF field containing the beginning of a command supported by the PICC.
- c) Wait for the answer of the PICC. The PICC shall answer with R(ACK)₀.
- d) Send an erroneous block to the PICC.
- e) If the PICC does not start sending a block within Frame Waiting Time then send the correct R-block R(NAK)₁ to the PICC.
- f) Record the response of the PICC. The PICC shall repeat the R-Block R(ACK)₀.
- g) Send I-block I(0)₁ with the INF field containing the end of the command needing chaining supported by the PICC. Get response from the PICC.
- h) The PICC shall answer with the I-Block I(0)₁.

Test Scenario 7 — Retransmission by the PICC, Procedure 3 (with chaining)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.2.2.3.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

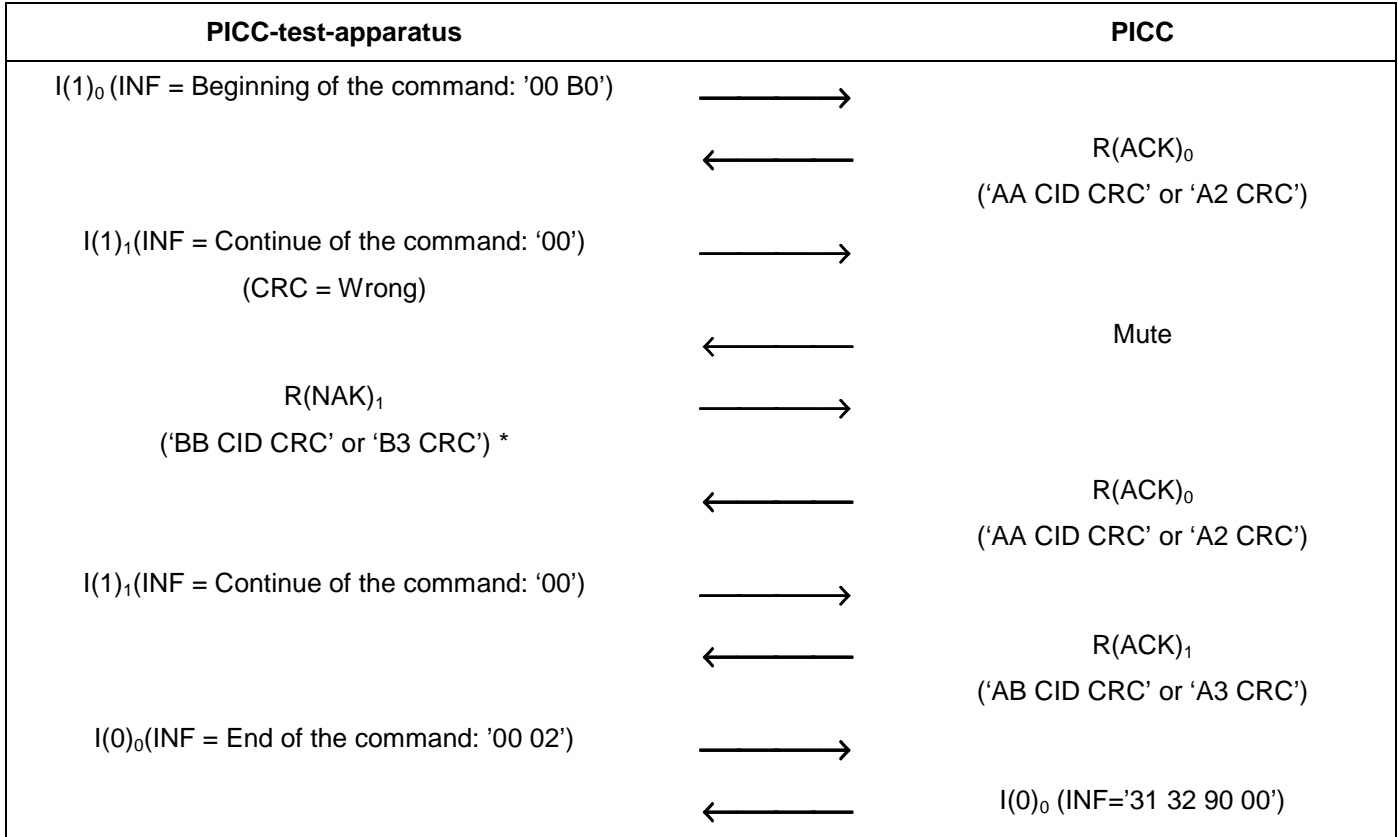
Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.2.2.4 Procedure 4 (with chaining) (see ISO/IEC 14443-4:2001, Informative Annex B, Scenario 17)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(1)₀ to the PICC, with the INF field containing a part of the command supported by the PICC.
- c) Wait for the answer of the PICC. The PICC shell answer with R(ACK)₀.
- d) Send an erroneous block I(1)₁ to the PICC.
- e) If the PICC does not start sending a block within Frame Waiting Time then send the correct R-block R(NAK)₁ to the PICC.
- f) Record the response of the PICC. The PICC shell answer with the R-Block R(ACK)₀.
- g) Send I-block I(1)₁ with the INF field containing a continue of the command supported by the PICC.

- h) Get response from the PICC. The PICC shell answer with the R-Block R(ACK)₁.
- i) Send I-block I(0)₁ with the INF field containing the end of the command supported by the PICC.
- j) Get response from the PICC. The PICC shell answer with the I-Block I(0)₁.

Test Scenario 8 — Retransmission by the PICC, Procedure 4 (with chaining) (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 17)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.2.2.4.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

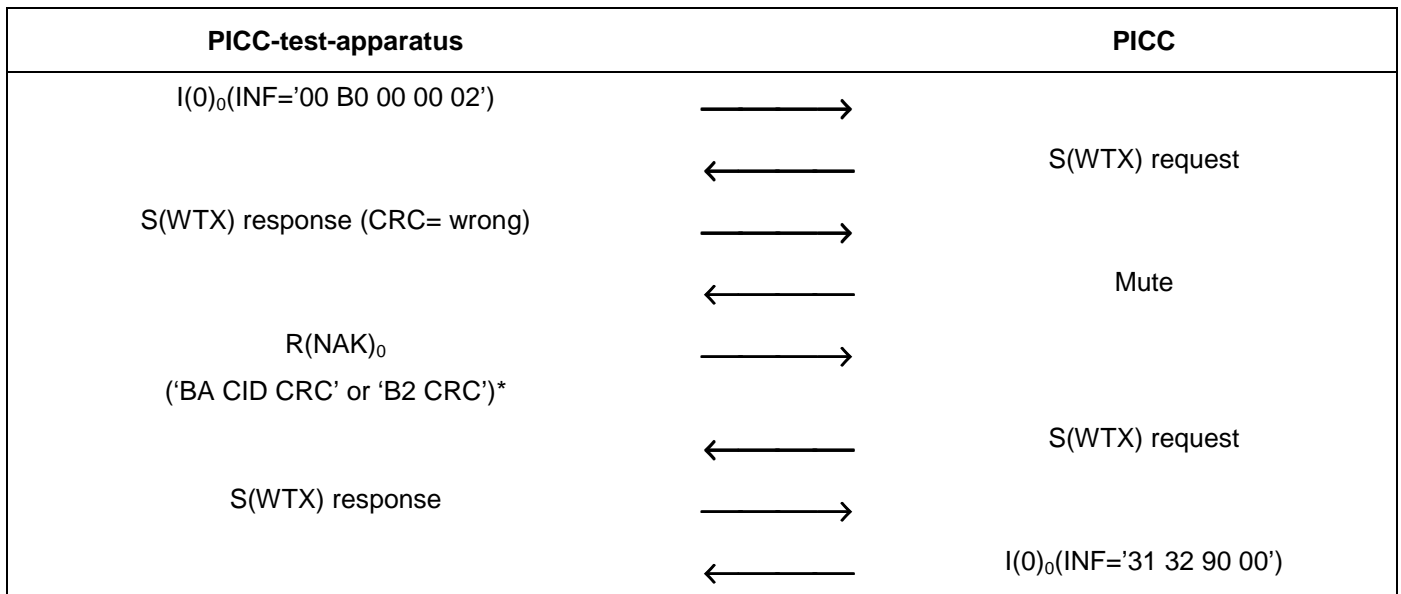
Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.2.2.5 Procedure 5 (ISO/IEC 14443-4:2001, 7.5.4.2 rule 11, Informative Annex B, Scenario 12)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).

- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC. Choose a command for which the PICC need more time than the defined FWT to process the received block and it would use an S(WTX) request for a waiting time extension.
- c) Wait for the answer of the PICC. The PICC shell answer with S(WTX) request.
- d) Send an erroneous S(WTX) response block to the PICC (block with wrong CRC).
- e) If the PICC does not start sending a block within Frame Waiting Time then send the correct R-block R(NAK)₀ to the PICC..
- f) Record the response of the PICC. The PICC shell retransmit the S(WTX) request.
- g) Send S(WTX) response block to the PICC.
- h) Get response from the PICC. The PICC shell answer with the I-Block I(0)₀.

Test Scenario 9 —Retransmission by the PICC, Procedure 5 (ISO/IEC 14443-4:2001, 7.5.4.2 rule 11, Informative Annex B, Scenario 12)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.2.2.5.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.3 Reactions of the PICC to transmission errors

The purpose of this test is to analyze the reaction of the PICC to transmission errors (frame error or CRC error as described in ISO/IEC 14443-4:2001 7.5.5).

Erroneous block: block, which suffered a transmission error, i.e. frame error or an error in the epilogue.

G.5.3.1 Apparatus

See clause 2.

G.5.3.2 Procedure

G.5.3.2.1 Procedure 1

Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(0)₀ to the PICC, with the INF field containing a command needing chaining supported by the PICC.
- c) PICC shell answer with I-Block, indicating chaining: I(1)₀.
- d) Send an erroneous block R(ACK)₁ to the PICC.
- e) If the PICC does not start sending a block within Frame Waiting Time then send the R-block R(ACK)₁ to the PICC.
- f) Wait for the answer of the PICC. The PICC shell answer with I(0)₁.

Test Scenario 10 — Reactions of the PICC to transmission errors

PICC-test-apparatus		PICC
I(0) ₀ (INF='00 B0 00 00 12')	→	
	←	I(1) ₀
R(ACK) ₁ (CRC = wrong) (‘AB CID CRC’ or ‘A3 CRC’)*	→	
	←	Mute
R(ACK) ₁ (‘AB CID CRC’ or ‘A3 CRC’)*	→	
	←	I(0) ₁

* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.3.2.1.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

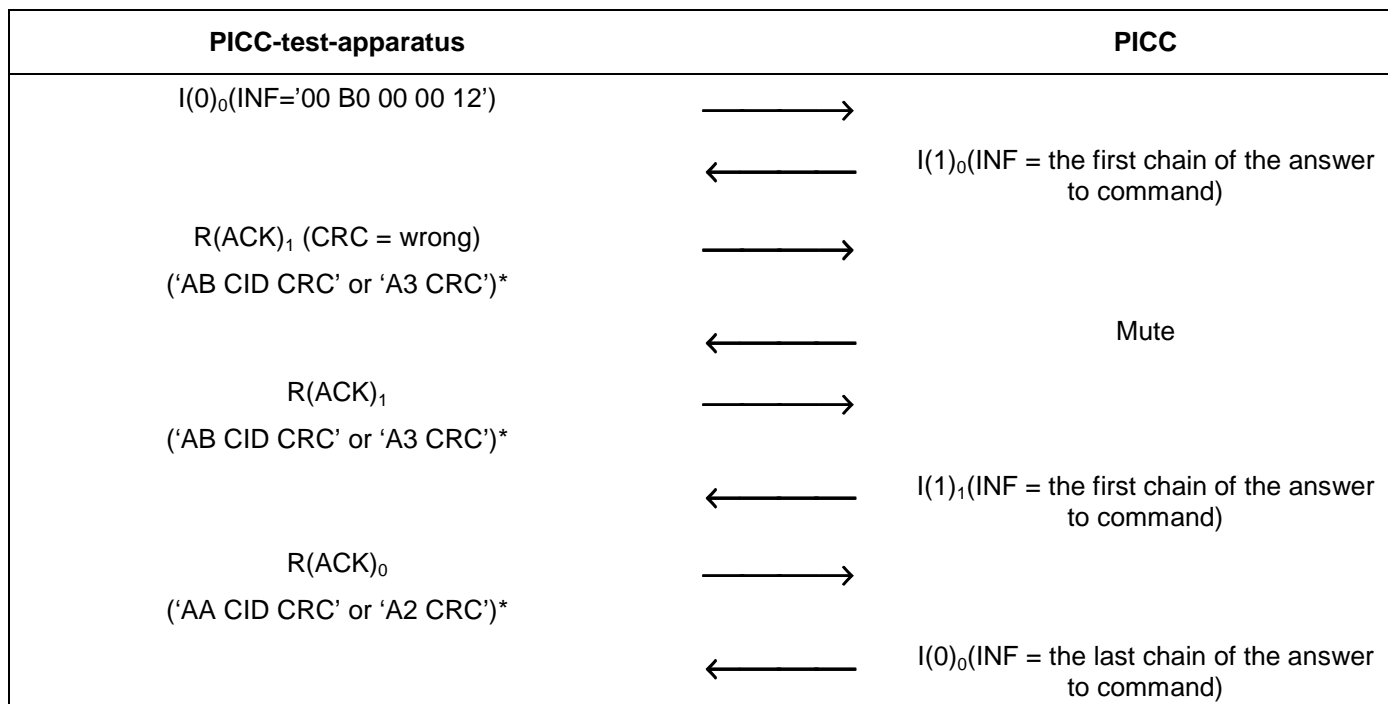
Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.3.2.2 Procedure 2 (ISO/IEC 14443-3:2001, Informative Annex B, Scenario 19)

Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(0)₀ to the PICC, with the INF field containing a command needing chaining supported by the PICC.
- c) PICC shall answer with I-Block, indicating chaining: I(1)₀.
- d) Send an erroneous block R(ACK)₁ to the PICC.
- e) If the PICC does not start sending a block within Frame Waiting Time then send the R-block R(ACK)₁ to the PICC.
- f) Wait for the answer of the PICC. The PICC shall answer with I(1)₁.
- g) Send the R-block R(ACK)₀ to the PICC.
- h) Wait for the answer of the PICC. The PICC shall answer with I(1)₀.

Test Scenario 11 — Reactions of the PICC to transmission errors (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 19)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.3.2.2.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

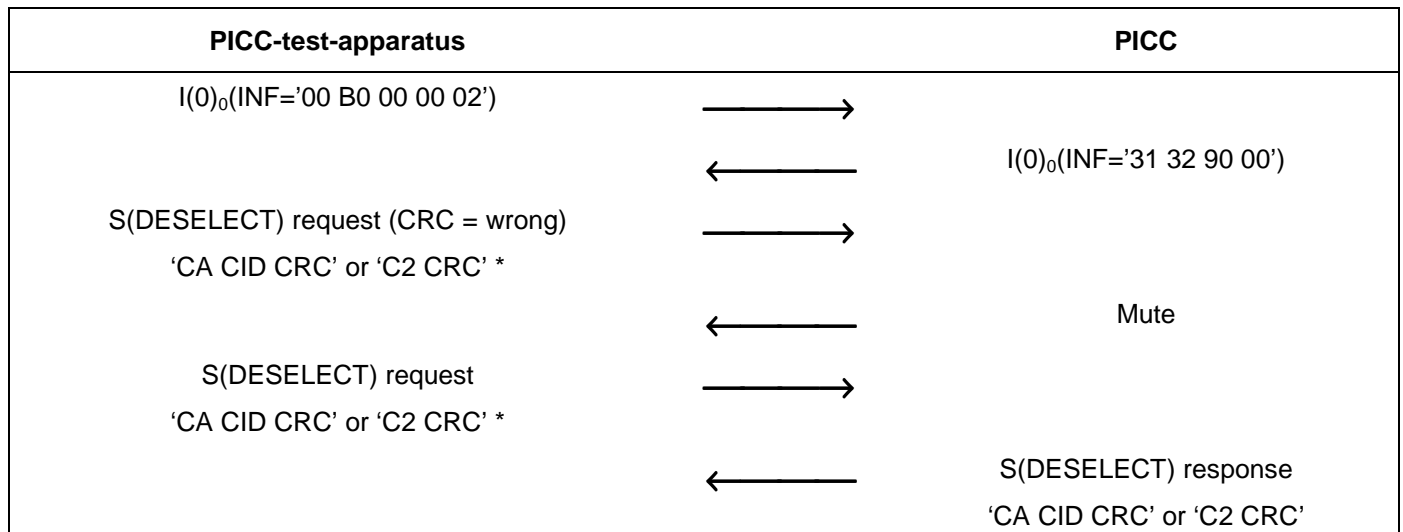
G.5.3.2.3 Procedure 3 (ISO/IEC 14443-3:2001, Informative Annex B, Scenario 15)

Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC.
- c) Wait for the answer of the PICC. The PICC shall answer with I(0)₀.
- d) Send an erroneous S(DESELECT) request block to the PICC.
- e) If the PICC does not start sending a block within Frame Waiting Time then send the S(DESELECT) request to the PICC.

f) Wait for the answer of the PICC. The PICC shell answer with S(DESELECT) response.

Test Scenario 12 — Reactions of the PICC to transmission errors (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 15)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.3.2.3.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.4 Reactions of the PICC to protocol errors

The purpose of this test is to analyze the reaction of the PICC to protocol errors (infringement of the protocol rules as described in ISO/IEC 14443-4:2001, 7.1, 7.5.5).

Faulty block: Invalid block with unknown PCB encoding, or PCB not matching with the expected block.

G.5.4.1 Apparatus

See clause 2.

G.5.4.2 Procedure (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 6)

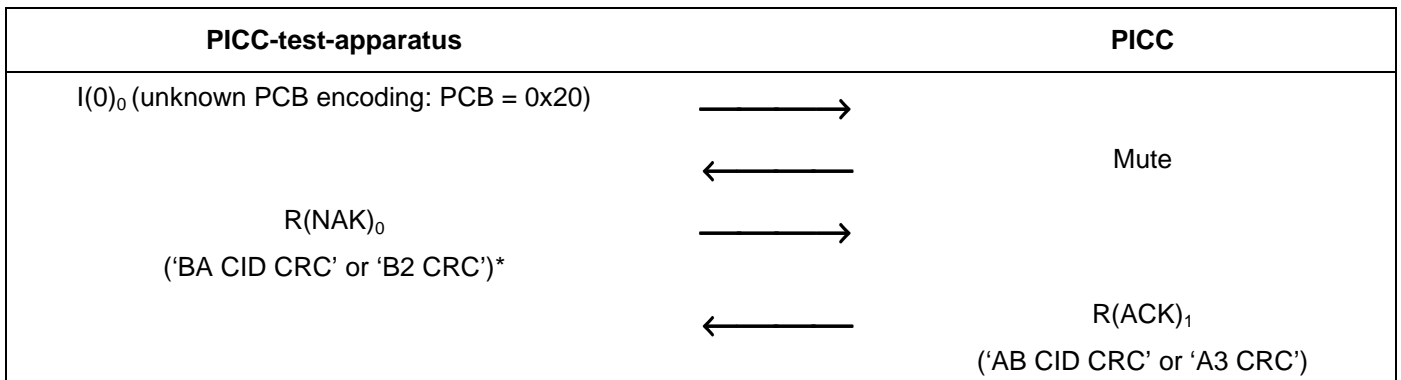
Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send a faulty block (block with unknown PCB encoding: PCB = 0x20) to the PICC.

- c) If the PICC does not start sending a block within Frame Waiting Time then send the R-block R(NAK)₀ to the PICC.
- d) Wait for the answer of the PICC. The PICC shall answer with R(ACK)₁.

This test may be repeated with different types of wrong PCB.

Test Scenario 13 — Reactions of the PICC to protocol errors (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 6)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.4.3 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.5 Reactions of the PICC to the deactivation sequence

The purpose of this test is to analyse the reaction of the PICC to a deactivation (as described in ISO/IEC 14443-4:2001: 7.5.5, 8).

The deactivation of the PICC is done by using a DESELECT Command.

G.5.5.1 Apparatus

See clause 2.

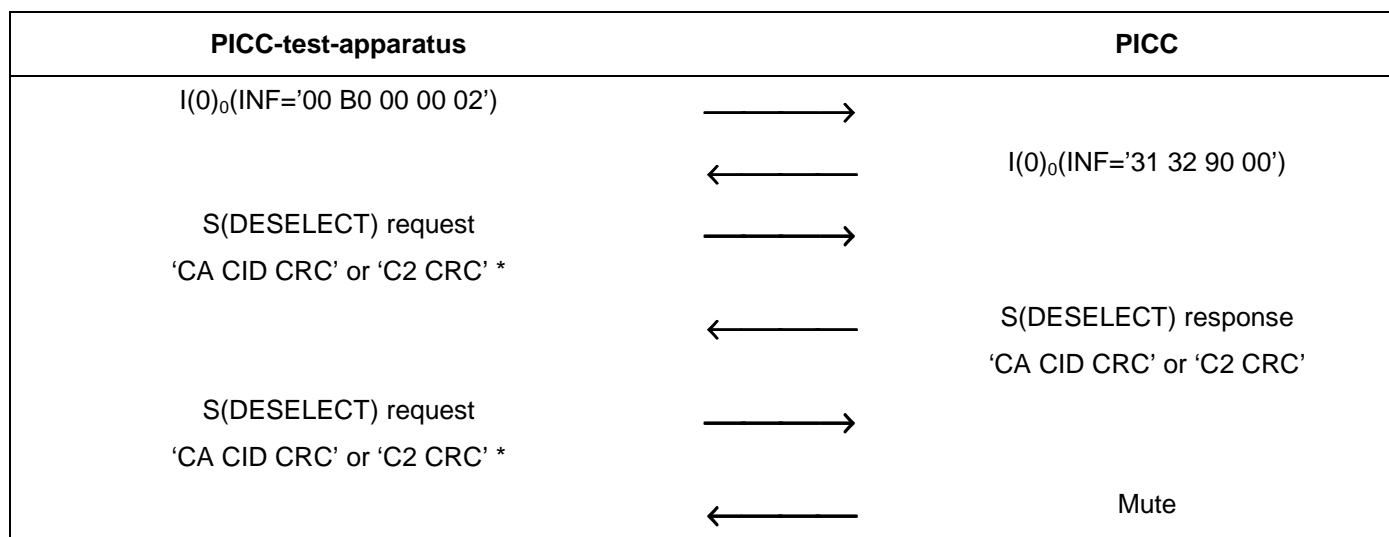
G.5.5.2 Procedure

Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).

- b) Send an I-block $I(0)_0$ to the PICC.
- c) Wait for the answer of the PICC. The PICC shell answer with $I(0)_0$.
- d) Send the S-block S(DESELECT) request to the PICC.
- e) Wait for the answer of the PICC. The PICC shell answer with S(DESELECT) response.
- f) Send the S-block S(DESELECT) request to the PICC.
- g) Wait for the answer of the PICC. The PICC shell not answer with S(DESELECT) response because the CID is released.

Test Scenario 14 — Reaction of the PICC to deactivation sequence



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.5.3 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.6 Deactivation frame waiting time

The purpose of this test is to determine the timing of the PICC answer during the deactivation sequence (as described in ISO/IEC 14443-4:2001: 8.1).

The deactivation of the PICC is done by using a DESELECT Command.

G.5.6.1 Apparatus

See clause 2.

G.5.6.2 Procedure

Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send the S-block S(DESELECT) request to the PICC.
- c) Record the presence, the content and the timing of the PICC S(DESELECT) response.

G.5.6.3 Test report

Report the signal recording. Fill "Table G.5 — Type B specific timing table" on page 81 with measured value of deactivation frame waiting time (time for the PICC to start sending its S(DESELECT) response).

G.5.7 Recovery of a transmission error during deactivation sequence

The purpose of this test is to analyse the reaction of the PICC to a retrying of deactivation sequence (as described in ISO/IEC 14443-4:2001: 8.2).

The PCD may retry the deactivation sequence when it fails to receive an S(DESELECT) response from the PICC.

G.5.7.1 Apparatus

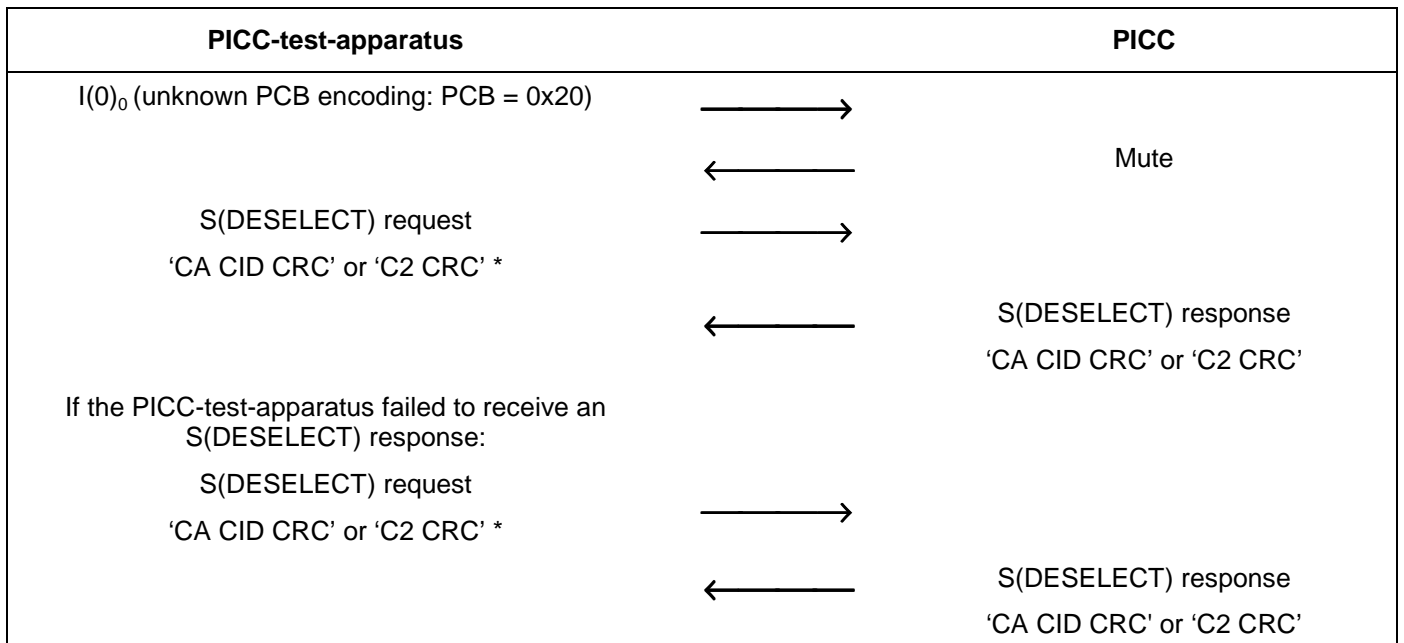
See clause 2.

G.5.7.2 Procedure

Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send a faulty block (block with unknown PCB encoding: PCB = 0x20) to the PICC.
- c) If the PICC does not start sending a block within Frame Waiting Time then send the S-block S(DESELECT) request to the PICC.
- d) Wait for the answer of the PICC. The PICC shall answer with S(DESELECT) response. If the PICC-test-apparatus received an S(DESELECT) response, stop test at this point.
- e) If the PICC-test-apparatus failed to receive an S(DESELECT) response, send the S-block S(DESELECT) request to the PICC.
- f) Wait for the answer of the PICC. The PICC shall answer with S(DESELECT) response.

Test Scenario 15 — Recovery of a transmission error during deactivation sequence



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.7.3 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.8 Error free operations

The purpose of this test is to analyse the behaviour of the PICC type B in different situations (see ISO/IEC 14443-4:2001: Informative Annex B, B.2).

G.5.8.1 Apparatus

See clause 2.

G.5.8.2 Procedure

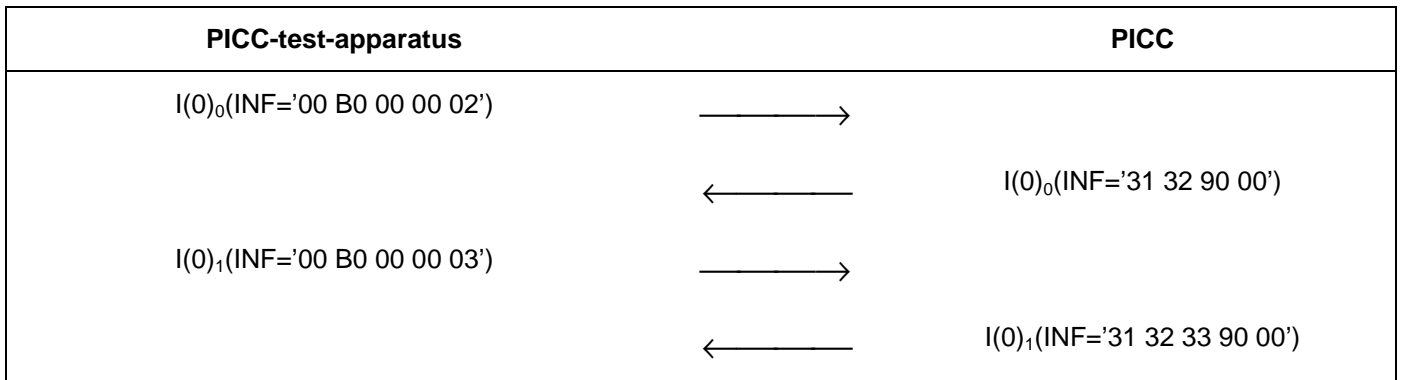
Place the reference PICC into the field.

During the following procedures only the logical content of the communication shall be recorded.

G.5.8.2.1 Procedure 1 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 1)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send an I-block I(0)₀ to the PICC.
- c) Wait for the answer of the PICC. The PICC shell answer with I(0)₀.
- d) Send an I-block I(0)₁ to the PICC.
- e) Wait for the answer of the PICC. The PICC shell answer with I(0)₁.

Test Scenario 16 — Exchange of I-blocks (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 1)



G.5.8.2.1.1 Test report

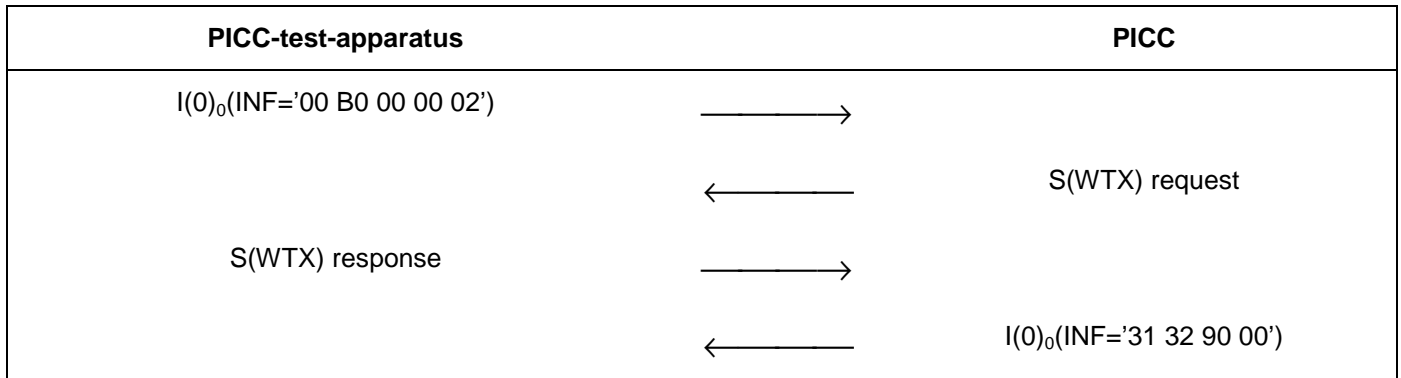
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.8.2.2 Procedure 2 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 2)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC. Choose a command for which the PICC need more time than the defined FWT to process the received block and it would use an S(WTX) request for a waiting time extension.
- c) Wait for the answer of the PICC. The PICC shell answer with S(WTX) request.
- d) Send S(WTX) response block to the PICC.
- e) Get response from the PICC. The PICC shell answer with the I-Block I(0)₀.

Test Scenario 17 — Waiting Time Extension (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 2)



G.5.8.2.2.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

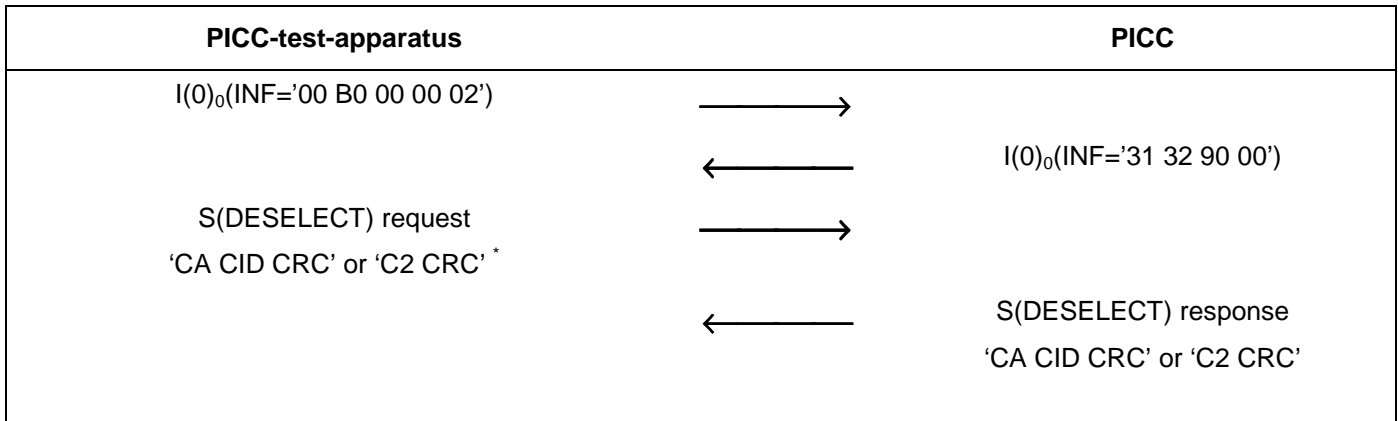
Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.8.2.3 Procedure 3 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 3)

Place the reference PICC into the field.

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC.
- c) Wait for the answer of the PICC. The PICC shall answer with I(0)₀.
- d) Send a S(DESELECT) request block to the PICC.
- e) Wait for the answer of the PICC. The PICC shall answer with S(DESELECT) response.

Test Scenario 18 — Reactions of the PICC to transmission errors (ISO/IEC 14443-4- 2001, Informative Annex B, Scenario 3)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.8.2.3.1 Test report

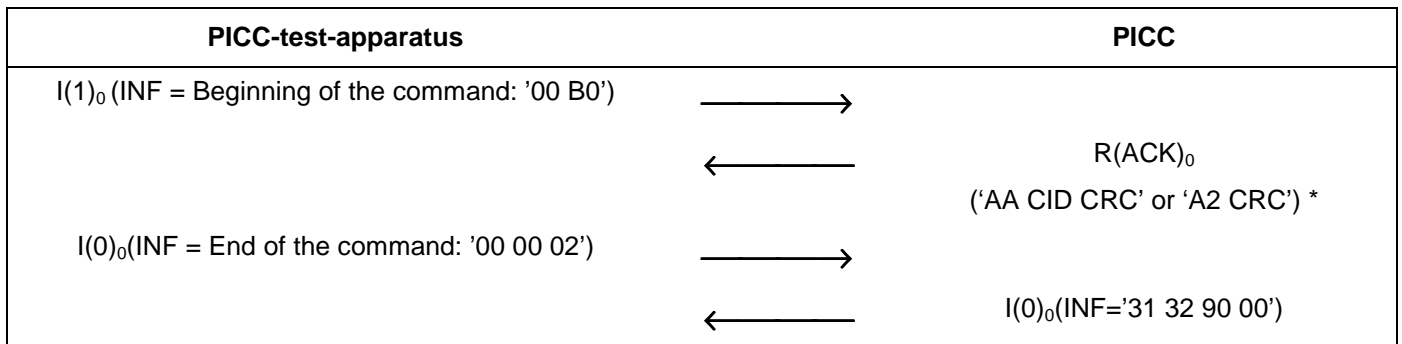
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.8.2.4 Procedure 4 (with chaining) (see ISO/IEC 14443-4:2001, Informative Annex B, Scenario 4)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) Send block I(1)₀ to the PICC, with the INF field containing the beginning of the command supported by the PICC.
- c) Wait for the answer of the PICC. The PICC shall answer with R(ACK)₀.
- d) Send I-block I(0)₁ with the INF field containing the end of the command supported by the PICC.
- e) Get response from the PICC. The PICC shall answer with the I-Block I(0)₁.

Test Scenario 19 —Procedure 4 (with chaining) (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 4)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.8.2.4.1 Test report

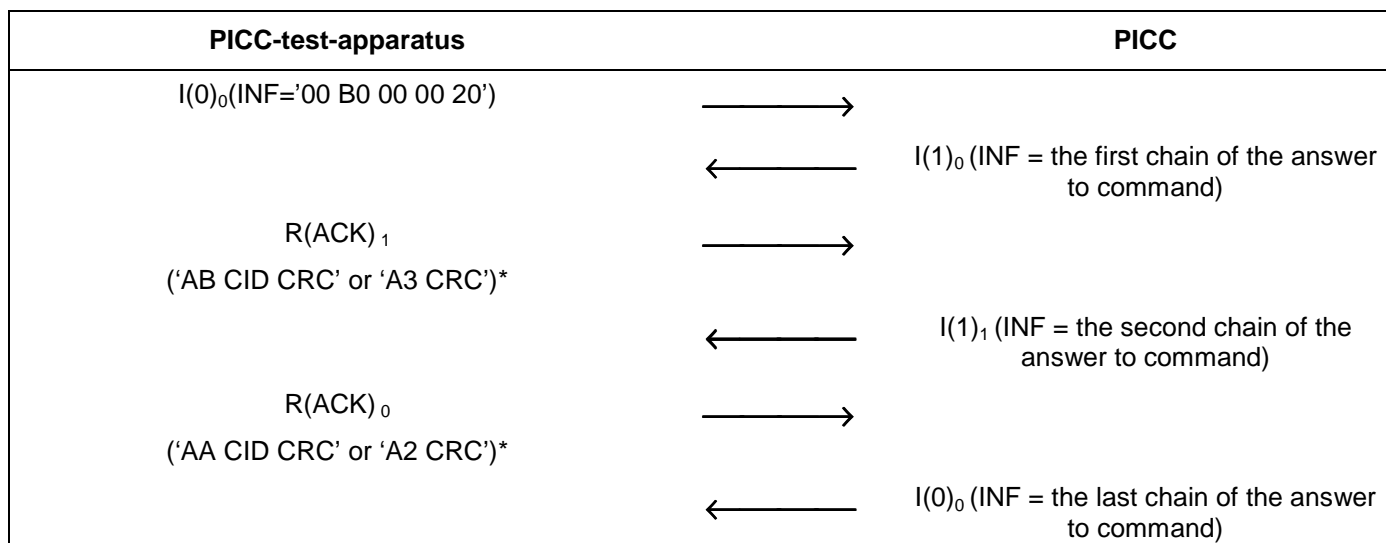
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.8.2.5 Procedure 5 (with chaining) (see ISO/IEC 14443-4:2001, Informative Annex B, Scenario 5)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001).
- b) PICC-test-apparatus sends an I-block I(0)₀ to the PICC, with the INF field containing a command needing chaining supported by the PICC.
- c) PICC shell answer with I-Block, indicating chaining I(1)₀.
- d) PICC-test-apparatus should send R(ACK)₁.
- e) PICC continue chaining and sends I(1)₁.
- f) PICC-test-apparatus should send R(ACK)₀.
- g) PICC sends the last block of the chain in I-Block I(0)₀.

Test Scenario 20 —Procedure 5 (with chaining) (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 5)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.8.2.5.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.9 Error handling by the PICC

The purpose of this test is to analyse the error handling by the PICC in different situations (see ISO/IEC 14443-4:2001: Informative Annex B, B.3).

G.5.9.1 Apparatus

See clause 2.

G.5.9.2 Procedure

Place the reference PICC into the field.

During the following procedures only the logical content of the communication shall be recorded.

G.5.9.2.1 Procedure 1 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 9)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001)
- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC.

- c) Wait for the answer of the PICC. The PICC shell answer with I(0)₀.
- d) Assume that the transmission error occurred during the last PICC-PCD communication (the last packet I(0)₀ had been received with CRC = Wrong).
- e) Send an erroneous R-block R(NAK)₀ to the PICC.
- f) PICC shell stay mute.
- g) Send R-block R(NAK)₀ to the PICC.
- h) Get response from the PICC. The PICC shell repeat the I-Block I(0)₀.

Test Scenario 21 —Procedure 1 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 9)

PICC-test-apparatus		PICC
I(0) ₀ (INF='00 B0 00 00 02')	→	
	←	I(0) ₀ (INF='31 32 90 00')
R(NAK) ₀ (CRC = Wrong) (‘BA CID CRC’ or ‘B2 CRC’) *	→	
	←	Mute
R(NAK) ₀ (‘BA CID CRC’ or ‘B2 CRC’)	→	
	←	I(0) ₀ (INF='31 32 90 00')

* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.9.2.1.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

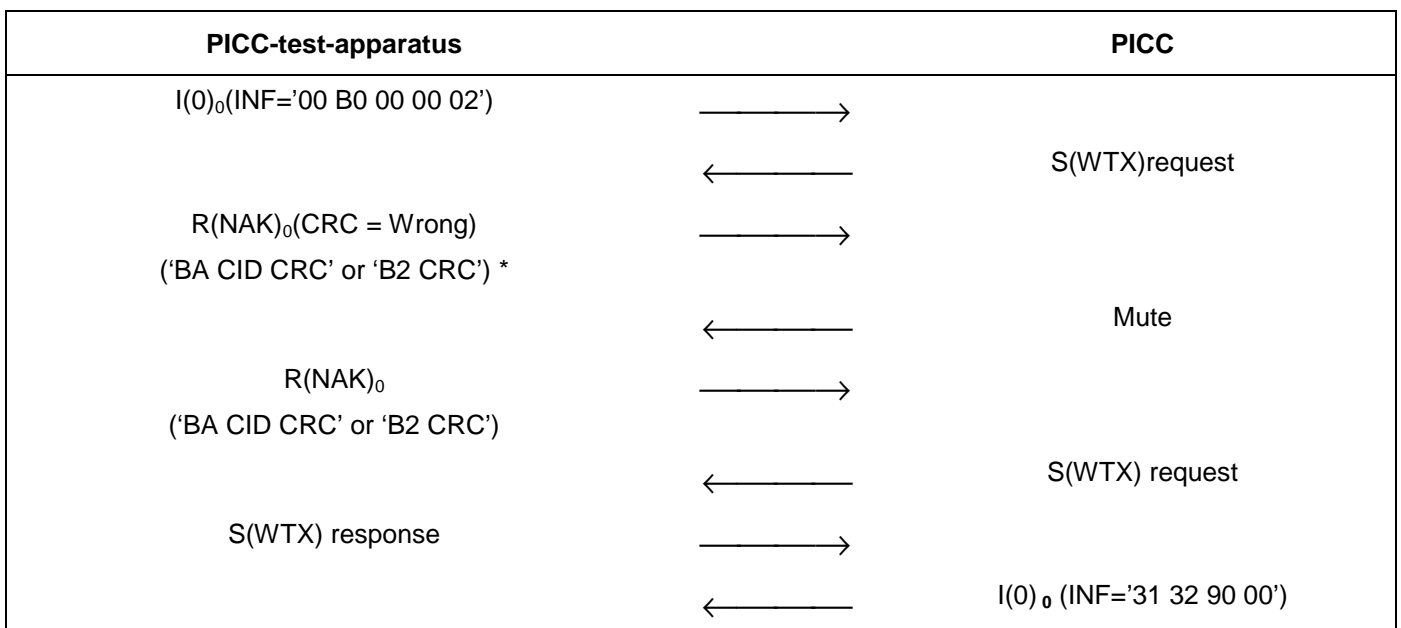
Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.9.2.2 Procedure 2 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 11)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001)
- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC. Choose a command for which the PICC need more time than the defined FWT to process the received block and it would use an S(WTX) request for a waiting time extension.
- c) PICC sends S(WTX) request block.

- d) Assume that the transmission error occurred during the last PICC-PCD communication (the last packet (S(WTX)request) had been received with CRC = Wrong).
- e) PICC-test-apparatus sends erroneous R-block.
- f) PICC shell stay mute.
- g) PICC-test-apparatus sends R(NAK)₀ block.
- h) PICC sends a valid S(WTX) request block.
- i) PICC-test-apparatus should answer with S(WTX) response.
- j) PICC sends I(0)₀.

Test Scenario 22 —Procedure 2 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 11)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.9.2.2.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

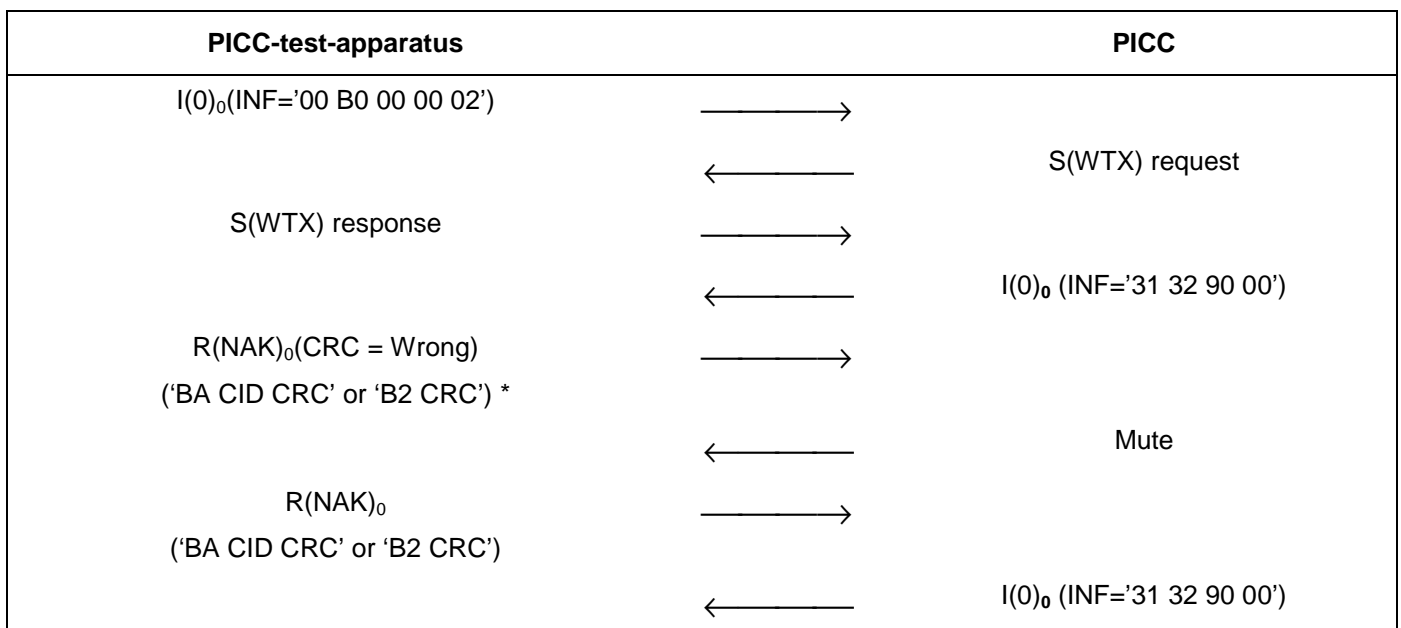
Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.9.2.3 Procedure 3 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 14)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001)

- b) Send block I(0)₀ to the PICC, with the INF field containing a command supported by the PICC. Choose a command for which the PICC need more time than the defined FWT to process the received block and it would use an S(WTX) request for a waiting time extension.
- c) PICC sends a valid S(WTX) request block.
- d) PICC-test-apparatus should answer with S(WTX) response.
- e) PICC sends an I-block.
- f) Assume that the transmission error occurred during the last PICC-PCD communication (the last packet I(0)₀ had been received with CRC = Wrong).
- g) PICC-test-apparatus sends erroneous R-block.
- h) PICC shell stay mute.
- i) PICC-test-apparatus sends R(NAK)₀ block.
- j) PICC sends I(0)₀.

Test Scenario 23 —Procedure 3 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 14)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.9.2.3.1 Test report

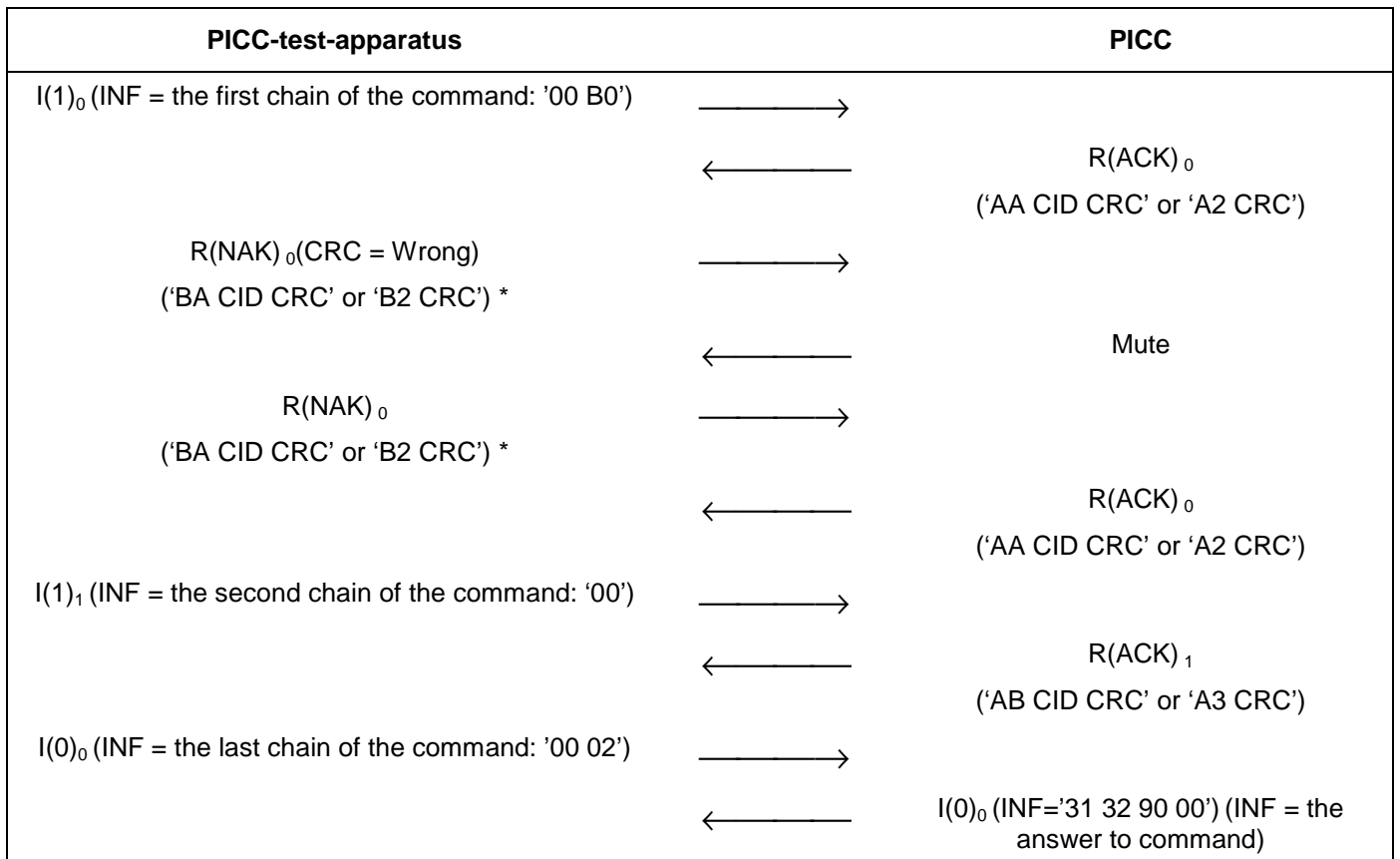
Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.9.2.4 Procedure 4 (with chaining) (see ISO/IEC 14443-4:2001, Informative Annex B, Scenario 18)

- a) Activate the PICC (as described in ISO/IEC 14443-3:2001 and ISO/IEC 14443-4:2001)
- b) PICC-test-apparatus sends an I-block $I(1)_0$ to the PCD-test-apparatus, with the INF field containing a part of the command supported by the PICC.
- c) PICC sends $R(ACK)_0$.
- d) Assume that the transmission error occurred during the last PICC-PCD communication (the last packet $R(ACK)_0$ had been received with CRC = Wrong).
- e) PICC-test-apparatus sends an erroneous $R(NAK)_0$.
- f) PICC shell stay mute.
- g) PICC-test-apparatus sends a valid $R(NAK)_0$.
- h) PICC shell answer with $R(ACK)_0$.
- i) PICC-test-apparatus should continue with the next block of the chain in I-Block $I(1)_1$.
- j) PICC sends $R(ACK)_1$ to the PCD.
- k) PICC-test-apparatus sends the last block of the chain in I-Block $I(0)_0$.
- l) Get response from the PICC. The PICC shell answer with the I-Block $I(0)_0$

Test Scenario 24 —Procedure 4 (with chaining) (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 18)



* NOTE For the PICC supporting CID, the left option must be used. For the PICC not supporting CID, the right option must be used.

G.5.9.2.4.1 Test report

Fill the appropriate row in "Table G.8 — Reported Results for test methods common for the PICC type A/B" on page 83 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.6 Reported results

Table G.4 — Type A specific timing table

No	Name	ISO Reference	Test value
1	Frame delay time PICC to PCD	ISO/IEC 14443-3:2001 6.1.3	
2	Frame delay time PCD to PICC (for REQA,WUPA, ANTICOLLISION, SELECT commands)	ISO/IEC 14443-3:2001 6.1.2	
3	Frame delay time PCD to PICC (for all commands, exclude ones from previous row)	ISO/IEC 14443-3:2001 6.1.2	
4	Request Guard Time	ISO/IEC 14443-3:2001 6.1.4	
5	Deactivation frame waiting time	ISO/IEC 14443-4:2001 8.1	
6			

Note: All timing values are calculated for carrier frequency $f_c = 13.56$ MHz and bit rate ~ 106 kbit/s

Table G.5 — Type B specific timing table

No	Name	ISO Reference	Std min	Std Max	Test value
1	SOF low	ISO/IEC 14443-3:2001 7.1.4	10 etu (94,40 us)	11 etu (103,83 us)	
2	SOF high	ISO/IEC 14443-3:2001 7.1.4	2 etu (18,88 us)	3 etu (28,32 us)	
3	EOF low	ISO/IEC 14443-3:2001 7.1.5	10 etu (94,40 us)	11 etu (103,83 us)	
4	Bit boundaries	ISO/IEC 14443-3:2001 7.1.1	(n - 1/8) etu	(n + 1/8) etu	
5	Baud rate		106 kbit/s		
6	EGT PICC to PCD	ISO/IEC 14443-3:2001 7.1.2	0 us	19 us	
7	TR0 for ATQB	ISO/IEC 14443-3:2001 7.1.6	64/fs (75,52 us)	256/fs (302,06 us)	
8	TR1 for ATQB	ISO/IEC 14443-3:2001 7.1.6	80/fs (94,40 us)	200/fs (235,99 us)	
9	TR0 Not ATQB	ISO/IEC 14443-3:2001 7.1.6 ISO/IEC 14443-3:2001 7.10.3	64/fs (75,52 us) or May be reduced	(256/fs)*2 ^{FWI} (302,06 *2 ^{FWI})	FWI = Max TR0 =
10	TR1 Not ATQB	ISO/IEC 14443-3:2001 7.1.6 ISO/IEC 14443-3:2001 7.10.3	80/fs (94,40 us) or May be reduced	200/fs (235,99 us)	
11	Delay from the end of EOF and Subcarrier off	ISO/IEC 14443-3:2001 7.1.7	0 etu	2 etu	
12	Deactivation frame waiting time	ISO/IEC 14443-4:2001 8.1	64/fs + 80/fs (169,92 us)	65536/fc (~4,8 ms)	

Note: All timing values are calculated for carrier frequency $f_c = 13.56$ MHz and bit rate ~106 kbit/s

Table G.6 — Reported Results for type A specific test methods (TBD/A)

Test method from ISO/IEC 10373-6		Scenario Numbers	Test result
Clause	Name	Test Scenario Number ISO/IEC 10373-6	PASS/FAIL
G.3.1	Polling		
G.3.2	Frame format and I/O transmission timing for type A protocol		
G.3.3	Behaviour of the PICC type A in the IDLE state	Scenario A 1	
G.3.4	Behaviour of the PICC type A in the READY state	Scenario A 2	
		Scenario A 3	
		Scenario A 4	
		Scenario A 5	
G.3.5	Behaviour of the PICC type A in the ACTIVE state	Scenario A 6	
G.3.6	Behaviour of the PICC Type A in the HALT state	Scenario A 7	
G.3.7	Behaviour of the PICC type A in the READY* state	Scenario A 8	
		Scenario A 9	
		Scenario A 10	
		Scenario A 11	
G.3.8	Behaviour of the PICC type A in the ACTIVE* state	Scenario A 12	
G.3.9	Handling of RATS by the PICC type A	Scenario A 13	
G.3.10	Handling of PPS request by the PICC type A	Scenario A 14	
		Scenario A 15	
G.3.11	Additional tests	Scenario A 16	

Table G.7 — Reported Results for type B specific test methods

Test method from ISO/IEC 10373-6		Scenario Numbers		Test result
Clause	Name	Test Scenario Number ISO/IEC 10373-6		PASS/FAIL
G.4.1	Polling			
G.4.2	I/O transmission timing for type B protocol			
G.4.3	I/O reception timing for type B protocol			
G.4.4	Behaviour of the PICC type B in the IDLE state	Scenario B 1		
		Scenario B 2		
		Scenario B 3		
G.4.5	Behaviour of the PICC type B in the ACTIVE state	Scenario B 4		
G.4.6	Behaviour of the PICC type B in the HALT state	Scenario B 5		
G.4.7	PICC-reaction to protocol errors in the HALT state	Scenario B 6		
G.4.8	PICC reaction to the ATQB command frame with wrong parameters.	Scenario B 7		
G.4.9	Slot-MARKER Command			
G.4.10	HLTB Command	Scenario B 8		
G.4.11	ATTRIB command	Scenario B 9		
G.4.12	Different values of PCD maximum frame size	Scenario B 10		
G.4.13	PICC bit rate	Scenario B 11		
		Scenario B 12		

Table G.8 — Reported Results for test methods common for the PICC type A/B

Test method from ISO/IEC 10373-6		Scenario Numbers		Test result
Clause	Name	Test Scenario Number ISO/IEC 10373-6	Scenario Number ISO/IEC 14443-4:2001, Informative Annex B	PASS/FAIL
G.5.1	Block sequencing by the PICC	Test Scenario 1		
		Test Scenario 2	Scenario 7	
		Test Scenario 3		
		Test Scenario 4		
G.5.2	Retransmission	Test Scenario 5		
		Test Scenario 6		
		Test Scenario 7		
		Test Scenario 8	Scenario 17	
		Test Scenario 9	Scenario 12	
G.5.3	Reactions of the PICC to transmission errors	Test Scenario 10		

Test method from ISO/IEC 10373-6		Scenario Numbers		Test result
Clause	Name	Test Scenario Number ISO/IEC 10373-6	Scenario Number ISO/IEC 14443-4:2001, Informative Annex B	PASS/FAIL
		Test Scenario 11	Scenario 19	
		Test Scenario 12	Scenario 15	
G.5.4	Reactions of the PICC to protocol errors	Test Scenario 13	Scenario 6	
G.5.5	Reactions of the PICC to the deactivation sequence	Test Scenario 14		
G.5.6	Deactivation frame waiting time			
G.5.7	Recovery of a transmission error during deactivation sequence	Test Scenario 15		
G.5.8	Error free operations	Test Scenario 16	Scenario 1	
		Test Scenario 17	Scenario 2	
		Test Scenario 18	Scenario 3	
		Test Scenario 19	Scenario 4	
		Test Scenario 20	Scenario 5	
G.5.9	Error handling by the PICC	Test Scenario 21	Scenario 9	
		Test Scenario 22	Scenario 11	
		Test Scenario 23	Scenario 14	
		Test Scenario 24	Scenario 18	

Table G.9 — Test coverage report

No	Name	Description	Information	
1	Default command used with test	Default is Read Binary of Ln bytes without offset '00 B0 00 00 Ln'		
2	Waiting Time Extension	Tested only if the PICC sends WTX		
3	Chaining	Tested only if there is a command that supports longer than 16 bytes		
4	Bit rate selection	Tested only If the PICC supports high bit rates	212 kbit/s	
			424 kbit/s	
			847 kbit/s	

Informative Annex (A)

General Test Outline

For an exhaustive test of the PICC type A state machine one must verify the correctness of every possible state transition at every possible state. Verifying one special state **TIS** from **StateSet** and one special state transition **T** from **TransitionSet** will be done as follows:

First reset the PICC and then put it into the test initial state (**TIS**). This is one of the states from **StateSet** where we are going to verify the transitions (**T**). Then we execute a transition **T** from **TransitionSet**. After execution of the state transition one must also check whether the PICC is in the expected target state **TTS (TIS, T)**. There is a difficulty in how to perform this check, because one cannot directly inspect the state machine of the PICC.

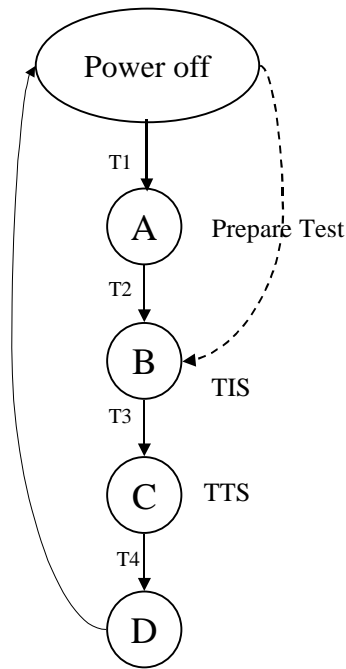
The solution to this problem is to make some additional state transitions and checking the answer of the PICC. The transitions for this purpose are selected in such way, that the state can be determined from the PICC answers as precisely as possible. For example, to determine whether the PICC is in the HALT state we send first a REQA command. If we get no answer from the PICC we send a WUPA command. If we then get a valid ATQA, we can be sure to be in HALT state. It should be noted, that the READY* and ACTIVE* states cannot be distinguished from the ACTIVE and READY states by this method. However this will be acceptable for our purposes.

We can now describe the general PICC state machine test algorithm for the test initial state (**TIS**) by the following pseudo code

BOOL StateTest (TIS)

```
1) Put the PICC into the Hf field
2) Switch the Hf field off
3) Put the PICC into the test initial state TIS (as described below)
4) for T in TransitionSet do
5)     Perform the state transition T.
6)     return FALSE if this did not work
7)     if the state of the PICC is TTS(TIS, T) then
8)         return TRUE
9)     else
10)        return FALSE
11) end
```

For an example, on the principle of testing a state-machine, we assume to have a state machine with 5 states (Power Off, A, B, C, D). We are going to test the behaviour of state B. Therefore state B becomes our initial state (**TIS**), so we have to set the state machine into state B to prepare further tests. To test state B force a transition from state B to state C. Therefore state C becomes the target state for this test (**TTS**). To check the proper transition we have to send a command and to check the answer generated for the card. Finally we have to check that we have reached **TTS** at the one hand and the card is still operating as intended at the other hand from the state we have reached. We do force a state transition from C to D and check the answer from the card.



Functions for putting the PICC in Test Initial State TIS

Putting the PICC into the State **TIS** will be done by a sequence of transition commands specified in the following table. The general method is as follows:

In order to put the PICC into State **TIS**, lookup the corresponding **State Transition Sequence** in the following table. Then successively apply the state transitions described in this column by looking up the corresponding commands in the **State Transition Table**. Always check the content and integrity of the PICC response.

State Transition Sequence Table

TIS	State Transition Sequence
Power Off	---
IDLE	Power Off → IDLE
READY	Power Off → IDLE → READY
ACTIVE	Power Off → IDLE → READY → ACTIVE
ISO14443	Power Off → IDLE → READY → ACTIVE → ISO14443
HALT	Power Off → IDLE → READY → ACTIVE → HALT
READY*	Power Off → IDLE → READY → ACTIVE → HALT → READY*
ACTIVE*	Power Off → IDLE → READY → ACTIVE → HALT → READY* → ACTIVE*

State Transition Table

State → Next State	PICC-test-apparatus	PICC
Power Off → IDLE	Power On (Hf Field on)	Mute
IDLE → READY	REQA (0100110)b	ATQA
READY → ACTIVE (single UID)	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	SAK (complete)
READY → ACTIVE (double UID)	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	SAK (cascade)
	SELECT (2) (‘95’ ‘70’ UIDTX2 CRC_A)	SAK (complete)
READY → ACTIVE (triple UID)	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	SAK (cascade)
	SELECT (2) (‘95’ ‘70’ UIDTX2 CRC_A)	SAK (cascade)
	SELECT (3) (‘97’ ‘70’ UIDTX3 CRC_A)	SAK (complete)

State → Next State	PICC-test-apparatus	PICC
ACTIVE → ISO14443	RATS (‘E0’ ‘00’ CRC_A)	ATS
ISO14443 → HALT	HALTA (‘50’ ‘00’ CRC_A)	Mute
HALT → READY*	WUPA (1010010) _b	ATQA
READY* → ACTIVE* (single UID)	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	SAK (complete)
READY* → ACTIVE* (double UID)	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	SAK (cascade)
	SELECT (2) (‘95’ ‘70’ UIDTX2 CRC_A)	SAK (complete)
READY* → ACTIVE* (triple UID)	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	SAK (cascade)
	SELECT (2) (‘95’ ‘70’ UIDTX2 CRC_A)	SAK (cascade)
	SELECT (3) (‘97’ ‘70’ UIDTX3 CRC_A)	

State → Next State	PICC-test-apparatus	PICC
		← SAK (complete)

Functions for checking the validity of the test target state TTS

The following table describes the state transitions, which are used to check whether the PICC is in the state S. The content of the PICC answer (i.e. ATQA, SAK, ...) should be thoroughly checked for ISO conformance.

Please note, that the tests may cause the PICC to change state. Note also, that READY/READY* and ACTIVE/ACTIVE* states are considered identical states.

State S	PICC-test-apparatus		PICC	Remark
IDLE	REQA (1010010)b	—————→		
		←————	ATQA	
READY	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	—————→		
		←————	SAK	
ACTIVE	ATS (‘E0’ ‘00’ CRC_A)	—————→		
		←————	RATS	
ISO14443	I(1)_0 (‘12’ CRC_A)	—————→		
		←————	R(ACK)_0	
HALT	REQA (01100110)b	—————→		
		←————	Mute	
	WUPA (1010010)b	—————→		
		←————	ATQA	
READY*	SELECT (1) (‘93’ ‘70’ UIDTX1 CRC_A)	—————→		state cannot be distinguished from READY state
		←————	SAK	

