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Identification cards — Test methods — Part 6: Proximity cards

AMENDMENT 1: Protocol test methods for proximity cards

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

AMENDMENT 1: Méthodes de test du protocole pour cartes de proximité

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Amendment 1 to ISO/IEC 10373-6:2001 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, Cards and Personal Identification.

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G.1 Terms and definitions

For the purpose of this amendment, the terms and definitions of ISO/IEC 14443-2, ISO/IEC 14443-3, ISO/IEC 14443-4 and the following apply.

CascadeLevels

number of cascade levels of the PICC

Command Set

The set describing the PICC commands during initialization and anticollision. (see ISO/IEC 14443-3: 6.3 for PICC type A and ISO/IEC 14443-3:2001, 7.5 for PICC type B)

Mute

No response within a specified timeout, e.g. expiration of FWT

PICC States

The different PICC states during initialization and anticollision. (see ISO/IEC 14443-3: 6.2 for PICC type A and ISO/IEC 14443-3: 7.4 for PICC type B)

Scenario

A defined typical protocol and application specific communication to be used with the test methods defined in this document

State Transition Map

This is the map describing all possible state transitions, i.e the map:

PICC States \times Command Set \rightarrow PICC States

Test Initial State (TIS)

An element from PICC States. This is the PICC state before performing a specific PICC command from Command Set

Test Target State (TTS)

An element from PICC States. This is the PICC state after performing a specific PICC command from Command Set

G.2 Symbols (and abbreviated terms)

For the purpose of this amendment, the symbols and abbreviations from ISO/IEC 14443-2, ISO/IEC 14443-3, ISO/IEC 14443-4 and the following apply. Elements in bold square brackets [] are optional

SELECT(l)	SELECT command of cascade level l, i.e. SELECT(1) = ('93 70' UIDTX ₁ BCC CRC_A) SELECT(2) = ('95 70' UIDTX ₂ BCC CRC_A) SELECT(3) = ('97 70' UIDTX ₃ BCC CRC_A)
READY(l)	READY state in cascade level l, $l \in \{1, 2, 3\}$; i. e. READY(2) is a PICC cascade level 2
READY*(l)	READY* state in cascade level l, $l \in \{1, 2, 3\}$; i. e. READY*(2) is a PICC cascade level 2
REQB(s)	REQB command with slot parameter s, s codes N as defined in ISO/IEC 14443-3:2001, 7.7.4 i.e. ('05 00' s CRC_B)
WUPB(s)	WUPB command with slot parameter s, s codes N as defined in ISO/IEC 14443-3:2001, 7.7.4 i.e. ('05 00' 8+s CRC_B)
SLOTMARKER(n)	Slot-MARKER command with slot number n, i.e. (16*(n-1)+5 CRC_B)
ATTRIB(cid, fsdi)	Default ATTRIB command with PUPI from ATQB, CID=cid and Maximum Frame Size Code value = fsdi i.e. ('1D' PUPI cid fsdi '01 00' CRC_B)
ATA(cid)	Answer to ATTRIB, i.e. (mbli+cid CRC_B), with mbli an arbitrary hex value (see ISO/IEC 14443-3:2001, 7.11)
RATS(cid, fsdi)	Default RATS command with CID=cid and FSDI value = fsdi i.e. ('E0' fsdi*16+cid CRC_A)
PPS(cid, dri, dsi)	Default PPS request with CID=cid, DRI=dri and DSI=dsi, i.e. ('D'+cid '11' dsi*4 + dri CRC_A)
SEL(c)	Select code of level c (i.e. SEL(1) = '93', SEL(2) = '95', SEL(3) = '97')
SAK(cascade)	the SELECT(l) answer with the cascade bit (bit 3) set to 1
SAK(complete)	the SELECT(l) answer with the cascade bit (bit 3) set to 0.
UIDTX _n	transmitted UID 32-bit data at cascade level n (see Table G. 1)
X[[n]]	Bit at position n of bit sequence X. First bit is at position 1
X[[a..b]]	Bit subsequence of bit sequence X consisting of the bits between position a and b included. If a > b then the sequence is empty
X[n]	Byte at position n of bit sequence X. First byte is at position 1 (i.e. X[n] = X[[(n-1)*8+1..n*8]])
X[a..b]	Bit subsequence of bit sequence X consisting of the bits between position a*8 and b*8, with bit b*8 not included. (i.e. X[a..b] = X[[(a-1)*8+1..(b-1)*8+1]])

~X	Bit sequence consisting of the inverted bits of bit sequence X or any other bit sequence different from X.
I(c) _n (inf [,CID=cid] [,NAD=nad] [,~CRC])	ISO/IEC 14443-4 I-Block with chaining bit c∈{1,0}, block number n∈{1,0} and information field inf. By default no CID and no NAD will be transmitted. If CID=cid∈{0...15} is specified, it will be transmitted as second parameter. If NAD=nad∈{0...'FF'} is specified it will be transmitted as third parameter. If the literal '~CRC' is not specified, a valid CRC corresponding to the type of the PICC will be transmitted by default (i.e. CRC_A or CRC_B).
R(ACK [,CID=cid] [,~CRC]) _n	ISO/IEC 14443-4 R(ACK) Block with block number n. The definition of the optional CID and ~CRC symbols is as described in the I(c) _n block above.
R(NAK [,CID=cid] [,~CRC]) _n	ISO/IEC 14443-4 R(NAK) Block with block number n. The definition of the optional CID and ~CRC symbols is as described in the I(c) _n block above.
S(WTX)(n [,CID=cid] [,~CRC])	ISO/IEC 14443-4 S(WTX) block with parameter WTXM= n. The definition of the optional CID and ~CRC symbols is as described in the I(c) _n block above.
S(DESELECT [,CID=cid] [,~CRC])	ISO/IEC 14443-4 S(DESELECT) block. The definition of the optional CID and ~CRC symbols is as described in the I(c) _n block above.
TEST_COMMAND1(1)	Default test command consisting of one unchained I-block <i>Note: This command depends on the negotiated maximum frame size value of the PICC</i>
TEST_COMMAND1(n), n > 1	Default test command consisting of n chained I-blocks. (PCD chaining) <i>Note: This command depends on the negotiated maximum frame size value of the PICC</i>
TEST_COMMAND1(n) _k	INF field of k'th I-block chain of TEST_COMMAND1(n). <i>Note: This I-block depends on the negotiated maximum frame size value of the PICC</i>
TEST_RESPONSE1(n)	INF field of the response to TEST_COMMAND1(n). This response is assumed to be always unchained.
TEST_COMMAND2(n), n > 1	Default test command which expects a response consisting of n chained I-blocks. <i>Note: This command depends on the negotiated maximum frame size value of the PCD.</i>
TEST_RESPONSE2(n)	Response to TEST_COMMAND2(n) <i>Note: This I-block depends on the negotiated maximum frame size value of the PCD.</i>
TEST_RESPONSE2(n) _k	INF field of k'th I-block chain of TEST_RESPONSE2(n) <i>Note: This I-block depends on the negotiated maximum frame size value of the PCD</i>
TEST_COMMAND3	Default test command consisting of one I-block which needs between n*FWT and (n+1)*FWT time for execution
TEST_RESPONSE3	Response I-block to TEST_COMMAND3. This response is always assumed to be unchained.

Table G. 1: Mapping from UID to UIDTX

Cascade level	single UID PICC	double UID PICC	triple UID PICC
UIDTX ₁	UID0 UID1 UID2 UID3	'88' UID0 UID1 UID2	'88' UID0 UID1 UID2
UIDTX ₂	---	UID3 UID4 UID5 UID6	'88' UID3 UID4 UID5
UIDTX ₃	---	---	UID6 UID7 UID8 UID9

G.3 Test apparatus and test circuits

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

- Calibration coil (see 6.1 of ISO/IEC 10373-6)
- Test PCD assembly (see 6.2 of ISO/IEC 10373-6)
- Digital sampling oscilloscope (see 6.4 of ISO/IEC 10373-6)

Care shall be taken to ensure that the results are not affected by the RF performance of the test circuits.

G.3.1 Emulating the I/O protocol

The PICC-test-apparatus shall be able to emulate the protocol type A, type B, which are required to test a PICC.

G.3.2 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. Timing parameters: start bit length, guard time, bit width, request guard time, start of frame width, end of frame width shall be configurable.

G.3.3 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.3.3.1 Protocol Analysis

The PICC-test-apparatus shall be able to analyse 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.3.3.2 RFU fields

RFU fields should be constantly monitored during the testing and shall always be verified to contain the assigned default value. A test shall fail and the tested PICC declared non-compliant in case an RFU field is not set to its default value at any time.

G.3.3.3 RFU values

Functional fields should be constantly monitored during the testing and shall always be verified to contain only functional values documented in the standard or proprietary values documented in the standard. A test shall fail and the tested PICC be declared non-compliant in case a functional field is not set to said values (and thus is set to an RFU or restricted value) at any time.

G.3.3.4 Timing measurements

The PICC-test-apparatus shall continuously monitor the following frame format and timing values:

For PICC Type A:

- Frame delay time PCD to PICC (see ISO/IEC 14443-3:2001 6.1.2)
- Frame formats (see ISO/IEC 14443-3:2001 6.1.5)
- Frame waiting time (see ISO/IEC 14443-4:2001, 7.2)

For PICC Type B:

- Character, frame format and timing (see ISO/IEC 14443-3:2001 7.1)
- Frame waiting time (see ISO/IEC 14443-4:2001, 7.2)

A test shall fail and the tested PICC be declared non-compliant in case one of the listed timing constraints is violated.

G.3.3.5 Timing measurement report

Fill out the Table G. 33 — Type A specific timing table for PICC type A and/or Table G. 34 — Type B specific timing table for PICC type B with the measure timing values

G.4 Relationship of test methods versus base standard requirement

Tests in "Table G. 2 — Test methods for logical operation of the PICC type A protocol" shall apply to Type A PICCs.

Tests in "Table G. 3 — Test methods for logical operation of the PICC type B protocol" shall apply to Type B PICCs.

Tests in "Table G. 4 — Test methods for logical operation of PICC of type A/B" shall apply both to Type A and Type B PICCs.

The ISO/IEC 14443-4:2001 PICC should also comply with ISO/IEC 14443-3:2001 and should be subjected to both the part 3 and part 4 tests for the applicable Type.

A PICC compliant with ISO/IEC 14443-3:2001 need not respond to frames not related to ISO/IEC 14443-3:2001.

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

Test method from ISO/IEC 10373-6		Corresponding requirement	
Clause	Name	Base standard	Clause(s)
G.5.2	Polling	ISO/IEC 14443-3:2001	5
G.5.3	Testing of the PICC type A state transitions	ISO/IEC 14443-3:2001	6.2, 6.3,6.4
G.5.4	Handling of type A anticollision	ISO/IEC 14443-3:2001	6.3.2
G.5.5	Handling of RATS	ISO/IEC 14443-4:2001	5.6.1
G.5.6	Handling of PPS request	ISO/IEC 14443-4:2001	5.6.2
G.5.7	Handling of FSD	ISO/IEC 14443-4:2001	5.1

Table G. 3 — Test methods for logical operation of the PICC type B protocol

Test method from ISO/IEC 10373-6		Corresponding requirement	
Clause	Name	Base standard	Clause(s)
G.6.2	Polling	ISO/IEC 14443-3:2001	5
G.6.3	PICC Reception	ISO/IEC 14443-3:2001	7.1
G.6.4	Testing of the PICC Type B State Transitions	ISO/IEC 14443-3:2001	7.4 – 7.12
G.6.5	Handling of type B anticollision	ISO/IEC 14443-3:2001	7.4 – 7.12
G.6.6	Handling of ATTRIB	ISO/IEC 14443-3:2001	7.10
G.6.7	Handling of Maximum Frame Size	ISO/IEC 14443-3:2001	7.10.4

Table G. 4 — Test methods for logical operation of PICC of type A/B

Test method from ISO/IEC 10373-6		Corresponding requirement	
Clause	Name	Base standard	Clause(s)
G.7.2	PICC reaction to ISO/IEC 14443-4 Scenarios	ISO/IEC 14443-4:2001	7
G.7.3REF FORMATIVE RBINDEN	Handling of PICC error detectionREF	ISO/IEC 14443-4:2001	7
G.7.4	PICC reaction on CID	ISO/IEC 14443-4:2001	7.1.1.2
G.7.5	PICC reaction on NAD	ISO/IEC 14443-4:2001	7.1.1.3

G.5 Test method for initialisation of the PICC of type A

G.5.1 Introduction

The tests in this chapter determine whether a PICC of type A conforms to the ISO/IEC 14443-3 standard and the activation sequence of ISO/IEC 14443-4:2001, 5.

G.5.2 Scenario 1: Polling

G.5.2.1 Scope

This test is to determine the behaviour of the PICC type A on receiving REQA commands according to ISO/IEC 14443-3:2001, 5.

G.5.2.2 Procedure

Perform the following steps for 3 different operating fields of 1,5, 4,5 and 7,5 A/m

- 1: Place the PICC into the field and adjust it
- 2: Switch the RF operating field off for a minimum delay time for resetting a PICC
- 3: Switch the RF operating field on
- 4: Do delay of 5 ms and send a valid REQA Command frame
- 5: Record the presence and the content of the PICC response.
- 6: Switch the RF operating field off for a minimum delay time for resetting a PICC
- 7: Switch the RF operating field on
- 8: Wait 5 ms and send a valid REQB Command frame (using type B modulation and bit coding)
- 9: Wait 5 ms and send a valid REQA Command frame
- 10: Record the presence and the content of the PICC response.

G.5.2.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods"SEITENREF according to the test results as follows:

Explanation	Test result
If the PICC's response is a valid ATQA in steps 5 and 10	Pass
If the PICC's response isn't a valid ATQA in steps 5 or 10	Fail

G.5.3 Testing of the PICC type A state transitions

G.5.3.1 Scope

These tests verify the correct implementation of the PICC type A state machine as described in ISO/IEC 14443-3:2001, 6.2.

G.5.3.2 General test outline

For an exhaustive test of the PICC type A state machine the correctness of every possible state transition at every state shall be verified. Verifying a specific state using a specific state transition will be done as follows:

First, reset the PICC and place it in the test initial state (**TIS**). This is one of the states from **StateSet** where the transitions (**T**) have to be verified. Then execute a transition **T** from **TransitionSet**. After execution of the state transition, check if the PICC is in the expected target state **TTS**. There is a difficulty in how to perform this check, because it is impossible to 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.

G.5.3.2.1 Functions for putting the PICC in the 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 Table G. 5. Then successively apply the state transitions described in the State Transition Sequence column by looking up the corresponding commands in Table G. 6. Always check the content and integrity of the PICC response.

Table G. 5: State Transition Sequence Table

TIS	State Transition Sequence
Power Off	---
IDLE	Power Off → IDLE
READY(1)	Power Off → IDLE → READY(1)
READY(2)	Power Off → IDLE → READY(1) → READY(2)
READY(3)	Power Off → IDLE → READY(1) → READY(2) → READY(3)
ACTIVE	Power Off → IDLE → READY(1) → ... → READY(CascadeLevels) → ACTIVE
PROTOCOL	Power Off → IDLE → READY(1) → ... → READY(CascadeLevels) → ACTIVE → PROTOCOL
HALT	Power Off → IDLE → READY(1) → ... → READY(CascadeLevels) → ACTIVE → HALT
READY*(1)	Power Off → IDLE → READY(1) → ... → READY(CascadeLevels) → ACTIVE → HALT → READY*(1)
READY*(2)	Power Off → IDLE → READY(1) → ... → READY(CascadeLevels) → ACTIVE → HALT → READY*(1) → READY*(2)
READY*(3)	Power Off → IDLE → READY(CascadeLevels) → ACTIVE → HALT → READY*(1) → READY*(2) → READY*(3)
ACTIVE*	Power Off → IDLE → READY(1) → ... → READY(CascadeLevels) → ACTIVE → HALT → READY*(1) → ... → READY*(CascadeLevels) → ACTIVE*

Table G. 6: State Transition Table

State → Next State	PICC-test-apparatus	PICC
Power Off → IDLE	Power On (RF Field on) → ←	Mute
IDLE → READY(1)	REQA → ←	ATQA
READY(1) → READY(2)	SELECT(1) → ←	SAK (cascade)
READY(2) → READY(3)	SELECT(2) → ←	SAK (cascade)
READY(CascadeLevels) → ACTIVE	SELECT (CascadeLevels) → ←	SAK (complete)
ACTIVE → PROTOCOL	RATS(0,0) → ←	ATS
ACTIVE → HALT	HLTA → ←	Mute
HALT → READY*(1)	WUPA → ←	ATQA
READY*(1) → READY*(2)	SELECT(1) → ←	SAK (cascade)
READY*(2) → READY*(3)	SELECT(2) → ←	SAK(cascade)
READY*(CascadeLevels) → ACTIVE*	SELECT (CascadeLevels) → ←	SAK (complete)

G.5.3.2.2 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 these tests may cause the PICC to change state.

The READY(n)/ READY*(n) states and the ACTIVE/ACTIVE* states cannot be distinguished with one test run. In order to distinguish the "*" -states from the non-"*" -states perform the following steps:

- 1 Rerun the test a second time, without checking the TTS
- 2 Send REQA command. The PICC response shall be Mute
- 3 Send REQA command
- 4 If the PICC response is Mute then the PICC state was a "*" -state
- 5 else the PICC was a non-"*" -state

The HALT state cannot be distinguished from READY*(n) state and from ACTIVE* state with one test run. In order to distinguish the HALT state perform the following steps:

- 1 Rerun the test a second time, without checking the TTS
- 2 Send WUPA command. The PICC response shall be ATQA

Table G. 7: Checking the TTS

State S	PICC-test-apparatus	PICC
IDLE	<div> <div>REQA</div> <div>→</div> <div>←</div> </div>	ATQA
READY(n), n < CascadeLevels	<div> <div>SELECT (n)</div> <div>→</div> <div>←</div> </div>	SAK (cascade)
READY(n), n = CascadeLevels	<div> <div>SELECT (n)</div> <div>→</div> <div>←</div> </div>	SAK (complete)
ACTIVE	<div> <div>RATS (0,0)</div> <div>→</div> <div>←</div> </div>	ATS
PROTOCOL	<div> <div>I(0)₀(TEST_COMMAND1(1))</div> <div>→</div> <div>←</div> </div>	I(0) ₀ (TEST_RESPONSE1(1))
HALT	<div> <div>REQA</div> <div>→</div> <div>←</div> <div>WUPA</div> <div>→</div> <div>←</div> </div>	<div>Mute</div> <div>ATQA</div>
READY*(n), n < CascadeLevels	<div> <div>SELECT (n)</div> <div>→</div> <div>←</div> </div>	SAK (cascade)
READY*(n), n = CascadeLevels	<div> <div>SELECT (n)</div> <div>→</div> <div>←</div> </div>	SAK (complete)
ACTIVE*	<div> <div>RATS(0,0)</div> <div>→</div> <div>←</div> </div>	ATS

G.5.3.3 Scenario 2: Behaviour of the PICC type A in the IDLE state

G.5.3.3.1 Scope

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.5.3.3.2 Procedure

Perform the following steps for every row of **Table G. 8**

- 1: Put the PICC into IDLE state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: If the PICC response is not Mute, check that the Frame Delay Time of the PICC conforms with the value indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 8: Transitions from IDLE state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	ATQA	1172/ <i>fc</i>	READY
WUPA	WUPA → ←	ATQA	1236/ <i>fc</i>	READY
HLTA	HLTA → ←	Mute		IDLE
AC ^a	('93 25' UIDTX ₁ [[1..n ₁]]) → ←	Mute		IDLE
nAC ^a	('93 25' ~UIDTX ₁ [[1.. n ₁]]) → ←	Mute		IDLE
SELECT	SELECT(1) → ←	Mute		IDLE
nSELECT	('93 70' ~UIDTX ₁ [[1..32]] BCC CRC_A) → ←	Mute		IDLE
RATS	RATS(0,0) → ←	Mute		IDLE
PPS	PPS(0,0,0) → ←	Mute		IDLE
ISO/IEC 14443-4 command	I(0) _o (TEST_COMMAND1(1)) → ←	Mute		IDLE
DESELECT	S(DESELECT) → ←	Mute		IDLE
Error condition	('26') ^b → ←	Mute		IDLE
^a Let $1 \leq n_1 \leq 32$ ^b the value is sent in a standard frame and not in a short frame				

G.5.3.3.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.3.4 Scenario 3: Behaviour of the PICC type A in the READY(1) state

G.5.3.4.1 Scope

This test is to determine the behaviour of the PICC type A in the READY state on cascade level 1 according to ISO/IEC 14443-3:2001, 6.2.3.

G.5.3.4.2 Procedure

Perform the following steps for all PICCs and every row of Table G. 9

- 1: Put the PICC into READY(1) state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: If the PICC response is not Mute, check that the Frame Delay Time of the PICC conforms with the value indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 9: Transitions from READY(1) state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		IDLE
WUPA	WUPA → ←	Mute		IDLE
HLTA	HLTA → ←	Mute		IDLE
AC ^a (split at 0-bit)	('93' NVB UIDTX ₁ [[1..n ₁]]) → ← (UIDTX ₁ [[n ₁ +1..32]] BCC)		1172/fc	READY(1)
AC ^b (split at 1-bit)	('93' NVB UIDTX ₁ [[1..n ₂]]) → ← (UIDTX ₁ [[n ₂ +1..32]] BCC)		1236/fc	READY(1)
nAC ^f (wrong UID)	('93 25' ~UIDTX ₁ [[1..n ₃]]) → ←	Mute		IDLE
SELECT	SELECT(1) → ←	SAK ^d	FDT ^d	TTS ^e
nSELECT (wrong UID)	('93 70' ~UIDTX ₁ BCC CRC_A) → ←	Mute		IDLE
Error condition	('93 70' UIDTX ₁ BCC ~CRC_A) → ←	Mute		IDLE
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	Mute		IDLE
DESELECT	S(DESELECT) → ←	Mute		IDLE
RATS	RATS(0,0) → ←	Mute		IDLE
PPS	PPS(0,0,0) → ←	Mute		IDLE
^a Let $1 \leq n_1 \leq 32$, UIDTX ₁ [[n ₁]] = 0. If such a number does not exist, the test can be skipped. ^b Let $1 \leq n_2 \leq 32$, UIDTX ₁ [[n ₂]] = 1. If such a number does not exist, the test can be skipped. ^c FDT is 1172/fc (~86,43 μs) if CRC_A[[16]] = 0 and 1236/fc (~91,15 μs) if CRC_A[[16]] = 1. ^d Cascade bit of SAK shall be zero for single size UID PICCs and one for double and triple size UID PICCs. ^e Single size UID PICC shall be in ACTIVE state; double and triple size UID PICCs shall be in READY state. ^f Let $1 \leq n_3 \leq 32$.				

G.5.3.4.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.3.5 Scenario 4: Behaviour of the PICC type A in the READY(2) state

G.5.3.5.1 Scope

This test is to determine the behaviour of the PICC type A in the READY state on cascade level 2 according to ISO/IEC 14443-3:2001, 6.2.3. This test is only for PICCs with double or triple size UID.

G.5.3.5.2 Procedure

Perform the following steps for all PICCs with double and triple size UID and every row of Table G. 10

- 1: Put the PICC into READY(2) state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: if the PICC response is not Mute, check that the Frame Delay Time of the PICC conforms with the value indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 10: Transitions from READY(2) state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		IDLE
WUPA	WUPA → ←	Mute		IDLE
HLTA	HLTA → ←	Mute		IDLE
AC ^a (split at 0-bit)	('95' NVB UIDTX ₂ [[1..n ₁]]) → ← (UIDTX ₂ [[n ₁ +1..32]] BCC)		1172/fc	READY(2)
AC ^b (split at 1-bit)	('95' NVB UIDTX ₂ [[1..n ₂]]) → ← (UIDTX ₂ [[n ₂ +1..32]] BCC)		1236/fc	READY(2)
nAC ^f (wrong UID)	('95 25' ~UIDTX ₂ [[1..n ₃]]) → ← Mute			IDLE
SELECT	SELECT(2) → ← SAK ^d		FDT ^c	TTS ^e
nSELECT (wrong UID)	('95 70' ~UIDTX ₂ BCC CRC_A) → ← Mute			IDLE
Error condition	('95 70' UIDTX ₂ BCC ~CRC_A) → ← Mute			IDLE
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ← Mute			IDLE
DESELECT	S(DESELECT) → ← Mute			IDLE
RATS	RATS(0,0) → ← Mute			IDLE
PPS	PPS(0,0,0) → ← Mute			IDLE
^a	Let $1 \leq n_1 \leq 32$, UIDTX ₂ [[n ₁]] = 0. If such a number does not exist, the test can be skipped.			
^b	Let $1 \leq n_2 \leq 32$, UIDTX ₂ [[n ₂]] = 1. If such a number does not exist, the test can be skipped.			
^c	FDT is 1172/fc (~86,43 μs) if CRC_A[[16]] = 0 and 1236/fc (~91,15 μs) if CRC_A[[16]] = 1.			
^d	Dascade bit of SAK shall be zero for double size UID PICCs and one for triple size UID PICCs.			
^e	Double size UID PICCs shall be in ACTIVE state; triple size UID PICCs shall be in READY state.			
^f	Let $1 \leq n_3 \leq 32$.			

G.5.3.5.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods"
SEITENREF according to the test results as follows:

Explanation	Test result
If the PICC has a single size UID	Not applicable (NA)
If the PICC has a double or triple size UID and responded as indicated in the procedure	Pass
Any other case	Fail

G.5.3.6 Scenario 5: Behaviour of the PICC type A in the READY(3) state

G.5.3.6.1 Scope

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. This test is only for PICCs with triple size UID.

G.5.3.6.2 Procedure

Perform the following steps for all PICCs with triple size UID and every row of Table G. 11

- 1: Put the PICC into READY(3) state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: if the PICC response is not Mute, check that the Frame Delay Time of the PICC conforms with the value indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 11: Transitions from READY(3) state

Transitions	PICC-test-apparatus	PICC	FDT	TTS
REQA	→			IDLE
	←	Mute		
WUPA	→			IDLE
	←	Mute		
HLTA	→			IDLE
	←	Mute		

Transitions	PICC-test-apparatus	PICC	FDT	TTS
AC ^a (split at 0-bit)	(‘97’ NVB UIDTX ₃ [[1..n ₁]]) → ←	(UIDTX ₃ [[n ₁ +1..32]] BCC) Mute	1172/fc	READY
AC ^b (split at 1-bit)	(‘97’ NVB UIDTX ₃ [[1..n ₂]]) → ←	(UIDTX ₃ [[n ₂ +1..32]] BCC) Mute	1236/fc	READY
nAC ^d (wrong UID)	(‘97 25’ ~UIDTX ₃ [[1..n ₃]]) → ←	Mute		IDLE
SELECT	SELECT(3) → ←	SAK (complete) Mute	FDT ^c	ACTIVE
nSELECT (wrong UID)	(‘97 70’ ~UIDTX ₃ BCC CRC_A) → ←	Mute		IDLE
Error condition	(‘97 70’ UIDTX ₃ BCC ~CRC_A) → ←	Mute		IDLE
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	Mute		IDLE
DESELECT	S(DESELECT) → ←	Mute		IDLE
RATS	RATS(0,0) → ←	Mute		IDLE
PPS	PPS(0,0,0) → ←	Mute		IDLE
^a Let $1 \leq n_1 \leq 32$, UIDTX ₃ [[n ₁]] = 0. If such a number does not exist, the test can be skipped. ^b Let $1 \leq n_2 \leq 32$, UIDTX ₃ [[n ₂]] = 1. If such a number does not exist, the test can be skipped. ^c FDT is 1172/fc (~86,43 μs) if CRC_A[[16]] = 0 and 1236/fc (~91,15 μs) if CRC_A[[16]] = 1. ^d Let $1 \leq n_3 \leq 32$.				

G.5.3.6.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

Explanation	Test result
If the PICC has a single or double size UID	Not applicable (NA)
If the PICC has a triple size UID and responded as indicated in the procedure	Pass
Any other case	Fail

G.5.3.7 Scenario 6: Behaviour of the PICC type A in the ACTIVE state

G.5.3.7.1 Scope

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.5.3.7.2 Procedure

Perform the following steps for every row of Table G. 12:

- 1: Put the PICC into ACTIVE state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: if the PICC response is not Mute, check that the Frame Delay Time of the PICC is as indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 12: Transitions from ACTIVE state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		IDLE
WUPA	WUPA → ←	Mute		IDLE
AC ^a	('93 25' UIDTX ₁ [[1..n ₁]]) → ←	Mute		IDLE
nAC ^a	('93 25' ~UIDTX ₁ [[1..n ₁]]) → ←	Mute		IDLE
HLTA	HLTA → ←	Mute		HALT
SELECT	SELECT(1) → ←	Mute		IDLE
nSELECT	('93 70' ~UIDTX ₁ BCC CRC_A) → ←	Mute		IDLE
RATS	RATS(0,0) → ←	ATS	<65536/fc	PROTOCOL
Error condition	('E0 00' ~CRC_A) → ←	Mute		IDLE
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	Mute		IDLE
DESELECT	S(DESELECT) → ←	Mute		IDLE
PPS	PPS(0,0,0) → ←	Mute		IDLE
^a Let $1 \leq n_3 \leq 32$.				

G.5.3.7.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.3.8 Scenario 7: Behaviour of the PICC Type A in the HALT state

G.5.3.8.1 Scope

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.5.3.8.2 Procedure

For every row of *Table G. 13* perform the following steps

- 1: Put the PICC into HALT state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: If the PICC response is not Mute, check that the Frame Delay Time of the PICC is as indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 13: Transitions from HALT state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		HALT
WUPA	WUPA → ←	ATQA	1236/fc	READY*
HLTA	HLTA → ←	Mute		HALT
AC ^a	('93 25' UIDTX ₁ [[1..n ₁]]) → ←	Mute		HALT
nAC ^a	('93 25' ~UIDTX ₁ [[1..n ₁]]) → ←	Mute		HALT
SELECT	SELECT(1) → ←	Mute		HALT
nSELECT	('93 70' ~UIDTX ₁ BCC CRC_A) → ←	Mute		HALT
RATS	RATS(0,0) → ←	Mute		HALT
Error condition	('52') → ←	Mute		HALT
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	Mute		HALT
DESELECT	S(DESELECT) → ←	Mute		HALT
PPS	PPS(0,0,0) → ←	Mute		HALT

^a Let $1 \leq n_1 \leq 32$.

G.5.3.8.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.3.9 Scenario 8: Behaviour of the PICC type A in the READY*(1) state

G.5.3.9.1 Scope

This test is to determine the behaviour of the PICC type A in the READY* state of cascade level 1 according to ISO/IEC 14443-3:2001, 6.2.6.

G.5.3.9.2 Procedure

Perform the following steps for every row of Table G. 14

- 1: Put the PICC into READY*(1) state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: if the PICC response is not Mute, check that the Frame Delay Time of the PICC conforms with the value indicated in the **FDT** column.
- 5: Check that the PICC is in the state **TTS**

Table G. 14: Transitions from READY*(1) state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		HALT
WUPA	WUPA → ←	Mute		HALT
HLTA	HLTA → ←	Mute		HALT
AC ^a (split at 0-bit)	('93' NVB UIDTX ₁ [[1..n ₁]]) → ← (UIDTX ₁ [[n ₁ +1..32]] BCC)		1172/fc	READY*(1)
AC ^b (split at 1-bit)	('93' NVB UIDTX ₁ [[1..n ₂]]) → ← (UIDTX ₁ [[n ₂ +1..32]] BCC)		1236/fc	READY*(1)
nAC ^f (wrong UID)	('93 25' ~UIDTX ₁ [[1..n ₃]]) → ←	Mute		HALT
SELECT	SELECT(1) → ←	SAK ^d	FDT ^c	TTS ^e
nSELECT (wrong UID)	('93 70' ~UIDTX ₁ BCC CRC_A) → ←	Mute		HALT
Error condition	('93 70' UIDTX ₁ BCC ~CRC_A) → ←	Mute		HALT
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	Mute		HALT
DESELECT	S(DESELECT) → ←	Mute		HALT
RATS	RATS(0,0) → ←	Mute		HALT
PPS	PPS(0,0,0) → ←	Mute		HALT
^a	Let $1 \leq n_1 \leq 32$, UIDTX ₁ [[n ₁]] = 0. If such a number does not exist, the test can be skipped.			
^b	Let $1 \leq n_2 \leq 32$, UIDTX ₁ [[n ₂]] = 1. If such a number does not exist, the test can be skipped.			
^c	FDT is 1172/fc (~86,43 μs) if CRC_A[[16]] = 0 and 1236/fc (~91,15 μs) if CRC_A[[16]] = 1.			
^d	Cascade bit of SAK shall be zero for single size UID PICCs and one for double and triple size UID PICCs.			
^e	Single size UID PICCs shall be in ACTIVE state; double and triple size UID PICCs should be in READY state.			
^f	Let $1 \leq n_3 \leq 32$.			

G.5.3.9.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.3.10 Scenario 9: Behaviour of the PICC type A in the READY*(2) state

G.5.3.10.1 Scope

This test is to determine the behaviour of the PICC type A in the READY* state of cascade level 2 according to ISO/IEC 14443-3:2001, 6.2.6. This test only applies to PICCs with double or triple size UID.

G.5.3.10.2 Procedure

Perform the following steps for every row of Table G. 15

- 1: Put the PICC into READY*(2) state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: If the PICC response is not Mute, check that the Frame Delay Time of the PICC conforms with the value indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 15: Transitions from READY*(2) state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		HALT
WUPA	WUPA → ←	Mute		HALT
HLTA	HLTA → ←	Mute		HALT
AC ^a (split at 0-bit)	('95' NVB UIDTX ₂ [[1..n ₁]]) → ← (UIDTX ₂ [[n ₁ +1..32]] BCC)		1172/fc	READY*(2)
AC ^b (split at 1-bit)	('95' NVB UIDTX ₂ [[1..n ₂]]) → ← (UIDTX ₂ [[n ₂ +1..32]] BCC)		1236/fc	READY*(2)
nAC ^f (wrong UID)	('95 25' ~UIDTX ₂ [[1..n ₃]]) → ←	Mute		HALT
SELECT	SELECT(2) → ←	SAK ^d	FDT ^c	TTS ^e
nSELECT (wrong UID)	('95 70' ~UIDTX ₂ BCC CRC_A) → ←	Mute		HALT
Error condition	('95 70' UIDTX ₂ BCC ~CRC_A) → ←	Mute		HALT
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) →			HALT

Transition	PICC-test-apparatus		PICC	FDT	TTS
		←	Mute		
DESELECT	S(DESELECT)	→			HALT
		←	Mute		
RATS	RATS(0,0)	→			HALT
		←	Mute		
PPS	PPS(0,0,0)	→			HALT
		←	Mute		
^a	Let $1 \leq n1 \leq 32$, UIDTX2[[n1]] = 0. If such a number does not exist, the test can be skipped.				
^b	Let $1 \leq n2 \leq 32$, UIDTX2[[n2]] = 1 If such a number does not exist, the test can be skipped.				
^c	FDT is 1172/fc (~86,43 μs) if CRC_A[[16]] = 0 and 1236/fc (~91,15 μs) if CRC_A[[16]] = 1				
^d	Cascade bit of SAK shall be zero for double size UID PICCs and one for triple size UID PICCs.				
^e	Double size UID PICCs shall be in ACTIVE state; triple size UID PICCs shall be in READY state.				
^f	Let $1 \leq n3 \leq 32$.				

G.5.3.10.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

Explanation	Test result
If the PICC has a single size UID	Not applicable (NA)
If the PICC has a double or triple size UID and responded as indicated in the procedure	Pass
Any other case	Fail

G.5.3.11 Scenario 10: Behaviour of the PICC type A in the READY*(3) state

G.5.3.11.1 Scope

This test is to determine the behaviour of the PICC type A in the READY* state of cascade level 3 according to ISO/IEC 14443-3:2001, 6.2.6. This test is only for PICCs with triple size UID.

G.5.3.11.2 Procedure

Perform the following steps for every row of Table G. 16

- 1: Put the PICC into READY*(3) state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: if the PICC response is not Mute, check that the Frame Delay Time of the PICC conforms with the value indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 16: Transitions from READY*(3) state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		HALT
WUPA	WUPA → ←	Mute		HALT
HLTA	HLTA → ←	Mute		HALT
AC ^a (split at 0-bit)	('97' NVB UIDTX ₃ [[1..n ₁]]) → ← (UIDTX ₃ [[n ₁ +1..32]] BCC)		1172/fc	READY*(3)
AC ^b (split at 1-bit)	('97' NVB UIDTX ₃ [[1..n ₂]]) → ← (UIDTX ₃ [[n ₂ +1..32]] BCC)		1236/fc	READY*(3)
nAC ^d (wrong UID)	('97 25' ~UIDTX ₃ [[1..n ₃]]) → ←	Mute		HALT
SELECT	SELECT(3) → ←	SAK (complete)	FDT ^c	ACTIVE*
nSELECT (wrong UID)	('97 70' ~UIDTX ₃ BCC CRC_A) → ←	Mute		HALT
Error condition	('97 70' UIDTX ₃ BCC ~CRC_A) → ←	Mute		HALT
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	Mute		HALT
DESELECT	S(DESELECT) → ←	Mute		HALT
RATS	RATS(0,0) → ←	Mute		HALT
PPS	PPS(0,0,0) → ←	Mute		HALT
^a ^b ^c ^d	Let $1 \leq n_1 \leq 32$, UIDTX ₃ [[n ₁]] = 0. If such a number does not exist, the test can be skipped. Let $1 \leq n_2 \leq 32$, UIDTX ₃ [[n ₂]] = 1. If such a number does not exist, the test can be skipped. FDT is 1172/fc (~86,43 μs) if CRC_A[[16]] = 0 and 1236/fc (~91,15 μs) if CRC_A[[16]] = 1. Let $1 \leq n_3 \leq 32$.			

G.5.3.11.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods"
SEITENREF according to the test results as follows:

Explanation	Test result
If the PICC has a single or double size UID	Not applicable (NA)
If the PICC has a triple size UID and responded as indicated in the procedure	Pass
Any other case	Fail

G.5.3.12 Scenario 11: Behaviour of the PICC type A in the ACTIVE* state

G.5.3.12.1 Scope

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.5.3.12.2 Procedure

Perform the following steps for every row of table Table G. 17

- 1: Put the PICC into ACTIVE state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: If the PICC response is not Mute, check that the Frame Delay Time of the PICC is as indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 17: Transitions from ACTIVE* state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA →			
	←	Mute		HALT
WUPA	WUPA →			
	←	Mute		HALT
HLTA	HLTA →			
	←	Mute		HALT
AC ^a	('93 25' UIDTX ₁ [[1..n ₁]]) →			
	←	Mute		HALT
nAC ^a	('93 25' ~UIDTX ₁ [[1..n ₁]]) →			
	←	Mute		HALT
SELECT	SELECT(1) →			
	←	Mute		HALT

Transition	PICC-test-apparatus	PICC	FDT	TTS
nSELECT	('93 70' ~UIDTX ₁ BCC CRC_A) → ←	Mute		HALT
RATS	RATS(0,0) → ←	ATS	<65536/fc	PROTOCOL
Error condition	('E0 00' ~CRC_A) → ←	Mute		HALT
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	Mute		HALT
DESELECT	S(DESELECT) → ←	Mute		HALT
PPS	PPS(0,0,0) → ←	Mute		HALT
^a Let $1 \leq n_1 \leq 32$.				

G.5.3.12.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.3.13 Scenario 12: Behaviour of the PICC type A in the PROTOCOL state

G.5.3.13.1 Scope



This test is to determine the behaviour of the PICC type A in the **PROTOCOL** state according to ISO/IEC 14443-4:2001. This test shall ensure that the activated PICC does not respond to any anticollision or initialisation command

G.5.3.13.2 Procedure

For every row of table Table G. 18 perform the following steps

- 1: Put the PICC into PROTOCOL state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: If the PICC response is not Mute, check that the Frame Delay Time of the PICC is as indicated in the **FDT** column.
- 5: Check if the PICC is in the state **TTS**

Table G. 18: Transitions from PROTOCOL state

Transition	PICC-test-apparatus	PICC	FDT	TTS
REQA	REQA → ←	Mute		PROTOCOL
WUPA	WUPA → ←	Mute		PROTOCOL
AC ^a	('93 25' UIDTX ₁ [[1..n ₁]]) → ←	Mute		PROTOCOL
nAC ^a	('93 25' ~UIDTX ₁ [[1..n ₁]]) → ←	Mute		PROTOCOL
HLTA	HLTA → ←	Mute		PROTOCOL
SELECT	SELECT(1) → ←	Mute		PROTOCOL
nSELECT	('93 70' ~UIDTX ₁ BCC CRC_A) → ←	Mute		PROTOCOL
RATS	RATS(0,0) → ←	Mute		PROTOCOL
Error condition	('93 70' UIDTX ₁ BCC ~CRC_A) → ←	Mute		PROTOCOL
DESELECT	S(DESELECT) → ←	Mute		HALT
PPS	PPS(0,0,0) → ←	Mute		PROTOCOL
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) → ←	 I(0) ₀ (TEST_RESPONSE1(1))	< FWT 	PROTOCOL
^a Let $1 \leq n_1 \leq 32$.				

G.5.3.13.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.4 Scenario 13: Handling of type A anticollision

G.5.4.1 Scope

This test is to perform a full bitwise anticollision loop according to ISO/IEC 14443-3:2001, 6.4.3.

G.5.4.2 Procedure

- 1: Put the PICC into the field
- 2: Put the PICC into READY(1) state
- 3: Execute AnticollisionA
- 4: Put the PICC into READY*(1) state
- 5: Execute AnticollisionA

Pseudocode: Type A anticollision procedure

```
1  Procedure AnticollisionA
2
3  // TPDUSend and TPDURcv are PCD specific functions
4  // to send and receive frames
5
6  for c = 1 to CascadeLevels do
7
8      // anticollision over UID bits
9      for p = 1 to 32 do
10
11          // enter desired cascade level
12          if c ≥ 2 then TPDUSend(SELECT(1))
13          if c = 3 then TPDUSend(SELECT(2))
14
15          // anticollision with matched bit
16          NVB[[1..4]] = (p + 16) mod 8
17          NVB[[5..8]] = (p + 16) div 8
18          TPDUSend (SEL(c) NVB UIDTXc[[1..p]])
19          if TPDURcv() ≠ (UIDTXc[[p+1..32]] BCC)
20              then return FAIL
21
22          // anticollision with unmatched bit
23          TPDUSend(SEL(c) NVB UIDTXc[[1..p-1]] ~UIDTXc[[p]])
24          if TPDURcv() ≠ Mute
25              then return FAIL
26
27          // re-enter READY(1) (resp. READY*(1)) state
28          TPDUSend (WUPA)
29      end for
30
31      // anticollision over BCC bits
32      for p = 1 to 7 do
33
34          // enter desired cascade level
35          if c ≥ 2 then TPDUSend(SELECT(1))
36          if c = 3 then TPDUSend (SELECT(2))
37
38          // anticollision with matched bit
39          NVB[[1..4]] = (p + 48) mod 8
40          NVB[[5..8]] = (p + 48) div 8
41          TPDUSend (SEL(c) NVB UIDTXc BCC[[1..p]])
42          if TPDURcv() ≠ (BCC[[p+1..8]])
43              then return FAIL
44
45          // anticollision with unmatched bit
46          TPDUSend (SEL(c) NVB UIDTXc BCC[[1..p-1]] ~BCC[[p]])
47          if TPDURcv() ≠ Mute
48              then return FAIL
49
50          // re-enter READY(1) resp. READY*(1) state
51          TPDUSend (WUPA)
52      end for
53  end for
54  return PASS
```

G.5.4.3 Test report

Fill the appropriate row in “Table G. 35 — Reported Results for type A specific test methods“SEITENREF with test result according the following:

Explanation	Test result
If each AnticollisionTest procedure has returned PASS	Pass
If at least one AnticollisionTest procedure has returned the value FAIL	Fail

G.5.5 Handling of RATS

G.5.5.1 Scope

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.5.5.2 Procedure

For the scenarios given in G.5.5.4 the following sequence applies:”

- 1: Put the PICC into ACTIVE state
- 2: Send the command sequence as described in the PICC-test-apparatus
- 3: Check that the response of the PICC conforms with the one given in the PICC column
- 4: Check that the PICC is in PROTOCOL state

G.5.5.3 Test report

Fill the appropriate rows in "Table G. 35 — Reported Results for type A specific test methods“ SEITENREF according to the test results as follows:

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

G.5.5.4 Scenarios

Scenario 14: RATS after bad RATS

PICC-test-apparatus	PICC
(‘E0 00’ ~CRC_A)	—/→
	←
RATS(0)	→
	←
	Mute
	ATS or Mute

Scenario 15: RATS after RATS

PICC-test-apparatus	PICC
RATS(0,0)	→
	←
RATS(0,0)	→
	←
	ATS
	Mute

G.5.6 Handling of PPS request

G.5.6.1 Scope

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.5.6.2 Procedure

For each scenario under G.5.6.4 perform the following steps:

- 1: Put the PICC in PROTOCOL state
- 2: Send the command as described under the **PICC-test-apparatus** column in the table below
- 3: Check that the response of the PICC conforms with the one given in the **PICC** column
- 4: Check if the PICC is in PROTOCOL state

G.5.6.3 Test report

Fill the appropriate rows in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.5.6.4 Scenarios

Scenario 16: PPS without parameter change

PICC-test-apparatus	PICC
PPS(0,0,0) →	
←	Mute or ('D0' CRC_A) ^{note 1}

NOTE 1: Response depends on whether the PICC supports PPS or not. If the PICC does not support any changeable parameters it may not support the PPS request because the PCD shall not send PPS to such a PICC (see 14443-4:2001, 5, 6th dash)

Scenario 17: PPS without PPS1

PICC-test-apparatus	PICC
('D0 01' CRC_A) →	
←	Mute or ('D0' CRC_A) ^{note 1}

NOTE 1: Response depends on whether the PICC supports PPS or not. If the PICC does not support any changeable parameters it may not support the PPS request because the PCD shall not send PPS to such a PICC (see 14443-4:2001, 5, 6th dash)

Scenario 18: PPS after PPS

PICC-test-apparatus		PICC
PPS(0,0,0)	→	Mute or ('D0' CRC_A) ^a
	←	
PPS(0,0,0)	→	Mute
	←	
a Response depends on whether the PICC supports PPS or not. If the PICC does not support any changeable parameters it may not support the PPS request because the PCD shall not send PPS to such a PICC (see 14443-4:2001, 5, 6th dash)		

Scenario 19: PPS after unreceived PPS

PICC-test-apparatus		PICC
('D0 01' ~CRC_A)	→	Mute
	←	
PPS(0,0,0)	→	Mute
	←	

G.5.7 Scenario 20: Handling of FSD

G.5.7.1 Scope

This test is to determine if the PICC type A respects the FSD value as negotiated by the RATS according to ISO/IEC 14443-4:2001, 5.1.

G.5.7.2 Procedure

Perform the following steps for each row of Table G. 19

- 1: Put the PICC into ACTIVE state
- 2: Send the RATS(0, fsdi) command with parameter fsdi as described in the **FSDI** column
- 3: Check that the PICC answer is a valid ATS
- 4: Send the I-block I(0)₀(TEST_COMMAND2(2))
- 5: Check that the size of the I-block sent by the PICC is \leq **NMAX**

Table G. 19: Handling of different FSD values

FSDI	NMAX
0	13
1	21
2	29
3	37
4	45
5	61
6	93
7	125
8	253

G.5.7.3 Test report

Fill the appropriate row in "Table G. 35 — Reported Results for type A specific test methods" SEITENREF according to the test results as follows:

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

G.6 Test method for initialisation of the PICC of type B

G.6.1 Introduction

This chapter is to test if the PICC of type B conforms to the ISO/IEC 14443-3:2001 standard

G.6.2 Scenario 21: Polling

G.6.2.1 Scope

This test is to determine the behaviour of the PICC type B on receiving of REQB according to ISO/IEC 14443-3:2001, 5.

G.6.2.2 Procedure

Perform the following steps for 3 different operating fields of 1,5 , 4,5 and 7,5 A/m

- 1: Place the PICC into the field and adjust it.
- 2: Switch the RF operating field off for a minimum time for resetting a PICC in accordance with ISO/IEC14443-3:2001/AM1, 5.4
- 3: Switch the RF operating field on
- 4: Wait 5 ms and send a valid REQB(0) Command frame
- 5: Record the presence and the content of the PICC response.
- 6: Switch the RF operating field off for a minimum time for resetting a PICC in accordance with ISO/IEC14443-3:2001/AM1, 5.4
- 7: Switch the RF operating field on
- 8: Wait 5 ms and send a valid REQA Command frame (with type A modulation)
- 9: Wait 5 ms and send a valid REQB(0) Command frame
- 10: Record the presence and the content of the PICC response.

G.6.2.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

Explanation	Test result
If the PICC's response is a valid ATQB in steps 5 and 10	Pass
If the PICC's response isn't a valid ATQB in steps 5 or 10	Fail

G.6.3 Scenario 22: PICC Reception

G.6.3.1 Scope

This test is to determine the behaviour of a Type B PICC when receiving PCD messages according to ISO/IEC 14443-3:2001, 7.1.1, 7.1.2, 7.1.4 and 7.1.5.

G.6.3.2 Procedure

Perform the following steps for each row of Table G. 20

- 1: Place the reference PICC into the field.
- 2: Set the frame parameters of the PICC-test-apparatus according to Table G. 20
- 3: Send a REQB command
- 4: Record the presence, content and timing of the PICC response.
- 5: Check that the frame format of the PICC response conforms to the following
 - The PICC response shall be a valid ATQB
 - The SOF logic 0 timing shall be between 10 and 11 etu
 - The SOF logic 1 timing shall be between 2 and 3 etu
 - The EOF logic 0 timing shall be between 10 and 11 etu
 - The TR0 timing shall be in the range $64/fs \leq TR0 \leq 256/fs$
 - The TR1 timing shall be in the range $80/fs \leq TR1 \leq 200/fs$

Table G. 20 Type B frame parameters

EGT	SOF (logic 0)	SOF (logic 1)	EOF
0 μ s	10 etu	2 etu	10 etu
57 μ s	10 etu	2 etu	10 etu
0 μ s	11 etu	2 etu	10 etu
0 μ s	10 etu	3 etu	10 etu
0 μ s	10 etu	2 etu	11 etu

G.6.3.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.4 Testing of the PICC Type B State Transitions

These tests are to verify the correct implementation of the PICC type B state machine as described in ISO/IEC 14443-3:2001, 7.4.1.

G.6.4.1 General Test Outline

This is the same procedure as described for the PICC type A (see G.5.3.2)

G.6.4.1.1 Functions to set 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 "Table G. 22: State Transition". The general method is as follows:

In order to put the PICC into State **TIS**, lookup the corresponding **State Transition Sequence** in the "Table G. 21: State Transition Sequence". 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.

Table G. 21: State Transition Sequence

TIS	State Transition Sequence
Power Off	---
IDLE	Power Off → IDLE
READY REQUESTED	Power Off → IDLE → READY REQUESTED
READY DECLARED	Power Off → IDLE → READY DECLARED
ACTIVE	Power Off → IDLE → READY DECLARED → ACTIVE
HALT	Power Off → IDLE → READY DECLARED → HALT

Table G. 22: State Transition

State → Next State	PICC-test-apparatus	PICC
Power Off → IDLE	Power On (RF operating Field on)	→
		← Mute
IDLE → READY REQUESTED	REQB(4)	→
		← Mute ^a
IDLE → READY DECLARED	REQB(0)	→
		← ATQB
READY DECLARED → HALT	HLTB	→
		← '00' CRC_B
READY DECLARED → ACTIVE	ATTRIB(0,0)	→
		← ATA(0)

^a In case the PICC has selected slot 1, the REQB command shall be reissued until the PICC doesn't answer ATQB. If the PICC does not support Slot-MARKER command (option 1) the READY REQUESTED sub-state does not exist.

G.6.4.1.2 Functions for checking the validity of the Test Target Ttate TTS

The following “Table G. 23: Checking the TTS” 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. ATQB...) should be thoroughly checked for conformance.

Note: The tests may cause the PICC to change state.

Table G. 23: Checking the TTS

TTS	PICC-test-apparatus	PICC
IDLE	REQB(0) —→ ←—	ATQB
READY REQUESTED	SLOTMARKER (n) ^a —→ ←—	ATQB
READY DECLARED	ATTRIB(0,0) —→ ←—	ATA(0)
	I(0) ₀ (TEST_COMMAND1(1)) —→ ←—	I(0) ₀ (TEST_RESPONSE1(1))
HALT	REQB(0) —→ ←— WUPB(0) —→ ←—	Mute ATQB
^a Since the selected PICC slot is unknown, the Slot-MARKER command shall be reissued with different slot values until a ATQB is received. If the PICC does not support Slot-MARKER command (option 1) the READY REQUESTED sub-state does not exist.		

G.6.4.2 Scenario 23: Behaviour of the PICC type B in the IDLE state

G.6.4.2.1 Scope

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.

G.6.4.2.2 Procedure

Perform the following steps for every row of Table G. 24

- 1: Put the PICC into IDLE state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: Check if the PICC is in the state **TTS**

Table G. 24: Transitions from IDLE state

Transition	PICC-test-apparatus	PICC	TTS
REQB	REQB(0) → ←	ATQB	READY DECLARED
WUPB	WUPB(0) → ←	ATQB	READY DECLARED
REQB (wrong CRC)	('05 00 00' ~CRC_B) → ←	Mute	IDLE
WUPB (wrong CRC)	('05 00 08' ~CRC_B) → ←	Mute	IDLE
HLTB	HLTB → ←	Mute	IDLE
ATTRIB	ATTRIB(0,0) → ←	Mute	IDLE
Slot-MARKER	SLOTMARKER(n) ^a → ←	Mute	IDLE
ISO/IEC 14443-4 command	I(0) _o (TEST_COMMAND1(1)) → ←	Mute	IDLE
DESELECT	S(DESELECT) → ←	Mute	IDLE

^a n shall run through all values $1 \leq n \leq 15$.

G.6.4.2.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.4.3 Scenario 24: Behaviour of the PICC type B in the READY REQUESTED sub-state

G.6.4.3.1 Scope

This test is to determine the behaviour of the PICC type B in the READY REQUESTED sub-state according to ISO/IEC 14443-3:2001, 7.4.5.
This test only applies to PICC supporting the Slot-MARKER command (option 2).

G.6.4.3.2 Procedure

Perform the following steps for every row of Table G. 25

- 1: Put the PICC into READY REQUESTED sub-state

- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: Check if the PICC is in the state **TTS**

Table G. 25: Transitions from READY REQUESTED sub-state

Transition	PICC-test-apparatus	PICC	TTS
REQB	REQB(0) \longrightarrow \longleftarrow	ATQB	READY DECLARED
WUPB	WUPB(0) \longrightarrow \longleftarrow	ATQB	READY DECLARED
REQB (wrong CRC)	('05 00 00' ~CRC_B) \longrightarrow \longleftarrow	Mute	READY REQUESTED
WUPB (wrong CRC)	('05 00 08' ~CRC_B) \longrightarrow \longleftarrow	Mute	READY REQUESTED
HLTB	HLTB \longrightarrow \longleftarrow	Mute	READY REQUESTED
ATTRIB	ATTRIB(0,0) \longrightarrow \longleftarrow	Mute	READY REQUESTED
Slot-MARKER	SLOTMARKER(n) ^a \longrightarrow \longleftarrow	ATQB or Mute	READY DECLARED
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) \longrightarrow \longleftarrow	Mute	READY REQUESTED
DESELECT	S(DESELECT) \longrightarrow \longleftarrow	Mute	READY REQUESTED
^a n shall run through all values $1 \leq n \leq 15$. The PICC shall respond ATQB at exactly one value of n, else Mute.			

G.6.4.3.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.4.4 Scenario 25: Behaviour of the PICC type B in the READY DECLARED sub-state

G.6.4.4.1 Scope

This test is to determine the behaviour of the PICC type B in the READY DECLARED sub-state according to ISO/IEC 14443-3:2001, 7.4.6.

G.6.4.4.2 Procedure

Perform the following steps for every row of Table G. 26

- 1: Put the PICC into READY DECLARED SUB-state

- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: Check if the PICC is in the state **TTS**

Table G. 26: Transitions from READY DECLARED SUB-state

Transition	PICC-test-apparatus	PICC	TTS
REQB	REQB(0) \longrightarrow \longleftarrow	ATQB	READY DECLARED
WUPB	WUPB(0) \longrightarrow \longleftarrow	ATQB	READY DECLARED
REQB (wrong CRC)	('05 00 00' ~CRC_B) \longrightarrow \longleftarrow	Mute	READY DECLARED
WUPB (wrong CRC)	('05 00 08' ~CRC_B) \longrightarrow \longleftarrow	Mute	READY DECLARED
HLTB	HLTB \longrightarrow \longleftarrow	('00' CRC_B)	HALT
ATTRIB	ATTRIB(0,0) \longrightarrow \longleftarrow	ATA(0)	ACTIVE
Slot-MARKER	SLOTMARKER(n) ^a \longrightarrow \longleftarrow	Mute	READY DECLARED
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) \longrightarrow \longleftarrow	Mute	READY DECLARED
DESELECT	S(DESELECT) \longrightarrow \longleftarrow	Mute	READY DECLARED

^a n shall run through all values $1 \leq n \leq 15$

G.6.4.4.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.4.5 Scenario 26: Behaviour of the PICC type B in the HALT state

G.6.4.5.1 Scope

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.6.4.5.2 Procedure

Perform the following steps for every row of Table G. 27

- 1: Put the PICC into HALT state
- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.

3: Check if the PICC response is as indicated in the **PICC** column

4: Check if the PICC is in the state **TTS**

Table G. 27: Transitions from HALT state

Transition	PICC-test-apparatus	PICC	TTS
REQB	REQB(0) \longrightarrow \longleftarrow	Mute	HALT
WUPB	WUPB(0) \longrightarrow \longleftarrow	ATQB	READY DECLARED
WUPB (wrong CRC)	('05 00 04' ~CRC_B) \longrightarrow \longleftarrow	Mute	HALT
HLTB	HLTB \longrightarrow \longleftarrow	Mute	HALT
ATTRIB	ATTRIB(0,0) \longrightarrow \longleftarrow	Mute	HALT
Slot-MARKER	SLOTMARKER(n) ^a \longrightarrow \longleftarrow	Mute	HALT
ISO/IEC 14443-4 command	I(0) ₀ (TEST_COMMAND1(1)) \longrightarrow \longleftarrow	Mute	HALT
DESELECT	S(DESELECT) \longrightarrow \longleftarrow	Mute	HALT
^a n shall run through all values $1 \leq n \leq 15$			

G.6.4.5.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.4.6 Scenario 27: Behaviour of the PICC type B in the ACTIVE state

G.6.4.6.1 Scope

This test is to determine the behaviour of the PICC type B in the ACTIVE state according to ISO/IEC 14443-4:2001. This test shall ensure that the activated PICC does not respond to any initialisation command.

G.6.4.6.2 Procedure

Perform the following steps for every row of Table G. 28

1: Put the PICC into ACTIVE state

- 2: Perform the state transition by sending the command as indicated in the **PICC-test-apparatus** column.
- 3: Check if the PICC response is as indicated in the **PICC** column
- 4: Check if the PICC is in the state **TTS**

Table G. 28: Transitions from ACTIVE state

Transition	PICC-test-apparatus	PICC	TTS
REQB	REQB(0) \longrightarrow \longleftarrow	Mute	ACTIVE
WUPB	WUPB(0) \longrightarrow \longleftarrow	Mute	ACTIVE
REQB (wrong CRC)	('05 00 00' ~CRC_B) \longrightarrow \longleftarrow	Mute	ACTIVE
WUPB (wrong CRC)	('05 00 08' ~CRC_B) \longrightarrow \longleftarrow	Mute	ACTIVE
HLTB	HLTB \longrightarrow \longleftarrow	Mute	ACTIVE
ATTRIB	ATTRIB(0,0) \longrightarrow \longleftarrow	Mute	ACTIVE
Slot-MARKER	SLOTMARKER(n) ^a \longrightarrow \longleftarrow	Mute	ACTIVE
DESELECT	S(DESELECT) \longrightarrow \longleftarrow	S(DESELECT)	HALT
^a n shall run through all values $1 \leq n \leq 15$			

G.6.4.6.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.5 Scenario 28: Handling of type B anticollision

G.6.5.1 Scope

This test is to determine the handling of a PICC type B anticollision according to ISO/IEC 14443-3:2001, 7.4.1.

For this purpose the procedure AnticollisionB(N, outparam T, outparam chi2) is defined in the pseudocode below. The procedure performs 256 REQB(N) commands and following Slot-MARKER commands and counts how many times each of the 2^N slots has been selected by the PICC. Depending on whether the Slot-MARKER command will work or not, the procedure decides if the PICC uses the probabilistic approach (option = 1) or the timeslot approach (option = 2). If the PICC uses the timeslot approach then the procedure checks if the PICC has mapped each REQB(N) request to exactly one slot. If this is not the case the test returns FAIL.

Then the procedure calculates a value T for the statistical binomial test for slot number 1.

This test is to indicate whether the PICC has chosen the first slot with probability $1/2^N$.

G.6.5.2 Procedure

As it is the nature of all statistical tests, the tests of this scenario can fail even in the case the PICC behaves correctly. This so called Type I error will occur with probability α . For this reason it shall be the responsibility of the test lab to choose an appropriate significance value α . Also, if one of the statistical tests will fail in step 5, the test lab may choose to rerun the test for this parameter N, maybe also with another significance level. On the other hand, the test will unconditionally fail in case the AnticollisionB procedure returns FAIL (step 4).

Perform the following steps for each value $N = 1, 2, 3, 4$

- 1: Choose a significance level $\alpha \in \{0.1, 0.05, 0.01, 0.005\}$ and lookup from Table G. 29 the corresponding $\chi^2_{N-1, \alpha}$ and $\phi_{\alpha/2}$ quintile.
- 2: Reset the PICC
- 3: Execute AnticollisionB(N, T, chi2)
- 4: If AnticollisionB returns FAIL, fail the test
- 5: If $\text{chi2} \leq \chi^2_{N-1, \alpha}$ and $T \leq \phi_{\alpha/2}$ then pass the test Else fail the test

Table G. 29 α -quantile values

α	$\phi_{\alpha/2}$	$\chi^2_{N-1, \alpha}$			
		$\chi^2_{1, \alpha}$	$\chi^2_{3, \alpha}$	$\chi^2_{7, \alpha}$	$\chi^2_{15, \alpha}$
0.1	1.645	2.706	6.351	12.017	22.307
0.05	1.960	3.841	7.815	14.067	24.996
0.01	2.576	6.635	11.345	18.475	30.578
0.005	2.81	7.879	12.838	20.278	32.801

Pseudocode: Type B anticollision procedure

1. Procedure AnticollisionA	
2.	// TPDUSend and TPDUREcv are PCD specific functions
3.	// to send and receive TPDU frames
4.	
5.	// anticollision with not matching UID
6.	for c = 1 to CascadeLevels do
7.	
8.	// anticollision over UID bits
9.	for p = 1 to 32 do
10.	
11.	// enter desired cascade level
12.	if c ≥ 2 then TPDUSend(SELECT(1))
13.	if c = 3 then TPDUSend(SELECT(2))
14.	
15.	// anticollision with unmatched bit
16.	TPDUSend(SEL(c) NVB UIDTXc[[1..p-1]] ~UIDTXc[[p]])
17.	if TPDUREcv() ≠ Mute
18.	then return FAIL
19.	
20.	// re-enter READY(1) (resp. READY*(1)) state
21.	TPDUSend (WUPA)

```

22.     end for
23.
24.
25. end for
26.
27. // anticollision with matching UID
28. for c = 1 to CascadeLevels do
29.
30.     // anticollision over UID bits
31.     for p = 1 to 32 do
32.
33.         // anticollision with matched bit
34.         NVB[[1..4]] = (p + 16) mod 8
35.         NVB[[5..8]] = (p + 16) div 8
36.         TPDUSend (SEL(c) NVB UIDTXc[[1..p]])
37.         if TPDUREcv() ≠ (UIDTXc[[p+1..32]] BCC)
38.             then return FAIL
39.
40.     end for
41.
42.
43.     // enter next cascade level
44.     TPDUSend(SELECT(c))
45.
46. end for
47.
48. return PASS

```

G.6.5.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.6 Handling of ATTRIB

G.6.6.1 Scope

This test is to determine the behaviour of the PICC type B on ATTRIB command according to ISO/IEC 14443-3:2001, 7.10.2.

G.6.6.2 Procedure

Perform the following steps for each scenario listed under clause G.6.6.3

- 1: Put the PICC into READY DECLARED sub-state
- 2: Send the command sequence as described in the **PICC-test-apparatus**
- 3: Check that the response of the PICC conforms with the one given in the **PICC** column
- 4: Check if the PICC is in ACTIVE state

G.6.6.3 Scenarios

Scenario 29: ATTRIB with wrong PUPI

PICC-test-apparatus		PICC
('1D' ~PUI '00 00 01 00' CRC_B)	—/→ ←—	Mute
ATTRIB(0,0)	→ ←—	ATA(0)

Scenario 30: ATTRIB after bad ATTRIB

PICC-test-apparatus		PICC
('1D' PUI '00 00 01 00' ~CRC_B)	—/→ ←—	Mute
ATTRIB(0,0)	→ ←—	ATA(0)

G.6.6.4 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods" SEITENREF according to the test results as follows:

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

G.6.7 Handling of Maximum Frame Size

G.6.7.1 Scope

This test is to determine if the PICC type B respects the FSD size according to ISO/IEC 14443-4:2001, 7.10.4.

G.6.7.2 Procedure

Perform the following steps for each row of Table G. 30

- 1: Put the PICC into READY DECLARED SUB- state as described in G.6.4.1.1
- 2: Send the ATTRIB(0, fsdi) command with fsdi value as described in the **FSDI** column
- 3: Check if the PICC answer is ATA(0)
- 4: Send the I-block I(0)₀(TEST_COMMAND2(2))
- 5: Check if the size of the I-block response of the PICC response is $\leq \mathbf{NMAX}$

Table G. 30: Handling of different Maximum Frame Size values

FSDI	NMAX
0	13
1	21
2	29
3	37
4	45
5	61
6	93
7	125
8	253

G.6.7.3 Test report

Fill the appropriate row in "Table G. 36 — Reported Results for type B specific test methods"SEITENREF according to the test results as follows:

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

G.7 Test methods for logical operation of the PICC of Type A/B

G.7.1 Introduction

This chapter contains tests verifying that the activated PICC conforms to the ISO/IEC 14443-4. This chapter applies to PICC of type A and type B.

G.7.1.1 PICC activation process

PICC activation is the process of putting the PICC in the state where protocol blocks defined in ISO/IEC 14443-4:2001 may be exchanged. This process is dependent on the PICC type and the name of the state also depends on the PICC type (PROTOCOL for type A PICC and ACTIVE for type B PICC)

G.7.1.1.1 Activation of the PICC type A

- 1: Put the PICC into ACTIVE state as described in G.5.3.2.1
- 2: Send RATS(cid, fsdi)
- 3: Check that the PICC response is a valid ATS

G.7.1.1.2 Activation of the PICC type B

- 1: Put the PICC into READY DECLARED sub-state as described in G.6.4.1.1
- 2: Send ATTRIB(cid, fsdi)
- 3: Check that the PICC response is a valid ATA

G.7.2 PICC reaction to ISO/IEC 14443-4 Scenarios

G.7.2.1 Scope

This test is to determine the reaction of the PICC in different protocol scenarios. These tests are concrete implementations of the protocol scenarios of ISO/IEC 14443-4:2001 Annex B

G.7.2.2 Procedure

Perform the following steps for each scenario listed in this subclause. REFFORMATVERBINDEN

- 1: Activate the PICC as described in G.7.1.1, use CID=0 and FSDI=0
- 2: For each **Step** in the Scenario do
- 3: Send the command as described in the **PICC-test-apparatus** column
- 4: Check that the PICC response matches the one of the **PICC** column.
- 5: End for

Scenario 31: Exchange of I-blocks

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND1(1))	→	I(0) ₀ (TEST_RESPONSE1(1))
2	I(0) ₁ (TEST_COMMAND1(1))	→	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 32: Request for waiting time extension

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND3)	→ S(WTX) (n)
2	S(WTX) (n)	← I(0) ₀ (TEST_RESPONSE3)
3	I(0) ₁ (TEST_COMMAND1(1))	→ I(0) ₁ (TEST_RESPONSE1(1))

Scenario 33: DESELECT

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND1(1))	→ I(0) ₀ (TEST_RESPONSE1(1))
2	S(DESELECT)	← S(DESELECT)
3	REQA or REQB(0) ^a	→ Mute
4	WUPA or WUPB(0) ^a	→ ATQA or ATQB ^a

^a For the PICC type A, the left option shall be used. For the PICC type B, the right option shall be used.

Scenario 34: PCD uses chaining

Step	PICC-test-apparatus	PICC
1	I(1) ₀ (TEST_COMMAND1(2) ₁)	→ R(ACK) ₀
2	I(0) ₁ (TEST_COMMAND1(2) ₂)	→ I(0) ₁ (TEST_RESPONSE1(2))
3	I(0) ₀ (TEST_COMMAND1(1))	→ I(0) ₀ (TEST_RESPONSE1(1))

Scenario 35: PICC uses chaining

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND2(2))	→ I(1) ₀ (TEST_RESPONSE2(2) ₁)
2	R(ACK) ₁	→ I(0) ₁ (TEST_RESPONSE2(2) ₂)
3	I(0) ₀ (TEST_COMMAND1(1))	→ I(0) ₀ (TEST_RESPONSE1(1))

Scenario 36: Start of protocol

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND1(1), ~CRC)	→ Mute
2	R(NAK) ₀	→ R(ACK) ₁
3	I(0) ₀ (TEST_COMMAND1(1))	→ I(0) ₀ (TEST_RESPONSE1(1))
4	I(0) ₁ (TEST_COMMAND1(1))	→ I(0) ₁ (TEST_RESPONSE1(1))

Scenario 37: Exchange of I-Blocks

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND1(1))	→	
2	I(0) ₁ (TEST_COMMAND1(1), ~CRC)	←	I(0) ₀ (TEST_RESPONSE1(1))
3	R(NAK) ₁	→	Mute
4	I(0) ₁ (TEST_COMMAND1(1))	←	R(ACK) ₀
5	I(0) ₀ (TEST_COMMAND1(1))	→	I(0) ₁ (TEST_RESPONSE1(1))
		←	I(0) ₀ (TEST_RESPONSE1(1))

Scenario 38: Exchange of I-Blocks 1

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND1(1))	→	
2	R(NAK) ₀	←	I(0) ₀ (TEST_RESPONSE1(1))
3	I(0) ₁ (TEST_COMMAND1(1))	→	I(0) ₀ (TEST_RESPONSE1(1))
		←	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 39: Exchange of I-blocks 2

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND1(1))	→	
2	R(NAK, ~CRC) ₀	←	I(0) ₀ (TEST_RESPONSE1(1))
3	R(NAK) ₀	→	Mute
4	I(0) ₁ (TEST_COMMAND1(1))	←	I(0) ₀ (TEST_RESPONSE1(1))
		→	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 40: Request for waiting time extension

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND3)	→	
2	R(NAK) ₀	←	S(WTX)(n)
3	S(WTX)(n)	→	S(WTX)(n)
4	I(0) ₁ (TEST_COMMAND1(1))	←	I(0) ₀ (TEST_RESPONSE3)
		→	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 41: Request for waiting time extension

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND3)	→	
2	R(NAK, ~CRC) ₀	←	S(WTX)(n)
3	R(NAK) ₀	→	Mute
4	S(WTX)(n)	←	S(WTX)(n)
		→	I(0) ₀ (TEST_RESPONSE3)

5	I(0) ₁ (TEST_COMMAND1(1))	→ ←	I(0) ₁ (TEST_RESPONSE1(1))
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Scenario 42: Request for waiting time extension

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND3)	→	S(WTX)(n)
2	S(WTX)(n, ~CRC)	→ ←	Mute
3	R(NAK) ₀	→	S(WTX)(n)
4	S(WTX)(n)	→ ←	I(0) ₀ (TEST_RESPONSE3)
5	I(0) ₁ (TEST_COMMAND1(1))	→ ←	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 43: Request for waiting time extension

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND3)	→	S(WTX)(n)
2	S(WTX)(n)	→ ←	I(0) ₀ (TEST_RESPONSE3)
3	R(NAK) ₀	→ ←	I(0) ₀ (TEST_RESPONSE3)
4	I(0) ₁ (TEST_COMMAND1(1))	→ ←	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 44: Request for waiting time extension

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND3)	→	S(WTX)(n)
2	S(WTX)(n)	→ ←	I(0) ₀ (TEST_RESPONSE3)
3	R(NAK, ~CRC) ₀	→ ←	Mute
4	R(NAK) ₀	→ ←	I(0) ₀ (TEST_RESPONSE3)
5	I(0) ₁ (TEST_COMMAND1(1))	→ ←	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 45: DESELECT

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND1(1))	→	I(0) ₀ (TEST_RESPONSE1(1))
2	S(DESELECT, ~CRC)	→ ←	Mute
3	S(DESELECT)	→	S(DESELECT)
4	REQA or REQB(0) ^a	→ ←	Mute
5	WUPA or WUPB(0) ^a	→ ←	ATQA or ATQB ^a

^a For the PICC type A, the left option shall be used. For the PICC type B, the right option shall be used.

Scenario 46: PCD uses chaining

Step	PICC-test-apparatus	PICC
1	I(1) ₀ (TEST_COMMAND1(3) ₁)	→
2	R(NAK) ₀	←
3	I(1) ₁ (TEST_COMMAND1(3) ₂)	→
4	I(0) ₀ (TEST_COMMAND1(3) ₃)	→
5	I(0) ₁ (TEST_COMMAND1(1))	→
		←
		I(0) ₀ (TEST_RESPONSE1(3))
		I(0) ₁ (TEST_RESPONSE1(1))

Scenario 47: PCD uses chaining

Step	PICC-test-apparatus	PICC
1	I(1) ₀ (TEST_COMMAND1(3) ₁)	→
2	I(1) ₁ (TEST_COMMAND1(3) ₂ , ~CRC)	←
3	R(NAK) ₁	→
4	I(1) ₁ (TEST_COMMAND1(3) ₂)	→
5	I(0) ₀ (TEST_COMMAND1(3) ₃)	→
6	I(0) ₁ (TEST_COMMAND1(1))	→
		←
		R(ACK) ₀
		Mute
		R(ACK) ₁
		I(0) ₀ (TEST_RESPONSE1(1))
		I(0) ₁ (TEST_RESPONSE1(1))

Scenario 48: PCD uses chaining

Step	PICC-test-apparatus	PICC
1	I(1) ₀ (TEST_COMMAND1(3) ₁)	→
2	R(NAK, ~CRC) ₀	←
3	R(NAK) ₀	→
4	I(1) ₁ (TEST_COMMAND1(3) ₂)	→
5	I(0) ₀ (TEST_COMMAND1(3) ₃)	→
6	I(0) ₁ (TEST_COMMAND1(1))	→
		←
		R(ACK) ₀
		Mute
		R(ACK) ₁
		I(0) ₀ (TEST_RESPONSE1(3))
		I(0) ₁ (TEST_RESPONSE1(1))

Scenario 49: PICC uses chaining

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND2(3))	→
2	R(ACK, ~CRC) ₁	←
		←
		I(1) ₀ (TEST_RESPONSE2(3) ₁)
		Mute

3	R(ACK) ₁	→	I(1) ₁ (TEST_RESPONSE2(3) ₂)
4	R(ACK) ₀	→	I(0) ₀ (TEST_RESPONSE2(3) ₃)
5	I(0) ₁ (TEST_COMMAND1(1))	→	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 50: PICC uses chaining

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND2(3))	→	I(1) ₀ (TEST_RESPONSE2(3) ₁)
2	R(ACK) ₁	→	I(1) ₁ (TEST_RESPONSE2(3) ₂)
3	R(ACK) ₁	→	I(1) ₁ (TEST_RESPONSE2(3) ₂)
4	R(ACK) ₀	→	I(0) ₀ (TEST_RESPONSE2(3) ₃)
5	I(0) ₁ (TEST_COMMAND1(1))	→	I(0) ₁ (TEST_RESPONSE1(1))

Scenario 51: PICC uses chaining

Step	PICC-test-apparatus		PICC
1	I(0) ₀ (TEST_COMMAND2(2))	→	I(1) ₀ (TEST_RESPONSE2(2)) ₁
2	R(NAK) ₀	→	I(1) ₀ (TEST_RESPONSE2(2)) ₁
3	R(ACK) ₁	→	I(0) ₁ (TEST_RESPONSE2(2)) ₂
5	I(0) ₀ (TEST_COMMAND1(1))	→	I(0) ₀ (TEST_RESPONSE1(1))

G.7.2.3 Test report

Fill the appropriate rows in "Table G. 37 — Reported Results for test methods common for the PICC type A/B SEITENREF according to the test results as follows:

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

G.7.3 Handling of PICC error detection

G.7.3.1 Scope

This test is to determine the error detection mechanism of the PICC as described in ISO/IEC 14443-4:2001, 7.5.5.

G.7.3.2 Procedure

Perform the following steps for each scenario listed REFFORMATVERBINDEN in this subclause.

- 1: Place the reference PICC into the field.
- 2: Activate the PICC as described in G.7.1.1, use CID=0 and FSDI=0

- 3: For each **Step** in scenario do
- 4: Send the command as described in the **PICC-test-apparatus** column
- 5: Check if the PICC response is as described in the **PICC** column
- 6: End for

REFSEITENREF

Note: The **comment** column of the following tables refer to the rules of ISO/IEC 14443-4:2001 also as amended in ISO/IEC 14443-4/AM1, 7.5.3 – 7.5.5

Scenario 52: Bad block number on I-Block

Step	PICC-test-apparatus	PICC	Comment
1	I(0) ₁ (TEST_COMMAND1(1)) → ←	Mute	7.5.3.1 Rule A 7.5.5 b
2	I(0) ₀ (TEST_COMMAND1(1)) → ←	I(0) ₀ (TEST_RESPONSE1(1))	

Scenario 53: Bad block number on chained I-Block

Step	PICC-test-apparatus	PICC	Comment
1	I(1) ₀ (TEST_COMMAND1(2) ₁) → ←	R(ACK) ₀	
2	I(0) ₀ (TEST_COMMAND1(2) ₂) → ←	Mute	7.5.3.1 Rule A 7.5.5 b
3	I(0) ₁ (TEST_COMMAND1(2) ₂) → ←	I(0) ₁ (TEST_RESPONSE1(2))	

Scenario 54: Bad CRC on I-Block

Step	PICC-test-apparatus	PICC	comment
1	I(0) ₀ (TEST_COMMAND1(1), ~CRC) → ←	Mute	7.5.5 a
2	I(0) ₀ (TEST_COMMAND1(1)) → ←	I(0) ₀ (TEST_RESPONSE1(1))	

Scenario 55: Bad CRC on chained I-Block

Step	PICC-test-apparatus	PICC	comment
1	I(1) ₀ (TEST_COMMAND1(2) ₁) → ←	R(ACK) ₀	
2	I(0) ₀ (TEST_COMMAND1(2) ₂ , ~CRC) → ←	Mute	7.5.5 a
3	I(0) ₁ (TEST_COMMAND1(2) ₂) → ←	I(0) ₁ (TEST_RESPONSE1(2))	

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Scenario 58: Bad CRC on S(WTX)-Block

Step	PICC-test-apparatus	PICC	comment
1	I(0) ₀ (TEST_COMMAND3) → ←	S(WTX) (n)	
2	S(WTX)(n, ~CRC) → ←	Mute	7.5.5 a
3	S(WTX)(n) → ←	I(0) ₀ (TEST_RESPONSE3)	

G.7.3.3 Test report

Fill the appropriate rows in “Table G. 37 — Reported Results for test methods common for the PICC type A/B according to the test results as follows:

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

G.7.4 PICC reaction on CID

G.7.4.1 Scope

This test is to determine the reaction of the PICC to CID coding according to ISO/IEC 14443-4:2001, 7.1.1.2.

G.7.4.2 Procedure

Perform the following steps for each **Scenario** listed in REFFORMATVERBINDEN this subclause. Use the proper **CID test case table** depending upon whether the PICC supports CID or not.

For each row in the CID test case table (Table G. 31 or Table G. 32) do:

1. Activate the PICC with **cid_{ass}** as indicated in the column **Assigned CID**
2. Perform a block exchange as described in the corresponding Scenario. Use the **cid_{cmd}** as described in the **Command CID** column in the **CID test case table**.

3. Check if the PICC response matches that of the **PICC** column in the **Scenario**. If two response options are indicated for the PICC, then the unique expected response will be determined from the **expected PICC response** column in the **CID Test case table**.

Table G. 31: CID test case table (for PICCs which support CID)

Each test number in the table below shall be tested with each of the scenarios described below.

Test No.	Assigned CID (cid _{ass})	Command CID (cid _{cmd})	Expected PICC response
1	1	1	Response 1 of the test scenario
2	0	0	Response 1 of the test scenario
3	0	NO CID	Response 1 of the test scenario
4	1	NO CID	Response 2 of the test scenario (Mute)
5	0	1	Response 2 of the test scenario (Mute)
6	1	0	Response 2 of the test scenario (Mute)
7	2	1	Response 2 of the test scenario (Mute)

Table G. 32: CID test case table (for PICCs which do not support CID)

Each test number in the table below shall be tested with each of the scenarios described below.

Test No.	Assigned CID (cid _{ass})	Command CID (cid _{cmd})	Expected PICC response
1	0	0	Response 2 of the test scenario (Mute)
2	0	NO CID	Response 1 of the test scenario
3	0	1	Response 2 of the test scenario (Mute)
4	1	NO CID	Response 1 of the test scenario

REFSEITENREF

Scenario 59: CID on I-Block

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND1(1), CID = cid _{cmd}) →	 ← Response 1: I(0) ₀ (TEST_RESPONSE1(1), CID=cid _{cmd}) Response 2: Mute ^a
^a Response 1 or response 2 according to Table G. 31 or Table G. 32		

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Scenario 60: CID on I-Block with chaining

Step	PICC-test-apparatus	PICC
1	I(1) ₀ (TEST_COMMAND1(2) ₁ , CID = cid _{cmd}) →	 ← Response 1: R(ACK, CID=cid _{cmd}) ₀ Response 2: Mute ^a
^a response 1 or response 2 according to Table G. 31 or Table G. 32		

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Scenario 61: CID on R-Block

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND2(3), CID=cid _{ass})	→ ← I(1) ₀ (TEST_RESPONSE2(3) ₁ , CID=cid _{ass})
2	R(ACK, CID=cid _{cmd}) ₁	→ ← I(1) ₁ (TEST_RESPONSE2(3) ₂ , CID=cid _{cmd}) Response 1: Response 2: Mute ^a
^a Response 1 or response 2 according to Table G. 31 or Table G. 32		
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Scenario 62: CID on S(WTX)-Block

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND3, CID=cid _{ass})	→ ← S(WTX)(n, CID=cid _{ass})
2	S(WTX,)(n, CID=cid _{cmd})	→ ← I(0) ₀ (TEST_RESPONSE3, CID=cid _{cmd}) Response 1: Response 2: Mute ^a
^a Response 1 or response 2 according to Table G. 31 or Table G. 32		
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Scenario 63: CID on S(DESELECT)-Block

Step	PICC-test-apparatus	PICC
1	S(DESELECT, CID=cid _{cmd})	→ ← Response 1: S(DESELECT, CID=cid _{cmd}) Response 2: Mute ^a
^a Response 1 or response 2 according to Table G. 31 or Table G. 32. In case of response 1, to check the target state for type A PICCs apply G.5.3.2.2 procedure and for type B PICCs apply G.6.4.1.2 procedure		
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G.7.4.3 Test report

Fill the appropriate row in "Table G. 37 — Reported Results for test methods common for the PICC type A/B according to the test results as follows:

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

G.7.5 PICC reaction on NAD

G.7.5.1 Scope

This test is to determine the reaction of the PICC to NAD coding according to ISO/IEC 14443-4:2001, 7.1.1.3.

G.7.5.2 Procedure

Perform the following steps for each **scenario** listed REFFORMATVERBINDENin this subclause.

Activate the PICC as described in clause PICC activation process G.7.1.1, use CID=0 and FSDI=0,
For each **Step** in scenario do:

1. Send the command as described in the **PICC-test-apparatus** column
2. Check that the PICC response matches the one of the **PICC** column.

REFSEITENREF

Let n be an arbitrary value of a valid NAD with b4 and b8 set to 0

Scenario 64: NAD on I-Block (for PICCs supporting NAD)

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND1(1), NAD=n) \longrightarrow	\longleftarrow I(0) ₀ (TEST_RESPONSE1(1), NAD=don't care)

Scenario 65: NAD on chained I-Block (for PICCs supporting NAD)

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND2(3), NAD=n) \longrightarrow	\longleftarrow I(1) ₀ (TEST_RESPONSE2(3) ₁ , NAD = don't care)
2	R(ACK) ₁ \longrightarrow	\longleftarrow I(1) ₁ (TEST_RESPONSE2(3) ₂)

Scenario 66: NAD on I-Block (for PICCs not supporting NAD)

Step	PICC-test-apparatus	PICC
1	I(0) ₀ (TEST_COMMAND1(1), NAD=n) \longrightarrow	\longleftarrow Mute

G.7.5.3 Test report

Fill the appropriate rows in “Table G. 37 — Reported Results for test methods common for the PICC type A/B according to the test results as follows:

Explanation	Test result
If the scenario is not applicable for the PICC	NA
If the PICC's response is as indicated in the procedure	Pass
Any other case	Fail

G.8 Reported results

Table G. 33 — Type A specific timing table

No	Parameter	ISO Reference	Required Test value	Measured Value(s)
1	Frame delay time PICC to PCD	ISO/IEC 14443-3:2001 6.1.3	At least $1172/f_c$	
2	Frame delay time PCD to PICC (for REQA, WUPA, ANTICOLLISION, SELECT commands)	ISO/IEC 14443-3:2001 6.1.2	Last bit (1)b $\rightarrow 1236/f_c$ Last bit (0)b $\rightarrow 1172/f_c$	
3	Frame delay time PCD to PICC (for all commands, exclude ones from previous row)	ISO/IEC 14443-3:2001 6.1.2	Last bit (1)b $\rightarrow (n \cdot 128 + 84)/f_c$ Last bit (0)b $\rightarrow (n \cdot 128 + 20)/f_c$	
4	Deactivation frame waiting time	ISO/IEC 14443-4:2001, 8.1	See Table G. 34 No.12 (same values)	

Note: All timing values are calculated for carrier frequency $f_c = 13.56$ MHz and bit rate = $f_c/128$ (~106 kbit/s).

Table G. 34 — Type B specific timing table

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

Note: All timing values are calculated for carrier frequency $f_c = 13,56$ MHz and bit rate = $f_c/128$ (~106 kbit/s).

Table G. 35 — Reported Results for type A specific test methods

Test method from ISO/IEC 10373-6		Scenario Numbers	Test result
Clause	Parameter	Test Scenario Number ISO/IEC 10373-6	PASS/FAIL/NA
G.5.2	Polling	Scenario 1	
G.5.3	Testing of the PICC type A state transitions	Scenario 2	
		Scenario 3	
		Scenario 4	
		Scenario 5	
		Scenario 6	
		Scenario 7	
		Scenario 8	
		Scenario 9	
		Scenario 10	
		Scenario 11	
		Scenario 12	
G.5.4	Handling of type A anticollision	Scenario 13	
G.5.5	Handling of RATS	Scenario 14	
		Scenario 15	
G.5.6	Handling of PPS request	Scenario 16	
		Scenario 17	
		Scenario 18	
		Scenario 19	
G.5.7	Handling of FSD	Scenario 20	

Table G. 36 — Reported Results for type B specific test methods

Test method from ISO/IEC 10373-6		Scenario Numbers	
Clause	Parameter	Test Scenario Number ISO/IEC 10373-6	PASS/FAIL/NA
G.6.2	Polling	Scenario 21	
G.6.3	PICC Reception	Scenario 22	
G.6.4	Testing of the PICC Type B State Transitions	Scenario 23	
		Scenario 24	
		Scenario 25	
		Scenario 26	
		Scenario 27	
G.6.5	Handling of type B anticollision	Scenario 28	
G.6.6	Handling of ATTRIB	Scenario 29	
		Scenario 30	
G.6.7	Handling of Maximum Frame Size		

Table G. 37 — Reported Results for test methods common for the PICC type A/B

Test method from ISO/IEC 10373-6			
Clause	Parameter	Test Scenario Number ISO/IEC 10373-6	PASS/FAIL/NA
G.7.2	PICC reaction to ISO/IEC 14443-4 Scenarios	Scenario 31	
		Scenario 32	
		Scenario 33	
		Scenario 34	
		Scenario 35	
		Scenario 36	
		Scenario 37	
		Scenario 38	
		Scenario 39	
		Scenario 40	
		Scenario 41	
		Scenario 42	
		Scenario 43	
		Scenario 44	
		Scenario 45	
		Scenario 46	
		Scenario 47	
		Scenario 48	
		Scenario 49	
		Scenario 50	
		Scenario 51	
G.7.2.3	Handling of PICC error detectionREF	Scenario 52	
		Scenario 53	
		Scenario 54	
		Scenario 55 SEQARABISCH SEQARABISCH	
		Scenario 58	
G.7.4	PICC reaction on CID	Scenario 59	
		Scenario 60	
		Scenario 61	
		Scenario 62	
		Scenario 63	
G.7.5	PICC reaction on NAD	Scenario 64	
		Scenario 65	
		Scenario 66	
G.3.3.2	Generating the I/O character timing in reception mode		79
G.3.3.3	RFU values		

