ISO/IEC JTC 1/SC 17 N 2258

Date: 2002-12-20

N/A

ISO/IEC JTC 1/SC 17/WG 8

Secretariat: DIN

Draft AMENDMENT text for 2nd CD Ballot

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

Warning

This document is not an ISO International Standard. It is distributed for review and comment. It is subject to change without notice and may not be referred to as an International Standard.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document type: International Standard
Document subtype: Amendment
Document stage: (20) Preparatory
Document language: E

H:\Fjb\Winword\Sc17\E-mails from 1900\17n2258t.doc STD Version 1.0

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this Amendment may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Amendment G 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]:*

(INFORMATIVE)

G.1 Terms and definitions (additional to defined in 3.3)

G.1.1 General definitions

CRC	Cyclic Redundancy Check
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.
TEST_COMMAND1	Default Test command used for tests. See G.2.1.6 Test command
TEST_COMMAND2	Default Test command used for tests of the chaining. See G.2.1.6 Test command
TEST_COMMAND3	Default Test command used for tests deal with frame waiting time. See G.2.1.6 Test command

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 clause 6.1 of ISO/IEC 10373-6)
- Test PCD assembly (see clause 6.2 of ISO/IEC 10373-6)
- Reference PICCs (see clause 6.3 of ISO/IEC 10373-6)
- Digital sampling oscilloscope (see clause 6.4 of ISO/IEC 10373-6)

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. Timing parameters: start bit length, guard time, bit width, request guard time, start of frame width, end of frame width 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 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.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 A:

— The DUT supports CID. Single UID of the PICC is '12 23 34 45', `double UID '88 23 34 45' '56 67 78 89' and triple '88 23 34 45' '88 67 78 89' '9A AB BC CD'`

— The default CID value used in the test is CID=4.

G.2.1.6 Test command

TEST_COMMAND1 specifies the ISO instruction used as the default instruction for test scenarios.

TEST_COMMAND2 specifies the ISO instruction used as the default instruction for test scenarios deal with chaining.

TEST_COMMAND3 specifies the ISO instruction used as the default instruction for test scenarios deal with frame waiting time. It is the instruction, 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.

Please specify in the appropriate rows in Table G. 9 — Test coverage report on page 109 what default instructions are used as the default instructions 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

Test method from ISO/IEC 10373-6		Corresponding requirement	
Clause	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	Test for ATQA RFU and invalid values	ISO/IEC 14443-3:2001	6.4.2
G.3.4	Testing of the PICC type A State Transitions	ISO/IEC 14443-3:2001	6.2
G.3.5	Handling of Bitwise Anticollision	ISO/IEC 14443-4:2001	6.1.5.3.
G.3.6	Handling of RATS and ATS by the PICC type A	ISO/IEC 14443-4:2001	5.6.1
G.3.7	Handling of PPS request by the PICC type A	ISO/IEC 14443-4:2001	5.3

Table G. 2 — 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.4.1	Polling	ISO/IEC 14443-3:2001	7.1
G.4.2	PICC Reception	ISO/IEC 14443-3:2001	7.1
G.4.3	I/O transmission timing for type B protocol	ISO/IEC 14443-3:2001	7.1
G.4.4	I/O reception timing for type B protocol	ISO/IEC 14443-3:2001	7.1
G.4.5	Test for ATQB RFU and invalid values	ISO/IEC 14443-3:2001	7.9
G.4.6	Behaviour of the PICC type B in the IDLE state	ISO/IEC 14443-3:2001	7.4.4
G.4.7	Behaviour of the PICC type B in the READY REQUESTED state	ISO/IEC 14443-3:2001	7.4.5
G.4.8	Behaviour of the PICC type B in the READY DECLARED state	ISO/IEC 14443-3:2001	7.4.6
G.4.9	Behaviour of the PICC type B in the ACTIVE state	ISO/IEC 14443-3:2001	7.4.7
G.4.10	Behaviour of the PICC type B in the HALT state	ISO/IEC 14443-3:2001	7.4.8
G.4.11	WUPB command	ISO/IEC 14443-3:2001	7.7
G.4.12	REQB command	ISO/IEC 14443-3:2001	7.7
G.4.13	Slot-MARKER Command	ISO/IEC 14443-3:2001	7.8
G.4.14	HLTB Command	ISO/IEC 14443-3:2001	7.12
G.4.15	ATTRIB command	ISO/IEC 14443-3:2001	7.10
G.4.16	Different values of PCD maximum frame size	ISO/IEC 14443-3:2001	7.10.4
G.4.17	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

Test method from ISO/IEC 10373-6		Corresponding requirement	
Clause	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.5.10	PICC reaction to errors in PCB byte	ISO/IEC 14443-4:2001	7.1.1.1
G.5.11	Block Transmission Test	ISO/IEC 14443-4:2001	7.5
G.5.12	Chaining Block Transmission Test	ISO/IEC 14443-4:2001	7.5.2
G.5.13	Test for RFU value of CID byte	ISO/IEC 14443-4:2001	7.1.1.2
G.5.14	Test for PICC supporting NAD	ISO/IEC 14443-4:2001	7.1.1.3

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 G.2.

G.3.1.2 Procedure

Place the PICC into the field.

a) Send a valid REQB Command frame (e.g. '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. 6 — Reported Results for type A specific test methods" on page 106 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 G.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.

RF I/O
Receive
Transmit

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 104 with measured values.

G.3.3 Test for ATQA RFU and invalid values

The purpose of this test is to ensure that Answer To Request (ATQA) does not include RFU values and invalid values.

G.3.3.1 Procedure

Place the PICC into the field.

d) Send a valid REQA Command frame ((0100110)b).

e) Record the presence and the content of the PICC response.

G.3.3.2 Test report

ATQA has 15 RFU combinations ((2^4–1) = 15). In the test report indicate what percentage of the 15 RFU combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

Explanation	Test result
If the ATQA does not include RFU values, invalid values for UID size bit frame and wrong combination of bit frame anticollision	Pass
Any other case	Fail

G.3.4 Testing of the PICC type A State Transitions

The purpose of these tests is to verify the correct implementation of the PICC type A state machine as described in ISO/IEC 14443-3 2001: 6.2.

G.3.4.1 Terminology

CRC_A	Cyclic Redundancy Check, as defined for PICC type A in ISO/IEC 14443-3
SELECT(l) , l∈ {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 ∈ {0..9}	User ID byte Nr. n
UIDn[a] , n ∈ {0..9}, a ∈ {1..8}	Bit at position a of UID byte n
UIDn[a..b] , n ∈ {0..9}; a, b ∈ {1..8}	Bits between position a and b of UID byte n
~UIDn, n ∈ {0..9}	inverted bits of User ID byte Nr. n
~UIDn[a] , n ∈ {0..9}, a ∈ {1..8}	inverted bit at position a of UID byte n
~UIDn[a..b] , n ∈ {0..9}; a, b ∈ {1..8}	inverted bits between position a and b of UID byte n
UIDTXl, l∈ {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
UIDTXl	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

UIDTXl[a] , l ∈ {1..3}, a ∈ {1..32} Bit at position a of UID byte n

UIDTXl[a..b] , l ∈ {1..3}; a, b ∈ {1..32} Bits between position a and b of UIDTXl

~ UIDTXl, l ∈ {1..3} inverted bits of UIDTXl

~ UIDTXl[a] , l ∈ {1..3} , a ∈ {1..32} inverted bit at position a of UIDTXl

~ UIDTXl[a..b] , l ∈ {1..3} ; a, b ∈ {1..32} inverted bits between position a and b of UIDTXl

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 ∈ StateSet the Test Initial State

TTS ∈ (StateSet x TransitionSet) → 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.3.4.2 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:

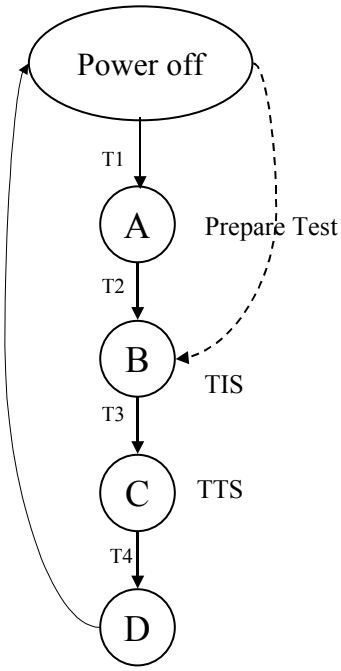
First reset the PICC and than put it into the test initial state (**TIS**). This is one of the states from **StateSet** where we are going to verify the transitions (**T**). Than we execute a transition **T** from **TransitionSet.** After execution of the state transition one must also check whether 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 than 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). Transitions T1,T2,T3 and T4 are the TransitionSet in this example. 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 form the card.



G.3.4.3 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. Than 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 (Rf 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)
ACTIVE → ISO14443	RATS (e.g. 'E0' '00' CRC_A)	→	

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

G.3.4.4 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	RATS (e.g. ‘E0’ ‘00’ CRC_A)	→		
		←	ATS	
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	
ACTIVE*	RATS (e.g. ‘E0’ ‘00’ CRC_A)	→		state cannot be distinguished from ACTIVE state
		←	ATS	

G.3.4.5 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.3.4.5.1 Apparatus

See clause G.2

G.3.4.5.2 Procedure

Place the PICC into the field.

For every state transition T in the following table do

a) Put the PICC into TIS=IDLE state as described in clause G.3.4.3

b) Apply the state transition T as described in the PICC-test-apparatus column

c) Check the answer from the card as described in the PICC column

d) Check the target state of the card according to clause 0

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

Transition (T)	PICC-test-apparatus		PICC	Target State
REQA	(0100110)b	→		READY
		←	ATQA	
WUPA	(1010010)b	→		READY
		←	ATQA	
AC (split byte)	(‘93’ ‘25’ UIDTX1[1..5])	→		IDLE
		←	Mute	
nAC (split byte)	(‘93’ ‘25’ UIDTX1[1..4] ~UIDTX1[5])	→		IDLE
		←	Mute	
AC (full byte)	(‘93’ ‘40’ UIDTX1[1..16])	→		IDLE
		←	Mute	
nAC (full byte)	(‘93’ ‘40’ UIDTX1[1.. 15] ~UIDTX1[16])	→		IDLE
		←	Mute	
SELECT	(‘93’ ‘70’ UIDTX1 CRC_A)	→		IDLE
		←	Mute	
nSELECT	(‘93’ ‘70’ ~UIDTX1 CRC_A)	→		IDLE

Transition (T)	PICC-test-apparatus		PICC	Target State
		⟵	Mute	
HALTA	(‘50’ ‘00’ CRC_A)	⟶		IDLE
		⟵	Mute	
ERROR (RFU short frame)	RFU_SHORT_FRAME (0100111)b*	⟶		IDLE
		⟵	Mute	
ERROR (wrong CRC)	(‘50’ ‘00’ ~CRC_A)	⟶		IDLE
		⟵	Mute	
ERROR	(e.g. ‘C2’ ‘00’ CRC_A)	⟶		IDLE
		⟵	Mute	

* According to ISO/IEC 14443-3:2001 clause 6.3.1 there are 101 RFU values for short frame: $(2^7 – (3 + 2^3 + 2^4) = 101$).
In the test report indicate what percentage of the combinations was tested.

G.3.4.5.3 Test report

Record the presence and the content of the PICC responses.

Short Frame has 101 RFU combinations. In the test report indicate what percentage of the 101 RFU combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according the following:

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

G.3.4.6 Behaviour of the PICC type A in the READY state (single/multiple UIDs)

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.3.4.6.1 Apparatus

See clause G.2.

G.3.4.6.2 Procedure

For every state transition T in the following table do

a) Put the PICC into READY state as described in clause G.3.4.3

b) Apply the state transition T as described in the PICC-test-apparatus column

c) Check the answer from the card as described in the PICC column

d) Check the target state of the card according to clause 0

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

Transition	PICC-test-apparatus		PICC	Target State
REQA	(0100110)b	→		IDLE
		←	Mute	
WUPA	(1010010)b	→		IDLE
		←	Mute	
AC (split byte)	(‘93’ ‘25’ UIDTX1[1..5])	→		READY
		←	UIDTX1[6..32] BCC	
nAC (split byte)	(‘93’ ‘25’ UIDTX1[1..4] ~UIDTX1[5])	→		IDLE
		←	Mute	
AC (full byte)	(‘93’ ‘40’ UIDTX1[1..16])	→		READY
		←	UIDTX1[17..32] BCC	
nAC (full byte)	(‘93’ ‘40’ UIDTX1[1..15] ~UIDTX1[16])	→		IDLE
		←	Mute	
HALTA	(‘50’ ‘00’ CRC_A)	→		IDLE
		←	Mute	
ERROR (RFU short frame)	RFU_SHORT_FRAME (0100111)b*	→		IDLE
		←	Mute	
ERROR (wrong CRC)	(‘93’ ‘70’ UIDTX1 ~CRC_A)	→		IDLE
		←	Mute	
ERROR (ISO-block)	(e.g. ‘C2’ ‘00’ CRC_A)	→		IDLE
		←	Mute	

* According to ISO/IEC 14443-4:2001 clause 6.3.1 there are 101 RFU values for short frame: $(2^7 – (3 + 2^3 + 2^4) = 101$).
In the test report indicate what percentage of the combinations was tested.

G.3.3.6.3 Behaviour of the PICC type A in the READY State (single UID)

These tests are for single UID cards only.

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
		←	SAK(complete)	
nSELECT	(‘93’ ‘70’ ~UIDTX1 CRC_A)	→		IDLE
		←	Mute	

G.3.3.6.4 Behaviour of the PICC type A in the READY State (double UID)

These tests are for double UID cards only.

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
		←	SAK(cascade)	
SELECT level 2	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘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)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ ~UIDTX2 CRC_A)	→		IDLE
		←	Mute	

G.3.3.6.5 Behaviour of the PICC type A in the READY State (triple UID)

These tests are for triple UID cards only.

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)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ UIDTX2 CRC_A)	→		READY
		←	SAK(cascade)	
SELECT level 3	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘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)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ ~UIDTX2 CRC_A)	→		IDLE
		←	Mute	
nSELECT level 3	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ UIDTX2 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘97’ ‘70’ ~UIDTX3 CRC_A)	→		IDLE
		←	Mute	

G.3.3.6.6 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“ on page 106 with test result according to the test results as follows:

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

G.3.4.7 Behaviour of the PICC type A in the ACTIVE state (single/multiple UIDs)

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.3.4.7.1 Apparatus

See clause G.2.

G.3.4.7.2 Procedure

For every state transition T in the following table do

a) Put the PICC into ACTIVE state as described in clause G.3.4.3

b) Apply the state transition T as described in the PICC-test-apparatus column

c) Check the answer from the card as described in the PICC column

d) Check the target state of the card according to clause 0

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

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

Transition	PICC-test-apparatus		PICC	Target State
		←	Mute	
nSELECT	(‘93’ ‘70’ UIDTX1 CRC_A)	→		IDLE
		←	Mute	
RATS	(e.g. ‘E0’ ‘00’ CRC_A)	→		ISO/IEC 14443-4
		←	ATS	
ERROR (RFU short frame)	RFU_SHORT_FRAME (0100111)b*	→		IDLE
		←	Mute	
ERROR (wrong CRC)	(‘93’ ‘70’ UIDTX1 CRC_A)	→		IDLE
		←	Mute	
ERROR (ISO/IEC-block)	(e.g. ‘C2’ ‘00’ CRC_A)	→		IDLE
		←	Mute	

* According to ISO/IEC 14443-4:2001 clause 6.3.1 there are 101 RFU values for short frame: $(2^7 – (3 + 2^3 + 2^4) = 101$).
In the test report indicate what percentage of the combinations was tested.

G.3.4.7.3 Test report

Record the presence, the content of the PICC responses.

Short Frame has 101 RFU combinations. In the test report indicate what percentage of the 101 RFU combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

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

G.3.4.8 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.3.4.8.1 Apparatus

See clause G.2.

G.3.4.8.2 Procedure

For every state transition T in the following table do

a) Put the PICC into HALT state as described in clause G.3.4.3

b) Apply the state transition T as described in the PICC-test-apparatus column

c) Check the answer from the card as described in the PICC column

d) Check the target state of the card according to clause 0

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

Transition	PICC-test-apparatus		PICC	Target State
REQA	(0100110)b	→		HALT
		←	Mute	
WUPA	(1010010)b	→		READY*
		←	ATQA	
AC (split byte)	(‘93’ ‘25’ UIDTX1[1..5])	→		HALT
		←	Mute	
nAC (split byte)	(‘93’ ‘25’ UIDTX1[1..4] ~UIDTX1[5])	→		HALT
		←	Mute	
AC (full byte)	(‘93’ ‘40’ UIDTX1[1..16])	→		HALT
		←	Mute	
nAC (full byte)	(‘93’ ‘40’ UIDTX1[1..15] ~UIDTX1[16])	→		HALT
		←	Mute	
HALTA	(‘50’ ‘00’ CRC_A)	→		HALT
		←	Mute	
SELECT	(‘93’ ‘70’ UIDTX1 CRC_A)	→		HALT
		←	Mute	
nSELECT	(‘93’ ‘70’ ~UIDTX1 CRC_A)	→		HALT
		←	Mute	
RATS	(e.g. ‘E0’ ‘00’ CRC_A)	→		HALT
		←	Mute	
ERROR (RFU short frame)	RFU_SHORT_FRAME (0100111)b*	→		HALT
		←	Mute	
ERROR (wrong CRC)	(‘93’ ‘70’ UIDTX1 CRC_A)	→		HALT
		←	Mute	
ERROR (ISO-block)	(e.g. ‘C2’ ‘00’ CRC_A) (*)	→		HALT
		←	Mute	

* According to ISO/IEC 14443-4:2001 clause 6.3.1 there are 101 RFU values for short frame: $(2^7 – (3 + 2^3 + 2^4) = 101$).
In the test report indicate what percentage of the combinations was tested.

G.3.4.8.3 Test report

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

Short Frame has 101 RFU combinations. In the test report indicate what percentage of the 101 RFU combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

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

G.3.4.9 Behaviour of the PICC type A in the READY* state (single/multiple UIDs)

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.3.4.9.1 Apparatus

See clause G.2.

G.3.4.9.2 Procedure

For every state transition T in the following table do

a) Put the PICC into READY* state as described in clause G.3.4.3

b) Apply the state transition T as described in the PICC-test-apparatus column

c) Check the answer from the card as described in the PICC column

d) Check the target state of the card according to clause 0

Scenario A 8 — Behaviour of the PICC type A in the READY* State (single/multiple UIDs)

Transition	PICC-test-apparatus		PICC	Target State
REQA	(0100110)b	→		HALT
		←	Mute	
WUPA	(1010010)b	→		HALT
		←	Mute	
AC (split byte)	(‘93’ ‘25’ UIDTX1[1..5])	→		READY*
		←	UIDTX1[6..32] BCC	
nAC (split byte)	(‘93’ ‘25’ UIDTX1[1..4] ~UIDTX1[5])	→		HALT
		←	Mute	
AC (full byte)	(‘93’ ‘25’ UIDTX1[1..16])	→		READY*
		←	UIDTX1[17..32] BCC	
nAC (full byte)	(‘93’ ‘40’ UIDTX1[1..15] ~UIDTX1[16])	→		HALT
		←	Mute	
HALTA	(‘50’ ‘00’ CRC_A)	→		HALT
		←	Mute	
ERROR (RFU short frame)	RFU_SHORT_FRAME (0100111)b*	→		HALT
		←	Mute	
ERROR (wrong CRC)	(‘93’ ‘70’ UIDTX1 CRC_A)	→		HALT
		←	Mute	
ERROR (ISO block)	(e.g. ‘C2’ ‘00’ CRC_A)	→		HALT
		←	Mute	

* According to ISO/IEC 14443-4:2001 clause 6.3.1 there are 101 RFU values for short frame: $(2^7 – (3 + 2^3 + 2^4) = 101$).
In the test report indicate what percentage of the combinations was tested.

Depending on the PICC UID cascade level perform also tests according to Scenario A 9 or Scenario A 10 or Scenario A 11.

G.3.4.9.3 Behaviour of the PICC type A in the READY* state (single UIDs)

These tests are for single UID cards only.

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*
		←	SAK(complete)	
nSELECT	(‘93’ ‘70’ ~UIDTX1 CRC_A)	→		HALT
		←	Mute	

G.3.4.9.4 Behaviour of the PICC type A in the READY* state (double UIDs)

These tests are for double UID cards only.

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*
		←	SAK(cascade)	
SELECT level 2	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ UIDTX2 CRC_A)	→		ACTIVE*
		←	SAK(complete)	
nSELECT level 1	(‘93’ ‘70’ ~UIDTX1 CRC_A)	→		HALT
		←	Mute	
nSELECT level 2	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ ~UIDTX2 CRC_A)	→		HALT
		←	Mute	

G.3.4.9.5 Behaviour of the PICC type A in the READY* state (triple UIDs)

These tests are for triple UID cards only.

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*
		←	SAK(cascade)	
SELECT level 2	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ UIDTX2 CRC_A)	→		READY*
		←	SAK(cascade)	
SELECT level 3	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘97’ ‘70’ UIDTX2 CRC_A)	→		ACTIVE*
		←	SAK(complete)	
nSELECT level 1	(‘93’ ‘70’ ~UIDTX1 CRC_A)	→		HALT
		←	Mute	
nSELECT level 2	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ ~UIDTX2 CRC_A)	→		HALT
		←	Mute	
nSELECT level 3	(‘93’ ‘70’ UIDTX1 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘95’ ‘70’ UIDTX2 CRC_A)	→		*don’t check*
		←	SAK(cascade)	
	(‘97’ ‘70’ ~UIDTX3 CRC_A)	→		HALT
		←	Mute	

G.3.4.9.6 Test report

Record the presence, the content of the PICC responses.

Short Frame has 101 RFU combinations. In the test report indicate what percentage of the 101 RFU combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

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

G.3.4.10 Behaviour of the PICC type A in the ACTIVE* state (single/multiple UIDs)

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.3.4.10.1 Apparatus

See clause G.2.

G.3.4.10.2 Procedure

For every state transition T in the following table do

a) Put the PICC into ACTIVE* state as described in clause G.3.4.3

b) Apply the state transition T as described in the PICC-test-apparatus column

c) Check the answer from the card as described in the PICC column

d) Check the target state of the card according to clause 0

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

Transition	PICC-test-apparatus		PICC	Target State
REQA	(0100110)b	→		HALT
		←	Mute	
WUPA	(1010010)b	→		HALT
		←	Mute	
AC (split byte)	(‘93’ ‘25’ UIDTX1[1..5])	→		HALT
		←	Mute	
nAC (split byte)	(‘93’ ‘25’ UIDTX1[1..4] ~UIDTX1[5])	→		HALT
		←	Mute	
AC (full byte)	(‘93’ ‘40’ UIDTX1[1..16])	→		HALT
		←	Mute	
nAC (full byte)	(‘93’ ‘40’ UIDTX1[1..15] ~UIDTX1[16])	→		HALT
		←	Mute	
HALTA	(‘50’ ‘00’ CRC_A)	→		HALT
		←	Mute	
SELECT	(‘93’ ‘70’ UIDTX1 CRC_A)	→		HALT
		←	Mute	
nSELECT	(‘93’ ‘70’ UIDTX1 CRC_A)	→		HALT
		←	Mute	
RATS	(e.g. ‘E0’ ‘00’ CRC_A)	→		ISO/IEC 14443-4
		←	ATS	
ERROR (RFU short frame)	RFU_SHORT_FRAME (0100111)b *	→		HALT
		←	Mute	
ERROR (wrong CRC)	(‘93’ ‘70’ UIDTX1 CRC_A)	→		HALT
		←	Mute	
ERROR (ISO-block)	(e.g. ‘C2’ ‘00’ CRC_A)	→		HALT
		←	Mute	

* According to ISO/IEC 14443-4:2001 clause 6.3.1 there are 101 RFU values for short frame: $(2^7 – (3 + 2^3 + 2^4) = 101$).
In the test report indicate what percentage of the combinations was tested.

G.3.4.10.3Test report

Record the presence, the content of the PICC responses.

Short Frame has 101 RFU combinations. In the test report indicate what percentage of the 101 RFU combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

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

G.3.5 Handling of Bitwise Anticollision

The purpose of this test is to determine the handling of bitwise anticollision by the PICC type A according to ISO/IEC 14443-3 2001: 6.4.3.

G.3.5.1 Apparatus

See clause G.2.

G.3.5.2 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.3.5.2.1 Definitions:

See G.3.4.1 for general terminology.

PICC_levels number of PICC UID cascade levels.

PICC_answer PICC response of the last sent command

SEL(l) SEL(1) = 93; SEL(2) = 95; SEL(3) = 97

UIDTX(cl) Use ID as transmitted by the PICC for cascade level c, see G.3.4.1

BCC the one byte block checksum

NVB NVB byte

Scenario A 13 — Handling of Bitwise Anticollision

```
BOOL AnticollisionTest
1)  for cl = 1 to PICC_levels do
2)      Put PICC into READY state
3)      if cl = 1 then
4)          Send '93' UIDTX1 CRC_A
5)     if PICC_answer is incorrect then
6)          return FALSE
7)      if cl = 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(cl)[1..pos])
15)         if PICC_answer != UIDTX(cl)[pos+1..32] BCC)
16)             return FALSE
17)         Send WUPA
18)         Send (SEL(cl) NVB UIDTX(cl)[1..pos-1] ~UIDTX(cl)[pos])
19)         if PICC_answer != Mute
20)             return FALSE
21)     end
22)     Send (SEL(cl) '70' UIDTX(cl)[1..31] ~UID(cl)[32] CRC_A)
23)     if PICC_answer != Mute
24)         return FALSE
25)     Send (SEL(cl) NVB UIDTX(cl) 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.3.5.3 Test report

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

Explanation	Test result
If the Anticollision procedure returns TRUE	Pass
If the Anticollision procedure returns FALSE	Fail

G.3.6 Handling of RATS and ATS 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.3.6.1 Handling of RATS and ATS with valid parameters

G.3.6.1.1 Apparatus

See clause G.2.

G.3.6.1.2 Procedure 1 (for PICCs supporting CID)

For the following CID and FSDI values:

$0 \leq CID \leq 14$

$0 \leq FSDI \leq 8$

perform the following actions:

a) Put the PICC into ACTIVE state as described in clause G.3.4.3

b) Send RATS (CID, FSDI)

c) Check the answer from the card as described in the PICC column. Ensure, that ATS returned by ICC does not include RFU bits. Bit8 of the format byte T0 shall be set to 0 and FSDI shall be not in range {'9'-'F'}.Bit 4 of the interface byte TA(1) shall be set to 0. SFGI value (in TB(1)) shall be other than 15. Bits b8 to b3 of the interface byte TC(1) shall be (000000)b.

Scenario A 14 — Handling of RATS for PICC supporting CID

Test	PICC-test-apparatus		PICC
RATS (CID*, FSDI**)	('E0' PARAM*** CRC_A)	⟶	
		⟵	ATS

* $0 \leq CID \leq 14$

** $0 \leq FSDI \leq 8$

*** PARAM[0..3] = CID, PARAM[4..7] = FSDI

G.3.6.1.3 Procedure 2 (for PICCs not supporting CID)

For the following FSDI values:

$0 \leq FSDI \leq 8$

perform the following actions:

a) Put the PICC into ACTIVE state as described in clause G.3.4.3

b) Send RATS (0, FSDI)

c) Check the answer from the card as described in the PICC column. Ensure, that ATS returned by ICC does not include RFU bits. Bit8 of the format byte T0 shall be set to 0 and FSDI shall be not in range {'9'-'F'}.Bit 4 of the interface byte TA(1) shall be set to 0. SFGI value (in TB(1)) shall be other than 15. Bits b8 to b3 of the interface byte TC(1) shall be (000000)b.

Scenario A 15 — Handling of RATS for PICC not supporting CID

Test	PICC-test-apparatus		PICC
RATS (CID, FSDI*)	('E0' PARAM** CRC_A)	⟶	
		⟵	ATS

* $0 \leq FSDI \leq 8$

** PARAM[0..3] = 0, PARAM[4..7] = FSDI

G.3.6.1.4 Test report

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

Explanation	Test result
If the PICC responded as expected and ATS does not include any RFU value	Pass
Any other case	Fail

G.3.6.2 Handling of RATS and ATS with invalid parameters

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

G.3.6.2.1 Apparatus

See clause G.2.

G.3.6.2.2 Procedure

For all transitions in the table below do

a) Put the PICC into ACTIVE state as described in clause G.3.4.3

b) Perform the tests as described under the "test" column in the table below

c) Check the answer from the card as described in the PICC column

Scenario A 16 — Handling of RATS with invalid parameters

Test	PICC-test-apparatus		PICC
RATS (15,0)	(‘E0’ ‘0F’ CRC_A)	⟶	
		⟵	Mute
RATS_badCRC	(‘E0’ ‘0F’ ~CRC_A)	⟶	
		⟵	Mute
RATS_RFU	(‘E0’ PARAM_RFU* CRC_A)	⟶	
		⟵	Mute
RATS_RATS	(e.g. ‘E0’ ‘00’ CRC_A)	⟶	
		⟵	ATS
	(e.g. ‘E0’ ‘00’ CRC_A)	⟶	
		⟵	Mute

* According to ISO/IEC 14443-4:2001 clause 5.1 there are 8 RFU values for RATS parameter byte (7(for FSDI) + 1(CID=15) = 8).

G.3.6.2.3 Test report

This command has 8 RFU combinations. In the test report indicate what percentage of the combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

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

G.3.7 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.3.7.1 Handling of PPS request with valid parameters

G.3.7.1.1 Apparatus

See clause G.2.

G.3.7.1.2 Procedure

Perform the following actions for all supported DRI and DSI values (as reported by the TA(1) ATS interface byte). If no explicit DSI and DRI values are supported then use only DSI=0 and DRI=0.

a) Put the PICC into ISO/IEC 14443 state as described in clause G.3.4.3

b) Apply the Test commands

c) Check the answer from the card

Scenario A 17 — Handling of PPS (valid parameters)

Test	PICC-test-apparatus		PICC
PPS(DRI,DSI)	(‘D0’ ‘11’ PARAM* CRC_A)	→	
		←	(‘D0’ CRC_A)

* PARAM[0..1] = DRI, PARAM[2..3] = DSI, PARAM[4..7] =(0000)b

G.3.7.2 Handling of PPS request with invalid parameters (unsupported DSI/DRI)

G.3.7.2.1 Apparatus

See clause G.2.

G.3.7.2.2 Procedure

Perform the following actions for all unsupported DRI and DSI values (as reported by the TA(1) ATS interface byte).

a) Put the PICC into ISO/IEC 14443 state as described in clause G.3.4.3

b) Apply the Test command PPS(DRI,DSI)

c) Check the answer from the card

Scenario A 18 — Handling of PPS (unsupported DRI and DSI)

Test	PICC-test-apparatus		PICC
PPS(DRI,DSI)	(‘D0’ ‘11’ PARAM* CRC_A)	→	
		←	Mute

* PARAM[0..1] = DRI, PARAM[2..3] = DSI, PARAM[4..7] =(0000)b

G.3.7.3 Handling of PPS request with invalid parameters

G.3.7.3.1 Apparatus

See clause G.2.

G.3.7.3.2 Procedure

For every state transition T in the following table do

a) Put the PICC into ISO/IEC 14443 state as described in clause G.3.4.3

b) Apply the Test command PPS(DRI,DSI)

c) Check the answer from the card

Scenario A 19 — Handling of PPS (invalid parameters)

Test	PICC-test-apparatus		PICC
PPS(0,0)	(‘D0’ ‘11’ '00' CRC_A)	→	
		←	(D0 CRC_A)
PPS(0,0)	(‘D0’ ‘11’ '00' CRC_A)	→	
		←	Mute
PPS_badCRC	(‘D0’ ‘00’ ~CRC_A)	→	
		←	Mute
PPS_RFU	(‘D0’ PPS0_RFU* PPS1_RFU** CRC_A)	→	
		←	Mute
PPS(0,0)	(‘D0’ ‘11’ '00' CRC_A)	→	
		←	Mute

* According to ISO/IEC 14443-4:2001 clause 5.3 there are 49 RFU values for PPS0 ($(2^3-1)*(2^3-1) = 49$).

** According to ISO/IEC 14443-4:2001 clause 5.3 there are 15 RFU values for PPS1 ($(2^4-1) = 15$).

G.3.7.4 Test report

This command has 64 RFU combinations (49 + 15 = 64). In the test report indicate what percentage of the combinations was tested.

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

Explanation	Test result
If the PICC responded as expected	Pass
Any other case	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 G.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 (e.g. ’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 105 with measured values from c).

G.4.2 PICC Reception

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

G.4.2.1 Apparatus

See clause G.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
Transmit
Subcarrier

a) Send a valid REQB Command frame (’05 00 00 71 FF’) for which bit boundaries, EGT, SOF timing and EOF timing vary within the limits given in ISO/IEC 14443-3:2001

b) Record the presence and the content of the PICC response.

c) Repeat the procedure and report the number of cycles and the variations in the parameters.

G.4.2.3 Test report

Report the signal recording and the ATQB. Fill the “Table G. 7 — Reported Results for type B specific test methods” on page 107 with measured values from a) up to c).

G.4.3 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.4.3.1 Apparatus

See clause G.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.

RF I/O
Receive
Transmit
Subcarrier

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.4.3.3 Test report

Report the signal recording and the ATQB. Fill the “Table G. 5 — Type B specific timing table” on page 105 with measured values from c) up to g).

G.4.4 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.4.4.1 Apparatus

See clause G.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.

RF I/O
Receive
Transmit
Subcarrier

a) Send a valid REQB Command frame (e.g. '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.4.4.3 Test report

Report the signal recording. Fill the "Table G. 5 — Type B specific timing table" on page 105 with measured values from c) and d).

G.4.5 Test for ATQB RFU and invalid values

The purpose of this test is to ensure that Answer To Request (ATQB) does not include RFU values (in Application Data, FWI, Protocol_Type, Max_Frame_Size and Bit_Rate_capability).

G.4.5.1 Procedure

Place the PICC into the field.

a) Send a valid REQB Command frame (e.g. '05 00 00 71 FF').

b) Record the presence and the content of the PICC response.

G.4.5.2 Test report

Fill the appropriate row in “Table G. 6 — Reported Results for type A specific test methods“ on page 106 with test result according to the test results as follows:

Explanation	Test result
If the ATQB does not include RFU values	Pass
Any other case	Fail

G.4.6 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 reject all messages other than REQB and WUPB.

G.4.6.1 Apparatus

See clause G.2.

G.4.6.2 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
Transmit

G.4.6.2.1 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 (e.g. '05 00 00 71 FF')	→	
	←	ATQB

G.4.6.2.1.1 Expected result

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

G.4.6.2.1.2 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 107 according to the test results as follows:

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

G.4.6.2.2 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

PICC-test-apparatus		PICC
WUPB command (e.g. '05 00 08 CRC_B')	→	
	←	ATQB

G.4.6.2.2.1 Expected result

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

G.4.6.2.2.2 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 107 according to the test results as follows:

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

G.4.6.2.3 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.

f) Send a valid I-block Command frame.

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

PICC-test-apparatus		PICC
SLOT_MARKER commands (e.g.‘15 54 B7’, ’25 D7 86’, etc.)	→	
	←	Mute
ATTRIB Command (e.g.‘1D 12 23 34 45 00 06 01 04 74 61’)	→	
	←	Mute
HLTB Command (e.g.‘50 12 23 34 45 F6 68’)	→	
	←	Mute
DESELECT S-block (e.g. ‘CA CID CRC_B’ or ‘C2 CRC_B’) *	→	
	←	Mute
Any valid I-block command	→	
	←	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.4.6.3 Expected result

No PICC's response is expected.

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 107 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.4.7 Behaviour of the PICC type B in the READY REQUESTED state

The purpose of this test is to determine the behaviour of the PICC in the READY REQUESTED state according to ISO/IEC 14443-3 2001: 7.4.5. This test tries to cause the card to answer to commands.

G.4.7.1 Apparatus

See clause G.2.

G.4.7.2 Procedure

Place the reference PICC into the field.

Enter the PICC to the READY REQUESTED state by following actions:

a) Send a valid REQB Command frame with slot number > 1.

b) No PICC response should be received (i.e. PICC entered READY REQUESTED state). If any PICC response (ATQB) is received, send the REQB command again until no response is received from PICC.

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
Transmit

a) Send a valid ATTRIB Command frame.

b) Send a valid HLTB Command frame.

c) Send a valid DESELECT S-block Command frame.

d) Send a valid I-block Command frame.

e) Send a valid SLOT_MARKER command.

f) Send a valid REQB Command frame.

g) Send a valid WUPB Command frame.

Scenario B 4 — Behaviour of the PICC type B in the READY REQUESTED state with unsupported commands

PICC-test-apparatus		PICC
ATTRIB Command (e.g.‘1D 12 23 34 45 00 06 01 04 74 61’)	→	
	←	Mute
HLTB Command (e.g.‘50 12 23 34 45 F6 68’)	→	
	←	Mute
DESELECT S-block (e.g. ‘CA CID CRC_B’ or ‘C2 CRC_B’) *	→	
	←	Mute
Any valid I-block command	→	
	←	Mute

Scenario B 5 — Behaviour of the PICC type B in the READY REQUESTED state with supported commands

PICC-test-apparatus		PICC
SLOT_MARKER commands (e.g.‘15 54 B7’, ’25 D7 86’, etc.)	→	
	←	ATQB or Mute
REQB command (e.g.‘05 00 00 CRC_B')	→	
	←	ATQB
WUPB command (e.g.‘05 00 08 CRC_B')	→	
	←	ATQB

NOTE If the tester knows characteristics of the PICC under the test, he may be able to choose the appropriate S(DESELECT) request block to send to the PICC. If PICC has a CID of 0, it will be able to accept a block containing no CID. If its CID is different from 0, the PICC test apparatus shall send an S-block containing the CID.

G.4.7.3 Expected result

The PICC shall respond to only REQB/WUPB and SLOT_MARKER command frames.

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 107 according to the test results as follows:

Explanation	Test result
For Scenario B 4	
If no PICC response is received	Pass
If any PICC response is received	Fail
For Scenario B 5	
If any PICC response is received	Pass
If no PICC response is received	Fail

G.4.8 Behaviour of the PICC type B in the READY DECLARED state

The purpose of this test is to determine the behaviour of the PICC in the READY DECLARED state according to ISO/IEC 14443-3 2001: 7.4.6. This test tries to cause the card to answer to commands.

G.4.8.1 Apparatus

See clause G.2.

G.4.8.2 Procedure

Place the reference PICC into the field.

Enter the PICC to the READY DECLARED state by following actions:

a) Send a valid REQB Command frame with slot number = 1.

b) Extract the PUPI from the ATQB response. Assume, that PUPI of the PICC is ’12 23 34 45’ and the PICC supports CID.

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
Transmit

a) Send a valid SLOT_MARKER command.

b) Send a valid DESELECT S-block Command frame.

c) Send a valid I-block Command frame.

d) Send a valid ATTRIB Command frame.

e) Send a valid REQB Command frame.

f) Send a valid WUPB Command frame.

g) Send a valid HLTB Command frame.

Scenario B 6 — Behaviour of the PICC type B in the READY DECLARED state with unsupported commands

PICC-test-apparatus		PICC
SLOT_MARKER commands (e.g.‘15 54 B7’, ’25 D7 86’, etc.)	⟶	
	⟵	Mute
DESELECT S-block (e.g. ‘CA CID CRC_B’ or ‘C2 CRC_B’) *	⟶	
	⟵	Mute
Any valid I-block command	⟶	
	⟵	Mute

Scenario B 7 — Behaviour of the PICC type B in the READY DECLARED state with supported commands

PICC-test-apparatus		PICC
ATTRIB Command (e.g.‘1D 12 23 34 45 00 06 01 04 74 61’)	⟶	
	⟵	Answer to ATTRIB
REQB command (e.g.‘05 00 00 CRC_B')	⟶	
	⟵	ATQB
WUPB command (e.g.‘05 00 08 CRC_B')	⟶	
	⟵	ATQB
HLTB Command (e.g.‘50 12 23 34 45 F6 68’)	⟶	
	⟵	Answer to HLTB

G.4.8.3 Expected result

The PICC shall respond to only REQB/WUPB ATTRIB and HLTB command frames.

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 107 according to the test results as follows:

Explanation	Test result
For Scenario B 6	
If no PICC response is received	Pass
If any PICC response is received	Fail
For Scenario B 7	
If any PICC response is received	Pass
If no PICC response is received	Fail

G.4.9 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.4.9.1 Apparatus

See clause G.2.

G.4.9.2 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 (e.g.’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 (e.g.‘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.

RF I/O
Receive
Transmit
Subcarrier

a) Send a valid REQB Command frame (e.g. '05 00 00 71 FF’).

b) Send a valid ATTRIB Command frame (e.g.‘1D 12 23 34 45 00 06 01 04 74 61’).

c) Send a valid SLOT_MARKER Command frame (e.g.‘15 54 B7’).

d) Send a valid WUPB Command frame (e.g.'05 00 08 CRC_B').

e) Send a valid HLTB Command frame (e.g. '50 12 23 34 45 CRC_B').

f) Send a valid DESELECT S-block Command frame (e.g. 'CA CID CRC_B').

g) Send any valid I-block command

Scenario B 8 — Behaviour of the PICC type B in the ACTIVE state with unsupported commands

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

Scenario B 9 — Behaviour of the PICC type B in the ACTIVE state with supported commands

PICC-test-apparatus		PICC
DESELECT S-block (e.g. 'CA CID CRC_B' or 'C2 CRC_B') *	→	
	←	DESELECT response
Any valid I-block command	→	
	←	I/R/S-block response

G.4.9.3 Expected result

The PICC shall respond to all higher layer messages. No PICC answer is expected for all anticollision command frames.

G.4.9.4 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 107 according to the test results as follows:

Explanation	Test result
For Scenario B 8	
If no PICC response is received	Pass
If any PICC response is received	Fail
For Scenario B 9	
If any PICC response is received	Pass
If no PICC response is received	Fail

G.4.10 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.4.10.1 Apparatus

See clause G.2.

G.4.10.2 Procedure

Place the reference PICC into the field.

Enter the PICC to the HALT state by the following 2 procedures. PICC should be tested with these both procedures:

G.4.10.2.1Procedure 1 for entering the PICC to the HALT state

a) Send a valid REQB Command frame (e.g. ’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 (e.g. ‘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 (e.g. 'CA 04 CRC_B’). The PICC enters the HALT state.

G.4.10.2.2Procedure 2 for entering the PICC to the HALT state

a) Send a valid REQB Command frame (e.g. ’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 HLTB Command frame (e.g. ‘50 12 23 34 45 F6 68’). 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.

RF I/O
Receive
Transmit

a) Send a valid REQB Command frame (e.g. ’05 00 00 71 FF’).

b) Send a valid SLOT_MARKER Command frame (e.g. ’15 54 B7’).

c) Send a valid ATTRIB Command frame (e.g. ‘1D 12 23 34 45 00 06 01 04 74 61’).

d) Send a valid HALT Command frame (e.g. ’50 12 23 34 45 CRC_B’).

e) Send a valid DESELECT S-block Command frame (e.g. ‘CA 04 CRC_B’).

f) Send a valid I-block Command frame.

g) Send a valid WUPB Command frame (e.g. ’05 00 08 CRC_B’).

Scenario B 10 — Behaviour of the PICC type B in the HALT state with unsupported commands

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

Scenario B 11 — Behaviour of the PICC type B in the HALT state with supported commands

PICC-test-apparatus		PICC
WUPB Command (e.g. ‘05 00 08 CRC_B’)	→	
	←	ATQB

G.4.10.3 Expected result

The PICC shall respond to only WUPB Command frame.

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 107 according to the test results as follows:

Explanation	Test result
For Scenario B 10	
If no PICC response is received	Pass
If any PICC response is received	Fail
For Scenario B 11	
If PICC response is received	Pass
If no PICC response is received	Fail

G.4.11 WUPB command

The purpose of this test is to determine the reaction of the PICC type B to the WUPB command frame with wrong parameters according to ISO/IEC 14443-3 2001: 7.7.

G.4.11.1 Apparatus

See clause G.2.

G.4.11.2 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 (e.g. ’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 (e.g. ‘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 (e.g. ‘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.

RF I/O
Receive
Transmit

a) Send a valid WUPB Command frame with wrong CRC_B value (e.g. ‘05 00 08 00 00’).

b) Send a valid WUPB command frame with RFU AFI value (e.g. ‘05 99 01 CRC_B’)

c) Send a valid WUPB command frame with RFU slots number (e.g. ‘05 00 0F CRC_B’).

d) Send a valid WUPB command frame with wrong PARAM parameter (e.g. ‘05 00 F0 CRC_B’).

Scenario B 12 — The PICC reaction to WUPB command

PICC-test-apparatus		PICC
WUPB Command with wrong CRC_B value (e.g. ‘05 00 08 00 00’)	→	
	←	Mute
WUPB Command with RFU AFI value (e.g. ‘05 RFU_AFI* 01 CRC_B’)	→	
	←	Mute
WUPB Command with RFU PARAM value (e.g. ‘05 00 RFU_PARAM** CRC_B’)	→	
	←	Mute
WUPB Command with wrong PARAM parameter (e.g. ‘05 00 F0 CRC_B’)	→	
	←	Mute

* According to ISO/IEC 14443-3:2001 clause 7.7.3 there are 112 RFU values for AFI ($7*2^4 = 112$).

** According to ISO/IEC 14443-3:2001 clause 7.7.4 there are 45 RFU values for PARAM ($(2^4-1)*3 = 45$).

G.4.11.3 Expected result

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

G.4.11.4 Test report

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

This command has 157 RFU bit combinations (112 + 45 = 157 assuming that RFU_AFI and RFU_PARAM are independent). In the test report indicate what percentage of the combinations was tested.

Fill the appropriate row in “Table G. 7 — Reported Results for type B specific test methods” on page 107 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 REQB command

The purpose of this test is to determine the reaction of the PICC to the REQB command frame with wrong parameters according to ISO/IEC 14443-3 2001: 7.7.

G.4.12.1 Apparatus

See clause G.2.

G.4.12.2 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
Transmit

a) Send a valid REQB command frame with RFU AFI value (e.g. ‘05 99 00 CRC_B’).

b) Send a valid REQB command frame with RFU slots number (e.g. ‘05 00 07 CRC_B’).

c) Send a valid REQB command frame with wrong PARAM parameter (e.g. ‘05 00 F0 CRC_B’).

d) Send a valid REQB command frame with wrong CRC value (e.g. ‘05 00 00 00 00’).

Scenario B 13 — The PICC reaction to the REQB command frame with wrong parameters

PICC-test-apparatus		PICC
REQB command with RFU AFI value (e.g. '05 AFI_RFU* 00 CRC_B’)	→	
	←	Mute
REQB command with RFU PARAM value (e.g. '05 00 PARAM_RFU** CRC_B’)	→	
	←	Mute
REQB command with wrong PARAM parameter (e.g. '05 00 F0 CRC_B’).	→	
	←	Mute
REQB command with wrong CRC value (e.g. '05 00 00 00 00’)	→	
	←	Mute

* According to ISO/IEC 14443-3:2001 clause 7.7.3 there are 112 RFU values for AFI ($7*2^4 = 112$).

** According to ISO/IEC 14443-3:2001 clause 7.7.4 there are 45 RFU values for PARAM ($(2^4-1)*3 = 45$).

G.4.12.3 Expected result

No card answer is expected for frames with wrong parameters.

G.4.12.4 Test report

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

This command has 157 RFU bit combinations (112 + 45 = 157 assuming that AFI and PARAM are independent). In the test report indicate what percentage of the combinations was tested.

Fill the appropriate row in “Table G. 7 — Reported Results for type B specific test methods” on page 107 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.4.13 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.4.13.1 Apparatus

See clause G.2.

G.4.13.2 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
Transmit

G.4.13.2.1Procedure 1

Place the reference PICC into the field.

a) Send a valid REQB command frame with the number of slots n = 2 (e.g. '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 $712/f_s$(TR0 + TR1 + FWT = $256/f_s$ + $200/f_s$ + $256/f_s$), then send a faulty Slot-Marker command frame with wrong APn parameter, e.g.: 16 CRC_B.

d) Repeat the same test procedure from a) to b). If the PICC does not start sending an ATQB within $712/f_s$, then send a valid Slot-Marker command frame with wrong CRC value (e.g. 'n5 00 00'), where n is the slot number.

This test may be repeated with REQB command with incremental numbers of slots. (n-1)*Slot-Marker command frame with wrong parameters must be sent for every REQB command with n number of slots.

Scenario B 14 — The PICC reaction to the SLOT-MARKER command frame with wrong parameters

PICC-test-apparatus		PICC
SLOT-MARKER commands (e.g. '16 CRC_B' etc.)	→	
	←	Mute
SLOT-MARKER commands with wrong CRC value (e.g. '15 00 00' , '25 00 00')	→	
	←	Mute

G.4.13.2.1.1 Expected result

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

G.4.13.2.1.2 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 107 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.4.13.2.2Procedure 2

Place the reference PICC into the field.

a) Send a valid REQB command frame with the number of slots n = 2 (e.g. '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, e.g.: 15 CRC_B

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

G.4.13.2.2.1 Expected result

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

G.4.13.2.2.2 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 107 according to the test results as follows:

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

G.4.14 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.4.14.1 Apparatus

See clause G.2.

G.4.14.2 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
Transmit

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 (e.g. '50 00 00 00 00 CRC_B’).

c) Send a valid HLTB command frame with an erroneous CRC (e.g. '50 12 23 34 45 00 00’).

d) Send a valid HLTB command (e.g. '50 12 23 34 45 CRC_B’).

Scenario B 15 — Reaction of the PICC to the HLTB command frame

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

G.4.14.3 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.4.14.4 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 107 according to the test results as follows:

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

G.4.15 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.

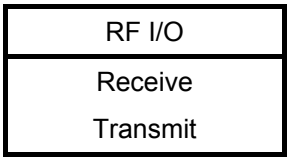
G.4.15.1 Apparatus

See clause G.2.

G.4.15.2 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 (e.g. '1D 00 00 00 00 00 06 01 04 CRC_B’).

c) Send a valid ATTRIB Command frame with RFU value for PARAM1 (e.g. PARAM1 = 0x03: ‘1D 12 23 34 45 03 06 01 04 CRC_B’).

d) Send a valid ATTRIB Command frame with RFU value for PARAM2 (e.g. PARAM2 = 0x0F: ‘1D 12 23 34 45 00 0F 01 04 CRC_B’).

e) Send a valid ATTRIB Command frame with RFU value for PARAM3 (e.g. PARAM3 = 0xF0: ‘1D 12 23 34 45 00 06 F0 04 CRC_B’)).

f) Send a valid ATTRIB Command frame with RFU value for PARAM4 (e.g. PARAM4 = 0xF0: ‘1D 12 23 34 45 00 06 01 F0 CRC_B’).

g) Send a valid ATTRIB Command frame with wrong CRC (e.g. '1D 12 23 34 45 00 06 01 04 00 00’).

Scenario B 16 — The PICC reaction of the to the ATTRIB command frame with wrong parameters

PICC-test-apparatus		**PICC**
ATTRIB command frame with wrong PUPI (e.g. '1D 00 00 00 00 00 06 01 04 CRC_B’).	→	
	←	Mute
ATTRIB command frame with RFU PARAM1 (e.g. PARAM1 = 0x03) (e.g. '1D 12 23 34 45 PARAM1_RFU* 06 01 04 CRC_B’).	→	
	←	Mute
ATTRIB command frame with RFU PARAM2 (e.g. PARAM2 = 0x0F): (e.g. '1D 12 23 34 45 00 PARAM2_RFU** 01 04 CRC_B’)	→	
	←	Mute

PICC-test-apparatus		PICC
ATTRIB command frame with RFU PARAM3 (e.g. PARAM3 = 0xF0) (e.g. '1D 12 23 34 45 00 06 PARAM3_RFU*** 04 CRC_B')	→	
	←	Mute
ATTRIB command frame with RFU PARAM4 (e.g. PARAM4 = 0x0F) (e.g. '1D 12 23 34 45 00 06 01 PARAM4_RFU**** CRC_B')	→	
	←	Mute
ATTRIB command frame with wrong CRC (e.g. '1D 12 23 34 45 00 06 01 04 00 00')	→	
	←	Mute

* According to ISO/IEC 14443-3:2001 clause 7.10.3 there are 6 RFU combinations for PARAM1: $(1+1+2^2 = 6)$.

** According to ISO/IEC 14443-3:2001 clause 7.10.4 there are 7 RFU combinations for PARAM2.

*** According to ISO/IEC 14443-3:2001 clause 7.10.5 there are 15 RFU combinations for PARAM3: $(2^4-1 = 15)$.

**** According to ISO/IEC 14443-3:2001 clause 7.10.6 there are 16 RFU combinations for PARAM4: $(1+2^4-1 = 16)$.

G.4.15.3 Expected result

No PICC answer is expected for all commands frames.

G.4.15.4 Test report

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

ATTRIB command has 44 RFU combinations (assuming that PARAM1 – PARAM4 are independent). In the test report indicate what percentage of the 44 RFU combinations was tested.

Fill the appropriate row in “Table G. 7 — Reported Results for type B specific test methods” on page 107 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.4.16 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.4.16.1 Apparatus

See clause G.2.

G.4.16.2 Procedure

Place the reference PICC into the field.

Activate the PICC by the following sequence:

a) Send a valid REQB Command frame (e.g. '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 TEST_COMMAND2.

e) Record the presence, the content and the timing of the PICC response.

f) PICC shall 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 17 — PCD Maximum Frame Size

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND2)	→	
	←	$I(1)_0$(INF = the first chain includes the first block of the answer to TEST_COMMAND2)
$R(ACK)_1$ (e.g. 'AB CID CRC_B' or 'A3 CRC_B')*	→	
	←	$I(0)_0$(INF = the last chain includes the last block of the answer to TEST_COMMAND2)

*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.4.16.3 Expected result

The PICC behaivior is expected according to the Scenario B 17.

G.4.16.4 Test report

Fill the appropriate row in "Table G. 7 — Reported Results for type B specific test methods" on page 107 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.4.17 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.4.17.1 Apparatus

See clause G.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.4.17.2 Procedure

Place the reference PICC into the field.

Activate the PICC by the following sequence:

a) Send a valid REQB Command frame (e.g. '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.

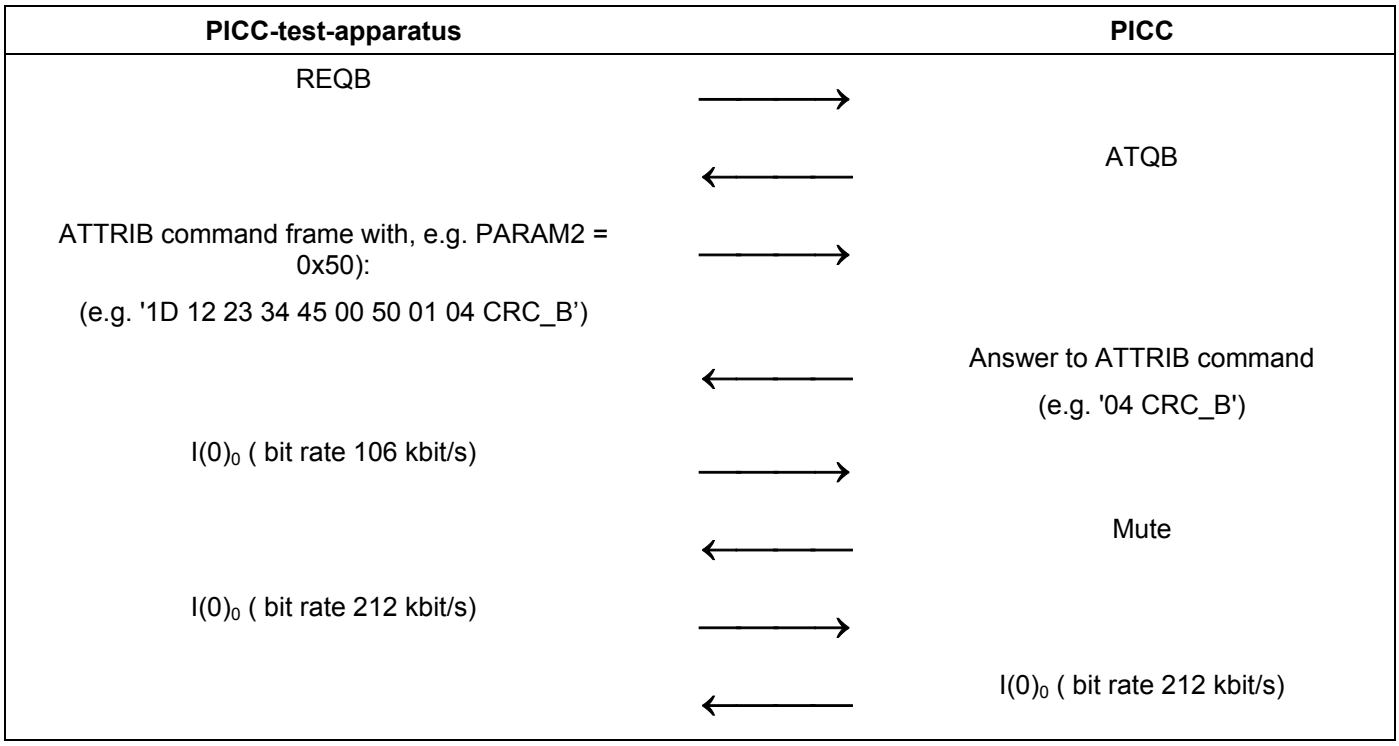
f) PICC shall stay mute.

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 18 — The PICC bit rate selection mechanism



G.4.17.3 Expected result

The PICC behaivior is expected according to the Scenario B 18.

G.4.17.4 Test report

Fill the appropriate row in “Table G. 7 — Reported Results for type B specific test methods” on page 107 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 G.2.

G.5.1.2 Procedure

Place the reference PICC into the field.

G.5.1.2.1 Procedure 1 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 7)

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 TEST_COMMAND1.

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 $R(NAK)_1$.

e) Record the response of the PICC. The PICC shall answer with $R(ACK)_0$.

Test Scenario 1 — Block sequencing by the PICC, Procedure 1 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 7)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)
$I(0)_1$ (INF=TEST_COMMAND1, CRC= wrong)	→	
	←	Mute
$R(NAK)_1$ (e.g. 'BB CID CRC' or 'B3 CRC') *	→	
	←	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')
$I(0)_1$ (INF=TEST_COMMAND1)	→	
	←	$I(0)_1$(INF=the answer to TEST_COMMAND1)

* 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.5.1.2.1.1 Expected result

The PICC behaivior is expected according to the Test Scenario 1.

G.5.1.2.1.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.1.2.2 Procedure 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 TEST_COMMAND1.

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 2 — Block sequencing by the PICC, Procedure 2

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND1)
$I(0)_1$ (INF=TEST_COMMAND1 CRC= wrong)	→	
	←	Mute
$I(0)_1$ (INF=TEST_COMMAND1 CRC= wrong)	→	
	←	Mute
$I(0)_1$ (INF=TEST_COMMAND1 CRC= wrong)	→	
	←	Mute

G.5.1.2.2.1 Expected result

The PICC behaivior is expected according to the Test Scenario 2.

G.5.1.2.2.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.1.2.3 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 first chain of TEST_COMMAND1.

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 the an erroneous block again.

e) 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 last chain of TEST_COMMAND1.

Test Scenario 3 — Block sequencing by the PICC, Procedure 3 (with chaining)

PICC-test-apparatus		PICC
$I(1)_0$ (INF = the first chain includes the first bytes of : TEST_COMMAND1)	→	
	←	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')*
$I(0)_1$(INF = the last chain includes the rest bytes of : TEST_COMMAND1, CRC= wrong)	→	
	←	Mute
$I(0)_1$(INF = the last chain includes the rest bytes of : TEST_COMMAND1, CRC= wrong)	→	
	←	Mute
$I(0)_1$(INF = the last chain includes the rest bytes of : TEST_COMMAND1)	→	
	←	$I(0)_1$(INF=the answer to TEST_COMMAND1)

* 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.5.1.2.3.1 Expected result

The PICC behaivior is expected according to the Test Scenario 3.

G.5.1.2.3.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 G.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, 7.5.4.3 rule 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 TEST_COMMAND1.

c) Wait for the answer of the PICC. The PICC shall answer with $I(0)_0$.

d) Send R-block $R(NAK)_0$ to the PICC. Get response from the PICC.

e) The PICC shall repeat the I-Block $I(0)_0$.

Test Scenario 4 — Retransmission by the PICC, Procedure 1 (ISO/IEC 14443-4:2001, 7.5.4.3 rule 11)

PICC-test-apparatus		PICC
$I(0)_0$ (INF=TEST_COMMAND1)	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')*	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 4.

G.5.2.2.1.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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)

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 TEST_COMMAND1.

c) Wait for the answer of the PICC. The PICC shall answer with $I(0)_0$.

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 $R(NAK)_0$ to the PICC..

f) Record the response of the PICC. The PICC shall answer with $I(0)_0$.

g) Send R-block $R(NAK)_0$ to the PICC. Get response from the PICC.

h) The PICC shall repeat the I-Block $I(0)_0$.

Test Scenario 5 —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=TEST_COMMAND1)	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND1)
$I(0)_1$ (INF=TEST_COMMAND1, CRC= wrong)	→	
	←	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')*	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')*	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND1)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 5.

G.5.2.2.2.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 first chain of TEST_COMMAND1.

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 last chain of TEST_COMMAND1.

h) Get response from the PICC. The PICC shall answer with the I-Block $I(0)_1$.

Test Scenario 6 — Retransmission by the PICC, Procedure 3 (with chaining)

PICC-test-apparatus		PICC
$I(1)_0$ (INF = the first chain includes the first bytes of : TEST_COMMAND1)	⟶	
	⟵	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')
$I(0)_1$(INF = the last chain includes the rest bytes of : TEST_COMMAND1) (CRC= wrong)	⟶	
	⟵	Mute
$R(NAK)_1$ (e.g. 'BB CID CRC' or 'B3 CRC') *	⟶	
	⟵	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')
$I(0)_1$(INF = the last chain includes the rest bytes of : TEST_COMMAND1)	⟶	
	⟵	$I(0)_1$(INF=the answer to TEST_COMMAND1)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 6.

G.5.2.2.3.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B" on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 the first chain of the TEST_COMMAND1.

c) Wait for the answer of the PICC. The PICC shall 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 shall answer with the R-Block $R(ACK)_0$.

g) Send I-block $I(1)_1$ with the INF field containing a continue of the TEST_COMMAND1.

h) Get response from the PICC. The PICC shall answer with the R-Block $R(ACK)_1$.

i) Send I-block $I(0)_1$ with the INF field containing the last chain of TEST_COMMAND1.

j) Get response from the PICC. The PICC shall answer with the I-Block $I(0)_1$.

Test Scenario 7 — Retransmission by the PICC, Procedure 4 (with chaining) (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 17)

PICC-test-apparatus		PICC
$I(1)_0$ (INF = the first chain includes the first bytes of : TEST_COMMAND1)	→	
	←	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')
$I(1)_1$(INF = the next chain includes next bytes of TEST_COMMAND1) (CRC = Wrong)	→	
	←	Mute
$R(NAK)_1$ (e.g. 'BB CID CRC' or 'B3 CRC') *	→	
	←	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')
$I(1)_1$(INF = the previous chain includes bytes of TEST_COMMAND1)	→	
	←	$R(ACK)_1$ (e.g. 'AB CID CRC' or 'A3 CRC')
$I(0)_0$(INF = the last chain includes the rest bytes of TEST_COMMAND1)	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 7.

G.5.2.2.4.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND3.

c) Wait for the answer of the PICC. The PICC shall answer with S(WTX) request. Please ensure, that WTXM value do not have values 0 and 60 to 63 (RFU).

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 shall retransmit the S(WTX) request.

g) Send S(WTX) response block to the PICC.

h) Get response from the PICC. The PICC shall answer with the I-Block $I(0)_0$.

Test Scenario 8 —Retransmission by the PICC, Procedure 5 (ISO/IEC 14443-4:2001, 7.5.4.2 rule 11, Informative Annex B, Scenario 12)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND3)	→	
	←	S(WTX) request
S(WTX) response (CRC= wrong)	→	
	←	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')*	→	
	←	S(WTX) request
S(WTX) response	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND3)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 8.

G.5.2.2.5.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 G.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 TEST_COMMAND2.

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 $I(0)_1$.

Test Scenario 9 — Reactions of the PICC to transmission errors

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND2)	→	
	←	$I(1)_0$
$R(ACK)_1$ (CRC = wrong) (e.g. 'AB CID CRC' or 'A3 CRC')*	→	
	←	Mute
$R(ACK)_1$ (e.g. '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 Expected result

The PICC behaivior is expected according to the Test Scenario 9.

G.5.3.2.1.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B" on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND2.

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 $I(0)_0$.

Test Scenario 10 — Reactions of the PICC to transmission errors (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 19)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND2)	→	
	←	$I(1)_0$(INF = the first chain of the answer to TEST_COMMAND2)
$R(ACK)_1$ (CRC = wrong) (e.g. 'AB CID CRC' or 'A3 CRC')*	→	
	←	Mute
$R(ACK)_1$ (e.g. 'AB CID CRC' or 'A3 CRC')*	→	
	←	$I(1)_1$(INF = the next chain of the answer to TEST_COMMAND2)
$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')*	→	
	←	$I(0)_0$(INF = the last chain of the answer to TEST_COMMAND2)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 10.

G.5.3.2.2.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B" on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND1.

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 shall answer with S(DESELECT) response.

Test Scenario 11 — Reactions of the PICC to transmission errors (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 15)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND1)
S(DESELECT) request (CRC = wrong) 'CA CID CRC' or 'C2 CRC' *	→	
	←	Mute
S(DESELECT) request 'CA CID CRC' or 'C2 CRC' *	→	
	←	S(DESELECT) response 'CA CID CRC' or 'C2 CRC'

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 11.

G.5.3.2.3.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B" on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 G.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 12 — Reactions of the PICC to protocol errors (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 6)

PICC-test-apparatus		PICC
$I(0)_0$ (unknown PCB encoding: PCB = 0x20)	⟶	
	⟵	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')*	⟶	
	⟵	$R(ACK)_1$ (e.g. 'AB CID CRC' or 'A3 CRC')

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 12.

G.5.4.4 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B" on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 G.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 shall 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 shall 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 shall not answer with S(DESELECT) response because the CID is released.

Test Scenario 13 — Reaction of the PICC to deactivation sequence

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND1)
S(DESELECT) request 'CA CID CRC' or 'C2 CRC' *	→	
	←	S(DESELECT) response 'CA CID CRC' or 'C2 CRC'
S(DESELECT) request 'CA CID CRC' or 'C2 CRC' *	→	
	←	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.5.5.2.1.1 Expected result

The PICC behaivior is expected according to the Test Scenario 13.

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 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 G.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 105 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 G.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 not answer with S(DESELECT) response because the CID is released.

Test Scenario 14 — Recovery of a transmission error during deactivation sequence

PICC-test-apparatus		PICC
$I(0)_0$ (unknown PCB encoding: PCB = 0x20)	→	
	←	Mute
S(DESELECT) request 'CA CID CRC' or 'C2 CRC' *	→	
	←	S(DESELECT) response 'CA CID CRC' or 'C2 CRC'
If the PICC-test-apparatus failed to receive an S(DESELECT) response: S(DESELECT) request 'CA CID CRC' or 'C2 CRC' *	→	
	←	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.5.7.3 Expected result

The PICC behaivior is expected according to the Test Scenario 14.

G.5.7.4 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B" on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 G.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 shall 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 shall answer with $I(0)_1$.

Test Scenario 15 — Exchange of I-blocks (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 1)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	⟶	
	⟵	$I(0)_0$(INF=the answer to TEST_COMMAND1)
$I(0)_1$(INF=TEST_COMMAND1)	⟶	
	⟵	$I(0)_1$(INF=the answer to TEST_COMMAND1)

G.5.8.2.1.1 Expected result

The PICC behaivior is expected according to the Test Scenario 15.

G.5.8.2.1.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND3.

c) Wait for the answer of the PICC. The PICC shall answer with S(WTX) request.

d) Send S(WTX) response block to the PICC.

e) Get response from the PICC. The PICC shall answer with the I-Block $I(0)_0$.

Test Scenario 16 — Waiting Time Extension (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 2)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND3)	→	
	←	S(WTX) request
S(WTX) response	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND3)

G.5.8.2.2.1 Expected result

The PICC behaivior is expected according to the Test Scenario 16.

G.5.8.2.2.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND1.

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

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$(INF=the answer to TEST_COMMAND1)
S(DESELECT) request 'CA CID CRC' or 'C2 CRC' *	→	
	←	S(DESELECT) response 'CA CID CRC' or 'C2 CRC'

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 17.

G.5.8.2.3.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 first chain of TEST_COMMAND1.

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 last chain of TEST_COMMAND1.

e) Get response from the PICC. The PICC shall answer with the I-Block $I(0)_1$.

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

PICC-test-apparatus		PICC
$I(1)_0$ (INF = the first chain includes the first bytes of TEST_COMMAND1)	⟶	
	⟵	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC') *
$I(0)_1$(INF = the last chain includes the rest bytes of TEST_COMMAND1)	⟶	
	⟵	$I(0)_1$(INF=the answer to TEST_COMMAND1)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 18.

G.5.8.2.4.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND2.

c) PICC shall 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 19 —Procedure 5 (with chaining) (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 5)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND2)	→	
	←	$I(1)_0$ (INF = the first chain of the answer to TEST_COMMAND2)
$R(ACK)_1$ (e.g. 'AB CID CRC' or 'A3 CRC')*	→	
	←	$I(1)_1$ (INF = the second chain of the answer to TEST_COMMAND2)
$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')*	→	
	←	$I(0)_0$ (INF = the last chain of the answer to TEST_COMMAND2)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 19.

G.5.8.2.5.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.8.2.6 Procedure 6 (only for PICC supporting NAD)

Repeat steps a)-g) from Procedure 5, using NAD in blocks sending to PICC.

G.5.8.2.6.1 Expected result

The PICC answer is expected according to the Scenario 19. NAD should only be present in the first packet of chaining.

G.5.8.2.6.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If NAD is only present in the first packet of chaining	Pass
In any other case	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 G.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 TEST_COMMAND1.

c) Wait for the answer of the PICC. The PICC shall 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 shall stay mute.

g) Send R-block $R(NAK)_0$ to the PICC.

h) Get response from the PICC. The PICC shall repeat the I-Block $I(0)_0$.

Test Scenario 20 —Procedure 1 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 9)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)
$R(NAK)_0$ (CRC = Wrong) (e.g. 'BA CID CRC' or 'B2 CRC') *	→	
	←	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 20.

G.5.9.2.1.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND3.

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 shall 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 21 —Procedure 2 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 11)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND3)	→	
	←	S(WTX)request
$R(NAK)_0$(CRC = Wrong) (e.g. 'BA CID CRC' or 'B2 CRC') *	→	
	←	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')	→	
	←	S(WTX) request
S(WTX) response	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND3)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 21.

G.5.9.2.2.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 TEST_COMMAND3.

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 shall stay mute.

i) PICC-test-apparatus sends $R(NAK)_0$ block.

j) PICC sends $I(0)_0$.

Test Scenario 22 —Procedure 3 (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 14)

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND3)	→	
	←	S(WTX) request
S(WTX) response	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND3)
$R(NAK)_0$(CRC = Wrong) (e.g. 'BA CID CRC' or 'B2 CRC') *	→	
	←	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC')	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND3)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 22.

G.5.9.2.3.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	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 PICC, with the INF field containing the first chain of the TEST_COMMAND1.

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 shall stay mute.

g) PICC-test-apparatus sends a valid $R(NAK)_0$.

h) PICC shall 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 shall answer with the I-Block $I(0)_0$

Test Scenario 23 —Procedure 4 (with chaining) (ISO/IEC 14443-4:2001, Informative Annex B, Scenario 18)

PICC-test-apparatus		PICC
$I(1)_0$ (INF = the first chain of TEST_COMMAND1)	→	
	←	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')
$R(NAK)_0$(CRC = Wrong) (e.g. 'BA CID CRC' or 'B2 CRC') *	→	
	←	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC' or 'B2 CRC') *	→	
	←	$R(ACK)_0$ (e.g. 'AA CID CRC' or 'A2 CRC')
$I(1)_1$ (INF = the second chain of TEST_COMMAND1)	→	
	←	$R(ACK)_1$ (e.g. 'AB CID CRC' or 'A3 CRC')
$I(0)_0$ (INF = the last chain of TEST_COMMAND1)	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)

* 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 Expected result

The PICC behaivior is expected according to the Test Scenario 23.

G.5.9.2.4.2 Test report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B" on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	Pass
If the PICC fails on at least one step of Test Scenario	Fail

G.5.10 PICC reaction to errors in PCB byte

The purpose of this test is to determine the reaction of the PICC to the I-block with wrong PCB parameters according to ISO/IEC 14443-4 2001:7.1.1.1.

G.5.10.1 Apparatus

See clause G.2.

G.5.10.2 Procedure

Place the reference PICC into the field.

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

G.5.10.2.1PCB byte of I-block

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

b) For PICC supporting CID, send an I-block (0000**0**010$_b$) with CID in the prologue field, and the INF field containing TEST_COMMAND1.

c) For PICC supporting CID, send an I-block (0000**1**010$_b$) without CID in the prologue field, and the INF field containing TEST_COMMAND1.

d) For PICC supporting CID, send an I-block (0000**0**010$_b$) without CID in the prologue field, and the INF field containing TEST_COMMAND1.

e) For PICC not supporting CID, send an I-block (0000**0**010$_b$) with CID in the prologue field, and the INF field containing TEST_COMMAND1.

f) For PICC not supporting CID, send an I-block (0000**1**010$_b$) without CID in the prologue field, and the INF field containing TEST_COMMAND1.

g) For PICC not supporting CID, send an I-block (0000**1**010$_b$) with CID in the prologue field, and the INF field containing TEST_COMMAND1.

h) For step (b) – (g), test all cases with CID equal to 0 and CID not equal to 0.

i) For PICC supporting and not supporting CID, send an erroneous I-block (with and without CID bit set) with wrong block coding (**01**00x010$_b$) and the INF field containing TEST_COMMAND1.

j) For PICC supporting and not supporting CID, send an erroneous I-block (with and without CID bit set) with wrong RFU bit set (00**1**0x010$_b$), (0000x0**0**0$_b$) and the INF field containing TEST_COMMAND1.

k) For PICC supporting and not supporting CID, send a valid I-block (with and without CID bit set) with INF field empty or incomplete. PICC shall stay mute.

l) For PICC supporting and not supporting CID, send an erroneous I-block (with and without CID bit set) with CRC error.

m) For PICC supporting and not supporting CID, send an I-block (with and without CID bit set) without epilogue field.

n) Repeat step (a) – (g) for NAD.

o) For PICC supporting and not supporting NAD, send an erroneous I-block block (with and without NAD bit set) with wrong block coding (**01**00x010$_b$) - (**11**00x010$_b$) and the INF field containing TEST_COMMAND1.

p) For PICC supporting and not supporting NAD, send an erroneous I-block (with and without NAD bit set) with wrong RFU bit set (00**1**0xx10$_b$) and the INF field containing TEST_COMMAND1.

q) For PICC supporting and not supporting NAD, send an erroneous I-block (with and without NAD bit set) with wrong RFU bit set (0000xx**0**0_b) and the INF field containing TEST_COMMAND1.

r) For PICC supporting and not supporting NAD, send an erroneous I-block (with and without NAD bit set) with wrong initial block number (0000x01**1**$_b$) and the INF field containing TEST_COMMAND1.

s) For PICC supporting and not supporting NAD, send a valid I-block (with and without NAD bit set) with INF field empty. PICC shall stay mute.

t) For PICC supporting and not supporting NAD, send an erroneous I-block (with and without NAD bit set) with CRC error.

u) For PICC supporting and not supporting NAD, send an I-block (with and without CID bit set) without epilogue field.

v) Repeat step (a) – (u) for PICC that support both CID and NAD.

w) Repeat step (a) – (u) for PICC that do not support both CID and NAD.

x) For PICC not supporting NAD, send an erroneous I-block (with NAD bit set) including NAD and the INF field containing TEST_COMMAND1.

G.5.10.2.2Expected Result

No PICC answer is expected for all commands frames.

G.5.10.2.3Test Report

This test has RFU combinations. In the test report indicate what combinations was tested.

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 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.5.10.3 PCB byte of R-block

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

b) For PICC supporting CID, send a R-block (101x**0**010_b) with CID in the prologue field, and empty INF field.

c) For PICC supporting CID, send a R -block (101x**1**010_b) without CID in the prologue field, and empty INF field.

d) For PICC supporting CID, send a R -block (101x**0**010_b) without CID in the prologue field, and empty INF field.

e) For PICC not supporting CID, send a R-block (101x**0**010_b) with CID in the prologue field, and empty INF field.

f) For PICC not supporting CID, send a R-block (101x**1**010_b) without CID in the prologue field, and empty INF field.

g) For PICC not supporting CID, send a R-block (101x**1**010_b) with CID in the prologue field, and empty INF field.

h) For PICC supporting and not supporting CID, send an erroneous R-block (with and without CID bit set) with wrong block coding (**01**0xx010_b).

i) For PICC supporting and not supporting CID, send an erroneous R-block (with and without CID bit set) with wrong RFU bit set (10**0**xx010_b). This test includes 2^2=4 RFU combinations for PCB.

j) For PICC supporting and not supporting CID, send an erroneous R-block (with and without CID bit set) with wrong RFU bit set (101xx**00**0_b), (101xx**10**0_b) & (101xx**11**0_b).

k) For PICC supporting and not supporting CID, send an erroneous R-block (with and without CID bit set) with INF field containing TEST_COMMAND1 and incomplete INF field to PICC.

l) For PICC supporting and not supporting CID, send an erroneous R-block (with and without CID bit set) with CRC error.

m) For PICC supporting and not supporting CID, send an R-block (with and without CID bit set) without epilogue field.

G.5.10.3.1Expected Result

No PICC answer is expected for all commands frames.

G.5.10.3.2Test Report

This test has 4 RFU bit combinations. In the test report indicate what percentage of the 4 RFU combinations was tested.

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 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.5.10.4 PCB byte of S-block (DESELECT)

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

b) For PICC supporting CID, send a S-block (1100**0**010_b) with CID in the prologue field, and empty INF field.

c) For PICC supporting CID, send a S-block (1100**1**010_b) without CID in the prologue field, and empty INF field.

d) For PICC supporting CID, send a S-block (1100**0**010_b) without CID in the prologue field, and empty INF field.

e) For PICC not supporting CID, send a S-block (1100**1**010_b) without CID in the prologue field, and empty INF field.

f) For PICC not supporting CID, send a S-block (1100**1**010_b) without CID in the prologue field, and empty INF field.

g) For PICC not supporting CID, send a S-block (1100**1**010$_b$) with CID in the prologue field, and empty INF field.

h) For PICC supporting and not supporting CID, send an erroneous S(DESELECT) (with and without CID bit set) with wrong RFU bit set (1100x**000**$_b$) - (1100x**111**$_b$) excluding (1100x010$_b$). This test includes (2^3-1)=7 RFU combinations for PCB.

i) For PICC supporting and not supporting CID, send an erroneous S(DESELECT) (with and without CID bit set) with INF field containing TEST_COMMAND1 and incomplete INF field to PICC.

j) For PICC supporting and not supporting CID, send an erroneous S(DESELECT) (with and without CID bit set) with CRC error.

k) For PICC supporting and not supporting CID, send an S(DESELECT) (with and without CID bit set) without epilogue field.

G.5.10.4.1 Expected Result

No PICC answer is expected for all commands frames.

G.5.10.4.2 Test Report

This test has 7 RFU bit combinations. In the test report indicate what percentage of the 7 RFU combinations was tested.

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 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.5.10.5 PCB byte of S-block (Waiting Time Extension)

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

b) For PICC supporting CID, send a S-block (1111**0**010$_b$) with CID in the prologue field, and 1 byte long INF field.

c) For PICC supporting CID, send a S-block (1111**1**010$_b$) without CID in the prologue field, and 1 byte long INF field.

d) For PICC supporting CID, send a S-block (1111**0**010$_b$) without CID in the prologue field, and 1 byte long INF field.

e) For PICC not supporting CID, send a S-block (1111**1**010$_b$) without CID in the prologue field, and 1 byte long INF field.

f) For PICC not supporting CID, send a S-block (1111**1**010$_b$) without CID in the prologue field, and 1 byte long INF field.

g) For PICC not supporting CID, send a S-block (1111**1**010$_b$) with CID in the prologue field, and 1 byte long INF field.

h) For PICC supporting and not supporting CID, send an erroneous $S(WTX)_{response}$ (with and without CID bit set) with wrong block coding (**00**11x010$_b$), (**01**11x010$_b$) & (**10**11x010$_b$), and 1 byte long INF field.

i) For PICC supporting and not supporting CID, send an erroneous $S(WTX)_{response}$ (with and without CID bit set) with wrong RFU bit set (1111x**000**$_b$) - (1111x**111**$_b$) excluding (1111x010$_b$) , and 1 byte long INF field.This test includes $2*(2^3-1)=14$ RFU combinations for PCB.

j) For PICC supporting and not supporting CID, send an erroneous $S(WTX)_{response}$ (with and without CID bit set) with empty and incomplete INF field. PICC shall stay mute.

k) For PICC supporting and not supporting CID, send an erroneous $S(WTX)_{response}$ (with and without CID bit set) with INF field containing wrong bit set of b8-b7 other than (**00**xxxxxx$_b$). This test includes $(2^2-1)*2^6=192$ RFU combinations for PCB.

l) For PICC supporting and not supporting CID, send an erroneous $S(WTX)_{response}$ (with and without CID bit set) with INF field containing wrong WTXM as requested (00**xxxxxx**$_b$).

m) For PICC supporting and not supporting CID, send an erroneous $S(WTX)_{response}$ (with and without CID bit set) with CRC error.

n) For PICC supporting and not supporting CID, send an $S(WTX)_{response}$ (with and without CID bit set) without epilogue field.

G.5.10.5.1Expected Result

No PICC answer is expected for all commands frames.

G.5.10.5.2Test Report

This test has 206 RFU combinations. In the test report indicate what percentage of the 206 RFU combinations was tested.

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 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.5.11 Block Transmission Test

The purpose of this test is to analyse the error handling of the PICC in different situations.

G.5.11.1 Apparatus

See clause G.2.

G.5.11.2 Procedure

Place the reference PICC into the field.

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

G.5.11.2.1 Procedure 1

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

b) Send block $I(0)_0$ to the PICC, with the INF field containing TEST_COMMAND1 supported by the PICC.

c) Wait for the answer of the PICC. The PICC should answer with $I(0)_0$.

d) Send again block $I(0)_0$ to the PICC, with the INF field containing TEST_COMMAND1 supported by the PICC.

e) Wait for the answer of the PICC. The PICC should answer with $I(0)_1$.

f) Send block $I(0)_1$ to the PICC, with the INF field containing TEST_COMMAND1 supported by the PICC.

g) Wait for the answer of the PICC. The PICC should answer with $I(0)_0$.

Test Scenario 24 —Procedure 1

PICC-test-apparatus		PICC
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)
$I(0)_0$(INF=TEST_COMMAND1)	→	
	←	$I(0)_1$ (INF=the answer to TEST_COMMAND1)
$I(0)_1$(INF=TEST_COMMAND1)	→	
	←	$I(0)_0$ (INF=the answer to TEST_COMMAND1)

G.5.11.2.1.1 Expected result

The PICC behaivior is expected according to the Test Scenario 24.

G.5.11.2.1.2 Test Report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC’s behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	Pass
If PICC fails on at least one step of Test Scenario	Fail

G.5.11.2.2Procedure 2

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

b) Send R-block $R(ACK)_0$ to the PICC, the PICC shall stay mute.

c) Send R-block $R(NAK)_0$ to the PICC, the PICC shall respond with $R(ACK)_1$.

d) Send R-block $R(ACK)_1$ to the PICC, the PICC shall stay mute.

e) Send R-block $R(NAK)_1$ to the PICC, the PICC shall stay mute.

Test Scenario 25 —Procedure 2

PICC-test-apparatus		PICC
$R(ACK)_0$ (e.g. 'AA CID CRC')	→	
	←	Mute
$R(NAK)_0$ (e.g. 'BA CID CRC')	→	
	←	$R(ACK)_1$ (e.g. 'AB CID CRC')
$R(ACK)_1$ (e.g. 'AB CID CRC')	→	
	←	Mute
$R(NAK)_1$ (e.g. 'BB CID CRC')	→	
	←	Mute

G.5.11.2.2.1 Expected result

The PICC behaivior is expected according to the Test Scenario 25.

G.5.11.2.2.2 Test Report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	Pass
If PICC fails on at least one step of Test Scenario	Fail

G.5.12 Chaining Block Transmission Test

The purpose of this test is to analyse the error handling of the PICC in different situations with uplink and downlink chaining.

G.5.12.1 Apparatus

See clause G.2.

G.5.12.2 Procedure

Place the reference PICC into the field.

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

G.5.12.2.1Procedure 1

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

b) Send block $I(0)_0$ to the PICC, with the INF field containing TEST_COMMAND2.

c) PICC should answer with I-block, indicating chaining: $I(1)_0$.

d) Send the R-block $R(ACK)_0$ to the PICC.

e) The PICC shall retransmit previous I-block, $I(1)_0$.

f) Send the R-block $R(ACK)_1$ to the PICC.

g) PICC should answer with I-block, indicating end of chaining: $I(0)_1$.

Test Scenario 26 —Procedure 1

PICC-test-apparatus		PICC
$I(0)_0$ (INF=TEST_COMMAND2)	→	
	←	$I(1)_0$ (INF = the first chain of the answer to TEST_COMMAND2)
$R(ACK)_0$ (e.g. 'AA CID CRC')	→	
	←	$I(1)_0$ (INF = the first chain of the answer to TEST_COMMAND2)
$R(ACK)_1$ (e.g. 'AB CID CRC')	→	
	←	$I(0)_1$ (INF = the last chain of the answer to TEST_COMMAND2)

G.5.12.2.1.1 Expected result

The PICC behaivior is expected according to the Test Scenario 26.

G.5.12.2.2Test Report

Fill the appropriate row in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
If the PICC's behaviour matches an expected Test Scenario exactly (including "Test for RFU value of CID byte")	Pass
If PICC fails on at least one step of Test Scenario	Fail

G.5.13 Test for RFU value of CID byte

The purpose of this test is to ensure that CID byte does not have a RFU values, according to ISO/IEC 14443-4:2001 clause 7.1.1.2. This test is applicable for all PICCs that support CID and shall be done for each test from G.5.1 to G.5.12.

G.5.13.1 Apparatus

See clause G.2.

G.5.13.2 Procedure

Repeat each test from G.5.1 to G.5.12 using CID in the communication blocks.

G.5.13.2.1.1 Expected Result

Bits b5 and b6 of CID shall be set to (00)b.

G.5.13.2.1.2 Test Report

During each test ensure that bits b5 and b6 of CID are set to (00)b. If bits b5 and b6 of CID are set to RFU value, the test must be reported as failed.

Please specify in the appropriate row in Table G. 9 — Test coverage report on page 109 that CID is tested.

G.5.14 Test for PICC supporting NAD

The purpose of this test is to ensure that PICC maintains the NAD in proper way according to ISO/IEC 14443-4:2001 clause 7.1.1.3. This test is applicable for all PICCs that support NAD and may be done for each test from G.5.1 to G.5.12.

G.5.14.1 Apparatus

See clause G.2.

G.5.14.2 Procedure

Repeat each test from G.5.1 to G.5.12 using NAD in the communication blocks.

G.5.14.2.1.1 Expected Result

The definitions a) – e) from ISO/IEC 14443-4:2001 clause 7.1.1.3 shall apply.

G.5.14.2.1.2 Test Report

Fill the appropriate rows in "Table G. 8 — Reported Results for test methods common for the PICC type A/B“ on page 108 according to the test results as follows:

Explanation	Test result
The definitions a) – e) from ISO/IEC 14443-4:2001 clause 7.1.1.3 apply.	Pass
In any other case	Fail

Please specify in the appropriate row in Table G. 9 — Test coverage report on page 109 that NAD is tested.

G.6 Reported results

Table G. 4 — Type A specific timing table

No	Name	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/fc	
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->1236/fc Last bit (0)b -> 1172/fc	
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 -> (n*128+84)/fc Last bit (0)b -> (n*128+20)/fc	
4	Request Guard Time	ISO/IEC 14443-3:2001 6.1.4	Min. 7000/fc	
5	Deactivation frame waiting time	ISO/IEC 14443-4:2001 8.1	See **Table G. 5** No.12 (same values)	

Note: All timing values are calculated for carrier frequency fc = 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	Measured value(s)
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 fc = 13.56 MHz and bit rate ~106 kbit/s

Table G. 6 — Reported Results for type A specific test methods

Test method from ISO/IEC 10373-6		Scenario Numbers	Test result	
Clause	Name	Test Scenario Number ISO/IEC 10373-6	RFU test coverage	PASS/FAIL
G.3.1	Polling		Not applicable	
G.3.2	Frame format and I/O transmission timing for type A protocol		Not applicable	
G.3.3	Test for ATQA RFU and invalid values			
G.3.4	Testing of the PICC type A State Transitions	Scenario A 1		
		Scenario A 2		
		Scenario A 3	Not applicable	
		Scenario A 4	Not applicable	
		Scenario A 5	Not applicable	
		Scenario A 6		
		Scenario A 7		
		Scenario A 8		
		Scenario A 9	Not applicable	
		Scenario A 10	Not applicable	
		Scenario A 11	Not applicable	
		Scenario A 12		
G.3.5	Handling of Bitwise Anticollision	Scenario A 13	Not applicable	
G.3.6	Handling of RATS and ATS by the PICC type A	Scenario A 14	Not applicable	
		Scenario A 15	Not applicable	
		Scenario A 16		
G.3.7	Handling of PPS request by the PICC type A	Scenario A 17	Not applicable	
		Scenario A 18	Not applicable	
		Scenario A 19		

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	RFU test coverage	PASS/FAIL
G.4.1	Polling		Not applicable	
G.4.2	PICC Reception		Not applicable	
G.4.3	I/O transmission timing for type B protocol		Not applicable	
G.4.4	I/O reception timing for type B protocol		Not applicable	
G.4.5	Test for ATQB RFU and invalid values			
G.4.6	Behaviour of the PICC type B in the IDLE state	Scenario B 1	Not applicable	
		Scenario B 2	Not applicable	
		Scenario B 3	Not applicable	
G.4.7	Behaviour of the PICC type B in the READY REQUESTED state	Scenario B 4	Not applicable	
		Scenario B 5	Not applicable	
G.4.8	Behaviour of the PICC type B in the READY DECLARED state	Scenario B 6	Not applicable	
		Scenario B 7	Not applicable	
G.4.9	Behaviour of the PICC type B in the ACTIVE state	Scenario B 8	Not applicable	
		Scenario B 9	Not applicable	
G.4.10	Behaviour of the PICC type B in the HALT state	Scenario B 10	Not applicable	
		Scenario B 11	Not applicable	
G.4.11	WUPB command	Scenario B 12		
G.4.12	REQB command	Scenario B 13		
G.4.13	Slot-MARKER Command	Scenario B 14	Not applicable	
G.4.14	HLTB Command	Scenario B 15	Not applicable	
G.4.15	ATTRIB command	Scenario B 16		
G.4.16	Different values of PCD maximum frame size	Scenario B 17	Not applicable	
G.4.17	PICC bit rate	Scenario B 18	Not applicable	

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	RFU test coverage	PASS/FAIL
G.5.1	Block sequencing by the PICC	Test Scenario 1	Scenario 7		
		Test Scenario 2			
		Test Scenario 3			
G.5.2	Retransmission	Test Scenario 4			
		Test Scenario 5			
		Test Scenario 6			
		Test Scenario 7	Scenario 17		
		Test Scenario 8	Scenario 12		
G.5.3	Reactions of the PICC to transmission errors	Test Scenario 9			
		Test Scenario 10	Scenario 19		
		Test Scenario 11	Scenario 15		
G.5.4	Reactions of the PICC to protocol errors	Test Scenario 12	Scenario 6		
G.5.5	Reactions of the PICC to the deactivation sequence	Test Scenario 13			
G.5.6	Deactivation frame waiting time				
G.5.7	Recovery of a transmission error during deactivation sequence	Test Scenario 14			
G.5.8	Error free operations	Test Scenario 15	Scenario 1		
		Test Scenario 16	Scenario 2		
		Test Scenario 17	Scenario 3		
		Test Scenario 18	Scenario 4		
		Test Scenario 19	Scenario 5		
G.5.9	Error handling by the PICC	Test Scenario 20	Scenario 9		
		Test Scenario 21	Scenario 11		
		Test Scenario 22	Scenario 14		
		Test Scenario 23	Scenario 18		
G.5.10	PICC reaction to errors in PCB byte				
G.5.11	Block Transmission Test	Test Scenario 24			
		Test Scenario 25			
G.5.12	Chaining Block Transmission Test	Test Scenario 26			
G.5.13	Test for RFU value of CID byte				
G.5.14	Test for PICC supporting NAD				

Table G. 9 — Test coverage report

No	Name	Description	Information	
1	TEST_COMMAND1	Default command used with test		
2	TEST_COMMAND2	Default command used with test of the chaining		
3	TEST_COMMAND3	Default command used with test deals with the frame waiting time		
4	Waiting Time Extension	Tested only if the PICC sends WTX		
5	Chaining	Tested only if there is a command that supports longer than 16 bytes		
6	NAD	Tested only if PICC supports NAD		
7	CID	Tested only if PICC supports CID		
8	Bit rate selection	Tested only If the PICC supports high bit rates	212 kbit/s	
			424 kbit/s	
			847 kbit/s	