INTERNATIONAL STANDARD

ISO/IEC 18745-2

First edition
2016-08-15

Information technology — Test methods for machine readable travel documents (MRTD) and associated devices —

Part 2: Test methods for the contactless interface

Technologies de l'information — Méthodes d'essai pour les documents de voyage lisibles par machine (MRTD) et dispositifs associés —

Partie 2: Méthodes d'essai de l'interface sans contact

Reference number
ISO/IEC 18745-2:2016(E)

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Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definition **1**
4 Symbols and abbreviated terms **2**
5 Test methods for eMRTD **2**
5.1 General test conditions 2
5.1.1 Test setup 3
5.1.2 Values unless otherwise specified 3
5.1.3 Test report 4
5.1.4 Applicant declaration 5
5.2 Test of ISO/IEC 14443-1 parameters 6
5.2.1 “Class 1” verification test (optional) 6
5.2.2 Static electricity test 6
5.2.3 Alternating magnetic field test 7
5.3 Test of ISO/IEC 14443-2 parameters 7
5.3.1 eMRTD transmission 7
5.3.2 Operating field strength 8
5.3.3 eMRTD reception 9
5.3.4 eMRTD resonance frequency (optional) 9
5.3.5 eMRTD maximum loading effect 10
5.4 Test of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters 10
5.5 List of the test command sequences 10
5.5.1 Test commands for eMRTD without access control (plain) 10
5.5.2 Test commands for eMRTD supporting BAC 12
5.5.3 Test commands for eMRTD supporting PACE 15
5.6 Functionality check test 17
5.6.1 General 17
5.6.2 Optional procedure 1: Application functionality check test 17
5.6.3 Optional procedure 2: Electrical functionality check test 18
6 Test methods for eMRTD reader **19**
6.1 General test requirements 19
6.1.1 Test setup 19
6.1.2 Values unless otherwise specified 19
6.1.3 Test report 20
6.1.4 Applicant declaration 20
6.1.5 Definition of measurement points 21
6.2 Test of ISO/IEC 14443-1 parameters 21
6.2.1 Purpose 21
6.2.2 Test procedure 22
6.2.3 Test report 22
6.3 Test of ISO/IEC 14443-2 parameters 22
6.3.1 eMRTD reader field strength 22
6.3.2 Modulation index and waveform 22
6.3.3 Load modulation reception 23
6.4 Test of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters 24
6.5 List of test command sequences 24
6.5.1 Test commands sequence for scenarios without eMRTD reader chaining 24
6.5.2 Test commands sequence for scenarios dealing with eMRTD reader chaining 25
6.6 Measurement positions 25
7 Additional eMRTD test methods **27**

7.1 Test conditions 27
7.2 Test of ISO/IEC 14443-2 parameters for eMRTD 28
7.2.1 Operating field strength for bit rates higher than ***fc***/16 28
7.2.2 eMRTD reception for bit rates higher than ***fc***/16 29
7.2.3 eMRTD EMD level and low EMD time test (optional) 30
7.3 Test of ISO/IEC 14443-2 parameters for eMRTD reader 31
7.3.1 eMRTD reader field strength for additional classes 31
7.3.2 Modulation index and waveform for bit rates higher than ***fc***/16 or additional classes 31
7.3.3 Load modulation reception for bit rates higher than ***fc***/16 or additional classes 31
7.3.4 eMRTD reader EMD immunity test (optional) 32
7.3.5 eMRTD reader EMD recovery test (optional) 32
7.4 Additional tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters for PICC 33
7.5 Additional tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters for PCD 33

8 Specific access control test sequences 33
8.1 General 33
8.2 List of the test command sequences with EAC for eMRTD 33
8.2.1 Test commands for eMRTD supporting EAC 33
8.2.2 Test commands for eMRTD supporting PACE and EAC 34

Bibliography 37

Foreword

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, SC 17, *Cards and personal identification*.

ISO/IEC 18745 consists of the following parts, under the general title, *Test methods for machine readable travel documents (MRTD) and associated devices*:

— *Part 1: Physical test methods for passport books (durability)*

— *Part 2: Test methods for the contactless interface*

Introduction

This part of ISO/IEC 18745 defines the test plan regarding contactless interface for eMRTDs and eMRTD associated readers compliant to ICAO Doc 9303.

Information technology — Test methods for machine readable travel documents (MRTD) and associated devices —

Part 2:
Test methods for the contactless interface

1 Scope

This part of ISO/IEC 18745 defines the test plan, based on ISO/IEC 10373-6, for the contactless interface of eMRTDs and eMRTD associated readers compliant with ICAO Doc 9303.

Application requirements for eMRTD and eMRTD reader are outside of the scope of this part of ISO/IEC 18745.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 7810:2003/Amd 1:2009, *Identification cards — Physical characteristics*

ISO/IEC 10373-6:2016, *Identification cards — Test methods — Part 6: Proximity cards*[1)]

ISO/IEC 14443-1:2016, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 1: Physical characteristics*[1)]

ISO/IEC 14443-2:2016, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 2: Radio frequency power and signal interface*[1)]

ISO/IEC 14443-3, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 3: Initialization and anticollision*[1)]

ISO/IEC 14443-4:2016, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 4: Transmission protocol*[1)]

ICAO Doc 9303, *Machine Readable Travel Documents — Seventh Edition, 2015*

3 Terms and definition

For the purposes of this document, the following terms and definitions apply.

3.1
test method
method for testing the characteristics of eMRTDs and eMRTD associated readers for the purpose of assessing their conformance with International Standards

1) If ISO/IEC 10373 or ISO/IEC 14443 series are referred, read with replacing PICC with eMRTD and PCD with eMRTD associated reader.

3.2
sample
one piece of the total number of eMRTDs or eMRTD associated readers required and presented for testing according to this specification

3.3
room temperature
convenient temperature within the range of 23 °C ± 3 °C (73 °F ± 5 °F)

4 Symbols and abbreviated terms

For the purposes of this document, the following abbreviations apply.

AA	active authentication
BAC	basic access control
CVCA	country verifying certification authority
DV	document verifier
EAC	extended access control (throughout this part of ISO/IEC 18745, the term EAC refers to EAC v1)
IS	inspection system
LDS	logical data structure
PACE	password authenticated connection establishment (throughout this part of ISO/IEC 18745, the term PACE refers to PACE v2)
DUT	device under test
H_{min}	minimum field strength as defined in ISO/IEC 14443-2
H_{max}	maximum field strength as defined in ISO/IEC 14443-2
eMRTD	electronic machine readable travel document
"XY"	hexadecimal notation, equal to XY in base 16

5 Test methods for eMRTD

5.1 General test conditions

The test methods defined in Clause 5 are in line with the test methods defined in ISO/IEC 10373-6:2001/Amd 7:2010, but updated in accordance with ISO/IEC 10373-6:2016.

Test conditions and procedures in this Clause are based on ISO/IEC 10373-6 taking into account specific needs of eMRTD application.

Clause 7 addresses only requirements introduced by amendments on ISO/IEC 10373-6:2011 published after 2011 and integrated in the third edition of ISO/IEC 10373-6:

— ISO/IEC 10373-6:2011/Amd.1:2012;

— ISO/IEC 10373-6:2011/Amd.2:2012;

— ISO/IEC 10373-6:2011/Amd.3:2012;

— ISO/IEC 10373-6:2011/Amd.4:2012;

— ISO/IEC 10373-6:2011/Amd.5:2015;[2)]

— ISO/IEC 10373-6:2011/Amd.6:2015;[2)]

— ISO/IEC 10373-6:2011/Amd.7:2015.[2)]

The following subclauses specify the different test setups, the values used for the tests, and a recommendation for the format of the test report.

Depending on the implementation statement of the applicant, Type A or Type B tests shall be performed.

For tests of ISO/IEC 14443-1 and ISO/IEC 14443-2 parameters, the minimum number of samples provided for testing is three, unless explicitly defined otherwise. The applicant may request that a larger number of samples are tested. The samples provided by the applicant should be personalized and marked each with a unique serial number. Serial numbers shall be reported in the test report.

It is not mandatory to use the same samples to run all the tests defined in this standard. For example, an applicant can provide:

— 3 samples for static electricity test;

— 3 samples for alternating magnetic field test;

— 3 samples for ISO/IEC 14443-2 parameters;

— 1 sample for ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters.

For tests where mandatory field strength values are specified, a transition period for eMRTD requiring higher field strength may apply.

5.1.1 Test setup

The Test PCD assembly that is defined in ISO/IEC 10373-6 is the basis for the physical and electrical tests. The matching network defined in ISO/IEC 10373-6:2016, A.2.2 is used together with the Test PCD assembly.

The Test PCD assembly shall be adapted to carry an eMRTD with the additional ability to center an ID-1 sized antenna of an eMRTD in the Test PCD assembly.

Some of the following tests are assuming an antenna size within ID-1 outline. If antenna is greater than ID-1 size, those tests might not generate accurate results.

5.1.2 Values unless otherwise specified

The values defined in Table 1 are typical values for communication parameters.

Unless otherwise specified, the following environmental parameters and values defined in Table 1 shall be used.

Table 1 — Values unless otherwise specified

Parameter	Value	To be applied to
Parameters applicable for all bit rates		
Environment temperature	room temperature	Type A and Type B
Relative humidity	25 % to 75 %[a]	Type A and Type B
[a] Any convenient relative humidity within the specified range.		

2) Not published but integrated in the third revision of ISO/IEC 10373-6.

Table 1 *(continued)*

Parameter	Value	To be applied to
Start Of Frame timing (SOF)	10 etu "0" followed by 2 etu "1"	Type B
End Of Frame timing (EOF)	10 etu "0"	Type B
Extra Guard Time (EGT)	0 etu	Type B
Maximum Frame Size Code in ATTRIB	8	Type B
FSDI	8	Type A
Parameters applicable for eMRTD reader to eMRTD bit rate *fc*/128		
Modulation	100 %	Type A
t_1	40/*fc*	Type A
t_2	7/*fc*	Type A
t_3	12/*fc*	Type A
t_4	6/*fc*	Type A
Overshoot	0 %	Type A and Type B
Modulation index *m*	12 %	Type B
Rise time, t_r, fall time, t_f	12/*fc*	Type B
Parameters applicable for eMRTD reader to eMRTD bit rate *fc*/64		
a	0,1	Type A
t_1	18/*fc*	Type A
t_5	15/*fc*	Type A
t_6	9/*fc*	Type A
Overshoot	0 %	Type A and Type B
Modulation index *m*	12 %	Type B
Rise time t_r, fall time t_f	10/*fc*	Type B
Parameters applicable for eMRTD reader to eMRTD bit rate *fc*/32		
a	0,2	Type A
t_1	9/*fc*	Type A
t_5	7/*fc*	Type A
t_6	8/*fc*	Type A
Overshoot	0 %	Type A and Type B
Modulation index *m*	12 %	Type B
Rise time t_r, fall time t_f	8/*fc*	Type B
Parameters applicable for eMRTD reader to eMRTD bit rate *fc*/16		
a	0,4	Type A
t_1	5/*fc*	Type A
t_5	4/*fc*	Type A
t_6	5/*fc*	Type A
Overshoot	0 %	Type A and Type B
Modulation index *m*	12 %	Type B
Rise time t_r, fall time t_f	6/*fc*	Type B

[a] Any convenient relative humidity within the specified range.

5.1.3 Test report

The test report shall include the number of successful evaluations versus the total number of evaluations for each sample and for each test. A description of each test, the information whether the result was a pass or a fail, and the date of the tests shall be included.

For all functionality check tests, the report shall state what tools and methods have been used to verify the functionality of the eMRTD.

5.1.4 Applicant declaration

In order to set up the tests properly, the applicant shall provide the information specified in Table 2.

Table 2 — Applicant information on eMRTD product

Product characteristic	Standard reference	Applicant declaration
Physical Size of Product[a]	ICAO Doc 9303-2	ID-1: YES/NO
Location of antenna within eMRTD	ICAO Doc 9303-9	
Claimed PICC class[b]	ISO/IEC 14443-1 ISO/IEC 14443-2	PICC Class 1 or 2 or 3 or 4 or 5 or 6
(Optional) shielding of eMRTD	Application Profile for Contactless Interface Doc9303 v1.3	YES/NO If yes, precise where shielding is applied
(Optional) eMRTD resonance frequency range	Application Profile for Contactless Interface Doc9303 v1.3	Minimum and maximum resonance frequency in MHz
Type	ISO/IEC 14443-2 ISO/IEC 14443-3 ISO/IEC 14443-4	Type A/Type B
Random or fixed UID (Type A) or PUPI (Type B)	ISO/IEC 14443-3	Indicate if the UID (Type A) or PUPI (Type B) is random or fixed
(Optional) eMRTD reader to eMRTD supported bit rates	ISO/IEC 14443-2 ISO/IEC 14443-3 ISO/IEC 14443-4	List of supported optional eMRTD reader to eMRTD bit rates
(Optional) eMRTD to eMRTD reader supported bit rates	ISO/IEC 14443-2 ISO/IEC 14443-3 ISO/IEC 14443-4	List of supported optional eMRTD to eMRTD reader bit rates
(Optional) support of exchange of additional parameters	ISO/IEC 14443-4	YES/NO
Maximum frame size supported	ISO/IEC 14443-3 ISO/IEC 14443-4	Declare the maximum frame size integer in reception supported by the eMRTD
(Optional) Frames with error corrections supported	ISO/IEC 14443-4	YES/NO
(Optional) support of NAD and CID	ISO/IEC 14443-4	NAD: YES/NO CID: YES/NO
Command requesting S(WTX)	ISO/IEC 14443-4	Provide a command needing more than FWT time for execution. If the eMRTD does not support any command needing more than FWT time for execution, the scenarios using this command are not applicable.

[a] If eMRTD size is ID-2 or ID-3, select NO.

[b] If no PICC Class is claimed, PICC Class 1 is used in the test methods.

[c] Information required to perform authentication will be provided by the applicant (Machine Readable Zone (MRZ)/ Card Access Number (CAN), EAC certificates chain with IS private key, static/dynamic binding). If no access control is selected by the applicant, eMRTD supports plaintext access.

[d] Information required to perform Active Authentication will be provided by the applicant (Extended Length).

Table 2 *(continued)*

Product characteristic	Standard reference	Applicant declaration
Access control applied[c]	ICAO Doc 9303-11	BAC: YES/NO EAC: YES/NO PACE: YES/NO
Active Authentication[d]	ICAO Doc 9303-11	YES/NO
(Optional) Extended Length APDU supported	ISO/IEC 7816-4	YES/NO
(Optional) EMD	ISO/IEC 14443-2	

[a] If eMRTD size is ID-2 or ID-3, select NO.

[b] If no PICC Class is claimed, PICC Class 1 is used in the test methods.

[c] Information required to perform authentication will be provided by the applicant (Machine Readable Zone (MRZ)/ Card Access Number (CAN), EAC certificates chain with IS private key, static/dynamic binding). If no access control is selected by the applicant, eMRTD supports plaintext access.

[d] Information required to perform Active Authentication will be provided by the applicant (Extended Length).

5.2 Test of ISO/IEC 14443-1 parameters

5.2.1 "Class 1" verification test (optional)

5.2.1.1 Purpose

The purpose of this test is to check if the physical coil dimensions meet the requirements according to ISO/IEC 14443-1.

This test is optional and shall be applied if the applicant claims compliance with "Class 1" in Table 2.

5.2.1.2 Test procedure

Determine whether the eMRTD antenna is within the PICC antenna zone as described in ISO/IEC 14443-1:2016, A.1.1. The applied method (for example, X-ray) is under responsibility of test laboratory.

5.2.1.3 Test report

The test report shall state whether the coil geometry of the antenna is in accordance with "Class 1" definition.

5.2.2 Static electricity test

5.2.2.1 Purpose

See ISO/IEC 10373-6:2016, 6.2.2.

5.2.2.2 Test procedure

Apply ISO/IEC 10373-6:2016, 6.2.2. The discharge value is selected according to ISO/IEC 7810:2003/Amd 1, 9.4.2.

In case the physical size of the eMRTD is different from ID-1, the test procedure shall be applied at the centers of a two dimensional 1 cm × 1 cm mesh placed over the DUT.

5.2.2.3 Test report

The test report shall state whether or not the eMRTDs operate as described in 5.6 after the applied test procedure.

5.2.3 Alternating magnetic field test

5.2.3.1 Purpose

See ISO/IEC 10373-6:2016, 6.2.1.

5.2.3.2 Test procedure

Apply ISO/IEC 10373-6:2016, 6.2.1.

5.2.3.3 Test report

The test report shall state whether or not the eMRTDs operate as described in 5.6 after the applied test procedure.

5.3 Test of ISO/IEC 14443-2 parameters

5.3.1 eMRTD transmission

5.3.1.1 Purpose

See ISO/IEC 10373-6:2016, 7.2.1.1.

5.3.1.2 Test procedure

Apply ISO/IEC 10373-6:2016, 7.2.1 under the following conditions:

At temperatures –10 °C and room temperature:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 7,5 A/m(rms);

— optional: 5,5 A/m(rms), 6,5 A/m(rms).

At temperature 50 °C:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 6,0 A/m(rms);

— optional: 5,5 A/m(rms).

NOTE Optional and mandatory field strength values are chosen in line with the following reasons:

— most of eMRTD associated readers operate between 1,5 A/m(rms) and 4,5 A/m(rms);

— check that there is no potential communication hole between 1,5 A/m(rms) and 4,5 A/m(rms) or more.

5.3.1.3 Test report

The test report shall give the load modulation amplitudes of the upper and lower sidebands at *fc* + *fs* and *fc* - *fs* and the applied fields strengths and modulations.

5.3.2 Operating field strength

5.3.2.1 Purpose

The purpose of this test is to check if the eMRTD operates its application within the operating field strength range defined in ISO/IEC 14443-2.

5.3.2.2 Test procedure

For this procedure, the Test PCD assembly shall be used as the eMRTD associated reader antenna. The eMRTD under test shall be placed in the DUT position, concentric with sense coil a. The field strength into the Test PCD assembly antenna shall be readjusted to the required field strength.

The following command sequence shall be used for this procedure:

For Type A:

a) REQA command;

b) repeat ANTICOLLISION and SELECT commands until UID is complete;

c) RATS command;

d) PPS command;

e) TEST_COMMAND_SEQUENCE1.

For Type B:

a) REQB command;

b) ATTRIB command;

c) TEST_COMMAND_SEQUENCE1.

TEST_COMMAND_SEQUENCE1 is specified in 5.5 and 8.2 depending on the access control mechanism declared in Table 2.

Execute the command sequence under the following conditions:

— every supported symmetric bitrate and maximum bitrate in both directions shall be tested.

At temperatures –10 °C and room temperature:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 7,5 A/m(rms);

— optional: 5,5 A/m(rms), 6,5 A/m(rms).

At temperature 50 °C:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 6,0 A/m(rms);

— optional: 5,5 A/m(rms).

NOTE Optional and mandatory field strength values are chosen in line with the following reasons:

— most of eMRTD associated readers operate between 1,5 A/m(rms) and 4,5 A/m(rms);

— check that there is no potential communication hole between 1,5 A/m(rms) and 4,5 A/m(rms).

5.3.2.3 Test report

The test report shall confirm the intended operation at the supported bit rates. Used test conditions shall be mentioned in the test report.

5.3.3 eMRTD reception

5.3.3.1 Purpose

See ISO/IEC 10373-6:2016, 7.2.3.1.

5.3.3.2 Test procedure

Apply ISO/IEC 10373-6:2016, 7.2.3 under the following conditions:

— bit rates *fc*/128, *fc*/64, *fc*/32, *fc*/16, if supported.

At temperatures –10 °C and room temperature:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 7,5 A/m(rms);

— optional: 5,5 A/m(rms), 6,5 A/m(rms).

At temperature 50 °C:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 6,0 A/m(rms);

— optional: 5,5 A/m(rms).

NOTE Optional and mandatory field strength values are chosen in line with the following reasons:

— most of eMRTD associated readers operate between 1,5 A/m(rms) and 4,5 A/m(rms)

— check that there is no potential communication hole between 1,5 A/m(rms) and 4,5 A/m(rms).

The three tests conditions shall be executed at least five times for each combination of field and temperature parameters.

For each PCD to PICC bit rate supported by the eMRTD, the eMRTD shall respond correctly to an I-block containing the TEST_COMMAND1 as defined in 5.5 after selection of that bit rate.

5.3.3.3 Test report

The test report shall confirm the intended operation at the supported bit rates. Used test conditions shall be mentioned in the test report.

5.3.4 eMRTD resonance frequency (optional)

5.3.4.1 Purpose

See ISO/IEC 10373-6:2016, 7.2.4.1.

This test is optional and shall be applied if the applicant provides a resonance frequency range in Table 2.

5.3.4.2 Test procedure

Apply ISO/IEC 10373-6:2016, 7.2.4 at room temperature.

5.3.4.3 Test report

The test report shall state whether the measured resonance frequency is within the range of resonance frequency declared by the applicant in Table 2.

In addition, the test report shall describe the applied test setup and conditions.

5.3.5 eMRTD maximum loading effect

5.3.5.1 Purpose

See ISO/IEC 10373-6:2016, 7.2.5.1.

5.3.5.2 Test procedure

Apply ISO/IEC 10373-6:2016, 7.2.5 under the following conditions:

— At temperatures –10 °C, room temperature and 50 °C

5.3.5.3 Test report

The test report shall give the values of the measured field strength.

5.4 Test of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters

Perform the tests defined in ISO/IEC 10373-6:2016, Annex G at room temperature and 1,5 A/m(rms) according to the declarations made in Table 2. The test command sequences to apply are defined in 5.5 and 8.2. The appropriate block number in each tests scenario needs to be respected.

Tests ISO/IEC 10373-6:2016, G.3.2 polling and ISO/IEC 10373-6:2016, G.4.2 polling shall be executed with the minimum delay between each Type as defined in Application Profile for Contactless Interface v1.3.

NOTE The operating field condition chosen to perform these tests [1,5 A/m (rms)] represents the worst case.

5.5 List of the test command sequences

This subclause provides test command sequences depending on the access control mechanism declared in Table 2.

5.5.1 Test commands for eMRTD without access control (plain)

5.5.1.1 TEST_COMMAND_SEQUENCE1

TEST_COMMAND_SEQUENCE1 is the sequence of commands used for operating field strength test.

TEST_COMMAND_SEQUENCE1 shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1. The bit rate appropriate to the applied test procedure shall be selected.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	'00 A4 04 0C 07 A0 00 00 02 47 10 01'
2	INTERNAL AUTHENTICATEa	'00 88 00 00 08 F1 73 58 99 74 BF 40 C6 00'
3	READ BINARY	'00 B0 82 00 00'
a INTERNAL AUTHENTICATE command is sent only if AA is supported by eMRTD.		

5.5.1.2 TEST_COMMAND1

5.5.1.2.1 TEST_COMMAND1(1)

TEST_COMMAND1(1) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of one unchained I-block.

TEST_COMMAND1(1) shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	'00 A4 04 0C 07 A0 00 00 02 47 10 01'

5.5.1.2.2 TEST_COMMAND1(2)

TEST_COMMAND1(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of two chained I-blocks (eMRTD reader chaining).

TEST_COMMAND1(2) shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	First I-block: '00 A4 04 0C 07' Second I-block: 'A0 00 00 02 47 10 01'

5.5.1.2.3 TEST_COMMAND1(3)

TEST_COMMAND1(3) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of three chained I-blocks (eMRTD reader chaining).

TEST_COMMAND1(3) shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	First I-block: '00 A4 04 0C 07' Second I-block: 'A0 00 00 02' Third I-block: '47 10 01'

5.5.1.3 TEST_COMMAND2

5.5.1.3.1 TEST_COMMAND2(2)

TEST_COMMAND2(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) which expects a response consisting of two chained I-blocks.

TEST_COMMAND2(2) shall come after:

— eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed;

— LDS application (AID = 'A0 00 00 02 47 10 01') is successfully selected.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'00 B0 82 00 00'

The recommended maximum frame size is 256 bytes (FSD = 256/FSDI = 8).

5.5.1.3.2 TEST_COMMAND2(3)

TEST_COMMAND2(3) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) which expects a response consisting of three chained I-blocks.

TEST_COMMAND2(3) shall come after:

— eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed;

— LDS application (AID = 'A0 00 00 02 47 10 01') is successfully selected.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'00 B0 82 00 00'

The recommended maximum frame size is 128 bytes (FSD=128/FSDI=7).

5.5.1.4 TEST_COMMAND3

TEST_COMMAND3 is the default test command consisting of one I-block which needs more than FWT time for execution.

UT_APDU definition:

— to be defined by applicant.

5.5.2 Test commands for eMRTD supporting BAC

5.5.2.1 TEST_COMMAND_SEQUENCE1

TEST_COMMAND_SEQUENCE1 is the sequence of commands, used for operating field strength test.

TEST_COMMAND_SEQUENCE1 shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	'00 A4 04 0C 07 A0 00 00 02 47 10 01'
2	GET CHALLENGE	'00 84 00 00 08'
3	MUTUAL AUTHENTICATE	'00 82 00 00 28 <authentication token> 28'
4	INTERNAL AUTHENTICATE[a]	According to AA key length, select following command: '0C 88 00 00 20 87 11 01 <encrypted challenge> 97 01 00 8E 08 <mac> 00 'or '0C 88 00 00 00 00 21 87 11 01 <encrypted challenge> 97 02 00 00 8E 08 <mac> 00 00'
5	READ BINARY	'0C B0 82 00 0D 97 01 80 8E 08 <mac> 00'
[a] INTERNAL AUTHENTICATE command is sent only if AA is supported by eMRTD.		

5.5.2.2 TEST_COMMAND1

5.5.2.2.1 TEST_COMMAND1(1)

TEST_COMMAND1(1) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of one unchained I-block.

TEST_COMMAND1 shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	'00 A4 04 0C 07 A0 00 00 02 47 10 01'

5.5.2.2.2 TEST_COMMAND1(2)

TEST_COMMAND1(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of two chained I-blocks (eMRTD reader chaining).

TEST_COMMAND1(2) shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	First I-block: '00 A4 04 0C 07' Second I-block: 'A0 00 00 02 47 10 01'

5.5.2.2.3 TEST_COMMAND1(3)

TEST_COMMAND1(3) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of three chained I-blocks (eMRTD reader chaining).

TEST_COMMAND1(3) shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	First I-block: '00 A4 04 0C 0C' Second I-block: 'A0 00 00 02' Third I-block: '47 10 01'

5.5.2.3 TEST_COMMAND2

5.5.2.3.1 TEST_COMMAND2(2)

TEST_COMMAND2(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) which expects a response consisting of two chained I-blocks.

TEST_COMMAND2(2) shall come after:

— eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed;

— LDS application 'A0 00 00 02 47 10 01' is successfully selected;

— basic access is granted.

UT_APDU definition:

If extended length is not supported by the sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 0D 97 01 80 8E 08 <mac> 00'

The recommended maximum frame size is 128 bytes (FSD = 128/FSDI = 7). In this case, maximum frame size test with FSD = 256 is not applicable.

If extended length is supported by the sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 00 00 0E 97 02 01 00 8E 08 <mac> 00 00'

The recommended maximum frame size is 256 bytes (FSD=256/FSDI=8).

5.5.2.3.2 TEST_COMMAND2(3)

TEST_COMMAND2(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) which expects a response consisting of two chained I-blocks.

TEST_COMMAND2(3) shall come after:

— eMRTD activation process described in ISO/IEC 10373-6:2016, 6.5.1.1 shall be performed;

— LDS application 'A0 00 00 02 47 10 01' is successfully selected;

— basic access is granted.

UT_APDU definition:

If extended length is not supported by sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 0D 97 01 80 8E 08 <mac> 00'

The recommended maximum frame size is 64 bytes (FSD = 64/FSDI = 5).

If extended length is supported by sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 00 00 0E 97 02 02 00 8E 08 <mac> 00 00'

The recommended maximum frame size is 256 bytes (FSD = 256/FSDI = 8).

5.5.2.4 TEST_COMMAND3

TEST_COMMAND3 is the default test command consisting of one I-block which needs more than FWT time for execution.

UT_APDU definition:

— to be defined by applicant.

5.5.3 Test commands for eMRTD supporting PACE

5.5.3.1 General

These test commands shall be used for eMRTD with PACE. It shall be also used for eMRTD supporting BAC in addition to PACE.

5.5.3.2 TEST_COMMAND_SEQUENCE1

TEST_COMMAND_SEQUENCE1 is the sequence of commands, used for operating field strength test.

TEST_COMMAND_SEQUENCE1 shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	READ BINARY for EF.CardAccess	'00 B0 9C 00 06' '00 B0 00 06 E0' ...
2	MSE: Set AT	'00 22 C1 A4 <L_c> 80 <L_{80}> <PACE OID> 83 01 01 84 <L_{84}> <private key reference>'
3	GENERAL AUTHENTICATE for encrypted nonce	'10 86 00 00 <L_c> 7C 00 00'
4	GENERAL AUTHENTICATE to map the nonce	'10 86 00 00 <L_c> 7C <L_{7C}> 81 <L_{81}> <Mapping Data> 00'
5	GENERAL AUTHENTICATE to perform Key agreement	'10 86 00 00 <L_c> 7C <L_{7C}> 83 <L_{83}> <Ephemeral Public Key> 00'
6	GENERAL AUTHENTICATE to perform Mutual Authenticate	'00 86 00 00 <L_c> 7C <L_{7C}> 85 <L_{85}> <Authentication Token> 00'
7	SELECT	'0C A4 04 0C <L_c> 87 <L_{87}> 01 <Cryptogram> 8E 08 <Checksum> 00'
8	INTERNAL AUTHENTICATE[a]	According to AA key length, select following command: '0C 88 00 00 20 87 11 01 <encrypted challenge> 97 01 00 8E 08 <mac> 00' or '0C 88 00 00 00 00 21 87 11 01 <encrypted challenge> 97 02 00 00 8E 08 <mac> 00 00'
9	READ BINARY for EF.DG2	'0C B0 82 00 0D 97 01 06 8E 08 <mac> 00'
[a] INTERNAL AUTHENTICATE command is sent only if AA is supported by eMRTD.		

NOTE The EF.CardAccess can be read implicitly or explicitly (SELECT EF.CardAccess command sent before READ BINARY).

5.5.3.3 TEST_COMMAND1

5.5.3.3.1 TEST_COMMAND1(1)

TEST_COMMAND1(1) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of one unchained I-block.

TEST_COMMAND1 shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	'00 A4 04 0C 07 A0 00 00 02 47 10 01'

5.5.3.3.2 TEST_COMMAND1(2)

TEST_COMMAND1(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of two chained I-blocks (eMRTD reader chaining).

TEST_COMMAND1(2) shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	First I-block: '00 A4 04 0C 07' Second I-block: 'A0 00 00 02 47 10 01'

5.5.3.3.3 TEST_COMMAND1(3)

TEST_COMMAND1(3) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) consisting of three chained I-blocks (eMRTD reader chaining).

TEST_COMMAND1(3) shall come after eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	SELECT	First I-block: '00 A4 04 0C 0C' Second I-block: 'A0 00 00 02' Third I-block: '47 1001'

5.5.3.4 TEST_COMMAND2

5.5.3.4.1 TEST_COMMAND2(2)

TEST_COMMAND2(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) which expects a response consisting of two chained I-blocks.

TEST_COMMAND2(2) shall come after:

— eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed.

— PACE is granted.

— LDS application 'A0 00 00 02 47 10 01' is successfully selected.

UT_APDU definition:

If extended length is not supported by sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 0D 97 01 80 8E 08 <mac> 00'

The maximum frame size should be set to 128 bytes (FSD = 128/FSDI = 7). In this case, maximum frame size test with FSD = 256 is not applicable.

If extended length is supported by sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 00 00 0E 97 02 01 00 8E 08 <mac> 00 00'

The maximum frame size should be set to 256 bytes (FSD = 256/FSDI = 8).

5.5.3.4.2 TEST_COMMAND2(3)

TEST_COMMAND2(2) is the default test command used for tests of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters (5.4) which expects a response consisting of two chained I-blocks.

TEST_COMMAND2(3) shall come after:

— eMRTD activation process described in ISO/IEC 10373-6:2016, G.5.1.1 shall be performed;

— PACE is granted;

— LDS application 'A0 00 00 02 47 10 01' is successfully selected.

UT_APDU definition:

If extended length is not supported by sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 0D 97 01 80 8E 08 <mac> 00'

The maximum frame size should be set to 64 bytes (FSD = 64/FSDI = 5).

If extended length is supported by sample under test:

Step	Command	COMMAND UT_APDU
1	READ BINARY	'0C B0 82 00 00 00 0E 97 02 02 00 8E 08 <mac> 00 00'

The maximum frame size should be set to 256 bytes (FSD = 256/FSDI = 8).

5.5.3.5 TEST_COMMAND3

TEST_COMMAND3 is the default test command consisting of one I-block which needs more than FWT time for execution.

UT_APDU definition:

— to be defined by applicant.

5.6 Functionality check test

5.6.1 General

For potentially destructive tests such as mechanical and electrical (ISO/IEC 14443-1 parameters) stress tests, it is often required to check if the eMRTD "operates as intended". These tests are not defined further by the ISO/IEC standards, and thus they are left to the responsibility of the test laboratories.

Since there may be different requirements for performing functionality check tests, this subclause specifies two optional tests to verify the eMRTD's functionality on the electrical and on the application level without performing all these, sometimes time-consuming tests specified in this part of ISO/IEC 18745.

The functionality check tests require specialized equipment and may only be performed by test laboratories that have the necessary skills and equipment, whereas the application functionality check test may be performed with standard equipment.

5.6.2 Optional procedure 1: Application functionality check test

5.6.2.1 Purpose

This test is a basic functionality check test.

The purpose of this test is to check if the eMRTD's mandatory LDS application data as specified in ICAO Doc 9303-10 can be retrieved from the eMRTD. It shall be verified that this information has not been altered by the destructive tests.

5.6.2.2 Test setup

The test may be performed with standard PC/SC readers and any software that is able to send commands to the eMRTD and that can verify the integrity of the data retrieved.

5.6.2.3 Test procedure

The test procedure shall be performed as follows:

a) put the eMRTD on the contactless reader of the tests setup;

b) activate the eMRTD as described in ISO/IEC 10373-6:2016, G.5.1.1;

c) select the LDS application;

d) perform access control if indicated in the implementation conformance statement;

e) read data of file EF.COM;

f) read data of file EF.DG1;

g) read data of file EF.DG2;

h) read the document security object of file EF.SOD.

5.6.2.4 Test report

The test report shall state whether the defined LDS application data can be retrieved and whether the data has been altered.

5.6.3 Optional procedure 2: Electrical functionality check test

5.6.3.1 Purpose

The purpose of this test is to check the electrical functionality of the eMRTD and may be used in addition to the specified in ISO/IEC 10373-6:2016, G.5.1.1.

5.6.3.2 Test setup

For this test, the test setup defined in the corresponding tests shall be used.

5.6.3.3 Test procedure

The test procedure shall be performed using at least one of the following methods:

— apply resonance frequency test as specified in 5.3.4;

— apply operating field strength test as specified in 5.3.2;

— apply an alternative method comparing relative values of the threshold field strength before and after the mechanical or electrical stress test. The threshold field strength is the minimum field strength to operate the eMRTD as intended (operational mode).

5.6.3.4 Test report

The test report shall state whether the resonance frequency is in the range specified in the implementation conformance statement or whether the eMRTD operates as intended for all combinations of temperatures and field strengths.

6 Test methods for eMRTD reader

6.1 General test requirements

The test methods defined in Clause 6 are in line with the test methods defined in ISO/IEC 10373-6:2001/Amd 7:2010, but updated in accordance with ISO/IEC 10373-6:2016.

Test conditions and procedures in this clause are based on ISO/IEC 10373-6 taking into account specific needs of eMRTD application.

The Clause 7 addresses only requirements introduced by amendments on ISO/IEC 10373-6:2011 published after 2011 and integrated in the third edition of ISO/IEC 10373-6.

— ISO/IEC 10373-6:2011/Amd 1:2012;

— ISO/IEC 10373-6:2011/Amd 2:2012;

— ISO/IEC 10373-6:2011/Amd 3:2012;

— ISO/IEC 10373-6:2011/Amd 4:2012;

— ISO/IEC 10373-6:2011/Amd 5:2015;[3)]

— ISO/IEC 10373-6:2011/Amd 6:2015;[3)]

— ISO/IEC 10373-6:2011/Amd 7:2015.

The following subclauses specify the different test setups, the values used for the tests and a recommendation of the report.

Errors shall be handled in the eMRTD reader and not in the upper tester or host. If possible, the final operating system shall be tested.

6.1.1 Test setup

The Test PCD assembly and the Reference PICCs that are defined in ISO/IEC 10373-6 are the basis for the tests.

6.1.2 Values unless otherwise specified

Unless otherwise specified, the values defined in Table 3 shall be used to adjust parameters of PCD-test-apparatus:

Table 3 — Values of the PCD-test-apparatus unless otherwise specified

Parameter	Value	Applies to
Environment temperature	23 °C ± 3 °C (73 °F ± 5 °F)	Type A and Type B
Relative humidity	25 % to 75 %[a]	Type A and Type B
PCD to PICC and PICC to PCD Bit rates	*fc*/128	Type A and Type B
[a] Any convenient relative humidity within the specified range.		

3) Not published but integrated in the third revision of ISO/IEC 10373-6.

Table 3 *(continued)*

Parameter	Value	Applies to
Load modulation amplitude	More than 20 mV at H_{min}	Type A and Type B
Reference PICC Resonance frequency	16,5 MHz	Type A and Type B
J1 setting	position "a"	Type A and Type B
J2 setting	position "a"	Type A and Type B
Reference PICC position	X = 0, Y = 0, Z = 7,5 mm	Type A and Type B
Start Of Frame timing (SOF)	10 etu "0" followed by 2 etu "1"	Type B
End Of Frame timing (EOF)	10 etu "0"	Type B
Extra Guard Time (EGT)	0 etu	Type B
TR0 for ATQB and DESELECT	200/*fs*	Type B
Frame waiting time	Any value as specified in ISO/IEC 14443-4:2016, 7.2	Type A and Type B
TR1	140/*fs*	Type B
FSCI	8	Type A
Maximum Frame Size Code in ATQB	8	Type B
[a] Any convenient relative humidity within the specified range.		

Tests shall be done at the same temperature range as the eMRTD tests (–10 °C ... 50 °C). The customer is free to specify a limited range (for example, for indoor systems) in the implementation conformance statement.

6.1.3 Test report

The test report shall include the number of successful evaluations versus the total number of evaluations for each sample and for each test. A description of each test, the information whether the result was a pass or a fail, and the date of the tests shall be included.

6.1.4 Applicant declaration

In order to set up the tests properly, an applicant shall provide the information specified in Table 4.

Table 4 — Applicant Information on eMRTD reader Product

Product characteristic	Standard reference	Applicant declaration
eMRTD associated reader design type	Application profile v1.3	Type:
(Optional) eMRTD reader to eMRTD supported bit rates	ISO/IEC 14443-2 ISO/IEC 14443-3 ISO/IEC 14443-4	List of supported optional eMRTD reader to eMRTD bit rates
(Optional) eMRTD to eMRTD reader supported bit rates	ISO/IEC 14443-2 ISO/IEC 14443-3 ISO/IEC 14443-4	List of supported optional eMRTD to eMRTD reader bit rates
Operating temperature range	Application profile v1.3	Minimum and maximum temperature values
Z_{max}	Application profile v1.3	Z_{max} is the maximum operating distance in the Z axis. Z_{max} is provided only if Z_{max} is beyond the minimum operating range of the design type declared
(Optional) support of exchange of additional parameters	ISO/IEC 14443-4	YES/NO

Table 4 *(continued)*

Product characteristic	Standard reference	Applicant declaration
Maximum frame size supported	ISO/IEC 14443-3 ISO/IEC 14443-4	Declare the maximum frame size integer in reception supported by the eMRTD
(Optional) Frames with error corrections supported	ISO/IEC 14443-4	YES/NO
(Optional) Support of PICC classes	ISO/IEC 14443-1 ISO/IEC 14443-2	List of supported PICC classes (1 and/or 2 and/or 3 and/or 4 and/or 5 and/or 6)
(Optional) support of NAD and CID	ISO/IEC 14443-4	NAD: YES/NO CID: YES/NO
(Optional) support of EMD	ISO/IEC 14443-2	

Laboratory may ask if PC/SC is supported or not with available interface.

6.1.5 Definition of measurement points

ISO/IEC 14443-1 and ISO/IEC 14443-2 parameters tests shall be performed over a certain set of points within the defined volume.

Volume definition:

Volume dimensions are defined in 6.6, depending on "eMRTD reader design types". If due to the construction and/or normal use of the eMRTD reader other dimension sizes are recommended by the manufacturer of the eMRTD reader, the test institute shall check if these dimension sizes are appropriate and define the dimensions of the volume accordingly.

Volume location:

The eMRTD reader manufacturer shall define the position of the volume in the technical documentation of the eMRTD reader. The volume shall be located with one surface exactly on the surface of the eMRTD reader.

Alternatively, the volume may be located within the eMRTD reader. In this case, the volume size definition shall be adopted accordingly.

eMRTD reader shall be tested inside of their housing, exactly as they are used in border control applications.

Applying the eMRTD reader type concept, it is required to consider mechanical and optical constraints specific to an eMRTD reader. The test may be adapted to match these constraints. The report shall state the specific operating conditions during a particular test.

Measurement points:

Measurement points are defined in 6.6.

Height Z = 0 mm: The Reference PICC shall be placed exactly at the bottom of the volume (at the surface of the scanner plate, if appropriate).

Height Z = x mm: The top surface of the Reference PICC shall be located in a distance of x mm of the bottom of the volume (in a distance of x mm from the surface of the scanner plate, if appropriate).

6.2 Test of ISO/IEC 14443-1 parameters

6.2.1 Purpose

See ISO/IEC 10373-6:2016, 6.1.1.1.

6.2.2 Test procedure

Apply ISO/IEC 10373-6:2016, 6.1.1 test using Reference PICC 1 at room temperature.

6.2.3 Test report

The test report shall give the DC voltage measured at CON3.

6.3 Test of ISO/IEC 14443-2 parameters

6.3.1 eMRTD reader field strength

6.3.1.1 Purpose

See ISO/IEC 10373-6:2016, 7.1.1.1.

6.3.1.2 Test procedure

Apply ISO/IEC 10373-6:2016, 7.1.1 under the following conditions using Reference PICC 1:

— For this test, set H_{min} to 2 A/m (rms) and H_{max} to 7 A/m (rms). Set H_{min} to 1,5 A/m (rms) only for eMRTD type M reader.

At room temperature:

— at the appropriate measurement positions defined in Table 5 according to the reader type.

At –10 °C and 50 °C:

— at nominal position as defined in Table 3.

All positions defined in Table 5 shall be tested at –10 °C and/or 50 °C, if

— the deviation of results at nominal position at –10 °C and 50 °C is more than 10 % compared to room temperature, and

— the result is closer than 10 % to the limit.

NOTE ISO/IEC 14443 requires mandatory testing with Reference PICC 1, 2 and 3.

6.3.1.3 Test report

The test report shall give the DC voltage measured at CON3 for R2 or variable load resistor adjusted to H_{min} and H_{max} under the conditions applied.

6.3.2 Modulation index and waveform

6.3.2.1 Purpose

See ISO/IEC 10373-6:2016, 7.1.4.1.

6.3.2.2 Test procedure

Apply ISO/IEC 10373-6:2016, 7.1.4 under the following conditions using Reference PICC 1:

— resonance frequency 16,5 MHz;

— other resonance frequencies 13,56 MHz, 15 MHz and 19 MHz are optional;

— all declared bit rates in Table 4.

At room temperature:

— at the appropriate measurement positions defined in Table 5 according to the reader type.

At –10 °C and 50 °C:

— at nominal position as defined in Table 3.

All positions defined in Table 5 shall be tested at –10 °C and/or 50 °C, if

— the deviation of results at nominal position at –10 °C and 50 °C is more than 10 % compared to room temperature, and

— and the result is closer than 10 % to the limit.

NOTE 1 ISO/IEC 14443-2 requires mandatory testing with Reference PICC 1, 2 and 3.

NOTE 2 Testing with resonance frequencies 13,56 MHz, 15 MHz and 19 MHz increases interoperability.

NOTE 3 For bit rates higher than *fc*/128, The PCD-test-apparatus defined in ISO/IEC 10373-6:2016, H.1 is also used to send a test command.

6.3.2.3 Test report

The test report shall give the measured modulation index of the eMRTD reader field, the rise and fall times and overshoot values, within the defined operating volume.

6.3.3 Load modulation reception

6.3.3.1 Purpose

See ISO/IEC 10373-6:2016, 7.1.5.1.

6.3.3.2 Test procedure

Apply ISO/IEC 10373-6:2016, 7.1.5 under the following conditions using Reference PICC 1:

— resonance frequencies 13,56 MHz and 15 MHz;

— resonance frequencies 12 MHz and 16,5 MHz are optional;

— at all supported eMRTD reader bit rates.

At room temperature:

— at the appropriate measurement positions defined in Table 5 according to the reader type.

At –10 °C and 50 °C:

— at nominal position as defined in Table 3.

All positions defined in Table 5 shall be tested at –10 °C and/or 50 °C, if

— the deviation of results at nominal position at –10 °C and 50 °C is more than 10 % compared to room temperature, and

—- the result is closer than 10 % to the limit.

NOTE 1 ISO/IEC 14443 requires mandatory testing with Reference PICC 1, 2 and 3.

NOTE 2 Testing with resonance frequencies 12 MHz and 16,5 MHz increases interoperability.

NOTE 3 For bit rates higher than *fc*/128, the PCD-test-apparatus defined in ISO/IEC 10373-6:2016, H.1 is also used to send a test command.

6.3.3.3 Test report

The test report shall give the eMRTD reader load modulation sensitivity for the tested positions.

6.4 Test of ISO/IEC 14443-3 and ISO/IEC 14443-4 parameters

Perform the test defined in ISO/IEC 10373-6:2016, Annex H and ISO/IEC 10373-6:2016, Annex I at room temperature and nominal position as defined in 6.1.2 according to the declarations made in Table 4. The test commands to apply are defined in 6.5.

Apply the pass criteria defined in ISO/IEC 10373-6:2016, Table H.13 with the minimum delay between each type as defined in Application Profile for Contactless Interface v1.3. In addition, verify that at least one polling command for both Type A and Type B occur within the delay defined in ICAO Doc 9303 and its amendments.

6.5 List of test command sequences

This subclause provides mandatory test command sequences.

6.5.1 Test commands sequence for scenarios without eMRTD reader chaining

6.5.1.1 UT_TEST_COMMAND1

UT_TEST_COMMAND1, decided by the PCD-test-apparatus, specifies the ISO instruction used as the default instruction for Scenarios without eMRTD reader chaining.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	UT_TEST_COMMAND1	'00 A4 04 0C 07 A0 00 00 02 47 10 01'

Answer to UT_APDU definition:

Step	Answer	Answer to UT_APDU
1	Answer to UT_TEST_COMMAND1	'12 34 90 00'

6.5.1.2 Commands sequence definition

Following sequence shall be applied for Scenarios without eMRTD reader chaining:

Step	Command
1	INITIALIZE_PCD_TEST_MODE
2	INITIATE_ANTICOLLISION
3	UT_TEST_COMMAND1
4	UT_TEST_COMMAND1

NOTE Some scenarios require a second UT_TEST_COMMAND1.

6.5.2 Test commands sequence for scenarios dealing with eMRTD reader chaining

6.5.2.1 UT_TEST_COMMAND2

UT_TEST_COMMAND2, decided by the PCD-test-apparatus, specifies the ISO instruction used as the default instruction for Scenarios dealing with eMRTD reader chaining.

UT_APDU definition:

Step	Command	COMMAND UT_APDU
1	UT_TEST_COMMAND2	' 00 DA 00 00 FF 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11...FE FF'

Answer to UT_APDU definition:

Step	Answer	Answer to UT_APDU
1	Answer to UT_TEST_ COMMAND2	First I-block: '01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F' Second I-block: '11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F' Third I-block: '90 00'

6.5.2.2 Commands sequence definition

The following sequence shall be applied for Scenarios dealing with eMRTD reader chaining:

Step	Command
1	INITIALIZE_PCD_TEST_MODE
2	INITIATE_ANTICOLLISION
3	UT_TEST_COMMAND2

UT_TEST_Command1 may be sent before step 3.

6.6 Measurement positions

The volume and measurement points depend on the eMRTD reader design type as defined in Table 5 and described in Figures 1 and 2.

NOTE An eMRTD containing a "Class 1" antenna is not always outer physical size of ID-3.

Table 5 — Volume and measurement points for eMRTD reader design types

eMRTD reader design type	Volume definition			Measurement points	
	X dimension	Y dimension	Z dimension mm	X-Y-plane	Height mm
1	Twice ID-3 + 20 % (of ID-3) enlarged by 10 %	ID-3 enlarged by 10 %	7,5	— All four corners of both connected ID-3 + 10 % fields — Center of both fields — Center of both fields, 90° rotated — X-left corner, X-right corner, 90° rotated	$Z_0 = 0,0$ $Z_1 = 7,5$ Z_{max} as specified by manufacturer (if $Z_{max} > 7,5$)
2	ID-3 + 10 % (of ID-3) enlarged by 10 %	ID-3 enlarged by 10 %	7,5	— All four corners of ID-3 + 10 % field — Center of the field — Center of field, 90° rotated — X-left corner, X-right corner, 90° rotated	$Z_0 = 0,0$ $Z_1 = 7,5$ Z_{max} as specified by manufacturer (if $Z_{max} > 7,5$)
3	ID-1 +10 % (of ID-1) enlarged by 10 %	ID-1 enlarged by 10 %	20,0	— All four corners of ID-1 + 10 % field — Center of the field — Center of field, 90° rotated — X-left corner, X-right corner, 90° rotated	$Z_0 = 0,0$ $Z_1 = 7,5$ $Z_{max} = 20,0$ or as specified by manufacturer (if $Z_{max} > 20,0$)
M	0	0	7,5	— Center derived from max. Field strength — Center derived from max. Field strength, 90° rotated	$Z_0 = 0,0$ $Z_1 = 7,5$ Z_{max} as specified by manufacturer (if $Z_{max} > 7,5$)

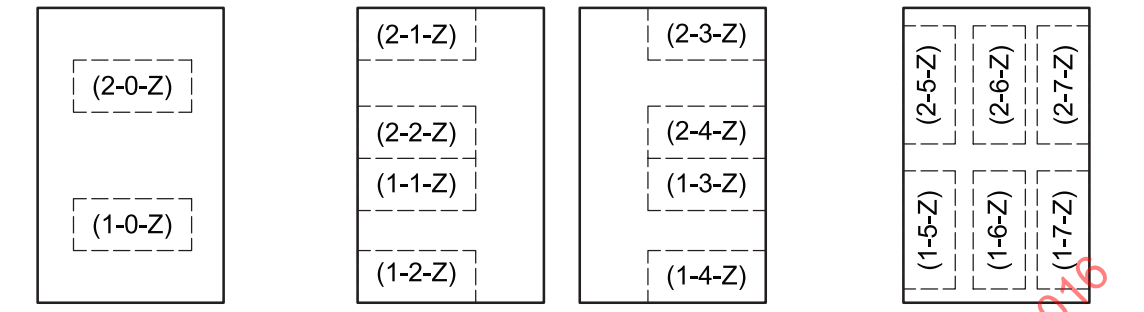

Figure 1 — Measurement positions for eMRTD reader design type 1

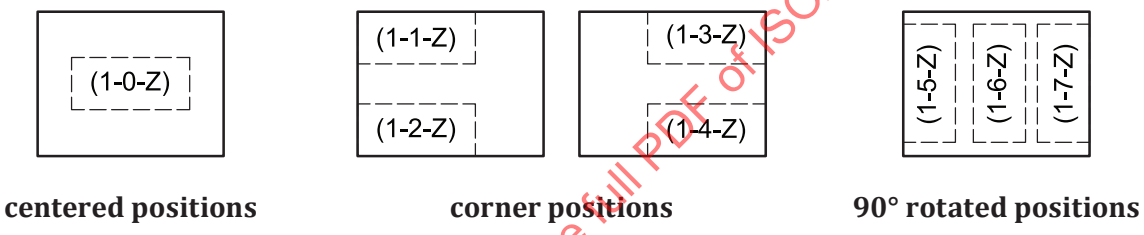

Figure 2 — Measurement positions for eMRTD reader design type 2 and 3

Figure 3 — Measurement positions for eMRTD reader design type M

NOTE The centered position on the eMRTD Reader type M is defined as the position where the field strength is maximum.

7 Additional eMRTD test methods

7.1 Test conditions

The conditions defined in 5.1 shall be applied unless otherwise specified.

For bit rates higher than *fc*/16, unless otherwise specified, the values defined in Table 6 shall be used.

Table 6 — Values for bit rates higher than *fc*/16 unless otherwise specified

Parameter	Value	To be applied to
Parameters applicable for eMRTD reader to eMRTD bit rate *fc*/8		
Overshoot	0	Type A and Type B
Modulation index *m*	15 %	Type A and Type B
Rise time t_r, fall time t_f	5/*fc*	Type A and Type B
Parameters applicable for eMRTD reader to eMRTD bit rate *fc*/4		
Overshoot	0	Type A and Type B
Modulation index *m*	15 %	Type A and Type B
Rise time t_r, fall time t_f	4/*fc*	Type A and Type B
Parameters applicable for eMRTD reader to eMRTD bit rate *fc*/2		
Overshoot	0	Type A and Type B
Modulation index *m*	15 %	Type A and Type B
Rise time t_r, fall time t_f	3/*fc*	Type A and Type B
Parameters applicable for a eMRTD reader to eMRTD bit rate of 3*fc*/4 and 3*fc*/2		
PR	56°	Type A and Type B
ISI_d	0	Type A and Type B
ISI_m	1	Type A and Type B
Phase noise	0,03	Type A and Type B
Parameters applicable for a PCD to PICC bit rate of *fc* and 2*fc*		
PR	60°	Type A and Type B
ISI_d	0	Type A and Type B
ISI_m	1	Type A and Type B
Phase noise	0,012 5	Type A and Type B

7.2 Test of ISO/IEC 14443-2 parameters for eMRTD

7.2.1 Operating field strength for bit rates higher than *fc*/16

7.2.1.1 Purpose

The purpose of this test is to perform 5.3.2 for bit rates higher than *fc*/16 declared by the applicant.

This test is optional and shall be applied if the applicant declares support of bit rates higher than *fc*/16 in Table 2.

7.2.1.2 Test procedure

For this procedure, the Test PCD assembly shall be used as the eMRTD associated reader antenna. The eMRTD under test shall be placed in the DUT position, concentric with sense coil a. The field strength into the Test PCD assembly antenna shall be re-adjusted to the required field strength.

The following command sequence shall be used for this procedure:

For Type A:

a) REQA command;

b) repeat ANTICOLLISION and SELECT commands until UID is complete;

c) RATS command;

d) PPS command;

e) S(PARAMETERS) commands;

f) TEST_COMMAND_SEQUENCE1.

For Type B:

a) REQB command;

b) ATTRIB command;

c) S(PARAMETERS) commands;

d) TEST_COMMAND_SEQUENCE1.

TEST_COMMAND_SEQUENCE1 is specified in 5.5 and 8.2 depending on the access control mechanism declared in Table 2.

Execute the command sequence under the following conditions:

— every supported symmetric bitrate and maximum bitrate in both directions shall be tested.

At temperatures –10 °C and room temperature:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 7,5 A/m(rms);

— optional: 5,5 A/m(rms), 6,5 A/m(rms).

At temperature 50 °C:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 6,0 A/m(rms);

— optional: 5,5 A/m(rms).

NOTE Optional and mandatory field strength values are chosen in line with the following reasons:

— most of eMRTD associated readers operate between 1,5 A/m(rms) and 4,5 A/m(rms);

— check that there is no potential communication hole between 1,5 A/m(rms) and 4,5 A/m(rms).

7.2.1.3 Test report

The test report shall confirm the intended operation at the supported bit rates. Used test conditions shall be mentioned in the test report.

7.2.2 eMRTD reception for bit rates higher than *fc*/16

7.2.2.1 Purpose

The purpose of this test is to perform 5.3.3 for bit rates higher than *fc*/16 declared by the applicant.

This test is optional and shall be applied if the applicant declares support of bit rates higher than *fc*/16 in Table 2.

7.2.2.2 Test procedure

Apply 5.3.3.2 using the following conditions:

— bit rates *fc*/8, *fc*/4, *fc*/2 if supported.

At temperatures –10 °C and room temperature:

— mandatory: 1,5 A/m(rms), 2,5 A/m(rms), 3,5 A/m(rms), 4,5 A/m(rms), 7,5 A/m(rms);